



**THE DATASHEET OF  
PBSS5540X,135**





# PBSS5540X

40 V, 5 A PNP low  $V_{CEsat}$  (BISS) transistor

20 March 2018

Product data sheet

## 1. General description

PNP low  $V_{CEsat}$  transistor in a medium power SOT89 (SC-62) package.

NPN complement: PBSS4540X.

## 2. Features and benefits

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability:  $I_C$  and  $I_{CM}$
- High efficiency leading to less heat generation.
- AEC-Q101 qualified

## 3. Applications

- Supply line switching circuits
- Battery management applications
- DC/DC converter applications
- Strobe flash units
- Medium power driver (e.g. relays, buzzers and motors).

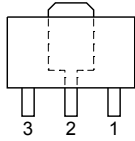
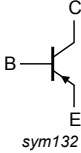
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-40	V
$I_C$	collector current		-	-	-4	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	-10	A
$h_{FE}$	DC current gain	$V_{CE} = -2$ V; $I_C = -0.5$ A; $T_{amb} = 25$ °C	250	-	-	
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -5$ A; $I_B = -500$ mA; $t_p \leq 300$ $\mu$ s; pulsed; $\delta \leq 0.02$ ; $T_{amb} = 25$ °C	-	45	75	m $\Omega$

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E	emitter	 <p>SOT89</p>	 <p>sym132</p>
2	C	collector		
3	B	base		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS5540X	SOT89	plastic surface-mounted package; die pad for good heat transfer; 3 leads	SOT89

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PBSS5540X	%1G

[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	-	-40	V	
$V_{CEO}$	collector-emitter voltage	open base	-	-40	V	
$V_{EBO}$	emitter-base voltage	open collector	-	-6	V	
$I_C$	collector current		-	-4	A	
$I_{CRM}$	repetitive peak collector current	$\delta \leq 0.2$ ; $t_p \leq 10$ ms	-	-5	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-10	A	
$I_B$	base current		-	-1	A	
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	-2	A	
$P_{tot}$	total power dissipation		[1] [2]	-	2.5	W
		$T_{amb} \leq 25$ °C	[2]	-	0.55	W
			[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	

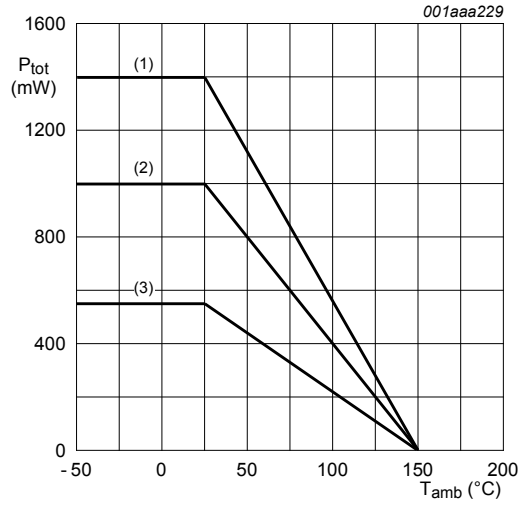
[1] Pulsed  $t_p \leq 10$  ms;  $\delta \leq 0.2$

[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 7 cm<sup>2</sup> ceramic printed-circuit board, 1 cm<sup>2</sup> single-sided copper and tin-plated.



- (1) FR4 PCB; 6 cm<sup>2</sup> mounting pad for collector
- (2) FR4 PCB; 1 cm<sup>2</sup> mounting pad for collector
- (3) FR4; standard footprint

