

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 ^[1]	Package			NPN complement
	NXP	JEITA	JEDEC	
BC640 ^[2]	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

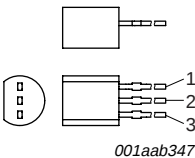
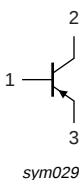
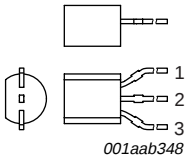
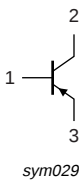
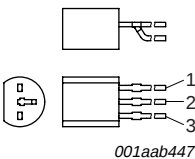
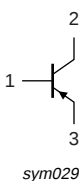
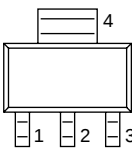
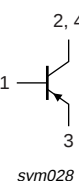
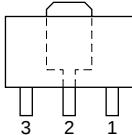
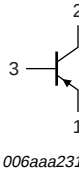
1.4 Quick reference data

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
SOT54			
1	base		
2	collector		
3	emitter		
SOT54A			
1	base		
2	collector		
3	emitter		
SOT54 variant			
1	base		
2	collector		
3	emitter		
SOT223			
1	base		
2	collector		
3	emitter		
4	collector		
SOT89			
1	emitter		
2	collector		
3	base		

3. Ordering information

Table 4. Ordering information

Type number ^[1]	Package		
	Name	Description	Version
BC640 ^[2]	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

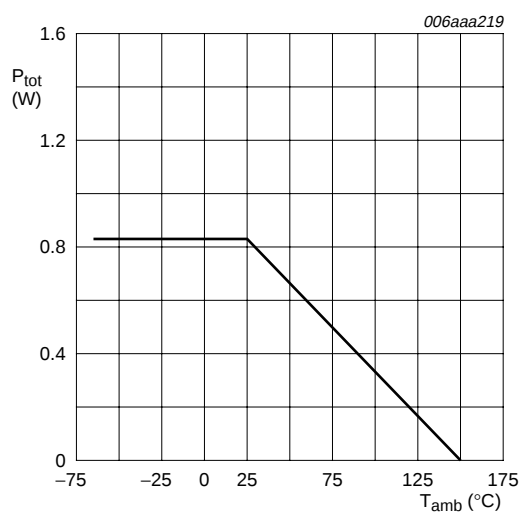
In accordance with the Absolute Maximum Rating System (IEC 60134).

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.

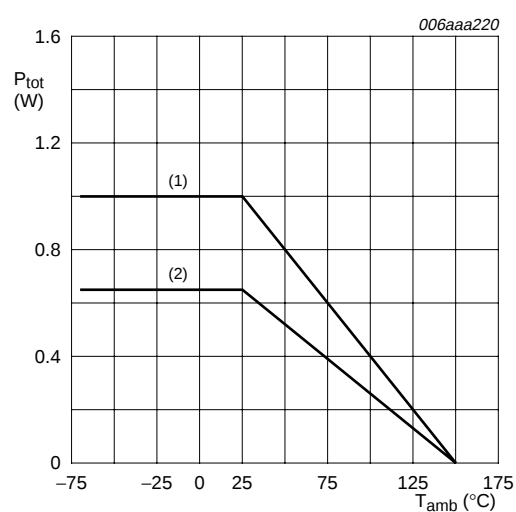
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².



