

# BC635; BCP54; BCX54

45 V, 1 A NPN medium power transistors

Rev. 07 — 4 June 2007

Product data sheet

## 1. Product profile

### 1.1 General description

NPN medium power transistor series.

Table 1. Product overview

Type number <sup>[1]</sup>	Package			PNP complement
	NXP	JEITA	JEDEC	
BC635 <sup>[2]</sup>	SOT54	SC-43A	TO-92	BC636
BCP54	SOT223	SC-73	-	BCP51
BCX54	SOT89	SC-62	TO-243	BCX51

[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
- Low 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	-	-	45	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>sym056</p>
2	collector		
3	emitter		
<b>SOT54A</b>			
1	base	<p>001aab348</p>	<p>sym056</p>
2	collector		
3	emitter		
<b>SOT54 variant</b>			
1	base	<p>001aab447</p>	<p>sym056</p>
2	collector		
3	emitter		
<b>SOT223</b>			
1	base	<p>sym016</p>	<p>sym016</p>
2	collector		
3	emitter		
4	collector		
<b>SOT89</b>			
1	emitter	<p>sym042</p>	<p>sym042</p>
2	collector		
3	base		

### 3. Ordering information

**Table 4. Ordering information**

Type number <sup>[1]</sup>	Package		
	Name	Description	Version
BC635 <sup>[2]</sup>	SC-43A	plastic single-ended leaded (through hole) package; 3 leads	SOT54
BCP54	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCX54	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
BC635	C635
BC635-16	C63516
BCP54	BCP54
BCP54-10	BCP54/10
BCP54-16	BCP54/16
BCX54	BA
BCX54-10	BC
BCX54-16	BD

## 5. Limiting values

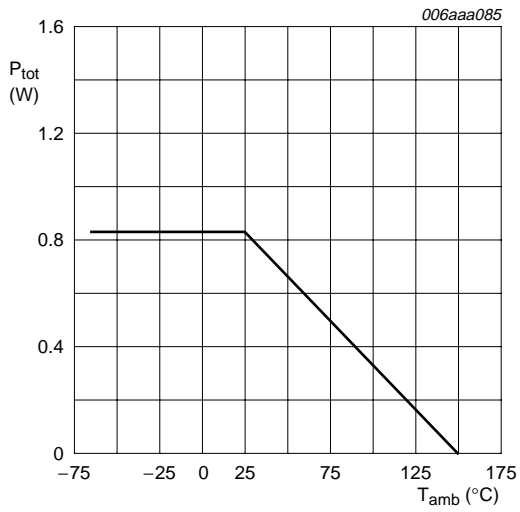
**Table 6. Limiting values***In accordance with the Absolute Maximum Rating System (IEC 60134).*

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	-	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				
			BC635	[1] -	0.83	W
			BCP54	[1] -	0.64	W
				[2] -	0.96	W
				[1] -	0.5	W
			[2] -	0.85	W	
[3] -	1.25	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.

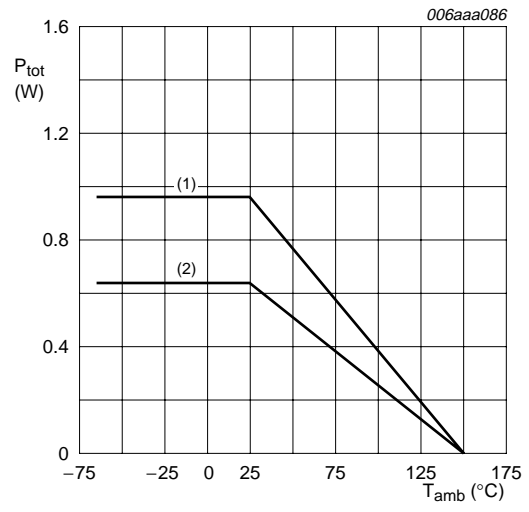
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

