

# BC639; BCP56; BCX56

80 V, 1 A NPN medium power transistors

Rev. 08 — 22 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	
BC639 <sup>[2]</sup>	SOT54	SC-43A	TO-92	BC640
BCP56	SOT223	SC-73	-	BCP53
BCX56	SOT89	SC-62	TO-243	BCX53

[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	-	-	80	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>
2	collector		
3	emitter		
4	collector		
<b>SOT89</b>			
1	emitter		<p>sym042</p>
2	collector		
3	base		

### 3. Ordering information

**Table 4. Ordering information**

Type number <sup>[1]</sup>	Package		
	Name	Description	Version
BC639 <sup>[2]</sup>	SC-43A	plastic single-ended leaded (through hole) package; 3 leads	SOT54
BCP56	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCX56	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
BC639	C639
BC639-10	C63910
BC639-16	C63916
BCP56	BCP56
BCP56-10	BCP56/10
BCP56-16	BCP56/16
BCX56	BH
BCX56-10	BK
BCX56-16	BL

## 5. Limiting values

**Table 6. Limiting values**

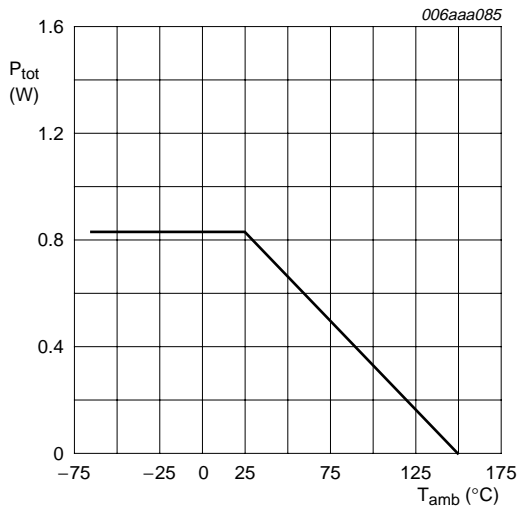
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{CBO}$	collector-base voltage	open emitter	-	100	V	
$V_{CEO}$	collector-emitter voltage	open base	-	80	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				
			BC639	[1] -	0.83	W
			BCP56	[1] -	0.64	W
				[2] -	0.96	W
			BCX56	[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.

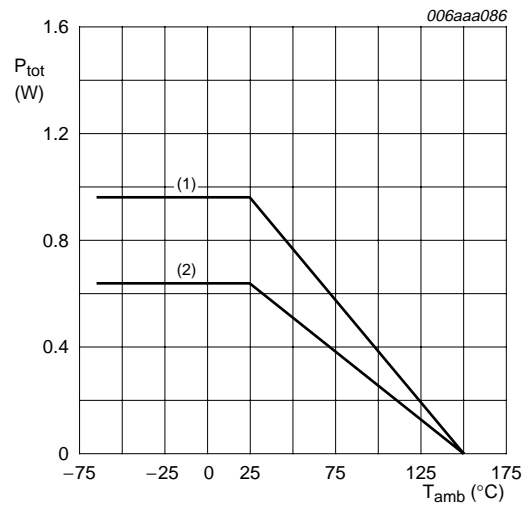
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

