

# PBHV8540Z

500 V, 0.5 A NPN high-voltage low V<sub>CEsat</sub> transistor

17 July 2023

Product data sheet

## 1. General description

NPN high-voltage low V<sub>CEsat</sub> transistor in a SOT223 (SC-73) medium power Surface-Mounted Device (SMD) plastic package.

PNP complement: PBHV9040Z

## 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

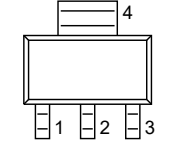
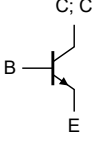
## 4. Quick reference data

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		-	-	0.5	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	B	base	 <p>SC-73 (SOT223)</p>	 <p>sym016</p>
2	C	collector		
3	E	emitter		
4	C	collector		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PBHV8540Z</a>	SC-73	plastic, surface-mounted package with increased heatsink; 4 leads; 2.3 mm pitch; 6.5 mm x 3.5 mm x 1.65 mm body	<a href="#">SOT223</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PBHV8540Z	V8540Z

## 8. Limiting values

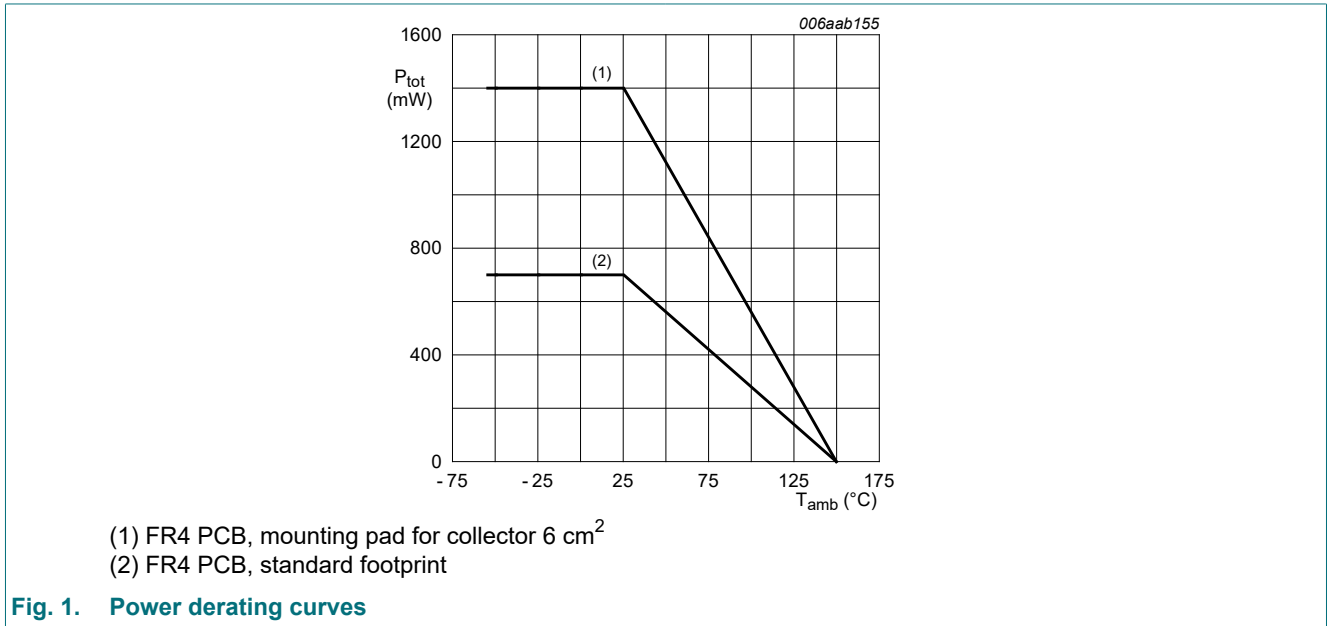
**Table 5. Limiting values**

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		-	0.5	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	1	A	
$I_{BM}$	peak base current		-	200	mA	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	0.7	W
			[2]	-	1.4	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>.



## 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]	-	-	175	K/W
			[2]	-	-	89	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>.

