PMBT2222

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. 30 V)
- AEC-Q101 qualified

3. Applications

- Switching and linear amplification

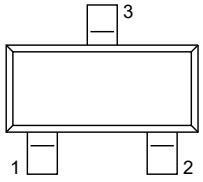
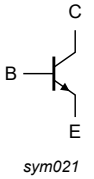
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	30	V
I_C	collector current			-	-	600	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 150 mA; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_j = 25 °C		100	-	300	
		V_{CE} = 10 V; I_C = 500 mA; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_j = 25 °C		30	-	-	

5. Pinning information

Table 2. Pinning information

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

SOT23

sym021

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMBT2222	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]
PMBT2222	%1B

[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		-	60	V
V_{CEO}	collector-emitter voltage	open base		-	30	V
V_{EBO}	emitter-base voltage	open collector		-	5	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	$T_{amb} \leq 25$ °C	[1]	-	250	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-65	150	°C
T_{stg}	storage temperature			-65	150	°C

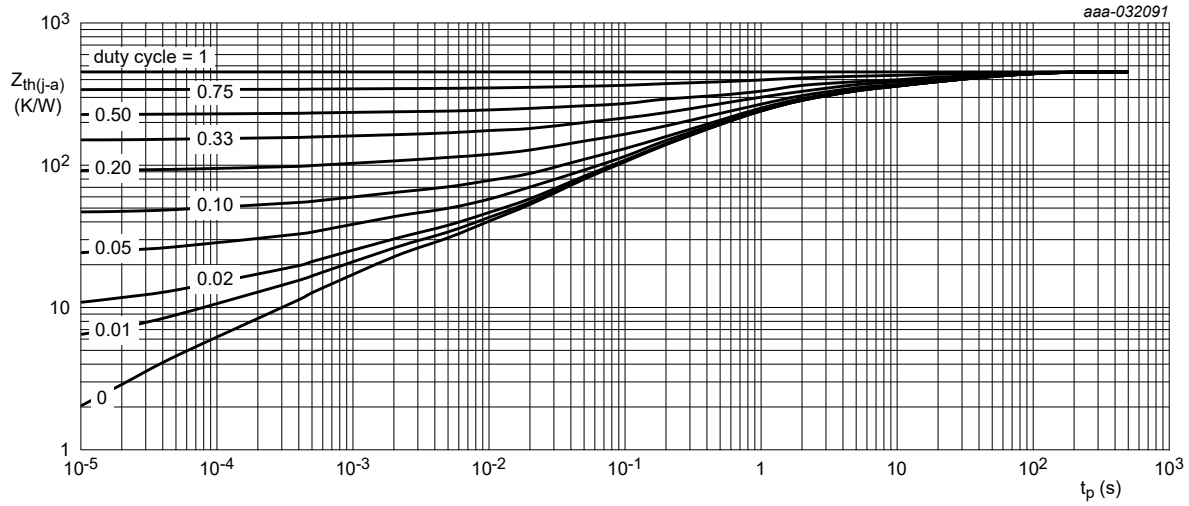
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient		[1]	-	-	500	K/W

