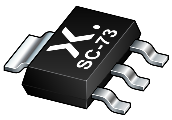


BCP54T series

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 comlement
	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 °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; $t_p \leq 1$ ms		-	-	2	A

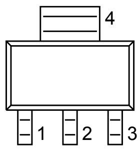
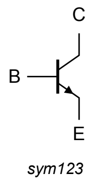
nexperia

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

[1] pulsed; 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
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

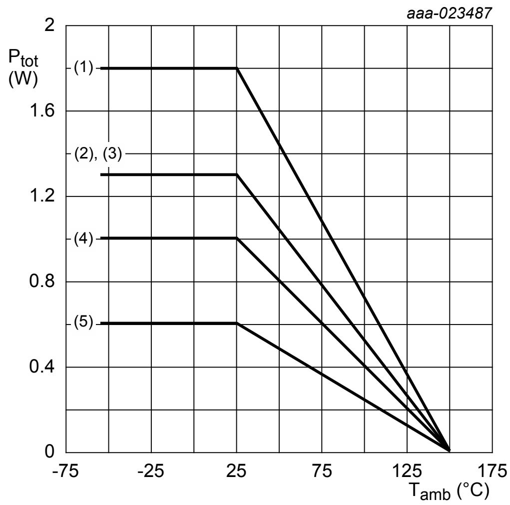
Table 6. Limiting values

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

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

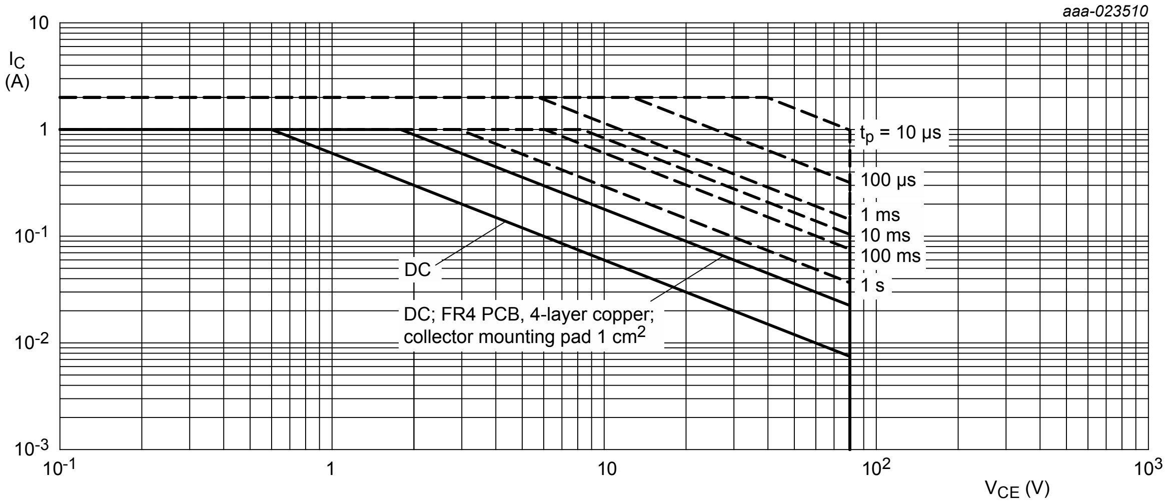
Symbol	Parameter	Conditions		Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter		-	45	V
V_{CEO}	collector-emitter voltage	open base		-	45	V
V_{EBO}	emitter-base voltage	open collector		-	5	V
I_C	collector current			-	1	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	2	A
I_B	base 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 Printed-Circuit-Board (PCB); single-sided copper; tin-plated; mounting pad for collector 1 cm^2.
[3] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated; mounting pad for collector 6 cm^2.
[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^2.



