



# PMBT2222A

NPN switching transistor

5 August 2020

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	$V_{CE} = 10 \text{ V}; I_C = 150 \text{ mA}; T_j = 25 \text{ }^\circ\text{C}$	[1]	100	-	300	
		$V_{CE} = 10 \text{ V}; I_C = 500 \text{ mA}; T_j = 25 \text{ }^\circ\text{C}$	[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	<p>SOT23</p>	<p>sym021</p>
2	E	emitter		
3	C	collector		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMBT2222A	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	SOT23

## 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

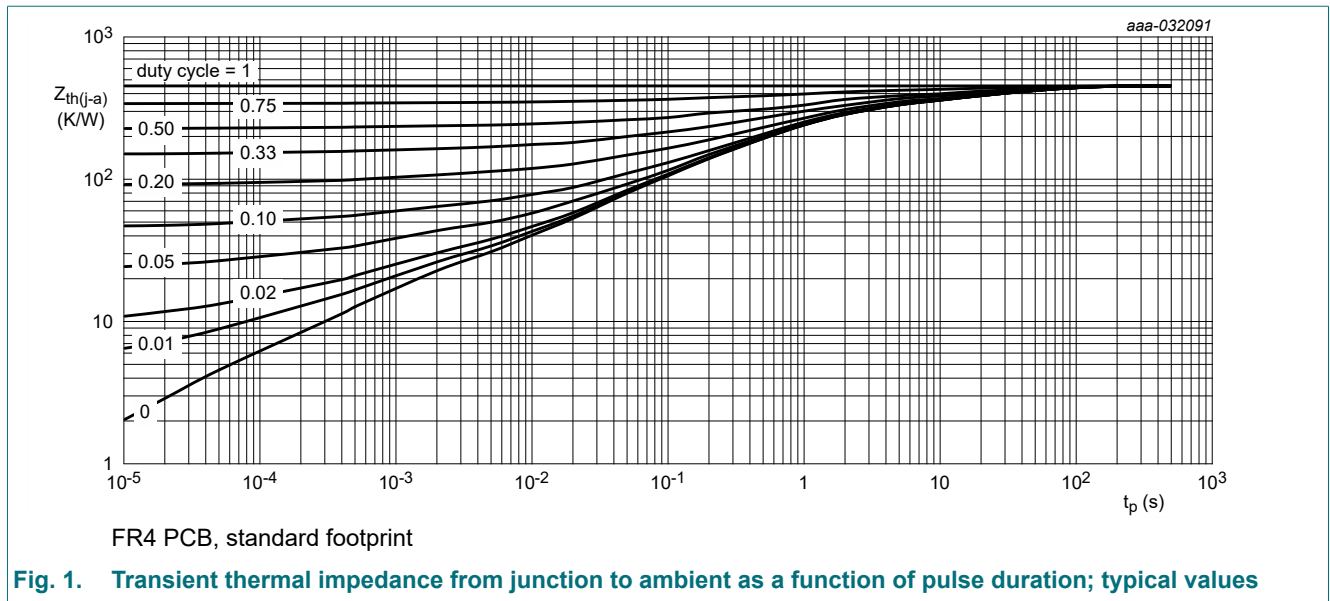
[1] Device mounted on an FR4 Printed-Circuit Board (PCM), single-sided copper, tin-plated and standard footprint.

