

BCP56; BCX56; BC56PA

80 V, 1 A NPN medium power transistors

Rev. 9 — 25 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 ^[1]	Package			PNP complement
	NXP	JEITA	JEDEC	
BCP56	SOT223	SC-73	-	BCP53
BCX56	SOT89	SC-62	TO-243	BCX53
BC56PA	SOT1061	-	-	BC53PA

[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

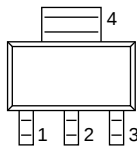
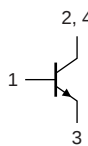
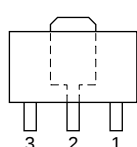
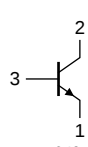
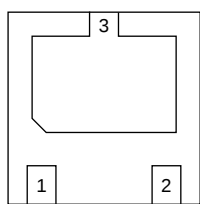
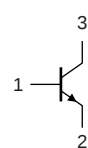
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CE0}	collector-emitter voltage	open base	-	-	80	V
I_C	collector current		-	-	1	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	-	2	A
h_{FE}	DC current gain	$V_{CE} = 2$ V; $I_C = 150$ mA ^[1]	63	-	250	
	h_{FE} selection -10	$V_{CE} = 2$ V; $I_C = 150$ mA ^[1]	63	-	160	
	h_{FE} selection -16	$V_{CE} = 2$ V; $I_C = 150$ mA ^[1]	100	-	250	

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



2. Pinning information

Table 3. Pinning

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

3. Ordering information

Table 4. Ordering information

Type number ^[1]	Package		
	Name	Description	Version
BCP56	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223
BCX56	SC-62	plastic surface-mounted package; exposed die pad for good heat transfer; 3 leads	SOT89
BC56PA	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
BCP56	BCP56
BCP56-10	BCP56/10
BCP56-16	BCP56/16
BCX56	BH
BCX56-10	BK
BCX56-16	BL
BC56PA	AZ
BC56-10PA	BK
BC56-16PA	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 ≤ 1 ms	-	2	A		
I _B	base current		-	0.3	A		
I _{BM}	peak base current	single pulse; t _p ≤ 1 ms	-	0.3	A		
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C					
			BCP56	[1]	-	0.65	W
				[2]	-	1.00	W
	[3]			-	1.35	W	
	BCX56		[1]	-	0.50	W	
			[2]	-	0.95	W	
			[3]	-	1.35	W	
	BC56PA		[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		

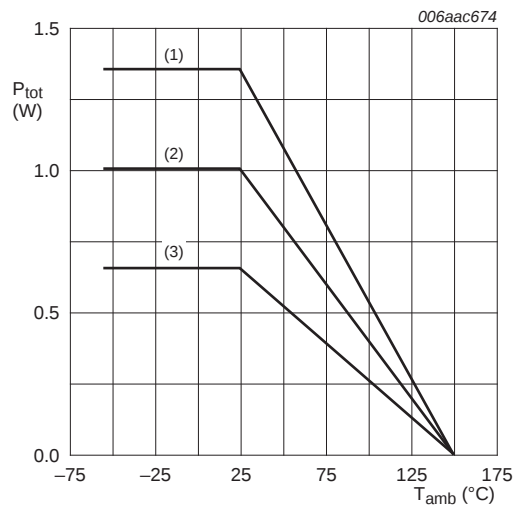
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

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

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

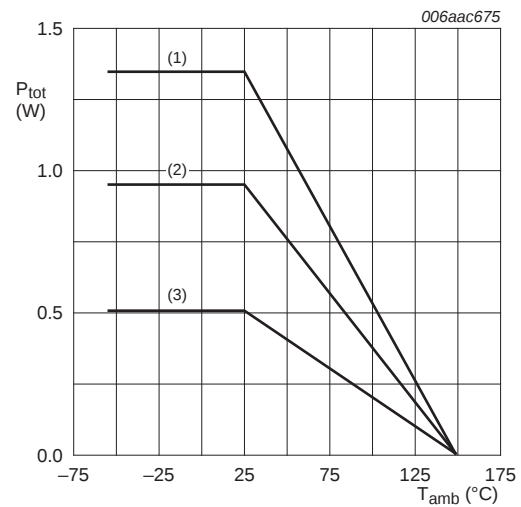
[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm².



