



# PBHV9040Z

500 V, 0.25 A PNP high-voltage low  $V_{CEsat}$  (BISS) transistor

Rev. 02 — 15 January 2009

Product data sheet

## 1. Product profile

### 1.1 General description

PNP high-voltage low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a SOT223 (SC-73) medium power Surface-Mounted Device (SMD) plastic package.

NPN complement: PBHV8540Z.

### 1.2 Features

- 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

### 1.3 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

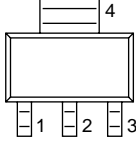
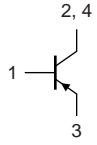
### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	-500	V
$V_{CEO}$	collector-emitter voltage	open base	-	-	-400	V
$I_C$	collector current		-	-	-0.25	A
$h_{FE}$	DC current gain	$V_{CE} = -10\text{ V};$ $I_C = -50\text{ mA}$	100	200	-	

## 2. Pinning information

**Table 2. Pinning**

Pin	Description	Simplified outline	Graphic symbol
1	base		 <p style="text-align: center;">sym028</p>
2	collector		
3	emitter		
4	collector		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
PBHV9040Z	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

## 4. Marking

**Table 4. Marking codes**

Type number	Marking code
PBHV9040Z	V9040Z

## 5. Limiting values

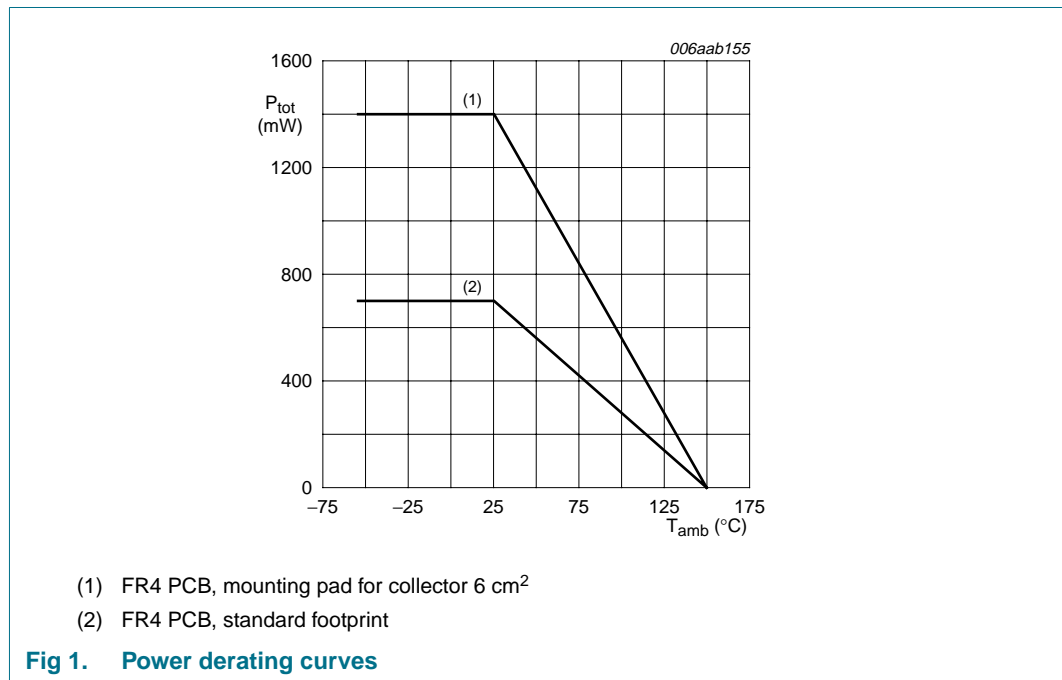
**Table 5. Limiting values**

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		-	-0.25	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-0.5	A
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	-200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °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 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm<sup>2</sup>.



