



# PMBT3904MB

40 V, 200 mA NPN switching transistor

Rev. 1 — 7 March 2012

Product data sheet

## 1. Product profile

### 1.1 General description

NPN single switching transistor in a leadless ultra small SOT883B Surface-Mounted Device (SMD) plastic package.

PNP complement: PMBT3906MB.

### 1.2 Features and benefits

- Single general-purpose switching transistor
- AEC-Q101 qualified
- Ultra small SMD plastic package
- Board-space reduction
- Low package height of 0.37 mm

### 1.3 Applications

- General-purpose switching and amplification
- Mobile applications

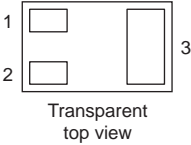
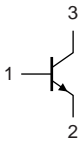
### 1.4 Quick reference data

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	

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	base		
2	emitter		
3	collector		

*sym021*



### 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PMBT3904MB		leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.37 mm	SOT883B

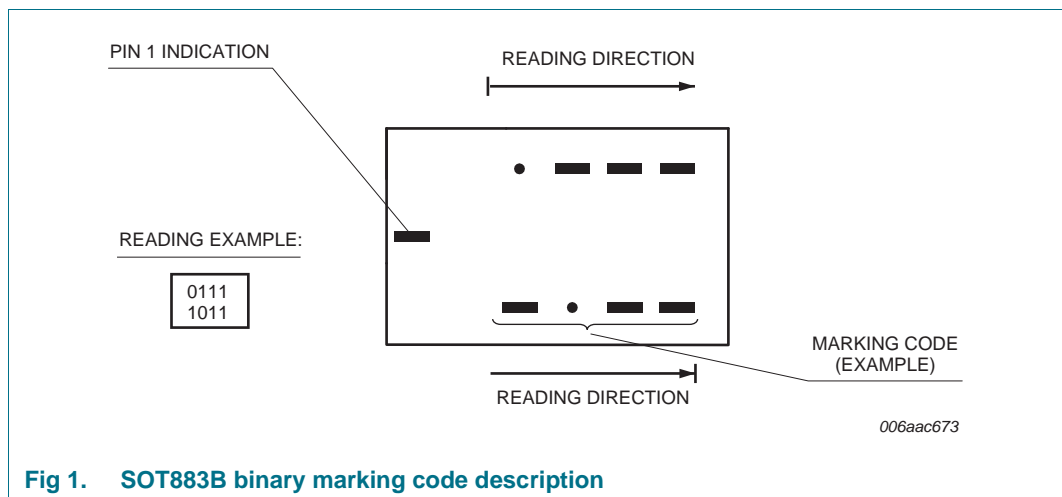
### 4. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PMBT3904MB	0100 0111

[1] For SOT883B binary marking code description see [Figure 1](#).

#### 4.1 Binary marking code description



## 5. 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	single pulse; $t_p \leq 1$ ms	-	100	mA	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1][2]	-	250	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 cm<sup>2</sup>.

