

PBHV8540X

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

5 December 2013

Product data sheet

1. General description

NPN 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.

PNP complement: PBHV9040X.

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

- LED driver for LED chain module
- LCD backlighting
- Automotive motor management
- Hook switch for wired telecom
- Switch Mode Power Supply (SMPS)

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CESM}	collector-emitter peak voltage	V _{BE} = 0 V	-	-	500	V
V _{CEO}	collector-emitter voltage	open base	-	-	400	V
I _C	collector current		-	-	0.5	A
h _{FE}	DC current gain	V _{CE} = 10 V; I _C = 50 mA; T _{amb} = 25 °C	100	200	-	

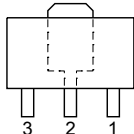
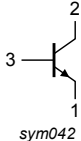


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5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBHV8540X	SOT89	plastic surface-mounted package; die pad for good heat transfer; 3 leads	SOT89

7. Marking

Table 4. Marking codes

Type number	Marking code
PBHV8540X	%4D

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. Limiting values

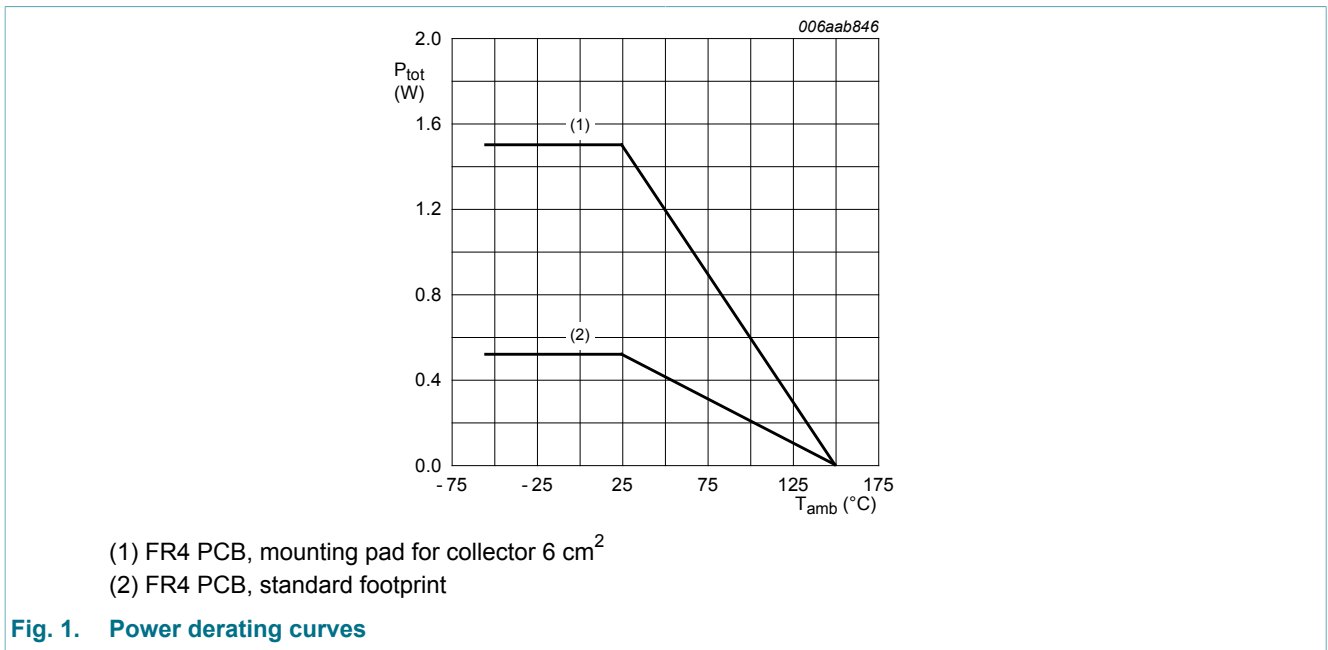
In accordance with the Absolute Maximum Rating System (IEC 60134).

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	$V_{BE} = 0$ V	-	500	V
V_{EBO}	emitter-base voltage	open collector	-	6	V
I_C	collector current		-	0.5	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	1	A
I_{BM}	peak base current		-	200	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	0.52	W

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Symbol	Parameter	Conditions		Min	Max	Unit
			[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.



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.

