

# 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.

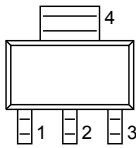
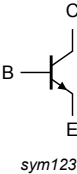
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	45	V
$I_C$	collector current		-	-	1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	-	2	A

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
h <sub>FE</sub>	DC current gain						
	BCP54T	V <sub>CE</sub> = 2 V; I <sub>C</sub> = 150 mA	[1]	63	-	250	
	BCP54-10T		[1]	63	-	160	
	BCP54-16T		[1]	100	-	250	

[1] pulsed; t<sub>p</sub> ≤ 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		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

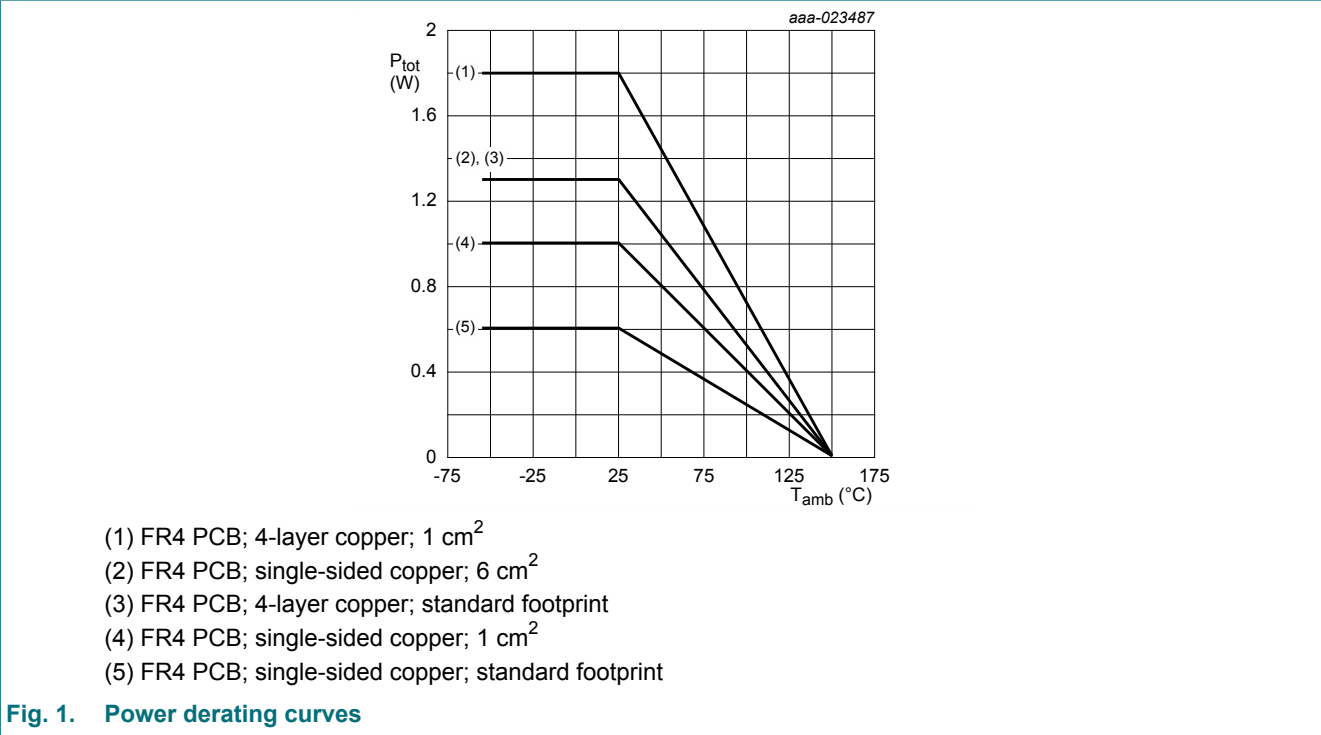
Table 6. Limiting values

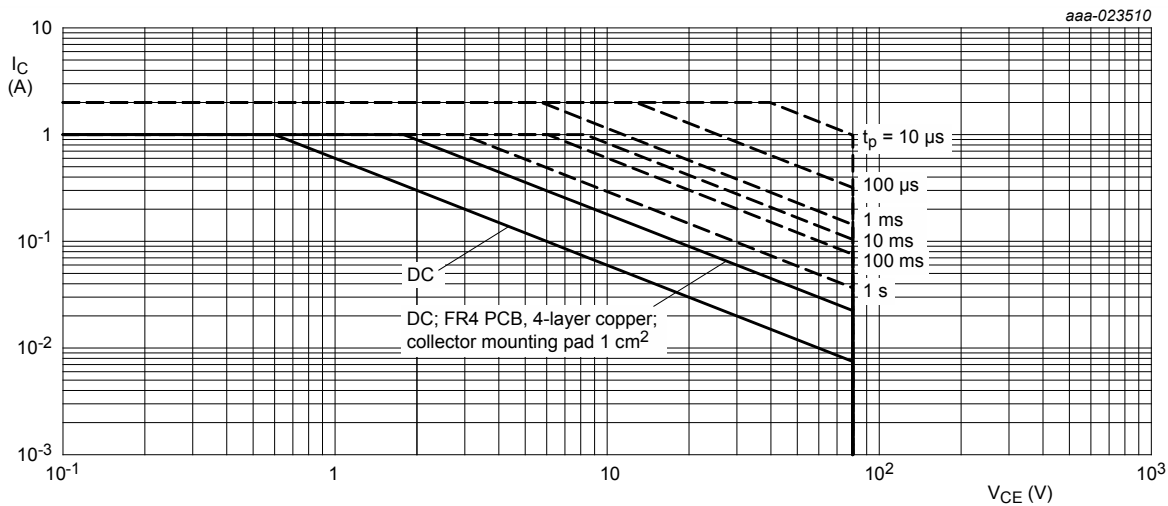
In accordance with the Absolute Maximum Rating System (IEC 60134).

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CBO</sub>	collector-base voltage	open emitter	-	45	V
V <sub>CEO</sub>	collector-emitter voltage	open base	-	45	V
V <sub>EBO</sub>	emitter-base voltage	open collector	-	5	V
I <sub>C</sub>	collector current		-	1	A
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms	-	2	A
I <sub>B</sub>	base current		-	0.2	A
I <sub>BM</sub>	peak base current	single pulse; t <sub>p</sub> ≤ 1 ms	-	0.3	A
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C [1]	-	0.6	W
		[2]	-	1	W
		[3]	-	1.3	W
		[4]	-	1.3	W
		[5]	-	1.8	W
T <sub>j</sub>	junction temperature		-	150	°C
T <sub>amb</sub>	ambient temperature		-55	150	°C
T <sub>stg</sub>	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>.





FR4 PCB; single-sided copper; standard footprint  
single pulse;  $T_{amb} = 25\text{ }^{\circ}\text{C}$

**Fig. 2.** Safe operating area; junction to ambient; continous and peak collector currents as a funtion of collec-  
emitter voltage

