

PBSS5540X

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

15 April 2020

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).

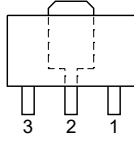
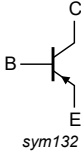
4. Quick reference data

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 ≤ 10 ms	-	-	-10	A
R _{CEsat}	collector-emitter saturation resistance	I _C = -5 A; I _B = -500 mA; t _p ≤ 300 μs; pulsed; δ ≤ 0.02; T _{amb} = 25 °C	-	45	75	mΩ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E	emitter	 <p style="text-align: center;">SOT89</p>	 <p style="text-align: center;"><i>sym132</i></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; 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]
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; $t_p \leq 10$ 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		[1] [2]	-	2.5	W
		T _{amb} ≤ 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 cm².
- [4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [5] Device mounted on a 7 cm² ceramic printed-circuit board, 1 cm² single-sided copper and tin-plated.

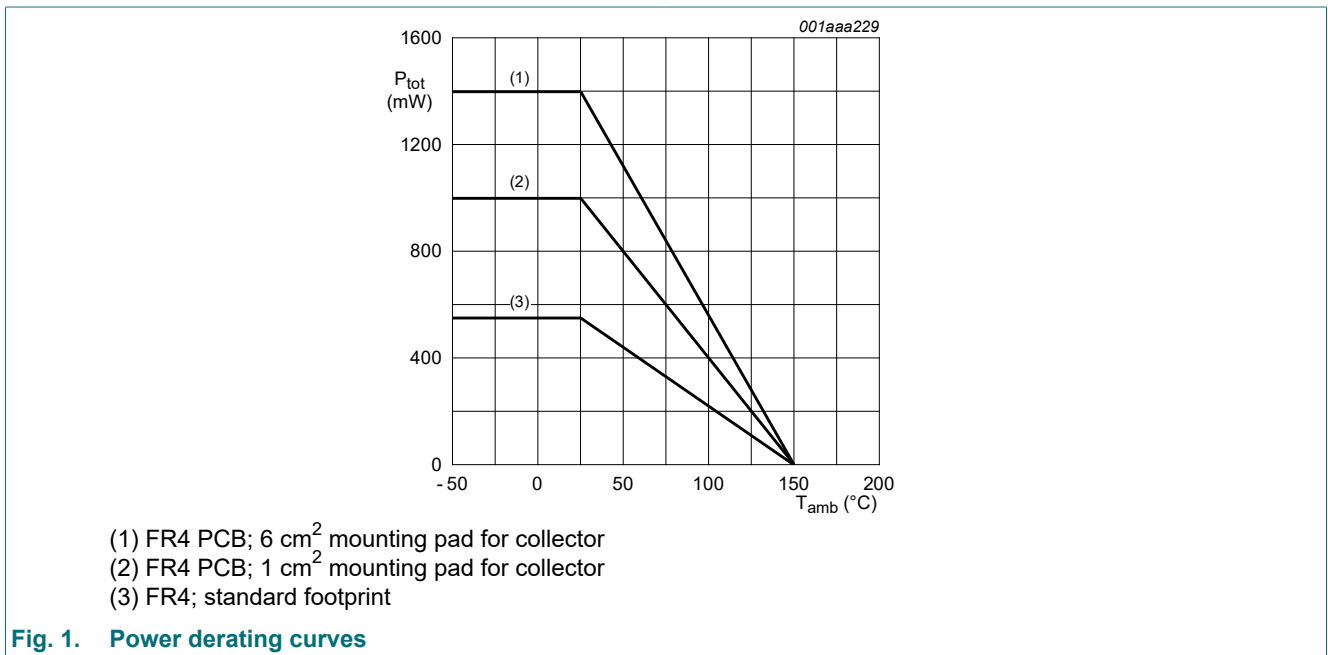


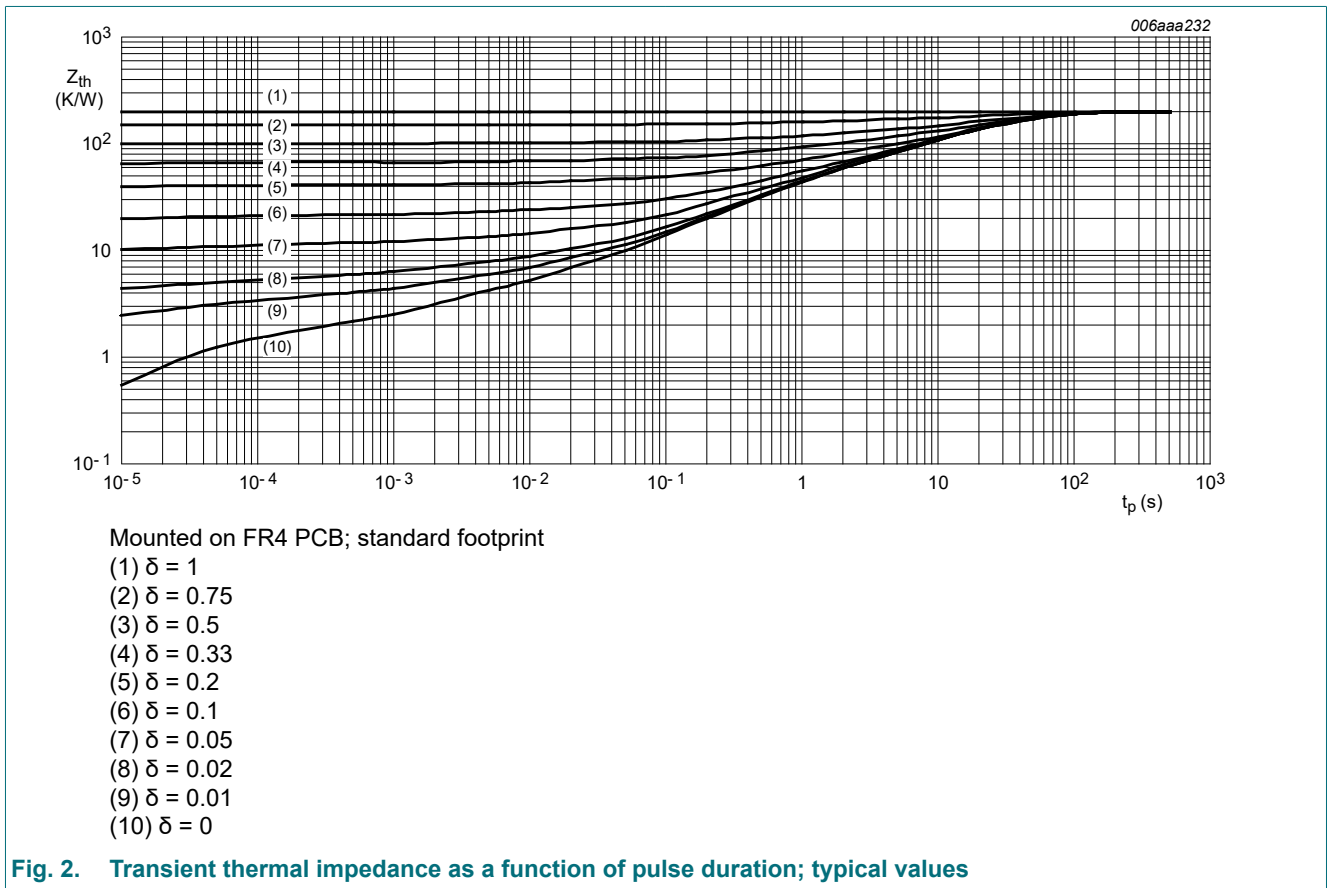
Fig. 1. Power derating curves

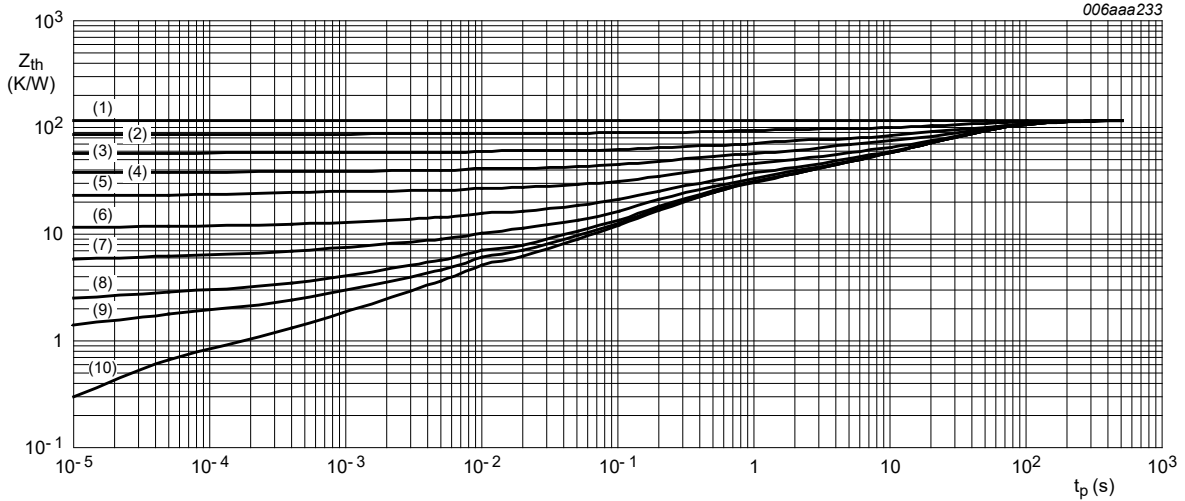
9. Thermal characteristics

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] [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] 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^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 printed-circuit board, 1 cm^2 single-sided copper and tin-plated.

