BC639; BCP56; BCX56

80 V, 1 A NPN medium power transistor series

Rev. 07 — 8 March 2005 Product data sheet

1. Product profile

1.1 General description

NPN medium power transistor series.

Table 1: Product overview

Type number [1]	Package		PNP complement
	Philips	JEITA	
BC639 [2]	SOT54	SC-43A*	BC640
BCP56	SOT223	SC-73	BCP53
BCX56	SOT89	SC-62	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
- Three current gain selections

1.3 Applications

- Linear voltage regulators
- Low side switches
- Supply line switches
- MOSFET drivers

1.4 Quick reference data

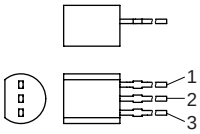
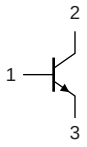
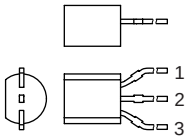
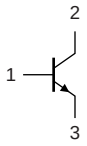
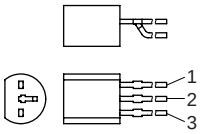
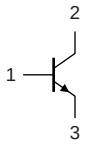
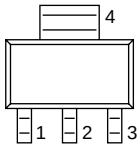
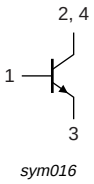
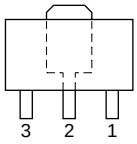
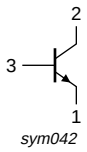
Table 2: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	80	V
I_C	collector current (DC)		-	-	1	A
I_{CM}	peak collector current		-	-	1.5	A
h_{FE}	DC current gain	V_{CE} = 2 V; I_C = 150 mA	63	-	250	
	selection -10	V_{CE} = 2 V; I_C = 150 mA	63	-	160	
	selection -16	V_{CE} = 2 V; I_C = 150 mA	100	-	250	

PHILIPS

2. Pinning information

Table 3: Pinning

Pin	Description	Simplified outline	Symbol
SOT54			
1	base	 001aab347	 sym056
2	collector		
3	emitter		
SOT54A			
1	base	 001aab348	 sym056
2	collector		
3	emitter		
SOT54 variant			
1	base	 001aab447	 sym056
2	collector		
3	emitter		
SOT223			
1	base		 sym016
2	collector		
3	emitter		
4	collector		
SOT89			
1	emitter		 sym042
2	collector		
3	base		

3. Ordering information

Table 4: Ordering information

Type number [1]	Package		
	Name	Description	Version
BC639 [2]	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

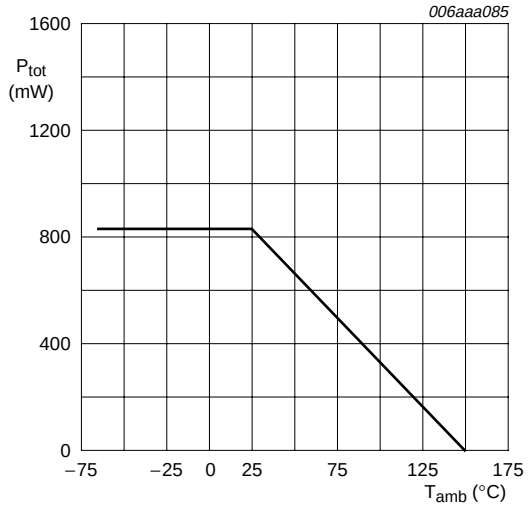
In accordance with the Absolute Maximum Rating System (IEC 60134).