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



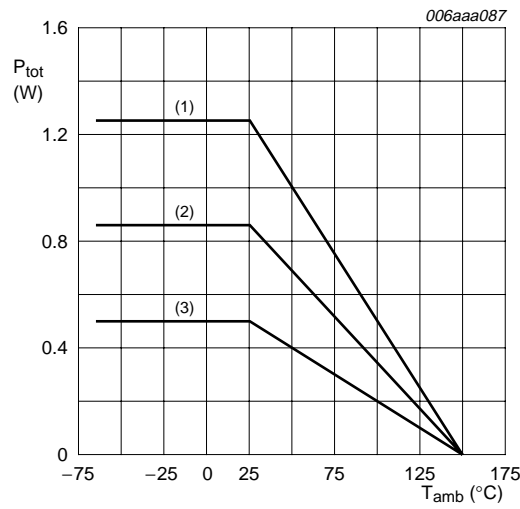
FR4 PCB, standard footprint

**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

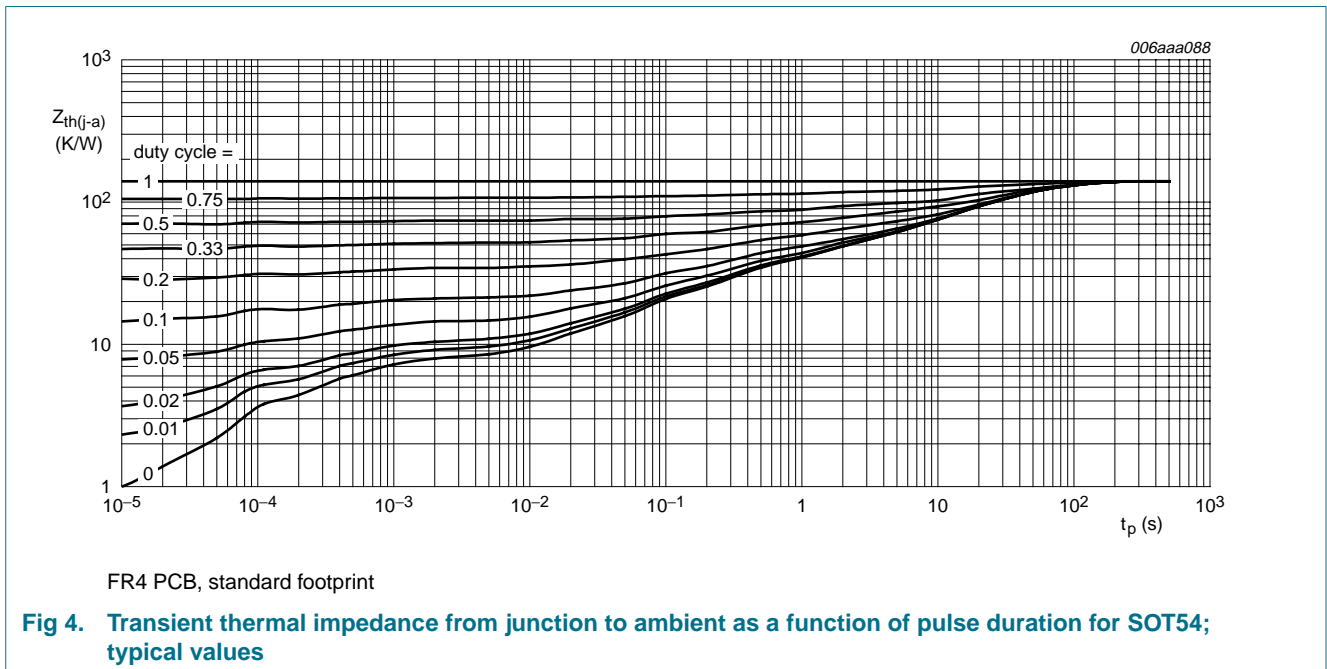
**Fig 3. Power derating curves SOT89**

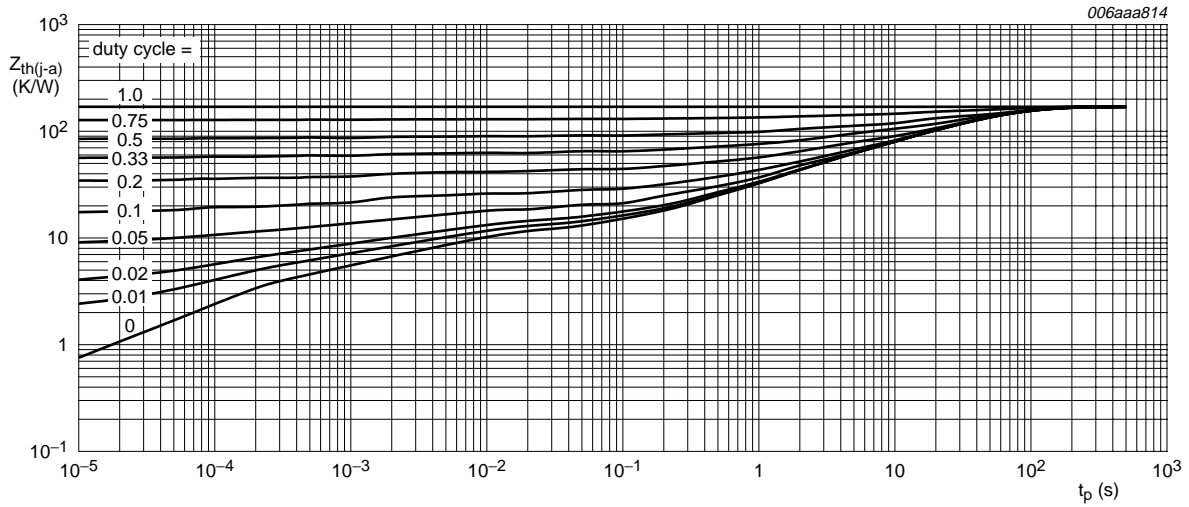
**6. Thermal characteristics**

**Table 7. Thermal characteristics**

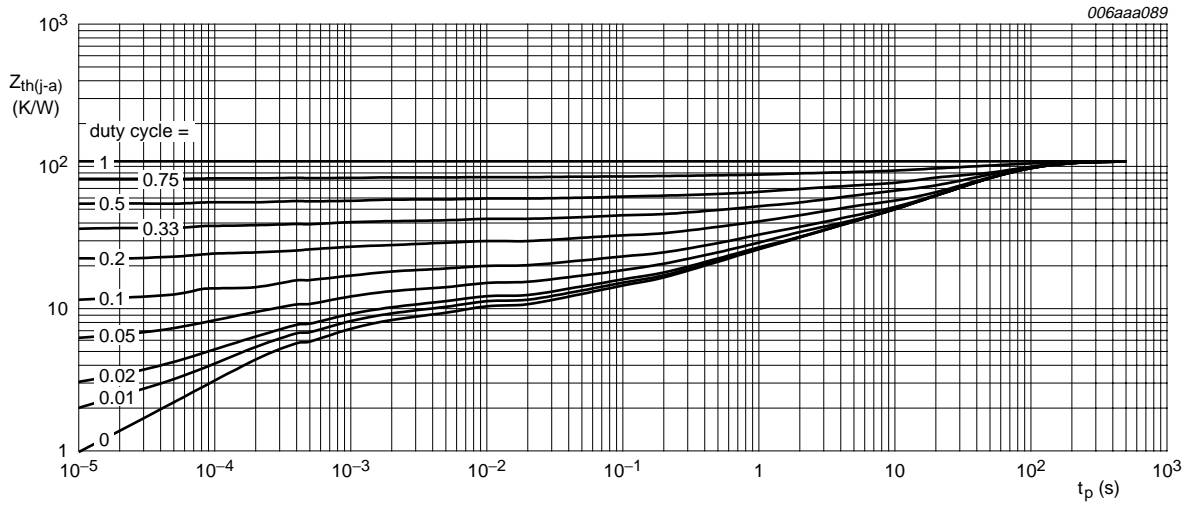
Symbol	Parameter	Conditions	Min	Typ	Max	Unit		
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air						
			BC635	[1]	-	-	150	K/W
			BCP54	[1]	-	-	195	K/W
				[2]	-	-	130	K/W
			BCX54	[1]	-	-	250	K/W
				[2]	-	-	145	K/W
[3]	-	-		100	K/W			
$R_{th(j-sp)}$	thermal resistance from junction to solder point							
		BC635	-	-	40	K/W		
		BCP54	-	-	17	K/W		
		BCX54	-	-	30	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>.

