



PBHV9540X

400 V, 0.5 A PNP high-voltage low V_{CEsat} (BISS) transistor

28 September 2017

Product data sheet

1. General description

PNP high-voltage low V_{CEsat} Breakthrough In Small Signal (BISS) 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_{CEsat}
- High collector current capability I_C and I_{CM}
- High collector current gain (h_{FE}) at high I_C
- 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

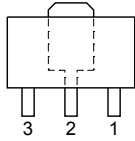
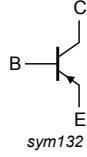
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CEO}	collector-emitter voltage	open base	-	-	-400	V
I _C	collector current		-	-	-0.5	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms	-	-	-1	A
h _{FE}	DC current gain	V _{CE} = -5 V; I _C = -20 mA; T _{amb} = 25 °C	140	-	450	
R _{CEsat}	collector-emitter saturation resistance	I _C = -200 mA; I _B = -40 mA; T _{amb} = 25 °C	[1]	-	2000	mΩ

[1] Pulse test: t_p ≤ 300 μs; δ ≤ 0.02

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
PBHV9540X	SOT89	plastic surface-mounted package; die pad for good heat transfer; 3 leads	SOT89

7. Marking

Table 4. Marking codes

Type number	Marking code ^[1]
PBHV9540X	%4H

[1] % = placeholder for manufacturing site code

8. Limiting values

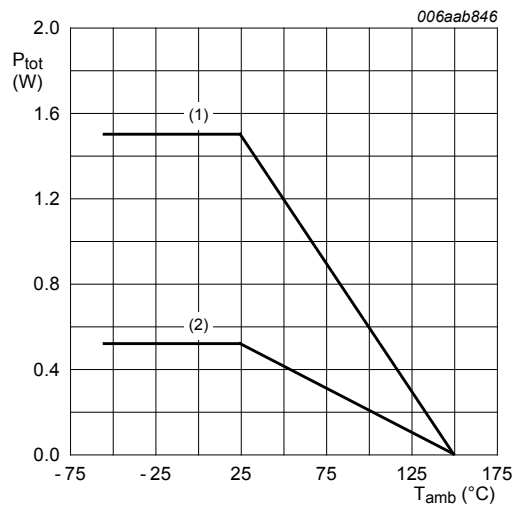
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit	
V_{CBO}	collector-base voltage	open emitter	-	-400	V	
V_{CEO}	collector-emitter voltage	open base	-	-400	V	
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$ V	-	-400	V	
V_{EBO}	emitter-base voltage	open collector	-	-7	V	
I_C	collector current		-	-0.5	A	
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-1	A	
I_B	base current		-	-250	mA	
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °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 cm².



(1) FR4 PCB, mounting pad for collector 6 cm²
 (2) 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]	-	-	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 cm².