## 6. Thermal characteristics

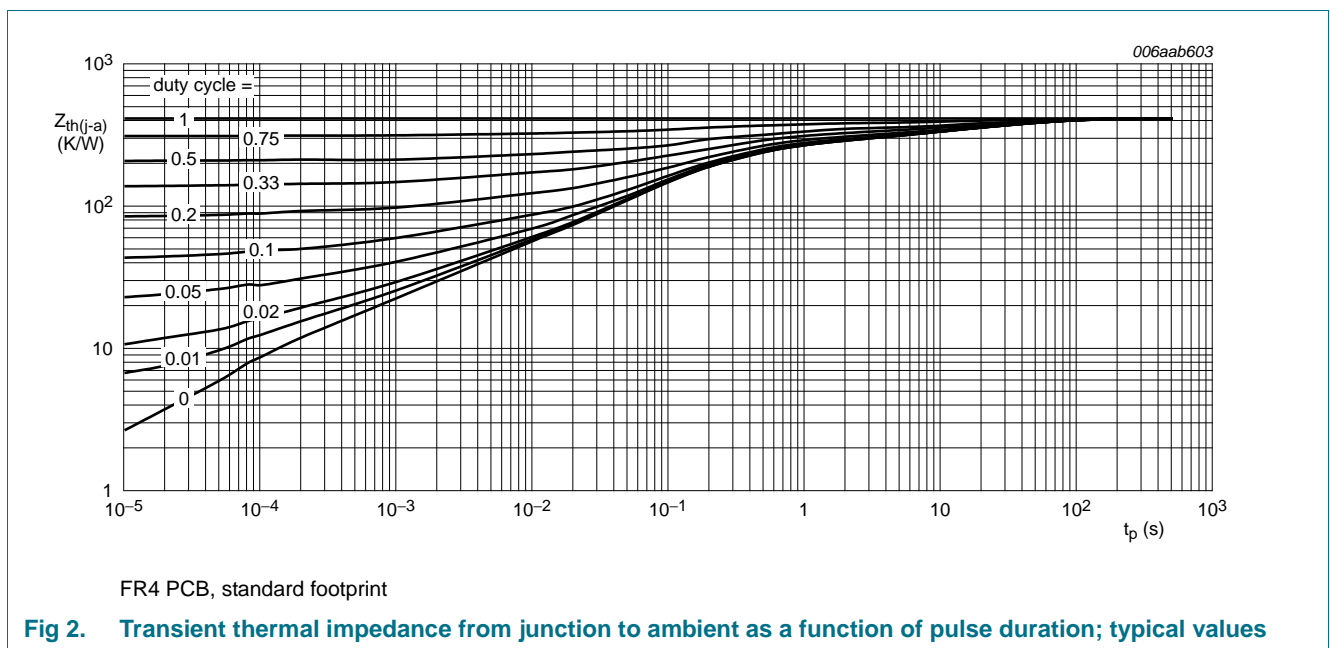
**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1][2]	-	-	500	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 cm<sup>2</sup>.



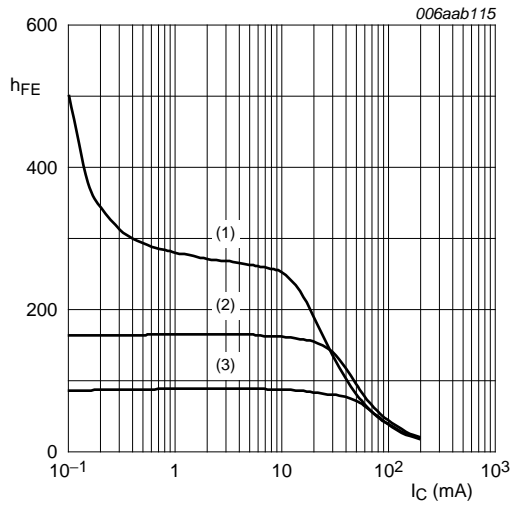
**Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

## 7. Characteristics

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

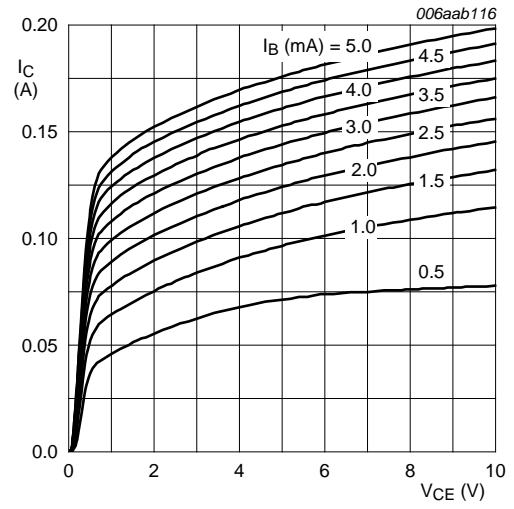
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 30\text{ V}; I_E = 0\text{ A}$	-	-	50	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 6\text{ V}; I_C = 0\text{ A}$	-	-	50	nA
$h_{FE}$	DC current gain	$V_{CE} = 1\text{ V}$				
		$I_C = 0.1\text{ mA}$	60	180	-	
		$I_C = 1\text{ mA}$	80	180	-	
		$I_C = 10\text{ mA}$	100	180	300	
		$I_C = 50\text{ mA}$	60	105	-	
$V_{CEsat}$	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	$V_{CC} = 3\text{ V}; I_C = 10\text{ mA}; I_{Bon} = 1\text{ mA}; I_{Boff} = -1\text{ mA}$	-	-	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	$V_{CB} = 5\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$	-	-	4	pF
$C_e$	emitter capacitance	$V_{EB} = 500\text{ mV}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$	-	-	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	$V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}; R_S = 1\text{ k}\Omega; f = 10\text{ Hz to }15.7\text{ kHz}$	-	-	5	dB