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



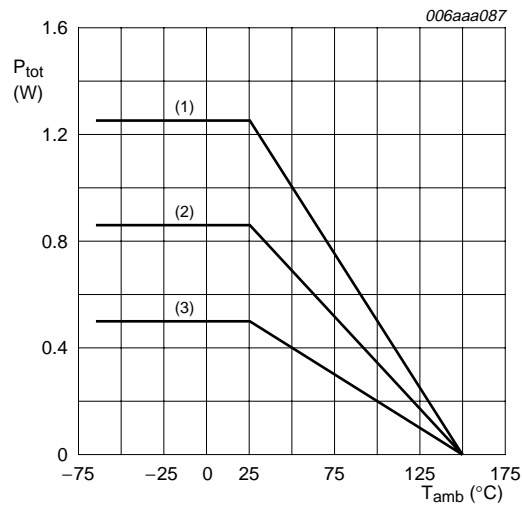
FR4 PCB, standard footprint

**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

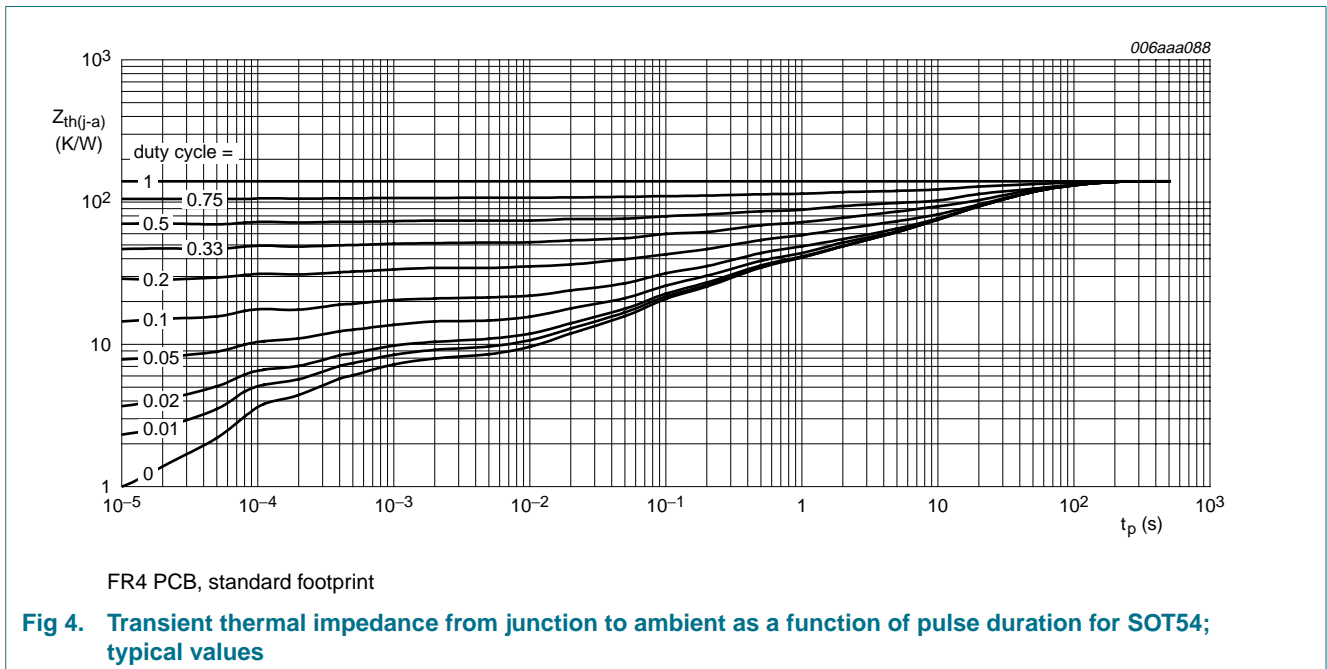
**Fig 3. Power derating curves SOT89**

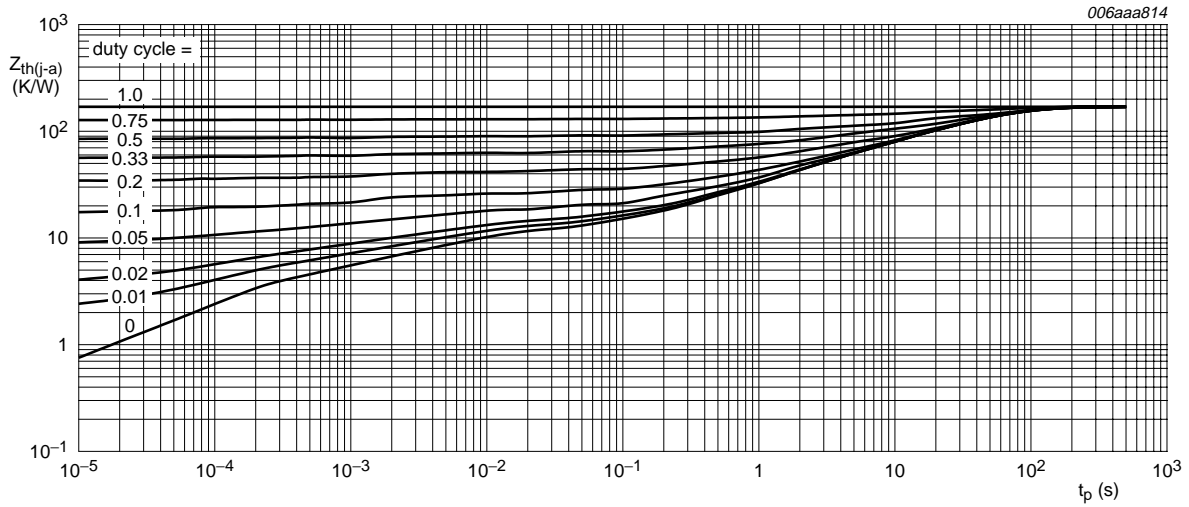
6. Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit		
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air						
