PBHV9540Z-Q

500 V, 0.5 A PNP high-voltage low VCEsat transistor

17 July 2023 Product data sheet

1. General description

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

NPN complement: PBHV8140Z-Q

2. Features and benefits

- High voltage
- Low collector-emitter saturation voltage VCEsat
- High collector current capability IC and ICM
- High collector current gain (hFE) at high IC
- Medium power SMD plastic package
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

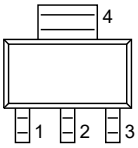
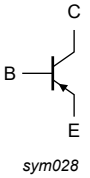
4. Quick reference data

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; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		100	155	-	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SC-73 (SOT223)	 sym028
2	C	collector		
3	E	emitter		
4	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBHV9540Z-Q	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	SOT223

7. Marking

Table 4. Marking codes

Type number	Marking code
PBHV9540Z-Q	V9540Z

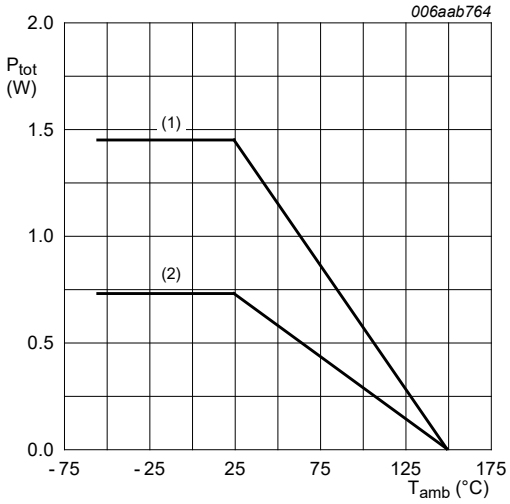
8. Limiting values

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]	-	1.45	W
			[2]	-	0.73	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, mounting pad for collector 6 cm^2.
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.



(1) FR4 PCB, mounting pad for collector 6 cm^2
(2) FR4 PCB, standard footprint

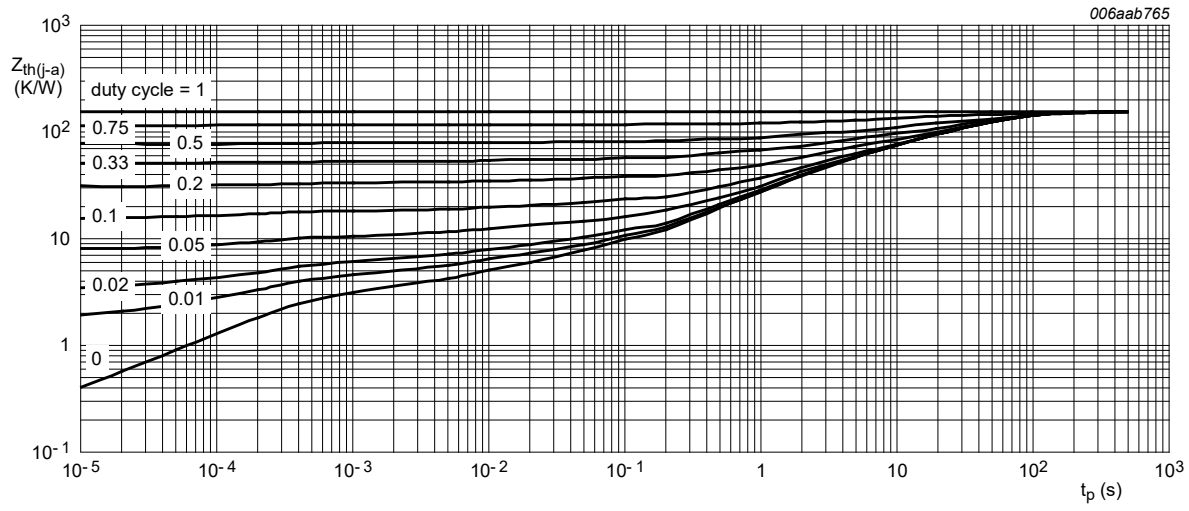
Fig. 1. Power derating curves

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]	-	-	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, mounting pad for collector 6 cm^2.



