

# BC640; BCP53; BCX53

80 V, 1 A PNP medium power transistors

Rev. 08 — 22 February 2008

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

[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	-	-	-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		
2	collector		
3	emitter		
<b>SOT54A</b>			
1	base		
2	collector		
3	emitter		
<b>SOT54 variant</b>			
1	base		
2	collector		
3	emitter		
<b>SOT223</b>			
1	base		
2	collector		
3	emitter		
4	collector		
<b>SOT89</b>			
1	emitter		
2	collector		
3	base		

### 3. Ordering information

**Table 4. Ordering information**

Type number <sup>[1]</sup>	Package		
	Name	Description	Version
BC640 <sup>[2]</sup>	SC-43A	plastic single-ended leaded (through hole) package; 3 leads	SOT54
BCP53	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCX53	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
BC640	C640
BCP53	BCP53
BCP53-10	BCP53/10
BCP53-16	BCP53/16
BCX53	AH
BCX53-10	AK
BCX53-16	AL

## 5. Limiting values

**Table 6. Limiting values**

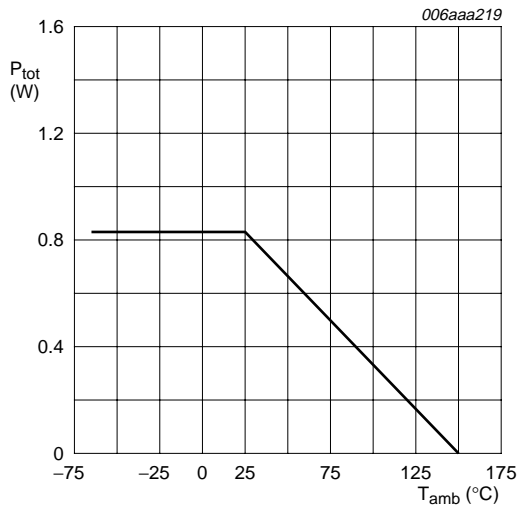
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

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				
			BC640	[1] -	0.83	W
			BCP53	[1] -	0.65	W
				[2] -	1	W
			BCX53	[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.

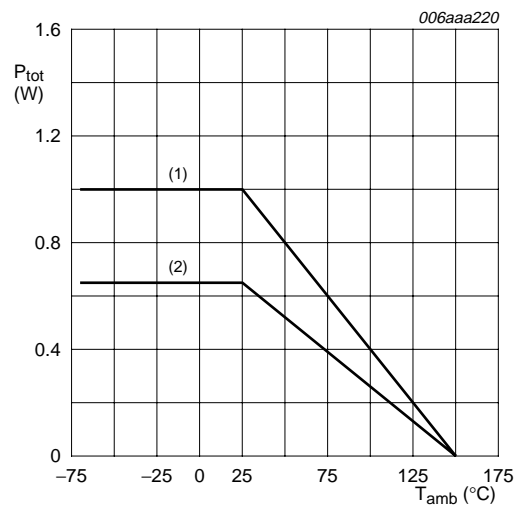
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

