

# PBHV9040X

500 V, 0.25 A PNP high-voltage low V<sub>CEsat</sub> transistor

17 July 2023

Product data sheet

## 1. General description

PNP high-voltage low V<sub>CEsat</sub> transistor in a SOT89 (SC-62) medium power and flat lead Surface-Mounted Device (SMD) plastic package.

NPN complement: PBHV8540X

## 2. Features and benefits

- High voltage
- Low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability I<sub>C</sub> and I<sub>CM</sub>
- High collector current gain (h<sub>FE</sub>) at high I<sub>C</sub>
- AEC-Q101 qualified

## 3. Applications

- Electronic ballast for fluorescent lighting
- LED driver for LED chain module
- LCD backlighting
- High Intensity Discharge (HID) front lighting
- Automotive motor management
- Hook switch for wired telecom
- Switch mode power supply

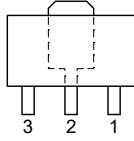
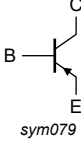
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CESM</sub>	collector-emitter peak voltage	V <sub>BE</sub> = 0 V	-	-	-500	V
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	-400	V
I <sub>C</sub>	collector current		-	-	-0.25	A
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = -10 V; I <sub>C</sub> = -50 mA; T <sub>amb</sub> = 25 °C	100	200	-	

## 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;"><i>sym079</i></p>
2	C	collector		
3	B	base		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PBHV9040X</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[1]
PBHV9040X	% 4 E

[1] % = placeholder for manufacturing site code

## 8. Limiting values

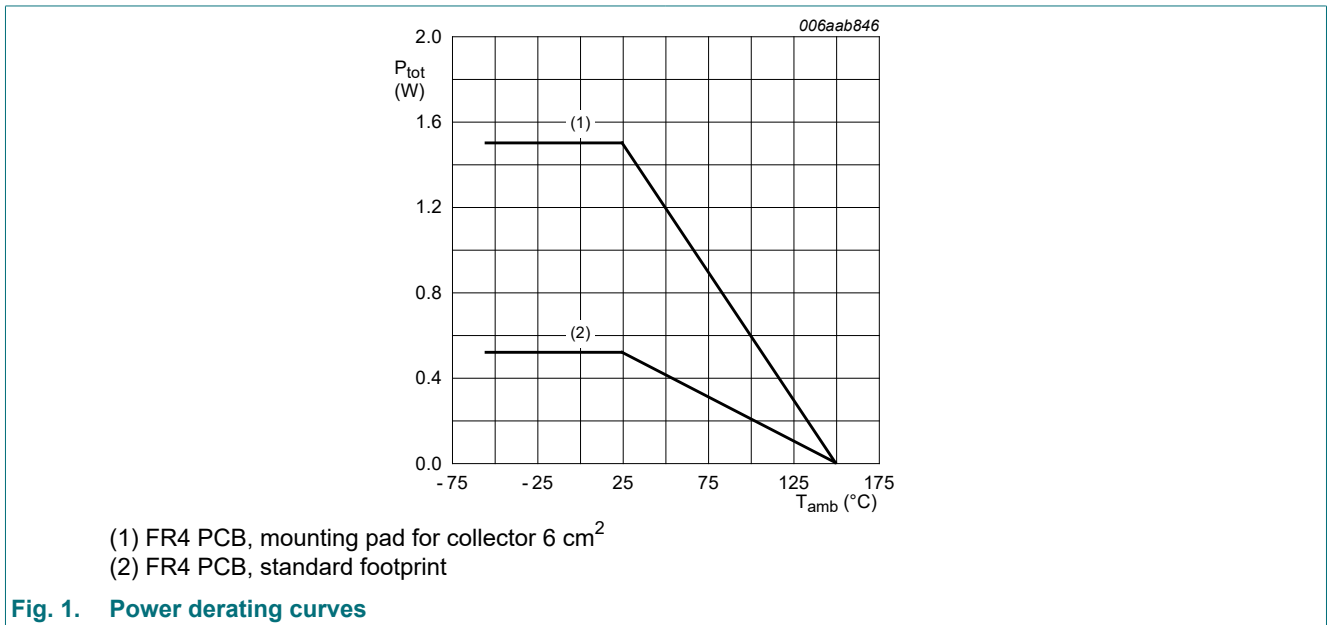
**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{CBO}$	collector-base voltage	open emitter	-	-500	V	
$V_{CEO}$	collector-emitter voltage	open base	-	-400	V	
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-500	V	
$V_{EBO}$	emitter-base voltage	open collector	-	-6	V	
$I_C$	collector current		-	-0.25	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	-0.5	A	
$I_{BM}$	peak base current		-	-200	mA	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	0.52	W
			[2]	-	1.5	W
$T_j$	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>.



