

# BC638; BCP52; BCX52

60 V, 1 A PNP medium power transistors

Rev. 07 — 26 June 2007

Product data sheet

## 1. Product profile

### 1.1 General description

PNP medium power transistor series.

Table 1. Product overview

Type number <sup>[1]</sup>	Package			NPN complement
	NXP	JEITA	JEDEC	
BC638 <sup>[2]</sup>	SOT54	SC-43A	TO-92	BC637
BCP52	SOT223	SC-73	-	BCP55
BCX52	SOT89	SC-62	TO-243	BCX55

[1] Valid for all available selection groups.

[2] Also available in SOT54A and SOT54 variant packages (see [Section 2](#)).

### 1.2 Features

- High current
- Two current gain selections
- High power dissipation capability

### 1.3 Applications

- Linear voltage regulators
- High-side switches
- 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	-	-	-60	V
$I_C$	collector current		-	-	-1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	-1.5	A
$h_{FE}$	DC current gain	$V_{CE} = -2$ V; $I_C = -150$ mA	63	-	250	
	$h_{FE}$ selection -10	$V_{CE} = -2$ V; $I_C = -150$ mA	63	-	160	
	$h_{FE}$ selection -16	$V_{CE} = -2$ V; $I_C = -150$ mA	100	-	250	

## 2. Pinning information

**Table 3. Pinning**

Pin	Description	Simplified outline	Symbol
<b>SOT54</b>			
1	base	<p>001aab347</p>	<p>sym029</p>
2	collector		
3	emitter		
<b>SOT54A</b>			
1	base	<p>001aab348</p>	<p>sym029</p>
2	collector		
3	emitter		
<b>SOT54 variant</b>			
1	base	<p>001aab447</p>	<p>sym029</p>
2	collector		
3	emitter		
<b>SOT223</b>			
1	base		<p>sym028</p>
2	collector		
3	emitter		
4	collector		
<b>SOT89</b>			
1	emitter		<p>006aaa231</p>
2	collector		
3	base		

### 3. Ordering information

**Table 4. Ordering information**

Type number <sup>[1]</sup>	Package		
	Name	Description	Version
BC638 <sup>[2]</sup>	SC-43A	plastic single-ended leaded (through hole) package; 3 leads	SOT54
BCP52	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCX52	SC-62	plastic surface-mounted package; collector pad for good heat transfer; 3 leads	SOT89

[1] Valid for all available selection groups.

[2] Also available in SOT54A and SOT54 variant packages (see [Section 2](#) and [Section 9](#)).

### 4. Marking

**Table 5. Marking codes**

Type number	Marking code
BC638	C638
BC638-16	C63816
BCP52	BCP52
BCP52-10	BCP52/10
BCP52-16	BCP52/16
BCX52	AE
BCX52-10	AG
BCX52-16	AM

## 5. Limiting values

**Table 6. Limiting values**

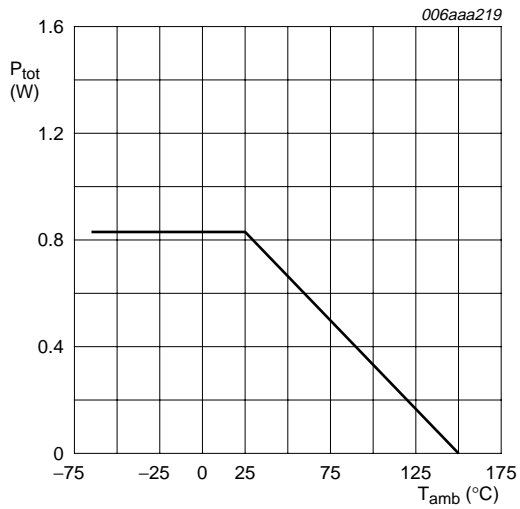
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit		
$V_{CBO}$	collector-base voltage	open emitter	-	-60	V		
$V_{CEO}$	collector-emitter voltage	open base	-	-60	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	-	-1.5	A		
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	-0.2	A		
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C					
			BC638	[1]	-	0.83	W
			BCP52	[1]	-	0.65	W
				[2]	-	1	W
			BCX52	[1]	-	0.5	W
				[2]	-	0.9	W
[3]	-	1.3		W			
$T_j$	junction temperature		-	150	°C		
$T_{amb}$	ambient temperature		-65	+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.

