MITSUBISHI SEMICONDUCTORS 1989

RF POWER SEMICONDUCTORS

DATA BOOK

MITSUBISHI ELECTRIC

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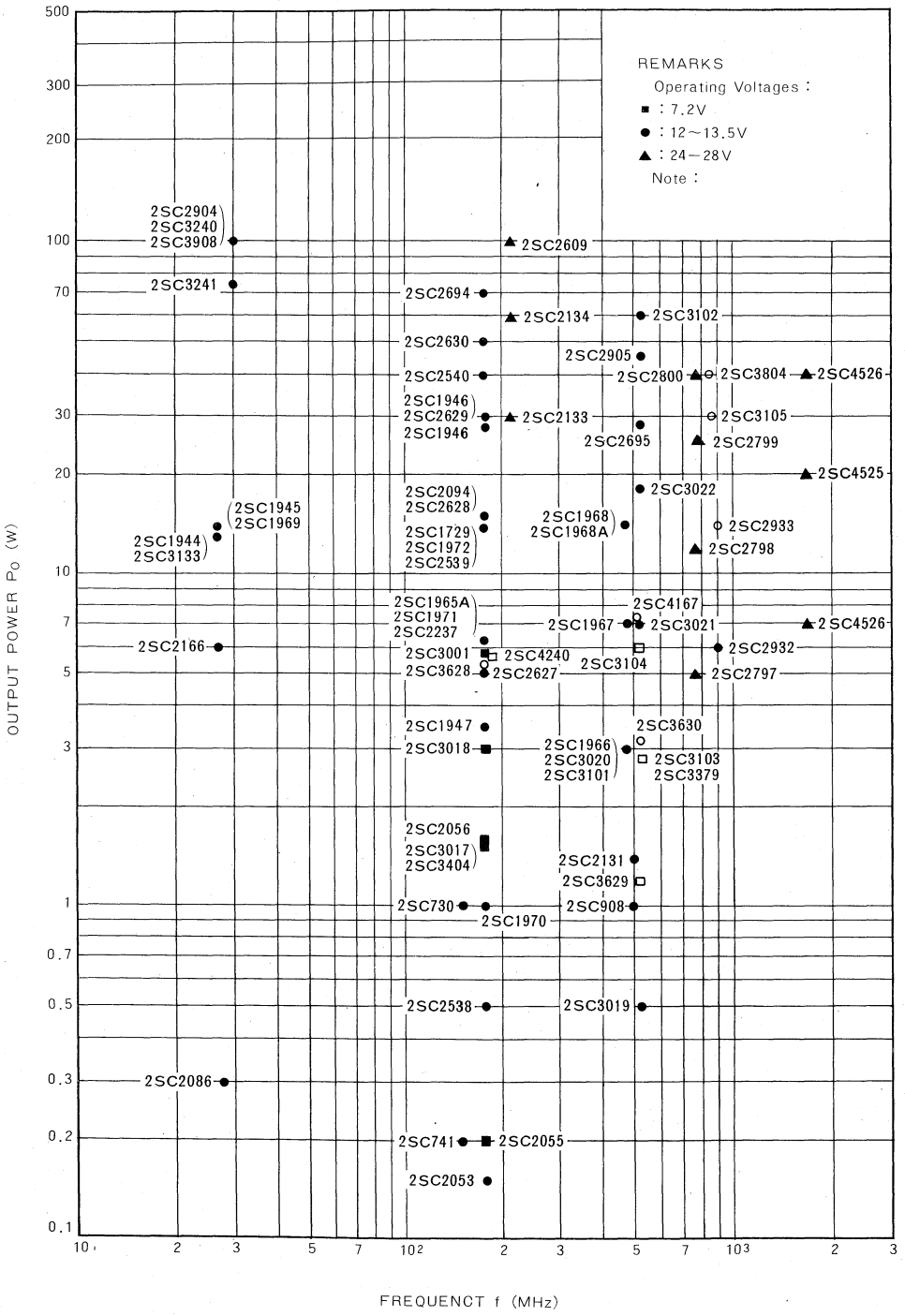

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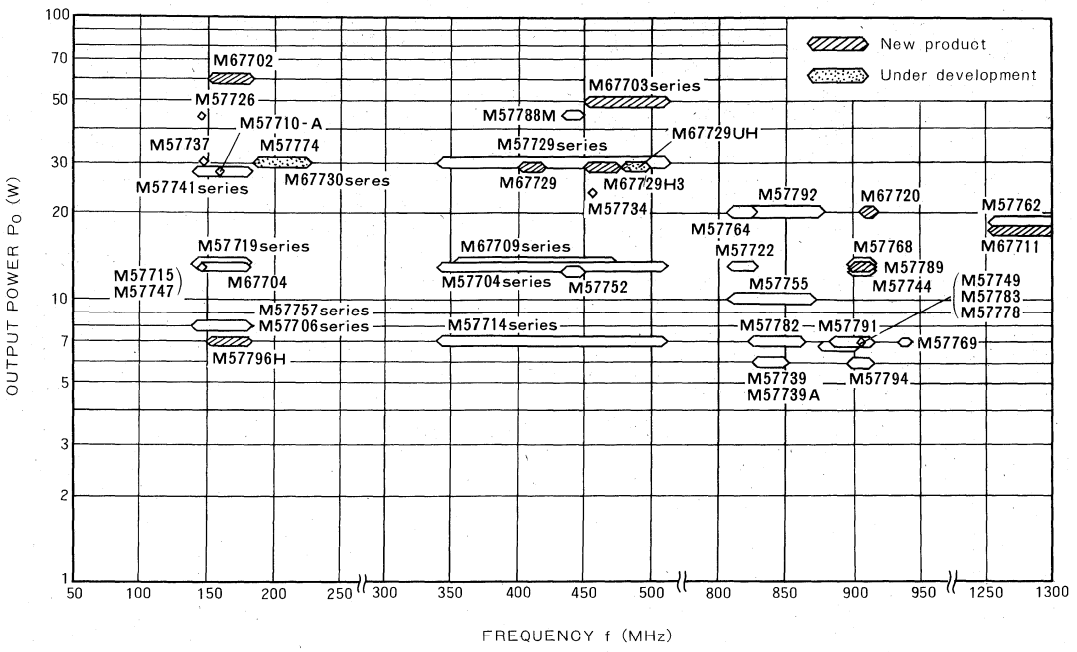

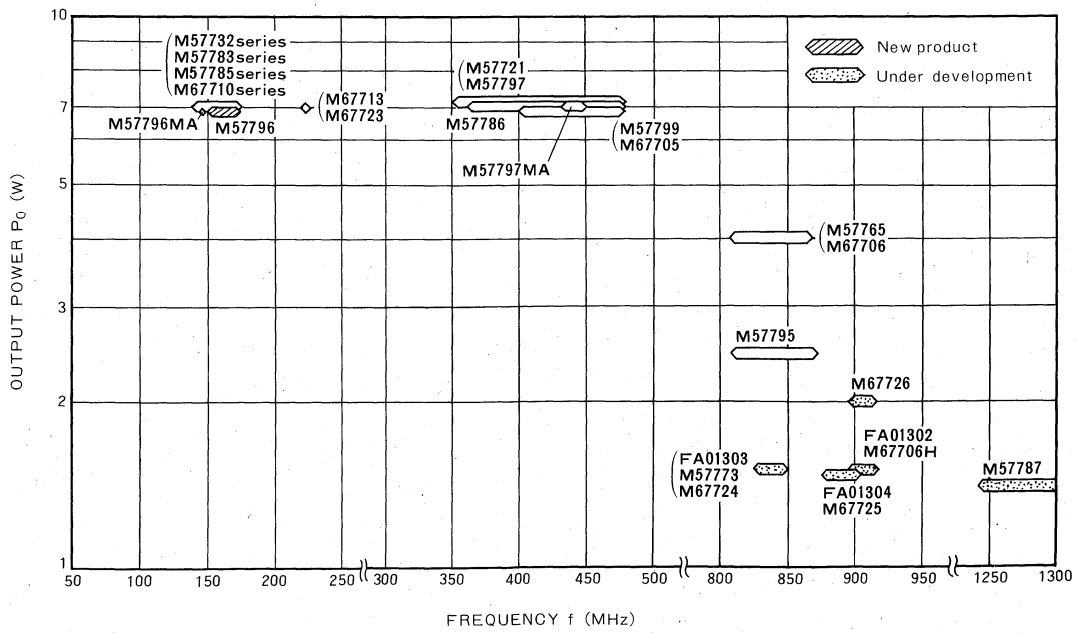

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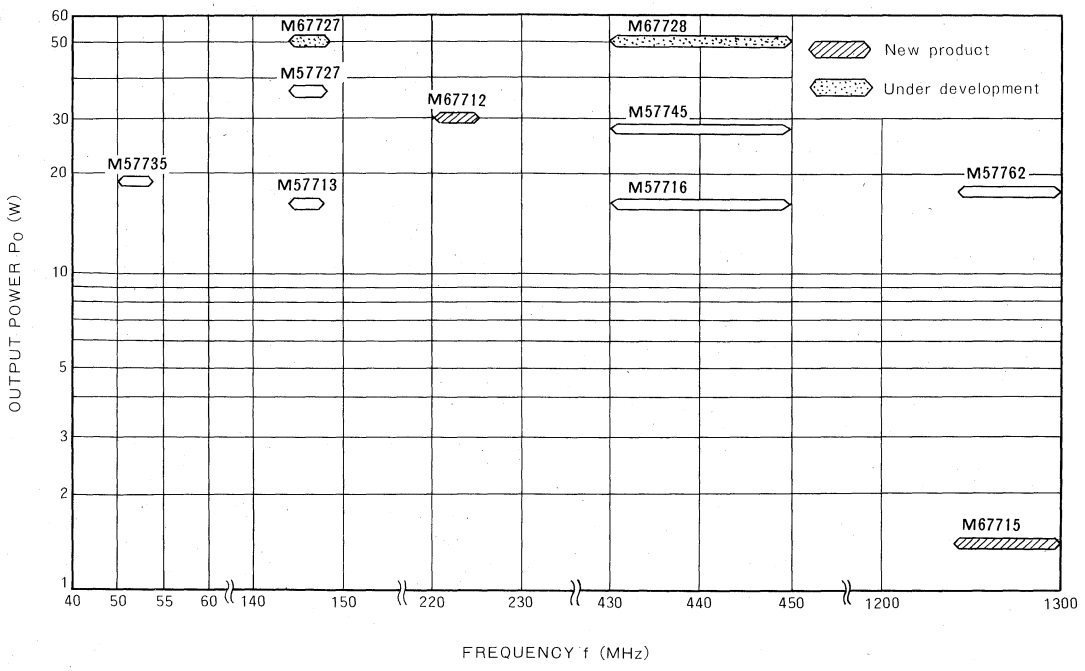

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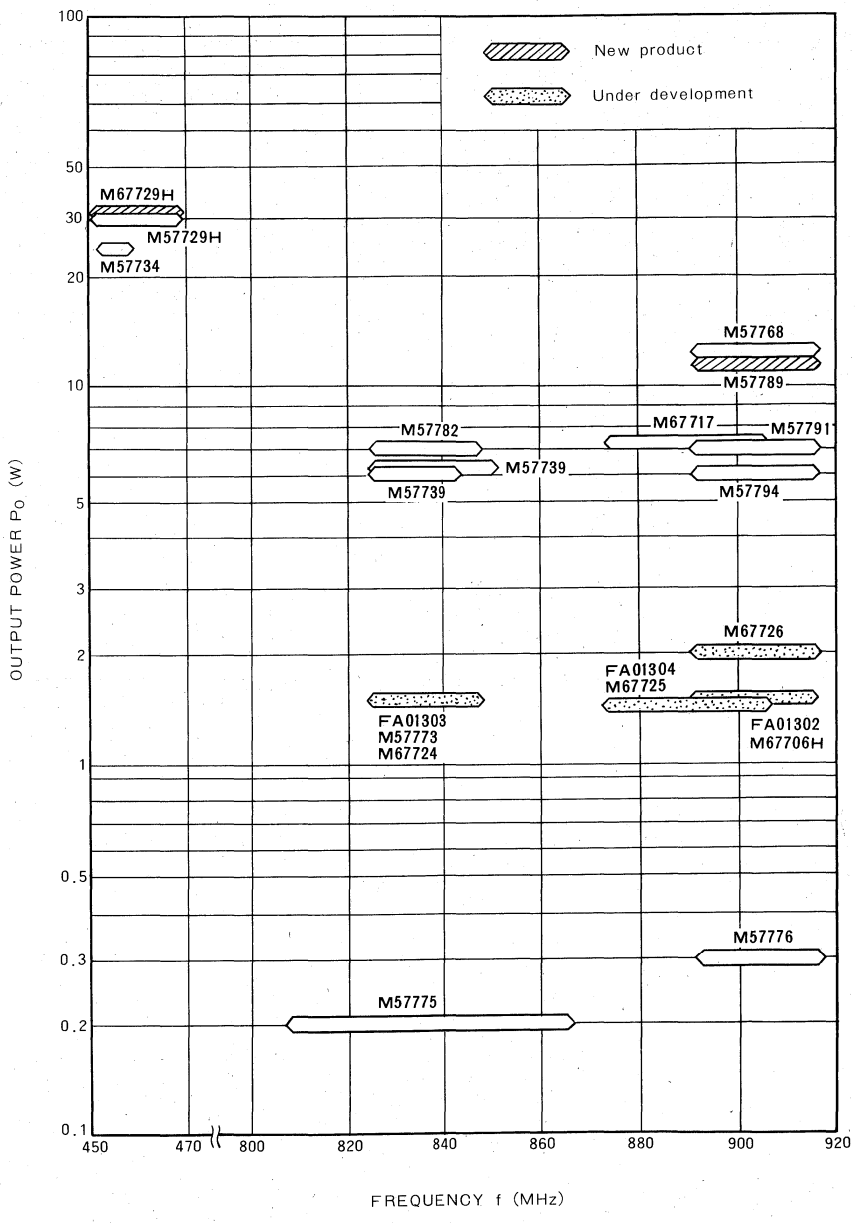

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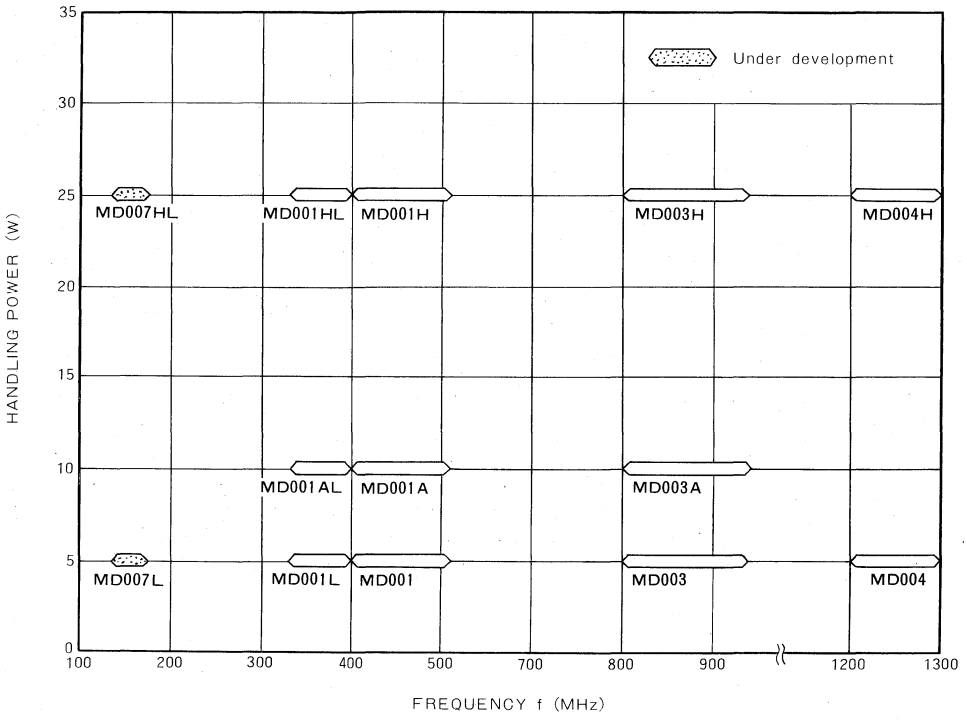

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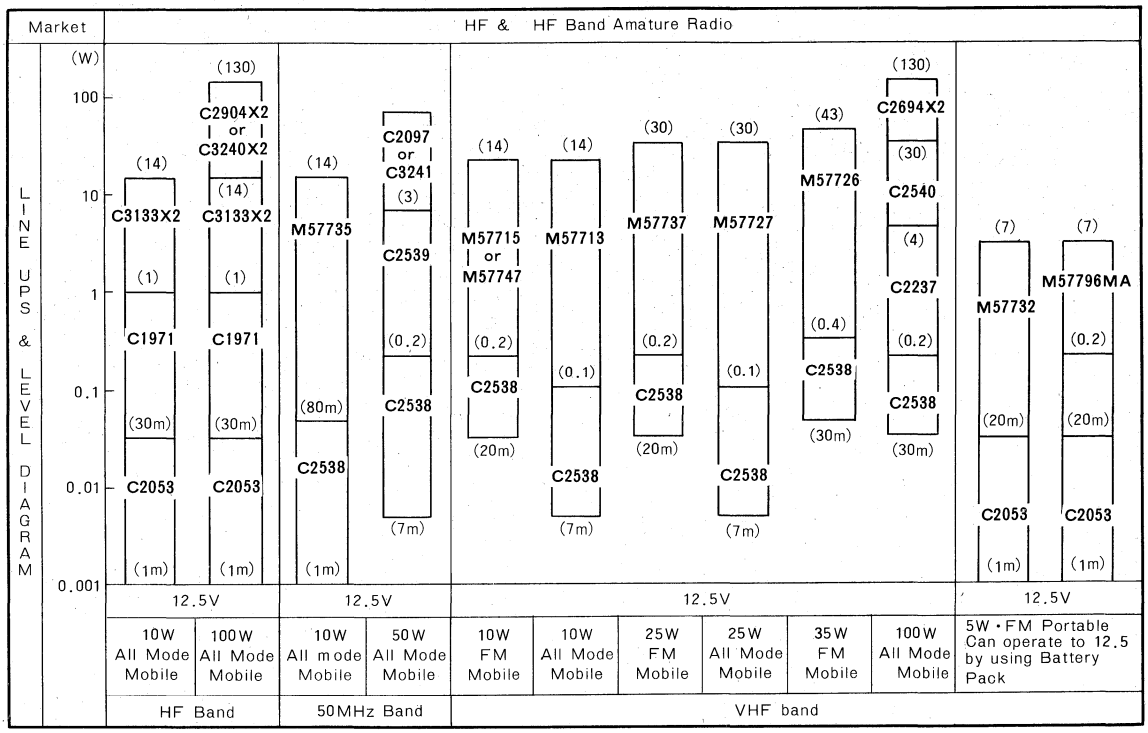

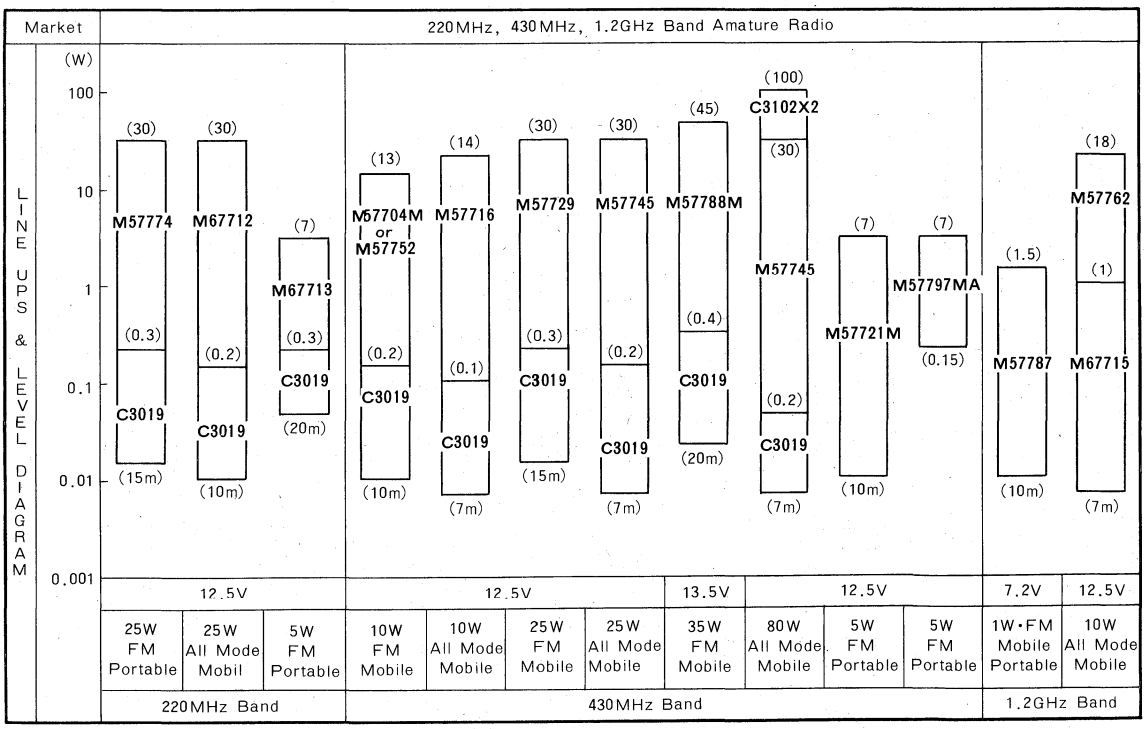

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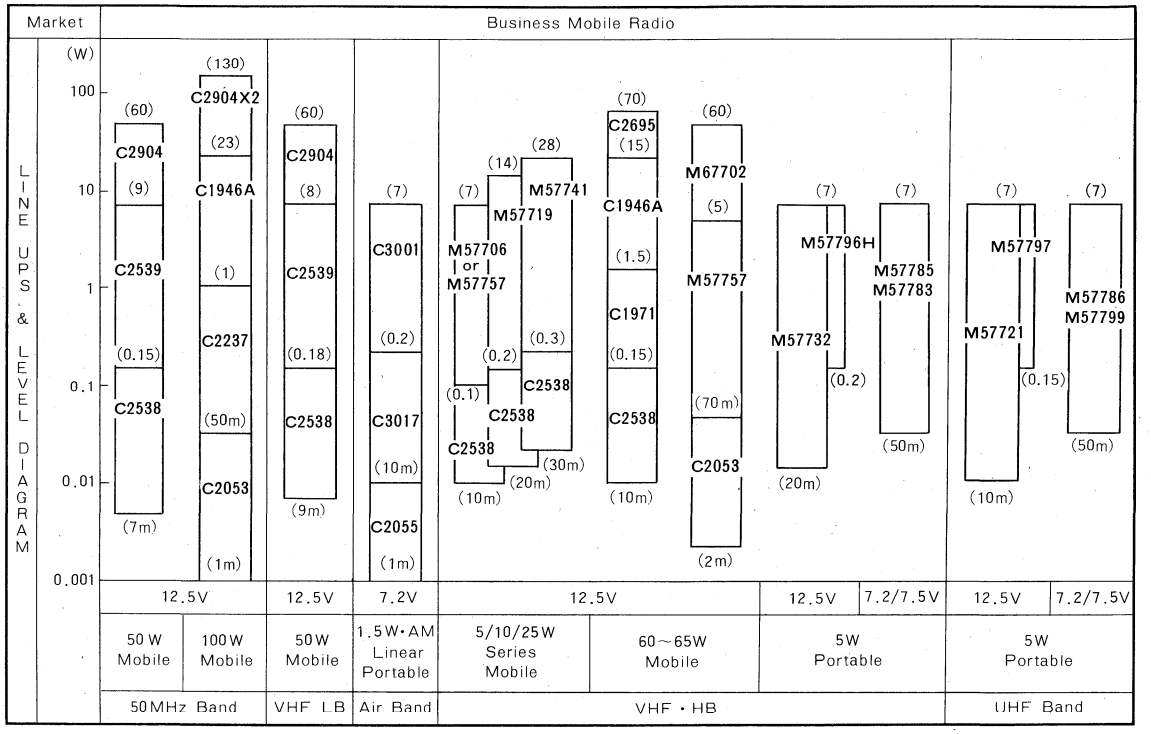
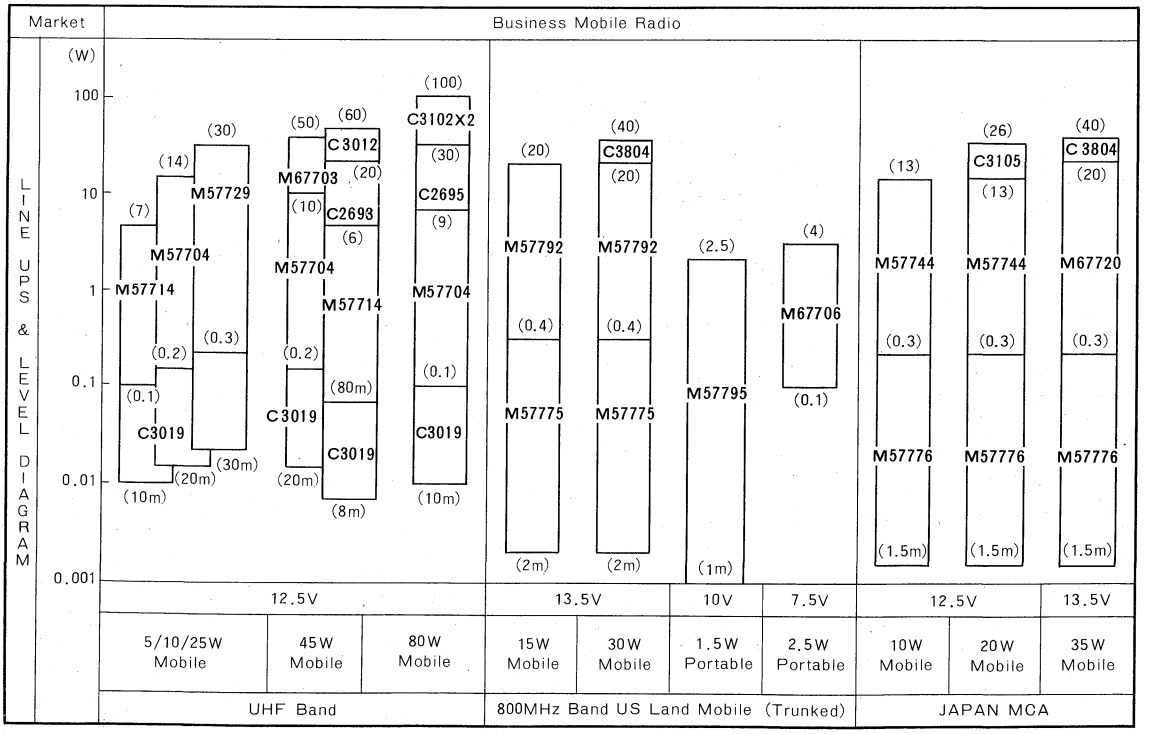
Mobile Radio Transmit Stage Block Diagram





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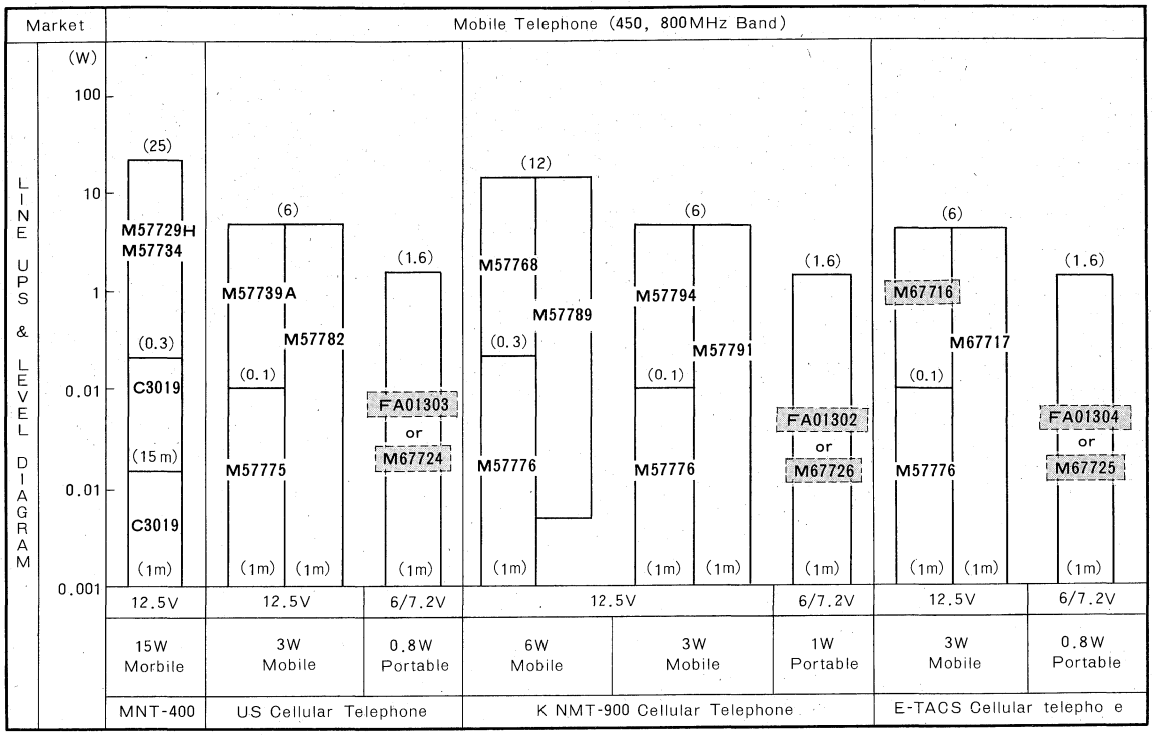
KINDS OF APPLICATION TABLE

Mobile Radio Transmit Stage Block Diagram

Under Development



SELECTION GUIDE BY FUNCTION

Type No.	Applications				Stage No.		Features						Outline
		Mode	Note 1		2~3	4~5	f (MHz)	P_O (W)	G_P (dB)	η_T (%)	P_{in} (W)	V_{CC} (V)	
			M	P									
M57735	VHF 6m	SSB	○		②		50—54	19	19.7	40	0.2	12.5	H3C
M57796MA ★	VHF 2m BAND	FM		○	②		144—148	7	15.4	50	0.2	12.5	H14
M57715			○		②		144—148	13	18.1	48	0.2	12.5	H2
M57747			○		②		144—148	13	18.1	48	0.2	12.5	H6
M57737			○		②		144—148	30	21.8	45	0.2	12.5	H2
M57726			○		②		144—148	43	23.3	50	0.4	12.5	H2
M57713		SSB	○		②		144—148	17	19.3	40	0.2	12.5	H3B
M57727			○		②		144—148	37	30.9	50	0.3	12.5	H3B
M67727 ∗★★			○		②		144—148	50	20.0	40	0.5	12.5	H17
M57713	220MHz BAND	FM		○	①		220—225	7	11.4	45	0.3	12.5	H14
M57723 ★			○	○	②		220—225	7	25.4	45	20m	12.5	H13
M57774			○		②		220—225	30	20.0	43	0.3	12.5	H2
M57712 ★		SSB	○		②		220—225	30	20.0	43	0.3	12.5	H3B
M57797MA ★	UHF 400MHz BAND	FM		○	②		430—450	7	16.7	40	0.1	12.5	H15
M57714M			○		③		430—450	7	18.4	38	0.1	12.5	H3A
M57704M			○		③		430—450	13	18.1	35	0.2	12.5	H3A
M57752			○		③		430—450	13	18.1	40	0.2	12.5	H3A
M57729			○		③		430—450	30	20.0	40	0.3	12.5	H3A
M57788M			○		③		430—450	45	20.5	40	0.4	13.5	H3A
M57716	UHF 400MHz BAND	SSB	○		③		430—450	17	19.3	35	0.2	12.5	H3C
M57745			○		③		430—450	33	20.4	40	0.3	12.5	H3C
M67728 ∗★★			○		②		430—450	50	10.0	40	5	12.5	H17
M67715	UHF 1.2GHz BAND	SSB		○		④	1.24—1.3	1.5	21.7	28	7m	7.2	H13A
M57787 ★		FM		○		④	1.24—1.3	1.5	21.7	23	10m	8	H13A
M67711 ★			○		③		1.24—1.3	16	12.0	30	1	12.5	H3B
M57762		FM/SSB	○		③		1.24—1.3	18	12.6	30	1	12.5	H3B

Note 1) M : for MOBILE, P : for PORTABLE. ★ : New product. ★★ : Under development
Specifications are shown in minimum value. Outline : see references "Package outline"
∗ : for 35W set

SELECTION GUIDE BY FUNCTION

Type No.	Applications				Stage No.		Features						Outline
		Mode	Note 1		2—3	4—5	f (MHz)	P_O (W)	G_P (dB)	η_T (%)	Pin (W)	V_{CC} (V)	
			M	P									
M57785L ★ **M57785M** ★ **M57785H** ★	VHF HIGH BAND	FM		○	②		135—150 150—162 162—174	7	21.5	40	0.05	7.2	H12A
M57783L ★ **M57783H** ★				○	②		135—160 150—175	7	21.5	40	0.05	7.5	H13
M67710L **M67710H** ★				○	②		135—160 150—175	7	21.5	40	0.05	9.6	H13
M57796H				○	②		150—175	7	13.7	50	0.3	12.5	H14
M57732L ★ **M57732** ★				○	②		135—160 144—175	7	25.4	40	0.02	12.5	H12A
M57706L **M57706**			○		②		135—145 145—175	8	16.0	35	0.2	12.5	H2
M57757L **M57757**			○		②		136—160 148—175	8	19.0	35	0.1	12.5	H2
M57719L **M57719N** **M57719**			○		②		135—145 142—163 145—175	14	18.5	40	0.2	12.5	H2
M67704			○				142—175	13	28.1	40	0.02	12.5	H16
M57741UL **M57741L** **M57741M** **M57741H**			○		②		135—148 146—160 156—168 164—175	28	19.7	40	0.2 0.2 0.25 0.3	12.5	H2
M57710A			○		②		156—160	28	21.5	45	0.2	12.5	H2
M67702 ★			○		②		150—175	60	10.8	40	5	12.5	H17
M67730L **M67730H** ★★	VHF 200MHz	FM	○		②		175—200 200—225	30	20.0	43	0.3	12.5	H2
M67786UL **M57786L** ★ **M57786M** ★ **M57786H** ★	UHF 400MHz BAND	FM		○	③		360—380 400—430 430—470 470—512	7	21.5	40	0.05	7.2	H12
M57799L **M57799M** **M57799H**				○	③		400—430 430—470 470—512	7	22.4	40	0.04	7.5	H13A
M67705L ★ **M67705M** ★ **M67705H** ★				○	③		400—430 430—470 470—512	7	25.4	40	0.02	9.6	H13A
M57797SL **M57797UL** **M57797L** **M57797H** **M57797UH** **M57797SH**				○	①		350—380 380—400 400—430 450—470 470—490 490—512	7	15.4	40	0.2	12.5	H14
M57721L ★ **M57721M** ★ **M57721** ★				○	③		350—400 400—450 450—512	7	25.4	40	0.01	12.5	H12

Note 1) M : for MOBILE, P : for PORTABLE. ★ : New product. ★★ : Under development
Specifications are shown in minimum value. Outline : see references "Package outline"

SELECTION GUIDE BY FUNCTION

Type No.	Applications				Stage No.		Features						Outline
		Mode	Note 1		2—3	4—5	f (MHz)	P_O (W)	G_P (dB)	η_T (%)	Pin (W)	V_{CC} (V)	
			M	P									
M57714EL							335—360						
M57714SL					③		360—380	7	18.5	38	0.1	12.5	H3A
M57714UL							380—400						
M57714L			○				400—420						
M57714M							430—450						
M57704H							450—470						
M57704UH					③		470—490	13	18.1	35	0.2	12.5	H3A
M57704SH							490—512						
M67709L							350—390						
M67709M	UHF		○			④	390—430	13	31.1	35	0.01	12.5	H16
M67709	400MHz	FM					430—470						
M57729EL	BAND						335—360						
M57729SL							360—380						
M57729UL							380—400						
M57729L							400—420						
M57729			○		③		430—450	30	20.0	40	0.3	12.5	H3A
M57729H							450—470						
M57729UH							470—490						
M57729SH							490—512						
M67729L ★★							400—420						
M67729H3 ★★			○		③		450—470	30	20.0	40	0.3	12.5	H18
M67729UH ★★							470—490						
M67703H ★							450—470						
M67703UH ★			○		②		470—490	50	7.0	40	10	12.5	H17
M67703SH ★							490—512						
M57775	800MHz		○		③		806—866	0.2	23.0	*1	1m	8	H8A
M57776	DRIVER		○		③		890—915	0.3	23.0	*2	1.5m	8	H8A
M57795				○		⑤	806—870	2.5	34.0	30	1m	10	H1
M67706	800MHz			○	③		806—866	4	16.0	30	0.1	7.5	H13B
M57765 ★	US			○	③		806—866	4	14.3	*3	0.15	12.5	H8
M57755 ★	TRUNK		○		③		806—866	10	20.0	35	0.1	12.6	H3
M57722	SYSTEM		○		③		806—825	13	18.1	35	0.3	12.5	H3A
M57764		FM	○		③		806—825	20	16.8	30	0.4	12.5	H3A
M57792 ★			○		③		806—870	20	16.8	30	0.4	13.5	H3A
M57744	JAPAN MCA		○		③		905—915	13	16.4	30	0.3	12.5	H3A
M67720 ★	SYSTEM		○		③		905—915	20	16.8	30	0.4	13.5	H3A
M57749	JAPAN		○		③		903—905	7	15.4	30	0.2	12.5	H3A
M57793	PERSONAL		○			⑤	903—905	7	38.4	35	1m	12.5	H11
M57778	RADIO		○			⑤	903—905	7	38.4	35	1m	12.5	H11
M57769	UK CB		○		③		933—937	7	15.4	35	0.2	12.5	H3A

Note 1) M : for MOBILE, P : for PORTABLE. ★ : New product. ★★ : Under development
Specifications are shown in minimum value. Outline : see references "Package outline"
*1 : $I_t \leqq 230mA$, @0.2W *2 : $I_t \leqq 250mA$, @0.3W *3 : $I_1 \leqq 0.17A$, $I_2 \leqq 1A$

SELECTION GUIDE BY FUNCTION

Type No.	Applications				Stage No.		Features						Outline
		Mode	Note 1		2—3	4—5	f	P_O	G_P	η_T	P_{in}	V_{CC}	
			M	P			(MHz)	(W)	(dB)	(%)	(W)	(V)	
M57734	400MHz NMT-400	FM	○		③		453—458	25	19.2	40	0.3	12.5	H3A
M57729H			○		③		450—470	30	20.0	40	0.3	12.5	H3A
M67729H2 ★★			○		③		450—470	30	20.0	40	0.3	12.5	H18
M57775	800MHz DRIVER		○		③		806—866	0.2	23.0	—	1 m	8	H8A
M57776			○		③		890—915	0.3	23.0	—	1.5m	8	H8A
FA01303 ★★	US CELLULAR RADIO			○	③		824—849	1.6	32.0	50	1 m	6	GH3
M67724 ★★				○		④	824—849	1.6	32.0	40	1 m	7.2	H25
M57739			○		③		825—845	6	19.3	35	70m	12.5	H3A
M57739A			○		③		825—851	6	17.7	35	0.1	12.5	H10
M57782			○			⑤	824—849	7	38.5	35	1 m	12.5	H11
FA01302 ★★	UK, NMT CELLULAR RADIO			○	③		890—915	1.6	32.0	50	1 m	6	GH3
M67726 ★★				○		④	890—915	2	33.0	40	1 m	7.2	H25
M67706H ★				○	③		890—915	1.6	15.0	30	40m	7.2	H13B
M57794			○		③		890—915	6	17.7	35	0.1	12.5	H10
M57791 ★			○			⑤	890—915	7	38.5	35	1 m	12.5	H11
M57768			○		③		890—915	13	16.4	30	0.3	12.5	H3A
M57789 ★			○			⑤	890—915	12	37.8	30	5 m	12.5	H3B
FA01304 ★★				○	③		872—905	1.6	32.0	50	1 m	6	GH3
M67725 ★★			○	○		④	872—905	1.6	32.0	40	1 m	7.2	H25
M67716			○		③		872—905	6	17.7	35	0.1	12.5	H10
M67717 ★			○			⑤	872—905	7	38.5	35	1 m	12.5	H11

Note 1) M : for MOBILE. P : for PORTABLE. ★ : New produect. ★★ : Under development
Specifications are shown in minimum value. Outline : see references "Package outline"

SELECTION GUIDE BY FUNCTION

Type No.	Application	Features											PKG
		f	P_{in}	*3 ISO			*4 α1			*5 α2			
		(MHz)	Max. (W)	Min. (dB)	Typ. (dB)	Ibias (mA)	Typ. (dB)	Max. (dB)	Ibias (mA)	Typ. (dB)	Max. (dB)	Ibias (mA)	
MD007L ★★	135—175MHz for 5 W	135～175	*1 10	25	28	20	0.4	0.7	20	0.5	0.8	0	D11
MD007HL ★★	135—175MHz for 25W	135～175	*2 50	25	28	20	0.4	0.7	20	0.5	0.8	0	D10C
MD001L	330—400MHz for 5 W	330～400	*1 12	30	38	50	0.5	0.7	50	0.8	1.5	0	D8
MD001AL	330—400MHz for 10W	330～400	*1 17	30	38	50	0.5	0.7	50	0.8	1.5	0	D9b
MD001HL	330—400MHz for 25W	330～400	*2 50	30	38	50	0.5	0.7	50	0.8	1.5	0	D10b
MD001	400—512MHz for 5 W	400～512	*1 12	30	40	50	0.5	0.7	50	1.0	1.5	0	D8
MD001A	400—512MHz for 10W	400～512	*1 17	30	40	50	0.5	0.7	50	1.0	1.5	0	D9b
MD001H	400—512MHz for 25W	400～512	*2 50	30	40	50	0.5	0.7	50	1.0	1.5	0	D10b
MD003	800—940MHz for 5 W	800～940	*1 12	30	35	50	0.5	0.7	50	1.0	1.5	0	D7
MD003A	800—940MHz for 10W	800～940	*1 17	30	35	50	0.5	0.7	50	1.0	1.5	0	D9a
MD003H	800—940MHz for 25W	800～940	*2 50	30	35	50	0.5	0.7	50	1.0	1.5	0	D10a
MD004	1200—1300MHz for 5 W	1200～1300	*1 10	25	30	50	0.8	1.2	50	1.0	1.5	0	D7
MD004H	1200—1300MHz for 25W	1200～1300	*2 50	25	30	50	0.8	1.2	50	1.0	1.5	0	D10a

Note : *1 @$T_a \leqq 60°C$. *2 @$T_C \leqq 90°C$. *3 Isolation (TX-RX). *4 Insertion loss (TX-ANT).
*5 Insertion loss (ANT-RX). *6 Bias Current. ★ : New products. ★★ : Under Development

SELECTION GUIDE BY FUNCTION

For Citizen's Band Transciever, 27MHz 12V Series

<Tc=25°C>

Type No.	Aplication	Structure	Max. ratings						I_{CB} (max) (μA)	P_O (min)				η_C (min) (%)	Package outline
			V_{CBO} (V)	V_{EBO} (V)	I_C (I)	P_C (W)	T_j (°C)	R_{th-c} (°C/W)		V_{CC} (V)	f (MHz)	P_{in} (W)	(W)		
2SC2086	HPA	SI, NPN, EP	75	4	1	#0.8	+135	#137.5$	100	12	27	0.015	0.3	50	T-1B
2SC2166	HPA	SI, NPN, EP	75	5	4	12.5	+150	10	100	12	27	0.25	6	55	T-30
2SC1944	HPA	SI, NPN, EP	80	5	6	20	+150	6.25	100	12	27	1	13	55	T-30
2SC1945	HPA	SI, NPN, EP	80	5	6	20	+150	6.25	100	12	27	0.5	14	60	T-30E
2SC1969	HPA	SI, NPN, EP	60	5	6	20	+150	6.25	100	12	27	1	16	60	T-30
2SC3133	HPA	SI, NPN, EP	60	5	6	20	+150	6.25	100	12	27	0.5	13	60	T-30E

: T_a=25°C $: R_{th-a}

For Mobile radios, 30MHz 13.5V Series

<Tc=25°C>

2SC2097	HPA	SI, NPN, EP	50	5	15	150	+175	1.2	5000	13.5	30	4	75	55	T-40E
2SC3241	HPA	SI, NPN, EP	50	5	18	180	+175	0.83	5000	12.5	30	4	75	55	T-45E
2SC2904	HPA	SI, NPN, EP	50	5	22	200	+175	0.75	5000	12.5	30	7	100	55	T-40E
2SC3908	HPA	SI, NPN, EP	50	5	22	200	+175	0.75	5000	12.5	30	7	100	55	T-40E
2SC3240	HPA	SI, NPN, EP	50	5	25	270	+175	0.556	5000	12.5	30	7	100	55	T-45E

28V Series to Fixed Station Applications

<Tc=25°C>

2SC2133 *	HPA	SI, NPN, EP	55	4	5	75	+175	2	2000	28	220	4.5	30	55	T-40E
2SC2134 *	HPA	SI, NPN, EP	55	4	10	120	+175	1.25	5000	28	220	12	60	55	T-40E
2SC2609 *	HPA	SI, NPN, EP	55	4	15	170	+175	0.88	10mA	28	220	25	100	55	T-40E

* : Commuication grade

150MHz/400MHz Band 7.2V Series for Mobile Radios

<Tc=25°C>

2SC2055	HPA	SI, NPN, EP		4	0.3	#0.5	+135	$220	30	7.2	175	0.01	0.2	50	T-1B
2SC3404	HPA	SI, NPN, EP	18	3.5	1	5	+175	30	200	7.2	175	0.08	1.5	55	T-46
2SC3017	HPA	SI, NPN, EP	20	3.5	1	4	+175	37.5	200	7.2	175	0.1	1.5	55	T-8E
2SC2056 *	HPA	SI, NPN, EP	20	4	0.6	4	+175	37.5	100	7.2	175	0.2	1.6	55	T-8E
2SC3018	HPA	SI, NPN, EP	18	3.5	1.5	10	+175	15	300	7.2	175	0.15	3	55	T-31E
2SC3001	HPA	SI, NPN, EP	20	3.5	3	20	+175	7.5	500	7.2	175	0.3	6	60	T-31E
2SC4240	HPA	SI, NPN, EP	20	3.5	3	20	+175	7.5	500	7.2	175	0.3	6	60	T-46
2SC3629	HPA	SI, NPN, EP	20	3.5	1	5	+175	30	200	7.2	520	0.2	1.2	55	T-46
2SC3103	HPA	SI, NPN, EP	20	3.5	1.5	10	+175	15	300	7.2	520	0.6	2.8	55	T-31E
2SC3379	HPA	SI, NPN, EP	20	3.5	1.5	10	+175	15	300	7.2	520	0.6	2.8	55	T-46
2SC3104	HPA	SI, NPN, EP	20	3.5	3	20	+175	7.5	500	7.2	520	2	6	60	T-31E

: T_a=25°C $: R_{th-a}

UHF Bandwidth Range 24V Series for Linear Ampliifier

<Tc=25°C>

2SC2797 *	HPA	SI, NPN, EP	45	4	1	10	+175	15	400	24	770	1	5	55	T-41
2SC2798 *	HPA	SI, NPN, EP	45	4	2	30	+175	5	1000	24	770	3	12	55	T-41
2SC2799 *	HPA	SI, NPN, EP	45	4	4	50	+175	3	1500	24	770	8	25	55	T-41E
2SC2800 *	HPA	SI, NPN, EP	45	4	6	75	+175	2	2000	24	770	15	40	50	T-41E

* : Communication grade

150MHz Band 13.5V Series for Mobil Radios

<Tc=25°C>

Type No.	Aplication	Structure	Max. ratings						I_{CBO} (max)	P_O (min)				η_C (min)	Package outline
			V_{CBO} (V)	V_{EBO} (V)	I_C (I)	P_C (W)	T_j (°C)	R_{th-c} (°C/W)	(μA)	V_{CC} (V)	f (MHz)	P_{in} (W)	(W)	(%)	
2SC2053	HPA	SI, NPN, EP	40	4	0.3	#0.6	+135	$183	20	13.5	175	0.004	0.15	40	T-1B
2SC741 **	HPA	SI, NPN, EP	40	4	0.3	2.5	+175	60	1	13.5	150	0.01	0.2	50	T-8C
2SC2538	HPA	SI, NPN, EP	40	4	0.4	3	+175	36.7	100	13.5	175	0.05	0.5	45	T-1B
2SC730 **	HPA	SI, NPN, EP	40	4	0.4	3	+175	50	10	13.5	150	0.1	1	50	T-8
2SC1970	HPA	SI, NPN, EP	40	4	0.6	5	+175	25	100	13.5	175	0.12	1	50	T-30
2SC1947 *	HPA	SI, NPN, EP	35	4	1	10	+175	15	500	13.5	175	0.3	3.5	50	T-8E
2SC2627	HPA	SI, NPN, EP	35	4	2	20	+175	7.5	1000	13.5	175	0.25	5	60	T-41
2SC2237	HPA	SI, NPN, EP	35	4	2	20	+175	7.5	500	13.5	175	0.25	6	60	T-31E
2SC3628	HPA	SI, NPN, EP	35	4	2	20	+175	7.5	500	13.5	175	0.25	6	60	T-46
2SC1971	HPA	SI, NPN, EP	35	4	2	12.5	+175	10	500	13.5	175	0.6	6	60	T-30E
2SC1965 *	HPA	SI, NPN, EP	35	4	1	15	+175	10	500	13.5	175	0.6	6	50	TC-17
2SC2539	HPA	SI, NPN, EP	35	4	4	35	+175	4.3	1000	13.5	175	0.5	14	60	T-31E
2SC1729	HPA	SI, NPN, EP	35	4	3.5	35	+175	4.3	1000	13.5	175	1.4	14	60	T-31E
2SC1972	HPA	SI, NPN, EP	35	4	3.5	25	+175	6	1000	13.5	175	2.5	14	60	T-30E
2SC2628	HPA	SI, NPN, EP	35	4	4	40	+175	3.75	2000	13.5	175	1	15	60	T-41
2SC2094	HPA	SI, NPN, EP	40	4.5	3.5	30	+175	5	2000	13.5	175	2	15	60	T-31E
2SC1746	HPA	SI, NPN, EP	35	4	7	50	+175	3	2000	13.5	175	6	28	60	T-31E
2SC1946	HPA	SI, NPN, EP	35	4	7	50	+175	3	2000	13.5	175	6	28	60	T-31E
2SC1946A	HPA	SI, NPN, EP	35	4	7	50	+175	3	2000	13.5	175	3	30	60	T-31E
2SC2629	HPA	SI, NPN, EP	35	4	8	60	+175	2.5	3000	13.5	175	3.5	30	60	T-41
2SC2540	HPA	SI, NPN, EP	35	4	10	75	+175	2	2500	13.5	175	6	40	60	T-40E
2SC2630	HPA	SI, NPN, EP	35	4	14	100	+175	1.5	5000	13.5	175	10	50	60	T-40
2SC2694	HPA	SI, NPN, EP	35	4	20	140	+175	1.07	5000	13.5	175	15	70	60	T-40

: T_a=25°C $: R_{th-a} * : Communication grade ** : High-reliability communication grade

400MHz Band 13.5V Series for Mobile Radios

<Tc=25°C>

2SC3019	HPA	SI, NPN, EP	35	4	0.4	0.9	+135	166	500	12.5	520	0.02	0.5	40	T-43
2SC908 **	HPA	SI, NPN, EP	40	4	0.5	4.3	+175	35	50	13.5	500	0.4	1	50	T-8
2SC2131 *	HPA	SI, NPN, EP	40	4	0.6	4	+175	37.5	100	13.5	500	0.3	1.4	50	T-8E
2SC3101	HPA	SI, NPN, EP	35	4	1	10	+175	15	300	12.5	520	0.8	3	50	T-8E
2SC3630	HPA	SI, NPN, EP	35	4	1	10	+175	15	300	12.5	520	0.8	3	50	T-46
2SC1966	HPA	SI, NPN, EP	35	3.5	1	10	+175	15	100	13.5	470	0.5	3	50	T-31E
2SC3020	HPA	SI, NPN, EP	35	4	1	10	+175	15	300	12.5	520	0.3	3	50	T-31E
2SC1967	HPA	SI, NPN, EP	35	4	2	20	+175	7.5	200	13.5	470	1.5	7	50	T-31E
2SC3021	HPA	SI, NPN, EP	35	4	2	20	+175	7.5	500	12.5	520	1.2	7	50	T-31E
2SC4167	HPA	SI, NPN, EP	35	4	2	20	+175	7.5	500	12.5	520	1.2	7	50	T-46
2SC1968	HPA	SI, NPN, EP	35	4	5	40	+175	3.75	500	13.5	470	6	14	50	T-31E
2SC1968A	HPA	SI, NPN, EP	35	4	5	40	+175	3.75	500	13.5	470	4	14	55	T-31E
2SC3022	HPA	SI, NPN, EP	35	4	7	50	+175	3	2000	12.5	520	6	18	55	T-31E
2SC2695	HPA	SI, NPN, EP	35	4	10	75	+175	2	2000	13.5	520	9	28	55	T-31E
2SC2905	HPA	SI, NPN, EP	35	4	15	120	+175	1.25	2000	12.5	520	15	45	60	T-40E
2SC3102	HPA	SI, NPN, EP	35	4	18	170	+175	0.88	5000	12.5	520	20	60	60	T-41E

: T_a=25°C * : Communication grade ** : High-reliability communication grade

SELECTION GUIDE BY FUNCTION

900MHz Band 12.5V Series for Mobile Radios

<Tc=25°C>

Type No.	Aplication	Structure	Max. ratings						I_{CBO} (max) (μA)	P_O (min)				η_C (min) (%)	Package outline
			V_{CBO} (V)	V_{EBO} (V)	I_C (I)	P_C (W)	T_j (°C)	Rth-c (°C/W)		V_{CC} (V)	f (MHz)	P_{in} (W)	(W)		
2SC2932	HPA	SI, NPN, EP	35	3	2	20	+175	7.5	2000	12.5	900	1	6	55	T-31B
2SC2933	HPA	SI, NPN, EP	35	3	4	40	+175	3.75	2000	12.5	900	3	14	50	T-31B
2SC3105	HPA	SI, NPN, EP	35	3	7	80	+175	1.87	5000	12.5	850	15	30	50	T-44
2SC3804	HPA	SI, NPN, EP	35	3	12	100	+175	1.5	5000	13.5	850	20	40	50	T-44

L-Band (1.65GHz) 28V Series

<Tc=25°C>

2SC4524	HPA	SI, NPN, EP	50	4	2.5	30	+175	5	1000	28	1.65GHz	7	7	45	T-31B
2SC4525	HPA	SI, NPN, EP	50	4	5	60	+175	2.5	2000	28	1.65GHz	25	20	40	X-139
2SC4526	HPA	SI, NPN, EP	50	4	7.5	90	+175	1.7	3000	28	1.65GHz	10	28	40	X-139

15V Series for CATV/MATV Amplifier

<Tc=25°C>

2SC1324 **	HPA	SI, NPN, EP	35	4	0.15	3	+175	50	50	15	770	0.03	9		T-8

** : High-reliability communication grade

SELECTION GUIDE BY FUNCTION

RF DIODE's FOR MOBILE RADIO APPLICATIONS RF POWER SWITCHING

TYPE	Maximum Ratings (@Ta=25°C)			Main Electrical Characteristics (@Ta=25°C)				Package
	Tstg (°C)	Tj (°C)	P (mW)	$V_{(BR)R}$(V) @I_R=10μA	Ct (pF) @f=1MHz	rfs (Ω) @f=470MHz	I_F (mA) @V_F=1V	
MI301	−55~+175	+175	350	80min	*1 3.0max	*3 1.2max	100min	D-1
MI303	−55~+175	+175	500	180min	*1 4.0max	*3 1.0max	200min	D-2
MI402	−55~+175	+175	1.0W	270min	*2 3.0max	*4 0.7max	500min	D-3

*1 V_R=0V, *2 V_R=12V, *3 I_F=20mA, *4 I_F=50mA

TYPE	Maximum Ratings (@Ta=25°C)			Main Electrical Characteristics (@Ta=25°C)				Package
	Tstg (°C)	Tj (°C)	P (mW)	$V_{(BR)R}$ (V) @I_R=10μA	Ct (pF) @f=100MHz	rfs (Ω) @f=470MHz	I_F (mA) @V_F=1V	
MI308	−55~+175	+175	500	50min	*1 1.6max	*2 0.7max	100min	D-2
MI407	−55~+175	+175	1.0W	50min	*1 1.8max	*2 0.7max	100min	D-3
MI808	−55~+175	+175	*3 1.0W	50min	*1 1.2max	*2 0.7max	100min	D-6

*1 V_R=0V, *2 IF=50mA, *3 See the data sheet

RF SMALL SIGNAL SWITCHING

TYPFE	Maximum Ratings (@Ta=25°C)			Main Electrical Characteristics (@Ta=25°C)				Package
	Tstg (°C)	Tj (°C)	P (mW)	$V_{(BR)R}$ (V) @I_R=10μA	Ct (pF) @f=1MHz	rfs (Ω) @f=470MHz	I_F (mA) @V_F=1V	
MC103A	−55~+175	+175	200	30min	*1 1.5max	*4 1.0max	100min	D-4
MC301	−55~+175	+175	200	30min	*1 2.0max	*4 1.2max	100min	D-1
MC302	−55~+175	+175	200	30min	*2 2.2max	*5 0.8max	100min	D-1
MC804	−55~+125	+125	150	35min	*3 1.3max	*6 0.9max	100min	D-5

*1 V_R=15V, *2 V_R=10V, *3 V_R=6V, *4 I_F=10mA, *5 I_F=3mA, *6 I_F=2mA, f=100MHz

TYPE	Maximum Ratings (@Ta=25°C)			Main Electrical Characteristics (@Ta=25°C)				Package
	Tstg (°C)	Tj (°C)	P (mW)	$V_{(BR)R}$ (V) @I_R=10μA	Ct (pF) *1 @f=100MHz	rfs (Ω) *2 @I_F=10mA	rfs (kΩ) *2 @I_F=10μA	
MI105	−55~+175	+175	200	30min	0.5max	20max	1.0min	D-4

*1 V_R=0V, *2 f=50MHz

ATTENUATOR

TYPE	Maximum Ratings (@Ta=25°C)			Main Electrical Characteristics (@Ta=25°C)				Package
	Tstg (°C)	Tj (°C)	P (mW)	$V_{(BR)R}$ (V) @I_R=10μA	Ct (pF) *1 @f=1MHz	rfs (Ω) *2 @I_F=10mA	rfs (kΩ) *2 @I_F=10μA	
MI204	−55~+175	+175	200	30min	1.2max	10max	1.0min	D-1

*1 V_R=15V, *2 f=50MHz

AFC

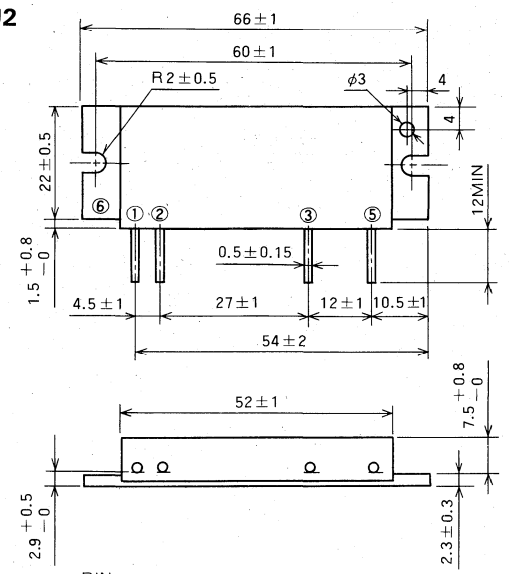
TYPE	Maximum Ratings (@Ta=25°C)			Main Electrical Characteristics (@Ta=25°C)			Package
	Tstg (°C)	Topr (°C)	P (mW)	$V_{(BR)R}$ (V) @I_R=10μA	Ct (pF) @f=1MHz, V_R=3V	Ct (pF) @f=1MHz, V_R=20V	
MV201	−55~+100	−50~+100	250	23min	9~14	2.3~3.3	D-1

OUTLINE DRAWINGS

OUTLINE DIAGRAM

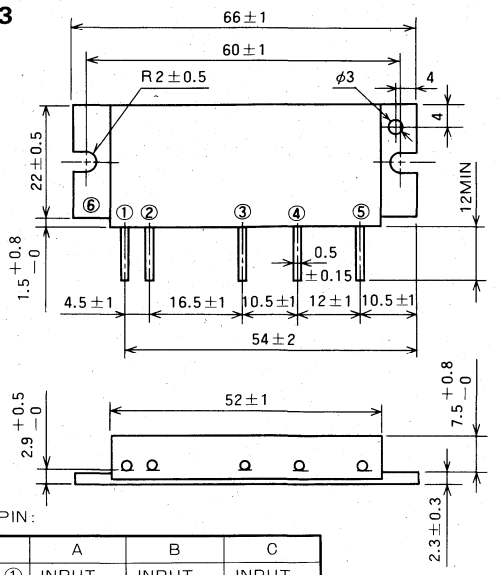
Dimensions in mm

H2



PIN:
① INPUT
② V_{CC1}
③ V_{CC2}
④ OUTPUT
⑤ GND

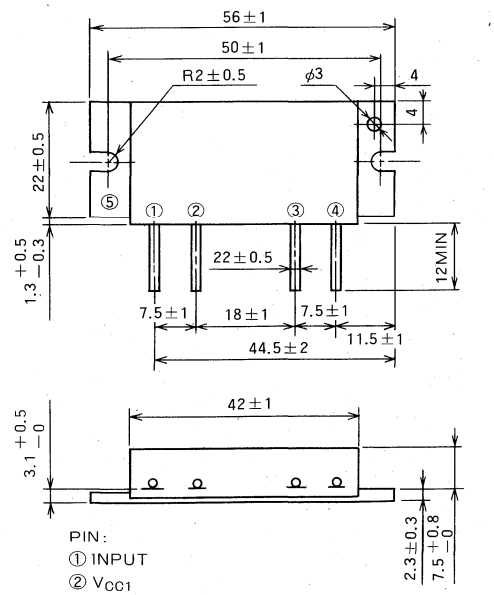
H3



PIN:

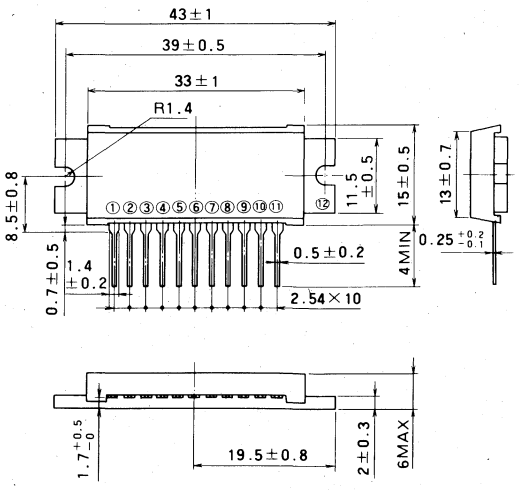
	A	B	C
①	INPUT	INPUT	INPUT
②	V_{CC1}	V_{CC1}	V_{BB}
③	V_{CC2}	V_{BB}	V_{CC1}
④	V_{CC3}	V_{CC2}	V_{CC2}
⑤	OUTPUT	OUTPUT	OUTPUT
⑥	GND	GND	GND

H6



PIN:
① INPUT
② V_{CC1}
③ V_{CC2}
④ OUTPUT
⑤ GND

H8



PIN:

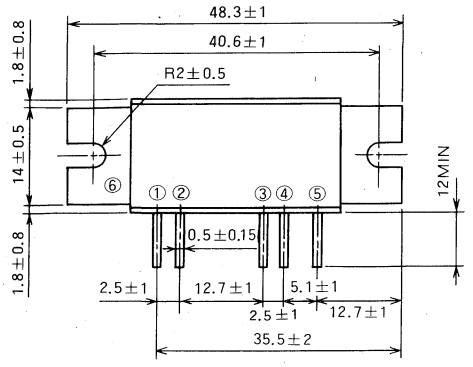
①	INPUT
②~④	GND
⑤	V_{CC1}
⑥~⑧	GND
⑨	V_{CC2}
⑩	GND
⑪	OUTPUT
⑫	GND

OUTLINE DRAWINGS

OUTLINE DRAWING

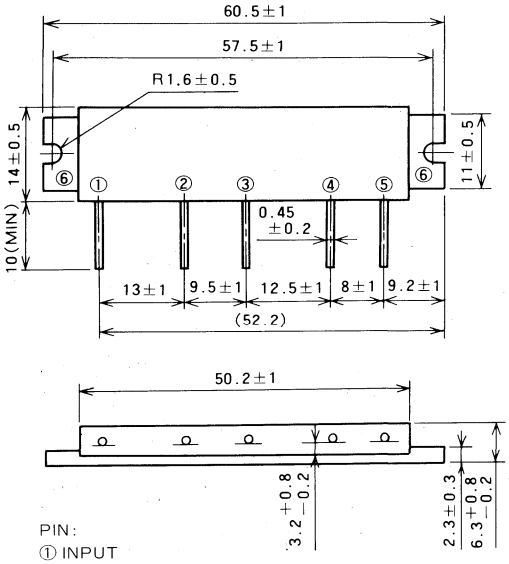
Dimensions in mm

H10



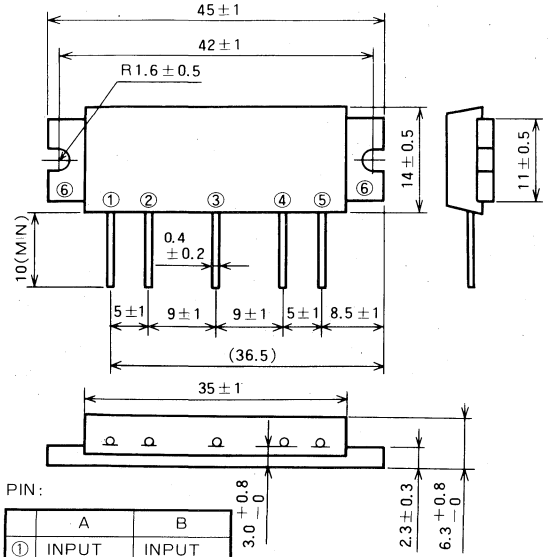
PIN; :
① INPUT
② V_{CC1}
③ V_{BB}
④ V_{CC2}
⑤ OUTPUT
⑥ GND

H11



PIN:
① INPUT
② V_{CC1}
③ V_{BB}
④ V_{CC2}
⑤ OUTPUT
⑥ GND

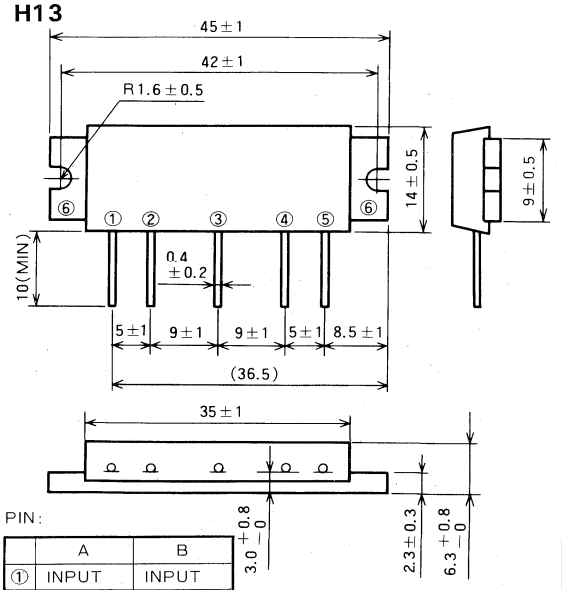
H12



PIN:

	A	B
①	INPUT	INPUT
②	V_{CC1}	V_{CC1}
③	V_{BB}	V_{CC2}
④	V_{CC2}	V_{CC3}
⑤	OUTPUT	OUTPUT
⑥	GND	GND

H13



PIN:

	A	B
①	INPUT	INPUT
②	V_{CC1}	V_{CC1}
③	V_{BB}	V_{CC2}
④	V_{CC2}	V_{CC3}
⑤	OUTPUT	OUTPUT
⑥	GND	GND

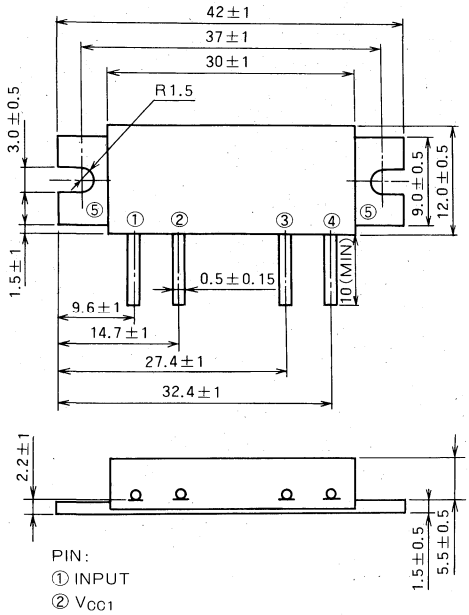
MITSUBISHI ELECTRIC

OUTLINE DRAWINGS

OUTLINE DRAWING

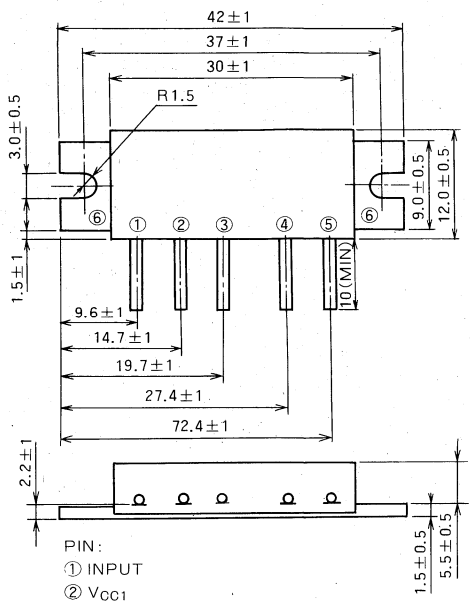
Dimensions in mm

H14



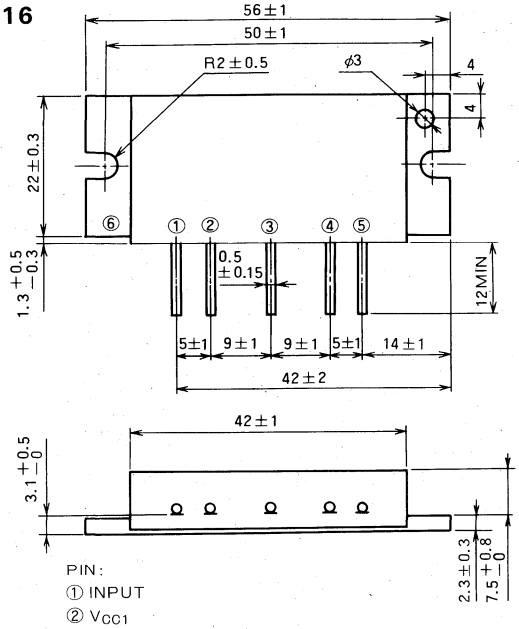
PIN:
① INPUT
② V_{CC1}
③ V_{CC2}
④ OUTPUT
⑤ GND

H15



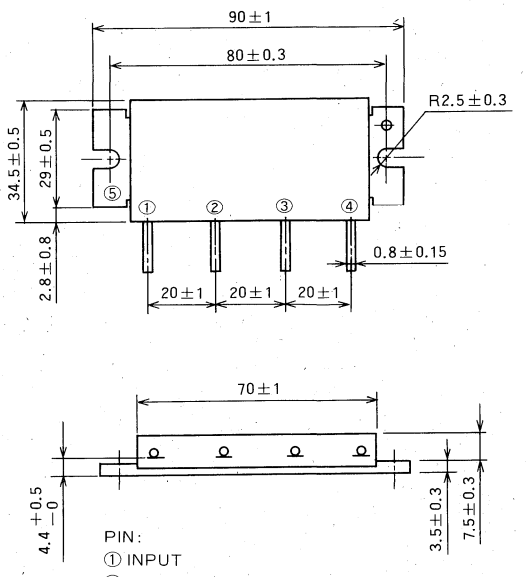
PIN:
① INPUT
② V_{CC1}
③ V_{CC2}
④ V_{CC3}
⑤ OUTPUT
⑥ GND

H16



PIN:
① INPUT
② V_{CC1}
③ V_{CC2}
④ V_{CC3}
⑤ OUTPUT
⑥ GND

H17



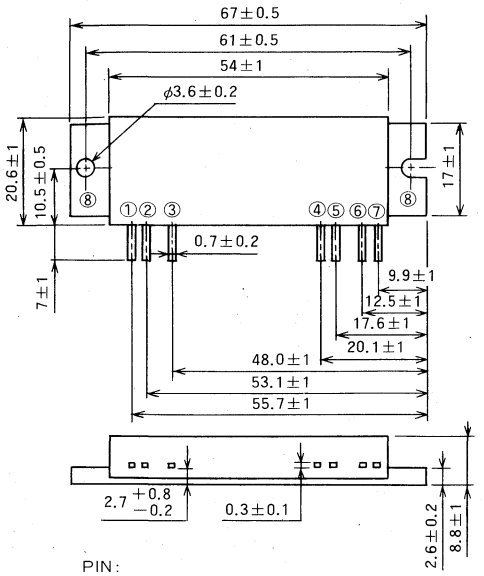
PIN:
① INPUT
② V_{CC2}
③ V_{CC2}
④ OUTPUT
⑤ GND

OUTLINE DRAWINGS

OUTLINE DRAWING

Dimensions in mm

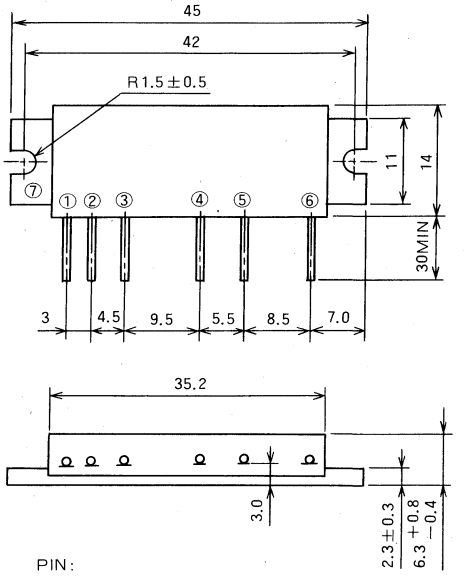
H18



PIN:

① OUTPUT	⑤ V_{CC1}
② GND	⑥ GND
③ V_{CC2}	⑦ INPUT
④ GND	⑧ GND

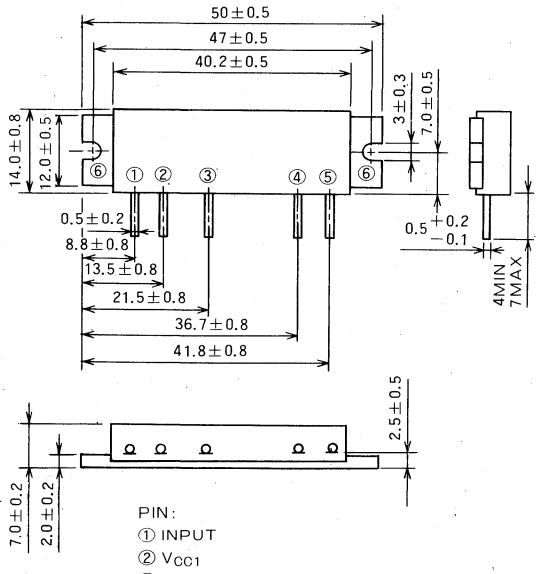
H24



PIN:

① INPUT	⑤ V_{D2}
② V_{G1}	⑥ OUTPUT
③ V_{D1}	⑦ GND
④ V_{G2}	

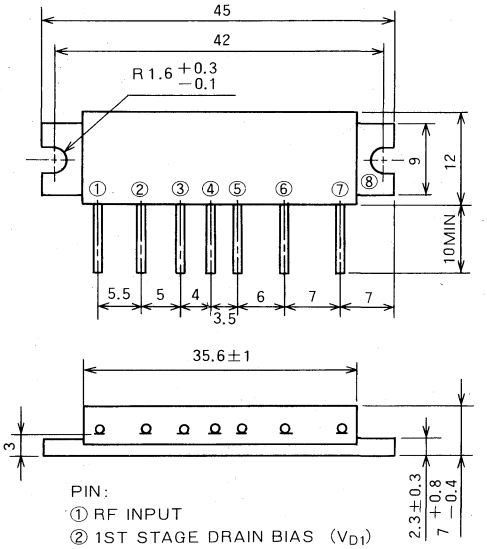
H25



PIN:

① INPUT
② V_{CC1}
③ V_{CC2}
④ V_3
⑤ OUTPUT
⑥ GND

GH-3



PIN:

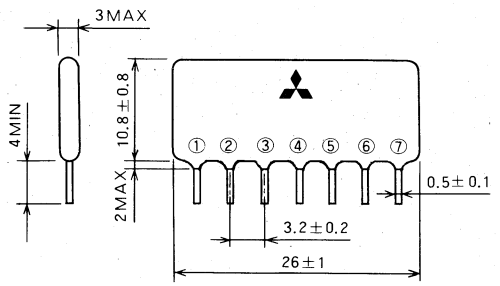
① RF INPUT	
② 1ST STAGE DRAIN BIAS	(V_{D1})
③ 3nd STAGE GATE BIAS	(V_{G2})
④ 2nd STAGE DRAIN BIAS	(V_{D2})
⑤ 3rd STAGE GATE BIAS	(V_{G3})
⑥ 3rd STAGE DRAIN BIAS	(V_{D3})
⑦ RF OUTPUT	
⑧ FLANGE (GROUND)	

MITSUBISHI ELECTRIC

OUTLINE DRAWING

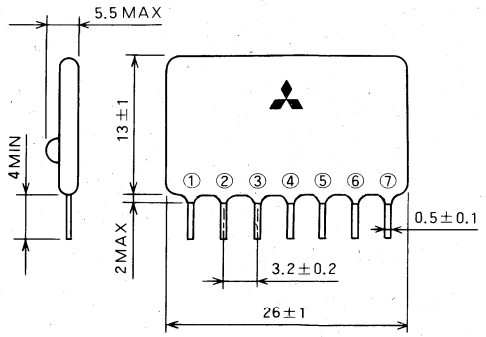
Dimensions in mm

D-7



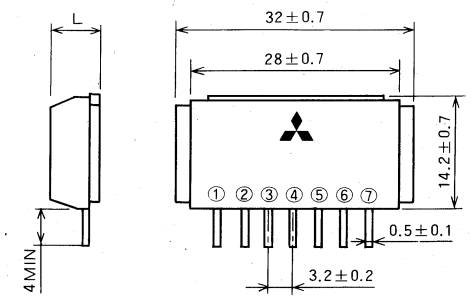
① GND TERMINAL
② RX TERMINAL
③ GND TERMINAL
④ BIAS TERMINAL
⑤ ANT TERMINAL
⑤ GND TERMINAL
⑦ TX TERMINAL

D-8



① GND TERMINAL
② RX TERMINAL
③ GND TERMINAL
④ BIAS TERMINAL
⑤ ANT TERMINAL
⑥ GND TERMINAL
⑦ TX TERMINAL

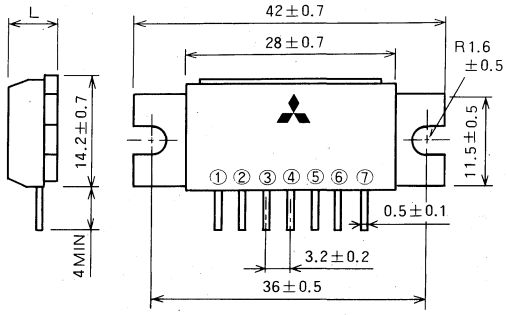
D-9



① TX TERMINAL
② GND TERMINAL
③ ANT TERMINAL
④ BIAS TERMINAL
⑤ GND TERMINAL
⑥ RX TERMINAL
⑦ GND TERMINAL

	L
a	5±0.5
b	6±0.5

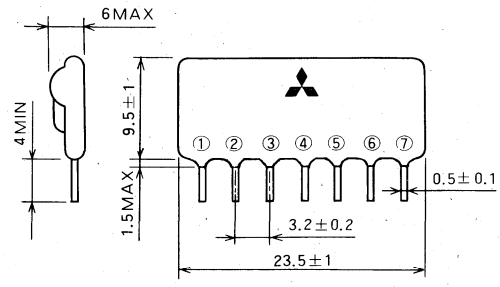
D-10



① TX TERMINAL
② GND TERMINAL
③ ANT TERMINAL
④ BIAS TERMINAL
⑤ GND
⑥ RX
⑦ GND

	L
a	5.5±0.5
b	6.5±0.5
c	9±0.5

D-11

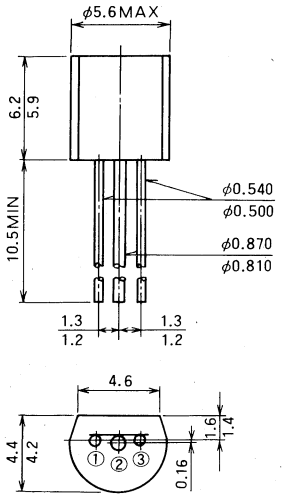


① GND TERMINAL
② RX TERMINAL
③ GND TERMINAL
④ BIAS TERMIN L
⑤ ANT TERMINAL
⑥ GND TERMINAL
⑦ TX TERMINAL

OUTLINE DRAWING

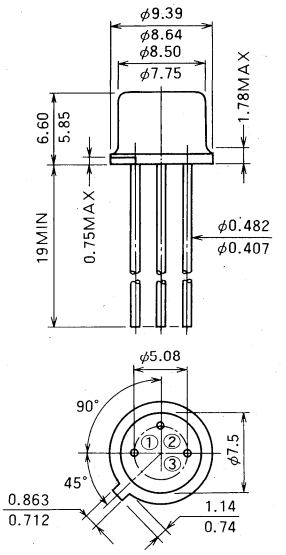
Dimensions in mm

T-1B



① EMITTER
② COLLECTOR
③ BASE

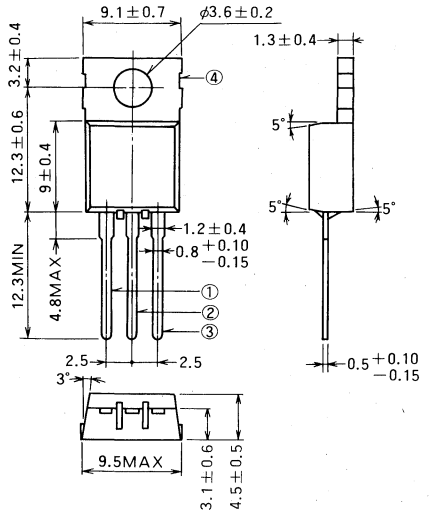
T-8



① EMITTER
② BASE
③ COLLECTOR JEDEC : TO-39

NOTE T-8C : COLLECTTOR ELECTRODE IS CONNECTED WITH CASE.
T-8E : EMITTER ELECTRODE IS CONNECTED WITH CASE.

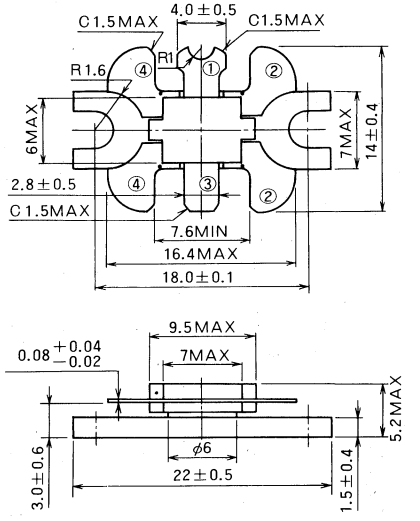
T-30



T-30
① BASE
② COLLECTOR (FIN)
③ EMITTER
④ FIN (COLLECTOR)

T-30E
① BASE
② EMITTER (FIN)
③ COLLECTOR
④ FIN (EMITTER)

T-31



T-31E :
① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

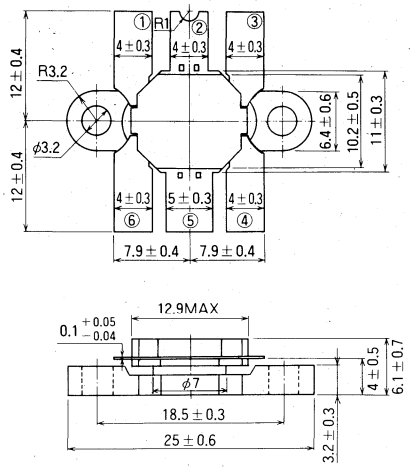
T-31B :
① COLLECTOR
② BASE (FLANGE)
③ EMITTER
④ BASE (FLANGE)

MITSUBISHI ELECTRIC

OUTLINE DRAWING

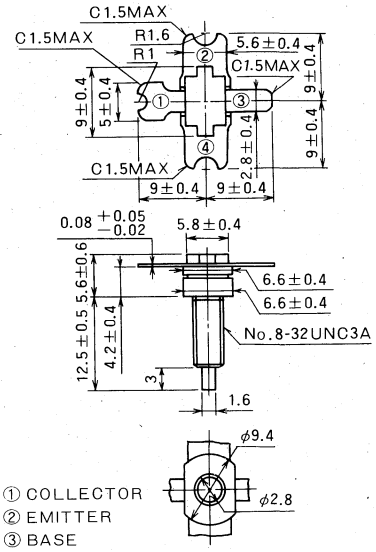
Dimensions in mm

T-40



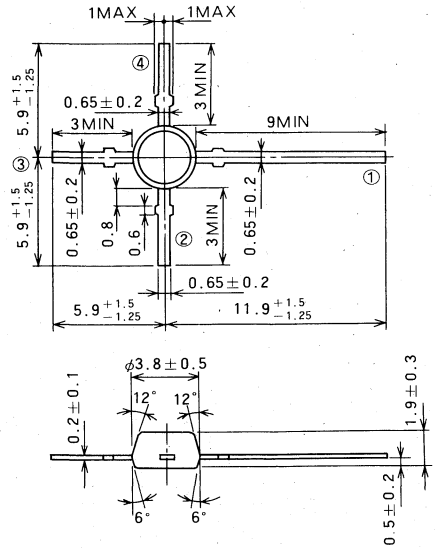
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
NOTE
T-40 : ALL ELECTRODES ARE ISOLATED FROM FLANGE.
T-40E : EMITTER ELECTRODES ARE CONNECTED WITH FLANGE.

T-41



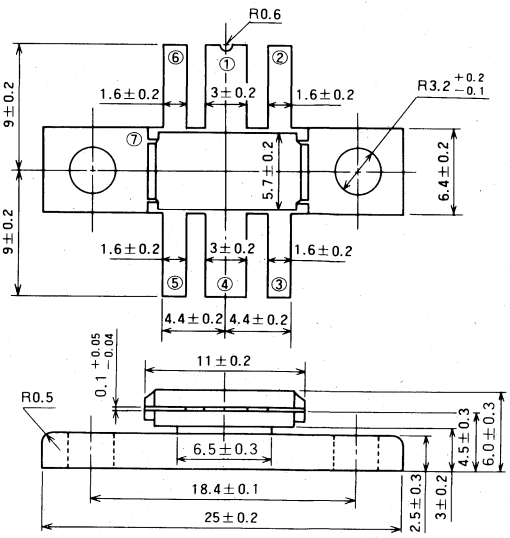
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
NOT
T-41 : ALL ELECTRODES ARE ISOLATED FROM FLANGE.
T-41E : EMITTER ELECTRODES ARE CONNECTED WITH FLANGE

T-43



① COLLECTOR
② EMITTER
③ BASE
④ EMITTER

T-44



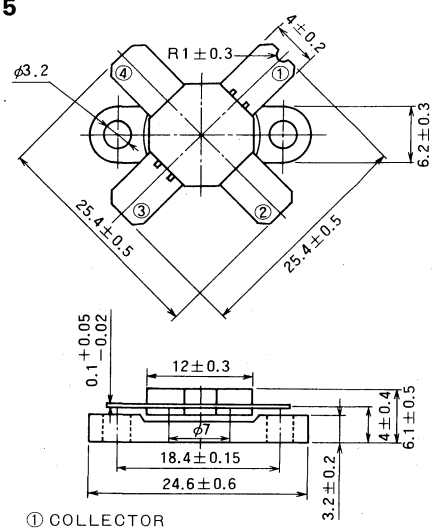
① COLLECTOR
② BASE (FLANGE)
③ EMITTER
④ BASE (FLANGE)

OUTLINE DRAWINGS

OUTLINE DRAWING

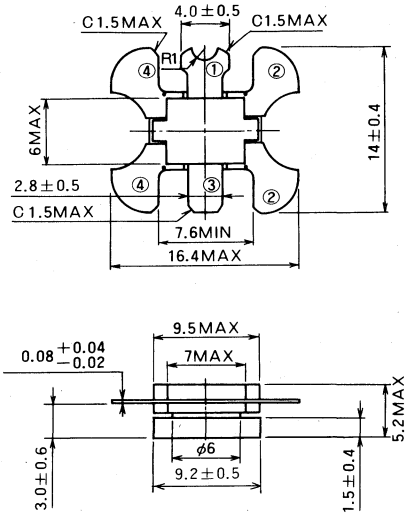
Dimensions in mm

T-45



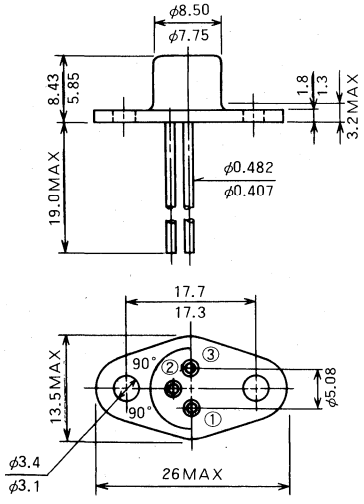
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
NOTE
T-45 : ALL ELECTRODES ARE ISOLATED FROM FLANGE.
T-45E : EMITTER ELECTRODES ARE CONNECTED WITH FLANGE.

T-46



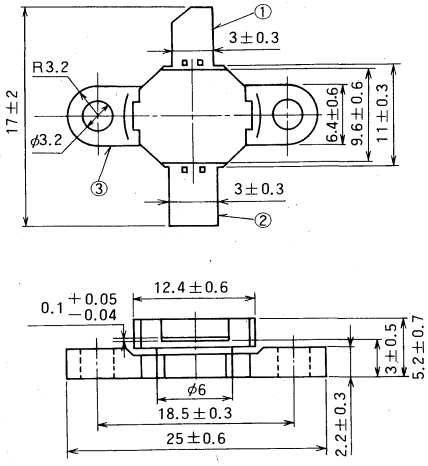
① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

TC-17



① EMITTER (CASE)
② BASE
③ COLLECTOR

X-139



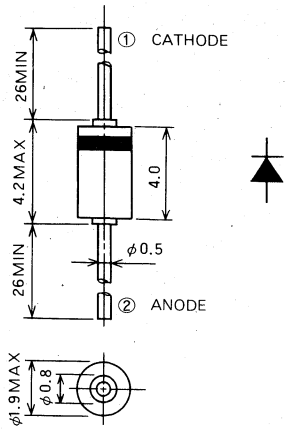
① COLLECTOR
② EMITTER
③ BASE (FLANGE)

MITSUBISHI ELECTRIC

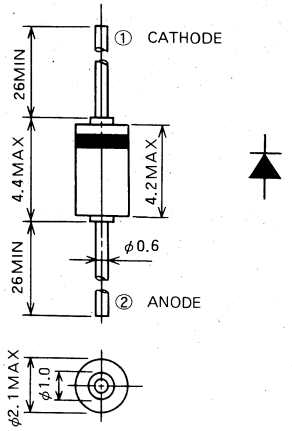
OUTLINE DRAWING

Dimensions in mm

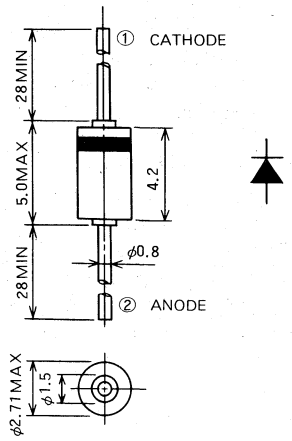
D-1



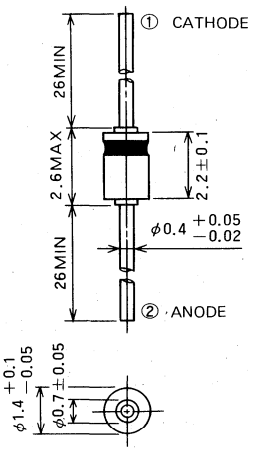
D-2



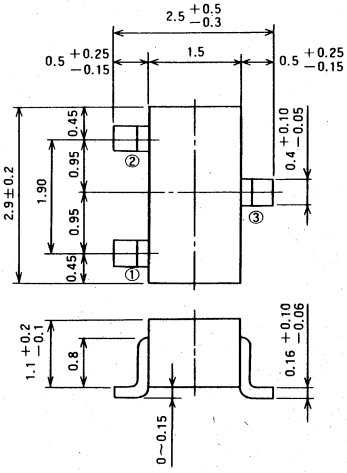
D-3



D-4

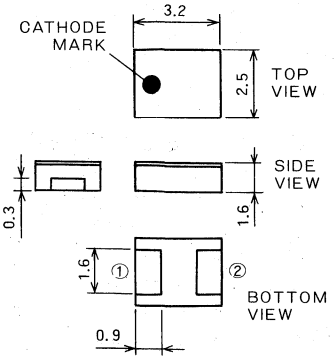


D-5



① ANODE
② ANODE
③ CATHODE (COMMON)

D-6



① CATHODE
② ANODE

PRECAUTIONS AND RECOMMENDATIONS

GENERAL

Mitsubishi RF Power Modules for mobile radio applications have high reliability and good performance, as they are designed and manufactured under strict quality control. However, the reliability of semiconductor devices is remarkably affected by usage conditions such as circuit constructions, mounting method, environments, etc.. In order to keep high reliability and obtain good performance when using Mitsubishi RF Power Modules, the following important points concerning maximum ratings, handling, etc., should be noted before use.

1. MAXIMUM RATINGS

Maximum ratings of the RF Power Modules are defined by the "Absolute Maximum Ratings" shown in separate specification sheet. Maximum ratings should not be exceeded in any circumstances, even momentarily. If a device is operated in excess of the absolute maximum ratings, the device may immediately be degraded or destroyed. Futhermore, in designing an electronic circuit using RF power Modules, it is necessary to note that the maximum ratings of the devices should not be exceeded even if external conditions are changed.

2. NORMAL OPERATING VOLTAGE

Normal operating voltage is 12.5~13.8 volts for Mitsubishi RF Power Modules, because they are designed for mobile radio applications. The regulated 9 volts is recommended for the base biasing voltage of the modules for linear power amplifiers (for SSB).

3. THERMAL DESIGN

In order to keep high reliability of the equipment, it is better to keep the module temperature low. The case temperature of the module, when operated standard conditions, is lower than 90°C under all severe ambient temperature, recommend normally 60°C.

4. MOUNTING and HANDLING

4-1 When the module is mounted on to a heat sink of a equipment, thermal compound to get good heat sinking should be applied between the module's fin and the heat sink. Following thermal compound for good heat sinking is recommended.

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4-2 When mounting a module to the circuit, do not apply excessive stress to the terminal leads or the fin. In particular, if there are some foreign objects between the module and the heat sink, or if there are some burrs or rising on the surface of the heat sink, it may happen that the substrate of the module will crack or break due to excessive stress from screwing the module on to the heat sink. Therefore, the surface of the heat sink in contact with the module must be as flat as possible.

When screwing a module to the heat sink, torque screw is recommended as 5 to 6kg-cm when using ϕ3mm screws.

4-3 For soldering, the major precautions are as follows:

1) Flux;
Roles of flux are to remove oxidized layer on the object, and prevent from oxidation during heating or lowering surface tension on the objects. Rosin flux, which is less corrosional and highly insulative, is recommended.

2) Soldering temperature;
The temperature of the lead soldering should be lower than 260°C and shorter than 10 seconds, or lower than 350°C and shorter than 3 seconds.

3) Cleaning after soldering;
The recommended solvent for cleaning the residual flux is the Ethyl Alcohol. Trichlene type solvents should not be used.

4-4 When the module is screwed after soldering the terminal leads to the circuit board, excessive stress is applied to the leads. Therefore, please solder the terminal leads to the circuit board after screwing the module to the heat sink.

4-5 If the module falls onto a hard surface, it will be damaged by mechanical shock and can no longer be used.

4-6 To obtain good stability and electrical performances, it is necessary to take precausions concerning the earth potential of the module. As the fin is the ground terminal, the fin should be connected to the ground of the set completly in RF condition.

4-7 The values of input VSWR and output VSWR of the module indicated in the specification sheet are guaranteed when the input and output leads are straight and these leads are connected to the load 50Ω within 10mm length. If the device is mounted under different conditions from these mentionedabove, the performances, such as output power and efficiency, may be degraded due to the impedance mismatch. In order to reform such an impedance mismatch, please set the additional matching circuits to get good impedance matching.

5. VOLTAGE SUPPLY

The modules have 2 or 3 terminals for DC power supply. If these terminals are combined without RFC (Radio Frequency Choke), or if each terminal is not bypassed with the condenser, parasitic oscillation occasionally may occured. Therefore, the DC Power Supply Terminals should be combined with RFC, and each terminal bypassed with the condensers (10μF and 4700pF in Parallel).

The first stage transistor of the module even for FM is operated in class AB. When excessively high voltage is applied to the first stage DC Power Supply Terminal, the first stage transistor may be destroyed due to current runaway. Therefore, the first stage supply voltage must be controlled, not exceeding 17 volts DC.

RF POWER MODULES

2

M57704 SERIES

335~512MHz, 12.5V, 13W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57704 is a thick film RF power Imodule specifically designed for 335 ~ 512MHz, 10W FM mobile radios.

FEATURES

- High power gain: G_P = 18.1dB, P_O = 13W
  @V_{CC} = 12.5V, P_{in} = 0.2W
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 14W.
- Wide range on operation case temperature.
- Excellent stability from low power to high power level due to the class AB operation of 1st stage.

APPLICATION

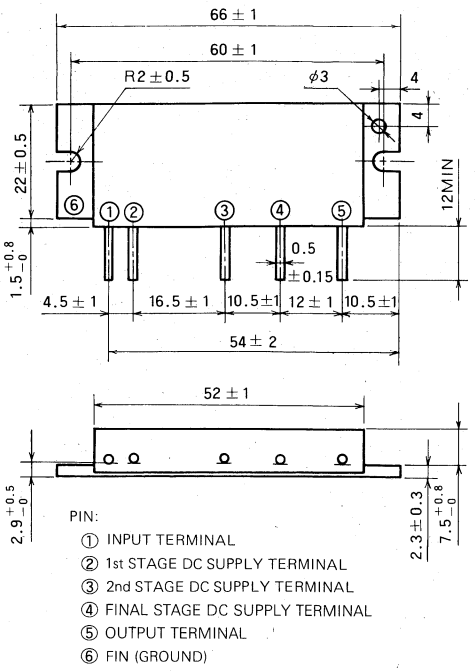
Output stage of 10 watts output mobile radio sets (FM) in 335 ~ 512MHz UHF band.

FREQUENCY ITEMS

M57704EL : 335 ~ 360MHz
M57704SL : 360 ~ 380MHz
M57704UL : 380 ~ 400MHz
M57704L : 400 ~ 420MHz
M57704M : 430 ~ 450MHz
M57704H : 450 ~ 470MHz
M57704UH : 470 ~ 490MHz
M57704SH : 490 ~ 512MHz

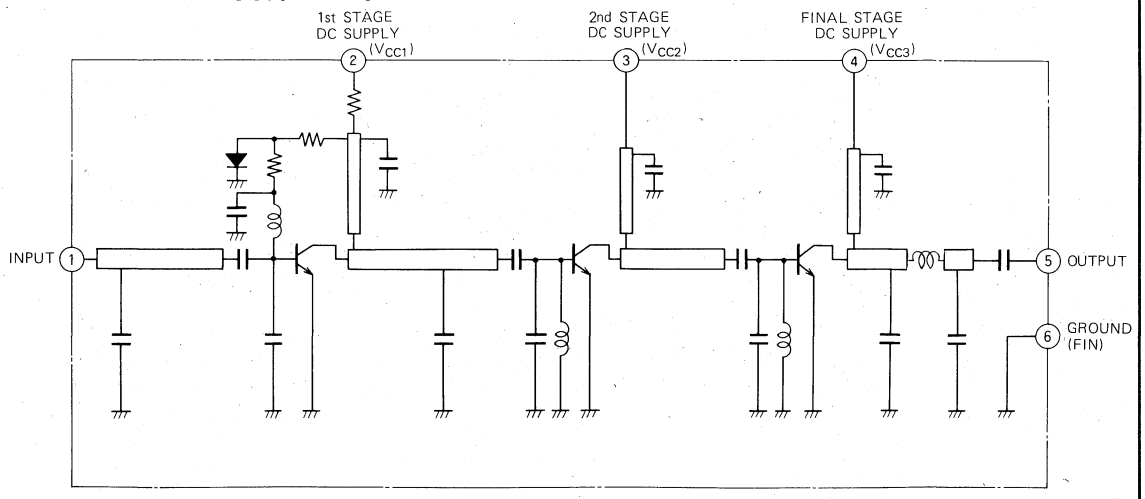
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



335～512MHz, 12.5V, 13W, FM FOR MOBILE RADIO APPLICATION

ABSOLUTE MAXIMUM RATINGS (T_C=25℃ unless otherwise specified)

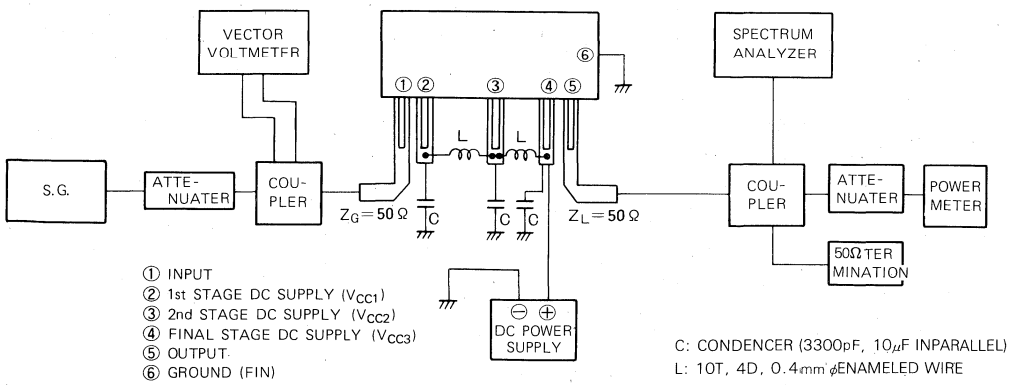
Symbol	Ratings	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		5	A
P_{in}	Input power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\Omega$	20	W
$T_{C(op)}$	Operation case temperature		−30～+110	℃
T_{stg}	Storage temperature		−40～+110	℃

ELECTRICAL CHARACTERISTICS (T_C=25℃ unless otherwise specified)

Symbol	Characteristics	Test conditions	Limits			
			Min	Typ	Max	
P_O	Output power	$V_{CC}=12.5V$, $P_{in}=0.2W$, $Z_G=Z_L=50\Omega$ (Note 1)	13	15		W
η_T	Total efficiency		35	40		%
—	2nd Harmonic				−30	dB
—	3rd Harmonic				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2		—
—	Load VSWR tolerance	$V_{CC}=15.2V$, $P_O=14W$, $Z_G=50\Omega$ $T=5sec.$ (Note 1)	20 : 1			—

Note 1. Test frequency condition
- M57704EL : 335～360MHz
- M57704SL : 360～380MHz
- M57704UL : 380～400MHz
- M57704L : 400～420MHz
- M57704M : 430～450MHz
- M57704H : 450～470MHz
- M57704UH : 470～490MHz
- M57704SH : 490～512MHz

TEST DIAGRAM

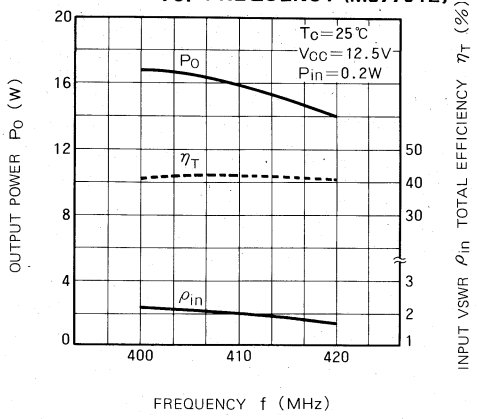


① INPUT
② 1st STAGE DC SUPPLY (V_{CC1})
③ 2nd STAGE DC SUPPLY (V_{CC2})
④ FINAL STAGE DC SUPPLY (V_{CC3})
⑤ OUTPUT
⑥ GROUND (FIN)

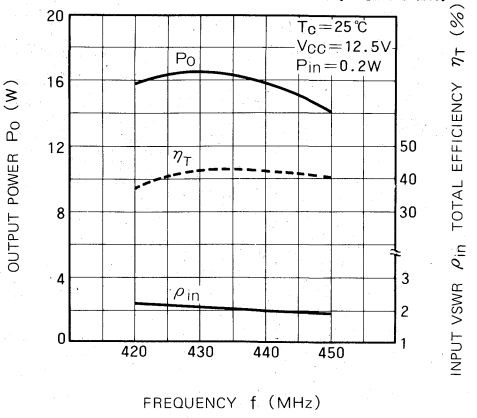
C: CONDENCER (3300pF, 10μF INPARALLEL)
L: 10T, 4D, 0.4mm φENAMELED WIRE

TYPICAL PERFORMANCE DATA

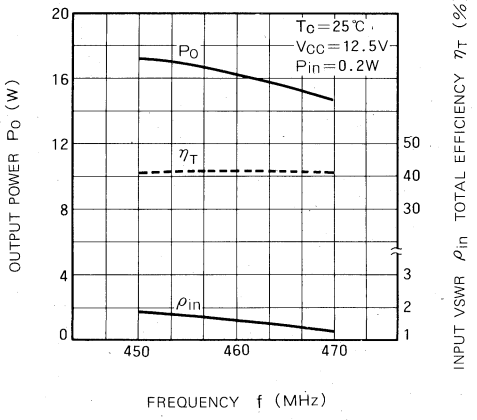
OUTPUT POWER TOTAL EFFICIENCY INPUT VSWR VS. FREQUENCY (M57704L)



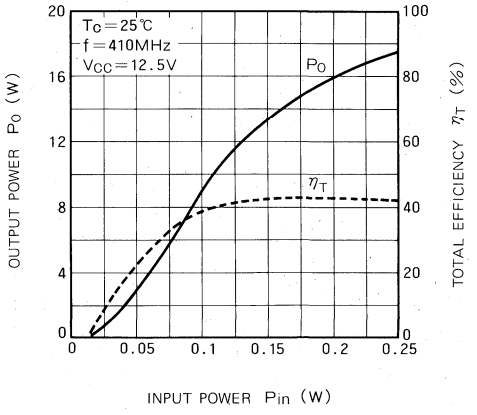
OUTPUT POWER TOTAL EFFICIENCY INPUT VSWR VS. FREQUENCY (M57704M)



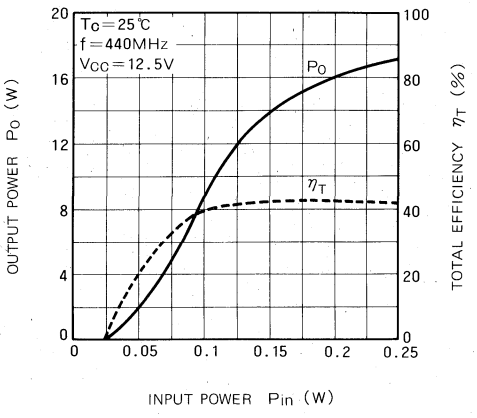
OUTPUT POWER TOTAL EFFICIENCY INPUT VSWR VS. FREQUENCY (M57704H)



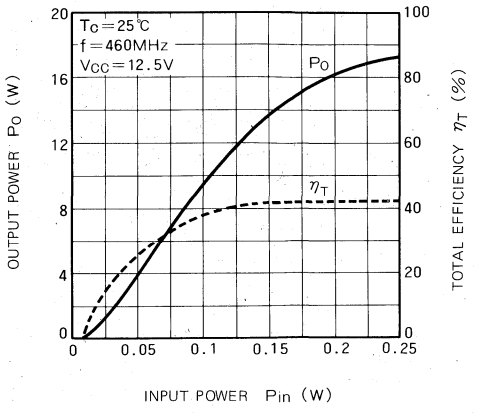
OUTPUT POWER TOTAL EFFICIENCY VS, INPUT POWER (M57704L)



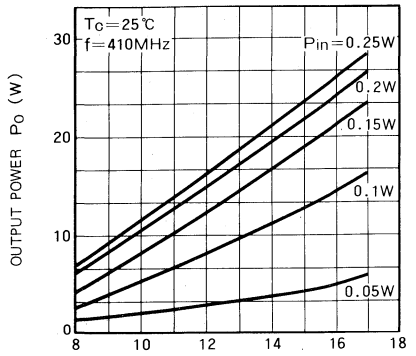
OUTPUT POWER TOTAL EFFICIENCY VS. INPUT POWER (M57704M)



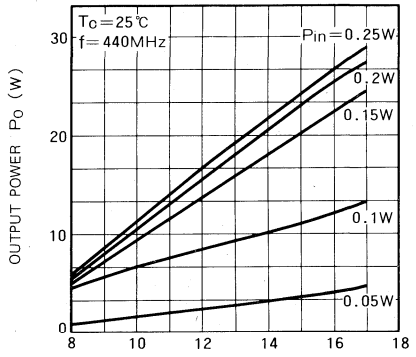
OUTPUT POWER TOTAL EFFICIENCY VS. INPUT POWER (M57704H)



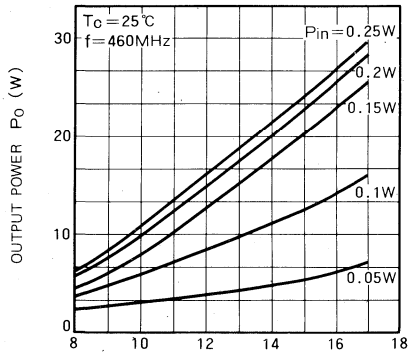
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57704L)



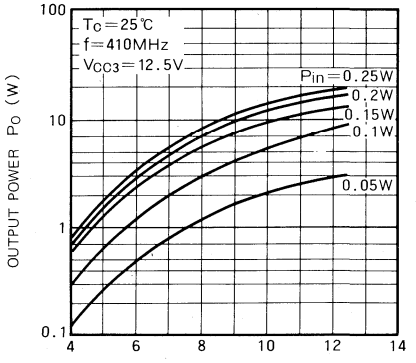
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57704M)



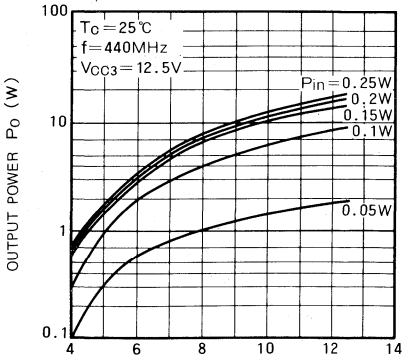
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57704H)



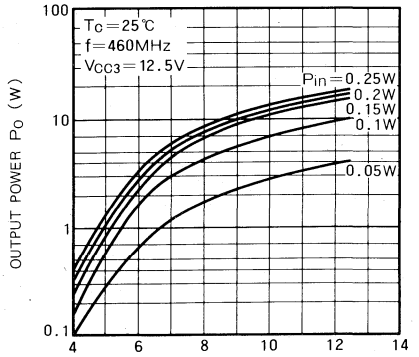
OUTPUT POWER VS. 1st AND 2nd STAGE VOLTAGE (M57704L)



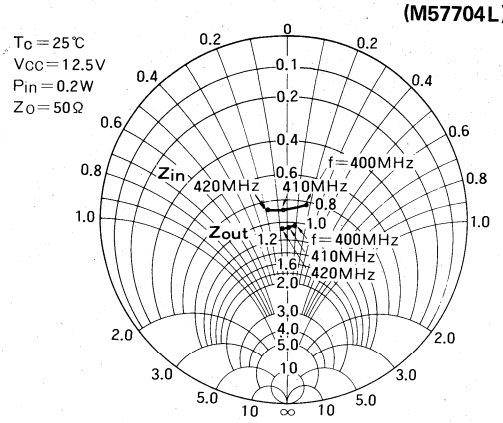
OUTPUT POWER VS. 1st AND 2nd STAGE VOLTAGE (M57704M)



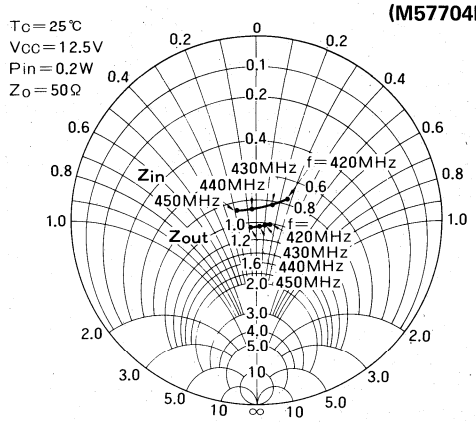
OUTPUT POWER VS. 1st AND 2nd STAGE VOLTAGE (M57704H)



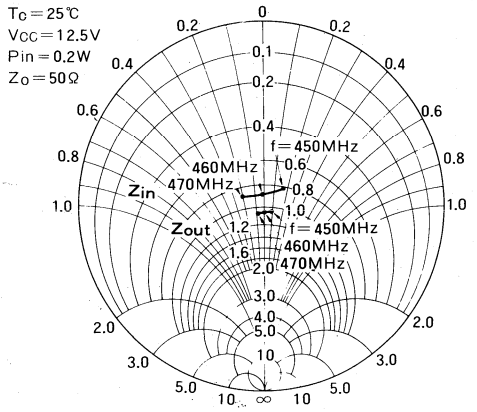
INPUT IMPEDANCE OUTPUT IMPEDANCE
(M57704L)



INPUT IMPEDANCE OUTPUT IMPEDANCE
(M57704M)



INPUT IMPEDANCE OUTPUT IMPEDANCE
(M57704H)



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 15°C/W (Typ.)

b) Second stage transistor

$R_{th(j-c)2}$ = 6°C/W (Typ.)

c) Final stage transistor

$R_{th(j-c)3}$ = 2.5°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

P_O = 13W, V_{CC} = 12.5V, P_{in} = 0.2W, η_T = 35% (minimum rating), P_{O1} (Note 1) = 1.5W, P_{O2} (2) = 6W, I_T = 3.0A (I_{T1} (3) = 0.25A, I_{T2} (4) = 0.75A, I_{T3} (5) = 2.0A)

Note 1: Output power of the first stage transistor
Note 2: Output power of the second stage transistor
Note 3: Circuit current of the first stage transistor
Note 4: Circuit current of the second stage transistor
Note 5: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
$= (12.5 \times 0.25 - +0.2) \times 15 + T_C$
$= 27 + T_C$ (°C)

Note 6: Package temperature of device

- Junction temperature of the second stage transistor

$T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1} \times R_{th(j-c)2} + T_C$
$= (12.5 \times 0.75 - 6 + 1.5) \times \quad + T_C$
$= 29 + T_C$ (°C)

- Junction temperature of the final stage transistor

$T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-3)} + T_C$
$= (12.5 \times 2.0 - 13 + 6) \times 2.5 + T_C$
$= 45 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep to package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 13W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_c - T_a}{(P_o/\eta_T) - P_o + P_{in}} = \frac{90 - 60}{(13/0.35) - 13 + 0.2}$$
$$= 1.2\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 117°C, T_{j2} = 119°C, T_{j3} = 135°C at T_{j3} = 135°C at Ta = 60°C, T_C = 90°C.

In the annual average of ambinet temperature is 30°C,

T_{j1} = 87°C, T_{j2} = 89°C, T_{j3} = 105°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57706 SERIES

135~175MHz, 5W, FM
FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57706 is a thick film RF power module specifically designed for 135 ~ 175MHz, 5W FM mobile radios.

FEATURES

- Frequency Range . . . . . 135 ~ 175MHz
- High Power 8W
- High Gain 16.0dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 12W.

APPLICATION

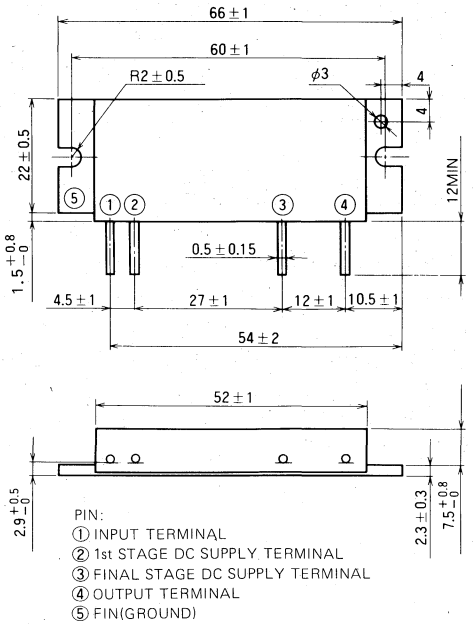
Output stage of 5W output mobile radio sets (FM) is 135 ~ 175MHz VHF band.

FREQUENCY ITEMS

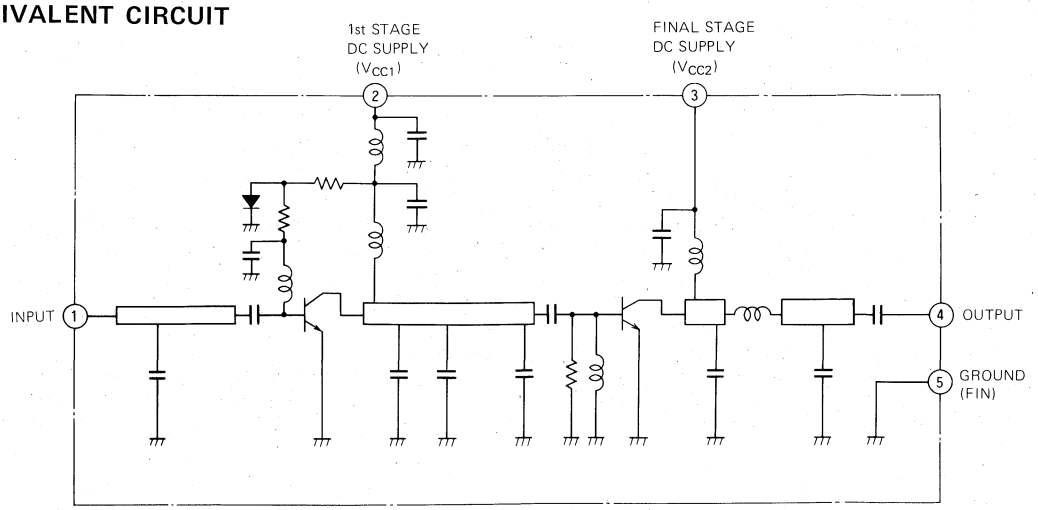
M57706L: 135 ~ 145MHz
M57706 : 145 ~ 175MHz

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



135～175MHz, 5W, FM
FOR MOBILE RADIO APPLICATION

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

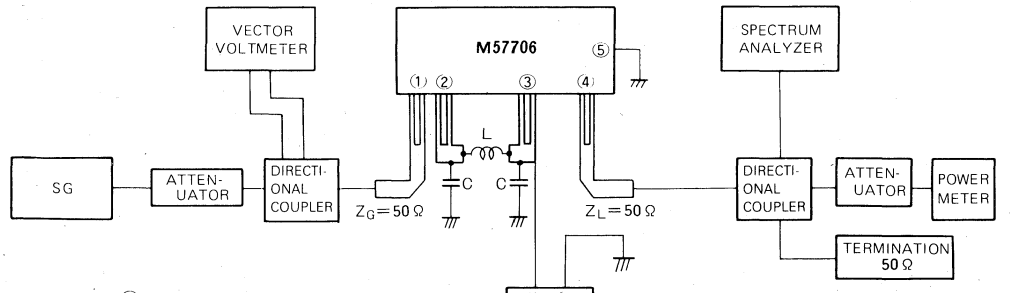
Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		5	A
Pin	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	14	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, Pin=0.2W, $Z_G=Z_L=50\,\Omega$ (Note.1)	8	10		W
η_T	Total efficiency		35	40		%
—	2nd harmonic				−15	dB
—	3rd harmonic				−25	dB
ρin	Input VSWR				4	—
ρout	Output VSWR				2	—
—	Load VSWR tolerance	V_{CC}=15.2V, P_O=8W, $Z_G=50\,\Omega$, 5sec (Note.1)	20：1			—

Note 1. Test frequency condition
M57706L: 135～145MHz
M57706 : 145～175MHz

TEST DIAGRAM



① INPUT
② 1st STAGE DC SUPPLY (V_{CC1})
③ FINAL STAGE DC SUPPLY (V_{CC2})
④ OUTPUT
⑤ FIN(GROUND)

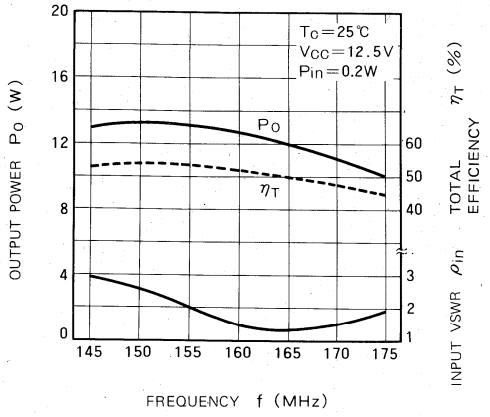
C : 3300pF, 22μF(50V)
L : 10T, 4D, φ0.4mm ENAMELED WIRE

MITSUBISHI ELECTRIC

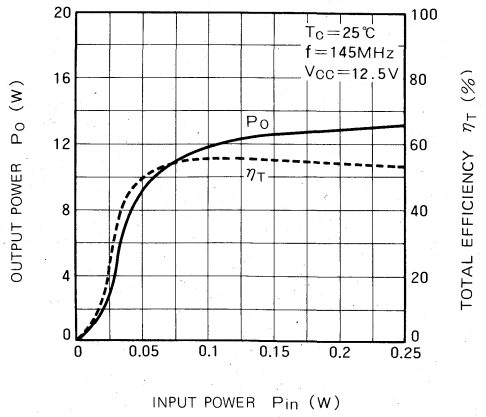
TYPICAL PERFORMANCE DATA

(Typical performance datas of M57706 are shown under, Typical performance datas of M57706L are similar to these of M57706)

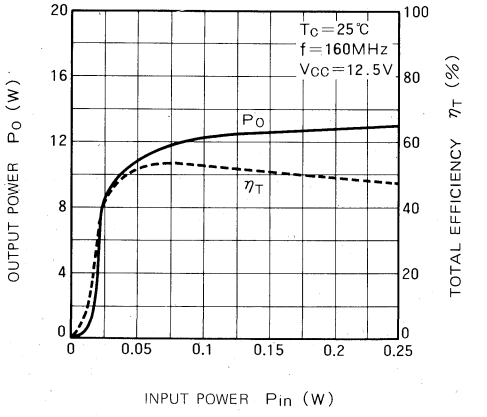
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



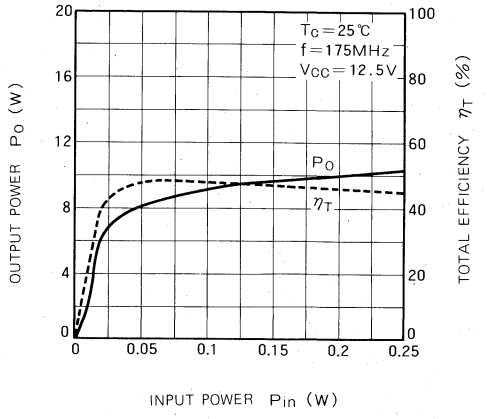
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (f = 145MHz)



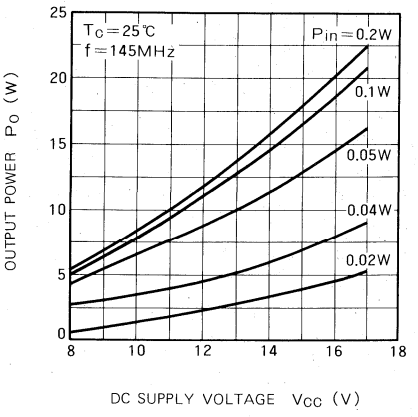
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (f = 160MHz)



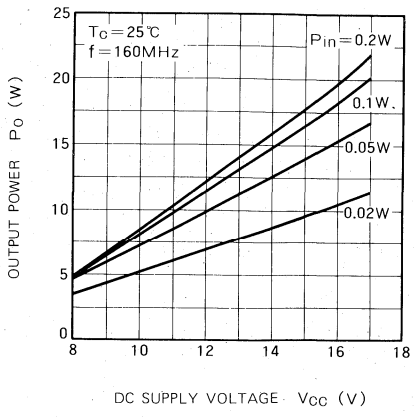
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (f = 175MHz)



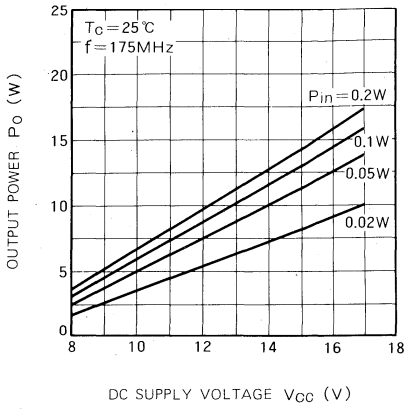
OUTPUT POWER VS. DC SUPPLY VOLTAGE (f = 145MHz)



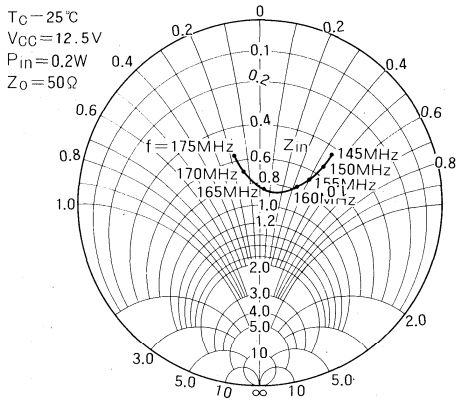
OUTPUT POWER VS. DC SUPPLY VOLTAGE (f = 160MHz)



OUTPUT POWER VS. DC SUPPLY VOTAGE (f = 175MHz)



INPUT IMPEDANCE VS. FREQUENCY



DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 10°C/W (Typ.)

b) Final stage transistor

$R_{th(j-c)2}$ = 3°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

P_o = 8W, V_{CC} = 12.5V, P_{in} = 0.2W, η_T = 35% (minimum rating), P_{o1} (Note 1) = 1.8W, I_T = 1.9A (I_{T1} (2) = 0.3A, I_{T2} (3) = 1.6A)

Note 1: Output power of the first stage transistor

Note 2: Circuit current of the first stage transistor

Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{o1} + P_{in}) \times R_{th(j-c)1} + T_c$ (4)

$= (12.5 \times 0.3 - 1.8 + 0.2) \times 10 + T_c$

$= 22 + T_c$ (°C)

Note 4: Package temperature of device

- Junction temperature of the final stage transistor

$T_{j2} = (V_{CC} \times I_{T2} - P_o + P_{o1}) \times R_{th(j-c)2} + T_c$

$= (12.5 \times 1.6 - 8 + 1.8) \times 3 + T_c$

$= 42 + T_c$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 8W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)}^{\text{Note 5}} = \frac{T_c - T_a}{(P_o/\eta_T) - P_o + P_{in}} = \frac{90 - 60}{(8/0.35) - 8 + 0.2}$$

$= 2.0$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 122°C, T_{j2} = 142°C at T_a = 60°C, T_c = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 92°C, T_{j2} = 112°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensure.

M57710A

156~160MHz, 25W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57710-A is a thick film RF power module specifically designed for 156 ~ 160MHz, 25W FM mobile radios.

FEATURES

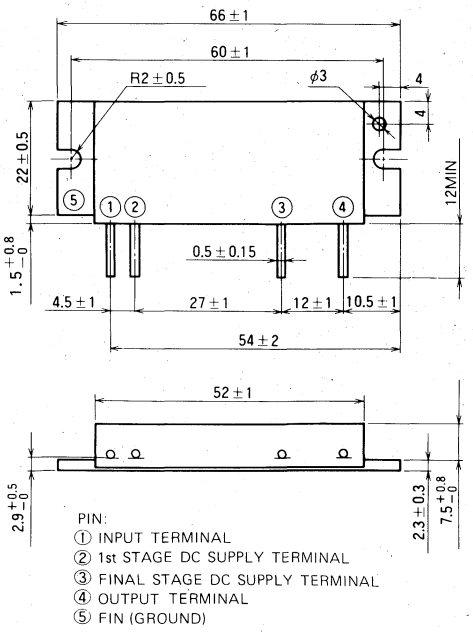
- Frequency Range . . . . . 156 ~ 160MHz
- High Power 28W
- High Gain 20.0dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W.

APPLICATION

Output stage of 25W output mobile radio sets (FM) in 156 ~ 160MHz VHF band.

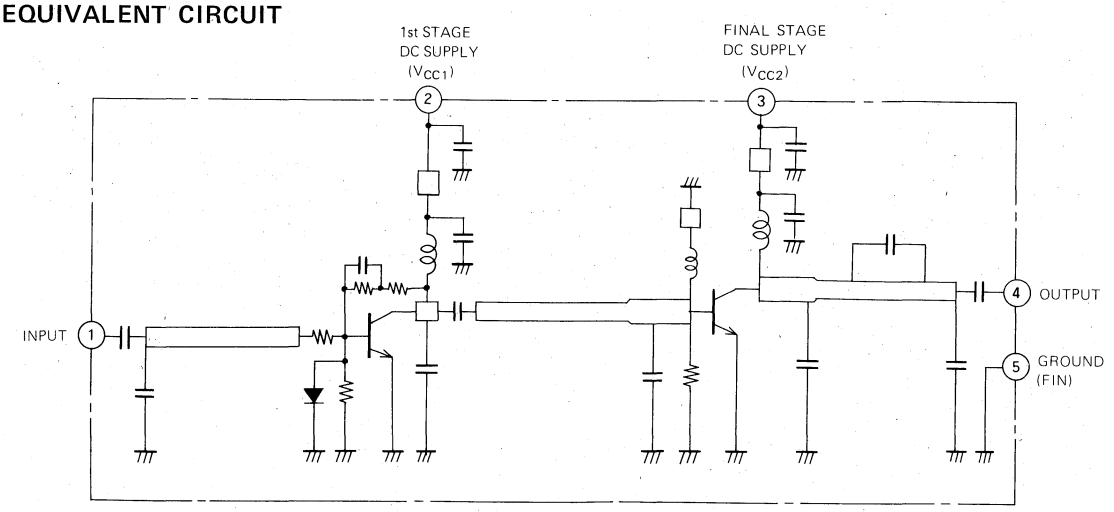
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ FINAL STAGE DC SUPPLY TERMINAL
④ OUTPUT TERMINAL
⑤ FIN (GROUND)

EQUIVALENT CIRCUIT



156～160MHz, 25W, FM
FOR MOBILE RADIO APPLICATION

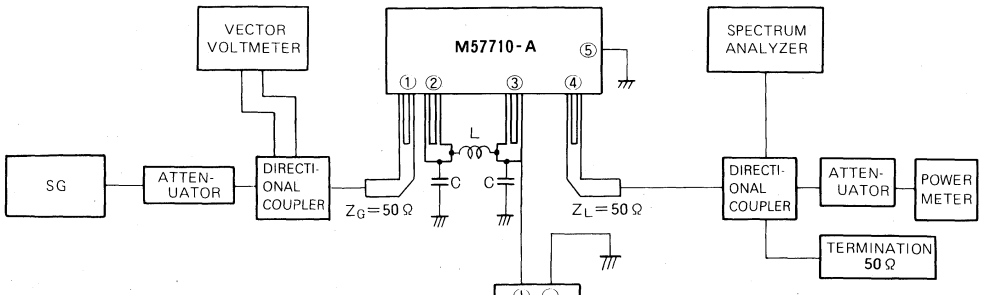
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		7	A
Pin	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	40	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, f=156～160MHz, Pin=0.2W, $Z_G=Z_L=50\,\Omega$	28	34		W
η_T	Total efficiency		45	49		%
—	2nd harmonic				−25	dB
ρin	Input VSWR				2.8	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	f=156～160MHz, V_{CC}=15.2V, P_O=30W, $Z_G=50\,\Omega$, 5sec	20 : 1			—

TEST DIAGRAM

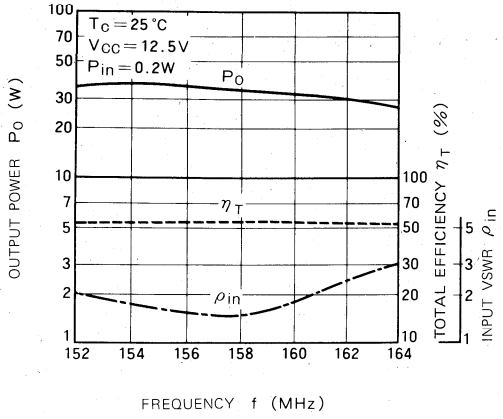


① INPUT
② 1st STAGE DC SUPPLY (V_{CC1})
③ FINAL STAGE DC SUPPLY (V_{CC2})
④ OUTPUT
⑤ FIN(GROUND)

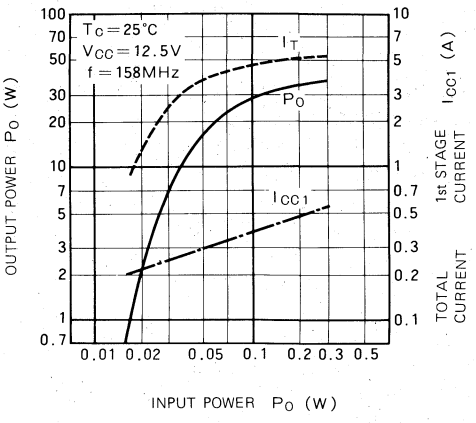
C : 3300pF, 10μF(50V)
L : 10T, 4D, φ0.4mm ENAMELED WIRE

TYPICAL PERFORMANCE DATA

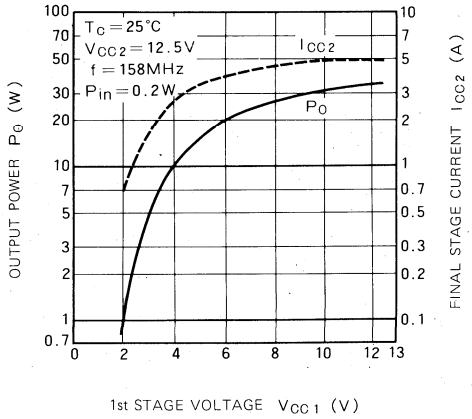
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



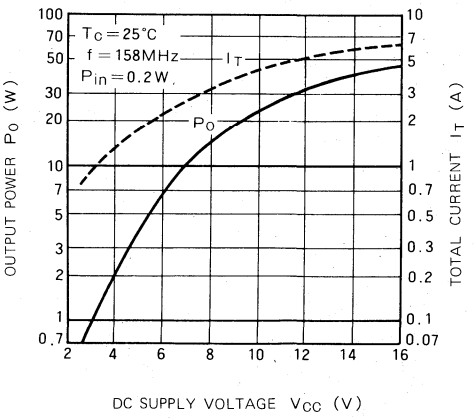
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER



OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE VOLTAGE



OUTPUT POWER, TOTAL CURRENT VS. DC SUPPLY VOLTAGE



DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 8°C/W$ (Typ.)

b) Final stage transistor

$R_{th(j-c)2} = 2°C/W$ (Typ.);

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  P_O = 28W, V_{CC} = 12.5V, P_{in} = 0.2W, η_T = 45% (minimum rating), P_{O1} (Note 1) = 5W, I_T = 5.0A (I_{T1} (2) = 0.9A, I_{T2} (3) = 4.1A)

  Note 1: Output power of the first stage transistor

  Note 2: Circuit current of the first stage transistor

  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)

  $= (12.5 \times 0.9 - 5 + 0.2) \times 8 + T_C$

  $= 52 + T_C$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$

  $= (12.5 \times 4.1 - 28 + 5) \times 2 + T_C$

  $= 57 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 8W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(28/0.45) - 28 + 0.2}$$

$= 0.87$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 142°C, T_{j2} = 147°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 112°C, T_{j2} = 117°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensure.

M57713

144~148MHz, 10W, SSB FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57713 is a thick film RF power module specifically designed for 144 ~ 148MHz, 10W SSB mobile radios.

FEATURES

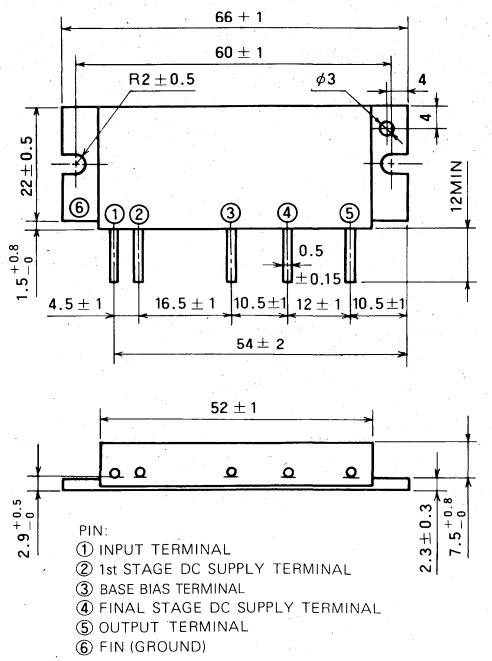
- Frequency Range . . . . . 144 ~ 148MHz
- High Power 17W
- High Linear Power Gain 21dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 14W.

APPLICATION

Output stage of 10W output mobile radio sets (SSB) in 144 ~ 148MHz VHF band.

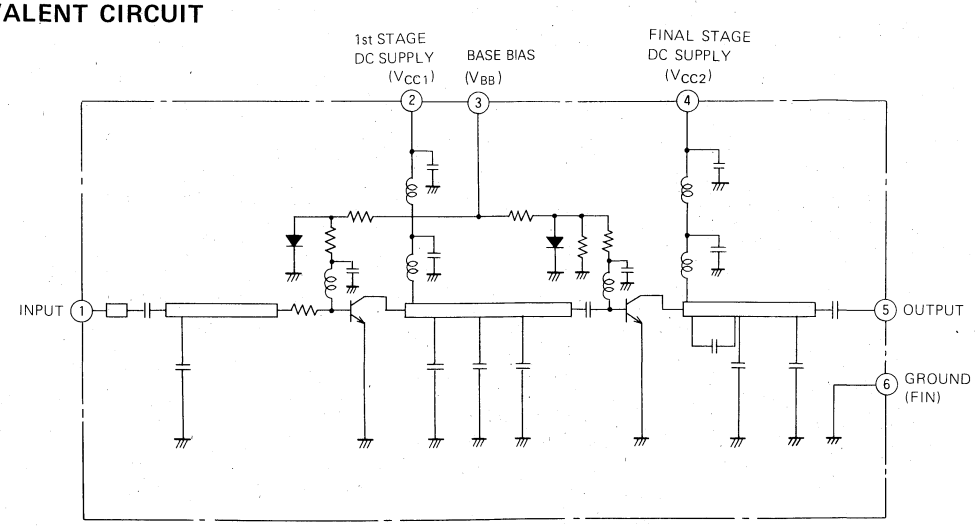
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



144～148MHz, 10W, SSB FOR MOBILE RADIO APPLICATION

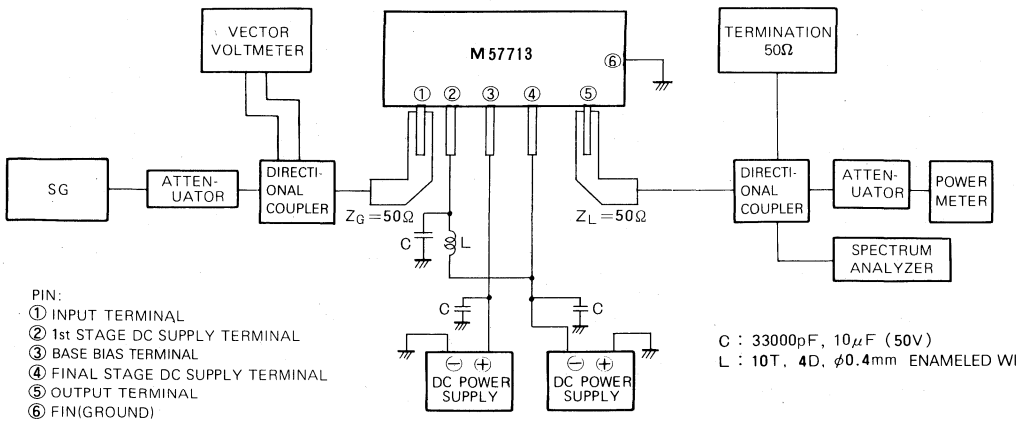
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
V_{BB}	Base bias terminal		10	W
I_{CC}	Total current		6	A
Pin	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$, $V_{BB}=9V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	26	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=144～148MHz V_{CC}=12.5V, V_{BB}=9V Pin=0.2W $Z_G=Z_L=50\,\Omega$	17	19		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3rd harmonic				−30	dB
ρin	Input VSWR				2.2	—
ρout	Output VSWR			1.8		—
G_P	Power gain	f=144～148MHz, V_{CC}12.5V, V_{BB}=9V P_i=10dBm, $Z_G=Z_L=50\,\Omega$	21			dB
—	3rd IMD	f_1=144～148MHz, $\|f_1-f_2\|$=1.5kHz, V_{CC}=12.5V, V_{BB}=9V, $P_{O(PEP)}\leqq$14W $Z_G=Z_L=50\,\Omega$		−30	−26	dB
—	5th IMD				−31	dB
—	Load VSWR tolerance	f=144～148MHz, V_{CC}=15.2V, V_{BB}=9V, P_O=14W, $Z_G=50\,\Omega$, 5sec	20：1			—

TEST DIAGRAM (1)



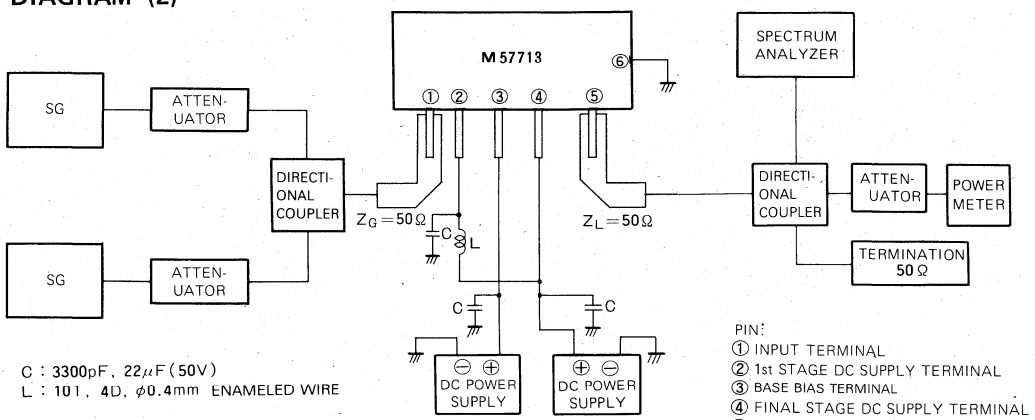
PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN(GROUND)

C : 33000pF, 10μF (50V)
L : 10T, 4D, φ0.4mm ENAMELED WIRE

MITSUBISHI ELECTRIC

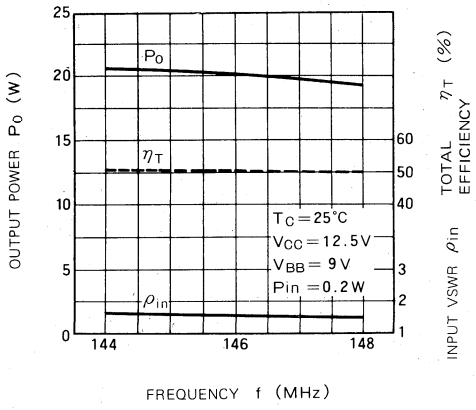
144～148MHz, 10W, SSB FOR MOBILE RADIO APPLICATION

TEST DIAGRAM (2)

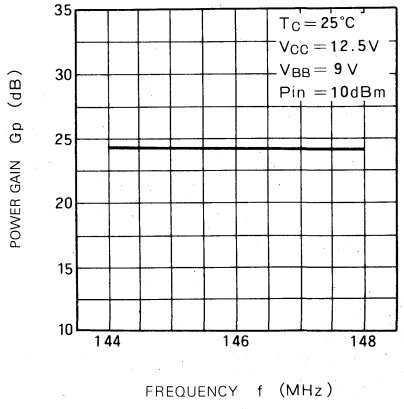


TYPICAL PERFORMANCE DATA

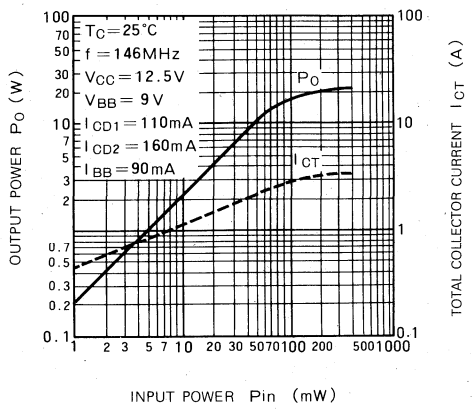
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



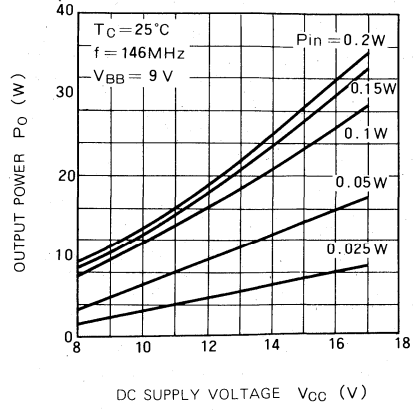
POWER GAIN VS. FREQUENCY



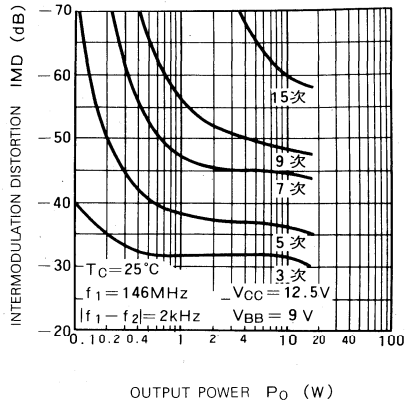
OUTPUT POWER, TOTAL COLLECTOR CURRENT VS. INPUT POWER



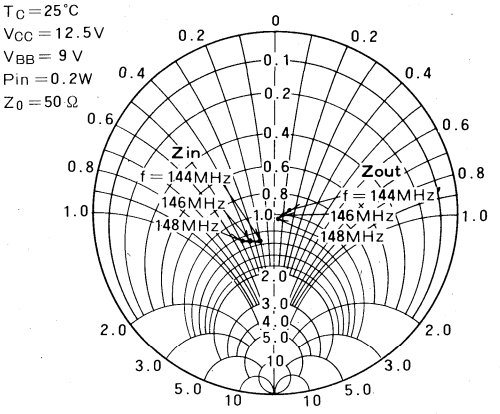
OUTPUT POWER VS. SUPPLY VOLTAGE



INTERMODULATION DISTORTION VS. OUTPUT POWER



INPUT IMPEDANCE, OUTPUT IMPEDANCE VS. FREQUENCY



DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 10°C/W$ (Typ.)

b) Final stage transistor

$R_{th(j-c)2} = 2°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

P_O = 14W, V_{CC} = 12.5V, P_{in} = 0.07W, η_T = 40% (minimum rating), P_{O1} (Note 1) = 2.5W, I_T = 2.8A (I_{T1} (2) = 0.5A, I_{T2} (3) = 2.3A)

Note 1: Output power of the first stage transistor
Note 2: Circuit current of the first stage transistor
Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_c$ (4)
$= (12.5 \times 0.5 - 2.5 + 0.07) \times 10 + T_c$
$= 39 + T_c$ (°C)

Note 4: Package temperature of device

- Junction temperature of the final stage transistor

$T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_c$
$= (12.5 \times 2.3 - 14 + 2.5) \times 2 + T_c$
$= 35 + T_c$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 14W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_c - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(14/0.4) - 14 + 0.07}$$
$$= 1.42\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 129°C, T_{j2} = 125°C at T_a = 60°C, T_c = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 99°C, T_{j2} = 95°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57714 SERIES

335~512MHz, 12.5V, 7W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57714 is a thick film RF power module specifically designed for 335 ~ 512MHz, 5W FM mobile ratios.

FEATURES

- High power gain: G_P = 18.4dB, P_O = 7W
  @V_{CC} = 12.5V, P_{in} = 0.1W
- High ruggedness: Ability to withstand load VSWR more than 20:1 when operated at V_{CC} = 15.2V, P_O = 7W
- Wide range on operation case temperature.
- Excellent stability from low power to high power level due to class AB operation of 1st stage.

APPLICATION

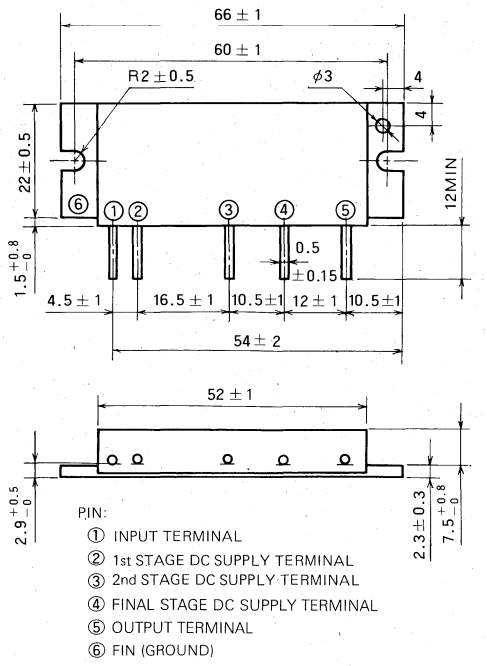
335 ~ 512MHz UHF band 5 watts output mobile radio sets.

FREQUENCY ITEMS

M57714EL :	335 ~ 360MHz
M57714SL :	360 ~ 380MHz
M57714UL :	380 ~ 400MHz
M57714L :	400 ~ 420MHz
M57714M :	430 ~ 450MHz
M57714 :	450 ~ 470MHz
M57714UH :	470 ~ 490MHz
M57714SH :	490 ~ 512MHz

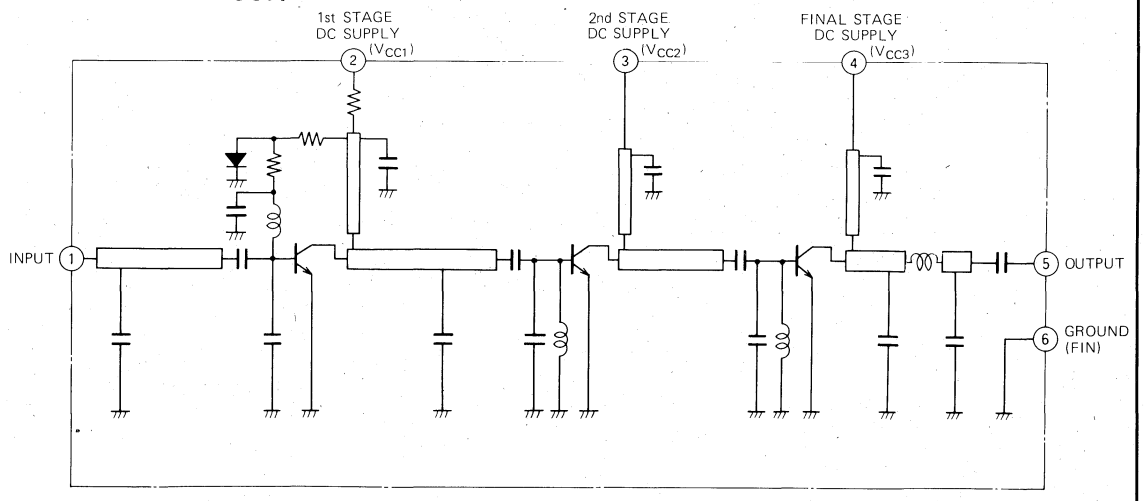
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



M57714 SERIES

335~512MHz, 12.5V, 7W, FM FOR MOBILE RADIO APPLICATION

ABSOLUTE MAXIMUM RATINGS (T_C=25℃ unless otherwise specified)

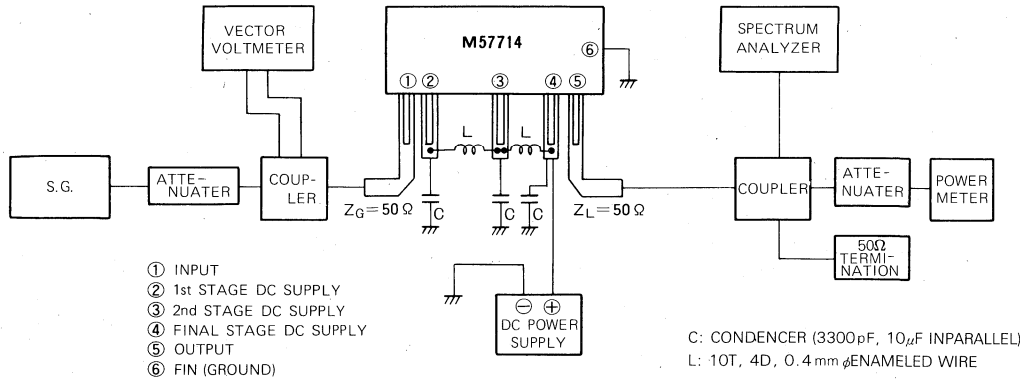
Symbol	Ratings	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		4	A
P_{in}	Input Power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 12.5V$	0.3	W
P_O	Output power	$Z_G=Z_L=50\Omega$	12	W
$T_{C(op)}$	Operation case temperature		−30~+110	℃
Tstg	Storage temperature		−40~+110	℃

ELECTRICAL CHARACTERISTICS (T_C=25℃ unless otherwise specified)

Symbol	Characteristics	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC}=12.5V$, $P_{in}=0.1W$, $Z_G=Z_L=50\Omega$ (Note 1)	7	9		W
η_T	Total efficiency		38	43		%
—	2nd Harmonic				−30	dB
—	3rd Harmonic				−30	dB
ρ_{in}	Input VSWR				2	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR Tolerance	$V_{CC}=15.2V$, $P_O=7W$, $Z_G=50\Omega$ T=5sec (Note 1)	20 : 1			—

Note 1. Test frequency condition
- M57714EL : 335 ~ 360MHz
- M57714SL : 360 ~ 380MHz
- M57714UL : 380 ~ 400MHz
- M57714L : 400 ~ 420MHz
- M57714M : 430 ~ 450MHz
- M57714H : 450 ~ 470MHz
- M57714UH : 470 ~ 490MHz
- M57714SH : 490 ~ 512MHz

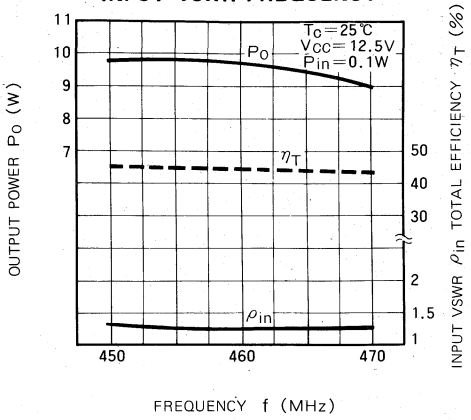
TEST DIAGRAM



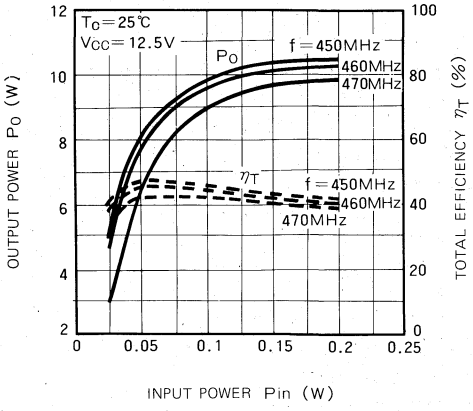
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

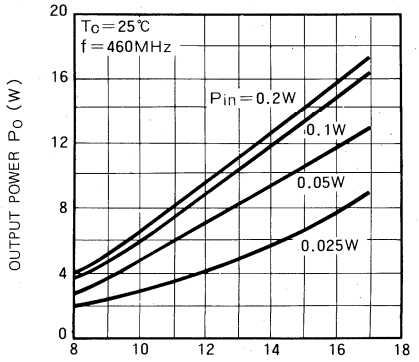
OUTPUT POWER TOTAL EFFICIENCY INPUT VSWR FREQUENCY



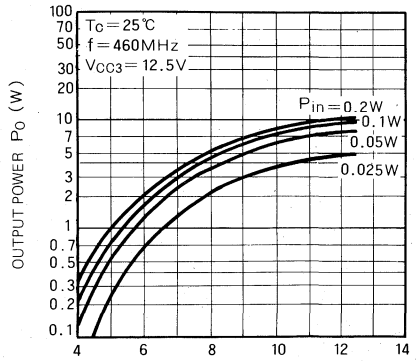
OUTPUT POWER TOTAL EFFICIENCY VS. INPUT POWER



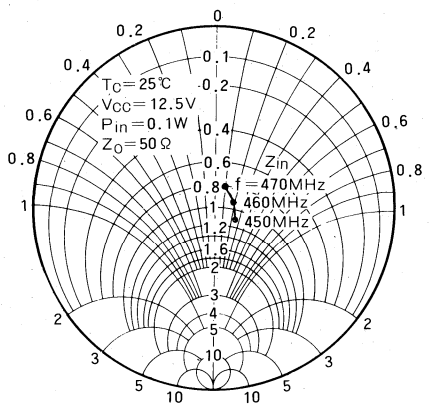
OUTPUT POWER VS. DC SUPPLY VOLTAGE



OUTPUT POWER 1st AND 2nd STAGE VOLTAGE



INPUT IMPEDANCE VS. FREQUENCY



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat shink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 20°C/W (Type)

b) Second stage transistor

$R_{th(j-c)2}$ = 10°C/W (Type)

c) Final stage transistor

$R_{th(j-c)3}$ = 5°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

P_O = 7W, V_{CC} = 12.5V, P_{in} = 0.1W, η_T = 38% (minimum rating), P_{O1} (Note 1) = 0.8W, P_{O2} (2) = 3.2W, I_T = 1.47A (I_{T1} (3) = 0.12A, I_{T2} (4) = 0.42A, I_{T3} (5) = 0.93A)

Note 1: Output power of the first stage transistor

Note 2: Output power of the second stage transistor

Note 3: Circuit current of the first stage transistor

Note 4: Circuit current of the second stage transistor

Note 5: Circuit current of the final stage transistor

Junction temperature of the first stage transistor

$$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C{}^{(6)}$$
$$= (12.5 \times 0.12 - 0.8 + 0.1) \times 20 + T_C$$
$$= 16 + T_C\ (°C)$$

Note 6: Package temperature of device

Junction temperature of the second stage transistor

$$T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$$
$$= (12.5 \times 0.42 - 3.2 + 0.8) \times 10 + T_C$$
$$= 29 + T_C\ (°C)$$

Junction temperature of the final stage transistor

$$T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2})\ R_{th(j-c)3} + T_C$$
$$= (12.5 \times 0.93 - 7 + 3.2) \times 5 + T_C$$
$$= 39 + T_C\ (°C)$$

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 7W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(7/0.38) - 7 + 0.1}$$
$$= 2.6\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 106°C, T_{j2} = 119°C, T_{j3} = 129°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 76°C, T_{j2} = 89°C, T_{j3} = 99°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57715

144~148MHz, 10W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57715 is a thick film RF power module specifically designed for 144 ~ 148MHz, 10W FM mobile radios.

FEATURES

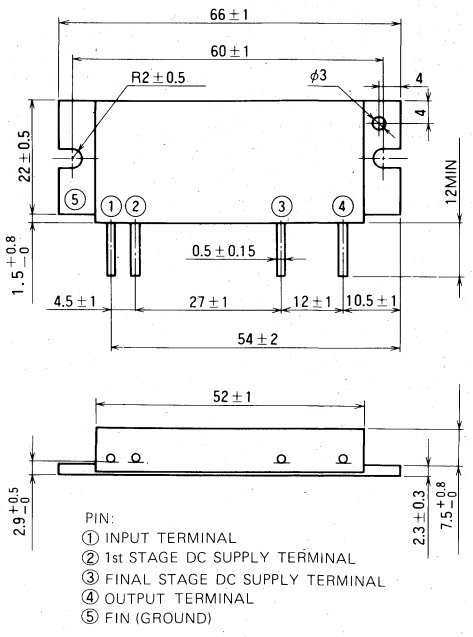
- Frequency Range . . . . . 144 ~ 148MHz
- High Power 13W
- High Gain 18.1dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 14W.

APPLICATION

Output stage of 10W output mobile radio sets (FM) in 144 ~ 148MHz UHF band.

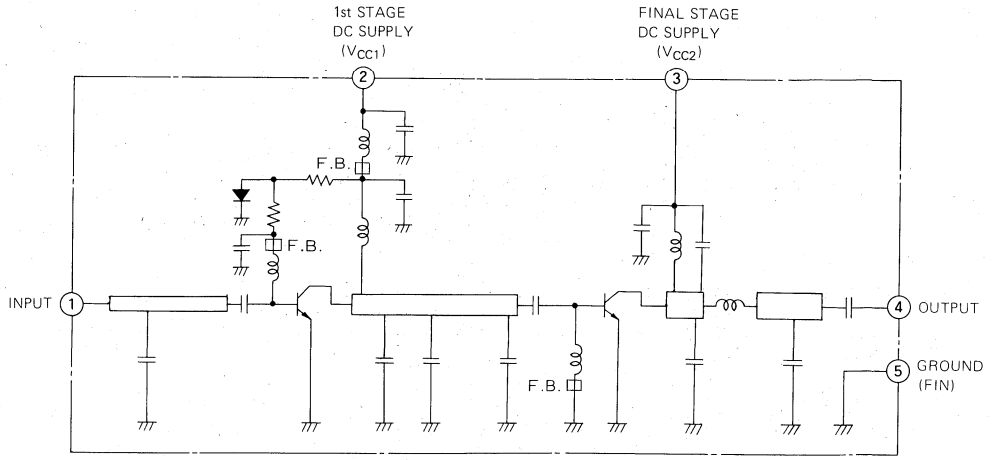
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ FINAL STAGE DC SUPPLY TERMINAL
④ OUTPUT TERMINAL
⑤ FIN (GROUND)

EQUIVALENT CIRCUIT



144~148MHz, 10W, FM
FOR MOBILE RADIO APPLICATION

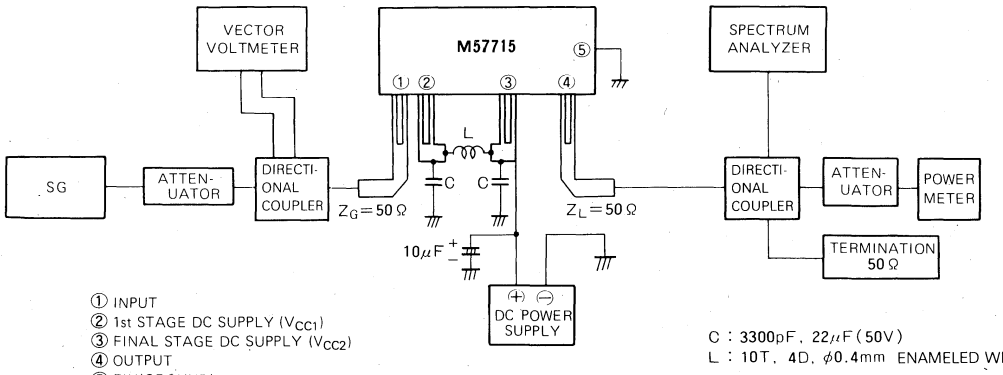
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		5	A
Pin	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
Po	Output power	$Z_G=Z_L=50\,\Omega$	20	W
$T_{C(OP)}$	Operation case temperature		−30~+110	°C
Tstg	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

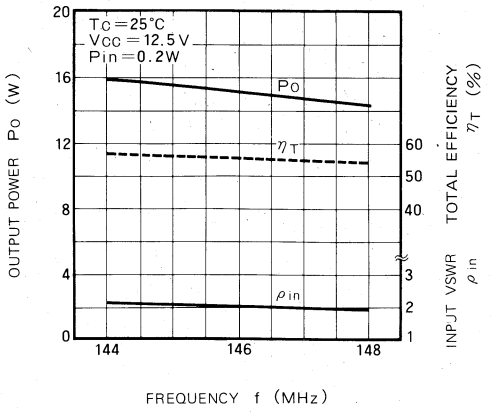
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
Po	Output power	f=144~148MHz, V_{CC}=12.5V, Pin=0.2W, $Z_G=Z_L=50\,\Omega$	13	15		W
η_T	Total efficiency		48	55		%
—	2nd harmonic				−25	dB
—	3rd harmonic				−30	dB
ρin	Input VSWR			2	2.8	—
ρout	Output VSWR			1.3	1.8	—
—	Load VSWR tolerance	f=144~148MHz, V_{CC}=15.2V, P_O=14W, $Z_G=50\,\Omega$, 5sec	20 : 1			—

TEST DIAGRAM

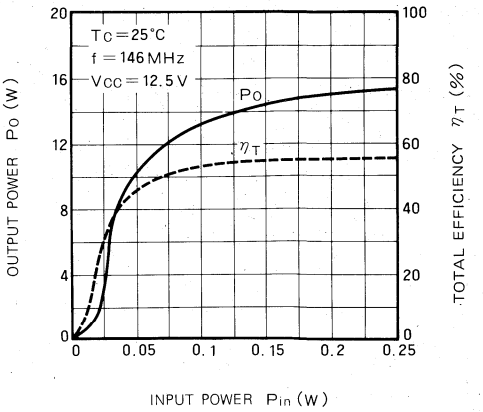


TYPICAL PERFORMANCE DATA

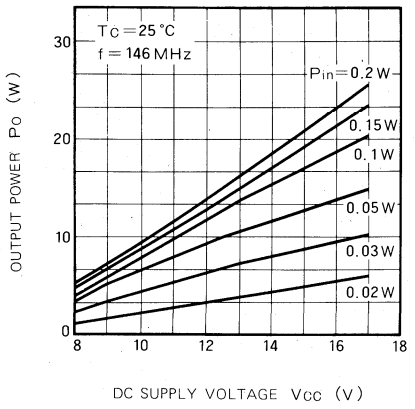
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



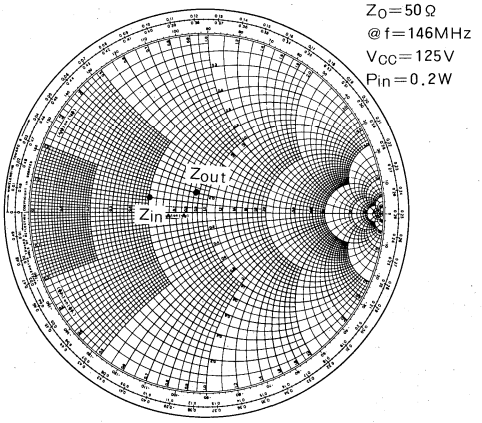
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER



OUTPUT POWER VS. DC SUPPLY VOLTAGE



INPUT IMPEDANCE, OUTPUT IMPEDANCE



DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 10°C/W$ (Typ.)

b) Final stage transistor

$R_{th(j-c)2} = 3°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  P_o = 13W, V_{CC} = 12.5V, P_{in} = 0.2W, η_T = 48% (minimum rating), P_{o1} (Note 1) = 2.5W, I_T = 2.2A (I_{T1} (2) = 0.45A, I_{T2} (3) = 1.75A)

  Note 1: Output power of the first stage transistor

  Note 2: Circuit current of the first stage transistor

  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{o1} + P_{in}) \times R_{th(j-c)1} + T_c$ (4)

  $= (12.5 \times 0.45 - 2.5 + 0.2) \times 10 + T_c$

  $= 33 + T_c$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_o + P_{o1}) \times R_{th(j-c)2} + T_c$

  $= (12.5 \times 1.15 - 13 + 2.5) \times 3 + T_c$

  $= 34 + T_c$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 8W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_c - T_a}{(P_o/\eta_T) - P_o + P_{in}} = \frac{90 - 60}{(13/0.48) - 13 + 0.2}$$

$= 2.8$ (°C)

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 113°C, T_{j2} = 134°C at T_a = 60°C, T_c = 90°C.

In the annual average of ambient temperature is 33°C),

T_{j1} = 103°C, T_{j2} = 104°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensure.

M57716

430~450MHz, 10W, SSB FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57716 is a thick film RF power module specifically designed for 430 ~ 450MHz, 10W SSB mobile radios.

FEATURES

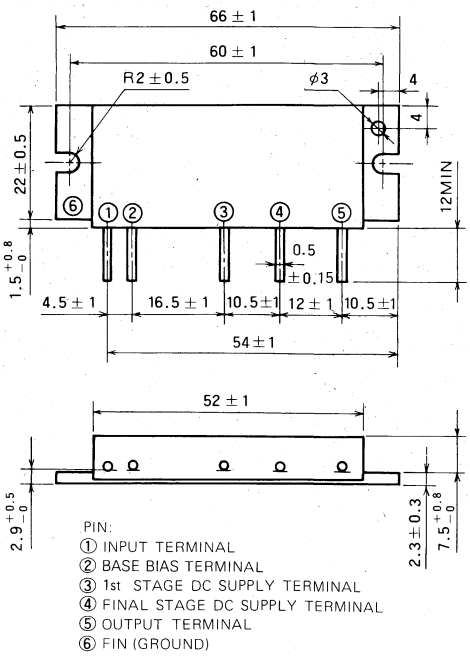
- Frequency Range . . . . . 430 ~ 450MHz
- High Power 17W
- High Linear Power Gain 21dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 14W.

APPLICATION

Output stage of 10W output mobile radio set (SSB) in 430 ~ 450MHz UHF band.

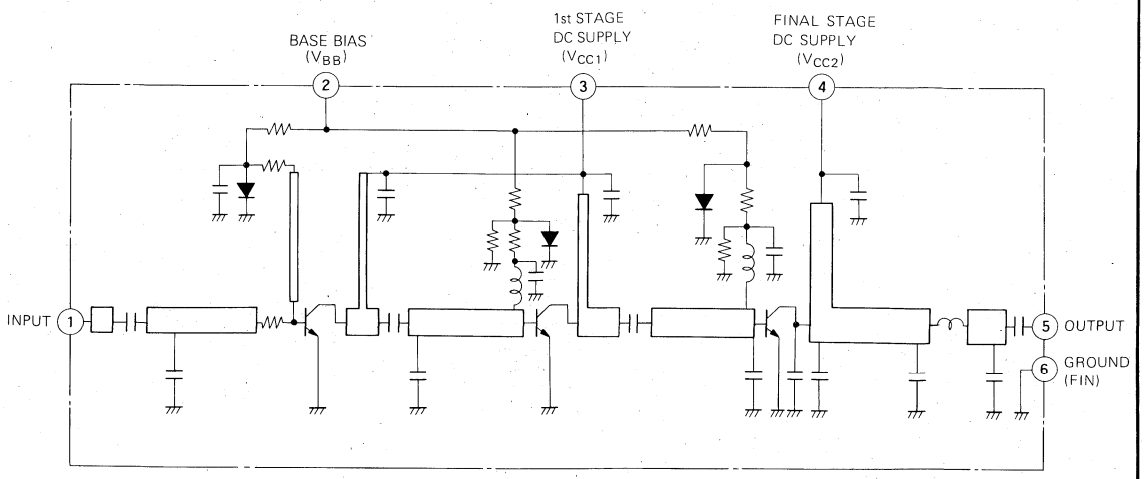
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② BASE BIAS TERMINAL
③ 1st STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALET CIRCUIT



430~450MHz, 10W, SSB FOR MOBILE RADIO APPLICATION

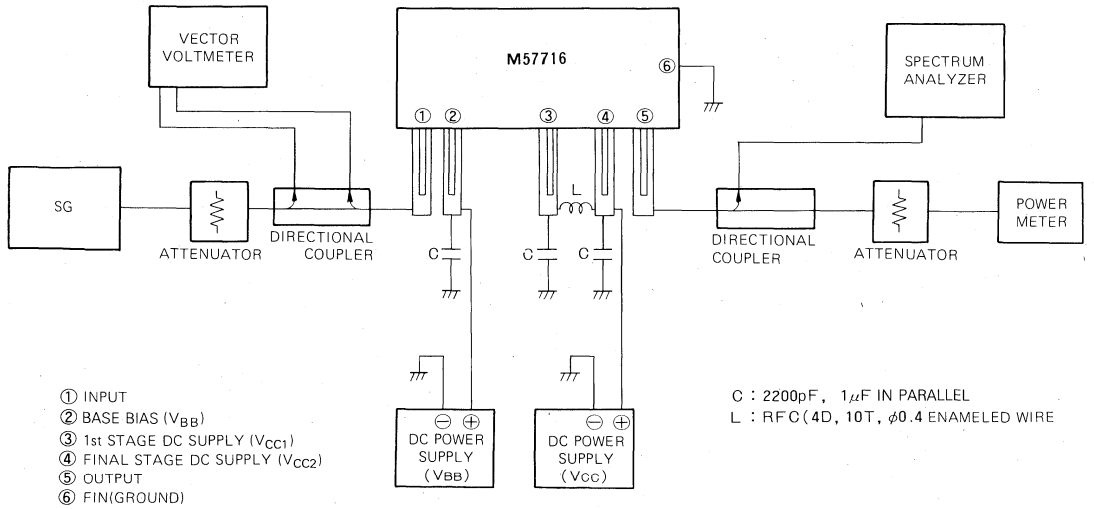
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
V_{BB}	Base bias voltage		10	V
I_{CC}	Total current		6	A
P_{in}	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}=12.5V$, $V_{BB}=9V$	0.3	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	28	W
T_C(op)	Operation case temperature		−30~+110	°C
T_{stg}	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=430~450MHz $V_{CC}=12.5V$, $V_{BB}=9V$ $P_{in}=0.2W$ $Z_G=Z_L=50\,\Omega$	17	19		W
η_T	Total efficiency		35	40		%
—	2nd harmonic				−30	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR				2.5	—
ρ_{out}	Output VSWR			2.0		—
G_P	Power gain	f=430~450MHz, $V_{CC}=12.5V$, $V_{BB}=9V$ $P_{in}=10dBm$, $Z_G=Z_L=50\,\Omega$	21			dB
—	3rd IMD	$f_1=430$~450MHz, $f_1-f_2=2kHz$, $V_{CC}=12.5V$, $V_{BB}=9V$, $P_{O(PEP)}\leqq 14W$ $Z_G=Z_L=50\,\Omega$		−30	−26	dB
—	5th IMD				−31	dB
—	Load VSWR tolerance	f=430~450MHz, $V_{CC}=15.2V$, $V_{BB}=9V$, $P_O=14W$, $Z_G=50\,\Omega$, 5sec.	20 : 1			—

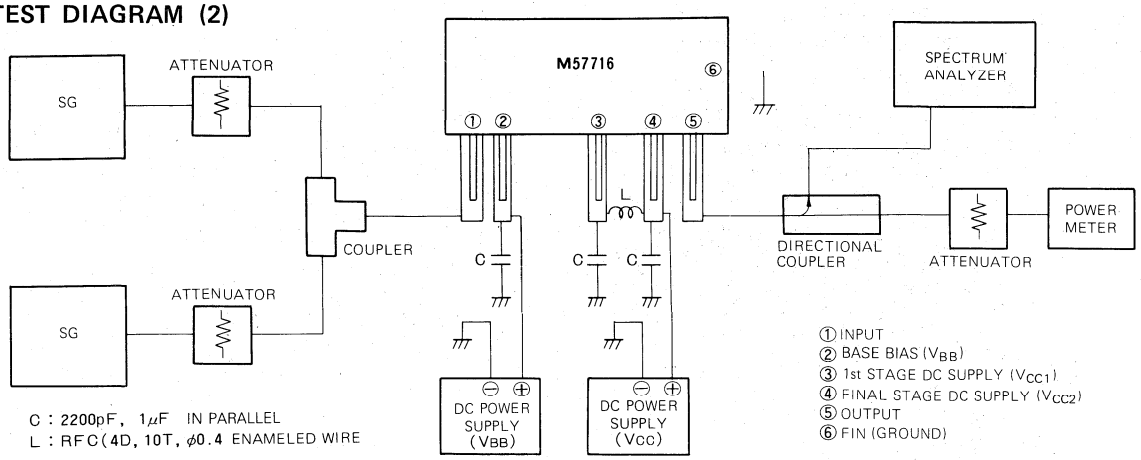
TEST DIAGRAM (1)



MITSUBISHI ELECTRIC

430~450MHz, 10W, SSB FOR MOBILE RADIO APPLICATION

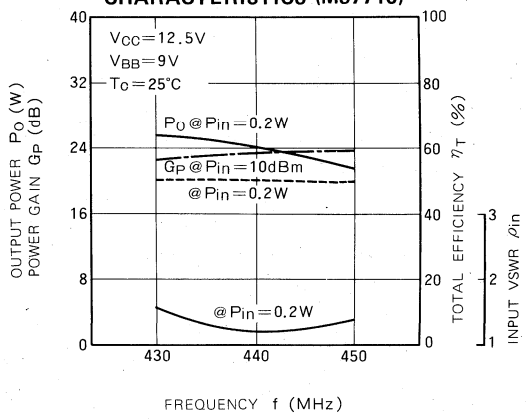
TEST DIAGRAM (2)



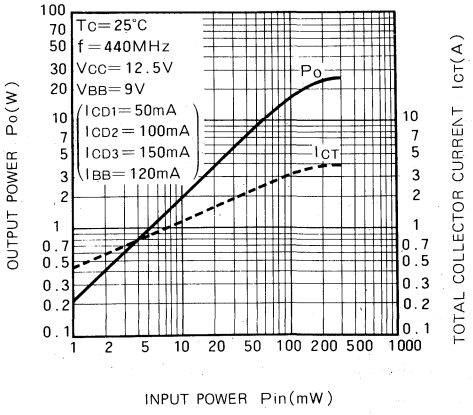
C : 2200pF, 1μF IN PARALLEL
L : RFC(4D, 10T, φ0.4 ENAMELED WIRE

TYPICAL PERFORMANCE DATA

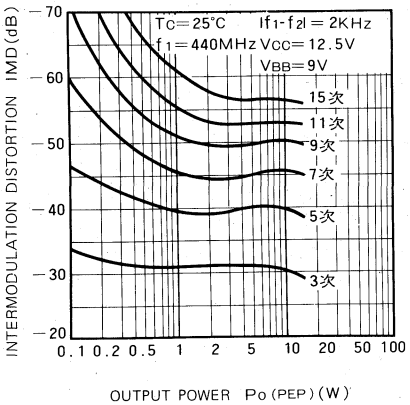
OUTPUT POWER, POWER GAIN, TOTAL EFFICIENCY, INPUT VSWR-FREQUENCY CHARACTERISTICS (M57716)



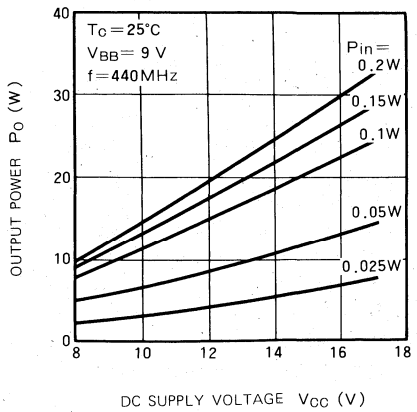
OUTPUT POWER, TOTAL COLLECTOR CURRENT VS. INPUT POWER



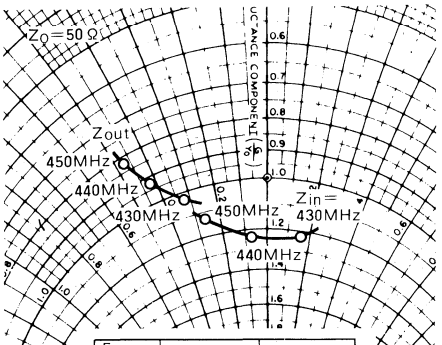
INTERMODULATION DISTORTION VS. OUTPUT POWER



OUTPUT POWER VS. DC SUPPLY VOLTAGE



INPUT IMPEDANCE, OUTPUT IMPEDANCE VS. FREQUENCY



Frequency (MHz)	Zin (Ω)	Zout (Ω)
430	60.5+j 8.3	55.7−j16.2
440	61.8−j 4.9	45.6−j21.3
450	58.3−j14.8	41.3−j23.4

Test condition : V_{CC}=12.5V, V_{BB}=9V
P_{in}=0.2W

DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat shink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor
$R_{th(j-c)1}$ = 15°C/W (Typ.)

b) Second stage transistor
$R_{th(j-c)2}$ = 6°C/W (Typ.)

c) Final stage transistor
$R_{th(j-c)3}$ = 2°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.
  P_o = 14W, V_{CC} = 12.5V, P_{in} = 80mW, η_T = 35% (minimum rating), P_{o1} (Note 1) = 1W, P_{o2} (2) = 4.5W, I_T = 3.2A (I_{T1} (3) = 0.15A, I_{T2} (4) = 0.55A, I_{T3} (5) = 2.5A)
  Note 1: Output power of the first stage transistor
  Note 2: Output power of the second stage transistor
  Note 3: Circuit current of the first stage transistor
  Note 4: Circuit current of the second stage transistor
  Note 5: Circuit current of the final stage transistor
- Junction temperature of the first stage transistor
  $T_{j1} = (V_{CC} \times I_{T1} - P_{o1} + P_{in}) \times R_{th(j-c)1} + T_c$ (6)
  $= (12.5 \times 0.15 - 1 + 0.08) \times 15 + T_c$
  $= 14.4 + T_c$ (°C)
  Note 6: Package temperature of device
- Junction temperature of the second stage transistor
  $T_{j2} = (V_{CC} \times I_{T2} - P_{o2} + P_{o1}1) \times R_{th(j-c)2} + T_c$
  $= (12.5 \times 0.55 - 4.5 + 1) \times 6 + T_c$
  $= 20.3 + T_c$ (°C)
- Junction temperature of the final stage transistor
  $T_{j3} = (V_{CC} \times I_{T3} - P_o + P_{o2}) \times R_{th(j-c)3} + T_c$
  $= (12.5 \times 2.5 - 14 + 4.5) \times 2 + T_c$
  $= 43.5 + T_c$ (°C

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 14W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$\text{Note 7: } R_{th(c-a)} = \frac{T_c - T_a}{(P_o/\eta_T) - P_o + P_{in}} = \frac{90 - 60}{(14/0.35) - 14 + 0.08}$$

$= 1.15$ (°C/W)

Note 7: Inclusive of the contact thermal resistance between device and heat sink.

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 104.4°C, T_{j2} = 110.3°C, T_{j3} = 133.5°C at T_a = 60°C, T_c = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 74.4°C, T_{j2} = 80.3°C, T_{j3} = 103.5°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57719 SERIES

135~175MHz, 10W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57719 is a thick film RF power module specifically designed for 135 ~ 175 MHz, 10W FM mobile radios.

FEATURES

- Frequency Range . . . . . 135 ~ 175 MHz
- High Power 14W
- High Gain 18.4dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 14W.

APPLICATION

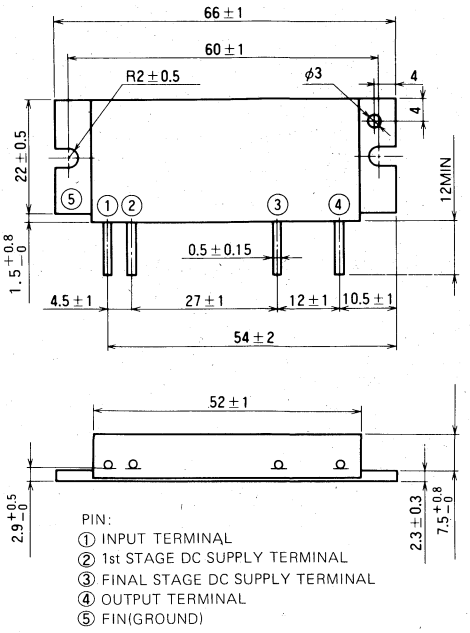
Output stage of 10W output mobile radio sets (FM) in 135 ~ 175MHz VHF band.

FREQUENCY ITEMS

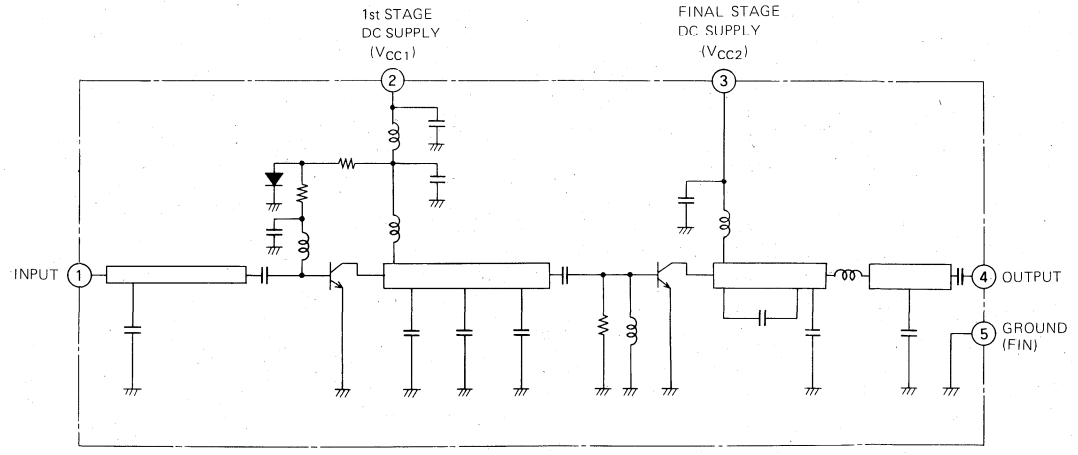
135 ~ 145MHz: M57719L
145 ~ 175MHz: M57719
142 ~ 163MHz: M57719N

OUTLINE DIAGRAM

Dimensions in mm



EQUIVALENT CIRCUIT



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

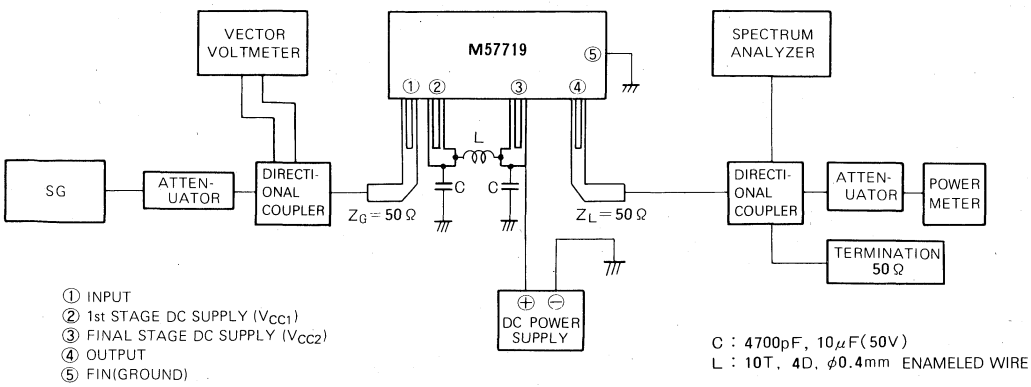
Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		6	A
Pin	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	21	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, f=135～175MHz, Pin=0.2W, $Z_G=Z_L=50\,\Omega$ (Note. 1)	14	16		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3rd harmonic				−35	dB
ρin	Input VSWR				4	—
ρout	Output VSWR			1.8		—
—	Load VSWR tolerance	V_{CC}=15.2V, f=135～175MHz, P_O=14W, $Z_G=50\,\Omega$, 5sec	20：1			—

Note. 1 Test frequency condition M57719 (145～175MHz), M57719N (142～163MHz), M57719L (135～145MHz)

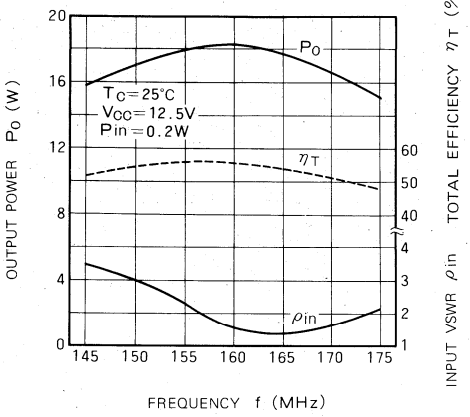
TEST DIAGRAM



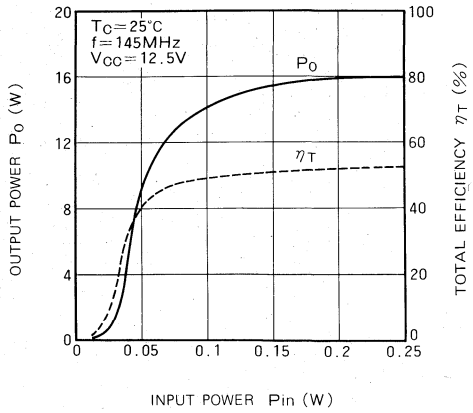
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

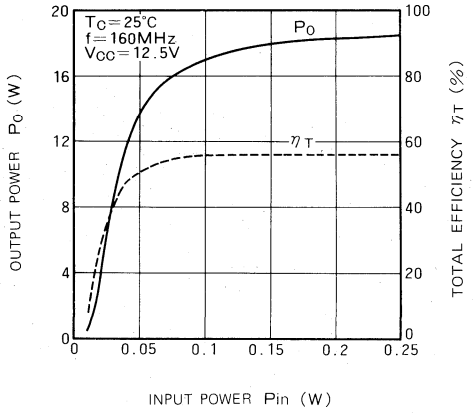
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY (M57719)



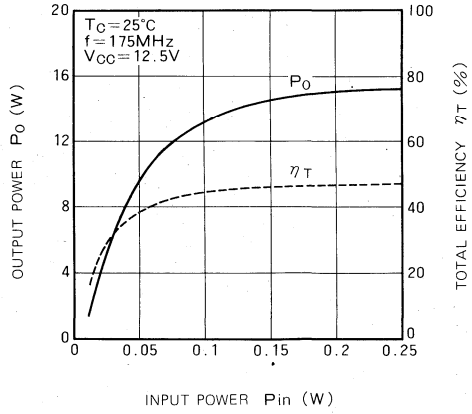
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57719)



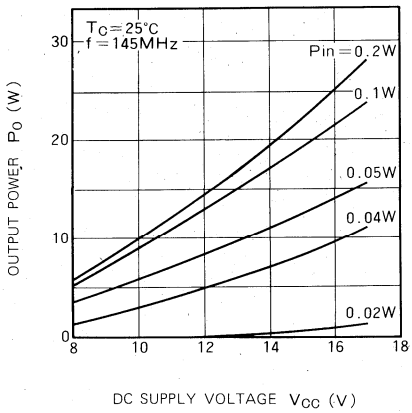
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57719)



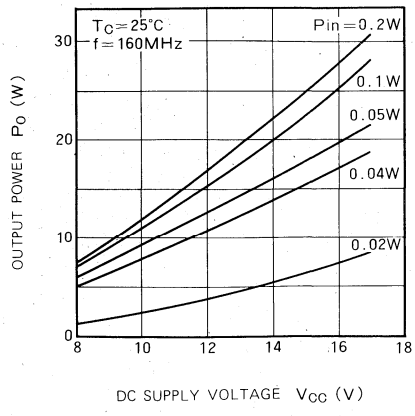
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57719)



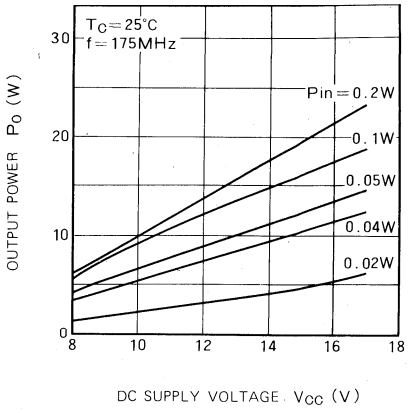
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57719)



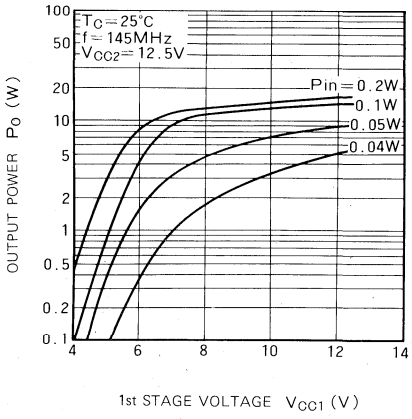
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57719)



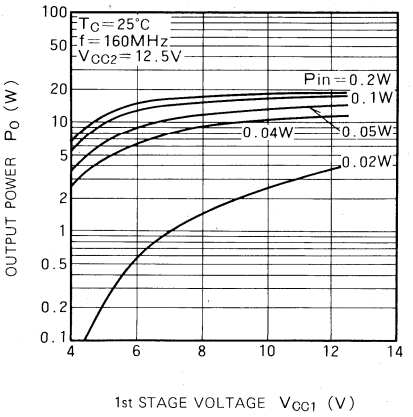
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57719)



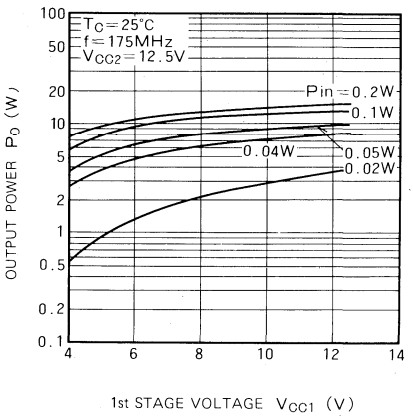
OUTPUT POWER VS. 1st STAGE VOLTAGE (M57719)



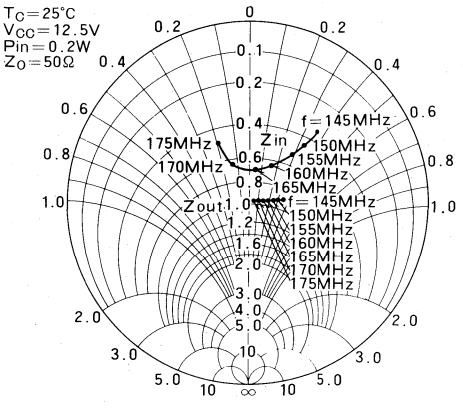
OUTPUT POWER VS. 1st STAGE VOLTAGE (M57719)



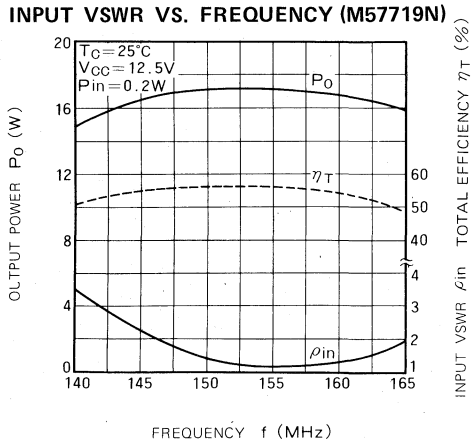
OUTPUT POWER VS. 1st STAGE VOLTAGE (M57719)



OUTPUT IMPEDANCE, INPUT IMPEDANCE VS. FREQUENCY (M57719)

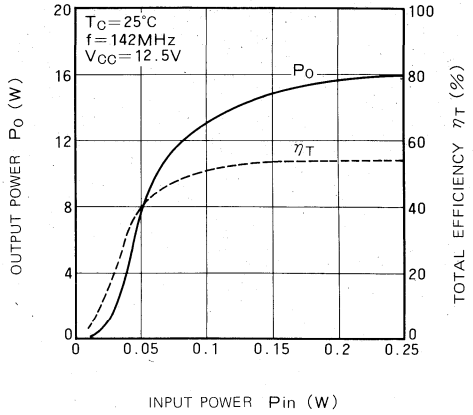


OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY (M57719N)

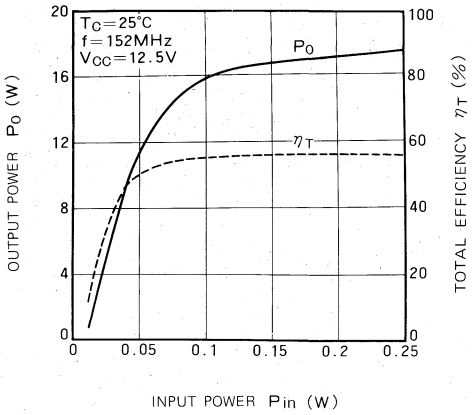


MITSUBISHI ELECTRIC

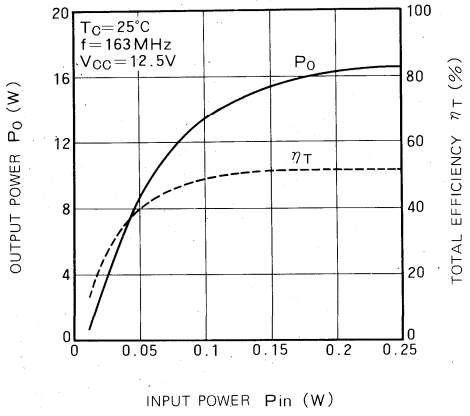
OUTPUT POWER, TOTAL EFFICIENCY VS. INPUT POWER (M57719N)



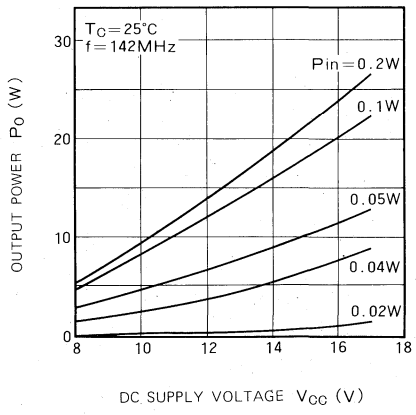
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57719N)



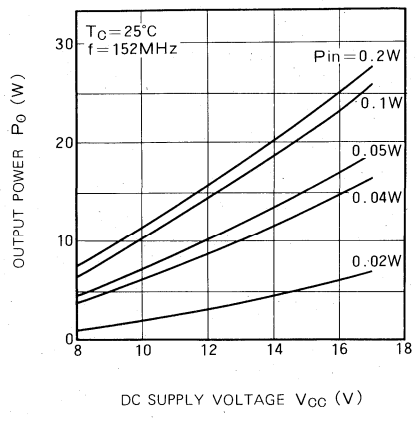
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57719N)



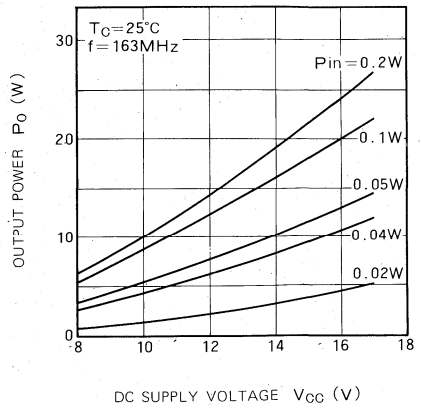
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57719N)



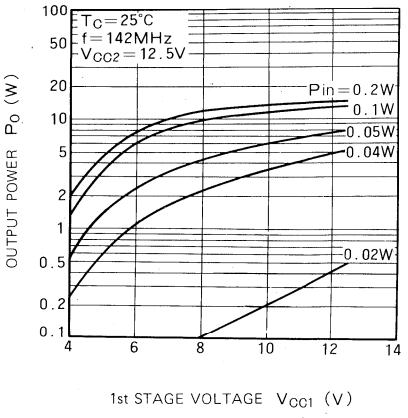
OUTPUT POWER VS. SUPPLY VOLTAGE (M57719N)



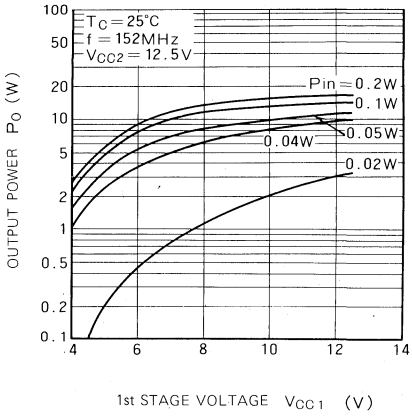
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57719N)



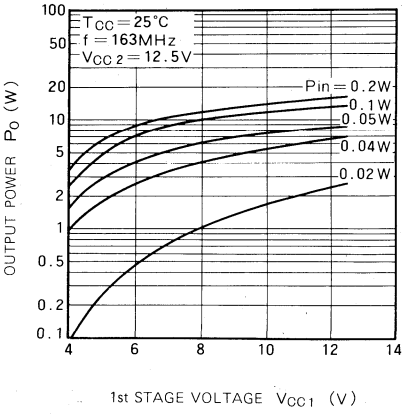
OUTPUT POWER VS. 1st STAGE VOLTAGE (M57719N)



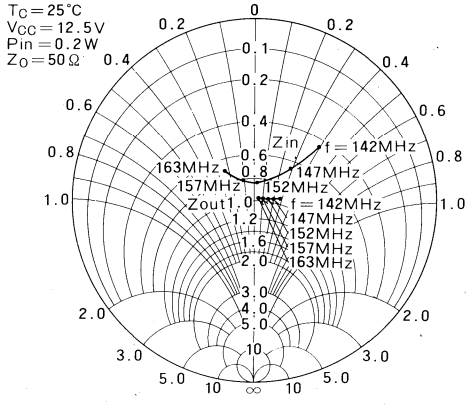
OUTPUT POWER VS. 1st STAGE VOLTAGE (M57719N)



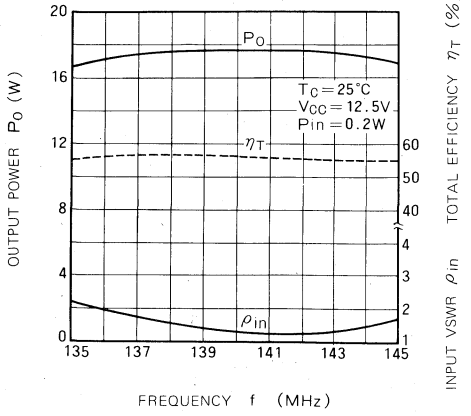
OUTPUT POWER VS. 1st STAGE VOLTAGE (M57719N)



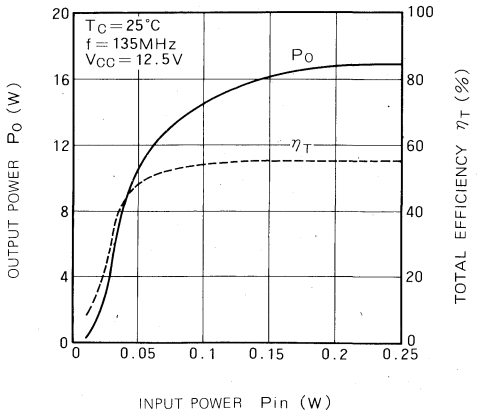
OUTPUT IMPEDANCE, INPUT IMPEDANCE VS. FREQUENCY (M57719N)



OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY (M57719L)

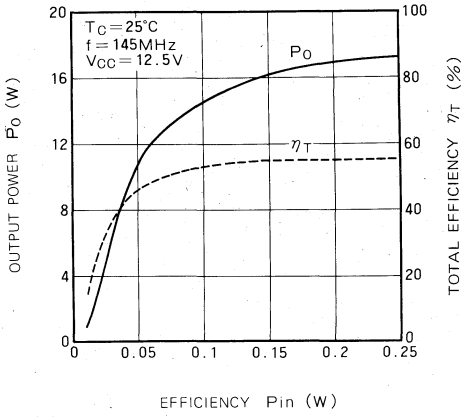


OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57719L)

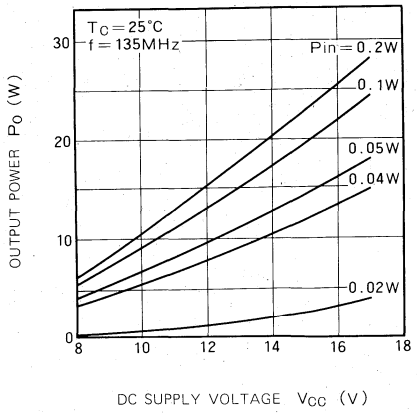


MITSUBISHI ELECTRIC

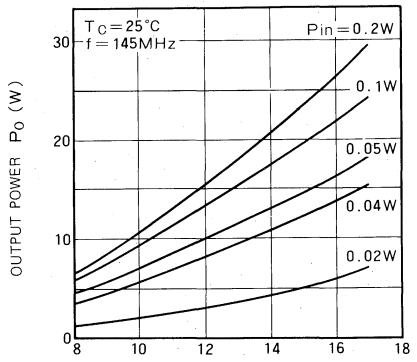
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57719L)



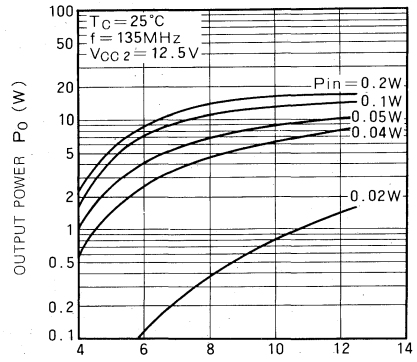
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57719L)



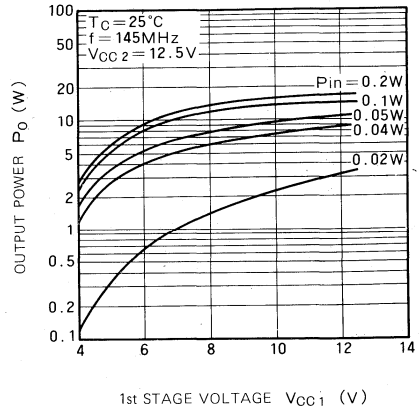
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57719L)



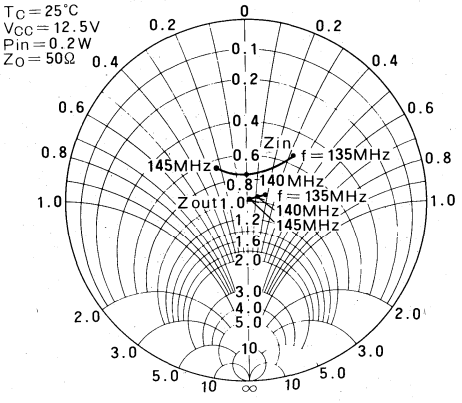
OUTPUT POWER VS. 1st STAGE VOLTAGE (M57719L)



OUTPUT POWER VS. 1st STAGE VOLTAGE (M57719L)



INPUT IMPEDANCE, OUTPUT IMPEDANCE VS. FREQUENCY (M57719L)



DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 10°C/W (Typ.)

b) Final stage transistor

$R_{th(j-c)2}$ = 3°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  P_O = 14W, V_{CC} = 12.5V, P_{in} = 0.2W, η_T = 40% (minimum rating), P_{O1} (Note 1) = 2.5W, I_T = 2.8A (I_{T1} (2) = 0.5A, I_{T2} (3) = 2.3A)

  Note 1: Output power of the first stage transistor
  Note 2: Circuit current of the first stage transistor
  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)
  $= (12.5 \times 0.5 - 2.5 + 0.2) \times 10 + T_C$
  $= 39.5 + T_C$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 2.3 - 14 + 2.5) \times 3 + T_C$
  $= 51.8 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 14W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(14/0.40) - 14 + 0.2}$$
$$= 1.9\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 140°C, T_{j2} = 152°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 110°C, T_{j2} = 122°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57721

450～512MHz, 1～5W, FM PORTABLE RADIO

DESCRIPTION

M57721 is a thick film RF power module specifically designed for 450～512MHz, 1W～5W FM portable sets.

FEATURES

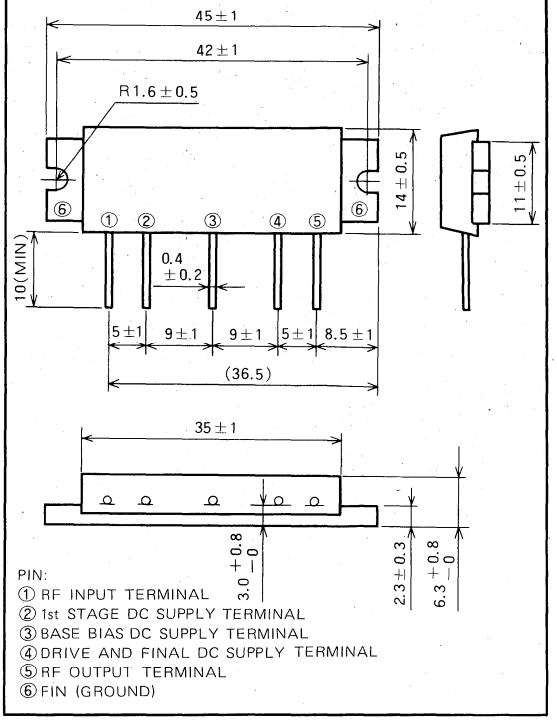
- Wide band: 62MHz, f = 450～512MHz.
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  Gp ≧ 28dB @V_{CC} = 12.5V, Po ≧ 7W, Pin = 10mW
  Gp ≧ 27dB @V_{CC} = 10.8V, Po ≧ 5W, Pin = 10mW
  Gp ≧ 25dB @V_{CC} = 8.4V, Po ≧ 3W, Pin = 10mW
  Gp ≧ 22dB @V_{CC} = 7.2V, Po ≧ 1.5W, Pin = 10mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 1～5W output UHF band portable radio sets.

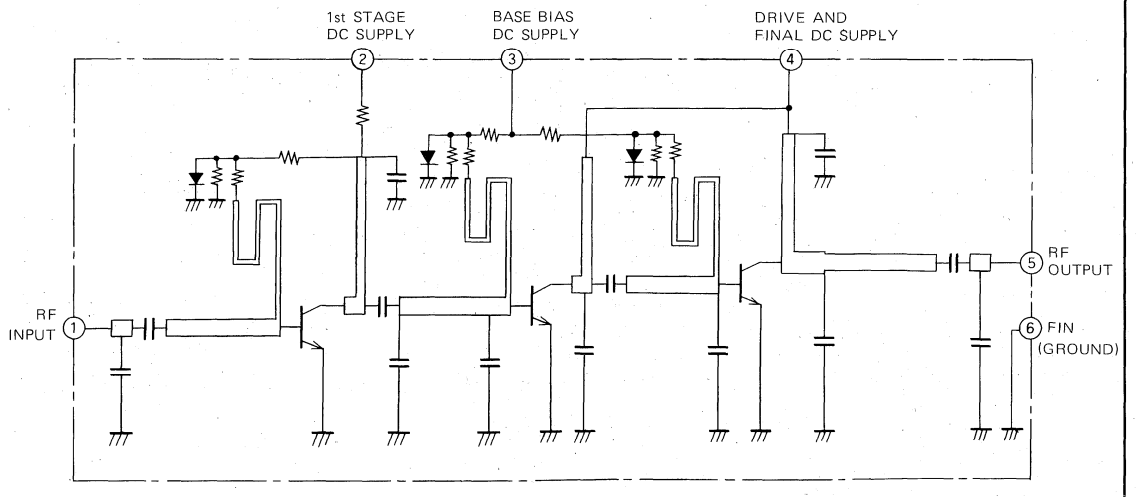
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



450～512MHz, 1～5W, FM PORTABLE RADIO

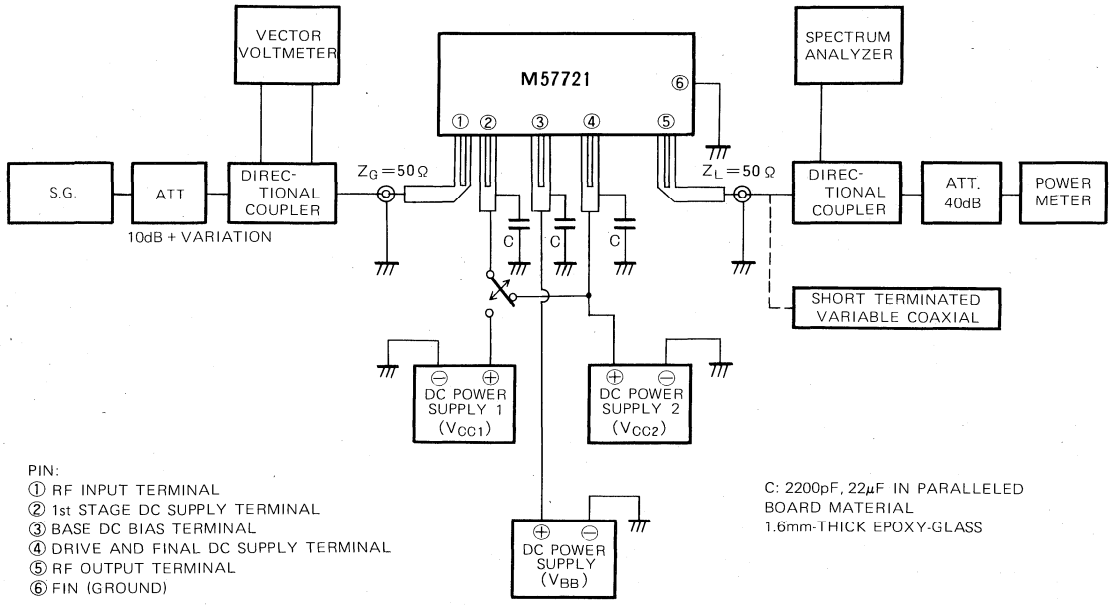
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}(max)	Input power	$Z_G = Z_L = 50\,\Omega$	20	mW
P_O(max)	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 12.5V, V_{BB} = 5V, f = 450～512MHz, P_{in} = 10mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic			−35	−30	dB
—	3nd harmonic			−40	−35	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 13.2V, V_{BB} = 5V, f = 450～512 MHz, P_O = 7W, $\rho_L \geqq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM



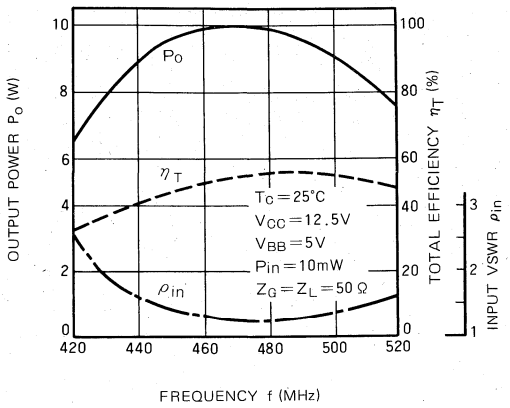
PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

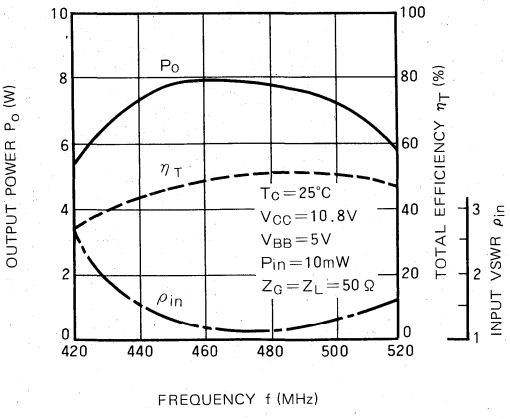
450～512MHz, 1～5W, FM PORTABLE RADIO

TYPICAL PERFORMANCE DATA

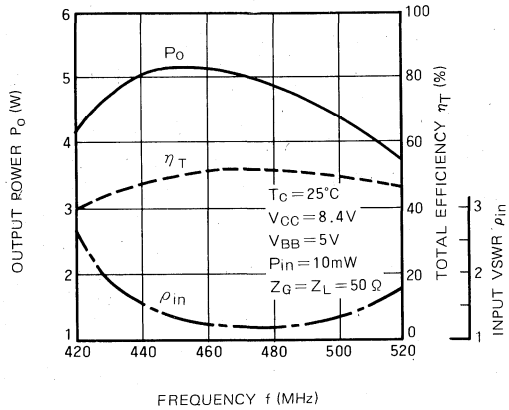
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



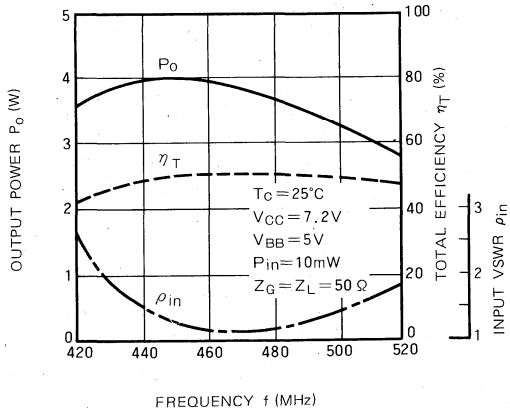
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



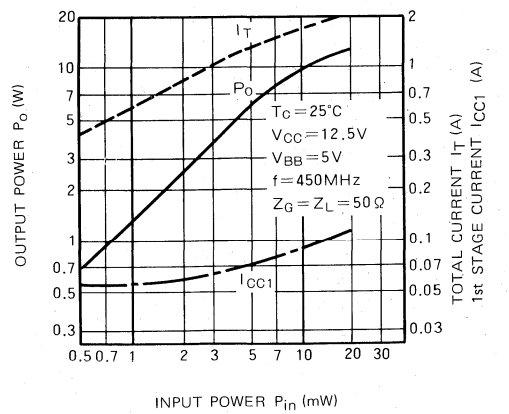
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



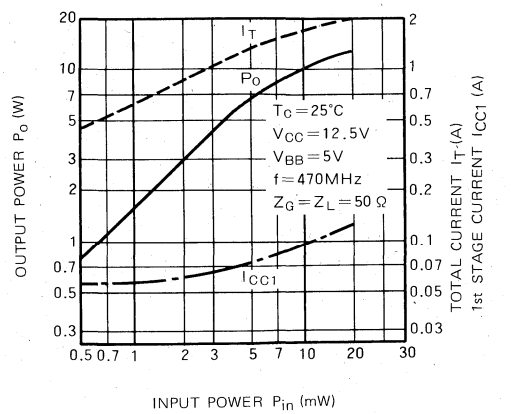
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



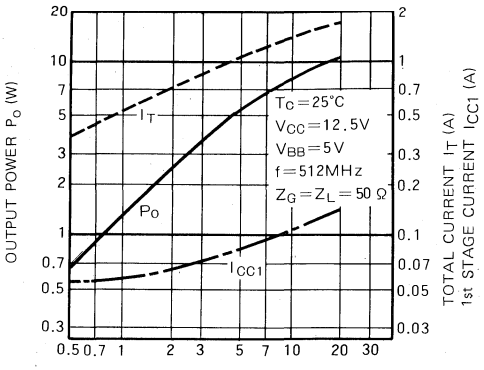
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. INPUT POWER CHARACTERISTICS



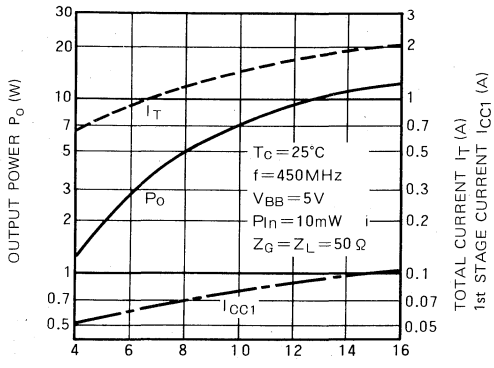
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. INPUT POWER CHARACTERISTICS



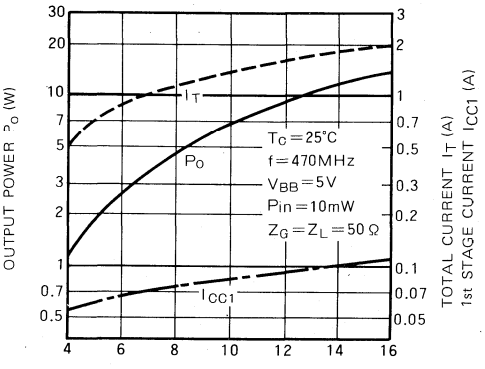
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



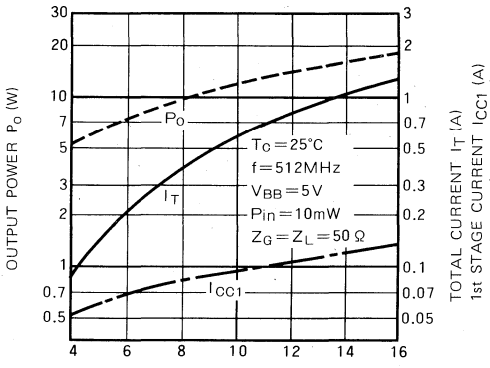
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



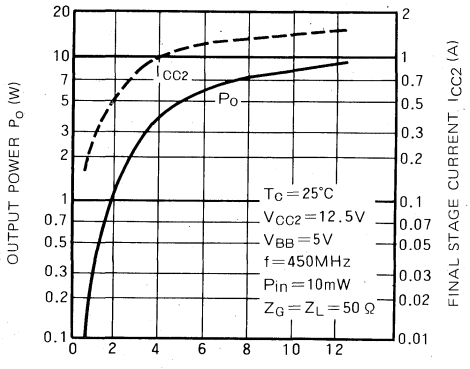
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



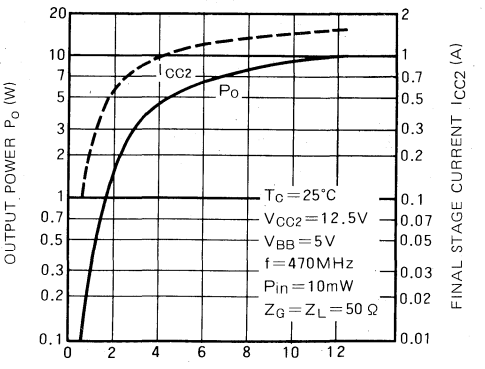
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



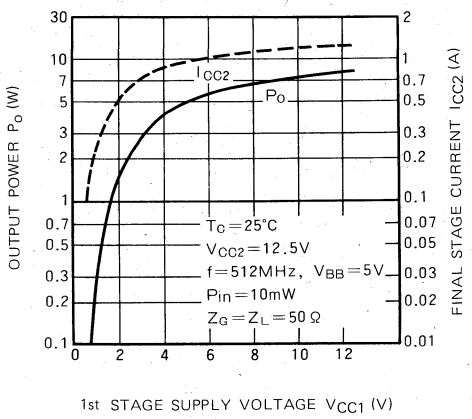
OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



M57721L

350~400MHz, 1~5W, FM PORTABLE RADIO

DESCRIPTION

M57721L is a thick film RF power module specifically designed for 350 ~ 400MHz, 1W ~ 5W FM portable sets.