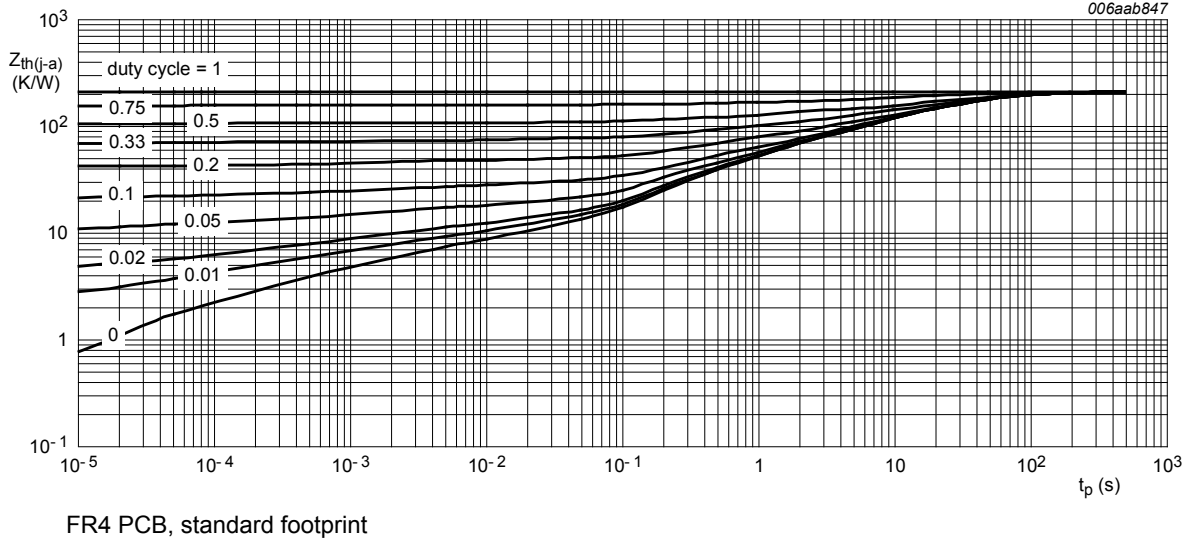


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

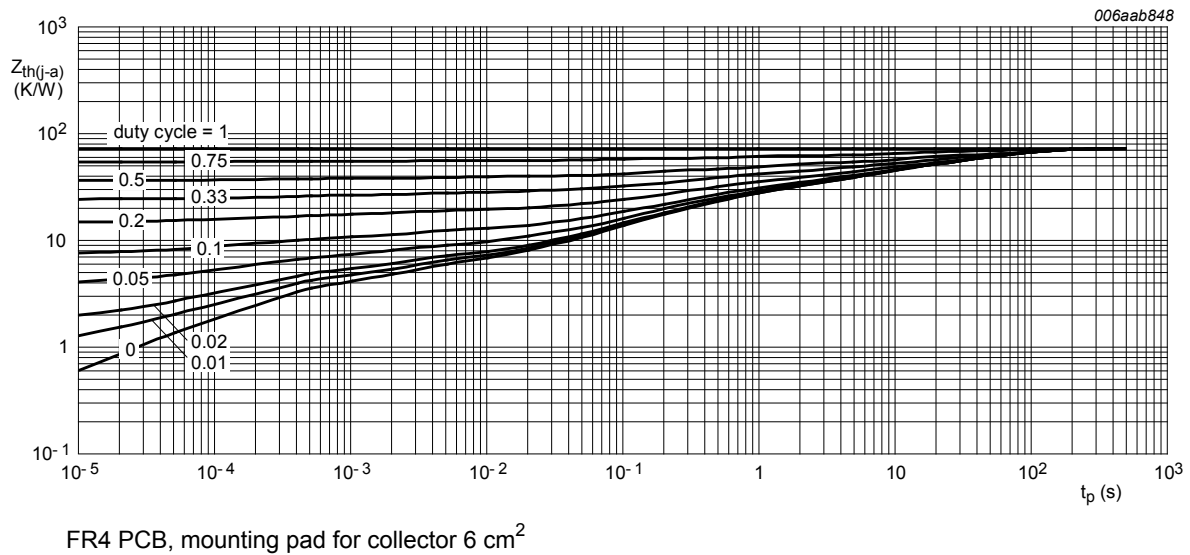


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I _{CBO}	collector-base cut-off current	V _{CB} = 320 V; I _E = 0 A; T _{amb} = 25 °C	-	-	100	nA
		V _{CB} = 320 V; I _E = 0 A; T _j = 150 °C	-	-	10	μA
I _{CES}	collector-emitter cut-off current	V _{CE} = 320 V; V _{BE} = 0 V; T _{amb} = 25 °C	-	-	100	nA
I _{EBO}	emitter-base cut-off current	V _{EB} = 4 V; I _C = 0 A; T _{amb} = 25 °C	-	-	100	nA
h _{FE}	DC current gain	V _{CE} = 10 V; I _C = 50 mA; T _{amb} = 25 °C	100	200	-	
		V _{CE} = 10 V; I _C = 100 mA; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C; pulsed	80	150	-	
		V _{CE} = 10 V; I _C = 300 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	10	20	-	
V _{CEsat}	collector-emitter saturation voltage	I _C = 100 mA; I _B = 10 mA; T _{amb} = 25 °C	-	100	200	mV
		I _C = 100 mA; I _B = 20 mA; T _{amb} = 25 °C	-	60	90	mV
