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Kind regards,

Team Nexperia



PBHV9540Z

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

Rev. 01 — 11 December 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 medium power SOT223 (SC-73) Surface-Mounted Device (SMD) plastic package.

NPN complement: PBHV8140Z.

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
- Medium power SMD plastic package

1.3 Applications

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

1.4 Quick reference data

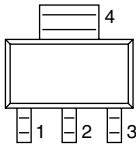
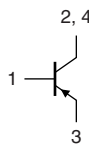
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$ 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	[1] 100	155	-	

[1] Pulse test: $t_p \leq 300$ μ s; $\delta \leq 0.02$.

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	base		 <i>sym028</i>
2	collector		
3	emitter		
4	collector		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBHV9540Z	SC-73	plastic surface-mounted package with increased heat sink; 4 leads	SOT223

4. Marking

Table 4. Marking codes

Type number	Marking code
PBHV9540Z	V9540Z

5. Limiting values

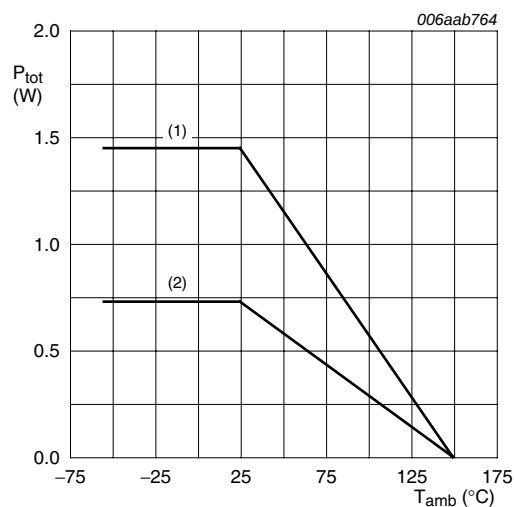
Table 5. Limiting values

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]	0.73	W
			[2]	1.45	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 cm².



(1) FR4 PCB, mounting pad for collector 6 cm²

(2) FR4 PCB, standard footprint

Fig 1. Power derating curves

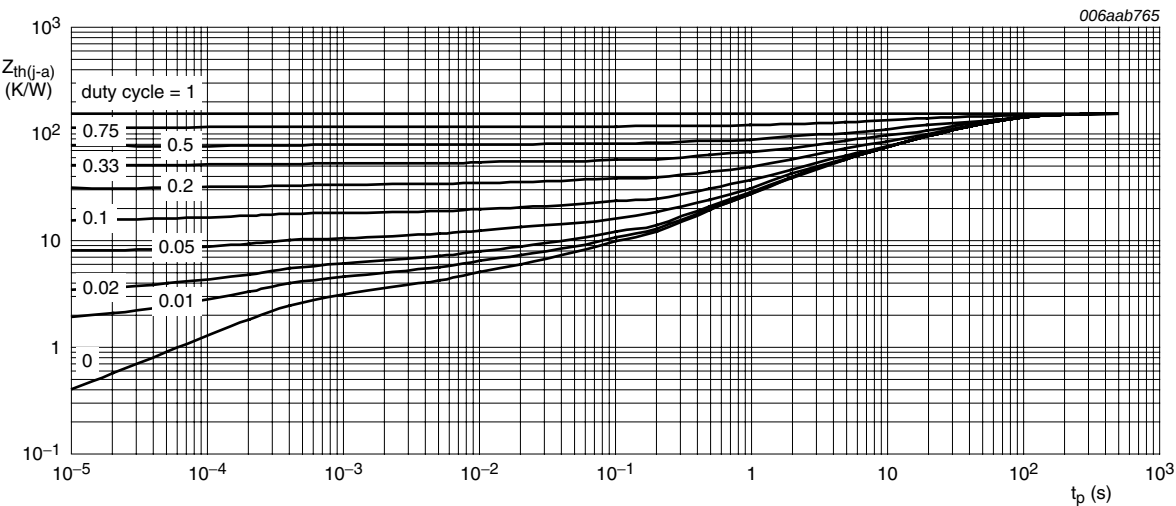
6. Thermal characteristics

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]	-	-	170 K/W
			[2]	-	-	85 K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	15	K/W