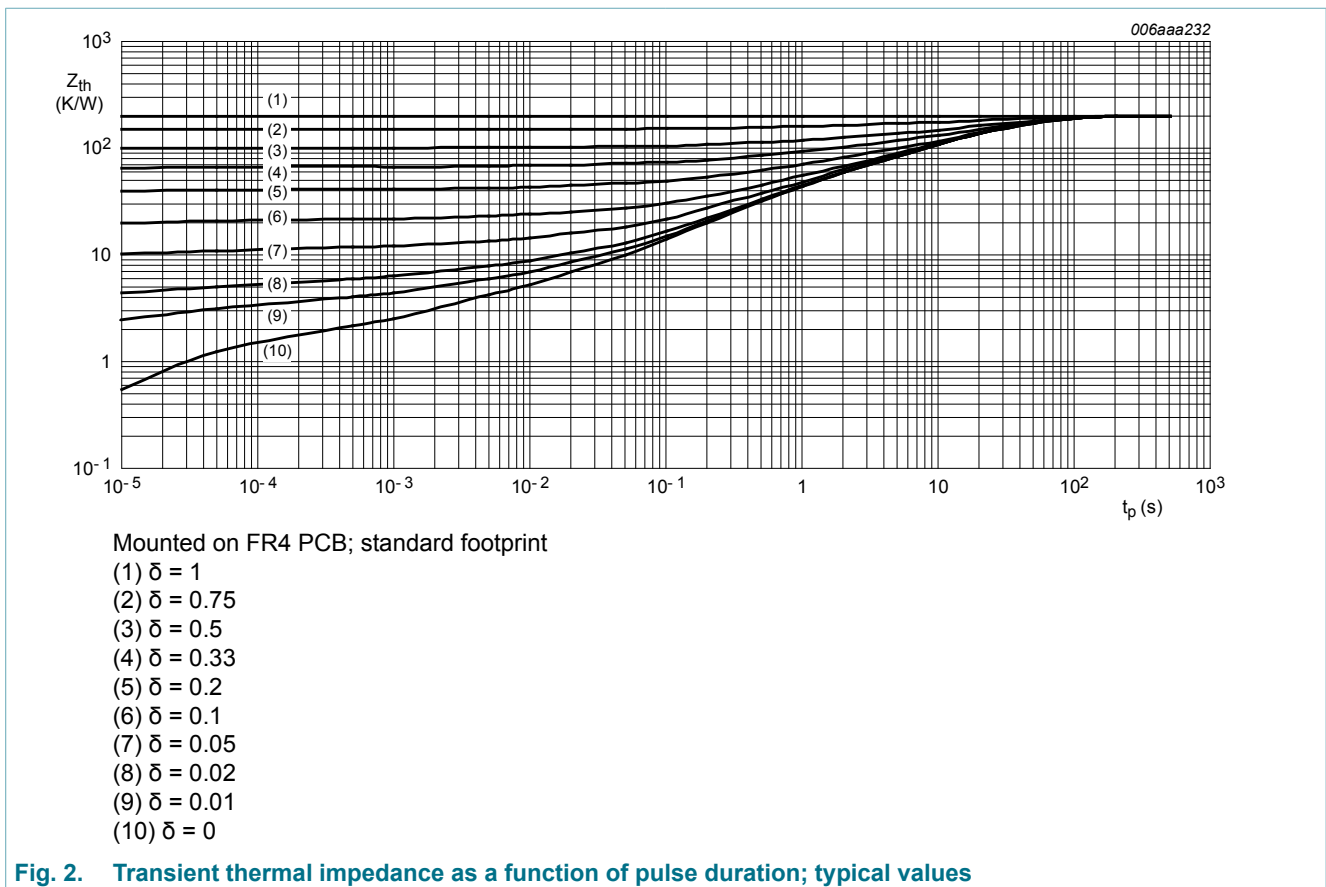
Fig. 1. Power derating curves

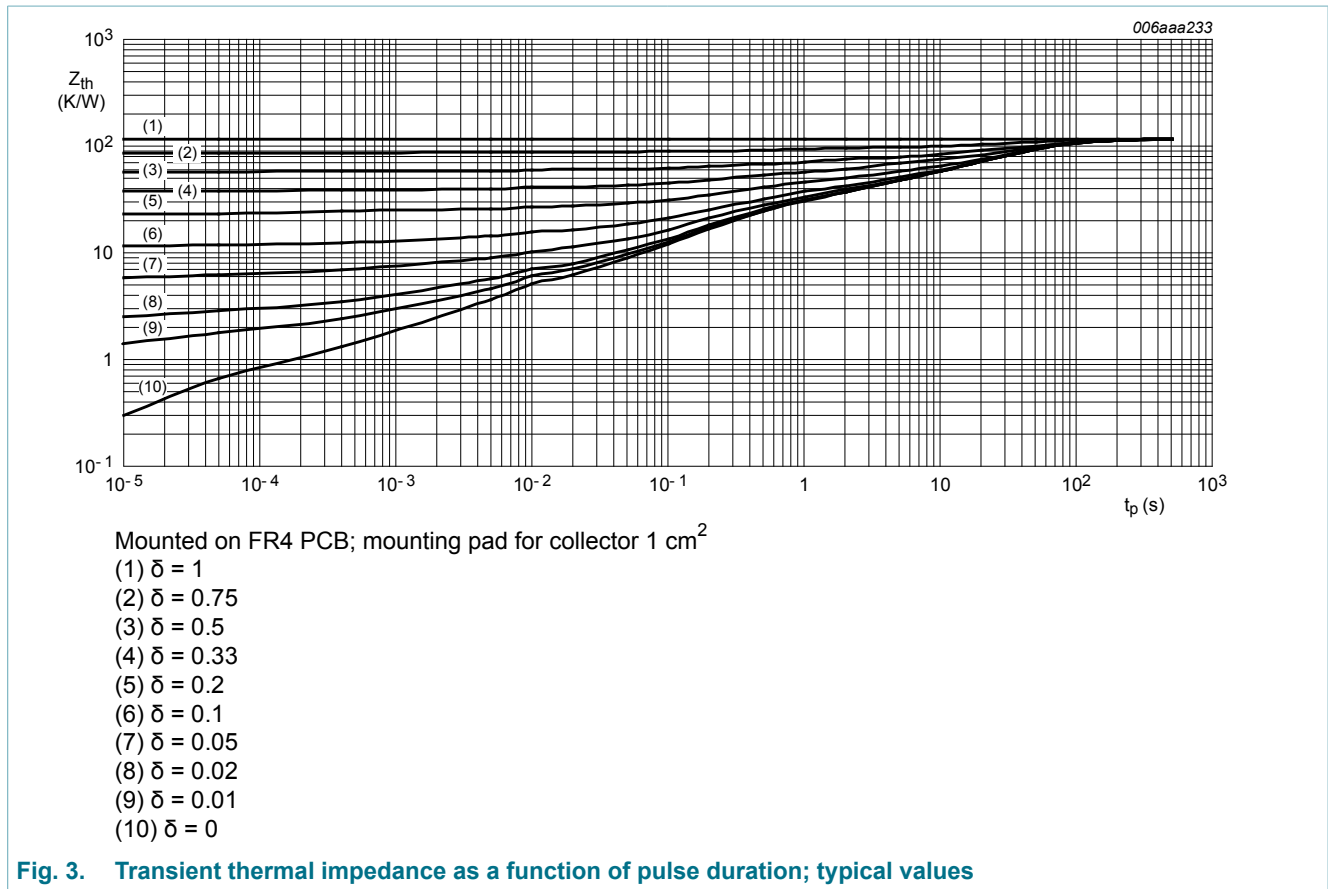
## 9. Thermal characteristics

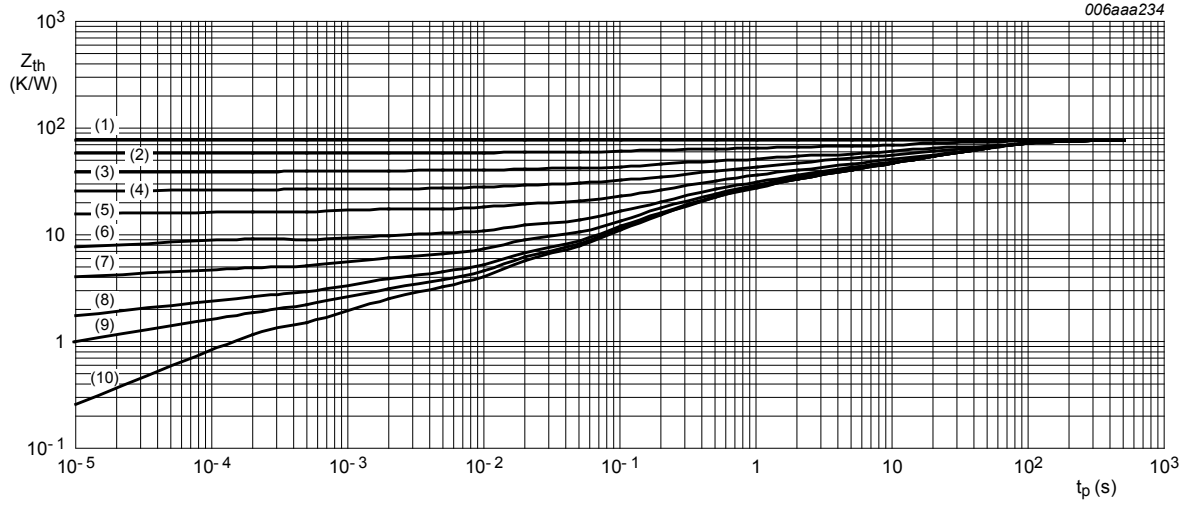
Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1] [2]	-	-	50	K/W
			[1]	-	-	225	K/W
			[3]	-	-	125	K/W
			[4]	-	-	90	K/W
			[5]	-	-	80	K/W
R <sub>th(j-sp)</sub>	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] Pulse test:  $t_p \leq 10$  ms;  $\delta \leq 0.2$ .
- [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 7 cm<sup>2</sup> ceramic printed-circuit board, 1 cm<sup>2</sup> single-sided copper and tin-plated.







