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

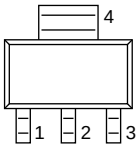
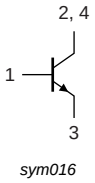
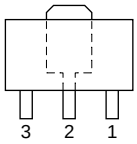
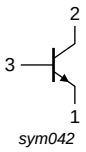
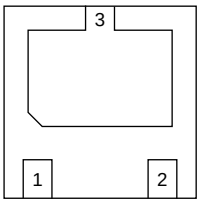
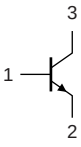
Table 2. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{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		-	-	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: $t_p \leq 300$ μs; $\delta = 0.02$.

2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
SOT223			
1	base		
2	collector		
3	emitter		
4	collector		
SOT89			
1	emitter		
2	collector		
3	base		
SOT1061			
1	base		
2	emitter		
3	collector		

Transparent top view

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.

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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

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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		-	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				
	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 cm^2.

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

[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^2.

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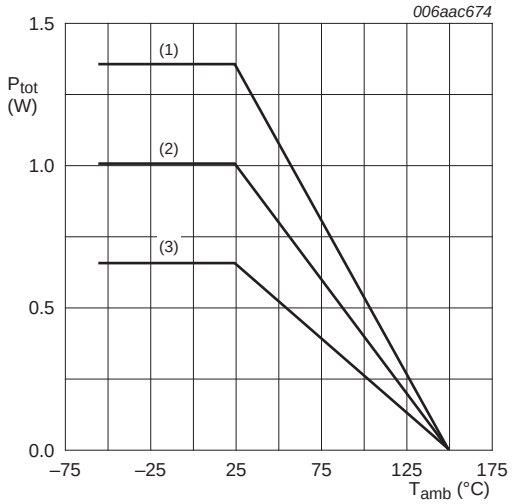
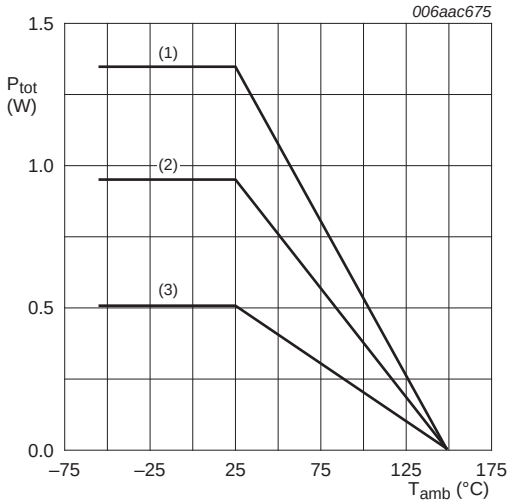


(1) FR4 PCB, mounting pad for collector 6 cm^2

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

(3) FR4 PCB, standard footprint

Fig 1. Power derating curves SOT223

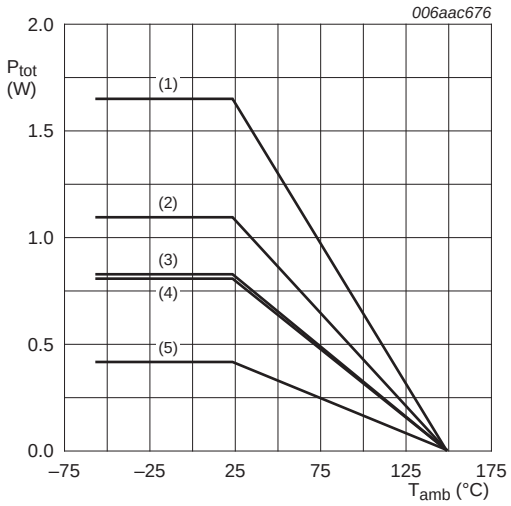


(1) FR4 PCB, mounting pad for collector 6 cm^2

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

(3) FR4 PCB, standard footprint

Fig 2. Power derating curves SOT89



(1) FR4 PCB, 4-layer copper, mounting pad for collector 1 cm^2

(2) FR4 PCB, single-sided copper, mounting pad for collector 6 cm^2

(3) FR4 PCB, single-sided copper, mounting pad for collector 1 cm^2

(4) FR4 PCB, 4-layer copper, standard footprint

(5) FR4 PCB, single-sided copper, standard footprint

Fig 3. Power derating curves SOT1061

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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 cm^2.

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

[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^2.