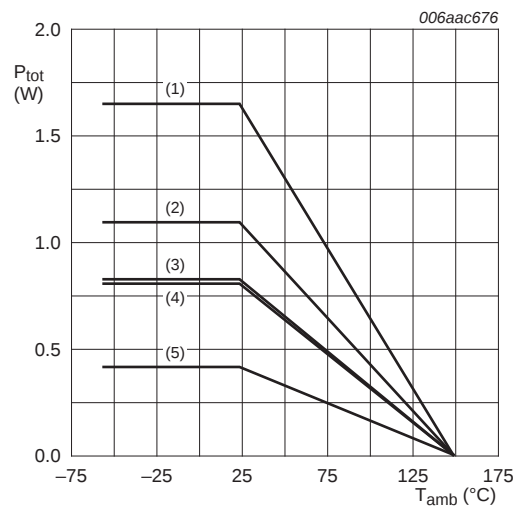
- (1) FR4 PCB, mounting pad for collector 6 cm²
- (2) FR4 PCB, mounting pad for collector 1 cm²
- (3) FR4 PCB, standard footprint

Fig 1. 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 2. Power derating curves SOT89



- (1) FR4 PCB, 4-layer copper, mounting pad for collector 1 cm²
- (2) FR4 PCB, single-sided copper, mounting pad for collector 6 cm²
- (3) FR4 PCB, single-sided copper, mounting pad for collector 1 cm²
- (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							
			BCP56	[1]	-	-	192	K/W	
				[2]	-	-	125	K/W	
				[3]	-	-	93	K/W	
			BCX56	[1]	-	-	250	K/W	
				[2]	-	-	132	K/W	
				[3]	-	-	93	K/W	
			BC56PA	[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					
					BCP56	-	-	16	K/W
					BCX56	-	-	16	K/W
BC56PA	-	-			20	K/W			

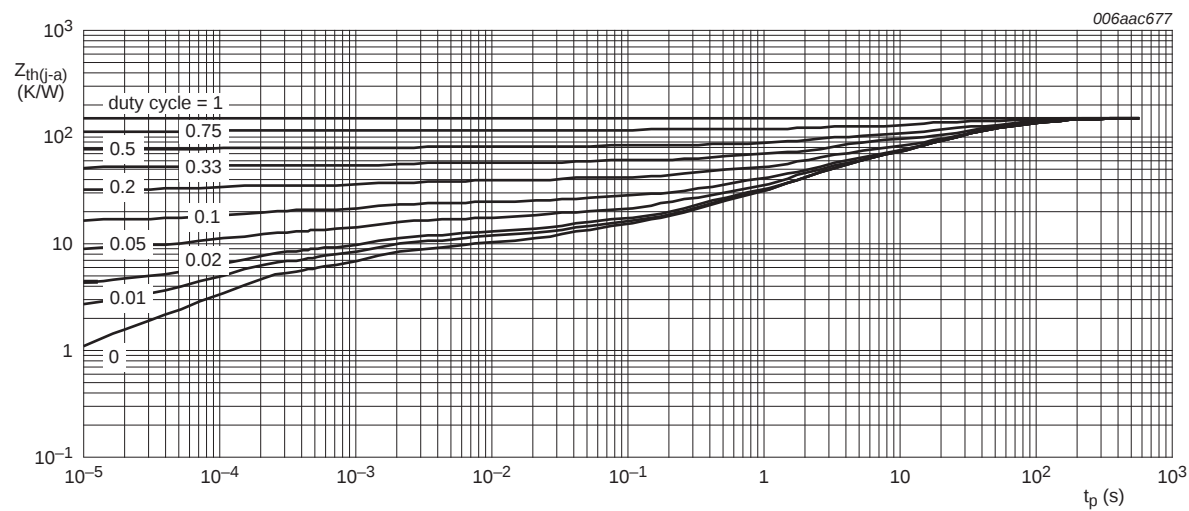
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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.

