BC56xPAS-Q series

80 V, 1 A NPN medium power transistors

28 May 2024 Product data sheet

1. General description

NPN medium power transistor series encapsulated in an ultra thin DFN2020D-3 (SOT1061D) leadless small Surface-Mounted Device (SMD) plastic package with medium power capability and visible and solderable side pads.

2. Features and benefits

- High collector current capability I_C and I_{CM}
- Reduced Printed-Circuit Board (PCB) area requirements
- Exposed heat sink for excellent thermal and electrical conductivity
- Two current gain selections
- Leadless very small SMD plastic package with medium power capability
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

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

4. Quick reference data

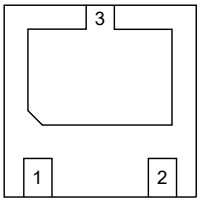
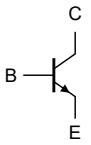
Table 1. Quick reference data

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						
	BC56PAS-Q	V_{CE} = 2 V; I_C = 150 mA; T_{amb} = 25 °C	[1]	63	-	250	
	BC56-10PAS-Q		[1]	63	-	160	
	BC56-16PAS-Q		[1]	100	-	250	

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 Transparent top view **DFN2020D-3 (SOT1061D)**	 *sym021*
2	E	emitter		
3	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BC56PAS-Q	DFN2020D-3	plastic, leadless thermal enhanced ultra thin small outline package with side-wettable flanks (SWF); no leads; 3 terminals; 1.3 mm pitch; 2 mm x 2 mm x 0.65 mm body	SOT1061D
BC56-10PAS-Q			
BC56-16PAS-Q			

7. Marking

Table 4. Marking codes

Type number	Marking code
BC56PAS-Q	CK
BC56-10PAS-Q	CL
BC56-16PAS-Q	CM

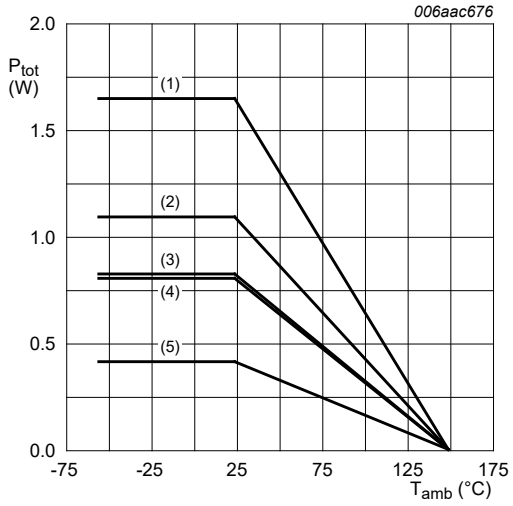
8. Limiting values

Table 5. 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
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	0.42	W
			[2]	-	0.81	W
			[3]	-	0.83	W
			[4]	-	1.10	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, 4-layer copper, tin-plated and standard footprint.
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 1 cm^2.
[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm^2.
[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and 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

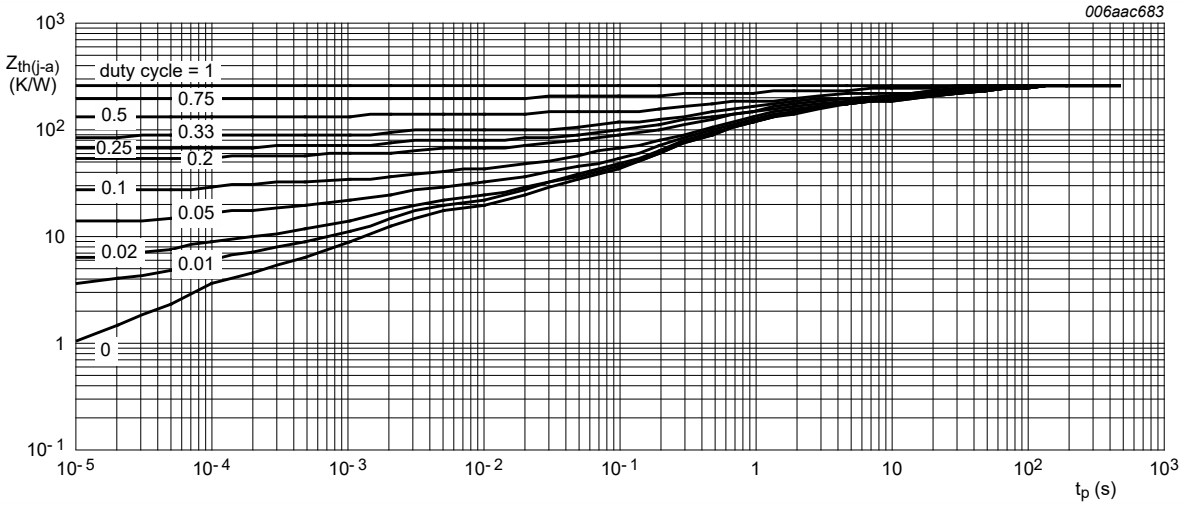
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

