BC56PA-Q series

80 V, 1 A NPN medium power transistors

Rev. 2 — 24 June 2022 Product data sheet

1. General description

NPN medium power transistor in a SOT1061 (DFN2020-3) leadless very small Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- High collector current capability I_C and I_{CM}
- Three current gain selections
- High power dissipation capability
- Exposed heatsink for excellent thermal and electrical conductivity
- Leadless very small SMD plastic package with medium power capability
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

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4. Quick reference data

Table 1. Quick reference data

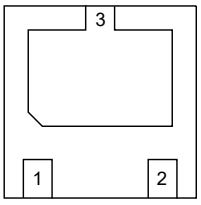
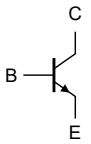
T_{amb} = 25 °C unless otherwise specified.

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						
	BC56PA-Q	V_{CE} = 2 V; I_C = 150 mA	[1]	63	-	250	
	BC56-10PA-Q		[1]	63	-	160	
	BC56-16PA-Q		[1]	100	-	250	

[1] pulsed; $t_p \leq 300$ µs; $\delta \leq 0.02$

5. Pinning information

Table 2. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 Transparent top view	 sym021
2	E	emitter		
3	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BC56PA-Q	DFN2020-3	plastic, thermal enhanced ultra thin small outline package; no leads; 3 Terminals; body 2 x 2 x 0.65 mm	SOT1061
BC56-10PA-Q			
BC56-16PA-Q			

7. Marking

Table 4. Marking

Type number	Marking code
BC56PA-Q	AZ
BC56-10PA-Q	BK
BC56-16PA-Q	BL

8. Limiting values

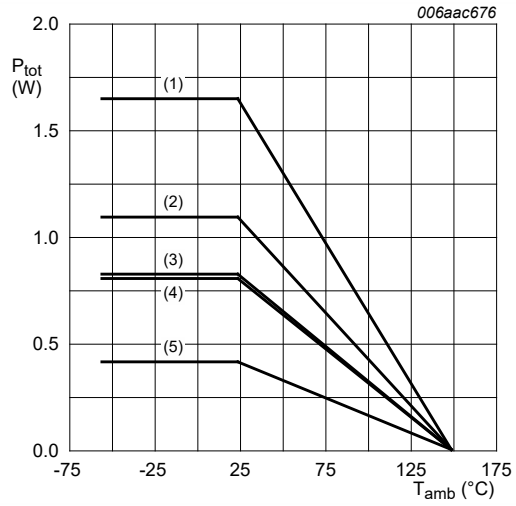
Table 5. Limiting values

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

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

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	[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.



(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. 1. Power derating curves SOT1061

