

## Important notice

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Kind regards,

Team Nexperia

# BCP51; BCX51; BC51PA

45 V, 1 A PNP medium power transistors

Rev. 9 — 13 October 2011

Product data sheet

## 1. Product profile

### 1.1 General description

PNP medium power transistor series in Surface-Mounted Device (SMD) plastic packages.

Table 1. Product overview

Type number <sup>[1]</sup>	Package			NPN complement
	NXP	JEITA	JEDEC	
BCP51	SOT223	SC-73	-	BCP54
BCX51	SOT89	SC-62	TO-243	BCX54
BC51PA	SOT1061	-	-	BC54PA

[1] Valid for all available selection groups.

### 1.2 Features and benefits

- High current
- Three current gain selections
- High power dissipation capability
- Exposed heatsink for excellent thermal and electrical conductivity (SOT89, SOT1061)
- Leadless very small SMD plastic package with medium power capability (SOT1061)
- AEC-Q101 qualified

### 1.3 Applications

- Linear voltage regulators
- High-side switches
- Battery-driven devices
- Power management
- MOSFET drivers
- Amplifiers

### 1.4 Quick reference data

Table 2. Quick reference data

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

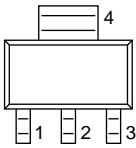
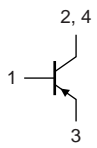
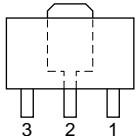
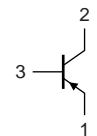
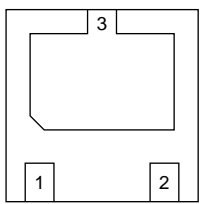
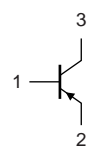


**Table 2. Quick reference data ...continued**

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

## 2. Pinning information

**Table 3. Pinning**

Pin	Description	Simplified outline	Graphic symbol
<b>SOT223</b>			
1	base		 sym028
2	collector		
3	emitter		
4	collector		
<b>SOT89</b>			
1	emitter		 006aaa231
2	collector		
3	base		
<b>SOT1061</b>			
1	base	 Transparent top view	 sym013
2	emitter		
3	collector		

### 3. Ordering information

**Table 4. Ordering information**

Type number <sup>[1]</sup>	Package		
	Name	Description	Version
BCP51	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCX51	SC-62	plastic surface-mounted package; collector pad for good heat transfer; 3 leads	SOT89
BC51PA	HUSON3	plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 × 2 × 0.65 mm	SOT1061

[1] Valid for all available selection groups.

### 4. Marking

**Table 5. Marking codes**

Type number	Marking code
BCP51	BCP51
BCP51-10	BCP51/10
BCP51-16	BCP51/16
BCX51	AA
BCX51-10	AC
BCX51-16	AD
BC51PA	BP
BC51-10PA	BQ
BC51-16PA	BR

## 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	-	-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		-	-0.3	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									
						BCP51	[1]	-	0.65	W	
							[2]	-	1.00	W	
							[3]	-	1.35	W	
						BCX51	[1]	-	0.50	W	
							[2]	-	0.95	W	
							[3]	-	1.35	W	
						BC51PA	[1]	-	0.42	W	
							[2]	-	0.83	W	
							[3]	-	1.10	W	
							[4]	-	0.81	W	
							[5]	-	1.65	W	
						$T_j$	junction temperature		-	150	°C
						$T_{amb}$	ambient temperature		-55	+150	°C
						$T_{stg}$	storage temperature		-65	+150	°C

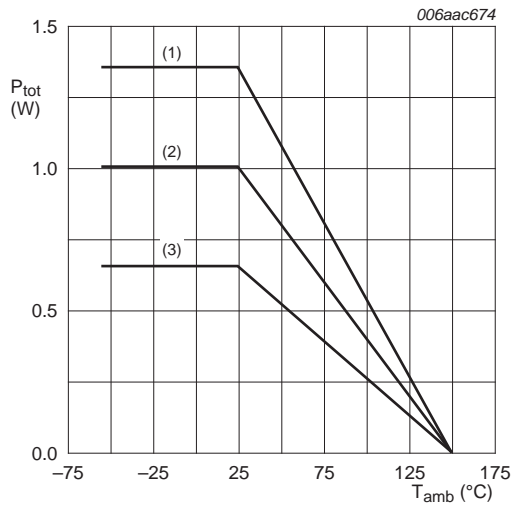
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.

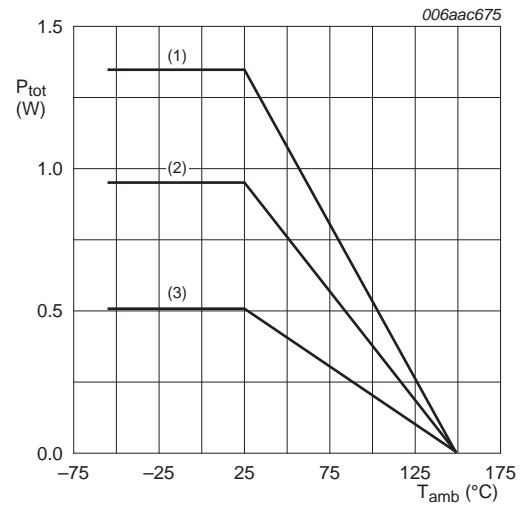
[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



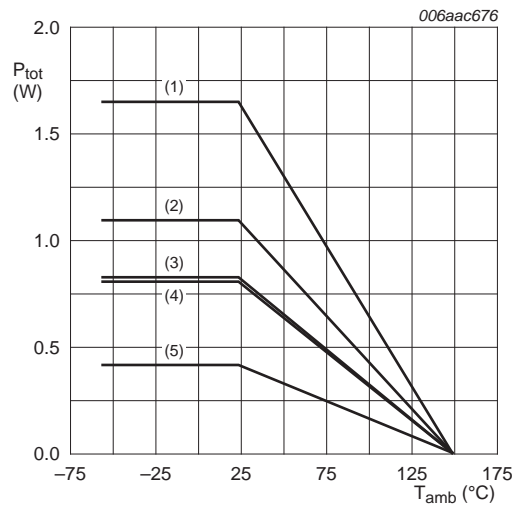
- (1) FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>
- (2) FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>
- (3) FR4 PCB, standard footprint

**Fig 1. Power derating curves SOT223**



- (1) FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>
- (2) FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>
- (3) FR4 PCB, standard footprint

**Fig 2. Power derating curves SOT89**



- (1) FR4 PCB, 4-layer copper, mounting pad for collector 1 cm<sup>2</sup>
- (2) FR4 PCB, single-sided copper, mounting pad for collector 6 cm<sup>2</sup>
- (3) FR4 PCB, single-sided copper, mounting pad for collector 1 cm<sup>2</sup>
- (4) FR4 PCB, 4-layer copper, standard footprint
- (5) FR4 PCB, single-sided copper, standard footprint

**Fig 3. Power derating curves SOT1061**

## 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	BCP51	[1]	-	-	192	K/W					
				[2]	-	-	125	K/W					
				[3]	-	-	93	K/W					
			BCX51	[1]	-	-	250	K/W					
				[2]	-	-	132	K/W					
				[3]	-	-	93	K/W					
			BC51PA	[1]	-	-	298	K/W					
				[2]	-	-	151	K/W					
				[3]	-	-	114	K/W					
	[4]	-		-	154	K/W							
	[5]	-		-	76	K/W							
	$R_{th(j-sp)}$	thermal resistance from junction to solder point											
									BCP51	-	-	16	K/W
									BCX51	-	-	16	K/W
									BC51PA	-	-	20	K/W

