



# PBSS4160T

60 V, 1 A NPN low V<sub>CEsat</sub> (BISS) transistor

1 April 2023

Product data sheet

## 1. General description

NPN low V<sub>CEsat</sub> transistor in a small SOT23 plastic package. PNP complement: PBSS5160T.

## 2. Features and benefits

- Low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability I<sub>C</sub> and I<sub>CM</sub>
- High efficiency, reduces heat generation
- Reduces printed-circuit board area required

## 3. Applications

- Major application segments:
  - Automotive 42 V power
  - Telecom infrastructure
  - Industrial.
- Power management:
  - DC-to-DC conversion
  - Supply line switching.
- Peripheral driver
  - Driver in low supply voltage applications (e.g. lamps and LEDs)
  - Inductive load driver (e.g. relays, buzzers and motors).

## 4. Quick reference data

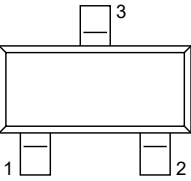
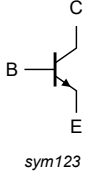
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	60	V
I <sub>C</sub>	collector current	[1]	-	-	1	A
I <sub>CM</sub>	peak collector current	or limited by T <sub>j(max)</sub> ; t <sub>p</sub> = 1 ms	-	-	2	A
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = 1 A; I <sub>B</sub> = 100 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	200	250	mΩ

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p style="text-align: center;">SOT23</p>	 <p style="text-align: center;">sym123</p>
2	E	emitter		
3	C	collector		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PBSS4160T</a>	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	<a href="#">SOT23</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PBSS4160T	%U5

[1] % = placeholder for manufacturing site code

## 8. Limiting values

**Table 5. Limiting values**

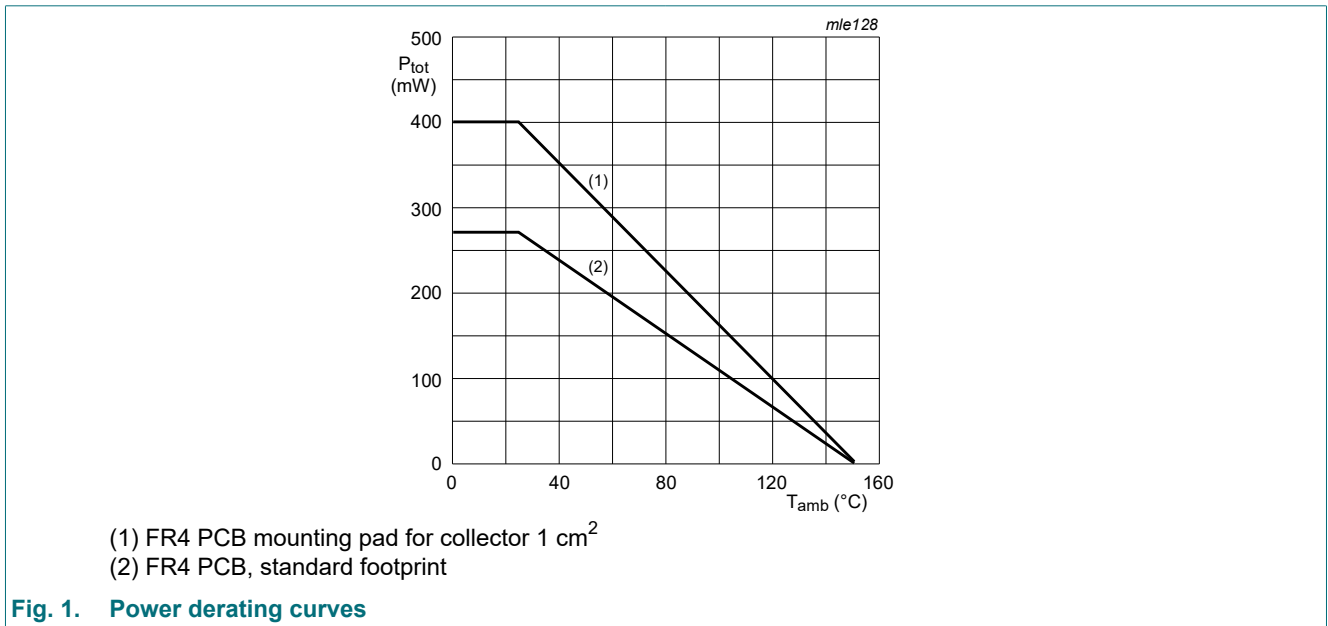
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter		-	80	V
$V_{CEO}$	collector-emitter voltage	open base		-	60	V
$V_{EBO}$	emitter-base voltage	open collector		-	5	V
$I_C$	collector current		[1]	-	0.9	A
			[2]	-	1	A
$I_{CM}$	peak collector current	or limited by $T_{j(max)}$ ; $t_p = 1$ ms		-	2	A
$I_B$	base current			-	300	mA
$I_{BM}$	peak base current	$t_p \leq 300 \mu s$ ; $\delta \leq 0.02$		-	1	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^\circ\text{C}$	[1]	-	270	mW
			[2]	-	400	mW
			[1] [3]	-	1.25	W
$T_j$	junction temperature			-	150	$^\circ\text{C}$
$T_{amb}$	ambient temperature			-65	150	$^\circ\text{C}$
$T_{stg}$	storage temperature			-65	150	$^\circ\text{C}$

