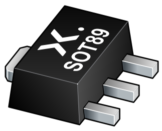


PBSS5540X-Q

40 V, 5 A PNP low VCEsat transistor

23 January 2024

Product data sheet

1. General description

PNP low V_{CEsat} transistor in a SOT89 (SC-62/TO-243) small and flat lead Surface-Mounted Device(SMD) plastic package.

NPN complement: PBSS4540X-Q

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
- Qualified according to AEC-Q101 and recommended for use in automotive applications

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)

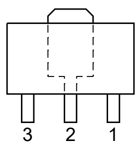
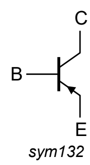
4. Quick reference data

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; $t_p \leq$ 10 ms		-	-	-10	A
R_{CEsat}	collector-emitter saturation resistance	I_C = -5 A; I_B = -500 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 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	 SOT89	
2	C	collector		
3	B	base		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS5540X-Q	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-Q	%1G

[1] % = placeholder for manufacturing site code

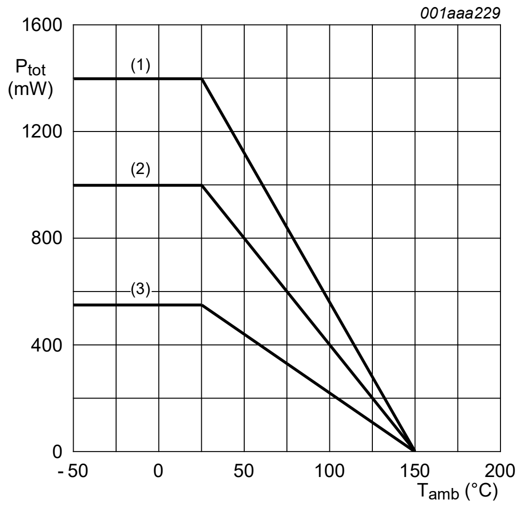
8. Limiting values

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
		$T_{amb} \leq 25$ °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^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.



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

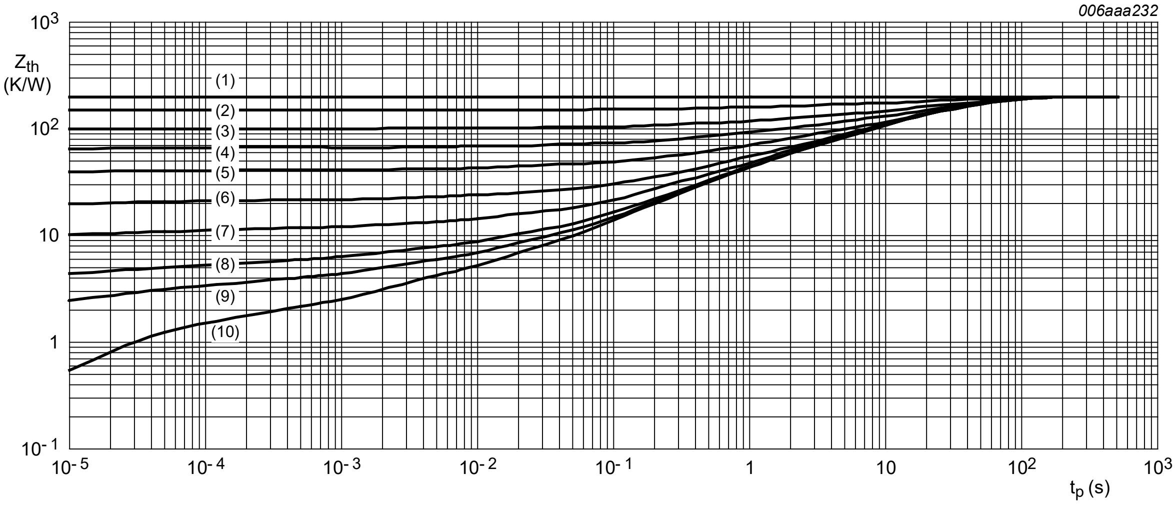
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

