



# PBSS4041PX-Q

60 V, 5 A PNP low VCEsat transistor

23 April 2024

Product data sheet

## 1. General description

PNP low  $V_{CEsat}$  transistor in a medium power and flat lead SOT89 (SC-62) Surface-Mounted Device (SMD) plastic package.

NPN complement: PBSS4041NX.

## 2. Features and benefits

- Very low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability  $I_C$  and  $I_{CM}$
- High collector current gain ( $h_{FE}$ ) at high  $I_C$
- High energy 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

- Loadswitch
- Battery-driven devices
- Power management
- Charging circuits
- Power switches (e.g. motors, fans)

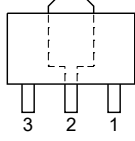
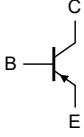
## 4. Quick reference data

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		-	-	-5	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	-15	A
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -4$ A; $I_B = -400$ mA; pulsed; $t_p \leq 300$ $\mu$ s; $\delta \leq 0.02$ ; $T_{amb} = 25$ °C	-	40	60	m $\Omega$

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	E	emitter	 <p style="text-align: center;"><b>SOT89</b></p>	 <p style="text-align: center;">006aaa231</p>
2	C	collector		
3	B	base		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PBSS4041PX-Q</a>	SOT89	plastic, surface-mounted package; 3 leads; 1.5 mm pitch; 4.5 mm x 2.5 mm x 1.5 mm body	<a href="#">SOT89</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PBSS4041PX-Q	%6G

[1] % = placeholder for manufacturing site code

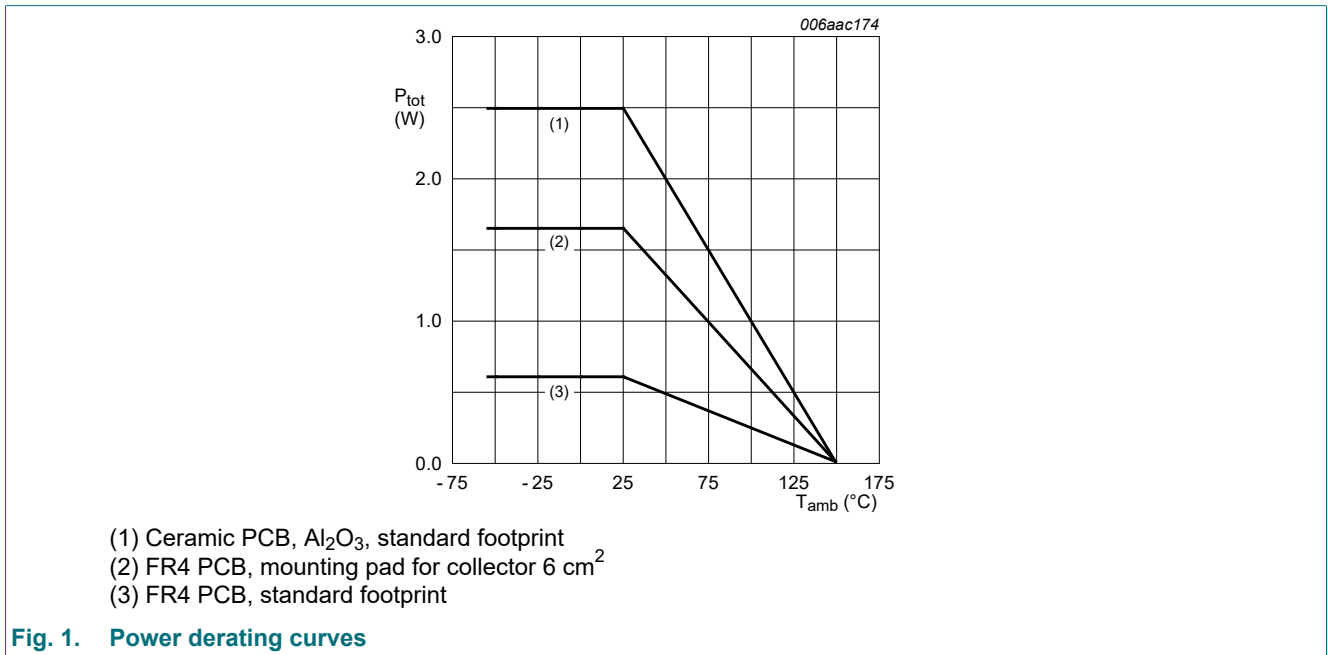
## 8. Limiting values

**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			-	-5	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms		-	-15	A
$I_B$	base current			-	-1	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	600	mW
			[2]	-	1650	mW
			[3]	-	2500	mW
$T_j$	junction temperature			-	150	°C
$T_{amb}$	ambient temperature			-55	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<sup>2</sup>.
- [3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, 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]	-	-	210	K/W
			[2]	-	-	75	K/W
			[3]	-	-	50	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<sup>2</sup>.
- [3] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.