FR4 PCB, standard footprint

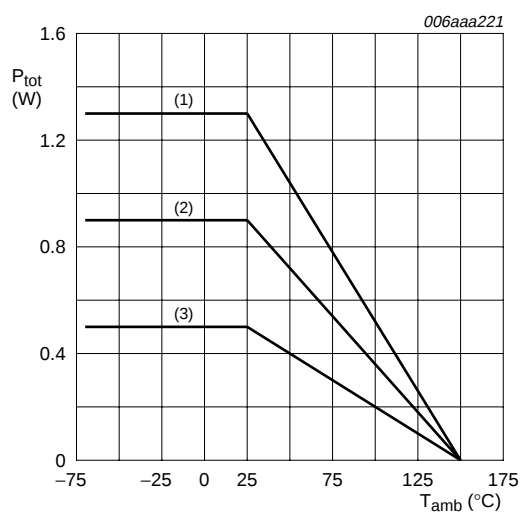
Fig 1. Power derating curve SOT54



(1) FR4 PCB, mounting pad for collector 1 cm²

(2) FR4 PCB, standard footprint

Fig 2. Power derating curves SOT223



(1) FR4 PCB, mounting pad for collector 6 cm²

(2) FR4 PCB, mounting pad for collector 1 cm²

(3) FR4 PCB, standard footprint

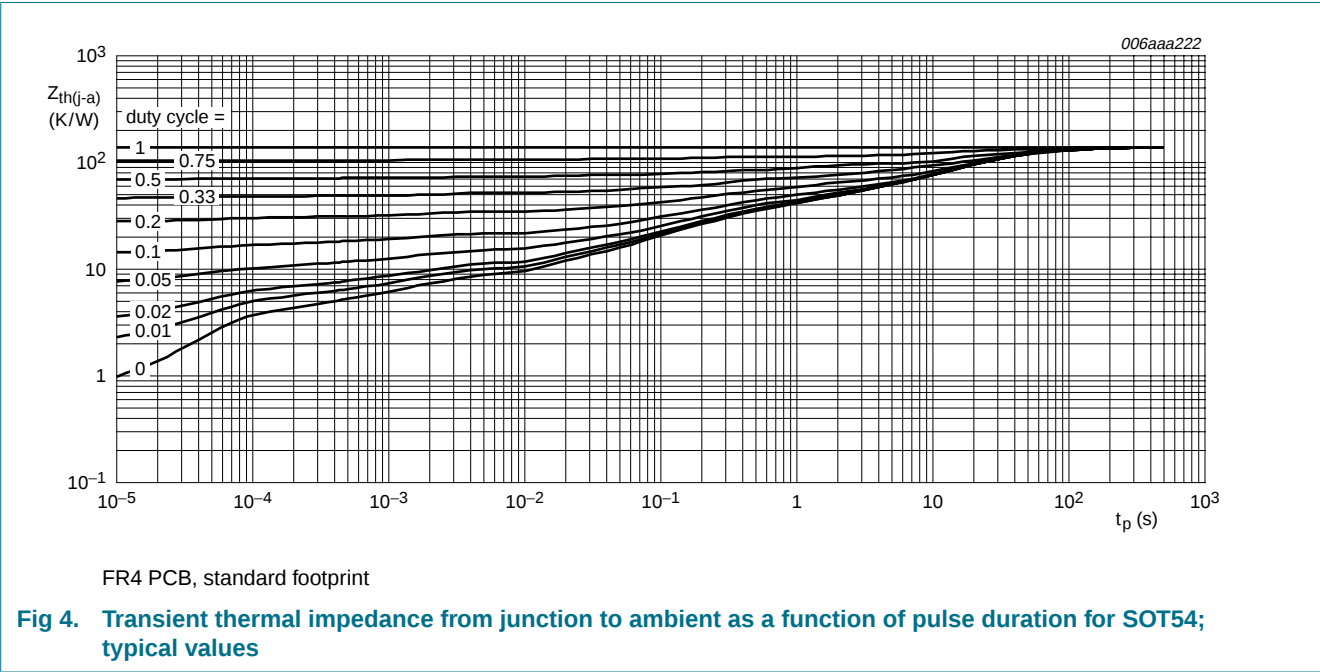
Fig 3. Power derating curves SOT89

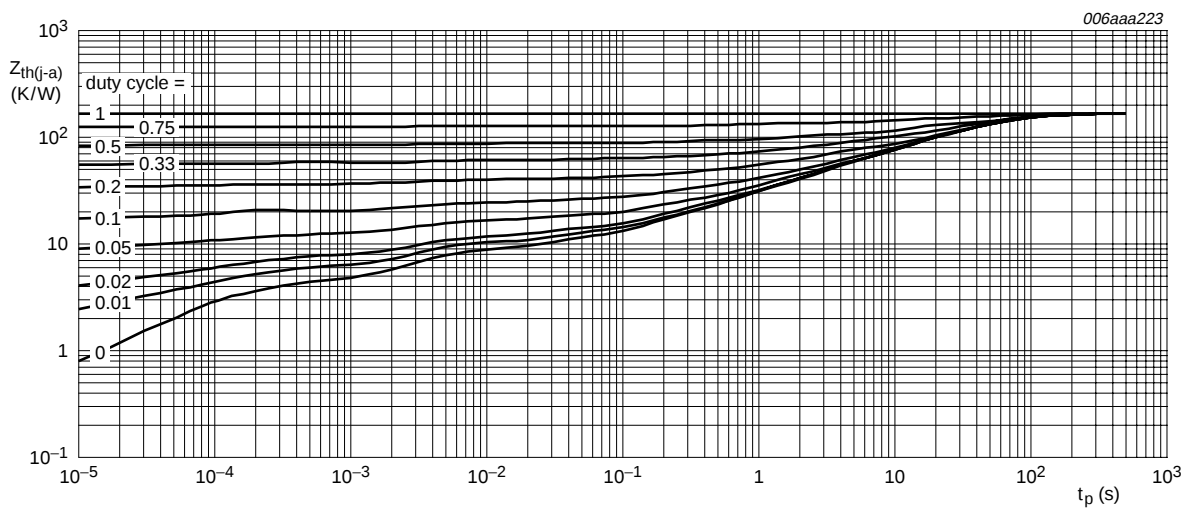
6. Thermal characteristics

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

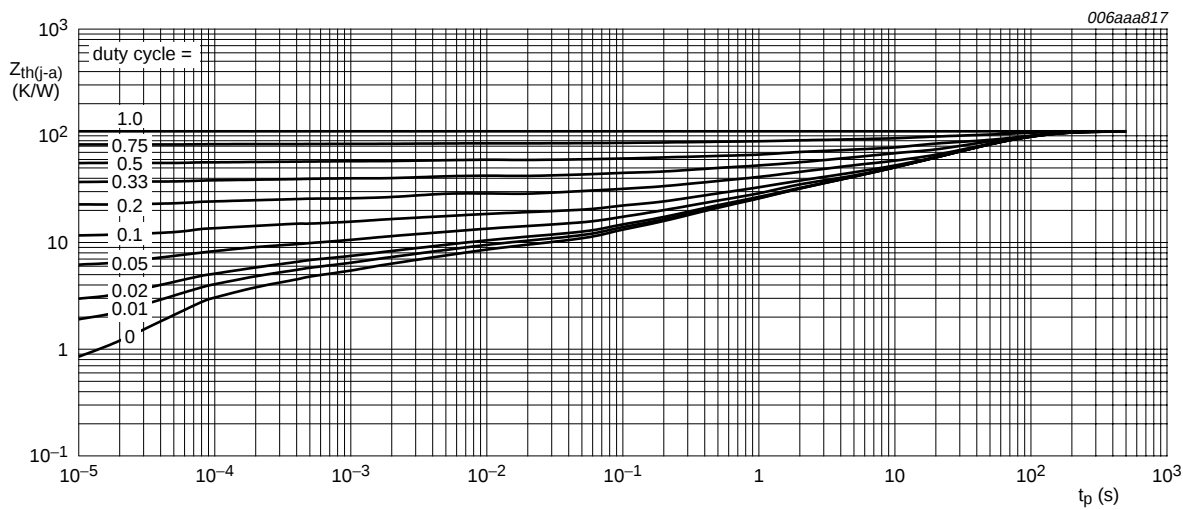
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².