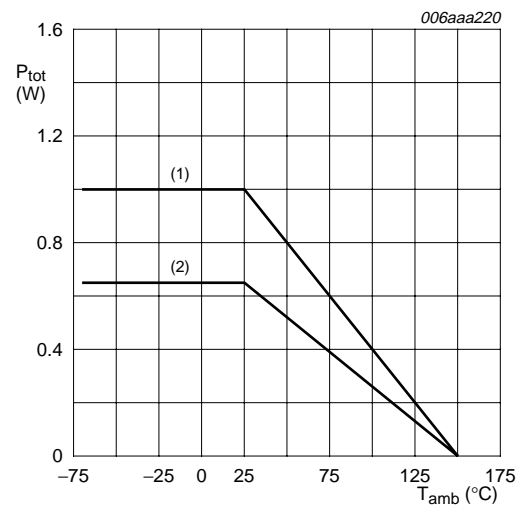
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

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



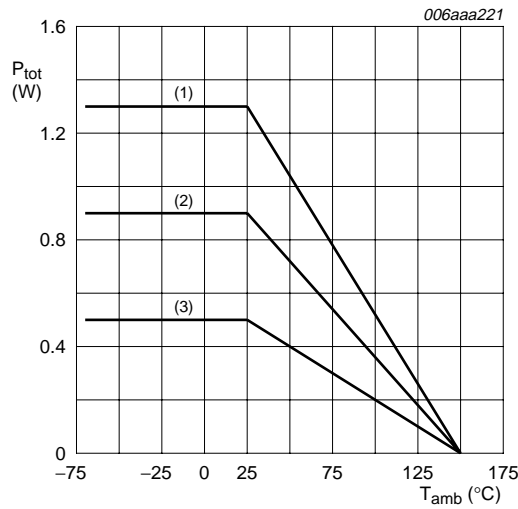
FR4 PCB, standard footprint

**Fig 1. Power derating curve SOT54**



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

**Fig 2. 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

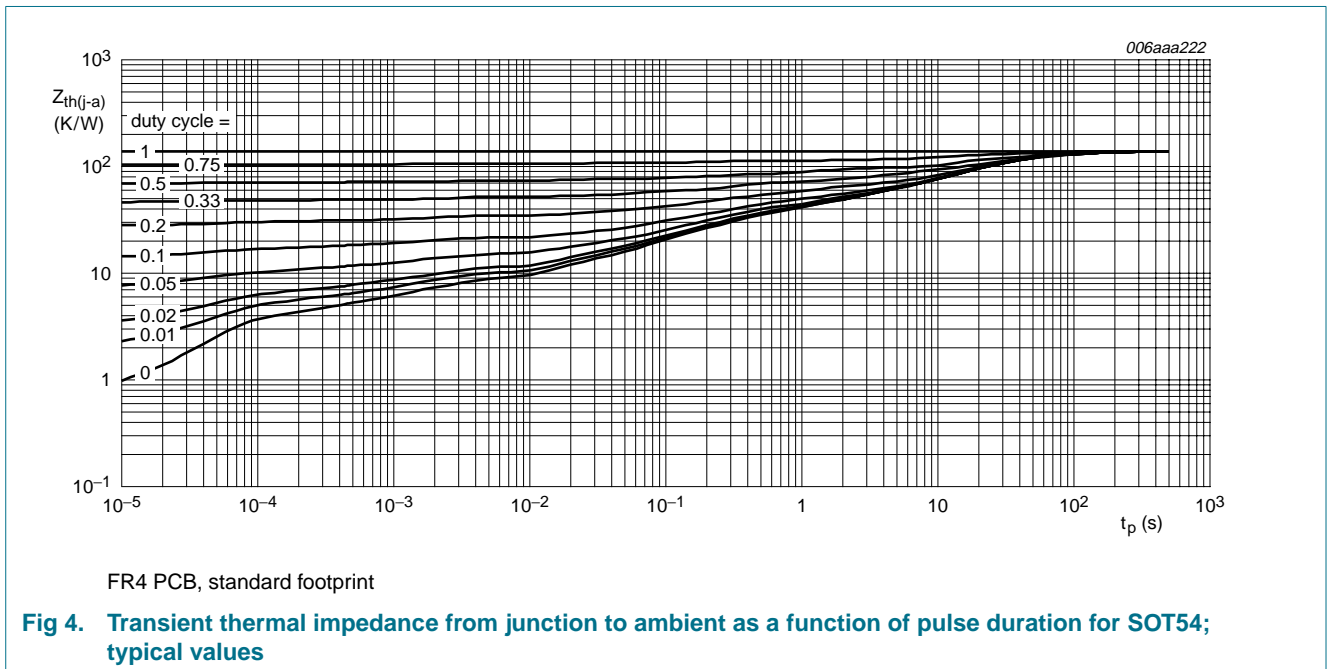
