



# BCP56H series

80 V, 1 A NPN medium power transistors

Rev. 1 — 23 November 2016

Product data sheet

## 1. Product profile

### 1.1 General description

NPN medium power transistors in a medium power SOT223 (SC-73) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	Package			PNP complement
	Nexperia	JEITA	JEDEC	
BCP56H	SOT223	SC-73	-	BCP53H
BCP56-10H				BCP53-10H
BCP56-16H				BCP53-16H

### 1.2 Features and benefits

- High collector current capability  $I_C$  and  $I_{CM}$
- Three current gain selections
- High power dissipation capability
- High-temperature applications up to 175 °C
- AEC-Q101 qualified

### 1.3 Applications

- Linear voltage regulators
- MOSFET drivers
- Low-side switches
- Power management
- Amplifiers

### 1.4 Quick reference data

Table 2. Quick reference data

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	80	V
$I_C$	collector current		-	-	1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	-	2	A

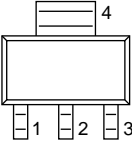
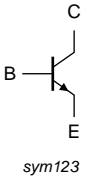
**Table 2. Quick reference data ...continued**  
 $T_{amb} = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$h_{FE}$	DC current gain	$V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ [1]	63	-	250	
	BCP56-10H	$V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ [1]	63	-	160	
	BCP56-16H	$V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ [1]	100	-	250	

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

## 2. Pinning information

**Table 3. Pinning**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		
2	C	collector		
3	E	emitter		
4	C	collector		

## 3. Ordering information

**Table 4. Ordering information**

Type number	Package		
	Name	Description	Version
BCP56H	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCP56-10H			
BCP56-16H			

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code
BCP56H	BCP56H
BCP56-10H	P5610H
BCP56-16H	P5616H

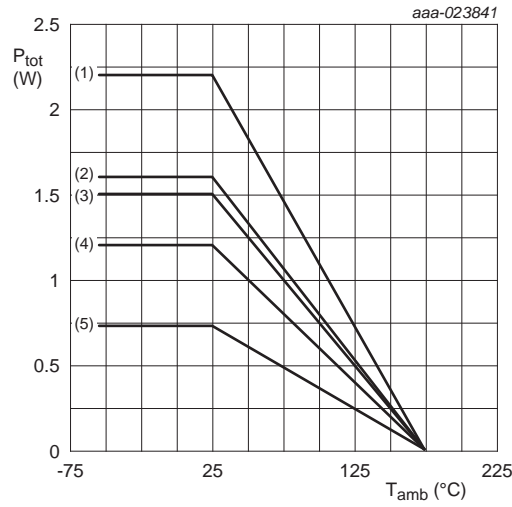
## 5. Limiting values

**Table 6. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

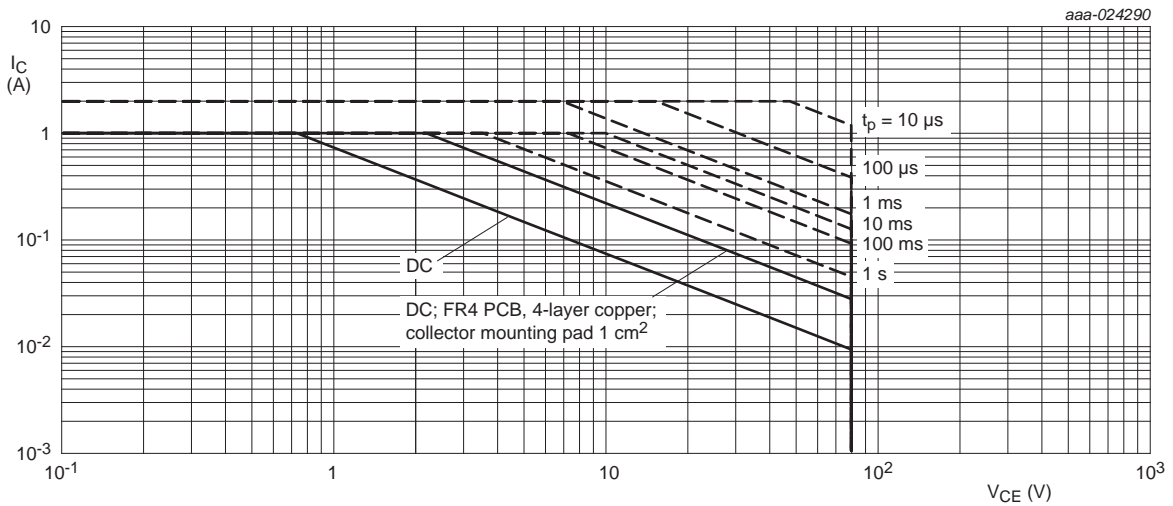
Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{CBO}$	collector-base voltage	open emitter	-	100	V	
$V_{CEO}$	collector-emitter voltage	open base	-	80	V	
$V_{EBO}$	emitter-base voltage	open collector	-	7	V	
$I_C$	collector current		-	1	A	
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	2	A	
$I_B$	base current		-	0.2	A	
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	0.3	A	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	725	mW
			[2]	-	1.2	W
			[3]	-	1.5	W
			[4]	-	1.6	W
			[5]	-	2.2	W
$T_j$	junction temperature		-	+175	°C	
$T_{amb}$	ambient temperature		-55	+175	°C	
$T_{stg}$	storage temperature		-65	+175	°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; mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on an FR4 PCB, 4-layer copper; tin-plated and standard footprint.
- [5] Device mounted on an FR4 PCB, 4-layer copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>.



