PBDTC124ET

50 V, 100 mA low VCEsat NPN resistor-equipped transistor; R1 = 22 kΩ, R2 = 22 kΩ

9 October 2025 Product data sheet

1. General description

NPN low V_{CEsat} energy efficient Resistor-Equipped Transistor (RET) in a small SOT23 Surface-Mounted Device (SMD) plastic package.

PNP complement: PBDTA124ET

2. Features and benefits

- Low collector-emitter saturation voltage V_{CEsat}
- High collector current gain (h_{FE})
- High energy efficiency due to less heat generation
- Improved device reliability due to reduced heat generation
- Built-in bias resistors
- Reduces component count
- Reduces pick and place costs
- Simplifies circuit design

3. Applications

- Digital applications in industrial segments
- Battery-driven low power devices
- Load-switches
- Low current drivers
- Power management and charging circuits

4. Quick reference data

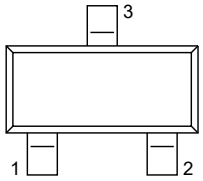
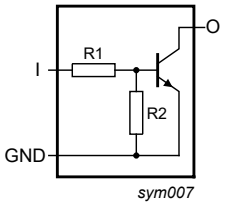
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	50	V
I_O	output current			-	-	100	mA
R1	bias resistor 1 (input)	T_{amb} = 25 °C	[1]	15.4	22	28.6	kΩ
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	

[1] See "Section 11: Test information" for resistor calculation and test conditions.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 SOT23	
2	GND	ground (emitter)		
3	O	output (collector)		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBDTC124ET	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	SOT23

7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PBDTC124ET	%6P

[1] % = placeholder for manufacturing site code

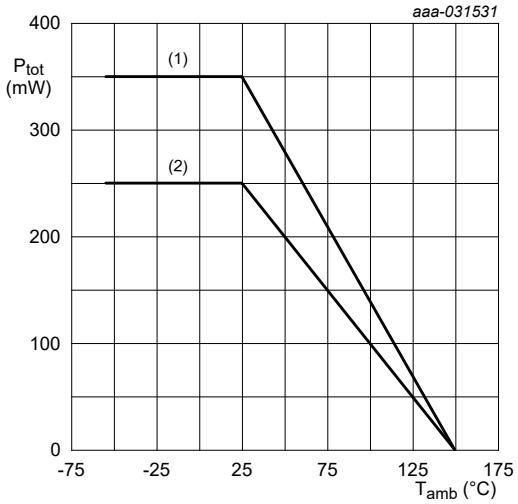
8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter		-	50	V
V_{CEO}	collector-emitter voltage	open base		-	50	V
V_{EBO}	emitter-base voltage	open collector		-	10	V
V_I	input voltage			-10	60	V
I_O	output current			-	100	mA
I_{OM}	peak output current	single pulse; $t_p \leq 1$ ms		-	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	250	mW
			[2]	-	350	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 µm copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.



(1) FR4 PCB, 4-layer copper, standard footprint
(2) FR4 PCB, single-sided copper, tin-plated and standard footprint