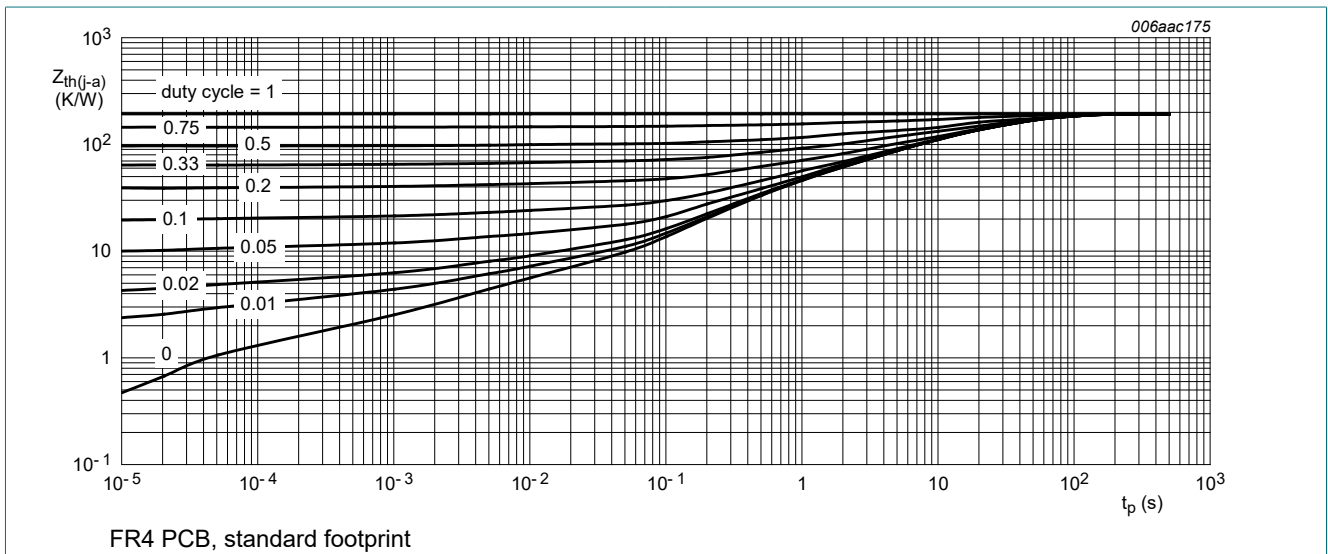


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

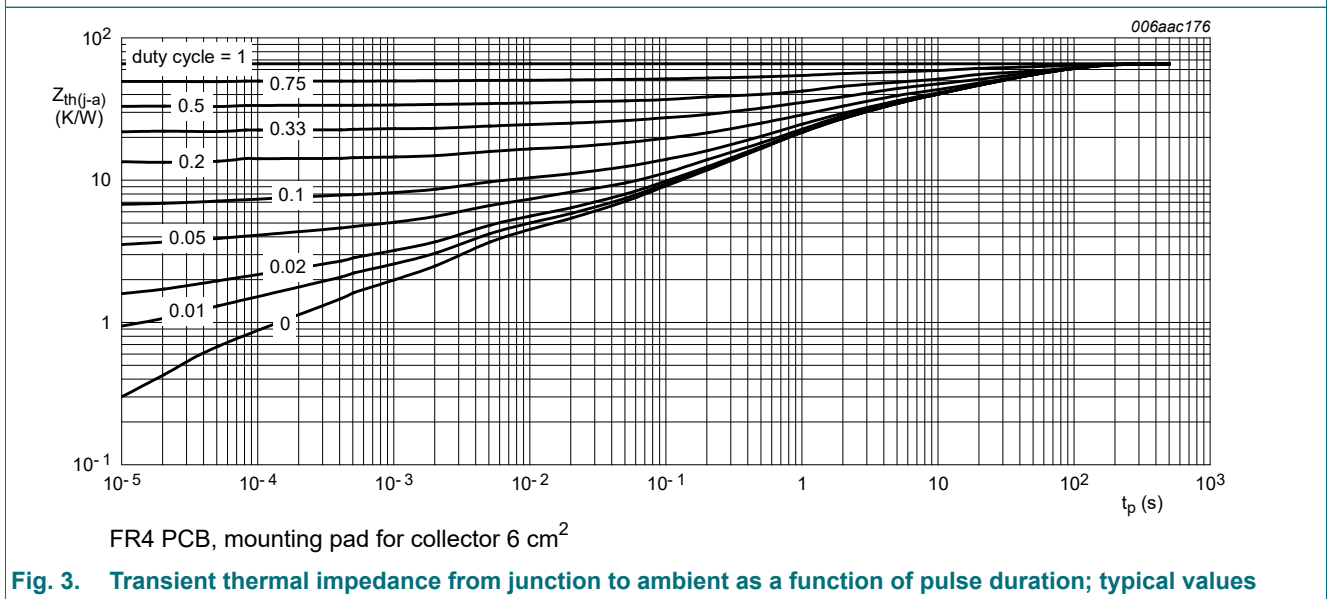
