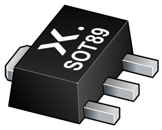


PBSS304PX-Q

60 V, 4.2 A PNP low VCEsat transistor

9 November 2023 **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: PBSS304NX

2. Features and benefits

- Low collector-emitter saturation voltage V_{CEsat}
- High collector current capability I_C and I_{CM}
- High collector current gain (hFE) at high I_C
- High efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- High-voltage DC-to-DC conversion
- High-voltage MOSFET gate driving
- High-voltage motor control
- High-voltage power switches (e.g. motors, fans)
- Automotive applications

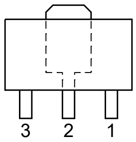
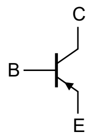
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	-60	V
I_C	collector current			-	-	-4.2	A
I_{CM}	peak collector current	single pulse; $t_p \leq$ 1 ms		-	-	-8.4	A
R_{CEsat}	collector-emitter saturation resistance	I_C = -4 A; I_B = -200 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	48	69	mΩ

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS304PX-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]
PBSS304PX-Q	%5L

[1] % = placeholder for manufacturing site code

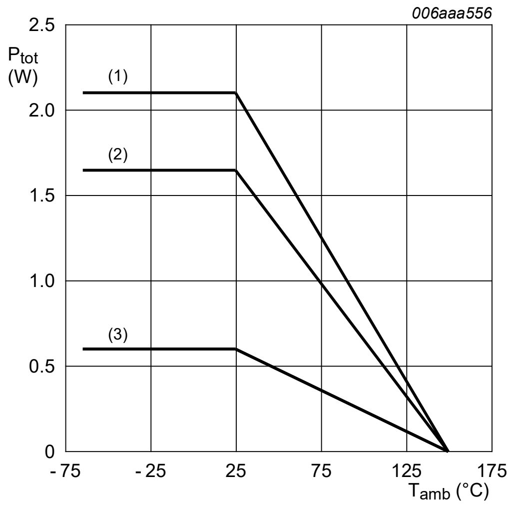
8. Limiting values

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		-	-60	V
V_{CEO}	collector-emitter voltage	open base		-	-60	V
V_{EBO}	emitter-base voltage	open collector		-	-5	V
I_C	collector current			-	-4.2	A
I_{CM}	peak collector current	single pulse; $t_p \leq$ 1 ms		-	-8.4	A
P_{tot}	total power dissipation	$T_{amb} \leq$ 25 °C	[1]	-	0.6	W
			[2]	-	1.65	W
			[3]	-	2.1	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] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.
[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.



(1) Ceramic PCB, Al_2O_3, standard footprint
(2) FR4 PCB, mounting pad for collector 6 cm^2
(3) FR4 PCB, standard footprint

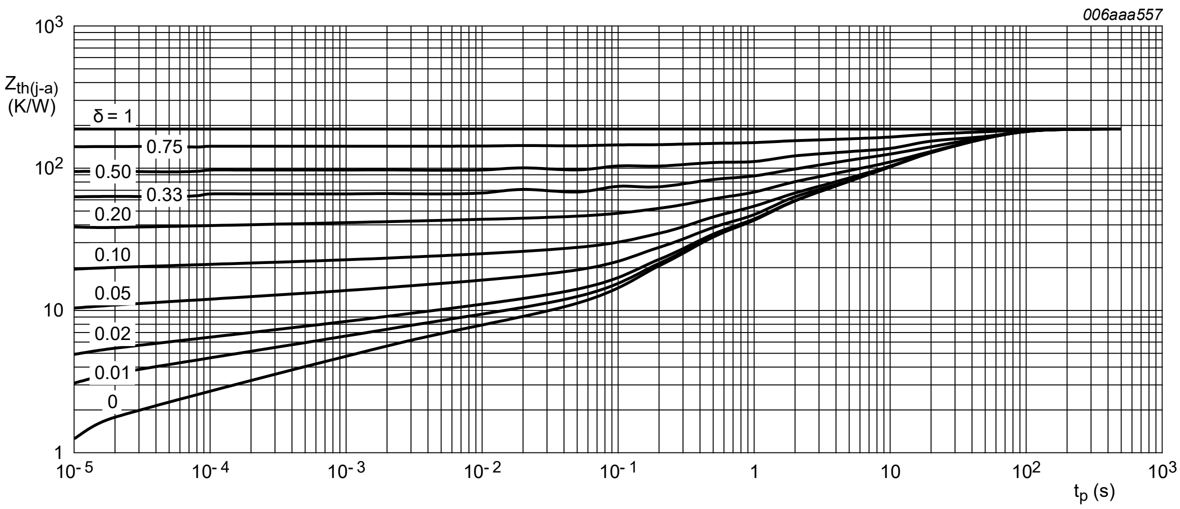
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