- (1) FR4 PCB, 4-layer copper, 1 cm<sup>2</sup>
- (2) FR4 PCB, 4-layer copper, standard footprint
- (3) FR4 PCB, single-sided copper, 6 cm<sup>2</sup>
- (4) FR4 PCB, single-sided copper, 1 cm<sup>2</sup>
- (5) FR4 PCB, single-sided copper, standard footprint

Fig 1. Power derating curves



Unless otherwise specified:  
 T<sub>amb</sub> = 25 °C  
 Single pulse  
 FR4 PCB, single-sided copper; standard footprint

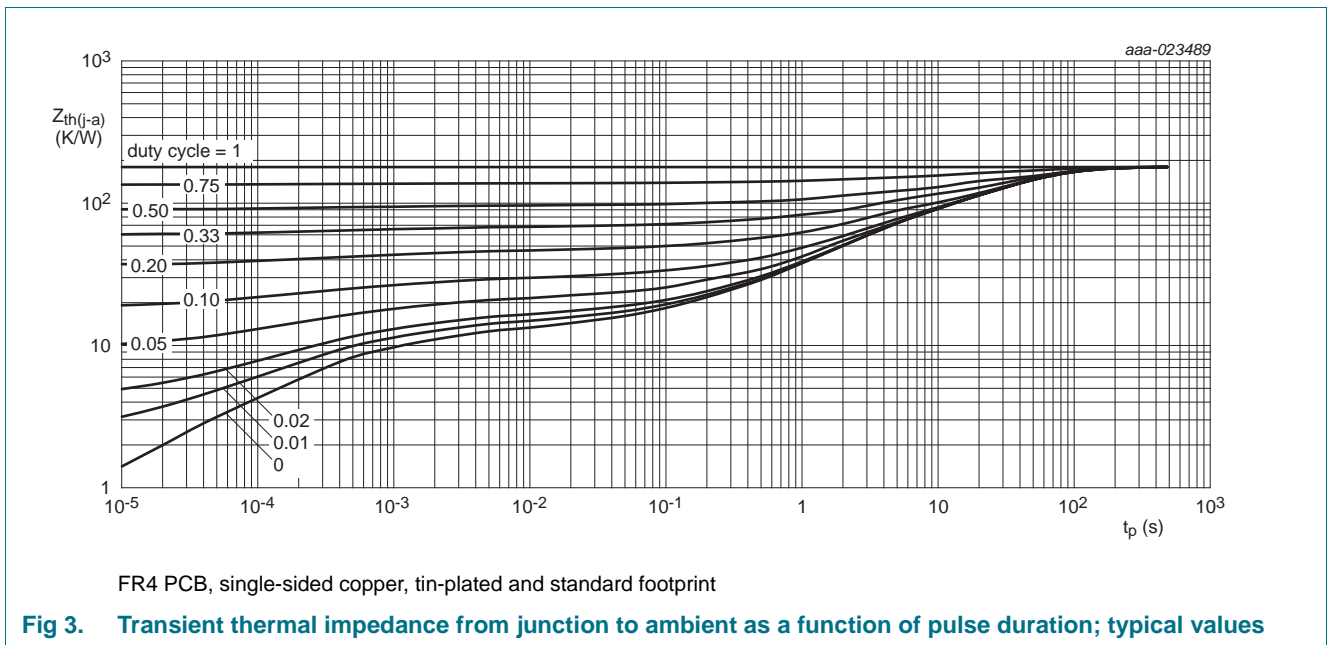
Fig 2. Safe operating area; junction to ambient; continuous and peak collector currents as a function of collector-emitter voltage