**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]	-	-	240	K/W
			[2]	-	-	83	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>.

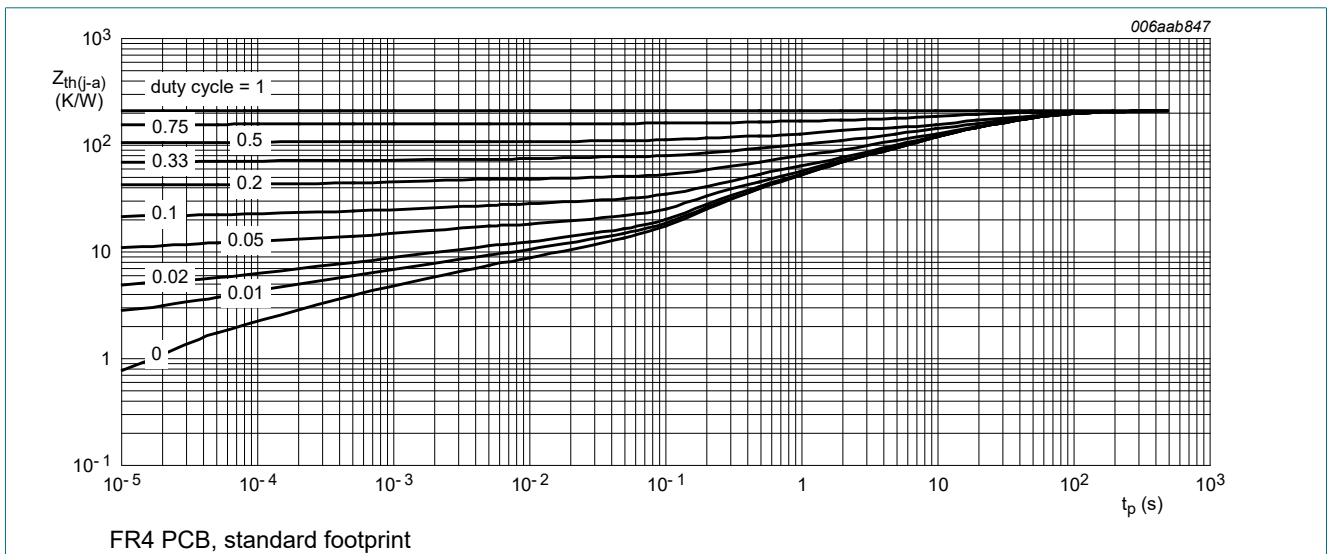


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

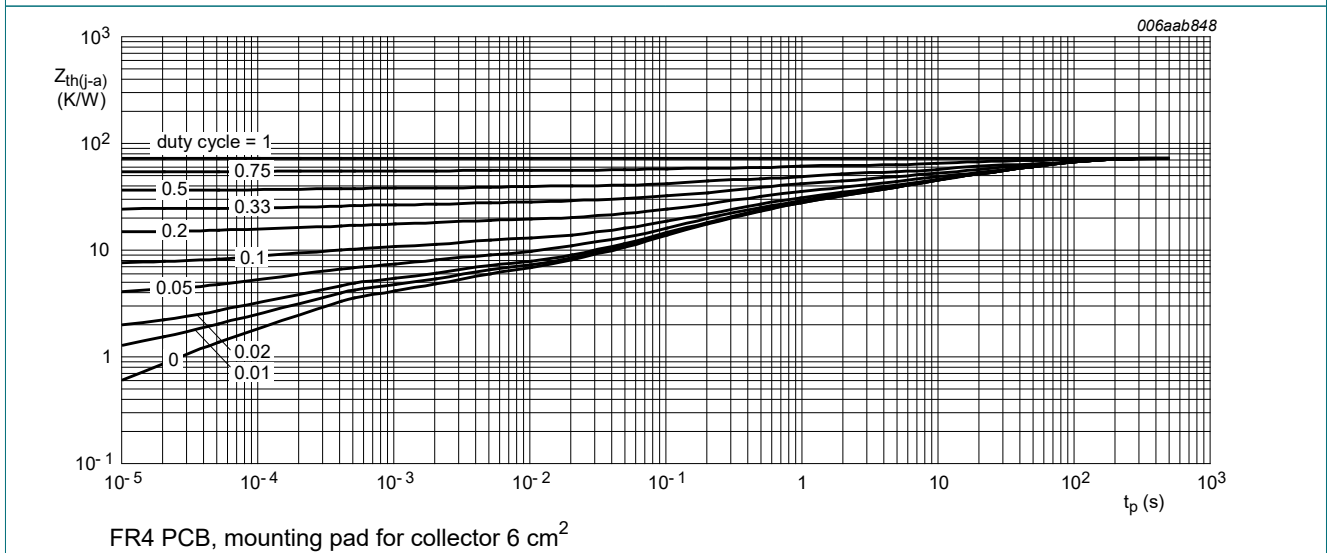
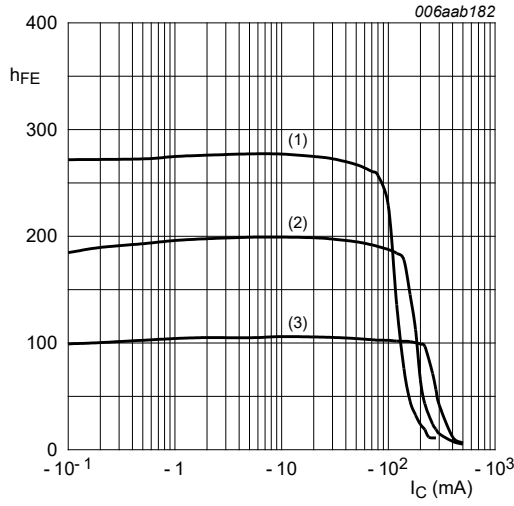


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

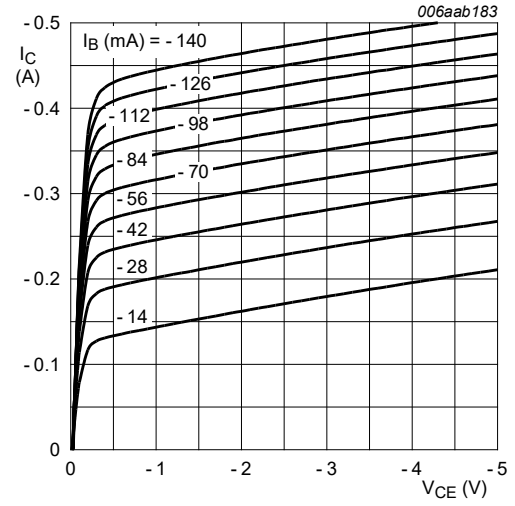
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -320 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
		$V_{CB} = -320 \text{ V}; I_E = 0 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$	-	-	-10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -4 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -320 \text{ V}; V_{BE} = 0 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -10 \text{ V}; I_C = -50 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	100	200	-	
		$V_{CE} = -10 \text{ V}; I_C = -100 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	80	200	-	
		$V_{CE} = -10 \text{ V}; I_C = -250 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	10	25	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -100 \text{ mA}; I_B = -20 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-110	-200	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -100 \text{ mA}; I_B = -20 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-1	-1.1	V
$t_d$	delay time	$V_{CC} = -2 \text{ V}; I_C = -0.15 \text{ A}; I_{B(on)} = -0.03 \text{ A}; I_{B(off)} = 0.03 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	9	-	ns
$t_r$	rise time		-	1810	-	ns
$t_{on}$	turn-on time		-	1819	-	ns
$t_s$	storage time		-	715	-	ns
$t_f$	fall time		-	1085	-	ns
$t_{off}$	turn-off time		-	1800	-	ns
$f_T$	transition frequency		$V_{CE} = -10 \text{ V}; I_C = -10 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	55	-
$C_c$	collector capacitance	$V_{CB} = -20 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	7	-	pF
$C_e$	emitter capacitance	$V_{EB} = -0.5 \text{ V}; I_C = 0 \text{ A}; i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	150	-	pF



