

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
	Nexperia	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

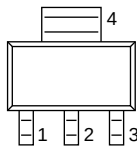
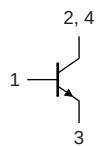
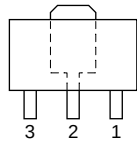
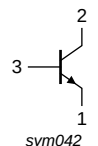
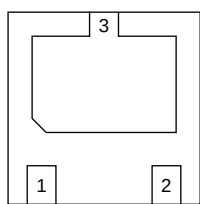
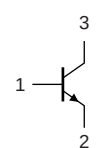
Table 2. Quick reference data

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		
2	collector		
3	emitter		
4	collector		
sym016			
SOT89			
1	emitter		
2	collector		
3	base		
sym042			
SOT1061			
1	base		
2	emitter		
3	collector		
		Transparent top view	sym021

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		

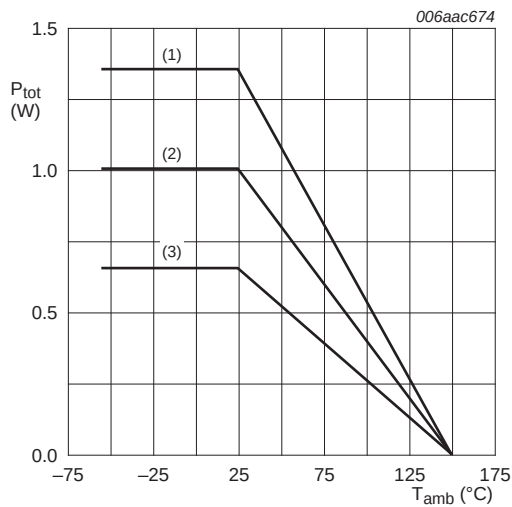
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[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.

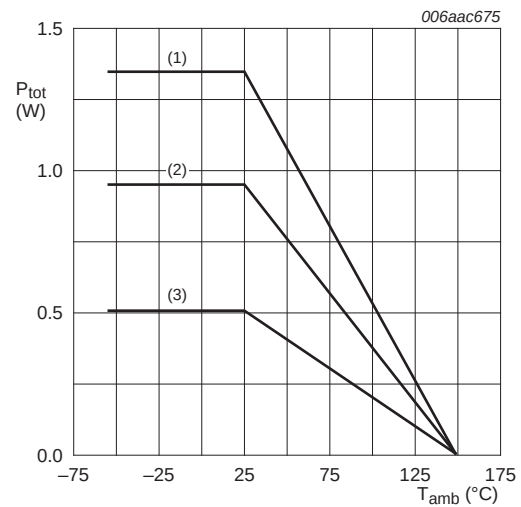
[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

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



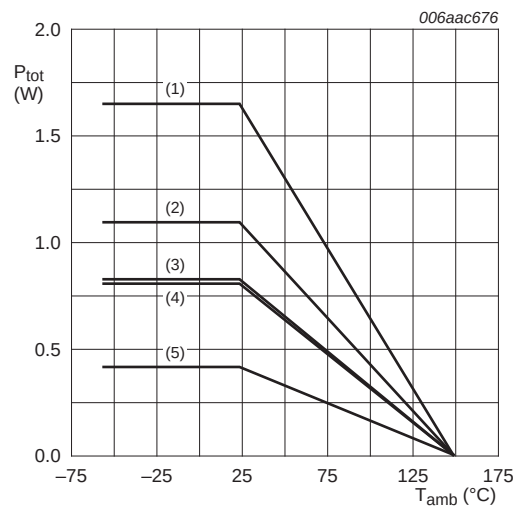
- (1) FR4 PCB, mounting pad for collector 6 cm²
- (2) FR4 PCB, mounting pad for collector 1 cm²
- (3) FR4 PCB, standard footprint

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				
			[1]	-	-	192 K/W
			[2]	-	-	125 K/W
			[3]	-	-	93 K/W
			[1]	-	-	250 K/W
			[2]	-	-	132 K/W
			[3]	-	-	93 K/W
			[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

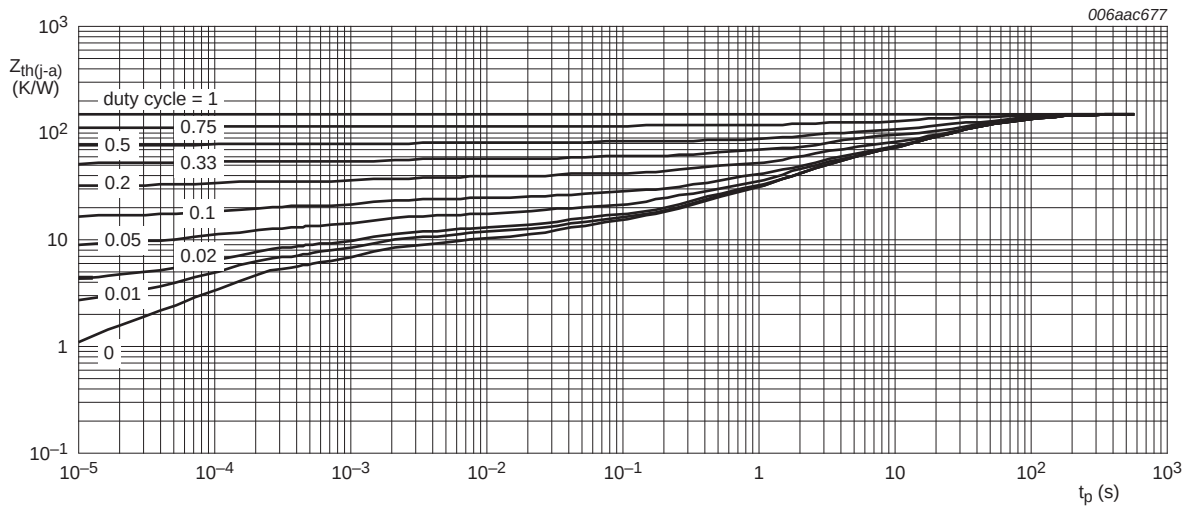
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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.