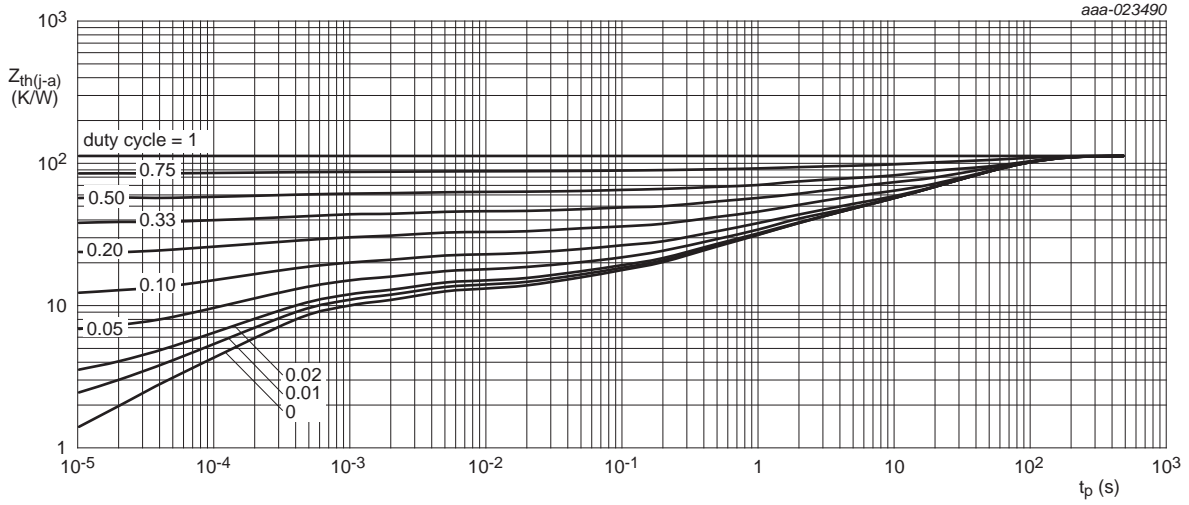
## 6. Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	207	K/W
			[2]	-	-	125	K/W
			[3]	-	-	100	K/W
			[4]	-	-	94	K/W
			[5]	-	-	69	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	18	K/W	

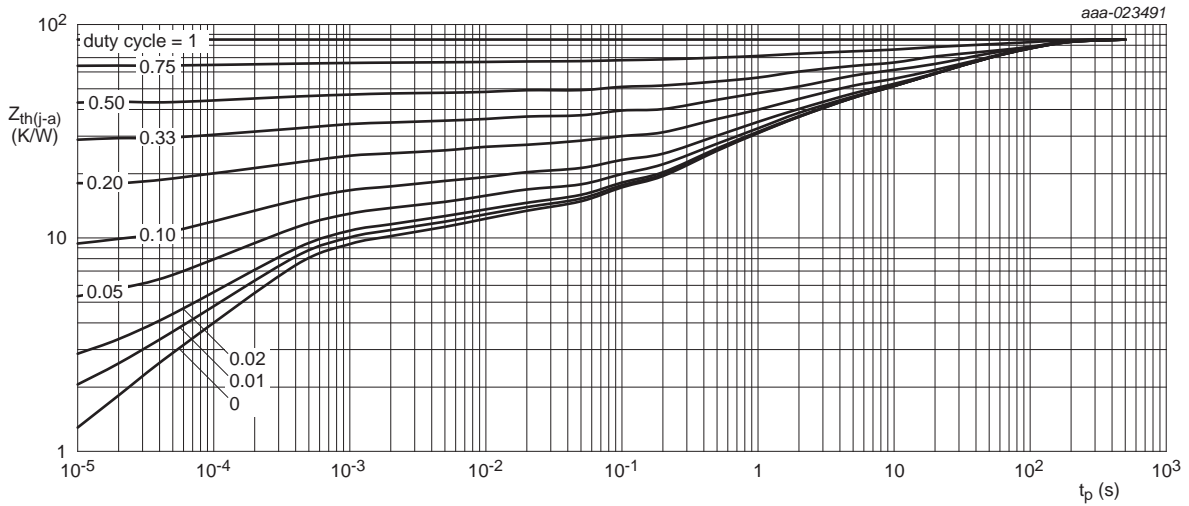
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on an FR4 PCB, 4-layer copper; tin-plated and standard footprint.
- [5] Device mounted on an FR4 PCB, 4-layer copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>.