		I _C = 300 mA; I _B = 60 mA; T _{amb} = 25 °C	-	135	250	mV
V _{BEsat}	base-emitter saturation voltage	I _C = 300 mA; I _B = 60 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C	-	0.91	1.1	V
t _d	delay time	V _{CC} = 6 V; I _C = 0.5 A; I _{Bon} = 0.1 A; I _{Boff} = -0.1 A; T _{amb} = 25 °C	-	50	-	ns
t _r	rise time		-	6200	-	ns
t _{on}	turn-on time		-	6250	-	ns
t _s	storage time		-	800	-	ns
t _f	fall time		-	2200	-	ns
t _{off}	turn-off time		-	3000	-	ns
f _T	transition frequency		V _{CE} = 10 V; I _C = 100 mA; f = 100 MHz; T _{amb} = 25 °C	-	30	-
C _c	collector capacitance	V _{CB} = 20 V; I _E = 0 A; i _e = 0 A; f = 1 MHz; T _{amb} = 25 °C	-	4	-	pF
C _e	emitter capacitance	V _{EB} = 0.5 V; I _C = 0 A; i _c = 0 A; f = 1 MHz; T _{amb} = 25 °C	-	165	-	pF

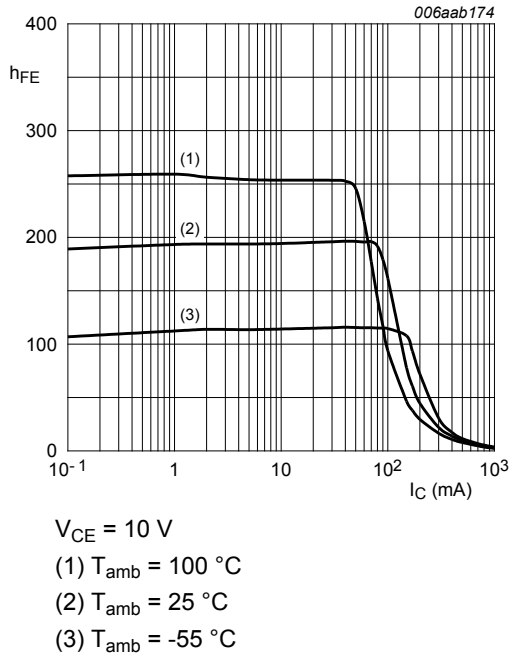


Fig. 4. DC current gain as a function of collector current; typical values

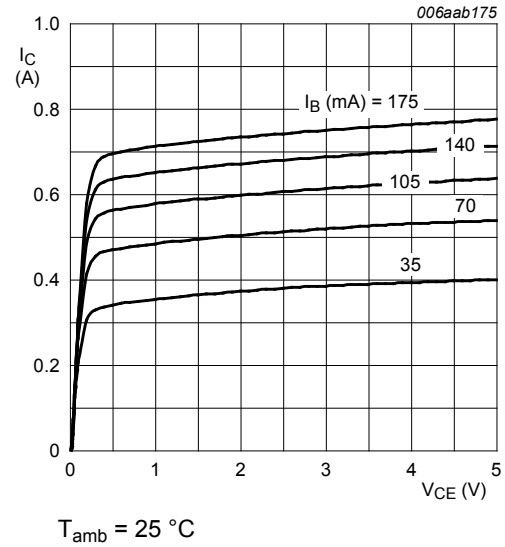


Fig. 5. Collector current as a function of collector-emitter voltage; typical values

