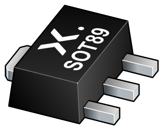

PBSS4540X

40 V, 5 A NPN low VCEsat (BISS) transistor

15 April 2020 — Product data sheet

1. General description

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

PNP complement: PBSS5540X.

2. Features and benefits

- High h_{FE} and low V_{CEsat} at high current operation
- High collector current capability: I_C maximum 4 A
- High efficiency leading to less heat generation.
- AEC-Q101 qualified

3. Applications

- Medium power peripheral drivers (e.g. fan and motor)
- Strobe flash units for DSC and mobile phones
- Inverter applications (e.g. TFT displays)
- Power switch for LAN and ADSL systems
- Medium power DC-to-DC conversionc
- Battery chargers.

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; $t_p \leq$ 10 ms		-	-	10	A
R_{CEsat}	collector-emitter saturation resistance	I_C = 5 A; I_B = 500 mA; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	40	71	mΩ

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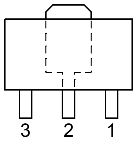
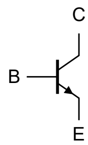
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E	emitter	 SOT89	 sym123
2	C	collector		
3	B	base		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4540X	SOT89	plastic, surface-mounted package; 3 leads; 1.5 mm pitch; 4.5 mm x 2.5 mm x 1.5 mm body	SOT89

7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PBSS4540X	%1B

[1] % = placeholder for manufacturing site code

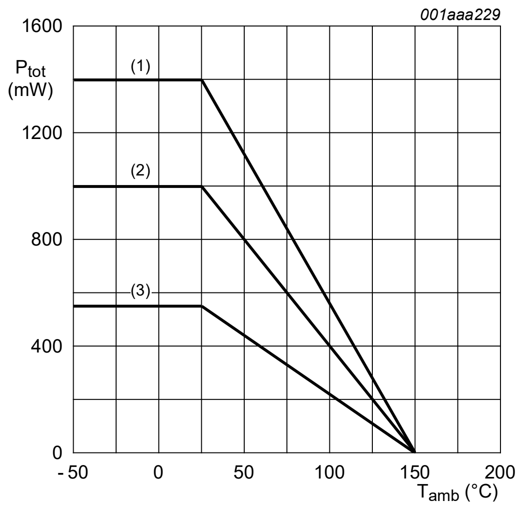
8. Limiting values

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	$\delta \leq 0.02$; $t_p \leq 10$ ms	[1]	-	5	A
I_{CM}	peak collector current	single pulse; $t_p \leq 10$ 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	$T_{amb} \leq 25$ °C	[1] [2]	-	2.5	W
			[1]	-	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] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
[2] Operated under pulsed conditions; $t_p \leq 10$ ms; $\delta \leq 0.2$.
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm^2.
[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.
[5] Device mounted on a 7 cm^2 ceramic PCB, 1 cm^2 single-sided copper and tin-plated.



(1) FR4 PCB; 6 cm^2 mounting pad for collector
(2) FR4 PCB; 1 cm^2 mounting pad for collector
(3) FR4; standard footprint

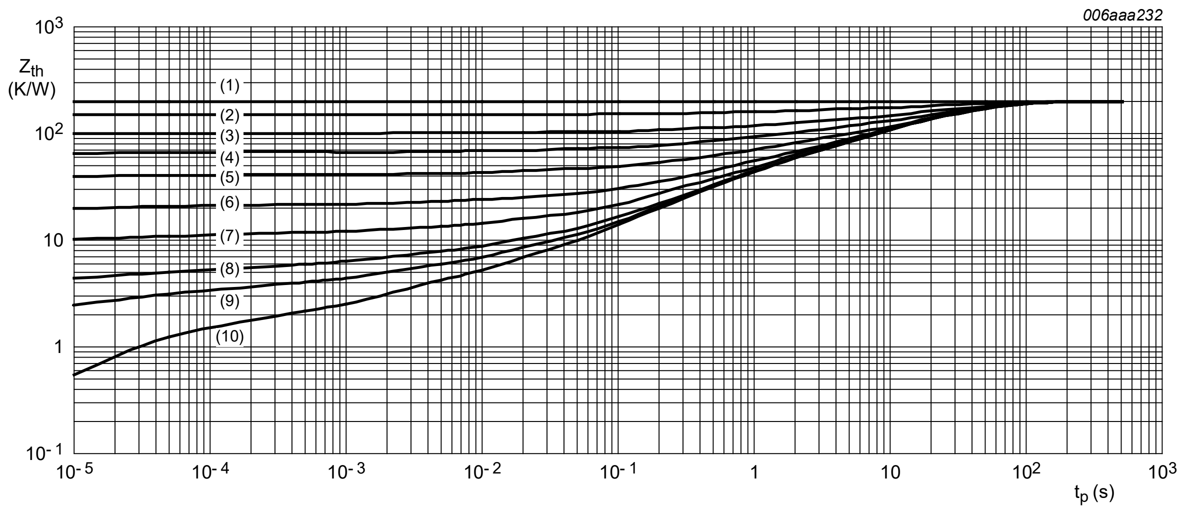
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