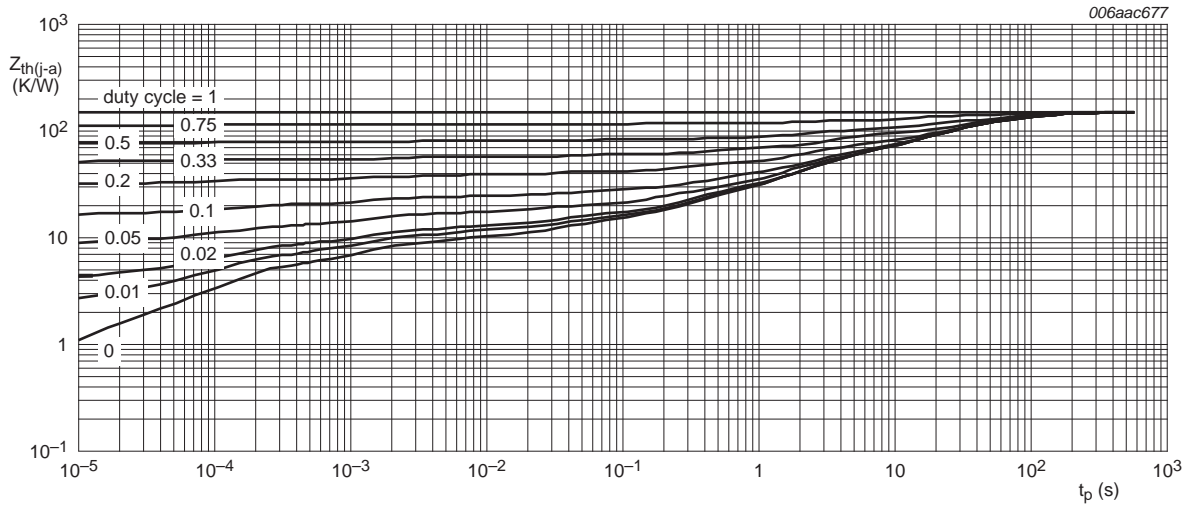
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

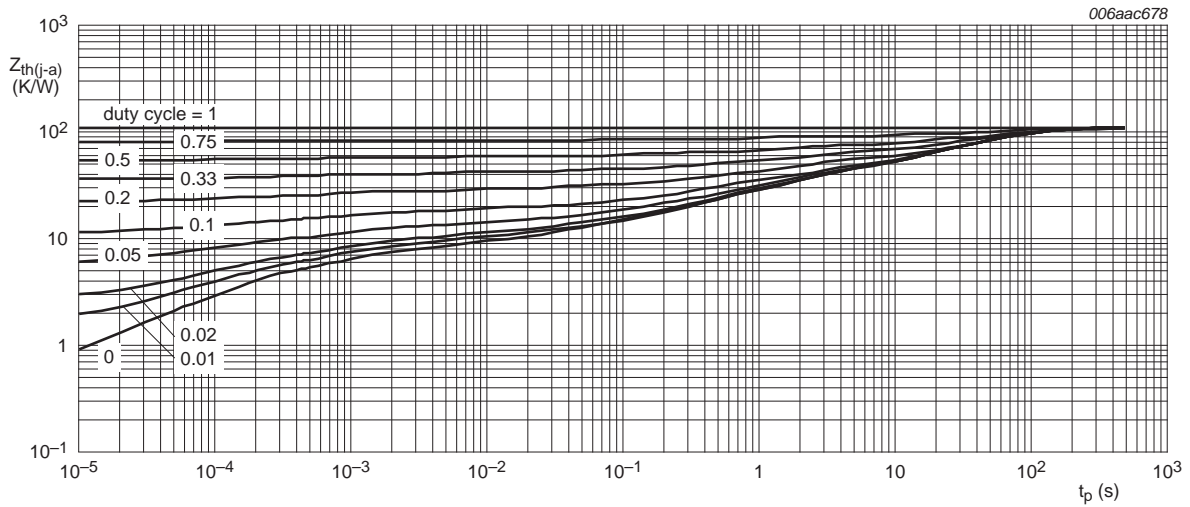
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.

[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 cm<sup>2</sup>.