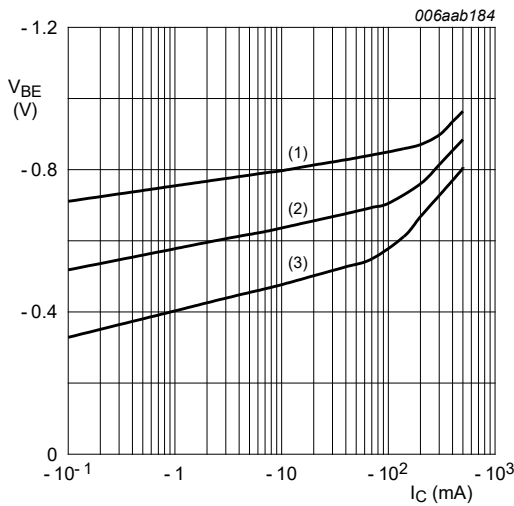
$V_{CE} = -10$  V  
 (1)  $T_{amb} = 100$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = -55$  °C

Fig. 4. DC current gain as a function of collector current; typical values



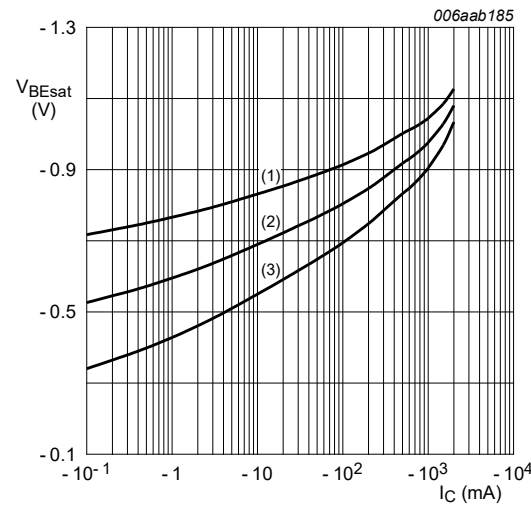
$T_{amb} = 25$  °C

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



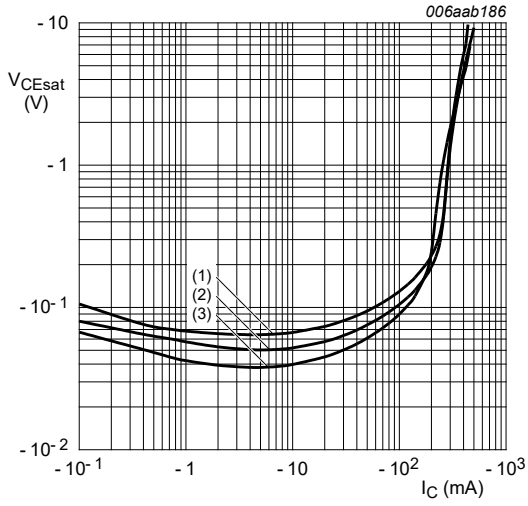
$V_{CE} = -10$  V  
 (1)  $T_{amb} = -55$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = 100$  °C

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



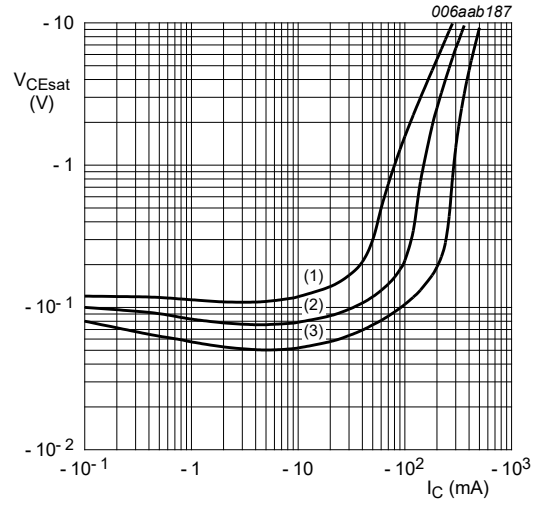
$I_C/I_B = 5$   
 (1)  $T_{amb} = -55$  °C  
 (2)  $T_{amb} = 25$  °C  
 (3)  $T_{amb} = 100$  °C