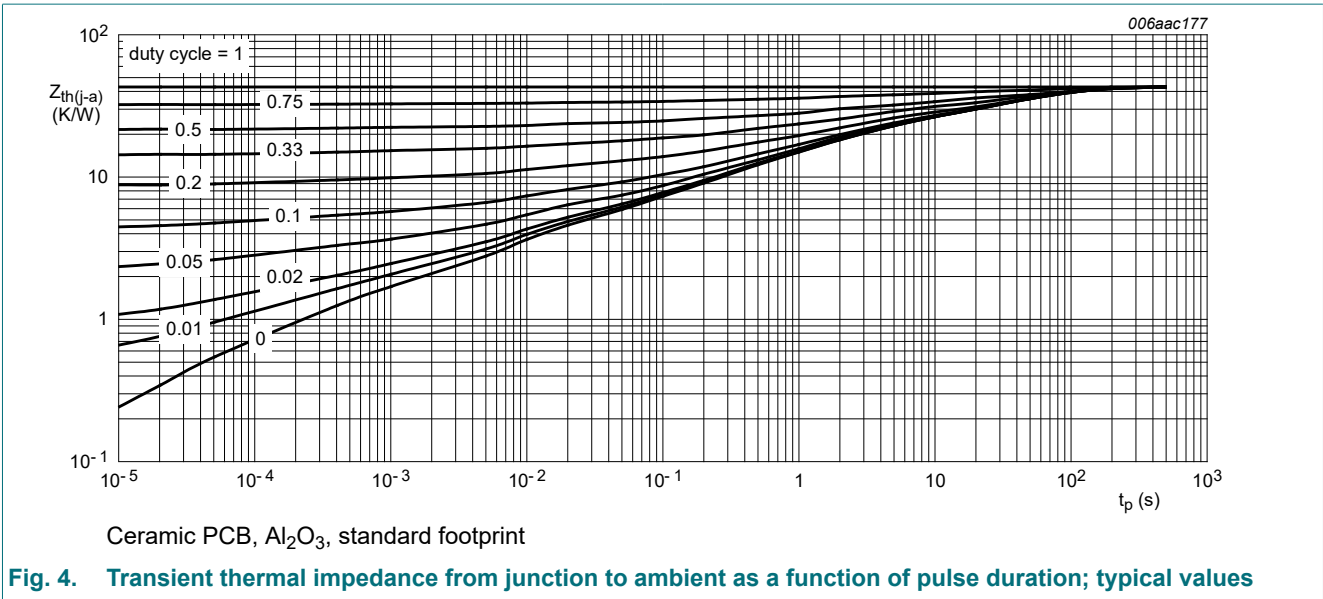


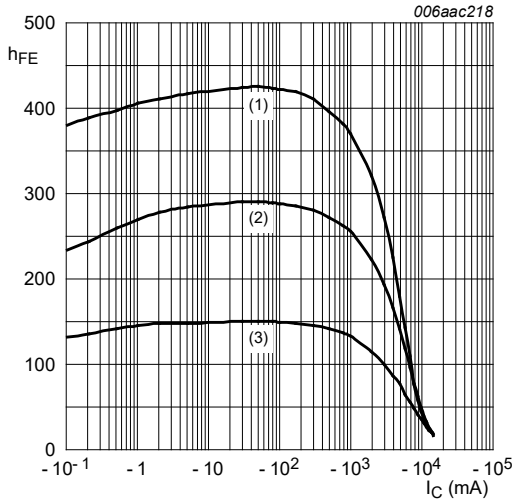
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



