

# 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>	<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
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**

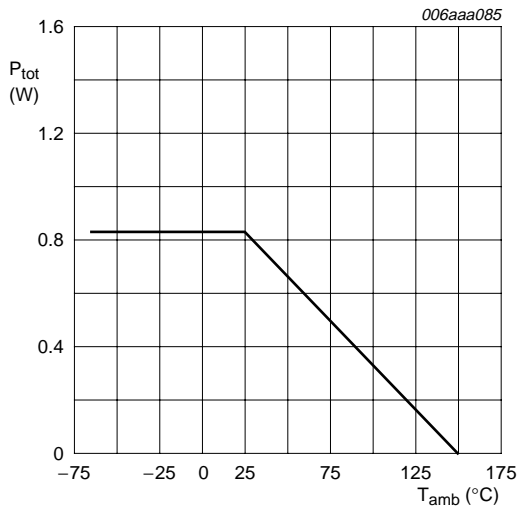
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

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.

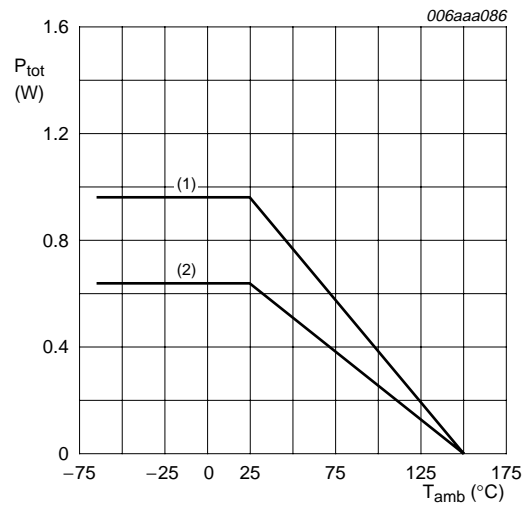
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