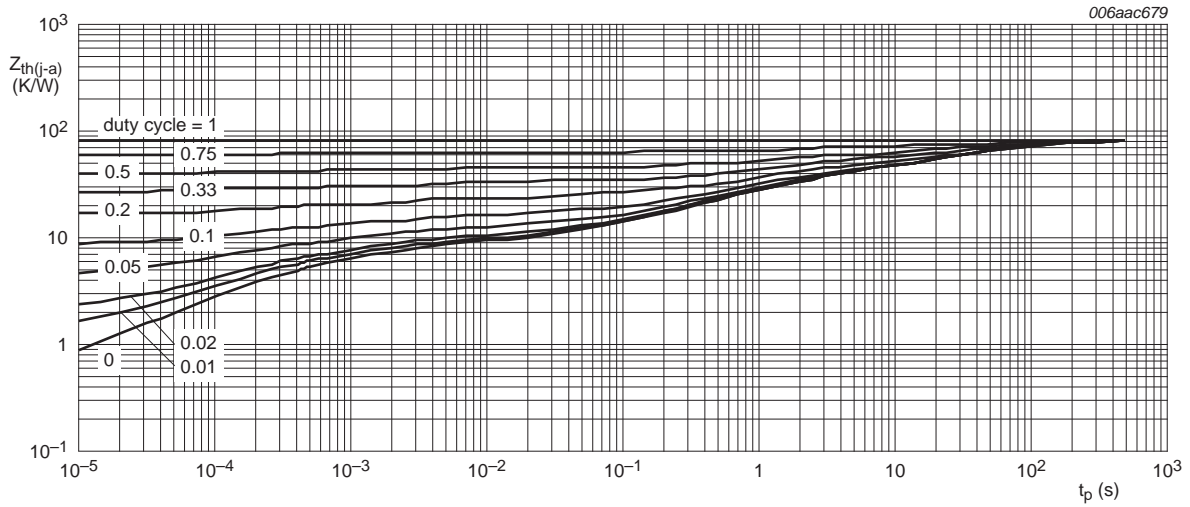


**Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values**



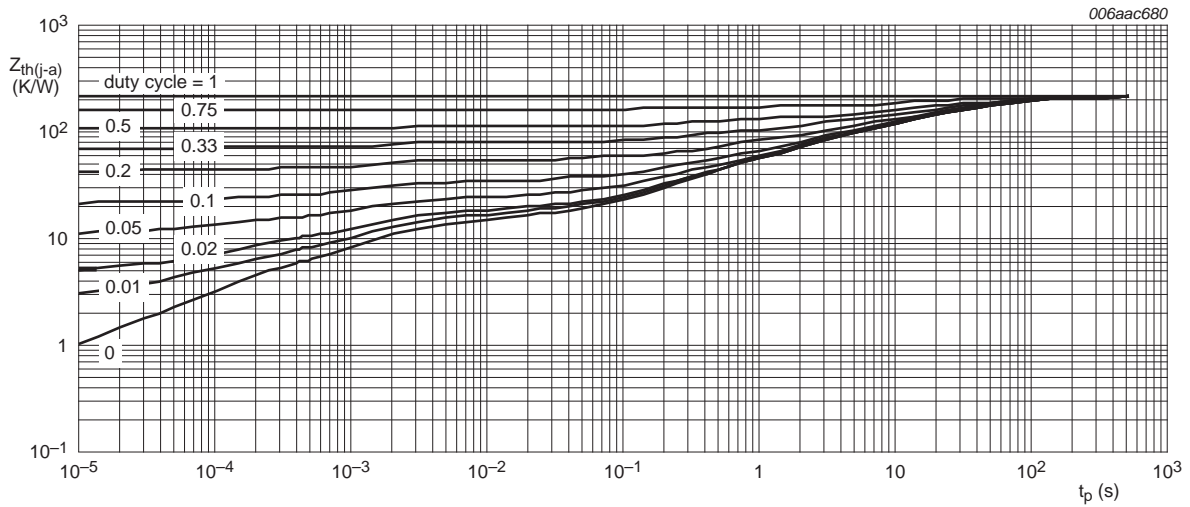
**Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values**





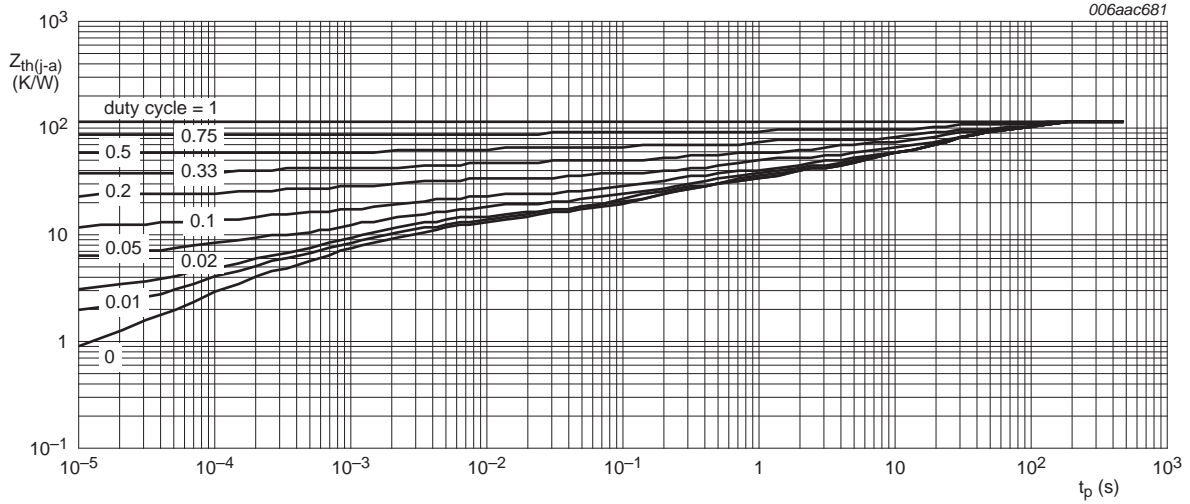
FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

**Fig 6. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values**



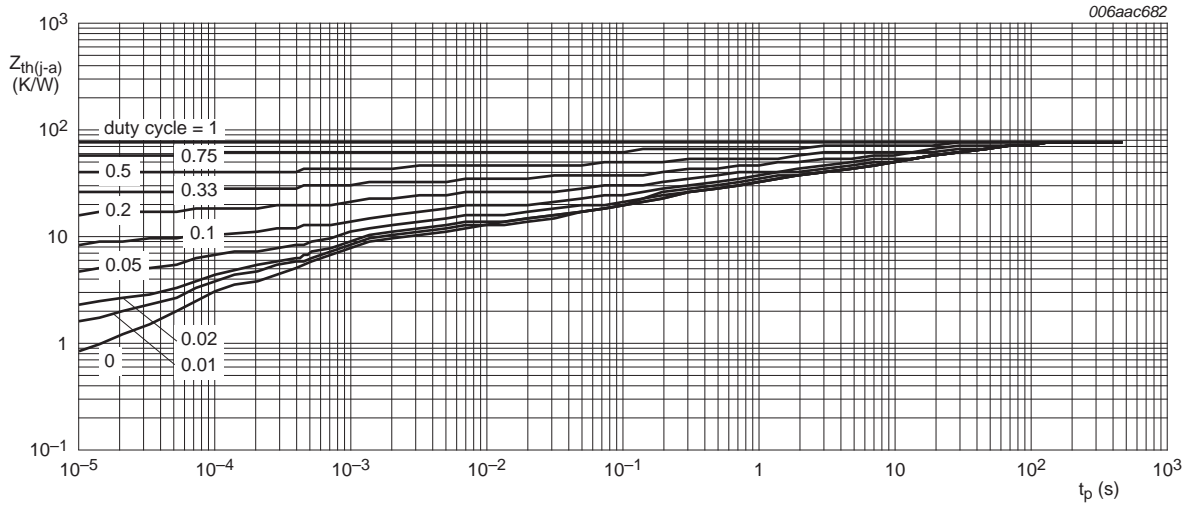
FR4 PCB, standard footprint

**Fig 7. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values**



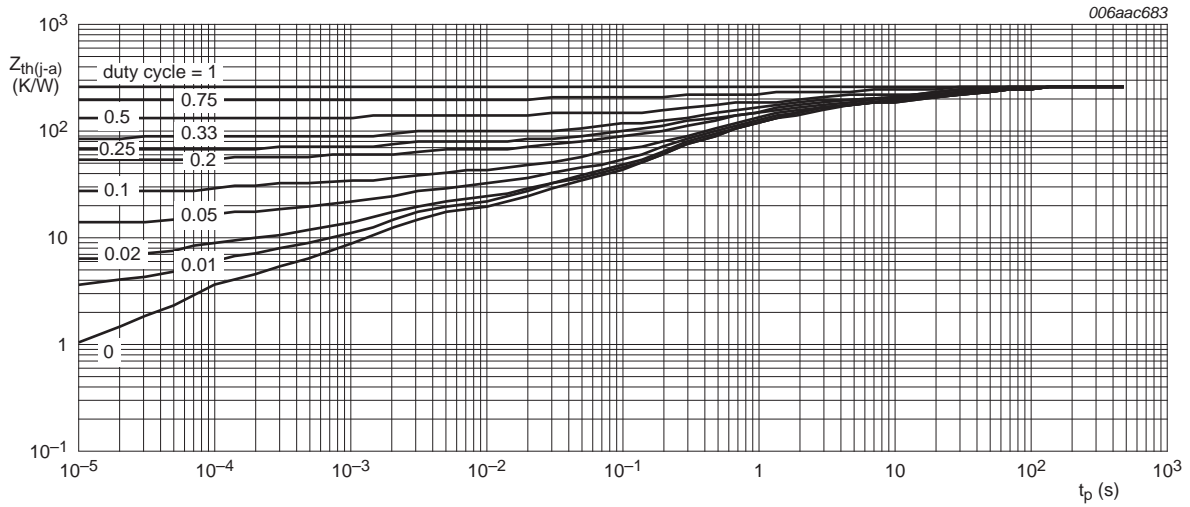
FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