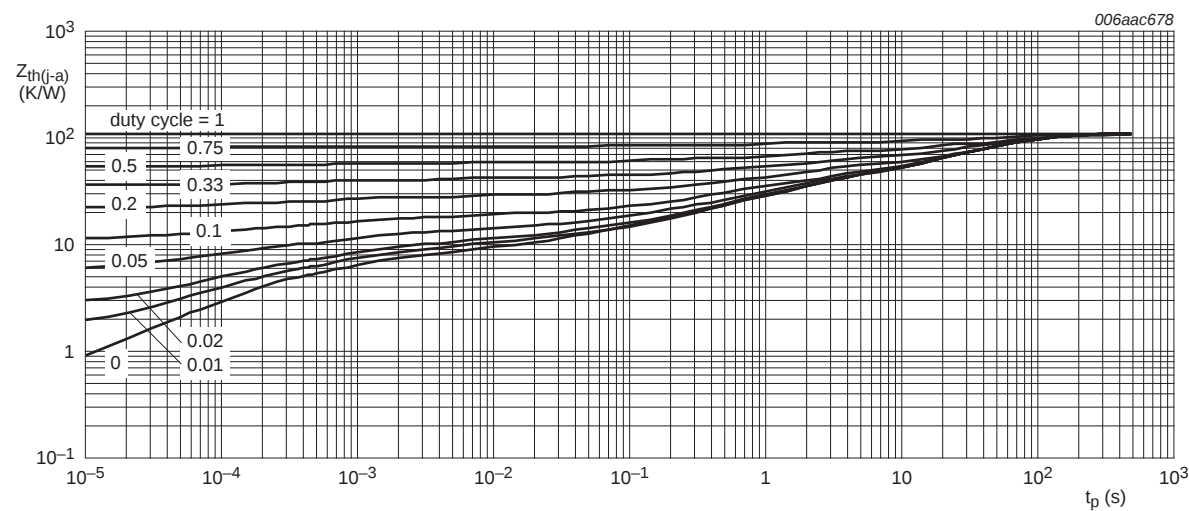
[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm².



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^2

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



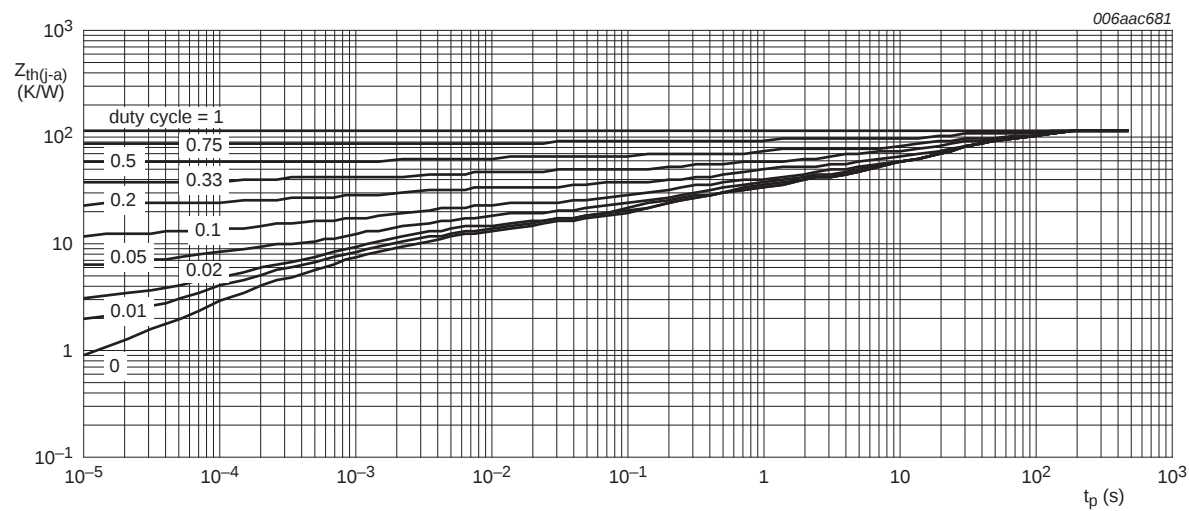
FR4 PCB, mounting pad for collector 6 cm²