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



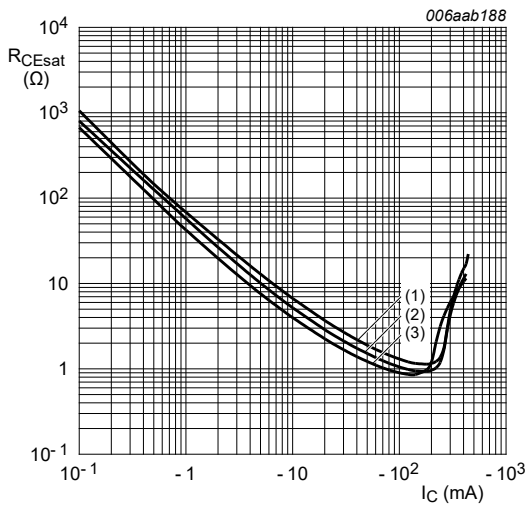
$I_C/I_B = 5$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



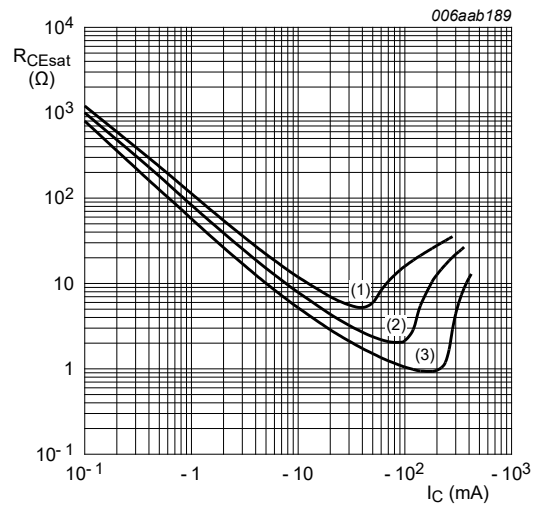
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 20$   
 (2)  $I_C/I_B = 10$   
 (3)  $I_C/I_B = 5$

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



$I_C/I_B = 5$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 20$   
 (2)  $I_C/I_B = 10$   
 (3)  $I_C/I_B = 5$