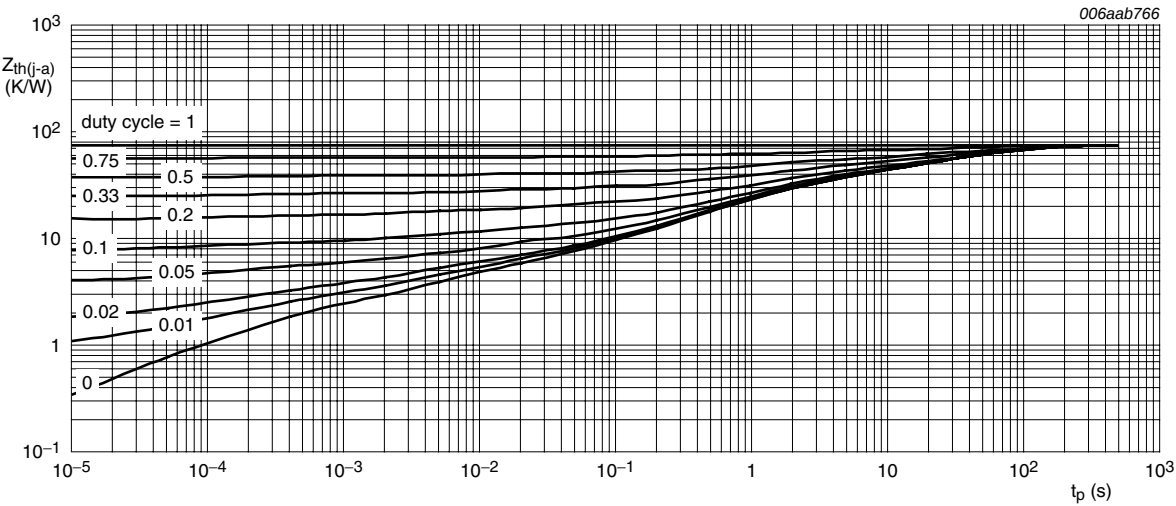
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm².



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 cm²

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

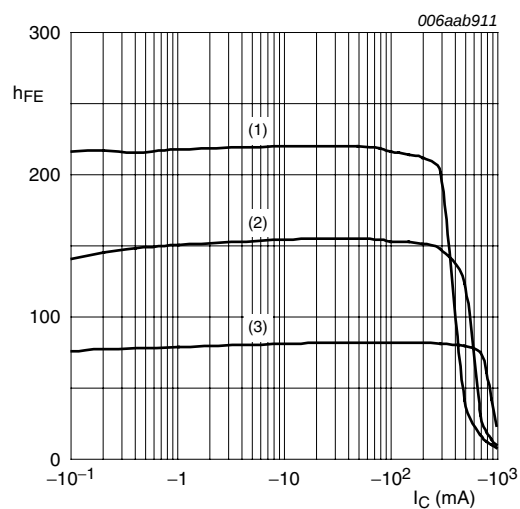
7. Characteristics

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	μA
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	$V_{CE} = -10\text{ V}$				
		$I_C = -50\text{ mA}$	[1] 100	155	-	
		$I_C = -100\text{ mA}$	[1] 100	155	-	
		$I_C = -300\text{ mA}$	[1] 80	145	-	
		$I_C = -500\text{ mA}$	[1] 65	130	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = -100\text{ mA}; I_B = -10\text{ mA}$	-	-100	-190	mV
		$I_C = -100\text{ mA}; I_B = -20\text{ mA}$	[1] -	-65	-110	mV
		$I_C = -300\text{ mA}; I_B = -60\text{ mA}$	[1] -	-110	-210	mV
		$I_C = -500\text{ mA}; I_B = -100\text{ mA}$	[1] -	-180	-320	mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = -500\text{ mA}; I_B = -100\text{ mA}$	[1] -	360	640	$\text{m}\Omega$
V_{BEsat}	base-emitter saturation voltage	$I_C = -100\text{ mA}; I_B = -20\text{ mA}$	[1] -	-0.75	-0.9	V
t_d	delay time	$V_{CC} = -2\text{ V}; I_C = -0.15\text{ A}; I_{Bon} = -0.03\text{ A}; I_{Boff} = 0.03\text{ A}$	-	55	-	ns
t_r	rise time		-	1775	-	ns
t_{on}	turn-on time		-	1830	-	ns
t_s	storage time		-	1545	-	ns
t_f	fall time		-	920	-	ns
t_{off}	turn-off time		-	2465	-	ns
f_T	transition frequency	$V_{CE} = -10\text{ V}; I_C = -10\text{ mA}; f = 100\text{ MHz}$	-	30	-	MHz
C_c	collector capacitance	$V_{CB} = -20\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	20	-	pF
C_e	emitter capacitance	$V_{EB} = -0.5\text{ V}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$	-	540	-	pF