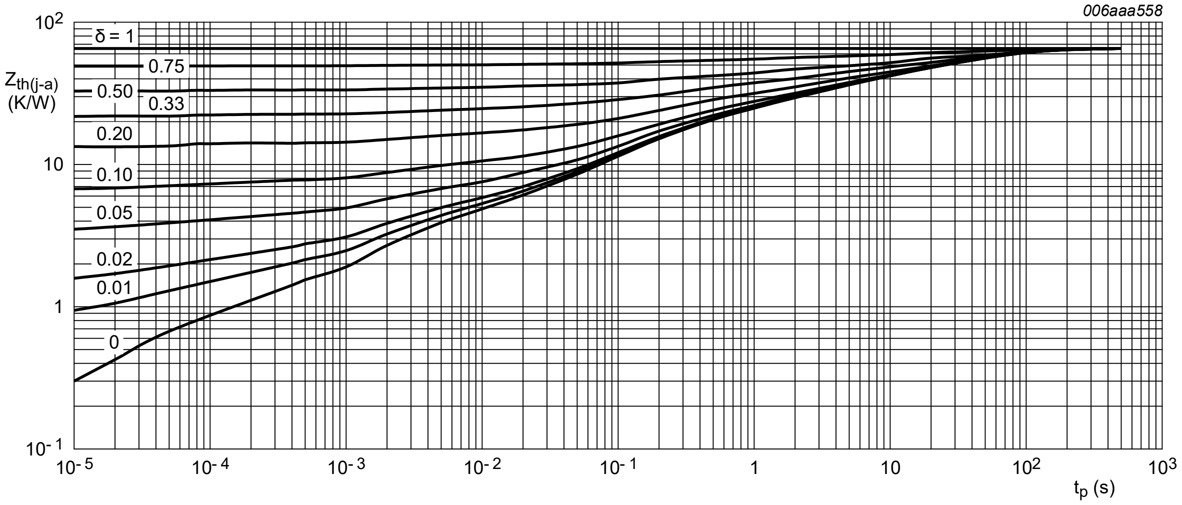
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	208	K/W
			[2]	-	-	76	K/W
			[3]	-	-	60	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	20	K/W

[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 6 cm^2.
[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.