(1) FR4 PCB; 4-layer copper; 1 cm^2
(2) FR4 PCB; single-sided copper; 6 cm^2
(3) FR4 PCB; 4-layer copper; standard footprint
(4) FR4 PCB; single-sided copper; 1 cm^2
(5) FR4 PCB; single-sided copper; standard footprint

Fig. 1. Power derating curves



FR4 PCB; single-sided copper; standard footprint

single pulse; T_{amb} = 25 °C

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

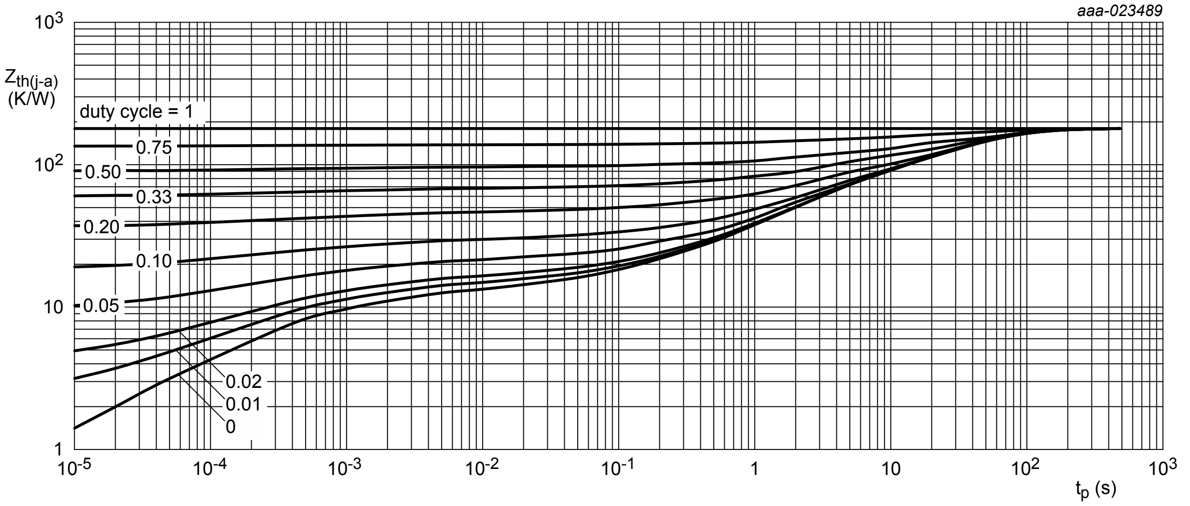
6. Thermal characteristics

Table 7. Thermal characteristics

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

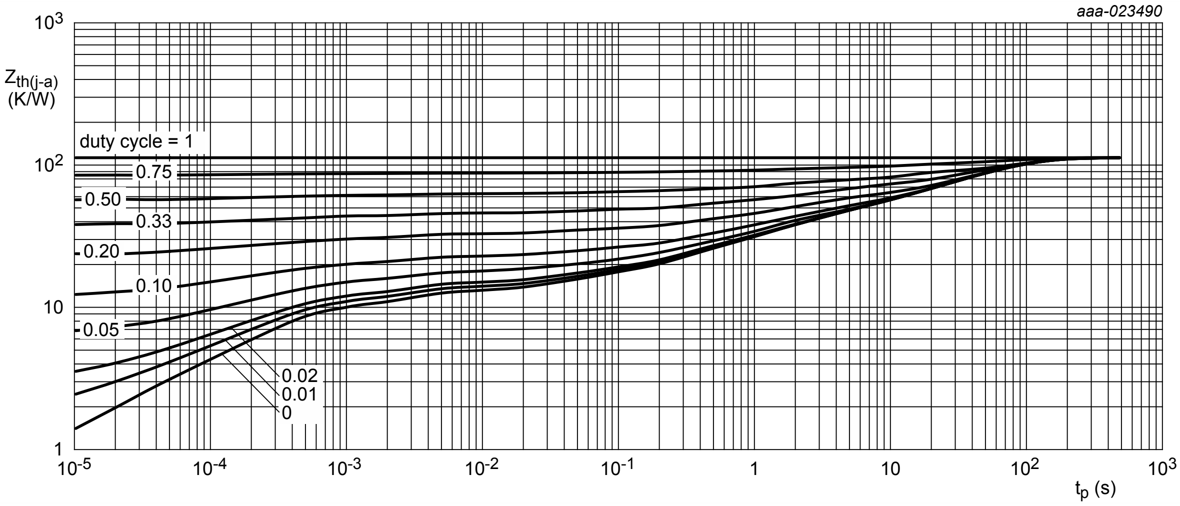
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	209	K/W
			[2]			125	K/W
			[3]			97	K/W
			[4]	-	-	97	K/W
			[5]	-	-	70	K/W
$R_{(j-sp)}$	thermal resistance from junction to solder point			-	-	18	K/W