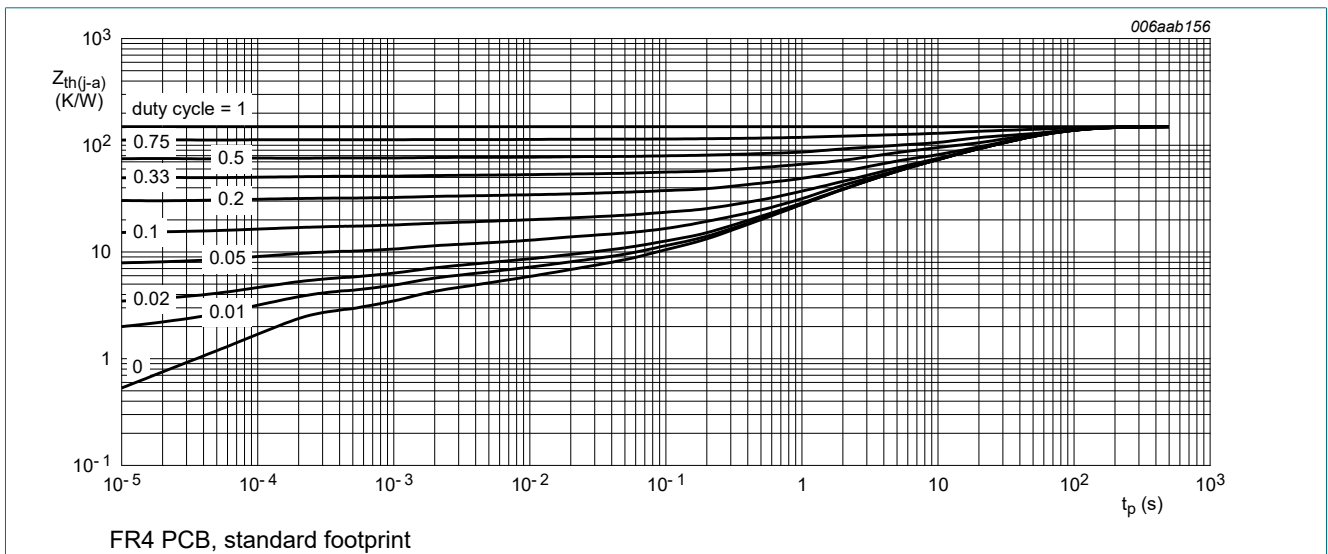


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

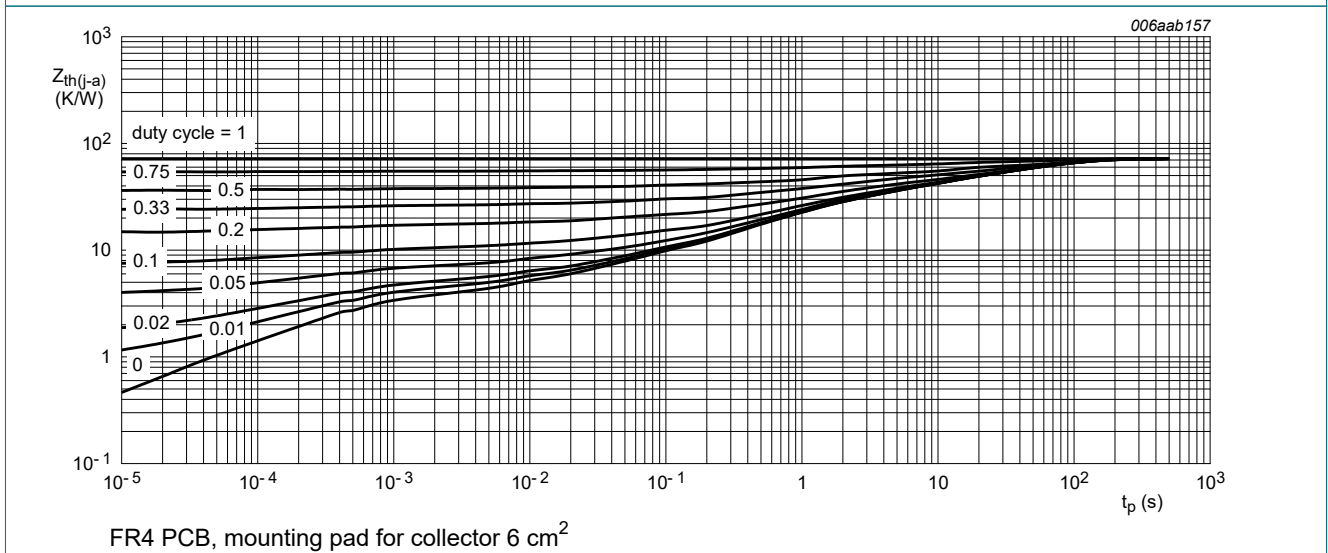
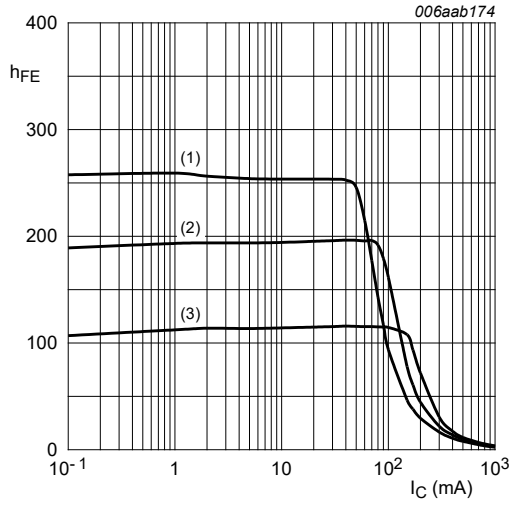