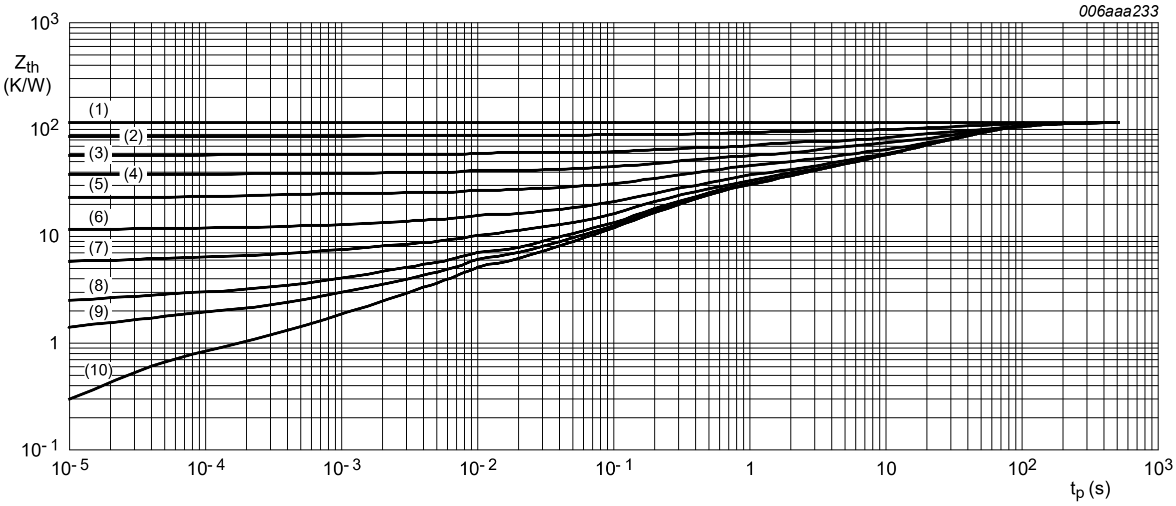
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] [2]	-	-	50	K/W
			[1]	-	-	225	K/W
			[3]	-	-	125	K/W
			[4]	-	-	90	K/W
			[5]	-	-	80	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	16	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
[2] Operated under pulsed conditions; $t_p \leq 10$ ms; $\delta \leq 0.2$.
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm^2.
[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.
[5] Device mounted on a 7 cm^2 ceramic PCB, 1 cm^2 single-sided copper and tin-plated.



Mounted on FR4 PCB; standard footprint
(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) $\delta = 0$