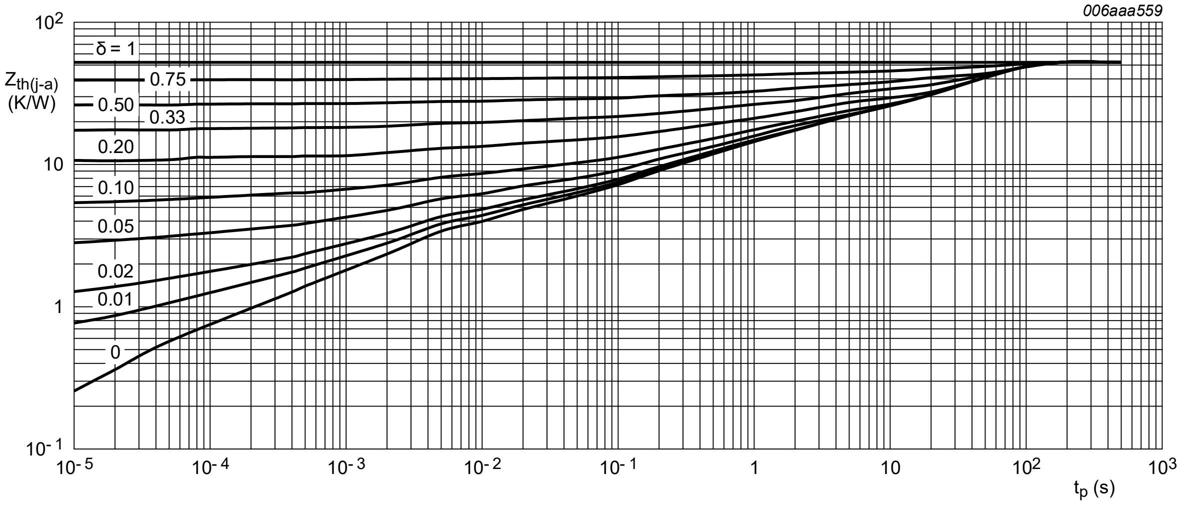
FR4 PCB, standard footprint

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, mounting pad for collector 6 cm^2

Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



Ceramic PCB, Al_2O_3, standard footprint

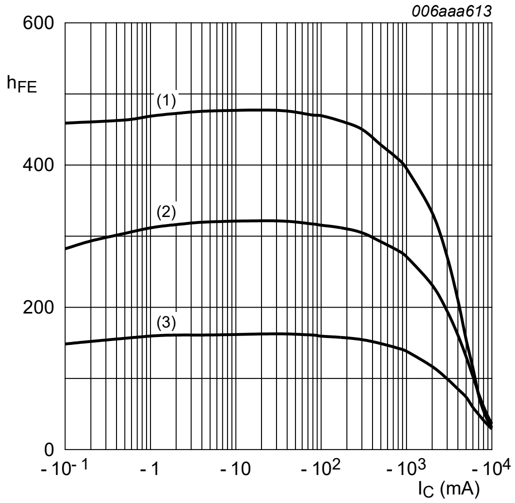
Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

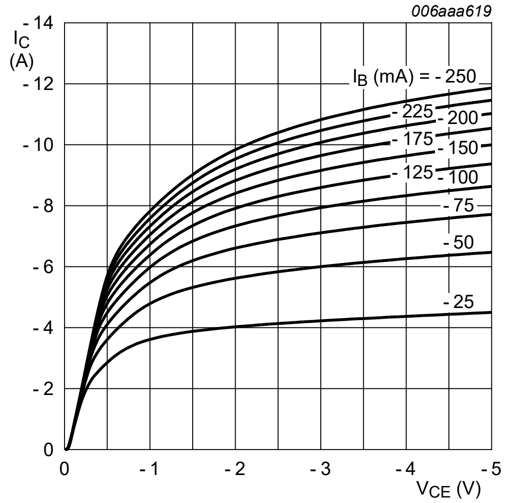
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = -60 V; I_E = 0 A; T_{amb} = 25 °C		-	-	-100	nA
		V_{CB} = -60 V; I_E = 0 A; T_j = 150 °C		-	-	-50	μA
I_{EBO}	emitter-base cut-off current	V_{EB} = -5 V; I_C = 0 A; T_{amb} = 25 °C		-	-	-100	nA

