

BCP56T series

80 V, 1 A NPN medium power transistors

Rev. 1 — 5 July 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
	NXP	JEITA	JEDEC	
BCP56T	SOT223	SC-73	-	BCP53T
BCP56-10T				BCP53-10T
BCP56-16T				BCP53-16T

1.2 Features and benefits

- High collector current capability I_C and I_{CM}
- Three current gain selections
- High power dissipation capability
- 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



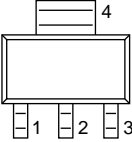
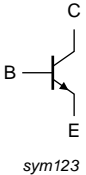
Table 2. Quick reference data ...continued
T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
h _{FE}	DC current gain	V _{CE} = 2 V; I _C = 150 mA [1]	63	-	250	
	BCP56-10T	V _{CE} = 2 V; I _C = 150 mA [1]	63	-	160	
	BCP56-16T	V _{CE} = 2 V; I _C = 150 mA [1]	100	-	250	

[1] Pulse test: t_p ≤ 300 μs; δ = 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
BCP56T	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCP56-10T			
BCP56-16T			

4. Marking

Table 5. Marking codes

Type number	Marking code
BCP56T	BCP56T
BCP56-10T	P5610T
BCP56-16T	P5616T

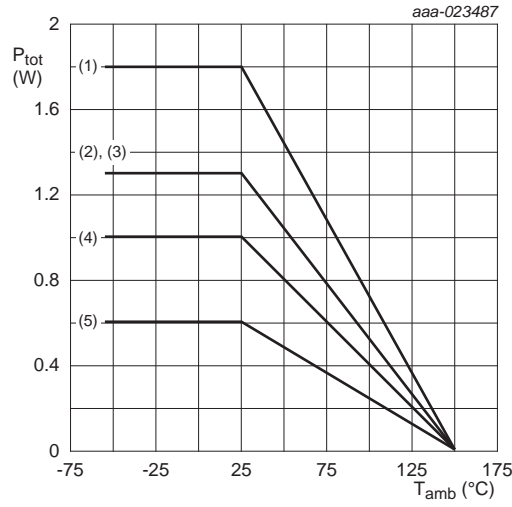
5. Limiting values

Table 6. Limiting values

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

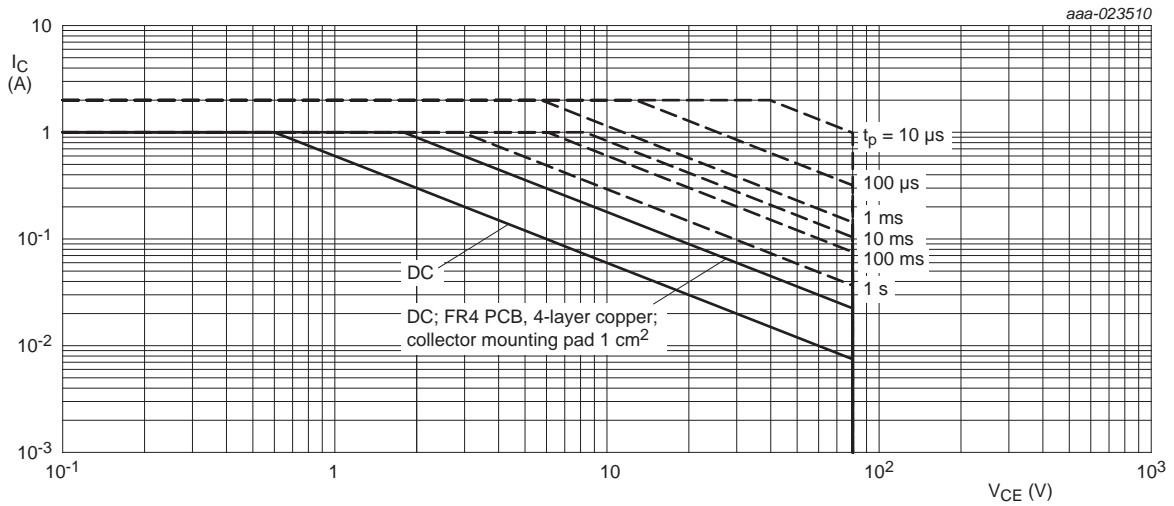
Symbol	Parameter	Conditions	Min	Max	Unit	
V_{CBO}	collector-base voltage	open emitter	-	100	V	
V_{CEO}	collector-emitter voltage	open base	-	80	V	
V_{EBO}	emitter-base voltage	open collector	-	5	V	
I_C	collector current		-	1	A	
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	2	A	
I_B	base 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]	-	0.6	W
			[2]	-	1	W
			[3]	-	1.3	W
			[4]	-	1.3	W
			[5]	-	1.8	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; mounting pad for collector 1 cm².
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 6 cm².
- [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 cm².