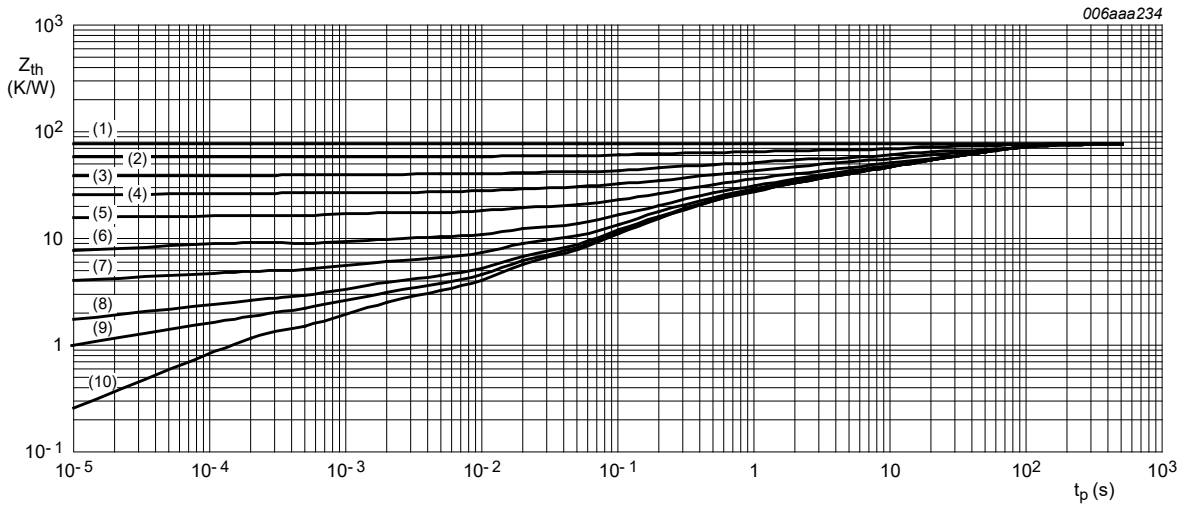




Mounted on FR4 PCB; mounting pad for collector 1 cm²

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



Mounted on FR4 printed-circuit board; mounting pad for collector 6 cm²

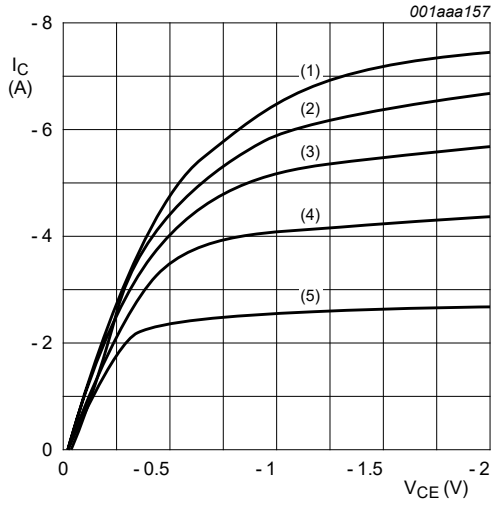
- (1) $\delta = 1$
- (2) $\delta = 0.75$
- (3) $\delta = 0.5$
- (4) $\delta = 0.33$
- (5) $\delta = 0.2$
- (6) $\delta = 0.1$
- (7) $\delta = 0.05$
- (8) $\delta = 0.02$
- (9) $\delta = 0.01$
- (10) $\delta = 0$

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

10. Characteristics

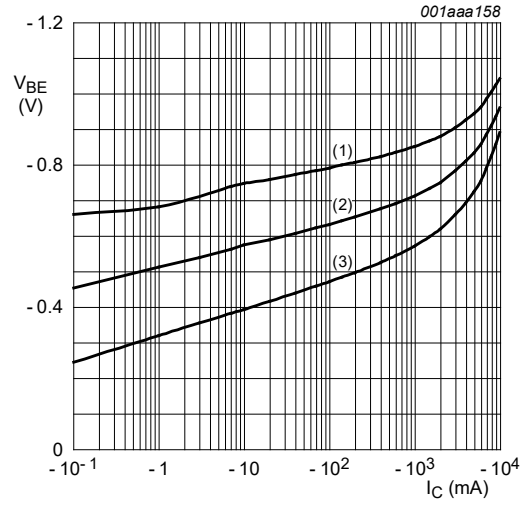
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I _{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 _{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	250	-	-	
		V _{CE} = -2 V; I _C = -1 A; t _p ≤ 300 μs; pulsed; δ ≤ 0.02; T _{amb} = 25 °C	200	-	-	
		V _{CE} = -2 V; I _C = -2 A; t _p ≤ 300 μs; pulsed; δ ≤ 0.02; T _{amb} = 25 °C	150	-	-	