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



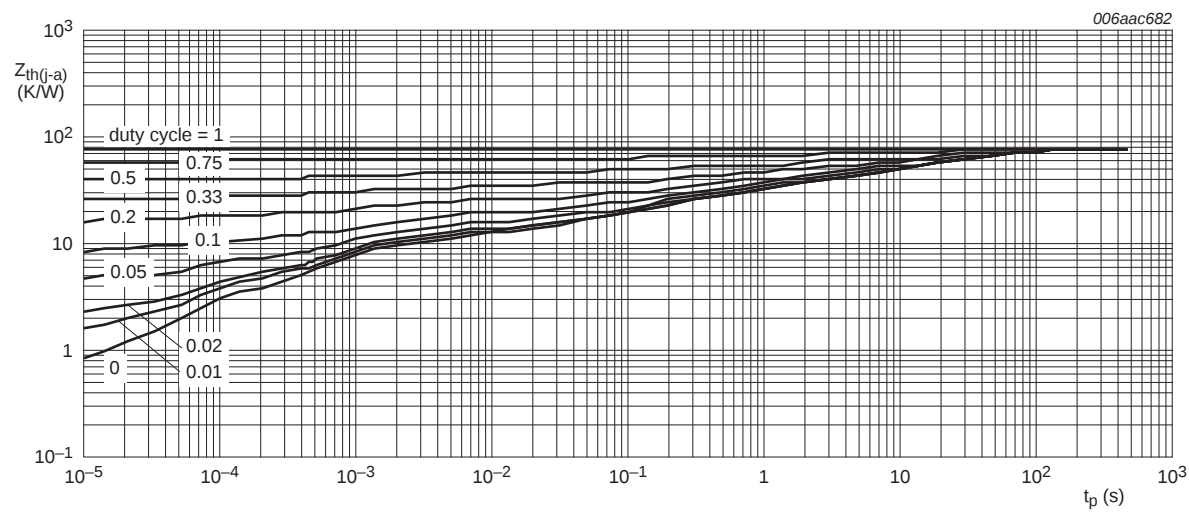
FR4 PCB, standard footprint

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



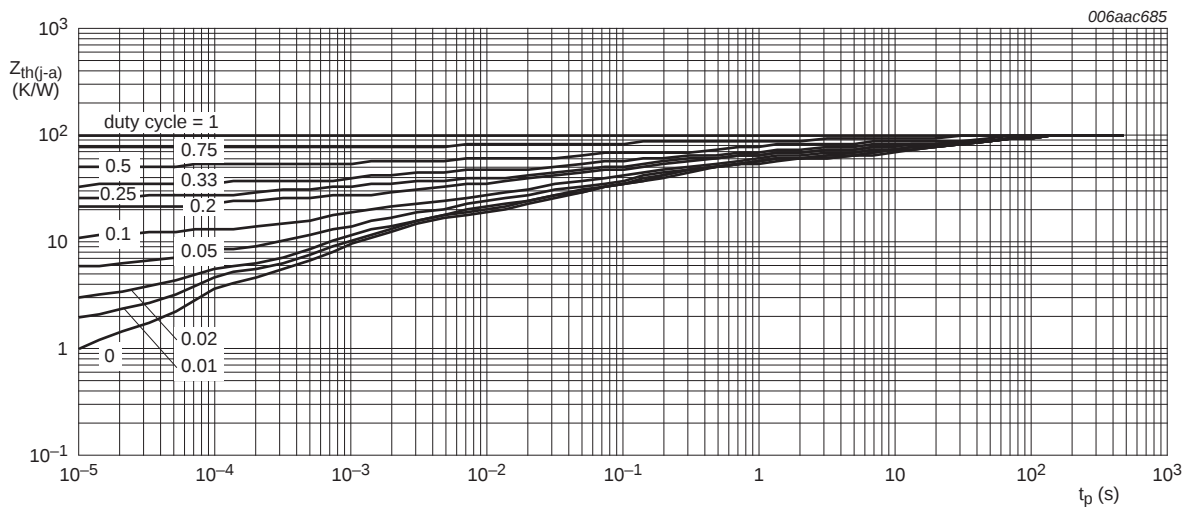
FR4 PCB, single-sided copper, standard footprint

