

# BCP54; BCX54; BC54PA

45 V, 1 A NPN medium power transistors

Rev. 8 — 21 October 2011

Product data sheet

## 1. Product profile

### 1.1 General description

NPN medium power transistor series in Surface-Mounted Device (SMD) plastic packages.

Table 1. Product overview

Type number <sup>[1]</sup>	Package			PNP complement
	Nexperia	JEITA	JEDEC	
BCP54	SOT223	SC-73	-	BCP51
BCX54	SOT89	SC-62	TO-243	BCX51
BC54PA	SOT1061	-	-	BC51PA

[1] Valid for all available selection groups.

### 1.2 Features and benefits

- High current
- Three current gain selections
- High power dissipation capability
- Exposed heatsink for excellent thermal and electrical conductivity (SOT89, SOT1061)
- Leadless very small SMD plastic package with medium power capability (SOT1061)
- AEC-Q101 qualified

### 1.3 Applications

- Linear voltage regulators
- Low-side switches
- Battery-driven devices
- Power management
- MOSFET drivers
- Amplifiers

### 1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CE0}$	collector-emitter voltage	open base	-	-	45	V
$I_C$	collector current		-	-	1	A
$I_{CM}$	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	2	A
$h_{FE}$	DC current gain	$V_{CE} = 2$ V; $I_C = 150$ mA	<a href="#">[1]</a> 63	-	250	
	$h_{FE}$ selection -10	$V_{CE} = 2$ V; $I_C = 150$ mA	<a href="#">[1]</a> 63	-	160	
	$h_{FE}$ selection -16	$V_{CE} = 2$ V; $I_C = 150$ mA	<a href="#">[1]</a> 100	-	250	

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

## 2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
<b>SOT223</b>			
1	base		 sym016
2	collector		
3	emitter		
4	collector		
<b>SOT89</b>			
1	emitter		 sym042
2	collector		
3	base		
<b>SOT1061</b>			
1	base	 Transparent top view	 sym021
2	emitter		
3	collector		

## 3. Ordering information

Table 4. Ordering information

Type number <sup>[1]</sup>	Package		Version
	Name	Description	
BCP54	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCX54	SC-62	plastic surface-mounted package; exposed die pad for good heat transfer; 3 leads	SOT89
BC54PA	HUSON3	plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 × 2 × 0.65 mm	SOT1061

[1] Valid for all available selection groups.

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code
BCP54	BCP54
BCP54-10	BCP54/10
BCP54-16	BCP54/16
BCX54	BA
BCX54-10	BC
BCX54-16	BD
BC54PA	AT
BC54-10PA	BF
BC54-16PA	BG

## 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	-	45	V			
$V_{CEO}$	collector-emitter voltage	open base	-	45	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	-	2	A			
$I_B$	base current		-	0.3	A			
$I_{BM}$	peak base current	single pulse; $t_p \leq 1$ ms	-	0.3	A			
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C						
			BCP54	[1]	-	0.65	W	
				[2]	-	1.00	W	
				[3]	-	1.35	W	
			BCX54	[1]	-	0.50	W	
				[2]	-	0.95	W	
				[3]	-	1.35	W	
			BC54PA	[1]	-	0.42	W	
				[2]	-	0.83	W	
				[3]	-	1.10	W	
				[4]	-	0.81	W	
				[5]	-	1.65	W	
			$T_j$	junction temperature		-	150	°C
			$T_{amb}$	ambient temperature		-55	+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>.

[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



- (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 1. 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 2. Power derating curves SOT89**



- (1) FR4 PCB, 4-layer copper, mounting pad for collector 1 cm<sup>2</sup>
- (2) FR4 PCB, single-sided copper, mounting pad for collector 6 cm<sup>2</sup>
- (3) FR4 PCB, single-sided copper, mounting pad for collector 1 cm<sup>2</sup>
- (4) FR4 PCB, 4-layer copper, standard footprint
- (5) FR4 PCB, single-sided copper, standard footprint

**Fig 3. Power derating curves SOT1061**

## 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	BCP54	[1]	-	-	192	K/W					
				[2]	-	-	125	K/W					
				[3]	-	-	93	K/W					
			BCX54	[1]	-	-	250	K/W					
				[2]	-	-	132	K/W					
				[3]	-	-	93	K/W					
			BC54PA	[1]	-	-	298	K/W					
				[2]	-	-	151	K/W					
				[3]	-	-	114	K/W					
	[4]	-		-	154	K/W							
	[5]	-		-	76	K/W							
	$R_{th(j-sp)}$	thermal resistance from junction to solder point											
									BCP54	-	-	16	K/W
									BCX54	-	-	16	K/W
									BC54PA	-	-	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>.