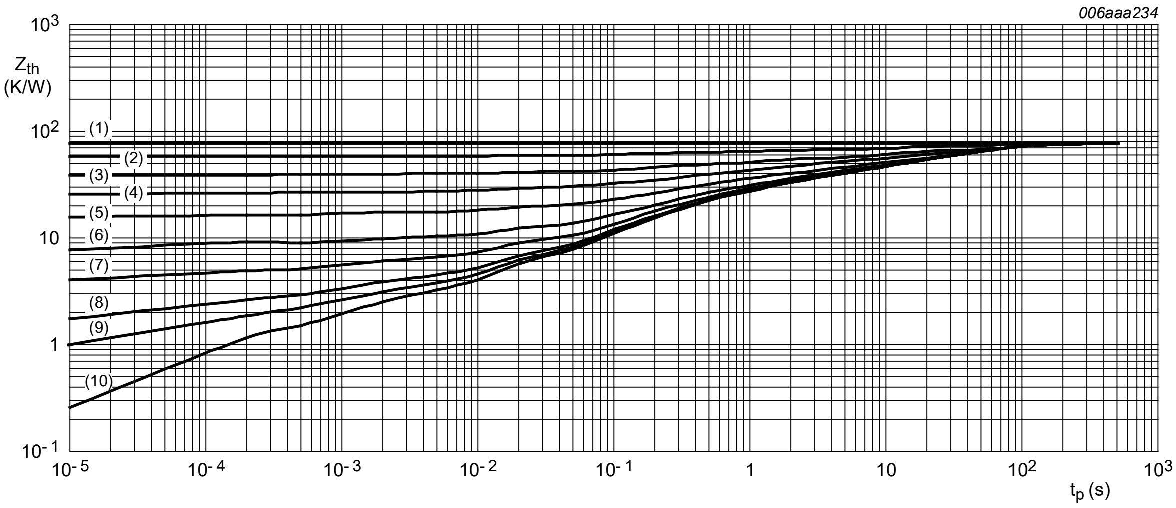
Fig. 2. Transient thermal impedance as a function of pulse duration; typical values



Mounted on FR4 PCB; mounting pad for collector 1 cm^2

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

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



Mounted on FR4 printed-circuit board; mounting pad for collector 6 cm^2

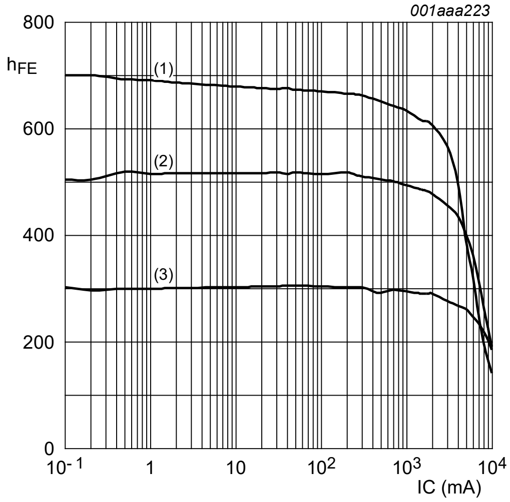
(1) δ = 1
(2) δ = 0.75
(3) δ = 0.5
(4) δ = 0.33
(5) δ = 0.2
(6) δ = 0.1
(7) δ = 0.05
(8) δ = 0.02
(9) δ = 0.01
(10) δ = 0

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

10. Characteristics

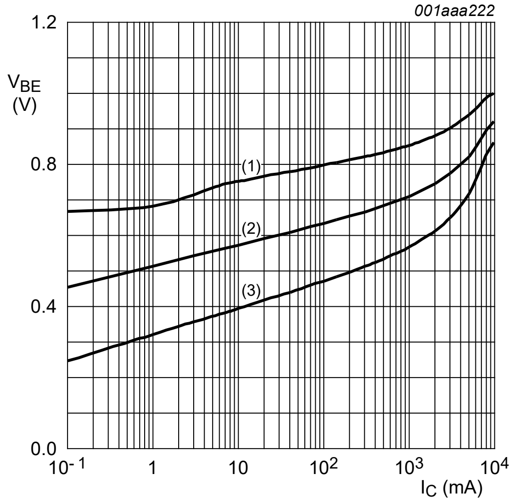
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = 30 V; I_E = 0 A; T_{amb} = 25 °C		-	-	100	nA
		V_{CB} = 30 V; I_E = 0 A; T_j = 150 °C		-	-	50	µA
I_{CES}	collector-emitter cut-off current	V_{CE} = 30 V; V_{BE} = 0 V; T_{amb} = 25 °C		-	-	100	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A; T_{amb} = 25 °C		-	-	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V; I_C = 0.5 A; T_{amb} = 25 °C		300	-	-	
		V_{CE} = 2 V; I_C = 1 A; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		300	-	-	
		V_{CE} = 2 V; I_C = 2 A; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		250	-	-	
		V_{CE} = 2 V; I_C = 5 A; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		100	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 0.5 A; I_B = 5 mA; T_{amb} = 25 °C		-	-	90	mV
		I_C = 1 A; I_B = 10 mA; T_{amb} = 25 °C		-	-	120	mV
		I_C = 2 A; I_B = 200 mA; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-	150	mV
		I_C = 4 A; I_B = 200 mA; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-	290	mV
		I_C = 5 A; I_B = 500 mA; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-	355	mV
R_{CEsat}	collector-emitter saturation resistance			-	40	71	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = 4 A; I_B = 200 mA; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-	1.1	V
		I_C = 5 A; I_B = 500 mA; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-	1.2	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = 2 V; I_C = 2 A; $t_p \leq$ 300 µs; pulsed; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-	1.1	V
f_T	transition frequency	V_{CE} = 10 V; I_C = 0.1 A; f = 100 MHz; T_{amb} = 25 °C		70	-	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	-	75	pF