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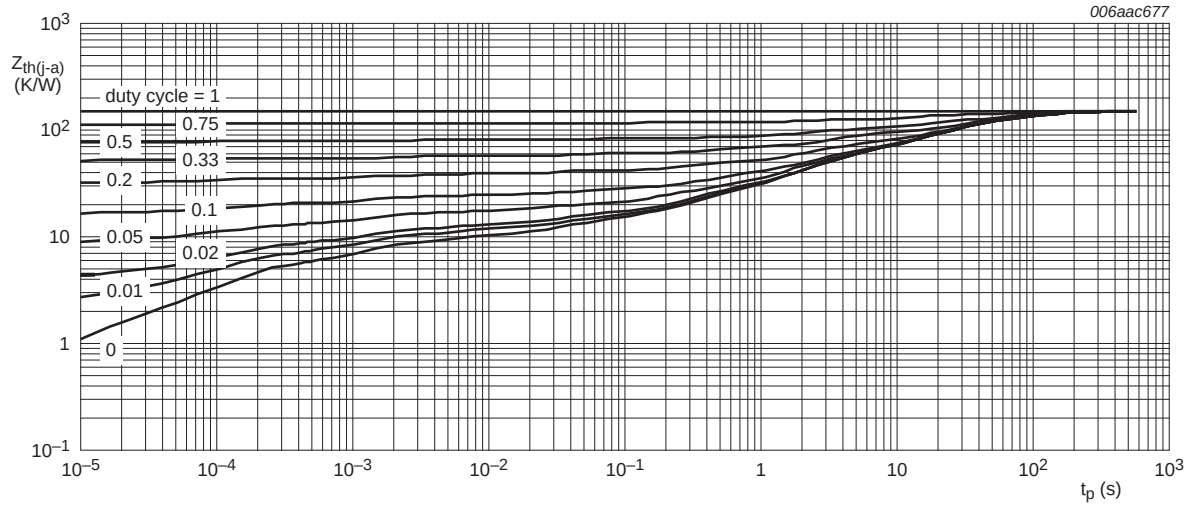
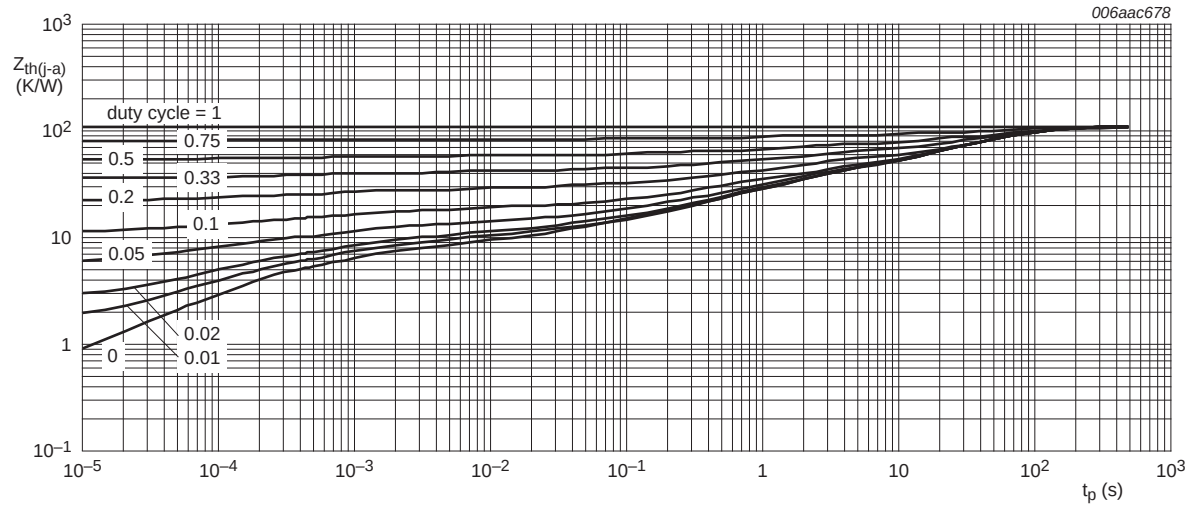


FR4 PCB, standard footprint

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

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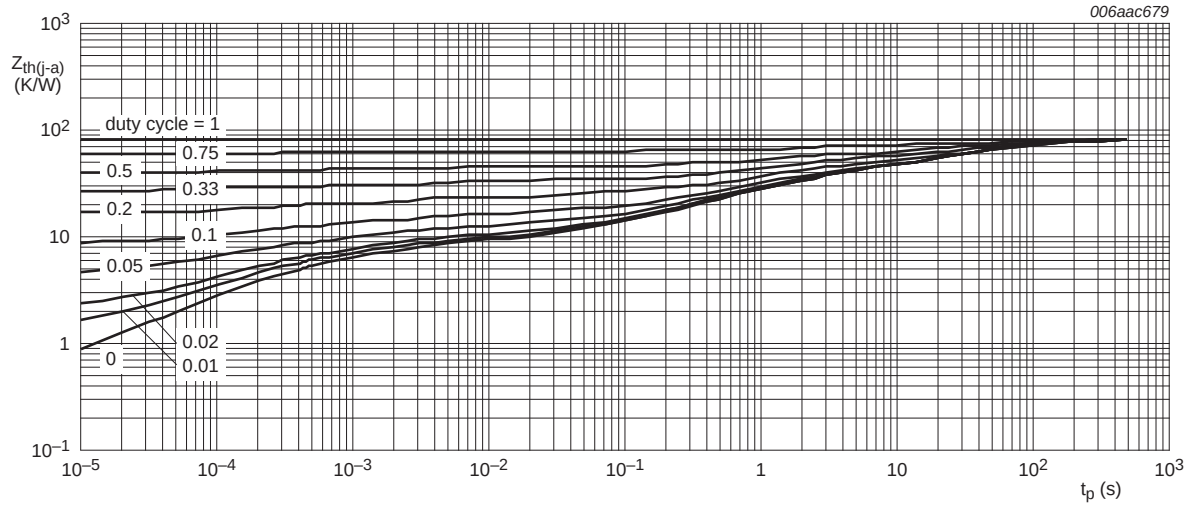
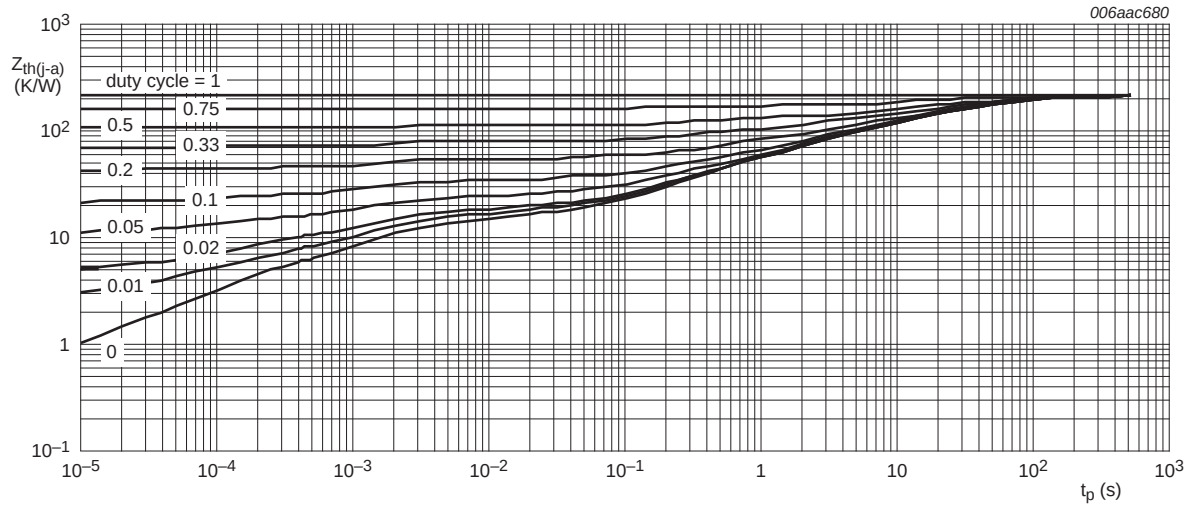


