



# BCP51T series

45 V, 1 A PNP medium power transistors

Rev. 1 — 29 April 2019

Product data sheet

## 1. Product profile

### 1.1. General description

PNP 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	
BCP51T	SOT223	SC-73	BCP54T
BCP51-10T			BCP54-10T
BCP51-16T			BCP54-16T

### 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.

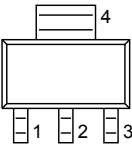
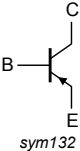
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-45	V
$I_C$	collector current		-	-	-1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1\text{ ms}$	-	-	-2	A

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$h_{FE}$	DC current gain						
	BCP51T	$V_{CE} = -2 \text{ V}; I_C = -150 \text{ mA}$	[1]	63	-	250	
	BCP51-10T		[1]	63	-	160	
BCP51-16T	[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		 sym132
2	C	collector		
3	E	emitter		
4	C	collector		

## 3. Ordering information

Table 4. Ordering information

Type number	Package		Version
	Name	Description	
BCP51T	SC-73	plastic, surface-mounted package with increased heatsink; 4 leads	SOT223
BCP51-10T			
BCP51-16T			

## 4. Marking

Table 5. Marking

Type number	Marking code
BCP51T	BCP51T
BCP51-10T	P5110T
BCP51-16T	P5116T

## 5. Limiting values

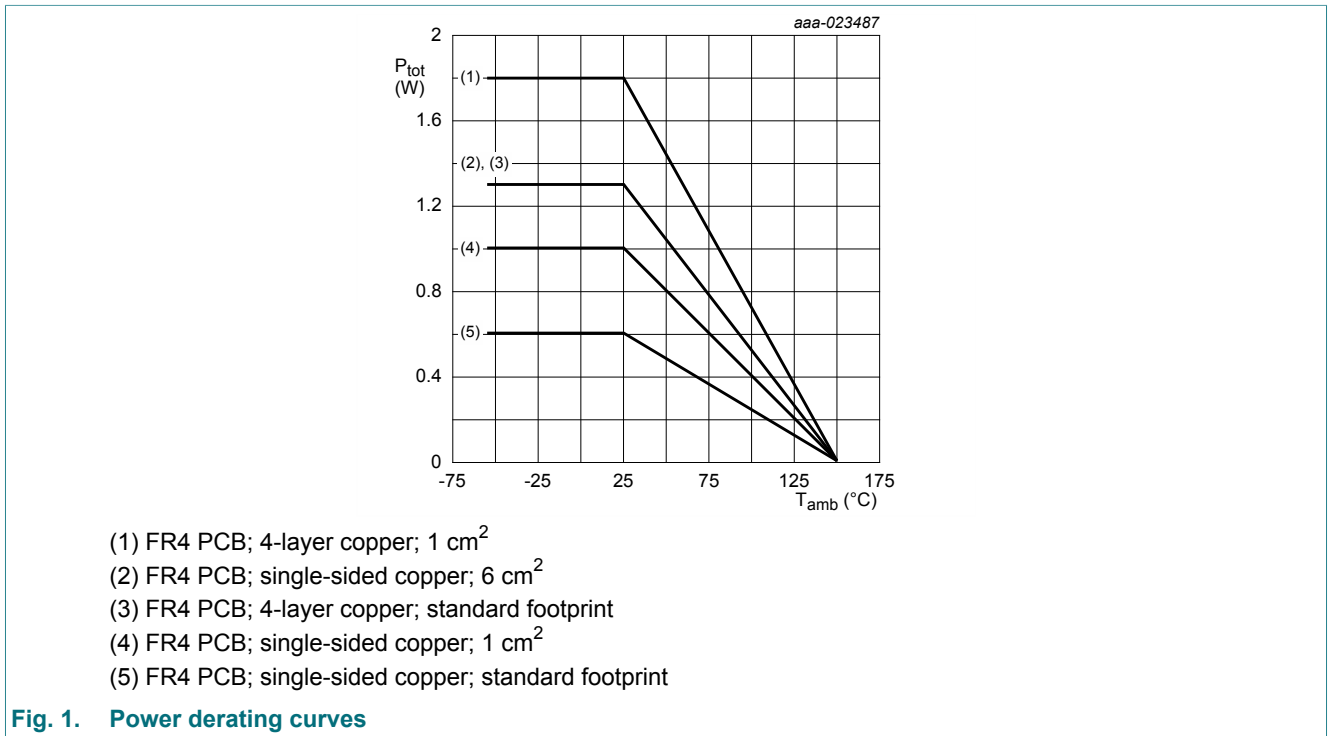
**Table 6. Limiting values**

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

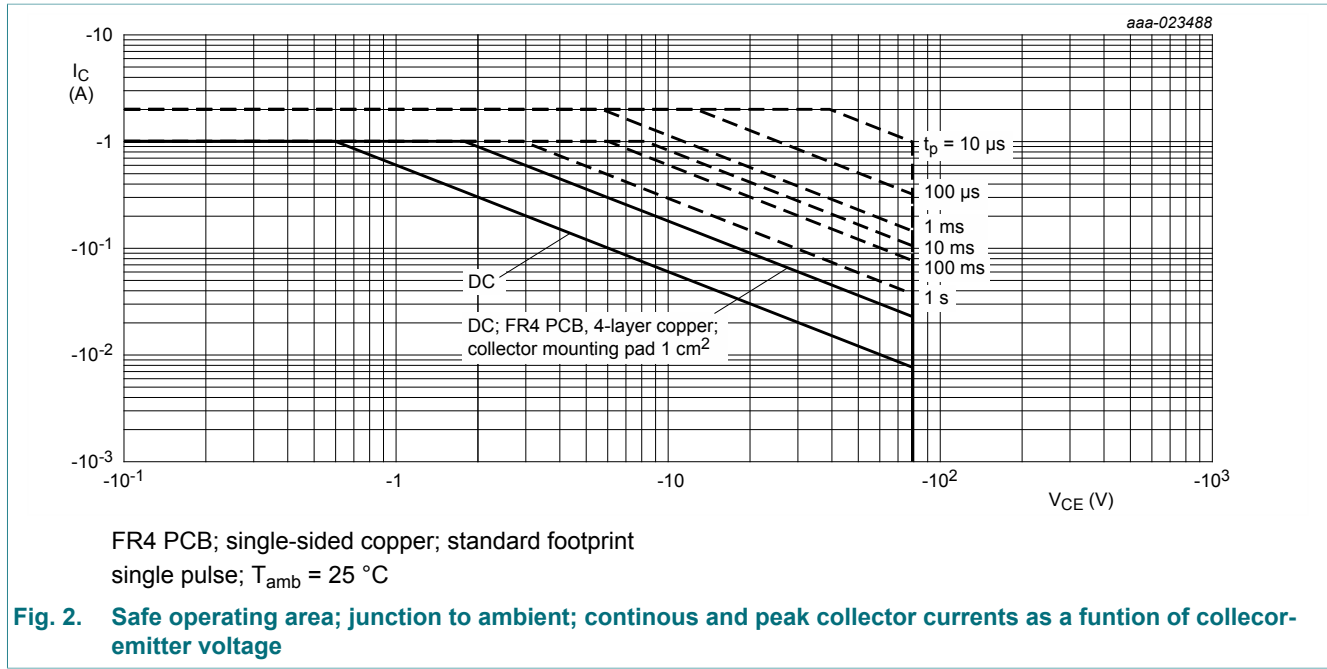
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