## 10. Characteristics

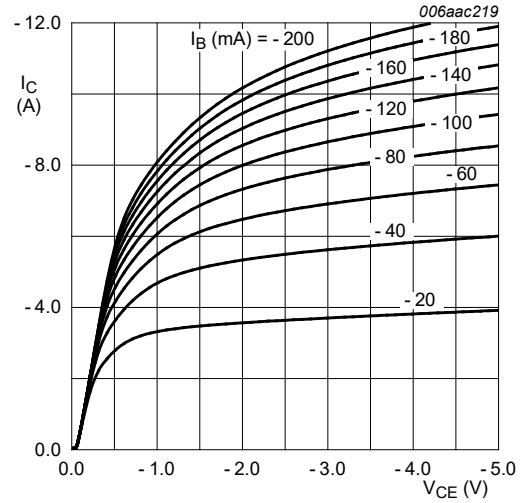
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -60\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-100	nA
		$V_{CB} = -60\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^\circ\text{C}$	-	-	-50	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-100	nA
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -48\text{ V}; V_{BE} = 0\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -2\text{ V}; I_C = -500\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	200	300	-	
		$V_{CE} = -2\text{ V}; I_C = -1\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	180	270	-	
		$V_{CE} = -2\text{ V}; I_C = -2\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	150	250	-	
		$V_{CE} = -2\text{ V}; I_C = -4\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	120	180	-	
		$V_{CE} = -2\text{ V}; I_C = -6\text{ A}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	80	125	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -1\text{ A}; I_B = -50\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-60	-90	mV
		$I_C = -1\text{ A}; I_B = -10\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-120	-180	mV
		$I_C = -2\text{ A}; I_B = -40\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-145	-210	mV
		$I_C = -4\text{ A}; I_B = -200\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-195	-300	mV
		$I_C = -4\text{ A}; I_B = -400\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-160	-240	mV
		$I_C = -5\text{ A}; I_B = -500\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-200	-300	mV
$R_{CEsat}$	collector-emitter saturation resistance	$I_C = -4\text{ A}; I_B = -400\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	40	60	m $\Omega$
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -1\text{ A}; I_B = -100\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.84	-0.9	V
		$I_C = -4\text{ A}; I_B = -400\text{ mA}; \text{pulsed}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.98	-1.05	V
$V_{BEon}$	base-emitter turn-on voltage	$V_{CE} = -2\text{ V}; I_C = -2\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-0.77	-0.85	V
$t_d$	delay time	$V_{CC} = -12.5\text{ V}; I_C = -1\text{ A}; I_{B(on)} = -0.05\text{ A}; I_{B(off)} = 0.05\text{ A}; T_{amb} = 25\text{ }^\circ\text{C}$	-	45	-	ns
$t_r$	rise time		-	60	-	ns
$t_{on}$	turn-on time		-	105	-	ns
$t_s$	storage time		-	440	-	ns
$t_f$	fall time		-	75	-	ns
$t_{off}$	turn-off time		-	515	-	ns
$f_T$	transition frequency		$V_{CE} = -10\text{ V}; I_C = -100\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	110	-
$C_C$	collector capacitance	$V_{CB} = -10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	-	85	-	pF



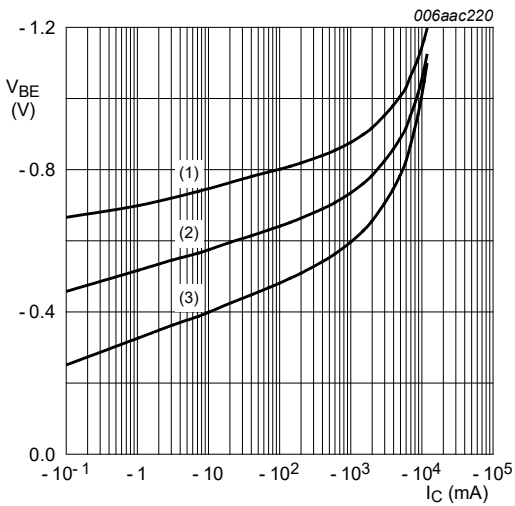
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