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



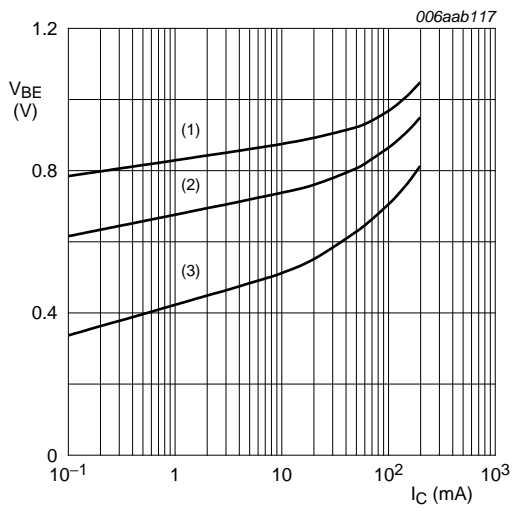
- $V_{CE} = 1\text{ V}$
- (1)  $T_{amb} = 150\text{ °C}$
  - (2)  $T_{amb} = 25\text{ °C}$
  - (3)  $T_{amb} = -55\text{ °C}$

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



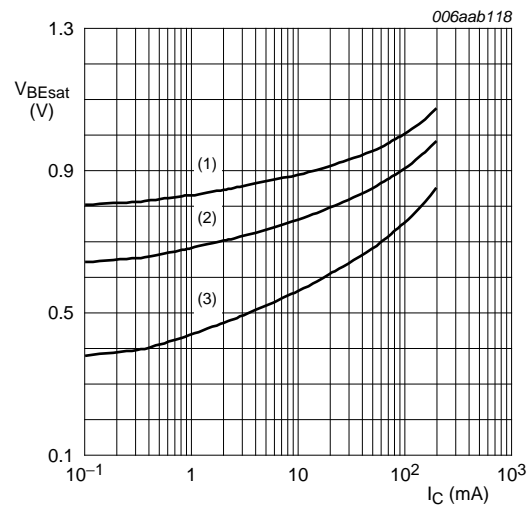
$T_{amb} = 25\text{ °C}$

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



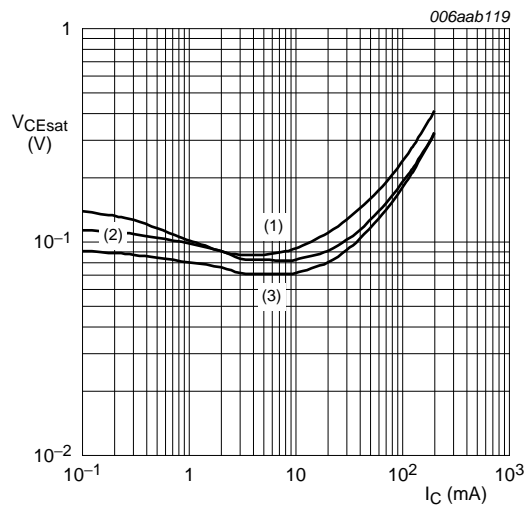
$V_{CE} = 1\text{ V}$   
 (1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