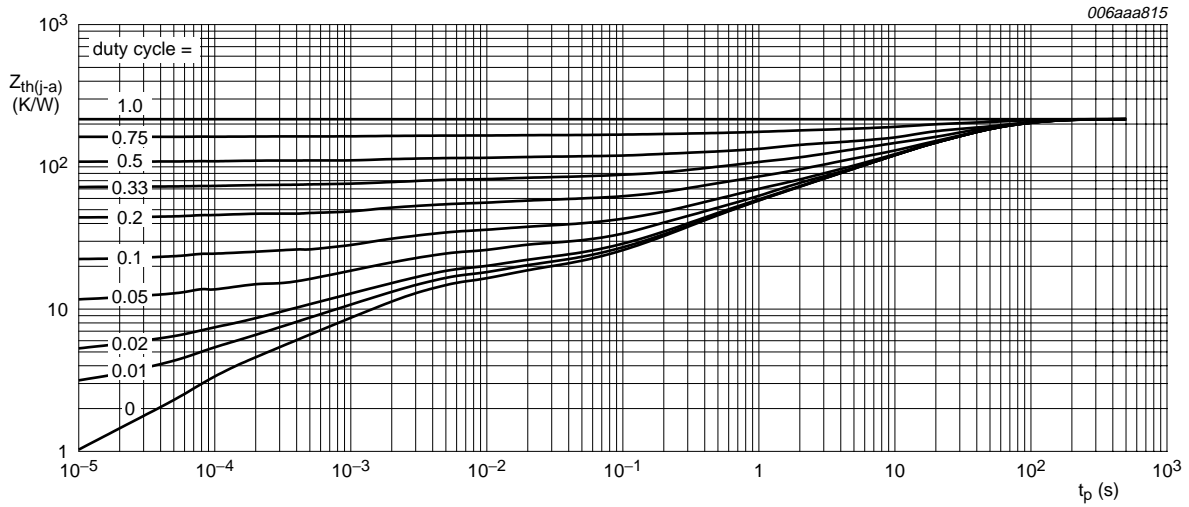




**Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values**

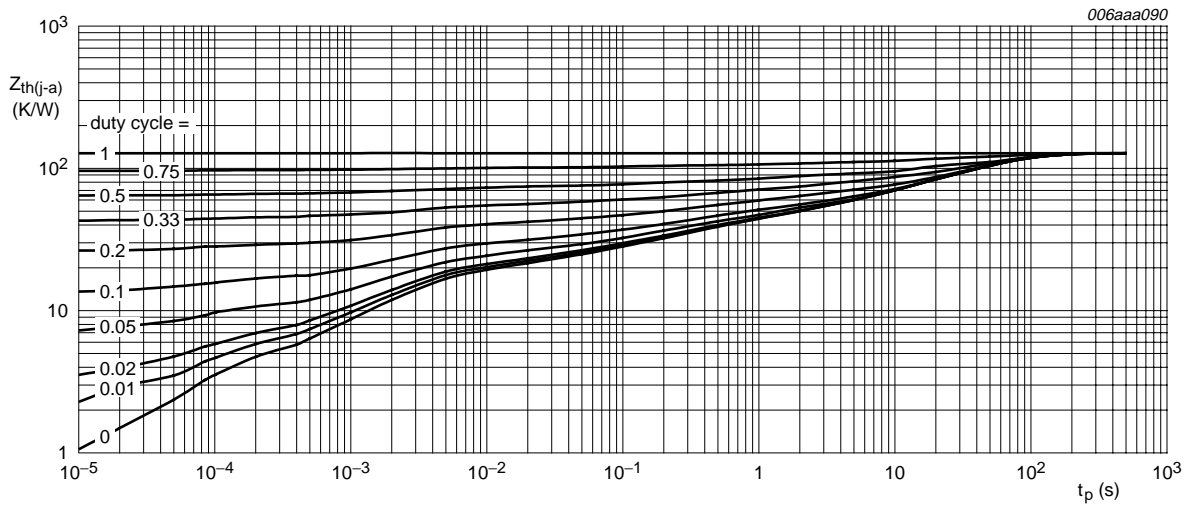


**Fig 6. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values**



FR4 PCB, standard footprint

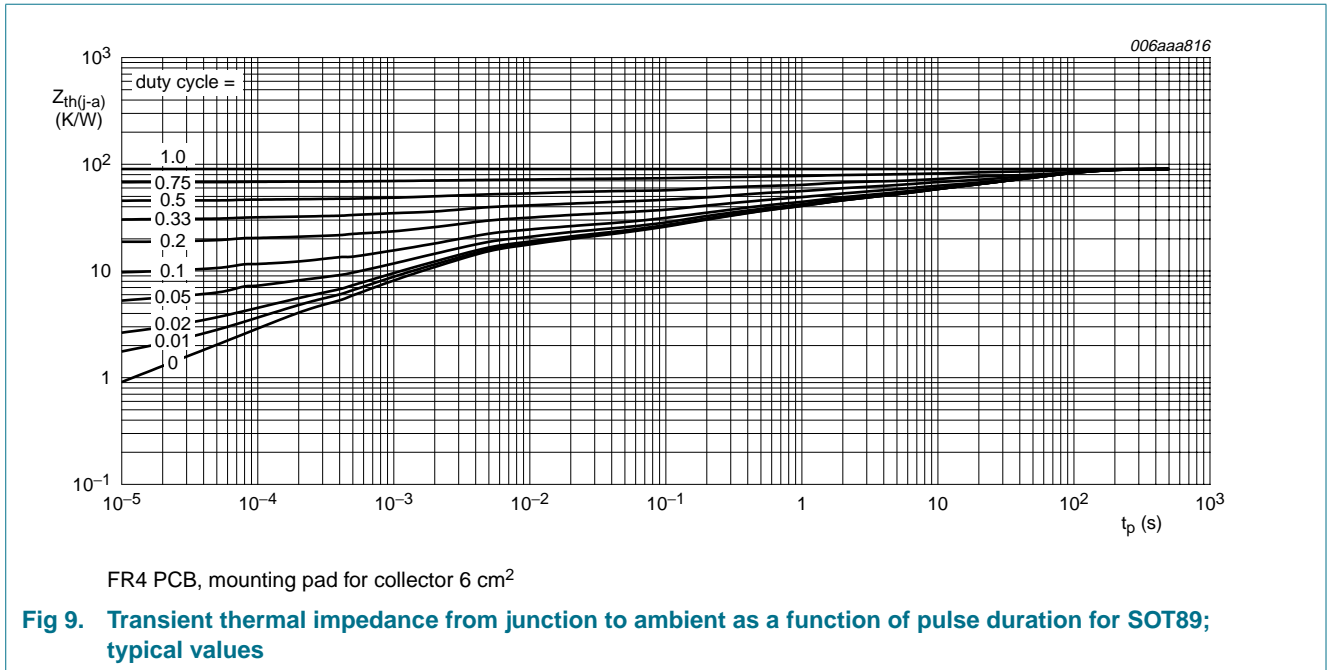
Fig 7. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values



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





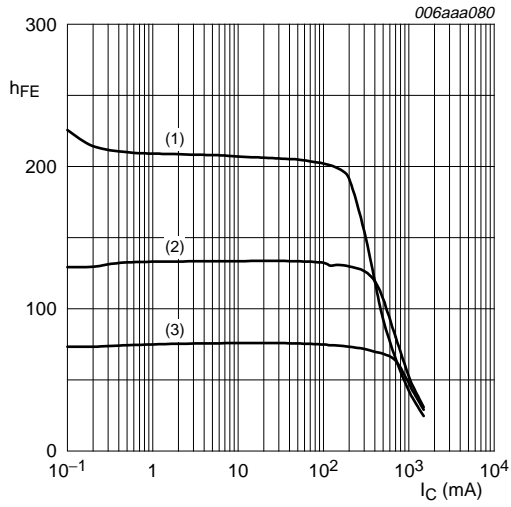
## 7. Characteristics

**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] -	-	500	mV
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	-	6	-	pF
f <sub>T</sub>	transition frequency	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 50 mA; f = 100 MHz	100	180	-	MHz

