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DEFINITION OF SYMBOLS AND TERMS

*	Contact local representative for latest information
NPN	Silicon Planar Transistor, N-Polarity
PNP	Silicon Planar Transistor, P-Polarity
DNPN	Dual NPN Transistor
DPNP	Dual PNP Transistor
PFET	Silicon Planar Junction Field Effect Transistor,
	P-Channel
NFET	Silicon Planar Junction Field Effect Transistor,
	N-Channel
DNFET	Dual N-Channel Field Effect Transistor
DPFET	Dual P-Channel Field Effect Transistor
DMNPN	Dual Monolithic NPN Transistor
MDDNPN	Monolithic Dual Darlington NPN Transistor
MDPFET	Monolithic Dual P-Channel Field Effect Transistor
HNIL	High Noise Immunity Logic
TTL	Transistor-Transistor Logic
DTL	Diode Transistor Logic
ULP	Ultra Low Power

Device Part No.	Type	Description	Sheet No.
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TRANSISTORS

2N718	NPN	General Purpose	*
2N718A	NPN	General Purpose	*
JAN-2N718A	NPN	General Purpose	*
JAN-TX-2N718A	NPN	General Purpose	*
2N720	NPN	General Purpose	*
2N760	NPN	General Purpose	1101
2N760A	NPN	General Purpose	1101
2N869	PNP	General Purpose	1601
2N910	NPN	General Purpose	*
JAN-2N910	NPN	General Purpose	*
2N911	NPN	General Purpose	*
2N915	NPN	RF/IF Amplifier	1501
2N915A	NPN	RF/IF Amplifier	1501
2N916	NPN	RF/IF Amplifier	1502
JAN-2N916	NPN	RF/IF Amplifier	1502
2N916A	NPN	RF/IF Amplifier	1502
2N916B	NPN	RF/IF Amplifier	1502
2N917	NPN	RF/IF Amplifier	*
2N918	NPN	RF/IF Amplifier	1503
JAN-2N918	NPN	RF/IF Amplifier	1503
JAN-TX-2N918	NPN	RF/IF Amplifier	1503
2N929	NPN	General Purpose	1102
JAN-2N929	NPN	General Purpose	1102
JAN-TX-2N929	NPN	General Purpose	1102
2N929A	NPN	General Purpose	1102
2N930	NPN	General Purpose	1102
JAN-2N930	NPN	General Purpose	1102
JAN-TX-2N930	NPN	General Purpose	1102
2N930A	NPN	General Purpose	1102
2N930B	NPN	General Purpose	1102
2N995	PNP	General Purpose	1602
2N998	DNPN	General Purpose	*
2N1613	NPN	General Purpose	*
JAN-2N1613	NPN	General Purpose	*
JAN-TX-2N1613	NPN	General Purpose	*
2N1711	NPN	General Purpose	*
2N2060	DNPN	General Purpose	*
JAN-2N2060	DNPN	General Purpose	*
JAN-TX-2N2060	DNPN	General Purpose	*
2N2060A	DNPN	General Purpose	*
2N2192	NPN	Medium Power	1301
2N2192A	NPN	Medium Power	1301
2N2192B	NPN	Medium Power	1301

Device Part No.	Type	Description	Sheet No.
2N2193	NPN	Medium Power	1301
2N2193A	NPN	Medium Power	1301
2N2193B	NPN	Medium Power	1301
2N2194	NPN	Medium Power	1301
2N2194A	NPN	Medium Power	1301
2N2194B	NPN	Medium Power	1301
2N2195	NPN	Medium Power	1301
2N2195A	NPN	Medium Power	1301
2N2195B	NPN	Medium Power	1301
2N2217	NPN	Medium Power	1302
2N2218	NPN	Medium Power	1302
JAN-2N2218	NPN	Medium Power	1302
JAN-TX-2N2218	NPN	Medium Power	1302
2N2218A	NPN	Medium Power	1303
JAN-2N2218A	NPN	Medium Power	1303
JAN-TX-2N2218A	NPN	Medium Power	1303
2N2219	NPN	Medium Power	1302
JAN-2N2219	NPN	Medium Power	1302
JAN-TX-2N2219	NPN	Medium Power	1302
2N2219A	NPN	Medium Power	1303
JAN-2N2219A	NPN	Medium Power	1303
JAN-TX-2N2219A	NPN	Medium Power	1303
2N2220	NPN	Medium Power	1302
2N2221	NPN	Medium Power	1302
JAN-2N2221	NPN	Medium Power	1302
JAN-TX-2N2221	NPN	Medium Power	1302
2N2221A	NPN	Medium Power	1303
JAN-2N2221A	NPN	Medium Power	1303
JAN-TX-2N2221A	NPN	Medium Power	1303
2N2222	NPN	Medium Power	1302
JAN-2N2222	NPN	Medium Power	1302
JAN-TX-2N2222	NPN	Medium Power	1302
2N2222A	NPN	Medium Power	1303
JAN-2N2222A	NPN	Medium Power	1303
JAN-TX-2N2222A	NPN	Medium Power	1303
2N2222B	NPN	Medium Power	1304
2N2223	DNPN	Medium Power	2301
2N2223A	DNPN	Medium Power	2301
2N2243	NPN	Medium Power	1305
2N2243A	NPN	Medium Power	1305
2N2297	NPN	Medium Power	1306
2N2368	NPN	RF/IF Amplifier	*
2N2369	NPN	RF/IF Amplifier	*
2N2369A	NPN	RF/IF Amplifier	1504
2N2453	DNPN	General Purpose	2101
2N2453A	DNPN	General Purpose	2101
2N2481	NPN	RF/IF Amplifier	*
2N2483	NPN	General Purpose	1103
2N2484	NPN	General Purpose	1103
2N2484A	NPN	General Purpose	1103
2N2509	NPN	General Purpose	1104
2N2510	NPN	General Purpose	1104
2N2511	NPN	General Purpose	1104
2N2586	NPN	General Purpose	1105
2N2601	PNP	General Purpose	1603
2N2602	PNP	General Purpose	1603
2N2603	PNP	General Purpose	1603
2N2604	PNP	General Purpose	1604
2N2605	PNP	General Purpose	1604
2N2616	NPN	RF/IF Amplifier	1505

Device Part No.	Type	Description	Sheet No.
2N2639	DNP	General Purpose	2102
2N2640	DNP	General Purpose	2102
2N2641	DNP	General Purpose	2102
2N2642	DNP	General Purpose	2102
2N2643	DNP	General Purpose	2102
2N2644	DNP	General Purpose	2102
2N2708	NPN	RF/IF Amplifier	1506
JAN-2N2708	NPN	RF/IF Amplifier	1506
2N2720	DNP	General Purpose	2103
2N2721	DNP	General Purpose	2103
2N2722	DNP	General Purpose	2103
2N2729	NPN	RF/IF Amplifier	1505
2N2865	NPN	RF/IF Amplifier	1507
2N2903	DNP	General Purpose	*
2N2903A	DNP	General Purpose	*
2N2904	PNP	Medium Power	1801
JAN-2N2904	PNP	Medium Power	1801
JAN-TX-2N2904	PNP	Medium Power	1801
2N2904A	PNP	Medium Power	1801
JAN-2N2904A	PNP	Medium Power	1801
JAN-TX-2N2904A	PNP	Medium Power	1801
2N2905	PNP	Medium Power	1801
JAN-2N2905	PNP	Medium Power	1801
JAN-TX-2N2905	PNP	Medium Power	1801
2N2905A	PNP	Medium Power	1801
JAN-2N2905A	PNP	Medium Power	1801
JAN-TX-2N2905A	PNP	Medium Power	1801
2N2906	PNP	Medium Power	1801
JAN-2N2906	PNP	Medium Power	1801
JAN-TX-2N2906	PNP	Medium Power	1801
2N2906A	PNP	Medium Power	1801
JAN-2N2906A	PNP	Medium Power	1801
JAN-TX-2N2906A	PNP	Medium Power	1801
2N2907	PNP	Medium Power	1801
JAN-2N2907	PNP	Medium Power	1801
JAN-TX-2N2907	PNP	Medium Power	1801
2N2907A	PNP	Medium Power	1801
JAN-2N2907A	PNP	Medium Power	1801
JAN-TX-2N2907A	PNP	Medium Power	1801
2N2913	DNP	General Purpose	2104
2N2914	DNP	General Purpose	2104
2N2915	DNP	General Purpose	2104
2N2915A	DNP	General Purpose	2104
2N2916	DNP	General Purpose	2104
2N2916A	DNP	General Purpose	2104
2N2917	DNP	General Purpose	2104
2N2918	DNP	General Purpose	2104
2N2919	DNP	General Purpose	2104
JAN-2N2919	DNP	General Purpose	2104
JAN-TX-2N2919	DNP	General Purpose	2104
2N2919A	DNP	General Purpose	2104
2N2920	DNP	General Purpose	2104
JAN-2N2920	DNP	General Purpose	2104
JAN-TX-2N2920	DNP	General Purpose	2104
2N2920A	DNP	General Purpose	2104
2N2972	DNP	General Purpose	2105
2N2973	DNP	General Purpose	2105
2N2974	DNP	General Purpose	2105
2N2975	DNP	General Purpose	2105
2N2976	DNP	General Purpose	2105

Device Part No.	Type	Description	Sheet No.
2N2977	DNP	General Purpose	2105
2N2978	DNP	General Purpose	2105
2N2979	DNP	General Purpose	2105
2N2980	DNP	General Purpose	*
2N3117	NPN	General Purpose	1106
2N3289	NPN	RF/IF Amplifier	1508
2N3290	NPN	RF/IF Amplifier	1508
2N3291	NPN	RF/IF Amplifier	1509
2N3292	NPN	RF/IF Amplifier	1509
2N3293	NPN	RF/IF Amplifier	1509
2N3294	NPN	RF/IF Amplifier	1509
2N3347	DPNP	General Purpose	2601
2N3348	DPNP	General Purpose	2601
2N3349	DPNP	General Purpose	2601
2N3350	DPNP	General Purpose	2601
2N3351	DPNP	General Purpose	2601
2N3352	DPNP	General Purpose	2601
2N3423	DNP	RF/IF Amplifier	2501
2N3424	DNP	RF/IF Amplifier	2501
2N3680	DNP	General Purpose	2106
2N3800	DPNP	General Purpose	2602
2N3801	DPNP	General Purpose	2602
2N3802	DPNP	General Purpose	2602
2N3803	DPNP	General Purpose	2602
2N3804	DPNP	General Purpose	2602
2N3805	DPNP	General Purpose	2602
2N3806	DPNP	General Purpose	2602
2N3807	DPNP	General Purpose	2602
2N3808	DPNP	General Purpose	2602
2N3809	DPNP	General Purpose	2602
2N3810	DPNP	General Purpose	2602
2N3811	DPNP	General Purpose	2602
2N4015	DPNP	General Purpose	*
2N4016	DPNP	General Purpose	*
2N4017	DPNP	General Purpose	2603
2N4018	DPNP	General Purpose	2603
2N4019	DPNP	General Purpose	2603
2N5079	NPN	Medium Power	1307
2N5080	NPN	Medium Power	1307
A1109	NPN	General Purpose	*
A1341	NPN	General Purpose	*
DL1009	DPNP	General Purpose	*
SA2206	DNP	General Purpose	*
SA2253	DNP	General Purpose	*
SA2664	MDDNP	General Purpose	*
SA2710	DMNP	Medium Power	*
SA2711	DMNP	Medium Power	*
SA2712	DMNP	Medium Power	*
SA2713	DMNP	Medium Power	*
SA2714	DMNP	Medium Power	*
SA2715	DMNP	Medium Power	*
SA2716	DMNP	Medium Power	2302
SA2717	DMNP	Medium Power	2302
SA2718	DMNP	Medium Power	2302
SA2719	DMNP	Medium Power	*
SA2720	DMNP	Medium Power	*
SA2721	DMNP	Medium Power	*
SA2722	DMNP	Medium Power	*
SA2723	DMNP	Medium Power	*
SA2724	DMNP	Medium Power	*

Device Part No.	Type	Description	Sheet No.
SA2725	DMNPN	Medium Power	*
SA2726	DMNPN	Medium Power	*
SA2738	DMNPN	Medium Power	*
SA2739	DMNPN	Medium Power	*

FIELD EFFECT TRANSISTORS

2N2386	PFET	Amplifier	*
2N2497	PFET	Amplifier	*
2N2498	PFET	Amplifier	*
2N2499	PFET	Amplifier	*
2N2606	PFET	Amplifier	3501
JAN-2N2606	PFET	Amplifier	3501
2N2607	PFET	Amplifier	3501
JAN-2N2607	PFET	Amplifier	3501
2N2608	PFET	Amplifier	3501
JAN-2N2608	PFET	Amplifier	3501
2N2609	PFET	Amplifier	3501
JAN-2N2609	PFET	Amplifier	3501
2N2841	PFET	Amplifier	*
2N2842	PFET	Amplifier	*
2N2843	PFET	Amplifier	*
2N3066	NFET	Amplifier	*
2N3067	NFET	Amplifier	*
2N3068	NFET	Amplifier	*
2N3069	NFET	Amplifier	3101
2N3070	NFET	Amplifier	3101
2N3071	NFET	Amplifier	3101
2N3329	PFET	Amplifier	*
2N3330	PFET	Amplifier	*
2N3331	PFET	Amplifier	*
2N3365	NFET	Amplifier	*
2N3366	NFET	Amplifier	*
2N3367	NFET	Amplifier	*
2N3368	NFET	Amplifier	3101
2N3369	NFET	Amplifier	3101
2N3370	NFET	Amplifier	3101
2N3376	PFET	Amplifier	*
2N3380	PFET	Amplifier	*
2N3382	PFET	Amplifier	*
2N3386	PFET	Amplifier	*
2N3436	NFET	Amplifier	3102
2N3437	NFET	Amplifier	3102
2N3438	NFET	Amplifier	3102
2N3452	NFET	Amplifier	3103
2N3453	NFET	Amplifier	3103
2N3454	NFET	Amplifier	3103
2N3455	NFET	Amplifier	3103
2N3456	NFET	Amplifier	3103
2N3457	NFET	Amplifier	3103
2N3458	NFET	Amplifier	3102
2N3459	NFET	Amplifier	3102
2N3460	NFET	Amplifier	3102
2N3823	NFET	Amplifier	3104
2N3921	DNFET	Amplifier	4101
2N3922	DNFET	Amplifier	4101
2N3934	DNFET	Amplifier	4102
2N3935	DNFET	Amplifier	4102
2N3966	NFET	Amplifier	3105

Device Part No.	Type	Description	Sheet No.
2N3967	NFET	Amplifier	3105
2N3967A	NFET	Amplifier	3105
2N3968	NFET	Amplifier	3105
2N3968A	NFET	Amplifier	3105
2N3969	NFET	Amplifier	3105
2N3969A	NFET	Amplifier	3105
2N3970	NFET	Switch	3301
2N3971	NFET	Switch	3301
2N3972	NFET	Switch	3301
2N4066	MDPFET	Amplifier	4501
2N4067	MDPFET	Amplifier	4501
2N4082	DNFET	Amplifier	4102
2N4083	DNFET	Amplifier	4102
2N4084	DNFET	Amplifier	4101
2N4085	DNFET	Amplifier	4101
2N4091	NFET	Switch	3302
2N4092	NFET	Switch	3302
2N4093	NFET	Switch	3302
2N4139	NFET	Amplifier	3106
2N4223	NFET	Amplifier	3107
2N4224	NFET	Amplifier	3107
2N4302	NFET	Amplifier	3108
2N4303	NFET	Amplifier	3108
2N4304	NFET	Amplifier	3108
2N4391	NFET	Switch	*
2N4392	NFET	Switch	*
2N4393	NFET	Switch	*
2N4416	NFET	Amplifier	3109
2N4416A	NFET	Amplifier	3109
2N4856	NFET	Switch	3303
2N4857	NFET	Switch	3303
2N4858	NFET	Switch	3303
2N4859	NFET	Switch	3303
2N4860	NFET	Switch	3303
2N4861	NFET	Switch	3303
2N4881	NFET	Amplifier	3110
2N4882	NFET	Amplifier	3110
2N4883	NFET	Amplifier	3110
2N4884	NFET	Amplifier	3110
2N4885	NFET	Amplifier	3110
2N4886	NFET	Amplifier	3110
2N4977	NFET	Switch	3304
2N4978	NFET	Switch	3304
2N4979	NFET	Switch	3304
2N5018	PFET	Switch	3701
2N5019	PFET	Switch	3701
2N5078	NFET	Amplifier	3111
2N5163	NFET	Amplifier	3112
2N5277	NFET	Amplifier	3113
2N5278	NFET	Amplifier	3113
2N5391	NFET	Amplifier	3114
2N5392	NFET	Amplifier	3114
2N5393	NFET	Amplifier	3114
2N5394	NFET	Amplifier	3114
2N5395	NFET	Amplifier	3114
2N5396	NFET	Amplifier	3114
2N5505	MDPFET	Amplifier	4502
2N5506	MDPFET	Amplifier	4502
2N5507	MDPFET	Amplifier	4502

Device Part No.	Type	Description	Sheet No.
2N5508	MDPFET	Amplifier	4502
2N5509	MDPFET	Amplifier	4502
2N5510	MDPFET	Amplifier	4503
2N5511	MDPFET	Amplifier	4503
2N5512	MDPFET	Amplifier	4503
2N5513	MDPFET	Amplifier	4503
2N5514	MDPFET	Amplifier	4503
P1027	PFET	Amplifier	*
P1028	PFET	Amplifier	*
P1029	PFET	Amplifier	*
P1069E	PFET	Amplifier	3502
P1086E	PFET	Switch	3702
P1087E	PFET	Switch	3702
SU2078	DNFET	Amplifier	*
SU2079	DNFET	Amplifier	*
SU2080	DNFET	Amplifier	*
SU2081	DNFET	Amplifier	*
SU2098	DNFET	Amplifier	4103
SU2098A	DNFET	Amplifier	4104
SU2098B	DNFET	Amplifier	4104
SU2099	DNFET	Amplifier	4103
SU2099A	DNFET	Amplifier	4104
U1277	NFET	Amplifier	*
U1278	NFET	Amplifier	*
U1279	NFET	Amplifier	*
U1280	NFET	Amplifier	*
U1281	NFET	Amplifier	*
U1282	NFET	Amplifier	*
U1283	NFET	Amplifier	*
U1284	NFET	Amplifier	*
U1285	NFET	Amplifier	*
U1286	NFET	Amplifier	*
U1325	NFET	Amplifier	*
U1714	NFET	Amplifier	3115
U1715	NFET	Amplifier	3116
U1837E	NFET	Amplifier	3117
U1897E	NFET	Switch	3305
U1898E	NFET	Switch	3305
U1899E	NFET	Switch	3305
U1994E	NFET	Amplifier	3118
U2047E	NFET	Amplifier	3119

DIGITAL MICROCIRCUITS

301	HNIL	Dual 5 Input Buffer	5002
302	HNIL	Quad 2 Input Power Gate	5003
303	HNIL	Quad 2 Input Buffer	5004
311	HNIL	RST-JK Flip-Flop	5005
312	HNIL	Dual JK Flip-Flop	5006
321	HNIL	Quad 2 Input Gate	5007
322	HNIL	Dual 5 Input Gate	5008
323	HNIL	Quad 2 Input Gate	5009
324	HNIL	Quad 2 Input Gate	5010
325	HNIL	Dual 2, Dual 3 Input Gate	5011
326	HNIL	Dual 2, Dual 3 Input Gate	5012
331	HNIL	Dual 5 Input Expander	5013
341	HNIL	Dual Exclusive-Or	5014
342	HNIL	Dual One Shot	5015
361	HNIL	Dual Input Interface	5016
362	HNIL	Dual Output Interface	5017

Device Part No.	Type	Description	Sheet No.
370	HNIL	Quad D Flip-Flop	5018
371	HNIL	Decade Counter	5019
372	HNIL	Hexidecimal Counter	5019
380	HNIL	BCD to Decade Decoder	5020
500	TTL	Dual 4 Input Gate	5201
501	TTL	Quad 2 Input Gate	5202
503	TTL	Triple 3 Input Gate	5204
504	TTL	Dual 4 Input Gate	5202
505	TTL	Quad 2 Input Gate	5203
507	TTL	Triple 3 Input Gate	5504
508	TTL	Dual 4 Input Nand/Nor Gate	5505
509	TTL	JK Flip-Flop	5506
510	TTL	Dual 3 Input Gate	*
510	TTL	Dual 3 Input Gate	*
511	TTL	Dual 3 Input Gate	*
512	TTL	JK Flip-Flop	*
513	TTL	Dual 4 Input Gate	*
525	ULP	Quad 2 Input Gate	5212
526	ULP	Dual 4 Input Gate	5212
527	ULP	Dual 3 Input Gate	5212
528	ULP	Dual 3 Input Gate	5212
529	ULP	JK Flip-Flop	5212
530	TTL	Dual 4 Input Gate	5202
531	TTL	Quad 2 Input Gate	5203
533	TTL	Triple 3 Input Gate	5204
534	TTL	Dual 4 Input Gate	5202
535	TTL	Quad 2 Input Gate	5202
537	TTL	Triple 3 Input Gate	5204
538	TTL	Dual 4 Input Nand/Nor Gate	5205
539	TTL	JK Flip-Flop	5206
540	TTL	Dual 4 Input Buffer	5207
541	TTL	Dual 4 Input Buffer	5207
543	TTL	Dual 4 Input Gate	5208
544	TTL	Dual 4 Input Gate	5208
547	TTL	Dual 4 Input Power Gate	5209
548	TTL	Dual 4 Input Power Gate	5209
570	TTL	Dual 4 Input Gate	5202
571	TTL	Quad 2 Input Gate	5202
573	TTL	Triple 3 Input Gate	5204
574	TTL	Dual 4 Input Gate	5202
575	TTL	Quad 2 Input Gate	5203
577	TTL	Triple 3 Input Gate	5204
578	TTL	Dual 4 Input Nand/Nor Gate	5205
579	TTL	JK Flip-Flop	5206
580	TTL	Dual 4 Input Buffer	5210
583	TTL	Dual 4 Input Gate	5209
584	TTL	Dual 4 Input Gate	5209
587	TTL	Dual 4 Input Buffer	5210
6040	DTL	(LPDTML 9040)	5301
6041	DTL	(LPDTML 9041)	5301
6042	DTL	(LPDTML 9042)	5301
6044	DTL	(LPDTML 9044)	5301
6046	DTL	(LPDTML 9046)	5301
6047	DTL	(LPDTML 9047)	5301

LINEAR MICROCIRCUITS

709	Monolithic	Operational Amplifier	6001
710	Monolithic	Operational Amplifier	6002
711	Monolithic	Operational Amplifier	6003

Device Part No.	Type	Description	Sheet No.
741	Monolithic	Operational Amplifier	6004
747	Dual	Operational Amplifier	6005
800	Monolithic	Operational Amplifier	6101
801	Monolithic	Operational Amplifier	6101
805	Monolithic	Operational Amplifier	6102
806	Monolithic	Operational Amplifier	6102
807	Monolithic	Operational Amplifier	6102
808	Monolithic	Operational Amplifier	6102
809	Monolithic	Operational Amplifier	6103
810	Dual	Operational Amplifier	6104
811	Monolithic	Operational Amplifier	6105
813	Monolithic	Operational Amplifier	6106
819	Monolithic	Operational Amplifier	6107
831	Monolithic	Differential Amplifier	6108
841	Monolithic	Operational Amplifier	6109
901	Monolithic	Video Amplifier	6201
903	Monolithic	VHF Amplifier	6202

Device Part No.	Type	Description	Sheet No.
911	Monolithic	RF/IF Amplifier	6203
HYBRID MICROCIRCUITS			
2001	Hybrid	High Voltage/Current Driver	7001
2107	Hybrid	SPST FET Analog Switch	7101
2110	Hybrid	SPST FET Analog Switch	7101
2114	Hybrid	SPDT FET Analog Switch	7102
2126	Hybrid	SPDT FET Analog Switch	7103
2128	Hybrid	Quad SPST FET Analog Sw.	7104
2404	Hybrid	Operational Amplifier	7401
2405	Hybrid	Operational Amplifier	7401
2709	Hybrid	Operational Amplifier	*
2741	Hybrid	Operational Amplifier	7701
2802	Hybrid	Voltage Regulator	7801
2803	Hybrid	Voltage Regulator	7801
2809	Hybrid	Operational Amplifier	7802

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NPN GENERAL PURPOSE

TYPE NO.	V_{CE}^* OR V_{CEO} V	V_{CBO} V	V_{EBO} V	h_{fe}^* @ 1KHz OR h_{FE}	$V_{CE(sat)}$ V	$V_{BE(sat)}$ V	I_{EBO} nA	I_{CBO} nA	I_{CBO} 150°C μ A	C_{ob} pf	C_{ib} pf	f_T MHz	NF db	PACKAGE	
	min	min	min	min max	max	max	max	max	max	max	max	min	max	TYPE	BASE
2N718	*40	60	5	40 120	1.5	1.3		1.0K	100	35		50		TO-18	3L
2N718A	*50	75	7	40 120	1.5	1.3	10	10	10	25	80	70		TO-18	3L
2N720	*80	120	5	40 120	5.0	1.3		2.0K	200	20		50		TO-18	3L
2N760	45	45	8	*76 333	1.0	1.0		200	10	8		50		TO-18	3L
2N760A	60	60	8	*76 333	1.0	1.1		100	10	8		50		TO-18	3L
2N910	60	100	7	*80 200	0.4	0.8	25	25	15	15	85	60		TO-18	3L
2N911	60	100	7	*40 100	0.4	0.8	25	25	15	15	85	50		TO-18	3L
2N929	45		5	40 120	1.0		10			8		30	4	TO-18	3L
2N929A	45	60	6	40 120	0.5	0.9	2	2	2	6		45	4	TO-18	3L
2N930	45		5	100 300	1.0		10			8		30	4	TO-18	3L
2N930A	45	60	6	100 300	0.5	0.9	2	2	2	6		45	3	TO-18	3L
2N930B	45	60	6	100 300	0.5	0.9	2	2	2	6		45	3	TO-18	3L
2N1613	*50	75	7	40 120	1.5	1.3	10	10	10	25	80	60		TO-5	3L
2N1711	*50	75	7	100 300	1.5	1.3	5	10	10	25	80	70		TO-5	3L
2N2192	40	60	5	100	.35		50	10		20		50		TO-5	3L
2N2192A	40	60	5	100	.25		50	10		20		50		TO-5	3L
2N2192B	40	60	5	100	.18		50	10		20		50		TO-5	3L
2N2193	50	80	8	40	.35		50	10		20		50		TO-5	3L
2N2193A	50	80	8	40	.25		50	10		20		50		TO-5	3L
2N2193B	50	80	8	40	.18		50	10		20		50		TO-5	3L
2N2194	40	60	5	20	.35		50	10		20		50		TO-5	3L
2N2194A	40	60	5	20	.25		50	10		20		50		TO-5	3L
2N2194B	40	60	5	20	.18		50	10		20		50		TO-5	3L
2N2195	25	45	5	20	.35		100	100		20		50		TO-5	3L
2N2195A	25	45	5	20	.25		100	100		20		50		TO-5	3L
2N2195B	25	45	5	20	.18		100	100		20		50		TO-5	3L
2N2217	30	60	5	20	0.4		10	10		8		250		TO-5	3L
2N2218	30	60	5	40	0.4		10	10		8		250		TO-5	3L
2N2218A	40	75	6	40	0.3		10	10		8	25	250		TO-5	3L
2N2219	30	60	5	100	0.4		10	10		8		250		TO-5	3L
2N2219A	40	75	6	100	0.3		10	10		8	25	300		TO-5	3L
2N2220	30	60	5	20	0.4		10	10		8		250		TO-18	3L
2N2221	30	60	5	40	0.4		10	10		8		250		TO-18	3L
2N2221A	40	75	6	40	0.3		10	10		8	25	250		TO-18	3L
2N2222	30	60	5	100	0.4		10	10		8		250		TO-18	3L
2N2222A	40	75	6	100	0.3		10	10		8	25	300		TO-18	3L
2N2222B	40	75	6	100	0.2			10	10	8	25	300	4	TO-18	3L

NPN GENERAL PURPOSE (Cont.)

TYPE NO.	$V_{CE(sat)}$ OR V_{CE0} V	V_{CBO} V	V_{EBO} V	h_{fe} @ 1KHz OR h_{FE}	$V_{CE(sat)}$ V	$V_{BE(sat)}$ V	I_{EBO} nA	I_{CBO} nA	I_{CBO} 150°C μA	C_{ob} pf	C_{ib} pf	f_T MHz	NF db	PACKAGE		
	min	min	min	min	max	max	max	max	max	max	max	min	max	TYPE	BASE	
2N2243		120	7	40	120	0.35		50	10	15	15			TO-5	3L	
2N2243A		120	7	40	120	0.25		50	10	15	15			TO-5	3L	
2N2297	35	80	7	40	120		1.6	10	10	10	12	60		TO-5	3L	
2N2483	60	60	6	40	120	0.35		10	10	10	6	6	60	4	TO-18	3L
2N2484	60	60	6	100	500	0.35		10	10	10	6	6	60	3	TO-18	3L
2N2484A	60	60	6	100	500	0.35	0.7	10	10	10	6	6	60	2	TO-18	3L
2N2509	80	125	7	25		1.0	0.9	2	5	10	6	10	45	7	TO-18	3L
2N2510	65	100	7	75		1.0	0.9	2	5	10	6	10	45	4	TO-18	3L
2N2511	50	80	7	120		1.0	0.9	2	5	10	6	10	45	4	TO-18	3L
2N2586	45	60	6	120	360	0.5	0.9	2	2		7		45	3	TO-18	3L
2N2865	13	25	3	20	200	0.4	1.0		10	1.0	2.5		600	4.5	TO-18	4L
2N3117	60	60	6	250	500	0.35		10	10	10	4.5	6	60	1.0	TO-18	3L
2N5079	30	60	5	100	300	0.2	1.0	10	10	10	7.0	30	400	4	TO-18	3L
2N5080	30	60	5	200	500	0.2	1.0	10	10	10	7.0	30	400	4	TO-18	3L
A1109		45	5	70		0.6	0.9		100		8.0		40		TO-18	3L
A1341		75	5	50		1.2	1.2		10		10		40		TO-5	3L

PNP GENERAL PURPOSE

2N869	18	25	5	20	120	1.0	1.0		10	25	9	11	100		TO-18	3L
2N995	15	20	4	35	140	0.2	0.95	10K	5.0	25	10	11	100		TO-18	3L
2N2601	60	60	6	12.5		0.5	0.9	5	25	25	6		20		TO-46	3L
2N2602	60	60	6	25		0.5	0.9	5	25	25	6		40		TO-46	3L
2N2603	60	60	6	50		0.7	0.9	5	25	25	6		60		TO-46	3L
2N2604	-45	-60	-6	40	120	0.5	0.9	-2	10		6		30	4	TO-46	3L
2N2605	-45	-60	-6	100	300	0.5	0.9	-2	10		6		30	3	TO-46	3L
2N2904	40	60	5	20		0.4	1.3		20	20	8	30	200		TO-5	3L
2N2904A	60	60	5	40		0.4	1.3		10	10	8	30	200		TO-5	3L
2N2905	40	60	5	35		0.4	1.3		20	20	8	30	200		TO-5	3L
2N2905A	60	60	5	75		0.4	1.3		10	10	8	30	200		TO-5	3L
2N2906	40	60	5	20		0.4	1.3		20	20	8	30	200		TO-18	3L
2N2906A	60	60	5	40		0.4	1.3		10	10	8	30	200		TO-18	3L
2N2907	40	60	5	35		0.4	1.3		20	20	8	30	200		TO-18	3L
2N2907A	60	60	5	75		0.4	1.3		10	10	8	30	200		TO-18	3L

NPN MEDIUM POWER TRANSISTORS

TYPE NO.	V_{CEO}	V_{CBO}	V_{EBO}	h_{FE}	$V_{CE(sat)}$	I_{CBO}	I_{EBO}	C_{ob}	C_{ib}	h_{fe}	h_{ie}	f_t	t_r	t_s	t_f	PACKAGE	
	V	V	V	min	max	nA	nA	pf	pf	1 KHz	Ω	MHz	nsec	nsec	nsec	TYPE	BASE
2N2192	40	60	5	100	0.35	10	50	20				50	70	150	50	TO-5	3L
2N2192A	40	60	5	100	0.25	10	50	20				50	70	150	50	TO-5	3L
2N2192B	40	60	5	100	0.18	10	50	20				50	70	150	50	TO-5	3L
2N2193	50	80	8	40	0.35	10	50	20				50	70	150	50	TO-5	3L
2N2193A	50	80	8	40	0.25	10	50	20				50	70	150	50	TO-5	3L
2N2193B	50	80	8	40	0.18	10	50	20				50	70	150	50	TO-5	3L
2N2194	40	60	5	20	0.35	10	50	20				50	70	150	50	TO-5	3L
2N2194A	40	60	5	20	0.25	10	50	20				50	70	150	50	TO-5	3L
2N2194B	40	60	5	20	0.18	10	50	20				50	70	150	50	TO-5	3L
2N2195	25	45	5	20	0.35	100	100	20				50				TO-5	3L
2N2195A	25	45	5	20	0.25	100	100	20				50				TO-5	3L
2N2195B	25	45	5	20	0.18	100	100	20				50				TO-5	3L
2N2217	30	60	5	20	0.4	10	10	8			60	250				TO-5	3L
2N2218	30	60	5	40	0.4	10	10	8			60	250				TO-5	3L
2N2218A	40	75	6	30	0.3	10	10	8	25	50		250				TO-5	3L
2N2219	30	60	5	100	0.4	10	10	8			60	250				TO-5	3L
2N2219A	40	75	6	100	0.3	10	10	8	25	75		300				TO-5	3L
2N2220	30	60	5	20	0.4	10	10	8			60	250				TO-18	3L
2N2221	30	60	5	40	0.4	10	10	8			60	250				TO-18	3L
2N2221A	40	75	6	40	0.3	10	10	8	25	50		250				TO-18	3L
2N2222	30	60	5	100	0.4	10	10	8			60	250				TO-18	3L
2N2222A	40	75	6	100	0.3	10	10	8	25	75		300				TO-18	3L
2N2222B	40	75	6	100	0.2	10	10	8	25	75		300				TO-18	3L
2N2243		120	7	40	0.35	10	50	15		2.5						TO-5	3L
2N2243A		120	7	40	0.25	10	50	15		2.5		$T_b = 2.1 \text{ nsec}$				TO-5	3L
2N2297	35	80	7	40		10	10	12				60				TO-5	3L

PNP MEDIUM POWER TRANSISTORS

2N2904	40	60	5	20	0.4	20		8	30			200	40	80	30	TO-5	3L
2N2904A	60	60	5	40	0.4	10		8	30			200	40	80	30	TO-5	3L
2N2905	40	60	5	35	0.4	20		8	30			200	40	80	30	TO-5	3L
2N2905A	60	60	5	75	0.4	10		8	30			200	40	80	30	TO-5	3L
2N2906	40	60	5	20	0.4	20		8	30			200	40	80	30	TO-18	3L
2N2906A	60	60	5	40	0.4	10		8	30			200	40	80	30	TO-18	3L
2N2907	40	60	5	35	0.4	20		8	30			200	40	80	30	TO-18	3L
2N2907A	60	60	5	75	0.4	10		8	30			200	40	80	30	TO-18	3L

NPN SWITCHING TRANSISTORS

TYPE NO.	V_{CE0} V	V_{CE0} V	V_{E0} V	h_{FE} min	$V_{CE(sat)}$ V	I_{CBO} nA	C_{ob} pf	C_{in} pf	f_t MHz	t_r nsec	t_f nsec	t_i nsec	PACKAGE TYPE BASE
2N2192	40	60	5.0	100	0.35	10	20		50	70	150	50	TO-5 3L
2N2192A	40	60	5.0	100	0.25	10	20		50	70	150	50	TO-5 3L
2N2192B	40	60	5.0	100	0.18	10	20		50	70	150	50	TO-5 3L
2N2193	50	80	8.0	40	0.35	10	20		50	70	150	50	TO-5 3L
2N2193A	50	80	8.0	40	0.25	10	20		50	70	150	50	TO-5 3L
2N2193B	50	80	8.0	40	0.18	10	20		50	70	150	50	TO-5 3L
2N2194	40	60	5.0	20	0.35	10	20		50	70	150	50	TO-5 3L
2N2194A	40	60	5.0	20	0.25	10	20		50	70	150	50	TO-5 3L
2N2194B	40	60	5.0	20	0.18	10	20		50	70	150	50	TO-5 3L
2N2218A	40	75	6.0	40	0.30	10	8.0	25	250	25	225	60	TO-5 3L
2N2219A	40	75	6.0	100	0.30	10	8.0	25	300	25	225	60	TO-5 3L
2N2221A	40	75	6.0	40	0.30	10	8.0	25	250	25	225	60	TO-5 3L
2N2222A	40	75	6.0	100	0.30	10	8.0	25	300	25	225	60	TO-5 3L
2N2222B	40	75	6.0	100	0.20	10	8.0	25	300	25	225	60	TO-5 3L
2N2368	15	40	4.5	20	0.25	400	4.0		400	12 t_{on}	10	15 t_{off}	TO-18 3L
2N2369	15	40	4.5	40	0.25		4.0		500	12 t_{on}	13	18 t_{off}	TO-18 3L
2N2369A	15	40	4.5	40	0.20		4.0		500	12 t_{on}	13	18 t_{off}	TO-18 3L

PNP SWITCHING TRANSISTORS

2N2904	40	60	5.0	20	0.40	20	8.0	30	200	40	80	30	TO-5 3L
2N2904A	60	60	5.0	40	0.40	10	8.0	30	200	40	80	30	TO-5 3L
2N2905	40	60	5.0	35	0.40	20	8.0	30	200	40	80	30	TO-5 3L
2N2905A	60	60	5.0	75	0.40	10	8.0	30	200	40	80	30	TO-5 3L
2N2906	40	60	5.0	20	0.40	20	8.0	30	200	40	80	30	TO-18 3L
2N2906A	60	60	5.0	40	0.40	10	8.0	30	200	40	80	30	TO-18 3L
2N2907	40	60	5.0	35	0.40	20	8.0	30	200	40	80	30	TO-18 3L
2N2907A	60	60	5.0	75	0.40	10	8.0	30	200	40	80	30	TO-18 3L