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

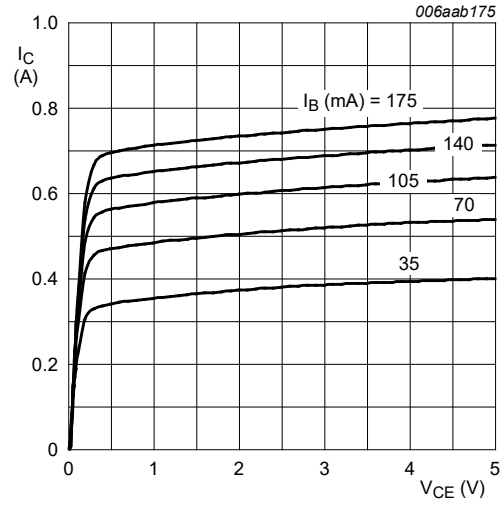
Table 7. Characteristics

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	150	-	
		$V_{CE} = 10 \text{ V}; I_C = 300 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	10	20	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 100 \text{ mA}; I_B = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	100	200	mV
		$I_C = 100 \text{ mA}; I_B = 20 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	60	90	mV
		$I_C = 300 \text{ mA}; I_B = 60 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	135	250	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 300 \text{ mA}; I_B = 60 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	0.91	1.1	V
$t_d$	delay time	$V_{CC} = 6 \text{ V}; I_C = 0.5 \text{ A}; I_{B(on)} = 0.1 \text{ A}; I_{B(off)} = -0.1 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	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		$V_{CE} = 10 \text{ V}; I_C = 100 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	30	-
$C_c$	collector capacitance	$V_{CB} = 20 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	4	-	pF
$C_e$	emitter capacitance	$V_{EB} = 0.5 \text{ V}; I_C = 0 \text{ A}; i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	165	-	pF



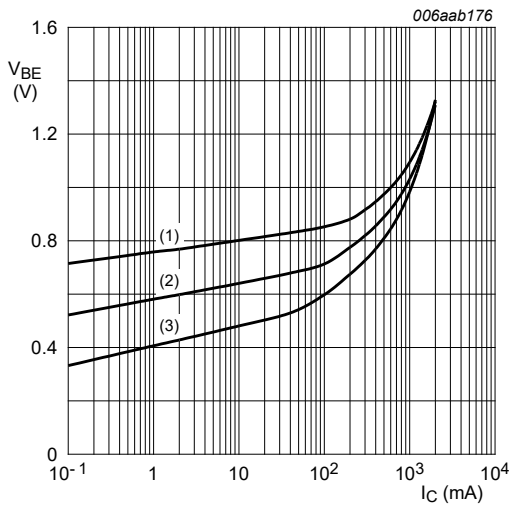
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = 100^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = -55^\circ C$