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**



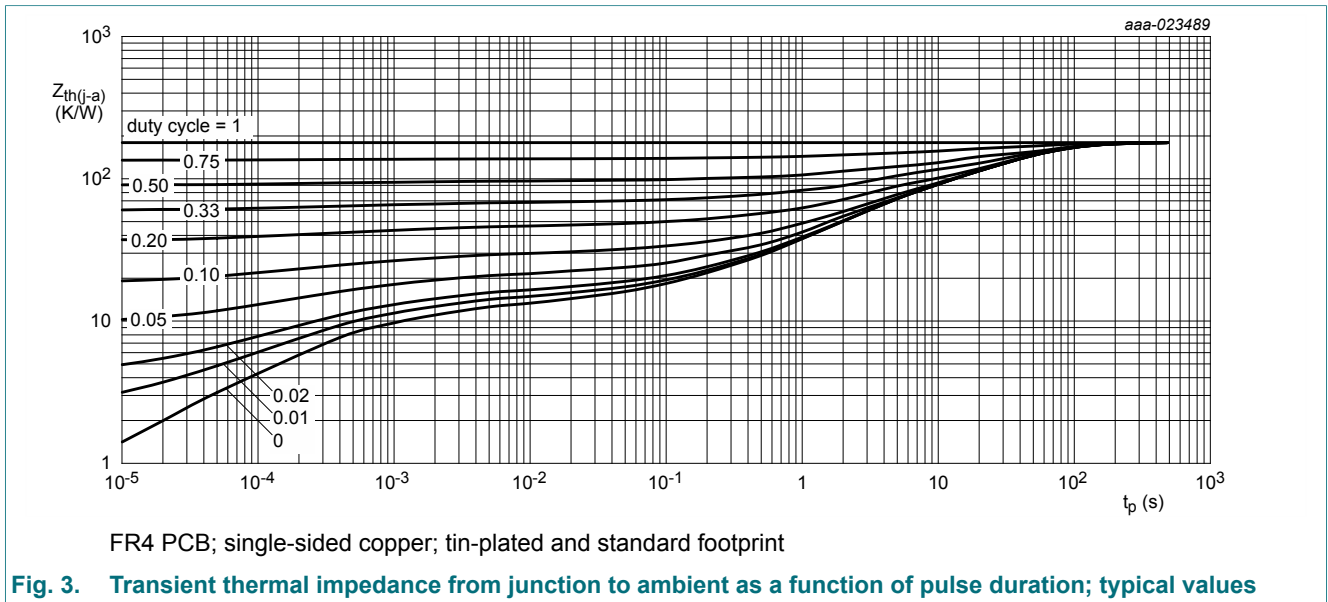
## 6. Thermal characteristics

**Table 7. Thermal characteristics**

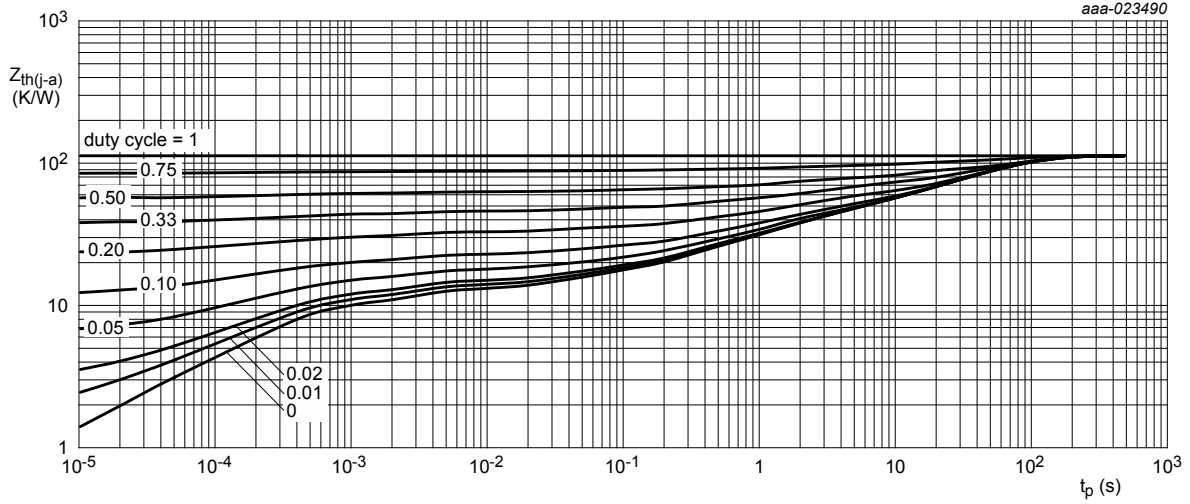
$T_{amb} = 25\text{ °C}$  unless otherwise specified.

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>.