Mounted on FR4 printed-circuit board; mounting pad for collector 6 cm<sup>2</sup>

- (1)  $\delta = 1$
- (2)  $\delta = 0.75$
- (3)  $\delta = 0.5$
- (4)  $\delta = 0.33$
- (5)  $\delta = 0.2$
- (6)  $\delta = 0.1$
- (7)  $\delta = 0.05$
- (8)  $\delta = 0.02$
- (9)  $\delta = 0.01$
- (10)  $\delta = 0$

Fig. 4. Transient thermal impedance as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = -30 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	-100	nA
		V <sub>CB</sub> = -30 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	-50	μA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = -5 V; I <sub>C</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	-100	nA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = -2 V; I <sub>C</sub> = -0.5 A; T <sub>amb</sub> = 25 °C	250	-	-	
		V <sub>CE</sub> = -2 V; I <sub>C</sub> = -1 A; t <sub>p</sub> ≤ 300 μs; pulsed; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	200	-	-	
		V <sub>CE</sub> = -2 V; I <sub>C</sub> = -2 A; t <sub>p</sub> ≤ 300 μs; pulsed; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	150	-	-	
		V <sub>CE</sub> = -2 V; I <sub>C</sub> = -5 A; t <sub>p</sub> ≤ 300 μs; pulsed; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	50	-	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = -0.5 A; I <sub>B</sub> = -5 mA; T <sub>amb</sub> = 25 °C	-	-	-120	mV
		I <sub>C</sub> = -1 A; I <sub>B</sub> = -10 mA; T <sub>amb</sub> = 25 °C	-	-	-170	mV
		I <sub>C</sub> = -2 A; I <sub>B</sub> = -200 mA; T <sub>amb</sub> = 25 °C	-	-	-160	mV
		I <sub>C</sub> = -4 A; I <sub>B</sub> = -200 mA; t <sub>p</sub> ≤ 300 μs; pulsed; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	-	-340	mV
		I <sub>C</sub> = -5 A; I <sub>B</sub> = -500 mA; t <sub>p</sub> ≤ 300 μs; pulsed; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	-	-375	mV
R <sub>CEsat</sub>	collector-emitter saturation resistance		-	45	75	mΩ
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = -4 A; I <sub>B</sub> = -200 mA; t <sub>p</sub> ≤ 300 μs; pulsed; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	-	-1.1	V
		I <sub>C</sub> = -5 A; I <sub>B</sub> = -500 mA; t <sub>p</sub> ≤ 300 μs; pulsed; δ ≤ 0.02 ; T <sub>amb</sub> = 25 °C	-	-	-1.2	V
V <sub>BEon</sub>	base-emitter turn-on voltage	V <sub>CE</sub> = -2 V; I <sub>C</sub> = -2 A; T <sub>amb</sub> = 25 °C	-	-	-1	V
f <sub>T</sub>	transition frequency	V <sub>CE</sub> = -10 V; I <sub>C</sub> = -0.1 A; f = 100 MHz; T <sub>amb</sub> = 25 °C	60	-	-	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; T <sub>amb</sub> = 25 °C	-	-	105	pF

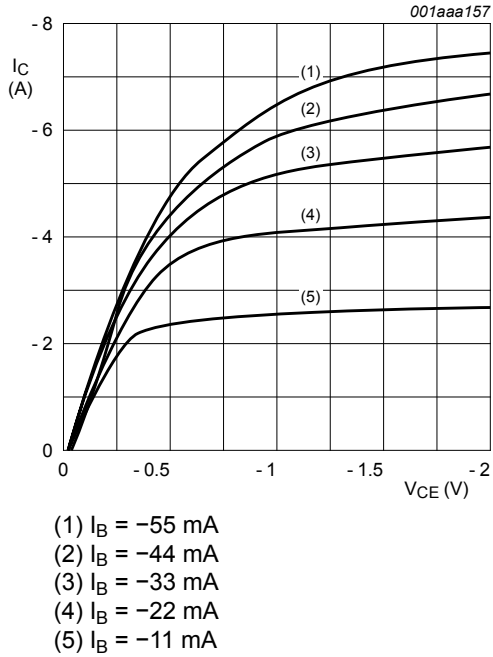


Fig. 5. Collector current as a function of collector-emitter voltage; typical values