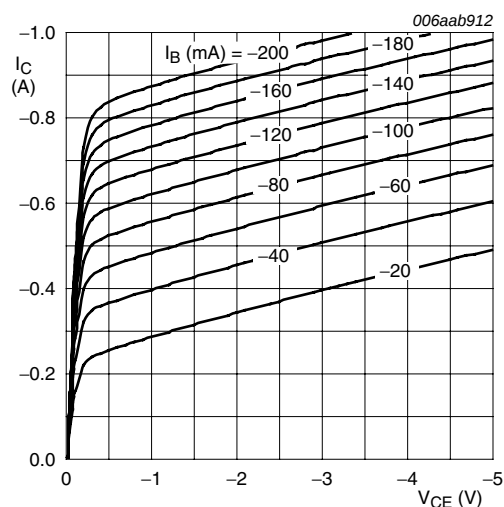
[1] Pulse test: $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$.



$V_{CE} = -10 \text{ V}$

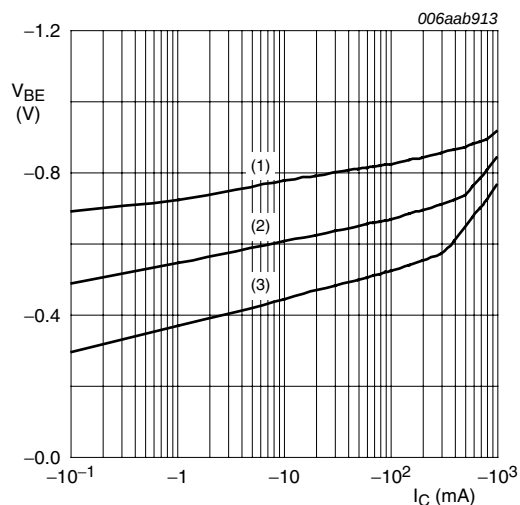
- (1) $T_{amb} = 100 \text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 25 \text{ }^{\circ}\text{C}$
- (3) $T_{amb} = -55 \text{ }^{\circ}\text{C}$

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



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

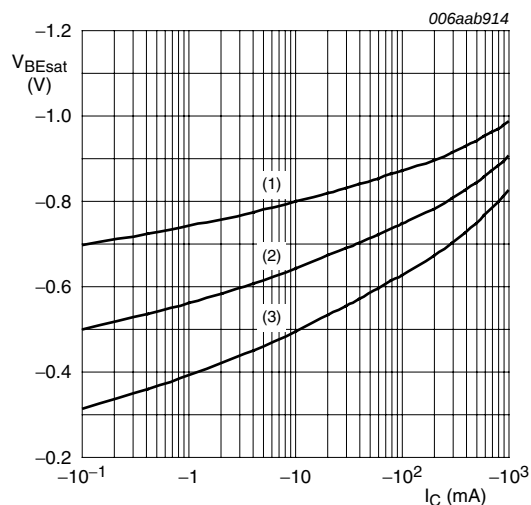
Fig 5. Collector current as a function of collector-emitter voltage; typical values



$V_{CE} = -10 \text{ V}$

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

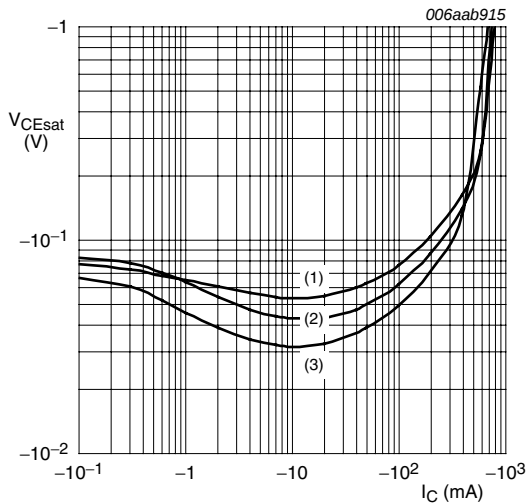
Fig 6. Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 5$