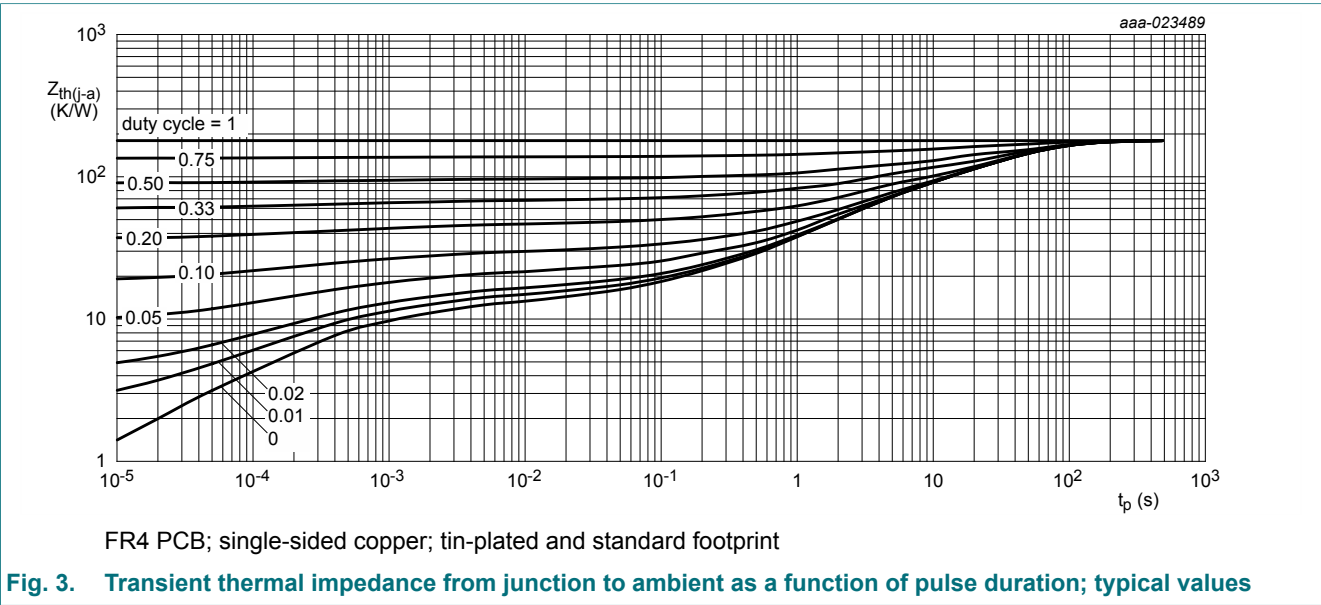
6. Thermal characteristics

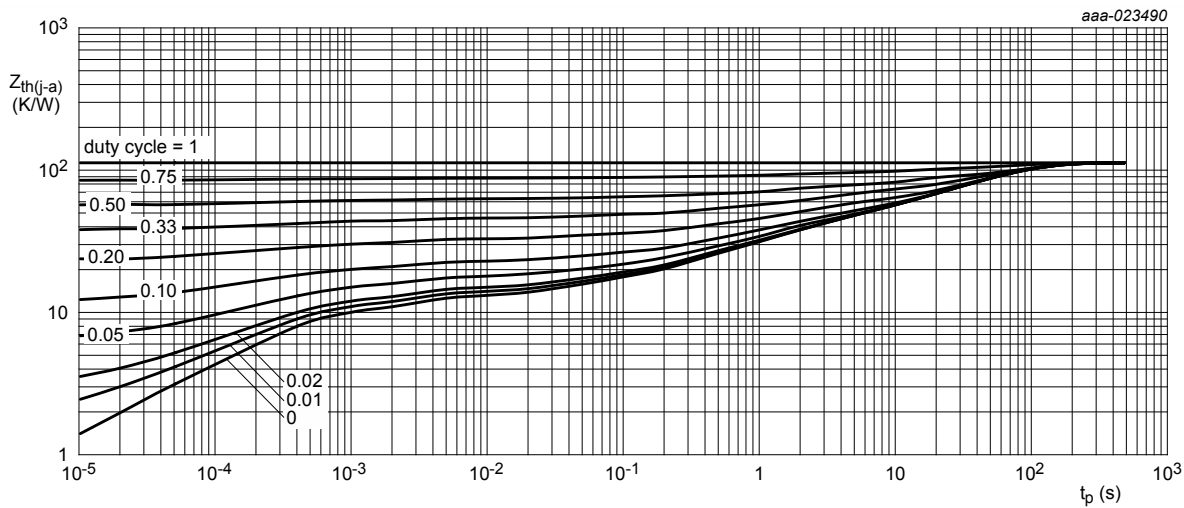
Table 7. Thermal characteristics

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

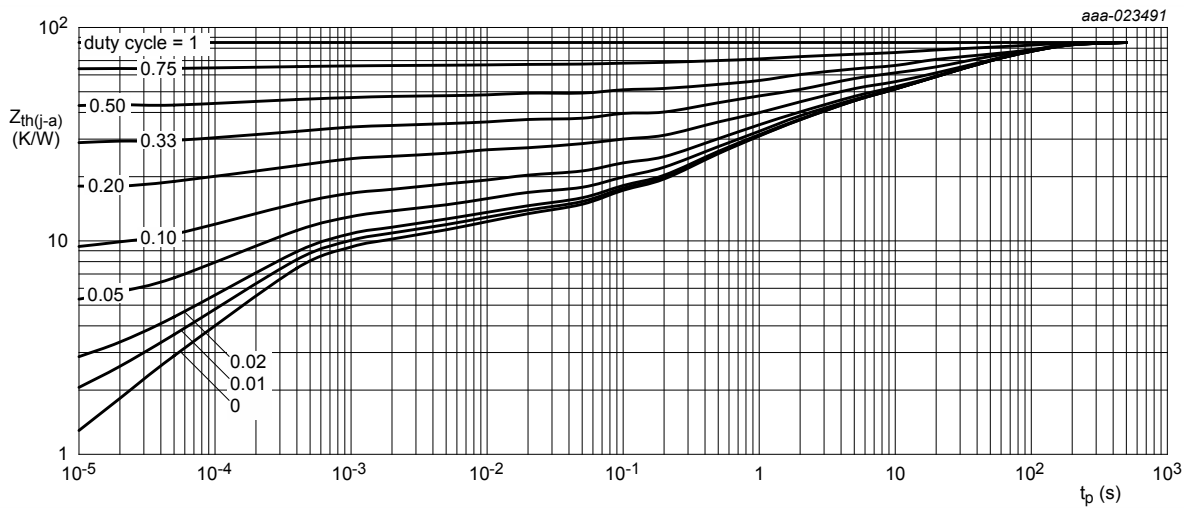
- [1] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated and standard footprint.  
[2] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>.  
[3] Device mounted on an FR4 Printed-Circuit-Board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