Fig. 1. Power derating curves

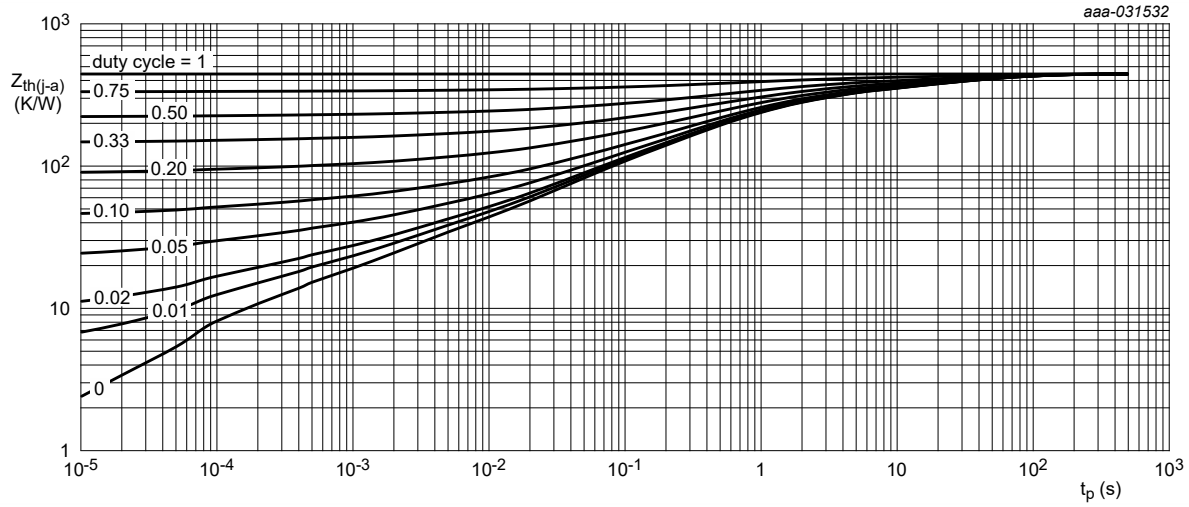
9. Thermal characteristics

Table 6. Thermal characteristics

T_{amb} = 25 °C unless otherwise specified.

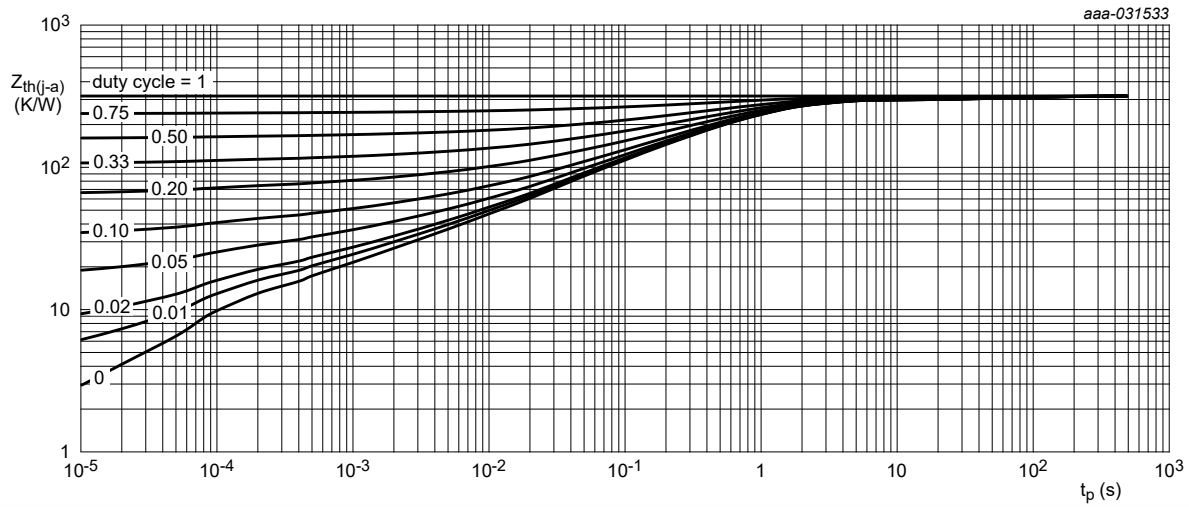
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	500	K/W
			[2]	-	-	357	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	130	K/W

[1] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.



FR4 PCB, single-sided copper, tin-plated and standard footprint

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, 4-layer copper, tin-plated and standard footprint.

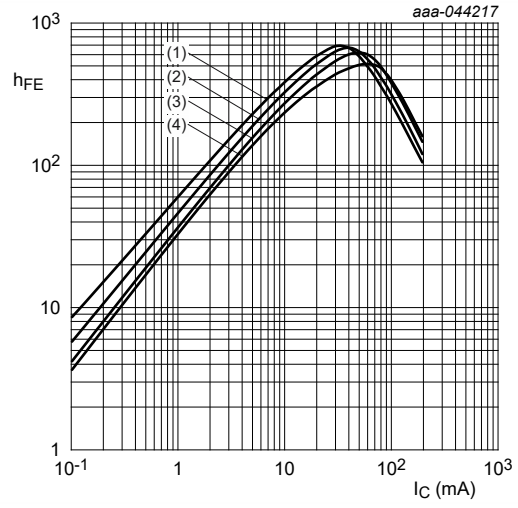
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