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



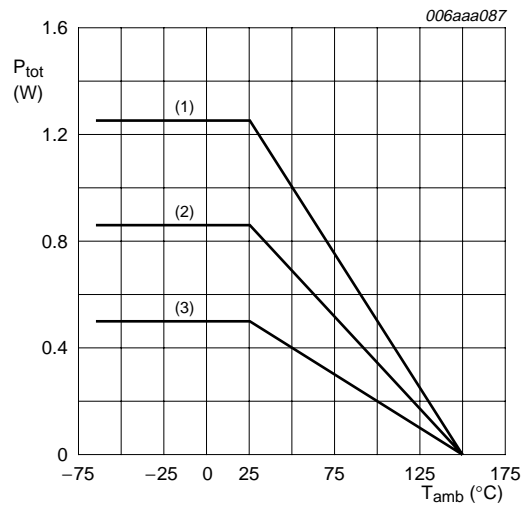
FR4 PCB, standard footprint

**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

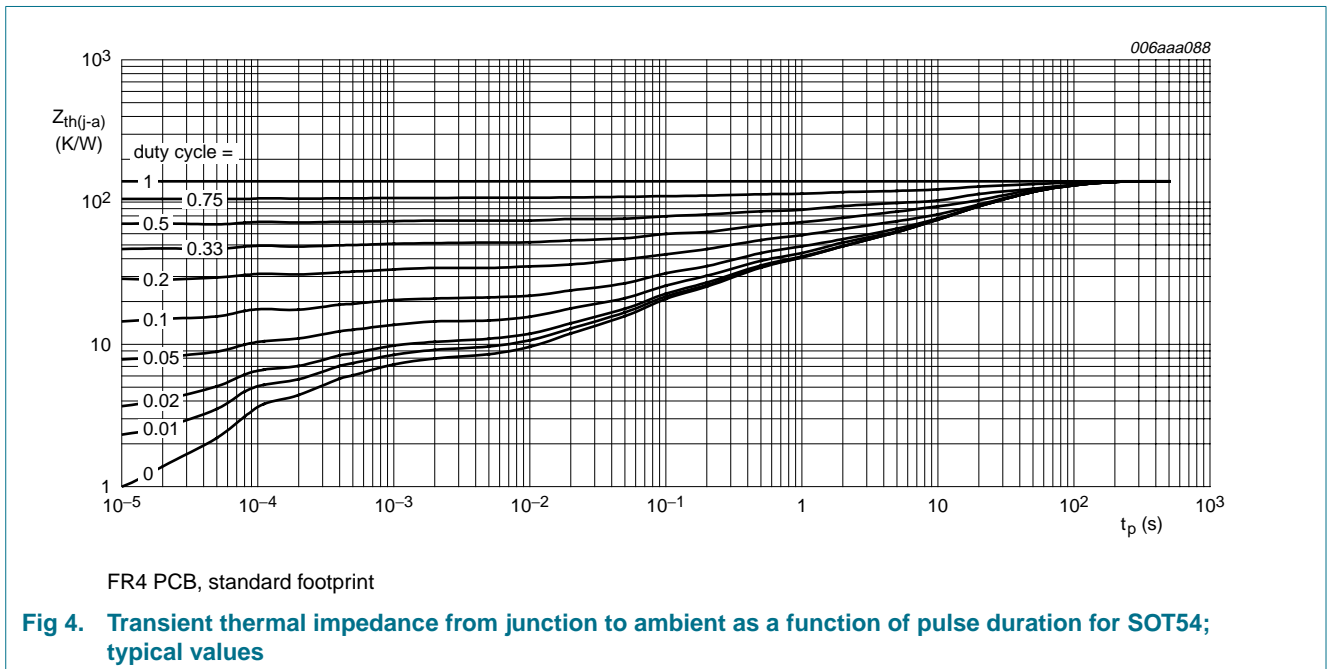
**Fig 3. Power derating curves SOT89**

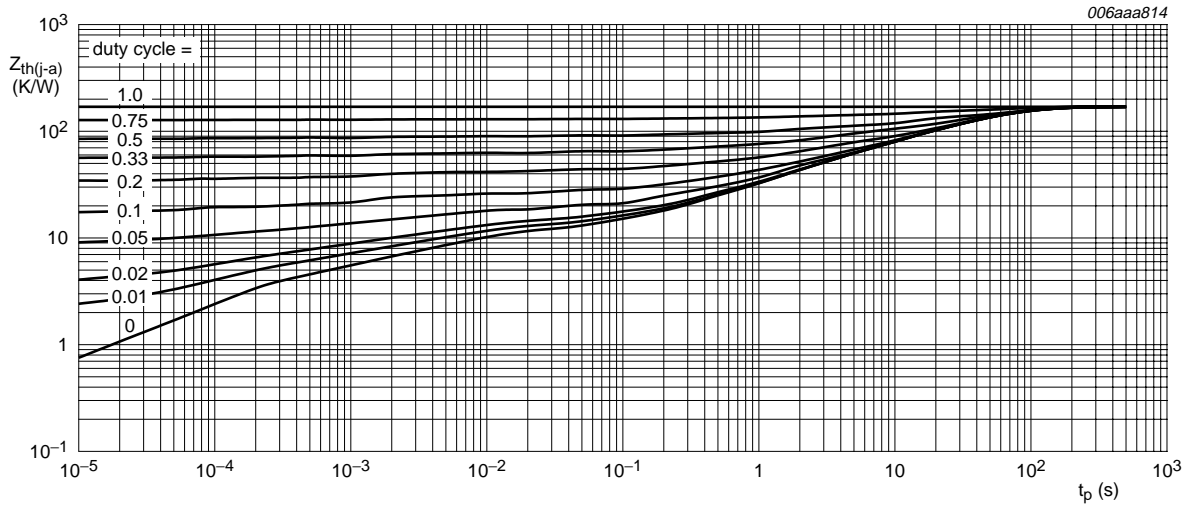