[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^2.
[3] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated; mounting pad for collector 6 cm^2.
[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^2.



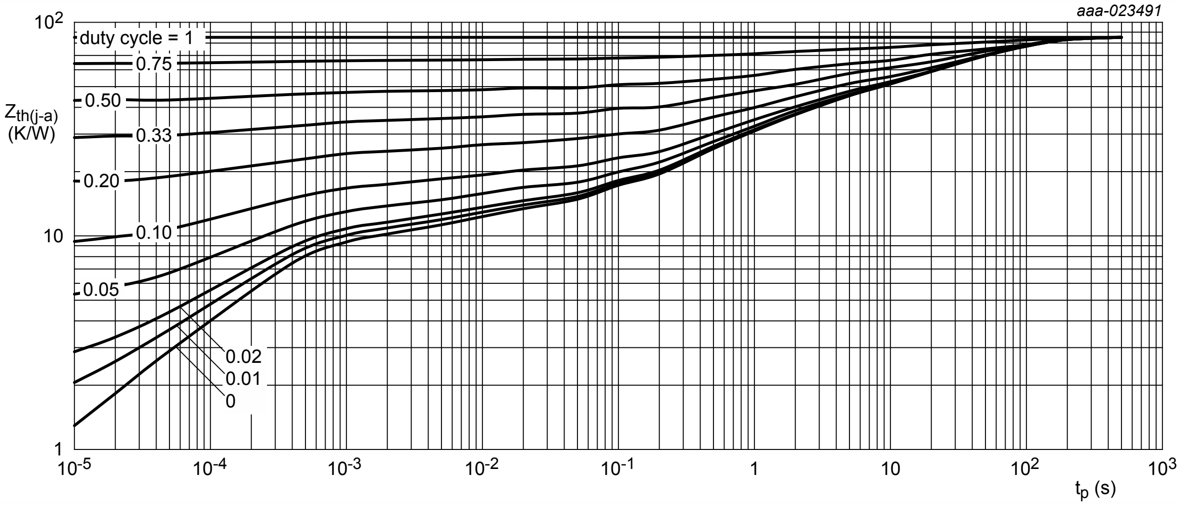
FR4 PCB; single-sided copper; tin-plated and standard footprint

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



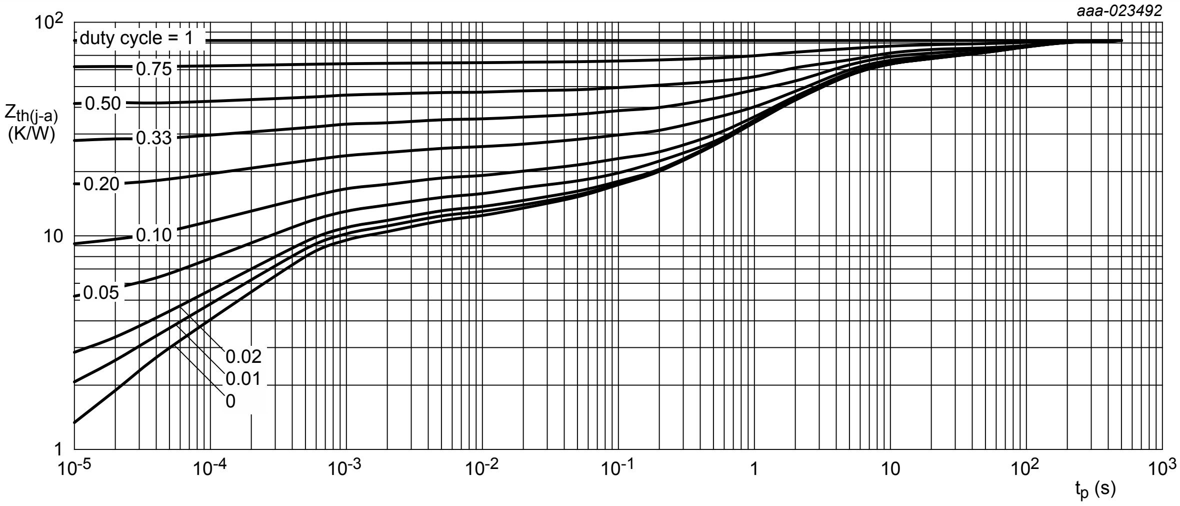
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 1 cm^2