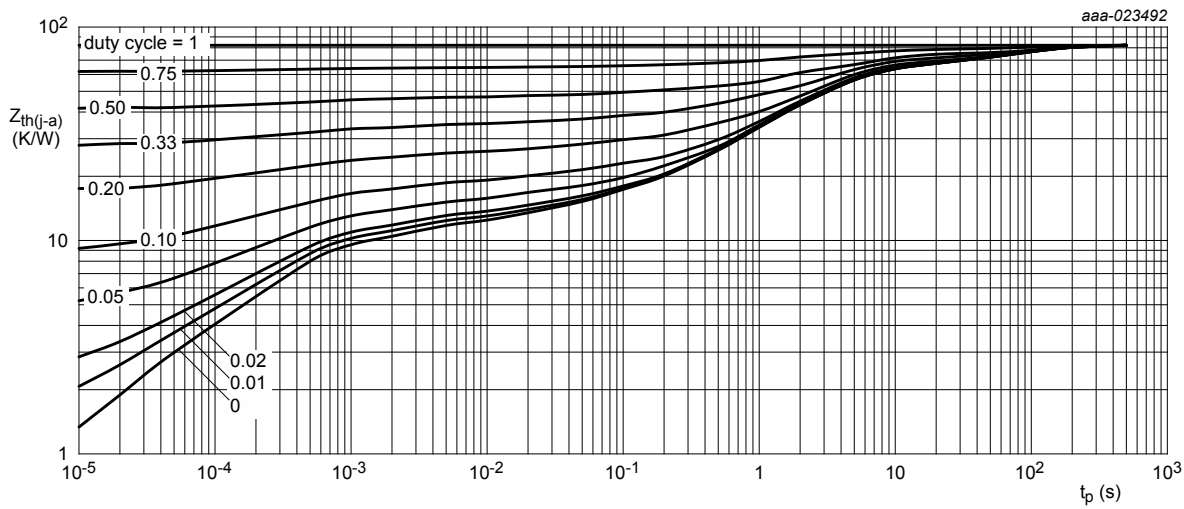
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>

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



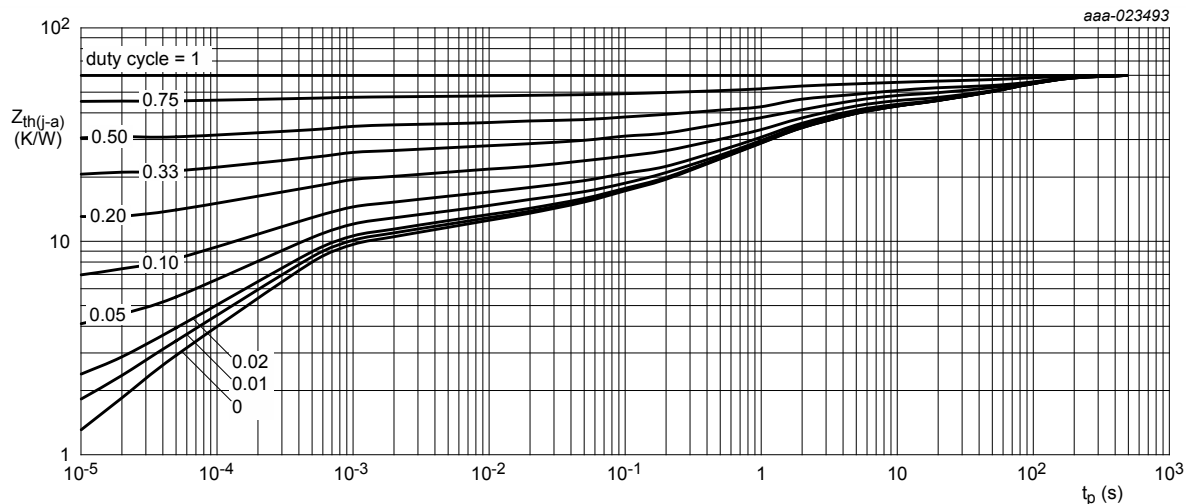
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 6 cm<sup>2</sup>

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
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\text{ }\mu\text{A}$ ; $I_E = 0\text{ A}$	45	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2\text{ mA}$ ; $I_E = 0\text{ A}$	45	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 100\text{ }\mu\text{A}$ ; $I_C = 0\text{ A}$	5	-	-	V
$I_{CBO}$	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					
	BCP54T, -10T, -16T	$V_{CE} = 2\text{ V}$ ; $I_C = 5\text{ mA}$	63	-	-	
		$V_{CE} = 2\text{ V}$ ; $I_C = 500\text{ mA}$	[1] 40	-	-	
	BCP54T	$V_{CE} = 2\text{ V}$ ; $I_C = 150\text{ mA}$	[1] 63	-	250	
	BCP54-10T	$V_{CE} = 2\text{ V}$ ; $I_C = 150\text{ mA}$	[1] 63	-	160	
	BCP54-16T	$V_{CE} = 2\text{ V}$ ; $I_C = 150\text{ mA}$	[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	$V_{CB} = 10\text{ V}$ ; $I_E = i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$	-	4.5	-	pF