			BC639	[1]	-	-	150	K/W
			BCP56	[1]	-	-	195	K/W
				[2]	-	-	130	K/W
			BCX56	[1]	-	-	250	K/W
				[2]	-	-	145	K/W
[3]	-	-		100	K/W			
$R_{th(j-sp)}$	thermal resistance from junction to solder point							
		BC639	-	-	40	K/W		
		BCP56	-	-	17	K/W		
		BCX56	-	-	30	K/W		

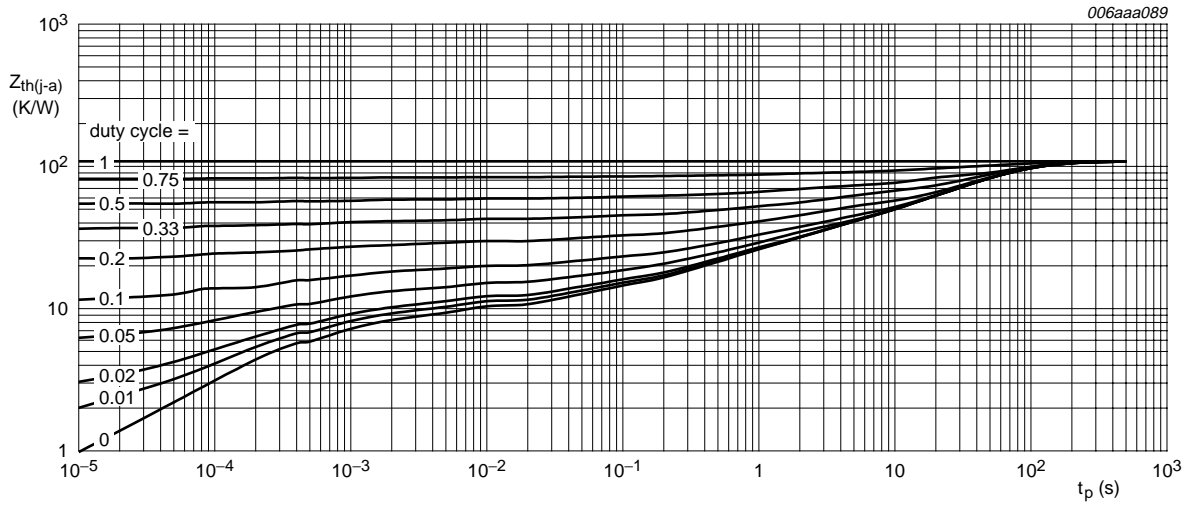
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector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