		V _{CE} = -2 V; I _C = -5 A; t _p ≤ 300 μs; pulsed; δ ≤ 0.02; T _{amb} = 25 °C	50	-	-	
V _{CEsat}	collector-emitter saturation voltage	I _C = -0.5 A; I _B = -5 mA; T _{amb} = 25 °C	-	-	-120	mV
		I _C = -1 A; I _B = -10 mA; T _{amb} = 25 °C	-	-	-170	mV
		I _C = -2 A; I _B = -200 mA; T _{amb} = 25 °C	-	-	-160	mV
		I _C = -4 A; I _B = -200 mA; t _p ≤ 300 μs; pulsed; δ ≤ 0.02; T _{amb} = 25 °C	-	-	-340	mV
		I _C = -5 A; I _B = -500 mA; t _p ≤ 300 μs; pulsed; δ ≤ 0.02; T _{amb} = 25 °C	-	-	-375	mV
R _{CEsat}	collector-emitter saturation resistance		-	45	75	mΩ
V _{BEsat}	base-emitter saturation voltage	I _C = -4 A; I _B = -200 mA; t _p ≤ 300 μs; pulsed; δ ≤ 0.02; T _{amb} = 25 °C	-	-	-1.1	V
		I _C = -5 A; I _B = -500 mA; t _p ≤ 300 μs; pulsed; δ ≤ 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 _{amb} = 25 °C	-	-	-1	V
f _T	transition frequency	V _{CE} = -10 V; I _C = -0.1 A; f = 100 MHz; T _{amb} = 25 °C	60	-	-	MHz
C _c	collector capacitance	V _{CB} = -10 V; I _E = 0 A; i _e = 0 A; f = 1 MHz; T _{amb} = 25 °C	-	-	105	pF