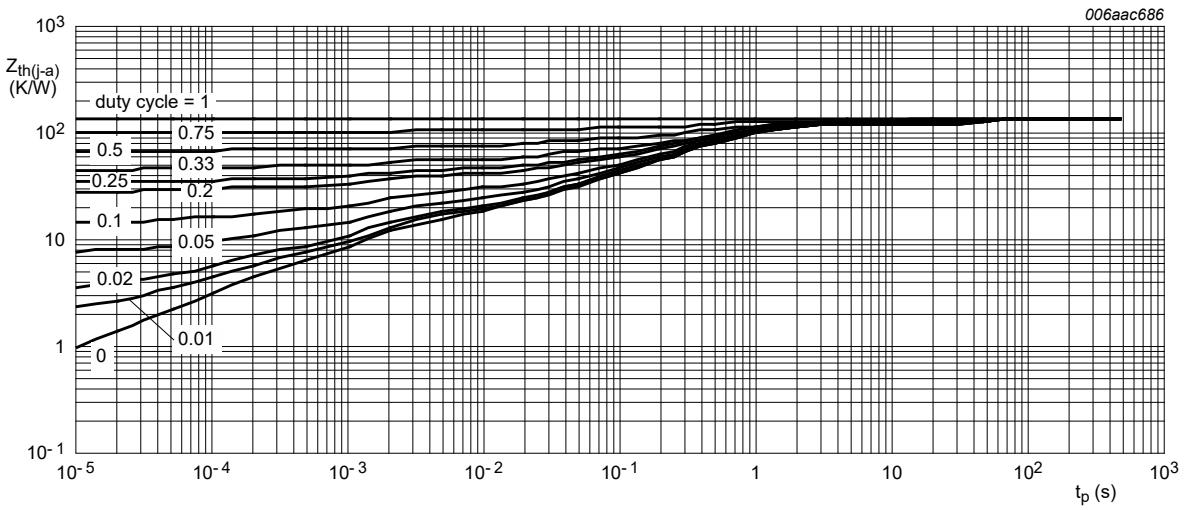
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	298	K/W
			[2]	-	-	154	K/W
			[3]	-	-	151	K/W
			[4]	-	-	114	K/W
			[5]	-	-	76	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	20	K/W

[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, 4-layer copper, tin-plated and standard footprint.
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 1 cm^2.
[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm^2.
[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm^2.