- (1) FR4 PCB, 4-layer copper, 1 cm²
- (2) FR4 PCB, single-sided copper, 6 cm²
- (3) FR4 PCB, 4-layer copper, standard footprint
- (4) FR4 PCB, single-sided copper, 1 cm²
- (5) FR4 PCB, single-sided copper, standard footprint

Fig 1. Power derating curves



Unless otherwise specified:
 T_{amb} = 25 °C
 Single pulse
 FR4 PCB, single-sided copper; standard footprint

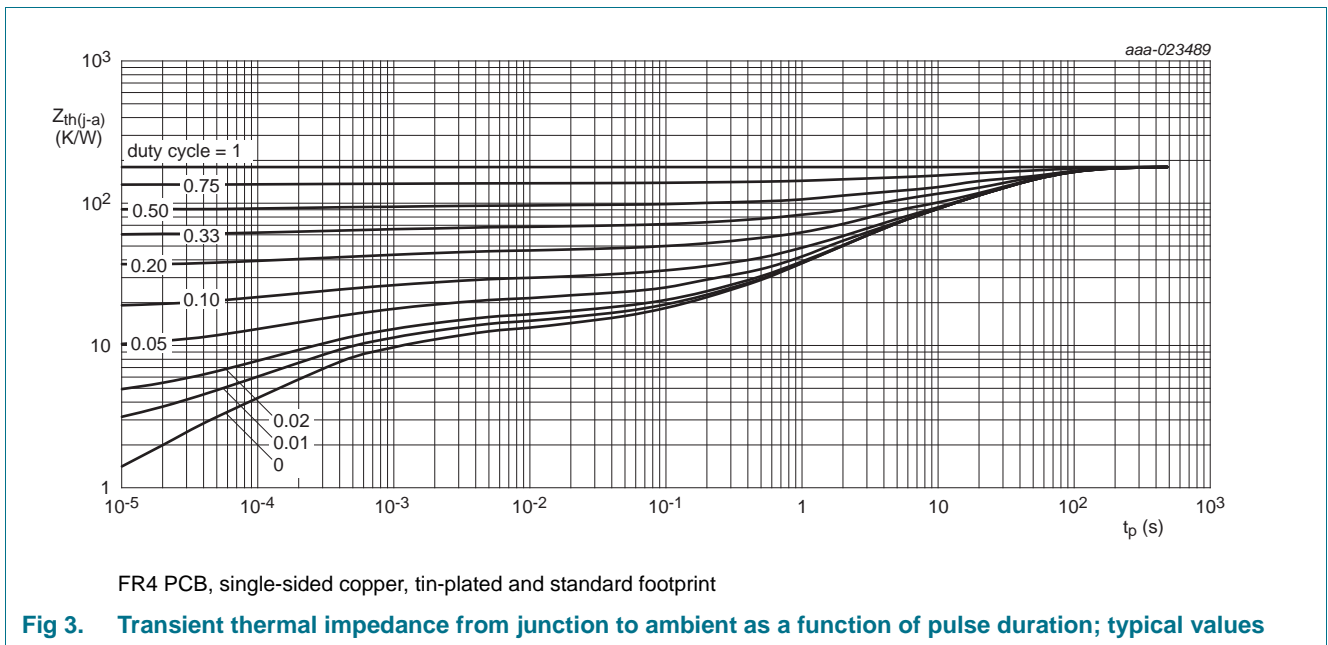
Fig 2. Safe operating area; junction to ambient; continuous and peak collector currents as a function of collector-emitter voltage