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



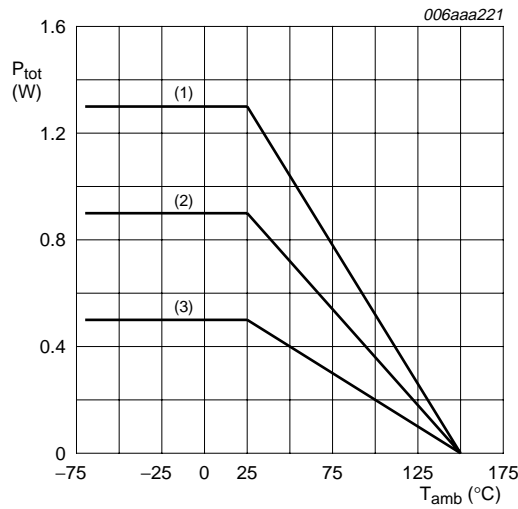
FR4 PCB, standard footprint

**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

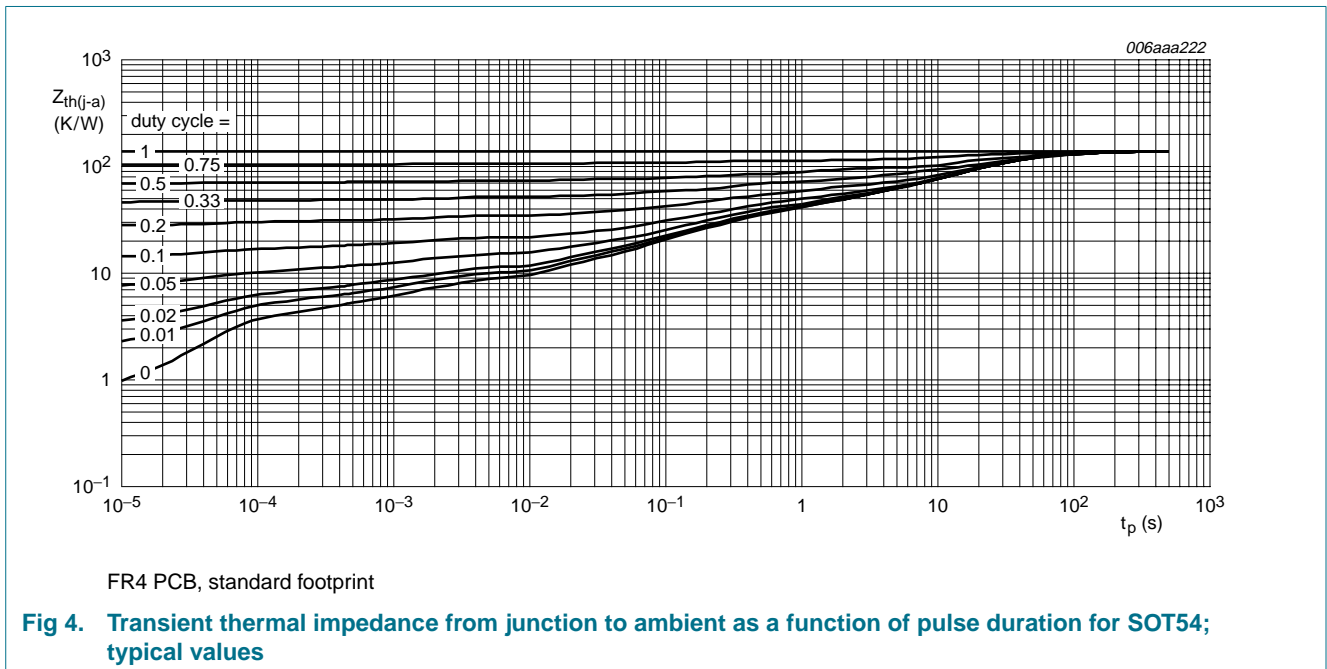
**Fig 3. Power derating curves SOT89**

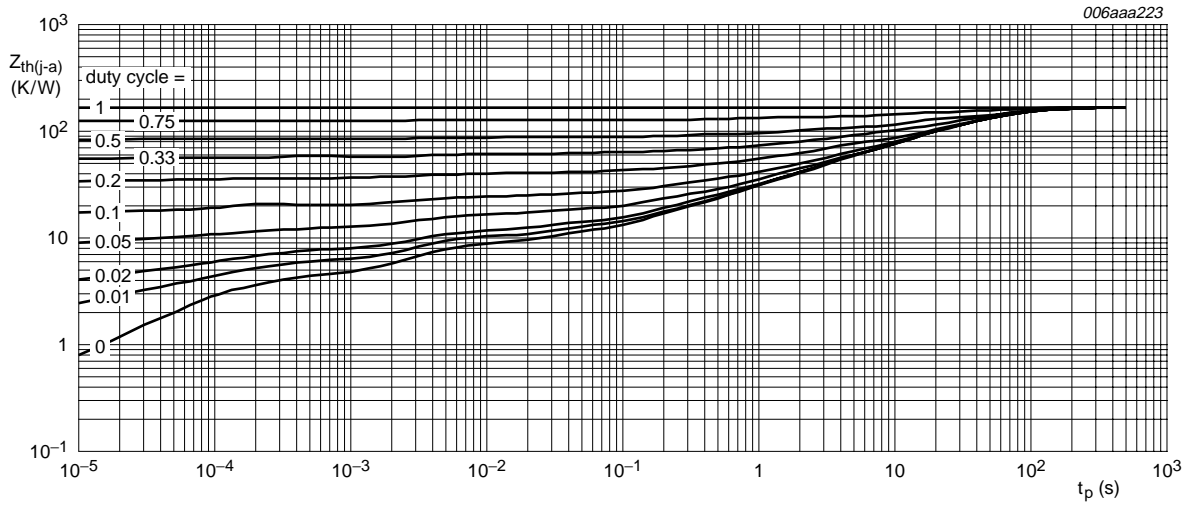
**6. Thermal characteristics**

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit		
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air						