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

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Pulsed;  $t_p \leq 10$  ms;  $\delta \leq 0.02$



## 9. Thermal characteristics

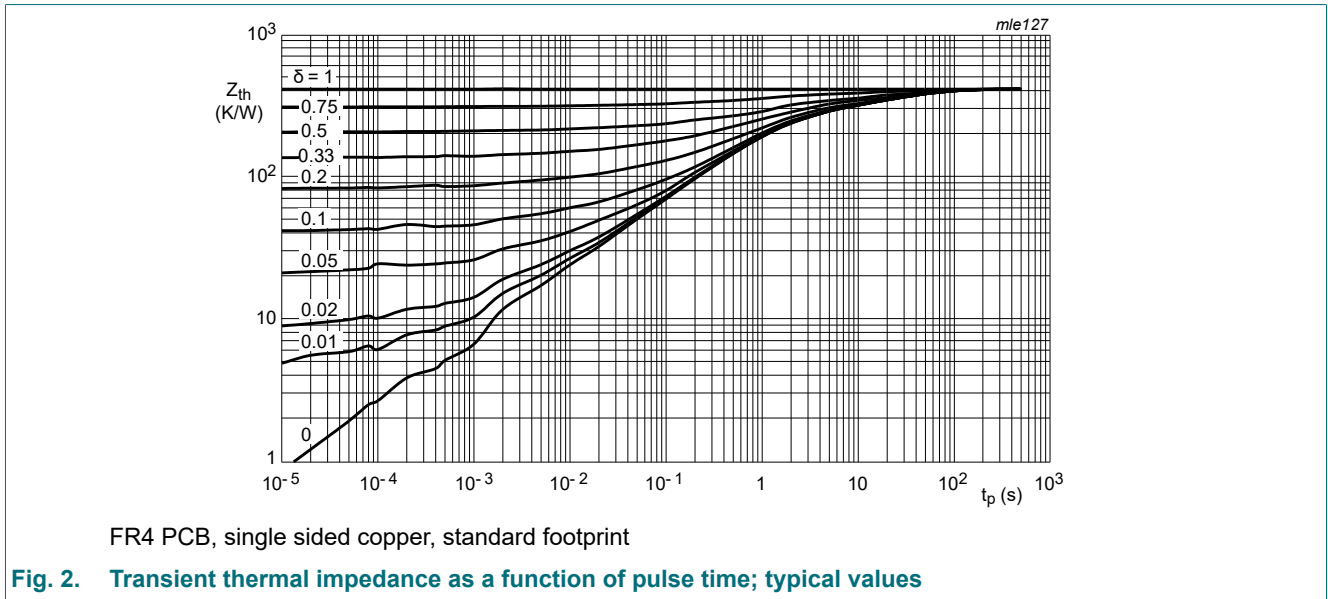
Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	465	K/W
			[2]	-	-	312	K/W
			[1] [3]	-	-	100	K/W

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

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

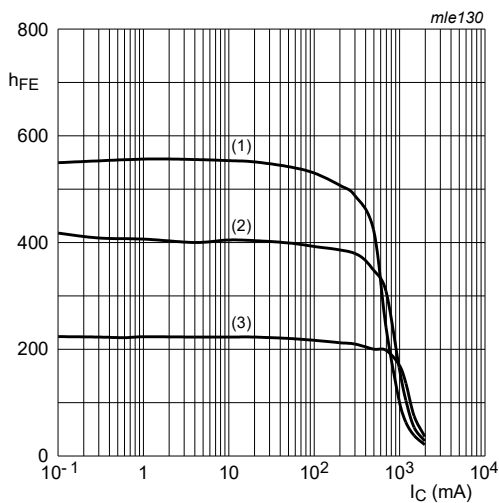
[3] Pulsed;  $t_p \leq 10$  ms;  $\delta \leq 0.02$ .