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



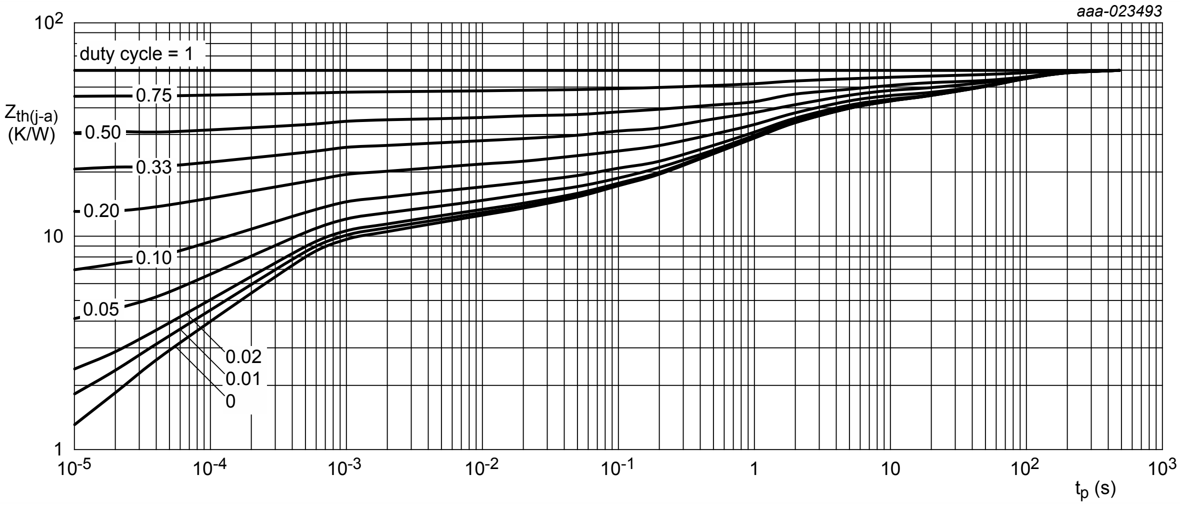
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 6 cm^2