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

### 11. Test information

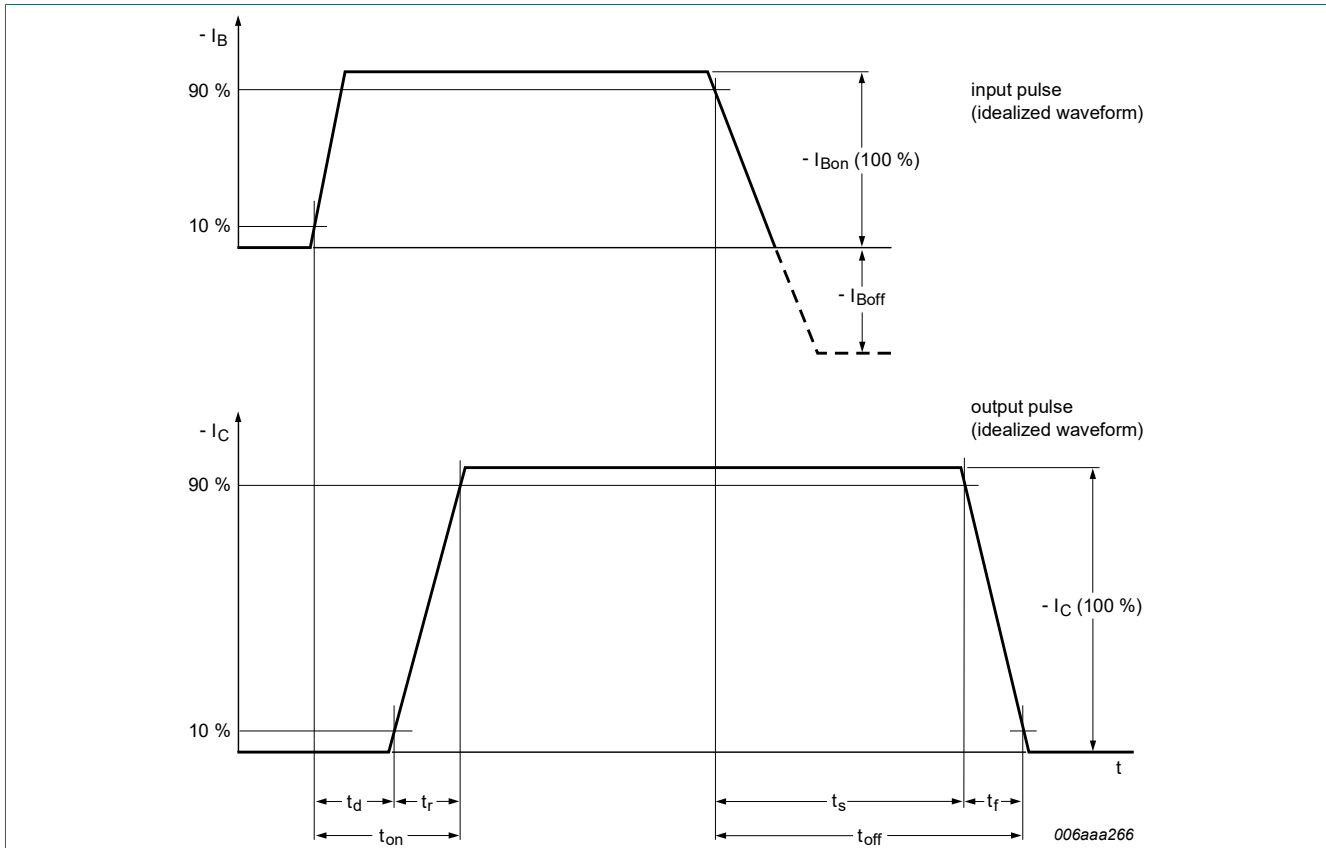


Fig. 12. BISS transistor switching time definition

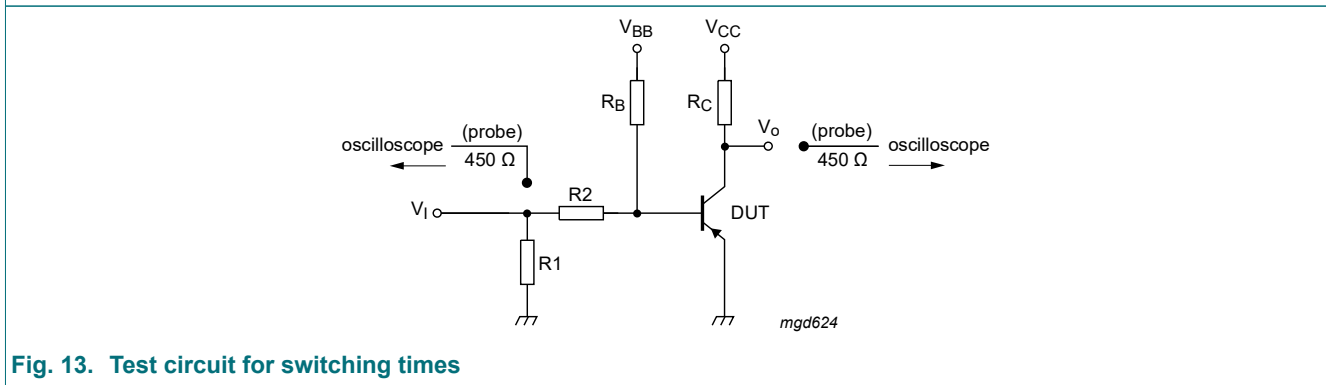


Fig. 13. Test circuit for switching times