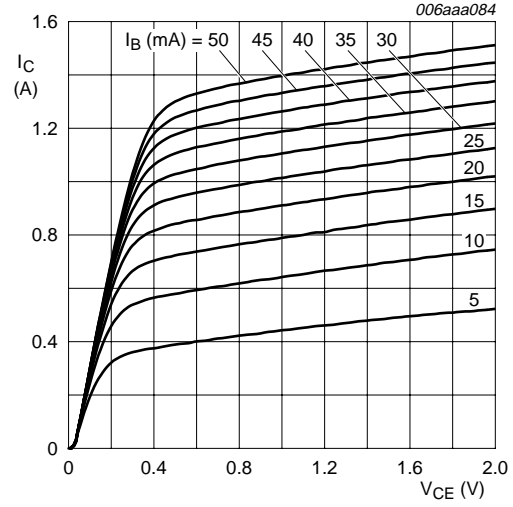
[1] Pulse test: t<sub>p</sub> ≤ 300 μs; δ = 0.02.



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

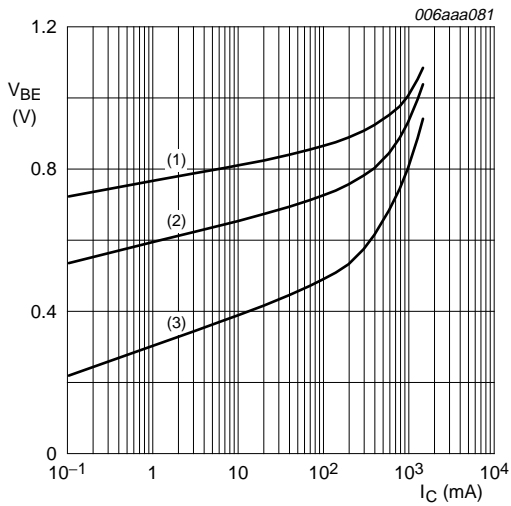
- (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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



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

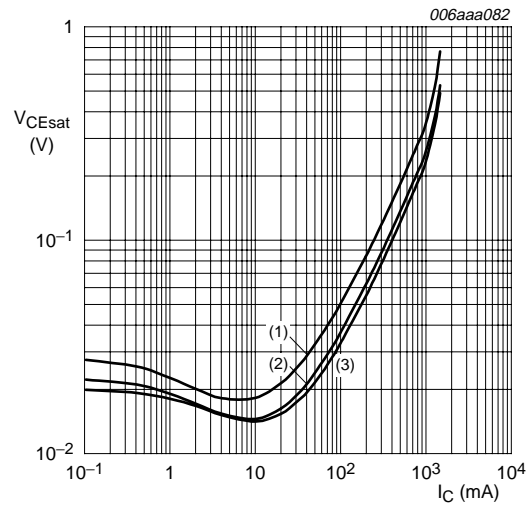
**Fig 11. Collector current as a function of collector-emitter voltage; typical values**



