



# PMBT2222A

NPN switching transistor

27 July 2022

Product data sheet

## 1. General description

NPN switching transistor in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- High current (max. 600 mA)
- Low voltage (max. 40 V)
- AEC-Q101 qualified

## 3. Applications

- Switching and linear amplification

## 4. Quick reference data

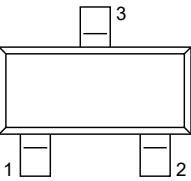
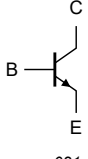
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{CEO}$	collector-emitter voltage	open base	-	-	40	V	
$I_C$	collector current		-	-	600	mA	
$h_{FE}$	DC current gain	$V_{CE} = 10\text{ V}; I_C = 150\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	[1]	100	-	300	
		$V_{CE} = 10\text{ V}; I_C = 500\text{ mA}; T_{amb} = 25\text{ }^\circ\text{C}$	[1]	40	-	-	

[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SOT23	 sym021
2	E	emitter		
3	C	collector		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
<a href="#">PMBT2222A</a>	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	<a href="#">SOT23</a>

## 7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PMBT2222A	%1P

[1] % = placeholder for manufacturing site code

## 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		-	75	V
$V_{CEO}$	collector-emitter voltage	open base		-	40	V
$V_{EBO}$	emitter-base voltage	open collector		-	6	V
$I_C$	collector current			-	600	mA
$I_{CM}$	peak collector current			-	800	mA
$I_{BM}$	peak base current			-	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	250	mW
$T_j$	junction temperature			-	150	°C
$T_{amb}$	ambient temperature			-65	150	°C
$T_{stg}$	storage temperature			-65	150	°C

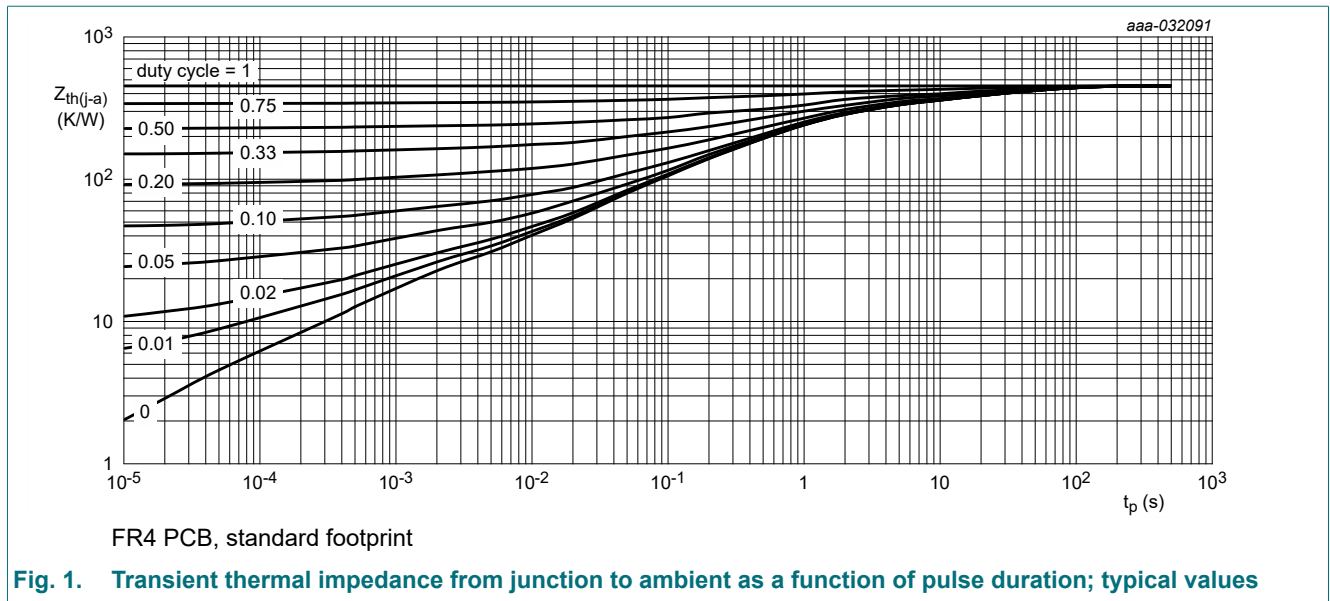
[1] Device mounted on an FR4 Printed-Circuit Board (PCM), single-sided copper, tin-plated and standard footprint.