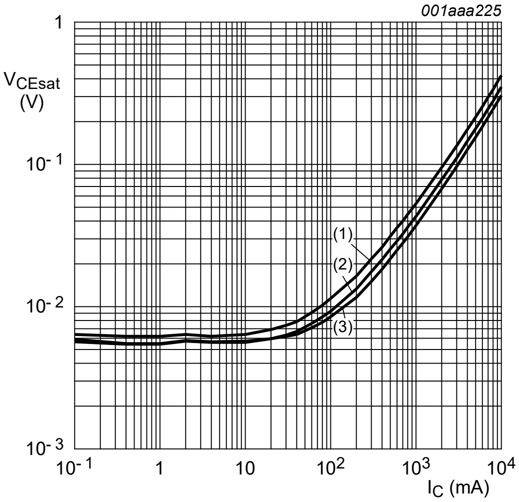
V_{CE} = 2 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



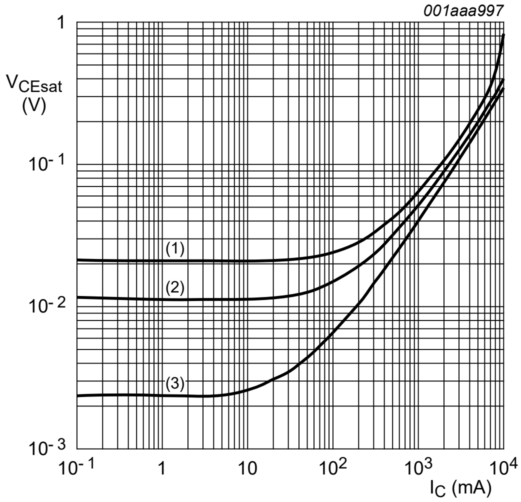
V_{CE} = 2 V
(1) T_{amb} = -55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

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



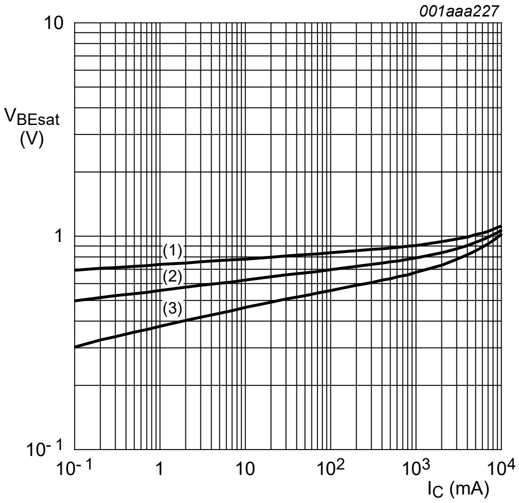
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



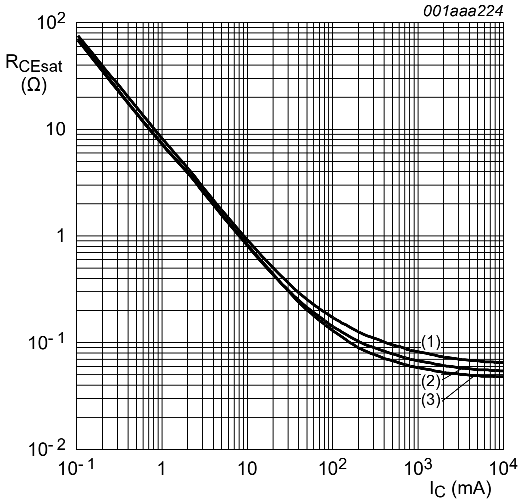
T_{amb} = 25 °C
(1) I_C/I_B = 100
(2) I_C/I_B = 50
(3) I_C/I_B = 10