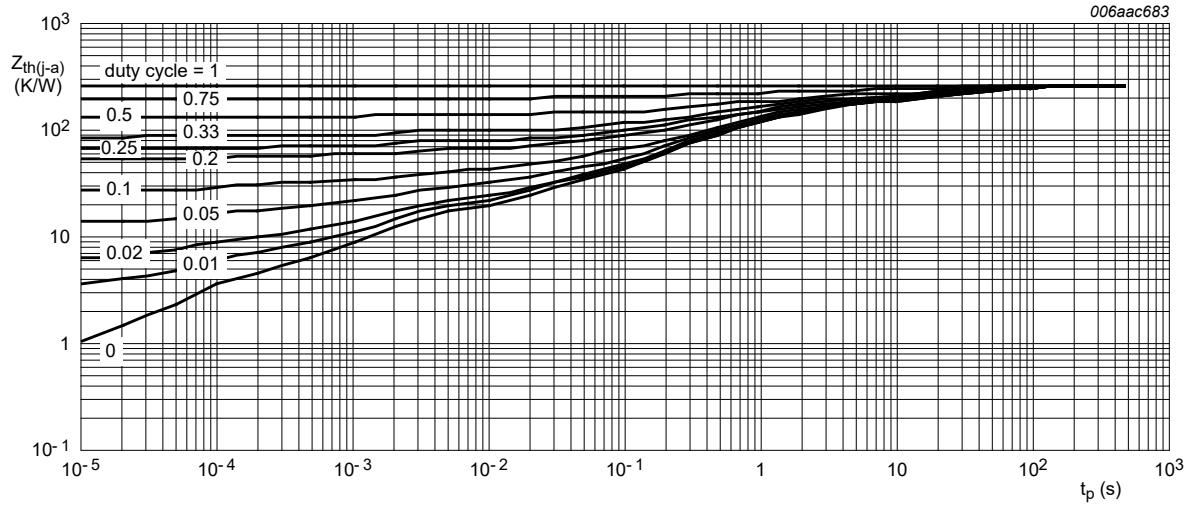
9. Thermal characteristics

Table 6. Thermal characteristics

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

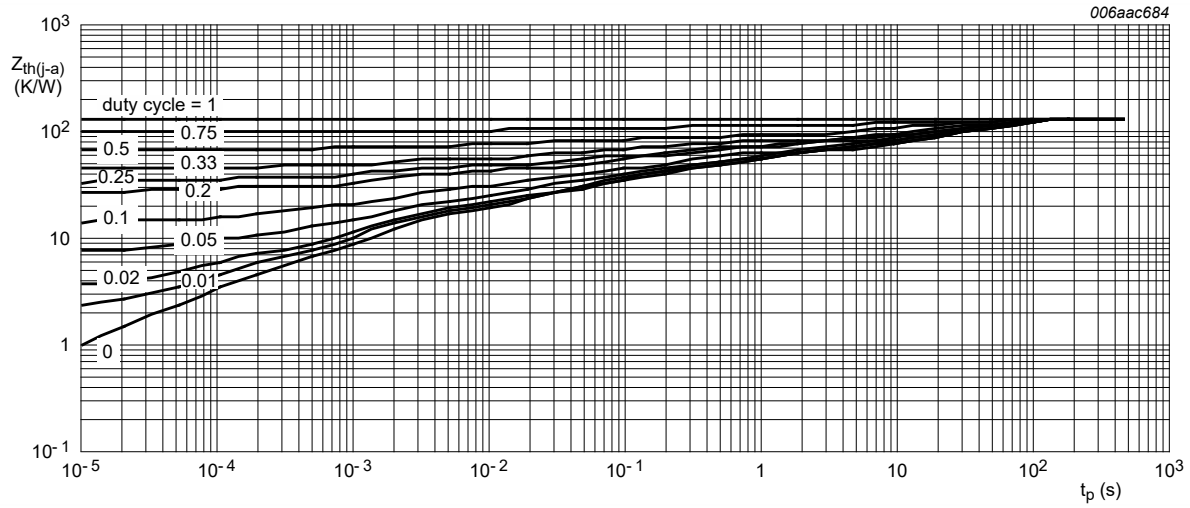
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	298	K/W
			[2]	-	-	151	K/W
			[3]	-	-	114	K/W
			[4]	-	-	154	K/W
			[5]	-	-	76	K/W
$R_{(j-sp)}$	thermal resistance from junction to solder point			-	-	20	K/W

[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.



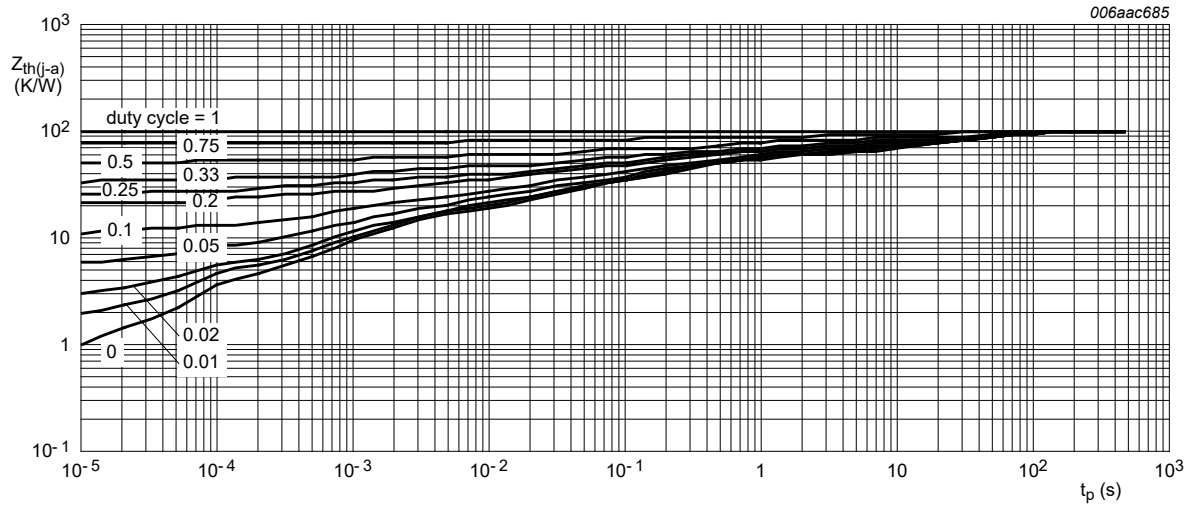
FR4 PCB, single-sided copper, standard footprint