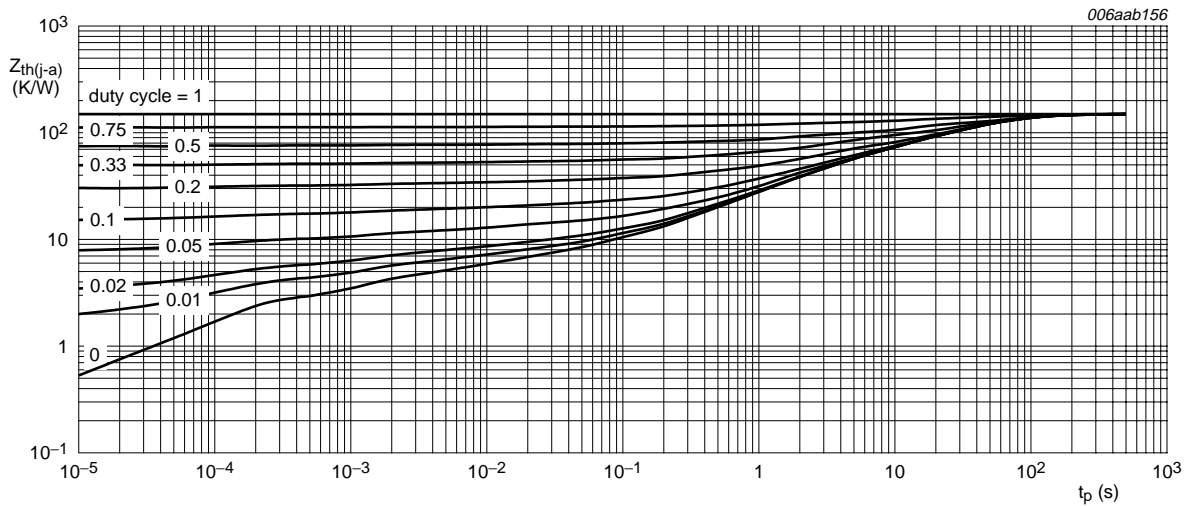
## 6. Thermal characteristics

**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	

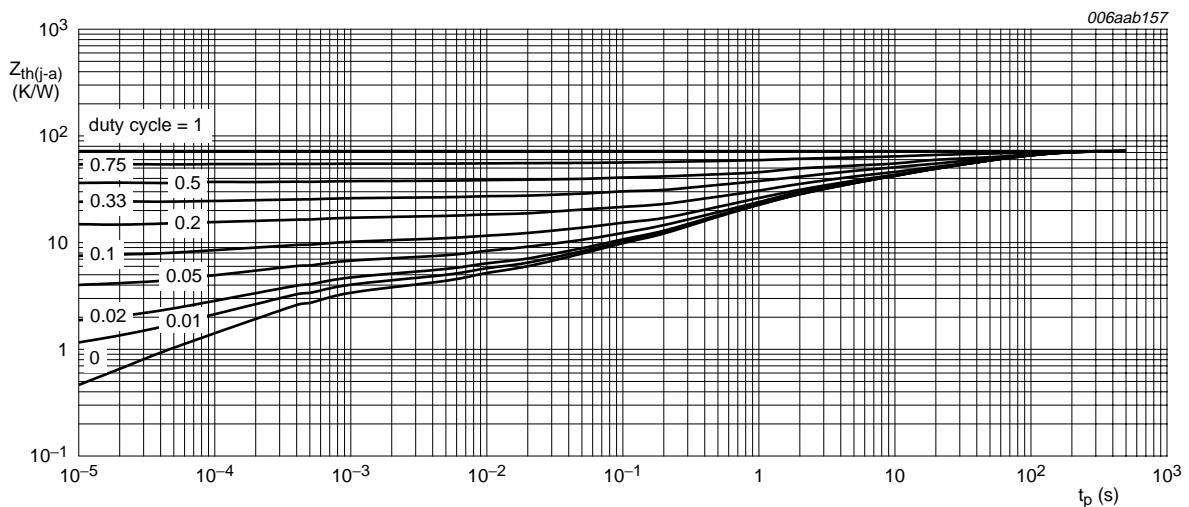
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm<sup>2</sup>.



FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

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

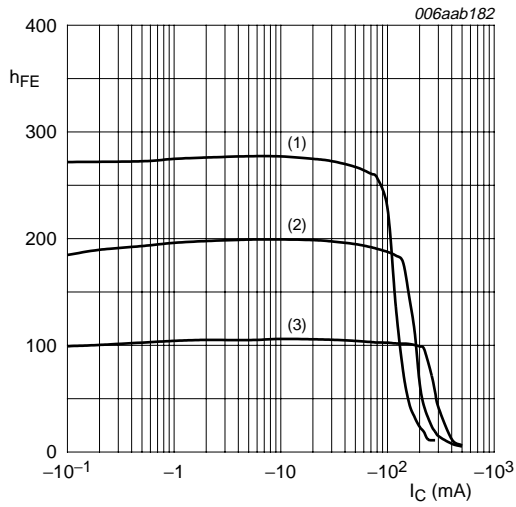
## 7. Characteristics

**Table 7. Characteristics**

$T_{amb} = 25^\circ\text{C}$  unless otherwise specified.

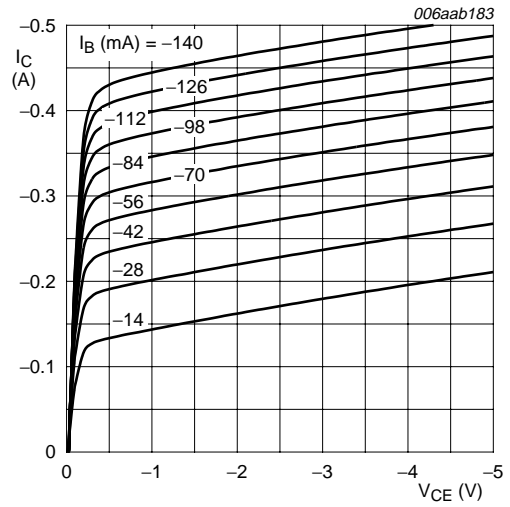
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -320\text{ V}; I_E = 0\text{ A}$	-	-	-100	nA
		$V_{CB} = -320\text{ V}; I_E = 0\text{ A}; T_j = 150^\circ\text{C}$	-	-	-10	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = -320\text{ V}; V_{BE} = 0\text{ V}$	-	-	-100	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = -4\text{ V}; I_C = 0\text{ A}$	-	-	-100	nA
$h_{FE}$	DC current gain	$V_{CE} = -10\text{ V}$				
		$I_C = -50\text{ mA}$	100	200	-	
		$I_C = -100\text{ mA}$	80	200	-	
		$I_C = -250\text{ mA}$	[1] 10	25	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -100\text{ mA}; I_B = -20\text{ mA}$	-	-110	-200	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -100\text{ mA}; I_B = -20\text{ mA}$	[1] -	-1	-1.1	V
$f_T$	transition frequency	$V_{CE} = -10\text{ V}; I_E = -10\text{ mA}; f = 100\text{ MHz}$	-	55	-	MHz
$C_c$	collector capacitance	$V_{CB} = -20\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	7	-	pF
$C_e$	emitter capacitance	$V_{EB} = -0.5\text{ V}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$	-	150	-	pF
$t_d$	delay time	$V_{CC} = -2\text{ V}; I_C = -0.15\text{ A}; I_{Bon} = -0.03\text{ A}; I_{Boff} = 0.03\text{ A}$	-	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

[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .