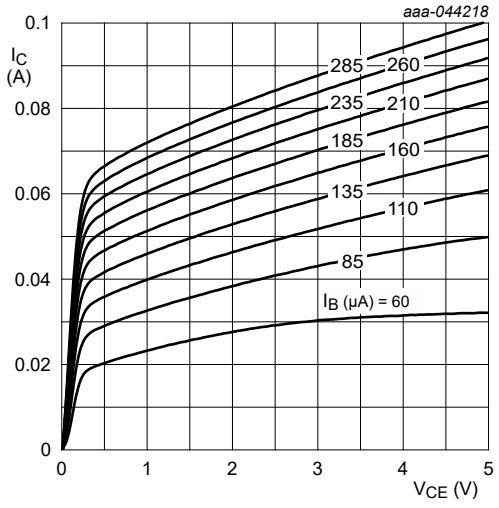
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 µA; I_E = 0 A; T_{amb} = 25 °C		50	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 2 mA; I_B = 0 A; T_{amb} = 25 °C		50	-	-	V
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0 A; T_{amb} = 25 °C		-	-	100	nA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 30 V; I_B = 0 A; T_{amb} = 25 °C		-	-	100	nA
		V_{CE} = 30 V; I_B = 0 A; T_j = 150 °C		-	-	5	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A; T_{amb} = 25 °C		-	-	180	µA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 10 mA; T_{amb} = 25 °C		145	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA; T_{amb} = 25 °C		-	-	100	mV
$V_{I(off)}$	off-state input voltage	V_{CE} = 5 V; I_C = 100 µA; T_{amb} = 25 °C		-	1.1	0.8	V
$V_{I(on)}$	on-state input voltage	V_{CE} = 0.3 V; I_C = 10 mA; T_{amb} = 25 °C		3	2.3	-	V
R1	bias resistor 1 (input)	T_{amb} = 25 °C	[1]	15.4	22	28.6	kΩ
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	
C_c	collector capacitance	V_{CB} = 10 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	-	2	pF
f_T	transition frequency	V_{CE} = 5 V; I_C = 10 mA; f = 100 MHz; T_{amb} = 25 °C	[2]	-	245	-	MHz

[1] See "Section 11: Test information" for resistor calculation and test conditions.
[2] Characteristics of built-in transistor.



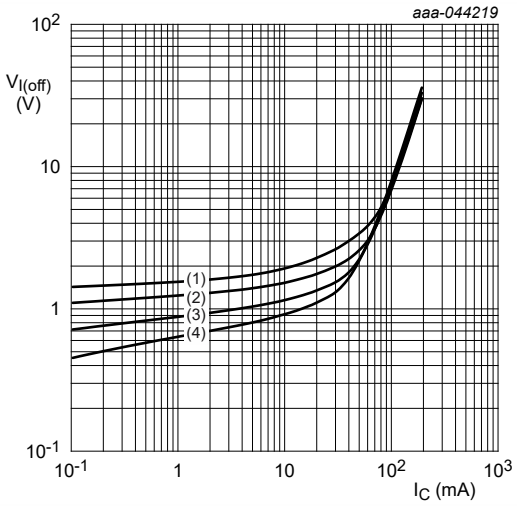
V_{CE} = 5 V
(1) T_{amb} = 150 °C
(2) T_{amb} = 100 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = −40 °C

Fig. 4. DC current gain as a function of collector current; typical values



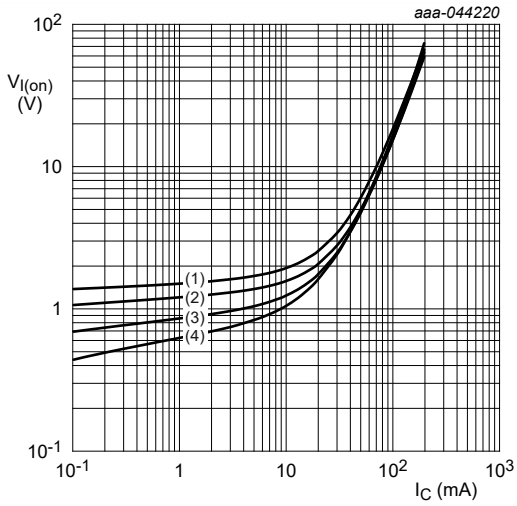
T_{amb} = 25 °C

Fig. 5. Collector current as a function of collector-emitter voltage; typical values