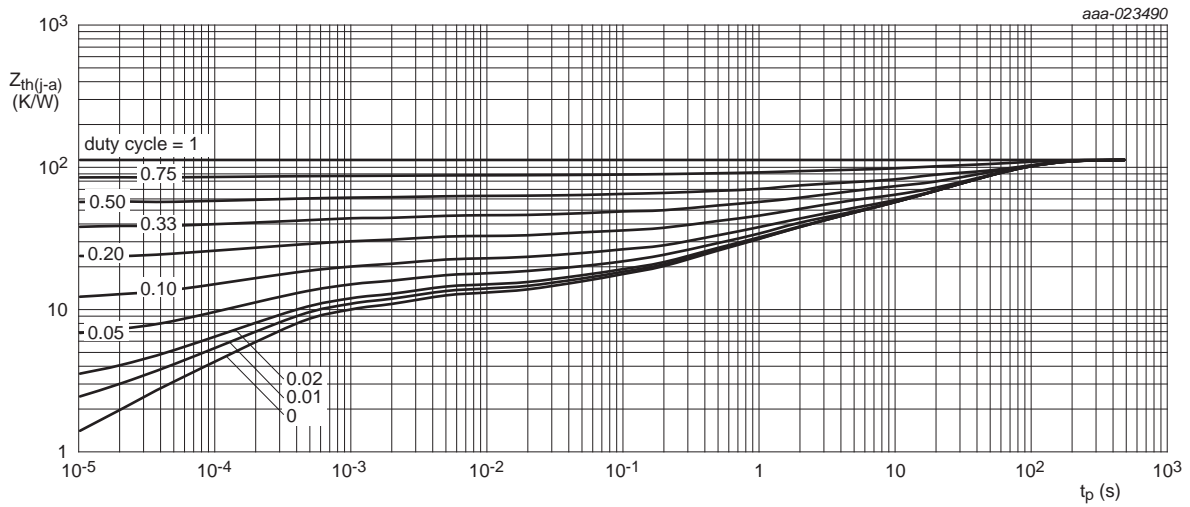
6. Thermal characteristics

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]	-	-	209	K/W
			[2]	-	-	125	K/W
			[3]	-	-	97	K/W
			[4]	-	-	97	K/W
			[5]	-	-	70	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	18	K/W	

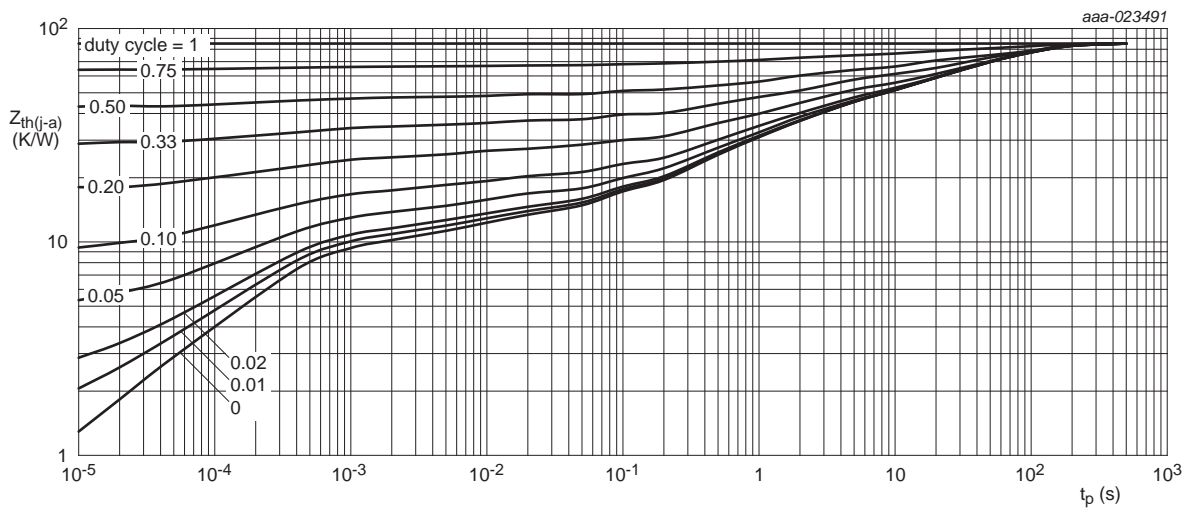
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 1 cm².
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 6 cm².
- [4] 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 cm².