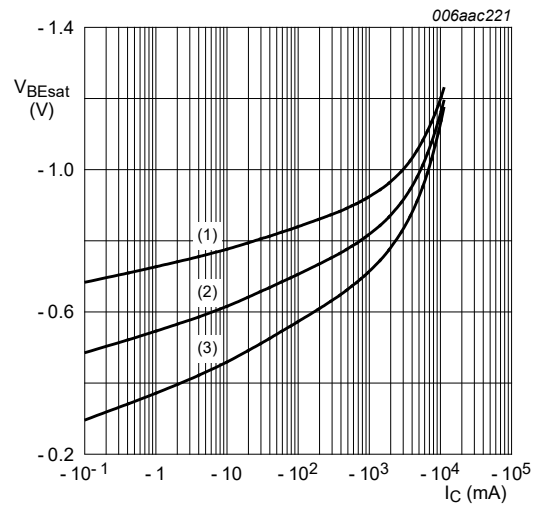
$T_{amb} = 25\text{ }^\circ\text{C}$

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



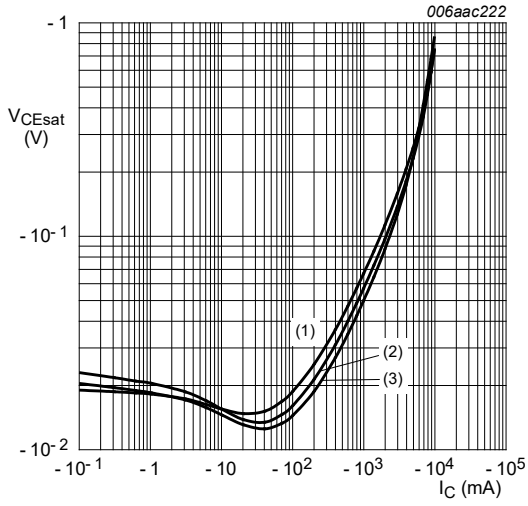
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



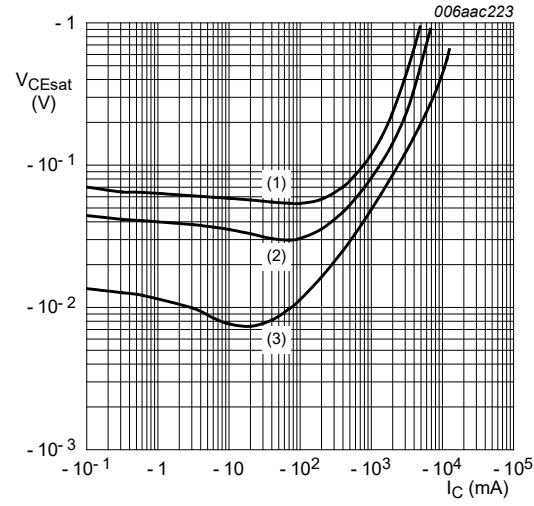
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



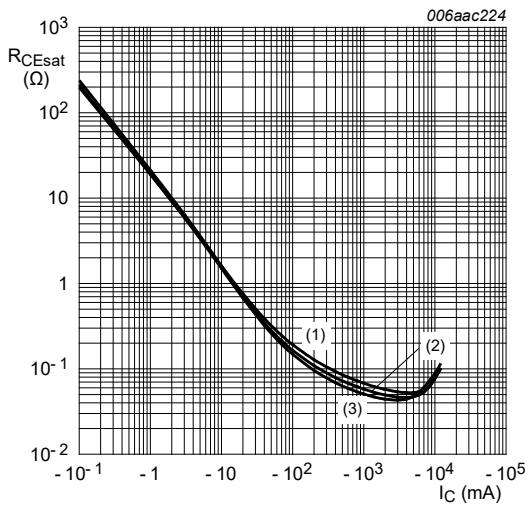
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



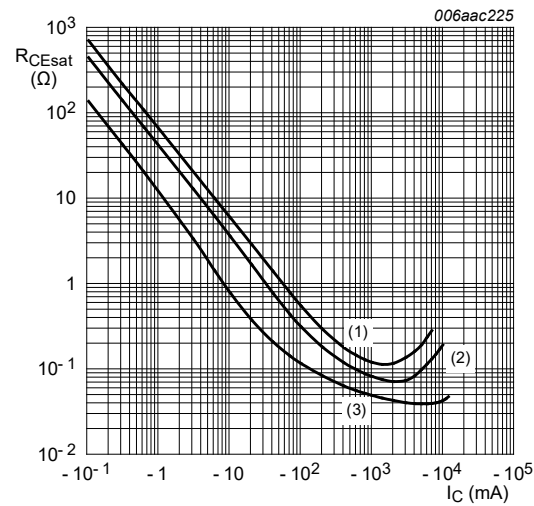
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 100$   
 (2)  $I_C/I_B = 50$   
 (3)  $I_C/I_B = 10$

