



# BCP54T series

45 V, 1 A NPN medium power transistors

Rev. 1 — 29 April 2019

Product data sheet

## 1. Product profile

### 1.1. General description

NPN medium power transistors in a medium power SOT223 (SC73) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	Package		NPN complement
	Nexperia	JEDEC	
BCP54T	SOT223	SC-73	BCP51T
BCP54-10T			BCP51-10T
BCP54-16T			BCP51-16T

### 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
- High-side switches
- Power management
- Amplifiers

### 1.4. Quick reference data

Table 2. Quick reference data

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

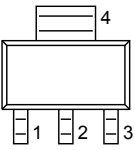
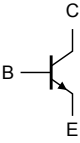
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	45	V
$I_C$	collector current		-	-	1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	-	2	A

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$h_{FE}$	DC current gain						
	BCP54T	$V_{CE} = 2 \text{ V}; I_C = 150 \text{ mA}$	[1]	63	-	250	
	BCP54-10T		[1]	63	-	160	
BCP54-16T	[1]		100	-	250		

[1] pulsed;  $t_p \leq 300 \mu\text{s}$ ;  $\delta \leq 0.02$

## 2. Pinning information

Table 3. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		 sym123
2	C	collector		
3	E	emitter		
4	C	collector		

## 3. Ordering information

Table 4. Ordering information

Type number	Package		Version
	Name	Description	
BCP54T	SC-73	plastic, surface-mounted package with increased heatsink; 4 leads	SOT223
BCP54-10T			
BCP54-16T			