**Fig 3. Power derating curves SOT89**

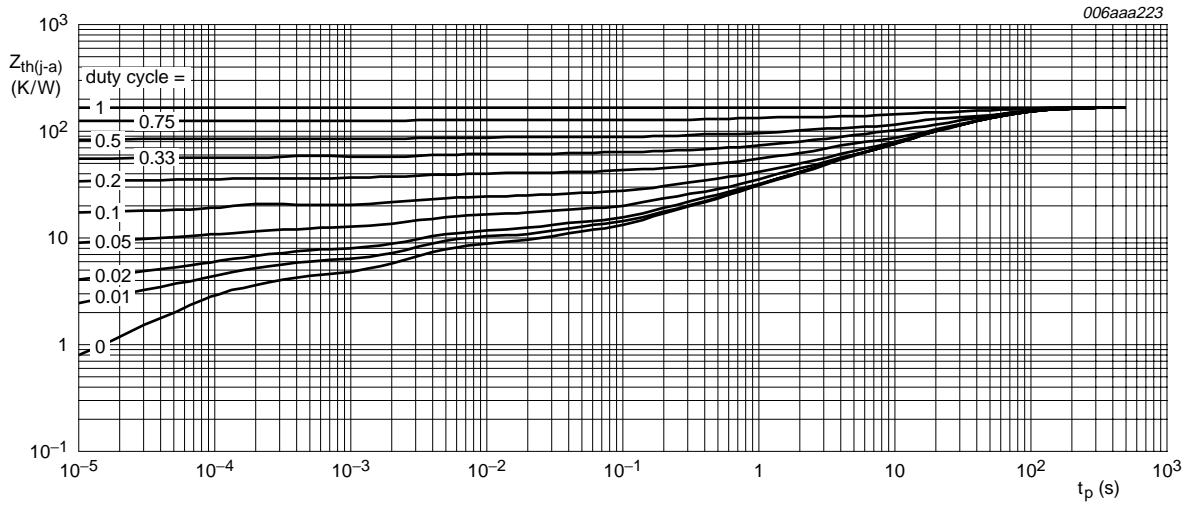
6. Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit		
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air						
			BC638	[1]	-	-	150	K/W
			BCP52	[1]	-	-	190	K/W
				[2]	-	-	125	K/W
			BCX52	[1]	-	-	230	K/W
				[2]	-	-	135	K/W
[3]	-	-		95	K/W			
$R_{th(j-sp)}$	thermal resistance from junction to solder point							
		BC638	-	-	40	K/W		
		BCP52	-	-	17	K/W		
		BCX52	-	-	20	K/W		