## 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]	-	-	500	K/W

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

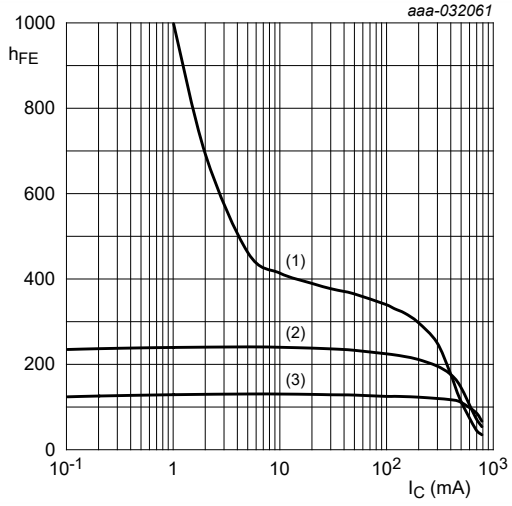


## 10. Characteristics

Table 7. Characteristics

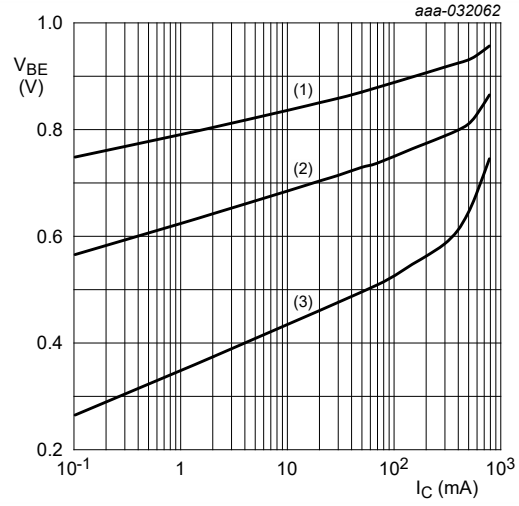
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	10	nA
		$V_{CB} = 60 \text{ V}; I_E = 0 \text{ A}; T_J = 125 \text{ }^\circ\text{C}$	-	-	10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	10	nA
$h_{FE}$	DC current gain	$V_{CE} = 10 \text{ V}; I_C = 0.1 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	35	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 1 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	50	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	75	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 10 \text{ mA}; T_{amb} = -55 \text{ }^\circ\text{C}$	35	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 150 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$ [1]	100	-	300	
		$V_{CE} = 1 \text{ V}; I_C = 150 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$ [1]	50	-	-	
		$V_{CE} = 10 \text{ V}; I_C = 500 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$ [1]	40	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 150 \text{ mA}; I_B = 15 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$ [1]	-	-	300	mV
		$I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$ [1]	-	-	1	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 150 \text{ mA}; I_B = 15 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$ [1]	0.6	-	1.2	V
		$I_C = 500 \text{ mA}; I_B = 50 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$ [1]	-	-	2	V
$t_d$	delay time	$I_C = 150 \text{ mA}; I_{B(on)} = 15 \text{ mA}; I_{B(off)} = -15 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	15	ns
$t_r$	rise time		-	-	20	ns
$t_{on}$	turn-on time		-	-	35	ns
$t_s$	storage time		-	-	200	ns
$t_f$	fall time		-	-	60	ns
$t_{off}$	turn-off time		-	-	250	ns
$C_c$	collector capacitance		$V_{CB} = 10 \text{ V}; I_E = 0 \text{ A}; i_e = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	8
$C_e$	emitter capacitance	$V_{EB} = 500 \text{ mV}; I_C = 0 \text{ A}; i_c = 0 \text{ A}; f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	25	pF
$f_T$	transition frequency	$V_{CE} = 20 \text{ V}; I_C = 20 \text{ mA}; f = 100 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	300	-	-	MHz
NF	noise figure	$V_{CE} = 5 \text{ V}; I_C = 100 \text{ } \mu\text{A}; R_S = 1 \text{ k}\Omega; f = 1 \text{ kHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	4	dB

