



PMBT3904M

40 V, 200 mA NPN switching transistor

27 March 2023

Product data sheet

1. General description

NPN single switching transistor in a SOT883 (SC-101) leadless ultra small Surface-Mounted Device (SMD) plastic package.

PNP complement: PMBT3906M

2. Features and benefits

- Single general-purpose switching transistor
- Board-space reduction
- Ultra small SMD plastic package
- AEC-Q101 qualified

3. Applications

- General-purpose switching and amplification

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CE0}	collector-emitter voltage	open base	-	-	40	V
I_C	collector current		-	-	200	mA
h_{FE}	DC current gain	$V_{CE} = 1\text{ V}; I_C = 10\text{ mA}$	100	180	300	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	<p>Transparent top view DFN1006-3 (SOT883)</p>	<p>sym021</p>
2	E	emitter		
3	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMBT3904M	DFN1006-3	plastic, leadless ultra small package; 3 terminals; 0.35 mm pitch; 1 mm x 0.6 mm x 0.48 mm body	SOT883

7. Marking

Table 4. Marking codes

Type number	Marking code
PMBT3904M	6P

8. Limiting values

Table 5. Limiting values

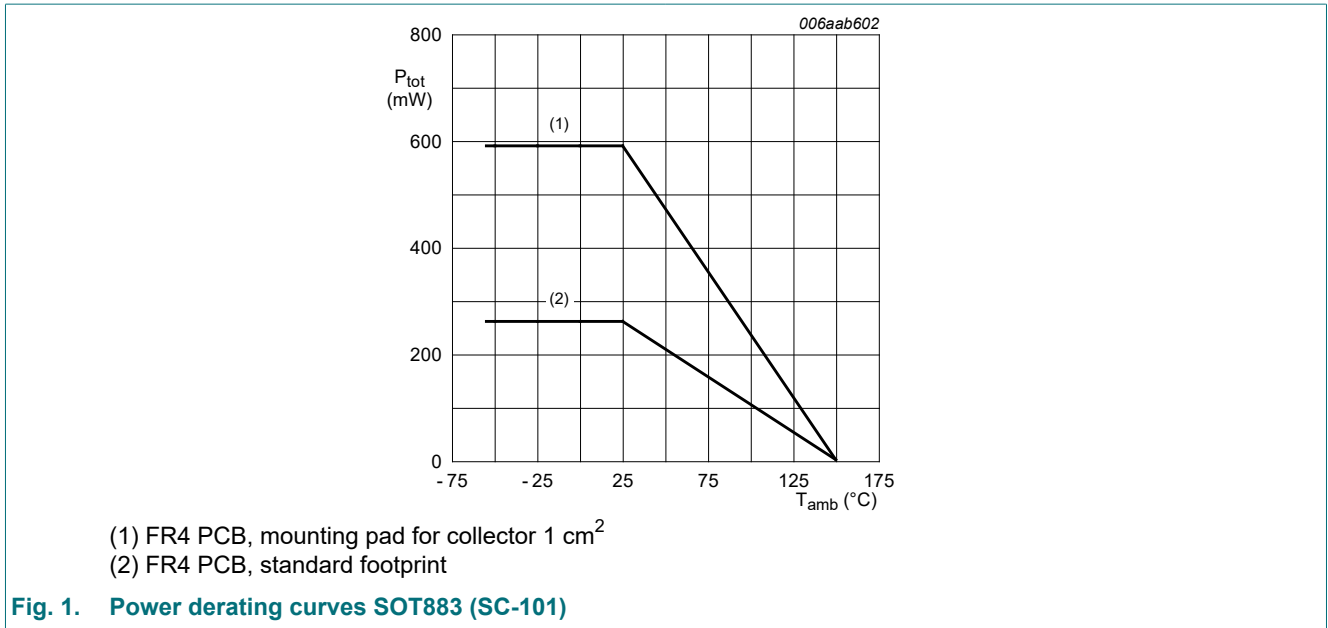
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit	
V_{CBO}	collector-base voltage	open emitter	-	60	V	
V_{CEO}	collector-emitter voltage	open base	-	40	V	
V_{EBO}	emitter-base voltage	open collector	-	6	V	
I_C	collector current		-	200	mA	
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	200	mA	
I_{BM}	peak base current		-	100	mA	
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1] [2]	-	260	mW
			[1] [3]	-	590	mW
T_j	junction temperature		-	150	°C	
T_{amb}	ambient temperature		-55	150	°C	
T_{stg}	storage temperature		-65	150	°C	

[1] Reflow soldering is the only recommended soldering method.