## 4. Marking

Table 5. Marking

Type number	Marking code
BCP54T	BCP54T
BCP54-10T	P5410T
BCP54-16T	P5416T

## 5. Limiting values

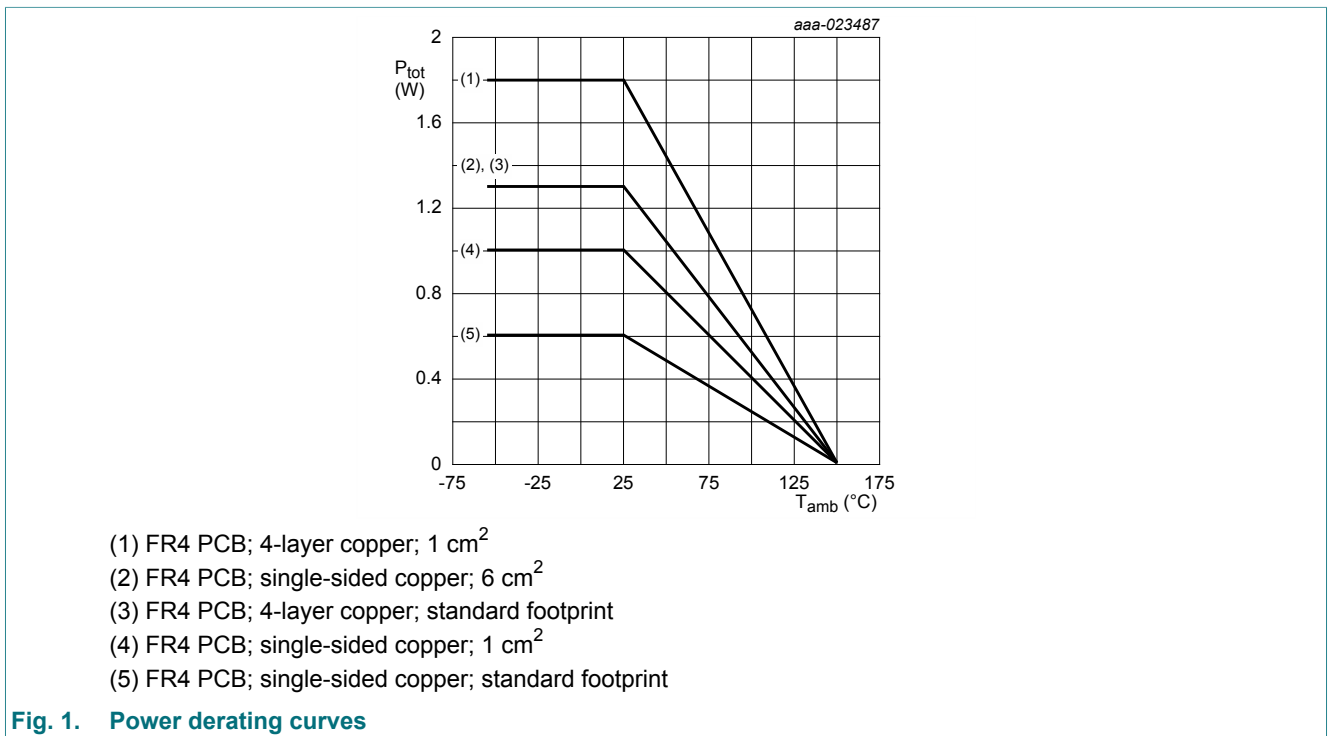
**Table 6. Limiting values**

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

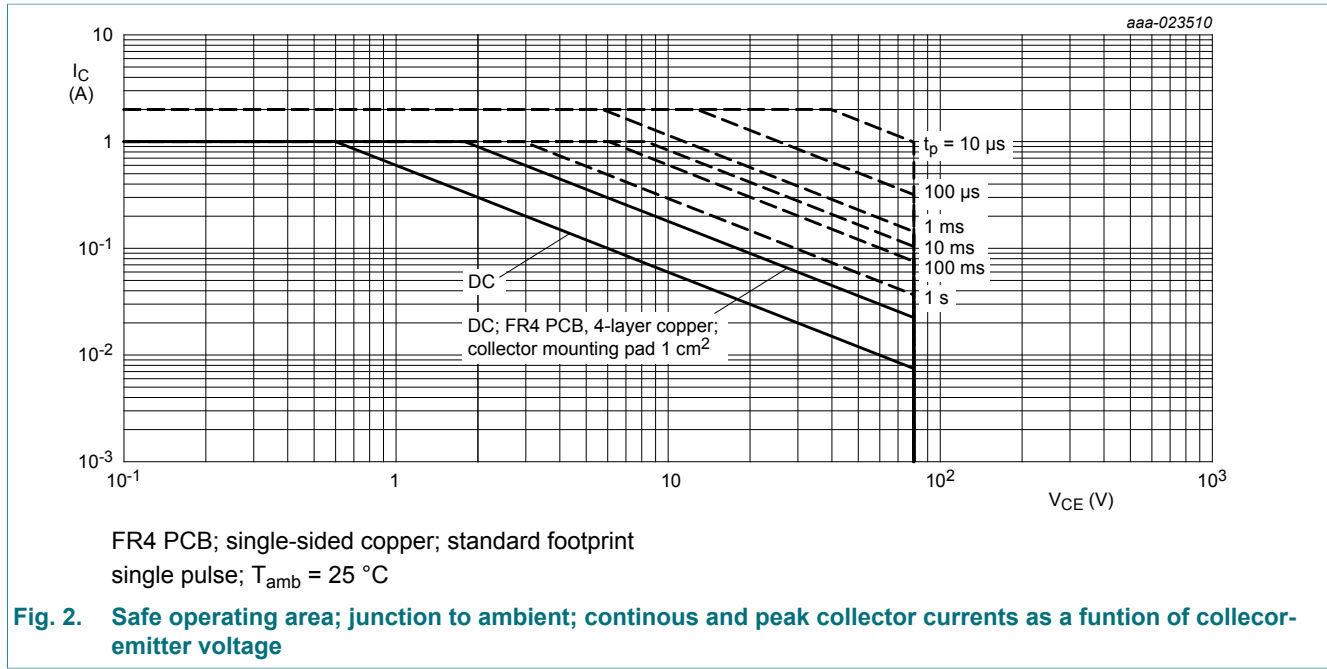
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CBO}$	collector-base voltage	open emitter	-	45	V
$V_{CEO}$	collector-emitter voltage	open base	-	45	V
$V_{EBO}$	emitter-base voltage	open collector	-	5	V
$I_C$	collector current		-	1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	2	A
$I_B$	base current		-	0.2	A
$I_{BM}$	peak base current	single pulse; $t_p \leq 1\text{ ms}$	-	0.3	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[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 Printed-Circuit-Board (PCB); single-sided copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated; mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on an FR4 Printed-Circuit-Board (PCB); 4-layer copper; tin-plated and standard footprint.
- [5] Device mounted on an FR4 Printed-Circuit-Board (PCB); 4-layer copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>.



