

# PBHV8540Z

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

Rev. 01 — 7 February 2008

Product data sheet

## 1. Product profile

### 1.1 General description

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

PNP complement: PBHV9040Z.

### 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

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### 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		-	-	0.5	A
$h_{FE}$	DC current gain	$V_{CE} = 10\text{ V}; I_C = 50\text{ mA}$	100	-	-	

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	base		
2	collector		
3	emitter		
4	collector		

*sym016*

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBHV8540Z	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PBHV8540Z	V8540Z

## 5. Limiting values

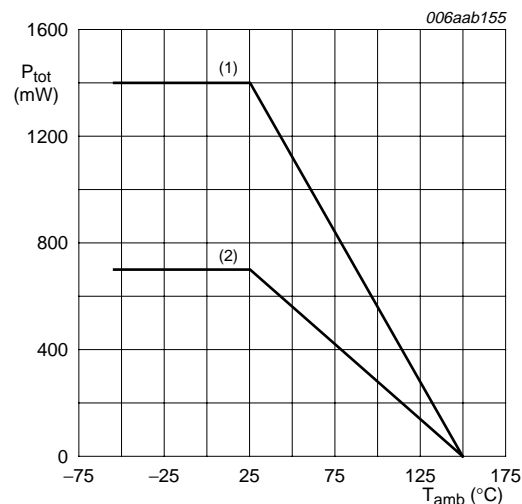
**Table 5. Limiting values**

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		-	0.5	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	1	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>.