## 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.

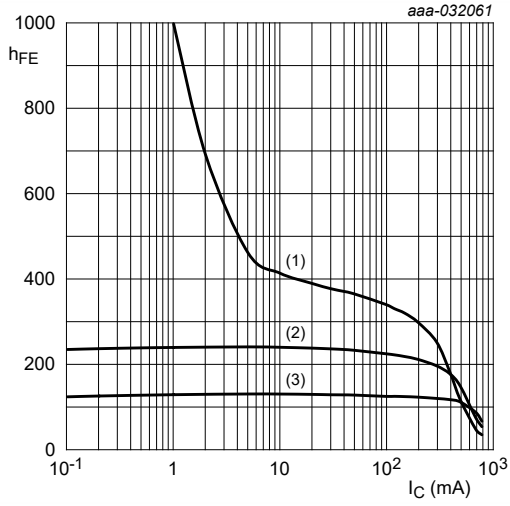


## 10. Characteristics

Table 7. Characteristics

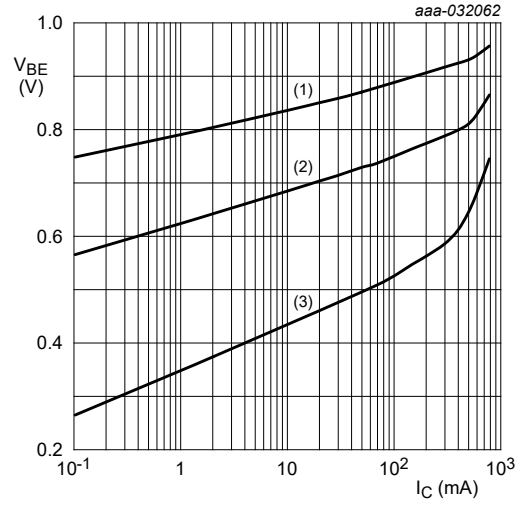
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	-	10	nA
		$V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 125\text{ }^\circ\text{C}$	-	-	10	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current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

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



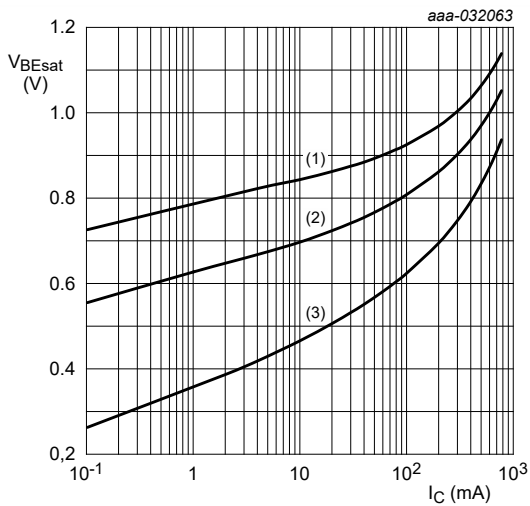
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



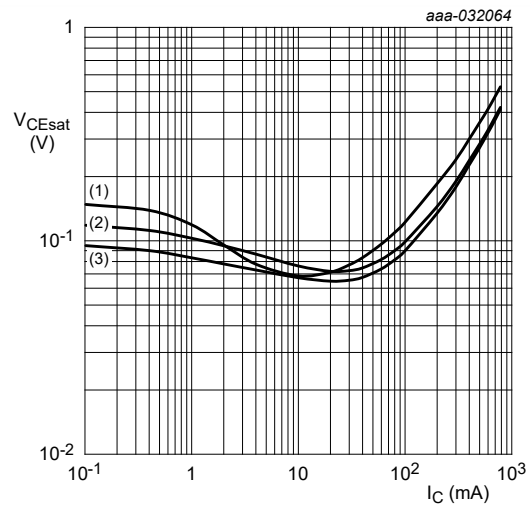
$V_{CE} = 10\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