6. Thermal characteristics

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		

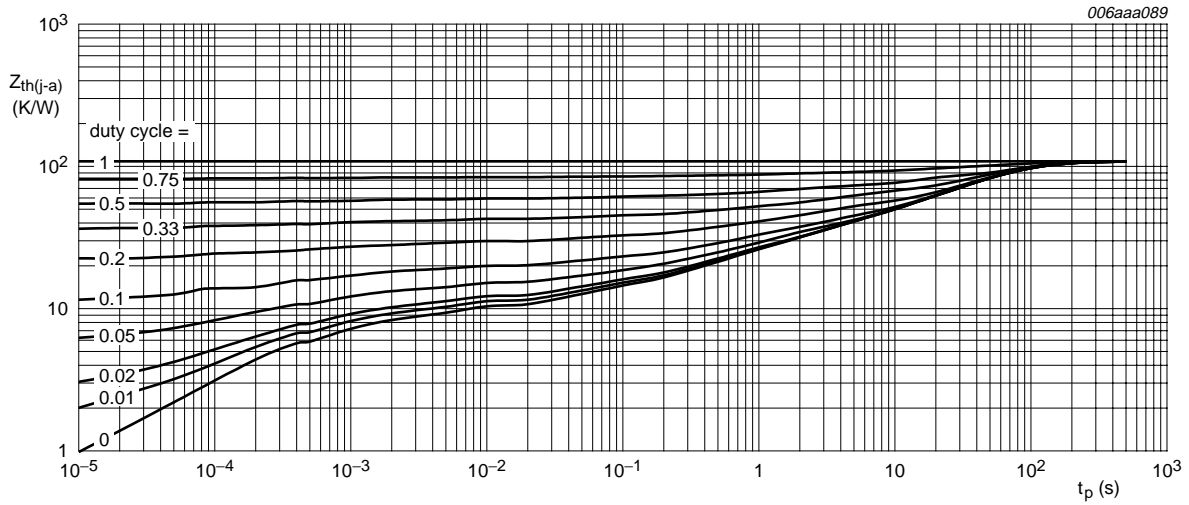
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector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