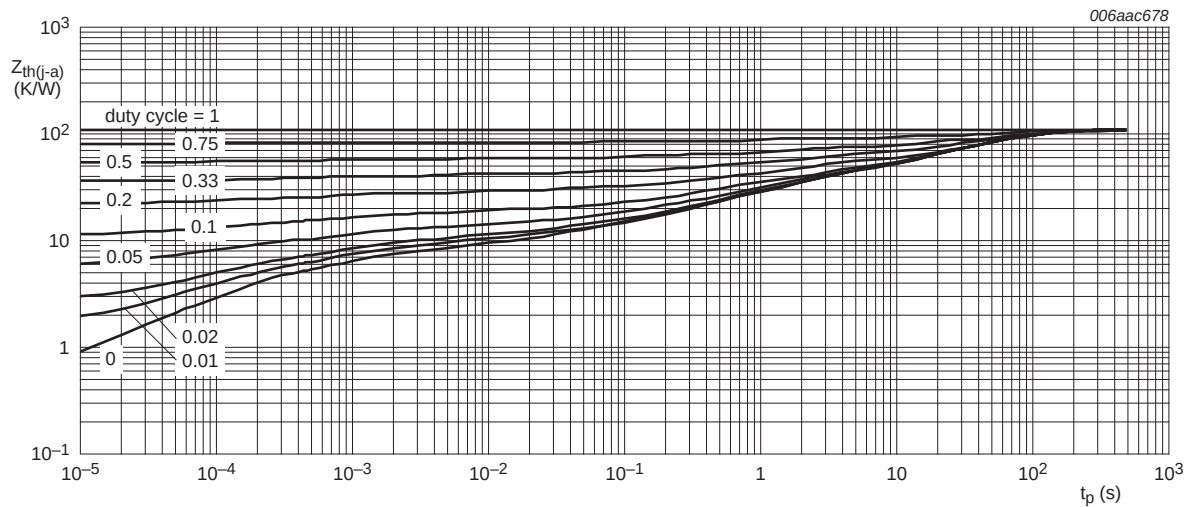
[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

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



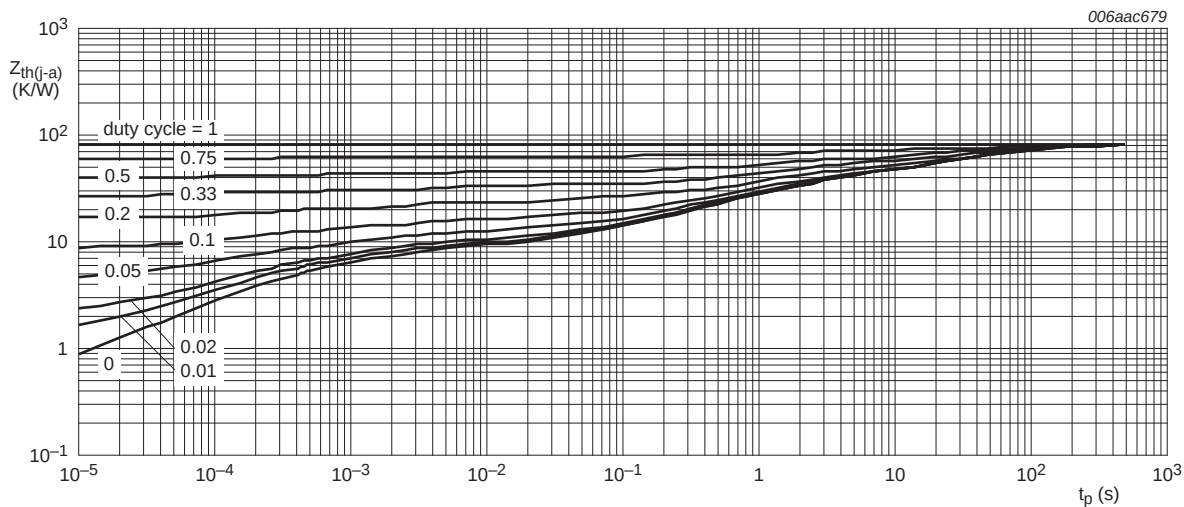
FR4 PCB, standard footprint

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



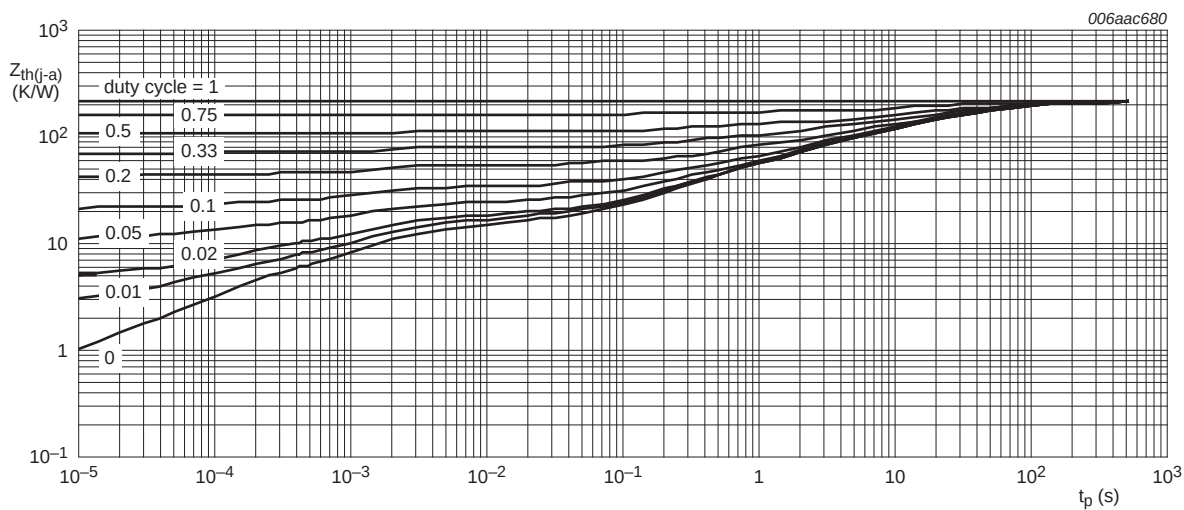
FR4 PCB, mounting pad for collector 1 cm²