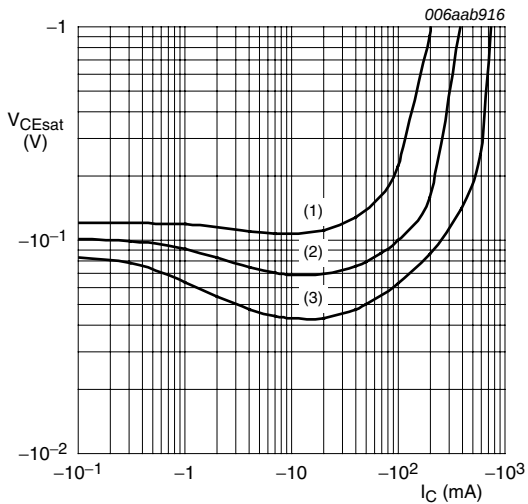
- (1) $T_{amb} = -55 \text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 25 \text{ }^{\circ}\text{C}$
- (3) $T_{amb} = 100 \text{ }^{\circ}\text{C}$

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



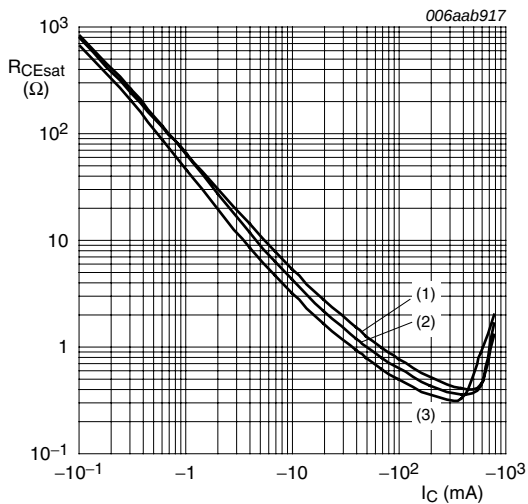
- $I_C/I_B = 5$
- (1) $T_{amb} = 100^\circ\text{C}$
 - (2) $T_{amb} = 25^\circ\text{C}$
 - (3) $T_{amb} = -55^\circ\text{C}$

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



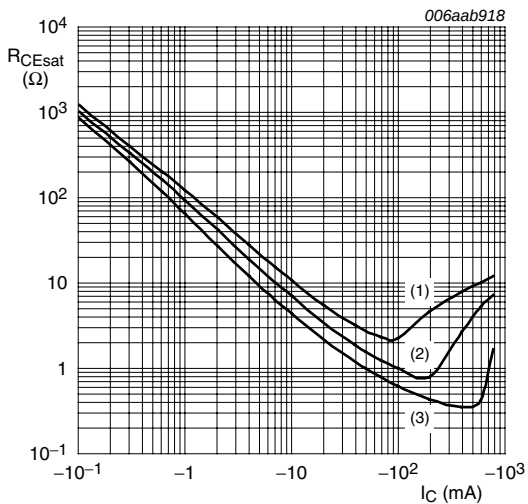
- $T_{amb} = 25^\circ\text{C}$
- (1) $I_C/I_B = 20$
 - (2) $I_C/I_B = 10$
 - (3) $I_C/I_B = 5$

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) $T_{amb} = -55^\circ\text{C}$

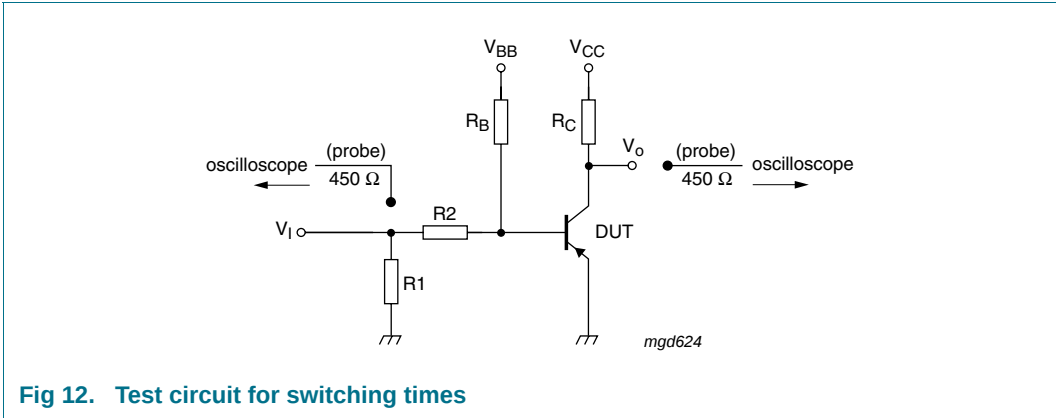
Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values