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 cm²

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



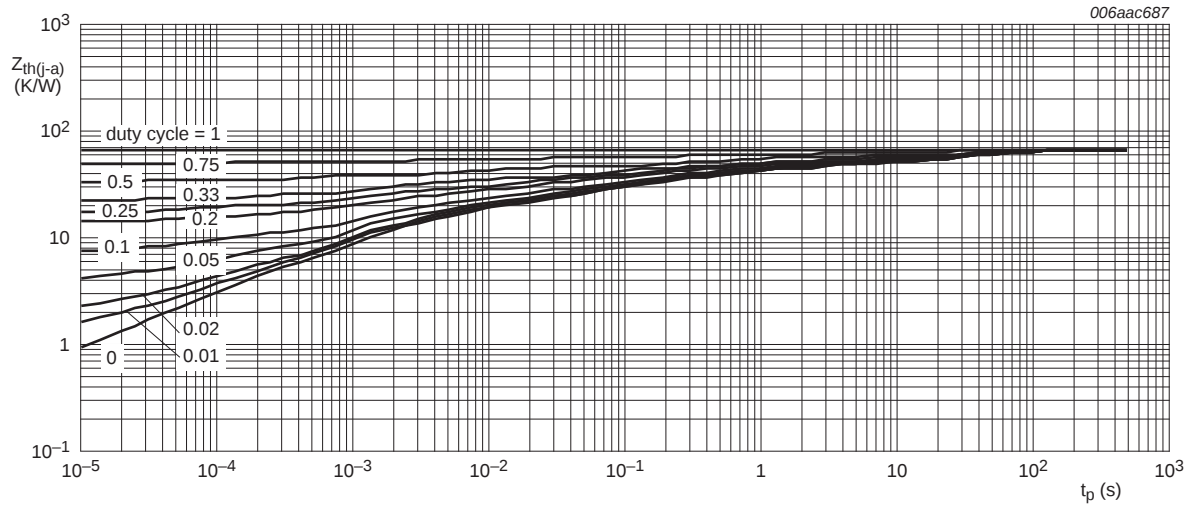
FR4 PCB, single-sided copper, mounting pad for collector 6 cm²

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



FR4 PCB, 4-layer copper, mounting pad for collector 1 cm²

Fig 14. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values

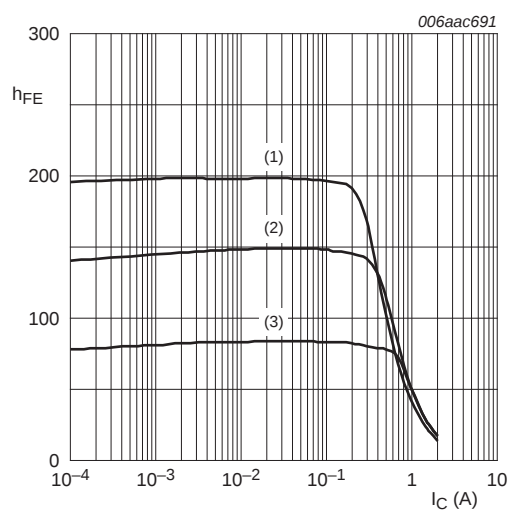
7. Characteristics

Table 8. Characteristics

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

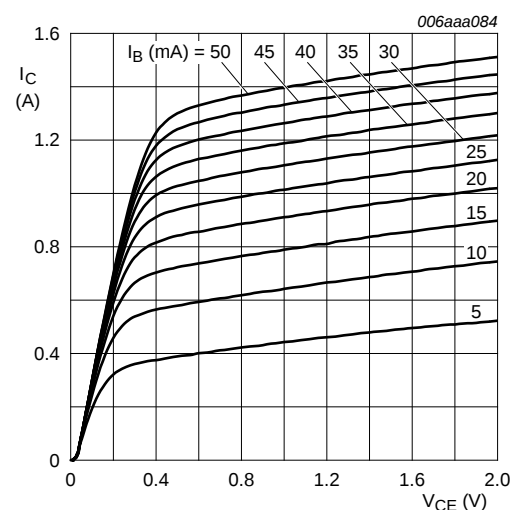
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$	-	-	10	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
h_{FE}	DC current gain	$V_{CE} = 2\text{ V}$				
		$I_C = 5\text{ mA}$	[1] 63	-	-	
		$I_C = 150\text{ mA}$	[1] 63	-	250	
		$I_C = 500\text{ mA}$	[1] 40	-	-	
	DC current gain	$V_{CE} = 2\text{ V}$				
		h_{FE} selection -10	[1] 63	-	160	
	h_{FE} selection -16	$I_C = 150\text{ mA}$	[1] 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	$V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$	-	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: $t_p \leq 300\text{ }\mu\text{s}$; $\delta = 0.02$.