**Fig 8. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values**



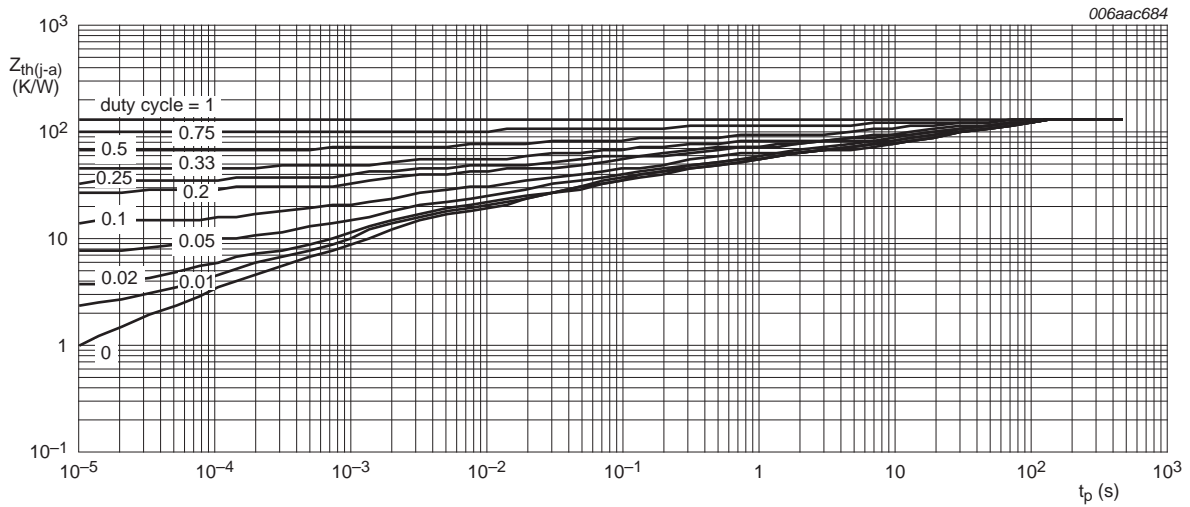
FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

**Fig 9. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values**



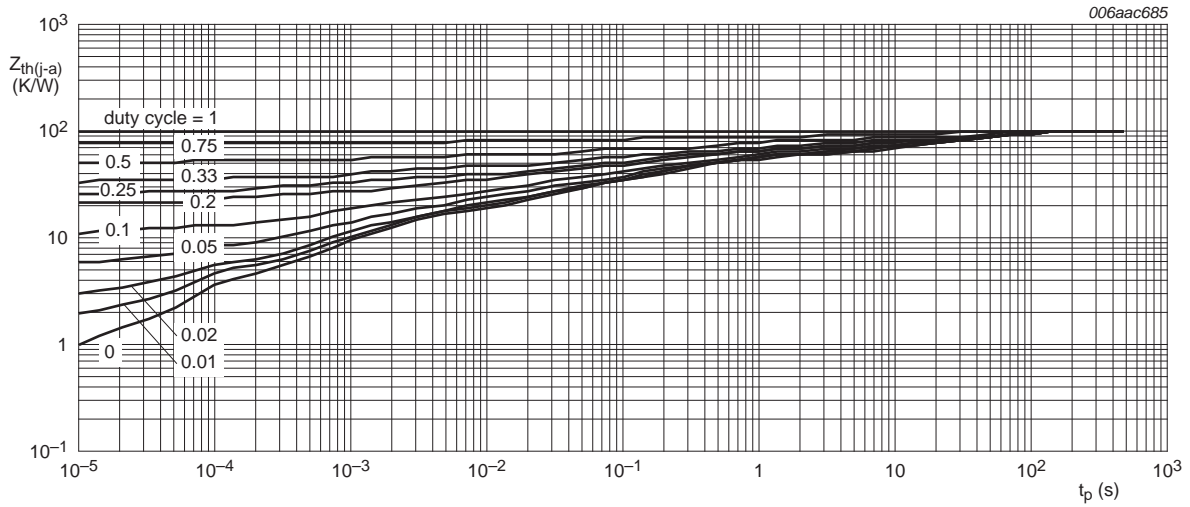
FR4 PCB, single-sided copper, standard footprint

**Fig 10. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**



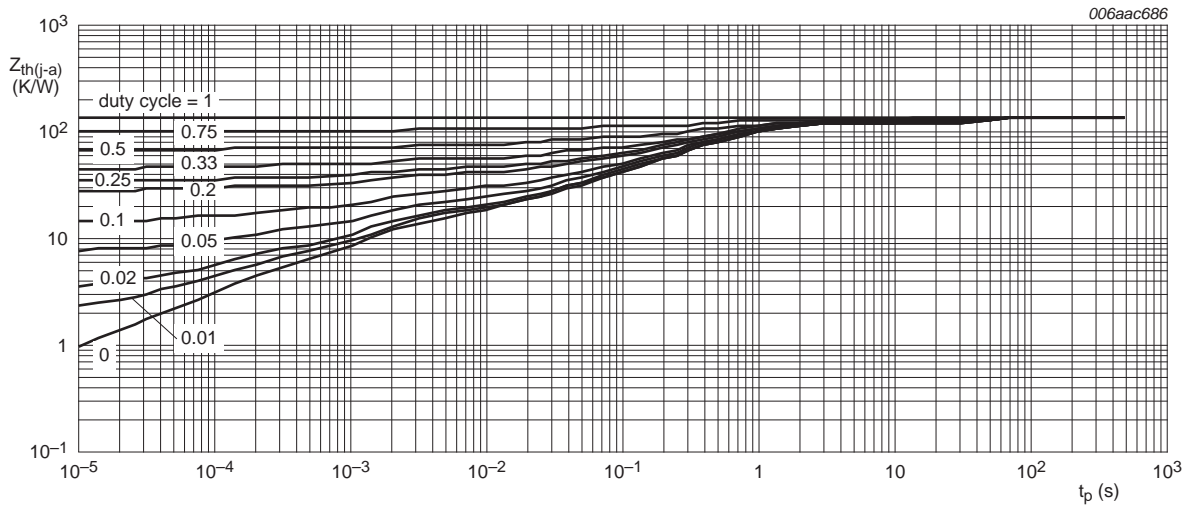
FR4 PCB, single-sided copper, mounting pad for collector 1 cm<sup>2</sup>