**Fig. 1. Power derating curves**



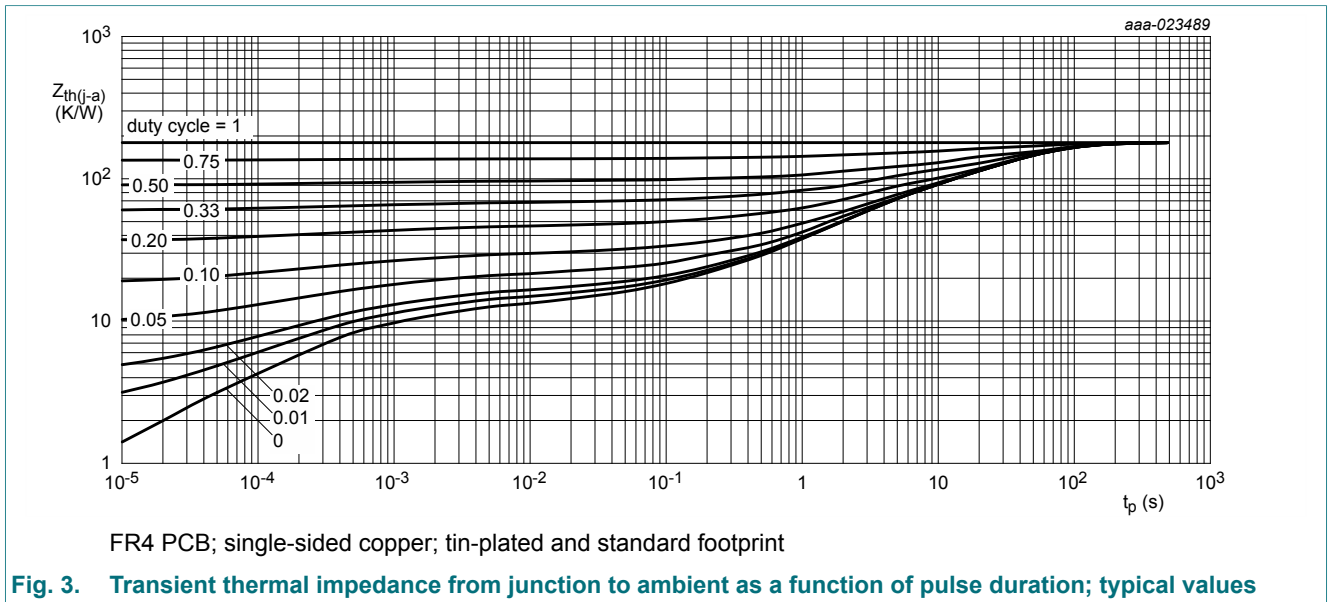
## 6. Thermal characteristics

**Table 7. Thermal characteristics**

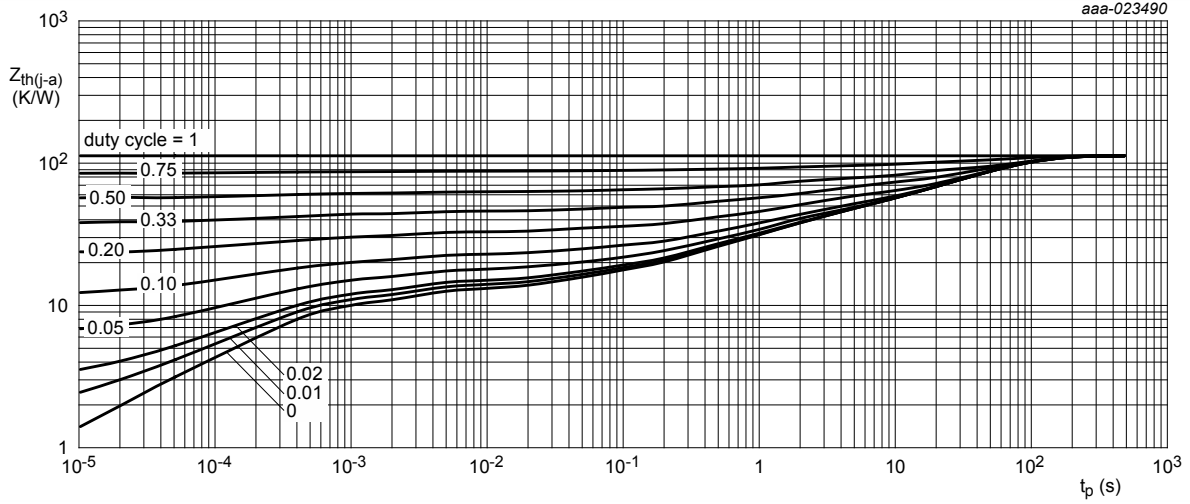
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

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
$R_{(j-sp)}$	thermal resistance from junction to solder point			-	-	18	K/W

