

# PBSS4320X

20 V, 3 A NPN low V<sub>CEsat</sub> (BISS) transistor

27 May 2019

Product data sheet

## 1. General description

NPN low V<sub>CEsat</sub> transistor in a medium power flat lead SOT89 plastic package.

PNP complement: PBSS5320X

## 2. Features and benefits

- SOT89 (SC-62) package
- Low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability: I<sub>C</sub> and I<sub>CM</sub>
- Higher efficiency leading to less heat generation
- Reduced printed-circuit board requirements.
- AEC-Q101 qualified

## 3. Applications

- Power management
  - DC/DC converters
  - Supply line switching
  - Battery charger
  - LCD backlighting.
- Peripheral drivers
  - 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

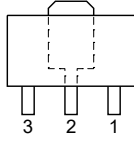
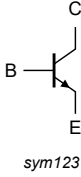
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	20	V
I <sub>C</sub>	collector current		[1]	-	3	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	-	5	A
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 0.1 A	220	-	-	
R <sub>CEsat</sub>	collector-emitter saturation resistance	I <sub>C</sub> = 3 A; I <sub>B</sub> = 300 mA	[2]	85	105	mΩ

[1] Device mounted on a ceramic printed-circuit board 7 cm<sup>2</sup>, single-sided copper, tin-plated.

[2] Pulsed test: t<sub>p</sub> ≤ 300 μs; δ ≤ 0.02

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E	emitter	 <p style="text-align: center;"><b>SOT89</b></p>	 <p style="text-align: center;"><i>sym123</i></p>
2	C	collector		
3	B	base		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4320X	SOT89	plastic surface-mounted package; die pad for good heat transfer; 3 leads	SOT89

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4320X	S44

## 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		-	20	V
$V_{CEO}$	collector-emitter voltage	open base		-	20	V
$V_{EBO}$	emitter-base voltage	open collector		-	5	V
$I_C$	collector current		[1]	-	3	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms		-	5	A
$I_B$	base current			-	0.5	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[2]	-	550	mW
			[3]	-	1	W
			[4]	-	1.4	W
			[5]	-	1.6	W
$T_j$	junction temperature			-	150	°C
$T_{amb}$	ambient temperature			-65	150	°C
$T_{stg}$	storage temperature			-65	150	°C

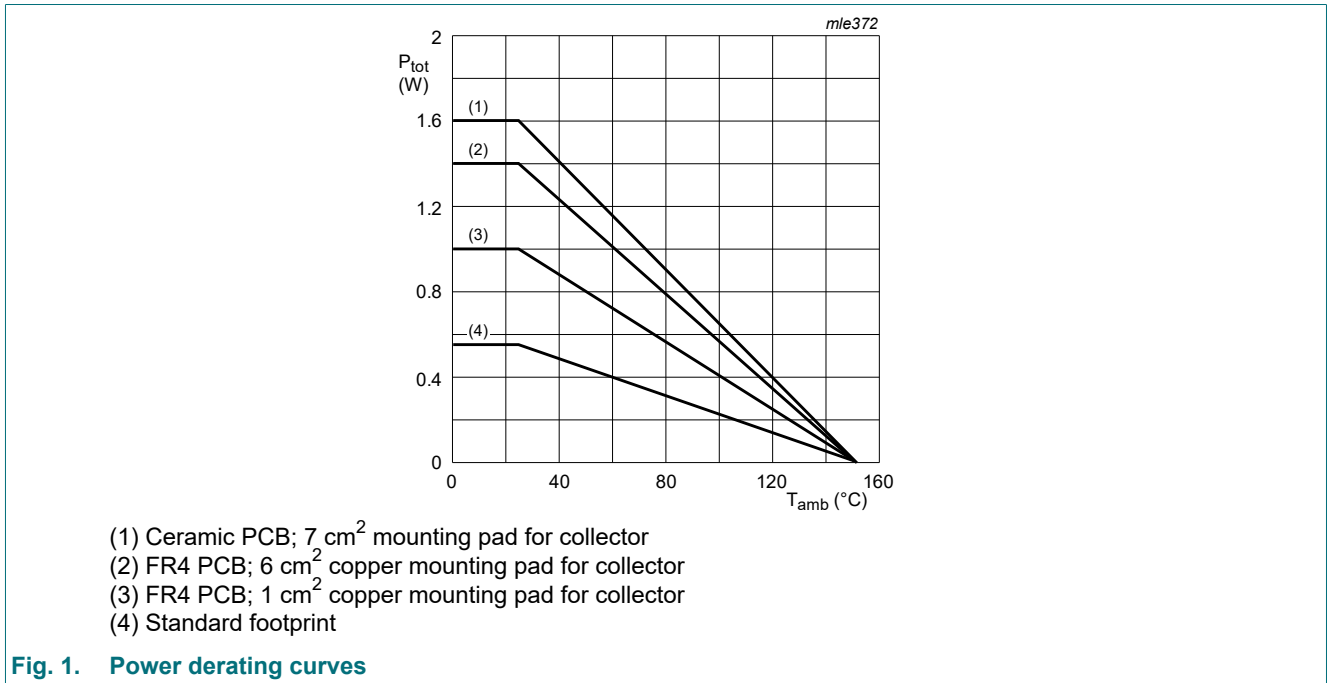
[1] Device mounted on a ceramic printed-circuit board 7 cm<sup>2</sup>, single-sided copper, tin-plated.