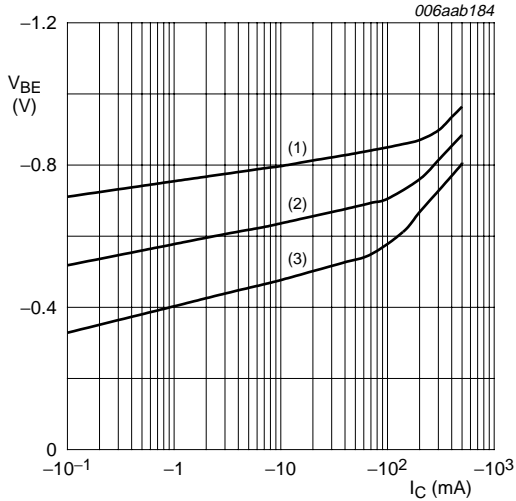
$V_{CE} = -10\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



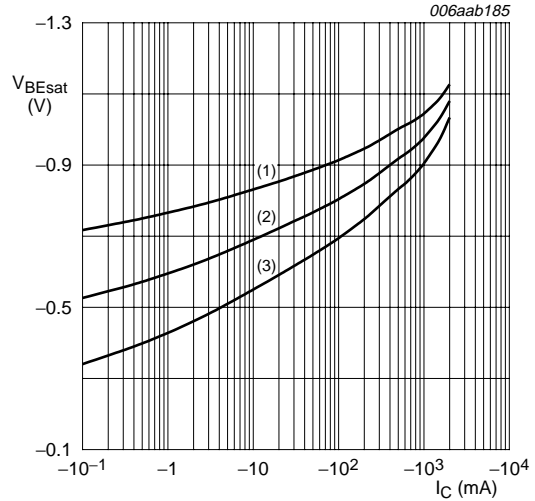
$T_{amb} = 25\text{ }^\circ\text{C}$

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



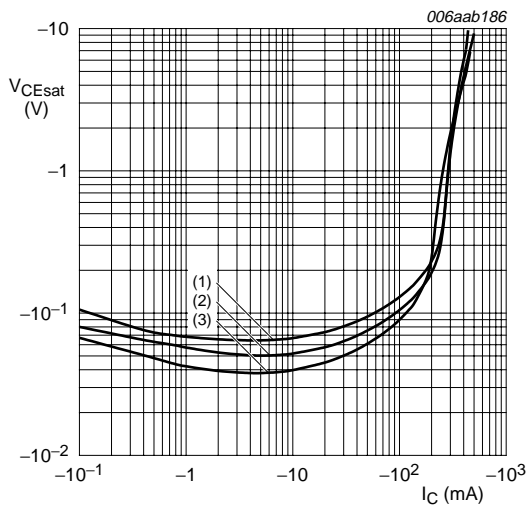
$V_{CE} = -10\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



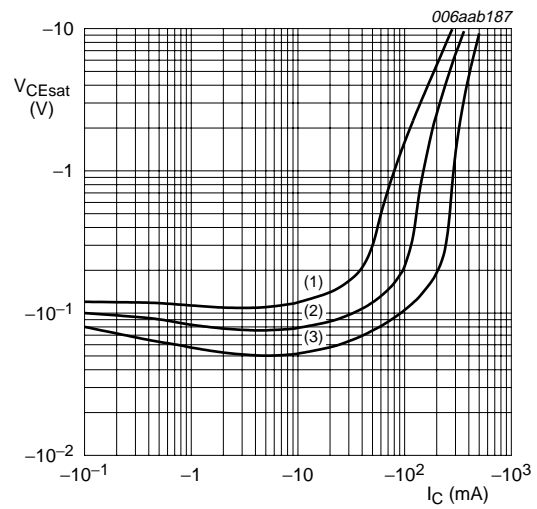
$I_C/I_B = 5$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