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

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

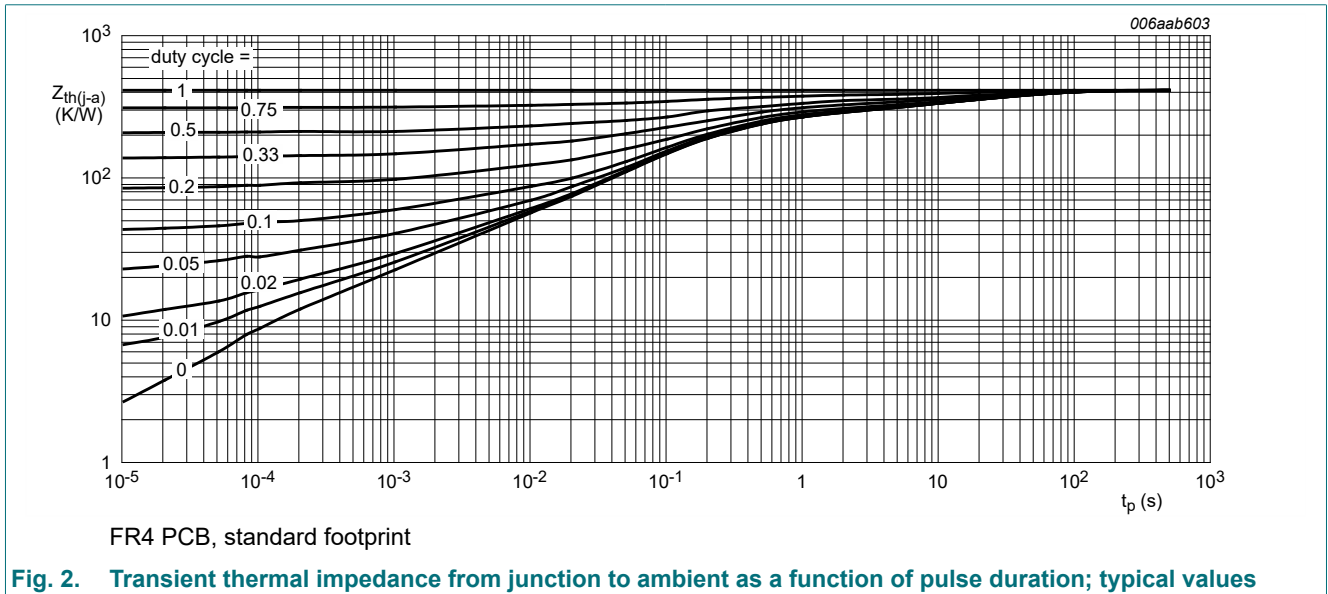


9. Thermal characteristics

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] [2]	-	-	481	K/W
			[1] [3]	-	-	212	K/W

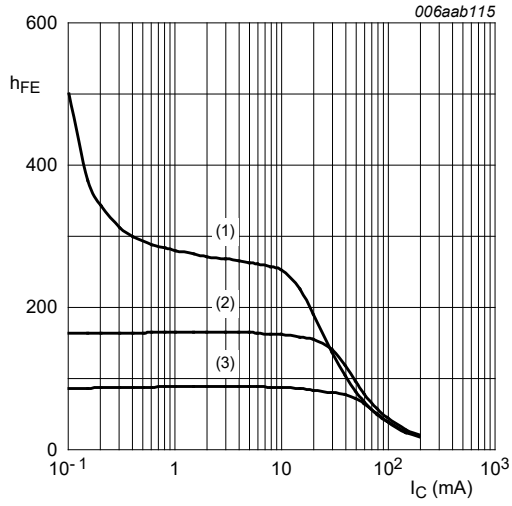
- [1] Reflow soldering is the only recommended soldering method.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².