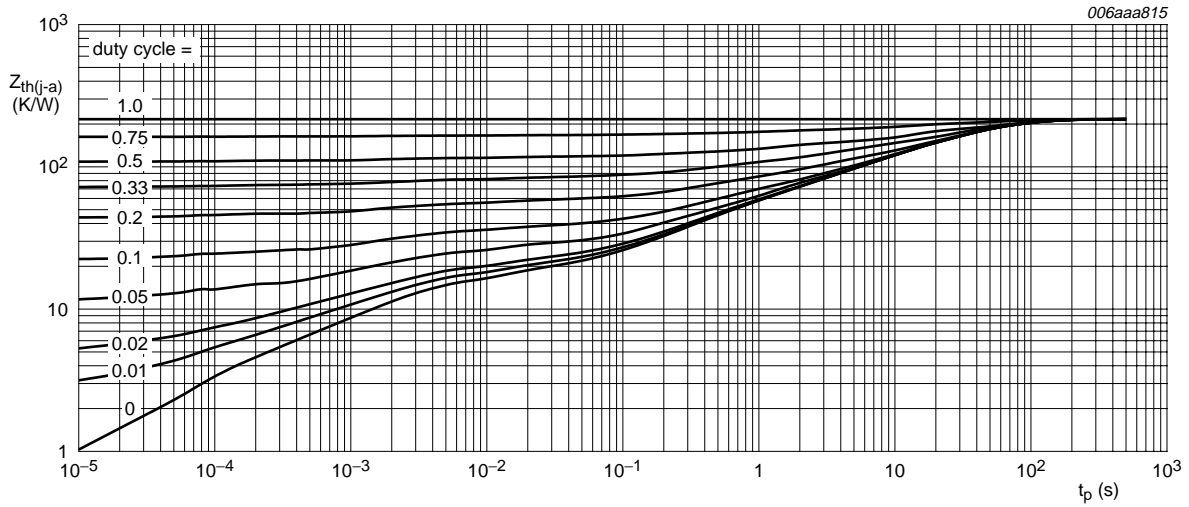
FR4 PCB, standard footprint

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



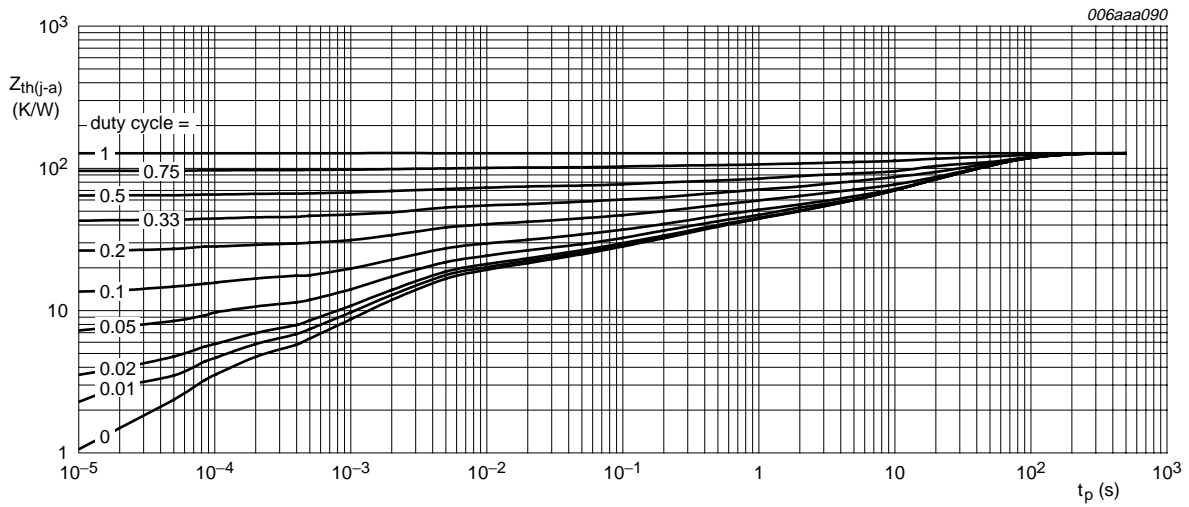
FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