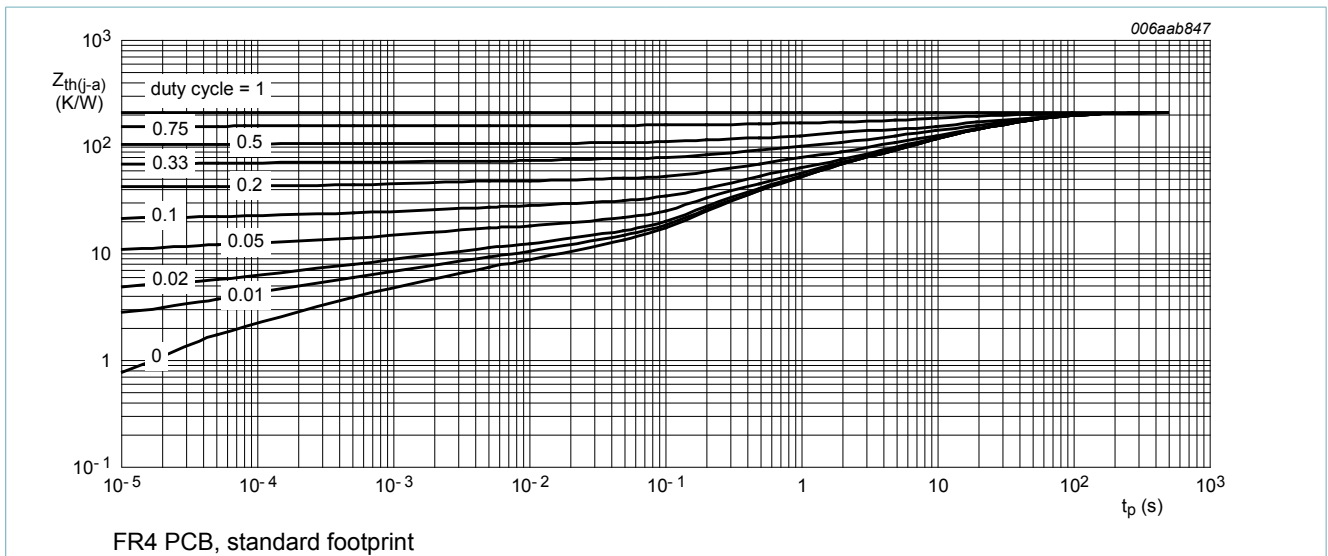


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

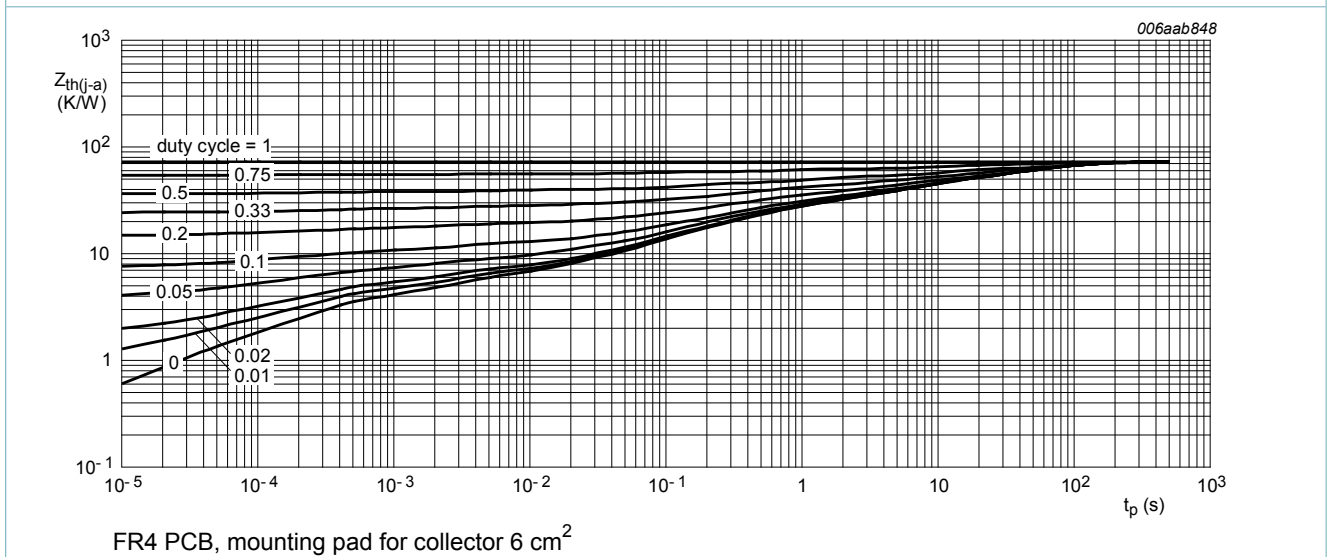


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