NPN RF/IF TRANSISTORS

TYPE NO.	V_{CE0}	V_{CBO}	V_{EBO}	h_{FE}	$V_{CE(sat)}$	I_{EBO}^*	I_{CBO}	C_{ob}	C_{ib}	f_t	A_p	P_o	PACKAGE	
	V	V	V		V	nA	μA			MHz				
	min	min	min	min	max	max	max	max	max	min	db	mW	TYPE	BASE
2N915	50	70	5.0	50	1.0	10	10	3.5	10	250			TO-18	3L
2N915A	50	70	5.0	50	0.20	2.0	3.0	3.0	5.0	500			TO-18	3L
2N916	25	45	5.0	50	0.50	10	10	6.0	10	300			TO-18	3L
2N916A	25	45	5.0	50	0.50	10	10	6.0	10	300			TO-18	3L
2N916B	30	60	5.0	50	0.20	2.0	3.0	3.0	5.0	500			TO-18	3L
2N917	15	30	3.0	20	0.50	1.0	0.1	3.0	1.6	500	9	10	TO-18	4L
2N918	15	30	3.0	20	0.40	10	1.0	3.0	2.0	600	15	30	TO-18	4L
2N2368	15	40	4.5	20	0.25	400	30	4.0		400			TO-18	3L
2N2369	15	40	4.5	40	0.25	400	30	4.0		500			TO-18	3L
2N2369A	15	40	4.5	40	0.20	400	30	4.0		500			TO-18	3L
2N2481	15	40	5.0	40	0.25		30	5.0	7.0	300			TO-18	3L
2N2616	15	30	3.0	20	0.40	1.0	1.0	2.8	2.0	600	15	30	TO-18	3L
2N2708	20	35	3.0	30		10	10	1.5		700	22		TO-18	4L
2N2729	15	30	3.0	20	0.40	1.0	1.0	2.8	2.0	600	15	30	TO-46	3L
2N2865	13	25	3.0	20	0.40	10	1.0	2.5		600	16.5	40	TO-18	4L
2N3289	15	30	3.0	10	0.40	10	3.0	1.5		300	17		TO-18	4L
2N3290	15	30	3.0	10	0.40	10	3.0	1.5		300	17		TO-18	4L
2N3291	25	25	3.0	10		100*		2.0		250	16		TO-18	4L
2N3292	25	25	3.0	10		100*		2.0		250	16		TO-18	4L
2N3293	20	20	3.0	10		100*		2.0		250			TO-18	4L
2N3294	20	20	3.0	10		100*		2.0		250	14		TO-18	4L
2N5079	30	60	5.0	100	0.20	10	10	7.0	30	400			TO-18	3L
2N5080	30	60	5.0	200	0.20	10	10	7.0	30	400			TO-18	3L

PNP RF/IF TRANSISTORS

2N869	18	25	5.0	20	1.0	10	25	9.0	11	100			TO-18	3L
2N995	15	20	4.0	35	0.20	5.0	25	10	11	100			TO-18	3L
2N2905A	60	60	5.0	75	0.40	10	10	8.0	30	200			TO-5	3L
2N2907A	60	60	5.0	75	0.40	10	10	8.0	30	200			TO-18	3L

NPN TRANSISTORS DUAL ASSEMBLIES

TYPE NO.	V_{CEO}	V_{CBO}	V_{EBO}	h_{FE}		$\frac{h_{FE1}}{h_{FE2}}$		$V_{CE(sat)}$	$V_{BE(sat)}$	$V_{BE(1-2)}$	$\frac{\Delta V_{BE(1-2)}}{\Delta T}$
	V	V	V					V	V	mV	$\mu V/^{\circ}C$
	min	min	min	min	max	min	max	max	max	max	max
2N998	60	100	15	1600	8000			1.2	1.8		
2N2060	60	100	7	40	120	0.9	1.0	1.2	0.9	5	10
2N2060A	60	100	7	40	120	0.9	1.0	0.6	0.9	3	5
2N2223	60	100	7	25	150	0.8	1.0	1.2	0.9	15	25
2N2223A	60	100	7	25	150	0.9	1.0	1.2	0.9	5	25
2N2453	30	60	7	150	600	0.9	1.0	1.0	0.9	3	10
2N2453A	50	80	7	150	600	0.9	1.0	1.0	0.9	3	5
2N2480	40	75	5	20		0.8	1.0	1.3	1.0	10	15
2N2639	45	45	5	65		0.9	1.0	1.0	1.0	5	10
2N2640	45	45	5	65		0.8	1.0	1.0	1.0	10	20
2N2641	45	45	5	65				1.0	1.0		
2N2642	45	45	5	130		0.9	1.0	1.0	1.0	5	10
2N2643	45	45	5	130		0.8	1.0	1.0	1.0	10	20
2N2644	45	45	5	130				1.0	1.0		
2N2720	60	80	6	35		0.9	1.0	1.0	0.85	5	10
2N2721	60	80	6	35		0.8	1.0	1.0	0.85	10	20
2N2722	45	45	5	100		0.9	1.0	1.0	0.85	5	10
2N2903	30	60	7	125	625	0.8	1.0	1.0	0.9	10	20
2N2903A	30	60	7	125	625	0.9	1.0	1.0	0.9	5	10
2N2913	45	45	6	150				0.35			
2N2914	45	45	6	300				0.35			
2N2915	45	45	6	150		0.9	1.0	0.35		3	10
2N2916	45	45	6	300		0.9	1.0	0.35		3	10
2N2917	45	45	6	150		0.8	1.0	0.35		5	20
2N2918	45	45	6	300		0.8	1.0	0.35		5	20
2N2919	60	60	6	150		0.9	1.0	0.35		3	10
2N2920	60	60	6	300		0.9	1.0	0.35		3	10
2N2972	45	45	6	150				0.35			
2N2973	45	45	6	300				0.35			
2N2974	45	45	6	150		0.9	1.0	0.35		3	10
2N2975	45	45	6	300		0.9	1.0	0.35		3	10
2N2976	45	45	6	150		0.8	1.0	0.35		5	20
2N2977	45	45	6	300		0.8	1.0	0.35		5	20
2N2978	60	60	6	150		0.9	1.0	0.35		3	10
2N2979	60	60	6	300		0.9	1.0	0.35		3	10
2N2980	60	100	7	40	120	0.9	1.0	1.2	0.9	3	10
2N3423	15	30	3	20	200	0.8	1.0	0.4	1.0	10	40
2N3424	15	30	3	20	200	0.9	1.0	0.4	1.0	5	20
2N3680	50	60	6	150	600	0.9	1.0	0.7	0.8	3	6
SA2253		40		25		0.7	1.0			20	30
SA2664	20	60	5	800		0.75	1.0	1.5	1.7	5	10

I_{EBO} nA	I_{CBO} nA	I_{CBO} 150°C μA	C_{ob} pf	C_{ib} pf	f_T MHz	REMARKS	PACKAGE		
max	max	max	max	max	min		TYPE	BASE	TYPE NO.
10	10	15	30	50		Darlington	TO-18	4L	2N998
2	2	10	15	85	60	Differential Amplifier	TO-5	6L	2N2060
2	2	10	15	85	60	Differential Amplifier	TO-5	6L	2N2060A
10	10	15	15	85	50	Differential Amplifier	TO-5	6L	2N2223
10	10	15	15	85	50	Differential Amplifier	TO-5	6L	2N2223A
2	5	10	8	10	60	Differential Amplifier	TO-5	6L	2N2453
2	5	10	4	10	60	Differential Amplifier	TO-5	6L	2N2453A
50	50	15	20		50	Differential Amplifier	TO-5	6L	2N2480
10	10	10	8		80	Differential Amplifier	TO-5	6L	2N2639
10	10	10	8		80	Differential Amplifier	TO-5	6L	2N2640
10	10	10	8		80	Dual Transistor	TO-5	6L	2N2641
10	10	10	8		80	Differential Amplifier	TO-5	6L	2N2642
10	10	10	8		80	Differential Amplifier	TO-5	6L	2N2643
10	10	10	8		80	Dual Transistor	TO-5	6L	2N2644
10	10	10	6		80	Differential Amplifier	TO-5	6L	2N2720
10	10	10	6		80	Differential Amplifier	TO-5	6L	2N2721
1	1	1	6		100	Differential Amplifier	TO-5	6L	2N2722
10	10	15	8	10	60	Differential Amplifier	TO-5	6L	2N2903
10	10	15	8	10	60	Differential Amplifier	TO-5	6L	2N2903A
2	10	10	6		60	Dual Transistor	TO-5	6L	2N2913
2	10	10	6		60	Dual Transistor	TO-5	6L	2N2914
2	10	10	6		60	Differential Amplifier	TO-5	6L	2N2915
2	10	10	6		60	Differential Amplifier	TO-5	6L	2N2916
2	10	10	6		60	Differential Amplifier	TO-5	6L	2N2917
2	10	10	6		60	Differential Amplifier	TO-5	6L	2N2918
2	2	10	6		60	Differential Amplifier	TO-5	6L	2N2919
2	2	10	6		60	Differential Amplifier	TO-5	6L	2N2920
2	10	10	6		60	Dual Transistor	TO-18	6L	2N2972
2	10	10	6		60	Dual Transistor	TO-18	6L	2N2973
2	10	10	6		60	Differential Amplifier	TO-18	6L	2N2974
2	10	10	6		60	Differential Amplifier	TO-18	6L	2N2975
2	10	10	6		60	Differential Amplifier	TO-18	6L	2N2976
2	10	10	6		60	Differential Amplifier	TO-18	6L	2N2977
2	2	10	6		60	Differential Amplifier	TO-18	6L	2N2978
2	2	10	6		60	Differential Amplifier	TO-18	6L	2N2979
2	2	10	8	30	60	Differential Amplifier	TO-18	6L	2N2980
10	10	1	1.7	2	600	Hf, low noise mtchd pr.	TO-5	6L	2N3423
10	10	1	1.7	2	600	Hf, low noise mtchd pr.	TO-5	6L	2N3424
10	10	10	6	6	60	Matched Pr.	TO-5	6L	2N3680
	50					Differential Amplifier	TO-5	6L	SA2253
10	10		7			Monolithic Dual Darlington	TO-5	8L	SA2664

PNP TRANSISTORS DUAL ASSEMBLIES

TYPE NO.	V_{CEO}	V_{CBO}	V_{EBO}	h_{FE}		$\frac{h_{FE1}}{h_{FE2}}$	$V_{CE(sat)}$	$V_{BE(sat)}$	$V_{BE(1-2)}$	$\frac{\Delta V_{BE(1-2)}}{\Delta T}$
	V min	V min	V min			min max	V max	V max	mV max	$\mu V/^{\circ}C$ max
2N3347	45	60	6	60		0.9 1.0	0.5		5	10
2N3348	45	60	6	60		0.8 1.0	0.5		10	20
2N3349	45	60	6	60		0.6 1.0	0.5		20	40
2N3350	45	60	6	150		0.9 1.0	0.5		5	10
2N3351	45	60	6	150		0.8 1.0	0.5		10	20
2N3352	45	60	6	150		0.6 1.0	0.5		20	40
2N3800	60	60	5	100			0.2	0.7		
2N3801	60	60	5	225			0.2	0.7		
2N3802	60	60	5	100		0.8 1.0	0.2	0.7	5	20
2N3803	60	60	5	225		0.8 1.0	0.2	0.7	5	20
2N3804	60	60	5	100		0.9 1.0	0.2	0.7	3	10
2N3805	60	60	5	225		0.9 1.0	0.2	0.7	3	10
2N3806	60	60	5	100			0.2	0.7		
2N3807	60	60	5	225			0.2	0.7		
2N3808	60	60	5	100		0.8 1.0	0.2	0.7	5	20
2N3809	60	60	5	225		0.8 1.0	0.2	0.7	5	20
2N3810	60	60	5	100		0.9 1.0	0.2	0.7	3	10
2N3811	60	60	5	225		0.9 1.0	0.2	0.7	3	10
2N4015	60	60	5	135	350	0.9 1.0	0.25	1.0	5	20
2N4016	60	60	5	135	350	0.9 1.0	0.25	1.0	2.5	10
2N4017	80	80	6	100	500		0.25	0.9		
2N4018	60	60	6	100	600		0.25	0.9		
2N4019	45	45	6	250	600		0.25	0.9		

I_{EBO}	I_{CBO}	I_{CBO} 150°C	C_{ob}	C_{ib}	f_T	REMARKS	PACKAGE		
nA	nA	μA	pf	pf	MHz		TYPE	BASE	TYPE NO.
max	max	max	max	max	min				
2	10	10	6	8	60	Differential Amplifier	TO-5	6L	2N3347
2	10	10	6	8	60	Differential Amplifier	TO-5	6L	2N3348
2	10	10	6	8	60	Differential Amplifier	TO-5	6L	2N3349
2	10	10	6	8	60	Differential Amplifier	TO-5	6L	2N3350
2	10	10	6	8	60	Differential Amplifier	TO-5	6L	2N3351
2	10	10	6	8	60	Differential Amplifier	TO-5	6L	2N3352
20	10	10	4	8	100	Dual Transistor	TO-18	6L	2N3800
20	10	10	4	8	100	Dual Transistor	TO-18	6L	2N3801
20	10	10	4	8	100	Differential Amplifier	TO-18	6L	2N3802
20	10	10	4	8	100	Differential Amplifier	TO-18	6L	2N3803
20	10	10	4	8	100	Differential Amplifier	TO-18	6L	2N3804
20	10	10	4	8	100	Differential Amplifier	TO-18	6L	2N3805
20	10	10	4	8	100	Dual Transistor	TO-5	6L	2N3806
20	10	10	4	8	100	Dual Transistor	TO-5	6L	2N3807
20	10	10	4	8	100	Differential Transistor	TO-5	6L	2N3808
20	10	10	4	8	100	Differential Transistor	TO-5	6L	2N3809
20	10	10	4	8	100	Differential Transistor	TO-5	6L	2N3810
20	10	10	4	8	100	Differential Transistor	TO-5	6L	2N3811
100	10	10	8	25	200	Differential Transistor	TO-5	6L	2N4015
100	10	10	8	25	200	Differential Transistor	TO-5	6L	2N4016
10	10	10	6		40	Dual Transistor	TO-5	6L	2N4017
10	10	10	6		40	Dual Transistor	TO-5	6L	2N4018
10	10	10	6		50	Dual Transistor	TO-5	6L	2N4019

MILITARY TYPES

*JAN2N718A MIL-S-19500/181C	*JAN2N2218 MIL-S-19500/251E	JAN2N2606 MIL-S-19500/292	*JAN2N2905A MIL-S-19500/290B
JAN2N910 MIL-S-19500/274A	*JAN2N2218A MIL-S-19500/251E	JAN2N2607 MIL-S-19500/294	*JAN2N2906 MIL-S-19500/291B
JAN2N916 MIL-S-19500/271A	*JAN2N2219 MIL-S-19500/251E	JAN2N2608 MIL-S-19500/295	*JAN2N2906A MIL-S-19500/291B
*JAN2N918 MIL-S-19500/301A	*JAN2N2219A MIL-S-19500/255E	JAN2N2609 MIL-S-19500/296	JAN2N2907 MIL-S-19500/291B
*JAN2N929 MIL-S-19500/253B	*JAN2N2221 MIL-S-19500/255E	JAN2N2708 MIL-S-19500/302	*JAN2N2907A MIL-S-19500/291B
*JAN2N230 MIL-S-19500/253B	*JAN2N2221A MIL-S-19500/255E	*JAN2N2904 MIL-S-19500/290B	*JAN2N2919 MIL-S-19500/355
*JAN2N1613 MIL-S-19500/181C	*JAN2N2222 MIL-S-19500/255E	*JAN2N2904A MIL-S-19500/290B	*JAN2N2920 MIL-S-19500/355
*JAN2N2060 MIL-S-19500/270B	*JAN2N2222A MIL-S-19500/255E	*JAN2N2905 MIL-S-19500/290B	*Also Available To Jan TX specification

N-CHANNEL FIELD EFFECT TRANSISTORS GENERAL PURPOSE

TYPE NO.	BV _{DGO}	I _{GSS}	I _{GSS}	I _{DSS}		gm		V _P	C _{rss} * or	C _{DG}	C _{SG}	NF	PACKAGE	
	V	nA	@ 150°C	min	max	min	max	V	C _{DG}	pf	pf	10 Hz	TYPE	BASE
	min	max	μA					max	max		max	max		
2N3066	50	1.0	1.0	0.8	4.0	400	1000	10.0	1.5		3.0		TO-18	3L
2N3067	50	1.0	1.0	0.2	1.0	300	1000	5.0	1.5		3.0		TO-18	3L
2N3068	50	1.0	1.0	0.05	0.25	200	1000	2.5	1.5		3.0		TO-18	3L
2N3069	50	1.0	1.0	2.0	10.0	1000	2500	10.0	2.5		5.0		TO-18	3L
2N3070	50	1.0	1.0	0.5	2.5	750	2500	5.0	2.5		5.0		TO-18	3L
2N3071	50	1.0	1.0	0.1	0.6	500	2500	2.5	2.5		5.0		TO-18	3L
2N3365	40	5.0	1.0(100°C)	0.8	4.0	400	2000	12.0	2.0		3.0		TO-18	3L
2N3366	40	5.0	1.0(100°C)	0.2	1.0	250	1000	7.0	2.0		3.0		TO-18	3L
2N3367	40	5.0	1.0(100°C)	0.05	0.25	100	1000	2.5	2.0		3.0		TO-18	3L
2N3368	40	5.0	1.5(100°C)	2.0	12.0	1000	4000	12.0	3.5		6.0		TO-18	3L
2N3369	40	5.0	1.5(100°C)	0.5	2.5	600	2500	7.0	3.5		6.0		TO-18	3L
2N3370	40	5.0	1.5(100°C)	0.1	0.6	300	2500	3.5	3.5		6.0		TO-18	3L
2N3436	50	0.5	1.0	3.0	15.0	2500	10K	10.0	5.0		5.0		TO-18	3L
2N3437	50	0.5	1.0	0.8	4.0	1500	6000	5.0	5.0		5.0		TO-18	3L
2N3438	50	0.5	1.0	0.2	1.0	800	4500	2.5	5.0		5.0		TO-18	3L
2N3452	50	0.1	0.4	0.8	4.0	200	1200	10.0	1.2		1.8		TO-18	4L
2N3453	50	0.1	0.4	0.2	1.0	150	900	5.0	1.2		1.8		TO-18	4L
2N3454	50	0.1	0.4	0.05	0.25	100	600	2.5	1.2		1.8		TO-18	4L
2N3455	50	0.04	0.15	0.8	4.0	400	1200	10.0	1.0		1.5		TO-18	4L
2N3456	50	0.04	0.15	0.2	1.0	300	900	5.0	1.0		1.5		TO-18	4L
2N3457	50	0.04	0.15	0.05	0.25	150	600	2.5	1.0		1.5		TO-18	4L
2N3458	50	0.25	0.5	3.0	15.0	2500	10K	8.0	5.0		5.0		TO-18	3L
2N3459	50	0.25	0.5	0.8	4.0	1500	6000	4.0	5.0		5.0		TO-18	3L
2N3460	50	0.25	0.5	0.2	1.0	800	4500	2.0	5.0		5.0		TO-18	3L
2N3967	30	0.1	0.2	2.5	10.0	1600	2400	5.0	1.3*				TO-18	4L
2N3967A	30	0.1	0.2	2.5	10.0	1600	2400	5.0	1.3*			4.0	TO-18	4L
2N3968	30	0.1	0.2	1.0	5.0	1400	2000	3.0	1.3*				TO-18	4L
2N3968A	30	0.1	0.2	1.0	5.0	1400	2000	3.0	1.3*			4.0	TO-18	4L
2N3969	30	0.1	0.2	0.4	2.0	950	1450	1.7	1.3*				TO-18	4L
2N3969A	30	0.1	0.2	0.4	2.0	950	1450	1.7	1.3*			4.0	TO-18	4L
2N4139	50	1.0	1.0	8.0	11.0	3500	7000	8.0	5.0		5.0		TO-18	3L
2N4302	30	1.0	0.1(85°C)	0.5	5.0	1000		4.0	3.0*			2.0	RO-97B	3L
2N4303	30	1.0	0.1(85°C)	4.0	10.0	2000		6.0	3.0*			2.0	RO-97B	3L
2N4304	30	1.0	0.1(85°C)	5.0	15.0	1000		10.0	3.0*			3.0	RO-97B	3L

LOW NOISE N CHANNEL

2N5391	70	0.1	0.2	0.5	1.5	1500	4500	2.0	5.0*			2.0	TO-18	3L
2N5392	70	0.1	0.2	1.0	3.0	2000	6000	2.5	5.0*			2.0	TO-18	3L
2N5393	70	0.1	0.2	2.5	4.5	3000	6500	3.0	5.0*			2.0	TO-18	3L
2N5394	70	0.1	0.2	4.0	6.0	4000	7000	4.0	5.0*			2.0	TO-18	3L
2N5395	70	0.1	0.2	5.5	8.0	4500	7000	4.0	5.0*			2.0	TO-18	3L
2N5396	70	0.1	0.2	7.5	10.0	4500	7500	5.0	5.0*			2.0	TO-18	3L

GENERAL PURPOSE P CHANNEL

TYPE NO.	BV _{DGO}	I _{GSS}	I _{GSS}	I _{DSS}		gm		V _P	C _{iss}	PACKAGE	
	V	nA	150°C	mA		μmhos		V	pf	TYPE	BASE
	min	max	μA	min	max	min	max	max	max		
2N2499	20	10.0	10.0	5.0	15.0	2000	4000	8.0	32	TO-18	3L
2N2841	30	1.0	1.0	.025	.125	60		1.7	6	TO-18	3L
2N2842	30	3.0	3.0	.065	.325	180		1.7	10	TO-18	3L
2N2843	30	10.0	10.0	.2	1.0	540		1.7	17	TO-18	3L
2N3329	20	10.0	10.0	1.0	3.0	1000	2000	5.0	20	TO-18	4L
2N3330	20	10.0	10.0	2.0	6.0	1500	3000	6.0	20	TO-18	4L
2N3331	20	10.0	10.0	5.0	15.0	2000	4000	8.0	20	TO-18	4L
2N3376	30	3.0	3.0	0.6	6.0	800	2300	5.0	5	TO-18	4L
2N3380	30	3.0	3.0	3.0	20.0	1500	3000	9.5	5	TO-18	4L
2N3382	30	15.0	15.0	3.0	30.0	4500	12500	5.0	16	TO-18	4L
P1027	30	3.0	6.0	0.6	6.0	750	3500	3.0	20	TO-18	3L
P1028	30	3.0	6.0	2.0	20.0	2500	8000	5.0	30	TO-18	3L
P1029	30	3.0	6.0	5.0	50.0	5000		8.0	50	TO-18	3L

EPOXY ENCASED N CHANNEL

TYPE NO.	BV _{DGO}	I _{DGO} *	I _{DSS}		gm		V _P	C _{DG} *	g _{os}	R _{on}	PACKAGE	
	V	or I _{GSS}	mA		μmhos		V	or C _{rss}			TYPE	BASE
	min	nA	min	max	min	max	max	pf	μmhos	Ω		
2N4302	30	1	0.5	5	1000		4	3	50		RO-97B	3L
2N4303	30	1	4.0	10	2000		6	3	50		RO-97B	3L
2N4304	30	1	5.0	15	1000		10	3	50		RO-97B	3L
U1837E	30	0.25	4.0	25	4500		8	2			RO-97B	3L
U1897E	40	0.2*	30.0				10	5*		30	RO-97B	3L
U1898E	40	0.2*	15				7	5*		50	RO-97B	3L
U1899E	40	0.2*	8				5	5*		80	RO-97B	3L

EPOXY ENCASED P CHANNEL

P1086E	30	2	10				10	8		75	RO-97B	3L
P1087E	30	2	5				5	8		150	RO-97B	3L

HIGH FREQUENCY N CHANNEL

TYPE NO.	BV _{DGO}	I _{GSS}	I _{GSS}	I _{DSS}		yfs		V _P	C _{rss}	Power Gain		PACKAGE	
	V	nA	@ 150°	mA		μmhos		V	pf	@ f = 200 MHz		TYPE	BASE
	min	max	μA	min	max	min	max	max	max	db min			
2N3823	30	0.50	0.50	4	20	3500	6500	8	2			TO-18	4L
2N4223	30	0.25	0.25	3	18	3000	7000	8	2	10		TO-18	4L
2N4224	30	0.50	0.50	2	20	2000	7500	8	2			TO-18	4L
2N5078	30	0.25	0.25	4	25	4500	10000	8	2	15		TO-18	4L
2N4416	30	0.10	0.20	5	15	4500	7500	6	0.8	18 (100MHz)		TO-18	4L
U1837E	30	0.25	0.02	4	25	4500	10000	8	2	15		RO-97B	3L

(85°C)

LOW CAPACITANCE N CHANNEL

TYPE NO.	BV _{DGO} V	I _{GSS} nA	I _{GSS} at 150°C μA	I _{DSS} mA		g _m μmhos		V _p V	C _{DG} pf	C _{SG} pf	NF 10 Hz db	PACKAGE	
												TYPE	BASE
2N3452	50	0.1	0.4	0.8	4.0	200	1200	10.0	1.2	1.8		TO-18	4L
2N3453	50	0.1	0.4	0.2	1.0	150	900	5.0	1.2	1.8		TO-18	4L
2N3454	50	0.1	0.4	0.05	0.25	100	600	2.5	1.2	1.8		TO-18	4L
2N3455	50	0.04	0.15	0.8	4.0	400	1200	10.0	1.0	1.5		TO-18	4L
2N3456	50	0.04	0.15	0.2	1.0	300	900	5.0	1.0	1.5		TO-18	4L
2N3457	50	0.04	0.15	0.05	0.25	150	600	2.5	1.0	1.5		TO-18	4L
2N3967	30	0.1	0.2	2.5	10.0	1600	2400	5.0	1.3*			TO-18	4L
2N3967A	30	0.1	0.2	2.5	10.0	1600	2400	5.0	1.3*		4	TO-18	4L
2N3968	30	0.1	0.2	1.0	5.0	1400	2000	3.0	1.3*			TO-18	4L
2N3968A	30	0.1	0.2	1.0	5.0	1400	2000	3.0	1.3*		4	TO-18	4L
2N3969	30	0.1	0.2	0.4	2.0	950	1450	1.7	1.3*			TO-18	4L
2N3969A	30	0.1	0.2	0.4	2.0	950	1450	1.7	1.3*		4	TO-18	4L
U1277	50	0.1	0.2	1.5	8.0	450	@ 1.5 mA	8.0	1.2	1.8		TO-18	4L
U1278	50	0.1	0.2	0.5	3.0	350	@ 0.5 mA	4.5	1.2	1.8		TO-18	4L
U1279	50	0.1	0.2	0.2	1.5	250	@ 0.2 mA	2.5	1.2	1.8		TO-18	4L
U1280	50	0.1	0.2	0.1	10.0	250		10.0	1.2	1.8		TO-18	4L
U1285	30	5.0		0.1		200	1200	8.0	2.0	3.0		TO-18	4L
U1325	30	0.1	0.2	0.1	0.5	500		1.2	1.3	1.5		TO-18	4L

HIGH GAIN N CHANNEL

2N3436	50	0.5	1.0	3.0	15.0	2500	10000	10.0	5.0	5.0		TO-18	3L
2N3437	50	0.5	1.0	0.8	4.0	1500	6000	5.0	5.0	5.0		TO-18	3L
2N3438	50	0.5	1.0	0.2	1.0	800	4500	2.5	5.0	5.0		TO-18	3L
2N3458	50	0.25	0.5	3.0	15.0	2500	10000	8.0	5.0	5.0		TO-18	3L
2N3459	50	0.25	0.5	0.8	4.0	1500	6000	4.0	5.0	5.0		TO-18	3L
2N3460	50	0.25	0.5	0.2	1.0	800	4500	2.0	5.0	5.0		TO-18	3L
2N4139	50	1.0	1.0	8.0	11.0	3500	7000	8.0	5.0	5.0		TO-18	3L
U1281	50	0.5	1.0	8.0		3000		8.0	5.0	5.0		TO-18	3L
U1282	50	0.5	1.0	4.0	20.0	2500		4.5	5.0	5.0		TO-18	3L
U1283	50	0.5	1.0	1.0	10.0	1500		2.5	5.0	5.0		TO-18	3L
U1284	50	0.5	1.0	0.2	40.0	1000		10.0	5.0	5.0		TO-18	3L
U1286	30	10.0		0.2		1000	1000	8.0	8.0	8.0		TO-18	3L

LOW Ron P CHANNEL

TYPE NO.	BV _{DGO} V	BV _{SGO} V	R _{on} Ω	I _{DSS} mA		I _{DGO} nA	I _{D(off)} nA	V _p V	C _{is} pf	t _d nSec	t _r nSec	t _{off} nSec	PACKAGE	
													TYPE	BASE
2N5018	30	30	75	10.0		2.0	10.0	10	45	15	20	50	TO-18	3L
2N5019	30	30	150	5.0		2.0	10.0	5	45	15	75	100	TO-18	3L
P1086E	30	30	75	10.0		2.0	10.0	10	45	15	20	50	RO-97B	3L
P1087E	30	30	150	5.0		2.0	10.0	5	45	15	75	100	RO-97B	3L

LOW Ron N CHANNEL

TYPE NO.	BV _{DGO} V	BV _{SGO} V	R _{on} Ω	I _{DSS} mA		I _{DGO} nA		I _{D(off)} nA	V _p V	C _{is} pf	t _d nSec	t _r nSec	t _{off} nSec	PACKAGE	
	min	min	max	min	max	max	max	max	max	max	max	max	max	TYPE	BASE
2N3966	30	30	220	2.0		0.1	1.0	6	6	6	20	100	100	TO-18	4L
2N3970	40	40	30	50.0	150	0.25	0.25	10	16	16	10	15	60	TO-18	3L
2N3971	40	40	60	25.0	75	0.25	0.25	5	16	16	15	15	60	TO-18	3L
2N3972	40	40	100	5.0	30	0.25	0.25	3	16	16	40	40	100	TO-18	3L
2N4091	40	40	30	30.0		0.2	0.2	10	16	16	15	10	40	TO-18	3L
2N4092	40	40	50	15.0		0.2	0.2	7	16	16	15	20	60	TO-18	3L
2N4093	40	40	80	8.0		0.2	0.2	5	16	16	20	40	80	TO-18	3L
2N4391	40	40	30	50.0	150	0.1	0.1*	10	14	14		5	20	TO-18	3L
2N4392	40	40	60	25.0	75	0.1	0.1*	5	14	14		5	35	TO-18	3L
2N4393	40	40	100	5.0	30	0.1	0.1*	3	14	14		5	50	TO-18	3L
2N4856	40	40	25	50.0		0.25	0.25*	10	18	18	6	3	25	TO-18	3L
2N4857	40	40	40	20.0	100	0.25	0.25*	6	18	18	6	4	50	TO-18	3L
2N4858	40	40	60	8.0	80	0.25	0.25*	4	18	18	10	10	100	TO-18	3L
2N4859	30	30	25	50.0		0.25	0.25*	10	18	18	6	3	25	TO-18	3L
2N4860	30	30	40	20.0	100	0.25	0.25*	6	18	18	6	4	50	TO-18	3L
2N4861	30	30	60	8.0	80	0.25	0.25*	4	18	18	10	10	100	TO-18	3L
2N4977	30	30	15	50.0		0.5	0.5	10	35	35	5	5	20	TO-18	3L
2N4978	30	30	20	15.0		0.5	0.5	8	35	35	5	10	40	TO-18	3L
2N4979	30	30	40	7.5		0.5	0.5	5	35	35	10	30	60	TO-18	3L
U1897E	40	40	30	30.0		0.2	0.2	10	16	16	15	10	40	RO-97B	3L
U1898E	40	40	50	15.0		0.2	0.2	7	16	16	15	20	60	RO-R7B	3L
U1899E	40	40	80	8.0		0.2	0.2	5	16	16	20	40	80	RO-97B	3L

HIGH VOLTAGE N CHANNEL

TYPE NO.	BV _{DGO} V	I _{GSS} nA	I _{GSS} @ 150°C μA	I _{DSS} mA		g _m μmhos		V _p V	C _{DG} pf	C _{SG} pf	PACKAGE	
	min	max	max	min	max	min	max	max	max	max	TYPE	BASE
2N4881	300	2	4	0.4	2.0	350	1000	15	1.5	1.5	TO-5	3L
2N4882	300	2	4	1.5	7.5	600	1500	15	1.5	1.5	TO-5	3L
2N4883	200	1	2	0.4	2.0	350	1000	10	1.5	1.5	TO-5	3L
2N4884	200	1	2	1.5	7.5	600	1500	10	1.5	1.5	TO-5	3L
2N4885	125	1	2	0.4	2.0	350	1000	10	1.5	1.5	TO-5	3L
2N4886	125	1	2	1.5	7.5	600	1500	10	1.5	1.5	TO-5	3L
2N5277	150	5	5	2.5	12.5	2000	5000	7.0	5.0	5.0	TO-5	3L
2N5278	150	5	5	10.0	25.0	3000	6000	10	5.0	5.0	TO-5	3L
U1715	200	5		10.0	50.0	R _{ON} = 400Ω max		15	4.0	4.0	TO-5	3L

ULTRA LOW LEAKAGE N CHANNEL

U1714	25	.005		0.5	5.0	400		5	1.2	1.2	TO-18	3L
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SMALL SIGNAL P CHANNEL

TYPE NO.	BV_{DGO}	I_{GSS}	I_{GSS}	I_{DSS}		g_m	NF	V_p	C_{iss}	PACKAGE	
	V	na	at 150°C mA	min	max	$\mu mhos$	db	V	pf	TYPE	BASE
	max	max	max			min	max	max	max		
2N2606	-30	1.0	1.0	-0.1	- 0.5	110	3.0	4.0	6.0	TO-18	3L
2N2607	-30	3.0	3.0	-0.3	- 1.5	330	3.0	4.0	17	TO-18	3L
2N2608	-30	10	10	-0.9	- 4.5	1000	3.0	4.0	17	TO-18	3L
2N2609	-30	30	30	-2.0	-10	2500	3.0	4.0	30	TO-18	3L

See page 12 for a complete list of our military approved devices.

FIELD EFFECT TRANSISTORS DUAL ASSEMBLIES

TYPE NO.	BV_{DGO}	V_p	g_m	$\frac{g_{m1}}{g_{m2}}$		I_{DSS}		$V_{GS(1-2)}$	$\frac{\Delta V_{GS(1-2)}}{\Delta T}$	I_G	I_G	C_{iss}	REMARKS	PACKAGE	
	V	V	$\mu mhos$	min	max	min	max	mV	$\mu V/^\circ C$	nA	100°C nA	pf		TYPE	BASE
	min	max	min					max	max	max	max	max			
2N3921	50	3	1500	0.95	1	1	10	5	10	0.25	25	18	Matched Pair	TO-18	6L
2N3922	50	3	1500	0.95	1	1	10	5	25	0.25	25	18	Matched Pair	TO-18	6L
2N3934	50	3	300	0.95	1	0.25	1.3	5	10	0.1	10	7	Matched Pair	TO-18	6L
2N3935	50	3	300	0.95	1	0.25	1.3	5	25	0.1	10	7	Matched Pair	TO-18	6L
2N4082	50	3	300	0.95	1	0.25	1.3	15	10	0.1	10	7	Matched Pair	TO-18	6L
2N4083	50	3	300	0.95	1	0.25	1.3	15	25	0.1	10	7	Matched Pair	TO-18	6L
2N4084	50	3	1500	0.95	1	1	10	15	10	0.25	25	18	Matched Pair	TO-18	6L
2N4085	50	3	1500	0.95	1	1	10	15	25	0.25	25	18	Matched Pair	TO-18	6L
SU2078	50	4	300	0.9	1	0.25	2	15	35	0.25	25	7	Matched Pair	TO-18	6L
SU2079	50	4	300	0.9	1	0.25	2	15	60	0.25	25	7	Matched Pair	TO-18	6L
SU2080	50	4	1500	0.9	1	1	10	15	35	0.5	50	18	Matched Pair	TO-18	6L
SU2081	50	4	1500	0.9	1	1	10	15	60	0.5	50	18	Matched Pair	TO-18	6L
SU2098	30	4	1000	0.95	1	1	8	5	10	0.1	10	7	Matched Pair	TO-18	6L
SU2099	30	4	1000	0.95	1	1	8	5	25	0.1	10	7	Matched Pair	TO-18	6L
SU2098A	50	4	1500	0.95	1	1	8	5	10	0.05	5	6	Matched Pair	TO-18	6L
SU2098B	50	4	1500	0.95	1	1	8	5	5	0.05	5	6	Matched Pair	TO-18	6L
SU2099A	50	4	1500	0.95	1	1	8	5	25	0.05	5	6	Matched Pair	TO-18	6L
2N5045	50	4.5	1.5	0.95	1	0.5	8	5	67	0.25		8	Matched Pair	TO-18	6L
2N5046	50	4.5	1.5	0.90	1	0.5	8	10	133	0.25		8	Matched Pair	TO-18	6L
2N5047	50	4.5	1.5	0.80	1	0.5	8	15	200	0.25		8	Matched Pair	TO-18	6L

MONOLITHIC P CHANNEL DUAL ASSEMBLIES

2N5505	30	4	1000	0.95	1	0.8	7	5	10	0.2	25	16	Matched Pair	TO-18	6L
2N5506	30	4	1000	0.95	1	0.8	7	15	10	0.2	25	16	Matched Pair	TO-18	6L
2N5507	30	4	1000	0.95	1	0.8	7	5	15	0.2	25	16	Matched Pair	TO-18	6L
2N5508	30	4	1000	0.95	1	0.8	7	15	25	0.2	25	16	Matched Pair	TO-18	6L
2N5509	30	5	1000	0.90	1	0.25	5	25	50	0.2	25	16	Matched Pair	TO-18	6L
2N5510	30	4	500	0.95	1	0.25	5	5	10	0.2	25	16	Matched Pair	TO-18	6L
2N5511	30	4	500	0.95	1	0.25	5	15	10	0.2	25	16	Matched Pair	TO-18	6L
2N5512	30	4	500	0.95	1	0.25	5	5	25	0.2	25	16	Matched Pair	TO-18	6L
2N5513	30	4	500	0.95	1	0.25	5	15	25	0.2	25	16	Matched Pair	TO-18	6L
2N5514	30	5	500	0.90	1	0.25	5	25	50	0.2	25	16	Matched Pair	TO-18	6L

MILITARY GRADE OPERATIONAL AMPLIFIERS

Operating Temperature Range -55°C to $+125^{\circ}\text{C}$

TYPE NO.	Power Supply $\pm V_{CC}$	A_{VOL} kV/V		V_{OS} mV		V_{OS} $-T_A$ to $+T_A$ mV		V_{OS} Drift $\mu\text{V}/^{\circ}\text{C}$		I_{BIAS} nA		I_{BIAS} (Note 2) nA		I_{OFF} nA		I_{OFF} (Note 2) nA		I_{OFF} Drift nA/ $^{\circ}\text{C}$	
709A	± 15	25	45	0.5	1.0	1.0	2.0	3.0	10	100	200	250	750	10	50	50	250	1.0	3
709B	± 15	25	45	1.0	5.0	2.0	6.0	3.0		200	500	500	1500	50	200	100	500	1.0	
741B	± 15	50	200	1.0	5.0	2.0	6.0	3.0		200	500	500	1.5	30	200	75	500	1.0	
747B	± 15	50	200	1.0	5.0	2.0	6.0	3.0		200	500	500	1.5	30	200	75	500	1.0	
748B	± 15	50	200	1.0	5.0	2.0	6.0	3.0		200	500	500	1.5	30	200	75	500	1.0	
805B	± 15	30	60	1.0	5.0	2.0	7.0	5.0	20	250	500	750	1500	10	50	25	250	0.1	1
807B	± 15	30	60	0.1	2.5	1.0	3.0	3.0	10	250	500	750	1500	10	50	25	250	0.1	0
808A	± 15	25	40	1.0	5.0	2.0		5.0	10	25	50	75	250	3	15	10		0.03	0
808B	± 15	25	40	1.0	10	2.0		10.0	30	50	50	100	250	5	30	10		0.1	0
809B	± 15	10	40	5.0	10	7.0		10.0	50	300	500	600	1500	50	100	50	250	1.0	3
819B	± 6	5	10	5.0	10	7.0		70.0	100	300	500	1000		50	100	50		1.0	3
810B(Dual)	± 15	10	40	1.0	5.0	3.0		5.0		200	500	500	1.5	30	200			1.0	
811B	± 15	10	40	1.0	5.0	3.0		5.0		200	500	600	1.5	30	200			1.0	
841B*	± 15	50	200	1.0	5.0	2.0	6.0	3.0		200	500	500	1.5	30	200	75	500	1.0	
2404B**	± 15	31	100	3.0	10	5.0		5.0	25	.04	0.1	30	100	.015	0.05	15	50	.27	0
2405B**	± 30	31	100	3.0	10	5.0		5.0	25	.04	0.1	30	100	.015	0.05	15	50	.27	0
2709B**	± 15	17	45	3.0	10	6.0		15	33	.04	0.1	30	100	.015	0.05	15	50	.27	
2809B**	± 15	10	30	5.0	10	9.0		25	50	.04	0.1	30	100	.015	0.05	15	50	.27	
2741B**	± 15	31	50	3.0	5.0	2.0	5.0	11	27	.04	0.1	30	100	.015	0.05	15	50	.27	

INDUSTRIAL GRADE OPERATIONAL AMPLIFIERS

Operating Temperature Range 0°C to 100°C

709C	± 15	15	45	2.0	7.5	2.0	10			300	1500	500	2000	100	500	200	750	1.0	
741C	± 15	20	100	2.0	6.0		7.5	3.0		200	500	300	800	30	200	100	500	1.0	
747C	± 15	20	100	2.0	6.0		7.5	3.0		200	500	300	800	30	200	100	500	1.0	
748C	± 15	20	100	2.0	6.0		7.5	3.0		200	500	300	800	30	200	100	500	1.0	
805C	± 15	10	60	3.0	10	5.0		5	30	250	1000	750		30	100	50		0.1	
808C	± 15	15	40	2.0	10	5.0		4	14	25	75	50	150	5	40	10	100	0.1	
809C	± 15	10	40	5.0	10	8.0		10	50	500	1000	1000		50		100		1.0	
841C*	± 15	20	100	2.0	6.0		7.5	3.0		200	500	300	800	30	200	100	500	1.0	
810C(Dual)	± 15	20	100	2.0	6.0	3.0		5.0		500	1000	1000		50	350	100		1.0	
811C	± 15	10	40	1.0	10	3.0		5.0		500	1000	1000		50	350	100		1.0	
2741C**	± 15	20	31	5.0	10	2.0	5.0	20	50	0.05	0.2	25		50	25	100	15	25	

Note 1: 5 sec. maximum duration.