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



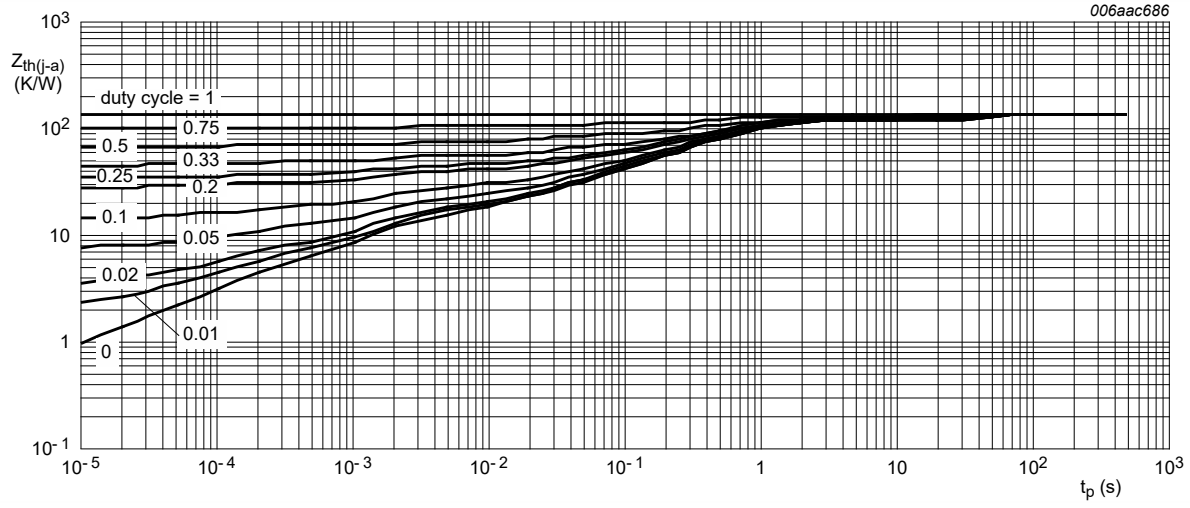
FR4 PCB, single-sided copper, mounting pad for collector 1 cm^2

Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



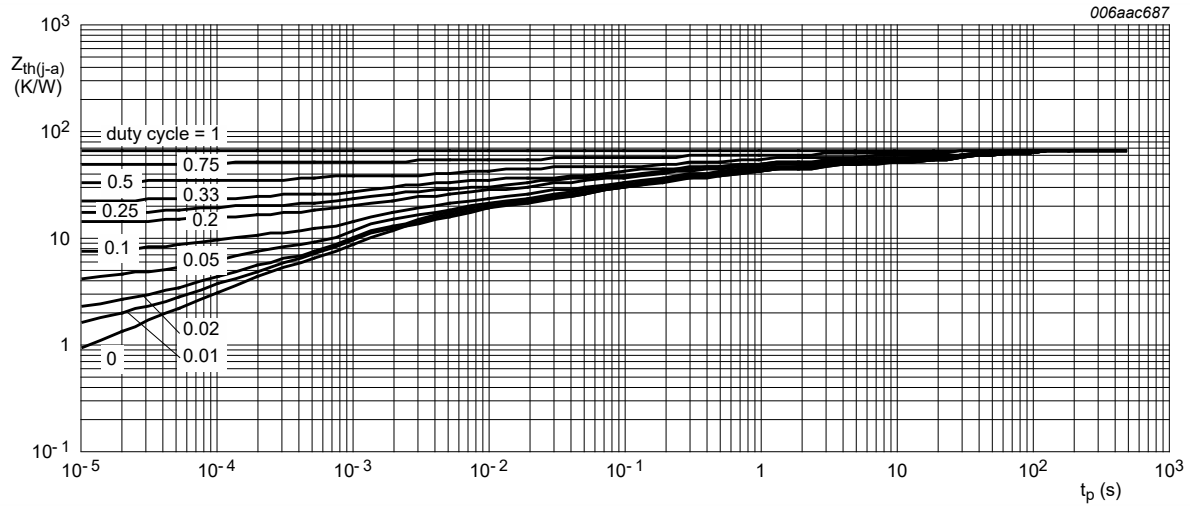
FR4 PCB, single-sided copper, mounting pad for collector 6 cm^2