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

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

[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.

[5] Device mounted on a ceramic PCB 7 cm<sup>2</sup>, single-sided copper, tin-plated.



**Fig. 1. Power derating curves**

### 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]	-	-	225	K/W
			[2]	-	-	125	K/W
			[3]	-	-	90	K/W
			[4]	-	-	80	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	16	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] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on a ceramic PCB 7 cm<sup>2</sup>, single-sided copper, tin-plated.

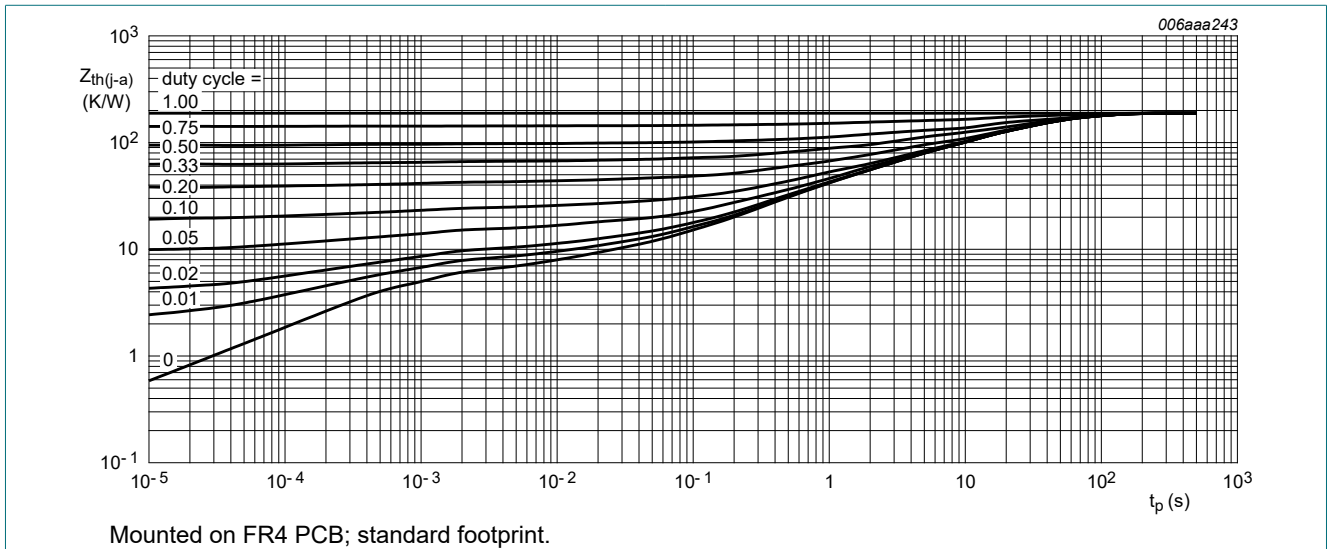


Fig. 2. Transient thermal impedance as a function of pulse duration; typical values