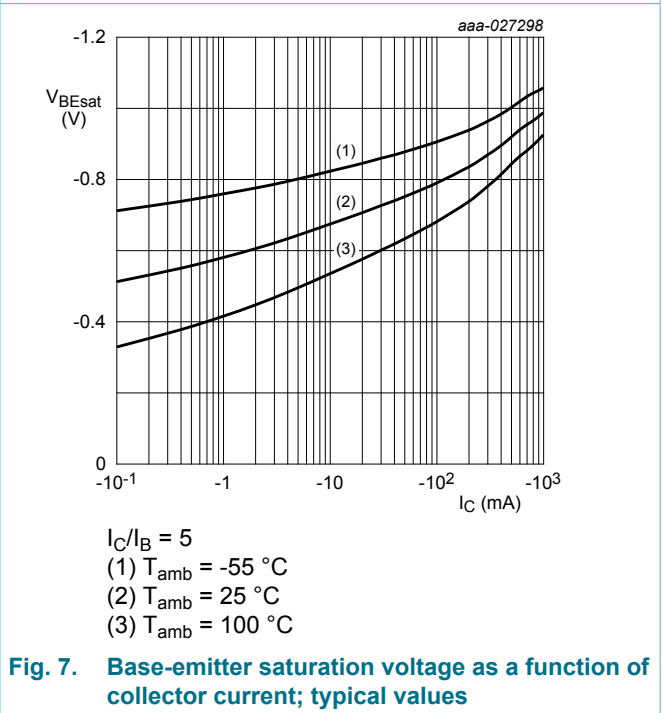
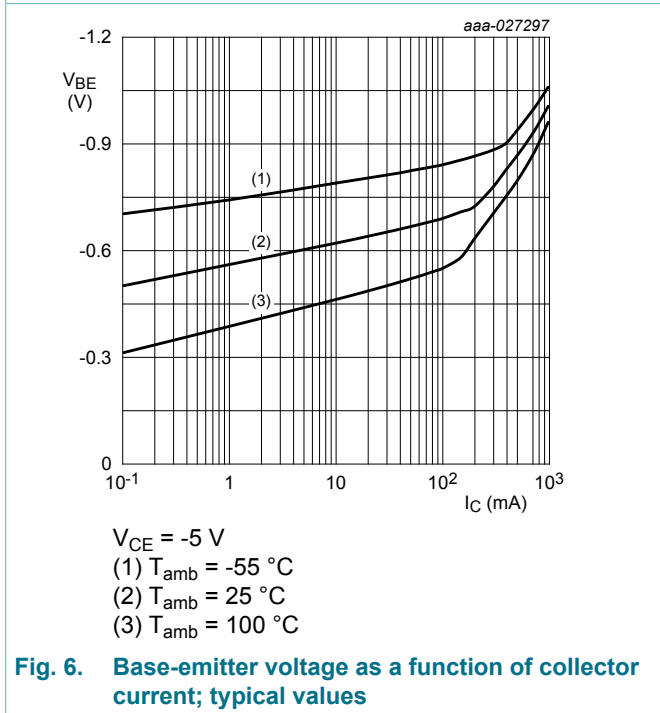
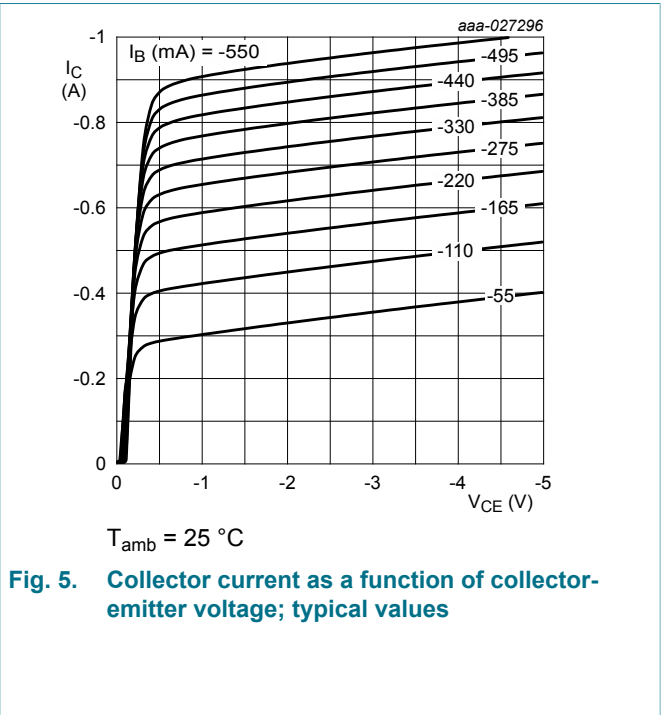
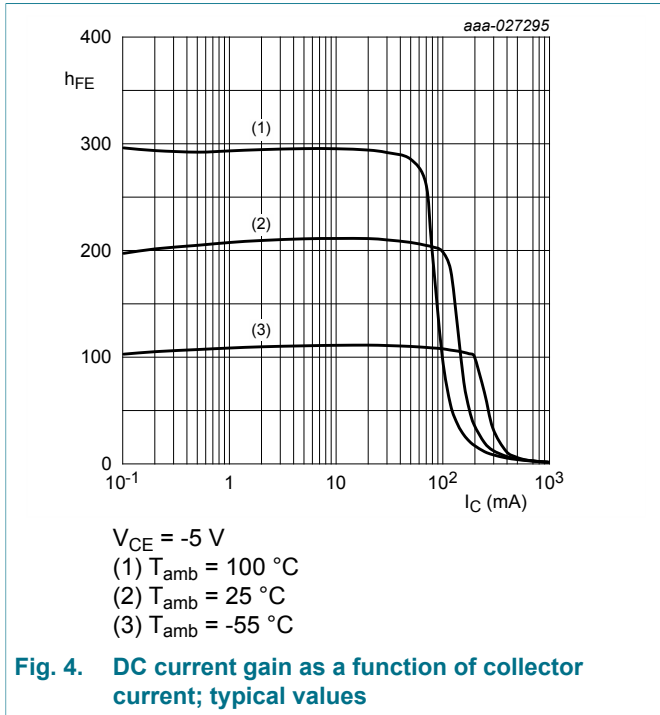
Table 7. Characteristics