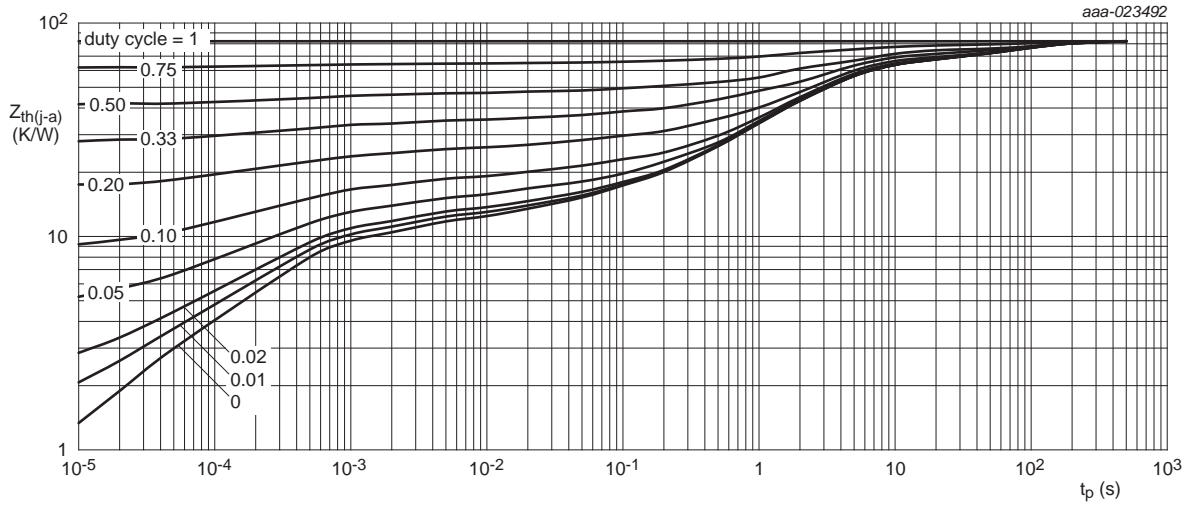
FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 1 cm²

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



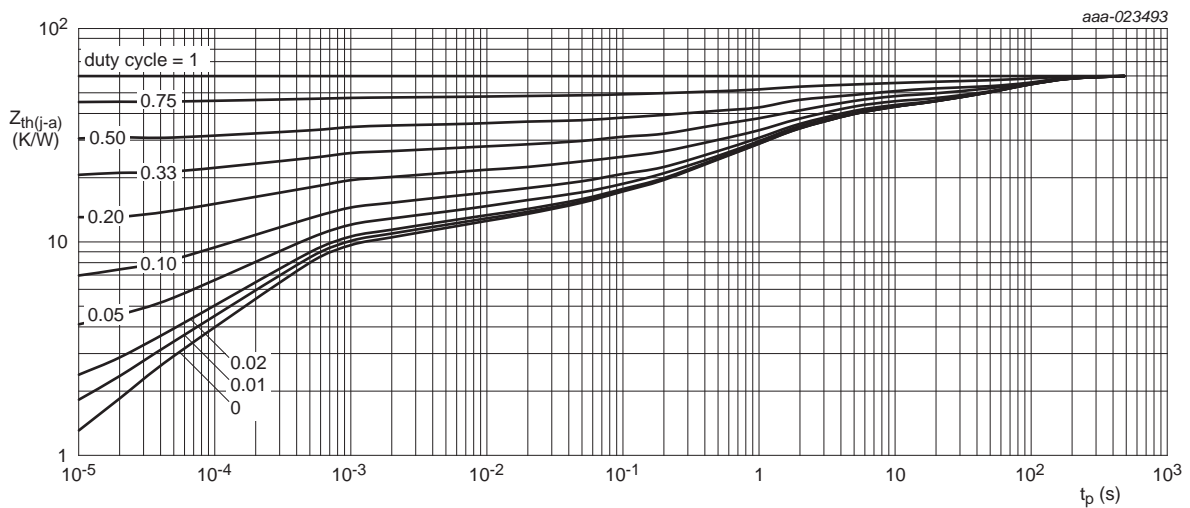
FR4 PCB, single-sided copper, tin-plated; mounting pad for collector 6 cm²