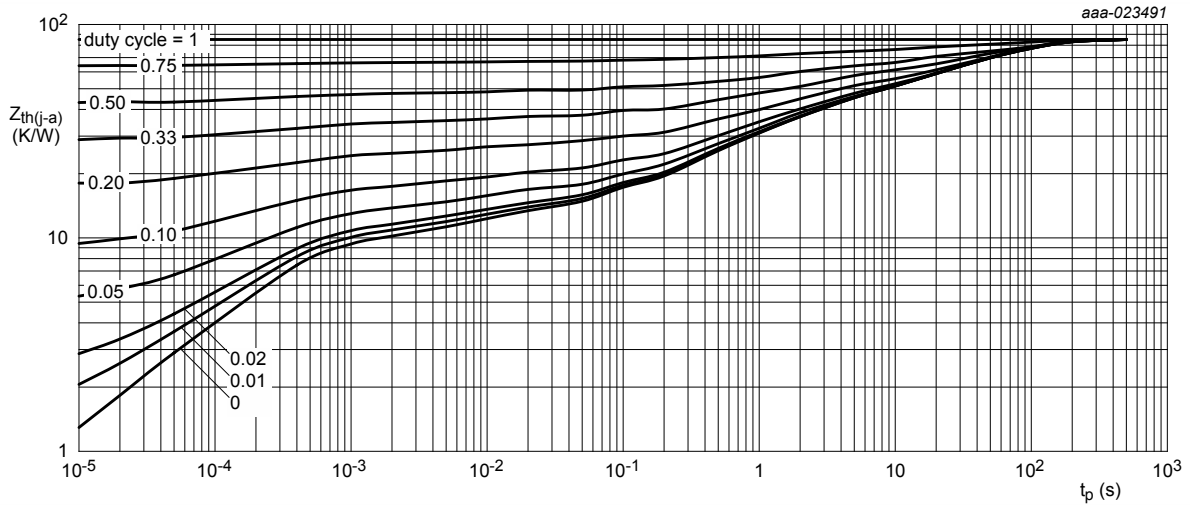


**Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



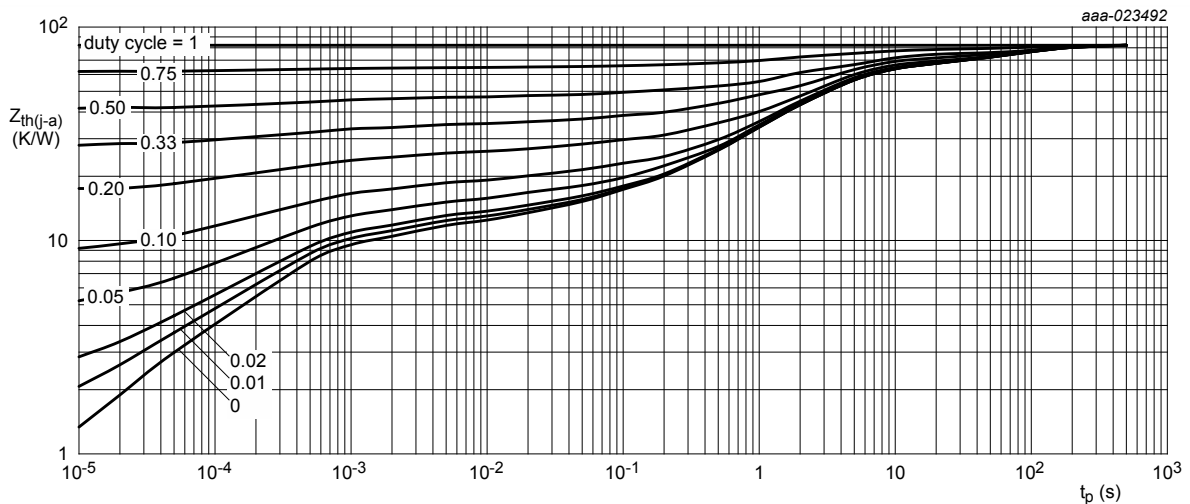
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 1 cm<sup>2</sup>

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



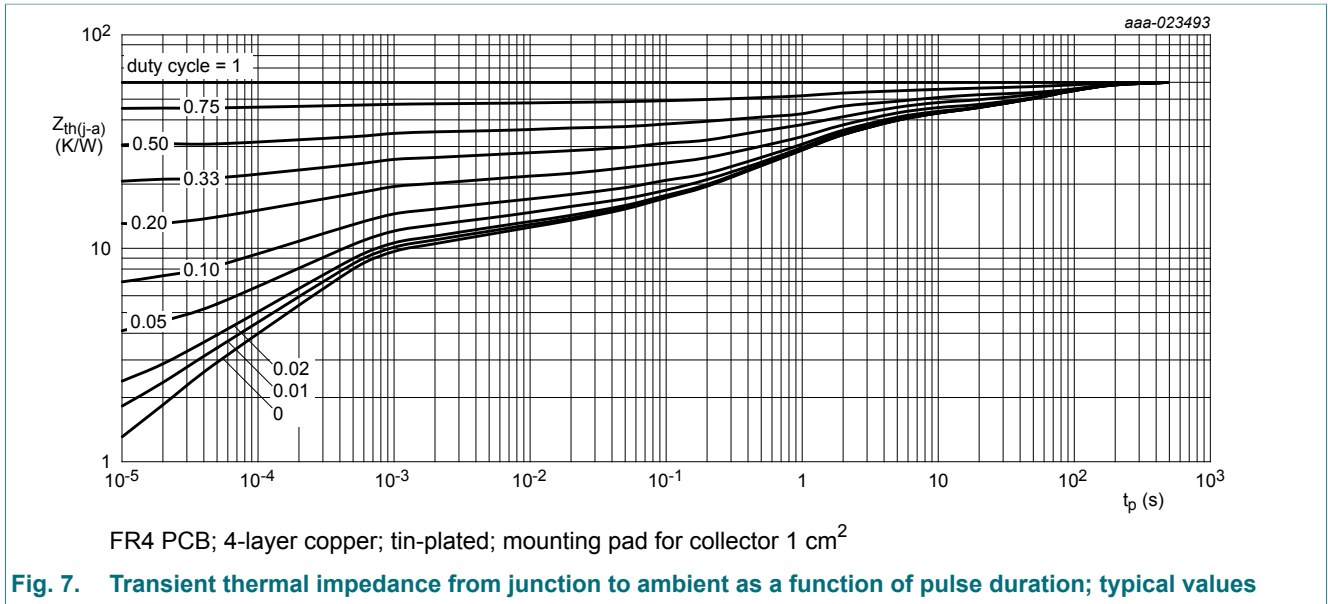
FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 6 cm<sup>2</sup>