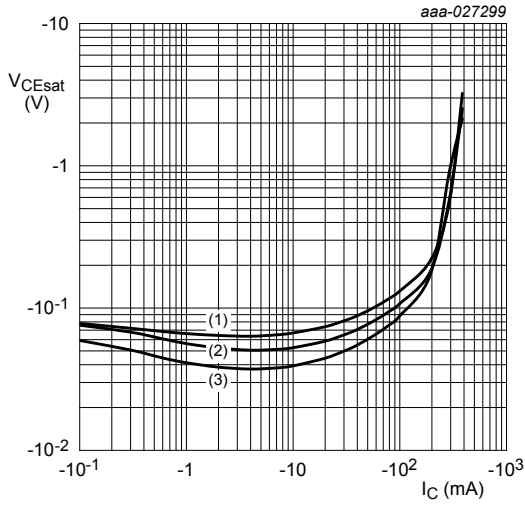
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = -100 \mu\text{A}$; $I_E = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-400	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = -2.5 \text{ mA}$; $I_B = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-400	-	-	V
$V_{(BR)CES}$	collector-emitter breakdown voltage (base shorted)	$I_C = -2.5 \text{ mA}$; $V_{BE} = 0 \text{ V}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-400	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage (collector open)	$I_E = -100 \mu\text{A}$; $I_C = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-7	-	-	V
I_{CBO}	collector-base cut-off current	$V_{CB} = -320 \text{ V}$; $I_E = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
		$V_{CB} = -320 \text{ V}$; $I_E = 0 \text{ A}$; $T_j = 150 \text{ }^\circ\text{C}$	-	-	-10	μA
I_{CES}	collector-emitter cut-off current	$V_{CE} = -320 \text{ V}$; $V_{BE} = 0 \text{ V}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
I_{EBO}	emitter-base cut-off current	$V_{EB} = -7 \text{ V}$; $I_C = 0 \text{ A}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
h_{FE}	DC current gain	$V_{CE} = -5 \text{ V}$; $I_C = -20 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	140	-	450	
		$V_{CE} = -5 \text{ V}$; $I_C = -100 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	140	-	400	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -100 \text{ mA}$; $I_B = -20 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	-	-	-250	mV
		$I_C = -200 \text{ mA}$; $I_B = -40 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	-	-	-400	mV
R_{CEsat}	collector-emitter saturation resistance	$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	-	-	2000	m Ω
V_{BEsat}	base-emitter saturation voltage	$I_C = -100 \text{ mA}$; $I_B = -10 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	-	-	-0.9	V
		$I_C = -200 \text{ mA}$; $I_B = -40 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	-	-	-1	V
V_{BE}	base-emitter voltage	$V_{CE} = -10 \text{ V}$; $I_C = -200 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ [1]	-	-	-0.9	V
t_d	delay time	$V_{CC} = -6.2 \text{ V}$; $I_C = -100 \text{ mA}$; $I_{Bon} = -10 \text{ mA}$; $I_{Boff} = 20 \text{ mA}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	60	-	ns
t_r	rise time		-	3650	-	ns
t_{on}	turn-on time		-	3710	-	ns
t_s	storage time		-	810	-	ns
t_f	fall time		-	900	-	ns
t_{off}	turn-off time		-	1710	-	ns
f_T	transition frequency		$V_{CE} = -5 \text{ V}$; $I_C = -50 \text{ mA}$; $f = 100 \text{ MHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	65	-
C_c	collector capacitance	$V_{CB} = -10 \text{ V}$; $I_E = 0 \text{ A}$; $i_e = 0 \text{ A}$; $f = 1 \text{ MHz}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$	-	14	-	pF

400 V, 0.5 A PNP high-voltage low VCEsat (BISS) transistor

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C _e	emitter capacitance	V _{EB} = -0.5 V; I _C = 0 A; i _c = 0 A; f = 1 MHz; T _{amb} = 25 °C	-	235	-	pF