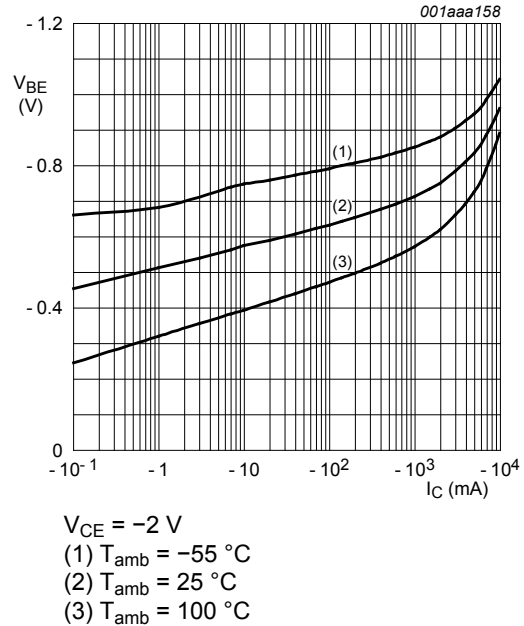


Fig. 6. Base-emitter voltage as a function of collector current; typical values

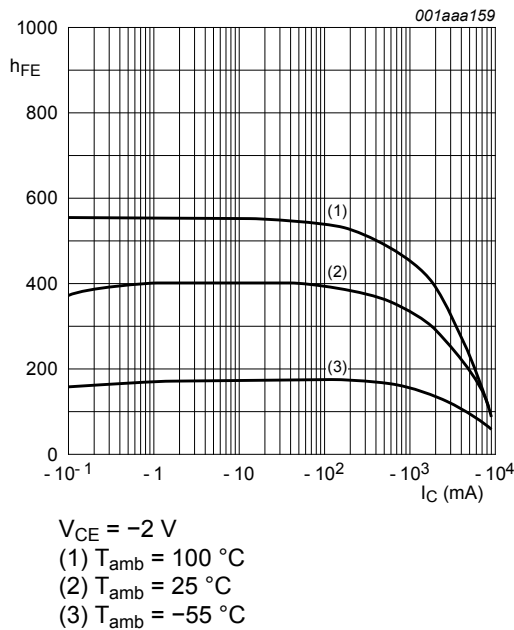


Fig. 7. DC current gain as a function of collector current; typical values

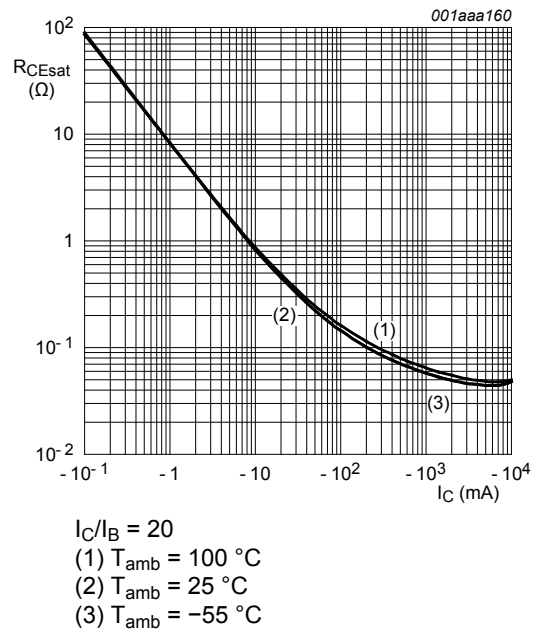
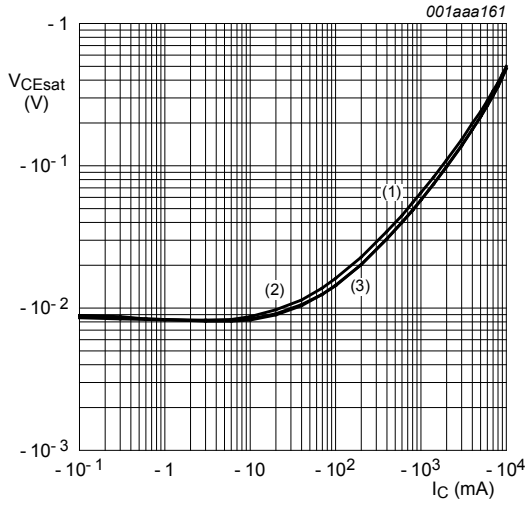
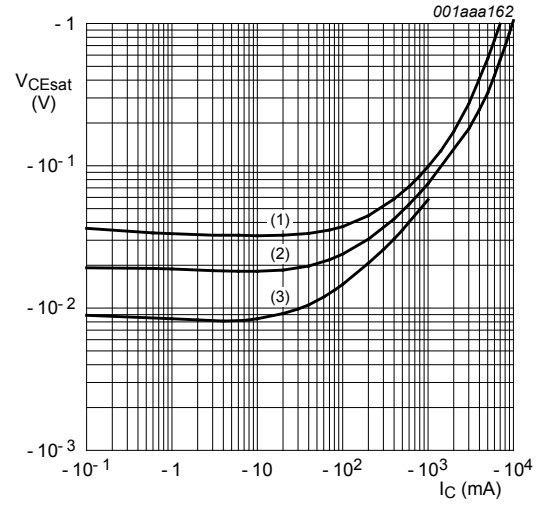