FEATURES

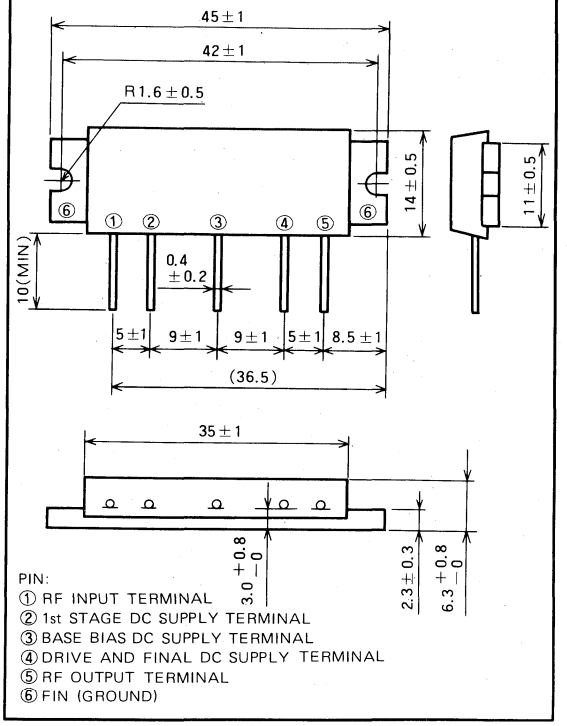
- Wide band: 50MHz, f = 350 ~ 400MHz.
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High ouput
  Gp $\geqq$ 28dB @V_{CC} = 12.5V, Po $\geqq$ 7W, Pin = 10mW
  Gp $\geqq$ 27dB @V_{CC} = 10.8V, Po $\geqq$ 5W, Pin = 10mW
  Gp $\geqq$ 25dB @V_{CC} = 8.4V, Po $\geqq$ 3W, Pin = 10mW
  Gp $\geqq$ 22dB @V_{CC} = 7.2V, Po $\geqq$ 1.5W, Pin = 10mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 1 ~ 5W output UHF band portable radio sets.

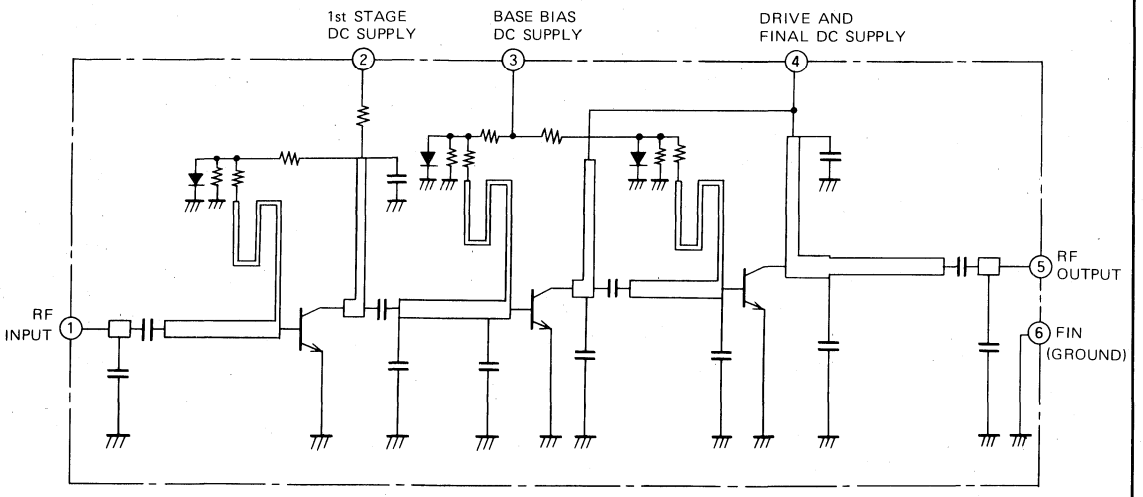
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

350~400MHz, 1~5W, FM PORTABLE RADIO

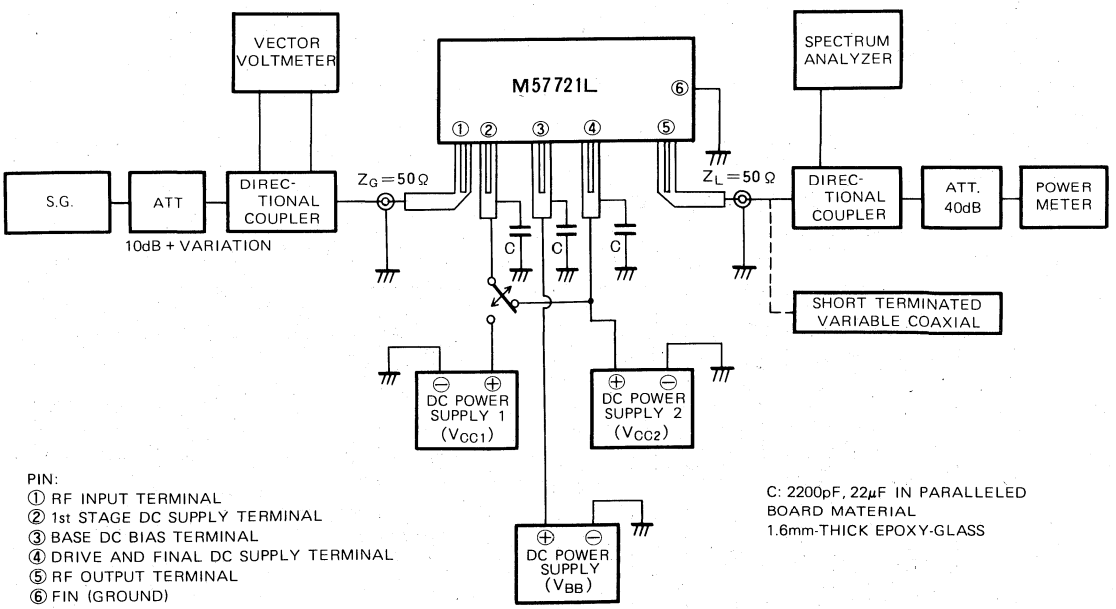
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}(max)	Input power	$Z_G = Z_L = 50\,\Omega$	20	mW
P_O(max)	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30~+110	°C
T_{stg}	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=350~400MHz, P_{in}=10mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−30	dB
—	3nd harmonic				−35	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=13.2V, V_{BB}=5V, f=350~400 MHz, P_O=7W, $\rho_L \geqq 20$(All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

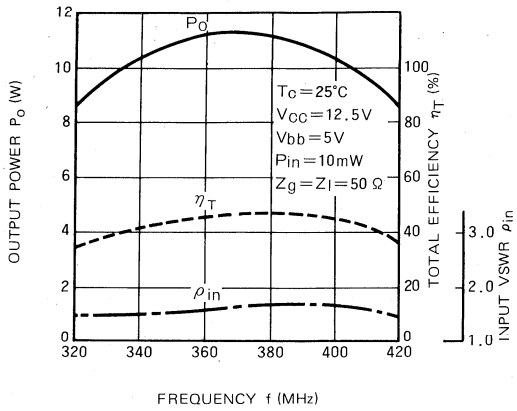


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

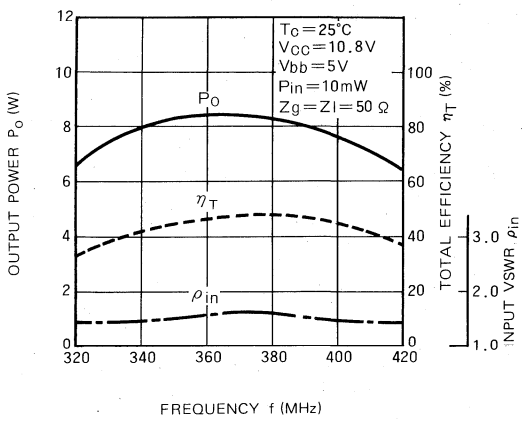
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

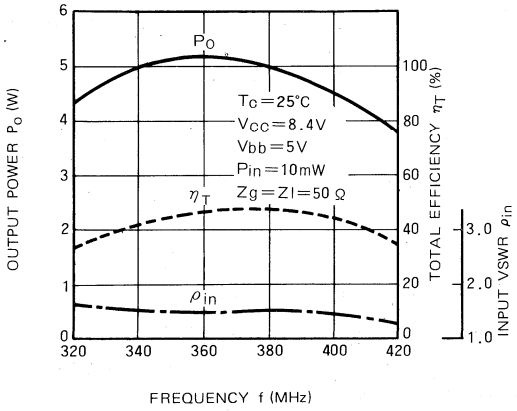
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



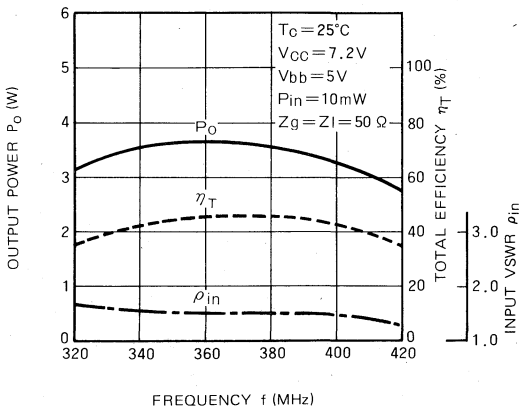
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



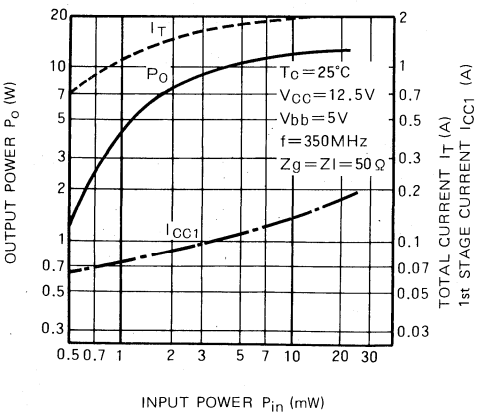
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



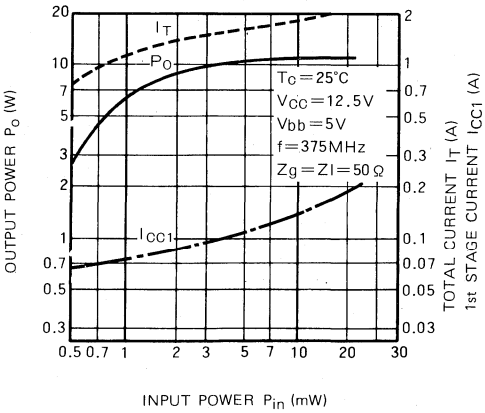
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. INPUT POWER CHARACTERISTICS

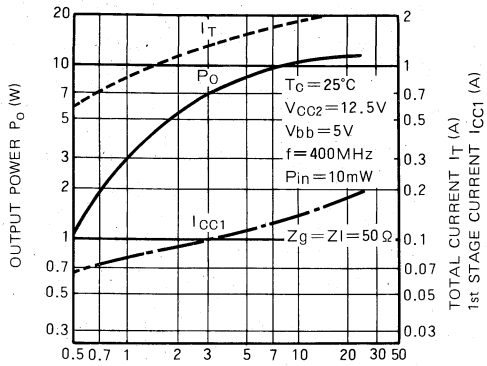


OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. INPUT POWER CHARACTERISTICS

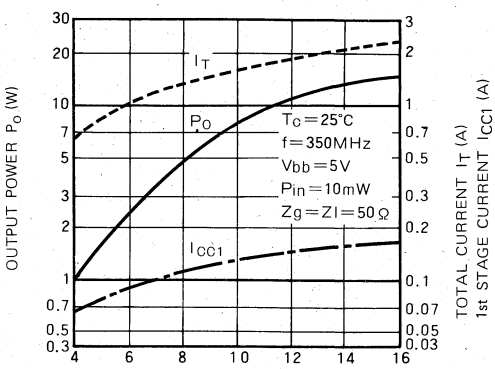


MITSUBISHI ELECTRIC

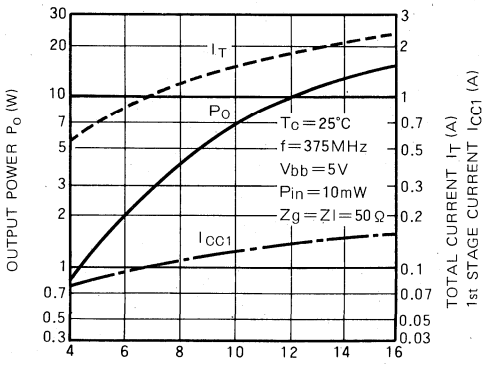
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



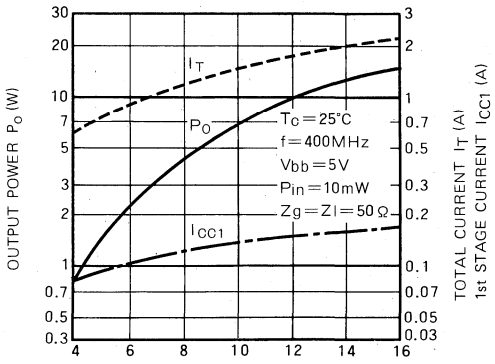
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



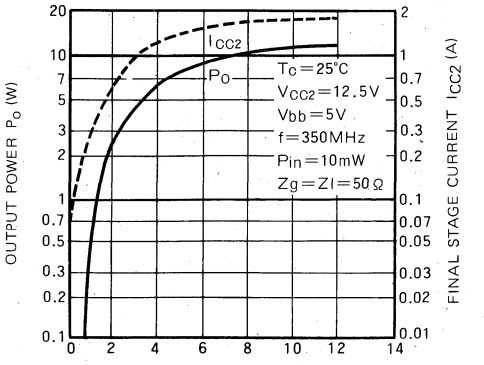
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



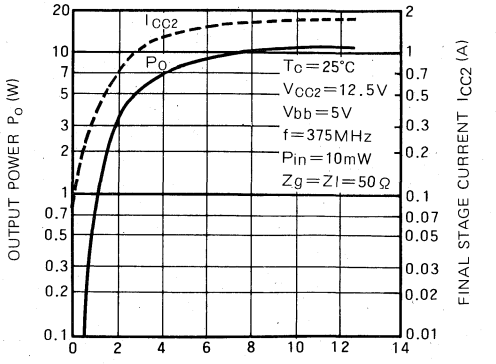
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



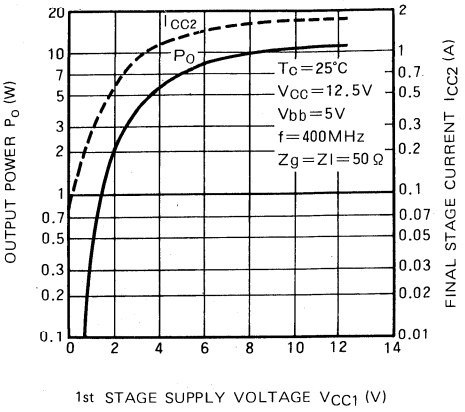
OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



1st STAGE SUPPLY VOLTAGE V_{CC1} (V)

M57721M

400~450MHz, 1~5W, FM PORTABLE RADIO

DESCRIPTION

M57721M is a thick film RF power module specifically designed for 400 ~ 450MHz, 1W ~ 5W FM portable sets.

FEATURES

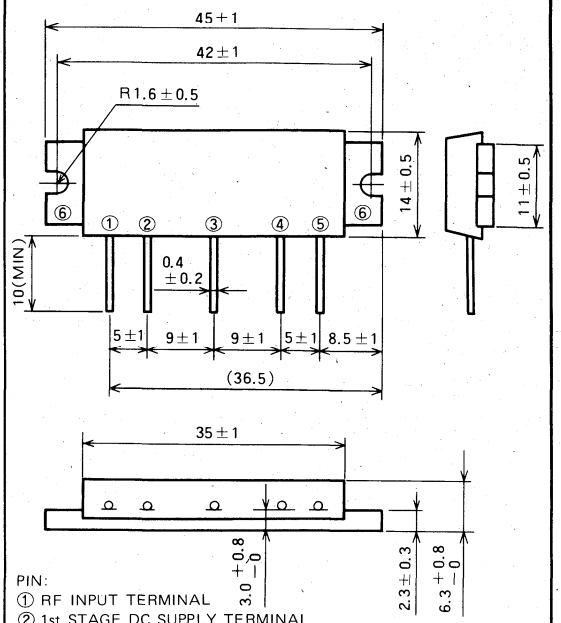
- Wide band: 50MHz, f = 400 ~ 450MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  Gp $\geqq$ 28dB @V_{CC} = 12.5V, Po $\geqq$ 7W, Pin = 10mW
  Gp $\geqq$ 27dB @V_{CC} = 10.8V, Po $\geqq$ 5W, Pin = 10mW
  Gp $\geqq$ 25dB @V_{CC} = 8.4V, Po $\geqq$ 3W, Pin = 10mW
  Gp $\geqq$ 22dB @V_{CC} = 7.2V, Po $\geqq$ 1.5W, Pin = 10mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 1 ~ 5W output UHF band portable radio sets.

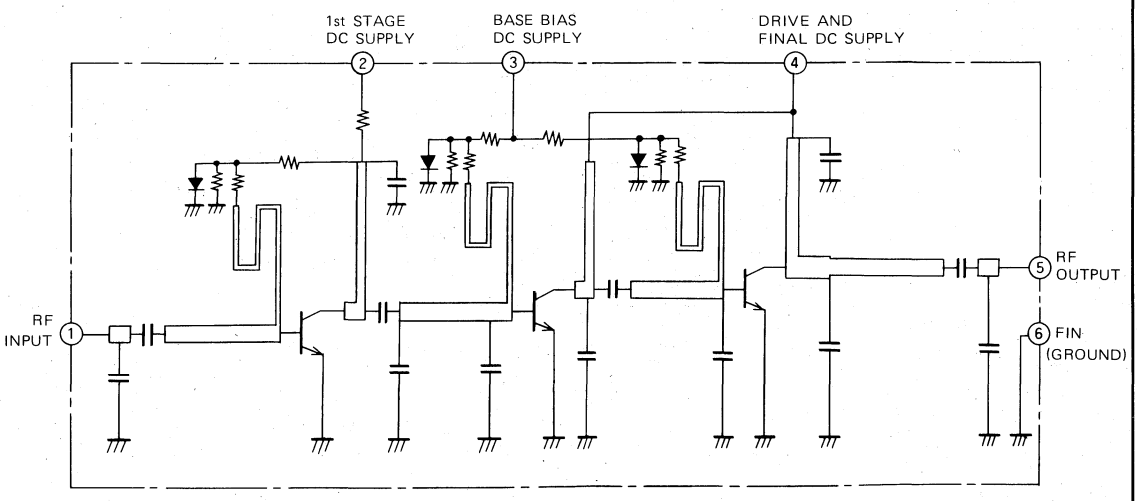
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



400～450MHz, 1～5W, FM PORTABLE RADIO

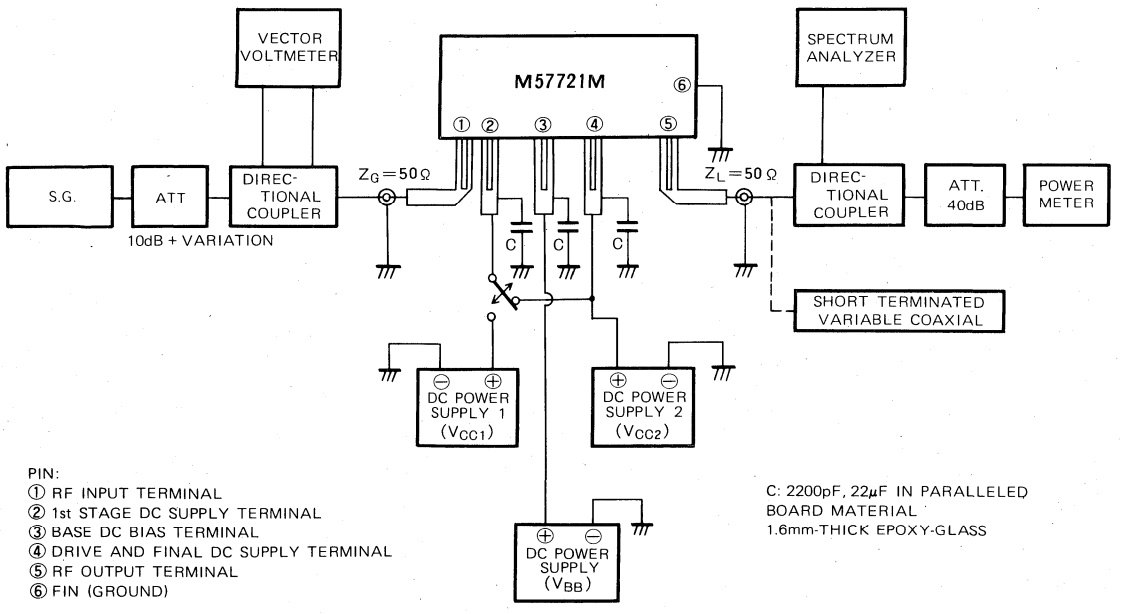
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}(max)	Input power	$Z_G=Z_L=50\Omega$	20	mW
P_O(max)	Output power	$Z_G=Z_L=50\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=400～450MHz, P_{in}=10mW, $Z_G=Z_L=50\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic			−35	−30	dB
—	3nd harmonic			−40	−35	dB
ρin	Input VSWR			1.5	2.5	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=15.2V, V_{BB}=5V, f=400～450MHz, P_O=7W, $\rho_L\geqq$20(All phase), Z_G=50Ω	20：1			—

TEST BLOCK DIAGRAM

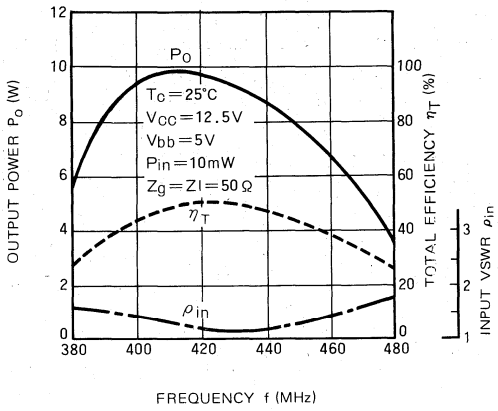


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

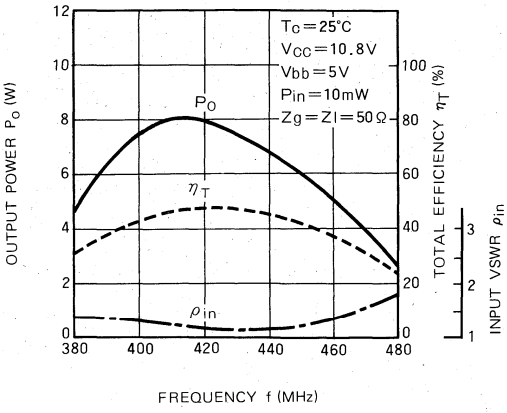
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

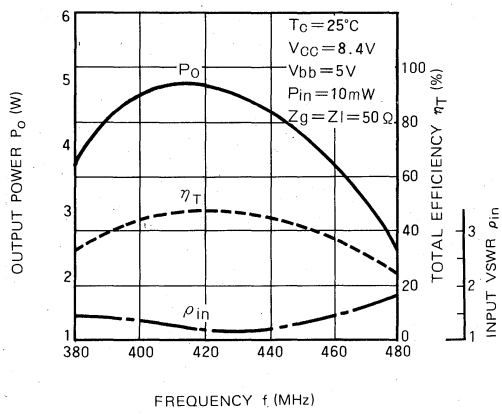
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



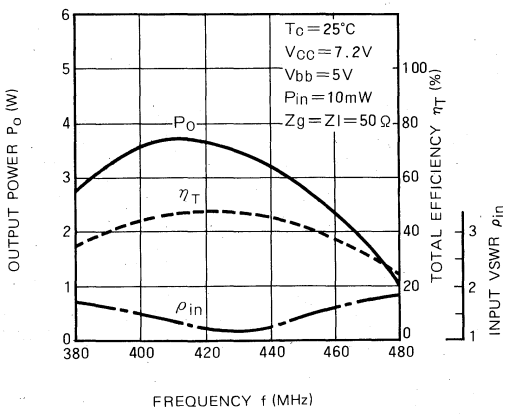
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



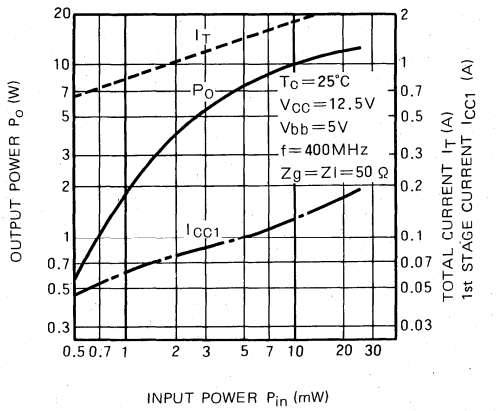
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



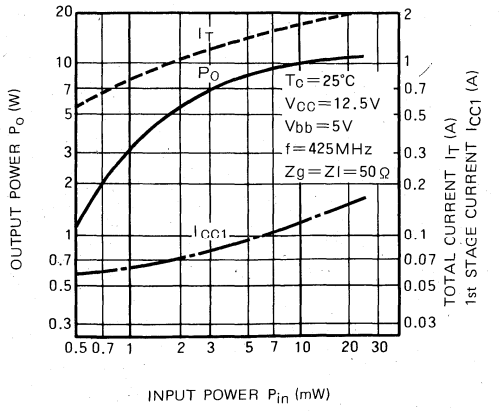
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



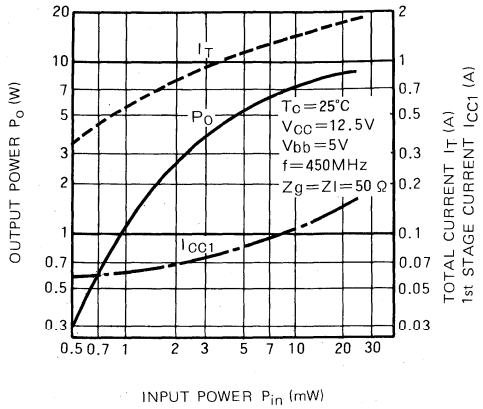
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. INPUT POWER CHARACTERISTICS



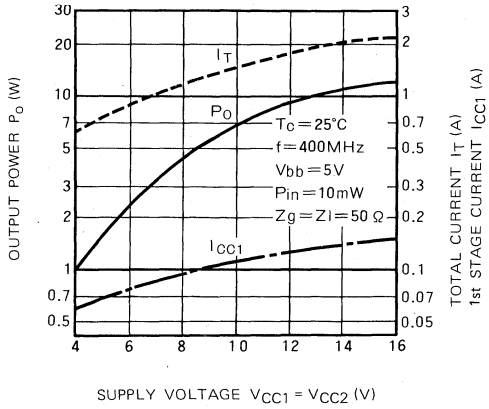
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. INPUT POWER CHARACTERISTICS



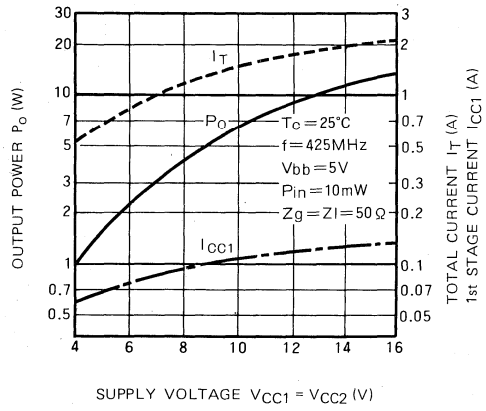
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



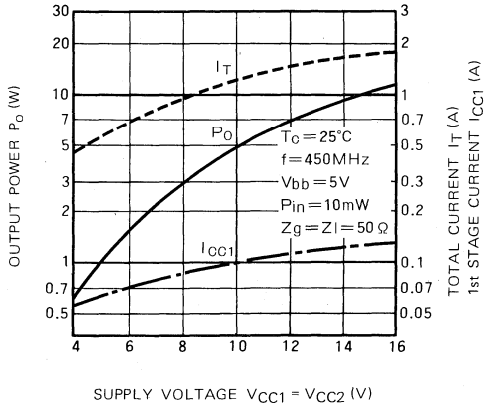
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



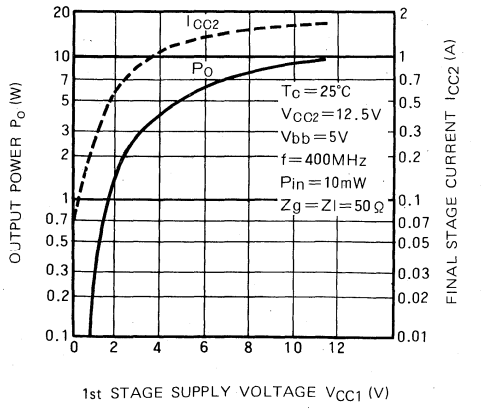
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



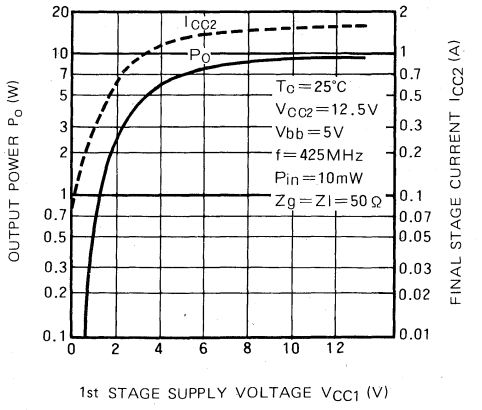
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT, VS. SUPPLY VOLTAGE CHARACTERISTICS



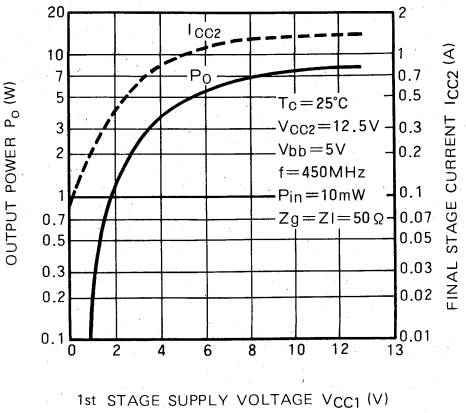
OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



M57722

806~825MHz, 10W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57722 is a thick film RF power module specifically designed for 806 ~ 825MHz, 10W FM mobile radios.

FEATURES

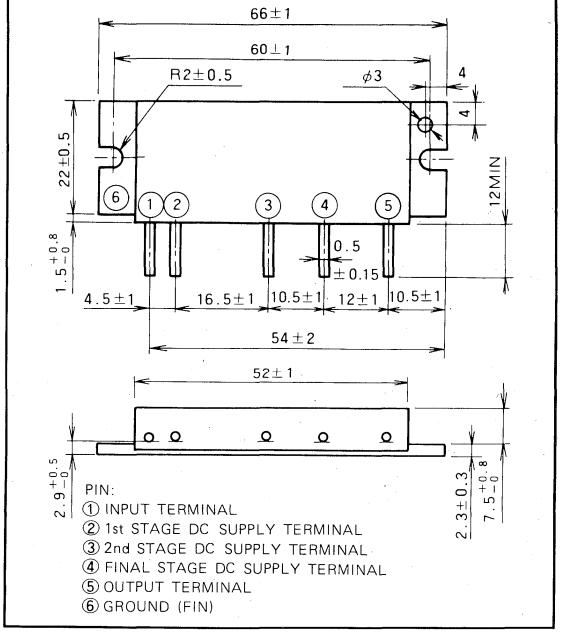
- Frequency Range . . . . . 806 ~ 825MHz
- High Power 13W
- High Gain 16.4dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 13W

APPLICATION

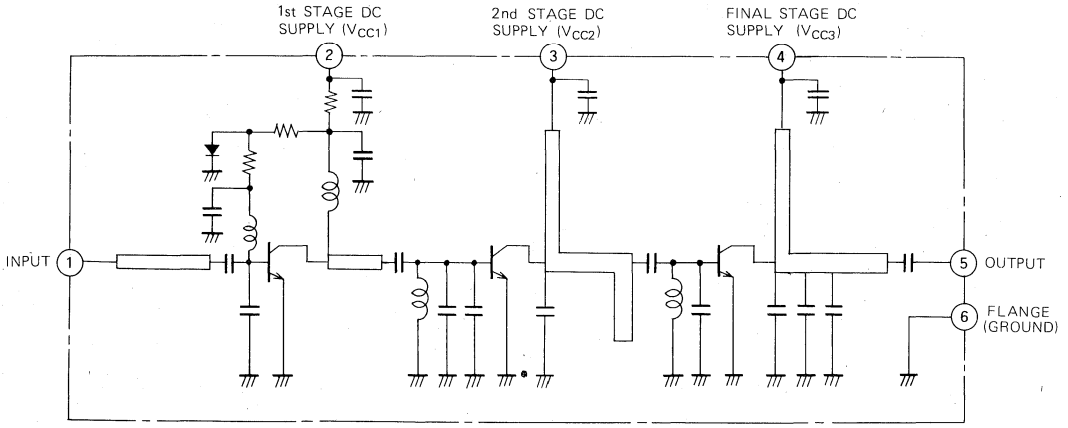
Output stage of 10W output mobile radio sets (FM) in 806 ~ 825MHz UHF band.

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

806~825MHz, 10W, FM
FOR MOBILE RADIO APPLICATION

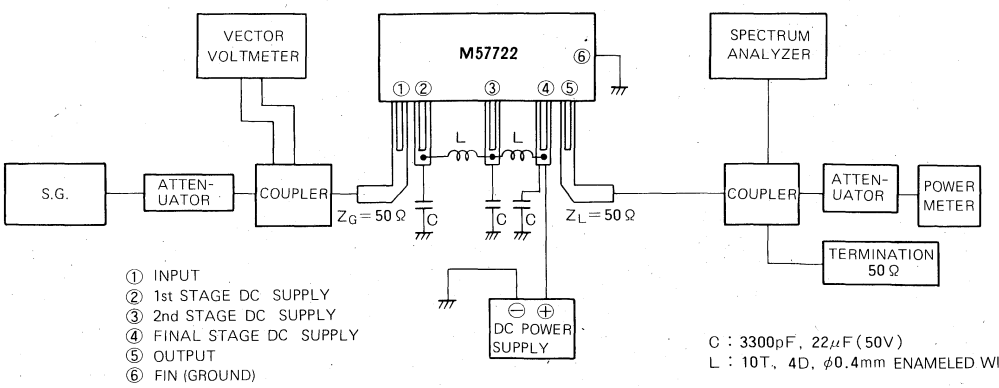
ABSOLUTE MAXIMUM RATINGS (T_C=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		5	A
Pin	Input power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 12.5V$	0.6	W
P_O	Output power	$Z_G=Z_L=50\Omega$	18	W
T_C (op)	Operation case temperature		−30~+110	℃
Tstg	Storage temperature		−40~+110	℃

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

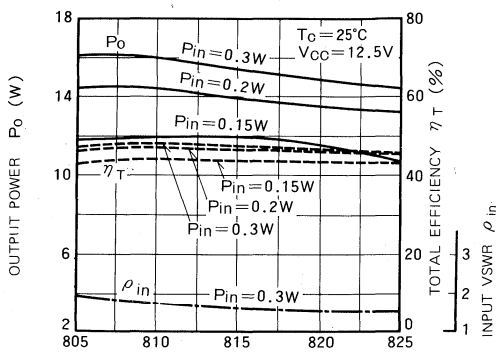
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=806~825MHz V_{CC}=12.5V, Pin=0.3W, $Z_G=Z_L=50\Omega$	13			W
η_T	Total efficiency		35			%
—	2nd harmonics				−30	dB
ρ_{in}	Input VSWR			2	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	VSWR tolerance	f=806~825MHz V_{CC}=15.2V, P_O=13W, Z_G=50Ω, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

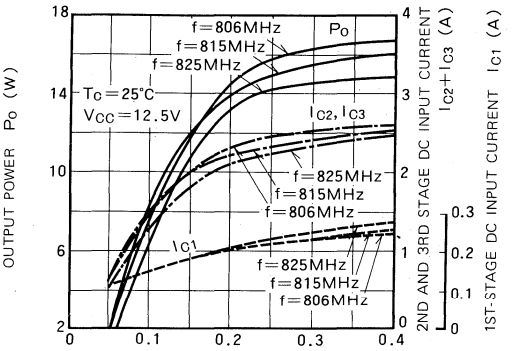


TYPICAL CHARACTERISTICS

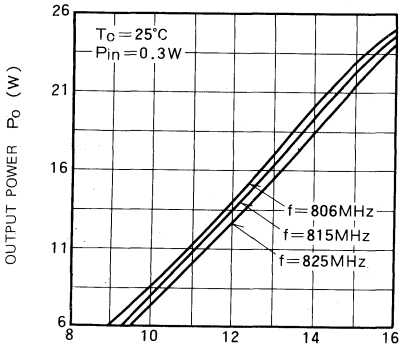
OUTPUT POWER, TOTAL EFFICIENCY AND INPUT VSWR VS. FREQUENCY



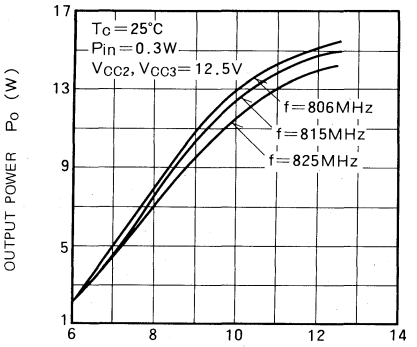
OUTPUT POWER, DC INPUT CURRENT VS. INPUT POWER



OUTPUT POWER VS. DC SUPPLY VOLTAGE



OUTPUT POWER VS. 1ST-STAGE SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.
   a) First stage transistor
      $R_{th(j-c)1}$ = 15°C/W (Typ.)
   b) Second stage transistor
      $R_{th(j-c)2}$ = 7.5°C/W (Typ.)
   c) Final stage transistor
      $R_{th(j-c)3}$ = 3.75°C/W (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.

- Conditions for standard operation.
  P_O = 13W, V_{CC} = 12.5V, P_{in} = 0.3W, η_T = 35% (minimum rating), P_{O1} (Note 1) = 1.5W, P_{O2} (2) = 6W, I_T = 2.97A (I_{T1} (3) = 0.25A, I_{T2} (4) = 0.87A, I_{T3} (5) = 1.85A)
  Note 1: Output power of the first stage transistor
  Note 2: Output power of the second stage transistor
  Note 3: Circuit current of the first stage transistor
  Note 4: Circuit current of the second stage transistor
  Note 5: Circuit current of the final stage transistor
- Junction temperature of the first stage transistor
  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)2} + T_C$ (6)
  $= (12.5 \times 0.25 - 1.5 + 0.3) \times 15 + T_C$
  $= 28.9 + T_C$ (°C)
  Note 6: Package temperature of device
- Junstion temperature of the second stage transistor
  $T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 0.87 - 6 + 1.5) \times 7.5 + T_C$
  $= 47.8 + T_C$ (°C)
- Junction temperature of the final stage transistor
  $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
  $= (12.5 \times 1.85 - 13 + 6) \times 3.75 + T_C$
  $= 60.5 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 13W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(13/0.35) - 13 + 0.3}$$

$$= 1.23\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 118.9°C, T_{j2} = 137.8°C, T_{j3} = 150.5°C
at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 88.9°C, T_{j2} = 107.8°C, T_{j3} = 120.5°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57726

144~148MHz, 40W,FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57726 is a thick film RF power module specifically designed for 144 ~ 148MHz, 40W FM mobile radios.

FEATURES

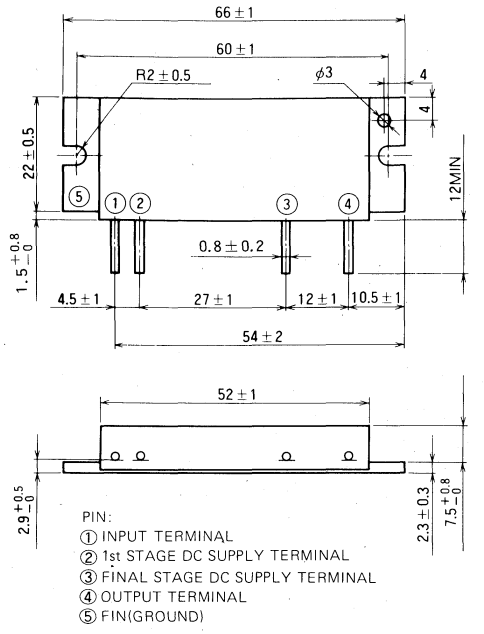
- Frequency Range . . . . . 144 ~ 148MHz
- High Power 43W
- High Gain 20.3dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 45W.

APPLICATION

Output stage of 40W output mobile radio sets (FM) in 144 ~ 148MHz VHF band.

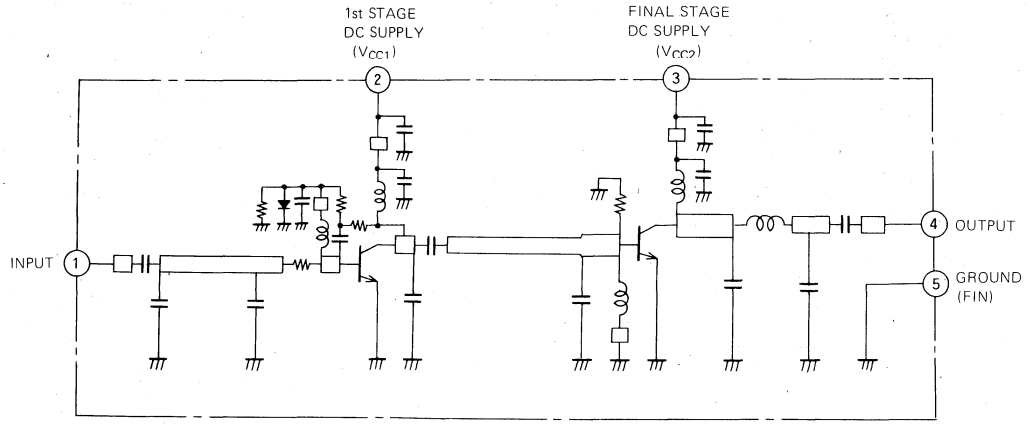
OUTLINE DIAGRAM

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ FINAL STAGE DC SUPPLY TERMINAL
④ OUTPUT TERMINAL
⑤ FIN(GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

144～148MHz, 40W,FM
FOR MOBILE RADIO APPLICATION

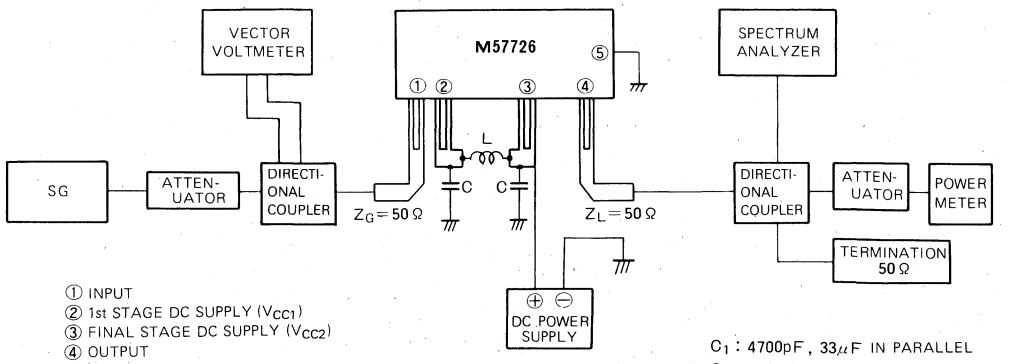
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		14	A
Pin	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.6	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	55	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

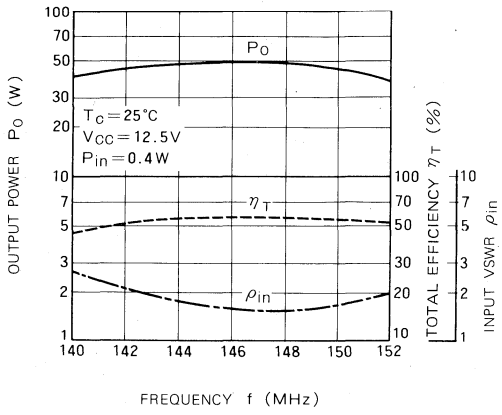
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC}=12.5V$, f=144～148MHz, Pin=0.2W, $Z_G=Z_L=50\,\Omega$	43	47		W
η_T	Total efficiency		50	54		%
—	2nd harmonic				−35	dB
—	3rd Harmonic				−45	dB
ρin	Input VSWR			2.0	2.8	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC}=15.2V$, f=144～148MHz, P_O=45W, $Z_G=50\,\Omega$, 5sec	20 : 1			—

TEST DIAGRAM

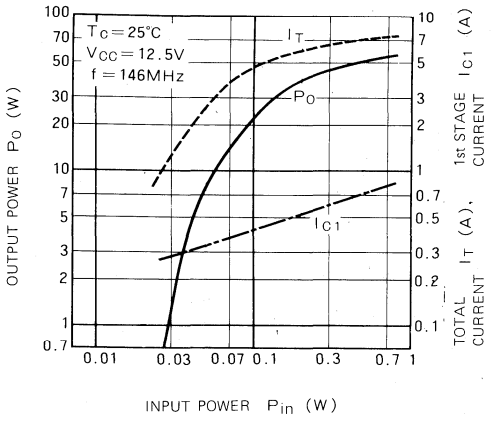


TYPICAL PERFORMANCE DATA

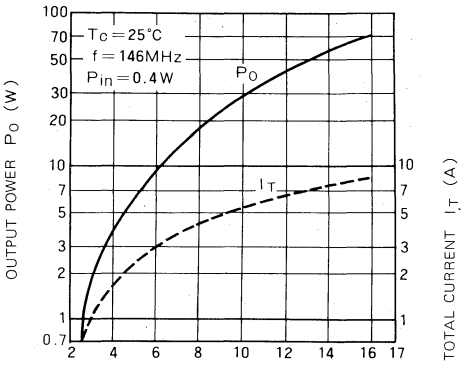
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



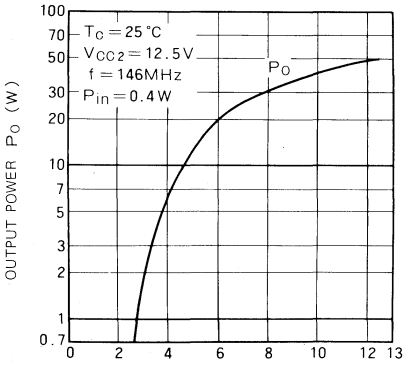
OUTPUT POWER, 1st STAGE CURRENT TOTAL CURRENT VS. INPUT POWER



OUTPUT POWER, TOTAL CURRENT VS. DC SUPPLY VOLTAGE



OUTPUT POWER VS. 1st STAGE VOLTAGE



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 4.3°C/W$ (Typ.)

b) Final stage transistor

$R_{th(j-c)2} = 1.5°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  $P_O = 43W$, $V_{CC} = 12.5V$, $P_{in} = 0.4W$, $\eta_T = 50\%$ (minimum rating), P_{O1} (Note 1) $= 9.4W$, $I_T = 6.88A$ (I_{T1} (2) $= 1.25A$, I_{T2} (3) $= 5.63A$)

  Note 1: Output power of the first stage transistor

  Note 2: Circuit current of the first stage transistor

  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)

  $= (12.5 \times 1.25 - 9.4 + 0.4) \times 4.3 + T_C$

  $= 28.5 + T_C$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}1) \times R_{th(j-c)2} + T_C$

  $= (12.5 \times 5.63 - 63 + 9.4) \times 1.5 + T_C$

  $= 55.2 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally $T_a = 60°C$) and at the output power of 43W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(43/0.5) - 43 + 0.4}$$

$$= 0.69\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

$T_{j1} = 118.5°C$, $T_{j2} = 145.2°C$ at $T_a = 60°C$, $T_C = 90°C$.

In the annual average of ambient temperature is 30°C,

$T_{j1} = 88.5°C$, $T_{j2} = 115.2°C$

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57727

144~148MHz, 25W, SSB FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57727 is a thick film RF power module specifically designed for 144 ~ 148MHz, 25W SSB mobile radios.

FEATURES

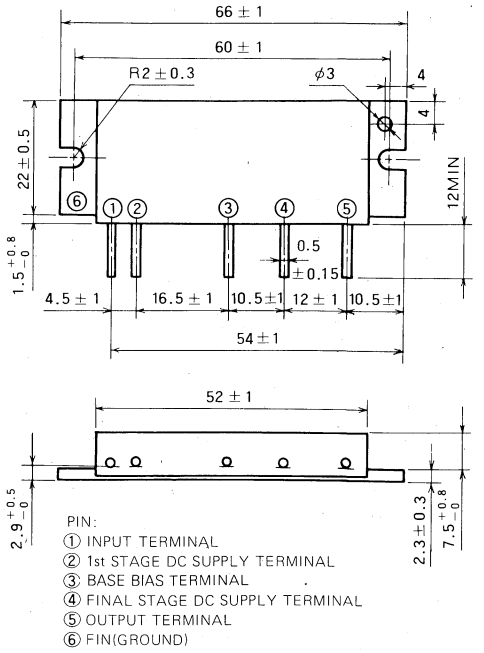
- Frequency Range . . . . . 144 ~ 148MHz
- High Power 30W
- High Linear Power Gain 24dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W.

APPLICATION

Output stage of 25W output mobile radio sets (SSB) in 144 ~ 148MHz VHF band.

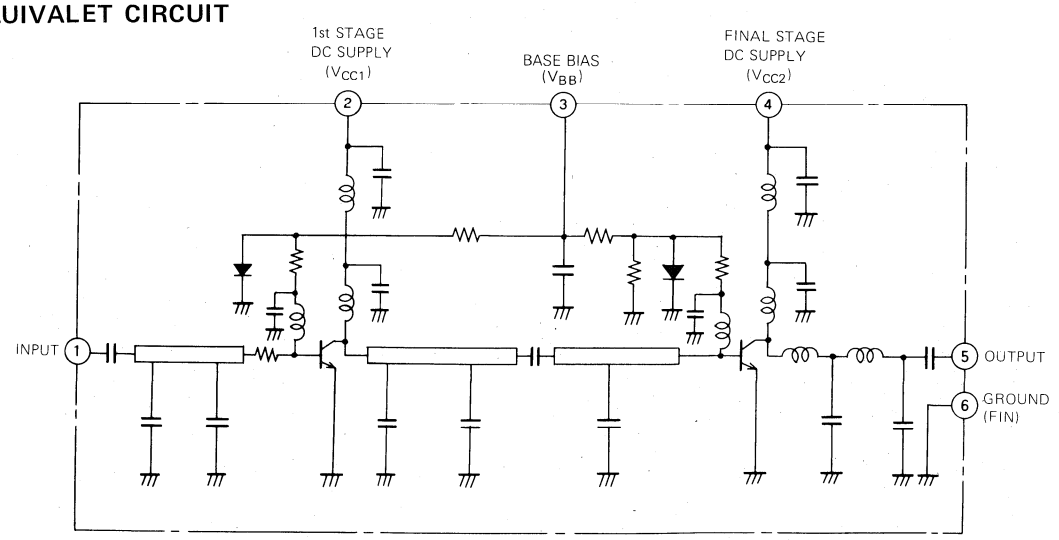
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN(GROUND)

EQUIVALET CIRCUIT



MITSUBISHI ELECTRIC

144～148MHz, 25W, SSB FOR MOBILE RADIO APPLICATION

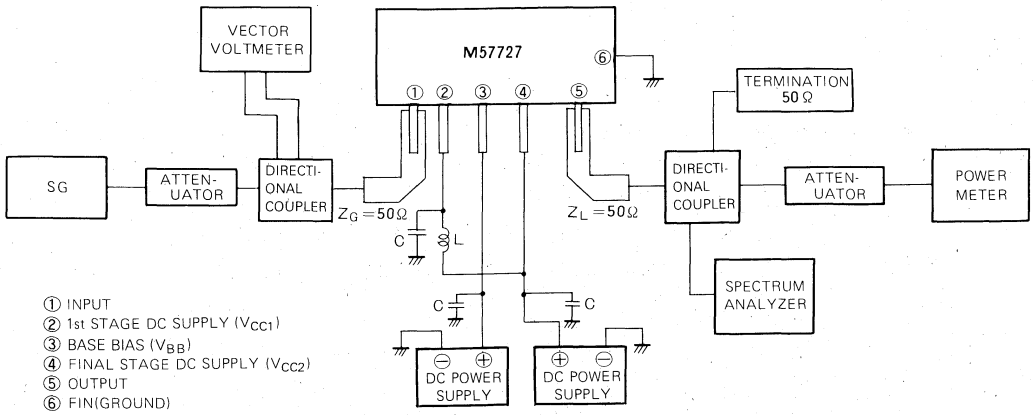
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
V_{BB}	Base bias voltage		10	V
I_{CC}	Total current		10	A
P_{in} (max)	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}=12.5V$, $V_{BB}=9V$	0.5	W
P_O (max)	Output power	$Z_G=Z_L=50\,\Omega$	40	W
T_C (op)	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

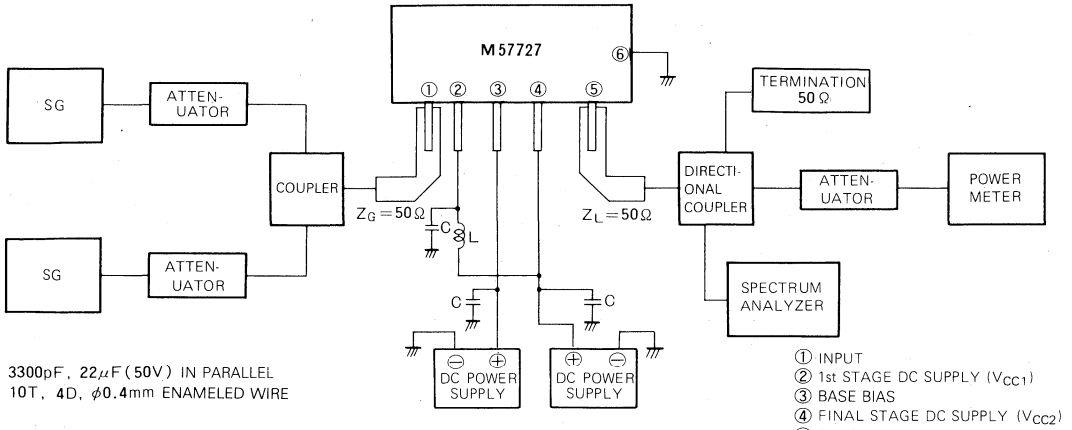
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=144～148MHz V_{CC}=12.5V, V_{BB}=9V P_{in}=0.3W $Z_G=Z_L=50\,\Omega$	37	42		W
η_T	Total efficiency		50	55		%
—	2nd harmonic				−25	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR				2.2	—
ρ_{out}	Output VSWR			1.8		—
G_P	Power gain	f=144～148MHz, V_{CC}=12.5V, V_{BB}=9V P_{in}=10dBm, $Z_G=Z_L=50\,\Omega$	24			dB
—	3rd IMD	f_1=144～148MHz, f_1-f_2=1.5kHz, V_{CC}=12.5V, V_{BB}=9V, $P_{O(PEP)}\leqq$30W $Z_G=Z_L=50\,\Omega$			−26	dB
—	5th IMD				−31	dB
—	Load VSWR tolerance	f=144～148MHz, V_{CC}=15.2V, V_{BB}=9V, P_O=30W, Z_G=50Ω, 5sec.	20 : 1			—

TEST DIAGRAM (1)



C : 33000pF, 10μF (50V)
L : 10T, 4D, φ0.4mm ENAMELED WIRE

TEST DIAGRAM (2)

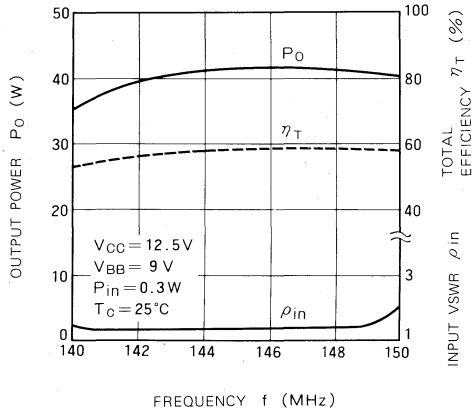


C : 3300pF, 22μF(50V) IN PARALLEL
L : 10T, 4D, φ0.4mm ENAMELED WIRE

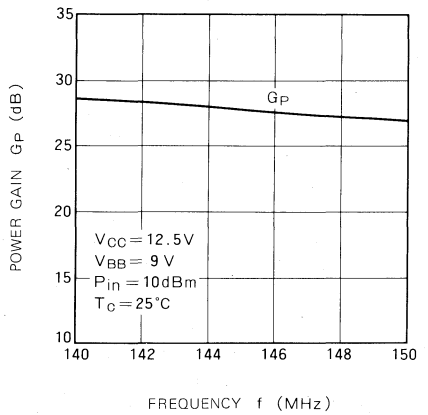
① INPUT
② 1st STAGE DC SUPPLY (V_{CC1})
③ BASE BIAS
④ FINAL STAGE DC SUPPLY (V_{CC2})
⑤ OUTPUT
⑥ FIN (GROUND)

TYPICAL PERFORMANCE DATA

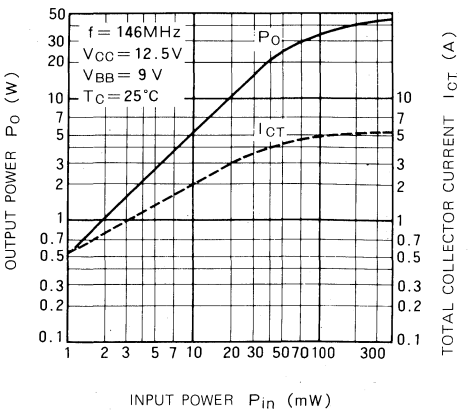
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



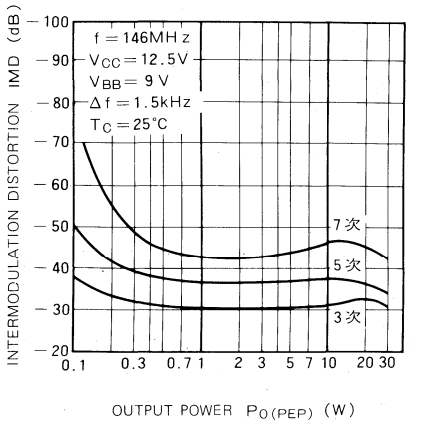
POWER GAIN VS. FREQUENCY



OUTPUT POWER, TOTAL COLLECTOR CURRENT VS. INPUT POWER



INTERMODULATION DISTORTION VS. OUTPUT POWER



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 3°C/W (Typ.)

b) Final stage transistor

$R_{th(j-c)2}$ = 1.5°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  P_O = 30W, V_{CC} = 12.5V, P_{in} = 0.1W, η_T = 50% (minimum rating), P_{O1} (Note 1) = 2W, I_T = 4.8A (I_{T1} (2) = 0.4A, I_{T2} (3) = 4.4A)

  Note 1: Output power of the first stage transistor
  Note 2: Circuit current of the first stage transistor
  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)2} + T_C$ (4)
  $= (12.5 \times 0.4 - 2 + 0.1) \times 3 + T_C$
  $= 9.3 + T_C$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 4.4 - 30 + 2) \times 1.5 + T_C$
  $= 40.5 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 30W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(30/0.5) - 30 + 0.1}$$
$$= 1.00\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 110°C, T_{j2} = 131°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 70°C, T_{j2} = 101°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57729 SERIES

335~512MHz, 25W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57729 is a thick film RF power module specifically designed for 335 ~ 512MHz, 25W FM mobile radios.

FEATURES

- Frequency Range . . . . . 335 ~ 512MHz
- High Power 30W
- High Gain 20.0dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W

APPLICATION

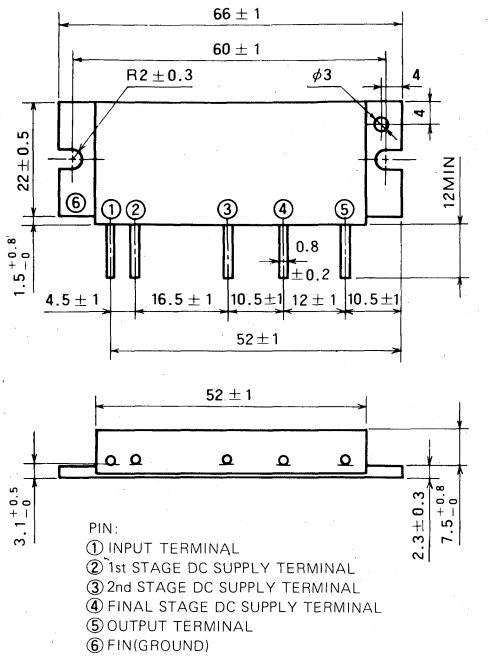
Output stage of 25W output mobile radio sets (FM) in 335 ~ 512MHz UHF band.

FREQUENCY ITEM

M57729EL : 335 ~ 360MHz
M57729SL : 360 ~ 380MHz
M57729UL : 380 ~ 400MHz
M57729L : 400 ~ 420MHz
M57729 : 430 ~ 450MHz
M57729H : 450 ~ 470MHz
M57729UH : 470 ~ 490MHz
M57729SH : 490 ~ 512MHz

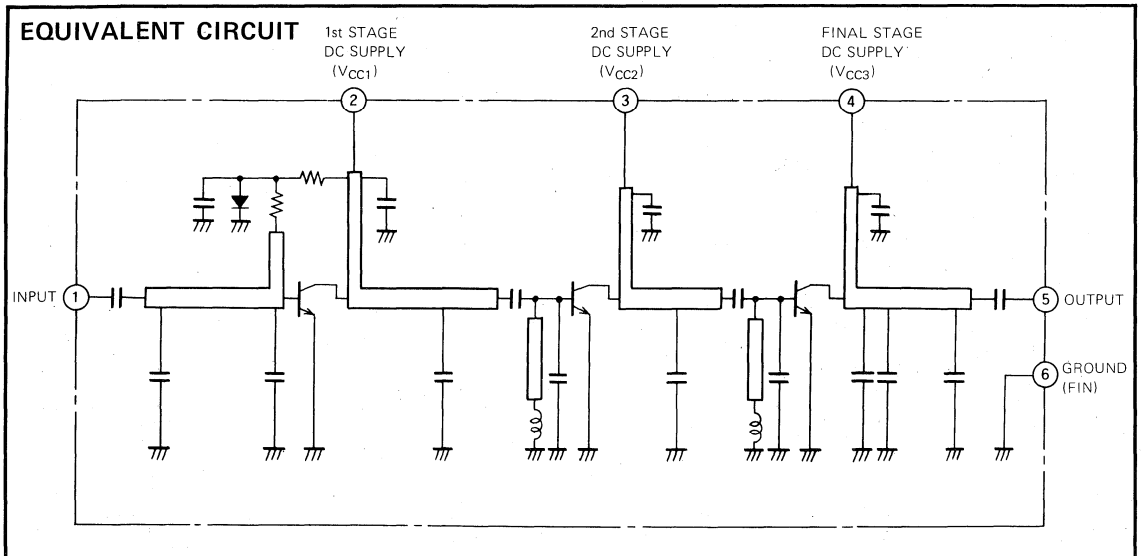
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN(GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

M57729 SERIES

335～512MHz, 25W, FM FOR MOBILE RADIO APPLICATION

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		10	A
P_{in}	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.6	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	40	W
T_C (op)	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

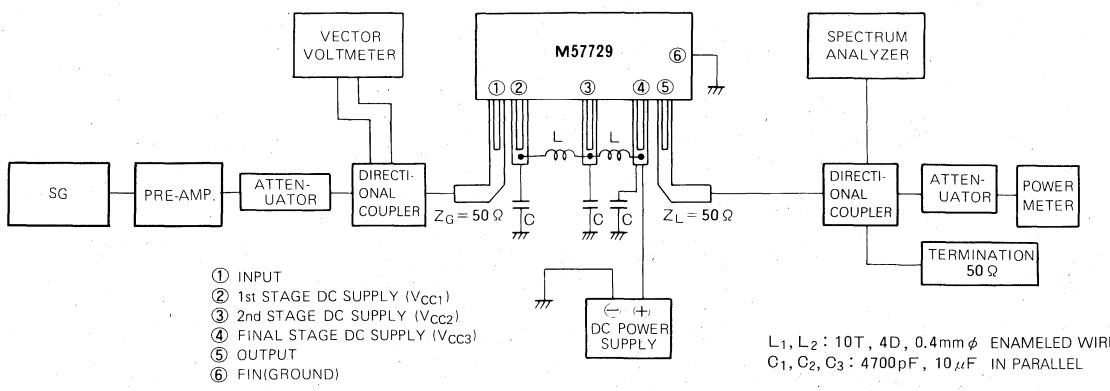
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC}=12.5V$, $P_{in}=0.3W$, $Z_G=Z_L=50\,\Omega$ (Note 1)	30	33		W
η_T	Total efficiency		40	45		%
—	2nd harmonics				−30	dB
—	3rd Harmonic				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2		—
—	Load VSWR tolerance	$V_{CC}=15.2V$, $P_O=30W$, $Z_G=50\,\Omega$, $T=5sec.$ (Note 1)	20 : 1			—

Note 1. Test frequency condition

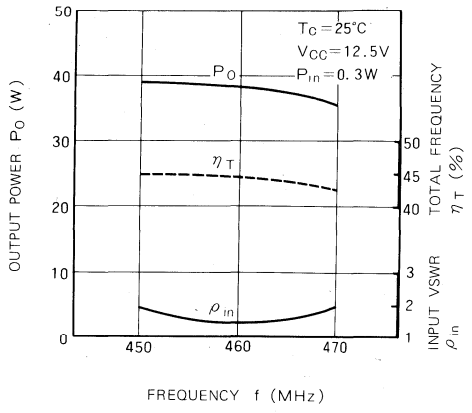
M57729EL : 335～360MHz		M57729 : 430～450MHz	
M57729SL : 360～380MHz		M57729H : 450～470MHz	
M57729UL : 380～400MHz		M57729UH : 470～490MHz	
M57729L : 400～420MHz		M57729SH : 490～512MHz	

TEST DIAGRAM

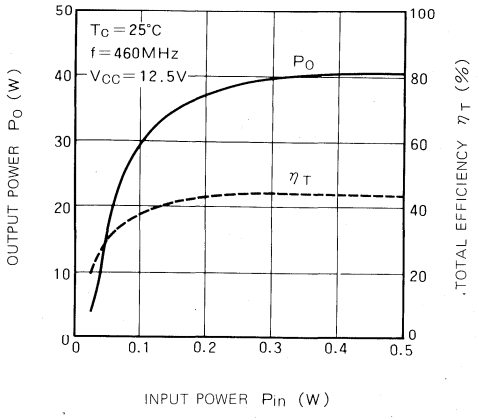


TYPICAL PERFORMANCE DATA

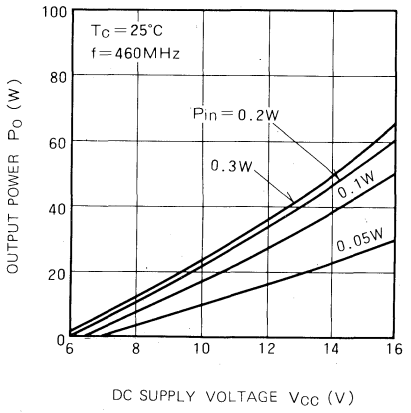
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY (M57729H)



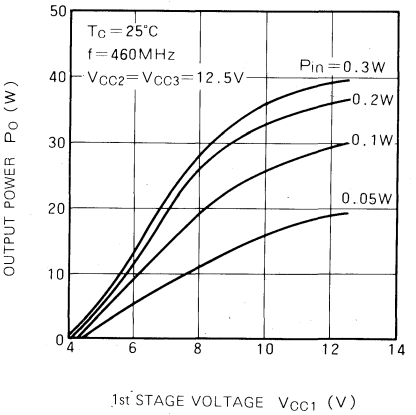
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57729H)



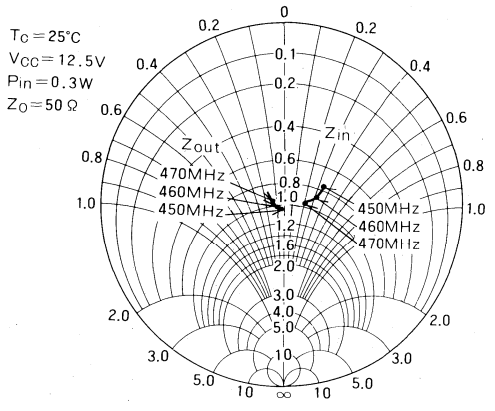
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57729H)



OUTPUT POWER VS. 1st STAGE VOLTAGE (M57729H)

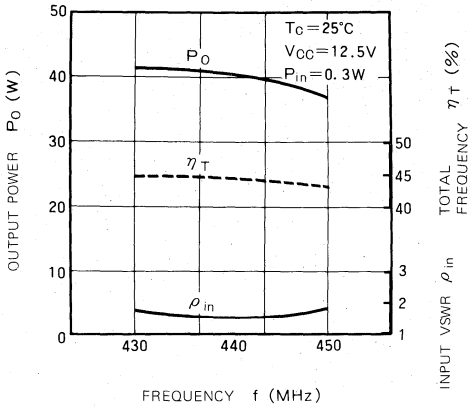


OUTPUT IMPEDANCE, INPUT IMPEDANCE VS. FREQUENCY (M57729H)

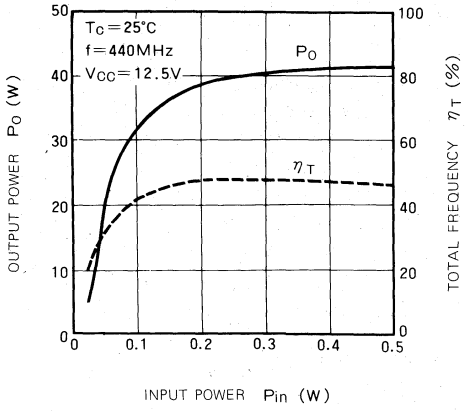


MITSUBISHI ELECTRIC

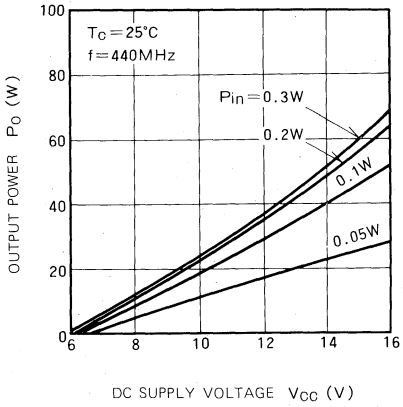
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY (M57729)



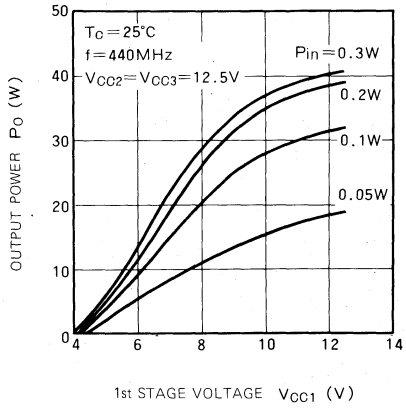
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER (M57729)



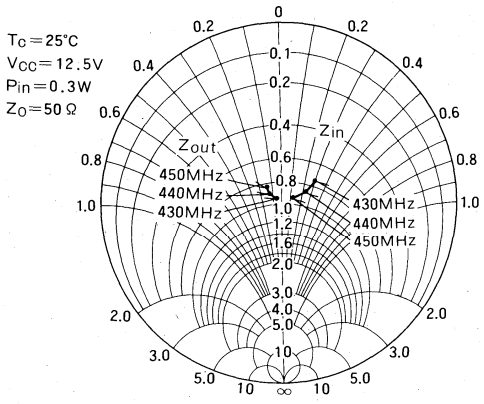
OUTPUT POWER VS. DC SUPPLY VOLTAGE (M57729)



OUTPUT POWER VS. 1st STAGE VOLTAGE (M57729)



INPUT IMPEDANCE, OUTPUT IMPEDANCE VS. FREQUENCY (M57729)



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 12°C/W$ (Typ.)

b) Second stage transistor

$R_{th(j-c)2} = 4°C/W$ (Typ.)

c) Final stage transistor

$R_{th(j-c)3} = 2°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.

- Conditions for standard operation.

  $P_O = 30W$, $V_{CC} = 12.5V$, $P_{in} = 0.3W$, $\eta_T = 40\%$ (minimum rating), P_{o1} (Note 1) $= 2.0W$, P_{o2} (2) $= 8.0W$, $I_T = 6.0A$ (I_{T1} (3) $= 0.35A$, I_{T2} (4) $= 1.32A$, I_{T3} (5) $= 4.33A$)

  Note 1: Output power of the first stage transistor
  Note 2: Output power of the second stage transistor
  Note 3: Circuit current of the first stage transistor
  Note 4: Circuit current of the second stage transistor
  Note 5: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{o1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
  $= (12.5 \times 0.35 - 2.0 + 0.3) \times 12 + T_C$
  $= 32 + T_C$ (°C)

  Note 6: Package temperature of device

- Junction temperature of the second stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_{o2} + P_{o1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 1.32 - 8.0 + 2.0) \times 4 + T_C$
  $= 42 + T_C$ (°C)

- Junction temperature of the final stage transistor

  $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{o2}) \times R_{th(j-c)3} + T_C$
  $= (12.5 \times 4.33 - 30 + 8) \times 2 + T_C$
  $= 64 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally $T_a = 60°C$) and at the output power of 7W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(30/0.4) - 30 + 0.3}$$

$$= 0.66\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

$T_{j1} = 122°C$, $T_{j2} = 132°C$, $T_{j3} = 155°C$ at $T_a = 60°C$, $T_C = 90°C$.

In the annual average of ambient temperature is 30°C,

$T_{j1} = 92°C$, $T_{j2} = 102°C$, $T_{j3} = 125°C$.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57732

144～175MHz, 1～5W, FM PORTABLE RADIO

DESCRIPTION

M57732 is a thick film RF power module specifically designed for 144 ～ 175MHz, 1W ～ 5W FM portable sets.

FEATURES

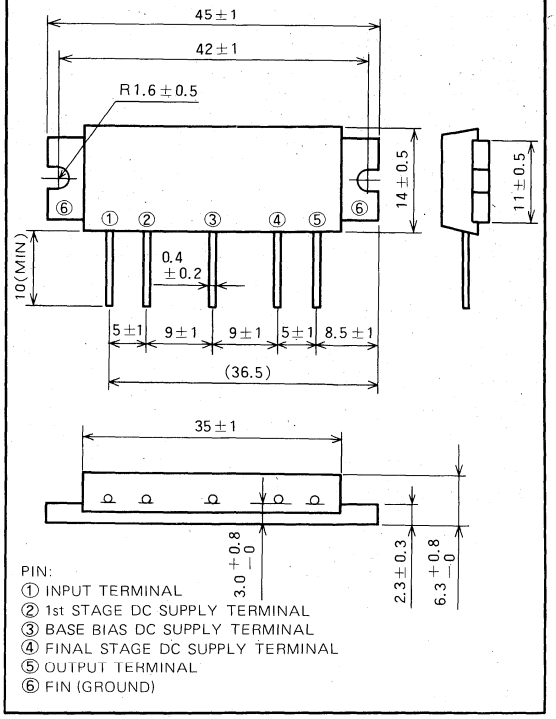
- Wide band: 31MHz, f = 144～175MHz
- High total efficiency
  η_T = 50% TYP, 40% MIN, @V_{CC} = 12.5V, Pin = 20mW
- High gain, High output power
  Gp : 25dB @V_{CC} = 12.5V, Po ≧ 7W, Pin = 20mW
  : 24dB @V_{CC} = 10.8V, Po ≧ 5W, Pin = 20mW
  : 21dB @V_{CC} = 8.4V, Po ≧ 3.5W, Pin = 20mW
  : 18dB @V_{CC} = 7.2V, Po ≧ 1.5W, Pin = 20mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output Stage of 1～5W output VHF band Portable radio sets.

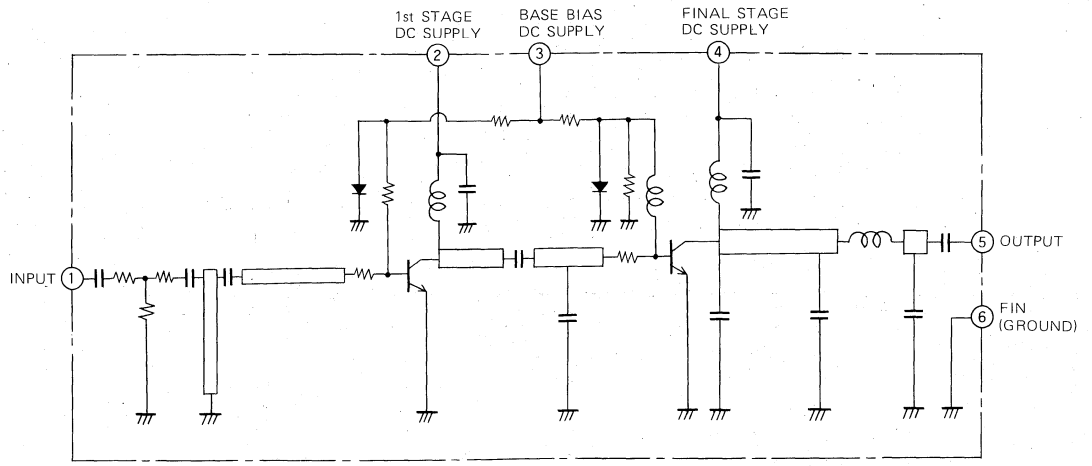
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



144～175MHz, 1～5W, FM PORTABLE RADIO

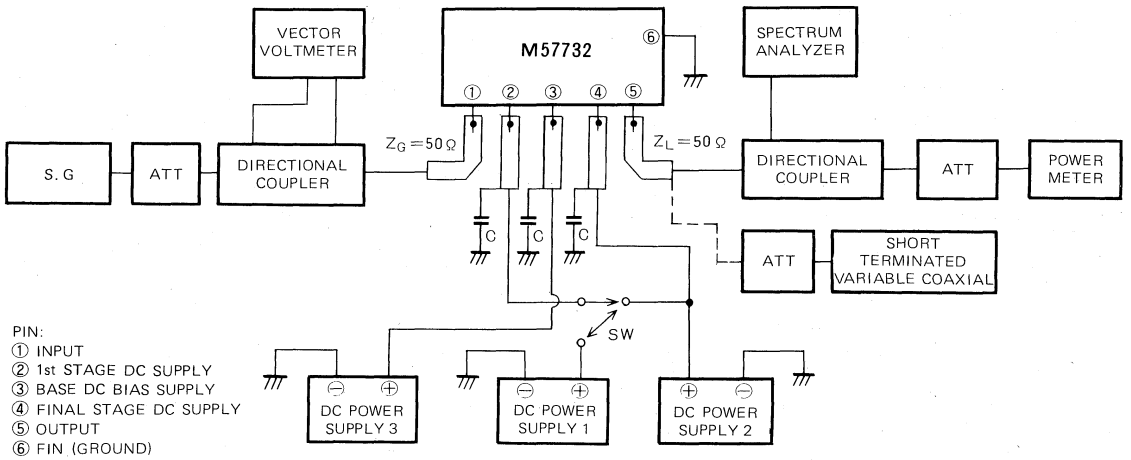
ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}(max)	Input power	$Z_G=Z_L=50\,\Omega$	40	mW
P_O(max)	Output power	$Z_G=Z_L=50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature range		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC}=12.5V$, $V_{BB}=5V$, f=144～175MHz, $P_{in}=20mW$, $Z_G=Z_L=50\,\Omega$	7	8		W
η_T	Total efficiency		40	50		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρ in	Input VSWR			1.5	2.5	—
ρ out	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}=13.2V$, $V_{BB}=5V$, f=144～175 MHz, $P_O=7W$, $\rho_L\geqq 20$(All phase), $Z_G=50\,\Omega$	20：1			—

TEST BLOCK DIAGRAM

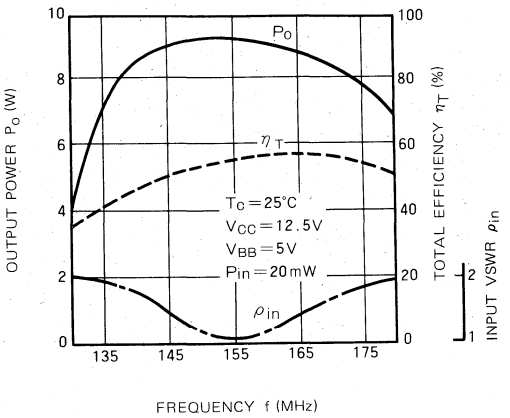


PIN:
① INPUT
② 1st STAGE DC SUPPLY
③ BASE DC BIAS SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

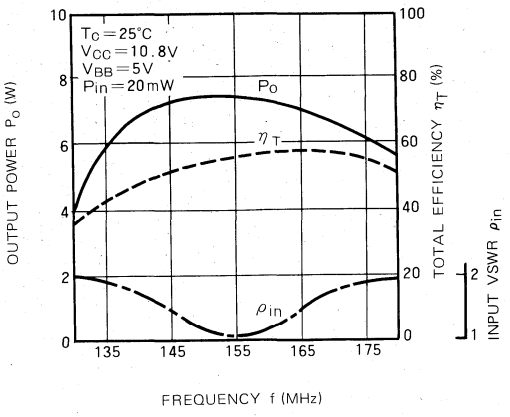
C: 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

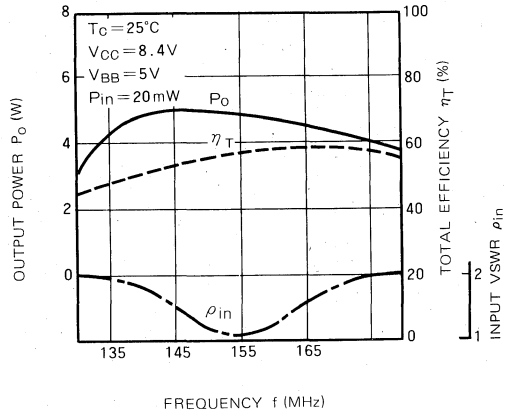
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



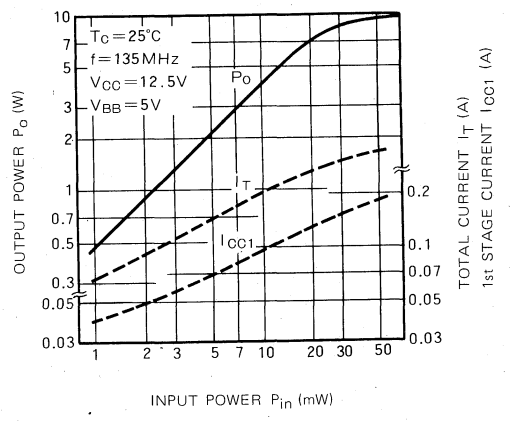
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



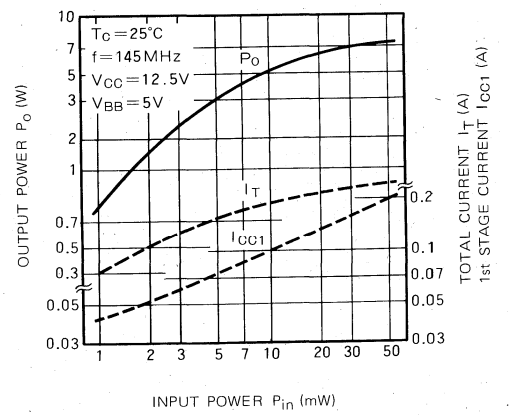
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



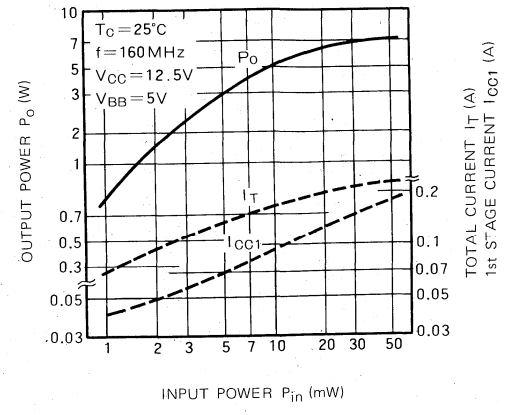
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



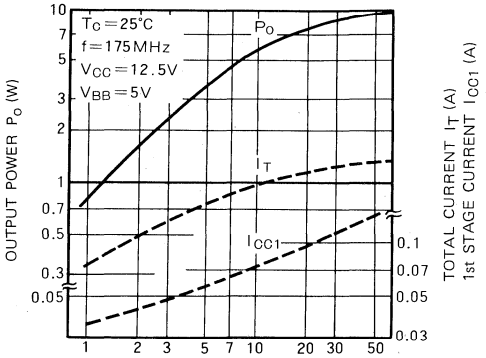
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



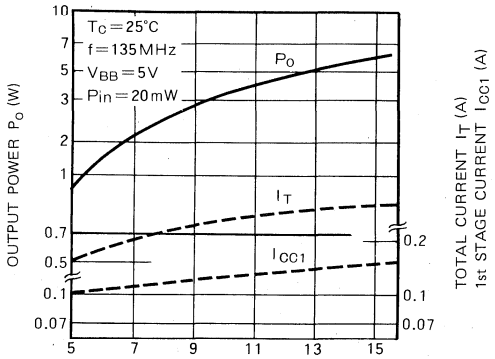
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



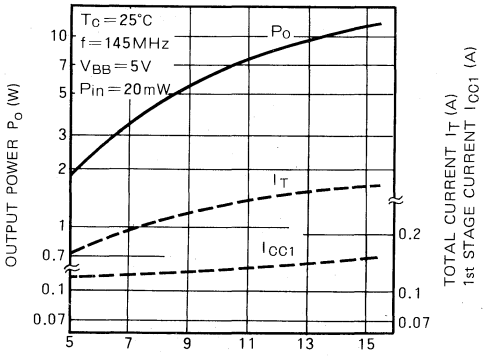
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



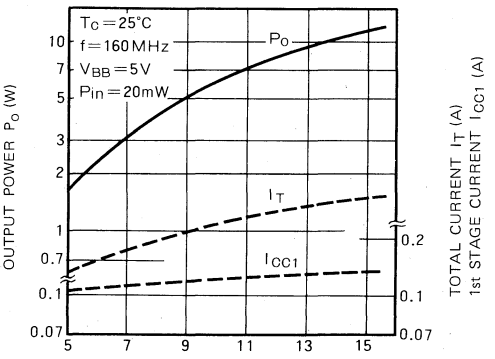
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



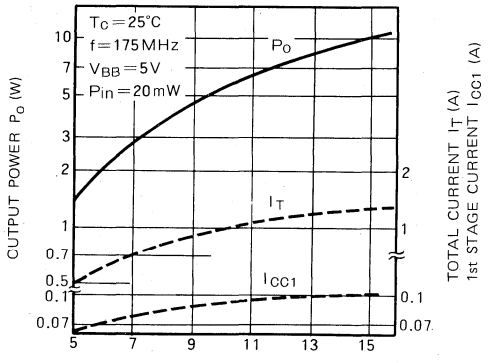
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



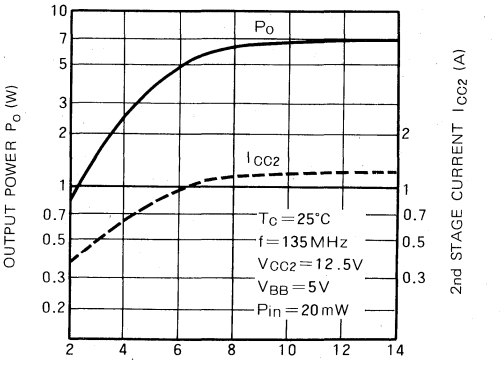
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS

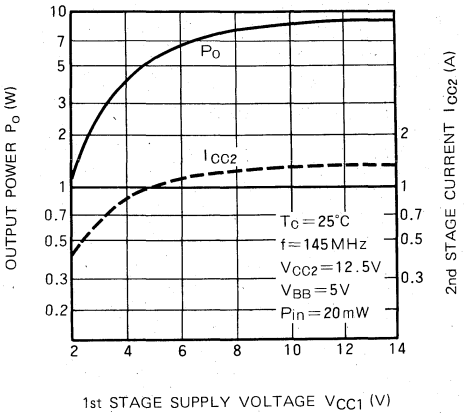


OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS

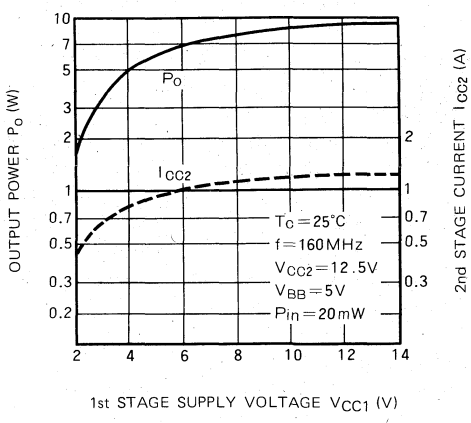


MITSUBISHI ELECTRIC

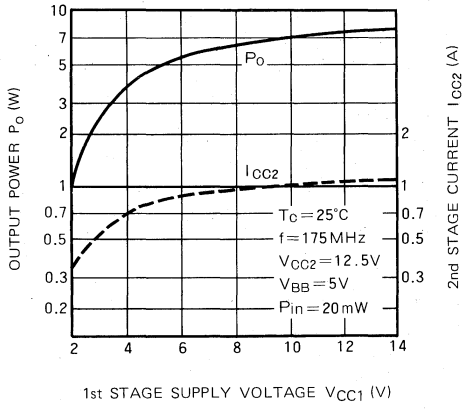
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



M57732L

135～160MHz, 1～5W, FM PORTABLE RADIO

DESCRIPTION

M57732L is a thick film RF power module specifically designed for 135～160MHz, 1～5W FM portable sets.

FEATURES

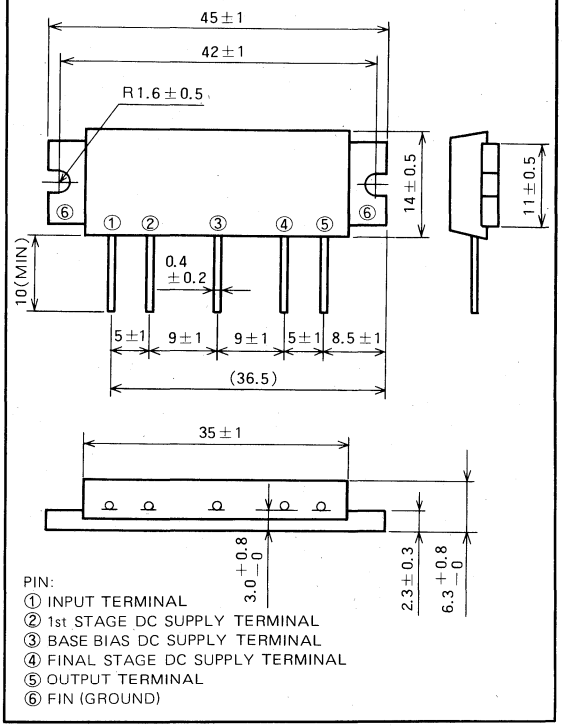
- Wide band: 25MHz, f=135～160MHz
- High total efficiency
  η_T = 50% TYP, 40% MIN, @V_{CC} = 12.5V, Pin = 20mW
- High gain, High output power
  Gp : 25dB @V_{CC} = 12.5V, Po ≧ 7W, Pin = 20mW
  : 24dB @V_{CC} = 10.8V, Po ≧ 5W, Pin = 20mW
  : 21dB @V_{CC} = 8.4V, Po ≧ 3W, Pin = 20mW
  : 18dB @V_{CC} = 7.2V, P_O ≧ 1.5W, Pin = 20mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 1 ～ 5W output VHF band portable radio sets.

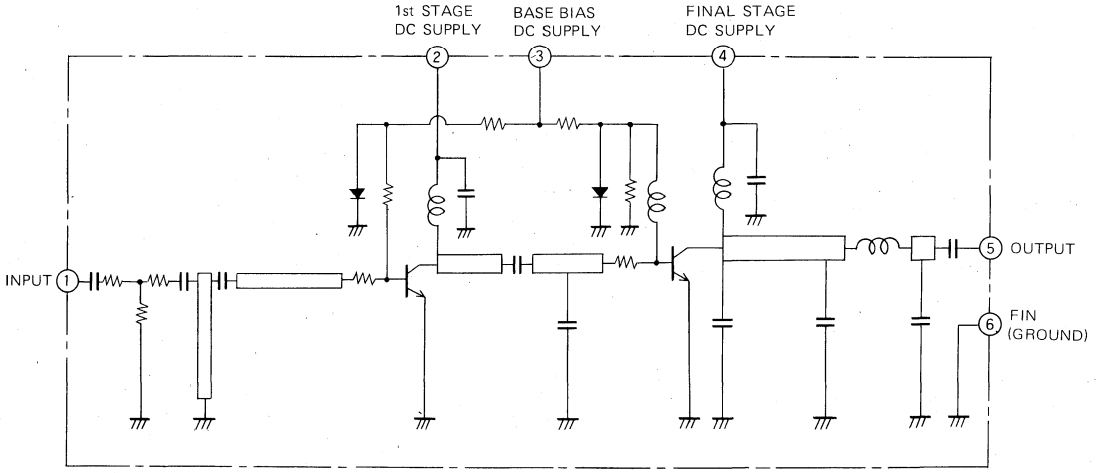
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

135～160MHz, 1～5W, FM PORTABLE RADIO

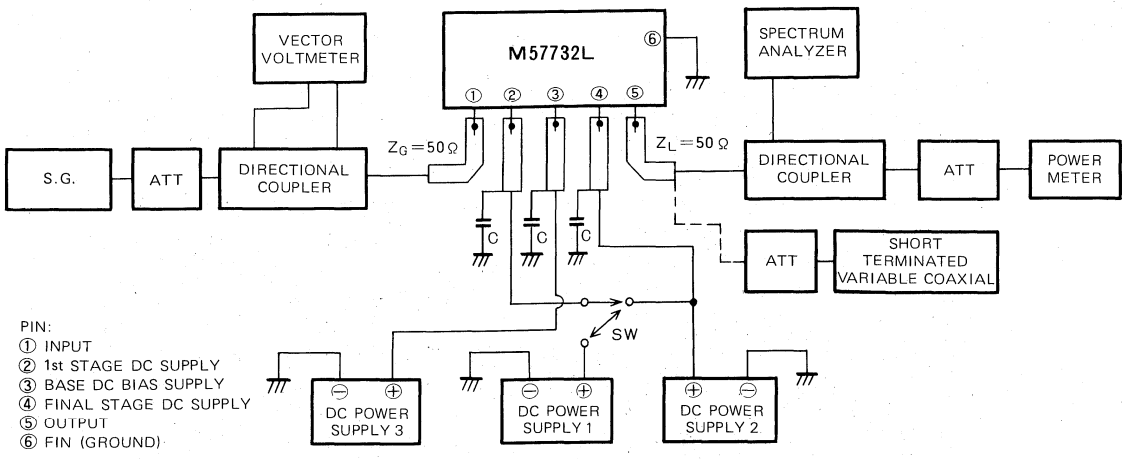
ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		16	V
V_{BB}	Base bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}	Input power	$Z_G=Z_L=50\,\Omega$	40	mW
P_O	Output power	$Z_G=Z_L=50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=135～160MHz, P_{in}=20mW, $Z_G=Z_L=50\,\Omega$	7	8		W
η_T	Total efficiency		40	50		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρ in	Input VSWR			1.5	2.5	—
ρ out	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=13.2V, V_{BB}=5V, f=135～160MHz, P_O=7W, $\rho_L \geqq 20$(All phase), $Z_G=50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

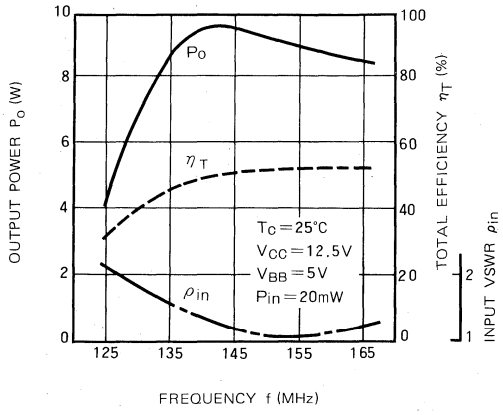


PIN:
① INPUT
② 1st STAGE DC SUPPLY
③ BASE DC BIAS SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

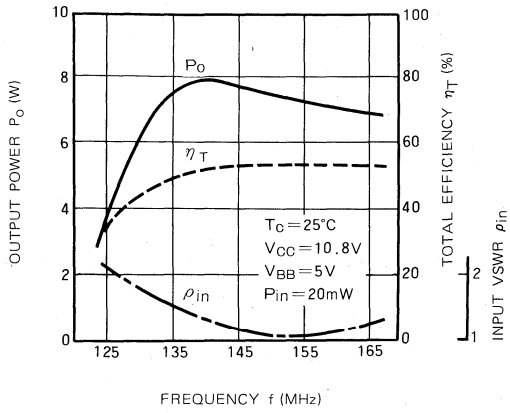
C: 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

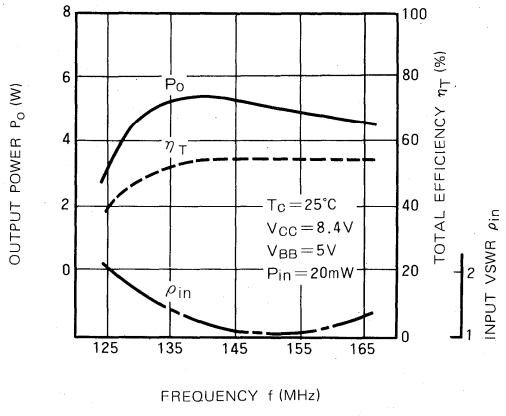
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



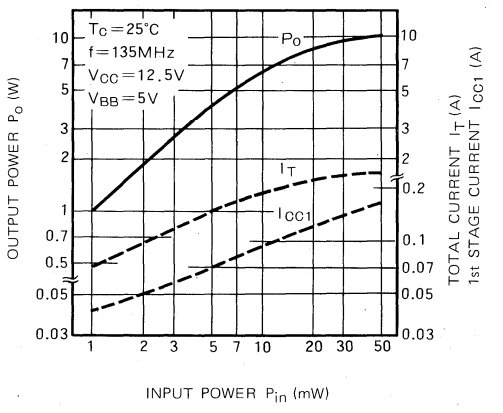
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



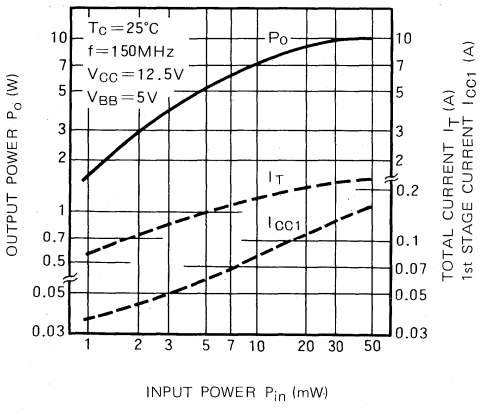
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



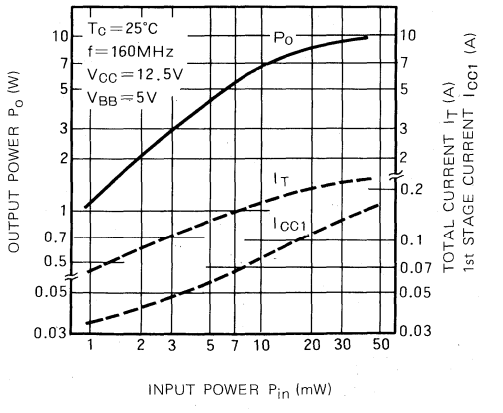
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS

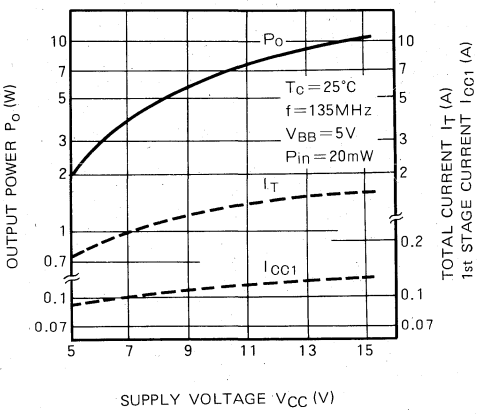


OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS

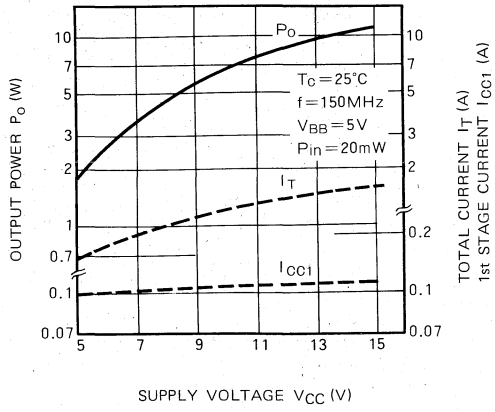


MITSUBISHI ELECTRIC

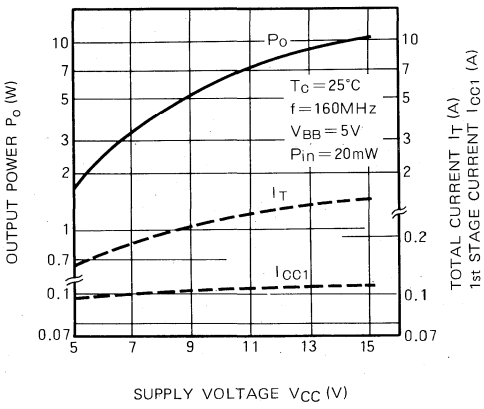
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



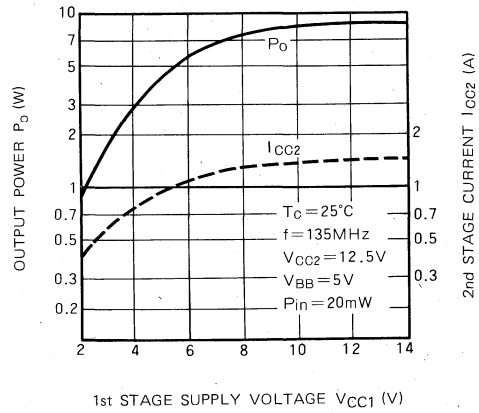
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



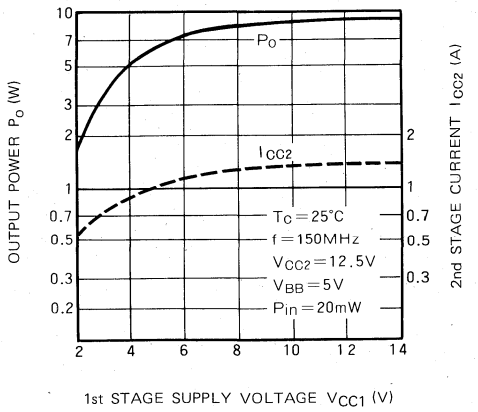
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



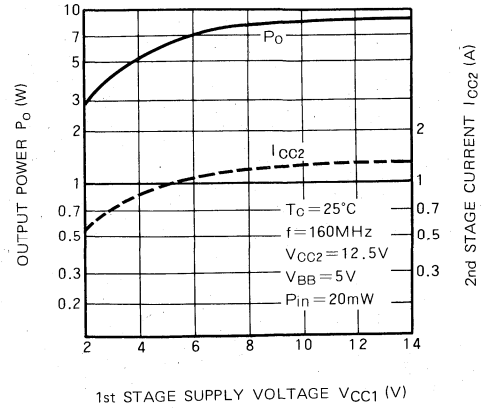
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



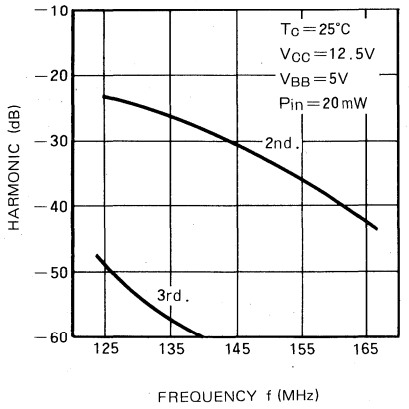
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC
VS. FREQUENCY CHARACTERISTICS



M57735

50~54MHz, 10W, SSB FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57735 is a thick film RF power module specifically designed for 50 ~ 54MHz, 10W SSB mobile radios.

FEATURES

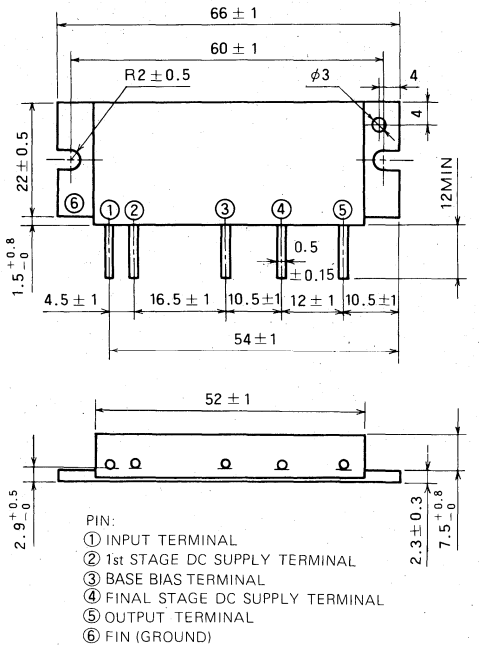
- Frequency Range . . . . . 50 ~ 54MHz
- High Power 14W
- High Linear Power Gain 21dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 14W.

APPLICATION

Output stage of 10W output mobile radio sets (SSB) in 50 ~ 54MHz VHF band.

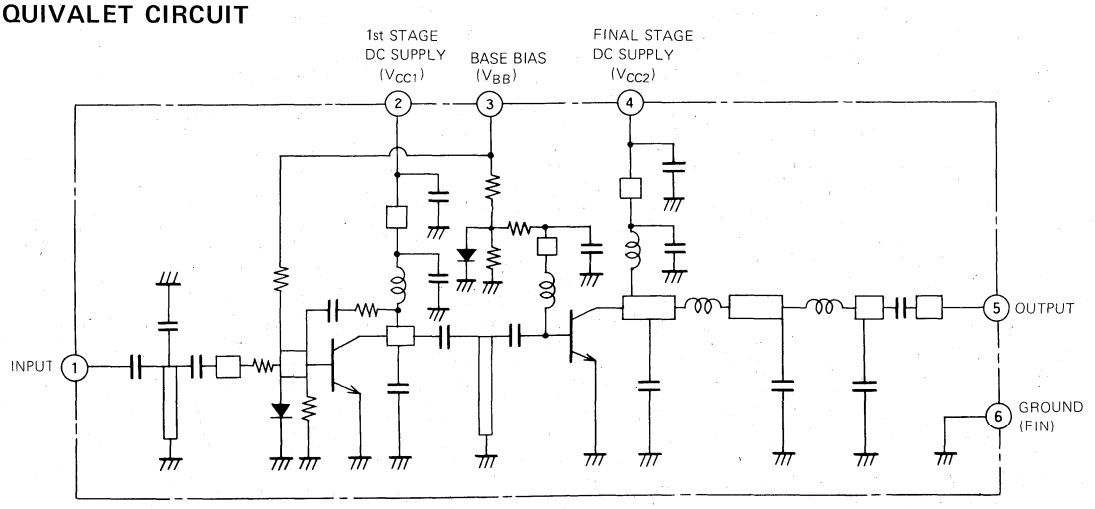
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALET CIRCUIT



50～54MHz, 10W, SSB FOR MOBILE RADIO APPLICATION

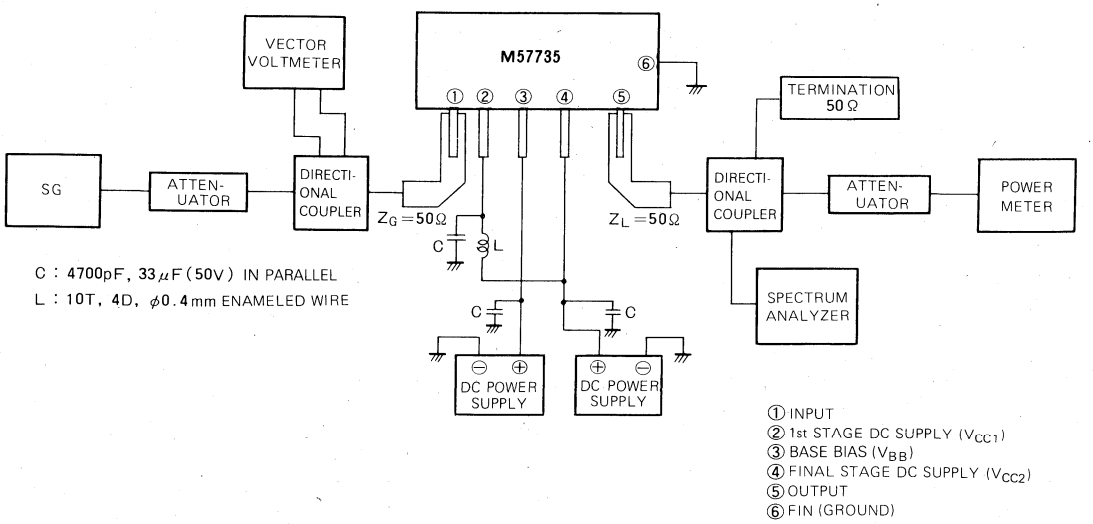
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
V_{BB}	Base bias voltage		10	V
I_{CC}	Total current		6	A
P_{in}	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}=12.5V$, $V_{BB}=9V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	25	W
T_C(op)	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

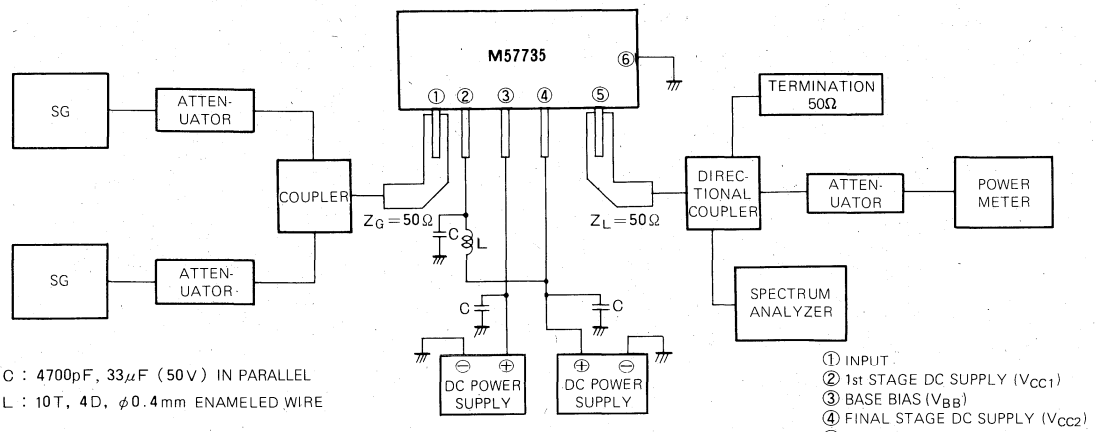
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=50～54MHz $V_{CC}=12.5V$, $V_{BB}=9V$ $P_{in}=0.2W$ $Z_G=Z_L=50\,\Omega$	19	22		W
η_T	Total efficiency		40	50		%
—	2nd harmonic				−25	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR				2.2	—
ρ_{out}	Output VSWR			2.0		—
G_P	Power gain	f=50～54MHz, $V_{CC}=12.5V$, $V_{BB}=9V$ $P_{in}=10dBm$, $Z_G=Z_L=50\,\Omega$	21			dB
—	3rd IMD	$f_1=50～54MHz$, $f_1-f_2=1.5kHz$, $V_{CC}=12.5V$, $V_{BB}=9V$, $P_{O(PEP)}\leqq 14W$ $Z_G=Z_L=50\,\Omega$		−30	−26	dB
—	5th IMD				−31	dB
—	Load VSWR tolerance	f=50～54MHz, $V_{CC}=15.2V$, $V_{BB}=9V$, $P_O=14W$, $Z_G=50\,\Omega$, 5sec.	20 : 1			—

TEST BLOCK DIAGRAM (1)



TEST BLOCK DIAGRAM (2)

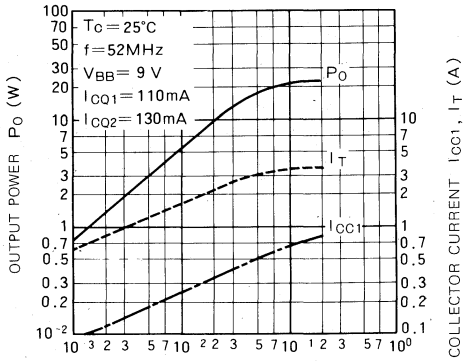


C : 4700pF, 33μF (50V) IN PARALLEL
L : 10T, 4D, φ0.4mm ENAMELED WIRE

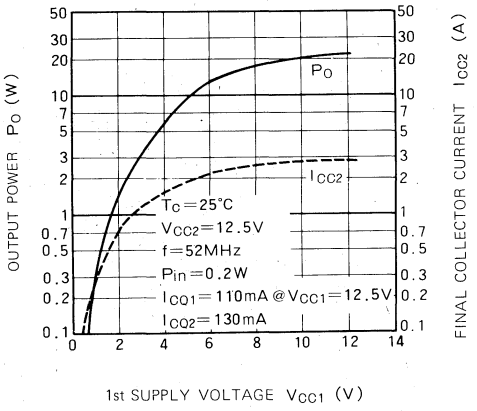
① INPUT
② 1st STAGE DC SUPPLY (V_{CC1})
③ BASE BIAS (V_{BB})
④ FINAL STAGE DC SUPPLY (V_{CC2})
⑤ OUTPUT
⑥ FIN (GROUND)

TYPICAL PERFORMANCE DATA

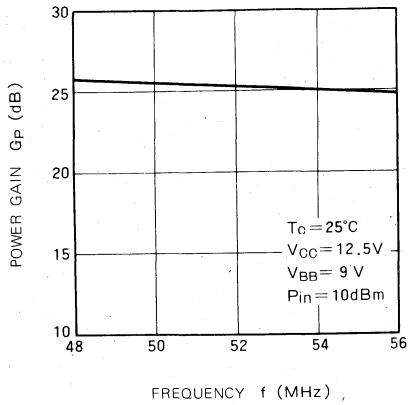
OUTPUT POWER, TOTAL COLLECTOR CURRENT 1st COLLECTOR CURRENT VS. INPUT POWER



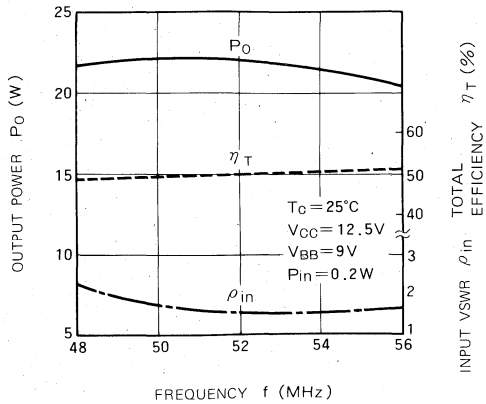
OUTPUT POWER, FINAL COLLECTOR CURRENT VS. 1st STAGE VOLTAGE



POWER GAIN VS. FREQUENCY

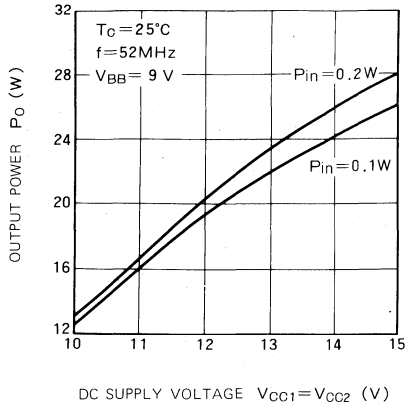


OUTPUT POWER, TOTAL EFFICIENCY INPUT VSWR VS. FREQUENCY

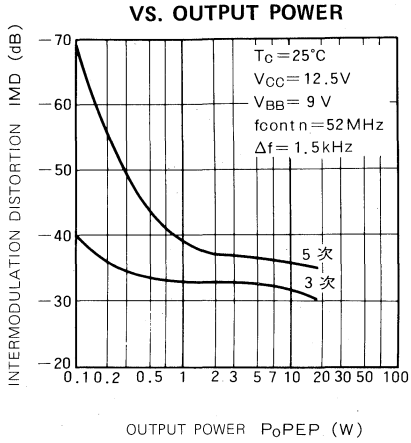


TYPICAL PERFORMANCE DATA

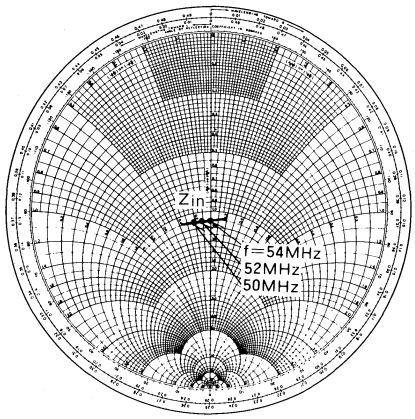
OUTPUT POWER VS. DC SUPPLY VOLTAGE



INTERMODULATION DISTORTION VS. OUTPUT POWER



INPUT IMPEDANCE VS. FREQUENCY



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 10°C/W (Typ.)

b) Final stage transistor

$R_{th(j-c)2}$ = 2°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  P_O = 14W, V_{CC} = 12.5V, P_{in} = 0.07W, η_T = 40% (minimum rating), P_{O1} (Note 1) = 2.5W, I_T = 2.8A (I_{T1} (2) = 0.5A, I_{T2} (3) = 2.3A)

  Note 1: Output power of the first stage transistor
  Note 2: Circuit current of the first stage transistor
  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)
  $= (12.5 \times 0.5 - 2.5 + 0.07) \times 10 + T_C$
  $= 39 + T_C$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 2.3 - 14 + 2.5) \times 2 + T_C$
  $= 35 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 14W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(14/0.4) - 14 + 0.07}$$
$$= 1.42\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 129°C, T_{j2} = 125°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 99°C, T_{j2} = 95°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57737

144~148MHz, 25W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57737 is a thick film RF power module specifically designed for 144 ~ 148MHz, 25W FM mobile radios.

FEATURES

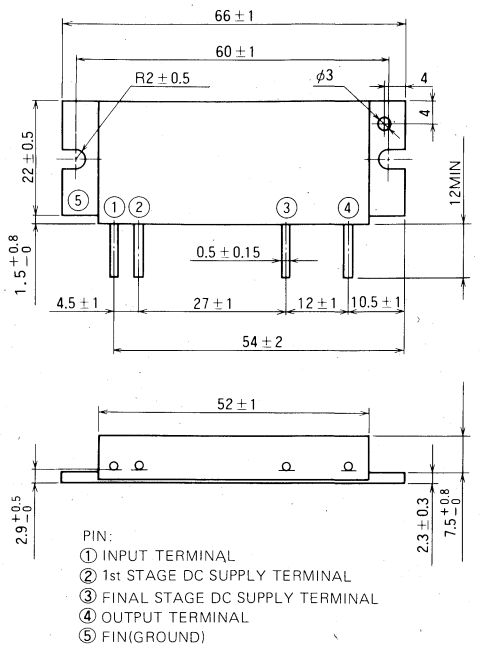
- Frequency Range . . . . . 144 ~ 148MHz
- High Power 30W
- High Gain 21.7dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 35W

APPLICATION

Output stage of 25W output mobile radio sets (FM) in 144 ~ 148MHz VHF band.

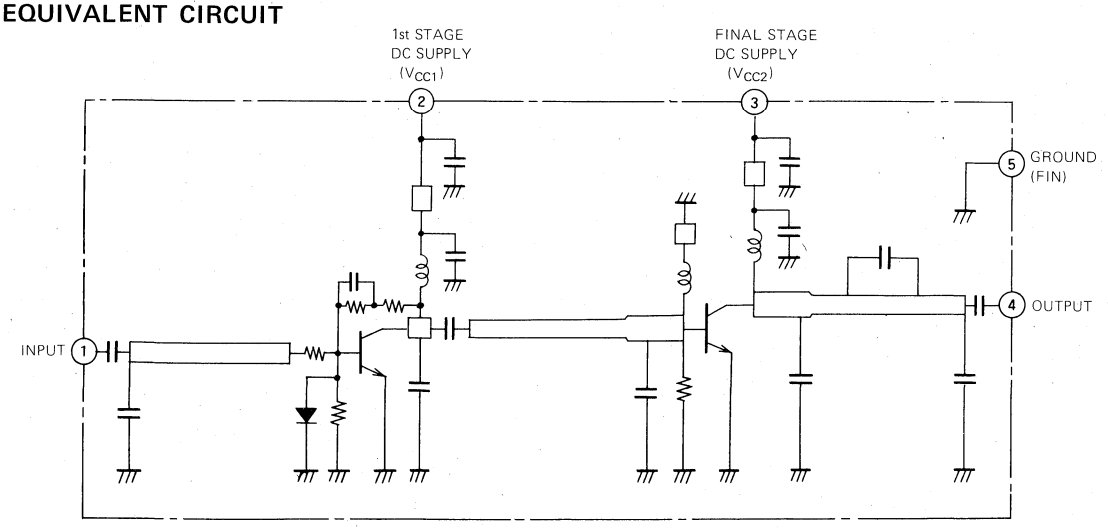
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ FINAL STAGE DC SUPPLY TERMINAL
④ OUTPUT TERMINAL
⑤ FIN(GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

144～148MHz, 25W, FM FOR MOBILE RADIO APPLICATION

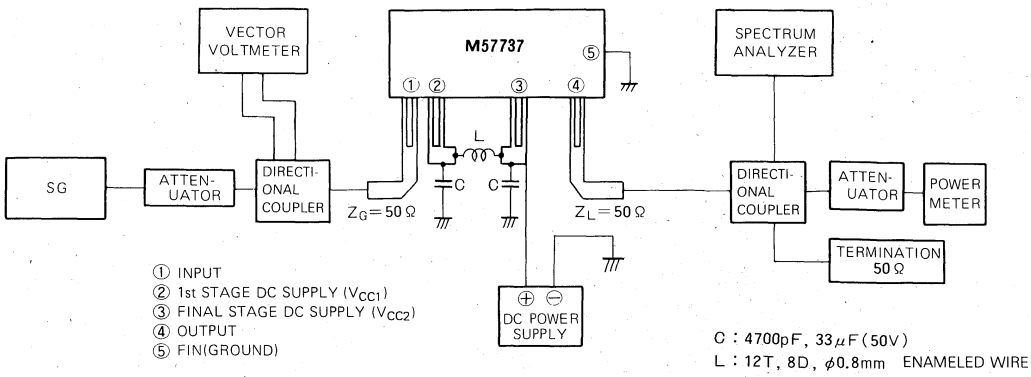
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		7	A
Pin	Input power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\Omega$	40	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

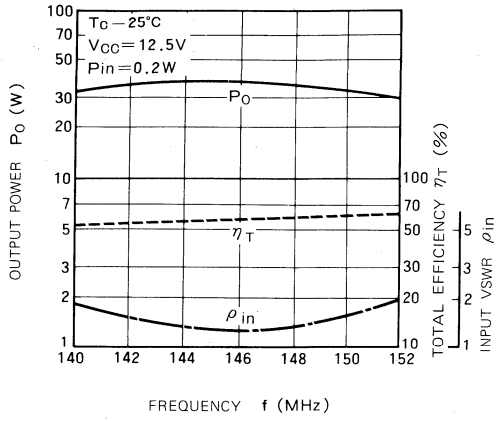
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Frequency range	V_{CC}=12.5V, f=144～148MHz, Pin=0.2W, $Z_G=Z_L=50\Omega$	30	35		W
η_T	Output power		45	50		%
—	Total efficiency				−25	dB
—	2nd harmonics				−30	dB
ρin	Input VSWR			2.0	2.8	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC}=15.2V, f=144～148MHz, P_O=35W, $Z_G=50\Omega$, 5sec	20：1			—

TEST BLOCK DIAGRAM

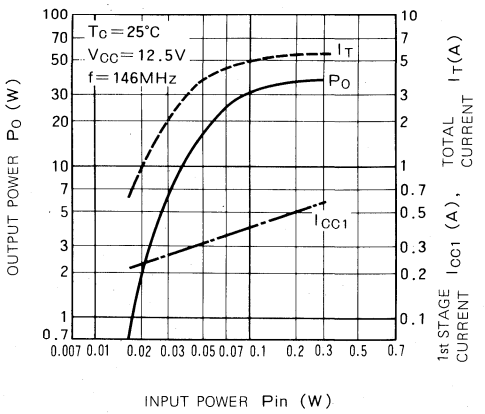


TYPICAL PERFORMANCE DATA

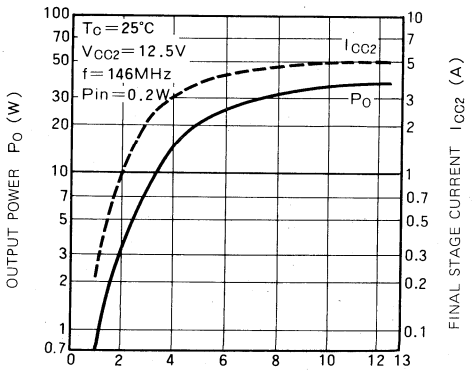
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



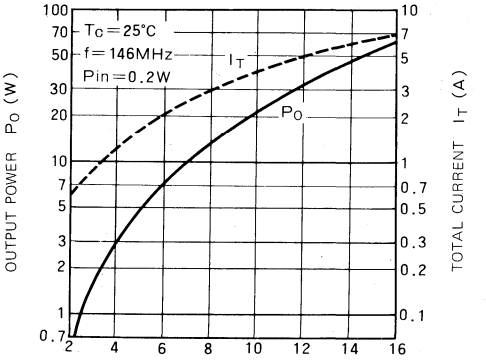
OUTPUT POWER, 1st STAGE CURRENT, TOTAL CURRENT VS. INPUT POWER



OUTPUT POWER, FINAL STAGE CURRENT VS. 1st STAGE VOLTAGE

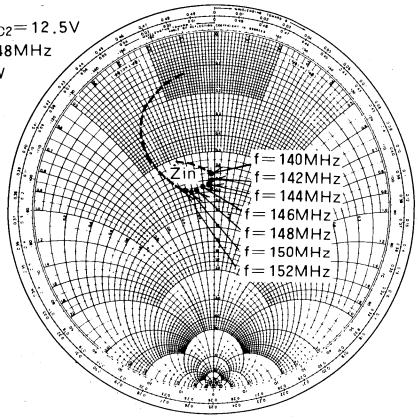


OUTPUT POWER, TOTAL CURRENT VS. DC SUPPLY VOLTAGE



INPUT INPEDANCE VS. FREQUENCY

Tc=25°C
VCC1=VCC2=12.5V
f=144～148MHz
Pin=0.2W
Zℓ=50Ω



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 8°C/W$ (Typ.)

b) Second stage transistor

$R_{th(j-c)2} = 2°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.

- Conditions for standard operation.

  $P_O = 28W$, $V_{CC} = 12.5V$, $P_{in} = 0.2W$, $\eta_T = 45\%$ (minimum rating), P_{O1} (Note 1) $= 5W$, $I_T = 5.0A$ (I_{T1} (2) $= 0.9A$, I_{T2} (3) $= 4.1A$)

  Note 1: Output power of the first stage transistor
  Note 2: Circuit current of the first stage transistor
  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)
  $= (12.5 \times 0.9 - 5 + 0.2) \times 8 + T_C$
  $= 52 + T_C$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor or

  $T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 4.1 - 28 + 5) \times 2 + T_C$
  $= 57 + T_C$ (°C)

2. Heat sink design;

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally $T_a = 60°C$) and at the output power of 28W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(28/0.45) - 28 + 0.2}$$
$$= 0.87\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

$T_{j1} = 142°C$, $T_{j2} = 147°C$ at $T_a = 60°C$, $T_C = 90°C$.

In the annual average of ambient temperature is 30°C,

$T_{j1} = 112°C$, $T_{j2} = 118°C$

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57739

824~851MHz, 3W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57739 is a thick film RF power module specifically designed for 824 ~ 851MHz, 3W FM mobile radios.

FEATURES

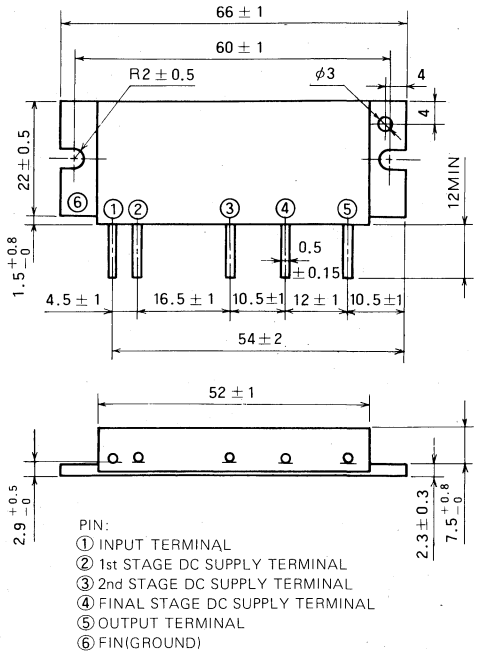
- Frequency Range . . . . . 824 ~ 851MHz
- High Power 6W
- High Gain 19.3dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W.

APPLICATION

Output stage of 3W output mobile radio sets (FM) in 824 ~ 851MHz UHF band.

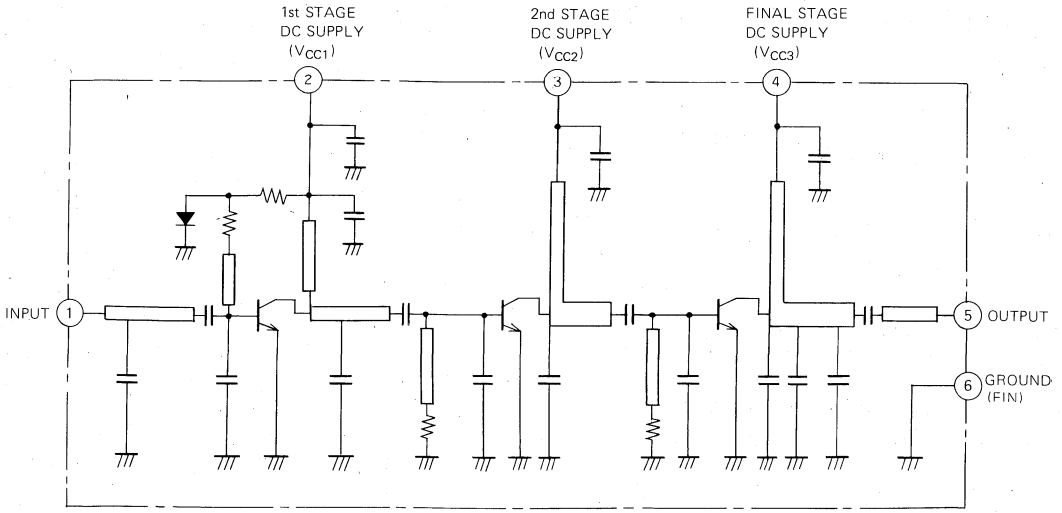
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN(GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

824～851MHz, 3W, FM FOR MOBILE RADIO APPLICATION

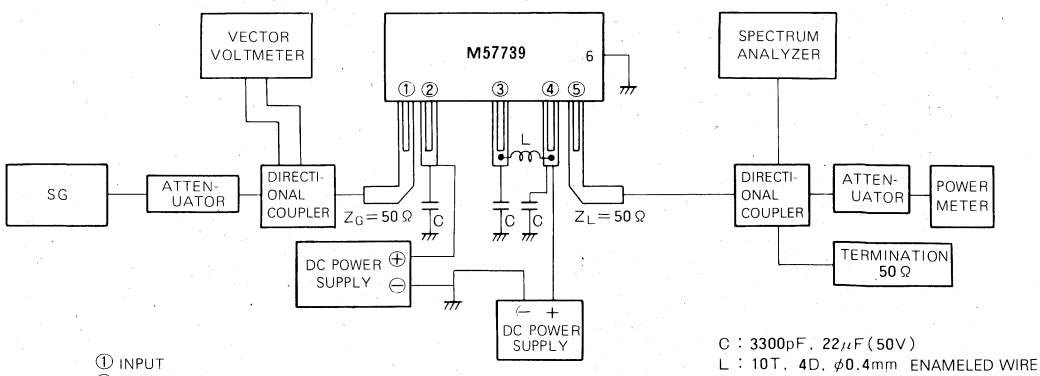
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		3	A
Pin	Input power	$Z_G = Z_L = 50\,\Omega$, $V_{CC1} \leqq 12.5V$	0.2	W
P_O	Output power	$Z_G = Z_L = 50\,\Omega$	12	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f = 824～851M, V_{CC} = 12.5V, Pin = 70mW, $Z_G = Z_L = 50\,\Omega$	6			W
η_T	Total efficiency		35			%
—	2nd harmonics				−30	dB
ρin	Input VSWR				2.5	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	f = 824～851MHz, V_{CC} = 15.2, P_O = 6W, $Z_G = 50\,\Omega$, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

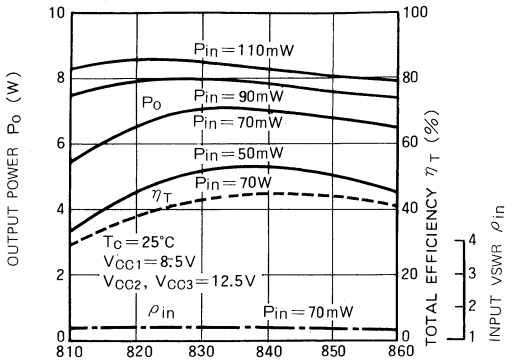


① INPUT
② 1st STAGE DC SUPPLY
③ 2nd STAGE DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
6 FIN (GROUND)

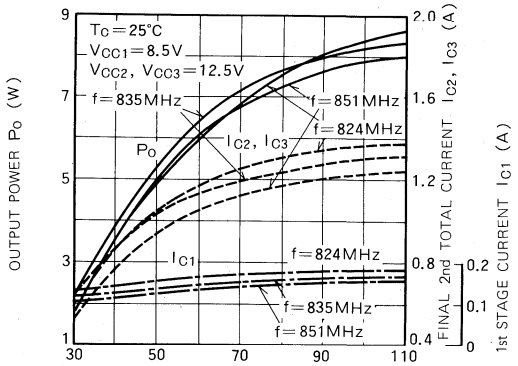
C : 3300pF, 22μF (50V)
L : 10T, 4D, φ0.4mm ENAMELED WIRE

TYPICAL PERFORMANCE DATA

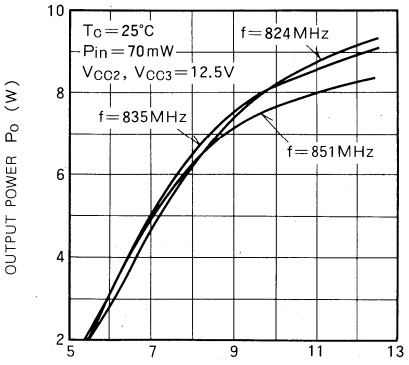
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



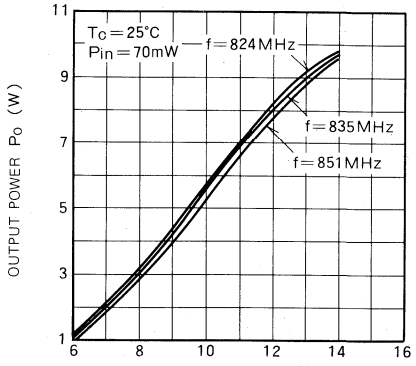
OUTPUT POWER, FINAL 2nd TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER



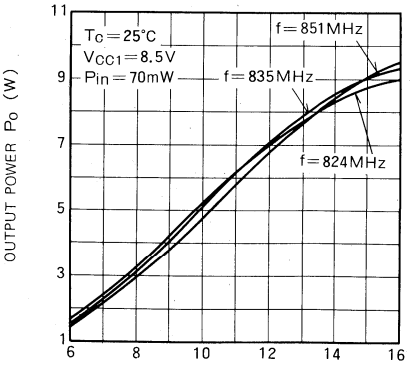
OUTPUT POWER VS. 1st STAGE VOLTAGE



OUTPUT POWER VS. DC SUPPLY VOLTAGE



OUTPUT POWER VS. 2nd, FINAL STAGE SUPPLY VOLTAGE V_{CC2}, V_{CC3}



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.
   a) First stage transistor
      $R_{th(j-c)1}$ = 20°C/W (Typ.)
   b) Second stage transistor
      $R_{th(j-c)2}$ = 15°C/W (Typ.)
   c) Final stage transistor
      $R_{th(j-c)3}$ = 7.5°C/W (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.

- Conditions for standard operation.
  P_O = 6W, V_{CC1} = 8.5V, $V_{CC2,3}$ = 12.5V, P_{in} = 70mW, η_T = 35% (minimum rating), P_{O1} (Note 1) = 0.5W, P_{O2} (2) = 2W, I_T = A (I_{T1} (3) = 0.14A, I_{T2} (4) = 0.37A, I_{T3} (5) = 0.9A)
  Note 1: Output power of the first stage transistor
  Note 2: Output power of the second stage transistor
  Note 3: Circuit current of the first stage transistor
  Note 4: Circuit current of the second stage transistor
  Note 5: Circuit current of the final stage transistor
- Junction temperature of the first stage transistor
  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
  $= (8.5 \times 0.14 - 0.5 + 0.07) \times 20 + T_C$
  $= 15.2 + T_C$ (°C)
  Note 6: Package temperature of device
- Junction temperature of the second stage transistor
  $T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 0.37 - 2 + 0.5) \times 15 + T_C$
  $= 46.8 + T_C$ (°C)
- Junction temperature of the final stage transistor
  $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
  $= (12.5 \times 0.9 - 6 + 2) \times 7.5 + T_C$
  $= 54.4 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 6W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(6/0.35) - 6 + 0.07}$$
$$= 2.68\ (°C/W)$$

Note 7; Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 105°C, T_{j2} = 137°C, T_{j3} = 144°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 75°C, T_{j2} = 137eC, T_{j3} = 114°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57739A

824~851MHz, 3W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57739A is a thick film RF power module specifically designed for 824 ~ 851MHz, 3W FM mobile radios.

FEATURES

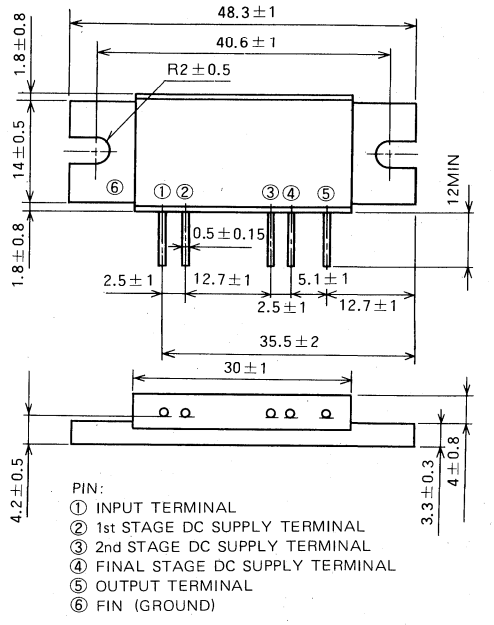
- Frequency Range . . . . . 824 ~ 851MHz
- High Power 6W
- High Gain 17.8dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W.

APPLICATION

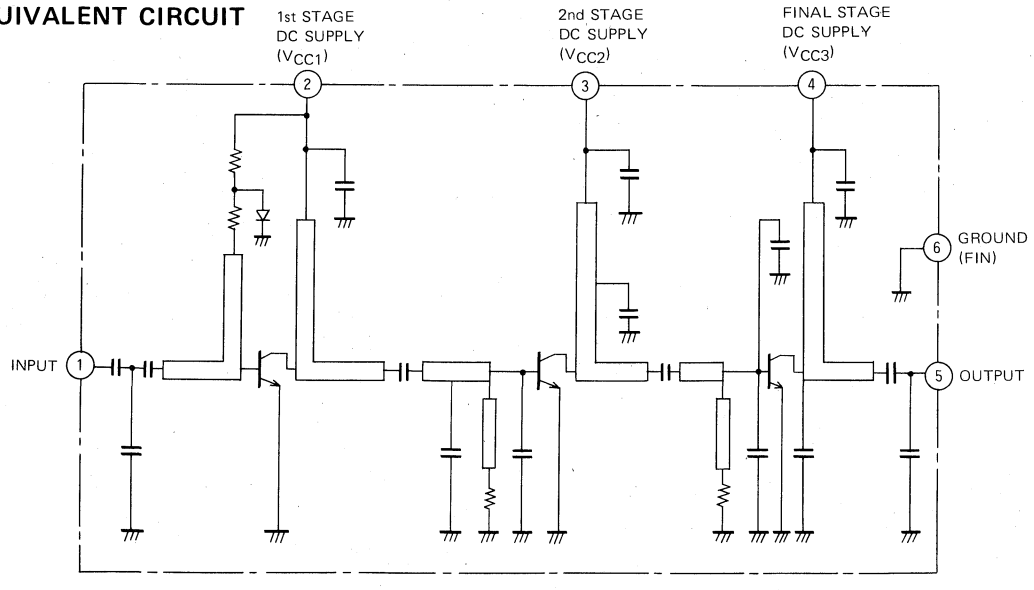
Output stage of 3W output mobile radio sets (FM) in 824 ~ 851MHz UHF band.

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

M57739A

824~851MHz, 3W, FM FOR MOBILE RADIO APPLICATION

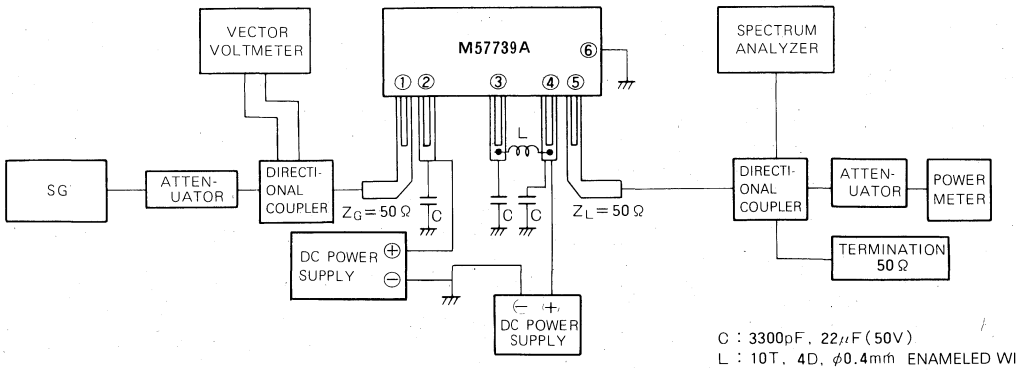
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		3	A
P_{in}	Input power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 12.5V$	0.2	W
P_O	Output power	$Z_G=Z_L=50\Omega$	12	W
T_C(op)	Operation case temperature		−30~+110	°C
Tstg	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=824~851MHz, V_{CC}=12.5V, P_{in}=0.1W, $Z_G=Z_L=50\Omega$	6	7.5		W
η_T	Total efficiency		35	40		%
—	2nd harmonics				−30	dB
ρ_{in}	Input VSWR				2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	f=824~851MHz, V_{CC}=15.2V, P_O=6W, Z_G=50Ω, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

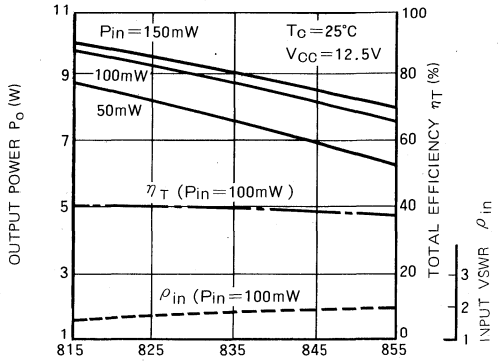


C : 3300pF, 22μF(50V)
L : 10T, 4D, φ0.4mm ENAMELED WIRE

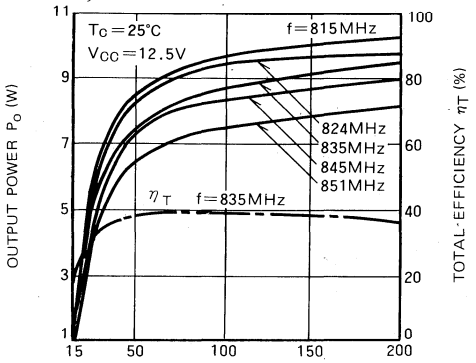
① INPUT
② 1st STAGE DC SUPPLY
③ 2nd STAGE DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ GROUND (FIN)

TYPICAL PERFORMANCE DATA

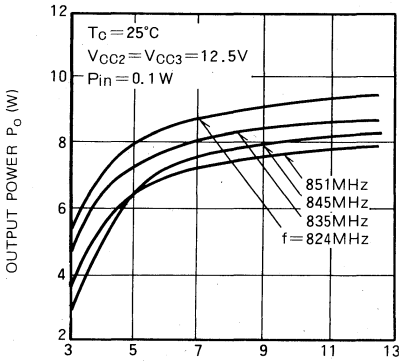
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



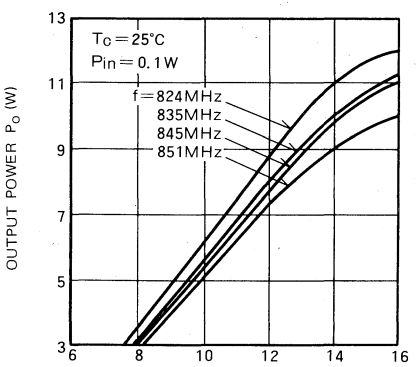
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER



OUTPUT POWER VS. 1st STAGE VOLTAGE



OUTPUT POWER VS. DC SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operaton.

(1) Thermal resistance between junction and package of incorporated transistors.
   a) First stage transistor
      $R_{th(j-c)1}$ = 20°C/W (Typ.)
   b) Second stage transistor
      $R_{th(j-c)2}$ = 15°C/W (Typ.)
   c) Final stage transistor
      $R_{th(j-c)3}$ = 6.5°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.
  P_O = 6W, V_{CC} = 12.5V, P_{in} = 100mW, η_T = 35% (minimum rating), P_{O1} (Note 1) = 0.5W, P_{O2} (2) = 2W, I_T = 1.37A (I_{T1} (3) = 0.14A, I_{T2} (4) = 0.33A, I_{T3} (5) = 0.9A)
  Note 1: Output power of the first stage transistor
  Note 2: Output power of the second stage transistor
  Note 3: Circuit current of the first stage transistor
  Note 4: Circuit current of the second stage transistor
  Note 5: Circuit current of the final stage transisotr
- Junction temperature of the first stage transistor
  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
  $= (12.5 \times 0.14 - 0.5 + 0.1) \times 20 + T_C$
  $= 27 + T_C$ (°C)
  Note 6: Package temperature of device
- Junction temperature of the second stage transistor
  $T_{j2} = V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 0.33 - 2 + 0.5) \times 15 + T_C$
  $= 39.4 + T_C$ (°C)
- Junction temperature of the final stage transistor
  $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
  $= (12.5 \times 0.9 - 6 + 2) \times 6.5 + T_C$
  $= 47.1 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 6W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(6/0.35) - 6 + 0.1}$$

$$= 2.67\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 117°C, T_{j2} = 129°C, T_{j3} = 137°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 87°C, T_{j2} = 99°C, T_{j3} = 107°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57741 SERIES

148~175MHz, 28W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57741 is a thick film RF power module specifically designed for 148 ~ 175MHz, 25W FM mobile radios.

FEATURES

- Frequency Range . . . . . 148 ~ 175MHz
- High Power 28W
- High Gain 19.7dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W.

APPLICATIONS

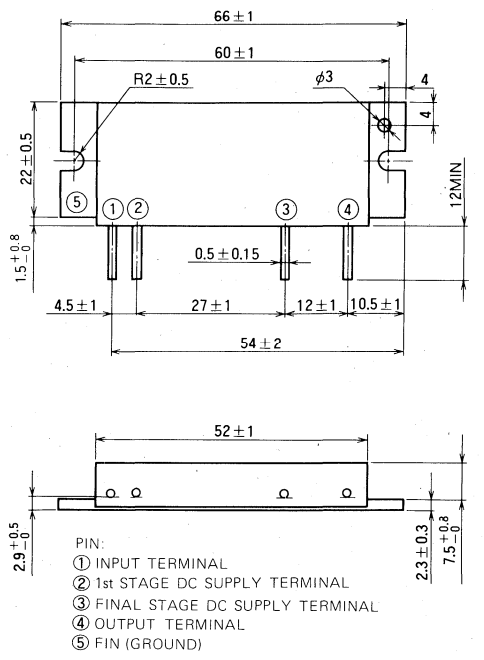
Output stage of 25W output mobile radio sets (FM) in 148 ~ 175 MHz VHF band.

FREQUENCY ITEMS

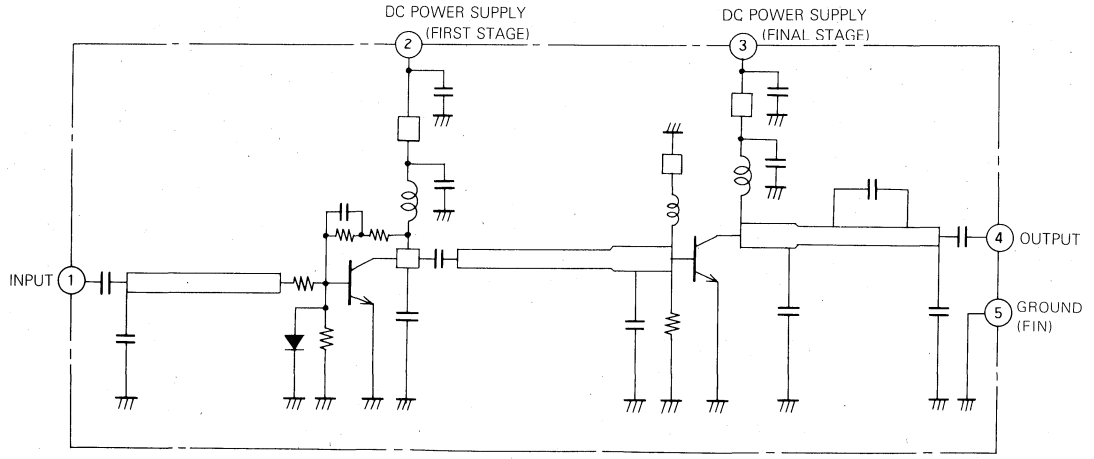
M57741L : 148 ~ 160MHz
M57741M: 156 ~ 168MHz
M57741H : 164 ~ 175 MHz

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

148~175MHz, 28W, FM
FOR MOBILE RADIO APPLICATION

ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Ratings	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		7	A
P_{in}	Power input	$Z_G = Z_L = 50\Omega$	0.5	W
P_O	Output power	$Z_G = Z_L = 50\Omega$	35	W
$T_{C(op)}$	Operation case temperature		−30 ~ +110	°C
Tstg	Storage temperature		−40 ~ +110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C)
M57741-L

Symbol	Characteristics	Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V f=148~160MHz P_{in}=0.2W $Z_G=Z_L=50\Omega$	28			W
η_T	Total efficiency		40			%
—	2nd harmonic				−25	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR				3.3	—
ρ_{out}	Output VSWR			2.0		—
—	Load VSWR tolerance	V_{CC}=15.2V, P_O=30W	More than 20:1 (All phase)			

ELECTRICAL CHARACTERISTICS (T_C=25°C)
M57741-M

Symbol	Characteristics	Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V f=156~168MHz P_{in}=0.25W $Z_G=Z_L=50\Omega$	28			W
η_T	Total efficiency		40			%
—	2nd harmonic				−25	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR				3.3	—
ρ_{out}	Output VSWR			2.0		—
—	Load VSWR tolerance	V_{CC}=15.2V, P_O=30W	More than 20:1 (All phase)			

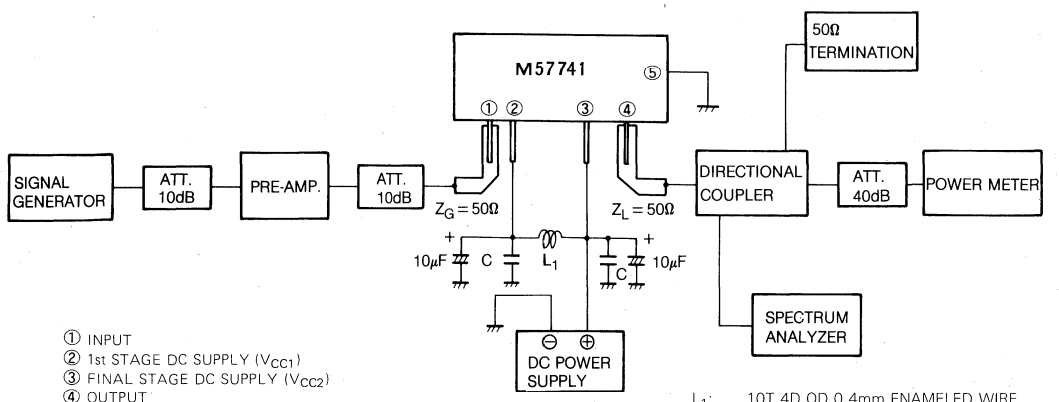
ELECTRICAL CHARACTERISTICS (T_C=25°C)
M57741-H

Symbol	Characteristics	Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V f=164~175MHz P_{in}=0.3W $Z_G=Z_L=50\Omega$	28			W
η_T	Total efficiency		40			%
—	2nd harmonic				−25	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR				3.3	—
ρ_{out}	Output VSWR			2.0		—
—	Load VSWR tolerance	V_{CC}=15.2V, P_O=30W	More than 20:1 (All phase)			

M57741 SERIES

148~175MHz, 28W, FM FOR MOBILE RADIO APPLICATION

TEST BLOCK DIAGRAM



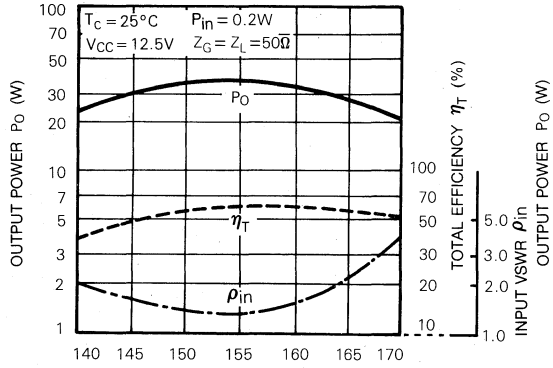
① INPUT
② 1st STAGE DC SUPPLY (V_{CC1})
③ FINAL STAGE DC SUPPLY (V_{CC2})
④ OUTPUT
⑤ FIN(GROUND)

L_1: 10T,4D,OD,0.4mm ENAMELED WIRE
C: 3300pF

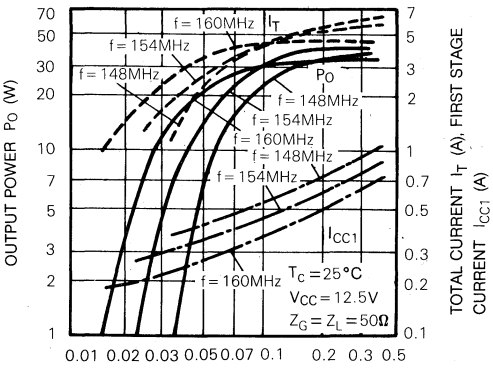
TYPICAL CHARACTERISTICS

M57741-L band

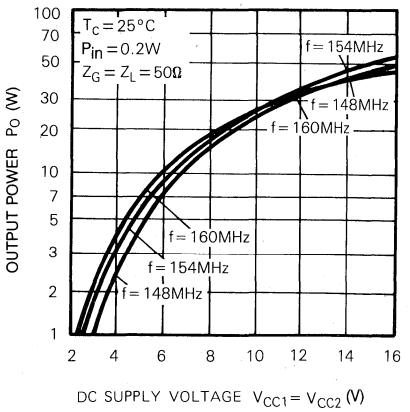
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



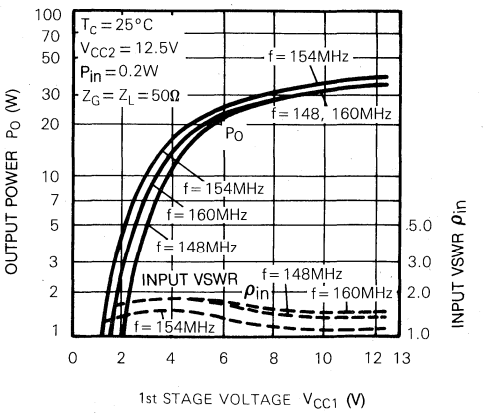
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER



OUTPUT POWER VS. SUPPLY VOLTAGE M57741 L-BAND



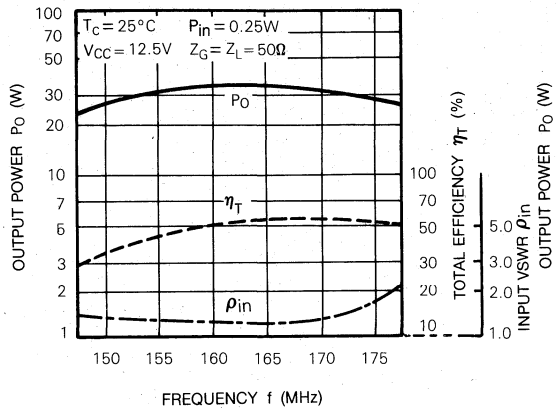
OUTPUT POWER, INPUT VSWR VS. FIRST STAGE VOLTAGE



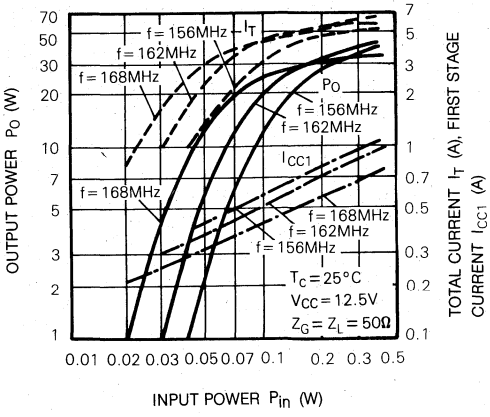
MITSUBISHI ELECTRIC

M57741-M band

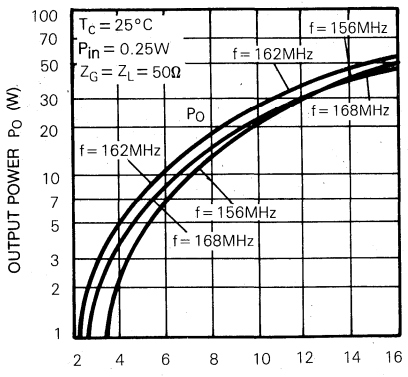
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



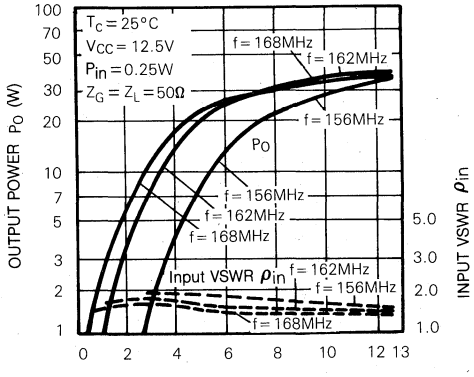
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER



OUTPUT POWER VS. SUPPLY VOLTAGE

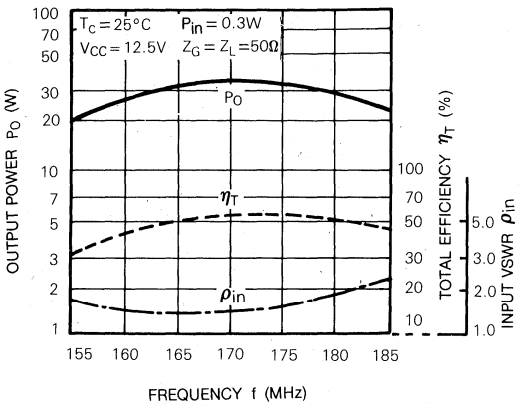


OUTPUT POWER, INPUT VSWR VS. FIRST STAGE VOLTAGE

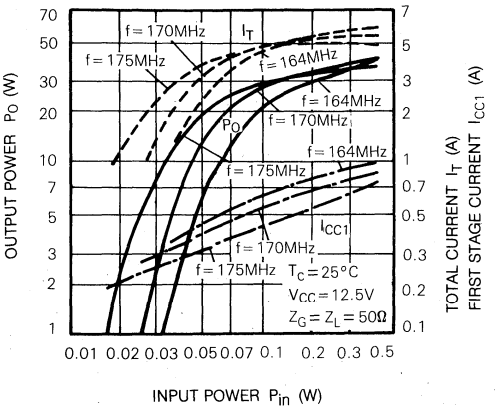


M57741-H band

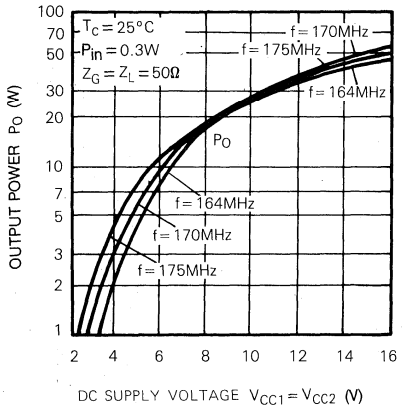
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



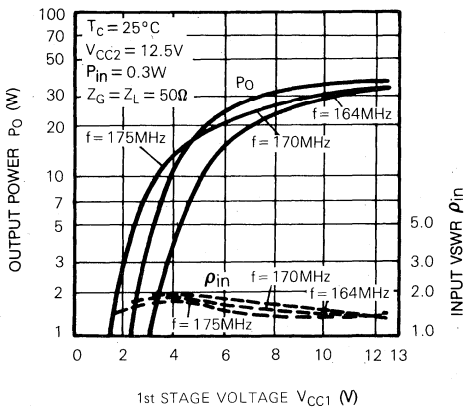
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER



OUTPUT POWER VS. SUPPLY VOLTAGE



OUTPUT POWER, INPUT VSWR VS. FIRST STAGE VOLTAGE



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 7°C/W$ (Typ.)

b) Final stage transistor

$R_{th(j-c)3} = 1.7°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  $P_O = 28W$, $V_{CC} = 12.5V$, $P_{in} = 0.2W$, $\eta_T = 40\%$ (minimum rating), P_{O1} (Note 1) $= 7.5W$, $I_T = 5.6A$ (I_{T1} (2) $= 1.2A$, I_{T2} (3) $= 4.4A$

  Note 1: Output power of the first stage transistor

  Note 2: Circuit current of the first stage transistor

  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)

  $= (12.5 \times 1.2 - 7.5 + 0.2) \times 7 + T_C$

  $= 54 + T_C$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor

  $T_{j3} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)3} + T_C$

  $= (12.5 \times 4.4 - 28 + 7.5) \times 1.7 + T_C$

  $= 59 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally $T_a = 60°C$) and at the output power of 28W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(28/0.4) - 28 + 0.2}$$

$$= 0.710\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

$T_{j1} = 144°C$, $T_{j2} = 149°C$, at $T_a = 60°C$, $T_C = 90°C$.

In the annual average of ambient temperature is 30°C,

$T_{j1} = 114°C$, $T_{j2} = 119°C$

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57744

905~915MHz, 13W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57744 is a power amplifier module designed for mobile radio applications in the 905 ~ 915MHz band.

This device offers a minimum broad-band output power of 13 watts operated at V_{CC} = 12.5 volts.

FEATURES

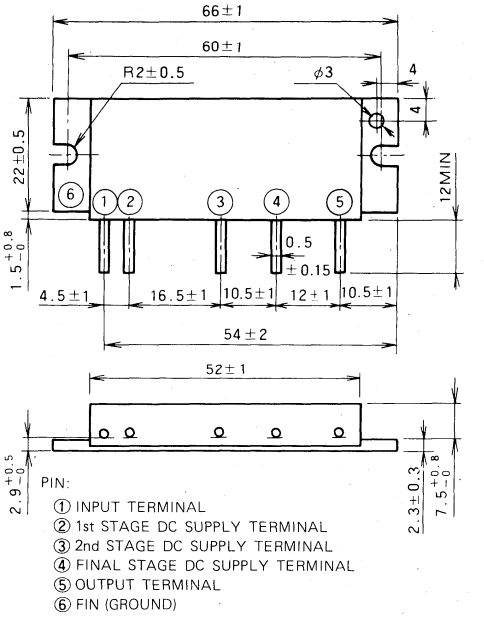
- High power output . . . . . 13 watts (min)
- Frequency range . . . . . 905 ~ 915MHz
- High efficiency . . . . . 30% (min)
- High gain . . . . . 15.1dB (min)

APPLICATION

Output stage of 10W output mobile radio sets (FM) in 905 ~ 915MHz UHF band.

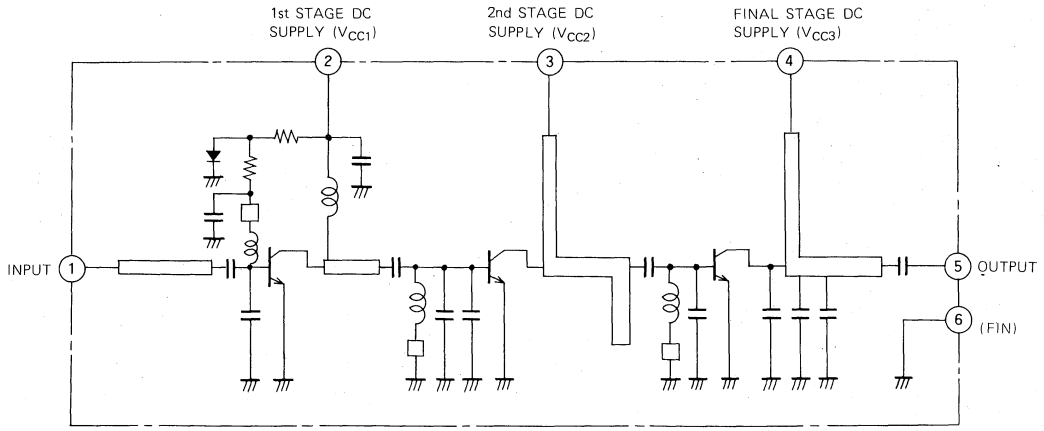
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

905～915MHz, 13W, FM FOR MOBILE RADIO APPLICATION

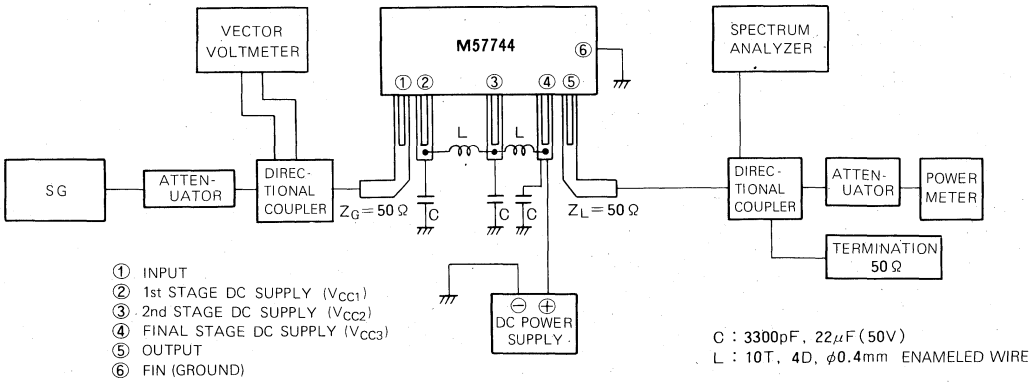
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		5	A
Pin(max)	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.6	W
P_O(max)	Output power	$Z_G=Z_L=50\,\Omega$	18	W
T_C(op)	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

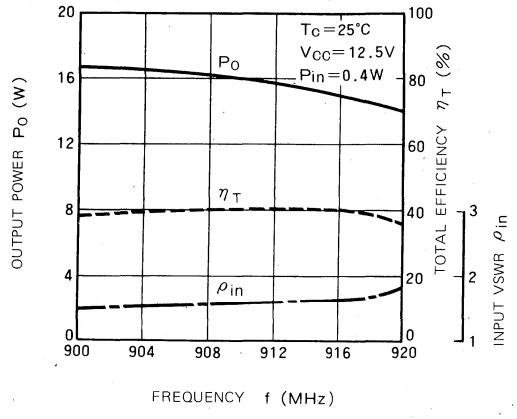
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
f	Frequency range	V_{CC}=12.5V, Pin=0.4W $Z_G=Z_L=50\,\Omega$	905		915	MHz
P_O	Output power		13	15		W
η_T	Total efficiency		30	35		%
—	2nd harmonics				−25	dB
ρ_{in}	Input VSWR			1.8	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	VSWR tolerance	V_{CC}=15.2V, P_O=14W,	20 : 1			—

TEST BLOCK DIAGRAM

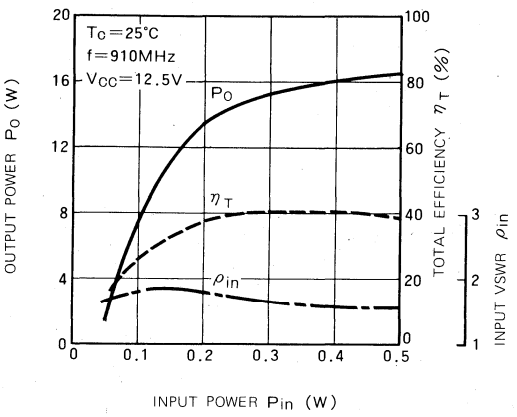


TYPICAL CHARACTERISTICS

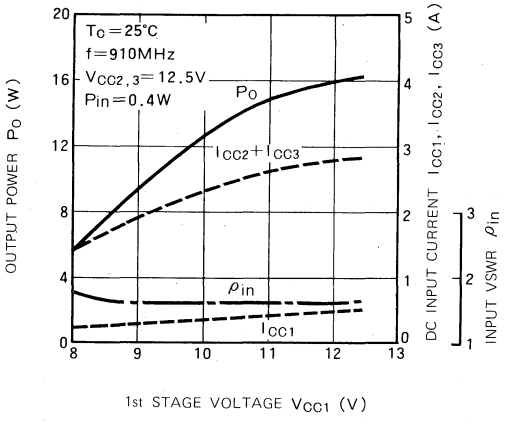
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. INPUT POWER



OUTPUT POWER, EACH STAGE DC CURRENT, INPUT VSWR VS. FIRST-STAGE SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 15°C/W$ (Typ.)

b) Second stage transistor

$R_{th(j-c)2} = 6°C/W$ (Typ.)

c) Final stage transistor

$R_{th(j-c)3} = 2.5°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.

- Conditions for standard operation.

P_O = 13W, V_{CC} = 12.5V, P_{in} = 0.4W, η_T = 35% (minimum rating), P_{O1} (Note 1) = 1.6W, P_{O2} (2) = 6W, I_T = 3.0A (I_{T1} (3) = 0.25A, I_{T2} (4) = 0.75A, I_{T3} (5) = 2A)

Note 1: Output power of the first stage transistor
Note 2: Output power of the second stage transistor
Note 3: Circuit current of the first stage transistor
Note 4: Circuit current of the second stage transistor
Note 5: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
$= (12.5 \times 0.25 - 1.6 + 0.4) \times 15 + T_C$
$= 29 + T_C$ (°C)

Note 6: Package temperature of device

- Junction temperature of the second stage transistor

$T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
$= (12.5 \times 0.75 - 6 + 1.6) \times$ $+ T_C$
$=$ $+ T_C$ (°C)

- Junction temperature of the final stage transistor

$T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
$= (12.5 \times 2 - 13 + 6) \times 2.5 + T_C$
$= 45 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 13W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(13/0.35) - 13 + 0.4}$$
$$= 1.2\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 119°C, T_{j2} = 120°C, T_{j3} = 135°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 89°C, T_{j2} = 90°C, T_{j3} = 105°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57745

430~450MHz, 25W, SSB FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57745 is a thick film RF power module specifically designed for 430 ~ 450MHz, 25W SSB mobile radios.

FEATURES

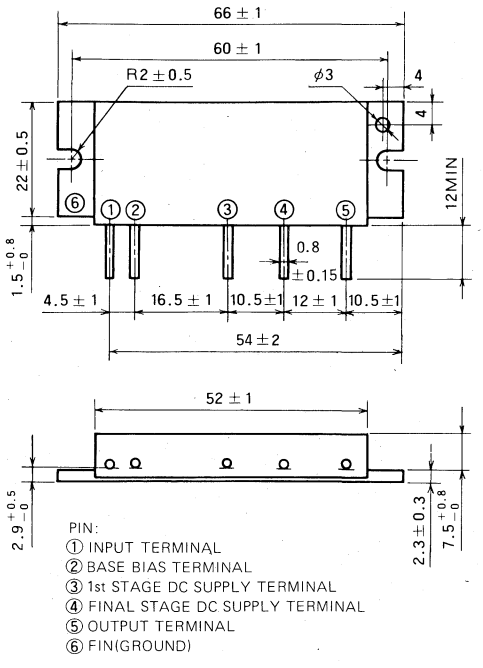
- Frequency Range . . . . . 430 ~ 450MHz
- High Power 30W
- High Linear Power Gain 24dB
- High Ruggedness: Ability to withstand more than 20:1
- load VSWR when operated at V_{CC} = 15.2V, 28W.

APPLICATION

Output stage of 25W output mobile radio sets (SSB) in 430 ~ 450MHz UHF band.

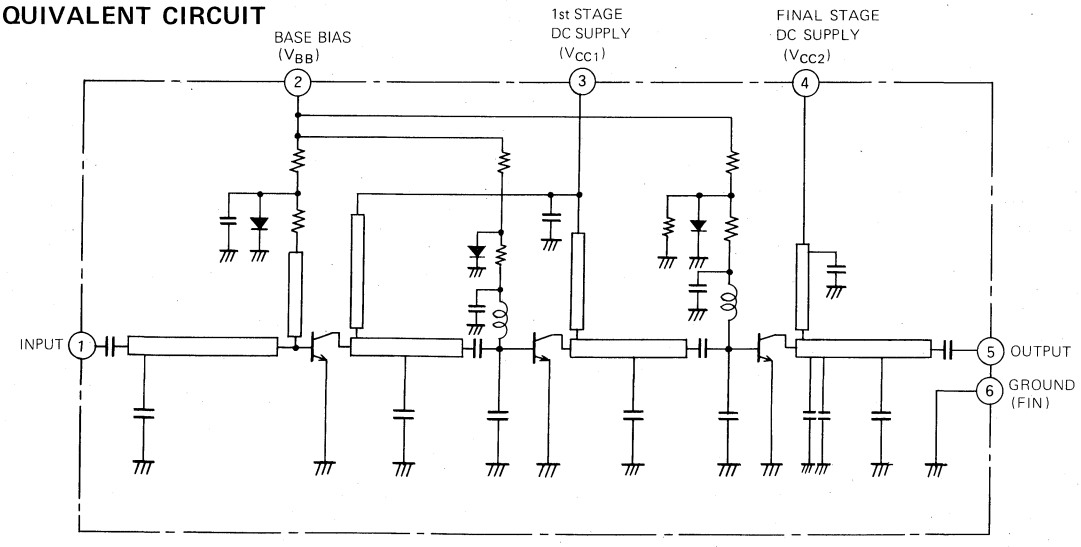
OUTLINE DIAGRAM

Dimensions in mm



PIN:
① INPUT TERMINAL
② BASE BIAS TERMINAL
③ 1st STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN(GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

430~450MHz, 25W, SSB FOR MOBILE RADIO APPLICATION

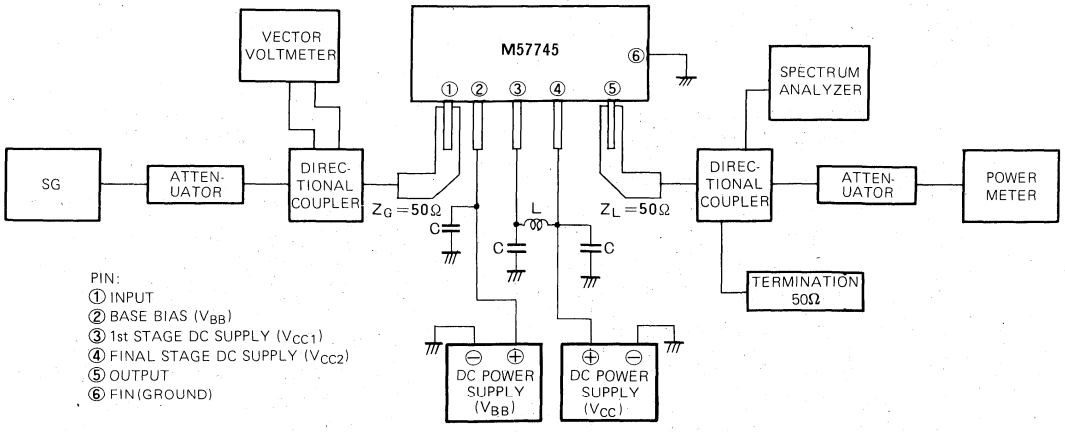
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
V_{BB}	Base bias voltage		10	W
I_{CC}	Total current		10	A
P_{in}	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$, $V_{BB}=9V$	0.5	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	40	W
T_C(op)	Operation case temperature		−30~+110	°C
Tstg	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=430~450MHz V_{CC}=12.5V, V_{BB}=9V P_{in}=0.3W $Z_G=Z_L=50\,\Omega$	33	35		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−30	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR				2.5	—
ρ_{out}	Output VSWR			2.0		—
G_P	Power gain	f=430~450MHz, V_{CC}=12.5V, V_{BB}=9V P_{in}=10dBm, $Z_G=Z_L=50\,\Omega$	24			dB
—	3rd IMD	f_1=430~450MHz, f_1-f_2=2kHz, V_{CC}=12.5V, V_{BB}=9V, $P_{O(PEP)}\leqq$30W $Z_G=Z_L=50\,\Omega$			−26	dB
—	5th IMD				−31	dB
—	Load VSWR tolerance	f=430~450MHz, V_{CC}=15.2V, V_{BB}=9V, P_O=28W, Z_G=50Ω, 5sec.	20 : 1			—

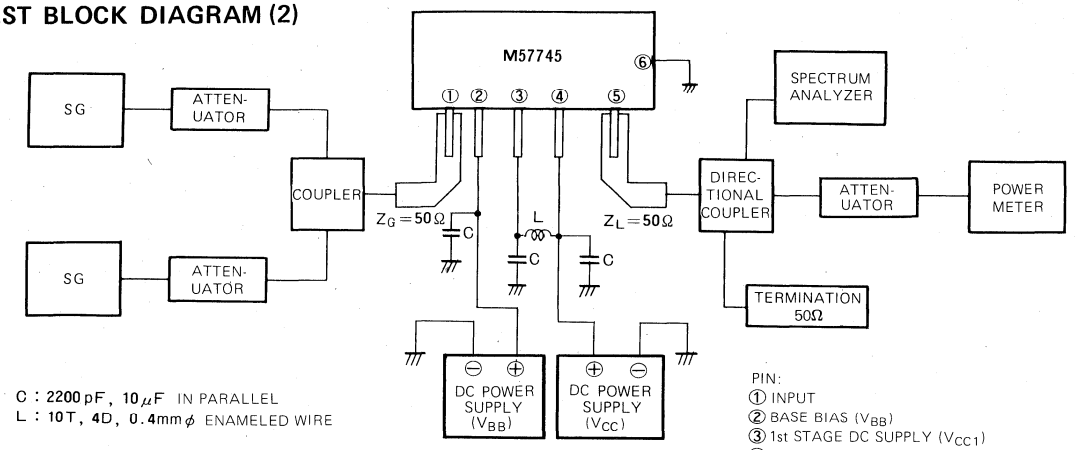
TEST BLOCK DIAGRAM (1)



C : 2200pF, 10μF IN PARALLEL
L : 10T, 4D, 0.4mmφ ENAMELED WIRE

430~450MHz, 25W, SSB FOR MOBILE RADIO APPLICATION

TEST BLOCK DIAGRAM (2)

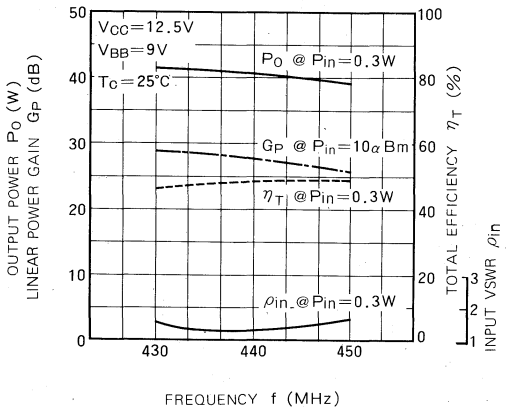


C : 2200pF, 10μF IN PARALLEL
L : 10T, 4D, 0.4mmφ ENAMELED WIRE

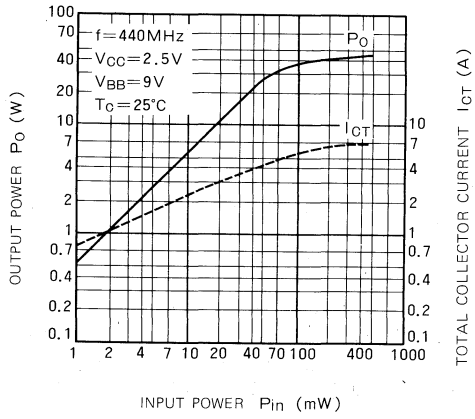
PIN:
① INPUT
② BASE BIAS (V_{BB})
③ 1st STAGE DC SUPPLY (V_{CC1})
④ FINAL STAGE DC SUPPLY (V_{CC2})
⑤ OUTPUT
⑥ FIN(GROUND)

TYPICAL PERFORMANCE DATA

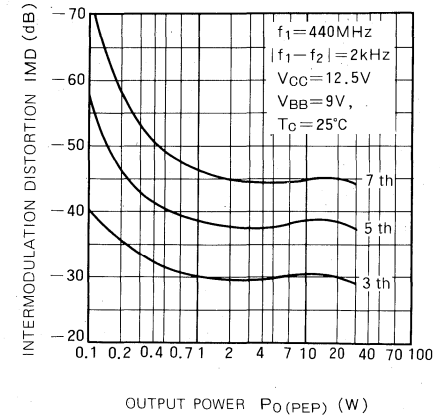
OUTPUT POWER, LINEAR POWER GAIN, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



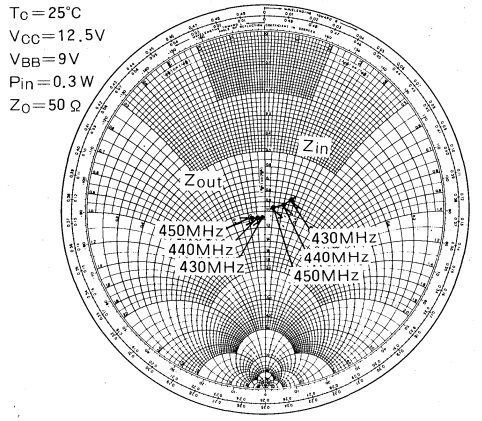
OUTPUT POWER, TOTAL COLLECTOR CURRENT, VS. INPUT POWER



INTERMODULATION DISTRIBUTION VS. OUTPUT POWER



INPUT IMPEDANCE, OUTPUT IMPEDANCE VS. FREQUENCY



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat shink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.
   a) First stage transistor
      $R_{th(j-c)1}$ = 12°C/W (Typ.)
   b) Second stage transistor
      $R_{th(j-c)2}$ = 4°C/W (Typ.)
   c) Final stage transistor
      $R_{th(j-c)3}$ = 1.75°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.
  P_O = 30W, V_{CC} = 12.5V, P_{in} = 0.3W, η_T = 40% (minimum rating), P_{O1} (Note 1) = 2W, P_{O2} (2) = 8W, I_T = 6A (I_{T1} (3) = 0.35A, I_{T2} (4) = 1.32A, I_{T3} (5) = 4.33A)
  Note 1: Output power of the first stage transistor
  Note 2: Output power of the second stage transistor
  Note 3: Circuit current of the first stage transistor
  Note 4: Circuit current of the second stage transistor
  Note 5: Circuit current of the final stage transistor
- Junction temperature of the first stage transistor
  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
  $= (12.5 \times 0.35 - 2 + 0.3) \times 12 + T_C$
  $= 32 + T_C$ (°C)

  Note 6: Package temperature of device
- Junction temperature of the second stage transistor
  $T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 1.32 - 8 + 2) \times 4 + T_C$
  $= 42 + T_C$ (°C)
- Junction temperature of the final stage transistor
  $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
  $= (12.5 \times 4.33 - 30 + 8) \times 1.75 + T_C$
  $= 56 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 30W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(30/0.4) - 30 + 0.3}$$
$$= 0.66\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink.

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 122°C, T_{j2} = 132°C, T_{j3} = 146°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 92°C, T_{j1} = 102°C, T_{j3} = 116°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57747

144~148MHz, 10W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57747 is a thick film RF power module specifically designed for 144 ~ 148MHz, 10W FM mobile radios.

FEATURES

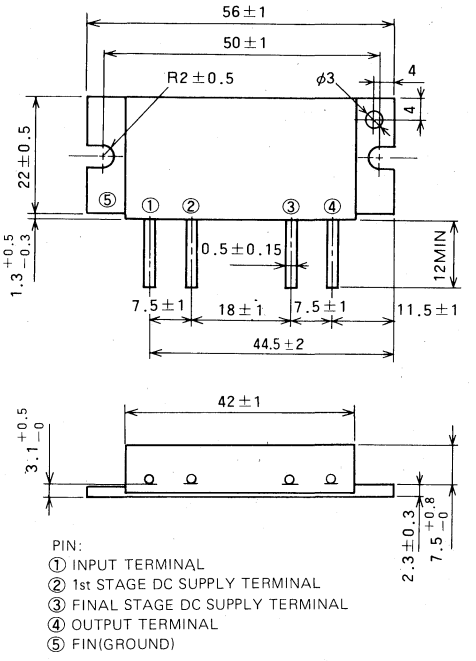
- Frequency Range . . . . . 144 ~ 148MHz
- High Power 13W
- High Gain 18.1dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 14W.

APPLICATION

Output stage of 10W output mobile radio sets (FM) in 144 ~ 148MHz VHF band.

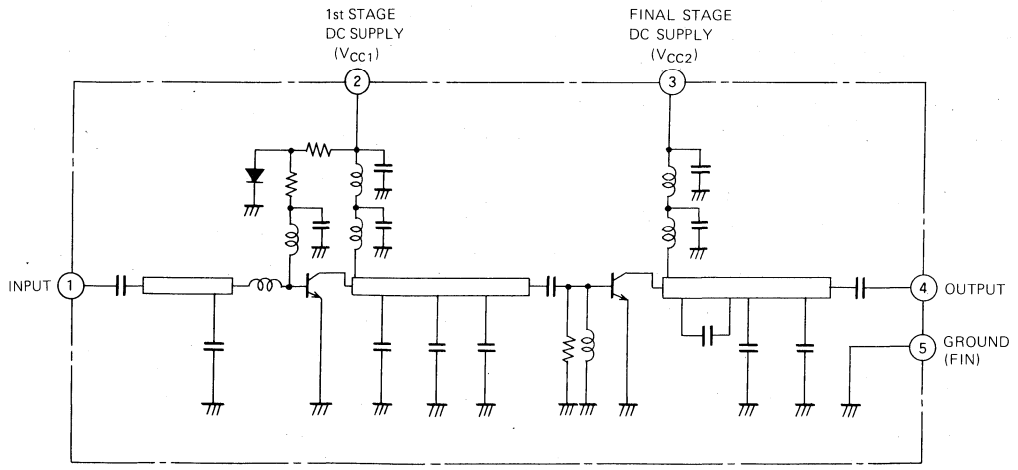
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ FINAL STAGE DC SUPPLY TERMINAL
④ OUTPUT TERMINAL
⑤ FIN(GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

144～148MHz, 10W, FM
FOR MOBILE RADIO APPLICATION

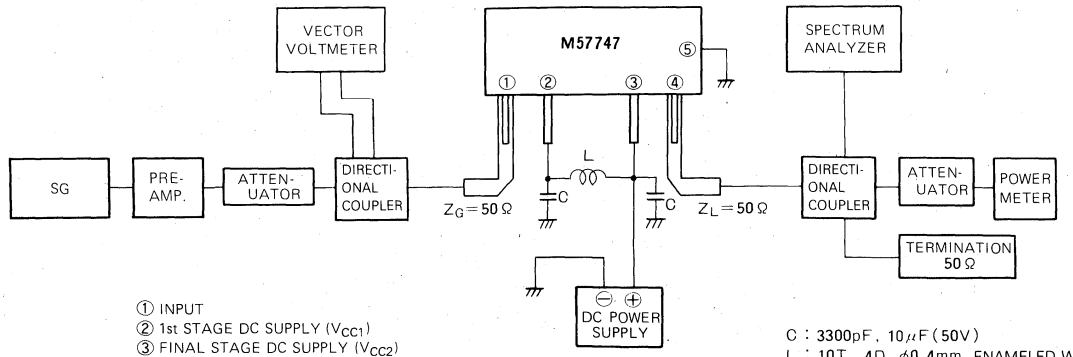
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		5	A
Pin	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	20	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

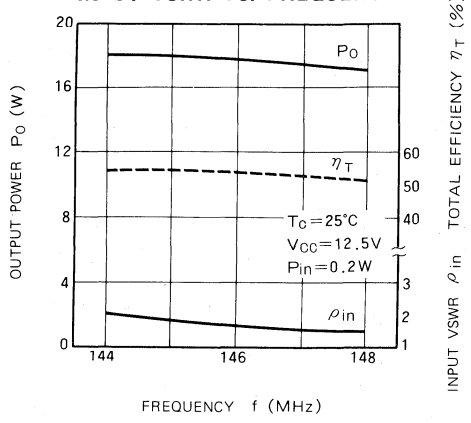
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, f=144～148MHz, Pin=0.2W, $Z_G=Z_L=50\,\Omega$	13	15		W
η_T	Total efficiency		48	55		%
—	2nd harmonic				−25	dB
—	3rd Harmonic				−35	dB
ρin	Input VSWR				2.8	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC}=15.2V, f=144～148MHz, P_O=14W, $Z_G=50\,\Omega$, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

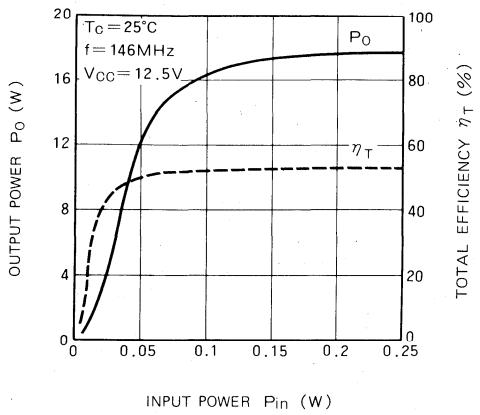


TYPICAL PERFORMANCE DATA

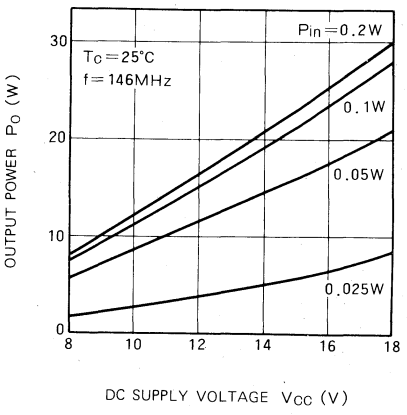
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



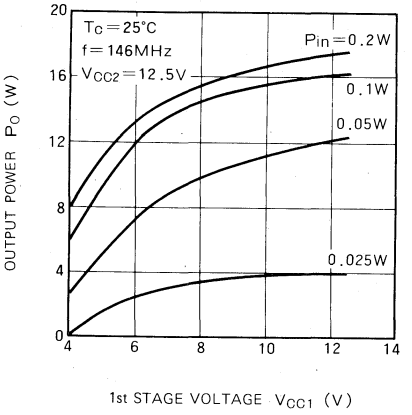
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER



OUTPUT POWER VS. DC SUPPLY VOLTAGE



OUTPUT POWER VS. 1st STAGE VOLTAGE



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 10°C/W$ (Typ.)

b) Final stage transistor

$R_{th(j-c)2} = 3°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  P_O = 13W, V_{CC} = 12.5V, P_{in} = 0.2W, η_T = 48% (minimum rating), P_{O1} (Note 1) = 2.5W, I_T = 2.2A (I_{T1} (2) = 0.45A, I_{T2} (3) = 1.75A)

  Note 1: Output power of the first stage transistor
  Note 2: Circuit current of the first stage transistor
  Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)
  $= (12.5 \times 0.45 - 2.5 + 0.2) \times 10 + T_C$
  $= 33 + T_C$ (°C)

  Note 4: Package temperature of device

- Junction temperature of the final stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 1.75 - 13 + 2.5) \times 3 + T_C$
  $= 34 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 13W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(13/0.48) - 13 + 0.2}$$
$$= 2.8 \ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 113°C, T_{j2} = 134°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 103°C, T_{j2} = 104°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57749

903~905MHz, 7W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57749 is a power amplifier module designed for mobile radio applications in the 903 ~ 905MHz band.

This device offers a minimum broad-band output power of 7 watts operated at V_{CC} = 12.5 volts.

FEATURES

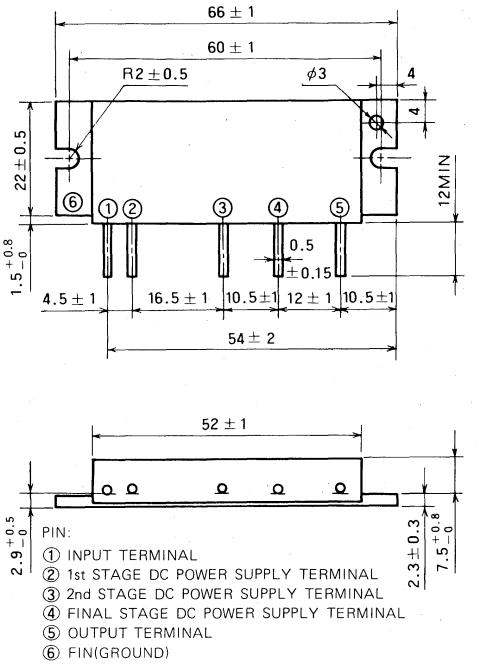
- High power output . . . . . 7 watts (min)
- Frequency range . . . . . 903 ~ 905MHz
- High efficiency . . . . . 30% (min)
- High gain 15.4dB

APPLICATION

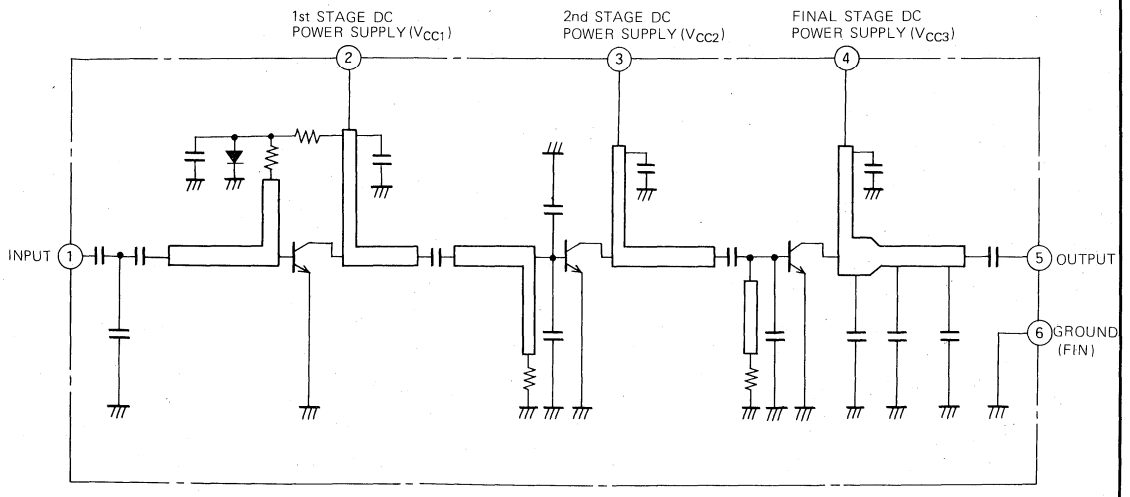
Output stage of 5W output mobile radio sets (FM) in 903 ~ 905MHz UHF band.

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

903~905MHz, 7W, FM
FOR MOBILE RADIO APPLICATION

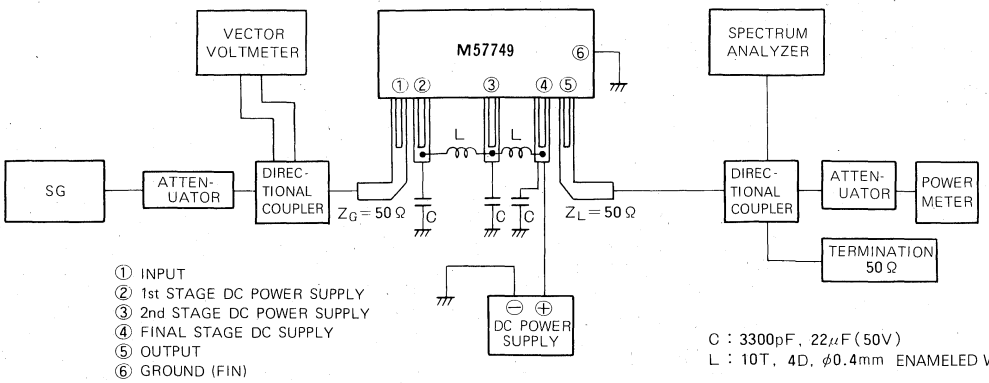
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		3	A
Pin(max)	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
P_O(max)	Output power	$Z_G=Z_L=50\,\Omega$	10	W
T_C(op)	Operation case temperature		−30~+110	°C
Tstg	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

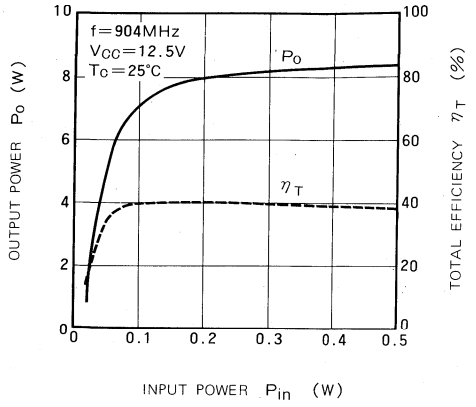
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
f	Frequency range	V_{CC}=12.5V, Pin=0.2W $Z_G=Z_L=50\,\Omega$	903		905	MHz
P_O	Output power		7	9		W
η_T	Total efficiency		30	35		%
—	2nd harmonics				−30	dB
ρ_{in}	Input VSWR			1.8	2.5	—
ρ_{out}	Output VSWR			2		—
—	VSWR tolerance	V_{CC}=15.2V P_O=7W	20 : 1			—

TEST BLOCK DIAGRAM

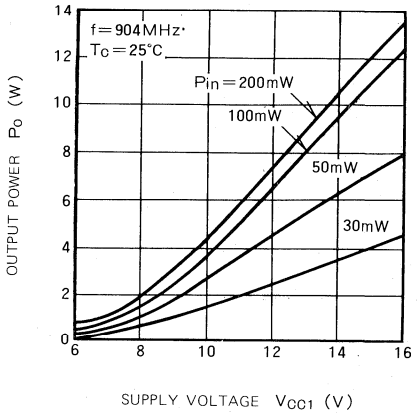


TYPICAL CHARACTERISTICS

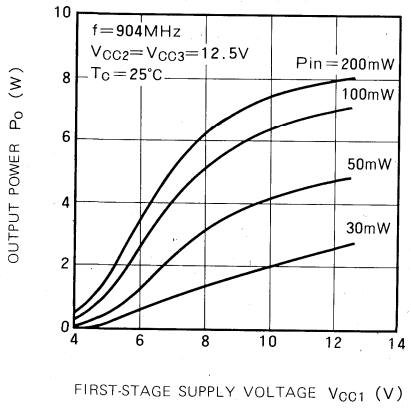
OUTPUT POWER, TOTAL EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. SUPPLY VOLTAGE



OUTPUT POWER VS. FIRST-STAGE, SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.
   a) First stage transistor
      $R_{th(j-c)1}$ = 13°C/W (Typ.)
   b) Second stage transistor
      $R_{th(j-c)2}$ = 9°C/W (Typ.)
   c) Final stage transistor
      $R_{th(j-c)3}$ = 4°C/W (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.
   Conditions for standard operation.
   P_O = 7W, V_{CC} = 12.5V, P_{in} = 0.2W, η_T = 30% (minimum rating), P_{O1} (Note 1) = 1.5W, P_{O2} (2) = 3.6W, I_T = 1.87A (I_{T1} (3) = 0.21A, I_{T2} (4) = 0.48A, I_{T3} (5) = 1.17A)
   Note 1: Output power of the first stage transistor
   Note 2: Output power of the second stage transistor
   Note 3: Circuit current of the first stage transistor
   Note 4: Circuit current of the second stage transistor
   Note 5: Circuit current of the final stage transistor
   Junction temperature of the first stage transistor
   $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
   $= (12.5 \times 0.21 - 1.5 + 0.2) \times 13 + T_C$
   $= 17 + T_C$ (°C)
   Note 6: Package temperature of device
   Junction temperature of the second stage transistor
   $T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
   $= (12.5 \times 0.48 - 3.6 + 1.5) \times 9 + T_C$
   $= 35 + T_C$ (°C)
   Junction temperature of the final stage transistor
   $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
   $= (12.5 \times 1.17 - 7 + 3.6) \times 4 + T_C$
   $= 45 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 7W below 90°C.
The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(7/0.3) - 7 + 0.2}$$
$$= 1.81 \text{ (°C/W)}$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,
T_{j1} = 107°C, T_{j2} = 125°C, T_{j3} = 135°C at T_a = 60°C, T_C = 90°C.
In the annual average of ambient temperature is 30°C,
T_{j1} = 77°C, T_{j2} = 95°C, T_{j3} = 105°C.
As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57752

430~450MHz, 12.5V, 10W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57752 is a thick film RF power module specification designed for 430 ~ 450MHz, 10W FM mobile radios.

FEATURES

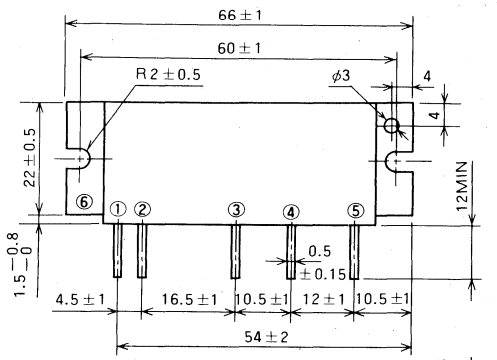
- High power gain: @G_P = 18.1dB, P_O = 13W
  @V_{CC} = 12.5V, P_{in} = 0.2W
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 14W.
- Wide range on operation case temperature.
- Excellent stability from low power to high power level due to the class AB operation of 1st stage.

APPLICATION

Output stage of 10 watts output mobile radio sets (FM) in 430 ~ 450MHz UHF band.

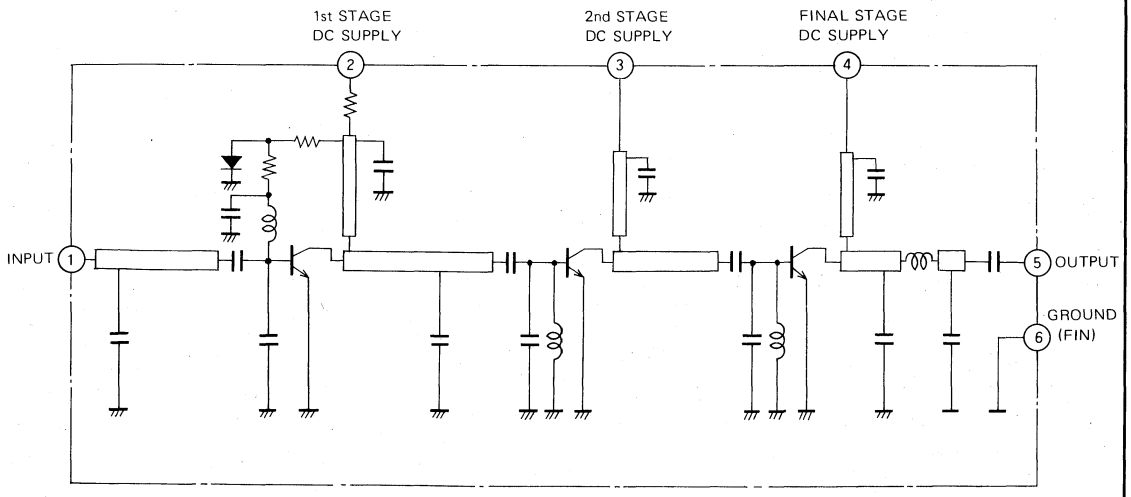
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

M57752

430~450MHz, 12.5V, 10W, FM FOR MOBILE RADIO APPLICATION

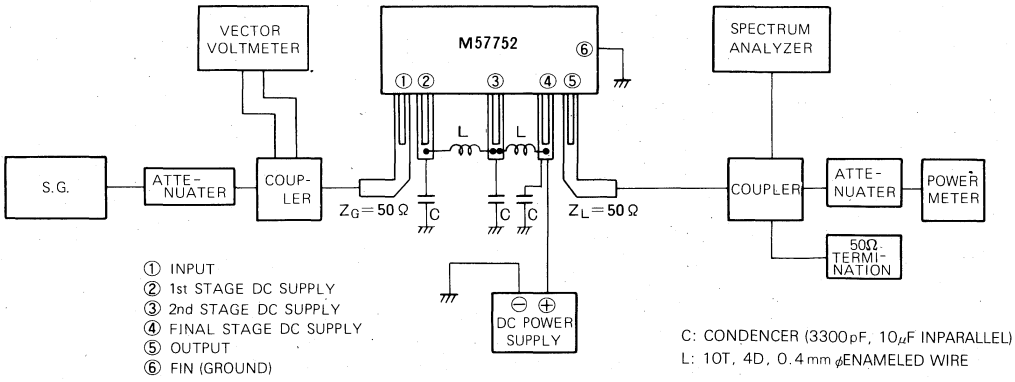
ABSOLUTE MAXIMUM RATINGS (T_C=25℃ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		5	A
P_{in}	Input Power	Z_L=50 Ω	0.4	W
P_O	Output power	Z_L=50 Ω	20	W
$T_{C(op)}$	Operation case temperature		−30~+110	℃
T_{stg}	Storage temperature		−40~+110	℃

ELECTRICAL CHARACTERISTICS (T_C=25℃ unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, P_{in}=0.2W, Z_G=Z_L=50 Ω	13	15		W
η_T	Total efficiency		40	43		%
—	2nd Harmonic				−30	dB
—	3rd Harmonic				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2		—
—	Load VSWR Tolerance	V_{CC}=15.2V, P_O=14W, Z_G=50 Ω T=5sec.	20 : 1			—

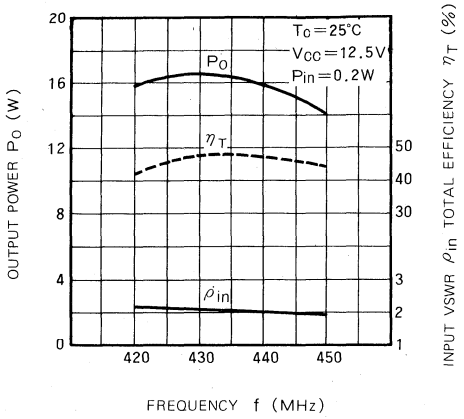
TEST BLOCK DIAGRAM



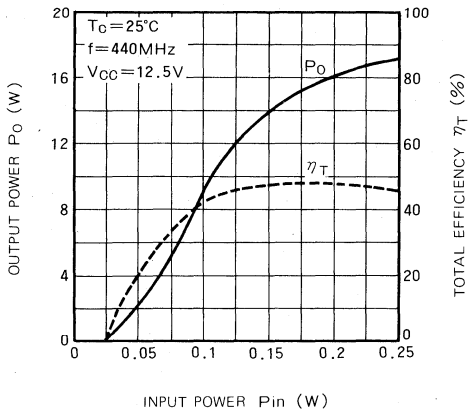
430~450MHz, 12.5V, 10W, FM FOR MOBILE RADIO APPLICATION

TYPICAL PERFORMANCE DATA

OUTPUT POWER TOTAL EFFICIENCY INPUT VSWR FREQUENCY

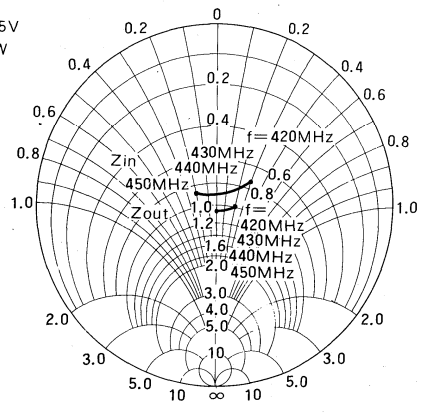


OUTPUT POWER TOTAL EFFICIENCY VS. INPUT POWER



INPUT IMPEDANCE VS. FREQUENCY

T_C=25°C
V_{CC}=12.5V
P_{in}=0.2W
Z_O=50 Ω



MITSUBISHI ELECTRIC

M57755

806~866MHz, 10W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57755 is a thick film RF power module specifically designed for 806 ~ 866MHz, 10W FM mobile radios.

FEATURES

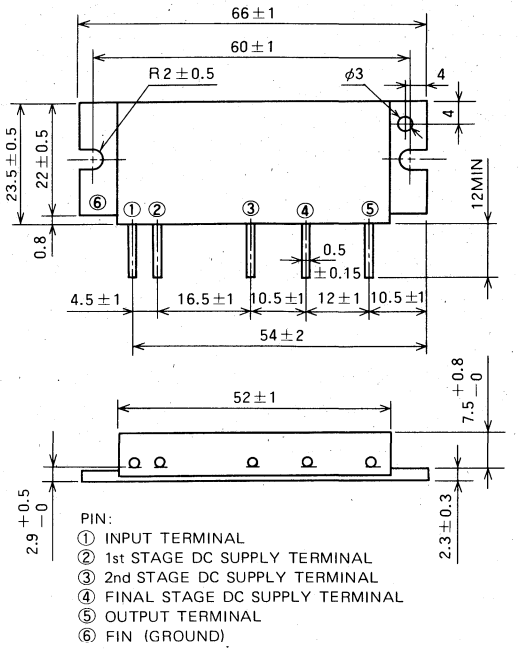
- Frequency Range . . . . . 806 ~ 866MHz
- High Power 10W
- High Gain 20dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_o = 10W.

APPLICATION

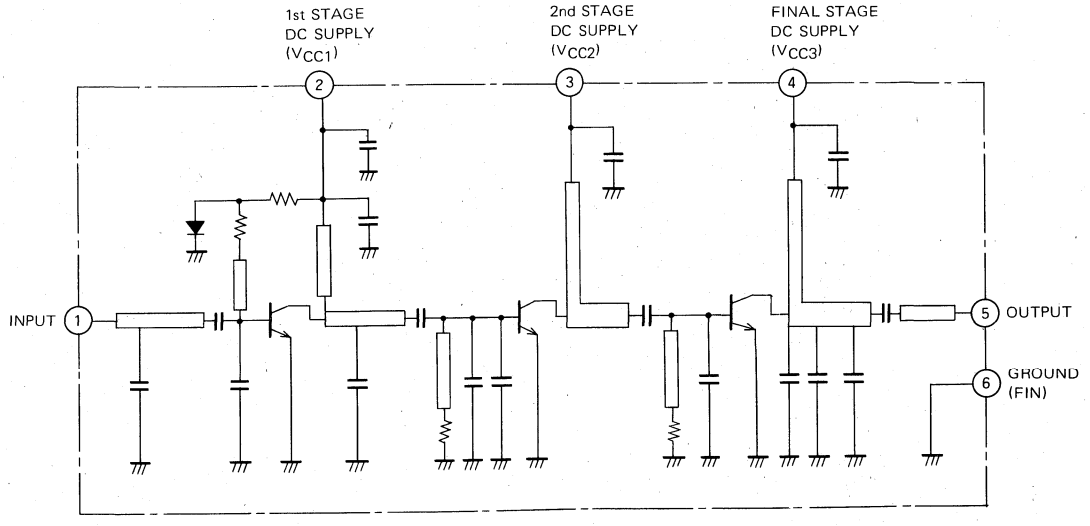
Drive stage of 25W output mobile radio sets (FM) in 806 ~ 866MHz UHF band.

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



M57755

806～866MHz, 10W, FM FOR MOBILE RADIO APPLICATION

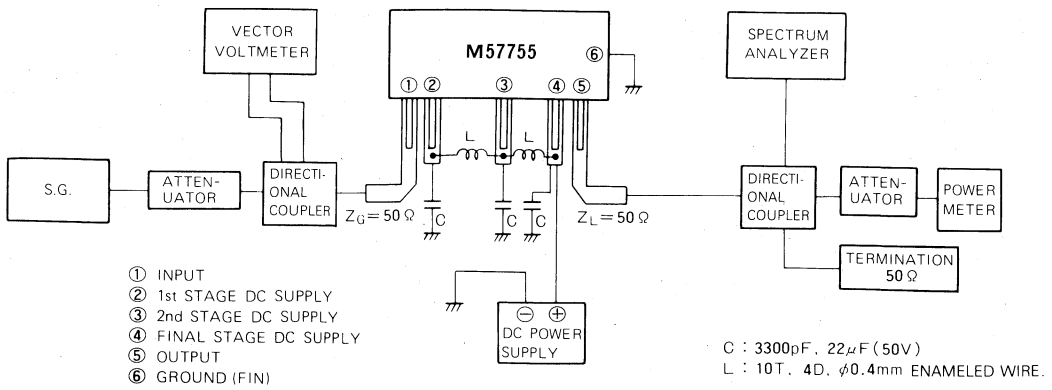
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		4	A
P_{in}	Input power	$Z_G = Z_L = 50\,\Omega$, $V_{CC1} \leqq 12.6V$	0.2	W
P_O	Output power	$Z_G = Z_L = 50\,\Omega$	16	W
T_C (op)	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

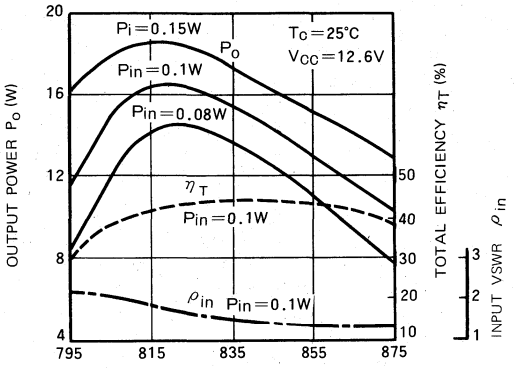
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=806～866MHz, V_{CC}=12.6V, P_{in}=0.1W, $Z_G = Z_L = 50\,\Omega$	10			W
η_T	Total efficiency		35			%
—	2nd harmonics				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2		—
—	Load VSWR tolerance	f=806～866MHz, V_{CC}=15.2V, P_O=10W, Z_G=50Ω, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

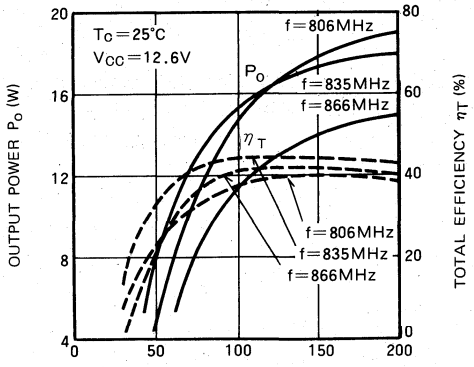


TYPICAL PERFORMANCE DATA

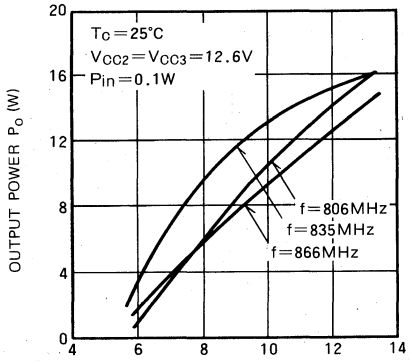
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



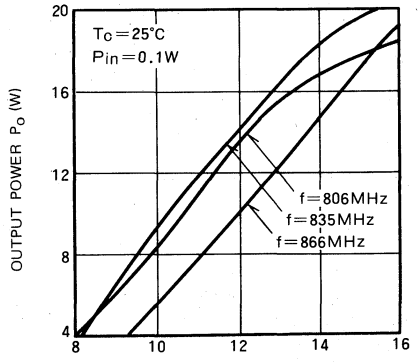
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER



OUTPUT POWER VS. 1st STAGE VOLTAGE



OUTPUT POWER VS. DC SUPPLY VOLTAGE



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operaton.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 15°C/W (Typ.)

b) Second stage transistor

$R_{th(j-c)2}$ = 6.5°C/W (Typ.)

c) Final stage transistor

$R_{th(j-c)3}$ = 4°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

P_O = 10W, V_{CC} = 12.6V, P_{in} = 0.1W, η_T = 35% (minimum rating), P_{O1} (Note 1) = 1W, P_{O2} (2) = 4W, I_T = 2.26A (I_{T1} (3) = 0.3A, I_{T2} (4) = 0.56A, I_{T3} (5) = 1.4A)

Note 1: Output power of the first stage transistor

Note 2: Output power of the second stage transistor

Note 3: Circuit current of the first stage transistor

Note 4: Circuit current of the second stage transistor

Note 5: Circuit current of the final stage transisotr

- Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)

$= (12.6 \times 0.3 - 1.0 + 0.1) \times 15 + T_C$

$= 43.2 + T_C$ (°C)

Note 6: Package temperature of device

- Junction temperature of the second stage transistor

$T_{j2} = V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$

$= (12.6 \times 0.56 - 4 + 1.0) \times 6.5 + T_C$

$= 26.4 + T_C$ (°C)

- Junction temperature of the final stage transistor

$T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$

$= (12.6 \times 1.4 - 10 + 4) \times 4 + T_C$

$= 46.6 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 10W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(10/0.35) - 10 + 0.1}$$

$$= 1.6\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 133.2°C, T_{j2} = 116.4°C, T_{j3} = 136.6°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 103.2°C, T_{j2} = 86.4°C, T_{j3} = 106.6°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57757

148~175MHz, 6W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M55757 is a thick film RF power module specifically designed for 148 ~ 175MHz, 6W FM mobile radios.