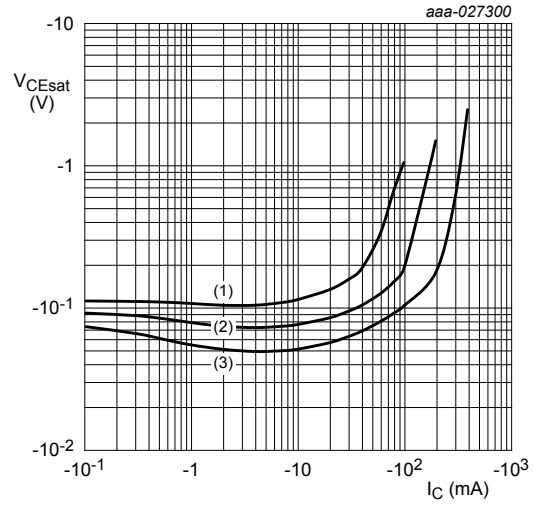
[1] Pulse test: t_p ≤ 300 μs; δ ≤ 0.02





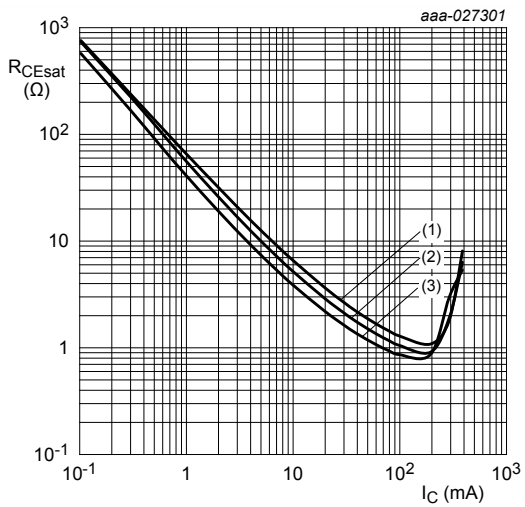
$I_C/I_B = 5$
 (1) $T_{amb} = 100^\circ\text{C}$
 (2) $T_{amb} = 25^\circ\text{C}$
 (3) $T_{amb} = -55^\circ\text{C}$

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



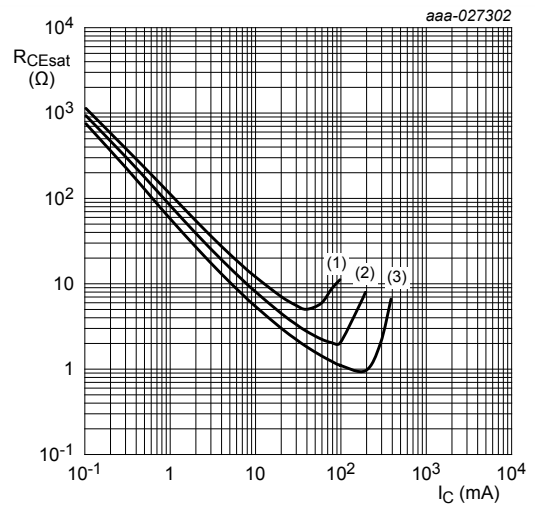
$T_{amb} = 25^\circ\text{C}$
 (1) $I_C/I_B = 20$
 (2) $I_C/I_B = 10$
 (3) $I_C/I_B = 5$