## 10. Characteristics

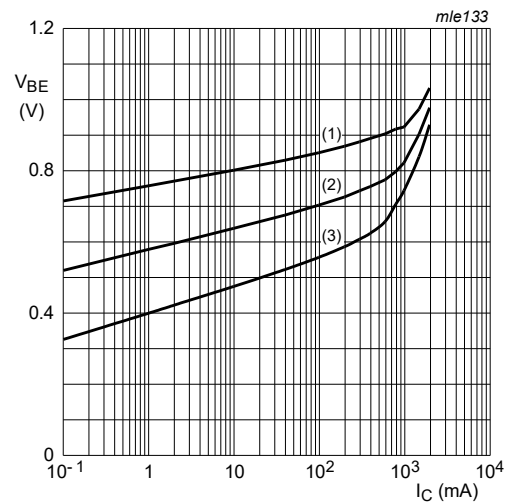
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	100	nA
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^\circ\text{C}$	-	-	50	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	100	nA
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 60\text{ V}; V_{BE} = 0\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}; I_C = 1\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	250	400	-	
		$V_{CE} = 5\text{ V}; I_C = 500\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	200	350	-	
		$V_{CE} = 5\text{ V}; I_C = 1\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	100	150	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 100\text{ mA}; I_B = 1\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	90	110	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	110	140	mV
		$I_C = 1\text{ A}; I_B = 100\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	200	250	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = 1\text{ A}; I_B = 100\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	200	250	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 1\text{ A}; I_B = 50\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	-	0.95	1.1	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = 5\text{ V}; I_C = 1\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	0.82	0.9	V
$f_T$	transition frequency	$V_{CE} = 10\text{ V}; I_C = 50\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	150	220	-	MHz
$C_c$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	5.5	10	pF



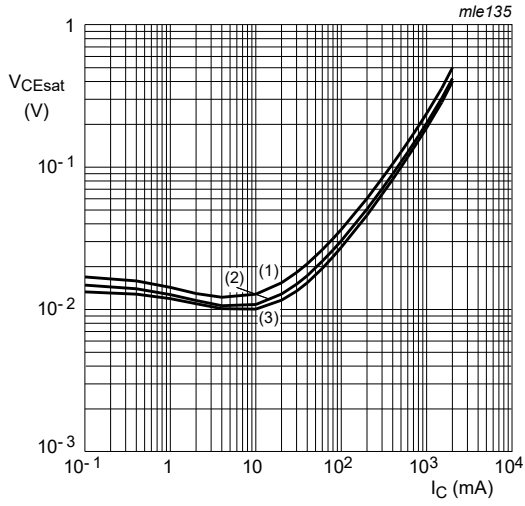
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

Fig. 3. DC current gain as a function of collector current; typical values



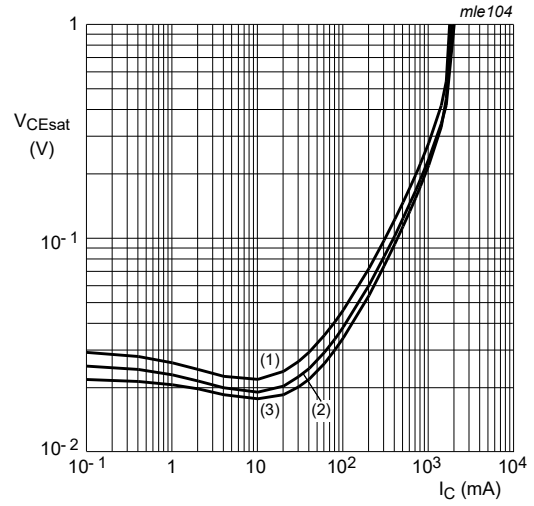
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