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



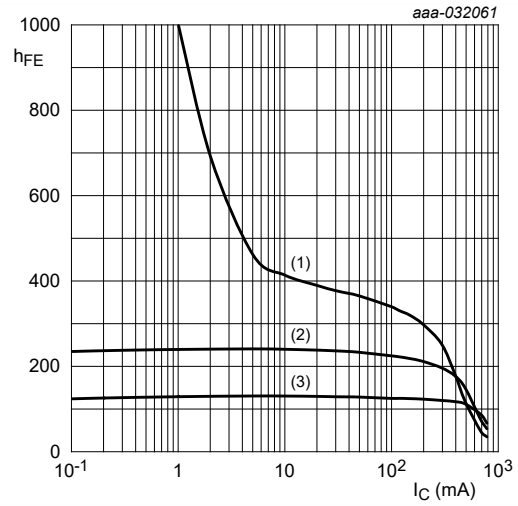
FR4 PCB, standard footprint

Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

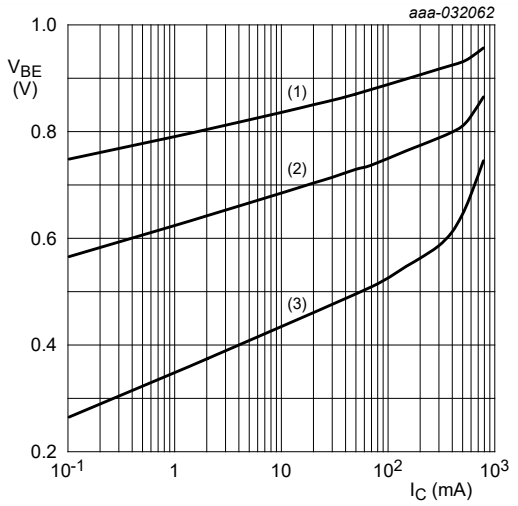
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0 A; T_j = 25 °C		-	-	10	nA
		V_{CB} = 50 V; I_E = 0 A; T_j = 125 °C		-	-	10	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A; T_j = 25 °C		-	-	10	nA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 0.1 mA; T_j = 25 °C		35	-	-	
		V_{CE} = 10 V; I_C = 1 mA; T_j = 25 °C		50	-	-	
		V_{CE} = 10 V; I_C = 10 mA; T_j = 25 °C		75	-	-	
		V_{CE} = 10 V; I_C = 10 mA; T_{amb} = -55 °C		35	-	-	
		V_{CE} = 10 V; I_C = 150 mA; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_j = 25 °C		100	-	300	
		V_{CE} = 1 V; I_C = 150 mA; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_j = 25 °C		50	-	-	
		V_{CE} = 10 V; I_C = 500 mA; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_j = 25 °C		30	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; T_j = 25 °C		-	-	400	mV
		I_C = 500 mA; I_B = 50 mA; T_j = 25 °C		-	-	1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = 150 mA; I_B = 15 mA; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_j = 25 °C		-	-	1.3	V
		I_C = 500 mA; I_B = 50 mA; $t_p \leq$ 300 µs; $\delta \leq$ 0.02; T_j = 25 °C		-	-	2.6	V
t_d	delay time	I_C = 150 mA; I_{Bon} = 15 mA; I_{Boff} = -15 mA; V_{CC} = 10 V; T_j = 25 °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 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_j = 25 °C		-	-	8	pF
C_e	emitter capacitance	V_{EB} = 500 V; I_C = 0 A; i_c = 0 A; f = 1 MHz; T_j = 25 °C		-	-	30	pF
f_T	transition frequency	V_{CE} = 20 V; I_C = 20 mA; f = 100 MHz; T_j = 25 °C		250	-	-	MHz
NF	noise figure	V_{CE} = 5 V; I_C = 100 µA; R_S = 1 kΩ; f = 1 kHz; T_j = 25 °C		-	-	4	dB



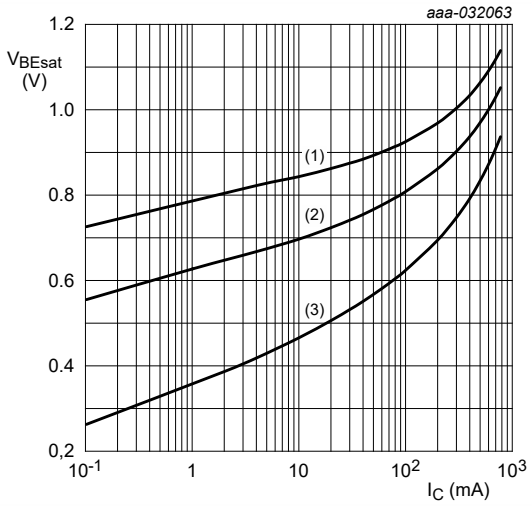
V_{CE} = 10 V
(1) T_{amb} = 150 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −55 °C