			BC640	[1]	-	-	150	K/W
			BCP53	[1]	-	-	190	K/W
				[2]	-	-	125	K/W
			BCX53	[1]	-	-	230	K/W
				[2]	-	-	135	K/W
[3]	-	-		95	K/W			
$R_{th(j-sp)}$	thermal resistance from junction to solder point							
		BC640	-	-	40	K/W		
		BCP53	-	-	17	K/W		
		BCX53	-	-	20	K/W		

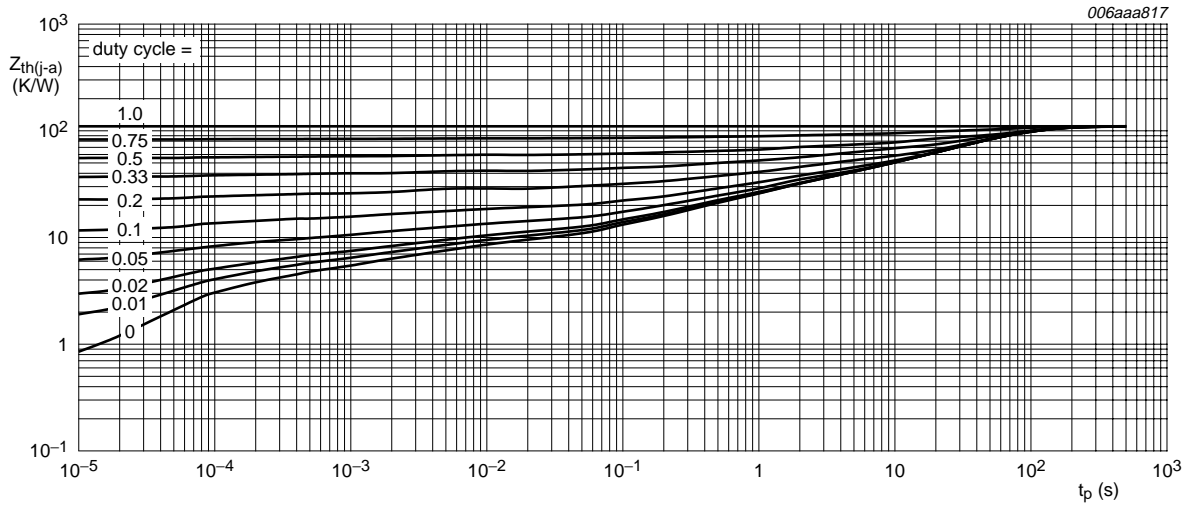
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector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