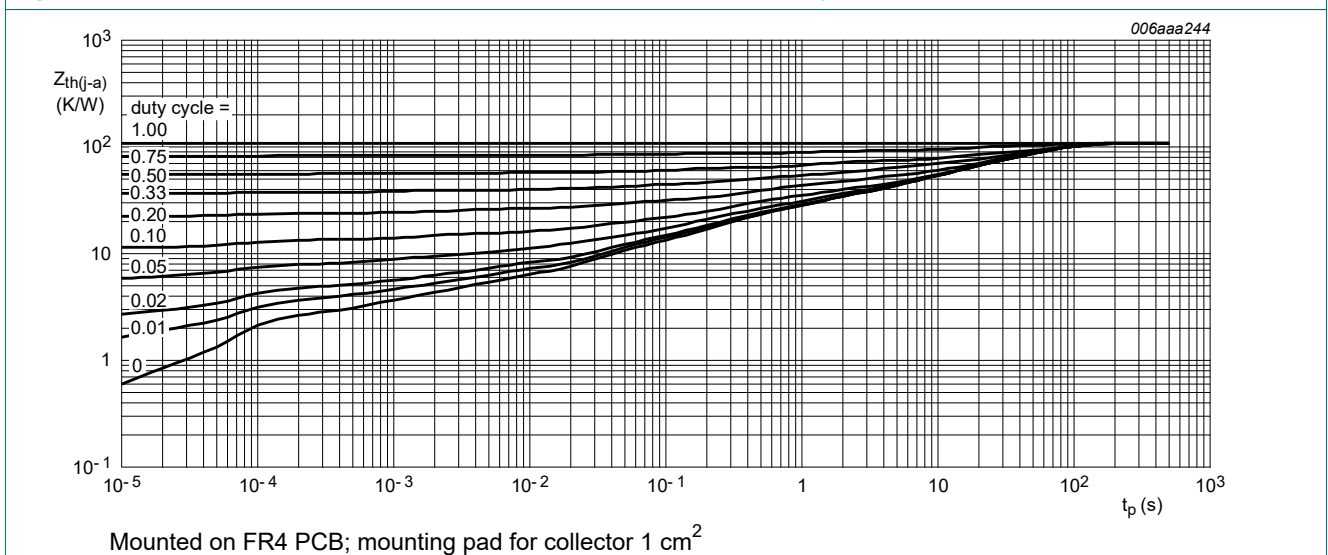
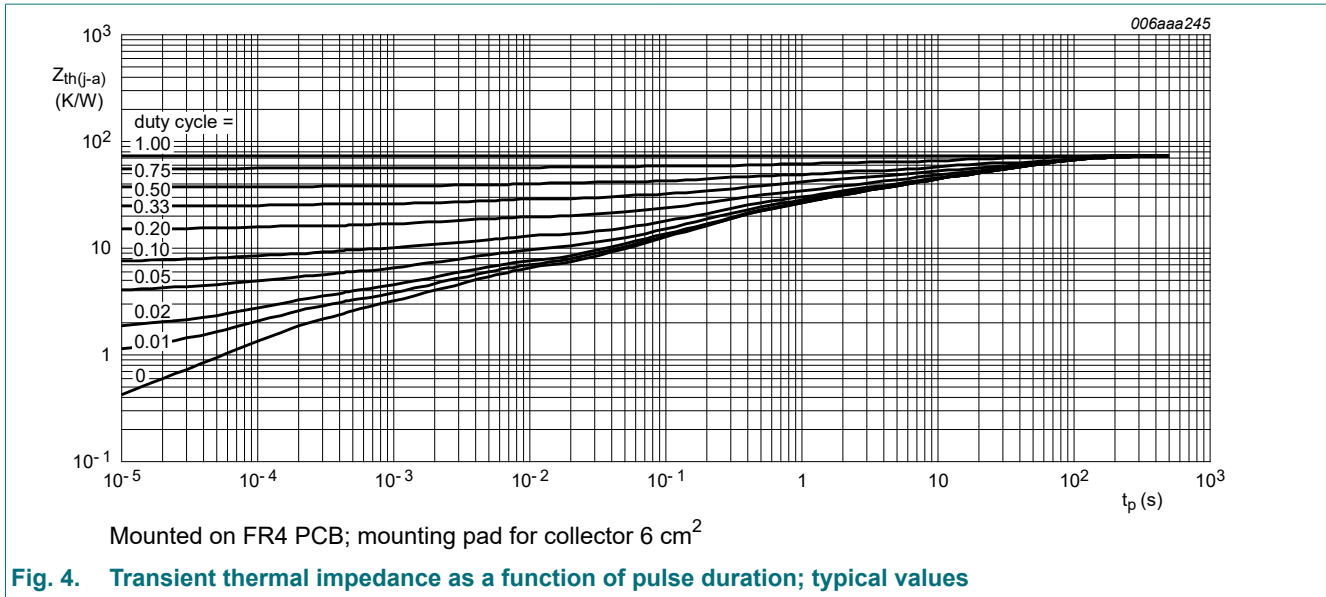