10. Characteristics

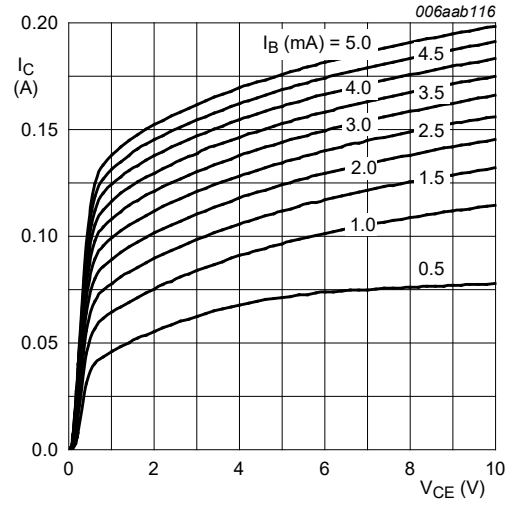
Table 7. Characteristics
 $T_{amb} = 25\text{ °C}$ unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	50	nA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 6\text{ V}; I_C = 0\text{ A}$	-	-	50	nA
h_{FE}	DC current gain	$V_{CE} = 1\text{ V}; I_C = 0.1\text{ mA}$	60	180	-	
		$V_{CE} = 1\text{ V}; I_C = 1\text{ mA}$	80	180	-	
		$V_{CE} = 1\text{ V}; I_C = 10\text{ mA}$	100	180	300	
		$V_{CE} = 1\text{ V}; I_C = 50\text{ mA}$	60	105	-	
		$V_{CE} = 1\text{ V}; I_C = 100\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$	30	50	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 1\text{ mA}$	-	75	200	mV
		$I_C = 50\text{ mA}; I_B = 5\text{ mA}$	-	120	300	mV
V_{BEsat}	base-emitter saturation voltage	$I_C = 10\text{ mA}; I_B = 1\text{ mA}$	650	750	850	mV
		$I_C = 50\text{ mA}; I_B = 5\text{ mA}$	-	850	950	mV
t_d	delay time	$I_C = 10\text{ mA}; I_{Bon} = 1\text{ mA}; I_{Boff} = -1\text{ mA}; V_{CC} = 3\text{ V}$	-	-	35	ns
t_r	rise time		-	-	35	ns
t_{on}	turn-on time		-	-	70	ns
t_s	storage time		-	-	200	ns
t_f	fall time		-	-	50	ns
t_{off}	turn-off time		-	-	250	ns
C_c	collector capacitance		$V_{CB} = 5\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	4
C_e	emitter capacitance	$V_{EB} = 500\text{ mV}; I_C = 0\text{ A}; i_c = 0\text{ A}; f = 1\text{ MHz}$	-	-	8	pF
f_T	transition frequency	$V_{CE} = 20\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$	300	-	-	MHz
NF	noise figure	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}; R_S = 1\text{ k}\Omega;$ $10\text{ Hz} \leq f \leq 15700\text{ Hz}$	-	-	5	dB



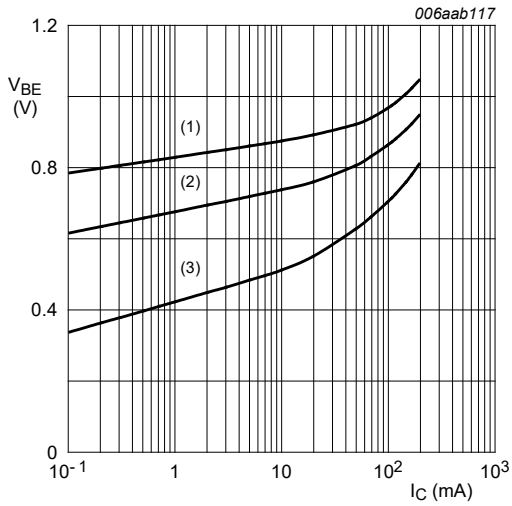
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 3. DC current gain as a function of collector current; typical values



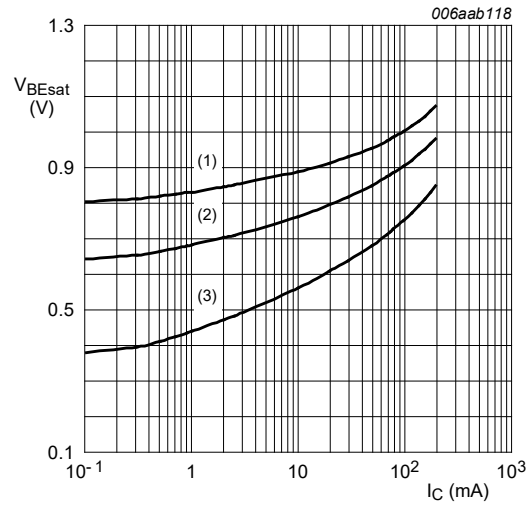
$T_{amb} = 25\text{ °C}$

Fig. 4. Collector current as a function of collector-emitter voltage; typical values