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

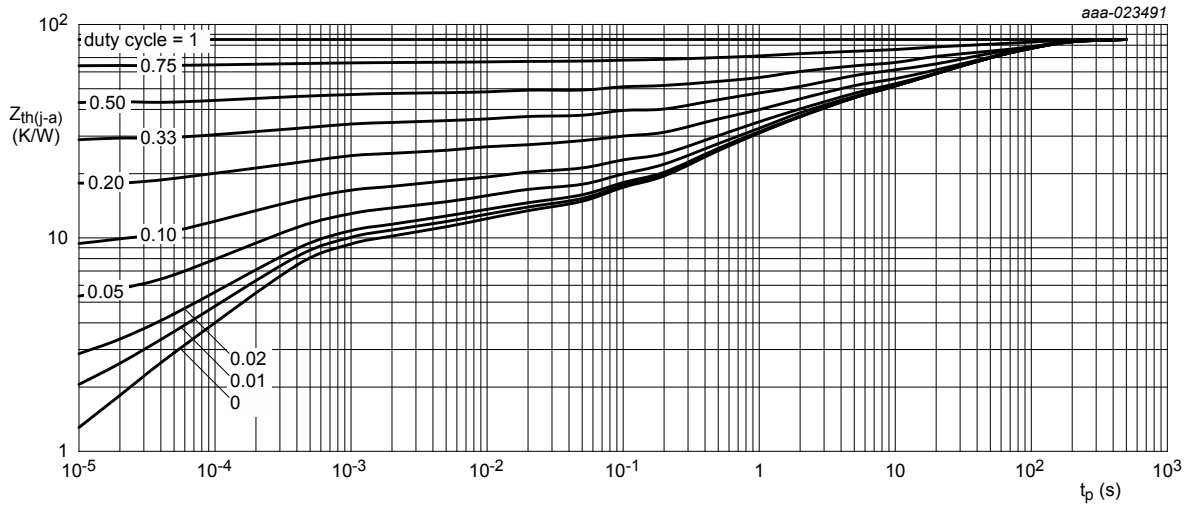


**Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



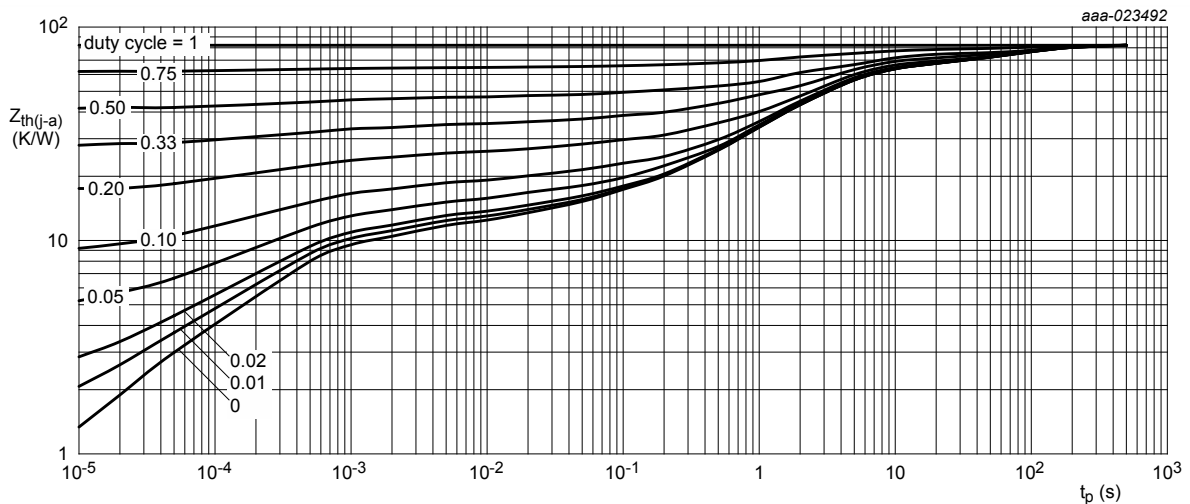
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>

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



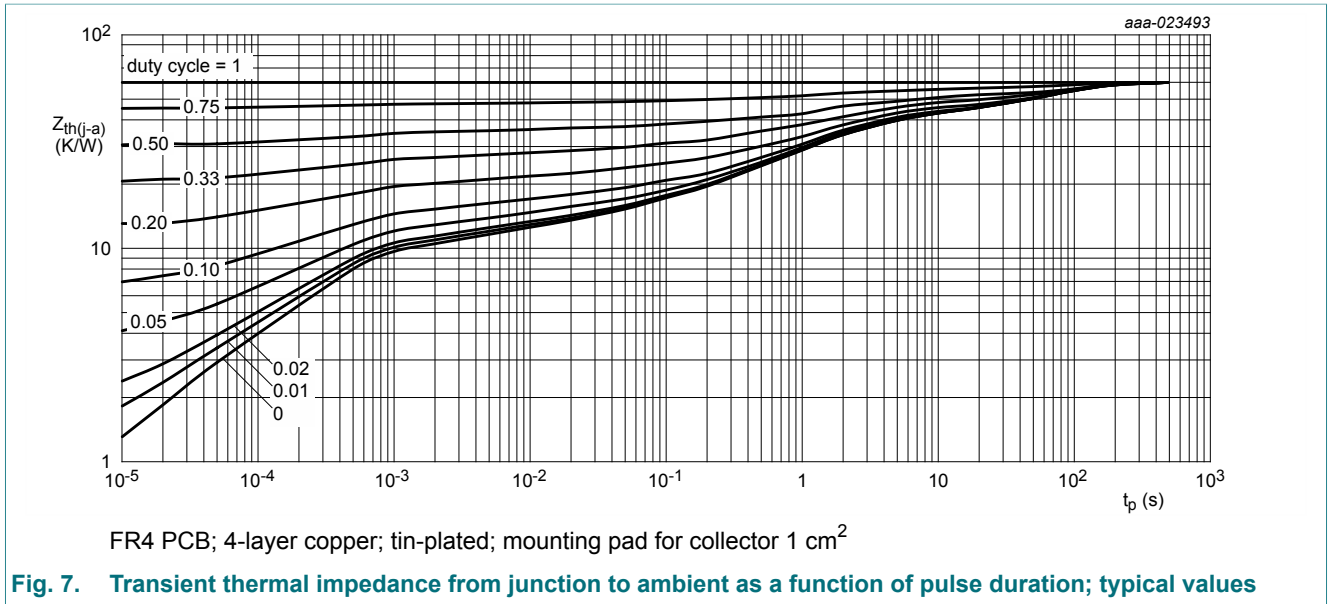
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 6 cm<sup>2</sup>