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
h_{FE}	DC current gain	V_{CE} = -2 V; I_C = -0.5 A; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		200	295	-	
		V_{CE} = -2 V; I_C = -1 A; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		200	270	-	
		V_{CE} = -2 V; I_C = -2 A; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		150	230	-	
		V_{CE} = -2 V; I_C = -4 A; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		120	170	-	
		V_{CE} = -2 V; I_C = -6 A; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		60	100	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = -0.5 A; I_B = -50 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-35	-50	mV
		I_C = -1 A; I_B = -50 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-65	-90	mV
		I_C = -1 A; I_B = -10 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-130	-190	mV
		I_C = -2 A; I_B = -40 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-155	-220	mV
		I_C = -4 A; I_B = -200 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-195	-275	mV
		I_C = -4 A; I_B = -400 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-150	-210	mV
		I_C = -4.2 A; I_B = -210 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-220	-310	mV
R_{CEsat}	collector-emitter saturation resistance	I_C = -2 A; I_B = -40 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	78	110	mΩ
		I_C = -4 A; I_B = -200 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	48	69	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = -1 A; I_B = -100 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-0.81	-0.9	V
		I_C = -4 A; I_B = -400 mA; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-0.93	-1.05	V
V_{BEon}	base-emitter turn-on voltage	V_{CE} = -2 V; I_C = -2 A; pulsed; $t_p \leq$ 300 μs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-0.77	-0.85	V
t_d	delay time	V_{CC} = -12.5 V; I_C = -3 A; I_{Bon} = -0.15 A; I_{Boff} = 0.15 A; T_{amb} = 25 °C		-	15	-	ns
t_r	rise time			-	65	-	ns
t_{on}	turn-on time			-	80	-	ns
t_s	storage time			-	225	-	ns
t_f	fall time			-	95	-	ns
t_{off}	turn-off time			-	320	-	ns
f_T	transition frequency	V_{CE} = -10 V; I_C = -100 mA; f = 100 MHz; T_{amb} = 25 °C		-	130	-	MHz
C_c	collector capacitance	V_{CB} = -10 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	90	120	pF



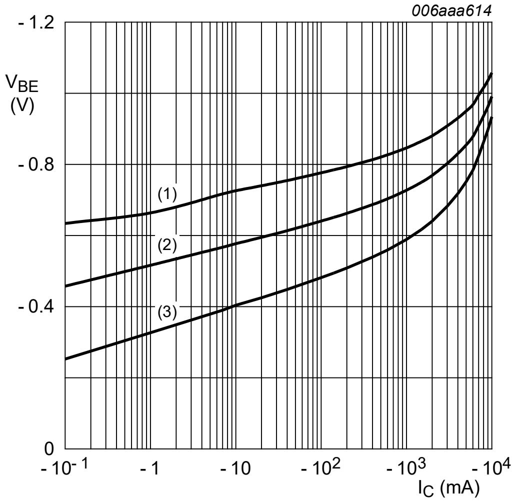
$V_{CE} = −2$ V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



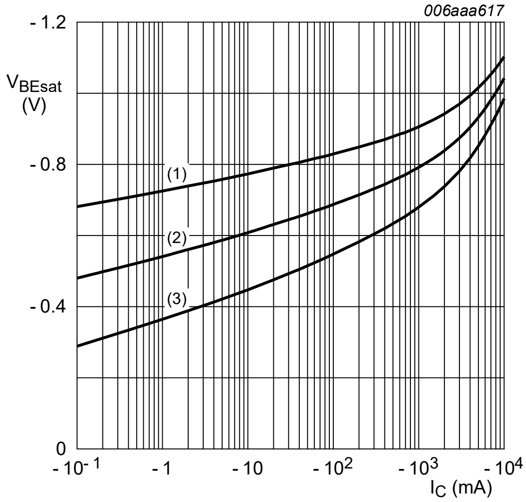
T_{amb} = 25 °C

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



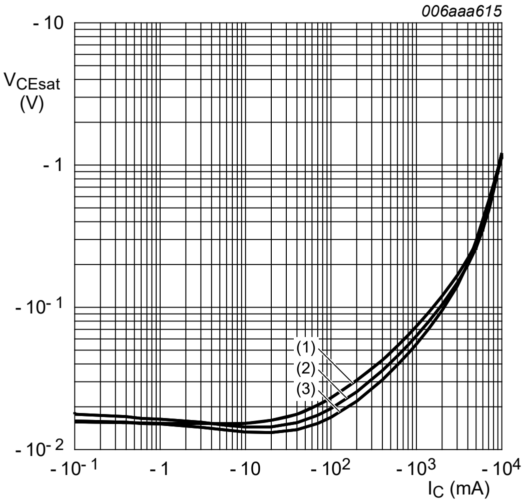
$V_{CE} = −2$ V
(1) T_{amb} = −55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