Fig. 8. Equivalent on-resistance as a function of collector current; typical values



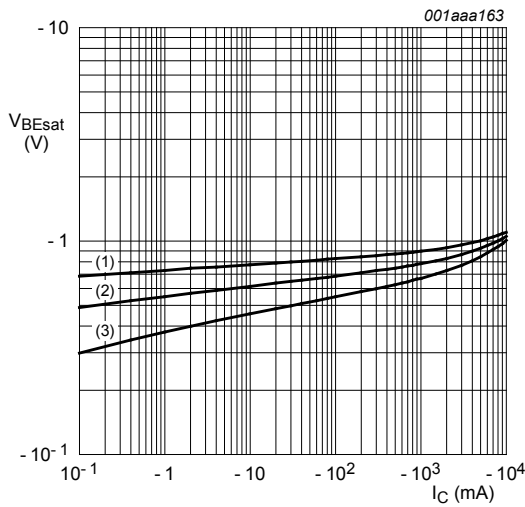
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



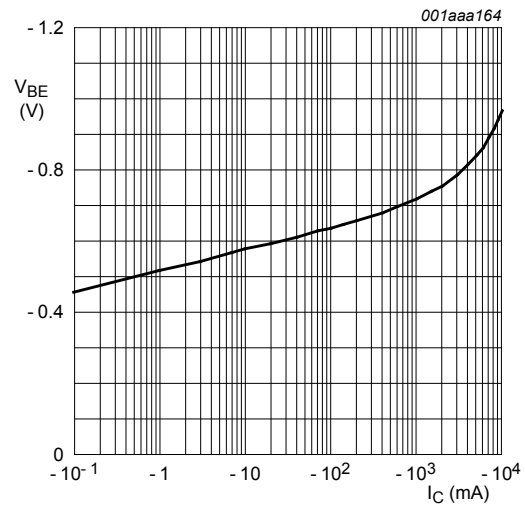
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

**Fig. 10. 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. 11. Base-emitter saturation voltage as a function of collector current; typical values**