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

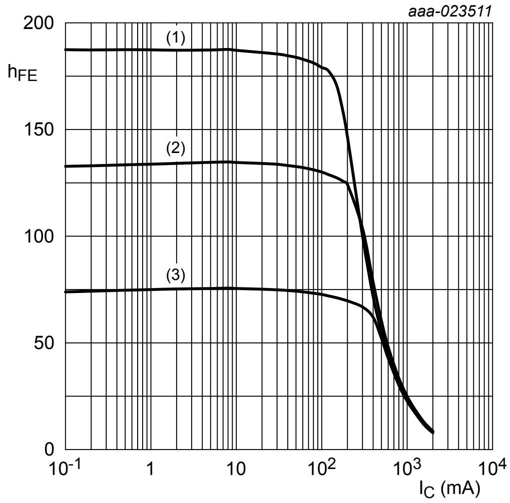
7. Characteristics

Table 8. Characteristics

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 µA; I_E = 0 A		45	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 2 mA; I_E = 0 A		45	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 100 µA; I_C = 0 A		5	-	-	V
I_{CBO}	collector-base cut-off current	V_{CB} = 30 V; I_E = 0 A		-	-	100	nA
		V_{CB} = 30 V; I_E = 0 A; T_j = 150 °C		-	-	10	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A		-	-	100	nA
h_{FE}	DC current gain						
	BCP54T, -10T, -16T	V_{CE} = 2 V; I_C = 5 mA		63	-	-	
		V_{CE} = 2 V; I_C = 500 mA	[1]	40	-	-	
	BCP54T	V_{CE} = 2 V; I_C = 150 mA	[1]	63	-	250	
	BCP54-10T	V_{CE} = 2 V; I_C = 150 mA	[1]	63	-	160	
	BCP54-16T	V_{CE} = 2 V; I_C = 150 mA	[1]	100	-	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	[1]	-	-	500	mV
V_{BE}	base-emitter voltage	V_{CE} = 2 V; I_C = 500 mA	[1]	-	-	1	V
f_T	transition frequency	V_{CE} = 5 V; I_C = 50 mA; f = 100 MHz		100	155	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	4.5	-	pF

[1] pulsed; t_p ≤ 300 µs; δ ≤ 0.02



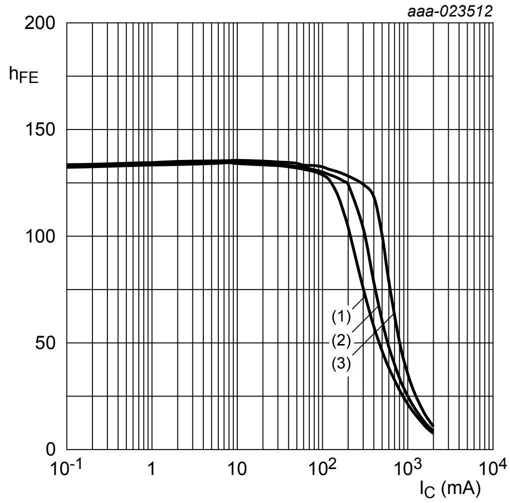
V_{CE} = 2 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = -55 °C