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

(2) FR4 PCB, standard footprint

**Fig 1. Power derating curves**

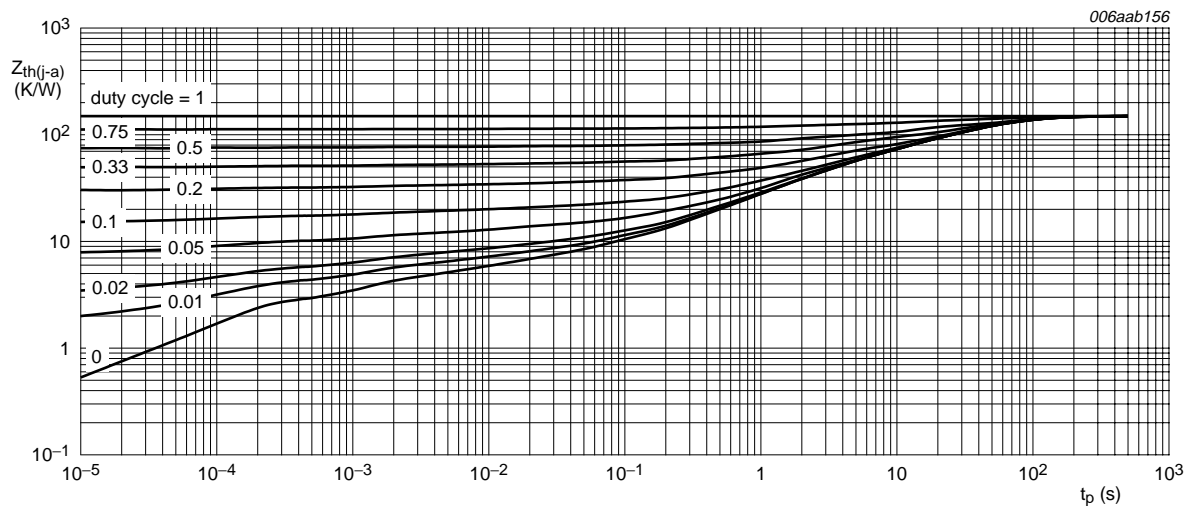
## 6. Thermal characteristics

**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	

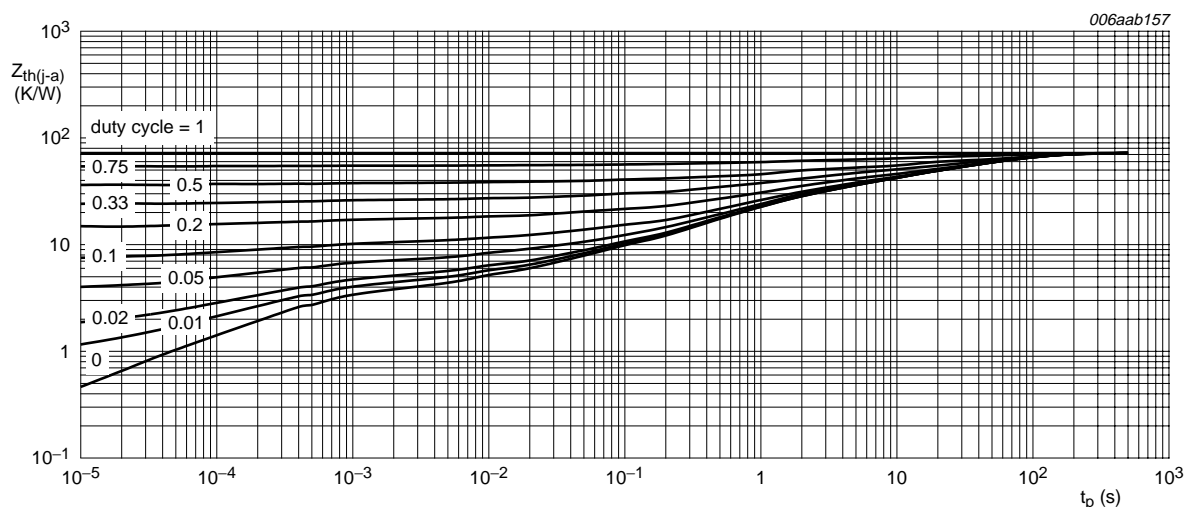
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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**

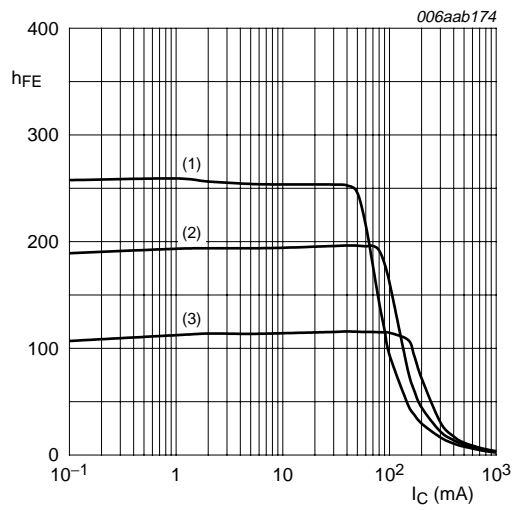
## 7. Characteristics

**Table 7. Characteristics**

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

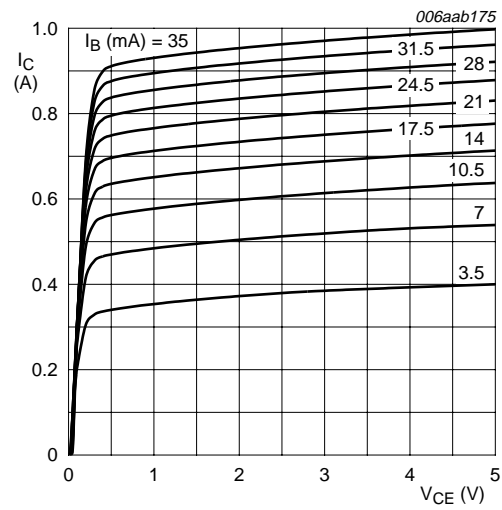
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 320\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 320\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	10	$\mu\text{A}$
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 320\text{ V}; I_C = 0\text{ A}$	-	-	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	150	-	
		$I_C = 300\text{ mA}$	[1] 10	20	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 100\text{ mA}; I_B = 10\text{ mA}$	-	100	200	mV
		$I_C = 100\text{ mA}; I_B = 20\text{ mA}$	-	60	90	mV
		$I_C = 300\text{ mA}; I_B = 60\text{ mA}$	-	135	250	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 300\text{ mA}; I_B = 60\text{ mA}$	[1] -	0.91	1.1	V
$f_T$	transition frequency	$V_{CE} = 10\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}$	-	30	-	MHz
$C_c$	collector capacitance	$V_{CB} = 20\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	4	-	pF
$C_e$	emitter capacitance	$V_{EB} = 0.5\text{ V}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$	-	165	-	pF
$t_d$	delay time	$V_{CC} = 6\text{ V}; I_C = 0.5\text{ A}; I_{Bon} = 0.1\text{ A}; I_{Boff} = -0.1\text{ A}$	-	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