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

- (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**

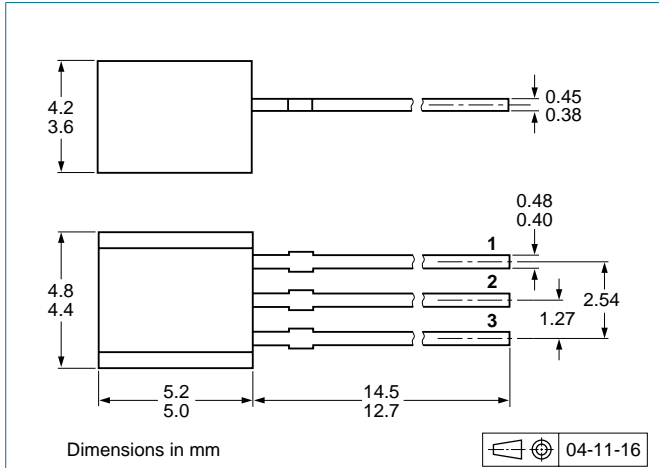


$I_C/I_B = 10$

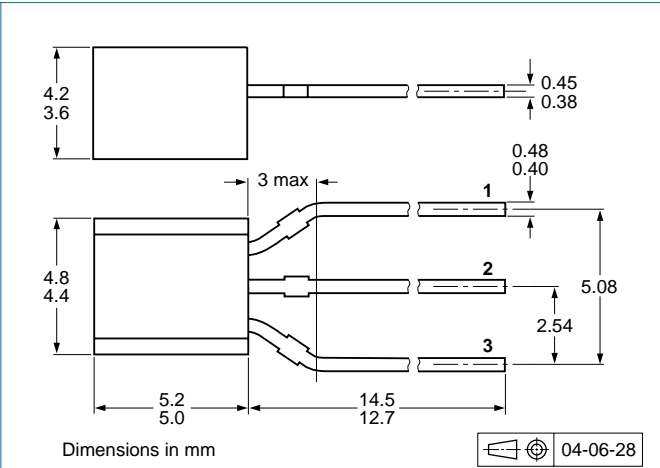
- (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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

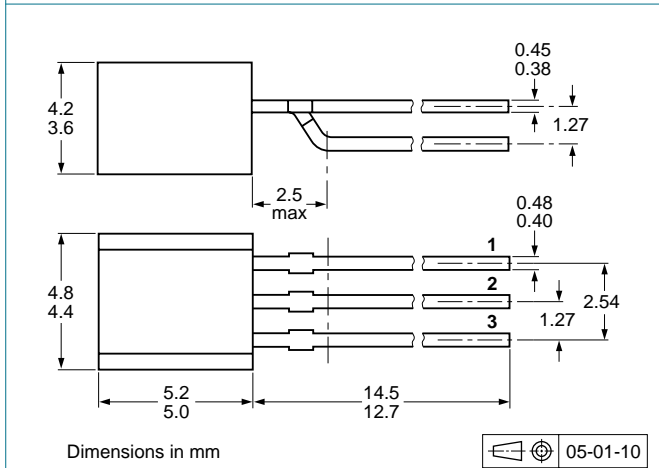
**8. Package outline**



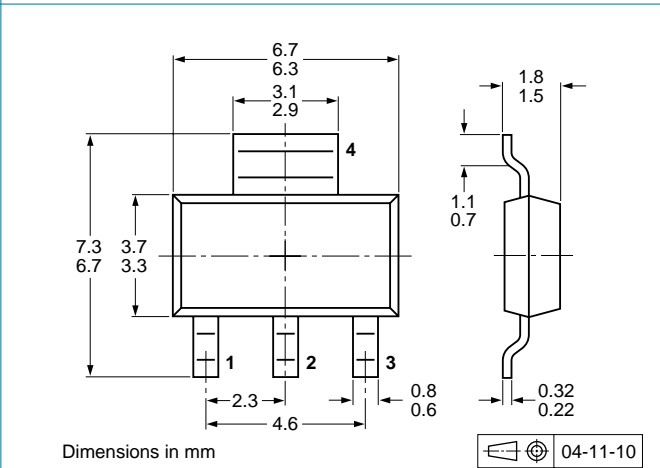
**Fig 14. Package outline SOT54 (SC-43A/TO-92)**