**Fig 11. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**



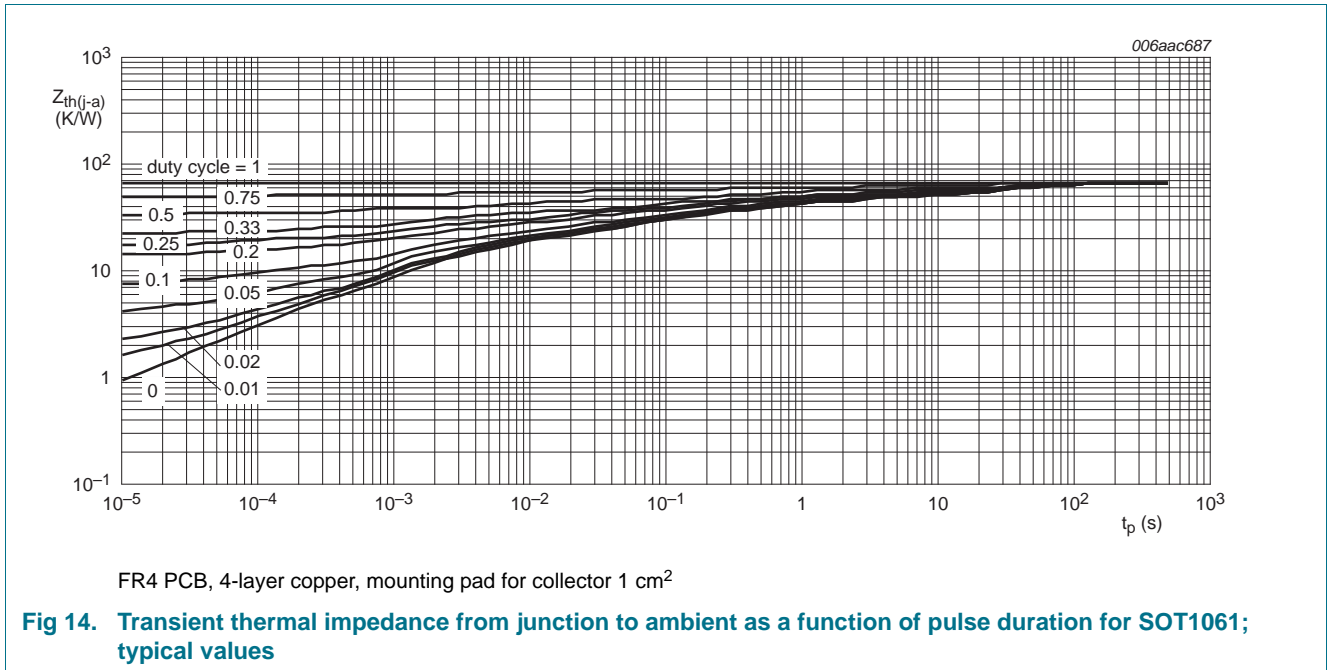
FR4 PCB, single-sided copper, mounting pad for collector 6 cm<sup>2</sup>

**Fig 12. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**



FR4 PCB, 4-layer copper, standard footprint

**Fig 13. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**



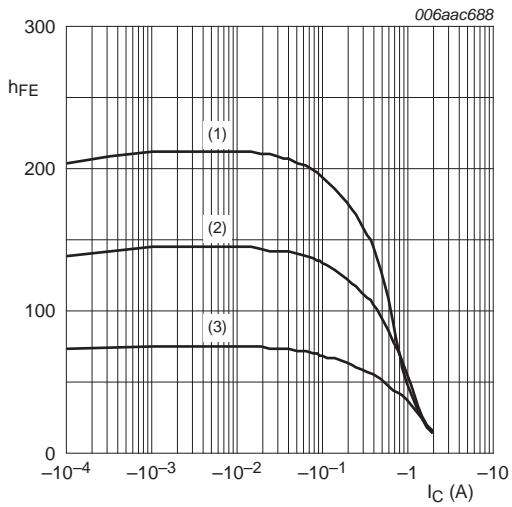
## 7. Characteristics

**Table 8. Characteristics**

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

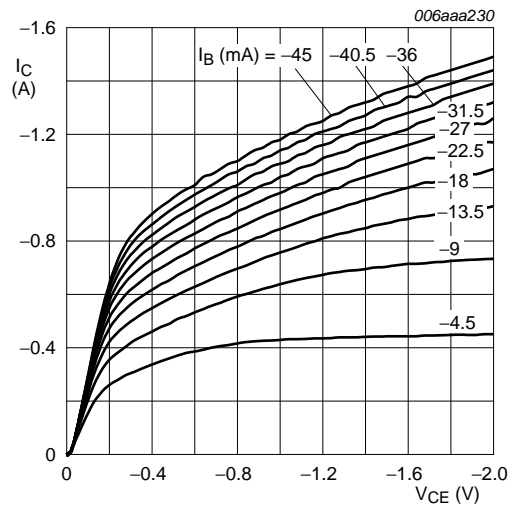
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = -30 V; I <sub>E</sub> = 0 A	-	-	-100	nA
		V <sub>CB</sub> = -30 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	-10	μA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = -5 V; I <sub>C</sub> = 0 A	-	-	-100	nA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = -2 V				
		I <sub>C</sub> = -5 mA	63	-	-	
		I <sub>C</sub> = -150 mA	63	-	250	
		I <sub>C</sub> = -500 mA	[1] 40	-	-	
	DC current gain	V <sub>CE</sub> = -2 V				
	h <sub>FE</sub> selection -10	I <sub>C</sub> = -150 mA	63	-	160	
	h <sub>FE</sub> selection -16	I <sub>C</sub> = -150 mA	100	-	250	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = -500 mA; I <sub>B</sub> = -50 mA	[1] -	-	-0.5	V
V <sub>BE</sub>	base-emitter voltage	V <sub>CE</sub> = -2 V; I <sub>C</sub> = -500 mA	[1] -	-	-1	V
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	-	15	-	pF
f <sub>T</sub>	transition frequency	V <sub>CE</sub> = -5 V; I <sub>C</sub> = -50 mA; f = 100 MHz	-	145	-	MHz

[1] Pulse test: t<sub>p</sub> ≤ 300 μs; δ = 0.02.



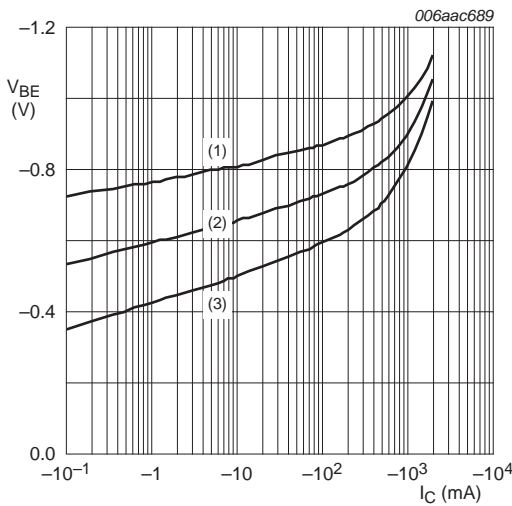
$V_{CE} = -2\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig 15. DC current gain as a function of collector current; typical values**



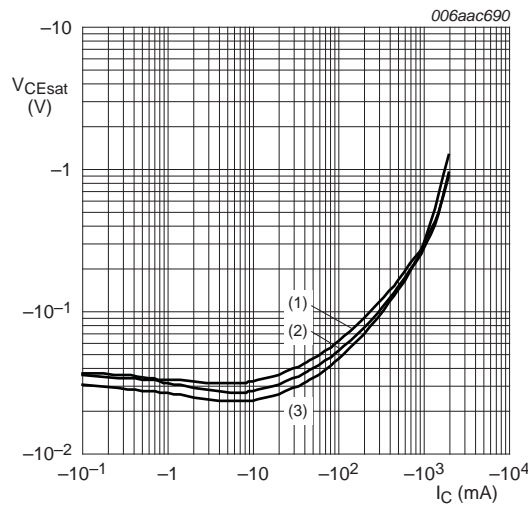
$T_{amb} = 25\text{ }^{\circ}\text{C}$

**Fig 16. 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 17. Base-emitter voltage as a function of collector current; typical values**