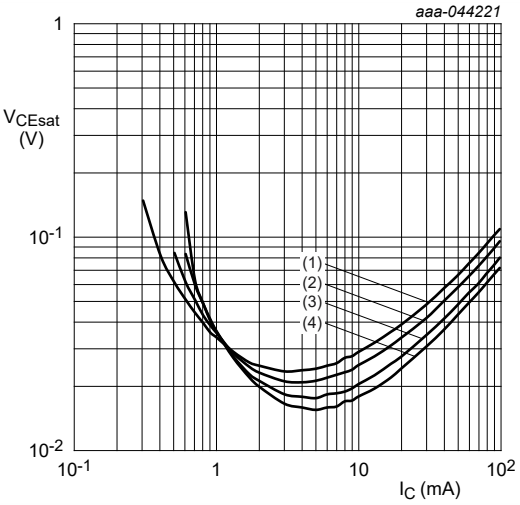
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C
(4) T_{amb} = 150 °C

Fig. 6. Off-state input voltage as a function of collector current; typical values



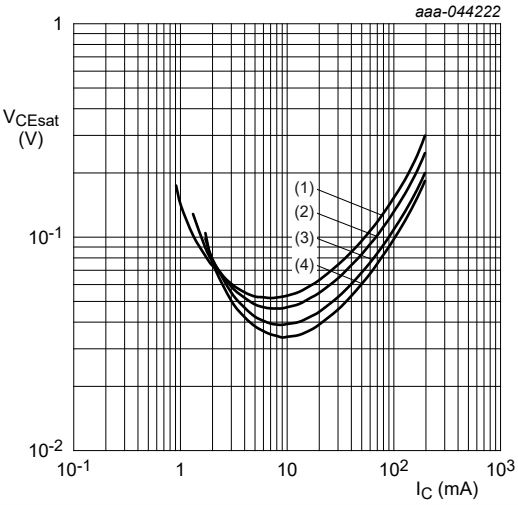
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C
(4) T_{amb} = 150 °C

Fig. 7. On-state input voltage as a function of collector current; typical values



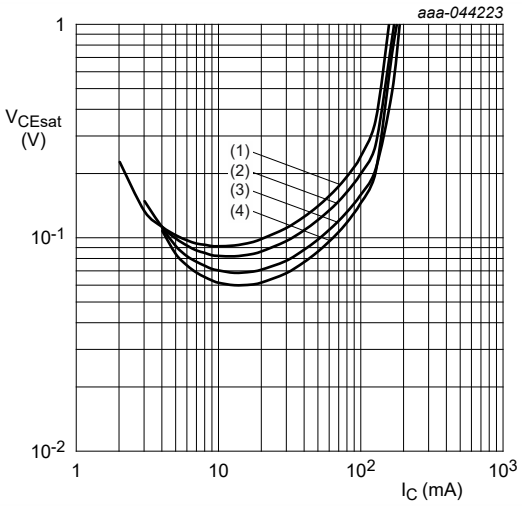
I_C/I_B = 20
(1) T_{amb} = 150 °C
(2) T_{amb} = 100 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = −40 °C

Fig. 8. Collector-emitter saturation voltage as a function of collector current; typical values



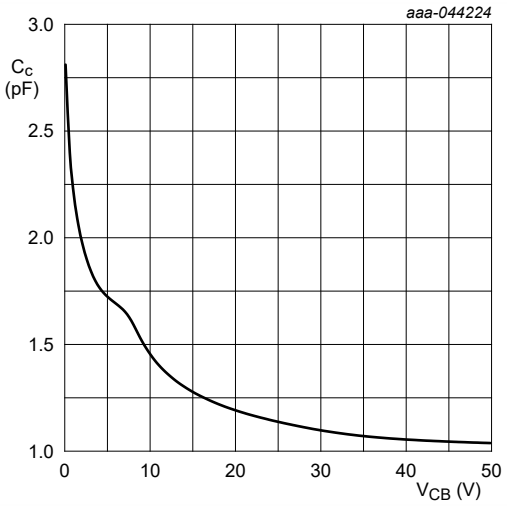
I_C/I_B = 50
(1) T_{amb} = 150 °C
(2) T_{amb} = 100 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = −40 °C

Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values



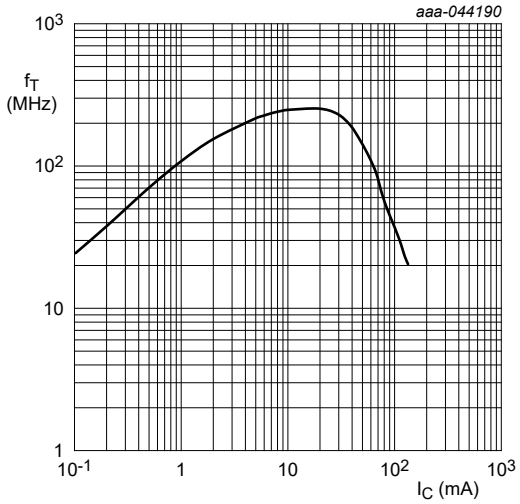
I_C/I_B = 100
(1) T_{amb} = 150 °C
(2) T_{amb} = 100 °C
(3) T_{amb} = 25 °C
(4) T_{amb} = −40 °C

Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values



f = 1 MHz
T_{amb} = 25 °C

Fig. 11. Collector capacitance as a function of collector-base voltage; typical values



f = 100 MHz
V_{CE} = 5 V
T_{amb} = 25 °C

Fig. 12. Transition frequency as a function of collector current; typical values of built-in transistor

11. Test information

Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R_1 = \frac{V(I_2) - V(I_1)}{I_2 - I_1}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I_4) - V(I_3)}{R1 \cdot (I_4 - I_3)} - 1$$

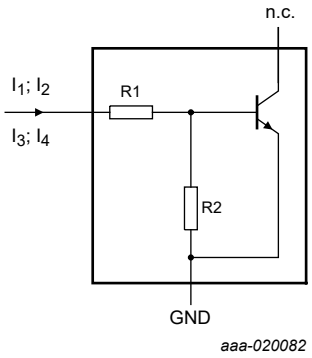


Fig. 13. Resistor test circuit

Resistor test conditions

Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I_1	I_2	I_3	I_4
PBDTC124ET	22	22	550 µA	750 µA	-150 µA	-230 µA