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



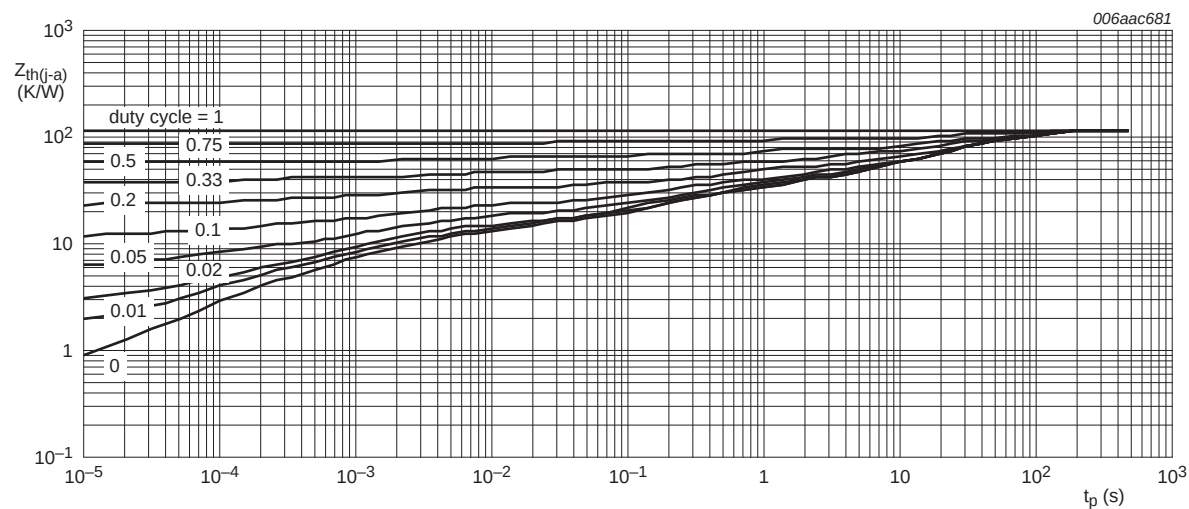
FR4 PCB, mounting pad for collector 6 cm²

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



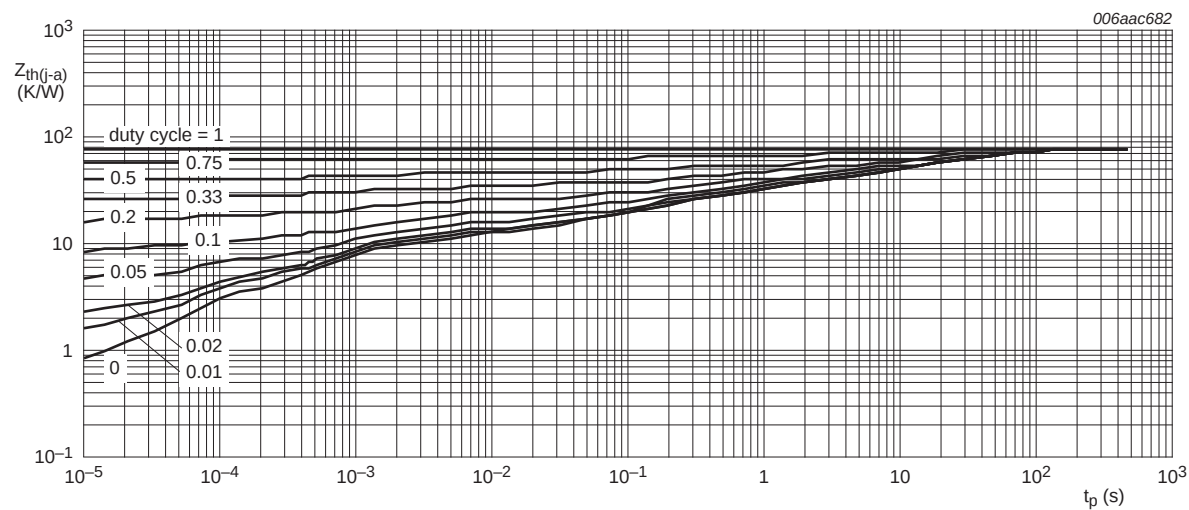
FR4 PCB, standard footprint

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



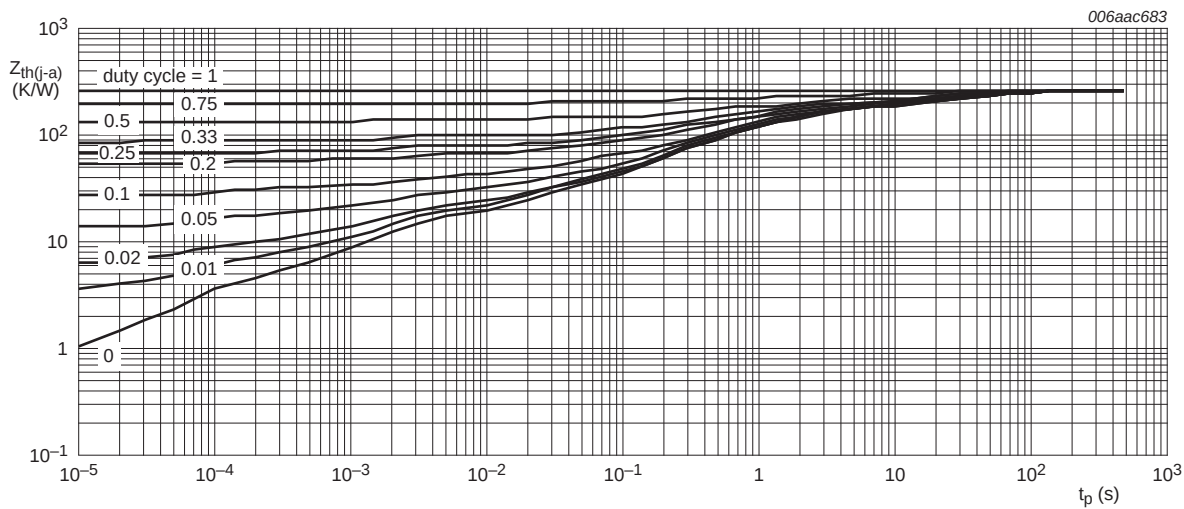
FR4 PCB, mounting pad for collector 1 cm²