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

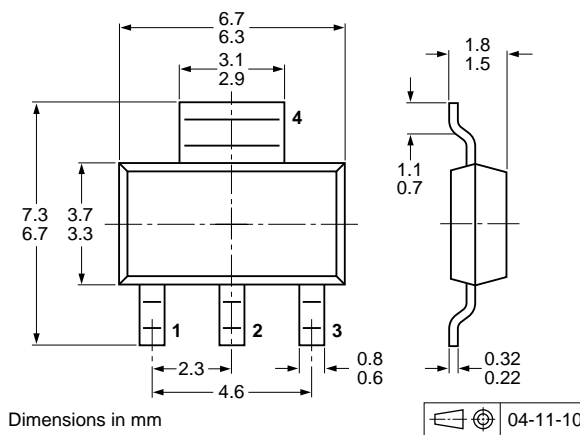
**Fig 18. Collector-emitter saturation voltage as a function of collector current; typical values**

## 8. Test information

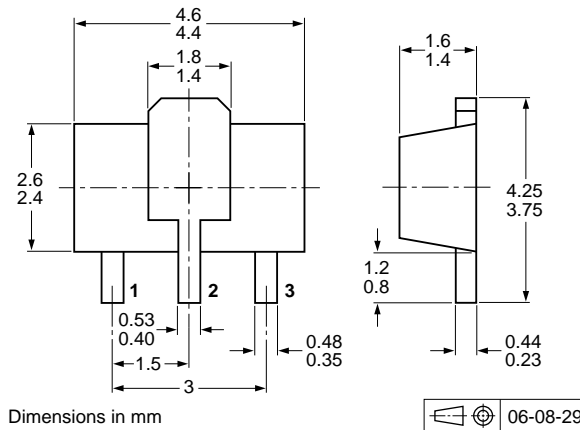
### 8.1 Quality information

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 19. Package outline SOT223 (SC-73)**



**Fig 20. Package outline SOT89 (SC-62/TO-243)**

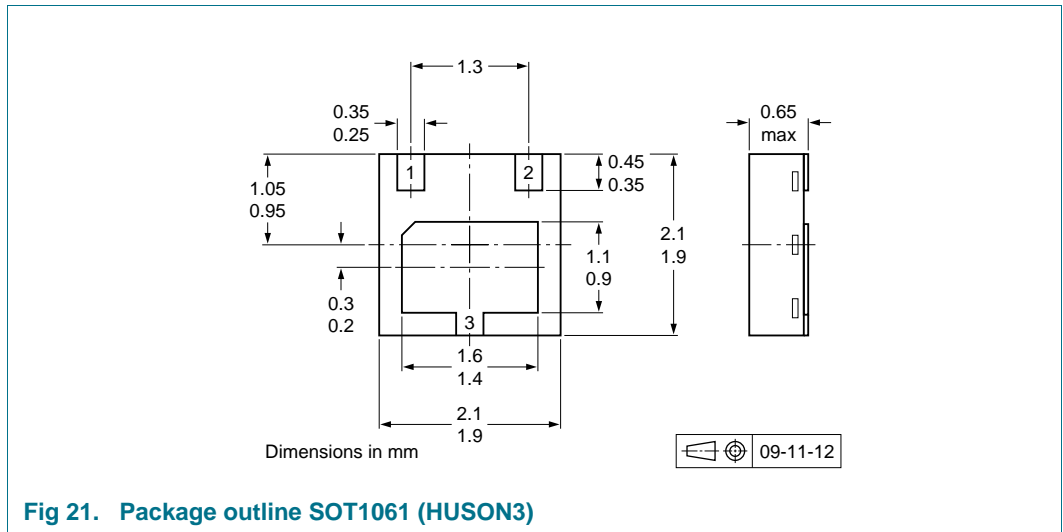


Fig 21. Package outline SOT1061 (HUSON3)

## 10. Packing information

**Table 9. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

Type number <sup>[2]</sup>	Package	Description	Packing quantity		
			1000	3000	4000
BCP51	SOT223	8 mm pitch, 12 mm tape and reel	-115	-	-135
BCX51	SOT89	8 mm pitch, 12 mm tape and reel; T1 <sup>[3]</sup>	-115	-	-135
		8 mm pitch, 12 mm tape and reel; T3 <sup>[4]</sup>	-146	-	-
BC51PA	SOT1061	4 mm pitch, 8 mm tape and reel	-	-115	-

[1] For further information and the availability of packing methods, see [Section 14](#).

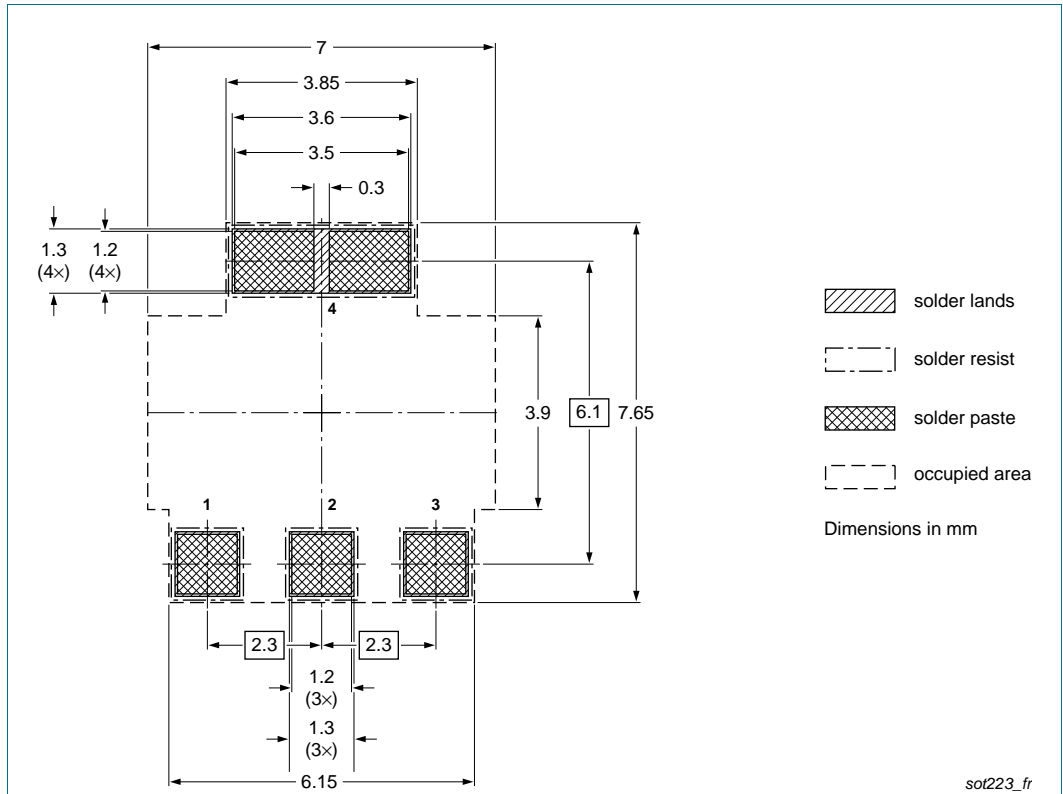
[2] Valid for all available selection groups.