Note 2: At operating temperature extreme.

*High slew rate 741.

**Hybrid Circuit.

***Uncompensated 741.

Selection Guide

Z _{IN}		Z _{IN} (Note 2)		CMR Volts		CMRR DB		PSRR DB		Z _{OUT} Ω		V _{OUT} (Load) V _{pp}		P _{DISS} No Load mW		Short Circuit	Protected	PKG
typ	min	typ	min	typ	min	typ	min	typ	min	typ	max	typ	min	typ	max			
0	350	100	40	±10	± 8	90	80	92	80	150		26 (2 K)	20	80	108	Note 1		E, H, N
0	150	100	40	±10	± 8	90	70	92	70	150		26 (2 K)	20	80	165	Note 1		E, H, N
0	300	150		±13	±12	90	70	90	70	150		26 (2 K)	20	50	85	Yes		E, H, N
0	300	150		±13	±12	90	70	90	70	150		26 (2 K)	20	60	100	Yes		E, H, N
0	300	150		±13	±12	90	70	90	70	150		26 (2 K)	20	60	100	Yes		E, H, N
0	500	500	200	± 9	± 8	90	70	80	70	150	300	24 (1 K)	20	180	225	Yes		E, H
0	500	750	300	± 9	± 8	90	80	80	70	150	300	24 (1 K)	20	180	225	Yes		E, H
0	1000	1000		± 9	± 8	90	70	80	70	150	300	24 (1 K)	20	180	225	Yes		E, H
0	1000	750		± 9	± 8	90	70	80	70	150	300	24 (1 K)	20	180	225	Yes		E, H
0	100	50		±13	±10	90	70	90	70	2500		24 (5 K)	20	100	150	Yes		E, H, N
0	50	20		± 5	± 4	90	70	90	60	1500		10 (5 K)	8	15	25	Yes		E, H, N
50	100	100		±13	±12	90	70	90	70	1500		24 (5 K)	20	160		Yes		H, N
0	100	100		±13	±12	90	70	90	70	1500		24 (5 K)	20	80		Yes		E, H, N
0	300	150		±13	±12	90	70	90	70	150		26 (2 K)	20	60	100	Yes		N
0 ^s	10 ⁷	10 ⁶		±10	± 8	90	74	90	74	600		22 (10 K)	20	40	55	Yes		G
0 ^s	10 ⁷	10 ⁵		±25	±16	90	74	90	74	600		50 (10 K)	40	80	110	Yes		G
0 ^s	10 ⁷	10 ⁶		±10	± 8	80	60	80	60	150		26 (2 K)	20	90	180	Note 1		G
0 ^s	10 ⁷	10 ⁶		±13	±10	80	60	80	60	2000		24 (5 K)	20	100	180	Yes		G
0 ^s	10 ⁷	10 ⁶		±13	±10	70	60	80	60	150		26 (2 K)	20	50	90	Yes		F, K
0	50	100	35	±10	± 8	90	65	92	74	150		26 (2 K)	20	80	200	Note 1		E, H, N
0	300	150		±13	±12	90	70	90	70	150		26 (2 K)	20	50		Yes		E, H, J
0	300	150		±13	±12	90	70	90	70	150		26 (2 K)	20	60	100	Yes		E, H, J, N
0	300	150		±13	±12	90	70	90	70	150		26 (2 K)	20	60	100	Yes		E, H, J, N
0	100	500		± 9	± 8	90	70	80		150	300	24 (1 K)	20	180	225	Yes		E, H
0	2000	750		± 9	± 8	90	70	80	70	150	300	24 (1 K)	20	180	225	Yes		E, H
0	50	100		±13	±10	90	70	90	70	2000		24 (5 K)	20	80		Yes		E, J
0	300	150		±13	±12	90	70	90	70	150		26 (2 K)	20	60	100	Yes		J, N
0	50	100		±13	±12	90	70	90	70	1500		24 (5 K)	20	160		Yes		H, J
0	50	100		±13	±12	90	70	90	70	1500		24 (5 K)	20	80		Yes		E, H, J
0 ⁷	10 ⁶	10 ⁵		±13	±10	70	60	80	60	150		26 (2 K)	20	60	100	Yes		F, K

OTHER LINEAR CIRCUITS

DIFFERENTIAL AMPLIFIERS

Part No.	Description	Voltage Gain	Input Offset mV	CMRR db	Z_{in} k Ω	Drift $\mu V/^{\circ}C$	BW -3 db kHz	Dissipation mW	Power Supply
739	Dual Preamplifier	20,000	1	80	150	10	20	180	± 15 V
749	Dual Preamplifier	20,000	1	80	150	10	20	180	± 15 V
831	Two Stage Differential Amplifier	2000	2.5	-100	40	2.0	400	100	± 12 V
813	High Speed Version of 749								

Available in A, B and C Grades, E and H packages.

HIGH FREQUENCY AMPLIFIERS

Part No.	Circuit Description	Voltage Gain db	Band-Width MHz	Power Gain db at 200 MHz	Dissipation mW	Power Supply Voltage
901	Video Amplifier	24	60		144	+12
903	VHF Amplifier	15	110		96	+12 - 6
911	IF Amplifier	20	250	25	170	+24

The 901 and 903 are available in B and C Grade and E Package.

The 911 is available in B and C Grade, E and J Package.

DEFINITION OF TERMS

V_{OS}	=	Input Offset Voltage—That voltage which must be applied between the input terminals to obtain zero output voltage. The input offset voltage may also be defined for the case where two equal resistances are inserted in series with the input leads.	$PSRR$	=	Power Supply Rejection Ratio—The ratio of the change in input offset voltage to the change in supply voltage producing it.
I_{OS}	=	Input Offset Current—The difference in the currents into the two input terminals with the output at zero volts.	A_{Vol}	=	Large-Signal Voltage Gain—The ratio of the maximum output voltage swing with load to the change in input voltage required to drive the output from zero to this voltage.
Z_{in}	=	Input Resistance—The resistance looking into either input terminal with the other grounded.	V_{out}	=	Output Voltage Swing—The peak output swing, referred to zero, that can be obtained without clipping.
I_{BIAS}	=	Input Bias Current—The average of the two input currents.	Z_{out}	=	Output Resistance—The resistance seen looking into the output terminal with the output at null. This parameter is defined only under small signal conditions at frequencies above a few hundred cycles to eliminate the influence of drift and thermal feedback.
CMR	=	Common Mode Range—The range of voltage which, if exceeded on either input terminal, could cause the amplifier to cease functioning properly.	D_{iss}	=	Power Consumption—The DC power required to operate the amplifier with the output at zero and with no load current.
CMRR	=	Common Mode Rejection Ratio—The ratio of the input voltage range to the maximum change in input offset voltage over this range.			

HIGH NOISE IMMUNITY LOGIC (HNIL)

SERIES 300

PART NO.	CIRCUIT DESCRIPTION	Noise Immunity	FanOut	t_{pd} nsec	V_{CC} Volts	P_{Diss} mW
		Volts				
301	Dual 5 Input Buffer with Expanders—Active Pull-Up	5.0	36	80	12	300
302	Quad 2 Input Buffer with Open Collector "OR" able Output	5.0	36	80	12	300
303	Quad 2 Input "OR" able Buffer-Resistor Pull-Up	5.0	36	80	12	300
311	Master Slave Flip-Flop	5.0	5	120	12	180
312	Dual J-K Flip-Flop	5.0	5	120	12	280
321	Quad 2 Input Gate with Expanders	5.0	5	80	12	96
322	Dual 5 Input Gate with Expanders	5.0	5	80	12	48
323	Quad 2 Input "OR" able Gate with Expanders	5.0	5	100	12	80
324	Quad 2 Input Gate with Expanders—Resistor Pull-Up	5.0	5	80	12	96
325	Dual 2 - Dual 3 Input Gate—Resistor Pull-Up	5.0	5	80	12	96
326	Dual 2 - Dual 3 Input Gate—Resistor Pull-Up	5.0	5	80	12	96
331	Dual 5 Input Expander with Node Resistors	5.0		40	12	
341	Dual Exclusive-OR with Expanders	5.0	5	75	12	72
342	Dual One-Shot with Expandable Trigger	5.0	5	100	12	100
370	Quad "D" Flip-Flop	5.0	5	100	12	190
371	Decade Counter	5.0	5	150	12	280
372	4 Bit Binary	5.0	5	150	12	280
380	BCD to Decade Counter	5.0	5	200	12	200

Available in B and C grade in 16 lead dual-in ceramic package and in C grade dual-in line plastic package.

Available in 15 Volt logic.

Available in B and C Grade in G, H and N Packages.

INTERFACE CIRCUITS

PART NO.	CIRCUIT DESCRIPTION	Noise Immunity	Input Range	Output Drive	Output Sink	t_{pd} nsec	P_{Diss} mW
		Volts	Volts	mA	mA		
361	Dual Input Interface Circuit with inverting and non-inverting inputs	5 ⁽¹⁾	15	5	10	50	60
362	Dual Output Interface Circuit—Current sink and current drive inputs and inverting non-inverting options	5 ⁽¹⁾	15	3	10	40	75

The 361 buffer and 362 receiver are compatible with all low level logic forms. They perform the level shifting function necessary for operation with 300 series logic or high level I/O equipment.

⁽¹⁾Noise immunity with a 362 driving a 361.

Available in B and C Grade in G and H Package.

Available in C Grade in J Package.

TTL 500 SERIES

Operating Temperature -55°C to +125°C

Operating Voltage 4.0 to 5.5 Volts

PRODUCT DESCRIPTION	P/N	Low Power			Medium Power				High Power			
		t _{pd} nsec	FAN OUT	PD mW/gate	t _{pd} nsec	FAN OUT	PD mW/gate		t _{pd} nsec	FAN OUT	PD mW/gate	
Dual 4 Input Gate [▲]	500	180	6	0.5	530	75	6	1.5	570	25	7	4.1
Quad 2 Input Gate [▲]	501	180	6	0.5	531	75	6	1.5	571	25	7	4.1
Triple 3 Input Gate [▲]	503	180	6	0.5	533	75	6	1.5	573	25	7	4.1
Dual 4 Input Gate [■]	504	140	6	0.7	534	60	6	2.0	574	25	7	5.0
Quad 2 Input Gate [■]	505	140	6	0.7	535	60	6	2.0	575	25	7	5.0
Triple 3 Input Gate [■]	507	140	6	0.7	537	60	6	2.0	577	25	7	5.0
Dual 4 NAND/NOR Gate [†]	508	200	6	1.4	538	100	6	3.8	578	35	7	8.9
JK Flip Flop	509	550	8	4.0	539	140	8	12.0	579	65	13	24.0
Dual 4 Input Buffer ^{*▲}					540	70	17	6.0				
Dual 4 Input Buffer ^{*■}					541	70	17	4.5				
Dual 4 Input Gate ^{*▲}					543	85	6	1.5	583	30	7	4.1
Dual 4 Input Power Gate ^{*■}					544	75	6	2.0	584	30	7	5.0
Dual 4 Input Pwr Gate & Lamp Dr. [▲]					547	60	45	7.5				
Dual 4 Input Pwr Gate & Lamp Dr. [■]					548	60	45	6.2				
Dual 4 Input Buffer [*]									580	45	33	17.0
Dual 4 Input Gate [*]									587	55	36	13.0

Ultra Low Power Logic

Operating Temperature -55°C to +125°C Voltage 4.5 to 5.5 Volts

When power consumption is the prime consideration the following

Ultra Low Power TTL should be utilized.

Quad 2 Input Gate	525BH	2.0 μsec	8	250 μW
Dual 4 Input Gate [*]	526BH	1.5 μsec	8	250 μW
Dual 3 Input Gate [*]	527BH	1.5 μsec	8	250 μW
Dual 3 Input Gate	528BH	1.5 μsec	8	250 μW
JK Flip Flop	529BH	2.5 μsec	8	1.0 mW

▲No Pull Up Resistor

■With Pull Up Resistor

†With Inverter

*With Expander

Low Power Logic

Operating Temperature -55°C to +125°C Voltage 4.5 to 5.5 Volts

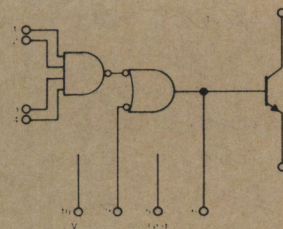
JK Flip Flop	6040BH (9040)	135 nsec	10	3.5 mW
Dual 3 Input Gate	6041BH (9041)	65 nsec	10	1.4 mW
Dual 3 Input Buffer				
with Expanders	6042BH (9042)	65 nsec	10	1.4 mW
Dual 4 Input Gate	6044BH (9044)	65 nsec	10	1.4 mW
Quad 2 Input Gate	6046BH (9046)	65 nsec	10	1.4 mW
Triple 3 Input Gate	6047BH (9047)	65 nsec	10	1.4 mW

HIGH VOLTAGE/CURRENT DRIVER

This circuit has been designed for use in latching relay, lamp, core, and line driver applications.

2001BE

$V_{OL} < 350 \text{ mV}$
 $I_L > 250 \text{ mA}$
 $LV_{CEO} > 40 \text{ V}$
 $V_{CC} = +5 \text{ V}$
 $-55^\circ\text{C to } +125^\circ\text{C}$
 TO-5 (10 Leads)



FET ANALOG SWITCHES

These circuits have been designed for use in multiplexing, sample and hold, and chopper applications.

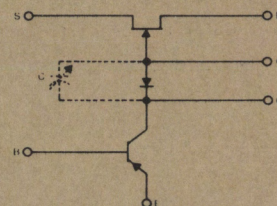
2107BE

$R_{ON} < 50\Omega$ (2110)

2110BE

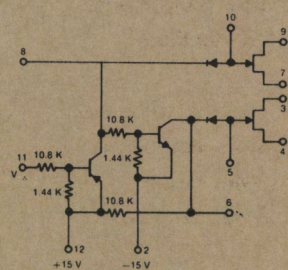
$R_{ON} < 100\Omega$ (2107)

$I_{D(off)} < 1.0 \text{ nA}$
 $LV_{CEO} > 40 \text{ V}$
 $-55^\circ\text{C to } +125^\circ\text{C}$
 TO-5 (6 Leads)



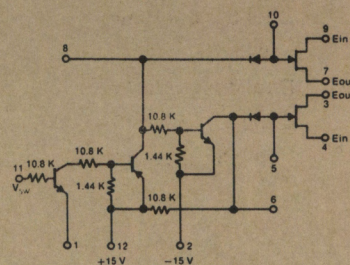
2114BF

$R_{ON} < 100\Omega$
 $I_{D(off)} < 1.0 \text{ nA}$
 t_{on} and $t_{off} < 0.9 \mu\text{Sec}$
 $E_{out} = \pm 9 \text{ V}$
 $-55^\circ\text{C to } +125^\circ\text{C}$
 TO-8 (12 Leads)



2126BG

$R_{ON} < 65\Omega$
 $I_{D(off)} < 1.0 \text{ nA}$
 t_{ON} and $t_{OFF} < 1.5 \mu\text{Sec}$
 $E_{out} = \pm 8 \text{ V}$
 $-55^\circ\text{C to } +125^\circ\text{C}$
 TO-8 (12 Leads)



FET ANALOG SWITCHES (cont.)

2128BG

$$R_{ON} < 50\Omega$$

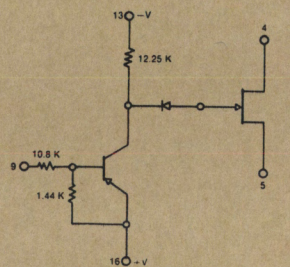
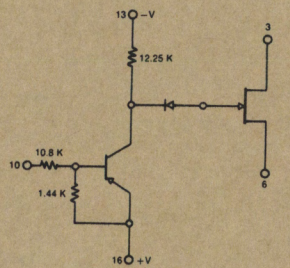
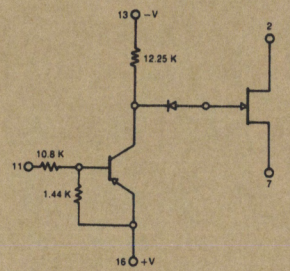
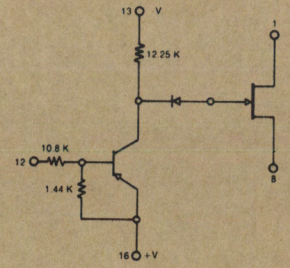
$$I_{D(off)} < 1.0 \text{ nA}$$

$$t_{ON} \text{ and } t_{OFF} < 1.0 \mu\text{Sec}$$

$$E_{out} = \pm 5 \text{ V}$$

$$-55^\circ\text{C to } +125^\circ\text{C}$$

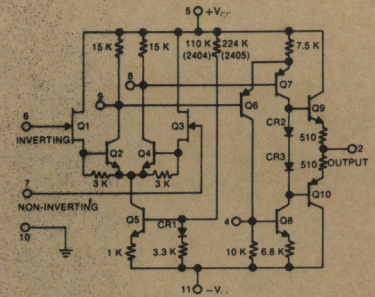
TO-8 (16 Leads)



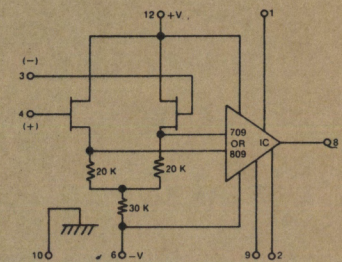
FET INPUT OPERATIONAL AMPLIFIERS

These circuits have been designed for use in active filter and high input impedance, low power, and high voltage applications.

2404BG Power < 55 mW (2404)
 2405BG Power < 110 mW (2405)
 $V_{CC} = \pm 15 \text{ V}$ (2404)
 $V_{CC} = \pm 30 \text{ V}$ (2405)
 $E_{out} > \pm 10 \text{ V}$ (2404)
 $E_{out} > \pm 20 \text{ V}$ (2405)
 $I_{OFF} < 100 \text{ pA}$
 $Z_{IN} > 10^{10} \Omega$
 -55°C to $+125^\circ\text{C}$
 TO-8 (12 Leads)



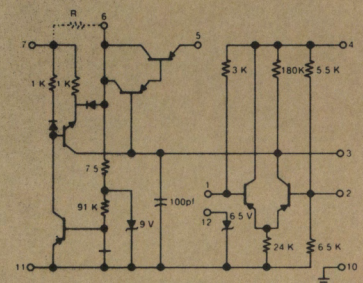
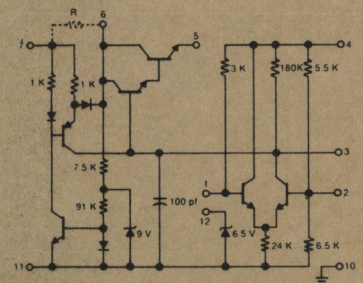
2709BG $V_{CC} = \pm 15 \text{ V}$
 2809BG $Z_{IN} > 10 \text{ KM}\Omega$
 $I_{OFF} < 100 \text{ pA}$
 $E_{out} > \pm 10 \text{ V}$
 $\text{CMR} > \pm 8 \text{ V}$
 -55°C to $+125^\circ\text{C}$
 TO-8 (12 Leads)

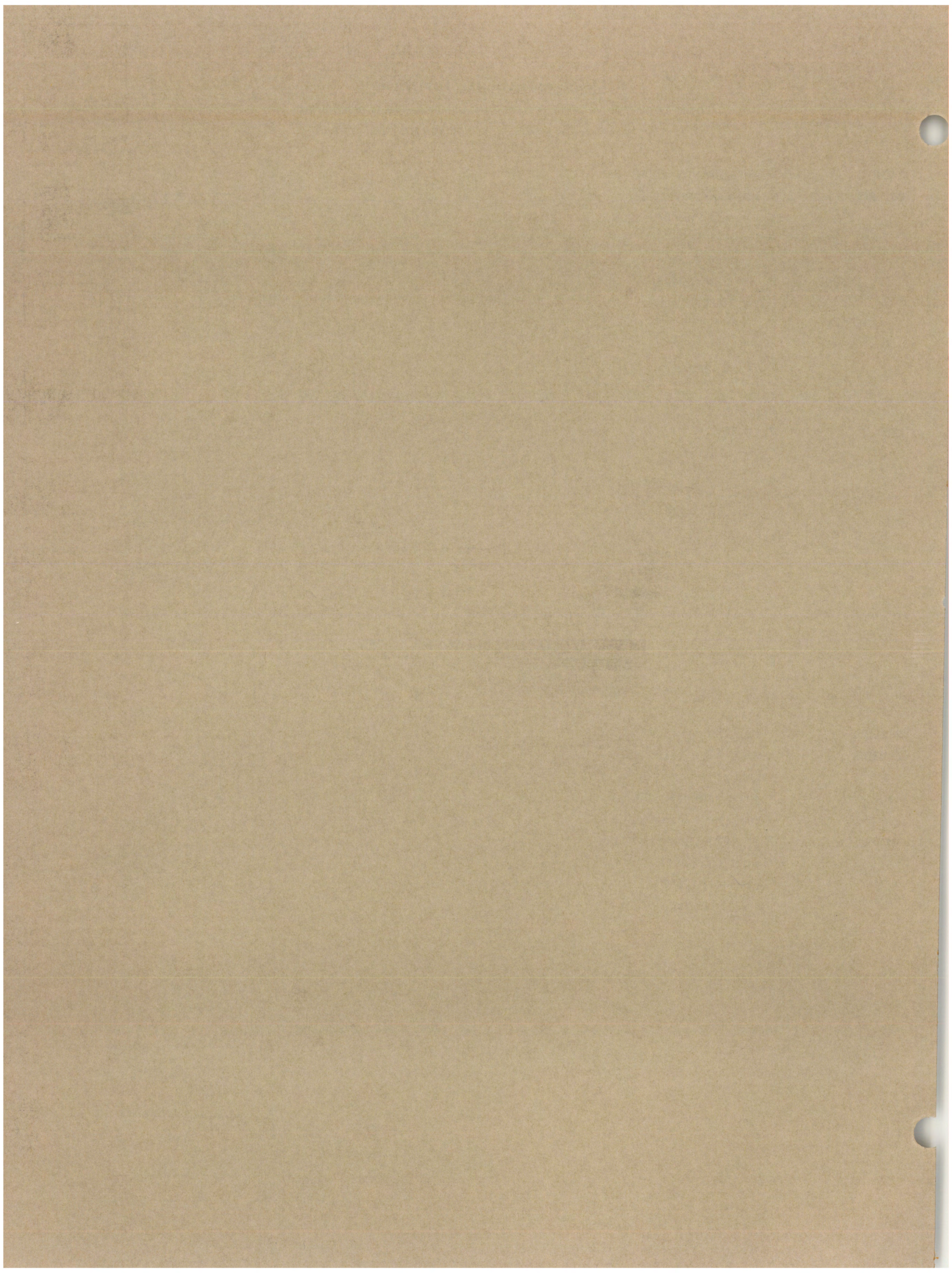


VOLTAGE REGULATORS

These circuits have been designed for use in power supply systems where a high degree of load and line regulation is required.

2802BG Output Range = 5 V to 40 V
 2803BG Load Current > 100 mA
 Load Regulation < 0.1%
 Line Regulation < 0.01% / V
 Temperature Stability < 0.5%
 Ripple Rejection > -60 db
 Output Impedance < 1.0 Ω
 -55°C to $+125^\circ\text{C}$
 TO-8 (12 Leads)







NPN TRANSISTOR GENERAL PURPOSE

- HIGH CURRENT GAIN
- HIGH BREAKDOWN VOLTAGE
- LOW SATURATION VOLTAGE

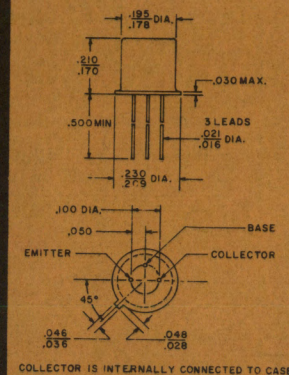
JANUARY 1968

2N760

2N760A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage 2N760 2N760A	V_{CBO}	45 60	Volts
Collector-Emitter Voltage 2N760 2N760A	V_{CEO}	45 60	Volts
Emitter-Base Voltage	V_{EBO}	8.0	Volts
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	0.5 1.5 0.86	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.5 8.5	mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage 2N760 2N760A	BV_{CBO}	$I_C = 50 \mu\text{A}, I_E = 0$	45 60		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0, I_E = 100 \mu\text{A}$	8.0		Volts
Collector-Emitter Sustaining Voltage 2N760 2N760A	$V_{CEO(sus)}^*$	$I_C = 1.0 \text{ mA}, I_B = 0$	45 60		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$		1.0	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$	0.6	1.1	Volts
Collector-Base Cutoff Current 2N760 2N760A 2N760, 760A	I_{CBO}	$I_E = 0, V_{CB} = 30 \text{ V}$ $I_E = 0, V_{CB} = 30 \text{ V}, T_A = 150^\circ\text{C}$		200 100 10	nA μA
Small Signal Current Gain	h_{fe}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 1.0 \text{ kHz}$	76	333	
Output Capacitance	C_{ob}	$I_E = 0, V_{CB} = 5.0 \text{ V}$ $f = 140 \text{ kHz}$		8.0	pf
Voltage Feedback Ratio	h_{rb}	$I_C = 1.0 \text{ mA}, V_{CB} = 5.0 \text{ V}$ $f = 1.0 \text{ kHz}$		10	$\times 10^{-4}$
Alpha Cutoff Frequency	f_{α_b}	$I_E = 1.0 \text{ mA}, V_{CB} = 5.0 \text{ V}$	50		MHz

* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle = 1%.



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NPN TRANSISTOR GENERAL PURPOSE

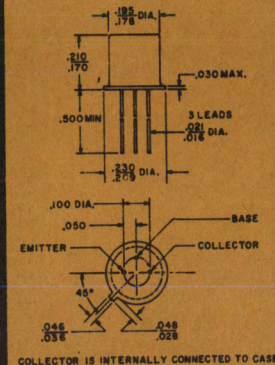
- HIGH CURRENT GAIN
- HIGH BREAKDOWN VOLTAGE
- LOW NOISE

JANUARY 1968

2N929, A
2N930, A, B

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage 2N929, 2N930 2N929A, 2N930A, B	V_{CBO}	45 60	Volts
Collector-Emitter Voltage	V_{CEO}	45	Volts
Emitter-Base Voltage 2N929, 2N930 2N929A, 2N930A, B	V_{EBO}	5.0 6.0	Volts
Collector Current	I_C	30	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	0.3 0.6	Watt
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.0 4.0	mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Emitter Breakdown Voltage	BV_{CEO}^*	$I_C = 10\text{ mA}, I_B = 0$	45		Volts
Collector-Base Breakdown Voltage 2N929A, 2N930A, B	BV_{CBO}	$I_C = 10\text{ }\mu\text{A}, I_E = 0$	60		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}^*$	$I_C = 10\text{ mA}, I_B = 0$	45		Volts
Emitter-Base Breakdown Voltage 2N929, 2N930 2N929A, 2N930A, B	BV_{EBO}	$I_E = 10\text{ }\mu\text{A}, I_C = 0$	5.0 6.0		Volts
Base-Emitter Voltage 2N929, 2N930 2N929A, 2N930A, B	V_{BE}^*	$I_C = 10\text{ mA}, I_B = 0.5\text{ mA}$	0.6 0.7	1.0 0.9	Volts
Collector Saturation Voltage 2N929, 2N930 2N929A, 2N930A, B	$V_{CE(sat)}$	$I_C = 10\text{ mA}, I_B = 0.5\text{ mA}$		1.0 0.5	Volts
Collector-Base Cutoff Current 2N929, 2N930 2N929A, 2N930A, B	I_{CBO}	$V_{CB} = 45\text{ V}, I_E = 0$		10 2.0	nA
Collector-Emitter Cutoff Current 2N929, 2N930 2N929A, 2N930A, B 2N929, 2N930 2N929A, 2N930A, B	I_{CES}	$V_{CE} = 45\text{ V}, V_{EB} = 0$ $V_{CE} = 45\text{ V}, V_{EB} = 0, T_A = 170^\circ\text{C}$		10 2.0 10 2.0	nA μA
Emitter-Base Cutoff Current 2N929, 2N930 2N929A, 2N930A, B	I_{EBO}	$V_{EB} = 5\text{ V}, I_C = 0$		10 2.0	nA
DC Pulse Current Gain 2N929A 2N930A, B 2N929, A 2N930, A, B 2N929 2N929A 2N930 2N930A, B 2N929, A 2N930, A, B 2N929, A 2N930, A, B	h_{FE}^*	$V_{CE} = 5\text{ V}, I_C = 1\text{ }\mu\text{A}$ $V_{CE} = 5\text{ V}, I_C = 10\text{ }\mu\text{A}$ $V_{CE} = 5\text{ V}, I_C = 10\text{ }\mu\text{A}$ $T_A = -55^\circ\text{C}$ $V_{CE} = 5\text{ V}, I_C = 500\text{ }\mu\text{A}$ $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	25 60 40 100 10 15 20 30 60 150	120 300	



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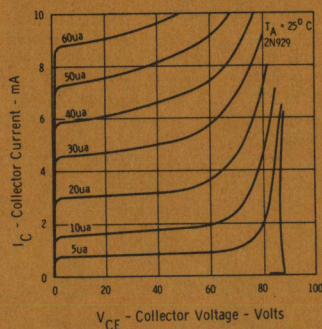
Phone (415) 968-9241

TWX: (910) 379-6494

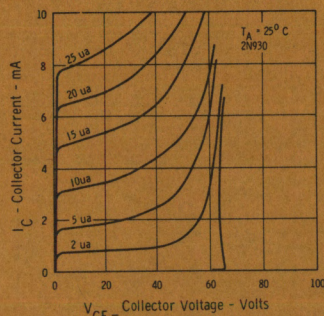
CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
High-Frequency Current Gain 2N929, 2N930 2N929A, 2N930A, B	$ h_{fe} $	$V_{CE} = 5.0 \text{ V}$, $I_C = 500 \mu\text{A}$ $f = 30 \text{ MHz}$	1.0 1.5		
Small-Signal Current Gain 2N929, A 2N930, A, B	h_{fe}	$V_{CE} = 5.0 \text{ V}$, $I_C = 1.0 \text{ mA}$ $f = 1.0 \text{ kHz}$	60 150	350 600	
Output Capacitance	C_{ob}	$V_{CB} = 5.0 \text{ V}$, $I_E = 0$, $f = 1.0 \text{ MHz}$		8.0	pf
Voltage Feedback Ratio	h_{rb}	$V_{CB} = 5.0 \text{ V}$, $I_E = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$		600	$\times 10^{-6}$
Input Resistance	h_{ib}	$V_{CB} = 5.0 \text{ V}$, $I_E = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$	25	32	Ohms
Output Conductance	h_{ob}	$V_{CB} = 5.0 \text{ V}$, $I_E = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$		1.0	μmhos
Noise Figure 2N929, A 2N930, A, B 2N930B 2N930B 2N930B	NF	$V_{CE} = 5.0 \text{ V}$, $I_C = 10 \mu\text{A}$, $R_g = 10 \text{ k}\Omega$ $BW = 10 \text{ Hz to } 15.7 \text{ kHz}$ $V_{CE} = 5.0 \text{ V}$, $I_C = 10 \mu\text{A}$, $R_g = 10 \text{ k}\Omega$ $f = 1.0 \text{ kHz}$, $BW = 200 \text{ Hz}$ $V_{CE} = 5.0 \text{ V}$, $I_C = 10 \mu\text{A}$, $R_g = 10 \text{ k}\Omega$ $f = 100 \text{ Hz}$, $BW = 20 \text{ Hz}$ $V_{CE} = 5.0 \text{ V}$, $I_C = 10 \mu\text{A}$, $R_g = 10 \text{ k}\Omega$ $f = 10 \text{ Hz}$, $BW = 5.0 \text{ Hz}$		4.0 3.0 3.0 5.0 6.0	db

* Pulse Test: Pulse Width $\leq 300 \mu\text{sec}$; Duty Cycle $\leq 2\%$.