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



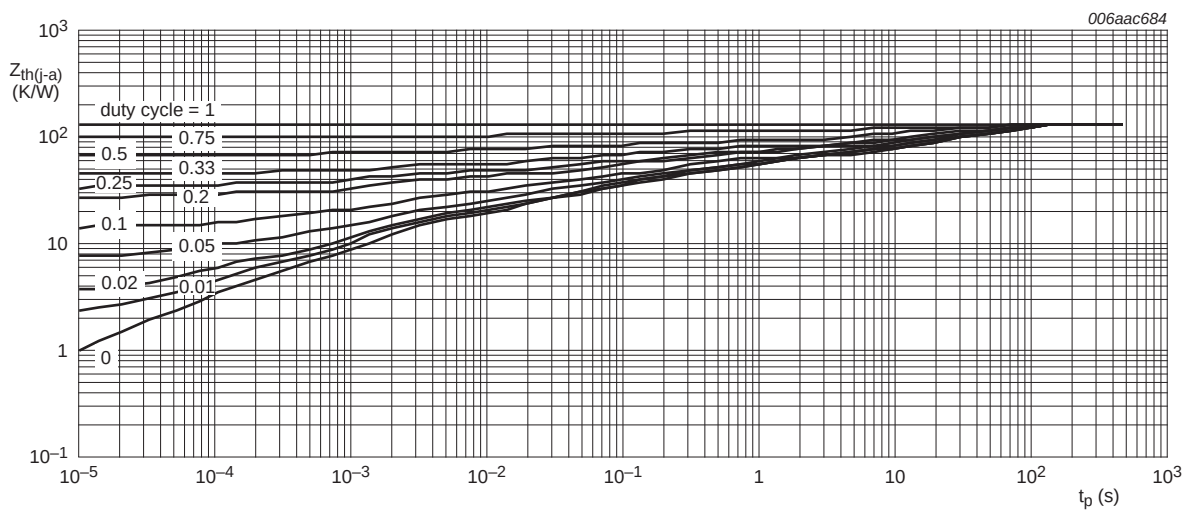
FR4 PCB, mounting pad for collector 6 cm²

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



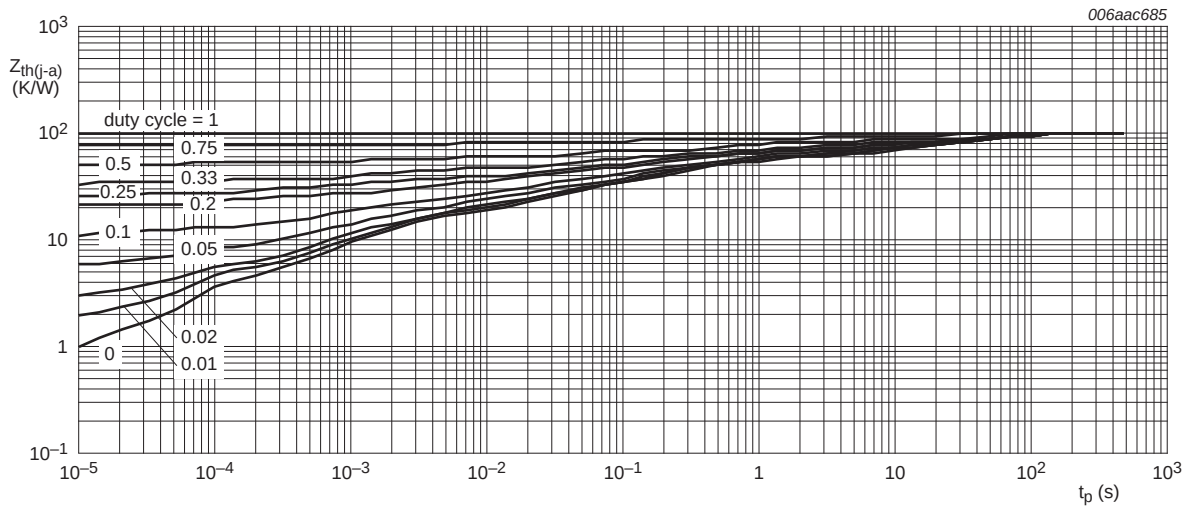
FR4 PCB, single-sided copper, standard footprint

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



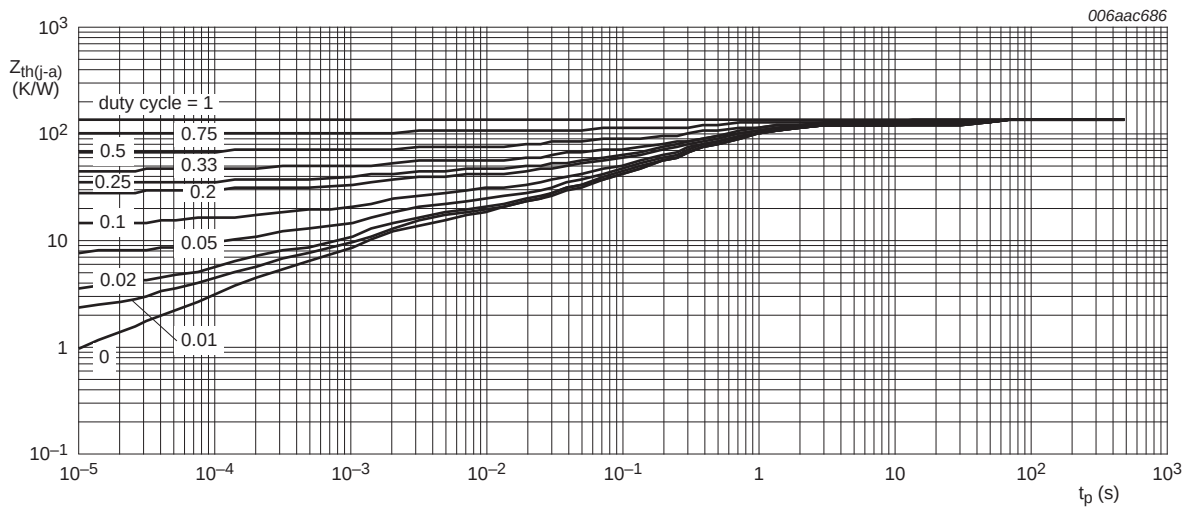
FR4 PCB, single-sided copper, mounting pad for collector 1 cm²