[3] T1: normal taping

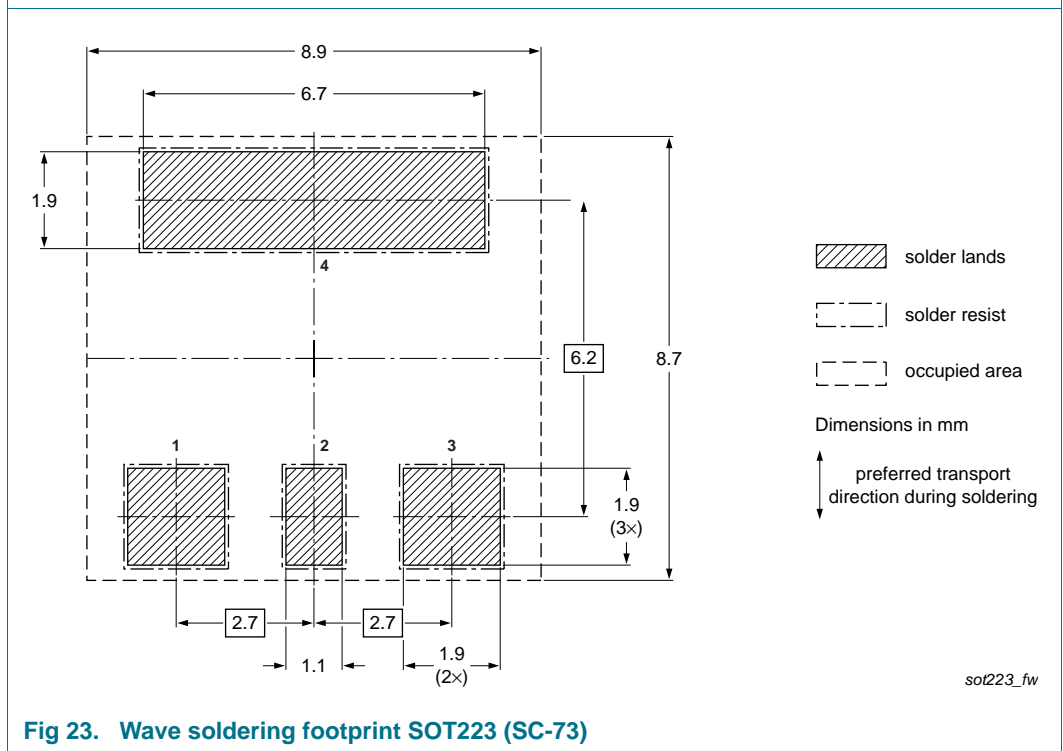
[4] T3: 90° rotated taping



**11. Soldering**



**Fig 22. Reflow soldering footprint SOT223 (SC-73)**



**Fig 23. Wave soldering footprint SOT223 (SC-73)**

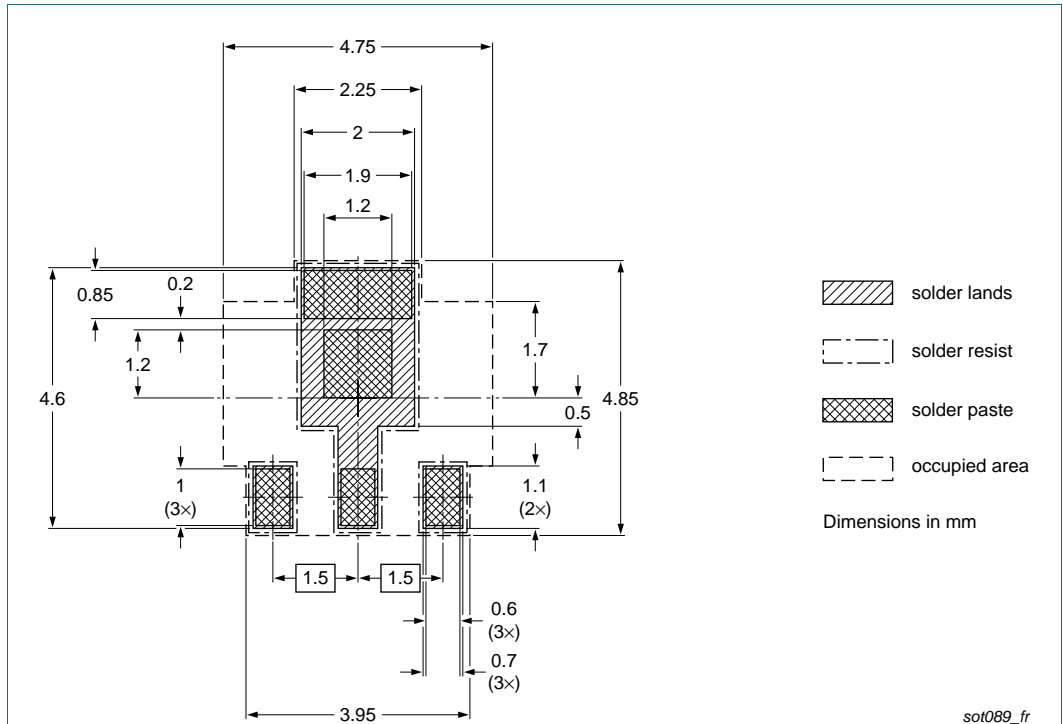


Fig 24. Reflow soldering footprint SOT89 (SC-62/TO-243)