FR4 PCB, mounting pad for collector 6 cm^2

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

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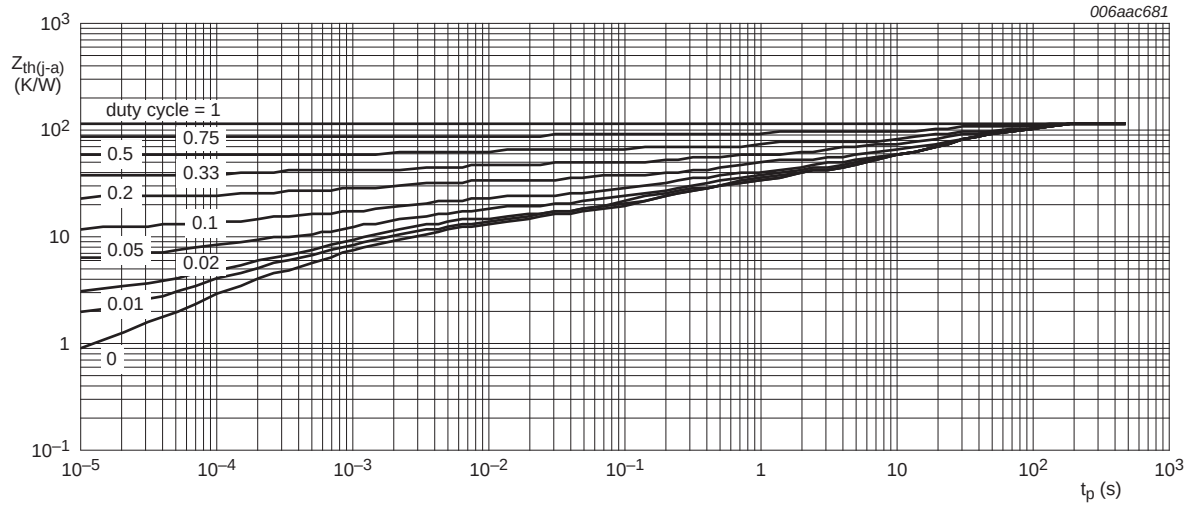
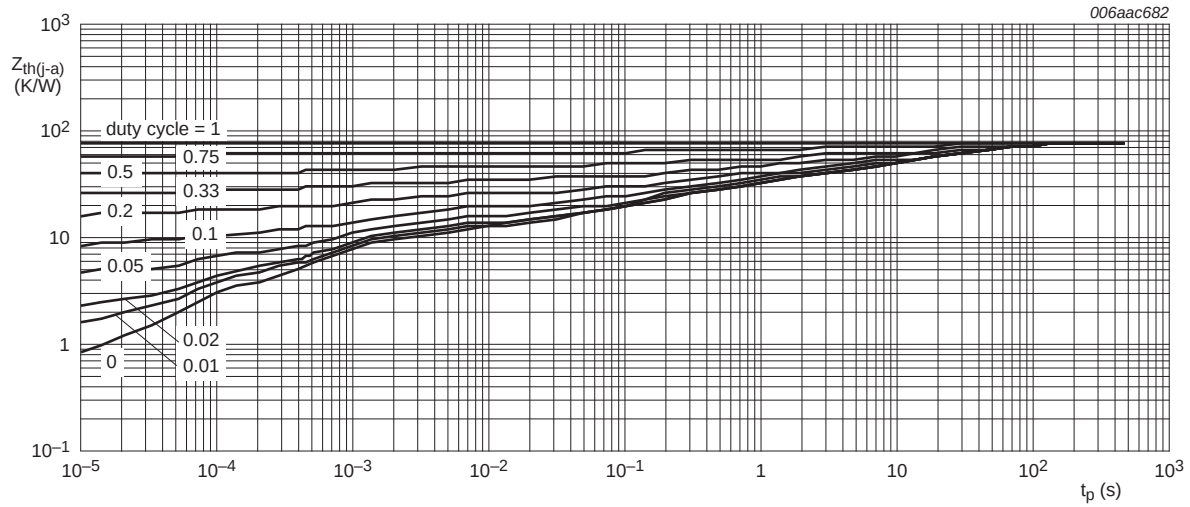