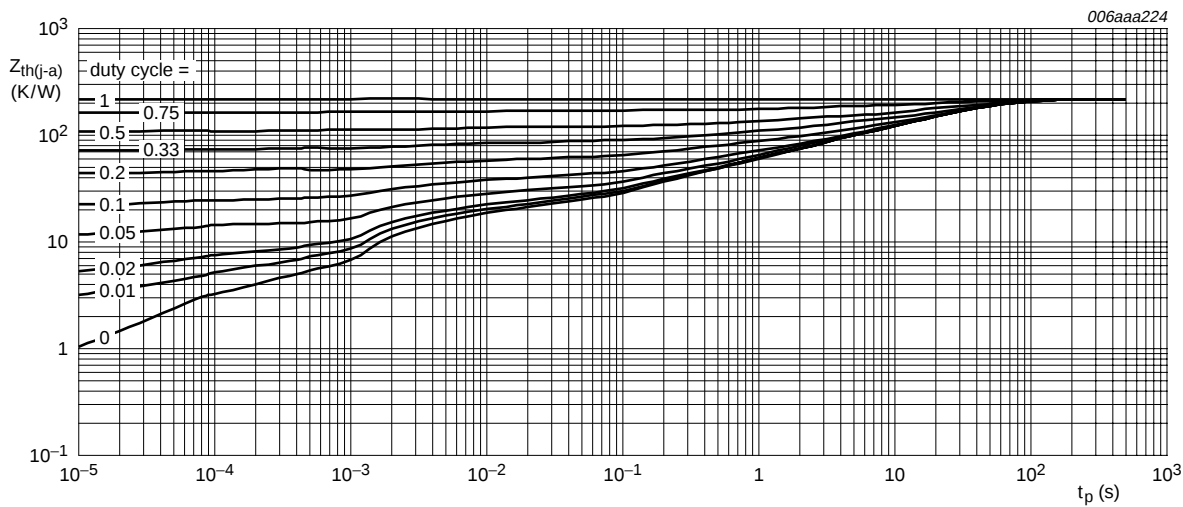
FR4 PCB, standard footprint

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



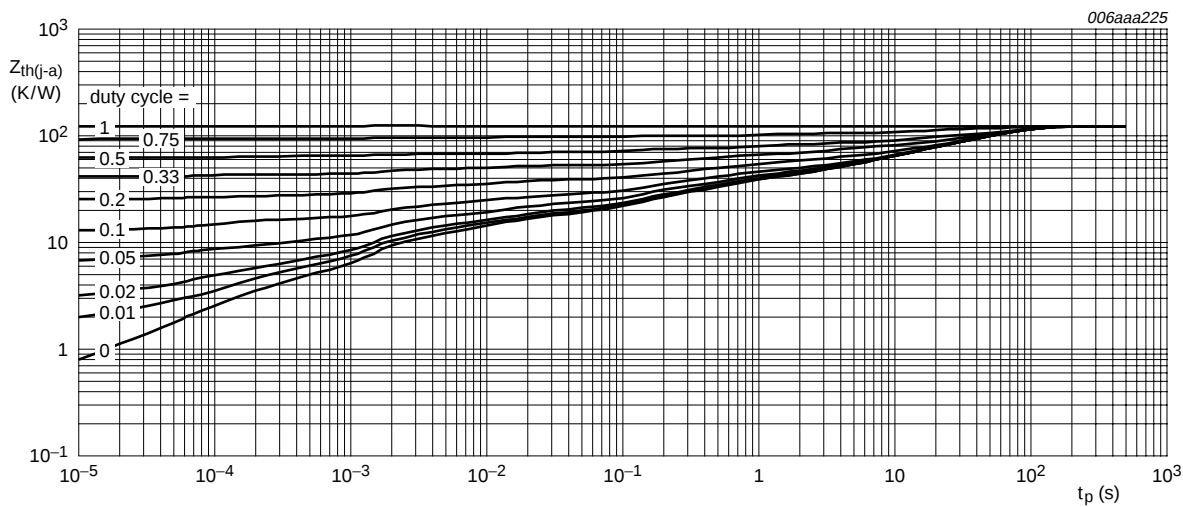
FR4 PCB, mounting pad for collector 1 cm²