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



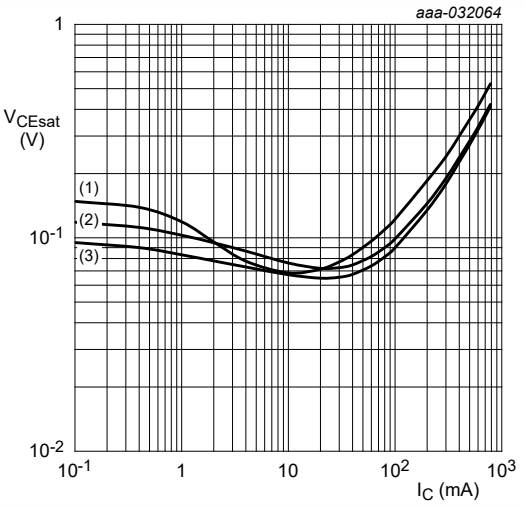
V_{CE} = 10 V
(1) T_{amb} = -55 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 150 °C

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



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

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



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

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

11. Test information

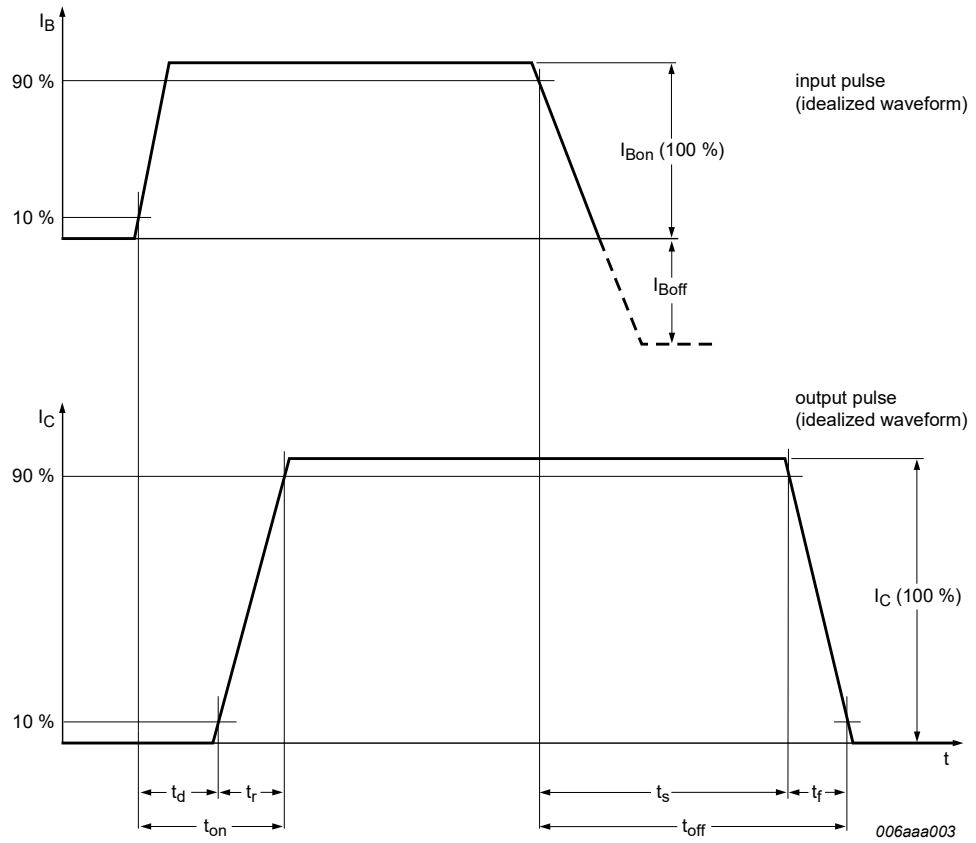


Fig. 6. BISS transistor switching time definition