FR4 PCB, mounting pad for collector 1 cm^2

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^2

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

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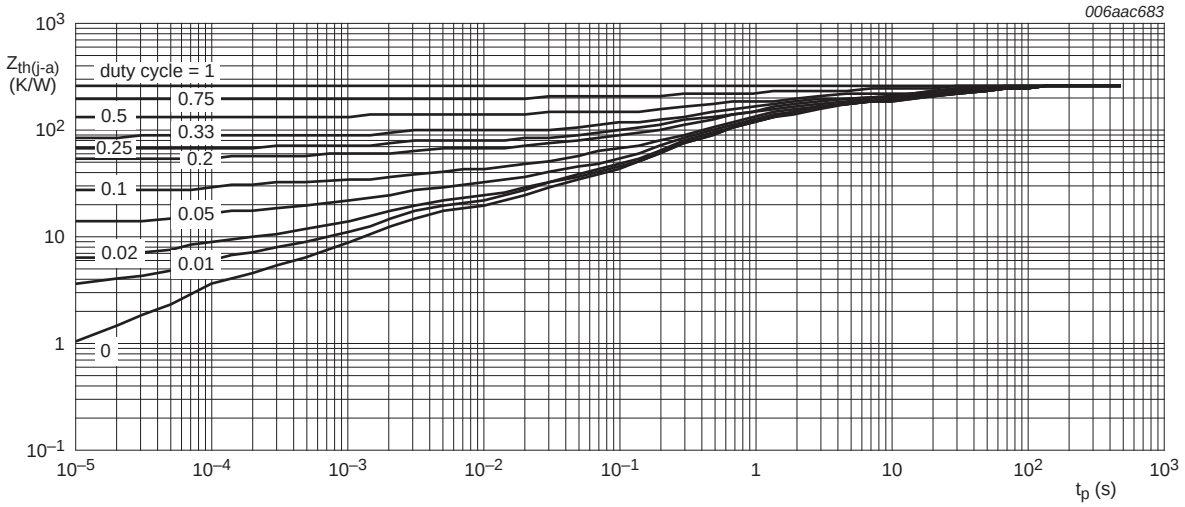
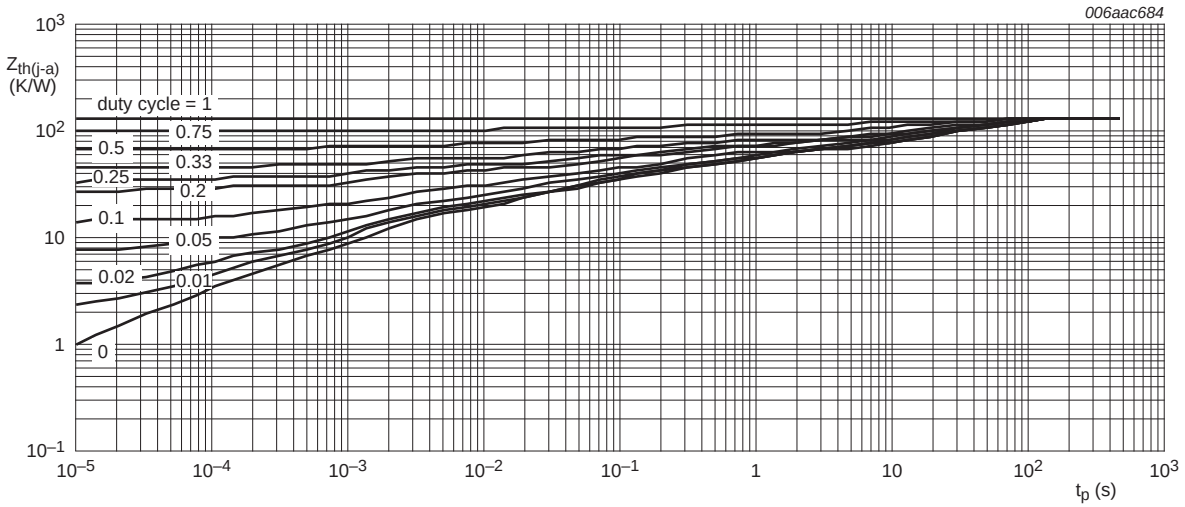


FR4 PCB, single-sided copper, standard footprint

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^2

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

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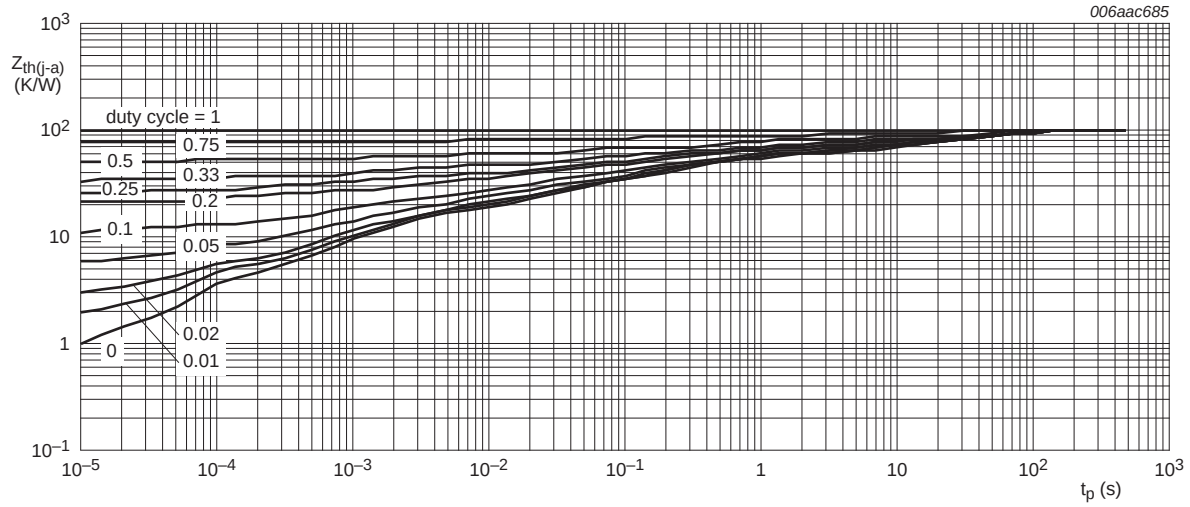
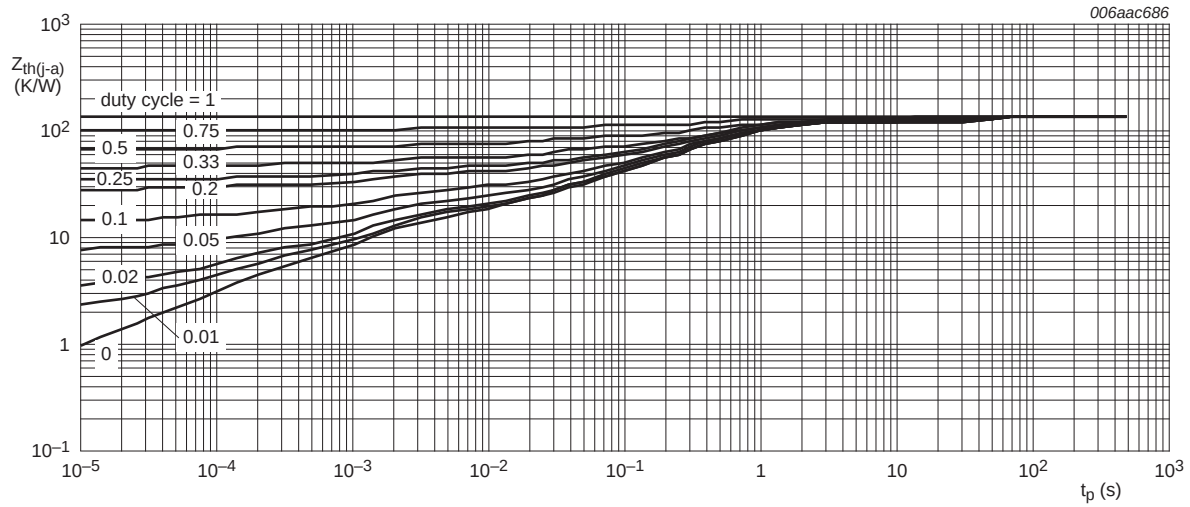