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



FR4 PCB, 4-layer copper, standard footprint

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



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

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

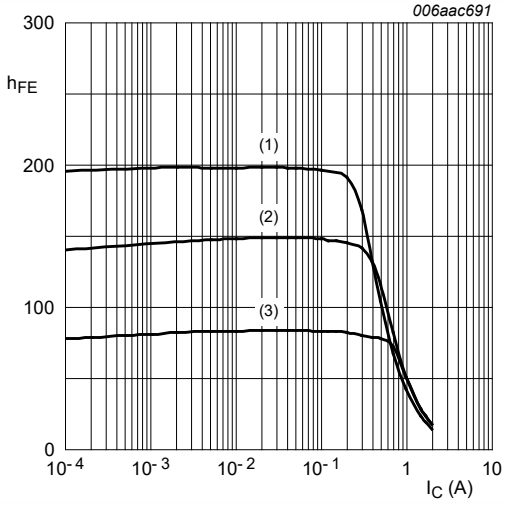
10. Characteristics

Table 7. Characteristics

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

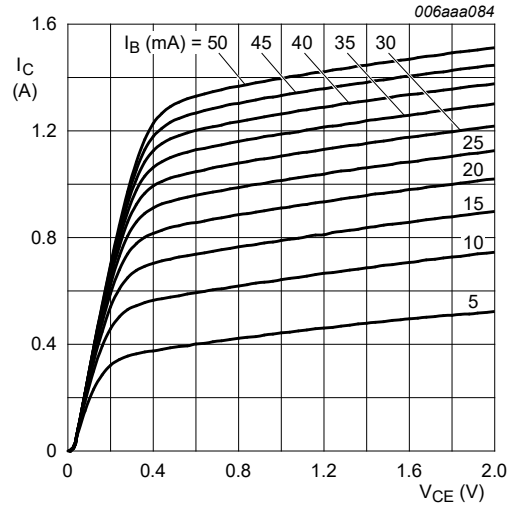
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 µA; I_E = 0 A		100	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 2 mA; I_B = 0 A		80	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 100 µA; I_C = 0 A		5	-	-	V
I_{CBO}	collector-base 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						
	BC56PA-Q	V_{CE} = 2 V; I_C = 5 mA	[1]	63	-	-	
		V_{CE} = 2 V; I_C = 150 mA	[1]	63	-	250	
		V_{CE} = 2 V; I_C = 500 mA	[1]	40	-	-	
	BC56-10PA-Q	V_{CE} = 2 V; I_C = 5 mA	[1]	63	-	-	
		V_{CE} = 2 V; I_C = 150 mA	[1]	63	-	160	
		V_{CE} = 2 V; I_C = 500 mA	[1]	40	-	-	
	BC56-16PA-Q	V_{CE} = 2 V; I_C = 5 mA	[1]	63	-	-	
		V_{CE} = 2 V; I_C = 150 mA		100	-	250	
		V_{CE} = 2 V; I_C = 500 mA		40	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA	[1]	-	-	500	mV
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] pulsed; $t_p \leq 300$ µs; $\delta \leq 0.02$



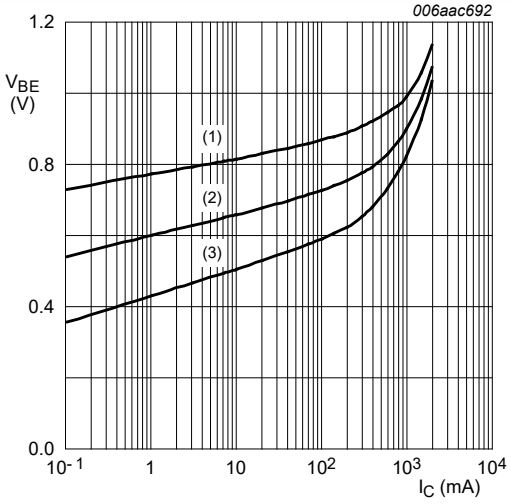
V_{CE} = 2 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -55 °C

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



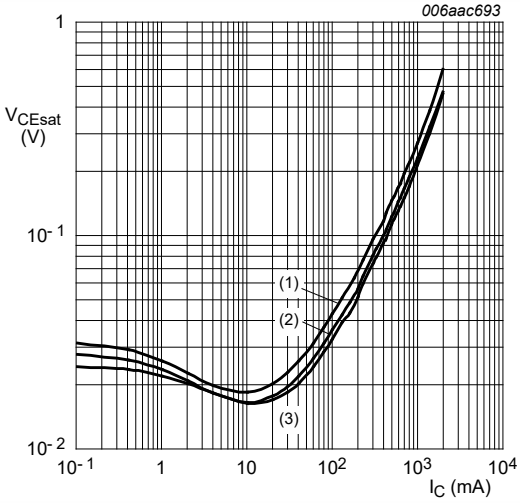
T_{amb} = 25 °C

Fig. 8. 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. 9. Base-emitter voltage as a function of collector current; typical values



V_{CE} = 2 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -55 °C

Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

11. Test information

11.1. 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.