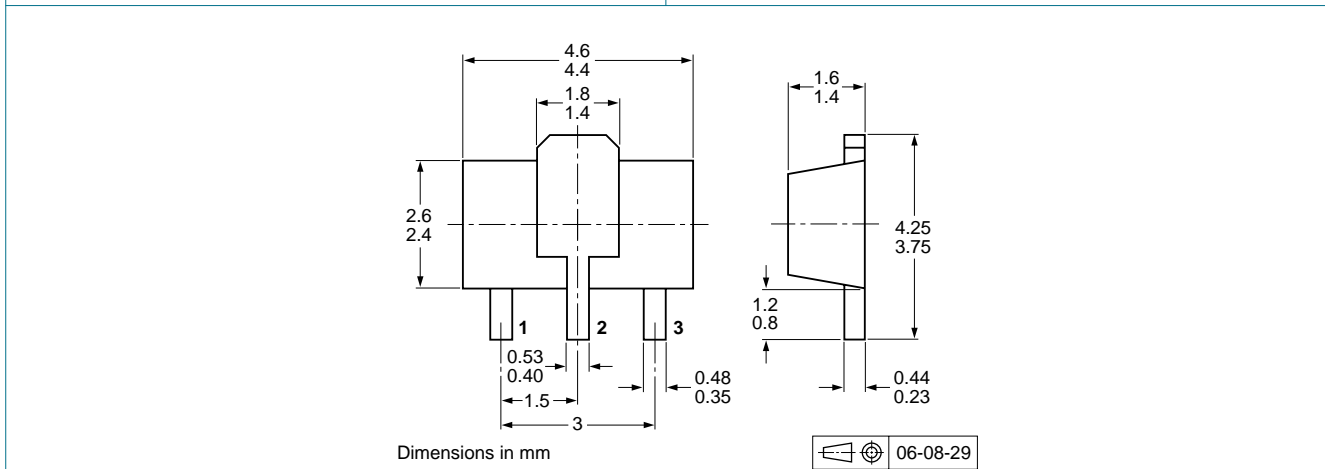
**Fig 15. Package outline SOT54A**



**Fig 16. Package outline SOT54 variant**



**Fig 17. Package outline SOT223 (SC-73)**



**Fig 18. Package outline SOT89 (SC-62/TO-243)**

## 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
BC635	SOT54	bulk, straight leads	-	-	-412	-
	SOT54A	tape and reel, wide pitch	-	-	-	-116
		tape ammopack, wide pitch	-	-	-	-126
	SOT54 variant	bulk, delta pinning	-	-	-112	-
BCP54	SOT223	8 mm pitch, 12 mm tape and reel	-115	-135	-	-
BCX54	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
BC635_BCP54_BCX54_7	20070604	Product data sheet	-	BC635_BCP54_BCX54_6
Modifications:				
<ul style="list-style-type: none"> <li>• <a href="#">Table 1 “Product overview”</a>: amended</li> <li>• <a href="#">Section 1.2 “Features”</a>: amended</li> <li>• <a href="#">Section 1.3 “Applications”</a>: amended</li> <li>• <a href="#">Table 2 “Quick reference data”</a>: I<sub>C</sub> parameter redefined to collector current</li> <li>• <a href="#">Table 2 “Quick reference data”</a>: I<sub>CM</sub> condition added</li> <li>• <a href="#">Figure 2</a> and <a href="#">3</a>: amended</li> <li>• <a href="#">Table 6 “Limiting values”</a>: I<sub>C</sub> parameter redefined to collector current</li> <li>• <a href="#">Table 6 “Limiting values”</a>: I<sub>CM</sub> condition added</li> <li>• <a href="#">Table 6 “Limiting values”</a>: P<sub>tot</sub> values for BCP54 and BCX54 adapted</li> <li>• <a href="#">Table 7 “Thermal characteristics”</a>: R<sub>th(j-a)</sub> values for BCP54 and BCX54 rounded</li> <li>• <a href="#">Figure 4</a>: Z<sub>th</sub> redefined to Z<sub>th(j-a)</sub> transient thermal impedance from junction to ambient</li> <li>• <a href="#">Figure 4</a>: t<sub>p</sub> parameter redefined to pulse duration</li> <li>• <a href="#">Figure 5</a>: added</li> <li>• <a href="#">Figure 6</a>: Z<sub>th</sub> redefined to Z<sub>th(j-a)</sub> transient thermal impedance from junction to ambient</li> <li>• <a href="#">Figure 6</a>: t<sub>p</sub> parameter redefined to pulse duration</li> <li>• <a href="#">Figure 7</a>: added</li> <li>• <a href="#">Figure 8</a>: Z<sub>th</sub> redefined to Z<sub>th(j-a)</sub> transient thermal impedance from junction to ambient</li> <li>• <a href="#">Figure 8</a>: t<sub>p</sub> parameter redefined to pulse duration</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 BCX54 added</li> <li>• <a href="#">Section 11 “Legal information”</a>: updated</li> </ul>				
BC635_BCP54_BCX54_6	20050225	Product data sheet	CPCN200405029	BC635_637_639_4 BCP54_55_56_5 BCX54_55_56_4
BC635_637_639_4	20011010	Product specification	-	BC635_637_639_3
BCP54_55_56_5	20030206	Product specification	-	BCP54_55_56_4
BCX54_55_56_4	20011010	Product specification	-	BCX54_55_56_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".

[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 URL <http://www.nxp.com>.

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