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



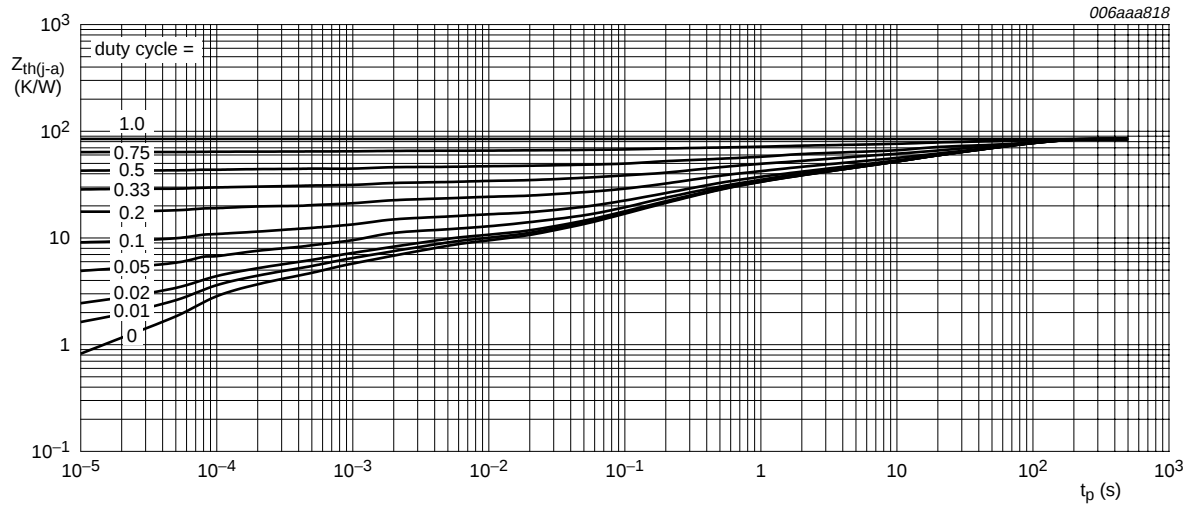
FR4 PCB, standard footprint

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 cm²

Fig 8. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values



FR4 PCB, mounting pad for collector 6 cm²

Fig 9. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT89; typical values

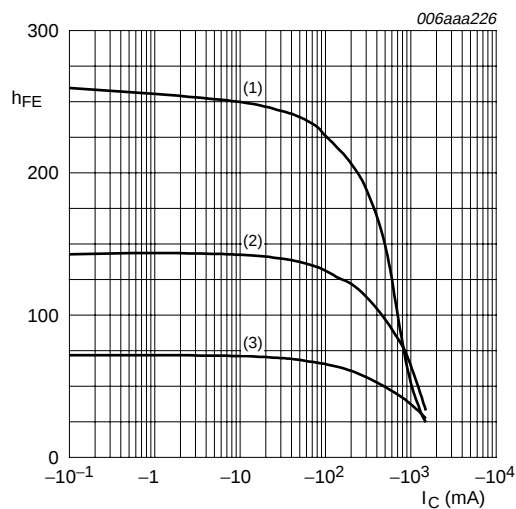
7. Characteristics

Table 8. Characteristics

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

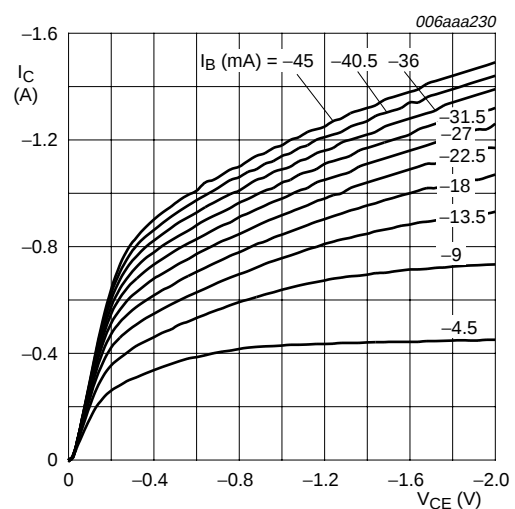
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = -30\text{ V}; I_E = 0\text{ A}$	-	-	-100	nA
		$V_{CB} = -30\text{ V}; I_E = 0\text{ A}; T_j = 150^{\circ}\text{C}$	-	-	-10	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = -5\text{ V}; I_C = 0\text{ A}$	-	-	-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	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] -	-	-0.5	V
V_{BE}	base-emitter voltage	$V_{CE} = -2\text{ V}; I_C = -500\text{ mA}$	[1] -	-	-1	V
C_C	collector capacitance	$V_{CB} = -15\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	15	-	pF
f_T	transition frequency	$V_{CE} = -5\text{ V}; I_C = -50\text{ mA}; f = 100\text{ MHz}$	-	145	-	MHz