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



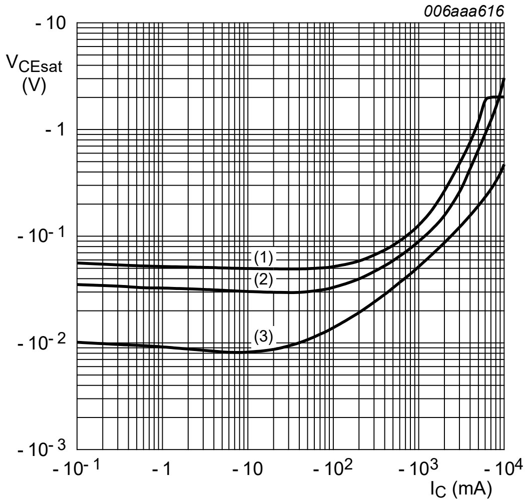
I_C/I_B = 20
(1) T_{amb} = −55 °C
(2) T_{amb}= 25 °C
(3) T_{amb} = 100 °C

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



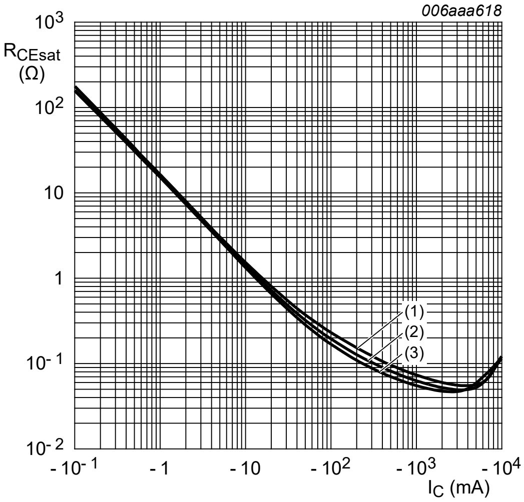
$I_C/I_B = 20$
(1) $T_{amb} = 100\ °C$
(2) $T_{amb} = 25\ °C$
(3) $T_{amb} = −55\ °C$

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



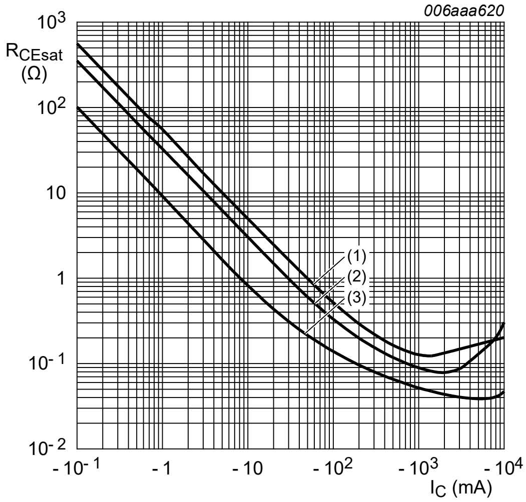
$T_{amb} = 25\ °C$
(1) $I_C/I_B = 100$
(2) $I_C/I_B = 50$
(3) $I_C/I_B = 10$

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



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

Fig. 11. Collector-emitter saturation 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. 12. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