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



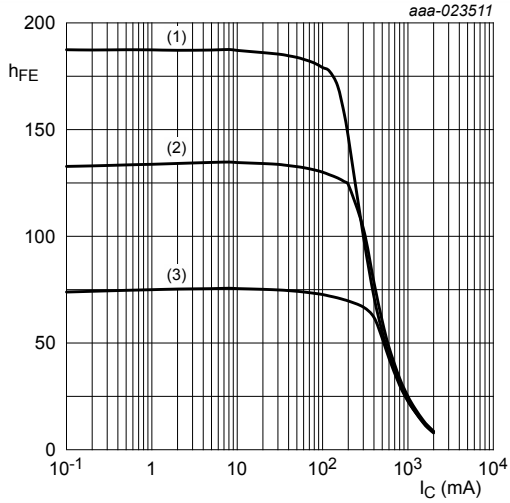
## 7. Characteristics

**Table 8. Characteristics**

*T<sub>amb</sub> = 25 °C unless otherwise specified.*

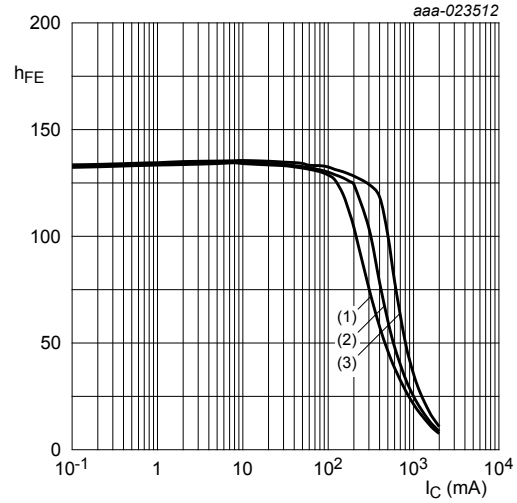
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>(BR)CBO</sub>	collector-base breakdown voltage	I <sub>C</sub> = 100 μA; I <sub>E</sub> = 0 A	45	-	-	V
V <sub>(BR)CEO</sub>	collector-emitter breakdown voltage	I <sub>C</sub> = 2 mA; I <sub>E</sub> = 0 A	45	-	-	V
V <sub>(BR)EBO</sub>	emitter-base breakdown voltage	I <sub>E</sub> = 100 μA; I <sub>C</sub> = 0 A	5	-	-	V
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 30 V; I <sub>E</sub> = 0 A	-	-	100	nA
		V <sub>CB</sub> = 30 V; I <sub>E</sub> = 0 A; T <sub>J</sub> = 150 °C	-	-	10	μA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A	-	-	100	nA
h <sub>FE</sub>	DC current gain					
	BCP54T, -10T, -16T	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 5 mA	63	-	-	
		V <sub>CE</sub> = 2 V; I <sub>C</sub> = 500 mA	[1] 40	-	-	
	BCP54T	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 150 mA	[1] 63	-	250	
	BCP54-10T	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 150 mA	[1] 63	-	160	
	BCP54-16T	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 150 mA	[1] 100	-	250	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 500 mA; I <sub>B</sub> = 50 mA	[1] -	-	500	mV
V <sub>BE</sub>	base-emitter voltage	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 500 mA	[1] -	-	1	V
f <sub>T</sub>	transition frequency	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 50 mA; f = 100 MHz	100	155	-	MHz
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = 10 V; I <sub>E</sub> = i <sub>e</sub> = 0 A; f = 1 MHz	-	4.5	-	pF

[1] pulsed; t<sub>p</sub> ≤ 300 μs; δ ≤ 0.02



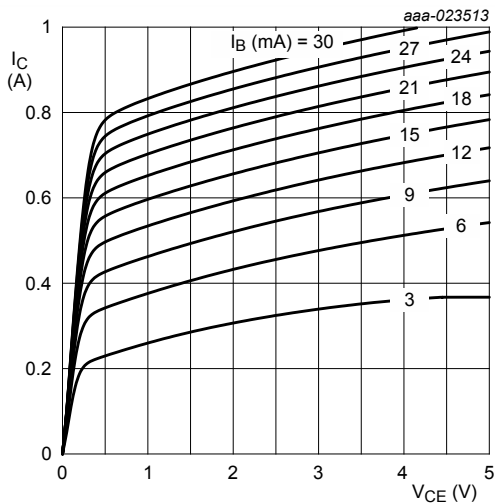
$V_{CE} = 2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25\text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