[1] Pulse test:  $t_p \leq 300 \text{ } \mu\text{s}$ ;  $\delta \leq 0.02$



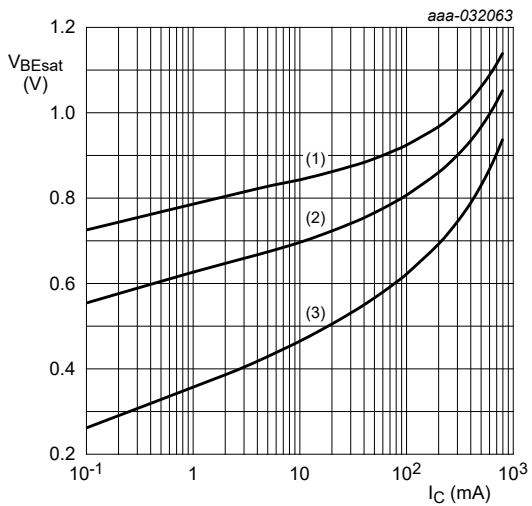
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

**Fig. 2. DC current gain as a function of collector current; typical values**



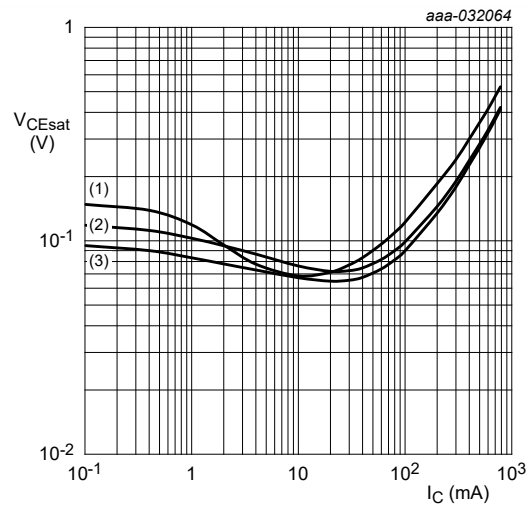
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