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



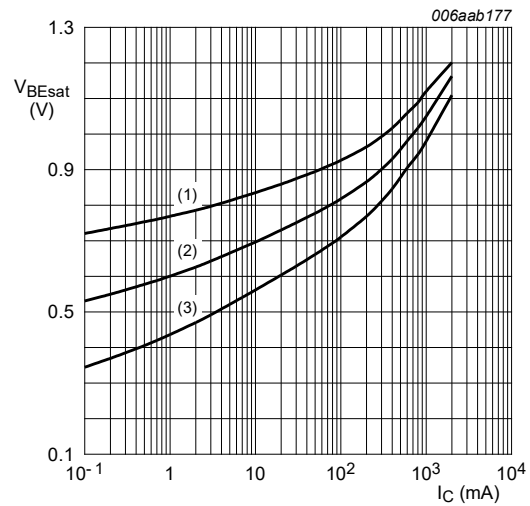
$T_{amb} = 25^\circ C$

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



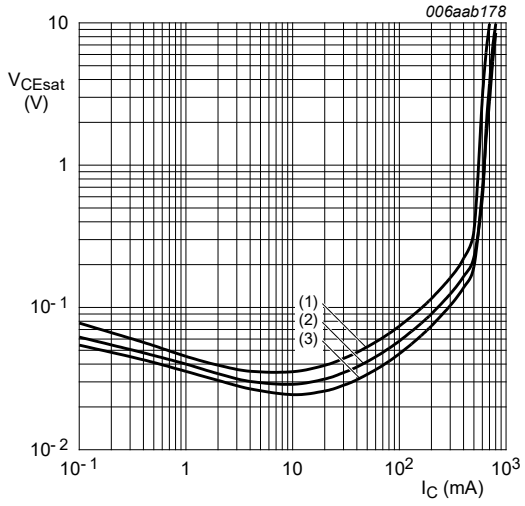
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 100^\circ C$

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



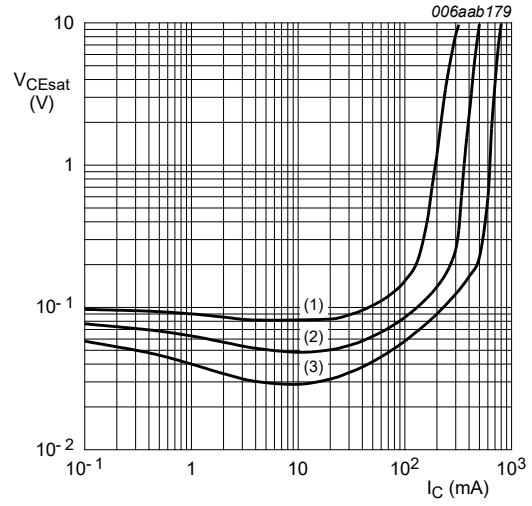
$I_C/I_B = 5$   
 (1)  $T_{amb} = -55^\circ C$   
 (2)  $T_{amb} = 25^\circ C$   
 (3)  $T_{amb} = 100^\circ C$

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



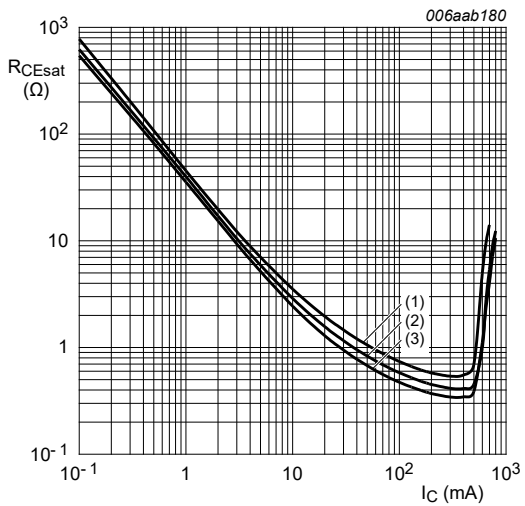
$I_C/I_B = 5$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



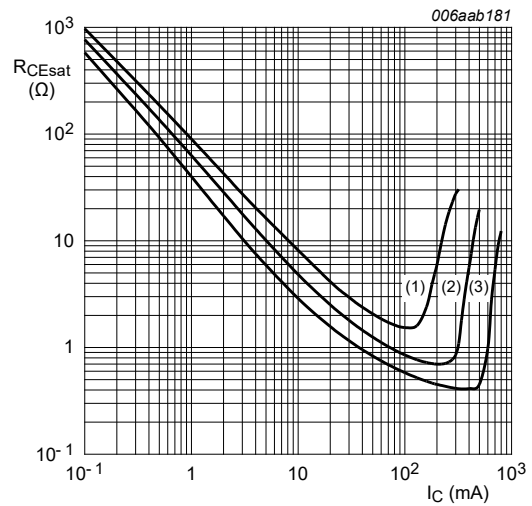
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 20$   
 (2)  $I_C/I_B = 10$   
 (3)  $I_C/I_B = 5$