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 (DC)			-	1	A
I_{CM}	peak collector current			-	1.5	A
I_{BM}	peak base current			-	0.2	A
P_{tot}	total power dissipation					
	BC639	$T_{amb} \leq 25$ °C	[1]	-	0.83	W
	BCP56	$T_{amb} \leq 25$ °C	[1]	-	0.65	W
	BCP56	$T_{amb} \leq 25$ °C	[2]	-	1	W
	BCP56	$T_{amb} \leq 25$ °C	[3]	-	1.4	W
	BCX56	$T_{amb} \leq 25$ °C	[1]	-	0.5	W
	BCX56	$T_{amb} \leq 25$ °C	[2]	-	0.85	W
	BCX56	$T_{amb} \leq 25$ °C	[3]	-	1.2	W
T_{stg}	storage temperature			–65	+150	°C
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			–65	+150	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

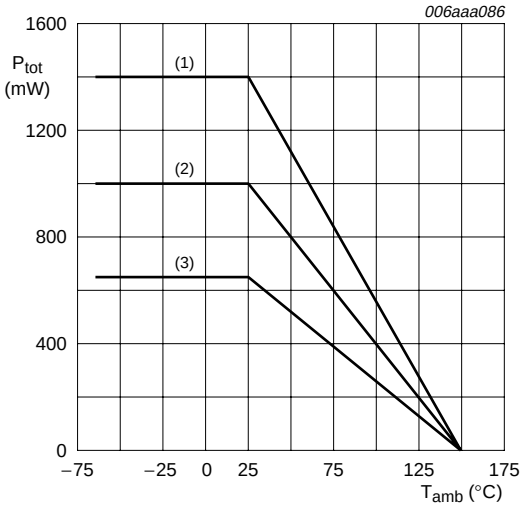
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm^2.