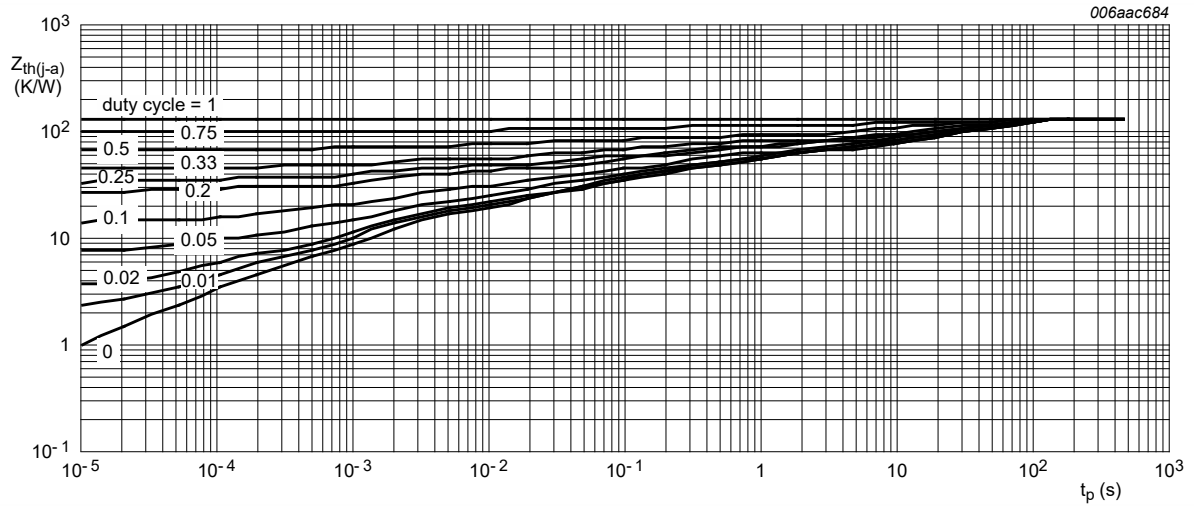
FR4 PCB, single-sided copper, standard footprint

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



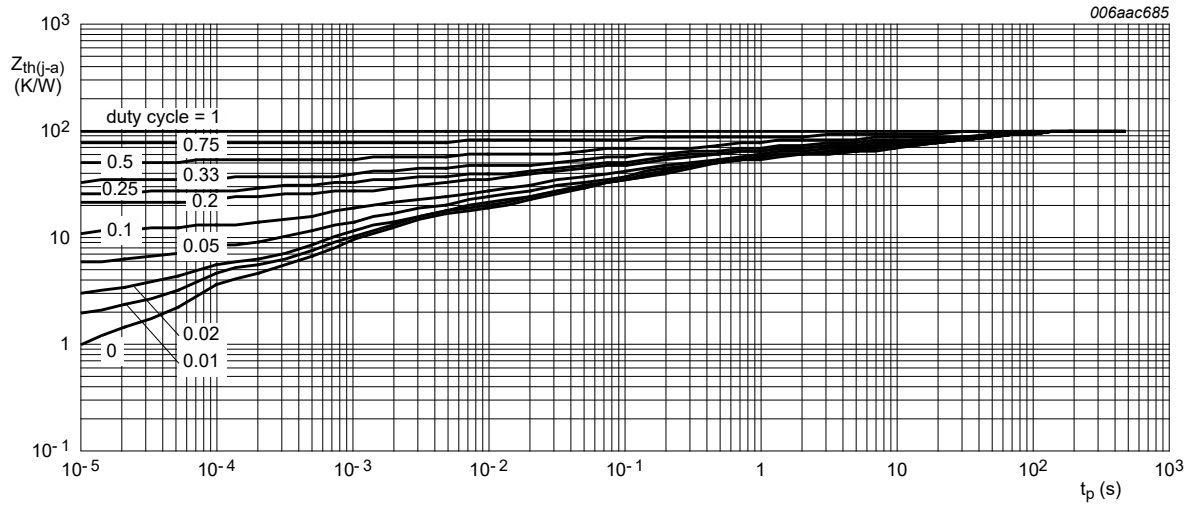
FR4 PCB, 4-layer copper, standard footprint