Fig. 3. Transient thermal impedance as a function of pulse duration; typical values



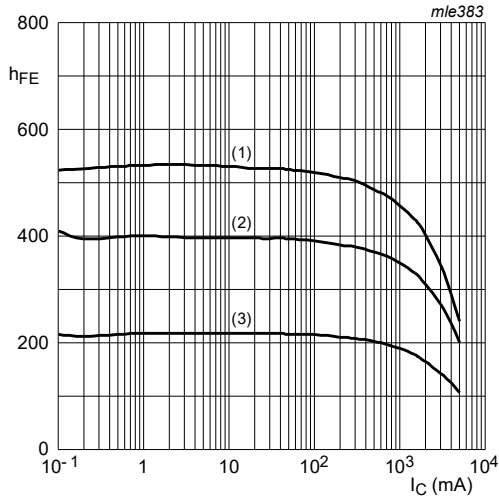
## 10. Characteristics

**Table 7. Characteristics**

*T<sub>amb</sub> = 25 °C unless otherwise specified.*

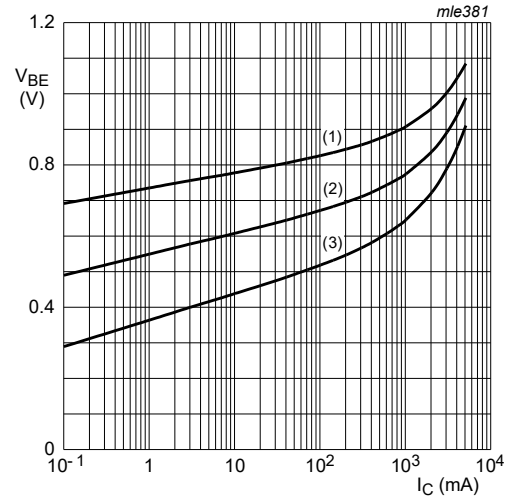
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 20 V; I <sub>E</sub> = 0 A	-	-	100	nA	
		V <sub>CB</sub> = 20 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	50	μA	
I <sub>CES</sub>	collector-emitter cut-off current	V <sub>CE</sub> = 20 V; V <sub>BE</sub> = 0 V	-	-	100	nA	
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A	-	-	100	nA	
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 0.1 A	220	-	-		
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 0.5 A	220	-	-		
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 1 A	[1]	220	-	-	
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 2 A	[1]	200	-	-	
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 3 A	[1]	150	-	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 0.5 A; I <sub>B</sub> = 50 mA	-	-	70	mV	
		I <sub>C</sub> = 1 A; I <sub>B</sub> = 50 mA	-	-	120	mV	
		I <sub>C</sub> = 2 A; I <sub>B</sub> = 100 mA	-	-	240	mV	
		I <sub>C</sub> = 3 A; I <sub>B</sub> = 300 mA	[1]	-	310	mV	
R <sub>CEsat</sub>	collector-emitter saturation resistance	[1]	-	85	105	mΩ	
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = 2 A; I <sub>B</sub> = 100 mA	-	-	1.1	V	
		I <sub>C</sub> = 3 A; I <sub>B</sub> = 300 mA	[1]	-	1.2	V	
V <sub>BEon</sub>	base-emitter turn-on voltage	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 1 A	1.1	-	-	V	
f <sub>T</sub>	transition frequency	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 100 mA; f = 100 MHz	100	-	-	MHz	
C <sub>C</sub>	collector capacitance	V <sub>CB</sub> = 10 V; I <sub>E</sub> = 0 A; i <sub>e</sub> = 0 A; f = 1 MHz	-	-	35	pF	