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



FR4 PCB, standard footprint

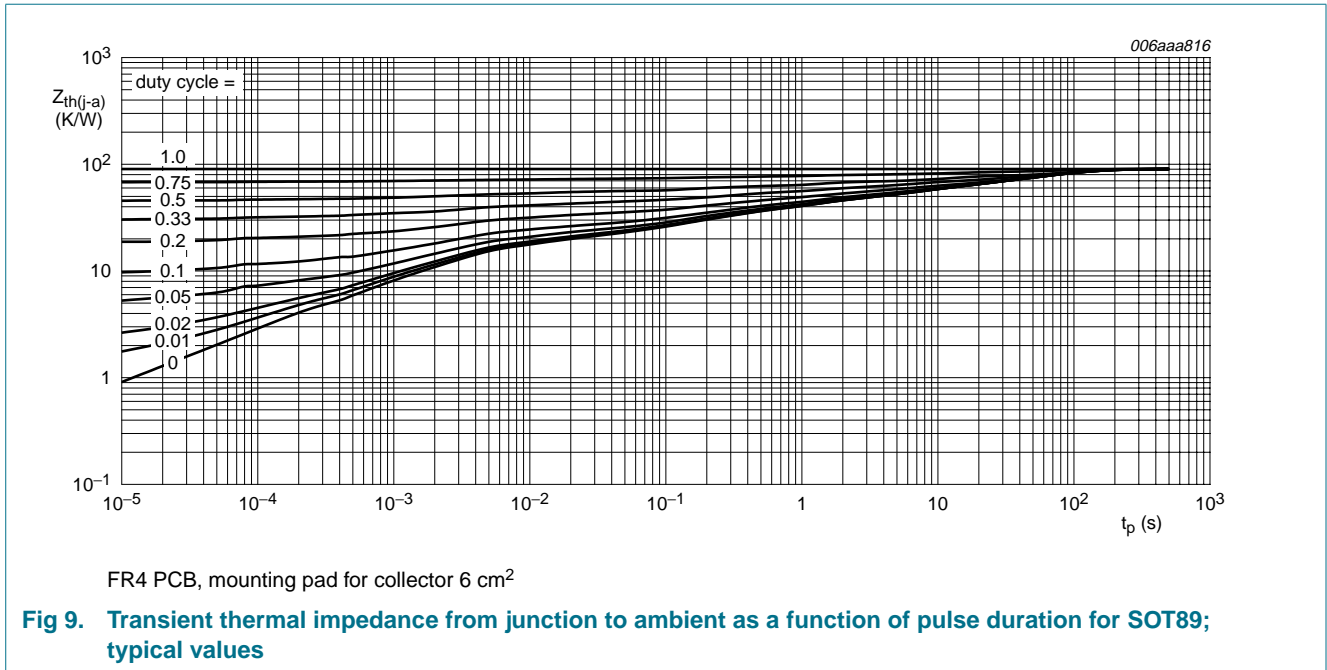
**Fig 7. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values**



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**





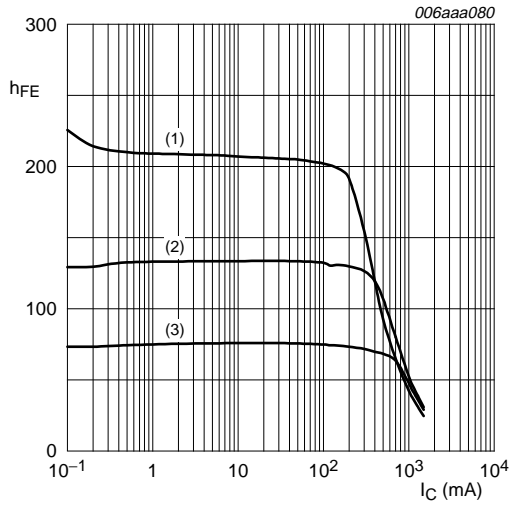
## 7. Characteristics

**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] -	-	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

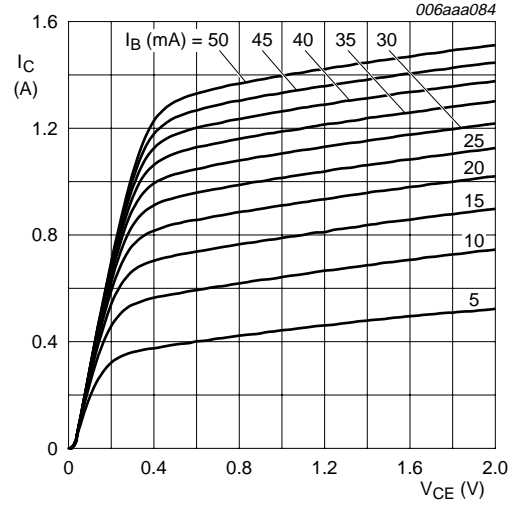
[1] Pulse test: t<sub>p</sub> ≤ 300 μs; δ = 0.02.