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

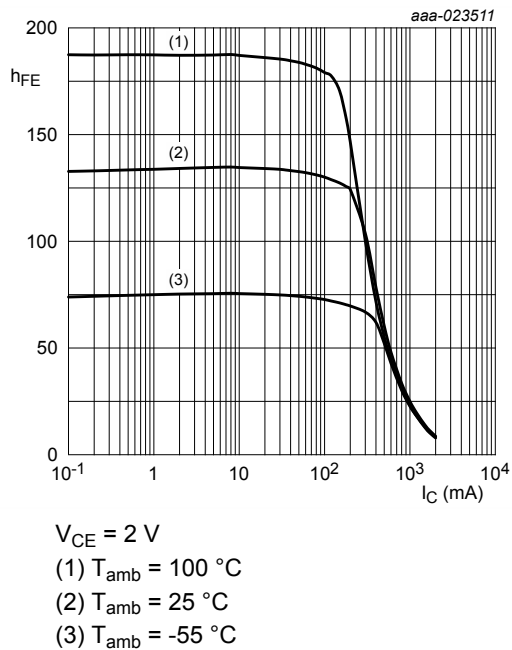


Fig. 8. DC current gain as a function of collector current; typical values

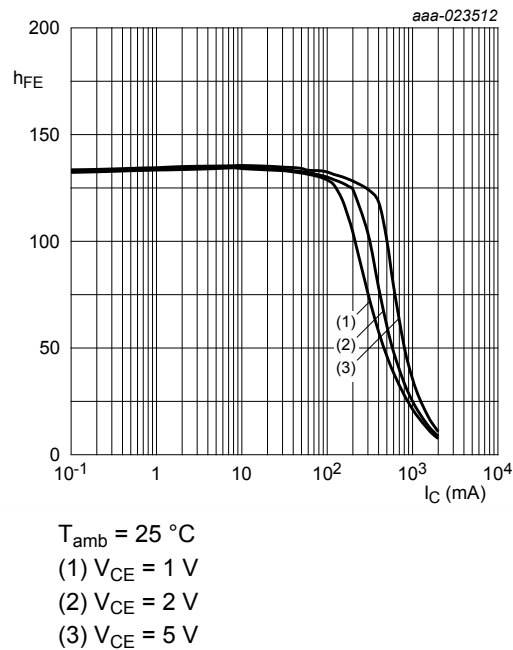


Fig. 9. DC current gain as a function of collector current; typical values

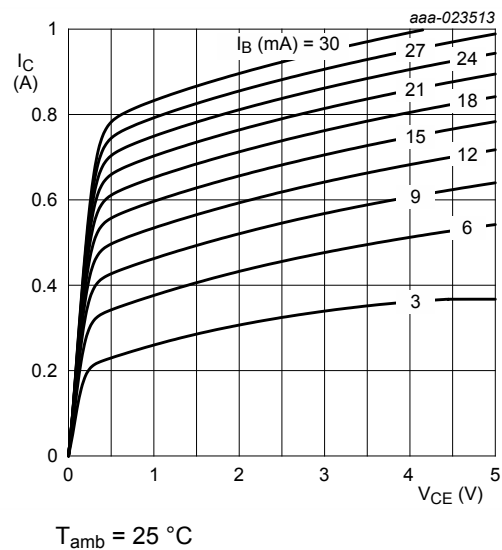


Fig. 10. Collector current as a function of collector-emitter voltage; typical values