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

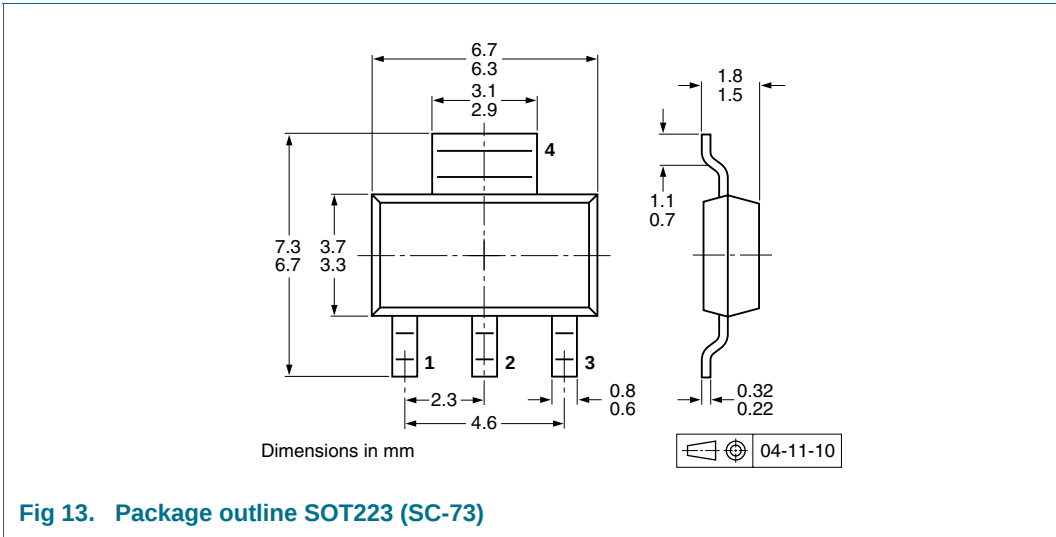
8. Test information



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.[\[1\]](#)

Type number	Package	Description	Packing quantity	
			1000	4000
PBHV9540Z	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