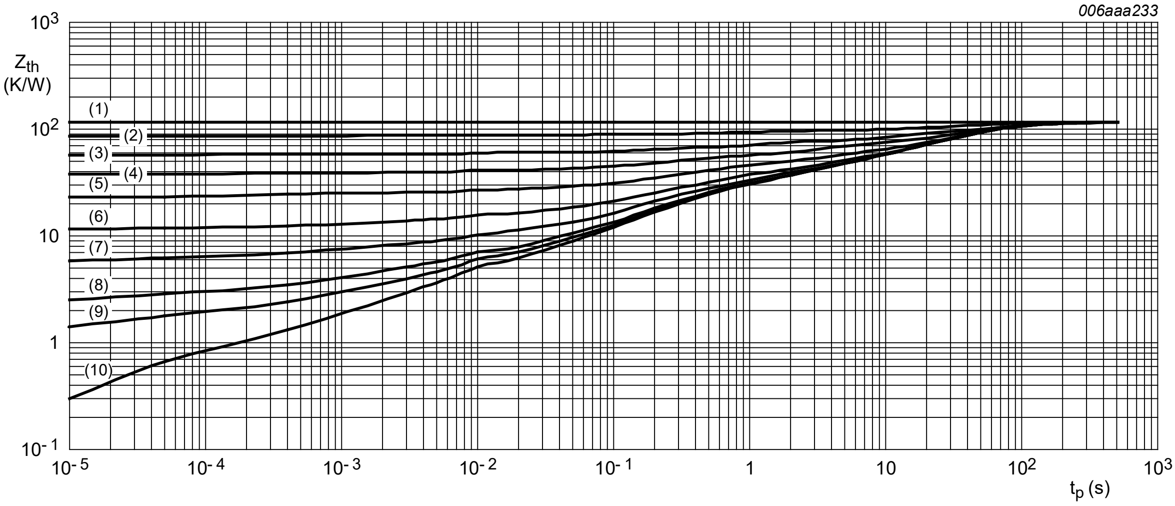
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] [2]	-	-	50	K/W
			[1]	-	-	225	K/W
			[3]	-	-	125	K/W
			[4]	-	-	90	K/W
			[5]	-	-	80	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	16	K/W

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



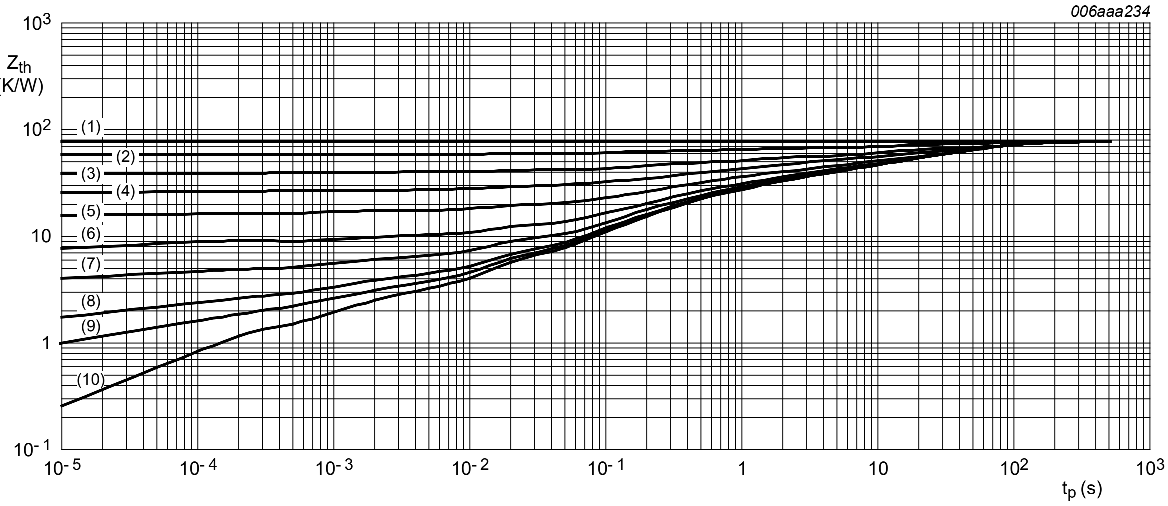
Mounted on FR4 PCB; standard footprint
(1) δ = 1
(2) δ = 0.75
(3) δ = 0.5
(4) δ = 0.33
(5) δ = 0.2
(6) δ = 0.1
(7) δ = 0.05
(8) δ = 0.02
(9) δ = 0.01
(10) δ = 0