**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

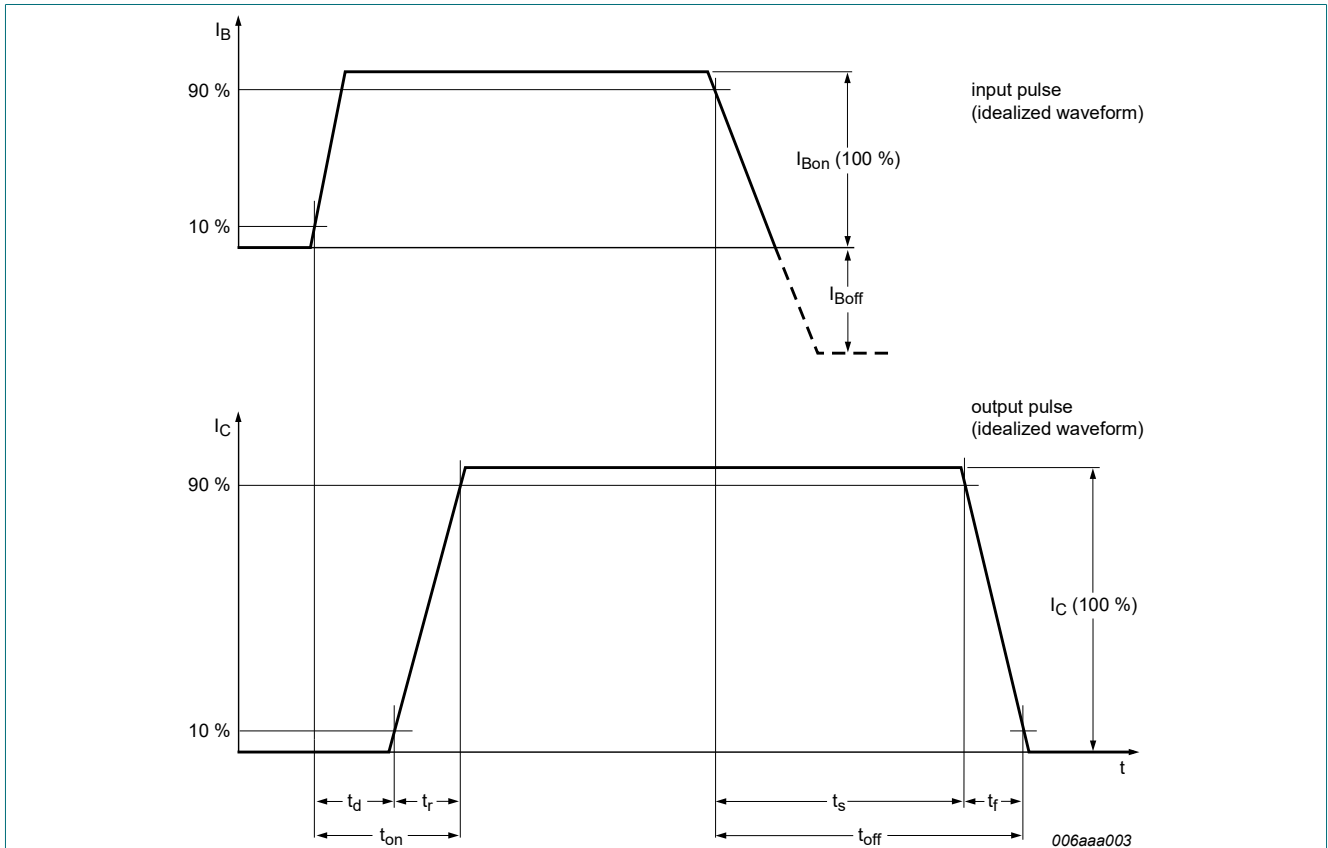


Fig. 6. BISS transistor switching time definition

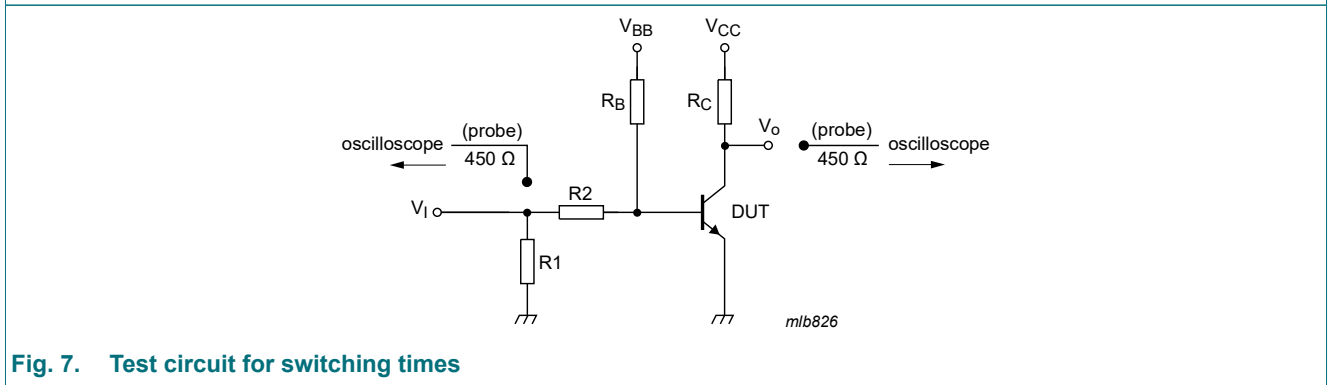


Fig. 7. Test circuit for switching times

### 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

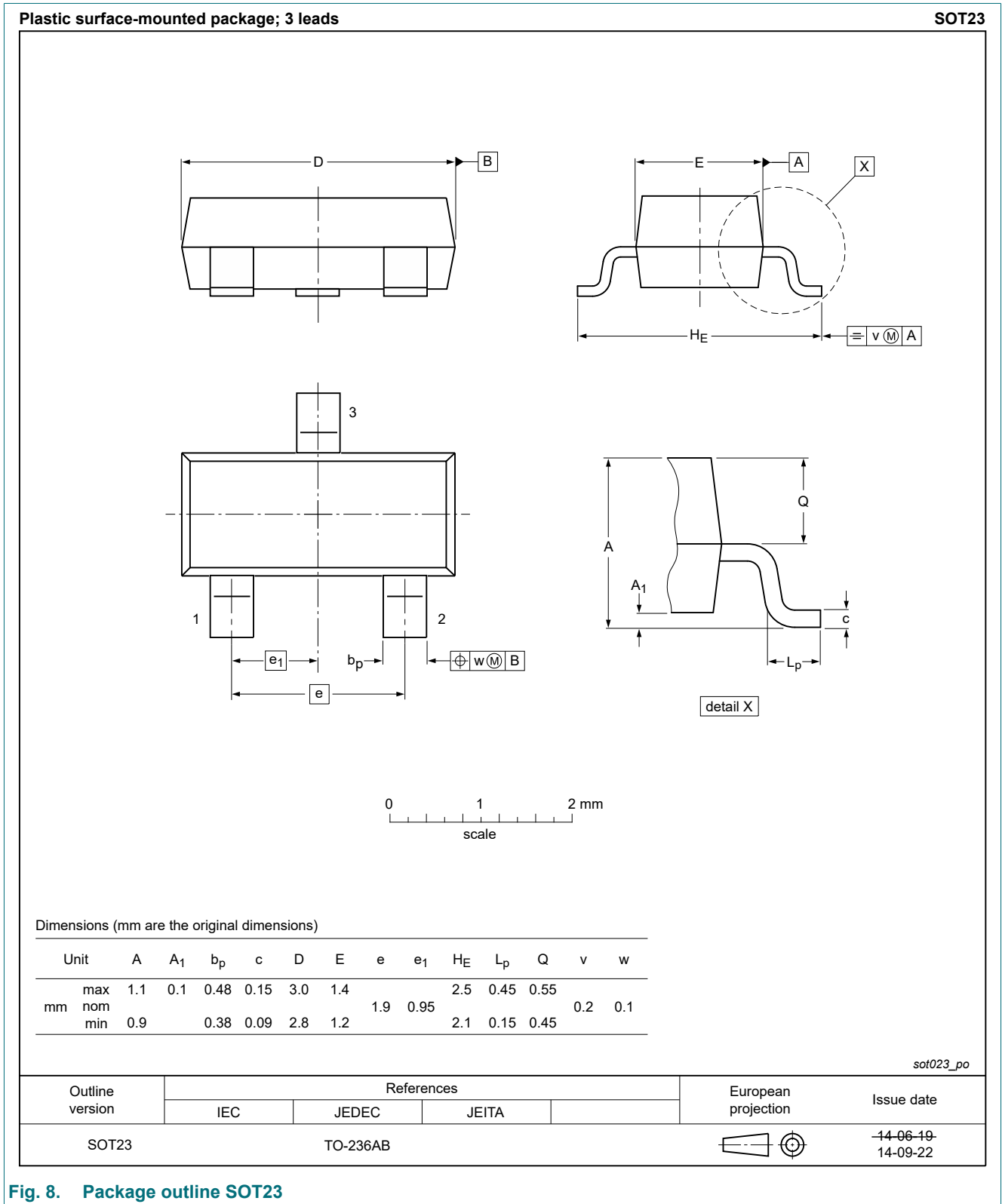