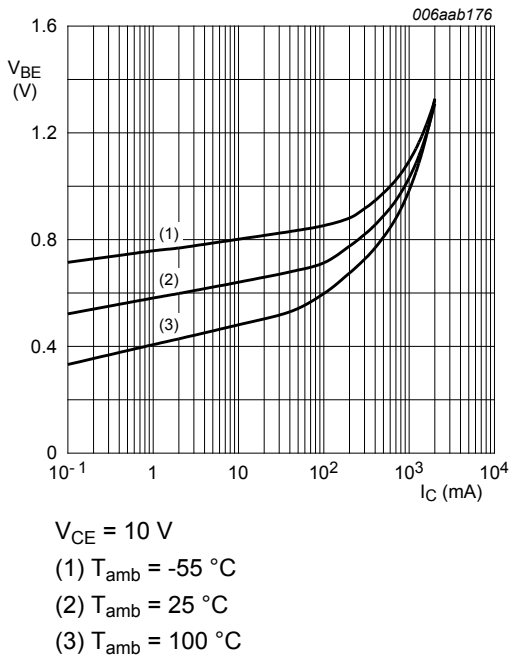


Fig. 6. Base-emitter voltage as a function of collector current; typical values

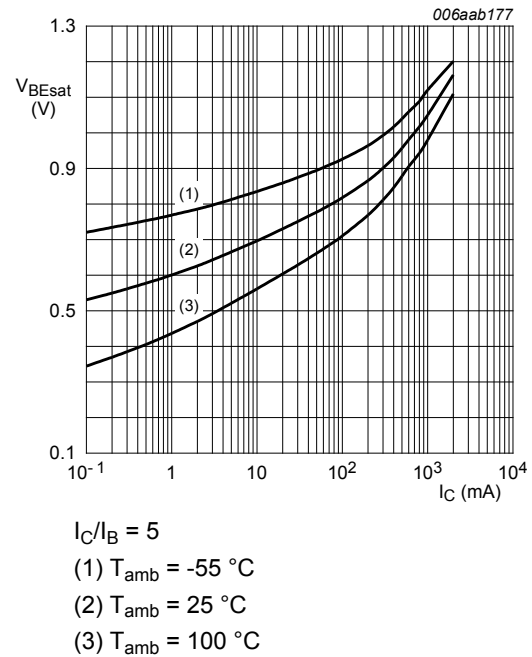
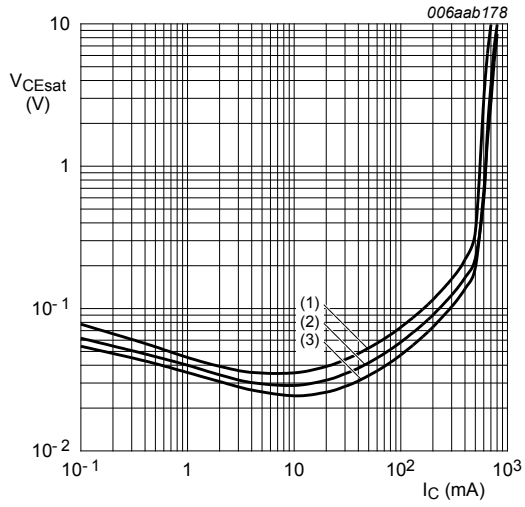


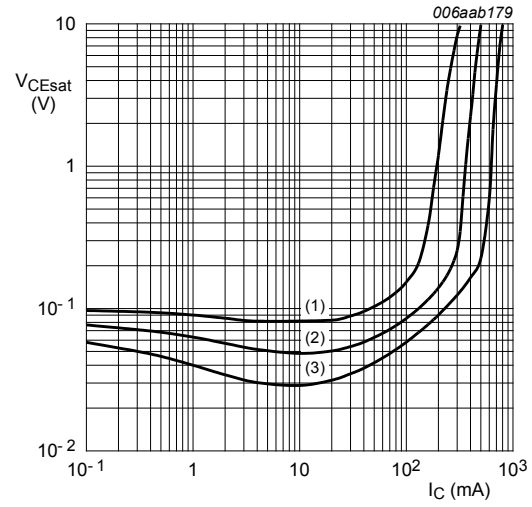
Fig. 7. Base-emitter saturation voltage as a function of collector current; typical values