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



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

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



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

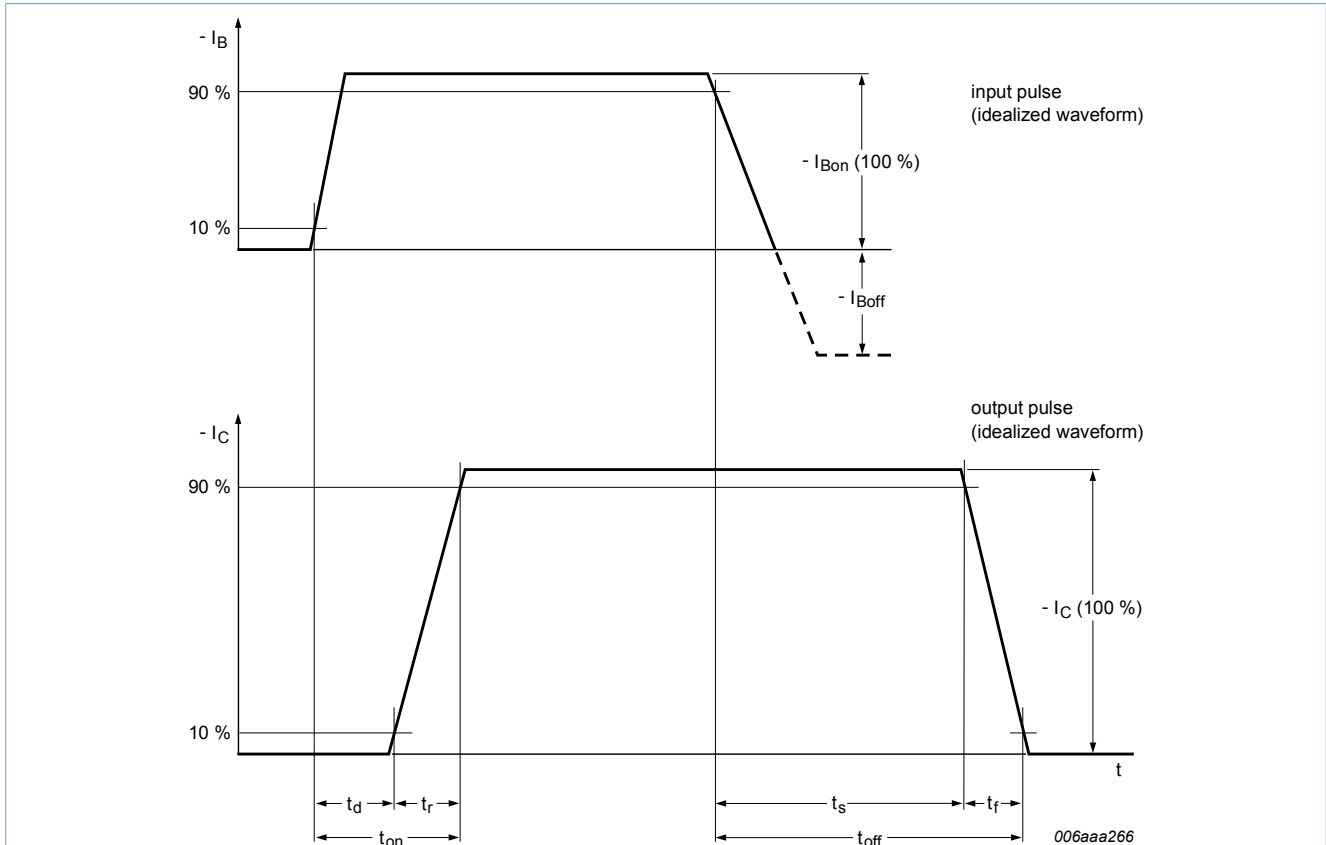


Fig. 12. BISS transistor switching time definition