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



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

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



### 11. Test information

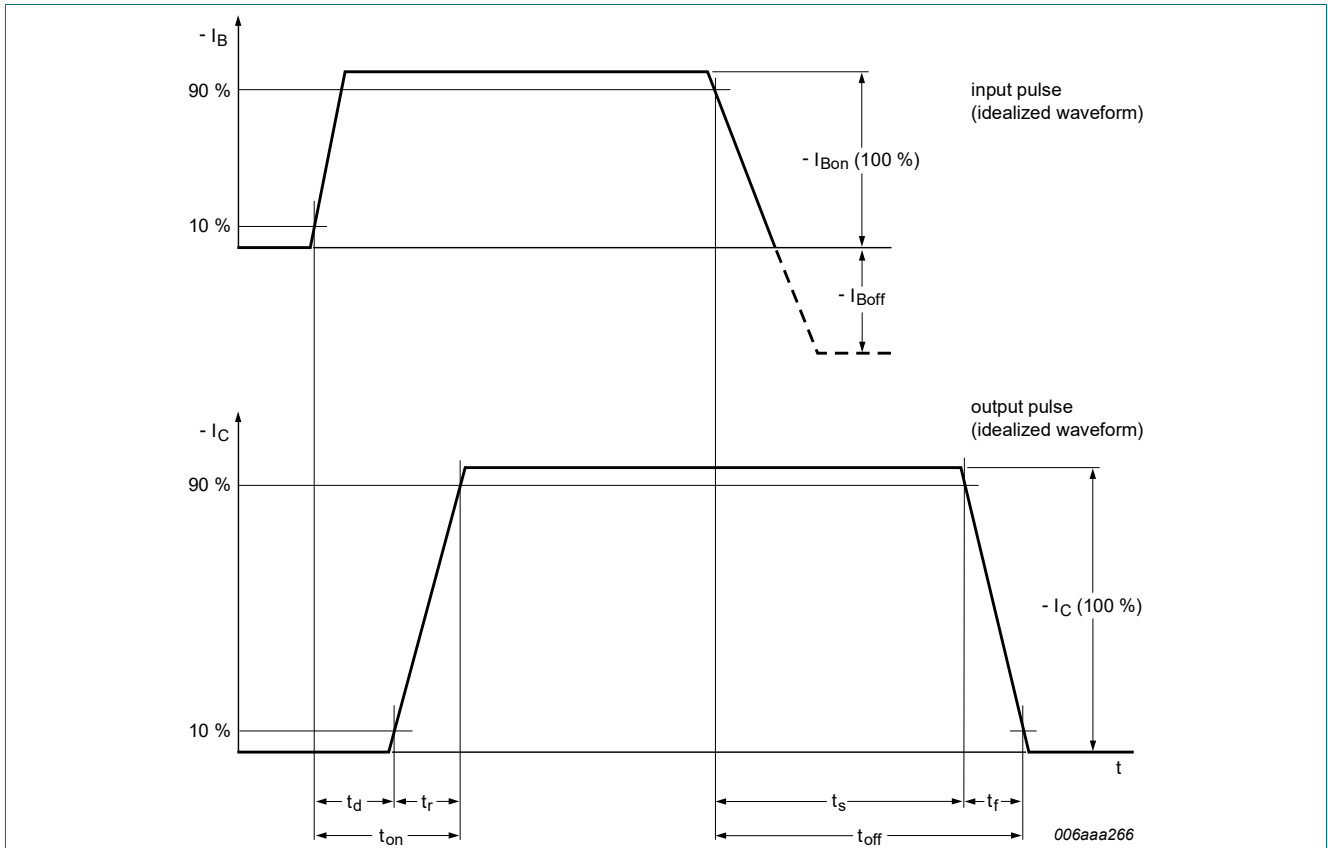


Fig. 13. Transistor switching time definition