Fig. 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

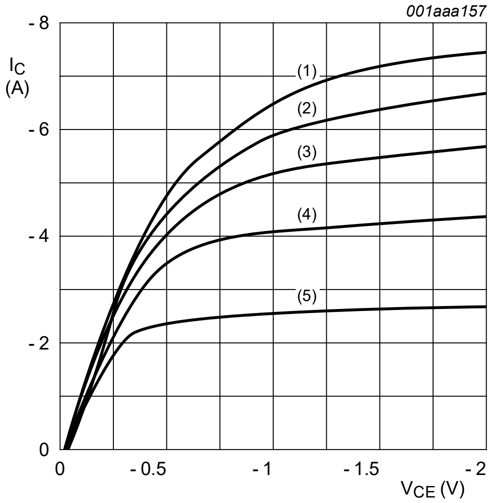
(1) δ = 1
(2) δ = 0.75
(3) δ = 0.5
(4) δ = 0.33
(5) δ = 0.2
(6) δ = 0.1
(7) δ = 0.05
(8) δ = 0.02
(9) δ = 0.01
(10) δ = 0

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

10. Characteristics

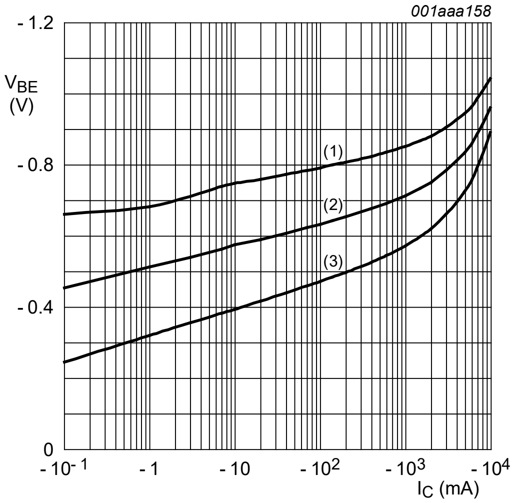
Table 7. Characteristics

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_{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; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		200	-	-	
		V_{CE} = -2 V; I_C = -2 A; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		150	-	-	
		V_{CE} = -2 V; I_C = -5 A; pulsed; t_p ≤ 300 µs; 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; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	-340	mV
		I_C = -5 A; I_B = -500 mA; pulsed; t_p ≤ 300 µs; 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; pulsed; t_p ≤ 300 µs; δ ≤ 0.02; T_{amb} = 25 °C		-	-	-1.1	V
		I_C = -5 A; I_B = -500 mA; pulsed; t_p ≤ 300 µs; 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



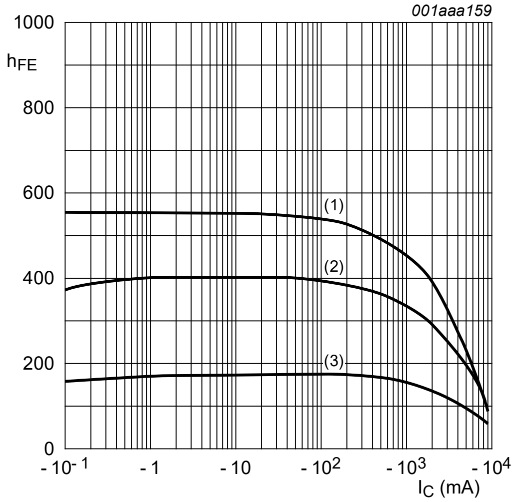
(1) $I_B = -55$ mA
(2) $I_B = -44$ mA
(3) $I_B = -33$ mA
(4) $I_B = -22$ mA
(5) $I_B = -11$ mA

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



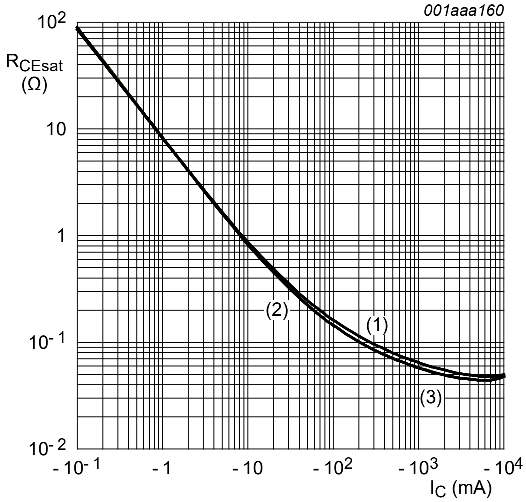
$V_{CE} = -2$ V
(1) $T_{amb} = -55$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = 100$ °C