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



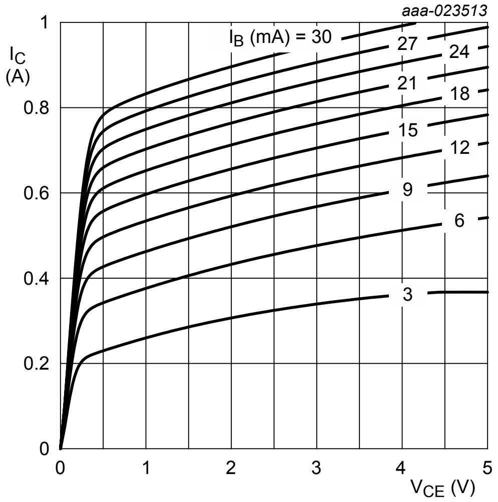
T_{amb} = 25 °C

(1) V_{CE} = 1 V

(2) V_{CE} = 2 V

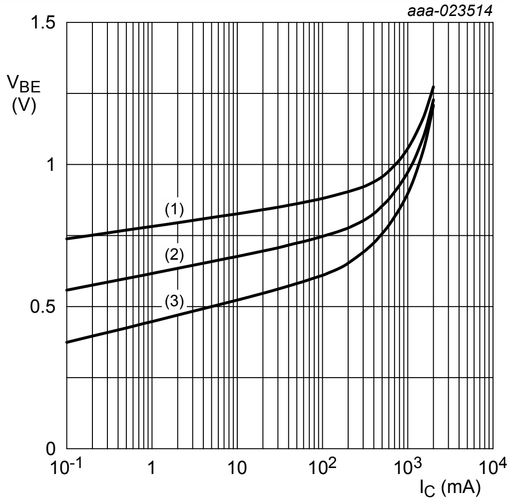
(3) V_{CE} = 5 V

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



T_{amb} = 25 °C

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



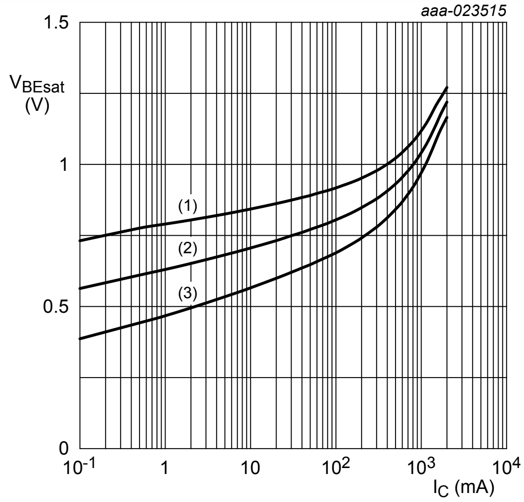
V_{CE} = 2 V

(1) T_{amb} = -55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



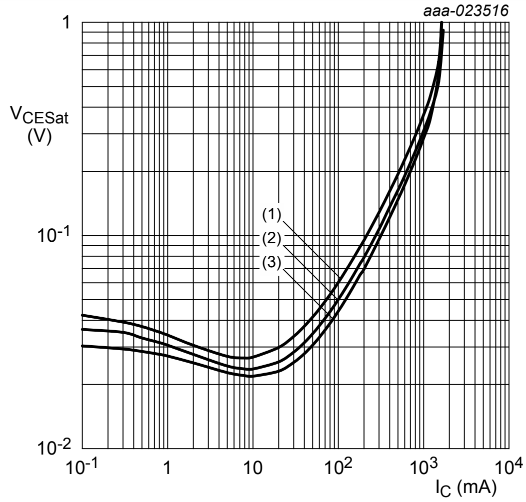
$I_C/I_B = 10$

(1) T_{amb} = -55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



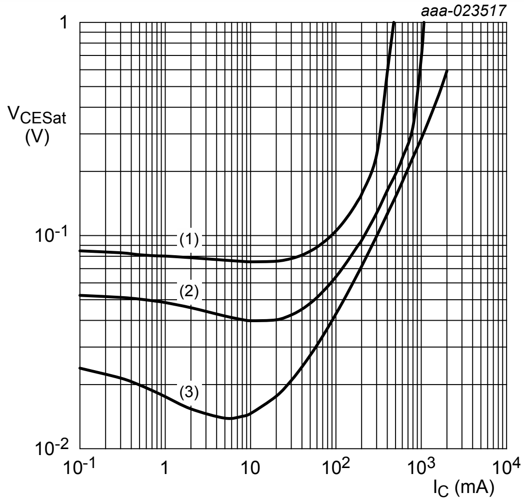
$I_C/I_B = 10$

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = -55 °C