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



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

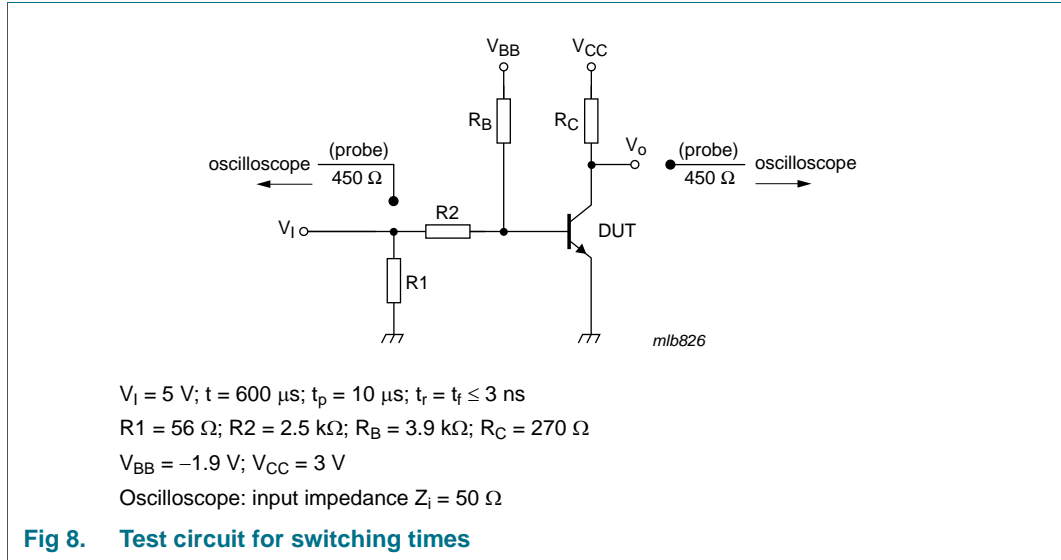
**Fig 6. Base-emitter saturation voltage as a function of collector current; typical values**