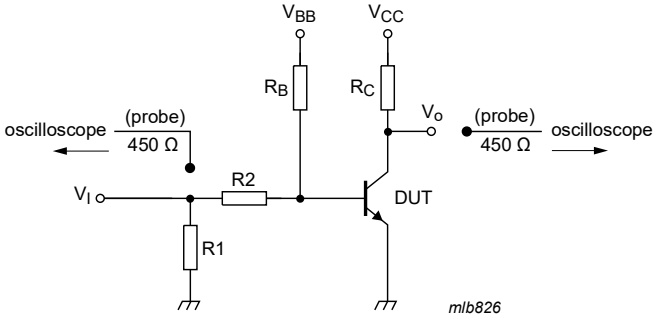


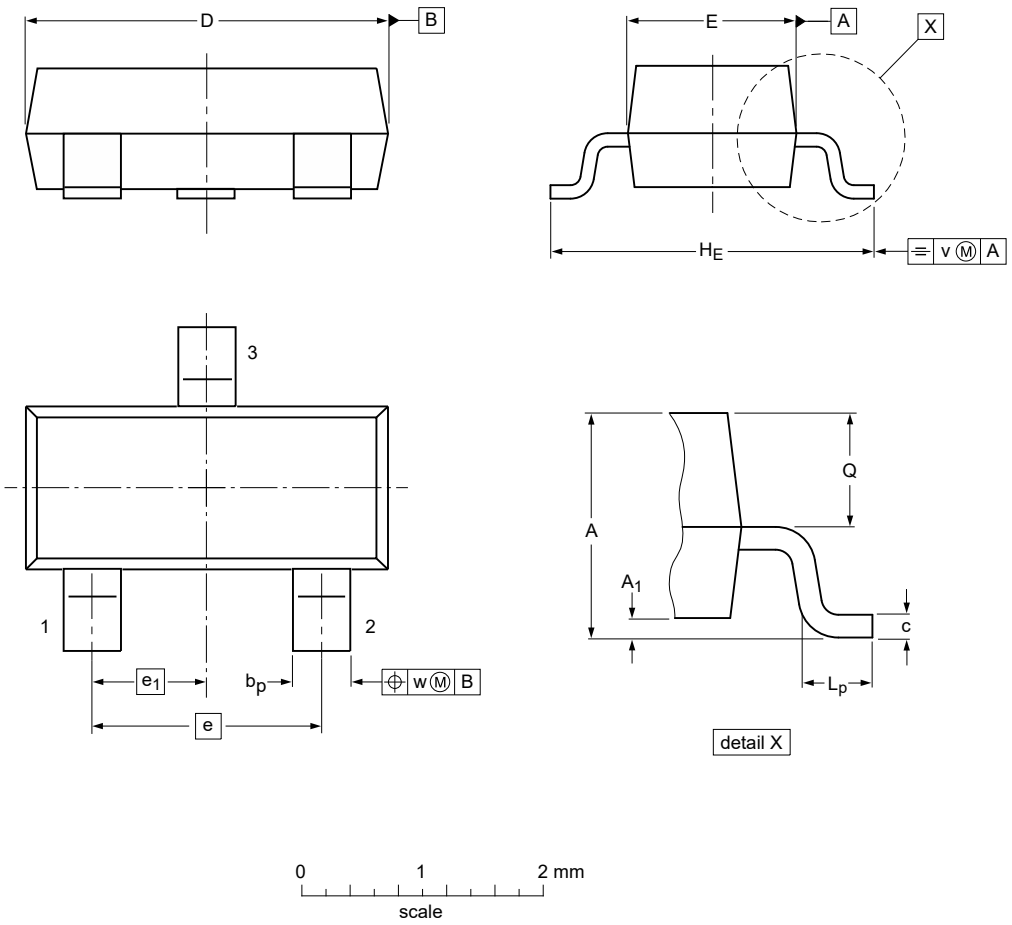
Fig. 7. Test circuit for switching times

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

Plastic surface-mounted package; 3 leads **SOT23**



Dimensions (mm are the original dimensions)

Unit		A	A_1	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	max	1.1	0.1	0.48	0.15	3.0	1.4			2.5	0.45	0.55		
	nom							1.9	0.95				0.2	0.1
	min	0.9		0.38	0.09	2.8	1.2			2.1	0.15	0.45		

sot023_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT23		TO-236AB				~~14-06-19~~ 14-09-22