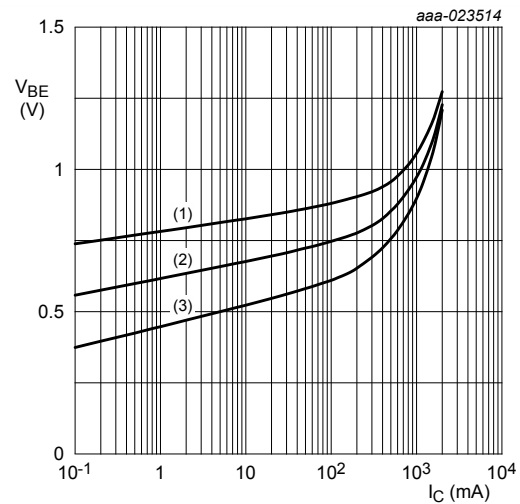
$T_{amb} = 25\text{ }^\circ\text{C}$   
 (1)  $V_{CE} = 1\text{ V}$   
 (2)  $V_{CE} = 2\text{ V}$   
 (3)  $V_{CE} = 5\text{ V}$

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



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

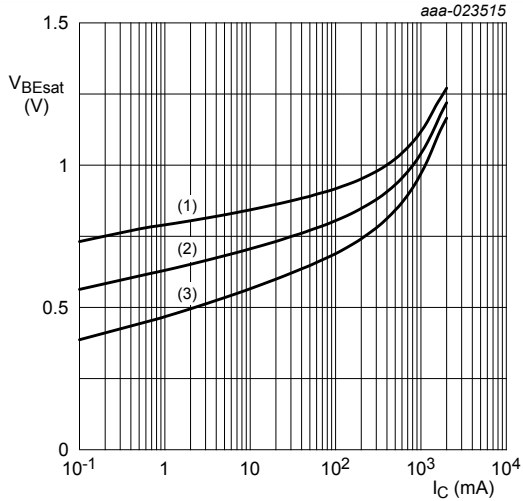
Fig. 10. Collector current as a function of collector-emitter voltage; typical values



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

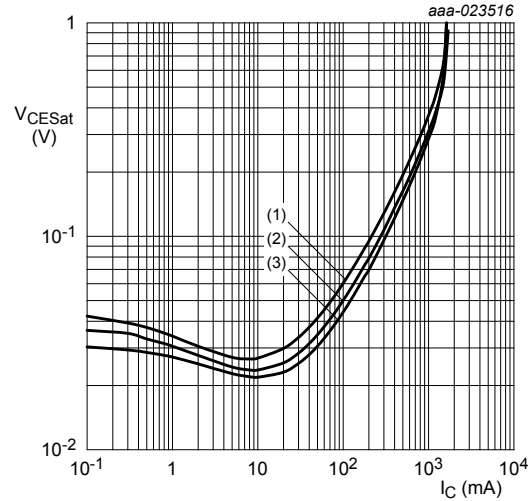
Fig. 11. Base-emitter voltage as a function of collector current; typical values





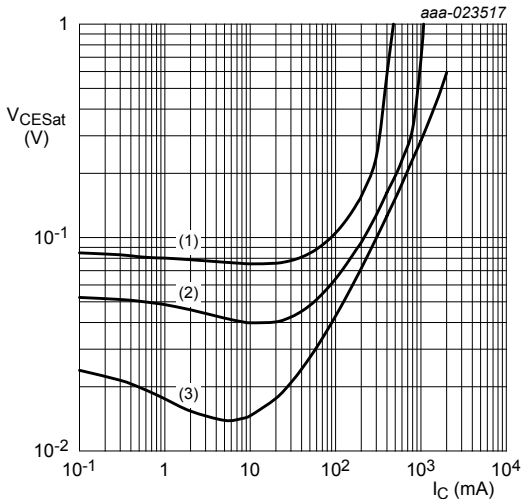
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



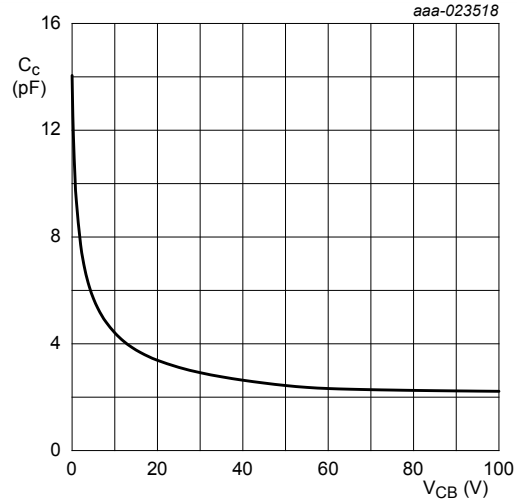
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