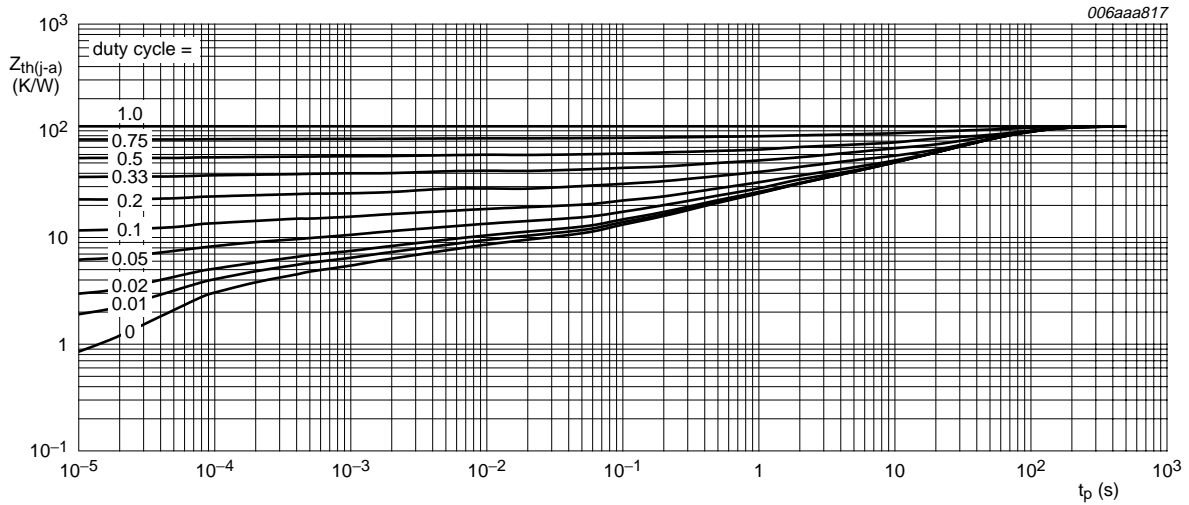
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.