FEATURES

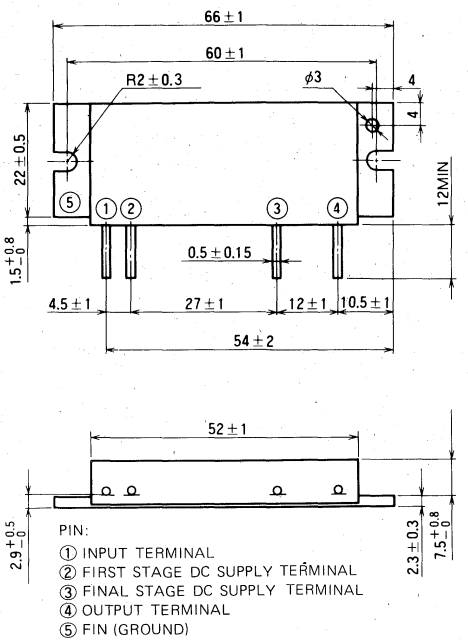
- Frequency Range . . . . . 148 ~ 175MHz
- High Power 8W
- High Gain 19.0dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 12W

APPLICATION

Output stage of 8W output mobile radio sets (FM) in 148 ~ 175MHz VHF band.

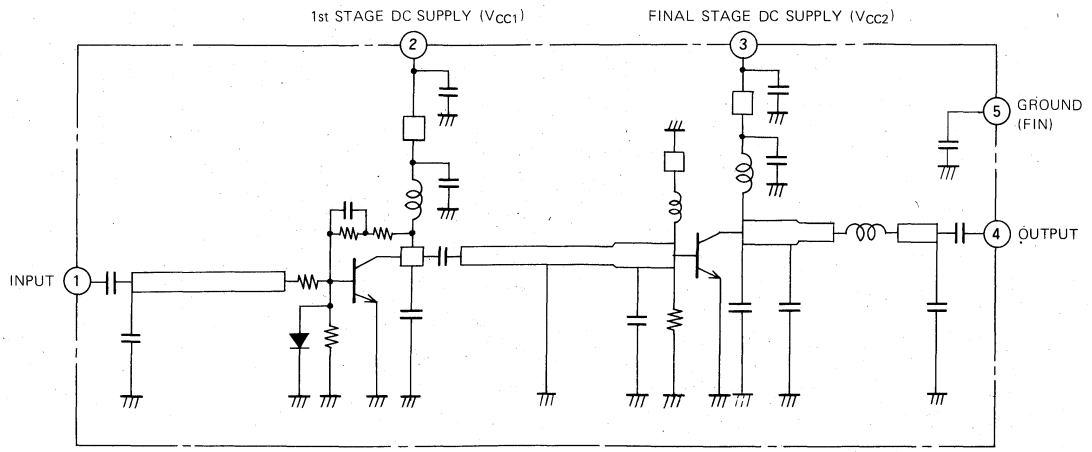
OUTLINE DIAGRAM

Dimensions in mm



PIN:
① INPUT TERMINAL
② FIRST STAGE DC SUPPLY TERMINAL
③ FINAL STAGE DC SUPPLY TERMINAL
④ OUTPUT TERMINAL
⑤ FIN (GROUND)

EQUIVALENT CIRCUIT



148～175MHz, 6W, FM FOR MOBILE RADIO APPLICATION

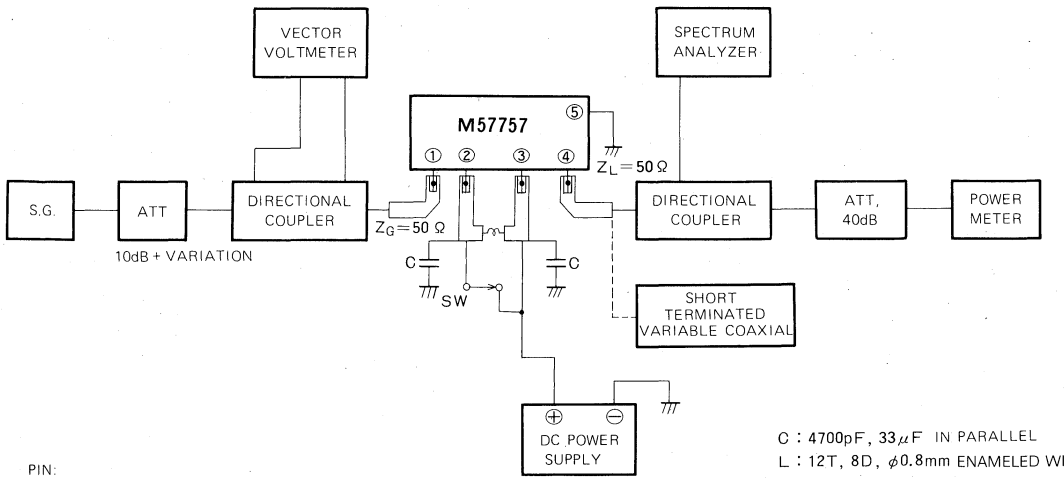
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Ratings	Unit
V_{CC}	DC Supply voltage	17	V
I_{CC}	Total current	5	A
Pin(max)	Input power ($Z_G=Z_L=50\,\Omega$)	0.2	W
P_O(max)	Output power ($Z_G=Z_L=50\,\Omega$)	16	W
T_C(op)	Operation case temperature	−30～+110	°C
Tstg	Storage temperature	−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC1}=V_{CC2}=12.5V$, f=148～175MHz, Pin=0.1W, $Z_G=Z_L=50\,\Omega$	8	10		W
η_T	Total efficiency		35	40		%
—	2nd harmonic				−15	dB
—	3rd harmonic				−20	dB
ρ_{in}	Input VSWR				4.0	—
ρ_{out}	Output VSWR				2.0	—
—	Load VSWR tolerance	V_{CC}=15.2V, f=148～175MHz, P_O=12W, $Z_G=50\,\Omega$, 5sec	20：1			—

TEST BLOCK DIAGRAM

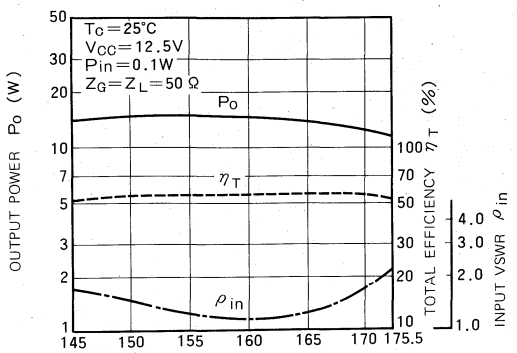


C：4700pF, 33μF IN PARALLEL
L：12T, 8D, φ0.8mm ENAMELED WIRE

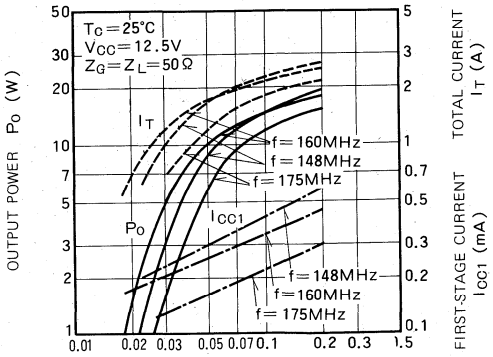
PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ FINAL STAGE DC SUPPLY
④ OUTPUT
⑤ FIN (GROUND)

TYPICAL CHARACTERISTICS

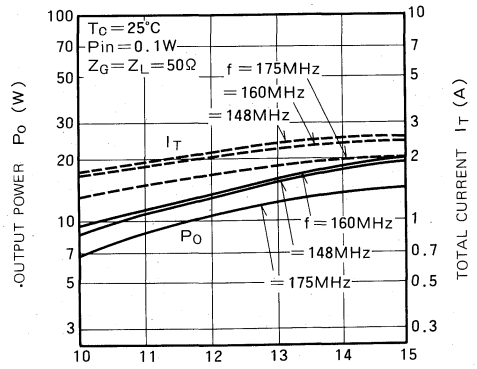
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



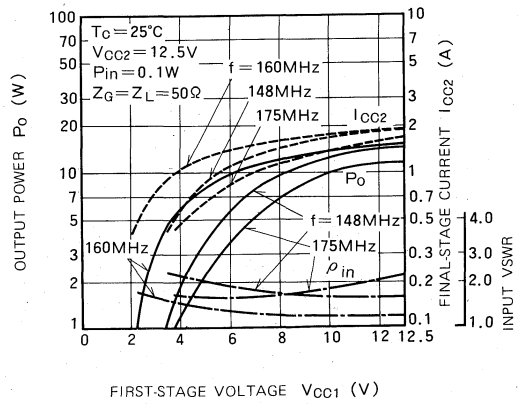
OUTPUT POWER, TOTAL CURRENT, FIRST-STAGE CURRENT VS. INPUT POWER



OUTPUT POWER, TOTAL CURRENT VS. SUPPLY VOLTAGE

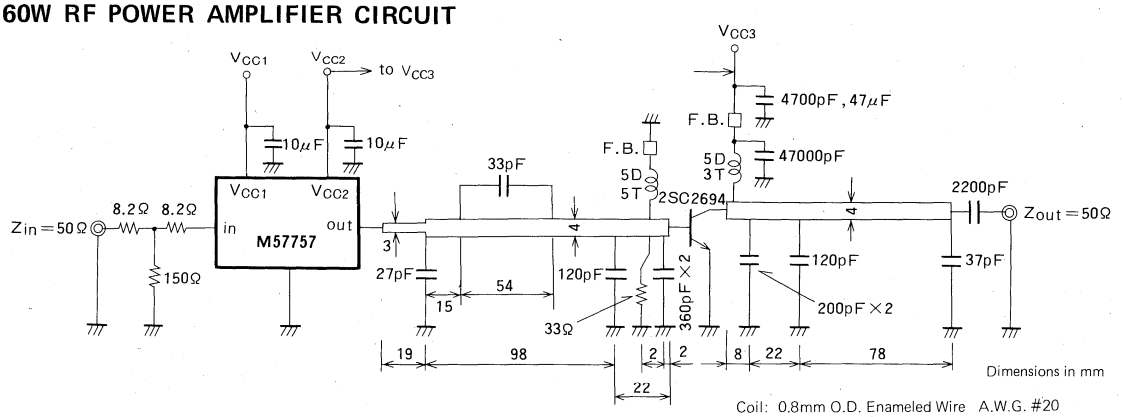


OUTPUT POWER, FINAL-STAGE CURRENT, INPUT VSWR VS. FIRST-STAGE VOLTAGE



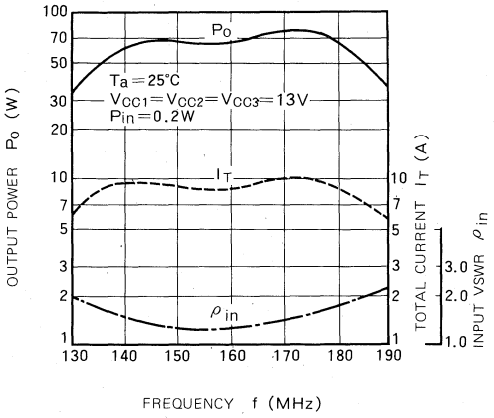
148~175MHz, 6W, FM
FOR MOBILE RADIO APPLICATION

APPLICATION DATA (M57757 – 2SC2694)
60W RF POWER AMPLIFIER CIRCUIT

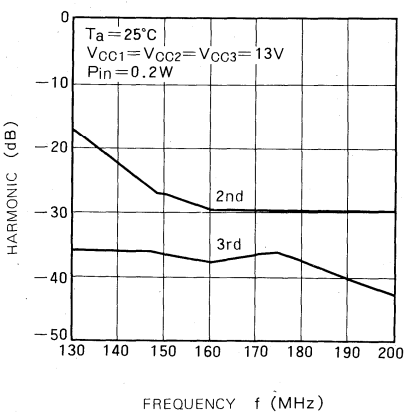


Coil: 0.8mm O.D. Enameled Wire A.W.G. #20
Strip Line Board Material: 1.6mm-Thick Epoxy-Glass
Capacitors are chip capacitors (Murata GR111, CM21) with exception of 10μF, 47μF

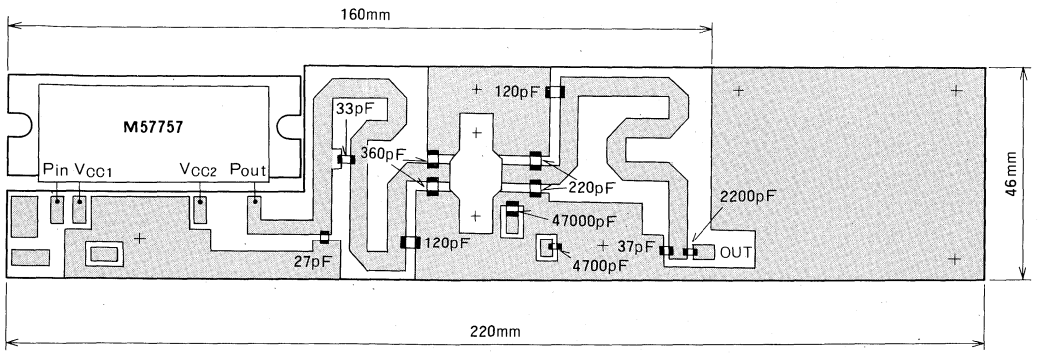
OUTPUT POWER, TOTAL CURRENT, INPUT VSWR VS. FREQUENCY



HARMONIC VS. FREQUENCY



60W RF POWER AMPLIFIER P.C.B. LAYOUT PATTERN



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 10°C/W$ (Typ.)

b) Final stage transistor

$R_{th(j-c)2} = 3°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.

Conditions for standard operation.

$P_O = 8W$, $V_{CC} = 12.5V$, $P_{in} = 0.1W$, $\eta_T = 35\%$ (minimum rating), P_{O1} (Note 1) $= 1.8W$, $I_T = 1.9A$ (I_{T1} (2) $= 0.3A$, I_{T2} (3) $= 1.6A$)

Note 1: Output power of the first stage transistor

Note 2: Circuit current of the first stage transistor

Note 3: Circuit current of the final stage transistor

Junction temperature of the first stage transistor

$$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)} + T_C \text{ (4)}$$
$$= (12.5 \times 0.3 - 1.8 + 0.1) \times 10 + T_C$$
$$= 21 + T_C\ (°C)$$

Note 4: Package temperature of device

Junction temperature of the final stage transistor

$$T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$$
$$= (12.5 \times 1.6 - 8 + 1.8) \times 3 + T_C$$
$$= 42 + T_C\ (°C)$$

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally $T_a = 60°C$) and at the output power of 8W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(8/0.35) - 8 + 0.1}$$
$$= 2.0\ (°C/W)$$

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

$T_{j1} = 121°C$, $T_{j2} = 142°C$ at $T_a = 60°C$, $T_C = 90°C$.

In the annual average of ambient temperature is 30°C,

$T_{j1} = 91°C$, $T_{j2} = 112°C$

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57757L

136~160MHz, 6W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M5575-L is a thick film RF power module specifically designed for 136 ~ 160MHz, 6W FM mobile radios.

FEATURES

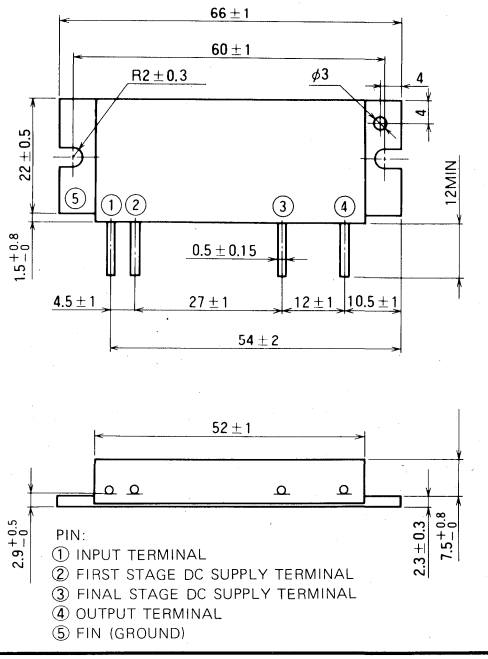
- Frequency Range . . . . . 136 ~ 160MHz
- High Power 8W
- High Gain 19.0dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 12W

APPLICATION

Output stage of 8W output mobile radio sets (FM) in 136 ~ 160MHz VHF band.

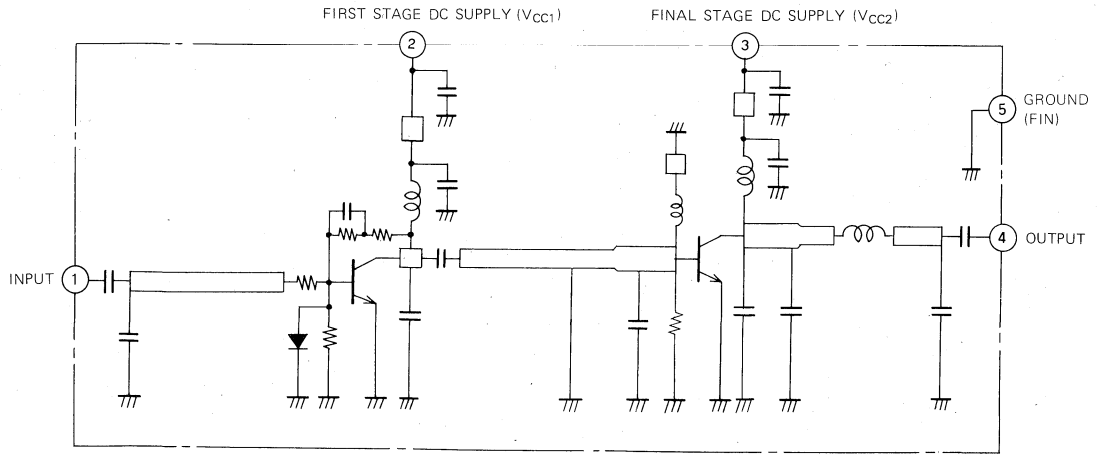
OUTLINE DIAGRAM

Dimensions in mm



PIN:
① INPUT TERMINAL
② FIRST STAGE DC SUPPLY TERMINAL
③ FINAL STAGE DC SUPPLY TERMINAL
④ OUTPUT TERMINAL
⑤ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

136～160MHz, 6W, FM FOR MOBILE RADIO APPLICATION

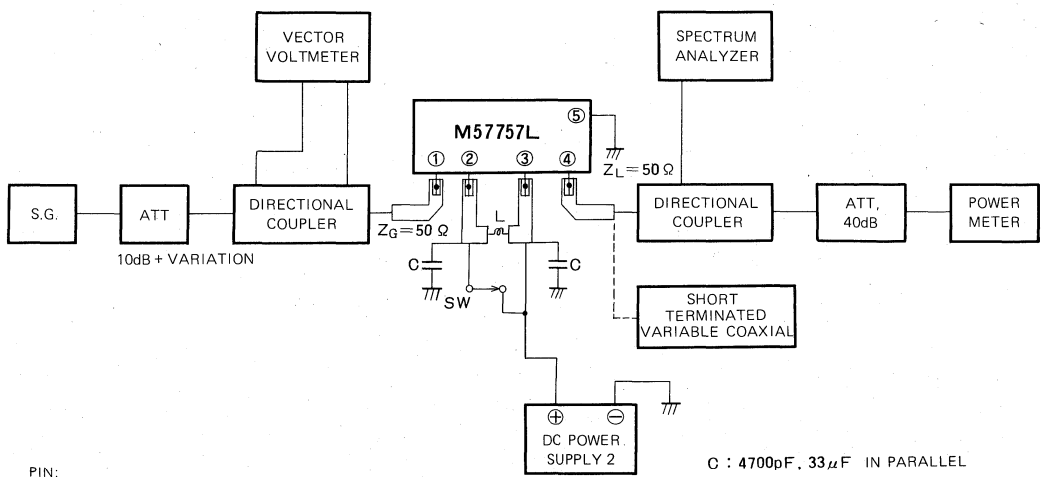
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Limits	Unit
V_{CC}	DC Supply voltage	17	V
I_{CC}	Total current	5	A
P_{in}(max)	Input power ($Z_G=Z_L=50\,\Omega$)	0.2	W
P_O(max)	Output Power ($Z_G=Z_L=50\,\Omega$)	16	W
T_C(op)	Operation case temperature	−30～+110	°C
T_{stg}	Storage temperature	−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC1}=V_{CC2}=12.5V$, f=136～160MHz $P_{in}=0.1W$, $Z_G=Z_L=50\,\Omega$	8	10		W
η_T	Total efficiency		35	40		%
—	2nd harmonic				−15	dB
—	3rd harmonic				−20	dB
ρ_{in}	Input VSWR				4.0	—
ρ_{out}	Output VSWR				2.0	—
—	Load VSWR tolerance	$V_{CC}=15.2V$, f=136～160MHz $P_O=12W$, $Z_G=50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

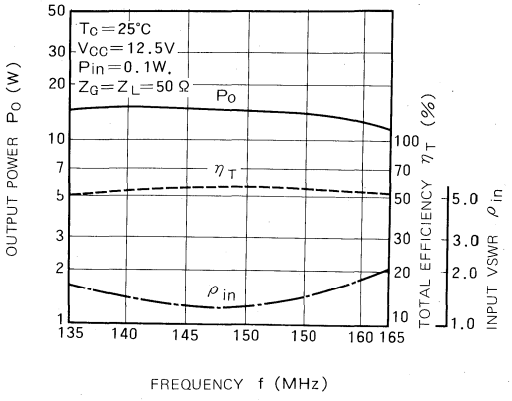


PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ FINAL STAGE DC SUPPLY
④ OUTPUT
⑤ FIN (GROUND)

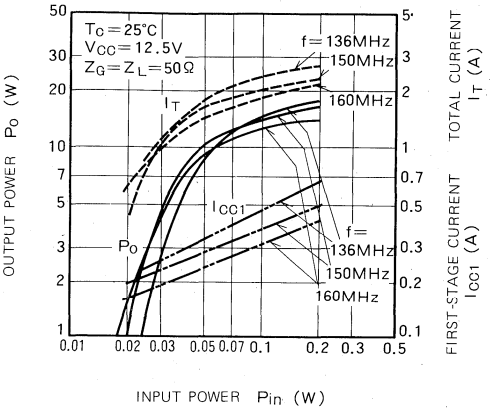
C : 4700pF, 33μF IN PARALLEL
L : 12T, 8D, φ0.8mm ENAMELED WIRE
BOARD MATERIAL:
1.6mm-THICK EPOXY-GLASS

TYPICAL CHARACTERISTICS

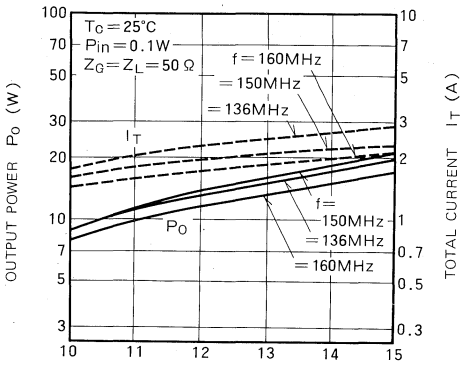
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



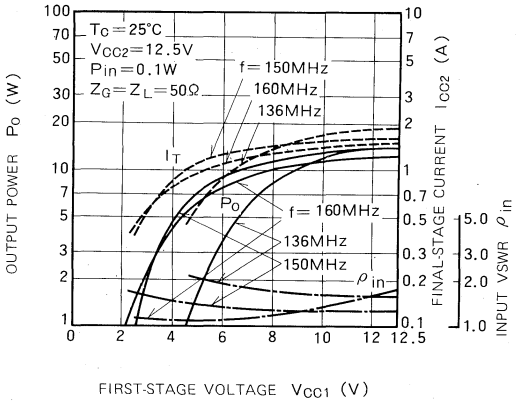
OUTPUT POWER, TOTAL CURRENT, FIRST-STAGE CURRENT VS. INPUT POWER



OUTPUT POWER, TOTAL CURRENT VS. SUPPLY VOLTAGE



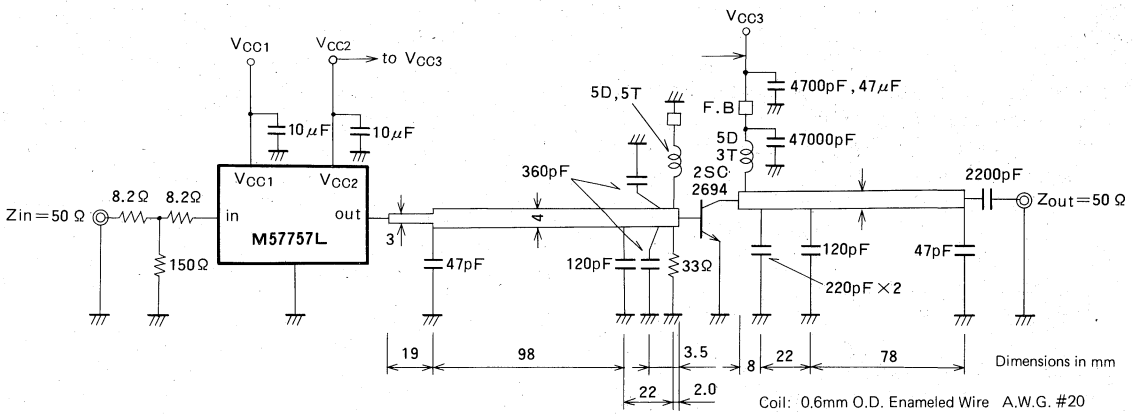
OUTPUT POWER, FINAL-STAGE CURRENT, INPUT VSWR VS. FIRST-STAGE VOLTAGE



MITSUBISHI ELECTRIC

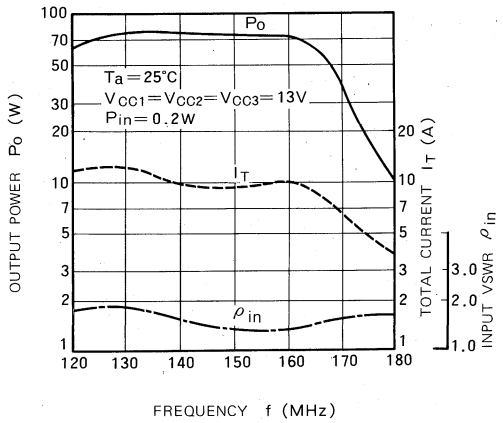
136~160MHz, 6W, FM
FOR MOBILE RADIO APPLICATION

APPLICATION DATA (M57757-L – 2SC2694)
60W RF POWER AMPLIFIER CIRCUIT

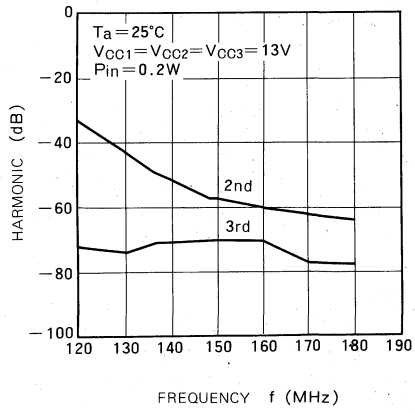


Coil: 0.6mm O.D. Enameled Wire A.W.G. #20
Strip Line Board Material: 1.6mm-Thick Epoxy-Glass
Capacitors are chip capacitors (Murata GR111, CM22) with exception of 10μF, 47μF

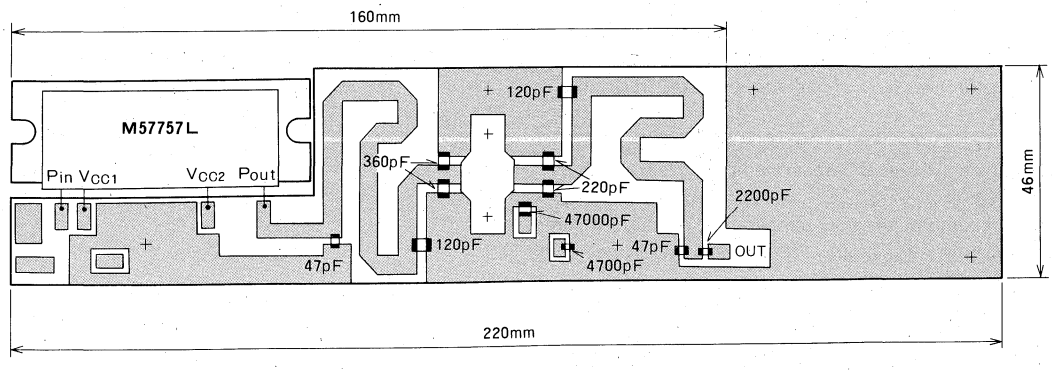
OUTPUT POWER, TOTAL CURRENT, INPUT VSWR VS. FREQUENCY



HARMONIC VS. FREQUENCY



60W RF POWER AMPLIFIER P.C.B. LAYOUT PATTERN



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 10°C/W$ (Typ.)

b) Final stage transistor

$R_{th(j-c)2} = 3°eC/W$ (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.

- Conditions for standard operation.

$P_O = 8W$, $V_{CC} = 12.5V$, $P_{in} = 0.1W$, $\eta_T = 35\%$ (minimum rating), P_{O1} (Note 1) $= 1.8W$, $I_T = 1.9A$ (I_{T1} (2) $= 0.3A$, I_{T2} (3) $= 1.6A$)

Note 1: Output power of the first stage transistor

Note 2: Circuit current of the first stage transistor

Note 3: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)

$= (12.5 \times 0.3 - 1.8 + 0.1) \times 10 + T_C$

$= 21 + T_C$ (°C)

Note 4: Package temperature of device

- Junction temperature of the final stage transistor

$T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$

$= (12.5 \times 1.6 - 8 + 1.8) \times 3 + T_C$

$= 42 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally $T_a = 60°C$) and at the output power of 8W below 90°C.

The thermal resistance $R_{th(c-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(8/0.35) - 8 + 0.1}$$

$= 2.0$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

$T_{j1} = 121°C$, $T_{j2} = 142°C$ at $T_a = 60°C$, $T_C = 90°C$

In the annual average of ambient temperature is 30°C,

$T_{j1} = 91°C$, $T_{j2} = 112°C$

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57758

903~905MHz BAND 5W FM EXCITER FOR MOBILE RADIO

DESCRIPTION

M57758 is a 903 ~ 905MHz band, 0.2W output thick film hybrid integrated circuit, and demonstrates excellent functions as a 903 ~ 905MHz band exciter.

FEATURES

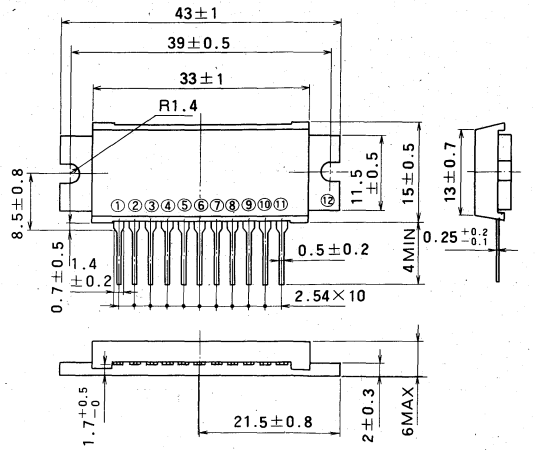
- High output, high gain: $P_O \geqq 0.2W$, $G_p \geqq 20dB$ V_{CC} = 8V, f = 903 ~ 905MHz, P_{in} = 2mV
- High Ruggedness: $P_O = 0.3W$, $V_{CC1} = 8V$, $V_{CC2} = 15.2V$, f = 903 ~ 905MHz, loading VSWR more than 20:1
- Broad operating case temperature: – 30 ~ +110°C
- Small package: 43 x 14.5 x 6 mm

APPLICATION

- Exciter stage of 903 ~ 905MHz band in FM mobile radio.

OUTLINE DIAGRAM

Dimension: mm

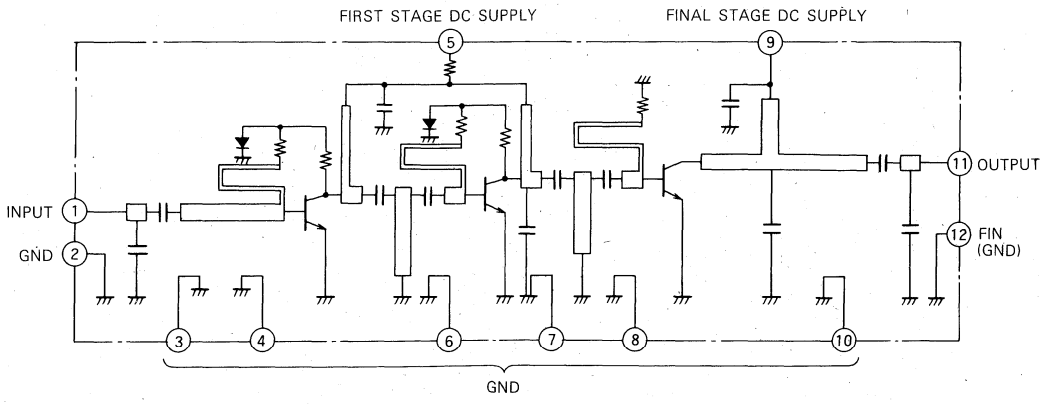


PIN STYLE

①	INPUT PIN	⑨	FINAL DC SUPPLY VOLTAGE PIN
②~④	GND PINS	⑩	GND PIN
⑤	FIRST DC SUPPLY VOLTAGE PIN	⑪	OUTPUT PIN
⑥~⑧	GND PINS	⑫	FIN (GND)

Note: The dimension that tolerance is not specified indicates the typical value.

EQUIVALENT CIRCUIT



903~905MHz BAND 5W FM EXCITER FOR MOBILE RADIO

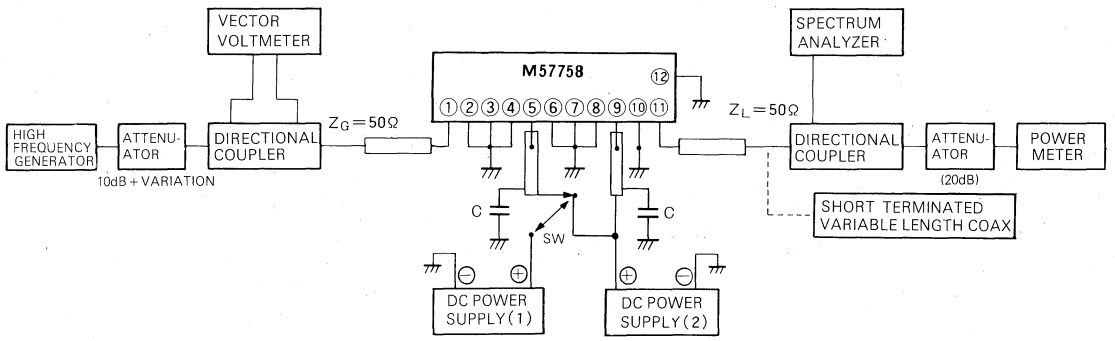
ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	Supply voltage (FIRST STAGE)		11	V
V_{CC2}	Supply voltage (FINAL STAGE)		17	V
I_{CC}	Circuit Current		0.6	A
$P_{in(max)}$	Power input	$Z_G=Z_L=50\Omega$	10	mW
$P_{O(max)}$	Output power	$Z_G=Z_L=50\Omega$	0.4	W
$T_{C(OP)}$	Operation case temperature		−30~+110	℃
T_{stg}	Storage temperature		−40~+110	℃

ELECTRICAL CHARACTERISTICS (T_C=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC1}=V_{CC2}=8V$, f=903~905MHz, $P_{in}=2mW$, $Z_G=Z_L=50\Omega$	200	320		mW
—	2nd Hormonic				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2.0		—
I_T	Total current	$V_{CC1}=V_{CC2}=8V$, f=903~905MHz, $P_O=0.2W$, $Z_G=Z_L=50\Omega$		150	190	mA
—	Load VSWR tolerance	$V_{CC1}=8V$, $V_{CC2}=15.2V$, f=903~905MHz, $P_O=0.3W$, $\rho_L\geqq 20$(All phase), $Z_G=50\Omega$	20:1			—

TEST BLOCK DIAGRAM



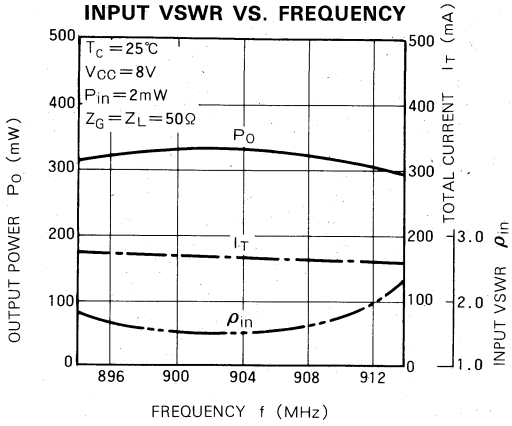
CONNECTIONS

① INPUT
②~④ GND
⑤ FIRST STAGE DC SUPPLY
⑥~⑧ GND
⑨ FINAL STAGE DC SUPPLY
⑩ GND
⑪ OUTPUT

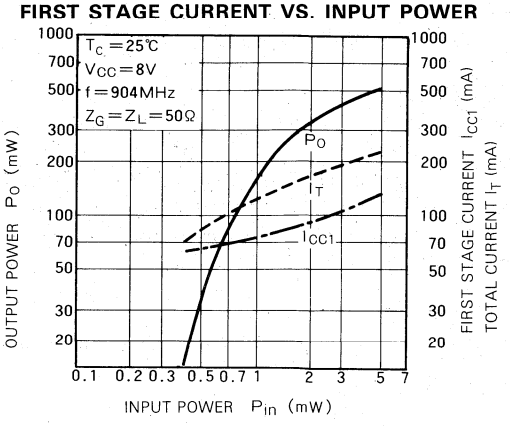
C: 2200pF, 3.3μF series connected, strip line
Board material: glass-epoxy
(εr=4.8, H=1.6mm)

TYPICAL CHARACTERISTICS

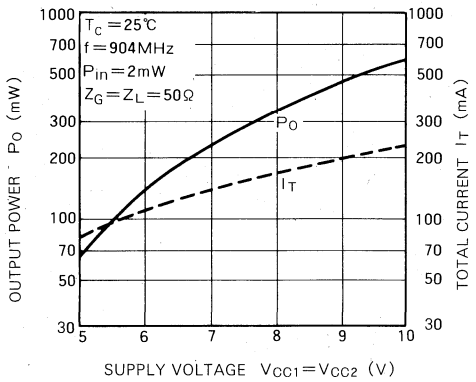
OUTPUT POWER/TOTAL CURRENT/ INPUT VSWR VS. FREQUENCY



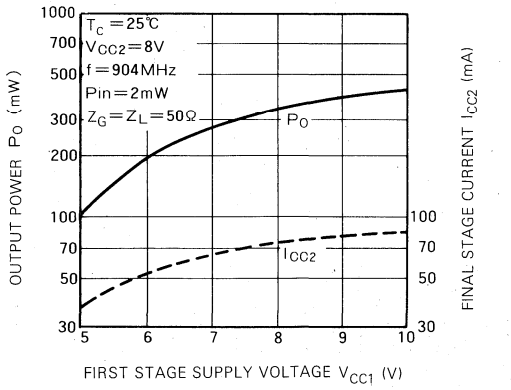
OUTPUT POWER/TOTAL CURRENT/ FIRST STAGE CURRENT VS. INPUT POWER



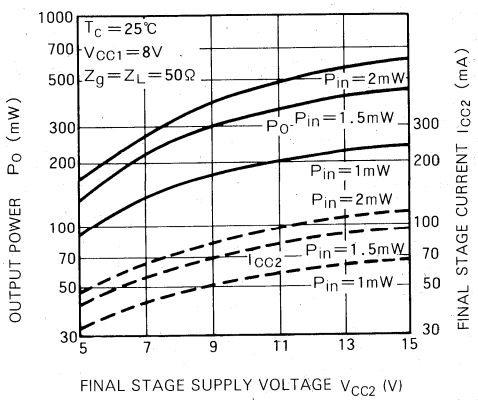
OUTPUT POWER/TOTAL CURRENT VS. SUPPLY VOLTAGE



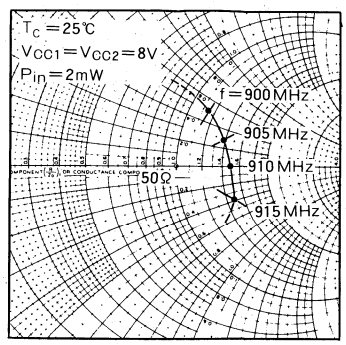
OUTPUT POWER/FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE



OUTPUT POWER/FINAL STAGE/CURRENT VS. FINAL STAGE SUPPLY VOLTAGE



INPUT IMPEDANCE VS. FREQUENCY



M57759

903~905MHz BAND 5W FM EXCITER FOR MOBILE RADIO

DESCRIPTION

M57759 is a 903~905MHz band, 0.2W output thick film hybrid integrated circuit, and demonstrates excellent functions as a 903~905MHz band exciter.

FEATURES

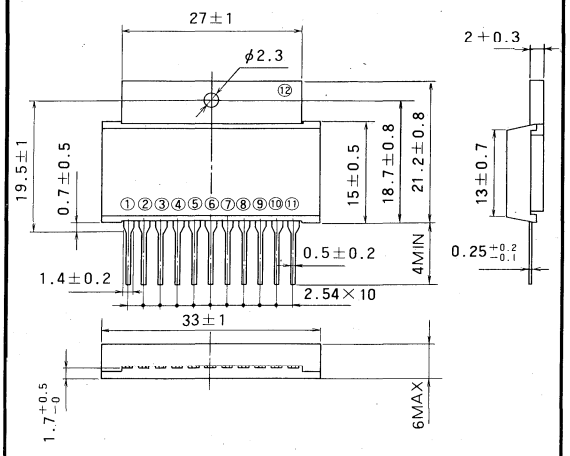
- High output, high gain: $P_O \geqq 0.2W$, $G_P \geqq 20dB$ $V_{CC}=8V$, $f=903\sim905MHz$, $P_{in}=2mV$
- High Ruggedness: $P_O=0.3W$, $V_{CC1}=8V$, $V_{CC2}=15.2V$, $f=903\sim905MHz$, loading VSWR more than 20:1
- Broad operating case temperature: $-30\sim+110°C$
- Small package: 33 x 14.5 x 6mm

APPLICATION

- Exciter stage of 903~905MHz band in FM mobile radio.

OUTLINE DIAGRAM

Dimension: mm

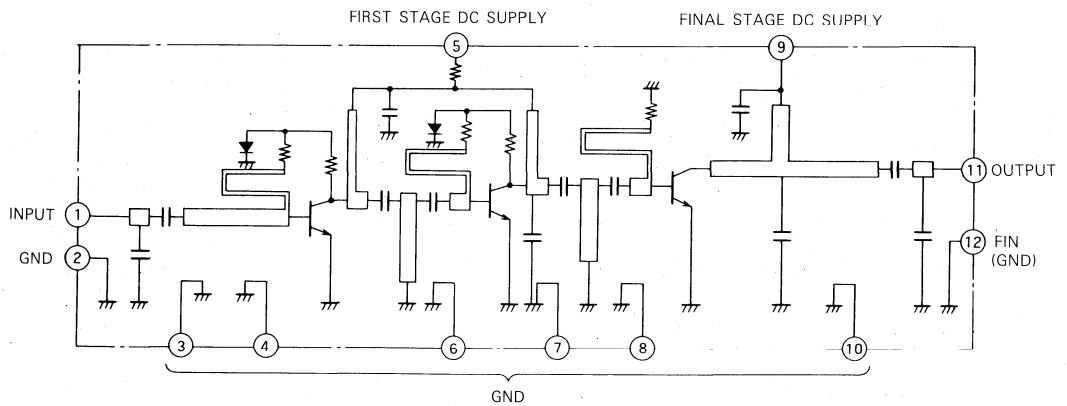


PIN STYLE

①	INPUT	⑨	FINAL STAGE DC SUPPLY
②~④	GND	⑩	GND
⑤	FIRST STAGE DC SUPPLY	⑪	OUTPUT
⑥~⑧	GND	⑫	FIN (GND)

Note: The dimension that tolerance is not specified indicates the typical value.

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

903~905MHz BAND 5W FM EXCITER FOR MOBILE RADIO

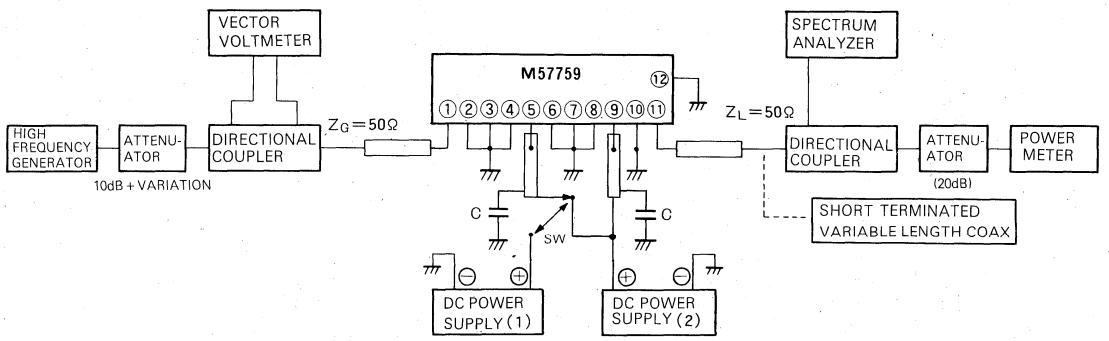
ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	Supply voltage (FIRST STAGE)		11	V
V_{CC2}	Supply voltage (FINAL STAGE)		17	V
I_{CC}	Circuit current		0.6	A
$P_{in(max)}$	Power input	$Z_G=Z_L=50\Omega$	10	mW
$P_{o(max)}$	Output power	$Z_G=Z_L=50\Omega$	0.4	W
$T_{C(OP)}$	Operation case temperature		−30~+110	°C
T_{stg}	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC1}=V_{CC2}=8V$, f=903~905MHz, $P_{in}=2mW$, $Z_G=Z_L=50\Omega$	200	320		mW
—	2nd Harmonic				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2.0		—
I_T	Total current	$V_{CC1}=V_{CC2}=8V$, f=903~905MHz, $P_O=0.2W$, $Z_G=Z_L=50\Omega$		150	190	mA
—	Load VSWR tolerance	$V_{CC1}=8V$, $V_{CC2}=15.2V$, f=903~905 MHz, $P_O=0.3W$, $\rho_L\geqq 20$ (All phase), $Z_G=50\Omega$	20:1			—

TEST BLOCK DIAGRAM



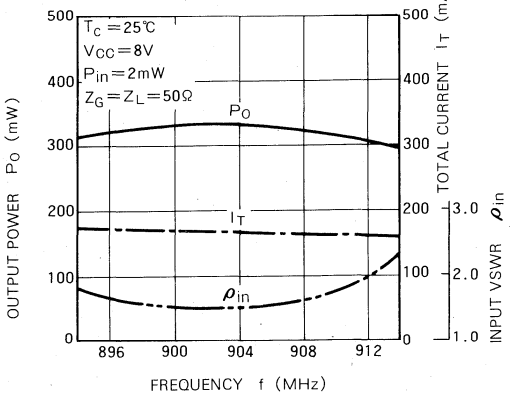
CONNECTIONS

① INPUT
②~④ GND
⑤ FIRST STAGE DC SUPPLY
⑥~⑧ GND
⑨ FINAL STAGE DC SUPPLY
⑩ GND
⑪ OUTPUT

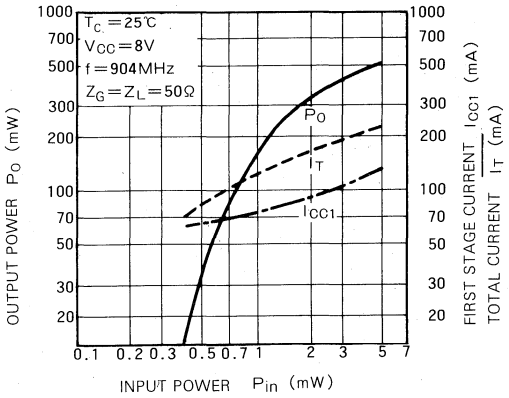
C: 2200pF, 3.3μF series connected, strip line
Board material: glass-epoxy
(εr=4.8, H=1.6mm)

TYPICAL CHARACTERISTICS

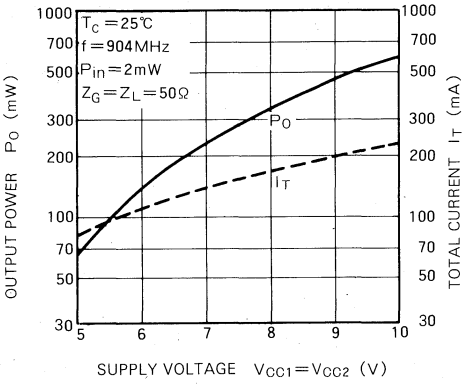
OUTPUT POWER/TOTAL CURRENT/ INPUT VSWR VS. FREQUENCY



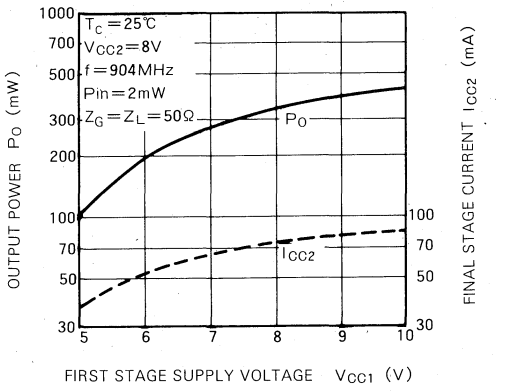
OUTPUT POWER/TOTAL CURRENT/ FIRST LEVEL CURRENT VS. INPUT POWER



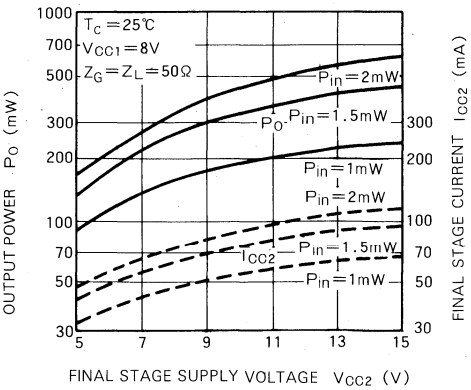
OUTPUT POWER/TOTAL CURRENT VS. SUPPLY VOLTAGE



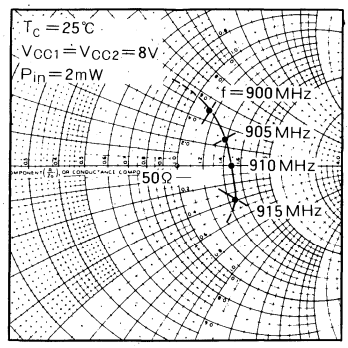
OUTPUT POWER/FINAL STAGE CURRNT VS. FIRST STAGE SUPPLY VOLTAGE



OUTPUT POWER/FINAL STAGE CURRENT VS. FINAL STAGE SUPPLY VOLTAGE



INPUT IMPEDANCE VS. FREQUENCY



MITSUBISHI ELECTRIC

M57762

1.24～1.3GHz, 10W, SSB FOR MOBILE RADIO APPLICATION

DESCRIPTION

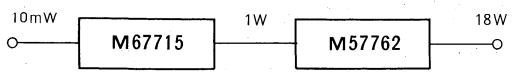
M57762 is a thick film RF power module specifically designed for 1.24 ～ 1.3GHz, 10W SSB mobile radios.

FEATURES

- Frequency Range ..... 1.24 ～ 1.3GHz
- High Power 18W
- High Total Efficiency 30%

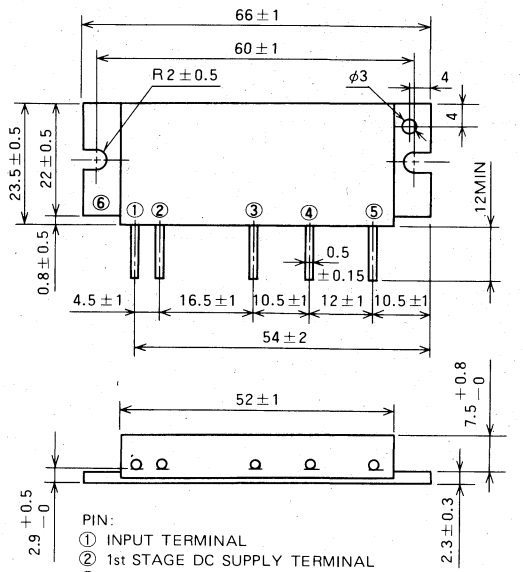
APPLICATION

Output stage of 10W output mobile radio FM and SSB set in 1.24 ～ 1.30GHz band.



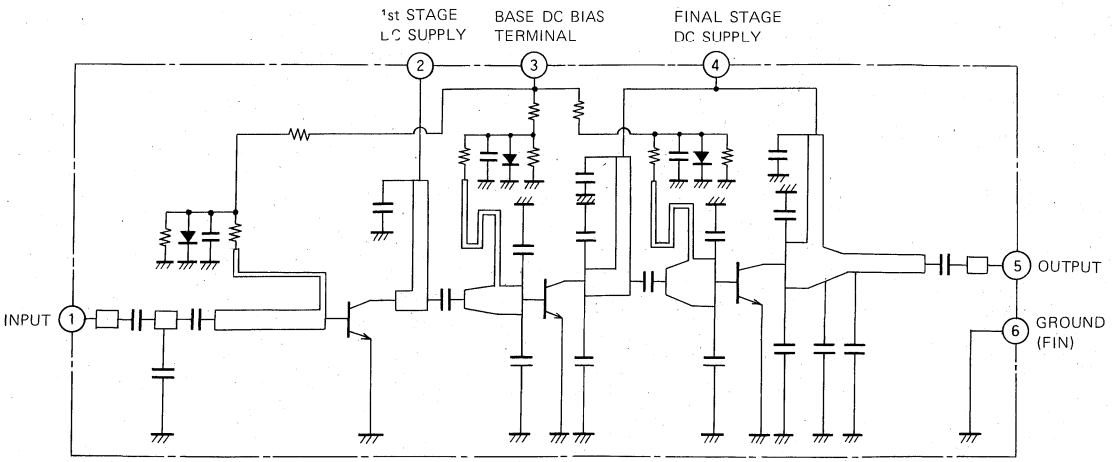
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



M57762

1.24～1.3GHz, 10W, SSB FOR MOBILE RADIO APPLICATION

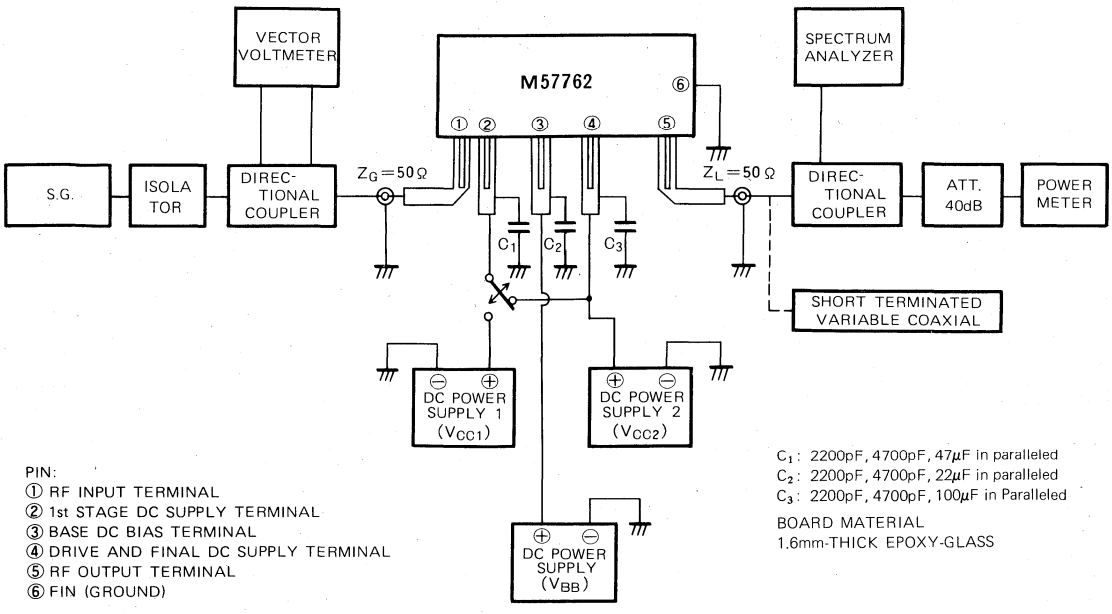
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Condition	Ratings	Unit
V_{CC}	Supply voltage		17	V
V_{BB}	Base bias voltage		10	V
I_{CC}	Total current		8	A
P_O	Output power	Z_O=50 Ω	25	W
P_{in}	Input power	V_{CC}=12.5V, V_{BB}=9V	2	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
f	Frequency		1.24		1.30	GHz
P_O	Output power	V_{CC}=12.5V, V_{BB}=9V, P_{in}=1W, Z_G=Z_L=50 Ω	18			W
η_T	Total efficiency		30			%
2f_O	2nd harmonic				−45	dB
ρ_{in}	Input VSWR				2.0	—
ρ_{out}	Output VSWR			1.5		—
I_{BB}	Base bias current				500	mA
G_P	Linear power gain	V_{CC}=12.5V, V_{BB}=9V, P_{in}=10dBm, Z_G=Z_L=50 Ω	13			dB
—	3rd order intermodulation distortion	V_{CC}=12.5V, V_{BB}=9V, Δf=|f_1−f_2|=10kHz, P_O≦14WPEP, Z_G=Z_G=50Ω			−24	dB
—	5th and higher intermodulation distortion				−31	dB
—	Load VSWR tolerance	V_{CC1}=V_{CC2}=15.2V, P_O=18W			16：1	—

TEST BLOCK DIAGRAM



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

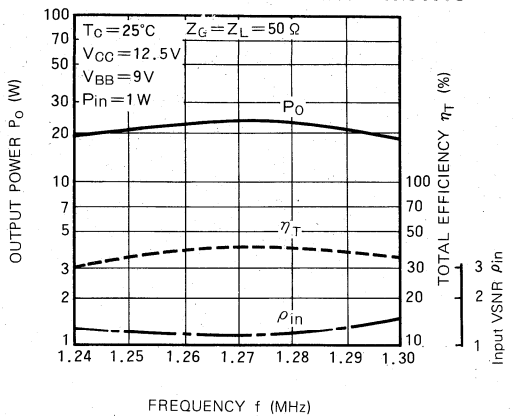
C_1: 2200pF, 4700pF, 47μF in paralleled
C_2: 2200pF, 4700pF, 22μF in paralleled
C_3: 2200pF, 4700pF, 100μF in Paralleled

BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

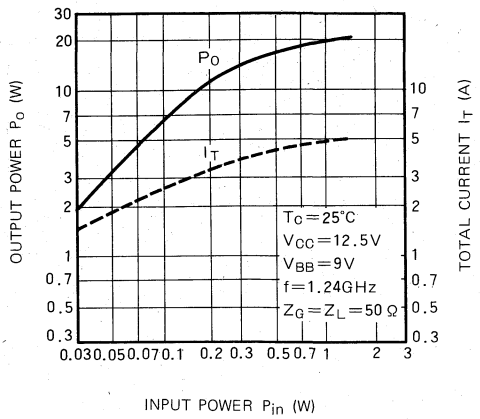
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

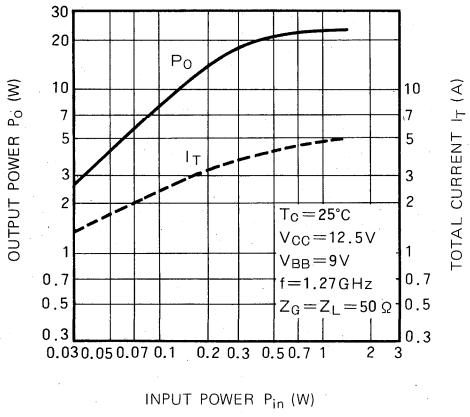
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



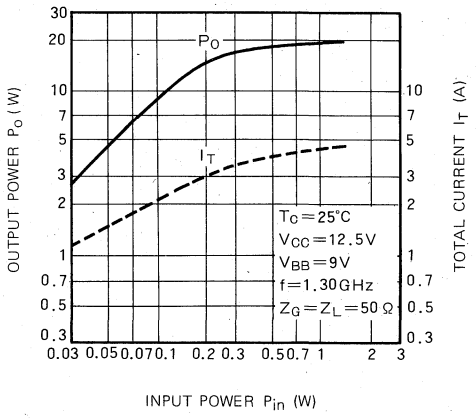
OUTPUT POWER, TOTAL CURRENT, VS. INPUT POWER CHARACTERISTICS



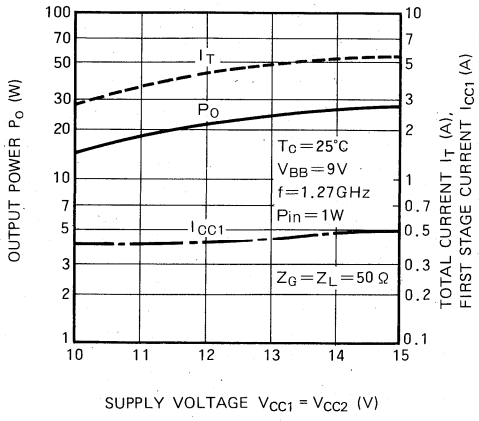
OUTPUT POWER, TOTAL CURRENT, VS. INPUT POWER CHARACTERISTICS



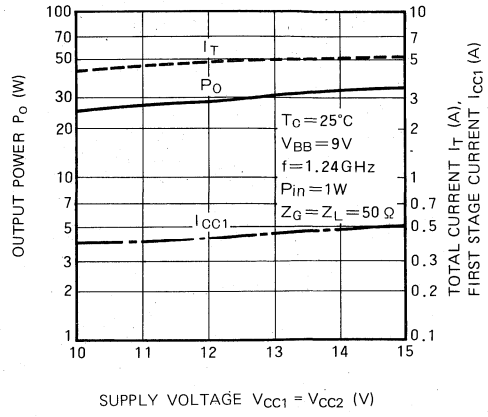
OUTPUT POWER, TOTAL CURRENT, VS. INPUT POWER CHARACTERISTICS



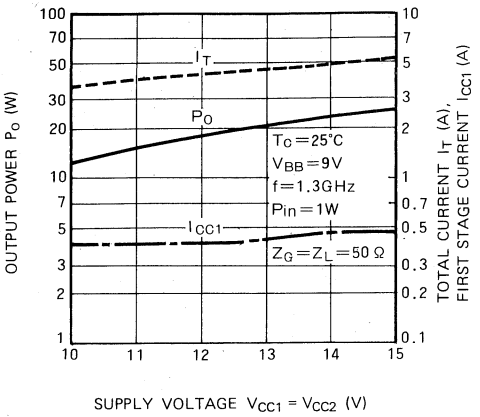
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



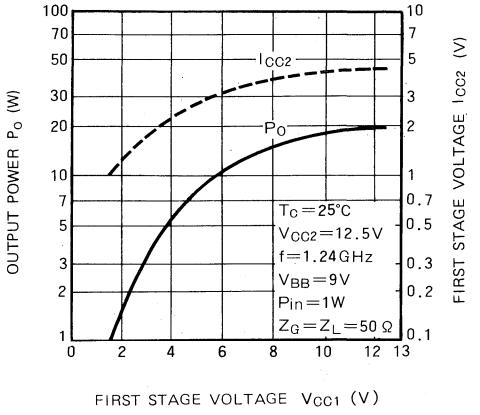
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



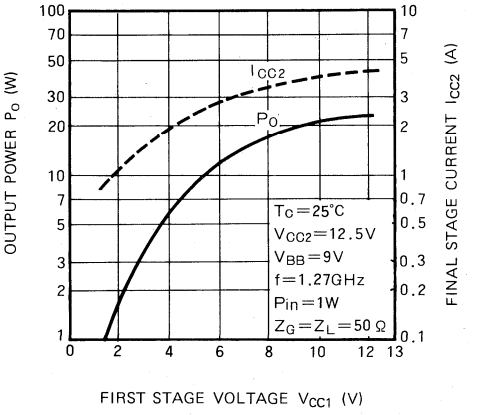
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



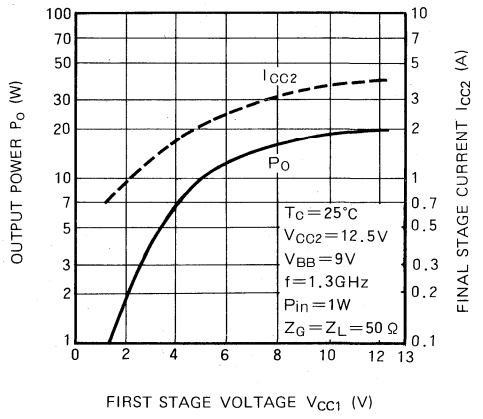
OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE CURRENT CHARACTERISTICS



M57764

806~825MHz, 20W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57764 is a thick film RF power module specifically designed for 806 ~ 825MHz, 15W FM mobile radios.

FEATURES

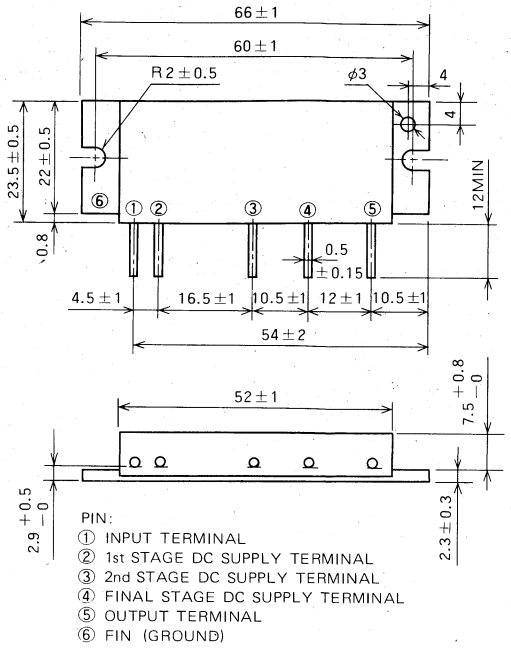
- Frequency Range . . . . . 806 ~ 825MHz
- High Power 20W
- High Gain 17dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 20W.

APPLICATION

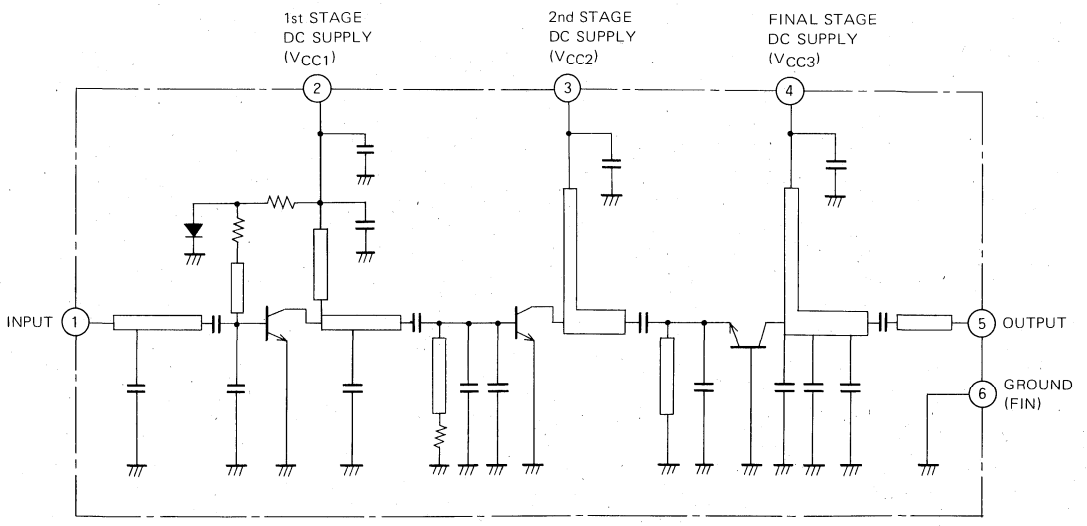
Drive stage of 35W output mobile radio sets (FM) in 806 ~ 825MHz UHF band.

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



M57764

806～825MHz, 20W, FM FOR MOBILE RADIO APPLICATION

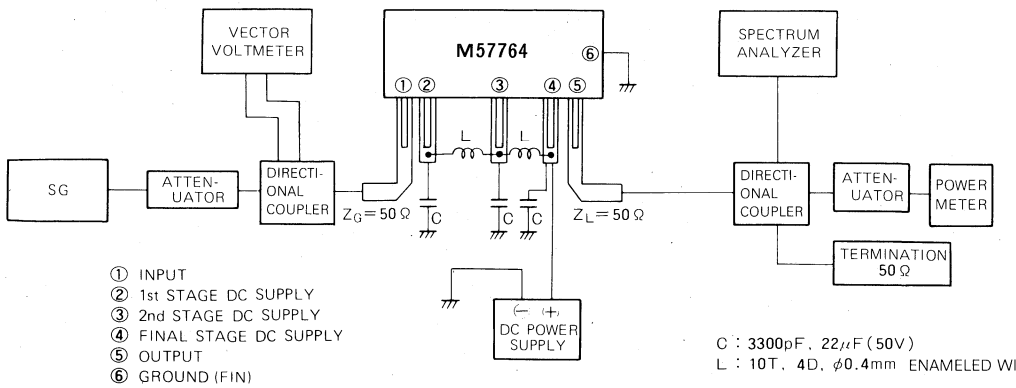
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		7	A
P_{in}	Input power	$Z_G = Z_L = 50\,\Omega$, $V_{CC1} \leqq 12.5V$	0.6	W
P_O	Output power	$Z_G = Z_L = 50\,\Omega$	25	W
T_C (op)	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

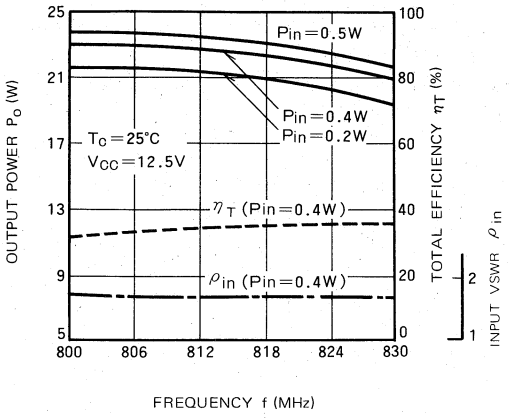
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=806～825MHz, V_{CC}=12.5V, P_{in}=0.4W, $Z_G = Z_L = 50\,\Omega$	20			W
η_T	Total efficiency		30			%
—	2nd harmonics				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2		—
—	Load VSWR tolerance	f=806～825MHz, V_{CC}=15.2V, P_O=20W, Z_G=50Ω, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

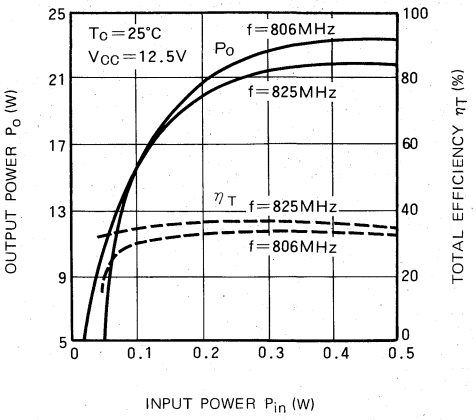


TYPICAL PERFORMANCE DATA

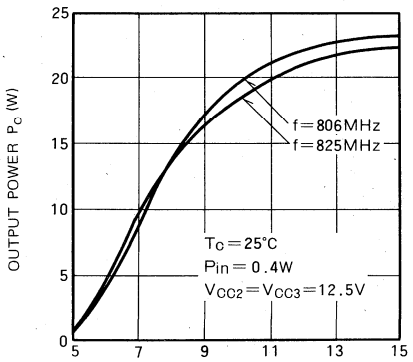
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



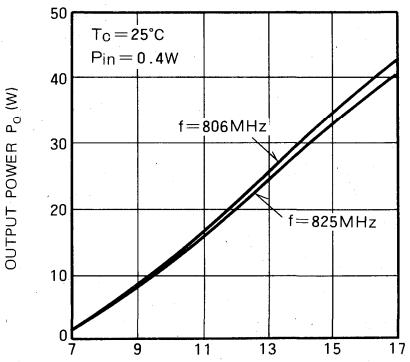
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER



OUTPUT POWER VS. 1st STAGE VOLTAGE



OUTPUT POWER VS. DC SUPPLY VOLTAGE



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operaton.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 15°C/W (Typ.)

b) Second stage transistor

$R_{th(j-c)2}$ = 5°C/W (Typ.)

c) Final stage transistor

$R_{th(j-c)3}$ = 1.87°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

P_O = 20W, V_{CC} = 12.5V, P_{in} = 0.4W, η_T = 30% (minimum rating), P_{O1} (Note 1) = 3W, P_{O2} (2) = 10W, I_T = 5.33A (I_{T1} (3) = 0.4A, I_{T2} (4) = 1.53A, I_{T3} (5) = 3.4A)

Note 1: Output power of the first stage transistor
Note 2: Output power of the second stage transistor
Note 3: Circuit current of the first stage transistor
Note 4: Circuit current of the second stage transistor
Note 5: Circuit current of the final stage transisotr

- Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
$= (12.5 \times 0.4 - 3 + 0.4) \times 15 + T_C$
$= 36 + T_C$ (°C)

Note 6: Package temperature of device

- Junction temperature of the second stage transistor

$T_{j2} = V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
$= (12.5 \times 1.53 - 10 + 3) \times 5 + T_C$
$= 60.6 + T_C$ (°C)

- Junction temperature of the final stage transistor

$T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
$= (12.5 \times 3.4 - 20 + 10) \times 1.87 + T_C$
$= 60.8 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 20W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(20/0.3) - 20 + 0.4}$$

$= 0.637$ (°C/W)

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 126°C, T_j² = 150.6°C, T_{j3} = 150.8°C at T_a = 60°C, T_C = 90°c.

In the annual average of ambient temperature is 30°C,

T_{j1} = 96°C T_{j2} = 120.6°C, T_{j3} = 120.8°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57765

806~866MHz, 3W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57765 is a thick film RF power module specifically designed for 806 ~ 866MHz, 3W FM mobile radios.

FEATURES

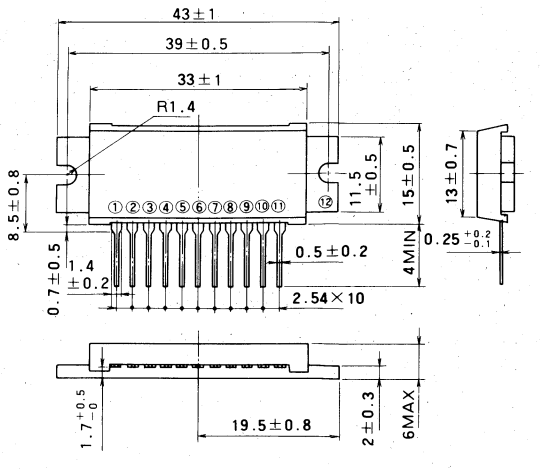
- Frequency Range . . . . . 806 ~ 866MHz
- High Power 4W
- High Gain 14dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 4W.

APPLICATION

Final stage of 3W output mobile radio sets (FM) in 806 ~ 866MHz UHF band.

OUTLINE DIAGRAM

Dimensions in mm

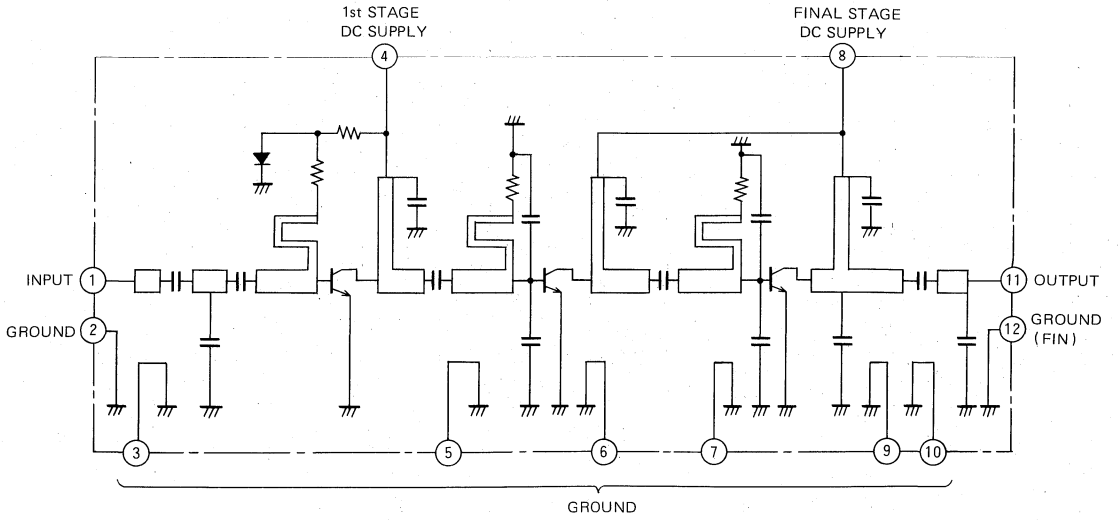


PIN:

① INPUT TERMINAL
②~③ GROUND TERMINAL
④ 1st STAGE DC SUPPLY TERMINAL
⑤~⑦ GROUND TERMINAL
⑧ FINAL STAGE DC SUPPLY TERMINAL
⑨~⑩ GROUND TERMINAL
⑪ OUTPUT TERMINAL
⑫ FIN (GROUND)

Note: The dimension that tolerance is not specified indicates the typical value.

EQUIVALENT CIRICUIT



M57765

806~866MHz, 3W, FM
FOR MOBILE RADIO APPLICATION

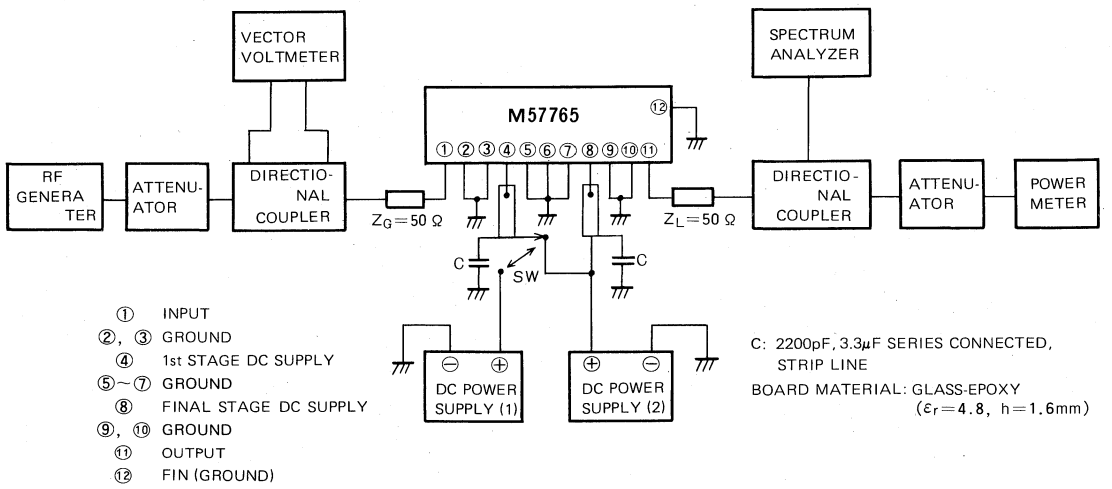
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	Supply voltage (1st)		13	V
V_{CC2}	Supply voltage (2nd, 3rd)		17	V
I_{CC}	Total current		3	A
P_{in}	Input power	$Z_G = Z_L = 50\,\Omega$, $V_{CC1} \leqq 10V$	0.3	W
P_O	Output power	$Z_G = Z_L = 50\,\Omega$, $V_{CC1} \leqq 10V$	10	W
$T_{C(OP)}$	Operating case temperature		−30~+110	°C
Tstg	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=806~866MHz, V_{CC1}=8V, V_{CC2}=12.5V, P_{in}=0.15W, $Z_G = Z_L = 50\,\Omega$	4			W
I_{C1}	1st current	f=806~866MHz, V_{CC2}=12.5V, P_{in}=0.15W, $Z_G = Z_L = 50\,\Omega$, P_O=4W			0.17	A
I_{C2}	2nd current				1.0	A
—	2nd Hormonic				−30	dB
ρ in	Input VSWR				2.8	—
ρ out	Output VSWR			1.5		—
	Load VSWR tolerance	f=806~866MHz, V_{CC2}=15.2V, V_{CC1}=10V, P_O=4W, Z_G=50Ω, 5sec	20 : 1			

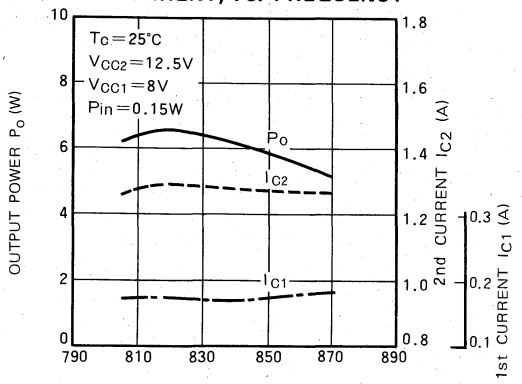
TEST BLOCK DIAGRAM



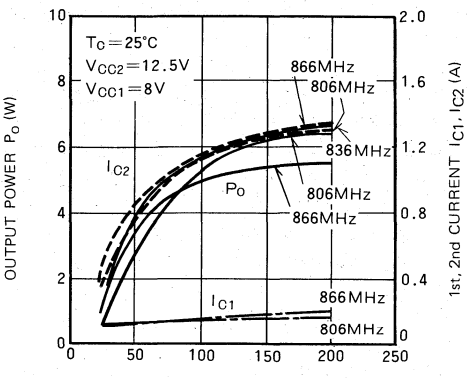
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

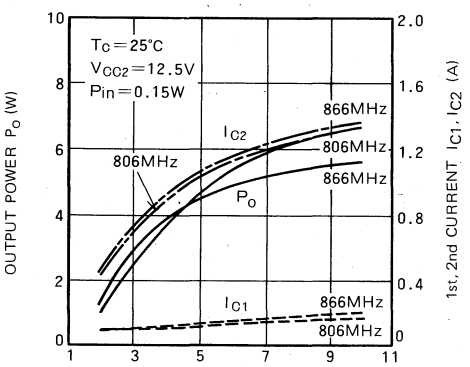
OUTPUT POWER, 2nd CURRENT, 1st CURRENT, VS. FREQUENCY



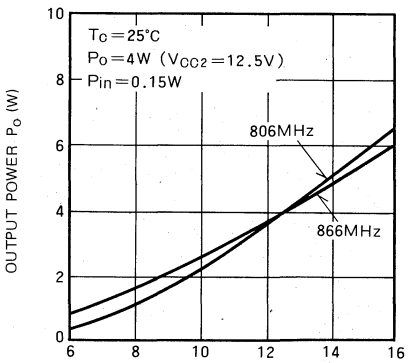
OUTPUT POWER, 1st, 2nd CURRENT, VS. INPUT POWER



OUTPUT POWER, 1st, 2nd CURRENT VS. 1st STAGE DC SUPPLY VOLTAGE



OUTPUT POWER VS. 2nd STAGE DC SUPPLY VOLTAGE



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operaton.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 20°C/W (Typ.)

b) Second stage transistor

$R_{th(j-c)2}$ = 15°C/W (Typ.)

c) Final stage transistor

$R_{th(j-c)3}$ = 6.5°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

P_O = 4W, V_{CC1} = 8V, V_{CC2} = 12.5V, P_{in} = 0.15W, η_T = 30% (minimum rating), P_{O1} (Note 1) = 0.5W, P_{O2} (2) = 2W, I_T = 1.11A (I_{T1} (3) = 0.13A, I_{T2} (4) = 0.38A, I_{T3} (5) = 0.6A)

Note 1: Output power of the first stage transistor
Note 2: Output power of the second stage transistor
Note 3: Circuit current of the first stage transistor
Note 4: Circuit current of the second stage transistor
Note 5: Circuit current of the final stage transisotr

- Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
$= (8 \times 0.13 - 0.5 + 0.15) \times 20 + T_C$
$= 13.8 + T_C$ (°C)

Note 6: Package temperature of device

- Junction temperature of the second stage transistor

$T_{j2} = V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
$= (12.5 \times 0.38 - 2 + 0.5) \times 15 + T_C$
$= 48.8 + T_C$ (°C)

- Junction temperature of the final stage transistor

$T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
$= (12.5 \times 0.6 - 4 + 2) \times 6.5 + T_C$
$= 35.8 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 4 W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(4/0.3) - 4 + 0.15}$$

$= 3.16$ (°C/W)

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 103.8°C, T_{j2} = 138.8°C, T_{j3} = 125.8°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 73.8°C, T_{j2} = 108.8°C, T_{j3} = 95.8°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57768

890~915MHz, 6W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57768 is a thick film RF power module specifically designed for 890 ~ 915 MHz, 6W FM mobile radios.

FEATURES

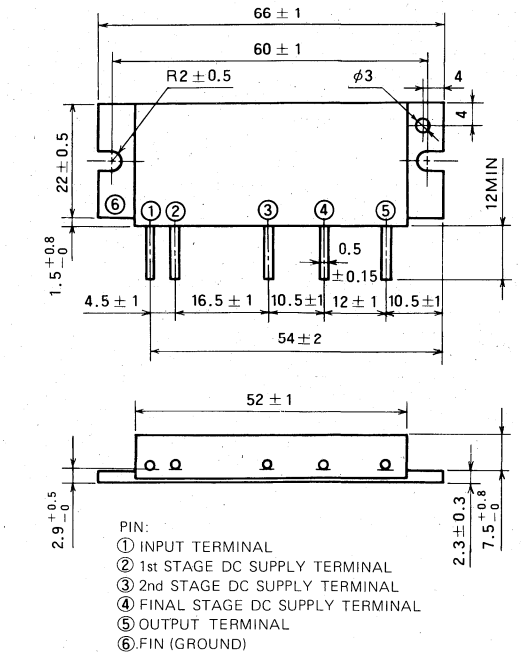
- Frequency Range . . . . . 890 ~ 915MHz
- High Power 13W
- High Gain 16.3dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 13W.

APPLICATION

Output stage of 6W output mobile radio sets (FM) in 890 ~ 915MHz UHF band.

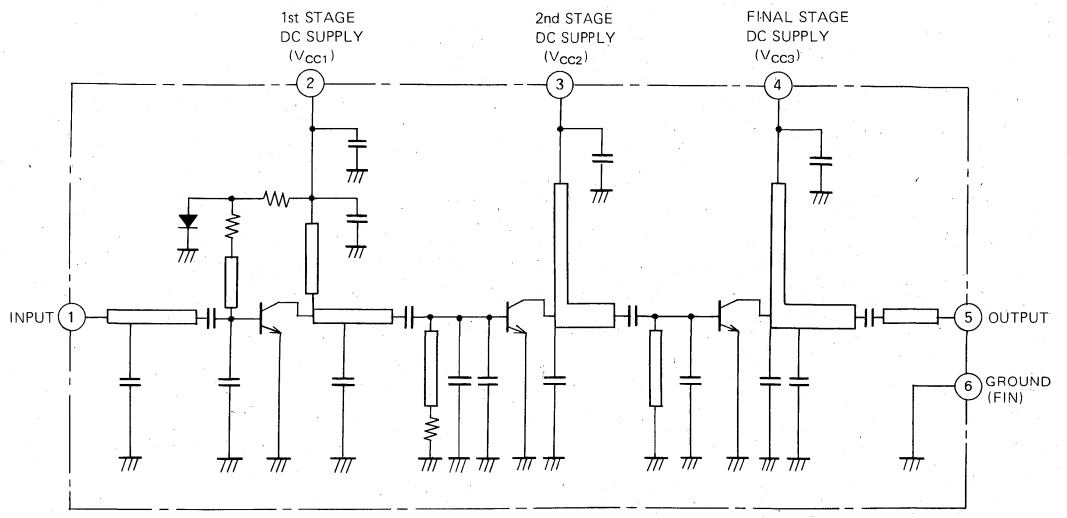
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



890～915MHz, 6W, FM
FOR MOBILE RADIO APPLICATION

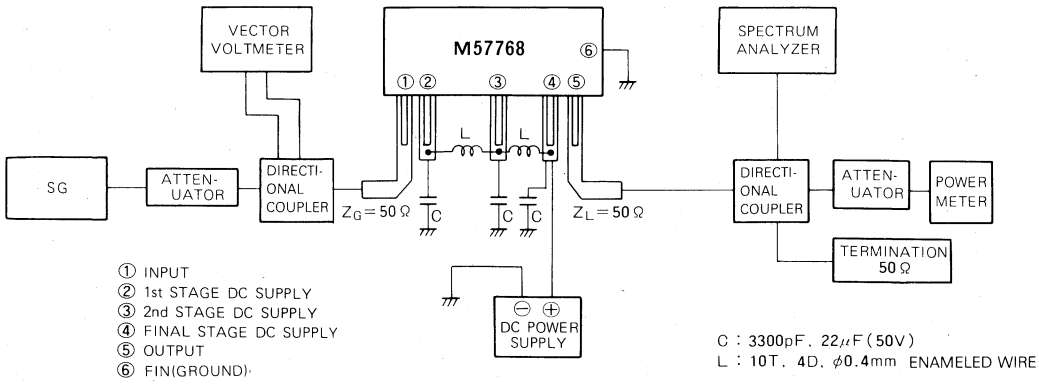
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		5	A
Pin	Input power	$Z_G = Z_L = 50\,\Omega$, $V_{CC1} \leqq 12.5V$	0.6	W
P_O	Output power	$Z_G = Z_L = 50\,\Omega$	20	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=890～915MHz, V_{CC}=12.5V, P_{in}=0.3W, $Z_G = Z_L = 50\,\Omega$	13	35		W
η_T	Total efficiency		30	50		%
—	2nd harmonics				−30	dB
ρin	Input VSWR			2.0	2.8	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	f=890～915MHz, V_{CC}=15.2V, P_O=13W, Z_G=50Ω, 5sec	20 : 1			—

TEST BLOCK DIAGRAM



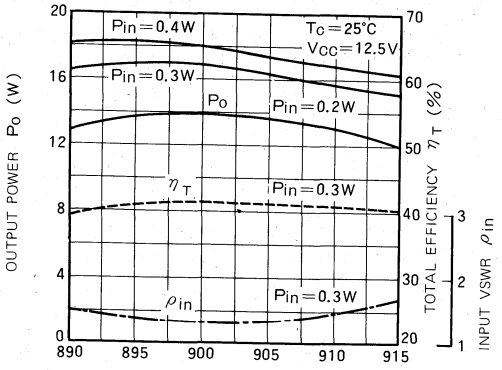
C : 3300pF, 22μF(50V)
L : 10T, 4D, φ0.4mm ENAMELED WIRE

MITSUBISHI ELECTRIC

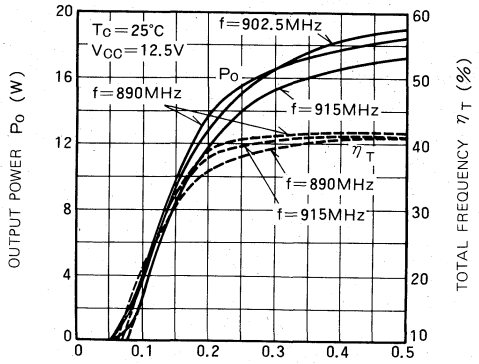
890~915MHz, 6W, FM FOR MOBILE RADIO APPLICATION

TYPICAL PERFORMANCE DATA

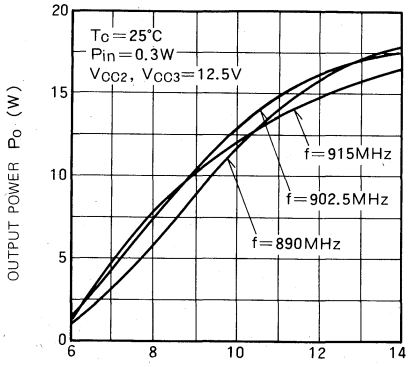
OUTPUT POWER, TOTAL FREQUENCY, INPUT VSWR VS. FREQUENCY



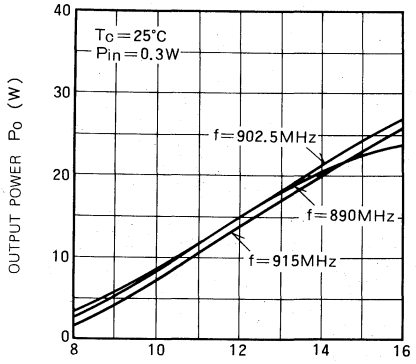
OUTPUT POWER, TOTAL EFFICIENCY, VS. INPUT POWER



OUTPUT POWER VS. 1st STAGE VOLTAGE



OUTPUT POWER VS. DC SUPPLY VOLTAGE



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1}$ = 15°C/W (Typ.)

b) Second stage transistor

$R_{th(j-c)2}$ = 1.5°C/W (Typ.)

c) Final stage transistor

$R_{th(j-c)3}$ = 3.75°C/W (Typ.)

(2) Junction temperature of incorporated transistors at stadard operation.

- Conditions for standard operation.

  P_O = 13W, V_{CC} = 12.5V, P_{in} = 0.3W, η_T = 35% (minimum rating), P_{O1} (Note 1) = 1.5W, P_{O2} (2) = 6W, I_T = 2.97A (I_{T1} (3) = 0.25A, I_{T2} (4) = 0.87A, I_{T3} (5) = 1.85A)

  Note 1: Output power of the first stage transistor

  Note 2: Output power of the second stage transistor

  Note 3: Circuit current of the first stage transistor

  Note 4: Circuit current of the second stage transistor

  Note 5: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)

  $= (12.5 \times 0.25 - 1.5 + 0.3) \times 15 + T_C$

  $= 28.9 + T_C$ (°C)

  Note 6: Package temperature of device

- Junction temperature of the second stage transistor

  $T_{j2} = V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$

  $= (12.5 \times 0.87 - 6 + 1.5) \times 7.5 + T_C$

  $= 47.8 + T_C$ (°C)

- Junction temperature of the final stage transistor

  $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$

  $= (12.5 \times 1.85 - 13 + 6) \times 3.75 + T_C$

  $= 60.5 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 13W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(13/0.35) - 13 + 0.3}$$

$$= 1.23\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 118.9°C, T_{j2} = 137.8°C, T_{j3} = 150.5°C at T_a = T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 88.9°C, T_{j2} = 107.8°C, T_{j3} = 120.5°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57769

933~937MHz, 5W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57769 is a thick film RF power module specifically designed for 933 ~ 937MHz, 5W FM mobile radios.

FEATURES

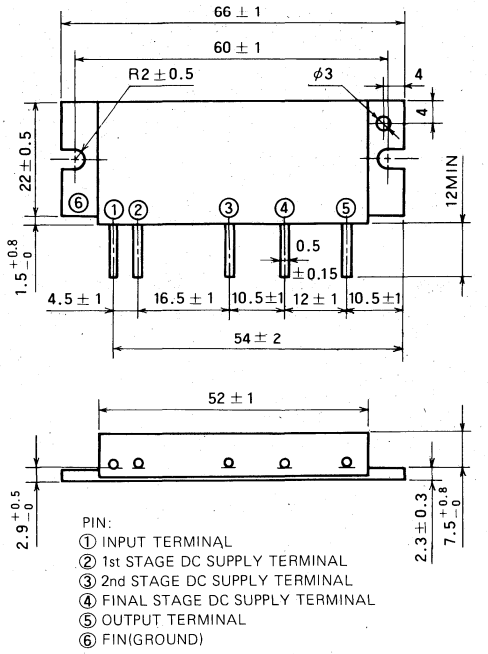
- Frequency Range ..... 933 ~ 937MHz
- High Power 7W
- High Gain 15.4dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 7W.

APPLICATION

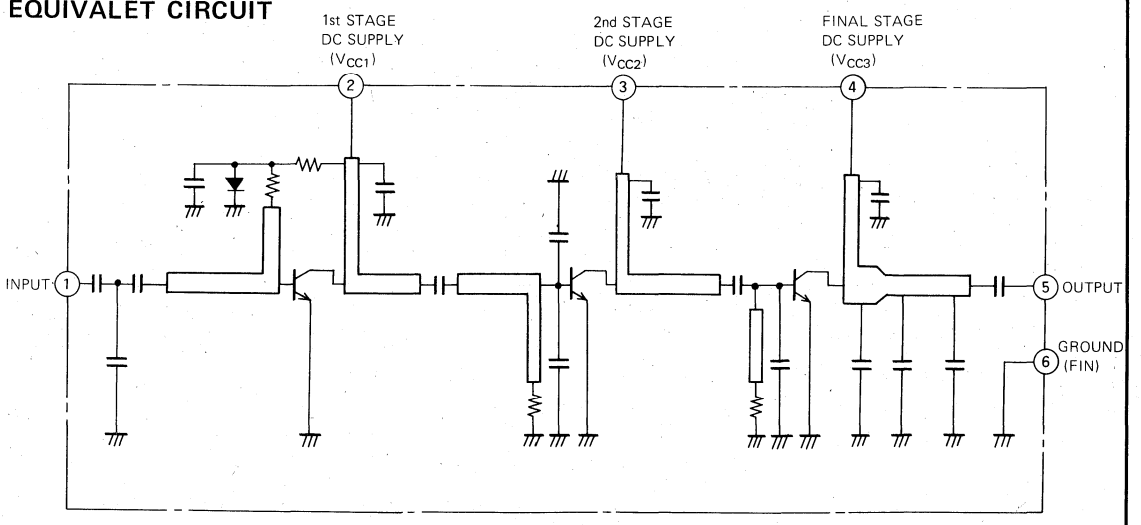
Output stage of 5W output mobile radio sets (FM) in 933 ~ 937MHz UHF band.

OUTLINE DIAGRAM

Dimensions in mm



EQUIVALET CIRCUIT



M57769

933～937MHz, 5W, FM FOR MOBILE RADIO APPLICATION

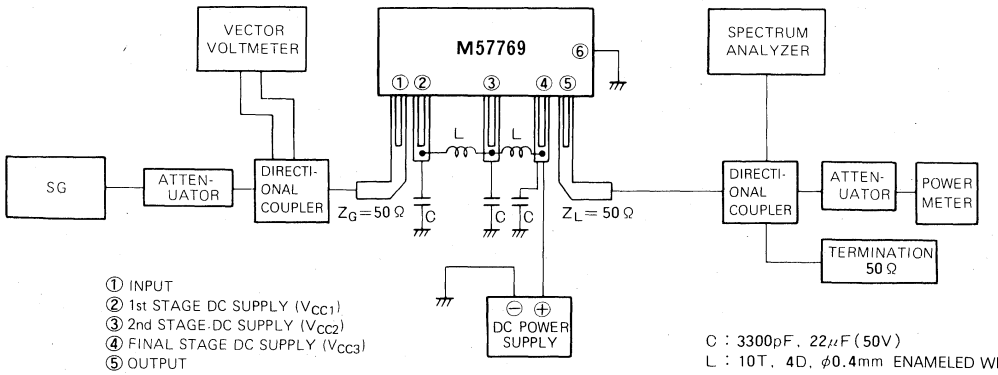
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		3	A
Pin	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 12.5V$	0.4	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

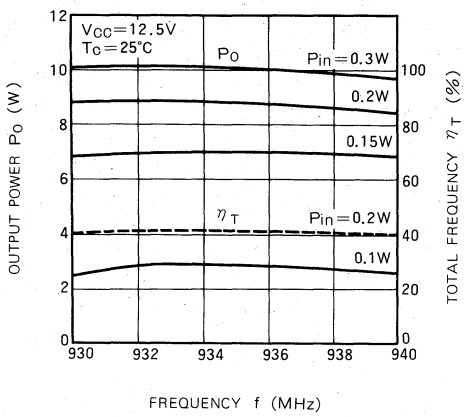
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=933～937MHz, V_{CC}=12.5V Pin=0.2W, $Z_G=Z_L=50\,\Omega$	7	9		W
η_T	Total efficiency		30	38		%
—	2nd harmonics				−30	dB
ρin	Input VSWR			1.8	2.5	—
ρout	Output VSWR			2		—
—	Load VSWR tolerance	f=933～937MHz, V_{CC}=15.2V P_O=7W, Z_G=50 Ω, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

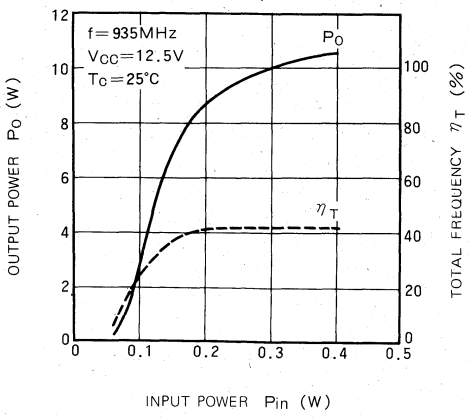


TYPICAL PERFORMANCE DATA

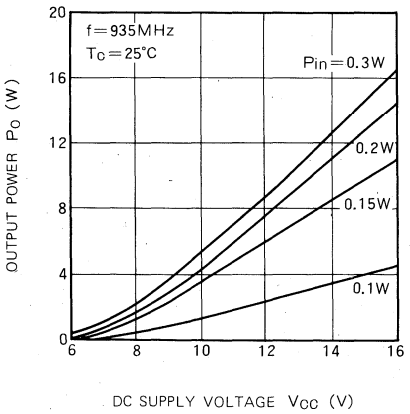
OUTPUT POWER, TOTAL EFFICIENCY VS. FREQUENCY



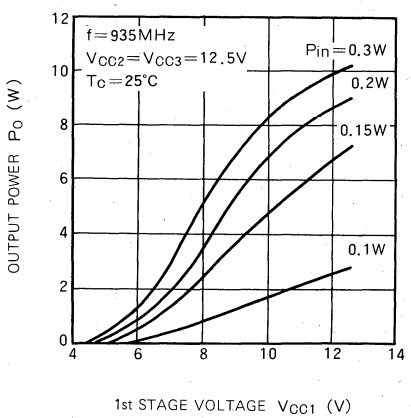
OUTPUT POWER, TOTAL EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. DC SUPPLY VOLTAGE



OUTPUT POWER VS. 1st STAGE VOLTAGE



DESIGN CONSIDERATION OF HEAT RADIATION.

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 13°C/W$ (Typ.)

b) Second stage transistor

$R_{th(j-c)2} = 9°C/W$ (Typ.)

c) Final stage transistor

$R_{th(j-c)3} = 4°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.

  P_O = 7W, V_{CC} = 12.5V, P_{in} = 0.2W, η_T = 30% (minimum rating), P_{O1} (Note 1) = 1.5W, P_{O2} (2) = 3.6W, I_T = 1.87A (I_{T1} (3) = 0.21A, I_{T2} (4) = 0.48A, I_{T3} (5) = 1.17A)

  Note 1: Output power of the first stage transistor

  Note 2: Output power of the second stage transistor

  Note 3: Circuit current of the first stage transistor

  Note 4: Circuit current of the second stage transistor

  Note 5: Circuit current of the final stage transistor

- Junction temperature of the first stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
  $= (12.5 \times 0.21 - 1.5 + 0.2) \times 13 + T_C$
  $= 17 + T_C$ (°C)

  Note 6: Package temperature of device

- Junction temperature of the second stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (12.5 \times 0.48 - 3.6 + 1.5) \times 9 + T_C$
  $= 35 + T_C$ (°C)

- Junction temperature of the final stage transistor

  $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
  $= (12.5 \times 1.17 - 7 + 3.6) \times 4 + T_C$
  $= 45 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambinet temperature (normally T_a = 60°C) and at the output power of 7W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_c - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(7/0.3) - 7 + 0.2}$$

$= 1.81$ (°C/W)

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 107°C, T_{j2} = 125°C, T_{j3} = 135°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 77°C, T_{j2} = 95°C, T_{j3} = 105°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57774

220~225MHz, 25W, FM MOBILE RADIO

DESCRIPTION

The M57774 is a thick film RF power module of 220 ~ 225MHz, 30W output, specifically designed for 220 ~ 225MHz, 25W FM mobile radios.

FEATURES

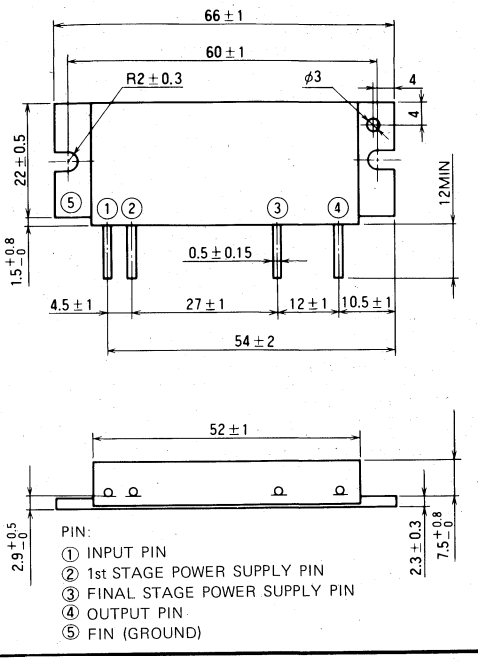
- High gain: $P_O \geqq 30W$ ($G_p \geqq 20dB$) @f = 220~225MHz, V_{CC} = 12.5V, P_{in} = 0.3W, $Z_G = Z_L = 50\Omega$
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at f = 220 ~ 225MHz, V_{CC} = 15.2V, P_O = 30W.
- Wide operating case temperature: $T_{C(op)}$ = -30 ~ +110°C
- Small package: 23.5W x 66L x 9.8H (mm)
- Use of first stage AB class operation and feedback circuit enables continuous and stable amplification from low level to high level.

APPLICATION

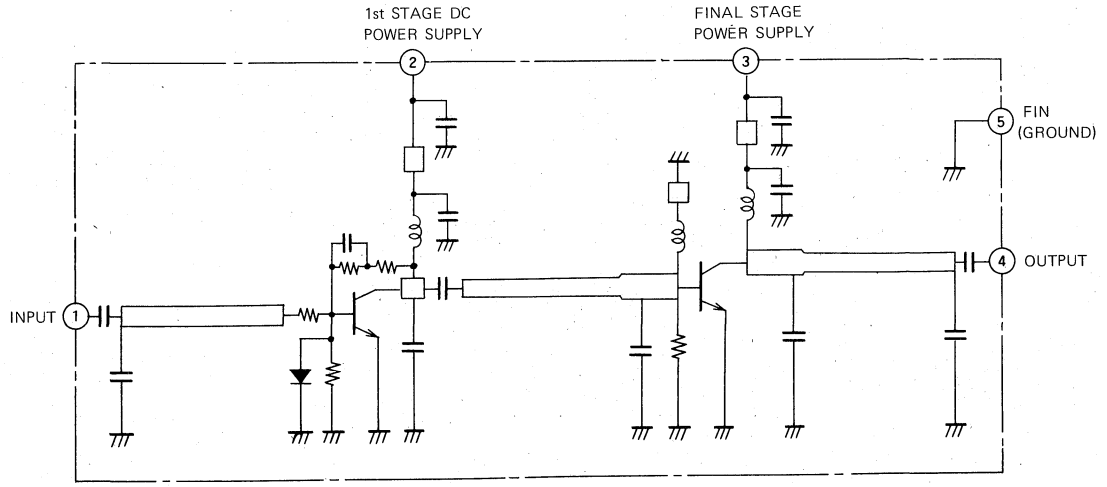
Output stage of 220 ~ 225MHz, 25W FM mobile radio application

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



220~225MHz, 25W, FM MOBILE RADIO

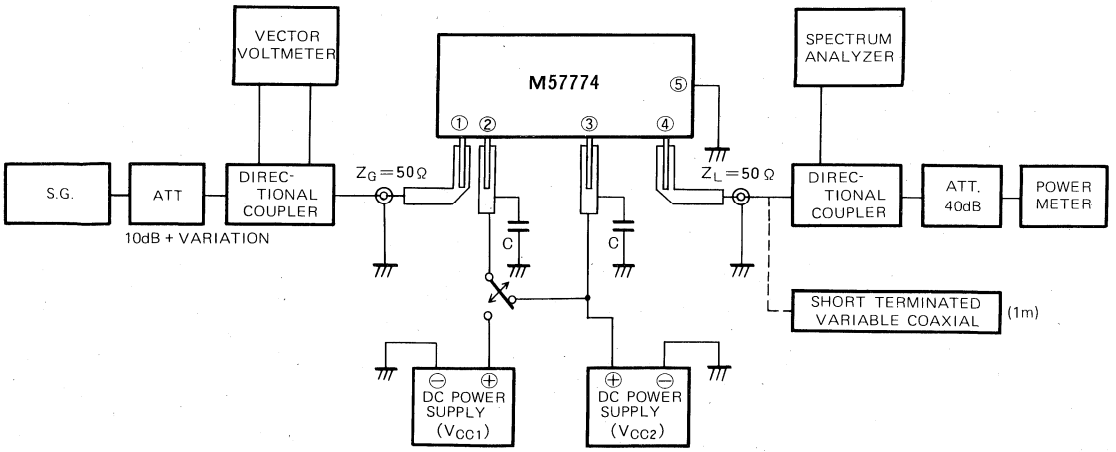
ABSOLUTE MAXIMUM RATINGS (T_C=25℃ unless otherwise specified)

Symbol	Ratings	Conditions	Value	Unit
V_{CC}	Supply voltage		17	V
I_{CC}	Total current		7	A
P_{in}	Input Power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 12.5V$	0.6	W
P_O	Output power	$Z_G=Z_L=50\Omega$	40	W
$T_{C(op)}$	Operation case temperature		−30~+110	℃
Tstg	Storage temperature		−40~+110	℃

ELECTRICAL CHARACTERISTICS (T_C=25℃ unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, f=220~225MHz P_{in}=0.3W, $Z_G=Z_L=50\Omega$	30	33		W
η_T	Total efficiency		43	48		%
	2nd harmonic				−30	dB
	3nd harmonic				−35	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			1.5		—
	Load VSWR tolerance	V_{CC}=15.2V, f=220~225MHz, P_O=30W, Z_G=50Ω	20 : 1			—

TEST BLOCK DIAGRAM

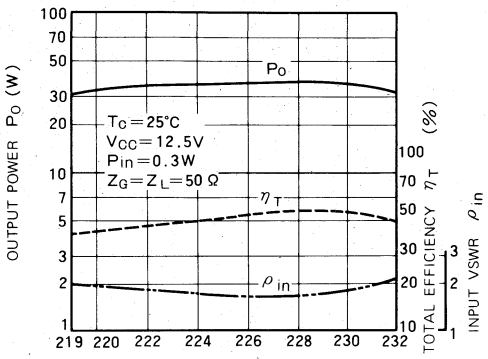


PIN:
① INPUT
② 1st STAGE POWER SUPPLY PIN
③ FINAL STAGE POWER SUPPLY PIN
④ OUTPUT PIN
⑤ FIN (GROUND)

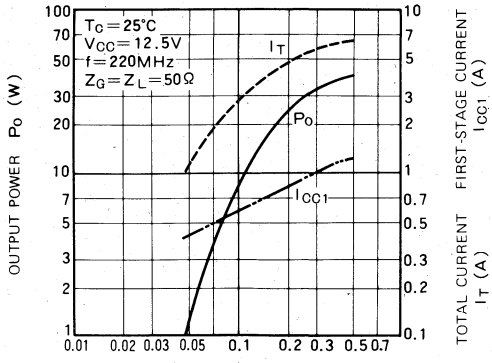
C: 4700pF, 33μF IN PARALLEL

TYPICAL CHARACTERISTICS

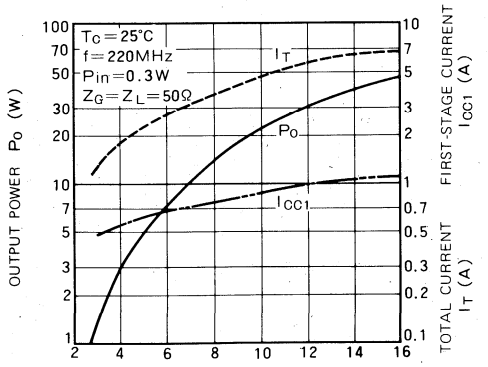
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY



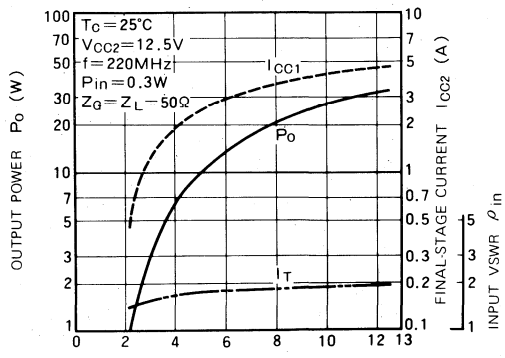
OUTPUT POWER, TOTAL CURRENT, FIRST-STAGE CURRENT VS. INPUT POWER



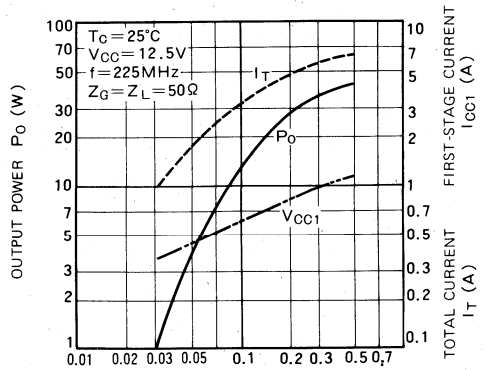
OUTPUT POWER, TOTAL CURRENT, FIRST-STAGE CURRENT VS. SUPPLY VOLTAGE



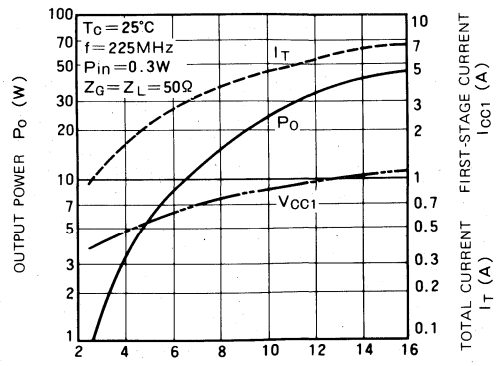
OUTPUT POWER, FINAL-STAGE CURRENT, INPUT VSWR VS. FIRST-STAGE VOLTAGE



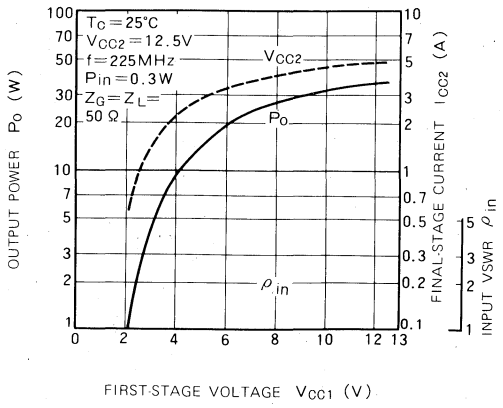
OUTPUT POWER, TOTAL CURRENT, FIRST-STAGE CURRENT VS. INPUT POWER



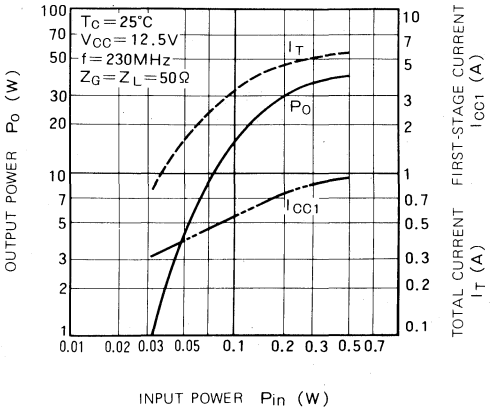
OUTPUT POWER, TOTAL CURRENT, FIRST-STAGE CURRENT VS. SUPPLY VOLTAGE



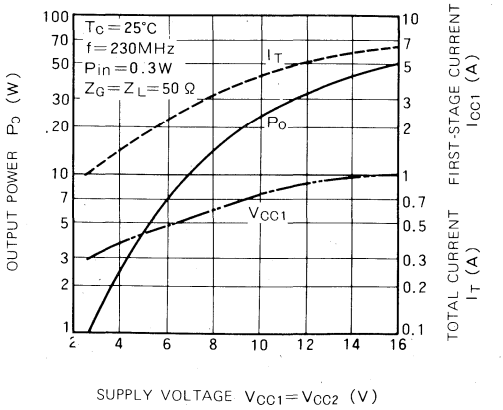
OUTPUT POWER, FINAL-STAGE CURRENT, INPUT VSWR VS. FIRST-STAGE VOLTAGE



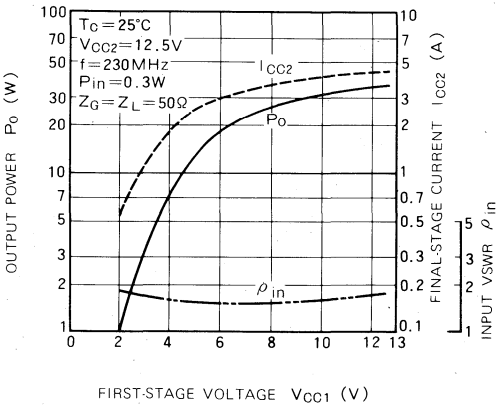
OUTPUT POWER, TOTAL CURRENT, FIRST-STAGE CURRENT VS. INPUT POWER



OUTPUT POWER, TOTAL CURRENT FIRST-STAGE CURRENT VS. SUPPLY VOLTAGE



OUTPUT POWER, FINAL-STAGE CURRENT, INPUT VSWR VS. FIRST-STAGE VOLTAGE



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Note the following when designing a heat sink:

1. Junction temperature of built-in transistor at standard operation

(1) Thermal resistance between junction of built-in transistors and case

Thermal resistance between junction of 1st stage transistor and case

$R_{th(j-c)1} = 8°C/W$ (typ.)

Thermal resistance between junction of final stage transistor and case

$R_{th(j-c)2} = 2°C/W$

(2) Junction temperature of built-in transistor at standard operation

- Standard operating conditions

  $P_O = 30W$, $V_{CC} = 12.5V$, $P_{in} = 0.3W$, $\eta_T = 43\%$ (rated minimum), $P_{O1} = 5W$(Note 1), $I_T = 5.6A$ (I_{T1}(Note 2) = 0.9A, I_{T2}(Note 3) = 4.7A)

  Note 1: Output power of 1st stage transistor

  Note 2: Current loss of 1st stage transistor

  Note 3: Current loss of final stage transistor

- Junction temperature of 1st stage transistor

  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$(Note 4)
  $= (12.5 \times 0.9 - 5 + 0.3) \times 8 + T_C$
  $= 52 + T_C$ (°C)

  Note 4: Case temperature of device

- Junction temperature of final stage transistor

  $T_{j2} = (V_{CC} \times I_{T2} - P_O + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= 912.5 \times 4.7 - 30 + 5) \times 2 + T_C$
  $= 68 + T_C$ (°C)

2. Heat sink design

To design the thermal characteristics of a heat sink, keep the case temperature below 90°C when output power P_O is 28W and the upper limit of ambient temperature T_a is 60°C.

The thermal resistance $R_{th(c-a)}$(Note 5) of a heat sink to achieve this:

$$R_{th(c-a)} = \frac{T_C - T_a}{\frac{P_O}{\eta_T} - P_O + P_{in}} = \frac{90 - 60}{\frac{30}{0.43} - 30 + 0.3}$$

Note 5: Including the contact thermal resistance between the device and the heat sink

Mounting the device on the heat sink with the above thermal resistance, junction temperatures of each transistor module becomes as follows:

$T_{j1} = 142°C$, $T_{j2} = 158°C$ at $T_a = 60°C$, $T_C = 90°C$, Since the annual average of ambient temperature is 30°C, junction temperature of each transistor becomes as follows: $T_{j1} = 112°C$ and $T_{j2} = 17°C$.

Use of these built-in transistors in temperatures below the maximum junction temperature T_{jmax} 175°C is guaranteed.

M57775

806~866MHz BAND FM EXCITER FOR MOBILE RADIO

DESCRIPTION

M57775 is a 806~866MHz band, 0.4W RF output thick film hybrid integrated circuit and demonstrates excellent functions as a 806~866MHz band exciter.

FEATURES

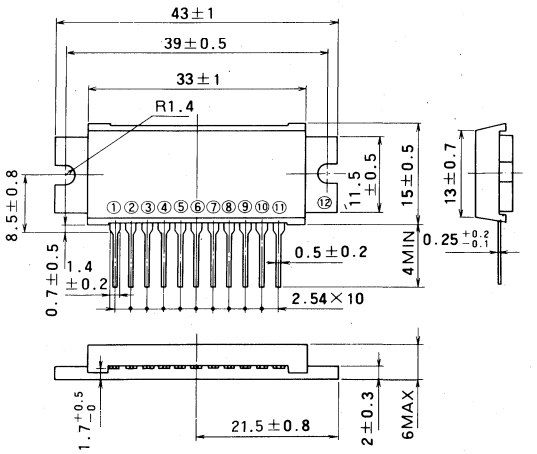
- High output, High gain: $P_O \geqq 0.4W$, $G_P \geqq 21$ dB @V_{CC}= 8V, f = 806~866MHz, P_{in} = 3mW.
- High Ruggedness: P_O = 0.4W, V_{CC1} = 8V, V_{CC2} = 15V, f = 806~ 866MHz, Load VSWR more than 20:1.
- Broad operating Temperature $T_{C(op)}$ = –30 ~ +110°C.
- Small package 43 x 14.5 x 6 mm.

APPLICATION

- Exciter stage of 806 ~ 866MHz band in FM mobile radio.

OUTLINE DRAWING

Dimension: mm

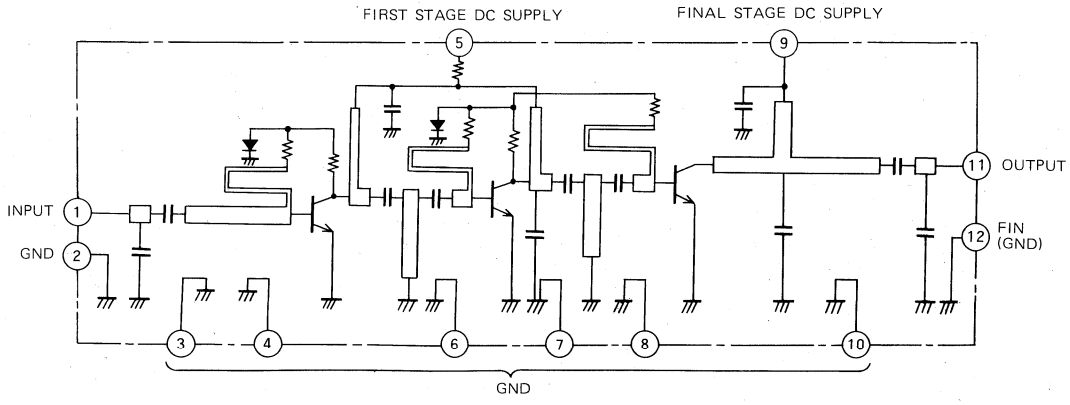


PIN STYLE

①	INPUT PIN	⑨	FINAL DC SUPPLY VOLTAGE PIN
②~④	GND PINS	⑩	GND PIN
⑤	FIRST DC SUPPLY VOLTAGE PIN	⑪	OUTPUT PIN
⑥~⑧	GND PINS	⑫	FIN (GND)

Note: The dimension that tolerance is not specified indicates the typical value.

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

806～866MHz BAND FM EXCITER FOR MOBILE RADIO

ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	Supply voltage (FIRST STAGE)		11	V
V_{CC2}	Supply voltage (FINAL STAGE)		15	V
I_{CC}	Circuit current		0.6	A
P_{in}(max)	Power input	$Z_G=Z_L=50\,\Omega$	10	mW
P_O(max)	Output power	$Z_G=Z_L=50\,\Omega$	0.8	W
$T_{C(OP)}$	Operating case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (Specification: 01) (T_C=25°C)

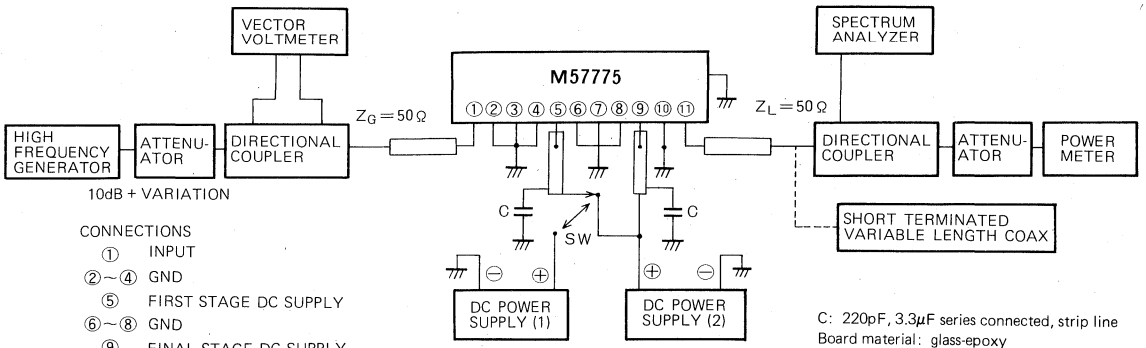
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC1}=V_{CC2}=8V$, f=806～866MHz, $P_{in}=3mW$, $Z_G=Z_L=50\,\Omega$	400	500		mW
—	2nd Hormonic				−30	dB
ρin	Input VSWR				3.0	—
ρout	Output VSWR			2.0		—
I_T	Total current	$V_{CC1}=V_{CC2}=8V$, f=806～866MHz, $P_O=0.4W$, $Z_G=Z_L=50\,\Omega$		250	190	mA
—	Load VSWR	$V_{CC1}=8V$, $V_{CC2}=15V$, f=806～866 MHz, $P_O=0.4W$, $\rho_L\geqq20$(All phase), $Z_G=50\,\Omega$	20 : 1			—

ELECTRICAL CHARACTERISTICS (Specification: 02) (T_C=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	$V_{CC1}=V_{CC2}=8V$, f=806～866MHz, $P_{in}=1mW$, $Z_G=Z_L=50\,\Omega$	200	300		mW
—	2nd Hormonic				−30	dB
ρin	Input VSWR				3.0	—
ρout	Output VSWR			2.0		—
I_T	Total current	$V_{CC1}=V_{CC2}=8V$, f=806～866MHz, $P_O=0.2W$, $Z_G=Z_L=50\,\Omega$		190	230	mA
—	Load VSWR	$V_{CC1}=8V$, $V_{CC2}=15V$, f=806～866 MHz, $P_O=0.4W$, $\rho_L=20$(All phase), $Z_G=50\,\Omega$	20 : 1			—

806～866MHz BAND FM EXCITER FOR MOBILE RADIO

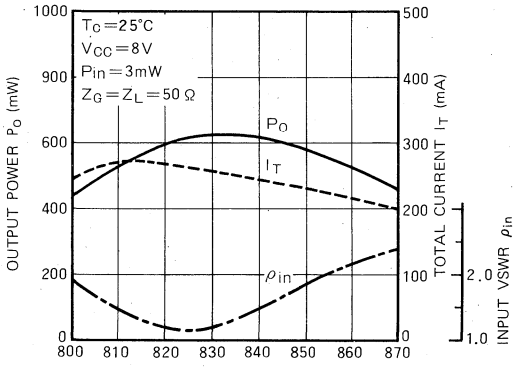
TEST BLOCK DIAGRAM



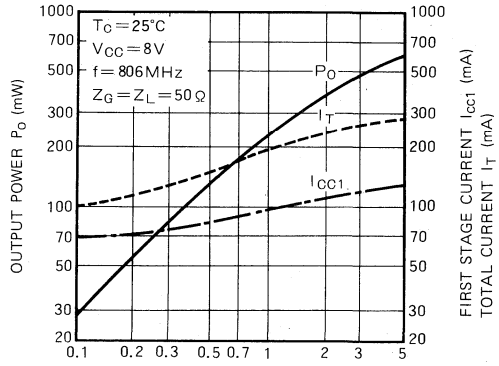
CONNECTIONS
- ① INPUT
- ②～④ GND
- ⑤ FIRST STAGE DC SUPPLY
- ⑥～⑧ GND
- ⑨ FINAL STAGE DC SUPPLY
- ⑩ GND
- ⑪ OUTPUT

TYPICAL CHARACTERISTICS

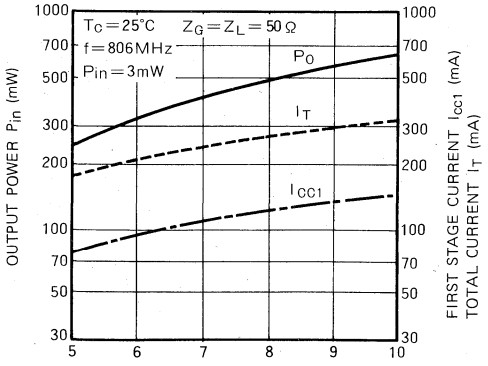
OUTPUT POWER, TOTAL CURRENT, INPUT VSWR VS. FREQUENCY



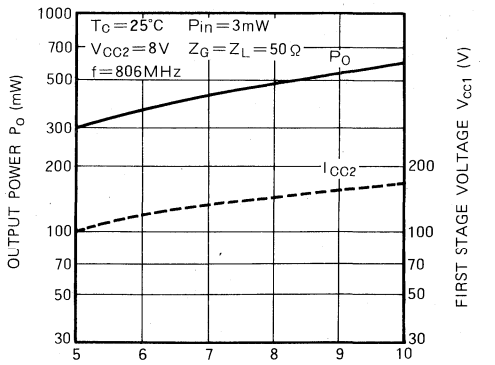
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER



OUTPUT POWER, TOTAL CURRENT VS. SUPPLY VOLTAGE

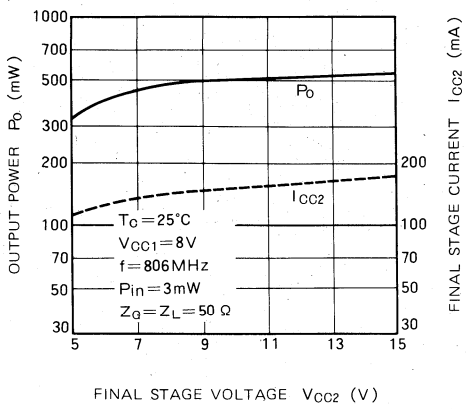


OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE VOLTAGE

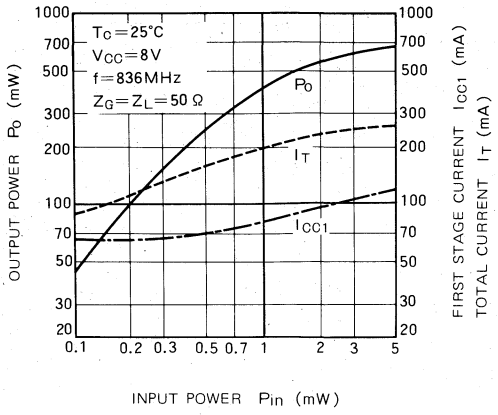


MITSUBISHI ELECTRIC

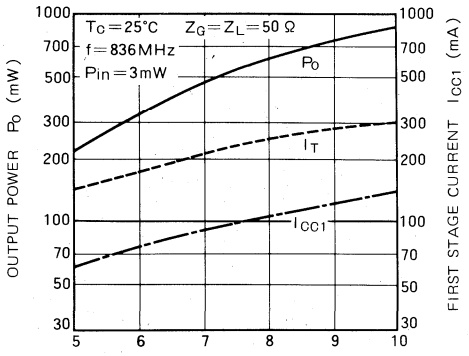
OUTPUT POWER, FINAL STAGE CURRENT VS. FINAL STAGE VOLTAGE



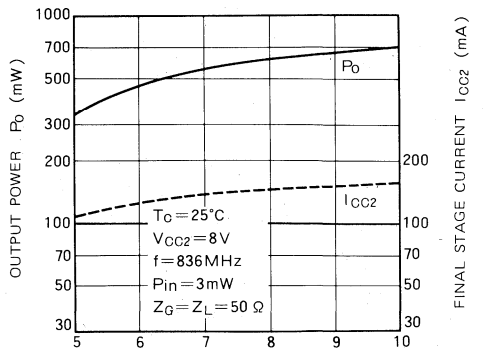
OUTPUT POWER, FIRST STAGE CURRENT TOTAL CURRENT VS. INPUT POWER



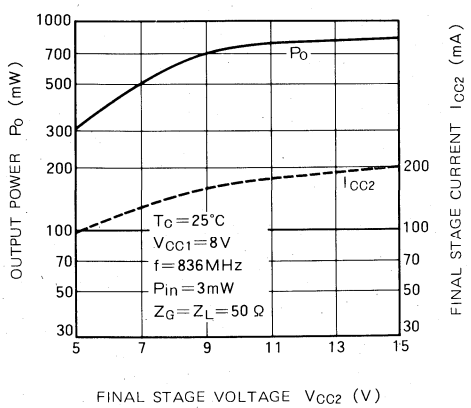
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE



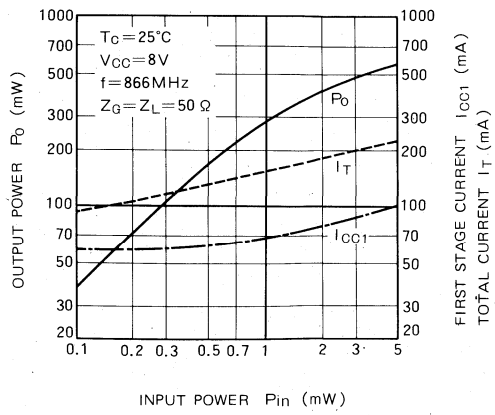
OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE VOLTAGE



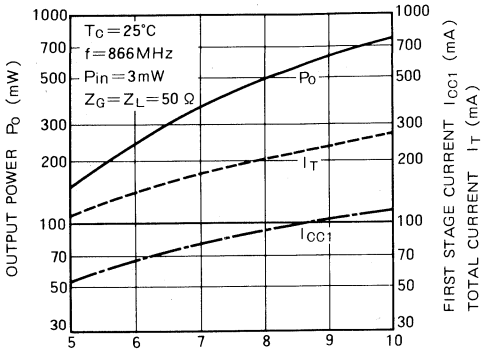
OUTPUT POWER, FINAL CURRENT VS. FINAL VOLTAGE



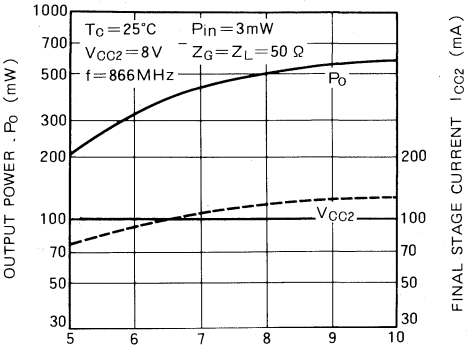
OUTPUT POWER, FIRST STAGE CURRENT, TOTAL CURRENT VS. INPUT POWER



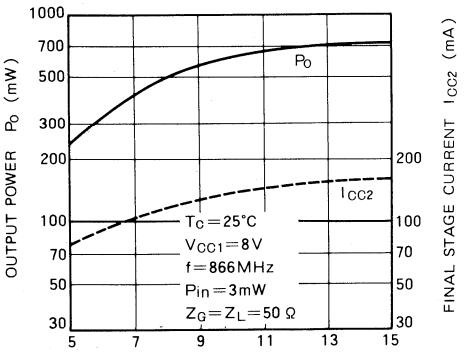
OUTPUT POWER, FIRST STAGE CURRENT, FINAL STAGE CURRENT VS. SUPPLY VOLTAGE



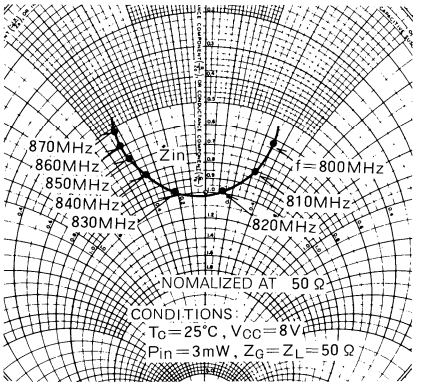
OUTPUT POWER, FINAL CURRENT VS. FIRST STAGE VOLTAGE



OUTPUT POWER, FINAL STAGE CURRENT VS. FINAL STAGE VOLTAGE



INPUT IMPEDANCE VS. FREQUENCY



MITSUBISHI ELECTRIC

M57776

890~915MHz BAND, 0.3W FM EXCITER FOR MOBILE RADIO

DESCRIPTION

M57776 is a 890 ~ 915MHz band, 0.3W, RF output thick film hybrid integrated circuit and demonstrates excellent performance as a 890 ~ 910MHz band exciter.

FEATURES

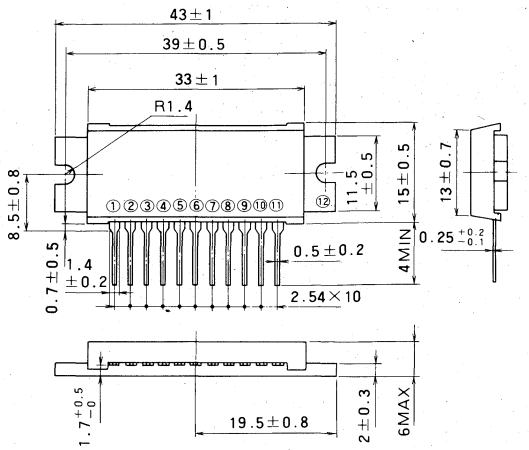
- High output, High gain:
  Po ≧ 0.3W, Gp ≧ 23dB @V_{CC} = 8V, f = 890 ~ 915MHz, Pin = 1.5mW
- High Ruggedness: Po = 0.3W
  V_{CC1} = 8V, V_{CC2} = 15V, f = 890 ~ 915MHz
  Load VSWR more than 20:1
- Broad operating temperature
  T_C = -30 ~ +110°C
- Small package 43 x 14.5 x 6mm

APPLICATION

Exciter stage of 0.3W output in 890 ~ 915MHz band.

OUTLINE DIAGRAM

Dimension: mm

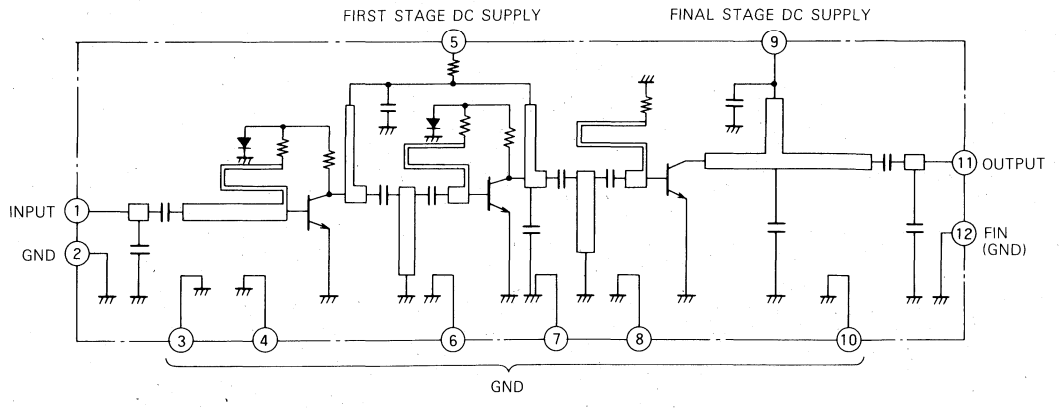


PIN STYLE

①	INPUT PIN	⑨	FINAL DC SUPPLY VOLTAGE PIN
②~④	GND PINS	⑩	GND PIN
⑤	FIRST DC SUPPLY VOLTAGE PIN	⑪	OUTPUT PIN
⑥~⑧	GND PINS	⑫	FIN (GND)

Note: The dimension that tolerance is not specified indicates the typical value.

EQUIVALENT CIRCUIT



890～915MHz BAND, 0.3W FM EXCITER FOR MOBILE RADIO

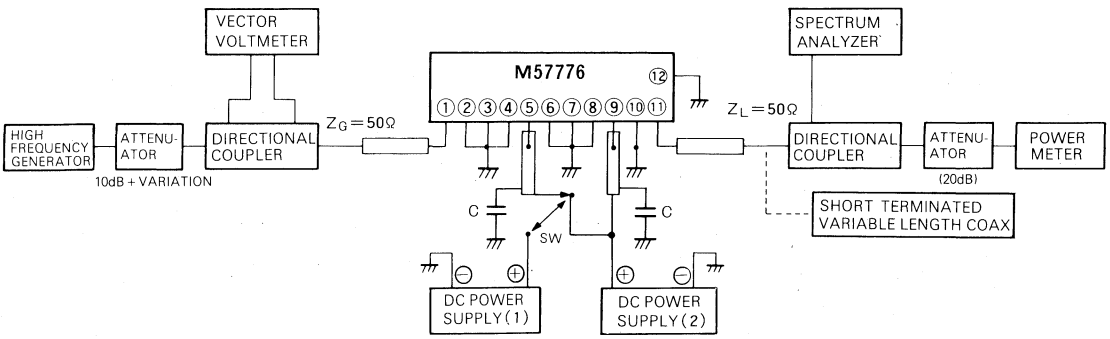
ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	Supply voltage (FIRST STAGE)		11	V
V_{CC2}	Supply voltage (FINAL STAGE)		15	V
I_{CC}	Total current		0.6	A
$P_{in(max)}$	Input power	$Z_G=Z_L=50\Omega$	5	mW
$P_{O(max)}$	Output power	$Z_G=Z_L=50\Omega$	0.6	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C)

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=8V, f=890～915MHz, P_{in}=1.5mW, Z_g=ZI=50Ω	300	350		mW
—	2nd Hormonic				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2.0		—
I_T	Total current	V_{CC}=8V, f=890～915MHz, P_O=0.3W, Z_g=ZI=50Ω		150	190	mA
—	Load VSWR	V_{CC1}=8V, V_{CC2}=15V, f=890～915MHz, P_O=0.3W	20：1			—

TEST BLOCK DIAGRAM



CONNECTIONS

① INPUT
②～④ GND
⑤ FIRST STAGE DC SUPPLY
⑥～⑧ GND
⑨ FINAL STAGE DC SUPPLY
⑩ GND
⑪ OUTPUT

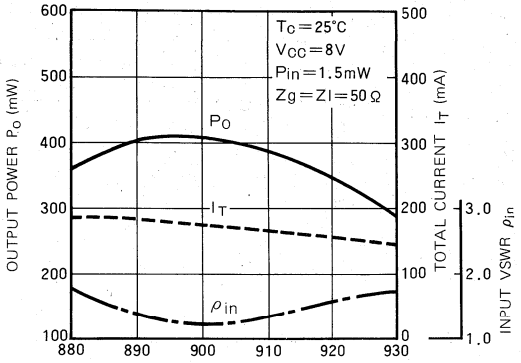
C: 2200pF, 3.3μF series connected, strip line
Board material: glass-epoxy
(εr=4.8, H=1.6mm)

MITSUBISHI ELECTRIC

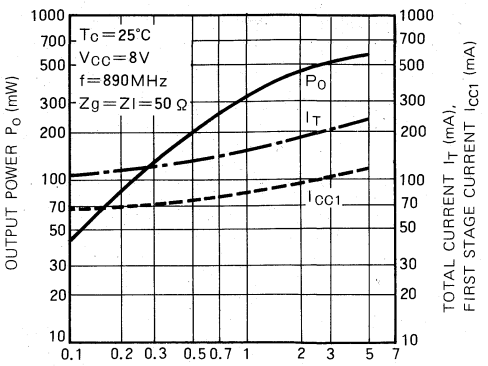
890~915MHz BAND, 0.3W FM EXCITER FOR MOBILE RADIO

TYPICAL PERFORMANCE DATA

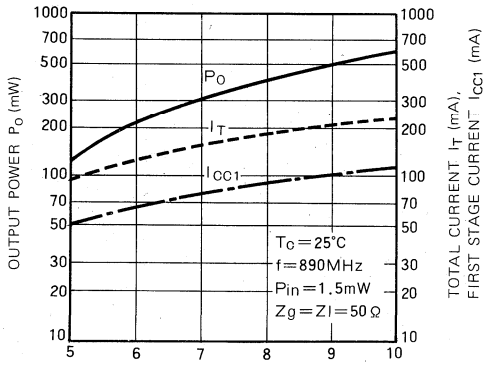
OUTPUT POWER, TOTAL CURRENT, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



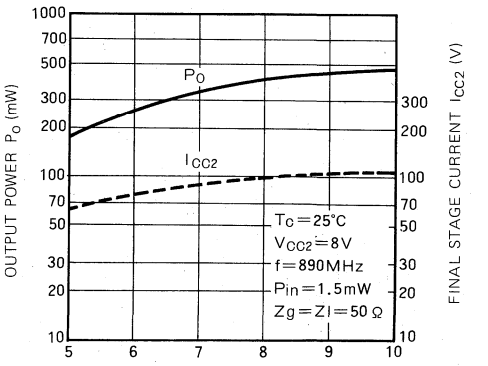
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



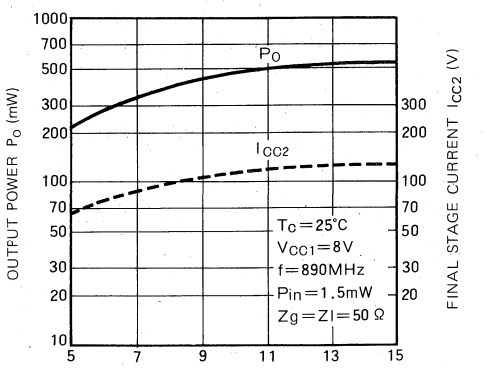
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



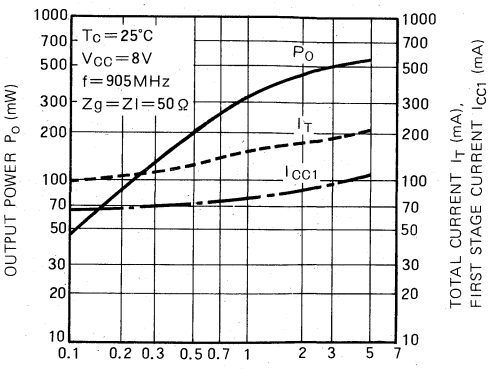
OUTPUT POWER, FINAL CURRENT, VS. FIRST STAGE CHARACTERISTICS



OUTPUT POWER, FINAL CURRENT VS. FINAL STAGE VOLTAGE CHARACTERISTICS

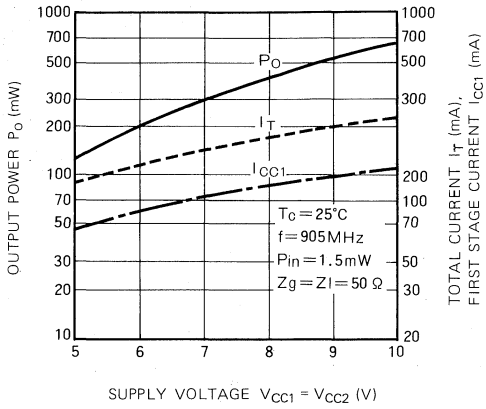


OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS

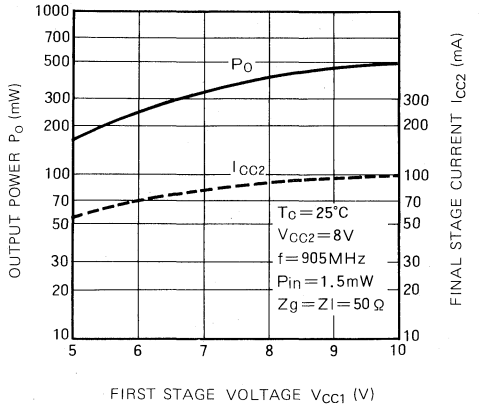


890～915MHz BAND, 0.3W FM EXCITER FOR MOBILE RADIO

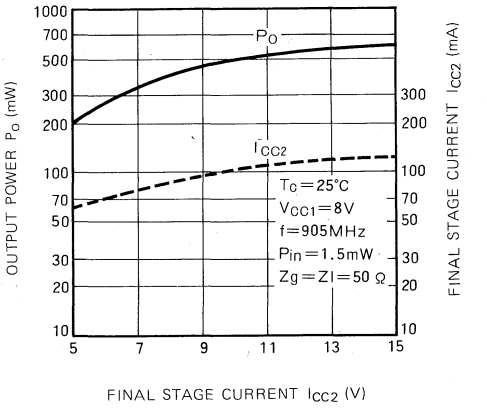
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



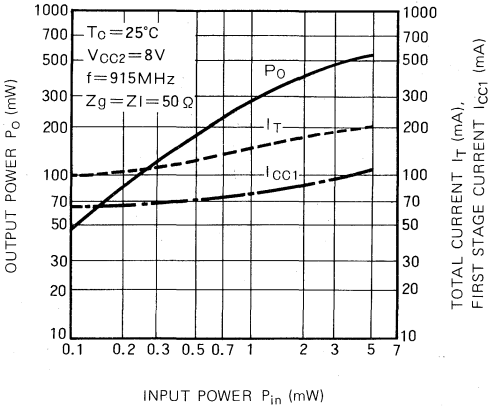
OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE VOLTAGE CHARACTERISTICS



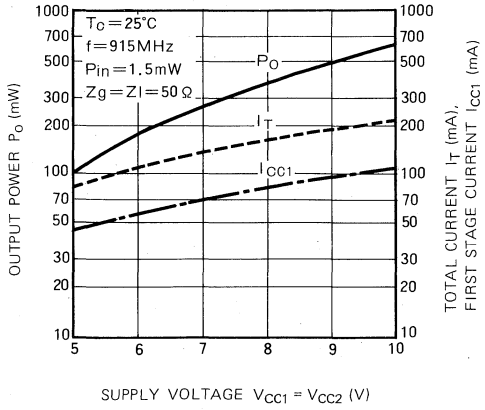
OUTPUT POWER, FINAL STAGE CURRENT FIAL STAGE VOLTAGE CHARACTERISTICS



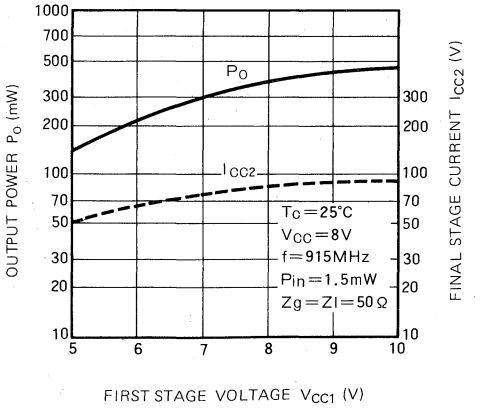
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS

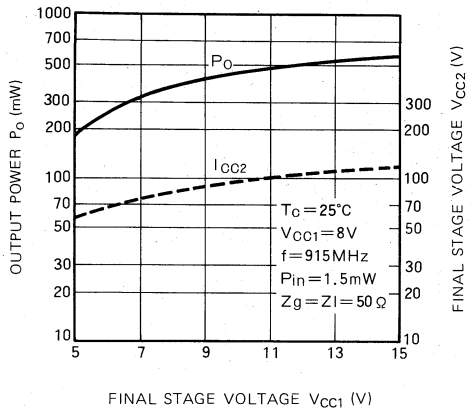


OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE VOLTAGE CHARACTERISTICS



MITSUBISHI ELECTRIC

OUTPUT POWER, FINAL STAGE CURRENT VS. FINAL STAGE VOLTAGE CHARACTERISTICS



M57778

903~905MHz, 5W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57778 is a thick film RF power module specifically designed for 903 ~ 905MHz, 5W FM mobile radios.

FEATURES

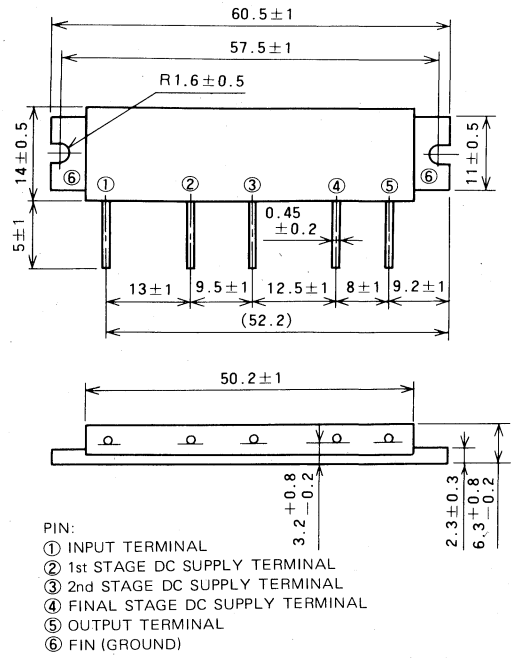
- Frequency Range ..... 903 ~ 905MHz
- High Power 7W
- High Gain 38.4dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC1} = V_{CC2} = 8V, V_{CC3} = 15.2V, P_O = 7W.

APPLICATION

Output stage of 3W output mobile radio sets (FM) in 903 ~ 905MHz UHF band.

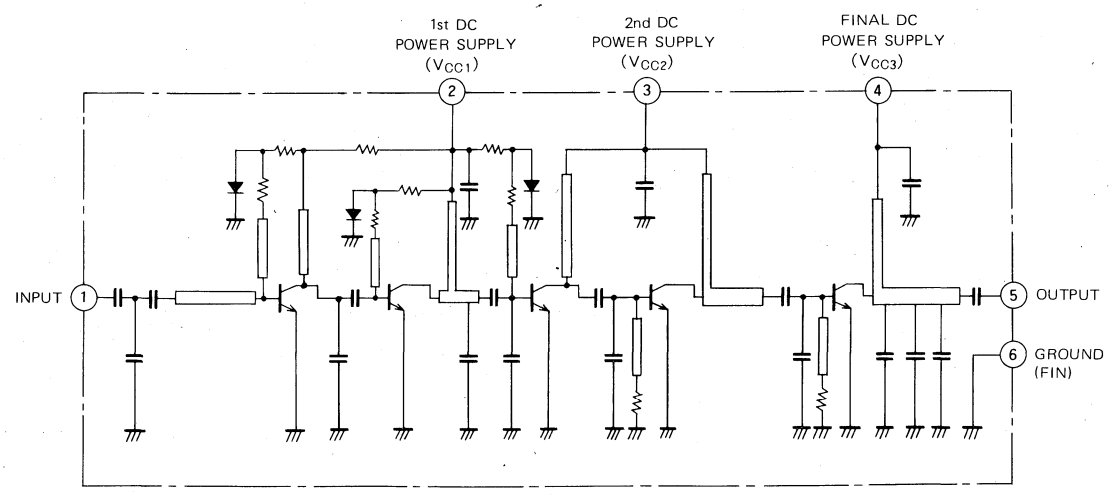
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

903~905MHz, 5W, FM
FOR MOBILE RADIO APPLICATION

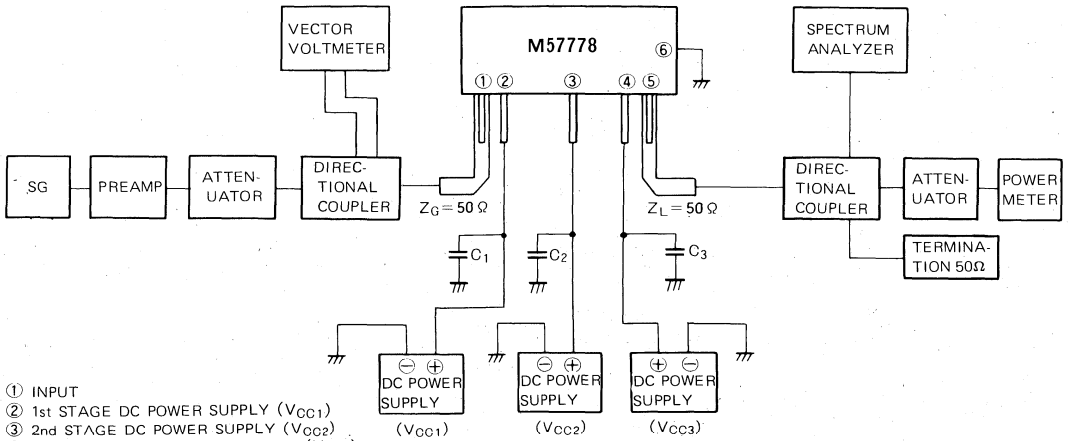
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC1,2}$	Supply voltage		9	V
V_{CC3}	Supply voltage		17	V
I_{CC}	Total current		4	A
P_{in}	Input power	$Z_G = Z_L = 50\Omega$, $V_{CC1} \leqq 8V$	7	mW
P_O	Output power	$Z_G = Z_L = 50\Omega$	10	W
T_C(op)	Operation case temperature		−30~+110	°C
T_{stg}	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C, unless otherwise noted)

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output Power	f=825~851MHz, $V_{CC1}=V_{CC2}=8V$, $V_{CC3}=12.5V$, $P_{in}=1mW$, $Z_G=Z_L=50\Omega$	7	9		W
η_T	Total efficiency		35	40		%
—	2nd Harmonics				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2		—
—	Load VSWR tolerance	f=825~851MHz, $V_{CC1}=V_{CC2}=8V$, $V_{CC3}=15.2V$, $P_O=7W$, $Z_G=50\Omega$, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

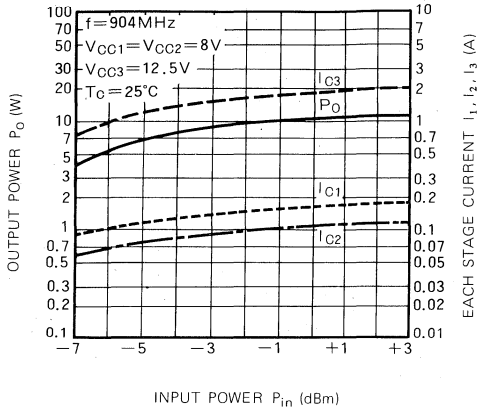


① INPUT
② 1st STAGE DC POWER SUPPLY (V_{CC1})
③ 2nd STAGE DC POWER SUPPLY (V_{CC2})
④ FINAL STAGE DC POWER SUPPLY (V_{CC3})
⑤ OUTPUT
⑥ GROUND (FIN)

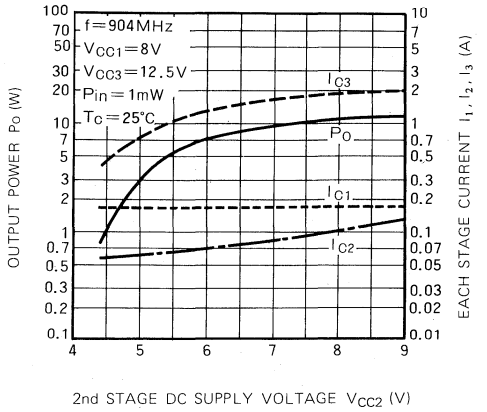
C_1, C_2, C_3 : 4700pF, 10μF IN PARALLEL

TYPICAL CHARACTERISTICS

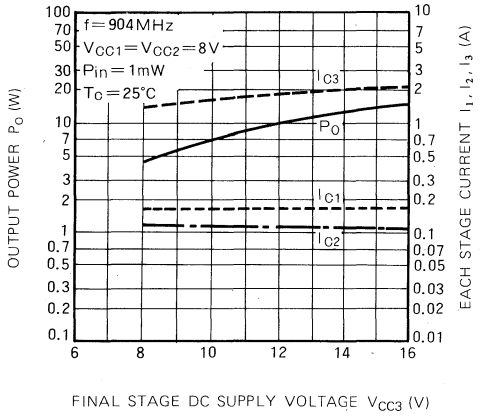
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



OUTPUT POWER, EACH STAGE CURRENT VS. 2nd STAGE DC SUPPLY VOLTAGE



OUTPUT POWER, EACH STAGE CURRENT VS. FINAL STAGE DC SUPPLY VOLTAGE



APC Method

For Automatic Power Control (APC), we recommend the method by V_{CC2} control.

Please regulate each stage supply voltage and input power as followings:

Symbol	Center value	Allowable changing value
P_{in}	1mW	0.7 – 3mW
V_{CC1}	8V	7 – 8.5V
V_{CC2}	3 – 8V	–
V_{CC3}	13.5V	12.5V – 13.8V

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to the following consideration when designing a heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistances between junction of incorporated transistors and case are shown in the followings.

a) First stage transistor
$R_{th(j-c)1}$ = 20°C/W (Typ.)

b) Second stage transistor
$R_{th(j-c)2}$ = 17.5°C/W (Typ.)

c) Third stage transistor
$R_{th(j-c)3}$ = 16°C/W (Typ.)

d) Fourth stage transistor
$R_{th(j-c)4}$ = 9°C/W (Typ.)

e) Final stage transistor
$R_{th(j-c)5}$ = 6.5°C/W (Typ.)

(2) V_{CC}, I_T, RF input & output power conditions at standard operation for each stage transistors are estimated as follows.

P_O = 7W, V_{CC1} = V_{CC2} = 8V, V_{CC3} = 12.5V, P_{in} = 1mW, η_T = 35% (minimum ratings),

I_{1+2} = 0.781A (Total current from 1st stage to 4th stage)

I_3 = 1.43A (Current of 5th stage)

The conditions at standard operation for each stage transistors are shown in Table 1.

Junction temperature of the first stage transistor

$T_{j1} = (V_{CC1} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (Note 1)
$= (8 \times 0.05 - + 0.001) \times 20 + T_C$
$= 7.6 + T_C$ (°C)

Note 1: Case temperature of device

Junction temperature of the second stage transistor

$T_{j2} = (V_{CC1} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
$= (8 \times 0.09 - 0.2 + 0.02) \times 17.5 + T_C$
$= 9.5 + T_C$ (°C)

Junction temperature of the third stage transistor

$T_{j3} = (V_{CC2} \times I_{Te} - P_{O3} + P_{O2}) \times R_{th(j-c)3} + T_C$
$= (8 \times 0.12 - 0.5 + 0.2) \times 16 + T_C$
$= 11.6 + T_C$ (°C)

Junction temperature of the fourth stage transistor

$T_{j4} = (V_{CC2} \times I_{T4} - P_{O4} + P_{O3}) \times R_{th(j-c)4} + T_C$
$= (12.5 \times 0.43 - 2 + 0.5) \times 9 + T_C$
$= 34.9 + T_C$ (°C)

Junction temperature of the final stage transistor

$T_{j5} = (V_{CC3} \times I_{T5} - P_{O5} + P_{O4}) \times R_{th(j-c)5} + T_C$
$= (12.5 \times 1.0 - 7 + 2) \times 6.5 + T_C$
$= 48.8 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, keep the case temperature below 90°C at output power P_O = 7W and ambient temperature = 60°C.

Table 1: The conditions at standard operation

Stage	V_{CC} (V)	I_T (mA)	P_{in} (mW)	P_O (mW)
1st	8	50	1	20
2nd	8	90	20	200
3rd	8	120	200	500
4th	8	430	500	2000
5th	12.5	1000	2000	7000

The thermal resistance $R_{th(c-a)}$ (Note 2) of the heat sink to realize this:

$$R_{th(a-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(7/0.35 - 7 + 0.001)}$$

Note 2: Including the contact thermal resistance between device and heat sink

Mounting the device on the heat sink with above thermal resistance, junction temperatures of each transistor become;
T_{j1} = 98°C, T_{j2} = 100°C, T_{j3} = 102°C, T_{j4} = 125°C, T_{j5} = 139°C at T_a = 60°C, T_C = 90°C.

Since the annual average of ambient temperature is 30°C, junction temperatures of each transistor become;
T_{j1} = 68°C, T_{j2} = 70°C, T_{j3} = 72°C, T_{j4} = 95°C, T_{j5} = 109°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57782

824~851MHz, 3W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57782 is a thick film RF power module specifically designed for 824 ~ 851MHz, 3W FM mobile radios.

FEATURES

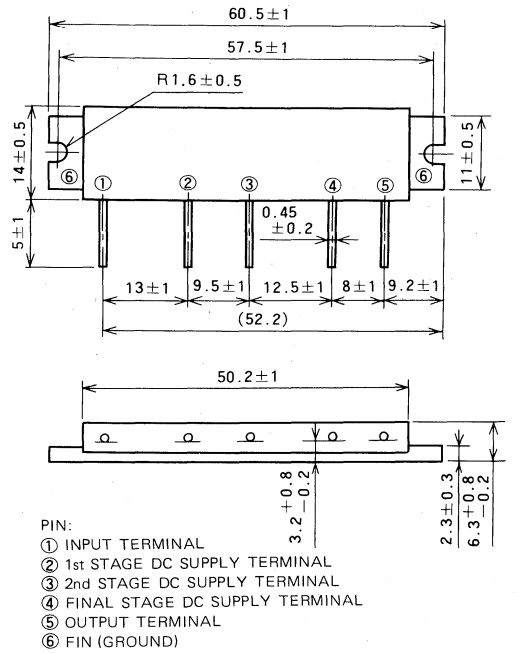
- Frequency Range . . . . . 824 ~ 851MHz
- High Power 7W
- High Gain 38.4dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC1} = V_{CC2} = 8V, V_{CC3} = 15.2V, P_O = 7W.

APPLICATION

Output stage of 3W output mobile radio sets (FM) in 824 ~ 851MHz UHF band.

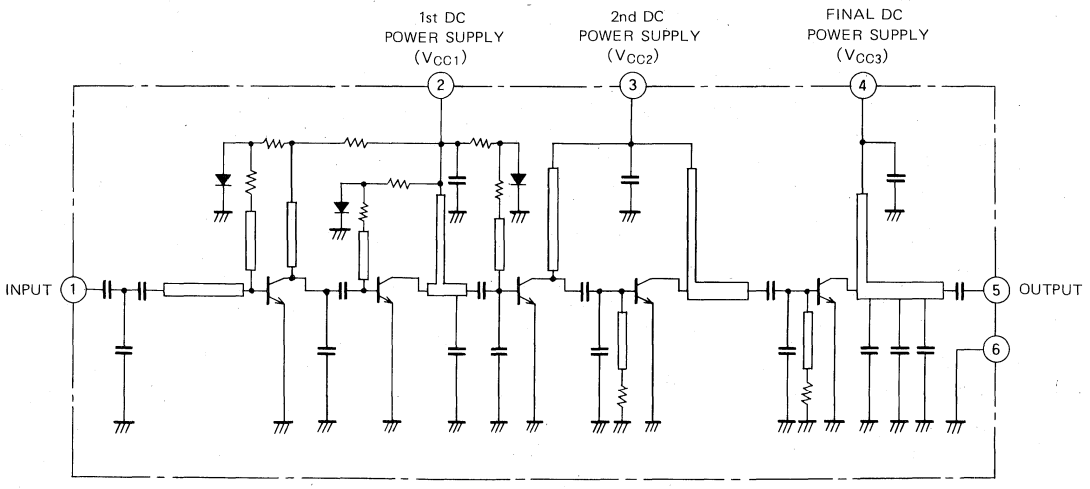
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

825~851MHz, 3W, FM
FOR MOBILE RADIO APPLICATION

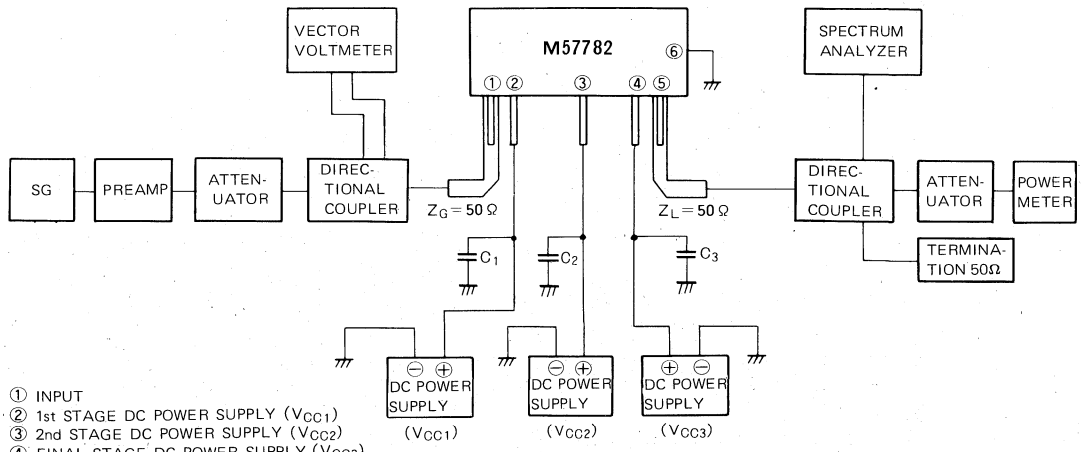
ABSOLUTE MAXIMUM RATINGS (T_C=25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC1,2}$	Supply voltage		9	V
V_{CC3}	Supply voltage		17	V
I_{CC}	Total current		4	A
P_{in}	Input power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 8V$	7	mW
P_O	Output power	$Z_G=Z_L=50\Omega$	10	W
T_C(op)	Operation case temperature		−30~+110	℃
Tstg	Storage temperature		−40~+110	℃

ELECTRICAL CHARACTERISTICS (T_C=25℃, unless otherwise noted)

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output Power	f=824~851MHz, $V_{CC1}=V_{CC2}=8V$, $V_{CC3}=12.5V$, $P_{in}=1mW$, $Z_G=Z_L=50\Omega$	7	9		W
η_T	Total efficiency		35	40		%
—	2nd Harmonics				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2		—
—	Load VSWR tolerance	f=824~851MHz, $V_{CC1}=V_{CC2}=8V$, $V_{CC3}=15.2V$, $P_O=7W$, $Z_G=50\Omega$, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

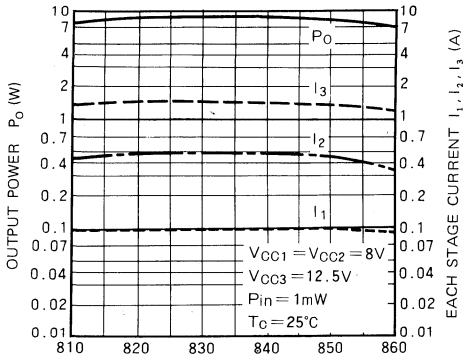


① INPUT
② 1st STAGE DC POWER SUPPLY (V_{CC1})
③ 2nd STAGE DC POWER SUPPLY (V_{CC2})
④ FINAL STAGE DC POWER SUPPLY (V_{CC3})
⑤ OUTPUT
⑥ GROUND (FIN)

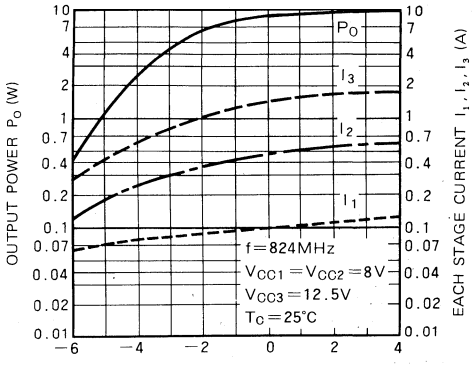
C_1, C_2, C_3 : 4700pF, 10μF IN PARALLEL

TYPICAL PERFORMANCE DATA

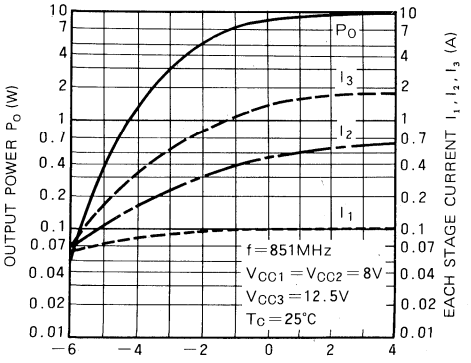
OUTPUT POWER, EACH STAGE CURRENT VS. FREQUENCY



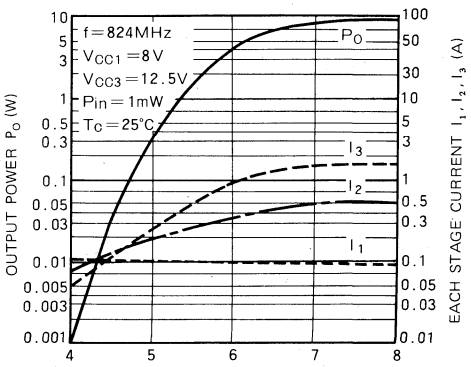
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



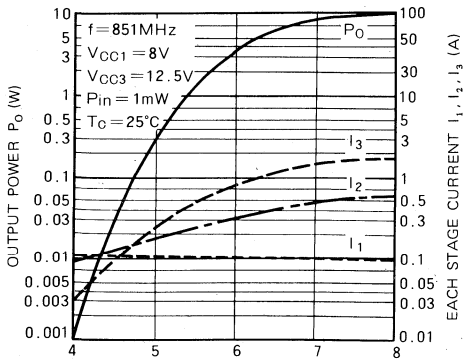
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



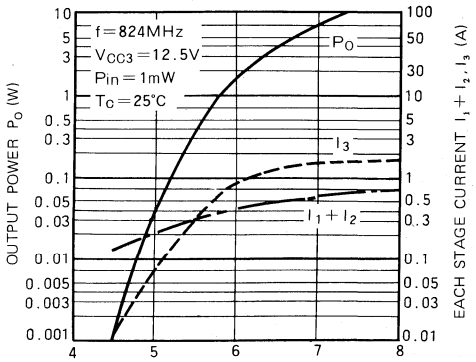
OUTPUT POWER, EACH STAGE CURRENT VS. 2nd STAGE DC SUPPLY VOLTAGE



OUTPUT POWER, EACH STAGE CURRENT VS. 2nd STAGE DC SUPPLY VOLTAGE

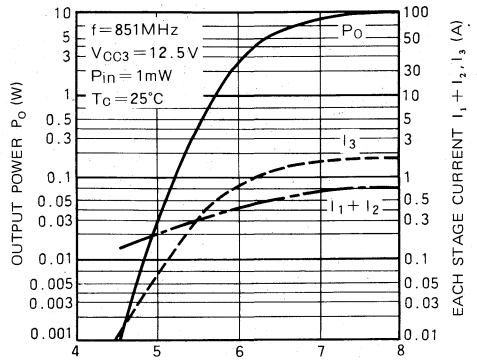


OUTPUT POWER, EACH STAGE CURRENT VS. 1st AND 2nd STAGE DC SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

OUTPUT POWER, EACH STAGE CURRENT
VS. 1st AND 2nd STAGE DC SUPPLY VOLTAGE



1st & 2nd STAGE DC SUPPLY VOLTAGE $V_{CC1} = V_{CC2}$ (V)

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to the following consideration when designing a heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistances between junction of incorporated transistors and case are shown in the followings.

a) First stage transistor
$R_{th(j-c)1} = 20°C/W$ (Typ.)

b) Second stage transistor
$R_{th(j-c)2} = 17.5°C/W$ (Typ.)

c) Third stage transistor
$R_{th(j-c)3} = 16°C/W$ (Typ.)

d) Fourth stage transistor
$R_{th(j-c)4} = 9°C/W$ (Typ.)

e) Final stage transistor
$R_{th(j-c)5} = 6.5°C/W$ (Typ.)

(2) V_{CC}, I_T, RF input & output power conditions at standard operation for each stage transistors are estimated as follows.

P_O = 7W, $V_{CC1} = V_{CC2}$ = 8V, V_{CC3} = 12.5V, P_{in} = 1mW, η_T = 35% (minimum ratings),

I_{1+2} = 0.781A (Total current from 1st stage to 4th stage)

I_3 = 1.1A (Current of 5th stage)

The conditions at standard operation for each stage transistors are shown in Table 1.

- Junction temperature of the first stage transistor
$T_{j1} = (V_{CC1} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (Note 1)
$= (8 \times 0.045 - 0.02 + 0.001) \times 20 + T_C$
$= 6.8 + T_C$ (°C)

Note 1: Case temperature of device

- Junction temperature of the second stage transistor
$T_{j2} = (V_{CC1} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
$= (8 \times 0.08 - 0.2 + 0.02) \times 17.5 + T_C$
$= 8.1 + T_C$ (°C)

- Junction temperature of the third stage transistor
$T_{j3} = (V_{CC2} \times I_{T3} - P_{O3} + P_{O2}) \times R_{th(j-c)3} + T_C$
$= (8 \times 0.16 - 0.5 + 0.2) \times 16 + T_C$
$= 15.7 + T_C$ (°C)

- Junction temperature of the fourth stage transistor
$T_{j4} = (V_{CC2} \times I_{T4} - P_{O4} + P_{O3}) \times R_{th(j-c)4} + T_C$
$= (8 \times 0.496 - 2 + 0.5) \times 9 + T_C$
$= 22.2 + T_C$ (°C)

- Junction temperature of the final stage transistor
$T_{j5} = (V_{CC3} \times I_{T5} - P_O + P_{O4}) \times R_{th(j-c)5} + T_C$
$= (12.5 \times 1.1 - 7 + 2) \times 6.5 + T_C$
$= 56.9 + T_C$ (°C)

Table 1: The conditions at standard operation

Stage	V_{CC} (V)	I_T (mA)	Pin (mW)	P_O (mW)
1st	8	45	1	20
2nd	8	80	20	200
3rd	8	160	200	500
4th	8	496	500	2000
5th	12.5	1100	2000	7000

2. Heat sink design

In thermal design of heat sink, keep the case temperature below 90°C at output power P_O = 7W and ambient temperature = 60°C.

The thermal resistance $R_{th(c-a)}$ (Note 2) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(7/0.35 - 7 + 0.001)}$$

$= 2.31$ (°C/W)

Note 2: Including the contact thermal resistance between device and heat sink

Mounting the device on the heat sink with above thermal resistance, junction temperatures of each transistor become;

T_{j1} = 97°C, T_{j2} = 99°C, T_{j3} = 106°C, T_{j4} = 113°C, T_{j5} = 147°C at T_a = 60°C, T_C = 90°C.

Since the annual average of ambient temperature is 30°C, junction temperatures of each transistor become;

T_{j1} = 67°C, T_{j2} = 69°C T_{j3} = 76°C, T_{j4} = 76°C, T_{j5} = 117°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

825~851MHz, 3W, FM FOR MOBILE RADIO APPLICATION

GENERAL

Mitsubishi RF Power Modules for mobile radio applications have high reliability and good performance, as they are designed and manufactured under strict quality control. However, the reliability of semiconductor devices is remarkably affected by usage conditions such as circuit constructions, mounting method, environments, etc.. In order to keep high reliability and obtain good performance when using Mitsubishi RF Power Modules, the following important points concerning maximum ratings, handling, etc., should be noted before use.

1. MAXIMUM RATINGS

Maximum ratings of the RF Power Modules are defined by the "Absolute Maximum Ratings" shown in separate specification sheet. Maximum ratings should not be exceeded in any circumstances, even momentarily. If a device is operated in excess of the absolute maximum ratings, the device may immediately be degraded or destroyed. Futhermore, in designing an electronic circuit using RF power Modules, it is necessary to note that the maximum ratings of the devices should not be exceeded even if external conditions are changed.

2. NORMAL OPERATING VOLTAGE

Normal operating voltage is 12.5 ~ 13.8 volts for Mitsubishi RF Power Modules, because they are designed for mobile radio applications. The regulated 9 volts is recommended for the base biasing voltage of the modules for linear power amplifiers (for SSB).

3. THERMAL DESIGN

In order to keep high reliability of the equipment, it is better to keep the module temperature low. The case temperature of the module, when operated standard conditions, is lower than 90°C under all severe ambient temperature, recommend normally 60°C.

4. MOUNTING and HANDLING

4-1 When the module is mounted on to a heat sink of a equipment, thermal compound to get good heat sinking should be applied between the module's fin and the heat sink. Following thermal compound for good heat sinking is recommended.

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4-2 When mounting a module to the circuit, do not apply excessive stress to the terminal leads or the fin. In particular, if there are some foreign objects between the module and the heat sink, or if there are some burrs or rising on the surface of the heat sink, it may happen that the substrate of the module will crack or break due to excessive stress from screwing the module on to the heat sink. Therefore, the surface of the heat sink in contact with the module must be as flat as possible.

When screwing a module to the heat sink, torque screw is recommended as 5 to 6kg-cm when using ϕ3mm screws.

4-3 For soldering, the major precautions are as follows:

1) Flux;

Roles of flux are to remove oxidized layer on the object, and prevent from oxidation during heating or lowering surface tension on the objects. Rosin flux, which is less corrosional and highly insulative, is recommended.

2) Soldering temperature;

The temperature of the lead soldering should be lower than 260°C and shorter than 10 seconds, or lower than 350°C and shorter than 3 seconds.

3) Cleaning after soldering;

The recommended solvent for cleaning the residual flux is the Ethyl Alcohol. Trichlene type solvents should not be used.

4-4 When the module is screwed after soldering the terminal leads to the circuit board, excessive stress is applied to the leads. Therefore, please solder the terminal leads to the circuit board after screwing the module to the heat sink.

4-5 If the module falls onto a hard surface, it will be damaged by mechanical shock and can no longer be used.

4-6 To obtain good stability and electrical performances, it is necessary to take precausions concerning the earth potential of the module. As the fin is the ground terminal, the fin should be connected to the ground of the set completly in RF condition.

4-7 The values of input VSWR and output VSWR of the module indicated in the specification sheet are guaranteed when the input and output leads are straight and these leads are connected to the load 50Ω within 10mm length. If the device is mounted under different conditions from these mentioneda above, the performances, such as output power and efficiency, may be degraded due to the impedance mismatch. In order to reform such an impedance mismatch, please set the additional matching circuits to get good impedance matching.

5. VOLTAGE SUPPLY

The modules have 2 or 3 terminals for DC power supply. If these terminals are combined without RFC (Radio Frequency Choke), or if each terminal is not bypassed with the condenser, parasitic oscillation occasionally may occured. Therefore, the DC Power Supply Terminals should be combined with RFC, and each terminal bypassed with the condensers (10μF and 4700pF in Parallel).

The first stage transistor of the module even for FM is operated in class AB. When excessively high voltage is applied to the first stage DC Power Supply Terminal, the first stage transistor may be destroyed due to current runaway. Therefore, the first stage supply voltage must be controlled, not exceeding 17 volts DC.

6. GUARANTEED CHARACTERISTICS

All the graphic characteristics illustrated in this catalog are typical examples. The characteristics of individual devices as specified in the tables of absolute maximum ratings and electrical characteristics are guaranteed under the specified conditions.

M57783L

135~160MHz, 7.5V, 5W, FM PORTABLE RADIO

DESCRIPTION

M57783L is a thick film RF power module specifically designed for 135 ~ 160MHz, 5W FM portable sets.

FEATURES

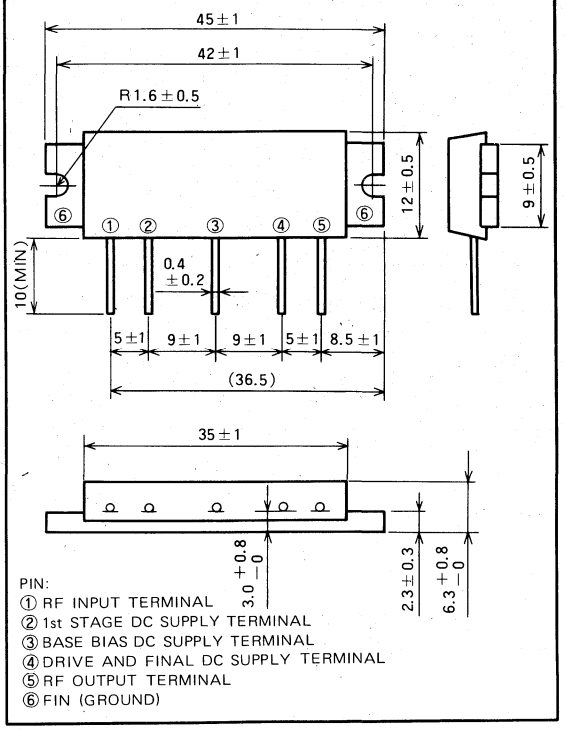
- High Gain, High Output power
  Gp: 21dB @V_{CC} = 7.5V, Po ≧ 7W, Pin = 50mW
- High Total Efficiency
  η_T = 45% TYP, 40% MIN @V_{CC} = 7.5V, Pin = 50mW
- Small package: 45 x 12 x 6.3mm

APPLICATION

Output Stage of 5W output VHF band Portable radio sets.
(especially 7.5V Battery sets)

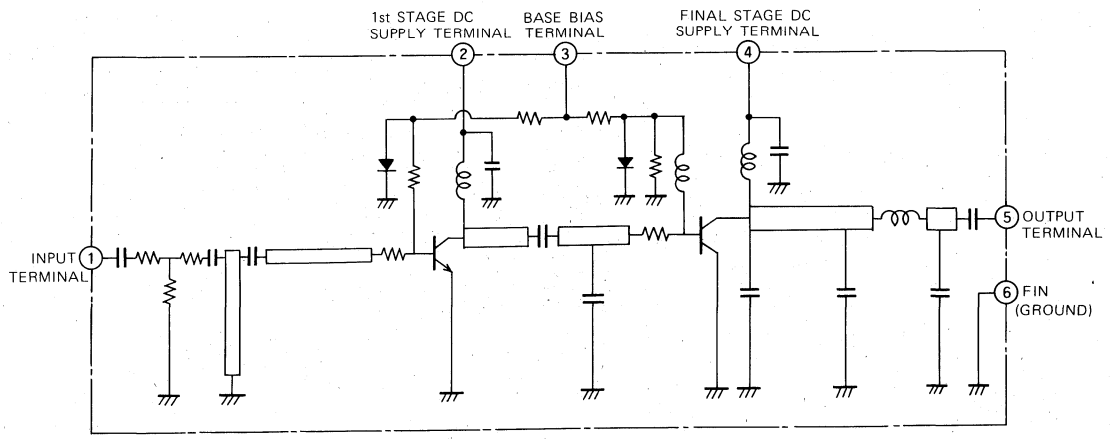
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



135～160MHz, 7.5V, 5W, FM PORTABLE RADIO

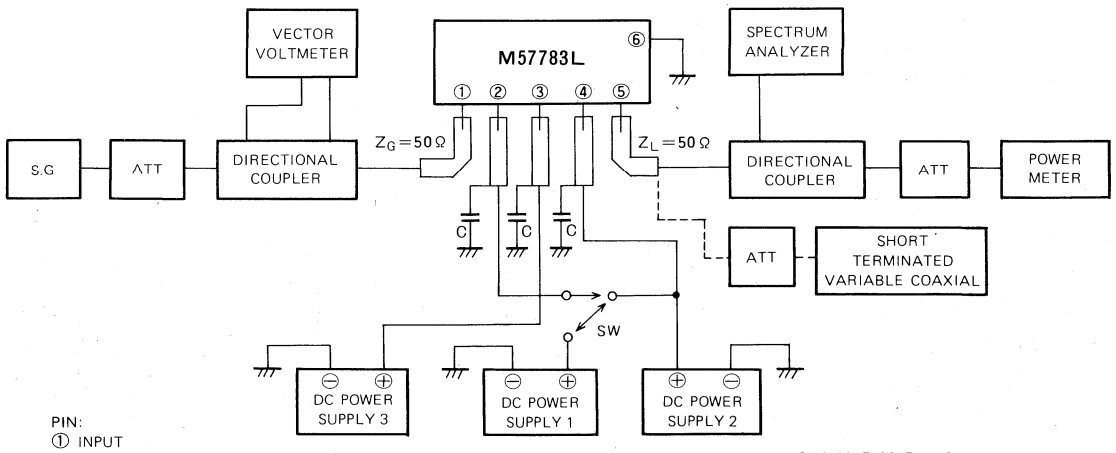
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		9	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\,\Omega$	100	mW
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 7.5V, V_{BB} = 5V, f = 135～160MHz, P_{in} = 50mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		45	50		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 7.5V, V_{BB} = 5V, f = 135～160 MHz, P_O = 7W, $\rho_L \geqq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

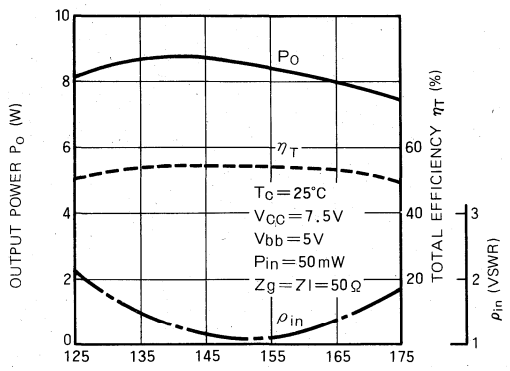


PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

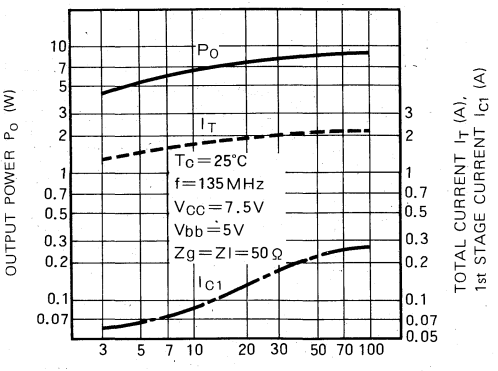
C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

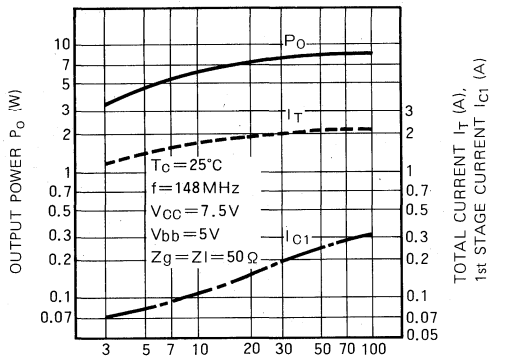
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



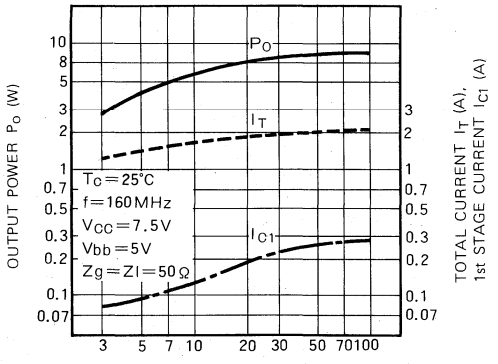
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



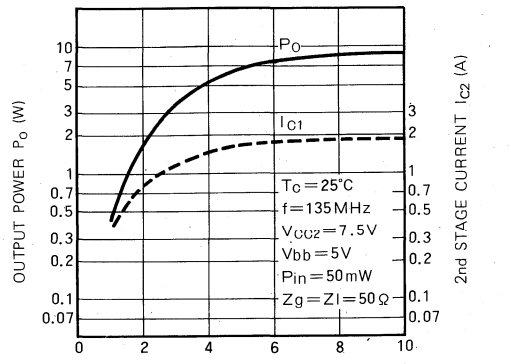
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



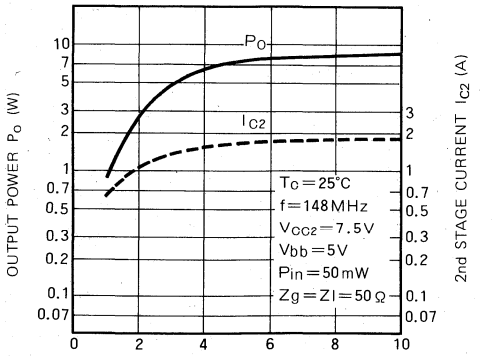
OUTPUT POWER, TOTAL CURRENT 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



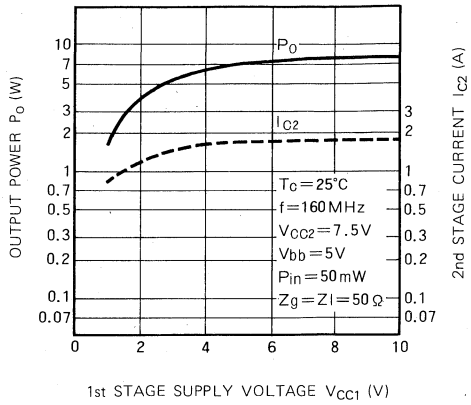
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



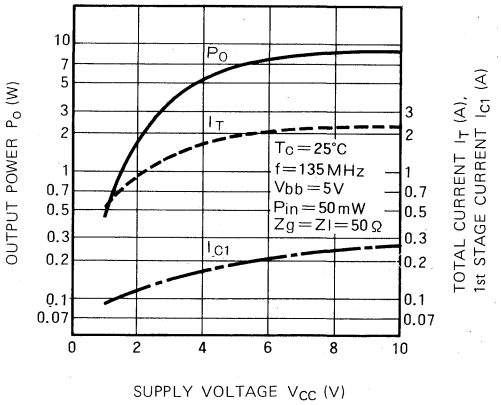
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



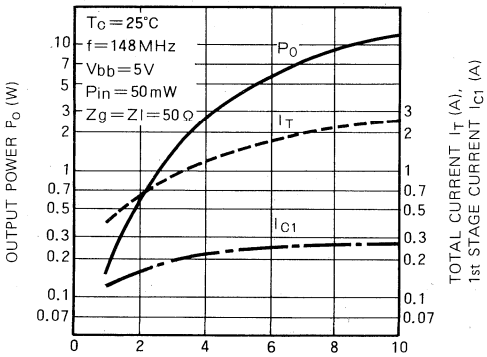
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



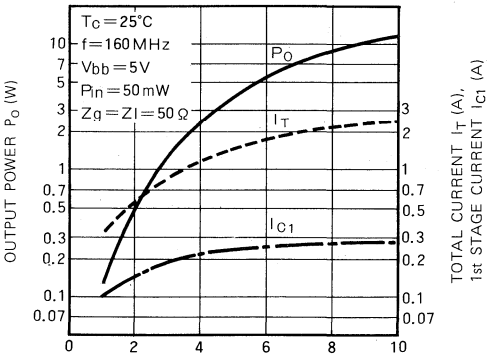
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



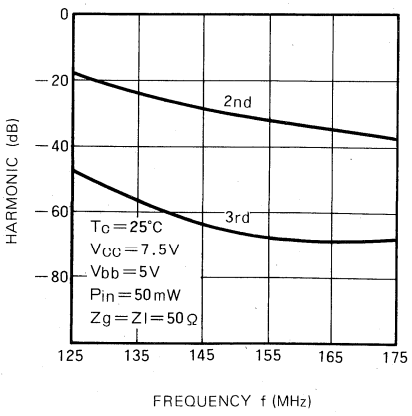
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M57783H

150~175MHz, 7.5V, 5W, FM PORTABLE RADIO

DESCRIPTION

M57783H is a thick film RF power module specifically designed for 150 ~ 175MHz, 5W FM portable sets.

FEATURES

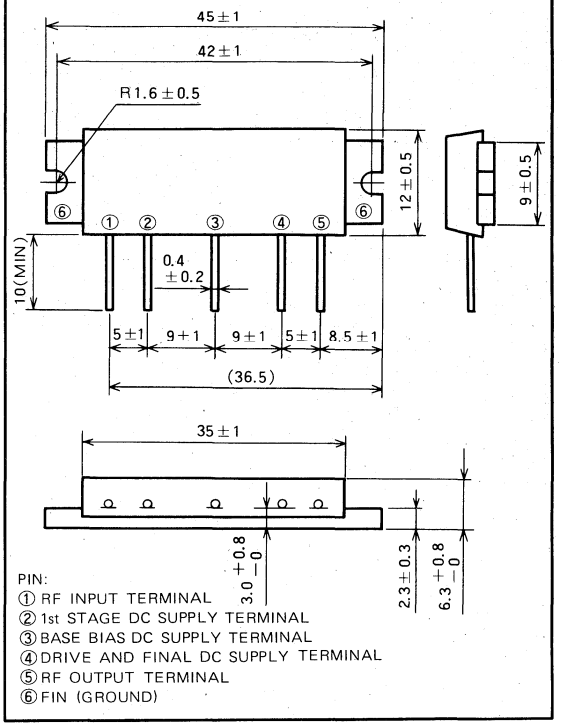
- High Gain, High Output power
  Gp: 21dB @V_{CC} = 7.5V, Po $\geqq$ 7W, Pin = 50mW
- High Total Efficiency
  η_T = 45% TYP, 40% MIN @V_{CC} = 7.5V, Pin = 50mW
- Small package: 45 x 12 x 6.3mm

APPLICATION

Output Stage of 5W output VHF band Portable radio sets. (especially 7.5V Battery sets)

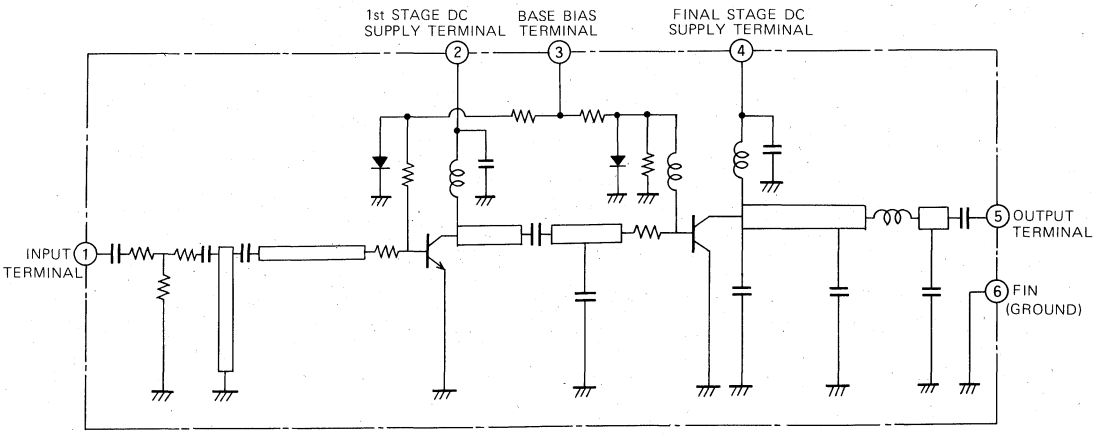
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



150～175MHz, 7.5V, 5W, FM PORTABLE RADIO

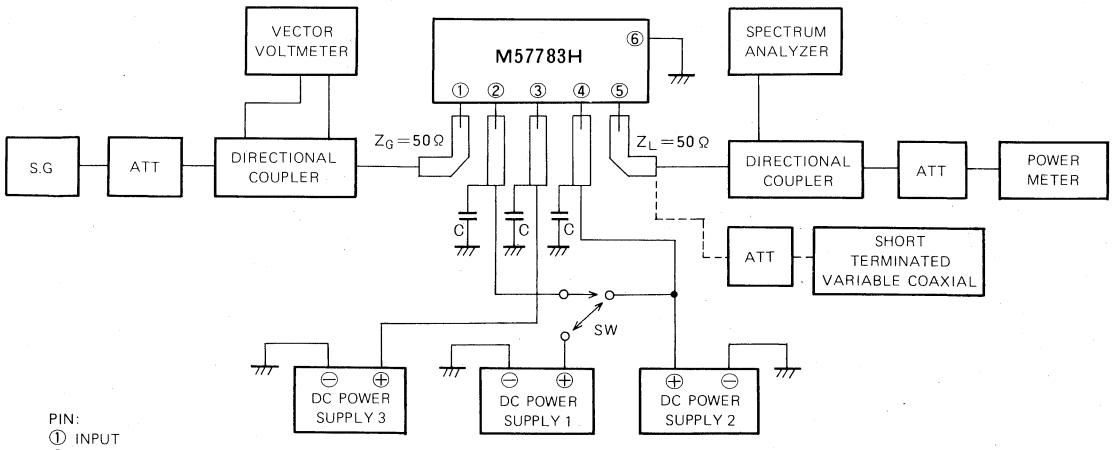
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		9	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}(max)	Input power	$Z_G = Z_L = 50\,\Omega$	100	mW
P_O (max)	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 7.5V, V_{BB} = 5V, f = 150～175MHz, P_{in} = 50mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		45	50		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρin	Input VSWR			1.5	2.5	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 7.5V, V_{BB} = 5V, f = 150～175 MHz, P_O = 7W, $\rho_L \geq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM



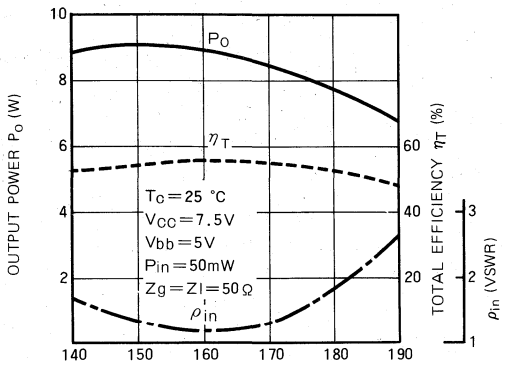
PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

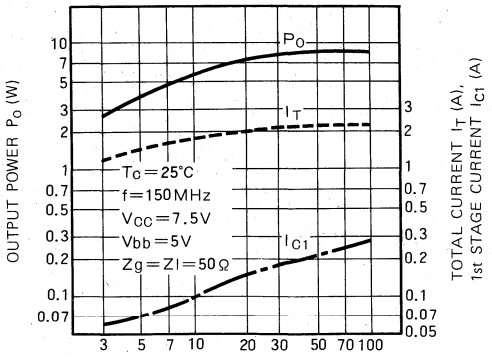
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

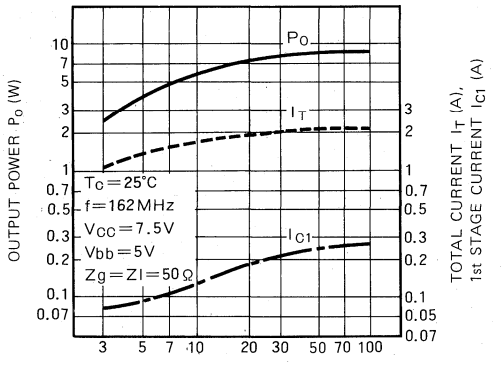
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



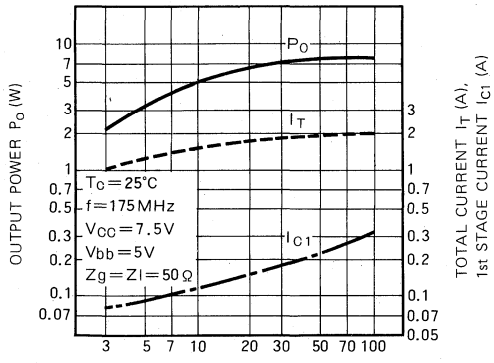
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



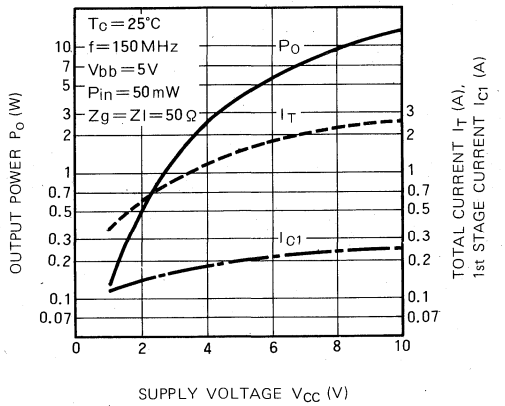
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



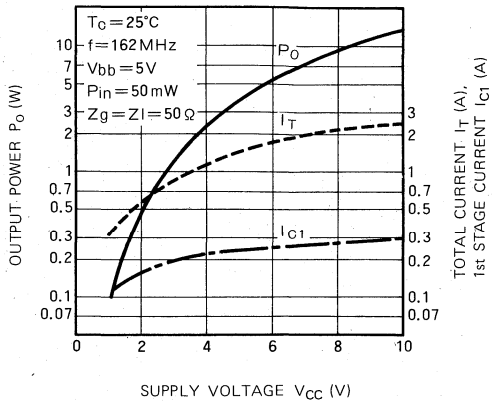
OUTPUT POWER, TOTAL CURRENT 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



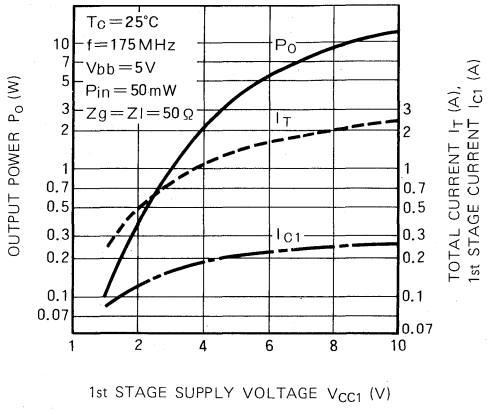
OUTPUT POWER, TOTAL CURRENT 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



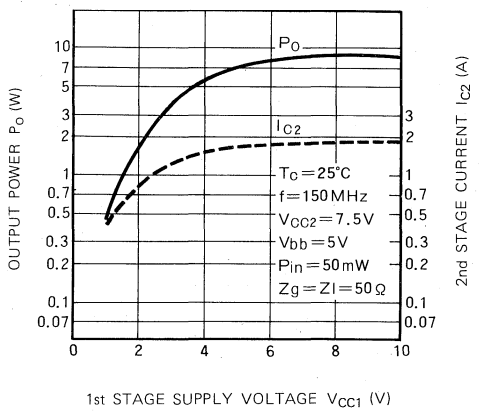
OUTPUT POWER TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



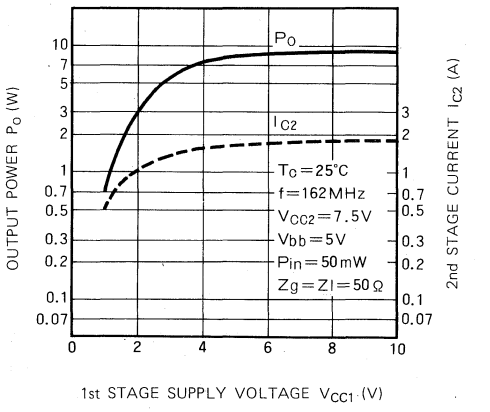
OUTPUT POWER TOTAL CURRENT 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



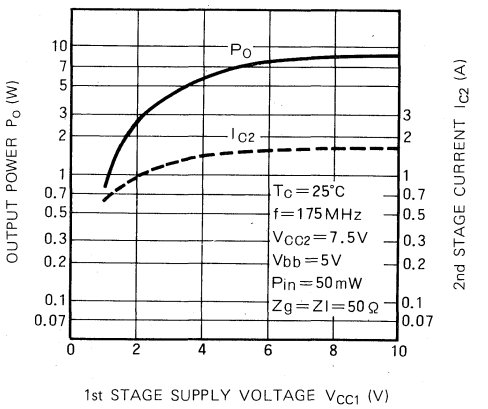
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



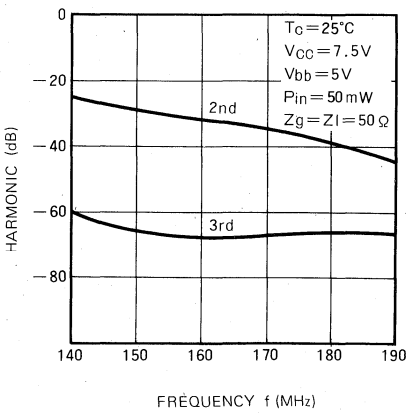
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M57785L

135~150MHz, 5W, FM PORTABLE RADIO

DESCRIPTION

M57785L is a thick film RF power module specifically designed for 135 ~ 150MHz, 5W FM portable sets.

FEATURES

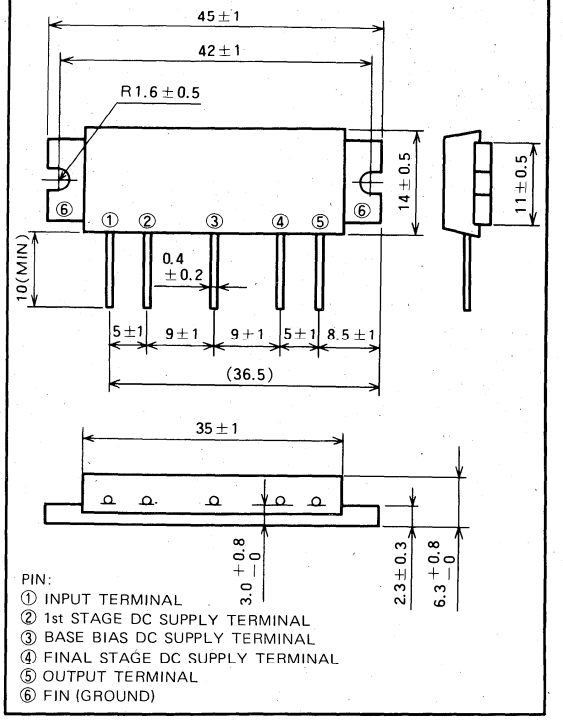
- High gain, High output power
  G_P: 21dB @V_{CC} = 7.2V, $P_O \geqq$ 7W, P_{in} = 50mW
- High total efficiency
  η_T = 50% TYP, 40% MIN @V_{CC} = 7.2V, P_{in} = 50mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 5W output VHF band portable radio sets. (especially 7.2V battery sets)

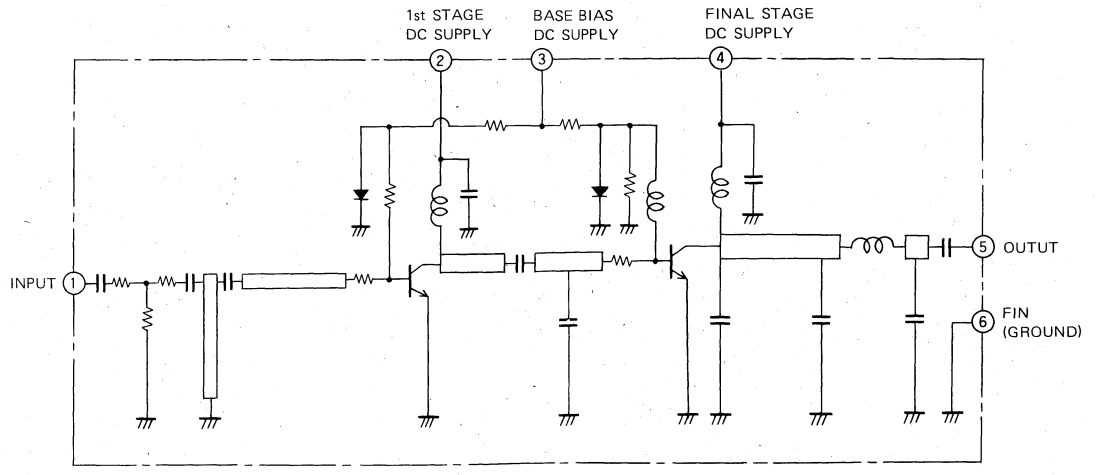
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



135～150MHz, 5W, FM PORTABLE RADIO

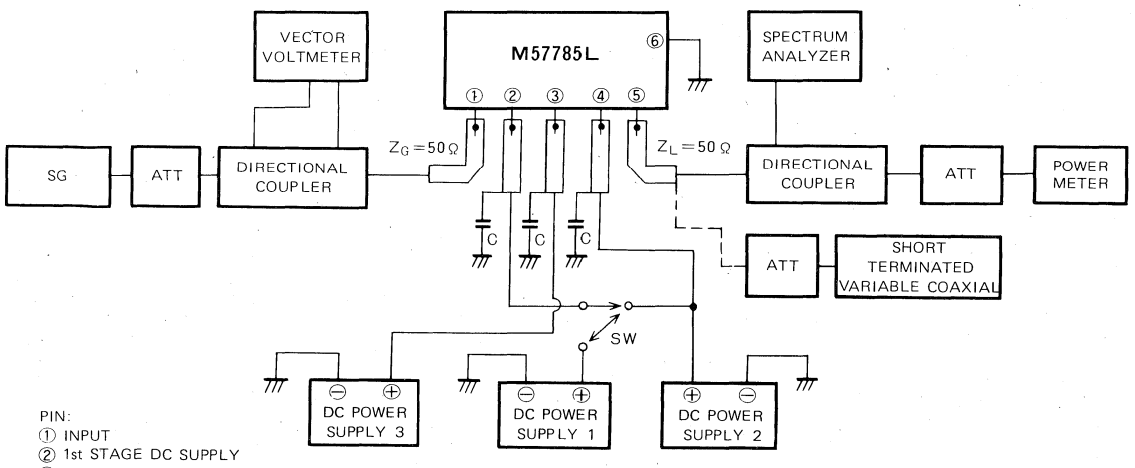
ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		10	V
V_{BB}	Base bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}	Input power	V_{CC}=7.2V, Z_G=Z_L=50Ω	80	mW
P_O	Output power	Z_G=Z_L=50Ω	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=7.2V, V_{BB}=5V, f=135～150MHz P_{in}=50mW, Z_G=Z_L=50Ω	7	8		W
η_T	Total efficiency		40	50		%
—	2nd harmonic				−20	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR			2.0	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC1}=V_{CC2}=7.2V, V_{BB}=5V, f=135～150MHz P_O=7W, ρ_L≧20(All phase), Z_G=Z_L=50Ω				—

TEST BLOCK DIAGRAM

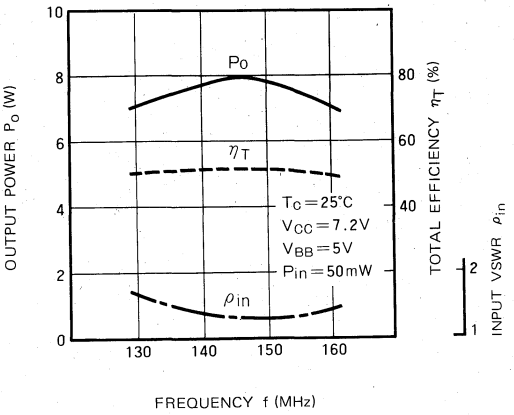


PIN:
① INPUT
② 1st STAGE DC SUPPLY
③ BASE BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

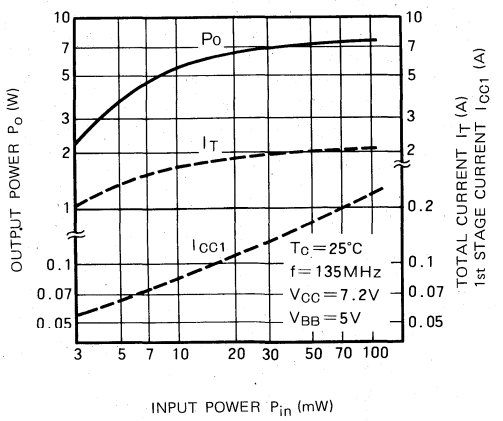
C: 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

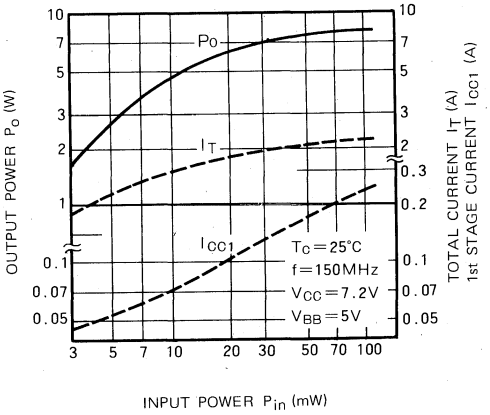
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



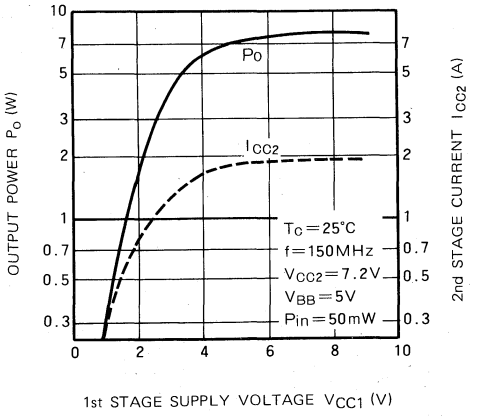
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



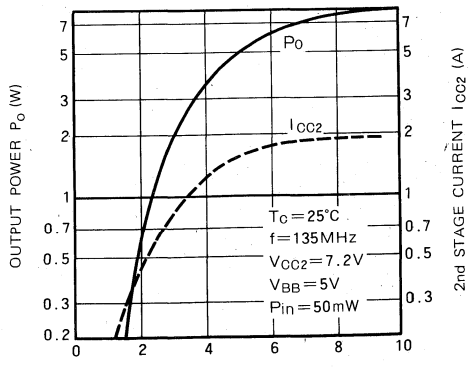
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



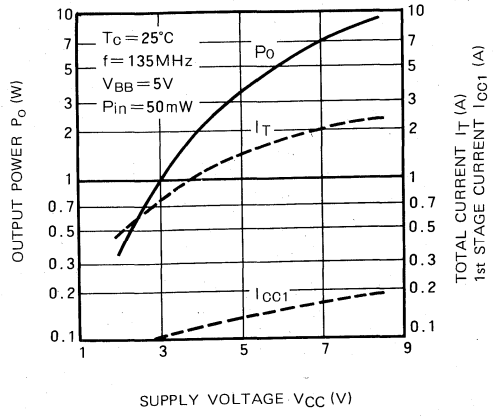
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



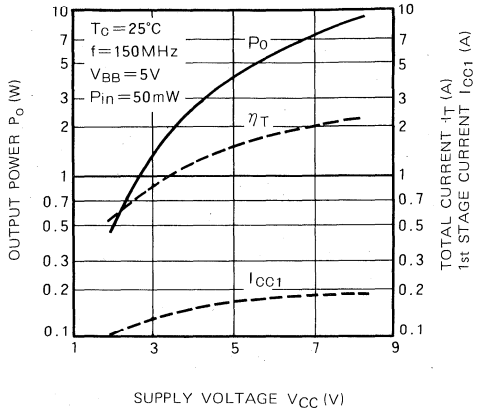
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



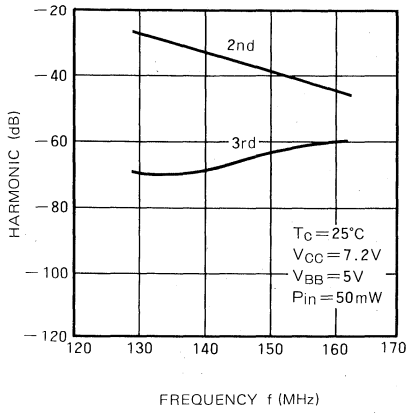
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONICS VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M57785M

150～162MHz, 5W, FM PORTABLE RADIO

DESCRIPTION

M57785M is a thick film RF power module specifically designed for 150 ～ 162MHz, 5W FM portable sets.