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



FR4 PCB; standard footprint

Fig 1. Power derating curve; SOT54

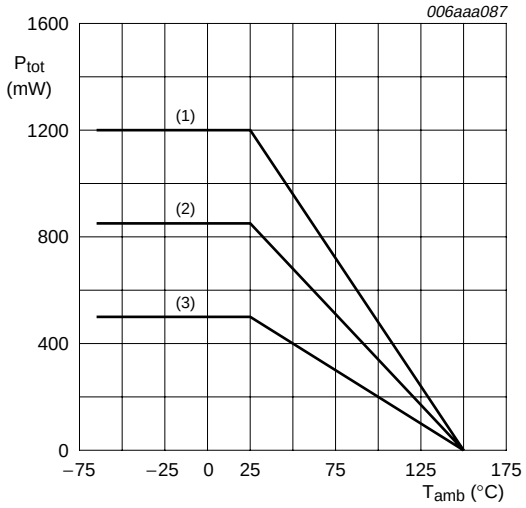


(1) FR4 PCB; 6 cm^2 mounting pad for collector

(2) FR4 PCB; 1 cm^2 mounting pad for collector

(3) FR4 PCB; standard footprint

Fig 2. Power derating curves; SOT223



(1) FR4 PCB; 6 cm^2 mounting pad for collector

(2) FR4 PCB; 1 cm^2 mounting pad for collector

(3) FR4 PCB; standard footprint

Fig 3. Power derating curves; SOT89

6. Thermal characteristics

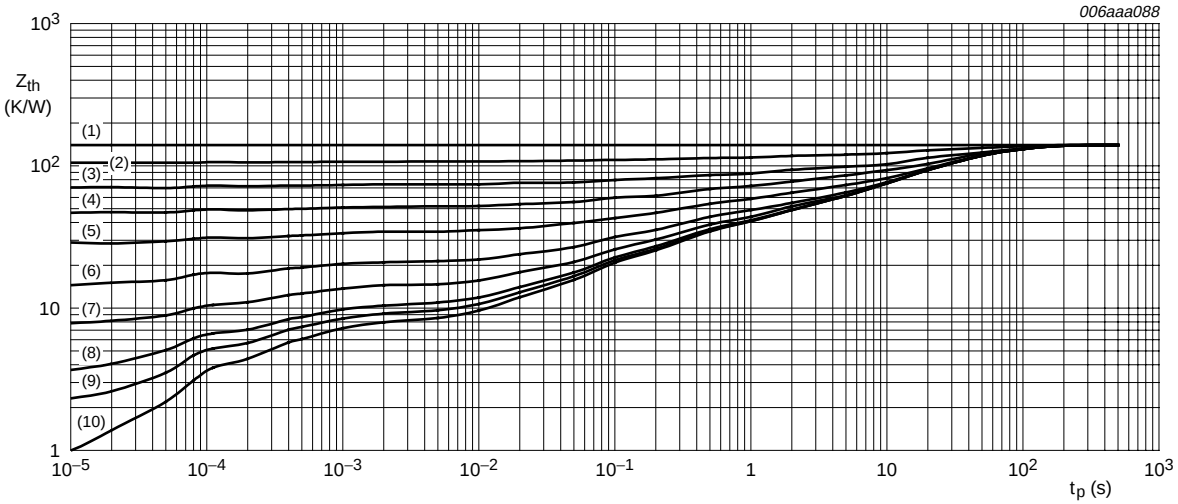
Table 7: Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient						
	BC639	$T_{amb} \leq 25$ °C	[1]	-	-	150	K/W
	BCP56	$T_{amb} \leq 25$ °C	[1]	-	-	192	K/W
	BCP56	$T_{amb} \leq 25$ °C	[2]	-	-	125	K/W
	BCP56	$T_{amb} \leq 25$ °C	[3]	-	-	89	K/W
	BCX56	$T_{amb} \leq 25$ °C	[1]	-	-	250	K/W
	BCX56	$T_{amb} \leq 25$ °C	[2]	-	-	147	K/W
	BCX56	$T_{amb} \leq 25$ °C	[3]	-	-	104	K/W
$R_{th(j-sp)}$	thermal resistance from junction to soldering point						
	BC639	$T_{amb} \leq 25$ °C		-	-	40	K/W
	BCP56	$T_{amb} \leq 25$ °C		-	-	17	K/W
	BCX56	$T_{amb} \leq 25$ °C		-	-	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^2.

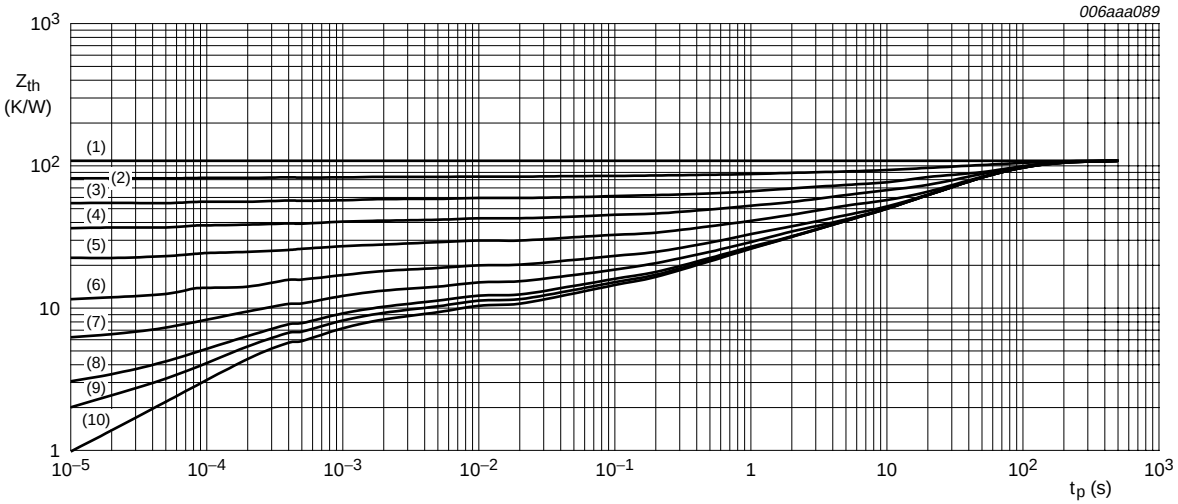
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm^2.