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



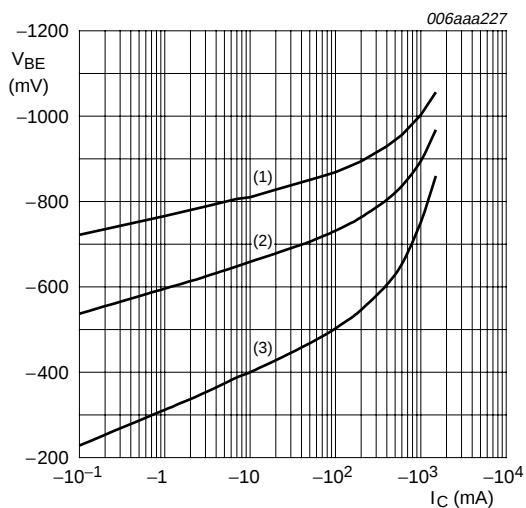
$V_{CE} = -2 \text{ V}$
(1) $T_{amb} = 150 \text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25 \text{ }^{\circ}\text{C}$
(3) $T_{amb} = -55 \text{ }^{\circ}\text{C}$

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



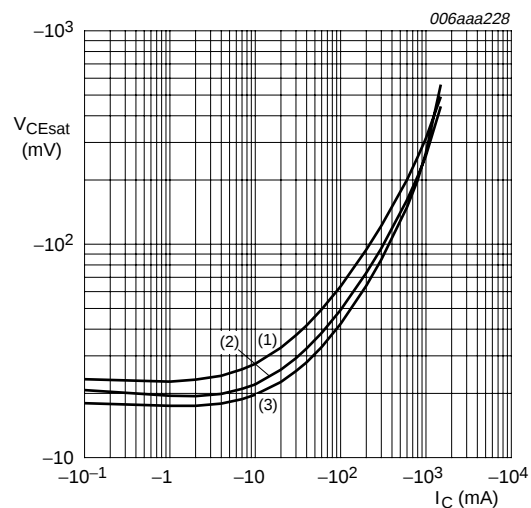
$T_{amb} = 25 \text{ }^{\circ}\text{C}$

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) $T_{amb} = 150 \text{ }^{\circ}\text{C}$