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



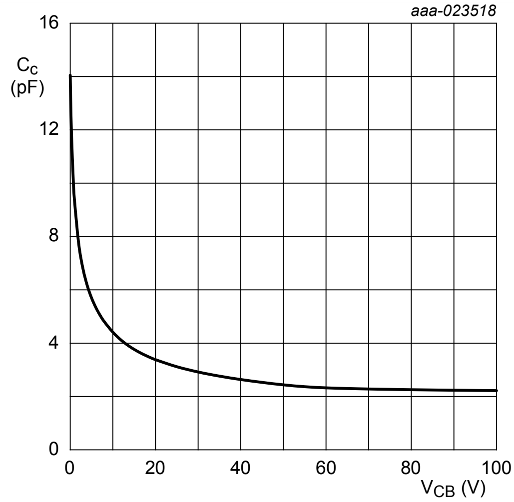
T_{amb} = 25 °C

(1) $I_C/I_B = 50$

(2) $I_C/I_B = 20$

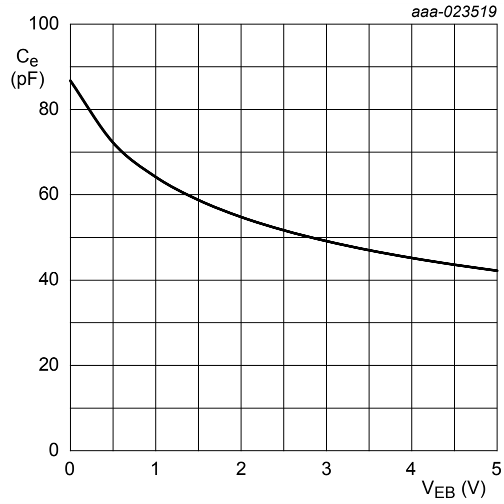
(3) $I_C/I_B = 5$

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



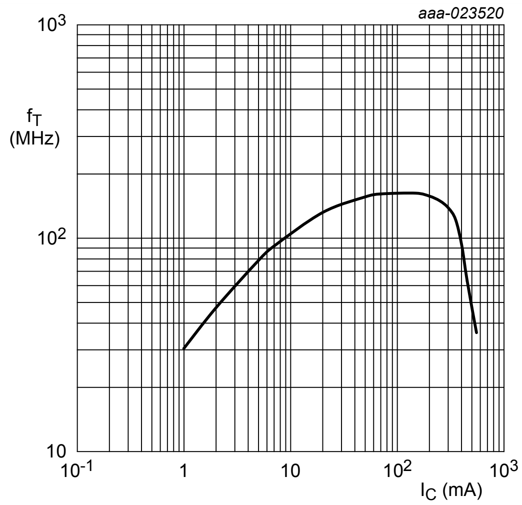
f = 1 MHz; T_{amb} = 25 °C

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



f = 1 MHz; T_{amb} = 25 °C

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



V_{CE} = 5 V
f = 100 MHz; T_{amb} = 25 °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

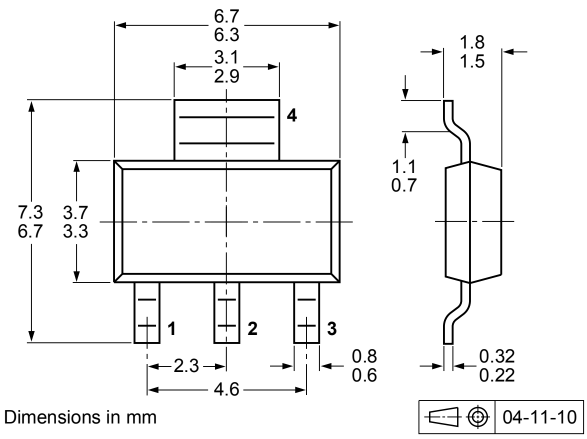


Fig. 18. Package outline SOT223 (SC-73)