FR4 PCB, standard footprint

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

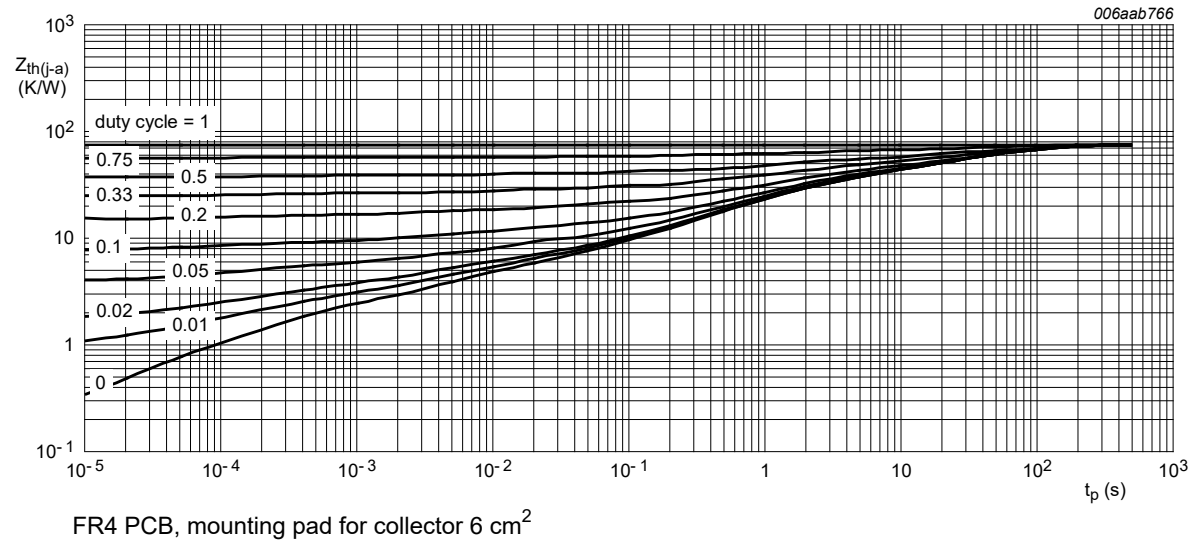


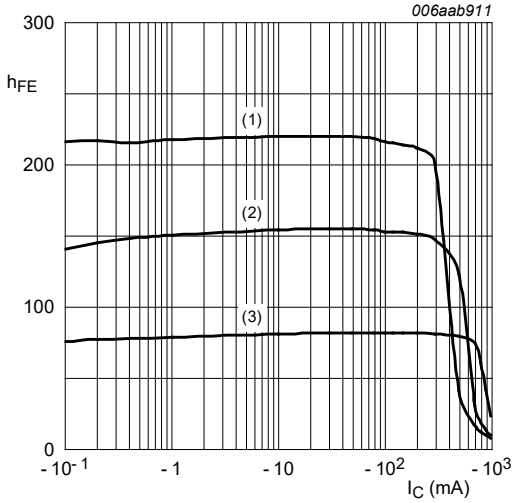
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

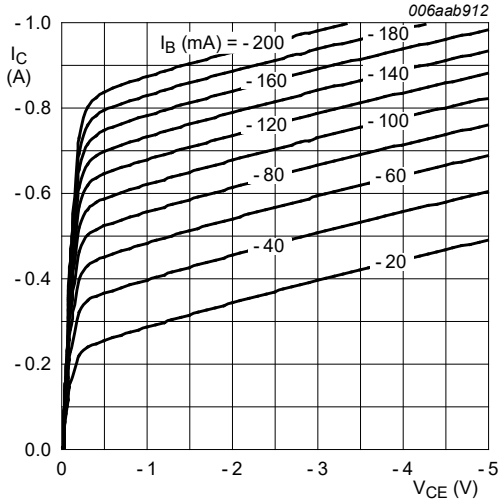
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = -320 V; I_E = 0 A; T_{amb} = 25 °C		-	-	-100	nA
		V_{CB} = -320 V; I_E = 0 A; T_j = 150 °C		-	-	-10	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = -4 V; I_C = 0 A; T_{amb} = 25 °C		-	-	-100	nA
I_{CES}	collector-emitter cut-off current	V_{CE} = -320 V; V_{BE} = 0 V; T_{amb} = 25 °C		-	-	-100	nA
h_{FE}	DC current gain	V_{CE} = -10 V; I_C = -50 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		100	155	-	
		V_{CE} = -10 V; I_C = -100 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		100	155	-	
		V_{CE} = -10 V; I_C = -300 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		80	145	-	
		V_{CE} = -10 V; I_C = -500 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		65	130	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = -100 mA; I_B = -10 mA; T_{amb} = 25 °C		-	-100	-190	mV
		I_C = -100 mA; I_B = -20 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-65	-110	mV
		I_C = -300 mA; I_B = -60 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-110	-210	mV
		I_C = -500 mA; I_B = -100 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-180	-320	mV
R_{CEsat}	collector-emitter saturation resistance			-	360	640	mΩ
V_{BEsat}	base-emitter saturation voltage	I_C = -100 mA; I_B = -20 mA; pulsed; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_{amb} = 25 °C		-	-0.75	-0.9	V