Fig. 4. Base-emitter voltage as a function of collector current; typical values



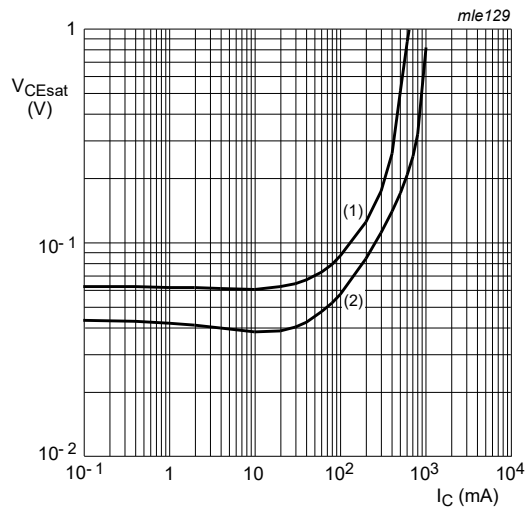
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



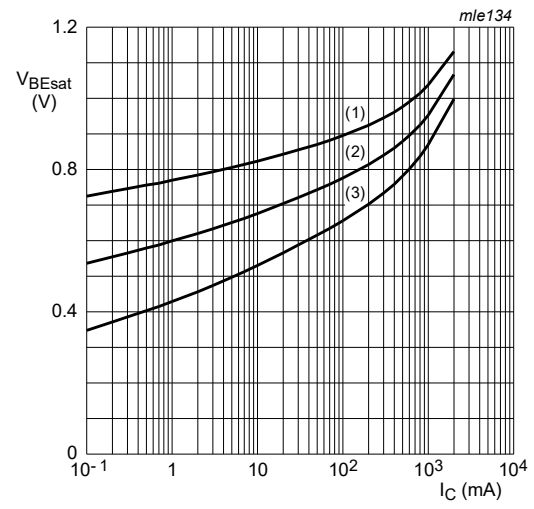
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 6. Collector-emitter saturation voltage as a function of collector current; typical values**



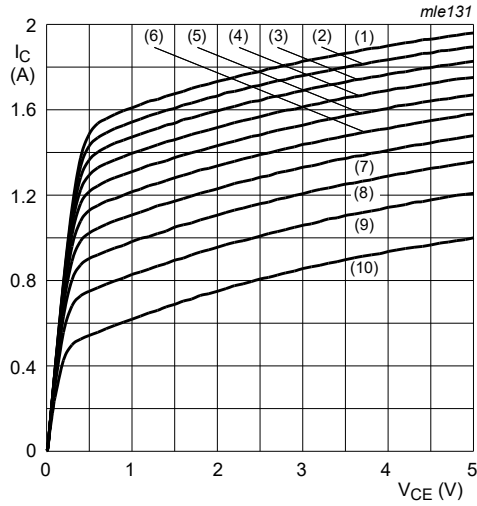
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$

**Fig. 7. Collector-emitter saturation voltage as a function of collector current; typical values**



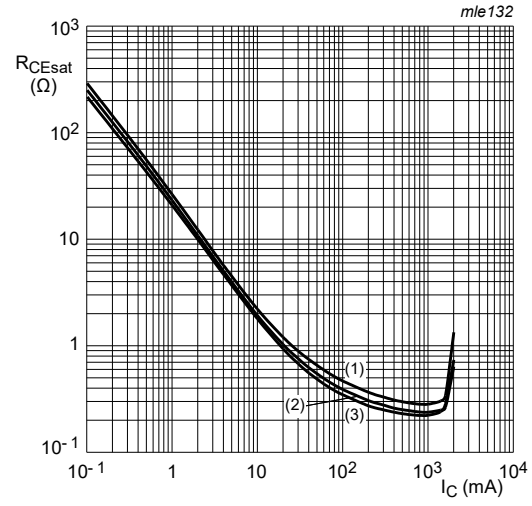
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



- $T_{amb} = 25\text{ }^\circ\text{C}$
- (1)  $I_B = 60\text{ mA}$
  - (2)  $I_B = 54\text{ mA}$
  - (3)  $I_B = 48\text{ mA}$
  - (4)  $I_B = 42\text{ mA}$
  - (5)  $I_B = 36\text{ mA}$
  - (6)  $I_B = 30\text{ mA}$
  - (7)  $I_B = 24\text{ mA}$
  - (8)  $I_B = 18\text{ mA}$
  - (9)  $I_B = 12\text{ mA}$
  - (10)  $I_B = 6\text{ mA}$

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



- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^\circ\text{C}$
  - (2)  $T_{amb} = 25\text{ }^\circ\text{C}$
  - (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