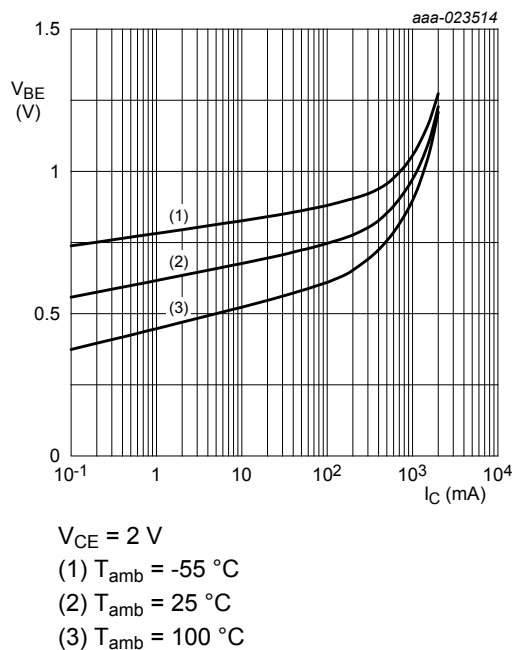


Fig. 11. Base-emitter voltage as a function of collector current; typical values



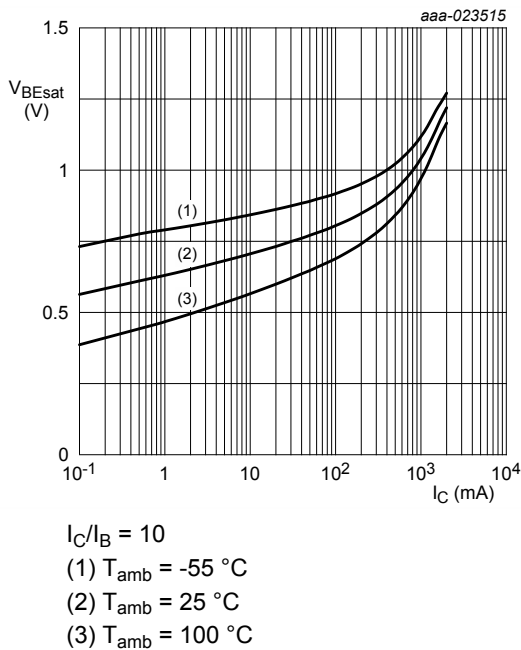


Fig. 12. Base-emitter saturation voltage as a function of collector current; typical values

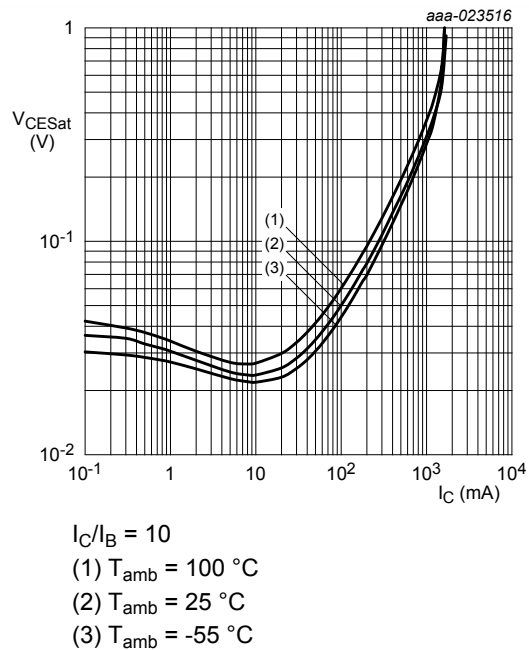


Fig. 13. Collector-emitter saturation voltage as a function of collector current; typical values

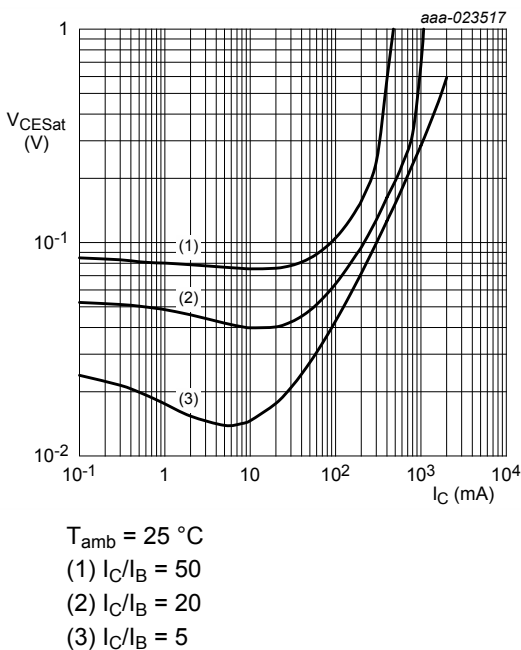


Fig. 14. Collector-emitter saturation voltage as a function of collector current; typical values

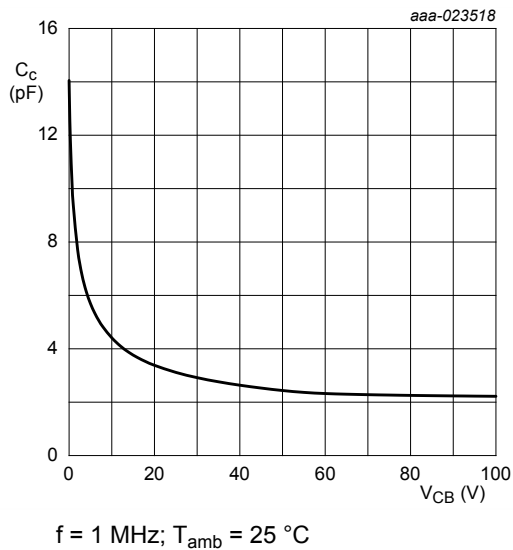


Fig. 15. Collector capacitance as a function of collector-base voltage; typical values