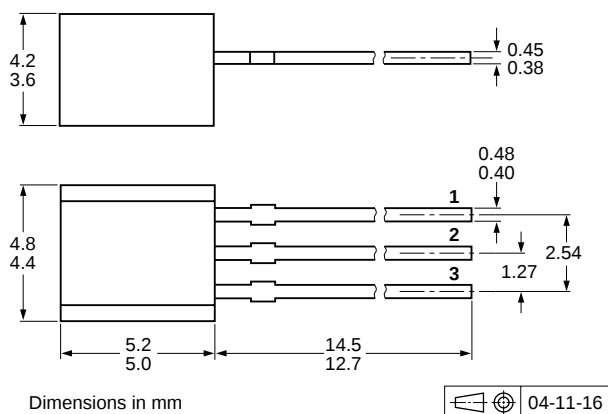
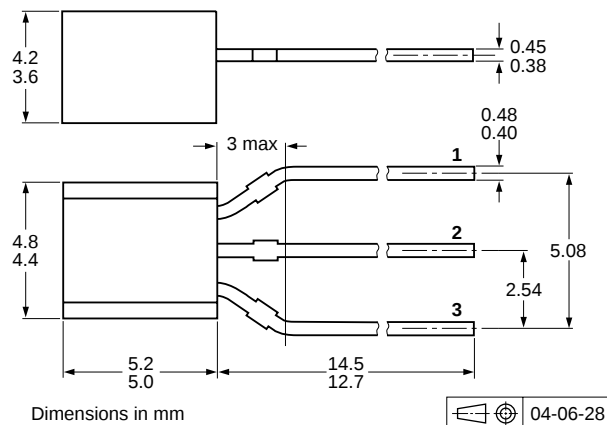
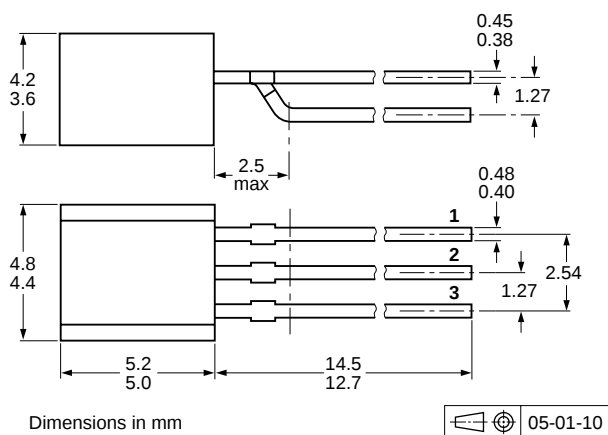
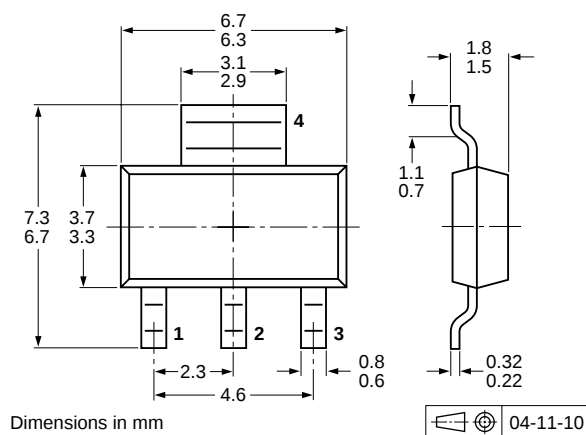
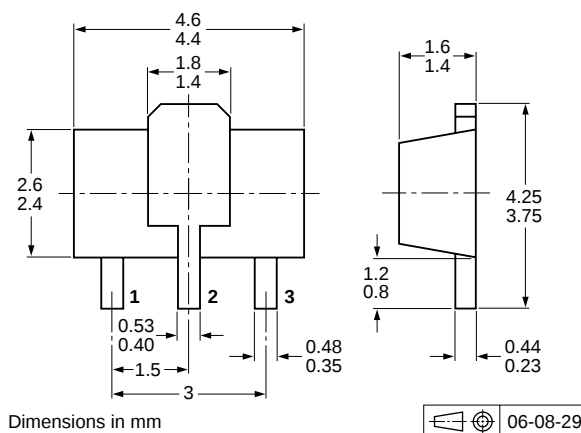
Fig 12. Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 10$
(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.^[1]

Type number ^[2]	Package	Description	Packing quantity			
			1000	4000	5000	10000
BC640	SOT54	bulk, straight leads	-	-	-412	-
	SOT54A	tape and reel, wide pitch	-	-	-	-116
		tape ammopack, wide pitch	-	-	-	-126
	SOT54 variant	bulk, delta pinning	-	-	-112	-
BCP53	SOT223	8 mm pitch, 12 mm tape and reel	-115	-135	-	-
BCX53	SOT89	8 mm pitch, 12 mm tape and reel; T1 ^[3]	-115	-135	-	-
		8 mm pitch, 12 mm tape and reel; T3 ^[4]	-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
BC640_BCP53_BCX53_8	20080222	Product data sheet	-	BC640_BCP53_BCX53_7
Modifications:				
- Type number BC640-16 has been removed Figure 11: amended				
BC640_BCP53_BCX53_7	20070627	Product data sheet	-	BC640_BCP53_BCX53_6
BC640_BCP53_BCX53_6	20060313	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 ^{[1][2]}	Product status ^[3]	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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