FEATURES

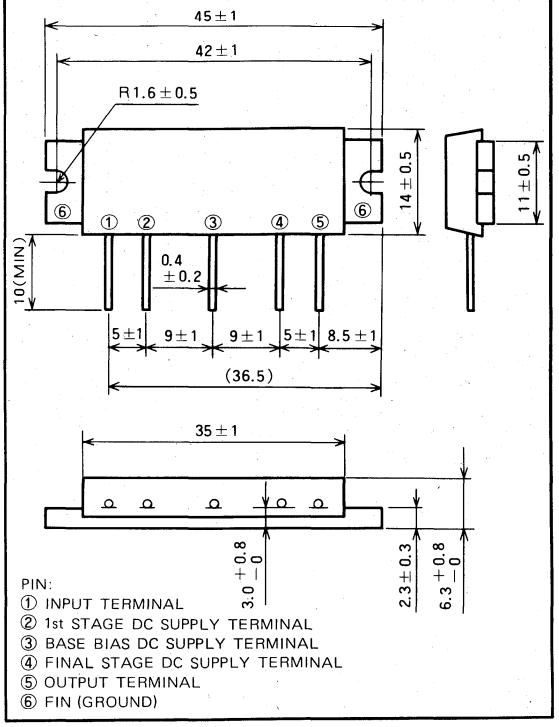
- High gain, High output power
  G_P = 21dB @V_{CC} = 7.2V, $P_O \geqq$ 7W, P_{in} = 50mW
- High total efficiency
  η_T = 50% TYP, 40% MIN @V_{CC} = 7.2V, P_{in} = 50mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 5W output VHF band portable radio sets. (especially 7.2V battery sets)

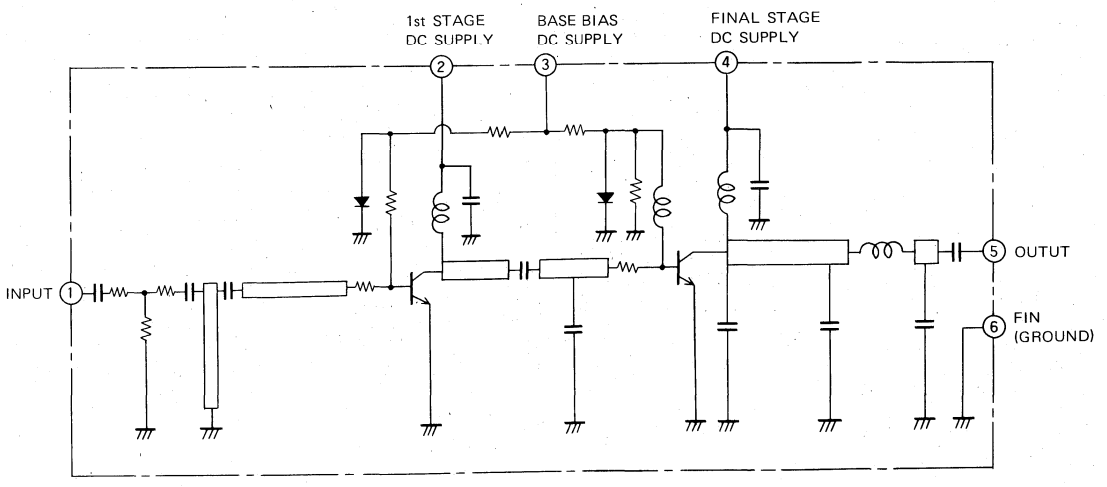
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



150～162MHz, 5W, FM PORTABLE RADIO

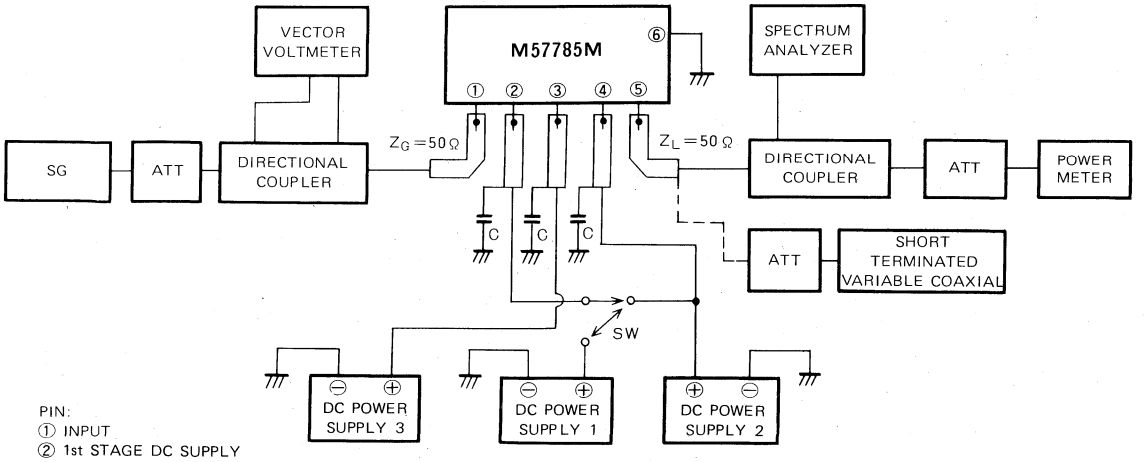
ABSOLUTE MAXIMUM RATINGS (T_C = 25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		10	V
V_{BB}	Base bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}	Input power	V_{CC} = 7.2V, $Z_G = Z_L$ = 50Ω	80	mW
P_O	Output power	$Z_G = Z_L$ = 50Ω	10	W
T_C(op)	Operation case temperature		−30～+110	℃
Tstg	Storage temperature		−40～+110	℃

ELECTRICAL CHARACTERISTICS (T_C = 25℃, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 7.2V, V_{BB} = 5V, f = 150～162MHz P_{in} = 50mW, $Z_G = Z_L$ = 50Ω	7	8		W
η_T	Total efficiency		40	50		%
—	2nd harmonic				−20	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR			2.0	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 7.2V, V_{BB} = 5V, f = 150～162MHz P_O = 7W, $\rho_L \geqq 20$ (All phase), $Z_G = Z_L$ = 50Ω				—

TEST BLOCK DIAGRAM

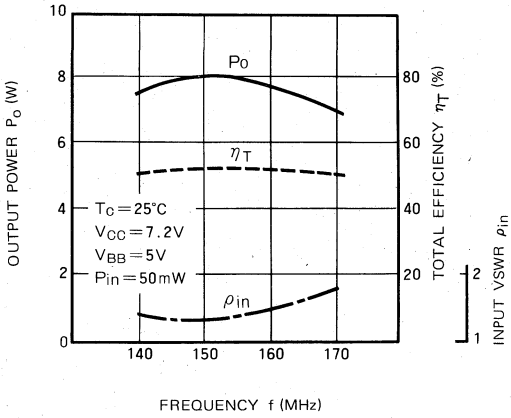


PIN:
① INPUT
② 1st STAGE DC SUPPLY
③ BASE BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

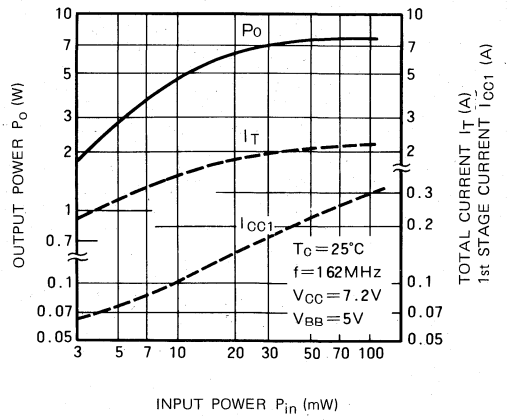
C: 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

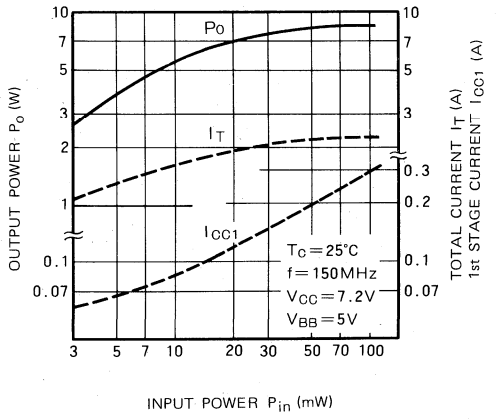
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



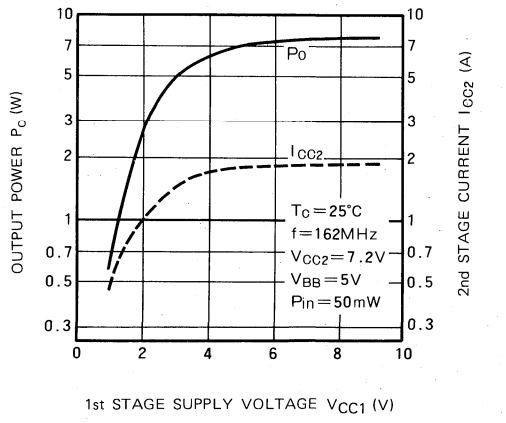
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



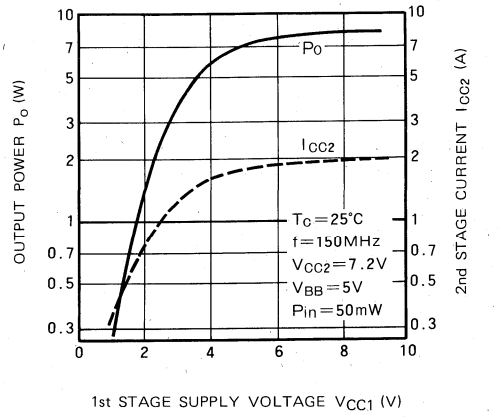
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



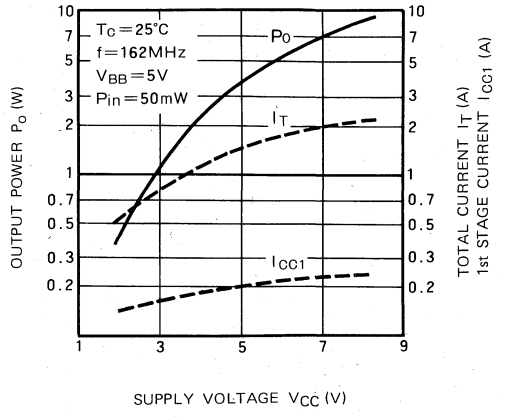
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



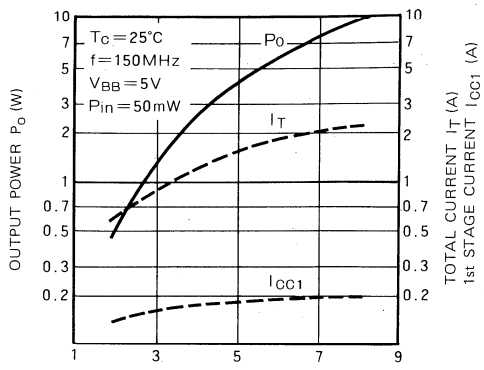
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



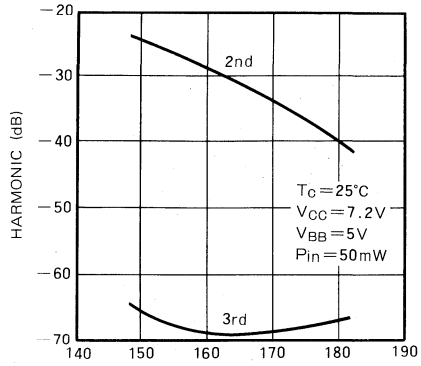
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONICS VS. FREQUENCY CHARACTERISTICS



M57785H

162~174MHz, 5W, FM PORTABLE RADIO

DESCRIPTION

M57785H is a thick film RF power module specifically designed for 162 ~ 174MHz, 5W FM portable sets.

FEATURES

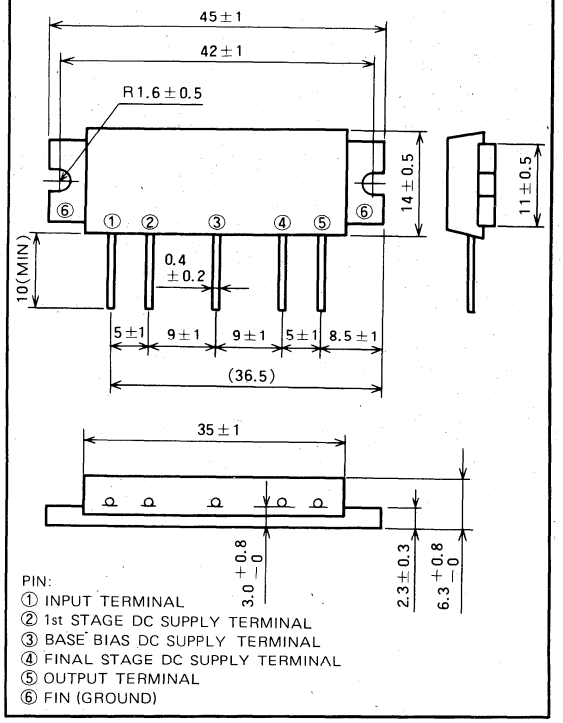
- High gain, High output power
  G_P: 21dB @V_{CC} = 7.2V, $P_O \geqq$ 7W, P_{in} = 50mW
- High total efficiency
  η_T = 50% TYP, 40% MIN @V_{CC} = 7.2V, P_{in} = 50mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 5W output VHF band portable radio sets. (especially 7.2V battery sets)

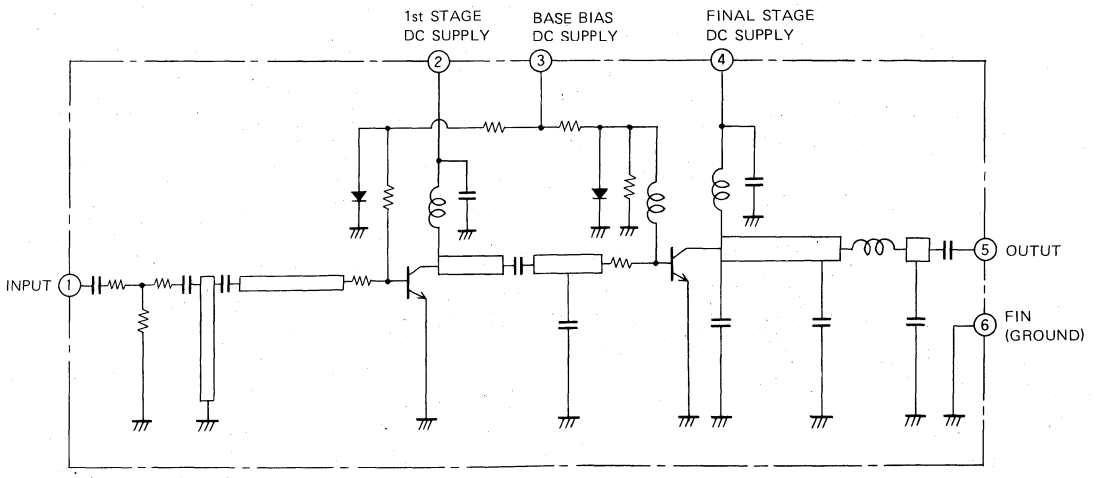
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



162～174MHz, 5W, FM PORTABLE RADIO

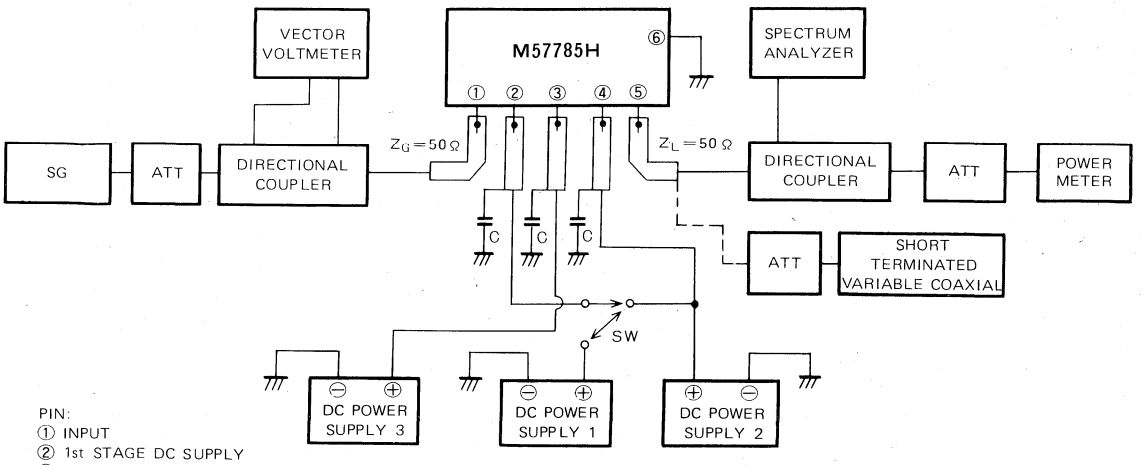
ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		10	V
V_{BB}	Base bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}	Input power	V_{CC}=7.2V, Z_G=Z_L=50Ω	80	mW
P_O	Output power	Z_G=Z_L=50Ω	10	W
T_C (op)	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=7.2V, V_{BB}=5V, f=162～174MHz P_{in}=50mW, Z_G=Z_L=50Ω	7	8		W
η_T	Total efficiency		40	50		%
—	2nd harmonic				−20	dB
—	3rd harmonic				−30	dB
ρ_{in}	Input VSWR			2.0	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC1}=V_{CC2}=7.2V, V_{BB}=5V, f=162～174MHz P_O=7W, ρ_L≧20 (All phase), Z_G=Z_L=50Ω				—

TEST BLOCK DIAGRAM

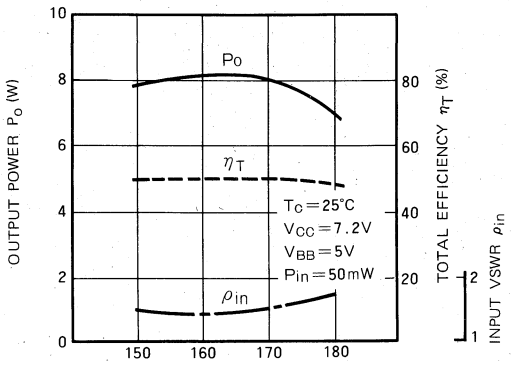


PIN:
① INPUT
② 1st STAGE DC SUPPLY
③ BASE BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

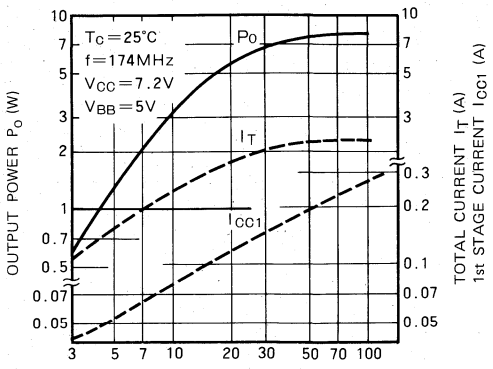
C: 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

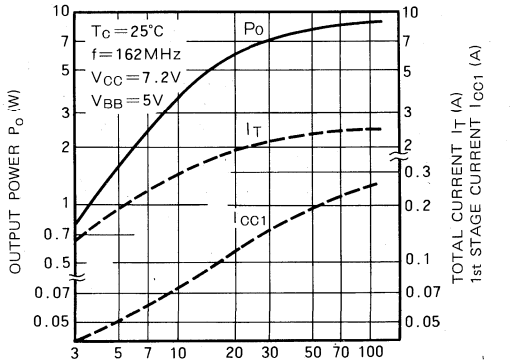
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



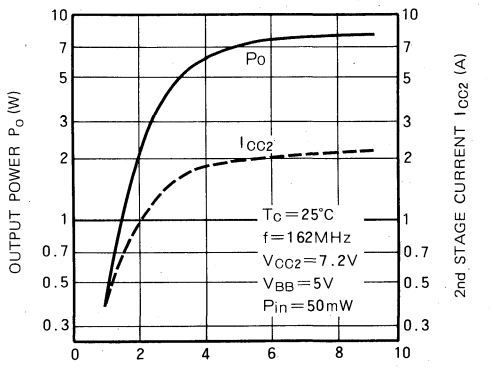
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



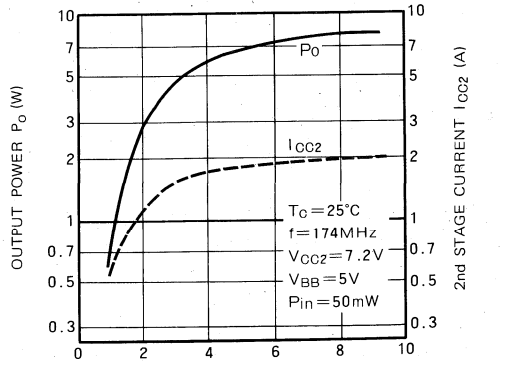
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



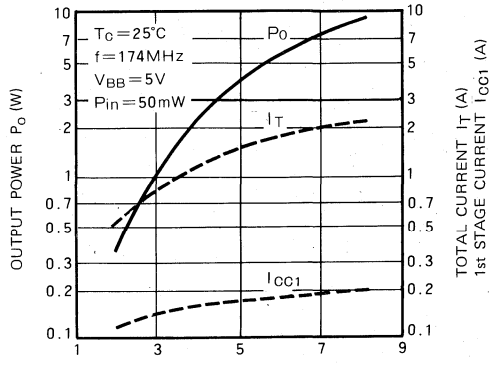
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



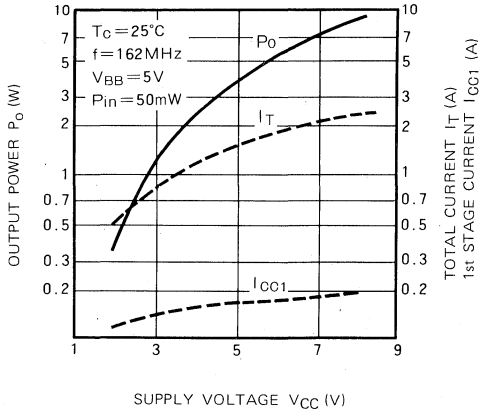
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



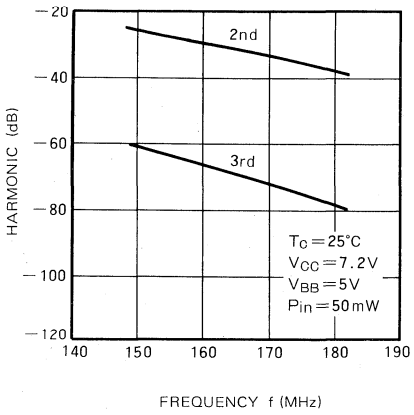
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT,
1st STAGE CURRENT VS.
SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONICS VS.
FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M57786L

400~430MHz, 5W, FM PORTABLE RADIO

DESCRIPTION

M57786L is a thick film RF power module specifically designed for 400 ~ 430 MHz, 5W FM portable sets.

FEATURES

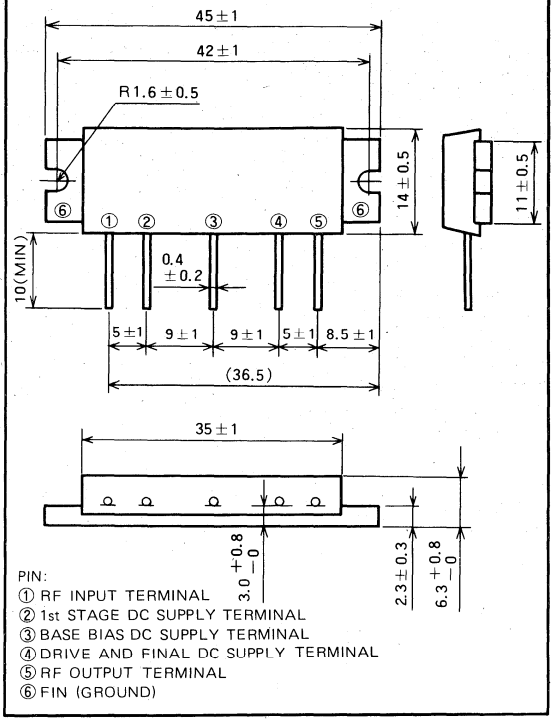
- Wide band: 30MHz, f = 400 ~ 430MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  $Gp \geqq 21dB$ @V_{CC} = 7.2V, $Po \geqq 7W$, Pin = 50mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

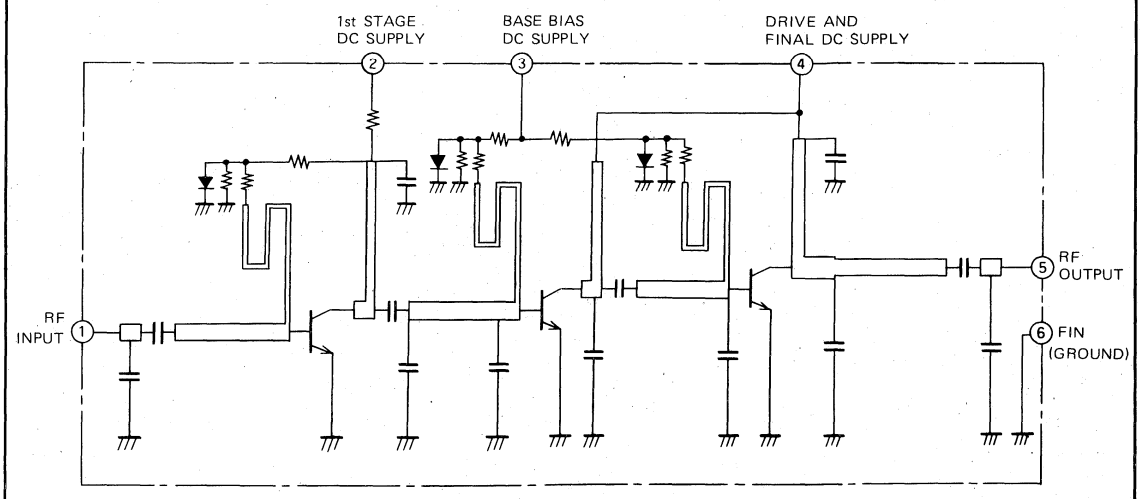
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



400~430MHz, 5W, FM PORTABLE RADIO

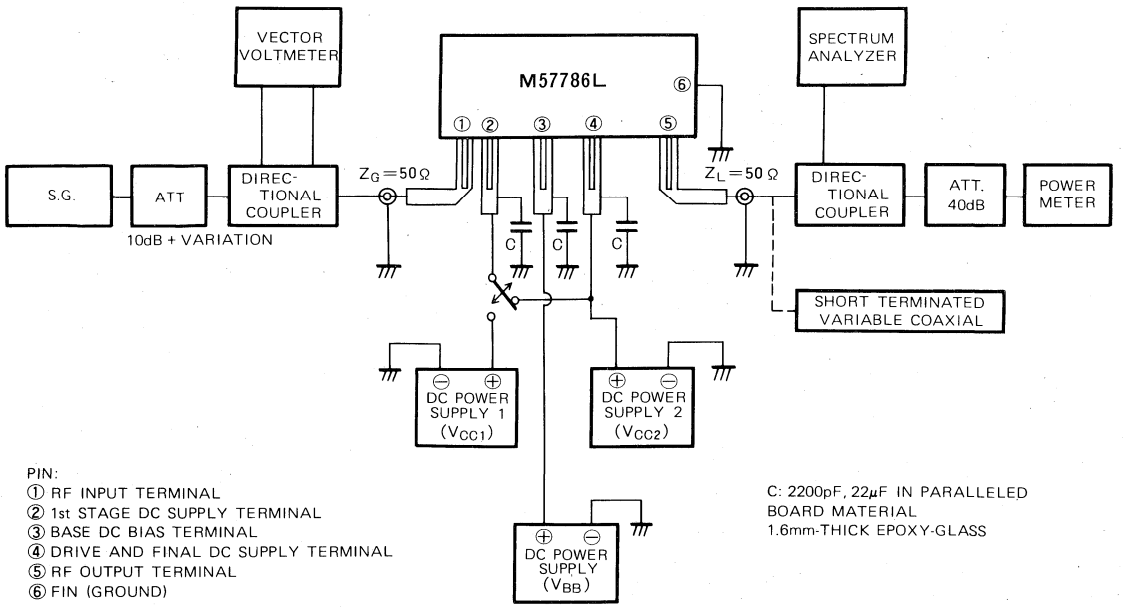
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		10	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
$P_{in}(max)$	Input power	$Z_G = Z_L = 50\,\Omega$	100	mW
$P_O(max)$	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30~+110	°C
T_{stg}	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 7.2V, V_{BB} = 5V, f = 400~430MHz, P_{in} = 50mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic			−27	−25	dB
—	3nd harmonic			−35	−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 7.2V, V_{BB} = 5V, f = 400~430 MHz, P_O = 7W, $\rho_L \geqq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

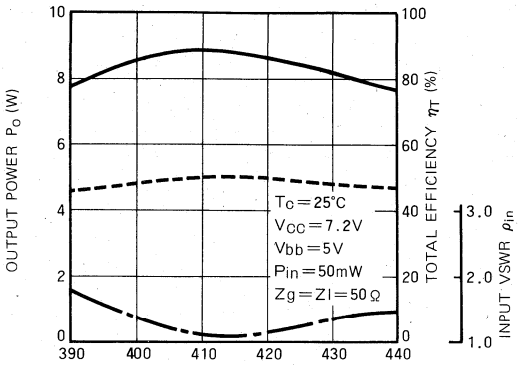


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

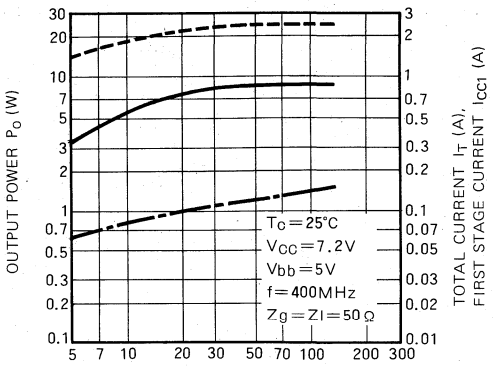
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

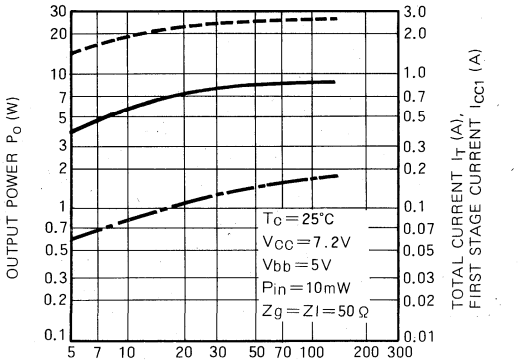
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



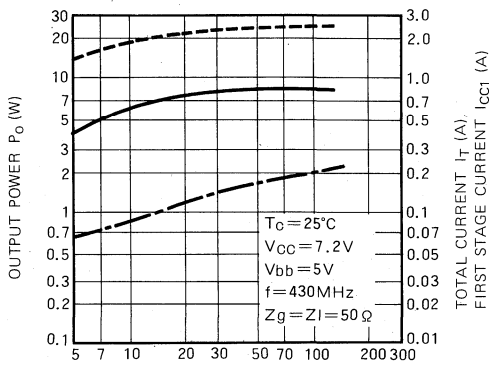
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



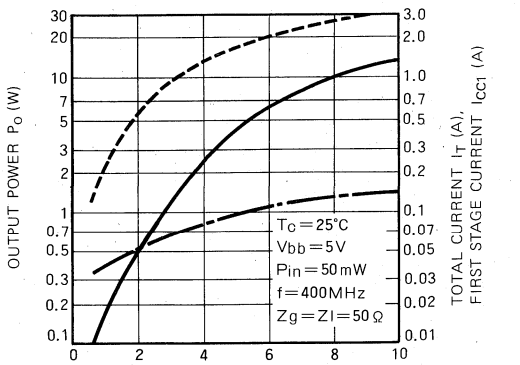
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



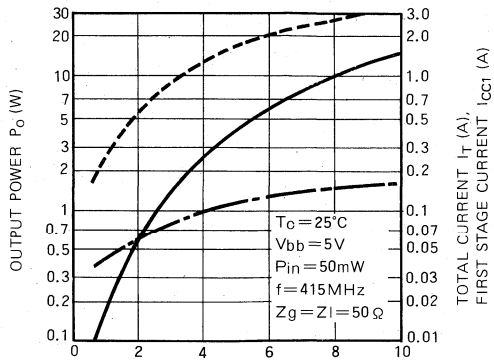
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



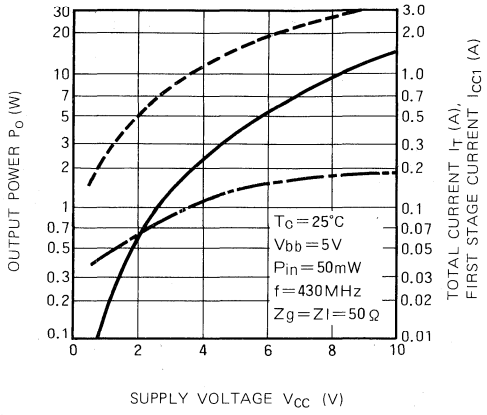
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



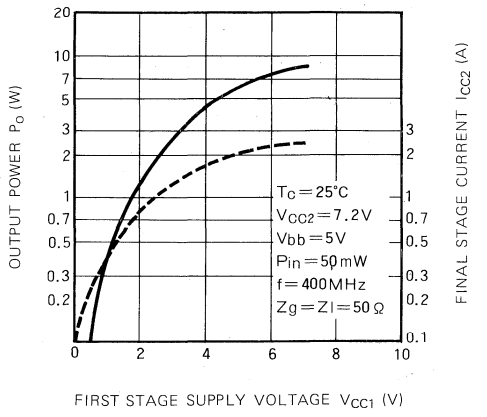
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



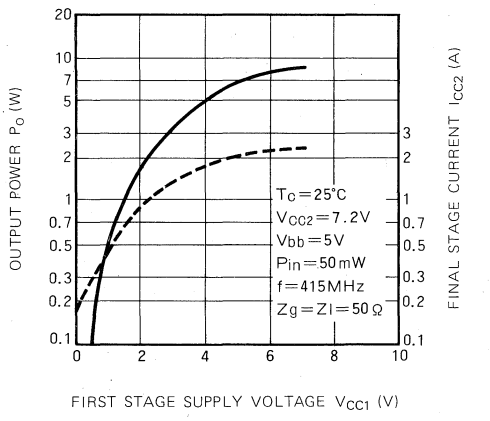
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



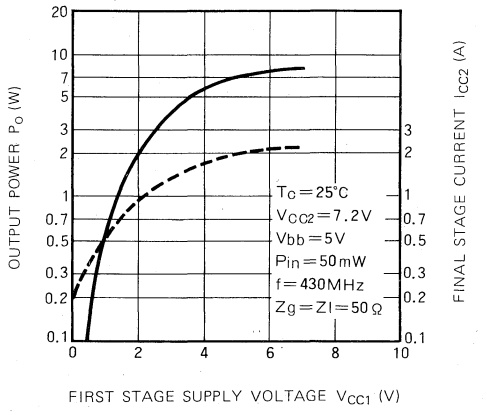
OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHRACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M57786M

430~470MHz, 5W, FM PORTABLE RADIO

DESCRIPTION

M57786M is a thick film RF power module specifically designed for 430 ~ 470 MHz, 5W FM portable sets.

FEATURES

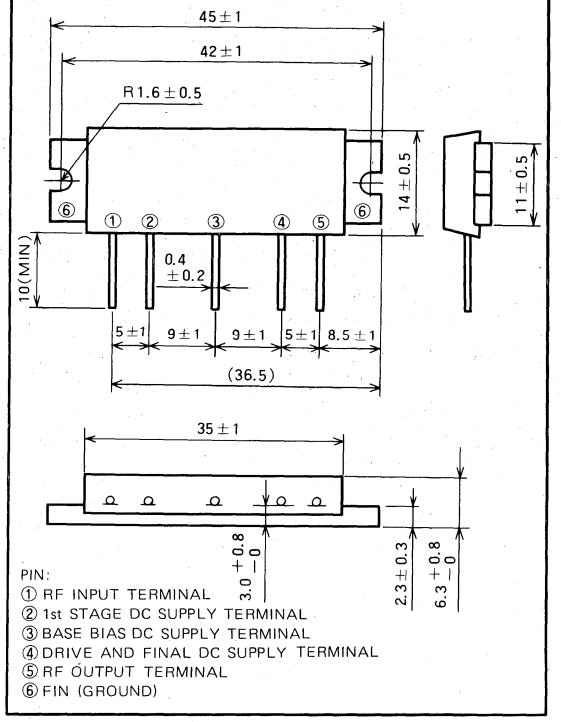
- Wide band: 40MHz, f = 430 ~ 470MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  $Gp \geqq 21dB$ @V_{CC} = 7.2V, Po $\geqq$ 7W, Pin = 50mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

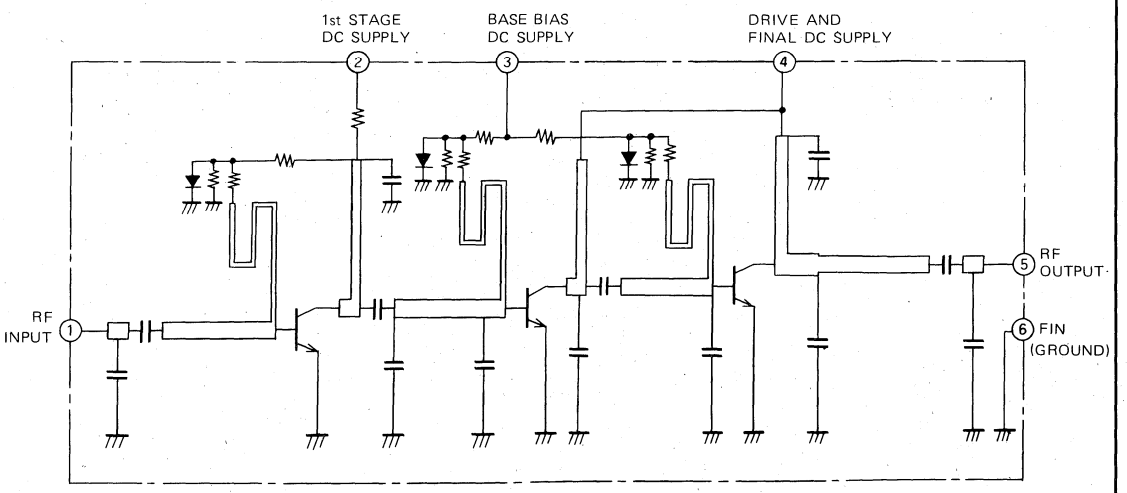
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



430~470MHz, 5W, FM PORTABLE RADIO

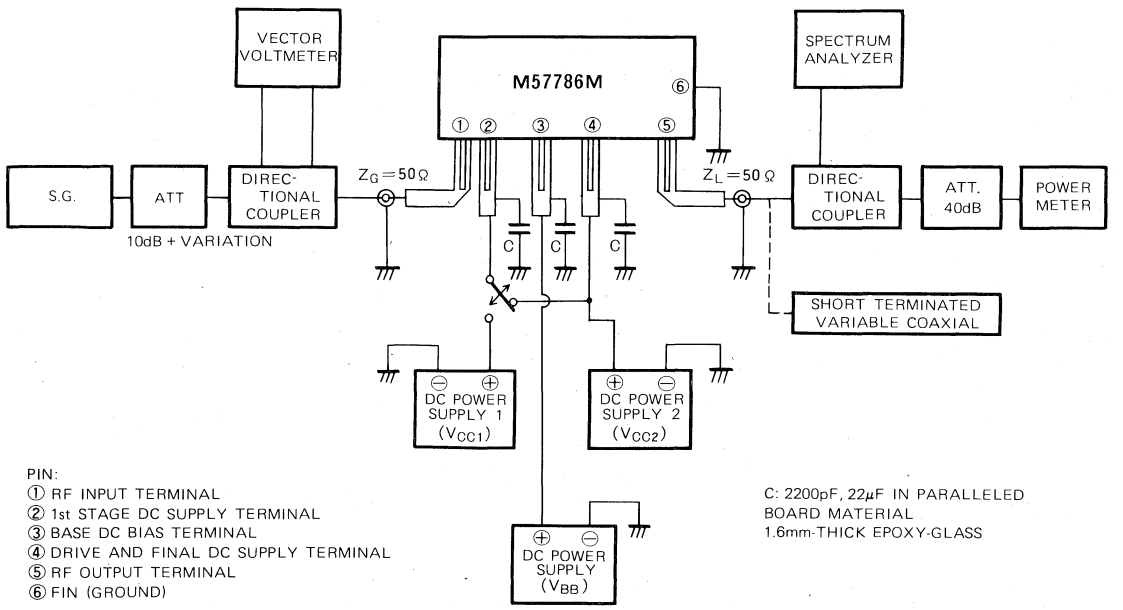
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		10	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\,\Omega$	100	mW
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30~−110	°C
T_{stg}	Storage temperature		−40~−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 7.2V, V_{BB} = 5V, f = 470~470MHz, P_{in} = 50mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic			−27	−25	dB
—	3nd harmonic			−35	−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 7.2V, V_{BB} = 5V, f = 430~470 MHz, P_O = 7W, $\rho_L \geqq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

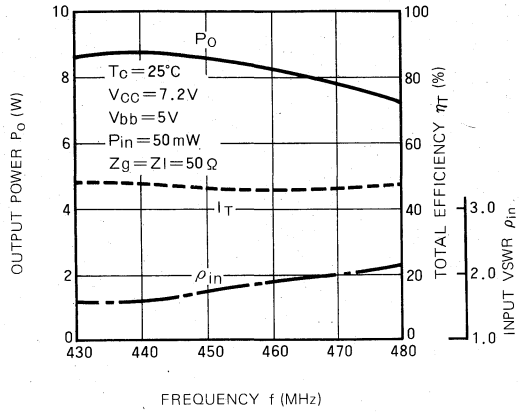


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

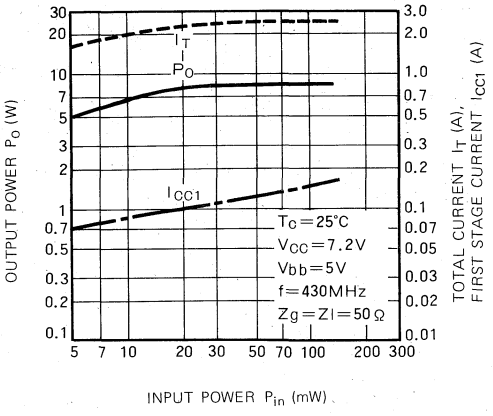
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

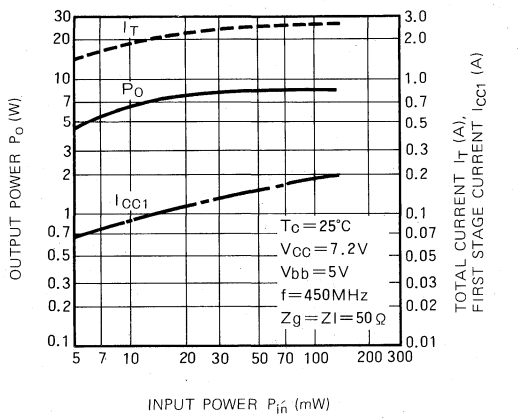
OUTPUT POWER, TOTAL EFFICIENCY INPUT VSWR VS. FREQUENCY CHARACTERISTICS



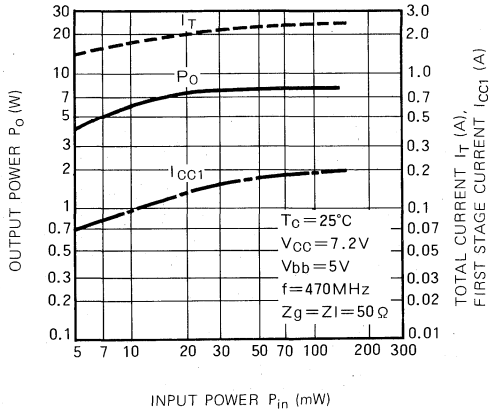
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



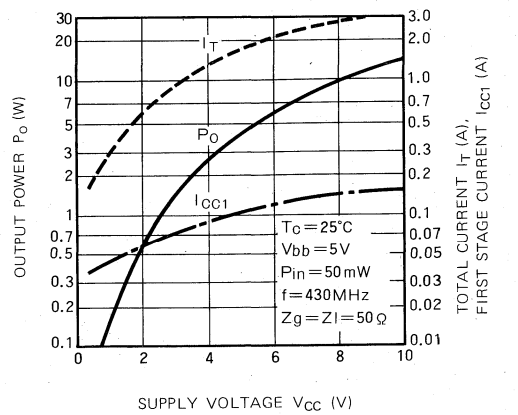
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



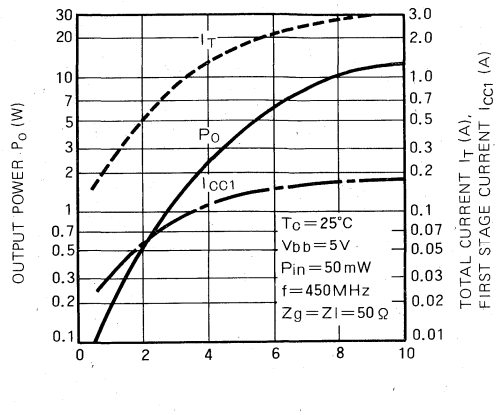
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



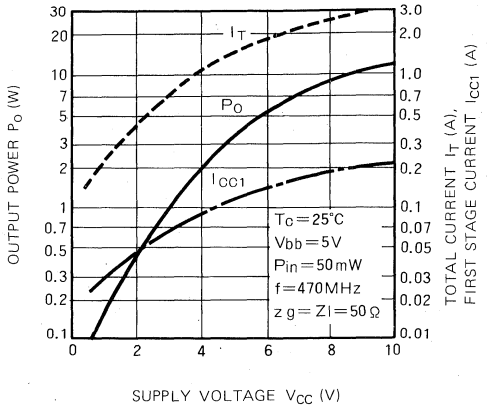
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



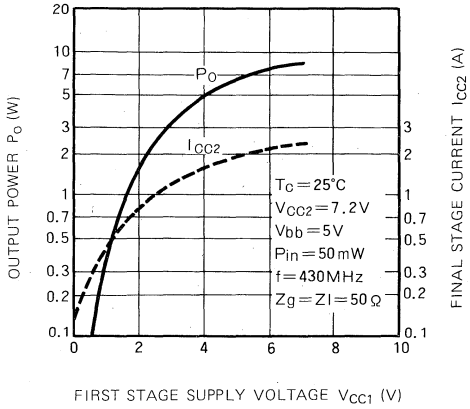
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



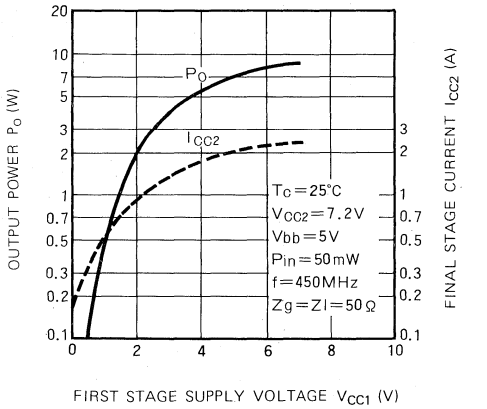
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



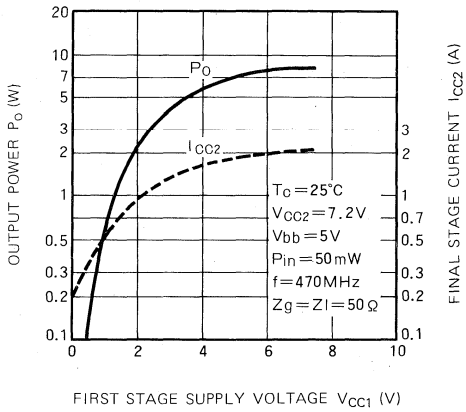
OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



MITSUBISHI ELECTRIC

M57786H

470~512MHz, 5W, FM PORTABLE RADIO

DESCRIPTION

M57786H is a thick film RF power module specifically designed for 470 ~ 512MHz, 5W FM portable sets.

FEATURES

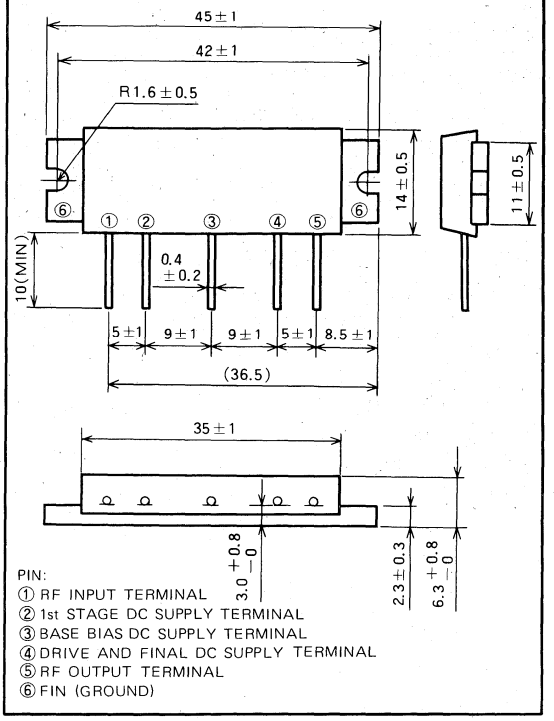
- Wide band: 42MHz, f = 470 ~ 512MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  Gp $\geqq$ 21dB @V_{CC} = 7.2V, Po $\geqq$ 7W, Pin = 50mW
- Small package: 45 x 14 x 6.3mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

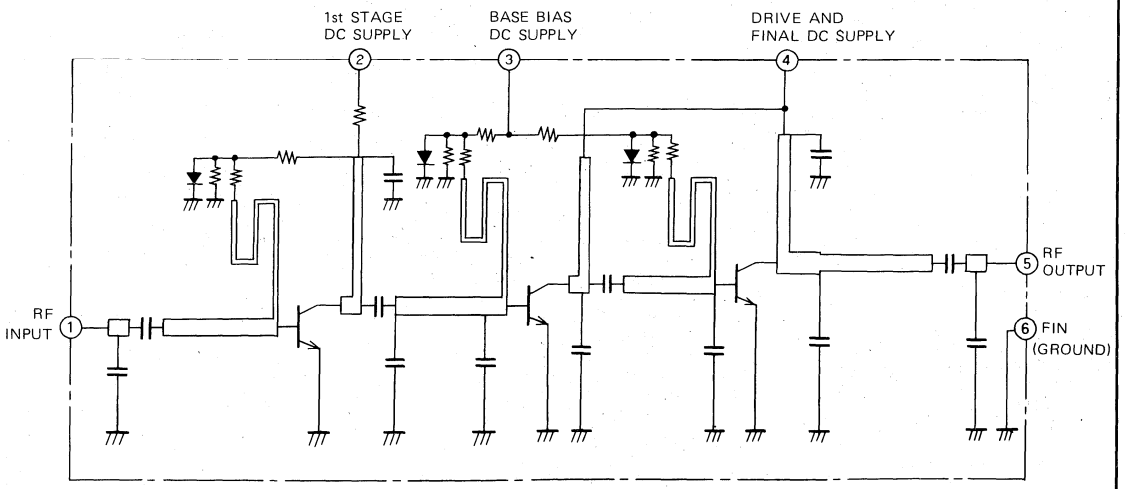
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



470～512MHz, 5W, FM PORTABLE RADIO

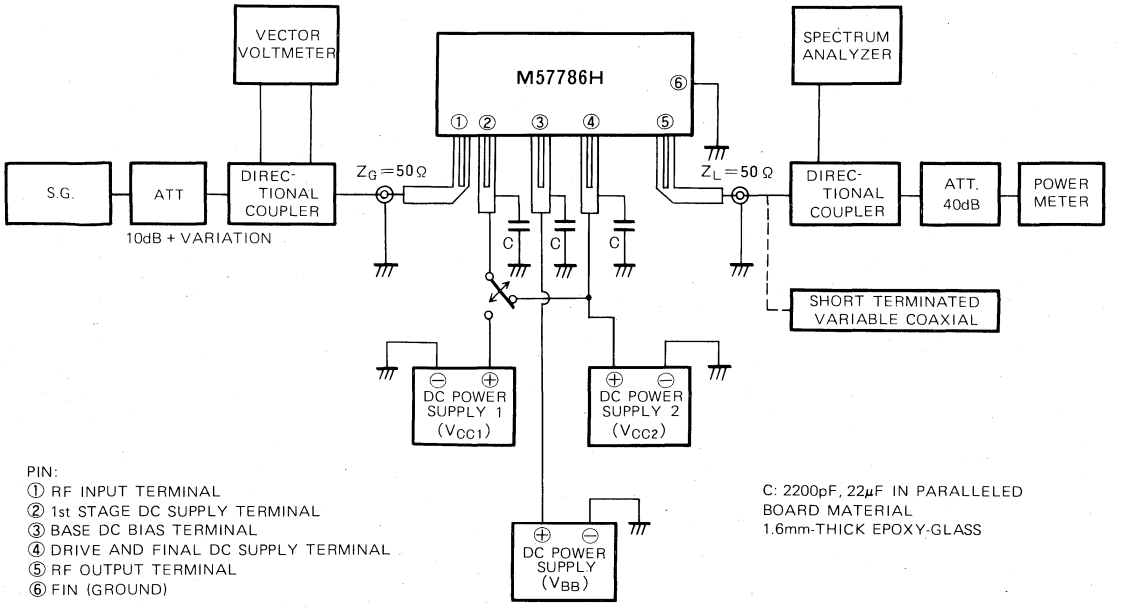
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		10	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\,\Omega$	100	mW
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 7.2V, V_{BB} = 5V, f = 470～512MHz, P_{in} = 50mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic			−27	−25	dB
—	3nd harmonic			−35	−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 7.2V, V_{BB} = 5V, f = 470～512 MHz, P_O = 7W, $\rho_L \geqq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM



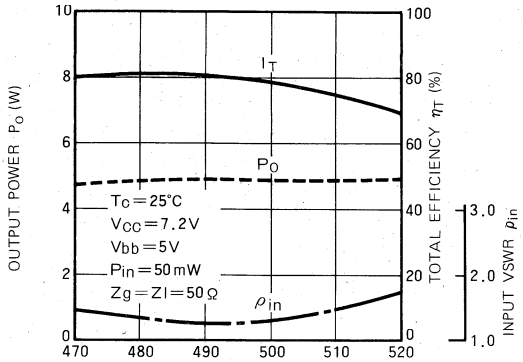
PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

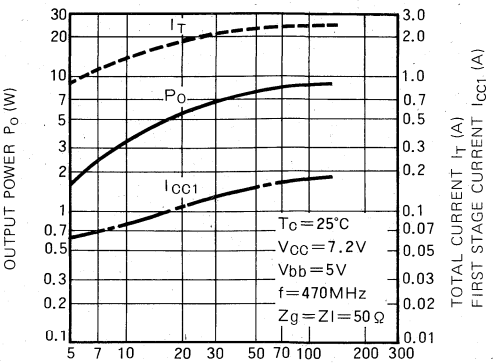
470~512MHz, 5W, FM PORTABLE RADIO

TYPICAL PERFORMANCE DATA

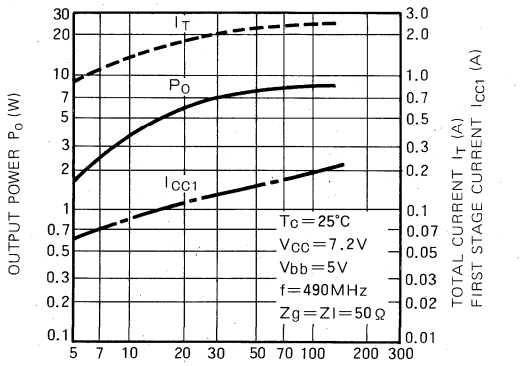
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



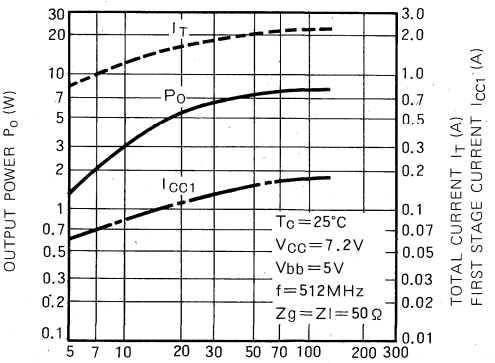
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



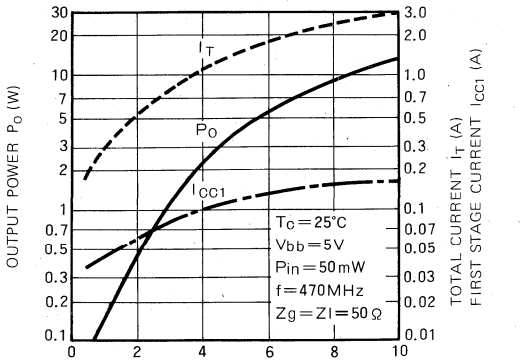
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



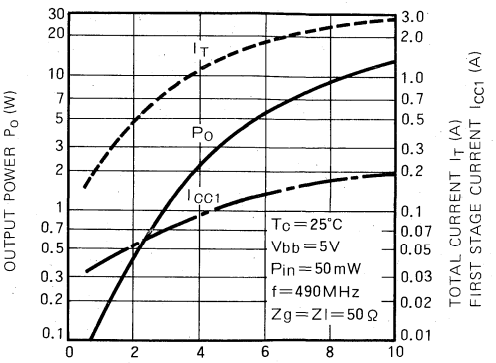
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



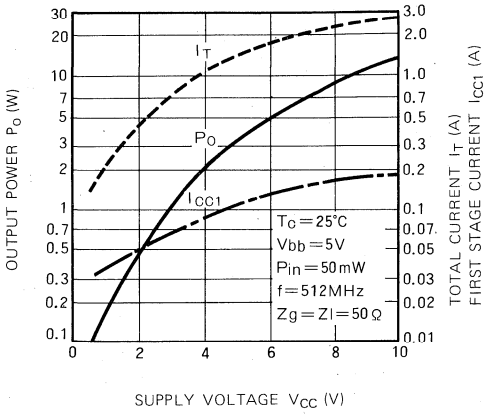
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



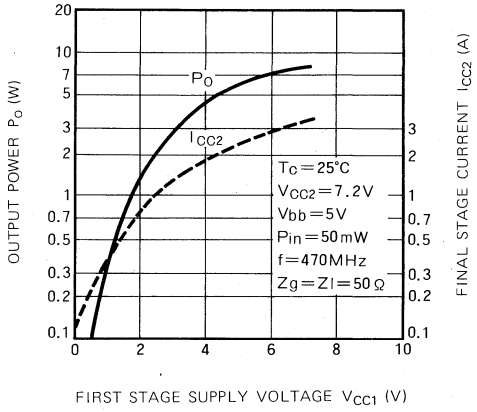
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



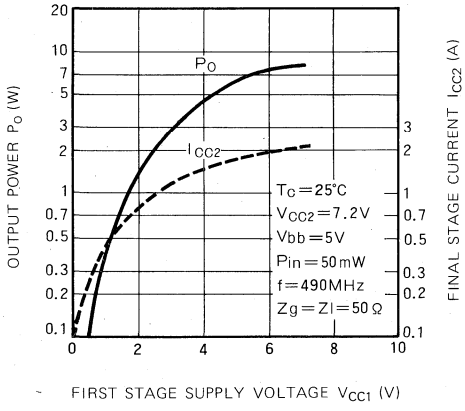
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



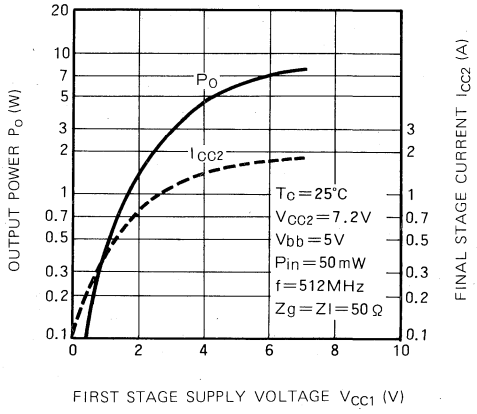
OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHRACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M57787

1.24～1.3GHz, 7.2V, 1W, FM PORTABLE RADIO

DESCRIPTION

M57787 is a thick film RF power module specifically designed for 1.24 ～ 1.3GHz, 1W FM portable sets.

FEATURES

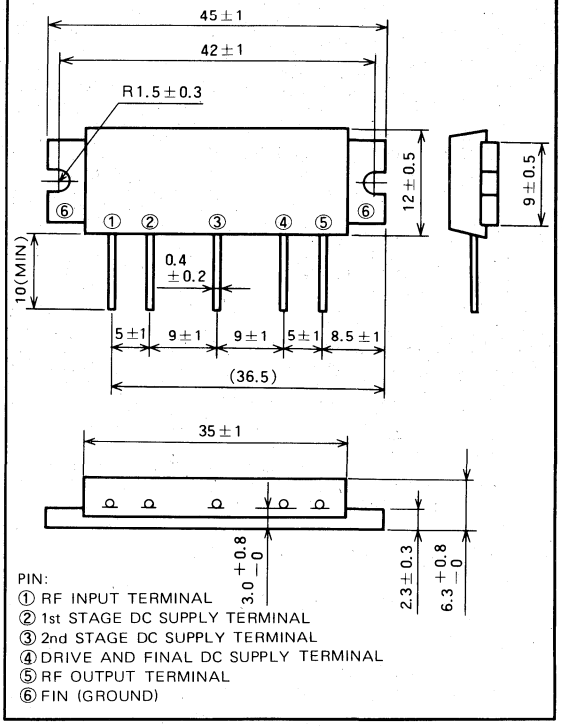
- High gain, High output power
  $G_p \geqq 23.3dB$, $P_o \geqq 1.5W$, @V_{CC} = 7.2V, P_{in} = 7mW
- High total efficiency
  η_T = 30% TYP, 28% MIN @V_{CC} = 7.2V, Pin = 7mW
- Small package: 45 x 12 x 6.3mm

APPLICATION

Output stage of output 1.2GHz band portable ratio sets. (especially 7.2V Battery sets)

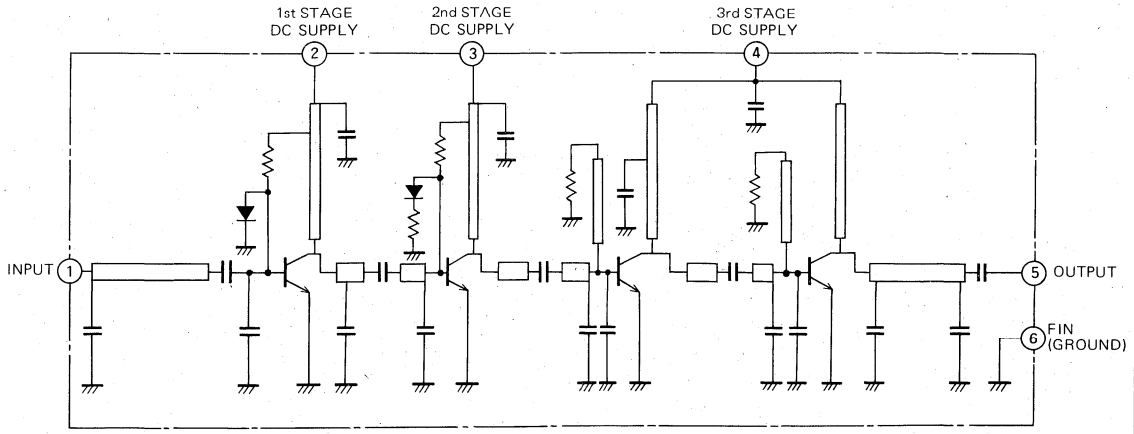
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



1.24～1.3GHz, 7.2V, 1W, FM PORTABLE RADIO

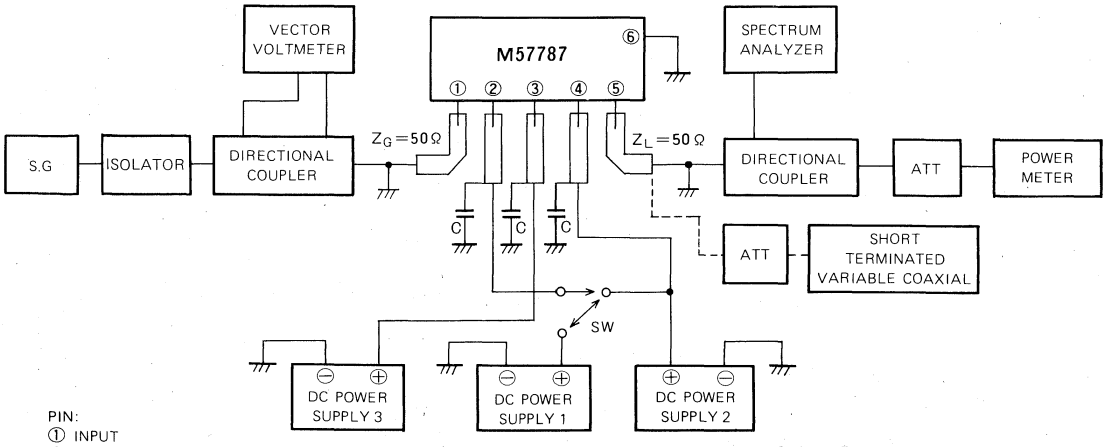
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	1st stage supply voltage		9	V
V_{CC2}	2nd stage supply voltage		9	V
V_{CC3}	3rd stage supply voltage		16	V
I_{CC}	Total current		1.5	A
P_{in}	Input power	$Zg = Zl = 50\Omega$, $V_{CC1} \leqq 8V$, $P_O \leqq 3W$	10	mW
P_O	Output power	$Zg = Zl = 50\Omega$	5	W
$T_C(op)$	Operation temperature		−20～+100	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power		1.5	1.7		W
η_T	Total efficiency		28	30		%
—	2nd harmonic	$V_{CC1} = V_{CC2} = V_{CC3} = 7.2V$, f = 1.24−1.3GHz, $P_{in} = 7mW$, $Zg = Zl = 50\Omega$			−30	dB
—	3rd harmonic				−35	dB
ρ_{in}	Input VSWR				2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2} = 9V$, $V_{CC3} = 15V$, f = 1.24～1.3 GHz, $P_O = 2W$, $Zg = Zl = 50\Omega$	20 : 1			—

TEST BLOCK DIAGRAM



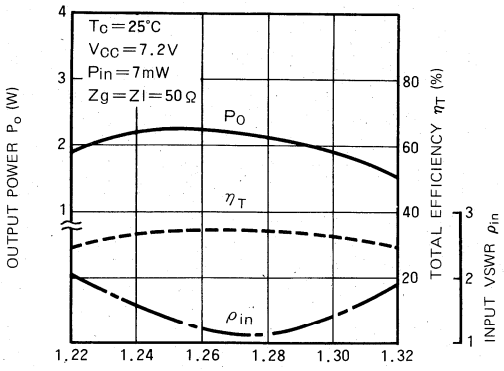
PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

C: 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS
INPUT AND OUTPUT STRIPLINE LENGTH
L = 35mm

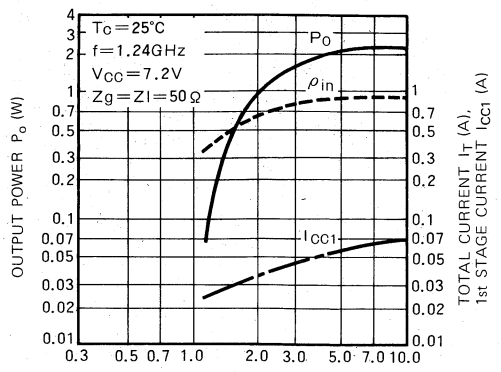
1.24～1.3GHz, 7.2V, 1W, FM PORTABLE RADIO

TYPICAL PERFORMANCE DATA

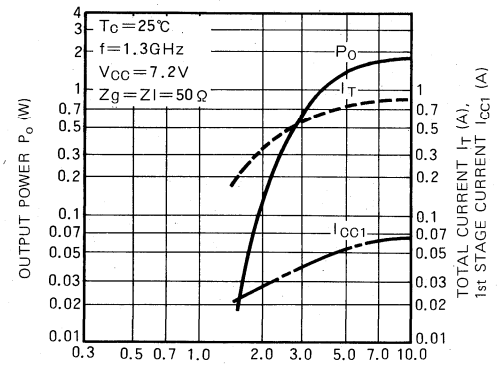
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



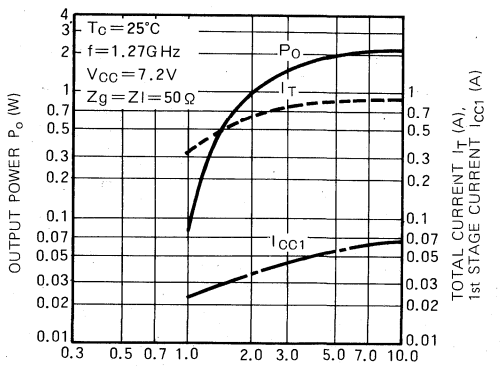
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



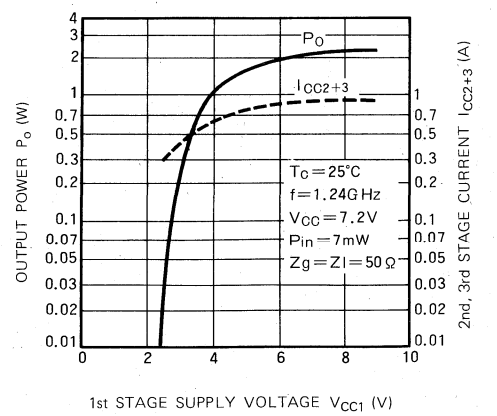
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



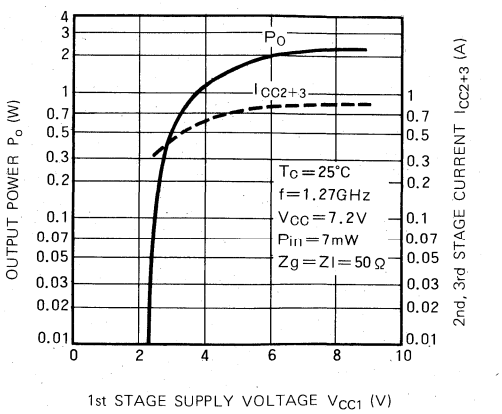
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



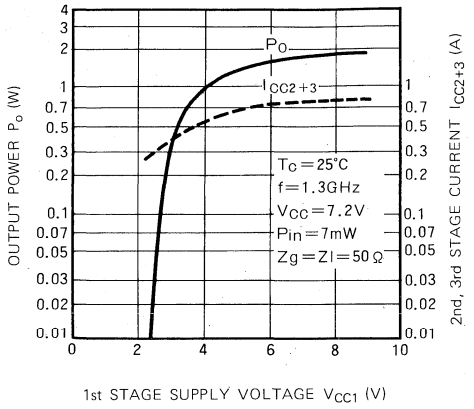
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



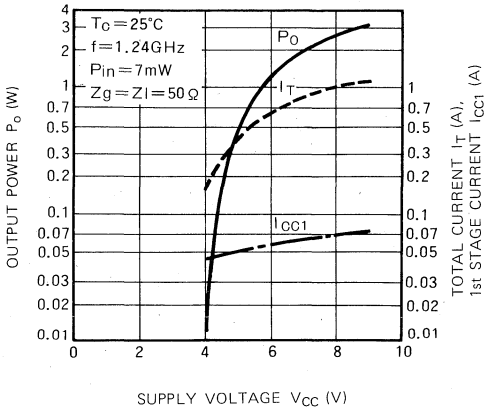
OUTPUT POWER, 2nd, 3rd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



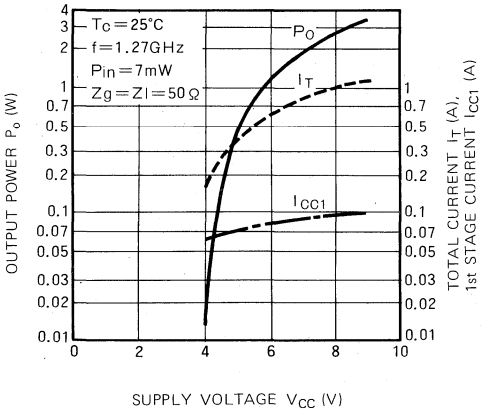
OUTPUT POWER, 2nd, 3rd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



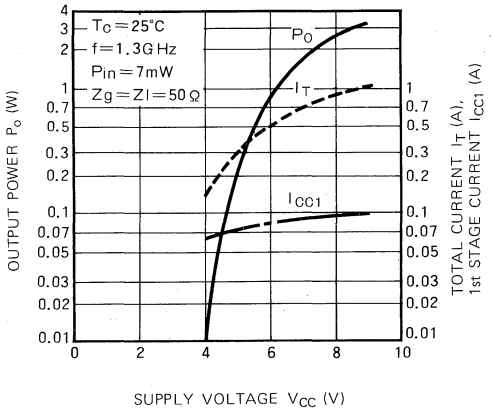
OUTPUT POWER, 2nd, 3rd STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



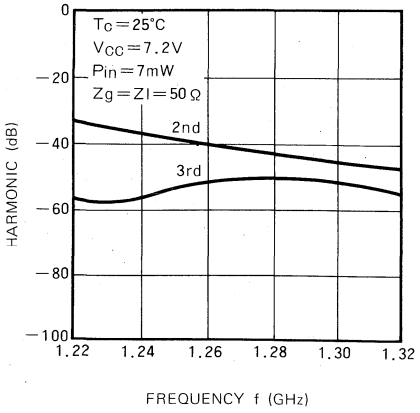
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M57789

890~915MHz BAND 6W MOBILE

DESCRIPTION

M57789 is a thick film RF power module specifically designed for 890 ~ 915MHz band NMT cellular 6W mobile radio.

FEATURES

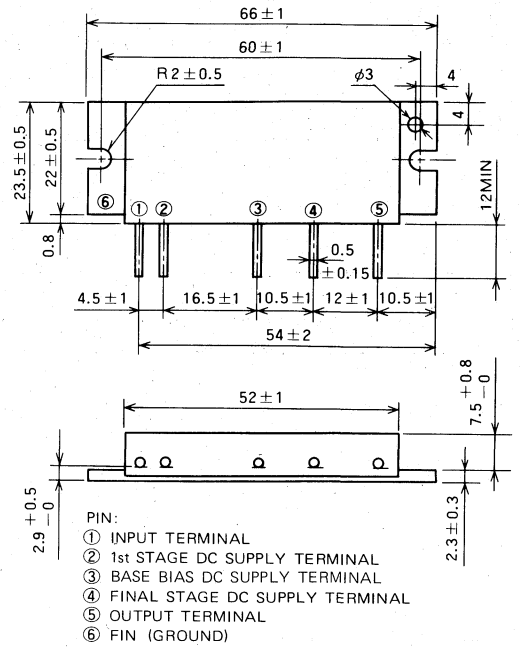
- Frequency range . . . . . 890 ~ 915MHz
- High power 12W
- High gain 33.8dB

APPLICATION

Output stage of 6W output mobile radio set in 890 ~ 915MHz ban NMT cellular radio.

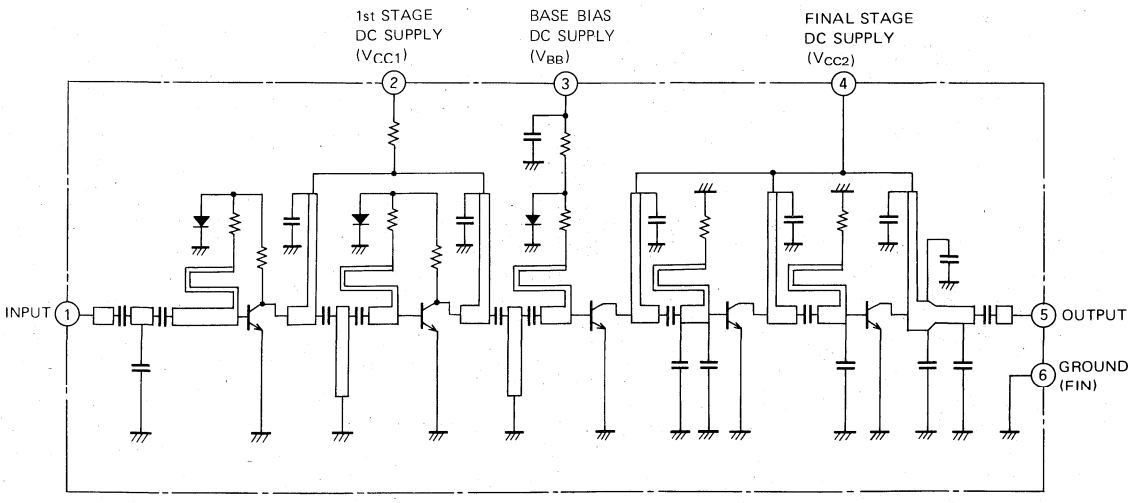
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



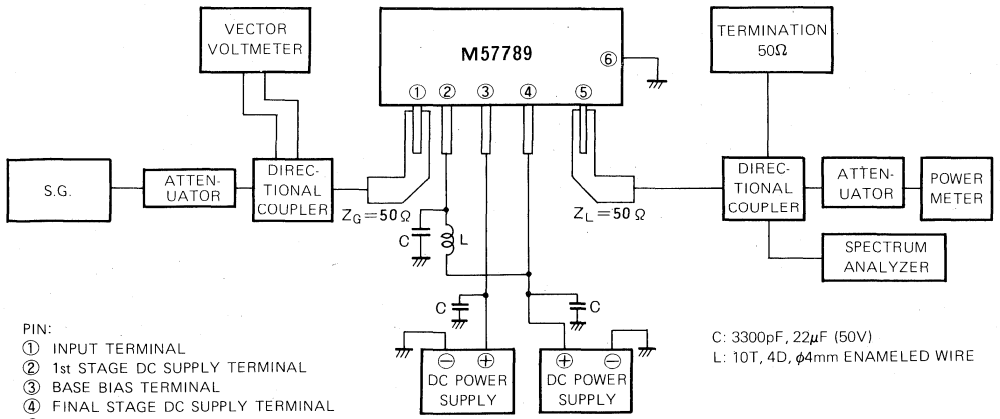
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	Supply voltage		13	V
V_{BB}	Base bias voltage		9	V
V_{CC2}	Supply voltage		17	V
I_{CC}	Total current		5	A
P_O	Output power	Z_O=50Ω	20	W
Pin	Input power	V_{CC1}≦12.5V	10	mW
Tc(op)	Operation case temperature		−30～+100	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ.	Max	
f	Frequency		890		915	MHz
P_O	Output power	V_{CC}=12.5V, V_{BB}=8V, P_{in}=5mW, Zg=Zl=50Ω	12			W
η_T	Total efficiency		30			%
—	2nd harmonics				−30	dB
ρin	Input VSWR				2.8	—
—	Load VSWR tolerance	V_{CC1}=12.5V, V_{CC2}=15.2V, V_{BB}=8V, P_O=12W, Z_G=50Ω, 5sec	20：1			—

TEST BLOCK DIAGRAM

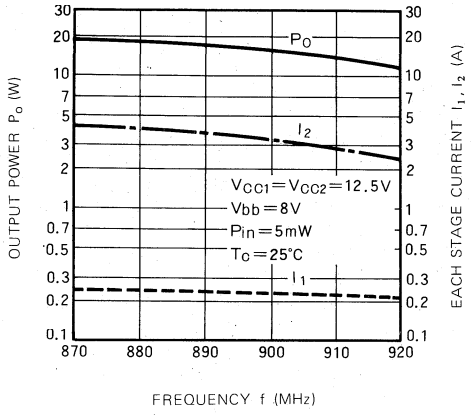


PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

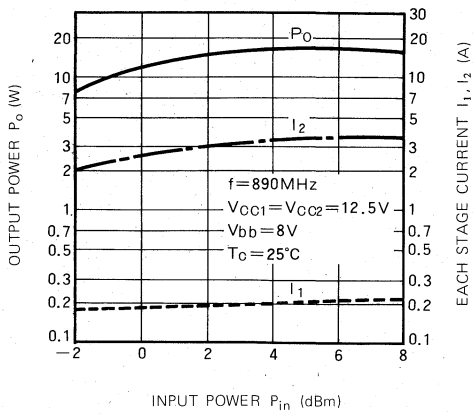
C: 3300pF, 22μF (50V)
L: 10T, 4D, φ4mm ENAMELED WIRE

TYPICAL PERFORMANCE DATA

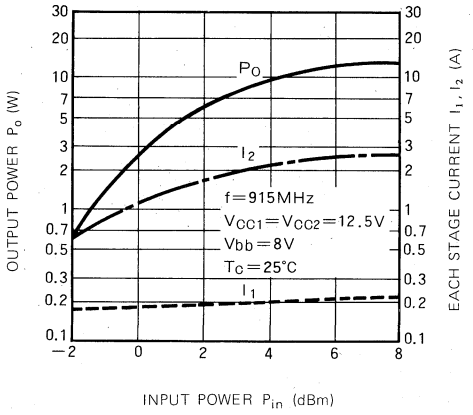
OUTPUT POWER, EACH STAGE CURRENT VS. FREQUENCY



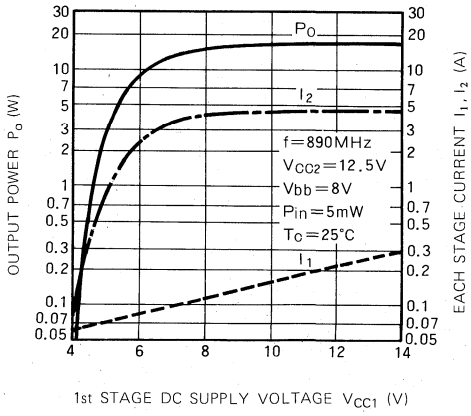
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



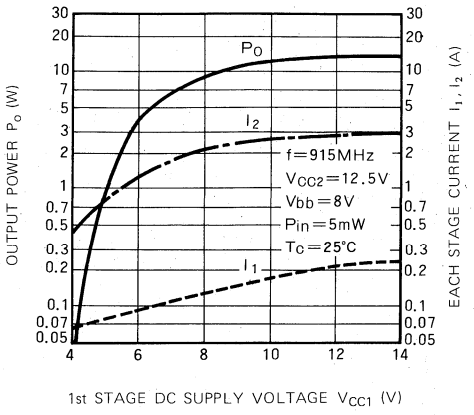
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



OUTPUT POWER, EACH STAGE CURRENT VS. 1st STAGE DC SUPPLY VOLTAGE



OUTPUT POWER, EACH STAGE CURRENT VS. 1st STAGE DC SUPPLY VOLTAGE



OUTPUT POWER, EACH STAGE CURRENT
VS. 1st AND 2nd STAGE DC SUPPLY VOLTAGE

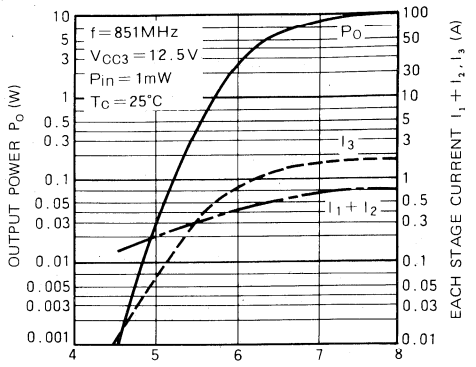


Table 1: The conditions at standard operation

Stage	V_{CC} (V)	I_T (mA)	Pin (mW)	P_O (mW)
1st	12.5	60	5	30
2nd	12.5	170	30	400
3rd	12.5	280	400	1300
4th	12.5	770	1300	4800
5th	12.5	1920	4800	12000

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to the following consideration when designing a heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistances between junction of incorporated transistors and case are shown in the followings.

a) First stage transistor
$R_{th(j-c)1}$ = 20°C/W (Typ.)

b) Second stage transistor
$R_{th(j-c)2}$ = 17.5°C/W (Typ.)

c) Third stage transistor
$R_{th(j-c)3}$ = 15°C/W (Typ.)

d) Fourth stage transistor
$R_{th(j-c)4}$ = 7.5°C/W (Typ.)

e) Final stage transistor
$R_{th(j-c)5}$ = 3.75°C/W (Typ.)

(2) V_{CC}, I_T, RF input & output power conditions at standard operation for each stage transistors are estimated as follows.

P_O = 12W, $V_{CC1} = V_{CC2} = V_{CC3}$ = 12.5V, P_{in} = 5mW, η_T = 30% (minimum ratings),
I_1 = 0.23A (Total current from 1st stage to 2nd stage)
I_2 = 2.97A (Total current from 3rd stage to 5th stage)
The conditions at standard operation for each stage transistors are shown in Table 1.

- Junction temperature of the first stage transistor
$T_{j1} = (V_{CC1} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (Note 1)
$= (12.5 \times 0.06 - 0.02 + 0.005) \times 20 + T_C$
$= 14.6 + T_C$ (°C)

Note 1: Case temperature of device

- Junction temperature of the second stage transistor
$T_{j2} = (V_{CC1} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
$= (12.5 \times 0.17 - 0.4 + 0.03) \times 17.5 + T_C$
$= 30.7 + T_C$ (°C)

- Junction temperature of the third stage transistor
$T_{j3} = (V_{CC2} \times I_{T3} - P_{O3} + P_{O2}) \times R_{th(j-c)3} + T_C$
$= (12.5 \times 0.28 - 1.3 + 0.4) \times 15 + T_C$
$= 39.0 + T_C$ (°C)

- Junction temperature of the fourth stage transistor
$T_{j4} = (V_{CC2} \times I_{T4} - P_{O4} + P_{O3}) \times R_{th(j-c)4} + T_C$
$= (12.5 \times 0.77 - 4.8 + 1.3) \times 7.5 + T_C$
$= 45.9 + T_C$ (°C)

- Junction temperature of the final stage transistor
$T_{j5} = (V_{CC3} \times I_{T5} - P_{O5} + P_{O4}) \times R_{th(j-c)5} + T_C$
$= (12.5 \times 1.92 - 12 + 4.8) \times 3.75 + T_C$
$= 63.0 + T_C$ (°C)

2. Heating sink design

In thermal design of heat sink, keep the case temperature below 90°C at output power P_O = 12W and ambient temperatue = 60°C.

The thermal resistance $R_{th(c-a)}$ (Note 2) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_P + P_{in}} = \frac{90 - 60}{(12/0.3 - 12 + 0.001)}$$

$= 1.00$ (°C/W)

Note 2: Including the contact thermal resistance between device and heat sink

Mounting the device on the heat sink with above thermal resistance, junction temperatures of each transistor become;
T_{j1} = 105°C, T_{j2} = 121°C, T_{j3} = 129°C, T_{j4} = 136°C,
T_{j5} = 153°C at T_a = 60°C, T_C = 90°C.
Since the annual average of ambient temperature is 30°C, junction temperatures of each transistor become;
T_{j1} = 75°C, T_{j2} = 91°C, T_{j3} = 99°C, T_{j4} = 106°C,
T_{j5} = 123°C.
As the maximum junction temperature of these incorporated transistors T_{jmax} are 153°C, application under fully derated condition is ensured.

M57791

890~915MHz, 3W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57791 is a thick film RF power module specifically designed for 890~915MHz, 3W FM mobile radios.

FEATURES

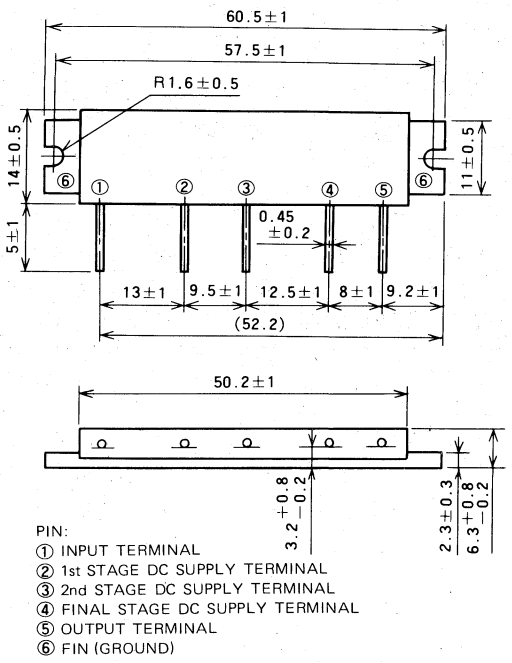
- Frequency Range . . . . . 890~915MHz
- High Power 7W
- High Gain 38.4dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC1} = V_{CC2} = 8V$, $V_{CC3} = 15.2V$, $P_O = 7W$.

APPLICATION

Output stage of 3W output mobile radio sets (FM) in 890~915MHz UHF band.

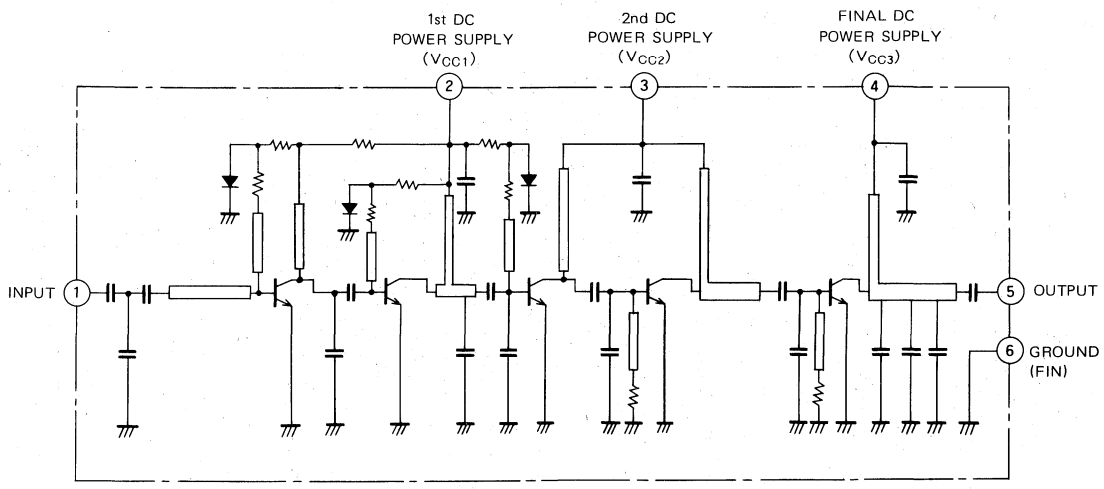
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



M57791

890～915MHz, 3W, FM FOR MOBILE RADIO APPLICATION

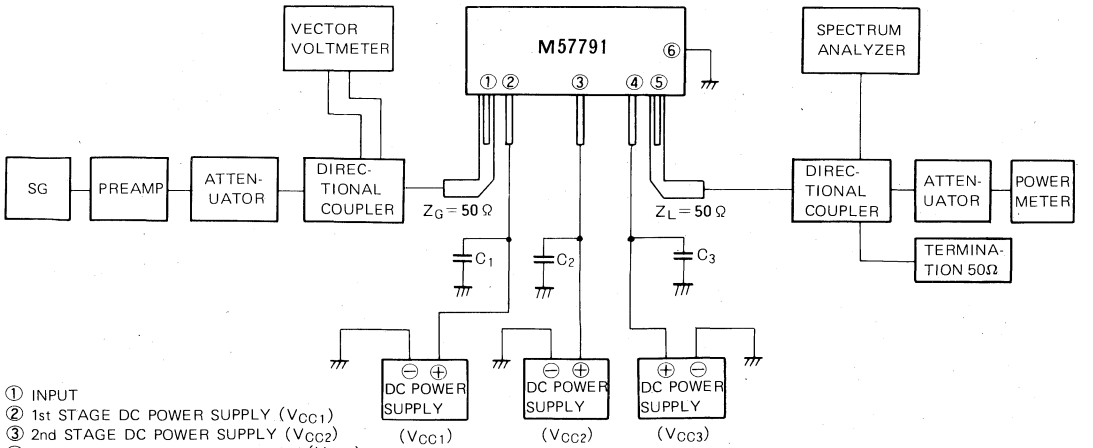
ABSOLUTE MAXIMUM RATINGS (T_C=25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC1,2}$	Supply voltage		9	V
V_{CC3}	Supply voltage		17	V
I_{CC}	Total current		4	A
P_{in}	Input power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 8V$	7	mW
P_O	Output power	$Z_G=Z_L=50\Omega$	10	W
$T_C(op)$	Operation case temperature		−30～+110	℃
T_{stg}	Storage temperature		−40～+110	℃

ELECTRICAL CHARACTERISTICS (T_C=25℃, unless otherwise noted)

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output Power	f=890～915MHz, $V_{CC1}=V_{CC2}=8V$, $V_{CC3}=12.5V$, $P_{in}=1mW$, $Z_G=Z_L=50\Omega$	7	9		W
η_T	Total efficiency		35	40		%
—	2nd Harmonics				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2		—
	Load VSWR tolerance	f=890～915MHz, $V_{CC1}=V_{CC2}=8V$, $V_{CC3}=15.2V$, $P_O=7W$, $Z_G=50\Omega$, 5sec	20 : 1			—

TEST BLOCK DIAGRAM



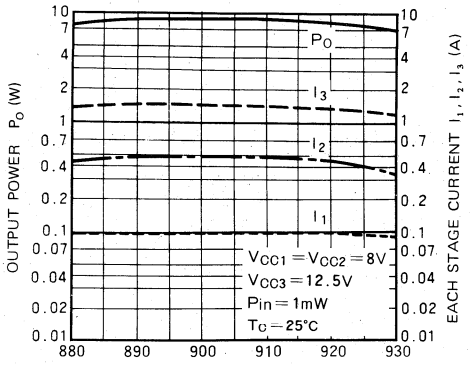
① INPUT
② 1st STAGE DC POWER SUPPLY (V_{CC1})
③ 2nd STAGE DC POWER SUPPLY (V_{CC2})
④ FINAL STAGE DC POWER SUPPLY (V_{CC3})
⑤ OUTPUT
⑥ GROUND (FIN)

C_1, C_2, C_3 : 4700pF, 10μF IN PARALLEL

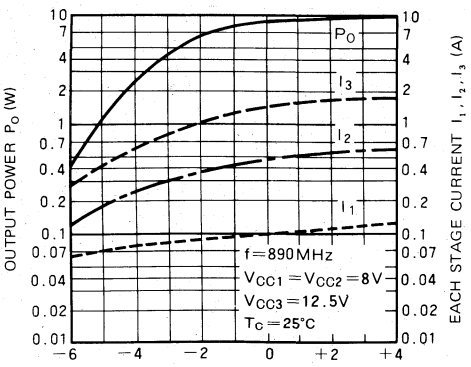
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

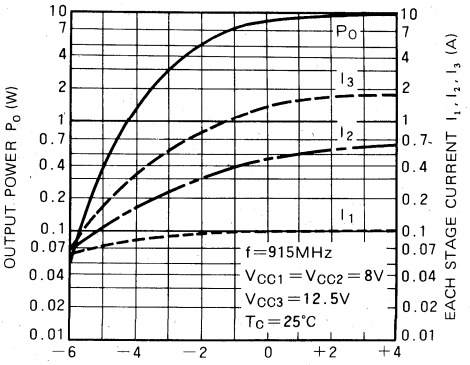
OUTPUT POWER, EACH STAGE CURRENT VS. FREQUENCY



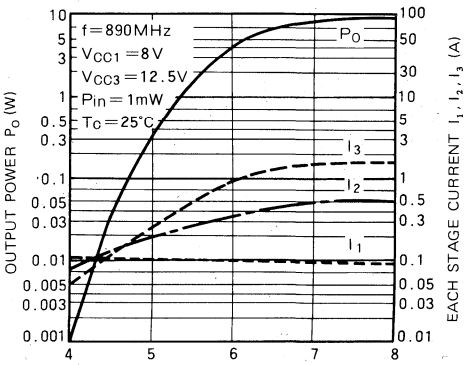
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



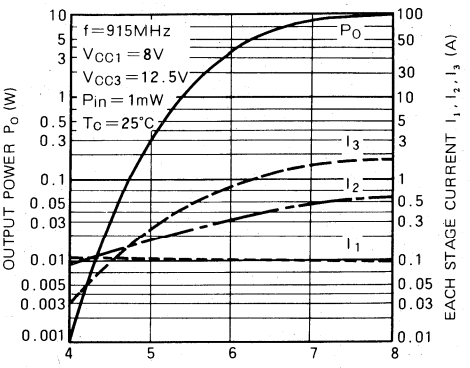
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



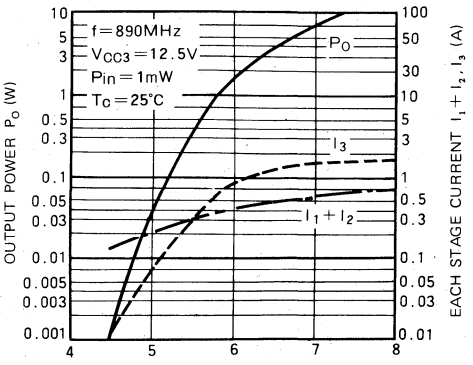
OUTPUT POWER, EACH STAGE CURRENT VS. 2nd STAGE DC SUPPLY VOLTAGE



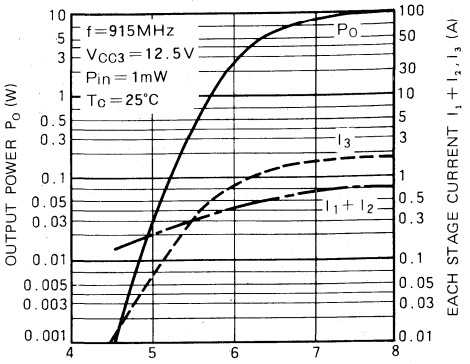
OUTPUT POWER, EACH STAGE CURRENT VS. 2nd STAGE DC SUPPLY VOLTAGE



OUTPUT POWER, EACH STAGE CURRENT VS. 1st AND 2nd STAGE DC SUPPLY VOLTAGE



OUTPUT POWER, EACH STAGE CURRENT
VS. 1st AND 2nd STAGE DC SUPPLY VOLTAGE



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to the following consideration when designing a heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistances between junction of incorporated transistors and case are shown in the followings.

a) First stage transistor
$R_{th(j-c)1}$ = 20°C/W (Typ.)

b) Second stage transistor
$R_{th(j-c)2}$ = 17.5°C/W (Typ.)

c) Third stage transistor
$R_{th(j-c)3}$ = 16°C/W (Typ.)

d) Fourth stage transistor
$R_{th(j-c)4}$ = 9°C/W (Typ.)

e) Final stage transistor
$R_{th(j-c)5}$ = 6.5°C/W (Typ.)

(2) V_{CC}, I_T, RF input & output power conditions at standard operation for each stage transistors are estimated as follows.

P_O = 7W, V_{CC1} = V_{CC2} = 8V, V_{CC3} = 12.5V, P_{in} = 1mW, η_T = 35% (minimum ratings),

I_{1+2} = 0.781A (Total current from 1st stage to 4th stage)

I_3 = 1.1A (Current of 5th stage)

The conditions at standard operation for each stage transistors are shown in Table 1.

- Junction temperature of the first stage transistor
$T_{j1} = (V_{CC1} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (Note 1)
$= (8 \times 0.045 - 0.02 + 0.001) \times 20 + T_C$
$= 6.8 + T_C$ (°C)

Note 1: Case temperature of device

- Junction temperature of the second stage transistor
$T_{j2} = (V_{CC1} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
$= (8 \times 0.08 - 0.2 + 0.02) \times 17.5 + T_C$
$= 8.1 + T_C$ (°C)

- Junction temperature of the third stage transistor
$T_{j3} = (V_{CC2} \times I_{T3} - P_{O3} + P_{O2}) \times R_{th(j-c)3} + T_C$
$= (8 \times 0.16 - 0.5 + 0.2) \times 16 + T_C$
$= 15.7 + T_C$ (°C)

- Junction temperature of the fourth stage transistor
$T_{j4} = (V_{CC2} \times I_{T4} - P_{O4} + P_{O3}) \times R_{th(j-c)4} + T_C$
$= (8 \times 0.496 - 2 + 0.5) \times 9 + T_C$
$= 22.2 + T_C$ (°C)

- Junction temperature of the final stage transistor
$T_{j5} = (V_{CC3} \times I_{T5} - P_O + P_{O4}) \times R_{th(j-c)5} + T_C$
$= (12.5 \times 1.1 - 7 + 2) \times 6.5 + T_C$
$= 56.9 + T_C$ (°C)

Table 1: The conditions at standard operation

Stage	V_{CC} (V)	I_T (mA)	P_{in} (mW)	P_O (mW)
1st	8	45	1	20
2nd	8	80	20	200
3rd	8	160	200	500
4th	8	496	500	2000
5th	12.5	1100	2000	7000

2. Heat sink design

In thermal design of heat sink, keep the case temperature below 90°C at output power P_O = 7W and ambient temperature = 60°C.

The thermal resistance $R_{th(c-a)}$ (Note 2) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(7/0.35 - 7 + 0.001)}$$

$= 2.31$ (°C/W)

Note 2: Including the contact thermal resistance between device and heat sink

Mounting the device on the heat sink with above thermal resistance, junction temperatures of each transistor become;

T_{j1} = 97°C, T_{j2} = 99°C, T_{j3} = 106°C, T_{j4} = 113°C, T_{j5} = 147°C at T_a = 60°C, T_C = 90°C.

Since the annual average of ambient temperature is 30°C, junction temperatures of each transistor become;

T_{j1} = 67°C, T_{j2} = 69°C T_{j3} = 76°C, T_{j4} = 76°C, T_{j5} = 117°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57792

806~870MHz, 15W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57792 is a thick film RF power module specifically designed for 806 ~ 870MHz, 15W FM mobile radios.

FEATURES

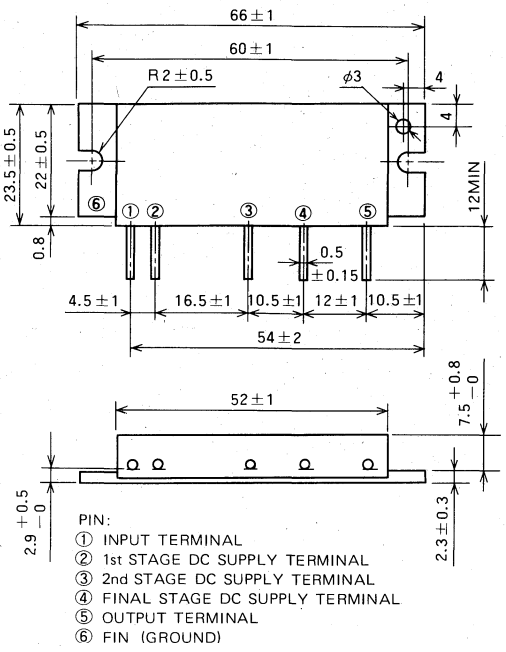
- Frequency Range . . . . . 806 ~ 870MHz
- High Power 20W
- High Gain 17dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 20W.

APPLICATION

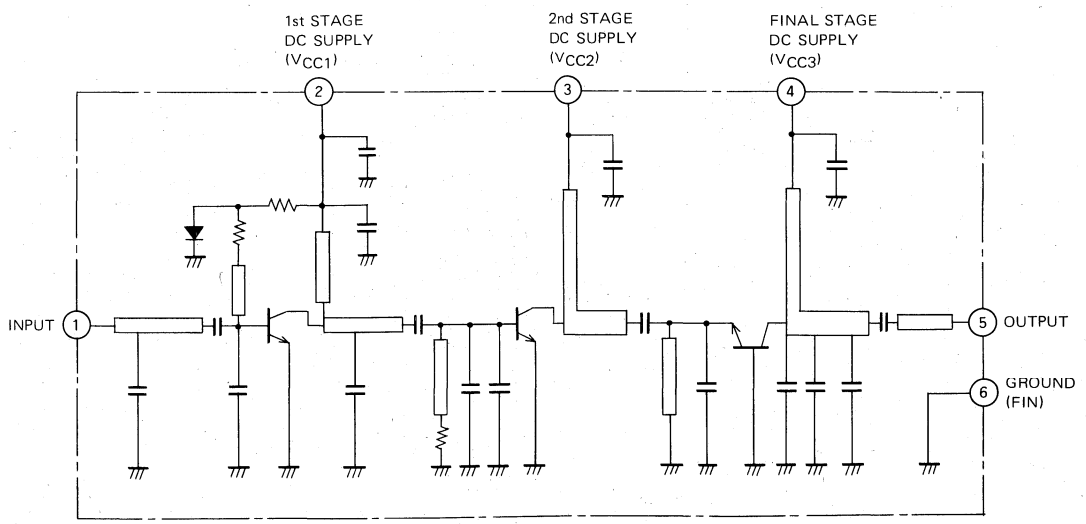
Drive stage of 35W output mobile radio sets (FM) in 806 ~ 870MHz UHF band.

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



M57792

806~870MHz, 15W, FM FOR MOBILE RADIO APPLICATION

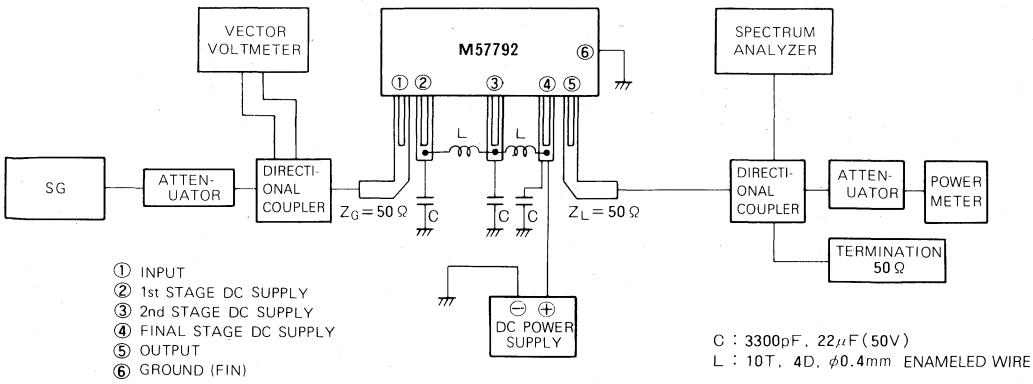
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	Supply voltage (1st)		14	V
$V_{CC2,3}$	Supply voltage (2nd, 3rd)		17	V
I_{CC}	Total current		7	A
P_{in}	Input power	$Z_G=Z_L=50\,\Omega$, $V_{CC1}\leqq 13.5V$	0.8	W
P_O	Output power	$Z_G=Z_L=50\,\Omega$	30	W
T_C (op)	Operation case temperature		−30~+110	°C
T_{stg}	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

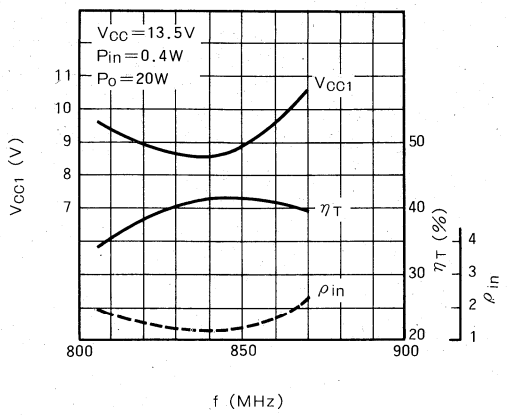
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	f=806~870MHz, V_{CC}=13.5V, P_{in}=0.4W, $Z_G=Z_L=50\,\Omega$	20			W
η_T	Total efficiency		30			%
—	2nd harmonics				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	f=806~870MHz, V_{CC1}=13.5V, $V_{CC2,3}$=15.5V, P_O=20W, Z_G=50Ω, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

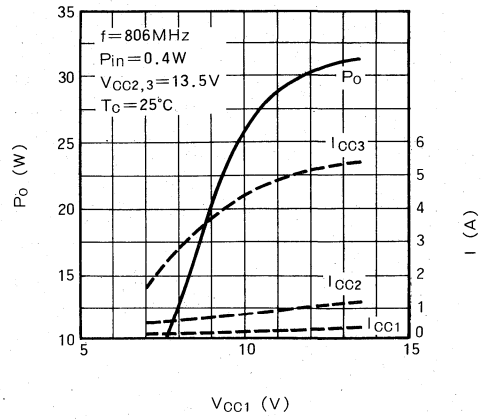


TYPICAL PERFORMANCE DATA

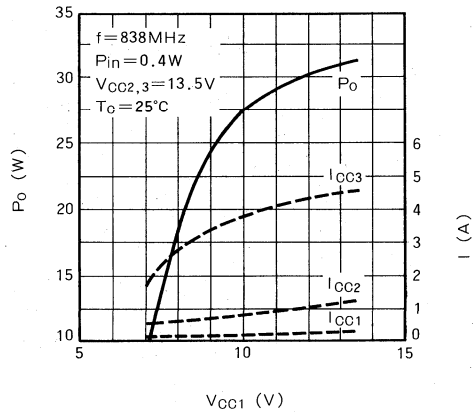
V_{CC1}, η_T, ρ_{in} CHARACTERISTIC
(P_O 20W SET)



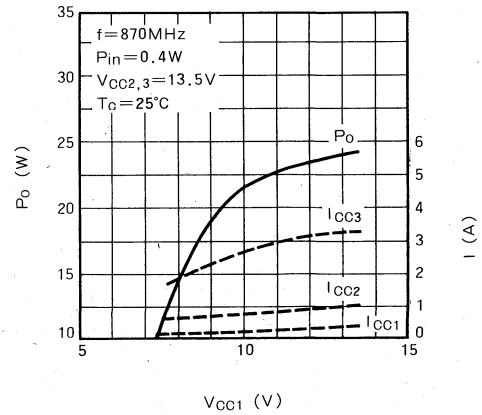
P_O, I VS. V_{CC1} CHARACTERISTIC



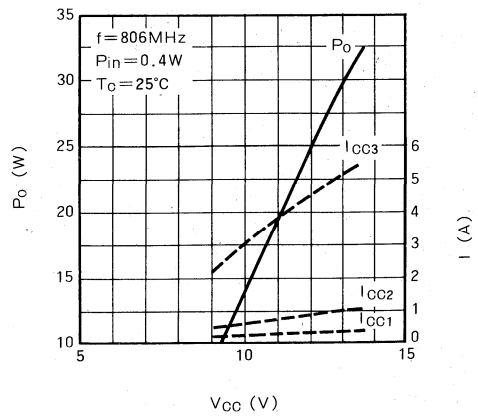
P_O, I VS. V_{CC1} CHARACTERISTIC



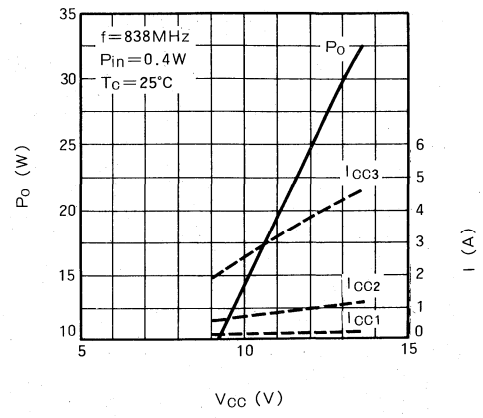
P_O, I VS. V_{CC1} CHARACTERISTIC



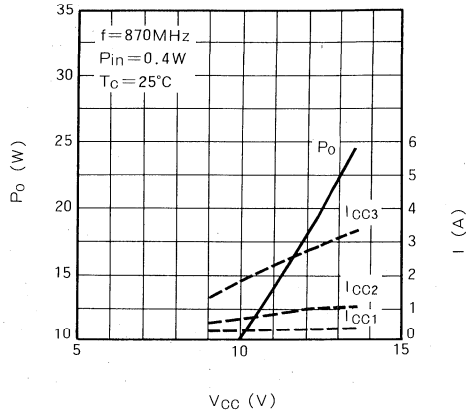
P_O, I VS. V_{CC} CHARACTERISTIC



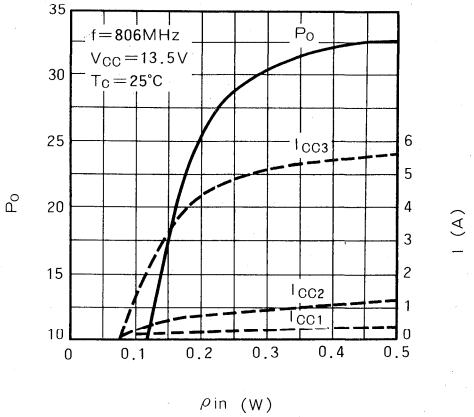
P_O, I VS. V_{CC} CHARACTERISTIC



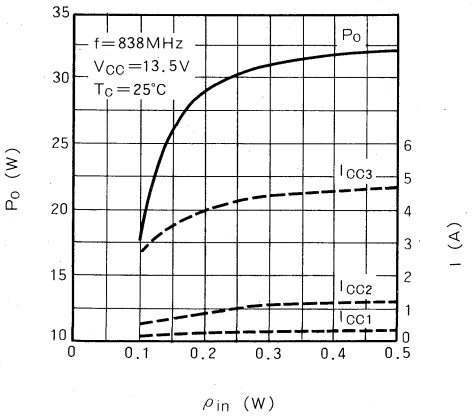
P_O , I VS. V_{CC} CHARACTERISTIC



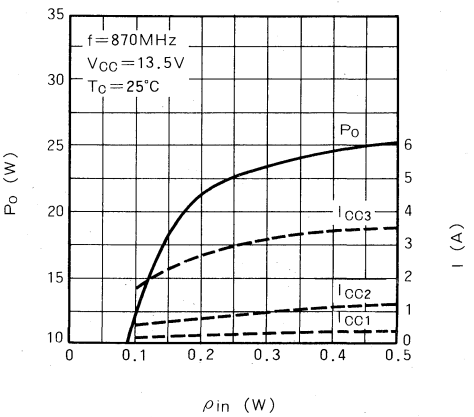
P_O , I VS. P_{in} CHARACTERISTIC



P_O , I VS. P_{in} CHARACTERISTIC



P_O , I VS. P_{in} CHARACTERISTIC



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operaton.

(1) Thermal resistance between junction and package of incorporated transistors.
   a) First stage transistor
      $R_{th(j-c)1}$ = 15°C/W (Typ.)
   b) Second stage transistor
      $R_{th(j-c)2}$ = 3°C/W (Typ.)
   c) Final stage transistor
      $R_{th(j-c)3}$ = 1.87°C/W (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

- Conditions for standard operation.
  P_O = 20W, V_{CC} = 13.5V, P_{in} = 0.4W, η_T = 30% (minimum rating), P_{O1} (Note 1) = 3W, P_{O2} (2) = 10W, I_T = 4.9A (I_{T1} (3) = 0.4A, I_{T2} (4) = 1.4A, I_{T3} (5) = 3.1A)
  Note 1: Output power of the first stage transistor
  Note 2: Output power of the second stage transistor
  Note 3: Circuit current of the first stage transistor
  Note 4: Circuit current of the second stage transistor
  Note 5: Circuit current of the final stage transisotr
- Junction temperature of the first stage transistor
  $T_{j1} = (V_{CC} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (6)
  $= (13.5 \times 0.4 - 3 + 0.4) \times 15 + T_C$
  $= 42 + T_C$ (°C)
  Note 6: Package temperature of device
- Junction temperature of the second stage transistor
  $T_{j2} = V_{CC} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
  $= (13.5 \times 1.4 - 10 + 3) \times 3 + T_C$
  $= 35.7 + T_C$ (°C)
- Junction temperature of the final stage transistor
  $T_{j3} = (V_{CC} \times I_{T3} - P_O + P_{O2}) \times R_{th(j-c)3} + T_C$
  $= (13.5 \times 3.1 - 20 + 10) \times 1.87 + T_C$
  $= 59.6 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 20W below 90°C.

The thermal resistance $R_{th(c-a)}$ (7) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(20/0.3) - 20 + 0.4}$$

$$= 0.637\ (°C/W)$$

Note 7: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device,

T_{j1} = 132°C, T_{j2} = 125.7°C, T_{j3} = 149.6°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 102°C, T_{j2} = 95.7°C, T_{j3} = 119.6°C.

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57793

903~905MHz, 5W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M57793 is a thick film RF power module specifically designed for 903 ~ 905MHz, 5W FM mobile radios.

FEATURES

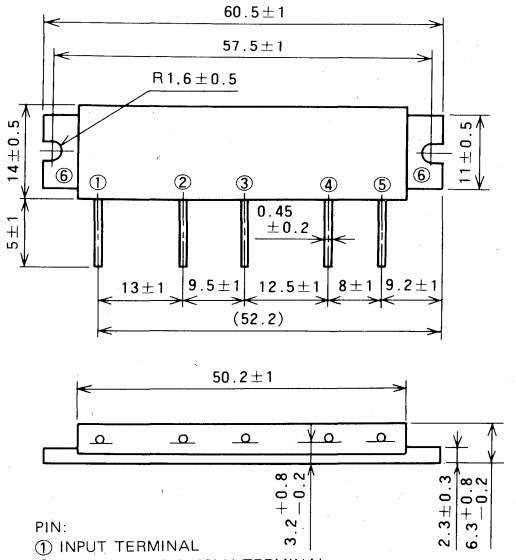
- Frequency Range . . . . . 903 ~ 905MHz
- High Power 7W
- High Gain 38.4dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC1} = V_{CC2} = 8V, V_{CC3} = 15.2V, P_O = 7W.

APPLICATION

Output stage of 3W output mobile radio sets (FM) in 903 ~ 590MHz UHF band.

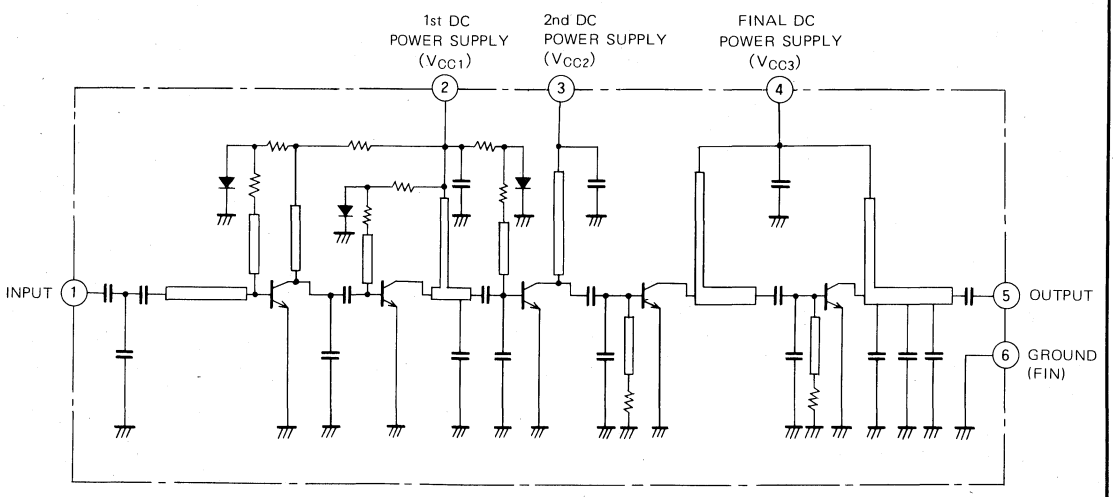
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

903~905MHz, 5W, FM
FOR MOBILE RADIO APPLICATION

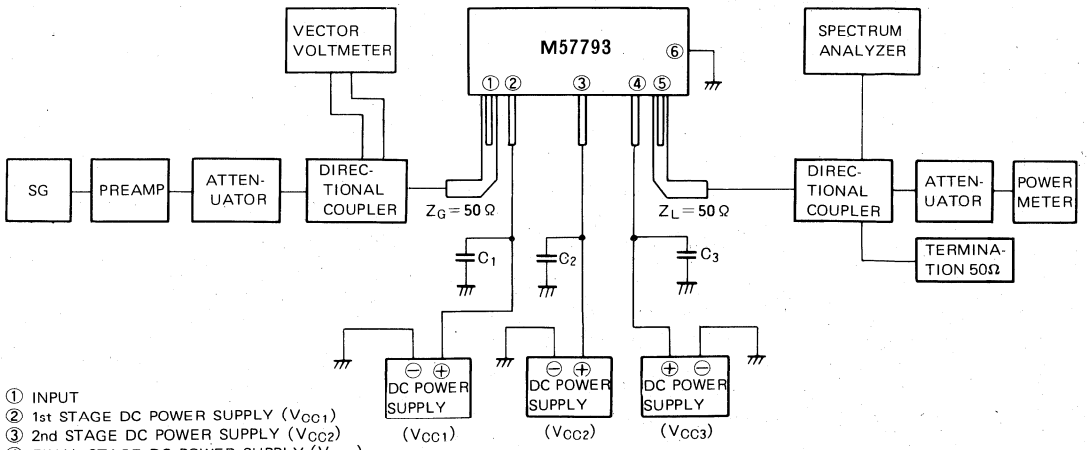
ABSOLUTE MAXIMUM RATINGS (T_C = 25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC1,2}$	Supply voltage		9	V
V_{CC3}	Supply voltage		17	V
I_{CC}	Total current		4	A
P_{in}	Input power	$Z_G = Z_L = 50\,\Omega$, $V_{CC1} \leqq 8V$	7	mW
P_O	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
T_C(op)	Operation case temperature		−30~+110	℃
Tstg	Storage temperature		−40~+110	℃

ELECTRICAL CHARACTERISTICS (T_C = 25℃, unless otherwise noted)

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output Power	f = 903~905MHz, $V_{CC1} = V_{CC2} = 8V$, $V_{CC3} = 12.5V$, $P_{in} = 1mW$, $Z_G = Z_L = 50\,\Omega$	7	9		W
η_T	Total efficiency		35	38		%
—	2nd Harmonics				−30	dB
ρ_{in}	Input VSWR				2.5	—
ρ_{out}	Output VSWR			2		—
—	Load VSWR tolerance	f = 903~905MHz, $V_{CC1} = V_{CC2} = 8V$, $V_{CC3} = 15.2V$, $P_O = 7W$, $Z_G = 50\,\Omega$, 5sec	20 : 1			—

TEST BLOCK DIAGRAM

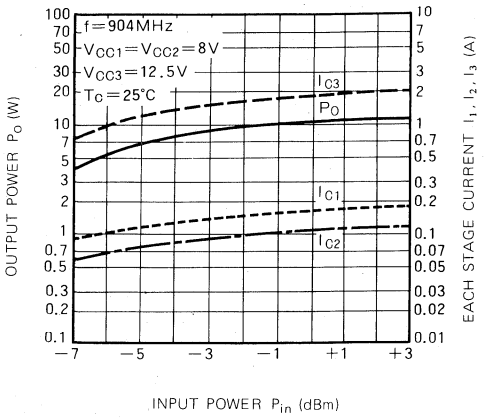


① INPUT
② 1st STAGE DC POWER SUPPLY (V_{CC1})
③ 2nd STAGE DC POWER SUPPLY (V_{CC2})
④ FINAL STAGE DC POWER SUPPLY (V_{CC3})
⑤ OUTPUT
⑥ GROUND (FIN)

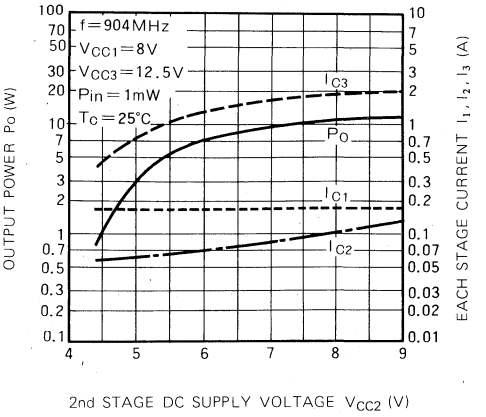
C_1, C_2, C_3 : 4700pF, 10μF IN PARALLEL

TYPICAL PERFORMANCE DATA

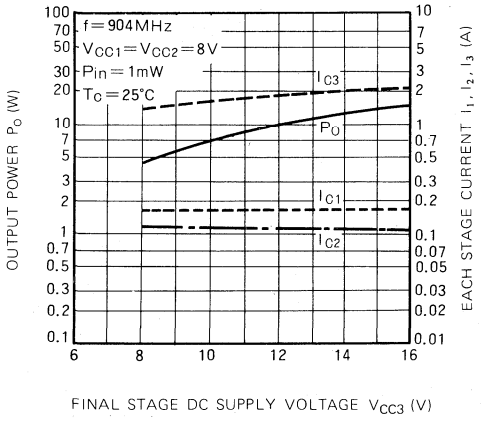
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



OUTPUT POWER, EACH STAGE CURRENT VS. 2nd STAGE DC SUPPLY VOLTAGE



OUTPUT POWER, EACH STAGE CURRENT VS. FINAL STAGE DC SUPPLY VOLTAGE



APC Method

For Automatic Power Control (APC), we recommend the method by V_{CC2} control.

Please regulate each stage supply voltage and input power as followings:

Symbol	Center value	Allowable changing value
P_{in}	1mW	0.7 ~ 3mW
V_{CC1}	8V	7 ~ 8.5V
V_{CC2}	3 ~ 8V	—
V_{CC3}	13.5V	12.5V ~ 13.8V

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to the following consideration when designing a heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistances between junction of incorporated transistors and case are shown in the followings.

a) First stage transistor
$R_{th(j-c)1} = 20°C/W$ (Typ.)

b) Second stage transistor
$R_{th(j-c)2} = 17.5°C/W$ (Typ.)

c) Third stage transistor
$R_{th(j-c)3} = 16°C/W$ (Typ.)

d) Fourth stage transistor
$R_{th(j-c)4} = 9°C/W$ (Typ.)

e) Final stage transistor
$R_{th(j-c)5} = 6.5°C/W$ (Typ.)

(2) V_{CC}, I_T, RF input & output power conditions at standard operation for each stage transistors are estimated as follows.

$P_O = 7W$, $V_{CC1} = V_{CC2} = 8V$, $V_{CC3} = 12.5V$, $P_{in} = 1mW$, $\eta_T = 35\%$ (minimum ratings),

$I_{1+2} = 0.781A$ (Total current from 1st stage to 4th stage)

$I_3 = 1.43A$ (Current of 5th stage)

The conditions at standard operation for each stage transistors are shown in Table 1.

Junction temperature of the first stage transistor

$$T_{j1} = (V_{CC1} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C \text{ (Note 1)}$$
$$= (8 \times 0.05 - + 0.001) \times 20 + T_C$$
$$= 7.6 + T_C \ (°C)$$

Note 1: Case temperature of device

Junction temperature of the second stage transistor

$$T_{j2} = (V_{CC1} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$$
$$= (8 \times 0.09 - 0.2 + 0.02) \times 17.5 + T_C$$
$$= 9.5 + T_C \ (°C)$$

Junction temperature of the third stage transistor

$$T_{j3} = (V_{CC2} \times I_{Te} - P_{O3} + P_{O2}) \times R_{th(j-c)3} + T_C$$
$$= (8 \times 0.12 - 0.5 + 0.2) \times 16 + T_C$$
$$= 11.6 + T_C \ (°C)$$

Junction temperature of the fourth stage transistor

$$T_{j4} = (V_{CC2} \times I_{T4} - P_{O4} + P_{O3}) \times R_{th(j-c)4} + T_C$$
$$= (12.5 \times 0.43 - 2 + 0.5) \times 9 + T_C$$
$$= 34.9 + T_C \ (°C)$$

Junction temperature of the final stage transistor

$$T_{j5} = (V_{CC3} \times I_{T5} - P_{O5} + P_{O4}) \times R_{th(j-c)5} + T_C$$
$$= (12.5 \times 1.0 - 7 + 2) \times 6.5 + T_C$$
$$= 48.8 + T_C \ (°C)$$

2. Heat sink design

In thermal design of heat sink, keep the case temperature below 90°C at output power P_O = 7W and ambient temperature = 60°C.

Table 1: The conditions at standard operation

Stage	V_{CC} (V)	I_T (mA)	P_{in} (mW)	P_O (mW)
1st	8	50	1	20
2nd	8	90	20	200
3rd	8	120	200	500
4th	8	430	500	2000
5th	12.5	1000	2000	7000

The thermal resistance $R_{th(c-a)}$ (Note 2) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(7/0.35 - 7 + 0.001)}$$
$$= 2.31(°C/W)$$

Note 2: Including the contact thermal resistance between device and heat sink

Mounting the device on the heat sink with above thermal resistance, junction temperatures of each transistor become;

T_{j1} = 98°C, T_{j2} = 100°C, T_{j3} = 102°C, T_{j4} = 125°C, T_{j5} = 139°C at T_a = 60°C, T_C = 90°C.

Since the annual average of ambient temperature is 30°C, junction temperatures of each transistor become;

T_{j1} = 68°C, T_{j2} = 70°C, T_{j3} = 72°C, T_{j4} = 95°C, T_{j5} = 109°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M57796MA

144~148MHz, 12.5V, 5W FM PORTABLE RADIO

DESCRIPTION

M57796MA is a thick film RF power module specifically designed for 144 ~ 148MHz, 5W FM portable sets.

FEATURES

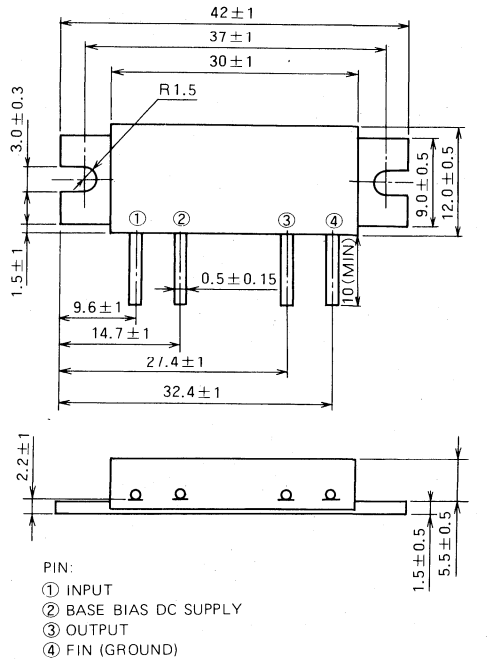
- High Gain, High Output RF Power and High Total Efficiency
  $G_p \geqq 15dB$, $P_O \geqq 7W$, $\eta_T \geqq 50\%$ (55% Typ.)
  @V_{CC} = 12.5V, V_{BB} = 5V, P_{in} = 200mW
- Small Package: 42 x 12 x 5.5mm

APPLICATION

Output stage of 5W output power VHF band Portable sets.

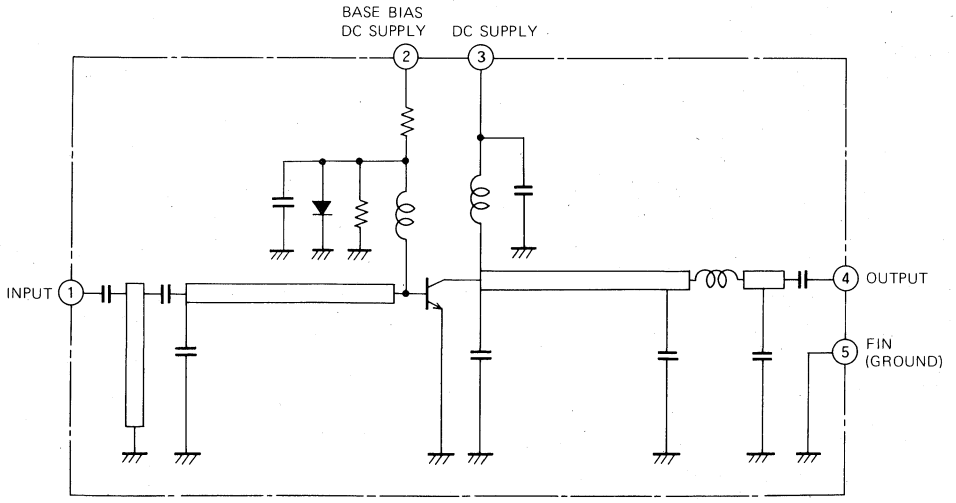
OUTLINE DIAGRAM

Dimensions in mm



PIN:
① INPUT
② BASE BIAS DC SUPPLY
③ OUTPUT
④ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

144～148MHz, 12.5V, 5W FM PORTABLE RADIO

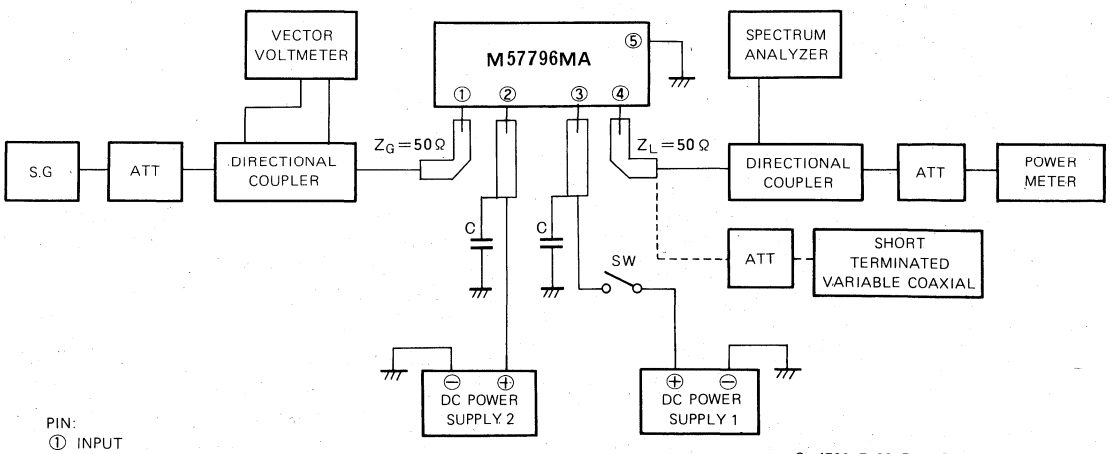
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		16	V
V_{BB}	Base bias voltage		6	V
I_{CC}	Total current		3	A
P_{in}	Input power	$Z_G = Z_L = 50\,\Omega$	300	W
P_O	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{bb}=5V, f=144～148MHz, P_{in}=200mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		50	55		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR				2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC}=13.2V, V_{bb}=5V, f=144～148MHz, P_O=7W, $\rho_L \geqq 20$(All phase), $Z_G = 50\,\Omega$				—

TEST BLOCK DIAGRAM

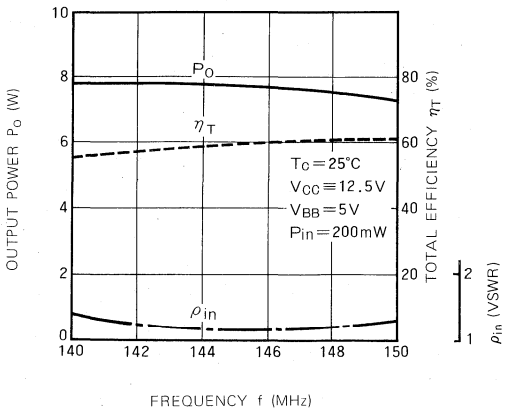


PIN:
① INPUT
② BASE BIAS DC SUPPLY
③ DC SUPPLY
④ OUTPUT
⑤ FIN (GROUND)

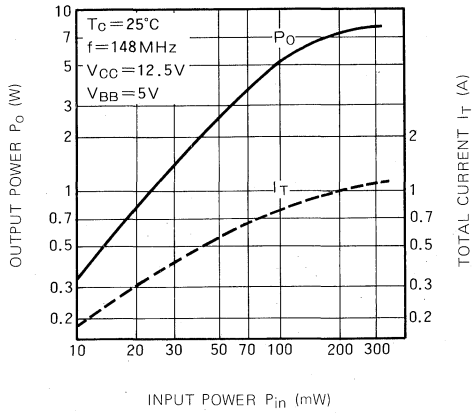
C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

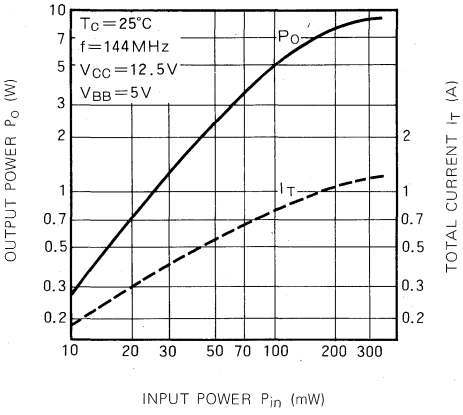
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



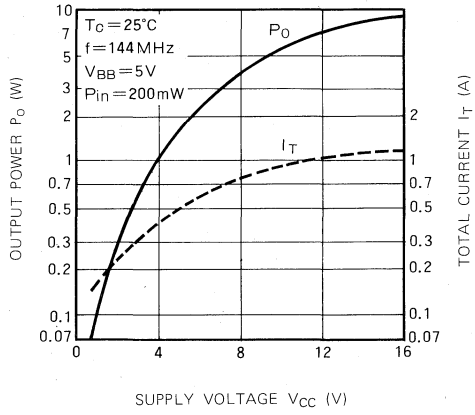
OUTPUT POWER, TOTAL CURRENT VS. INPUT POWER CHARACTERISTICS



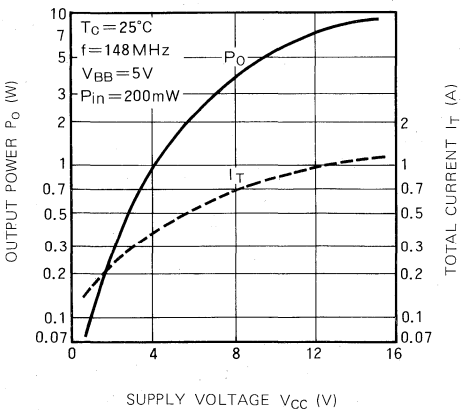
OUTPUT POWER, TOTAL CURRENT VS. INPUT POWER CHARACTERISTICS



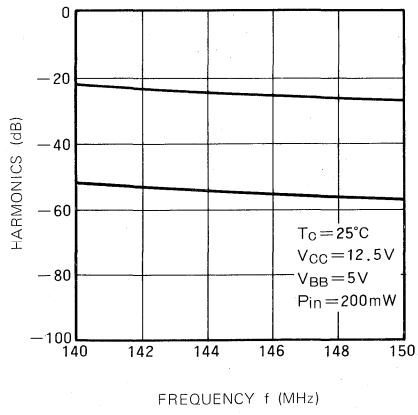
OUTPUT POWER, TOTAL CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2ND, 3RD HARMONICS VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M57796H

150～175MHz, 12.5V, 5W FM PORTABLE RADIO

DESCRIPTION

M57796H is a thick film RF power module specifically designed for 150～175MHz, 5W FM portable sets.

FEATURES

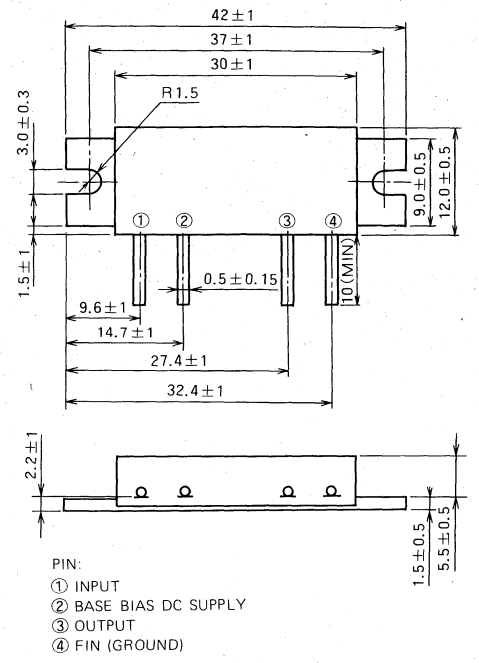
- High gain, High output power
  $G_p \geqq 13.7dB$, $P_o \geqq 7W$, @V_{CC} = 12.5V, P_{in} = 300mW
- High total efficiency
  η_T = 55% TYP., 50% MIN. @V_{CC} = 12.5V, Pin = 300mW
- Small package: 42 x 12 x 5.5mm

APPLICATION

Output stage of 5W output VHF band portable radio sets. (especially 12.5V Battery sets)

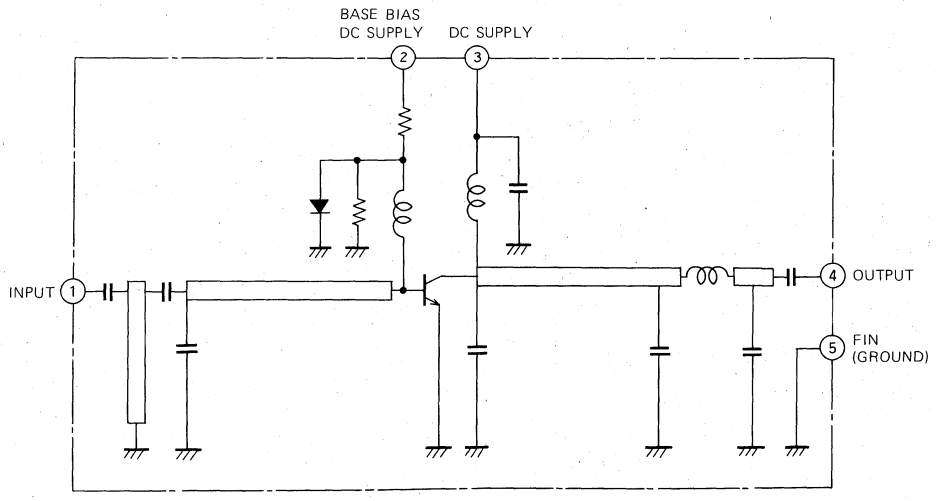
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT
② BASE BIAS DC SUPPLY
③ OUTPUT
④ FIN (GROUND)

EQUIVALENT CIRCUIT



150～175MHz, 12.5V, 5W FM PORTABLE RADIO

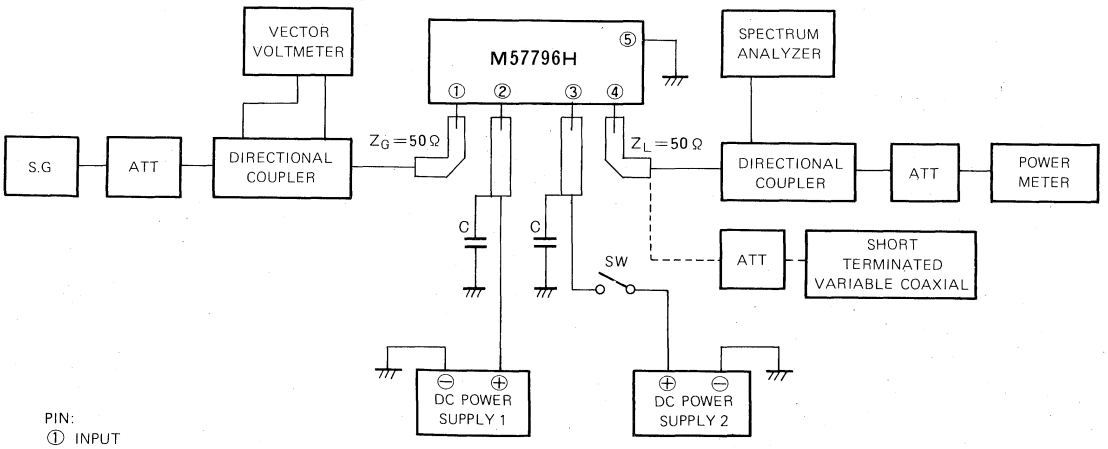
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		16	V
V_{BB}	Base bias voltage		6	V
I_{CC}	Total current		3	A
P_{in}	Input power	Zg=Zl=50Ω, V_{CC}≦12.5V, Vbb=5V	0.4	W
P_O	Output power	Zg=Zl=50Ω	10	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, Vbb=5V, f=150～175MHz, P_{in}=0.3W, Zg=Zl=50Ω	7	8		W
η_T	Total efficiency		50	55		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρin	Input VSWR				2.5	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC}=13.2V, Vbb=5V, f=150～175MHz, P_O=7W, Zg=50Ω	20：1			—

TEST BLOCK DIAGRAM



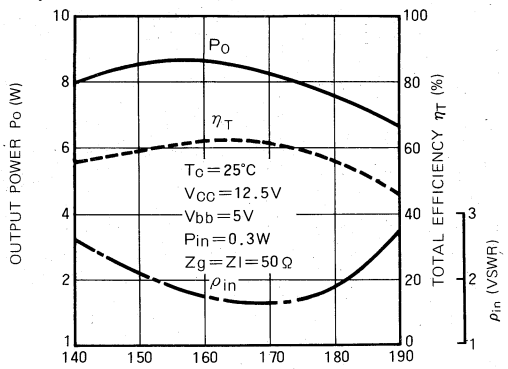
PIN:
① INPUT
② BASE BIAS DC SUPPLY
③ DC SUPPLY
④ OUTPUT
⑤ FIN (GROUND)

C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

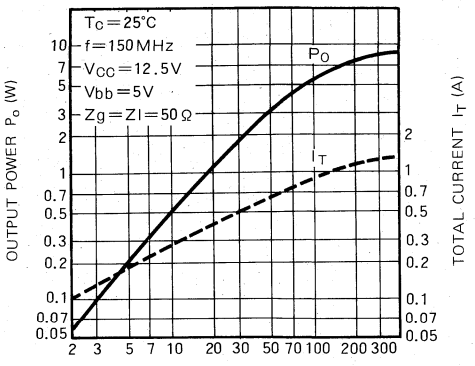
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

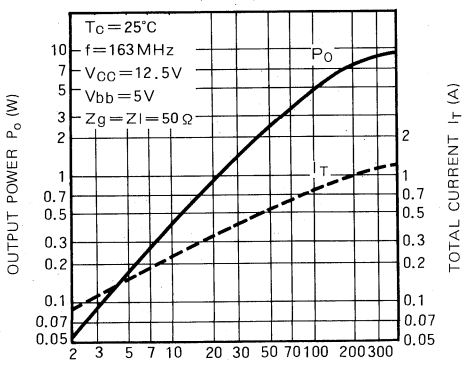
OUTPUT POWER, TOTAL EFFICIENCY, pin vs. FREQUENCY CHARACTERISTICS



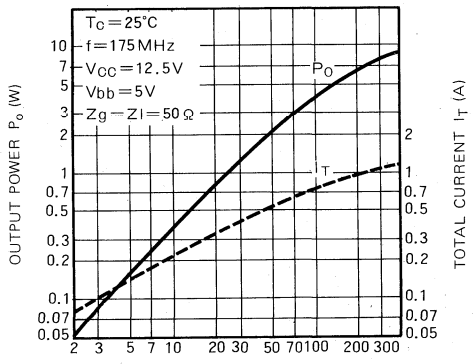
OUTPUT OUTPUT, TOTAL CURRENT VS. INPUT POWER CHARACTERISTICS



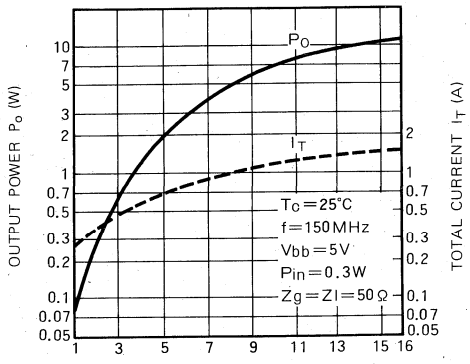
OUTPUT POWER, TOTAL CURRENT VS. INPUT POWER CHARACTERISTICS



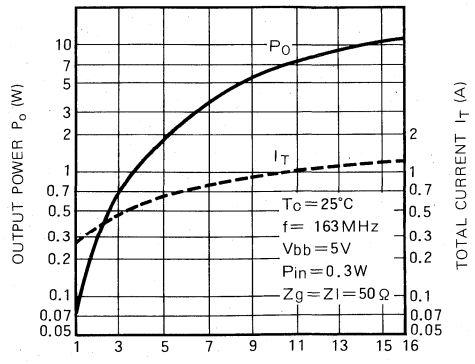
OUTPUT POWER, TOTAL CURRENT VS. INPUT POWER CHARACTERISTICS



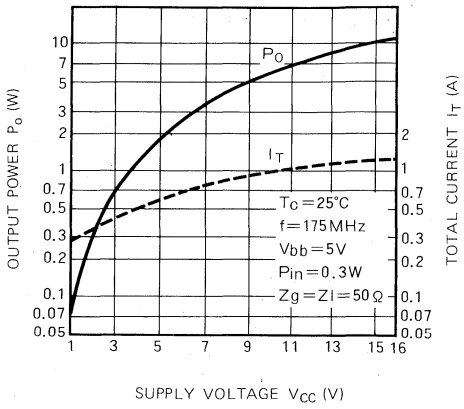
OUTPUT POWER, TOTAL CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



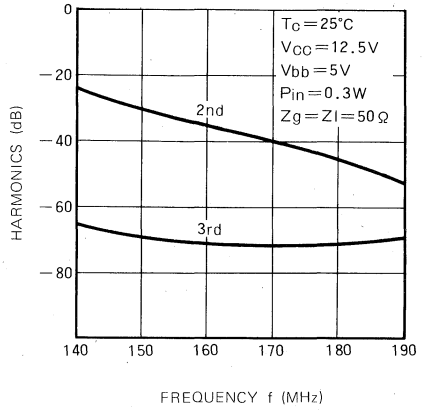
OUTPUT POWER, TOTAL CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONICS VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M57797MA

430~450MHz 5W FM PORTABLE RADIO

DESCRIPTION

M57797MA is a thick film RF power module specifically designed for 430 ~ 450MHz, 5W FM portable sets.

FEATURES

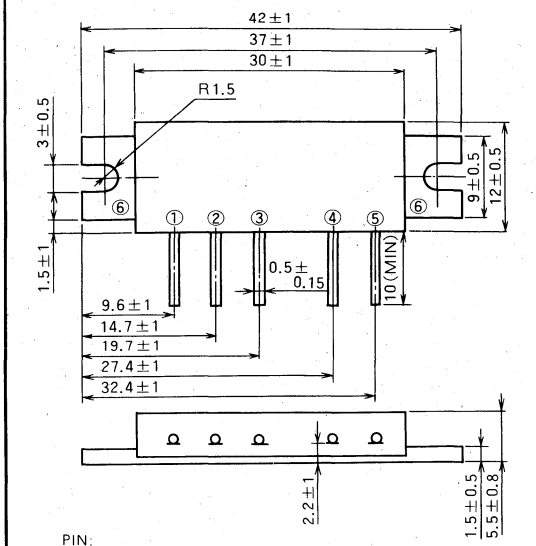
- Wide band: 20MHz, f = 430 ~ 450MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  Gp $\geqq$ 18dB Po $\geqq$ 7W, @V_{CC} = 12.5V, Pin = 100mW
- Small package: 42 x 12 x 5.5mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

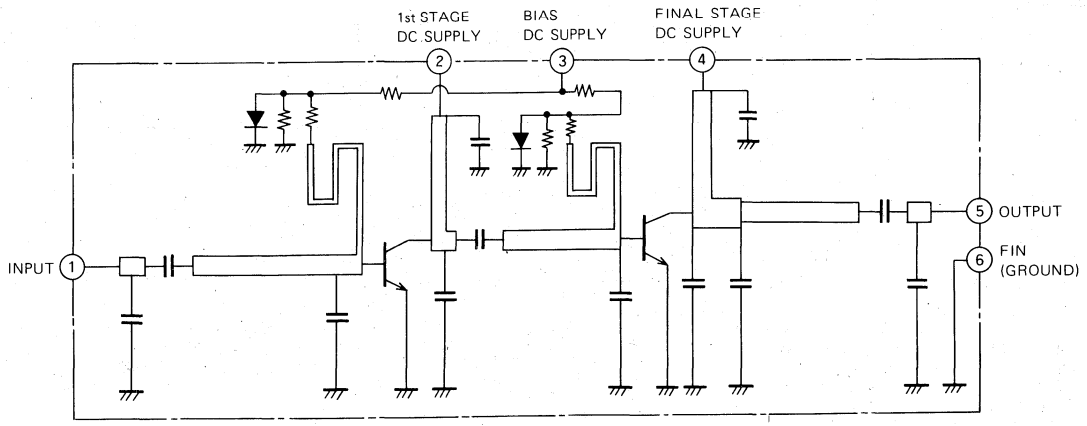
OUTLINE DRAWING

Dimension in mm



PIN:
① RF INPUT
② 1st STAGE DC SUPPLY
③ BASE DC BIAS
④ FINAL STAGE DC SUPPLY
⑥ RF OUTPUT
⑤ FIN (GROUND)

EQUIVALENT CIRCUIT



430～450MHz 5W FM PORTABLE RADIO

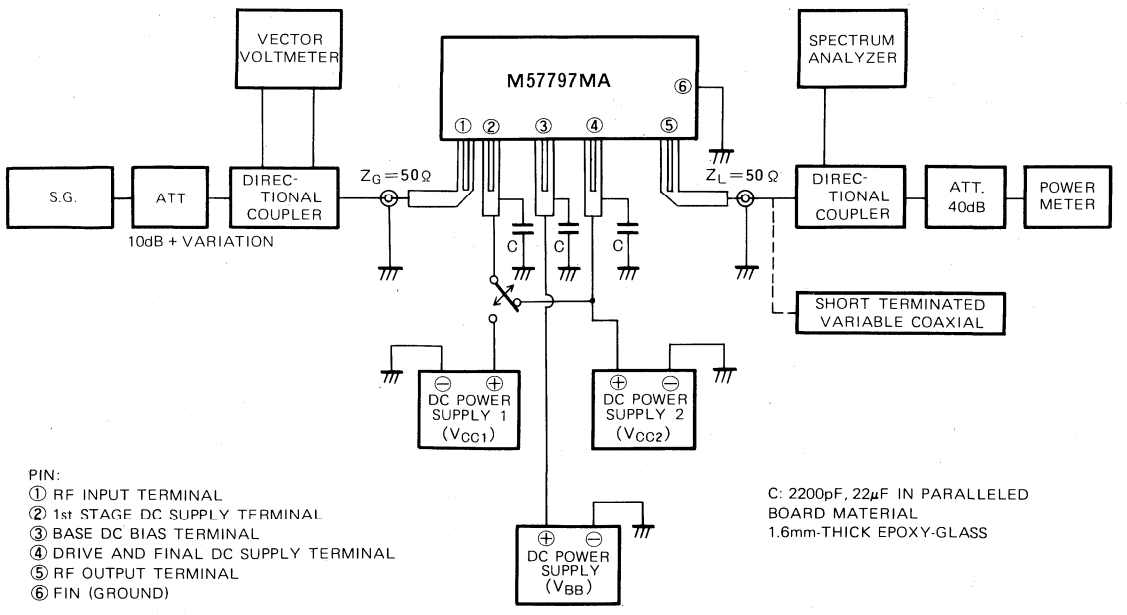
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		3.5	A
$P_{in}(max)$	Input power	$Z_G = Z_L = 50\,\Omega$	300	mW
$P_O(max)$	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=430～450MHz, P_{in}=100mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=13.2V, V_{BB}=5V, f=430～450 MHz, P_O=7W, $\rho_L \geqq 20$ (All pnase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

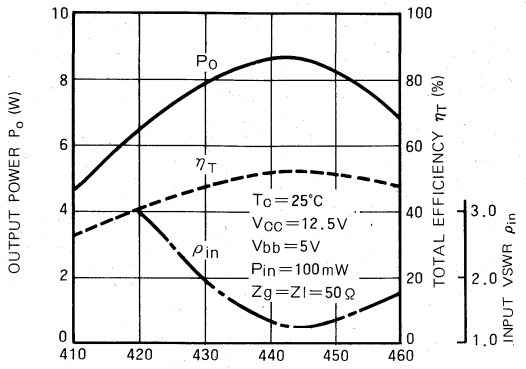


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

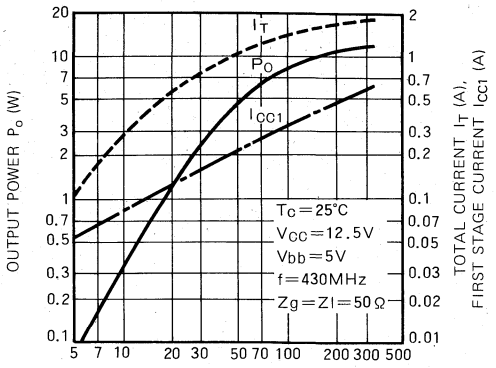
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

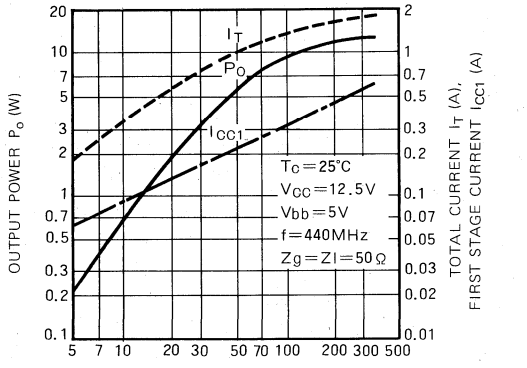
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



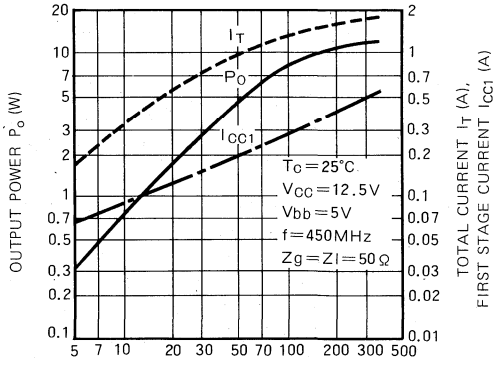
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



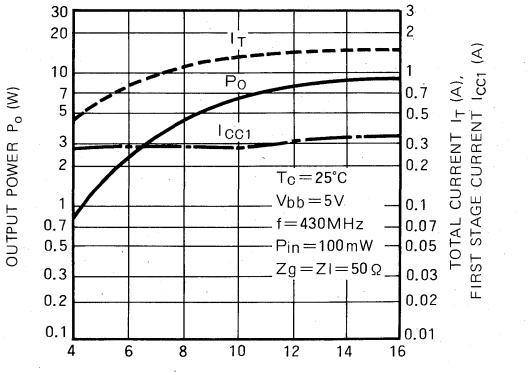
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



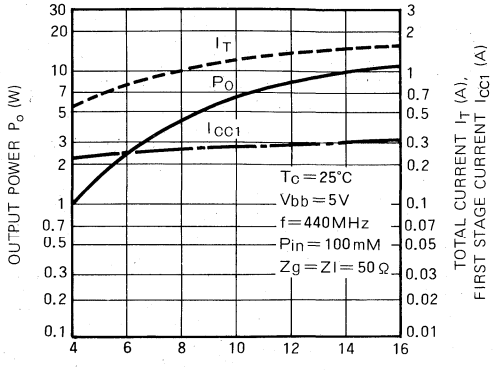
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



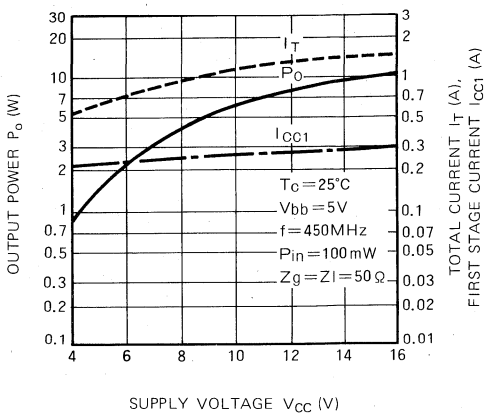
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



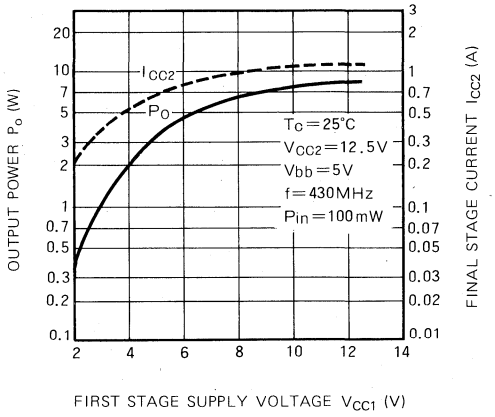
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



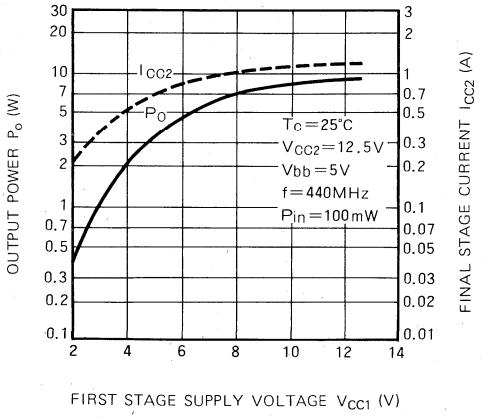
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



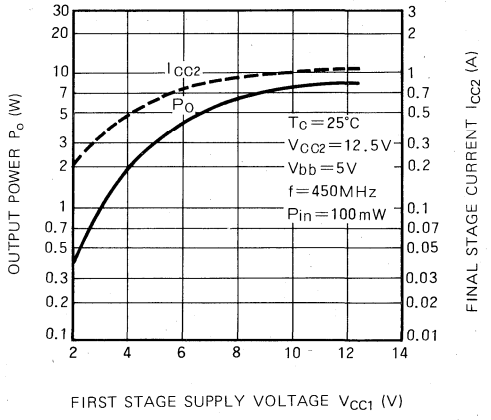
OUTPUT POWER, FIANL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIANL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIRST STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M57797H

450~470MHz 5W FM PORTABLE RADIO

DESCRIPTION

M57797H is a thick film RF power module specifically designed for 450 ~ 470MHz, 5W FM portable sets.

FEATURES

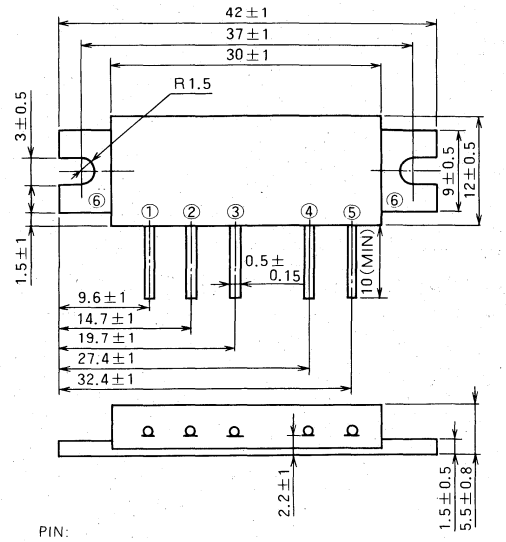
- Wide band: 20MHz, f = 450 ~ 470MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- HIgh gain, High output
  $G_p \geqq 15dB$, $P_o \geqq 7W$, @V_{CC} = 12.5V, P_{in} = 200mW
- Small package: 42 x 12 x 5.5mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

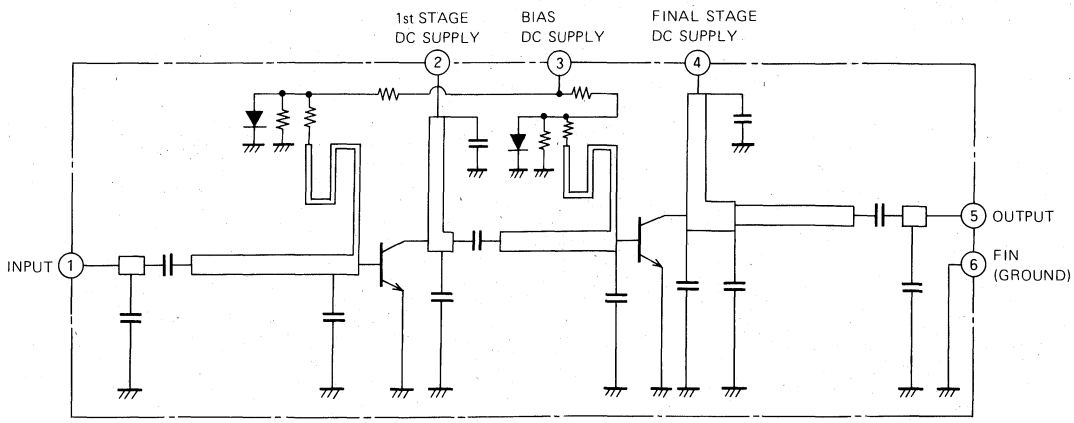
OUTLINE DRAWING

Dimension in mm



PIN:
① RF INPUT
② 1st STAGE DC SUPPLY
③ BASE DC BIAS
④ FINAL STAGE DC SUPPLY
⑥ RF OUTPUT
⑤ FIN (GROUND)

EQUIVALENT CIRCUIT



450～470MHz 5W FM PORTABLE RADIO

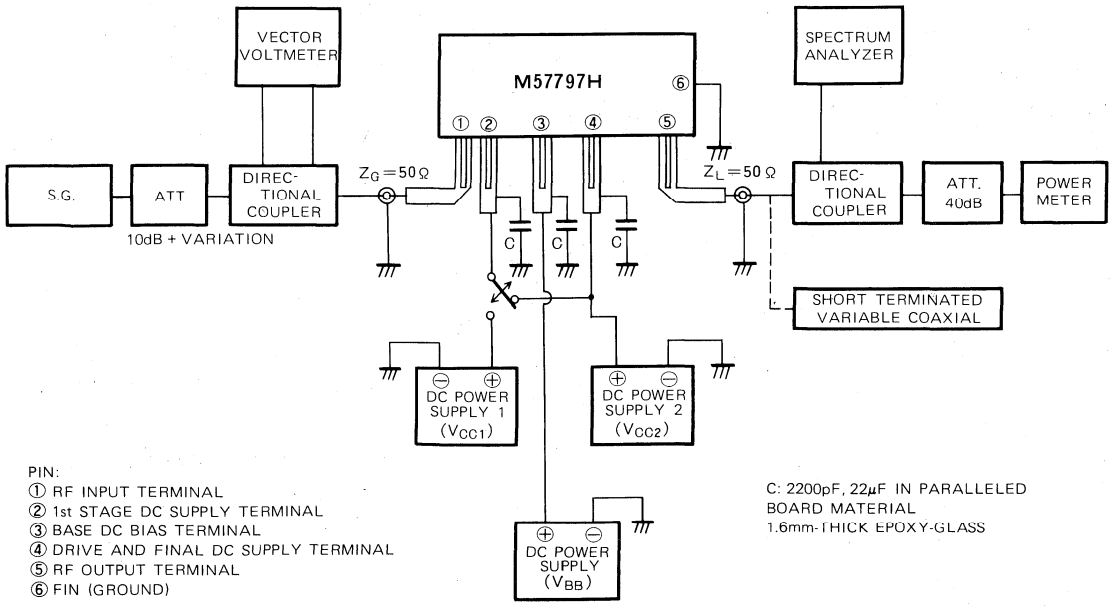
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		3.5	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\,\Omega$	300	mW
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=450～470MHz. P_{in}=200mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=13.2V, V_{BB}=5V, f=450～470 MHz, P_O=7W, $\rho_L \geqq 20$ (All pnase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

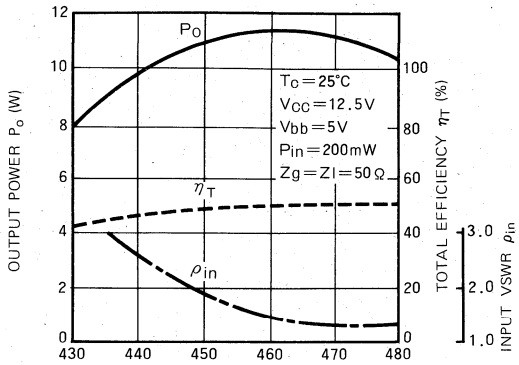


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

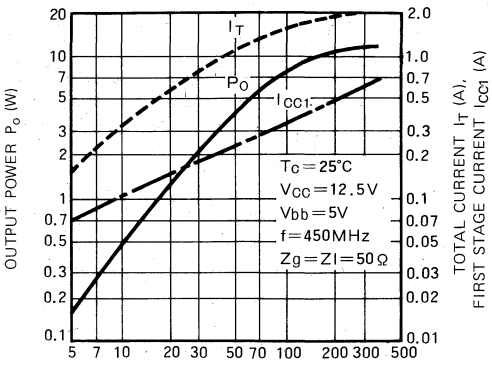
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

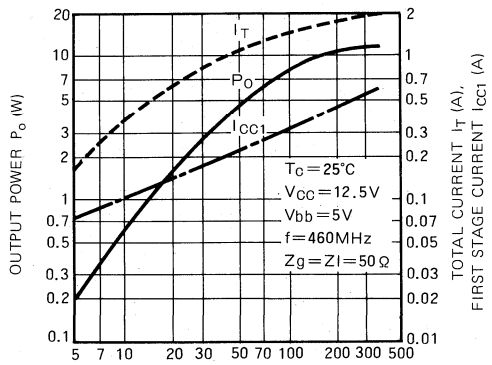
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



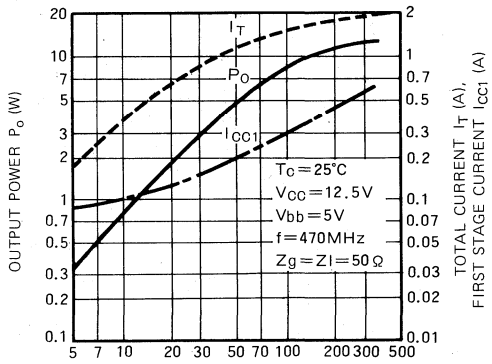
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



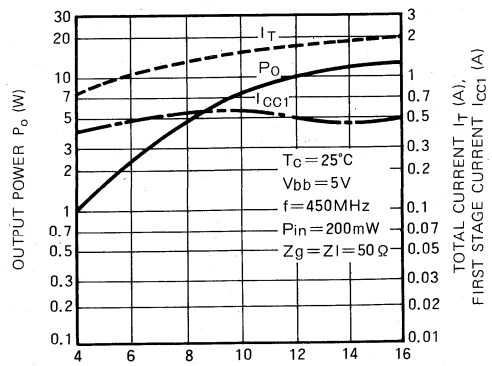
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



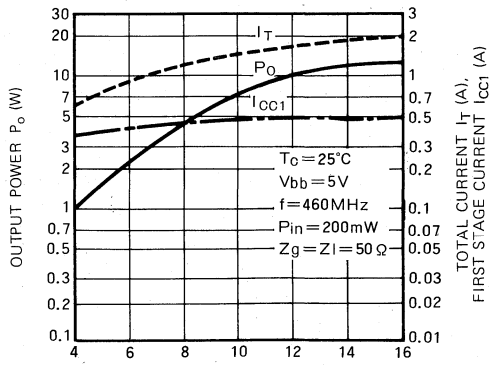
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



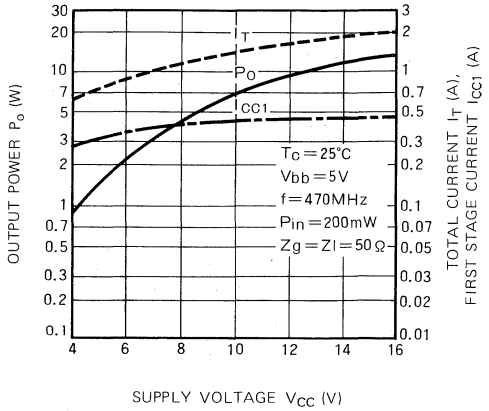
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



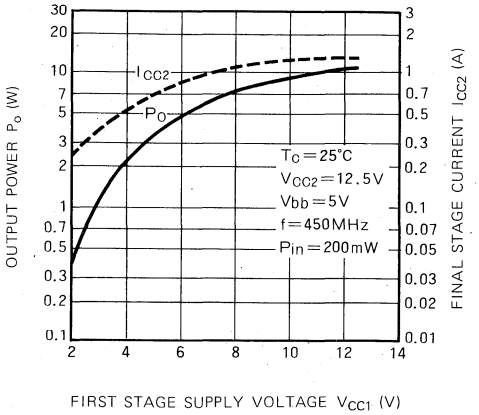
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



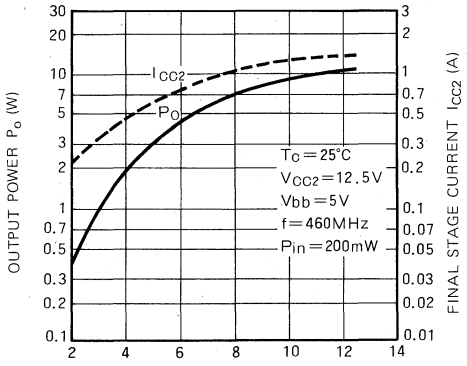
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



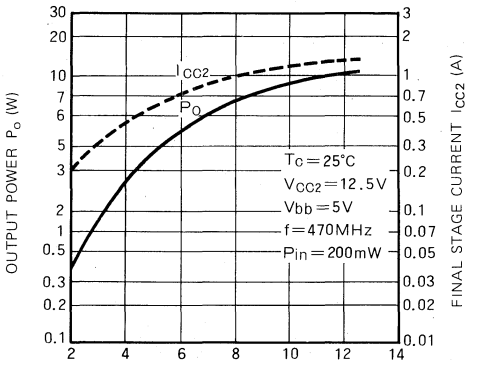
OUTPUT POWER, FINAL CURRENT VS. FIRST STAGE SUPPLY CHARACTERISTICS



OUTPUT POWER, FIRST STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIANL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M57797UH

470~490MHz 5W FM PORTABLE RADIO

DESCRIPTION

M57797UH is thick film RF power module speicfically designed for 470 ~ 490MHz, 5W FM portable sets.

FEATURES

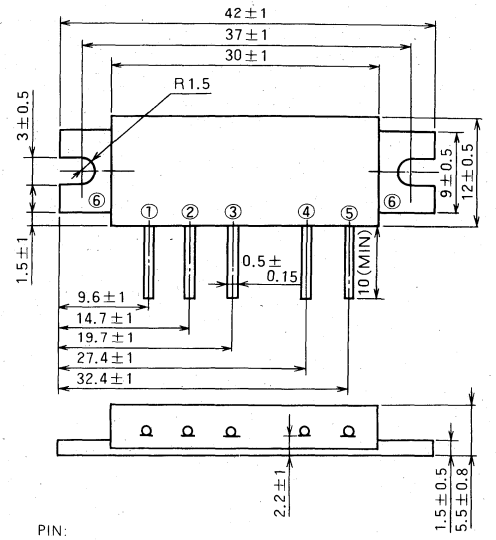
- Wide band: 20MHz, f = 470 ~ 490MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High ouptut
  $G_p \geqq 15dB$, $P_o \geqq 7W$, @V_{CC} = 12.5V, P_{in} = 200mW
- Small package: 42 x 12 x 5.5mm

APPLICATION

Ouput stage of 5W outut UHF band portable radio sets.

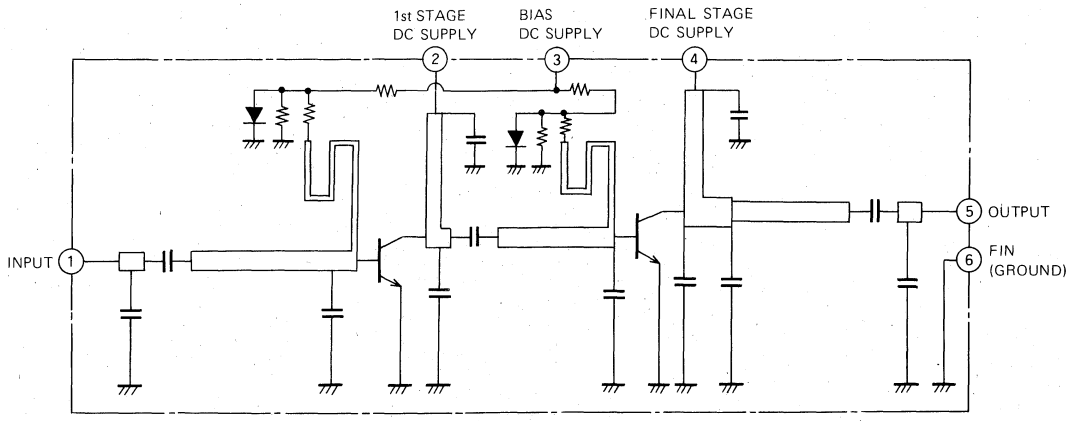
OUTLINE DRAWING

Dimension in mm



PIN:
① RF INPUT
② 1st STAGE DC SUPPLY
③ BASE DC BIAS
④ FINAL STAGE DC SUPPLY
⑥ RF OUTPUT
⑤ FIN (GROUND)

EQUIVALENT CIRCUIT



470～490MHz 5W FM PORTABLE RADIO

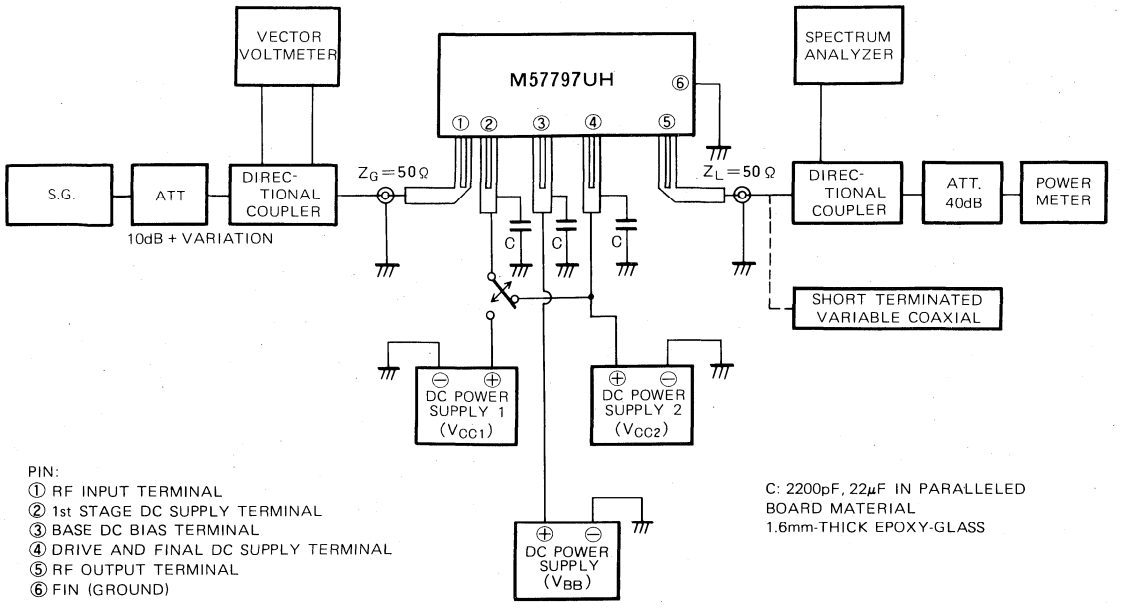
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		3.5	A
P_{in}(max)	Input power	$Z_G=Z_L=50\Omega$	300	mW
P_O(max)	Output power	$Z_G=Z_L=50\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=470～490MHz, P_{in}=200mW, $Z_G=Z_L=50\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3nd harmonic				−30	dB
ρin	Input VSWR			1.5	2.5	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=13.2V, V_{BB}=5V, f=470～490 MHz, P_O=7W, $\rho_L \geqq 20$ (All pnase), $Z_G=50\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

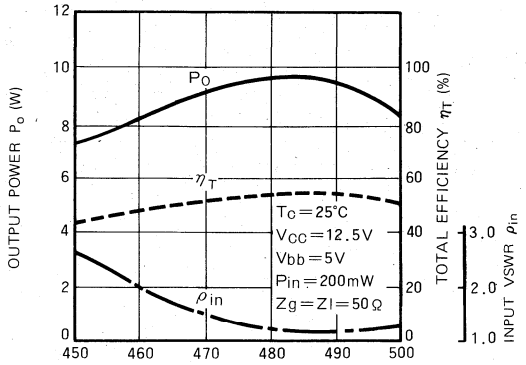


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

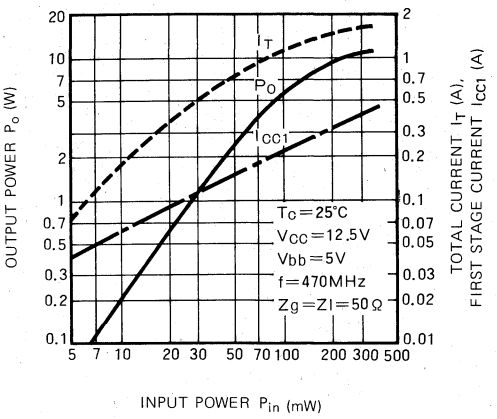
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

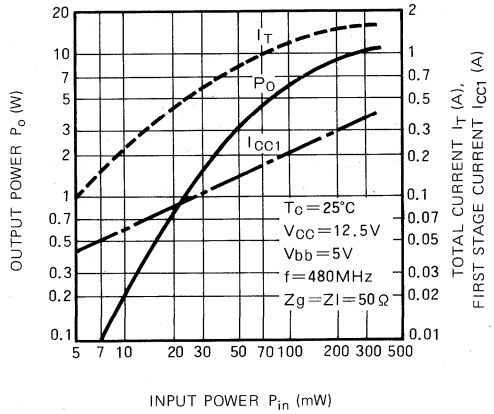
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



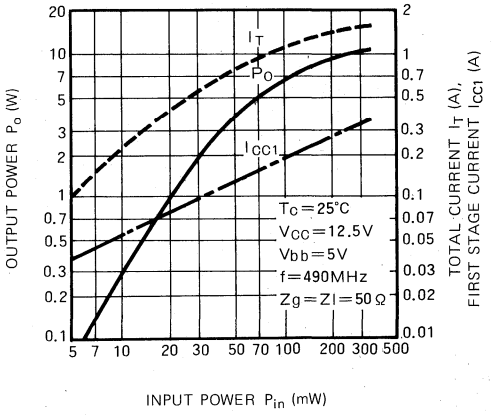
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



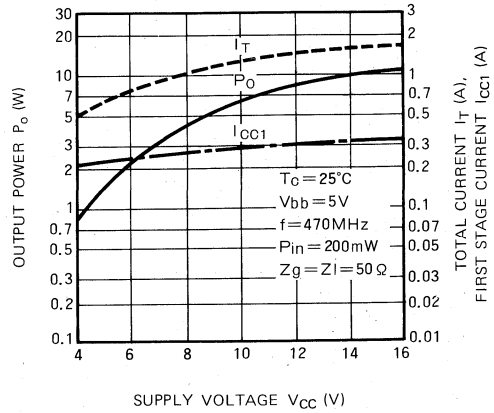
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



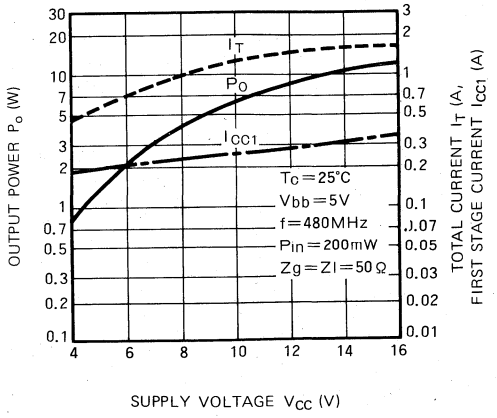
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



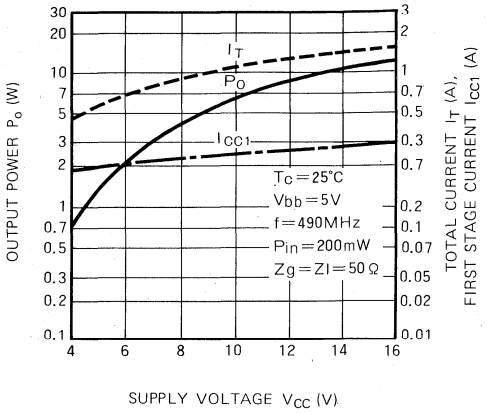
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



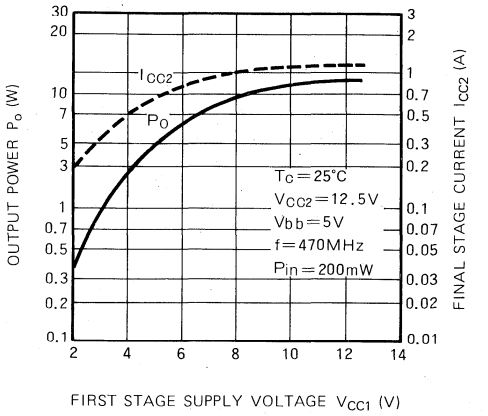
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



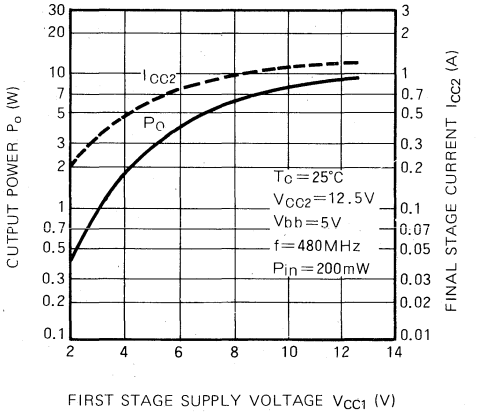
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



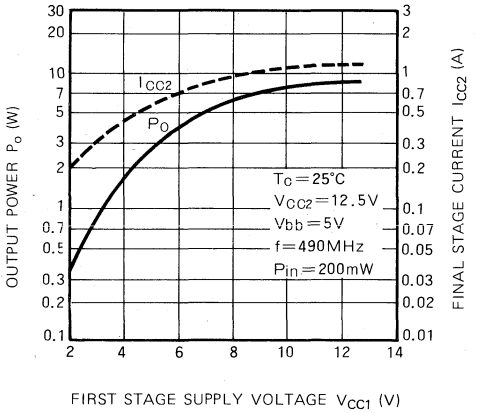
OUTPUT POWER, FINAL CURRENT VS. FIRST STAGE SUPPLY CHARACTERISTICS



OUTPUT POWER, FIRST STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIANL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M57797SH

490~512MHz 5W FM PORTABLE RADIO

DESCRIPTION

M57797SH is a thick film RF power module specifically designed for 490 ~ 512MHz, 5W FM portable sets.

FEATURES

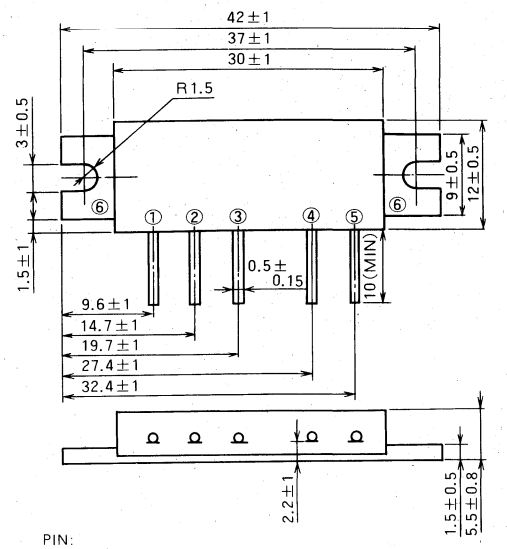
- Wide band: 22MHz, f = 490 ~ 512MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  $G_p \geqq 15dB$, $P_o \geqq 7W$, @V_{CC} = 12.5V, P_{in} = 200mW
- Small package: 42 x 12 x 5.5mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

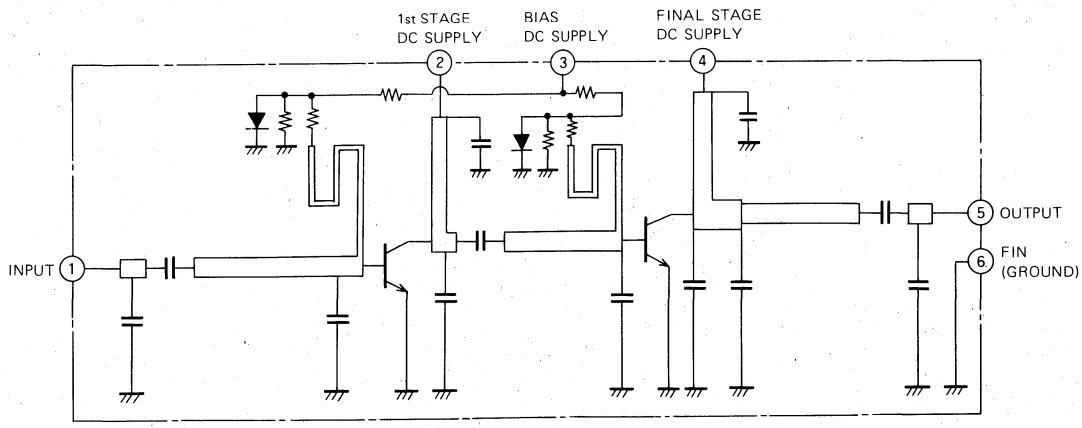
OUTLINE DRAWING

Dimension in mm



PIN:
① RF INPUT
② 1st STAGE DC SUPPLY
③ BASE DC BIAS
④ FINAL STAGE DC SUPPLY
⑥ RF OUTPUT
⑤ FIN (GROUND)

EQUIVALENT CIRCUIT



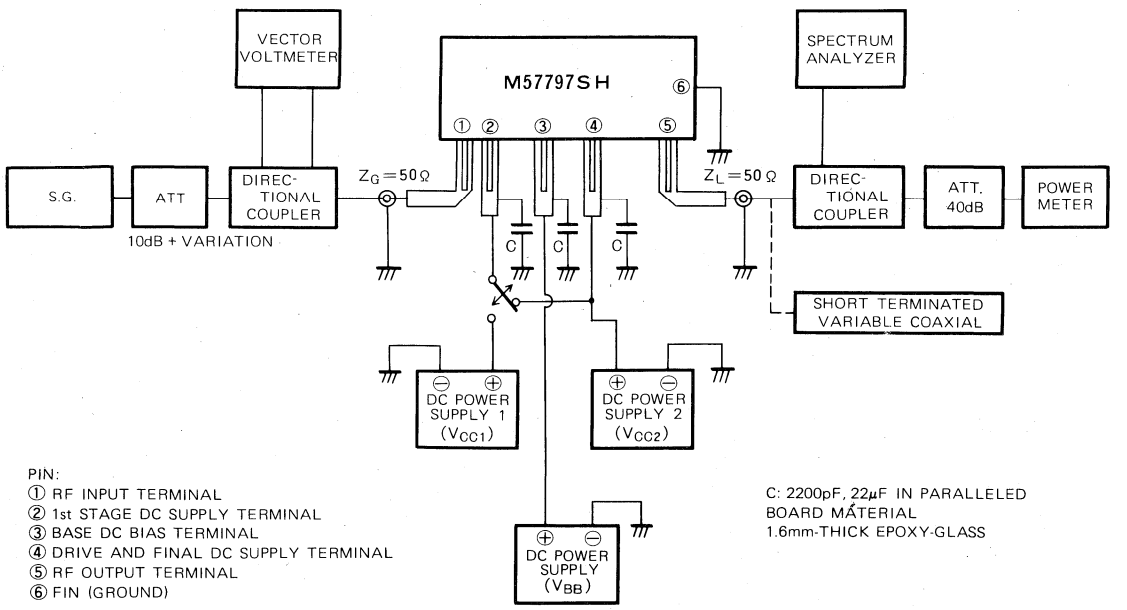
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		3.5	A
$P_{in}(max)$	Input power	$Z_G = Z_L = 50\,\Omega$	300	mW
$P_O(max)$	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=490～512MHz, P_{in}=200mW, $Z_G=Z_L=50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3nd harmonic				−30	dB
ρin	Input VSWR			1.5	2.5	—
ρout	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=13.2V, V_{BB}=5V, f=490～512 MHz, P_O=7W, $\rho_L \geqq 20$ (All pnase), $Z_G=50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

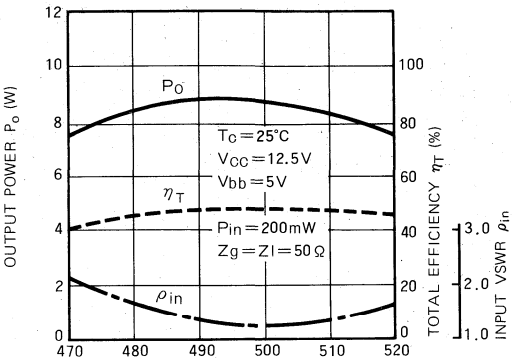


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

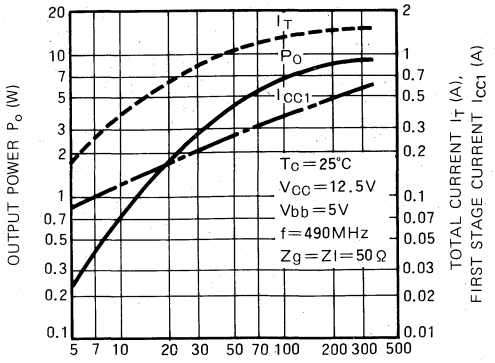
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

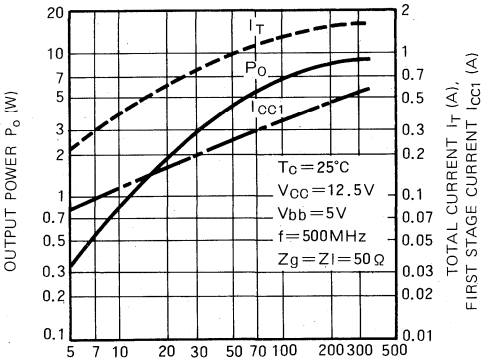
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



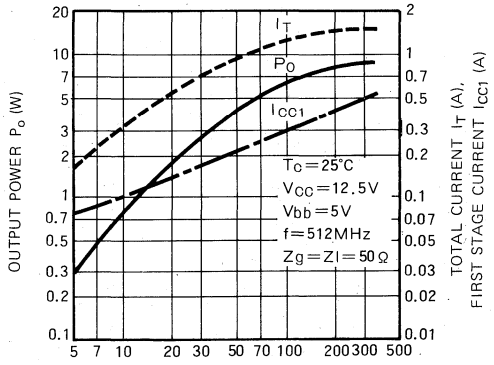
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



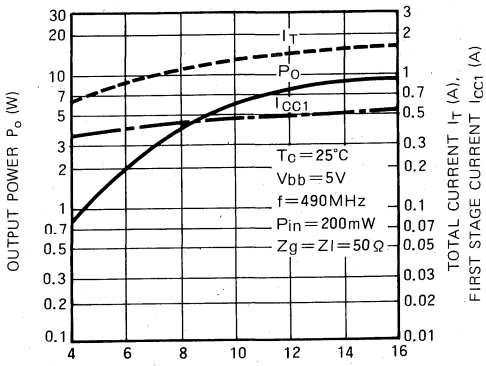
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



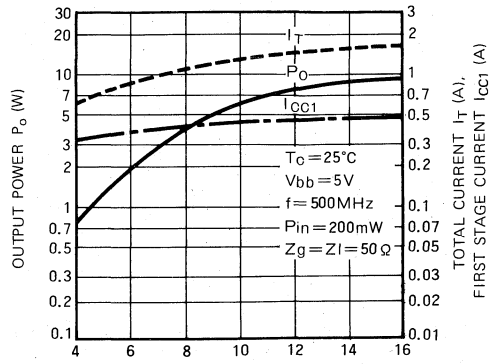
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



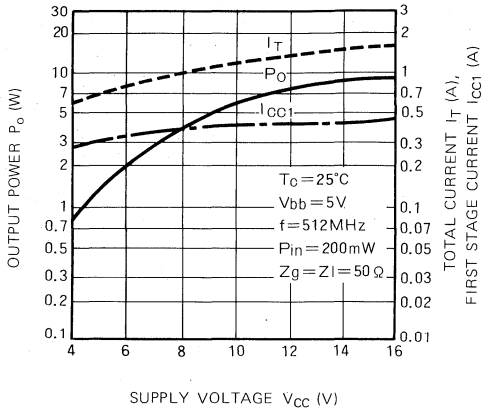
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



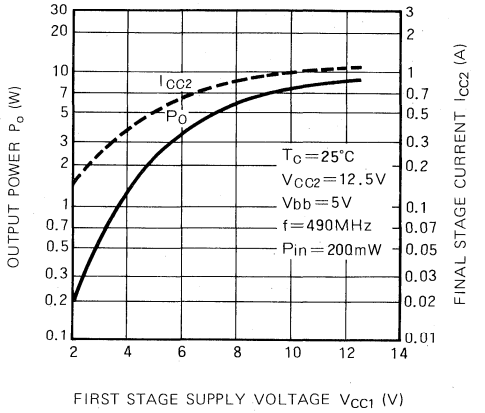
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



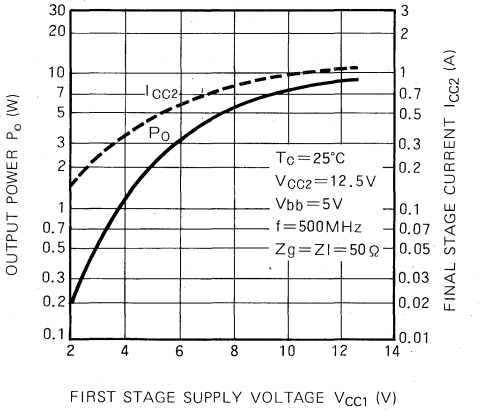
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



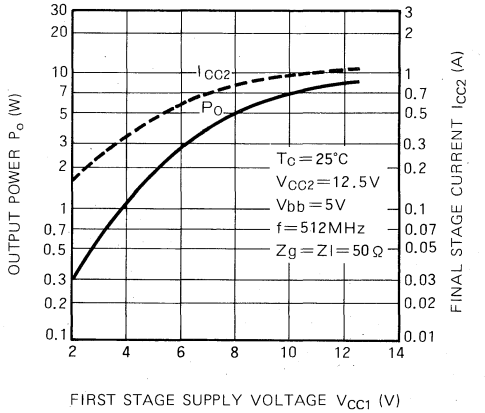
OUTPUT POWER, FIRST STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIRST STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIANL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M67704

142～175MHz, 12.5V, 10W FM MOBILE RADIO

DESCRIPTION

M67704 is a thick film RF Power module specifically designed for 142 ~ 175MHz, 10W FM portable sets.

FEATURES

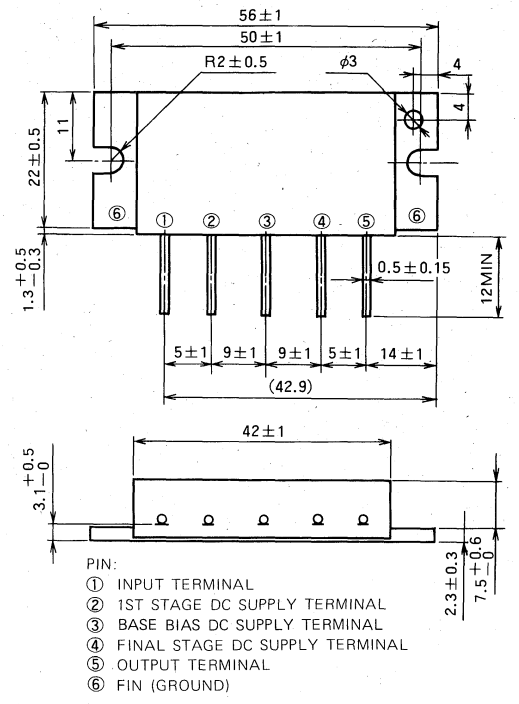
- High gain, High output power
  $G_p \geqq 28dB$, $P_o \geqq 13W$, @V_{CC} = 12.5V, P_{in} = 20mW
- High total efficiency
  η_T = 45% (TYP), 40% (MIN) @V_{CC} = 12.5V, Pin = 20mW
- Small package: 56 x 22 x 9.8mm

APPLICATION

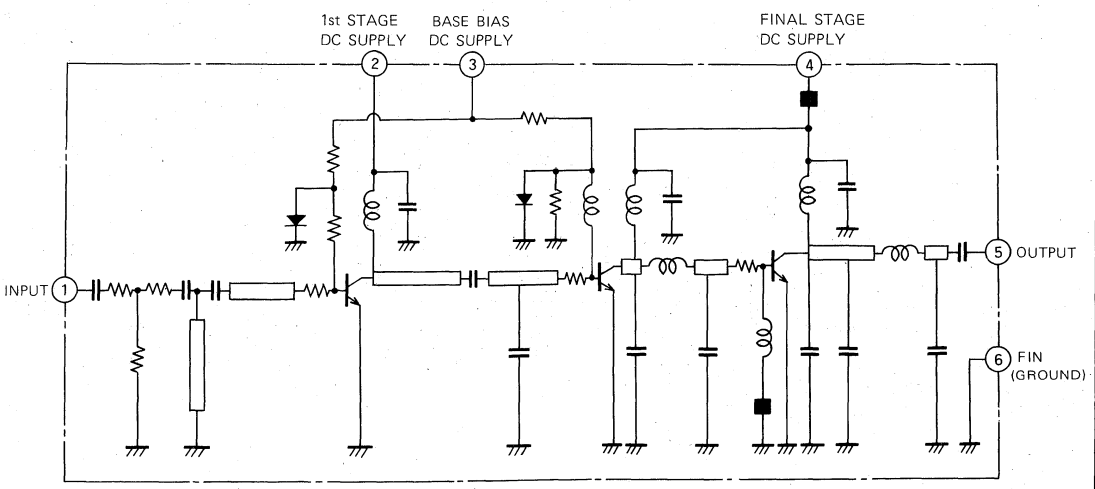
Output stage of 10W output VHF band mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



142～175MHz, 12.5V, 10W FM MOBILE RADIO

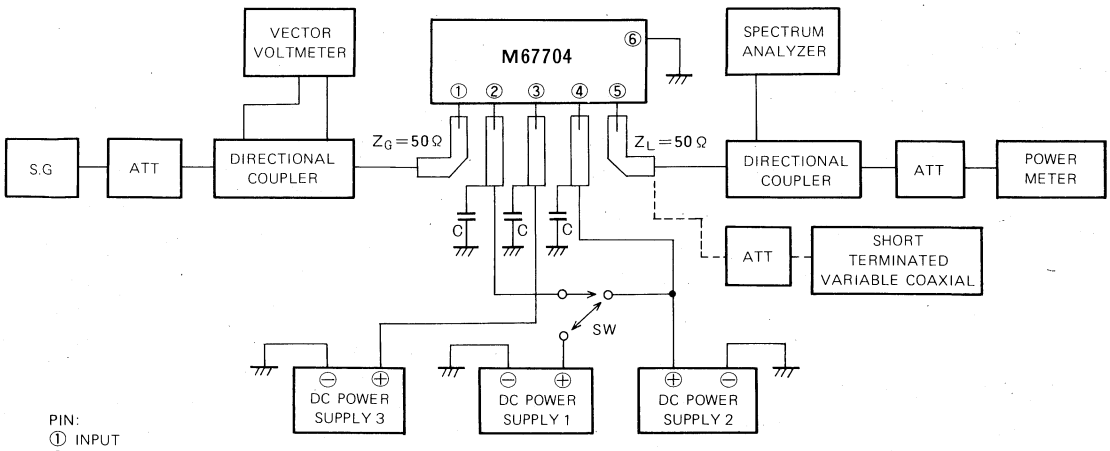
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		16	V
V_{BB}	Base bias voltage		6	V
I_{CC}	Total current		4	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\,\Omega$	40	mW
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\,\Omega$	20	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{SB}=5V, f=142～175MHz, P_{in}=20mW, $Z_G = Z_L = 50\,\Omega$	13	15		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC1}=12.5V, V_{CC2}=15.2V, V_{BB}=5V, f=142～175MHz, P_O=13W, $\rho_T \geqq 20$ (All phase)	20 : 1			—

TEST BLOCK DIAGRAM

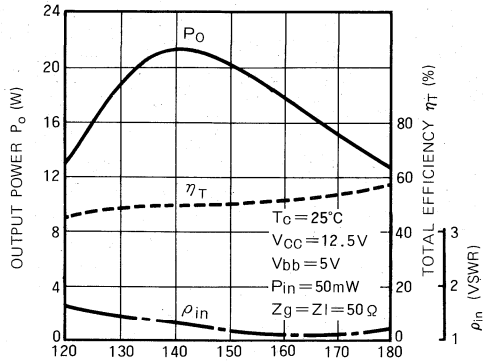


PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ BASE BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

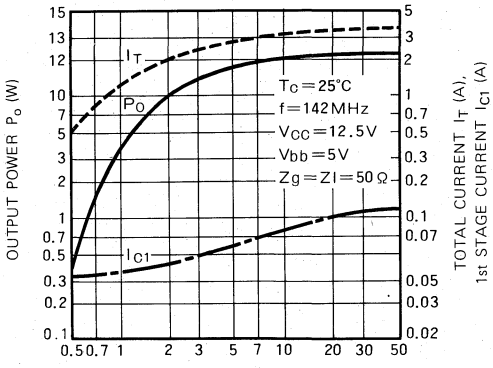
C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

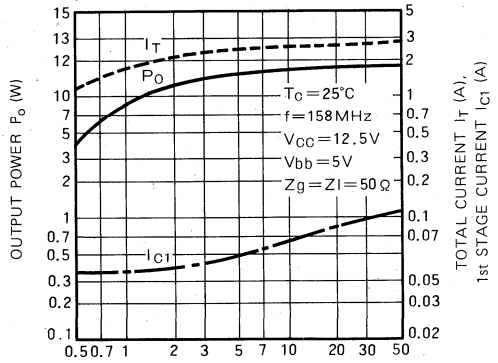
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



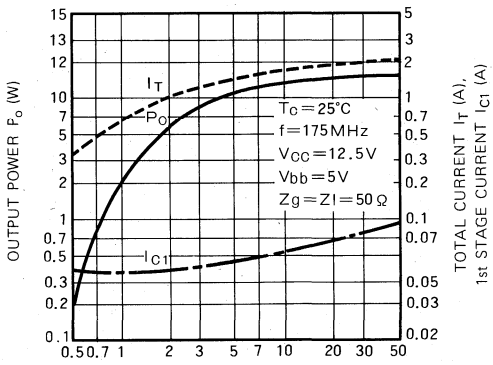
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



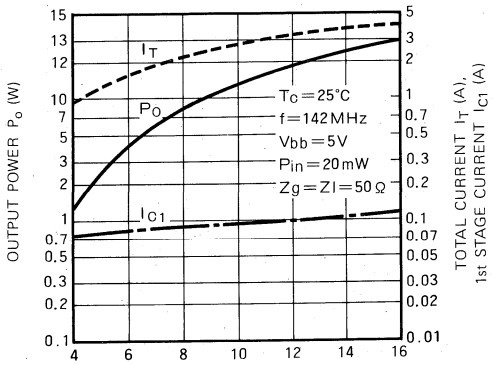
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



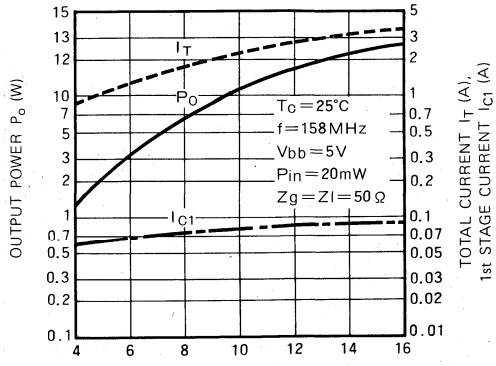
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



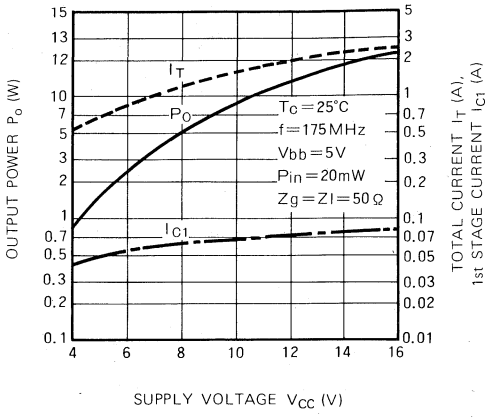
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



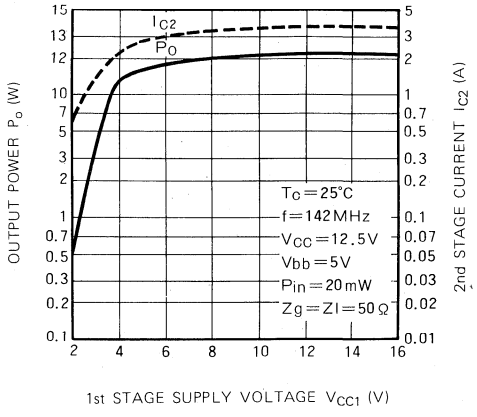
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



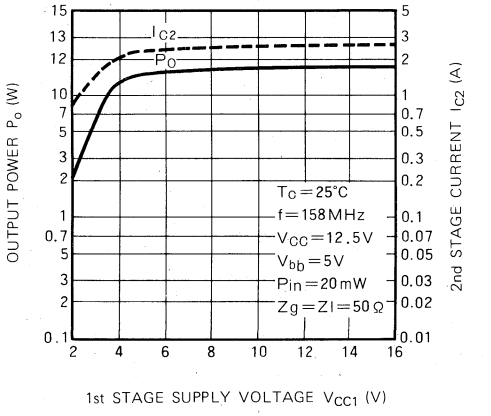
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



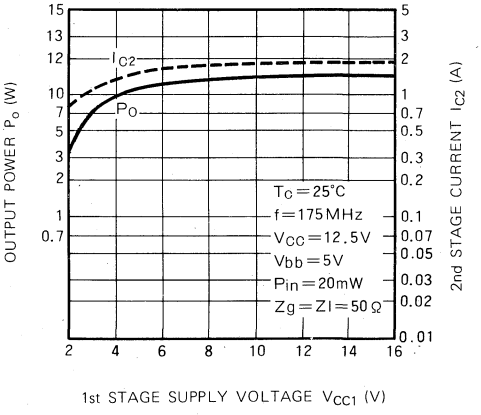
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



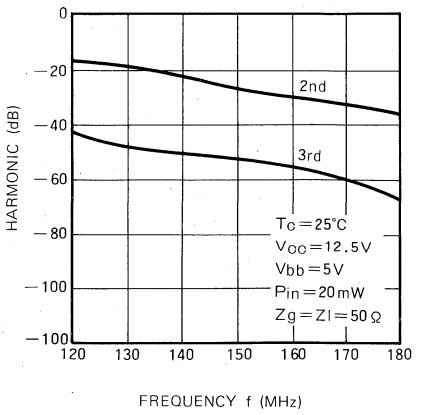
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M67705L

400~430MHz 5W FM PORTABLE RADIO

DESCRIPTION

M67705L is a thick film RF power module specifically designed for 400 ~ 430MHz, 5W FM portable sets.

FEATURES

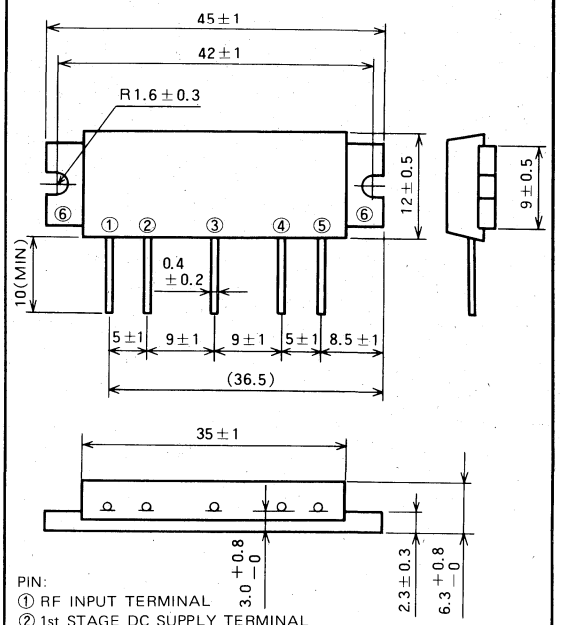
- Wide band: 30MHz, f = 400 ~ 430MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  $G_p \geqq 25dB$, $P_o \geqq 7W$, @V_{CC} = 9.6V, P_{in} = 20mW
- Small package: 45 x 12 x 6.3mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

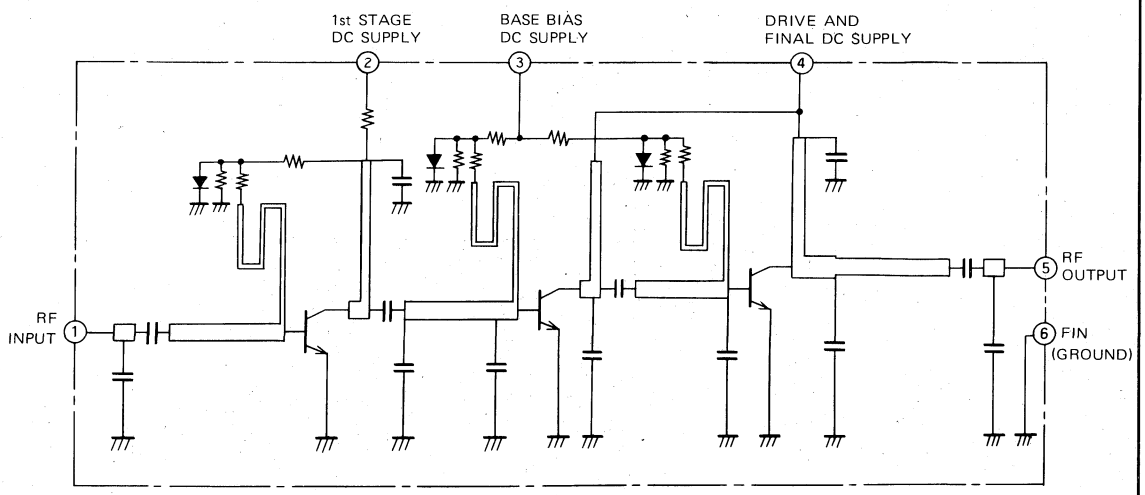
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



400～430MHz 5W FM PORTABLE RADIO

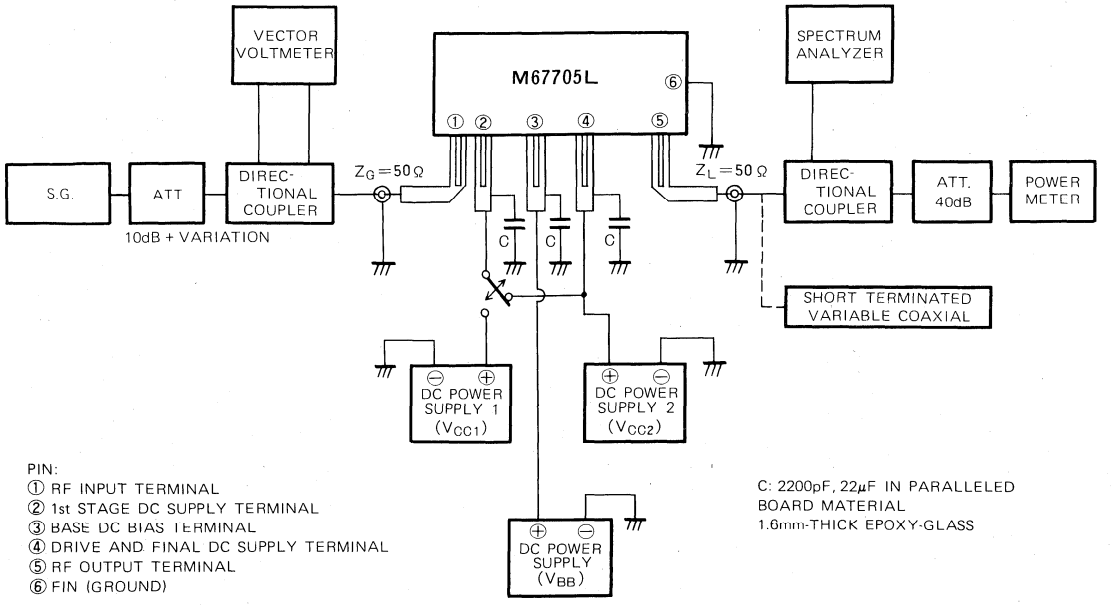
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		13	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}(max)	Input power	$Z_G = Z_L = 50\Omega$	40	mW
P_O(max)	Output power	$Z_G = Z_L = 50\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 9.6V, V_{BB} = 5V, f = 490～430MHz, P_{in} = 20mW, $Z_G = Z_L = 50\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 9.6V, V_{BB} = 5V, f = 400～430 MHz, P_O = 7W, $\rho_L \geqq 20$ (All pnase), $Z_G = 50\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

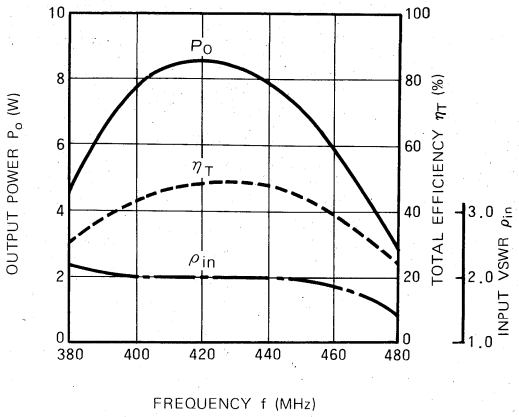


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

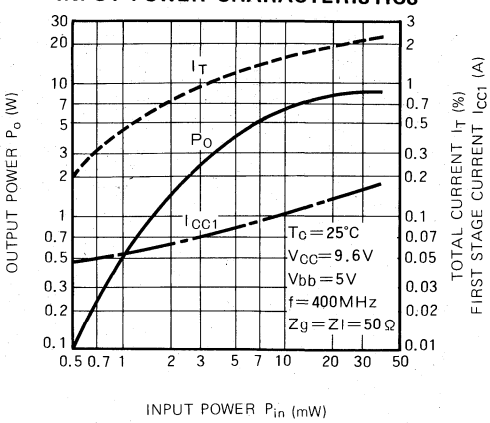
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

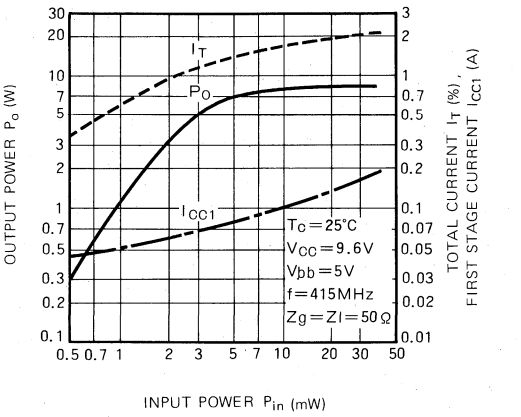
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



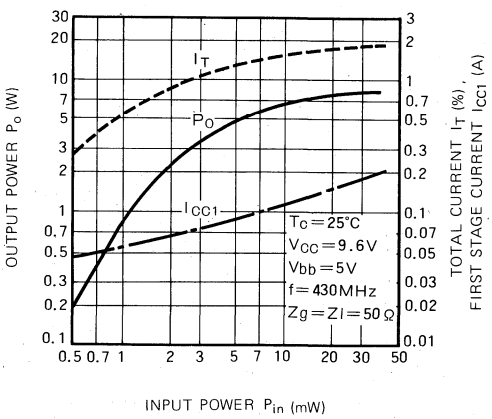
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



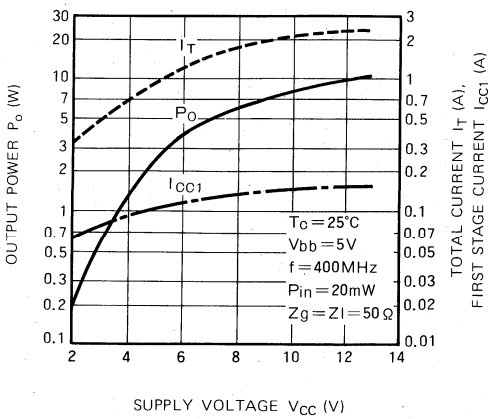
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



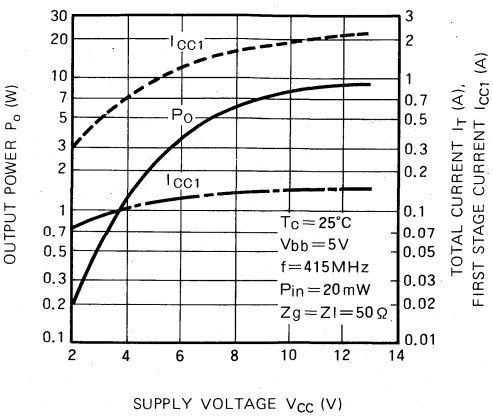
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



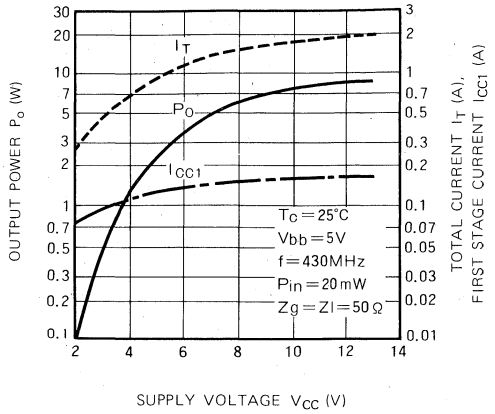
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



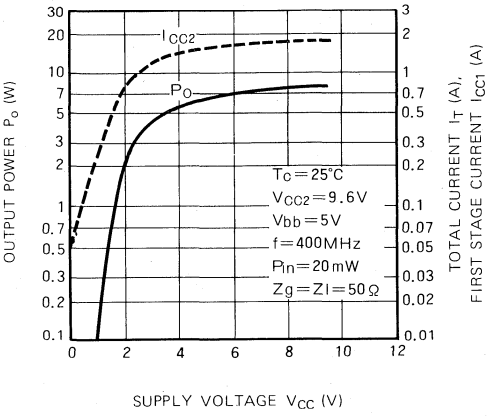
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



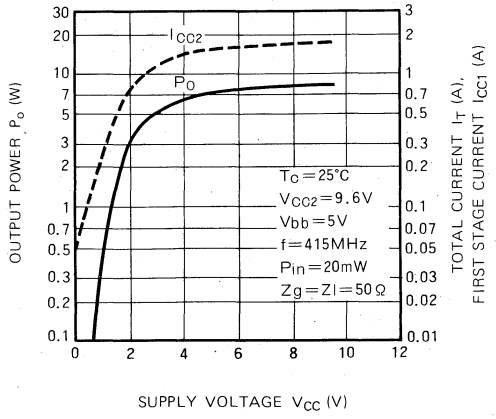
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



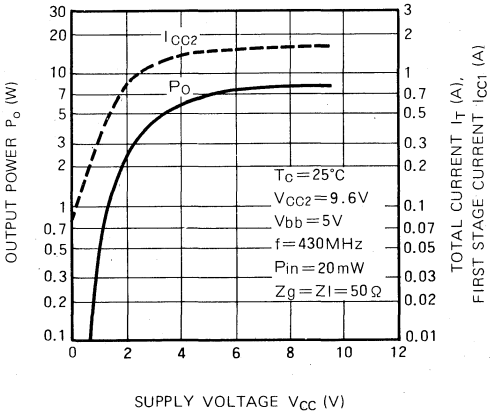
OUTPUT POWER, FINAL CURRENT VS. FIRST STAGE SUPPLY CHARACTERISTICS



OUTPUT POWER, FIRST STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIANL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M67705M

430~470MHz 5W FM PORTABLE RADIO

DESCRIPTION

M67705M is a thick film RF power module specifically designed for 430 ~ 470MHz, 5W FM portable sets.