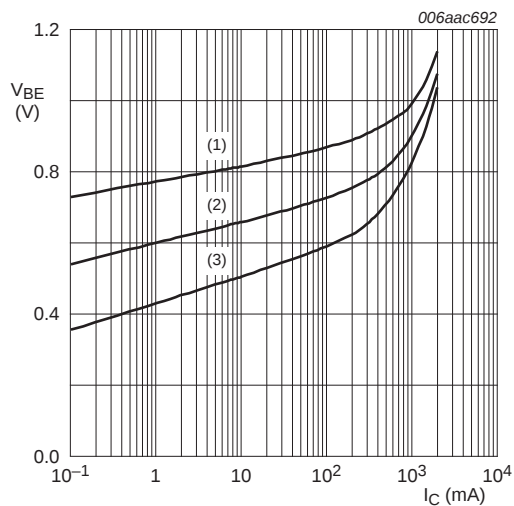
- $V_{CE} = 2\text{ V}$
- (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



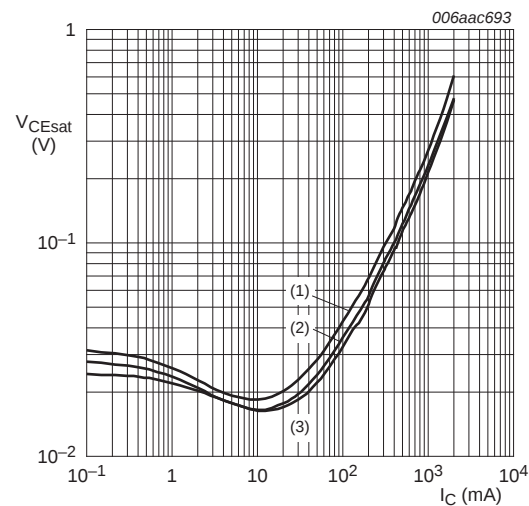
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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.

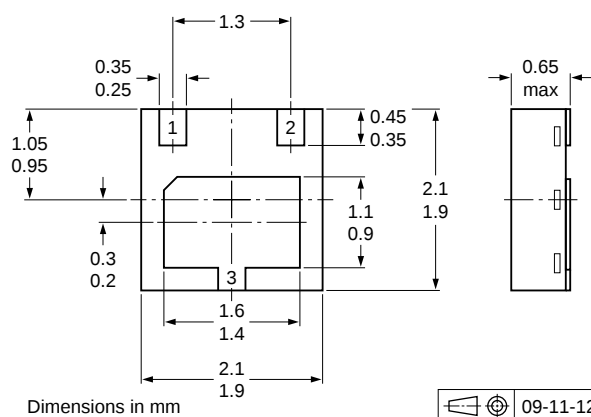
9. Package outline



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.^[1]

Type number ^[2]	Package	Description	Packing quantity		
			1000	3000	4000
BCP56	SOT223	8 mm pitch, 12 mm tape and reel	-115	-	-135
BCX56	SOT89	8 mm pitch, 12 mm tape and reel; T1 ^[3]	-115	-	-135
		8 mm pitch, 12 mm tape and reel; T3 ^[4]	-146	-	-
BC56PA	SOT1061	4 mm pitch, 8 mm tape and reel	-	-115	-