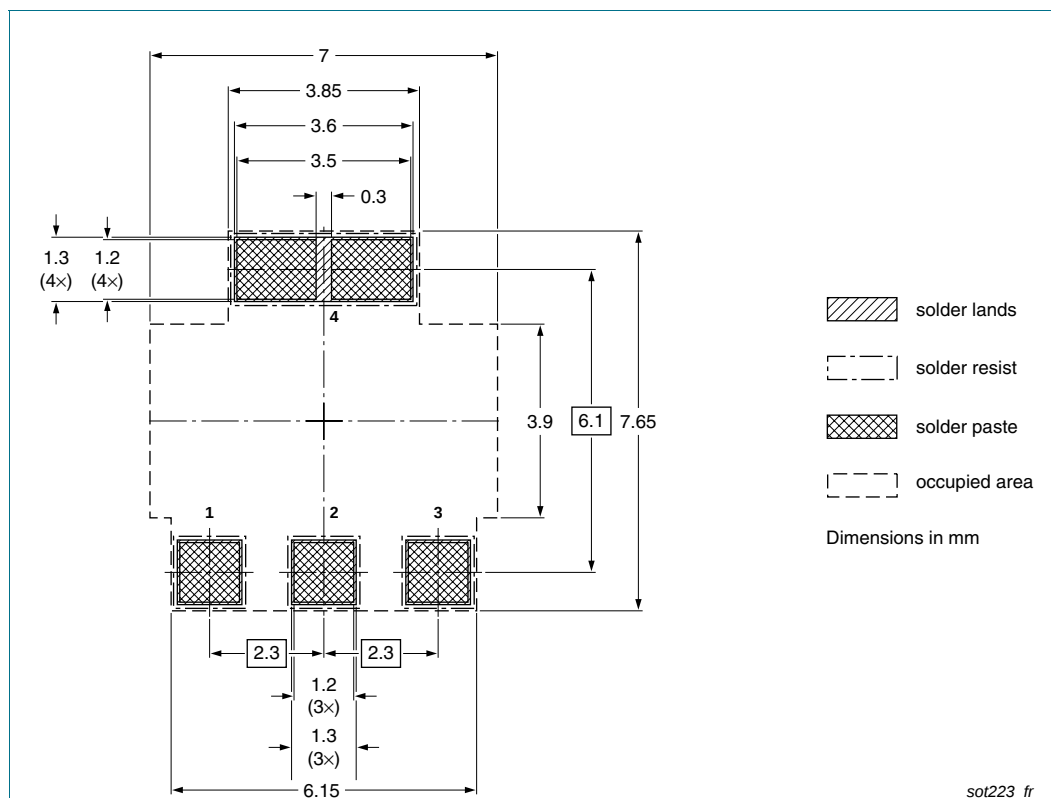


Fig 14. Reflow soldering footprint SOT223 (SC-73)

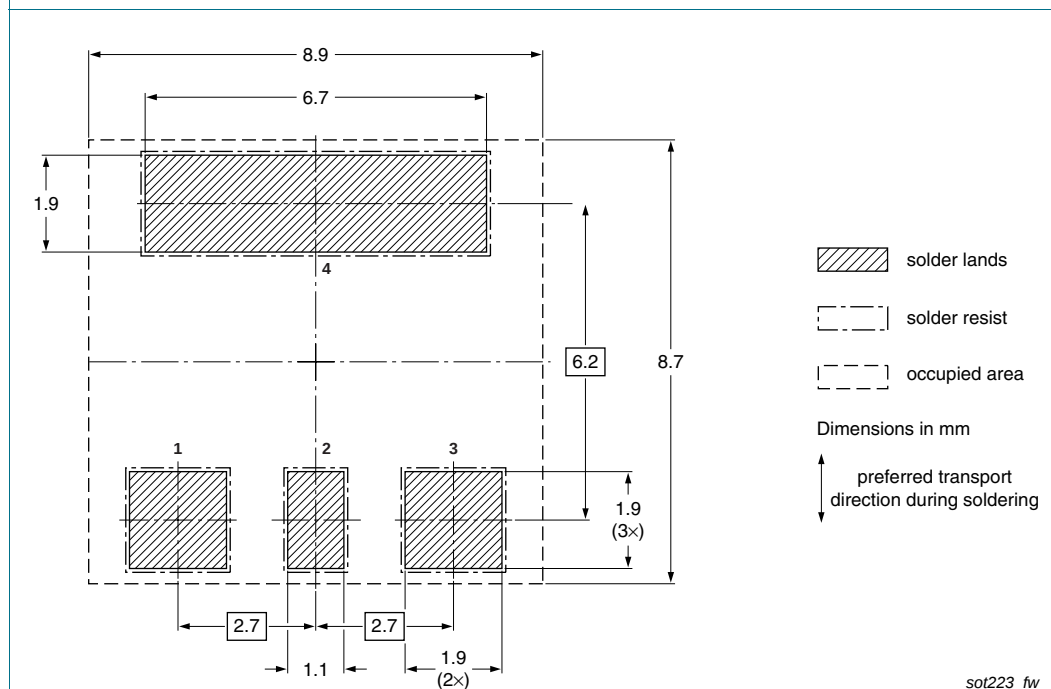


Fig 15. Wave soldering footprint SOT223 (SC-73)

12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBHV9540Z_1	20091211	Product data sheet	-	-

13. Legal information

13.1 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.
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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15. Contents

1 Product profile 1

1.1 General description 1

1.2 Features 1

1.3 Applications 1

1.4 Quick reference data 1

2 Pinning information..... 2

3 Ordering information..... 2

4 Marking 2

5 Limiting values..... 3

6 Thermal characteristics 4

7 Characteristics..... 5

8 Test information..... 8

8.1 Quality information 8

9 Package outline 8

10 Packing information 8

11 Soldering 9

12 Revision history..... 10

13 Legal information..... 11

13.1 Data sheet status 11

13.2 Definitions..... 11

13.3 Disclaimers..... 11

13.4 Trademarks..... 11

14 Contact information..... 11

15 Contents 12



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