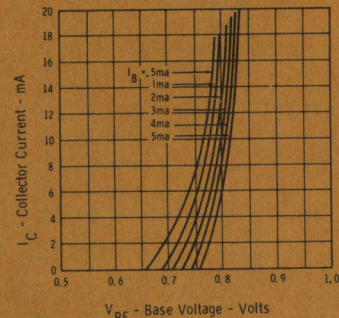
2N929 Collector Characteristics



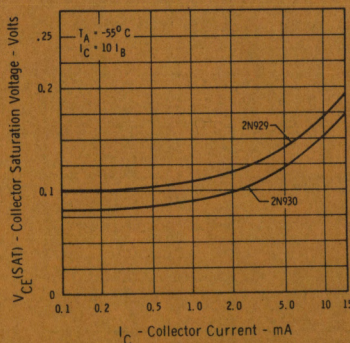
2N930 Collector Characteristics



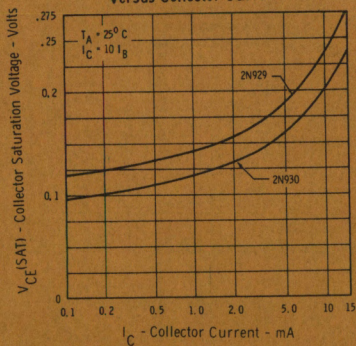
Typical Base Characteristics



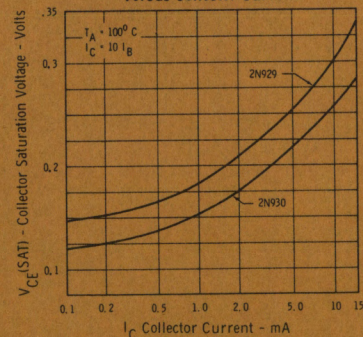
Collector Saturation Voltage Versus Collector Current



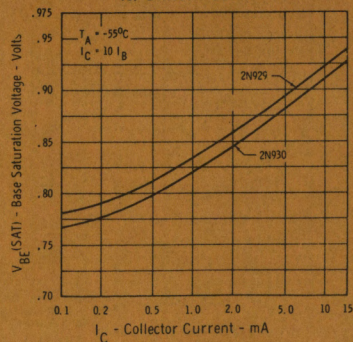
Collector Saturation Voltage Versus Collector Current



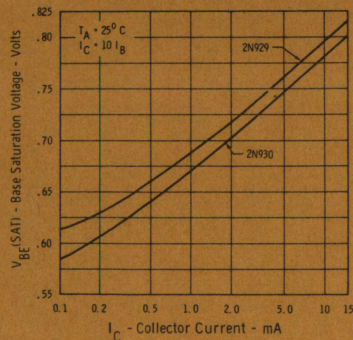
Collector Saturation Voltage Versus Collector Current



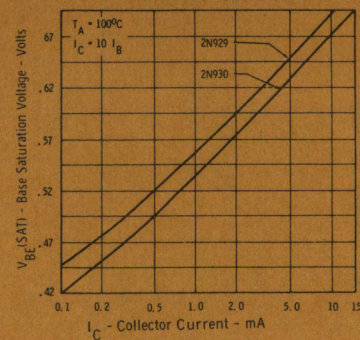
Base Saturation Voltage vs. Collector Current



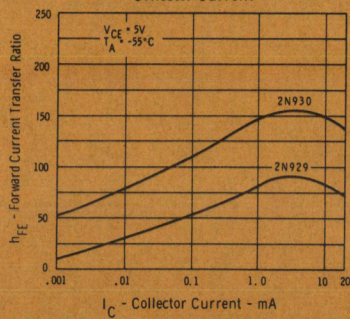
Base Saturation Voltage vs. Collector Current



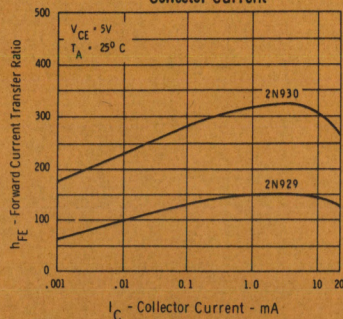
Base Saturation Voltage vs. Collector Current



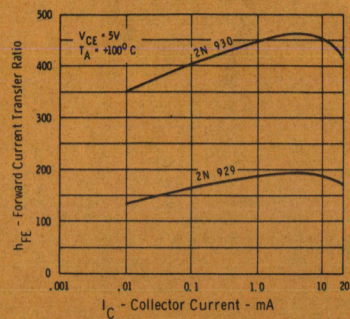
Pulsed DC Current Gain Versus Collector Current



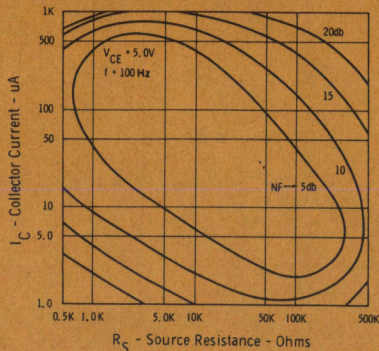
Pulsed DC Current Gain Versus Collector Current



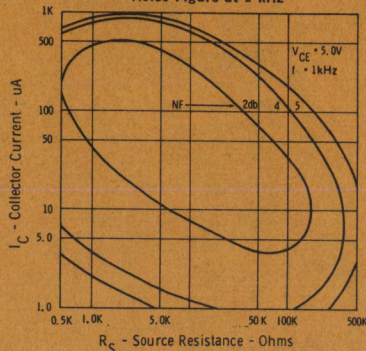
Pulsed DC Current Gain Versus Collector Current



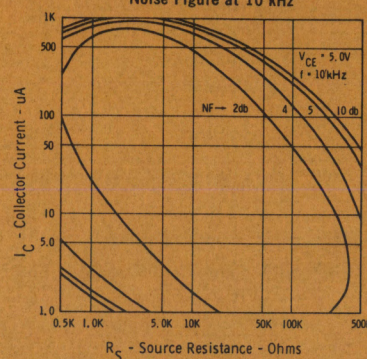
Noise Figure at 100 Hz



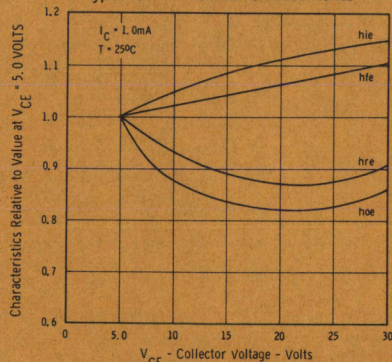
Noise Figure at 1 kHz



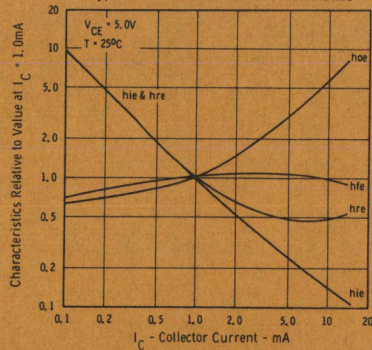
Noise Figure at 10 kHz



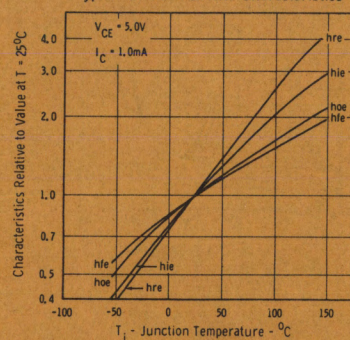
Typical Common Emitter Characteristics



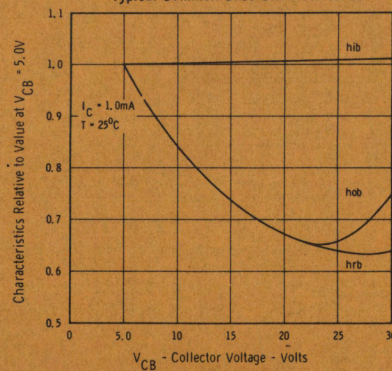
Typical Common Emitter Characteristics



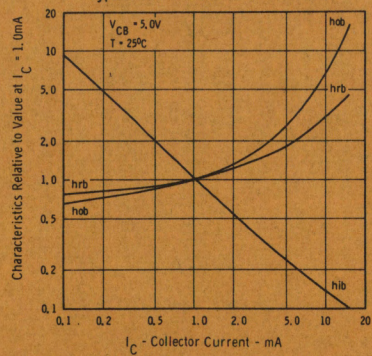
Typical Common Emitter Characteristics



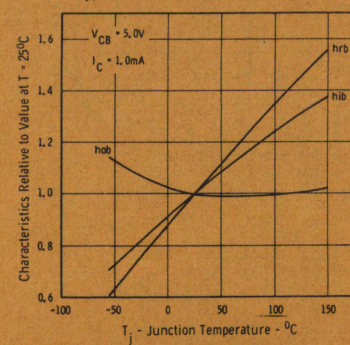
Typical Common Base Characteristics



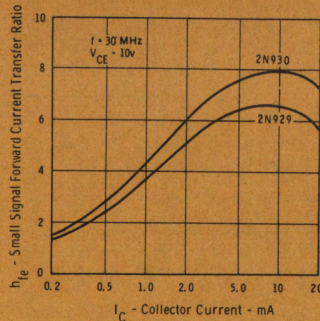
Typical Common Base Characteristics



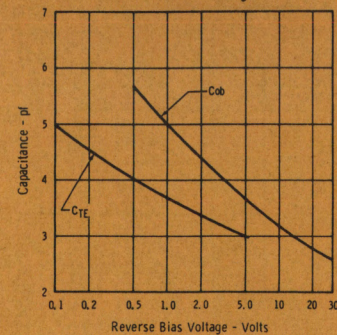
Typical Common Base Characteristics



Small Signal Current Gain at 30 MHz Versus Collector Current



Collector and Emitter Transition Capacitance Versus Reverse Bias Voltage





NPN TRANSISTOR GENERAL PURPOSE

- LOW NOISE
- LOW LEVEL AMPLIFIER
- HIGH CURRENT GAIN

JANUARY 1968

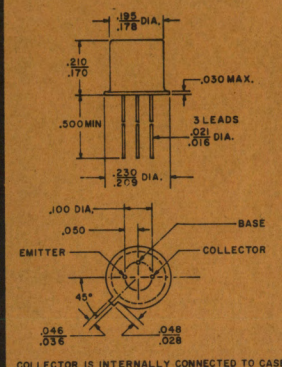
2N2483

2N2484

2N2484A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	Volts
Collector-Emitter Voltage	V_{CEO}	60	Volts
Emitter-Base Voltage	V_{EBO}	6	Volts
Collector Current	I_C	50	mA
Total Device Dissipation	P_D		Watts
@ $T_A = 25^\circ\text{C}$		0.36	
@ $T_C = 25^\circ\text{C}$		1.2	
@ $T_C = 100^\circ\text{C}$		0.68	
Derating Factor above 25°C			mW/ $^\circ\text{C}$
@ $T_A = 25^\circ\text{C}$		2.1	
@ $T_C = 25^\circ\text{C}$		6.9	
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	60		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 10 \mu\text{A}, I_C = 0$	6		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}$	$I_C = 10 \text{ mA}, I_B = 0$	60		Volts
Emitter-Base On Voltage	$V_{BE(on)}$	$I_C = 100 \mu\text{A}, V_{CE} = 5.0 \text{ V}$	0.5	0.7	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}, I_B = 0.5 \text{ mA}$		1.0	Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 1.0 \text{ mA}, I_B = 0.1 \text{ mA}$ $I_C = 10 \text{ mA}, I_B = 0.5 \text{ mA}$		0.35 1.0	Volts
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 45 \text{ V}, I_E = 0$ $V_{CB} = 45 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		0.010 10	μA
Emitter-Base Cutoff Current	I_{EBO}	$V_{EB} = 5.0 \text{ V}, I_C = 0$		0.010	μA
DC Current Gain	h_{FE}	$I_C = 1.0 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}, -55^\circ\text{C}$ $I_C = 100 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 500 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 5.0 \text{ V}^*$	30 40 100 10 20 75 175 100 200 175 250	120 500	
High-Frequency Current Gain	$ h_{fe} $	$I_C = 50 \mu\text{A}, V_{CE} = 5.0 \text{ V}, f = 5.0 \text{ MHz}$ $I_C = 500 \mu\text{A}, V_{CE} = 5.0 \text{ V}, f = 30 \text{ MHz}$	2.4 3.0 2.0		
Small Signal Current Gain	h_{fe}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}, f = 1 \text{ kHz}$	80 150	450 900	
Output Capacitance	C_{ob}	$V_{CB} = 5.0 \text{ V}, I_E = 0, f = 140 \text{ kHz}$		6.0	pf



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CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Input Capacitance	C_{ib}	$V_{EB} = 0.5 \text{ V}, I_C = 0, f = 140 \text{ kHz}$		6.0	pf
Voltage Feedback Ratio	h_{re}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}, f = 1 \text{ kHz}$		800	$\times 10^{-6}$
Input Resistance 2N2483 2N2484, 84A	h_{ie}	$I_C = 1 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}$	1.5 3.5	13 24	K ohms
Output Conductance 2N2483 2N2484, 84A	h_{oe}	$I_C = 1 \text{ mA}, V_{CE} = 5 \text{ V}, f = 1 \text{ kHz}$		30 40	μmhos
Noise Figure 2N2483 2N2484, 84A	NF	$I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}, R_S = 10 \text{ k}\Omega$ Power Bandwidth of 15.7 kHz 3 db points at 10 Hz and 10 kHz		4 3	db
2N2483 2N2484, 84A		$I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}, f = 1 \text{ kHz}$ $R_S = 10 \text{ k}\Omega$, Power Bandwidth = 200 Hz		4 3	
2N2483 2N2484, 84A		$I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}, f = 10 \text{ kHz}$ $R_S = 10 \text{ k}\Omega$, Power Bandwidth = 2 kHz		3 2	
2N2483 2N2484		$I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}, f = 100 \text{ Hz}$ $R_S = 10 \text{ k}\Omega$, Power Bandwidth = 20 Hz		15 10	
2N2484A				5	
2N2484A		$I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}, f = 10 \text{ Hz}$ $R_S = 10 \text{ k}\Omega$, Power Bandwidth = 5 Hz		6	

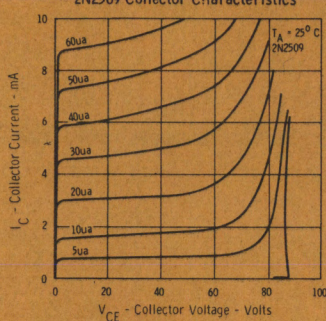
* Pulse Test: Pulse Width $\leq 300 \mu\text{sec}$, Duty Cycle $\leq 2\%$



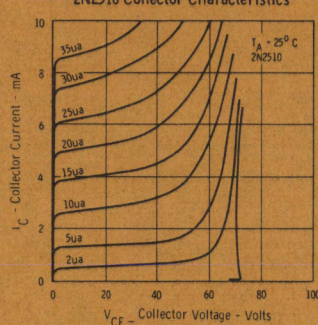
CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
High Frequency Current Gain	$ h_{fe} $	$I_C = 5.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 30 \text{ MHz}$	1.5		
Output Capacitance	C_{ob}	$I_E = 0$, $V_{CB} = 5.0 \text{ V}$ $f = 140 \text{ kHz}$		6.0	pf
Input Capacitance	C_{ib}	$I_C = 0$, $V_{BE} = 0.5 \text{ V}$ $f = 140 \text{ kHz}$		10	pf
Noise Figure 2N2511 2N2510 2N2509	NF	$f = 1.0 \text{ kHz}$ Source resistance = $10 \text{ K}\Omega$ Equivalent noise power bandwidth = 200 Hz $I_C = 10 \text{ }\mu\text{A}$, $V_{CE} = 5.0 \text{ V}$		4.0 4.0 7.0	db

* Pulse Test: Pulse Width = $300 \text{ }\mu\text{sec}$; Duty Cycle = 1%.

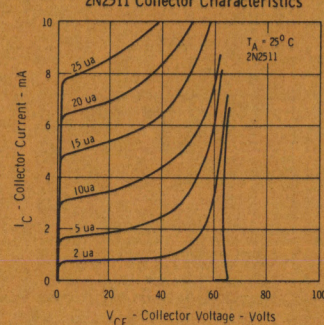
2N2509 Collector Characteristics



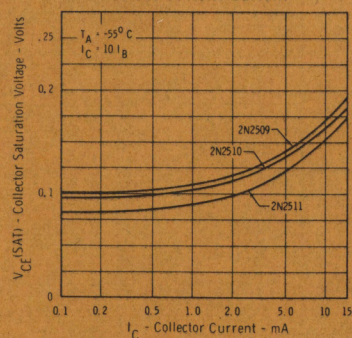
2N2510 Collector Characteristics



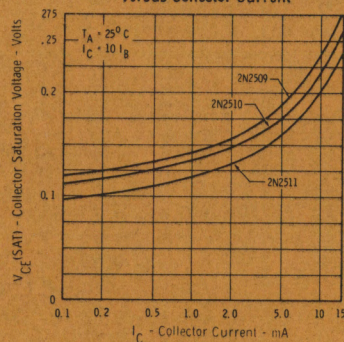
2N2511 Collector Characteristics



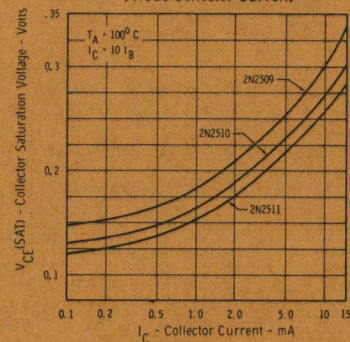
Collector Saturation Voltage Versus Collector Current



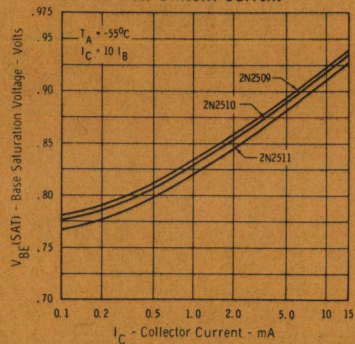
Collector Saturation Voltage Versus Collector Current



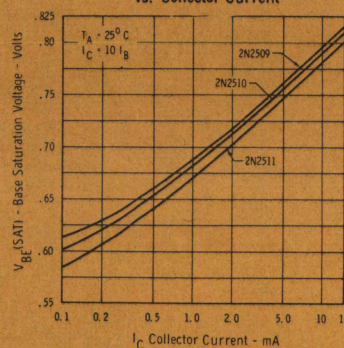
Collector Saturation Voltage Versus Collector Current



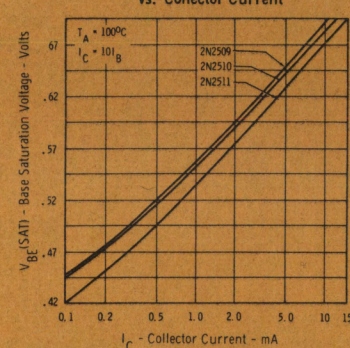
Base Saturation Voltage vs. Collector Current



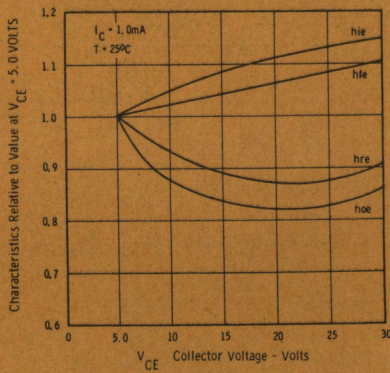
Base Saturation Voltage vs. Collector Current



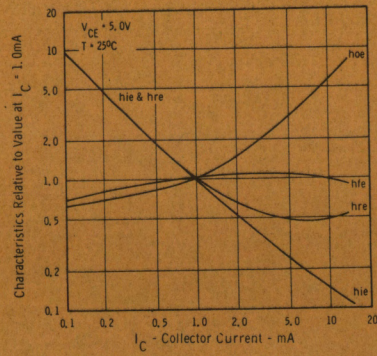
Base Saturation Voltage vs. Collector Current



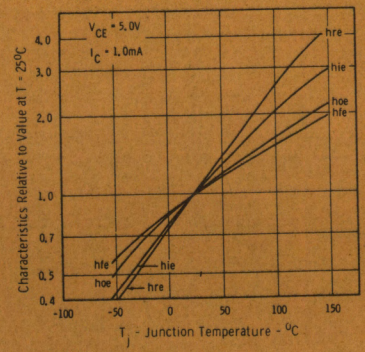
Typical Common Emitter Characteristics



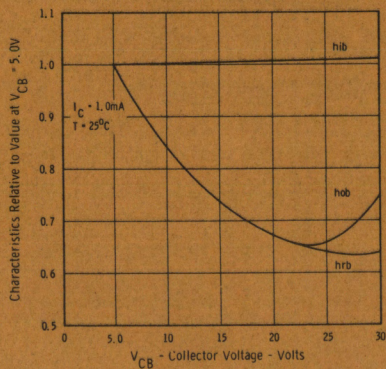
Typical Common Emitter Characteristics



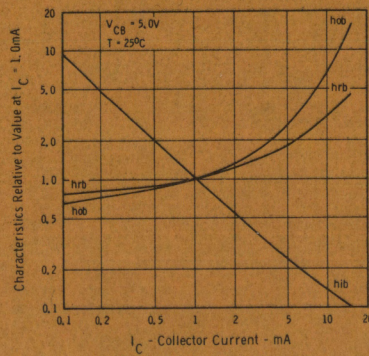
Typical Common Emitter Characteristics



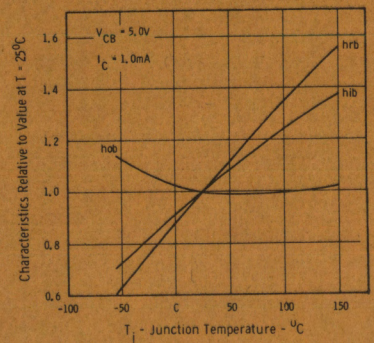
Typical Common Base Characteristics



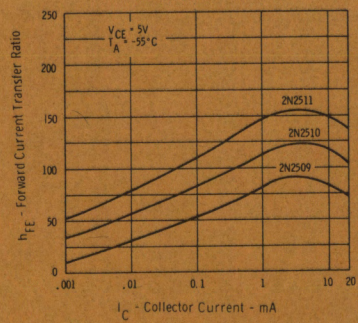
Typical Common Base Characteristics



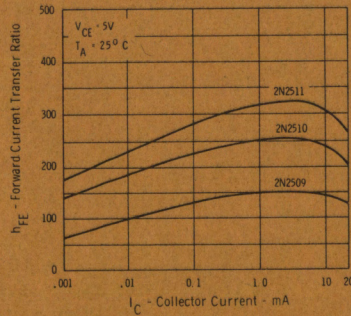
Typical Common Base Characteristics



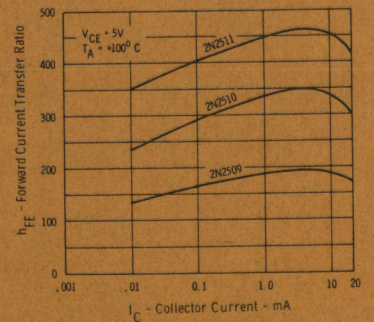
Pulsed DC Current Gain Versus Collector Current



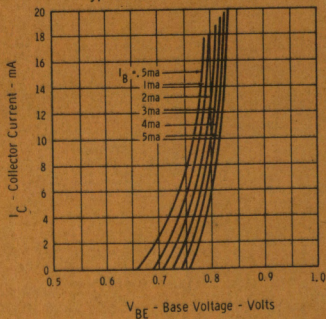
Pulsed DC Current Gain Versus Collector Current



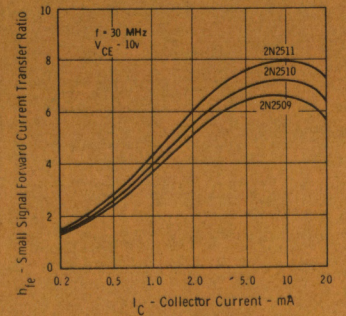
Pulsed DC Current Gain Versus Collector Current



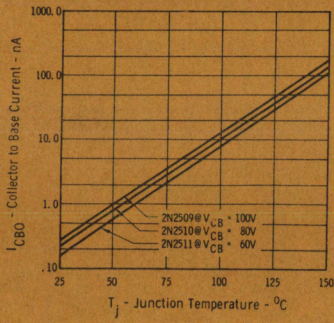
Typical Base Characteristics



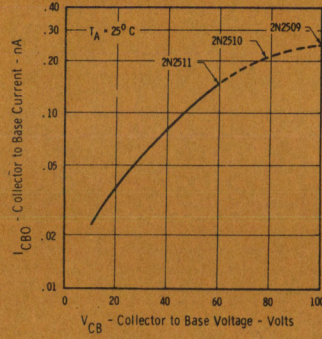
Small Signal Current Gain at 30 MHz Versus Collector Current



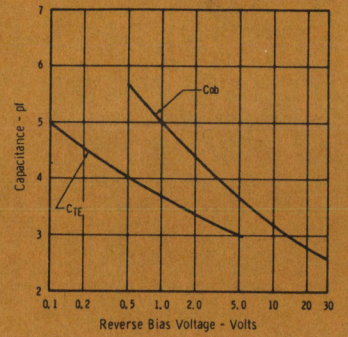
Collector - Base Diode Reverse
Current versus Temperature



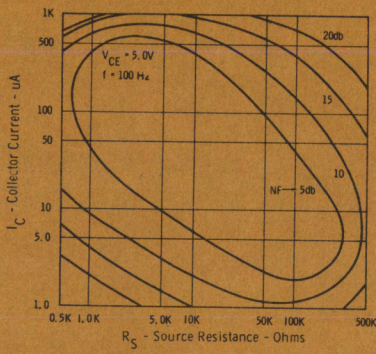
Collector - Base Diode Reverse
Current Versus Voltage



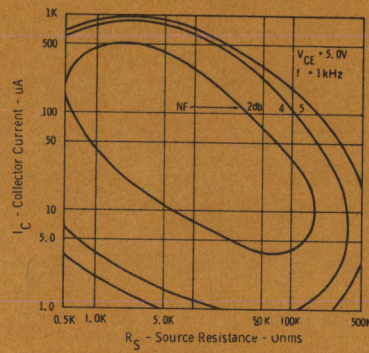
Collector and Emitter
Transition Capacitance Versus
Reverse Bias Voltage



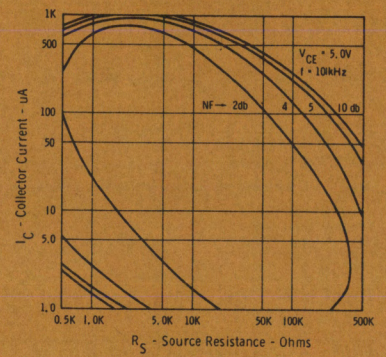
Noise Figure at 100 Hz



Noise Figure at 10 kHz



Noise Figure at 1 kHz





NPN TRANSISTOR GENERAL PURPOSE

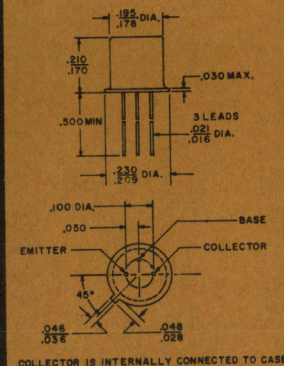
- LOW LEAKAGE
- HIGH CURRENT GAIN
- LOW NOISE

JANUARY 1968

2N2586

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	Volts
Collector-Emitter Voltage	V_{CEO}	45	Volts
Emitter-Base Voltage	V_{EBO}	6.0	Volts
Collector Current	I_C	30	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	0.3 0.6	Watts
Storage Temperature	T_{stg}	-65 to +300	$^\circ\text{C}$
Junction Temperature	T_J	+175	$^\circ\text{C}$
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.0 4.0	mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at +25°C (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	60		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0, I_E = 10 \mu\text{A}$	6.0		Volts
Collector-Emitter Sustaining Voltage	$V_{CE(sus)}^*$	$I_C = 10 \text{ mA}, I_B = 0$	45		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ mA}, I_B = 0.5 \text{ mA}$		0.5	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}, I_B = 0.5 \text{ mA}$	0.7	0.9	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0, V_{CB} = 45 \text{ V}$		2.0	nA
Collector-Emitter Cutoff Current	I_{CEO}	$I_B = 0, V_{CE} = 5.0 \text{ V}$		2.0	nA
Collector-Emitter Cutoff Current	I_{CES}	$V_{BE} = 0, V_{CE} = 45 \text{ V}$ $V_{BE} = 0, V_{CE} = 45 \text{ V}, T_A = 170^\circ\text{C}$		2.0 10	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0, V_{EB} = 5.0 \text{ V}$		2.0	nA
DC Current Gain	h_{FE}	$I_C = 1.0 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 500 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $T_A = -55^\circ\text{C}$	80 120 150 40	360 600	
Small Signal Current Gain	h_{fe}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 1 \text{ kHz}$	150	600	
High Frequency Current Gain	$ h_{fe} $	$I_C = 0.5 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 30 \text{ MHz}$	1.5		
Output Capacitance	C_{ob}	$I_E = 0, V_{CB} = 5.0 \text{ V}, f = 1 \text{ MHz}$		7.0	pf
Input Resistance	h_{ie}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 1 \text{ kHz}$	4.5	18	K Ω
Output Conductance	h_{oe}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 1 \text{ kHz}$		100	μmhos
Low Frequency Noise Figure	NF	$f = 1 \text{ kHz}$ Source resistance = 10 k Ω $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $f = 1 \text{ kHz}$ Source resistance = 1 M Ω $I_C = 1.0 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $f = 10 \text{ kHz}$ Source resistance = 10 k Ω $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $f = 10 \text{ kHz}$ Source resistance = 1 M Ω $I_C = 1.0 \mu\text{A}, V_{CE} = 5.0 \text{ V}$		3.0 3.5 2.0 2.0	db

* Pulse width = 300 μsec ; duty cycle = 1%.



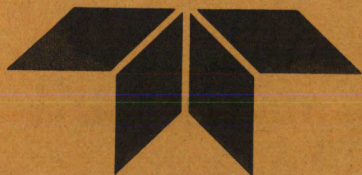
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NPN TRANSISTOR GENERAL PURPOSE

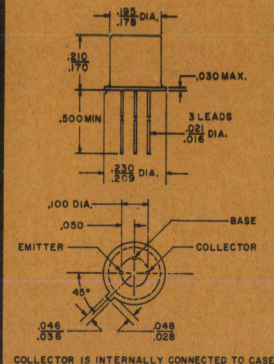
- HIGH CURRENT GAIN
- LOW NOISE
- HIGH BREAKDOWN VOLTAGE

JANUARY 1968

2N3117

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	Volts
Collector-Emitter Voltage	V_{CEO}	60	Volts
Emitter-Base Voltage	V_{EBO}	6.0	Volts
Collector Current	I_C	50	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	0.36 1.2 0.68	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.06 6.85	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	60		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0, I_E = 10 \mu\text{A}$	6.0		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}$	$I_C = 10 \text{ mA}, I_B = 0$	60		Volts
Nonsaturated Base Voltage	$V_{BE(on)}$	$I_C = 0.1 \text{ mA}, V_{CE} = 5.0 \text{ V}$		0.7	Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 1.0 \text{ mA}, I_B = 0.1 \text{ mA}$		0.35	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0, V_{CB} = 45 \text{ V}$ $I_E = 0, V_{CB} = 45 \text{ V}, T_A = 150^\circ\text{C}$		10 10	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0, V_{EB} = 5.0 \text{ V}$		10	nA
DC Current Gain	h_{FE}	$I_C = 1.0 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 100 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}, T_A = -55^\circ\text{C}$	100 250 300 400 50	500	
Small Signal Current Gain	h_{fe}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 1.0 \text{ kHz}$	400	900	
High Frequency Current Gain	$ h_{fe} $	$I_C = 0.5 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 30 \text{ MHz}$	2.0		
Output Capacitance	C_{ob}	$I_E = 0, V_{CB} = 5.0 \text{ V}$ $f = 140 \text{ kHz}$		4.5	pf
Input Capacitance	C_{ib}	$I_C = 0, V_{BE} = 5.0 \text{ V}$ $f = 140 \text{ kHz}$		6.0	pf
Reverse Voltage Feedback Ratio	h_{re}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 1.0 \text{ kHz}$		8.0	$\times 10^{-4}$
Input Resistance	h_{ie}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 1.0 \text{ kHz}$	10	24	K ohms
Output Conductance	h_{oe}	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $f = 1.0 \text{ kHz}$		40	μmhos
Noise Figure	NF	$f = 100 \text{ Hz}$ Source resistance = $10 \text{ k}\Omega$ Equivalent noise power bandwidth = 20 Hz $I_C = 30 \mu\text{A}, V_{CE} = 5.0 \text{ V}$		4.0	db



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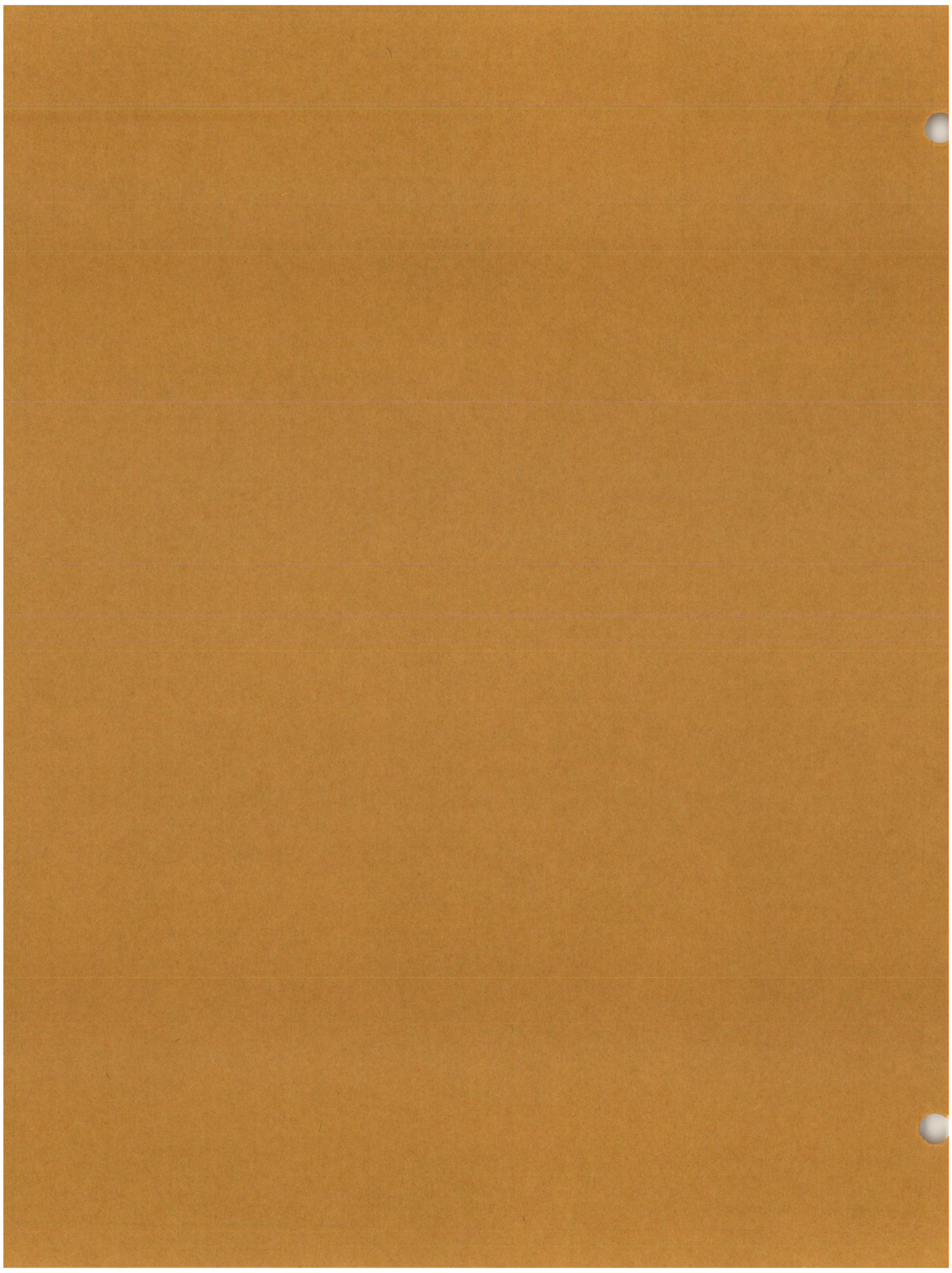
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CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Noise Figure	NF	$f = 1 \text{ kHz}$ Source resistance = $50 \text{ k}\Omega$ Equivalent noise power bandwidth = 200 cps $I_C = 5.0 \text{ }\mu\text{A}$, $V_{CE} = 5.0 \text{ V}$ $f = 10 \text{ kHz}$ Source resistance = $50 \text{ k}\Omega$ Equivalent noise power bandwidth = 1000 Hz $I_C = 5.0 \text{ }\mu\text{A}$, $V_{CE} = 5.0 \text{ V}$ $f = 10 \text{ Hz}$ Source resistance = $10 \text{ k}\Omega$ Equivalent noise power bandwidth = 2.0 Hz $I_C = 30 \text{ }\mu\text{A}$, $V_{CE} = 5.0 \text{ V}$		1.0 1.0 15	db

* Pulse Width = $300 \text{ }\mu\text{sec}$; duty Cycle = 1%.







NPN TRANSISTOR MEDIUM POWER

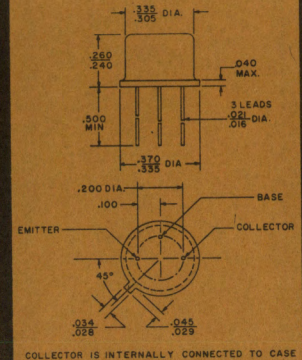
- HIGH CURRENT
- LOW SATURATION VOLTAGE
- HIGH CURRENT GAIN

JANUARY 1968

2N2192, A, B
2N2193, A, B
2N2194, A, B
2N2195, A, B

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	2N2192 2N2192A 2N2192B 2N2194 2N2194A 2N2194B	2N2193 2N2193A 2N2193B	2N2195 2N2195A 2N2195B	UNIT
Collector-Base Voltage	V_{CBO}	60	80	45	Volts
Collector-Emitter Voltage	V_{CEO}	40	50	25	Volts
Emitter-Base Voltage	V_{EBO}	5	8	5	Volts
Collector Current	I_C	1.0	1.0	1.0	Amp
Total Device Dissipation	P_D				Watt
@ $T_A = 25^\circ\text{C}$		0.8	0.8	0.6	
@ $T_C = 25^\circ\text{C}$		2.8	2.8	2.8	
@ $T_C = 100^\circ\text{C}$		1.6	1.6	1.6	
Derating Factor Above 25°C					mW/ $^\circ\text{C}$
@ $T_A = 25^\circ\text{C}$		4.56	4.56	3.43	
@ $T_C = 25^\circ\text{C}$		16	16	16	
Storage Temperature	T_{stg}		-65 to +200		$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage 2N2192, A, B, 2N2194, A, B 2N2193, A, B 2N2195, A, B	BV_{CBO}	$I_C = 100 \mu\text{A}, I_E = 0$	60 80 45		Volts
Emitter-Base Breakdown Voltage 2N2192, A, B, 2N2194, A, B 2N2193, A, B 2N2195, A, B	BV_{EBO}	$I_E = 100 \mu\text{A}, I_C = 0$	5 8 5		Volts
Collector-Emitter Sustaining Voltage 2N2192, A, B, 2N2194, A, B 2N2193, A, B 2N2195, A, B	$V_{CEO(sus)}$	$I_C = 25 \text{ mA (pulsed)}, I_B = 0$	40 50 25		Volts
Collector Saturation Voltage 2N2192 thru 2N2195 2N2192A thru 2N2195A 2N2192B thru 2N2195B	$V_{CE(sat)}$	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$		0.35 0.25 0.18	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$		1.3	Volts
Collector-Base Cutoff Current 2N2192, A, B, 2N2194, A, B 2N2195, A, B 2N2192, A, B, 2N2194, A, B 2N2195, A, B 2N2193, A, B 2N2193, A, B	I_{CBO}	$V_{CB} = 30 \text{ V}, I_E = 0$ $V_{CB} = 30 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$ $V_{CB} = 60 \text{ V}, I_E = 0$ $V_{CB} = 60 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		.010 .100 15 25 50 .010 25	μA
Emitter-Base Cutoff Current 2N2192, A, B, 2N2194, A, B 2N2195, A, B 2N2193, A, B	I_{EBO}	$V_{EB} = 3 \text{ V}, I_C = 0$ $V_{EB} = 5 \text{ V}, I_C = 0$		.050 .100 .050	μA



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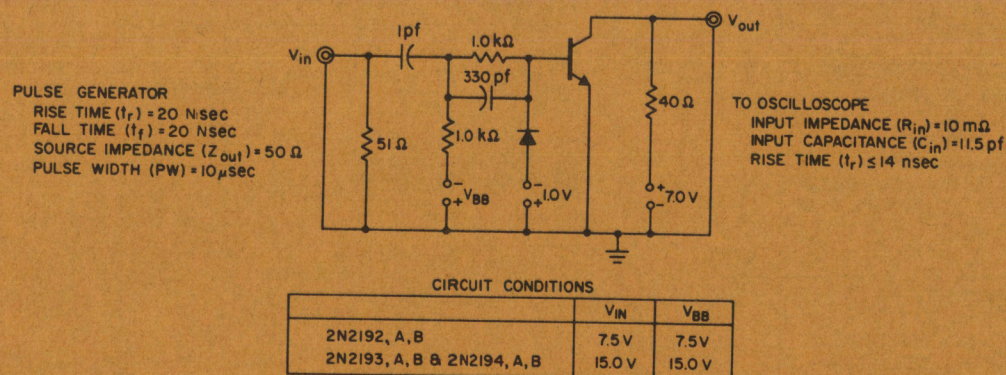
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CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
DC Pulse Current Gain	h_{FE}^*				
2N2192, A, B, 2N2193, A, B		$I_C = 0.1 \text{ mA}, V_{CE} = 10 \text{ V}$	15		
2N2192, A, B,		$I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}$	75		
2N2193, A, B			30		
2N2194, A, B			15		
2N2192, A, B,		$I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V},$	35		
2N2193, A, B		$T_A = -55^\circ\text{C}$	20		
2N2192, A, B,		$I_C = 150 \text{ mA}, V_{CE} = 10 \text{ V}$	100	300	
2N2193, A, B			40	120	
2N2194, A, B			20	60	
2N2195, A, B			20		
2N2192, A, B,		$I_C = 150 \text{ mA}, V_{CE} = 1.0 \text{ V}$	70		
2N2193, A, B			30		
2N2194, A, B			15		
2N2195, A, B			10		
2N2192, A, B,		$I_C = 500 \text{ mA}, V_{CE} = 10 \text{ V}$	35		
2N2193, A, B			20		
2N2194, A, B			12		
2N2192, A, B, 2N2193, A, B		$I_C = 1.0 \text{ A}, V_{CE} = 10 \text{ V}$	15		
Rise Time	t_r			70	nsec
Fall Time	t_f	2N2192-94, 2N2192A-94A, 2N2192B-94B (See Figure 1)		50	nsec
Storage Time	t_s			150	nsec
High Frequency Current Gain	$ h_{fe} $	$I_C = 50 \text{ mA}, V_{CE} = 10 \text{ V}, f = 20 \text{ MHz}$	2.5		
Output Capacitance	C_{ob}	$V_{CB} = 10 \text{ V}, I_E = 0, f = 1.0 \text{ MHz}$		20	pf

* Pulse Test: Pulse Width $\leq 300 \mu\text{sec}$; Duty Cycle $\leq 2\%$.