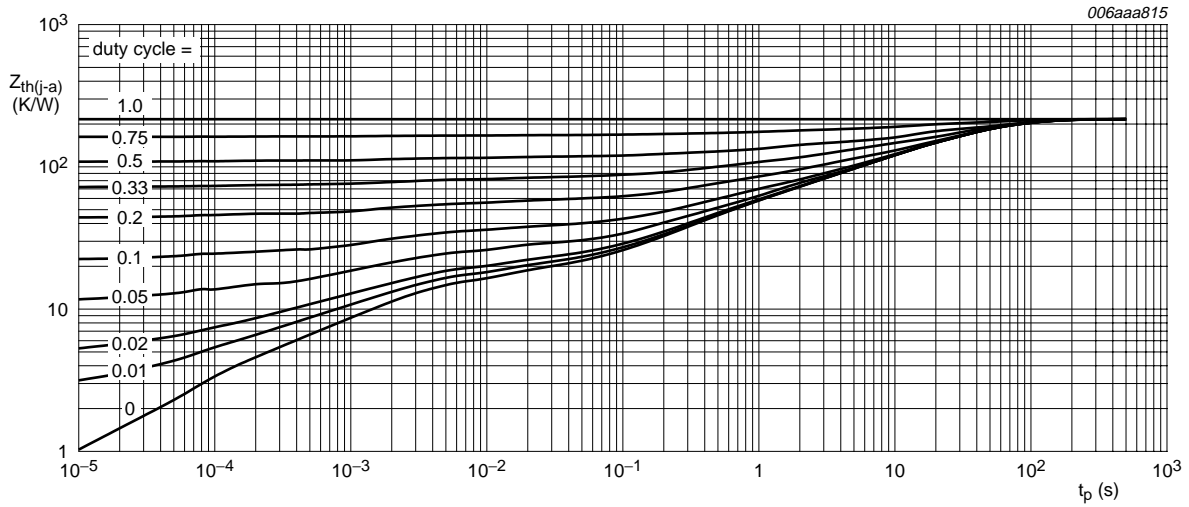
FR4 PCB, standard footprint

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



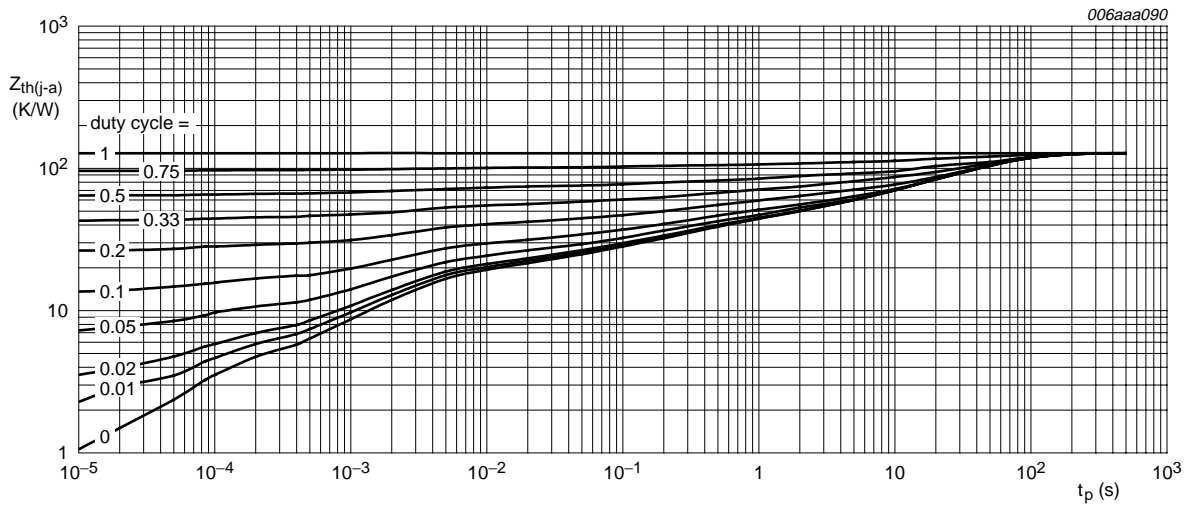
FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

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



FR4 PCB, standard footprint

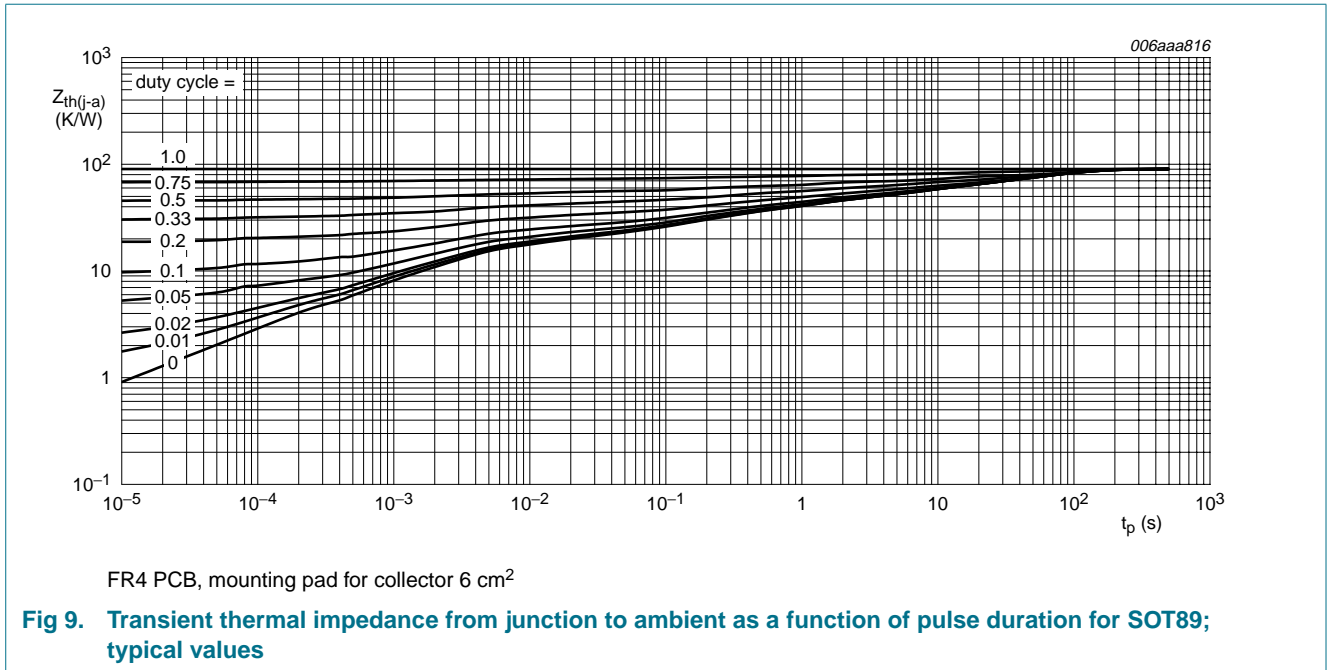
**Fig 7. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values**