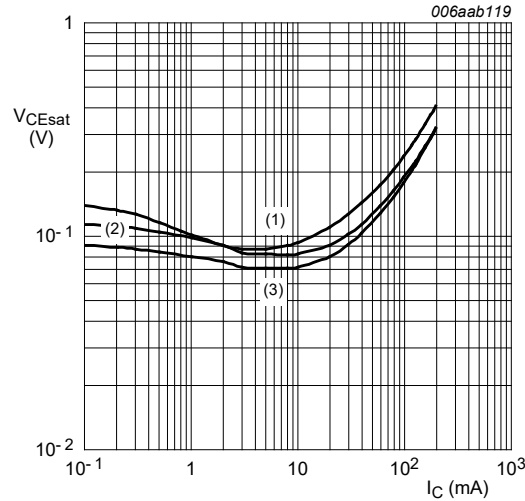
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

Fig. 5. Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 10$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

Fig. 6. Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 10$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 7. Collector-emitter saturation voltage as a function of collector current; typical values

11. Test information

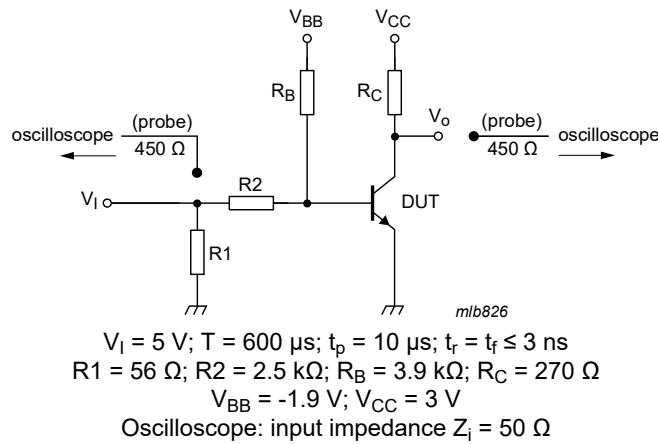


Fig. 8. Test circuit for switching times

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

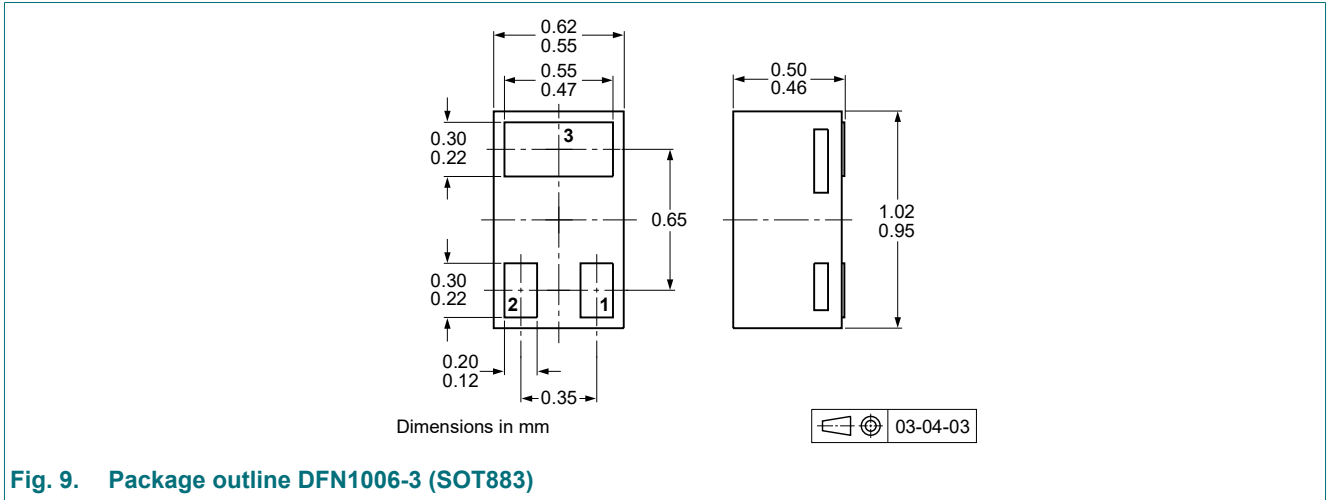


Fig. 9. Package outline DFN1006-3 (SOT883)