FR4 PCB, single-sided copper, mounting pad for collector 6 cm^2

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

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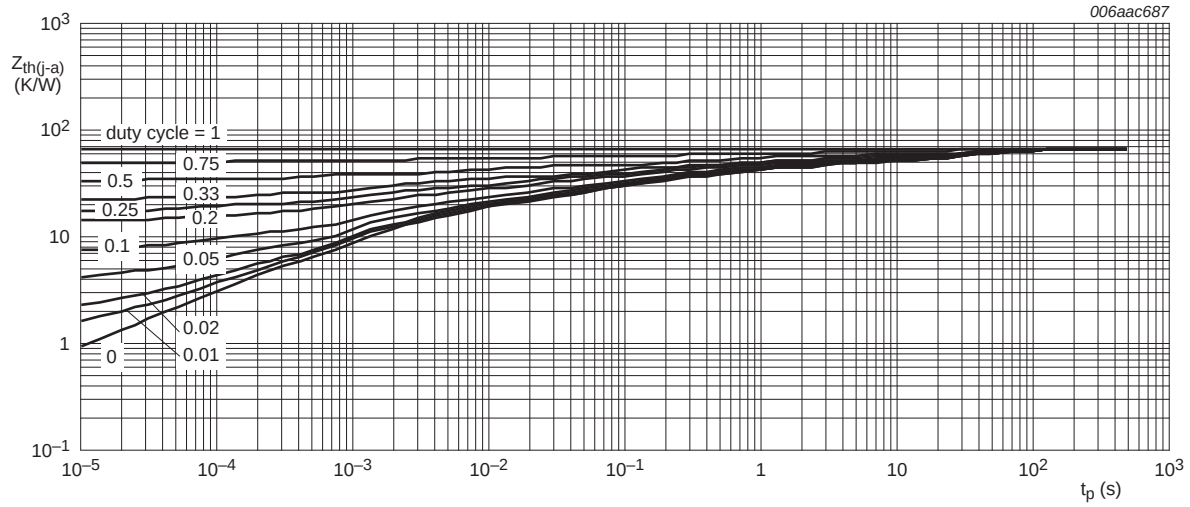

FR4 PCB, 4-layer copper, mounting pad for collector 1 cm^2

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 V; I_E = 0 A		-	-	100	nA
		V_{CB} = 30 V; I_E = 0 A; T_j = 150 °C		-	-	10	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A		-	-	100	nA
h_{FE}	DC current gain	V_{CE} = 2 V					
		I_C = 5 mA	[1]	63	-	-	
		I_C = 150 mA	[1]	63	-	250	
		I_C = 500 mA	[1]	40	-	-	
	DC current gain	V_{CE} = 2 V					
	h_{FE} selection -10	I_C = 150 mA	[1]	63	-	160	
	h_{FE} selection -16	I_C = 150 mA	[1]	100	-	250	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	[1]	-	-	0.5	V
V_{BE}	base-emitter voltage	V_{CE} = 2 V; I_C = 500 mA	[1]	-	-	1	V
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz		-	6	-	pF
f_T	transition frequency	V_{CE} = 5 V; I_C = 50 mA; f = 100 MHz		100	180	-	MHz

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

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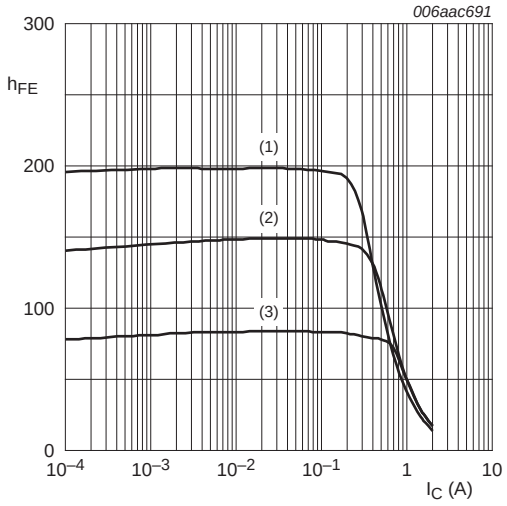


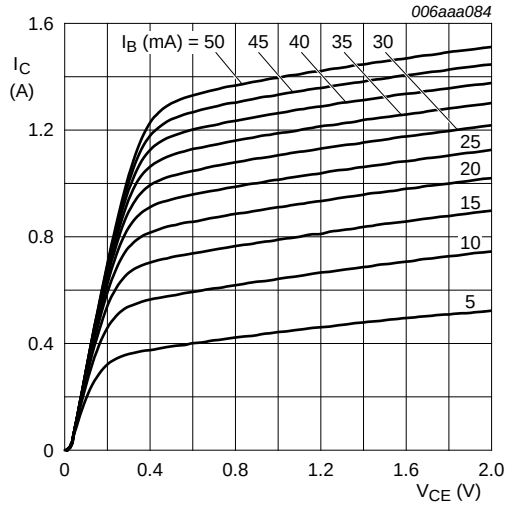
V_{CE} = 2 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