Mounted on FR4 PCB; standard footprint

(1) δ = 1
(2) δ = 0.75
(3) δ = 0.5
(4) δ = 0.33
(5) δ = 0.2
(6) δ = 0.1
(7) δ = 0.05
(8) δ = 0.02
(9) δ = 0.01
(10) δ = 0

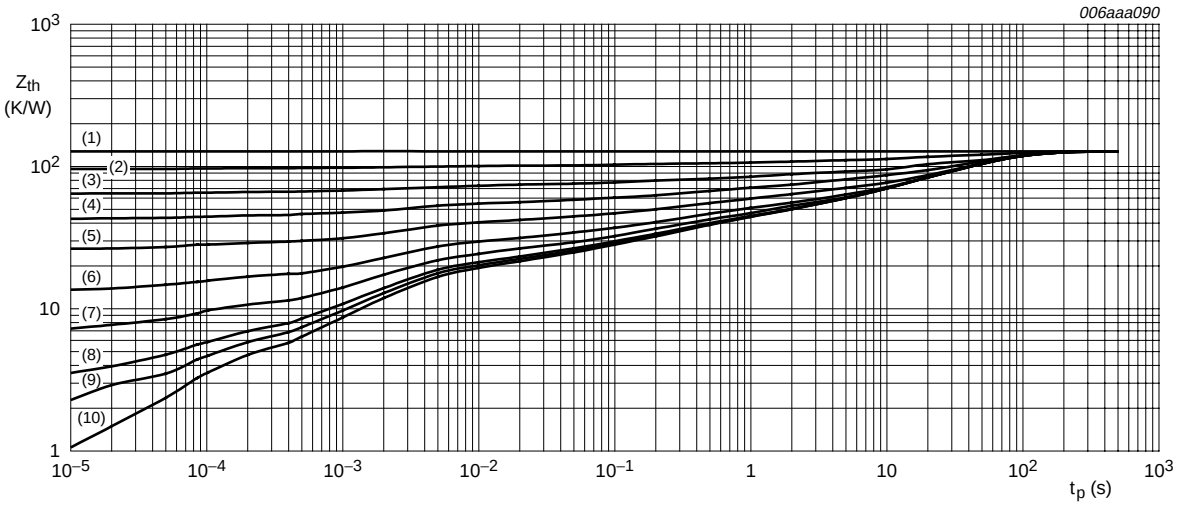
Fig 4. Transient thermal impedance as a function of pulse time for SOT54; typical values



Mounted on FR4 PCB; 1 cm^2 collector mounting pad

(1) δ = 1
(2) δ = 0.75
(3) δ = 0.5
(4) δ = 0.33
(5) δ = 0.2
(6) δ = 0.1
(7) δ = 0.05
(8) δ = 0.02
(9) δ = 0.01
(10) δ = 0

Fig 5. Transient thermal impedance as a function of pulse time for SOT223; typical values



Mounted on FR4 PCB; 1 cm^2 collector mounting pad

(1) $\delta = 1$
(2) $\delta = 0.75$
(3) $\delta = 0.5$
(4) $\delta = 0.33$
(5) $\delta = 0.2$
(6) $\delta = 0.1$
(7) $\delta = 0.05$
(8) $\delta = 0.02$
(9) $\delta = 0.01$
(10) $\delta = 0$

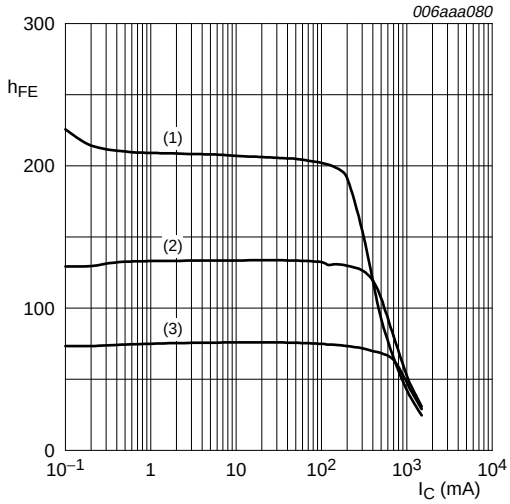
Fig 6. Transient thermal impedance as a function of pulse time for SOT89; typical values