13. Soldering

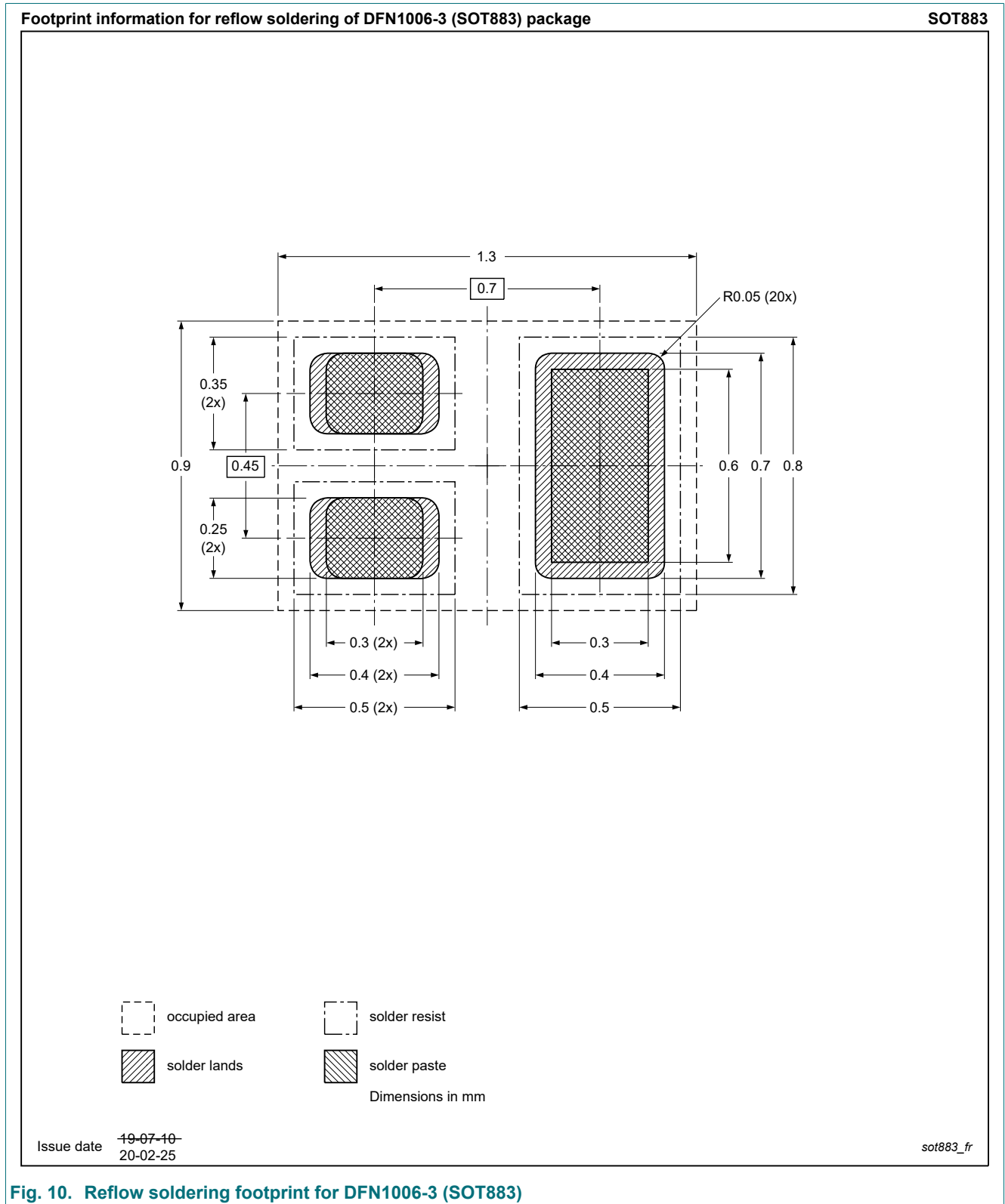


Fig. 10. Reflow soldering footprint for DFN1006-3 (SOT883)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3904M v.3	2023mmdd	Product data sheet	-	PMBT3904M v.2
Modifications:	<ul style="list-style-type: none">AEC-Q101 qualified added to sections Features and benefits, Test information and Legal information.			
PMBT3904M v.2	20190502	Product data sheet	-	PMBT3904M v.1
PMBT3904M v.1	20090721	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: 27 March 2023