FEATURES

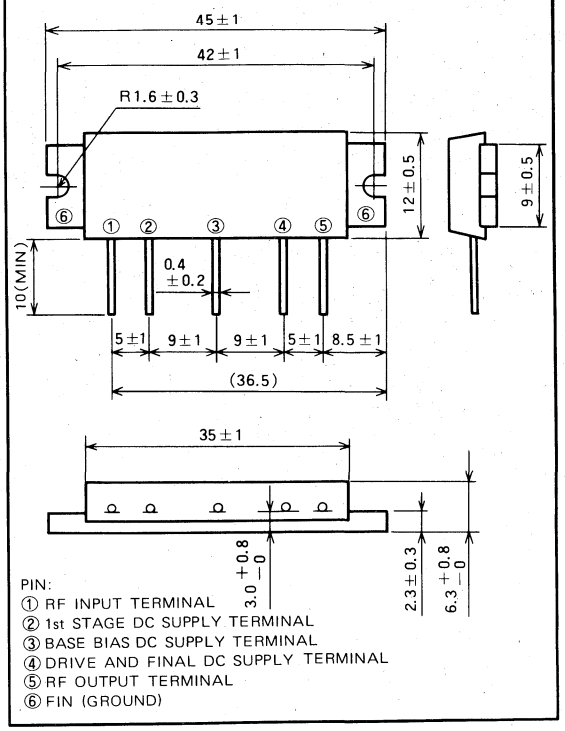
- Wide band: 40MHz, f = 430 ~ 470MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  $G_p \geqq 25dB$, $P_o \geqq 7W$, @V_{CC} = 9.6V, P_{in} = 20mW
- Small package: 45 x 12 x 6.3mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

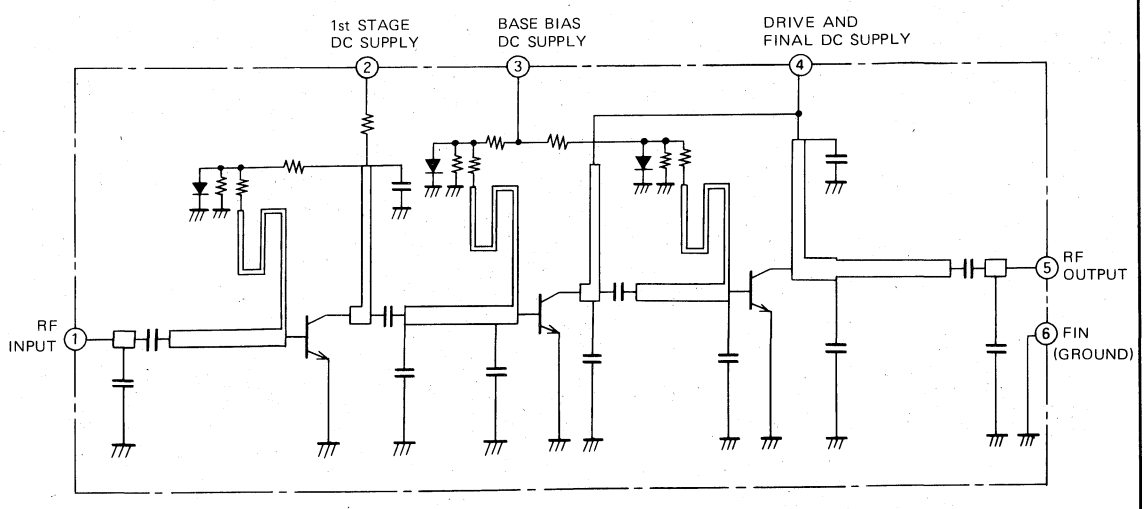
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



430～470MHz 5W FM PORTABLE RADIO

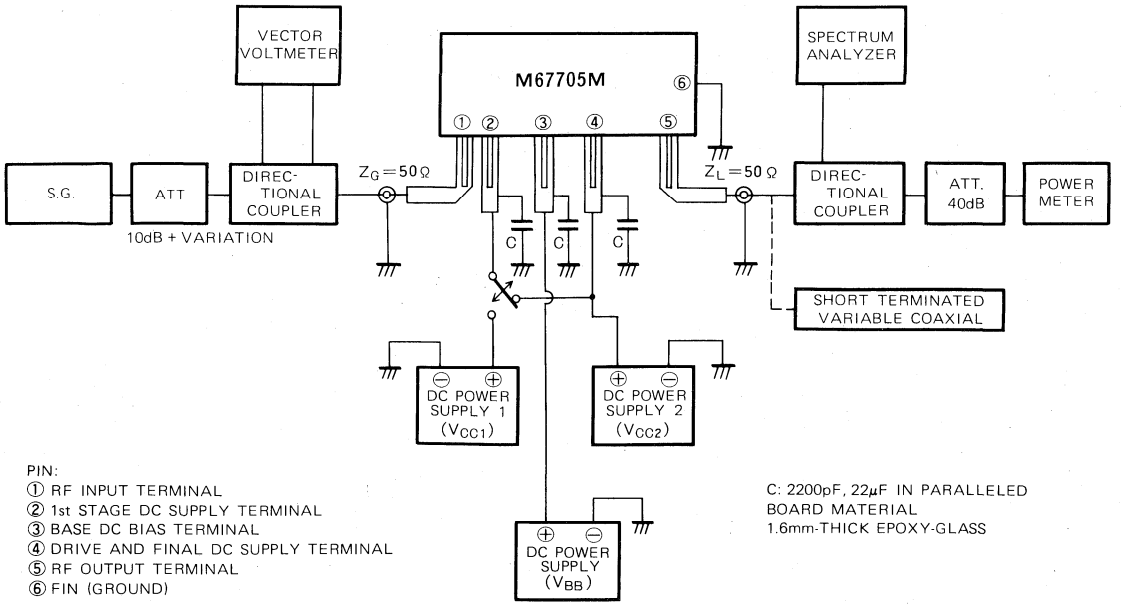
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		13	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
$P_{in(max)}$	Input power	$Z_G=Z_L=50\Omega$	40	mW
$P_{O(max)}$	Output power	$Z_G=Z_L=50\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=9.6V, V_{BB}=5V, f=430～470MHz, P_{in}=20mW, $Z_G=Z_L=50\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=9.6V, V_{BB}=5V, f=430～470 MHz, P_O=7W, $\rho_L \geqq 20$ (All pnase), Z_G=50Ω	20：1			—

TEST BLOCK DIAGRAM

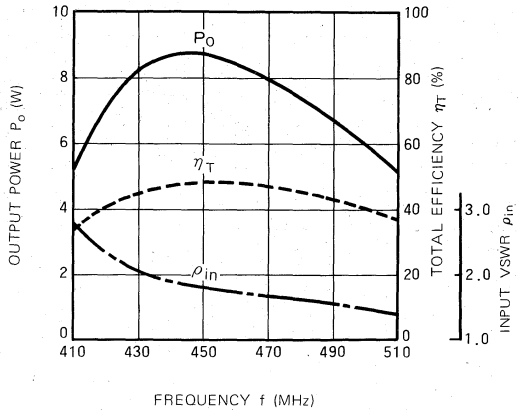


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

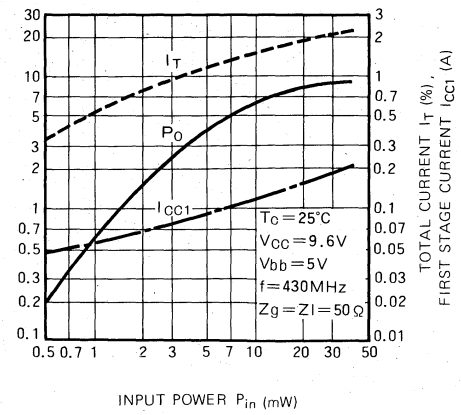
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

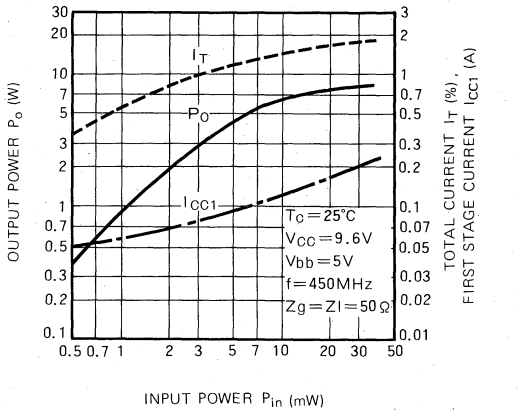
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



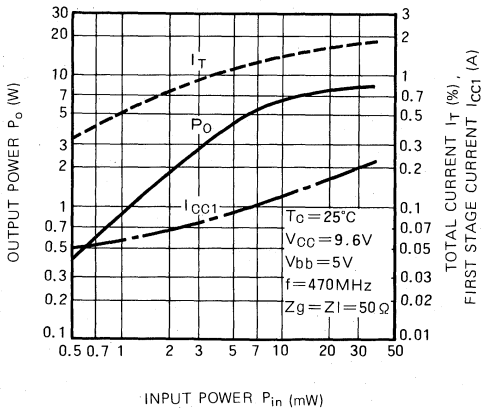
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



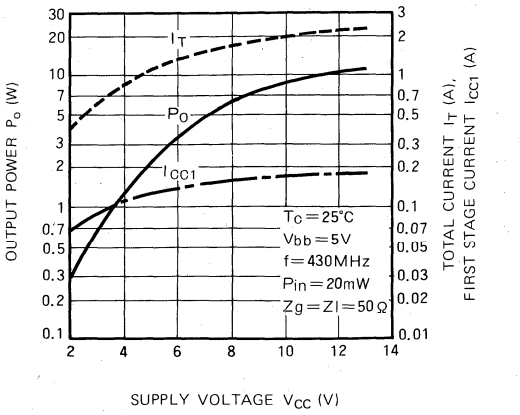
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



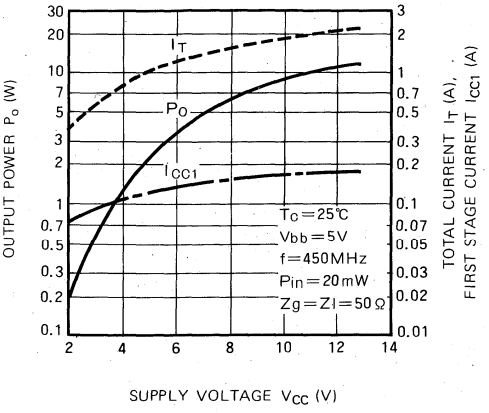
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



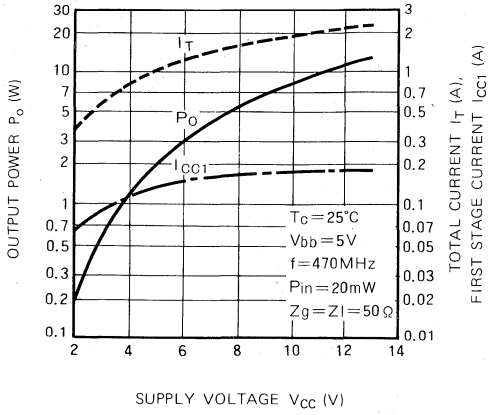
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



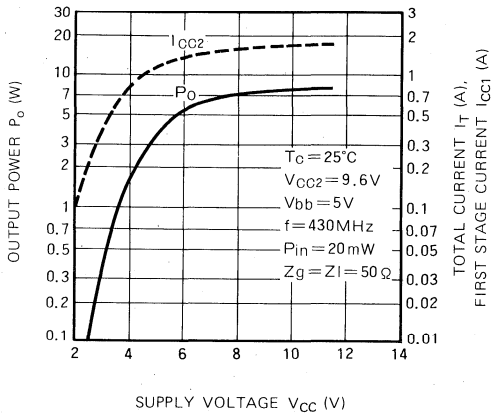
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



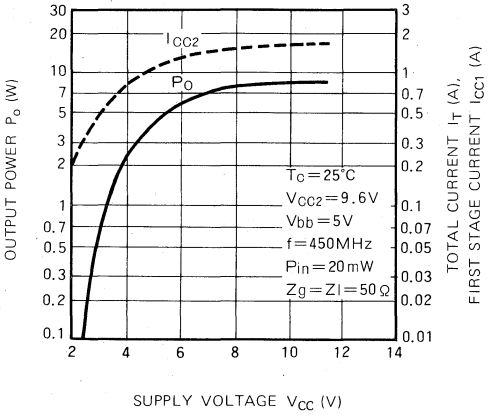
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



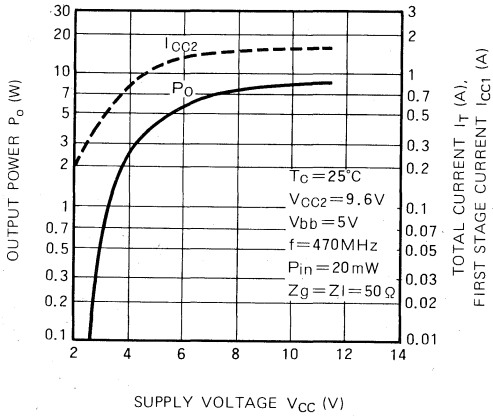
OUTPUT POWER, FINAL CURRENT VS. FIRST STAGE SUPPLY CHARACTERISTICS



OUTPUT POWER, FIRST STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIANL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M67705H

470~512MHz 5W FM PORTABLE RADIO

DESCRIPTION

M67705H is thick film RF power module specifically designed for 470 ~ 512MHz, 5W FM portable sets.

FEATURES

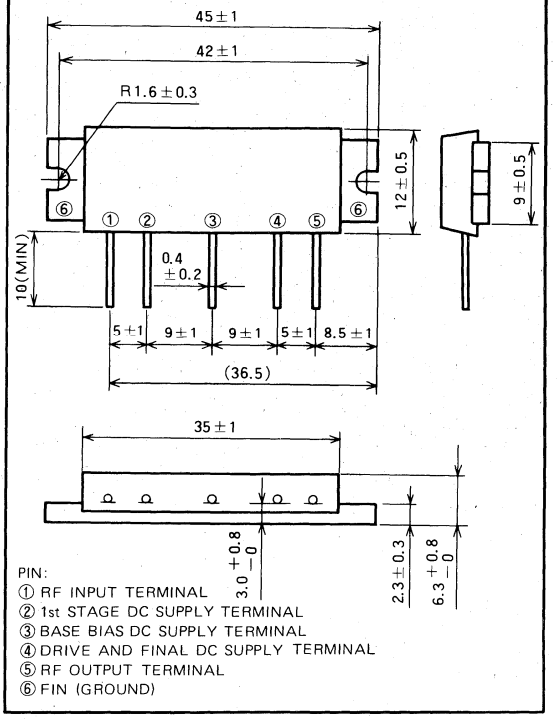
- Wide band: 40MHz, f = 470 ~ 512MHz
- High total efficiency
  $\eta_T \geqq 40\%$ MIN
- High gain, High output
  $G_p \geqq 25dB$, $P_o \geqq 7W$, @V_{CC} = 9.6V, P_{in} = 20mW
- Small package: 45 x 12 x 6.3mm

APPLICATION

Output stage of 5W output UHF band portable radio sets.

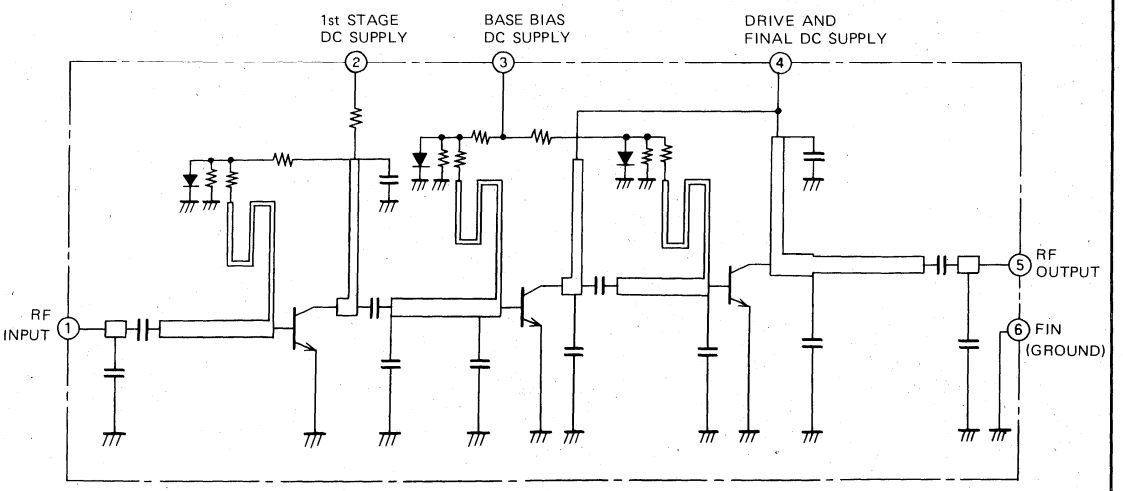
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



470～512MHz 5W FM PORTABLE RADIO

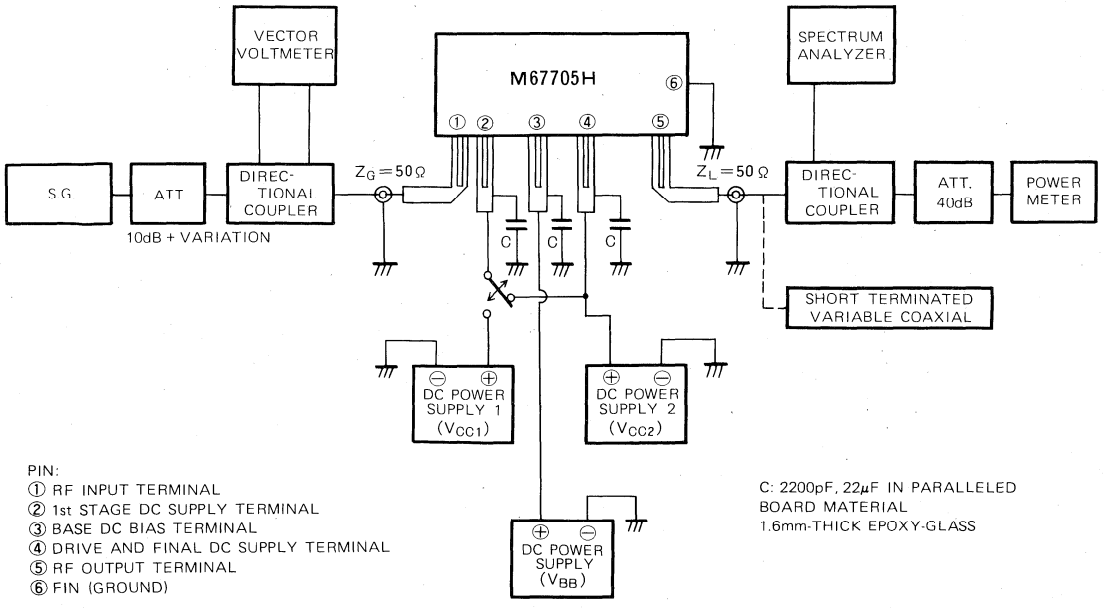
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		13	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\Omega$	40	mW
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=9.6V, V_{BB}=5V, f=400～430MHz, P_{in}=20mW, $Z_G = Z_L = 50\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−25	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=9.6V, V_{BB}=5V, f=400～430 MHz, P_O=7W, $\rho_L \geqq 20$(All pnase), $Z_G = 50\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

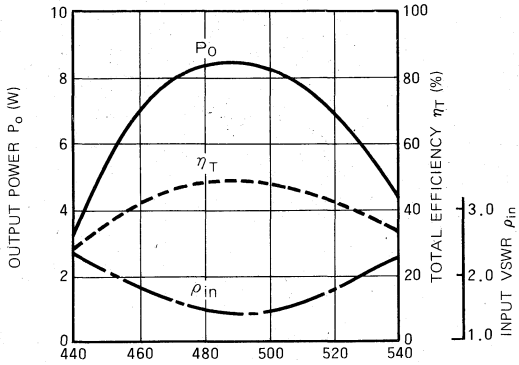


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

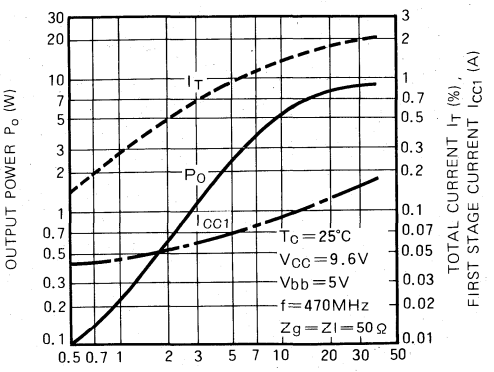
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

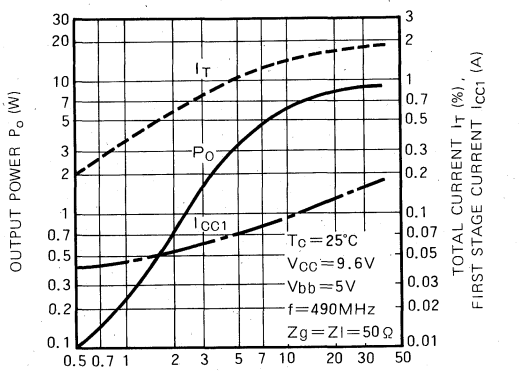
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



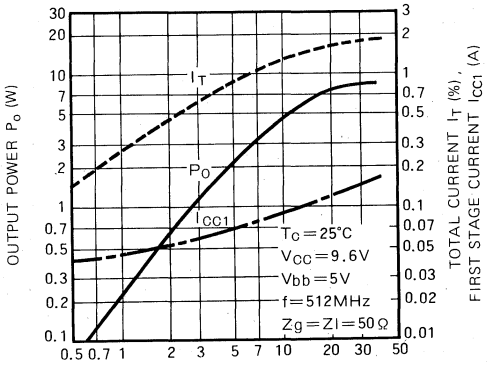
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



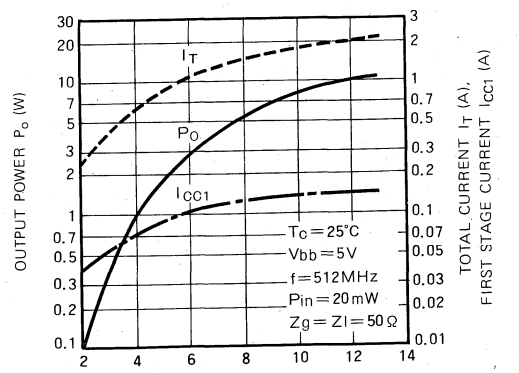
OUTPUT POWER, TOTAL CURRENT FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



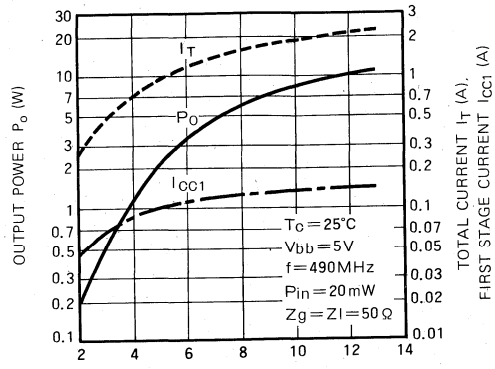
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



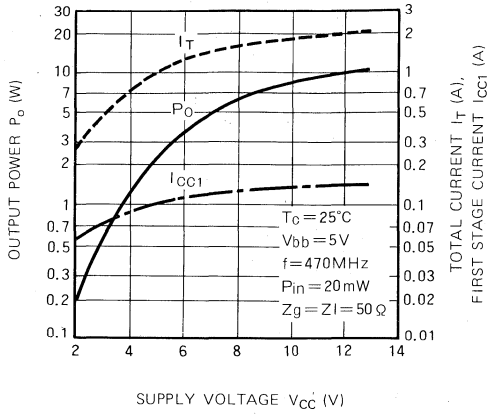
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



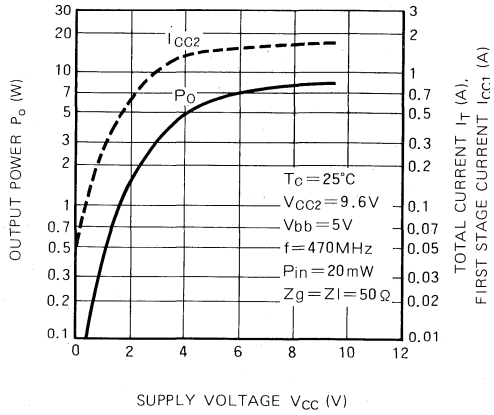
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



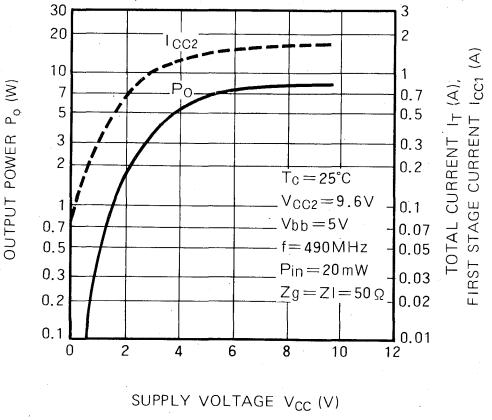
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



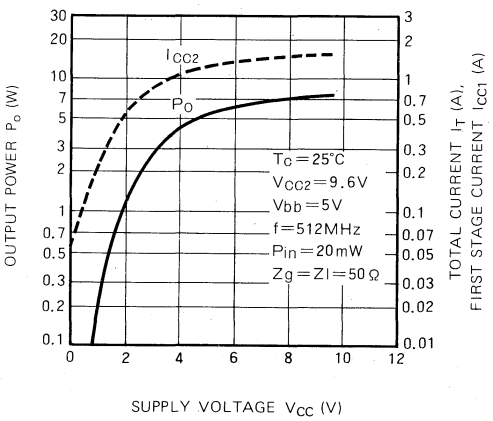
OUTPUT POWER, FINAL CURRENT VS. FIRST STAGE SUPPLY CHARACTERISTICS



OUTPUT POWER, FIRST STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FIANL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M67709

430~470MHz 10W FM MOBILE RADIO

DESCRIPTION

M67709 is a thick film RF power module specifically designed for 430 ~ 470MHz, 10W FM mobile sets.

FEATURES

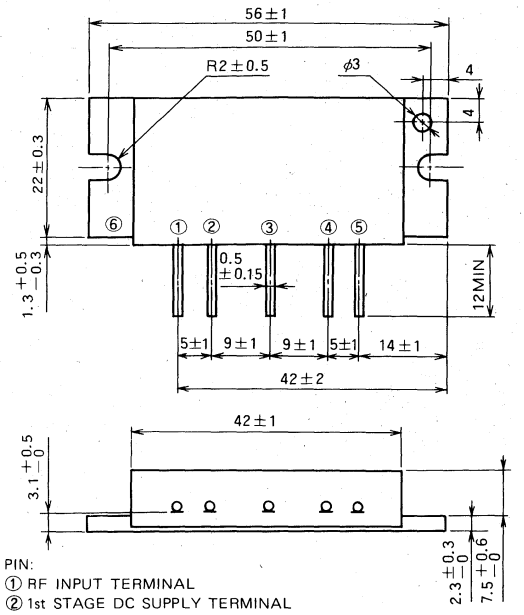
- Wide band: 40MHz, f = 430 ~ 470MHz
- High total efficiency
  $\eta_T \geqq 35\%$ MIN
- High gain, High output
  $G_p \geqq 31dB$, $P_o \geqq 13W$, @V_{CC} = 12.5V, P_{in} = 10mW
- Small package: 56 x 23.3 x 9.8mm

APPLICATION

Output stage of 10W output UHF band mobile radio sets.

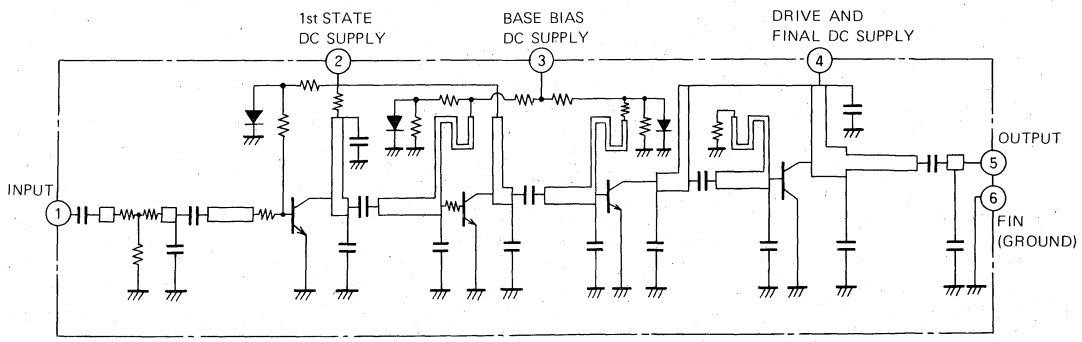
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



430～470MHz 10W FM MOBILE RADIO

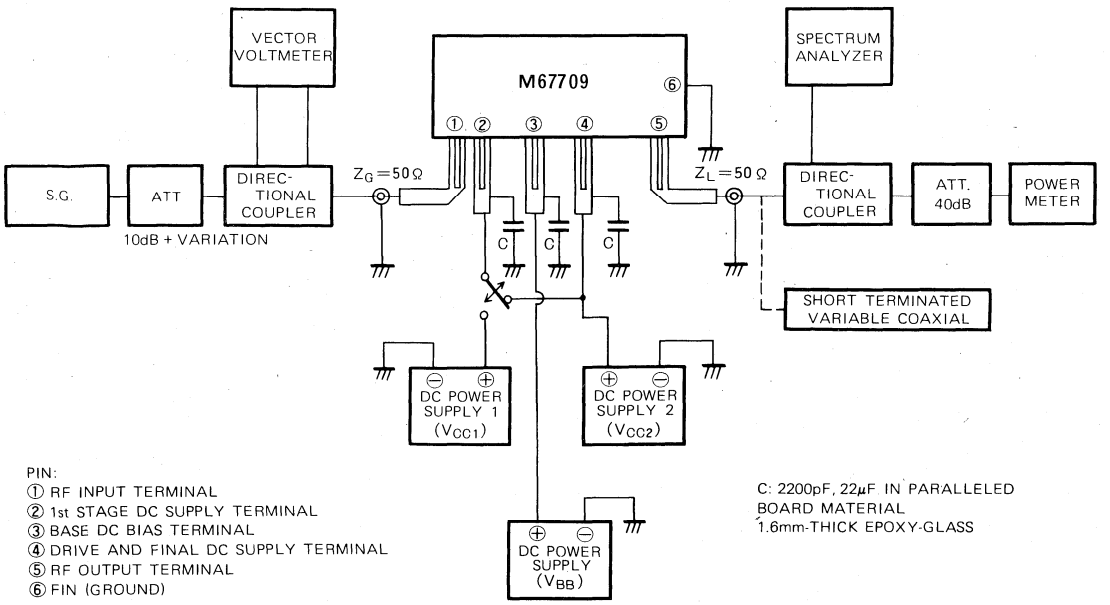
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		5	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\,\Omega$	20	mW
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\,\Omega$	18	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=430～470MHz, P_{in}=10mW, $Z_G = Z_L = 50\,\Omega$	13			W
η_T	Total efficiency		35			%
—	2nd harmonic				−30	dB
—	3nd harmonic				−35	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			2.0		—
—	Load VSWR tolerance	V_{CC1}=12.5V, V_{CC2}=15.2V, V_{BB}=5V, f=430～470MHz, P_O=7W, $\rho_L \geqq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM



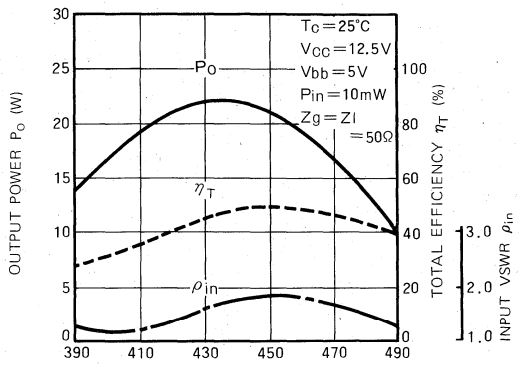
PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

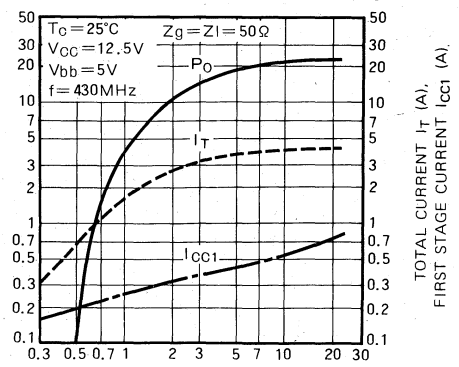
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

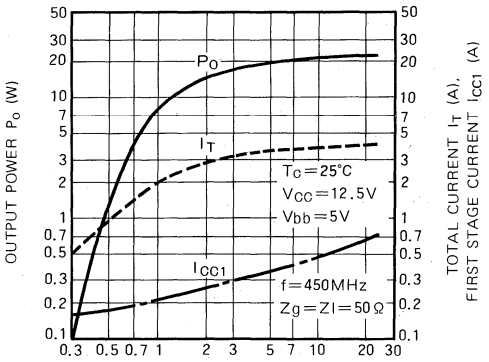
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



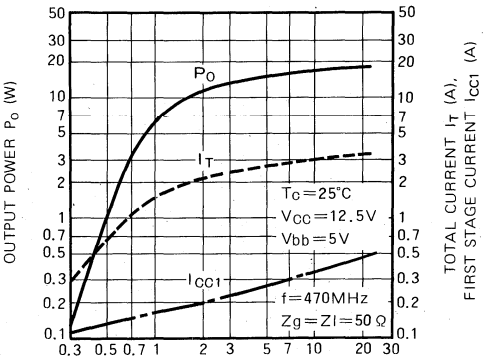
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



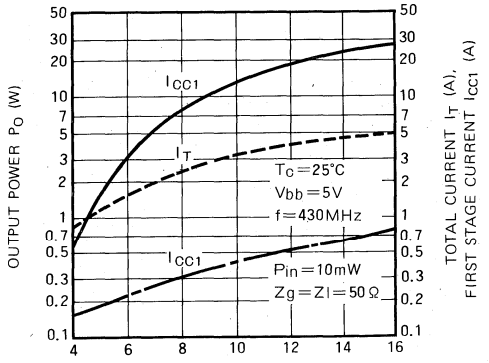
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



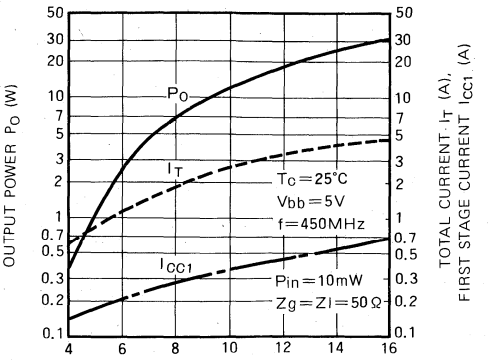
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



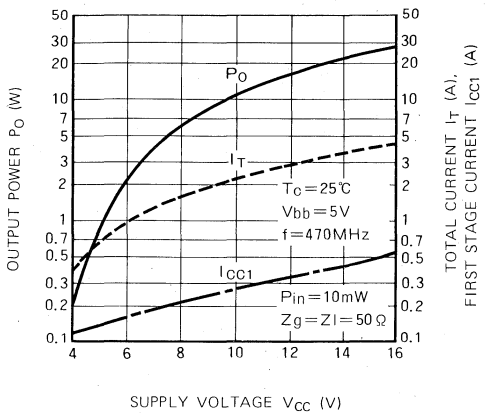
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



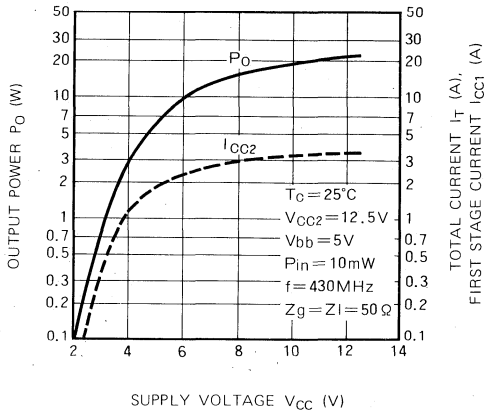
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



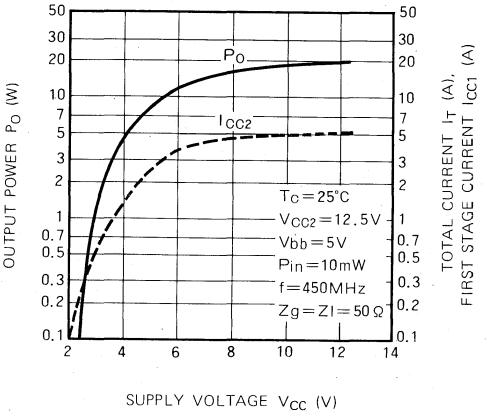
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



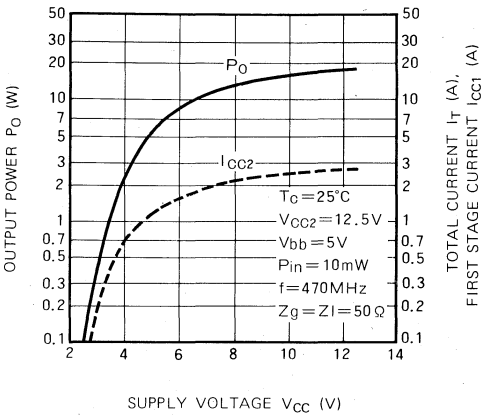
OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M67709M

390~430MHz 10W FM MOBILE RADIO

DESCRIPTION

M67709M is a thick film RF power module specifically designed for 390 ~ 430MHz, 10W FM mobile sets.

FEATURES

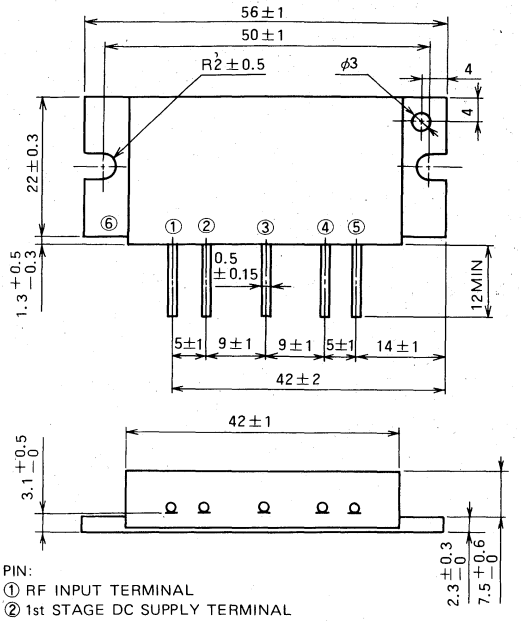
- Wide band: 40MHz, f = 390 ~ 430MHz
- High total efficiency
  $\eta_T \geqq 35\%$ MIN
- High gain, High output
  $G_p \geqq 31dB$, $P_O \geqq 13W$, @V_{CC} = 12.5V, P_{in} = 10mW
- Small package: 56 x 23.3 x 9.8mm

APPLICATION

Output stage of 10W output UHF band mobile radio sets.

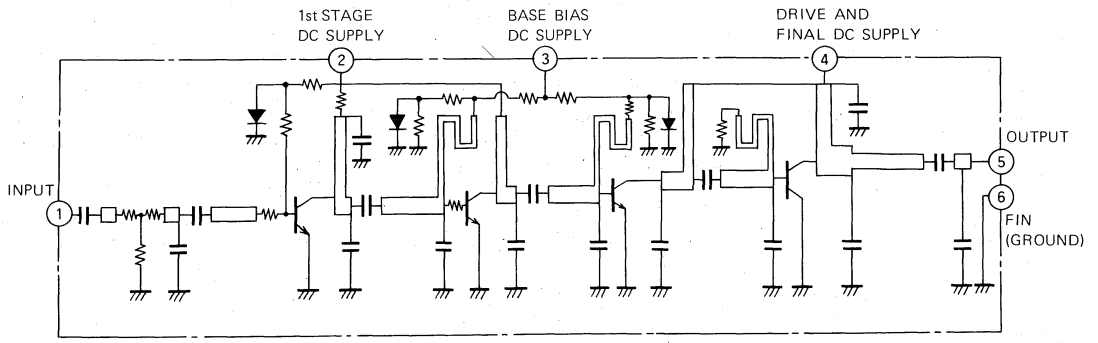
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



390～430MHz 10W FM MOBILE RADIO

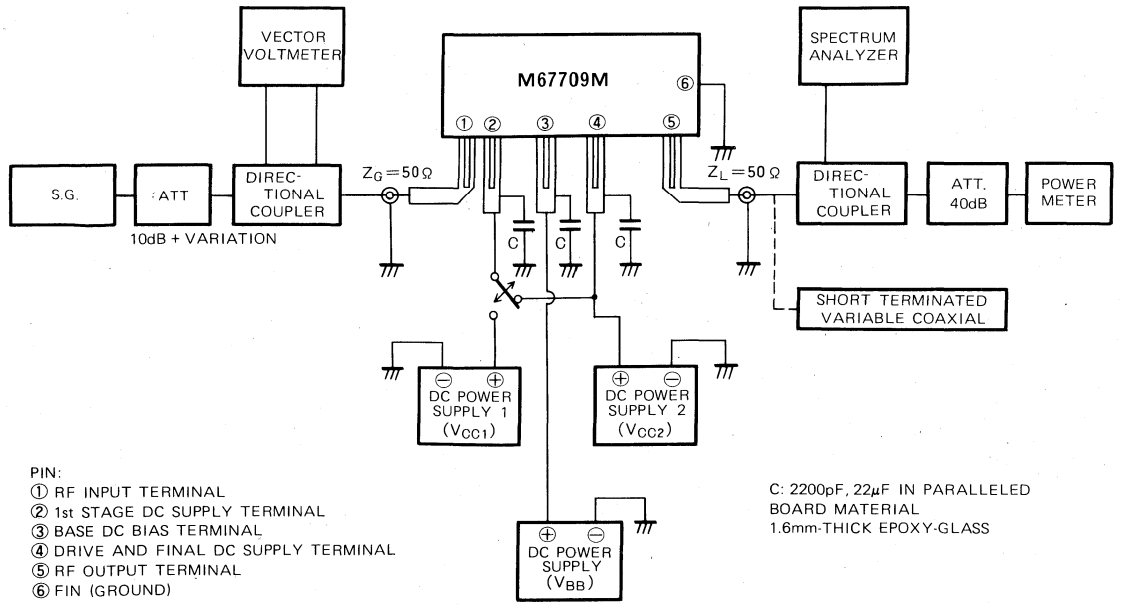
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		5	A
Pin(max)	Input power	$Z_G = Z_L = 50\,\Omega$	20	mW
P_O (max)	Output power	$Z_G = Z_L = 50\,\Omega$	18	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
Tstg	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=390～430MHz, P_{in}=10mW, $Z_G = Z_L = 50\,\Omega$	13			W
η_T	Total efficiency		35			%
—	2nd harmonic				−30	dB
—	3nd harmonic				−35	dB
ρin	Input VSWR				2.8	—
ρout	Output VSWR			2.0		—
—	Load VSWR tolerance	V_{CC1}=12.5V, V_{CC2}=15.2V, V_{BB}=5V, f=390～430 MHz, P_O=7W, $\rho_L \geqq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

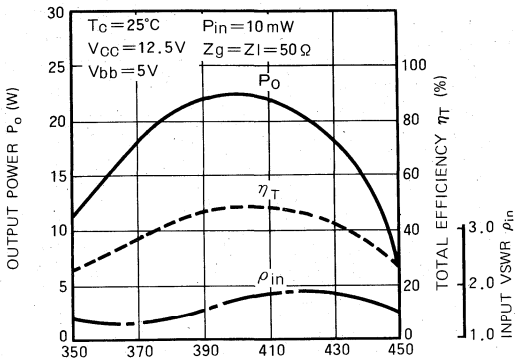


PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE DC BIAS TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

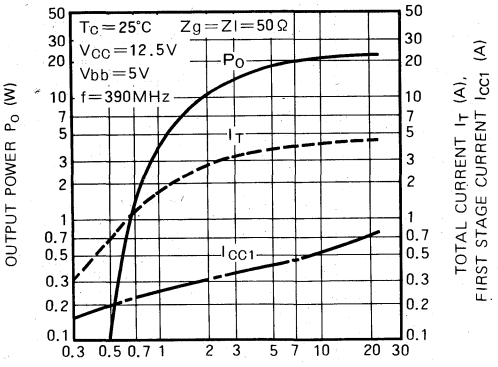
C: 2200pF, 22μF IN PARALLELED
BOARD MATERIAL
1.6mm-THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

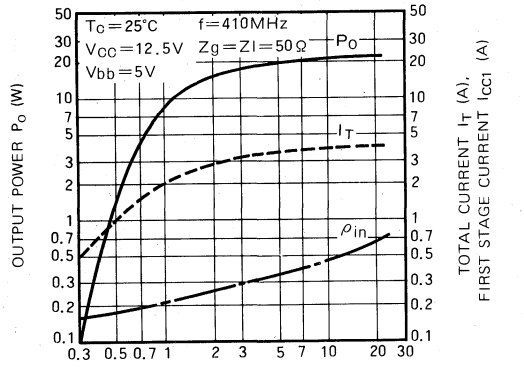
OUTPUT POWER, TOTAL EFFICIENCY, INPUT VSWR VS. FREQUENCY CHARACTERISTICS



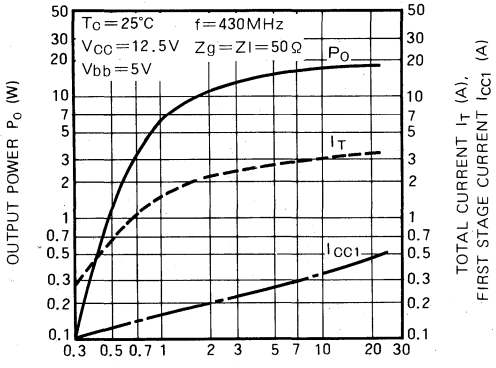
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



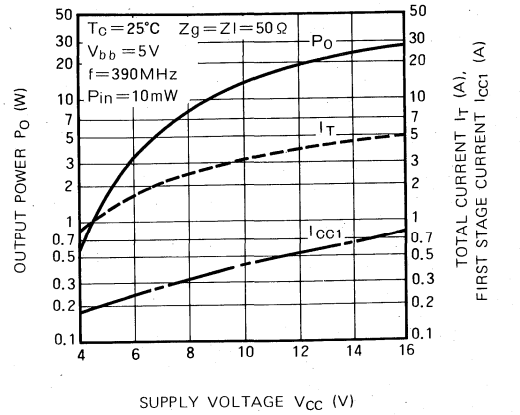
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



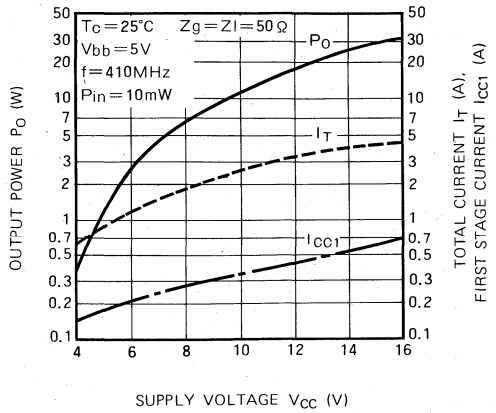
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



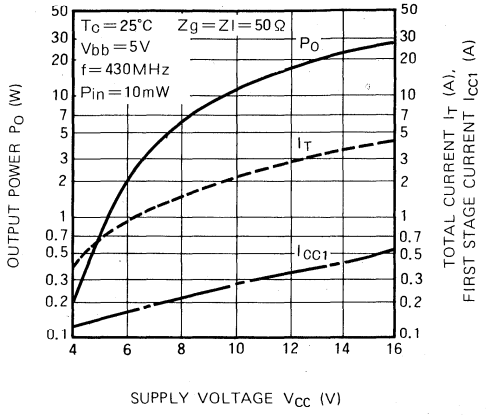
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



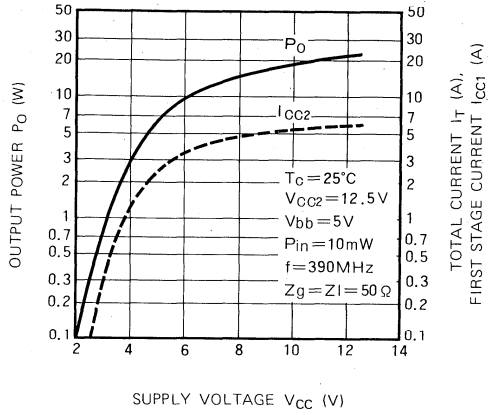
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



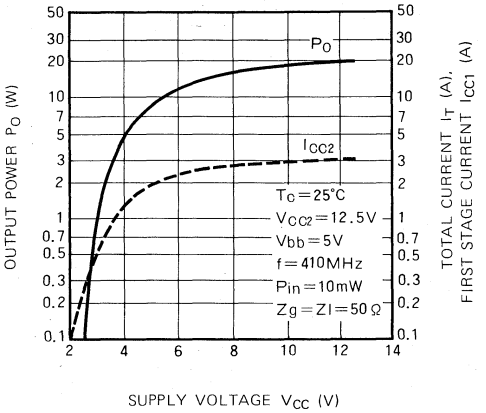
OUTPUT POWER, TOTAL CURRENT, FIRST STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



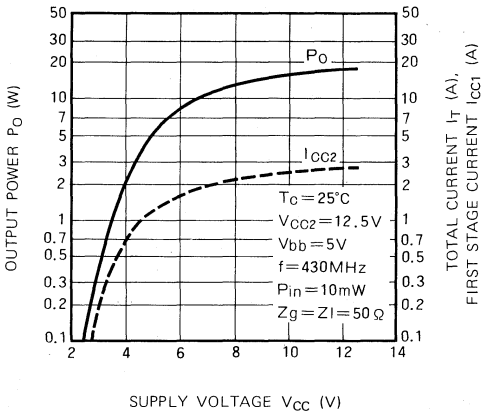
OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, FINAL STAGE CURRENT VS. FIRST STAGE SUPPLY VOLTAGE CHARACTERISTICS



M67710H

150～175MHz, 9.6V 5W FM PORTABLE RADIO

DESCRIPTION

M67710H is a thick film RF power module specifically designed for 150 ～ 175MHz, 5W FM portable sets.

FEATURES

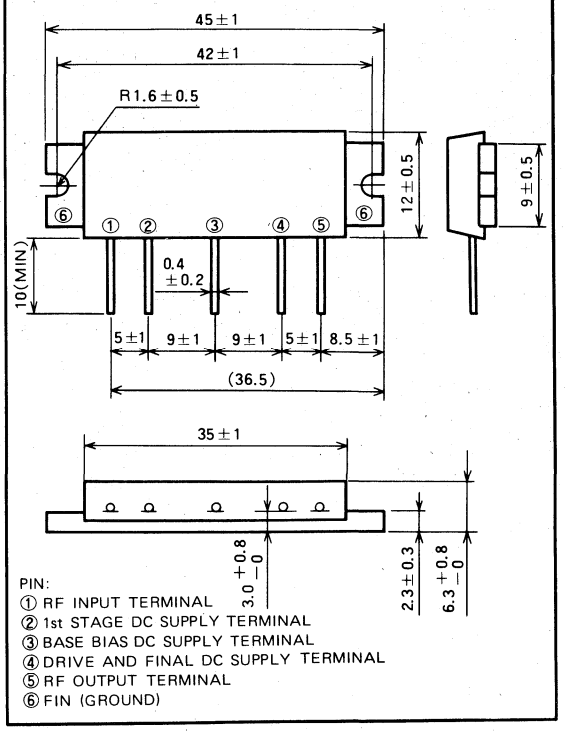
- High gain, High output power
  $Gp \geqq 21dB$ $Po \geqq 7W$, $@V_{CC} = 9.6V$, $Pin = 50mW$
- High total efficiency
  $\eta_T = 45\%$ TYP, 40% MIN $@V_{CC} = 9.6V$, $Pin = 50mW$
- Small package: 45 x 12 x 6.3mm

APPLICATION

Output stage of 5W output VHF band portable radio sets. (especially 9.6V battery sets)

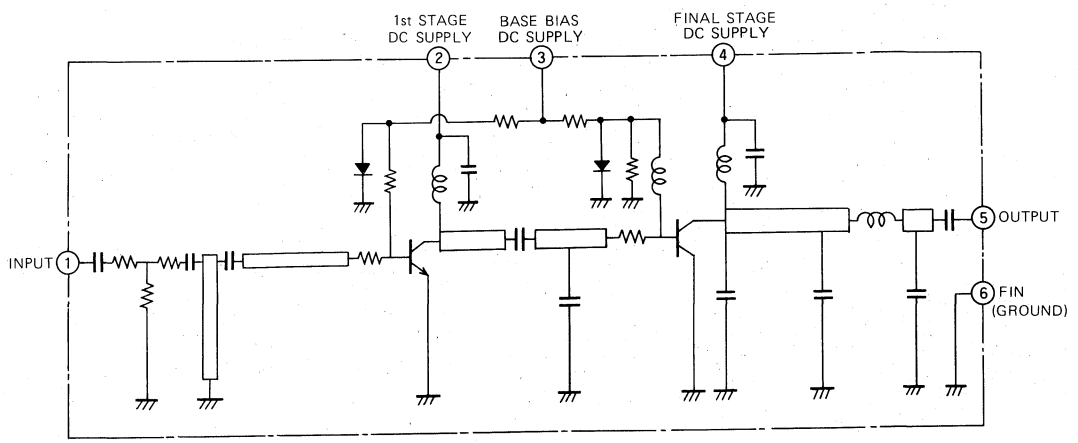
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



150～175MHz, 9.6V 5W FM PORTABLE RADIO

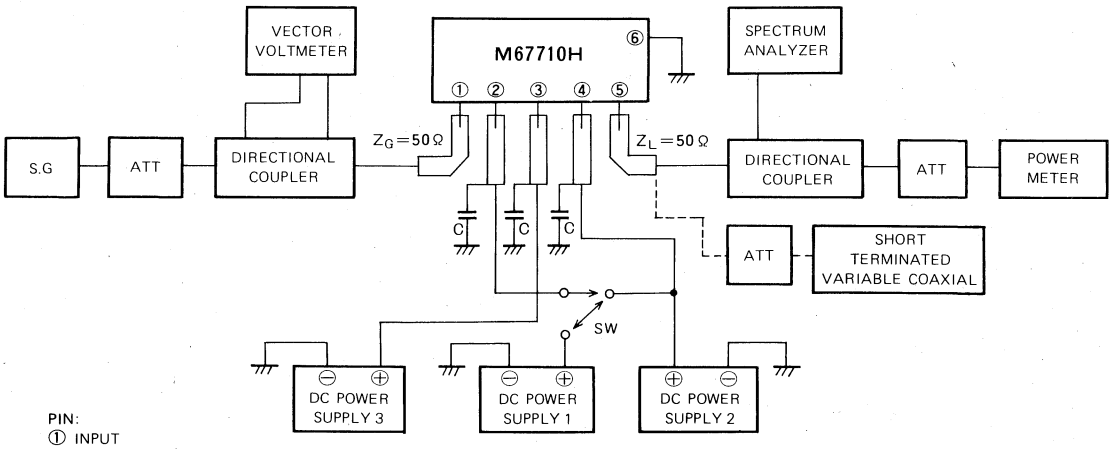
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		16	V
V_{BB}	DC bias voltage		6	V
I_{CC}	Total current		4	A
$P_{in(max)}$	Input power	$Z_G = Z_L = 50\,\Omega$	80	mW
$P_{O(max)}$	Output power	$Z_G = Z_L = 50\,\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 9.6V, V_{BB} = 5V, f = 150～175MHz P_{in} = 50mW, $Z_G = Z_L = 50\,\Omega$	7	8		W
η_T	Total efficiency		40	45		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1} = V_{CC2}$ = 13V, V_{BB} = 5V, f = 150～175MHz P_O = 7W, $\rho_L \geqq 20$ (All phase), $Z_G = 50\,\Omega$	20 : 1			—

TEST BLOCK DIAGRAM

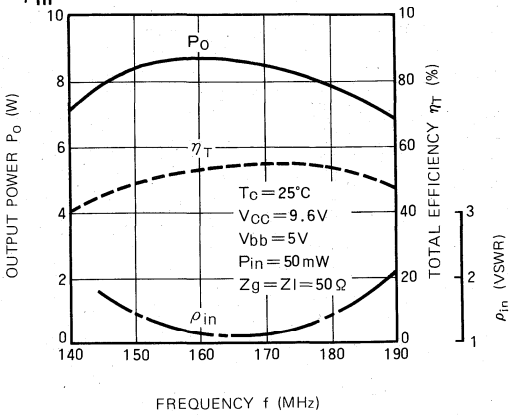


PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

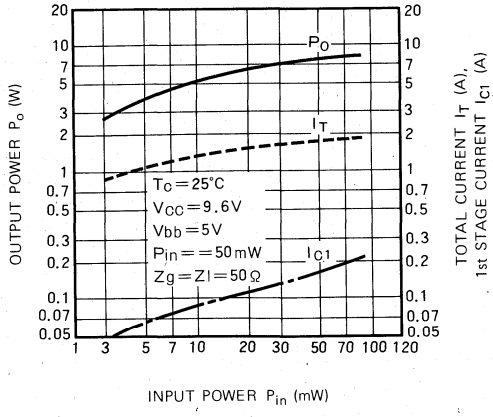
C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

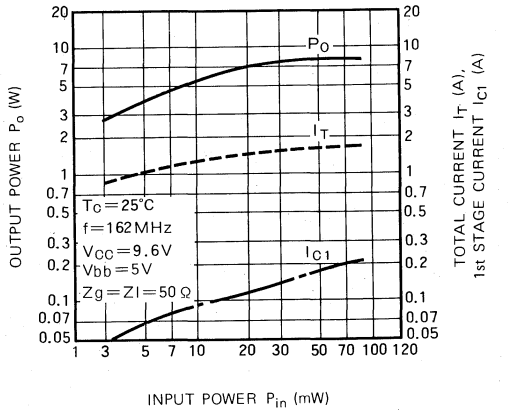
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



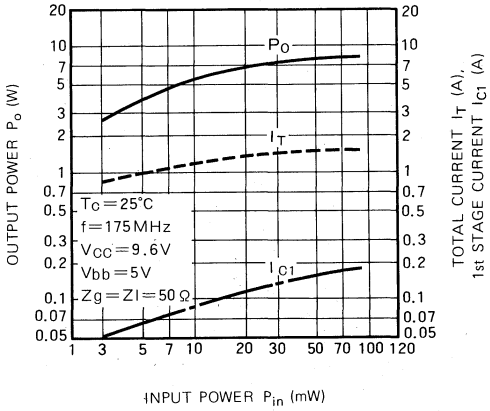
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



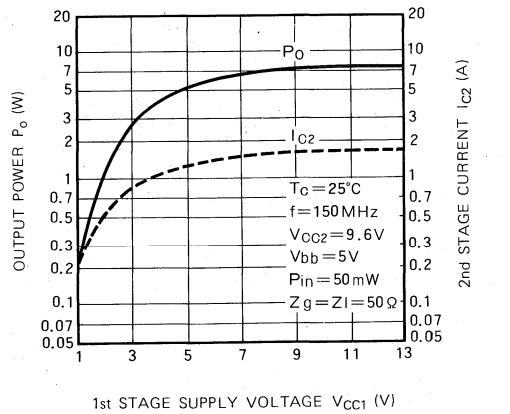
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



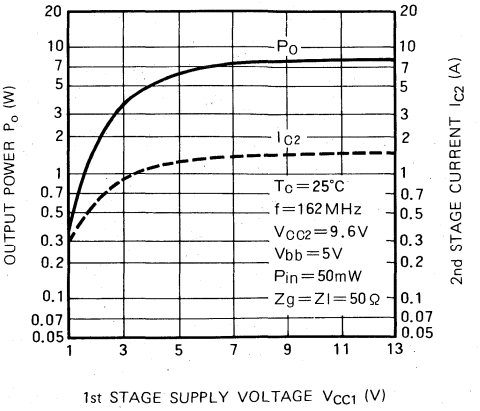
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



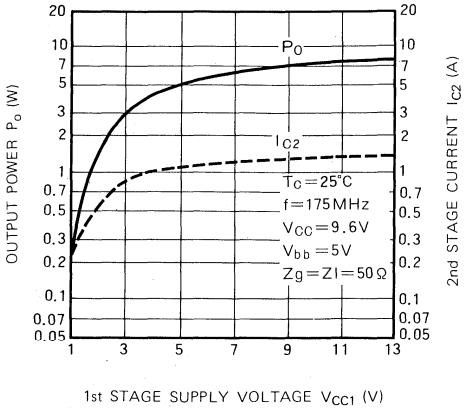
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS

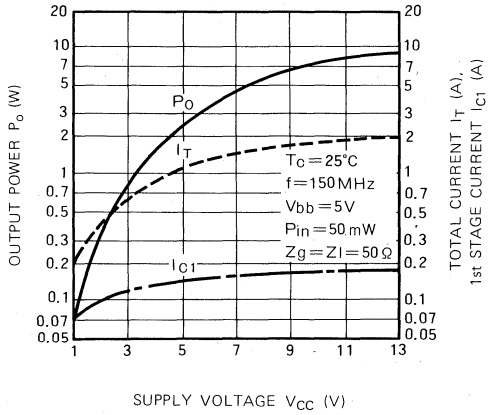
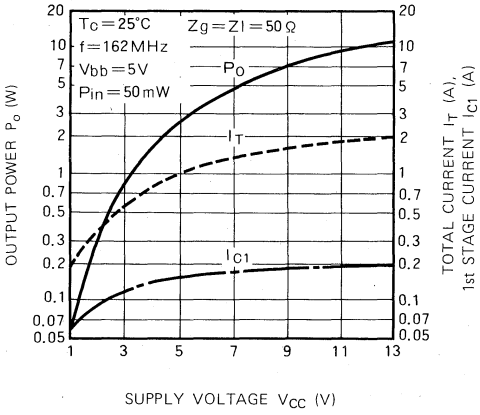
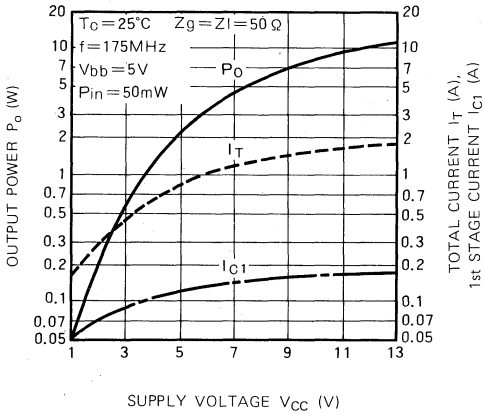


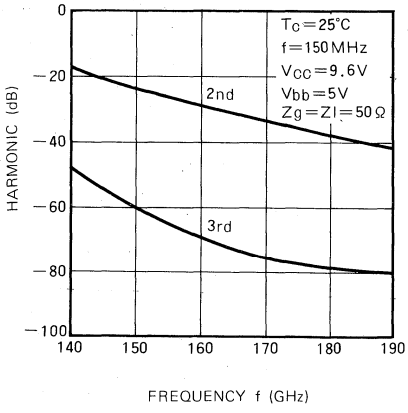
Fig. 9 OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M67712

220~225MHz, 25W, SSB MOBILE RADIO

DESCRIPTION

M67712 is a thick-film RF Power Module specifically designed for 220 ~ 225MHz 25W SSB mobile radios.

FEATURES

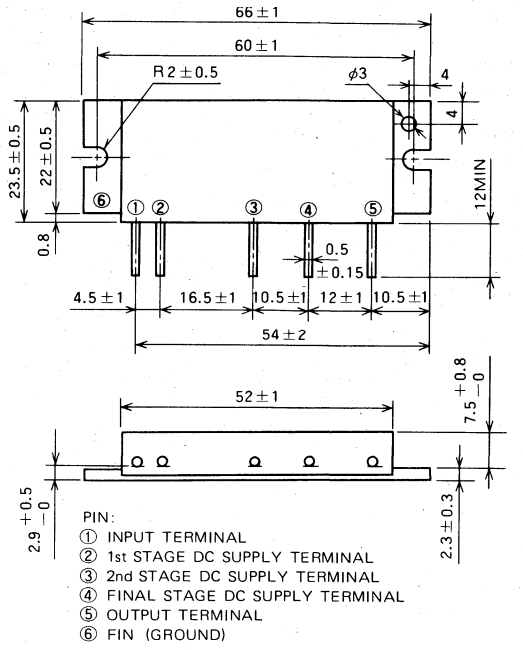
- High power, High gain: $P_O \geqq 30W$, $G_p \geqq 20dB$, @V_{CC} = 12.5V, V_{bb} = 9V, f = 220 ~ 225MHz, P_{in} = 0.3W, Z_g = ZI = 50Ω.
- High power, High gain: $P_O \geqq 30W$, $G_p \geqq 20dB$, @V_{CC} = 12.5V, V_{bb} = 9V, f = 220 ~ 225MHz, P_{in} = 0.3W, Z_g = ZI = 50Ω.

APPLICATION

For output stage of 25W mobile radio sets in 220 ~ 225MHz band.

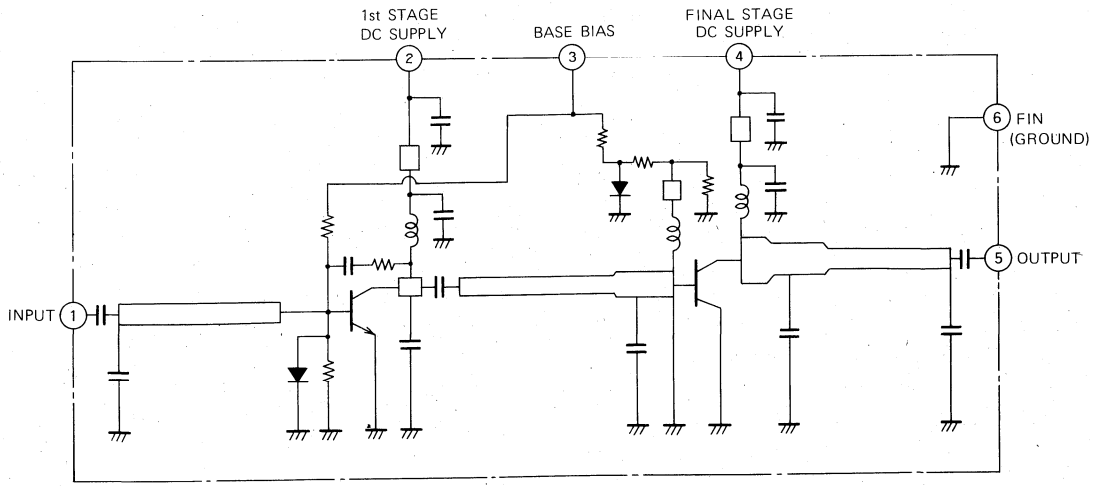
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



220～225MHz, 25W, SSB MOBILE RADIO

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

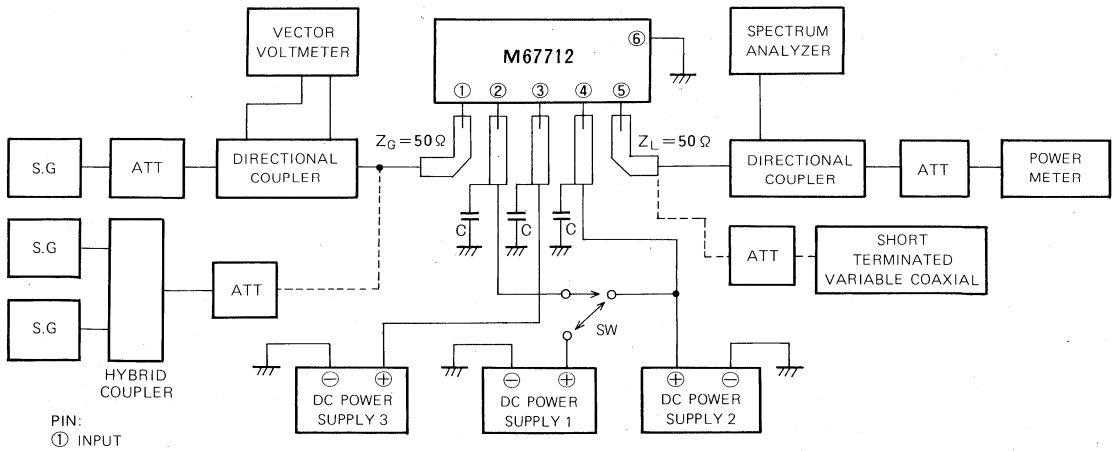
Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC supply voltage		17	V
V_{bb}	Base DC bias voltage		10	V
I_{CC}	Total current		7	A
P_{in}	Input power	Zg=Zl=50Ω	0.6	W
P_O	Output power	Zg=Zl=50Ω	40	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
Tstg	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{bb}=9V, f=220～225MHz, P_{in}=0.3W, Zg=Zl=50Ω	30	33		W
η_T	Total efficiency		43	48		%
—	2nd Harmonics				−30	dB
—	3rd Harmonics				−35	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC1}=V_{CC2}=15.2V, V_{bb}=9V, f=220～225 MHz, P_O=30W, ρ_L≧20(All phase), Zg=5Ω	20 : 1			—
IMD 3	3rd internalmodulation distortion	V_{CC}=12.5V, V_{bb}=9V, f=220～225MHz P.E.P≦30W, Δf=2kHz, Zg=Zl=50Ω			−26	dB
IMD 5	5th internalmodulation distortion				−31	

P.E.P: Peak envelope power

TEST BLOCK DIAGRAM



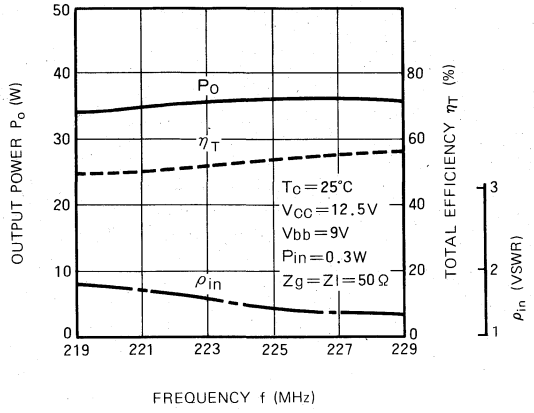
PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

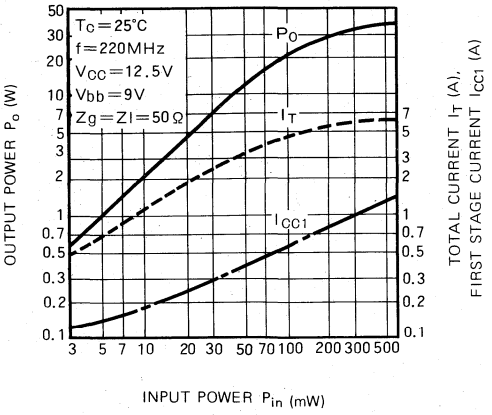
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

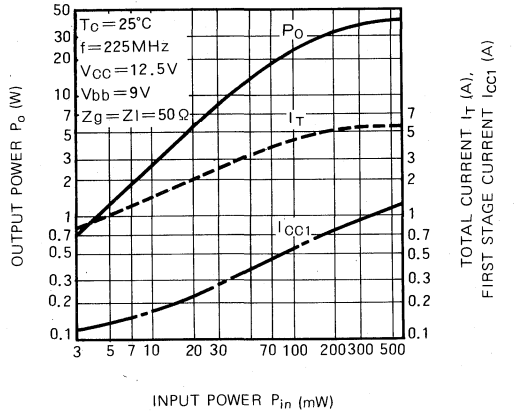
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



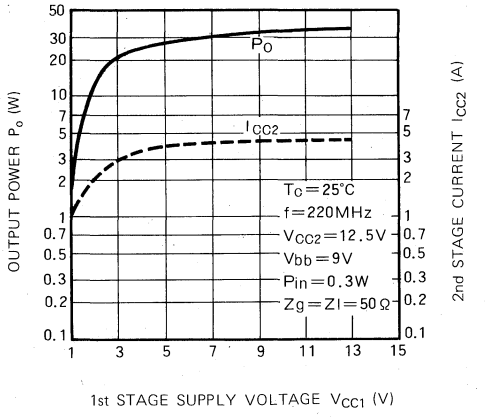
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



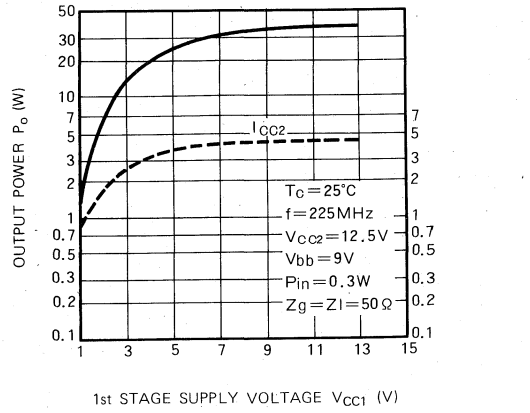
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



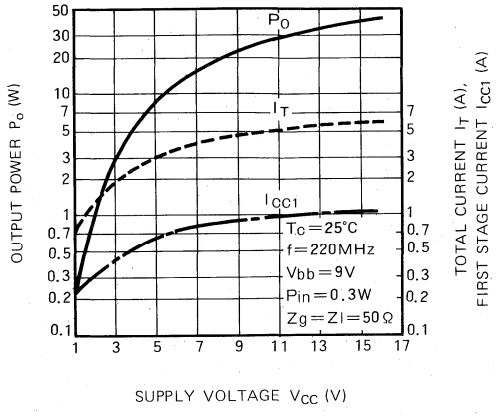
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



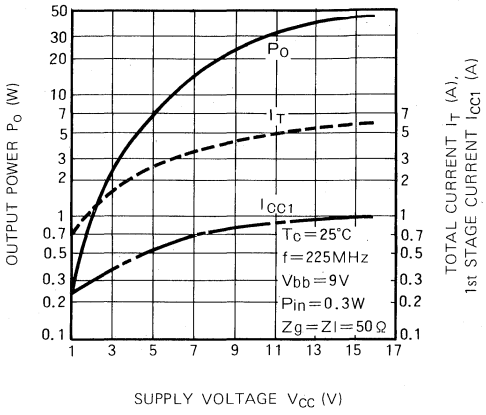
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



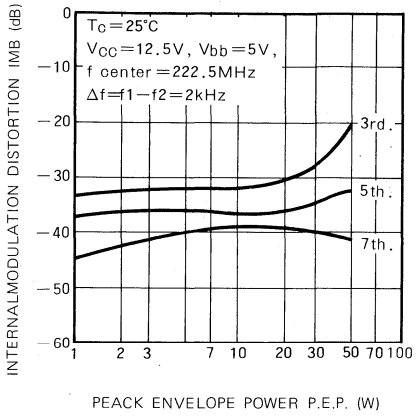
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



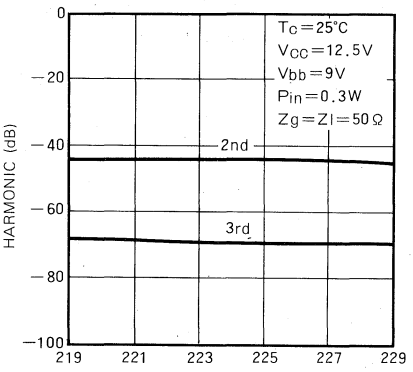
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



INTERNALMODULATION DISTORTION VS. PEACK ENVELOPE POWER CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



MITSUBISHI ELECTRIC

M67713

220~225MHz, 12.5V, 5W FM PORTABLE RADIO

DESCRIPTION

M67713 is a thick film RF power module specifically designed for 220 ~ 225MHz, 5W FM portable sets.

FEATURES

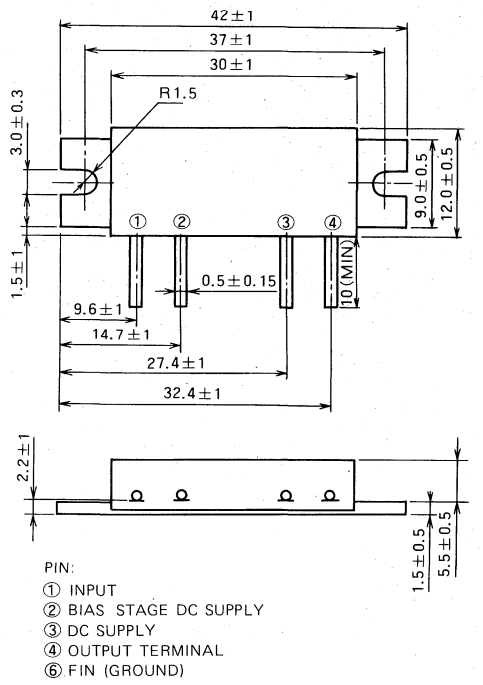
- High gain, High output power
  $G_p \geqq 11.5dB$, $P_o \geqq 7W$,@V_{CC} = 12.5V, P_{in} = 500mW
- High total efficiency
  η_T = 50% TYP, 45% MIN @V_{CC} = 12.5V, Pin = 500mW
- Small package: 42 x 12 x 5.5mm

APPLICATION

Output stage of 5W output VHF band portable radio sets. (especially 12.5V battery sets)

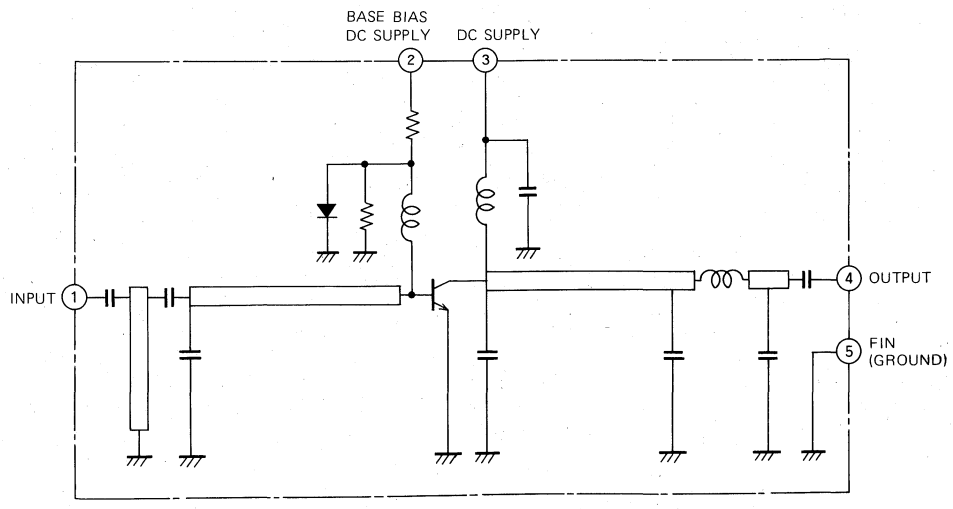
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT
② BIAS STAGE DC SUPPLY
③ DC SUPPLY
④ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



220～225MHz, 12.5V, 5W FM PORTABLE RADIO

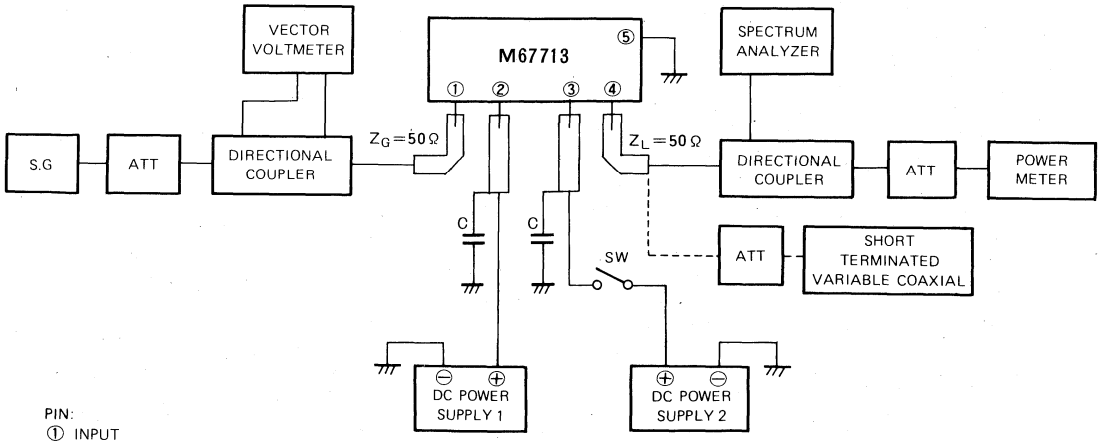
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		16	V
V_{BB}	Base bias voltage		6	V
I_{CC}	Total current		3	A
P_{in}	Input power	Zg = Zl = 50Ω, V_{CC} ≦ 12.5V, Vbb = 5V	1	W
P_O	Output power	Zg = Zl = 50Ω	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC} = 12.5V, V_{BB} = 5V, f = 220～225MHz, P_{in} = 0.5W, Z_G = Z_L = 50Ω	7	8		W
η_T	Total efficiency		45	50		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC1} = V_{CC2} = 13.2V, V_{BB} = 5V, f = 220～225 MHz, P_O = 7W, ρ_L ≧ 20(All phase), Z_G = 50Ω	20 : 1			—

TEST BLOCK DIAGRAM

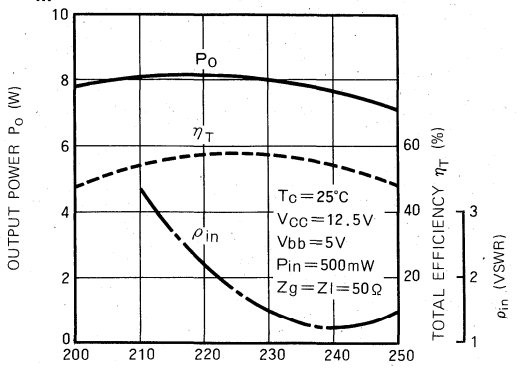


PIN:
① INPUT
② BASE BIAS DC SUPPLY
③ DC SUPPLY
④ OUTPUT
⑤ FIN (GROUND)

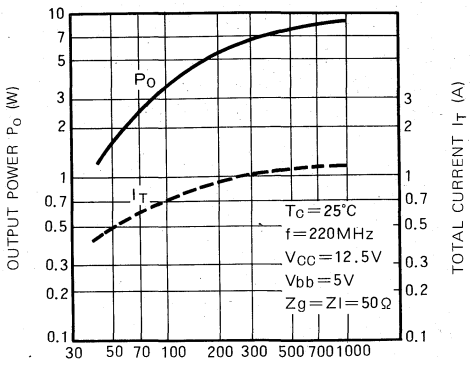
C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

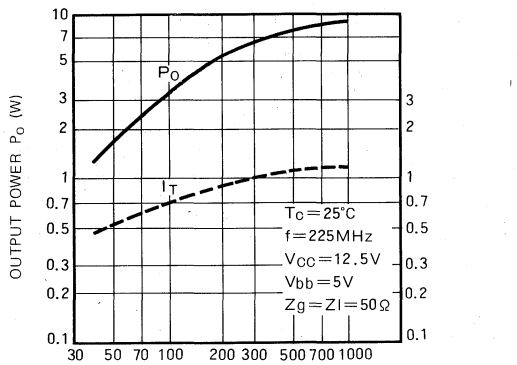
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



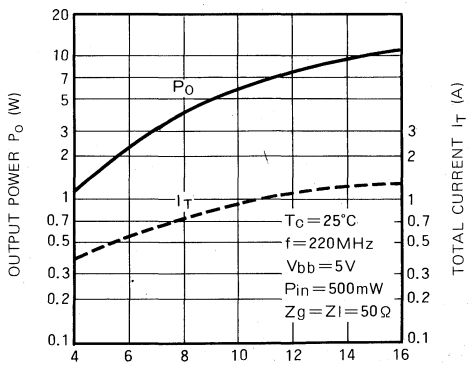
OUTPUT POWER, TOTAL CURRENT VS. INPUT POWER CHARACTERISTICS



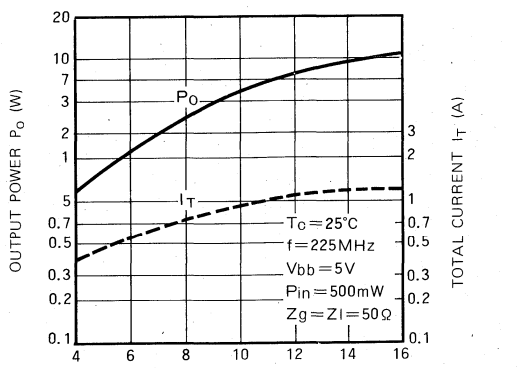
OUTPUT POWER, TOTAL CURRENT VS. INPUT POWER CHARACTERISTICS



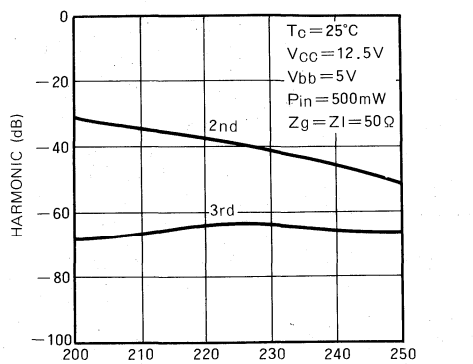
OUTPUT POWER, TOTAL CURRENT VS. TOTAL SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT VS. TOTAL SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS CURRENT VS. INPUT POWER CHARACTERISTICS



M67715

1.24～1.3GHz, 8V, 1W, SSB PORTABLE RADIO

DESCRIPTION

M67715 is thick film RF power module specifically designed for 1.24 ～ 1.3GHz, 1W SSB portable sets.

FEATURES

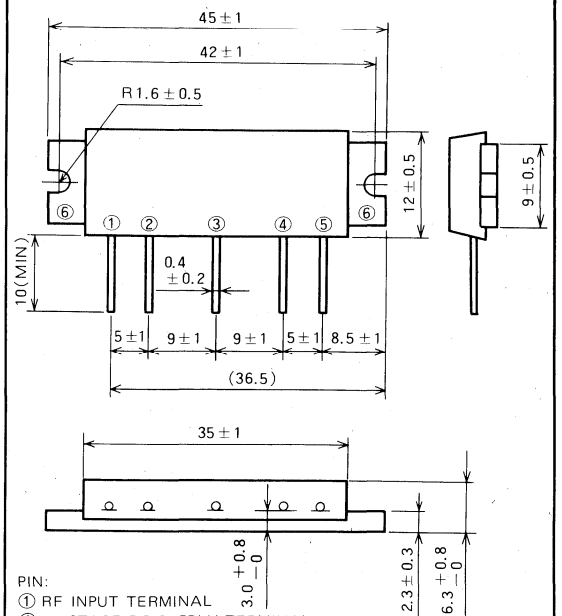
High gain, High output power
$Gp \geqq 21.7dB$ $Po \geqq 1.5W$, $@V_{CC} = 8V$, $Pin = 10mW$
High total efficiency
$\eta_T = 25$ TYP, 23% MIN $@V_{CC} = 8V$
Small package: 45 x 12 x 6.3mm

APPLICATION

Output Stage of 1W output 1.2GHz band portable radio sets (especially 7.2V battery sets) and drive module for M57762.

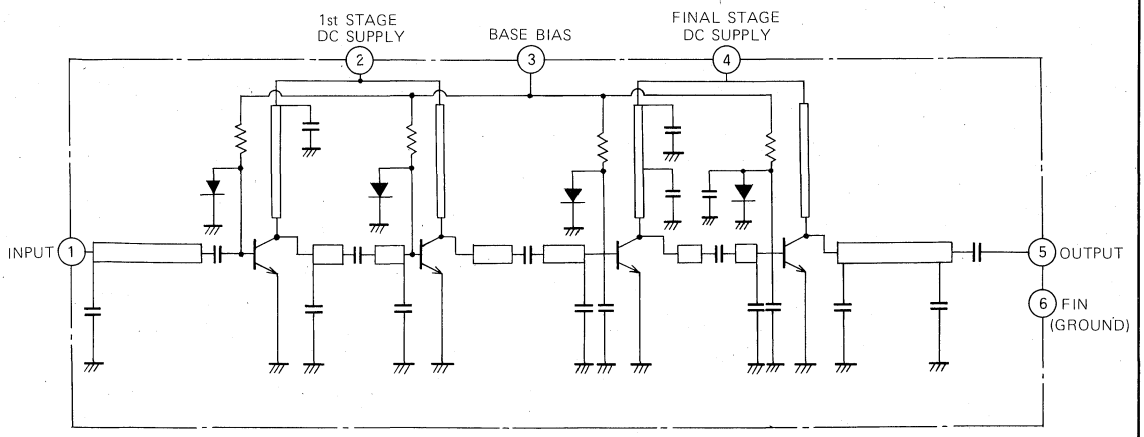
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

1.24～1.3GHz, 8V, 1W, SSB PORTABLE RADIO

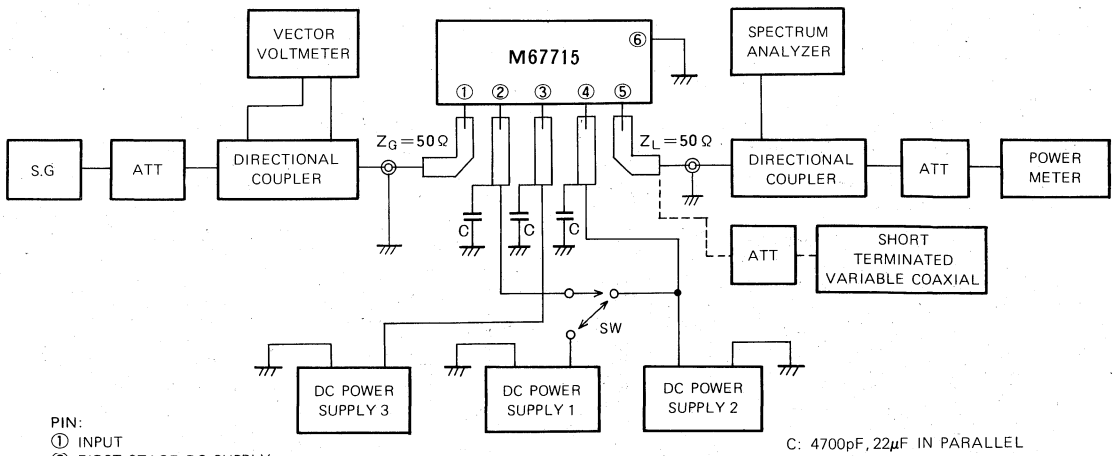
ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC1}	1st Stage supply voltage		9	V
V_{CC2}	2nd Stage supply voltage		16	V
V_{bb}	Base bias voltage		9	V
I_{CC}	Total current		1.5	A
P_{in}	Input power	$Z_g = Z_l = 50\Omega$, $V_{CC} \leqq 8V$, $V_{bb} \leqq 8V$	10	mW
P_O	Output power	$Z_g = Z_l = 50\Omega$	4	W
$T_{C(OP)}$	Operation case temperature		−20～+100	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=8V, V_{bb}=8V, f=1.24～1.3GHz, P_{in}=10mW, $Z_g = Z_l = 50\Omega$	1.5	1.7		W
η_T	Total efficiency		23	25		%
—	2nd Harmonic				−30	dB
—	3rd Harmonic				−35	dB
ρ_{in}	Input VSWR				2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC1}=9V, V_{bb}=9V, V_{CC2}=16V, f=1.24～1.3GHz, P_O=2W, $Z_g = Z_l = 50\Omega$	20 : 1			—
IMD	3rd Inter modulation DIS tortion	V_{CC}=8V, V_{bb}=8V, f=1.24～1.3GHz PEP=1.6W, $Z_g = Z_l = 50\Omega$, Δf=20kHz		−25	−23	dB

TEST BLOCK DIAGRAM

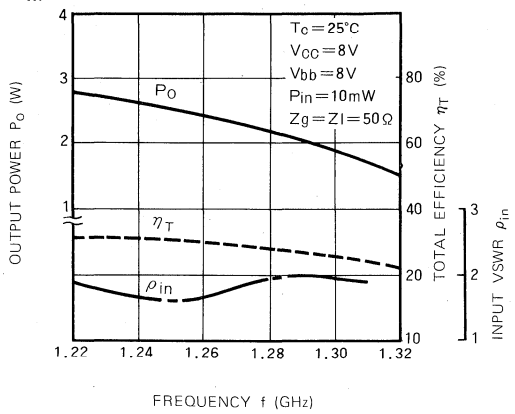


PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

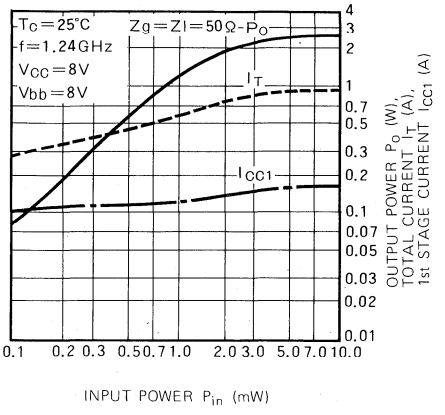
C: 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS
INPUT AND OUTPUT STRIPLINE LENGTH
L = 35mm

TYPICAL PERFORMANCE DATA

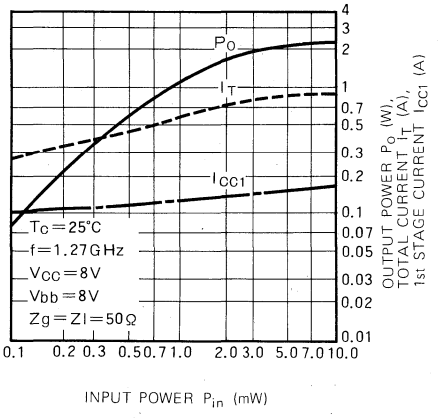
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



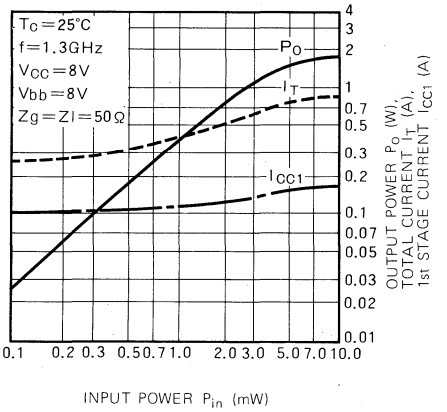
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



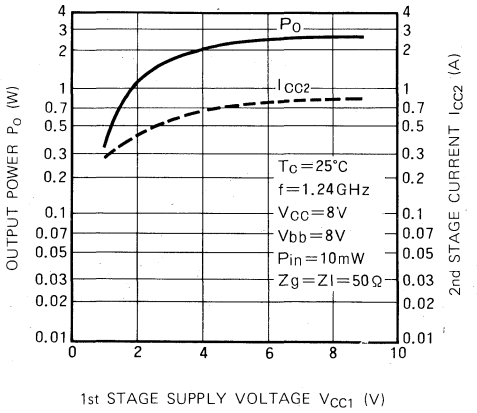
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



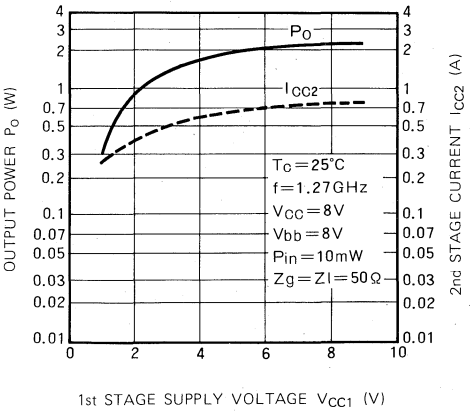
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS

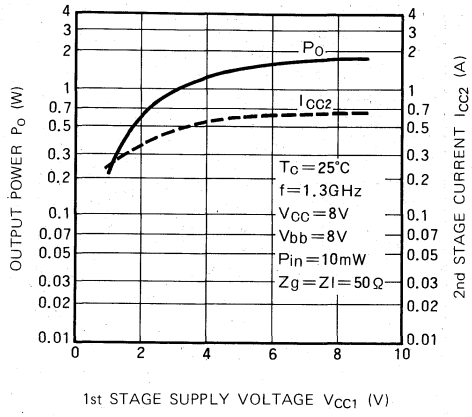


OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS

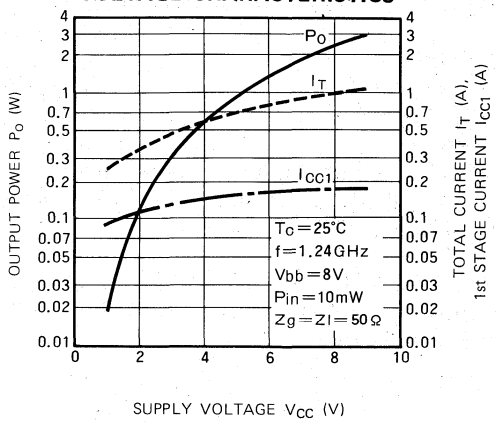


MITSUBISHI ELECTRIC

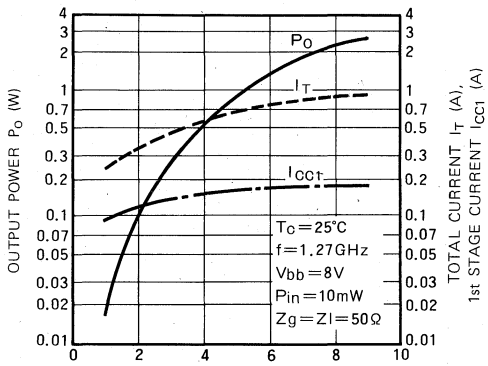
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



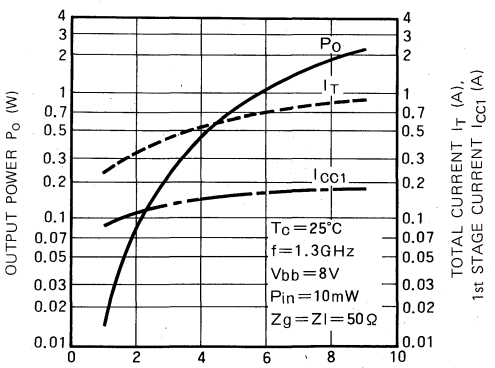
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



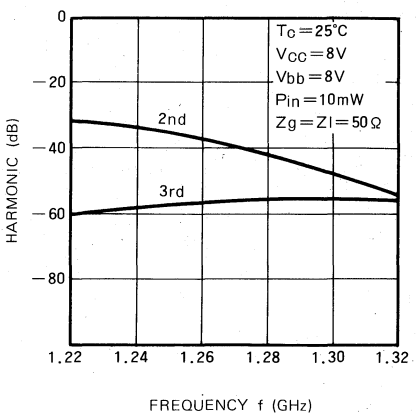
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



M67717

872~905MHz, 3W, FM FOR MOBILE RADIO APPLICATION

DESCRIPTION

M67717 is a thick film RF power module specifically designed for 872 ~ 905MHz, 3W FM mobile radios.

FEATURES

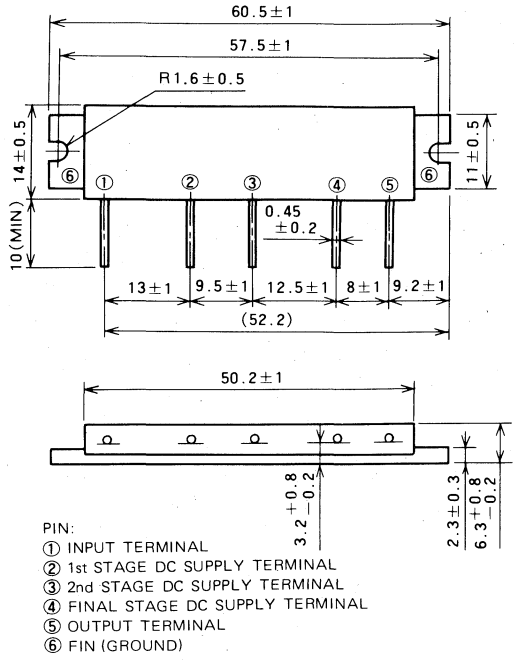
- Frequency Range . . . . . 872 ~ 905MHz
- High Power 7W
- High Gain 38.4dB
- High Ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC1} = V_{CC2} = 8V, V_{CC3} = 15.2V, P_O = 7W.

APPLICATION

Output stage of 3W output mobile radio sets (FM) in 872 ~ 905MHz UHF band.

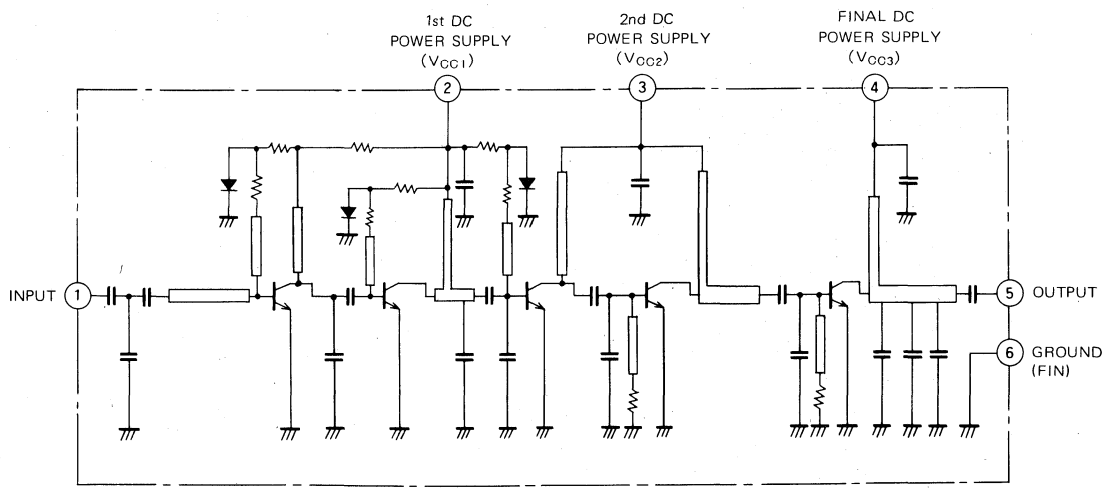
OUTLINE DRAWING

Dimensions in mm



PIN:
① INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ 2nd STAGE DC SUPPLY TERMINAL
④ FINAL STAGE DC SUPPLY TERMINAL
⑤ OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

M67717

872~905MHz, 3W, FM FOR MOBILE RADIO APPLICATION

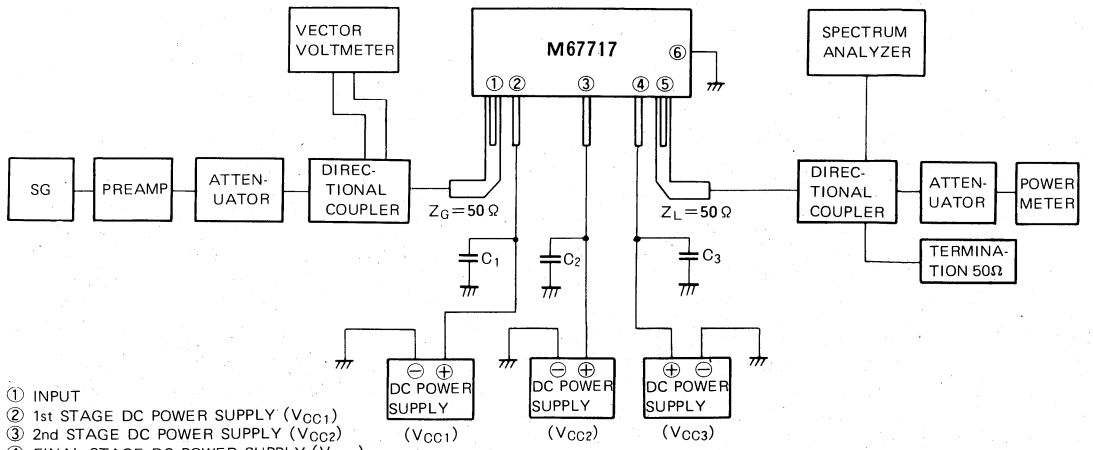
ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC1,2}$	Supply voltage		9	V
V_{CC3}	Supply voltage		17	V
I_{CC}	Total current		4	A
Pin	Input power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 8V$	7	mW
P_O	Output power	$Z_G=Z_L=50\Omega$	10	W
$T_C(op)$	Operation case temperature		−30~+110	°C
Tstg	Storage temperature		−40~+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output Power	f=872~905MHz, $V_{CC1}=V_{CC2}=8V$ $V_{CC3}=12.5V$, Pin=1mW $Z_G=Z_L=50\Omega$	7	9		W
η_T	Total efficiency		35	40		%
—	2nd Harmonics				−30	dB
ρ in	Input VSWR				2.8	—
ρ out	Output VSWR			2		—
—	Load VSWR tolerance	f=872~905MHz, $V_{CC1}=V_{CC2}=8V$ $V_{CC3}=15.2V$, P_O=7W, $Z_G=50\Omega$, 5sec	20 : 1			—

TEST BLOCK DIAGRAM



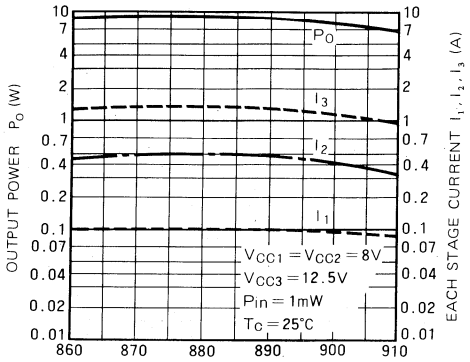
① INPUT
② 1st STAGE DC POWER SUPPLY (V_{CC1})
③ 2nd STAGE DC POWER SUPPLY (V_{CC2})
④ FINAL STAGE DC POWER SUPPLY (V_{CC3})
⑤ OUTPUT
⑥ GROUND (FIN)

C_1, C_2, C_3 : 4700pF, 10μF IN PARALLEL

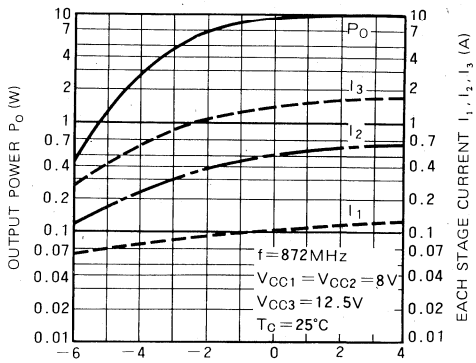
872~905MHz, 3W, FM FOR MOBILE RADIO APPLICATION

TYPICAL PERFORMANCE DATA

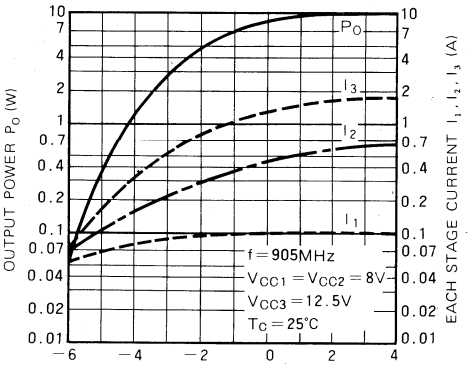
OUTPUT POWER, EACH STAGE CURRENT VS. FREQUENCY



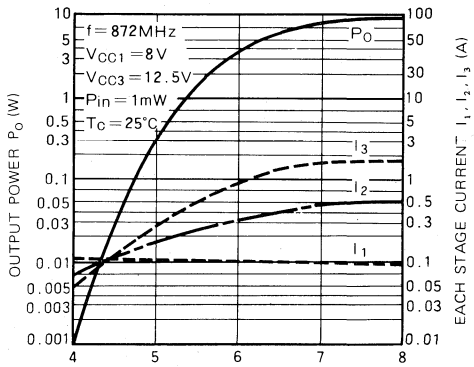
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



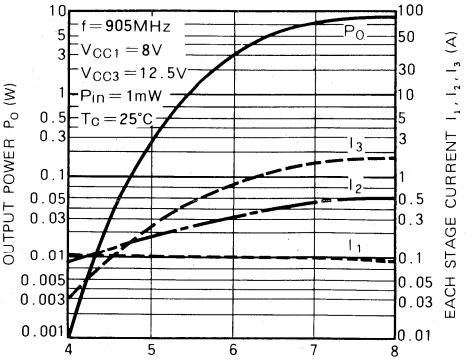
OUTPUT POWER, EACH STAGE CURRENT VS. INPUT POWER



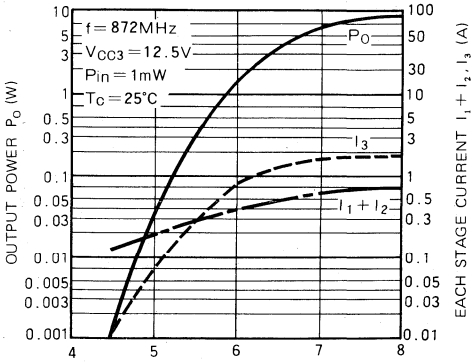
OUTPUT POWER, EACH STAGE CURRENT VS. 2nd STAGE DC SUPPLY VOLTAGE



OUTPUT POWER, EACH STAGE CURRENT VS. 2nd STAGE DC SUPPLY VOLTAGE

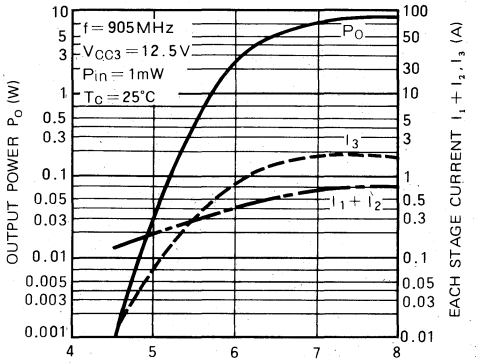


OUTPUT POWER, EACH STAGE CURRENT VS. 1st AND 2nd STAGE DC SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

OUTPUT POWER, EACH STAGE CURRENT
VS. 1st AND 2nd STAGE DC SUPPLY VOLTAGE



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to the following consideration when designing a heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistances between junction of incorporated transistors and case are shown in the followings.

a) First stage transistor
$R_{th(j-c)1} = 20°C/W$ (Typ.)

b) Second stage transistor
$R_{th(j-c)2} = 17.5°C/W$ (Typ.)

c) Third stage transistor
$R_{th(j-c)3} = 16°C/W$ (Typ.)

d) Fourth stage transistor
$R_{th(j-c)4} = 9°C/W$ (Typ.)

e) Final stage transistor
$R_{th(j-c)5} = 6.5°C/W$ (Typ.)

(2) V_{CC}, I_T, RF input & output power conditions at standard operation for each stage transistors are estimated as follows.

P_O = 7W, $V_{CC1} = V_{CC2}$ = 8V, V_{CC3} = 12.5V, P_{in} = 1mW, η_T = 35% (minimum ratings),
I_{1+2} = 0.781A (Total current from 1st stage to 4th stage)
I_3 = 1.1A (Current of 5th stage)

The conditions at standard operation for each stage transistors are shown in Table 1.

- Junction temperature of the first stage transistor
$T_{j1} = (V_{CC1} \times I_{T1} - P_{O1} + P_{in}) \times R_{th(j-c)1} + T_C$ (Note 1)
$= (8 \times 0.045 - 0.02 + 0.001) \times 20 + T_C$
$= 6.8 + T_C$ (°C)

Note 1: Case temperature of device

- Junction temperature of the second stage transistor
$T_{j2} = (V_{CC1} \times I_{T2} - P_{O2} + P_{O1}) \times R_{th(j-c)2} + T_C$
$= (8 \times 0.08 - 0.2 + 0.02) \times 17.5 + T_C$
$= 8.1 + T_C$ (°C)

Table 1: The conditions at standard operation

Stage	V_{CC} (V)	I_T (mA)	P_{in} (mW)	P_O (mW)
1st	8	45	1	20
2nd	8	80	20	200
3rd	8	160	200	500
4th	8	496	500	2000
5th	12.5	1100	2000	7000

- Junction temperature of the third stage transistor
$T_{j3} = (V_{CC2} \times I_{T3} - P_{O3} + P_{O2}) \times R_{th(j-c)3} + T_C$
$= (8 \times 0.16 - 0.5 + 0.2) \times 16 + T_C$
$= 15.7 + T_C$ (°C)

- Junction temperature of the fourth stage transistor
$T_{j4} = (V_{CC2} \times I_{T4} - P_{O4} + P_{O3}) \times R_{th(j-c)4} + T_C$
$= (8 \times 0.496 - 2 + 0.5) \times 9 + T_C$
$= 22.2 + T_C$ (°C)

- Junction temperature of the final stage transistor
$T_{j5} = (V_{CC3} \times I_{T5} - P_O + P_{O4}) \times R_{th(j-c)5} + T_C$
$= (12.5 \times 1.1 - 7 + 2) \times 6.5 + T_C$
$= 56.9 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, keep the case temperature below 90°C at output power P_O = 7W and ambient temperature = 60°C.

The thermal resistance $R_{th(c-a)}$ (Note 2) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_O/\eta_T) - P_O + P_{in}} = \frac{90 - 60}{(7/0.35 - 7 + 0.001)}$$

$= 2.31$ (°C/W)

Note 2: Including the contact thermal resistance between device and heat sink

Mounting the device on the heat sink with above thermal resistance, junction temperatures of each transistor become;
T_{j1} = 97°C, T_{j2} = 99°C, T_{j3} = 106°C, T_{j4} = 113°C, T_{j5} = 147°C at T_a = 60°C, T_C = 90°C.

Since the annual average of ambient temperature is 30°C, junction temperatures of each transistor become;
T_{j1} = 67°C, T_{j2} = 69°C T_{j3} = 76°C, T_{j4} = 76°C, T_{j5} = 117°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

M67723

220~225MHz, 12.5V, 5W FM PORTABLE RADIO

DESCRIPTION

M67723 is a thick film RF power module specifically designed for 220 ~ 225MHz, 5W FM portable sets.

FEATURES

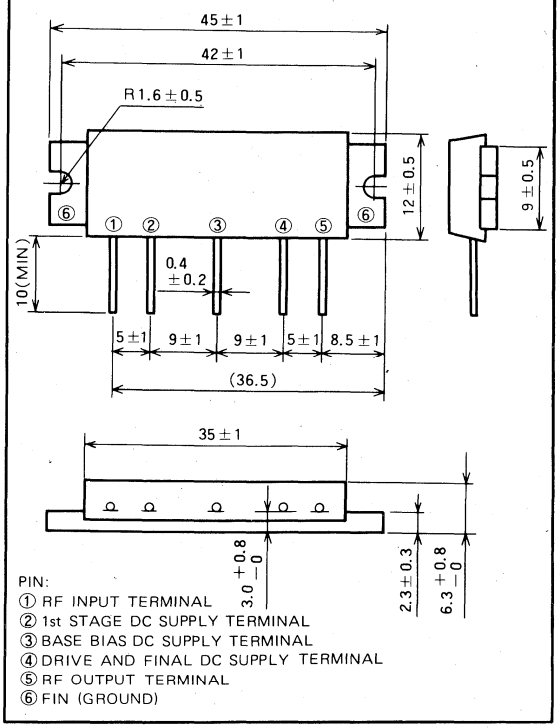
- High gain, High output power
  $G_p \geqq 25.4dB$, $P_o \geqq 7W$, @V_{CC} = 12.5V, P_{in} = 20mW
- High total efficiency
  η_T = 50% TYP, 45% MIN @V_{CC} = 12.5V, Pin = 20mW
- Small package: 45 x 12 x 6.3mm

APPLICATION

Output stage of 5W output VHF band portable radio sets. (especially 12.5V battery sets)

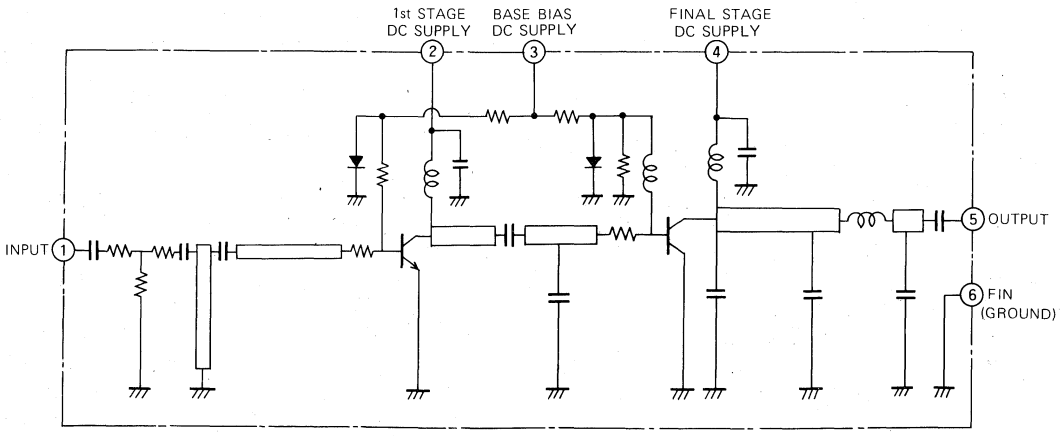
OUTLINE DRAWING

Dimensions in mm



PIN:
① RF INPUT TERMINAL
② 1st STAGE DC SUPPLY TERMINAL
③ BASE BIAS DC SUPPLY TERMINAL
④ DRIVE AND FINAL DC SUPPLY TERMINAL
⑤ RF OUTPUT TERMINAL
⑥ FIN (GROUND)

EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

220～225MHz, 12.5V, 5W FM PORTABLE RADIO

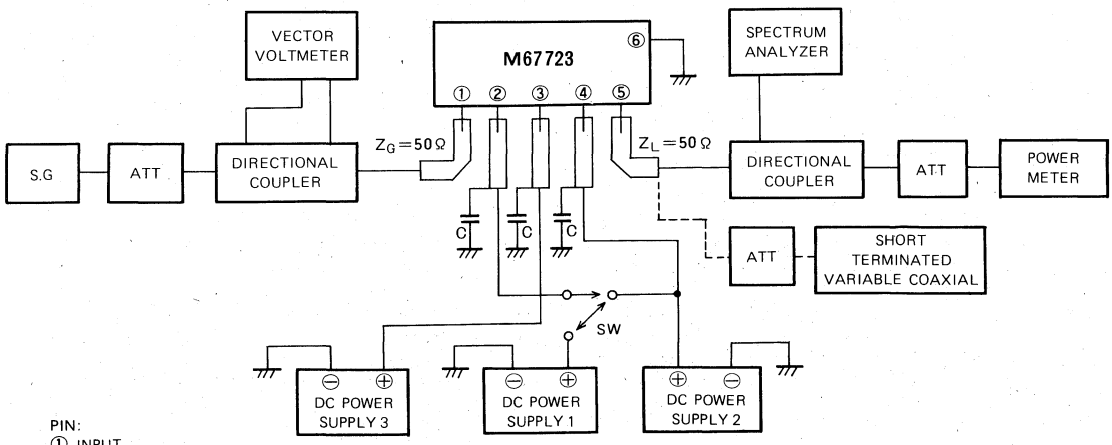
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		16	V
V_{BB}	Base DC bias voltage		6	V
I_{CC}	Total current		4	A
P_{in}(max)	Input power	$Z_G=Z_L=50\Omega$	40	mW
P_O(max)	Output power	$Z_G=Z_L=50\Omega$	10	W
$T_{C(OP)}$	Operation case temperature		−30～−110	°C
T_{stg}	Storage temperature		−40～−110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, V_{BB}=5V, f=220～225MHz P_{in}=20mW, $Z_G=Z_L=50\Omega$	7	8		W
η_T	Total efficiency		45	50		%
—	2nd harmonic				−20	dB
—	3nd harmonic				−30	dB
ρ_{in}	Input VSWR			1.5	2.5	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	$V_{CC1}=V_{CC2}$=13.2V, V_{BB}=5V, f=220～225 MHz, P_O=7W, $\rho_L \geqq 20$ (All phase), $Z_G=50\Omega$	20：1			—

TEST BLOCK DIAGRAM

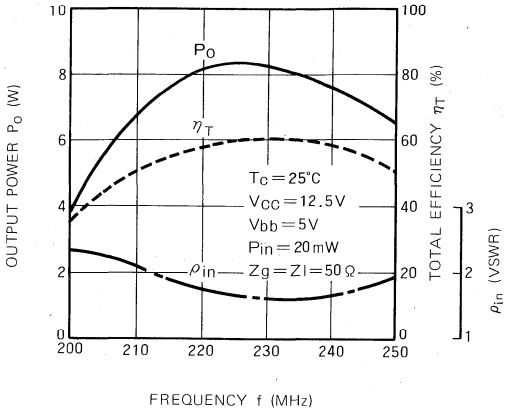


PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ BIAS DC SUPPLY
④ FINAL STAGE DC SUPPLY
⑤ OUTPUT
⑥ FIN (GROUND)

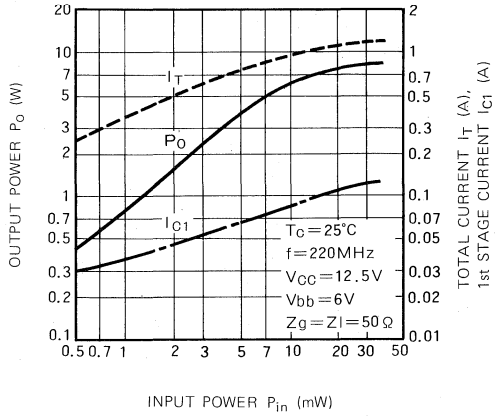
C; 4700pF, 22μF IN PARALLEL
BOARD MATERIAL
1.6mm THICK EPOXY-GLASS

TYPICAL PERFORMANCE DATA

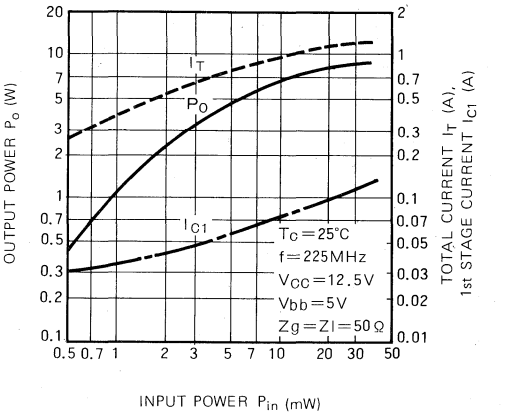
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



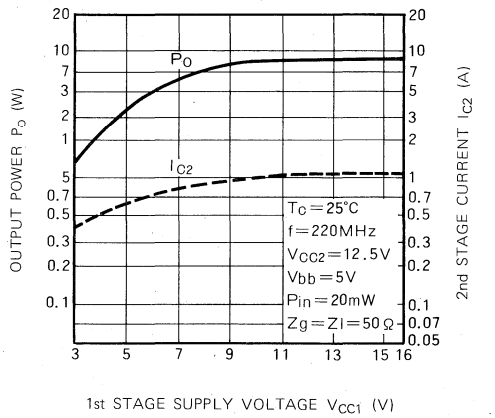
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



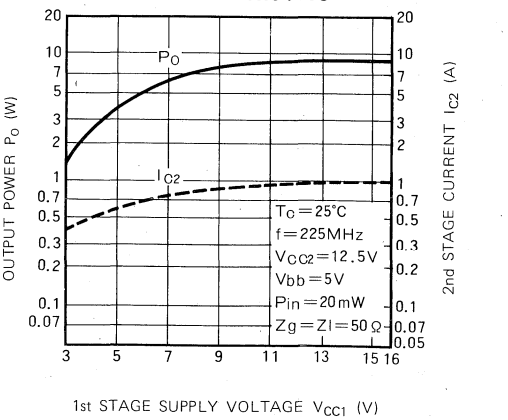
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



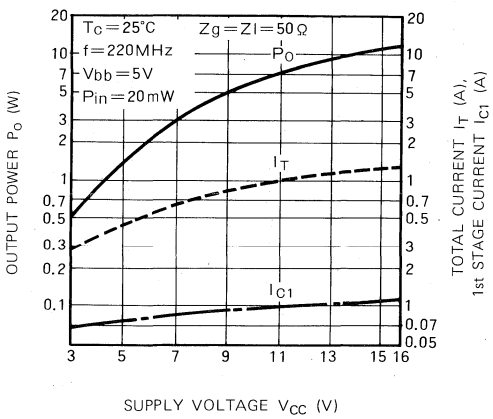
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS

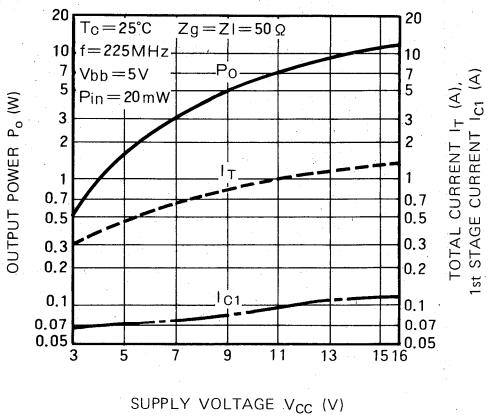


OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS

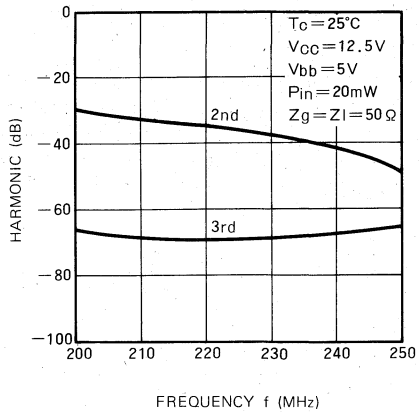


MITSUBISHI ELECTRIC

OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



M67730L

175~200MHz, 25W, FM MOBILE RADIO

DESCRIPTION

M67730L is a thick-film RF-power hybrid IC specifically designed for 175 ~ 200MHz 25W FM mobil radios.

FEATURES

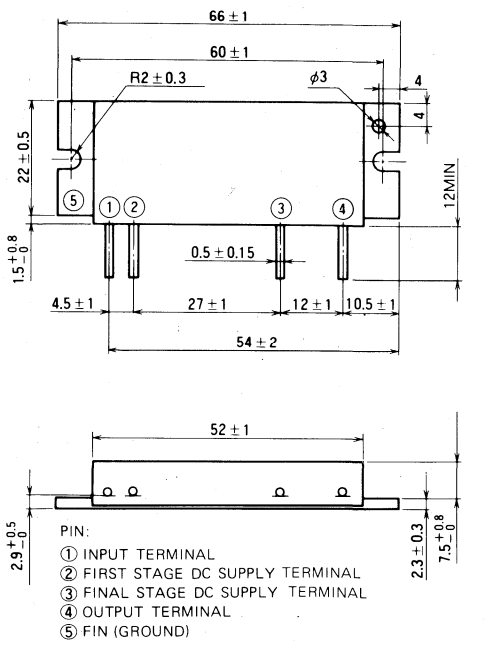
- High power, High gain: $P_o \geqq 30W$, $G_p \geqq 20dB$, @V_{CC} = 12.5V, f = 175 ~ 200MHz, P_{in} = 0.3W, $Z_G = Z_L = 50\Omega$.
- High ruggedness: ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, f = 175 ~ 200MHz, P_o = 30W.

APPLICATION

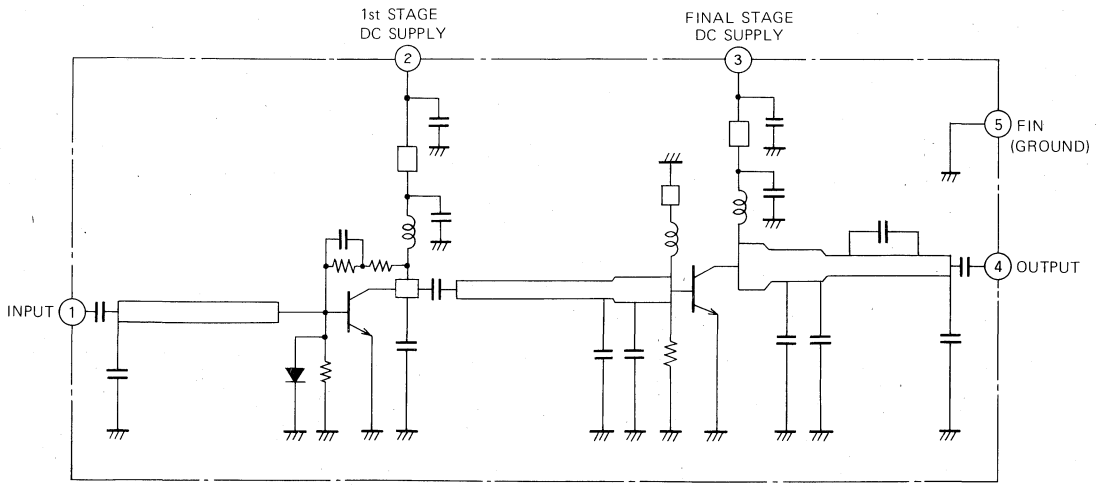
For output stage of 25W mobile radio sets in 175~200MHz band.

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT



MITSUBISHI ELECTRIC

175～200MHz, 25W, FM MOBILE RADIO

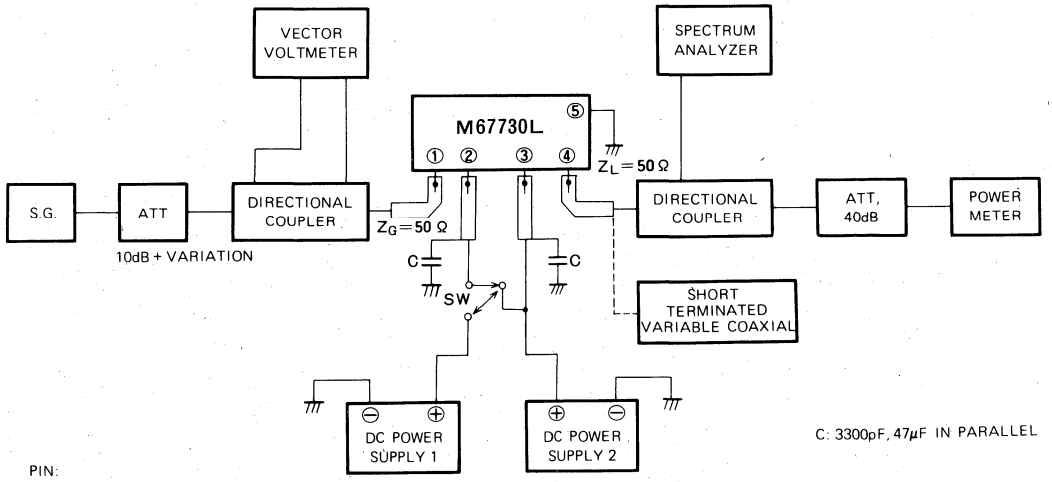
ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	DC Supply voltage		17	V
I_{CC}	Total current		7	A
P_{in}(max)	Input power	$Z_G=Z_L=50\Omega$, $V_{CC1}\leqq 12.5V$	0.6	mW
P_O(max)	Output power	$Z_G=Z_L=50\Omega$	40	W
$T_{C(OP)}$	Operation case temperature		−30～+110	°C
T_{stg}	Storage temperature		−40～+110	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
P_O	Output power	V_{CC}=12.5V, f=175～200MHz, P_{in}=0.3W, $Z_G=Z_L=50\Omega$	30	35		W
η_T	Total efficiency		43	47		%
—	2nd harmonic				−30	dB
ρ_{in}	Input VSWR				2.8	—
ρ_{out}	Output VSWR			1.5		—
—	Load VSWR tolerance	V_{CC}=15.2V, f=175～200MHz, P_O=30W, Z_G=50Ω	20：1			—

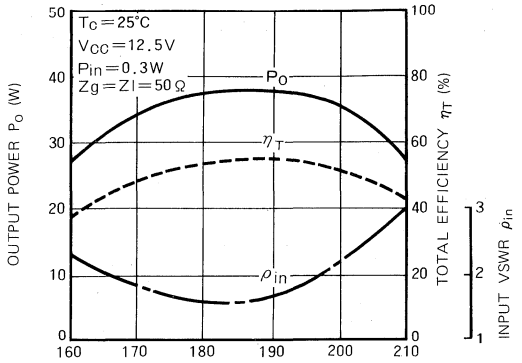
TEST BLOCK DIAGRAM



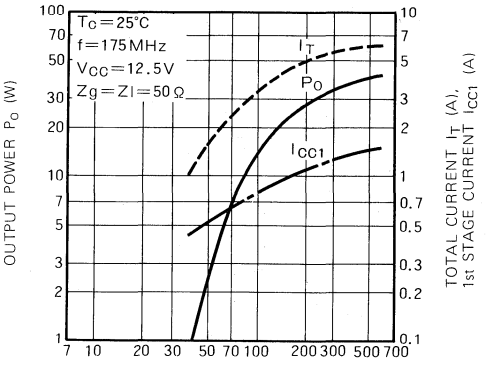
PIN:
① INPUT
② FIRST STAGE DC SUPPLY
③ FINAL STAGE DC SUPPLY
④ OUTPUT
⑤ FIN (GROUND)

TYPICAL PERFORMANCE DATA

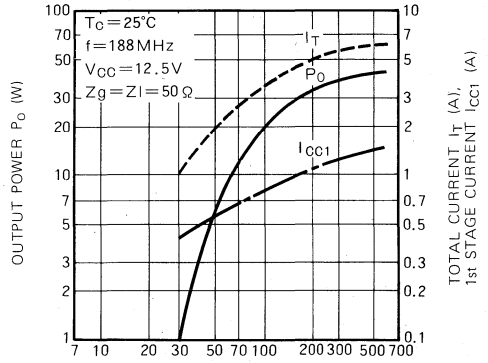
OUTPUT POWER, TOTAL EFFICIENCY, ρ_{in} VS. FREQUENCY CHARACTERISTICS



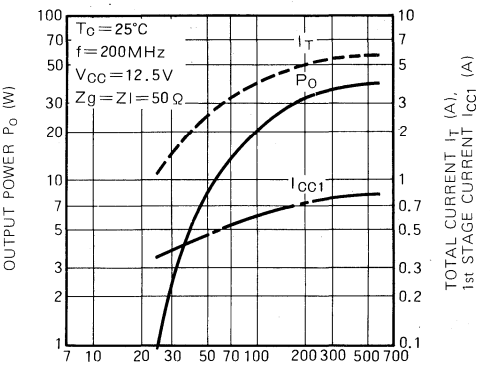
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



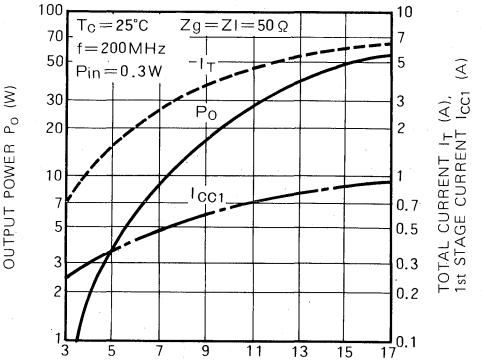
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



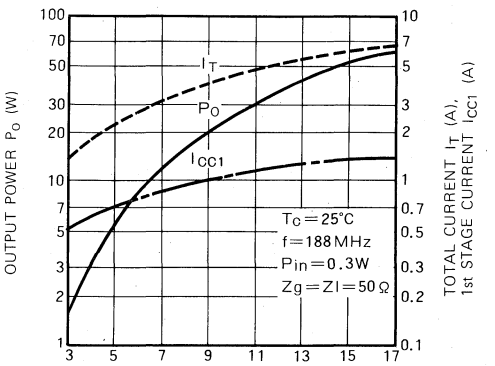
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS

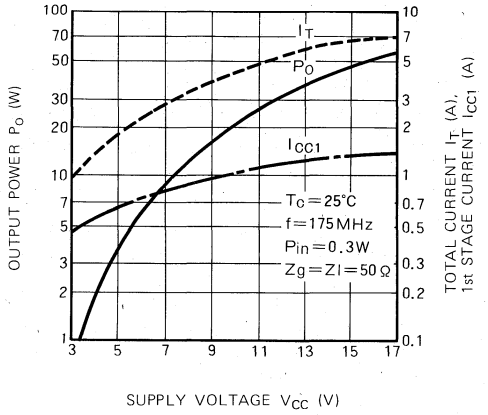


OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS

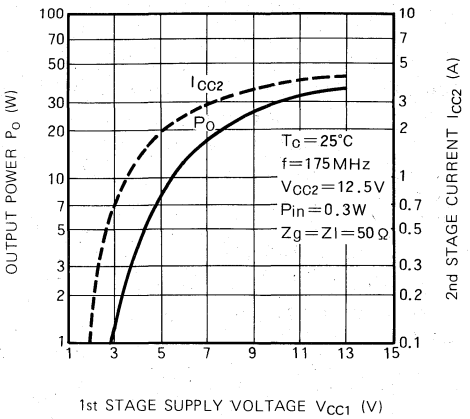


MITSUBISHI ELECTRIC

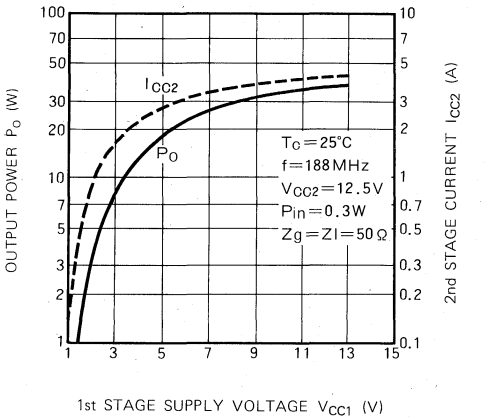
OUTPUT POWER, TOTAL CURRENT, 1st STAGE CURRENT VS. SUPPLY VOLTAGE CHARACTERISTICS



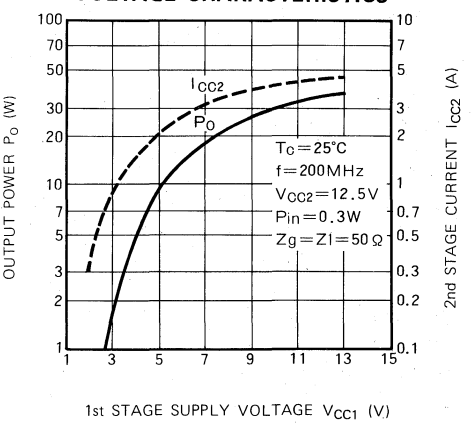
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



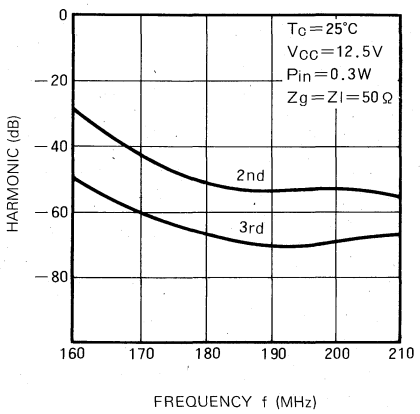
OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER, 2nd STAGE CURRENT VS. 1st STAGE SUPPLY VOLTAGE CHARACTERISTICS



2nd, 3rd HARMONIC VS. FREQUENCY CHARACTERISTICS



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated transistors at standard operation.

(1) Thermal resistance between junction and package of incorporated transistors.

a) First stage transistor

$R_{th(j-c)1} = 8°C/W$ (Typ.)

b) Second stage transistor

$R_{th(j-c)2} = 2°C/W$ (Typ.)

(2) Junction temperature of incorporated transistors at standard operation.

Conditions for standard operation.

P_o = 30W, V_{CC} = 12.5V, P_{in} = 0.3W, η_T = 43% (minimum rating), P_{o1} (Note 1) = 5W, I_T = 5.6A (I_{T1} (2) = 0.9A, I_{T2} (3) = 4.7A)

Note 1: Output power of the first stage transitor

Note 2: Circuit current of the first stage transistor

Note 3: Circuit current of the final stage transistor

Junction temperature of the first stage transistor

$T_{j1} = (V_{CC} \times I_{T1} - P_{o1} + P_{in}) \times R_{th(j-c)1} + T_C$ (4)

$= (12.5 \times 0.9 - 5 + 0.3) \times 8 + T_C$

$= 52 + T_C$ (°C)

Note 4: Package temperature of device

Junction temperature of the final stage transistor

$T_{j2} = (V_{CC} \times I_{T2} - P_o + P_{o1}) \times R_{th(j-c)2} + T_C$

$= (12.5 \times 4.7 - 30 + 5) \times 2 + T_C$

$= 68 + T_C$ (°C)

2. Heat sink design

In thermal design of heat sink, try to keep the package temperature at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the output power of 28W below 90°C.

The thermal resistance $R_{th(j-a)}$ (5) of the heat sink to realize this:

$$R_{th(c-a)} = \frac{T_C - T_a}{(P_o/\eta_T) - P_o + P_{in}} = \frac{90 - 60}{(30/0.43) - 30 + 0.3}$$

$= 0.75$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink

Mounting the heat sink of the above thermal resistance on the device.

T_{j1} = 142°C, T_{j2} = 158°C at T_a = 60°C, T_C = 90°C.

In the annual average of ambient temperature is 30°C,

T_{j1} = 112°C, T_{j2} = 128°C

As the maximum junction temperature of these incorporated transistors T_{jmax} are 175°C, application under fully derated condition is ensured.

HIGH FREQUENCY HIGH POWER TRANSISTORS

3

2SC730

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC730 is a silicon NPN epitaxial planar type transistor designed for industrual use RF power amplifiers on VHF band mobile radio applications.

FEATURES

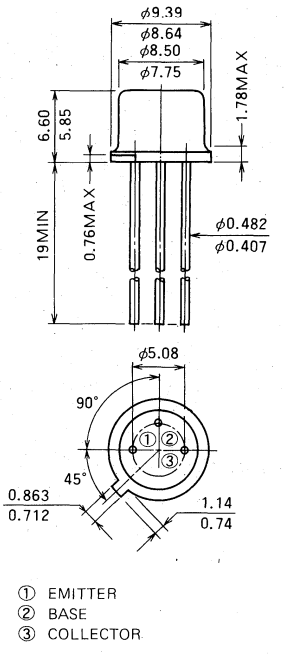
- High power gain: $G_{pe} \geqq 10dB$
  @V_{CC} = 13.5V, P_O = 1W, f = 150MHz
- TO-39 metal seeled package for high reliability.
- All electrodes are isolated from the case.

APPLICATION

0.5 to 0.8 watt power amplifiers, and driver stage in VHF band.

OUTLINE DRAWING

Dimensions in mm



① EMITTER
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CER}	Collector to emitter voltage	R_{BE}=10Ω	40	V
I_C	Collector current		0.4	A
P_C	Collector dissipation	Ta=25°C	1.03	W
		T_C=25°C	3	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−65~+175	°C
Rth-a	Thermal resistance	Junction to ambient	145	°C/W
Rth-c		Junction to case	50	°C/W

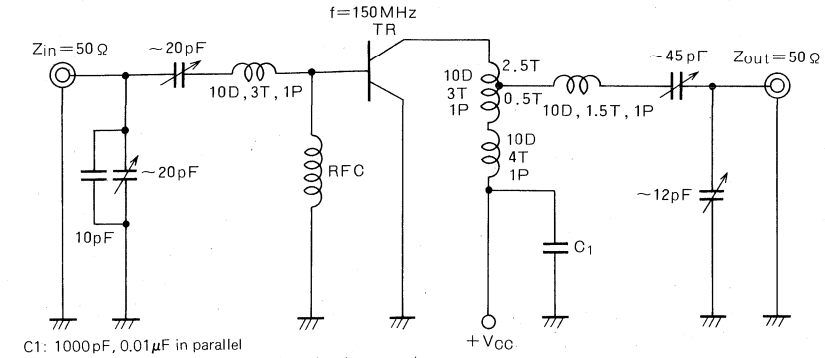
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=10Ω	40			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			10	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2.5V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.1W, f=150MHz	1	1.5		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

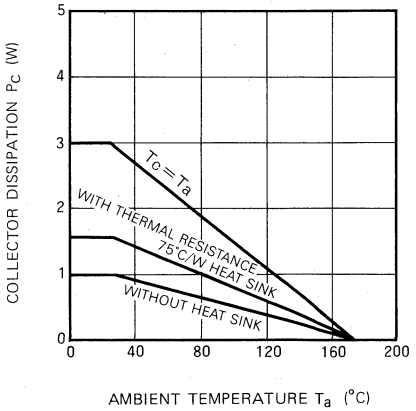


C1: 1000pF, 0.01μF in parallel

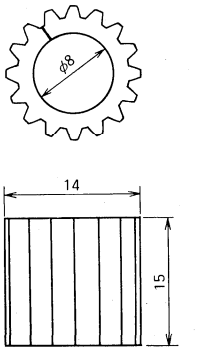
Notes: All coils are made from 1.5mm silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE

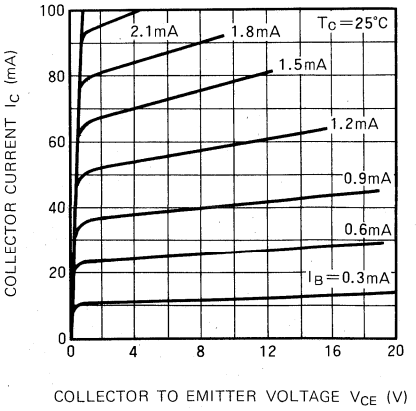


THERMAL RESISTANCE 75°C HEAT SINK DRAWING

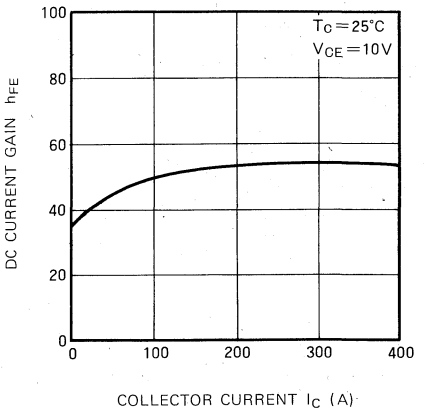


MATERIAL: Aℓ
DIMENSIONS: mm

OUTPUT CHARACTERISTICS, COMMON EMITTER



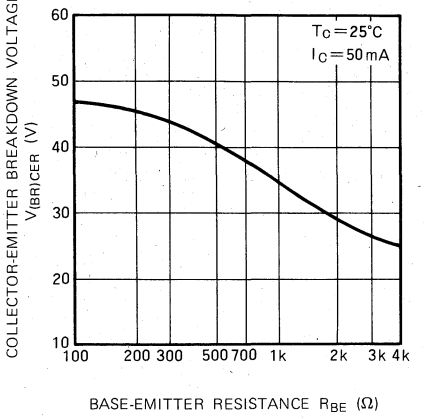
DC CURRENT GAIN VS. COLLECTOR CURRENT



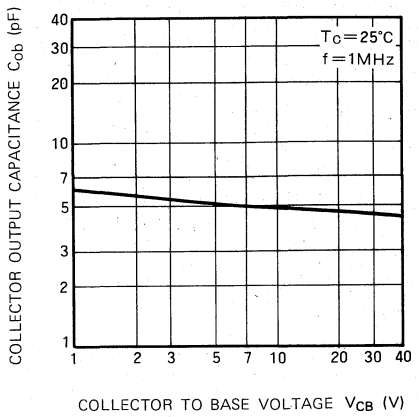
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

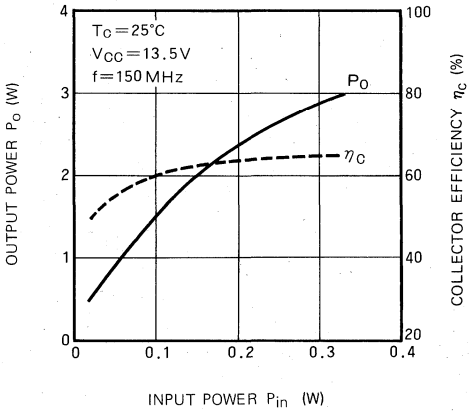
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



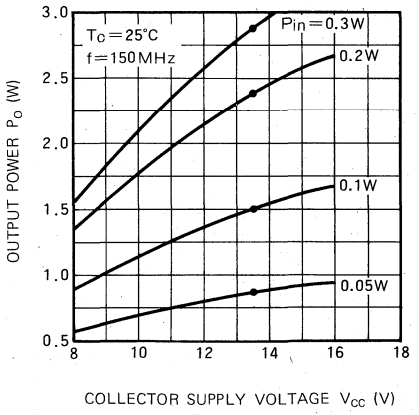
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC741

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC741 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on VHF band mobile radio applications.

FEATURES

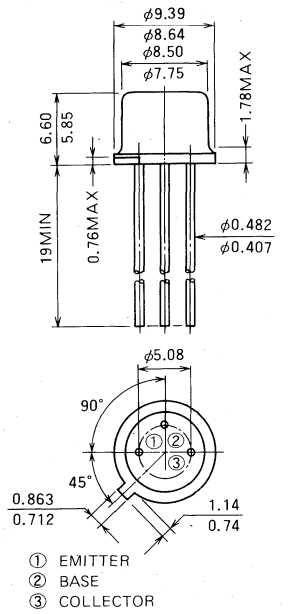
- High power gain: $G_{pe} \geqq 13dB$
  @V_{CC} = 13.5V, P_O = 0.2W, f = 150MHz
- TO-39 metal seeled package for high reliability.
- Collector electrode is electrically connected to the case.

APPLICATION

Driver stage in VHF band.

OUTLINE DRAWING

Dimensions in mm



NOTE T-8C: COLLECTOR ELECTRODE IS CONNECTED WITH CASE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CER}	Collector to emitter voltage	R_{BE}=10Ω	40	V
I_C	Collector current		0.3	A
P_C	Collector dissipation	Ta=25°C	0.68	W
		T_C=25°C	2.5	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-a	Thermal resistance	Junction to ambient	220	°C/W
Rth-c		Junction to case	60	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

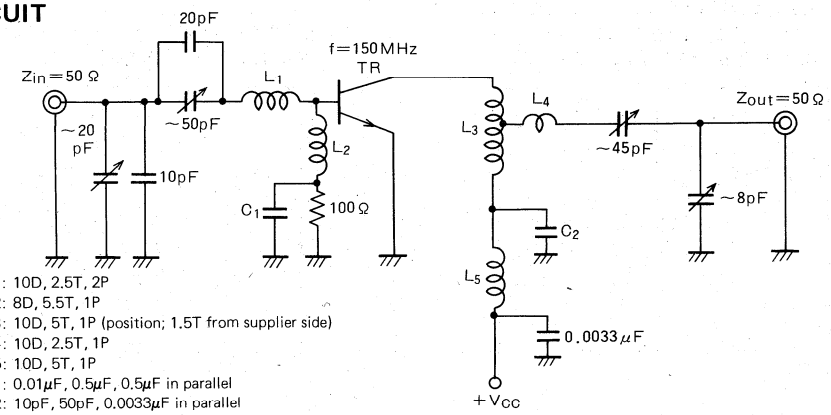
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=10Ω	40			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			1	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=10mW, f=150MHz	0.2	0.3		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

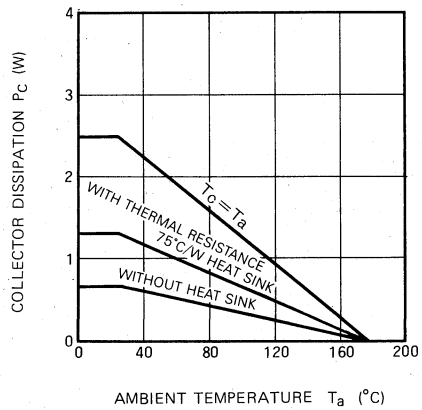
TEST CIRCUIT



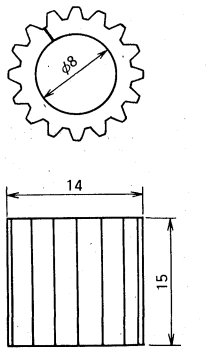
L1: 10D, 2.5T, 2P
L2: 8D, 5.5T, 1P
L3: 10D, 5T, 1P (position; 1.5T from supplier side)
L4: 10D, 2.5T, 1P
L5: 10D, 5T, 1P
C1: 0.01μF, 0.5μF, 0.5μF in parallel
C2: 10pF, 50pF, 0.0033μF in parallel
Notes: All coils are made from 1.5mm silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

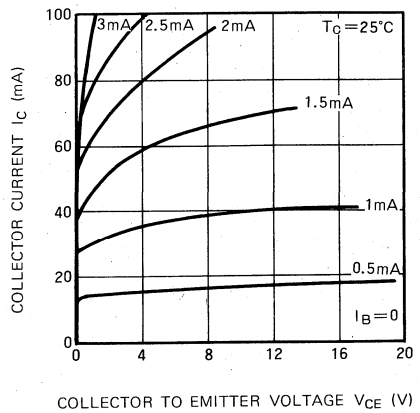
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



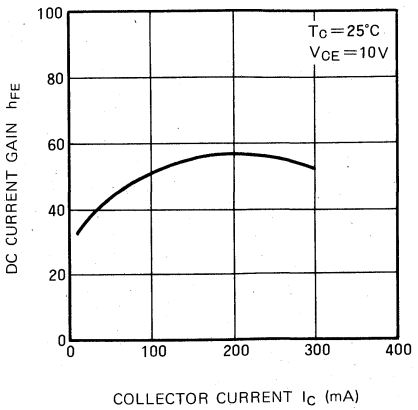
THERMAL RESISTANCE 75°C HEAT SINK DRAWING



OUTPUT CHARACTERISTICS, COMMON EMITTER

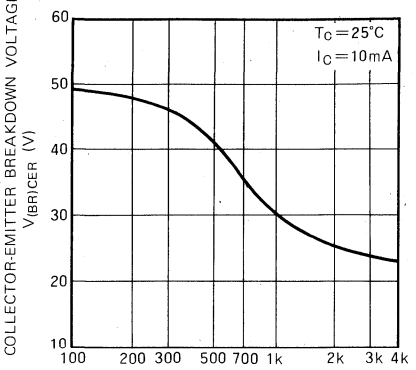


DC CURRENT GAIN VS. COLLECTOR CURRENT

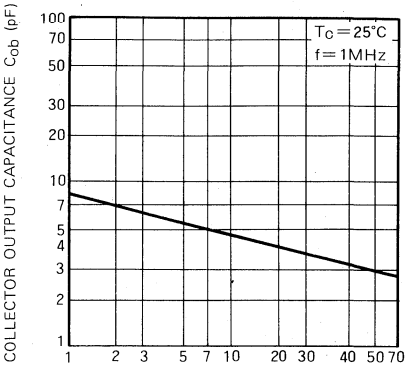


NPN EPITAXIAL PLANAR TYPE

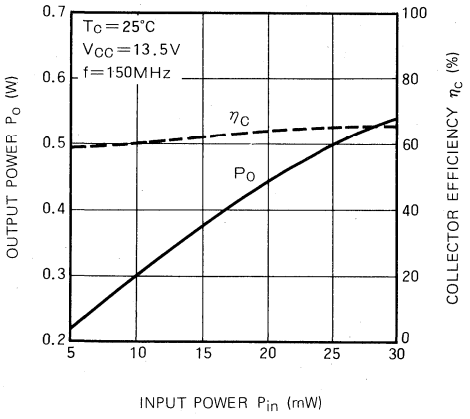
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



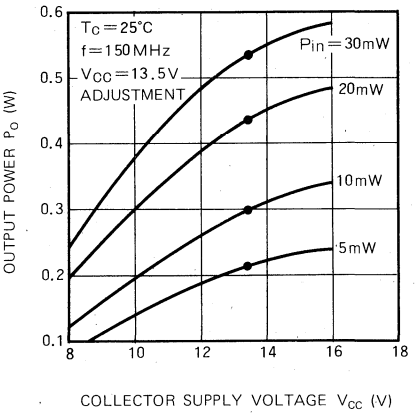
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC908

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC908 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on UHF band mobile radio applications.

FEATURES

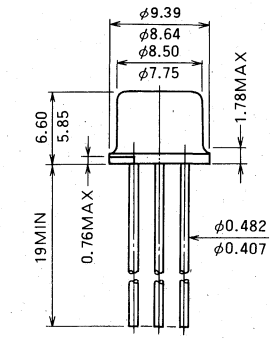
- High power gain: $G_{pe} \geqq 4dB$
  @V_{CC} = 13.5V, P_O = 1W, f = 500MHz
- TO-39 metal seeled package for high reliability.
- All electrodes are isolated from the case.

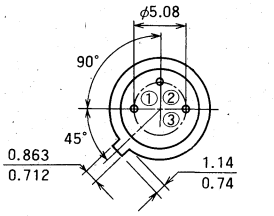
APPLICATION

0.5 to 0.8 watt power amplifiers, and driver stage in UHF band.

OUTLINE DRAWING

Dimensions in mm





① EMITTER
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CER}	Collector to emitter voltage	R_{BE}=10Ω	40	V
I_C	Collector current		0.5	A
P_C	Collector dissipation	T_a=25°C	0.86	W
		T_C=25°C	4.3	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-a	Thermal resistance	Junction to ambient	175	°C/W
Rth-c		Junction to case	35	°C/W

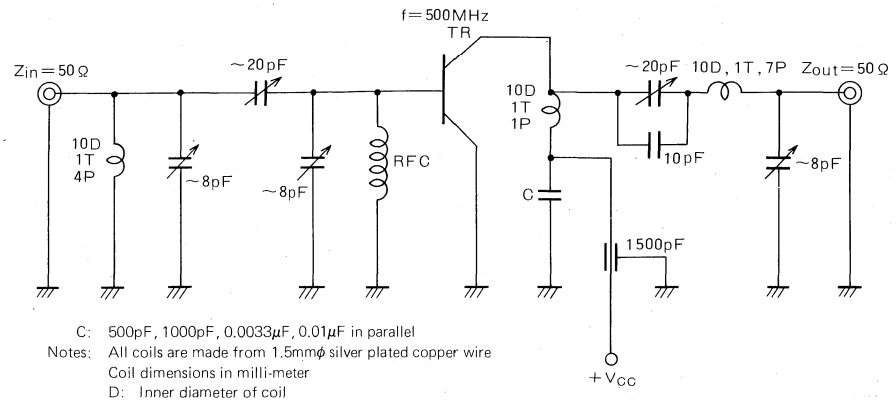
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	40			V
$V_{(BR)CER}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=10Ω	40			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			50	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.4W, f=500MHz	1	1.2		W
η_C	Collector efficiency		50	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

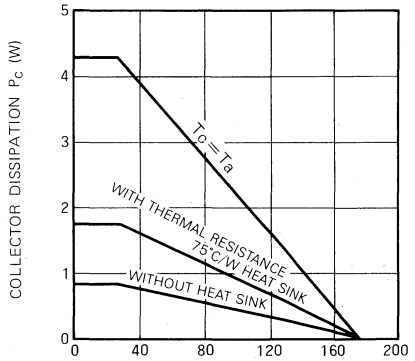
TEST CIRCUIT



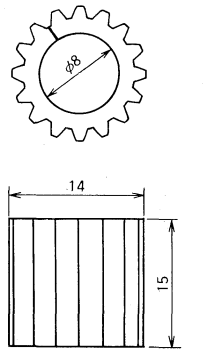
C: 500pF, 1000pF, 0.0033μF, 0.01μF in parallel
Notes: All coils are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE

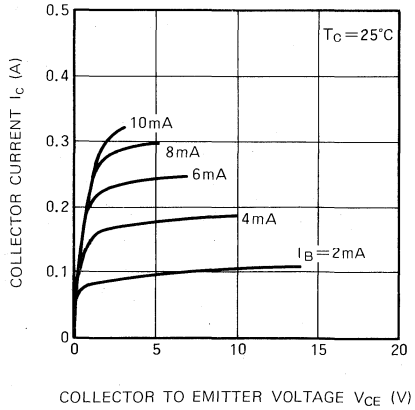


THERMAL RESISTANCE 75°C HEAT SINK DRAWING

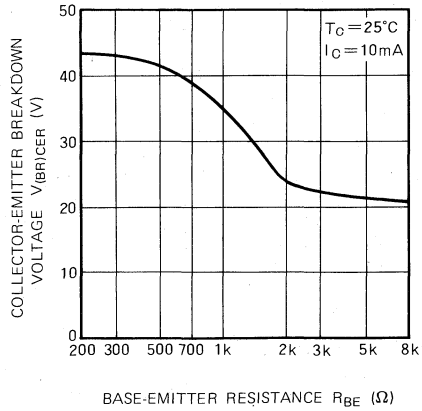


MATERIAL: Aℓ
DIMENSIONS: mm

OUTPUT CHARACTERISTICS, COMMON EMITTER



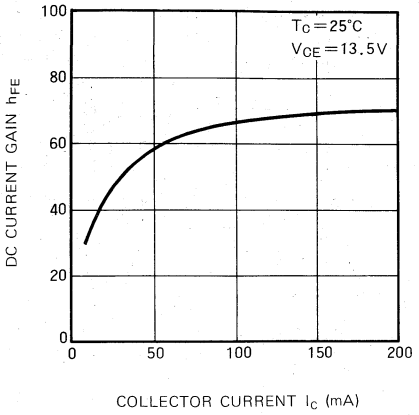
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



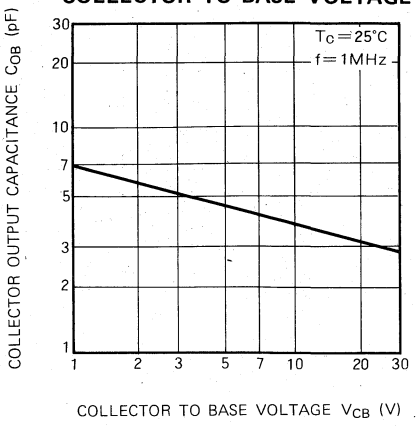
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

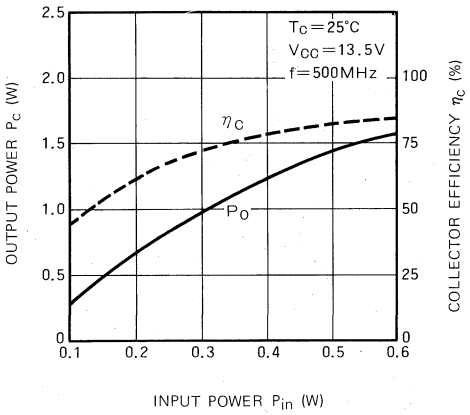
DC CURRENT GAIN VS. COLLECTOR CURRENT



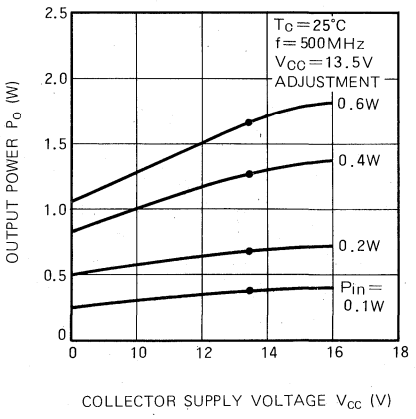
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



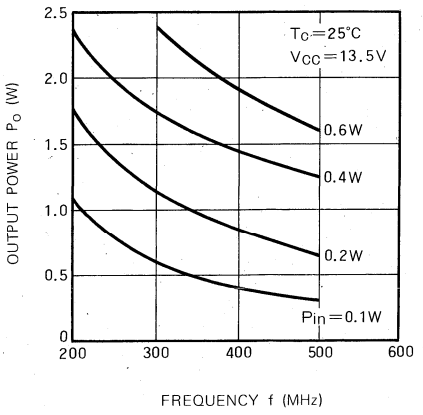
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



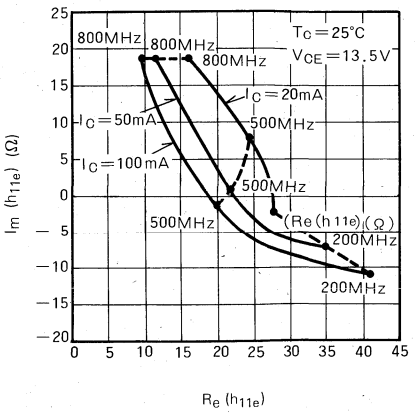
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. FREQUENCY

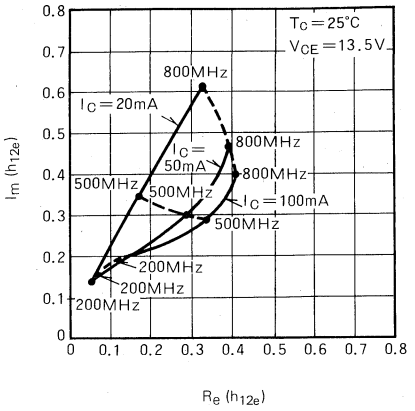


h11e — FREQUENCY

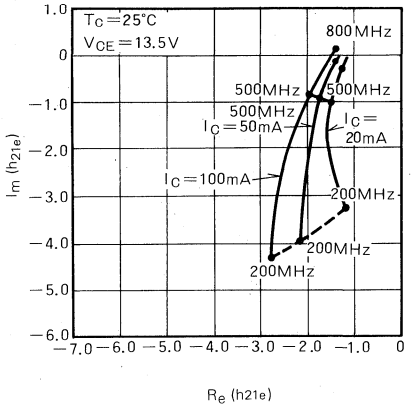


NPN EPITAXIAL PLANAR TYPE

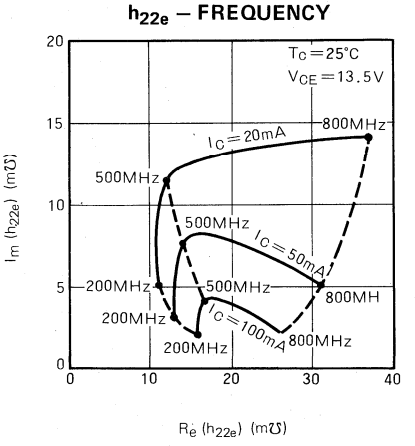
h_{12e} – FREQUENCY



h_{21e} – FREQUENCY



h_{22e} – FREQUENCY



MITSUBISHI ELECTRIC

2SC1324

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1324 is a silicon NPN epitaxial planar type transistor designed for industrial use RF broadband amplifiers from VHF to UHF band.

FEATURES

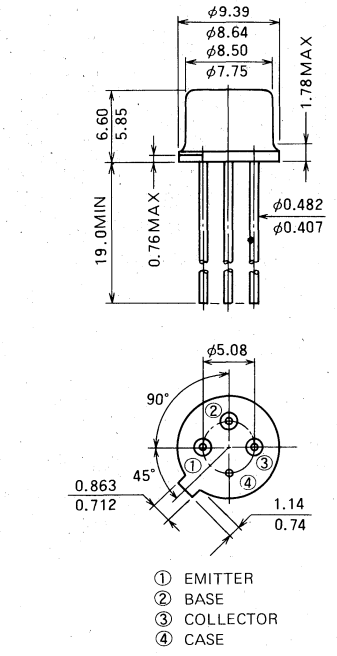
- High power gain: $G_{pe} \geqq 9dB$
  @V_{CC} = 15V, I_C = 30mA, f = 770MHz
- TO-12 metal seeled package with case grounded pin for high reliability and good performances.
- All electrodes excepted ground pin are isolated from the case.

APPLICATION

Broadband amplifiers from VHF to UHF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	25	V
I_C	Collector current		150	mA
P_C	Collector dissipation	T_a=25°C	0.8	W
		T_C=25°C	3	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−65～+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	187.5	°C/W
R_{th-c}		Junction to case	50	°C/W

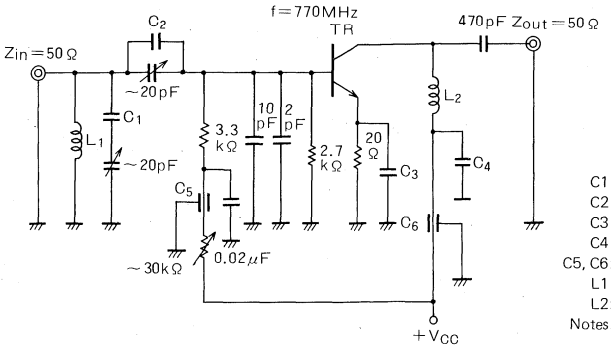
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	25			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			50	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			75	μA
h_{FE}	DC forward current gain *	V_{CE}=15V, I_C=30mA	20	70	180	—
Gpe	Power gain	V_{CC}=15V, f=770MHz, I_C=30mA	9	10		dB
f_T	Transition frequency	V_{CE}=15V, I_C=30mA		1.7		GHz
NF	Noise figure	V_{CC}=15V, I_C=30mA, f=500MHz, R_G=50Ω		5		dB

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

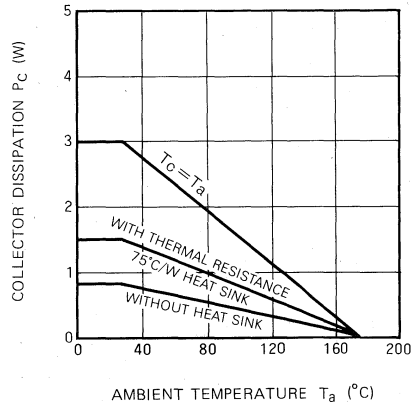
TEST CIRCUIT



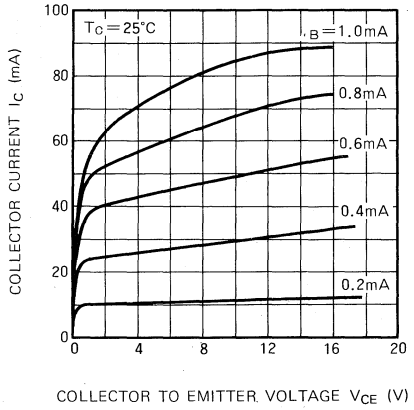
C1: 2pF, 3pF in parallel
C2: 3pF, 4pF in parallel
C3: 500pF, 0.02μF in parallel
C4: 0.05μF, 0.03μF, 0.01μF in parallel
C5, C6: 1500pF
L1: 4mm core, 10T, enameled wire
L2: Width 2mm, length 20mm ribbon lead (silver plated copper plate)
Notes: Coil dimensions in milli-meter
T: Turn number of coil

TYPICAL PERFORMANCE DATA

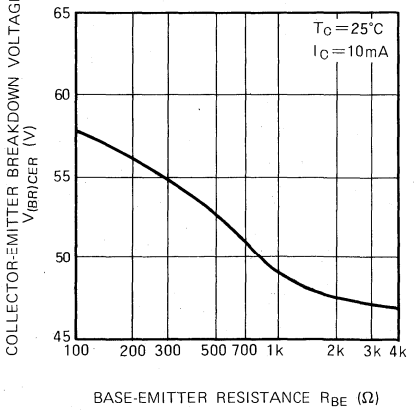
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



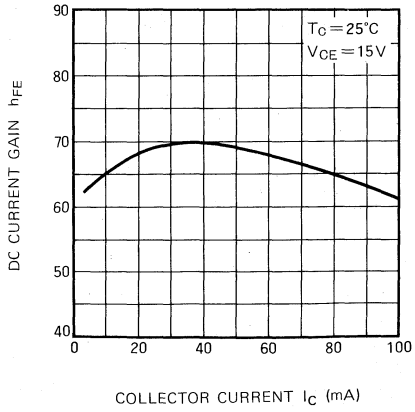
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



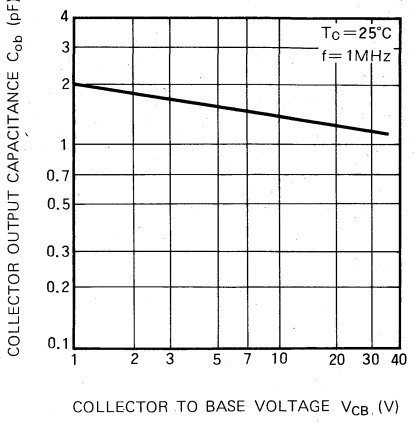
DC CURRENT GAIN VS. COLLECTOR CURRENT



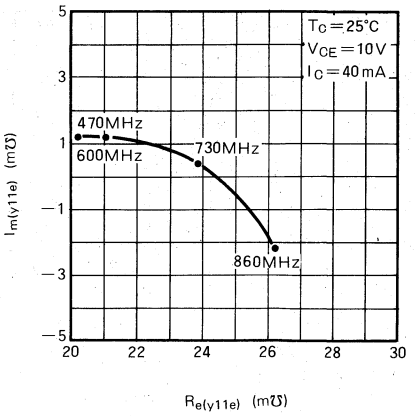
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

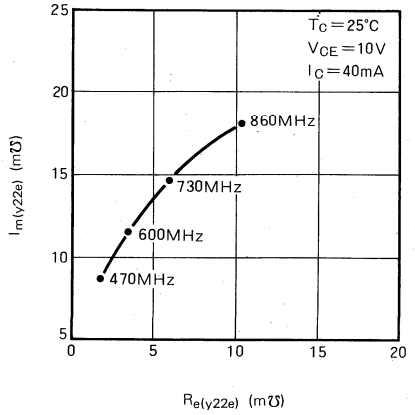
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



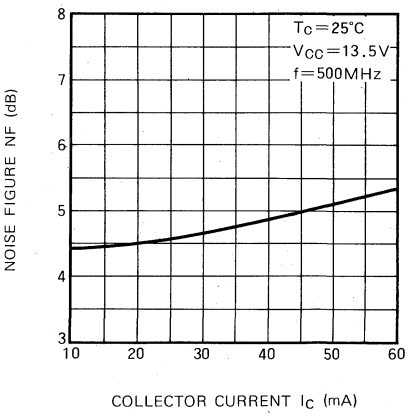
INPUT ADMITANCE VS. FREQUENCY



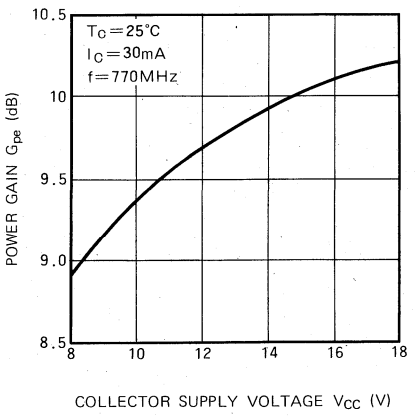
OUTPUT ADMITANCE VS. FREQUENCY



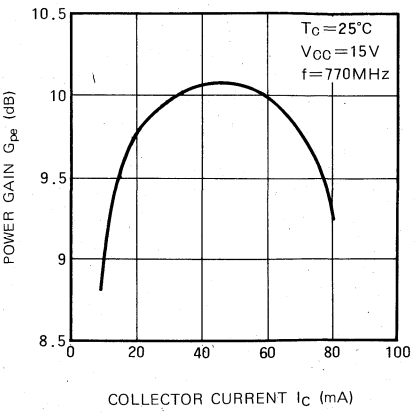
NOISE FIGURE VS. COLLECTOR CURRENT



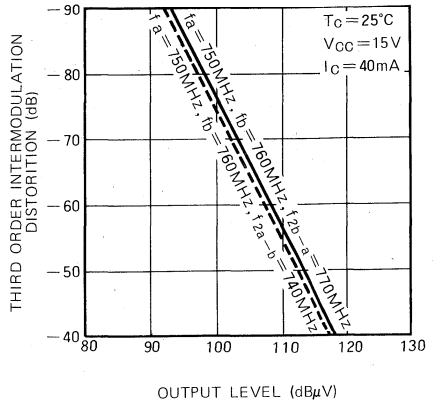
POWER GAIN VS. COLLECTOR SUPPLY VOLTAGE



POWER GAIN VS. COLLECTOR CURRENT



THIRD ORDER INTERMODULATION
DISTORTION VS. OUTPUT LEVEL



MITSUBISHI ELECTRIC

2SC1729

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1729 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio amplications.

FEATURES

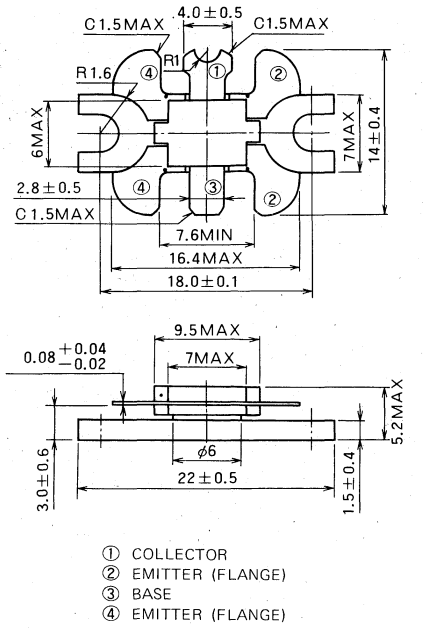
- High power gain: $G_{pe} \geqq 10dB$
  @V_{CC} = 13.5V, P_O = 14W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 and load VSWR when operated at V_{CC} = 15.2V, P_o = 18W, f = 175MHz.

APPLICATION

10 to 14 watts output power amplifiers applications in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		3.5	A
P_C	Collector dissipation	T_a=25°C	2.5	W
		T_C=25°C	35	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−65～+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	60	°C/W
R_{th-c}		Junction to case	4.3	°C/W

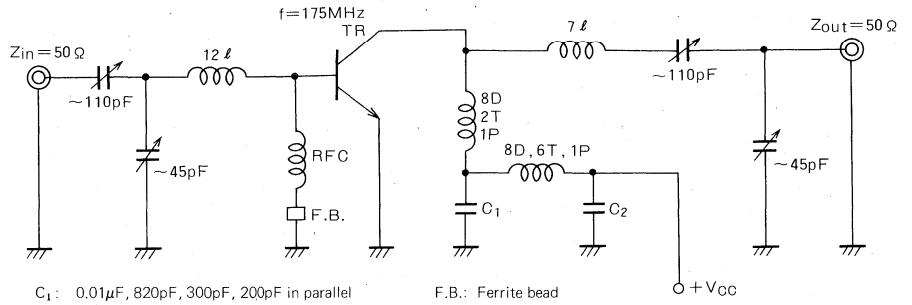
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			0.5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=1.4W, f=175MHz	14	16		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

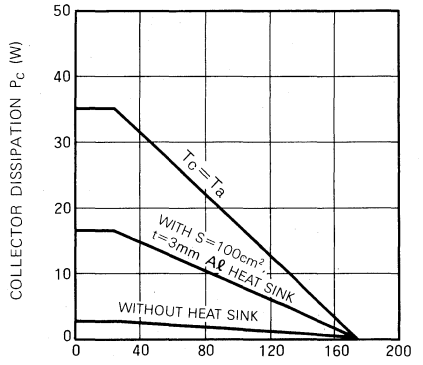
TEST CIRCUIT



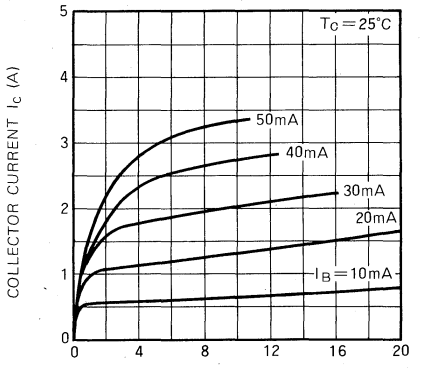
C_1: 0.01μF, 820pF, 300pF, 200pF in parallel
C_2: 22μF, 0.1μF, 0.02μF, 300pF in parallel
F.B.: Ferrite bead
Notes: All coils are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
ℓ: Length

TYPICAL PERFORMANCE DATA

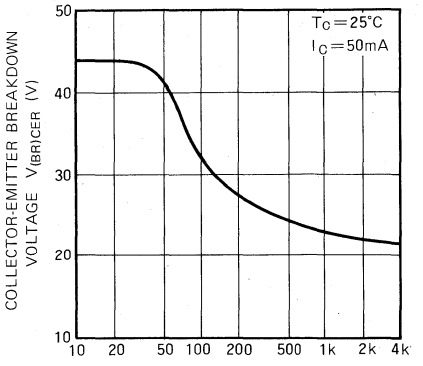
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



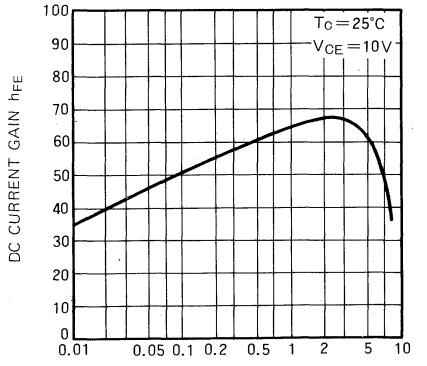
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



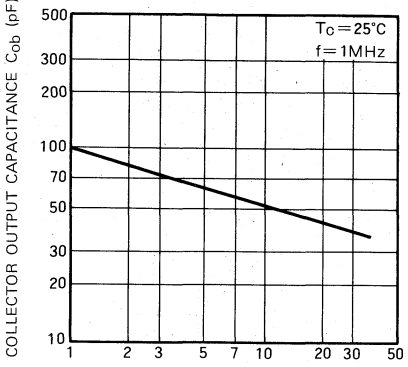
DC CURRENT GAIN VS. COLLECTOR CURRENT



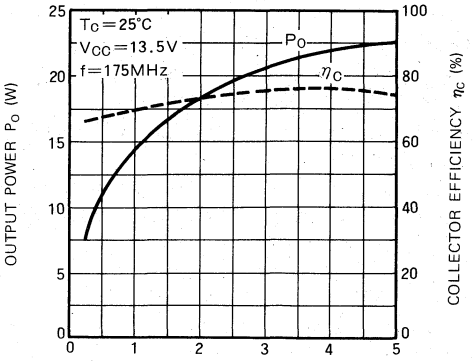
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

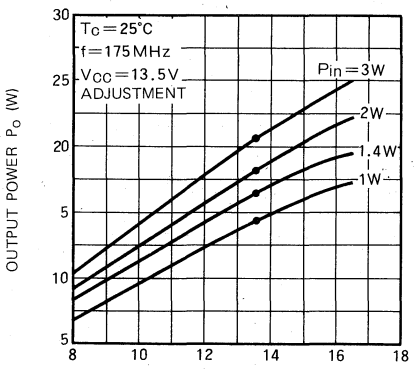
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1945

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1945 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on HF band mobile radio applications.

FEATURES

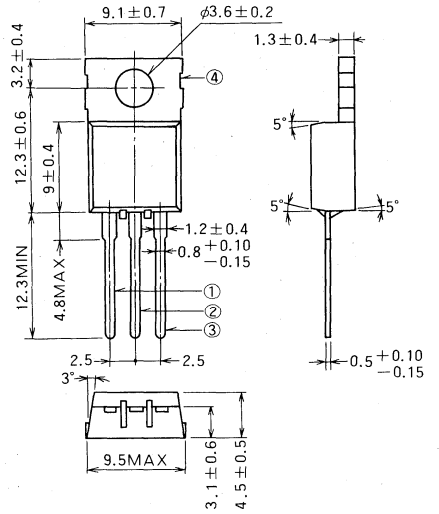
- High power gain: $G_{pe} \geqq 14.5$dB
  @V_{CC} = 12V, P_O = 14W, f = 27MHz
- Emitter ballasted construction for high reliability and good performances.
- TO-220 package similarly is combinient for mounting.
- Ability of withstanding infinite load VSWR when operated at V_{CC} = 16V, P_O = 18W, f = 27MHz.

APPLICATION

10 to 14 watts output power class AB amplifiers applications in HF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		80	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	40	V
I_C	Collector current		6	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	20	W
T_j	Junction temperature		+150	°C
T_{stg}	Storage temperature		−55～+150	°C
Rth-a	Thermal resistance	Junction to ambient	83.3	°C/W
Rth-c		Junction to case	6.25	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

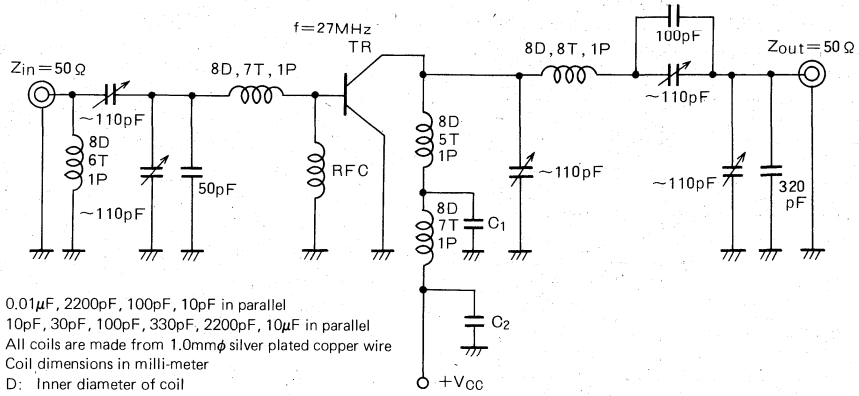
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	80			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	40			V
I_{CBO}	Collector cutoff current	V_{CB}=30V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=4V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=12V, P_{in}=0.5W, f=27MHz	14	16		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

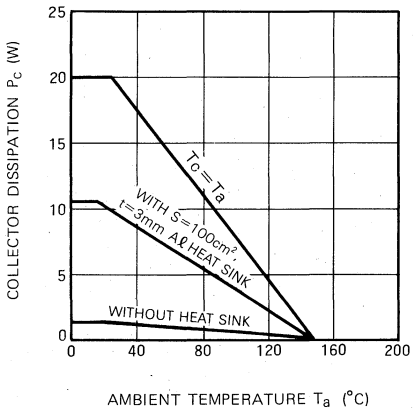
TEST CIRCUIT



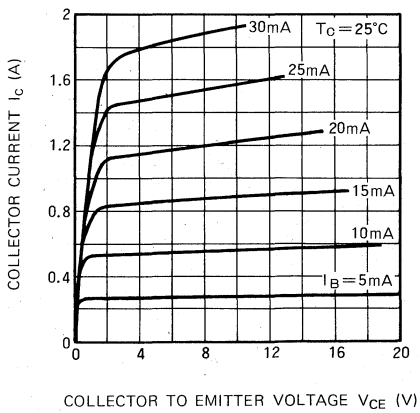
C_1: 0.01μF, 2200pF, 100pF, 10pF in parallel
C_2: 10pF, 30pF, 100pF, 330pF, 2200pF, 10μF in parallel
Notes: All coils are made from 1.0mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

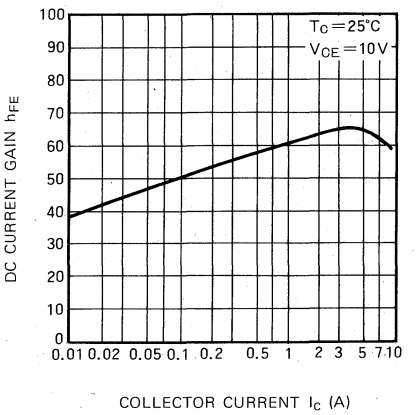
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



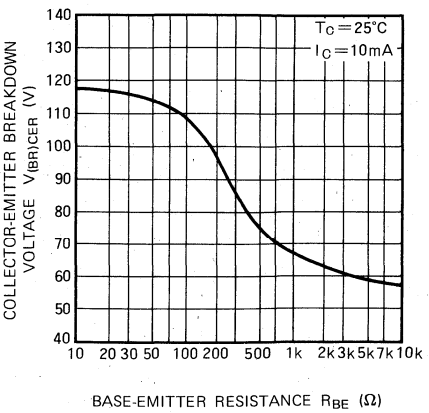
OUTPUT CHARACTERISTICS, COMMON EMITTER



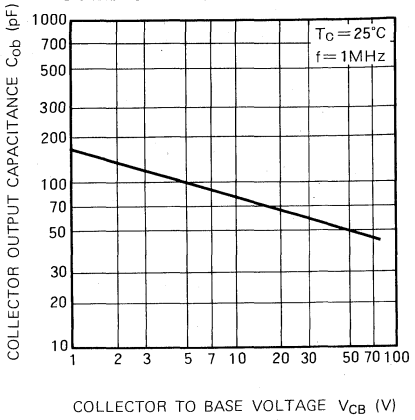
DC CURRENT GAIN VS. COLLECTOR CURRENT



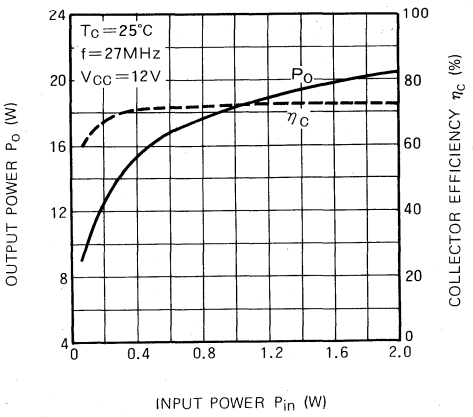
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



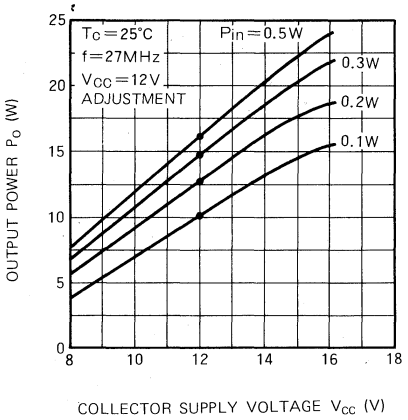
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1946

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC1946 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

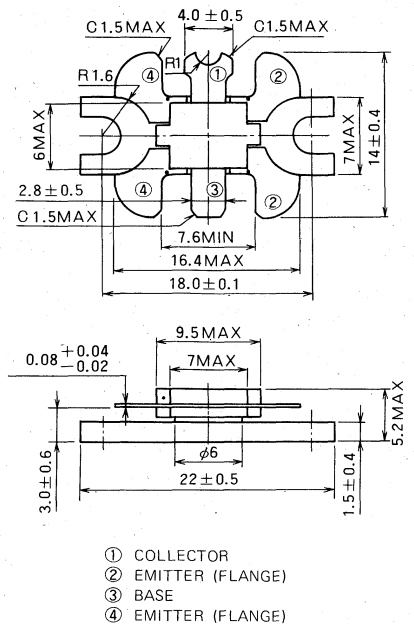
- High power gain: $G_{pe} \geqq 6.7$dB
  @V_{CC} = 13.5V, P_O = 28W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W, f = 175MHz.

APPLICATION

25 watts output power amplifiers applications in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		7	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	50	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−65~+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	50	°C/W
R_{th-c}		Junction to case	3	°C/W

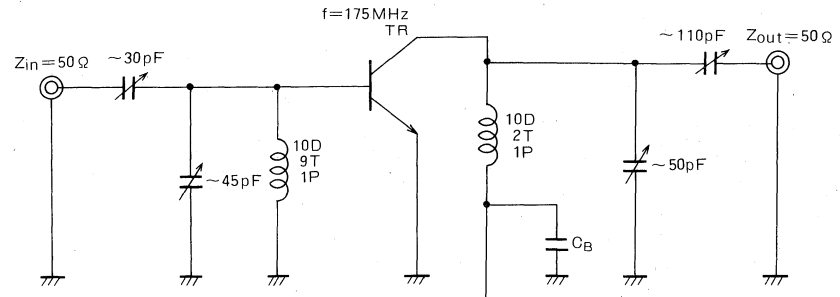
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=100mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.2A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=6W, f=175MHz	28	32		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

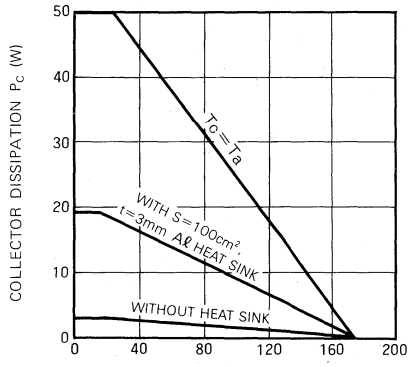
TEST CIRCUIT



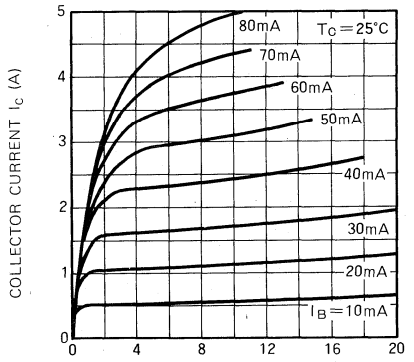
C_B: 220μF, 33μF, 0.04μF, 0.02μF, 0.01μF, 120pF in parallel
Notes: All coils are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

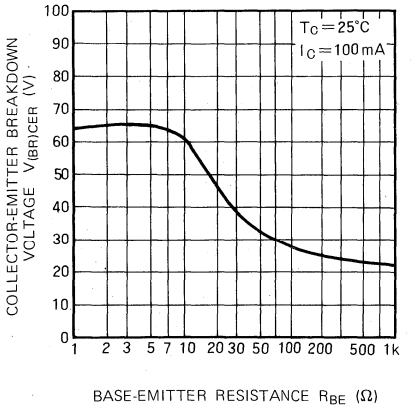
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



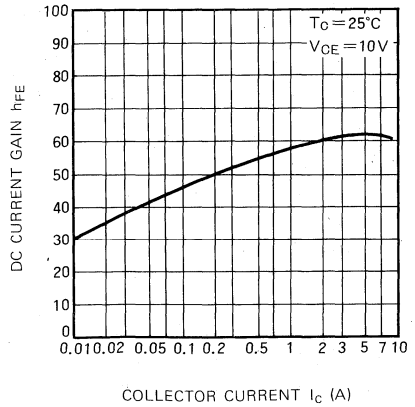
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



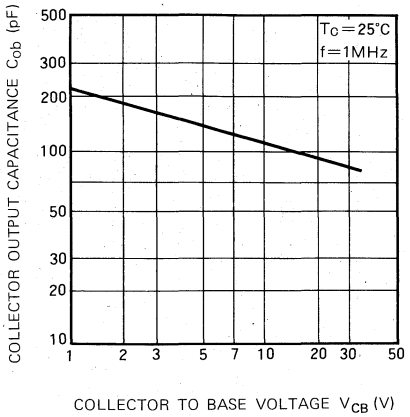
DC CURRENT GAIN VS. COLLECTOR CURRENT



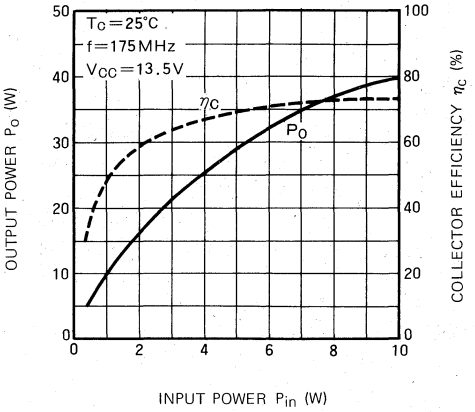
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

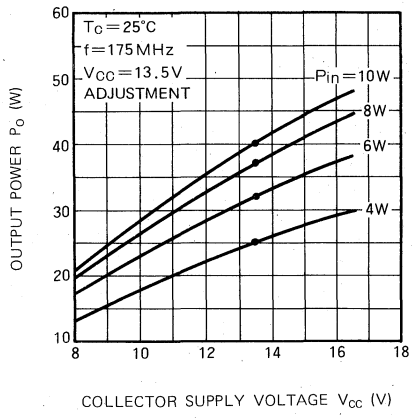
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1946A

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1946A is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

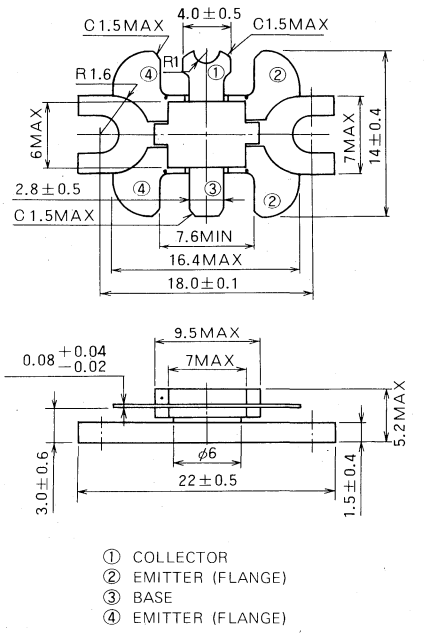
- High power gain: $G_{pe} \geqq 10$dB
  @V_{CC} = 13.5V, P_O = 30W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W, f = 175MHz.
- Equivalent input/output impedance at rated operating conditions: Z_{in} = 0.65 + j1.4Ω
  Z_{out} = 1.9 + j0.75Ω

APPLICATION

25 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		7	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	50	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	3	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

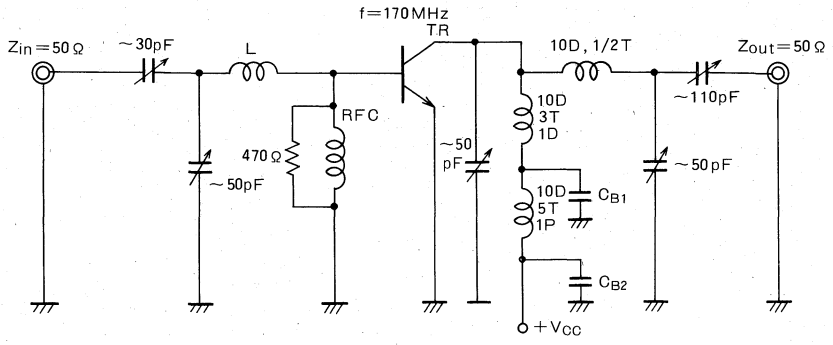
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.2A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=3W, f=175MHz	30	35		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

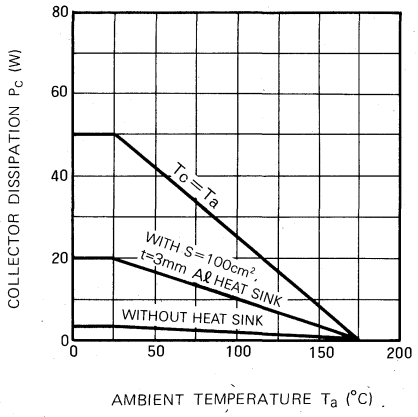


L: Length 10mm
RFC: 0.4mm enameled wire 12T with Ferrite Bead
C_{B1}: 220pF, 2200pF in parallel
C_{B2}: 220pF, 2200pF, 10μF in parallel

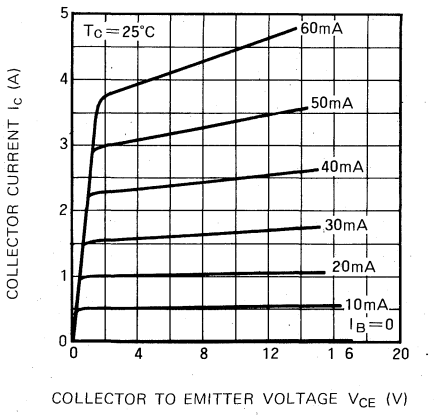
Notes: All coils are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

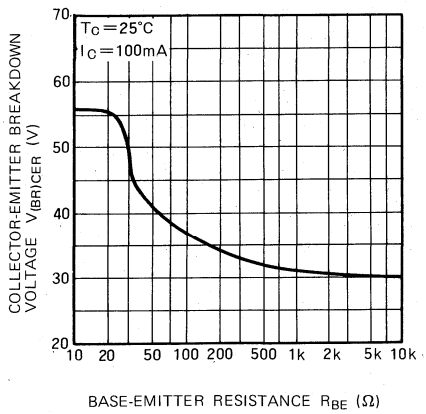
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



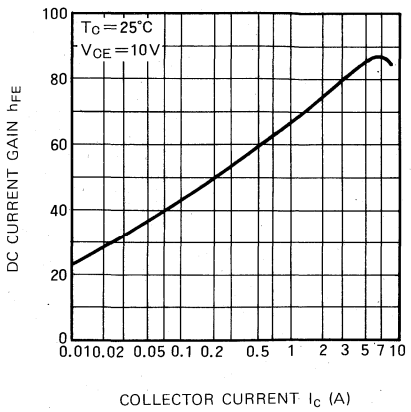
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

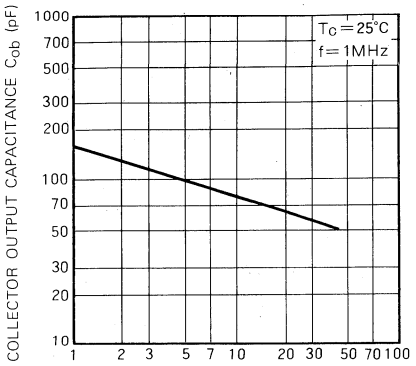


DC CURRENT GAIN VS. COLLECTOR CURRENT

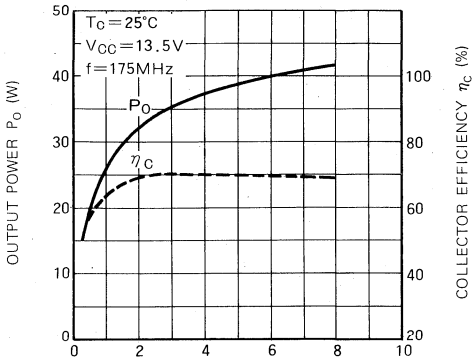


NPN EPITAXIAL PLANAR TYPE

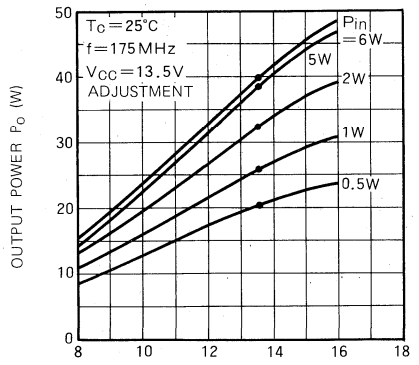
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1947

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1947 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on VHF band mobile radio applications.

FEATURES

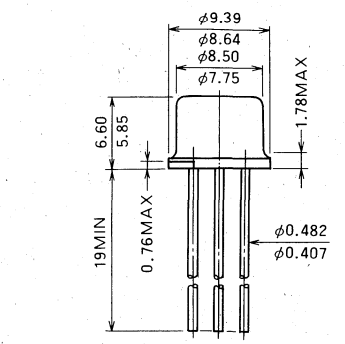
- High power gain: $G_{pe} \geqq 10.7$dB
  @V_{CC} = 13.5V, P_O = 3.5W, f = 175MHz
- TO-39 metal seeled package for high reliability.
- Emitter electrode is connected electrically to the case.

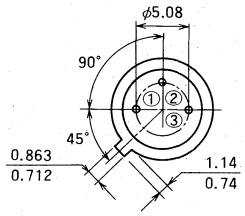
APPLICATION

1 to 3 watt power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm





① EMITTER (CASE)
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_a=25°C	1	W
		T_C=25°C	10	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−65～+175	°C
Rth-a	Thermal resistance	Junction to ambient	150	°C/W
Rth-c		Junction to case	15	°C/W

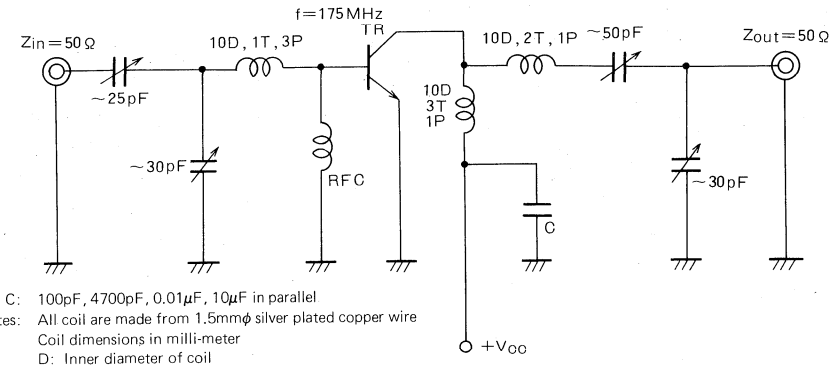
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5 mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power **	V_{CC}=13.5V, Pin=0.3W, f=175MHz	3.5	4		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%.
** Note: In case of the case grounded.

NPN EPITAXIAL PLANAR TYPE

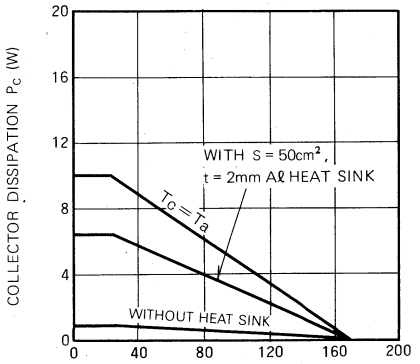
TEST CIRCUIT



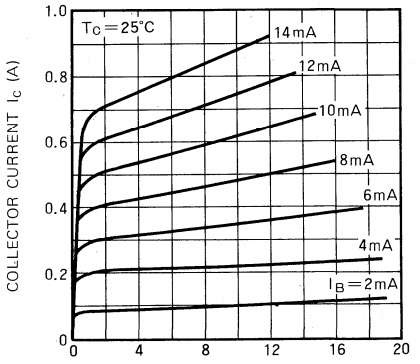
C: 100pF, 4700pF, 0.01μF, 10μF in parallel
Notes: All coil are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

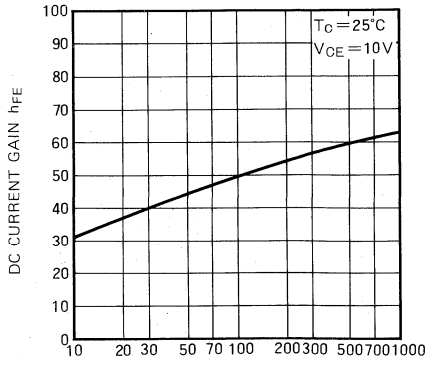
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



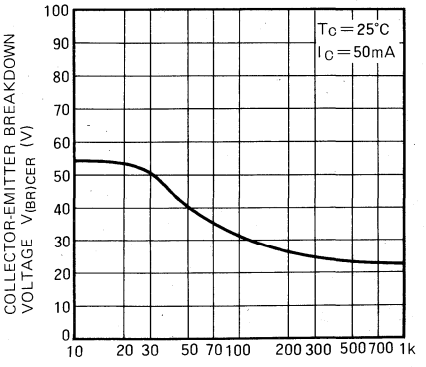
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

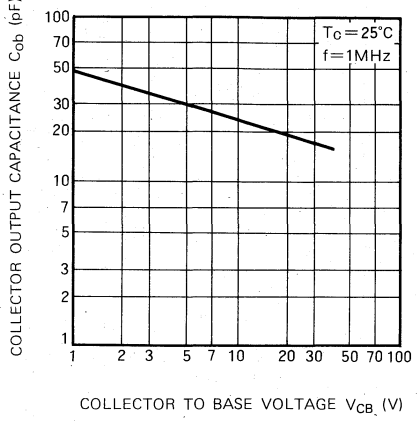


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

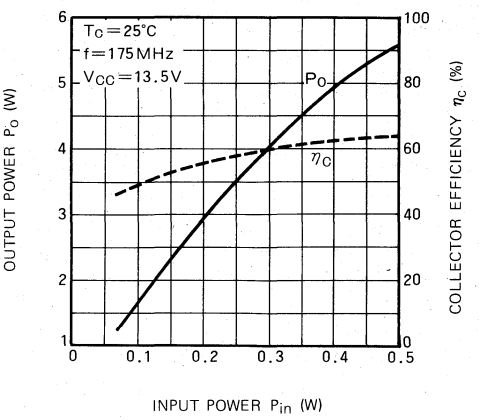


MITSUBISHI ELECTRIC

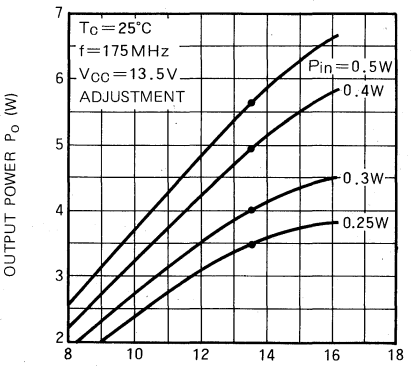
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1965

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1965 is a silicon NPN epitaxial planar type transistor designed for industrial use RF power amplifiers on VHF band mobile radio applications.

FEATURES

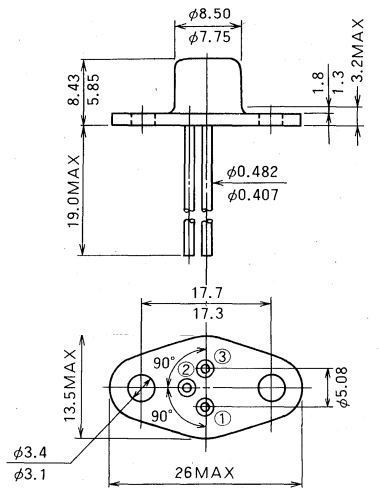
- High power gain: $G_{pe} \geqq 10$dB
  @V_{CC} = 13.5V, P_O = 6W, f = 175MHz
- T_C-17 metal seeled package for high reliability.
- Emitter ballasted construction for good performances.
- Emitter electrode is connected electrically to the case.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz, T_C = 25°C.

APPLICATION

4 watt pawer amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① EMITTER (CASE)
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	15	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−65～+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	100	°C/W
R_{th-c}		Junction to case	10	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

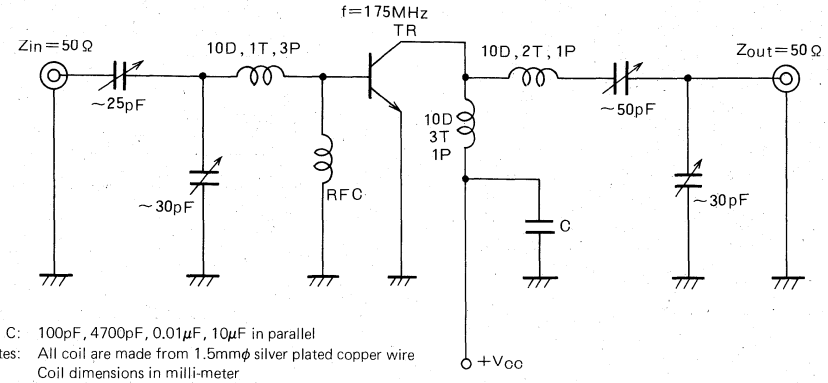
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power**	V_{CC}=13.5V, P_{in}=0.6W, f=175MHz	6	6.5		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_w = 150μs, duty = 5%.
** Note: In case of the case grounded.

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

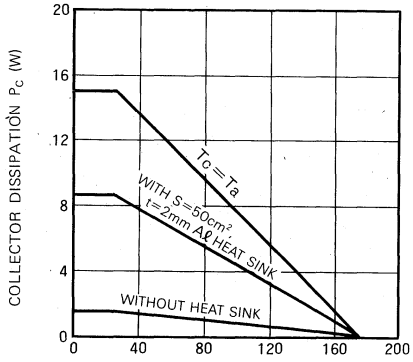
TEST CIRCUIT



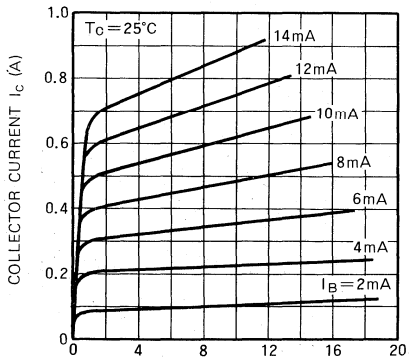
C: 100pF, 4700pF, 0.01μF, 10μF in parallel
Notes: All coil are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
F: Pitch of coil

TYPICAL PERFORMANCE DATA

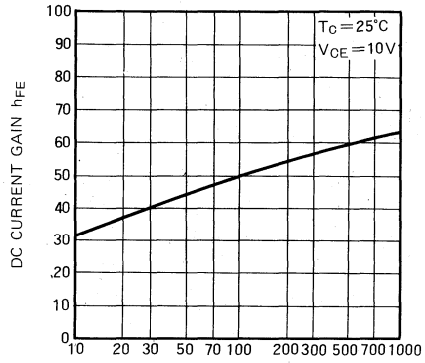
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



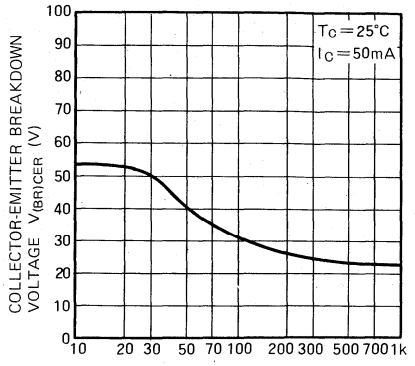
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

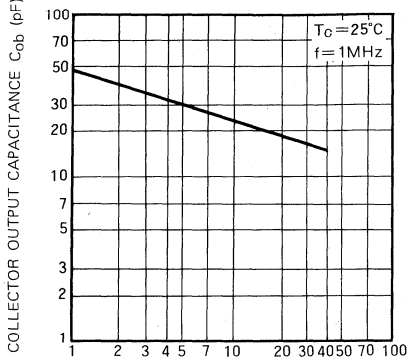


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

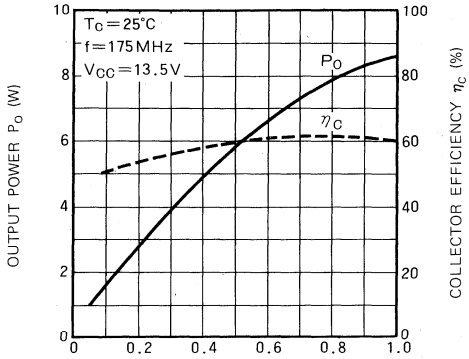


NPN EPITAXIAL PLANAR TYPE

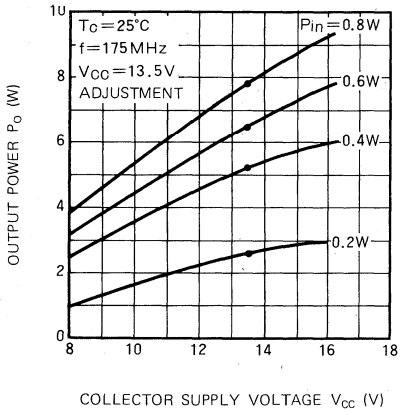
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1966

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1966 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on UHF band mobile radio applications.

FEATURES

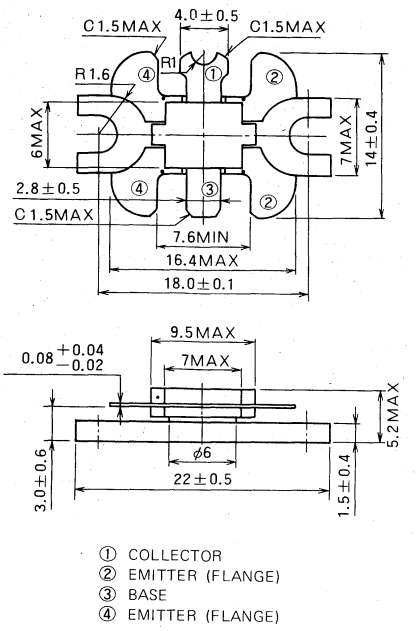
- High power gain: $G_{pe} \geqq 7.8$dB
  @V_{CC} = 13.5V, P_O = 3W, f = 470MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.