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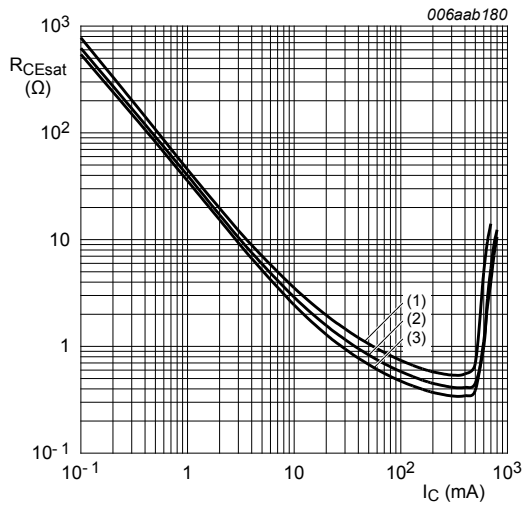
$I_C/I_B = 5$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



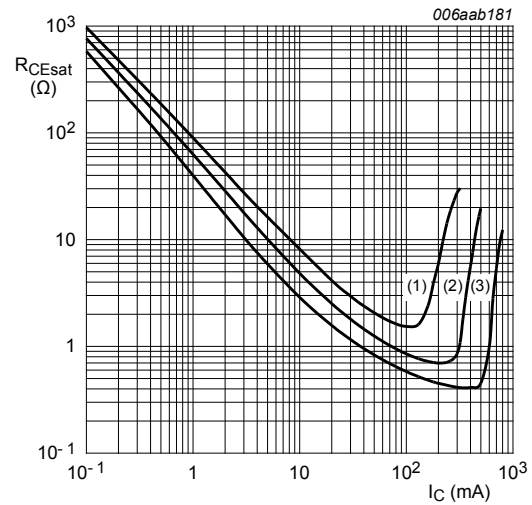
$T_{amb} = 25\text{ °C}$
 (1) $I_C/I_B = 20$
 (2) $I_C/I_B = 10$
 (3) $I_C/I_B = 5$