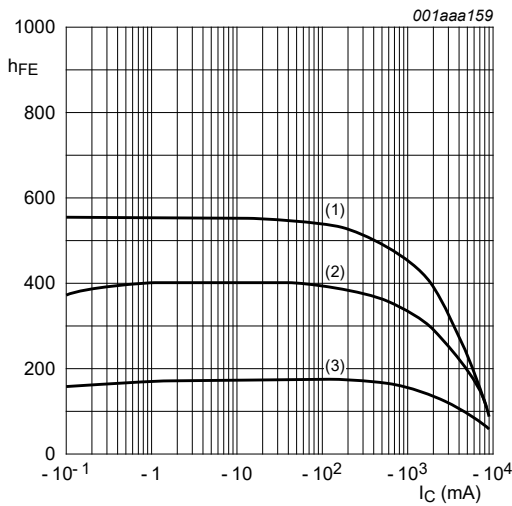
- (1) $I_B = -55$ mA
- (2) $I_B = -44$ mA
- (3) $I_B = -33$ mA
- (4) $I_B = -22$ mA
- (5) $I_B = -11$ mA

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



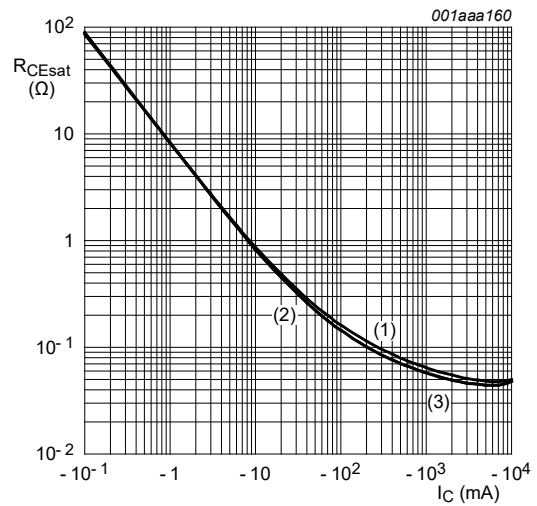
- $V_{CE} = -2$ V
- (1) $T_{amb} = -55$ °C
- (2) $T_{amb} = 25$ °C
- (3) $T_{amb} = 100$ °C

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



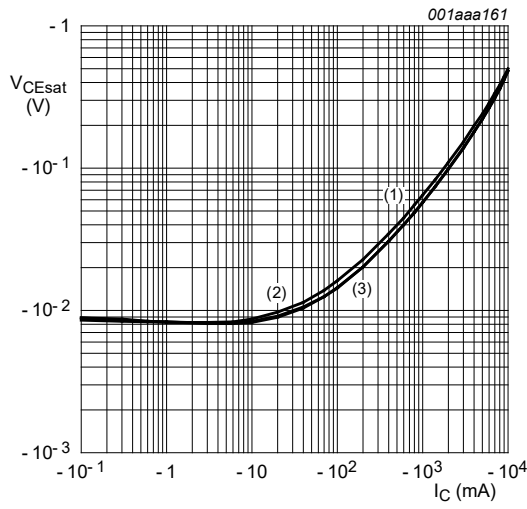
- $V_{CE} = -2$ V
- (1) $T_{amb} = 100$ °C
- (2) $T_{amb} = 25$ °C
- (3) $T_{amb} = -55$ °C