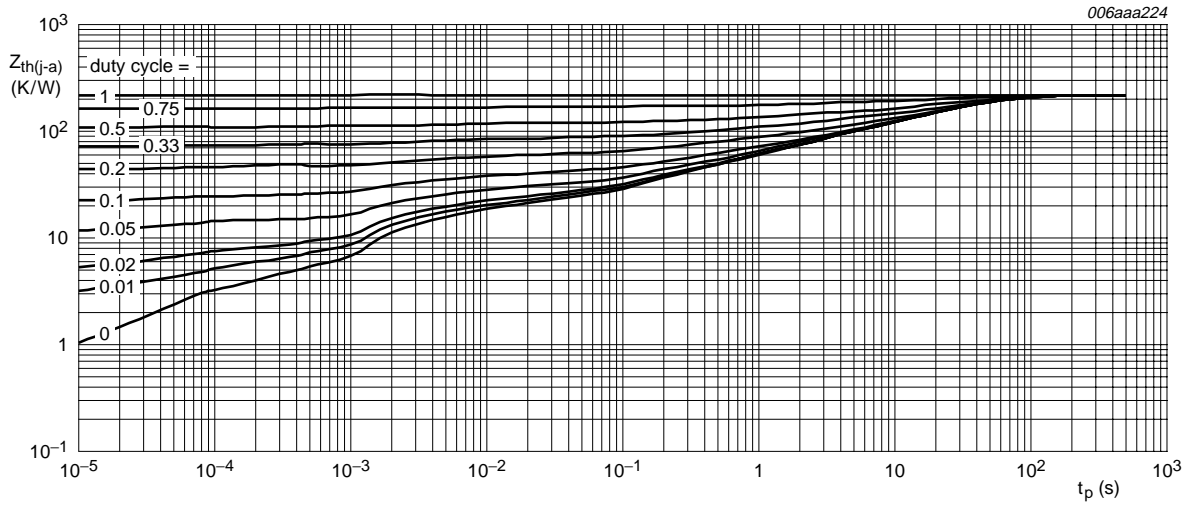
FR4 PCB, standard footprint

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



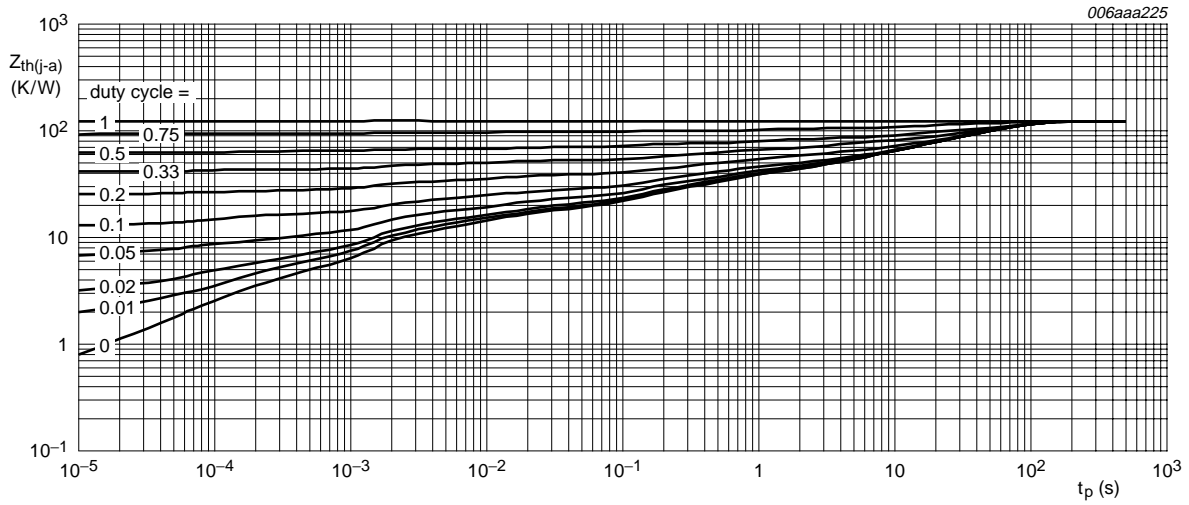
FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