**Fig. 3. Base-emitter voltage as a function of collector current; typical values**



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

**Fig. 4. Base-emitter saturation voltage as a function of collector current; typical values**



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

**Fig. 5. Collector-emitter saturation voltage as a function of collector current; typical values**

### 11. Test information

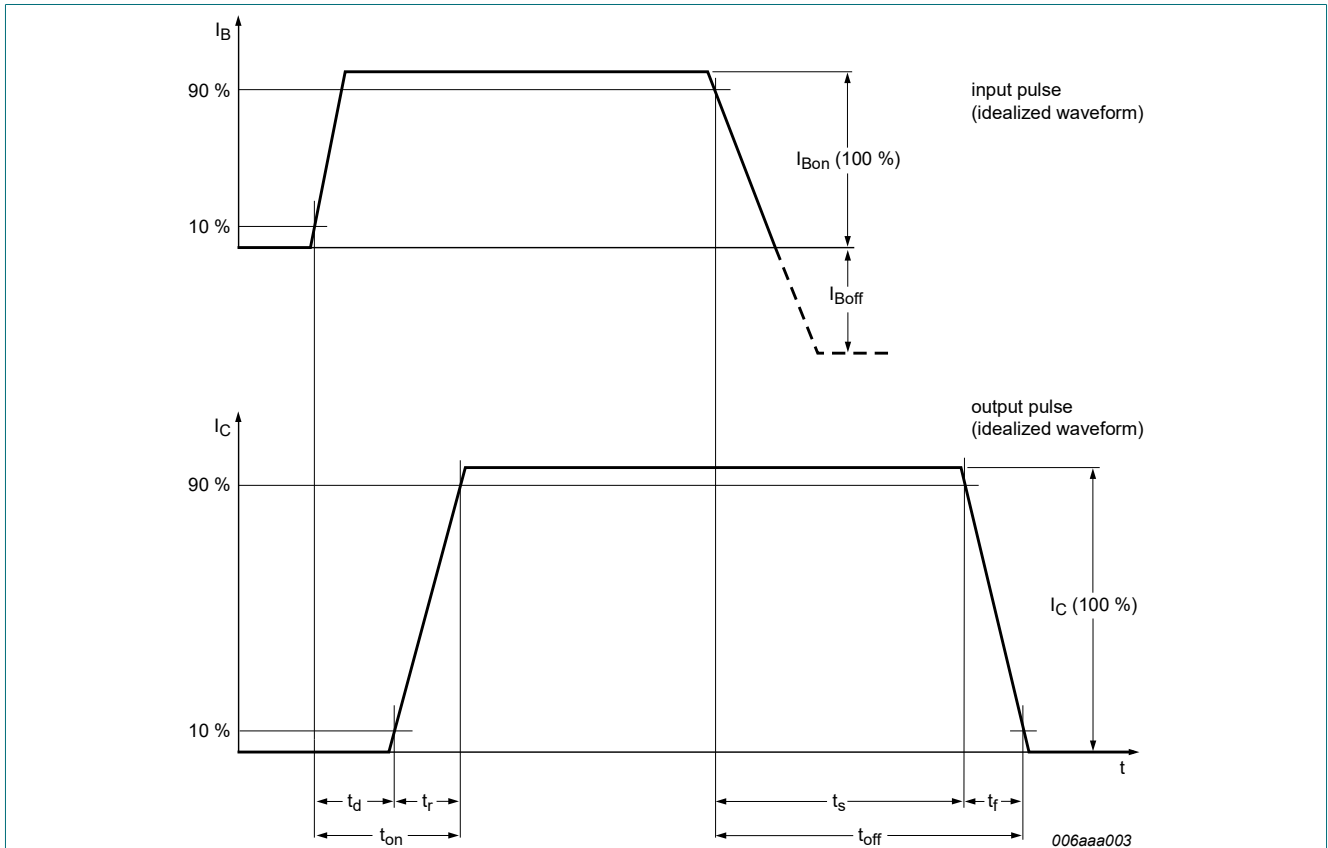


Fig. 6. Switching time definition

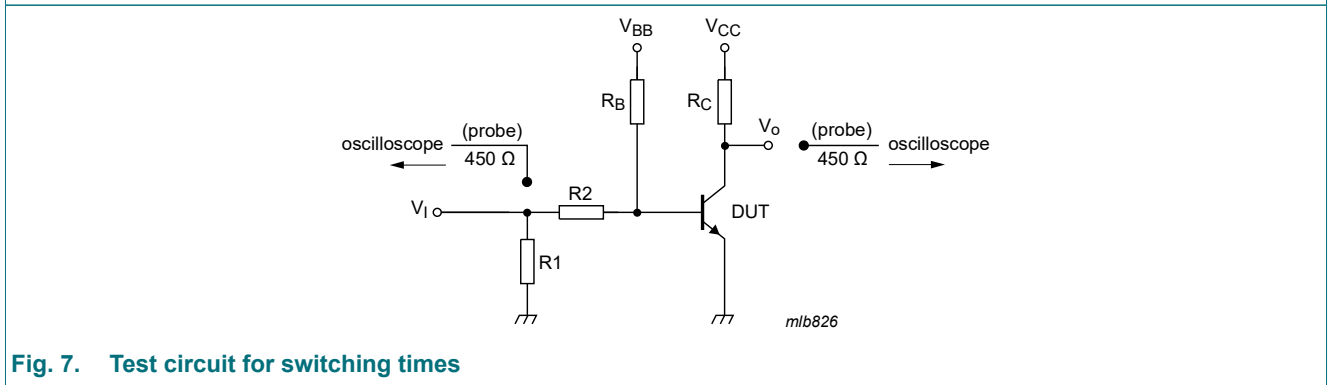


Fig. 7. Test circuit for switching times

### 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

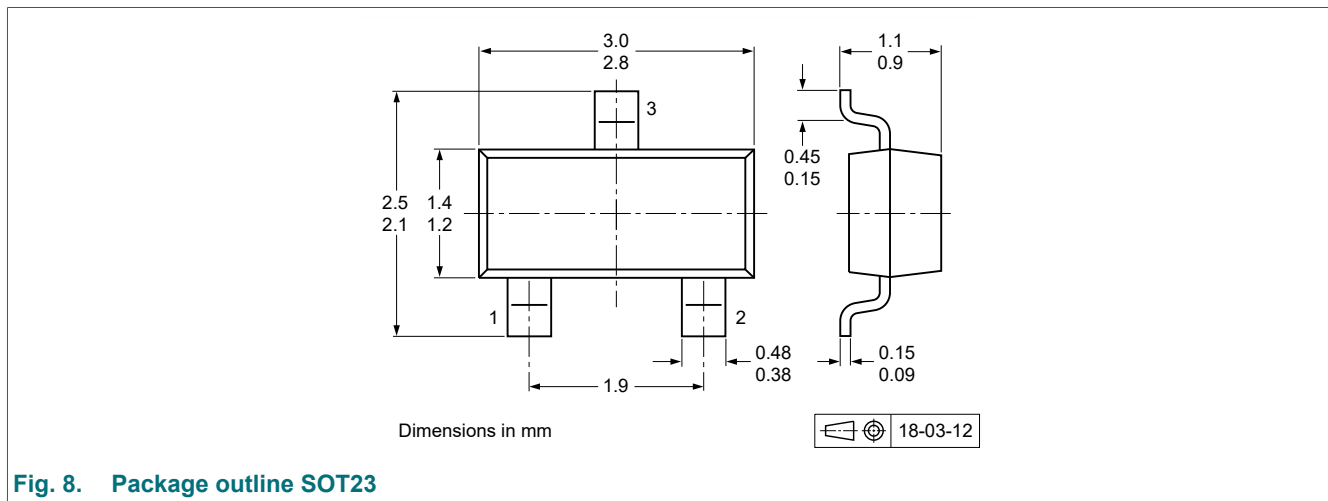


Fig. 8. Package outline SOT23