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



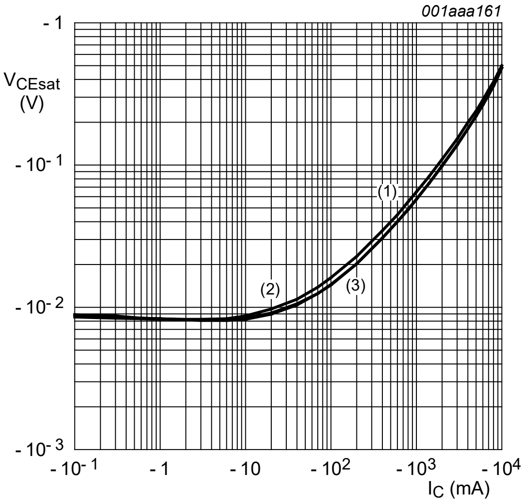
$V_{CE} = -2$ V
(1) $T_{amb} = 100$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

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



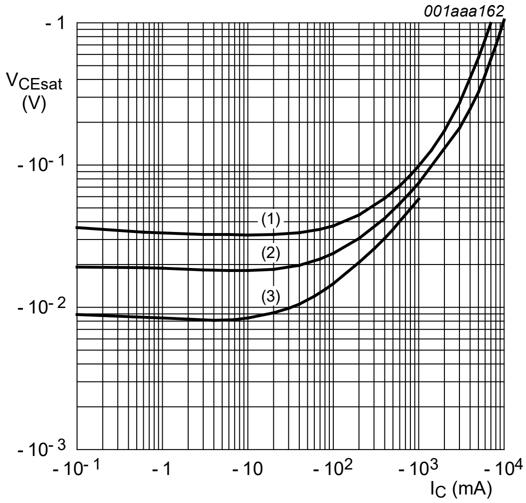
$I_C/I_B = 20$
(1) $T_{amb} = 100$ °C
(2) $T_{amb} = 25$ °C
(3) $T_{amb} = -55$ °C

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



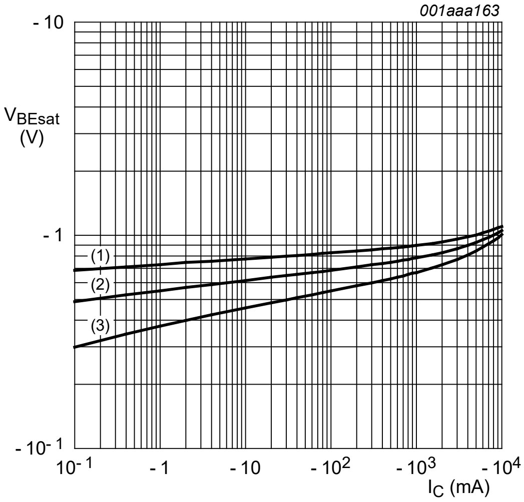
$I_C/I_B = 20$
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



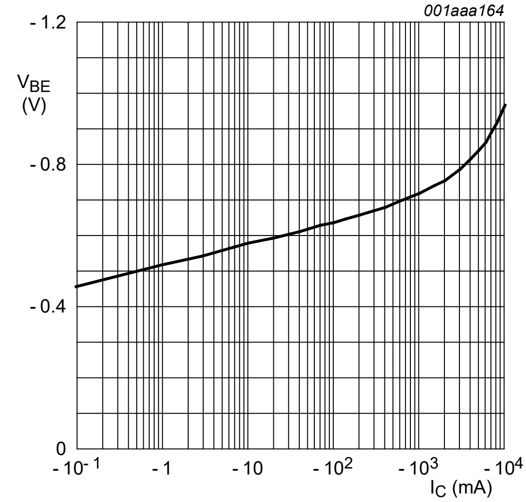
T_{amb} = 25 °C
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