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



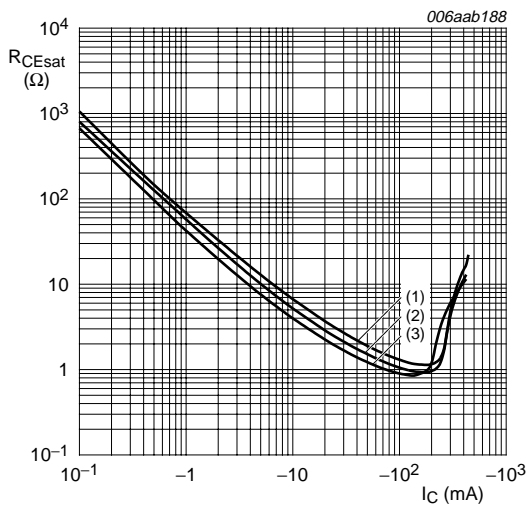
- $I_C/I_B = 5$
- (1)  $T_{amb} = 100\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = -55\text{ °C}$

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



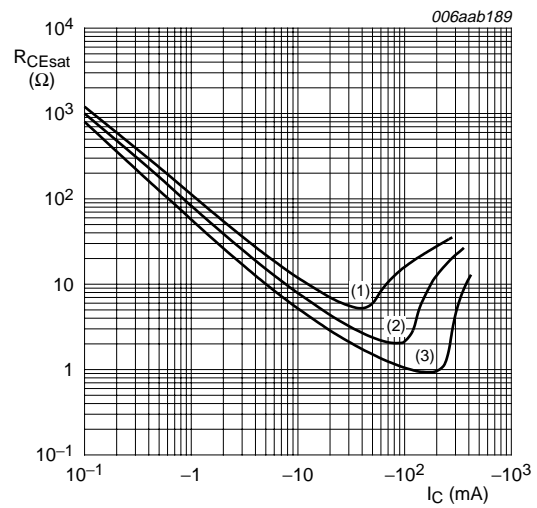
- $T_{amb} = 25\text{ °C}$
- (1)  $I_C/I_B = 20$
  - (2)  $I_C/I_B = 10$
  - (3)  $I_C/I_B = 5$

**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)  $T_{amb} = -55\text{ °C}$

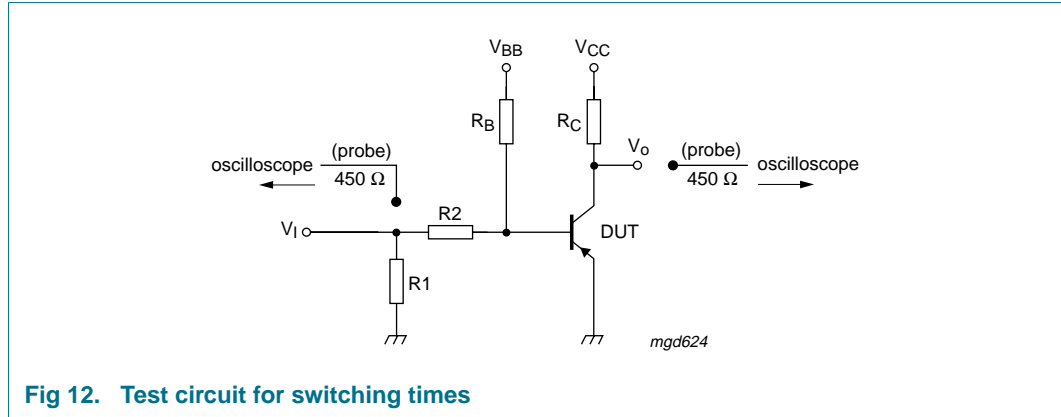
**Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values**



- $T_{amb} = 25\text{ °C}$
- (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**