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



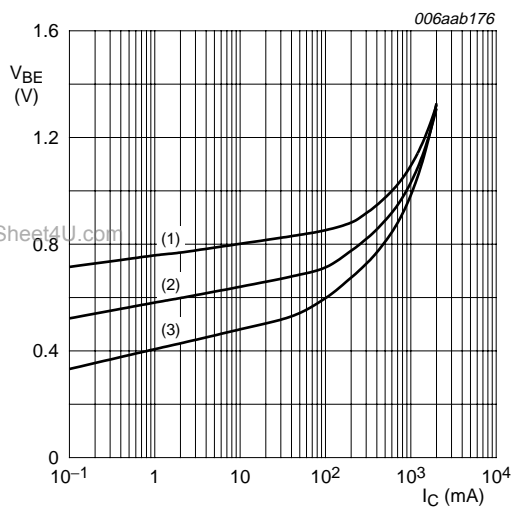
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



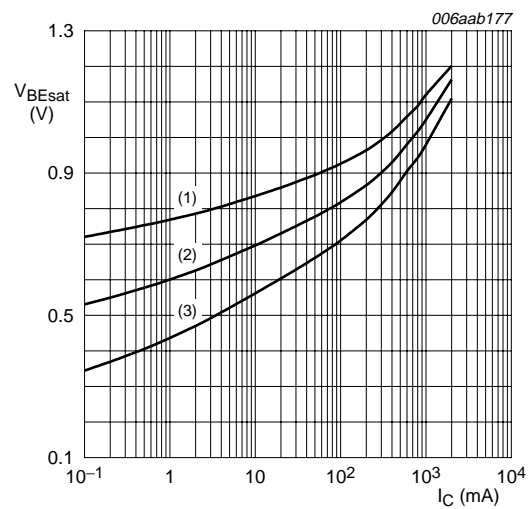
$T_{amb} = 25\text{ }^\circ\text{C}$

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



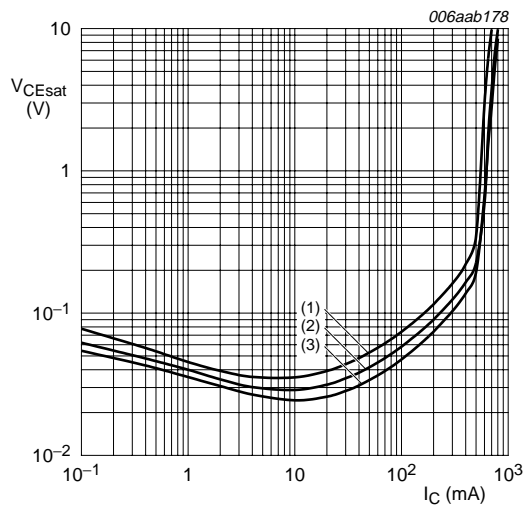
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100\text{ }^\circ\text{C}$