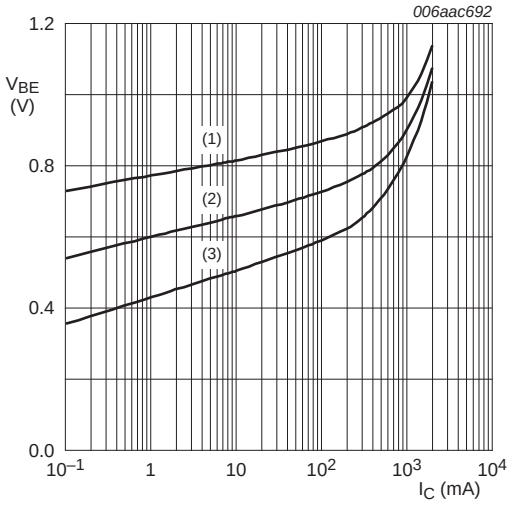
(3) T_{amb} = −55 °C

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



T_{amb} = 25 °C

Fig 16. Collector current as a function of collector-emitter voltage; typical values



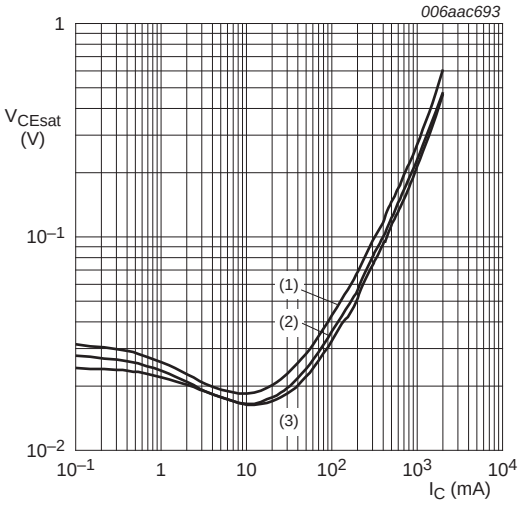
V_{CE} = 2 V

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



I_C/I_B = 10

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

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

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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

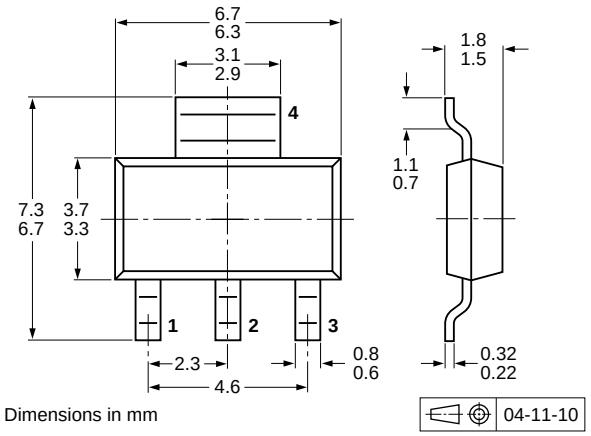

Fig 19. Package outline SOT223 (SC-73)

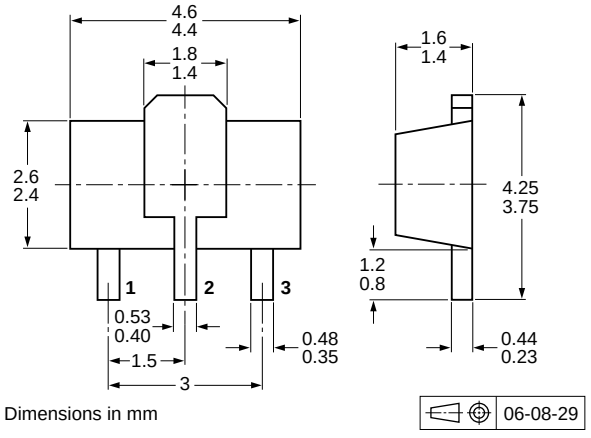

Fig 20. Package outline SOT89 (SC-62/TO-243)

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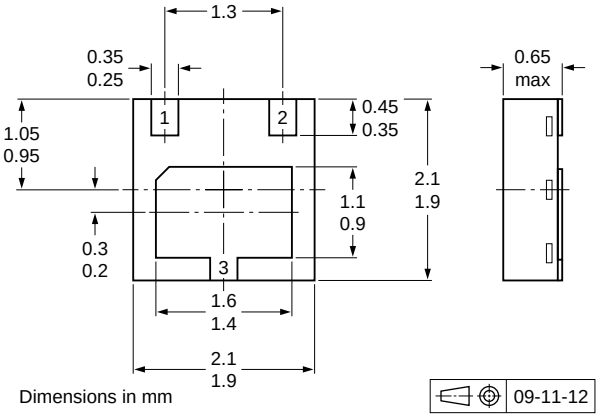

Fig 21. Package outline SOT1061 (HUSON3)