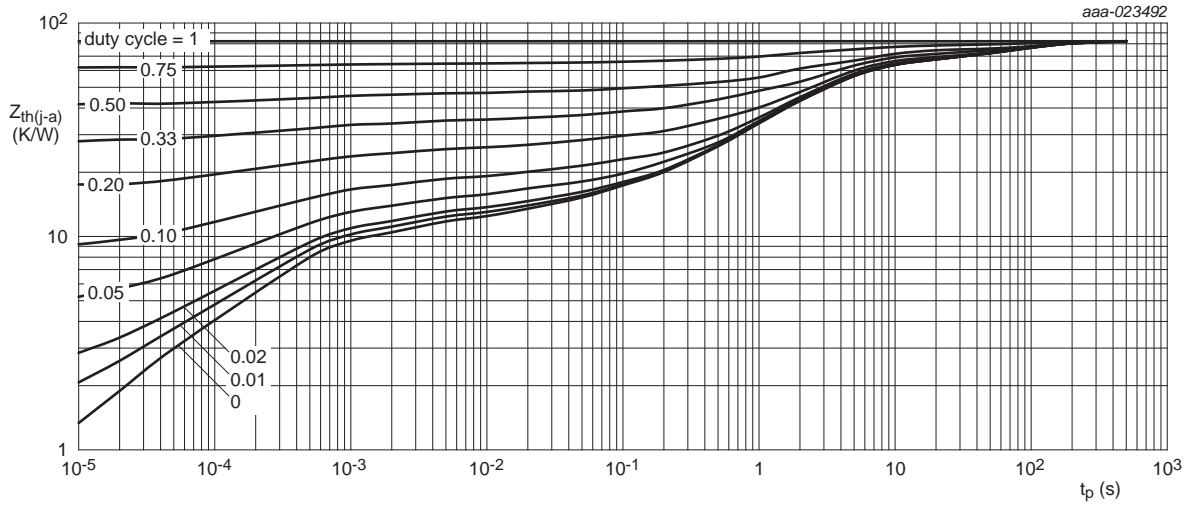
FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>

Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



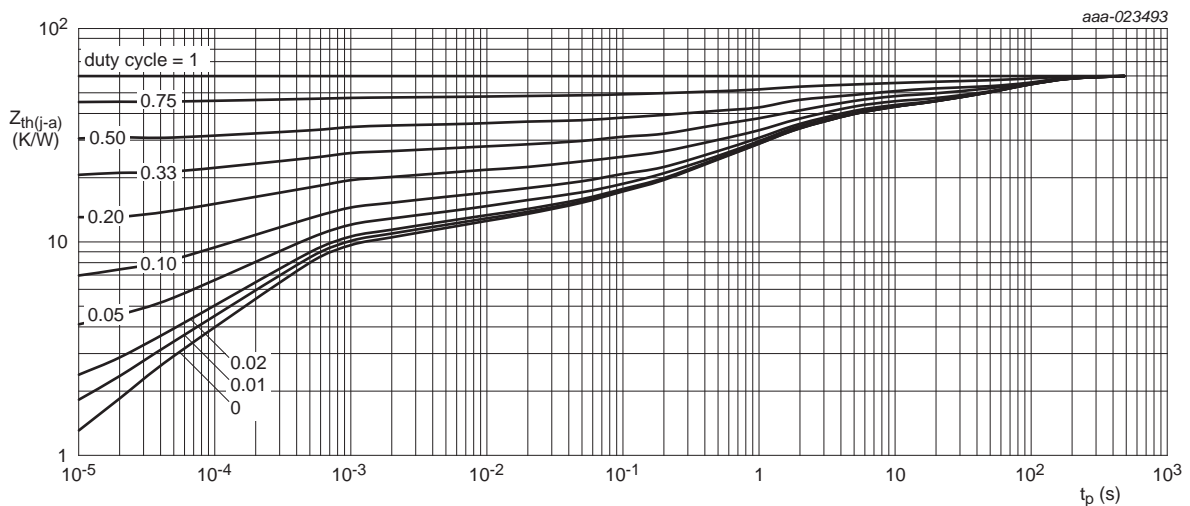
FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 6 cm<sup>2</sup>

Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, 4-layer copper, tin-plated and standard footprint.