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



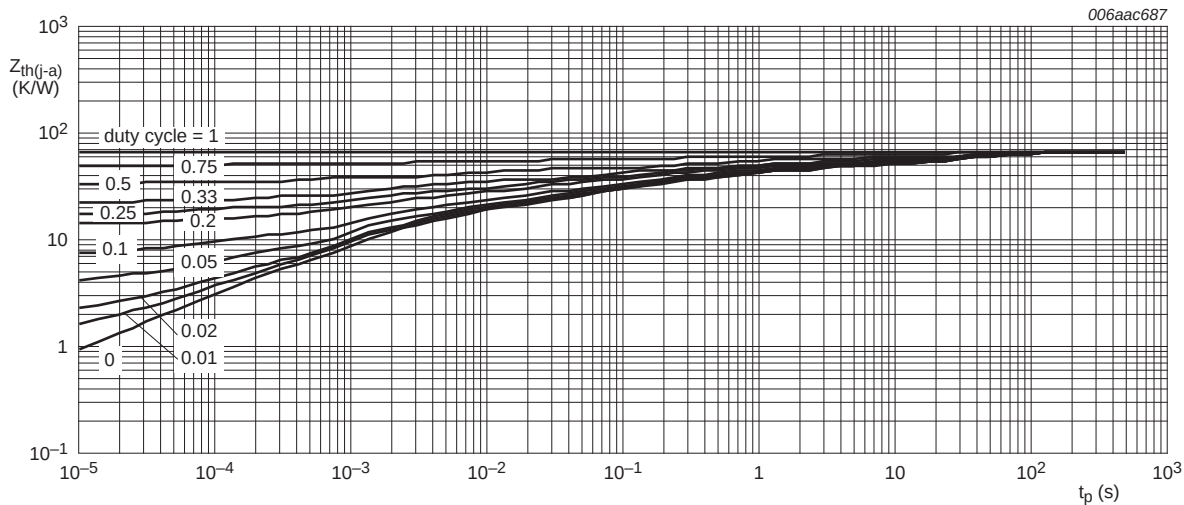
FR4 PCB, single-sided copper, mounting pad for collector 6 cm²

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

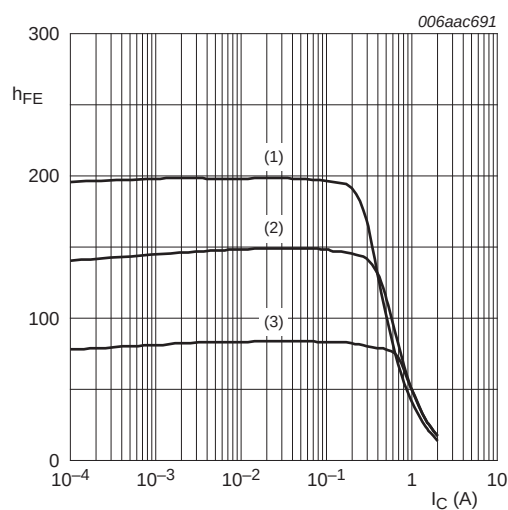
Fig 14. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT1061; typical values

7. Characteristics

Table 8. Characteristics
T_{amb} = 25 °C unless otherwise specified.

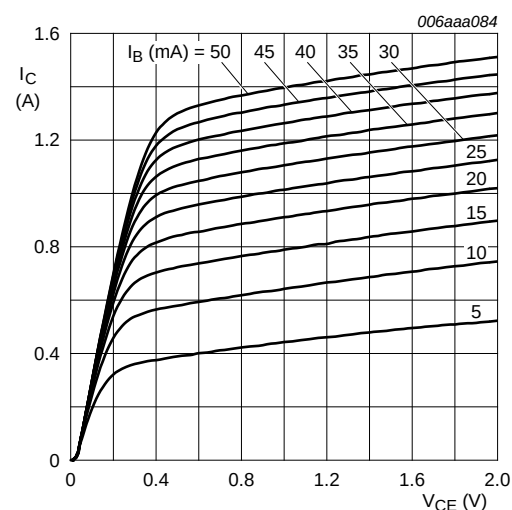
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	100	nA
		$V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$	-	-	10	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V}; I_C = 0\text{ A}$	-	-	100	nA
h_{FE}	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	$I_C = 150\text{ mA}$	[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	$V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	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: $t_p \leq 300\text{ μs}; \delta = 0.02$.



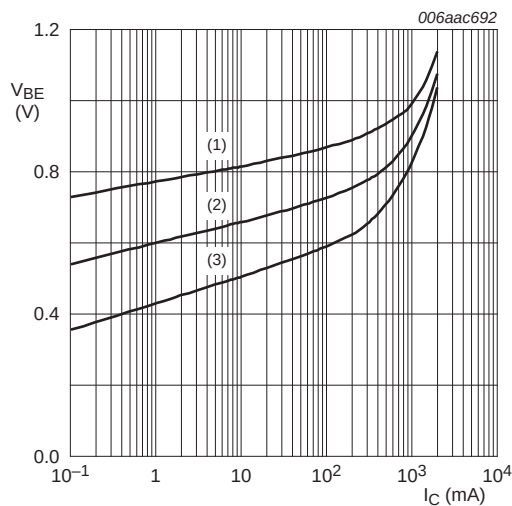
- $V_{CE} = 2\text{ V}$
- (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



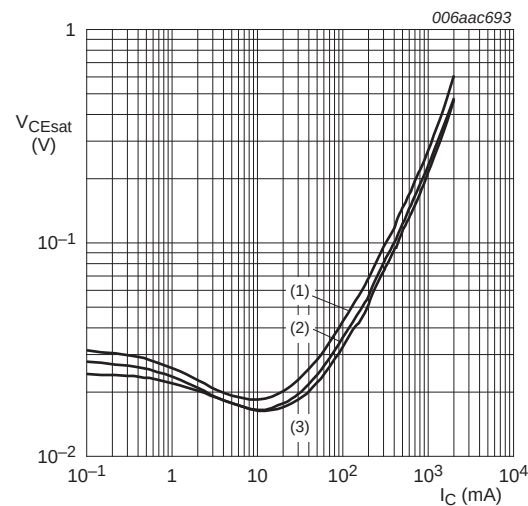
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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