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**





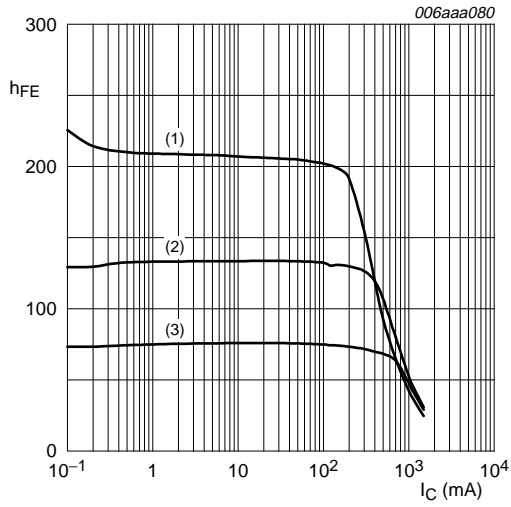
## 7. Characteristics

**Table 8. Characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	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	$V_{CE} = 2\text{ V}$				
		$I_C = 5\text{ mA}$	63	-	-	
		$I_C = 150\text{ mA}$	63	-	250	
		$I_C = 500\text{ mA}$	[1] 40	-	-	
	DC current gain	$V_{CE} = 2\text{ V}$				
	$h_{FE}$ selection -10	$I_C = 150\text{ mA}$	63	-	160	
	$h_{FE}$ selection -16	$I_C = 150\text{ mA}$	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
$C_C$	collector capacitance	$V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	6	-	pF
$f_T$	transition frequency	$V_{CE} = 5\text{ V}; I_C = 50\text{ mA}; f = 100\text{ MHz}$	100	180	-	MHz

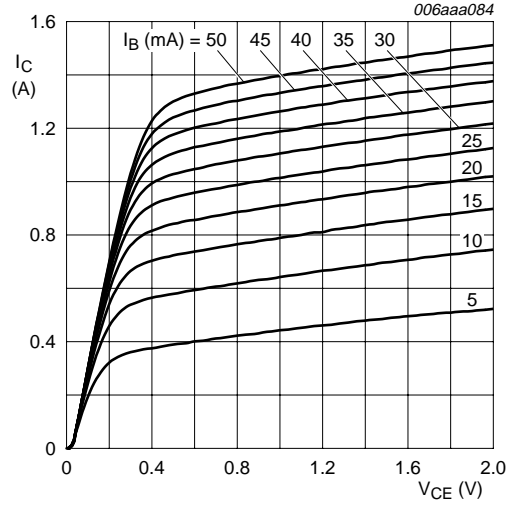
[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta = 0.02$ .