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



FR4 PCB, standard footprint

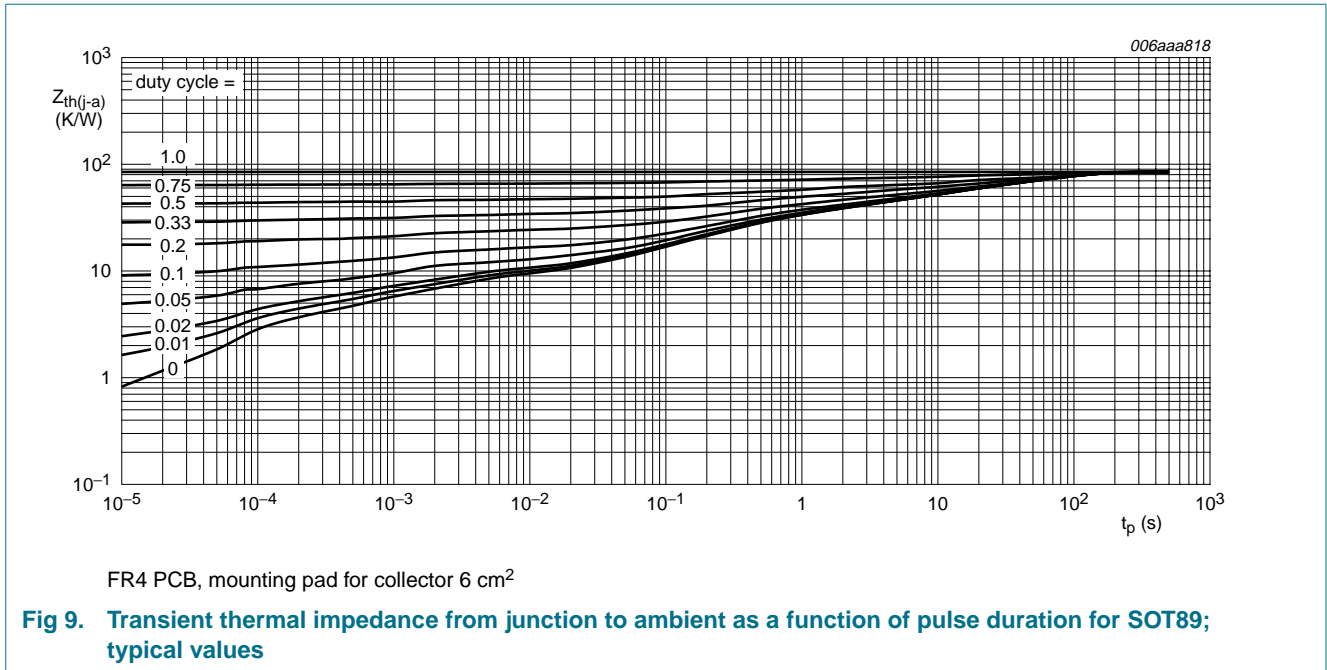
Fig 7. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values



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





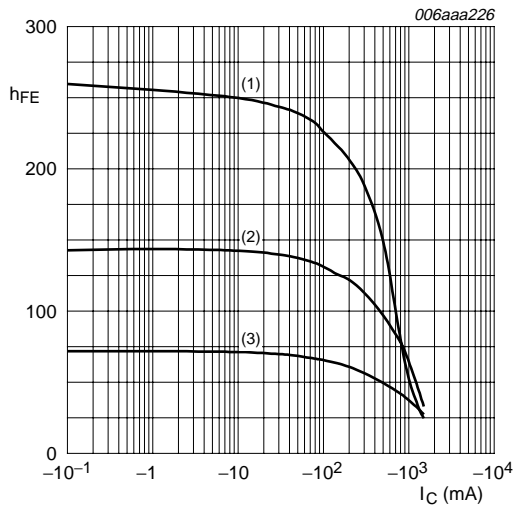
## 7. Characteristics

**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

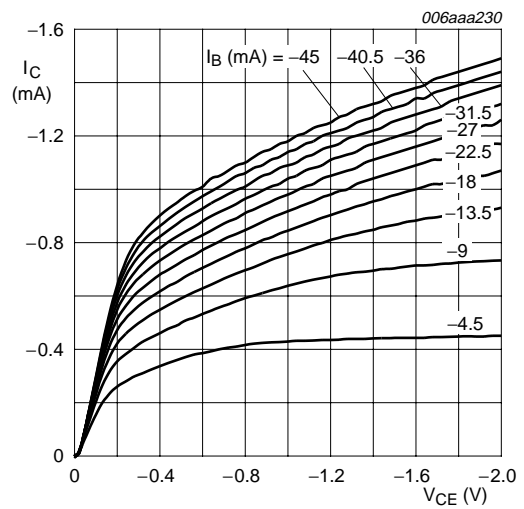
[1] Pulse test: t<sub>p</sub> ≤ 300 μs; δ = 0.02.