**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

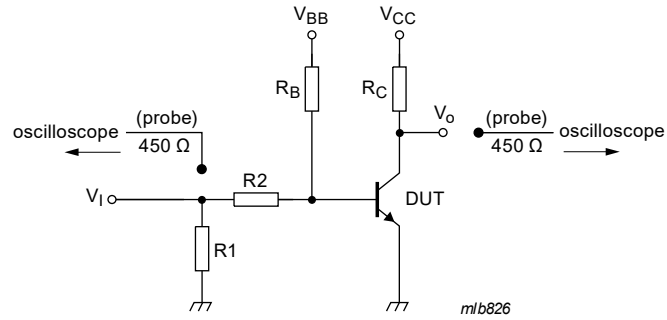


Fig. 12. Test circuit for switching times

### 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

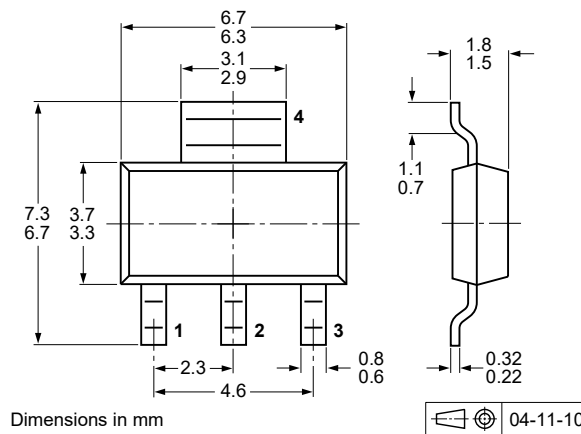


Fig. 13. Package outline SC-73 (SOT223)