[1] Pulsed test: t<sub>p</sub> ≤ 300 μs; δ ≤ 0.02



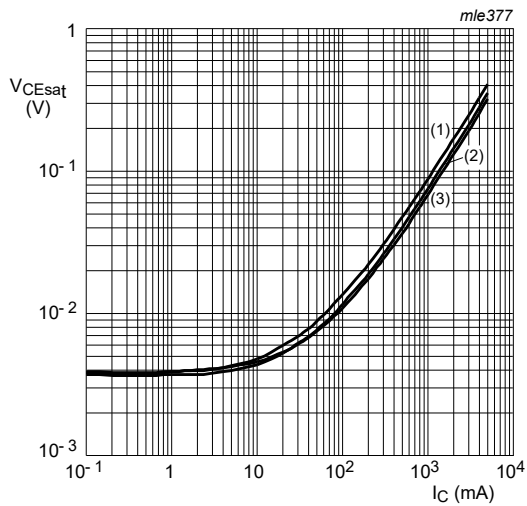
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig. 5. DC current gain as a function of collector current; typical values**



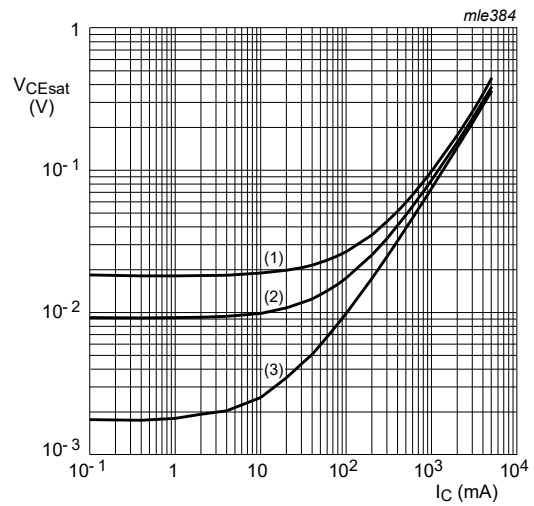
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



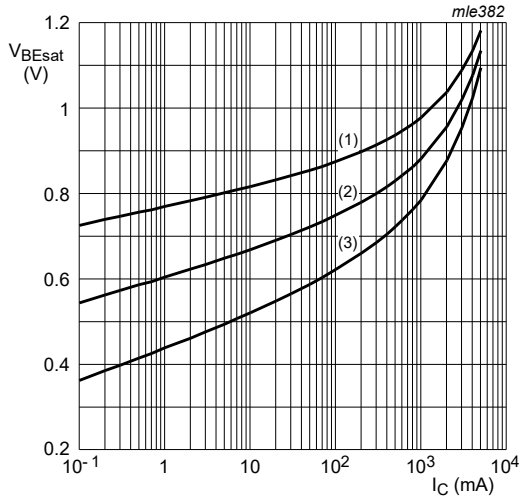
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



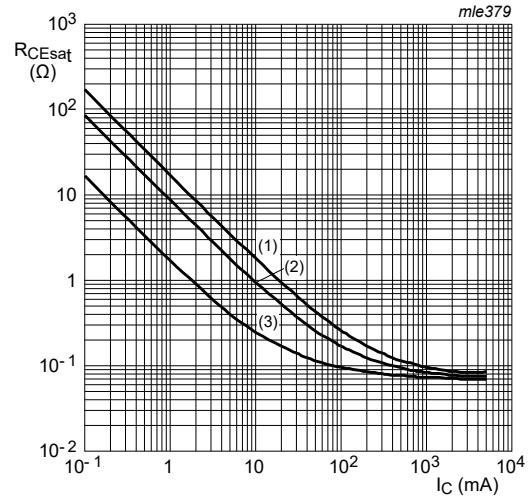
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

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



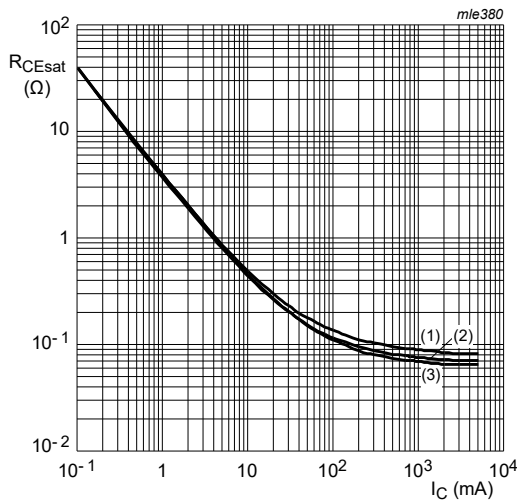
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