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

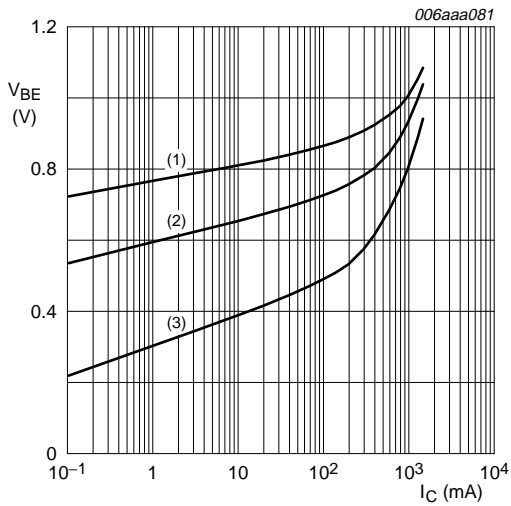
- (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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



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

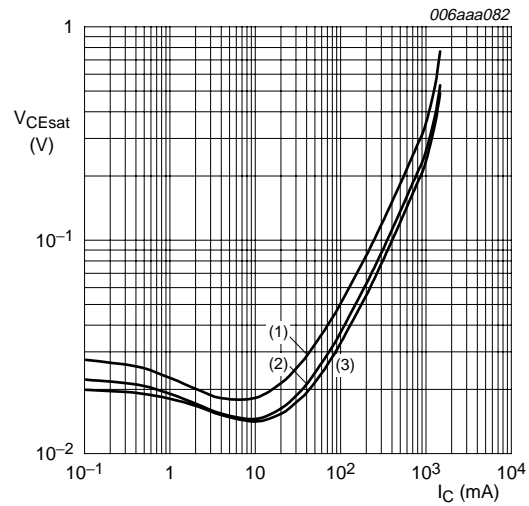
**Fig 11. Collector current as a function of collector-emitter voltage; typical values**



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

- (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**

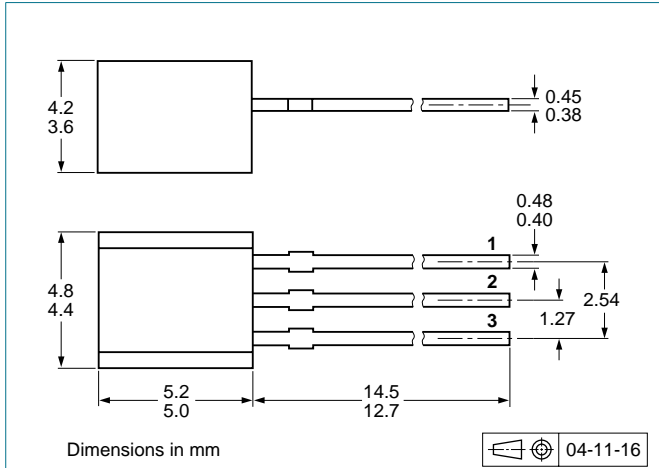


$I_C/I_B = 10$

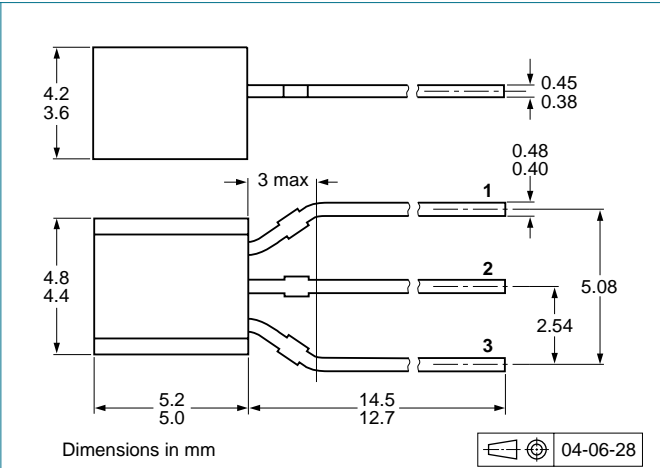
- (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$
- (3)  $T_{amb} = -55 \text{ }^\circ\text{C}$