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



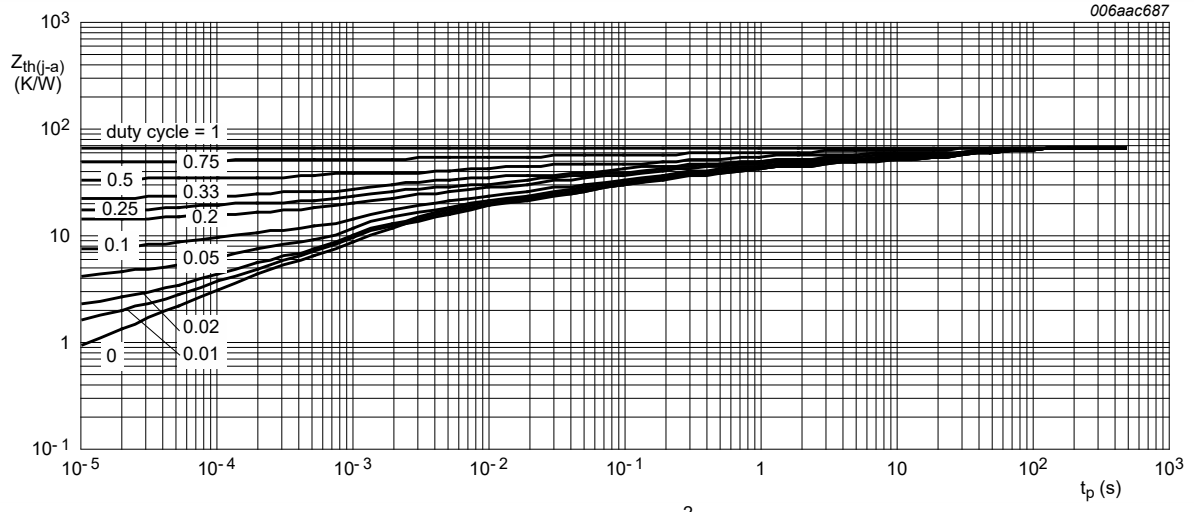
FR4 PCB, single-sided copper, mounting pad for collector 1 cm^2

Fig. 4. 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. 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

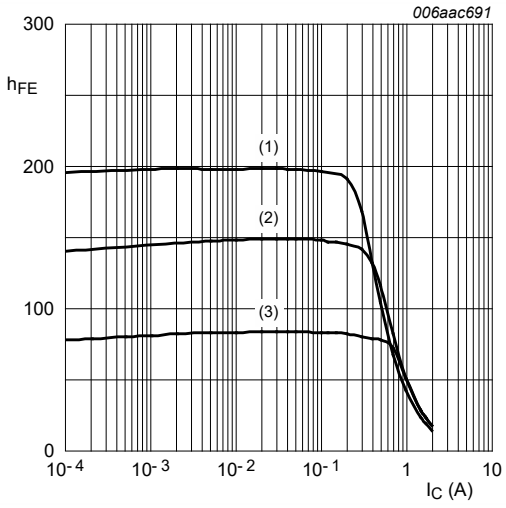
Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

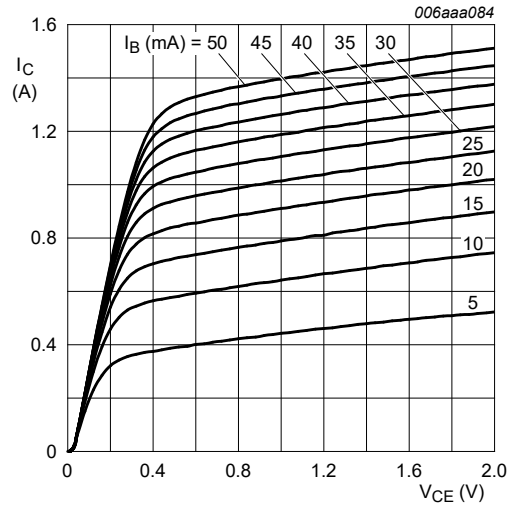
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current (emitter open)	V_{CB} = 30 V; I_E = 0 A; T_{amb} = 25 °C		-	-	100	nA
		V_{CB} = 30 V; I_E = 0 A; T_{amb} = 150 °C		-	-	10	µA
I_{EBO}	emitter-base cut-off current (collector open)	V_{EB} = 5 V; I_C = 0 A; T_{amb} = 25 °C		-	-	100	nA
h_{FE}	DC current gain						
	BC56PAS-Q	V_{CE} = 2 V; I_C = 5 mA; T_{amb} = 25 °C		63	-	-	
	BC56-10PAS-Q			63	-	-	
	BC56-16PAS-Q			63	-	-	
	BC56PAS-Q	V_{CE} = 2 V; I_C = 150 mA; T_{amb} = 25 °C	[1]	63	-	250	
	BC56-10PAS-Q		[1]	63	-	160	
	BC56-16PAS-Q		[1]	100	-	250	
	BC56PAS-Q	V_{CE} = 2 V; I_C = 500 mA; T_{amb} = 25 °C	[1]	40	-	-	
	BC56-10PAS-Q		[1]	40	-	-	
	BC56-16PAS-Q		[1]	40	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 500 mA; I_B = 50 mA; T_{amb} = 25 °C	[1]	-	-	500	mV
V_{BE}	base-emitter voltage	V_{CE} = 2 V; I_C = 500 mA; T_{amb} = 25 °C	[1]	-	-	1	V
C_c	collector capacitance	V_{CB} = 10 V; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	6	-	pF
f_T	transition frequency	V_{CE} = 5 V; I_C = 50 mA; f = 100 MHz; T_{amb} = 25 °C		100	180	-	MHz