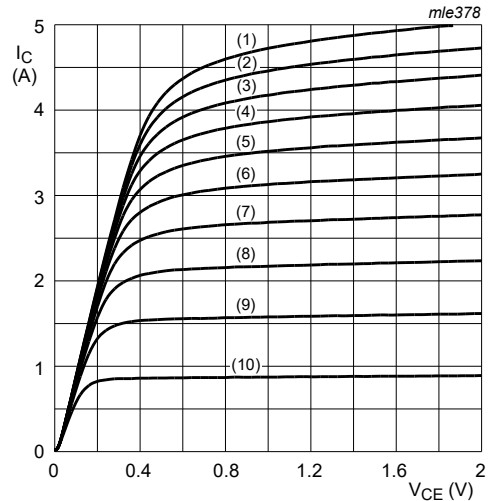
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig. 10. Equivalent on-resistance 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. 11. Equivalent on-resistance as a function of collector current; typical values**



$T_{amb} = 25\text{ °C}$   
 (1)  $I_B = 25\text{ mA}$   
 (2)  $I_B = 22.5\text{ mA}$   
 (3)  $I_B = 20\text{ mA}$   
 (4)  $I_B = 17.5\text{ mA}$   
 (5)  $I_B = 15\text{ mA}$   
 (6)  $I_B = 12.5\text{ mA}$   
 (7)  $I_B = 10\text{ mA}$   
 (8)  $I_B = 7.5\text{ mA}$   
 (9)  $I_B = 5\text{ mA}$   
 (10)  $I_B = 2.5\text{ mA}$

**Fig. 12. Collector current as a function of collector-emitter voltage; typical values**

## 11. Test information

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### Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