Fig. 8. Package outline SOT23

13. Soldering

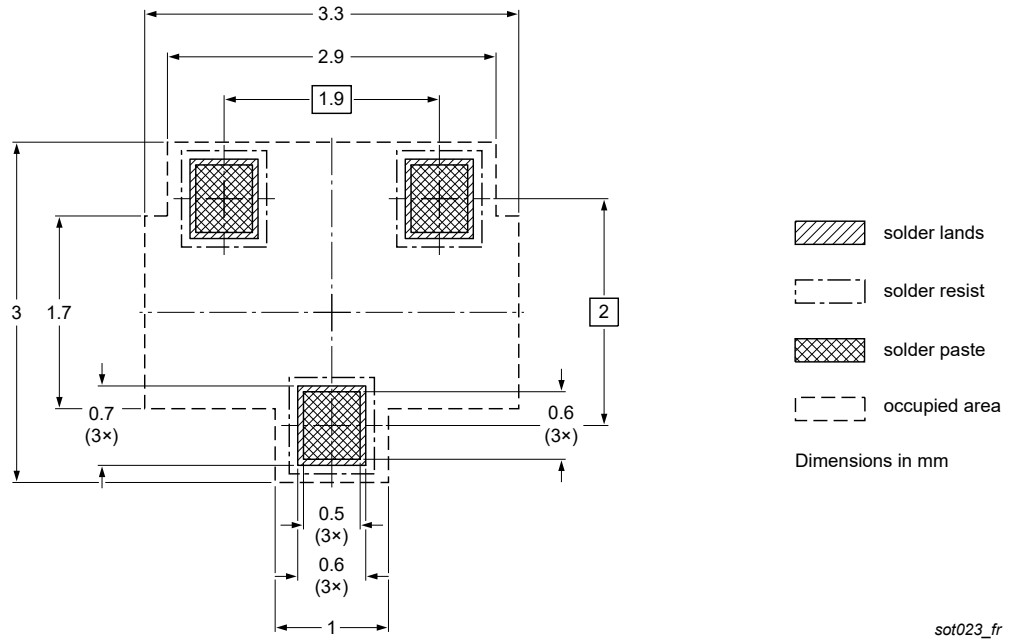


Fig. 9. Reflow soldering footprint for SOT23

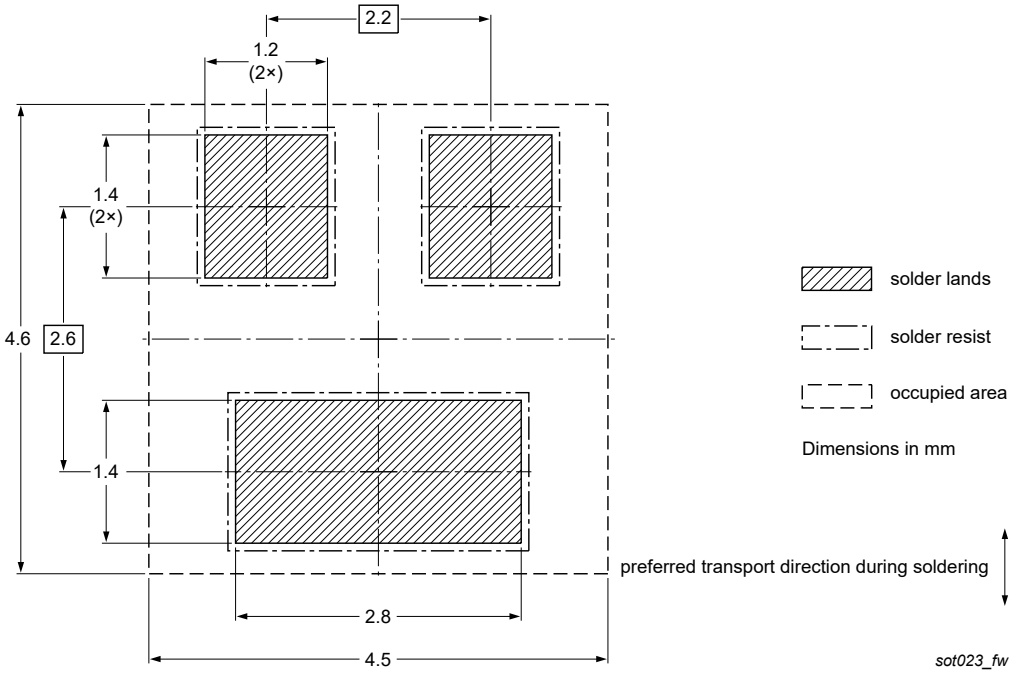


Fig. 10. Wave soldering footprint for SOT23

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT2222 v.7	20200805	Product data sheet	-	PMBT2222_2222A v.6
Modifications:	• Data sheet splitted into single type data sheets • Thermal characteristics: Figure 1 added • Characteristics: Figures 2 - 4 added • Section "Soldering" added • Section "Packing" removed			
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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