$V_{CE} = -2\text{ V}$

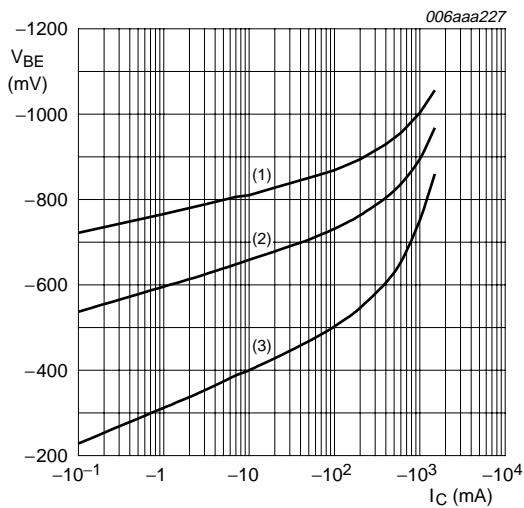
- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig 10. DC current gain as a function of collector current; typical values**



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

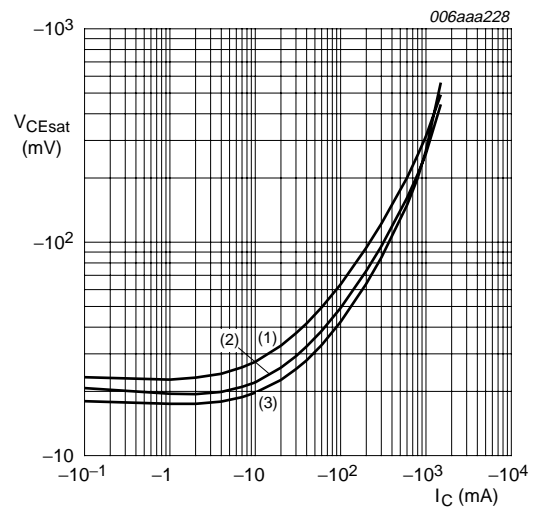
**Fig 11. Collector current as a function of collector-emitter voltage; typical values**