APPLICATION

1 to 2 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C=25°C	10	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65~+175	°C
Rth-c	Thermal resistance	Junction to case	15	°C/W

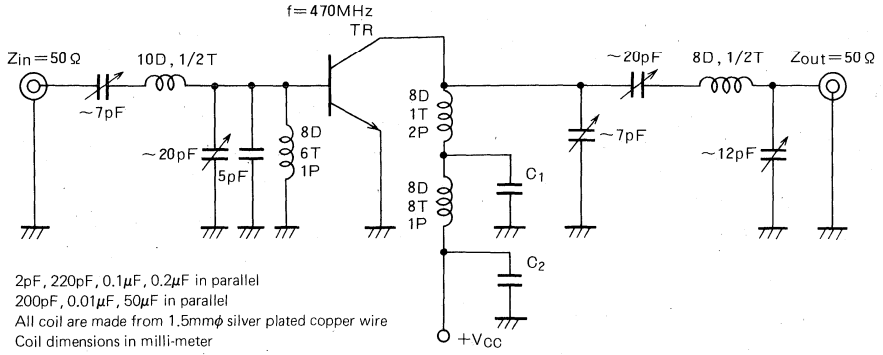
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2.5V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, Pin=0.5W, f=470MHz	3	3.5		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

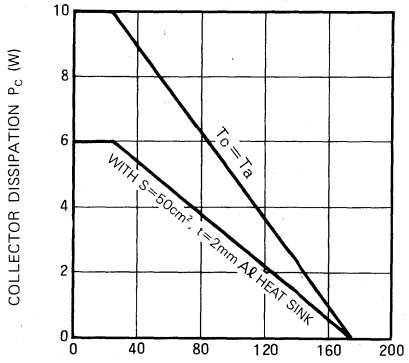
TEST CIRCUIT



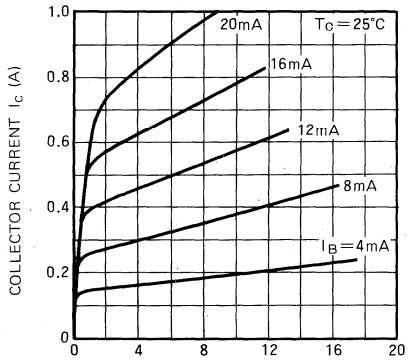
C_1: 2pF, 220pF, 0.1μF, 0.2μF in parallel
C_2: 200pF, 0.01μF, 50μF in parallel
Notes: All coil are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

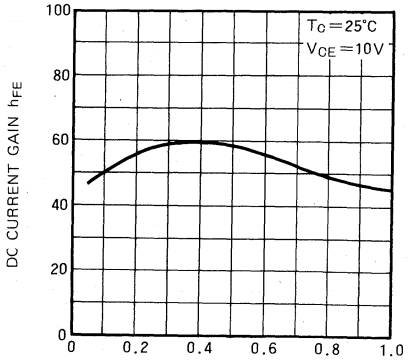
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



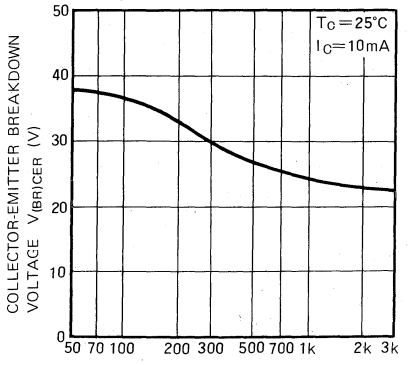
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



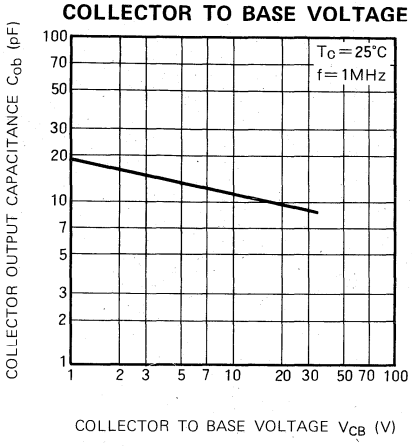
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



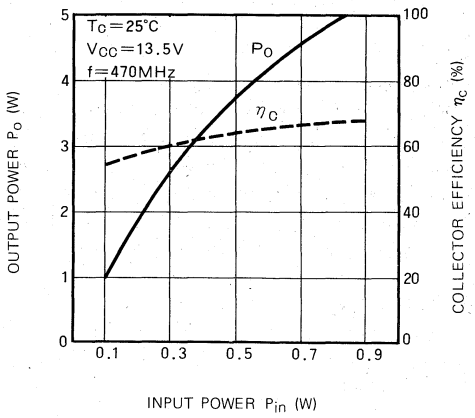
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

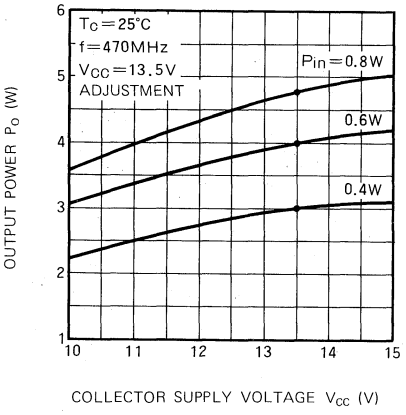
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1967

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1967 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on UHF band mobile radio applications.

FEATURES

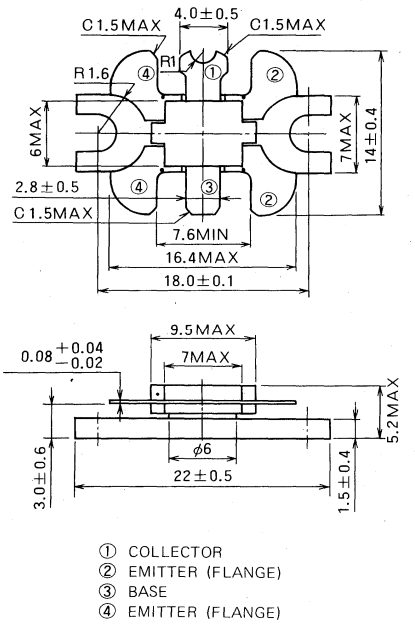
- High power gain: $G_{pe} \geqq 6.7$dB
  @V_{CC} = 13.5V, P_O = 7W, f = 470MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Ability of withstanding more than 20:1 load VSWR all phase when operated at V_{CC} = 15.2V, P_O = 7W, f = 470MHz.
- Low thermal resistance ceramic package with flange.

APPLICATION

3 to 5 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65～+175	°C
Rth-c	Thermal resistance	Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

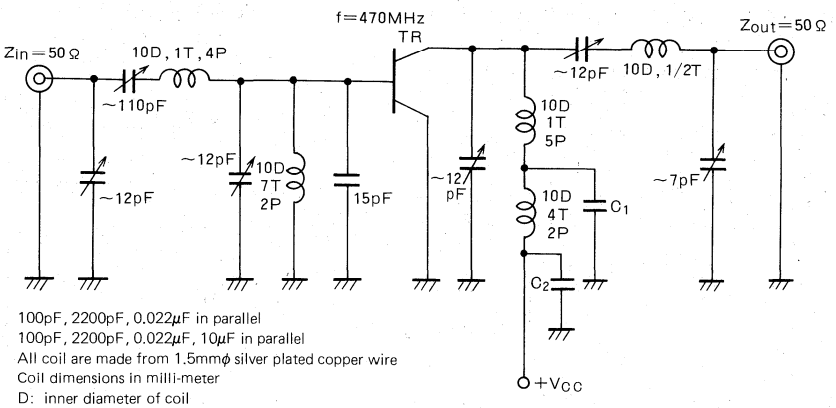
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			200	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			200	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=1.5W, f=470MHz	7	8		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

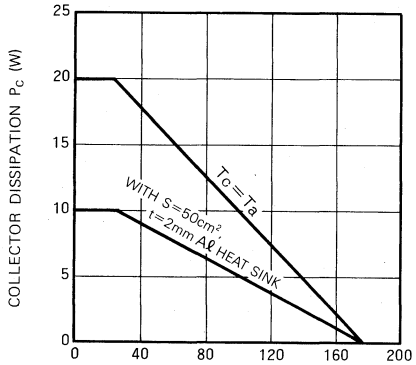
TEST CIRCUIT



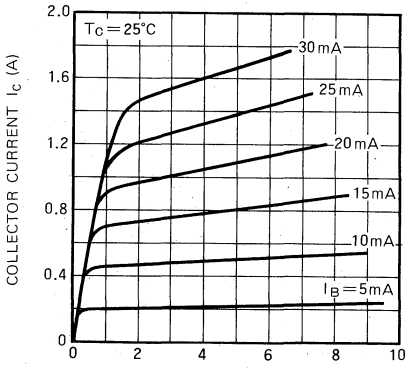
C_1: 100pF, 2200pF, 0.022μF in parallel
C_2: 100pF, 2200pF, 0.022μF, 10μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

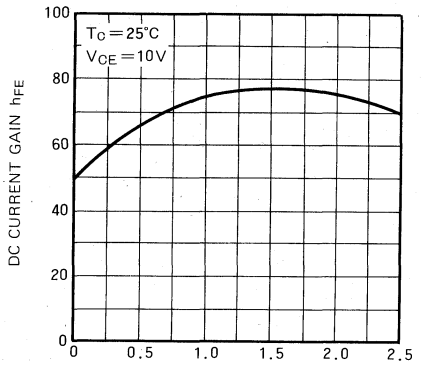
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



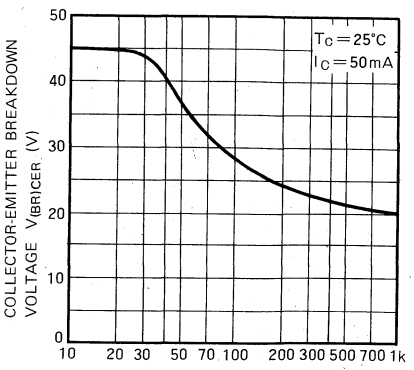
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

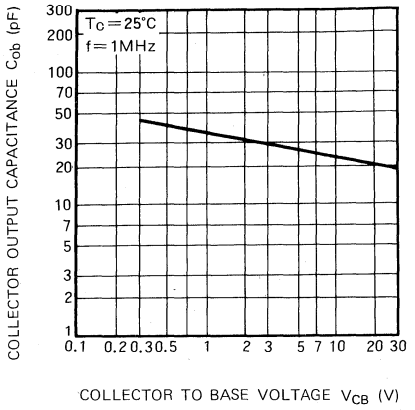


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

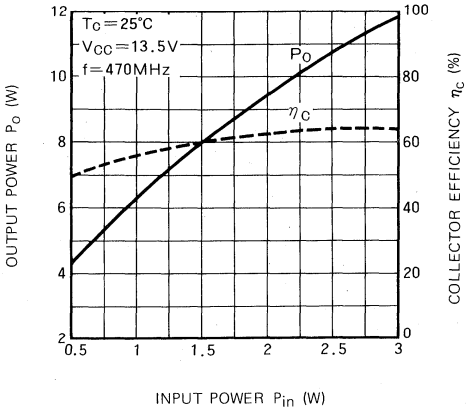


NPN EPITAXIAL PLANAR TYPE

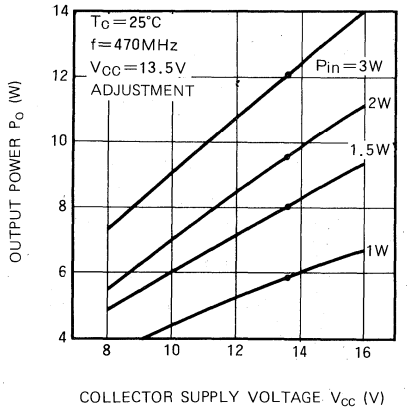
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1968

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1968 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on UHF band mobile radio applications.

FEATURES

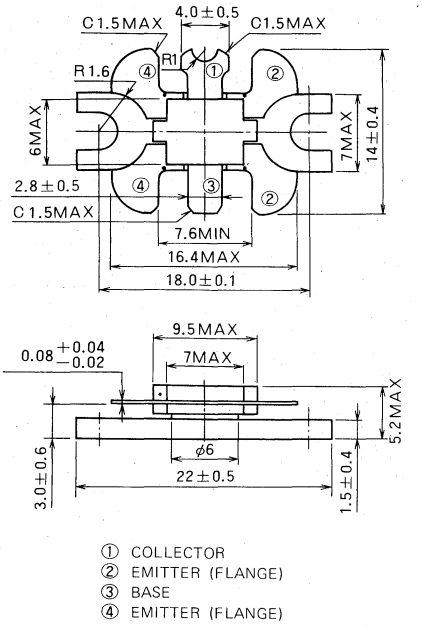
- High power gain: $G_{pe} \geqq 3.7$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 470MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR all phase when operated at V_{CC} = 15.2V, P_O = 18W, f = 470MHz.

APPLICATION

10 to 14 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		5	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	40	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−65~+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	3.75	°C/W

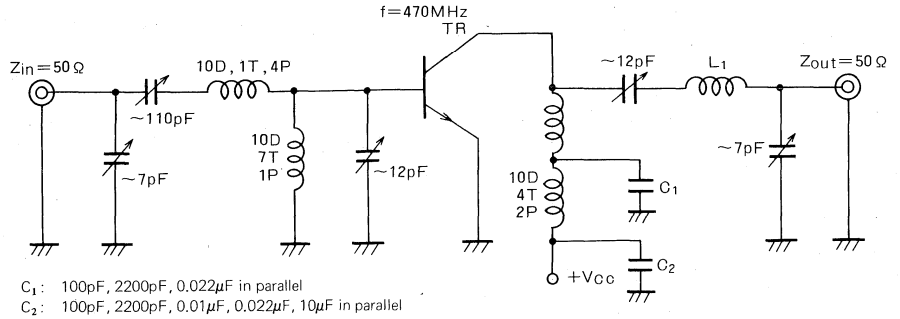
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			400	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=6W, f=470MHz	14	16		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

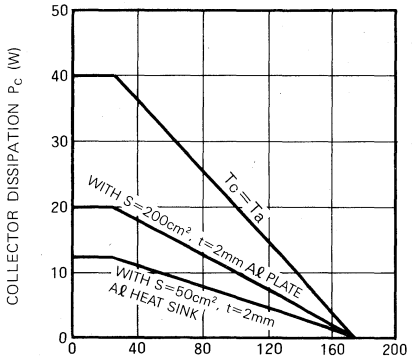
TEST CIRCUIT



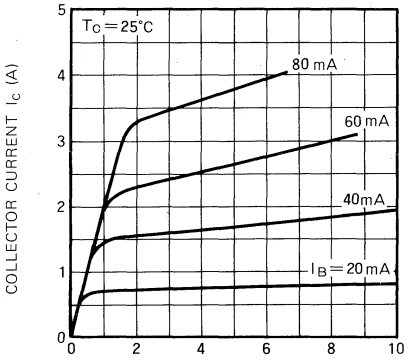
C_1: 100pF, 2200pF, 0.022μF in parallel
C_2: 100pF, 2200pF, 0.01μF, 0.022μF, 10μF in parallel
L_1: Length 4mm, width 8mm, thickness 0.3mm copper plate
Notes: All coil are made from 1.5 mmϕ silver plated copper wire except L_1
Coil dimensions in milli-meter
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

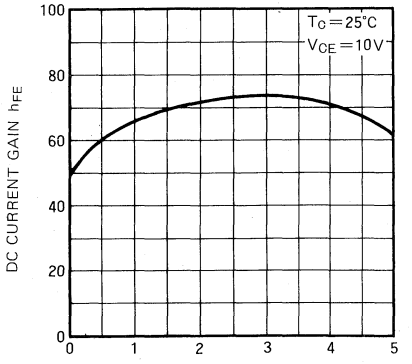
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



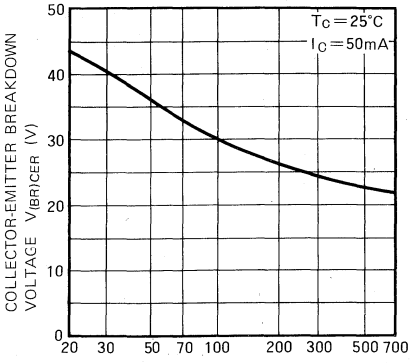
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



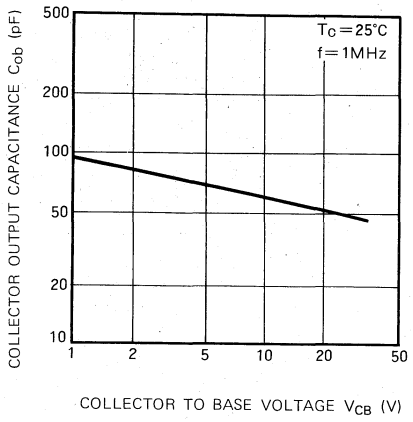
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



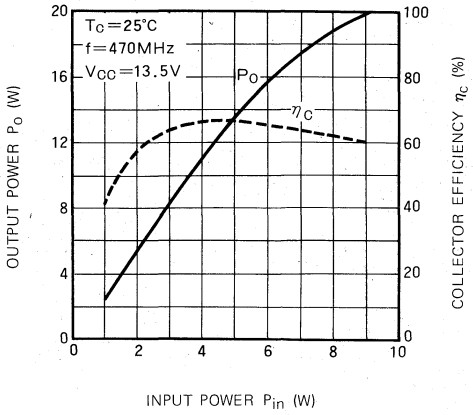
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

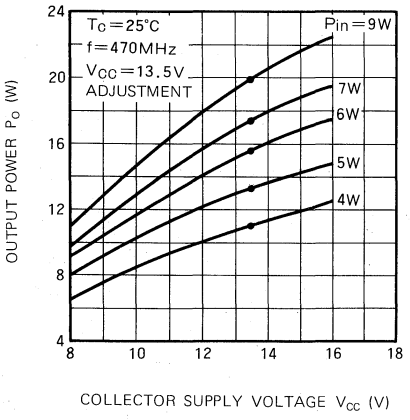
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1968A

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1968A is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on UHF band mobile radio applications.

FEATURES

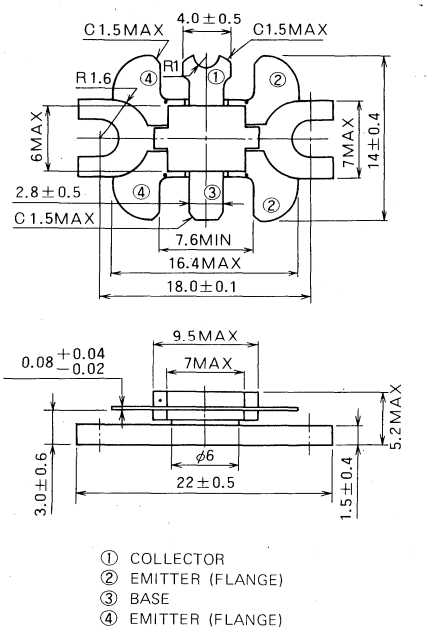
- High power gain: $G_{pe} \geqq 5.4$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 470MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR all phase when operated at V_{CC} = 15.2V, P_O = 18W, f = 470MHz.

APPLICATION

10 to 14 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		5	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	40	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−65∼+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	3.75	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

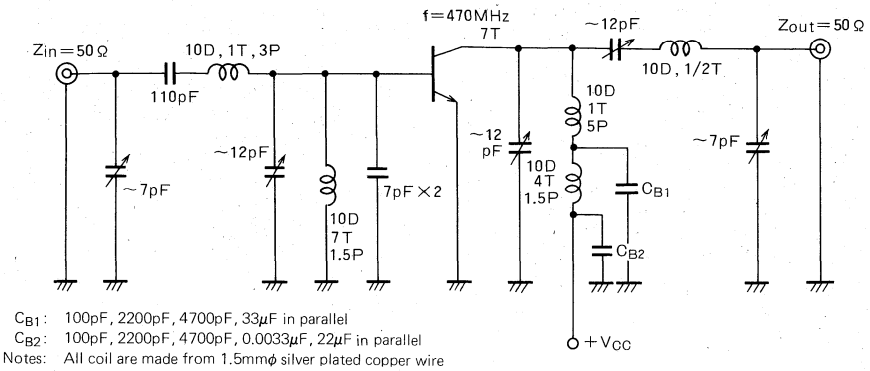
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			400	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=4W, f=470MHz	14	16		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

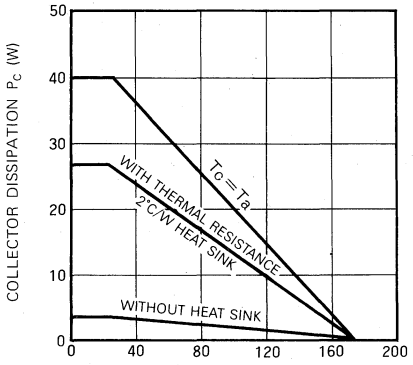
TEST CIRCUIT



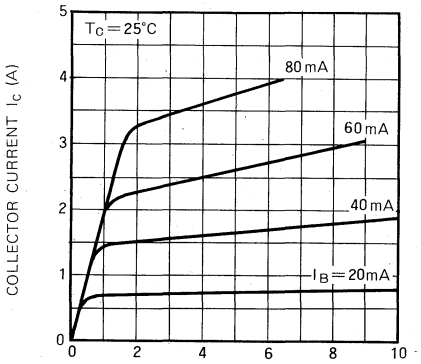
C_{B1}: 100pF, 2200pF, 4700pF, 33μF in parallel
C_{B2}: 100pF, 2200pF, 4700pF, 0.0033μF, 22μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

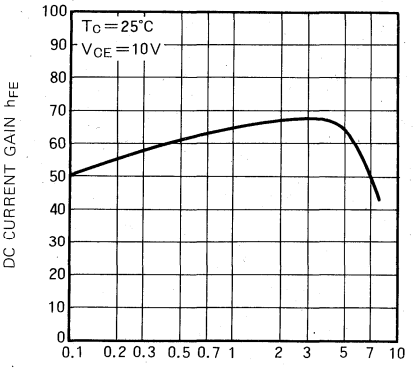
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



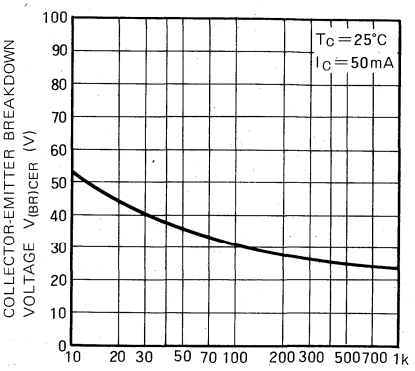
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

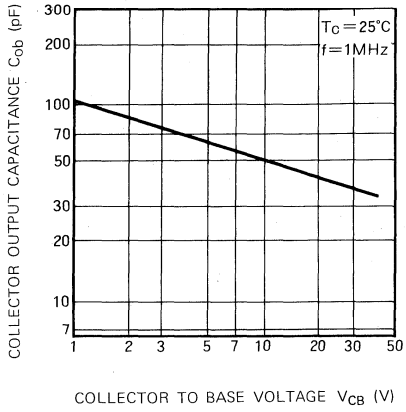


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

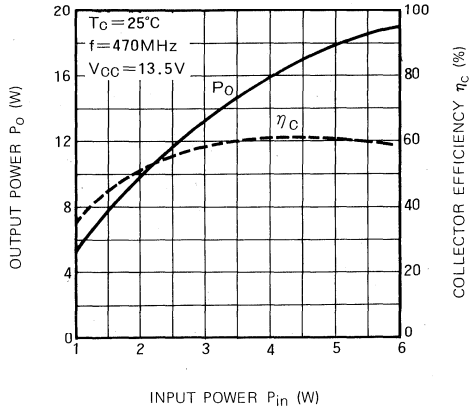


NPN EPITAXIAL PLANAR TYPE

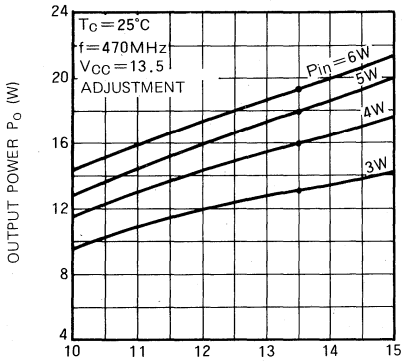
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1969

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1969 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on HF band mobile radio applications.

FEATURES

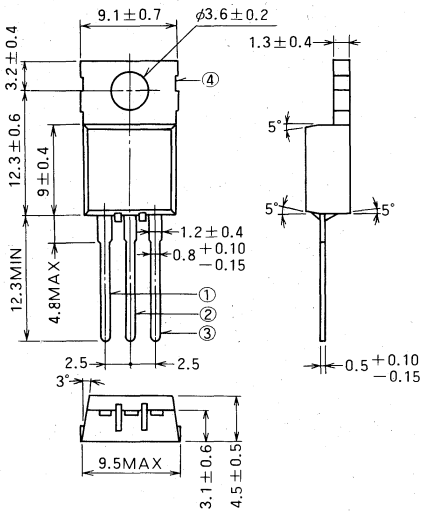
- High power gain: $G_{pe} \geqq 12$dB
  @V_{CC} = 12V, P_O = 16W, f = 27MHz
- Emitter ballasted construction for high reliaiblity and good performances.
- TO-220 package similarly is combinient for mounting.
- Ability of withstanding infinite load VSWR when operated at V_{CC} = 16V, P_O = 20W, f = 27MHz.

APPLICATION

10 to 14 watts output power class AB amplifiers applications in HF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		60	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	25	V
I_C	Collector current		6	A
P_C	Collector dissipation	T_a=25°C	1.7	W
		T_C=25°C	20	W
T_j	Junction temperature		+150	°C
T_{stg}	Storage temperature		−55～+150	°C
R_{th-a}	Thermal resistance	Junction to ambient	73.5	°C/W
R_{th-c}		Junction to case	6.25	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

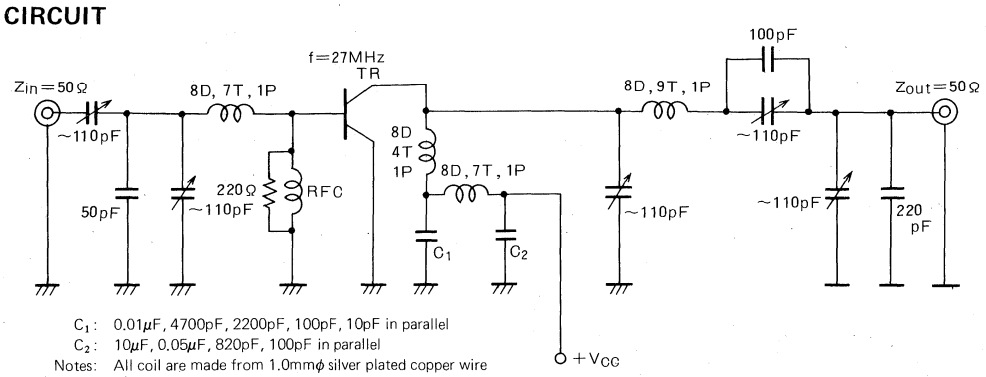
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	60			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	25			V
I_{CBO}	Collector cutoff current	V_{CB}=30V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=4V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=12V, I_C=10mA	10	50	180	—
P_O	Output power	V_{CC}=12V, P_{in}=1w, f=27MHz	16	18		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%, h_{FE} classification.

Item	X	A	B	C	D
h_{FE}	10～25	20～45	35～70	55～110	90～180

NPN EPITAXIAL PLANAR TYPE

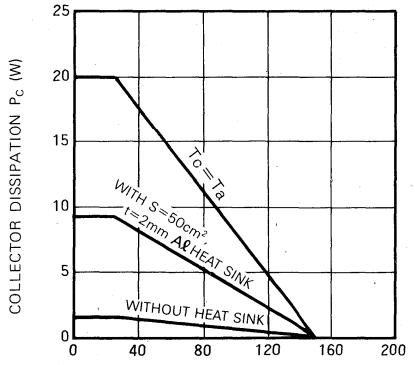
TEST CIRCUIT



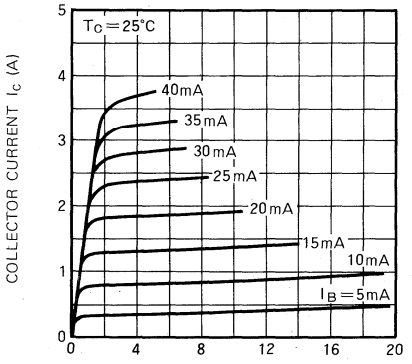
C_1: 0.01μF, 4700pF, 2200pF, 100pF, 10pF in parallel
C_2: 10μF, 0.05μF, 820pF, 100pF in parallel
Notes: All coil are made from 1.0mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

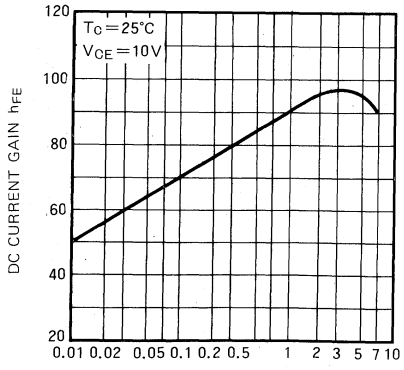
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



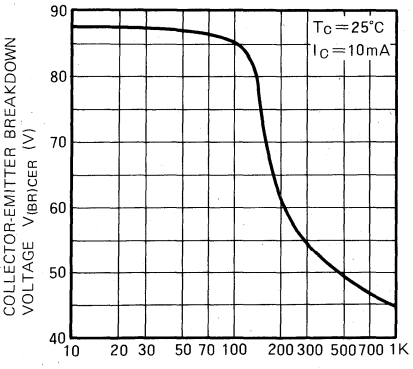
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



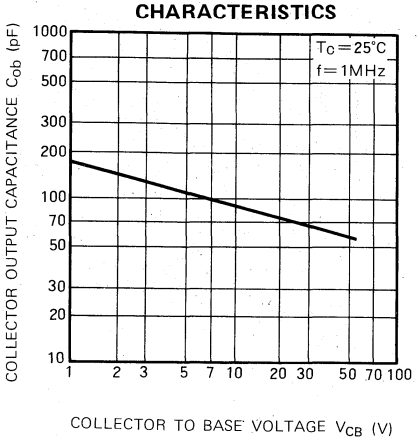
DC CURRENT GAIN VS. COLLECTOR CURRENT



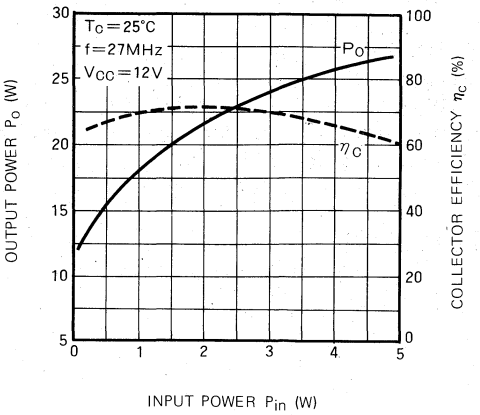
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

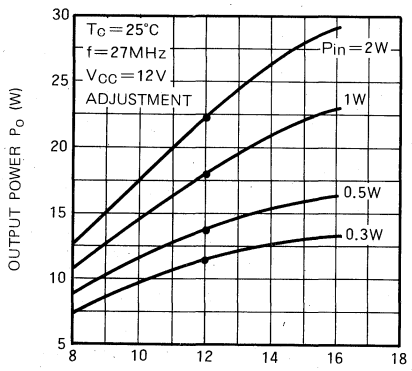
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



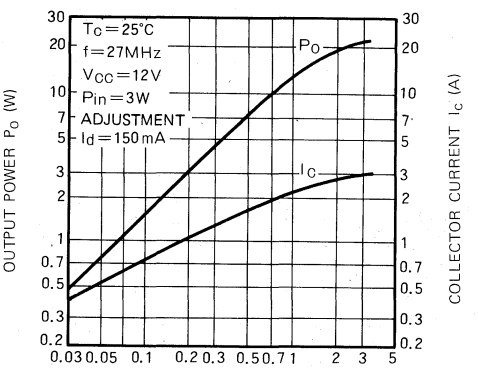
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



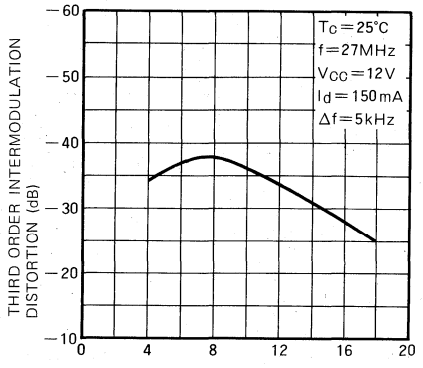
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



IN CASE AB OPERATING OUTPUT POWER COLLECTOR CURRENT VS. INPUT POWER



THIRD ORDER INTERMODULATION DISTORTION VS. OUTPUT POWER



2SC1970

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1970 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

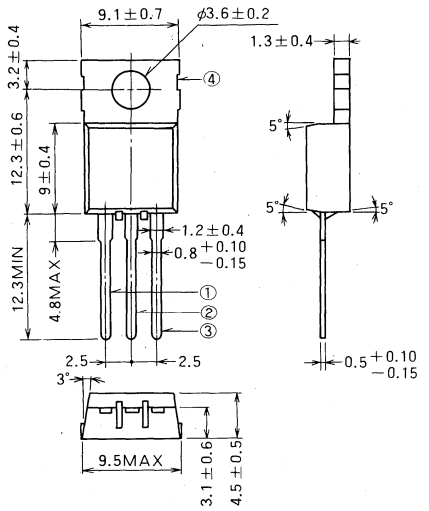
- High power gain: $G_{pe} \geqq 9.2$dB
  @V_{CC} = 13.5V, P_O = 1W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-220 package similarly is combinient for mounting.

APPLICATION

0.8 to 1 watts output power amplifiers and driver in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② COLLECTOR (FIN)
③ EMITTER
④ FIN (COLLECTOR)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		0.6	A
P_C	Collector dissipation	T_a=25°C	1	W
		T_C=25°C	5	W
T_j	Junction temperature		+150	°C
T_{stg}	Storage temperature		−55~+150	°C
R_{th-a}	Thermal resistance	Junction to ambient	125	°C/W
R_{th-c}		Junction to case	25	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

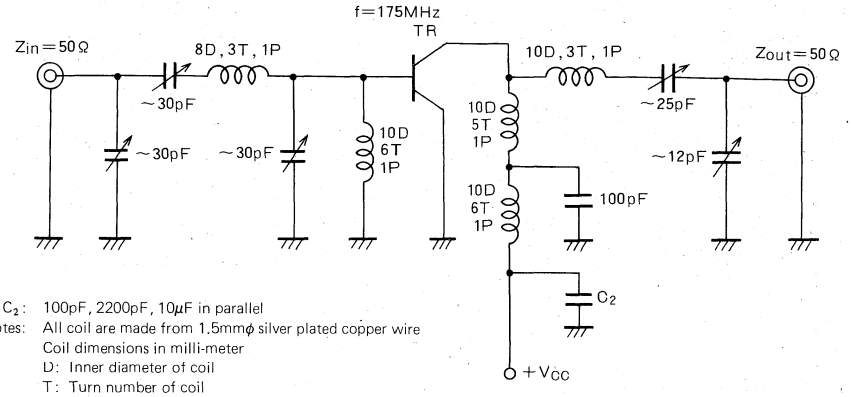
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=5mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.12W, f=175MHz	1	1.3		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

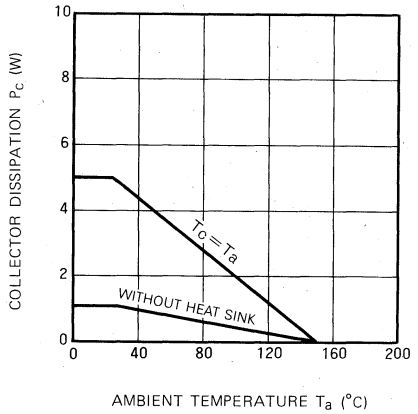
TEST CIRCUIT



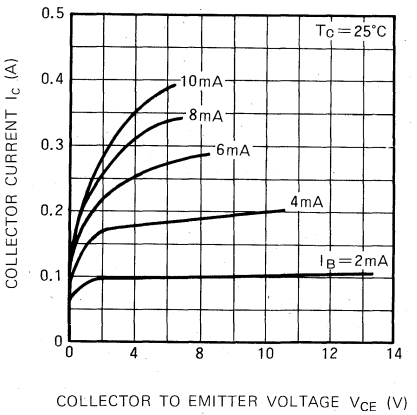
C_2: 100pF, 2200pF, 10μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
F: Pitch of coil

TYPICAL PERFORMANCE DATA

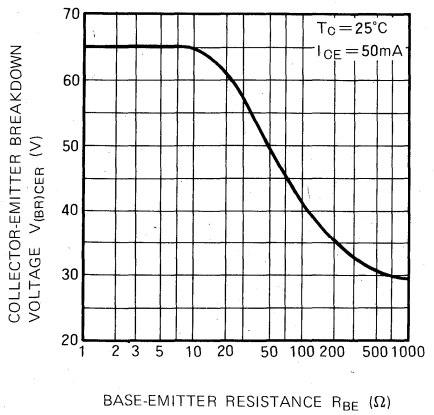
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



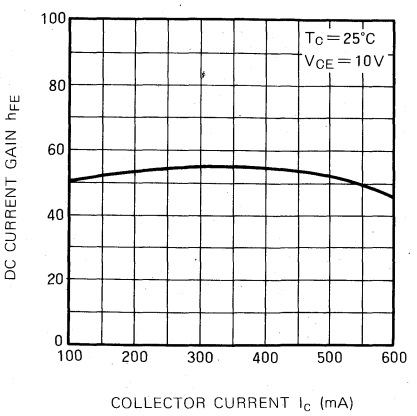
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

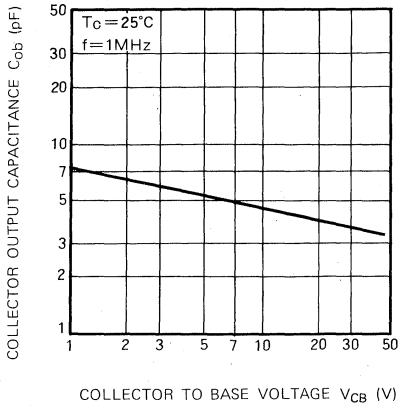


DC CURRENT GAIN VS. COLLECTOR CURRENT

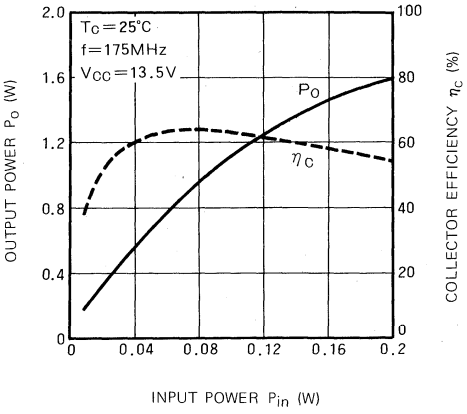


NPN EPITAXIAL PLANAR TYPE

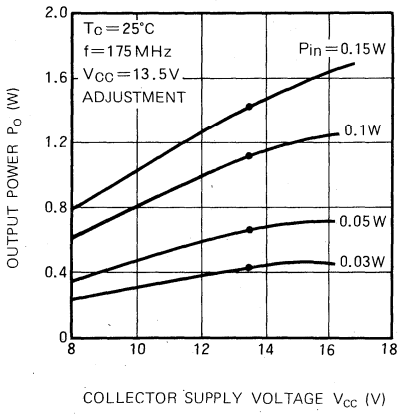
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC1971

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1971 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

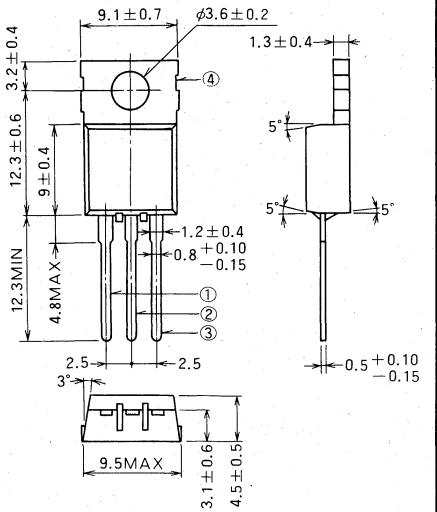
- High power gain: $G_{pe} \geqq 10$dB
  @V_{CC} = 13.5V, P_O = 6W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-220 package similar is combinient for mounting.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz.

APPLICATION

4 to 5 watts output power amplifiers in VHF band applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② EMITTER (FIN)
③ COLLECTOR
④ FIN (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		12	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	12.5	W
T_j	Junction temperature		+150	°C
Tstg	Storage temperature		−55～+150	°C
Rth-a	Thermal resistance	Junction to ambient	83	°C/W
Rth-c		Junction to case	10	°C/W

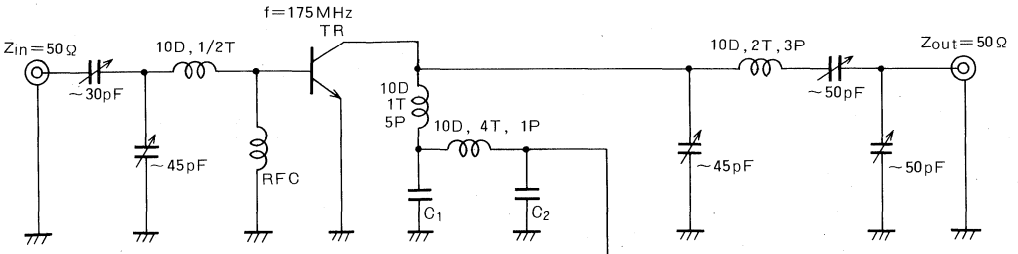
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_F=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.6W, f=175MHz	6	7		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

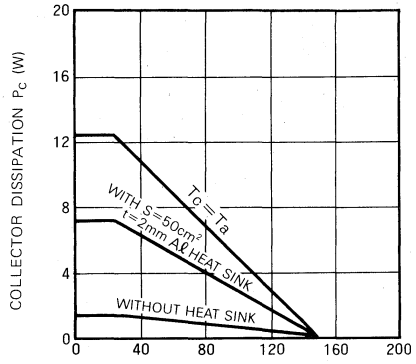
TEST CIRCUIT



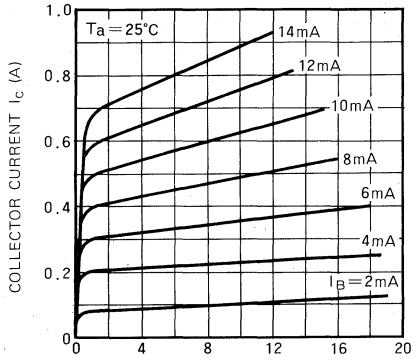
C_1: 0.05μF
C_2: 150pF, 0.03μF, 0.03μF, 33μF in parallel
Notes: All coils are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

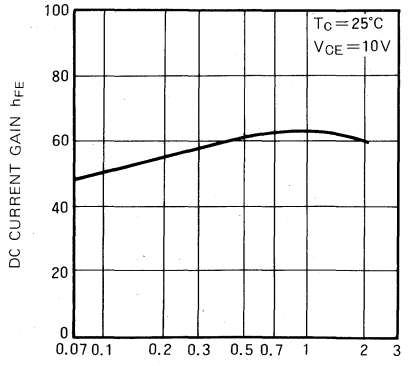
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



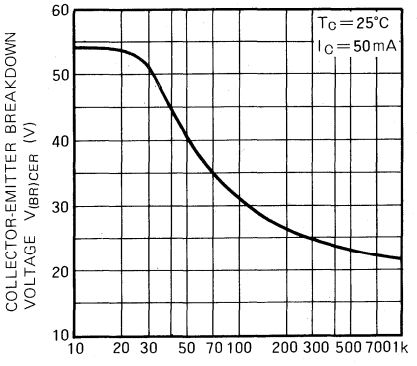
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



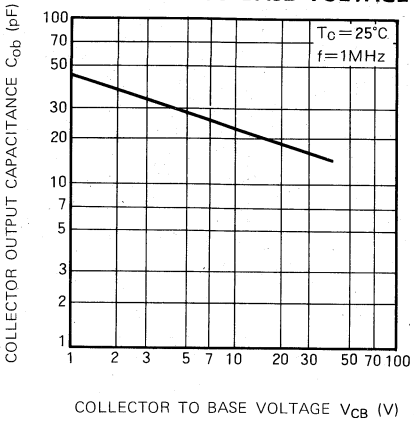
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



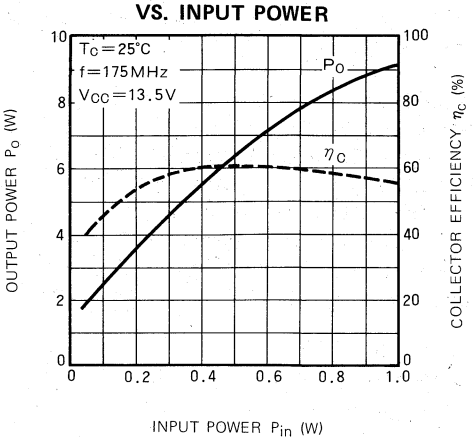
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

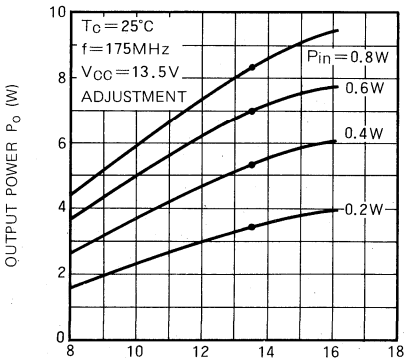
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC1972

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC1972 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers on VHF band mobile radio applications.

FEATURES

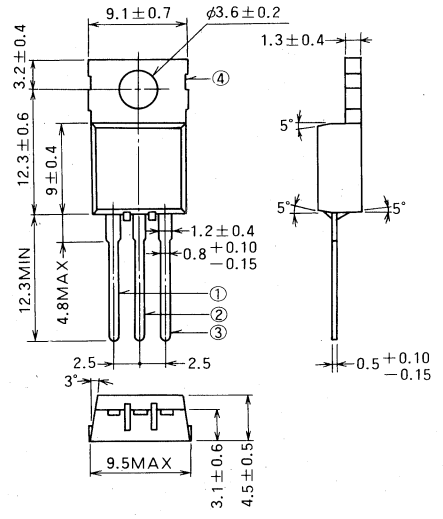
- High power gain: $G_{pe} \geqq 7.5$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-220 package similar is combinient for mounting.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 18W, f = 175MHz.

APPLICATION

10 to 14 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② EMITTER (FIN)
③ COLLECTOR
④ FIN (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		3.5	A
P_C	Collector dissipation	Ta=25°C	1.5	W
		T_C=25°C	25	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	100	°C/W
Rth-c		Junction to case	6	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

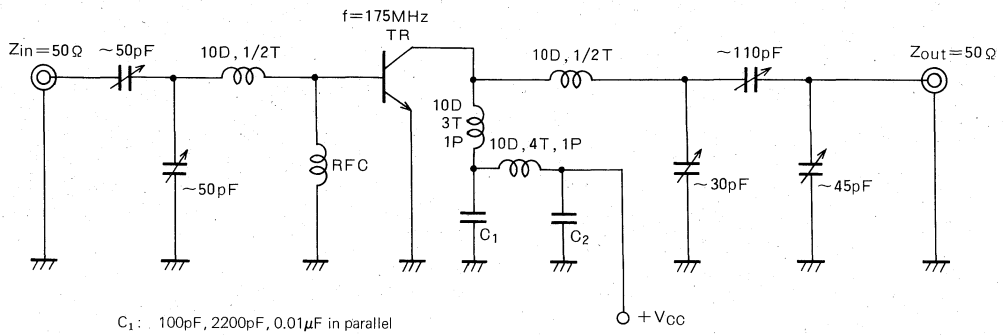
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1000	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=2.5W, f=175MHz	14	15		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

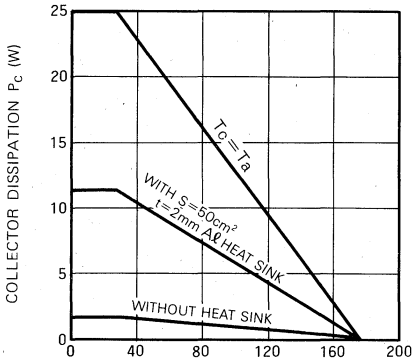
TEST CIRCUIT



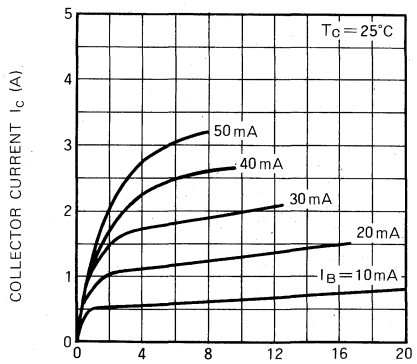
C_1: 100pF, 2200pF, 0.01μF in parallel
C_2: 100pF, 2200pF, 0.01μF, 10μF in parallel
Notes: All coil are made from 1.5mm] silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

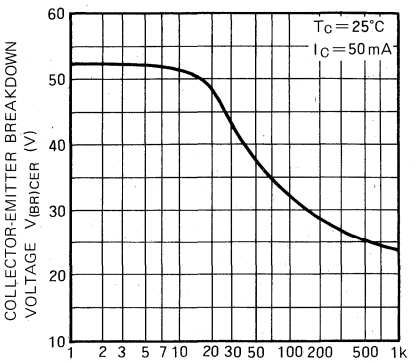
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



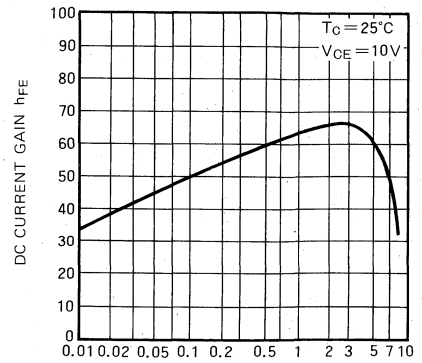
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

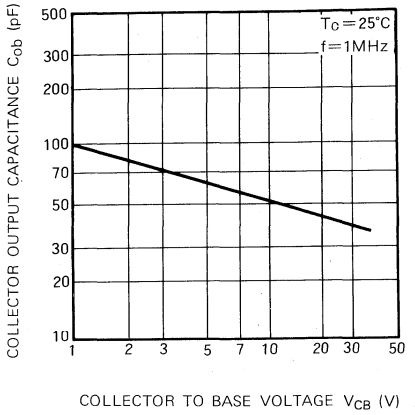


DC CURRENT GAIN VS. COLLECTOR CURRENT

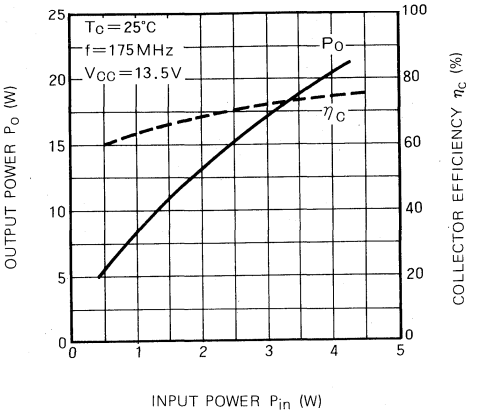


NPN EPITAXIAL PLANAR TYPE

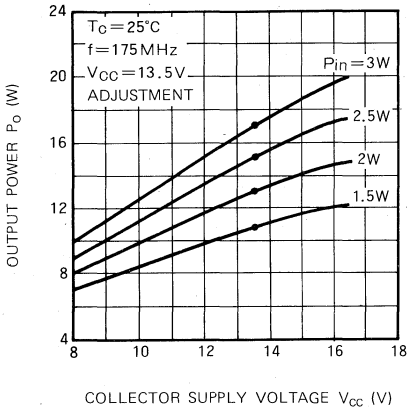
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2053

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2053 is a silicon NPN epitaxial planar type transistor designed for RF amplifiers on VHF band mobile radio applications.

FEATURES

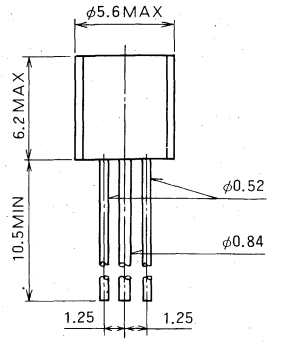
- High power gain: $G_{pe} \geqq 15.7$dB
  @V_{CC} = 13.5V, P_O = 150mW, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-92 similar package is combinient for mounting.

APPLICATION

Driver amplifiers in general in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② COLLECTOR
③ EMITTER

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		0.3	A
P_C	Collector dissipation	T_a=25°C	0.6	W
T_j	Junction temperature		+135	°C
T_{stg}	Storage temperature		−55～+135	°C
R_{th-a}	Thermal resistance	Junction to ambient	183	°C/W

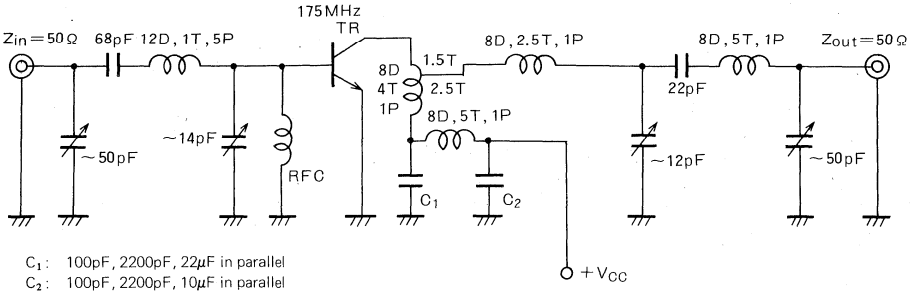
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			20	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			20	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=10mA	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=4mW, f=175MHz	150	200		mW
η_C	Collector efficiency		40	50		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

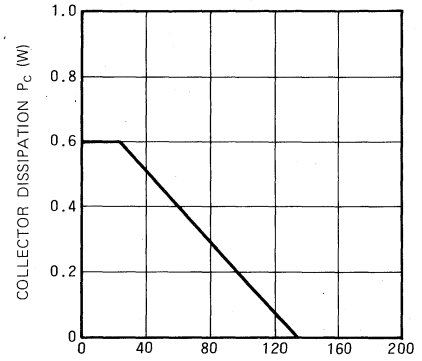
TEST CIRCUIT



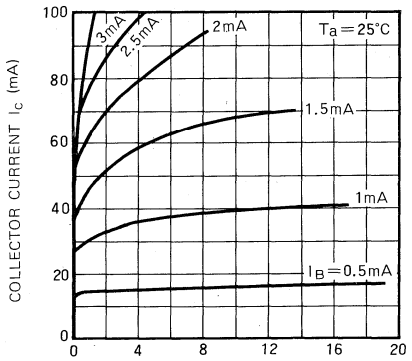
C_1: 100pF, 2200pF, 22μF in parallel
C_2: 100pF, 2200pF, 10μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

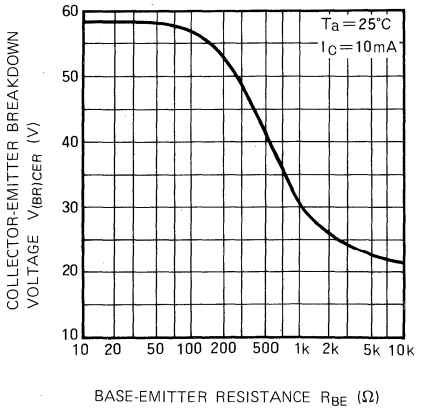
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



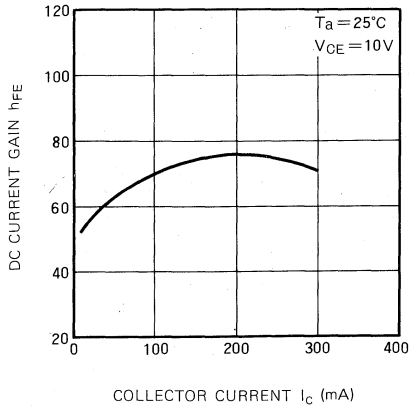
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



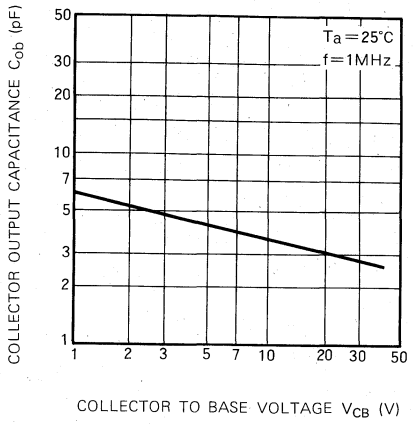
DC CURRENT GAIN VS. COLLECTOR CURRENT



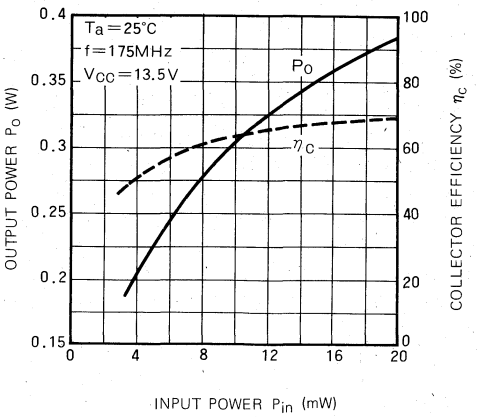
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

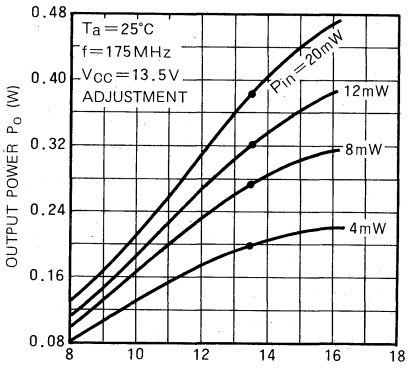
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2055

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2055 is a silicon NPN epitaxial planar type transistor designed for RF amplifiers on VHF band portable or hand-held radio applications.

FEATURES

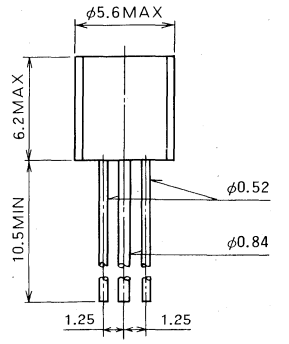
- High power gain: $G_{pe} \geqq 13$dB
  @V_{CC} = 7.2V, P_O = 0.2W, f = 175MHz
- Emitter ballasted construction, gold metallization for high reliability and good performances.
- TO-92 similar package is combinient for mounting.

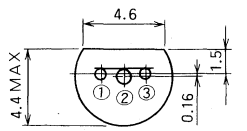
APPLICATION

Driver amplifiers in general in VHF band portable or hand-held radio applications.

OUTLINE DRAWING

Dimensions in mm





① BASE
② COLLECTOR
③ EMITTER

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		18	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		0.3	A
P_C	Collector dissipation	Ta=25°C	0.5	W
T_j	Junction temperature		+135	°C
Tstg	Storage temperature		−55～+135	°C
Rth-a	Thermal resistance	Junction to ambient	220	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

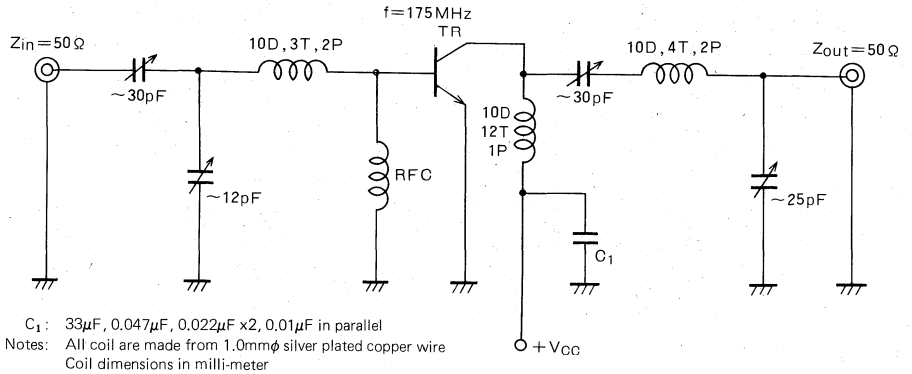
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	18			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cutoff current	V_{CB}=10V, I_E=0			30	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			30	μA
h_{FE}	DC forward current gain *	V_{CE}=7V, I_C=50mA	10	50	180	—
P_O	Output power	V_{CC}=7.2V, P_{in}=10mW, f=175MHz	0.2	0.25		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

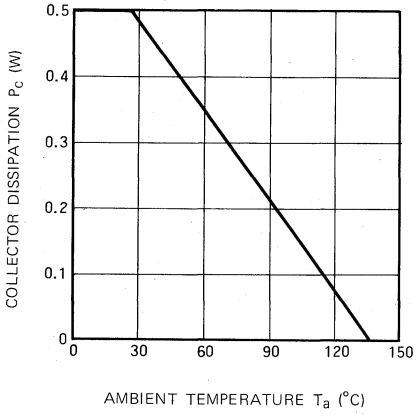
TEST CIRCUIT



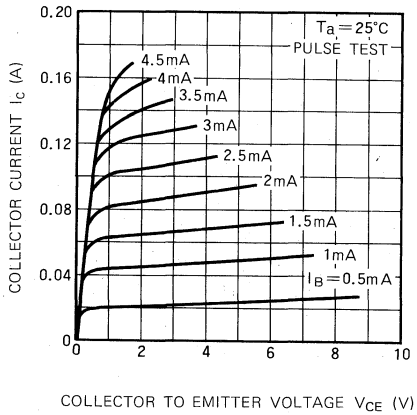
C_1: 33μF, 0.047μF, 0.022μF x2, 0.01μF in parallel
Notes: All coil are made from 1.0mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

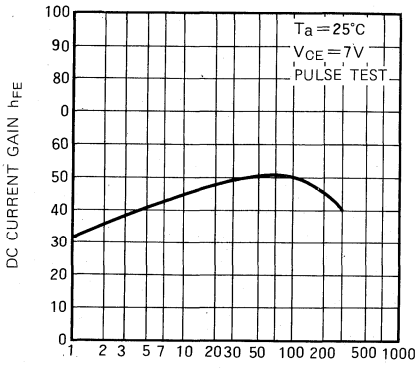
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



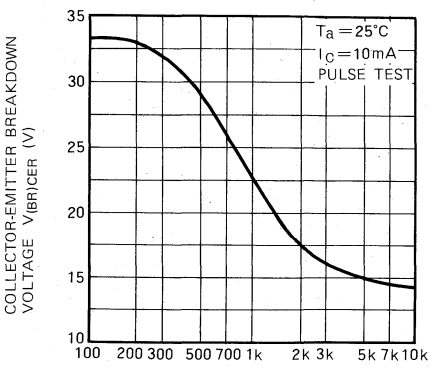
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

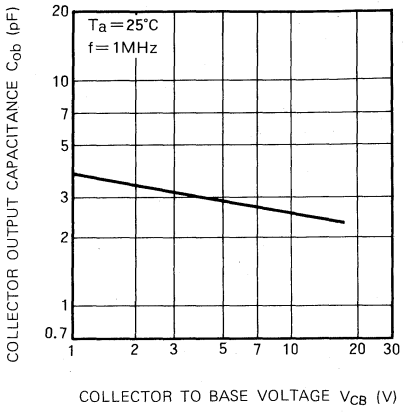


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

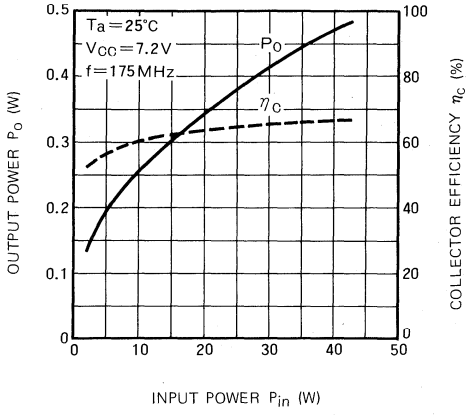


NPN EPITAXIAL PLANAR TYPE

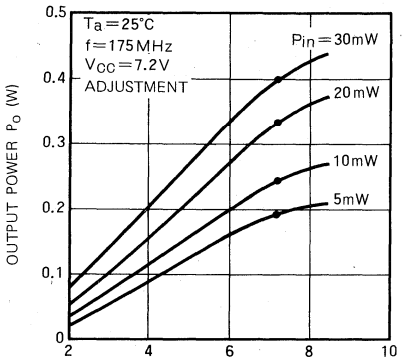
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2056

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2056 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band portable or hand-held radio applications.

FEATURES

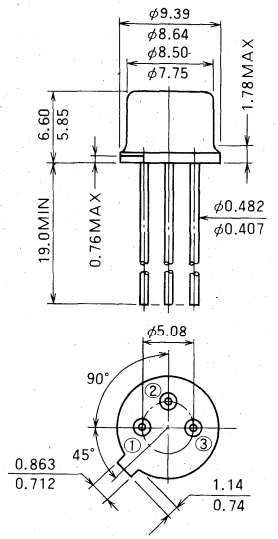
- High power gain: $G_{pe} \geqq 9dB$
  @V_{CC} = 7.2V, P_O = 1.6W, f = 175MHz
- TO-39 metal seeled package for high reliability.
- Emitter ballasted construction, gold metallization for good performances.
- Emitter electrode is connected electrically to the case.

APPLICATION

1 to 1.5 watt power amplifiers in VHF band portable or hand-held radio applications.

OUTLINE DRAWING

Dimensions in mm



① EMITTER (CASE)
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		18	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		0.6	A
P_C	Collector dissipation	T_a=25°C	0.8	W
		T_C=25°C	4	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	187.5	°C/W
Rth-c		Junction to case	37.5	°C/W

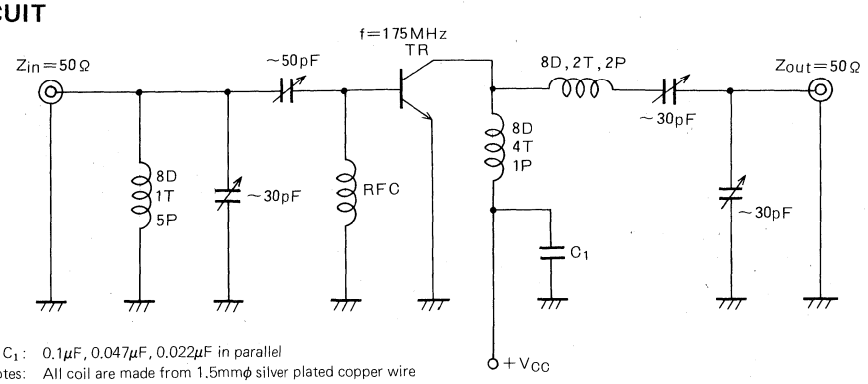
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	18			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cutoff current	V_{CB}=10V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=7V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=7.2V, P_{in}=0.2W, f=175MHz	1.6	2		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

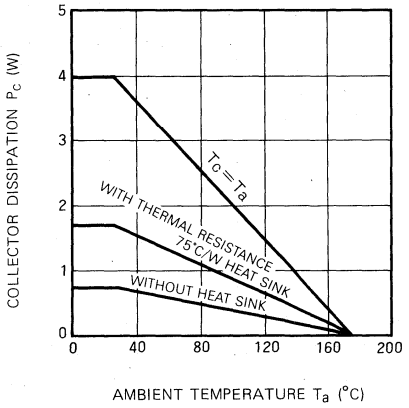
TEST CIRCUIT



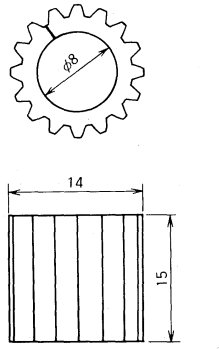
C_1: 0.1μF, 0.047μF, 0.022μF in parallel
Notes: All coil are made from 1.5mmφ silver plated copper wire
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE

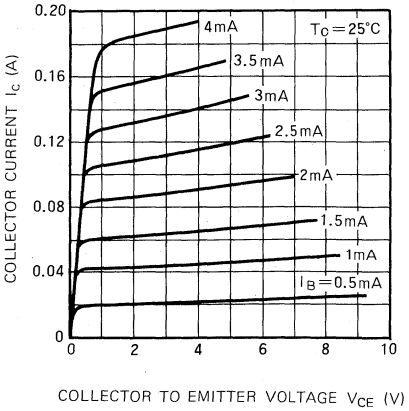


THERMAL RESISTANCE 75°C/W HEAT SINK OUTLINE DRAWING

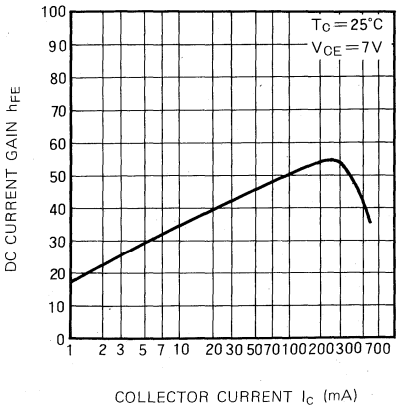


MATERIAL: Aℓ
DIMENSIONS: mm

OUTPUT CHARACTERISTICS, COMMON EMITTER



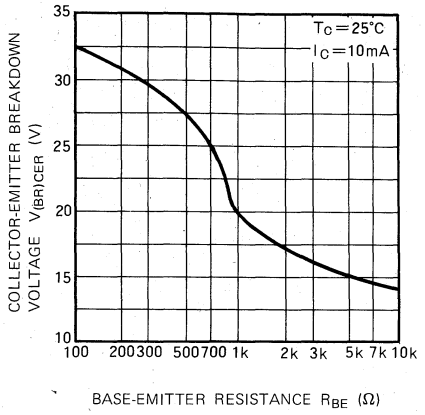
DC CURRENT GAIN VS. COLLECTOR CURRENT



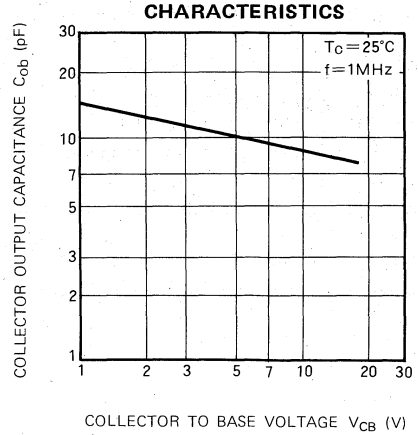
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

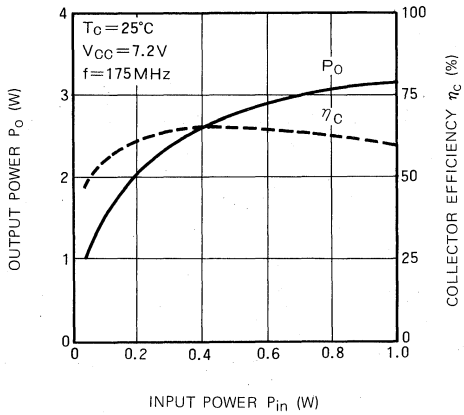
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



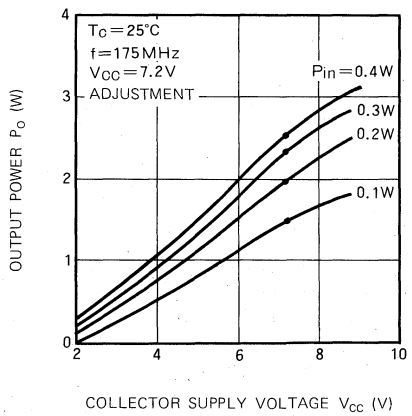
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2086

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2086 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in HF band mobile radio applications.

FEATURES

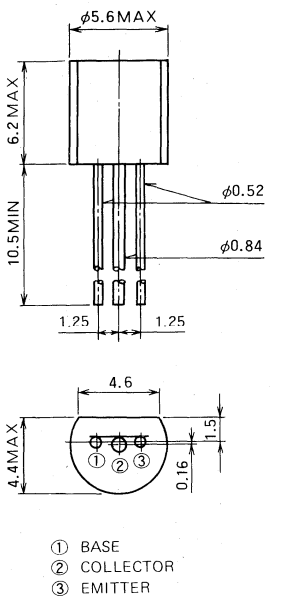
- High power gain: $G_{pe} \geqq 13$dB
  @V_{CC} = 12V, P_O = 300mW, f = 27MHz
- Emitter ballasted construction, gold metallization for good performances.
- TO-92 similar package with low thermal resistance.

APPLICATION

Driver amplifiers in general in HF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① BASE
② COLLECTOR
③ EMITTER

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		75	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_a=25°C	0.8	W
T_j	Junction temperature		+135	°C
T_{stg}	Storage temperature		−55～+135	°C
R_{th-a}	Thermal resistance	Junction to ambient	137.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

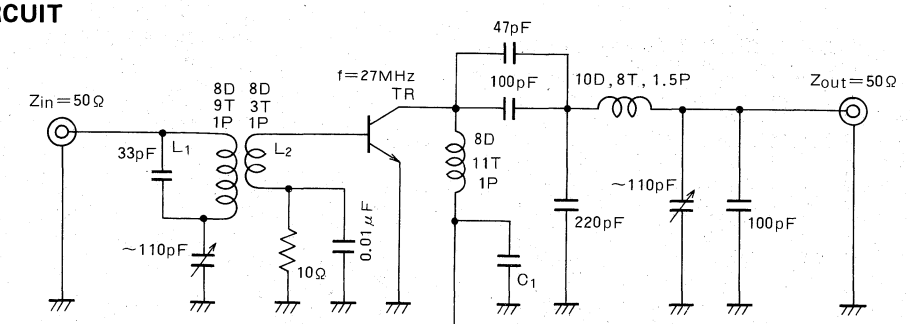
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	75			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB}=35V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	35	70	300	—
P_O	Output power	V_{CC}=12V, P_{in}=15mW, f=27MHz	0.3	0.45		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

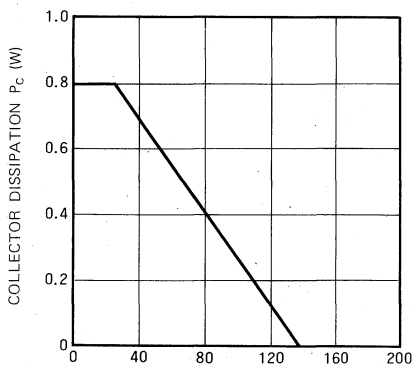
TEST CIRCUIT



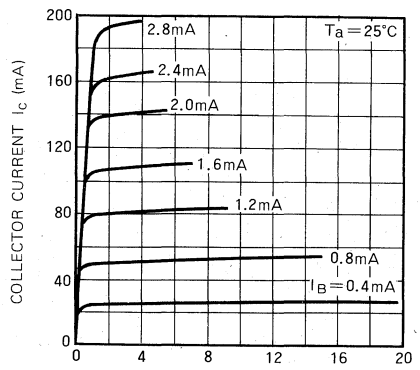
C_1: 33μF, 0.033μF, 0.01μF, 330pF, 100pF in parallel
Notes: L_1 and L_2 are reeled same core by turns
Coils are made from 1.0mmϕ silver plated copper wire, but L_2 is made from 0.8mmϕ enamel wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Coils dimensions in milli-meter

TYPICAL PERFORMANCE DATA

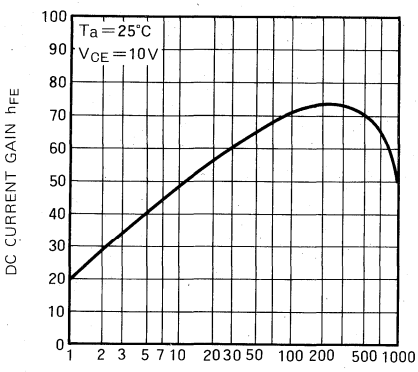
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



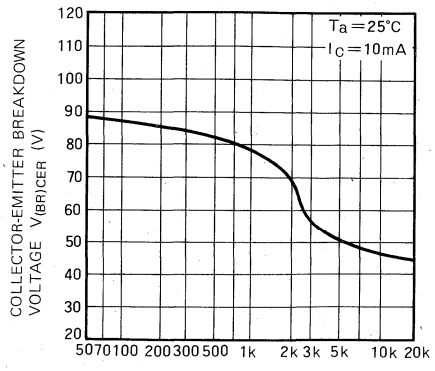
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

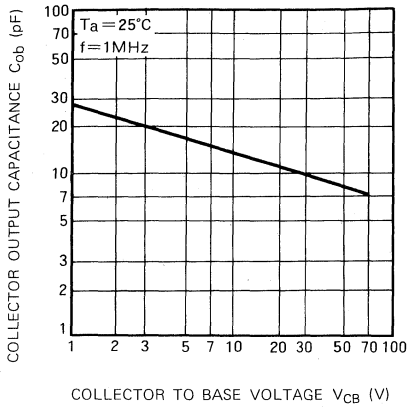


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

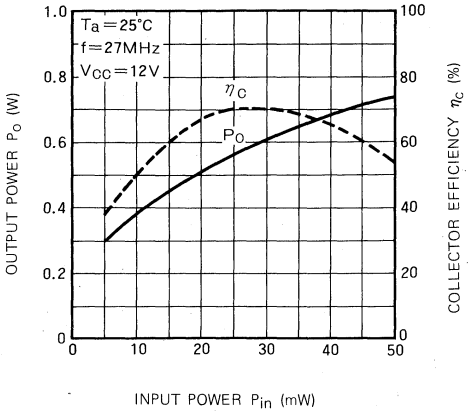


NPN EPITAXIAL PLANAR TYPE

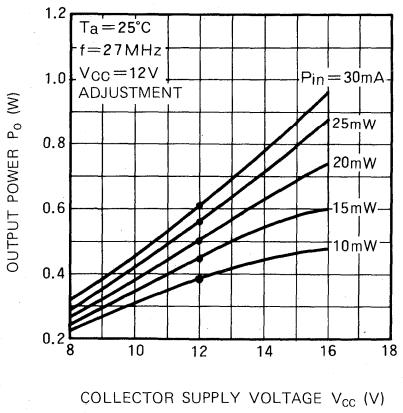
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2094

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2094 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

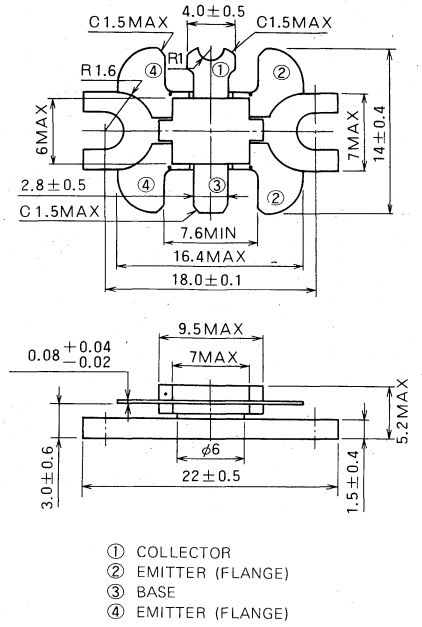
- High power gain: $G_{pe} \geqq 8.8$dB
  @V_{CC} = 13.5V, P_O = 15W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 18W, f = 175MHz.
- Low intermodulation distortion: IMD −30dB (typ) @15WPEP

APPLICATION

10 to 14 watts output linear power amplifiers in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		3.5	A
P_C	Collector dissipation	T_a=25°C	2	W
		T_C=25°C	30	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	75	°C/W
R_{th-c}		Junction to case	5	°C/W

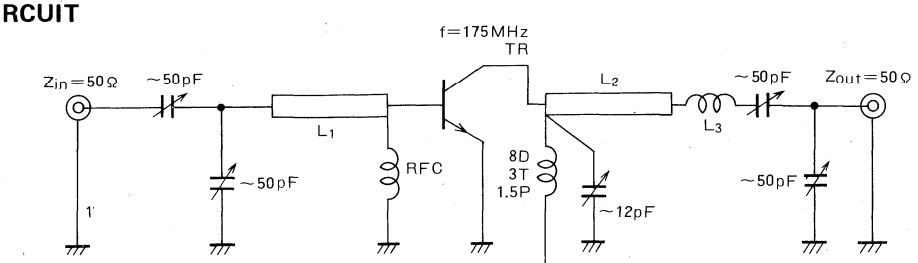
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			0.5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, Pin=2W, f=175MHz	15	17.5		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

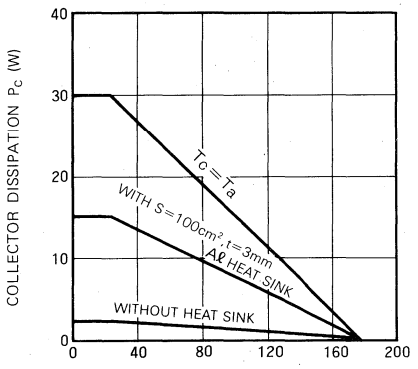
TEST CIRCUIT



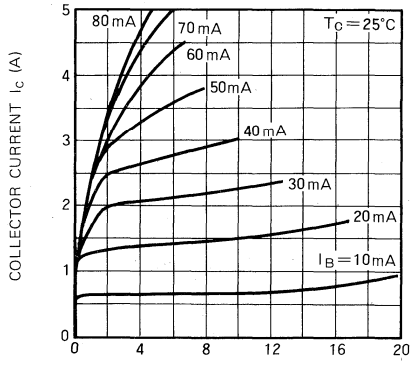
L_1: Width, 4mm, length 58mm, PCB (t = 1.6mm glass epoxy)
L_2: Width 4mm, length 42mm, PCB (t = 1.6mm glass epoxy)
L_3: 10D, 1T, 1.0mmϕ silver plated copper wire
C_1: 220pF, 2200pF, 2200pF in parallel
C_2: 0.01μF, 1μF in parallel
Notes: All coil are made from 1.5 mmϕ silver plated copper wire except L_1, L_2, L_3 & RFC
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

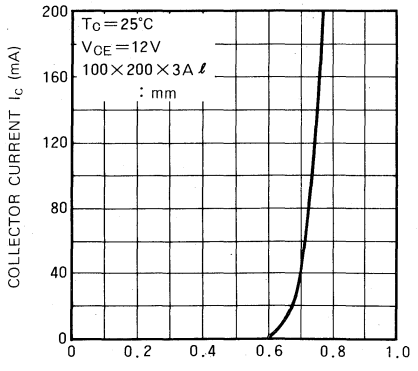
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



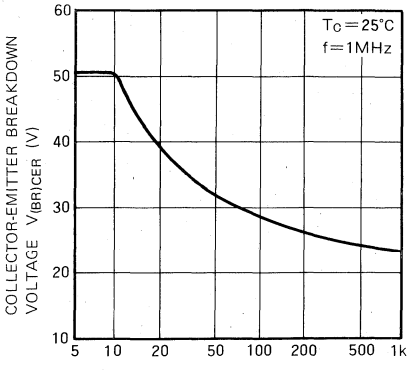
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR CURRENT VS. BASE TO EMITTER VOLTAGE



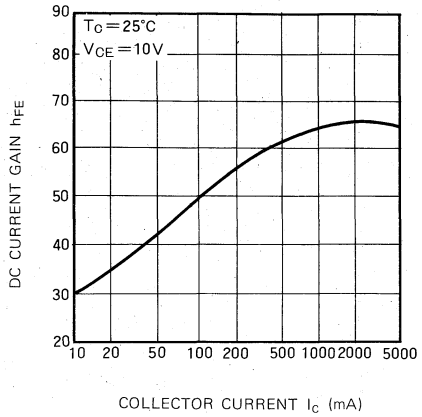
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



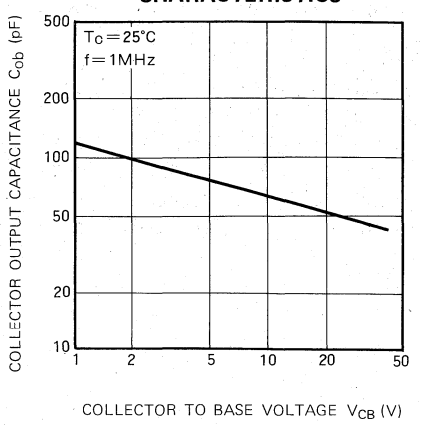
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

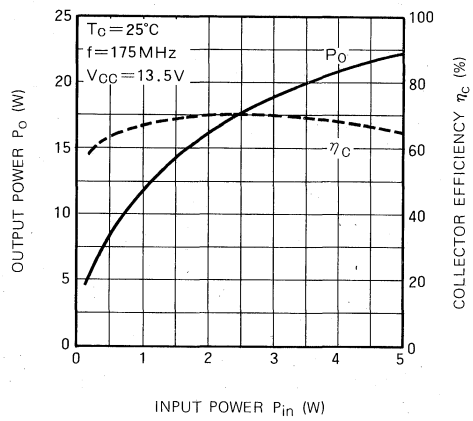
DC CURRENT GAIN VS. COLLECTOR CURRENT



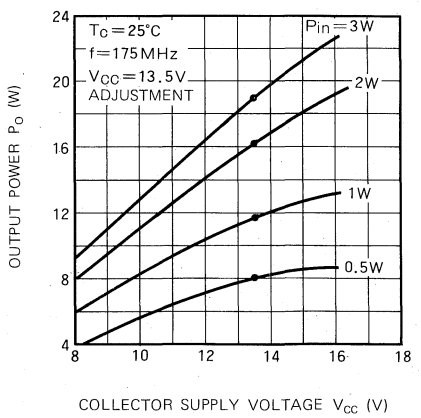
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



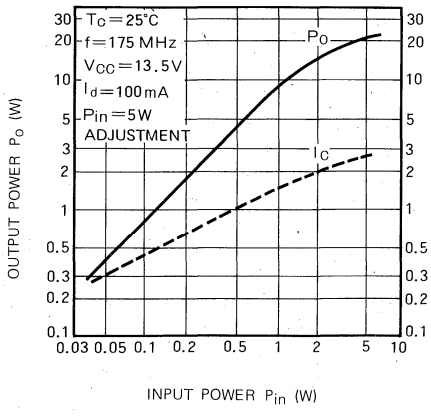
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



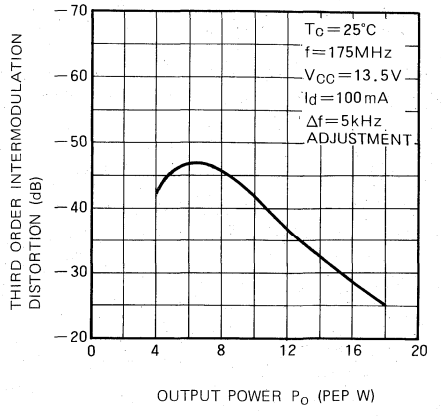
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



IN CASE AB OPERATING OUTPUT POWER COLLECTOR CURRENT VS. INPUT POWER



THIRD ORDER INTERMODULATION DISTORTION VS. OUTPUT POWER



2SC2097

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2097 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in HF band mobile radio applications.

FEATURES

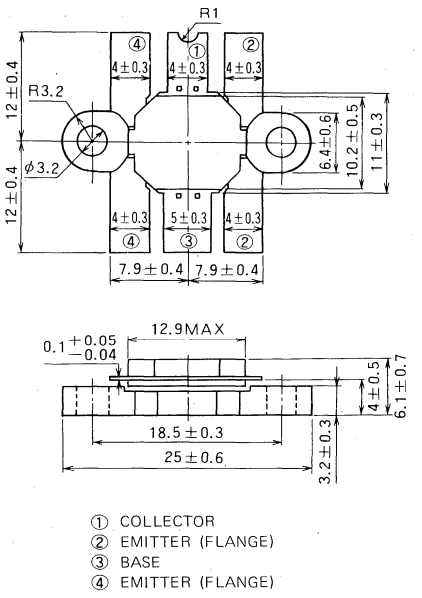
- High power gain: $G_{pe} \geqq 12.3$dB
  @V_{CC} = 13.5V, P_O = 75W, f = 30MHz
- Emitter ballasted construction for good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding infinite load VSWR when operated at V_{CC} = 15.2V, P_O = 70W, f = 30MHz, T_C = 25°C.

APPLICATION

HF band linear power amplifiers in push-pull class AB operation.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	20	V
I_C	Collector current		15	A
P_C	Collector dissipation	T_a=25°C	7.5	W
		T_C=25°C	125	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	20	°C/W
Rth-c		Junction to case	1.2	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

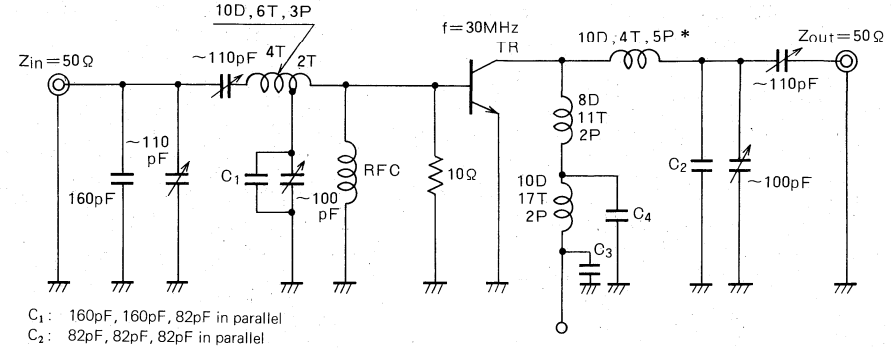
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=20mA, I_E=0	50			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	20			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			4	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=4W, f=30MHz	75	85		W
η_C	Collector efficiency		55	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

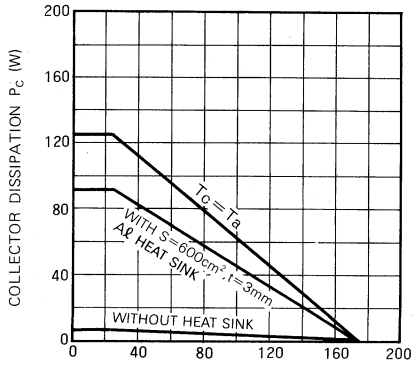
TEST CIRCUIT



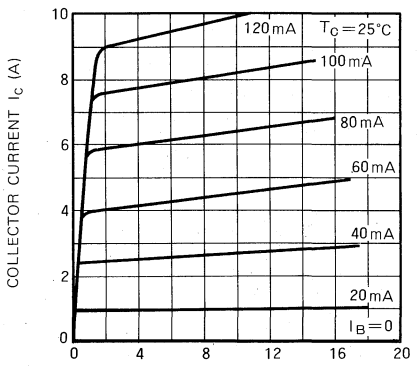
C_1: 160pF, 160pF, 82pF in parallel
C_2: 82pF, 82pF, 82pF in parallel
C_3: 100pF, 4700pF, 4700pF, 0.22μF, 0.22μF, 33μF, 330μF in parallel
C_4: 100pF, 220pF, 4700pF, 0.1μF, 330μF in parallel
RFC: 1mmφ enameled wire 27T.
Notes: All coils are made from 1.5mmφ silver plated copper wire but coil (sign *) is made from 2.3mmφ
D: Inner diameter of coil P: Pitch of coil
T: Turn number of coil Dimension in milli-meter

TYPICAL PERFORMANCE DATA

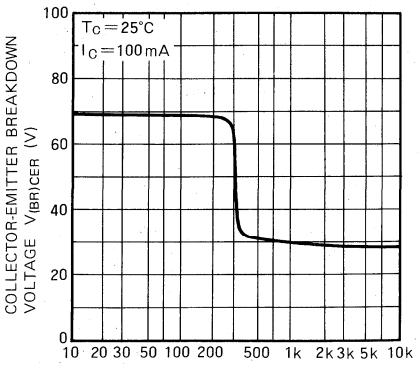
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



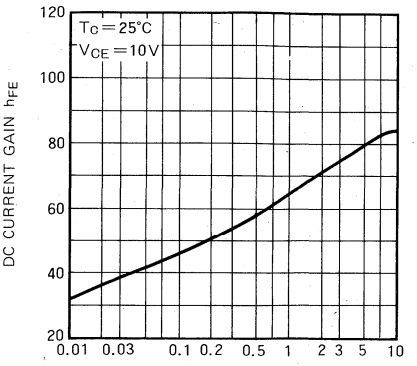
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

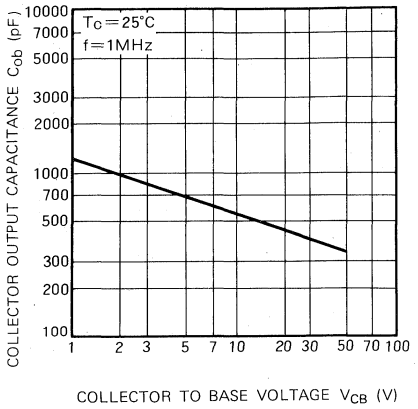


DC CURRENT GAIN VS. COLLECTOR CURRENT

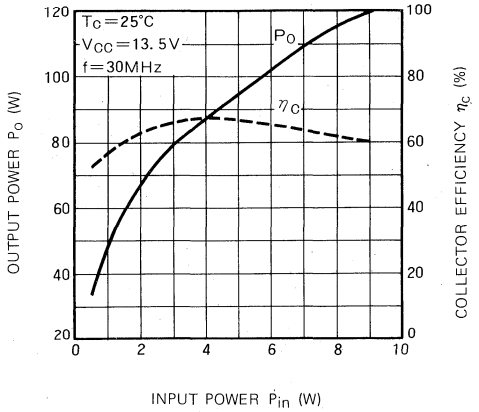


NPN EPITAXIAL PLANAR TYPE

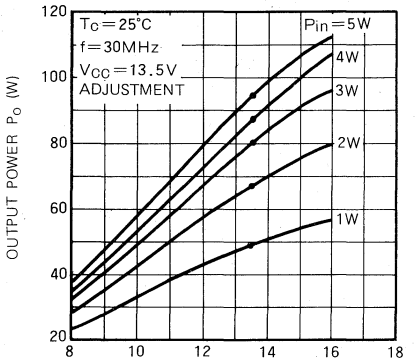
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2131

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2131 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band mobile radio applications.

FEATURES

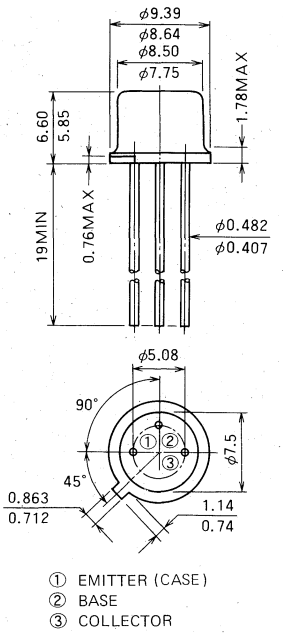
- High power gain: $G_{pe} \geqq 6.7$dB
  @V_{CC} = 13.5V, P_O = 1.4W, f = 500MHz
- TO-39 metal seeled package for high reliability.
- Emitter ballasted construction, gold metallization for good performances.
- Emitter electrode is connected electrically to the case.

APPLICATION

1 watt power amplifiers in UHF band mobile radio applications and driver amplifiers in general.

OUTLINE DRAWING

Dimensions in mm



① EMITTER (CASE)
② BASE
③ COLLECTOR

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	18	V
I_C	Collector current		0.6	A
P_C	Collector dissipation	T_a=25°C	0.8	W
		T_C=25°C	4	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	187.5	°C/W
Rth-c		Junction to case	37.5	°C/W

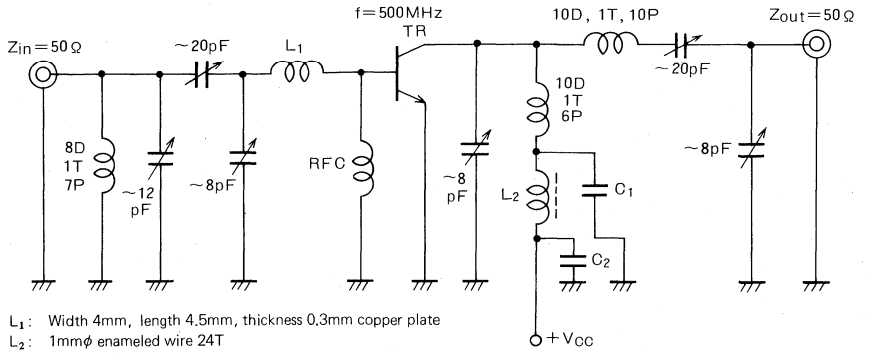
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=5mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	18			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.3W, f=500MHz	1.4	1.6		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

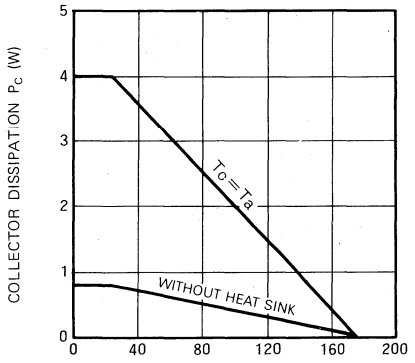
TEST CIRCUIT



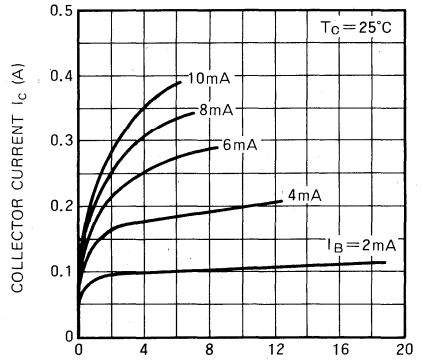
L_1: Width 4mm, length 4.5mm, thickness 0.3mm copper plate
L_2: 1mmϕ enameled wire 24T
RFC: 0.3mmϕ enameled wire 25T ~ 30T
C_1: 50pF, 100pF, 2200pF, 0.005μF, 0.0022μF in parallel
C_2: 0.02μF, 0.047μF, 0.47μF in parallel
Notes: Coils are made from 1.5mmϕ silver plated copper wire except L_1, L_2 & RFC
D: Inner diameter of coil P: Pitch of coil
T: Turn number of coil Coil dimensions in milli-meter

TYPICAL PERFORMANCE DATA

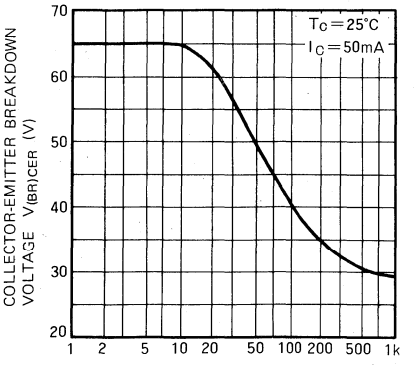
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



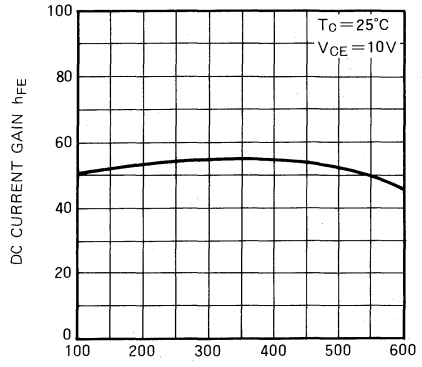
COLLECTOR CURRENT VS. BASE TO EMITTER VOLTAGE



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



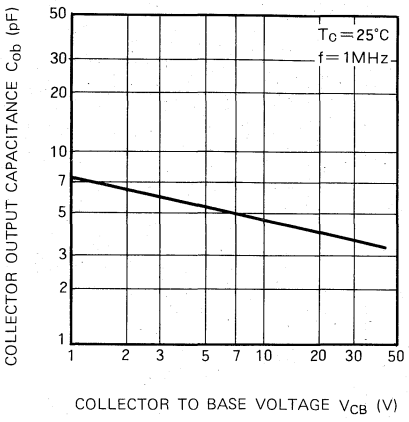
DC CURRENT GAIN VS. COLLECTOR CURRENT



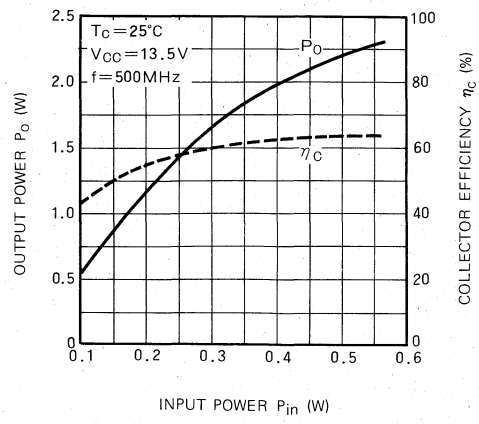
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

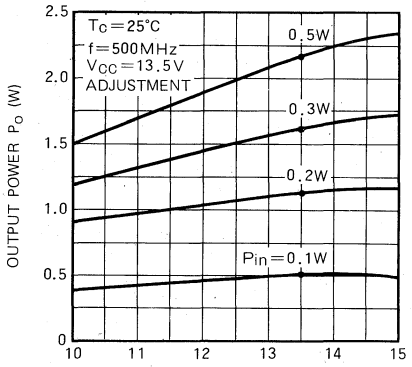
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



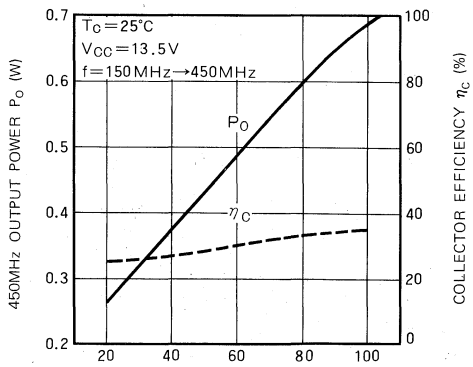
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE

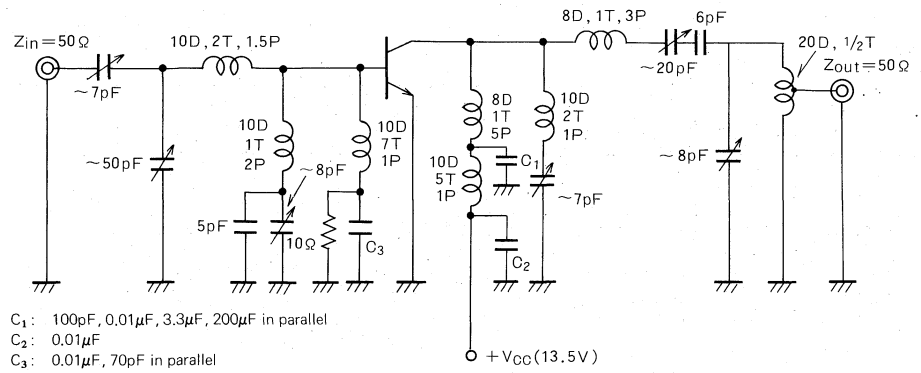


TRIPLER OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



APPLICATION CIRCUIT

TRIPLER CIRCUIT DIAGRAM (150MHz → 450MHz)



C_1: 100pF, 0.01μF, 3.3μF, 200μF in parallel
C_2: 0.01μF
C_3: 0.01μF, 70pF in parallel

Notes: All coils are made from 1.5mmϕ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

2SC2133

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2133 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band 24 to 28 volts operation applications.

FEATURES

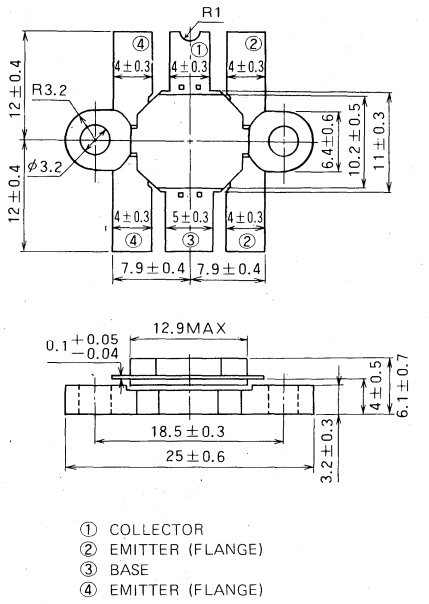
- High power gain: $G_{pe} \geqq 8.2$dB
  @V_{CC} = 28V, P_O = 30W, f = 220MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 28V, P_O = 30W, f = 220MHz, T_C = 25°C.
- Equivalent input series impedance: $Z_{in} = 1.2 + j3.3\Omega$
  @V_{CC} = 28V, P_O = 30W, f = 220MHz

APPLICATION

10 to 15 watts output linear power amplifiers such as TV transposer amplifiers in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		55	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		5	A
P_C	Collector dissipation	Ta=25°C	3.75	W
		T_C=25°C	75	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55 ~ +175	°C
Rth-a	Thermal resistance	Junction to ambient	40	°C/W
Rth-c		Junction to case	2	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

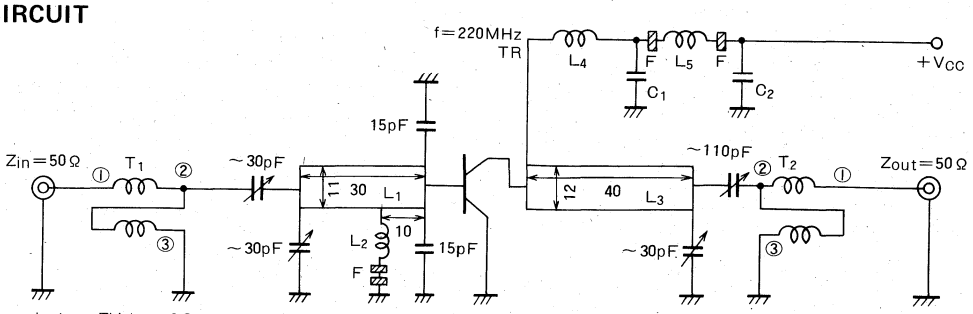
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	55			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB}=35V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	20	50	110	—
P_O	Output power	V_{CC}=28V, P_{in}=4.5W, f=220MHz	30	34		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

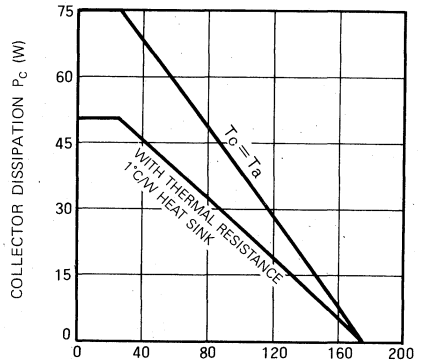


L_1, L_3: Thickness 0.2mm copper plate
L_2: 10D, 7T, 2P, ϕ1.0 silver plated copper wire
L_4: 12D, 3T, 3P, ϕ1.6 silver plated copper wire
L_5: 10D, 15T, ϕ1.0 enameled wire
T_1: 4:1 transformer
T_2: 1:4 transformer
F: Ferrite Sealed Bead
C_1: 330pF, 1000pF, 4700pF, 0.01μF, 0.1μF, 4.7μF in parallel
C_2: 330pF, 1000pF, 4700pF, 0.01μF, 0.1μF, 47μF in parallel

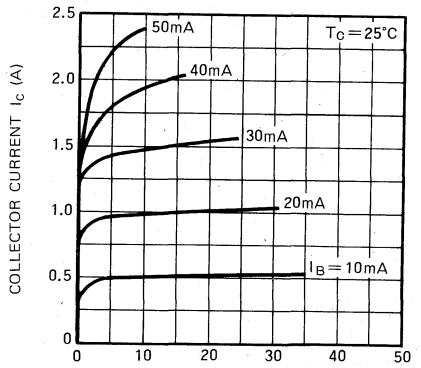
Note:
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

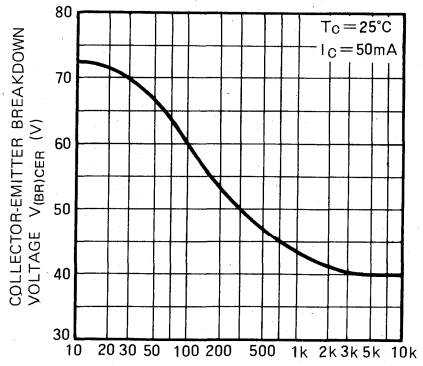
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



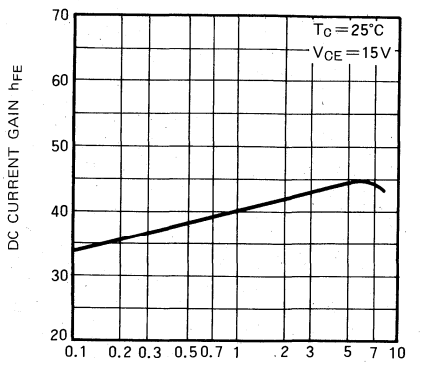
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

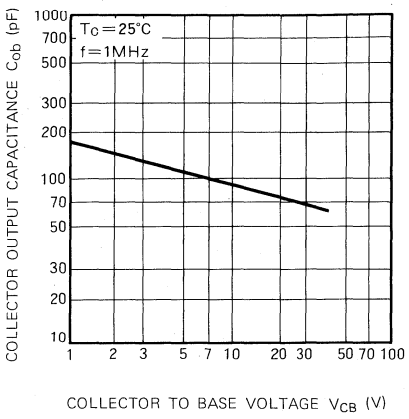


DC CURRENT GAIN VS. COLLECTOR CURRENT

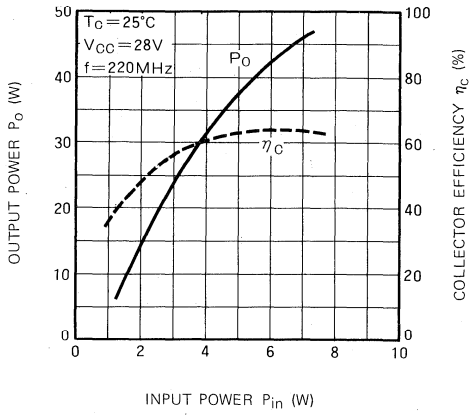


NPN EPITAXIAL PLANAR TYPE

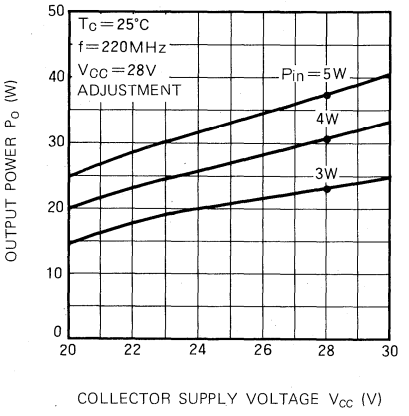
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



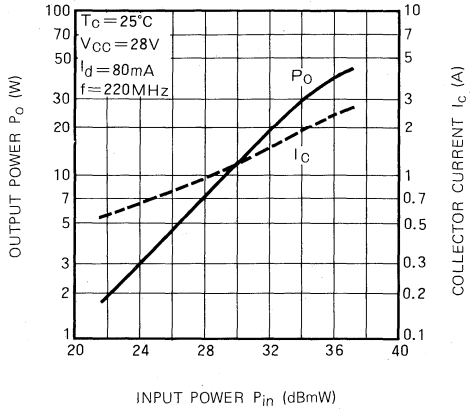
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



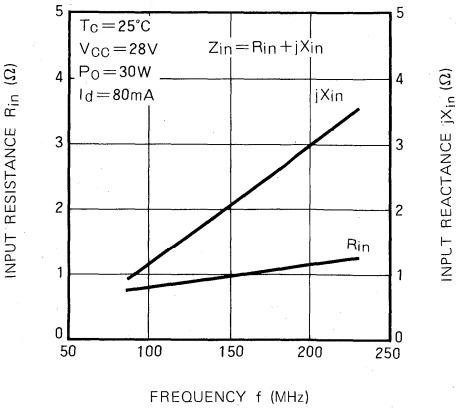
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



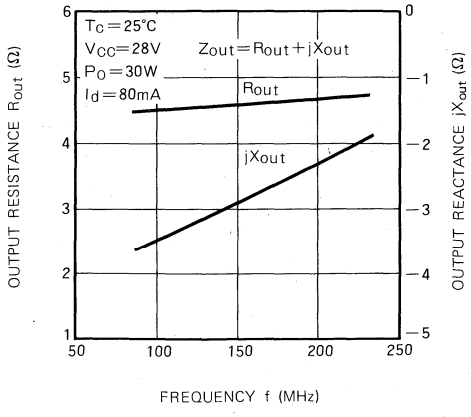
IN CASE AB OPERATING OUTPUT POWER COLLECTOR CURRENT VS. INPUT POWER



INPUT IMPEDANCE VS. FREQUENCY



OUTPUT IMPEDANCE VS. FREQUENCY



MITSUBISHI ELECTRIC

2SC2134

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2134 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band 24 to 28 volts operation applications.

FEATURES

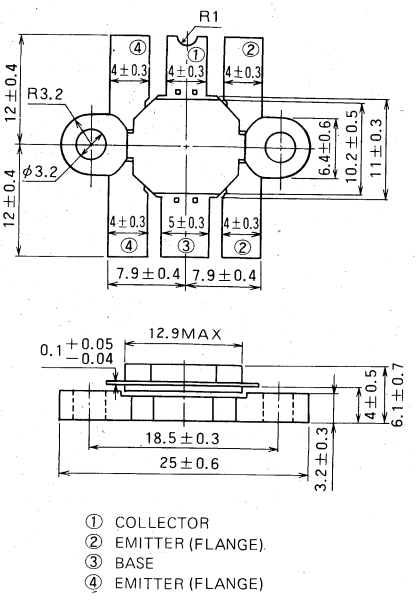
- High power gain: $G_{pe} \geqq 7$dB
  @V_{CC} = 28V, P_O = 60W, f = 220MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 28V, P_O = 50W, f = 220MHz, T_C = 25°C.
- Equivalent input series impedance: $Z_{in} = 1 + j3\Omega$
  @V_{CC} = 28V, P_O = 60W, f = 220MHz

APPLICATION

20 to 30 watts output linear power amplifiers such as TV transposer amplifiers in VHF band.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		55	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		10	A
P_C	Collector dissipation	T_a=25°C	4	W
		T_C=25°C	120	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	37.5	°C/W
Rth-c		Junction to case	1.25	°C/W

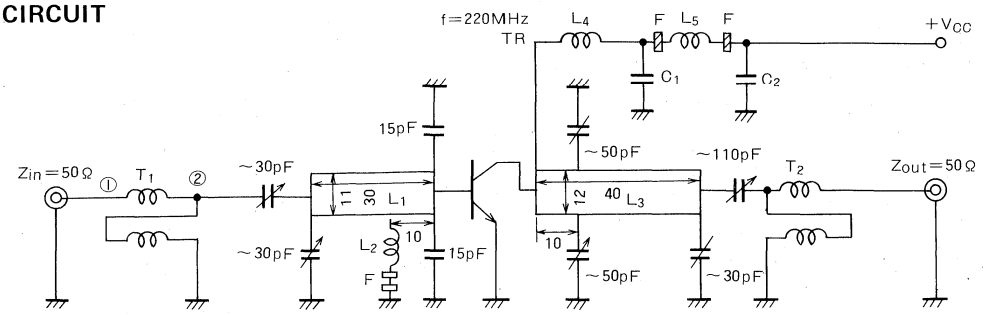
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=50mA, I_E=0	55			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB}=35V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			2	mA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	20	50	110	—
P_O	Output power	V_{CC}=28V, P_{in}=12W, f=220MHz	60	70		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, Pw = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

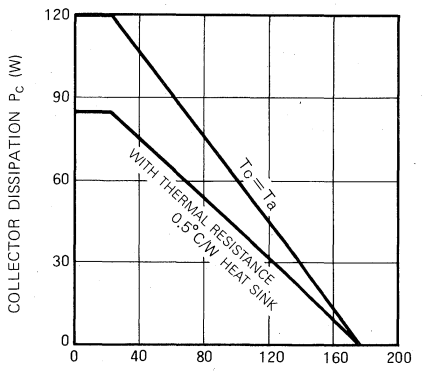


L_1, L_3: t = 0.2mm copper plate
L_2: 10D, 7T, 2P, ϕ1.0 silver plated copper wire
L_4: 12D, 3T, 3P, ϕ1.6 silver plated copper wire
L_5: 10D, 15T, ϕ1.0 enameled wire
T_1: 4:1 transformer
T_2: 1:4 transformer
F: Ferrite Bead
C_1: 330pF, 1000pF, 4700pF, 0.01μF, 0.1μF, 4.7μF in parallel
C_2: 330pF, 1000pF, 4700pF, 0.01μF, 0.1μF, 4.7μF in parallel

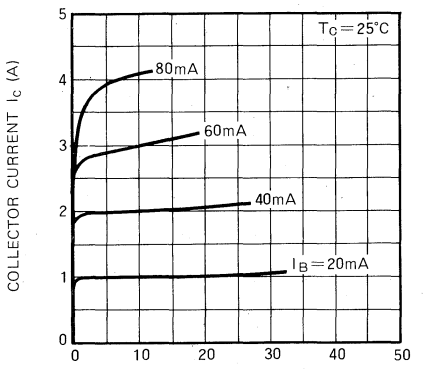
Notes: Coil
D: Inner diameter
P: Pitch
T: Turn number
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

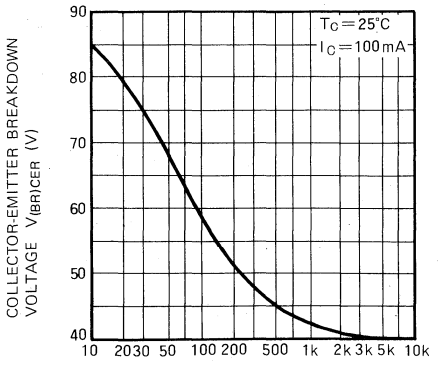
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



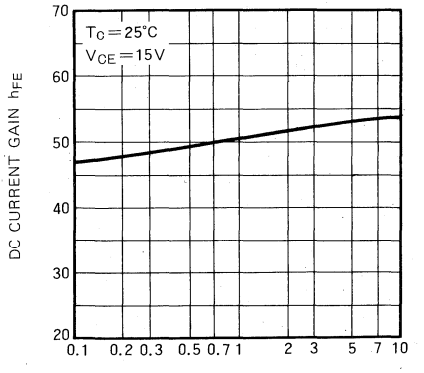
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BRREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



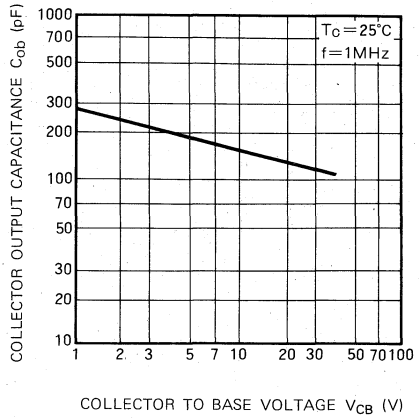
DC CURRENT GAIN VS. COLLECTOR CURRENT



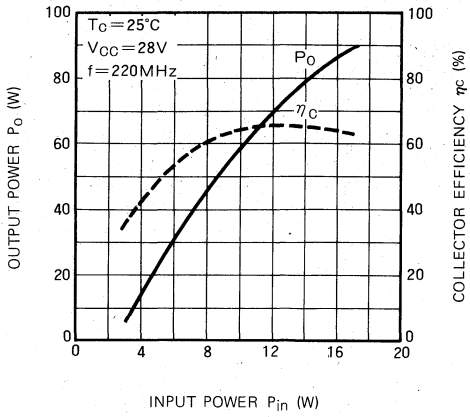
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

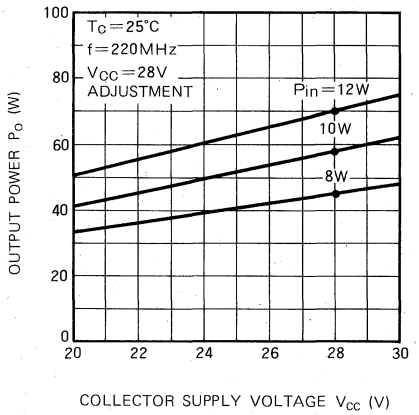
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



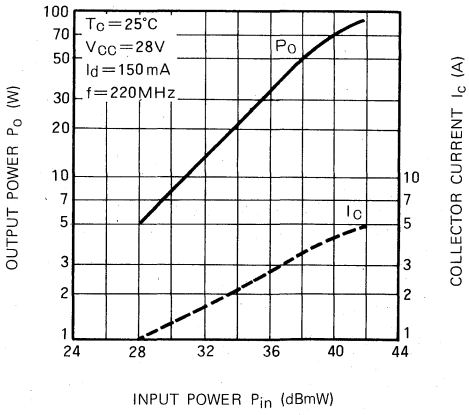
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



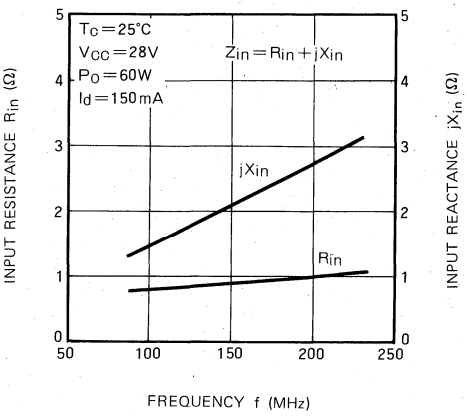
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



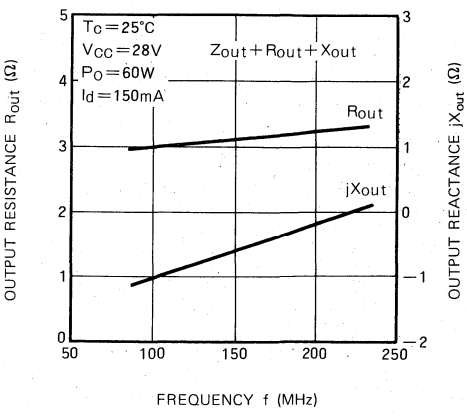
IN CASE AB OPERATING OUTPUT POWER, COLLECTOR CURRENT VS. INPUT POWER



INPUT IMPEDANCE VS. FREQUENCY



OUTPUT IMPEDANCE VS. FREQUENCY



2SC2166

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2166 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in HF band mobile radio applications.

FEATURES

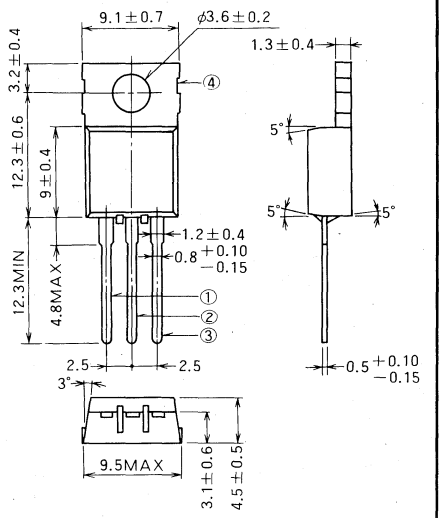
- High power gain: $G_{pe} \geqq 13.8$dB
  @V_{CC} = 12V, P_O = 6W, f = 27MHz
- Emitter ballasted construction for high reliability and good performances.
- TO-220 similar package is combinient for mounting.

APPLICATION

3 to 4 watts output power amplifiers in HF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		75	V
V_{EBO}	Emitter to base voltage		5	V
V_{CER}	Collector to emitter voltage	R_{BE} = 10Ω	75	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	12.5	W
T_j	Junction temperature		+150	°C
T_{stg}	Storage temperature		−55～+150	°C
R_{th-a}	Thermal resistance	Junction to ambient	83	°C/W
R_{th-c}		Junction to case	10	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	75			V
$V_{(BR)CER}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=10Ω	75			V
I_{CBO}	Collector cutoff current	V_{CB}=30V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			100	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	35	70	180	—
P_O	Output power	V_{CC}=12V, P_{in}=0.25W, f=27MHz	6	7.5		W
η_C	Collector efficiency		55	60		%

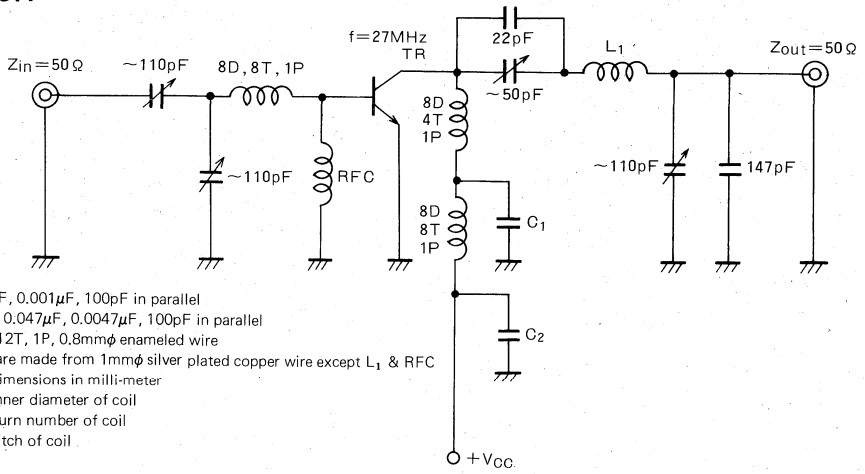
* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

2SC2166

NPN EPITAXIAL PLANAR TYPE

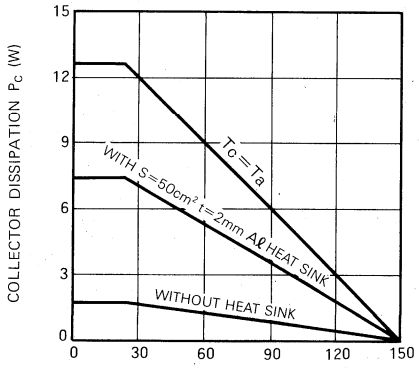
TEST CIRCUIT



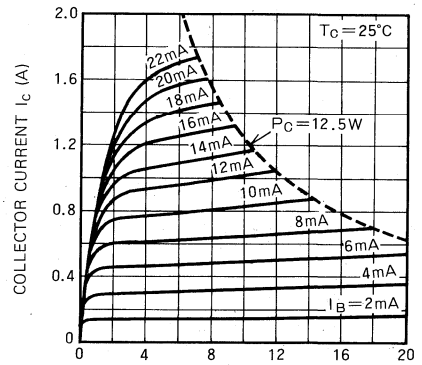
C_1 : 0.01μF, 0.001μF, 100pF in parallel
C_2 : 10μF, 0.047μF, 0.0047μF, 100pF in parallel
L_1 : 10D, 12T, 1P, 0.8mmφ enameled wire
Notes: Coils are made from 1mmφ silver plated copper wire except L_1 & RFC
Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

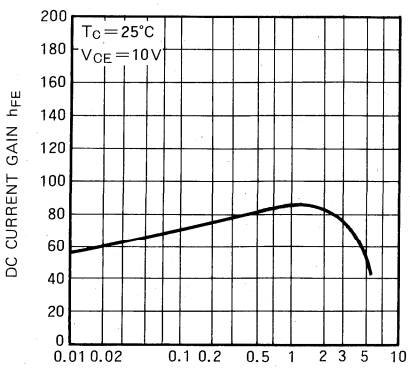
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



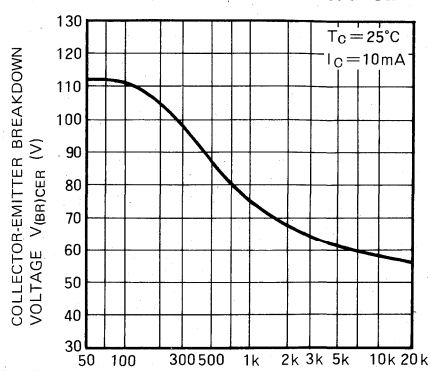
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

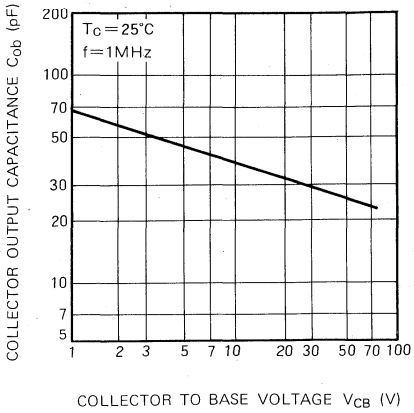


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

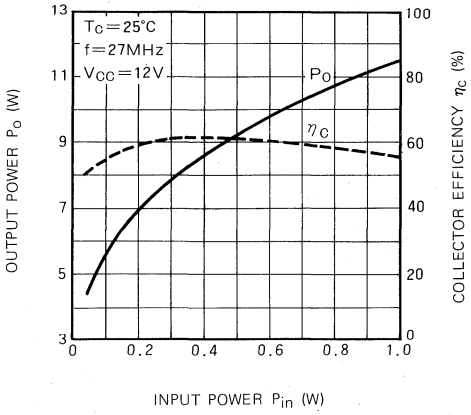


NPN EPITAXIAL PLANAR TYPE

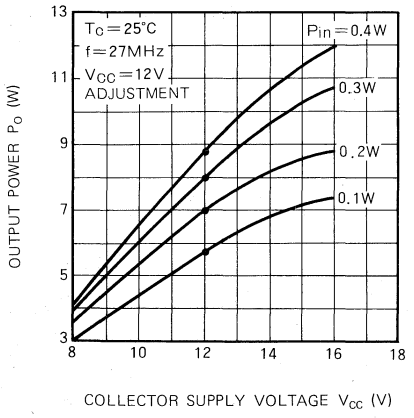
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2237

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2237 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

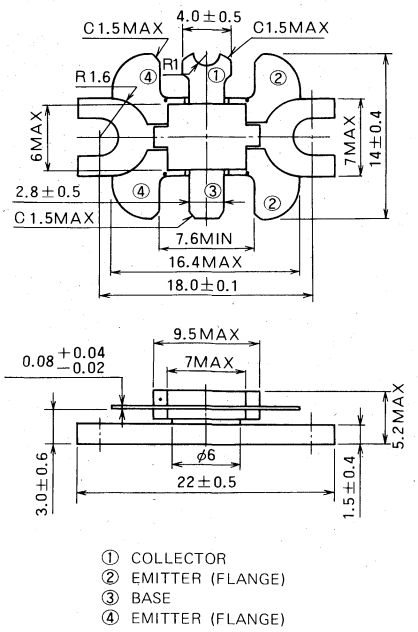
- High power gain: $G_{pe} \geqq 13.8$dB
  @V_{CC} = 13.5V, P_O = 6W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz.

APPLICATION

4 to 5 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_a=25°C	2	W
		T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	75	°C/W
Rth-c		Junction to case	7.5	°C/W

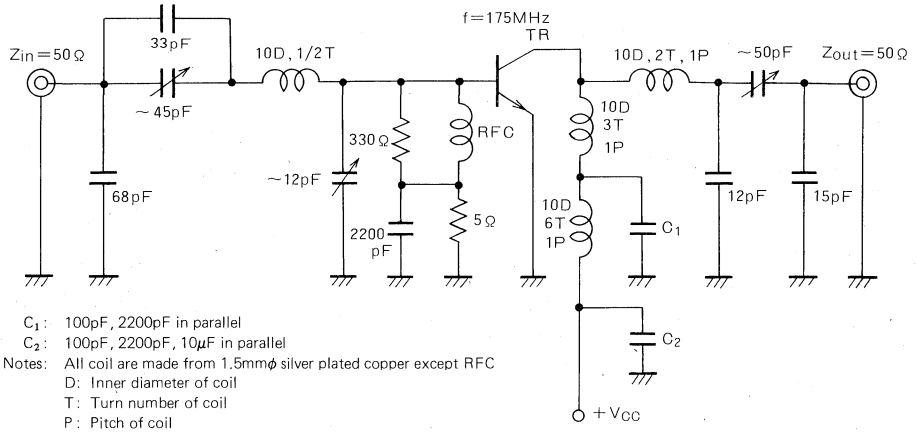
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.25W, f=175MHz	6	7.5		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

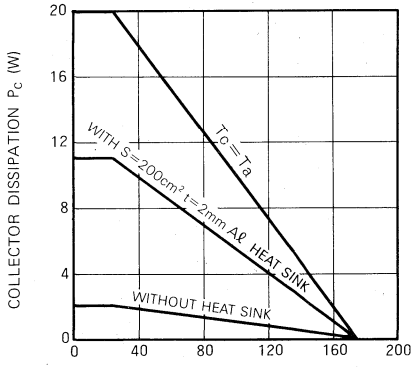
TEST CIRCUIT



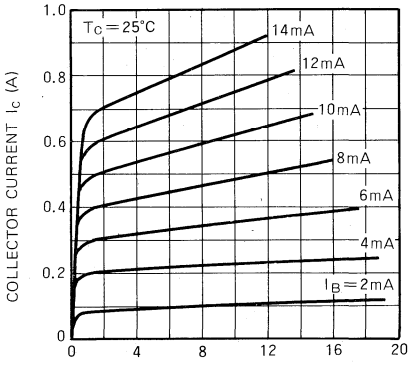
C_1: 100pF, 2200pF in parallel
C_2: 100pF, 2200pF, 10μF in parallel
Notes: All coil are made from 1.5mmϕ silver plated copper except RFC
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

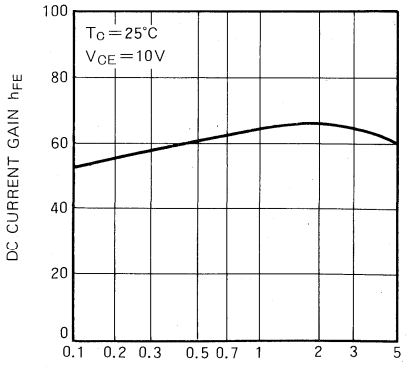
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



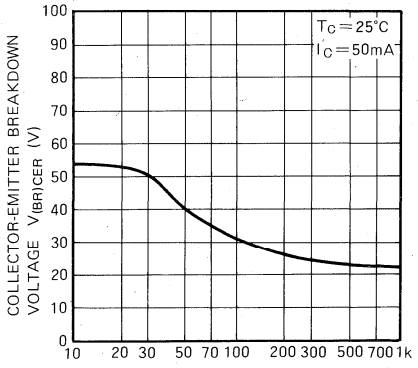
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



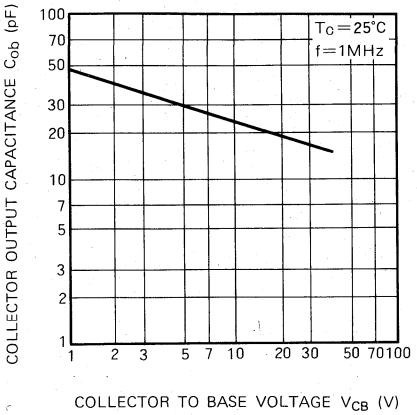
DC CURRENT GAIN VS. COLLECTOR CURRENT



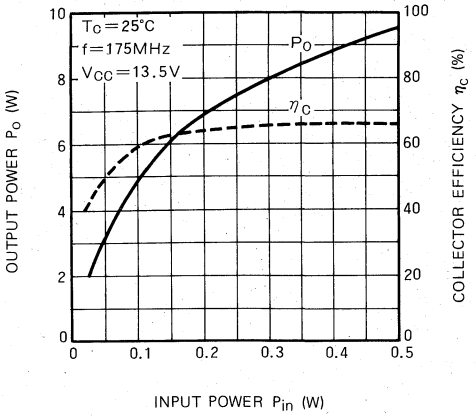
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

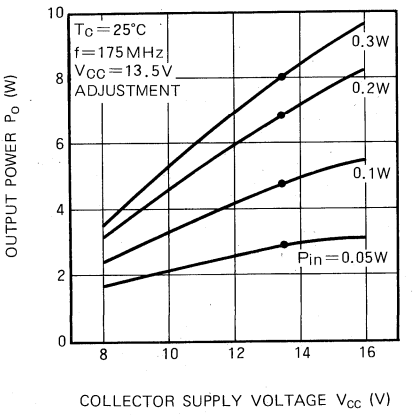
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2538

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2538 is a silicon NPN epitaxial planar type transistor designed for RF amplifiers on VHF band mobile radio applications.

FEATURES

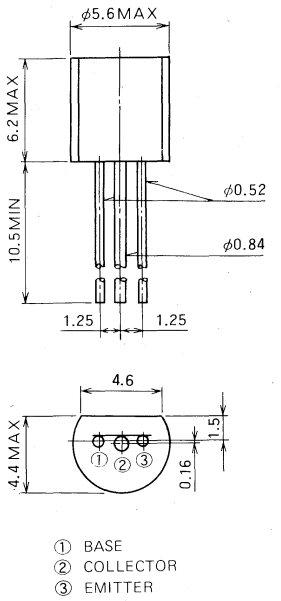
- High power gain: $G_{pe} \geqq 10$dB
  @V_{CC} = 13.5V, P_O = 500mW, f = 175MHz
- TO-92 similar package is combinient for mounting.
- Equivalent input/output series impedance:
  Z_{in} = 5.3 – j2.9Ω @V_{CC} = 13.5V, P_O = 500mW, f = 175MHz
  Z_{out} = 29 – j63.5Ω

APPLICATION

Driver amplifiers in general VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		40	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		0.4	A
P_C	Collector dissipation	Ta=25°C	0.7	W
		T_C=25°C	3	W
T_j	Junction temperature		+135	°C
Tstg	Storage temperature		−55～+135	°C
Rth-a	Thermal resistance	Junction to ambient	157	°C/W
Rth-c		Junction to case	36.7	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

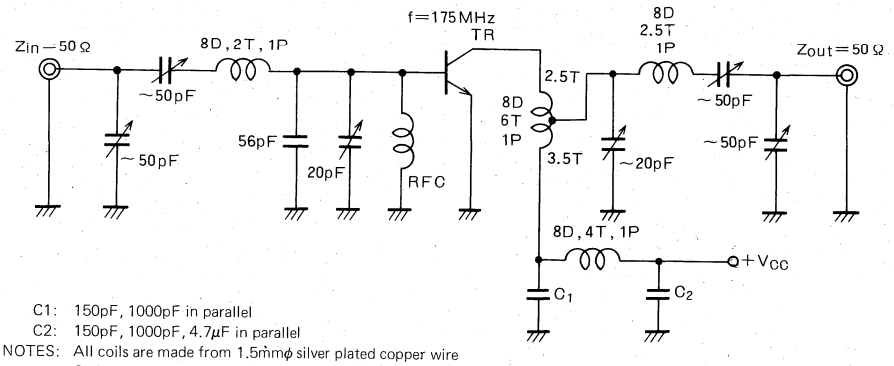
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	40			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			100	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			200	μA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.1A	10	80	300	—
P_O	Output power	V_{CC}=13.5V, P_{in}=50mW, f=175MHz	500	600		mW
η_C	Collector efficiency		45	55		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

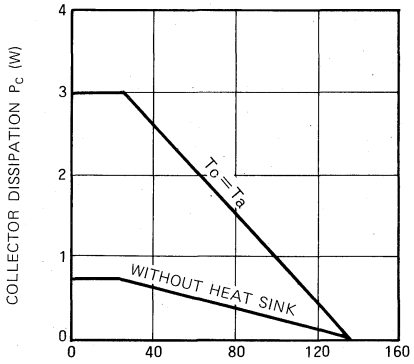
TEST CIRCUIT



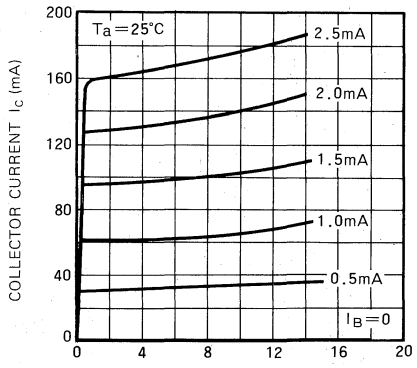
C1: 150pF, 1000pF in parallel
C2: 150pF, 1000pF, 4.7μF in parallel
NOTES: All coils are made from 1.5mmϕ silver plated copper wire
Coil Dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

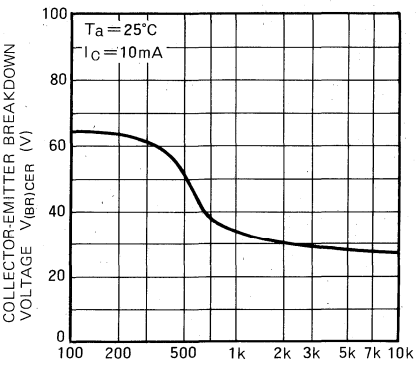
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



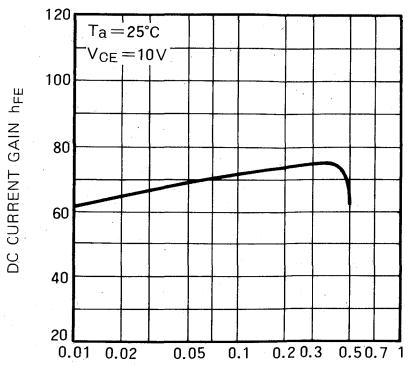
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

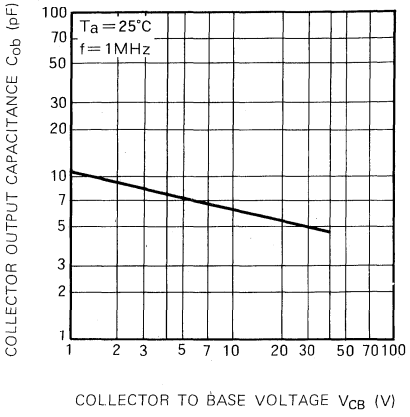


DC CURRENT GAIN VS. COLLECTOR CURRENT

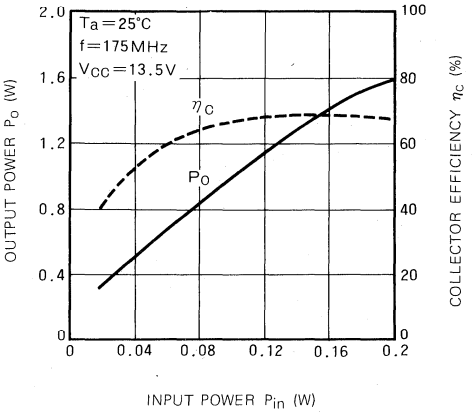


NPN EPITAXIAL PLANAR TYPE

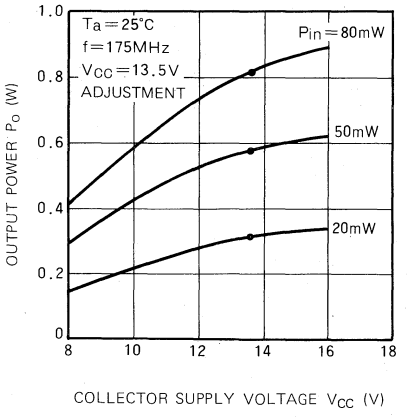
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2539

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2539 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

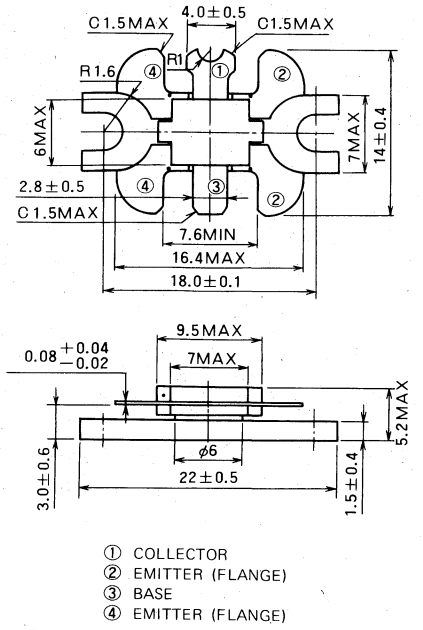
- High power gain: $G_{pe} \geqq 14.5$dB
  @V_{CC} = 13.5V, P_O = 14W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 18W, f = 175MHz, T_C = 25°C.

APPLICATION

10 to 14 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_a=25°C	2.5	W
		T_C=25°C	35	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55～+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	60	°C/W
R_{th-c}		Junction to case	4.3	°C/W

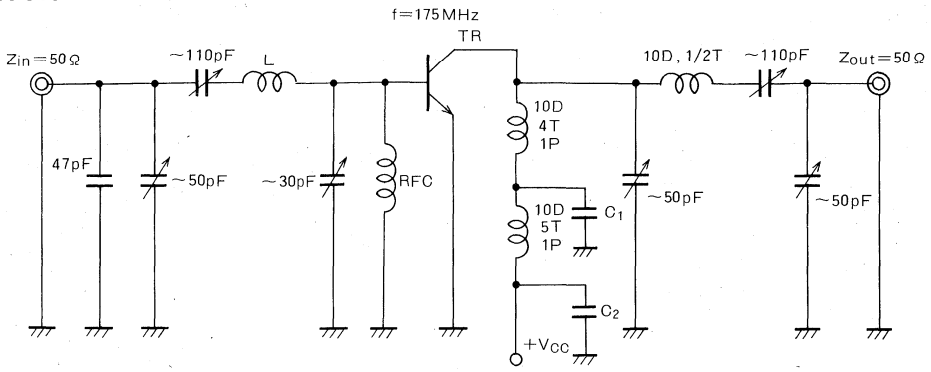
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1000	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1000	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, Pin=0.5W, f=175MHz	14	17		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

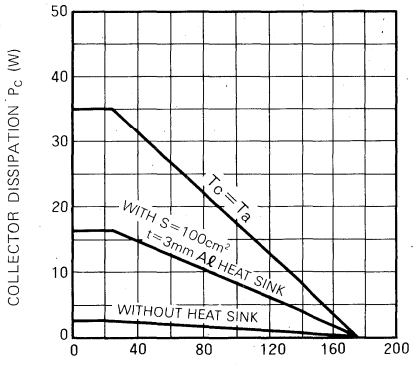


L: Length 10mm
RFC: 0.4mmφ enameled wire 12T with Ferrite Bead
C1: 220pF, 2200pF in parallel
C2: 220pF, 2200pF, 10μF in parallel

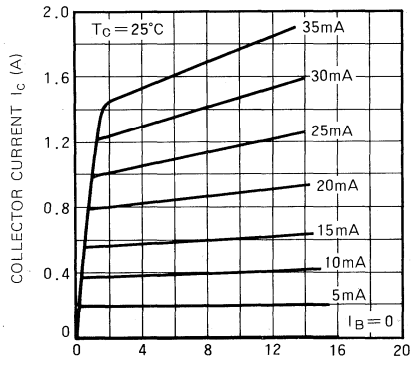
NOTES: All coils are made from 1.5mmφ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

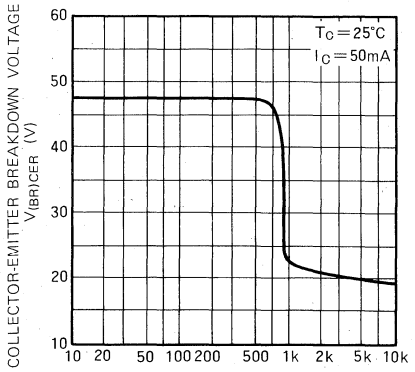
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



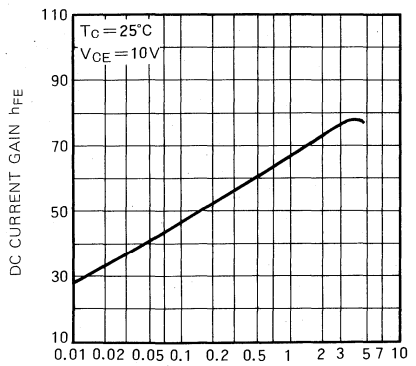
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



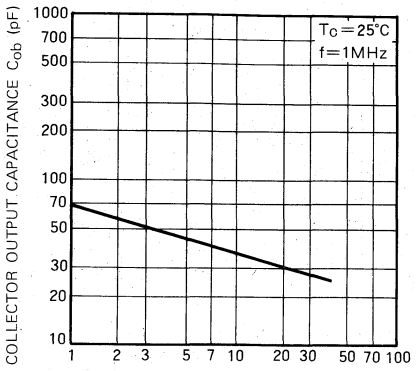
DC CURRENT GAIN VS. COLLECTOR CURRENT



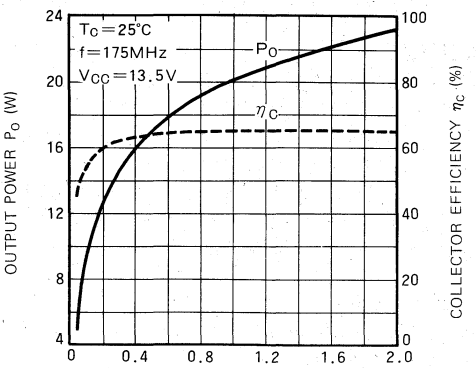
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

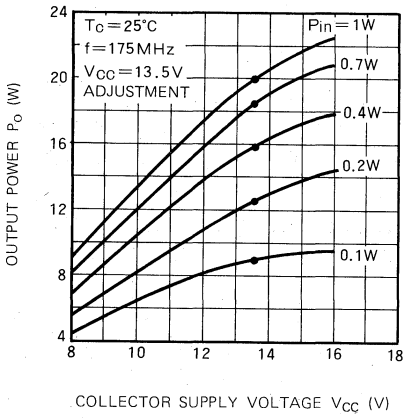
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2540

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2540 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

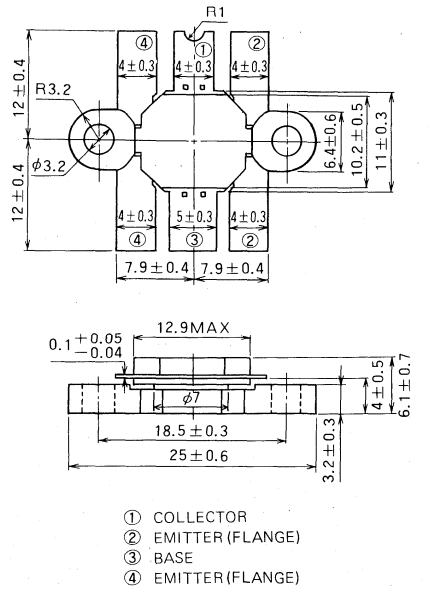
- High power gain: $G_{pe} \geqq 8.2$dB
  @V_{CC} = 13.5V, P_O = 40W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 40W, f = 175MHz, T_C = 25°C.

APPLICATION

30 to 35 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		10	A
P_C	Collector dissipation	T_a=25°C	4.5	W
		T_C=25°C	75	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55～+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	33.3	°C/W
R_{th-c}		Junction to case	2	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			2.5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			2	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.2A	10	60	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=6W, f=175MHz	40	45		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

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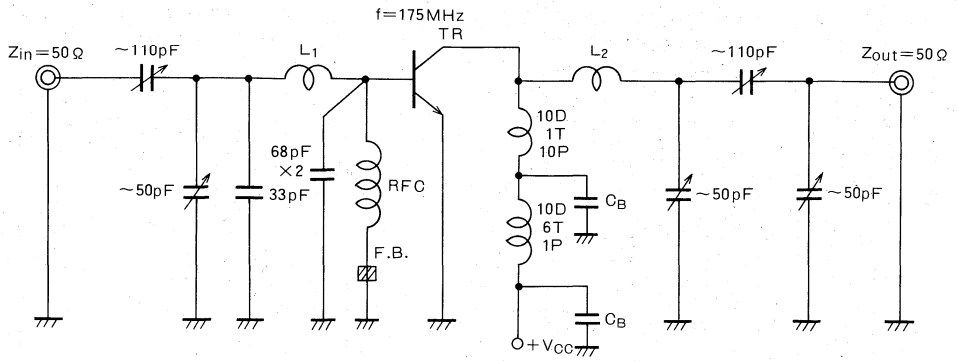
NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

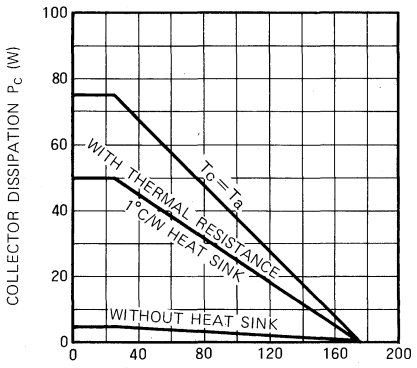


L1: Length = 10mm, width = 6mm, thickness = 0.3mm copper plate
L2: Length = 10mm, width = 3mm, thickness = 0.3mm copper plate
F.B.: Ferrite bead
RFC: 0.4mmφ enameled copper wire 17 turn
C_B: 10μF, 1000pF, 150pF in parallel

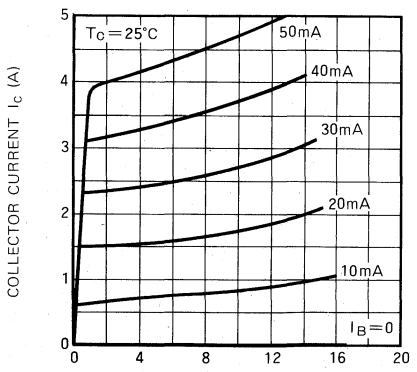
NOTES: Coils are made from 1.5mmφ silver plated copper wire except L1 & L2
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

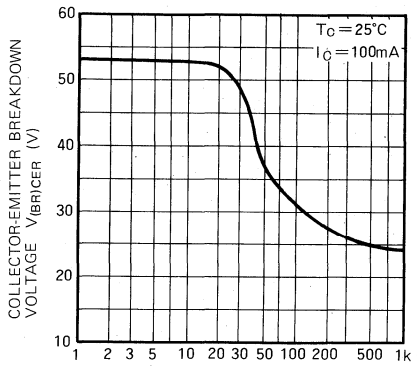
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



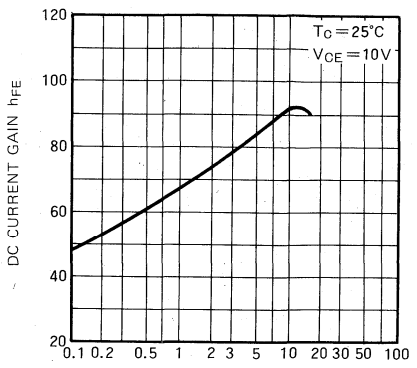
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

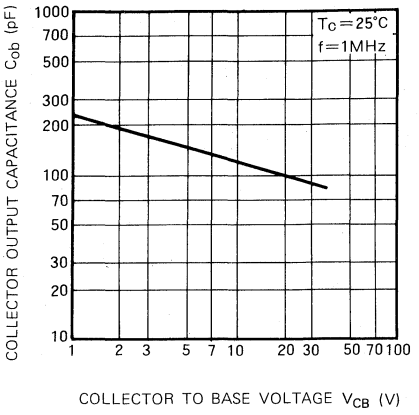


DC CURRENT GAIN VS. COLLECTOR CURRENT

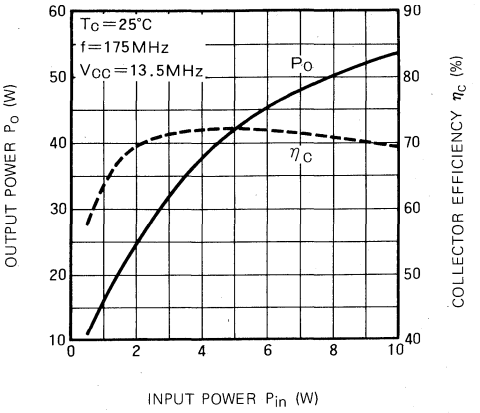


NPN EPITAXIAL PLANAR TYPE

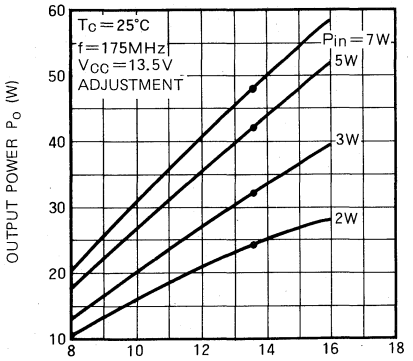
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2609

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

Mitsubishi 2SC2609 is a silicon NPN epitaxial planar type transistor specifically deisgned for VHF power amplifier applications.

FEATURES

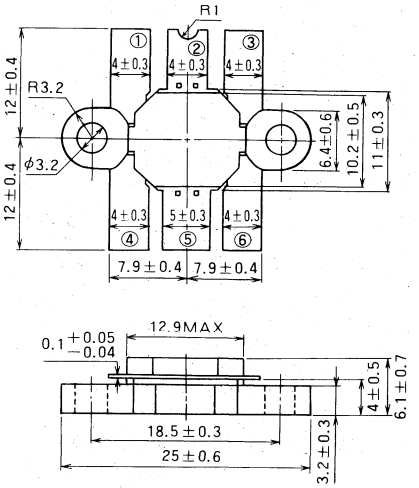
- High power gain: $G_{pe} \geqq 6.0$dB
  @V_{CC} = 28V, f = 220MHz, P_O = 100W
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 28V, f = 220MHz, P_O = 70W

APPLICATION

For output stage of 100W power amplifiers VHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① EMITTER (FLANGE)
② COLLECTOR
③ EMITTER (FLANGE)
④ EMITTER (FLAHGE)
⑤ BASE
⑥ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Ratings	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		55	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		15	A
P_C	Collector dissipation	T_C=25°C	170	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C

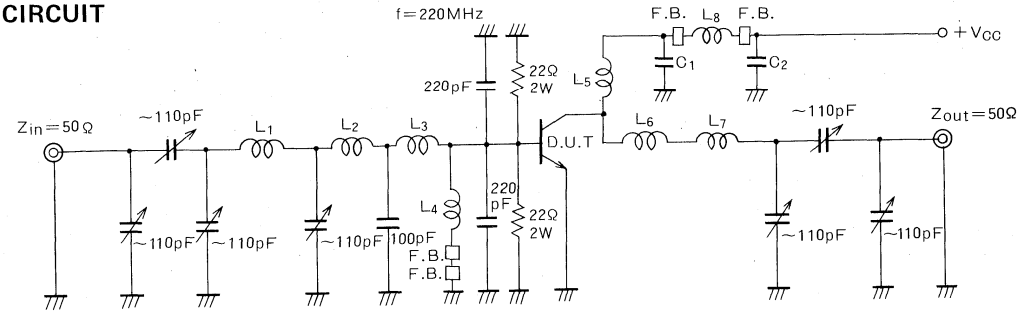
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Characteristics	Test conditions	Limits			Unit
			Max	Typ	Min	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=100mA, I_E=0	55			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=200mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cut off current	V_{BE}=35V, I_E=0			10	mA
I_{EBO}	Emitter cut off current	V_{EB}=3V, I_C=0			4	mA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	20	50	110	—
P_O	Power output	V_{CC}=28V, f=220MHz, P_{in}=25W	100	110		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%.

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

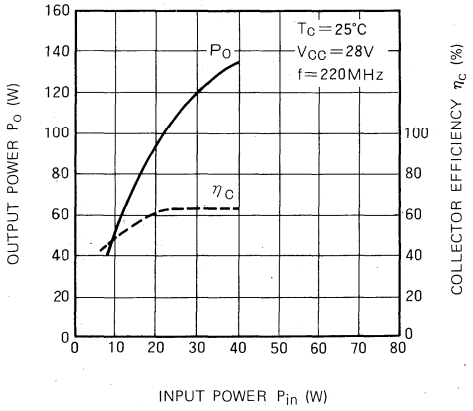


L_1 : 10D, 1T, ϕ1.6 Ag-plated Cu wire.
L_2 : Length 10, ϕ1.6 Ag-plated Cu wire.
L_3 : Length 15, ϕ1.6 Ag-plated Cu wire.
L_4 : 10D, 6T, 2P, ϕ1.6 Ag-plated Cu wire.
L_5 : 10D, 5T, 3P, ϕ1.6 Ag-plated Cu wire.
L_6 : Length 20, Width 4, Thinkness 0.2 Cupper plate.
L_7 : Length 27, ϕ1.6 Ag-plated Cu wire.
L_8 : 8D, 20T, 1P, ϕ0.8 Enameled wire.

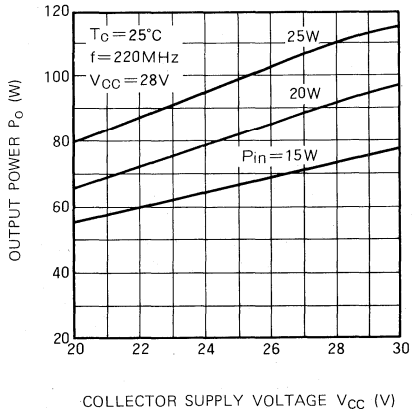
C_1 : 1000pF, 3300pF, 0.1μF, 4.7μF, in parallel.
C_2 : 1000pF, 3300μF, 0.1μF, 47μF, in parallel.
B.F : Ferrint Bead
inside diameter 1.35.
outside diameter 3.5.
length 3.0.
(Note) Dimensions: mm
D : inner diameter of coil.
T : turn numbers of coil.
P : pitch of coil.

TYPICAL PERFORMANCE DATA

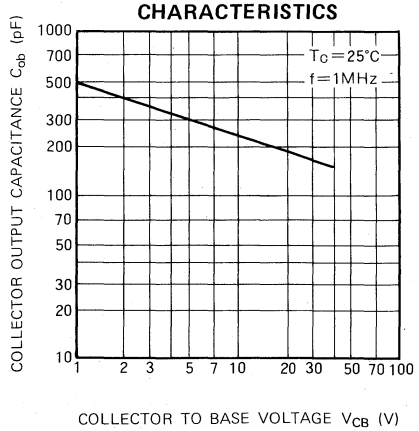
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



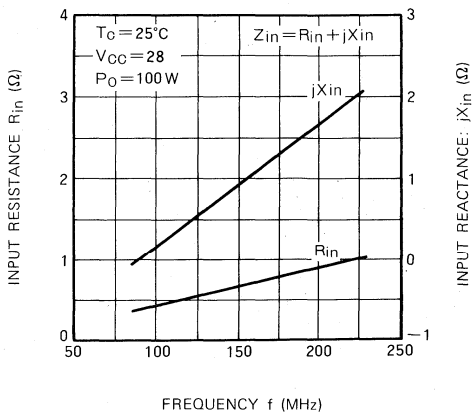
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



INPUT IMPEDANCE VS. FREQUENCY



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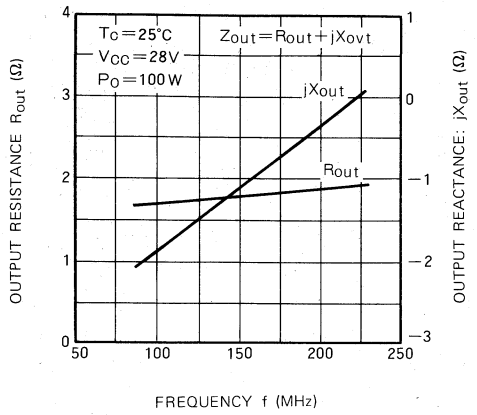
NPN EPITAXIAL PLANAR TYPE

INPUT IMPEDANCE VS. FREQUENCY



2SC2627

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2627 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

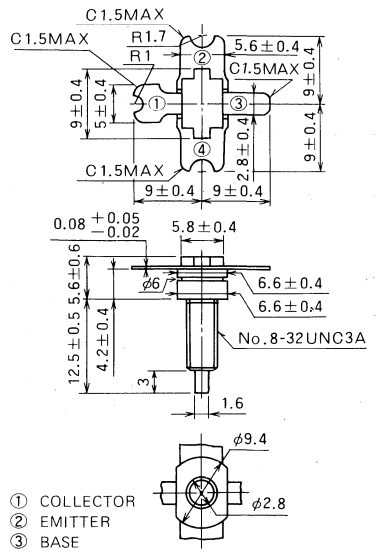
- High power gain: $G_{pe} \geqq 13$dB
  @V_{CC} = 12.5V, P_O = 5W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 2.9 + j0.5Ω @P_O = 6W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 11 −j1.9Ω

APPLICATION

4 to 5 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER
③ BASE
④ EMITTER

NOTE

NOTE: ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	Ta=25°C	2	W
		T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	75	°C/W
Rth-c		Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

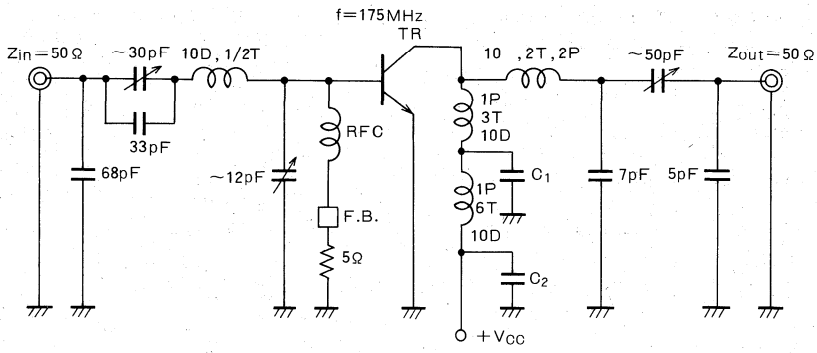
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	80	180	—
P_O	Output power	V_{CC}=12.5V, Pin=0.25W, f=175MHz	5	6		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

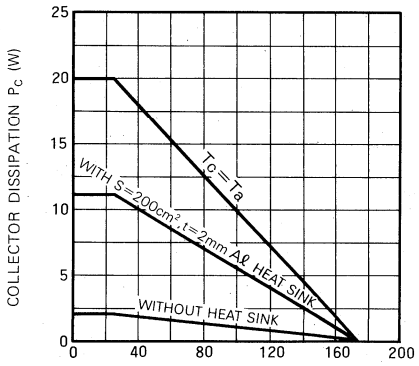


C1: 100pF, 2200pF, 0.01μF in parallel
C2: 100pF, 2200pF, 0.01μF, 10μF in parallel
F.B.: Ferrite Bead

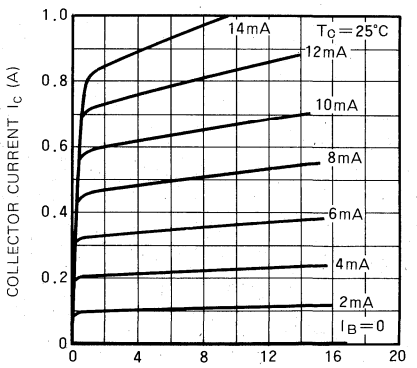
Notes: All coils are made from 1.5mmφ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

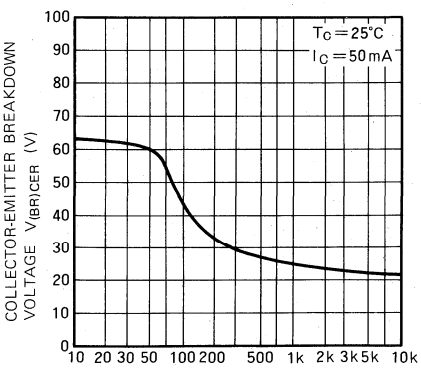
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



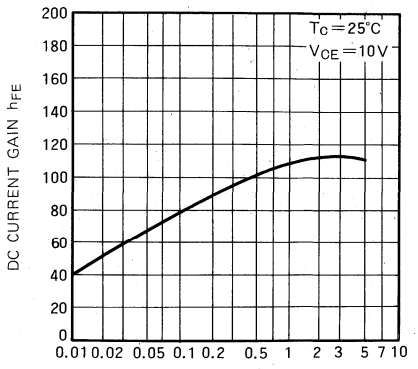
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

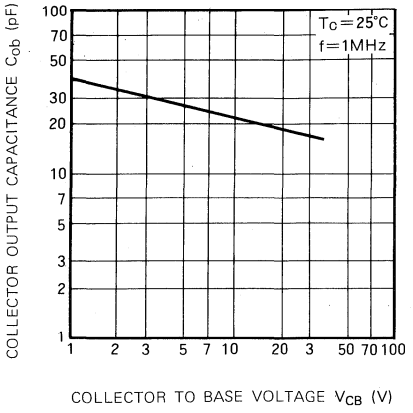


DC CURRENT GAIN VS. COLLECTOR CURRENT

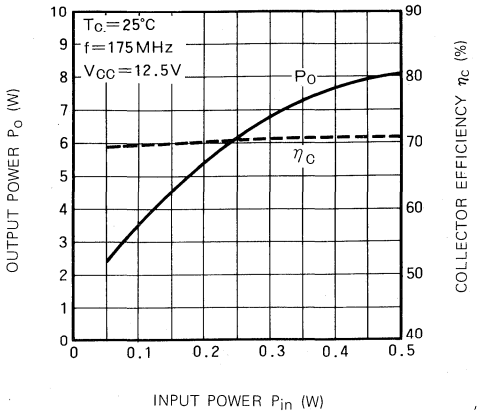


NPN EPITAXIAL PLANAR TYPE

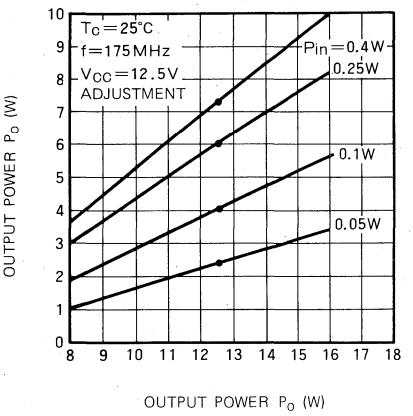
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2628

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2628 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

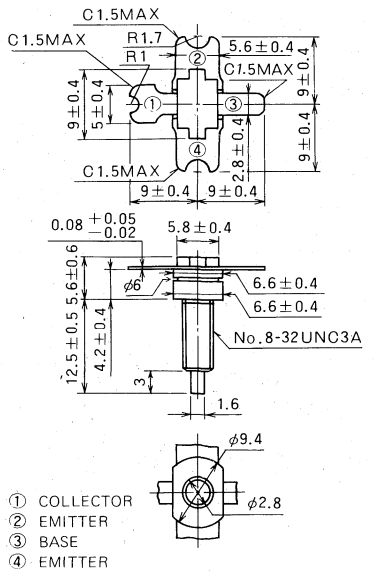
- High power gain: $G_{pe} \geqq 11.8$dB
  @V_{CC} = 12.5V, P_O = 15W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstading more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 18W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 2.0 + j0.4Ω @P_O = 18W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 3.9 – j2.0Ω

APPLICATION

10 to 15 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE: ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_a=25°C	4	W
		T_C=25°C	40	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	37.5	°C/W
Rth-c		Junction to case	3.75	°C/W

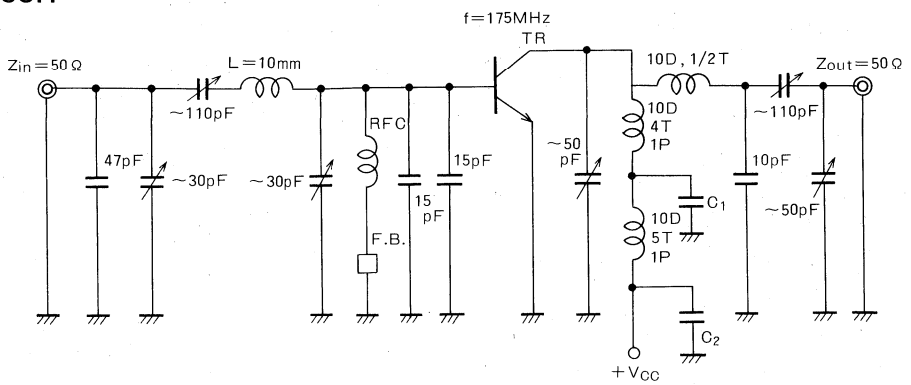
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			2	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	30	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=1W, f=175MHz	15	18		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

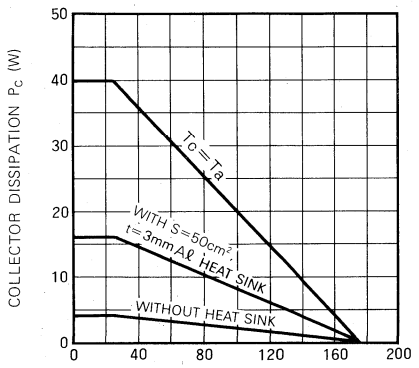


C1: 220pF, 4700pF, 0.01μF in parallel
C2: 220pF, 0.02μF, 0.1μF, 3.3μF in parallel
F.B.: Ferrite Bead

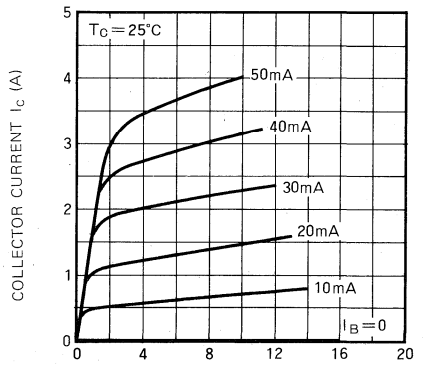
Notes. All coils are made from 1.5mmφ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

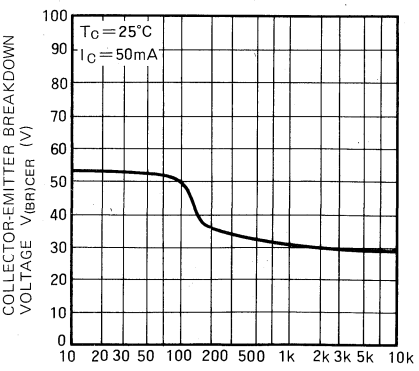
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



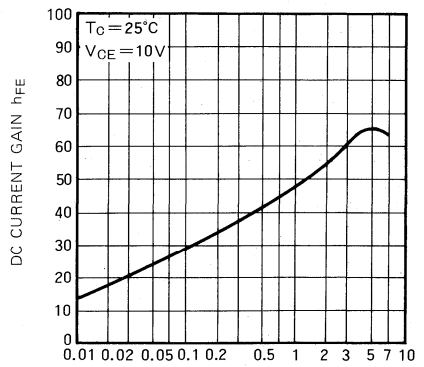
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



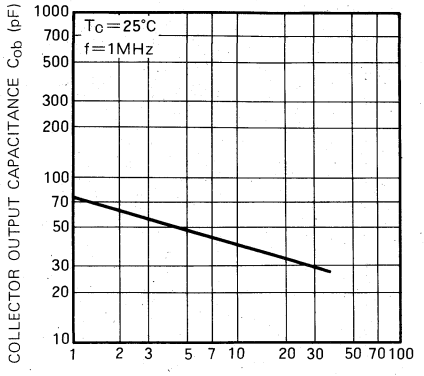
DC CURRENT GAIN VS. COLLECTOR CURRENT



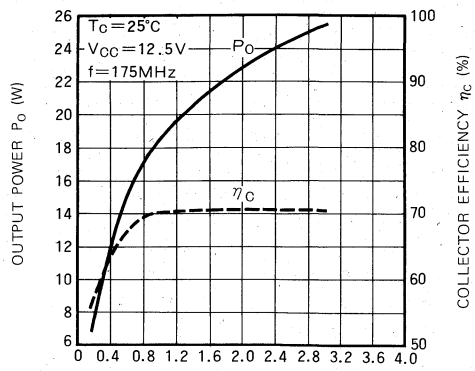
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

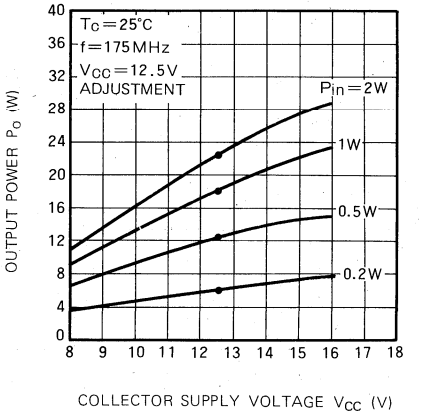
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2629

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2629 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

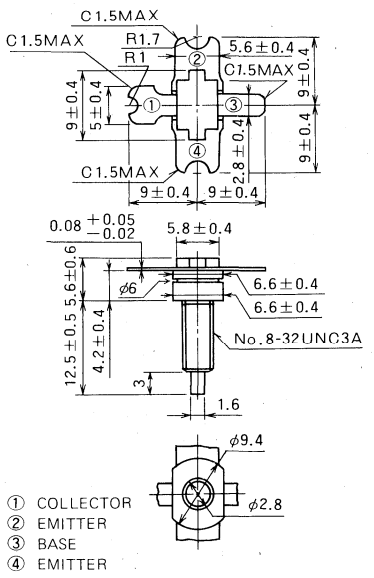
- High power gain: $G_{pe} \geqq 9.3$dB
  @V_{CC} = 12.5V, P_O = 30W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 30W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 1.8 + j0.5Ω @P_O = 34W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 2.3 – j1.2Ω

APPLICATION

25 to 30 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE: ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		8	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	60	
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	2.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

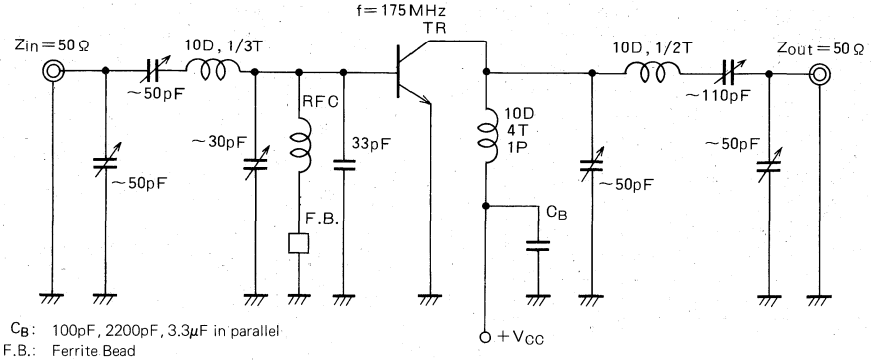
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			3	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			3	mA
h_{FE}	DC forward current gain*	V_{CE}=10V, I_C=0.2A	10	40	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=3.5W, f=175MHz	30	34		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

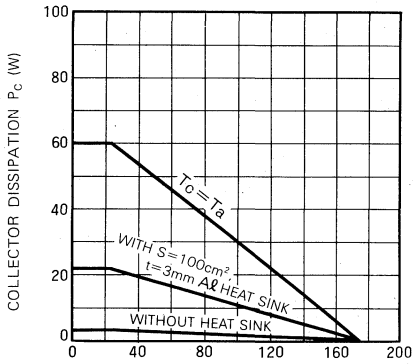
TEST CIRCUIT



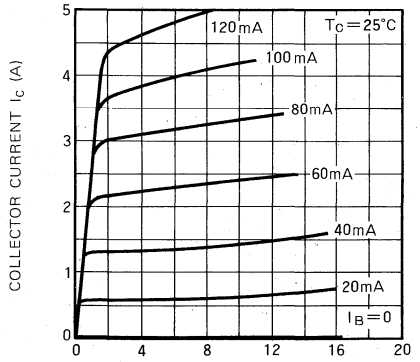
C_B: 100pF, 2200pF, 3.3μF in parallel
F.B.: Ferrite Bead
Notes: All coils are made from 1.5mmφ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

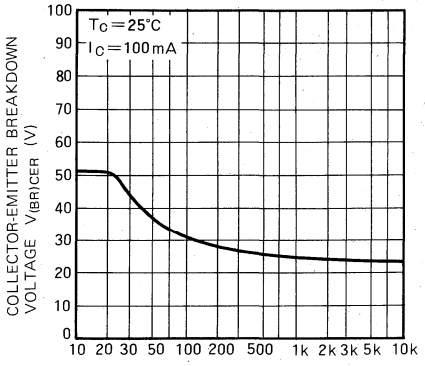
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



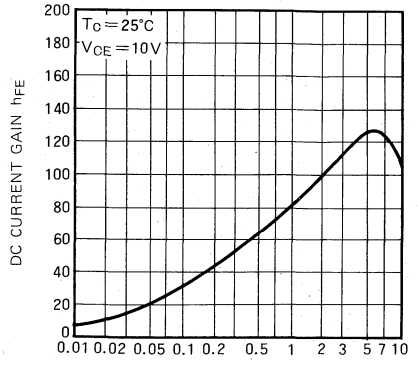
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

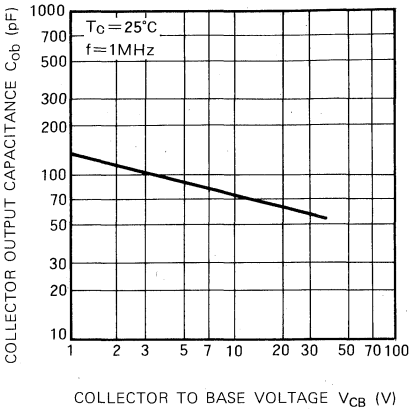


DC CURRENT GAIN VS. COLLECTOR CURRENT

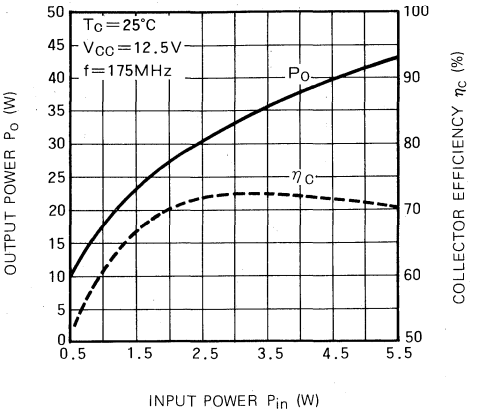


NPN EPITAXIAL PLANAR TYPE

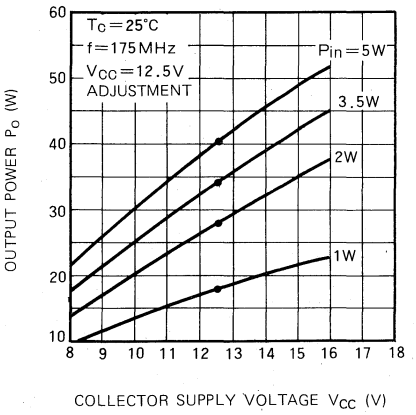
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2630

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2630 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

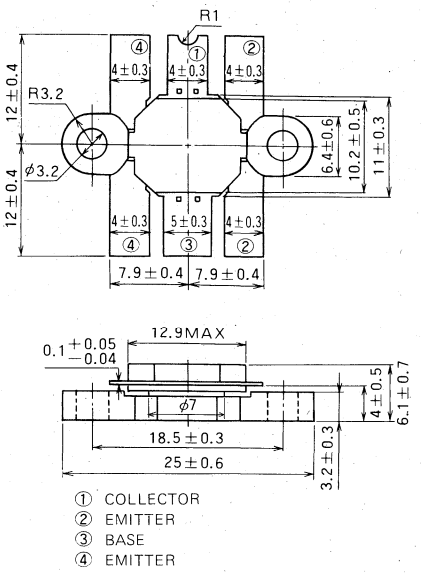
- High power gain: $G_{pe} \geqq 7$dB
  @V_{CC} = 12.5V, P_O = 50W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 50W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 0.8 + j1.2Ω @P_O = 60W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 1.5 – j0.6Ω

APPLICATION

40 to 60 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE: ALL ELECTRODES ARE ISOLATED FROM FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		14	A
P_C	Collector dissipation	T_a=25°C	5.5	W
		T_C=25°C	100	
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	27.2	°C/W
Rth-c		Junction to case	1.5	°C/W

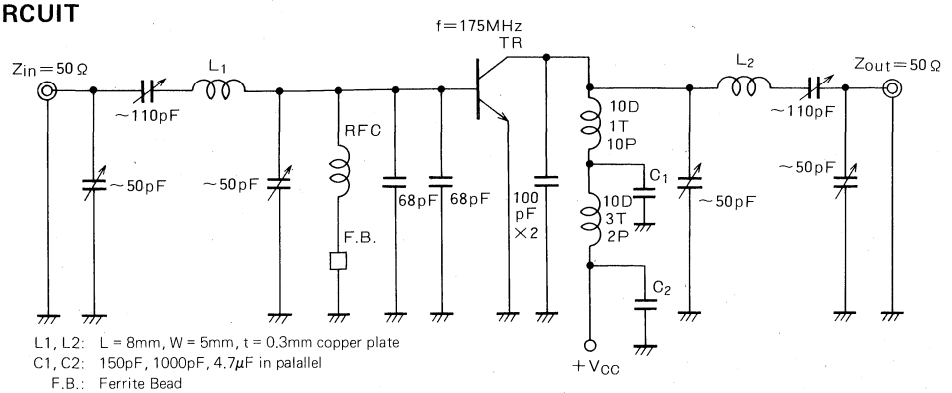
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.2A	10	40	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=10W, f=175MHz	50	60		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

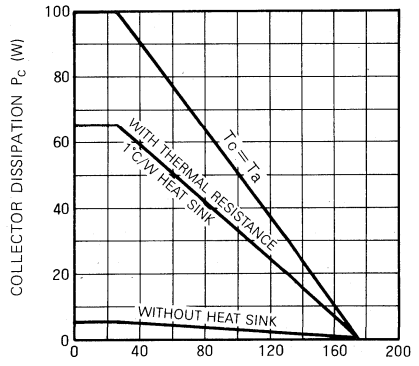
TEST CIRCUIT



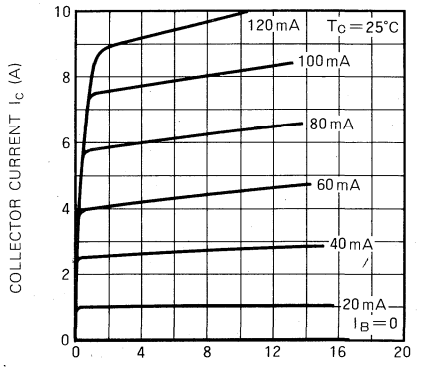
L1, L2: L = 8mm, W = 5mm, t = 0.3mm copper plate
C1, C2: 150pF, 1000pF, 4.7μF in palallel
F.B.: Ferrite Bead
NOTES: All coils are made from 1.5mmϕ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

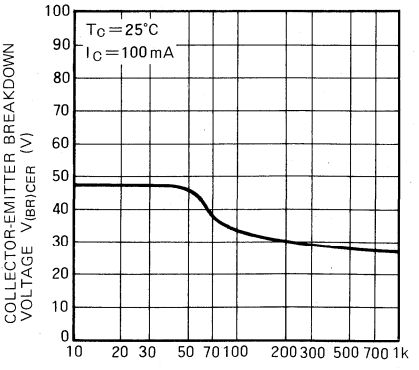
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



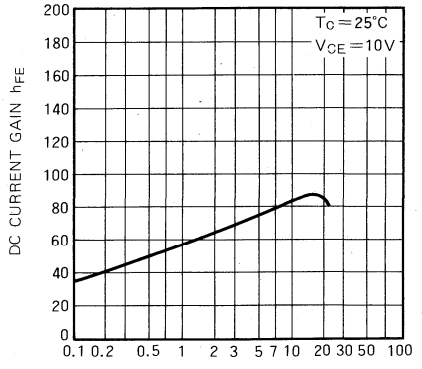
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



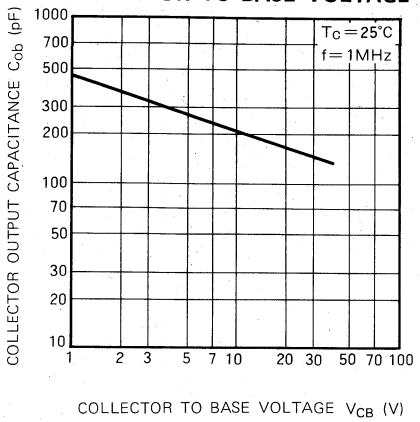
DC CURRENT GAIN VS. COLLECTOR CURRENT



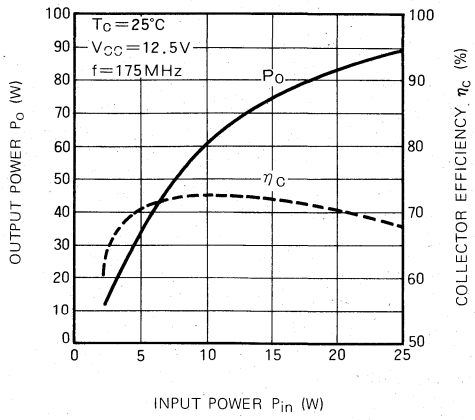
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

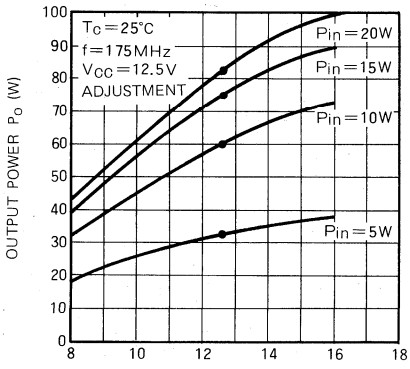
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2694

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2694 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

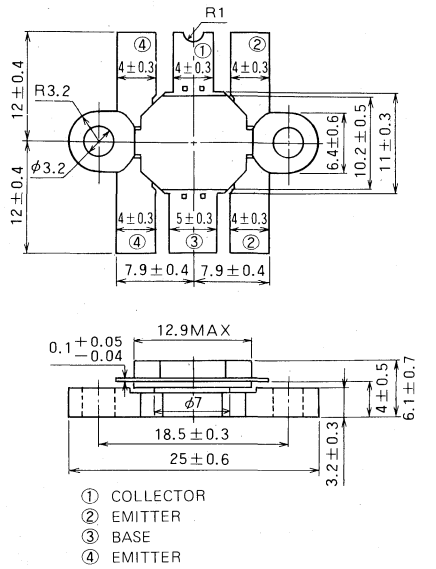
- High power gain: $G_{pe} \geqq 6.7$dB
  @V_{CC} = 12.5V, P_O = 70W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 70W, f = 175MHz, T_C = 25°C.
- Equivalent input/output series impedance:
  Z_{in} = 0.7 + j0.9Ω @P_O = 70W, V_{CC} = 12.5V, f = 175MHz
  Z_{out} = 1.2 − j0.3Ω

APPLICATION

50 to 60 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



NOTE: ALL ELECTRODES ARE ISOLATED FROM FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	17	V
I_C	Collector current		20	A
P_C	Collector dissipation	Ta=25°C	5.5	W
		T_C=25°C	140	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
R_{th-a}	Thermal resistance	Junction to ambient	27.2	°C/W
R_{th-c}		Junction to case	1.07	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

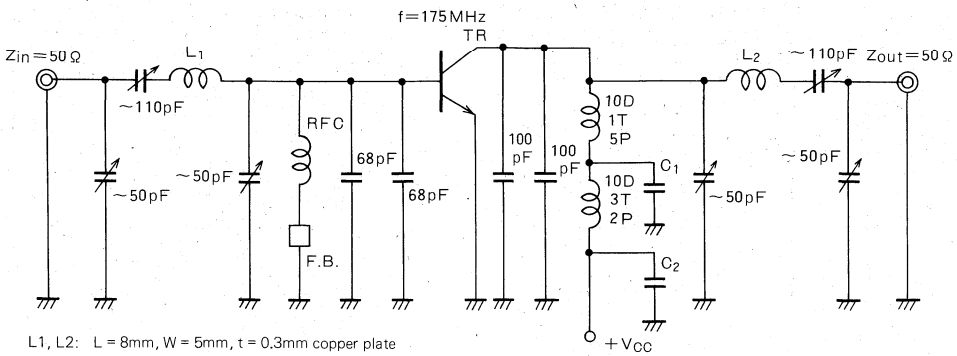
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=20mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=20mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=1A	10	50	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=15W, f=175MHz	70	75		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

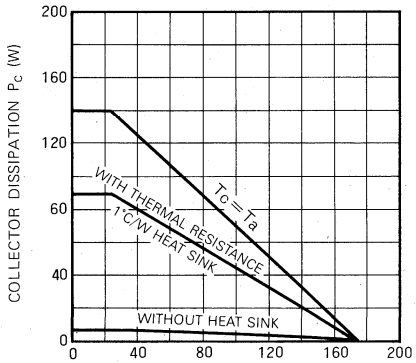


L1, L2: L = 8mm, W = 5mm, t = 0.3mm copper plate
C1, C2: 150pF, 1000pF, 4.7μF in parallel
F.B.: Ferrite Bead

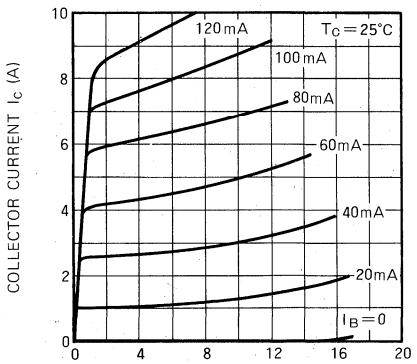
NOTES: All coils are made from 1.5mmϕ silver plated copper wire
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

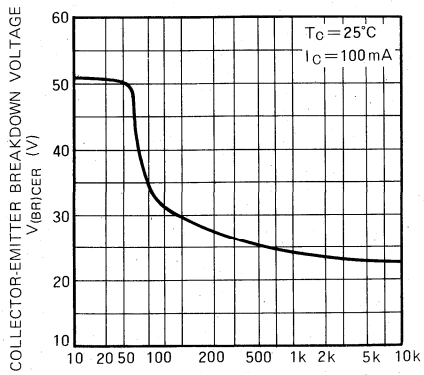
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



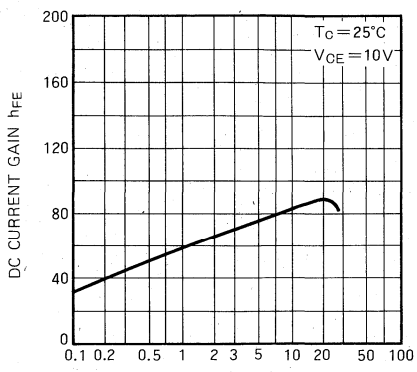
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

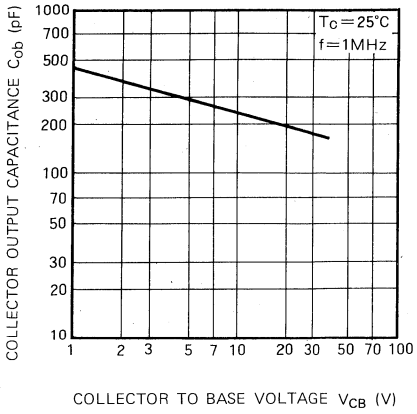


DC CURRENT GAIN VS. COLLECTOR CURRENT

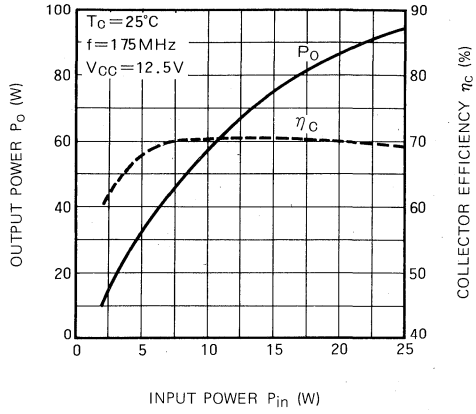


NPN EPITAXIAL PLANAR TYPE

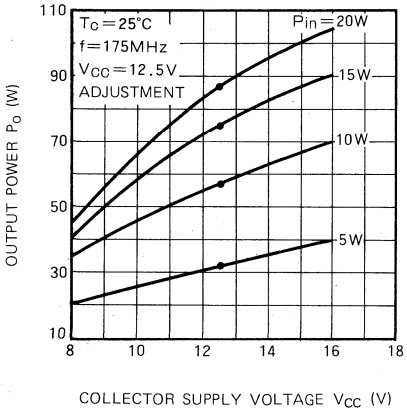
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2695

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2695 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band mobile radio applications.

FEATURES

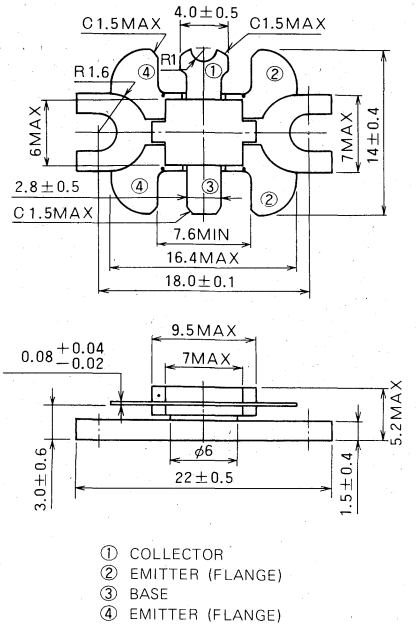
- High power gain: $G_{pe} \geqq 4.9$dB
  @V_{CC} = 13.5V, P_{in} = 9W, f = 520MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR all phase when operated at V_{CC} = 15.2V, P_O = 30W, f = 520MHz.
- Series equivalent input/output impedance:
  Z_{in} = 1.5 + j2Ω @P_O = 30W, V_{CC} = 13.5V, f = 520 MHz
  Z_{out} = 2.5 + j1Ω

APPLICATION

25 to 28 watts output power amplifiers in UHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	17	V
I_C	Collector current		10	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	75	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	2	°C/W

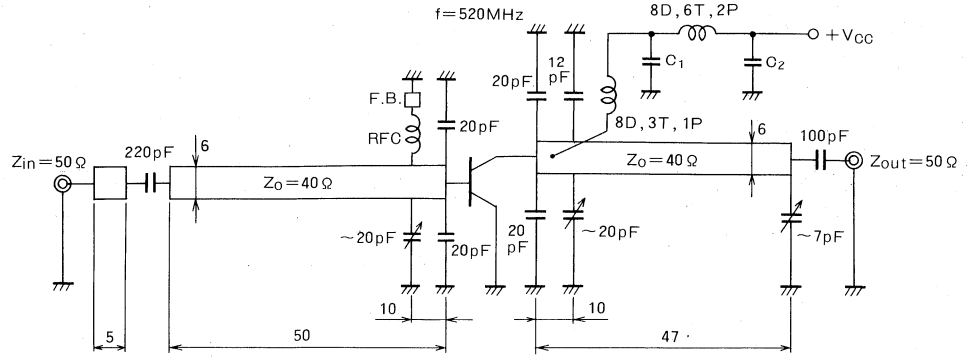
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			3	mA
h_{FE}	DC forward current gain *	V_{CC}=10V, I_C=1A	20	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=9W, f=520MHz	28	32		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

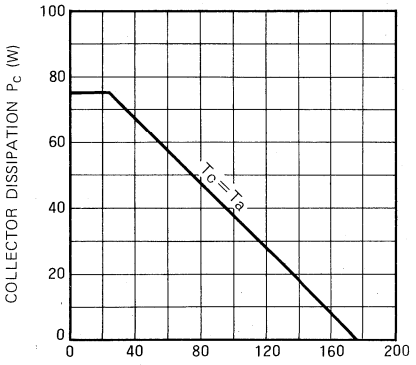


RFC: 0.4mmϕ enameled wire 8T on D = 4mm, L = 13mm Bakelite
F.B.: Ferrite bead
C1: 68pF, 3300pF, 4700pF, 33μF in parallel
C2: 3300pF, 4700pF, 33μF in parallel

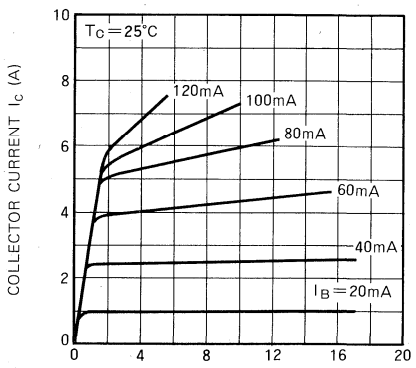
NOTES: Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Material of microstrip line: H = 1.6mm Teflon glass (ϵ_s = 2.7)

TYPICAL PERFORMANCE DATA

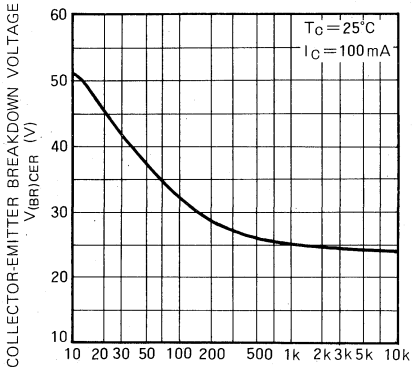
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



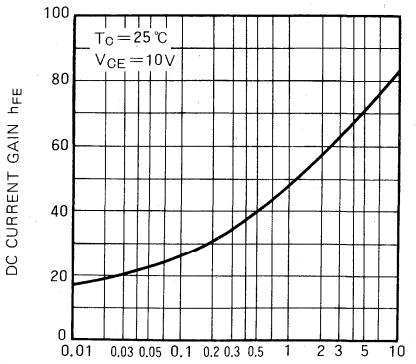
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



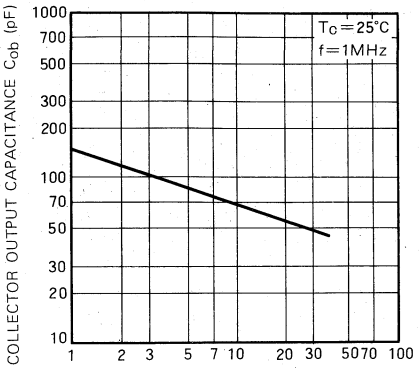
DC CURRENT GAIN VS. COLLECTOR CURRENT



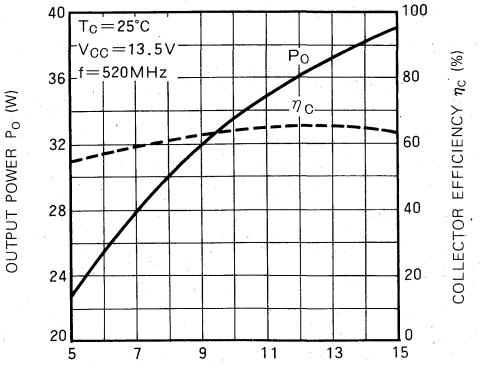
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

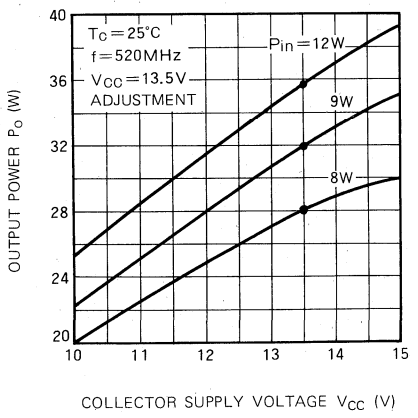
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2797

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2797 is a silicon NPN epitaxial planar type transistor designed for RF broad-band power amplifiers in UHF band.

FEATURES

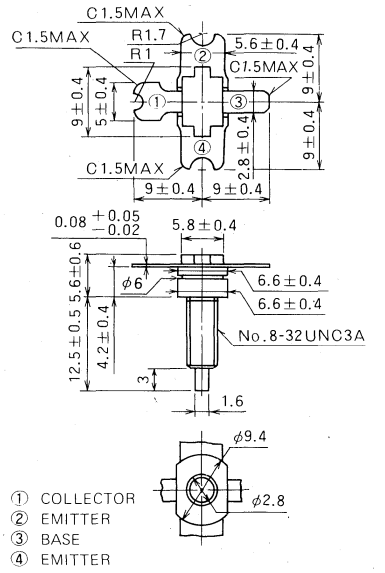
- High power gain: $G_{pe} \geqq 7$dB (Class AB)
  @V_{CC} = 24V, P_O = 5W, f = 770MHz, I_D = 20mA
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstanding load VSWR 8.8:1 when operated at V_{CC} = 24V, P_O = 5W, f = 175MHz, T_C = 25°C, class AB condition.

APPLICATION

UHF high voltage (24V) broad-band amplifiers

OUTLINE DRAWING

Dimensions in mm



NOTE: ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		45	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_a=25°C	1	W
		T_C=25°C	10	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
R_{th-c}	Thermal resistance	Junction to case	15	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

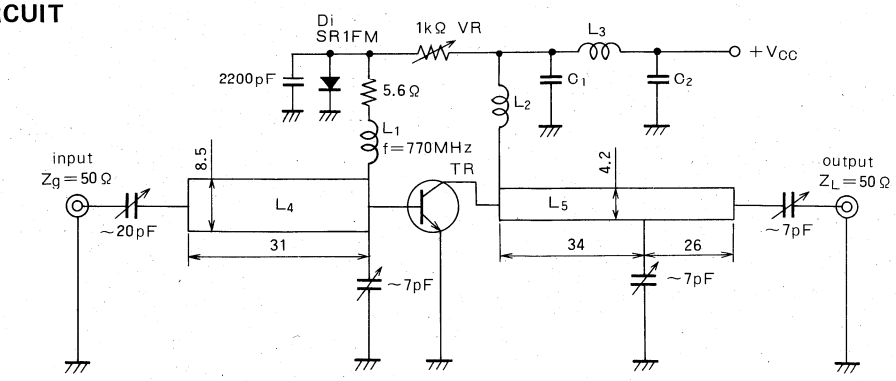
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_B=0	45			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			400	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			200	μA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=24V, P_{in}=1W,	5	6		W
η_C	Collector efficiency	f=770MHz, I_D=20mA **	55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5% ** Note: Class AB operation

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

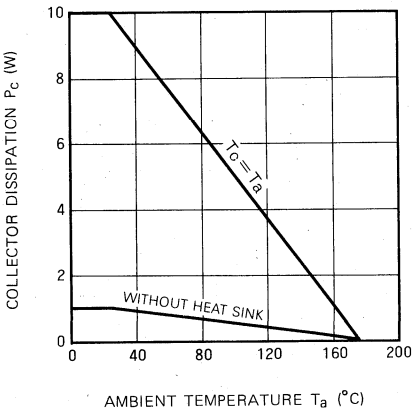


L1: 0.4mmϕ enameled wire 6T, 3P
L2: Width 3mm, length 25mm, thickness 0.15mm copper plate
L3: 0.4mmϕ enameled 21T
C1: 100pF, 1000pF, 0.01μF, 1μF in parallel
C2: 100pF, 1000pF, 0.1μF, 10μF in parallel
L4,L5: Microstrip line (t = 1.6mm, ϵ_s = 2.7 Teflon)

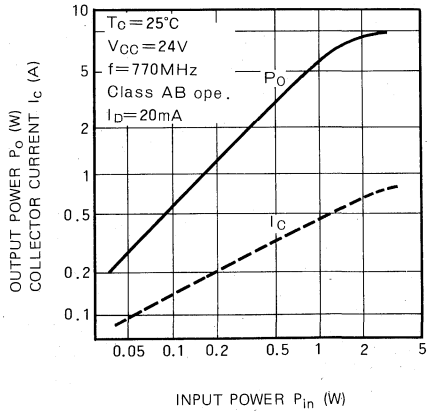
NOTES: Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

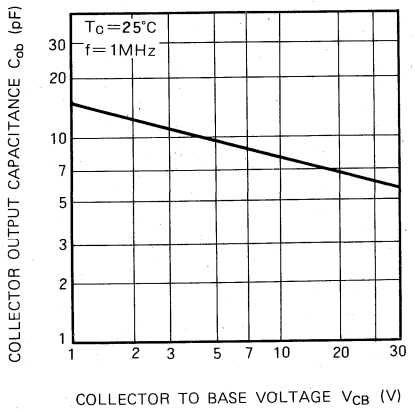
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



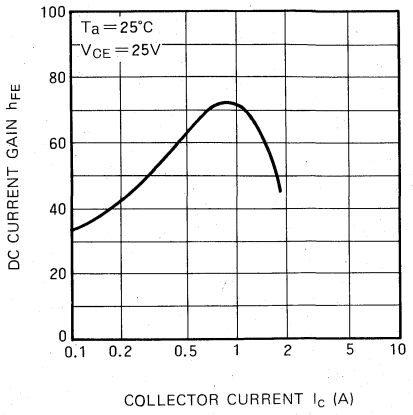
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



DC CURRENT GAIN VS. COLLECTOR CURRENT



2SC2798

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2798 is a silicon NPN epitaxial planar type transistor designed for RF broad-band power amplifiers in UHF band.

FEATURES

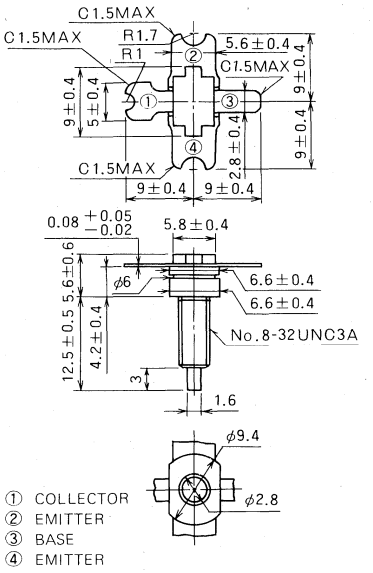
- High power gain: $G_{pe} \geqq 6$dB (Class AB)
  @V_{CC} = 24V, P_O = 12W, f = 770MHz, I_D = 50mA
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with stud.
- Ability of withstanding load VSWR 8.8:1 when operated at V_{CC} = 24V, P_O = 12W, f = 175MHz, I_D = 50mA, T_C = 25°C, class AB condition.

APPLICATION

UHF high voltage (24V) broad-band amplifiers

OUTLINE DRAWING

Dimensions in mm



NOTE: ALL ELECTRODES ARE ISOLATED FROM STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		45	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_C=25°C	30	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
R_{th-c}	Thermal resistance	Junction to case	5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

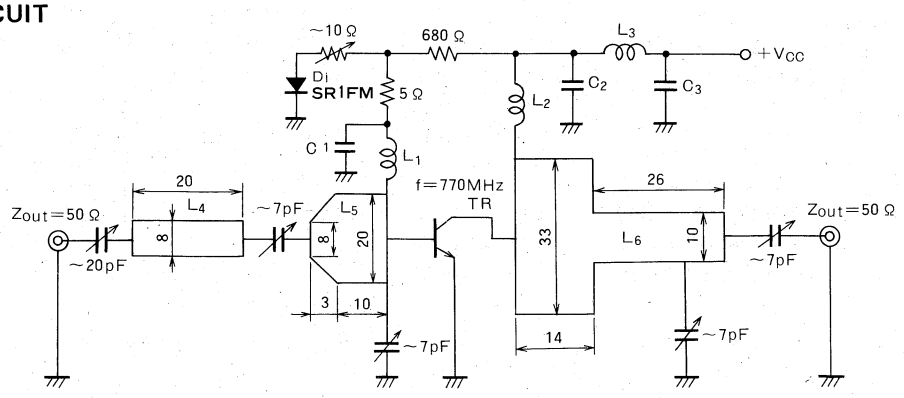
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	45			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1000	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			400	μA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=24V, P_{in}=3W, f=770MHz, I_D=50mA**	12	14		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5% ** Note: Class AB operation.

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

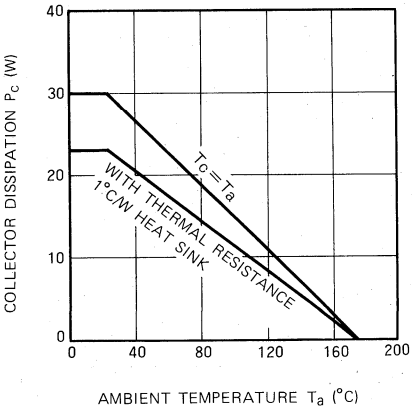


L1: 4D, 6T, 3P, 0.4mmϕ enameled wire
L2: Width = 3mm, thickness = 0.15mm, length = 23mm copper plate
L3: 4D, 20T, 1P, 0.4mmϕ enameled wire
L4~L6: Microstrip line (t = 1.6mm, ϵ_S = 2.7 Teflon)

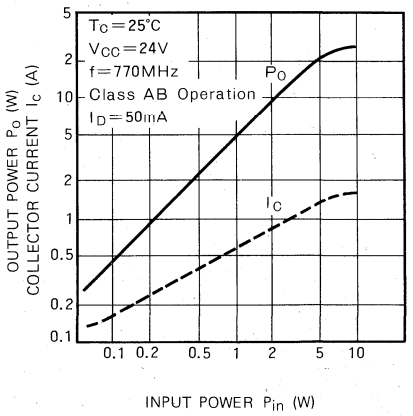
C1: 1000pF, 0.01μF in parallel
C2: 100pF, 1000pF, 0.01μF, 1μF in parallel
C3: 100pF, 1000pF, 0.1μF, 10μF in parallel
NOTES: Coil dimensions in milli-meter
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

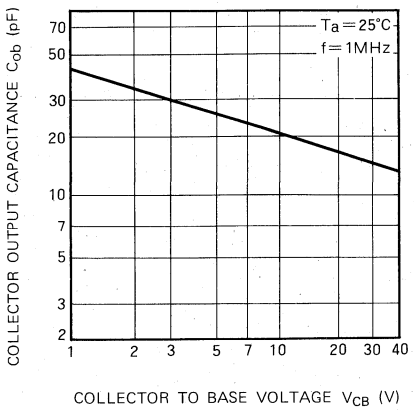
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



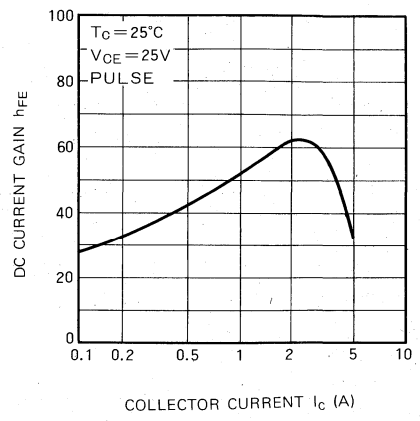
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



DC CURRENT GAIN VS. COLLECTOR CURRENT



2SC2799

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

MITSUBISHI 2SC2799 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifier applications.

FEATURES

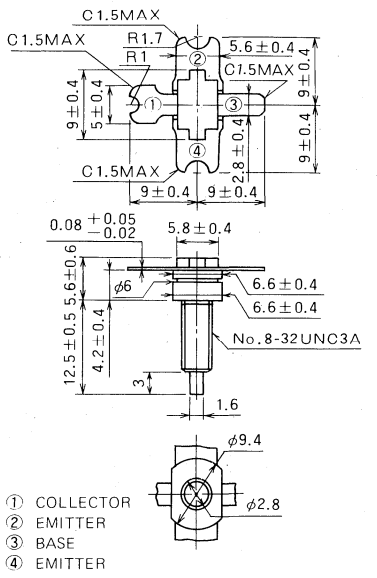
- High power gain: $G_{pe} \geqq 4.9$dB (Class AB)
  @V_{CC} = 24V, f = 770MHz, P_O = 25W, I_D = 80mA
- Ability to withstanding load VSWR 8.8:1 when operated at V_{CC} = 24V, P_O = 25W, f = 770MHz, I_D = 80mA, class AB condition.

APPLICATION

UHF high voltage (24V) broad-band amplifiers

OUTLINE DRAWING

Dimensions in mm



NOTE: EMITTER ELECTRODES ARE CONNECTED WITH STUD.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		45	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_C=25°C	50	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55 ~ +175	°C
R_{th-c}	Thermal resistance	Junction to case	3	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

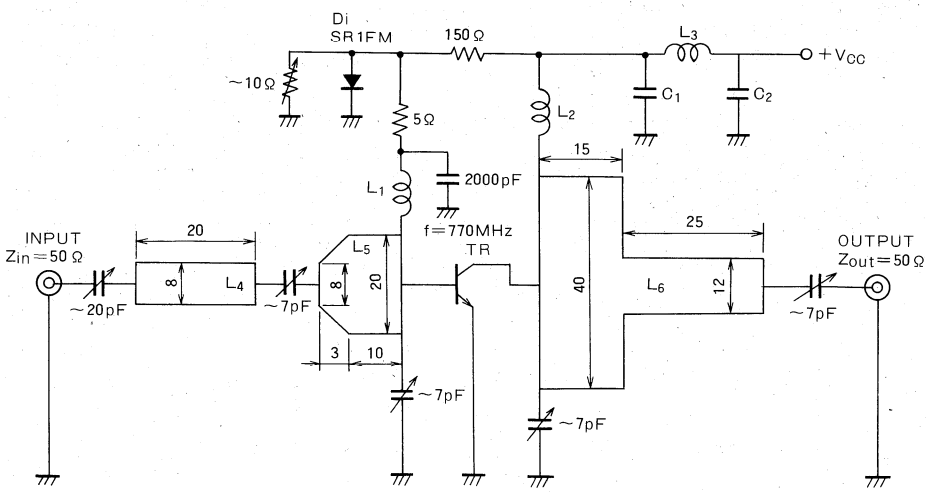
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	45			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			1.5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0V			500	μA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	10	50	180	—
P_O	Output power	V_{CC}=24V, f=770MHz, P_{in}=8W, I_D=80mA **	25	27		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty 5% ** Note: Class AB operation

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

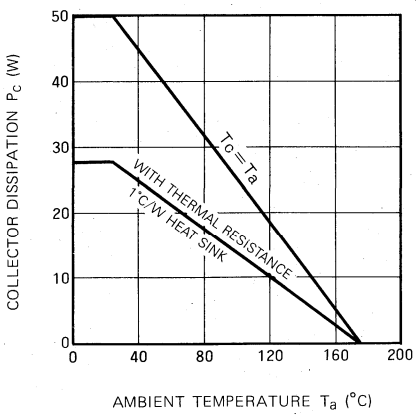
TEST CIRCUIT



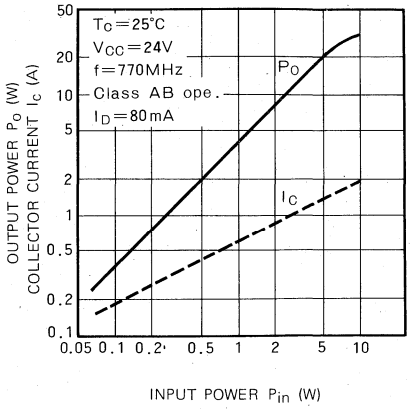
L1: 0.4mmϕ enameled wire 6T, 2P.
L2: Width = 3mm, thickness = 0.15mm, lenght = 25mm, copper plate.
L3: 0.4mmϕ enameled wire 20T, 1P.
C1: 100pF, 1000pF, 0.01μF, 1μF, in parallel.
C2: 100pF, 1000pF, 0.1μF, 10μF, in parallel.
L4~L6: Microstrip line: t = 1.6mm, teflon $\epsilon_s = 2.7$
NOTES: D: Inner diameter of coil.
T: Turn numbers of coil.
P: Pitch of coil.
Dimension in milli-meter

TYPICAL PERFORMANCE DATA

COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE

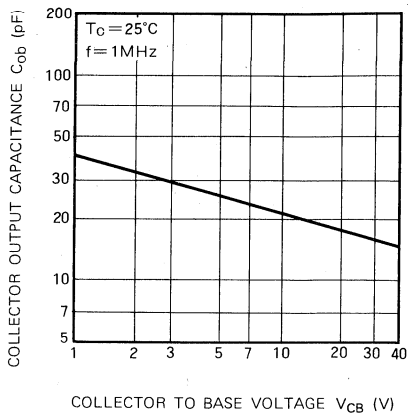


OUTPUT POWER, COLLECTOR CURRENT VS. INPUT POWER

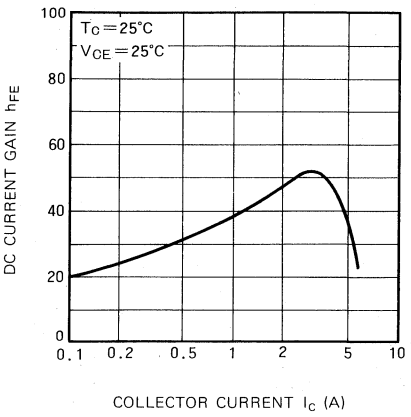


NPN EPITAXIAL PLANAR TYPE

COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



DC CURRENT GAIN VS. COLLECTOR CURRENT



MITSUBISHI ELECTRIC

2SC2800

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC2800 is a silicon NPN epitaxial planer type transistor for liner power amplifiers in UHF band.