**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)  $T_{amb} = 100\text{ }^\circ\text{C}$

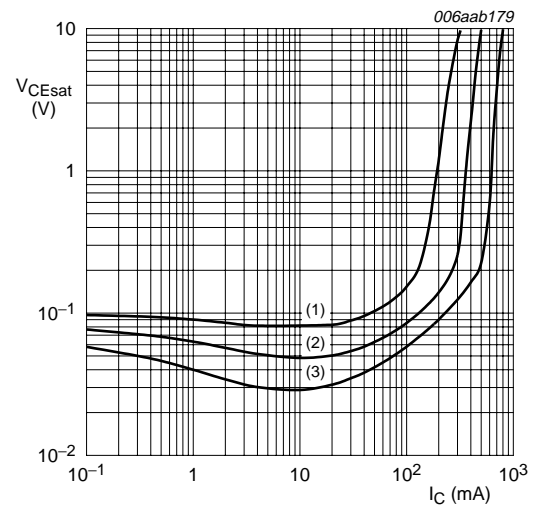
**Fig 7. Base-emitter saturation voltage as a function of collector current; typical values**



$$I_C/I_B = 5$$

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

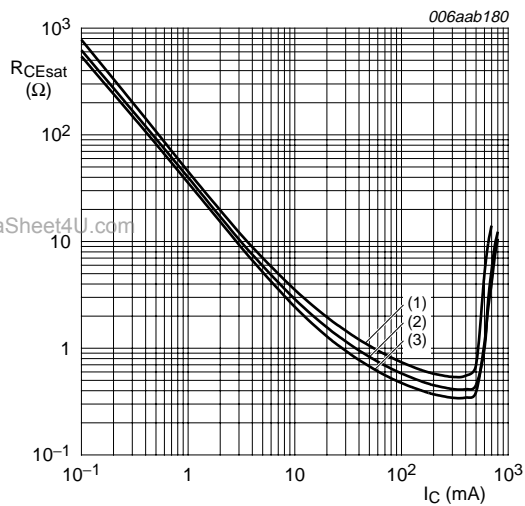
**Fig 8. Collector-emitter saturation voltage as a function of collector current; typical values**



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

- (1)  $I_C/I_B = 20$
- (2)  $I_C/I_B = 10$
- (3)  $I_C/I_B = 5$

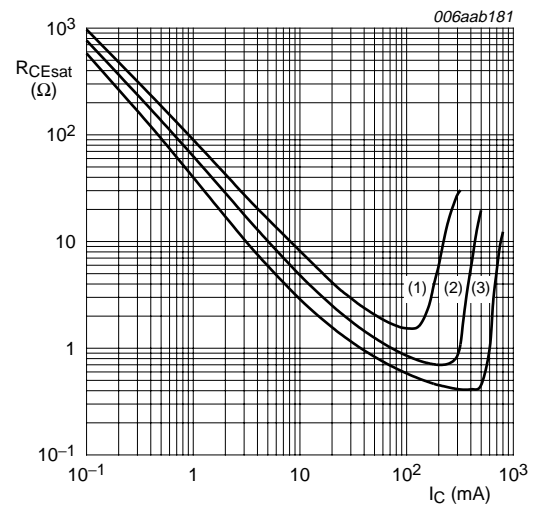
**Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values**