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^2

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

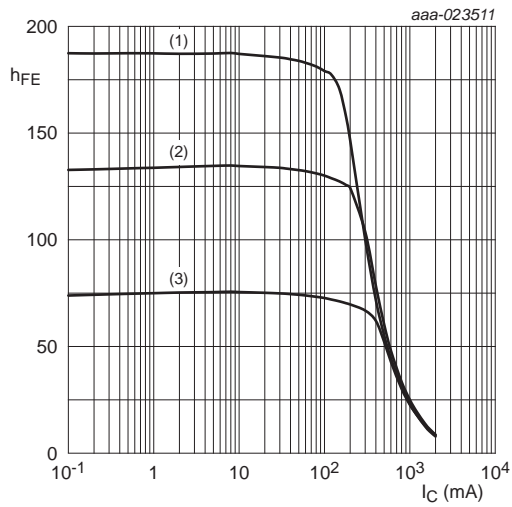
7. Characteristics

Table 8. Characteristics

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

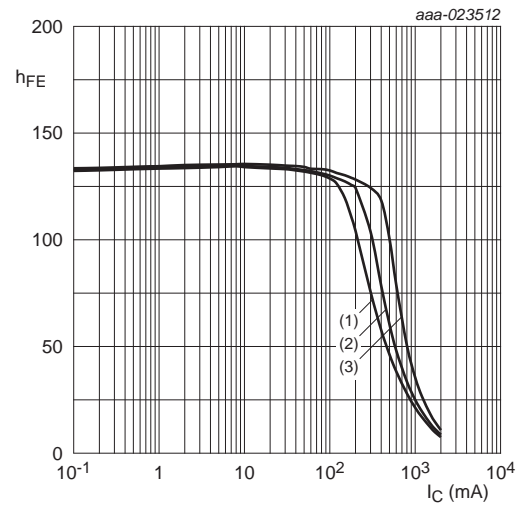
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	-	-	10	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
h_{FE}	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: $t_p \leq 300\text{ }\mu\text{s}; \delta = 0.02$



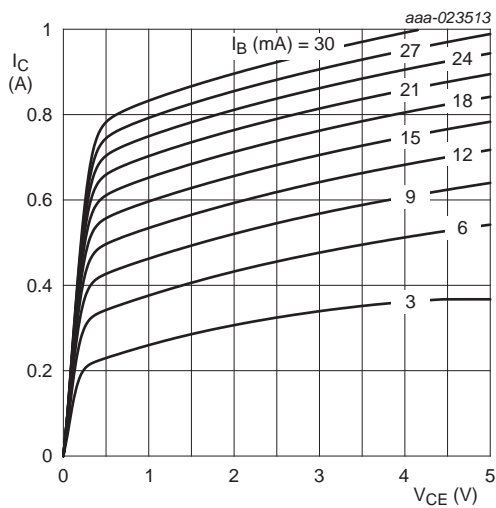
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



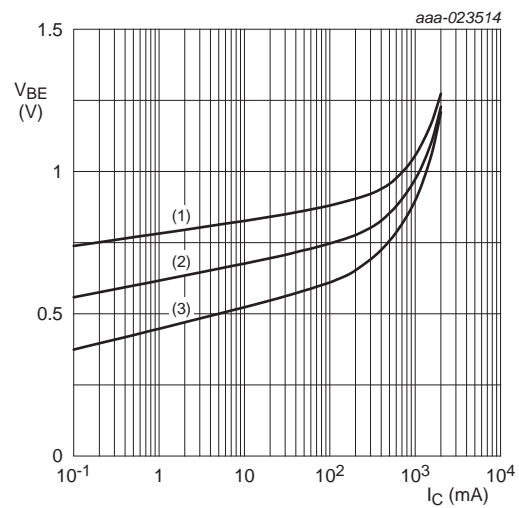
$T_{amb} = 25\text{ °C}$
 (1) $V_{CE} = 1\text{ V}$
 (2) $V_{CE} = 2\text{ V}$
 (3) $V_{CE} = 5\text{ V}$