### 13. Soldering

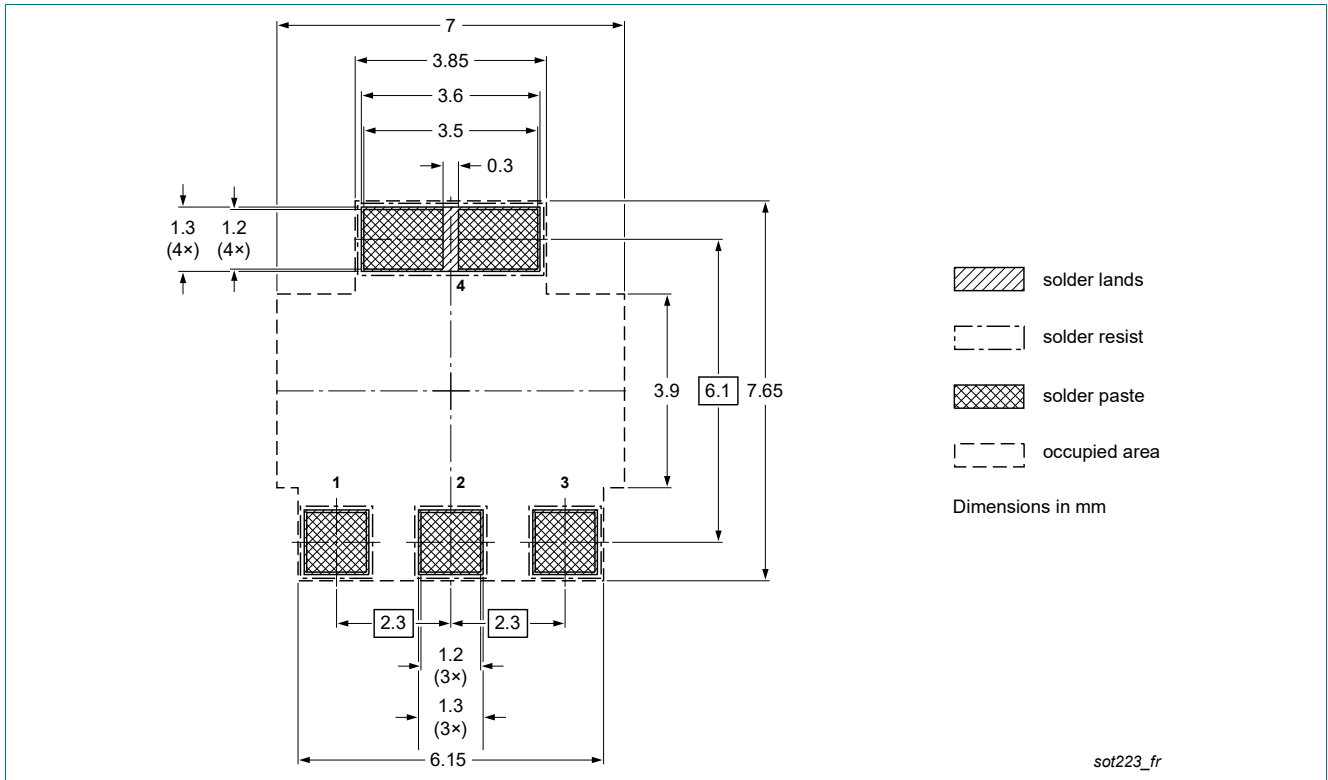


Fig. 14. Reflow soldering footprint for SC-73 (SOT223)

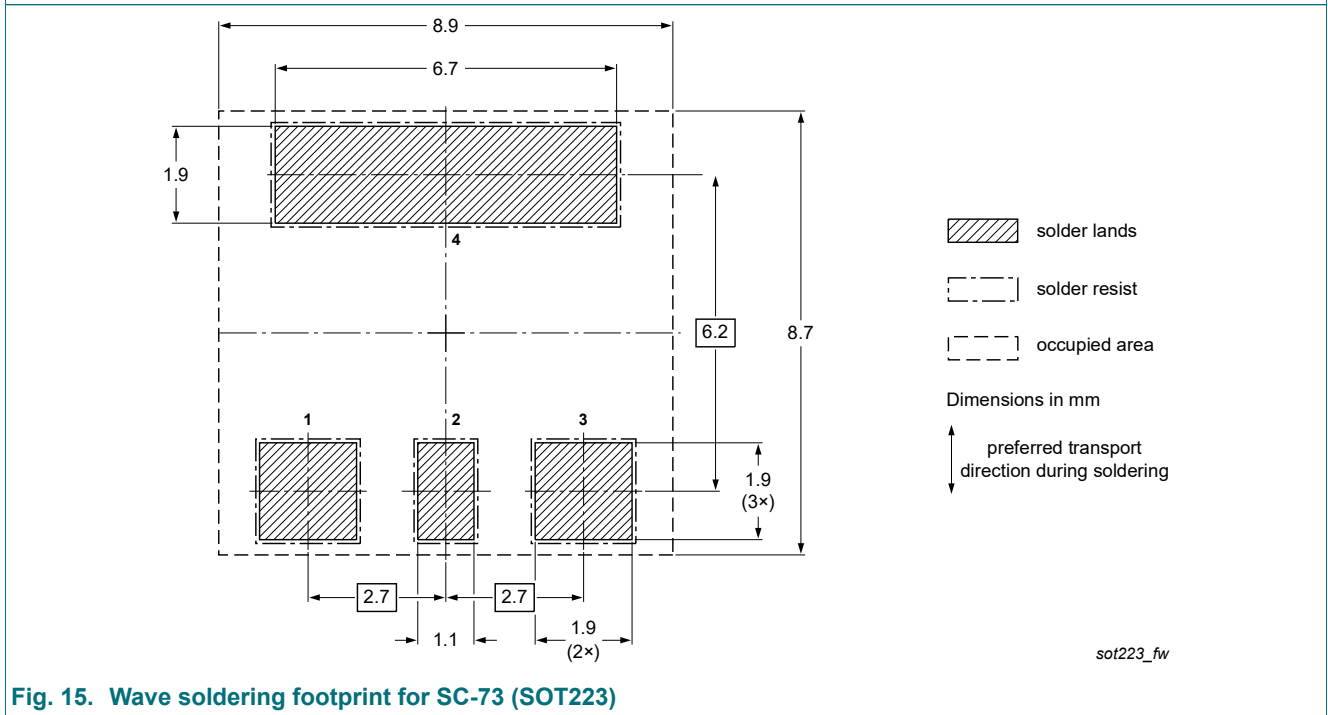


Fig. 15. Wave soldering footprint for SC-73 (SOT223)

## 14. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBHV8540Z v.3	20230717	Product data sheet	-	PBHV8540Z_2
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><li>• Section "Packing information" removed.</li></ul>			
PBHV8540Z_2	20090114	Product data sheet	-	PBHV8540Z_1
PBHV8540Z_1	20080207	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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