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
t_d	delay time	V_{CC} = -2 V; I_C = -0.15 A; I_{Bon} = -0.03 A; I_{Boff} = 0.03 A; T_{amb} = 25 °C		-	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 V; I_C = -10 mA; f = 100 MHz		-	30	-	MHz
C_c	collector capacitance	V_{CB} = -20 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	20	-	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		-	540	-	pF



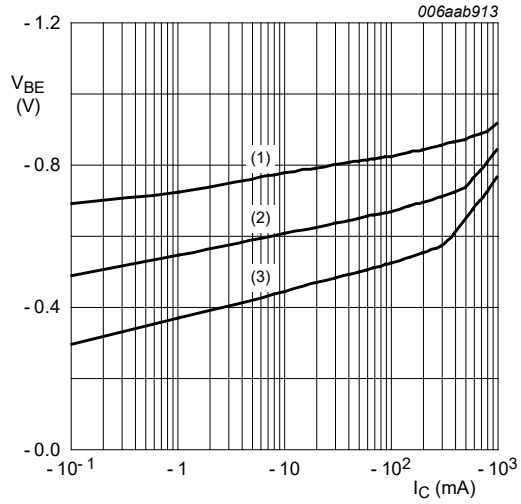
V_{CE} = −10 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



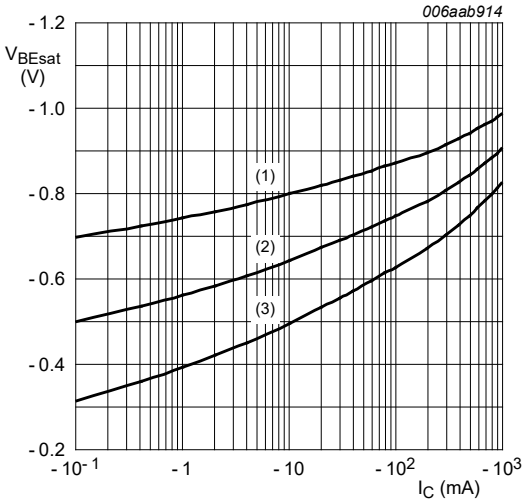
T_{amb} = 25 °C

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



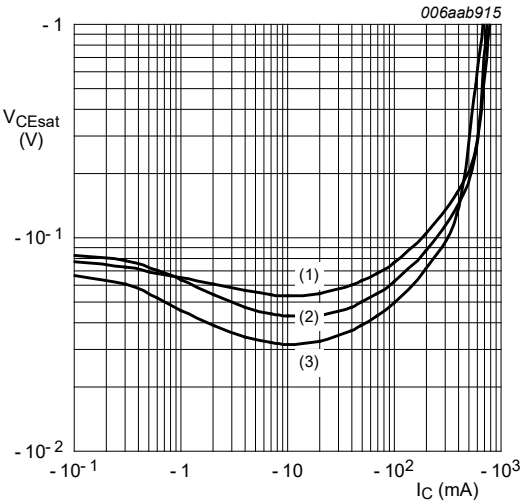
V_{CE} = −10 V
(1) T_{amb} = −55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

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



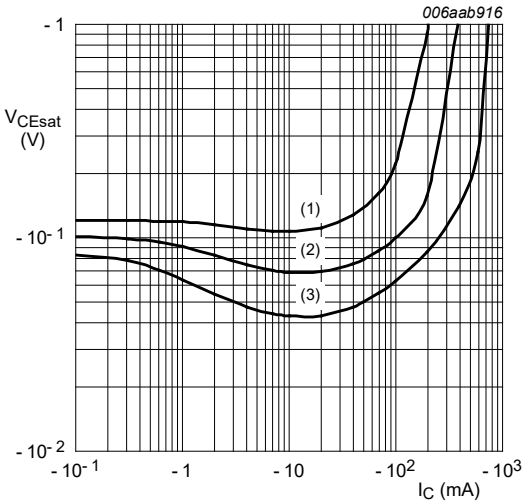
I_C/I_B = 5
(1) T_{amb} = −55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