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



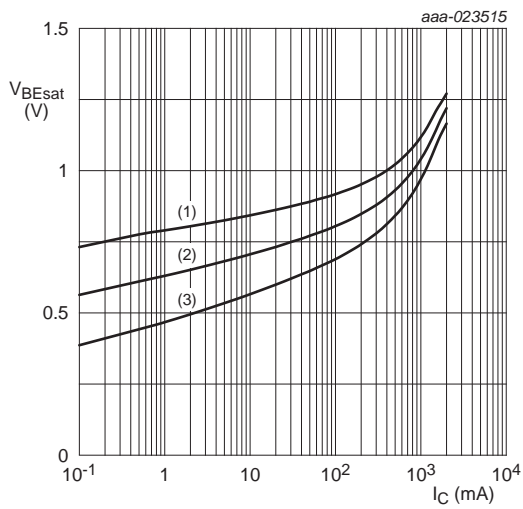
$T_{amb} = 25\text{ °C}$

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



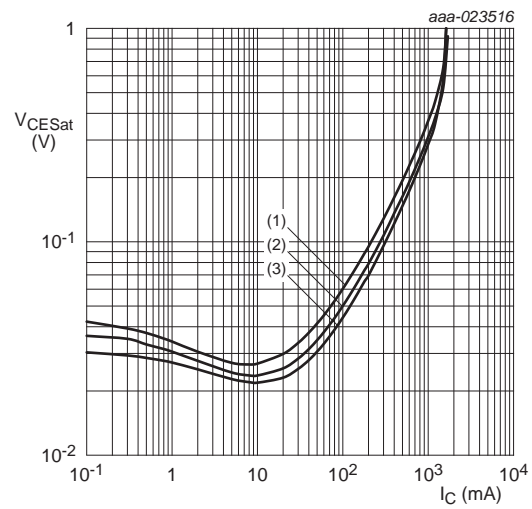
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



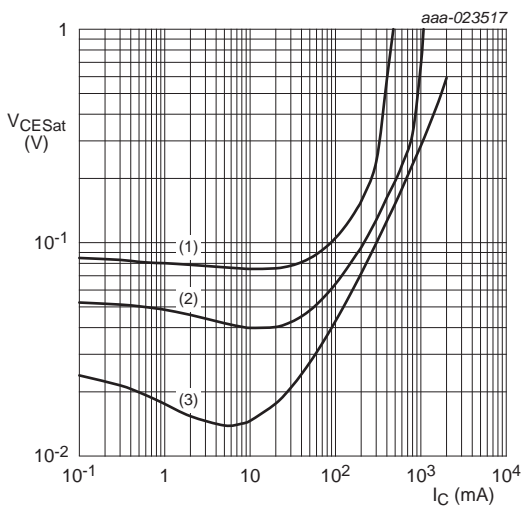
$I_C/I_B = 10$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



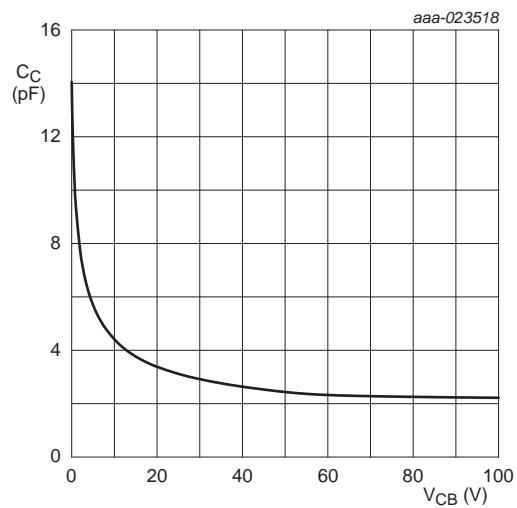
$I_C/I_B = 10$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



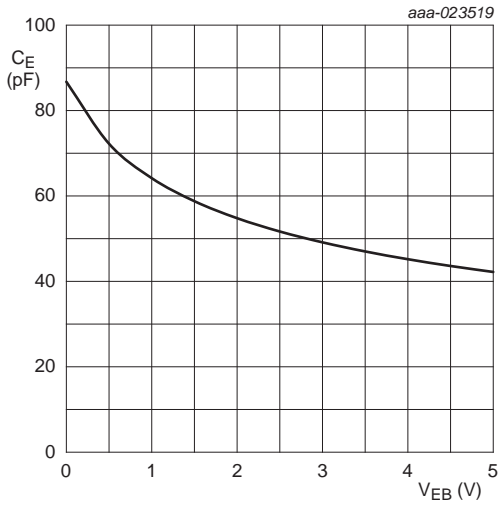
$T_{amb} = 25\text{ °C}$
 (1) $I_C/I_B = 50$
 (2) $I_C/I_B = 20$
 (3) $I_C/I_B = 5$