$$I_C/I_B = 5$$

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

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

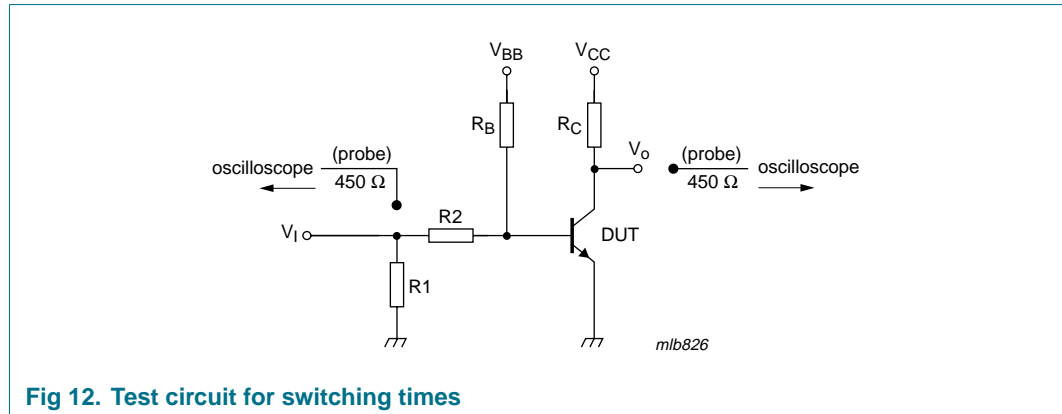


$$T_{amb} = 25\text{ }^{\circ}\text{C}$$

- (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**

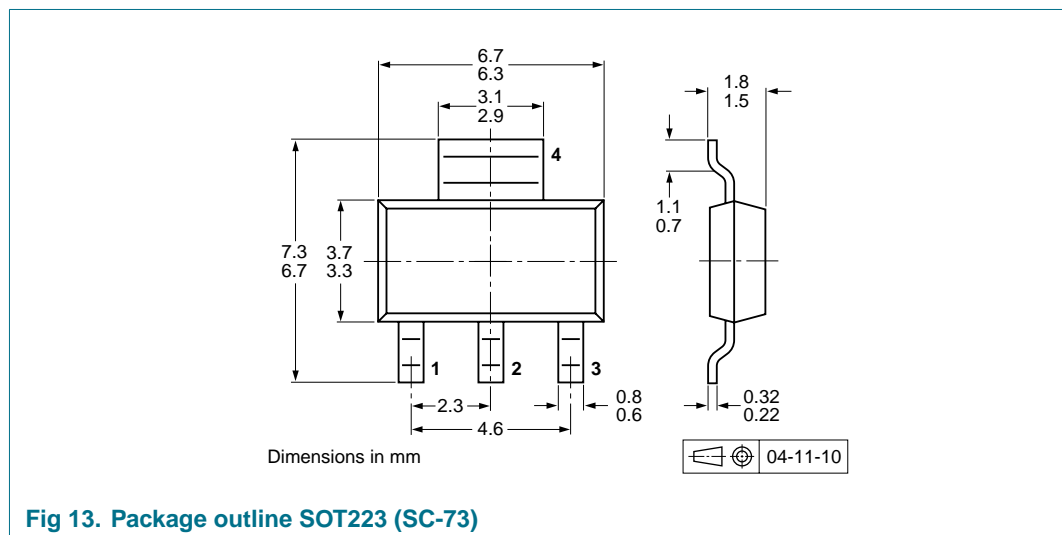
## 8. Test information



### 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
PBHV8540Z	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