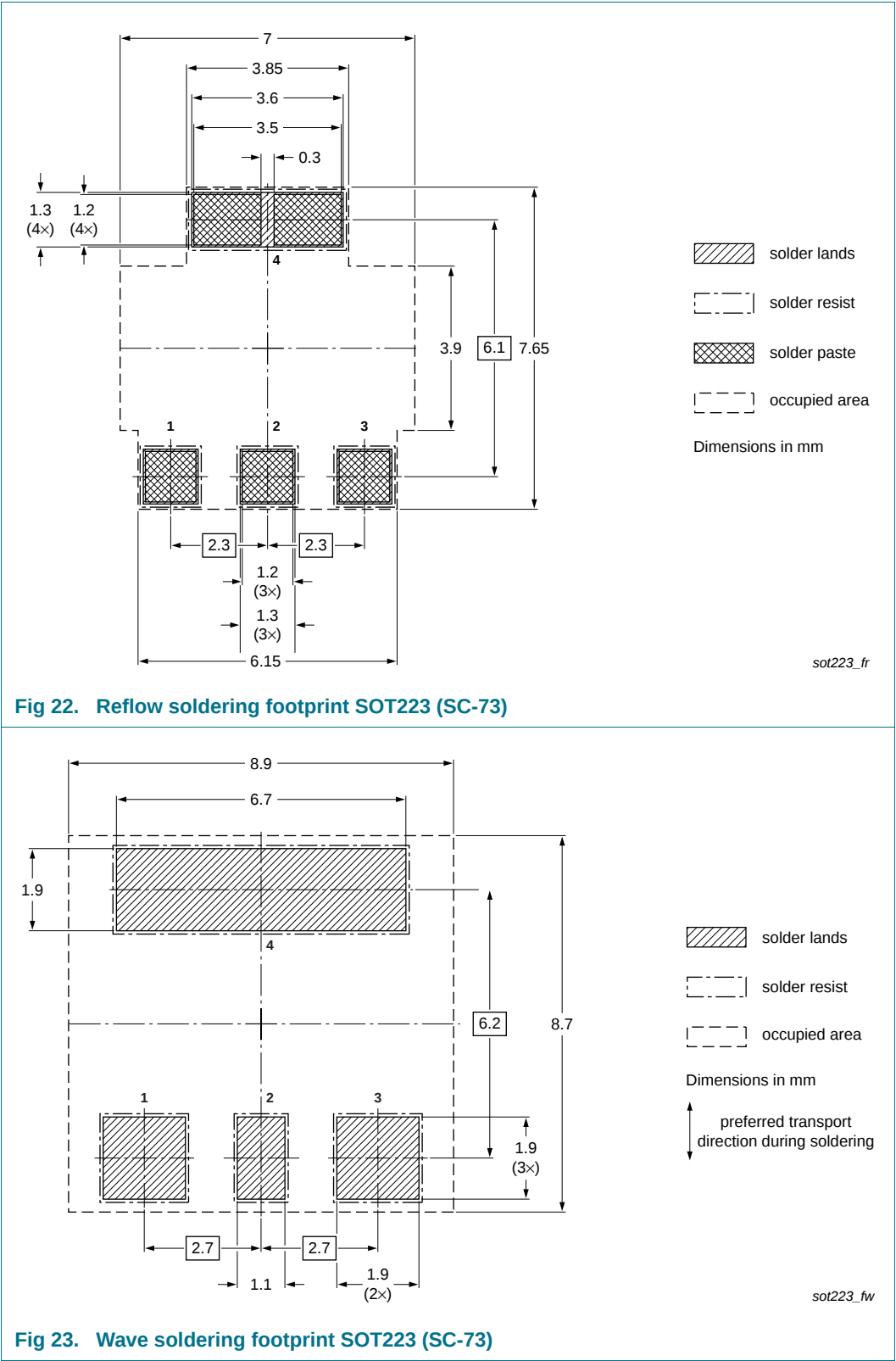
[1] For further information and the availability of packing methods, see [Section 14](#).

[2] Valid for all available selection groups.