### 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

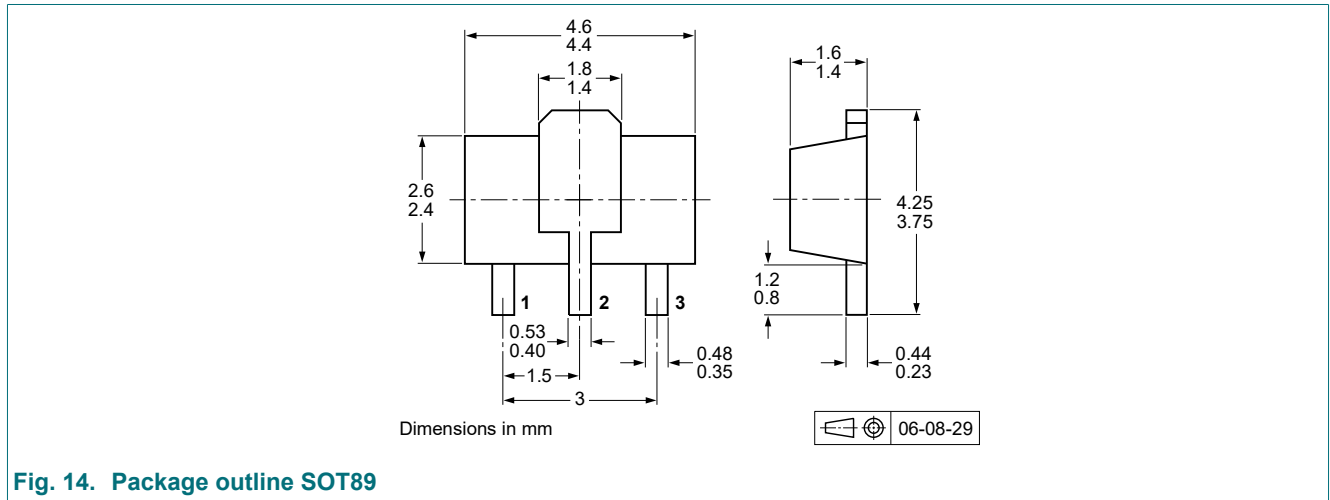


Fig. 14. Package outline SOT89

## 13. Soldering

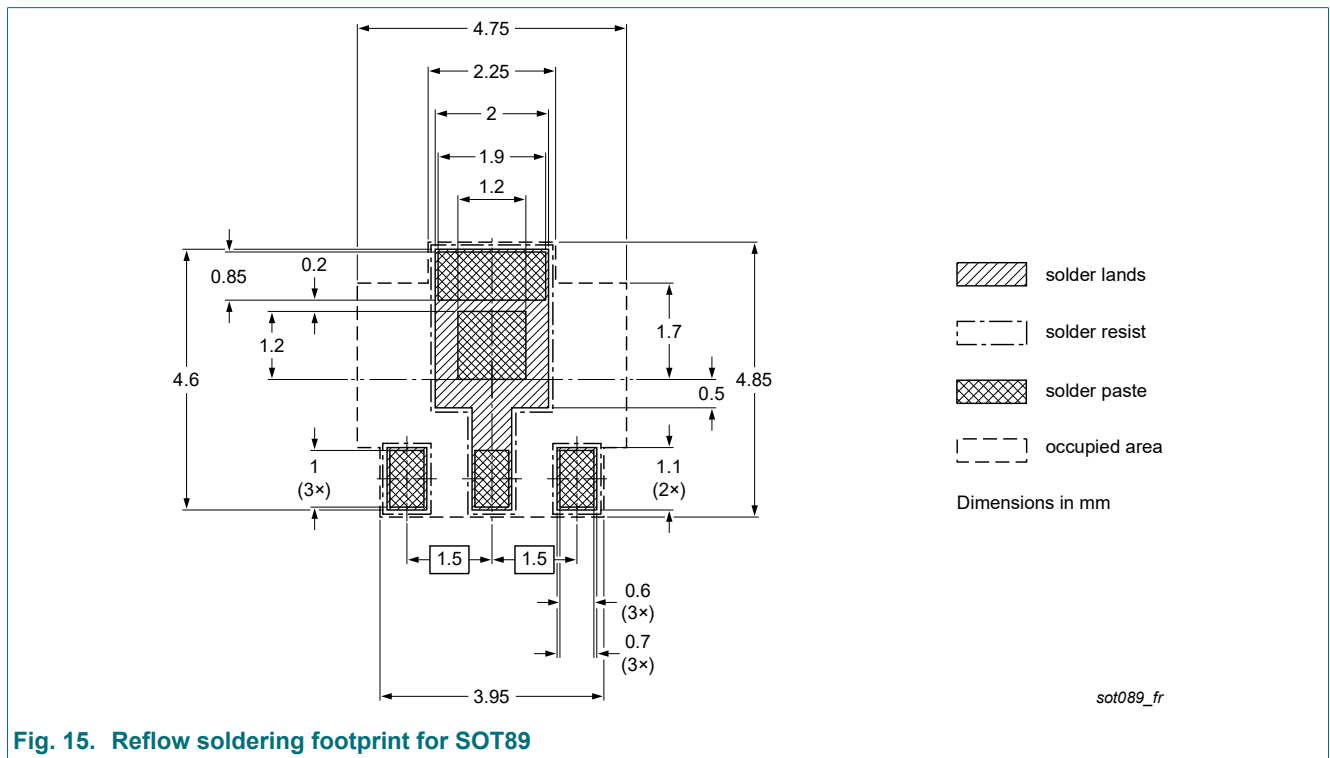


Fig. 15. Reflow soldering footprint for SOT89

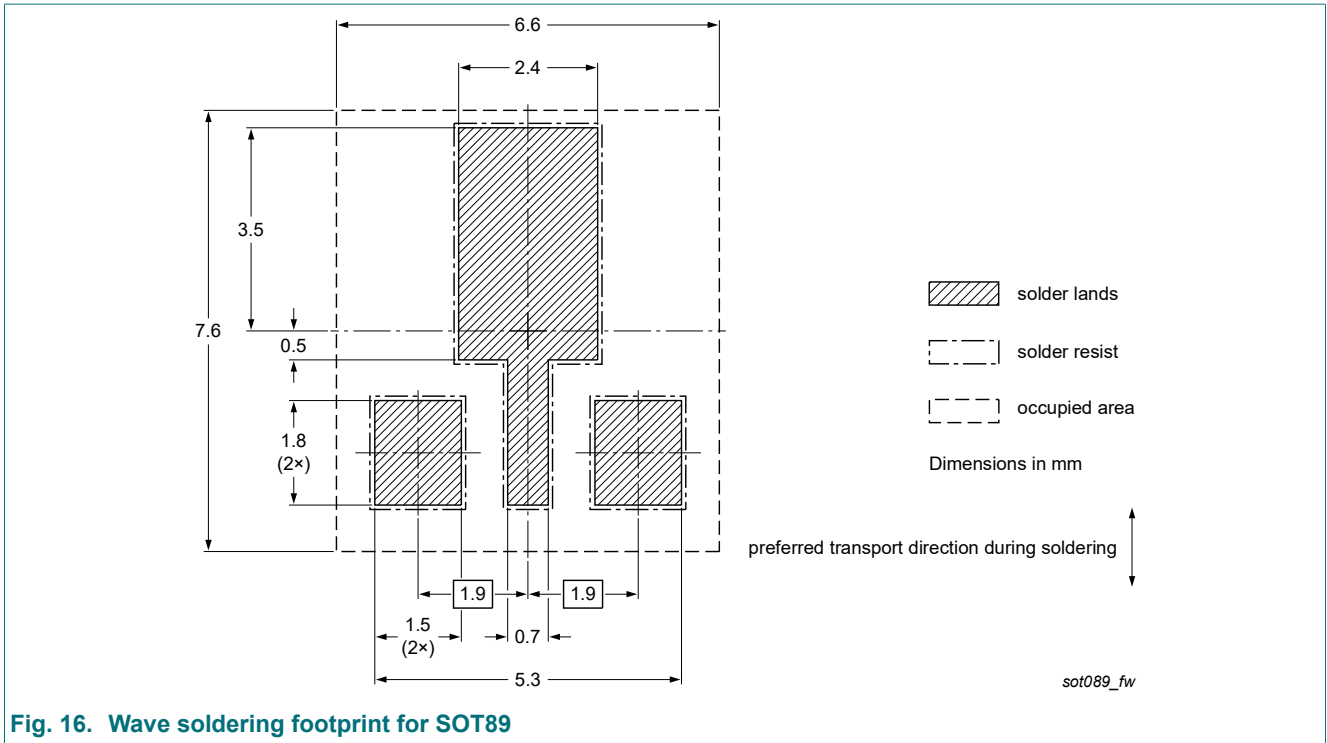


Fig. 16. Wave soldering footprint for SOT89

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBHV9040X v.2	20230717	Product data sheet	-	PBHV9040X v.1
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li></ul>			
PBHV9040X v.1	20131209	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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