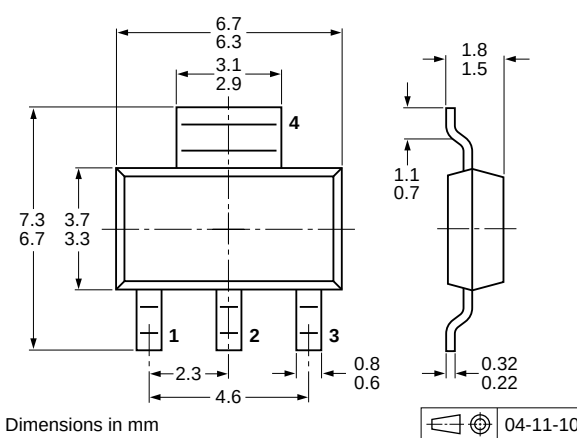


Fig 19. Package outline SOT223 (SC-73)

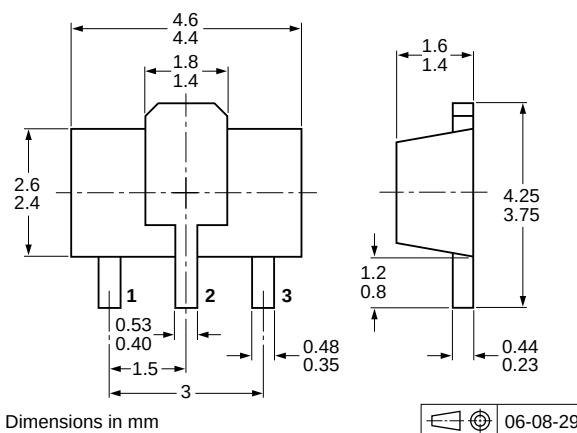
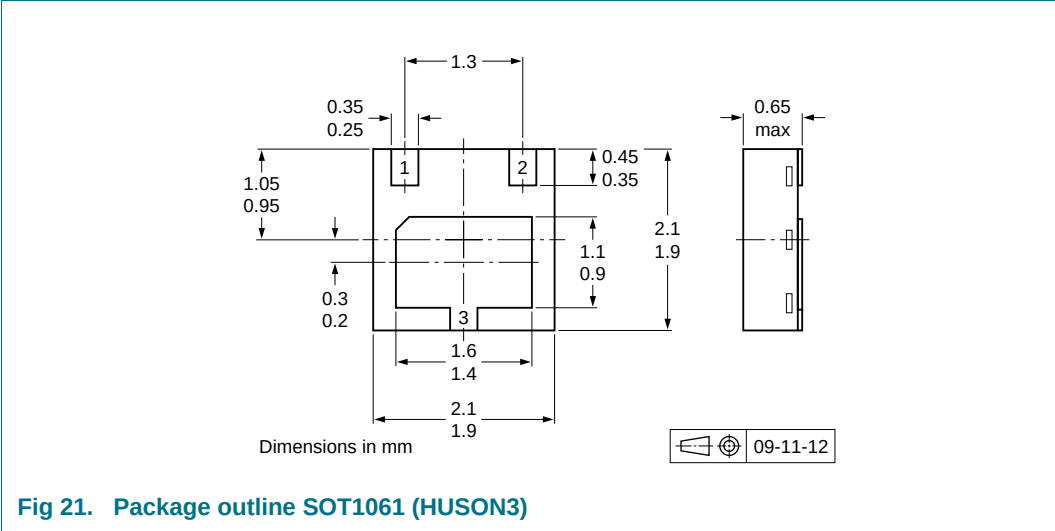


Fig 20. Package outline SOT89 (SC-62/TO-243)



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	-

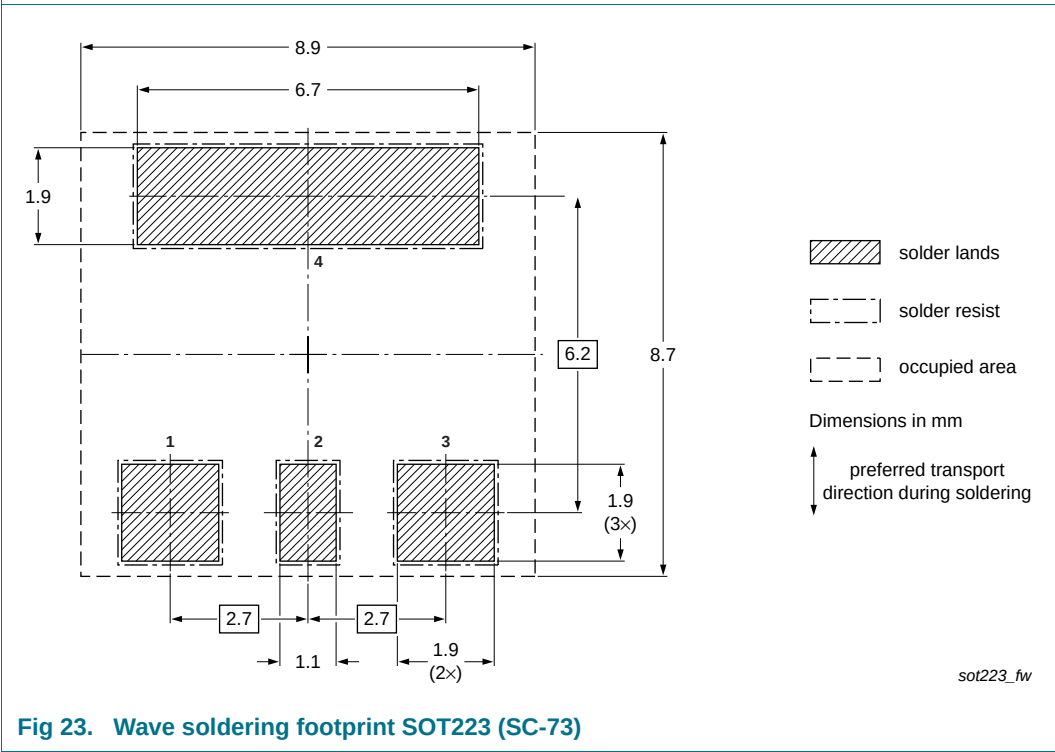
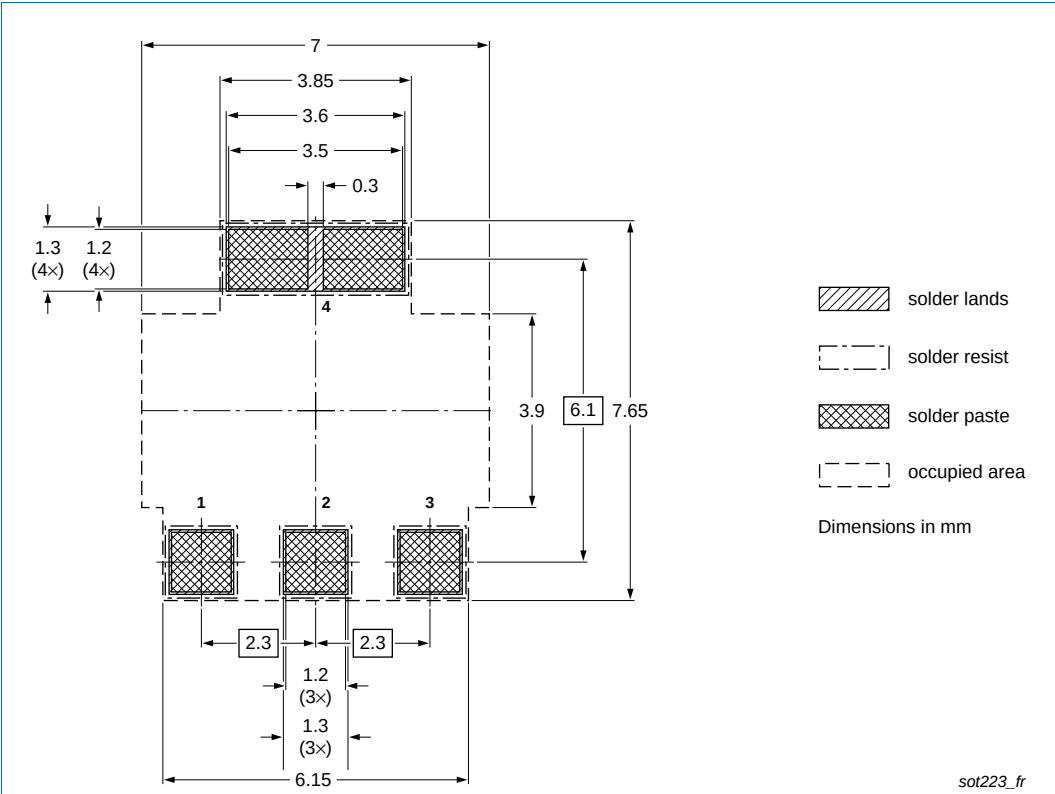
[1] For further information and the availability of packing methods, see [Section 14](#).