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



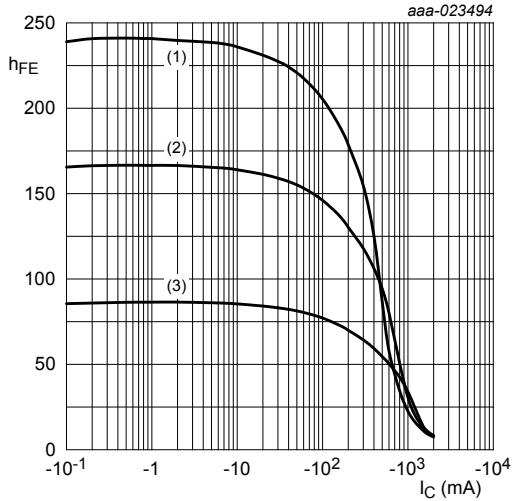
## 7. Characteristics

**Table 8. Characteristics**

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

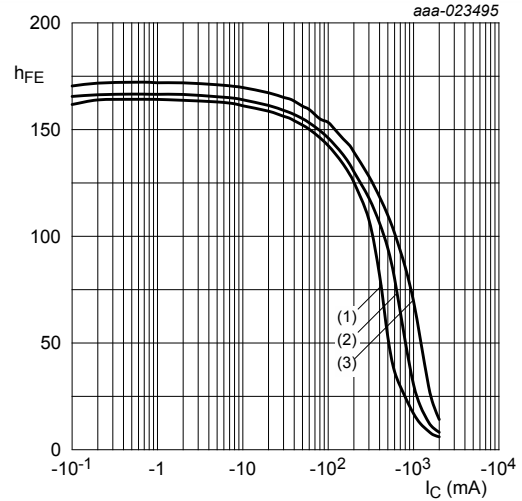
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = -100\ \mu\text{A}; I_E = 0\ \text{A}$	-45	-		V	
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = -2\ \text{mA}; I_E = 0\ \text{A}$	-45	-		V	
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = -100\ \mu\text{A}; I_C = 0\ \text{A}$	-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						
	BCP51T, -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	-	-	
	BCP51T	$V_{CE} = -2\ \text{V}; I_C = -150\ \text{mA}$	[1]	63	-	250	
	BCP51-10T	$V_{CE} = -2\ \text{V}; I_C = -150\ \text{mA}$	[1]	63	-	160	
BCP51-16T	$V_{CE} = -2\ \text{V}; I_C = -150\ \text{mA}$	[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	140	-	MHz
$C_c$	collector capacitance	$V_{CB} = -10\ \text{V}; I_E = I_C = 0\ \text{A}; f = 1\ \text{MHz}$		-	7	-	pF

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



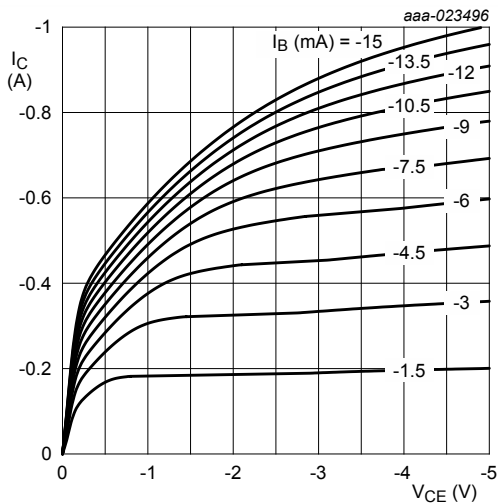
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



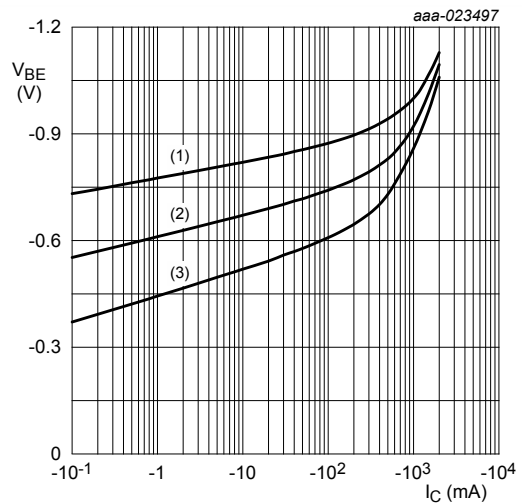
$T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (1)  $V_{CE} = -1\text{ V}$   
 (2)  $V_{CE} = -2\text{ V}$   
 (3)  $V_{CE} = -5\text{ V}$