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



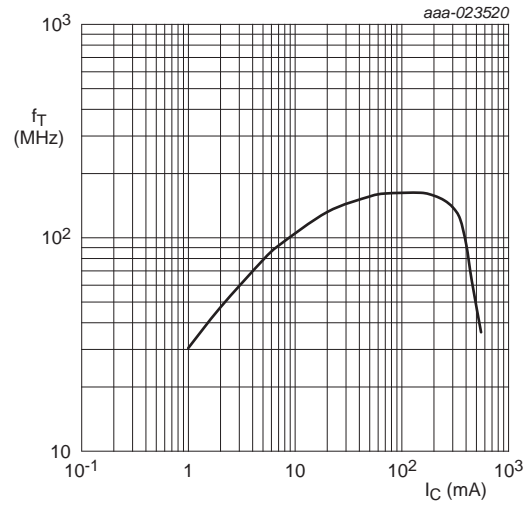
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

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

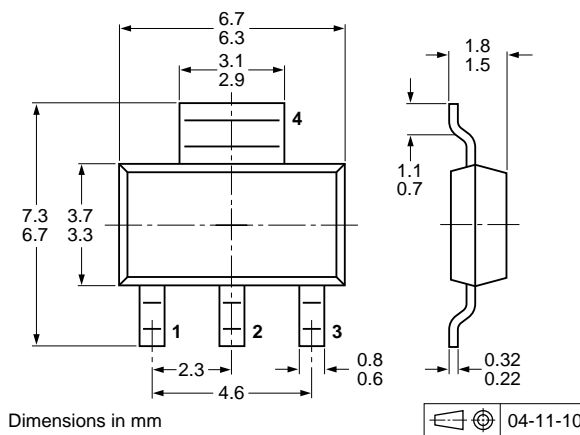


Fig 18. Package outline SOT223 (SC-73)