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



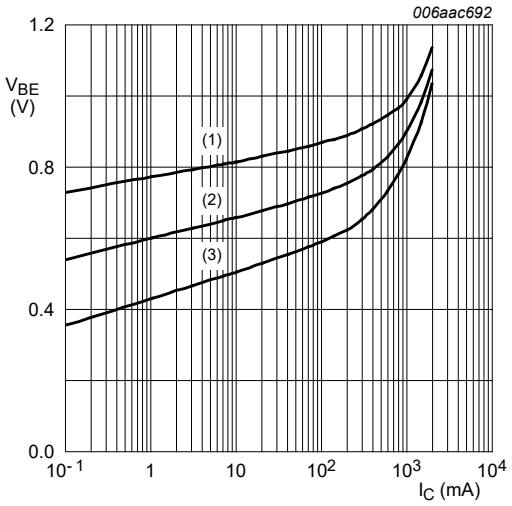
V_{CE} = 2 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -55 °C

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



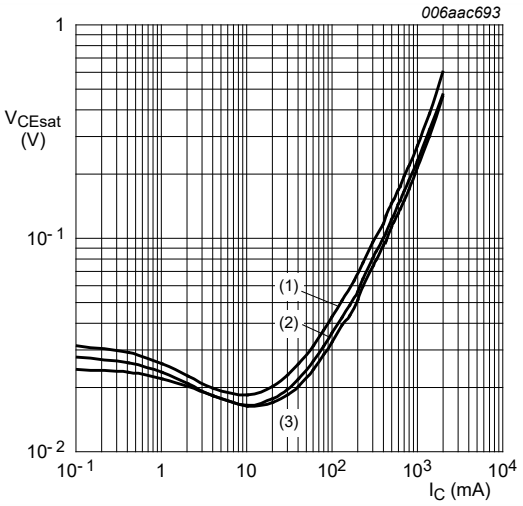
T_{amb} = 25 °C

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



I_C/I_B = 10
(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

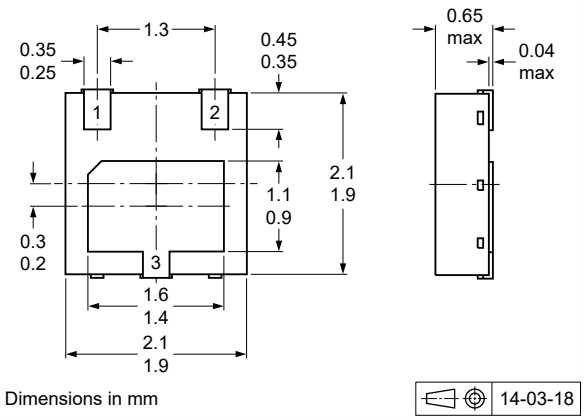


Fig. 11. Package outline DFN2020D-3 (SOT1061D)