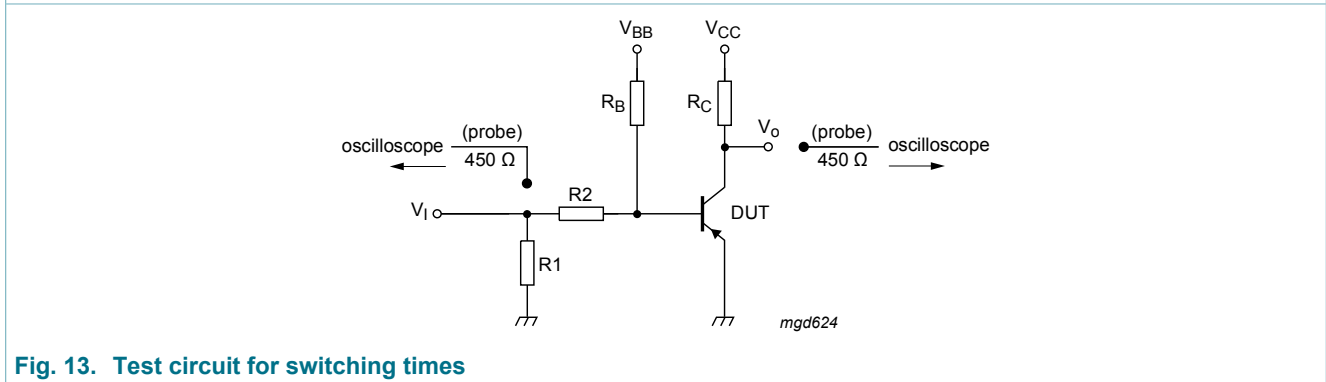


Fig. 13. Test circuit for switching times

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

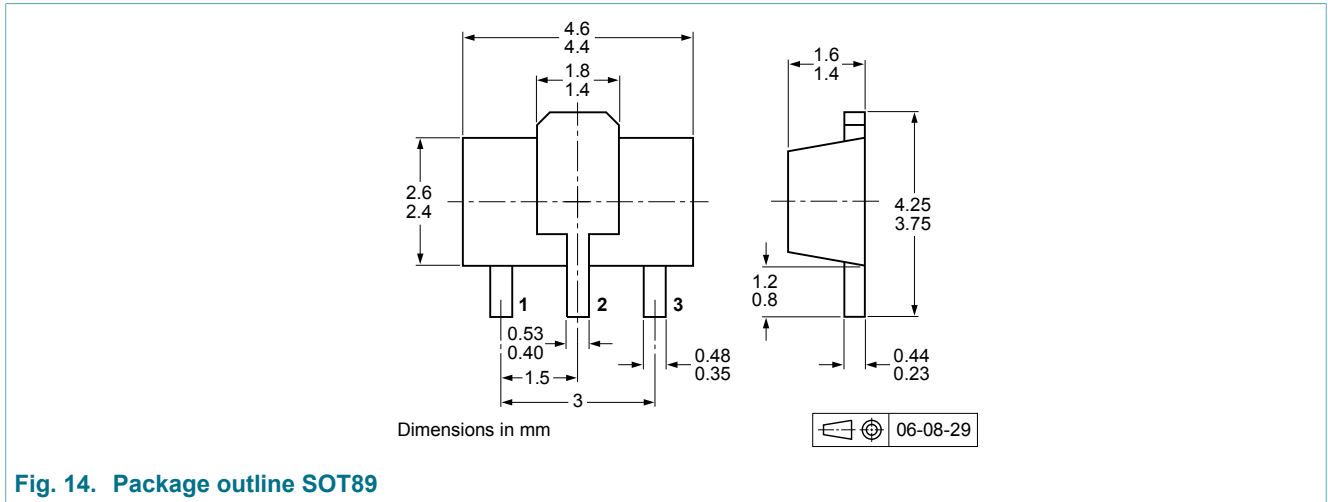


Fig. 14. Package outline SOT89

13. Soldering

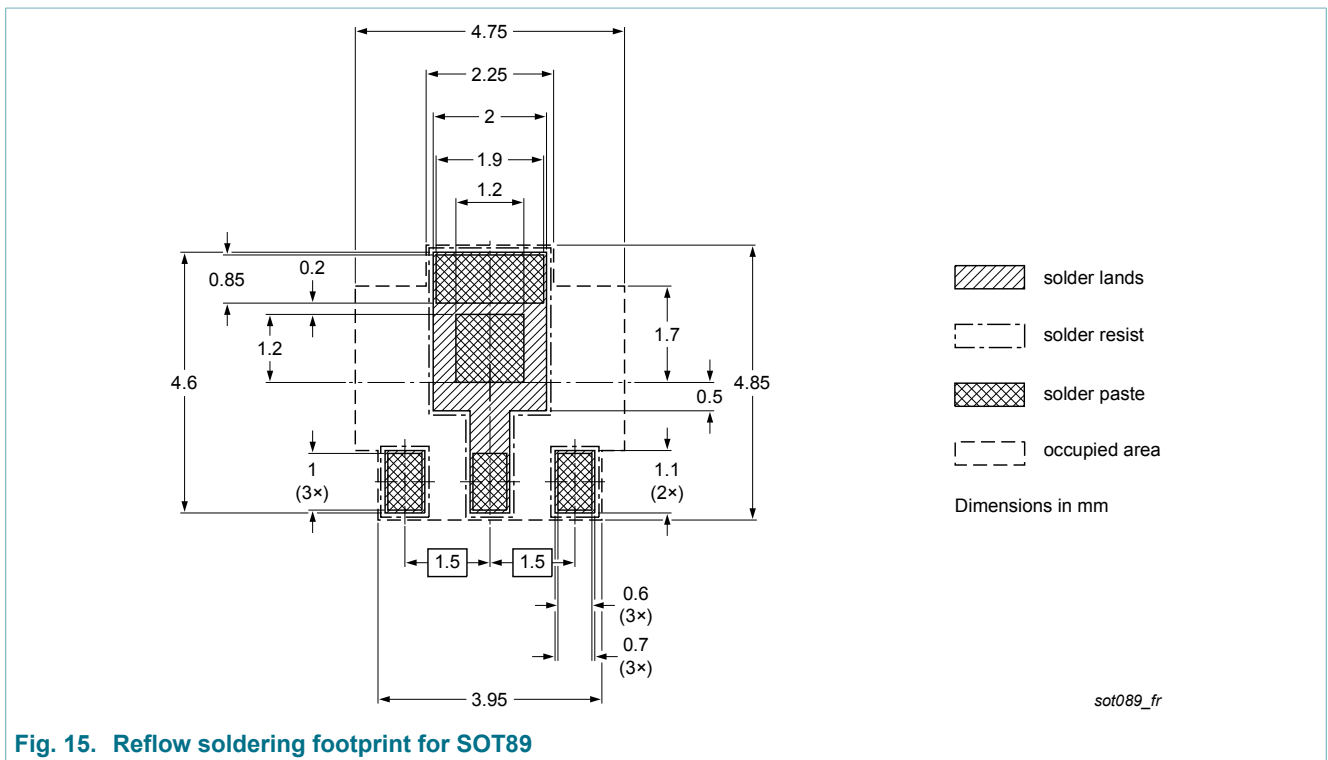


Fig. 15. Reflow soldering footprint for SOT89

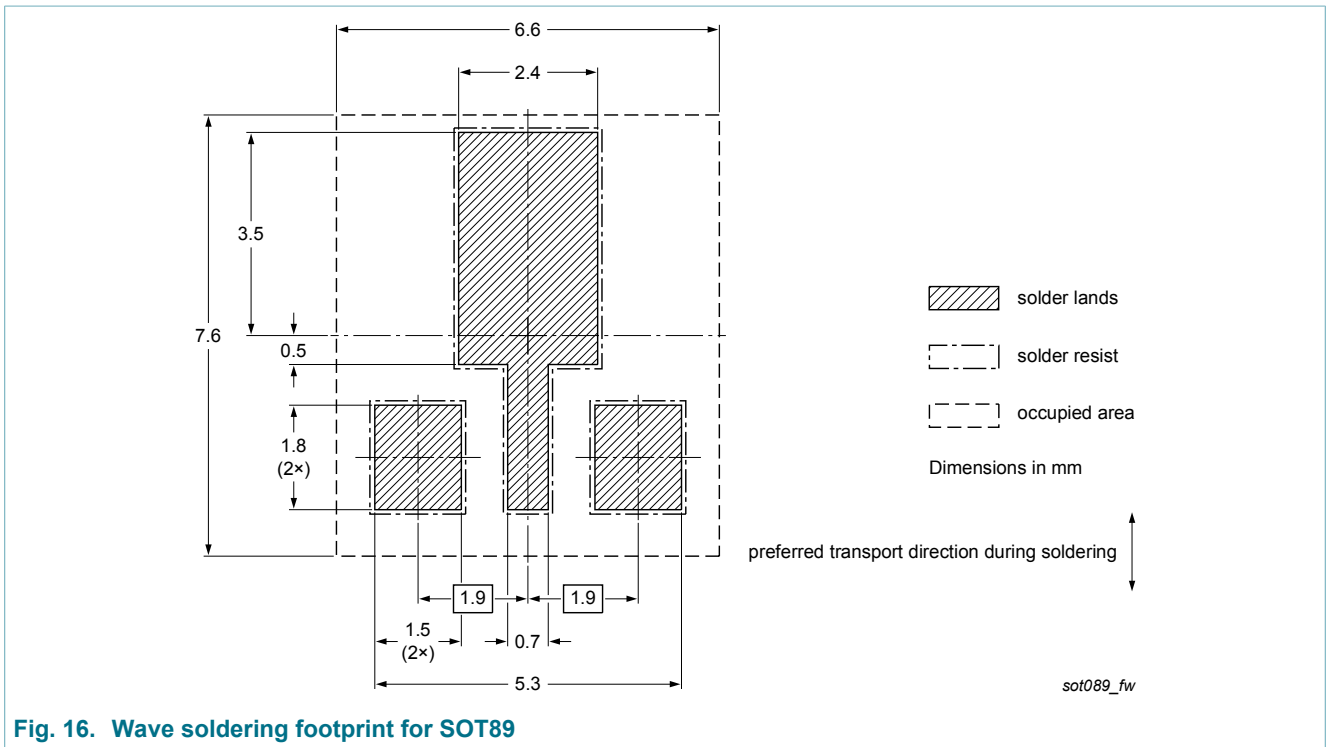


Fig. 16. Wave soldering footprint for SOT89

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBHV9540X v.1	20170928	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.

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Date of release: 28 September 2017

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