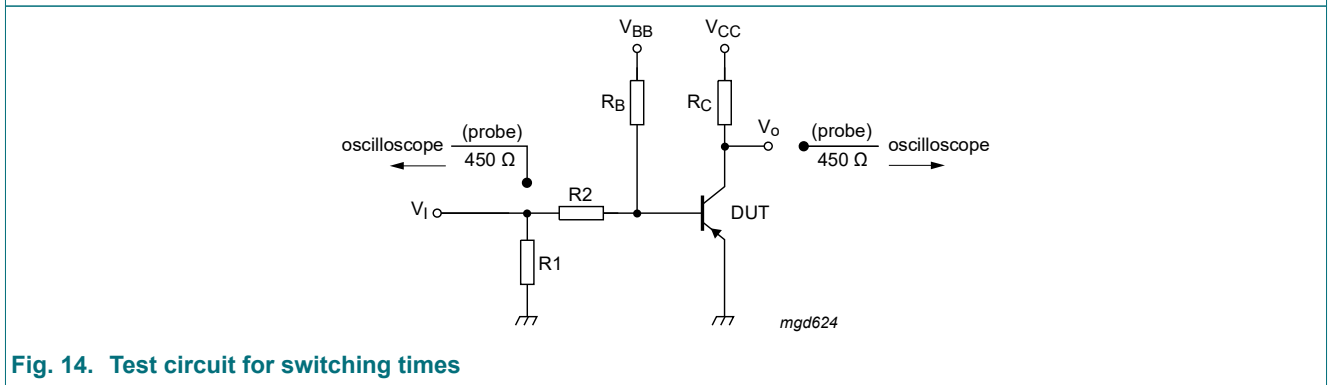


Fig. 14. Test circuit for switching times

### 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

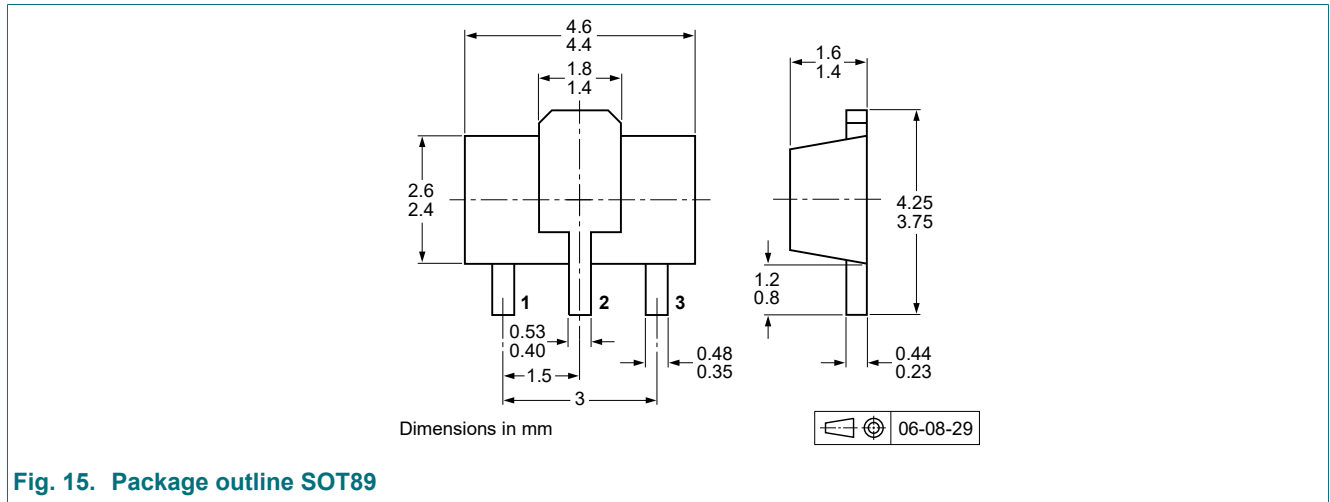


Fig. 15. Package outline SOT89

## 13. Soldering

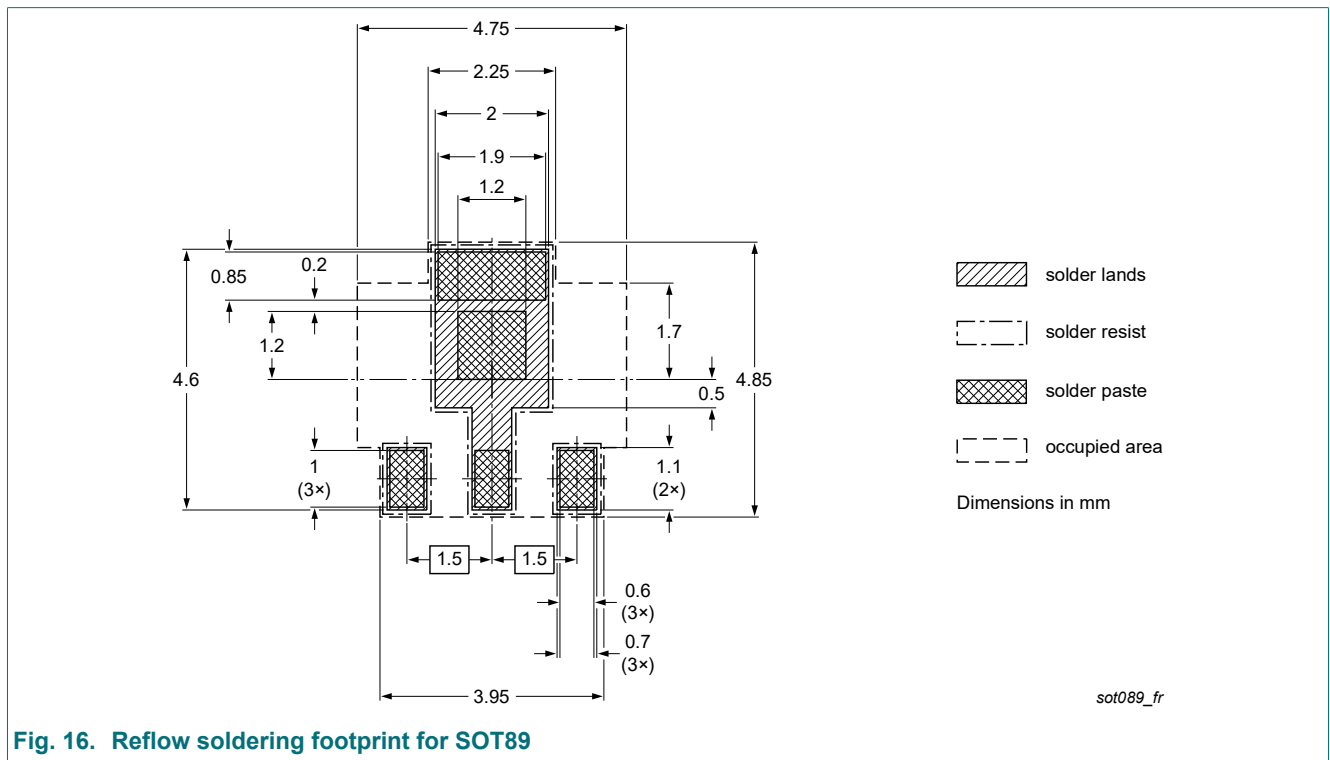


Fig. 16. Reflow soldering footprint for SOT89