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

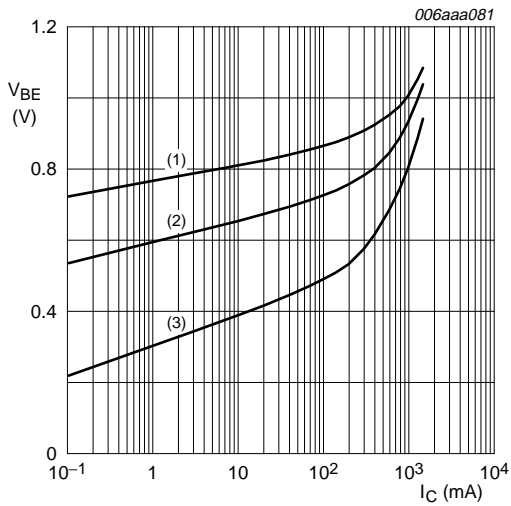
- (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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



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

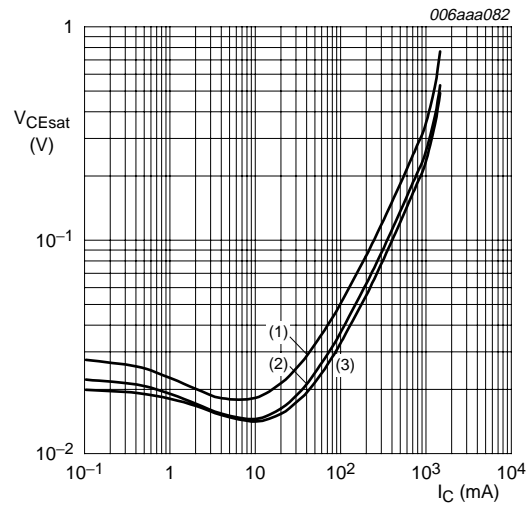
**Fig 11. Collector current as a function of collector-emitter voltage; typical values**



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

- (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**

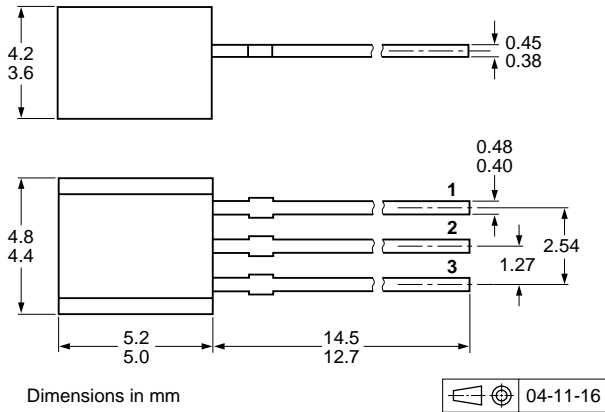


$I_C/I_B = 10$

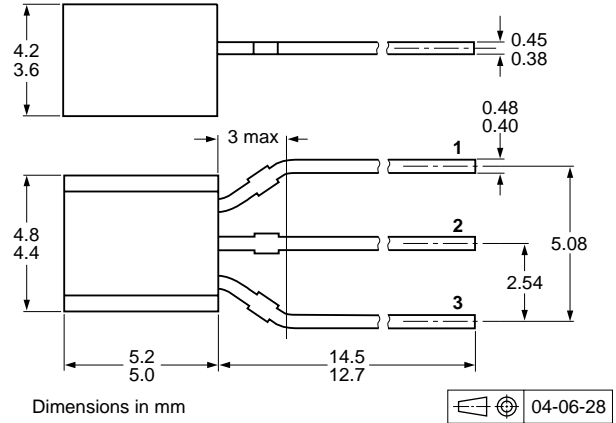
- (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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