## 12. Package outline

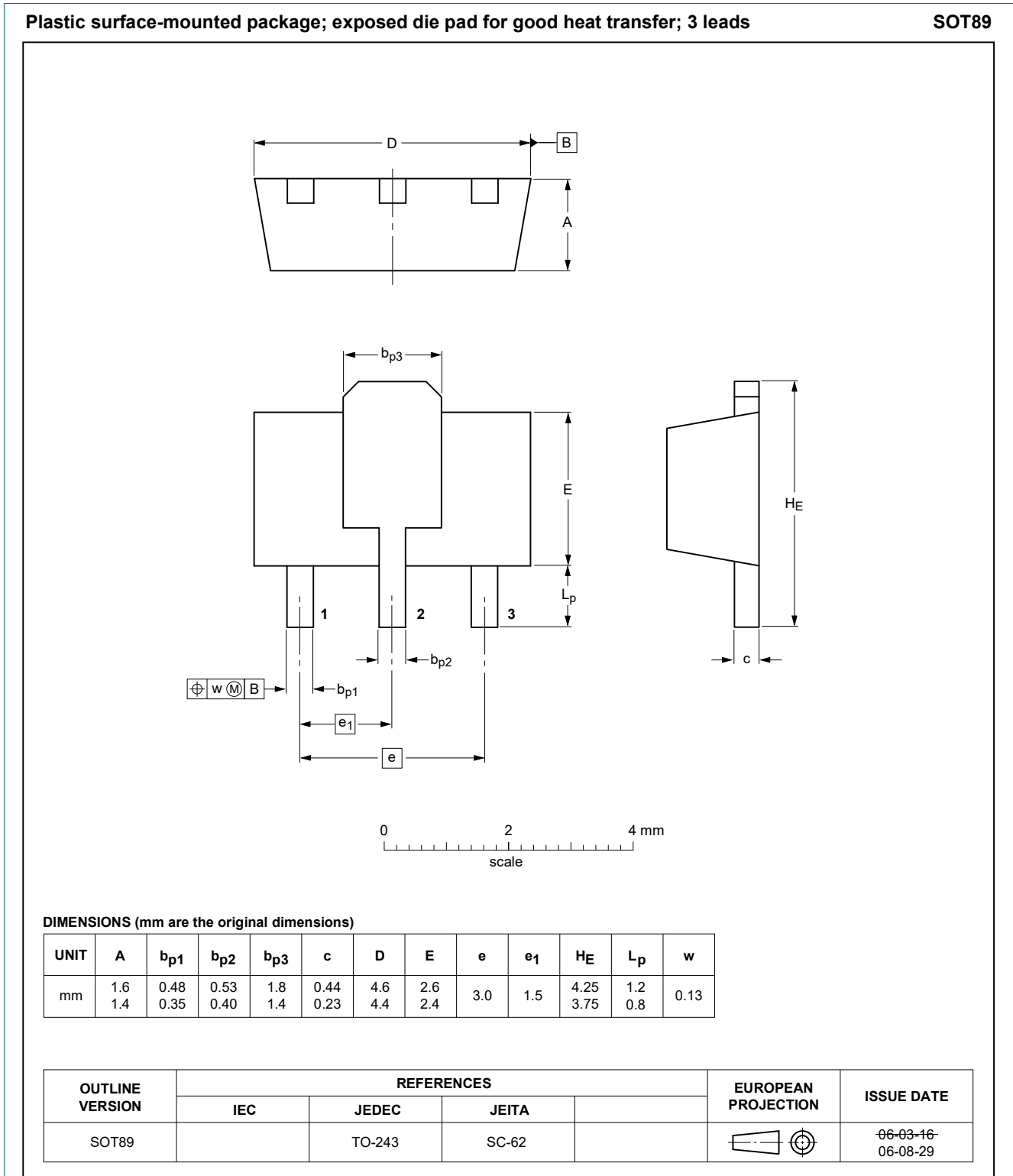


Fig. 13. Package outline SOT89

### 13. Soldering

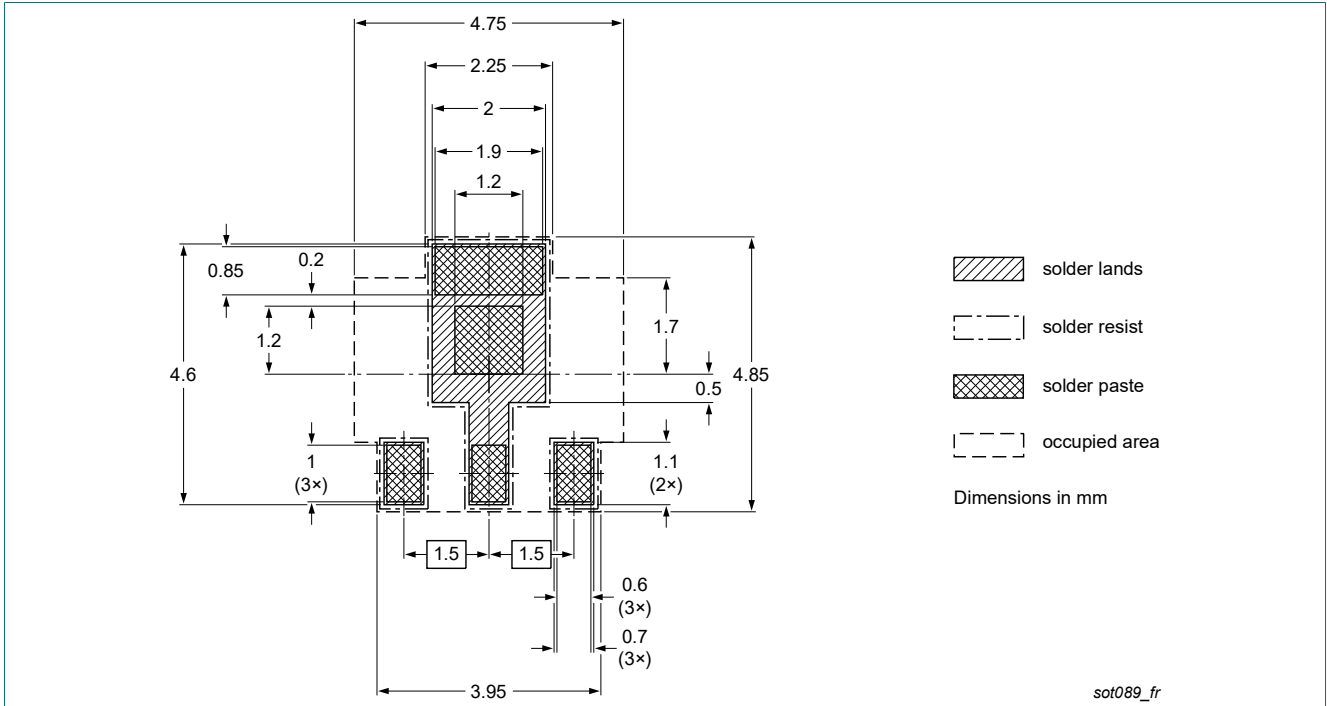


Fig. 14. Reflow soldering footprint for SOT89

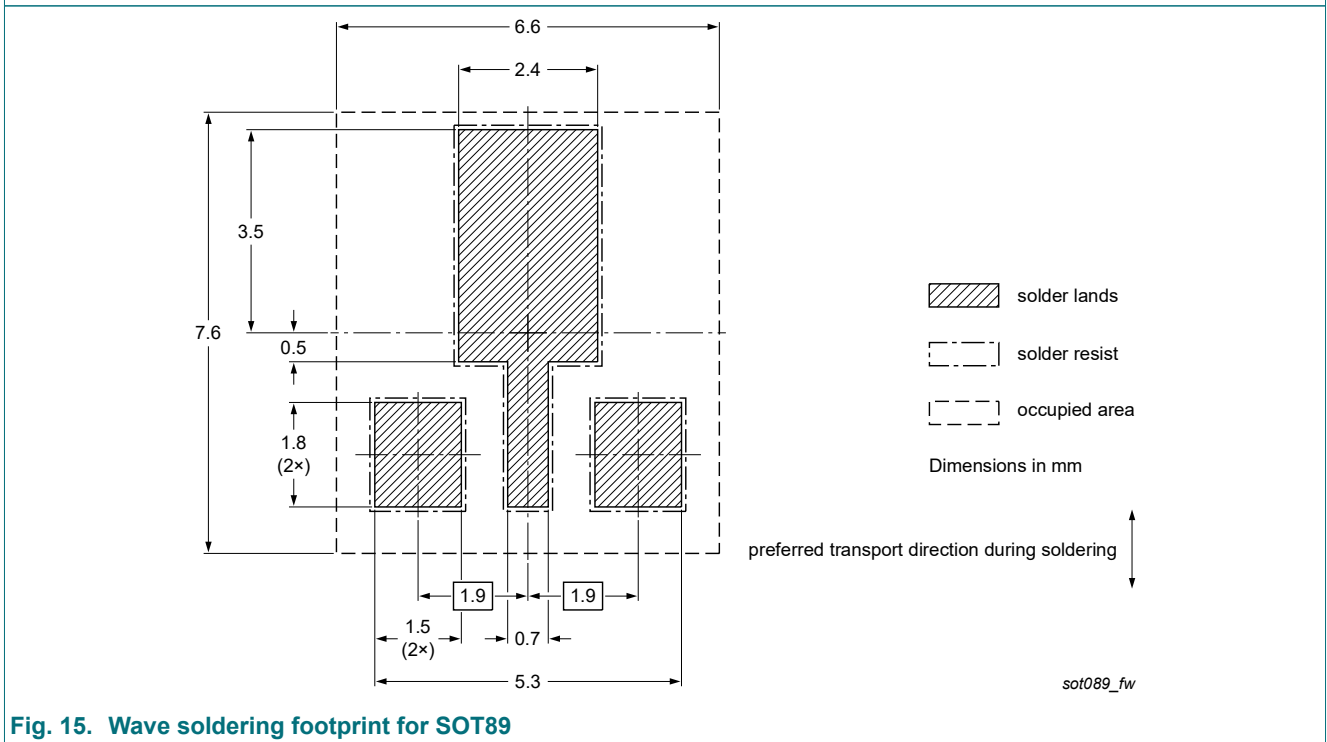


Fig. 15. Wave soldering footprint for SOT89

## 14. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4320X v.1	20190527	Product data sheet	-	PBSS4320X v.2
Modifications:	<ul style="list-style-type: none"><li>• Characteristics: <math>V_{BEsat}</math> corrected from typical to maximum.</li><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></ul>			
PBSS4320X v.2	20041103	Product data sheet	-	PBSS4320X v.1
PBSS4320X v.1	20031215	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".
- [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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