7. Characteristics

Table 8: Characteristics

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	I_E = 0 A; V_{CB} = 30 V	-	-	100	nA
		I_E = 0 A; V_{CB} = 30 V; T_j = 150 °C	-	-	10	µA
I_{EBO}	emitter-base cut-off current	I_C = 0 A; V_{EB} = 5 V	-	-	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V				
		I_C = 5 mA	63	-	-	
		I_C = 150 mA	63	-	250	
		I_C = 500 mA	40	-	-	
	DC current gain	V_{CE} = 2 V				
	h_{FE} selection -10	I_C = 150 mA	63	-	160	
	h_{FE} selection -16	I_C = 150 mA	100	-	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	-	-	500	mV
V_{BE}	base-emitter voltage	I_C = 500 mA; V_{CE} = 2 V	-	-	1	V
C_c	collector capacitance	I_E = i_e = 0 A; V_{CB} = 10 V; f = 1 MHz	-	6	-	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 100 MHz	100	180	-	MHz



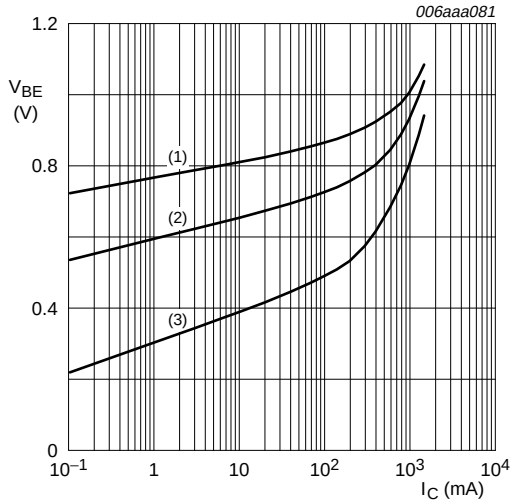
V_{CE} = 2 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = –55 °C