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



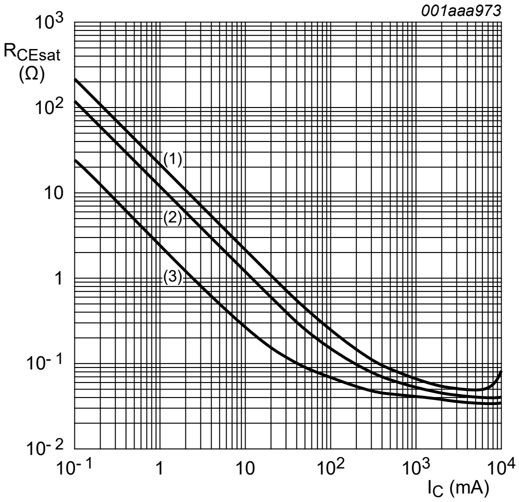
$I_C/I_B = 20$
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 100$ °C

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



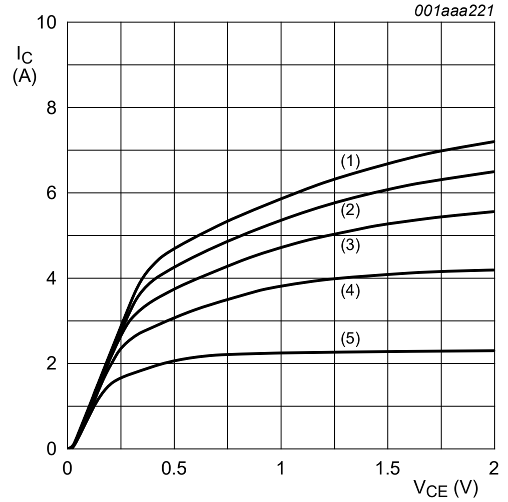
$I_C/I_B = 20$
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 100$ °C

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



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

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



(1) $I_B = 25$ mA
(2) $I_B = 20$ mA
(3) $I_B = 15$ mA
(4) $I_B = 10$ mA
(5) $I_B = 5$ mA