Fig 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, 4-layer copper, tin-plated; mounting pad for collector 1 cm<sup>2</sup>

Fig 7. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

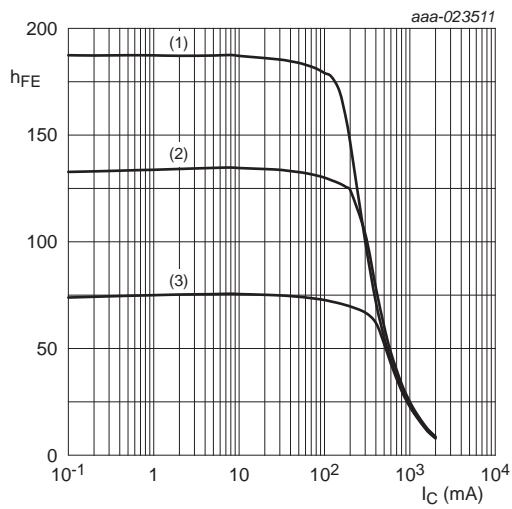
**Table 8. Characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	-	-	10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
$h_{FE}$	DC current gain	$V_{CE} = 2\text{ V}; I_C = 5\text{ mA}$	63	-	-	
		$V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ [1]	63	-	250	
		$V_{CE} = 2\text{ V}; I_C = 500\text{ mA}$ [1]	40	-	-	
	BCP56-10T	$V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ [1]	63	-	160	
	BCP56-16T	$V_{CE} = 2\text{ V}; I_C = 150\text{ mA}$ [1]	100	-	250	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 500\text{ mA}; I_B = 50\text{ mA}$ [1]	-	-	500	mV
$V_{BE}$	base-emitter voltage	$V_{CE} = 2\text{ V}; I_C = 500\text{ mA}$ [1]	-	-	1	V
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 50\text{ mA};$ $f = 100\text{ MHz}$	100	155	-	MHz
$C_C$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_B = 0\text{ A};$ $f = 1\text{ MHz}$	-	4.5	-	pF

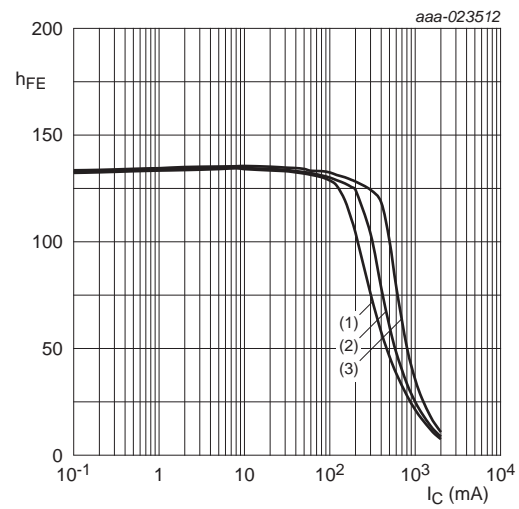
[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta = 0.02$





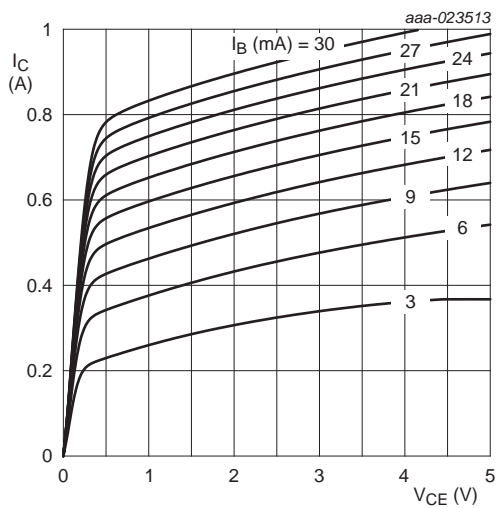
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig 8. DC current gain as a function of collector current; typical values**



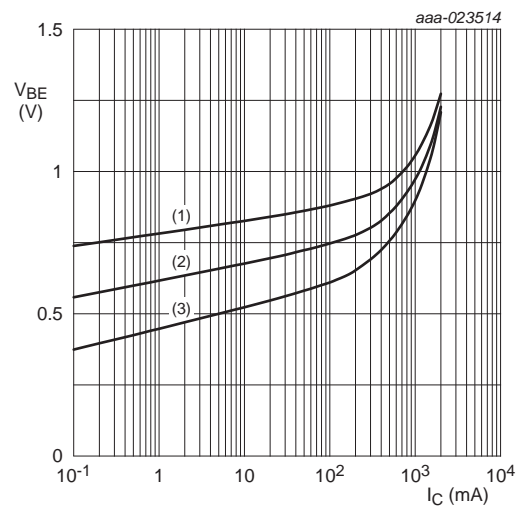
$T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (1)  $V_{CE} = 1\text{ V}$   
 (2)  $V_{CE} = 2\text{ V}$   
 (3)  $V_{CE} = 5\text{ V}$