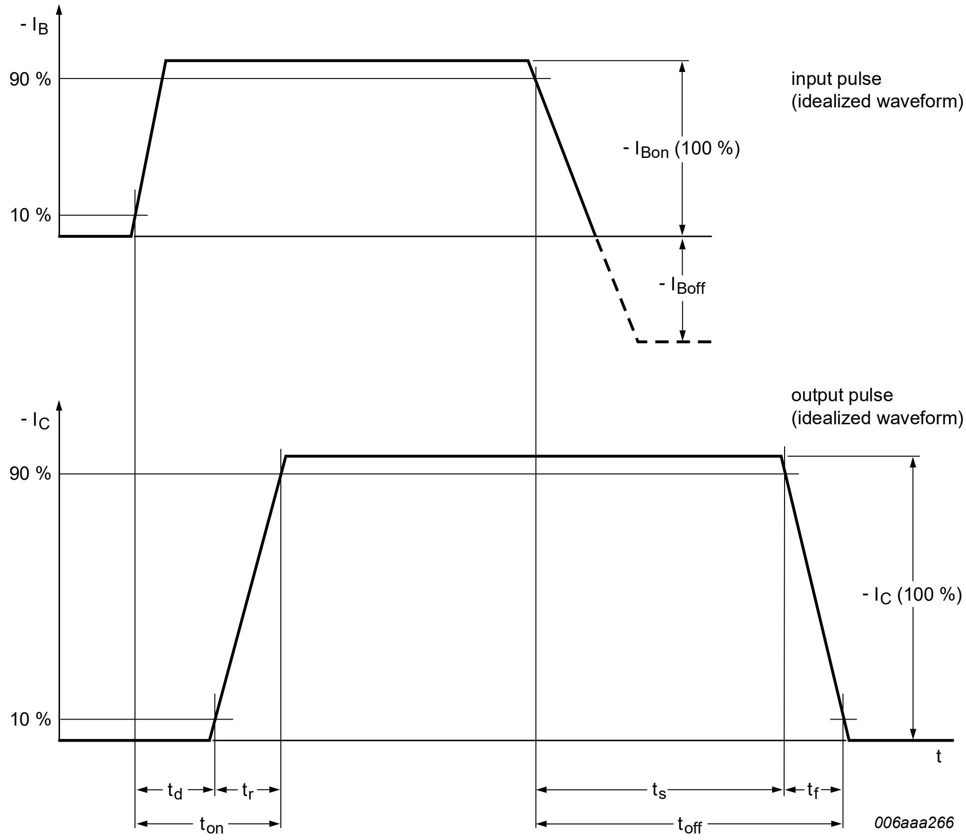


Fig. 13. Transistor switching time definition

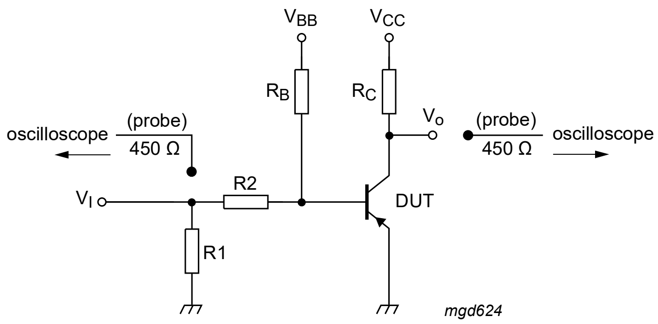


Fig. 14. Test circuit for switching times

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

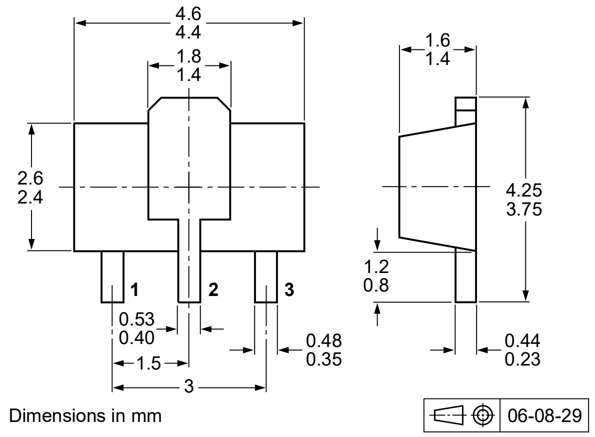


Fig. 15. Package outline SOT89

13. Soldering