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



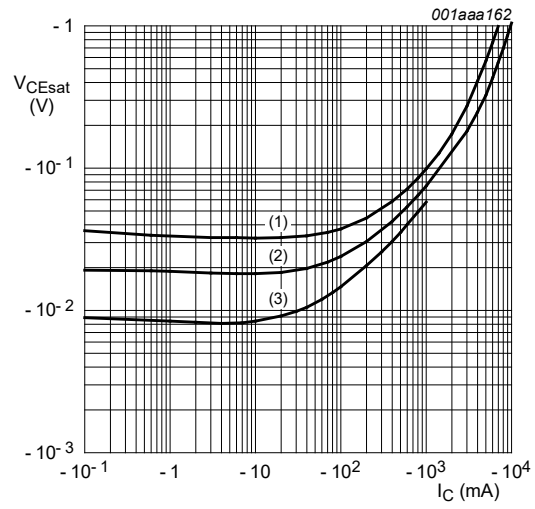
- $I_C/I_B = 20$
- (1) $T_{amb} = 100$ °C
- (2) $T_{amb} = 25$ °C
- (3) $T_{amb} = -55$ °C

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



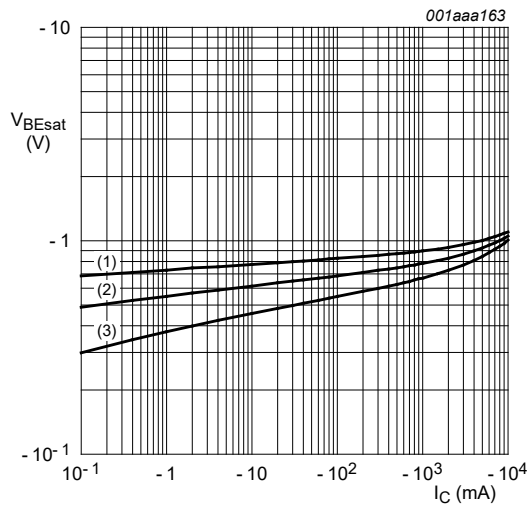
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



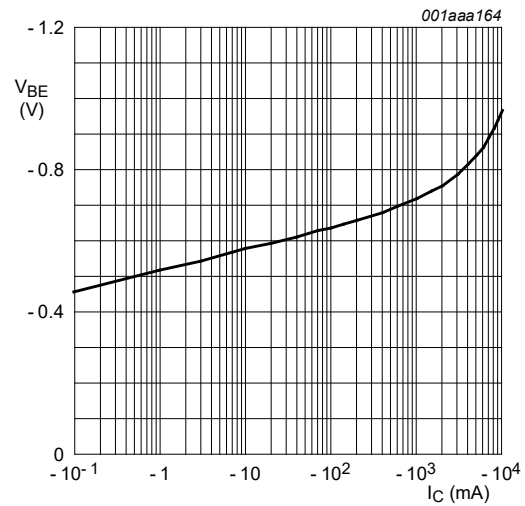
$T_{amb} = 25\text{ °C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 10$