Figure 1





NPN TRANSISTOR MEDIUM POWER

- LOW SATURATION VOLTAGE
- HIGH FREQUENCY
- LOW LEAKAGE

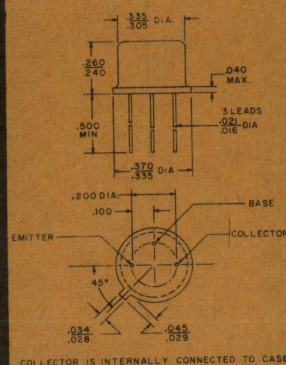
JANUARY 1968

2N2217
THRU
2N2222

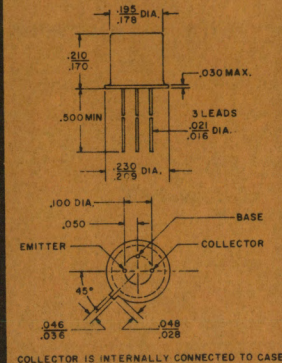
MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING		UNIT
Collector-Base Voltage	V_{CBO}	60		Volts
Collector-Emitter Voltage	V_{CEO}	30		Volts
Emitter-Base Voltage	V_{EBO}	5.0		Volts
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	2N2217-19 0.8 3.0	2N2220-22 0.5 1.8	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		5.33 20	3.33 12	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200		$^\circ\text{C}$
Junction Temperature	T_J	-65 to +175		$^\circ\text{C}$

2N2217-19



2N2220-22



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	60		Volts
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 10 \text{ mA}, I_B = 0$	30		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 10 \mu\text{A}, I_C = 0$	5.0		Volts
Collector Saturation Voltage All Types 2N2218, 19, 21, 22	$V_{CE(sat)}$ *	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$		0.4 1.6	Volts
Emitter-Base Voltage All Types 2N2218, 19, 21, 22	V_{BE} *	$I_B = 15 \text{ mA}, I_C = 150 \text{ mA}$ $I_B = 50 \text{ mA}, I_C = 500 \text{ mA}$		1.3 2.6	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0, V_{CB} = 50 \text{ V}$ $I_E = 0, V_{CB} = 50 \text{ V}, T_A = 150^\circ\text{C}$		10 10	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0, V_{EB} = 3.0 \text{ V}$		10	nA
DC Current Gain 2N2218, 21 2N2219, 22 2N2217, 20 2N2218, 21 2N2219, 22 2N2217, 20 2N2218, 21 2N2219, 22	h_{FE}	$I_C = 0.1 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}$	20 35 12 25 50 17 35 75		
DC Pulsed Current Gain 2N2217, 20 2N2218, 21 2N2219, 22 2N2218, 21 2N2219, 22 2N2217, 20 2N2218, 21 2N2219, 22	h_{FE} *	$I_C = 150 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 500 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 150 \text{ mA}, V_{CE} = 1.0 \text{ V}$	20 40 100 20 30 10 20 50	60 120 300	
High Frequency Current Gain	$ h_{fe} $	$I_C = 20 \text{ mA}, V_{CE} = 20 \text{ V}$ $f = 100 \text{ MHz}$	2.5		
Output Capacitance	C_{ob}	$I_E = 0, V_{CB} = 10 \text{ V}$ $f = 1.0 \text{ MHz}$		8.0	pf
Real Part of Input Impedance	$R_e(h_{ie})$	$I_C = 20 \text{ mA}, V_{CE} = 20 \text{ V}$ $f = 300 \text{ MHz}$		60	Ohms

* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle $\leq 2\%$.



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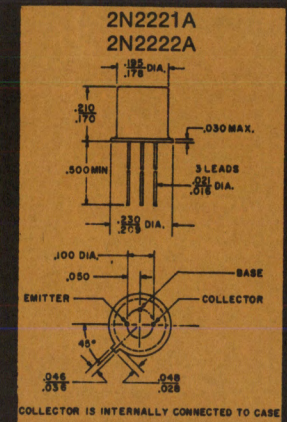
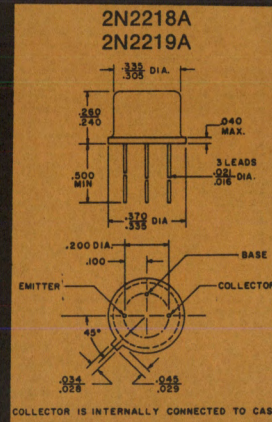
- HIGH BREAKDOWN VOLTAGE
- HIGH CURRENT GAIN
- LOW SATURATION VOLTAGE

JANUARY 1968

2N2218A
2N2219A
2N2221A
2N2222A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	2N2218A 2N2219A	2N2221A 2N2222A	UNIT
Collector-Base Voltage	V_{CBO}	75	75	Volts
Collector-Emitter Voltage	V_{CEO}	40	40	Volts
Emitter-Base Voltage	V_{EBO}	6	6	Volts
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	0.8 3.0	0.5 1.8	Watts
Derating Factor Above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		5.33 20	3.33 12	mW/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +200		$^\circ\text{C}$
Junction Temperature Range	T_J	-65 to +175		$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	75		Volts
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 10 \text{ mA}, I_B = 0$	40		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 10 \mu\text{A}, I_C = 0$	6		Volts
Collector Saturation Voltage	$V_{CE(sat)}^*$	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$		0.3 1.0	Volts
Base Saturation Voltage	$V_{BE(sat)}^*$	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$	0.6	1.2 2.0	Volts
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 60 \text{ V}, I_E = 0$ $V_{CB} = 60 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		0.01 10	μA
Emitter-Base Cutoff Current	I_{EBO}	$V_{EB} = 3 \text{ V}, I_C = 0$		10	nA
Base-Emitter Cutoff Current	I_{BEX}	$V_{CE} = 60 \text{ V}, V_{EB} = 3 \text{ V}$		20	nA
Collector-Emitter Cutoff Current	I_{CEX}	$V_{CE} = 60 \text{ V}, V_{EB} = 3 \text{ V}$		10	nA
DC Pulse Current Gain	h_{FE}^*	$I_C = 0.1 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}$ $T_A = -55^\circ\text{C}$ $I_C = 150 \text{ mA}, V_{CE} = 10 \text{ V}$ $I_C = 150 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 500 \text{ mA}, V_{CE} = 10 \text{ V}$	20 35 25 50 35 75 15 35 40 100 20 50 25 40	120 300	



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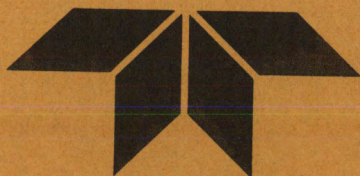
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TWX: (910) 379-6494

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Small Signal Current Gain 2N2218A, 2N2221A 2N2219A, 2N2222A 2N2218A, 2N2221A 2N2219A, 2N2222A	h_{fe}	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$	30 50 50 75	150 300 300 375	
High Frequency Current Gain 2N2218A, 2N2221A 2N2219A, 2N2222A	h_{fe}	$I_C = 20 \text{ mA}, V_{CE} = 20 \text{ V}, f = 100 \text{ MHz}$	2.5 3.0		
Output Capacitance	C_{ob}	$I_E = 0, V_{CB} = 10 \text{ V}, f = 100 \text{ kHz}$		8	pf
Input Capacitance	C_{ib}	$I_C = 0, V_{EB} = 0.5 \text{ V}, f = 1 \text{ kHz}$		25	pf
Voltage Feedback Ratio 2N2218A, 2N2221A 2N2219A, 2N2222A 2N2218A, 2N2221A 2N2219A, 2N2222A	h_{re}	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$		5 8 2.5 4	$\times 10^{-4}$
Input Resistance 2N2218A, 2N2221A 2N2219A, 2N2222A 2N2218A, 2N2221A 2N2219A, 2N2222A	h_{ie}	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$	1 2.0 0.2 0.25	3.5 8 1.0 1.25	K ohms
Output Conductance 2N2218A, 2N2221A 2N2219A, 2N2222A 2N2218A, 2N2221A 2N2219A, 2N2222A	h_{oe}	$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$ $I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$	3 5 10 25	15 35 100 200	μmhos
Collector-Base Time Constant	$r_b' C_c$	$I_C = 20 \text{ mA}, V_{CE} = 20 \text{ V}, f = 31.8 \text{ MHz}$		150	psec
Noise Figure 2N2219A 2N2222A	NF	$I_C = 100 \mu\text{A}, V_{CE} = 10 \text{ V}, R_g = 1 \text{ k}\Omega, f = 1 \text{ kHz}$		4	db

* Pulse Test: Pulse Width $\leq 300 \mu\text{sec}$; Duty Cycle $\leq 2\%$.





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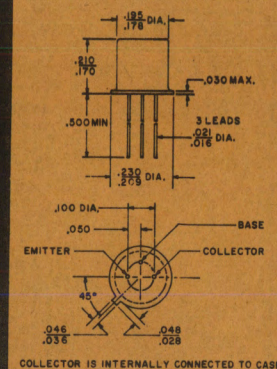
- LOW NOISE
- HIGH BREAKDOWN VOLTAGE
- LOW SATURATION VOLTAGE

JANUARY 1968

2N2222B

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	75	Volts
Collector-Emitter Voltage	V_{CEO}	6.0	Volts
Emitter-Base Voltage	V_{EBO}	40	Volts
Collector Current	I_C	1.0	A
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	0.5 1.8	Watts
Derating Factor Above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		3.3 12	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	200	$^\circ\text{C}$
Lead Temperature, 1/16 inch from case, 10 second max.		230	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_E = 0, I_C = 10 \mu\text{A}$	75		Volts
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 10 \text{ mA}, V_{BE} = 0$	40		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0, I_E = 10 \mu\text{A}$	6.0		Volts
Collector Saturation Voltage	$V_{CE(sat)}$ *	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ $I_C = 1.0 \text{ mA}, I_B = 100 \text{ mA}$		0.2 0.5 1.0	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ $I_C = 1.0 \text{ mA}, I_B = 100 \text{ mA}$	0.6	1.0 1.3 1.6	Volts
Collector-Base Cutoff Current	I_{CBO}	$V_{CE} = 60 \text{ V}, I_E = 0$ $V_{CB} = 60 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		10 10	nA μA
Collector-Emitter Reverse Current	I_{CEX}	$V_{CE} = 60 \text{ V}, V_{EB} = 3.0 \text{ V}$		10	nA
Base Leakage Current	I_{BL}	$V_{CE} = 60 \text{ V}, V_{EB} = 3.0 \text{ V}$		20	nA
Emitter-Base Cutoff Current	I_{EBO}	$V_{EB} = 3.0 \text{ V}, I_C = 0$		10	nA
DC Current Gain	h_{FE}	$V_{CE} = 10 \text{ V}, I_C = 100 \mu\text{A}$ $V_{CE} = 10 \text{ V}, I_C = 1.0 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 150 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 500 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 1.0 \text{ A}^*$ $V_{CE} = 1.0 \text{ V}, I_C = 150 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}, T_A = -55^\circ\text{C}$	35 50 75 100 40 15 50 35	300	
Rise Time	t_r	See Figure 1		25	nsec
Turn-on Delay Time	t_d	See Figure 1		10	nsec
Fall Time	t_f	See Figure 2		60	nsec
Storage Time	t_s	See Figure 2		225	nsec
Action Region Time Constant	t_a	See Figure 1		2.5	nsec
Small Signal Current Gain	h_{fe}	$V_{CE} = 10 \text{ V}, I_C = 1.0 \text{ mA}$ $f = 1.0 \text{ kHz}$ $V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$ $f = 1.0 \text{ kHz}$	50 75	300 375	



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CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
High Frequency Current Gain	$ h_{fe} $	$V_{CE} = 20 \text{ V}, I_C = 20 \text{ mA}$ $f = 100 \text{ MHz}$ $V_{CE} = 20 \text{ V}, I_C = 50 \text{ mA}$ $f = 100 \text{ MHz}$	3.0 4.0		
Output Capacitance	C_{ob}	$V_{CB} = 10 \text{ V}, I_E = 0$ $f = 100 \text{ kHz}$		8.0	pf
Input Capacitance	C_{ib}	$V_{EB} = 0.5 \text{ V}, I_C = 0$ $f = 100 \text{ kHz}$		25	pf
Input Resistance	h_{ie}	$V_{CE} = 10 \text{ V}, I_C = 1.0 \text{ mA}$ $f = 1.0 \text{ kHz}$ $V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$ $f = 1.0 \text{ kHz}$	2.0 0.25	8.0 1.25	k ohms
Voltage Feedback Ratio	h_{re}	$V_{CE} = 10 \text{ V}, I_C = 1.0 \text{ mA}$ $f = 1.0 \text{ kHz}$ $V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$ $f = 1.0 \text{ kHz}$		0.0008 0.0004	
Output Conductance	h_{oe}	$V_{CE} = 10 \text{ V}, I_C = 1.0 \text{ mA}$ $f = 1.0 \text{ kHz}$ $V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$ $f = 1.0 \text{ kHz}$	5.0 25	35 200	μmhos
Collector-Base Time Constant	$r_b' C_c$	$V_{CE} = 20 \text{ V}, I_C = 20 \text{ mA}$ $f = 31.8 \text{ MHz}$		150	psec
Real Part Input Impedance	$R_{e(hie)}$	$V_{CE} = 20 \text{ V}, I_C = 20 \text{ mA}$ $f = 300 \text{ MHz}$		60	Ohms
Current Gain Bandwidth Product	f_t	$V_{CE} = 20 \text{ V}, I_C = 20 \text{ mA}$ $f = 100 \text{ MHz}$	300		MHz
Noise Figure	NF	$V_{CE} = 10 \text{ V}, I_C = 100 \mu\text{A}$ $R_G = 1.0 \text{ k}\Omega, f = 1.0 \text{ kHz}$ $BW = 1.0 \text{ Hz}$		4.0	db

*Pulse Test: Pulse Width $\leq 300 \mu\text{sec}$; Duty Cycle $\leq 2\%$.

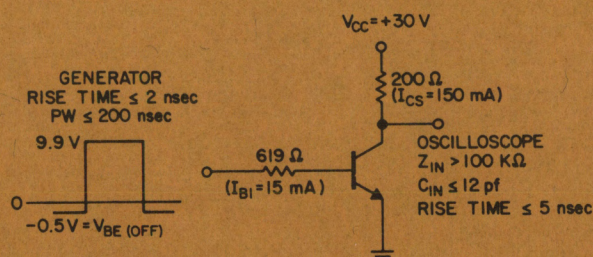


Figure 1 Equivalent Test Circuit for Measuring Delay and Rise Times

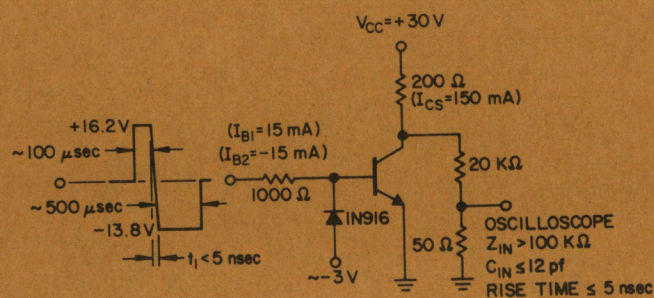
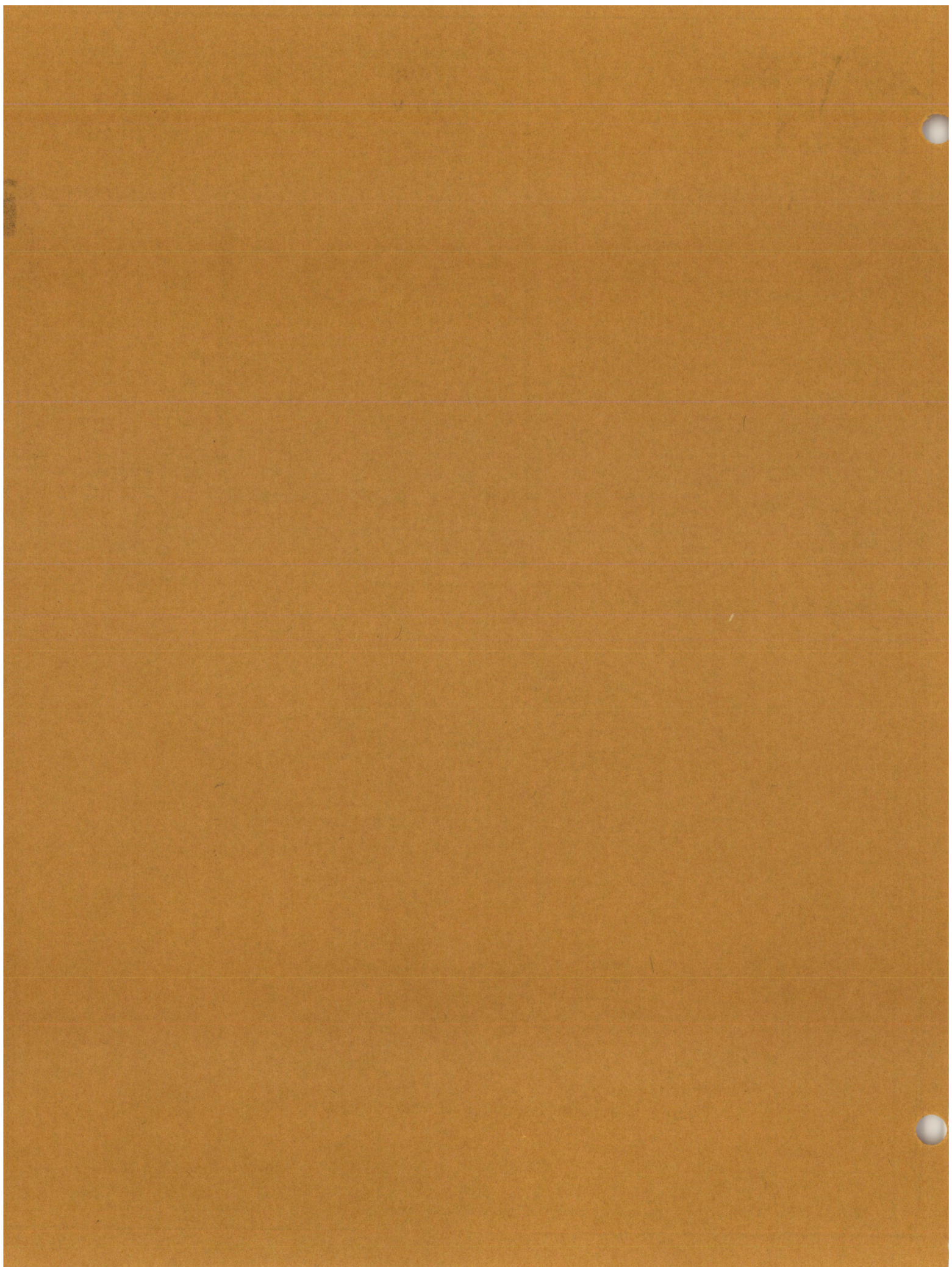


Figure 2 Equivalent Test Circuit for Measuring Storage Fall Time





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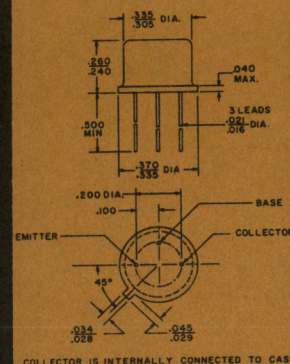
- HIGH BREAKDOWN VOLTAGE
- LOW SATURATION VOLTAGE
- FAST SWITCHING SPEEDS

JANUARY 1968

2N2243
2N2243A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	120	Volts
Collector-Emitter Voltage	V_{CEO}	80	Volts
Emitter-Base Voltage	V_{EBO}	7.0	Volts
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	0.8 2.8 1.6	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$		4.6	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	-65 to +200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 100 \mu\text{A}$, $I_E = 0$	120		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0$, $I_E = 100 \mu\text{A}$	7.0		Volts
Collector Saturation Voltage 2N2243 2N2243A	$V_{CE(sat)}$	$I_B = 15 \text{ mA}$, $I_C = 150 \text{ mA}$		0.35 0.25	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0$, $V_{CB} = 60 \text{ V}$ $I_E = 0$, $V_{CB} = 60 \text{ V}$, $T_A = 150^\circ\text{C}$		10 15	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0$, $V_{EB} = 5.0 \text{ V}$		50	nA
DC Current Gain	h_{FE}	$I_C = 100 \mu\text{A}$, $V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $T_A = -55^\circ\text{C}$	15 30 20		
DC Pulsed Current Gain	h_{FE}^*	$I_C = 150 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $I_C = 500 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $I_C = 150 \text{ mA}$, $V_{CE} = 1.0 \text{ V}$	40 15 30	120	
Small Signal Current Gain	h_{fe}	$I_C = 50 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 1.0 \text{ kHz}$	2.5		
Output Capacitance	C_{ob}	$I_C = 100 \mu\text{A}$, $I_E = 0$		15	pf
Stored-Charge Time Constant	T_b	See Figure 1		2.1	μSEC

* Pulse Test: Pulse Width $\leq 300 \mu\text{sec}$; Duty Cycle = 1%.

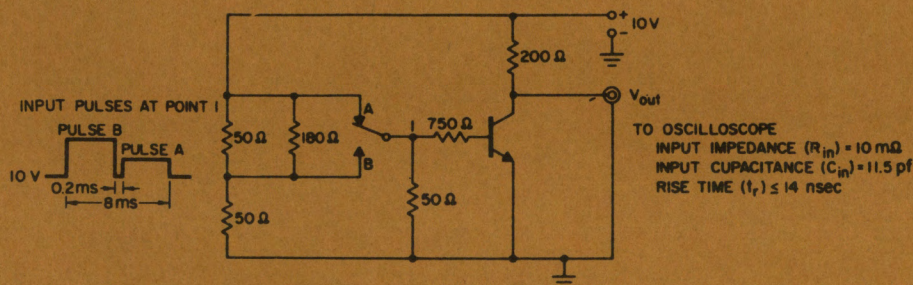


Figure 1



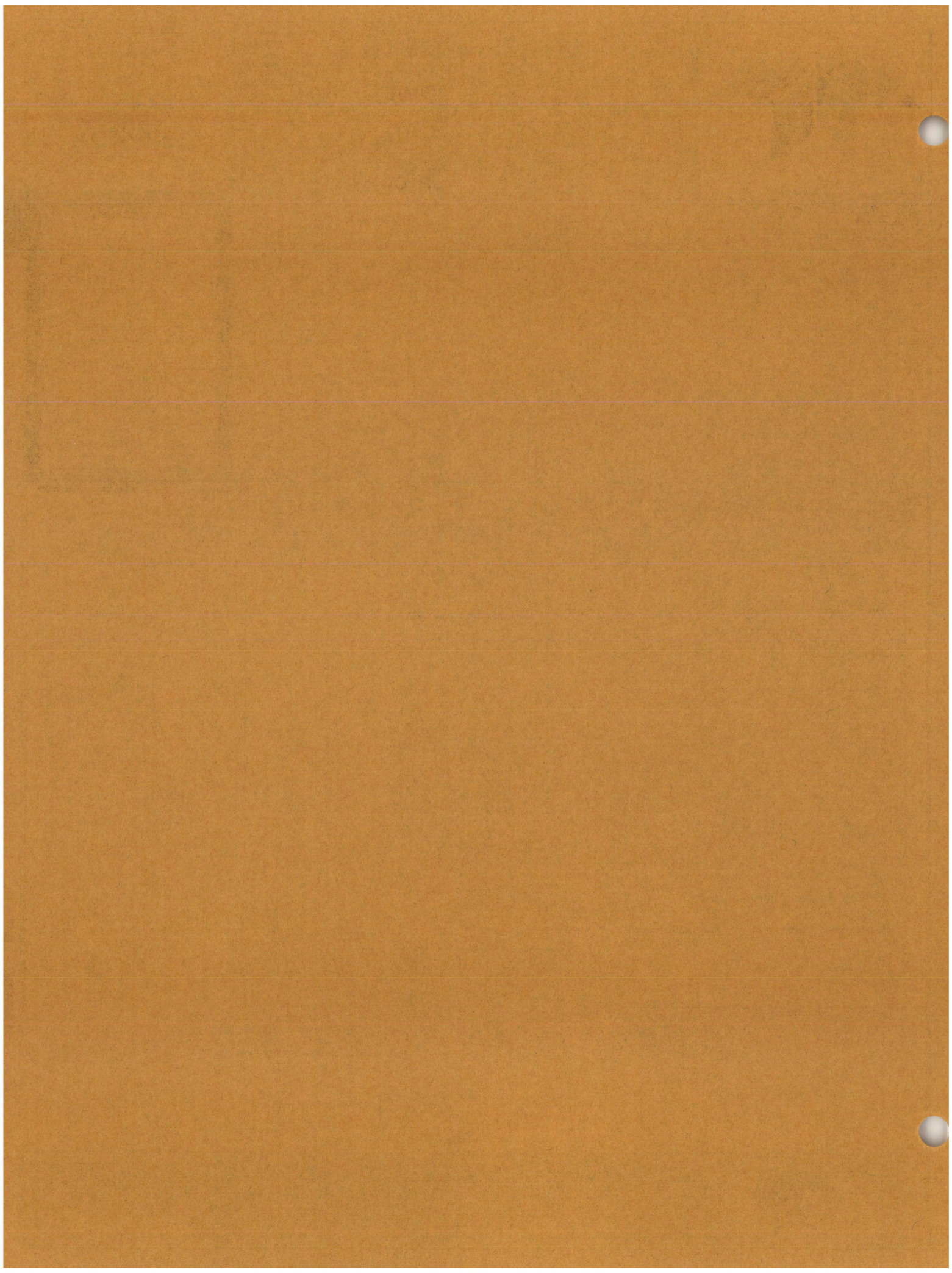
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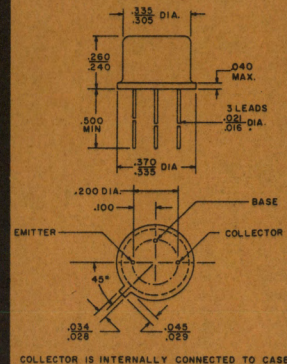
- LOW SATURATION VOLTAGE
- HIGH BREAKDOWN VOLTAGE
- HIGH COLLECTOR CURRENT

JANUARY 1968

2N2297

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	80	Volts
Collector-Emitter Voltage	V_{CEO}	35	Volts
Emitter-Base Voltage	V_{EBO}	7.0	Volts
Collector Current	I_C	1	Amp
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	0.8 5.0 2.8	Watts
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$
Lead Temperature, 1/16 inch from case, 10 sec. max.		+300	$^\circ\text{C}$
Derating Factor above 25°C $T_A = 25^\circ\text{C}$ $T_C = 25^\circ\text{C}$		4.06 2.86	mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 100 \mu\text{A}$, $I_E = 0$	80		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0$, $I_E = 100 \mu\text{A}$	7.0		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}^*$	$I_C = 30 \text{ mA}$, $I_B = 0$	35		Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 1000 \text{ mA}$, $I_B = 100 \text{ mA}$		1.6	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0$, $V_{CB} = 60 \text{ V}$ $I_E = 0$, $V_{CB} = 60 \text{ V}$, $T_A = 150^\circ\text{C}$		10 10	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0$, $V_{EB} = 5.0 \text{ V}$		10	nA
DC Pulsed Current Gain	h_{FE}^*	$I_C = 150 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $I_C = 1.0 \text{ A}$, $V_{CE} = 10 \text{ V}$	40 30 15	120	
High Frequency Current Gain	$ h_{fe} $	$I_C = 50 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 20 \text{ MHz}$	3.0		
Output Capacitance	C_{ob}	$I_E = 0$, $V_{CB} = 10 \text{ V}$ $f = 140 \text{ kHz}$		12	pf
Collector-Base Time Constant	$r_b'C_c$	$I_C = 10 \text{ mA}$, $V_{CB} = 10 \text{ V}$ $f = 4 \text{ MHz}$		800	psec

* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle $\leq 1\%$.



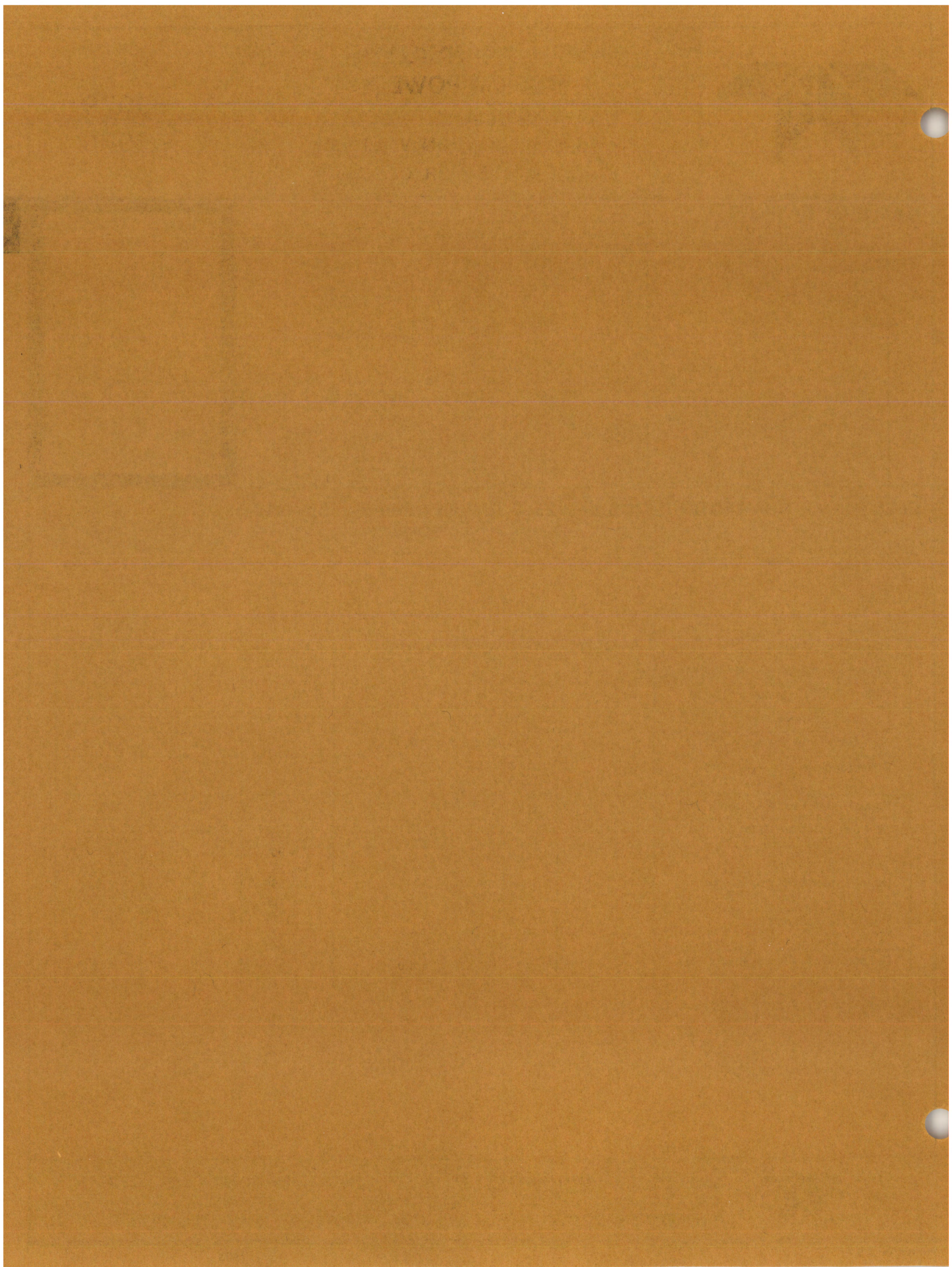
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NPN TRANSISTOR MEDIUM POWER

- LOW NOISE
- LOW SATURATION VOLTAGE
- HIGH COLLECTOR CURRENT

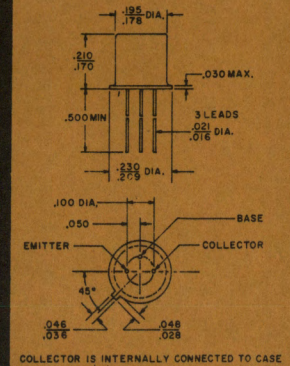
JANUARY 1968

2N5079

2N5080

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	60	Volts
Collector-Emitter Voltage	V_{CEO}	5	Volts
Emitter-Base Voltage	V_{EBO}	30	Volts
Collector Current	I_C	1.0	Amp
Base Current	I_B	200	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$	P_D	1.8	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$		10.3	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	200	$^\circ\text{C}$
Lead Temperature, 1/16 inch from case, 10 seconds max.		300	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	60		Volts
Collector-Emitter Breakdown Voltage	BV_{CEO}^*	$I_C = 10 \text{ mA}, I_B = 0$	30		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0, I_E = 10 \mu\text{A}$	5.0		Volts
Base Saturation Voltage	$V_{BE(sat)}^*$	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ $I_C = 1.0 \text{ A}, I_B = 100 \text{ mA}$		1.0 1.3 1.6	Volts
Collector Saturation Voltage	$V_{CE(sat)}^*$	$I_C = 150 \text{ mA}, I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ $I_C = 1.0 \text{ A}, I_B = 100 \text{ mA}$		0.2 0.5 1.0	Volts
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 50 \text{ V}, I_E = 0$ $V_{CB} = 50 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		10 10	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$V_{EB} = 3.0 \text{ V}, I_C = 0$		10	nA
DC Current Gain	h_{FE}^*	$V_{CE} = 10 \text{ V}, I_C = 0.1 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 1.0 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 10 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 150 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 500 \text{ mA}$ $V_{CE} = 10 \text{ V}, I_C = 1.0 \text{ A}$	35 50 50 75 100 150 200 50 90 15 25	300 500	
High Frequency Current Gain	h_{fe}	$V_{CE} = 20 \text{ V}, I_C = 50 \text{ mA}$ $f = 100 \text{ MHz}$	4		
Output Capacitance	C_{ob}	$V_{CB} = 10 \text{ V}, I_E = 0$ $f = 1.0 \text{ MHz}$		7	pf
Input Capacitance	C_{ib}	$V_{EB} = 0.5 \text{ V}, I_C = 0$ $f = 1.0 \text{ MHz}$		30	pf
Noise Figure	NF	$V_{CE} = 5.0 \text{ V}, I_C = 200 \mu\text{A}, R_S = 510\Omega$ $f = 1.0 \text{ kHz}, BW = 200 \text{ Hz}$		4.0	db

* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle = 1%.



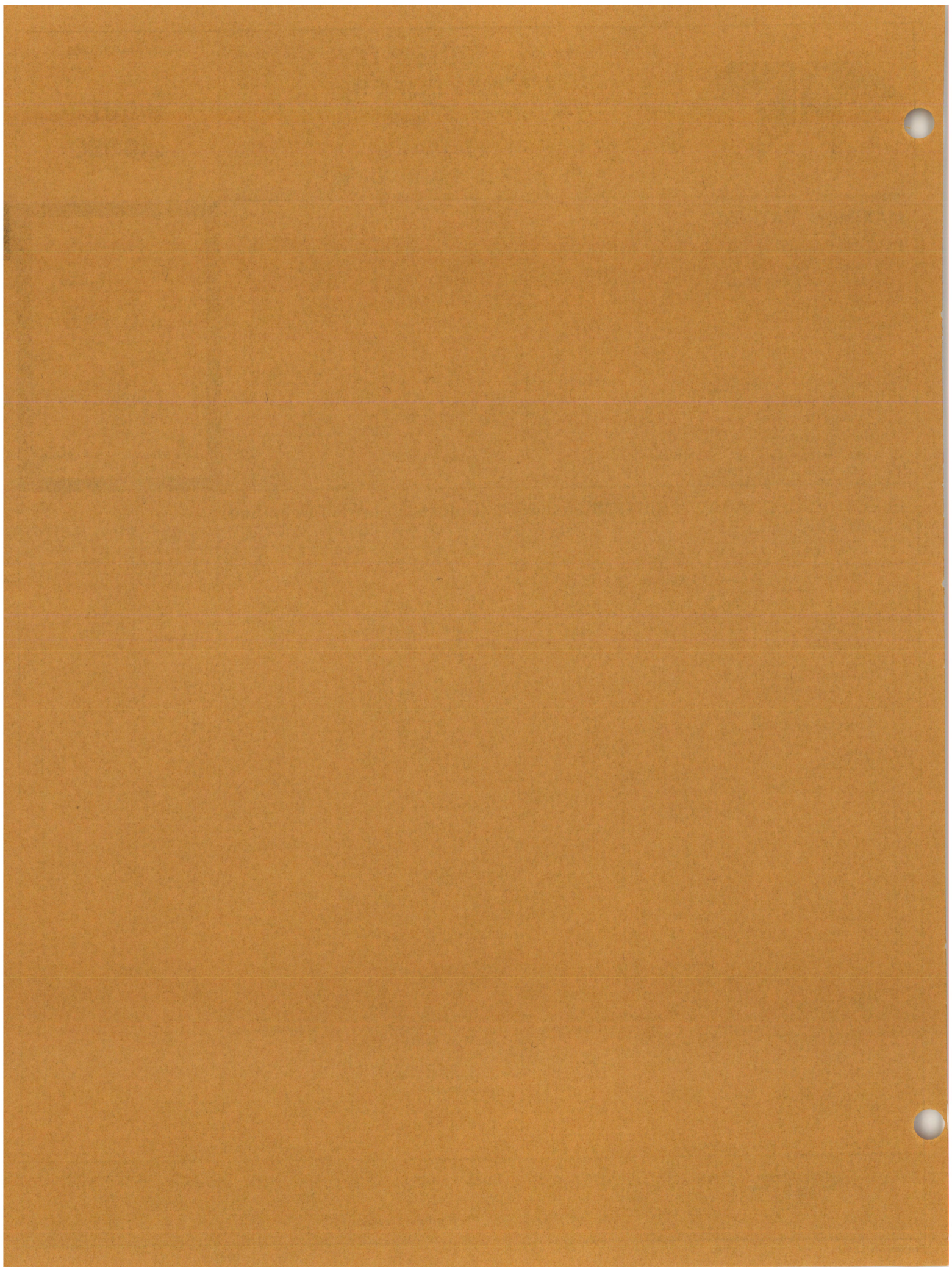
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NPN TRANSISTOR RF/IF AMPLIFIER

- HIGH FREQUENCY
- HIGH VOLTAGE
- HIGH CURRENT GAIN

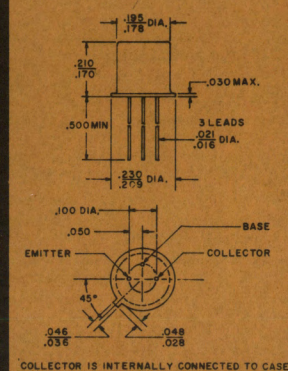
JANUARY 1968

2N915

2N915A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	70	Volts
Collector-Emitter Voltage	V_{CEO}	50	Volts
Emitter-Base Voltage	V_{EBO}	5	Volts
Collector Current	I_C	Limited by Dissipation only	
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	0.36 1.2 0.68	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.1 6.85	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage 2N915 2N915A	BV_{CBO}	$I_C = 100 \mu\text{A}, I_E = 0$ $I_C = 10 \mu\text{A}, I_E = 0$	70 70		Volts Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 10 \mu\text{A}, I_C = 0$	5		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}^*$	$I_C = 10 \text{ mA}, I_B = 0$	50		Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$		0.9	Volts
Collector Saturation Voltage 2N915 2N915A	$V_{CE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$		1.0 0.2	Volts
Collector-Base Cutoff Current 2N915 2N915A 2N915 2N915A	I_{CBO}	$V_{CB} = 60 \text{ V}, I_E = 0$ $V_{CB} = 60 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		10 2 30 3	nA μA
DC Pulse Current Gain	h_{FE}^*	$I_C = 10 \text{ mA}, V_{CE} = 5 \text{ V}$	50	200	
DC Pulse Current Gain 2N915A Both Types Both Types Both Types Both Types	h_{FE}^*	$I_C = 10 \mu\text{A}, V_{CE} = 5 \text{ V}$ $I_C = 100 \mu\text{A}, V_{CE} = 5 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 5 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 1 \text{ V}$ $I_C = 100 \text{ mA}, V_{CE} = 1 \text{ V}$	50 50 50 50 15	200 200 200 200	
Emitter-Base Cutoff Current 2N915A	I_{EBO}	$V_{EB} = 3 \text{ V}, I_C = 0$		2	nA
High Frequency Current Gain 2N915 2N915A	$ h_{fe} $	$V_{CE} = 15 \text{ V}, I_C = 10 \text{ mA}$ $f = 100 \text{ MHz}$	2.5 6.0		
Small Signal Current Gain 2N915 2N915A	h_{fe}	$V_{CE} = 5 \text{ V}, I_C = 1 \text{ mA}$ $f = 1 \text{ kHz}$	40 50	200 200	
Small Signal Current Gain	h_{fe}	$V_{CE} = 5 \text{ V}, I_C = 5 \text{ mA}$ $f = 1 \text{ kHz}$	50	250	



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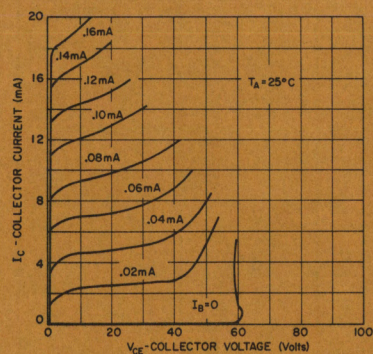
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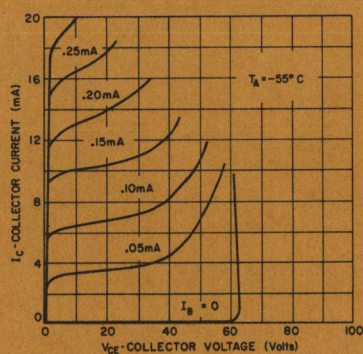
CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Output Capacitance 2N915 2N915A	C_{ob}	$V_{CB} = 10 \text{ V}, I_E = 0$		3.5 3.0	pf pf
Input Capacitance 2N915 2N915A	C_{ib}	$V_{EB} = 0.5 \text{ V}, I_C = 0$		10 5	pf pf
Input Resistance	h_{ie}	$V_{CE} = 5 \text{ V}, I_C = 5 \text{ mA}$ $f = 1 \text{ kHz}$ $V_{CE} = 5 \text{ V}, I_C = 1 \text{ mA}$ $f = 1 \text{ kHz}$		2000 6000	ohms ohms
Output Conductance	h_{oe}	$V_{CE} = 5 \text{ V}, I_C = 5 \text{ mA}$ $f = 1 \text{ kHz}$ $V_{CE} = 5 \text{ V}, I_C = 1 \text{ mA}$ $f = 1 \text{ kHz}$		75 125	μmhos μmhos
Collector-Base Time Constant	$r_b' C_c$	$V_{CB} = 10 \text{ V}, I_C = 10 \text{ mA}$ $f = 40 \text{ MHz}$		300	psec
Noise Figure 2N915A	NF	$V_{CE} = 5 \text{ V}, I_C = 10 \mu\text{A}$ $f = 1 \text{ kHz}$ $R_s = 10 \text{ k}\Omega$ $BW = 200 \text{ Hz}$		4	db

* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle = 1%.