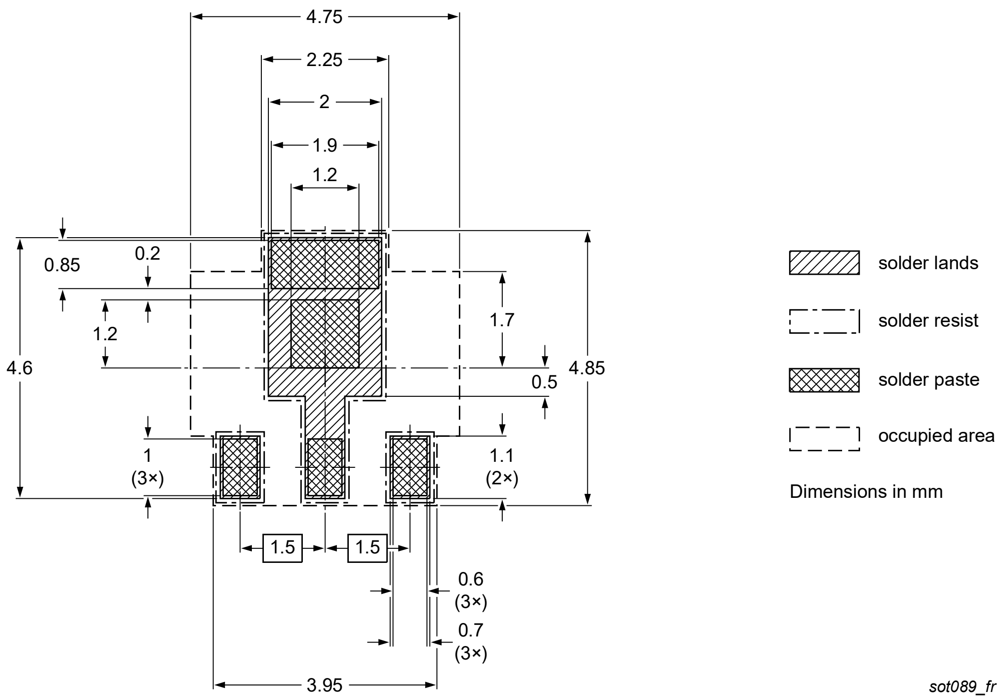


Fig. 16. Reflow soldering footprint for SOT89

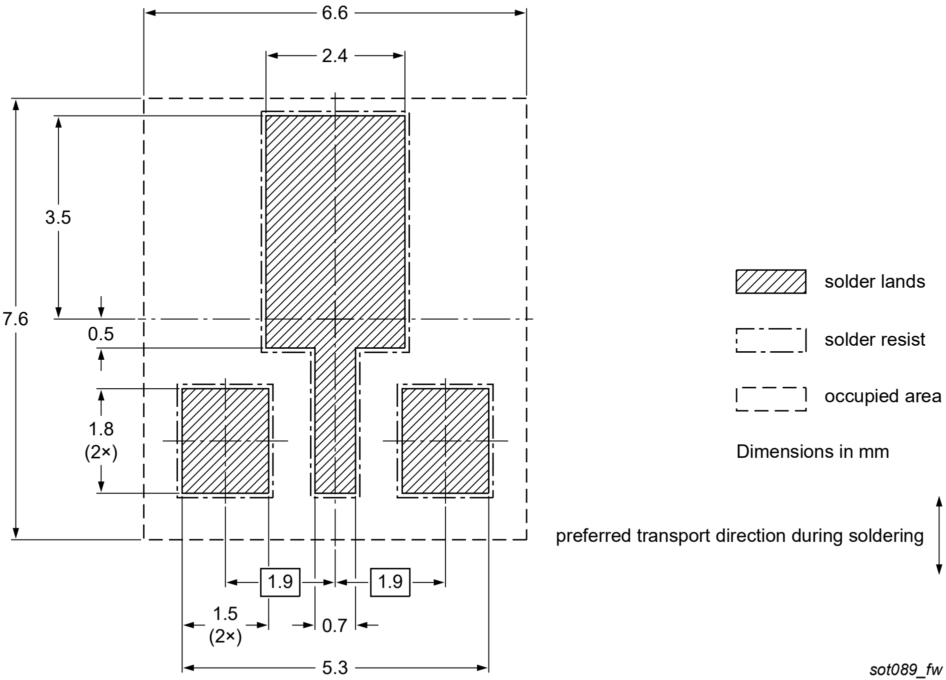


Fig. 17. Wave soldering footprint for SOT89

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS304PX-Q v.1	20231109	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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