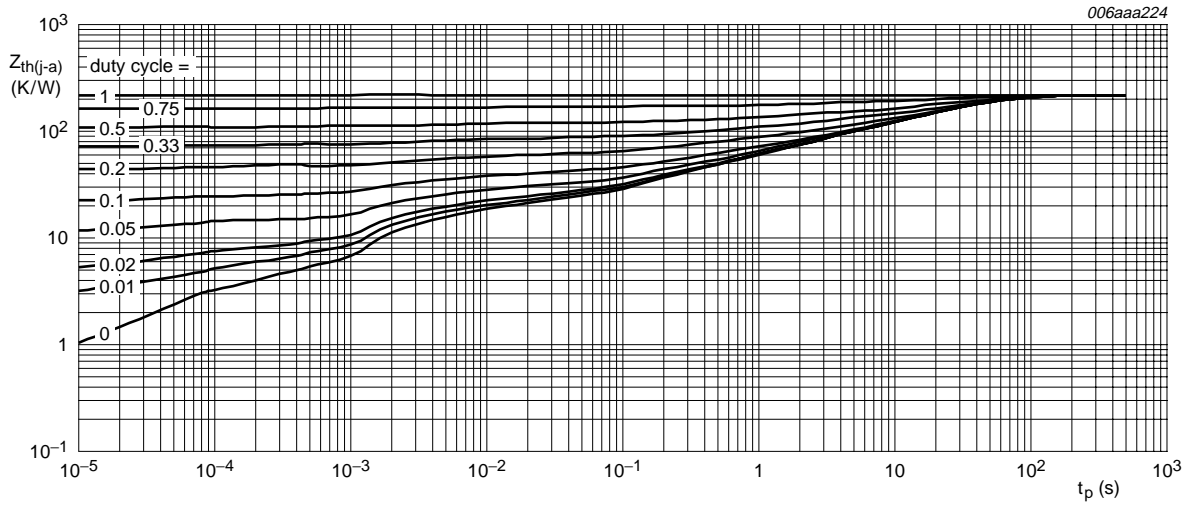
FR4 PCB, standard footprint

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



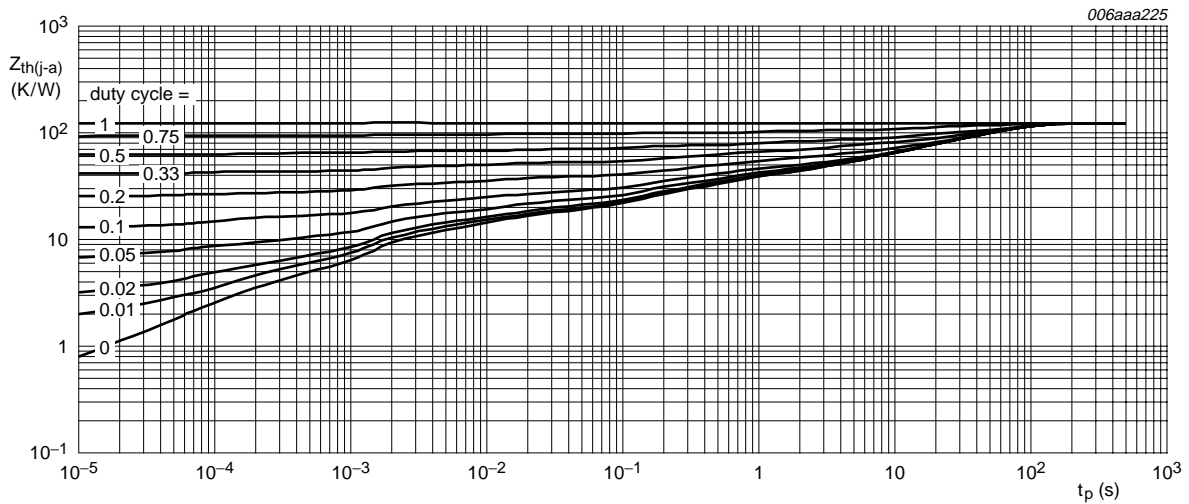
FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