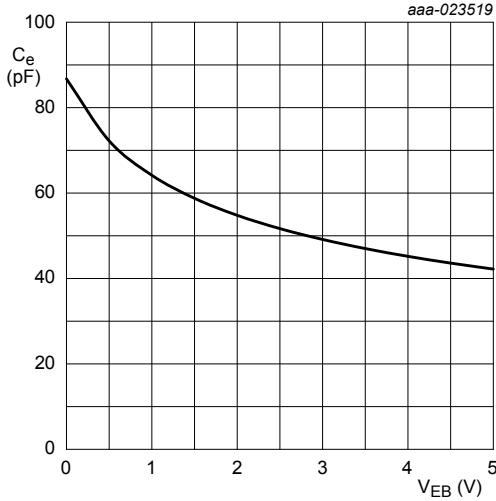
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 50$   
 (2)  $I_C/I_B = 20$   
 (3)  $I_C/I_B = 5$

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



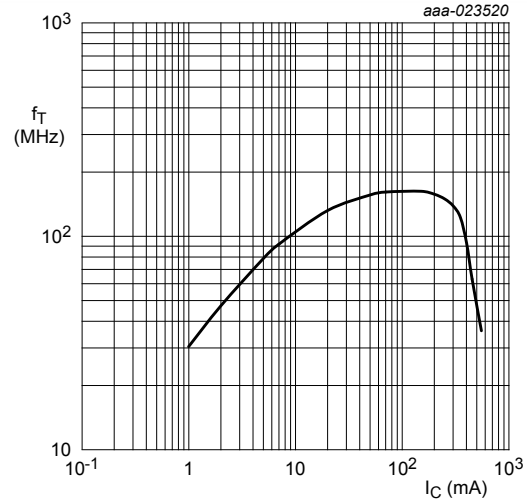
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