12. Package outline

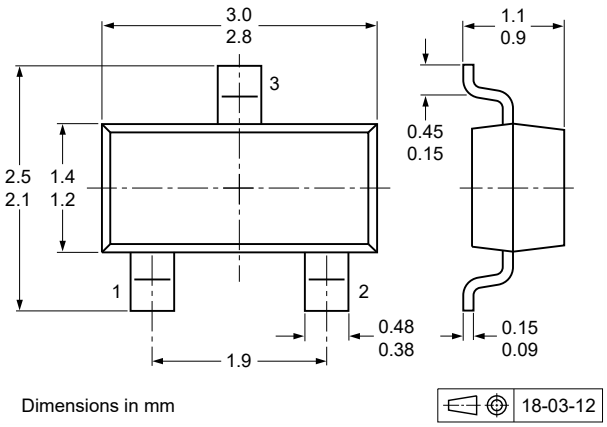


Fig. 14. Package outline SOT23

13. Soldering

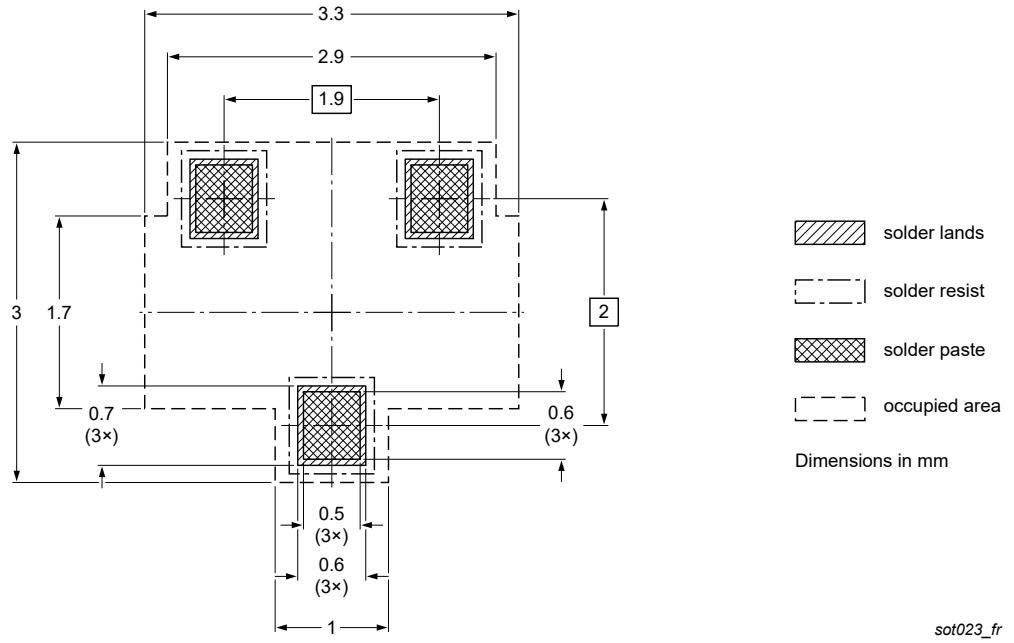


Fig. 15. Reflow soldering footprint for SOT23

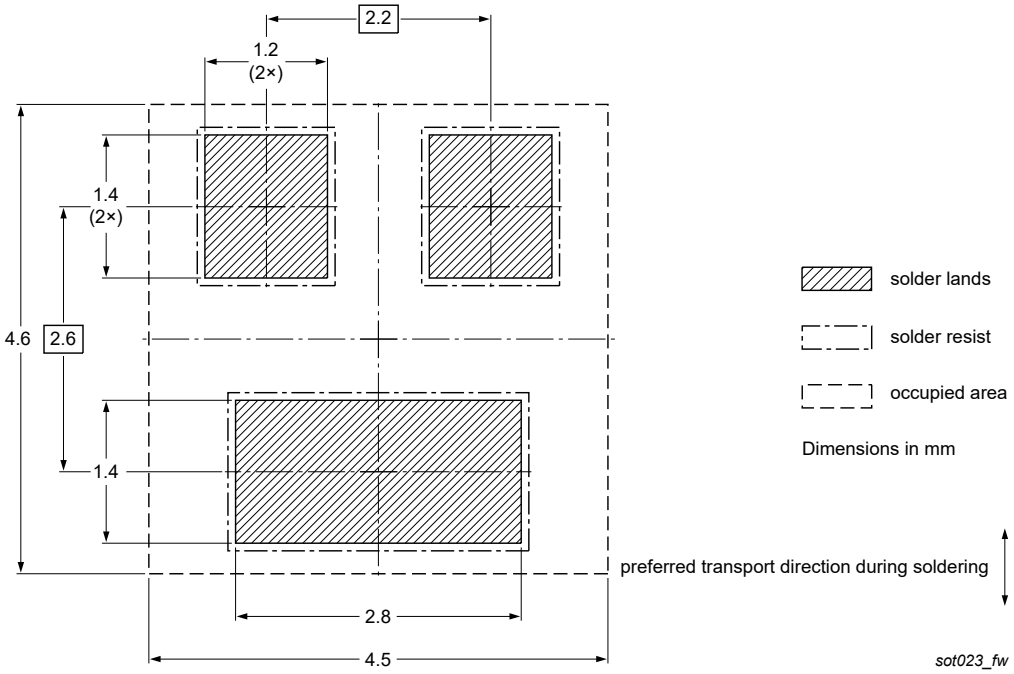


Fig. 16. Wave soldering footprint for SOT23

14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBDTC124ET v.1	20251009	Product data sheet	-	-

15. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 9 October 2025