$T_{amb} = 25\text{ °C}$

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

### 11. Package outline

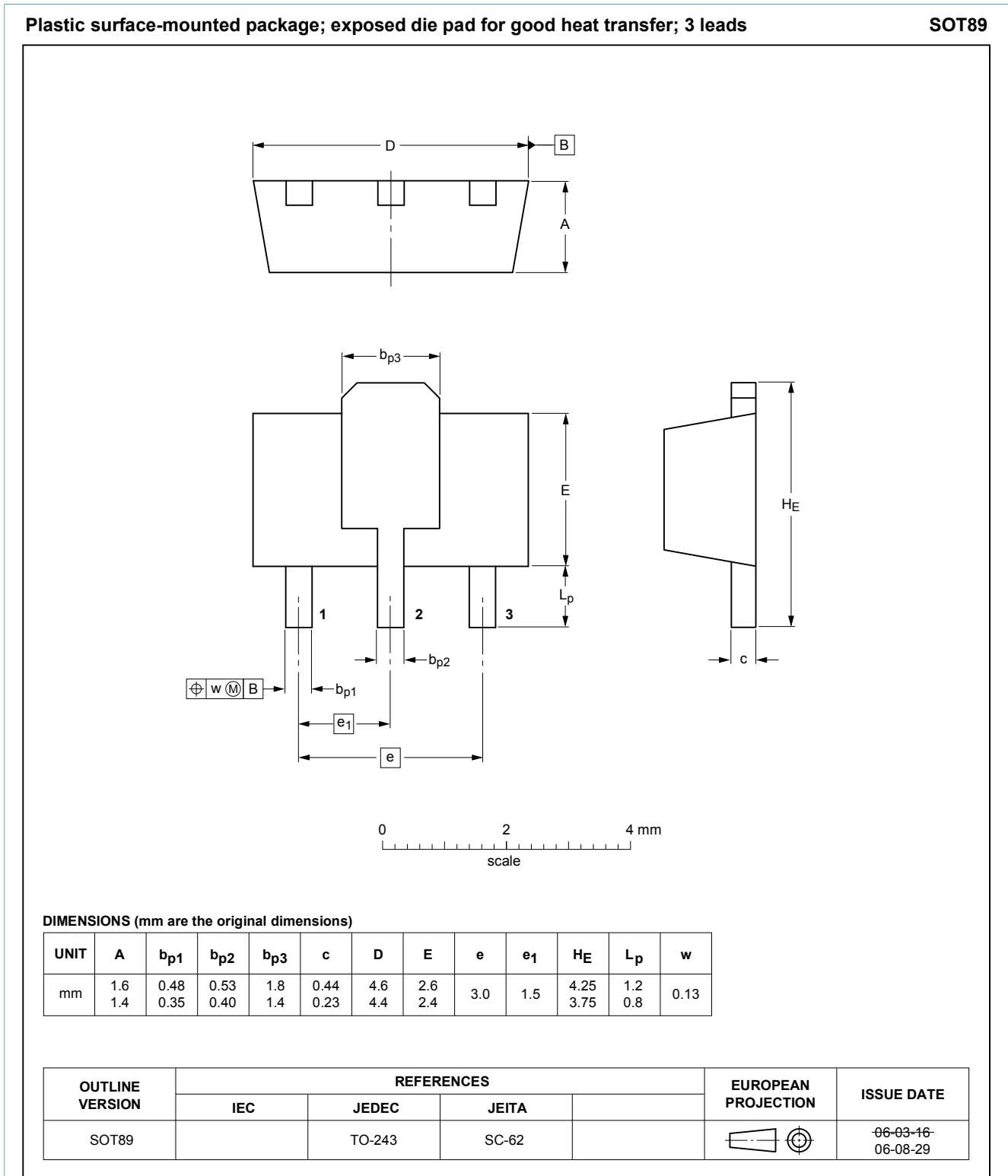


Fig. 13. Package outline SOT89

## 12. Soldering

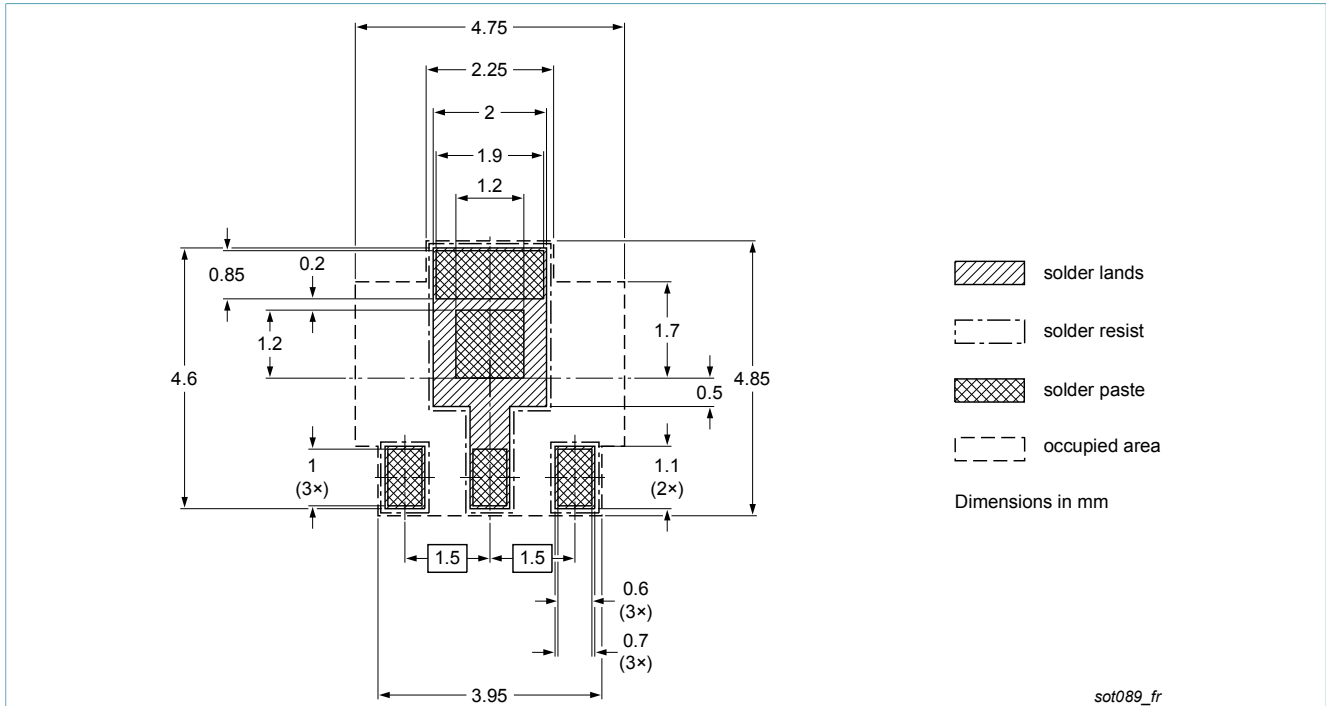


Fig. 14. Reflow soldering footprint for SOT89

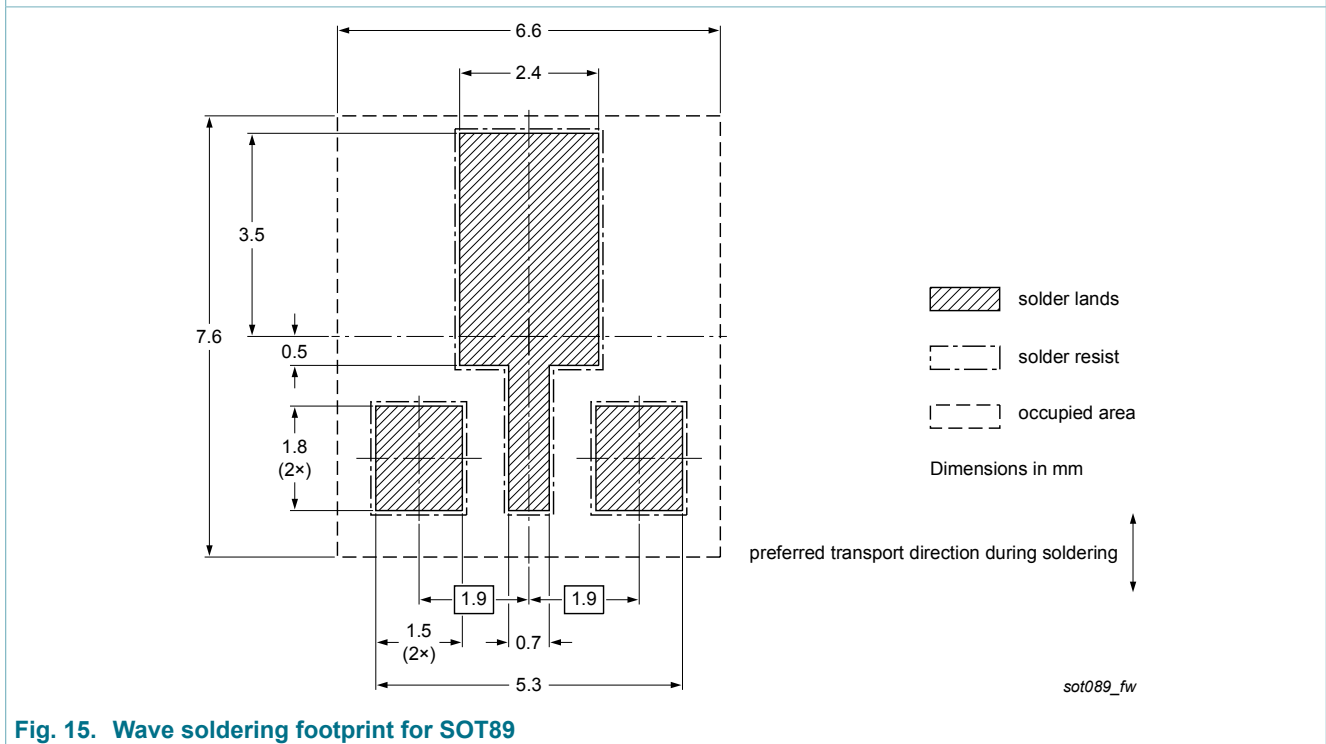


Fig. 15. Wave soldering footprint for SOT89

## 13. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS5540X v.3	20180320	Product data sheet	-	PBSS5540X 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>• Figure 5: Legend adapted</li></ul>			
PBSS5540X v.2	20041104	Product data sheet	-	PBSS5540X v.1
PBSS5540X v.1	20040115	Product data sheet	-	-

## 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.
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