**Fig 9. DC current gain as a function of collector current; typical values**



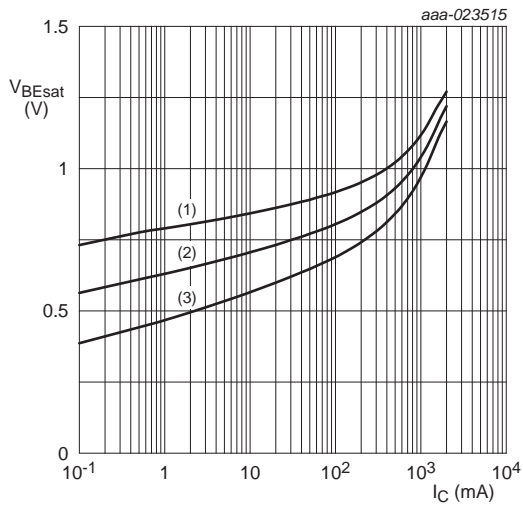
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



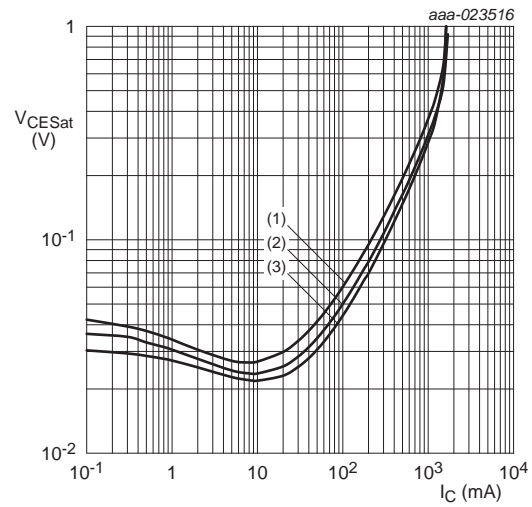
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 11. Base-emitter voltage as a function of collector current; typical values**



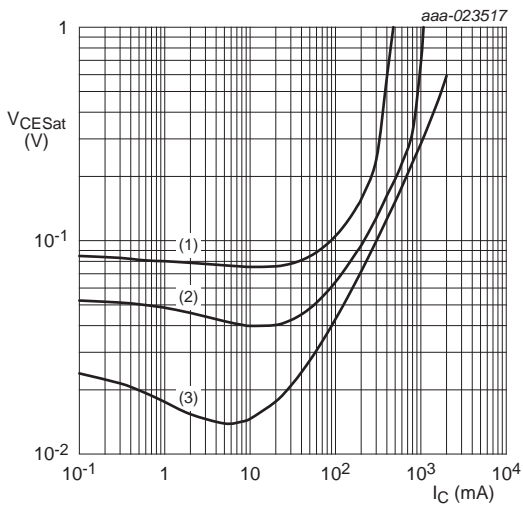
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 12. Base-emitter saturation voltage as a function of collector current; typical values**



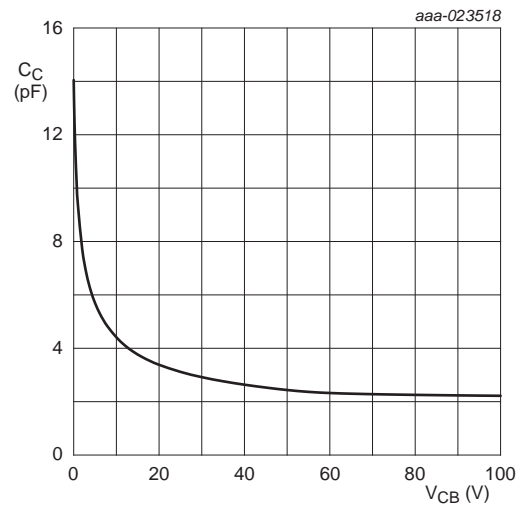
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 13. Collector-emitter saturation voltage as a function of collector current; typical values**



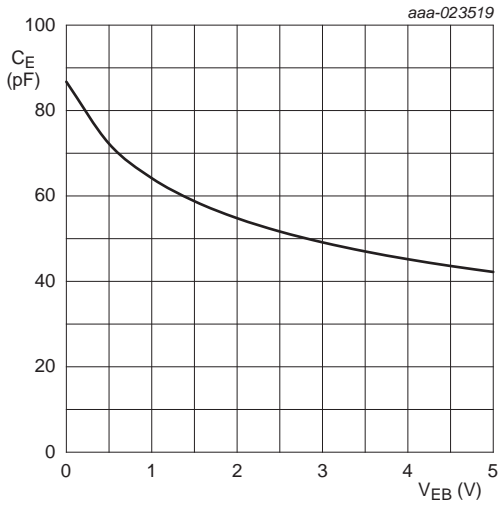
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 50$   
 (2)  $I_C/I_B = 20$   
 (3)  $I_C/I_B = 5$