Fig. 8. Package outline SOT23

### 13. Soldering

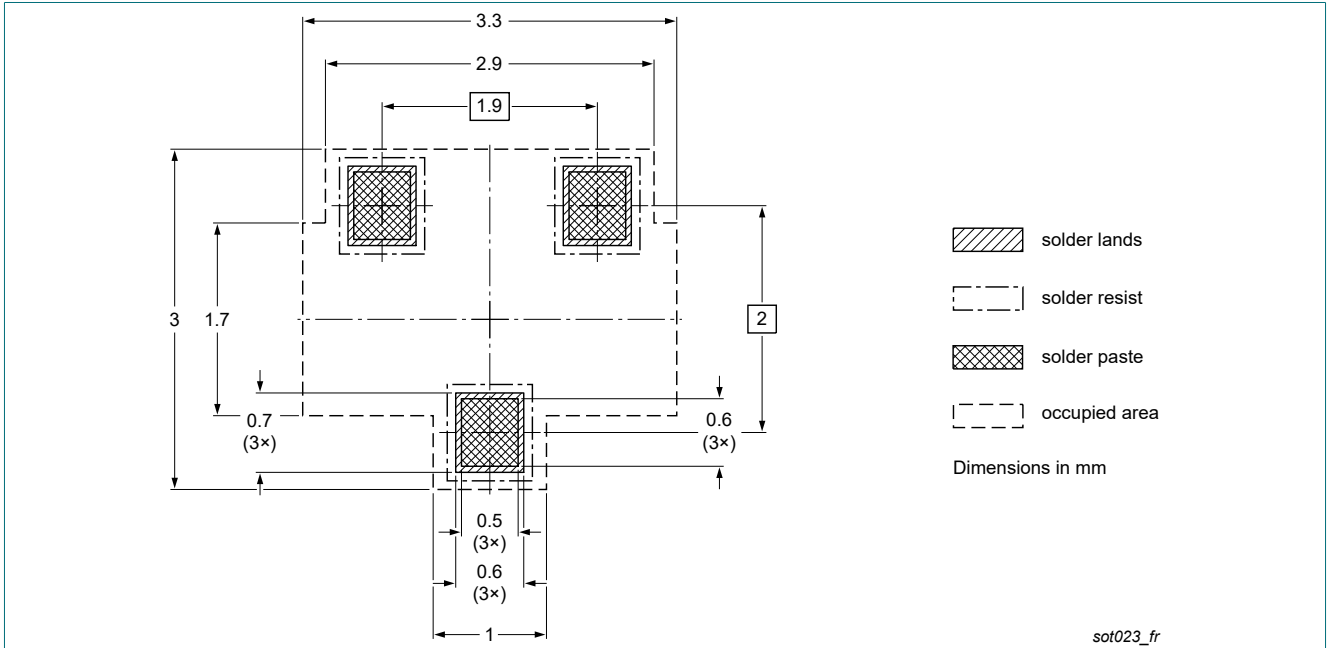


Fig. 9. Reflow soldering footprint for SOT23

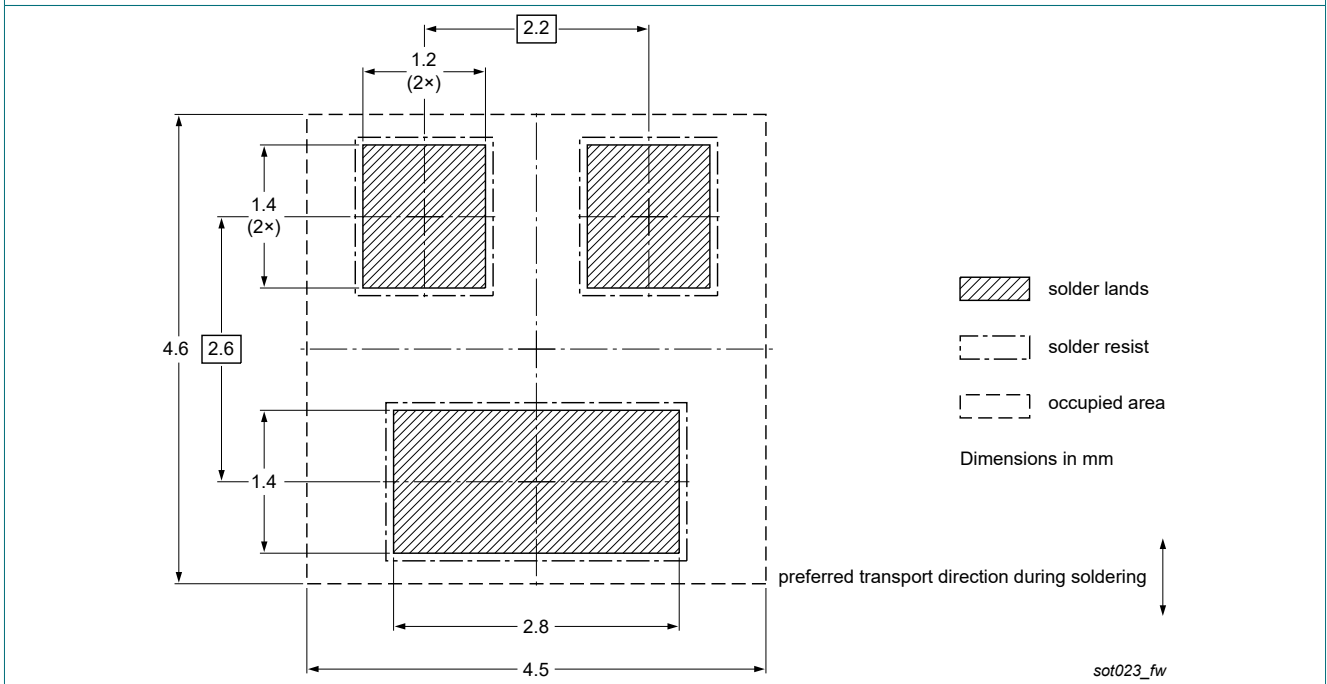


Fig. 10. Wave soldering footprint for SOT23



## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT2222A v.7	20200805	Product data sheet	-	PMBT2222_2222A v.6
Modifications:	<ul style="list-style-type: none"> <li>Data sheet splitted into single type data sheets</li> <li>Thermal characteristics: Figure 1 added</li> <li>Characteristics: Figures 2 - 4 added and conditions changed from <math>T_{sp}</math> to <math>T_j</math> in table 7</li> <li>Section "Soldering" added</li> <li>Section "Packing " removed</li> </ul>			
PMBT2222_2222A v.6	20101112	Product data sheet	-	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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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