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



T_{amb} = 25 °C

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

11. Test information

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

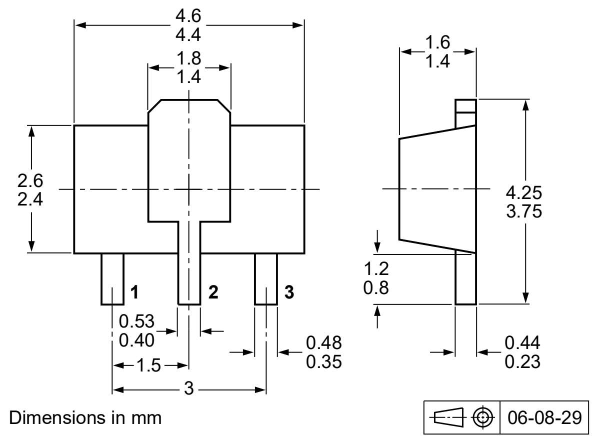


Fig. 13. Package outline SOT89

13. Soldering

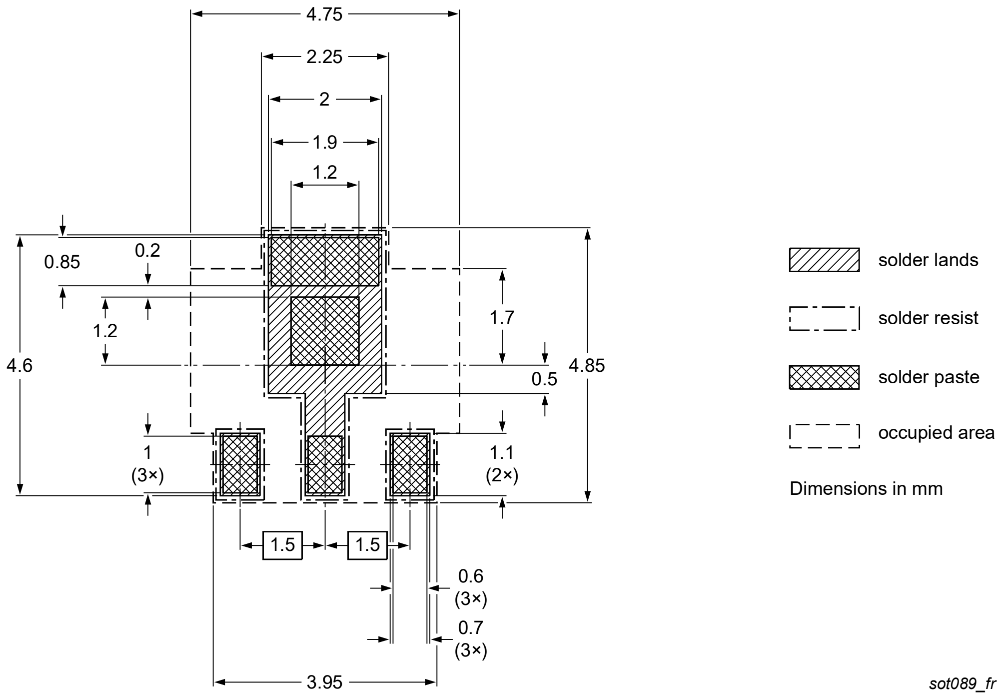


Fig. 14. Reflow soldering footprint for SOT89

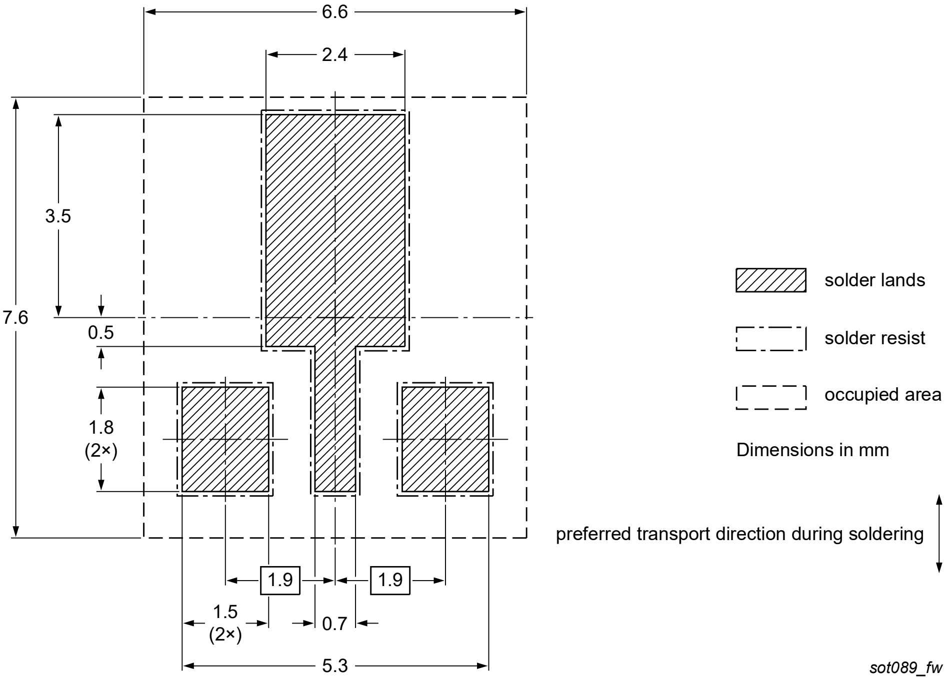


Fig. 15. Wave soldering footprint for SOT89

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS5540X-Q v.1	20240123	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".
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Date of release: 23 January 2024