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

11. Package outline

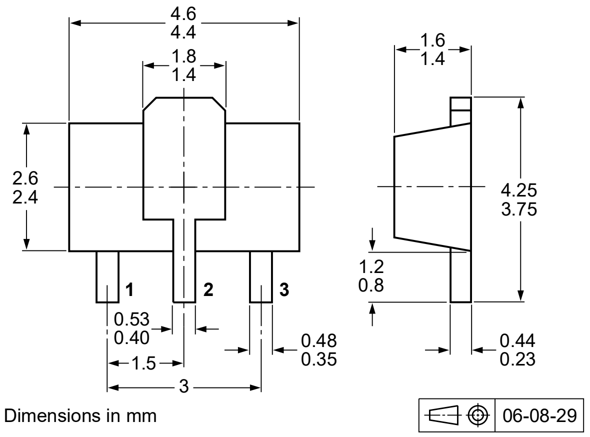


Fig. 13. Package outline SOT89

12. Soldering

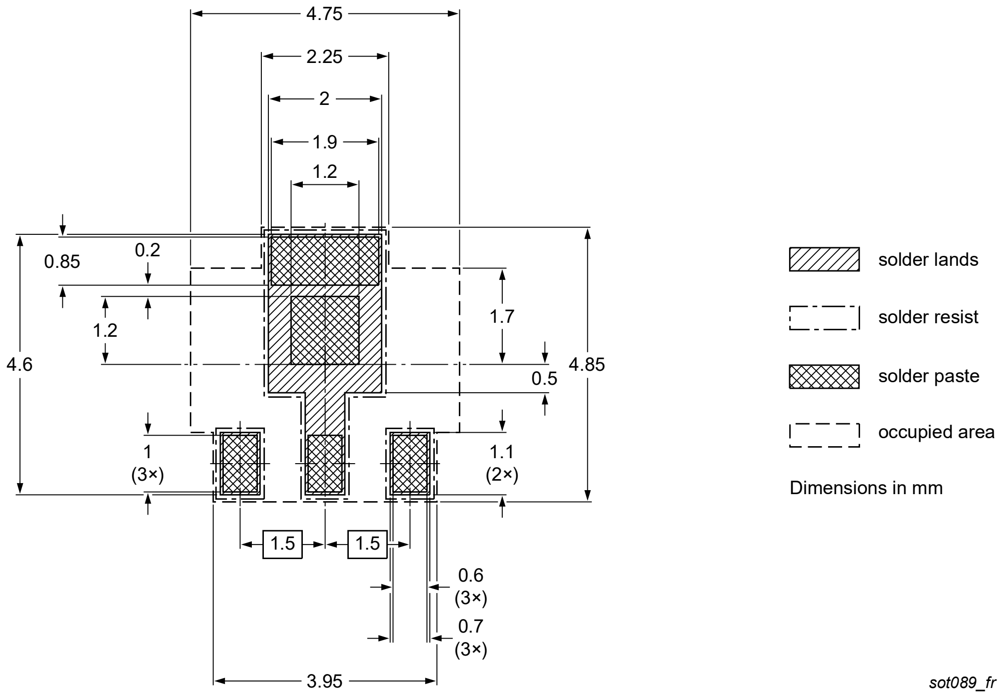


Fig. 14. Reflow soldering footprint for SOT89

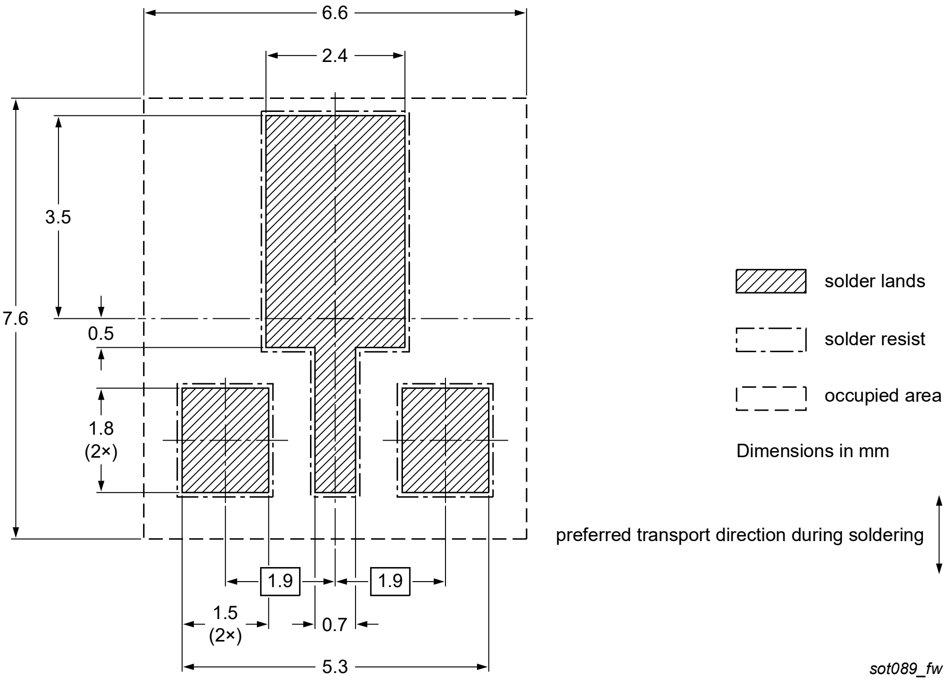


Fig. 15. Wave soldering footprint for SOT89

13. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4540X v.3	20200415	Product data sheet	-	PBSS4540X v.2
Modifications:	• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Limiting values at I_{CM}: conditions corrected • Characteristics at figure 6: legend corrected			
PBSS4540X v.2	20041104	Product data sheet	-	PBSS4540X v.1
PBSS4540X v.1	20040611	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.
[2] The term 'short data sheet' is explained in section "Definitions".
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