[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



FR4 PCB, standard footprint

**Fig 4. 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 5. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT223; typical values**



FR4 PCB, mounting pad for collector 6 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**



FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

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



FR4 PCB, single-sided copper, standard footprint

**Fig 10. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**



FR4 PCB, single-sided copper, mounting pad for collector 1 cm<sup>2</sup>

**Fig 11. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**



FR4 PCB, single-sided copper, mounting pad for collector 6 cm<sup>2</sup>

**Fig 12. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**



FR4 PCB, 4-layer copper, standard footprint

**Fig 13. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values**

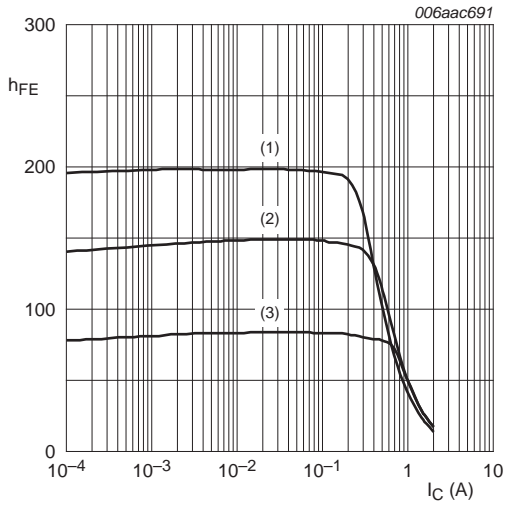


## 7. Characteristics

**Table 8. Characteristics**  
*T<sub>amb</sub> = 25 °C unless otherwise specified.*

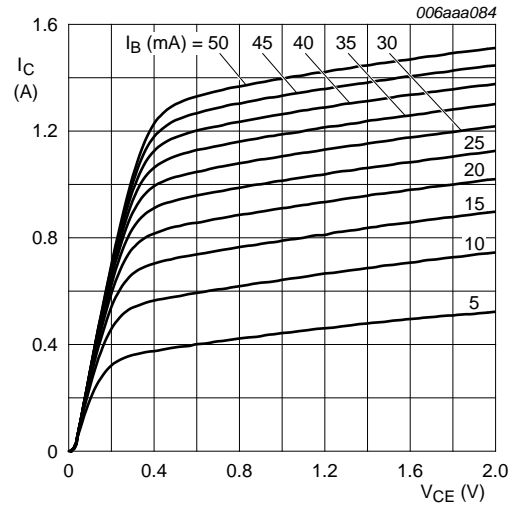
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 30 V; I <sub>E</sub> = 0 A	-	-	100	nA
		V <sub>CB</sub> = 30 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	10	μA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <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	[1]	63	-	-
		I <sub>C</sub> = 150 mA	[1]	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	[1]	63	-	160
	h <sub>FE</sub> selection -16	I <sub>C</sub> = 150 mA	[1]	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> = 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.