[2] Valid for all available selection groups.

[3] T1: normal taping

[4] T3: 90° rotated taping

11. Soldering



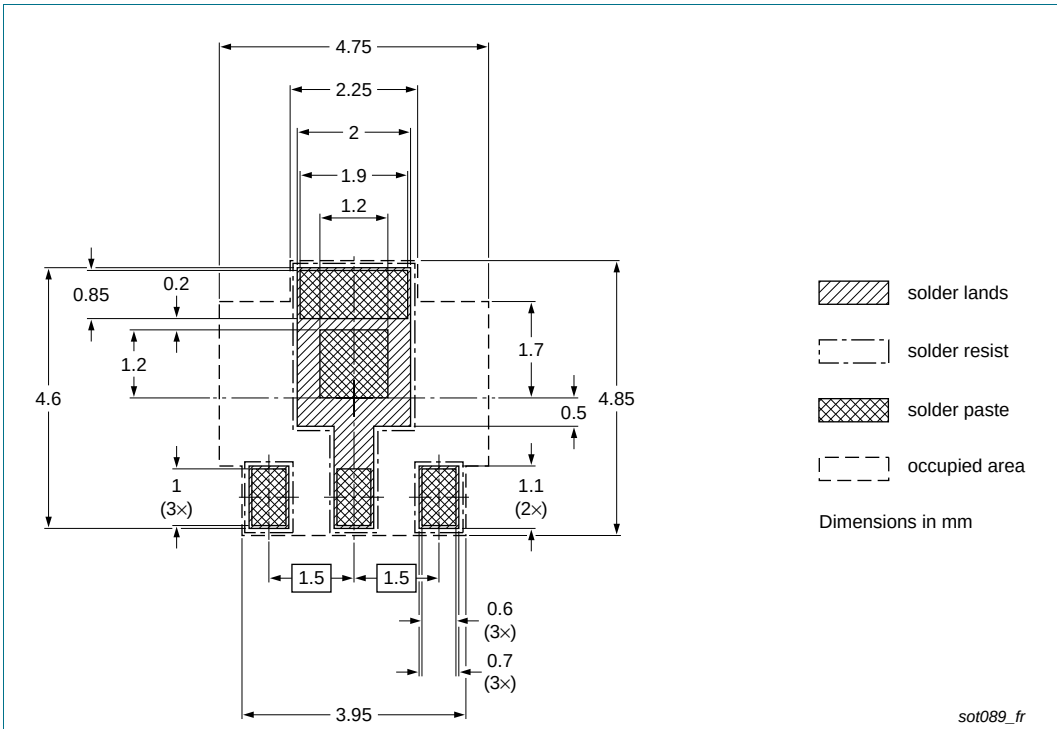


Fig 24. Reflow soldering footprint SOT89 (SC-62/TO-243)