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



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

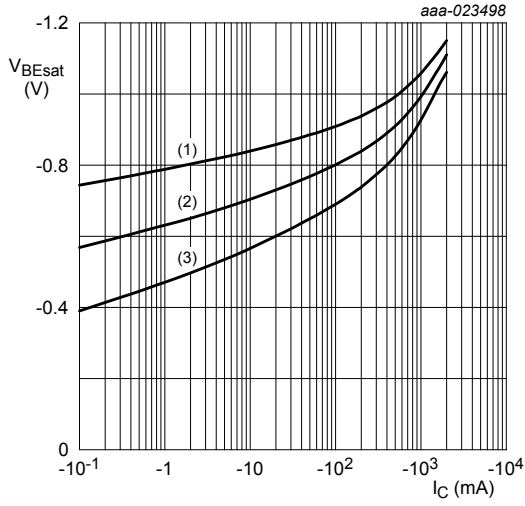
**Fig. 10. Collector current as a function of collector-emitter voltage; typical values**



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

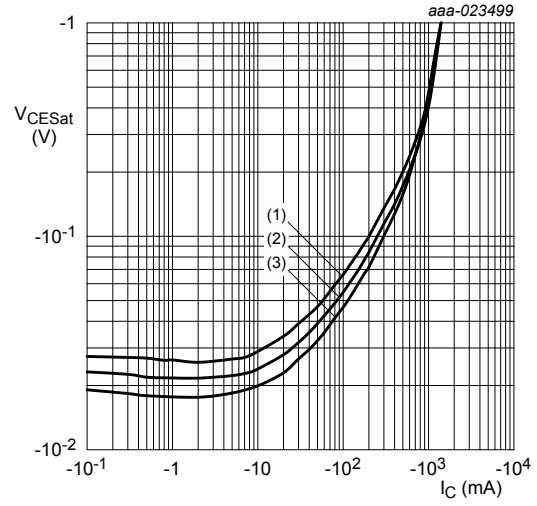
**Fig. 11. Base-emitter voltage as a function of collector current; typical values**





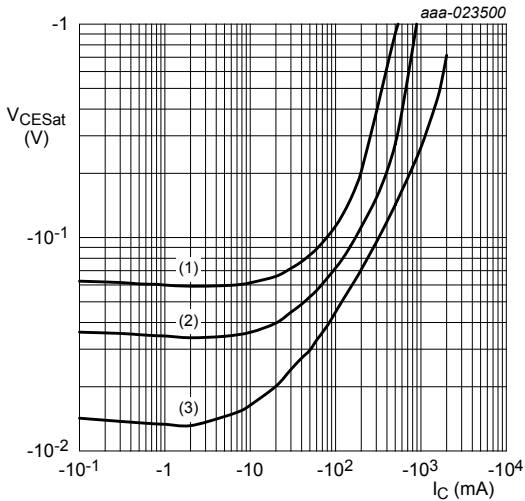
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

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



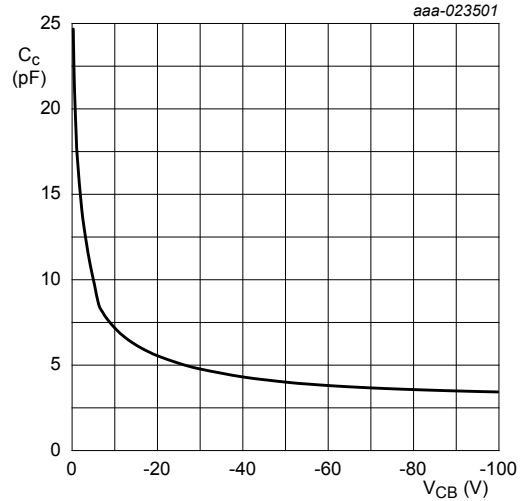
$I_C/I_B = 10$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

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



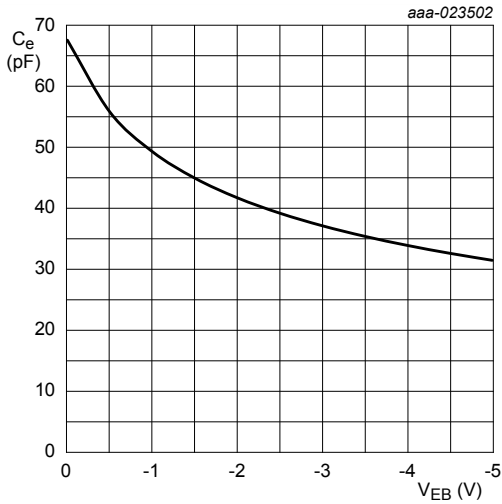
$T_{amb} = 25\text{ °C}$   
 (1)  $I_C/I_B = 50$   
 (2)  $I_C/I_B = 20$   
 (3)  $I_C/I_B = 5$