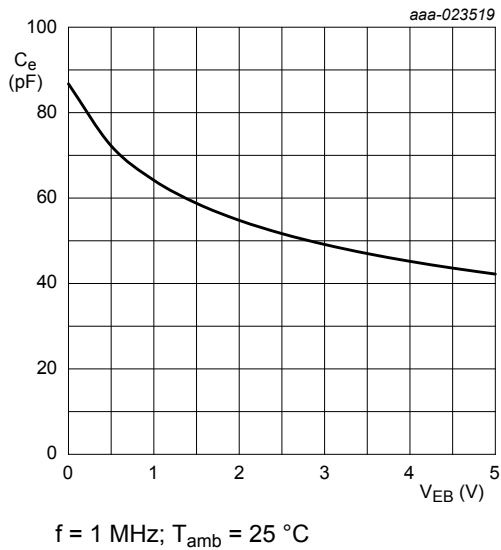


Fig. 16. Emitter capacitance as a function of emitter-base voltage; typical values

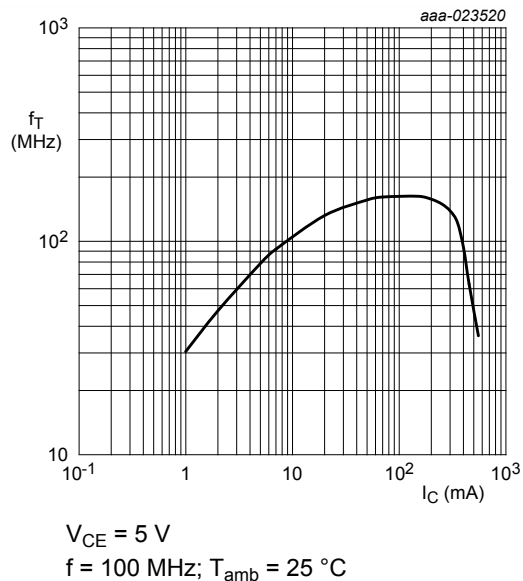


Fig. 17. Transition frequency as a function of collector current; typical values