12. Package outline

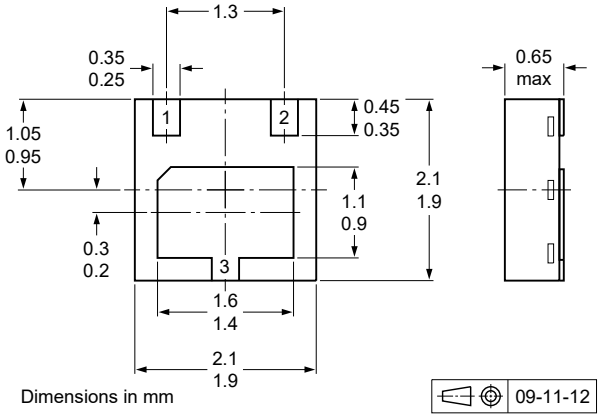


Fig. 11. Package outline SOT1061 (DFN2020-3)

13. Soldering

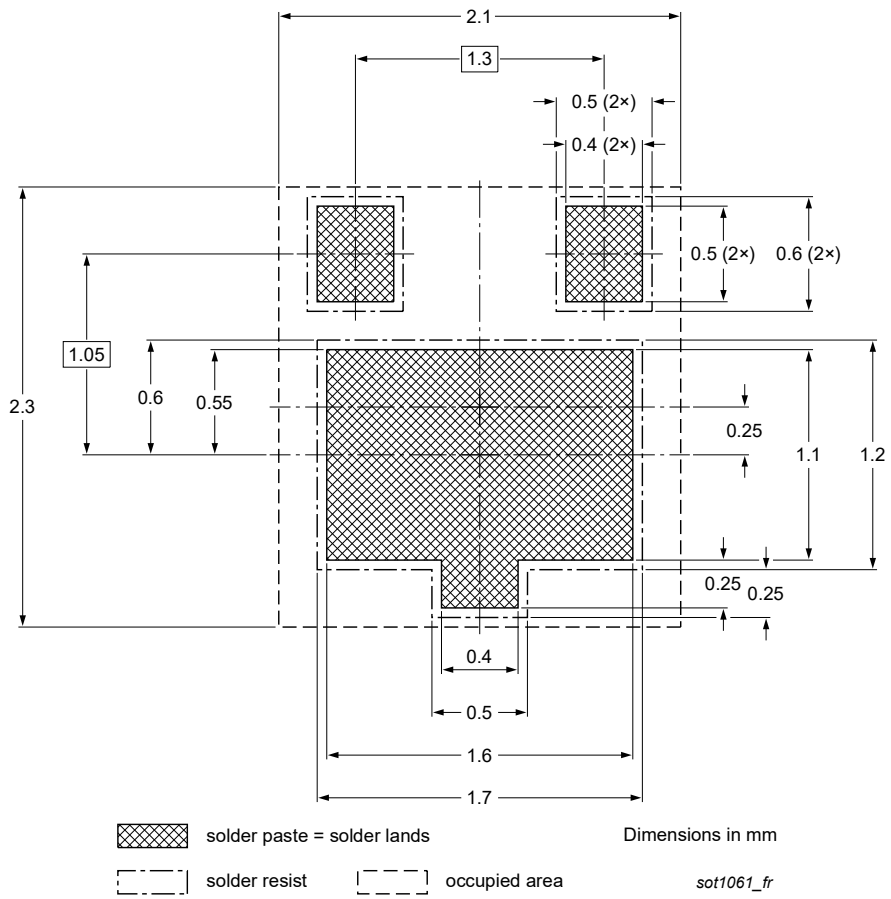


Fig. 12. Reflow soldering footprint for SOT1061 (DFN2020-3)

14. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BC56PA-Q_SER v.2	20220624	Product data sheet	-	BC56PA-Q_SER v.1
Modifications:	• Characteristics at $V_{(BR)CEO}$: Conditions corrected			
BC56PA-Q_SER v.1	20220119	Product data sheet	-	-

15. Legal information

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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Date of release: 24 June 2022