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



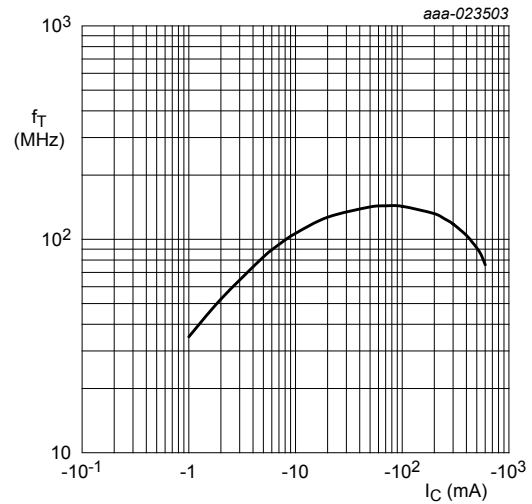
$f = 1\text{ MHz}; T_{amb} = 25\text{ °C}$

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**



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

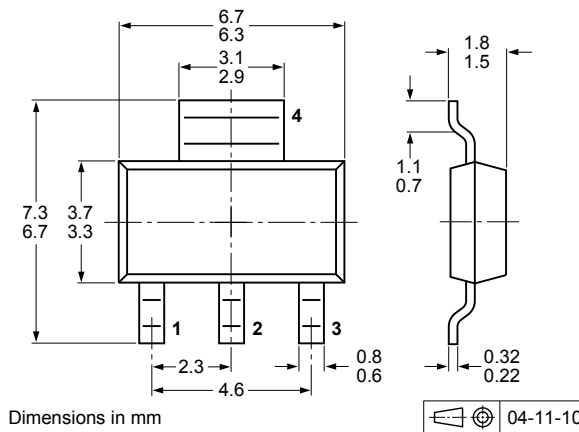
**Fig. 17. Transition frequency as a function of collector current; typical values**

## 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

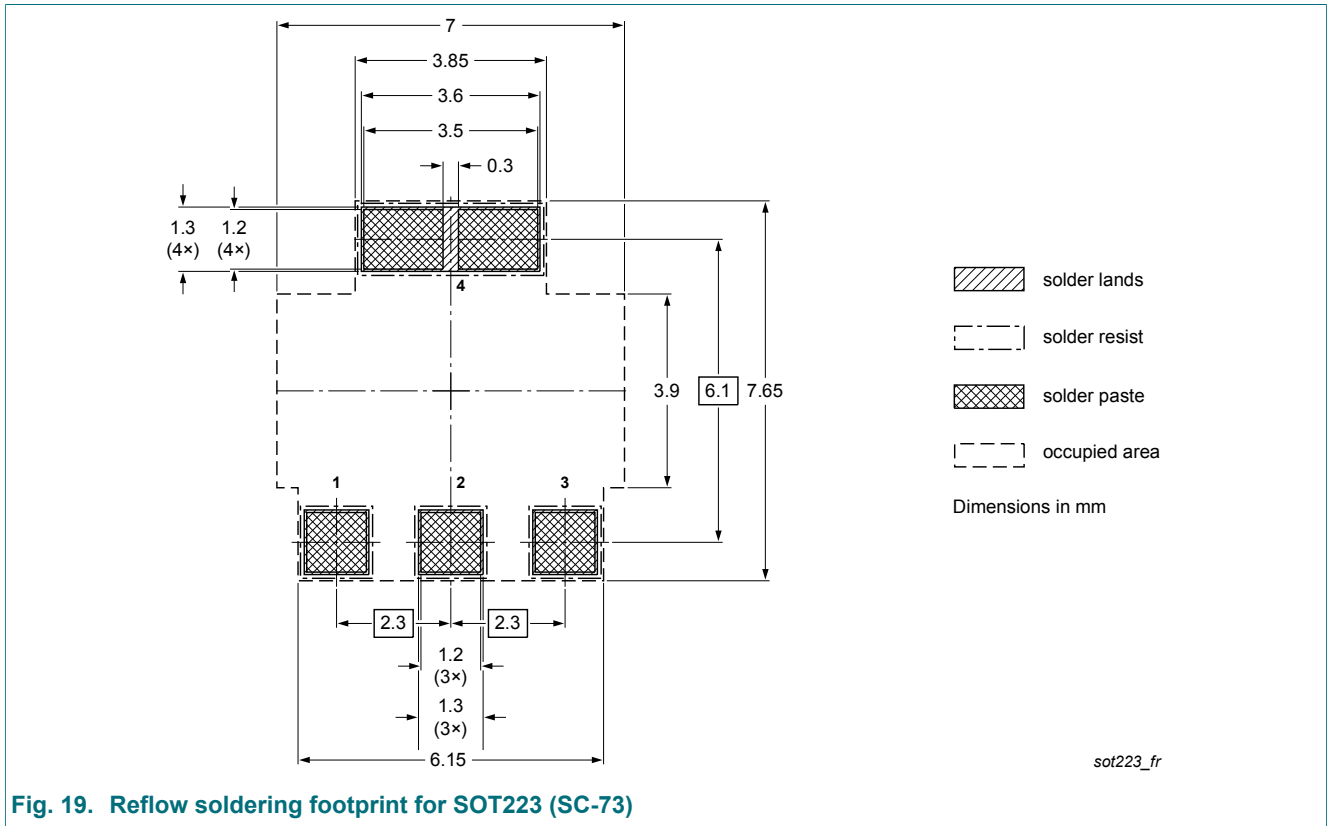


Fig. 19. Reflow soldering footprint for SOT223 (SC-73)