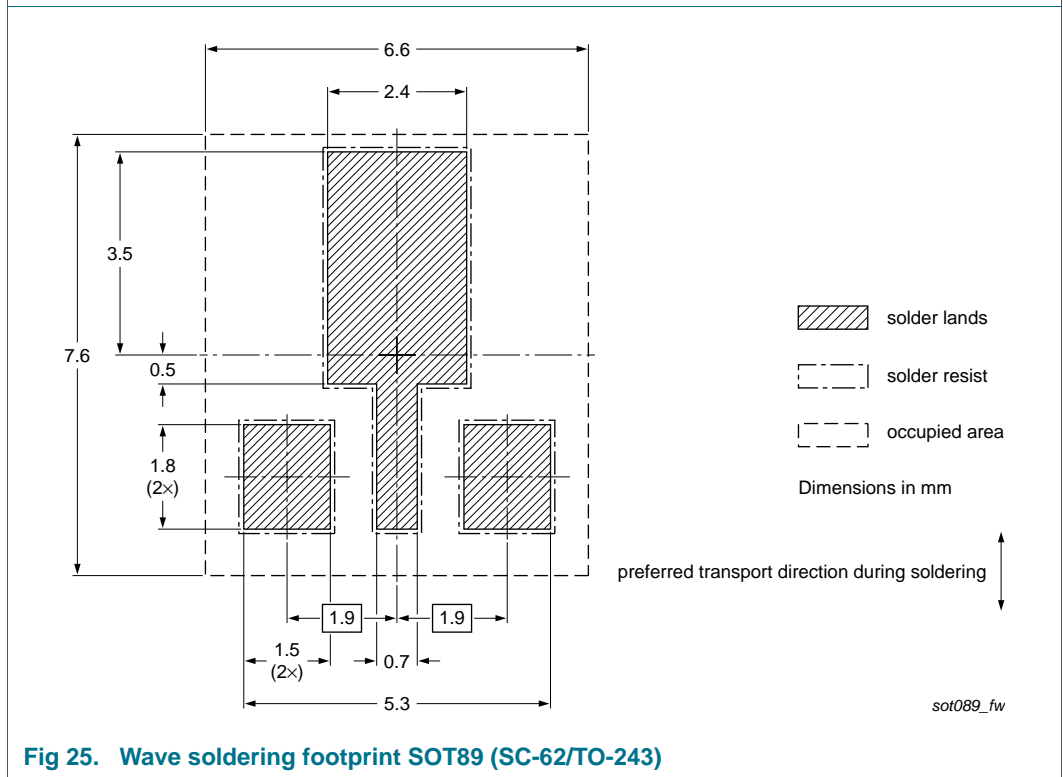
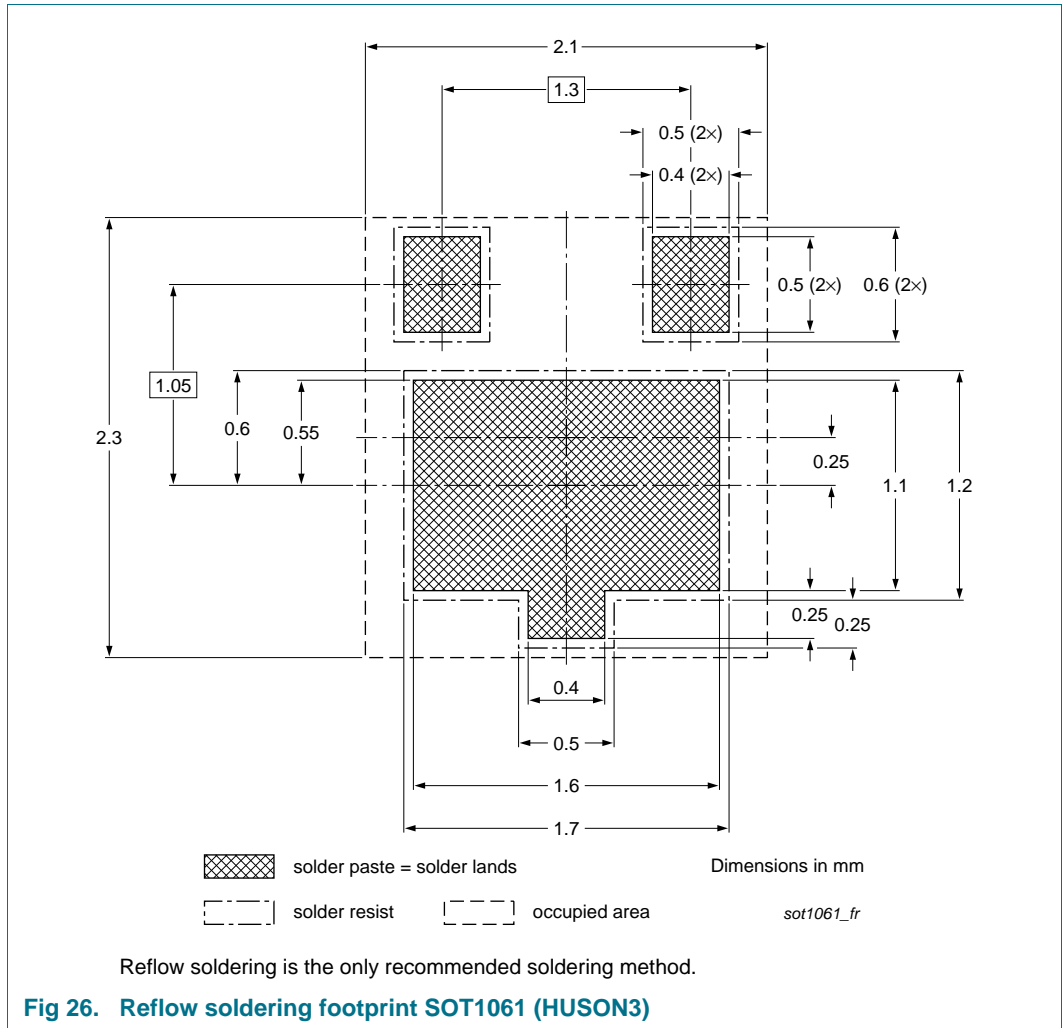


Fig 25. Wave soldering footprint SOT89 (SC-62/TO-243)



## 12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BCP51_BCX51_BC51PA v.9	20111013	Product data sheet	-	BC636_BCP51_BCX51 v.8
Modifications:	<ul style="list-style-type: none"> <li>Deleted type number BC636</li> <li>Added Type number BC51PA</li> <li><a href="#">Section 1 "Product profile"</a>: updated</li> <li><a href="#">Table 6</a> and <a href="#">7</a>: updated according to latest measurements</li> <li><a href="#">Figure 1</a> to <a href="#">9</a>, <a href="#">15</a>, <a href="#">17</a>, <a href="#">18</a> and <a href="#">21</a>: updated</li> <li><a href="#">Figure 10</a> to <a href="#">14</a>: added</li> <li><a href="#">Section 8 "Test information"</a>: added</li> <li><a href="#">Section 11 "Soldering"</a>: added</li> <li><a href="#">Section 13 "Legal information"</a>: updated</li> </ul>			
BC636_BCP51_BCX51 v.8	20080222	Product data sheet	-	BC636_BCP51_BCX51 v.7
BC636_BCP51_BCX51 v.7	20070629	Product data sheet	-	BC636_BCP51_BCX51 v.6
BC636_BCP51_BCX51 v.6	20060329	Product data sheet	-	BC636_638_640 v.5 BCP51_52_53 v.5 BCX51_52_53 v.4
BC636_638_640 v.5	20041011	Product specification	-	BC636_638_640 v.4
BCP51_52_53 v.5	20030206	Product specification	-	BCP51_52_53 v.4
BCX51_52_53 v.4	20011010	Product specification	-	BCX51_52_53 v.3

## 13. Legal information

### 13.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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## 15. Contents

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<b>1</b>	<b>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</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>3</b>
<b>4</b>	<b>Marking</b> . . . . .	<b>3</b>
<b>5</b>	<b>Limiting values</b> . . . . .	<b>4</b>
<b>6</b>	<b>Thermal characteristics</b> . . . . .	<b>6</b>
<b>7</b>	<b>Characteristics</b> . . . . .	<b>12</b>
<b>8</b>	<b>Test information</b> . . . . .	<b>14</b>
8.1	Quality information . . . . .	14
<b>9</b>	<b>Package outline</b> . . . . .	<b>14</b>
<b>10</b>	<b>Packing information</b> . . . . .	<b>15</b>
<b>11</b>	<b>Soldering</b> . . . . .	<b>16</b>
<b>12</b>	<b>Revision history</b> . . . . .	<b>19</b>
<b>13</b>	<b>Legal information</b> . . . . .	<b>20</b>
13.1	Data sheet status . . . . .	20
13.2	Definitions . . . . .	20
13.3	Disclaimers . . . . .	20
13.4	Trademarks . . . . .	21
<b>14</b>	<b>Contact information</b> . . . . .	<b>21</b>
<b>15</b>	<b>Contents</b> . . . . .	<b>22</b>

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