**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

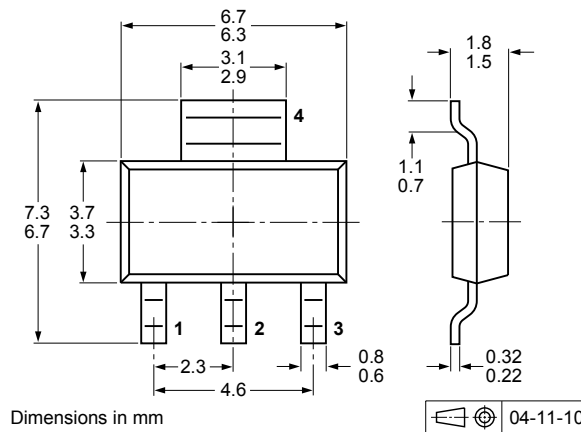
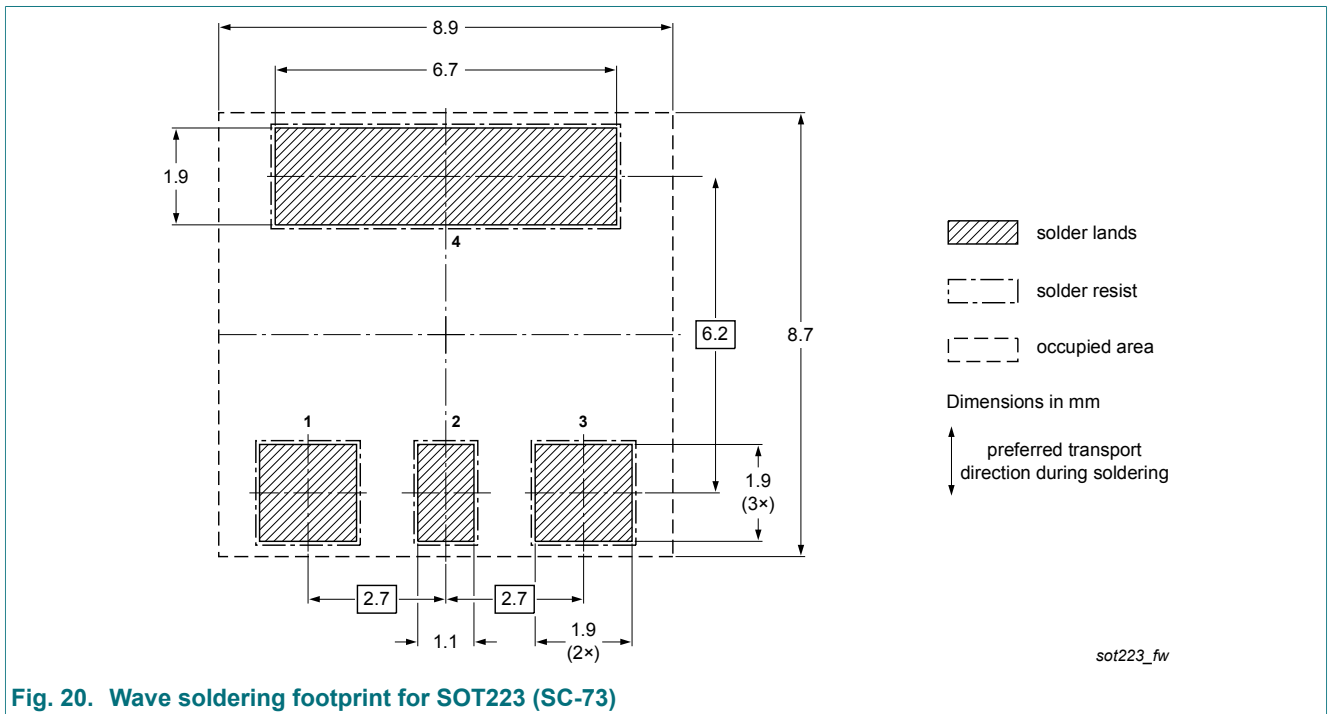
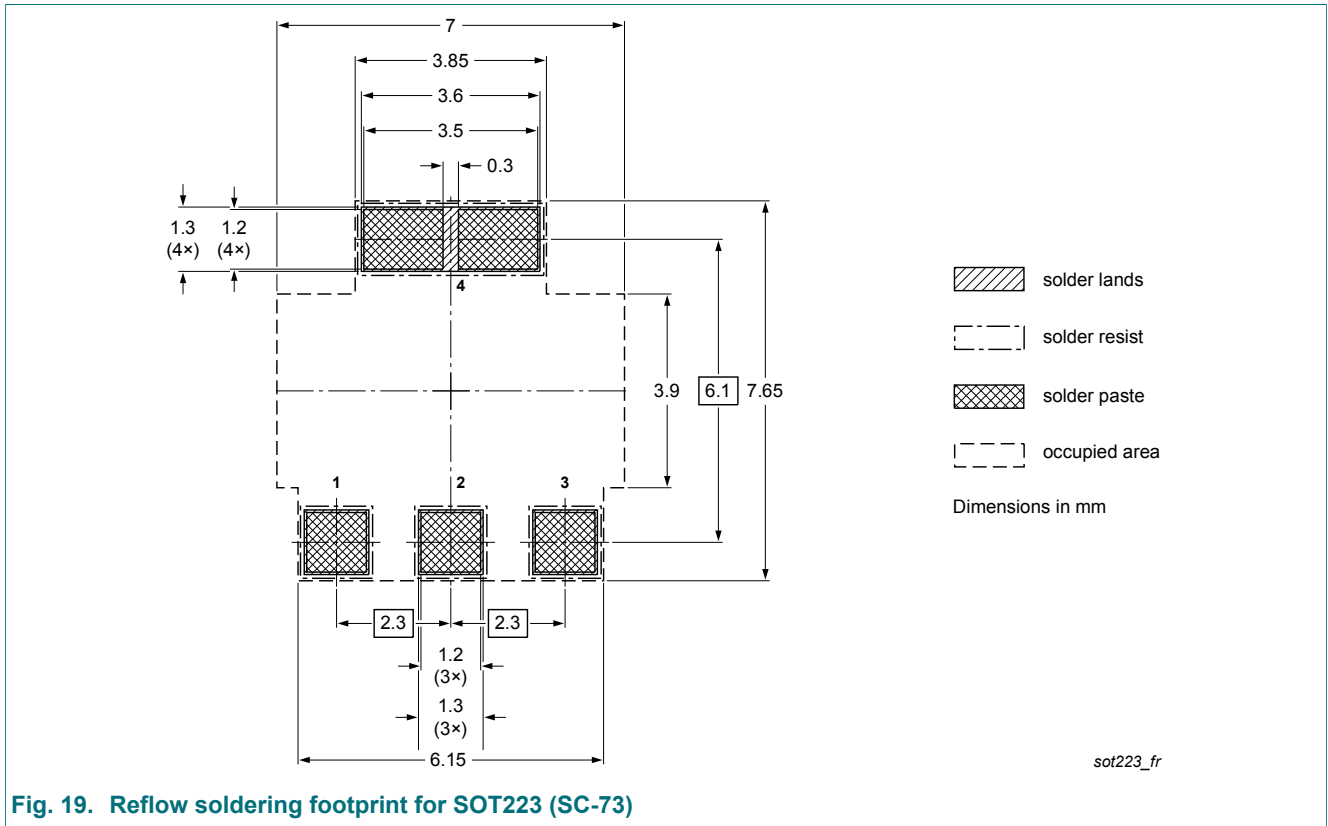


Fig. 18. Package outline SOT223 (SC-73)

10. Soldering



## 11. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BCP54T_SER v.1	20190429	Product data sheet	-	-

## 12. 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.

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