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



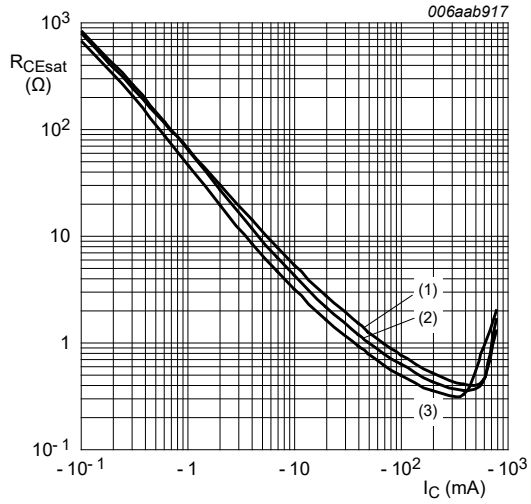
I_C/I_B = 5
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



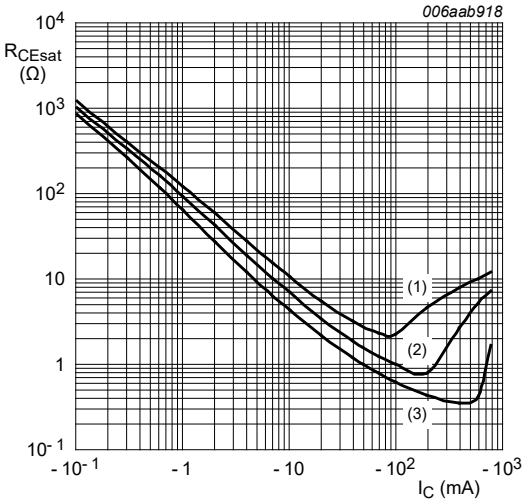
T_{amb} = 25 °C
(1) I_C/I_B = 20
(2) I_C/I_B = 10
(3) I_C/I_B = 5

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



I_C/I_B = 5
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



T_{amb} = 25 °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

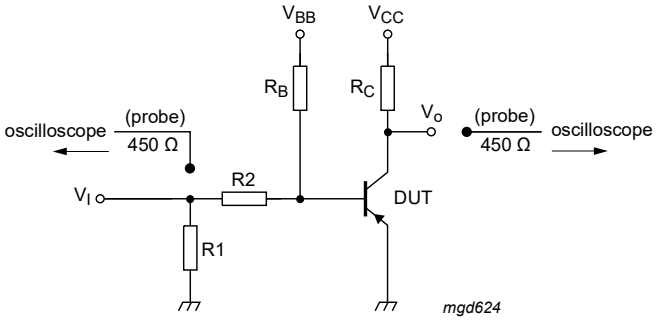


Fig. 12. Test circuit for switching times

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

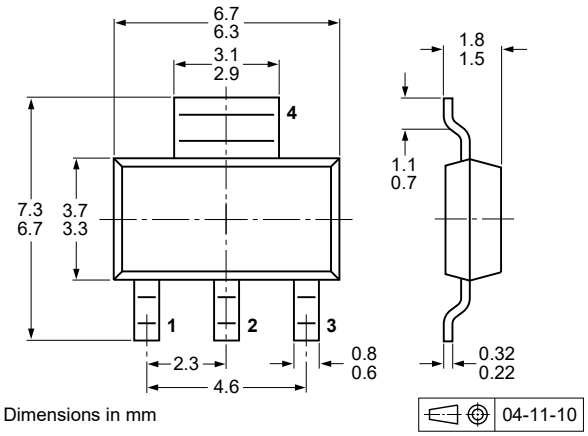


Fig. 13. Package outline SC-73 (SOT223)