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

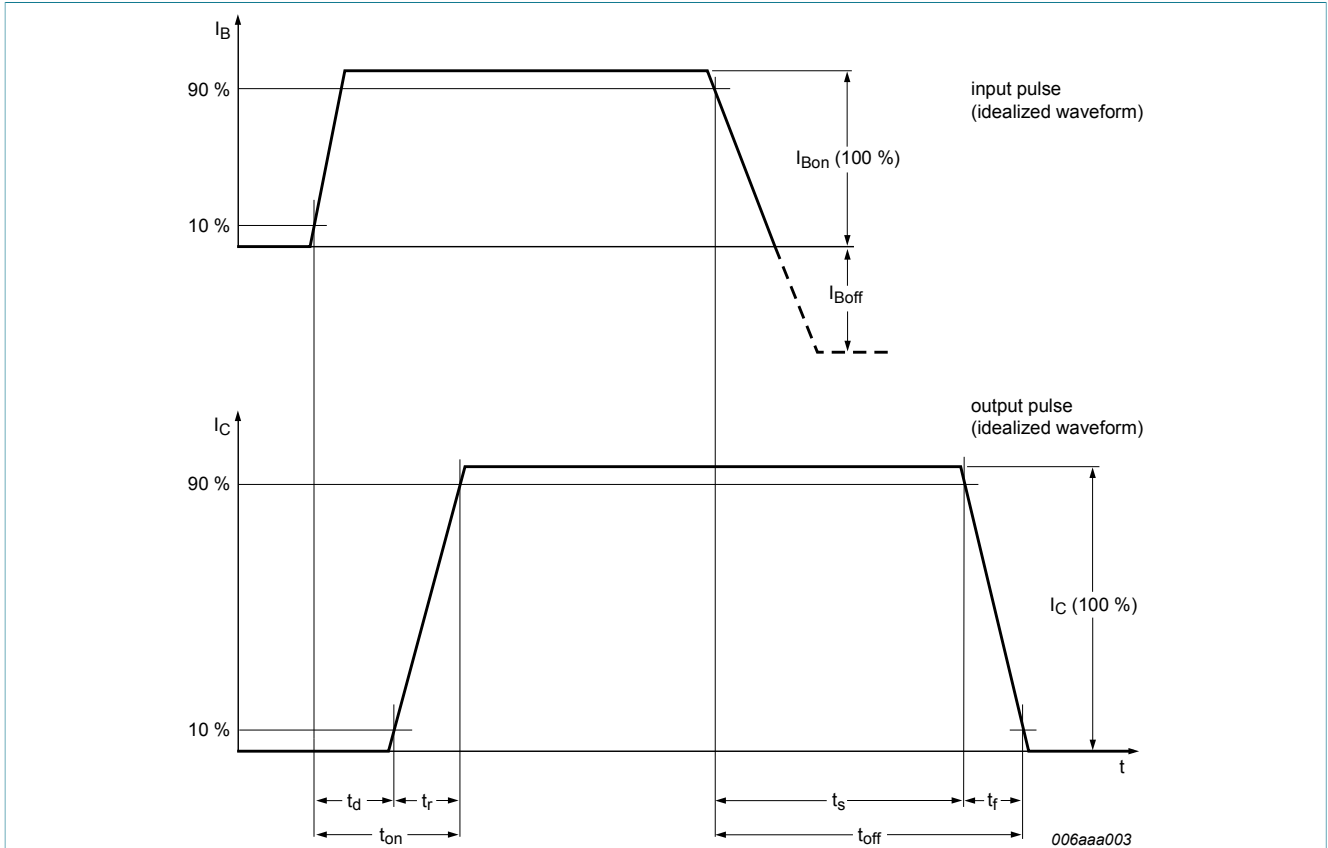


Fig. 12. BISS transistor switching time definition

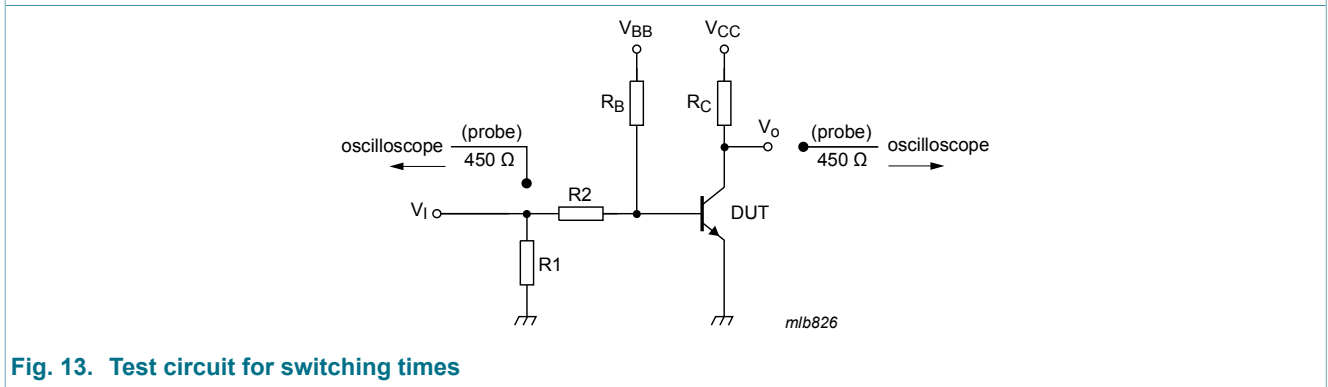


Fig. 13. Test circuit for switching times

11.1 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

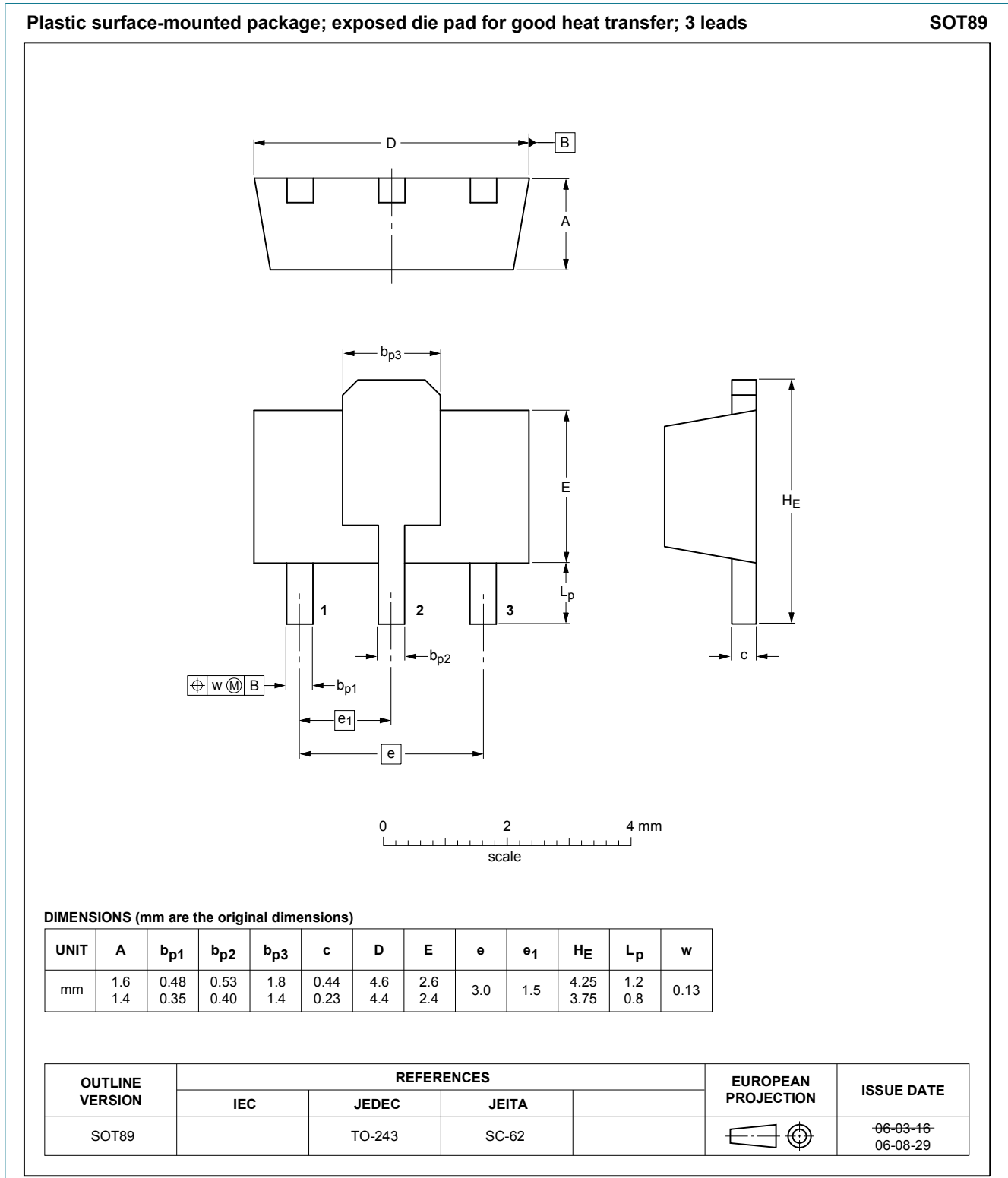


Fig. 14. Package outline SOT89

13. Soldering

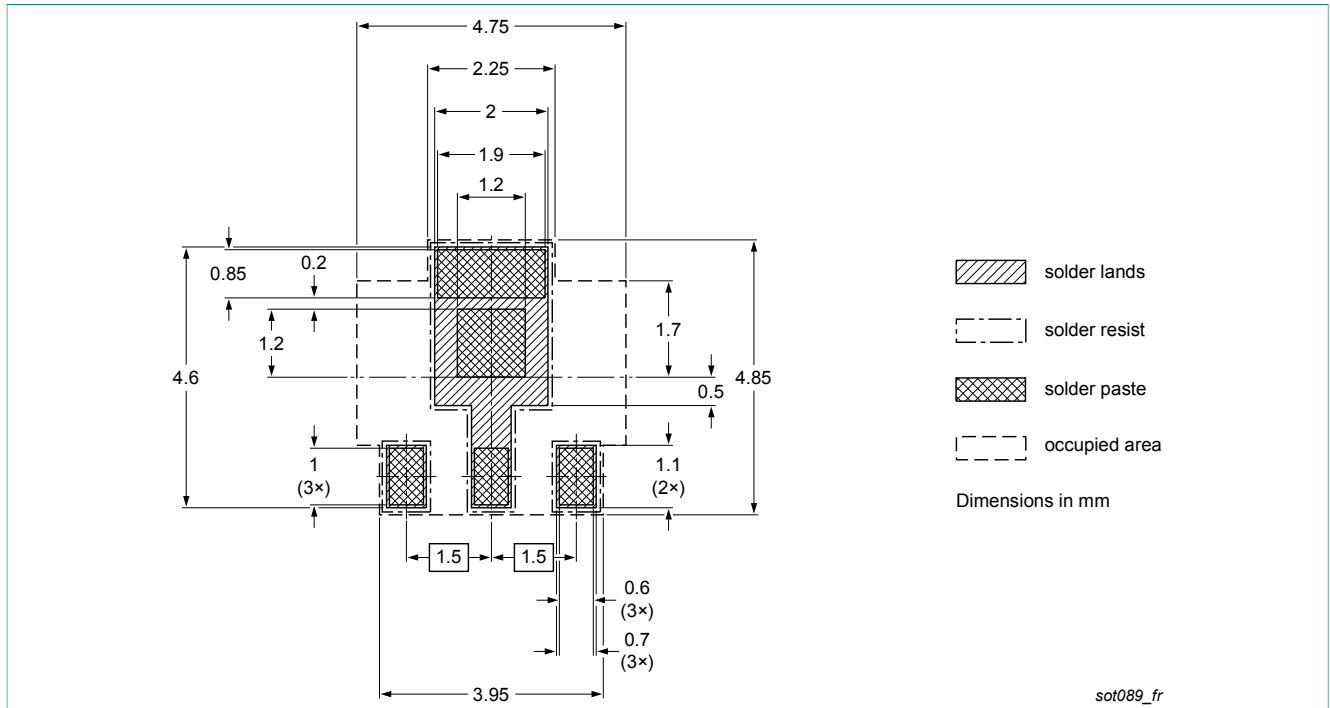