FEATURES

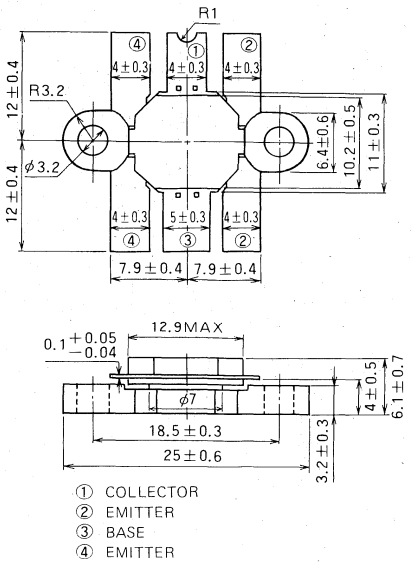
- High power gain: $G_{pe} \geqq 4.3$dB (Class AB)
  @V_{CC} = 24V, f = 770MHz, P_O = 40W, I_D = 100mA
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 8.8:1 load VSWR all phase when operated at V_{CC} = 24V, f = 770MHz, P_O = 40W, I_D = 100mA, class AB condition
- High Input-Impedance Transistor (HI^2T)

APPLICATION

Broadband liner amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



NOTE: EMITTER ELECTRODES ARE CONNECTED WITH FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		45	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	35	V
I_C	Collector current		6	A
P_C	Collector dissipation	T_C=25°C	75	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C
R_{th-c}	Thermal resistance	Junction to case	2	°C/W

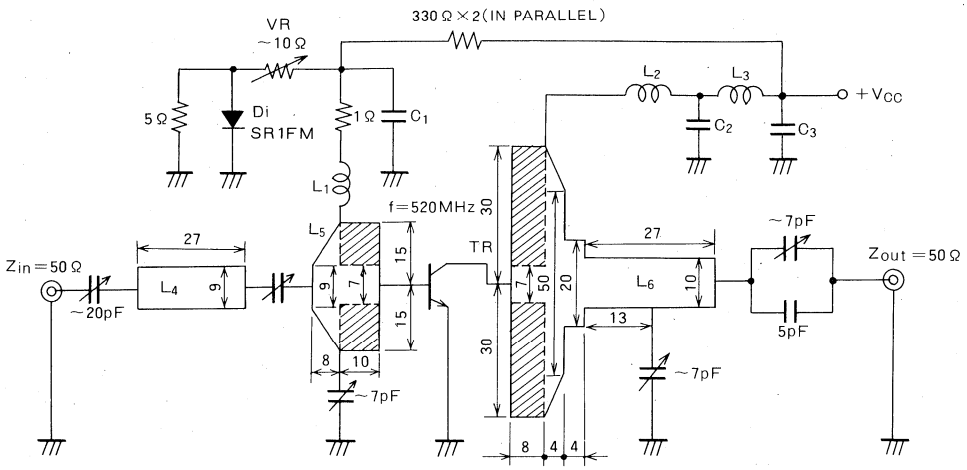
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	45			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	35			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			1	mA
h_{FE}	DC forward current gain *	V_{CE}=25V, I_C=0.2A	10	50	180	—
P_O	Output power	V_{CC}=24V, f=770MHz, P_{in}=15W	40	42		W
η_C	Collector efficiency	I_D=100mA **	50	55		%

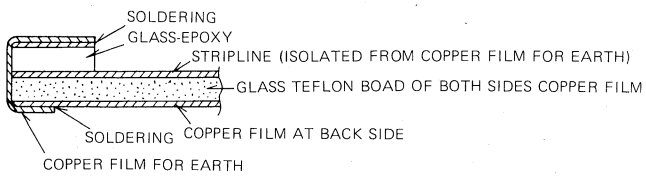
* Note: Pulse test, P_W = 150μs, duty 5% ** Note: Class AB operation

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

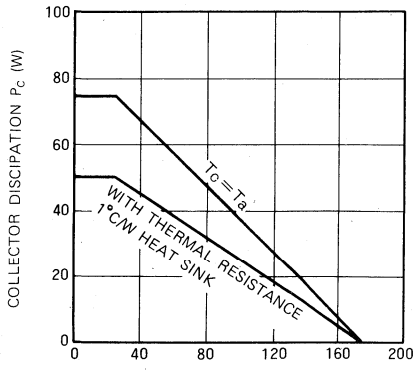


L_1: 6T, 2.5P, 0.4mmϕ enameled wire (Bakelite ribbon)
L_2: W = 3mm, T = 0.15mm, L = 23mm copper plate
L_3: 20T, 1P, 0.4mmϕ enameled wire (Bakelite ribbon)
$L_{4\sim6}$: Microstrip line
C_1: 1000pF, 0.01μF in parallel
C_2: 100pF, 1000pF, 0.01μF, 1μF in parallel
C_3: 100pF, 1000pF, 0.1μF, 10μF in parallel
NOTE 1. Boad for formation microstrip line: glass-teflon board $\epsilon_S = 2.7$, t = 1.6mm
2. Dimensions: mm
3. T: Turn number of coil, P: Pitch of coil
4. Sectional plan of oblique lines

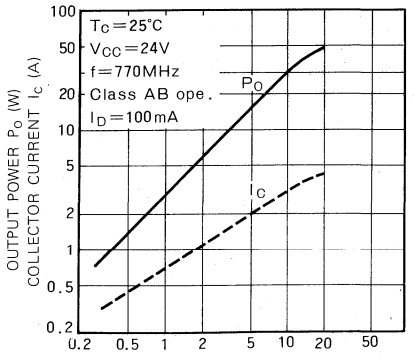


TYPICAL PERFORMANCE DATE

COLLECTOR DISSIPATION VS. AMBIENCE TEMPERATURE CHARACTERISTICS



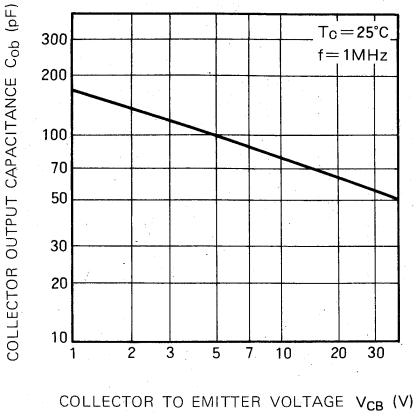
OUTPUT POWER, COLLECTOR CURRENT VS. INPUT POWER CHARACTERISTICS



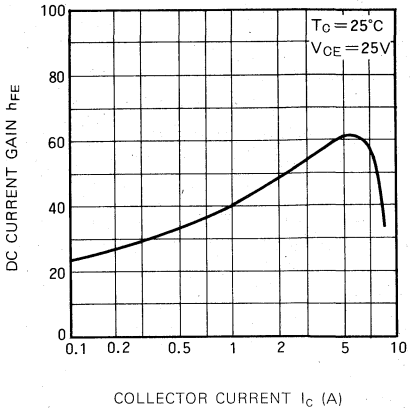
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO EMITTER VOLTAGE CHARACTERISTICS



DC CURRENT GAIN VS. COLLECTOR CURRENT CHARACTERISTICS



2SC2904

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC2904 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers in HF band.

FEATURES

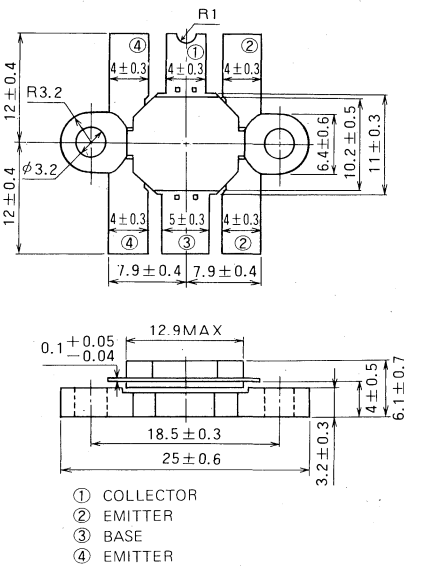
- High gain: $G_{pe} \geqq 11.5$dB
  @f = 30MHz, V_{CC} = 12.5V, P_o = 100W
- High ruggedness: Ability to withstand 20:1 load VSWR when operated at f = 30MHz
  P_o = 100W, V_{CC} = 15.2V
- Emitter ballansted construction
- Low thermal resistance ceramic package with flange.

APPLICATION

Output stage of transmitter in HF band SSB mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



NOTE: EMITTER ELECTRODES ARE CONNECTED WITH FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CER}	Collector to emitter voltage	$R_{BE}=\infty$	20	V
I_C	Collector current		22	A
P_C	Collector dissipation	T_a=25°C	7.8	W
		T_C=25°C	200	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-c	Thermal resistance		0.75	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

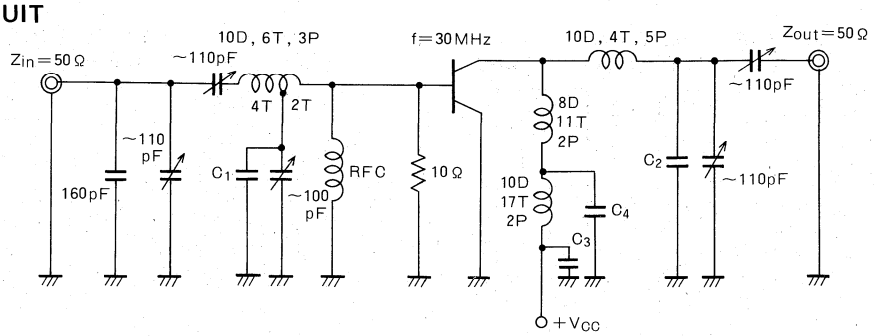
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=20mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=20mA, I_E=0	50			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=100mA, $R_{BE}=\infty$	20			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=1A	10	50	180	—
P_O	Output power	f=30MHz, V_{CC}=12.5V, P_{in}=7W	100	110		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

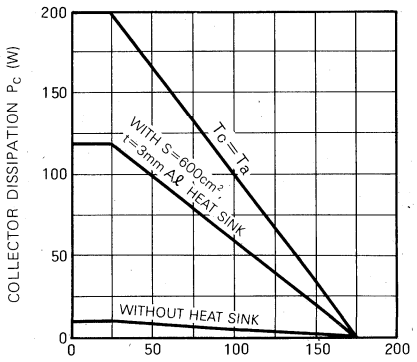
TEST CIRCUIT



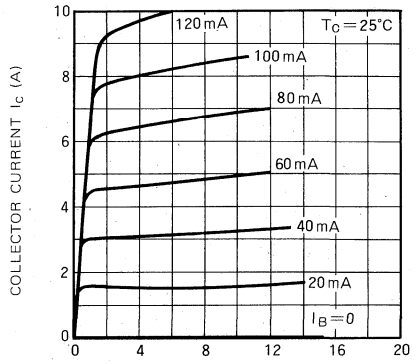
C_1: 160pF, 160pF, 82pF in parallel
C_2: 82pF, 82pF, 82pF in parallel
C_3: 100pF, 4700pF, 4700pF, 0.22μF, 0.22μF, 33μF, 330μF in parallel
C_4: 100pF, 220pF, 4700pF, 0.1μF, 330μF in parallel
NOTES: All coils but L_1 are made from 1.5φmm silver plated copper wire, L_1 is made from 2.3φmm copper wire.
D: Inner diameter of coil P: Pitch of coil
T: Turn number of coil Dimension is milli-meter

TYPICAL PERFORMANCE DATE

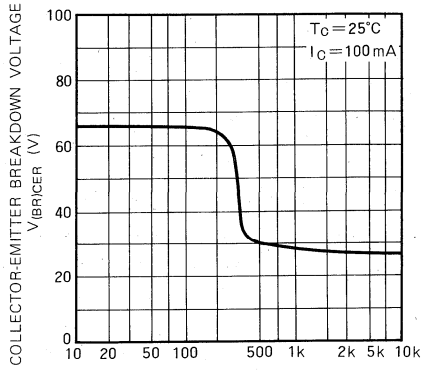
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



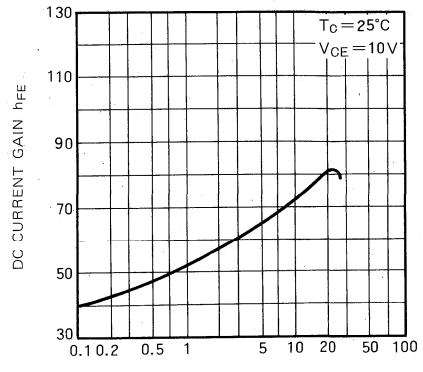
COLLECTOR CURRENT VS. COLLECTOR TO EMITTER VOLTAGE



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

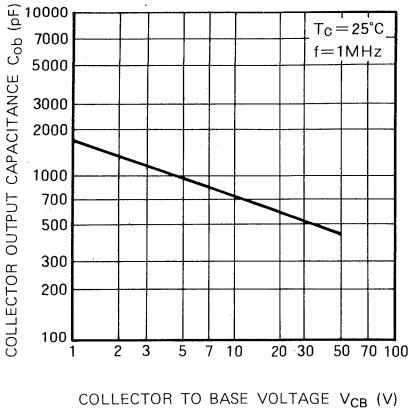


DC CURRENT GAIN VS. COLLECTOR CURRENT

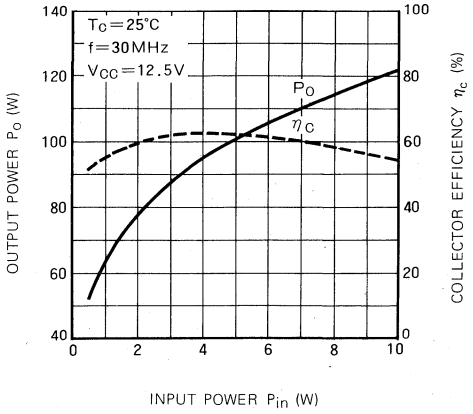


NPN EPITAXIAL PLANAR TYPE

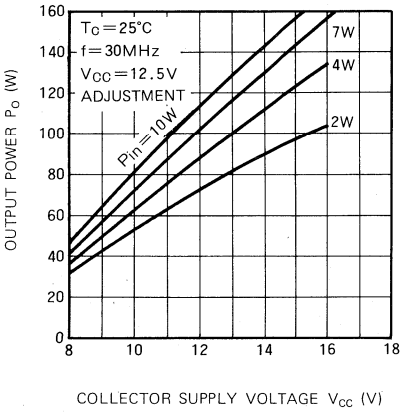
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



MITSUBISHI ELECTRIC

2SC2905

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2905 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers applications in UHF band.

FEATURES

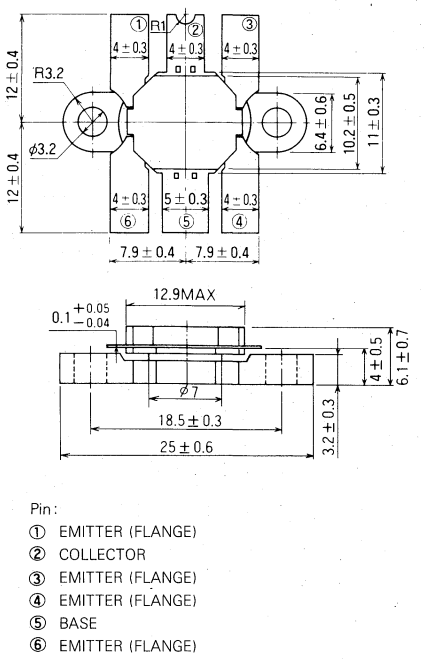
- High power output, high gain:
  $P_O \geqq 45W, G_{pe} \geqq 4.8dB$ @$V_{CC} = 12.5V$, f = 520MHz,
  $P_{in} = 15W$.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC} = 15.2V$, $P_O = 45W$, f = 520MHz.
- High reliability due to gold metalization die.
- Flange type ceramic package.
- $\dot{Z}_{in} = 1.2 + j1.1\Omega$, $\dot{Z}_{out} = 1.3 + j1.0\Omega$
  @$V_{CC} = 12.5V$, f = 520MHz, $P_O = 45W$.

APPLICATION

For output stage of 35 ~ 40W power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① EMITTER (FLANGE)
② COLLECTOR
③ EMITTER (FLANGE)
④ EMITTER (FLANGE)
⑤ BASE
⑥ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		15	A
P_C	Collector dissipation	$T_C = 25°C$	120	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

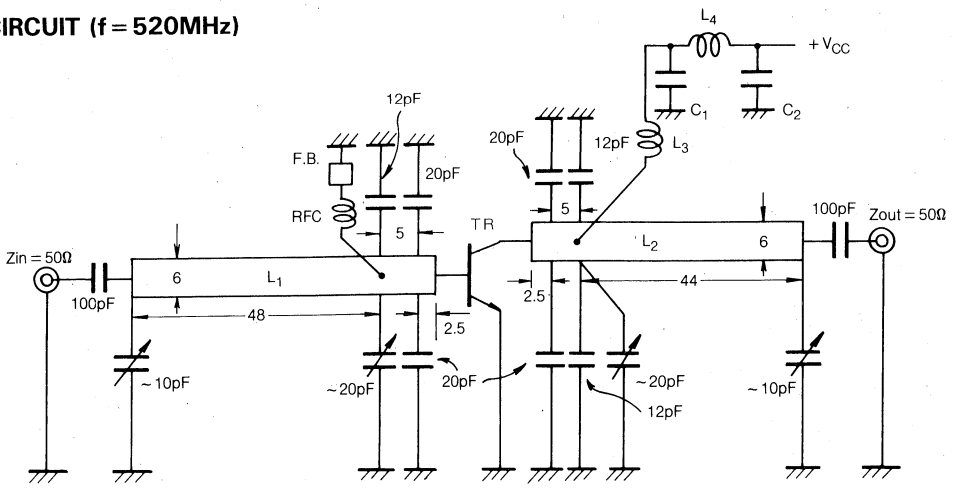
ELECTRICAL CHARACTERISTICS ($T_C = 25°C$)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 10mA$, $I_C = 0$	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 10mA$, $I_E = 0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 0.1A$, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB} = 15V$, $I_E = 0$			2	mA
I_{EBO}	Emitter cut off current	$V_{EB} = 3V$, $I_C = 0$			3	mA
h_{FE}	DC forward current gain *	$V_{CE} = 10V$, $I_C = 1A$	10	50	180	—
P_O	Power Output	$V_{CC} = 12.5V$, $P_{in} = 15W$, f = 520MHz	45	50		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, $P_W = 150\mu s$, duty = 5%

NPN EPITAXIAL PLANAR TYPE

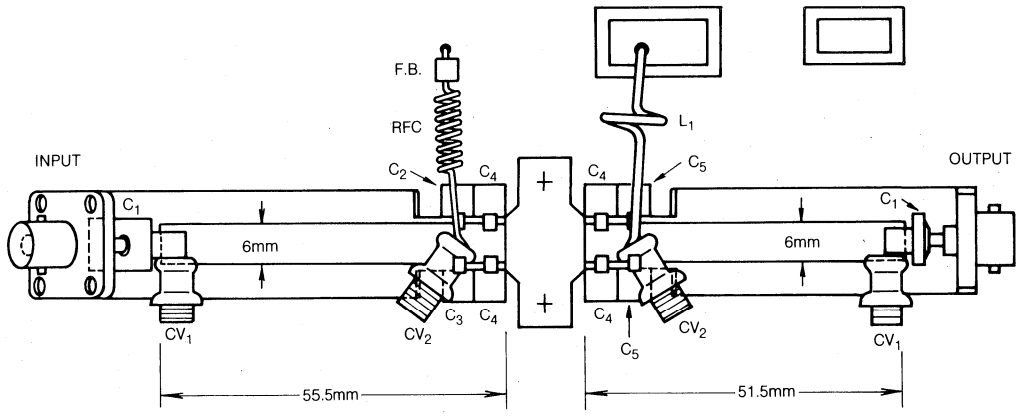
TEST CIRCUIT (f = 520MHz)



Dimensions: mm

L_1,L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 1 Turn, AWG #13, 8mm I.D.
L_4: 5 Turns, AWG #13, 8mm I.D.
RFC: 9 Turns, AWG #20, 4mm I.D.
F.B.: Ferrite Bead
C_1: 82pF, 220pF, 2200pF, 4700pF, 33μF in Parallel
C_2: 82pF, 220pF, 2200pF, 4700pF, 22μF in Parallel

TEST CIRCUIT BOARD LAYOUT (f = 520MHz)

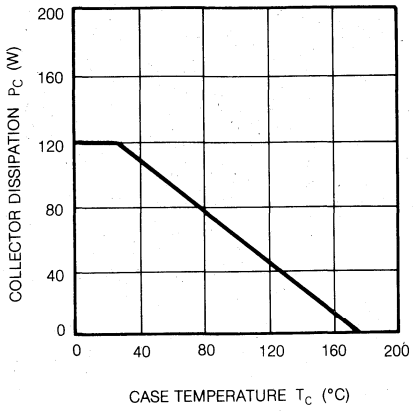


C_1: 100pF(Ribbon Lead Mica)
C_2: 12pF(Ribbon Lead Mica)
C_3: 0
C_4: 20pF(Ribbon Lead Mica)
C_5: 12pF(Ribbon Lead Mica)
CV_1: −10pF(Air Variable Capacitor) muRata TTA 43 A 100A
CV_2: −20pF(Air Variable Capacitor) muRata TTA 45 A 200A
F.B.: Ferrite Bead
RFC: 9 Turns, AWG #20, 4mm I.D.
L_1: 1 Turns, AWG #13, 8mm I.D.
Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon r = 2.7$

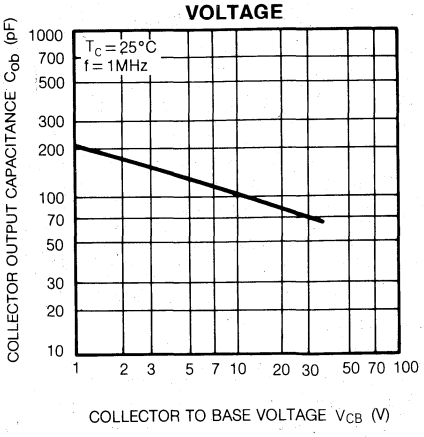
NPN EPITAXIAL PLANAR TYPE

TYPICAL PERFORMANCE DATA

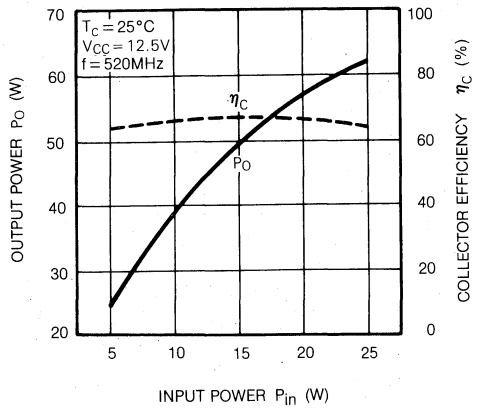
COLLECTOR DISSIPATION VS. CASE TEMPERATURE



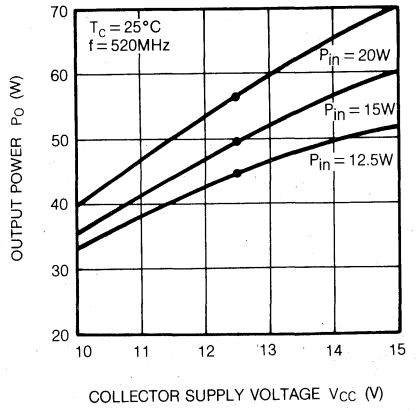
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



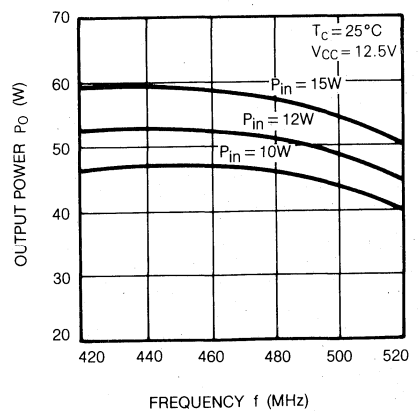
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



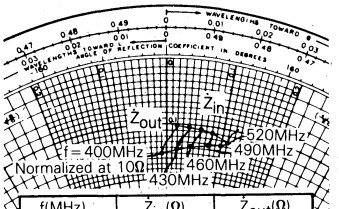
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



OUTPUT POWER VS. FREQUENCY



SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS



f(MHz)	Z_{in}(Ω)	Z_{out}(Ω)
400	1.02 + j0.20	1.50 − j0.1
430	1.03 + j0.40	1.45 + j0.19
460	1.05 + j0.60	1.40 + j0.45
490	1.08 + j0.85	1.35 + j0.74
520	1.20 + j1.10	1.30 + j1.00

Conditions:
P_O = 45W, T_C = 25°C, V_{CC} = 12.5V

2SC2932

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2932 is a silicon NPN epitaxial planar type transistor specifically designed for power amplifiers applications in 800~940 MHz UHF band.

FEATURES

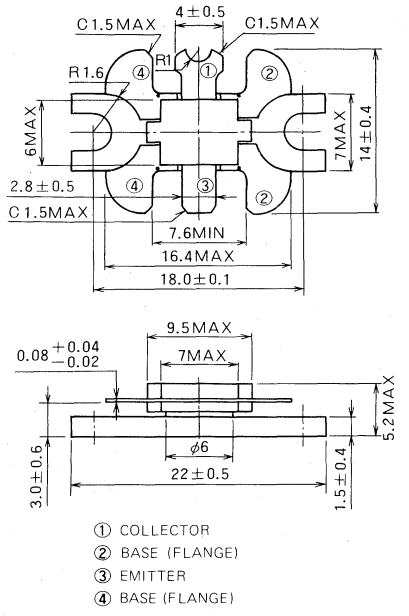
- High power gain: $G_P \geqq 7.8$dB, $P_O \geqq 6$W
  @ f = 900MHz, V_{CC} = 12.5V
- Emitter ballasted construction
- Gold metalization die in the transistor
- High ruggedness high reliability: Ability to withstand 20:1 load VSWR when operated at V_{CC}=15.2V, P_O=6W, f=900MHz.
- Small size, low common lead inductance strip line type ceramic package.
- Common base configuration.
- Series equivalent input/output impedance
  Z_{in} = 2.8–j1.4 (Ω), Z_{out} = 4.7–j5.9 (Ω)
  Operated at f = 900MHz, V_{CC} = 12.5V, P_O = 6W

APPLICATION

RF power amplifiers applications in 800 to 940 MHz mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		3	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_C=25°C	20	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55 ~ +175	°C
R_{th-c}	Thermal resistance	Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

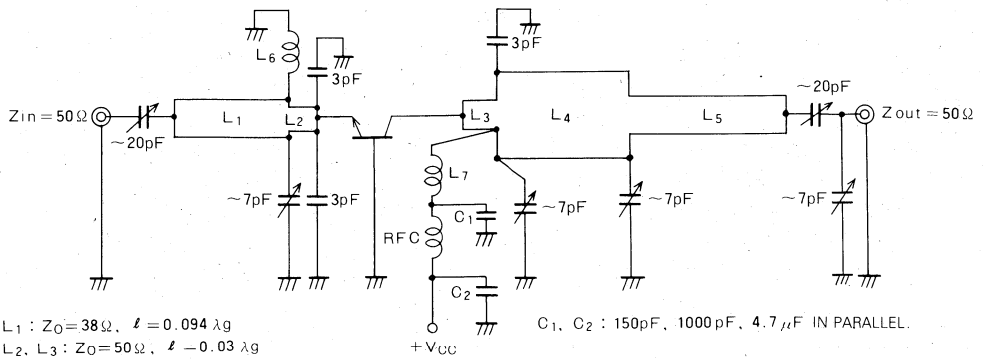
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	3			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cut-off current	V_{CB}=15V, I_E=0			2	mA
I_{EBO}	Emitter cut-off current	V_{EB}=2V, I_C=0			2	mA
h_{FE}	DC Current gain *	V_{CE}=10V, I_C=0.1A	10	30	180	—
P_O	Output power	f=900MHz, V_{CC}=12.5V, Pin=1W	6	7		W
η_C	Collector efficiency		55	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f=900MHz)



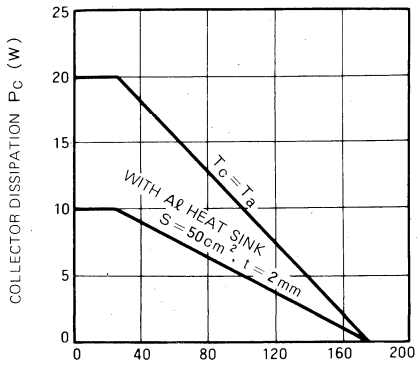
L_1 : Z_O=38Ω, ℓ =0.094 λg
L_2, L_3 : Z_O=50Ω, ℓ −0.03 λg
L_4 : Z_O=20Ω, ℓ =0.104 λg
L_5 : Z_O=38Ω, ℓ =0.123 λg
L_6 : 4D, 12T, OP(φ0.8 SILVER PLATED COPPER WIRE)
L_7 : ℓ =25, (φ1.0 SILVER PLATED COPPER WIRE)

C_1, C_2 : 150pF, 1000pF, 4.7μF IN PARALLEL.

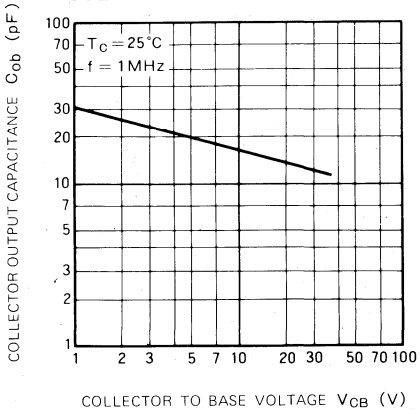
Note; Board Material: Glass Teflon, t=1.6, ε_r=2.7
D; Inner Diameter, T; Turn Number, P; Pitch,
All dimensions in mm.

TYPICAL PERFORMANCE DATA

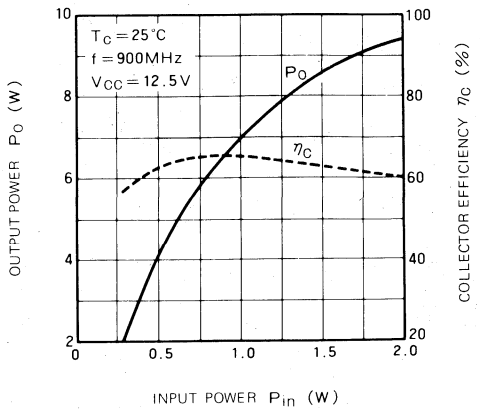
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



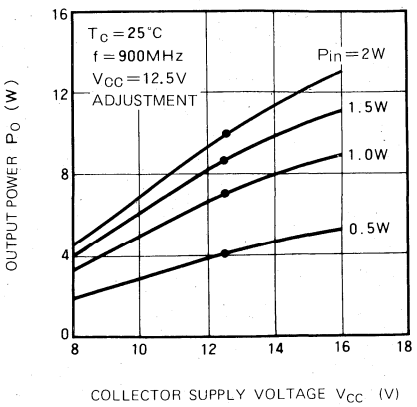
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER, COLLECTOR EFFICIENCY OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC2933

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC2933 is silicon NPN epitaxial planar type transitor specifically designed for power amplifiers in 800 ~ 940MHz band.

FEATURES

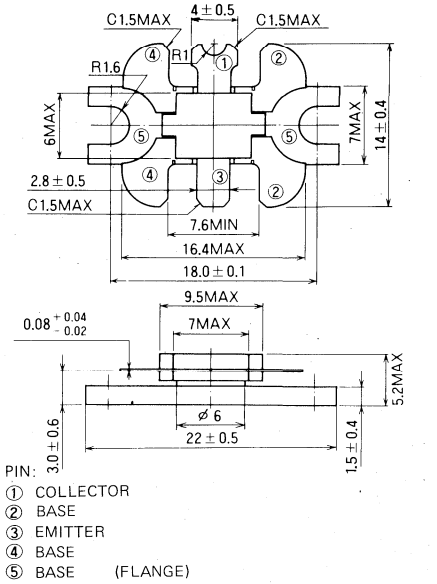
- High gain, High efficiency:
  G_{pb} = 6.7dB, $\eta_C \geqq 50\%$, $P_O \geqq 14W$
  @f = 900MHz, V_{CC} = 12.5V, P_{in} = 3W
- Gold metalization of transistor die.
- Flange type ceramic package.
- Equivalent input/output series impedance:
  Z_{in} = 2.5 + j0.75(Ω), Z_{out} = 2.2 – j2.1(Ω)
  @f = 900MHz, V_{CC} = 12.5V, P_O = 16W
- Common base type.
- The ability withstand infruite VSWR when operated at f = 900MHz V_{CC} = 15.2V, P_O = 14W.

APPLICATION

Output stage of power amplifiers in 800MHz band mobile radio equipment

OUTLINE DRAWING

Dimensions in mm



PIN:
① COLLECTOR
② BASE
③ EMITTER
④ BASE
⑤ BASE (FLANGE)

(NOTE 1) EMITTER AND FLANGE ARE SHORTED.
(NOTE 2) DIMENSIONS WITHOUT SPECIFICATION OF NOMINAL ERROR ARE SHOWN IN TYPICAL VALUES.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter		Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		3	V
V_{CEO}	Collector to emitter voltage		17	V
I_C	Collector current		4	A
P_C	Collector dissipation	T_a=25°C	3	W
		T_C=25°C	40	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-a	Thermal resistance		50	°C/W
Rth-c			3.75	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

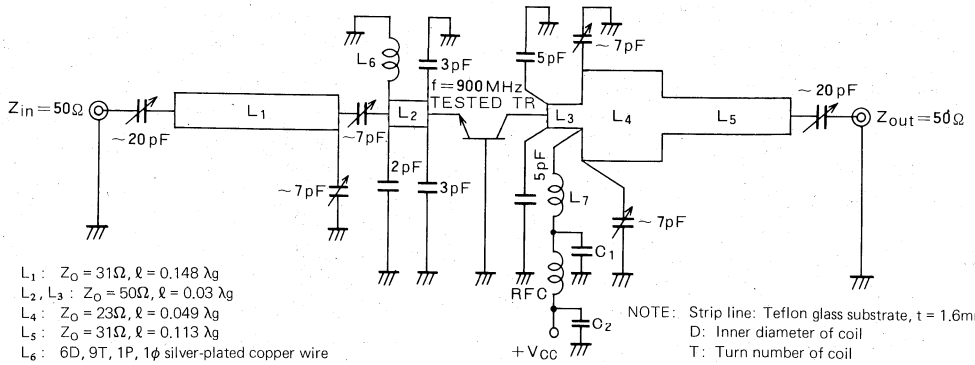
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	3			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			2	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			3	mA
h_{FE}	DC current gain *	V_{CE}=10V, I_C=0.2A	10		180	—
P_O	Output power	f=900MHz, V_{CC}=12.5V, Pin=3W	14	16		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

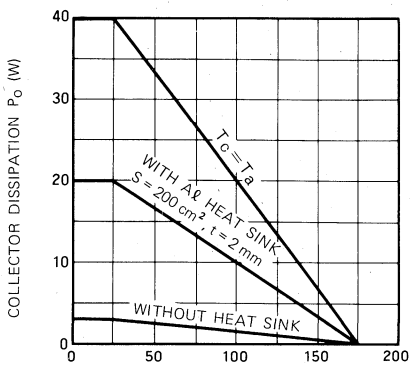


L_1 : $Z_O = 31\Omega$, $\ell = 0.148\ \lambda g$
L_2, L_3 : $Z_O = 50\Omega$, $\ell = 0.03\ \lambda g$
L_4 : $Z_O = 23\Omega$, $\ell = 0.049\ \lambda g$
L_5 : $Z_O = 31\Omega$, $\ell = 0.113\ \lambda g$
L_6 : 6D, 9T, 1P, 1ϕ silver-plated copper wire
L_7 : ℓ = 25, 1ϕ silver-plated copper wire
C_1 : 150pF, 1000pF, 22μF in parallel
C_2 : 150pF, 1000pF, 1μF in parallel

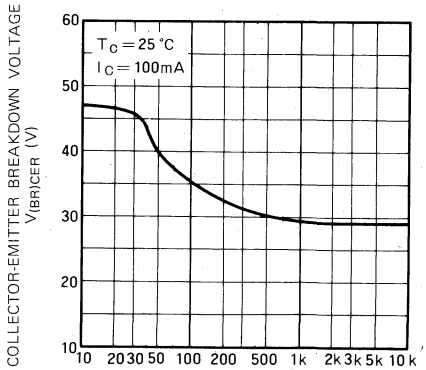
NOTE: Strip line: Teflon glass substrate, t = 1.6mm, $\epsilon_s = 2.7$
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
ℓ: Length
Coil dimensions in mm

TYPICAL PERFORMANCE DATA

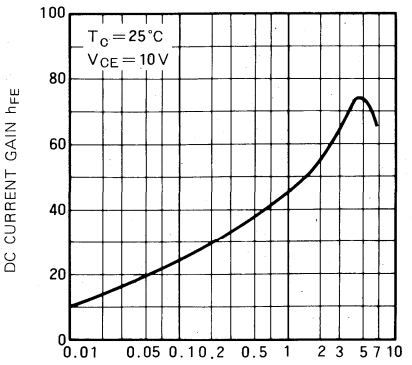
COLLECTOR LOSS VS. AMBIENT TEMPERATURE



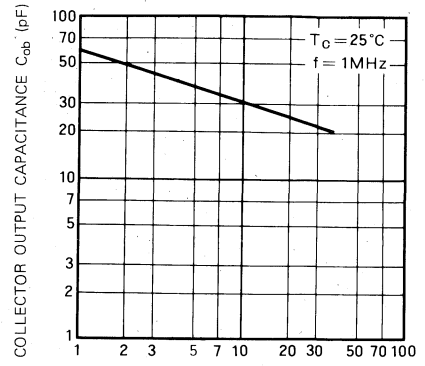
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



DC CURRENT AMPLIFICATION RATE VS. COLLECTOR CURRENT

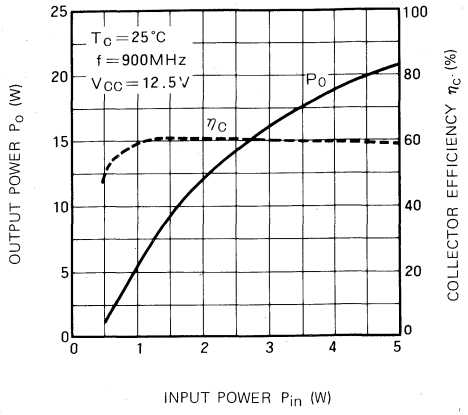


COLLECTOR OUTPUT CAPACITNCE VS. COLLECTOR-BASE VOLTAGE

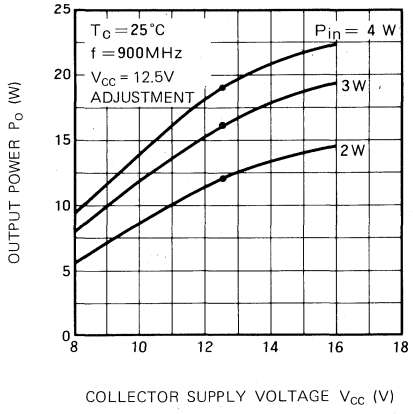


NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER, COLLECTOR SUPPLY VOLTAGE VARIATION



MITSUBISHI ELECTRIC

2SC3001

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3001 is a silicon NPN epitaxial planar type transistor specifically designed for VHF power amplifier applications.

FEATURES

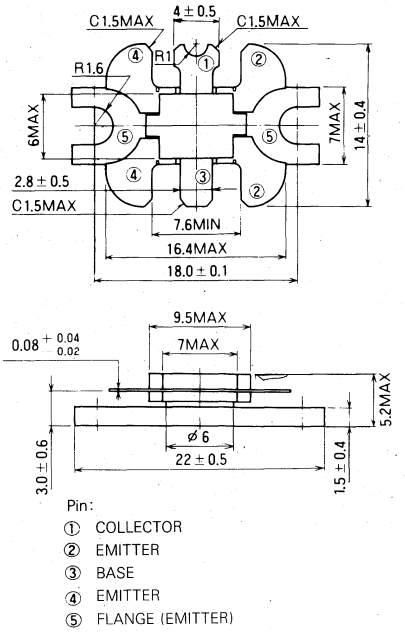
- High power gain: $G_{pe} \geqq 13$dB.
  @$V_{CC}=7.2$V, f=175MHz, $P_{in}=0.3$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC}=9$V, f=175MHz, $P_O=6.0$W.
- Flange type ceramic package.
- $Z_{in}=1.5-j1.3\Omega$, $Z_{out}=5.0-j1.2\Omega$
  @$V_{CC}=7.2$V, f=175MHz, $P_O=6.0$W.

APPLICATION

For output stage of 5W power amplifiers in VHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C=25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		3	A
P_C	Collector dissipation	$T_C=25°C$	20	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

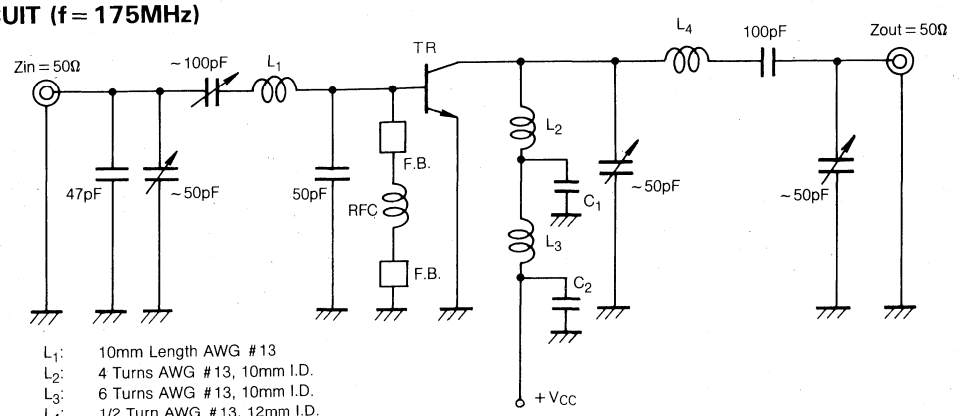
ELECTRICAL CHARACTERISTICS ($T_C=25°C$)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=5$mA, $I_C=0$	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C=50$mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cut-off current	$V_{CB}=10$V, $I_E=0$			500	μA
I_{EBO}	Emitter cut-off current	$V_{EB}=2$V, $I_C=0$			500	μA
h_{FE}	DC forward current gain *	$V_{CE}=5$V, $I_C=0.1$A	20	50	180	—
P_O	Power Output	$V_{CC}=7.2$V, Pin=0.3W, f=175MHz	6	7		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, $P_W=150\mu$s, duty 5%

NPN EPITAXIAL PLANAR TYPE

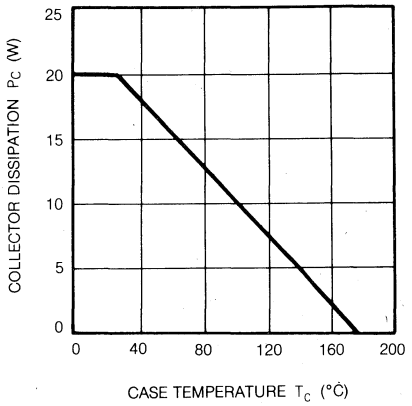
TEST CIRCUIT (f = 175MHz)



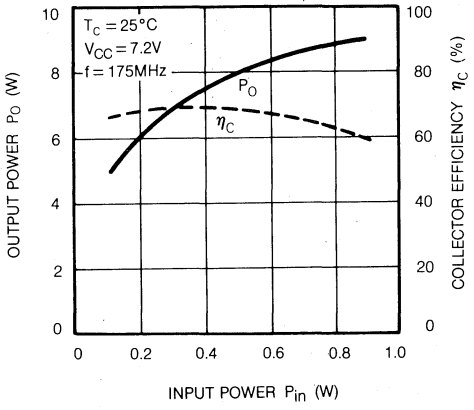
L_1: 10mm Length AWG #13
L_2: 4 Turns AWG #13, 10mm I.D.
L_3: 6 Turns AWG #13, 10mm I.D.
L_4: 1/2 Turn AWG #13, 12mm I.D.
RFC: 40 Turns AWG #32 Enameled wire Close Wound on 4mm O.D.
14mm Length Bakelite.
C_1: 220pF, 1000pF, 4700pF, 10μF in parallel.
C_2: 220pF, 1000pF, 4700pF, 10μF in parallel.

TYPICAL PERFORMANCE DATA

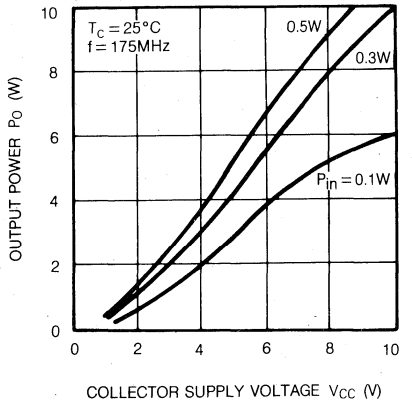
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



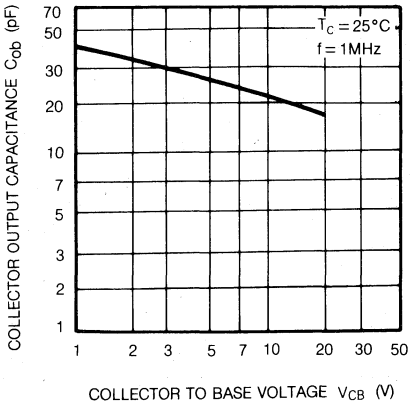
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS.



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



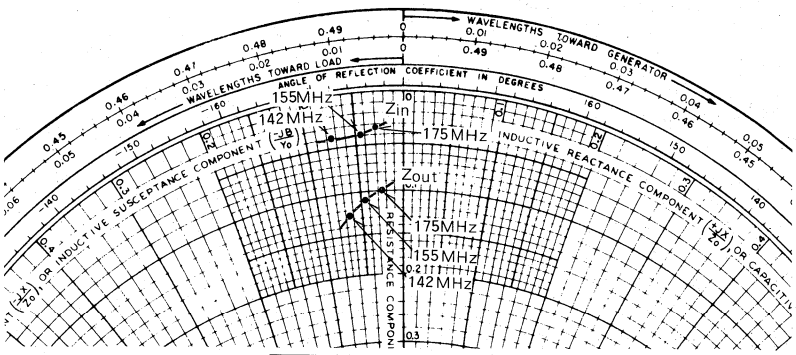
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

INPUT/OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS



f (MHz)	Zin (Ω)	Zout (Ω)
142	2.0—j3.6	6.0—j3.2
155	1.8—j2.0	5.4—j2.3
175	1.5—j1.3	5.0—j1.2
V_{CC}=7.2V, P_O=6W		

2SC3017

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3017 is a silicon NPN epitaxial planar type transistor specifically designed for VHF power amplifiers applications.

FEATURES

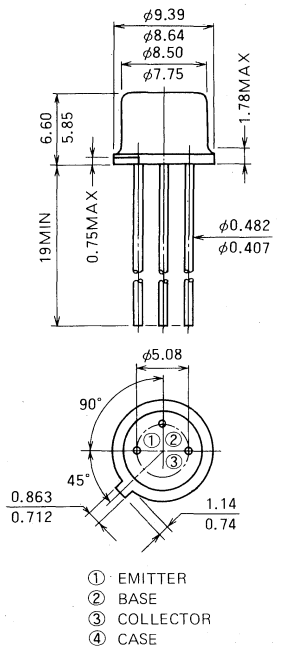
- High power gain: $G_{pe} \geqq 11$dB
  @$V_{CC}=7.2V$, $f=175MHz$, $P_{in}=0.1W$
- Emitter ballasted construction.
- Emitter case type TO-39 package.
  (connected internally to emitter)
- $Z_{in}=8-j12\Omega$, $Z_{out}=11-j1\Omega$
  @$V_{CC}=7.2V$, $f=175MHz$, $P_O=1.5W$.

APPLICATION

For drive stage and output stage of power amplifiers in VHF band portable radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS ($T_C=25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		1	A
P_C	Collector dissipation	$T_C=25°C$	4	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS ($T_C=25°C$)

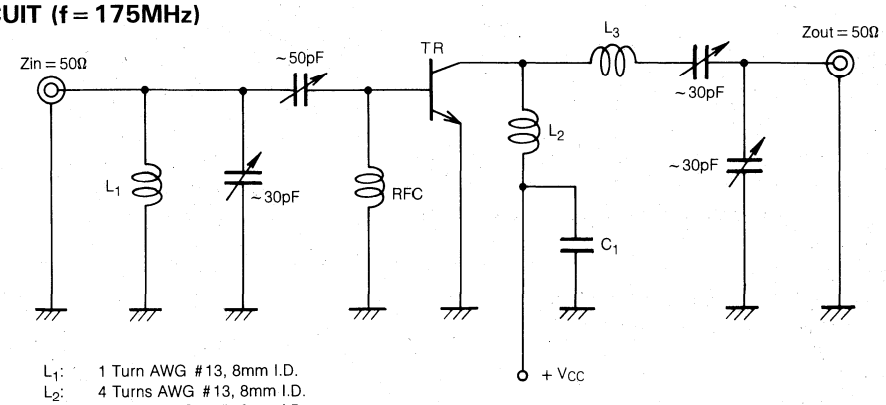
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=1mA$, $I_C=0$	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10mA$, $I_E=0$	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C=10mA$, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cut off current	$V_{CB}=10V$, $I_E=0$			200	μA
I_{EBO}	Emitter cut off current	$V_{EB}=2V$, $I_C=0$			200	μA
h_{FE}	DC forward current gain*	$V_{CE}=5V$, $I_C=0.1A$	20	50	180	—
P_O	Power Output	$V_{CC}=7.2V$, $P_{in}=0.1W$, $f=175MHz$	1.5	1.6		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, $P_W=150\mu s$, duty 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

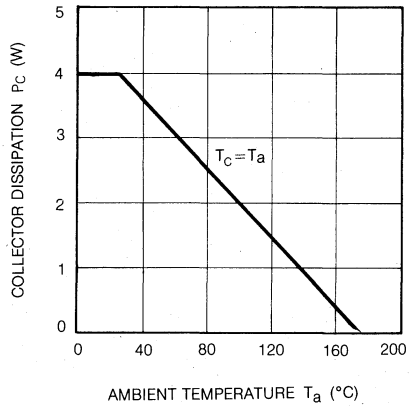
TEST CIRCUIT (f = 175MHz)



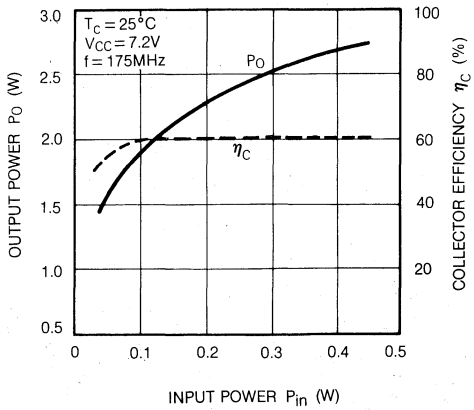
L_1: 1 Turn AWG #13, 8mm I.D.
L_2: 4 Turns AWG #13, 8mm I.D.
L_3: 2 Turns AWG #13, 8mm I.D.
RFC: 20 Turns AWG #26 Enameled wire Close Wound on 4mm O.D., 14mm Length Bakelite.
C_1: 0.022μF, 0.047μF, 0.1μF in parallel.

TYPICAL PERFORMANCE DATA

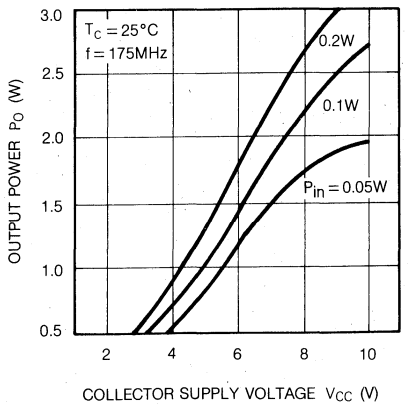
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS.



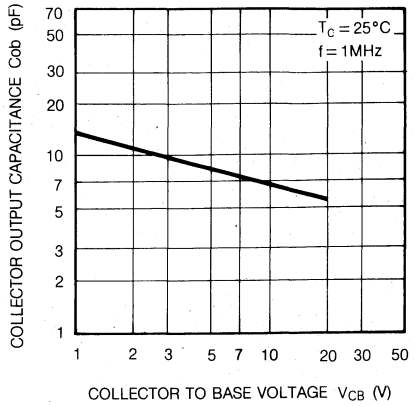
OUTPUT POWER COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS.



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS.



2SC3018

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3018 is a silicon NPN epitaxial planar type transistor designed for 7.2Volts VHF power amplifiers applications.

FEATURES

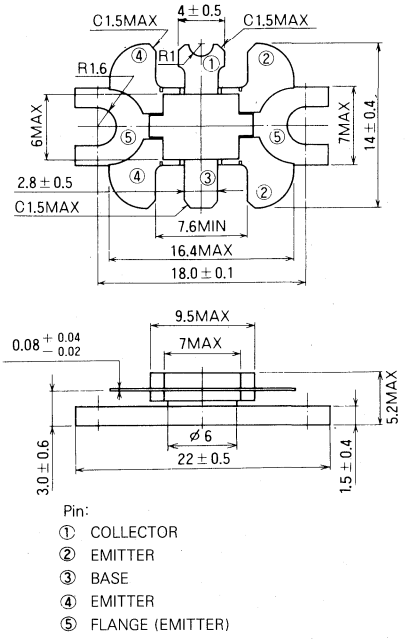
- High gain: Gpe ≧ 13dB @f = 175MHz, V_{CC} = 7.2V P_{in} = 0.15W.
- Convenient ceramic type package with flange for high gain and excellent heat dissipation.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 9V, P_O = 3W.

APPLICATION

Output stage of 2W portable type transmitter in VHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C)

Symbol	Parmeter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	R_{BE} = ∞	9	V
I_C	Collector current		1.5	A
P_C	Collector dissipation	T_C = 25°C	10	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 1mA, I_C = 0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 10mA, R_{BE} = ∞	9			V
I_{CBO}	Collector cut off current	V_{CB} = 10V, I_E = 0			300	μA
I_{EBO}	Emitter cut off current	V_{EB} = 2V, I_C = 0			300	μA
h_{FE}	DC forward current gain *	V_{CE} = 5V, I_C = 0.1A	20	50	180	—
P_O	Power Output	V_{CC} = 7.2V, P_{in} = 0.15W, f = 175MHz	3.0	3.5		W
η_C	Collector efficiency		55	60		%

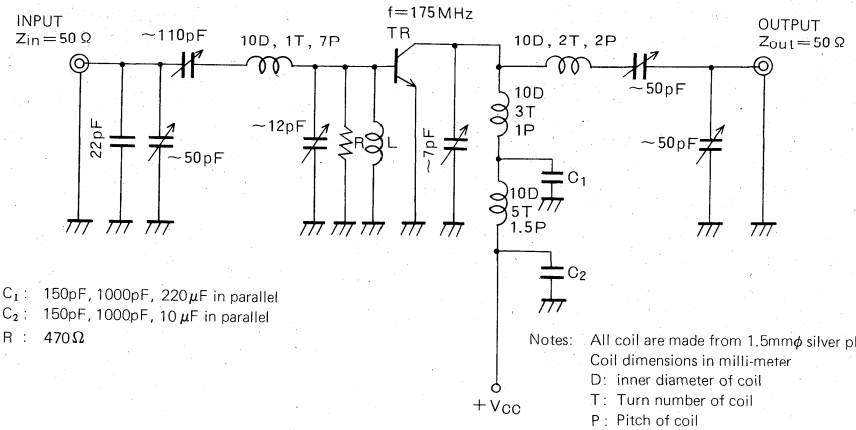
* Note: Pulse test, P_W = 150μs, duty 5%

MITSUBISHI ELECTRIC

2SC3018

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

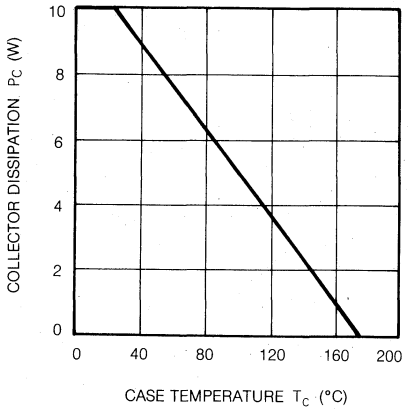


C_1 : 150pF, 1000pF, 220μF in parallel
C_2 : 150pF, 1000pF, 10μF in parallel
R : 470Ω

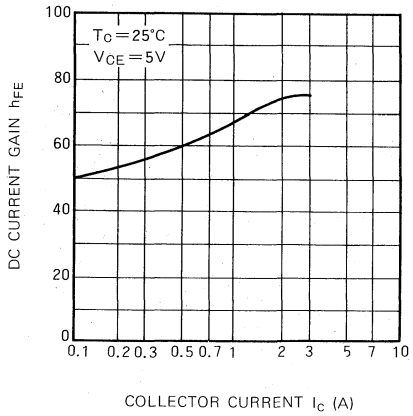
Notes: All coil are made from 1.5mmϕ silver plated copper wire
Coil dimensions in milli-meter
D: inner diameter of coil
T: Turn number of coil
P: Pitch of coil

TYPICAL PERFORMANCE DATA

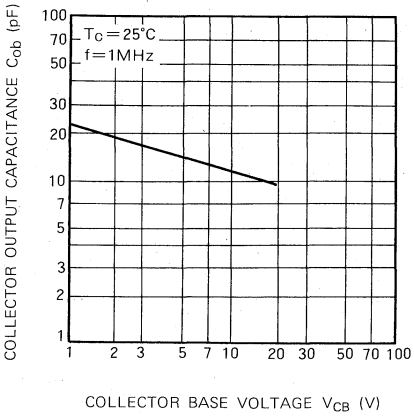
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



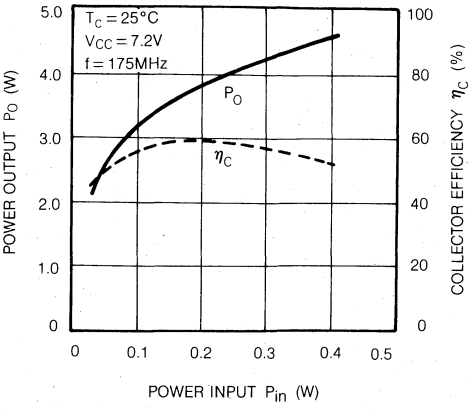
DC CURRENT GAIN VS. COLLECTOR CURRENT



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR BASE VOLTAGE

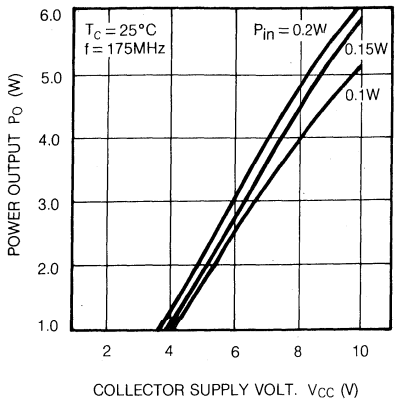


P_O, η_C VS. Pin CHARACTERISTICS

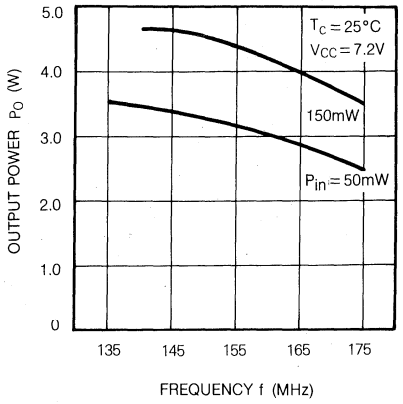


NPN EPITAXIAL PLANAR TYPE

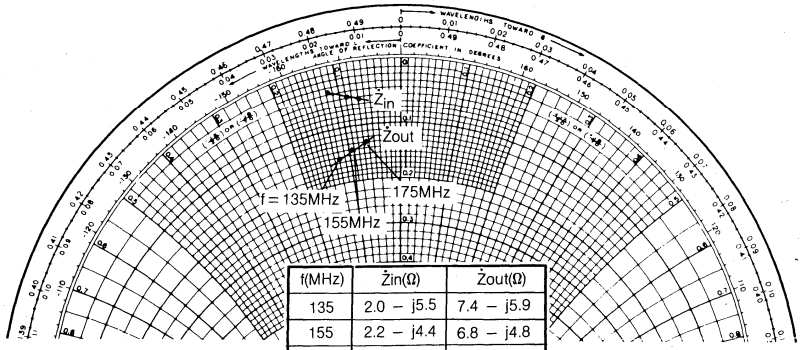
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



OUTPUT POWER VS. FREQUENCY CHARCTERISTICS



INPUT, OUTPUT IMPEDANCE VS. FREQUENCY CHARCTERISTICS



f(MHz)	Żin(Ω)	Żout(Ω)
135	2.0 – j5.5	7.4 – j5.9
155	2.2 – j4.4	6.8 – j4.8
175	2.5 – j3.5	6.5 – j3.75
Condition: $V_{CC} = 7.2V$ $P_O = 3.0W$		

2SC3019

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3019 is silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band.

FEATURES

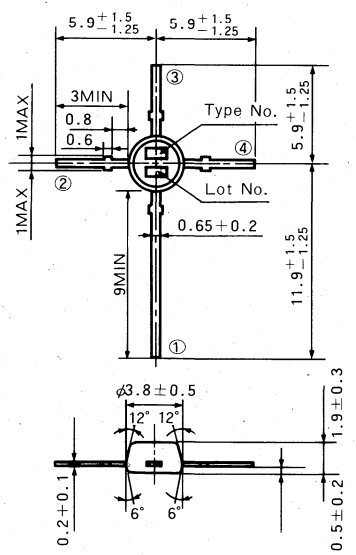
- High power gain: $G_{pe} \geqq 14$dB
  @P_O = 0.5W, f = 520MHz, V_{CC} = 12.5V
- Emitter ballasted construction for high reliability and good performance
- Small-disc-mold type package
- Collector dissipation: P_C = 0.6W, (@T_a = 25°C)
- Input/Output impedance:
  Z_{in} = 2.6 – j3.0Ω, Z_{out} = 16.5 – j56Ω
  @f = 520MHz, V_{CC} = 12.5V, P_O = 0.5W

APPLICATION

Exciter stage in UHF band mobile radio application

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		0.4	A
P_C	Collector dissipation	T_a=25°C	0.6	W
		T_C=25°C	0.9	W
T_j	Junction temperature		+135	°C
T_{stg}	Storage temperature		−55～+135	°C
R_{th-a}	Thermal resistance	Junction to ambient	250	°C/W
R_{th-c}		Junction to case	166	°C/W

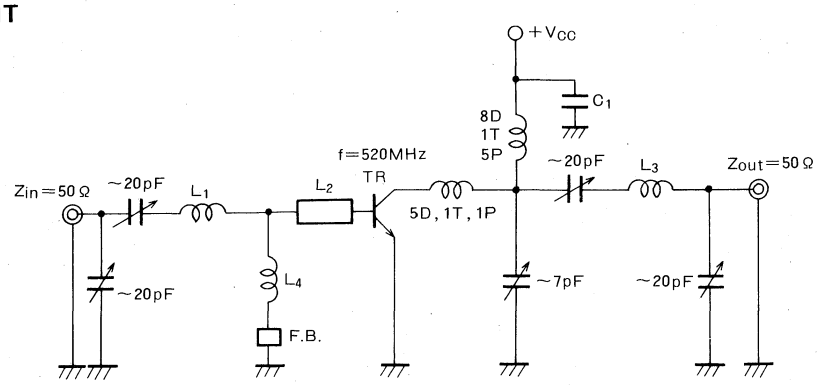
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=1mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=50mA	20	70	180	—
P_O	Output power	V_{CC}=12.5V, f=520MHz, P_{in}=20mW	500	600		W
η_C	Collector efficiency		40	50		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

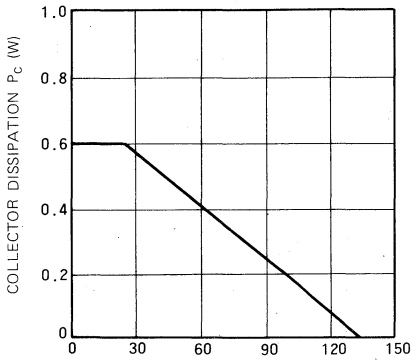


L_1: Length = 8, ϕ1.5 silver plated copper wire.
L_2: Width = 4, length = 12 (1.6 t glass-epoxy, ϵ_s = 4.7)
L_3: 10D, 1/2T, ϕ1.5 silver plated copper wire.
L_4: 3D, 8T, ϕ0.8 enameled wire.
C_1: 220pF, 330pF, 2200pF, 4700pF, 10μF in parallel

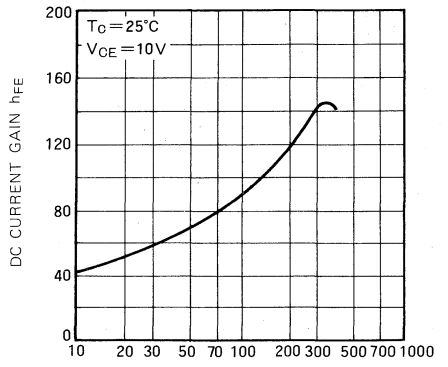
NOTES: ϕ1.5 silver plated copper wire except L_2 and L_4.
Dimension in milli-meter
D: Inner diameter of coil ferrite bead
T: Turn number of coil
P: Pitch of coil
F.B.: Ferrite bead

TYPICAL PERFORMANCE DATE

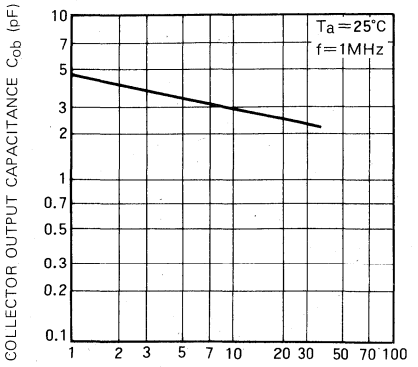
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



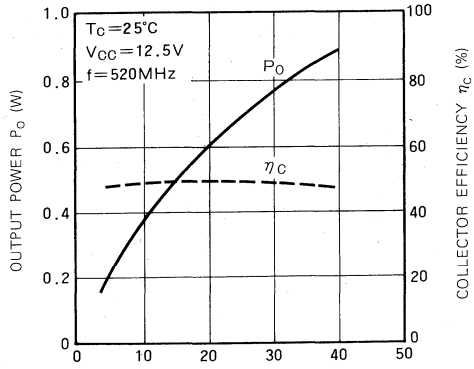
DC CURRENT GAIN VS. COLLECTOR CURRENT



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



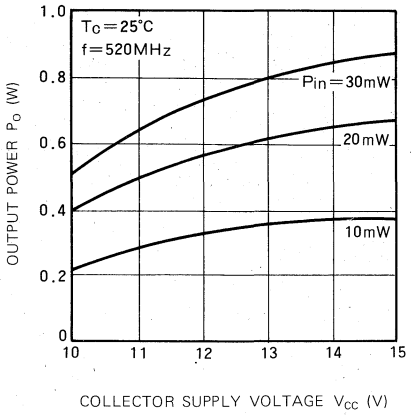
OUTPUT POWER · COLLECTOR EFFICIENCY VS. INPUT POWER



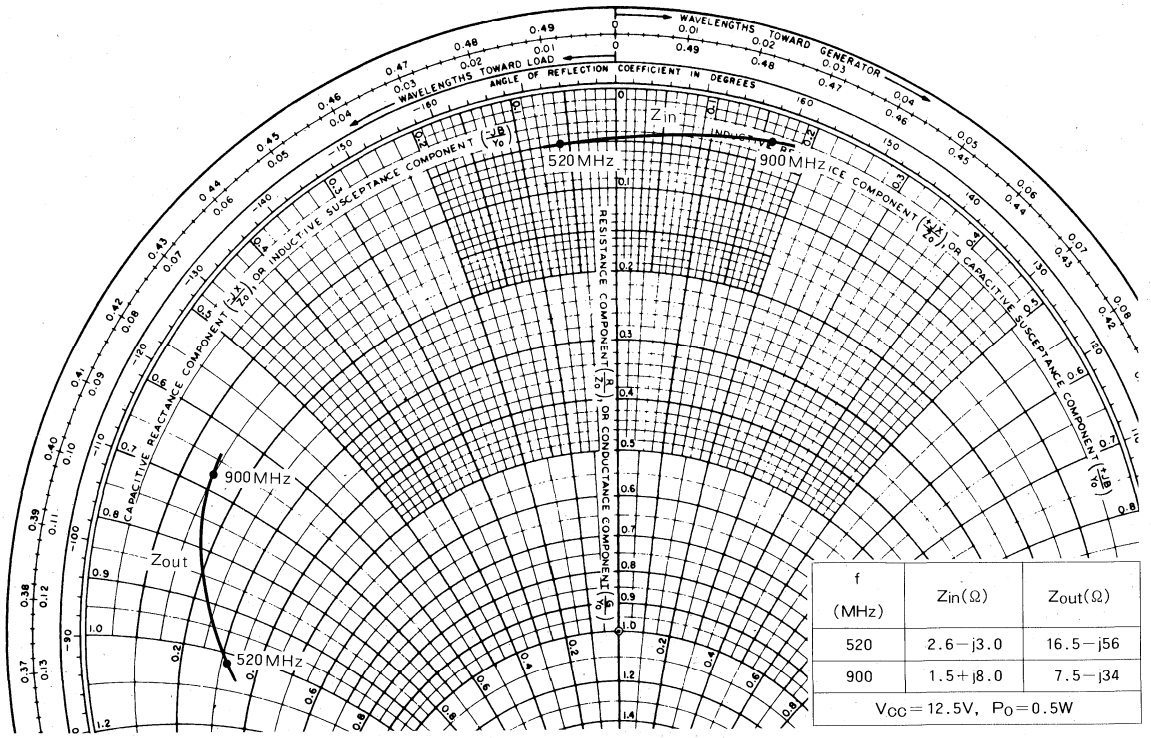
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



INPUT/OUTPUT IMPEDANCE

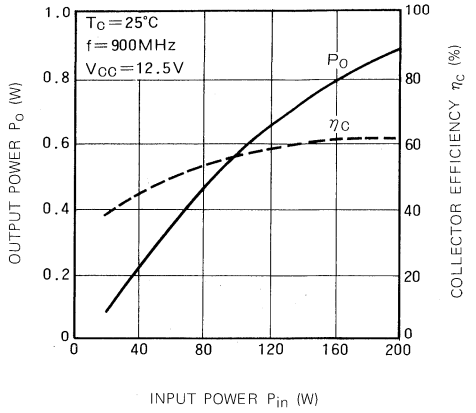


f (MHz)	Zin(Ω)	Zout(Ω)
520	2.6−j3.0	16.5−j56
900	1.5+j8.0	7.5−j34
V_{CC}=12.5V, P_O=0.5W		

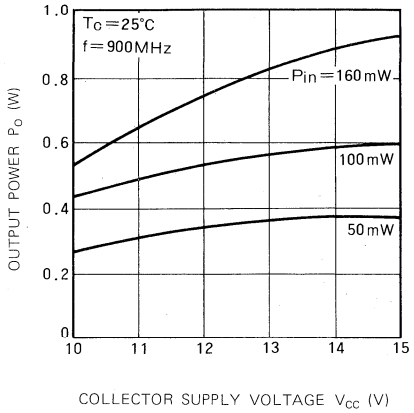
NPN EPITAXIAL PLANAR TYPE

REFERENCE DATA (f = 900MHz)

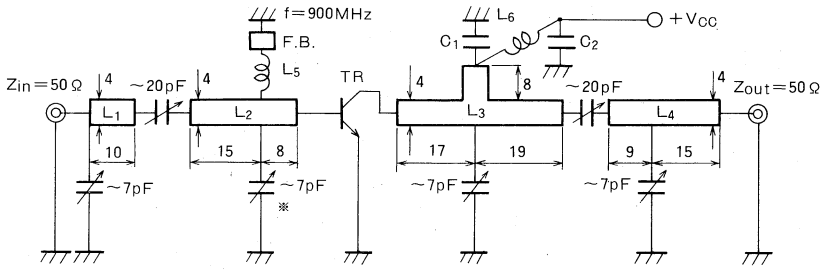
OUTPUT POWER · COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



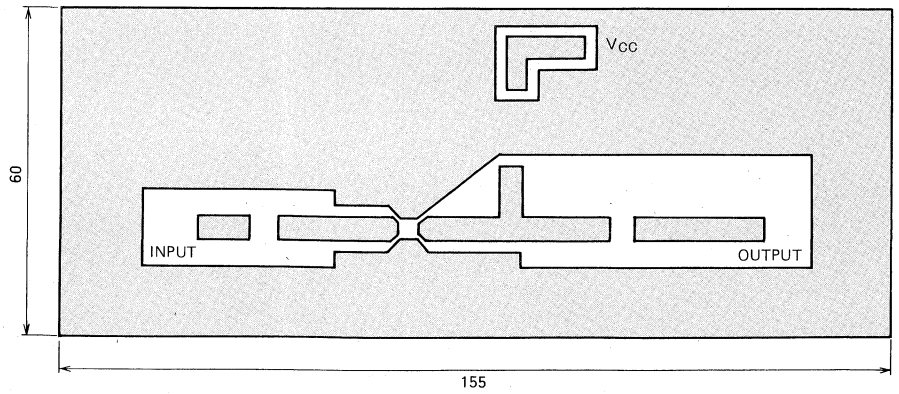
TEST CIRCUIT



L_1~L_4 : Strip-line: 1.6 t glass-teflon $\epsilon_r = 2.7$
L_5 : 4D, 6T, AWG #20 enameled wire (ϕ0.8 mm)
L_6 : 4D, 5T, AWG #20 enameled wire (ϕ0.8 mm)
F.B. : Ferrite bead
C_1 : 1000pF in parallel
C_2 : 100pF, 56pF, 560pF, 4.7μF in parallel

Unit: mm

MATCHING PATTERN



MITSUBISHI ELECTRIC

2SC3020

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3020 is a silicon NPN epitaxial planar type transistor designed for UHF power amplifier applications.

FEATURES

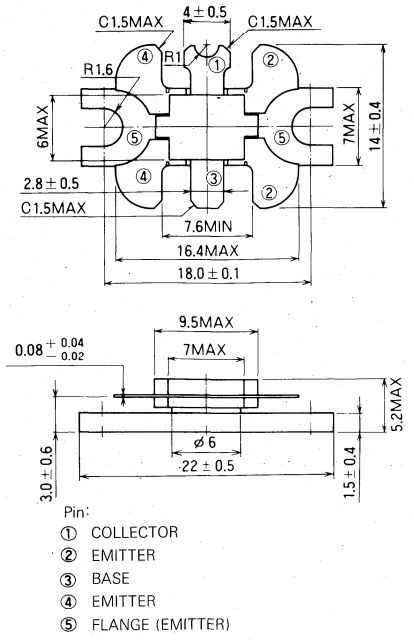
- High gain: $G_{pe} \geqq 10$dB, @f = 520MHz, $V_{CC} = 12.5$V, $P_{in} = 0.3$W.
- High ruggedness: Ability to withstand more than 20:1 load VSWR (all phase) when operated at $V_{CC} = 15.2$V, f = 520MHz, $P_O = 3$W.
- Emitter ballasted construction.
- Low thermal resistance: $R_{th} = 15$ °C/W($T_C = 25$°C)
- Convenient flange type ceramic package.

APPLICATION

For drive stage and output stage of 400MHz band mobile radio.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4.0	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	$T_C = 25$°C	10	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS ($T_C = 25$°C)

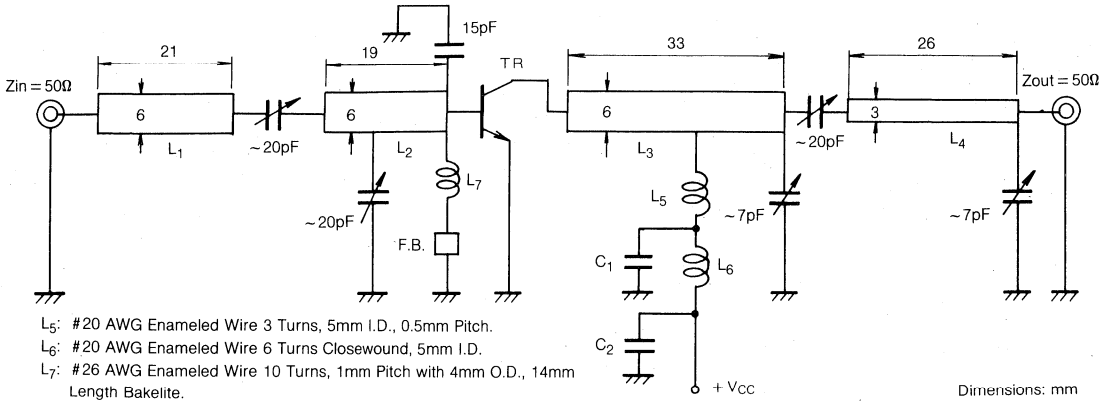
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 1$mA, $I_C = 0$	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 10$mA, $I_E = 0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 10$mA, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB} = 15$V, $I_E = 0$			300	μA
I_{EBO}	Emitter cut off current	$V_{EB} = 3.0$V, $I_C = 0$			300	μA
h_{FE}	DC forward current gain*	$V_{CE} = 10$V, $I_C = 0.1$A	10	50	180	—
P_O	Power Output	$V_{CC} = 12.5$V, $P_{in} = 0.3$W, f = 520MHz	3.0	3.5		W
η_C	Collector efficiency		50	55		%

* Note: Pulse test, $P_W = 150\mu s$, duty = 5%

2SC3020

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

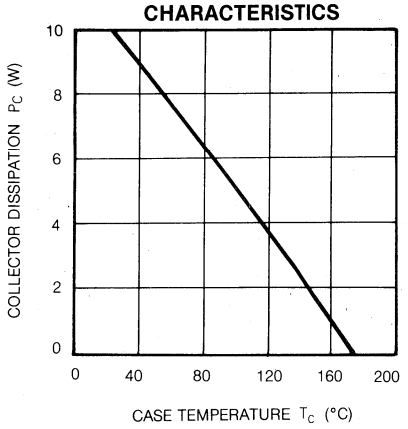


L_5: #20 AWG Enameled Wire 3 Turns, 5mm I.D., 0.5mm Pitch.
L_6: #20 AWG Enameled Wire 6 Turns Closewound, 5mm I.D.
L_7: #26 AWG Enameled Wire 10 Turns, 1mm Pitch with 4mm O.D., 14mm Length Bakelite.
$L_1 \sim L_4$: Microstripe (Board: 1.6mm Glass Teflon $\varepsilon_S = 2.7$)
C_1, C_2: 82pF, 220pF, 4700pF, 10μF in parallel.

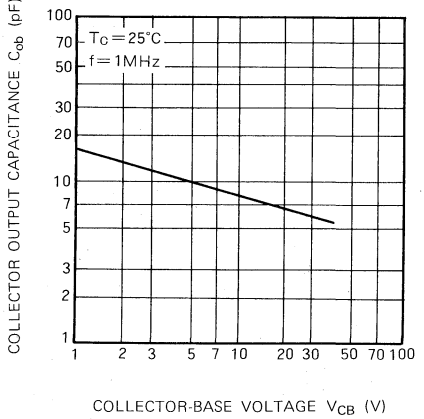
Dimensions: mm

TYPICAL PERFORMANCE DATA

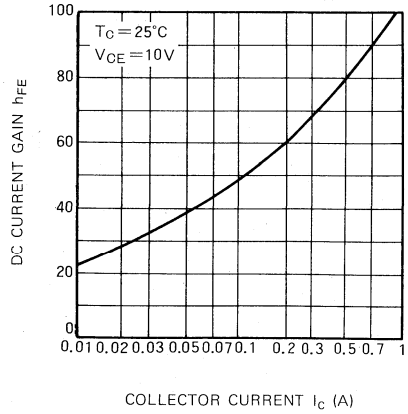
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



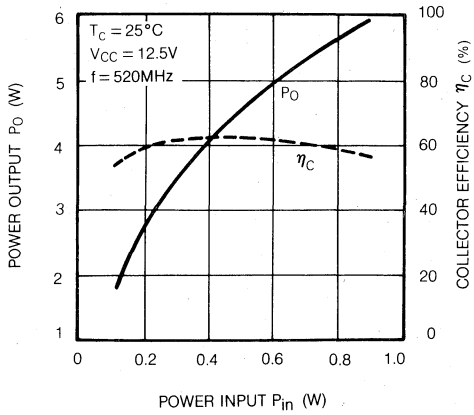
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR BASE VOLTAGE



DC CURRENT GAIN VS. COLLECTOR CURRENT



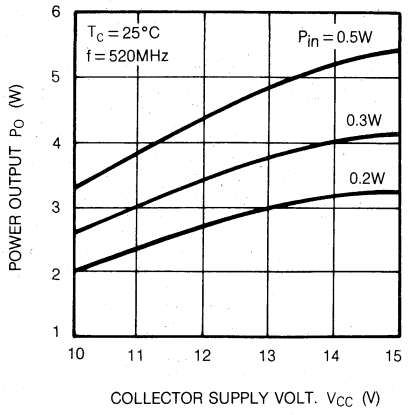
P_O, η_C VS. Pin CHARACTERISTICS



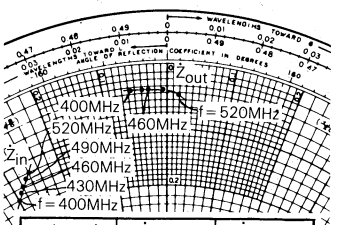
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS



f (MHz)	$\dot{Z}_{in}(\Omega)$	$\dot{Z}_{out}(\Omega)$
400	1.7−j2.9	8.0−j15
430	1.75−j2.1	7.5−j14.5
460	1.85−j1.35	7.0−j14
490	1.85−j0.3	6.5−j13.5
520	2.1+j0.85	6.0−j13

Conditions:
$P_O = 3.0W$, $T_C = 25°C$, $V_{CC} = 12.5V$

2SC3021

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3021 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifiers applications.

FEATURES

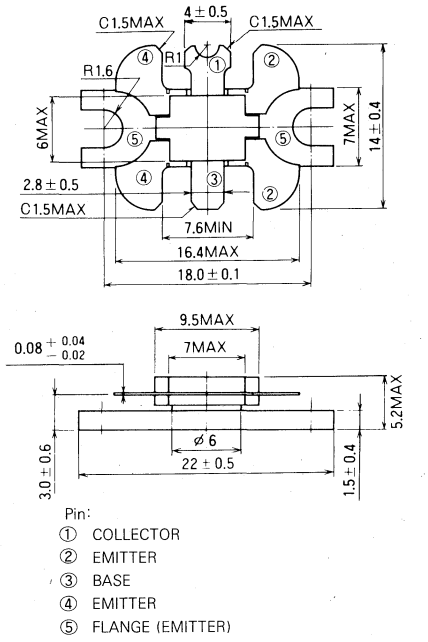
- High power gain: $G_{pe} \geqq 7.6$dB
  @$V_{CC}=12.5$V, f=520MHz, $P_{in}=1.2$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC}=15.2$V, f=520MHz, $P_O=7$W.
- Flange type ceramic package.
- $Z_{in}=2.2+j3.1\Omega$,
  $Z_{out}=6-j1.0\Omega$ @$V_{CC}=12.5$V, f=520MHz, $P_O=7$W.

APPLICATION

For output stage of 5W power amplifiers and drive stage of higher power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C=25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	$T_C=25°C$	20	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS ($T_C=25°C$)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=5$mA, $I_C=0$	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C=50$mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB}=15$V, $I_E=0$			500	μA
I_{EBO}	Emitter cut off current	$V_{EB}=3$V, $I_C=0$			500	μA
h_{FE}	DC forward current gain *	$V_{CE}=10$V, $I_C=0.1$A	10	50	180	—
P_O	Power Output	$V_{CC}=12.5$V, $P_{in}=1.2$W, f=520MHz	7	8		W
η_C	Collector efficiency		50	60		%

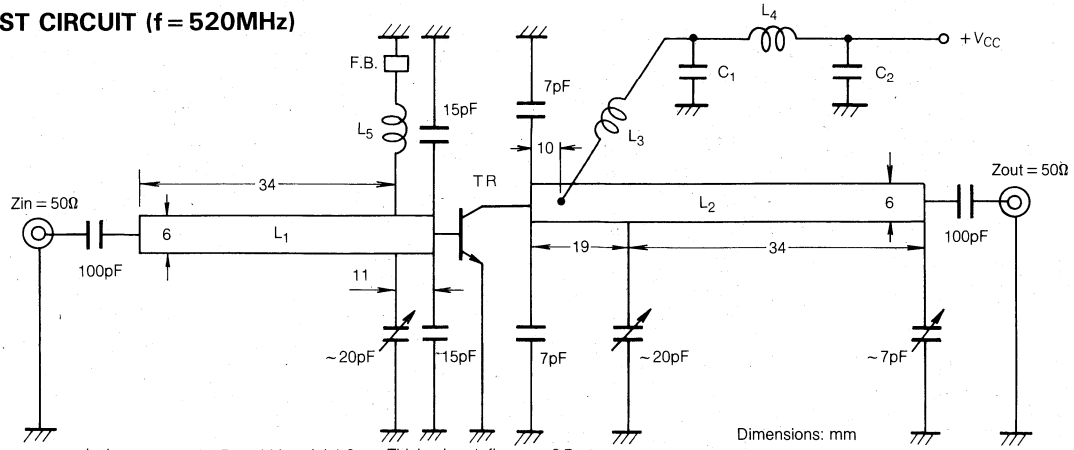
* Note: Pulse test, $P_W=150\mu$s, duty 5%

MITSUBISHI ELECTRIC

2SC3021

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

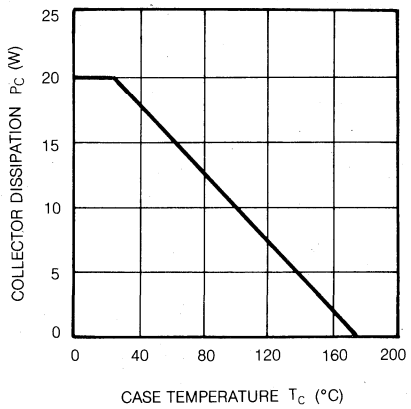


L_1, L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 3 Turns AWG #20, 5mm I.D.
L_4: 6 Turns AWG #20, 5mm I.D.
L_5: 10 Turns AWG #26 Enameled Wire on 4mm O.D., 14mm Length Bakelite.

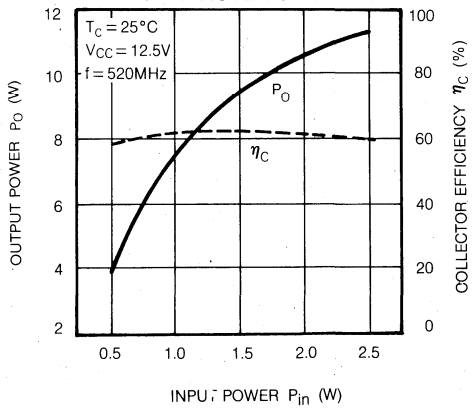
F.B.: Ferrite Bead
C_1: 82pF, 220pF, 4700pF, 10μF in parallel
C_2: 82pF, 220pF, 10μF in parallel

TYPICAL PERFORMANCE DATA

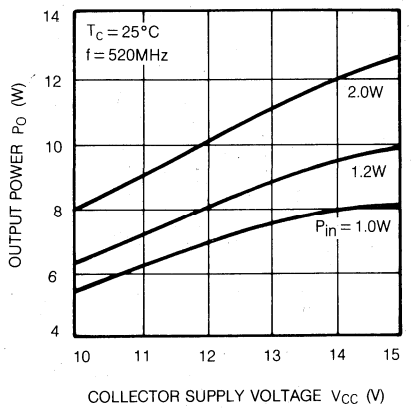
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



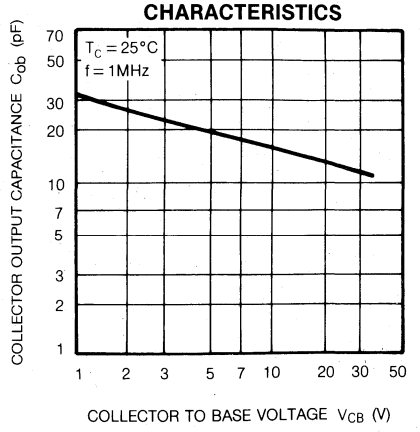
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS

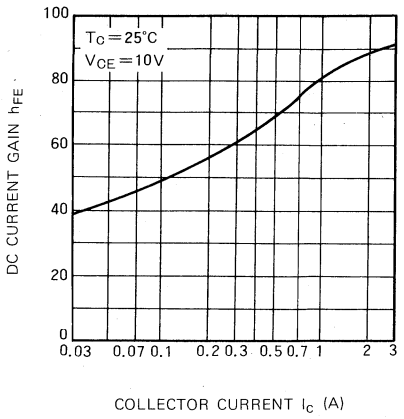


COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



NPN EPITAXIAL PLANAR TYPE

DC CURRENT GAIN
VS. COLLECTOR CURRENT



MITSUBISHI ELECTRIC

2SC3022

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3022 is a silicon NPN epitaxial planar type transistor specifically designed for UHF high power amplifier applications.

FEATURES

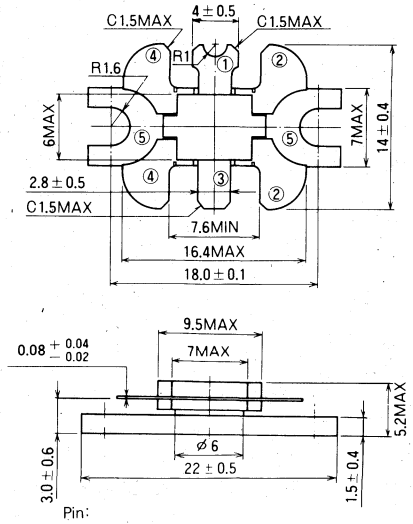
- High Power Gain: $G_{pe} \geqq 4.7$dB
  @$V_{CC}=12.5$V, f=520MHz, $P_{in}=6$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC}=15.2$V, f=520MHz, $P_O=18$W.
- Frange type ceramic package.
- $Z_{in}=1.5+j2.0\Omega$, $Z_{out}=2.8+j1.0\Omega$.
  @$V_{CC}=12.5$V, f=520MHz, $P_O=18$W.

APPLICATION

For output stage of 15W power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C=25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		7	A
P_C	Collector dissipation	$T_C=25°C$	50	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-a	Thermal resistance	Junction to ambient	50	°C/W
Rth-c		Junction to case	3	°C/W

ELECTRICAL CHARACTERISTICS ($T_C=25°C$)

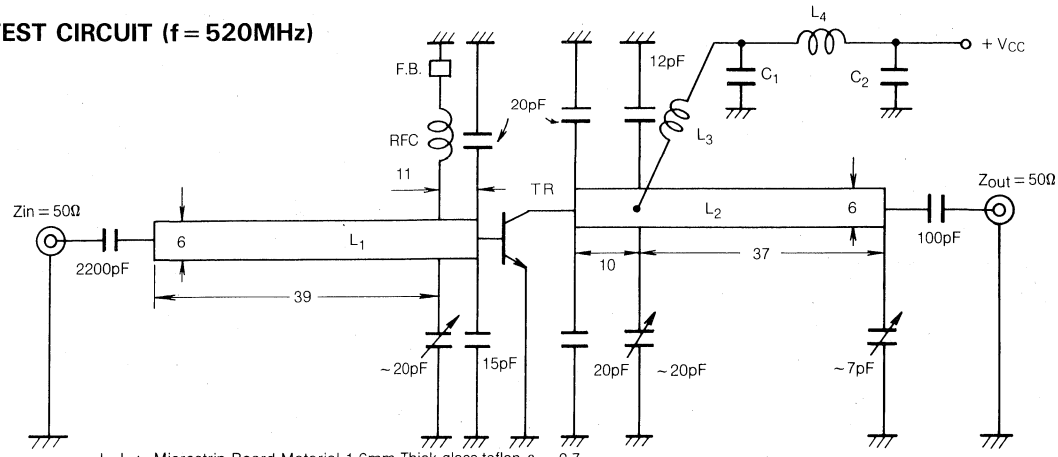
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=10$mA, $I_C=0$	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C=0.1$A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB}=15$V, $I_E=0$			2.0	mA
I_{EBO}	Emitter cut off current	$V_{EB}=3$V, $I_C=0$			3.0	mA
h_{FE}	DC forward current gain *	$V_{CE}=10$V, $I_C=1$A	20	50	180	—
P_O	Power Output	$V_{CC}=12.5$V, $P_{in}=6$W, f=520MHz	18	22		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, $P_W=150\mu$s, duty = 5%

2SC3022

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

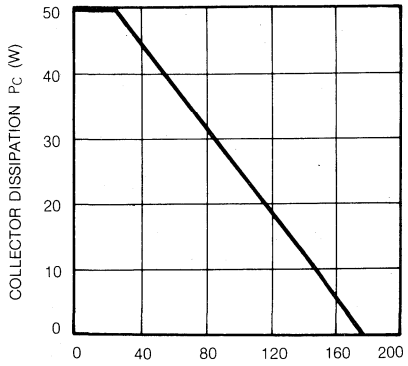


L_1,L_2: Microstrip Board Material 1.6mm Thick glass-teflon $\varepsilon_r = 2.7$
L_3: 3 Turns AWG #20, 8mm I.D.
L_4: 6 Turns AWG #20, 8mm I.D.
RFC: 8 Turns AWG #26 Enameled Wire on 4mm O.D., 14mm Length Bakelite.

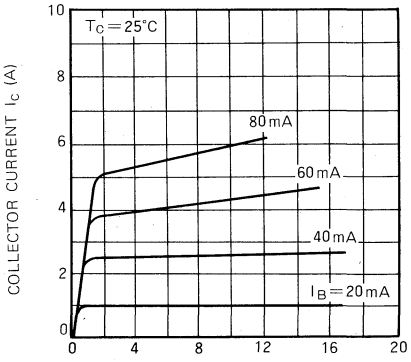
F.B.: Ferrite Bead
C_1: 68pF, 3300pF, 4700pF, 33μF in parallel
C_2: 3300pF, 4700pF, 33μF in parallel

TYPICAL PERFORMANCE DATA

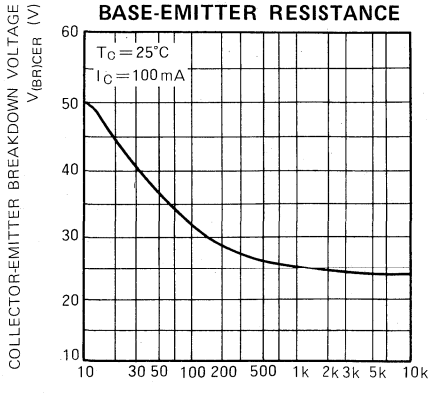
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



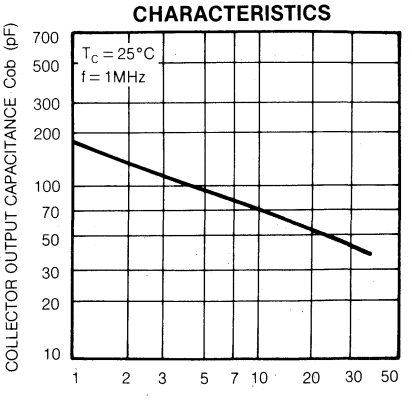
OUTPUT CHARACTRISTIC, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



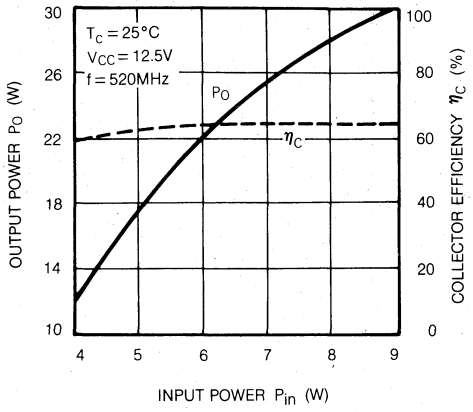
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



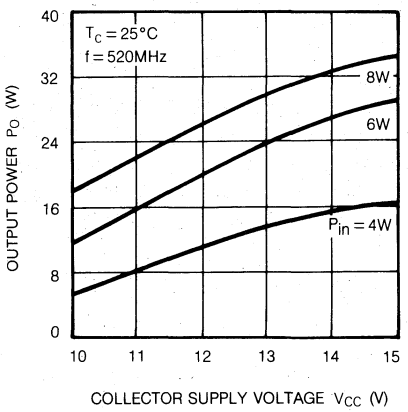
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

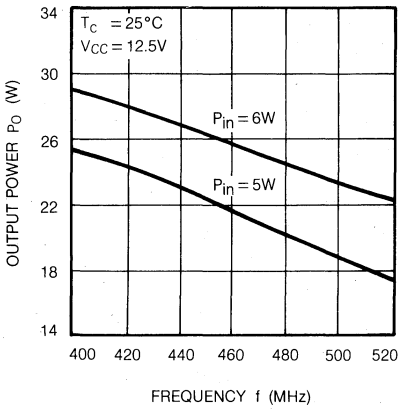
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



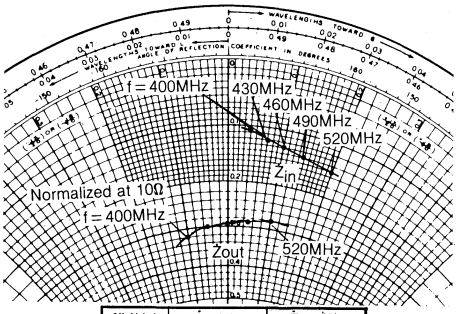
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISCTIS



OUTPUT POWER VS. FREQUENCY CHARACTERISTICS



SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS



f(MHz)	$\dot{Z}_{in}(\Omega)$	$\dot{Z}_{out}(\Omega)$
400	1.10 + j0.5	3.2 − j1.0
430	1.15 + j0.75	3.0 − j0.5
460	1.25 + j1.0	2.95 ± j0.0
490	1.35 + j1.4	2.9 + j0.5
520	1.50 + j2.0	2.8 + j1.0

Conditions:
$T_C = 25°C$, $V_{CC} = 12.5V$, $P_O = 18W$

PRECAUTIONS FOR MOUNTING HIGH-FREQUENCY HIGH-OUTPUT TRANSISTOR FOR MOBILE RADIO EQUIPMENT

When mounting high-frequency, high-output transistors for mobile radio equipment (flange screw fastening part cut package), care should be taken to the following points.

1. When mounting the device to the heat sink, silicon compound should be applied to the heat sink and device heat radiating fin and apply the device to the heat sink using a proper fastening tool.
2. If the device is soldered directly to heat sink, excessive thermal stress will result in deteriorating the reliability. Do not use this mounting method.
3. Care should be taken, if the device is applied to the heat sink, the force of soldering the leads to the printed circuit board results in continual mechanical stress, deteriorating the reliability and performance of the system.
4. Refer to Mitsubishi's DATADOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

2SC3101

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3101 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifiers applications.

FEATURES

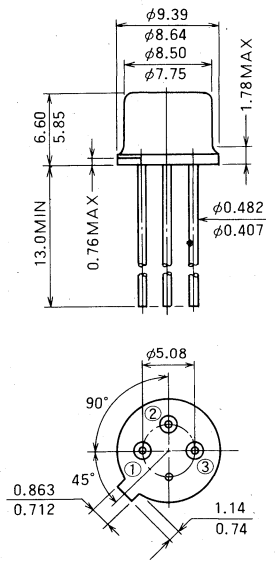
- High power gain: $G_{pe} \geqq 5.7$dB
  @V_{CC} = 12.5V, f = 520MHz, P_{in} = 0.8W
- Emitter ballasted construction
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at @V_{CC} = 15.2V, f = 520MHz, P_O = 3W.

APPLICATION

For drive stage and output stage of power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① EMITTER (CASE)
② BASE
③ COLLECTOR

EIAJ: TC-5, TB-5B
JEDEC: TO-39

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CEO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C = 25°C	10	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

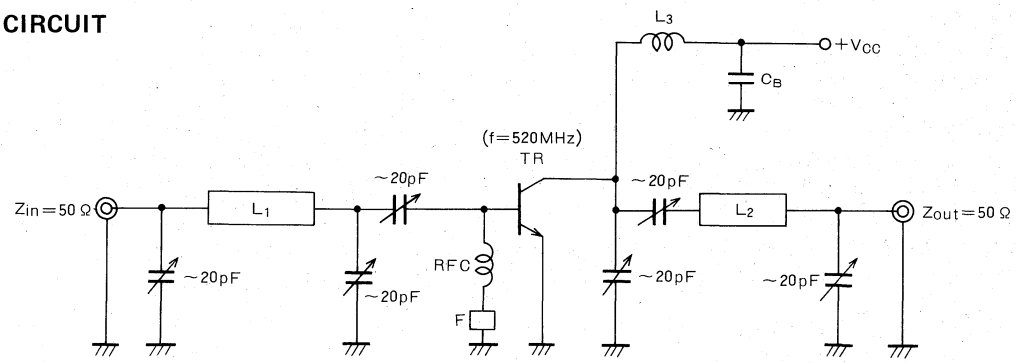
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 1mA, I_C = 0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 10mA, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB} = 15V, I_E = 0			300	μA
I_{EBO}	Emitter cutoff current	V_{EB} = 2V, I_C = 0			300	μA
h_{FE}	DC forward current gain *	V_{CB} = 10V, I_C = 0.1A	10		180	—
P_O	Output power	V_{CC} = 12.5V, P_{in} = 0.8W, f = 520MHz.	3	3.5		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

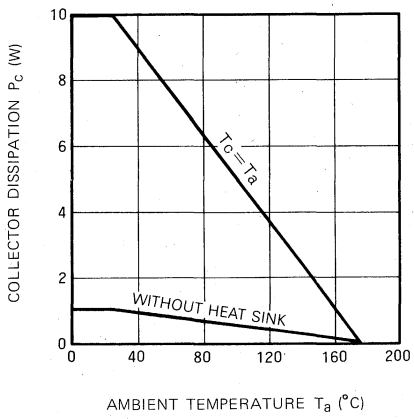


L_1 : Width 3.5, length 25, thinkness 0.3 cupper plate
L_2 : Width 3.5, length 17, thinkness 0.3 cupper plate
L_3 : 5Ω, 2T, 1P, ϕ0.8 enameled wire
RFC: j0, 5D, 6T, 0.5P ϕ0.8 enameled wire

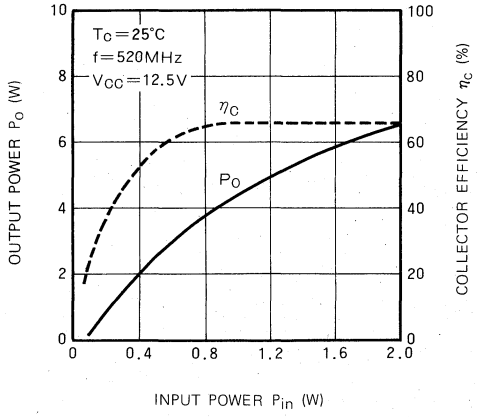
C_B : 150pF, 1500pF, 3.3μF in parallel
F : Ferrite bead
(Note) D: Inner diameter T: Turn numbers of coil
P : Pitch of coil Dimensions: mm

TYPICAL PERFORMANCE DATA

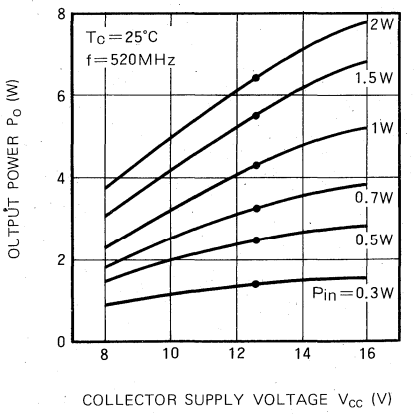
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



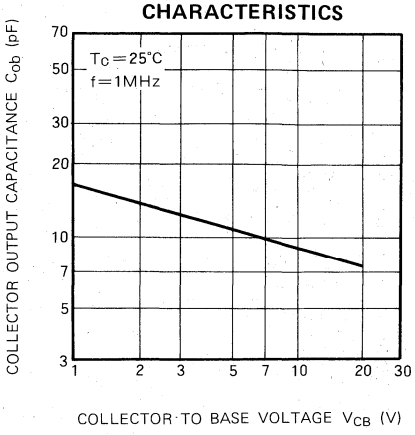
OUTPUT POWER COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



2SC3102

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3102 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers applications in UHF band.

FEATURES

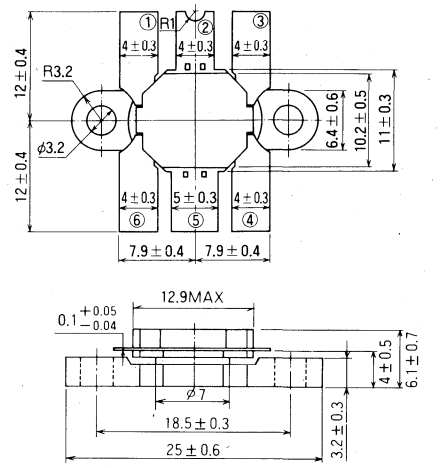
- High power output and high gain: $P_O \geqq 60W$, $Gpe \geqq 4.8dB$ @$V_{CC} = 12.5V$, $f = 520MHz$, $P_{in} = 20W$.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC} = 15.2V$, $P_O = 60W$, $f = 520MHz$.
- High reliability due to gold metalization die
- Flange type ceramic package
- $Z_{in} = 1.0 + j1.0\Omega$, $Z_{out} = 1.1 + j1.0\Omega$ @$V_{CC} = 12.5V$, $f = 520MHz$, $P_O = 60W$.

APPLICATION

For output stage of 50W power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



Pin:
① EMITTER (FLANGE)
② COLLECTOR
③ EMITTER (FLANGE)
④ EMITTER (FLANGE)
⑤ BASE
⑥ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		18	A
P_C	Collector dissipation	$T_C = 25°C$	170	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

ELECTRICAL CHARACTERISTICS ($T_C = 25°C$)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 20mA$, $I_C = 0$	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 20mA$, $I_E = 0$	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 0.2A$, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cut off current	$V_{CB} = 15V$, $I_E = 0$			5	mA
I_{EBO}	Emitter cut off current	$V_{EB} = 3V$, $I_C = 0$			5	mA
h_{FE}	DC forward current gain *	$V_{CE} = 10V$, $I_C = 2A$	10	50	180	—
P_O	Power Output	$V_{CC} = 12.5V$, $P_{in} = 20W$, $f = 520MHz$	60	65		W
η_C	Collector efficiency		60	65		%

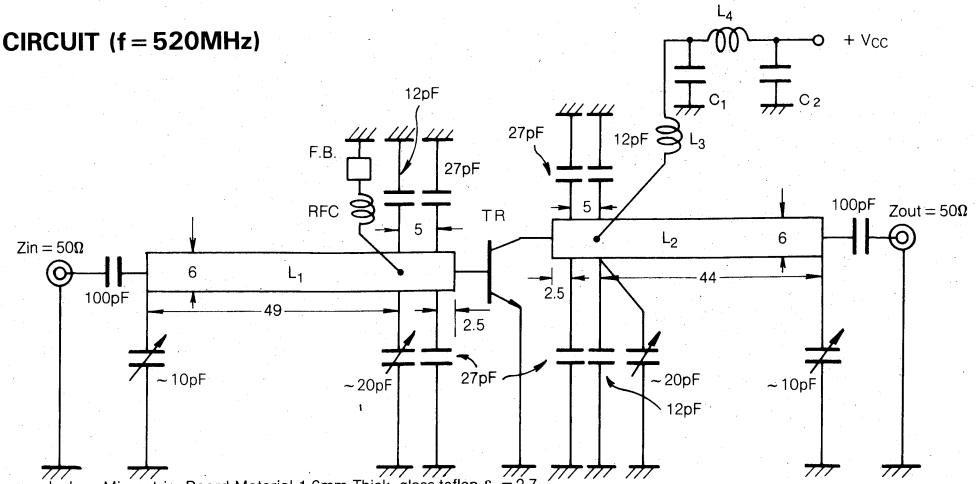
* Note: Pulse test, $P_W = 150\mu s$, duty 5%

MITSUBISHI ELECTRIC

2SC3102

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)



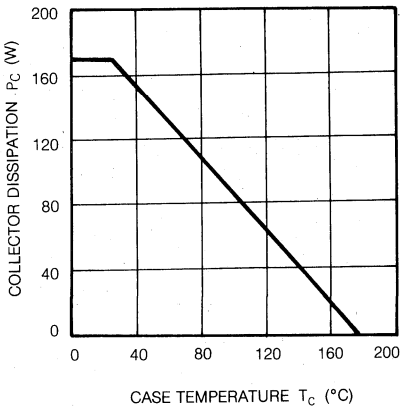
L_1,L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 1 Turn, AWG #13, 8mm I.D.
L_4: 4 Turns, AWG #13, 8mm I.D.
RFC: 8 Turns, AWG #20, 4mm I.D.

Dimensions: mm

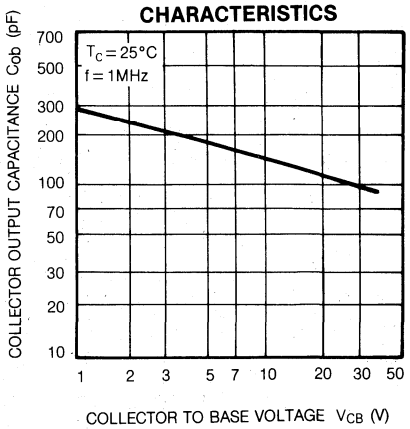
F.B.: Ferrite Bead
C_1: 82pF, 220pF, 2200pF, 4700pF, 33μF in Parallel
C_2: 82pF, 220pF, 2200pF, 4700pF, 22μF in Parallel

TYPICAL PERFORMANCE DATA

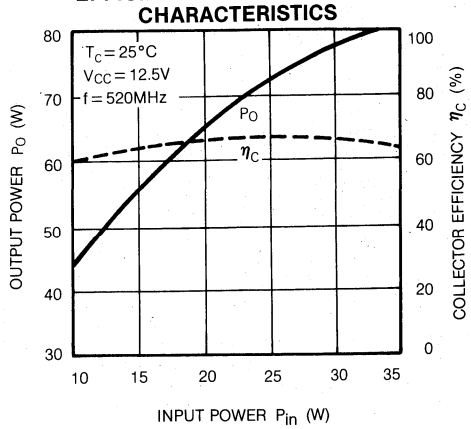
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



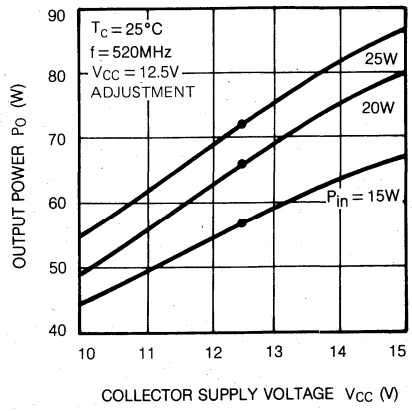
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS

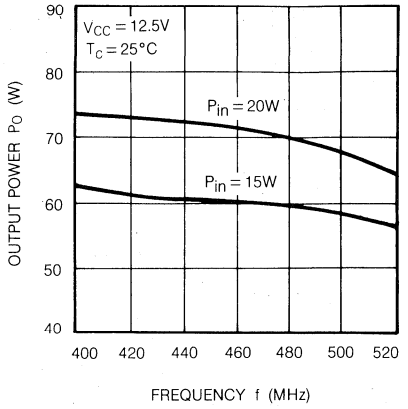


OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS

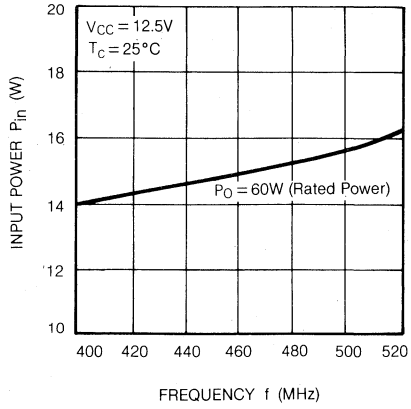


NPN EPITAXIAL PLANAR TYPE

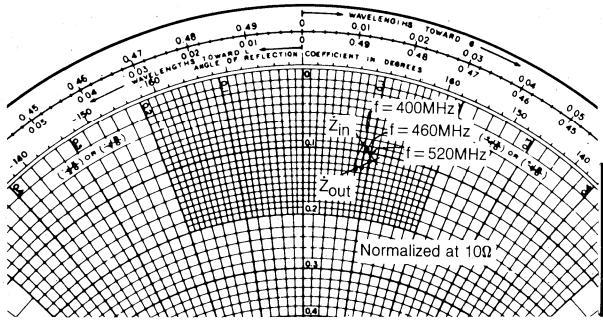
OUTPUT POWER VS. FREQUENCY CHARACTERISTICS



INPUT POWER VS. FREQUENCY CHARACTERISTICS @ RATED POWER

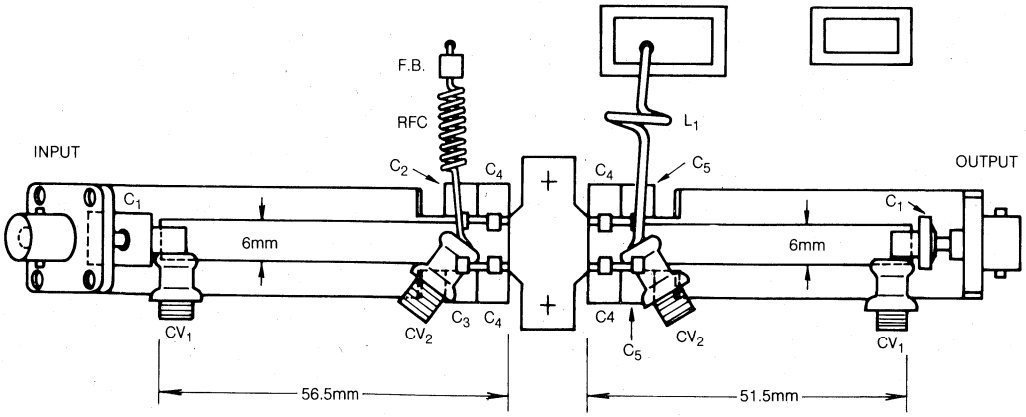


SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS, 2SC3102



f(MHz)	$\dot{Z}_{in}(\Omega)$	$\dot{Z}_{out}(\Omega)$
400	0.9 + j0.9	1.1 + j1.0
460	0.95 + j0.95	1.18 + j0.9
520	1.0 + j1.0	1.25 + j0.8
Conditions: V_{CC} = 12.5V P_O = 60W		

TEST CIRCUIT BOARD LAYOUT (f = 520MHz)



C_1: 100pF (Ribbon Lead Mica)
C_2: 12pF (Ribbon Lead Mica)
C_3: 0
C_4: 27pF (Ribbon Lead Mica)
C_5: 12pF (Ribbon Lead Mica)

CV_1: ~10pF (Air Variable Capacitor) muRata TTA 43 A 100A
CV_2: ~20pF (Air Variable Capacitor) muRata TTA 45 A 200A
F.B.: Ferrite Bead

RFC: 8 Turns, AWG #20, 4mm I.D.
L_1: 1 Turn, AWG #13, 8mm I.D.
Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon r = 2.7$

2SC3103

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3103 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifier applications.

FEATURES

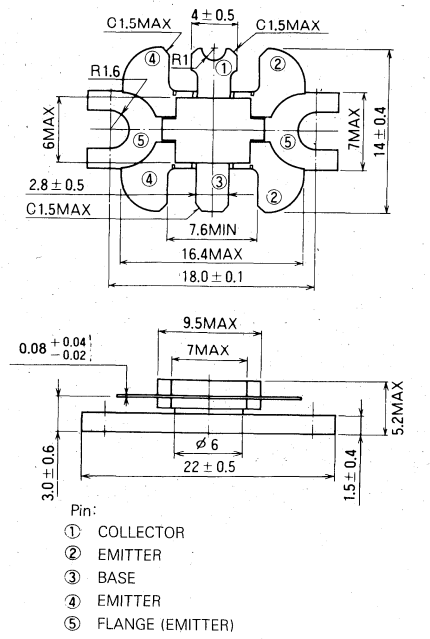
- High power gain: $G_{pe} \geqq 6.7$dB @$V_{CC}=7.2$V, f=520MHz, $P_{in}=0.6$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC}=9$V, f=520MHz, $P_O=2.8$W
- Flange type ceramic package
- $Z_{in}=1.8-j1.9\ \Omega$, $Z_{out}=6.0-j3.0\ \Omega$ @$V_{CC}=7.2$V, f=520MHz, $P_O=2.8$W.

APPLICATION

For drive stage of 5W power amplifiers and output stage of up to 2W power amplifiers in UHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C=25$°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	9	V
I_C	Collector current		1.5	A
P_C	Collector dissipation	$T_C=25$°C	10	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-c	Thermal resistance	Junction to case	15	°C/W

ELECTRICAL CHARACTERISTICS ($T_C=25$°C)

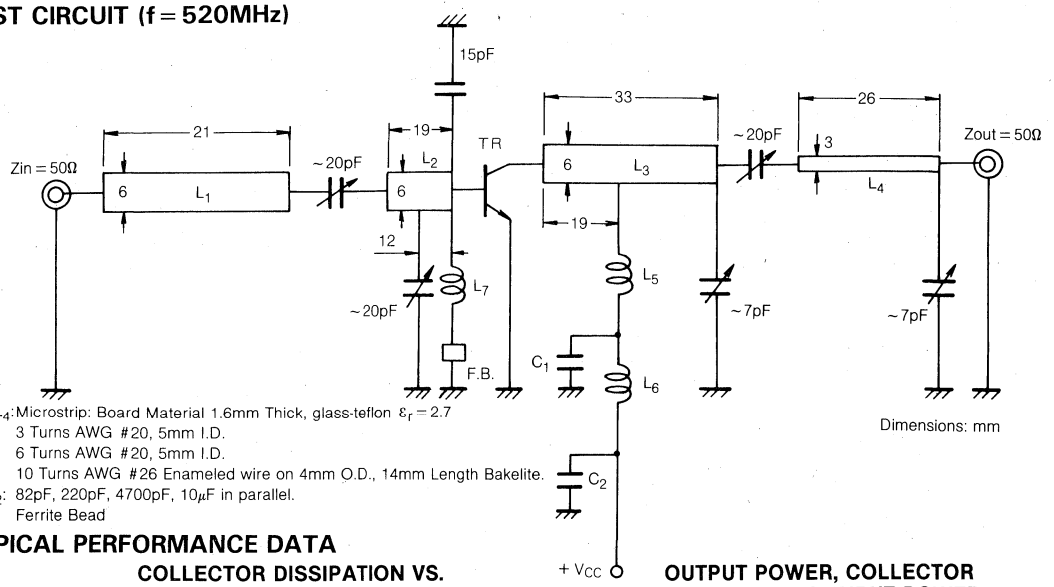
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=1$mA, $I_C=0$	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C=10$mA, $R_{BE}=\infty$	9			V
I_{CBO}	Collector cut-off current	$V_{CB}=10$V, $I_E=0$			300	μA
I_{EBO}	Emitter cut-off current	$V_{EB}=2$V, $I_C=0$			300	μA
h_{FE}	DC forward current gain *	$V_{CE}=5$V, $I_C=0.1$A	10	50	180	—
P_O	Power Output	$V_{CC}=7.2$V, $P_{in}=0.6$W, f=520MHz	2.8	3.2		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, $P_W=150\mu$s, duty 5%

2SC3103

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

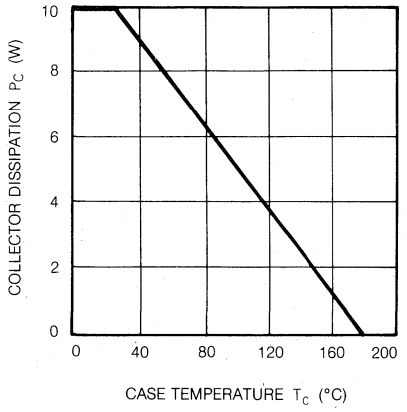


Dimensions: mm

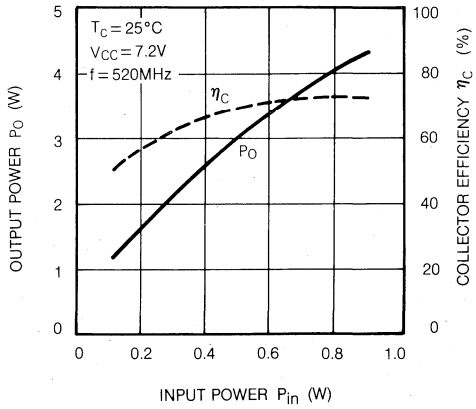
$L_1 \sim L_4$: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_5: 3 Turns AWG #20, 5mm I.D.
L_6: 6 Turns AWG #20, 5mm I.D.
L_7: 10 Turns AWG #26 Enameled wire on 4mm O.D., 14mm Length Bakelite.
C_1, C_2: 82pF, 220pF, 4700pF, 10μF in parallel.
F.B.: Ferrite Bead

TYPICAL PERFORMANCE DATA

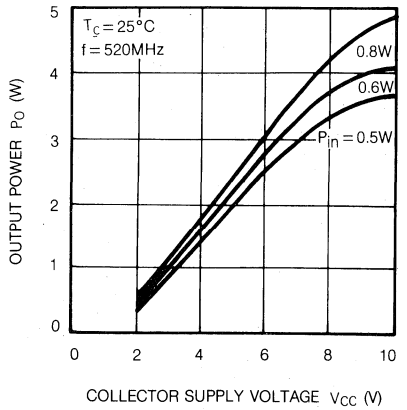
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



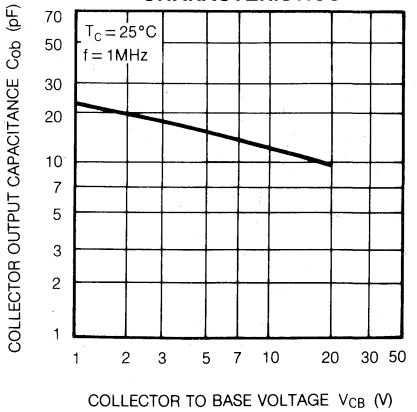
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



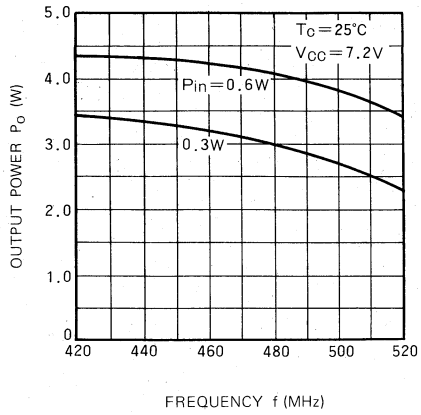
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



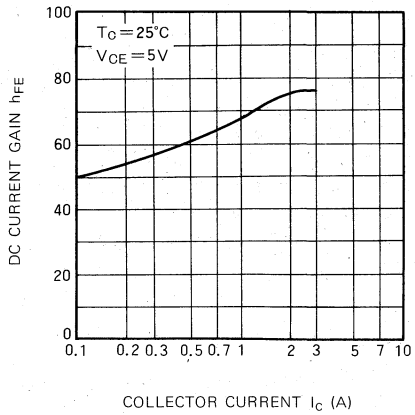
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

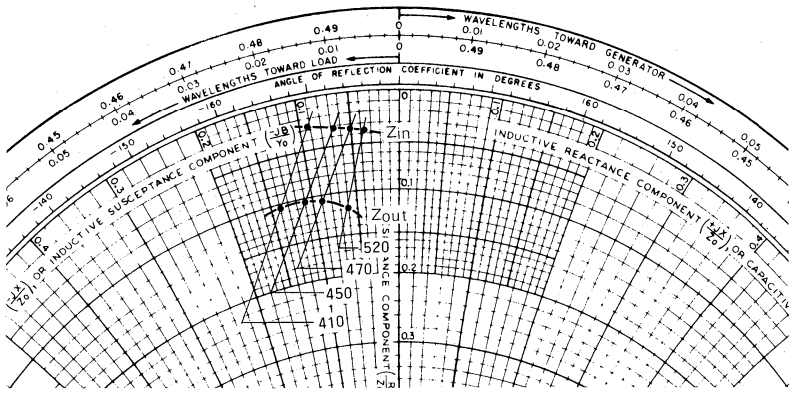
OUTPUT VS. FREQUENCY



DC CURRENT GAIN VS. COLLECTOR CURRENT



INPUT/OUTPUT IMPEDANCE VS. FREQUENCY



f (MHz)	Zin (Ω)	Zout (Ω)
410	1.5—j4.5	5.5—j7.0
450	1.5—j3.5	5.3—j5.5
470	1.6—j2.5	5.4—j4.5
520	1.8—j1.9	6.0—j3.0
V_{CC}=7.2V, P_O=2.8W		

2SC3104

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3104 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifier applications.

FEATURES

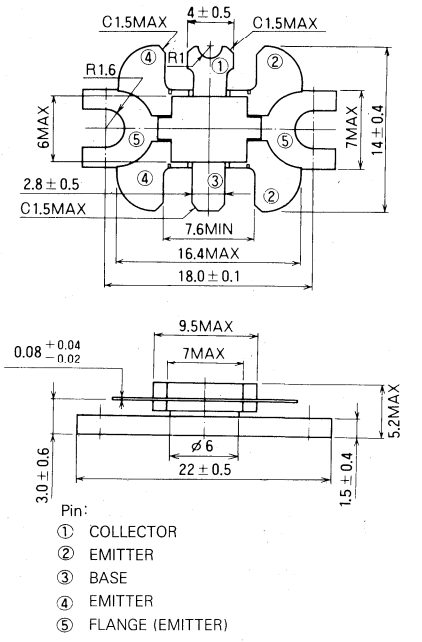
- High power gain: $G_{pe} \geqq 4.7$dB
  @$V_{CC} = 7.2$V, f = 520MHz, $P_{in} = 2$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC} = 9$V, f = 520MHz, $P_O = 6$W.
- Flange type ceramic package.
- $\dot{Z}_{in} = 1.6 - 0.4\ \Omega$, $\dot{Z}_{out} = 3.5 - j1.0\ \Omega$ at $V_{CC} = 7.2$V, f = 520MHz, $P_O = 6$W.

APPLICATION

For output stage of 5W power amplifiers in UHF band portable type radio set.

OUTLINE DRAWING

Dimensions in mm



Pin:
① COLLECTOR
② EMITTER
③ BASE
④ EMITTER
⑤ FLANGE (EMITTER)

ABSOLUTE MAXIMUM RATINGS ($T_C = 25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	9	V
I_C	Collector current		3	A
P_C	Collector dissipation	$T_C = 25°C$	20	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-c	Thermal resistance	Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS ($T_C = 25°C$)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 5$mA, $I_C = 0$	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 10$mA, $I_E = 0$	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 50$mA, $R_{BE} = \infty$	9			V
I_{CBO}	Collector cut off current	$V_{CB} = 10$V, $I_E = 0$			500	μA
I_{EBO}	Emitter cut off current	$V_{EB} = 2$V, $I_C = 0$			500	μA
h_{FE}	DC forward current gain *	$V_{CE} = 5$V, $I_C = 0.1$A	10	50	180	—
P_O	Power Output	$V_{CC} = 7.2$V, $P_{in} = 2$W, f = 520MHz	6	7		W
η_C	Collector efficiency		60	65		%

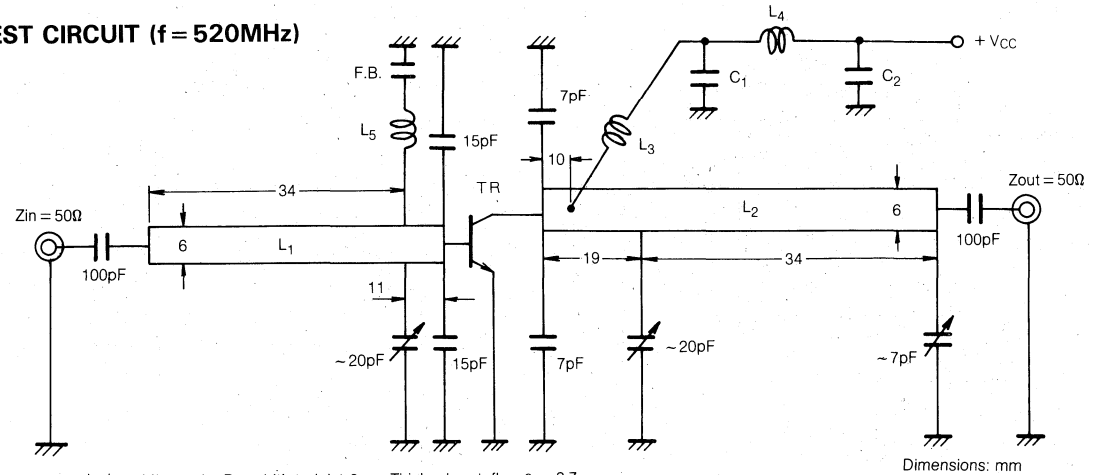
* Note: Pulse test, $P_W = 150\mu$s, duty 5%

MITSUBISHI ELECTRIC

2SC3104

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)



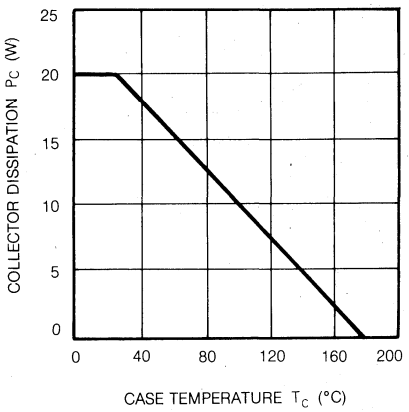
Dimensions: mm

L_1,L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 3 Turns AWG #20, 5mm I.D.
L_4: 6 Turns AWG #20, 5mm I.D.
L_5: 10 Turns AWG #26 Enameled Wire on 4mm O.D., 14mm Length Bakelite.

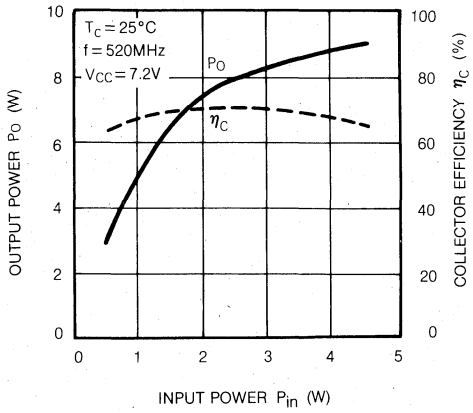
F.B.: Ferrite Bead
C_1: 82pF, 220pF, 4700pF, 10μF in parallel.
C_2: 82pF, 220pF, 10μF in parallel.

TYPICAL PERFORMANCE DATA

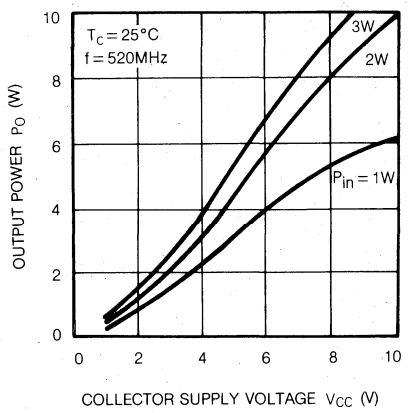
COLLECTOR DISSIPATION VS. CASE TEMPERATURE



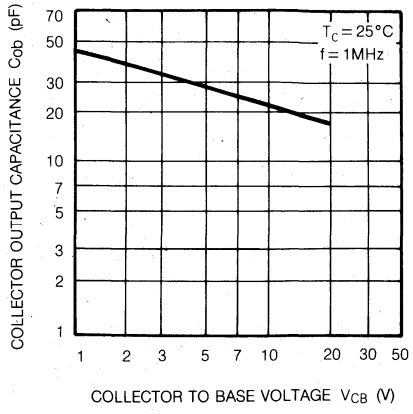
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE

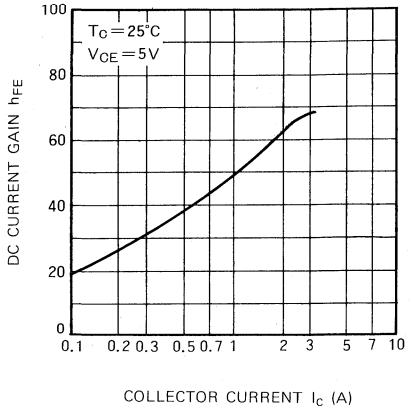


COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE

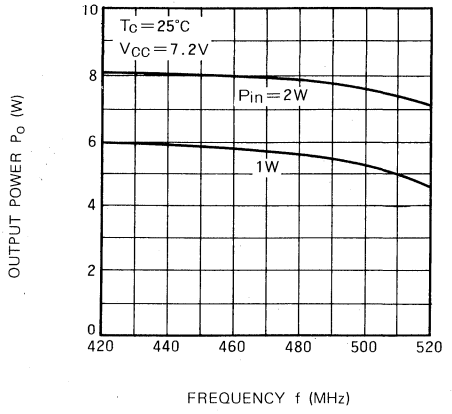


NPN EPITAXIAL PLANAR TYPE

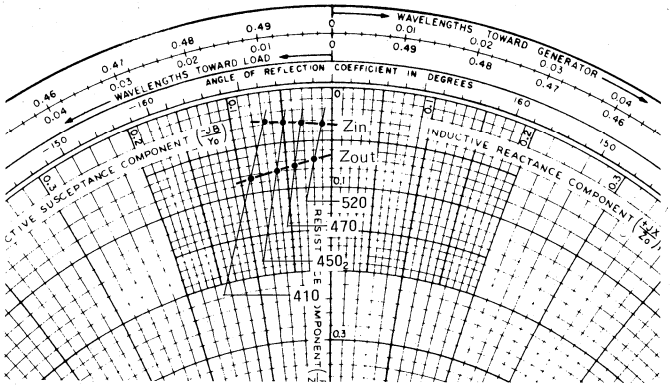
DC CURRENT GAIN VS. COLLECTOR CURRENT



OUTPUT POWER VS. FREQUENCY



INPUT/OUTPUT IMPEDANCE



f (MHz)	Zin (Ω)	Zot (Ω)
410	1.4—j3.0	4.0—j4.4
450	1.4—j2.2	3.8—j3.0
470	1.5—j1.5	3.6—j2.0
520	1.6—j0.4	3.5—j1.0
V_{CC}=7.2V, P_O=6W		

MITSUBISHI ELECTRIC

2SC3105

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3105 is a silicon NPN epitaxial planar type transistor specifically designed for power amplifiers in the 800 ~ 900MHz band range.

FEATURES

- High gain, high efficiency
  $P_O \geqq 30W$, $G_{pb} \geqq 3.0dB$, $\eta_C = 50\%$ (MIN)
  @f = 850MHz, $V_{CC} = 12.5V$, $P_{in} = 15W$
- Emitter ballasted by diffusion resistance.
- Gold metalization of transistor die for good reliability.
- The ability withstand infinite VSWR when operated at $P_O = 30W$, $V_{CC} = 15.2V$.
- High Input-Impedance Transistor (HI^2T); internal input matching network.
- Common-base type.

APPLICATION

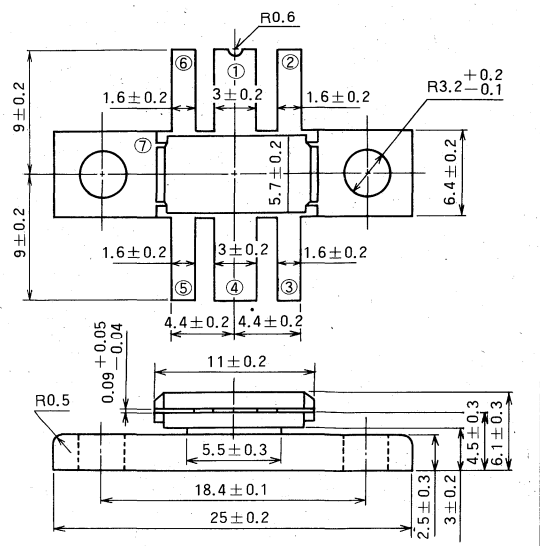
For RF power amplifiers in the 800 ~ 900MHz band range, especially suitable for mobile radio applications.

SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE

$Z_{in} = 2.75 - j0.65(\Omega)$, $Z_{out} = 3.45 + j0.15(\Omega)$, @f = 850MHz, $V_{CC} = 12.5V$, $P_O = 30W$.

OUTLINE DRAWING

Dimensions in mm



PIN:
① COLLECTOR
② BASE
③ BASE
④ EMITTER
⑤ BASE
⑥ BASE
⑦ FLANGE (BASE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CEO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		10	A
P_C	Collector dissipation	T_C=25°C	80	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C

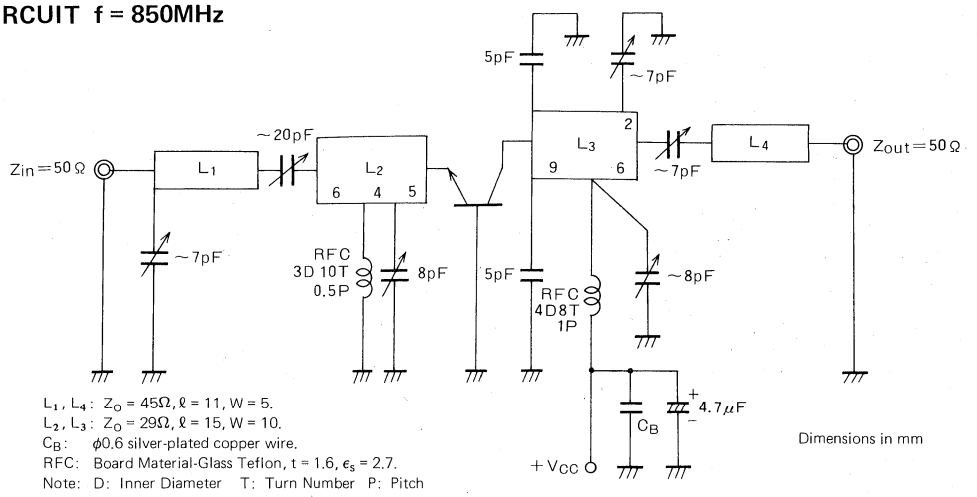
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	3			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=1A	10	30	180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=15W, f=850MHz	30	35		W
η_C	Collector efficiency		50	55		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT f = 850MHz

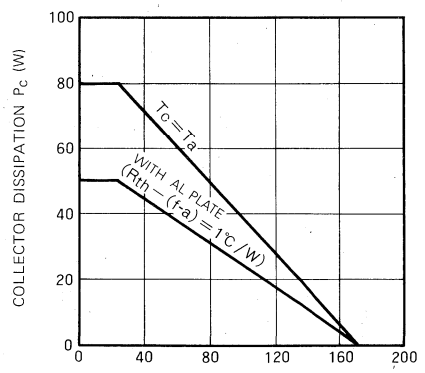


L_1, L_4: Z_O = 45Ω, ℓ = 11, W = 5.
L_2, L_3: Z_O = 29Ω, ℓ = 15, W = 10.
C_B: φ0.6 silver-plated copper wire.
RFC: Board Material-Glass Teflon, t = 1.6, ϵ_s = 2.7.
Note: D: Inner Diameter T: Turn Number P: Pitch

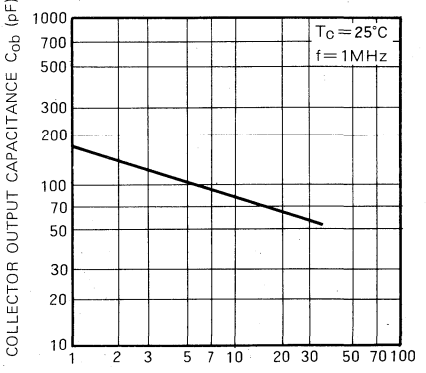
Dimensions in mm

TYPICAL CHARACTERISTICS

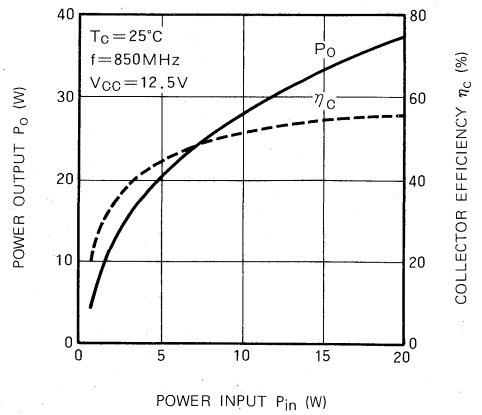
P_C VS. T_a CHARACTERISTICS



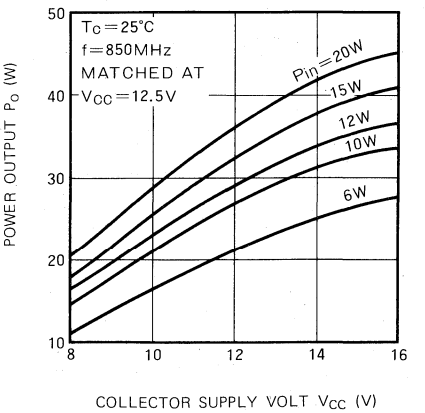
C_{ob} VS. V_{CB} CHARACTERISTICS



P_o, η_C VS. P_{in} CHARACTERISTICS



P_o VS. V_{CC} CHARACTERISTICS



MITSUBISHI ELECTRIC

2SC3133

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3133 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in HF band mobile radio applications.

FEATURES

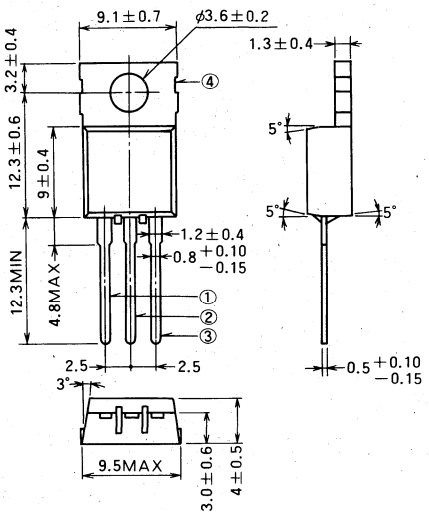
- High power gain: $G_{pe} \geqq 14$dB
  @f = 27MHz, V_{CC} = 12V, P_O = 13W
- Emitter ballasted construction for high reliability and good performances.
- High ruggedness: The ability withstand infinite VSWR when operated at f = 27MHz, P_O = 16W, V_{CC} = 16V.
- Intermodulation distortion: IMD $\leqq$ -25dB
  @f = 27MHz, V_{CC} = 12V, P_O = 13W (PEP)
- Input/output impedance:
  Z_{in} = 1.8 - j2.5(Ω), Z_{out} = 7.0 - j3.5(Ω)
  @f = 27MHz, V_{CC} = 12V, P_O = 13W

APPLICATION

10 watts output power amplifiers in HF band SSB mobile radio application.

OUTLINE DRAWING

Dimensions in mm



① BASE
② EMITTER (FIN)
③ COLLECTOR
④ FIN (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		60	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	25	V
I_C	Collector current		6	A
P_C	Collector dissipation	T_a=25°C	1.5	W
		T_C=25°C	20	W
T_j	Junction temperature		150	°C
Tstg	Storage temperature		−55 ~ +150	°C
Rth-a	Thermal resistance	Junction to ambient	83.3	°C/W
Rth-c		Junction to case	6.25	°C/W

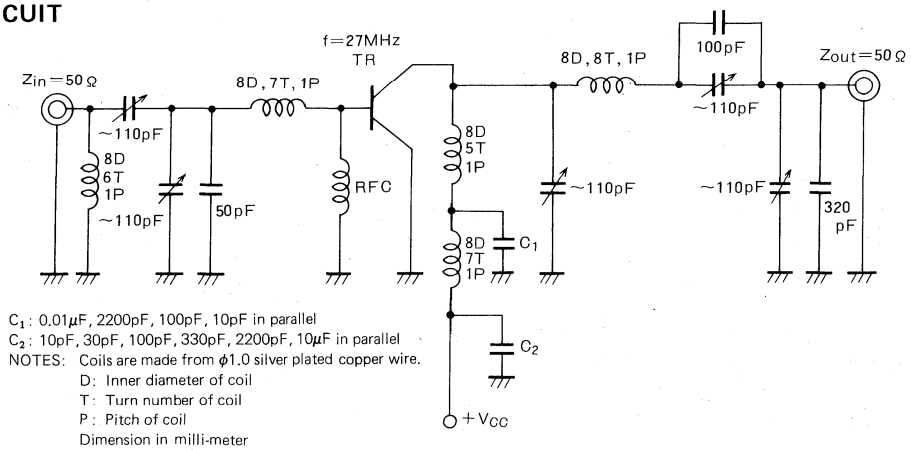
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=5mA, I_E=0	60			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	25			V
I_{CBO}	Collector cutoff current	V_{CB}=30V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=4V, I_C=0			500	μA
h_{FE}	DC current gain *	V_{CE}=12V, I_C=10mA	10	50	180	—
P_O	Output power	f=27MHz, V_{CC}=12V, P_{in}=0.5W	13	16		W
η_C	Collector efficiency		60	70		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

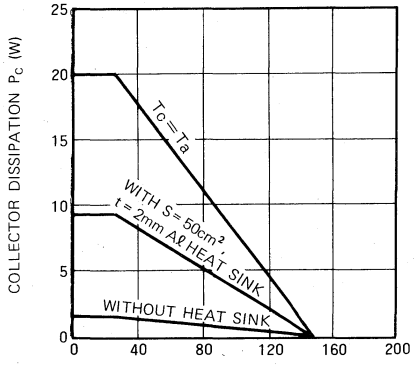
TEST CIRCUIT



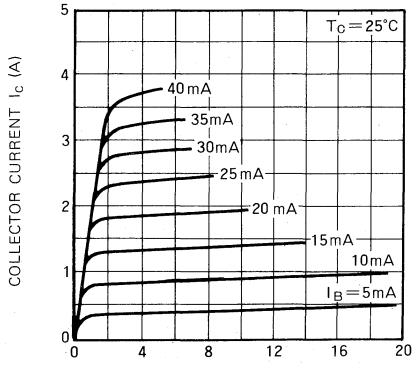
C_1: 0.01μF, 2200pF, 100pF, 10pF in parallel
C_2: 10pF, 30pF, 100pF, 330pF, 2200pF, 10μF in parallel
NOTES: Coils are made from φ1.0 silver plated copper wire.
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATE

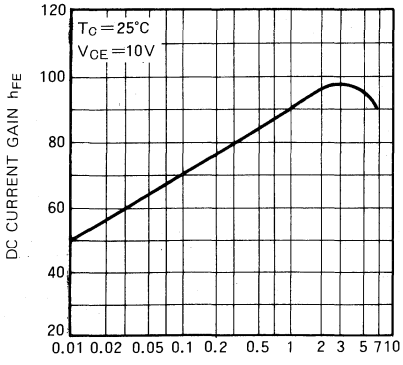
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



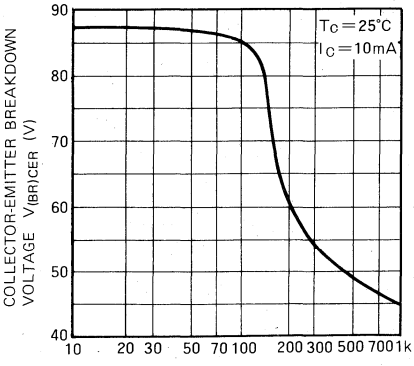
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT



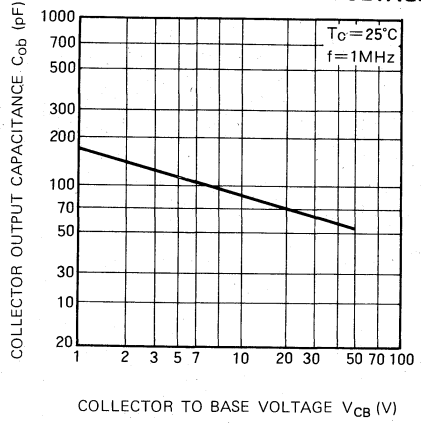
COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



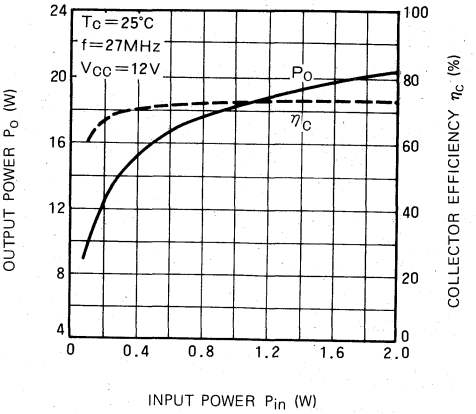
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

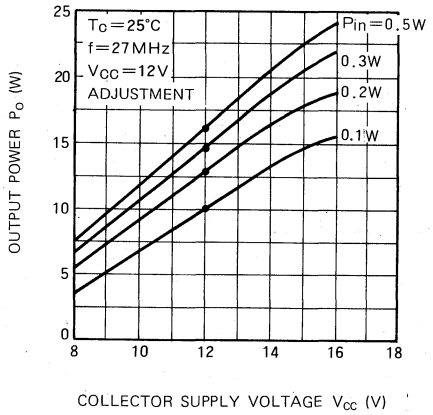
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC3240

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3240 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers in HF band.

FEATURES

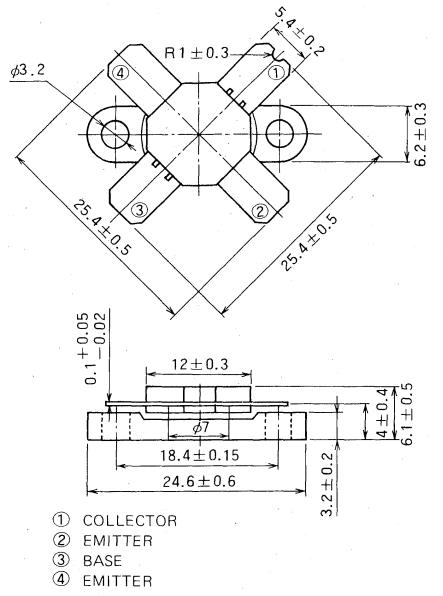
- High gain: $G_{pe} \geqq 11.5$dB, $P_O \geqq 100$W
  @f = 30MHz, V_{CC} = 12.5V, P_{in} = 7W
- High ruggedness: Ability to withstand 20:1 load VSWR when operated at f = 30MHz, P_O = 100W, V_{CC} = 15.2V.
- Emitter ballasted construction
- Low thermal resistance ceramic package with flange.
  Input-output impedance
  Z_{in} = 0.4 – j0.8 (Ω)
  Z_{out} = 1.0 – j1.1 (Ω)
  @f = 30MHz, V_{CC} = 12.5V, P_O = 100W

APPLICATION

Output stage of transmitter in HF band SSB mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER
③ BASE
④ EMITTER

NOTE: EMITTER ELECTRODES ARE CONNECTED WITH FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	20	V
I_C	Collector current		25	A
P_C	Collector dissipation	T_a=25°C	8	W
		T_C=25°C	270	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55～+175	°C
$R_{th\text{-}a}$	Thermal resistance	Junction to ambient	18.7	°C/W
$R_{th\text{-}c}$		Junction to case	0.556	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

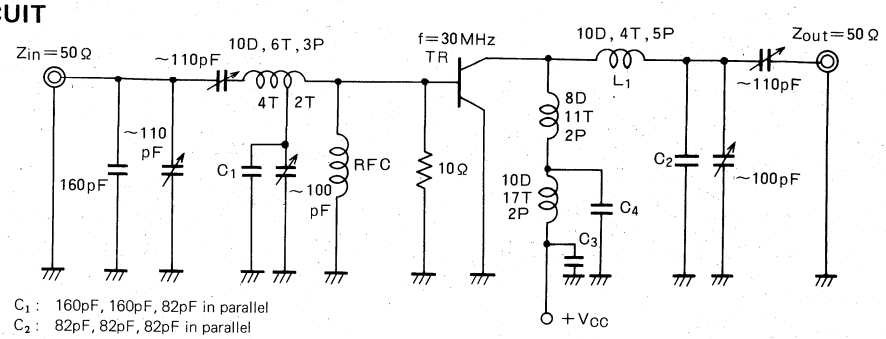
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=20mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=20mA, I_E=0	50			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=100mA, $R_{BE}=\infty$	20			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=1A	10	50	180	—
P_O	Output power	f=30MHz, V_{CC}=12.5V, P_{in}=7W	100	110		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT



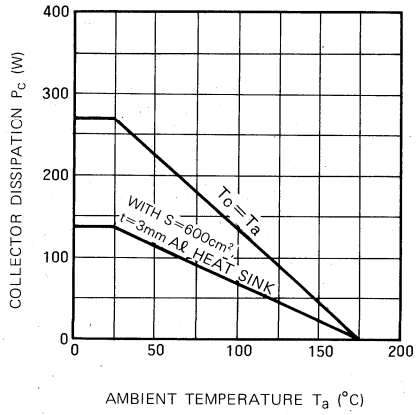
C_1 : 160pF, 160pF, 82pF in parallel
C_2 : 82pF, 82pF, 82pF in parallel
C_3 : 100pF, 4700pF, 4700pF, 0.22μF, 0.22μF, 33μF, 330μF in parallel
C_4 : 100pF, 220pF, 4700pF, 0.1μF, 330μF is parallel

RFC: 27 Turns 1φ enameled wire

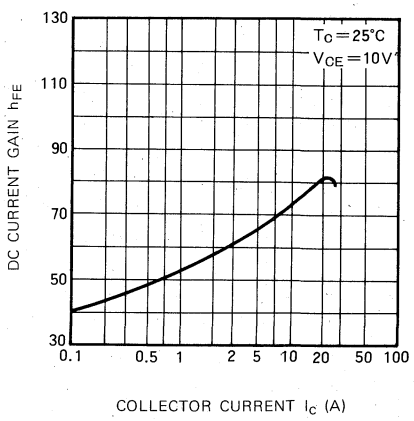
NOTES: All coils but L_1 are made from1.5φmm silver plated copper wire, L_1 is made from 2.3φmm copper wire.
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATE

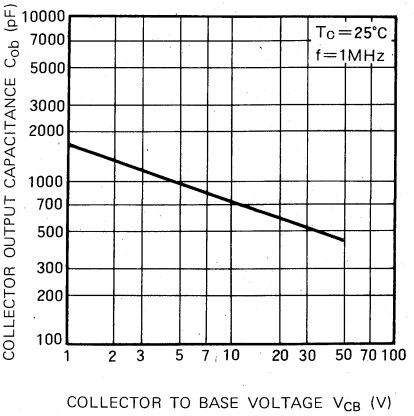
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



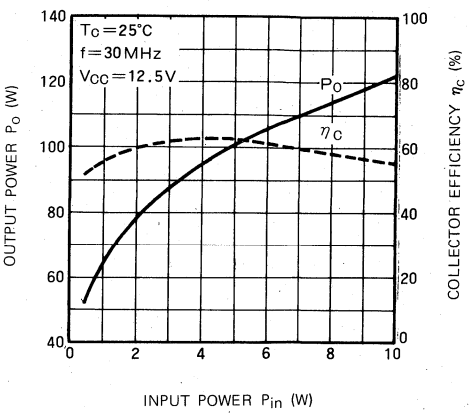
DC CURRENT GAIN VS. COLLECTOR CURRENT



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE

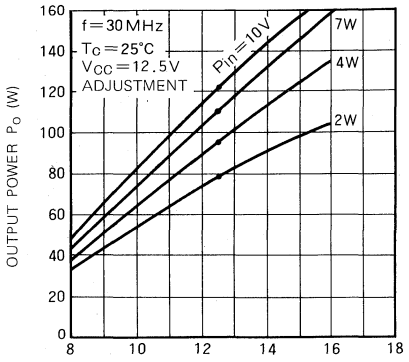


OUTPUT POWER COLLECTOR EFFICIENCY VS. INPUT POWER

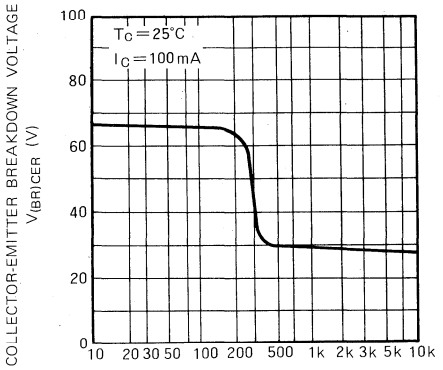


NPN EPITAXIAL PLANAR TYPE

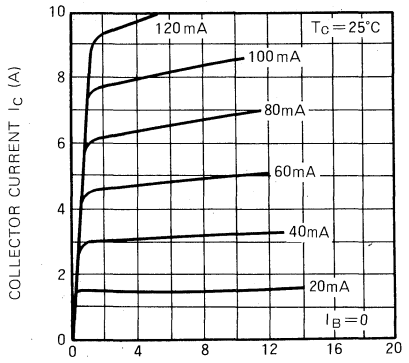
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



COLLECTOR CURRENT VS. COLLECTOR-TO-EMITTER VOLTAGE



MITSUBISHI ELECTRIC

2SC3241

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3241 is a silicon NPN epitaxial planar type transistor specifically designed for high power amplifiers in HF band.

FEATURES

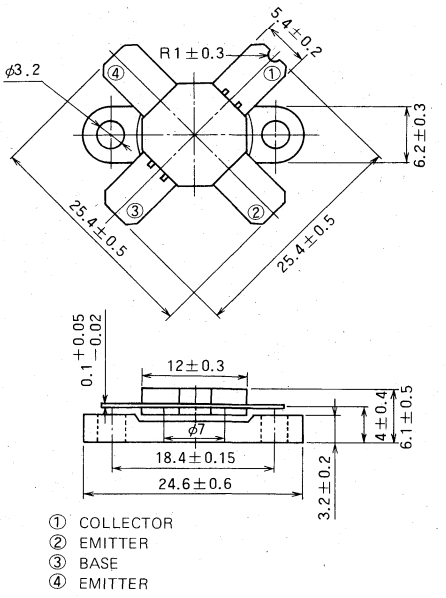
- High gain: $G_{pe} \geqq 12.3$dB
  @f = 30MHz, V_{CC} = 12.5V, P_{in} = 4W
- High ruggedness: Ability to withstand 20:1 load VSWR when operated at f = 30MHz, V_{CC} = 15.2V, P_O = 75W, T_c = 25°C.
- Emitter ballasted construction
- Low thermal resistance ceramic package with flange
- Input-output impedance: Z_{in} = 0.5 – j1.0(Ω), Z_{out} = 1.15 – j1.4(Ω) @f = 30MHz, V_{CC} = 12.5V, P_O = 75W

APPLICATION

Output stage of transmitter in HF band SSB mobile radio sets.

OUTLINE DRAWING

Dimensions in mm



NOTE: EMITTER ELECTRODES ARE CONNECTED WITH FLANGE.

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage	R_{BE}=∞	20	V
I_C	Collector current		18	A
P_C	Collector dissipation	T_a=25°C	7.5	W
		T_C=25°C	180	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance	Junction to ambient	20	°C/W
Rth-c		Junction to case	0.83	°C/W

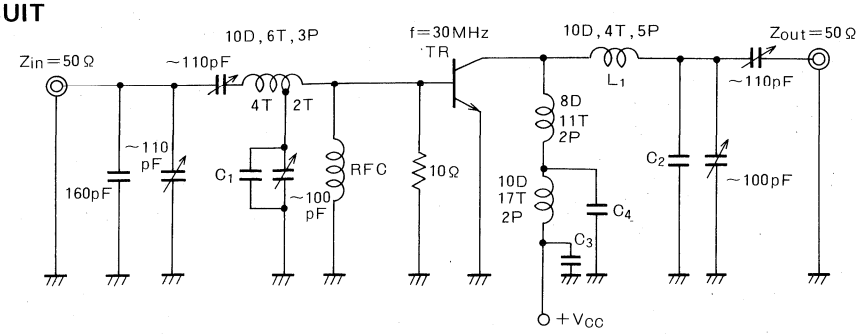
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=20mA, I_C=0	5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	50			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=100mA, R_{BE}=∞	20			V
I_{CBO}	Collector cutoff current	V_{CE}=25V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			4	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	f=30MHz, V_{CC}=12.5V, P_{in}=4W	75	85		W
η_C	Collector efficiency		55	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

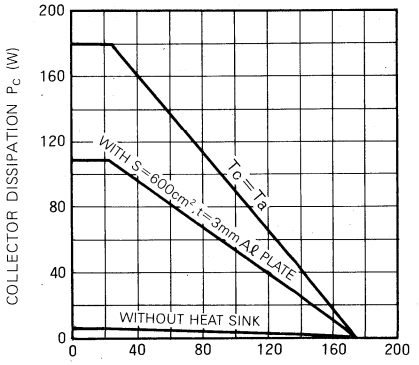
TEST CIRCUIT



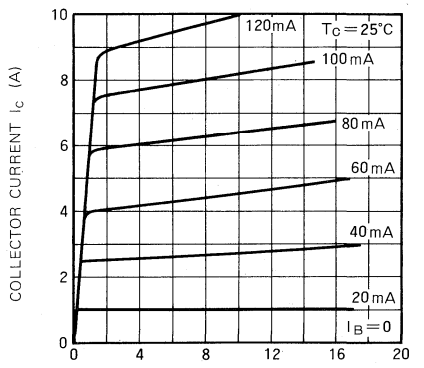
C_1 : 160pF, 160pF, 82pF in parallel
C_2 : 82pF, 82pF, 82pF in parallel
C_3 : 100pF, 4700pF, 4700pF, 0.22μF, 0.22μF, 33μF, 330μF in parallel
C_4 : 100pF, 220pF, 4700pF, 0.1μF, 330μF in parallel
RFC: 27 Turns 1φ enameled wire
NOTES: All coils but L_1 are made from 1.5φmm silver plated coper wire, L_1 is made from 2.3φmm copper wire.
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension is milli-meter

TYPICAL PERFORMANCE DATA

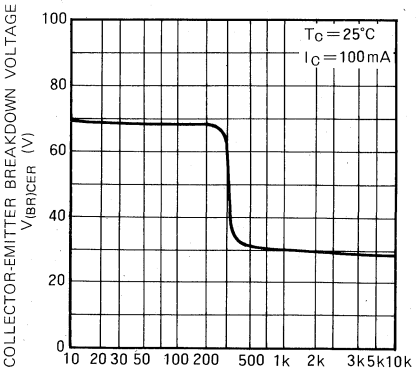
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



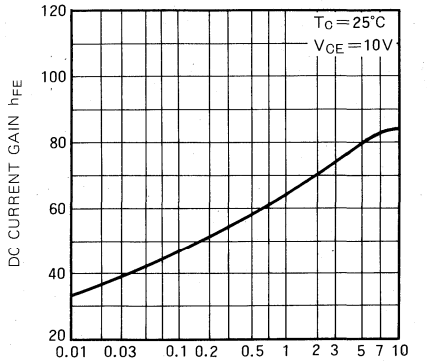
OUTPUT CHARACTERISTICS, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



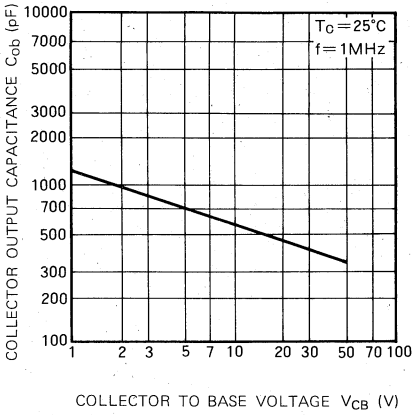
DC CURRENT GAIN VS. COLLECTOR CURRENT



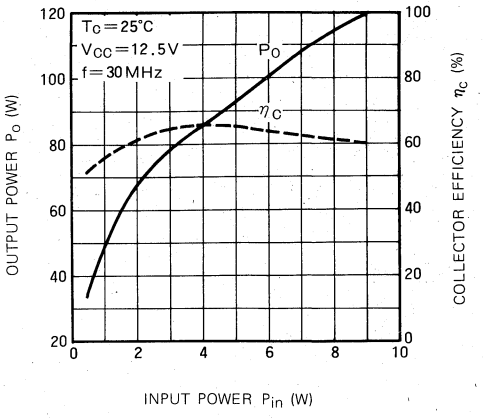
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

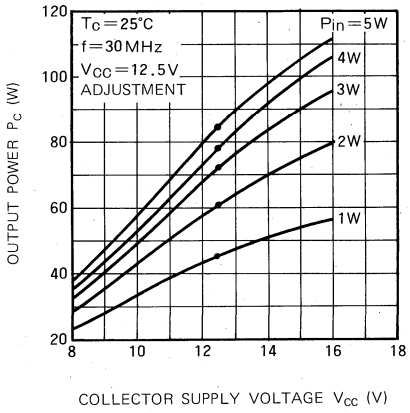
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



2SC3379

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3379 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifier applications.

FEATURES

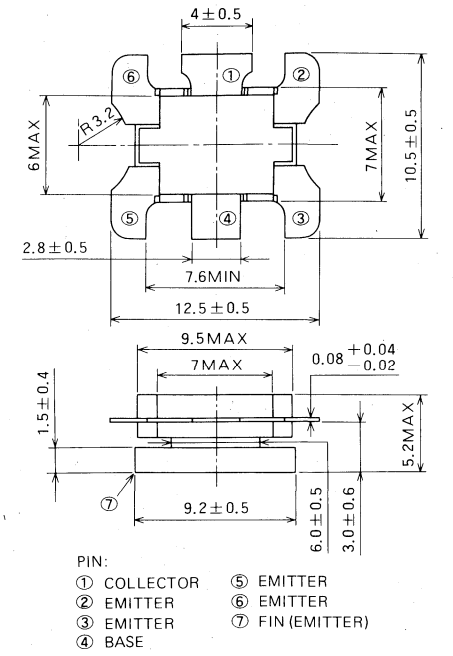
- High power gain: $G_{pe} \geqq 6.7$dB
  @$V_{CC} = 7.2$V, f = 520MHz, $P_{in} = 0.6$W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at $V_{CC} = 9$V, f = 520MHz, $P_O = 2.8$W.
- Flange type ceramic package.

APPLICATION

For output stage of 1 ~ 2W power amplifiers in UHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS ($T_C = 25°C$)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	9	V
I_C	Collector current		1.5	A
P_C	Collector dissipation	$T_C = 25°C$	10	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C
Rth-c	Thermal resistance	Junction to case	15	°C/W

ELECTRICAL CHARACTERISTICS ($T_C = 25°C$)

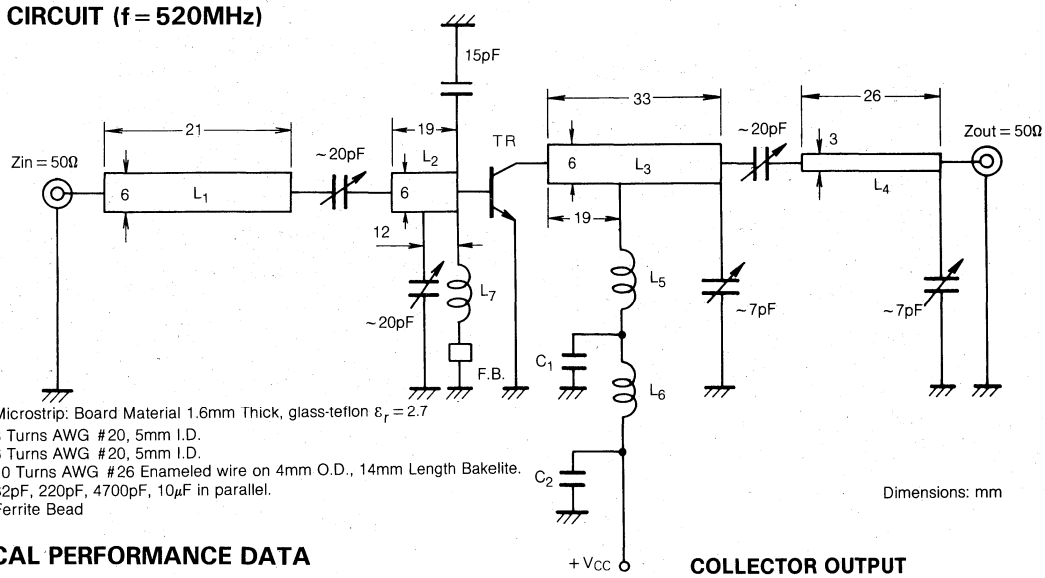
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E = 1$mA, $I_C = 0$	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C = 10$mA, $I_E = 0$	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	$I_C = 10$mA, $R_{BE} = \infty$	9			V
I_{CBO}	Collector cut-off current	$V_{CB} = 10$V, $I_E = 0$			300	μA
I_{EBO}	Emitter cut-off current	$V_{EB} = 2$V, $I_C = 0$			300	μA
h_{FE}	DC forward current gain*	$V_{CE} = 5$V, $I_C = 0.1$A	10	50	180	—
P_O	Power Output	$V_{CC} = 7.2$V, Pin = 0.6W, f = 520MHz	2.8	3.2		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, $P_W = 150\mu$s, duty 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

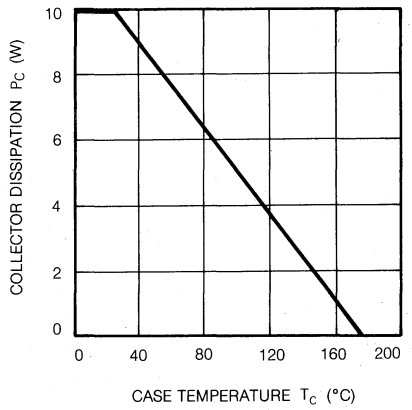


L_1~L_4: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_5: 3 Turns AWG #20, 5mm I.D.
L_6: 6 Turns AWG #20, 5mm I.D.
L_7: 10 Turns AWG #26 Enameled wire on 4mm O.D., 14mm Length Bakelite.
C_1,C_2: 82pF, 220pF, 4700pF, 10μF in parallel.
F.B.: Ferrite Bead

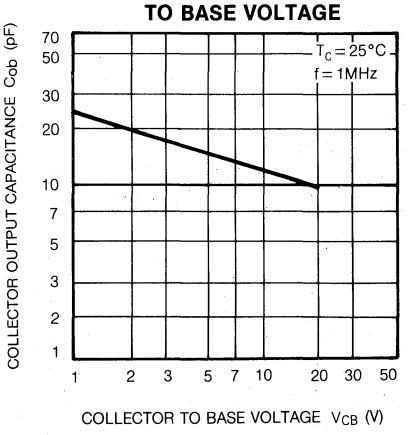
Dimensions: mm

TYPICAL PERFORMANCE DATA

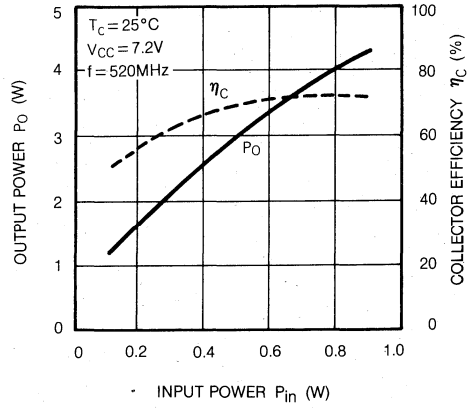
COLLECTOR DISSIPATION VS. CASE TEMPERATURE



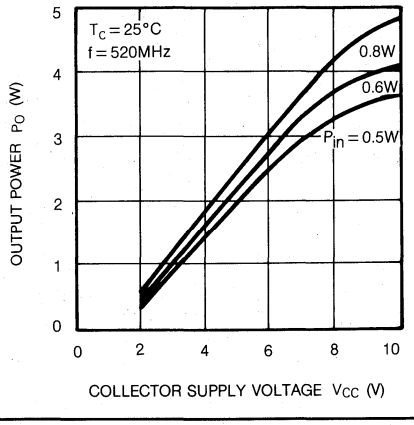
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER

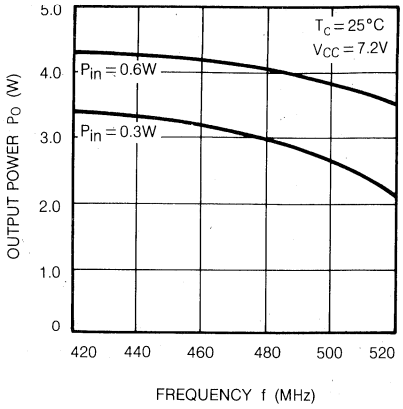


OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE

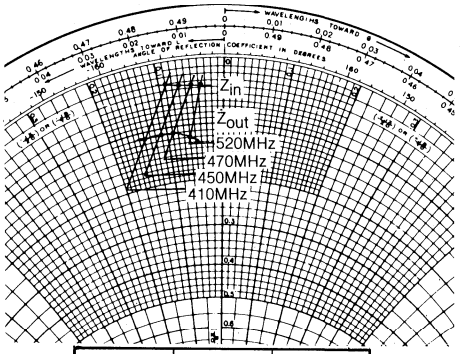


NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER VS. FREQUENCY



SERIES INPUT AND OUTPUT IMPEDANCE VS. FREQUENCY



f (MHz)	$\dot{Z}_{in}$ (Ω)	$\dot{Z}_{out}$ (Ω)
410	1.5 – j4.5	5.5 – j7.0
450	1.5 – j3.5	5.3 – j5.5
470	1.6 – j2.5	5.4 – j4.5
520	1.8 – j1.9	6.0 – j3.0
V_{CC} = 7.2V, P_O = 2.8W		

PRECAUTIONS FOR MOUNTING HIGH-FREQUENCY HIGH-OUTPUT TRANSISTOR FOR MOBILE RADIO EQUIPMENT

When mounting high-frequency, high-output transistors for mobile radio equipment (flange screw fastening part cut package), care should be taken to the following points.

1. When mounting the device to the heat sink, silicon compound should be applied to the heat sink and device heat radiating fin and apply the device to the heat sink using a proper fastening tool.
2. If the device is soldered directly to heat sink, excessive thermal stress will result in deteriorating the reliability. Do not use this mounting method.
3. Care should be taken, if the device is applied to the heat sink, the force of soldering the leads to the printed circuit board results in continual mechanical stress, deteriorating the reliability and performance of the system.
4. Refer to Mitsubishi's DATADOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

2SC3404

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3404 is a silicon NPN epitaxial planar type transistor specifically designed for VHF power amplifier applications.

FEATURES

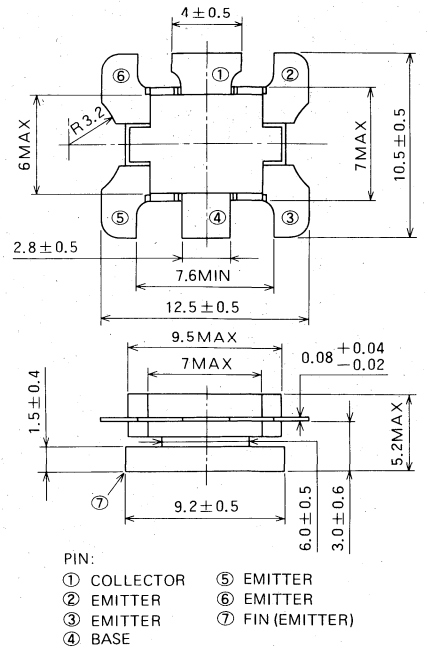
- High power gain: $G_{pe} \geqq 12.7$dB. @V_{CC} = 7.2V, f = 175MHz, P_{in} = 80mW.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 9V, f = 175MHz, P_O = 1.5W, T_C = 25°C.
- Flange type ceramic package.

APPLICATION

For output stage of 1W power amplifiers in VHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C = 25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	9	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C = 25°C	5	W
Ti	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

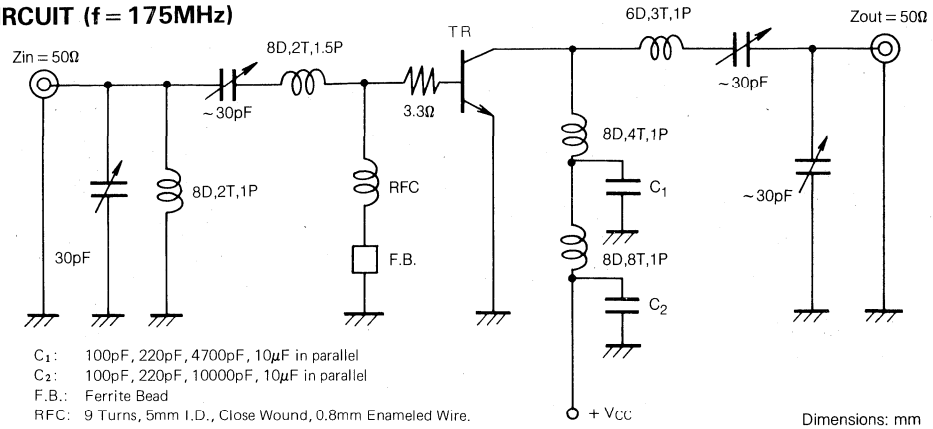
ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 1mA, I_C = 0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 10mA, $R_{BE} = \infty$	9			V
I_{CBO}	Collector cut off current	V_{CB} = 10V, I_E = 0			200	μA
I_{EBO}	Emitter cut off current	V_{EB} = 2V, I_C = 0			200	μA
h_{FE}	DC forward current gain *	V_{CE} = 5V, I_C = 0.1A	10	50	180	—
P_O	Power Output	V_{CC} = 7.2V, Pin = 80mW, f = 175MHz	1.5	1.8		W
η_C	Collector efficiency		55	60		%

*Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 175MHz)



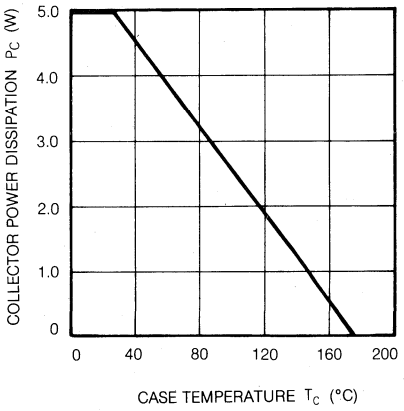
C_1: 100pF, 220pF, 4700pF, 10μF in parallel
C_2: 100pF, 220pF, 10000pF, 10μF in parallel
F.B.: Ferrite Bead
RFC: 9 Turns, 5mm I.D., Close Wound, 0.8mm Enameled Wire.

Note: 1.5mmϕ. Silvered Wire without FRC.
D: Inner diameter of coil, T: Turn number of coil, P: Pitch of coil

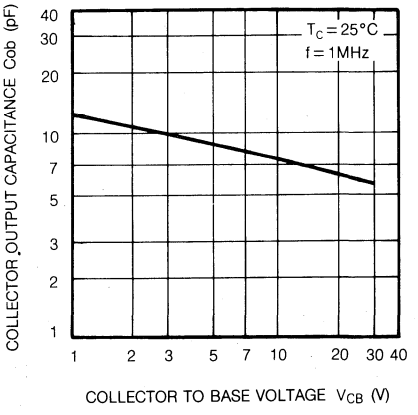
Dimensions: mm

TYPICAL PERFORMANCE DATA

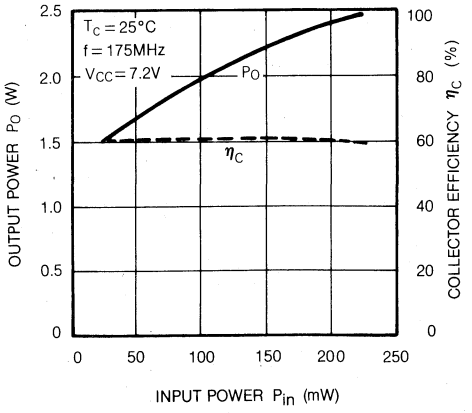
COLLECTOR POWER DISSIPATION VS. CASE TEMPERATURE



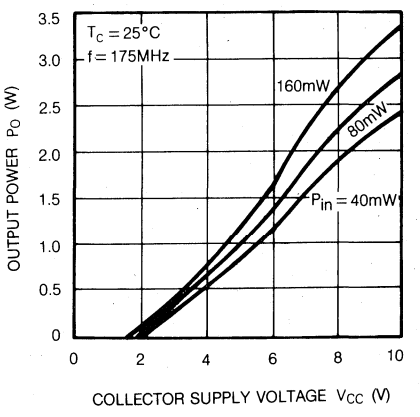
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



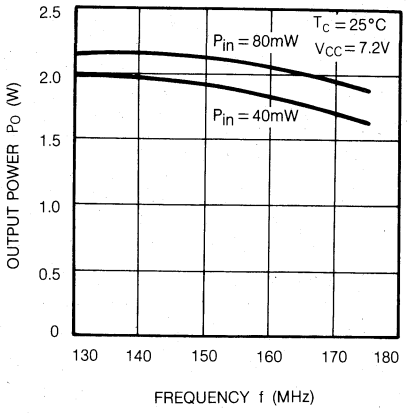
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



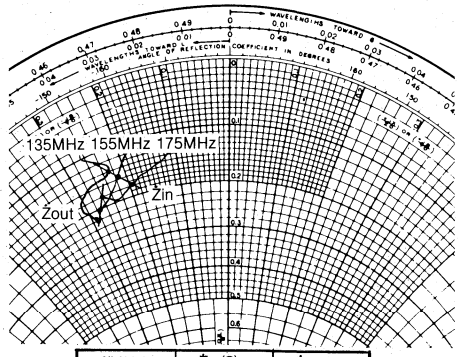
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

OUTPUT POWER VS. FREQUENCY



INPUT/OUTPUT IMPEDANCE VS. FREQUENCY



f(MHz)	$\dot{Z}_{in}(\Omega)$	$\dot{Z}_{out}(\Omega)$
135	7.0−j11.1	11−j14.1
155	7.8−j10.5	10−j13.5
175	8.5−j9.8	9.3−j13
$V_{CC} = 7.2V$, $P_O = 1.5W$		

PRECAUTIONS FOR MOUNTING HIGH-FREQUENCY HIGH-OUTPUT TRANSISTOR FOR MOBILE RADIO EQUIPMENT

When mounting high-frequency, high-output transistors for mobile radio equipment (flange screw fastening part cut package), care should be taken to the following points.

1. When mounting the device to the heat sink, silicon compound should be applied to the heat sink and device heat radiating fin and apply the device to the heat sink using a proper fastening tool.
2. If the device is soldered directly to heat sink, excessive thermal stress will result in deteriorating the reliability. Do not use this mounting method.
3. Care should be taken, if the device is applied to the heat sink, the force of soldering the leads to the printed circuit board results in continual mechanical stress, deteriorating the reliability and performance of the system.
4. Refer to Mitsubishi's DATADOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

2SC3628

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

2SC3628 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in VHF band mobile radio applications.

FEATURES

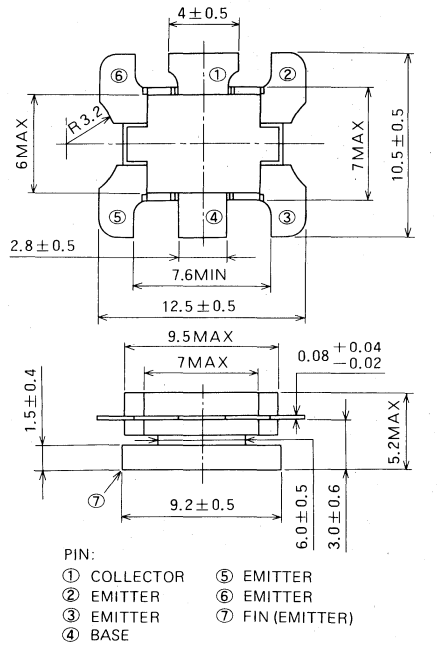
- High power gain: $G_{pe} \geqq 13.8$dB
  @V_{CC} = 13.5V, P_O = 6W, f = 175MHz
- Emitter ballasted construction and gold metallization for high reliability and good performances.
- Low thermal resistance ceramic package with flange.
- Ability of withstanding more than 20:1 load VSWR when operated at V_{CC} = 15.2V, P_O = 6W, f = 175MHz.

APPLICATION

4 to 5 watts output power amplifiers in VHF band mobile radio applications.

OUTLINE DRAWING

Dimensions in mm



PIN:
① COLLECTOR
② EMITTER
③ EMITTER
④ BASE
⑤ EMITTER
⑥ EMITTER
⑦ FIN (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	Ta=25°C	2	W
		T_C=25°C	20	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C
Rth-a	Thermal resistance	Junction to ambient	75	°C/W
Rth-c		Junction to case	7.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

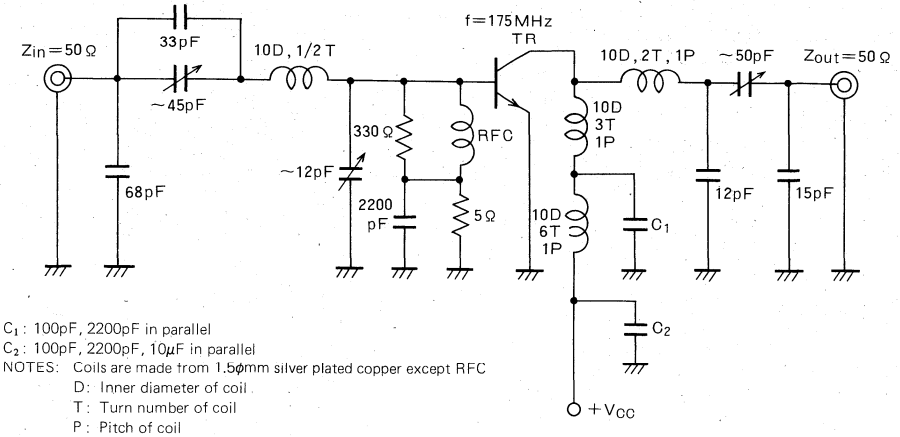
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=5mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_B=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=50mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			500	μA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			500	μA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=0.1A	10	50	180	—
P_O	Output power	V_{CC}=13.5V, P_{in}=0.25W, f=175MHz	6	7.5		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

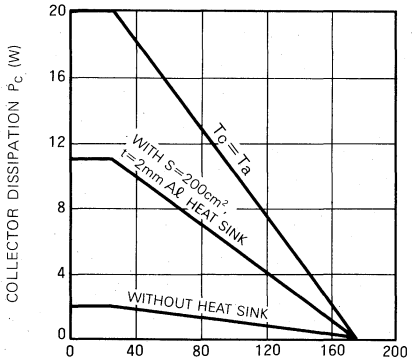
TEST CIRCUIT



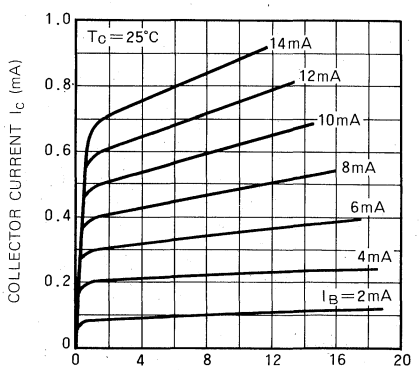
C_1 : 100pF, 2200pF in parallel
C_2 : 100pF, 2200pF, 10μF in parallel
NOTES: Coils are made from 1.5φmm silver plated copper except RFC
D: Inner diameter of coil
T: Turn number of coil
P: Pitch of coil
Dimension in milli-meter

TYPICAL PERFORMANCE DATE

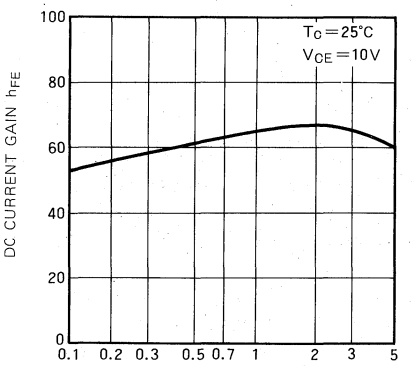
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



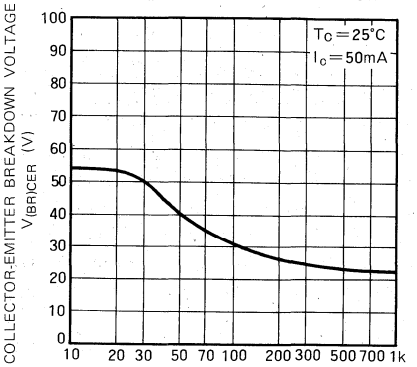
OUTPUT CHARACTERISTICS, COMMON EMITTER



DC CURRENT GAIN VS. COLLECTOR CURRENT

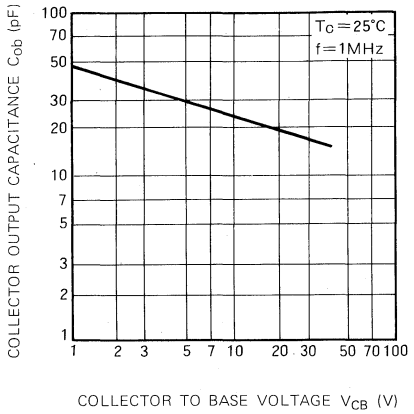


COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE

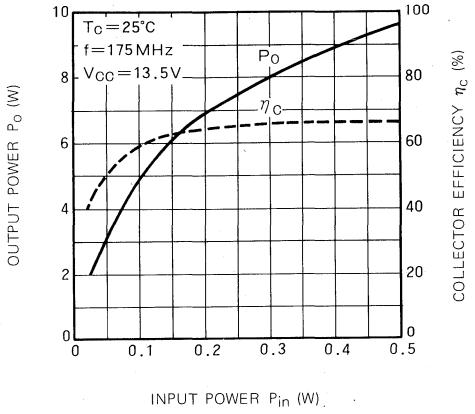


NPN EPITAXIAL PLANAR TYPE

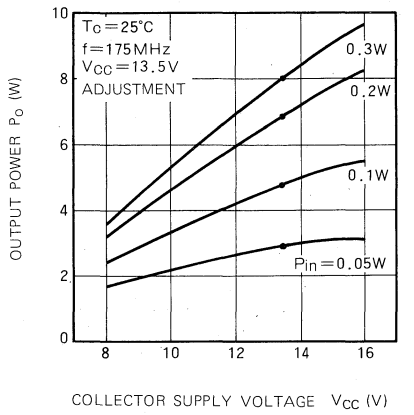
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



PRECAUTIONS FOR MOUNTING HIGH-FREQUENCY HIGH-OUTPUT TRANSISTOR FOR MOBILE RADIO EQUIPMENT

When mounting high-frequency, high-output transistors for mobile radio equipment (flange screw fastening part cut package), care should be taken to the following points.

1. When mounting the device to the heat sink, silicon compound should be applied to the heat sink and device heat radiating fin and apply the device to the heat sink using a proper fastening tool.
2. If the device is soldered directly to heat sink, excessive thermal stress will result in deteriorating the reliability. Do not use this mounting method.
3. Care should be taken, if the device is applied to the heat sink, the force of soldering the leads to the printed circuit board results in continual mechanical stress, deteriorating the reliability and performance of the system.
4. Refer to Mitsubishi's DATADOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

2SC3629

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3629 is a silicon NPN epitaxial planar type transistor designed for RF power amplifiers in UHF band 7.2 volts operation applications.

FEATURES

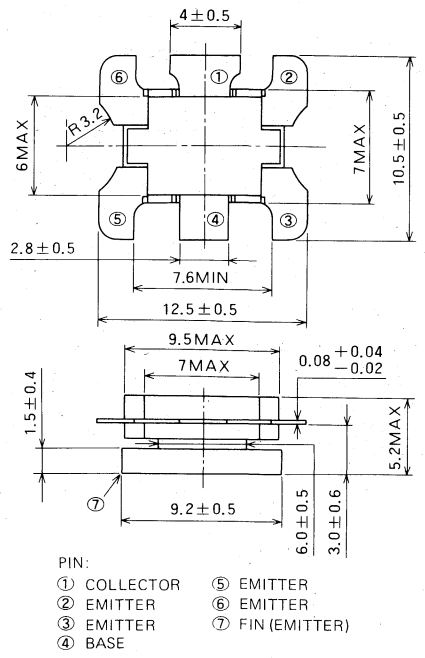
- High gain: $G_{pe} \geqq 7.7$dB
  @V_{CC} = 7.2V, f = 520MHz, P_{in} = 0.2W
- Ability of withstanding more than 20:1 load VSWR when operated at f = 520MHz, V_{CC} = 9V, P_O = 1.2W, T_C = 25°C.
- Emitter ballasted construction.
- Flange type ceramic package.

APPLICATION

Output stage of 1W output mobile radio equipment in UHF band

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter		Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage		9	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C=25°C	5	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55～+175	°C
R_{th-c}	Thermal resistance		30	°C/W

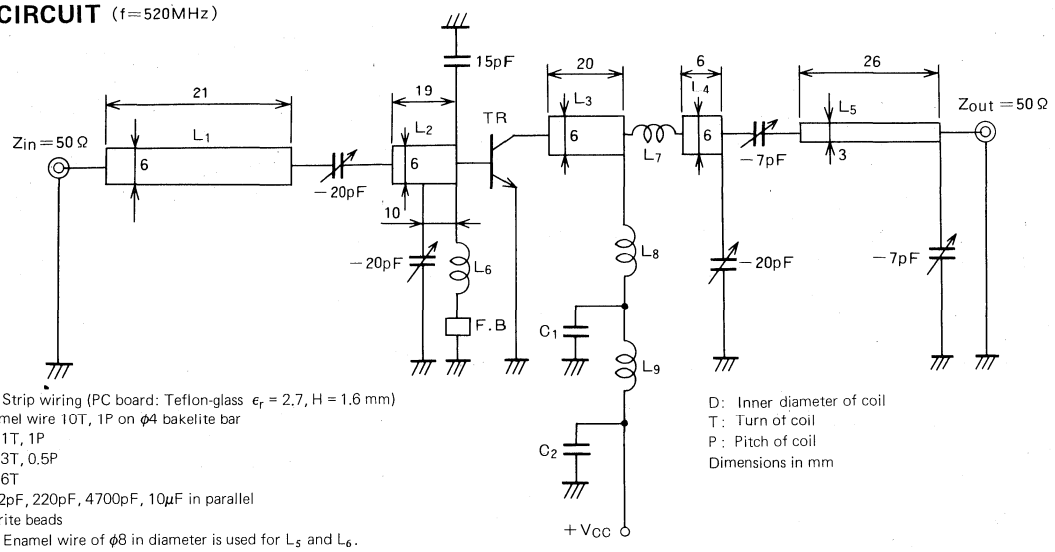
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_C=10mA, I_E=0	20			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_E=1mA, I_C=0	3.5			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, R_{BE}=∞	9			V
I_{CBO}	Collector cutoff current	V_{CB}=10V, I_E=0			200	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			200	μA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=0.1A	20	50	180	—
P_O	Output power	V_{CC}=7.2V, f=520MHz, Pin=0.2W	1.2	1.5		W
η_C	Collector efficiency		55	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f=520MHz)

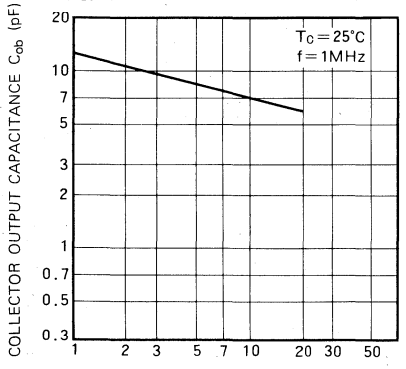


L_1~L_5 : Strip wiring (PC board: Teflon-glass ϵ_r = 2.7, H = 1.6 mm)
L_6 : Enamel wire 10T, 1P on ϕ4 bakelite bar
L_7 : 8D, 1T, 1P
L_8 : 5D, 3T, 0.5P
L_9 : 5D, 6T
L_1, L_2 : 82pF, 220pF, 4700pF, 10μF in parallel
F.B.: Ferrite beads
NOTE : Enamel wire of ϕ8 in diameter is used for L_5 and L_6.

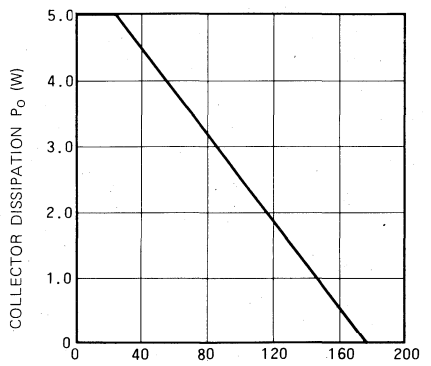
D: Inner diameter of coil
T: Turn of coil
P: Pitch of coil
Dimensions in mm

TYPICAL PERFORMANCE DATA

COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR-BASE VOLTAGE



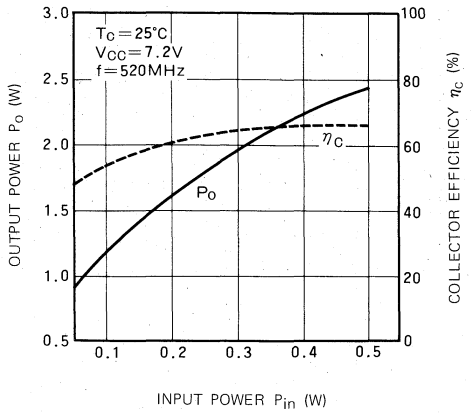
COLLECTOR-LOSS VS. AMBIENT TEMPERATURE



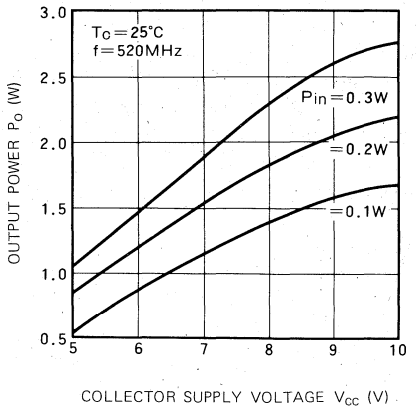
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

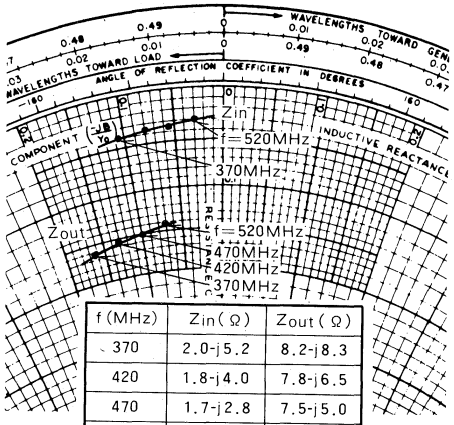
OUTPUT POWER, COLLECTOR LOSS VS. INPUT POWER



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE VARIATION



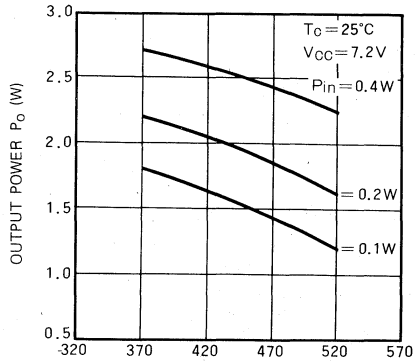
INPUT/OUTPUT IMPEDANCE VS. FREQUENCY



f (MHz)	Zin (Ω)	Zout (Ω)
370	2.0-j5.2	8.2-j8.3
420	1.8-j4.0	7.8-j6.5
470	1.7-j2.8	7.5-j5.0
520	1.5-j1.5	7.0-j3.5

CONDITIONS: V_{CC} = 7.2V, P_O = 1.5W

OUTPUT POWER VS. FREQUENCY



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4. Refer to Mitsubishi's DATADOOK or manuals for transistors, small-signal diodes and integrated circuit modules for mounting and handling of the device.

2SC3630

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3630 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifiers applications.

FEATURES

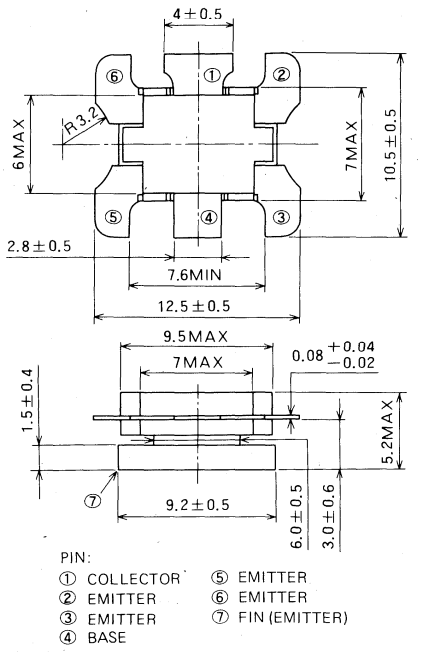
- High power gain: $G_{pe} \geqq 5.7$dB
  @V_{CC} = 12.5V, f = 520MHz, P_{in} = 0.8W
- Emitter ballasted construction
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at @V_{CC} = 15.2V, f = 520MHz, P_O = 3W.

APPLICATION

For drive stage and output stage of power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



PIN:
① COLLECTOR
② EMITTER
③ EMITTER
④ BASE
⑤ EMITTER
⑥ EMITTER
⑦ FIN (EMITTER)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		1	A
P_C	Collector dissipation	T_C=25°C	10	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55～+175	°C

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

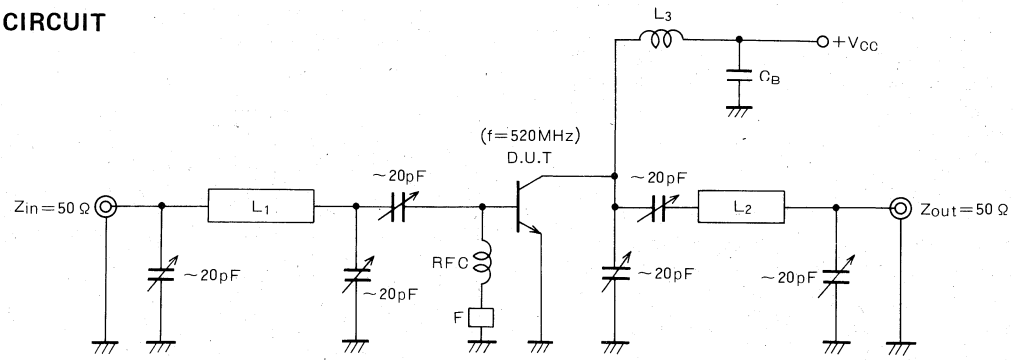
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=1mA, I_C=0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=10mA, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			300	μA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			300	μA
h_{FE}	DC forward current gain *	V_{CB}=10V, I_C=0.1A	10		180	—
P_O	Output power	V_{CC}=12.5V, P_{in}=0.8W, f=520MHz.	3	3.5		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

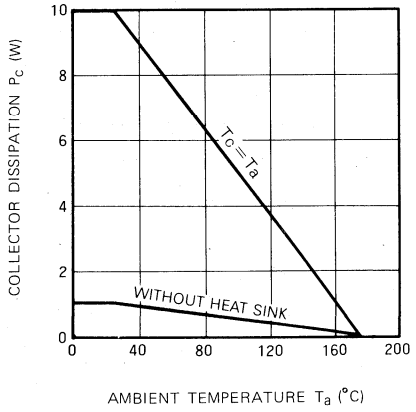


L_1 : Width 3.5, length 25, thinkness 0.3 cupper plate.
L_2 : Width 3.5, length 17, thinkness 0.8 cupper plate
L_3 : 50, 2T, 1P, ϕ0.8 enameled wire
RFC: j0, 5T, 0.5P ϕ0.8 enameled wire

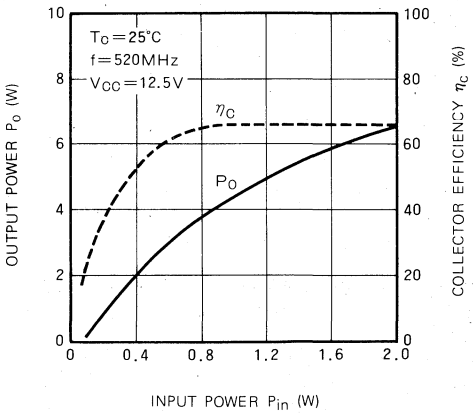
C_B : 150pF, 1500pF, 3.3μF inparallel
F : Ferrite bead
(Note) D: Inner diameter T: Turn numbers of coil
P : Pitch of coil Dimensions: mm

TYPICAL PERFORMANCE DATA

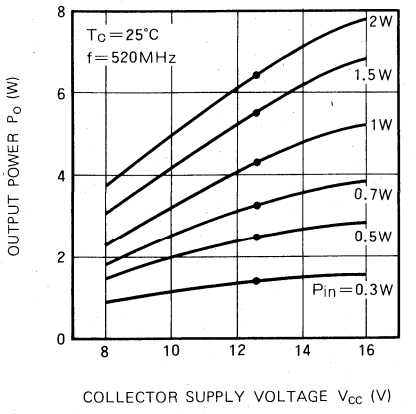
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



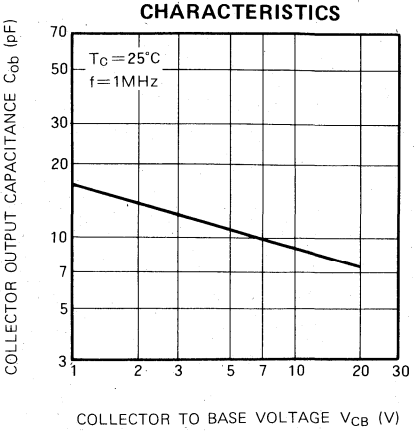
OUTPUT POWER COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



2SC3804

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3804 is a silicon NPN epitaxial planar-type transistor specifically designed for power amplifiers in the 800 ~ 900MHz band range.

FEATURES

- High gain, high efficiency
  $P_O \geqq 40W$, $G_{pe} \geqq 3.0dB$, $\eta_C = 50\%$ (MIN)
  @f = 850MHz, $V_{CC} = 13.5V$, $P_{in} = 20W$
- Emitter ballasted by diffusion resistance.
- Gold metalization of transistor die for good reliability.
- The ability withstand infinite VSWR when operated at $P_O = 40W$, $V_{CC} = 15.2V$.
- High Input-Impedance Transistor (HI^2T); internal input matching network.
- Common-base type.

APPLICATION

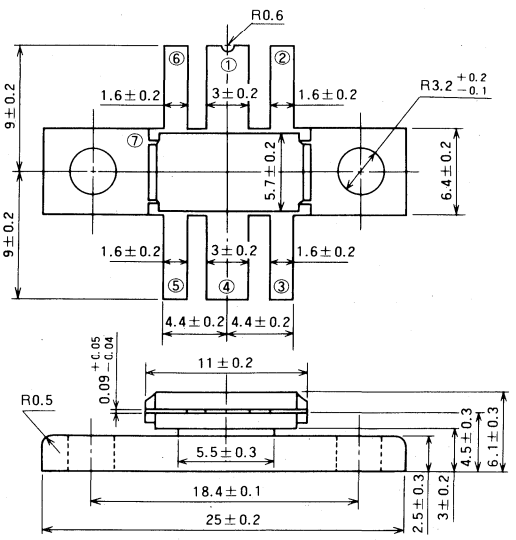
For RF power amplifiers in the 800 ~ 900MHz band range, especially suitable for mobile radio applications.

SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE

$Z_{in} = 1.4 - j2.4\ (\Omega)$, $Z_{out} = 2.5 + j1.0\ (\Omega)$ @f = 850MHz, $V_{CC} = 13.5V$, $P_O = 40W$

OUTLINE DRAWING

Dimensions in mm



PIN:

① COLLECTOR
② BASE
③ BASE
④ EMITTER
⑤ BASE
⑥ BASE
⑦ FLANGE (BASE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector-to-base voltage		35	V
V_{EBO}	Emitter-to-base voltage		3	V
V_{CEO}	Collector-to-emitter voltage	$R_{BE}=\infty$	17	V
I_C	Collector current		12	A
P_C	Collector dissipation	T_C=25℃	100	W
T_j	Junction temperature		+175	℃
T_{stg}	Storage temperature		−55 ~ +175	℃

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted)

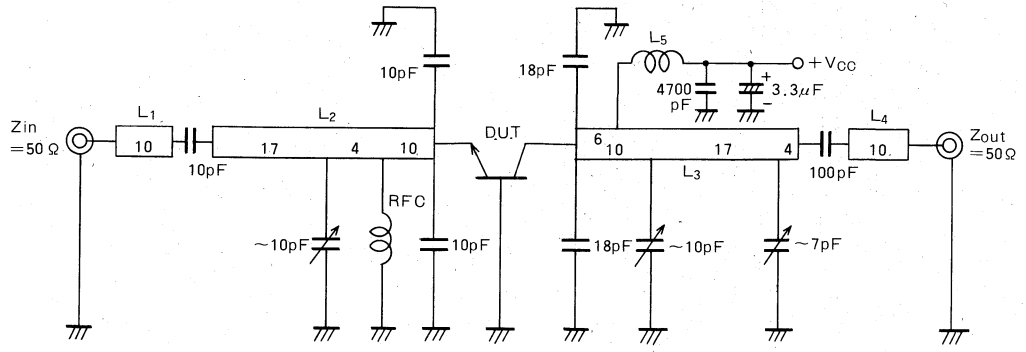
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter-to-base breakdown voltage	I_E=10mA, I_C=0	3			V
$V_{(BR)CBO}$	Collector-to-base breakdown voltage	I_C=10mA, I_E=0	35			V
$V_{(BR)CEO}$	Collector-to-emitter breakdown voltage	I_C=0.1A, $R_{BE}=\infty$	17			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=2V, I_C=0			5	mA
h_{FE}	DC forward current gain *	V_{CE}=10V, I_C=1A	10	40	120	—
P_O	Power output	V_{CC}=13.5V, P_{in}=20W, f=850MHz	40	45		W
η_C	Collector efficiency		50	55		%

* Note: Pulse test, P_W = 150μs, duty = 5%

MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

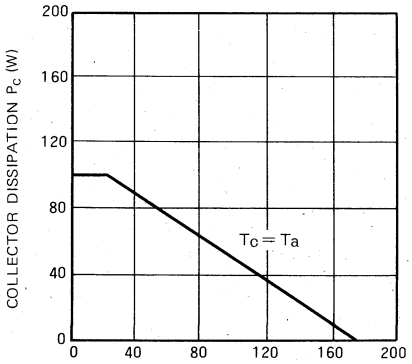
TEST CIRCUIT (f = 850MHz)



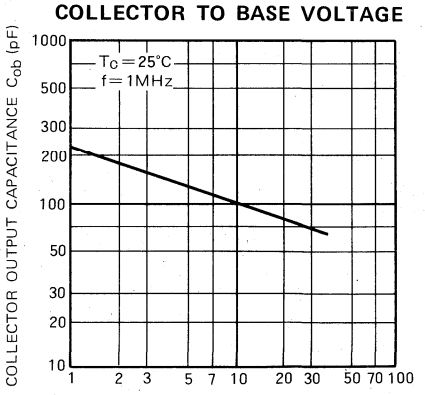
$L_1 \sim L_4$: W = 3mm STRIP-LINE
L_5: 5D, 1T, 0P, 1.0φ SILVER PLATED COPPER WIRE.
RFC: 5D, 1/2T, 1.0φ SILVER PLATED COPPER WIRE.
NOTE: BOARD MATERIAL-GLASS TEFLON. $\varepsilon_S = 2.6$, t = 0.8mm.
D: INNER DIAMETER. T: TURN NUMBER. P: PITCH.
ALL DIMENSIONS IN mm.

TYPICAL PERFORMANCE DATA

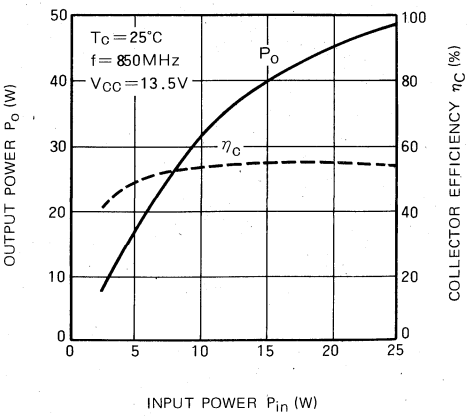
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



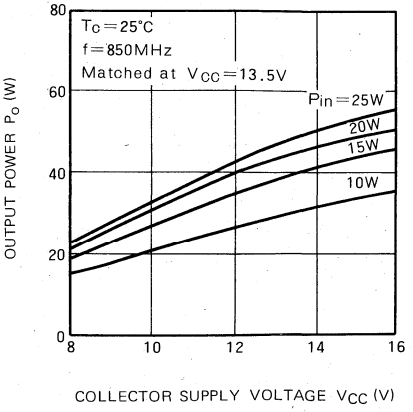
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER

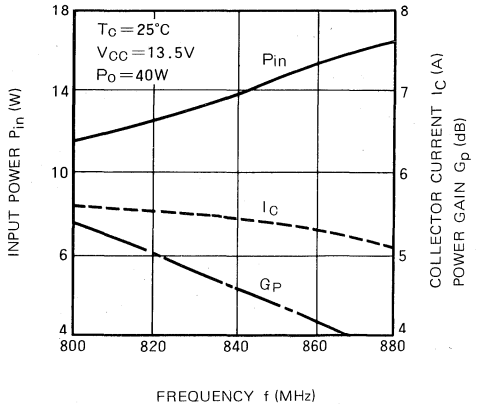


OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



NPN EPITAXIAL PLANAR TYPE

INPUT POWER, POWER GAIN,
COLLECTOR CURRENT VS. FREQUENCY



RECOMMENDATION AND PRECAUTION ON THE USE OF DEVICE

1. MOUNTING METHOD TO THE HEAT SINK

Mounting the device to the heat sink should be given a special consideration as follows.

Optimum distance between the centers of the installing bolt holes is 18.3 mm, and optimum diameter of this hole is 3.5 mm.

Apply a thin coat of thermal compound to every portions relating with the thermal conduction such as the flange bottom, the installing bolt holes etc.

Optimum tightening torque is 5 to 6 kg-cm.

Prevent the upward stress to the leads.

Soldering should be conducted at the temperature of 250°C or lower and within 8 seconds.

2. OPERATING JUNCTION TEMPERATURE Tj(op)

When designing the circuit, the thermal design should be performed so that the operating junction temperature Ti(op) will be 130°C or lower even under the ambinet temperature of 60°C.

3. BASE TO EMITTER BIAS RESISTANCE

Where a bias resistor is inserted between the base and the emitter for the devise to operate in AB or C class, make the resistance's value as small as possible, (normally 5Ω or less). If the value is excessibly large, reverse voltage will be applied to the emitter-base junction by this resistor when the drive power is large, and the emitter-base junction may be brought to avalanche breakdown by the drive power, resulting in the degradation of h_{FE} and output power.

4. GUARANTEED CHARACTERISTICS

All the graphic characteristics illustrated in this catalog are typical examples. The characteristics of individual device specified in Maximum ratings and Electrical characteristics are guaranteed under specified conditions.

5. DISPOSAL OF UNUSED DEVICES

The ceramic body of this transistor contains beryllium oxide (BeO). The dust or the vapor of BeO's porcelain is hazardous if inhaled, so don't crush, grind or abrade this portion. And don't treat the package in the high temperature (over 800°C) damp atmoshere.

MITSUBISHI ELECTRIC

2SC3908

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC3908 is a silicon NPN epitaxial planar type transistor designed for HF power amplifiers applications.

FEATURES

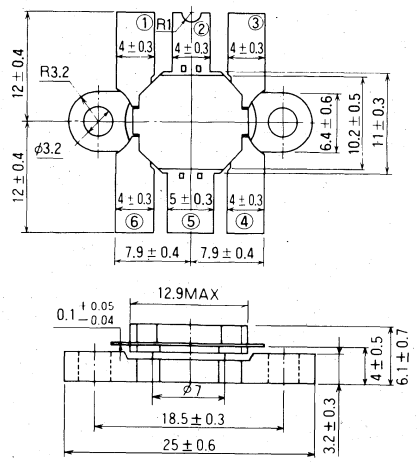
- High power gain: $G_{pe} \geqq 11.5$dB
  @P_O = 100W, f = 30MHz, V_{CC} = 12.5V
- The ability withstand infinite VSWR when operated at f = 30MHz. V_{CC} = 12.5V, P_O = 100W.
- Flange type ceramic package.

APPLICATION

For output stage of 100 ~ 150W power amplifiers in HF band SSB mobile radio sets. (Push-pull operation)

OUTLINE DRAWING

Dimensions in mm



PIN:
① EMITTER (FLANGE)
② COLLECTOR
③ EMITTER (FLANGE)
④ EMITTER (FLANGE)
⑤ BASE
⑥ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

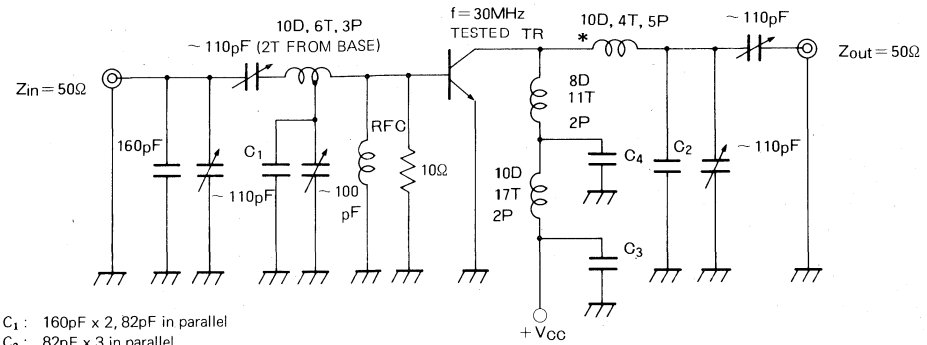
Symbol	Parameter		Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		5	V
V_{CEO}	Collector to emitter voltage		20	V
I_C	Collector current		22	A
P_C	Collector dissipation	T_a=25°C	7.8	W
		T_C=25°C	200	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−55~+175	°C
Rth-a	Thermal resistance		19.2	°C/W
Rth-c			0.75	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_C=20mA, I_E=0	50			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_E=20mA, I_C=0	5			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C=0.1A, R_{BE}=∞	20			V
I_{CBO}	Collector cutoff current	V_{CB}=15V, I_E=0			5	mA
I_{EBO}	Emitter cutoff current	V_{EB}=3V, I_C=0			5	mA
h_{FE}	DC forward current gain	V_{CE}=10V, I_C=1A	10	50	180	—
P_O	Output power	f=30MHz, V_{CC}=12.5V, P_{in}=7W	100	110		W
η_C	Collector efficiency		55	60		%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT

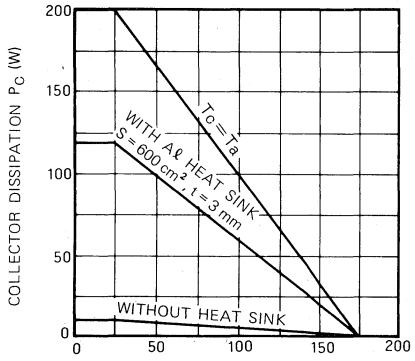


C_1 : 160pF x 2, 82pF in parallel
C_2 : 82pF x 3 in parallel
C_3 : 100pF, 4700pF x 2, 0.22μF x 2,,33μF, 330μF in parallel
C_4 : 100pF, 220pF, 4700pF, 0.1μF, 330μF in parallel
RFC : 27T on a dust core (V_9T-10-8-6), 1φ enamel dense wiring

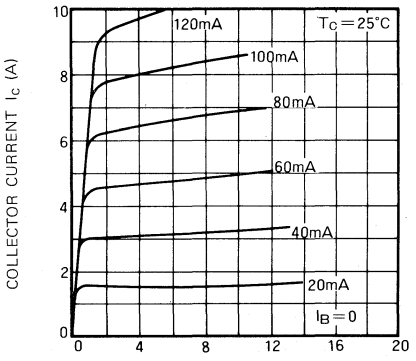
NOTES: 1.5φ silver plated copper wire coil, 2.3φ in diameter for those marked by *
D: Inner diameter of coil
T: Coil Turn
P: Coil pitch
Coil dimensions in mm

TYPICAL PERFORMANCE DATA

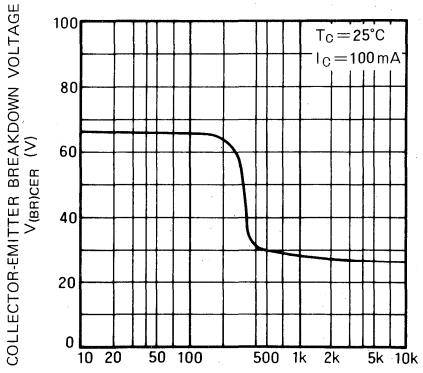
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



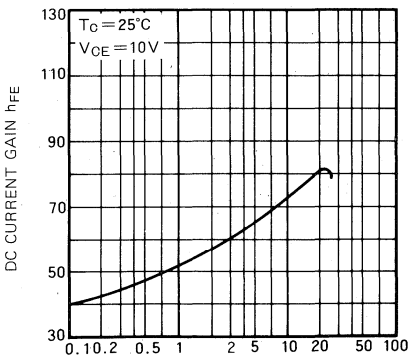
OUTPUT CHARACTRISTIC, COMMON EMITTER



COLLECTOR-EMITTER BREAKDOWN VOLTAGE VS. BASE-EMITTER RESISTANCE



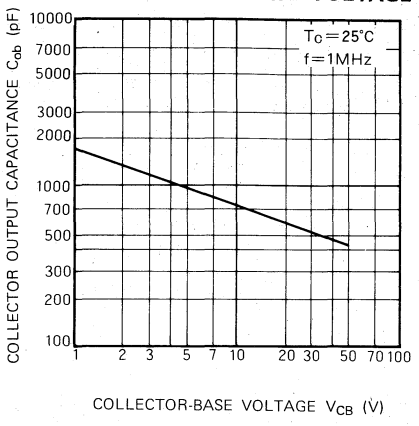
DC CURRENT GAIN VS. COLLECTOR CURRENT



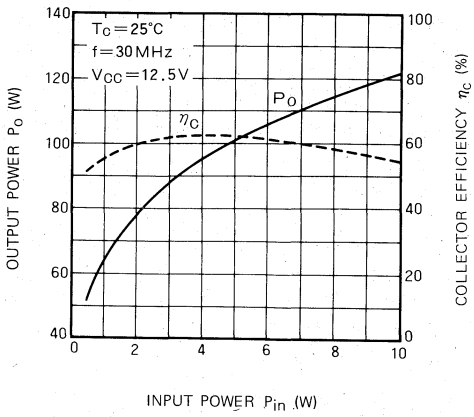
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

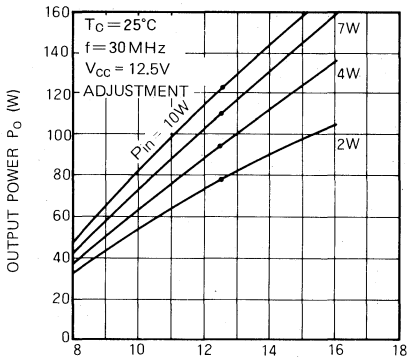
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR-BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



OUTPUT POWER, COLLECTOR SUPPLY VOLTAGE VARIATION



PRECAUTIONS FOR USE

Mitsubishi transistors have high reliability and good performance, as they are designed and manufactured under strict quality control. However, the characteristics and reliability of semiconductor devices are greatly affected by usage conditions if inappropriate thermal, mechanical or electrical stresses are applied.