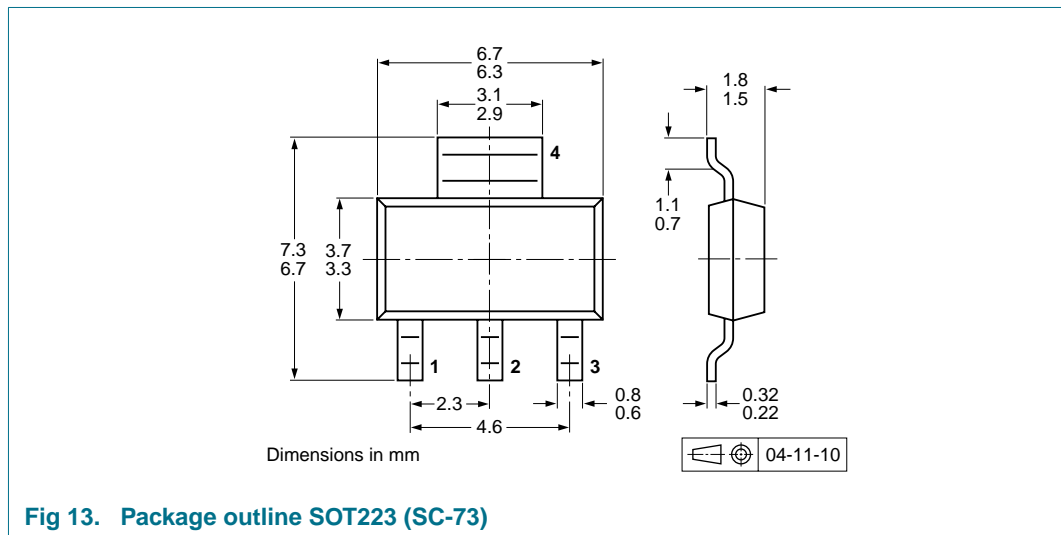
## 8. Test information



### 8.1 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.

## 9. Package outline



## 10. Packing information

**Table 8. Packing methods**

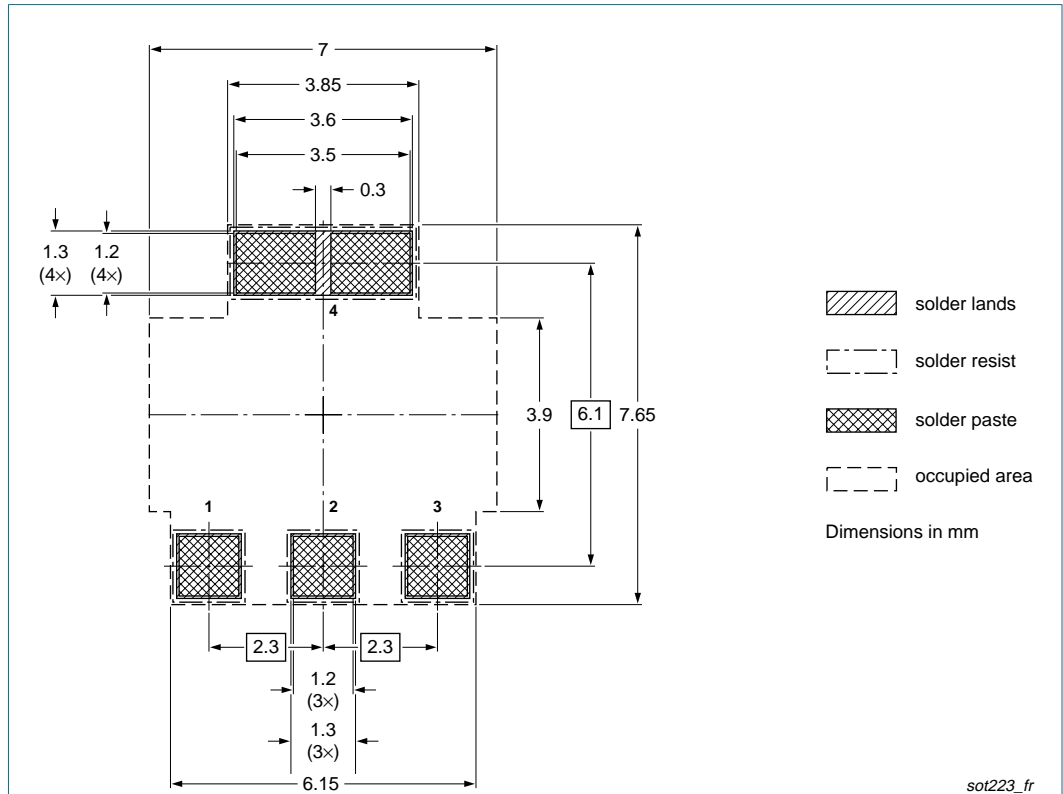
The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