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



FR4 PCB, standard footprint

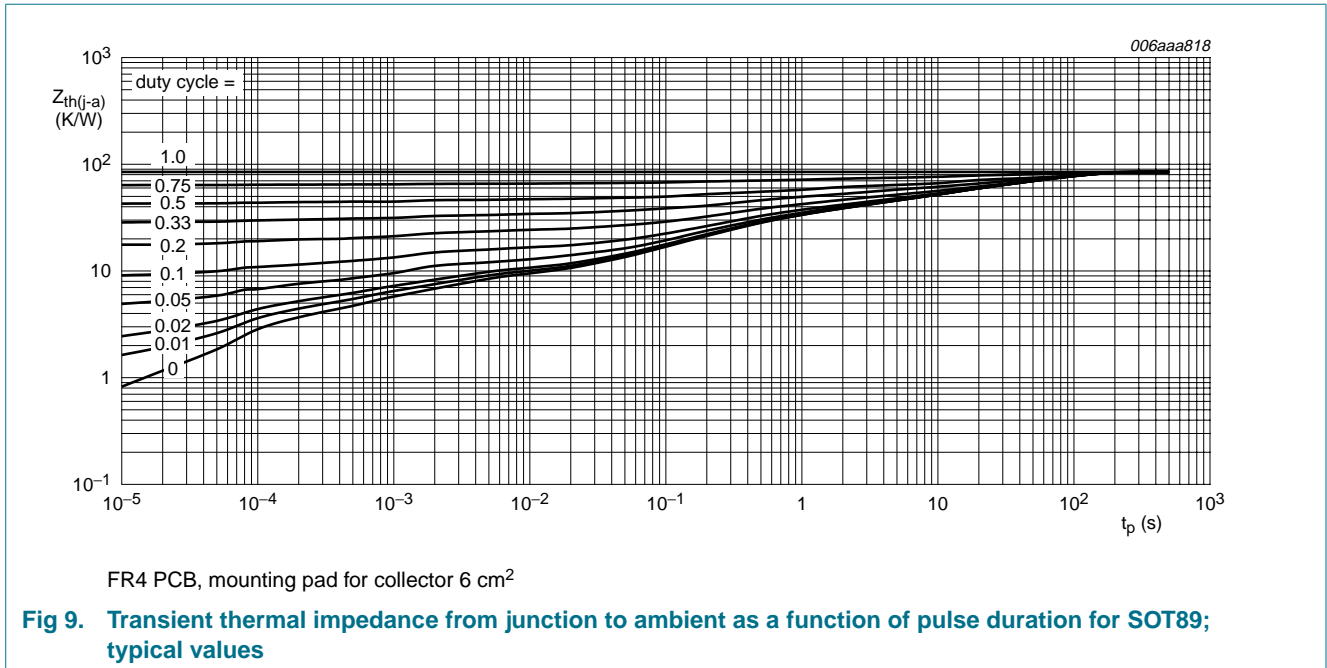
Fig 7. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values