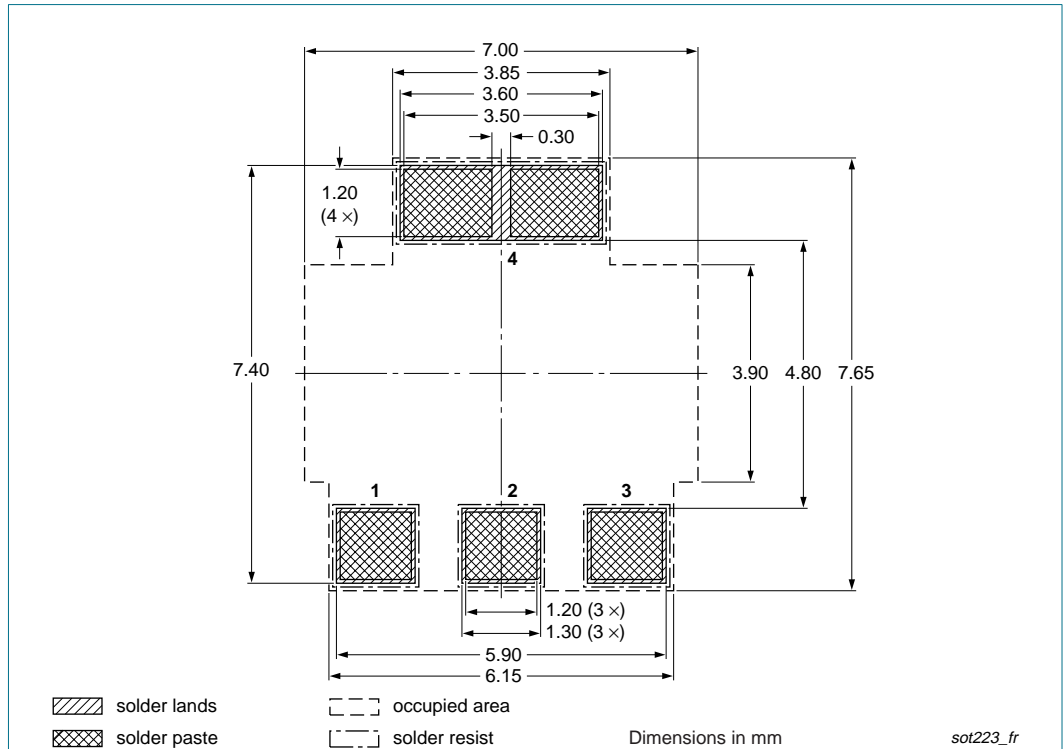


Fig 14. Reflow soldering footprint SOT223 (SC-73)

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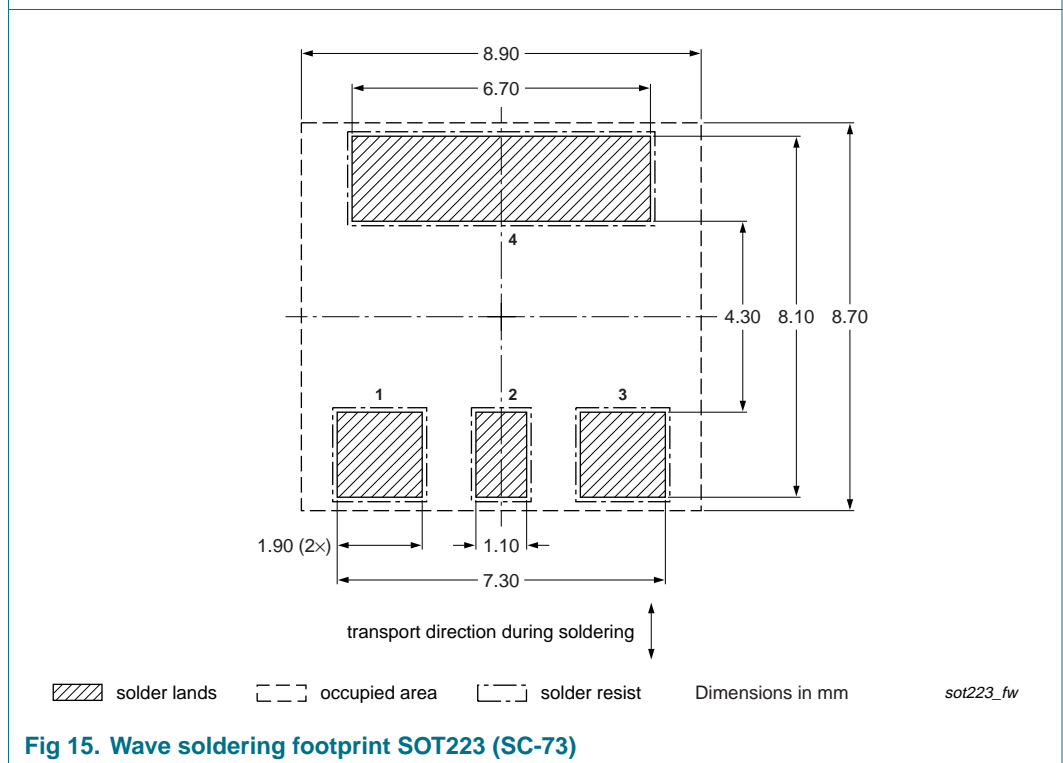


Fig 15. Wave soldering footprint SOT223 (SC-73)

## 12. Revision history

**Table 9.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBHV8540Z_1	20080207	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".

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