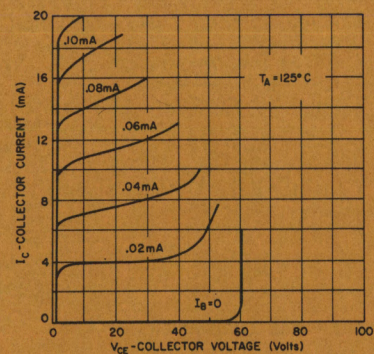
Collector Characteristics



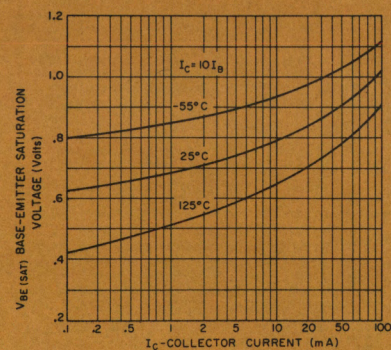
Collector Characteristics



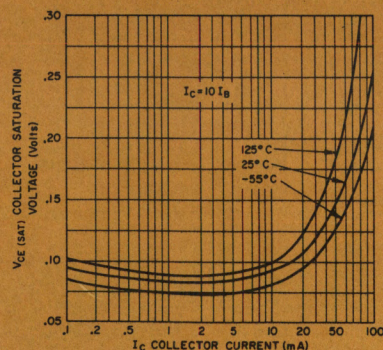
Collector Characteristics



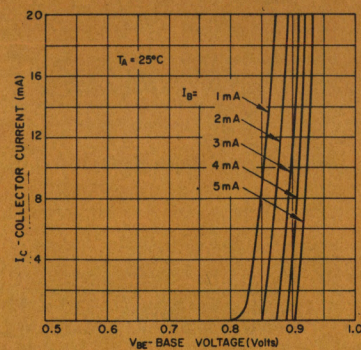
Base-Emitter Saturation Voltage
vs
Collector Current



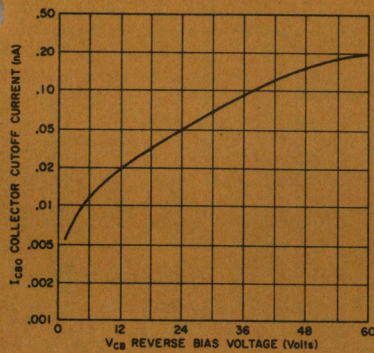
Collector Saturation Voltage
vs
Collector Current



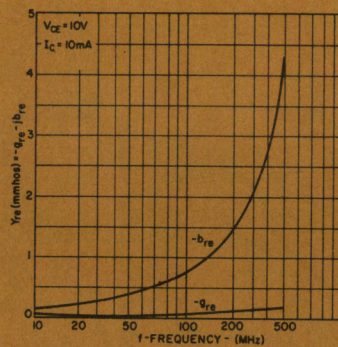
Typical Base Characteristics



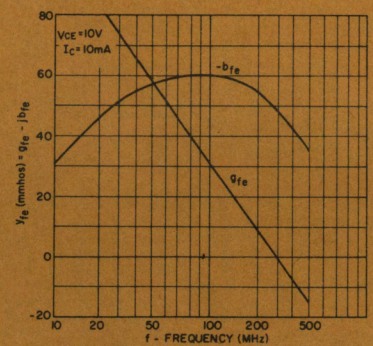
Collector Bias Reverse Current
VS
Reverse Bias Voltage



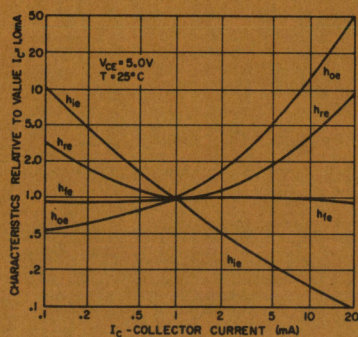
Reverse Transfer Admittance
VS
Frequency - Input Short Circuit



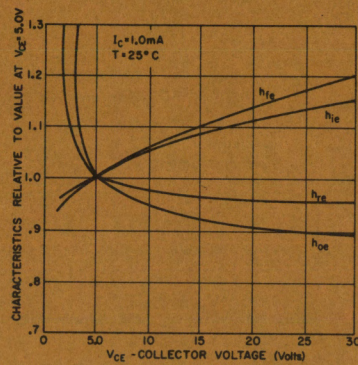
Forward Transfer Admittance
VS
Frequency - Output Short Circuit



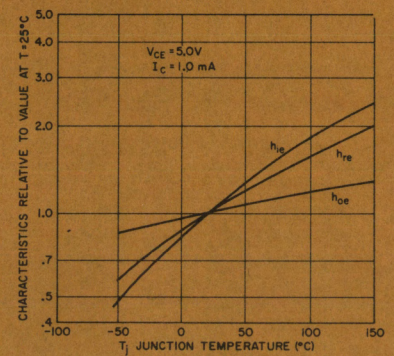
Typical Common Emitter Characteristics



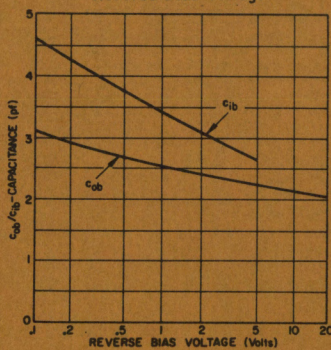
Typical Common Emitter Characteristics



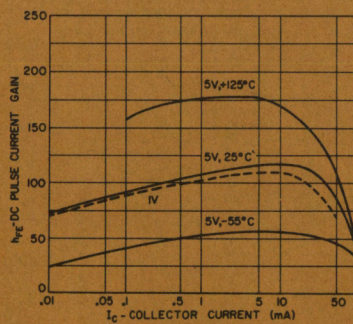
Typical Common Emitter Characteristics



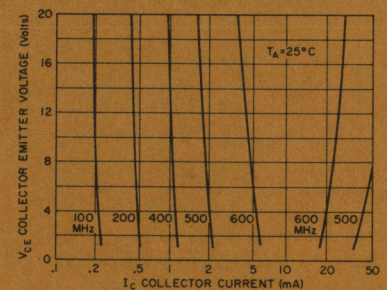
Output and Input Capacitance
VS
Reverse Bias Voltage



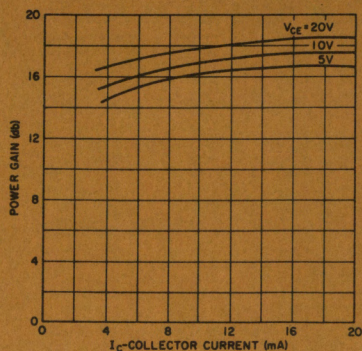
DC Pulse Current Gain
VS
Collector Current



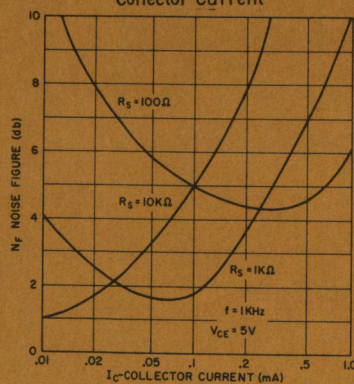
Contours of Constant Gain
Bandwidth Product - f_T



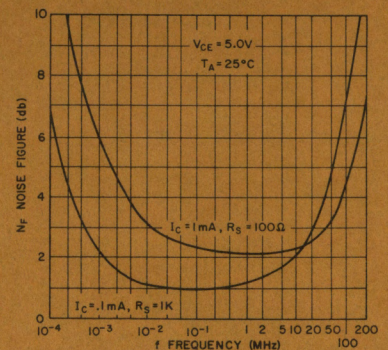
Neutralized 200 MHz Power Gain vs I_C



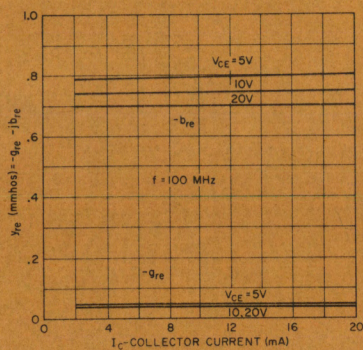
Noise Figure
VS
Collector Current



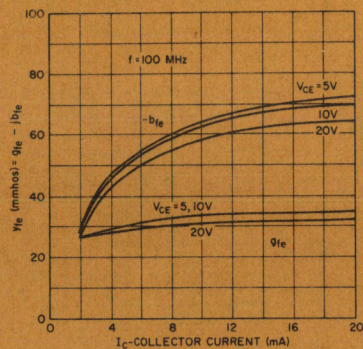
Noise Figure
VS
Frequency



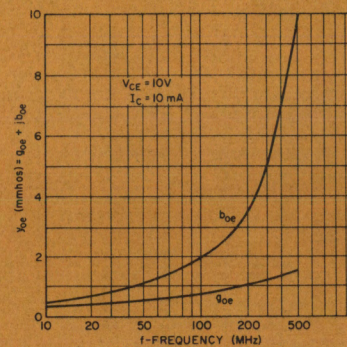
Reverse Transfer Admittance
vs
Collector Current and
Voltage-Input Short Circuit



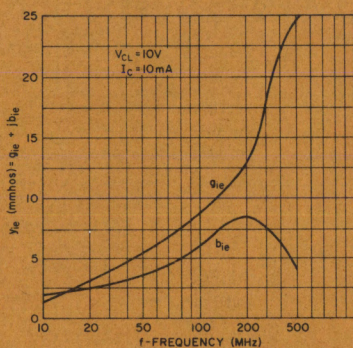
Forward Transfer Admittance
vs
Collector Current and
Voltage-Output Short Circuit



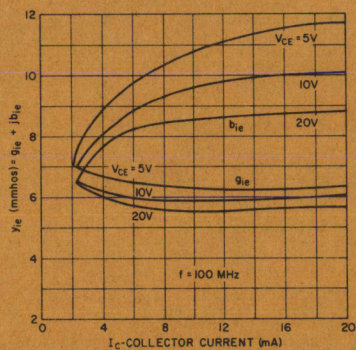
Output Admittance
vs
Frequency - Input Short Circuit



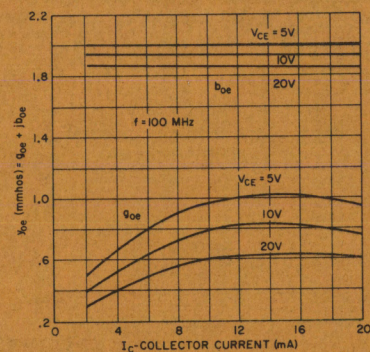
Input Admittance
vs
Frequency - Output Short Circuit



Input Admittance
vs
Collector Current and
Voltage-Output Short Circuit



Output Admittance
vs
Collector Current and
Voltage-Output Short Circuit





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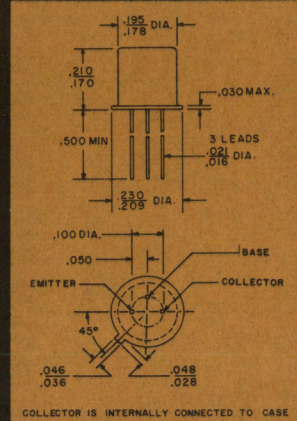
- HIGH FREQUENCY
- HIGH VOLTAGE
- HIGH CURRENT GAIN

JANUARY 1968

2N916
2N916A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING		UNIT
Collector-Base Voltage	V_{CBO}	2N916, 2N916A 45	2N916B 60	Volts
Collector-Emitter Voltage	V_{CEO}	25	30	Volts
Emitter-Base Voltage	V_{EBO}	5	5	Volts
Collector Current	I_C	Limited by Dissipation Only		
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	0.36 1.2 0.68		Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.1 6.85		mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200		$^\circ\text{C}$
Junction Temperature	T_J	+200		$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage 2N916, 2N916A 2N916B	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$ $I_C = 10 \mu\text{A}, I_E = 0$	45 60		Volts Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 10 \mu\text{A}, I_C = 0$	5		Volts
Collector-Emitter Sustaining Voltage 2N916, 2N916A 2N916B	$V_{CE(sus)}^*$	$I_C = 10 \text{ mA}, I_B = 0$	25 30		Volts Volts
Collector Saturation Voltage 2N916, 2N916A 2N916B	$V_{CE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$		0.5 0.2	Volts Volts
Collector Saturation Voltage 2N916A 2N916B	$V_{CE(sat)}$	$I_C = 100 \text{ mA}, I_B = 10 \text{ mA}$		1.0 0.5	Volts Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$		0.9	Volts
Base Saturation Voltage 2N916A 2N916B	$V_{BE(sat)}$	$I_C = 100 \text{ mA}, I_B = 10 \text{ mA}$		1.3 1.2	Volts
Collector-Base Cutoff Current 2N916, 2N916A 2N916B 2N916, 2N916A 2N916B	I_{CBO}	$V_{CB} = 30 \text{ V}, I_E = 0$ $V_{CB} = 45 \text{ V}, I_E = 0$ $V_{CB} = 30 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$ $V_{CB} = 45 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		10 2 10 3	nA μA
Emitter-Base Cutoff Current 2N916B	I_{EBO}	$V_{EB} = 3 \text{ V}, I_C = 0$		2	nA
DC Pulse Current Gain	h_{FE}^*	$I_C = 10 \text{ mA}, V_{CE} = 5 \text{ V}$	50	200	
DC Pulse Current Gain 2N916A, 2N916B	h_{FE}^*	$I_C = 100 \text{ mA}, V_{CE} = 1 \text{ V}$	15		



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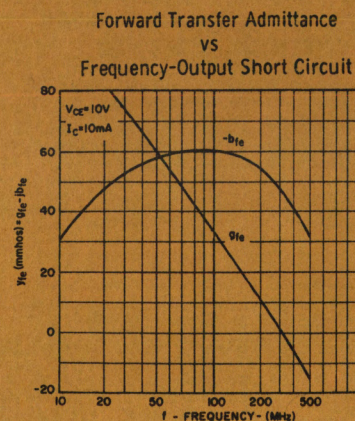
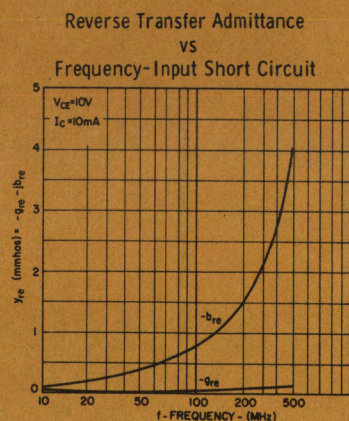
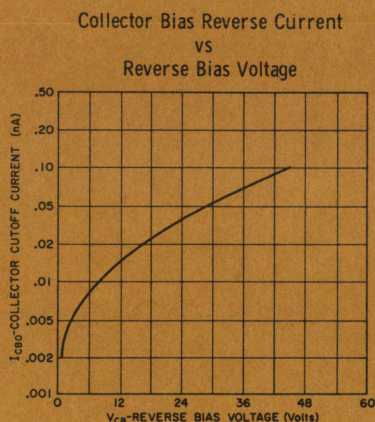
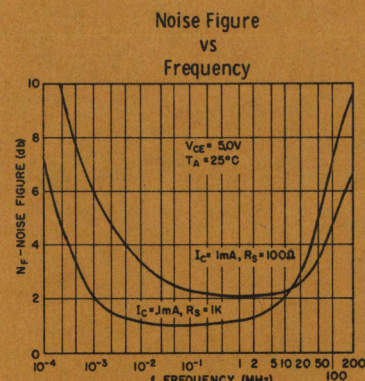
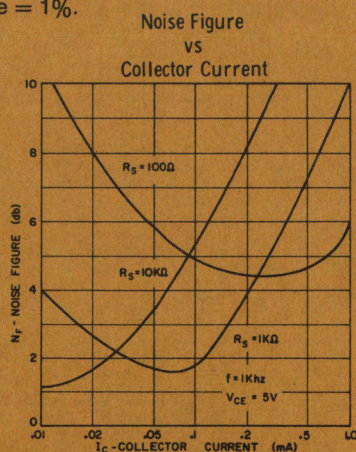
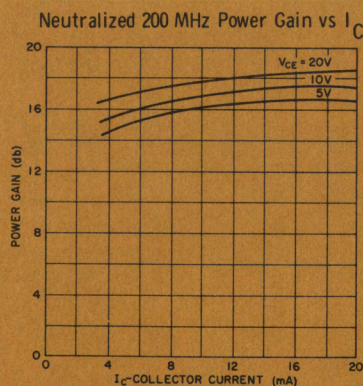
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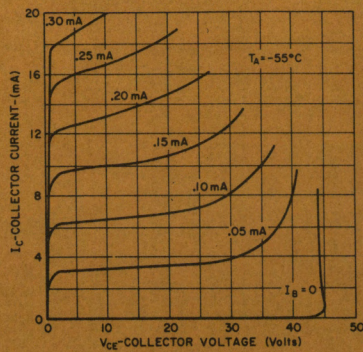
TWX: (910) 379-6494

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
DC Pulse Current Gain 2N916B All Types All Types All Types	h_{FE}^*	$I_C = 10 \mu A, V_{CE} = 5 V$ $I_C = 100 \mu A, V_{CE} = 5 V$ $I_C = 1.0 mA, V_{CE} = 5 V$ $I_C = 10 mA, V_{CE} = 1 V$	50 50 50 50	200 200 200 200	
High Frequency Current Gain 2N916, 2N916A 2N916B	$ h_{fe} $	$I_C = 10 mA, V_{CE} = 15 V$ $f = 100 MHz$	3.0 5.0		
Small Signal Current Gain	h_{fe}	$I_C = 5 mA, V_{CE} = 5 V$ $f = 1 kHz$	50	250	
Small Signal Current Gain 2N916, 2N916A 2N916B	h_{fe}	$I_C = 1 mA, V_{CE} = 5 V$ $f = 1 kHz$	40 50	200 200	
Output Capacitance 2N916, 2N916A 2N916B	C_{ob}	$V_{CB} = 5 V, I_E = 0$		6 3	pf pf
Input Capacitance 2N916, 2N916A 2N916B	C_{ib}	$V_{EB} = 0.5 V, I_C = 0$		10 5	pf pf
Input Resistance	h_{ie}	$I_C = 5 mA, V_{CE} = 5 V$ $f = 1 kHz$ $I_C = 1 mA, V_{CE} = 5 V$ $f = 1 kHz$		2000 6000	ohms ohms
Output Conductance	h_{oe}	$I_C = 1 mA, V_{CE} = 5 V$ $f = 1 kHz$ $I_C = 5 mA, V_{CE} = 5 V$ $f = 1 kHz$		75 125	$\mu mhos$ $\mu mhos$
Collector-Base Time Constant	$r_b' C_c$	$I_C = 10 mA, V_{CB} = 10 V$ $f = 40 MHz$		300	psec
Noise Figure 2N916B	NF	$I_C = 10 \mu A, V_{CE} = 5 V$ $f = 1 kHz$ $R_S = 10 K$ $BW = 200 Hz$		4.0	db

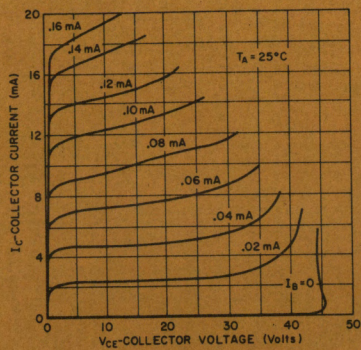
* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle = 1%.



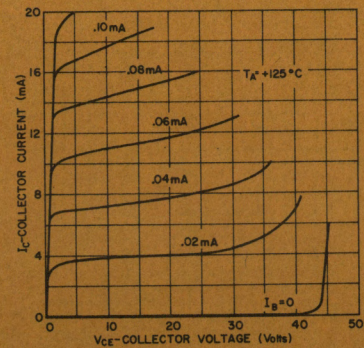
Collector Characteristics



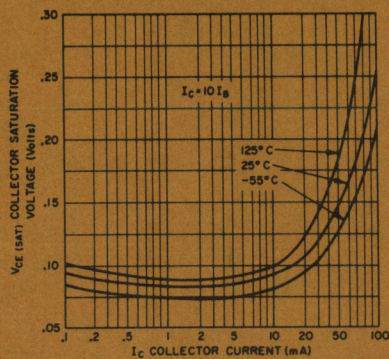
Collector Characteristics



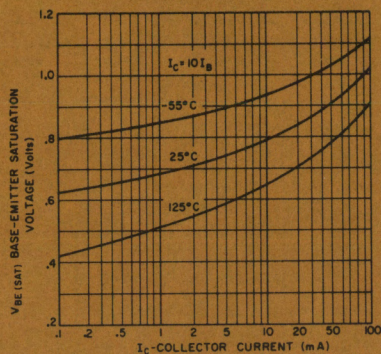
Collector Characteristics



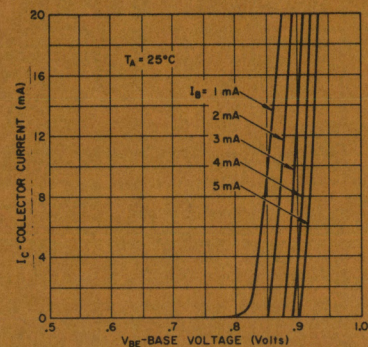
Collector Saturation Voltage
vs
Collector Current



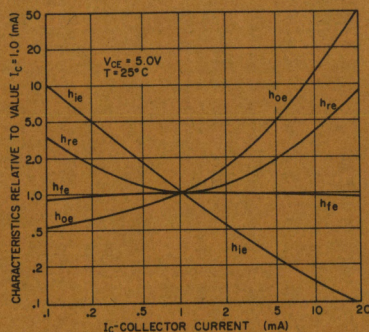
Base-Emitter Saturation Voltage
vs
Collector Current



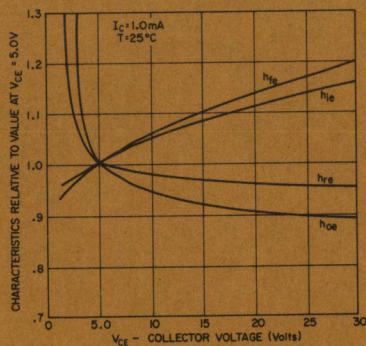
Typical Base Characteristics



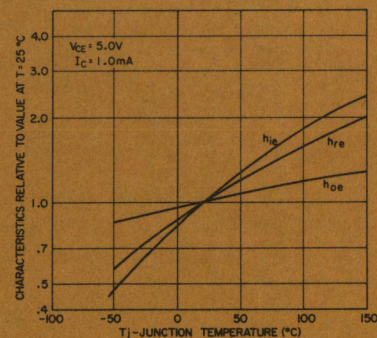
Typical Common Emitter Characteristics



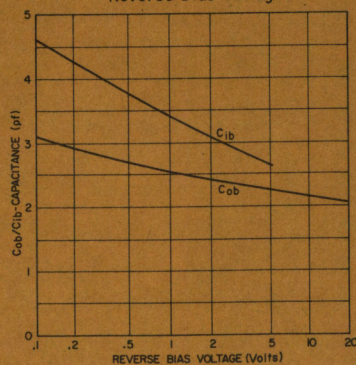
Typical Common Emitter Characteristics



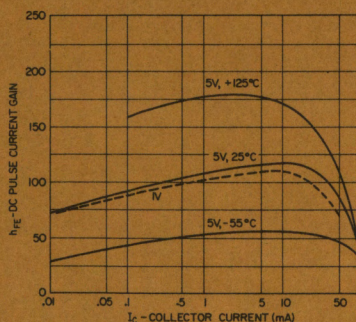
Typical Common Emitter
Characteristics



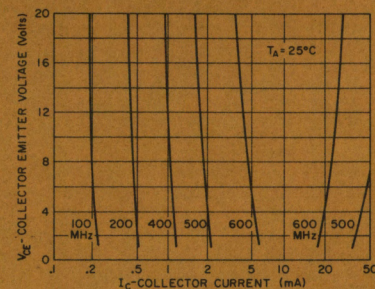
Output and Input Capacitance
vs
Reverse Bias Voltage



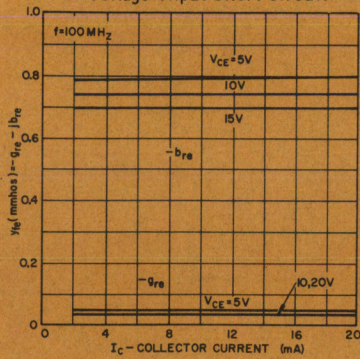
DC Pulse Current Gain
vs
Collector Current



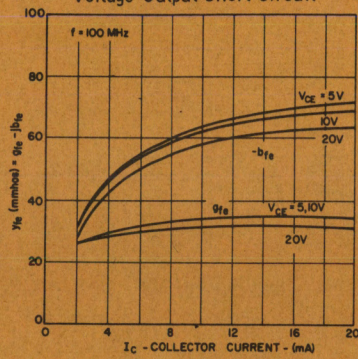
Contours of Constant Gain
Bandwidth Product - fT



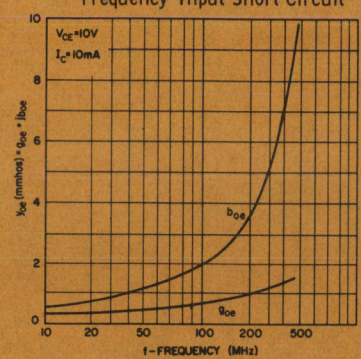
Reverse Transfer Admittance
VS
Collector Current and
Voltage-Input Short Circuit



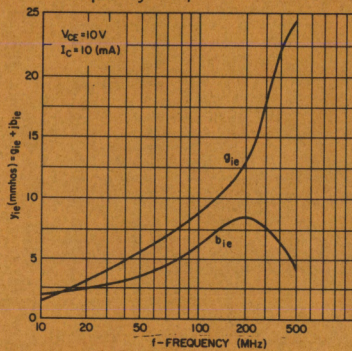
Forward Transfer Admittance
VS
Collector Current and
Voltage-Output Short Circuit



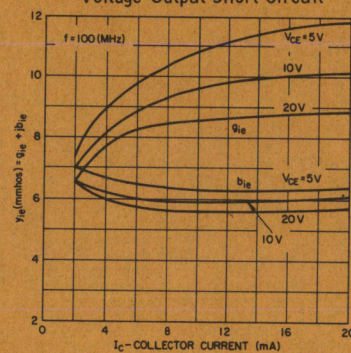
Output Admittance
VS
Frequency-Input Short Circuit



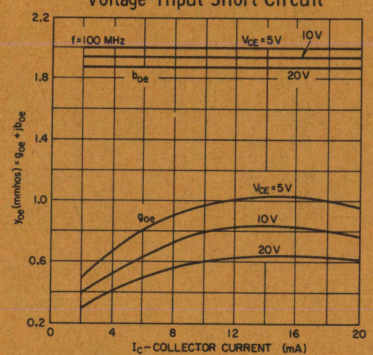
Input Admittance
VS
Frequency-Output Short Circuit



Input Admittance
VS
Collector Current and
Voltage-Output Short Circuit



Output Admittance
VS
Collector Current and
Voltage-Input Short Circuit





NPN TRANSISTOR RF/IF AMPLIFIER

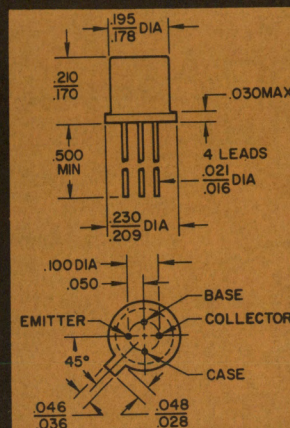
- HIGH FREQUENCY
- LOW SATURATION VOLTAGE
- LOW CAPACITANCE

JANUARY 1968

2N918

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	30	Volts
Collector-Emitter Voltage	V_{CEO}	15	Volts
Emitter-Base Voltage	V_{EBO}	3.0	Volts
Collector Current	I_C	50	mA
Total Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	0.2 0.3	Watt
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$		2.0	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +300	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 1.0 \mu\text{A}$, $I_E = 0$	30		Volts
Collector-Emitter Sustaining Voltage	$V_{CE(sus)}^*$	$I_C = 3 \text{ mA}$, $I_B = 0$	15		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 10 \mu\text{A}$, $I_C = 0$	3		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$		0.4	Volt
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$		1.0	Volt
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 15 \text{ V}$, $I_E = 0$ $V_{CB} = 15 \text{ V}$, $T_A = 150^\circ\text{C}$, $I_E = 0$		10 1.0	nA μA
DC Current Gain	h_{FE}	$V_{CE} = 1.0 \text{ V}$, $I_C = 3.0 \text{ mA}$	20		
High Frequency Current Gain	$ h_{fe} $	$I_C = 4.0 \text{ mA}$ $V_{CE} = 10 \text{ V}$ $f = 100 \text{ MHz}$	6.0		
Output Capacitance	C_{ob}	$V_{CB} = 10 \text{ V}$ $I_E = 0$, $f = 140 \text{ kHz}$ $V_{CB} = 0$, $f = 140 \text{ kHz}$ $I_E = 0$		1.7 3.0	pf
Input Capacitance	C_{ib}	$V_{EB} = 0.5 \text{ V}$ $I_C = 0$, $f = 140 \text{ kHz}$		2.0	pf
Collector Efficiency	η	$V_{CB} = 15 \text{ V}$ $f = 500 \text{ MHz}$ $I_C = 8.0 \text{ mA}$	25		%
Available Power Gain	A_p	$I_C = 6.0 \text{ mA}$ $V_{CB} = 12 \text{ V}$ $f = 200 \text{ MHz}$ (Figure 1)	15		db
Power Output	P_o	$I_C = 8.0 \text{ mA}$ $V_{CB} = 15 \text{ V}$ $f = 500 \text{ MHz}$ (Figure 2)	30		mW
Noise Figure	NF	$I_C = 1.0 \text{ mA}$ $V_{CE} = 6.0 \text{ V}$ $f = 60 \text{ MHz}$ $R_G = 400 \Omega$		6	db

* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle = 1%.



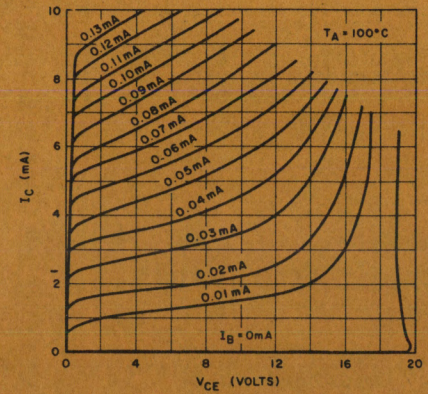
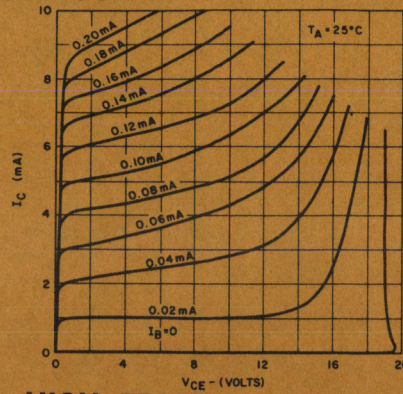
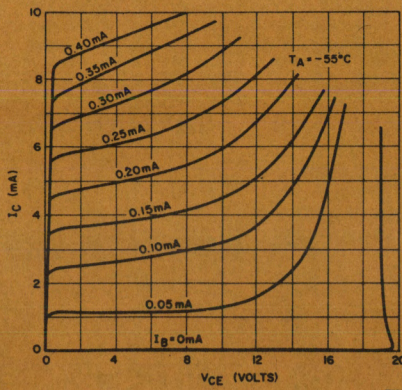
AMELCO SEMICONDUCTOR 1300 Terra Bella Ave. • Mountain View • Calif. 94040

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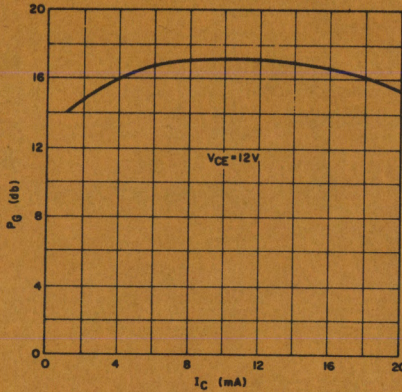
Phone (415) 968-9241

TWX: (910) 379-6494

TYPICAL COLLECTOR CHARACTERISTICS



200 MHz Power Gain
VS
Collector Current



500 MHz Oscillator
Test Circuit

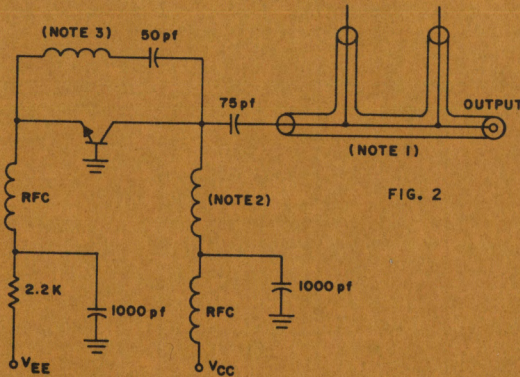


FIG. 2

Neutralized 200 MHz Power
Gain Amplifier Test Circuit

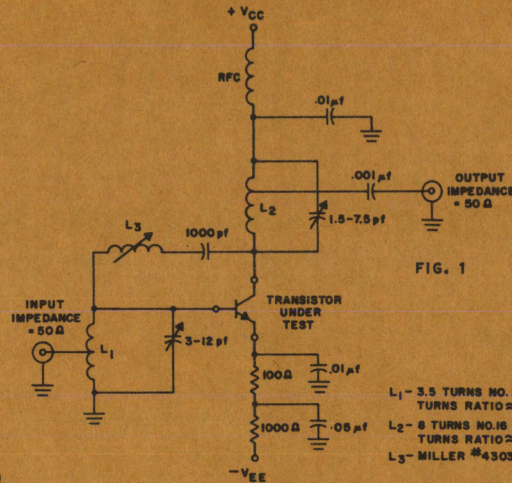


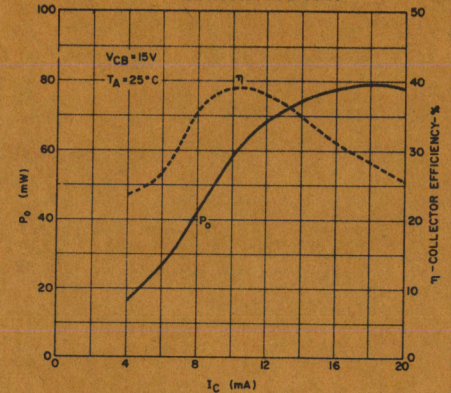
FIG. 1

L₁ - 3.5 TURNS NO. 16 TINNED COPPER WIRE; $\frac{5}{16}$ DIA; $\frac{7}{8}$ LONG.
TURNS RATIO ≈ 4 TO 2
L₂ - 8 TURNS NO. 16 TINNED COPPER WIRE; $\frac{1}{8}$ DIA; $\frac{7}{8}$ LONG
TURNS RATIO ≈ 8 TO 1
L₃ - MILLER #4303 (.4-.65 μH)

NOTES:

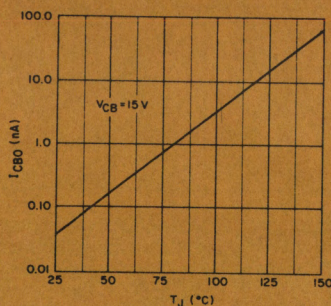
- (1) COAX PLUMBING CONSIST OF THE FOLLOWING GR AIR LINES:
2 TYPE 874 TEE
1 TYPE 874-D20 ADJUSTABLE STUB
1 TYPE 874-LA ADJUSTABLE STUB
1 TYPE 874-WN3 SHORT-CIRCUIT TERMINATION
- (2) 2 TURNS #16 AWG WIRE, 3/8 INCH OD, 1 1/4 INCH LONG
- (3) 9 TURNS #22 AWG WIRE, 3/16 INCH OD, 1/2 INCH LONG

500 MHz Power Output and
Collector Efficiency
VS
Collector Current

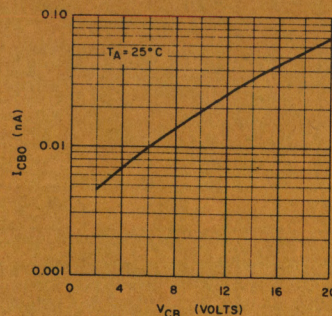


TYPICAL ELECTRICAL CHARACTERISTICS

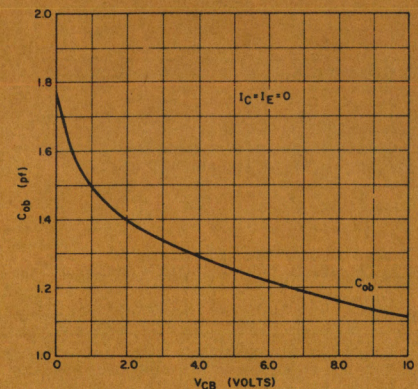
Collector-Base Diode
Reverse Current
VS
Temperature