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

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11. Soldering

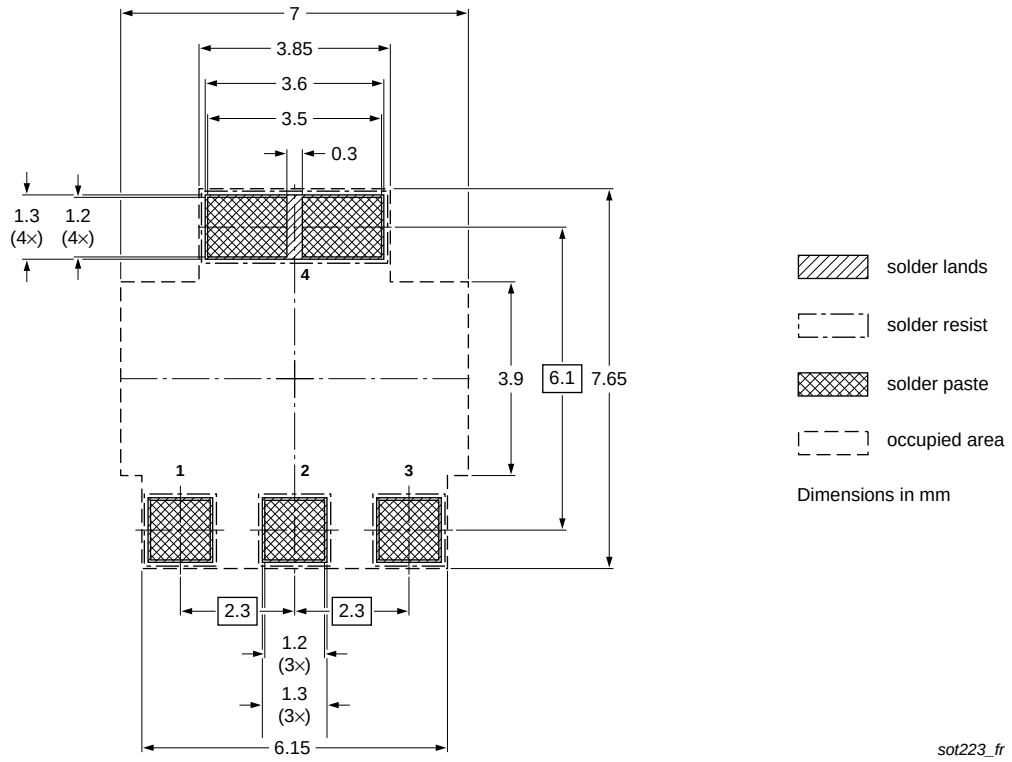

Fig 22. Reflow soldering footprint SOT223 (SC-73)

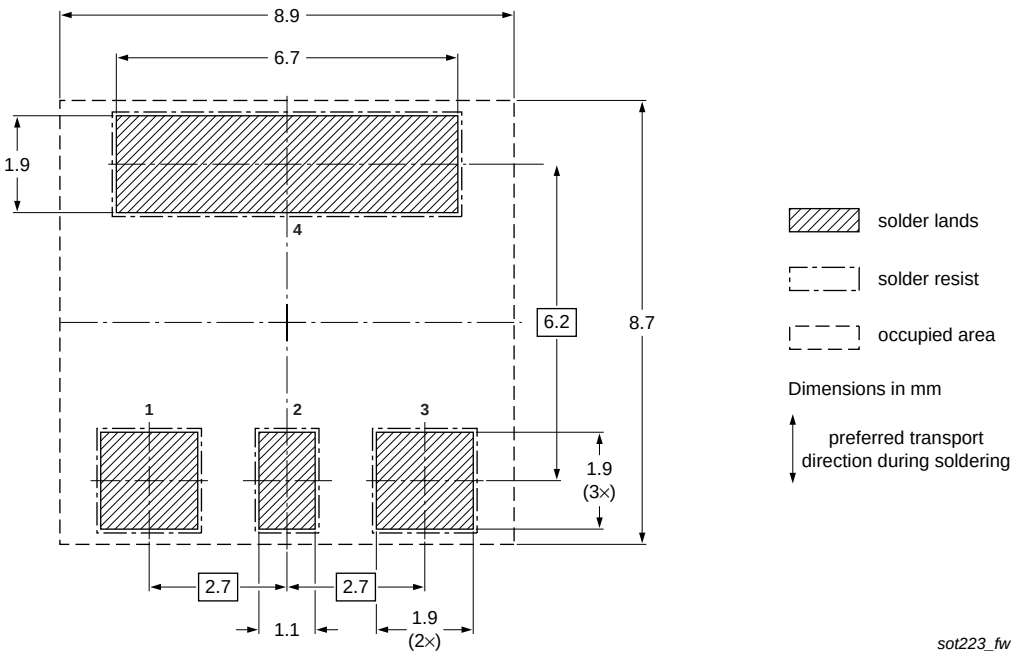

Fig 23. Wave soldering footprint SOT223 (SC-73)

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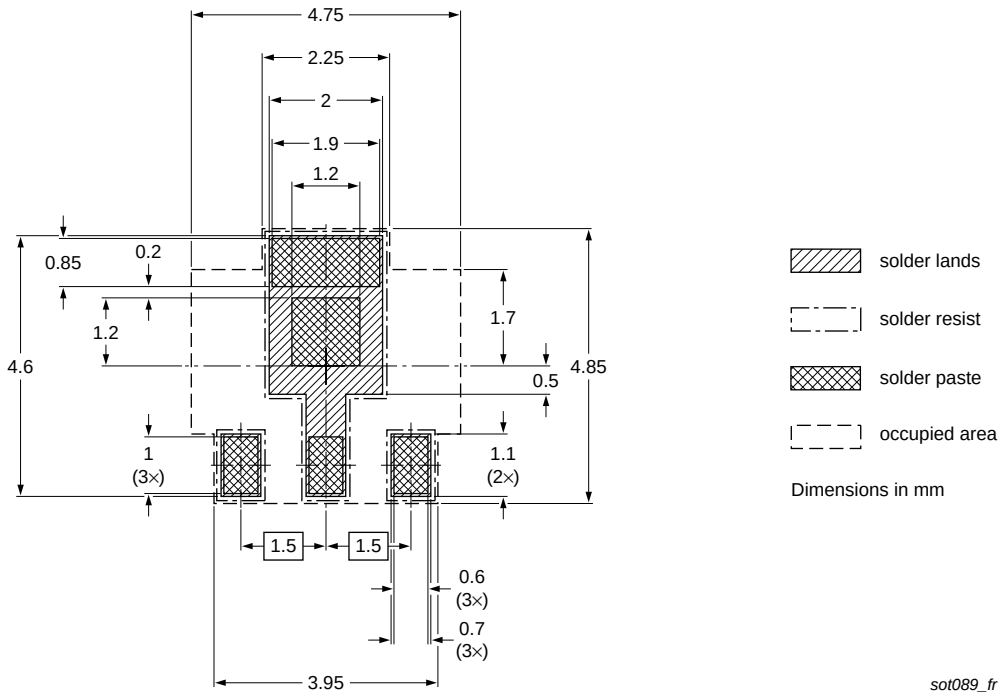