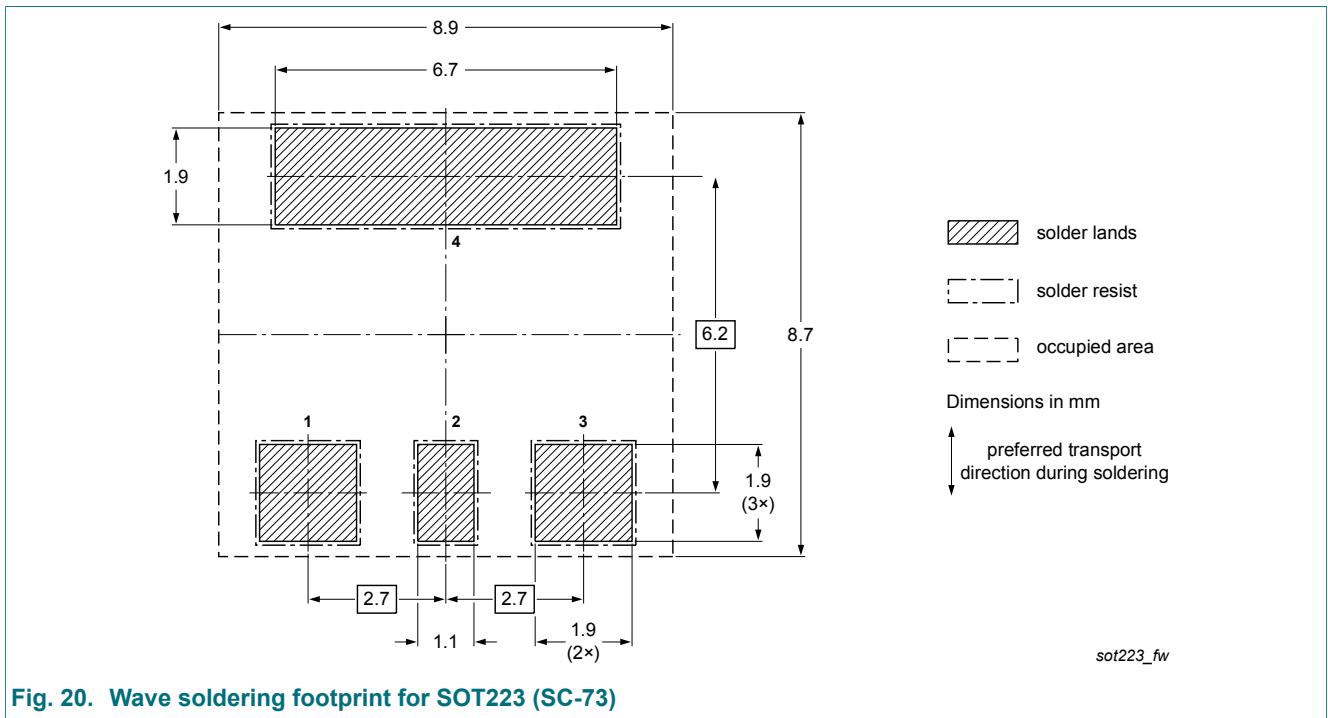


Fig. 20. Wave soldering footprint for SOT223 (SC-73)

## 11. Revision history

**Table 9. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BCP51T_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".
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## Contents

<b>1. Product profile</b> .....	<b>1</b>
1.1. General description.....	1
1.2. Features and benefits.....	1
1.3. Applications.....	1
1.4. Quick reference data.....	1
<b>2. Pinning information</b> .....	<b>2</b>
<b>3. Ordering information</b> .....	<b>2</b>
<b>4. Marking</b> .....	<b>2</b>
<b>5. Limiting values</b> .....	<b>3</b>
<b>6. Thermal characteristics</b> .....	<b>5</b>
<b>7. Characteristics</b> .....	<b>7</b>
<b>8. Test information</b> .....	<b>10</b>
8.1. Quality information.....	10
<b>9. Package outline</b> .....	<b>10</b>
<b>10. Soldering</b> .....	<b>11</b>
<b>11. Revision history</b> .....	<b>12</b>
<b>12. Legal information</b> .....	<b>13</b>

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Date of release: 29 April 2019