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

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

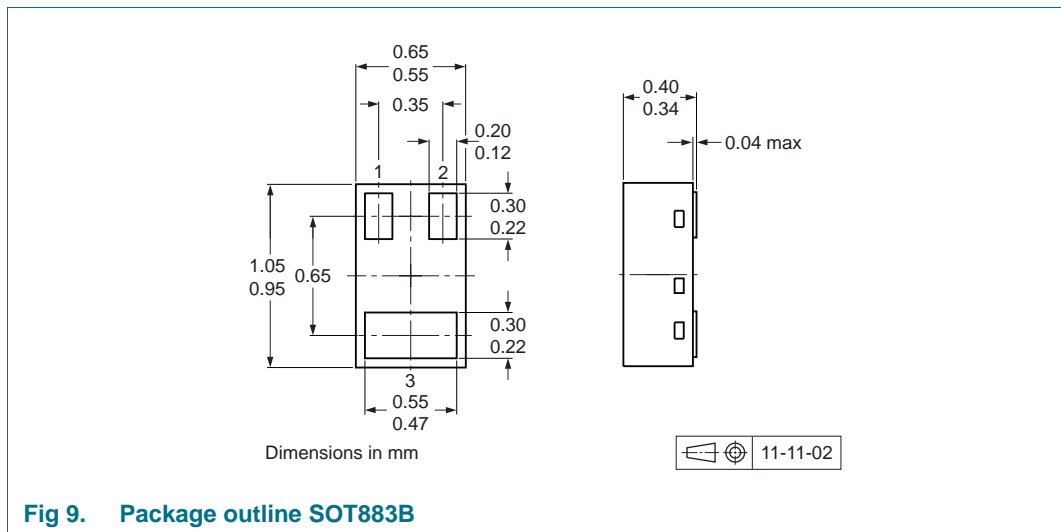
**8. Test information**



**8.1 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.

**9. Package outline**





## 10. Packing information

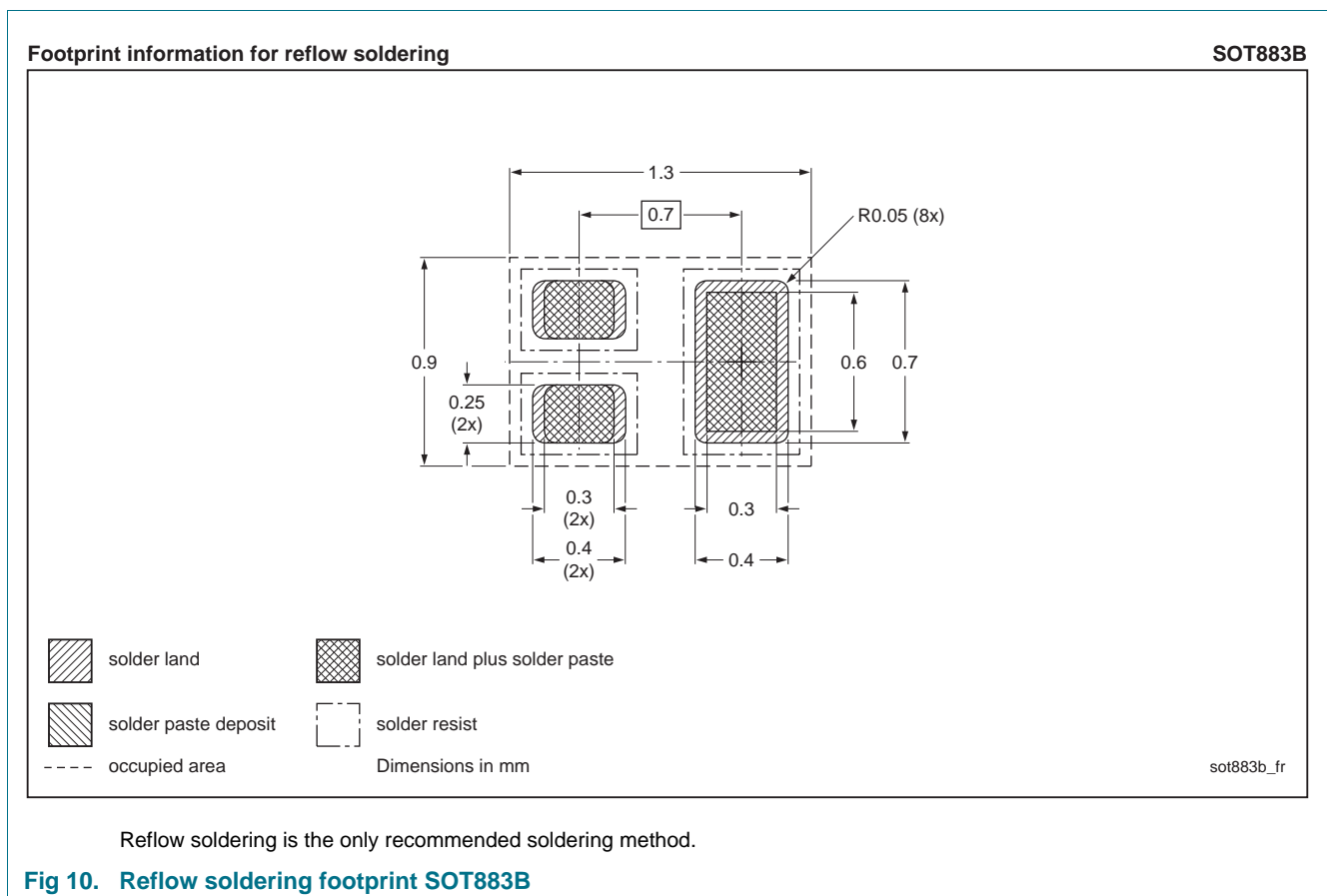
**Table 8. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

Type number	Package	Description	Packing quantity
			10000
PMBT3904MB	SOT883B	2 mm pitch, 8 mm tape and reel	-315

[1] For further information and the availability of packing methods, see [Section 14](#).

## 11. Soldering



## 12. Revision history

**Table 9.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3904MB v.1	20120307	Product data sheet	-	-

## 13. Legal information

### 13.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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