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





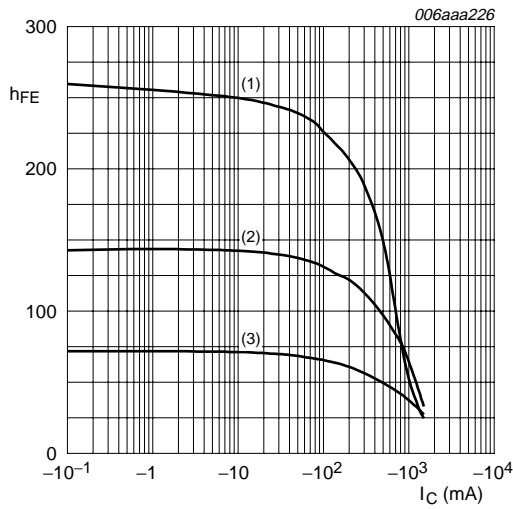
## 7. Characteristics

**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> = -15 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

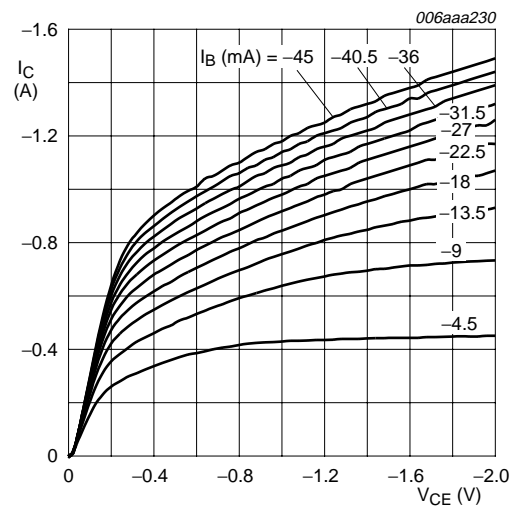
[1] Pulse test: t<sub>p</sub> ≤ 300 μs; δ = 0.02.



$V_{CE} = -2 V$

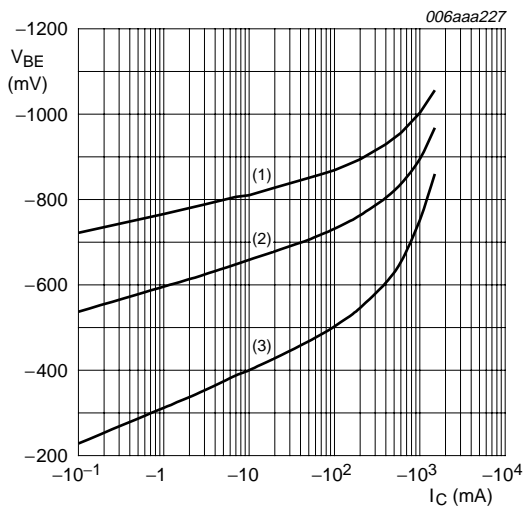
- (1)  $T_{amb} = 150^\circ C$
- (2)  $T_{amb} = 25^\circ C$
- (3)  $T_{amb} = -55^\circ C$

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



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

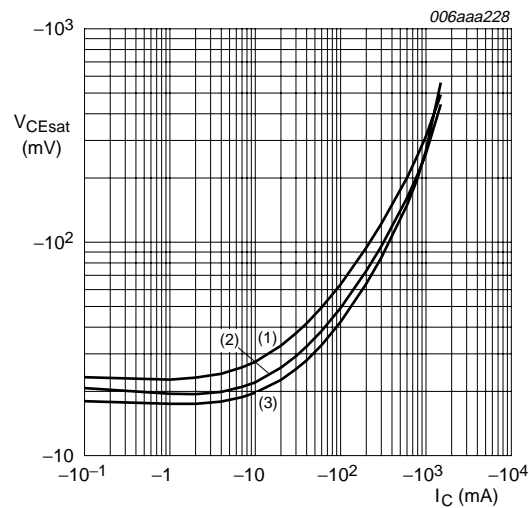
**Fig 11. Collector current as a function of collector-emitter voltage; typical values**