## 13. Soldering

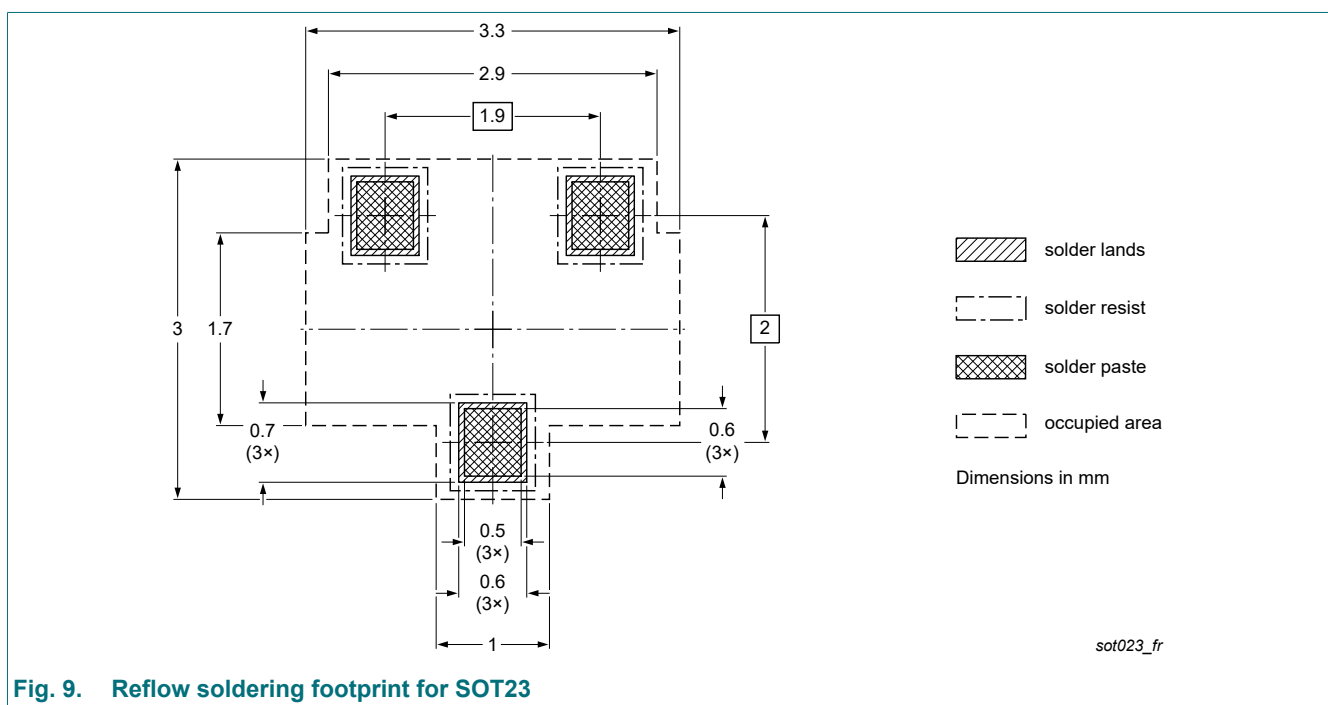


Fig. 9. Reflow soldering footprint for SOT23

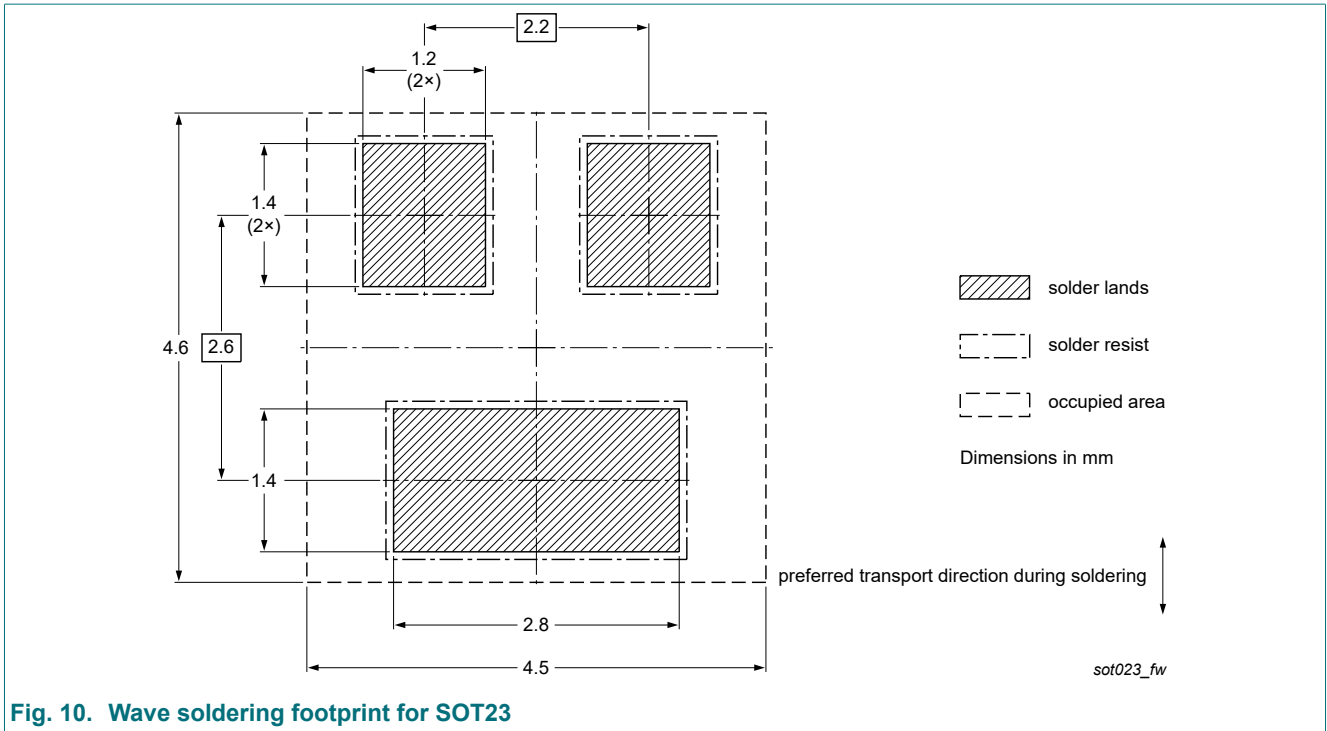


Fig. 10. Wave soldering footprint for SOT23



## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT2222A v.8	20220727	Product data sheet	-	PMBT2222A v.7
Modifications:	<ul style="list-style-type: none"> <li>Thermal characteristics: value corrected to maximum</li> <li>Characteristics: Conditions for <math>V_{CEsat}</math> corrected</li> <li>Characteristics: Conditions for <math>t_f</math> and <math>t_{off}</math> corrected</li> </ul>			
PMBT2222A v.7	20101112	Product data sheet	-	PMBT2222_2222A v.6
PMBT2222_2222A v.6				PMBT2222_2222A v.5
PMBT2222_2222A v.5	20040122	Product specification	-	PMBT2222_2222A v.4
PMBT2222_2222A v.4	19990427	Product specification	-	PMBT2222 v.3
PMBT2222 v.3	19970909	Product specification	-	-

## 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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## Contents

1. General description.....	1
2. Features and benefits.....	1
3. Applications.....	1
4. Quick reference data.....	1
5. Pinning information.....	1
6. Ordering information.....	2
7. Marking.....	2
8. Limiting values.....	2
9. Thermal characteristics.....	3
10. Characteristics.....	4
11. Test information.....	6
12. Package outline.....	7
13. Soldering.....	7
14. Revision history.....	9
15. Legal information.....	10

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