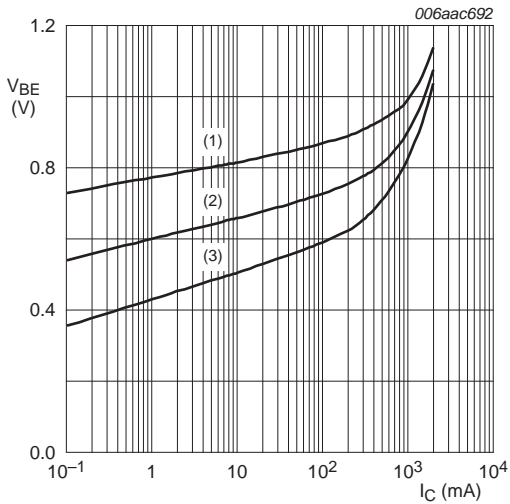
- $V_{CE} = 2\text{ V}$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig 15. DC current gain as a function of collector current; typical values**



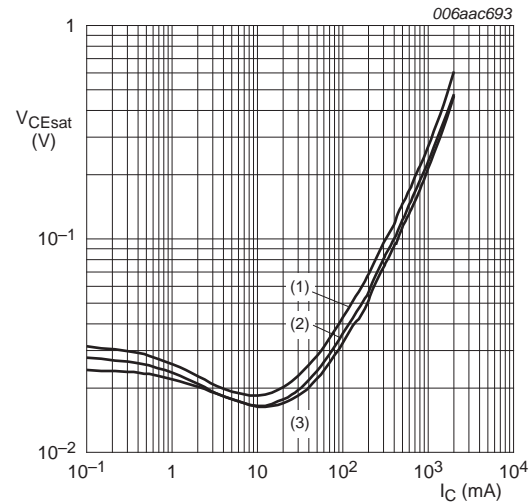
$T_{amb} = 25\text{ }^{\circ}\text{C}$

**Fig 16. 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)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 17. Base-emitter voltage as a function of collector current; typical values**



- $I_C/I_B = 10$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig 18. Collector-emitter saturation voltage as a function of collector current; typical values**

## 8. Test information

### 8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

## 9. Package outline



**Fig 19. Package outline SOT223 (SC-73)**



**Fig 20. Package outline SOT89 (SC-62/TO-243)**



Fig 21. Package outline SOT1061 (HUSON3)

## 10. 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	3000	4000
BCP54	SOT223	8 mm pitch, 12 mm tape and reel	-115	-	-135
BCX54	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>	-146	-	-
BC54PA	SOT1061	4 mm pitch, 8 mm tape and reel	-	-115	-

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

[2] Valid for all available selection groups.