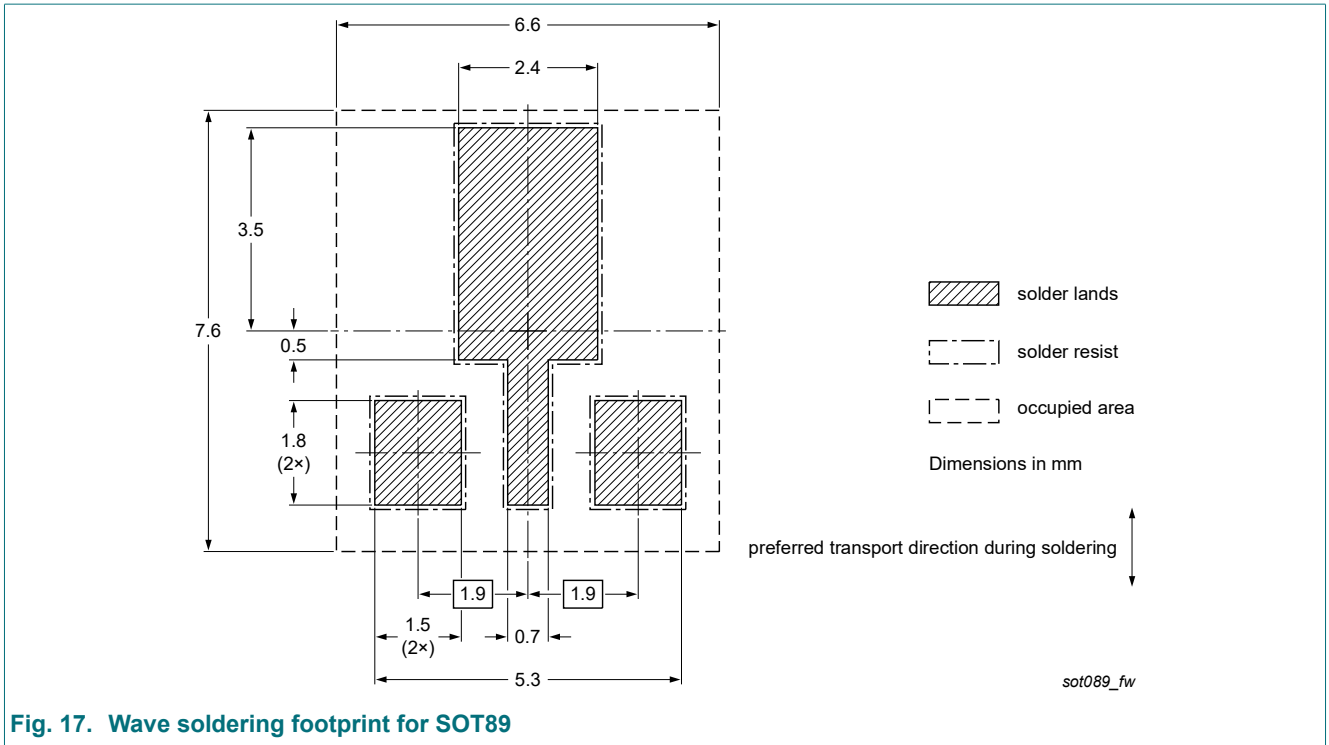


Fig. 17. Wave soldering footprint for SOT89

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4041PX-Q v.1	20240423	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 April 2024

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