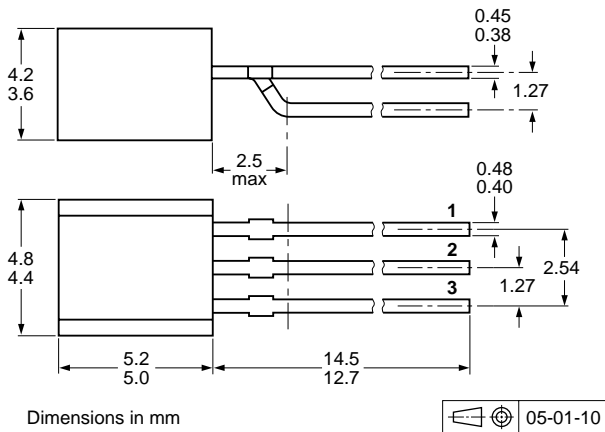
**8. Package outline**



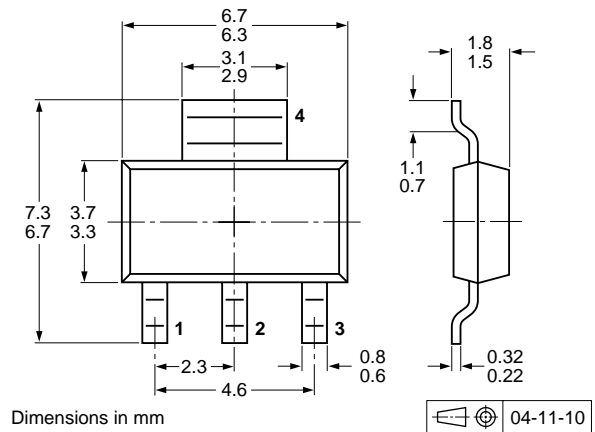
**Fig 14. Package outline SOT54 (SC-43A/TO-92)**



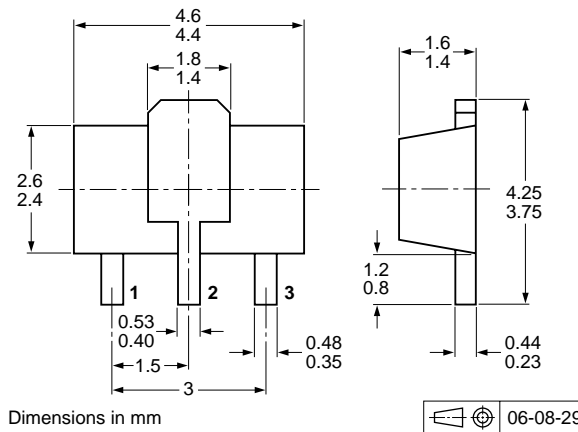
**Fig 15. Package outline SOT54A**



**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
BC639	SOT54	bulk, straight leads	-	-	-412	-
	SOT54A	tape and reel, wide pitch	-	-	-	-116
		tape ammopack, wide pitch	-	-	-	-126
	SOT54 variant	bulk, delta pinning	-	-	-112	-
BCP56	SOT223	8 mm pitch, 12 mm tape and reel	-115	-135	-	-
BCX56	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
BC639_BCP56_BCX56_8	20070622	Product data sheet	-	BC639_BCP56_BCX56_7
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="#">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 BCP56 and BCX56 adapted</li> <li>• <a href="#">Table 7 “Thermal characteristics”</a>: R<sub>th(j-a)</sub> values for BCP56 and BCX56 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 BCX56 added</li> <li>• <a href="#">Section 11 “Legal information”</a>: updated</li> </ul>				
BC639_BCP56_BCX56_7	20050308	Product data sheet	-	BC639_BCP56_BCX56_6
BC639_BCP56_BCX56_6	20050303	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".

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