**Fig. 10.** Equivalent on-resistance as a function of collector current; typical values

## 11. Package outline

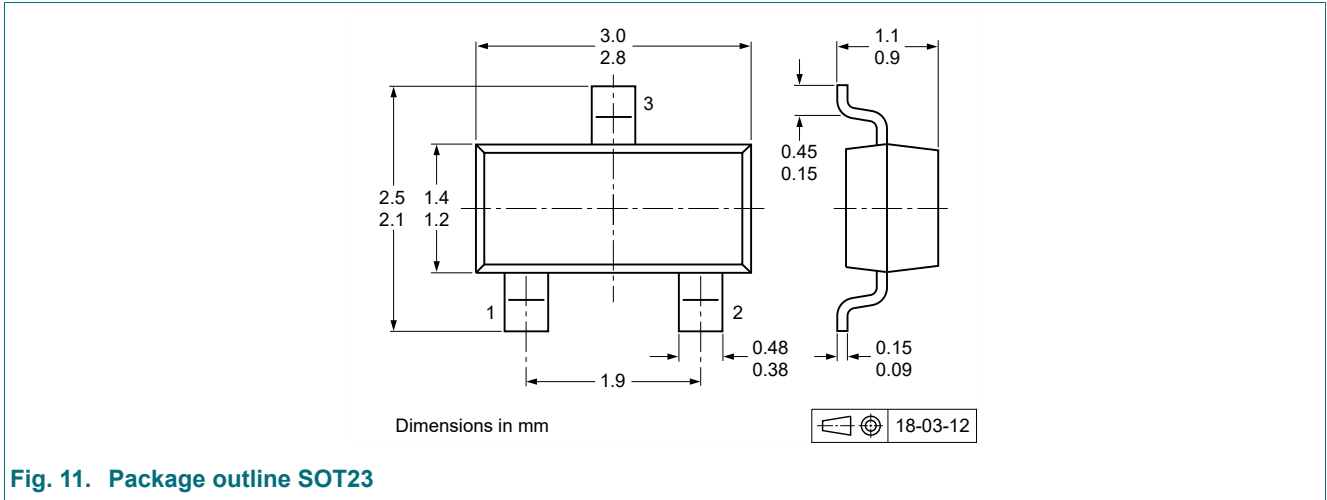


Fig. 11. Package outline SOT23

## 12. Soldering

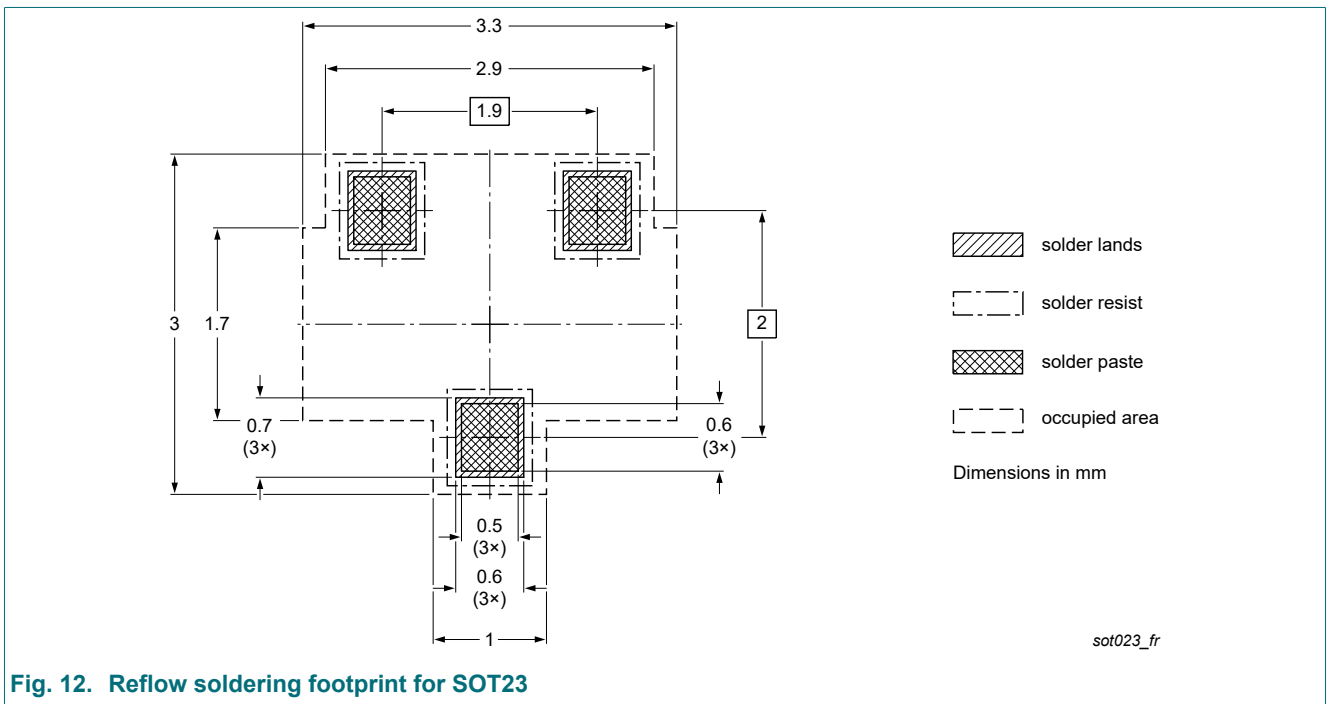


Fig. 12. Reflow soldering footprint for SOT23



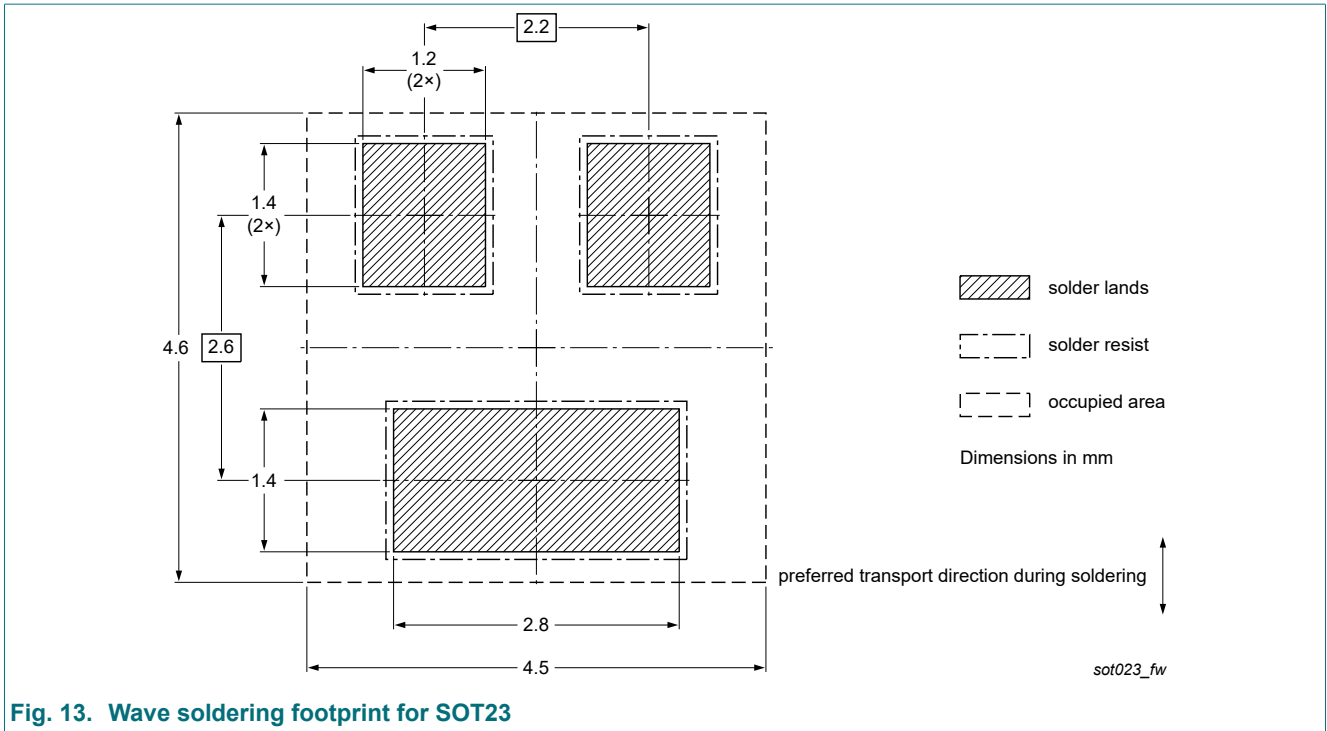


Fig. 13. Wave soldering footprint for SOT23

## 13. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4160T v.3	20230401	Product data sheet	-	PBSS4160T v.2
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Product changed to non automotive. Please refer to the automotive product(s) with -Q.</li></ul>			
PBSS4160T v.2	20040512	Product data sheet	-	PBSS4160T v.1
PBSS4160T v.1	20030624	Product specification	-	-

## 14. 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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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