10. Soldering

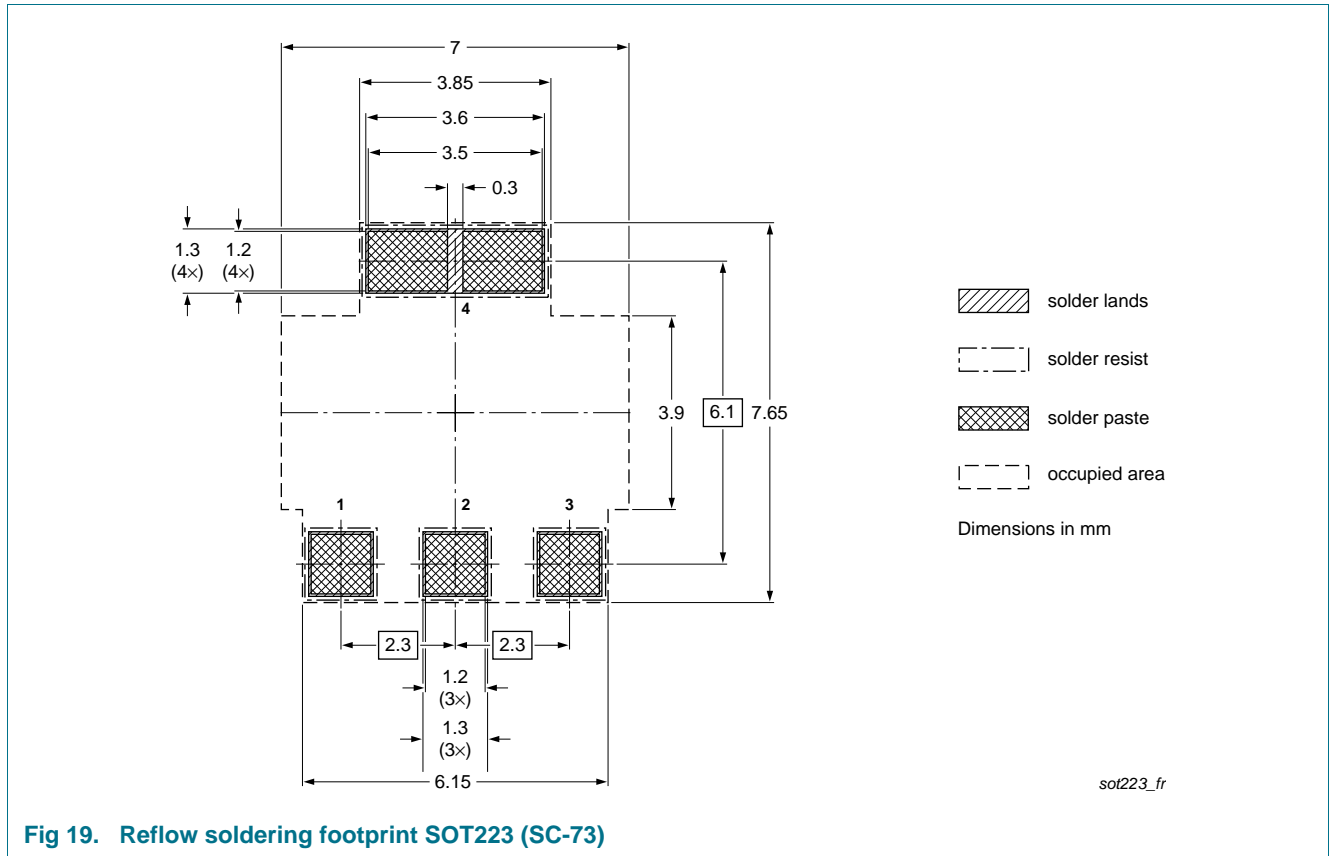


Fig 19. Reflow soldering footprint SOT223 (SC-73)

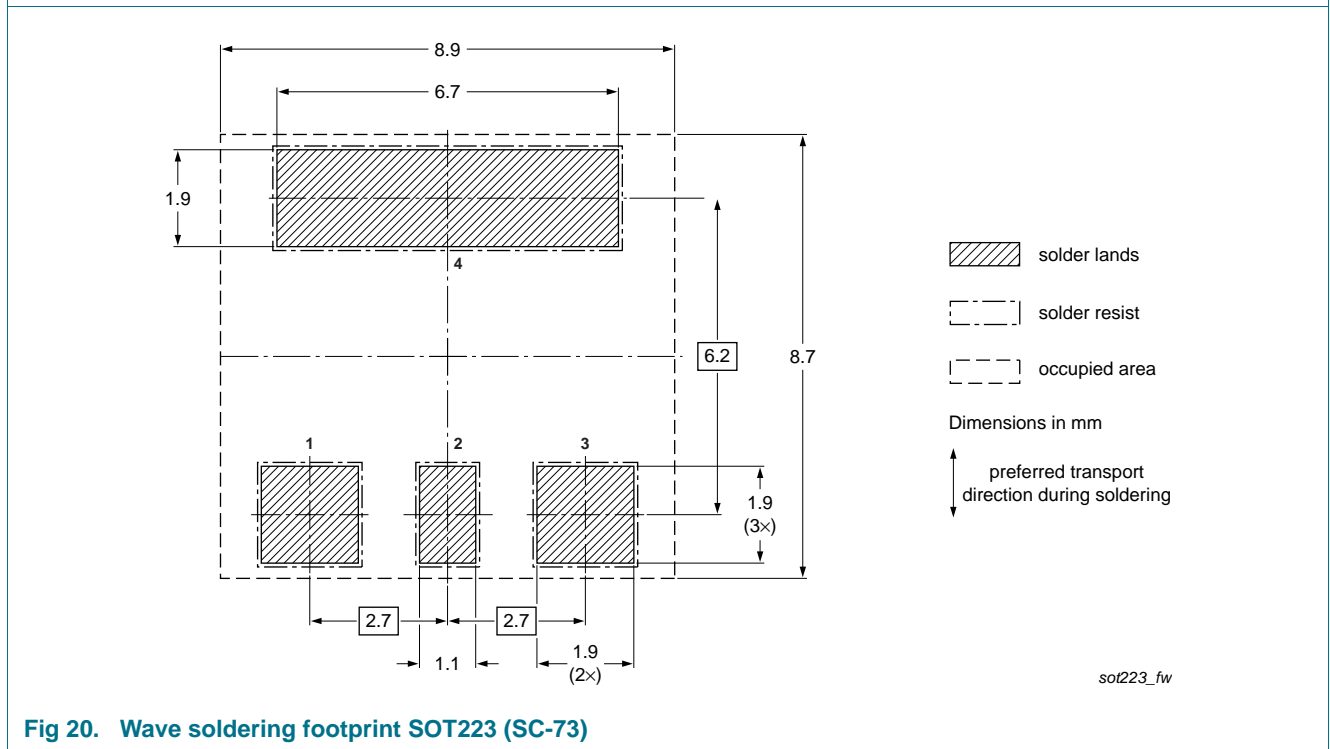


Fig 20. Wave soldering footprint SOT223 (SC-73)

11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BCP56T_SER v.1	20160705	Product data sheet	-	-

12. Legal information

12.1 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.
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[2] The term 'short data sheet' is explained in section "Definitions".

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13. Contact information

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