13. Soldering

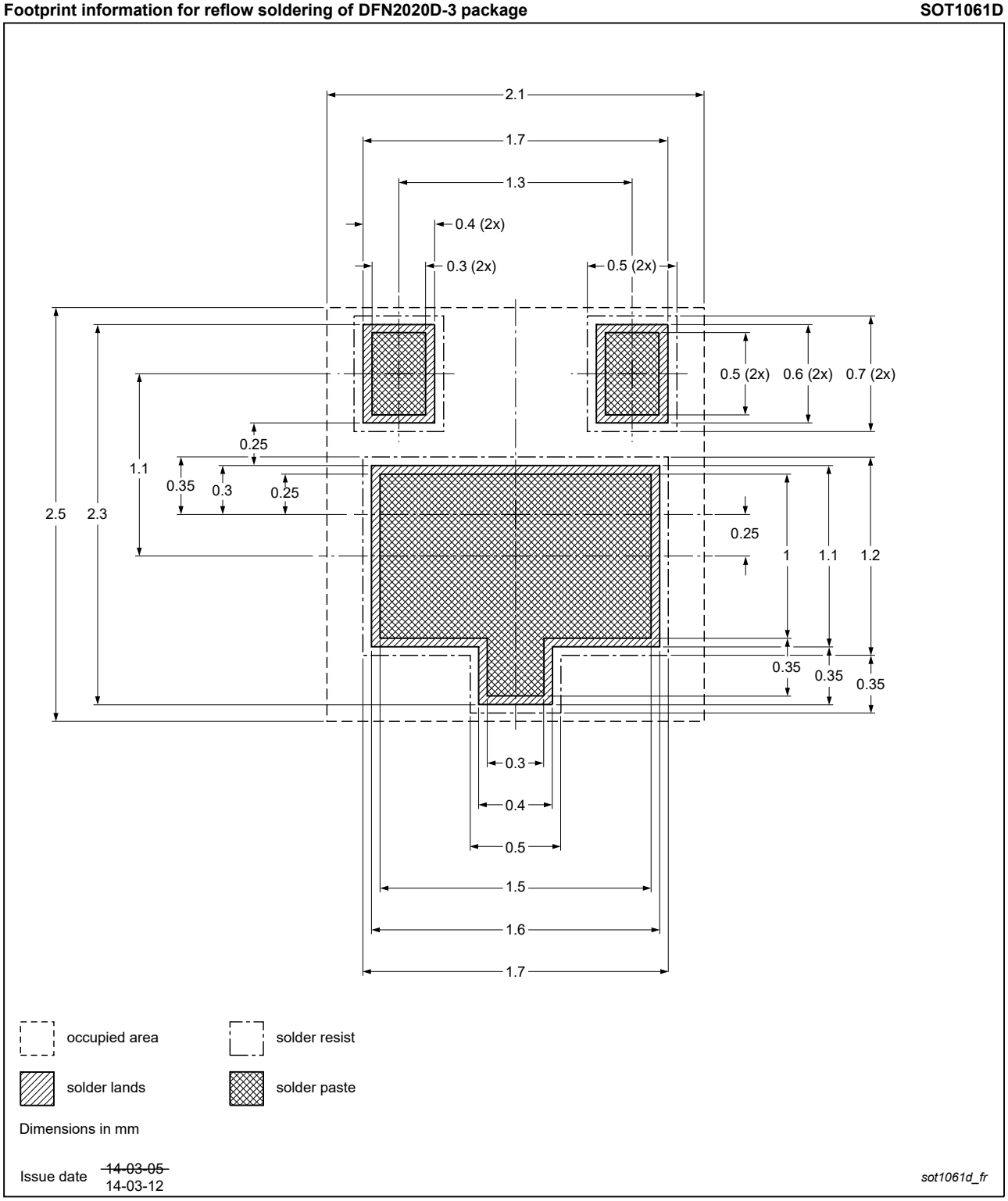


Fig. 12. Reflow soldering footprint for DFN2020D-3 (SOT1061D)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
BC56XPAS-Q_SER v.1	20240528	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: 28 May 2024