Collector-Base Diode
Reverse Current
VS
Voltage



Output Capacitance
VS
Reverse Bias Voltage

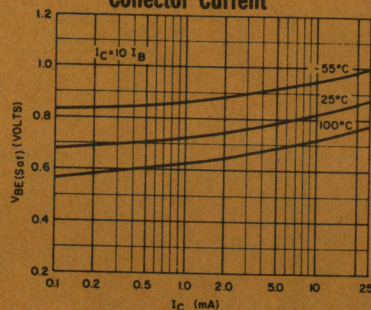


TYPICAL ELECTRICAL CHARACTERISTICS

Base Saturation Voltage

VS

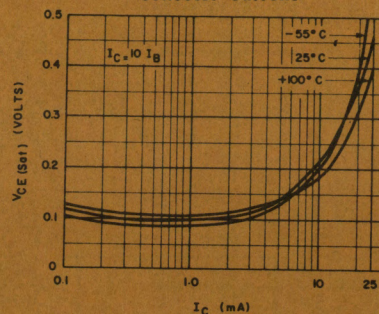
Collector Current



Collector Saturation Voltage

VS

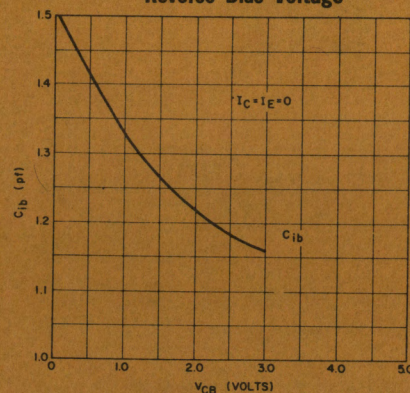
Collector Current



Input Capacitance

VS

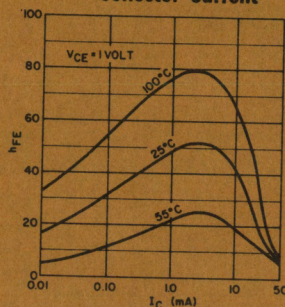
Reverse Bias Voltage



Pulsed DC Current Gain

VS

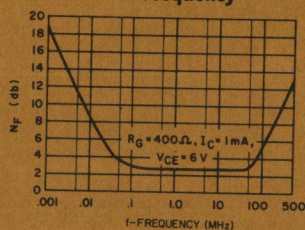
Collector Current



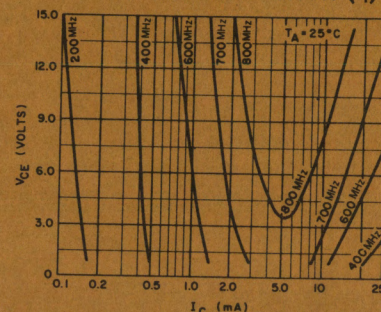
Noise Figure

VS

Frequency

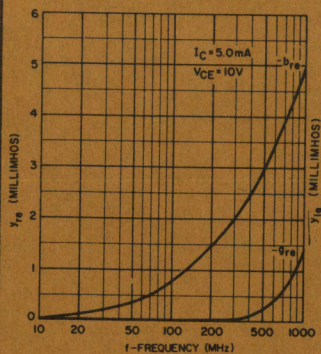


Contours of Constant Gain Bandwidth Product (f_T)

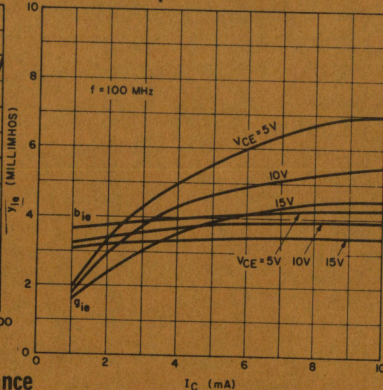


TYPICAL SMALL SIGNAL PARAMETERS

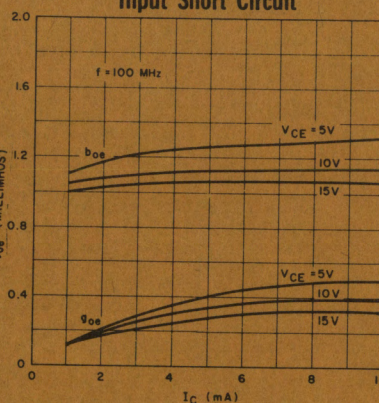
Reverse Transfer Admittance
VS
Frequency — Input Short Circuit



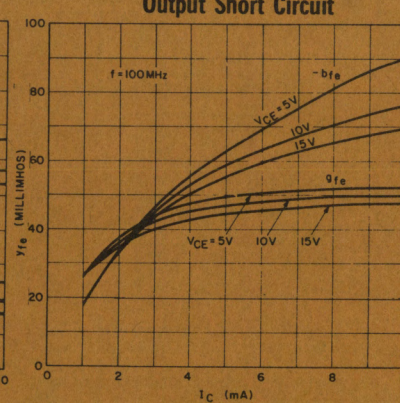
Input Admittance
VS
Collector Current —
Output Short Circuit



Output Admittance
VS
Collector Current —
Input Short Circuit



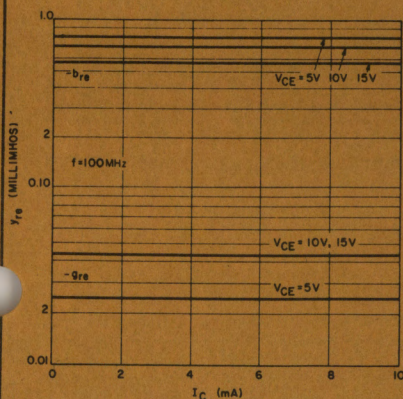
Forward Transfer Admittance
VS
Collector Current —
Output Short Circuit



Reverse Transfer Admittance

VS

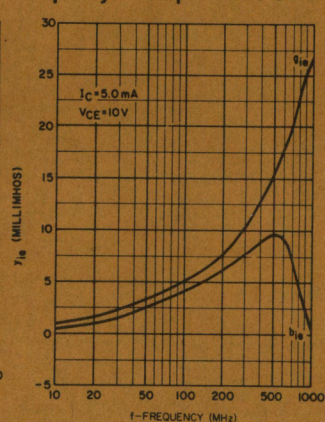
Collector Current —
Input Short Circuit



Input Admittance

VS

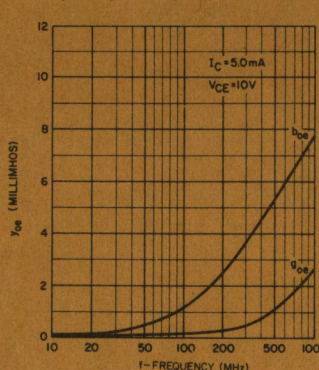
Frequency — Output Short Circuit



Output Admittance

VS

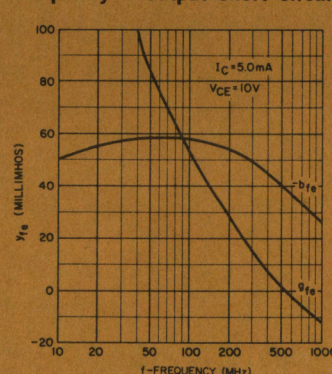
Frequency — Input Short Circuit



Forward Transfer Admittance

VS

Frequency — Output Short Circuit





NPN TRANSISTOR RF/IF AMPLIFIER

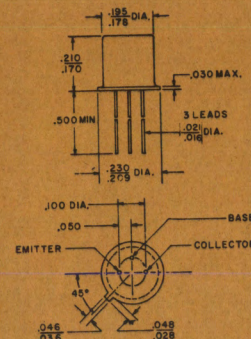
- HIGH FREQUENCY
- LOW SATURATION VOLTAGE
- FAST SWITCHING SPEEDS

JANUARY 1968

2N2369A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	40	Volts
Collector-Emitter Voltage	V_{CES}	40	Volts
Collector-Emitter Voltage	V_{CEO}	15	Volts
Emitter-Base Voltage	V_{EBO}	4.5	Volts
Collector Current	I_C	200	mA
Total Device Dissipation	P_D		Watt
@ $T_A = 25^\circ\text{C}$		0.36	
@ $T_C = 25^\circ\text{C}$		1.2	
@ $T_C = 100^\circ\text{C}$		0.68	
Derating Factor Above 25°C			mW/ $^\circ\text{C}$
@ $T_A = 25^\circ\text{C}$		2.1	
@ $T_C = 25^\circ\text{C}$		6.85	
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_B = 0$	40		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}$	$I_C = 10 \text{ mA}, I_B = 0$	15		Volts
Collector-Emitter Voltage	BV_{CES}	$I_C = 10 \mu\text{A}, I_B = 0$	40		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 10 \mu\text{A}, I_C = 0$	4.5		Volts
Base Current	I_B	$V_{CE} = 20 \text{ V}, V_{BE} = 0$		-0.4	μA
Collector-Emitter Cutoff Current	I_{CES}	$V_{CE} = 20 \text{ V}, V_{BE} = 0$		0.4	μA
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $I_C = 30 \text{ mA}, I_B = 3 \text{ mA}$ $I_C = 100 \text{ mA}, I_B = 10 \text{ mA}$ $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $T_A = 125^\circ\text{C}$		0.2 0.25 0.5 0.3	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $I_C = 30 \text{ mA}, I_B = 3 \text{ mA}$ $I_C = 100 \text{ mA}, I_B = 10 \text{ mA}$ $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $T_A = 125^\circ\text{C}$ $I_C = 10 \text{ mA}, I_B = 1 \text{ mA}$ $T_A = -55^\circ\text{C}$	0.7 0.59	0.85 1.15 1.6 1.02	Volts
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 20 \text{ V}, I_E = 0$ $V_{CB} = 20 \text{ V}, T_A = 150^\circ\text{C}$		0.4 30	μA
DC Pulse Current Gain	h_{FE}	$I_C = 10 \text{ mA}, V_{CE} = 0.35 \text{ V}$ $I_C = 10 \text{ mA}, V_{CE} = 0.35 \text{ V}, T_A = -55^\circ\text{C}$ $I_C = 100 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 30 \text{ mA}, V_{CE} = 0.4 \text{ V}$	40 20 20 20	120	
High Frequency Current Gain	$ h_{fe} $	$I_C = 10 \text{ mA}, V_{CE} = 10 \text{ V}, f = 100 \text{ MHz}$	5		
Output Capacitance	C_{ob}	$V_{CB} = 5 \text{ V}, I_E = 0, f = 140 \text{ kHz}$		4	pf
Storage Time	$t_s(\tau_s)$	$I_C = I_{B1} = I_{B2} = 10 \text{ mA}$ (See Figure 1)		13	nsec
Turn-On Time	t_{on}	$I_C = 10 \text{ mA}, I_{B1} = 3 \text{ mA}, V_{CC} = 3 \text{ V}, V_{OB} = 1.5 \text{ V}$ (See Figure 2)		12	nsec
Turn-Off Time	t_{off}	$I_C = 10 \text{ mA}, I_{B1} = 3 \text{ mA}, I_{B2} = 1.5 \text{ mA}, V_{CC} = 3 \text{ V}$ (See Figure 2)		18	nsec

* Pulse Test: Pulse Width = 300 μsec , Duty Cycle = 2%



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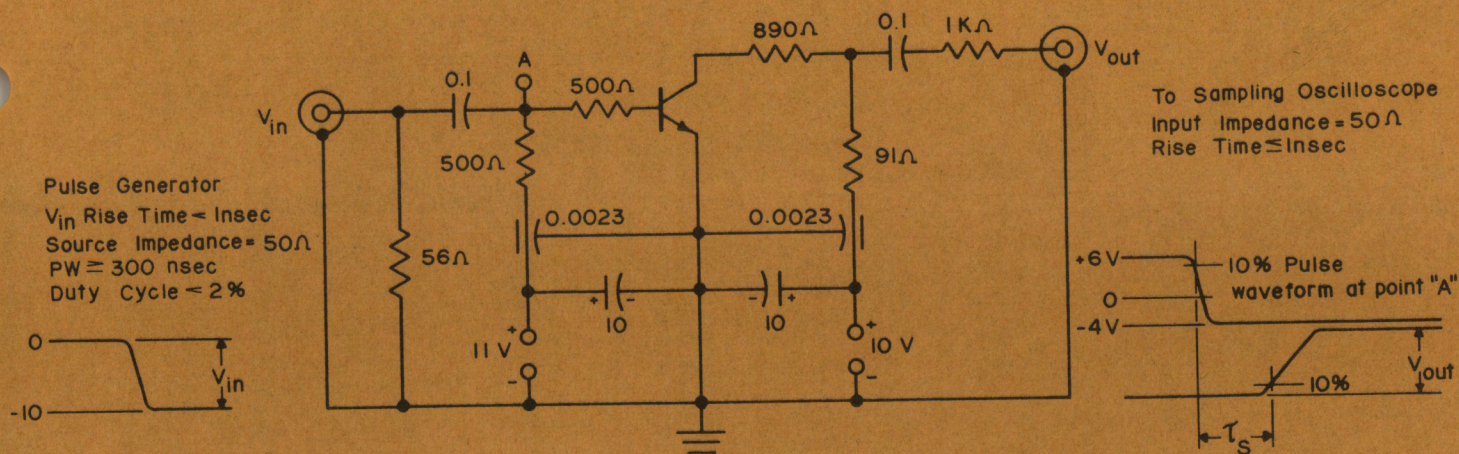


FIGURE 1

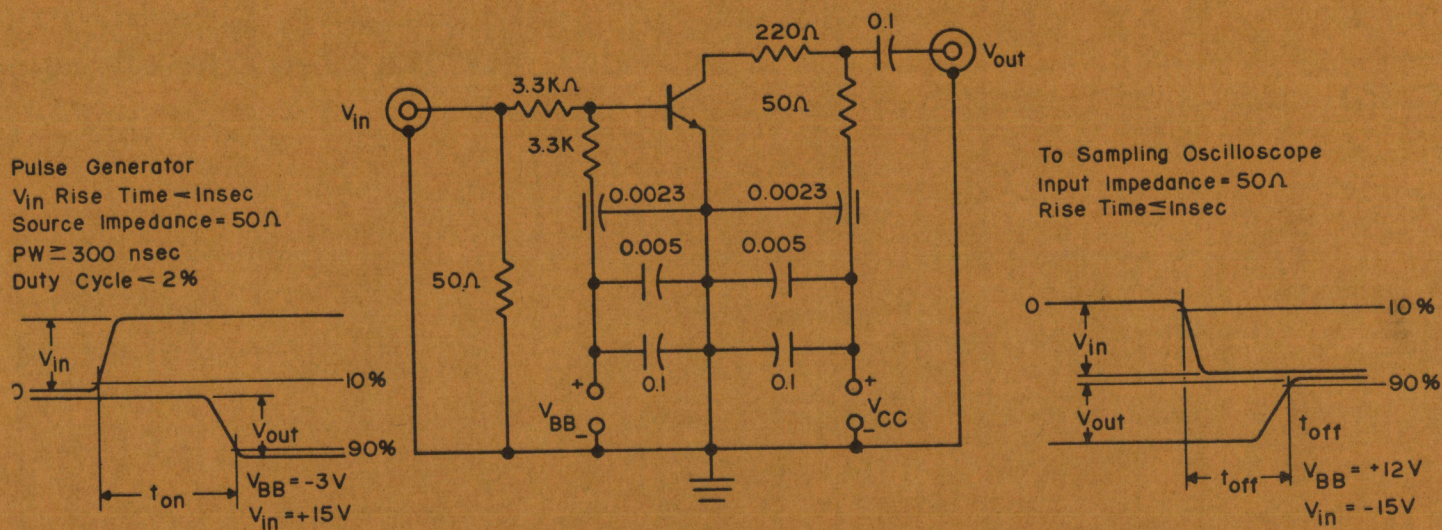


FIGURE 2





NPN TRANSISTOR

RF/IF AMPLIFIER

- HIGH FREQUENCY
- LOW LEAKAGE
- HIGH POWER GAIN

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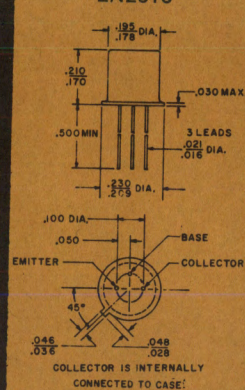
2N2616

2N2729

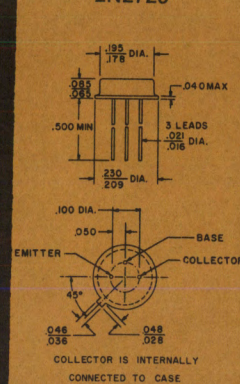
MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	30	Volts
Collector-Emitter Voltage	V_{CEO}	15	Volts
Emitter-Base Voltage	V_{EBO}	3.0	Volts
Collector Current	I_C	50	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	0.3 0.8	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.1 4.56	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +300	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$

2N2616



2N2729



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 1.0 \mu\text{A}$, $I_E = 0$	30		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0$, $I_E = 10 \mu\text{A}$	3.0		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}^*$	$I_C = 3.0 \text{ mA}$, $I_B = 0$	15		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$		0.4	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$		1.0	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0$, $V_{CB} = 15 \text{ V}$ $I_E = 0$, $V_{CB} = 15 \text{ V}$, $T_A = 150^\circ\text{C}$		1.0 1.0	nA μA
DC Pulsed Current Gain	h_{FE}^*	$I_C = 3.0 \text{ mA}$, $V_{CE} = 1.0 \text{ V}$	20		
High Frequency Current Gain	$ h_{fe} $	$I_C = 4.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 100 \text{ MHz}$	6.0		
Output Capacitance	C_{ob}	$I_E = 0$, $V_{CB} = 10 \text{ V}$ $f = 140 \text{ kHz}$		2.8	pf
Input Capacitance	C_{ib}	$I_C = 0$, $V_{BE} = 0.5 \text{ V}$ $f = 140 \text{ kHz}$		2.0	pf
Available Power Gain (See Figure 1)	A_p	$I_C = 6.0 \text{ mA}$, $V_{CE} = 12 \text{ V}$ $f = 200 \text{ MHz}$ (Figure 1)	15		db
Power Output (See Figure 2)	P_o	$I_C = 8.0 \text{ mA}$, $V_{CE} = 15 \text{ V}$ $f = 500 \text{ MHz}$ (Figure 2)	30		mW
Noise Figure	NF	$f = 60 \text{ MHz}$ Source resistance = 400Ω $I_C = 1.0 \text{ mA}$, $V_{CE} = 6.0 \text{ V}$		6.0	db
Collector Efficiency	η	$I_C = 8.0 \text{ mA}$, $V_{CB} = 15 \text{ V}$ $f = 500 \text{ MHz}$	25		%

*Pulse Test: Pulse Width = 300 μsec ; Duty Cycle = 1%



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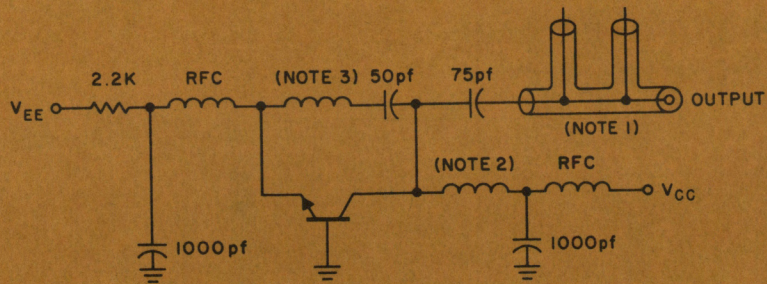
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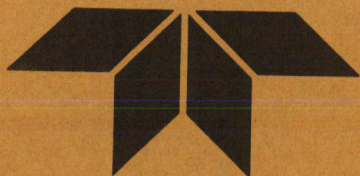
500 MHz OSCILLATOR TEST CIRCUIT



Notes:

- (1) Coax plumbing consists of the following GR air lines:
 - 2 Type 874 TEE
 - 1 Type 874 - D20 Adjustable Stub
 - 1 Type 874 - LA Adjustable Line
 - 1 Type 874 - WN3 Short-Circuit Termination
- (2) 2 turns #16 AWG wire, 3/8 inch OD, 1-1/4 inch long
- (3) 9 turns #22 AWG wire, 3/16 inch OD, 1/2 inch long





NPN TRANSISTOR

RF/IF AMPLIFIER

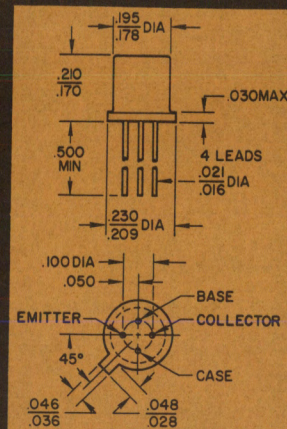
- HIGH FREQUENCY
- HIGH POWER GAIN
- LOW CAPACITANCE

JANUARY 1968

2N2708

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	35	Volts
Collector-Emitter Voltage	V_{CEO}	20	Volts
Emitter-Base Voltage	V_{EBO}	3.0	Volts
Collector Current	I_C	Limited by P_D only	
Total Device Dissipation $T_A = 25^\circ\text{C}$	P_D	0.2	Watts
Storage Temperature	T_{stg}	-65 to $+200$	$^\circ\text{C}$
Junction Temperature	T_J	$+200$	$^\circ\text{C}$
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$		1.14	mW/ $^\circ\text{C}$

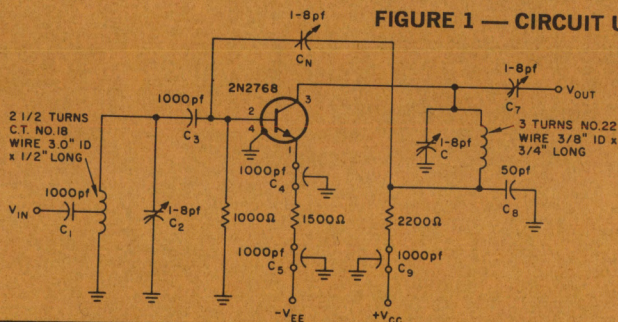


ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 1.0 \mu\text{A}$, $I_E = 0$	35		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0$, $I_E = 10 \mu\text{A}$	3.0		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}$	$I_C = 3.0 \text{ mA}$, $I_B = 0$	20		Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0$, $V_{CB} = 15 \text{ V}$ $I_E = 0$, $V_{CB} = 15 \text{ V}$, $T_A = 150^\circ\text{C}$		10 10	nA μA
DC Current Gain	h_{FE}	$I_C = 2.0 \text{ mA}$, $V_{CE} = 2.0 \text{ V}$	30	200	
Small Signal Current Gain	h_{fe}	$I_C = 2.0 \text{ mA}$, $V_{CE} = 15 \text{ V}$ $f = 1 \text{ kHz}$	30	180	
High Frequency Current Gain	$ h_{fe} $	$I_C = 2.0 \text{ mA}$, $V_{CE} = 15 \text{ V}$ $f = 100 \text{ MHz}$	7.0	12	
Output Capacitance	C_{ob}	$I_E = 0$, $V_{CB} = 15 \text{ V}$ $f = 140 \text{ kHz}$		1.5	pf
Collector-Base Time Constant	$r_b' C_c$	$I_C = 2.0 \text{ mA}$, $V_{CB} = 15 \text{ V}$ $f = 31.9 \text{ MHz}$, 4th Lead = gnd	15	33	psec
Available Power Gain Neutralized	G_{pe}	$I_C = 2.0 \text{ mA}$, $V_{CE} = 15 \text{ V}$ $f = 200 \text{ MHz}$ (Figure 1)	15	22	db
Noise Figure	NF	Source Resistance 50Ω $I_C = 2.0 \text{ mA}$, $V_{CE} = 15 \text{ V}$ $f = 200 \text{ MHz}$		8.5	db

* Pulse Test: Pulse Width = $300 \mu\text{sec}$; Duty Cycle = 1%.

FIGURE 1 — CIRCUIT USED TO MEASURE POWER GAIN AT 200 MHz



NOTE 1 (Neutralization Procedure): (a) Connect a 200 MHz signal generator (with $Z_{out} = 50 \text{ ohms}$) to the input terminals of the amplifier. (b) Connect a 50-ohm r-f voltmeter across the output terminals of the amplifier. (c) Apply V_{EE} and V_{CC} , and with the signal generator adjusted for 10 mV output, tune C_2 , C_4 , and C_6 for maximum output. (d) Interchange the connections to the signal generator and the output indicator. (e) With sufficient signal applied to the output terminals of the amplifier, adjust C_4 for a minimum indication at the input. (f) Repeat steps (a), (b), and (c) to determine if retuning is necessary.



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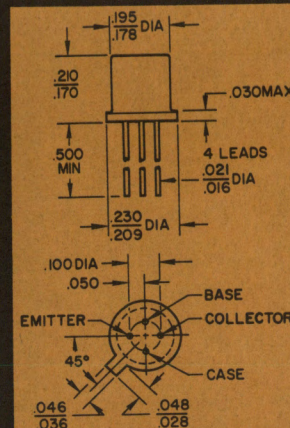
- HIGH POWER GAIN
- HIGH FREQUENCY
- LOW SATURATION VOLTAGE

JANUARY 1968

2N2865

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	25	Volts
Collector-Emitter Voltage	V_{CEO}	13	Volts
Emitter-Base Voltage	V_{EBO}	3.0	Volts
Collector Current	I_C	50	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	0.2 0.3	Watts
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$		1.14	mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 1.0 \mu\text{A}$, $I_E = 0$	25		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0$, $I_E = 10 \mu\text{A}$	3.0		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}$ *	$I_C = 4.0 \text{ mA}$, $I_B = 0$	13		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$		0.4	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$		1.0	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0$, $V_{CB} = 15 \text{ V}$ $I_E = 0$, $V_{CB} = 15 \text{ V}$, $T_A = 150^\circ\text{C}$		10 1.0	nA μA
DC Current Gain	h_{FE}	$I_C = 4.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$	20	200	
Small Signal Current Gain	h_{fe}	$I_C = 4.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 1 \text{ kHz}$	20	200	
High Frequency Current Gain	$ h_{fe} $	$I_C = 4.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 200 \text{ MHz}$	3.0		
Output Capacitance	C_{ob}	$I_E = 0$, $V_{CB} = 10 \text{ V}$ $f = 1 \text{ MHz}$		2.5	pf
Collector-Base Time Constant	$r_b'C_c$			15	psec
Neutralized Small-Signal Power Gain	G_{pe}	$I_C = 4.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 200 \text{ MHz}$ (Figure 1)	16.5		db
Unneutralized Small-Signal Power Gain	G_{pe}	$I_C = 4.0 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 200 \text{ MHz}$ (Figure 2)	10		db
Power Output	P_o	$I_E = -12 \text{ mA}$, $V_{CB} = 10 \text{ V}$ $f = 500 \text{ MHz}$ (Figure 3)	40		mW
Spot Noise Figure	NF	$f = 200 \text{ MHz}$ Source resistance = 75Ω $I_E = 1.5 \text{ mA}$, $V_{CB} = 10 \text{ V}$		4.5	db

* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle = 1%.



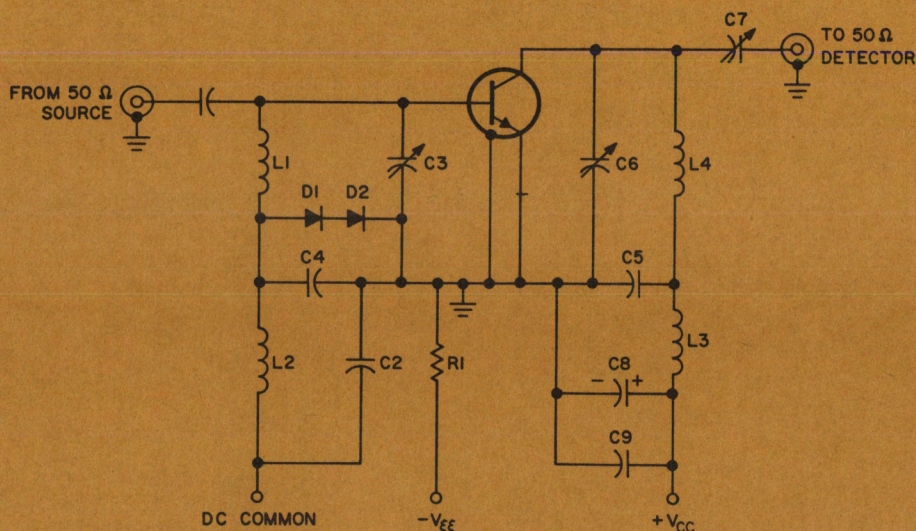
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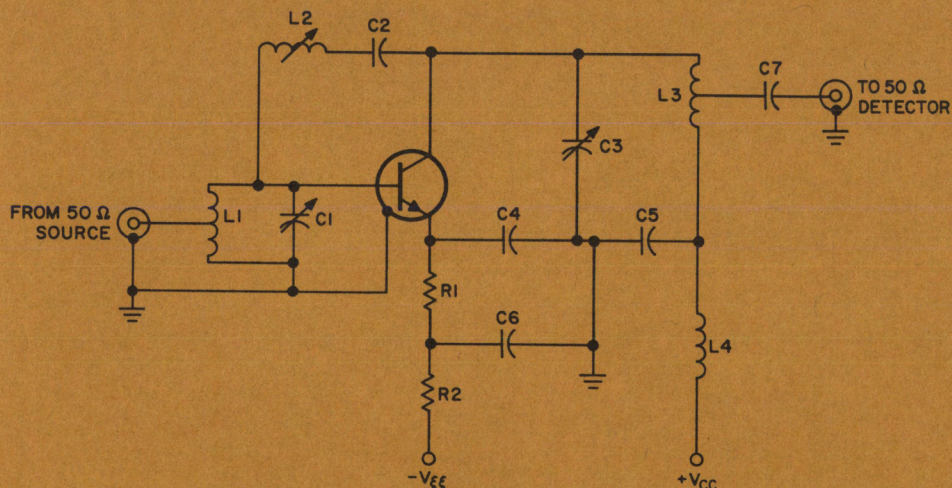
TWX: (910) 379-6494



CIRCUIT COMPONENT INFORMATION

C1, C2, and C9: 0.05 μ f
 C3: 1.5—10 pf
 C4 and C5: 1000 pf
 C6 and C7: 3—15 pf
 C8: 25 μ f
 R1: 2.2 k Ω
 L1: 1 T #12 AWG, 2 cm ID
 L2 and L3: 200 MHz RFC
 L4: 1/2 T #12 AWG, 3 cm ID
 D1 and D2: 1N2070

FIGURE 1 — NEUTRALIZED 200 MHz INSERTION POWER GAIN TEST CIRCUIT



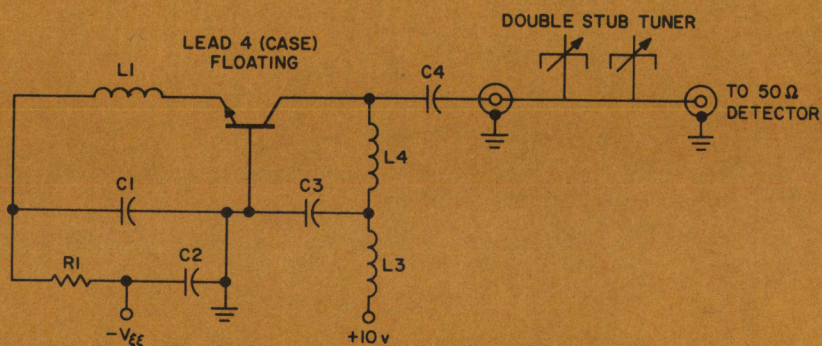
NEUTRALIZATION ADJUSTMENT PROCEDURE

After tuning amplifier as for normal gain measurement, reverse input and output connections and tune L2 for minimum indication on detector.

CIRCUIT COMPONENT INFORMATION

C1: 3—12 pf
 C2: 1000 pf
 C3: 1.5—7.5 pf
 C4 and C5: 0.01 μ f
 L1: 3 1/2 T #16 AWG, 5/16" ID, 1" length,
 Turns Ratio $\approx$ 3 1/2 to 3
 L2: 0.4—1.0 μ h, Q $\geq$ 75
 L3: 8 T #16 AWG, 1/8" ID, 7/8" length,
 Turns Ratio $\approx$ 8 to 1
 L4: 200 MHz RFC
 C6: 0.05 μ f
 C7: 0.001 μ f
 R1: 100 Ω
 R2: 1 k Ω

FIGURE 2 — UNNEUTRALIZED 200 MHz INSERTION POWER GAIN TEST CIRCUIT



CIRCUIT COMPONENT INFORMATION

C1, C2 and C3: 1000 pf
 C4: 250 pf
 R1: 2.2 k Ω
 L1: 7 T #22 AWG, 1/8" ID, 1/2" length
 L2: 3 3/4 T #18 AWG, 1/2" ID, 3/4" length
 L3: 500 MHz RFC
 Double Stub Tuner: Weinschel
 DS 109L (or equivalent)

FIGURE 3 — 500 MHz OSCILLATOR POWER OUTPUT TEST CIRCUIT





NPN TRANSISTOR RF/IF AMPLIFIER

- HIGH FREQUENCY
- LOW SATURATION VOLTAGE
- LOW CAPACITANCE

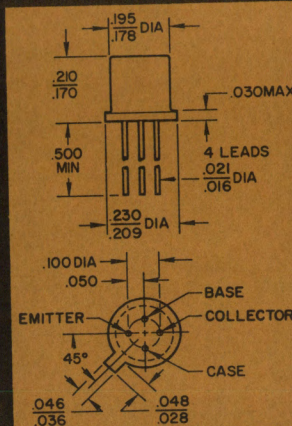
JANUARY 1968

2N3289

2N3290

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	2N3289 2N3290	UNIT
Collector-Base Voltage	V_{CBO}	30	Volts
Collector-Emitter Voltage	V_{CES}	30	Volts
Collector-Emitter Voltage	V_{CEO}	15	Volts
Emitter-Base Voltage	V_{EBO}	3.0	Volts
Collector Current	I_C	50	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	200 300	mW
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		1.14 1.71	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	30		Volts
Collector-Emitter Breakdown Voltage	BV_{CES}	$I_C = 10 \mu\text{A}, V_{BE} = 0$	30		Volts
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 2.0 \text{ mA}, I_B = 0$	15		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 10 \mu\text{A}, I_C = 0$	3.0		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 5 \text{ mA}, I_B = 0.5 \text{ mA}$		0.4	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 5 \text{ mA}, I_B = 0.5 \text{ mA}$		1.0	Volts
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 15 \text{ V}$		.010	μA
DC Current Gain	h_{FE}	$V_{CE} = 10 \text{ V}, I_C = 2 \text{ mA}$	10	150	
Small Signal Current Gain	h_{fe}	$V_{CE} = 10 \text{ V}, I_C = 2 \text{ mA}$ $f = 1 \text{ kHz}$	10	200	
Output Capacitance	C_{ob}^*	$V_{CB} = 10 \text{ V}, I_E = 0$ $f = 0.1 \text{ MHz}$		1.5	pf
Collector-Base Time Constant	$r_b'C_c$	$V_{CB} = 10 \text{ V}, I_C = 2 \text{ mA}$ $f = 31.8 \text{ MHz}$	3	20	psec
High Frequency Current Gain	$ h_{fe} $	$I_C = 2 \text{ mA}, V_{CE} = 10 \text{ V}$ $f = 100 \text{ MHz}$	3.0	12	
Maximum Frequency of Oscillation	f_{max}	$V_{CE} = 10 \text{ V}, I_C = 2 \text{ mA}$	2000 (Typ)		MHz
Power Gain	G_e	$V_{CE} = 10 \text{ V}, I_C = 2 \text{ mA}$ $f = 200 \text{ MHz}$	17	24	db
Power Gain (AGC) 2N3289	G_e^{**}	$V_{CE} = 5 \text{ V}, I_C = 20 \text{ mA}$ $f = 200 \text{ MHz}$		+5	db
Noise Figure	NF	$V_{CE} = 10 \text{ V}, I_C = 2 \text{ mA}$ $f = 200 \text{ MHz}$		7.0	db

* C_{ob} is measured in guarded circuit such that the can capacitance is not included.

**AGC is obtained by increasing I_C . The circuit remains adjusted for $V_{CE} = 10 \text{ Vdc}$, $I_C = 2 \text{ mAdc}$ operation.



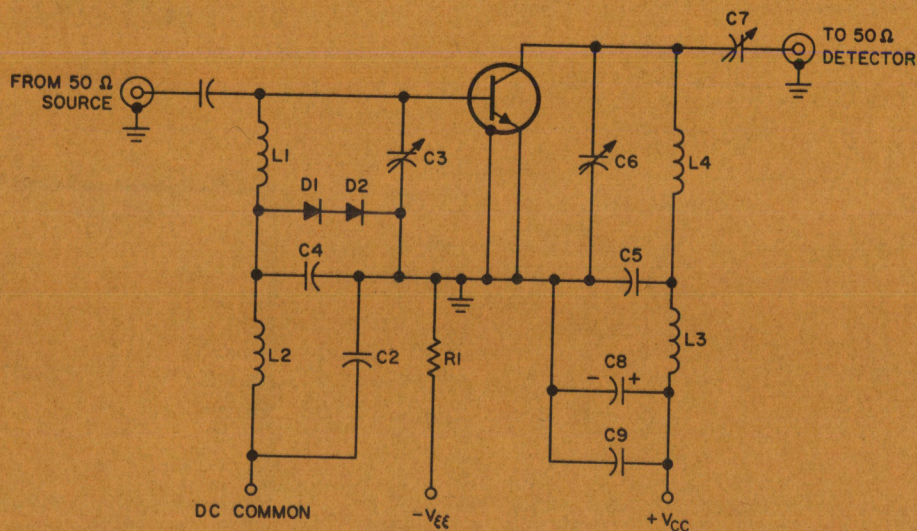
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CIRCUIT COMPONENT INFORMATION

C1, C2, and C9: 0.05 μ f
 C3: 1.5—10 pf
 C4 and C5: 1000 pf
 C6 and C7: 3—15 pf
 C8: 25 μ f
 R1: 2.2 k Ω
 L1: 1 T #12 AWG, 2 cm ID
 L2 and L3: 200 MHz RFC
 L4: 1/2 T #12 AWG, 3 cm ID
 D1 and D2: 1N2070

FIGURE 1 — NEUTRALIZED 200 MHz INSERTION POWER GAIN TEST CIRCUIT





NPN TRANSISTOR RF/IF AMPLIFIER

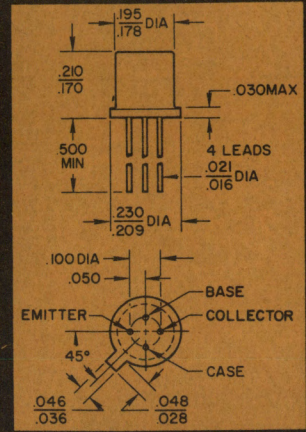
- HIGH FREQUENCY
- HIGH POWER GAIN
- LOW CAPACITANCE

JANUARY 1968

2N3291
THRU
2N3294

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	2N3291 2N3292	2N3293 2N3294	UNIT
Collector-Base Voltage	V_{CBO}	25	20	Volts
Collector-Emitter Voltage	V_{CES}	25	20	Volts
Emitter-Base Voltage	V_{EBO}	3.0	3.0	Volts
Collector Current	I_C	50	50	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	200 300	200 300	mW
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		1.14 1.71	1.14 1.71	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200		$^\circ\text{C}$
Junction Temperature	T_J	+200	+200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Emitter Breakdown Voltage 2N3291, 2N3292 2N3293, 2N3294	BV_{CES}	$I_C = 25 \mu\text{A}$, $V_{BE} = 0$	25 20		Volts
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 10 \text{ V}$, $I_E = 0$		0.1	μA
Emitter-Base Cutoff Current	I_{EBO}	$V_{EB} = 0.5 \text{ V}$, $I_C = 0$		100	μA
DC Current Gain	h_{FE}	$V_{CE} = 10 \text{ V}$, $I_C = 2 \text{ mA}$	10		
Small Signal Current Gain	h_{fe}	$V_{CE} = 10 \text{ V}$, $I_C = 2 \text{ mA}$ $f = 1 \text{ kHz}$	10	200	
High Frequency Current Gain	$ h_{fe} $	$V_{CE} = 10 \text{ V}$, $I_C = 2 \text{ mA}$ $f = 100 \text{ MHz}$	2.5	12	
Output Capacitance	C_{ob}^*	$V_{CB} = 10 \text{ V}$, $I_E = 0$ $f = 100 \text{ kHz}^*$		2.0	pf
Collector-Base Time Constant	$r_b' C_c$	$V_{CB} = 10 \text{ V}$, $I_C = 2 \text{ mA}$ $f = 31.8 \text{ MHz}$		30	psec
Maximum Frequency of Oscillation	f_{max}	$V_{CE} = 10 \text{ V}$, $I_C = 2 \text{ mA}$	2000 (Typ)		MHz
Power Gain 2N3291, 2N3292 2N3294	G_e	$I_C = 2 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 200 \text{ MHz}$ (Figure 1)	16 14		db
Noise Figure 2N3291 2N3292 2N3294	NF	$I_C = 2 \text{ mA}$, $V_{CE} = 10 \text{ V}$ $f = 200 \text{ MHz}$ (Figure 1)	8 (Typ) 9 (Typ) 7 (Typ)		db
Power Gain 2N3293	P_o	$V_{EE} = -11 \text{ V}$, $f = 257 \text{ MHz}$ (Figure 2)	2.0		db

* C_{ob} is measured in guarded circuit such that the can capacitance is not included.