**Fig 14. Collector-emitter saturation voltage as a function of collector current; typical values**



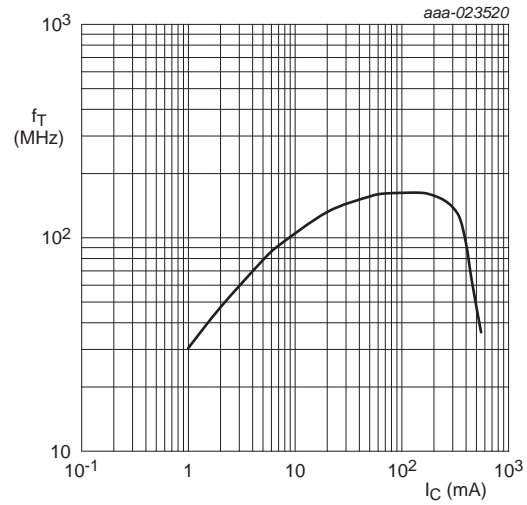
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

**Fig 15. Collector capacitance as a function of collector-base voltage; typical values**



$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

Fig 16. Emitter capacitance as a function of emitter-base voltage; typical values



$V_{CE} = 5 \text{ V};$   
 $f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

Fig 17. Transition frequency 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

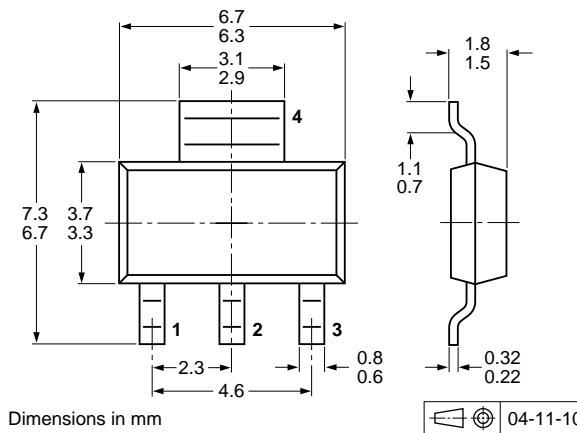


Fig 18. Package outline SOT223 (SC-73)