$V_{CE} = -2 V$

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

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

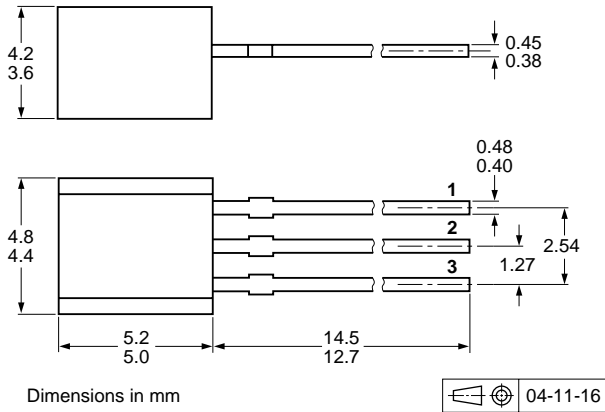


$I_C/I_B = 10$

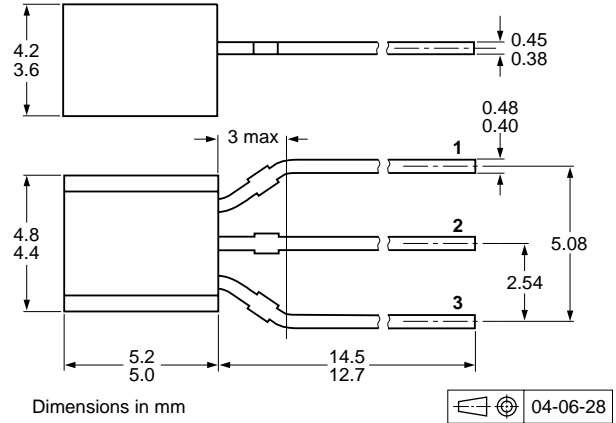
- (1)  $T_{amb} = 150^\circ C$
- (2)  $T_{amb} = 25^\circ C$
- (3)  $T_{amb} = -55^\circ C$

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

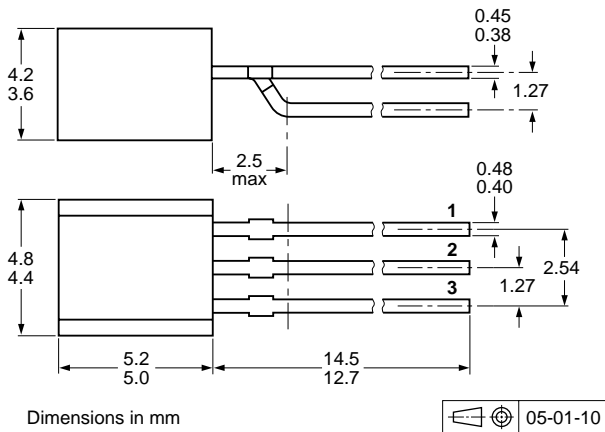
**8. Package outline**



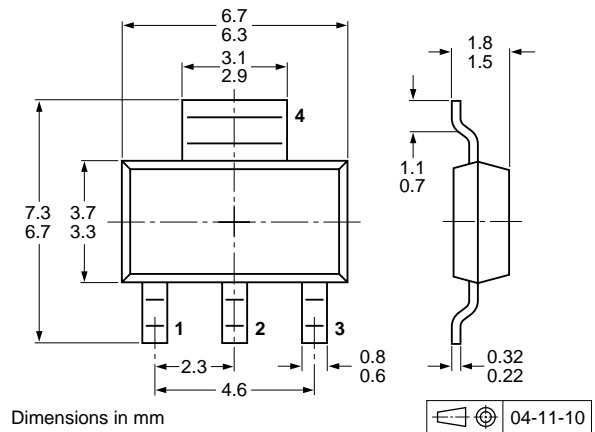
**Fig 14. Package outline SOT54 (SC-43A/TO-92)**



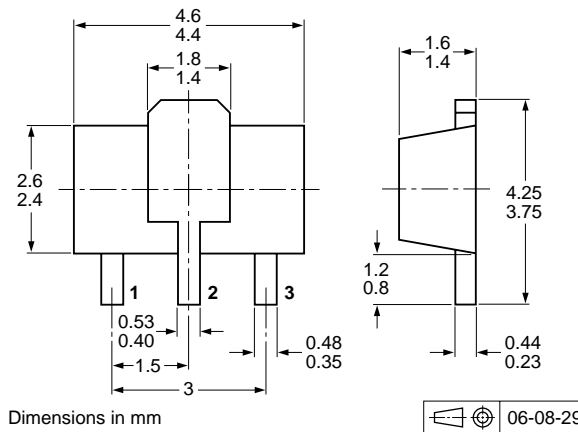
**Fig 15. Package outline SOT54A**



**Fig 16. Package outline SOT54 variant**



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



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