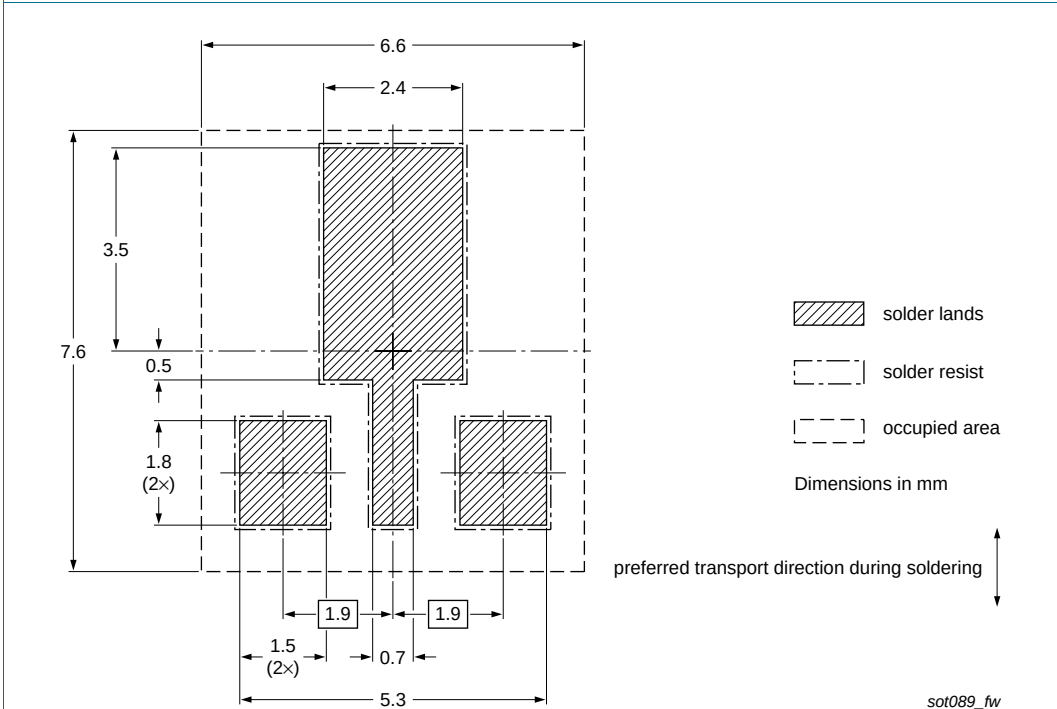
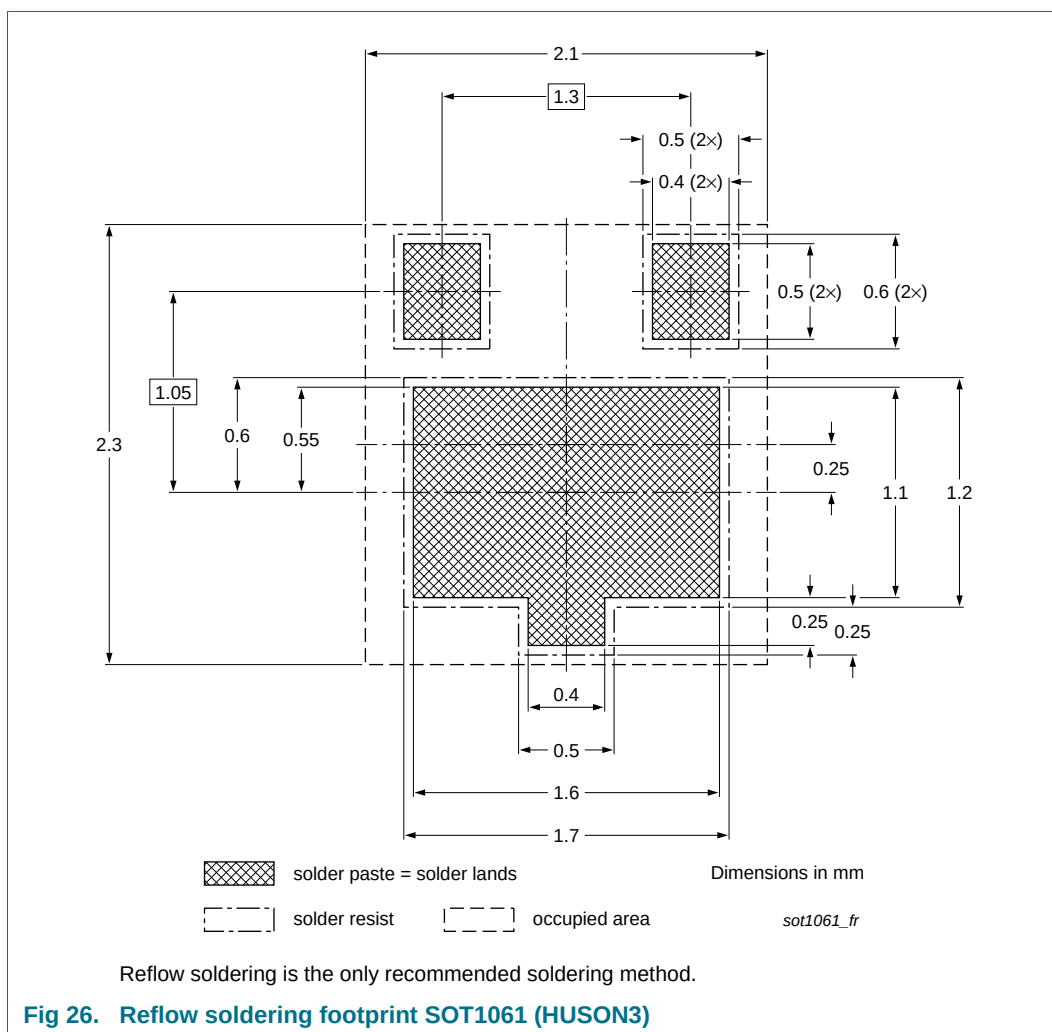


Fig 25. Wave soldering footprint SOT89 (SC-62/TO-243)



12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BCP56_BCX56_BC56PA v.9	20111025	Product data sheet	-	BC639_BCP56_BCX56 v.8
Modifications: - Type number removed: BC639 - Type number added: BC56PA, BC56-10PA and BC56-16PA Section 1 "Product profile": updated Section 2 "Pinning information": updated Table 6 and 7: updated according to latest measurements Figure 1, 2, 4, 5, 7 to 9, 15, 17 and 18: updated Figure 3, 6, 10 to 14: added Section 8 "Test information": added Section 10 "Packing information": updated Section 11 "Soldering": added Section 13 "Legal information": updated				
BC639_BCP56_BCX56 v.8	20070622	Product data sheet	-	BC639_BCP56_BCX56 v.7
BC639_BCP56_BCX56 v.7	20050308	Product data sheet	-	BC639_BCP56_BCX56 v.6
BC639_BCP56_BCX56 v.6	20050303	Product data sheet	CPCN200405029	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 ^{[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.nexperia.com>.

13.2 Definitions

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Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

13.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

14. Contact information

For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: salesaddresses@nexperia.com

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