10. Soldering

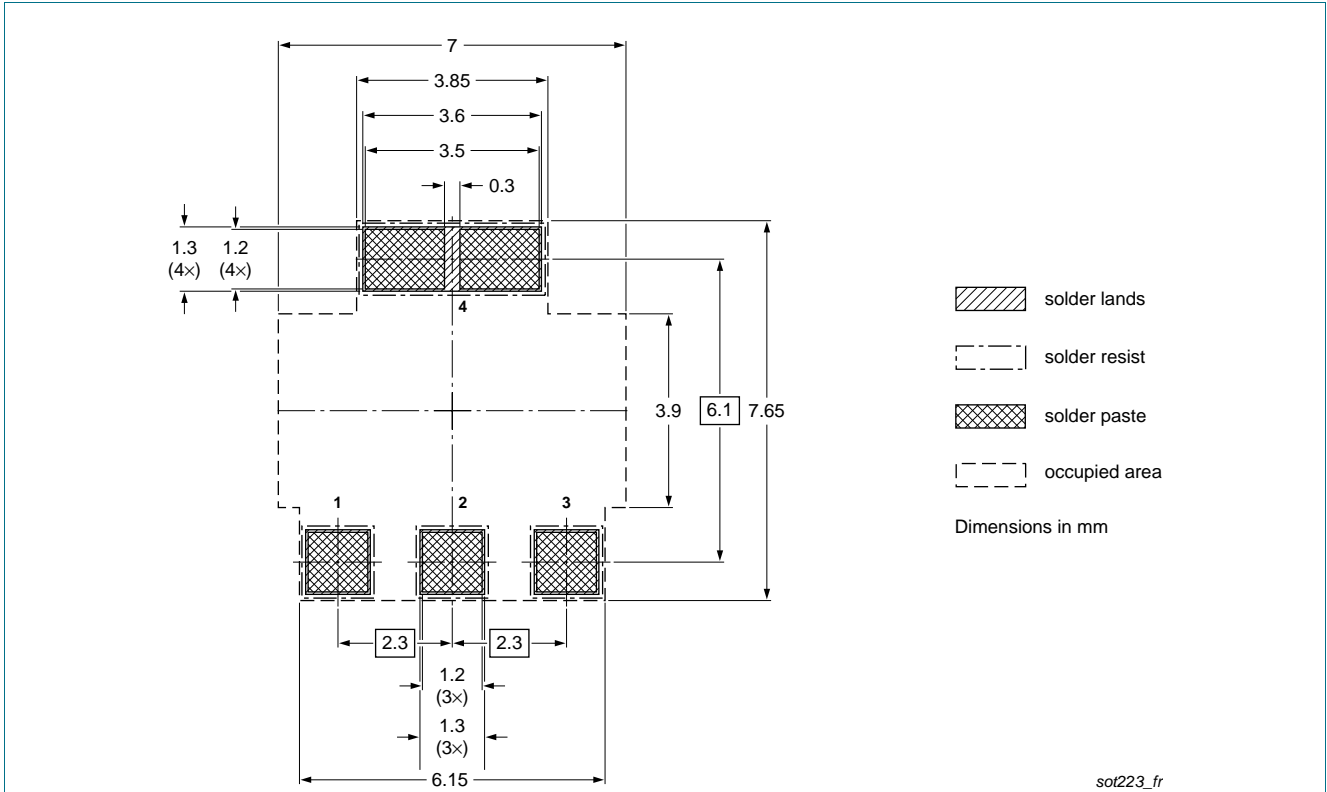


Fig 19. Reflow soldering footprint SOT223 (SC-73)

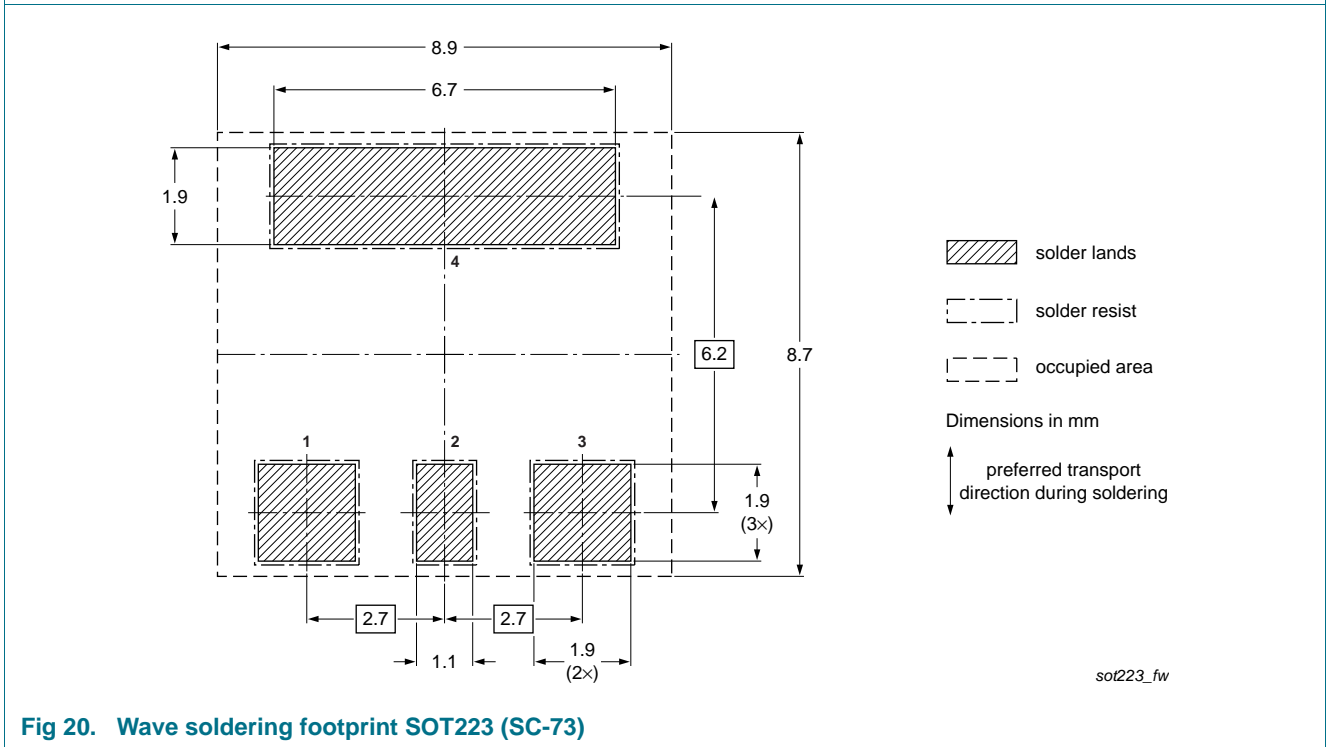


Fig 20. Wave soldering footprint SOT223 (SC-73)

## 11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BCP56H_SER v.1	20161123	Product data sheet	-	-

## 12. Legal information

### 12.1 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.
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