To keep high reliability and obtain good performance when using Mitsubishi transistors, the following important points should be noted before use:

1. OPERATING JUNCTION TEMPERATURE $T_{j\,(OP)}$

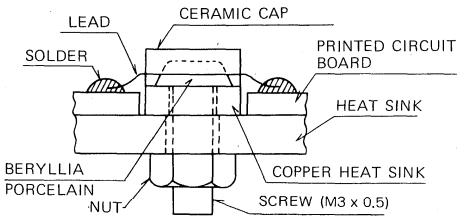
When designing a heat sink, keep the operating junction temperature $T_{j(OP)}$ below 130°C at ambient temperature T_a = 60°C.

2. BASE-EMITTER EXTERNALLY CONNECTED RESISTOR

If a base-emitter bias resistor is inserted for AB class or C class amplifiers, the resistance value should be minimized. (Normally less than 5Ω to 10Ω.) If this value is too large, exciting input is increased and reverse bias current is applied to base and emitter and the emitter-base junction breaks down because of this exciting input, thus reducing h_{FE} and output power.

3. MOUNTING METHOD

(1) Use fastening screws of M3 x 0.5.
(2) Fastening torque of screw is recommended as 5 to 6 kg-cm.
(3) Application of compound: Thermal compound to get good heat sinking should be applied to the bottom of the flange, fastening screws, as well as inside flange holes and holes of module's fin.
(4) The distance between the centers of screw holes of heat sink fins should be 18.3 ± 0.2mm and the diameter of holes should be 3.5 mm.
(5) When mounting the device to the substrate, do not apply upper tensile force to the leads.
(6) The temperature of lead soldering should be less than 250°C and shorter than 8 seconds.



4. GUARANTEED CHARACTERISTICS

All the graphic characteristics illustrated in this catalog are typical examples. The characteristics of individual devices as specified in the tables of absolute maximum ratings and electrical characteristics are guaranteed under the specified conditions.

5. PROCESSING OF DEFECTIVE PRODUCT OR DISCARDED PRODUCT

Beryllia porcelain is used in the transistor package. Dust or vapor of beryllia porcelain is extremely harmful to you. Do not cut, crack, or carve the device or do not process the device at high temperature (more than 800°C) in humid atmosphere.

2SC4167

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC4167 is a silicon NPN epitaxial planar type transistor specifically designed for UHF power amplifiers applications.

FEATURES

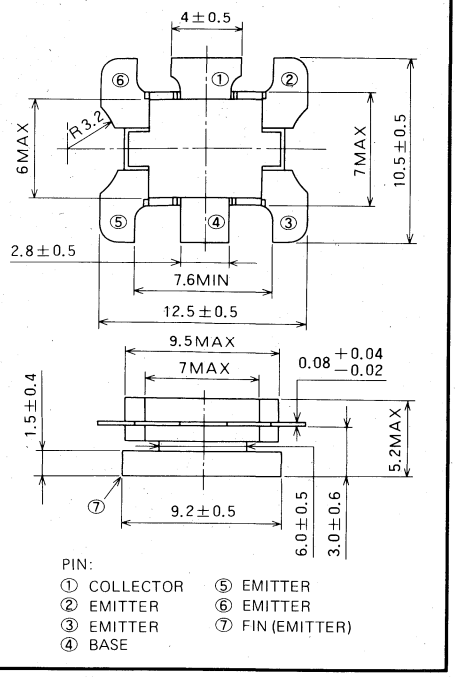
- High power gain: $G_{pe} \geqq 7.6$dB
  @V_{CC} = 12.5V, f = 520MHz, P_{in} = 1.2W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 15.2V, f = 520MHz, P_O = 7W.
- Flange type ceramic package.
- $Z_{in} = 2.2 + j3.1\Omega$,
  $Z_{out} = 6 - j1.0\Omega$ @V_{CC} = 12.5V, f = 520MHz, P_O = 7W.

APPLICATION

For output stage of 5W power amplifiers and drive stage of higher power amplifiers in UHF band.

OUTLINE DRAWING

Dimensions in mm



ABSOLUTE MAXIMUM RATINGS (T_C = 25°C)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		35	V
V_{EBO}	Emitter to base voltage		4	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	17	V
I_C	Collector current		2	A
P_C	Collector dissipation	T_C = 25°C	20	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

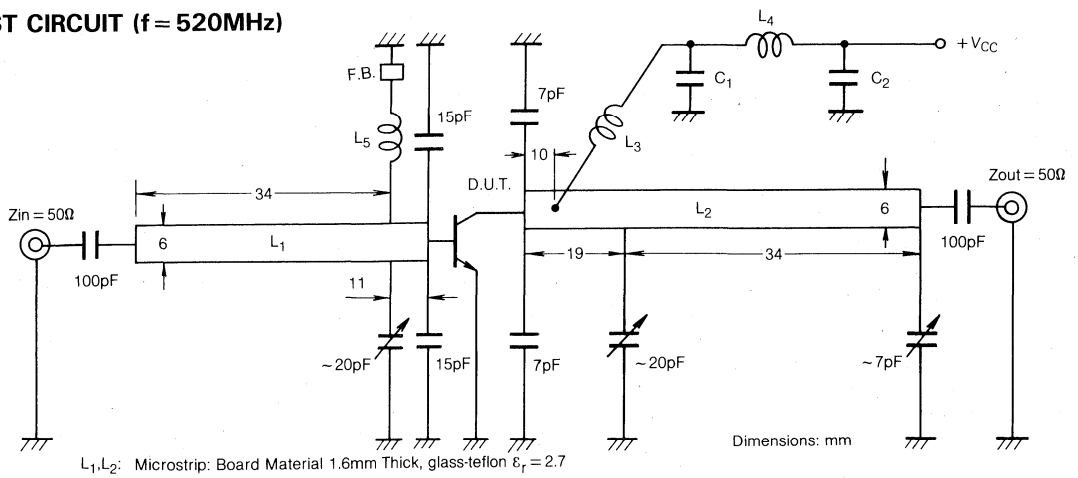
ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 5mA, I_C = 0	4			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	35			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 50mA, $R_{BE} = \infty$	17			V
I_{CBO}	Collector cut off current	V_{CB} = 15V, I_E = 0			500	μA
I_{EBO}	Emitter cut off current	V_{EB} = 3V, I_C = 0			500	μA
h_{FE}	DC forward current gain *	V_{CE} = 10V, I_C = 0.1A	10	50	180	—
P_O	Power Output	V_{CC} = 12.5V, P_{in} = 1.2W, f = 520MHz	7	8		W
η_C	Collector efficiency		50	60		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 520MHz)

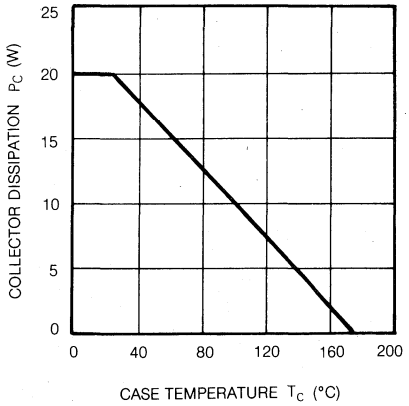


L_1,L_2: Microstrip: Board Material 1.6mm Thick, glass-teflon $\varepsilon_r = 2.7$
L_3: 3 Turns AWG #20, 5mm I.D.
L_4: 6 Turns AWG #20, 5mm I.D.
L_5: 10 Turns AWG #26 Enameled Wire on 4mm O.D., 14mm Length Bakelite.

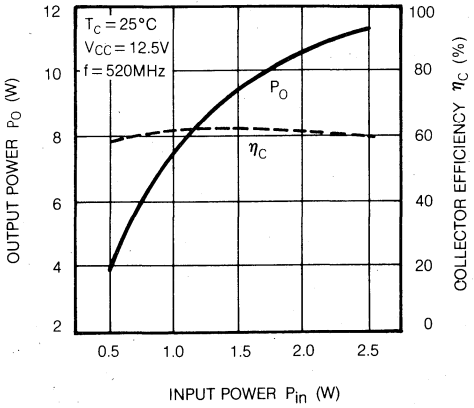
F.B.: Ferrite Bead
C_1: 82pF, 220pF, 4700pF, 10μF in parallel
C_2: 82pF, 220pF, 10μF in parallel

TYPICAL PERFORMANCE DATA

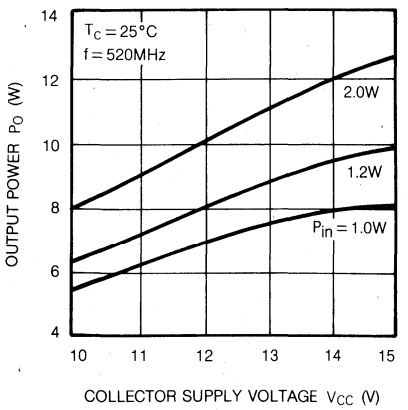
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



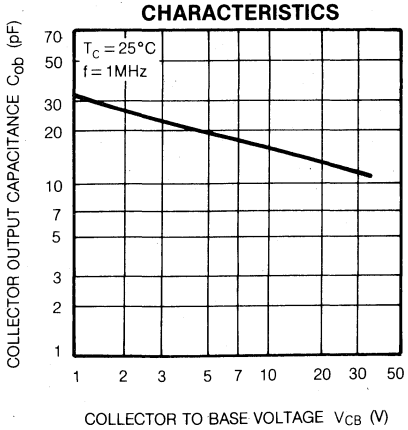
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



2SC4240

NPN EPITAXIAL PLANAR TYPE

DESCRIPTION

2SC4240 is a silicon NPN epitaxial planar type transistor specifically designed for VHF power amplifier applications.

FEATURES

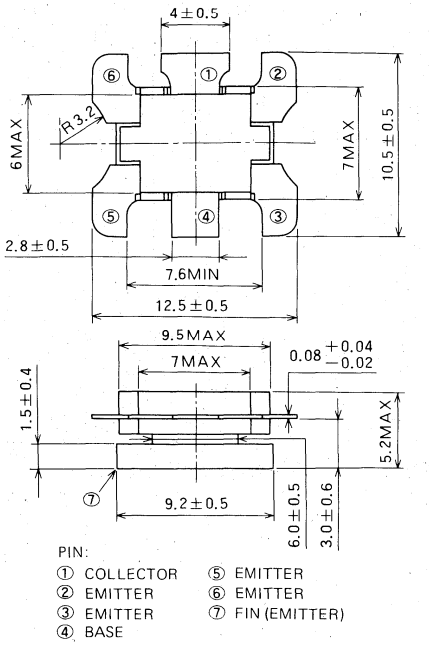
- High power gain: $G_{pe} \geqq 13$dB.
  @V_{CC} = 7.2V, f = 175MHz, P_{in} = 0.3W.
- Emitter ballasted construction.
- High ruggedness: Ability to withstand more than 20:1 load VSWR when operated at V_{CC} = 9V, f = 175MHz, P_O = 6.0W.
- Flange type ceramic package.
- $Z_{in} = 1.5 - j1.3\Omega$, $Z_{out} = 5.0 - j1.2\Omega$
  @V_{CC} = 7.2V, f = 175MHz, P_O = 6.0W.

APPLICATION

For output stage of 5W power amplifiers in VHF band portable type radio sets.

OUTLINE DRAWING

Dimensions in mm



PIN:

① COLLECTOR	⑤ EMITTER
② EMITTER	⑥ EMITTER
③ EMITTER	⑦ FIN (EMITTER)
④ BASE	

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C)

Symbol	Parmeter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		20	V
V_{EBO}	Emitter to base voltage		3.5	V
V_{CEO}	Collector to emitter voltage	$R_{BE} = \infty$	9	V
I_C	Collector current		3	A
P_C	Collector dissipation	T_C = 25°C	20	W
Tj	Junction temperature		+175	°C
Tstg	Storage temperature		−55 ~ +175	°C

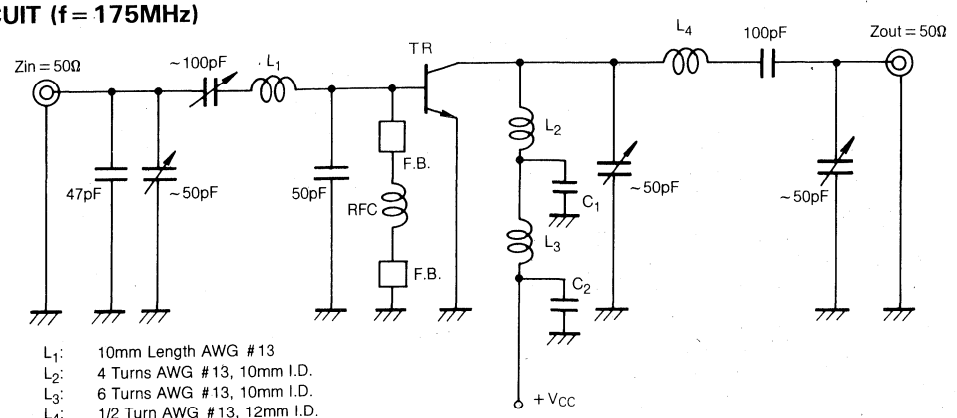
ELECTRICAL CHARACTERISTICS (T_C = 25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 5mA, I_C = 0	3.5			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	20			V
$V_{(BR)CEO}$	Collector to emitter breakdown voltage	I_C = 50mA, $R_{BE} = \infty$	9			V
I_{CBO}	Collector cut-off current	V_{CB} = 10V, I_E = 0			500	μA
I_{EBO}	Emitter cut-off current	V_{EB} = 2V, I_C = 0			500	μA
h_{FE}	DC forward current gain *	V_{CE} = 5V, I_C = 0.1A	20	50	180	—
P_O	Power Output	V_{CC} = 7.2V, Pin = 0.3W, f = 175MHz	6	7		W
η_C	Collector efficiency		60	65		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

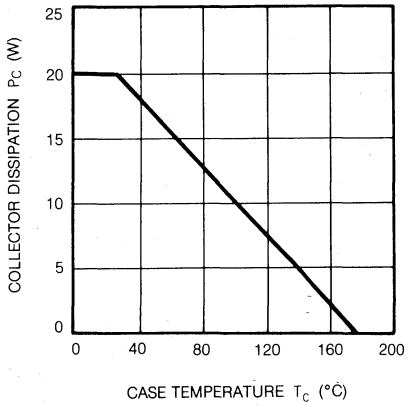
TEST CIRCUIT (f = 175MHz)



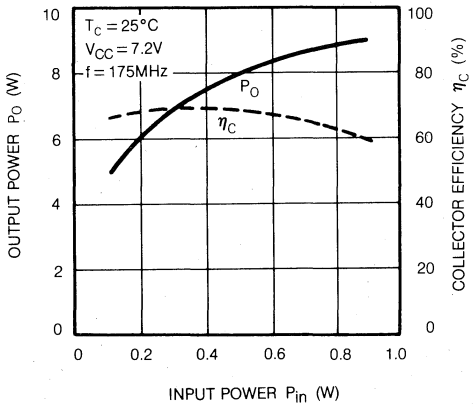
L_1: 10mm Length AWG #13
L_2: 4 Turns AWG #13, 10mm I.D.
L_3: 6 Turns AWG #13, 10mm I.D.
L_4: 1/2 Turn AWG #13, 12mm I.D.
RFC: 40 Turns AWG #32 Enameled wire Close Wound on 4mm O.D.
14mm Length Bakelite.
C_1: 220pF, 1000pF, 4700pF, 10μF in parallel.
C_2: 220pF, 1000pF, 4700pF, 10μF in parallel.

TYPICAL PERFORMANCE DATA

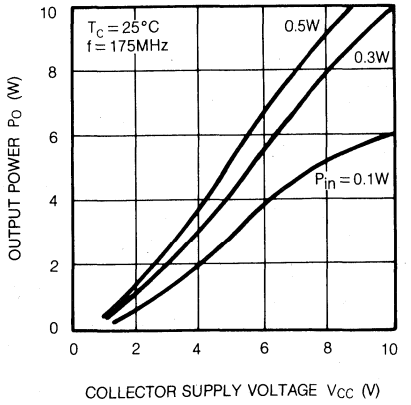
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



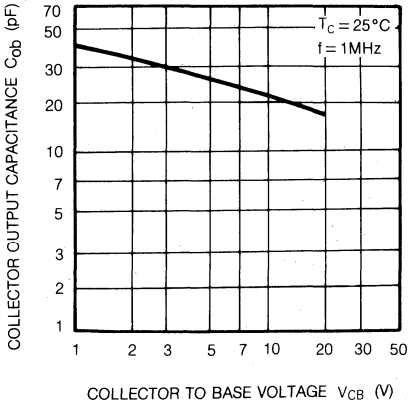
OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS.



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



2SC4524

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

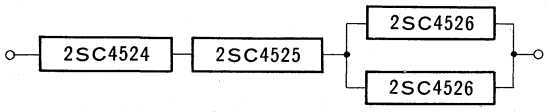
2SC4524 is a silicon NPN epitaxial planar type transistor specifically designed for RF power amplifiers applications in 1.65GHz.

FEATURES

- High power gain: $G_{pb} \geqq 5.4$dB, $P_O = 7$W @$V_{CC} = 28$V, f = 1.65GHz.
- High ruggedness: Ability to withstand 16:1 load VSWR when operated at $V_{CC} = 28$V, f = 1.65GHz, $P_O = 7$W.
- Emitter ballasted construction. Gold metalization die.

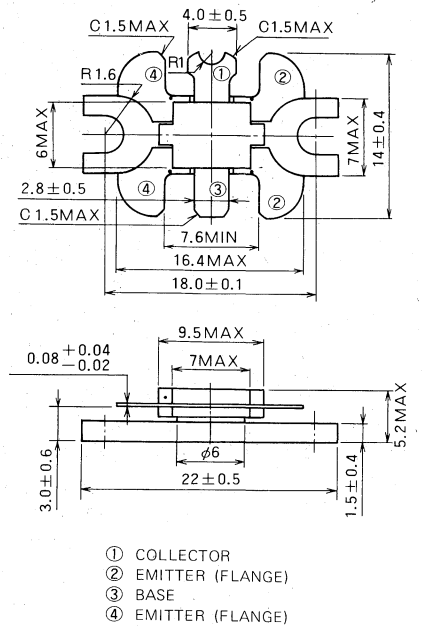
APPLICATION

For pre-amplifier stage of 50W, 1.6GHz – 1.65GHz, 28V, amamplifier.



OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② EMITTER (FLANGE)
③ BASE
④ EMITTER (FLANGE)

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		4	V
V_{CES}	Collector to emitter voltage	$R_{BE}=0$	45	V
I_C	Collector current		2.5	A
P_C	Collector dissipation	$T_C=25$°C	30	W
T_j	Junction temperature		+175	°C
Tstg	Storage temperature		−50 ~ +175	°C
Rth-c	Thermal resistance	Junction to case	5.0	°C/W

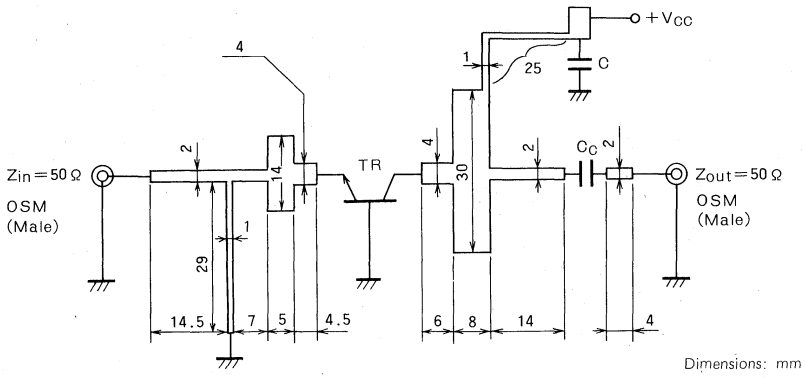
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	$I_E=5$mA, $I_C=0$	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	$I_C=10$mA, $I_E=0$	50			V
$V_{(BR)CES}$	Collector to emitter breakdown voltage	$I_C=10$mA, $R_{EB}=0$	45			V
I_{CBO}	Collector cutoff current	$V_{CB}=25$V, $I_E=0$			1	mA
h_{FE}	DC forward current gain *	$V_{CE}=5$V, $I_C=1$A	10	50	180	—
P_O	Output power	$V_{CC}=28$V, f=1.65GHz, $P_{in}=2$W	7	10		W
η_C	Collector efficiency		45	50		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

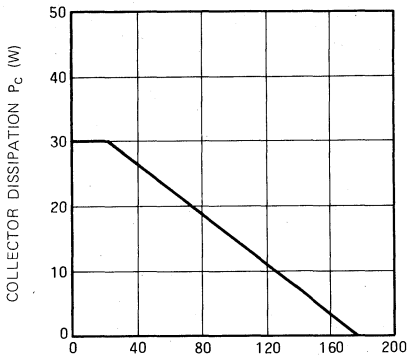
TEST CIRCUIT



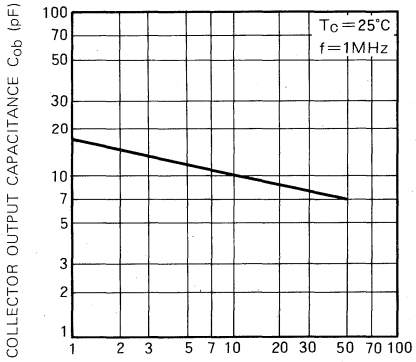
Cc: 50pF Chip capacita
C : 50pF, 2200pF, 22000pF, 100μF in parallel
Board Material: Teflon-Glass t = 0.8 mm

TYPICAL PERFORMANCE DATE

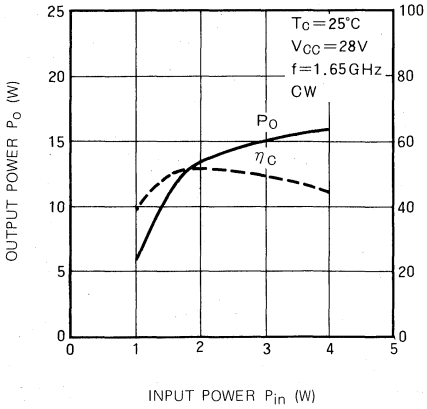
COLLECTOR DISSIPATION VS. AMBIENT TEMPERATURE



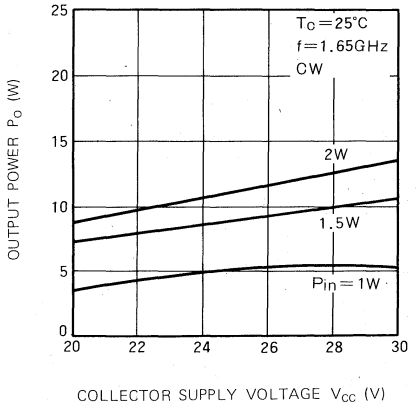
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER



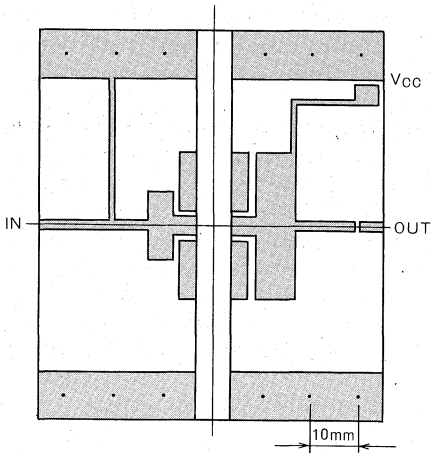
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE



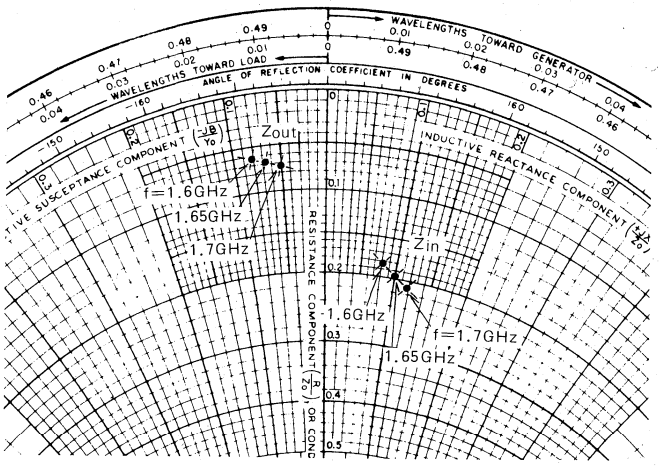
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

CIRCUIT PATTERN LAYOUT



INPUT AND OUTPUT SERIES IMPEDANCE



f	Zin (Ω)	Zout (Ω)
1.6GHz	9.2+j4.0	3.2−j3.0
1.65GHz	9.8+j4.9	3.4−j3.3
1.7GHz	10.3+j6	3.7−j2.5

CONDITIONS:
V_{CC}=28V, f=1.6−1.7GHz,
P_O=7W CW

1. Special Instructions for Flange-Mounted Ceramic-Encapsulated High-Frequency High-Output Transistor Installation

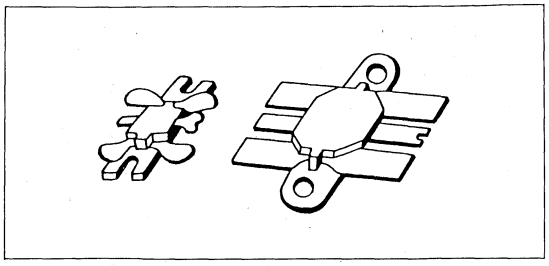


Fig. 1 Flange-Mounted Ceramic Encapsulated High-Frequency High-Output Transistor

When the flange-mounted ceramic-encapsulated transistor shown in Fig. 1 is mounted on a heat sink plate, be sure to follow the special instructions below, after referring to Fig. 2.

(1) Be sure to use M3 x 0.5 screws for mounting the transistor.

(2) Be sure that the fastening screws are tightened to a torque of 5 to 6kg.cm.

(3) Application of lubricants (grease): Apply lubricant (grease) to all heat-conducting components, including the bottom of the flange, the fastening screws, inside the flange holes, and the holes of the heat sink fins. Particular care is required in applying the lubricant compound. Be the more careful the greater the higher the operating level of the device concerned is.

(4) Be sure that the screw hole centers of the heat sink fins are spaced at a distance of 18.3 ± 0.2mm and that the holes have a diameter of 3.5mm.

(5) Take care to ensure that when the device is mounted on to the substrate, no tensile stress acting in the upward direction is applied to the leads. Mount so that the printed circuit board is positioned slightly lower than the bottom of the leads.

(6) After the device has been mounted, solder the leads so that the soldering temperature is below 250°C and that the time used for soldering one lead is within 8 seconds.

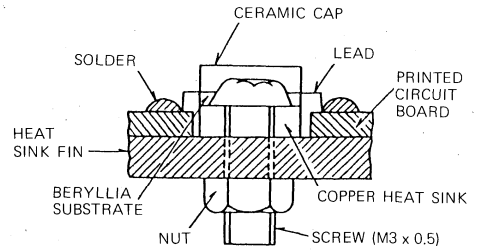


Fig. 2 Installation Procedure for Flange-Mounted Ceramic-Encapsulated Transistor with Printed Pattern on the Upper Surface

2. Precautions for Use of the Device

(1) Operating Junction Temperature (Tjop)

Be sure to design the circuit so that the operating junction temperature Tjop will not exceed 130°C at ambient temperature conditions within 60°C.

(2) Base-Emitter Externally Connected Resistor

If a bias resistor is inserted between the base and emitter for AB class amplifiers, be sure to design the bias circuit so that the resistance remains below 5 ohm. If this resistance value is excessively high, the exciting input will be increased, accordingly and a reverse bias current will be applied between the base and the emitter, thereby iving rise to the problem of a reduction in h_{FE} and a drop in the output power.

(3) Guaranteed Characteristics

All graphic characteristics illustrated in this catalog are typical examples. The characteristics for the individual devices are guaranteed under the specified conditions laid down with respect to the absolute maximum ratings and electrical characteristics.

3. Disposal of Defective or Discarded Products

All types of resin-encapsulated and ceramic-encapsulated high-frequency high-output transistors as well as some metal-encapsulated high-frequency high-output transistors use beryllia porcelain. The inhalation of beryllia dust and/or vapors can be extremely dangerous to the human body. It is therefore essential not to attempt to break, crush, cut, or dispose of these devices at high temperatures (above 800°C) in a moisture-containing atmosphere.

2SC4525

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

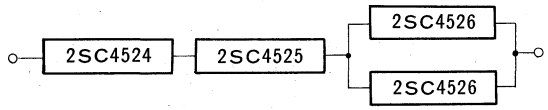
2SC4525 is a silicon NPN epitaxial planar type transistor specifically designed for RF power amplifiers applications in 1.65GHz.

FEATURES

- High power gain: $G_{pb} \geqq 6.0$dB, P_O = 20W @V_{CC} = 28V, f = 1.65GHz.
- High ruggedness: Ability to withstand 16:1 load VSWR when operated at V_{CC} = 28V, f = 1.65 GHz, P_O = 20W.
- Emitter ballasted construction. Gold metalization die.

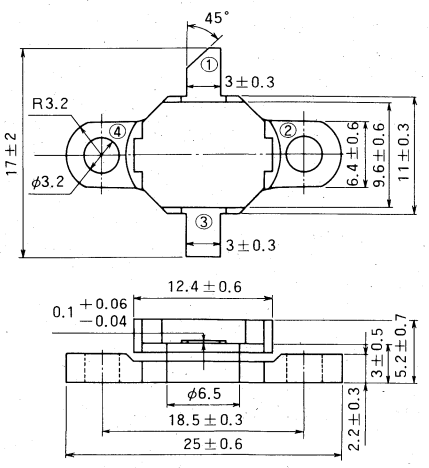
APPLICATION

For drive-amplifier stage of 50W, 1.6 ~ 1.65GHz amplifier.



OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② BASE
③ EMITTER
④ EMITTER

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		4.0	V
V_{CES}	Collector to emitter voltage	R_{BE} = 0	45	V
I_C	Collector current		5.0	A
P_C	Collector dissipation	T_C = 25°C	60	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55 ~ +175	°C

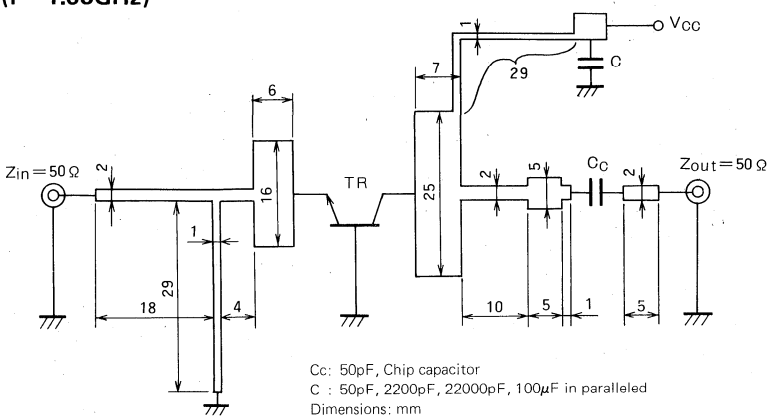
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E = 10mA, I_C = 0	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C = 10mA, I_E = 0	50			V
$V_{(BR)CES}$	Collector to emitter breakdown voltage	I_C = 10mA, R_{BE} = 0	45			V
I_{CBO}	Collector cutoff current	V_{CB} = 25V, I_E = 0			2	mA
h_{FE}	DC forward current gain *	V_{CE} = 5V, I_C = 5A	10	50	180	—
P_O	Output power	V_{CC} = 28V, f = 1.65GHz, P_{in} = 5W	20	25		W
η_C	Collector efficiency		40	45		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

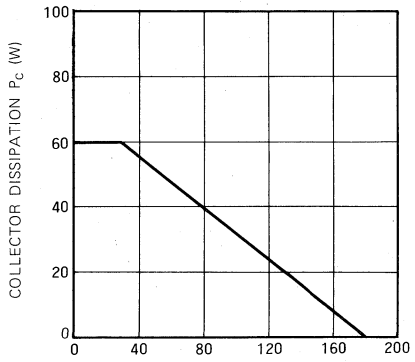
TEST CIRCUIT (f = 1.65GHz)



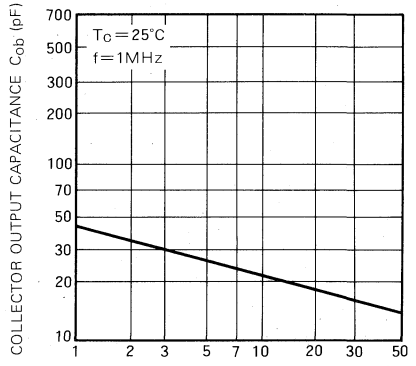
Cc: 50pF, Chip capacitor
C : 50pF, 2200pF, 22000pF, 100μF in paralleled
Dimensions: mm
Board material: Teflon-Grass 0.8 mm

TYPICAL PERFORMANCE DATE

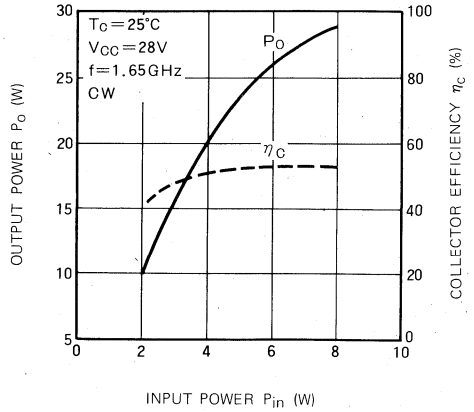
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



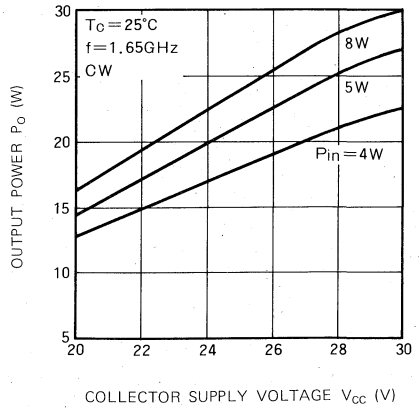
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



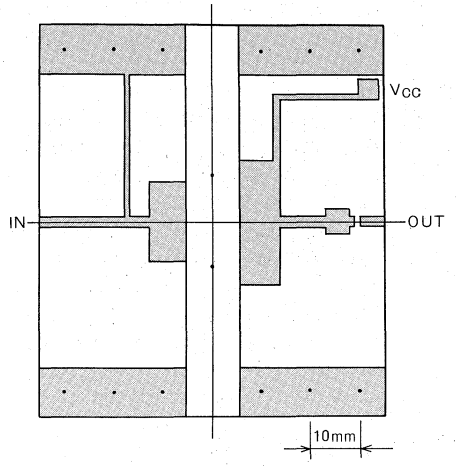
OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS



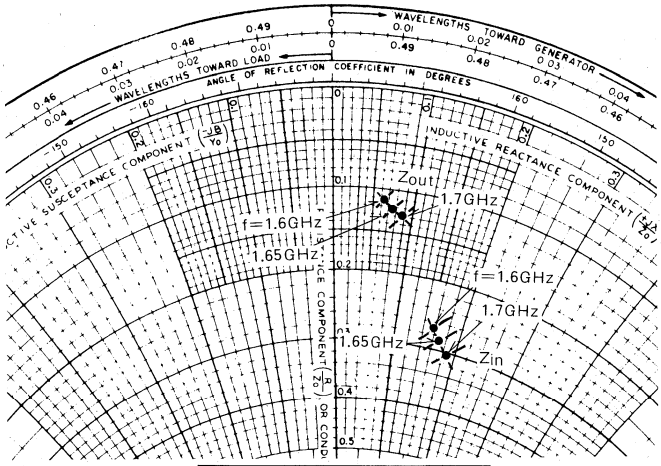
MITSUBISHI ELECTRIC

NPN EPITAXIAL PLANAR TYPE

CIRCUIT PATTERN LAYOUT



INPUT AND OUTPUT SERIES IMPEDANCE



f	Zin(Ω)	Zout(Ω)
1.6GHz	13.5+j8.0	5.6+j3.2
1.65GHz	14.5+j8.5	6.0+j3.8
1.7GHz	15.2+j9.2	6.5+j4.5

CONDITIONS:
V_{CC}=28V, f=1.6—1.7GHz,
P_O=20W CW

1. Special Instructions for Flange-Mounted Ceramic-Encapsulated High-Frequency High-Output Transistor Installation

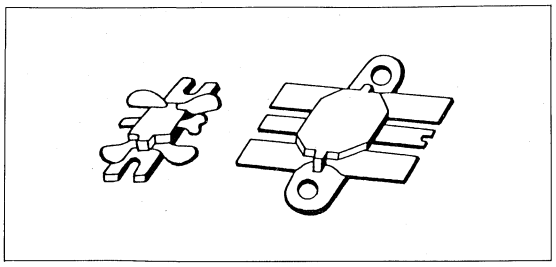


Fig. 1 Flange-Mounted Ceramic Encapsulated High-Frequency High-Output Transistor

When the flange-mounted ceramic-encapsulated transistor shown in Fig. 1 is mounted on a heat sink plate, be sure to follow the special instructions below, after referring to Fig. 2.

(1) Be sure to use M3 x 0.5 screws for mounting the transistor.

(2) Be sure that the fastening screws are tightened to a torque of 5 to 6kg.cm.

(3) Application of lubricants (grease): Apply lubricant (grease) to all heat-conducting components, including the bottom of the flange, the fastening screws, inside the flange holes, and the holes of the heat sink fins. Particular care is required in applying the lubricant compound. Be the more careful the greater the higher the operating level of the device concerned is.

(4) Be sure that the screw hole centers of the heat sink fins are spaced at a distance of 18.3 ± 0.2mm and that the holes have a diameter of 3.5mm.

(5) Take care to ensure that when the device is mounted on to the substrate, no tensile stress acting in the upward direction is applied to the leads. Mount so that the printed circuit board is positioned slightly lower than the bottom of the leads.

(6) After the device has been mounted, solder the leads so that the soldering temperature is below 250°C and that the time used for soldering one lead is within 8 seconds.

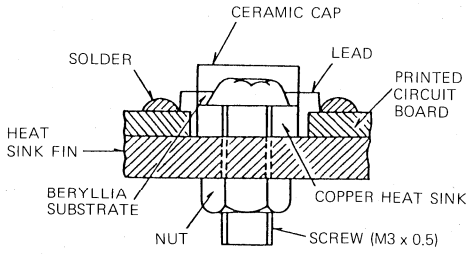


Fig. 2 Installation Procedure for Flange-Mounted Ceramic-Encapsulated Transistor with Printed Pattern on the Upper Surface

2. Precautions for Use of the Device

(1) Operating Junction Temperature (Tjop)

Be sure to design the circuit so that the operating junction temperature Tjop will not exceed 130°C at ambient temperature conditions within 60°C.

(2) Base-Emitter Externally Connected Resistor

If a bias resistor is inserted between the base and emitter for AB class amplifiers, be sure to design the bias circuit so that the resistance remains below 5 ohm. If this resistance value is excessively high, the exciting input will be increased, accordingly and a reverse bias current will be applied between the base and the emitter, thereby iving rise to the problem of a reduction in h_{FE} and a drop in the output power.

(3) Guaranteed Characteristics

All graphic characteristics illustrated in this catalog are typical examples. The characteristics for the individual devices are guaranteed under the specified conditions laid down with respect to the absolute maximum ratings and electrical characteristics.

3. Disposal of Defective or Discarded Products

All types of resin-encapsulated and ceramic-encapsulated high-frequency high-output transistors as well as some metal-encapsulated high-frequency high-output transistors use beryllia porcelain. The inhalation of beryllia dust and/or vapors can be extremely dangerous to the human body. It is therefore essential not to attempt to break, crush, cut, or dispose of these devices at high temperatures (above 800°C) in a moisture-containing atmosphere.

2SC4526

NPN EPITAXIAL PLANAR TYPE

DISCRIPTION

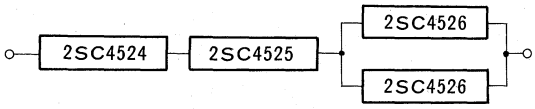
2SC4526 is a silicon NPN epitaxial planar type transistor specifically designed for RF power amplifier applications in 1.65GHz.

FEATURES

- High power gain: $G_{pb} \geqq 4.5$dB, $P_O = 28$W @$V_{CC} = 28$V, f = 1.65GHz.
- High ruggedness: Ability to withstand 16:1 load VSWR when operated at $V_{CC} = 28$V, f = 1.65 GHz, $P_O = 28$W.
- Emitter ballasted construction. Gold metalization die.

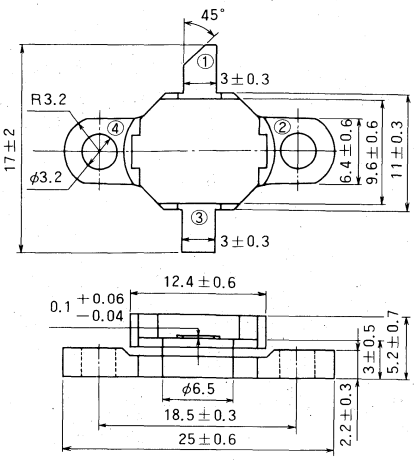
APPLICATION

For final stage (parallel or push-pull operation) of 50W, 1.6 ~ 1.65GHz, 28V, amplifier.



OUTLINE DRAWING

Dimensions in mm



① COLLECTOR
② BASE
③ EMITTER
④ EMITTER

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CBO}	Collector to base voltage		50	V
V_{EBO}	Emitter to base voltage		4	V
V_{CES}	Collector to emitter voltage	$R_{BE} = 0$	45	V
I_C	Collector current		7.5	A
P_C	Collector dissipation	T_C=25°C	90	W
T_j	Junction temperature		+175	°C
T_{stg}	Storage temperature		−55~+175	°C

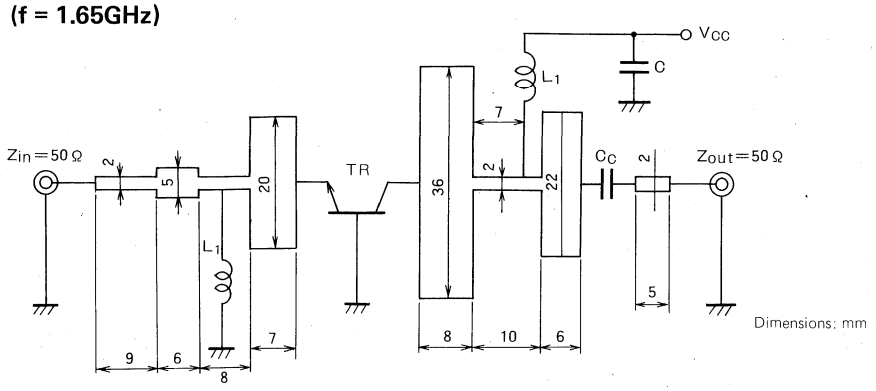
ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)EBO}$	Emitter to base breakdown voltage	I_E=10mA, I_C=0	4.0			V
$V_{(BR)CBO}$	Collector to base breakdown voltage	I_C=10mA, I_E=0	50			V
$V_{(BR)CES}$	Collector to emitter breakdown voltage	I_C=10mA, R_{EB}=0	45			V
I_{CBO}	Collector cutoff current	V_{CB}=25V, I_E=0			3	mA
h_{FE}	DC forward current gain *	V_{CE}=5V, I_C=6A	10	50	180	—
P_O	Output power	V_{CC}=28V, f=1.65GHz, P_{in}=10W	28	32		W
η_C	Collector efficiency		40	45		%

* Note: Pulse test, P_W = 150μs, duty = 5%

NPN EPITAXIAL PLANAR TYPE

TEST CIRCUIT (f = 1.65GHz)

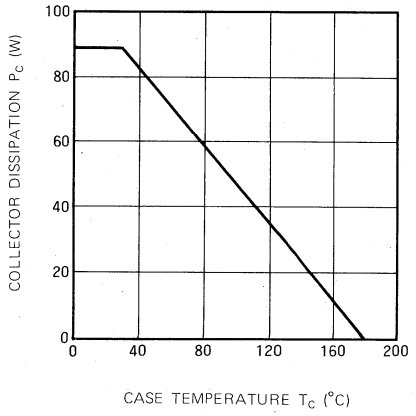


Cc: 50pF Chip capacitance
C : 50pF, 2200pF, 22000pF, 100μF in paralleled
L_1: O.D. AWG #20, 29 mm
L_2: O.D. AWG #20, 29 mm

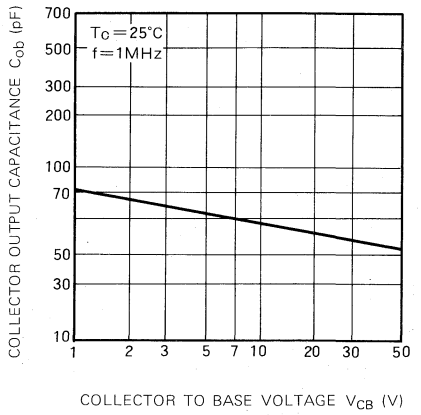
Board material: Teflon-Grass 0.8 mm

TYPICAL PERFORMANCE DATE

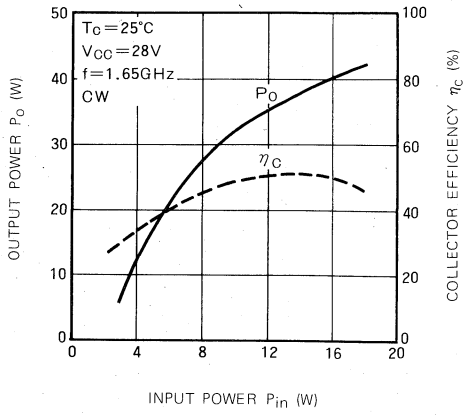
COLLECTOR DISSIPATION VS. CASE TEMPERATURE CHARACTERISTICS



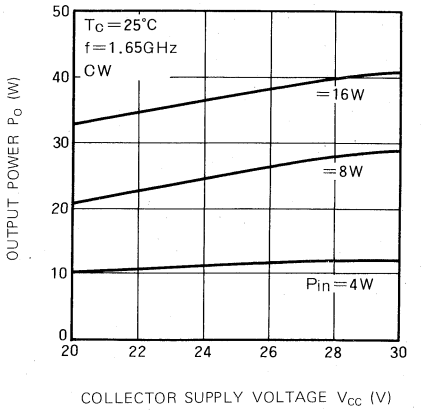
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE CHARACTERISTICS



OUTPUT POWER, COLLECTOR EFFICIENCY VS. INPUT POWER CHARACTERISTICS



OUTPUT POWER VS. COLLECTOR SUPPLY VOLTAGE CHARACTERISTICS

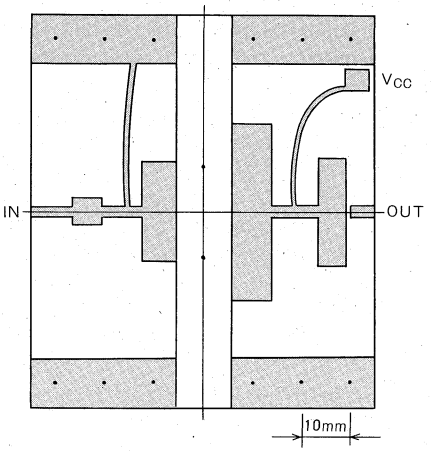


MITSUBISHI ELECTRIC

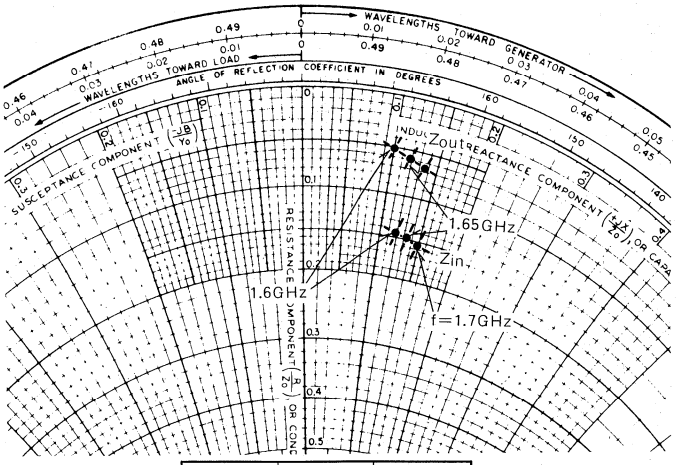
2SC4526

NPN EPITAXIAL PLANAR TYPE
1.65GHz, 28V, 28W

CIRCUIT PATTERN LAYOUT



INPUT AND OUTPUT SERIES IMPEDANCE



f	Zin (Ω)	Zout (Ω)
1.6GHz	7.1+j6.0	2.6+j5.1
1.65GHz	7.4+j6.6	3.0+j6.0
1.7GHz	7.9+j7.2	3.5+j6.8

CONDITIONS:
V_{CC}=28V, f=1.6−1.7GHz,
P_O=28W

1. Special Instructions for Flange-Mounted Ceramic-Encapsulated High-Frequency High-Output Transistor Installation

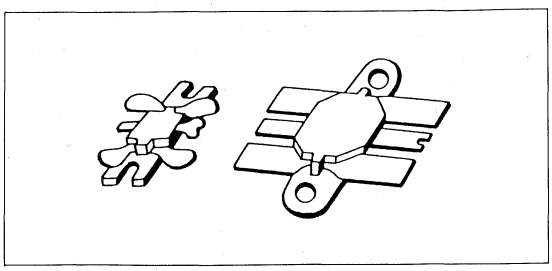


Fig. 1 Flange-Mounted Ceramic Encapsulated High-Frequency High-Output Transistor

When the flange-mounted ceramic-encapsulated transistor shown in Fig. 1 is mounted on a heat sink plate, be sure to follow the special instructions below, after referring to Fig. 2.

(1) Be sure to use M3 x 0.5 screws for mounting the transistor.

(2) Be sure that the fastening screws are tightened to a torque of 5 to 6kg.cm.

(3) Application of lubricants (grease): Apply lubricant (grease) to all heat-conducting components, including the bottom of the flange, the fastening screws, inside the flange holes, and the holes of the heat sink fins. Particular care is required in applying the lubricant compound. Be the more careful the greater the higher the operating level of the device concerned is.

(4) Be sure that the screw hole centers of the heat sink fins are spaced at a distance of 18.3 ± 0.2mm and that the holes have a diameter of 3.5mm.

(5) Take care to ensure that when the device is mounted on to the substrate, no tensile stress acting in the upward direction is applied to the leads. Mount so that the printed circuit board is positioned slightly lower than the bottom of the leads.

(6) After the device has been mounted, solder the leads so that the soldering temperature is below 250°C and that the time used for soldering one lead is within 8 seconds.

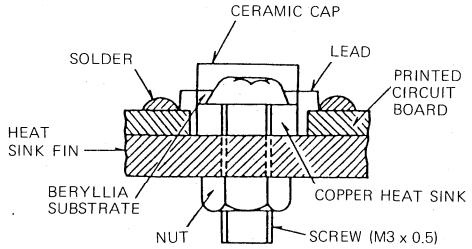


Fig. 2 Installation Procedure for Flange-Mounted Ceramic-Encapsulated Transistor with Printed Pattern on the Upper Surface

2. Precautions for Use of the Device

(1) Operating Junction Temperature (Tjop)

Be sure to design the circuit so that the operating junction temperature Tjop will not exceed 130°C at ambient temperature conditions within 60°C.

(2) Base-Emitter Externally Connected Resistor

If a bias resistor is inserted between the base and emitter for AB class amplifiers, be sure to design the bias circuit so that the resistance remains below 5 ohm. If this resistance value is excessively high, the exciting input will be increased, accordingly and a reverse bias current will be applied between the base and the emitter, thereby iving rise to the problem of a reduction in h_{FE} and a drop in the output power.

(3) Guaranteed Characteristics

All graphic characteristics illustrated in this catalog are typical examples. The characteristics for the individual devices are guaranteed under the specified conditions laid down with respect to the absolute maximum ratings and electrical characteristics.

3. Disposal of Defective or Discarded Products

All types of resin-encapsulated and ceramic-encapsulated high-frequency high-output transistors as well as some metal-encapsulated high-frequency high-output transistors use beryllia porcelain. The inhalation of beryllia dust and/or vapors can be extremely dangerous to the human body. It is therefore essential not to attempt to break, crush, cut, or dispose of these devices at high temperatures (above 800°C) in a moisture-containing atmosphere.

ANTENNA SWITCHES

4

MI105

PIN DIODE

DESCRIPTION

The MI105 PIN diode is employing a high reliability glass construction, designed for small signal switching.

FEATURES

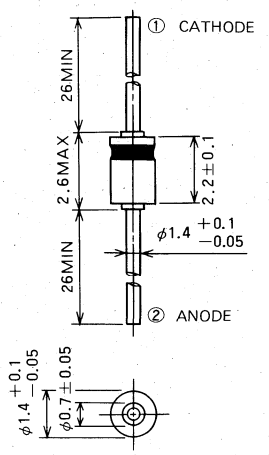
- Long carrier lifetime
- Low diode capacitance (0.25pF @VR=0V, f=100MHz)
- Low forward bias resistance
- Rugged for surge
- Small glass construction

APPLICATION

VTR. Video Disk Antenna switch.

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

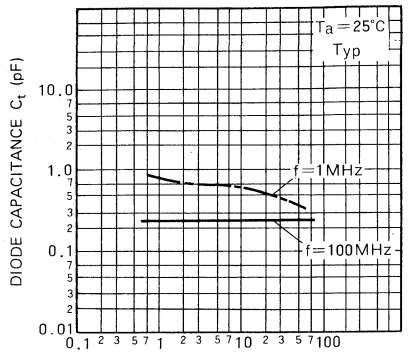
Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	30	V
V_R	Reverse voltage	30	V
P	Power dissipation	200	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C
I_{FM}	Forward current	150	mA

ELECTRICAL CHARACTERISTICS (Ta=25°C)

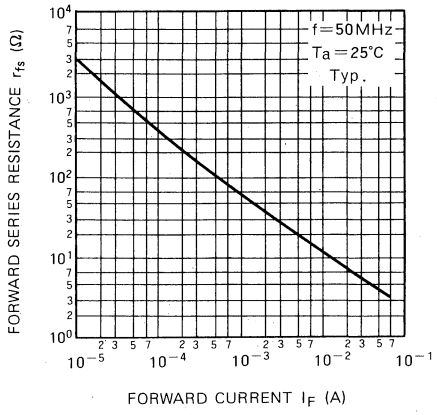
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=30V			10	μA
I_{R2}	Reverse current	V_R=28V			0.5	μA
I_F	Forward current	V_F=1.0V	30	70		mA
Ct	Diode capacitance	V_R=0V, f=100MHz		0.25	0.5	pF
r_{fs1}	Forward series resistance	I_F=10mA, f=50MHz		13	20	Ω
r_{fs2}	Forward series resistance	I_F=10μA, f=50MHz	1.0	3		kΩ

TYPICAL PERFORMANCE DATA

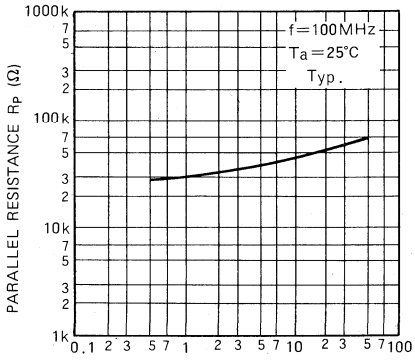
DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



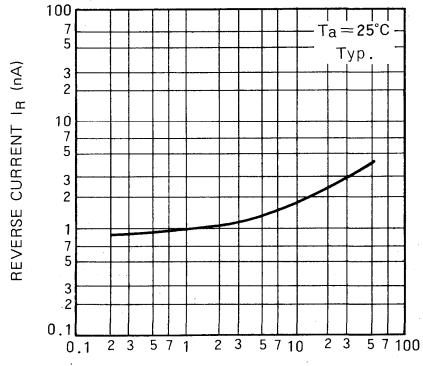
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



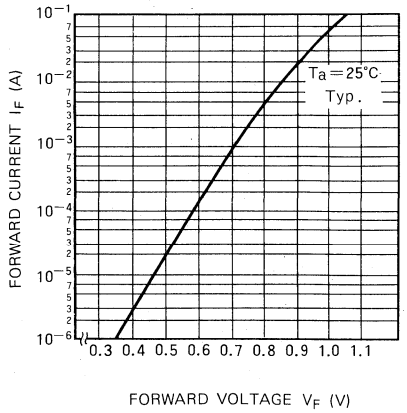
PARALLEL RESISTANCE VS. REVERSE VOLTAGE CHARACTERISTICS



REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



MITSUBISHI ELECTRIC

MI204

PIN DIODE

DESCRIPTION

The MI204 PIN diode is employing a high reliability glass construction designed for RF small signal attenuator in VHF UHF.

FEATURES

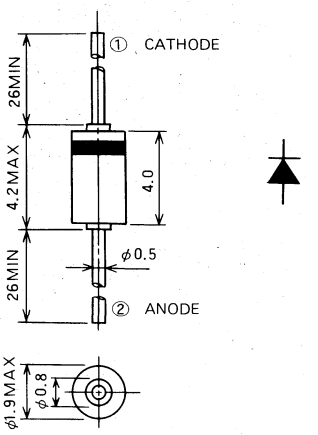
- Long carrier lifetime
- Low distortion
- Large dynamic range

APPLICATION

RF attenuator RF switching

OUTLINE DRAWING

Dimension: mm

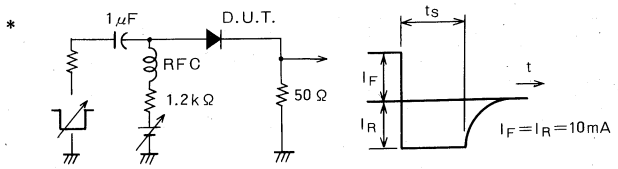


ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	30	V
V_R	Reverse voltage	28	V
P	Power dissipation	200	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

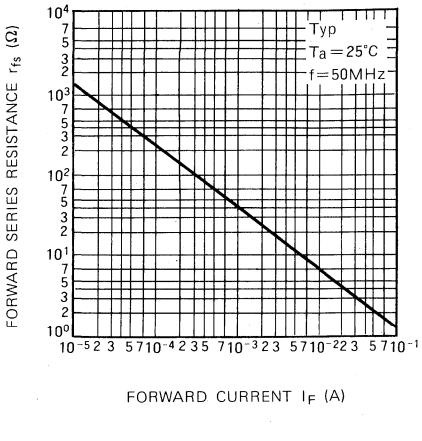
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=30V			10	μA
I_{R2}	Reverse current	V_R=28V			0.5	μA
V_F	Forward voltage	I_F=100mA			1.0	V
r_{fs1}	Forward series resistance	I_F=10mA, f=50MHz		5.5	10	Ω
r_{fs2}		I_F=10μA, f=50MHz	1.0	1.5		kΩ
Ct	Diode capacitance	V_R=15V, f=1.0MHz		0.7	1.2	pF
τ	Life time	I_F=10mA		2.1		μs
*ts	Storage time	I_F=10mA, I_R=10mA	0.6	1.5		μs

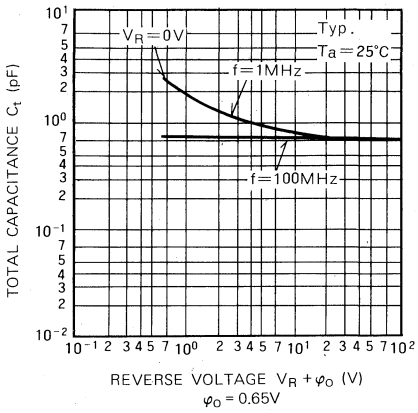


TYPICAL PERFORMANCE DATA

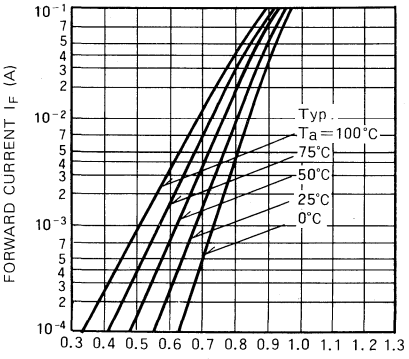
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



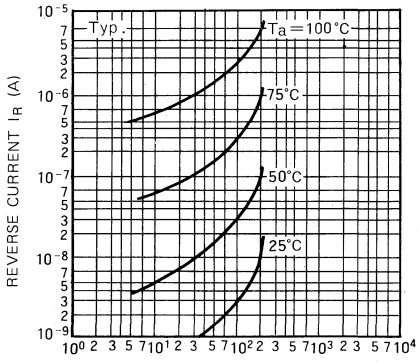
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



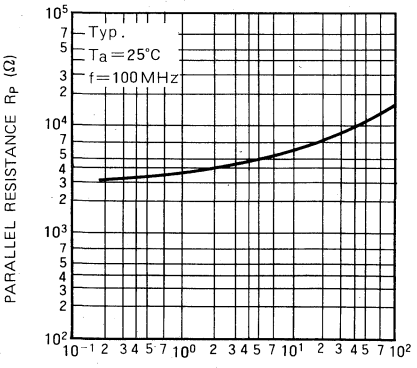
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



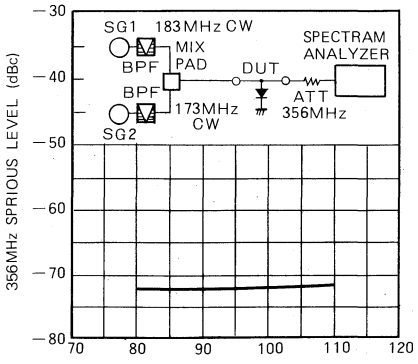
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



PARALLAEL RESISTANCE VS. REVERSE VOLTAGE CHARACTERISTICS



INTER MODULATION DISTORTION



MITSUBISHI ELECTRIC

MI301

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI301 PIN diode is employing high reliability glass construction, designed for solid state antenna switches in commercial two-way radios.

FEATURES

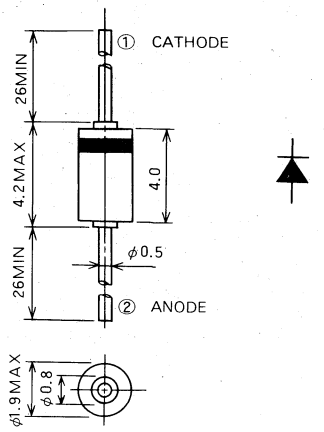
- Low insertion loss
- High isolation
- Small glass construction

APPLICATION

Antenna switching

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	80	V
I_{FSM} *	Forward surge current	2.0	A
P	Power dissipation	350	mW
T_j	Junction temperature	175	°C
T_{stg}	Storage temperature	−55～+175	°C

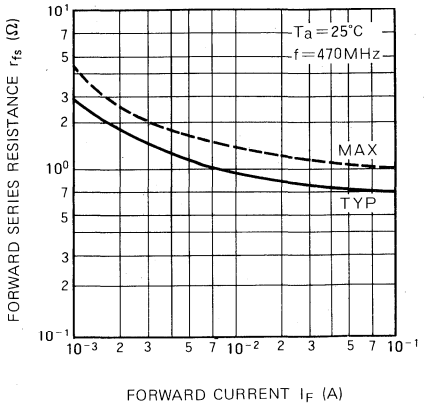
* : t=1sec

ELECTRICAL CHARACTERISTICS (Ta=25°C)

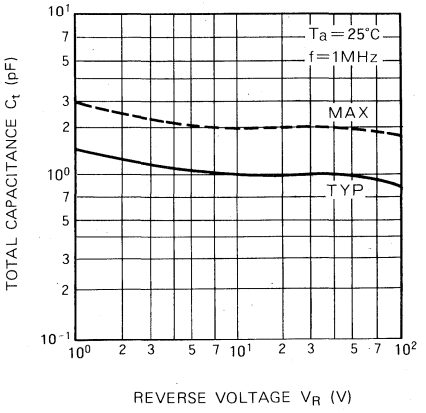
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_R	Reverse current	V_R=60V			150	nA
$V_{(BR)R}$	Reverse break-down voltage	I_R=10μA	80			V
I_F	Forward current	V_F=1.0V	100			mA
Ct	Diode capacitance	V_R=0V, f=1MHz			3.0	pF
r_{fs}	Forward series resistance	I_F=20mA, f=470MHz			1.2	Ω
Q	Q	V_R=0V, f=50MHz	20			—
L_S	Lead inductance	Total lead length 10mm		2.5		nH

TYPICAL PERFORMANCE DATA

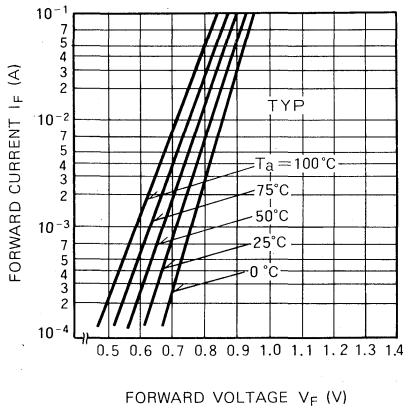
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



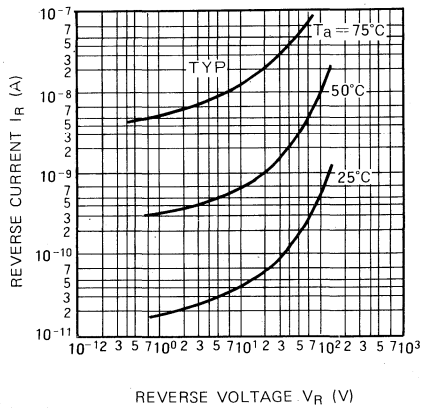
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



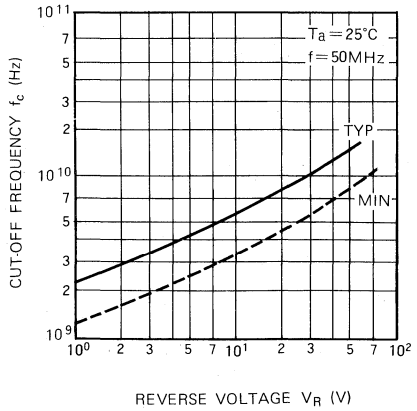
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



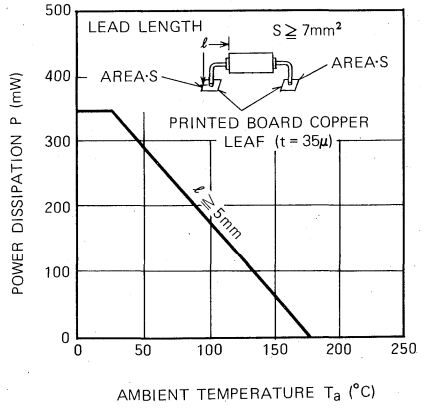
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



CUT-OFF FREQUENCY VS. REVERSE VOLTAGE CHARACTERISTICS

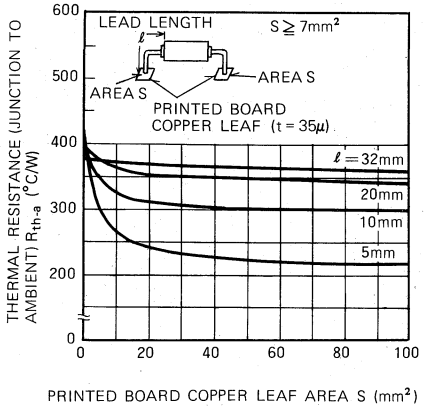


POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS

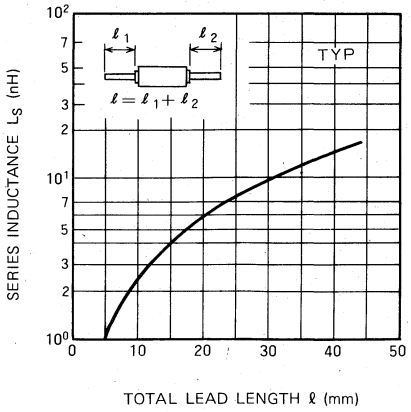


MITSUBISHI ELECTRIC

THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. PRINTED BOARD COPPER LEAF AREA CHARACTERISTICS

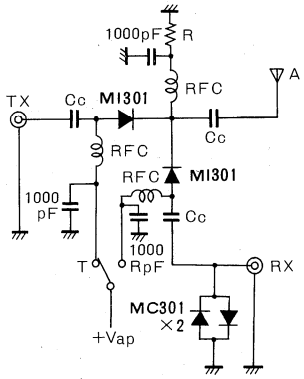


SERIES INDUCTANCE VS. TOTAL LEAD LENGTH CHARACTERISTICS

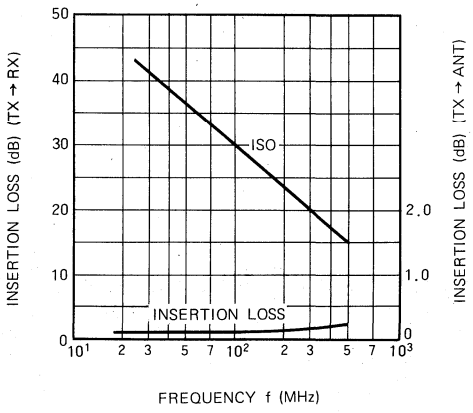


APPLICATION

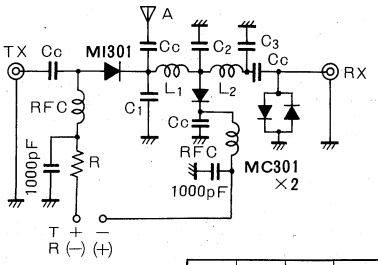
SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT



SINGLE POLE DOUBLE THROW SWITCHING CHARACTERISTICS

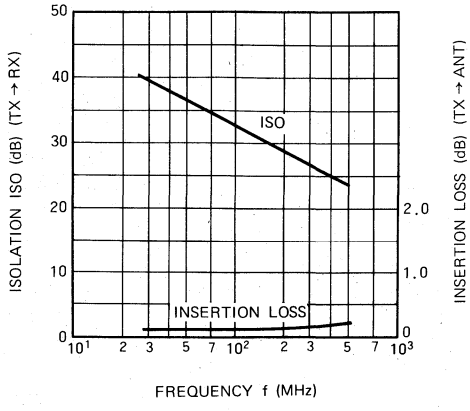


SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT (λ-4 TYPE)



	C1	C2	C3	L1, L2
50MHz	45pF	90pF	35pF	230nH
144MHz	15pF	24pF	6pF	75nH
440MHz	3pF	7pF	2pF	25nH

SINGLE POLE DOUBLE THROW SWITCHING (λ/4 TYPE) CHARACTERISTICS



MI303

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI303 PIN diode is employing high reliability glass construction, designed for solid state antenna switches in commercial two-way radios.

FEATURES

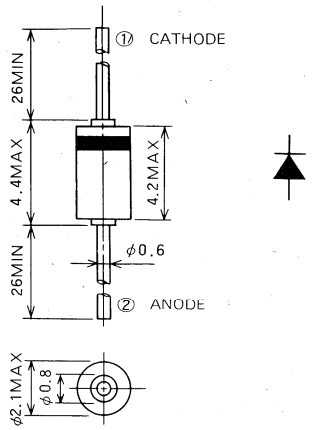
- Low insertion loss
- High isolation
- Small glass construction

APPLICATION

Antenna switching

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	180	V
I_{FSM} *	Forward surge current	2	A
P	Power dissipation	500	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

* : t=5sec

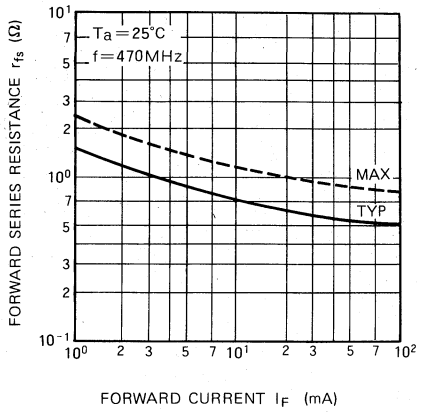
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=180V			10	μA
I_{R2}	Reverse current	V_R=140V			150	nA
I_F	Forward current	V_F=1.0V	200			mA
C_t	Diode capacitance	V_R=0V, f=1MHz			4.0	pF
r_{fs}	Forward series resistance	I_F=20mA, f=470MHz			1.0	Ω
f_c	Cut-off frequency	V_R=3V, f=50MHz	800			MHz

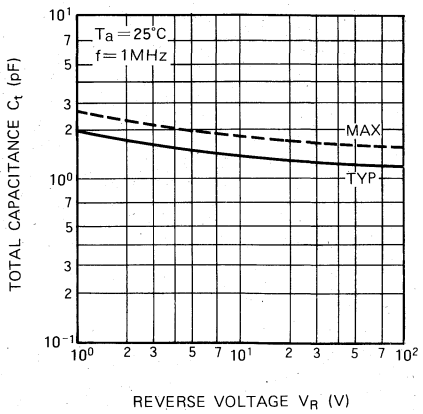
MITSUBISHI ELECTRIC

TYPICAL PERFORMANCE DATA

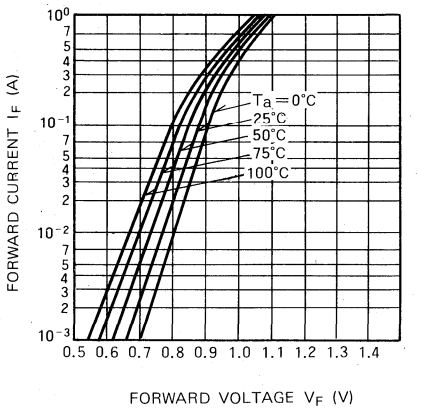
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



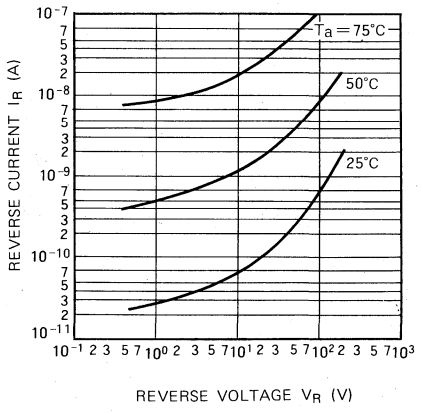
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



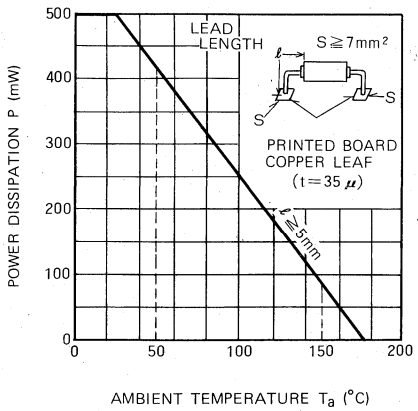
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



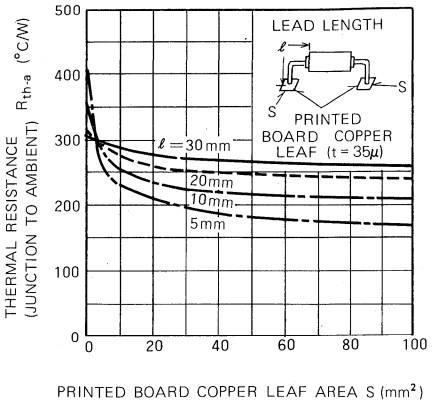
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



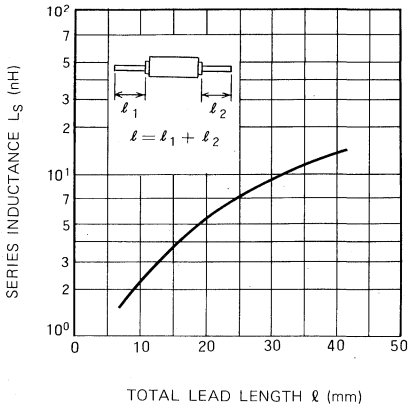
POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. PRINTED BOARD COPPER LEAF AREA CHARACTERISTICS

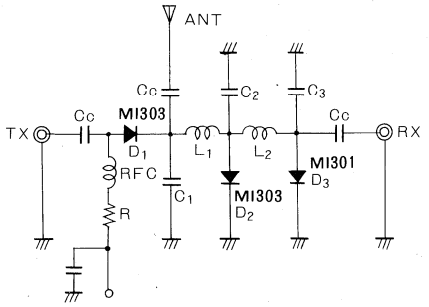


SERIES INDUCTANCE VS. TOTAL LEAD LENGTH CHARACTERISTICS



APPLICATION

SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT (λ-4 TYPE)



	C1	C2	C3	L1, L2
50MHz	45pF	90pF	35pF	230nH
144MHz	15pF	24pF	10pF	75nH
440MHz	3pF	6pF	2pF	25nH

TYPICAL DATA

f	Isolation TX→RX	Insertion Loss TX→ANT
50MHz	33dB	0.3dB
144MHz	33dB	0.3dB
440MHz	30dB	0.5dB

Handling Power 10W
Bias Current 20mA DC
2nd Harmonic >80dBc

MITSUBISHI ELECTRIC

MI308

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI308 PIN diode is employing a high reliability glass construction, designed for solid state antenna switchs in commercial two-way radios.

FEATURES

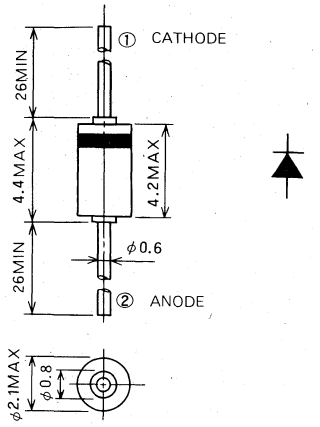
- High power handling
- High zero bias impedance
- Low forward bias resistance
- Low insertion loss, High isolation
- Low distortion (TX: sprious < -80dBc, RX: inter-modulation -73dBc @90dBμ)

APPLICATION

High power antenna switch (10W output two-way radio)

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Rating	Unit
V_{RM}	Repetitive peak reverse voltage	50	V
V_R	Reverse voltage	50	V
I_{FSM} *	Forward surge current	2	A
P	Power dissipation	500	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

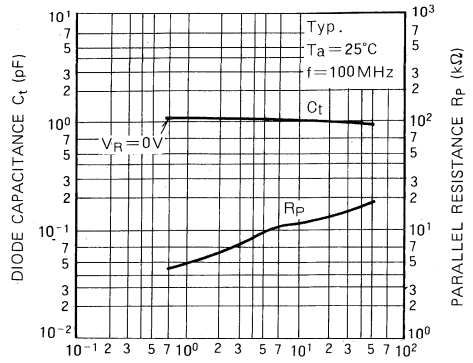
*: t=5sec

ELECTRICAL CHARACTERISTICS (Ta=25°C)

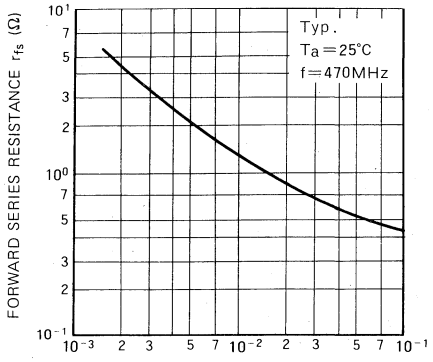
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=50V			10	μA
I_{R2}	Reverse current	V_R=45V			0.5	μA
I_F	Forward current	V_F=1.0V	100			mA
r_{fs}	Forward series resistance	I_F=50mA, f=470MHz		0.5	0.7	Ω
Ct	Diode capacitance	V_R=0V, f=100MHz			1.6	pF
R_P	Parallel resistance	V_R=0V, f=100MHz	1.0	3.0		kΩ

TYPICAL PERFORMANCE DATA

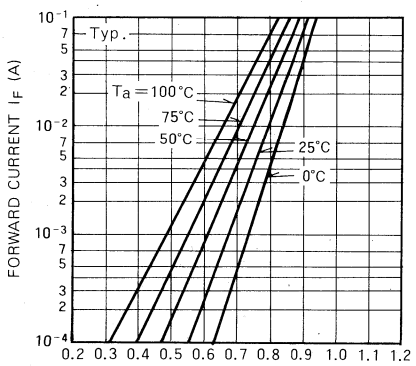
DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



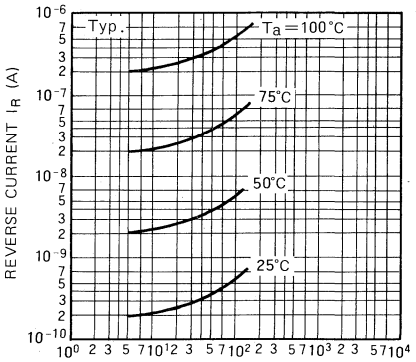
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



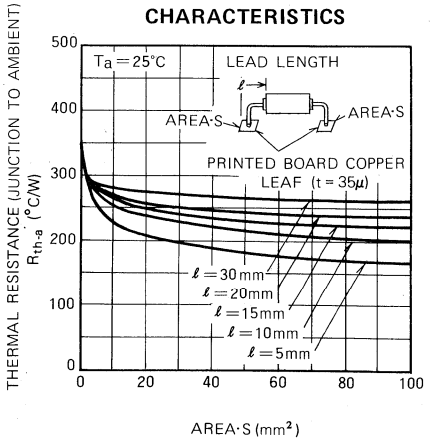
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS

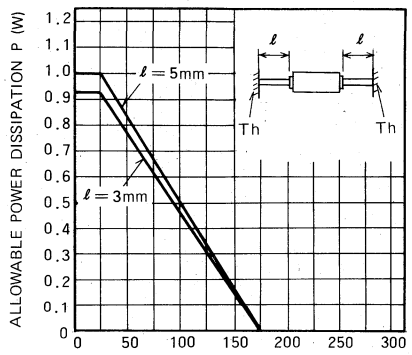


THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. AREA CHARACTERISTICS

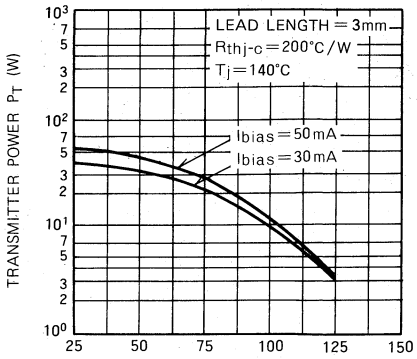


MITSUBISHI ELECTRIC

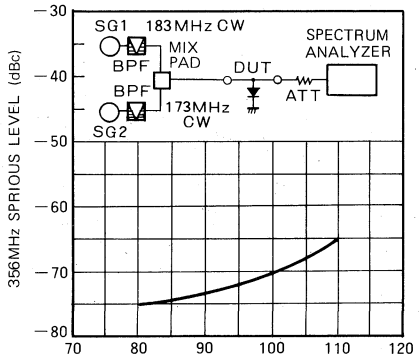
ALLOWABLE POWER DISSIPATION VS. HEAT SINK TEMPERATURE CHARACTERISTICS



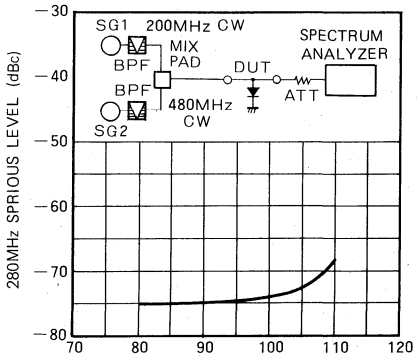
TRANSMITTER POWER VS. AMBIENT TEMPERATURE CHARACTERISTICS



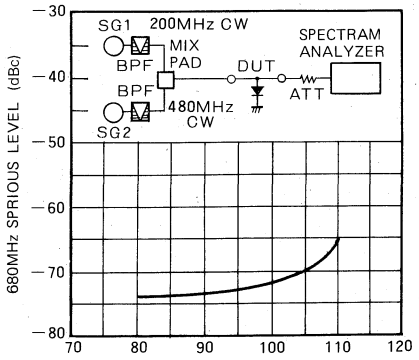
INTER MODULATION DISTORTION



INTER MODULATION DISTORTION



INTER MODULATION DISTORTION



MI402

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI402 PIN diode is employing a high reliability glass construction, designed for solid state antenna switches in commercial two-way radios.

FEATURES

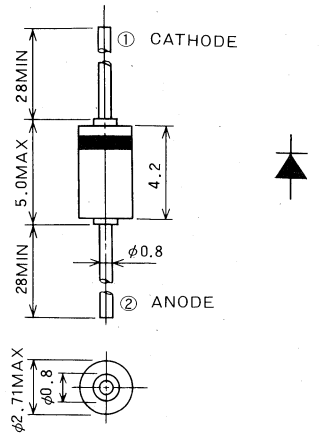
- High power handling
- Low insertion loss, High isolation

APPLICATION

High power antenna switch (25W output two-way radio)

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	270	V
I_{FSM} *	Forward surge current	2.0	A
P	Power dissipation	1.0	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55~+175	°C

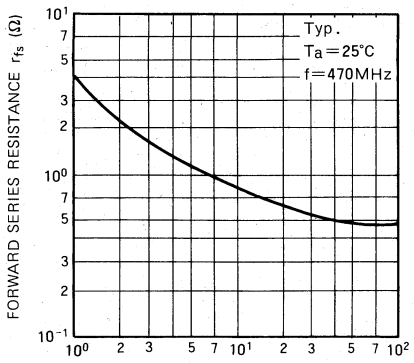
* : t=5sec

ELECTRICAL CHARACTERISTICS (Ta=25°C)

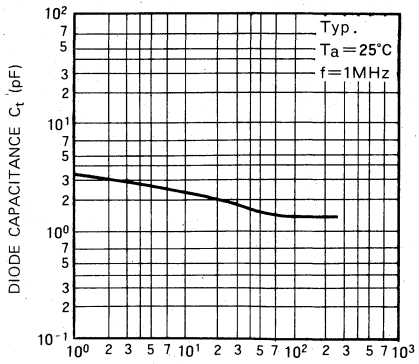
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=270V			10.0	μA
I_{R2}	Reverse current	V_R=200V			150	nA
I_F	Forward current	V_F=1.0V	500			mA
Ct	Diode capacitance	V_R=12V, f=1MHz			3.0	pF
r_{fs}	Forward series resistance	I_F=50mA, f=470MHz			0.7	Ω
f_C	Cut-off frequency	V_R=12V, f=50MHz	1.0			GHz

TYPICAL PERFORMANCE DATA

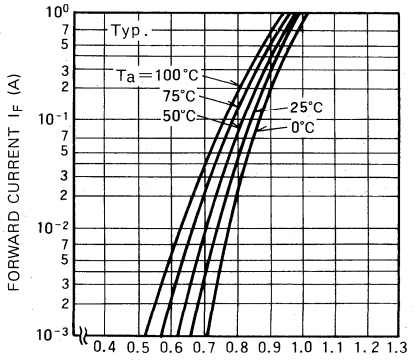
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



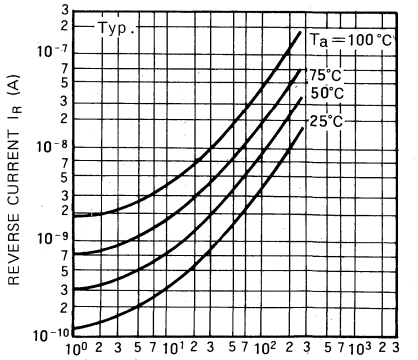
DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



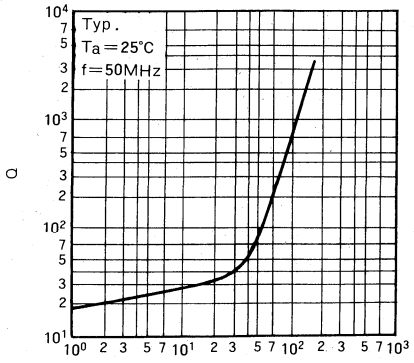
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



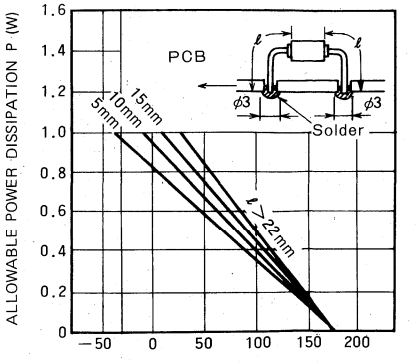
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



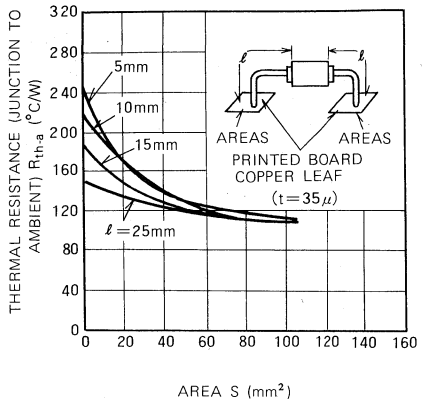
Q VS. REVERSE VOLTAGE CHARACTERISTICS



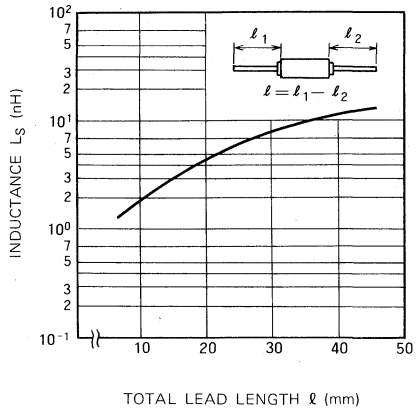
ALLOWABLE POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. AREA CHARACTERISTICS

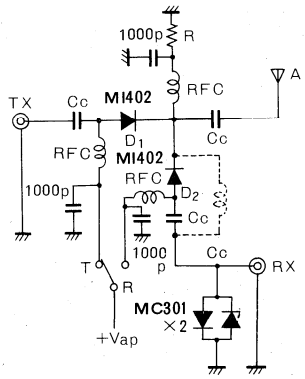


INDUCTANCE VS. TOTAL LEAD LENGTH CHARACTERISTICS



APPLICATION

SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT

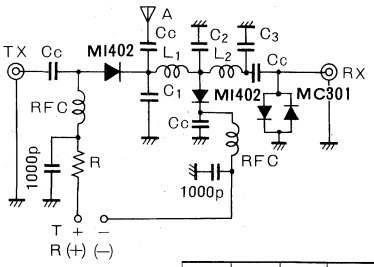


TYPICAL DATA

f	Isolation TX→RX	Insertion Loss TX→A
29MHz	40dB	0.3dB
50MHz	39dB	0.3dB
144MHz	39dB	0.3dB
220MHz	38dB	0.4dB
440MHz	36dB	0.5dB

HANDLING POWER 25W
BIAS CURRENT 50mA DC
SPRIOUS >80dB

SINGLE POLE DOUBLE THROW SWITCHING CIRCUIT (λ-4 TYPE)



	C_1	C_2	C_3	L_1, L_2
50MHz	45pF	90pF	35pF	230nH
144MHz	15pF	22pF	4pF	75nH
220MHz	8pF	15pF	3pF	50nH
440MHz	2pF	5pF	2pF	25nH

TYPICAL DATA

f	Isolation TX→RX	Insertion Loss TX→A
50MHz	27dB	0.3dB
144MHz	33dB	0.3dB
220MHz	31dB	0.4dB
440MHz	24dB	0.5dB

HANDLING POWER 25W
BIAS CURRENT 50mA DC
SPRIOUS >80dB

MITSUBISHI ELECTRIC

MI407

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI407 PIN diode is employing a high reliability glass construction, designed for solid state antenna switches in commercial two-way radios.

FEATURES

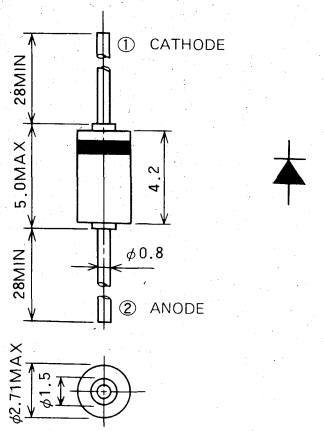
- High power handling
- High zero bias impedance
- Low forward bias resistance
- Low insertion loss, High isolation
- Low distortion (TX: sprious < -80dBc, RX: inter-modulation -73dBc @90dBμ)

APPLICATION

High power antenna switch (25W output two-way radio)

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	50	V
V_R	Reverse voltage	50	V
I_{FSM} *	Forward surge current	2	A
P	Power dissipation	1	W
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

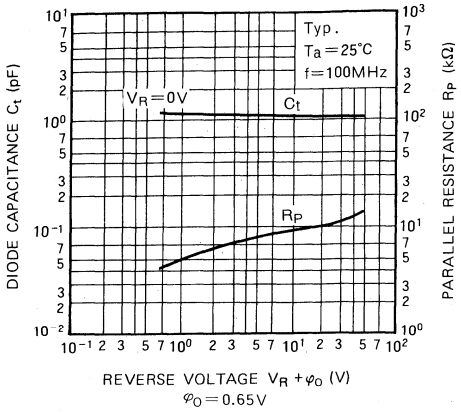
*: t=5sec

ELECTRICAL CHARACTERISTICS (Ta=25°C)

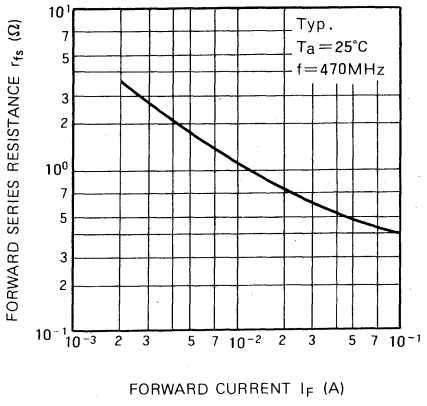
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=50V			10	μA
I_{R2}	Reverse current	V_R=45V			0.5	μA
I_F	Forward current	V_F=1.0V	100			mA
r_{fs}	Forward series resistance	I_F=50mA, f=470MHz		0.5	0.7	Ω
Ct	Diode capacitance	V_R=0V, f=100MHz			1.8	pF
R_P	Parallel resistance	V_R=0V, f=100MHz	1.0	3.0		kΩ

TYPICAL PERFORMANCE DATA

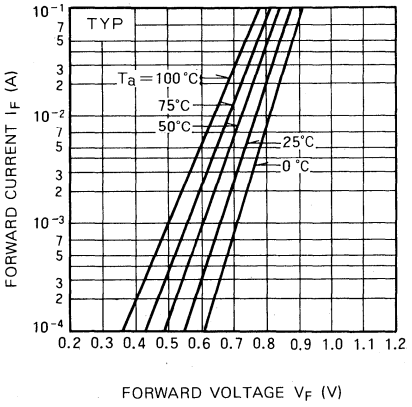
DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



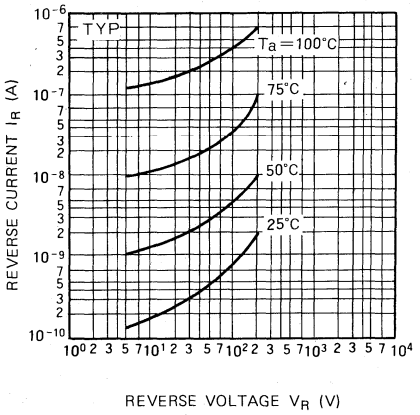
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



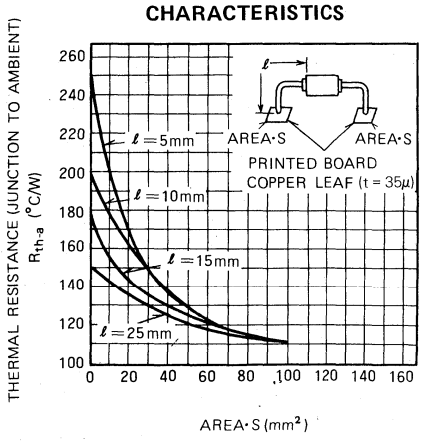
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS

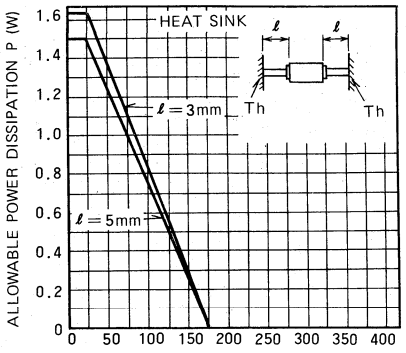


THERMAL RESISTANCE (JUNCTION TO AMBIENT) VS. AREA CHARACTERISTICS

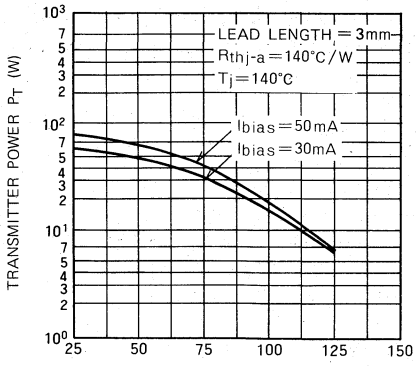


MITSUBISHI ELECTRIC

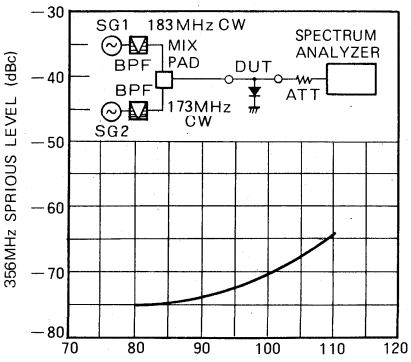
ALLOWABLE POWER DISSIPATION VS. HEAT SINK TEMPERATURE CHARACTERISTICS



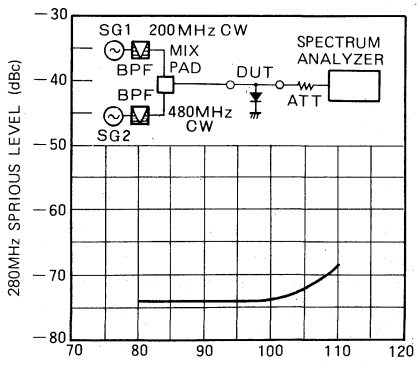
TRANSMITTER POWER VS. AMBIENT TEMPERATURE CHARACTERISTICS



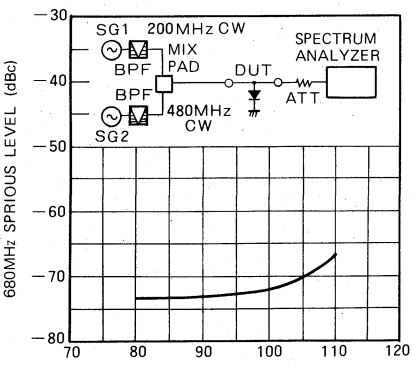
INTER MODULATION DISTORTION



INTER MODULATION DISTORTION



INTER MODULATION DISTORTION



MI808

PIN DIODE
RF POWER SWITCHING

DESCRIPTION

The MI808 PIN diode is designed for solid state antenna switching applications in mobile radios. The construction of MI808 is employing a ALUMINA-FLAT-PACKAGE which is suitable for reflow assembly on surface mounting.

FEATURES

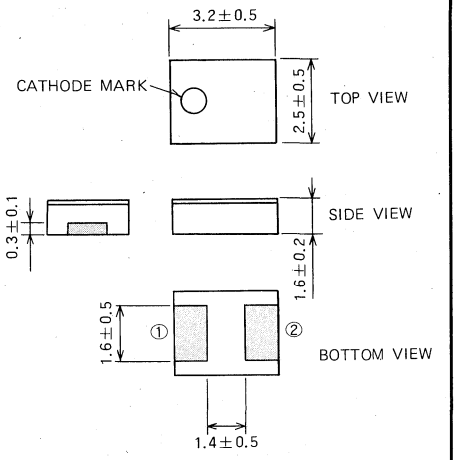
- High power handling
- High zero bias resistance
- Low forward bias resistance
- Low insertion loss, High isolation
- Low distortion (TX: sprious < −80dBc, RX: inter-modulation −73dBc @ 90dBμ)
- Surface mounting type (for reflow assembly)

APPLICATION

High power antenna switch (10W output two-way radio)

OUTLINE DRAWING

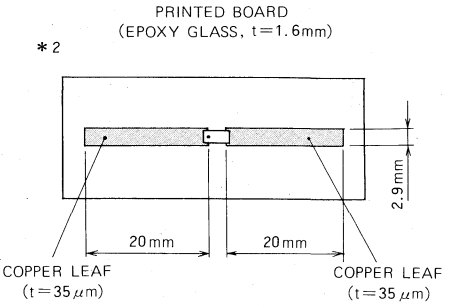
Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	50	V
V_R	Reverse voltage	50	V
I_{FSM} *1	Forward surge current	2	A
P *2	Power dissipation	1	W
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

*1: t=5sec



ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=50V			10	μA
I_{R2}	Reverse current	V_R=45V			0.5	μA
I_F	Forward current	V_F=1.8V 0	100			mA
r_{fs}	Forward series resistance	I_F=50mA, f=470MHz		0.5	0.7	Ω
Ct	Diode capacitance	V_R=0V, f=100MHz			1.2	pF
R_P	Parallel resistance	V_R=0V, f=100MHz	1.0	3.0		kΩ

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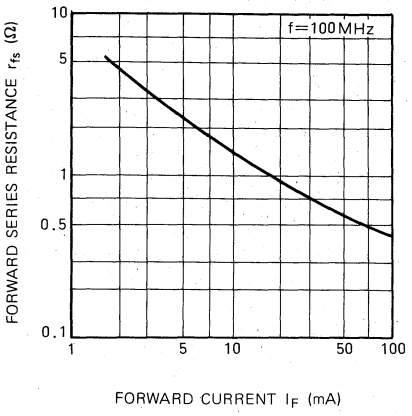
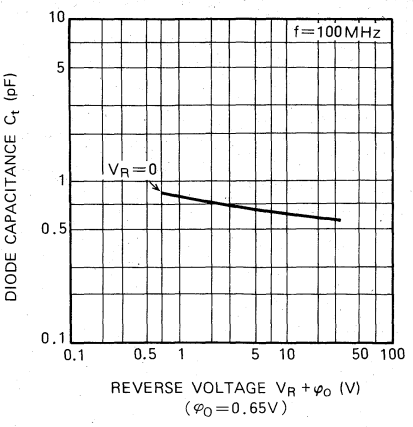
TYPICAL PERFORMANCE DATA

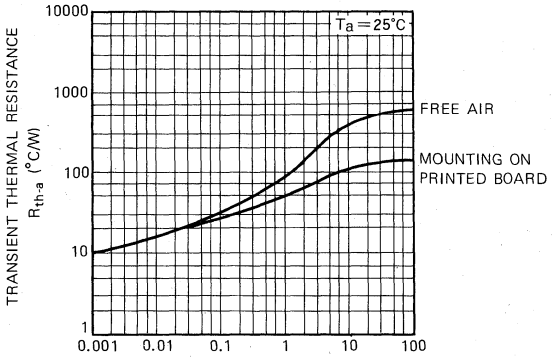
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS

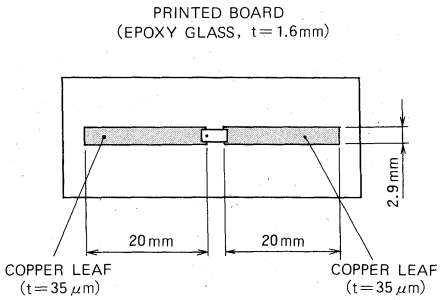


DIODE CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS

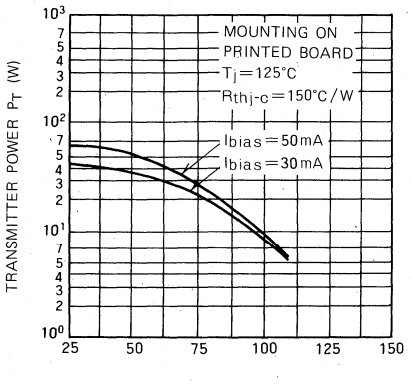


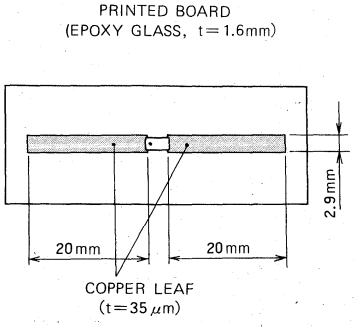
TRANSIENT THERMAL RESISTANCE VS. TIME CHARACTERISTICS





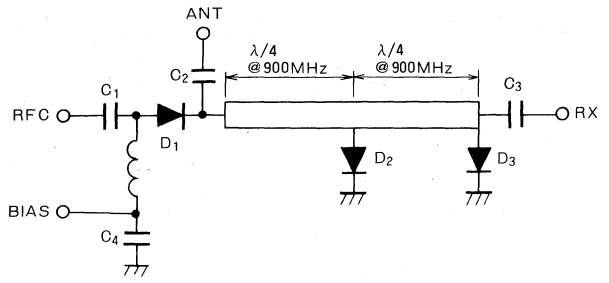
TRANSMITTER POWER VS. AMBIENT TEMPERATURE CHARACTERISTICS





APPLICATION

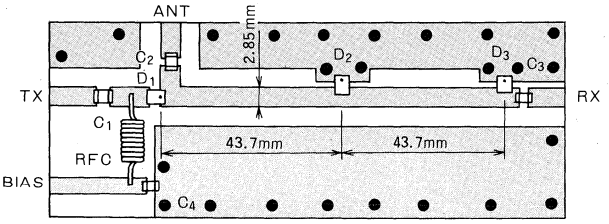
◎ 800MHz BAND ANTENNA SWITCH (800MHz ~ 940MHz, HANDLING POWER 15W)



CIRCUIT DIAGRAM

PARTS LIST

• C_1, C_2, C_3, C_4	1000pF CHIP CAPACITOR
• D_1, D_2, D_3	MI808
• RFC	9 TURN ϕ4 1.6 DIA. ENAMEL WIRE
• SUBSTRATE	EPOXY GLASS ϵ = 4.7, t = 1.6mm BOTH SIDES COPPER (t = 35μm)

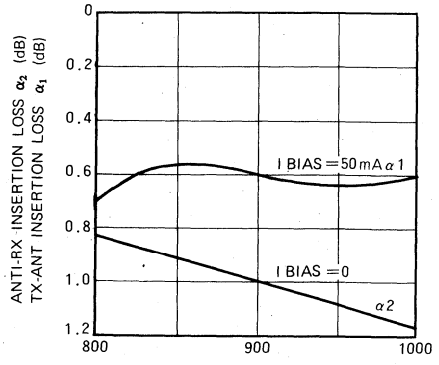


SUBSTRATE DRAWING

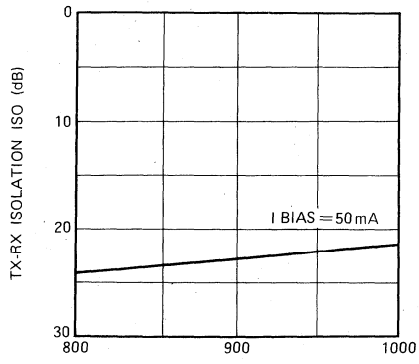
EACH • POINTS SHOULD BE TREATED CONNECTIONS BETWEEN BOTH SIDES GROUNDS ON THROUGH HOLE.

CHARACTERISTICS

TX-ANT INSERTION LOSS
ANT-RX INSERTION LOSS



TX-RX ISOLATION CHARACTERISTICS



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ASSEMBLY METHOD

◎ Solder and flux recommendation

Solder: Sn-Pb type solder containing 2 ~ 5% Ag.
Flux: Rosin type.

◎ Soldering

MI808 is designed for reflow assembly.

Fig. 1 show recommendable reflow method.

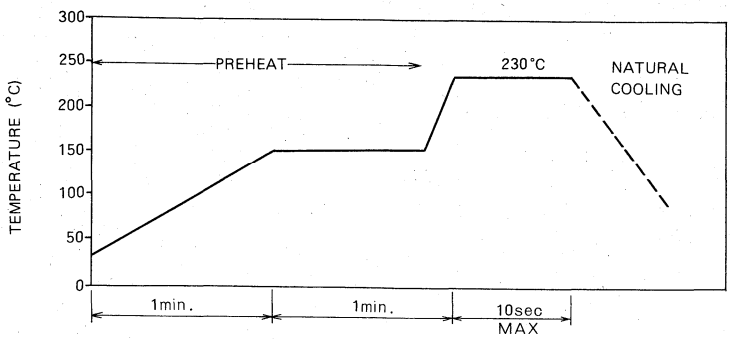
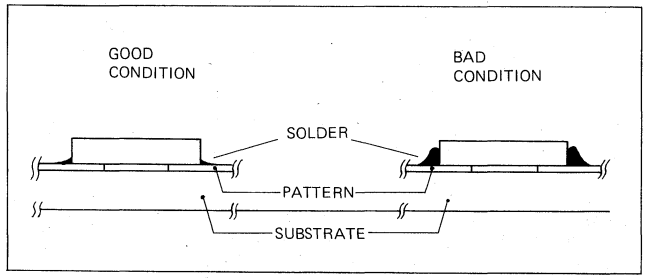


Fig. 2 show conditions of solder finishing.



◎ Recommendation for cleaning

Cleaning material: Diflon, Iso-propyl alcohol, Aceton.

MC103A

RF SMALL SIGNAL SWITCHING

DESCRIPTION

The MC103A diode is employing a high reliability glass construction, designed for RF small signal switching in VHF.

FEATURES

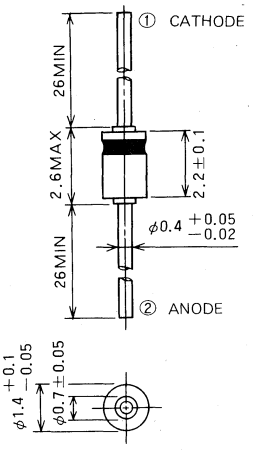
- Small glass construction
- Low diode capacitance
- Low forward series resistance
- Rugged for surge

APPLICATION

RF small signal switching

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_R	Reverse voltage	30	V
V_{RM}	Repetitive peak reverse voltage	30	V
P	Power dissipation	200	mW
T_j	Junction temperature	175	°C
Tstg	Storage temperature	−55～+175	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=30V			10	μA
I_{R2}	Reverse current	V_R=28V			150	nA
I_F	Forward current	V_F=1.0V	100			mA
Ct	Diode capacitance	V_R=15V, f=1MHz			1.5	pF
r_{fs}	Forward series resistance	I_F=10mA, f=470MHz			1.0	Ω
Q	Q	V_R=3V, f=50MHz	80			—

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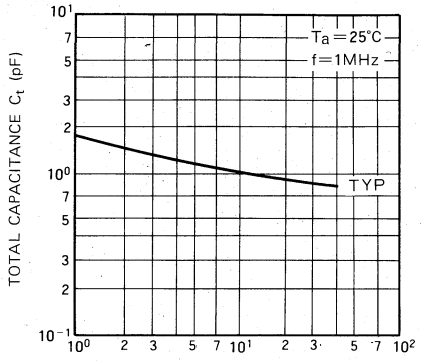
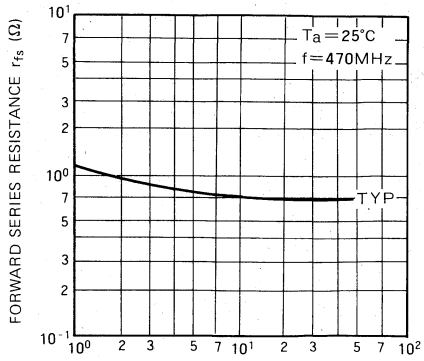
TYPICAL PERFORMANCE DATA

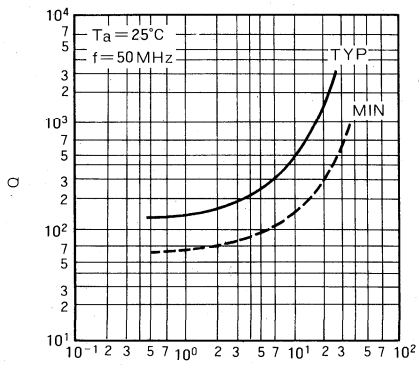
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



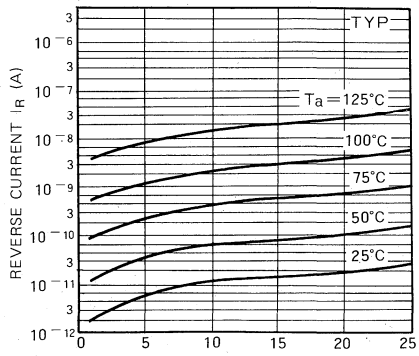
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



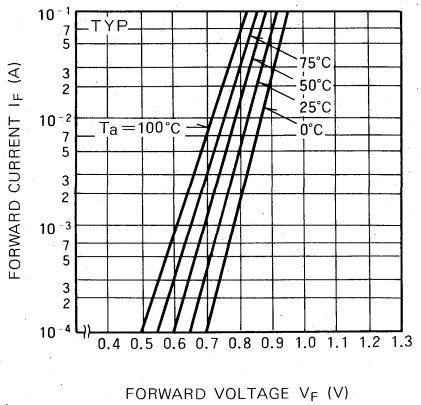
Q VS. REVERSE VOLTAGE CHARACTERISTICS



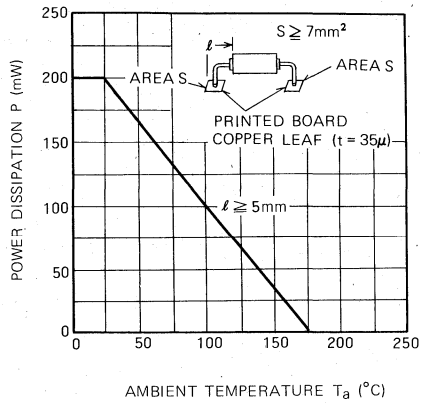
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



MC301

RF SMALL SIGNAL SWITCHING

DESCRIPTION

The MC301 diode is employing a high reliability glass construction, designed for RF small signal switching in VHF UHF.

FEATURES

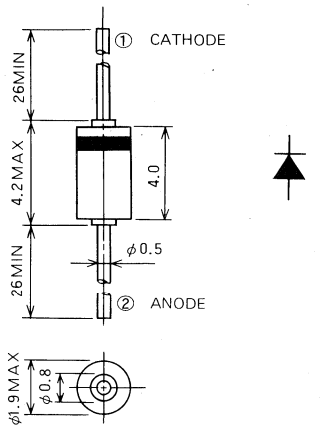
- Low diode capacitance
- Low forward series resistance
- Large Q

APPLICATION

RF small signal switching

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_R	Reverse voltage	28	V
V_{RM}	Repetitive peak reverse voltage	30	V
P	Power dissipation	200	mW
T_j	Junction temperature	175	°C
T_{stg}	Storage temperature	−55 ~ 175	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=30V			10	μA
I_{R2}	Reverse current	V_R=28V			150	nA
I_F	Forward current	V_F=1.0V	100			mA
Ct	Diode capacitance	V_R=15V, f=1MHz			2.0	pF
r_{fs}	Forward series resistance	I_F=10mA, f=470MHz			1.2	Ω
Q	Q	V_R=3V, f=50MHz	80			—
L_S	Lead inductance	Total lead length 10mm		2.5		nH

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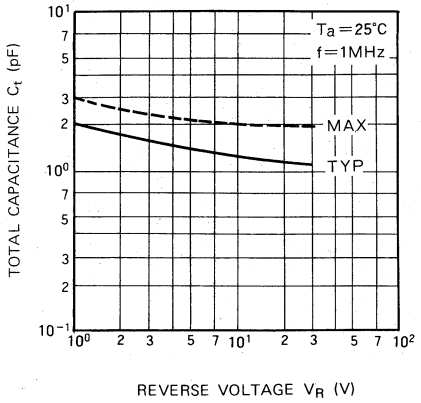
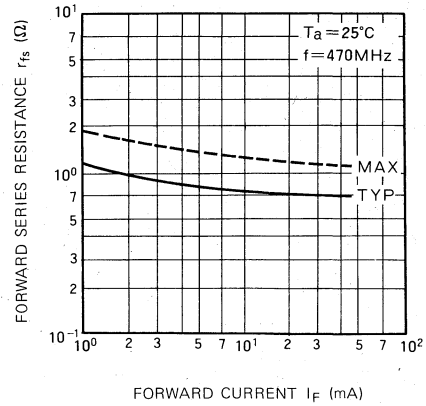
TYPICAL PERFORMANCE DATA

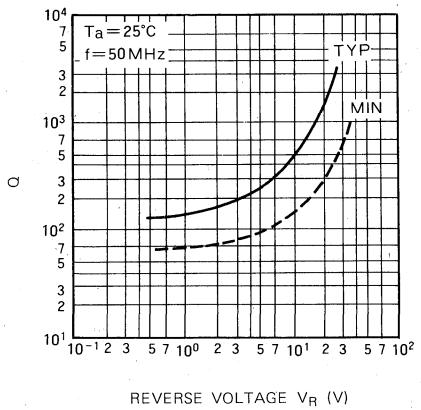
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



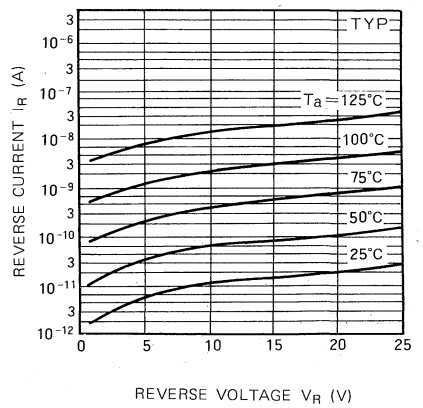
FORWARD SERIES RESSISTANCE VS. FORWARD CURRENT CHARACTERISTICS



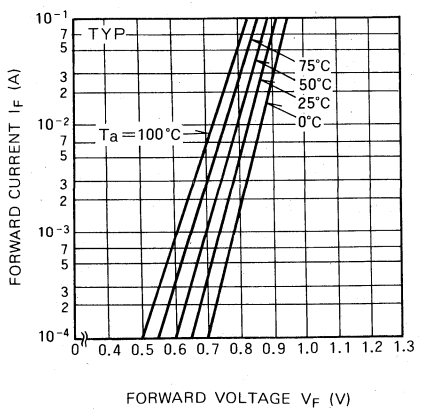
Q VS. REVERSE VOLTAGE CHARACTERISTICS



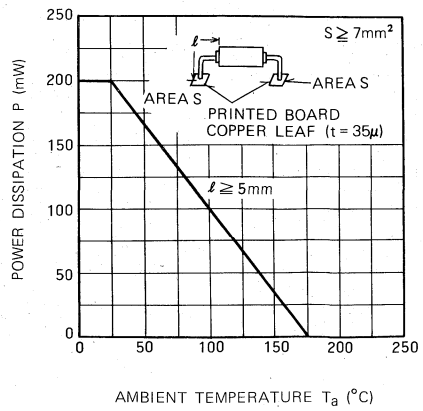
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



MC302

RF SMALL SIGNAL SWITCHING

DESCRIPTION

The MC302 diode is employing a high reliability glass construction, designed for RF small signal switching in VHF UHF.

FEATURES

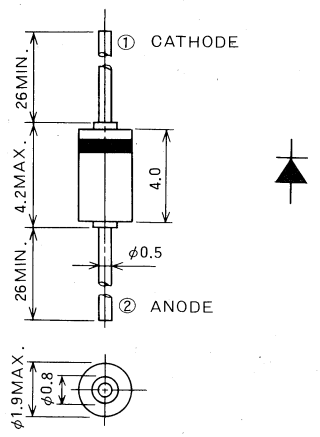
- Low diode capacitance
- Low forward series resistance
- Large Q

APPLICATION

RF small signal switching

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	30	V
V_R	Reverse voltage	28	V
R	Power dissipation	200	mW
T_j	Junction temperature	175	°C
T_{stg}	Storage temperature	−55~+175	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=30V			10	μA
I_{R2}	Reverse current	V_R=28V			150	nA
I_F	Forward current	V_F=1.0V	100			mA
Ct	Diode capacitance	V_R=10V, f=1MHz			2.2	pF
r_{fs}	Forward series resistance	I_F=3mA, f=470MHz			0.8	Ω
Q	Q	V_R=3V, f=50MHz	80			—

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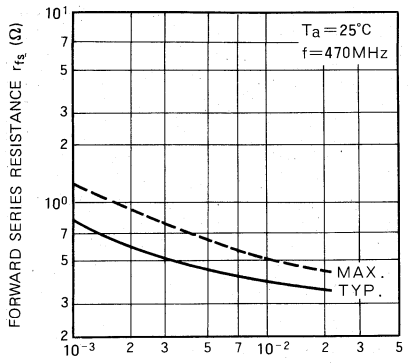
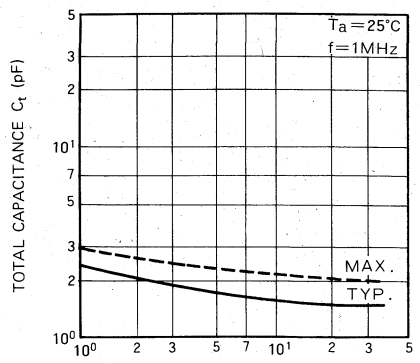
TYPICAL PERFORMANCE DATA

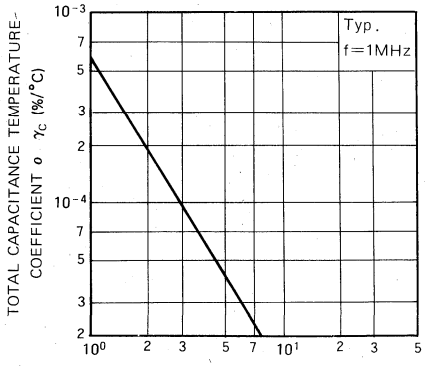
FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



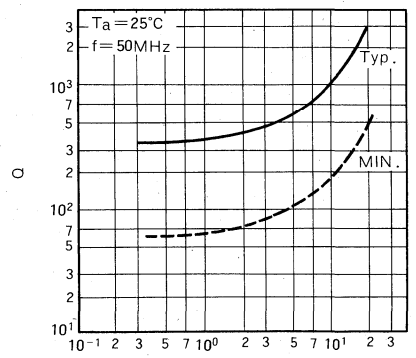
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



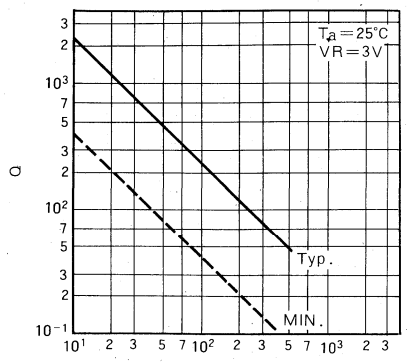
TOTAL CAPACITANCE TEMPERATURE COEFFICIENT VS. REVERSE VOLTAGE CHARACTERISTICS



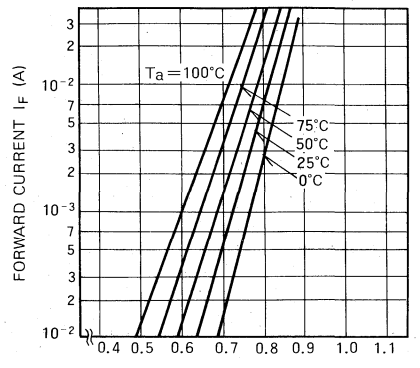
Q VS. REVERSE VOLTAGE CHARACTERISTICS



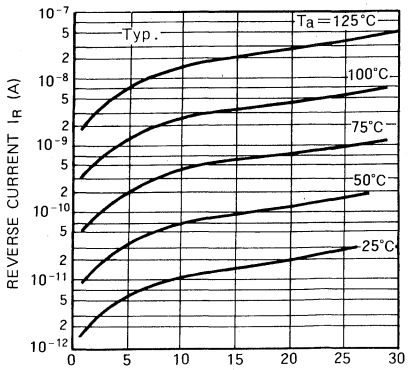
Q VS. f CHARACTERISTICS



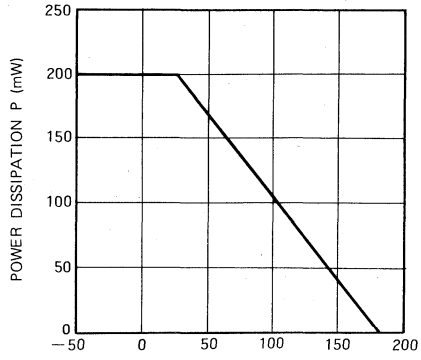
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



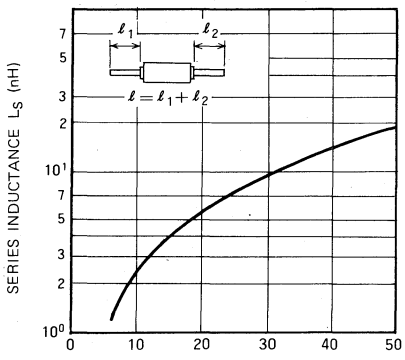
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



POWER DISSIPATION VS. AMBIENT TEMPERATURE CHARACTERISTICS



SERIES INDUCTANCE VS. TOTAL LEAD LENGTH CHARACTERISTICS



MITSUBISHI ELECTRIC

MC804

RF SMALL SIGNAL SWITCHING

DESCRIPTION

The MC804 diode is designed for RF small signal switching in VHF UHF

FEATURES

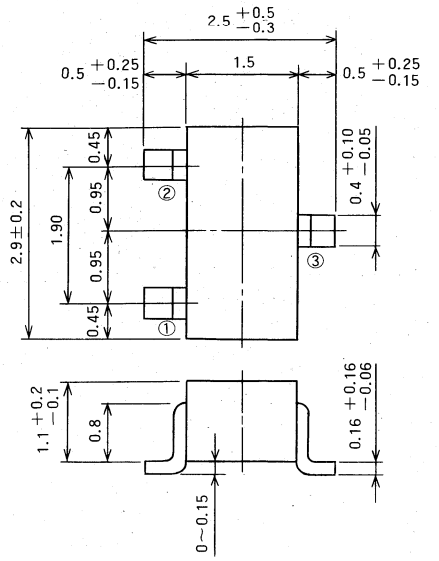
- Small construction
- Low diode capacitance
- Low forward series resistance

APPLICATION

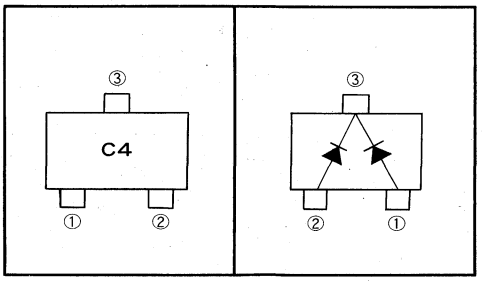
RF small signal switching

OUTLINE DRAWING

Dimension: mm



① ANODE
② ANODE
③ CATHODE (COMMON)



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

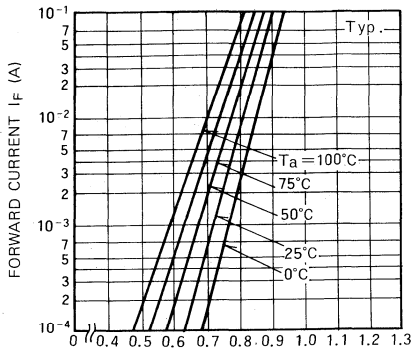
Symbol	Parameter	Ratings	Unit
V_{RM}	Repetitive peak reverse voltage	35	V
V_R	Reverse voltage	35	V
I_F	Forward current	100	mA
P_T	Power dissipation	150	mW
T_j	Junction temperature	+125	°C
T_{stg}	Storage temperature	−55~+125	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

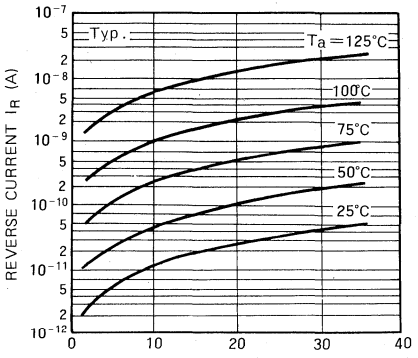
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{R1}	Reverse current	V_R=35			10	μA
I_{R2}	Reverse current	V_R=28V			150	nA
I_F	Forward current	V_F=1.0V	100			mA
C_t	Diode capacitance	V_R=6V, f=1MHz		1.0	1.3	pF
r_{fs}	Forward series resistance	I_F=2mA, f=100MHz		0.7	0.9	Ω

TYPICAL PERFORMANCE DATA

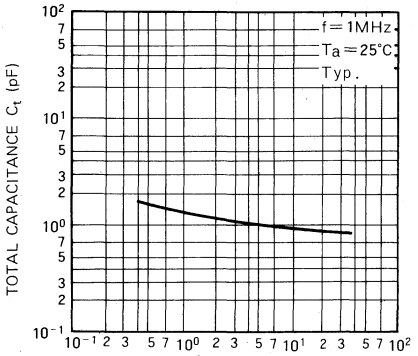
FORWARD CURRENT VS. FORWARD VOLTAGE CHARACTERISTICS



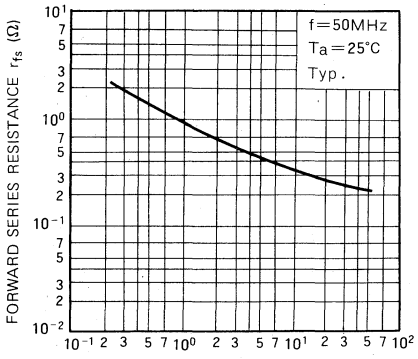
REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



FORWARD SERIES RESISTANCE VS. FORWARD CURRENT CHARACTERISTICS



MITSUBISHI ELECTRIC

MV201

VARACTOR DIODE

DESCRIPTION

The MV201 varactor diode is employing a high reliability glass, construction designed for AFC in VHF UHF.

FEATURES

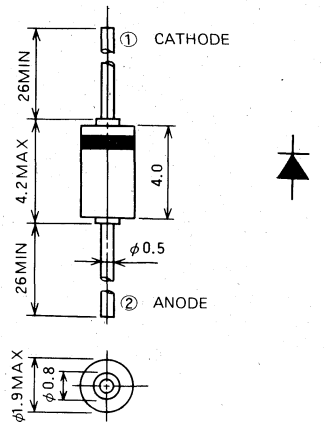
- High dc/dv due to hyper abrupt junction
- Large Q

APPLICATION

AFC of VHF UHF

OUTLINE DRAWING

Dimension: mm



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

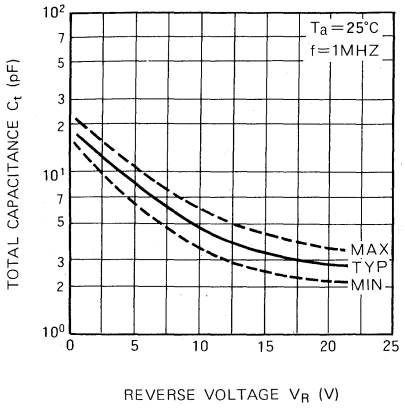
Symbol	Parameter	Ratings	Unit
V_R	Reverse voltage	23	V
P	Power dissipation	250	mV
Tstg	Storage temperature	−55～+100	°C
Topr	Operation temperature	−55～+100	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

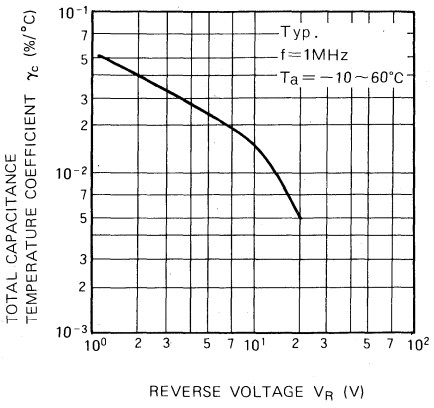
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{(BR)R}$	Reverse break-down voltage	I_R=10 μA	23			V
I_R	Reverse current	V_R=20V			150	nA
Ct_1	Diode capacitance	V_R=3V, f=1MHz	9	11	14	pF
Ct_2		V_R=20V, f=50MHz	2.3		3.3	pF
Q	Q	V_R=3V, f=50MHz	160			—
L_S	Lead inductance	Total lead length 10mm		2.5		nH

TYPICAL PERFORMANCE DATA

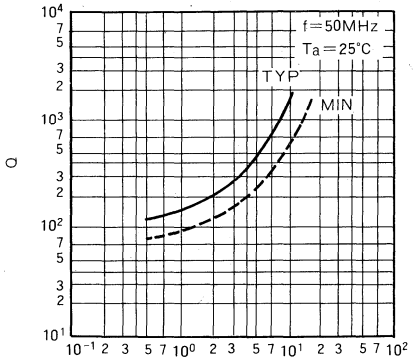
TOTAL CAPACITANCE VS. REVERSE VOLTAGE CHARACTERISTICS



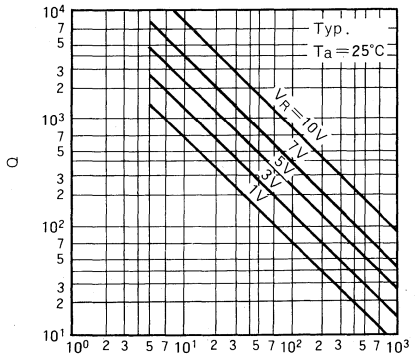
TOTAL CAPACITANCE TEMPERATURE COEFFICIENT VS. REVERSE VOLTAGE CHARACTERISTICS



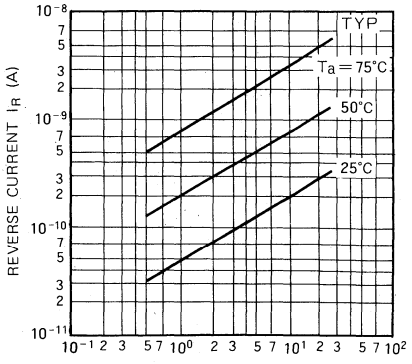
Q VS. REVERSE VOLTAGE CHARACTERISTICS



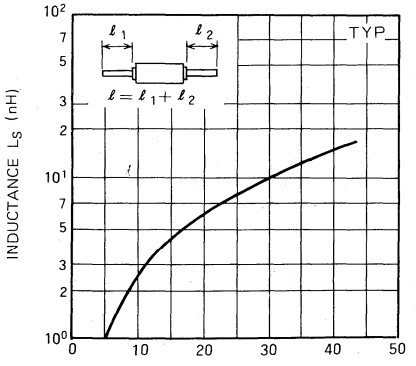
Q VS. FREQUENCY CHARACTERISTICS



REVERSE CURRENT VS. REVERSE VOLTAGE CHARACTERISTICS



INDUCTANCE VS. TOTAL LEAD LENGTH CHARACTERISTICS



MITSUBISHI ELECTRIC

HYBRID ANTENNA SWITCHES

5

MD001

400~512MHz, 5W, ANTENNA SWITCH

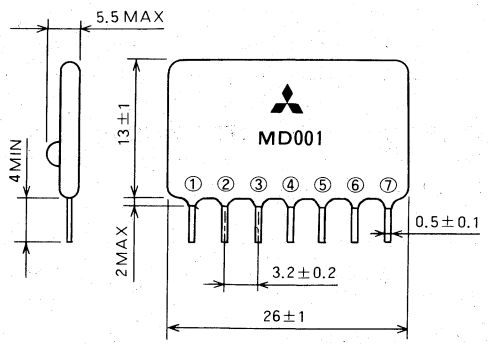
MINIATURE RF ANTENNA SWITCH

MD001 is designed to cover 400 ~ 512MHz, 5W, antenna switch module.

- Small, Easily Mounted Package.
- High Isolation: 40dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < -70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

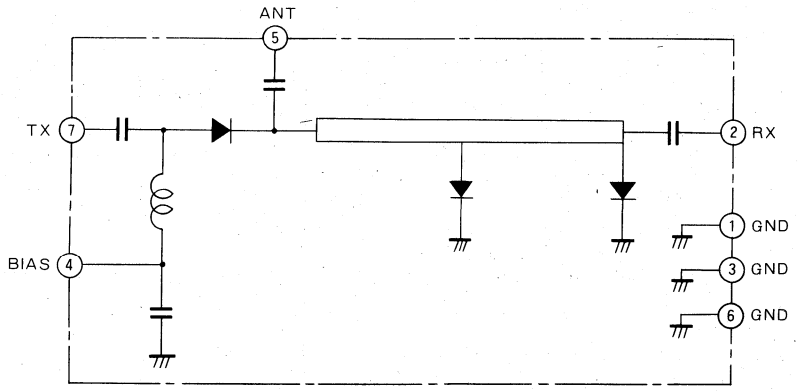
OUTLINE DRAWING

Dimensions in mm



① GND
② RX
③ GND
④ BIAS
⑤ ANT
⑥ GND
⑦ TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

400～512MHz, 5W, ANTENNA SWITCH

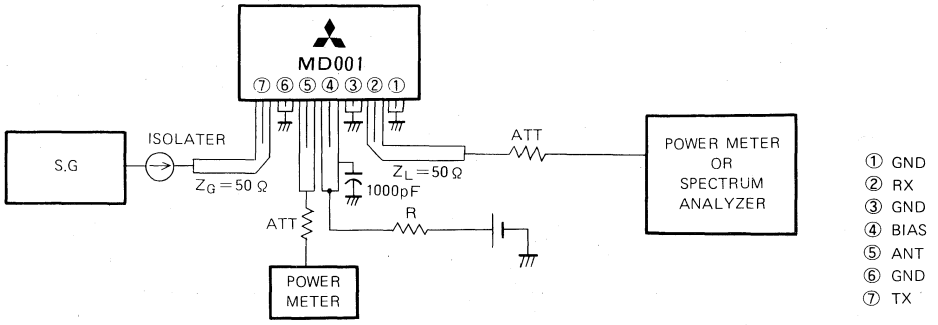
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	12 @Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

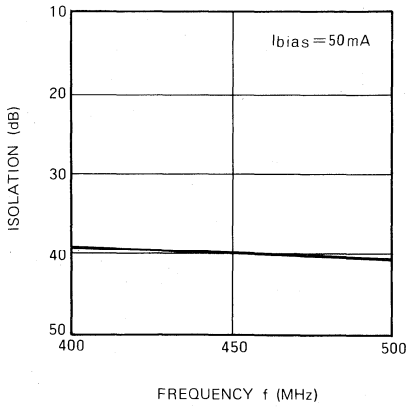
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		400		512	MHz
ISO	Isolation (TX-RX)	Pin= 8 W, Ibias=50mA, ANT port terminated 50 Ω	30	40		dB
α_1	Insertion loss (TX-ANT)	Pin= 8 W, Ibias=50mA, RX port terminated 50 Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50 Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

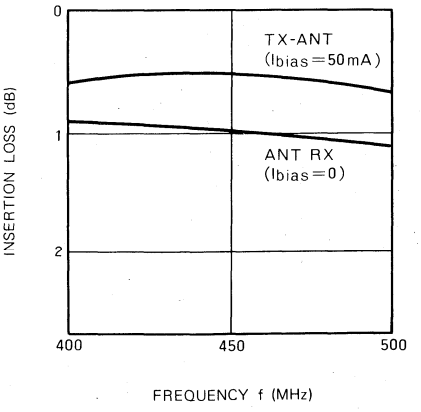


TYPICAL PERFORMANCE DATA

TX-RX ISOLATION

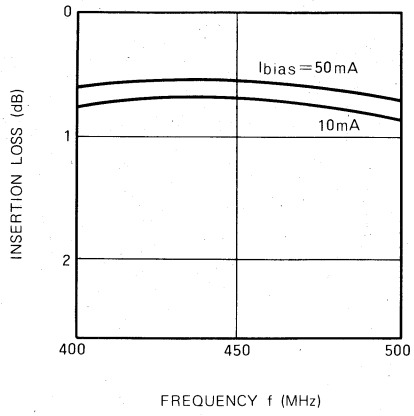


TX-ANT ANT-RX INSERTION LOSS

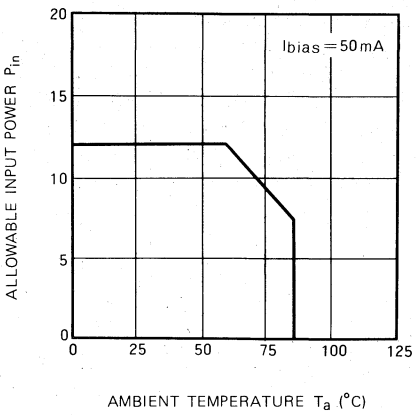


MITSUBISHI ELECTRIC

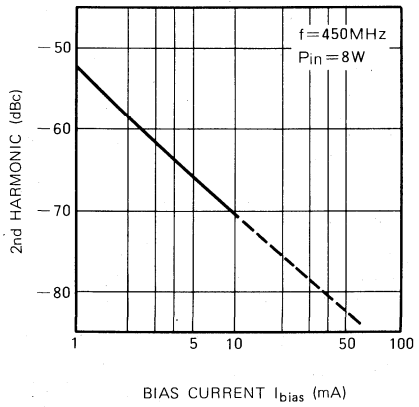
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD001.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

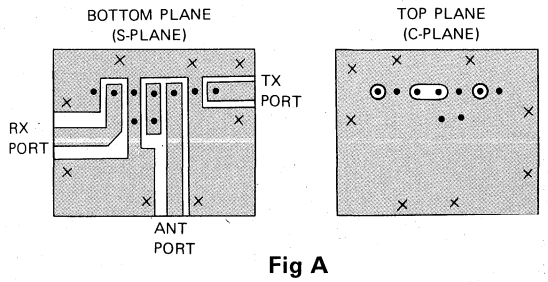


Fig A

MD001A

400~512MHz, 10W, ANTENNA SWITCH

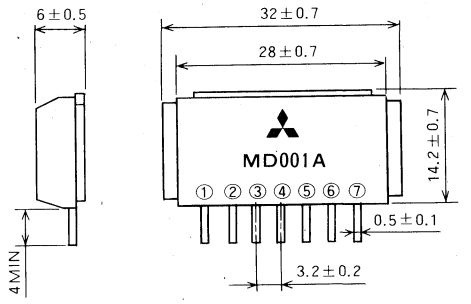
MINIATURE RF ANTENNA SWITCH

MD001A is designed to cover 400 ~ 512MHz, 10W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 40dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < -70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

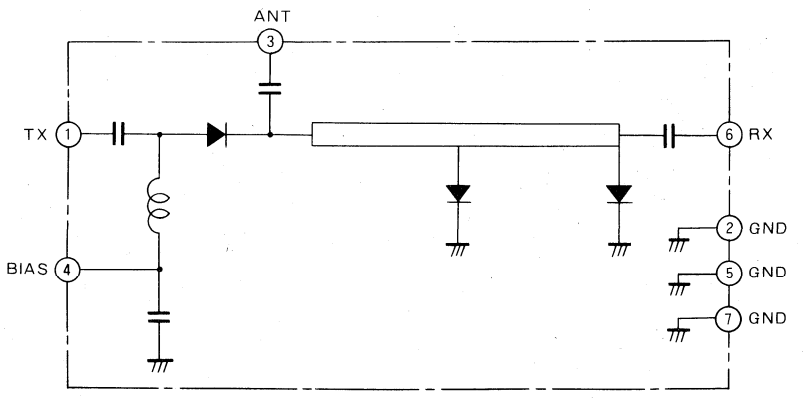
OUTLINE DRAWING

Dimenslons in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

400～512MHz, 10W, ANTENNA SWITCH

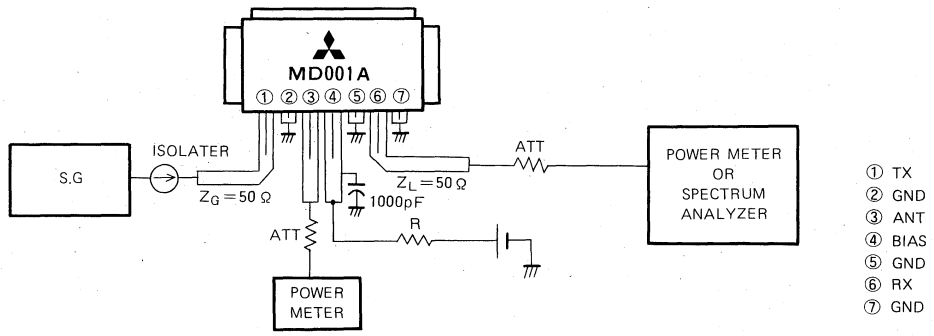
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	17 Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

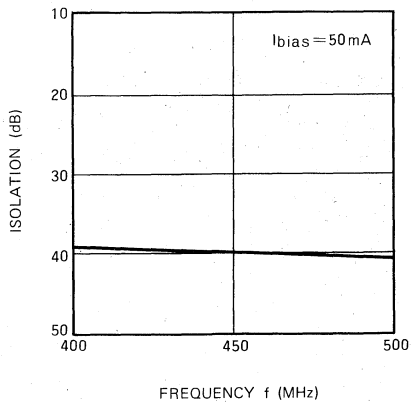
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		400		512	MHz
ISO	Isolation (TX-RX)	Pin=15W, Ibias=50mA, ANT port terminated 50Ω	30	40		dB
α_1	Insertion loss (TX ANT)	Pin=15W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

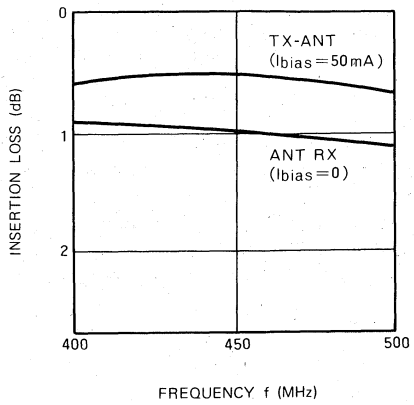


TYPICAL PERFORMANCE DATA

TX-RX ISOLATION

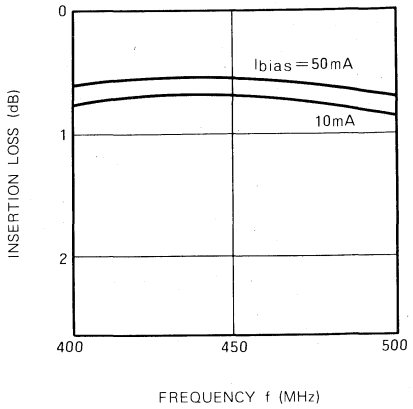


TX-ANT ANT-RX INSERTION LOSS

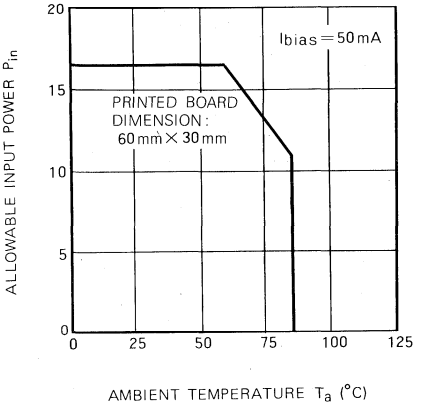


400~512MHz, 10W, ANTENNA SWITCH

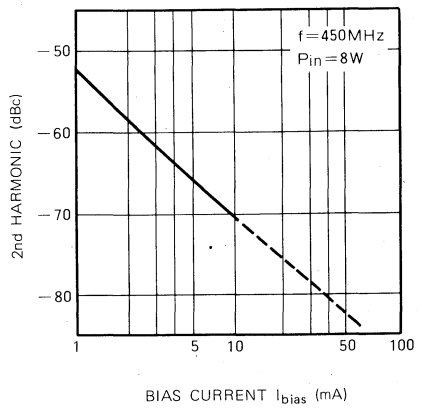
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD001A.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ②, ⑤, ⑦ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

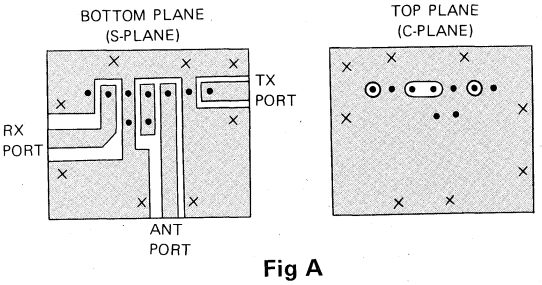


Fig A

MITSUBISHI ELECTRIC

MD001AL

330~400MHz, 10W, ANTENNA SWITCH

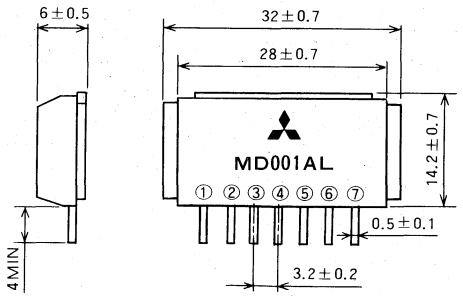
MINIATURE RF ANTENNA SWITCH

MD001AL is designed to cover 330 ~ 400MHz, 10W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 38dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 0.8dB Typ.
- Low Harmonic Output: 2nd Harmonic < -70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

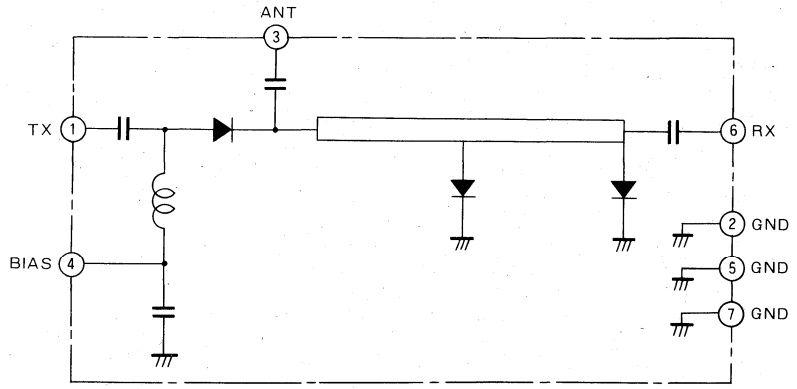
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

330～400MHz, 10W, ANTENNA SWITCH

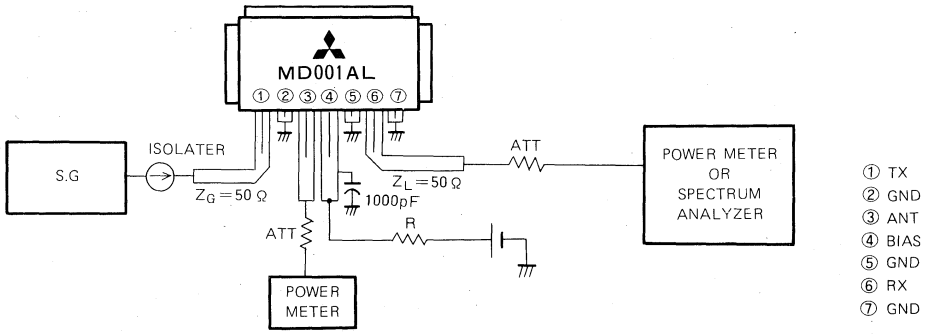
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	17 Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

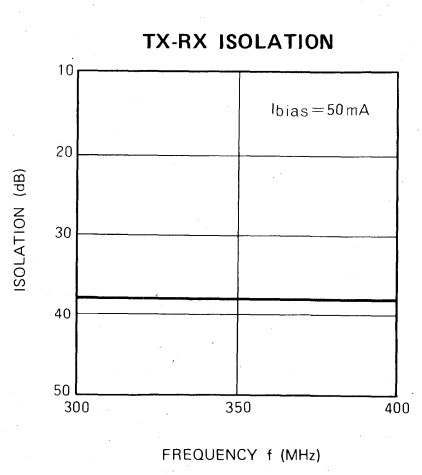
ELECTRICAL CHARACTERISTICS (Ta=25°C)

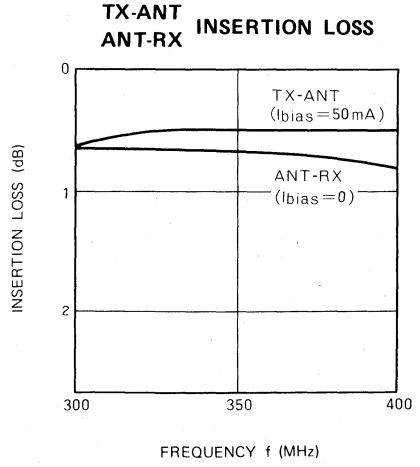
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		330		400	MHz
ISO	Isolation (TX-RX)	Pin=15W, Ibias=50mA, ANT port terminated 50Ω	30	38		dB
α_1	Insertion loss (TX-ANT)	Pin=15W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		0.8	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)



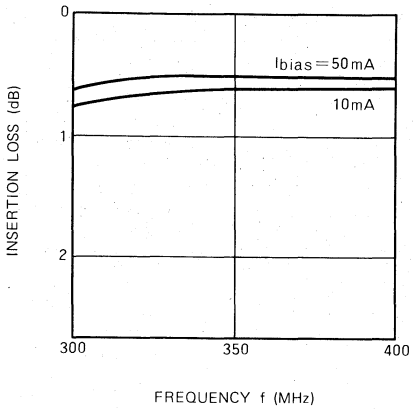
TYPICAL PERFORMANCE DATA



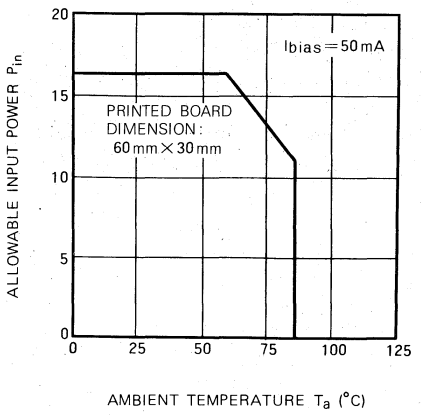


330~400MHz, 10W, ANTENNA SWITCH

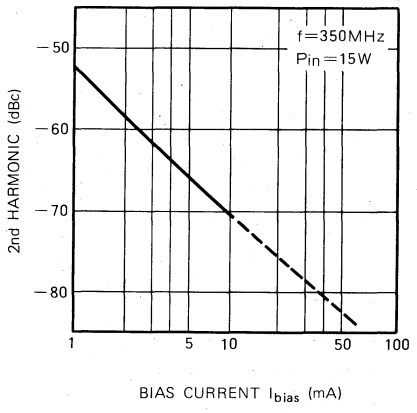
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD001AL.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ②, ⑤, ⑦ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

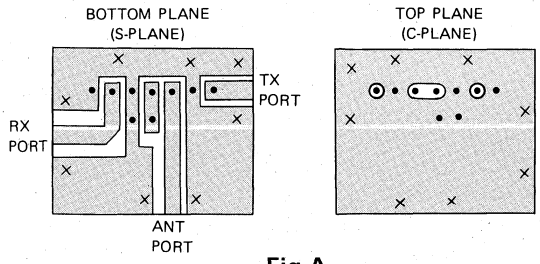


Fig A

MD001H

400~512MHz, 25W, ANTENNA SWITCH

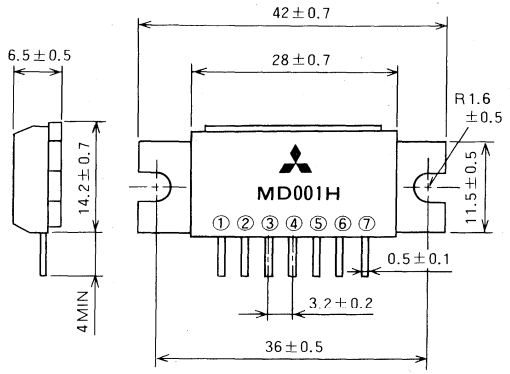
MINIATURE RF ANTENNA SWITCH

MD001H is designed to cover 400 ~ 512MHz, 25W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 40dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < -70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

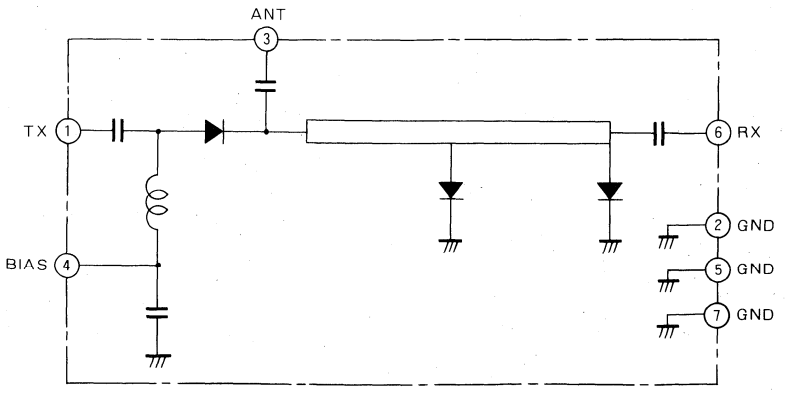
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

400～512MHz, 25W, ANTENNA SWITCH

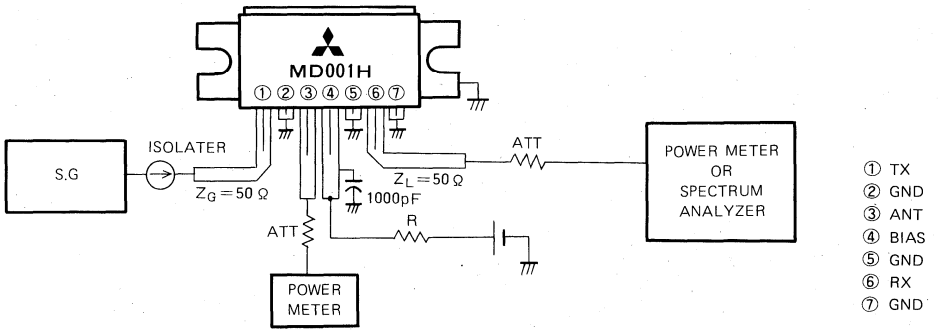
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
P_{in}	Input power	50 $T_C \leqq 90°C$	W
Tstg	Storage temperature	−30～+110	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

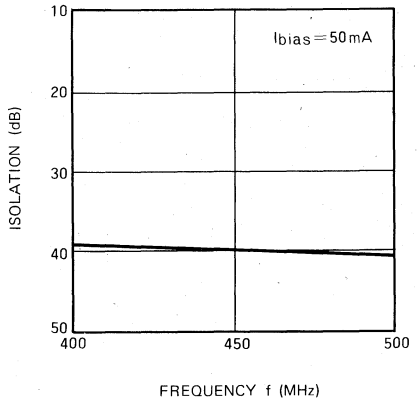
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		400		512	MHz
ISO	Isolation (TX-RX)	P_{in}=40W, Ibias=50mA, ANT port terminated 50Ω	30	40		dB
α_1	Insertion loss (TX-ANT)	P_{in}=40W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	P_{in}=1mW, Ibias=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

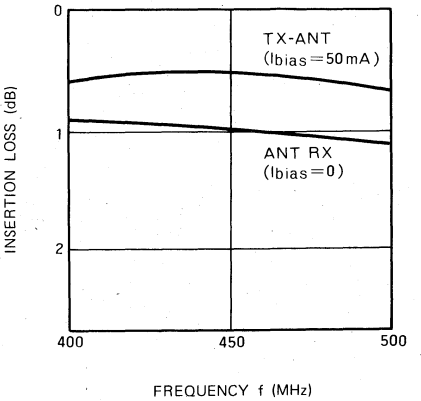


TYPICAL PERFORMANCE DATA

TX-RX ISOLATION

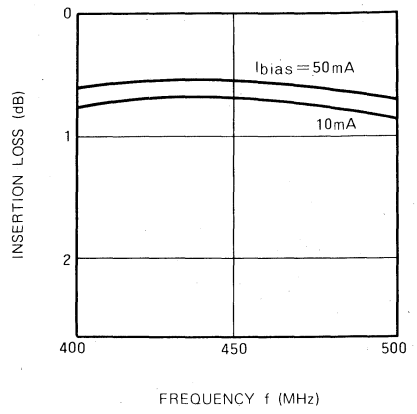


TX-ANT
ANT-RX INSERTION LOSS

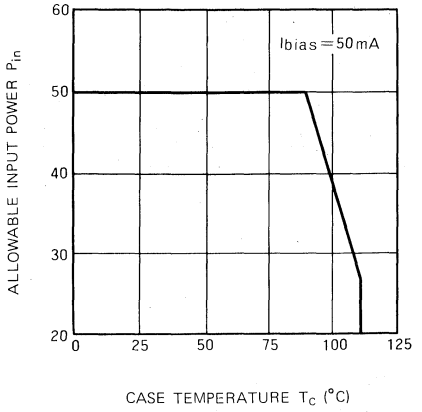


400~512MHz, 25W, ANTENNA SWITCH

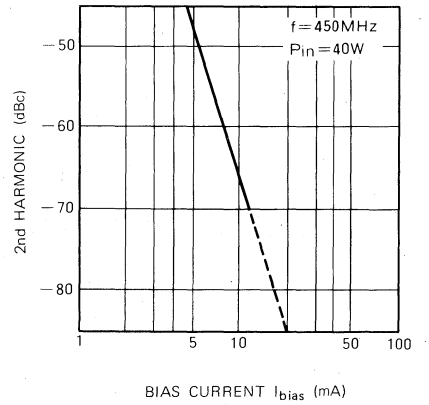
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated diodes at standard operation

(1) Thermal resistance between junction and package of incorporated diodes.
$R_{th(j-c)}$ = 70°C/W (Typ.)

(2) Junction temperature of incorporated diodes at standard operation. Conditions for standard operation.
P_{in} = 33W, I_{bias} = 50mA (VF = 0.85V)(1), r_{fs} = 0.7Ω(2), Z_o = 50Ω(3)

Note 1: Forward Voltage of diodes.
Note 2: Series Resistance of diodes.
Note 3: Characteristic Impedance.

- Junction temperature of diodes

$T_j = [(P_{in}/Z_o) \times r_{fs} + I_{bias} \times VF] \times R_{th(j-c)} + T_c$(4)
$= [(33/50) \times 0.7 + 0.05 \times 0.85] \times 70 + T_c$
$= 35.3 + T_c$ (°C)

Note 4: Package temperature of device

2. Heat sink design

In thermal design of heat sink, try to keep the package tempeatrure at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the input power of 33W below 90°C.

The thermal resistance $R_{th(c-a)}$(5) of the heat sink to realize this:

$R_{th(c-a)} = (T_c - T_a)/(P_{in} - P_{out}) = (90-60)/(33-29.4)$(6)
$= 8.3$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink.
Note 6: Insertion loss is 0.5dB

Mounting the heat sink of the above thermal resistance on the device,
T_j = 125.3°C, T_c = 90°C
In the annual average of ambient temperature is 30°C,
T_j = 95.3°C
As the maximum junction temperature of these incorporated diodes T_{jmax} are 175°C, application under fully derated condition is ensured.

MD001HL

330~400MHz, 25W, ANTENNA SWITCH

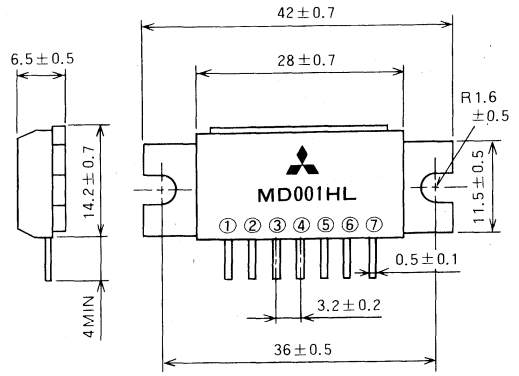
MINIATURE RF ANTENNA SWITCH

MD001HL is designed to cover 330 ~ 400MHz, 25W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 38dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 0.8dB Typ.
- Low Harmonic Output: 2nd Harmonic < -70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

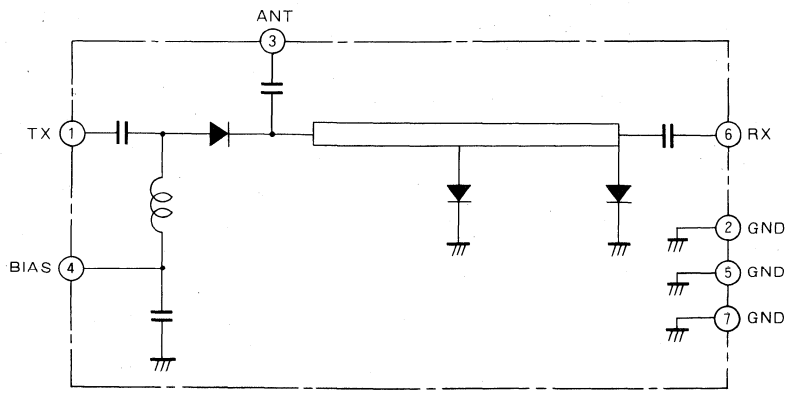
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
I_{bias} = 50mA	ON	OFF
I_{bias} = 0	OFF	ON

MITSUBISHI ELECTRIC

330~400MHz, 25W, ANTENNA SWITCH

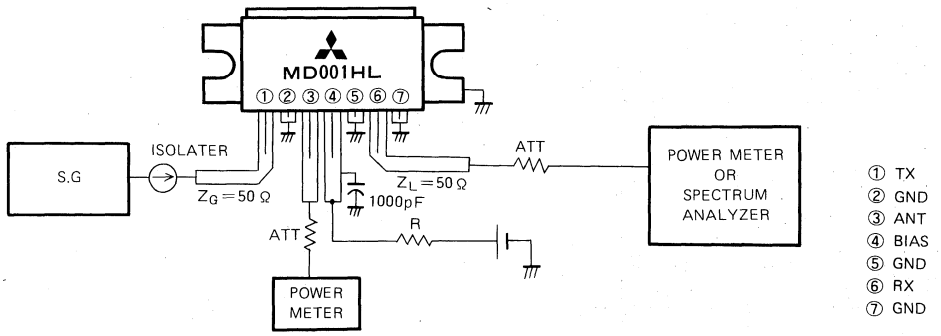
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	50 Tc≦90°C	W
Tstg	Storage temperature	−30~+110	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

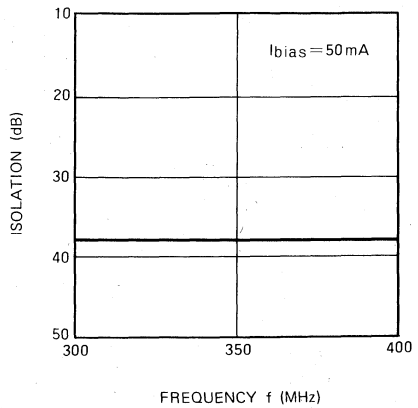
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		330		400	MHz
ISO	Isolation (TX-RX)	Pin=40W, Ibias=50mA, ANT port terminated 50Ω	30	38		dB
α_1	Insertion loss (TX-ANT)	Pin=40W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		0.8	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

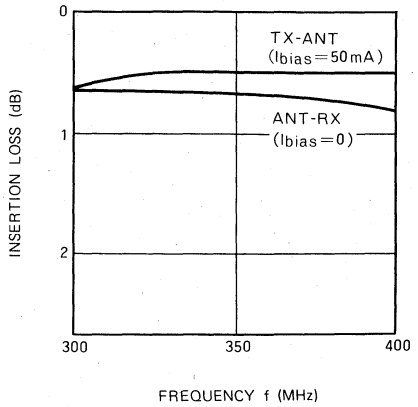


TYPICAL PERFORMANCE DATA

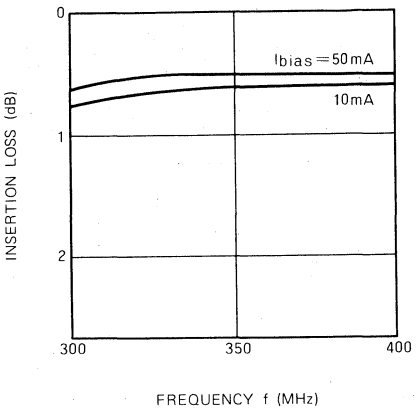
TX-RX ISOLATION



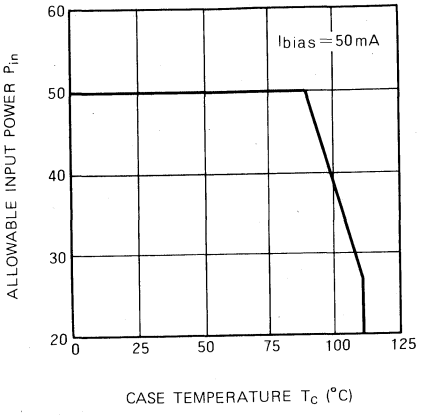
TX-ANT ANT-RX INSERTION LOSS



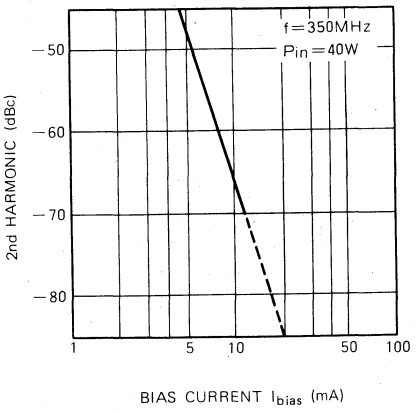
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



MITSUBISHI ELECTRIC

DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated diodes at standard operation

(1) Thermal resistance between junction and package of incorporated diodes.
$R_{th(j-c)}$ = 70°C/W (Typ.)

(2) Junction temperature of incorporated diodes at standard operation. Conditions for standard operation.
P_{in} = 33W, I_{bias} = 50mA (VF = 0.85V)(1), r_{fs} = 0.7Ω(2), Z_O = 50Ω(3)

Note 1: Forward Voltage of diodes.
Note 2: Series Resistance of diodes.
Note 3: Characteristic Impedance.

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$T_j = [(P_{in}/Z_o) \times r_{fs} + I_{bias} \times VF] \times R_{th(j-c)} + T_C$(4)
$= [(33/50) \times 0.7 + 0.05 \times 0.85] \times 70 + T_C$
$= 35.3 + T_C$ (°C)

Note 4: Package temperature of device

2. Heat sink design

In thermal design of heat sink, try to keep the package tempeatrure at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the input power of 33W below 90°C.

The thermal resistance $R_{th(c-a)}$(5) of the heat sink to realize this:

$R_{th(c-a)} = (T_C - T_a)/(P_{in} - P_{out}) = (90-60)/(33-29.4)$(6)
$= 8.3$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink.
Note 6: Insertion loss is 0.5dB

Mounting the heat sink of the above thermal resistance on the device,
T_j = 125.3°C, T_C = 90°C
In the annual average of ambient temperature is 30°C,
T_j = 95.3°C
As the maximum junction temperature of these incorporated diodes T_{jmax} are 175°C, application under fully derated condition is ensured.

MD001L

330~400MHz, 5W, ANTENNA SWITCH

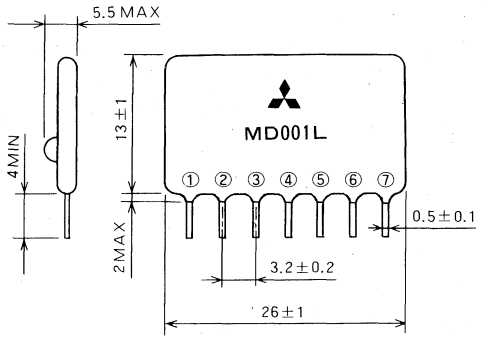
MINIATURE RF ANTENNA SWITCH

MD001L is designed to cover 330 ~ 400MHz, 5W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 38dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 0.8dB Typ.
- Low Harmonic Output: 2nd Harmonic < -70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

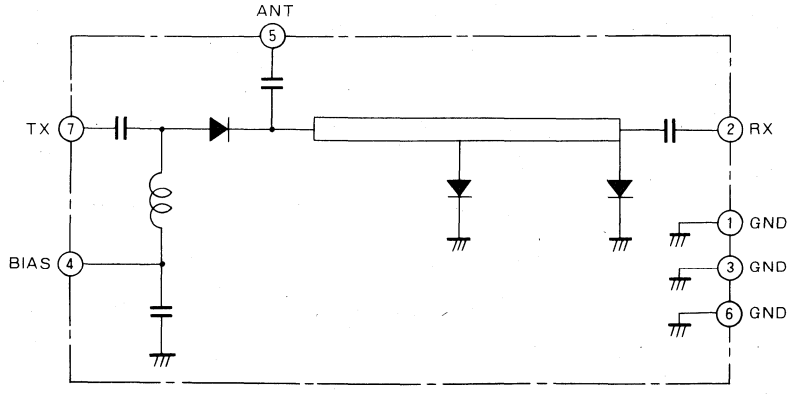
OUTLINE DRAWING

Dimensions in mm



① GND
② RX
③ GND
④ BIAS
⑤ ANT
⑥ GND
⑦ TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
I_{bias} = 50mA	ON	OFF
I_{bias} = 0	OFF	ON

MITSUBISHI ELECTRIC

330~400MHz, 5W, ANTENNA SWITCH

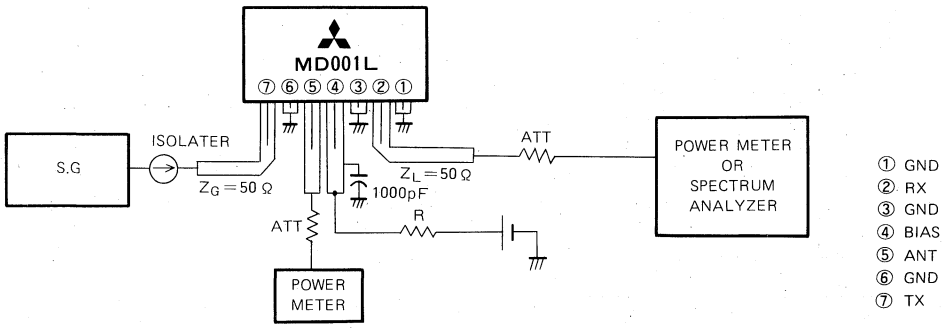
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	12 @Ta≦60°C	W
Tstg	Storage temperature	−30~+85	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

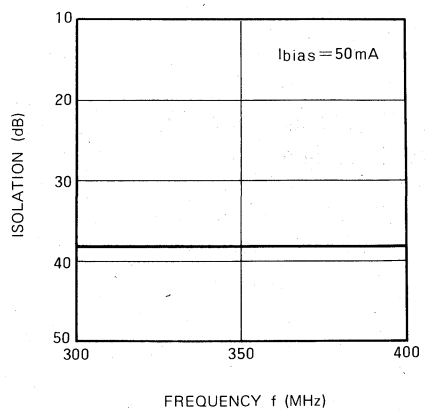
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		330		400	MHz
ISO	Isolation (TX-RX)	Pin=8W, Ibias=50mA, ANT port terminated 50Ω	30	38		dB
α_1	Insertion loss (TX-ANT)	Pin=8W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		0.8	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

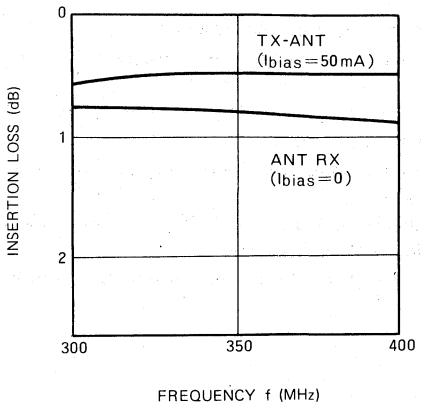


TYPICAL PERFORMANCE DATA

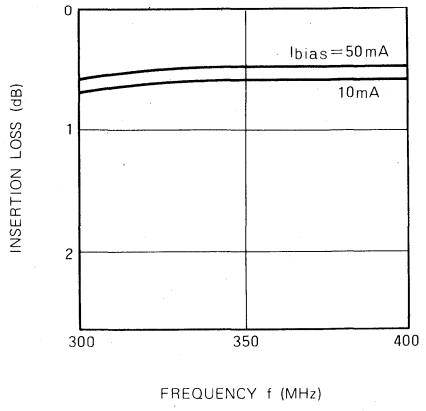
TX-RX ISOLATION



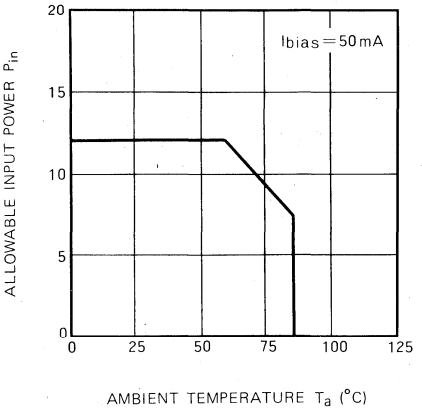
TX-ANT ANT-RX INSERTION LOSS



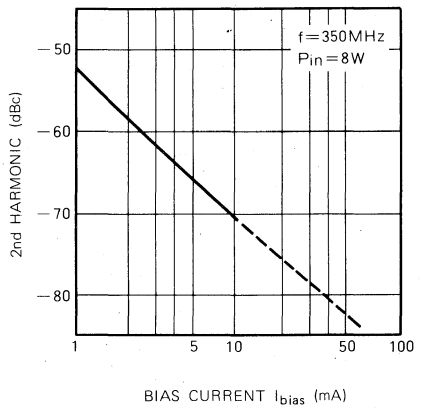
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD001L.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

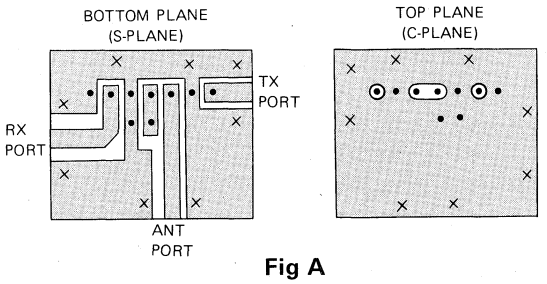


Fig A

MITSUBISHI ELECTRIC

MD003

800~940MHz, 5W, ANTENNA SWITCH

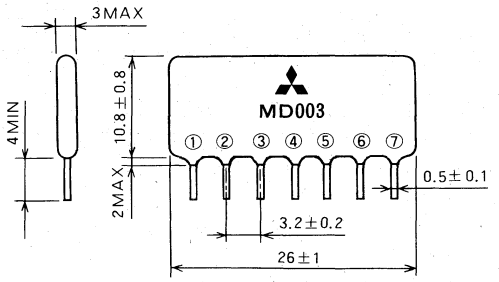
MINIATURE RF ANTENNA SWITCH

MD003 is designed to cover 800 ~ 940MHz, 5W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 35dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < -70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

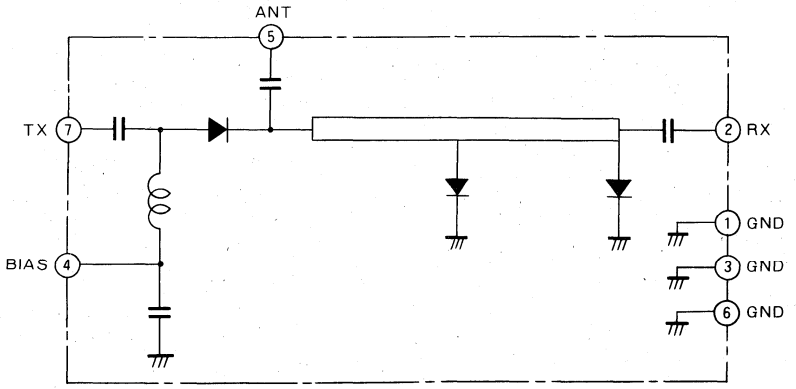
OUTLINE DRAWING

Dimensions in mm



① GND
② RX
③ GND
④ BIAS
⑤ ANT
⑥ GND
⑦ TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

800～940MHz, 5W, ANTENNA SWITCH

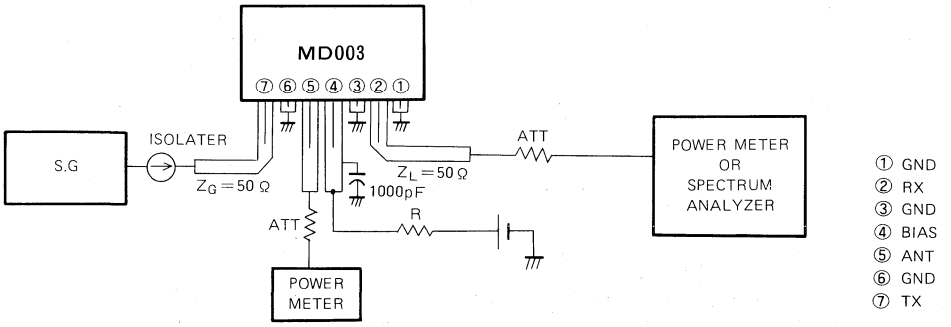
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	12 @Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

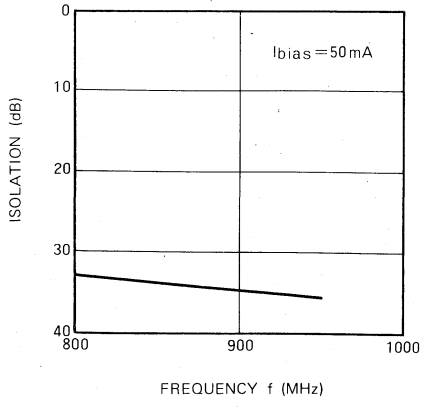
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		800		940	MHz
ISO	Isolation (TX-RX)	Pin= 8 W, Ibias=50mA, ANT port terminated 50 Ω	30	35		dB
α_1	Insertion loss (TX-ANT)	Pin= 8 W, Ibias=50mA, RX port terminated 50 Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50 Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

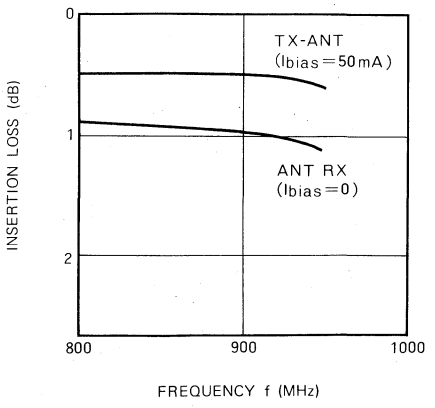


TYPICAL PERFORMANCE DATA

TX-RX ISOLATION



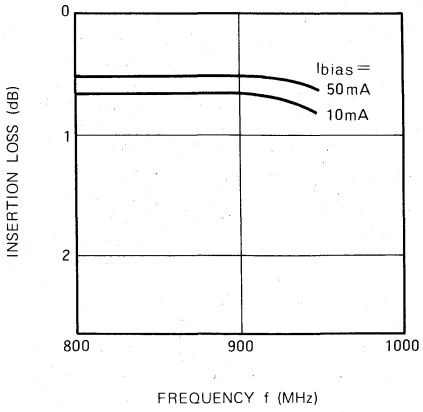
TX-ANT ANT-RX INSERTION LOSS



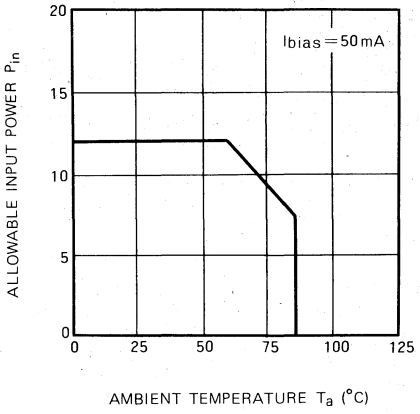
MITSUBISHI ELECTRIC

800~940MHz, 5W, ANTENNA SWITCH

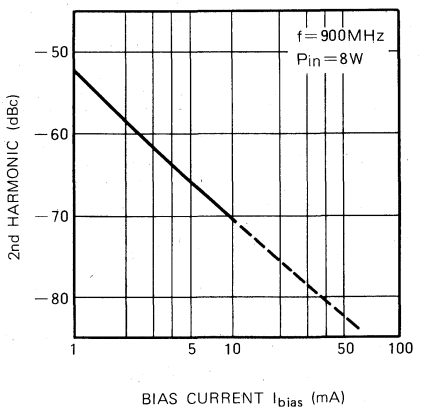
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD003.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

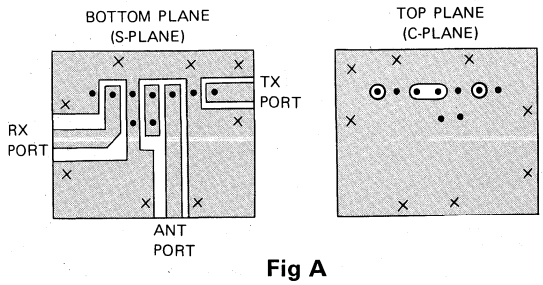


Fig A

MD003A

800~940MHz, 10W, ANTENNA SWITCH

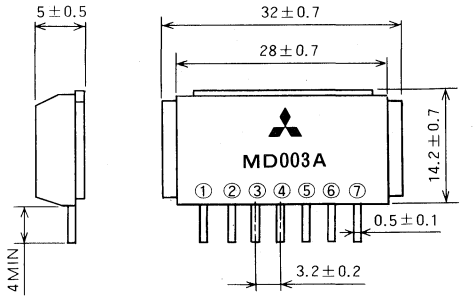
MINIATURE RF ANTENNA SWITCH

MD003A is designed to cover 800 ~ 940MHz, 10W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 35dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output: 2nd Harmonic < -70dBc
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

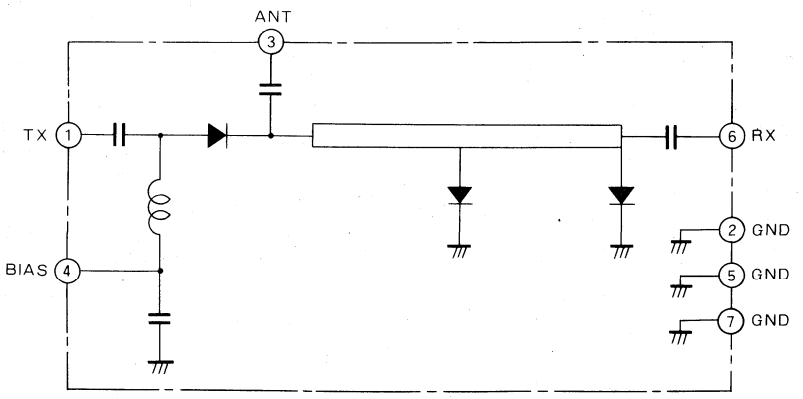
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

800～940MHz, 10W, ANTENNA SWITCH

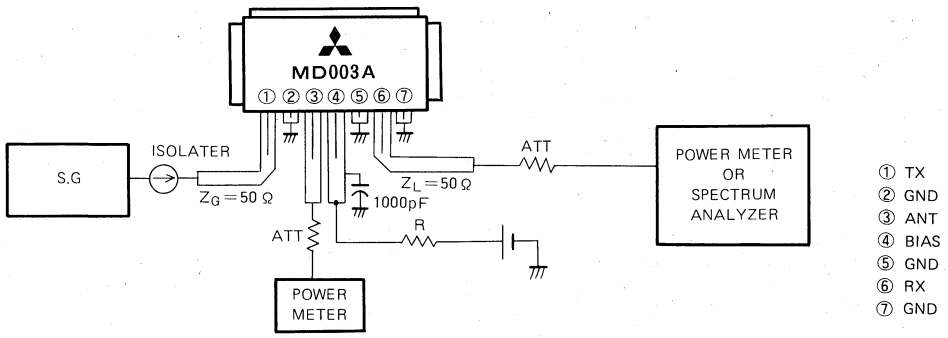
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	17 Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

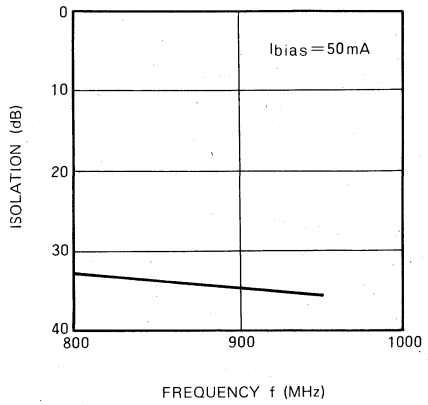
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		800		940	MHz
ISO	Isolation (TX-RX)	Pin=15W, Ibias=50mA, ANT port terminated 50Ω	30	35		dB
α_1	Insertion loss (TX-ANT)	Pin=15W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

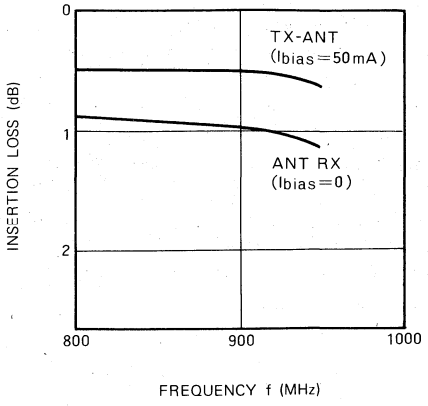


TYPICAL PERFORMANCE DATA

TX-RX ISOLATION

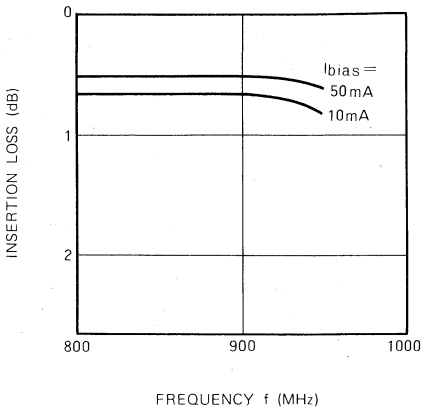


TX-ANT ANT-RX INSERTION LOSS

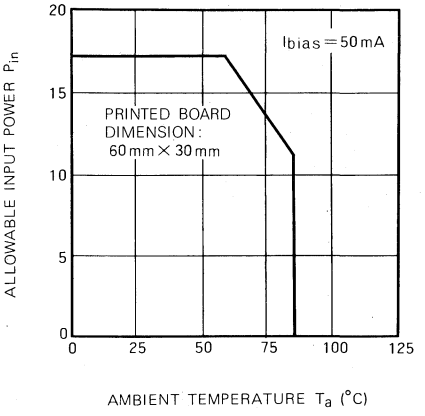


800~940MHz, 10W, ANTENNA SWITCH

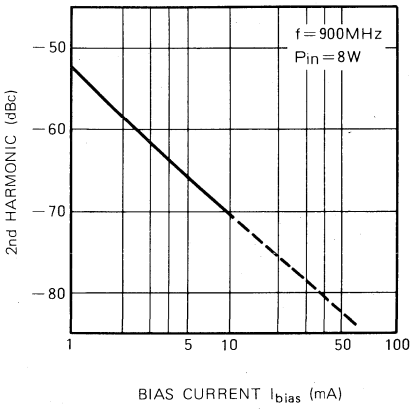
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



2nd HARMONIC VS. BIAS CURRENT



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD003A.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ②, ⑤, ⑦ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

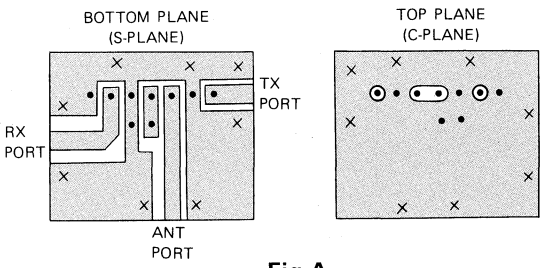


Fig A

MITSUBISHI ELECTRIC

MD003H

800~940MHz, 25W, ANTENNA SWITCH

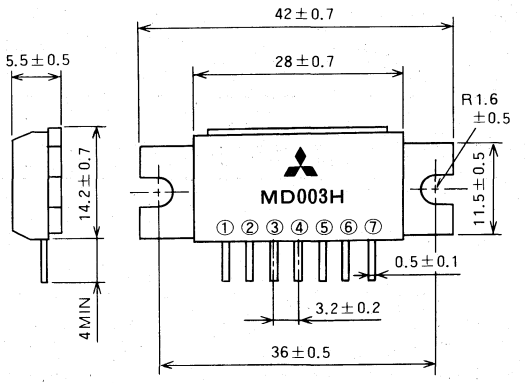
MINIATURE RF ANTENNA SWITCH

MD003H is designed to cover 800 ~ 940MHz, 25W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 35dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.5dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output:
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

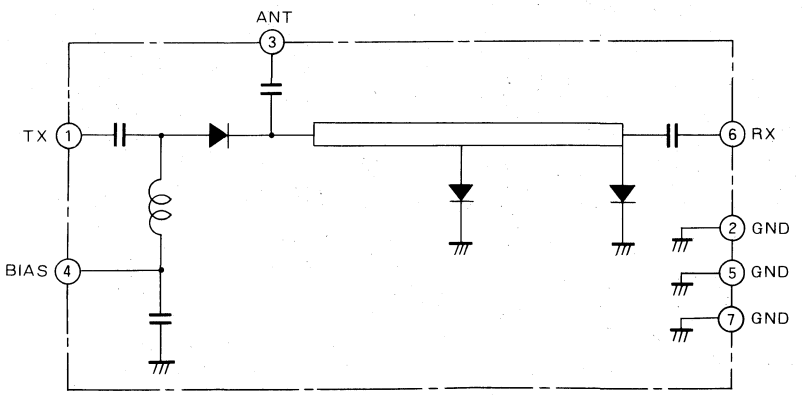
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

800～940MHz, 25W, ANTENNA SWITCH

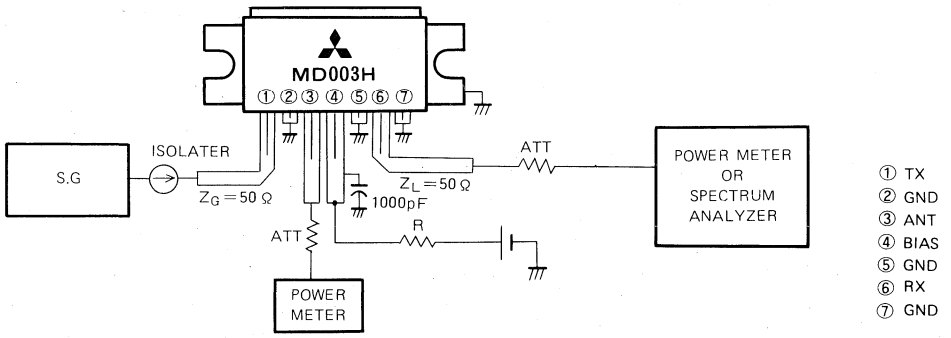
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	50 Tc≦90°C	W
Tstg	Storage temperature	−30～+110	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

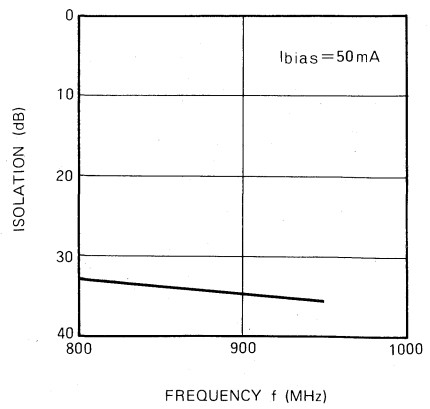
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		800		940	MHz
ISO	Isolation (TX-RX)	Pin=30W, Ibias=50mA, ANT port terminated 50Ω	30	35		dB
α_1	Insertion loss (TX-ANT)	Pin=30W, Ibias=50mA, RX port terminated 50Ω		0.5	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

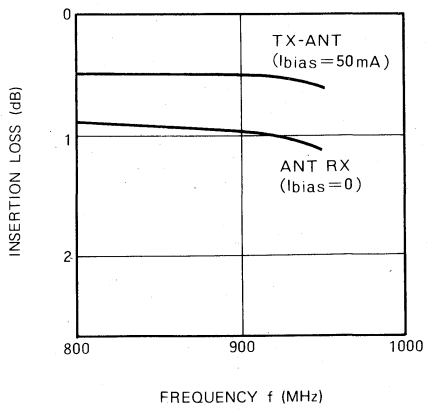


TYPICAL PERFORMANCE DATA

TX-RX ISOLATION

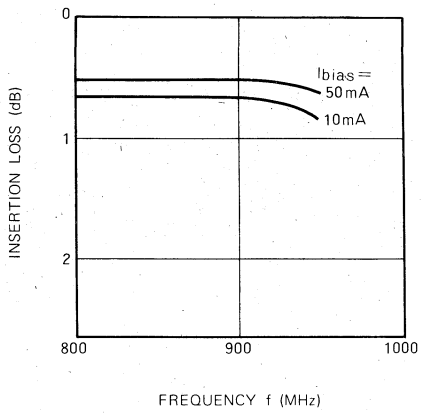


TX-ANT ANT-RX INSERTION LOSS

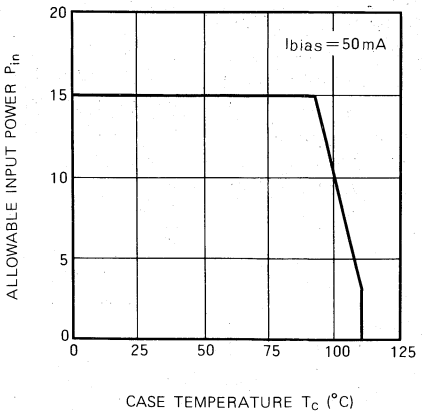


MITSUBISHI ELECTRIC

TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated diodes at standard operation

(1) Thermal resistance between junction and package of incorporated diodes.
$R_{th(j-c)}$ = 70°C/W (Typ.)

(2) Junction temperature of incorporated diodes at standard operation. Conditions for standard operation.
P_{in} = 33W, I_{bias} = 50mA (VF = 0.85V)(1), r_{fs} = 0.7Ω(2), Z_O = 50Ω(3)

Note 1: Forward Voltage of diodes.
Note 2: Series Resistance of diodes.
Note 3: Characteristic Impedance.

- Junction temperature of diodes
$T_j = [(P_{in}/Z_o) \times r_{fs} + I_{bias} \times VF] \times R_{th(j-c)} + T_c$(4)
$= [(33/50) \times 0.7 + 0.05 \times 0.85] \times 70 + T_c$
$= 35.3 + T_C$ (°C)

Note 4: Package temperature of device

2. Heat sink design

In thermal design of heat sink, try to keep the package tempeatrure at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the input power of 33W below 90°C.

The thermal resistance $R_{th(c-a)}$(5) of the heat sink to realize this:

$R_{th(c-a)} = (T_c - T_a)/(P_{in} - P_{out}) = (90-60)/(33-29.4)$(6)
$= 8.3$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink.

Note 6: Insertion loss is 0.5dB

Mounting the heat sink of the above thermal resistance on the device,

T_j = 125.3°C, T_c = 90°C

In the annual average of ambient temperature is 30°C,

T_j = 95.3°C

As the maximum junction temperature of these incorporated diodes T_{jmax} are 175°C, application under fully derated condition is ensured.

MD004

1200~1300MHz, 5W, ANTENNA SWITCH

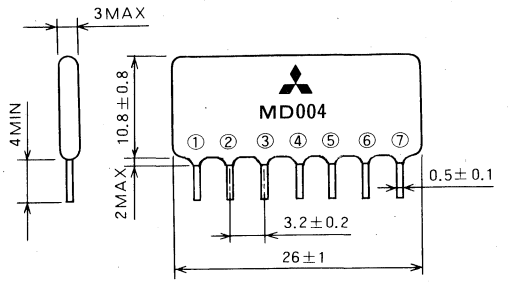
MINIATURE RF ANTENNA SWITCH

MD004 is designed to cover 1200 ~ 1300MHz, 5W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 30dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.8dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output:
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

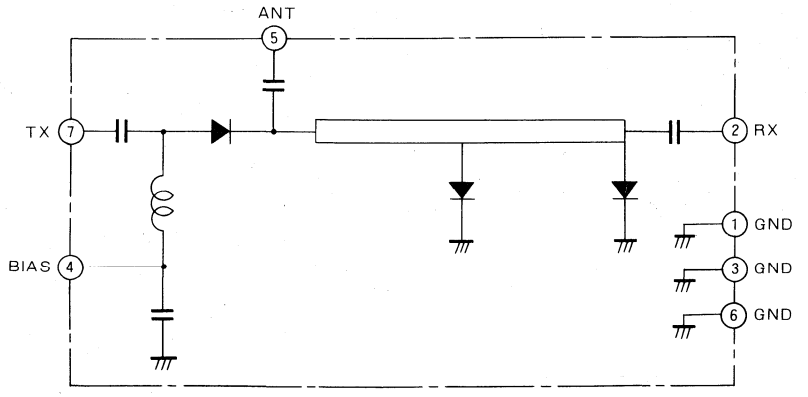
OUTLINE DRAWING

Dimensions in mm



① GND
② RX
③ GND
④ BIAS
⑤ ANT
⑥ GND
⑦ TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

1200～1300MHz, 5W, ANTENNA SWITCH

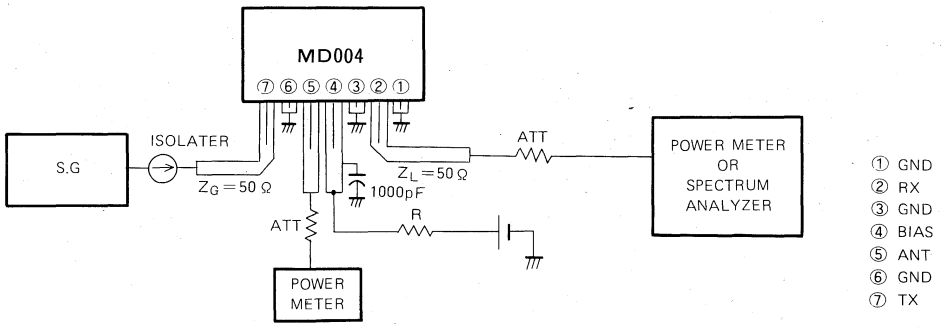
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	10 @Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

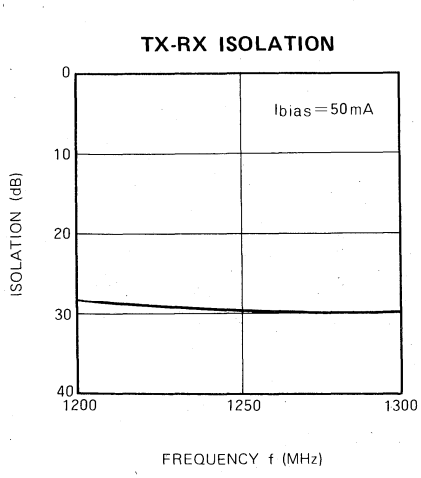
ELECTRICAL CHARACTERISTICS (Ta=25°C)

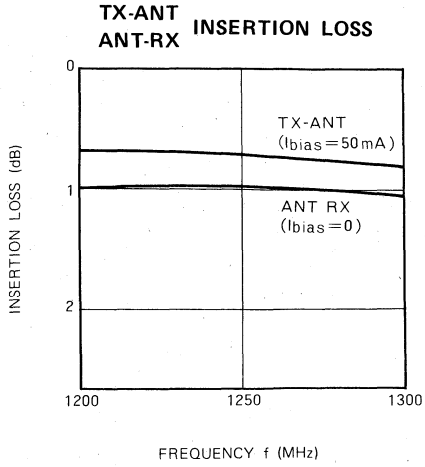
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		1200		1300	MHz
ISO	Isolation (TX-RX)	Pin= 8 W, Ibias=50mA, ANT port terminated 50 Ω	25	30		dB
α_1	Insertion loss (TX-ANT)	Pin= 8 W, Ibias=50mA, RX port terminated 50 Ω		0.8	1.2	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50 Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO, α_1)



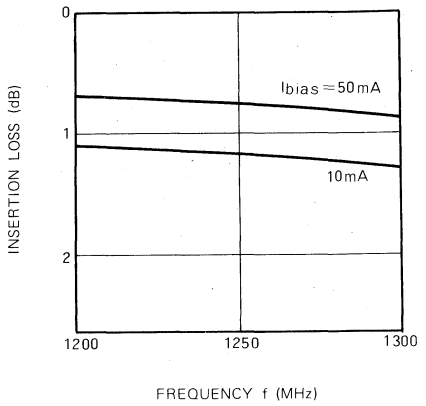
TYPICAL PERFORMANCE DATA



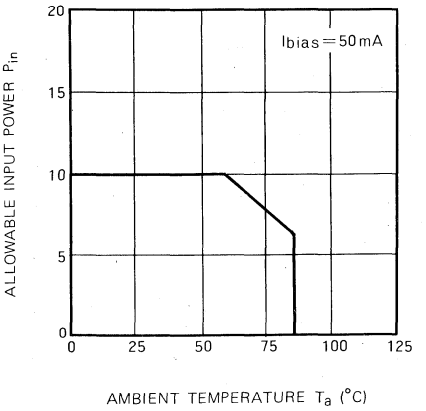


1200~1300MHz, 5W, ANTENNA SWITCH

TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD004.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

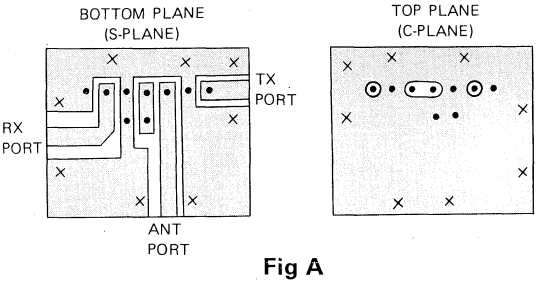


Fig A

MITSUBISHI ELECTRIC

MD004H

1200~1300MHz, 25W, ANTENNA SWITCH

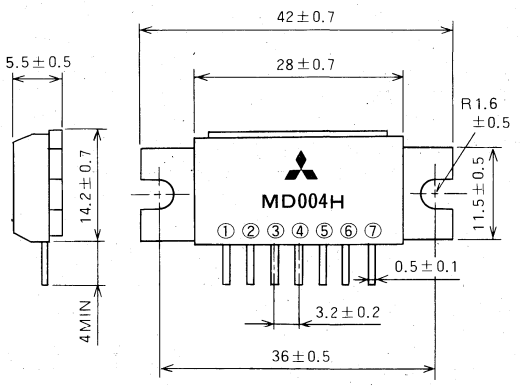
MINIATURE RF ANTENNA SWITCH

MD004H is designed to cover 1200 ~ 1300MHz, 25W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 30dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.8dB Typ.
  ANT-RX 1.0dB Typ.
- Low Harmonic Output:
- Low Operating Current (TX-ANT ON): 50mA
- Off Through (ANT-RX ON): 0mA

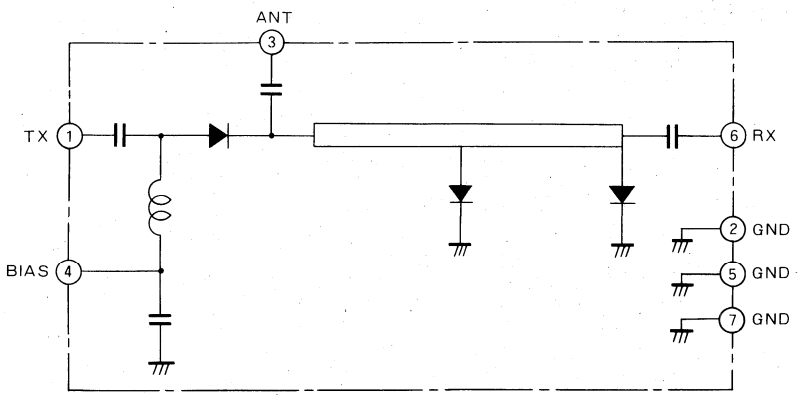
OUTLINE DRAWING

Dimensions in mm



① TX
② GND
③ ANT
④ BIAS
⑤ GND
⑥ RX
⑦ GND

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=50mA	ON	OFF
Ibias=0	OFF	ON

1200～1300MHz, 25W, ANTENNA SWITCH

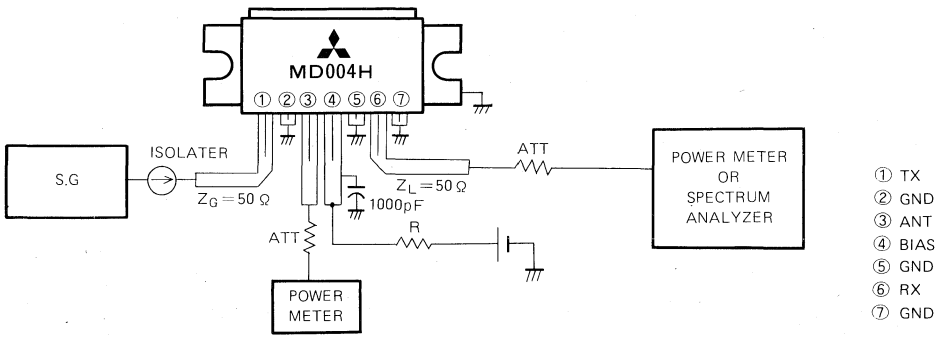
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
P_{in}	Input power	50 @Ta≦90°C	W
Tstg	Storage temperature	−30～+110	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C)

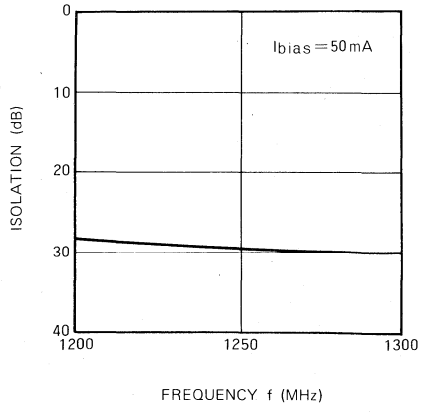
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		1200		1300	MHz
ISO	Isolation (TX-RX)	P_{in}=20W, Ibias=50mA, ANT port terminated 50Ω	25	30		dB
α_1	Insertion loss (TX-ANT)	P_{in}=20W, Ibias=50mA, RX port terminated 50Ω		0.8	1.2	dB
α_2	Insertion loss (ANT-RX)	P_{in}=1mW, Ibias=0, TX port terminated 50Ω		1.0	1.5	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

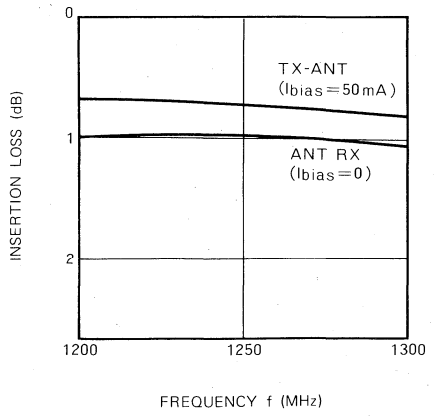


TYPICAL PERFORMANCE DATA

TX-RX ISOLATION



TX-ANT
ANT-RX INSERTION LOSS



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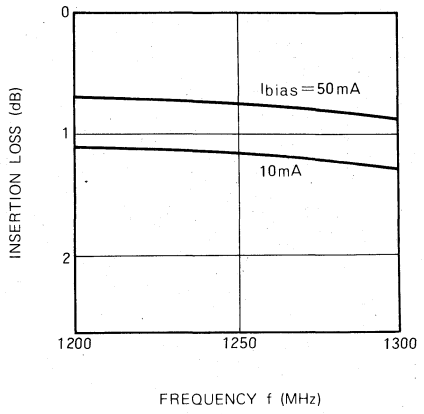
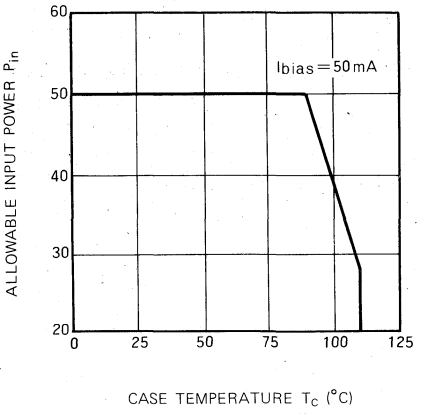
TX-ANT INSERTION LOSS VS. BIAS CURRENT



ALLOWABLE INPUT POWER



DESIGN CONSIDERATION OF HEAT RADIATION

Please refer to following consideration when designing heat sink.

1. Junction temperature of incorporated diodes at standard operation

(1) Thermal resistance between junction and package of incorporated diodes.
$R_{th(j-c)}$ = 70°C/W (Typ.)

(2) Junction temperature of incorporated diodes at standard operation. Conditions for standard operation.
P_{in} = 33W, I_{bias} = 50mA (VF = 0.85V)(1), r_{fs} = 0.8Ω(2), Z_o = 50Ω(3)

Note 1: Forward Voltage of diodes.
Note 2: Series Resistance of diodes.
Note 3: Characteristic Impedance.

- Junction temperature of diodes
$T_j = [(P_{in}/Z_o) \times r_{fs} + I_{bias} \times VF] \times R_{th(j-c)} + T_c$(4)
$= [(33/50) \times 0.7 + 0.05 \times 0.85] \times 70 + T_c$
$= 40.0 + T_c$ (°C)

Note 4: Package temperature of device

2. Heat sink design

In thermal design of heat sink, try to keep the package tempeatrure at the upper limit of the operating ambient temperature (normally T_a = 60°C) and at the input power of 33W below 90°C.

The thermal resistance $R_{th(c-a)}$(5) of the heat sink to realize this:

$R_{th(c-a)} = (T_c - T_a)/(P_{in} - P_{out}) = (90-60)/(33-27.5)$(6)
$= 5.5$ (°C/W)

Note 5: Inclusive of the contact thermal resistance between device and heat sink.

Note 6: Insertion loss is 0.8dB

Mounting the heat sink of the above thermal resistance on the device,

T_j = 130°C, T_c = 90°C

In the annual average of ambient temperature is 30°C,

T_j = 100°C

As the maximum junction temperature of these incorporated diodes T_{jmax} are 175°C, application under fully derated condition is ensured.

PRELIMINARY
Notice: This is not a final specification
Some parametric limits are subject to change.

MD007L

135~175MHz, 5W, ANTENNA SWITCH

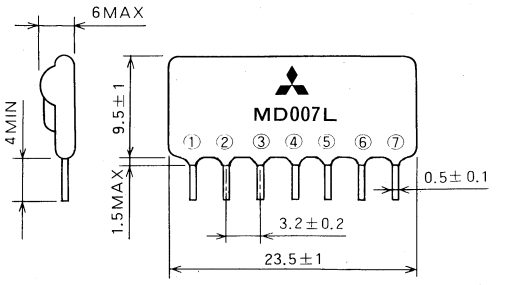
MINIATURE RF ANTENNA SWITCH

MD007L is designed to cover 135~175MHz, 5W, antenna switch module.

- Small, Easilly Mounted Package.
- High Isolation: 28dB Typ.
- Low Transmit Insertion Loss: TX-ANT 0.4dB Typ.
  ANT-RX 0.5dB Typ.
- Low Harmonic Output:
- Low Operating Current (TX-ANT ON): 20mA
- Off Through (ANT-RX ON): 0mA

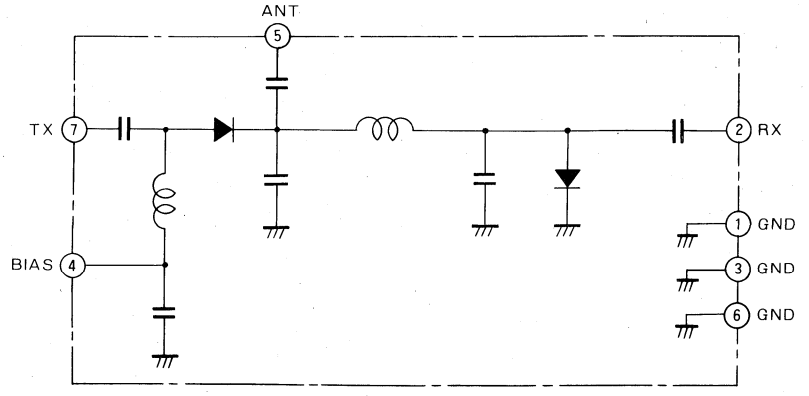
OUTLINE DRAWING

Dimensions in mm



① GND
② RX
③ GND
④ BIAS
⑤ ANT
⑥ GND
⑦ TX

EQUIVALENT CIRCUIT



OPERATING MATRIX

Bias condition	TX-ANT	ANT-RX
Ibias=20mA	ON	OFF
Ibias=0	OFF	ON

MITSUBISHI ELECTRIC

135～175MHz, 5W, ANTENNA SWITCH

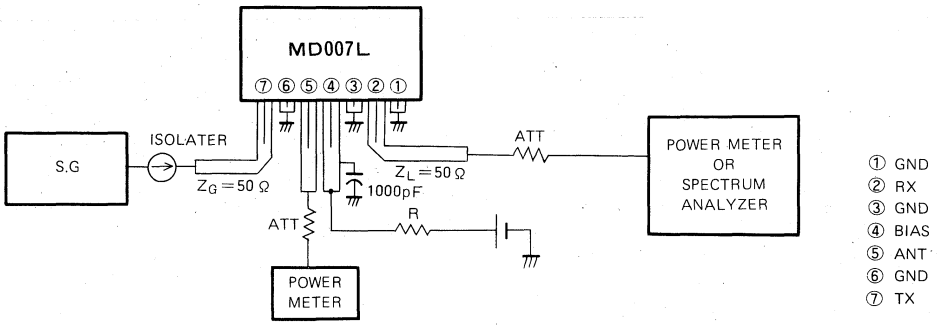
ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Ibias	Bias current	100	mA
Pin	Input power	10 @Ta≦60°C	W
Tstg	Storage temperature	−30～+85	°C

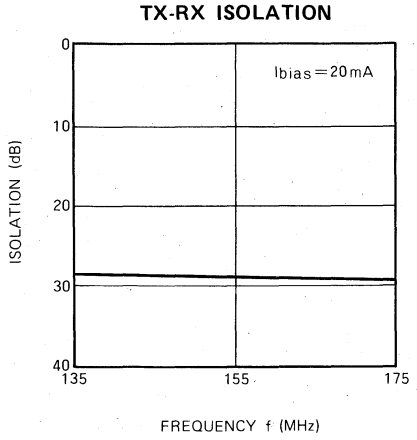
ELECTRICAL CHARACTERISTICS (Ta=25°C)

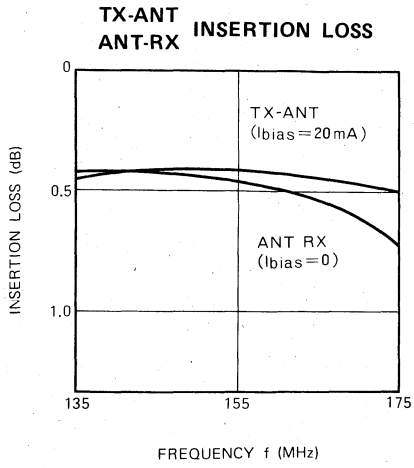
Symbol	Parameter	Test condition	Limits			Unit
			Min	Typ	Max	
f	Frequency Range		135		175	MHz
ISO	Isolation (TX-RX)	Pin=8W, Ibias=20mA, ANT port terminated 50Ω	25	28		dB
α_1	Insertion loss (TX-ANT)	Pin=8W, Ibias=20mA, RX port terminated 50Ω		0.4	0.7	dB
α_2	Insertion loss (ANT-RX)	Pin=1mW, Ibias=0, TX port terminated 50Ω		0.5	0.8	dB

TESTING CIRCUIT SCHEMATIC (ISO. α_1)

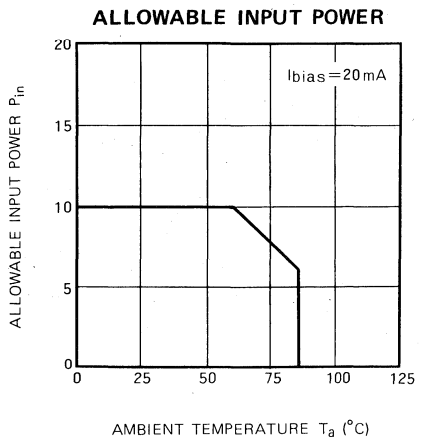


TYPICAL PERFORMANCE DATA





135~175MHz, 5W, ANTENNA SWITCH



Recommended Practical Design

Fig. A shows a practical circuit pattern for mounting MD007L.

This circuit pattern is 50Ω microstrip line with Epoxy-Glass printed circuit board.

- It's desirable that distance of each RF port is as far as possible.
- Each GND terminal ①, ③, ⑥ should be soldered at both side S, C ground plane.
- Each x point should be treated through hole or jumper.

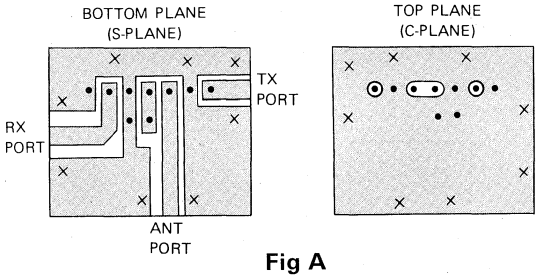


Fig A

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