[3] T1: normal taping

[4] T3: 90° rotated taping

11. Soldering



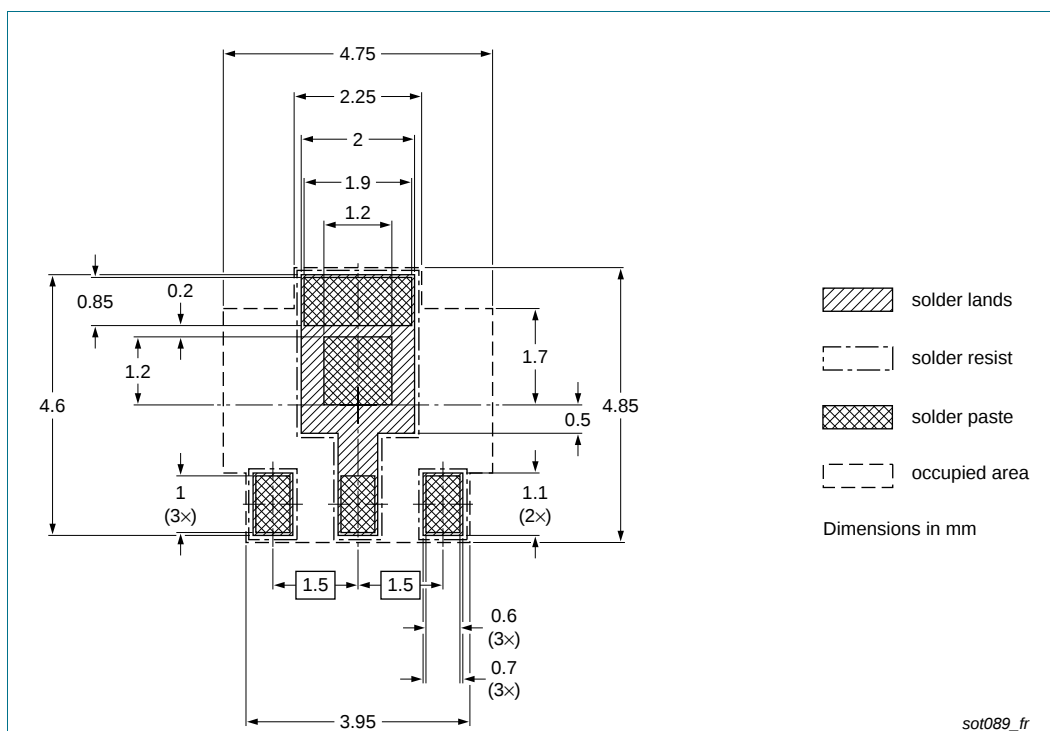


Fig 24. Reflow soldering footprint SOT89 (SC-62/TO-243)

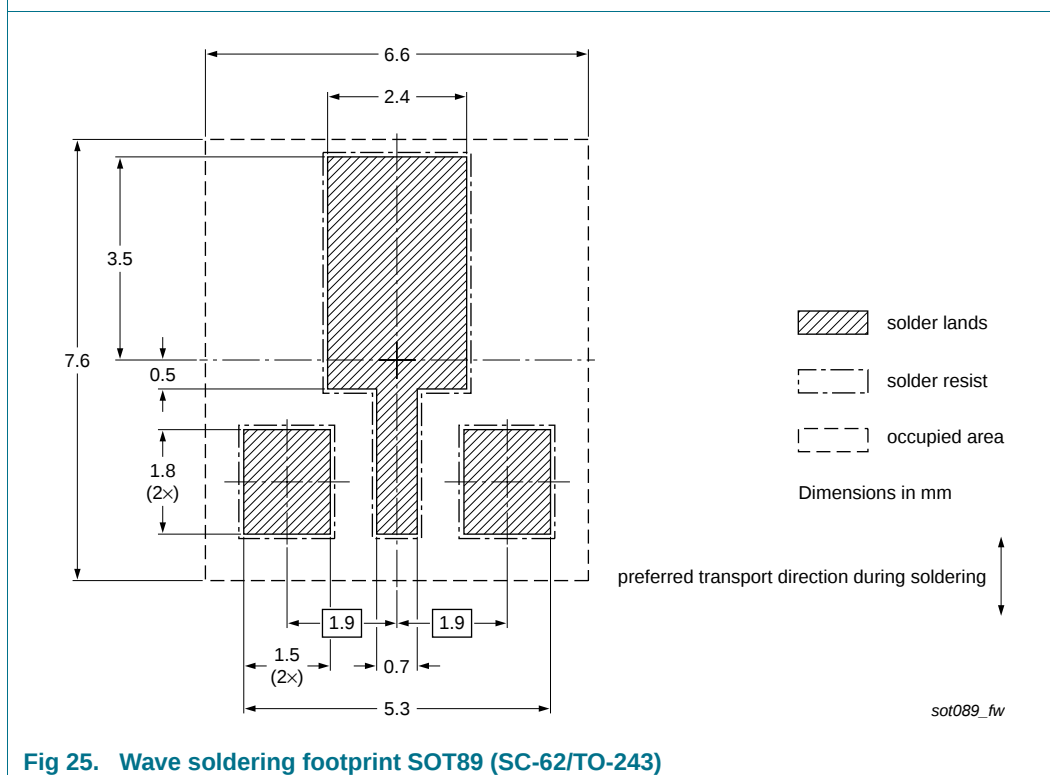


Fig 25. Wave soldering footprint SOT89 (SC-62/TO-243)