Fig 7. DC current gain as a function of collector current; typical values



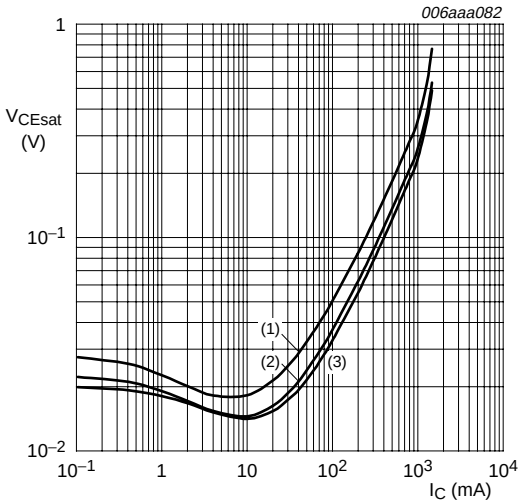
V_{CE} = 2 V

(1) T_{amb} = –55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 150 °C

Fig 8. Base-emitter voltage as a function of collector current; typical values



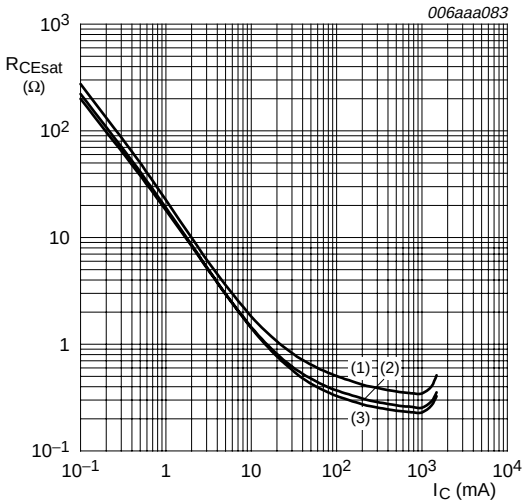
I_C/I_B = 10

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = –55 °C

Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values



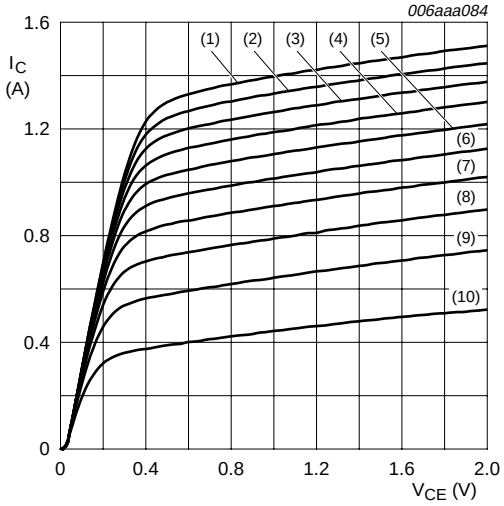
I_C/I_B = 10

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = –55 °C

Fig 10. Equivalent on-resistance as a function of collector current; typical values



(1) I_B = 50 mA
(2) I_B = 45 mA
(3) I_B = 40 mA
(4) I_B = 35 mA
(5) I_B = 30 mA
(6) I_B = 25 mA
(7) I_B = 20 mA
(8) I_B = 15 mA
(9) I_B = 10 mA
(10) I_B = 5 mA

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

8. Package outline

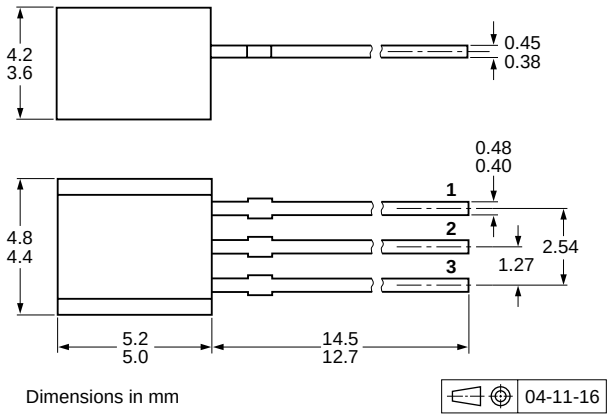


Fig 12. Package outline SOT54 (SC-43A/TO-92)