Fig. 15. Reflow soldering footprint for SOT89

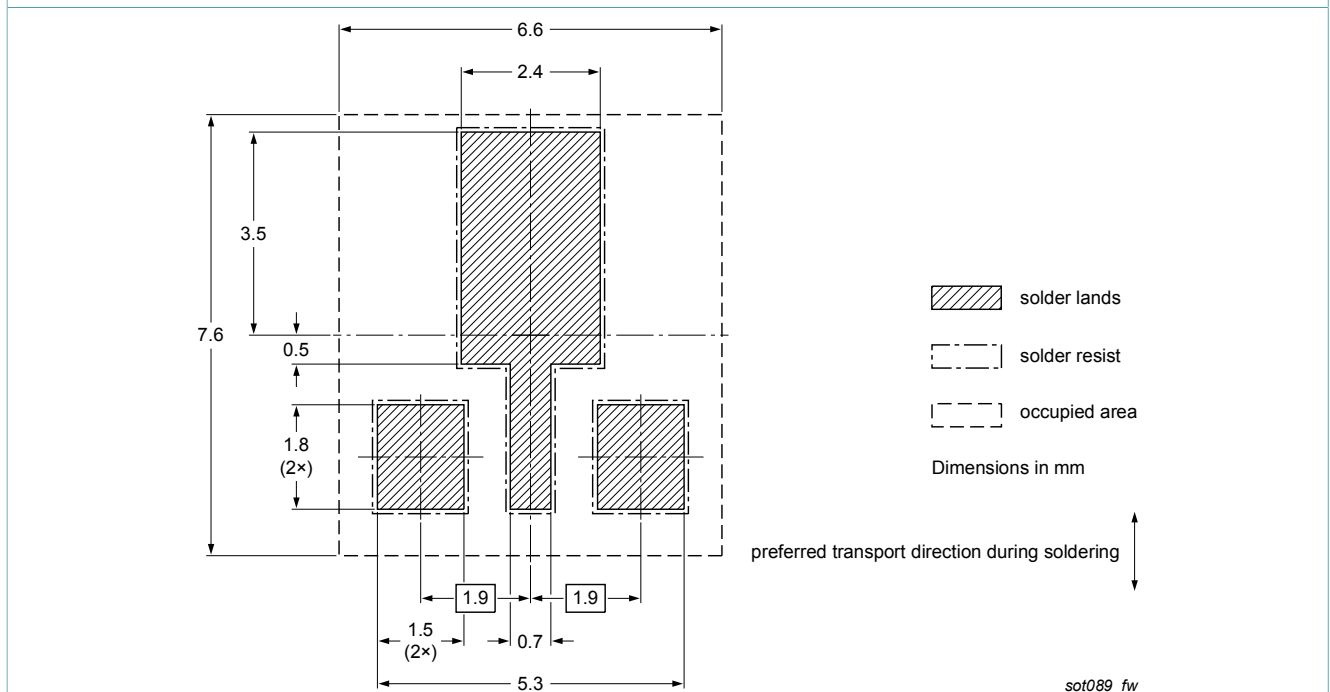


Fig. 16. Wave soldering footprint for SOT89

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBHV8540X v.1	20131205	Product data sheet	-	-

15. Legal information

15.1 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.
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16. Contents

1	General description	1
2	Features and benefits	1
3	Applications	1
4	Quick reference data	1
5	Pinning information	2
6	Ordering information	2
7	Marking	2
8	Limiting values	2
9	Thermal characteristics	3
10	Characteristics	5
11	Test information	8
11.1	Quality information	8
12	Package outline	9
13	Soldering	10
14	Revision history	11
15	Legal information	12
15.1	Data sheet status	12
15.2	Definitions	12
15.3	Disclaimers	12
15.4	Trademarks	13

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