Fig 24. Reflow soldering footprint SOT89 (SC-62/TO-243)

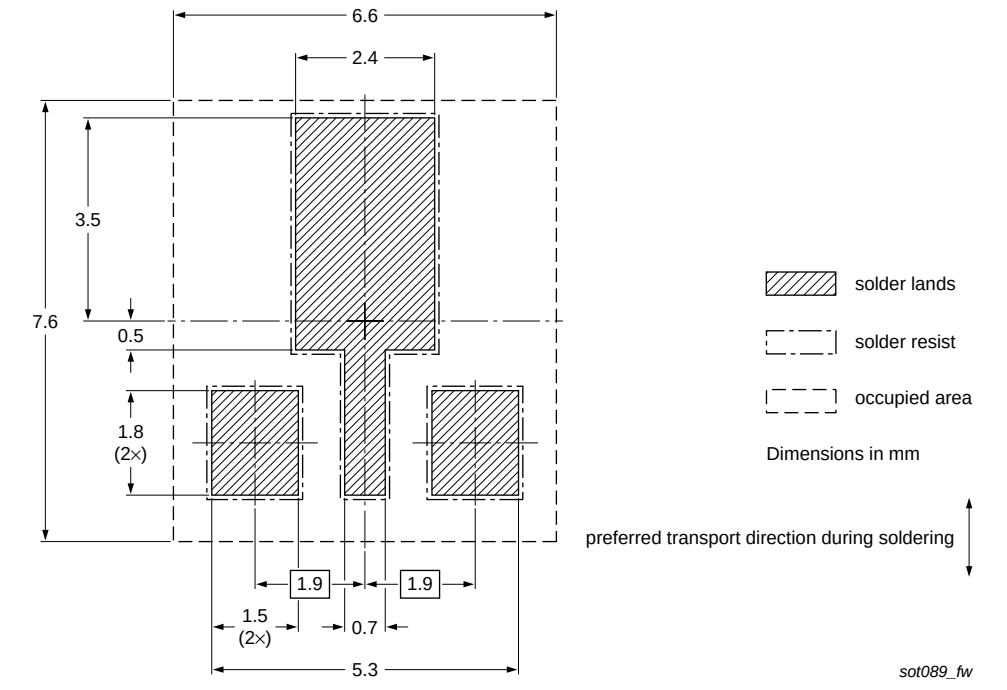

Fig 25. Wave soldering footprint SOT89 (SC-62/TO-243)

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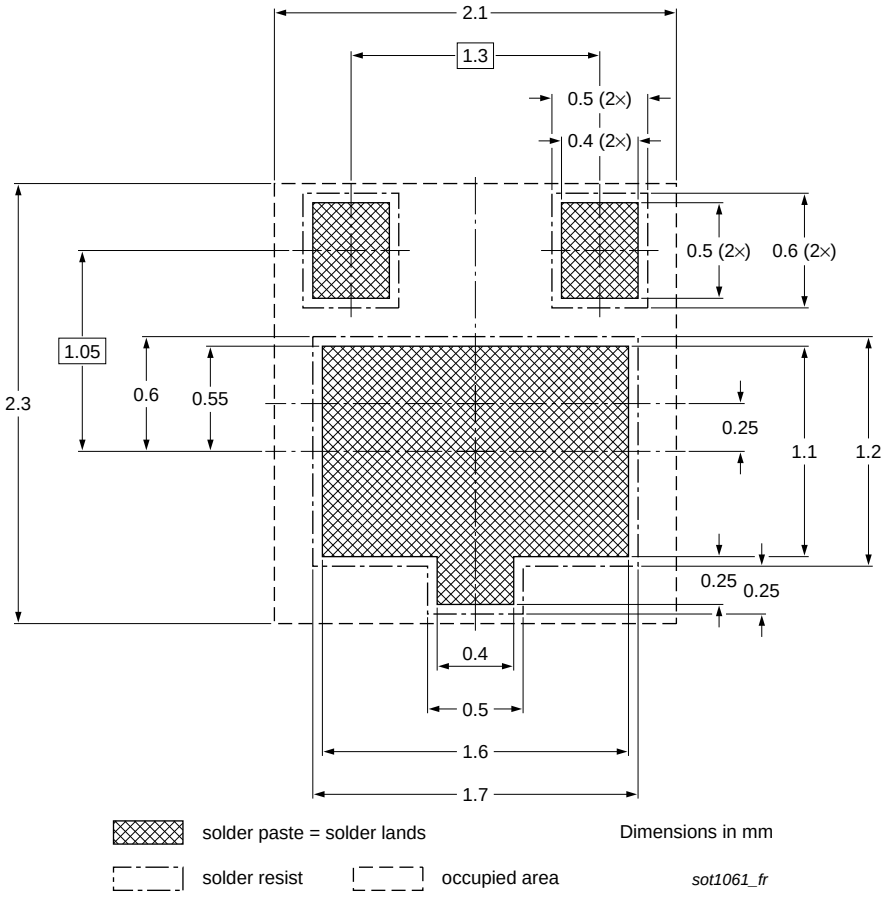

Reflow soldering is the only recommended soldering method.

Fig 26. Reflow soldering footprint SOT1061 (HUSON3)

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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	CPCN20040502 9	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

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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".

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