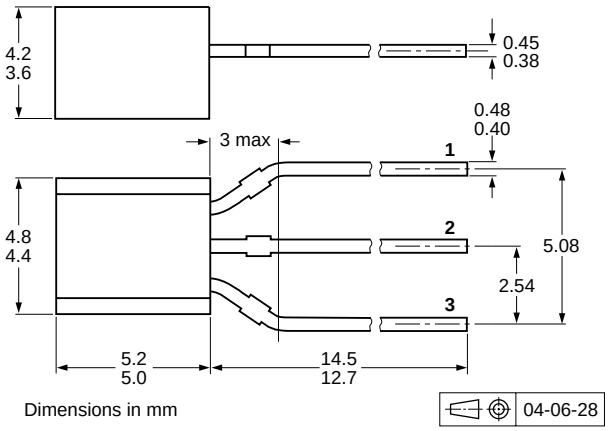


Fig 13. Package outline SOT54A

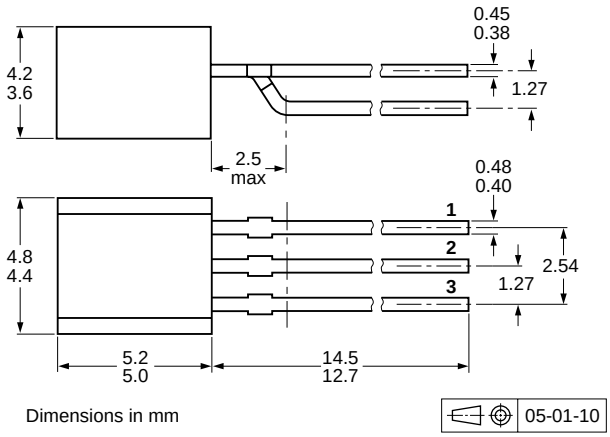


Fig 14. Package outline SOT54 variant

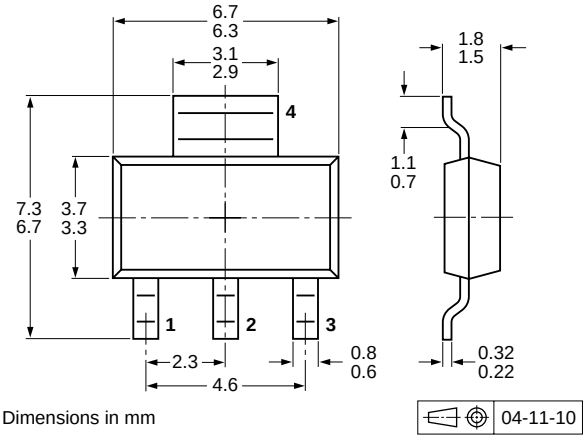


Fig 15. Package outline SOT223 (SC-73)

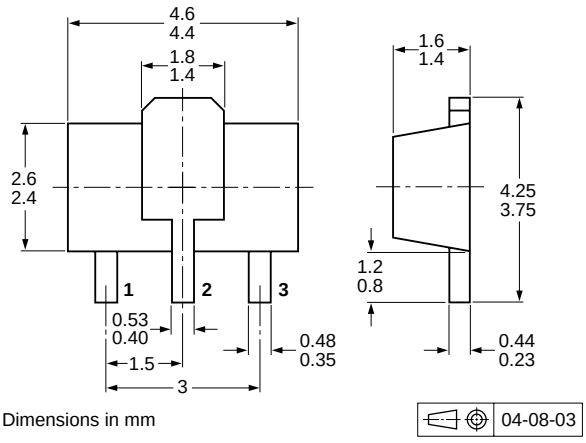


Fig 16. Package outline SOT89 (SC-62/TO-243)

9. Packing information

Table 9: Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code. [1]

Type number	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 (on-circle)	-	-	-112	-
BCP56	SOT223	8 mm pitch, 12 mm tape and reel	-115	-135	-	-
BCX56	SOT89	8 mm pitch, 12 mm tape and reel	-115	-135	-	-

[1] For further information and the availability of packing methods, see Section 14.

10. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BC639_BCP56_ BCX56_7	20050308	Product data sheet	-	9397 750 14863	BC639_BCP56_ BCX56_6
Modifications:	• The document IDs in the second bullet list item of the Modifications row in this table for document ID BC639_BCP56_BCX56_6 have been amended as shown.				
BC639_BCP56_ BCX56_6	20050303	Product data sheet	CPCN200405029	9397 750 14042	BC635_637_639_4; BCP54_55_56_5; BCX54_55_56_4
Modifications:	• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors. • This data sheet is a combination of data sheets BC635_637_639_4, BCP54_55_56_5 and BCX54_55_56_4. • Figure 1, 2, 3, 4, 5 and 6 added • Figure 7 replaced according to CPCN200405029 • Figure 8, 9, 10, 11, 13 and 14 added • Section 9 “Packing information” added				
BC635_637_639_4	20011010	Product specification	-	9397 750 08738	BC635_637_639_3
BCP54_55_56_5	20030206	Product specification	-	9397 750 10763	BCP54_55_56_4
BCX54_55_56_4	20011010	Product specification	-	9397 750 08744	BCX54_55_56_3

11. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

12. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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14. Contact information

For additional information, please visit: **http://www.semiconductors.philips.com**

For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**

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