AMELCO SEMICONDUCTOR

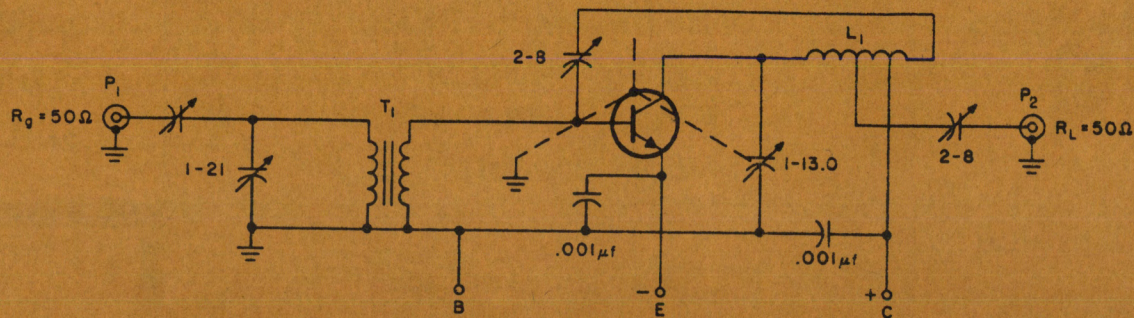
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FIGURE 1 — 200 MHz TEST CIRCUIT: POWER GAIN, NOISE FIGURE, & AGC



L_1 — 6 turns of #16 tinned wire; 3/8" ID; Air wound; winding length 3/4"; V_{CC} feeds tap 4-3/4 turns from collector end; output tap 3-1/2 turns from collector end.

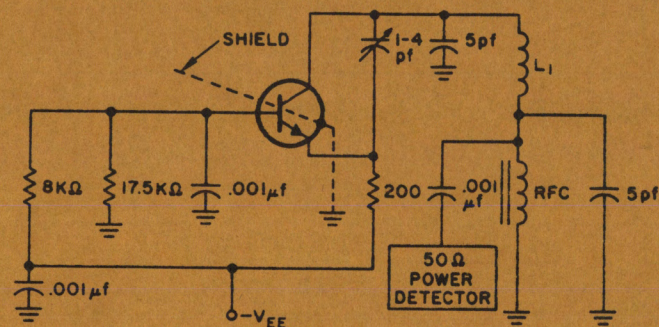
T_1 — 3 turns primary and secondary Bifilar wound (close wound) on 1/4" ceramic form (Cambion type) with brass slug. #22 enameled wire.

P_1 — General Radio 874 G6 Pad (6 db)

P_2 — General Radio 874 G6 Pad (6 db)

Figure 1

FIGURE 2 — 257 MHz OSCILLATOR POWER OUTPUT TEST CIRCUIT



L_1 — 4 turns of #22 Nykland wire spaced for 257 mc coil form 7/32" center Cambion LST ceramic aircore

RFC — 4.5 μ h, 24 turns #30 Nykland wire close wound 7/32" Cambion ceramic form

All capacitors are ceramic type

Figure 2





PNP TRANSISTOR GENERAL PURPOSE

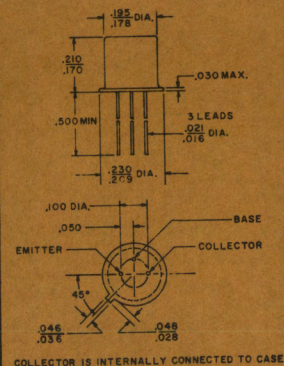
- HIGH FREQUENCY
- LOW SATURATION VOLTAGE
- LOW CAPACITANCE

JANUARY 1968

2N869

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	25	Volts
Collector-Emitter Voltage	V_{CEO}	18	Volts
Emitter-Base Voltage	V_{EBO}	5	Volts
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	0.36 1.2 0.68	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.1 6.85	mW/ $^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	25		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 10 \mu\text{A}, I_C = 0$	5		Volts
Collector-Emitter Sustaining Voltage*	$V_{CEO(sust)}^*$	$I_C = 10 \text{ mA}, I_B = 0$	18		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$		1.0	Volt
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$		1.0	Volt
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 15 \text{ V}, I_E = 0$ $V_{CB} = 15 \text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		.010 25	μA
DC Pulse Current Gain	h_{FE}^*	$I_C = 10 \text{ mA}, V_{CE} = 5.0 \text{ V}$	20	120	
High Frequency Current Gain	$ h_{fe} $	$I_C = 10 \text{ mA}, V_{CE} = 15 \text{ V}, f = 100 \text{ MHz}$	1.0		
Output Capacitance	C_{ob}	$V_{CB} = 10 \text{ V}, I_E = 0$		9	pf
Input Capacitance	C_{ib}	$V_{BE} = 0.5 \text{ V}, I_C = 0$		11	pf

* Pulse Test: Pulse Width = 300 μsec , Duty Cycle = 1%



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PNP TRANSISTOR GENERAL PURPOSE

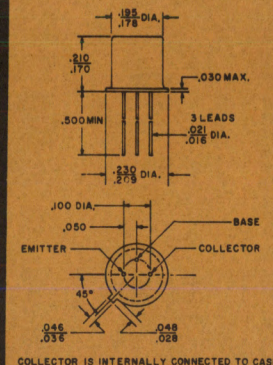
- LOW LEAKAGE
- LOW SATURATION VOLTAGE
- LOW NOISE

JANUARY 1968

2N995

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-20	Volts
Collector-Emitter Voltage	V_{CEO}	-15	Volts
Emitter-Base Voltage	V_{EBO}	-4.0	Volts
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	0.36 1.2 0.68	Watts
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$
Derating Factor above 25°C $T_A = 25^\circ\text{C}$ $T_C = 25^\circ\text{C}$		2.06 6.86	mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}$, $I_E = 0$	-20		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0$, $I_E = 10 \mu\text{A}$	-4		Volts
Collector-Emitter Sustaining Voltage	$V_{CE(sus)}^*$	$I_C = 10 \text{ mA}$, $I_B = 0$	-15		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 20 \text{ mA}$, $I_B = 2.0 \text{ mA}$		0.2	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 20 \text{ mA}$, $I_B = 2.0 \text{ mA}$		0.95	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0$, $V_{CB} = -15 \text{ V}$ $I_E = 0$, $V_{CB} = -15 \text{ V}$, $T_A = 150^\circ\text{C}$		5.0 25.0	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0$, $V_{EB} = 4.0 \text{ V}$		10	μA
DC Current Gain	h_{FE}^*	$I_C = 20 \text{ mA}$, $V_{CE} = -1.0 \text{ V}$ $I_C = 50 \text{ mA}$, $V_{CE} = -1.0 \text{ V}$ $I_C = 1.0 \text{ mA}$, $V_{CE} = -1.0 \text{ V}$	35 25 25	140	
High Frequency Current Gain	$ h_{fe} $	$I_C = 10 \text{ mA}$, $V_{CE} = -10 \text{ V}$ $f = 100 \text{ MHz}$	1.0		
Output Capacitance	C_{ob}	$I_E = 0$, $V_{CB} = -10 \text{ V}$		10	pf
Input Capacitance	C_{ib}	$I_C = 0$, $V_{BE} = -0.5 \text{ V}$		11	pf
Low Frequency Noise Figure	NF	$f = 1 \text{ kHz}$ Source resistance = $2 \text{ k}\Omega$ Equivalent noise power bandwidth = 200 Hz $I_C = 100 \mu\text{A}$, $V_{CE} = 5.0 \text{ V}$	6.0 Typ		db
100 MHz Oscillator Efficiency	η	$I_C = 10 \text{ mA}$, $V_{CB} = -10 \text{ V}$ (Figure 1)	40		%

* Pulse Test: Pulse Width = $300 \mu\text{s}$; Duty Cycle = 1%.



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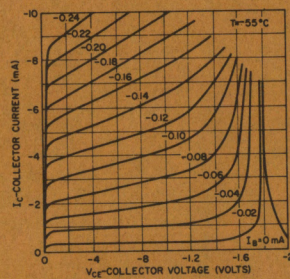
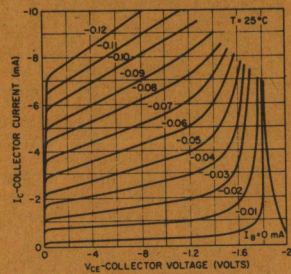
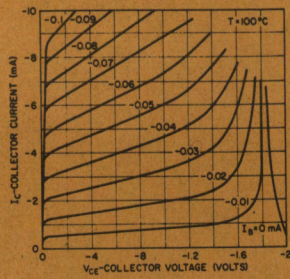
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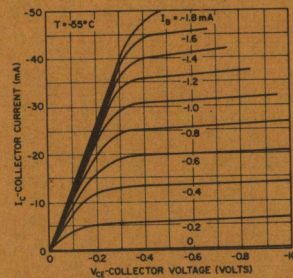
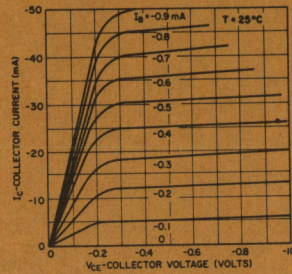
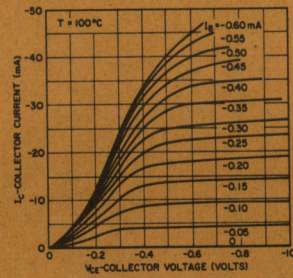
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TYPICAL COLLECTOR AND BASE CHARACTERISTICS*

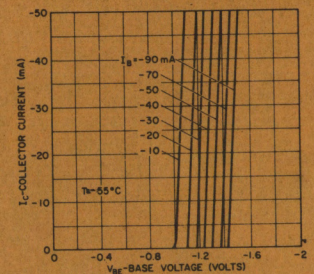
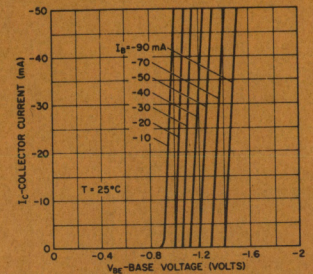
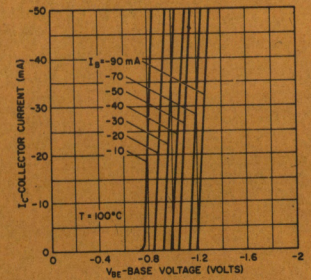
Active Region
Collector Characteristics



Saturation Region
Collector Characteristics

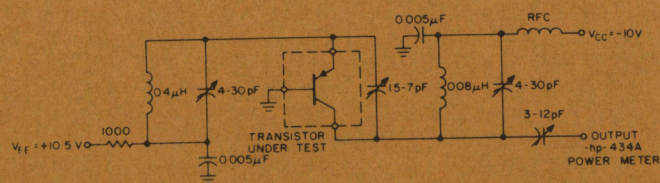


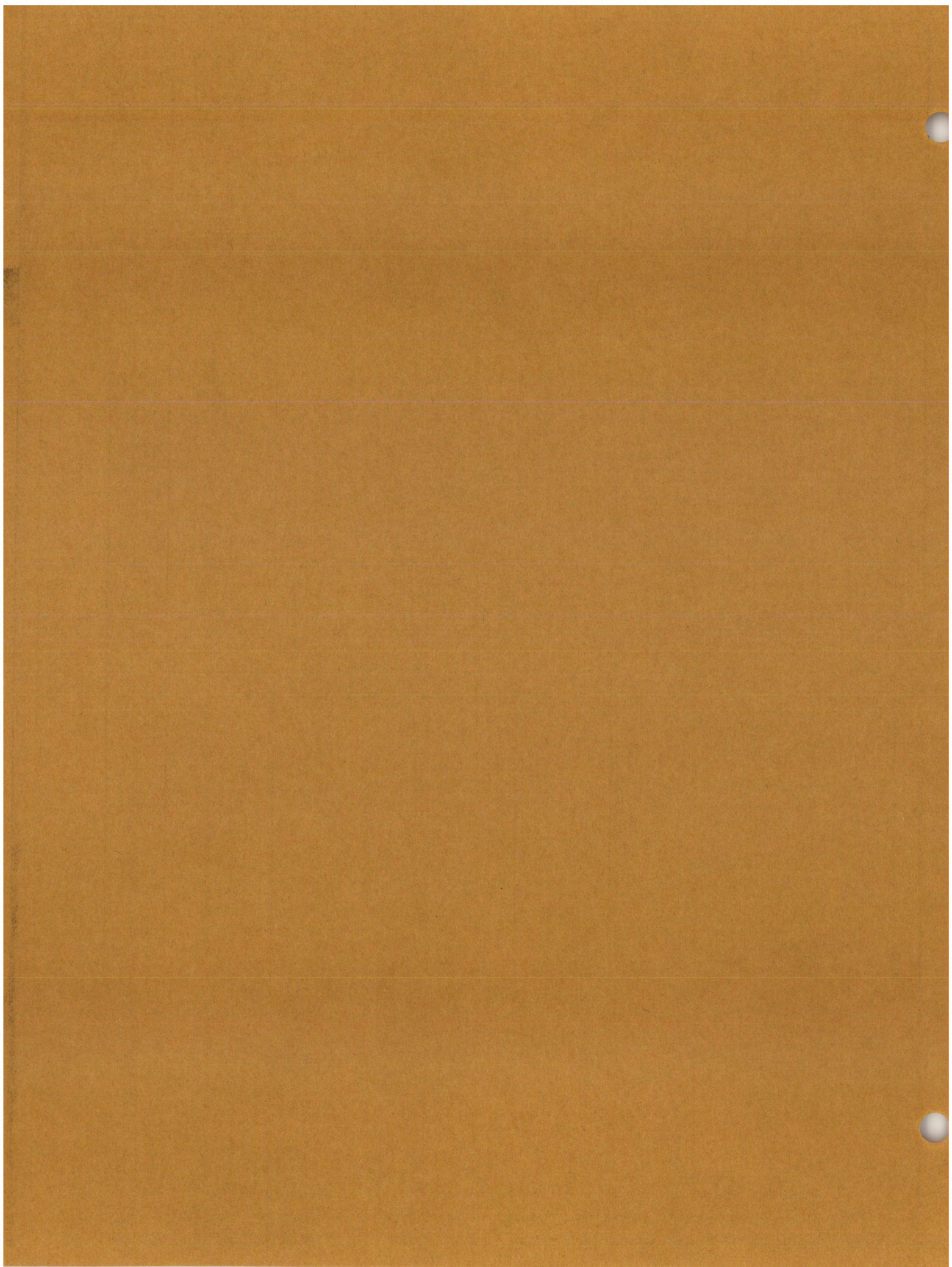
Base Characteristics



*Single family characteristics on transistor curve tracer.

Oscillator Efficiency Circuit ($I_C = 10 \text{ mA}$, $V_{CB} = -10\text{V}$)







PNP TRANSISTOR GENERAL PURPOSE

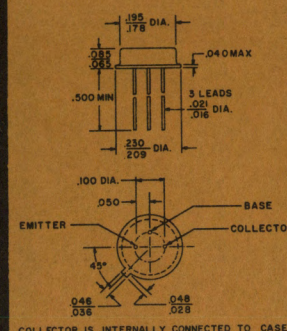
- HIGH BREAKDOWN VOLTAGE
- LOW SATURATION VOLTAGE
- LOW NOISE

JANUARY 1968

2N2601
2N2602
2N2603

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-60	Volts
Collector-Emitter Voltage	V_{CEO}	-60	Volts
Emitter-Base Voltage	V_{EBO}	-6	Volts
Collector Current	I_C	-50	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$	P_D	0.400	Watts
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+200	$^\circ\text{C}$
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$		2.28	mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -50 \mu\text{A}, I_E = 0$	-60		Volts
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -1 \text{ mA}, I_B = 0$	-60		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0, I_E = -100 \mu\text{A}$	-6		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = -10 \text{ mA}, I_B = -1 \text{ mA}$		-0.5	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = -10 \text{ mA}, I_B = -1 \text{ mA}$	-0.7	-0.9	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0, V_{CB} = -45 \text{ V}$ $I_E = 0, V_{CB} = -45 \text{ V}, T_A = 150^\circ\text{C}$		-25 -25	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0, V_{EB} = -5 \text{ V}$		-5	nA
DC Current Gain	h_{FE}	$I_C = -1 \text{ mA}, V_{CE} = -5 \text{ V}$	12.5 25.0 50.0		
Small Signal Current Gain	h_{fe}	$I_E = 100 \mu\text{A}, V_{CB} = -5 \text{ V}$ $f = 1 \text{ kHz}$	12 25 50		
		$I_E = 1 \text{ mA}, V_{CB} = -5 \text{ V}$ $f = 1 \text{ kHz}$	18 36 76	90 90 333	
		$I_E = 10 \text{ mA}, V_{CB} = -5 \text{ V}$ $f = 1 \text{ kHz}$	25 50 100		
		$I_E = 10 \text{ mA}, V_{CB} = -5 \text{ V}$ $f = 1 \text{ kHz}, T_A = -55^\circ\text{C}$	12 25 50		
High Frequency Current Gain	$ h_{fe} $	$I_C = -5 \text{ mA}, V_{CE} = -5 \text{ V}$ $f = 20 \text{ MHz}$	1.0 2.0 3.0		
Output Capacitance	C_{ob}	$I_E = 0, V_{CB} = -5 \text{ V}, f = 140 \text{ kHz}$		6.0	pf
Voltage Feedback Ratio	h_{rb}	$I_E = 1 \text{ mA}, V_{CB} = -5 \text{ V}$ $f = 1 \text{ kHz}$		10^{-3}	
Input Resistance	h_{ib}	$I_E = 1 \text{ mA}, V_{CB} = -5 \text{ V}$ $f = 1 \text{ kHz}$	25	35	ohms
Output Conductance	h_{ob}	$I_E = 1 \text{ mA}, V_{CB} = -5 \text{ V}$ $f = 1 \text{ kHz}$		1	μmhos
Real Part of Input Impedance	$\text{Re}(h_{ie})$	$I_E = 1 \text{ mA}, V_{CE} = 5 \text{ V}$ $f = 100 \text{ MHz}$		200	Ohms



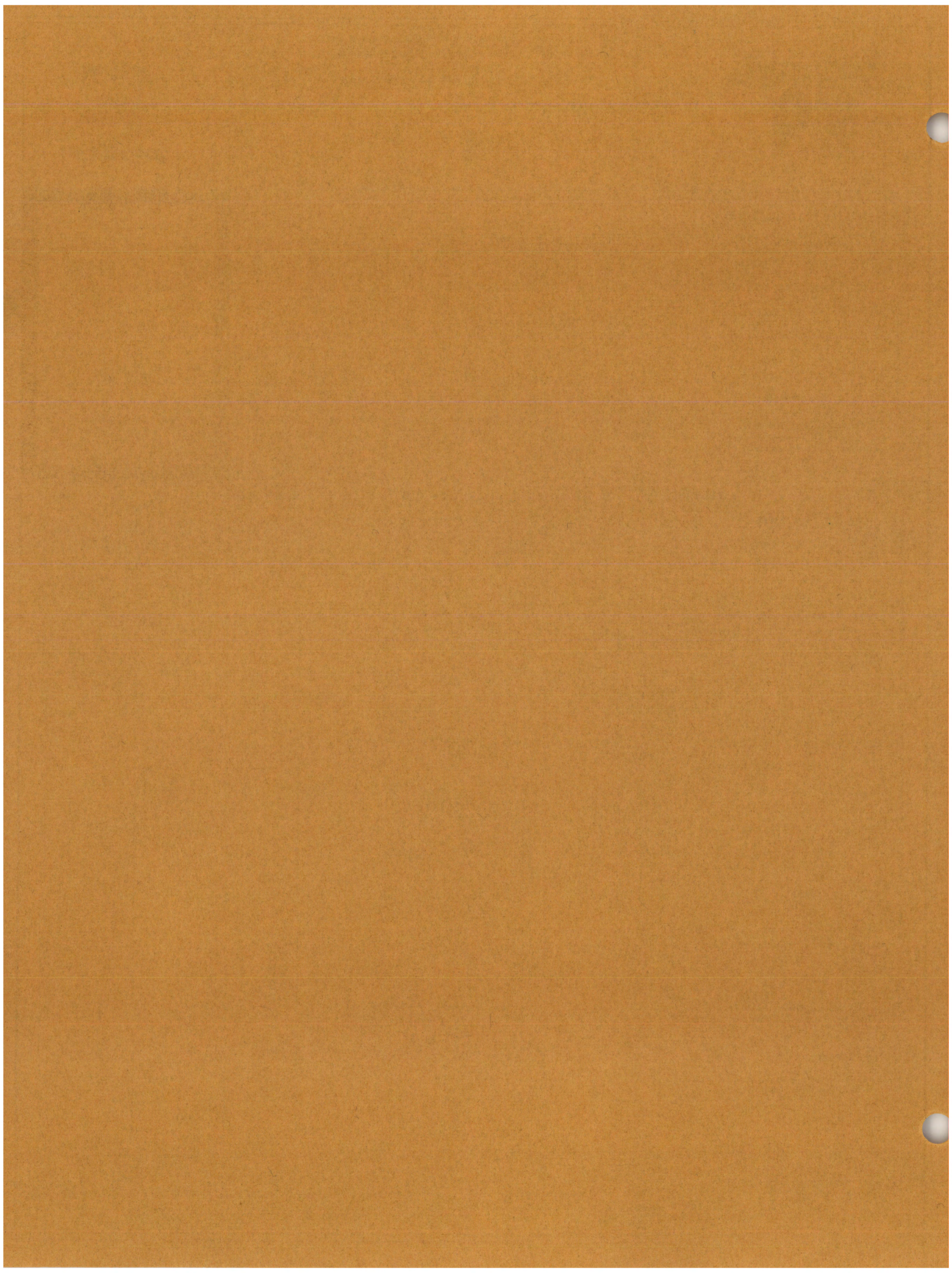
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PNP TRANSISTOR GENERAL PURPOSE

- LOW NOISE
- HIGH BREAKDOWN VOLTAGE
- HIGH CURRENT GAIN

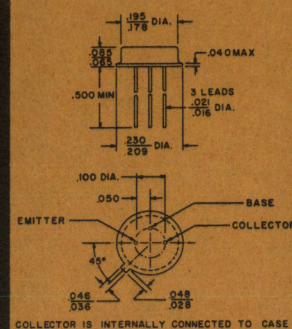
JANUARY 1968

2N2604

2N2605

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Collector-Base Voltage	V_{CBO}	-60	Volts
Collector-Emitter Voltage	V_{CEO}	-45	Volts
Emitter-Base Voltage	V_{EBO}	-6.0	Volts
Collector Current	I_C	30	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	0.4 1.2	Watts
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Junction Temperature	T_J	+175	$^\circ\text{C}$
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		2.28 6.9	mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	-60		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0, I_E = -10 \mu\text{A}$	-6		Volts
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}$	$I_C = -10 \text{ mA}, I_B = 0$	-45		Volts
Nonsaturated Base Voltage	V_{BE}	$I_C = -10 \text{ mA}, I_B = -0.5 \text{ mA}$	-0.7	-0.9	Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = -10 \text{ mA}, I_B = -0.5 \text{ mA}$		-0.5	Volts
Collector-Base Cutoff Current	I_{CBO}	$I_E = 0, V_{CB} = -45 \text{ V}$		-10	nA
Collector-Emitter Cutoff Current	I_{CES}	$V_{EB} = 0, V_{CE} = -45 \text{ V}$ $V_{EB} = 0, V_{CE} = -45 \text{ V}, T_A = 170^\circ\text{C}$		-10 -10	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0, V_{EB} = -5 \text{ V}$		-2	nA
DC Current Gain	h_{FE}	$I_C = -10 \mu\text{A}, V_{CE} = -5 \text{ V}$ $I_C = -500 \mu\text{A}, V_{CE} = -5 \text{ V}$ $I_C = -10 \mu\text{A}, V_{CE} = -5 \text{ V}$ $T_A = -55^\circ\text{C}$ $I_C = -10 \text{ mA}, V_{CE} = -5 \text{ V}$	40 100 60 150 10 20	120 300	
Small Signal Current Gain	h_{fe}	$I_C = -1.0 \text{ mA}, V_{CE} = -5 \text{ V}$ $f = 1 \text{ kHz}$	60 150	350 600	
High Frequency Current Gain	$ h_{fe} $	$I_C = -0.5 \text{ mA}, V_{CE} = -5 \text{ V}$ $f = 30 \text{ MHz}$	1.0		
Output Capacitance	C_{ob}	$I_E = 0, V_{CB} = -5 \text{ V}$ $f = 1 \text{ MHz}$		6	pf
Voltage Feedback Ratio	h_{rb}	$I_E = -1.0 \text{ mA}, V_{CB} = -5 \text{ V}$ $f = 1 \text{ kHz}$		10	$\times 10^{-4}$
Input Resistance	h_{ie}	$I_E = 1.0 \text{ mA}, V_{CB} = -5 \text{ V}$	25	35	ohms
Output Conductance	h_{oe}	$I_E = 1.0 \text{ mA}, V_{CE} = -5 \text{ V}$ $f = 1 \text{ kHz}$		1.0	μmhos



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CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Real Part of Input Impedance	$\text{Re}(h_{ie})$	$I_C = 1 \text{ mA}, V_{CE} = -5 \text{ V}$ $f = 100 \text{ MHz}$		200	ohms
Wideband Noise Factor 2N2604 2N2605	NF	$f = 10 \text{ kHz}$ Source resistance = $10 \text{ k}\Omega$ Equivalent noise power band- width = 15 kHz $I_C = -10 \text{ }\mu\text{A}, V_{CE} = -5 \text{ V}$		4 3	db

* Pulse Test: Pulse Width = $300 \text{ }\mu\text{sec}$; Duty Cycle $\leq 2\%$.





PNP TRANSISTOR MEDIUM POWER

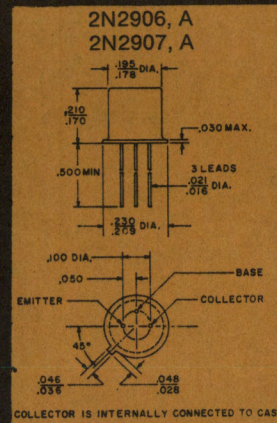
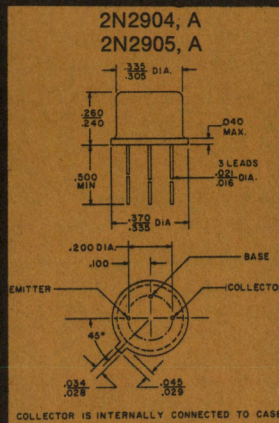
- LOW SATURATION VOLTAGE
- FAST SWITCHING SPEEDS
- HIGH BREAKDOWN VOLTAGE

JANUARY 1968

2N2904
THRU
2N2907A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING		UNIT
Collector-Base Voltage	V_{CBO}	60		Volts
Collector-Emitter Voltage 2N2904-2N2907, 2N2904A, 2N2907A	V_{CEO}	40 60		Volts
Emitter-Base Voltage	V_{EBO}	5		Volts
Collector Current	I_C	600		mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	2N2904, A 2N2905, A	2N2906, A 2N2907, A	Watts
Derating Factor above 25°C @ $T_A = 25^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$		0.6 3.0	0.4 1.8	
Storage Temperature	T_{stg}	-65 to +200		$^\circ\text{C}$
Junction Temperature	T_J	-65 to +200		$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 10\text{ A}, I_E = 0$	60		Volts
Collector-Emitter Sustaining Voltage 2N2904 thru 2N2907, 2N2904A thru 2N2907A,	$V_{CE(sus)}^*$	$I_C = 10\text{ mA}, I_B = 0$	40 60		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_B = 10\text{ A}, I_C = 0$	5		Volts
Collector Saturation Voltage	$V_{CE(sat)}^*$	$I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$		0.4 1.6	Volts
Base Saturation Voltage	$V_{BE(sat)}^*$	$I_C = 150\text{ mA}, I_B = 15\text{ mA}$ $I_C = 500\text{ mA}, I_B = 50\text{ mA}$		1.3 2.6	Volts
Collector-Base Cutoff Current 2N2904 thru 2N2907, 2N2904A thru 2N2907A, 2N2904 thru 2N2907, 2N2904A thru 2N2907A,	I_{CBO}	$V_{CB} = 50\text{ V}, I_E = 0$ $V_{CB} = 50\text{ V}, I_E = 0, T_A = 150^\circ\text{C}$		.020 .010 20 10	μA
Base Cutoff Current	I_{BL}	$V_{CE} = 30\text{ V}, V_{BE} = 0.5\text{ V}$		50	nA
Collector-Emitter Cutoff Current	I_{CEX}	$V_{CE} = 30\text{ V}, V_{BE} = 0.5\text{ V}$		50	nA
DC Current Gain 2N2904, 2N2906, 2N2905, 2N2907, 2N2904A, 2N2906A, 2N2905A, 2N2907A, 2N2904, 2N2906, 2N2905, 2N2907, 2N2904A, 2N2906A, 2N2905A, 2N2907A, 2N2904, 2N2906, 2N2905, 2N2907, 2N2904A, 2N2906A, 2N2905A, 2N2907A, 2N2904, 2N2906A, 2N2907A, 2N2905, 2N2907A, 2N2907A, 2N2904, 2N2906, 2N2905, 2N2907, 2N2904A, 2N2906A, 2N2905A, 2N2907A,	h_{FE}	$I_C = 0.1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 1\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}^*$ $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}^*$	20 35 40 75 25 50 40 100 35 75 40 100 40 100 20 30 40 50	120 300	



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CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Rise Time	t_r	$I_{CS} = 150 \text{ mA}$, $I_{B1} = 15 \text{ mA}$ (Figure 1)		40	nsec
Delay Time	t_d	$I_{CS} = 150 \text{ mA}$, $I_{B1} = 15 \text{ mA}$ (Figure 1)		10	nsec
Fall Time	t_f	$I_{CS} = 150 \text{ mA}$, $I_{B1} = I_{B2} = 15 \text{ mA}$ (Figure 2)		30	nsec
Storage Time	t_s	$I_{CS} = 150 \text{ mA}$, $I_{B1} = I_{B2} = 15 \text{ mA}$ (Figure 2)		80	nsec
Turn-On Time	t_{on}	$I_{CS} = 150 \text{ mA}$, $I_{B1} = 15 \text{ mA}$ (Figure 1)		45	nsec
Turn-Off Time	t_{off}	$I_{CS} = 150 \text{ mA}$, $I_{B1} = I_{B2} = 15 \text{ mA}$ (Figure 2)		100	nsec
Output Capacitance	C_{ob}	$V_{CE} = 10 \text{ V}$, $I_E = 0$, $f = 100 \text{ kHz}$		8	pf
Input Capacitance	C_{ib}	$V_{BE} = 2 \text{ V}$, $I_C = 0$, $f = 100 \text{ kHz}$		30	pf
High Frequency Current Gain	$ h_{fe} $	$I_C = 50 \text{ mA}$, $V_{CE} = 20 \text{ V}$ $f = 100 \text{ MHz}$	2		

* Pulse Test: Pulse Width = 300 μsec ; Duty Cycle $\leq 2\%$.

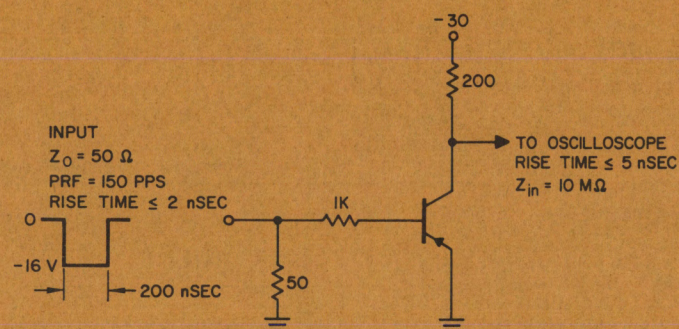


Figure 1. Test Circuit for Determining Delay Time and Rise Time

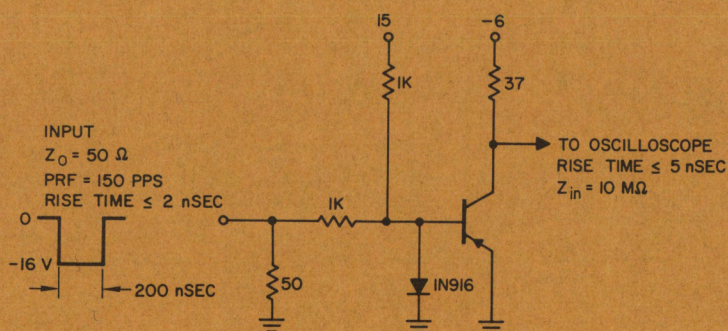


Figure 2. Test Circuit for Determining Storage Time and Fall Time





DUAL NPN TRANSISTOR GENERAL PURPOSE

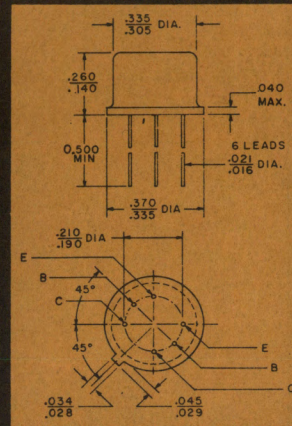
- CLOSELY MATCHED CURRENT GAIN
- VERY CLOSELY MATCHED, V_{BE}
- LOW DIFFERENTIAL DRIFT

JANUARY 1968

2N2453
2N2453A

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING		UNIT
Collector-Base Voltage 2N2453 2N2453A	V_{CBO}	60 80		Volts
Collector-Emitter Voltage 2N2453 2N2453A	V_{CEO}	30* 50		Volts
Emitter-Base Voltage	V_{EBO}	7.0		Volts
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$ @ $T_C = 25^\circ\text{C}$	P_D	Each Side 0.2 0.35 0.6	Both Sides 0.3 0.7 1.2	Watts
Storage Temperature	T_{stg}	-65 to +200		$^\circ\text{C}$
Junction Temperature	T_J	+200		$^\circ\text{C}$
Derating Factor above 25°C 2N2453 2N2453A		1.14 1.71		mW/ $^\circ\text{C}$



ELECTRICAL CHARACTERISTICS at $+25^\circ\text{C}$ (Unless Otherwise Specified)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage 2N2453 2N2453A	BV_{CBO}	$I_C = 10 \mu\text{A}, I_E = 0$	60 80		Volts
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_C = 0, I_E = 0.1 \mu\text{A}$	7.0		Volts
Collector-Emitter Sustaining Voltage 2N2453 2N2453A	$V_{CE(sus)}^{**}$	$I_C = 10 \text{ mA}, I_B = 0$	30 60		Volts
Collector Saturation Voltage	$V_{CE(sat)}$	$I_C = 5.0 \text{ mA}, I_B = 0.5 \text{ mA}$		1.0	Volts
Base Saturation Voltage	$V_{BE(sat)}$	$I_C = 5.0 \text{ mA}, I_B = 0.5 \text{ mA}$		0.9	Volts
Collector-Base Cutoff Current 2N2453 2N2453A 2N2453 2N2453A	I_{CBO}	$I_E = 0, V_{CB} = 50 \text{ V}$ $I_E = 0, V_{CB} = 60 \text{ V}$ $I_E = 0, V_{CB} = 50 \text{ V}, T_A = 150^\circ\text{C}$ $I_E = 0, V_{CB} = 60 \text{ V}, T_A = 150^\circ\text{C}$		5.0 5.0 10 10	nA μA
Emitter-Base Cutoff Current	I_{EBO}	$I_C = 0, V_{EB} = 5.0 \text{ V}$		2.0	nA
DC Current Gain	h_{FE}	$I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $T_A = -55^\circ\text{C}$ $I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $T_A = -55^\circ\text{C}$	80 40 150 75	600	
DC Current Gain Ratio 2N2453A only Both Types Both Types	h_{FE1}/h_{FE2}^*	$I_C = 100 \mu\text{A}, V_{CE} = 5.0 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $T_A = -55^\circ\text{C} \text{ to } +125^\circ\text{C}$	0.9 0.9 0.85	1.0 1.0 1.0	
Base Voltage Differential	$V_{BE1} - V_{BE2}$	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$ $I_C = 10 \mu\text{A}, V_{CE} = 5.0 \text{ V}$		5.0 3.0	mV



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CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN.	MAX.	UNIT
Base Voltage Differential Drift 2N2453 2N2453A	$\Delta(V_{BE1} - V_{BE2})/\Delta T$	$I_C = 10 \mu A, V_{CE} = 5.0 V$ $T_A = -55^\circ C \text{ to } +125^\circ C$		10 5.0	$\mu V/^\circ C$
Small Signal Current Gain	h_{fe}	$I_C = 1.0 mA, V_{CE} = 5.0 V$ $f = 1 kHz$	150	600	
High Frequency Current Gain	$ h_{fe} $	$I_C = 5.0 mA, V_{CE} = 10 V$ $f = 30 MHz$	2.0		
Output Capacitance 2N2453 2N2453A	C_{ob}	$I_E = 0, V_{CB} = 10 V$ $f = 140 kHz$		8.0 4.0	pf
Input Capacitance	C_{ib}	$I_C = 0, V_{BE} = 0.5 V$ $f = 140 kHz$		10	pf
Voltage Feedback Ratio	h_{rb}	$I_C = 1.0 mA, V_{CE} = 5.0 V$ $f = 1 kHz$		5.0	$\times 10^{-4}$
Reverse Voltage Feedback Ratio	h_{re}	$I_C = 1.0 mA, V_{CE} = 5.0 V$ $f = 1 kHz$		6.0	$\times 10^{-4}$
Input Resistance	h_{ib}	$I_C = 1.0 mA, V_{CB} = 5.0 V$ $f = 1 kHz$	20	30	ohms
Input Resistance	h_{ie}	$I_C = 1.0 mA, V_{CE} = 5.0 V$ $f = 1 kHz$		5.0	k Ω
Output Conductance	h_{ob}	$I_C = 1.0 mA, V_{CB} = 5.0 V$ $f = 1 kHz$		0.2	$\mu mhos$
Output Conductance	h_{oe}	$I_C = 1.0 mA, V_{CB} = 5.0 V$ $f = 1 kHz$	5.0	30	$\mu mhos$
Low Frequency Noise Figure 2N2453 2N2453A	NF	$f = 1 kHz$ Source resistance = 10 k Ω Equivalent noise power bandwidth = 200 Hz $I_C = 10 \mu A, V_{CE} = 5.0 V$		7.0 4.0	db

* The lower of the h_{FE} readings is taken as h_{FE1} .

** Pulse Test: Pulse Width = 300 μsec ; Duty Cycle = 1%.