10. Soldering

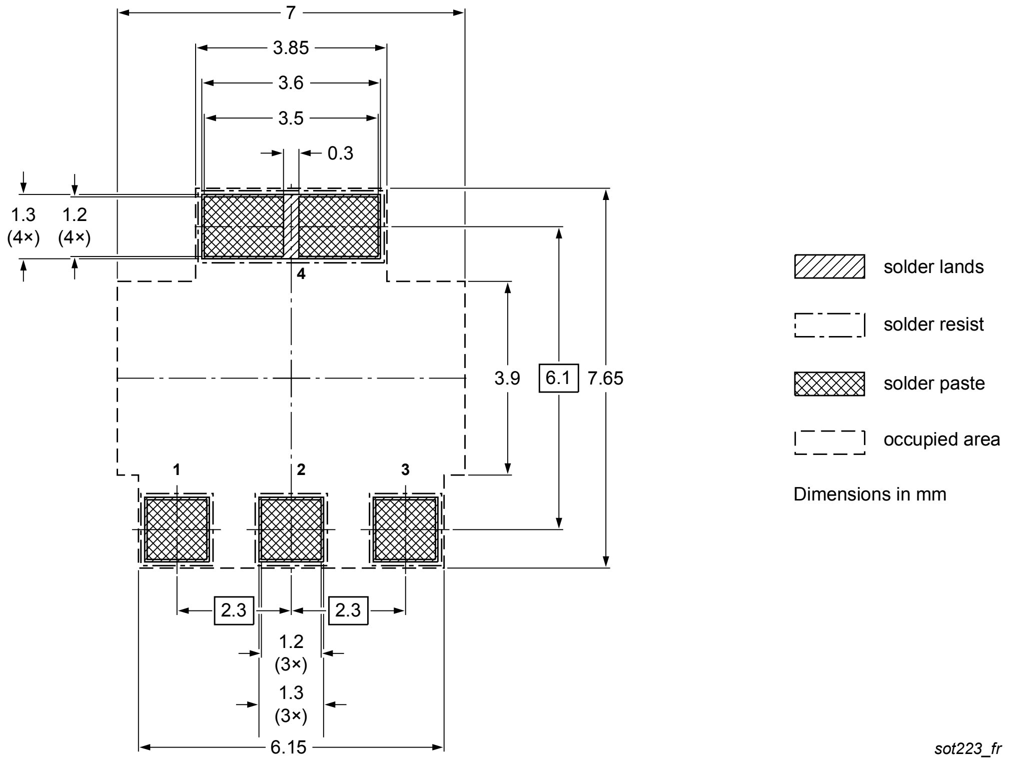


Fig. 19. Reflow soldering footprint for SOT223 (SC-73)

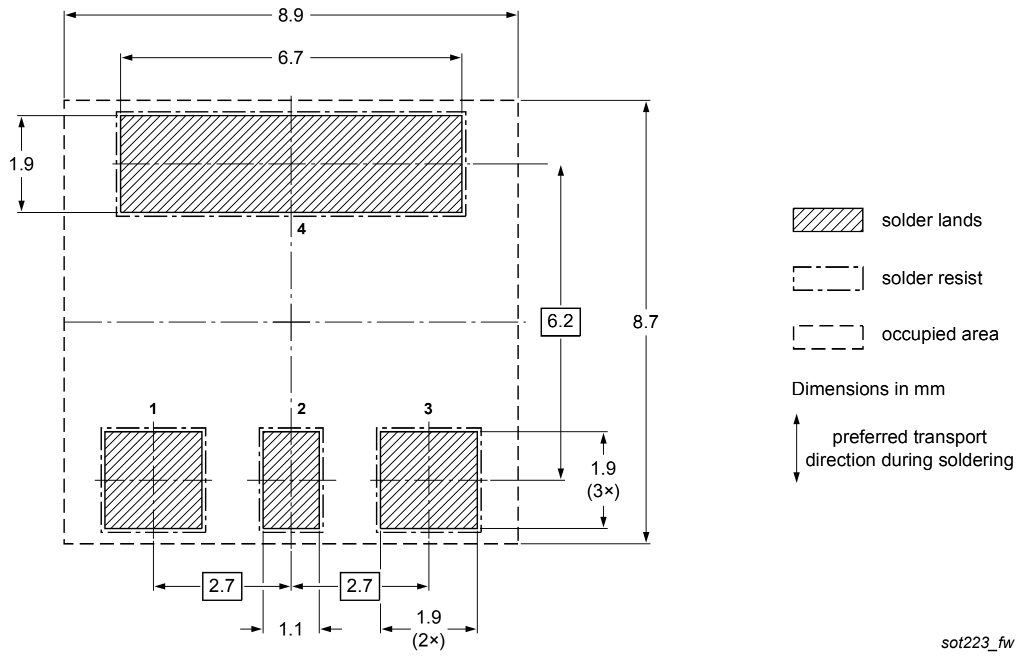


Fig. 20. Wave soldering footprint for SOT223 (SC-73)

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.

[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".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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Date of release: 29 April 2019