Type number	Package	Description	Packing quantity	
			1000	4000
PBHV9040Z	SOT223	8 mm pitch, 12 mm tape and reel	-115	-135

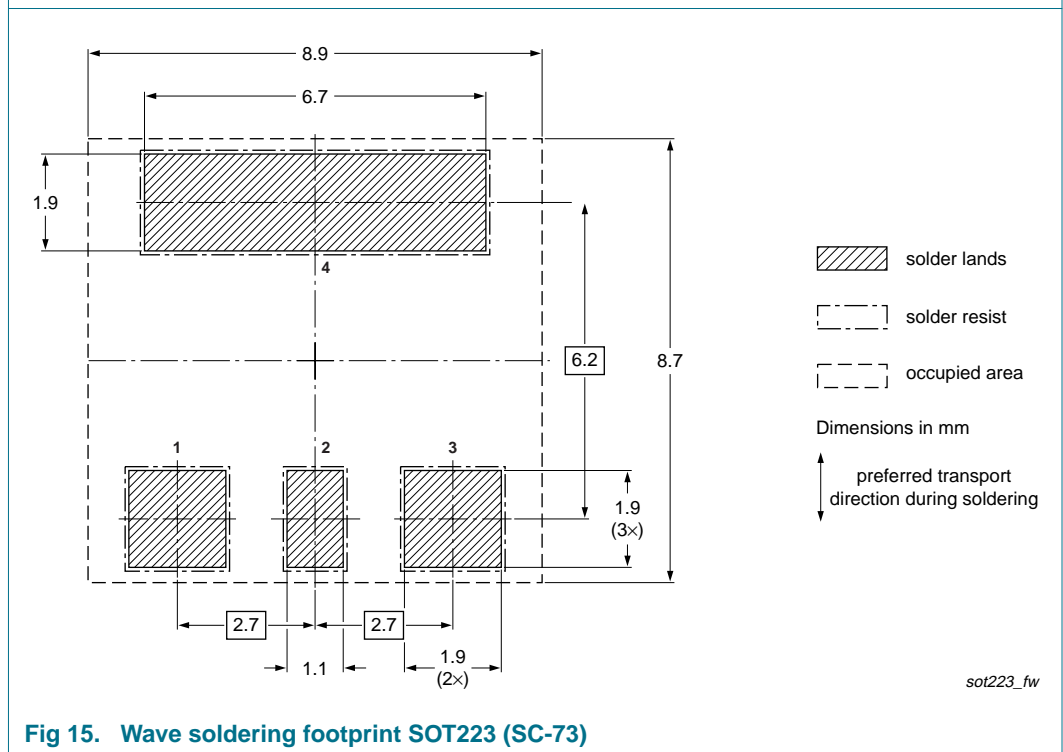
[1] For further information and the availability of packing methods, see [Section 14](#).



**11. Soldering**



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



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

## 12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBHV9040Z_2	20090115	Product data sheet	-	PBHV9040Z_1
Modifications:		<ul style="list-style-type: none"><li>• <a href="#">Table 5</a>: <math>I_{BM}</math> value changed from -100 mA to -200 mA</li><li>• <a href="#">Table 7</a>: <math>t_{off}</math> value amended to 1800 ns</li><li>• <a href="#">Section 13 "Legal information"</a>: updated</li></ul>		
PBHV9040Z_1	20080219	Product data sheet	-	-

## 13. Legal information

### 13.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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 URL <http://www.nxp.com>.

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