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

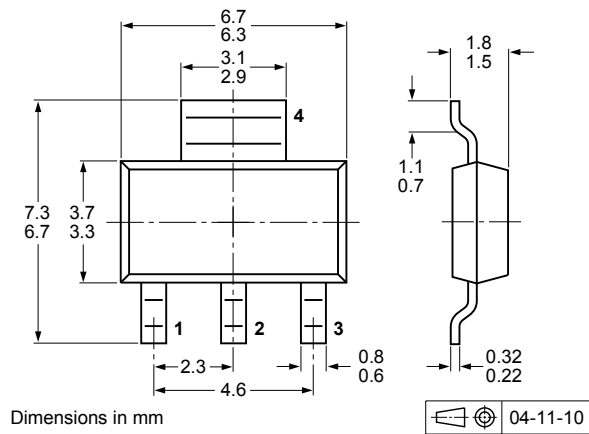
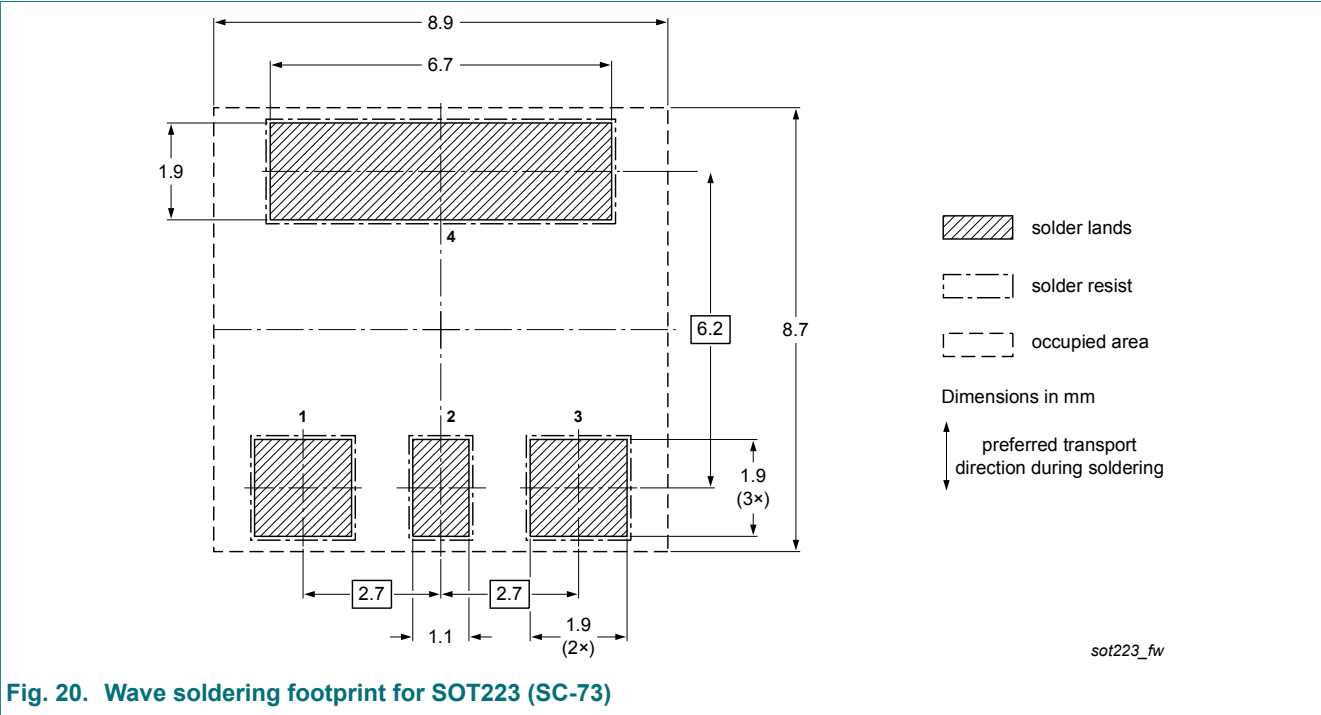
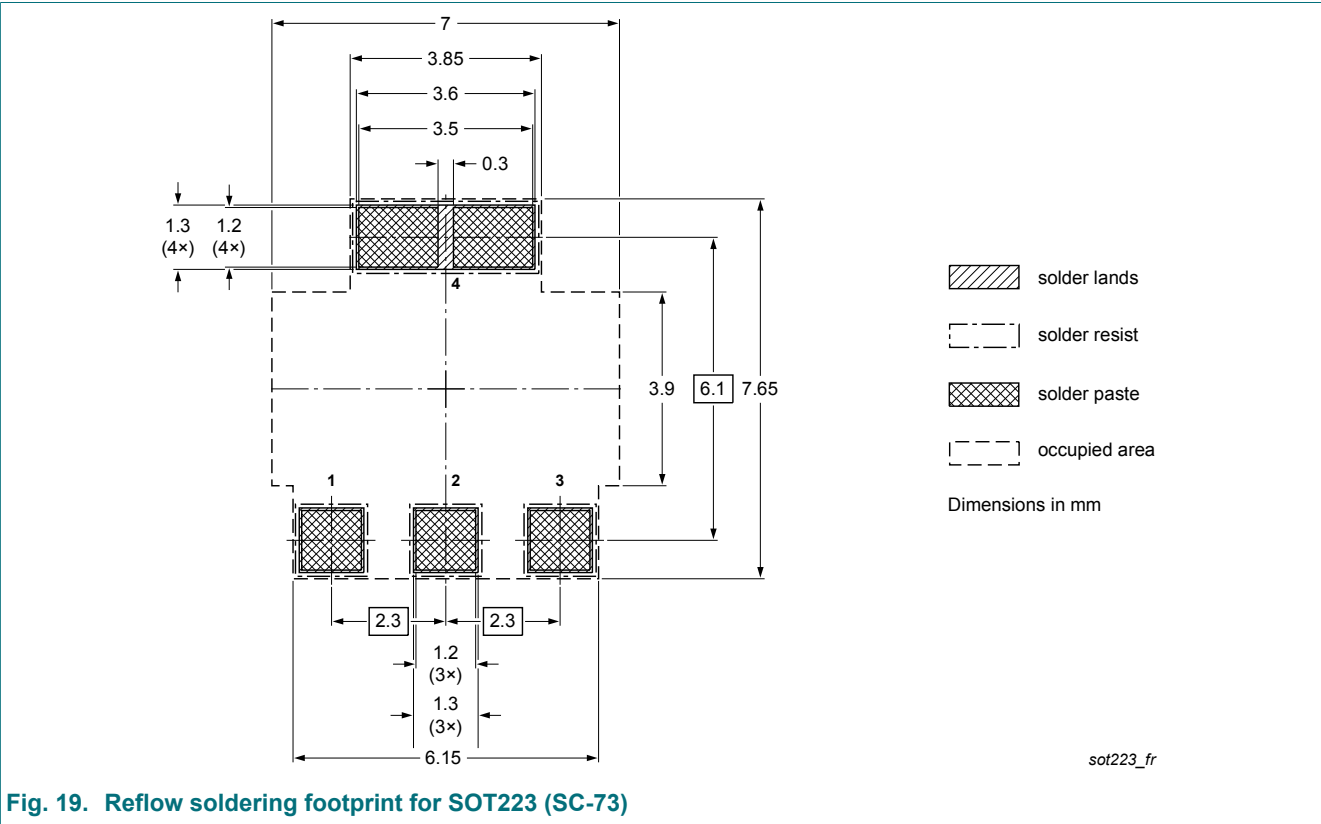


Fig. 18. Package outline SOT223 (SC-73)

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