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

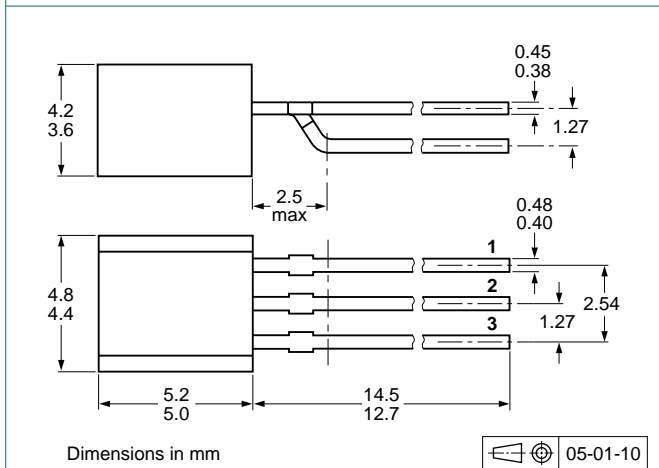
**8. Package outline**



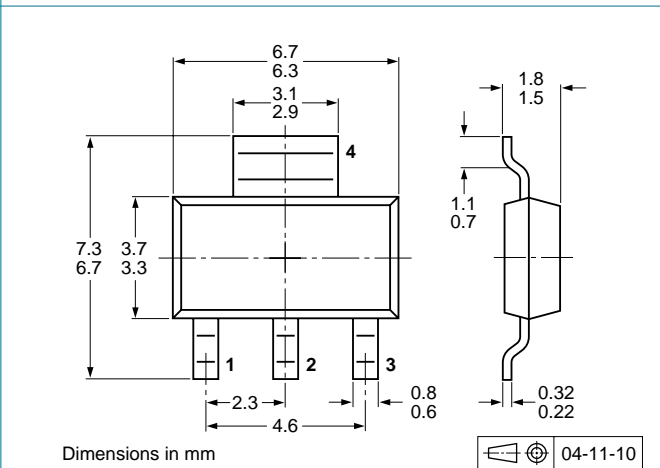
**Fig 14. Package outline SOT54 (SC-43A/TO-92)**



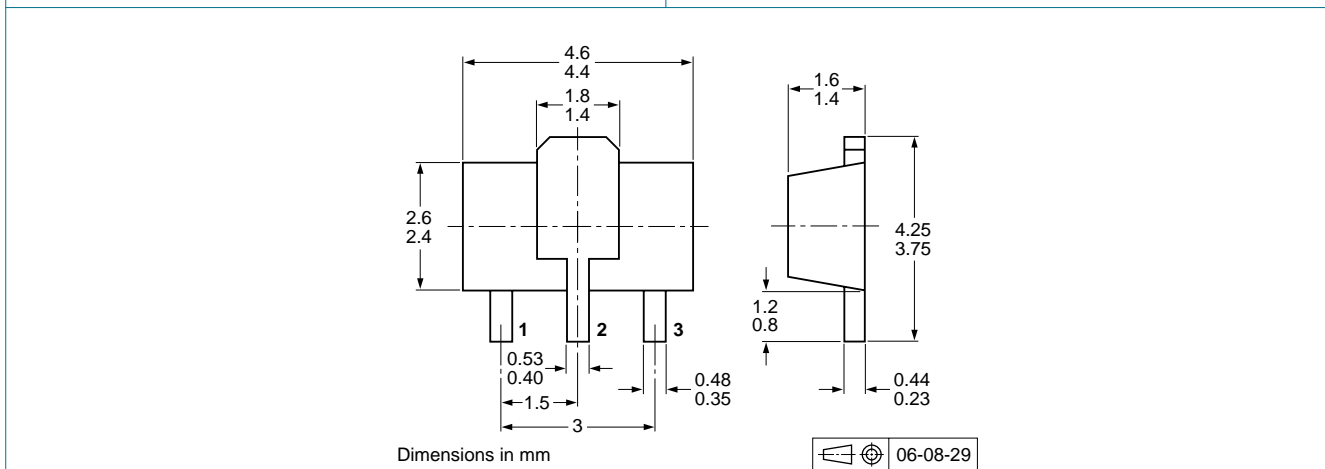
**Fig 15. Package outline SOT54A**



**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".

[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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