13. Soldering

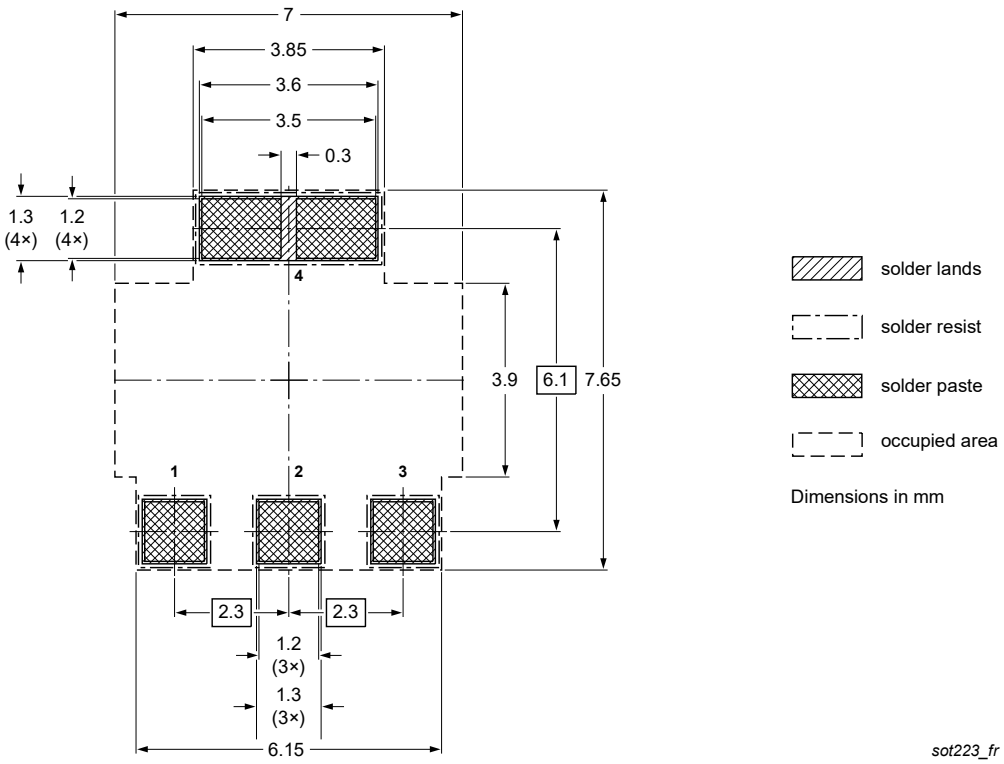


Fig. 14. Reflow soldering footprint for SC-73 (SOT223)

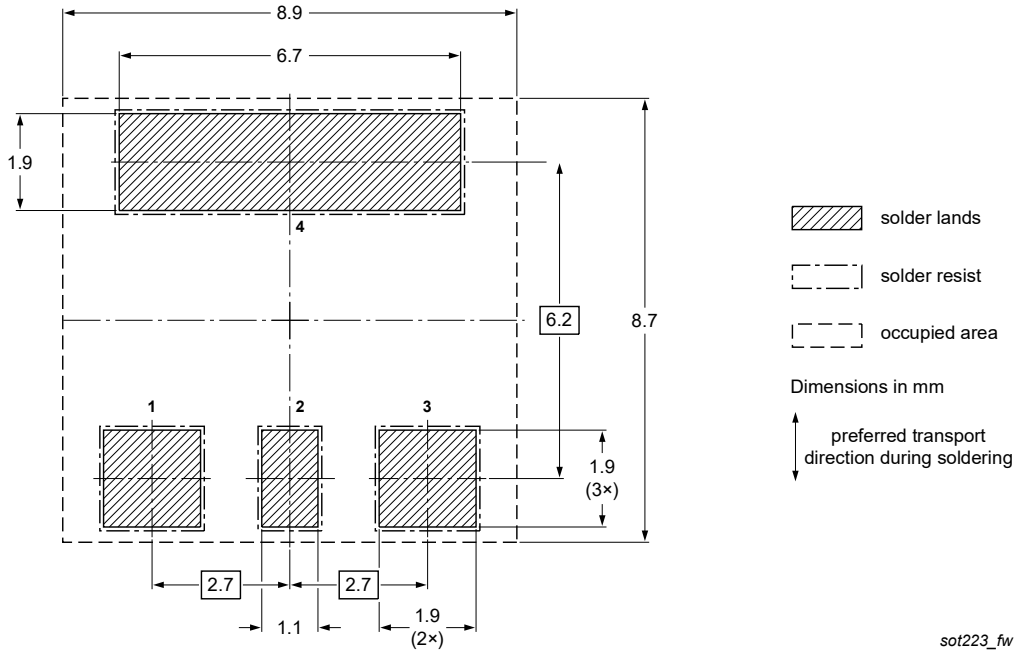


Fig. 15. Wave soldering footprint for SC-73 (SOT223)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBHV9540Z-Q v.1	20230717	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".
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Date of release: 17 July 2023