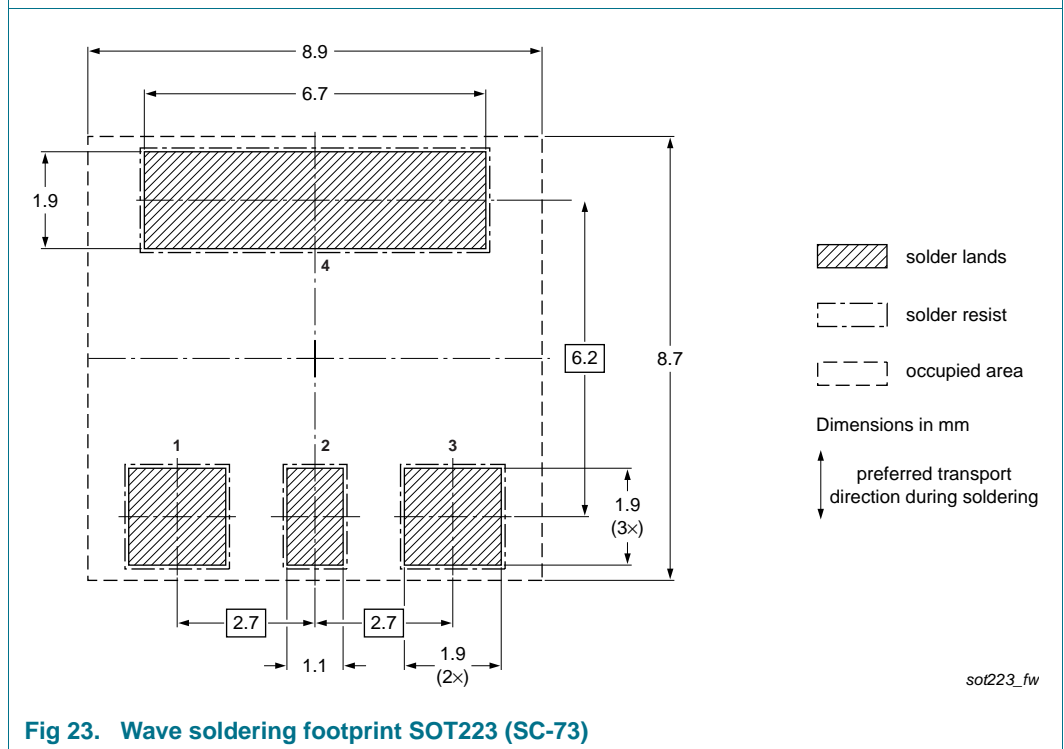
[3] T1: normal taping

[4] T3: 90° rotated taping

**11. Soldering**

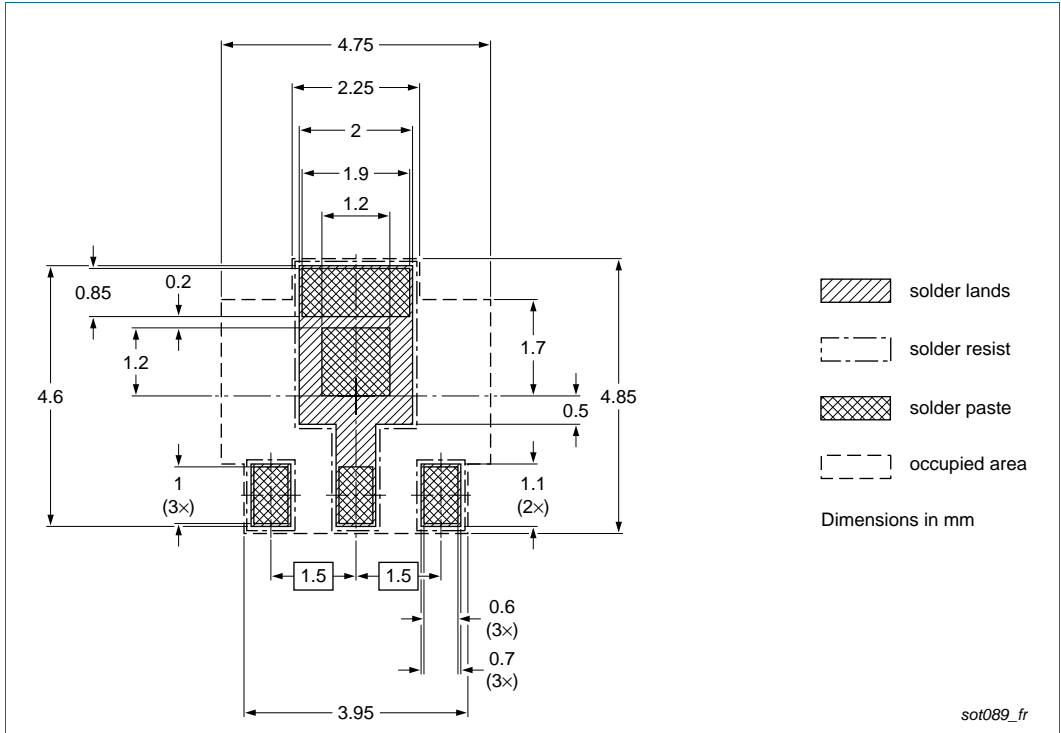


**Fig 22. Reflow soldering footprint SOT223 (SC-73)**

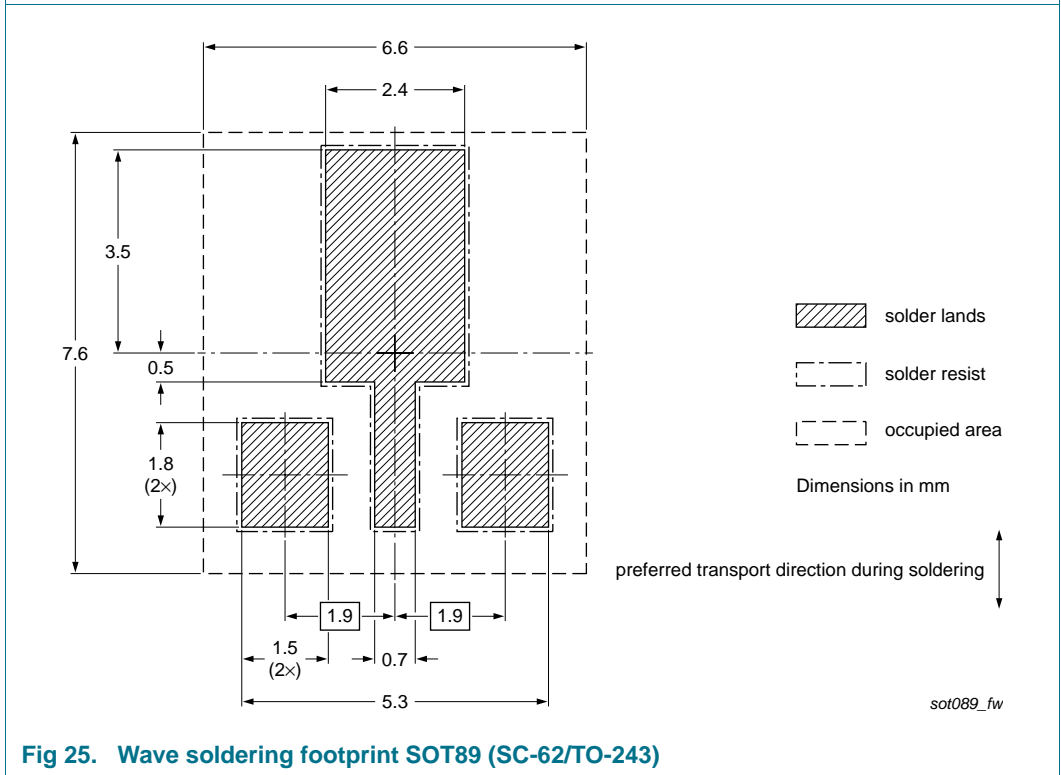


**Fig 23. Wave soldering footprint SOT223 (SC-73)**





**Fig 24. Reflow soldering footprint SOT89 (SC-62/TO-243)**



**Fig 25. Wave soldering footprint SOT89 (SC-62/TO-243)**



## 12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BCP54_BCX54_BC54PA v.8	20111021	Product data sheet	-	BC635_BCP54_BCX54 v.7
Modifications:		<ul style="list-style-type: none"> <li>Type number removed: BC635</li> <li>Type numbers added: BC54PA, BC54-10PA and BC54-16PA</li> <li><a href="#">Section 1 "Product profile"</a>: updated</li> <li><a href="#">Section 2 "Pinning information"</a>: updated</li> <li><a href="#">Table 6</a> and <a href="#">7</a>: updated according to latest measurements</li> <li><a href="#">Figure 1, 2, 4, 5, 7</a> to <a href="#">9, 15, 17</a> and <a href="#">18</a>: updated</li> <li><a href="#">Figure 3, 6, 10</a> to <a href="#">14</a>: added</li> <li><a href="#">Section 8 "Test information"</a>: added</li> <li><a href="#">Section 10 "Packing information"</a>: updated</li> <li><a href="#">Section 11 "Soldering"</a>: added</li> <li><a href="#">Section 13 "Legal information"</a>: updated</li> </ul>		
BC635_BCP54_BCX54 v.7	20070604	Product data sheet	-	BC635_BCP54_BCX54 v.6
BC635_BCP54_BCX54 v.6	20050225	Product data sheet	CPCN2004050 29	BC635_637_639 v.4 BCP54_55_56 v.5 BCX54_55_56 v.4
BC635_637_639 v.4	20011010	Product specification	-	BC635_637_639 v.3
BCP54_55_56 v.5	20030206	Product specification	-	BCP54_55_56 v.4
BCX54_55_56 v.4	20011010	Product specification	-	BCX54_55_56 v.3

## 13. Legal information

### 13.1 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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## 14. Contact information

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[732314D](#) [CMXT3906 TR](#) [CPH3121-TL-E](#) [CPH6021-TL-H](#) [SZT1010T1G](#) [873787E](#)