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

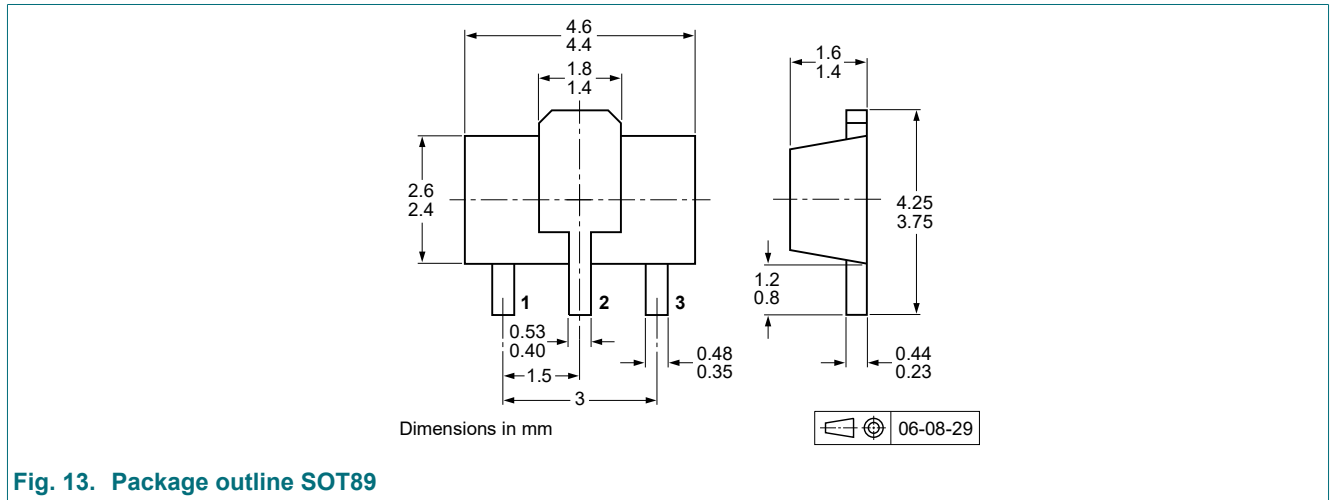


Fig. 13. Package outline SOT89

12. Soldering

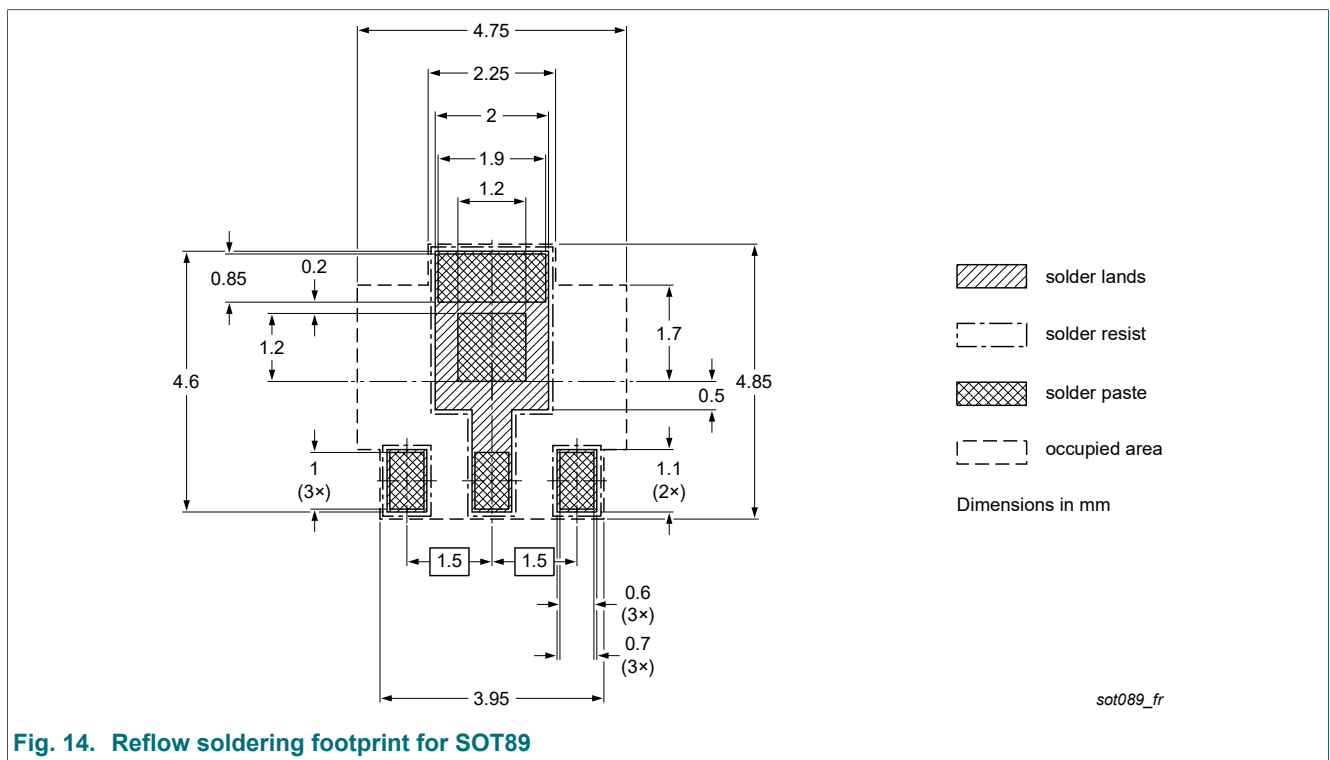


Fig. 14. Reflow soldering footprint for SOT89

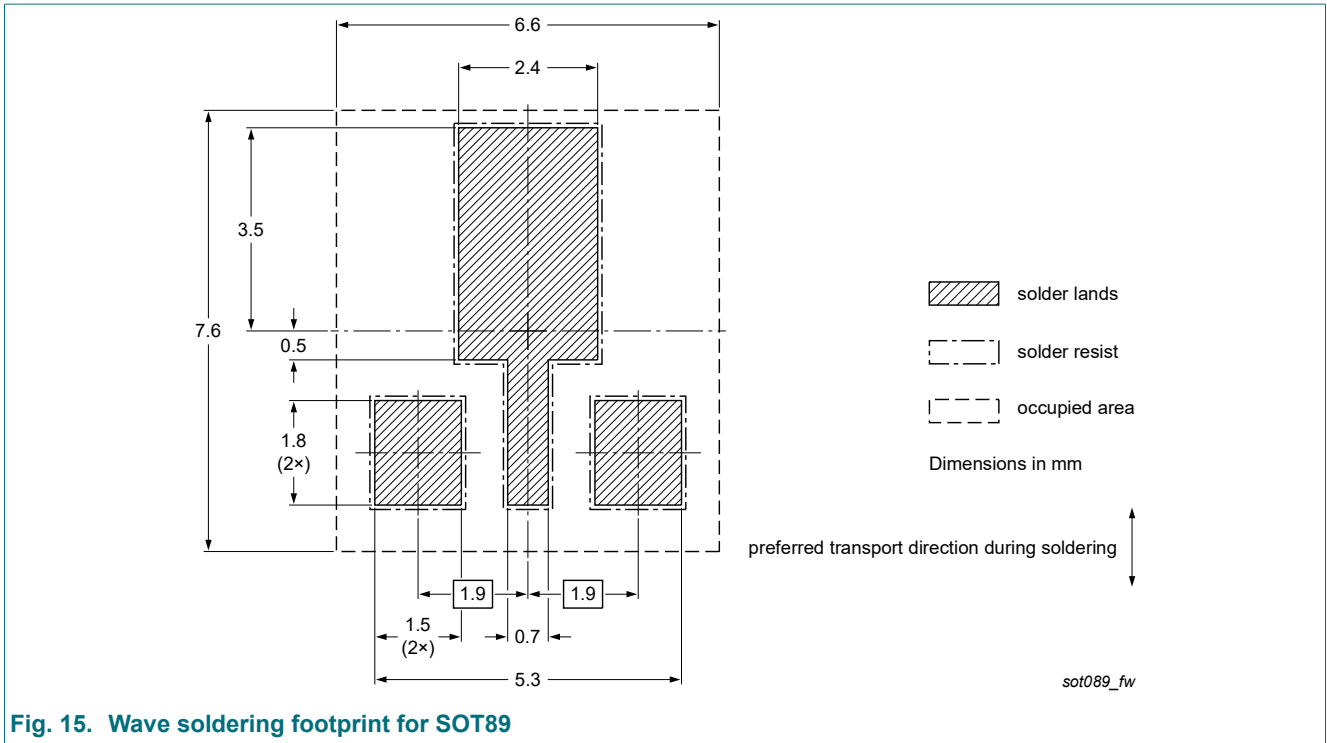


Fig. 15. Wave soldering footprint for SOT89

13. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS5540X v.4	20200415	Product data sheet	-	PBSS5540X v.3
Modifications:	• Limiting values at I_{CM} : conditions corrected			
PBSS5540X v.3	20180320	Product data sheet	-	PBSS5540X v.2
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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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