$V_{CE} = -2\text{ V}$

- (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

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

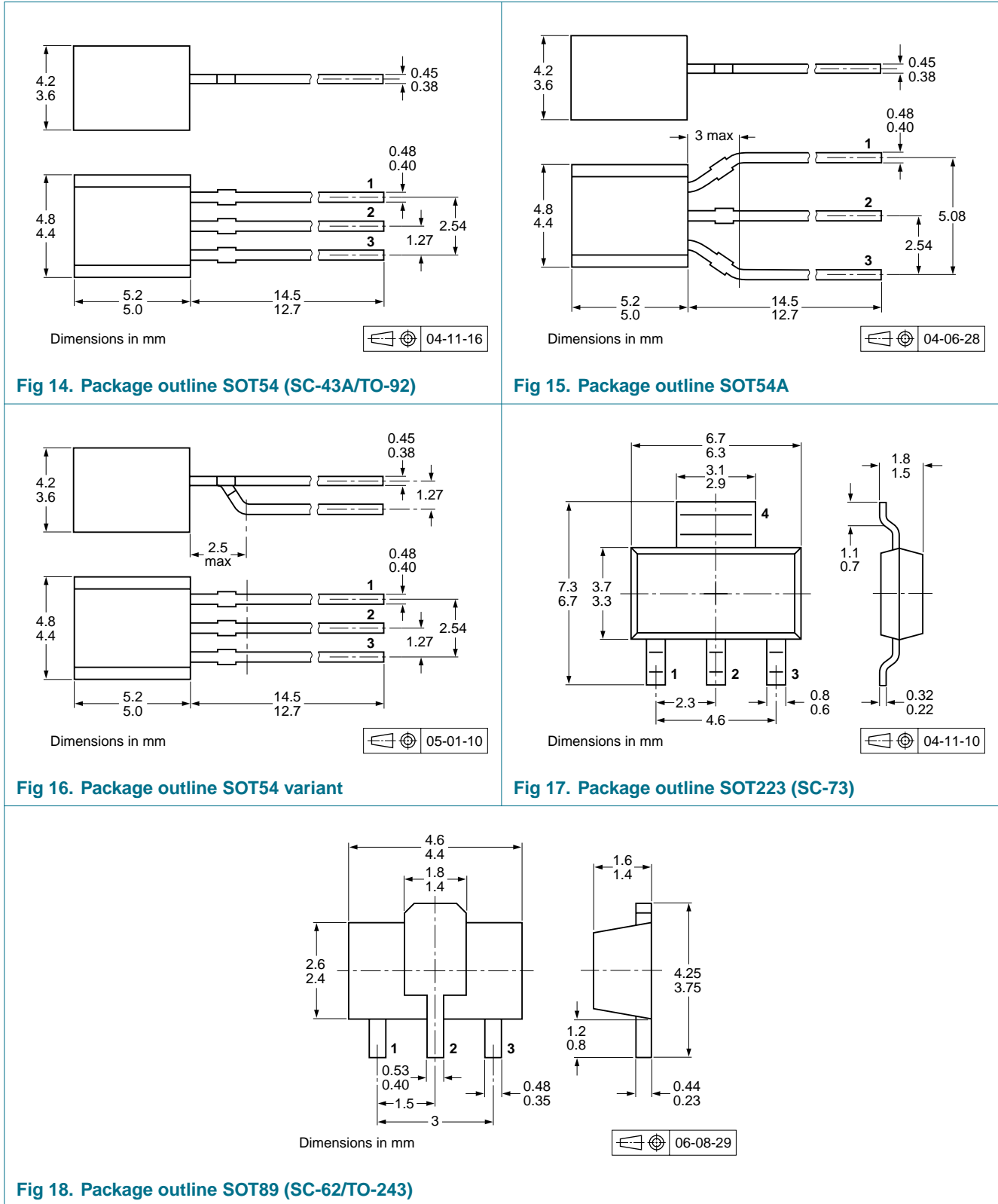


$I_C/I_B = 10$

- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
- (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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

**8. Package outline**



## 9. 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	4000	5000	10000
BC638	SOT54	bulk, straight leads	-	-	-412	-
	SOT54A	tape and reel, wide pitch	-	-	-	-116
		tape ammopack, wide pitch	-	-	-	-126
	SOT54 variant	bulk, delta pinning	-	-	-112	-
BCP52	SOT223	8 mm pitch, 12 mm tape and reel	-115	-135	-	-
BCX52	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> -120	-	-	-

[1] For further information and the availability of packing methods, see [Section 12](#).

[2] Valid for all available selection groups.

[3] T1: normal taping

[4] T3: 90° rotated taping

## 10. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BC638_BCP52_BCX52_7	20070626	Product data sheet	-	BC638_BCP52_BCX52_6
Modifications: <ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Section 1.3 "Applications"</a>: amended</li> <li>• <a href="#">Table 6 "Limiting values"</a>: typing error for BCX52 <math>P_{tot}</math> maximum value on 6 cm<sup>2</sup> corrected</li> <li>• <a href="#">Figure 1</a>, <a href="#">2</a>, <a href="#">3</a>, <a href="#">4</a> and <a href="#">5</a>: amended</li> <li>• <a href="#">Figure 6</a>: added</li> <li>• <a href="#">Figure 7</a> and <a href="#">8</a>: amended</li> <li>• <a href="#">Figure 9</a>: added</li> <li>• <a href="#">Figure 11</a>: amended</li> <li>• <a href="#">Table 9 "Packing methods"</a>: new packing method for BCX52 added</li> <li>• <a href="#">Section 11 "Legal information"</a>: updated</li> </ul>				
BC638_BCP52_BCX52_6	20060329	Product data sheet	-	BC636_638_640_5 BCP51_52_53_5 BCX51_52_53_4
BC636_638_640_5	20041011	Product specification	-	BC636_638_640_4
BCP51_52_53_5	20030206	Product specification	-	BCP51_52_53_4
BCX51_52_53_4	20011010	Product specification	-	BCX51_52_53_3

## 11. Legal information

### 11.1 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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