



# PMBT3904M

40 V, 200 mA NPN switching transistor

2 May 2019

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

## 3. Applications

- General-purpose switching and amplification

## 4. Quick reference data

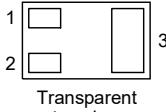
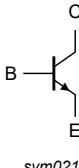
Table 1. Quick reference data

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

**nexperia**

## 5. Pinning information

**Table 2. Pinning information**

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

## 6. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
PMBT3904M	DFN1006-3	DFN1006-3: leadless ultra small plastic package; 3 solder lands	SOT883

## 7. Marking

**Table 4. Marking codes**

Type number	Marking code
PMBT3904M	6P

## 8. Limiting values

**Table 5. Limiting values**

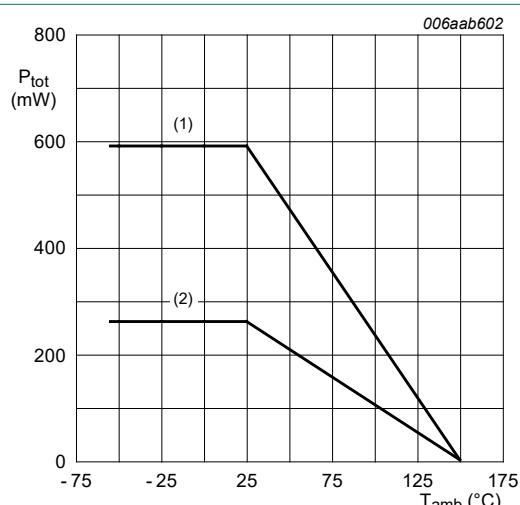
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

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 cm<sup>2</sup>.



(1) FR4 PCB, mounting pad for collector 1 cm<sup>2</sup>

(2) FR4 PCB, standard footprint

**Fig. 1. Power derating curves SOT883 (SC-101)**

## 9. Thermal characteristics

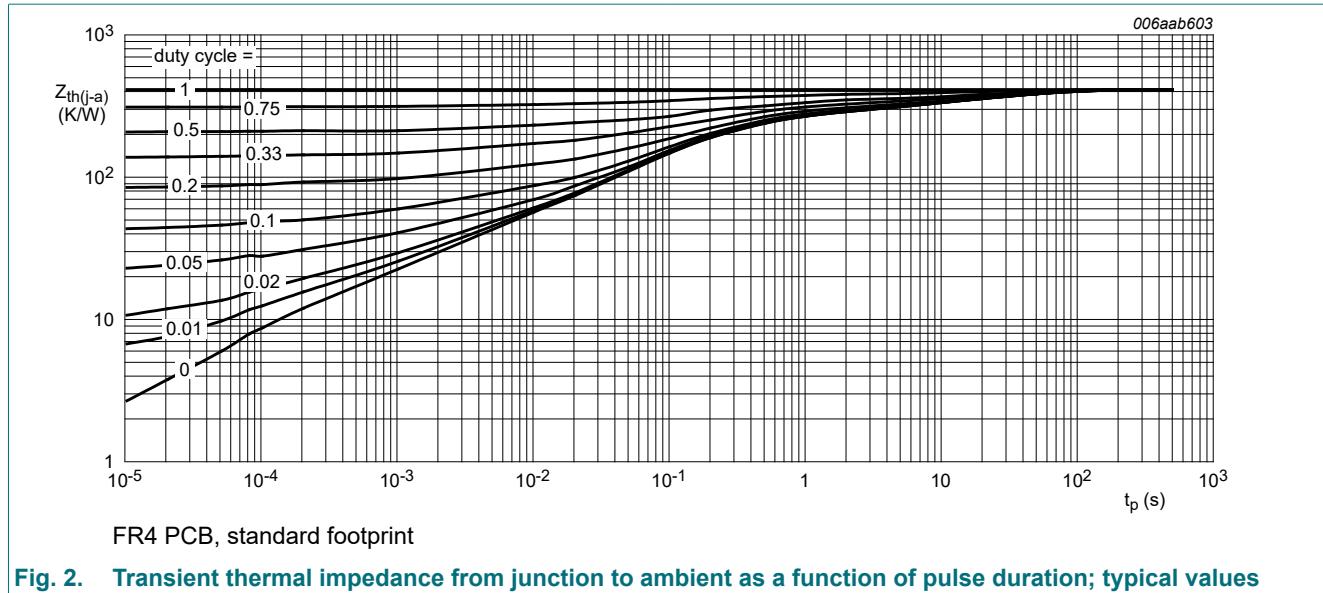
Table 6. Thermal characteristics

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 cm<sup>2</sup>.



## 10. Characteristics

**Table 7. Characteristics**

$T_{amb} = 25^\circ\text{C}$  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	-	
		$V_{CE} = 1\text{ V}$ ; $I_C = 1\text{ mA}$	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	pF
$C_e$	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

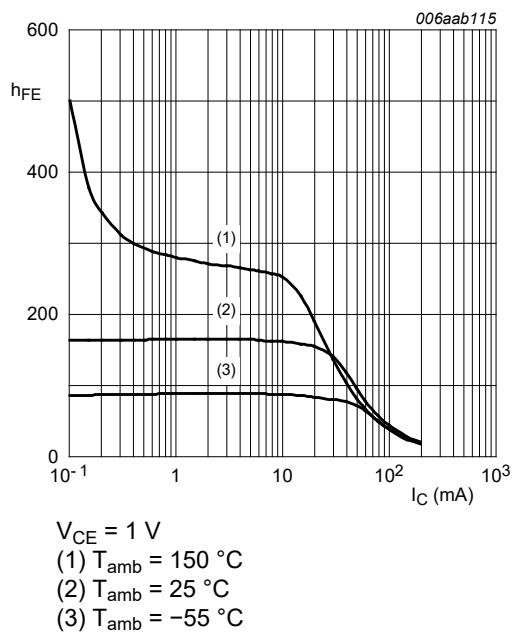


Fig. 3. DC current gain as a function of collector current; typical values

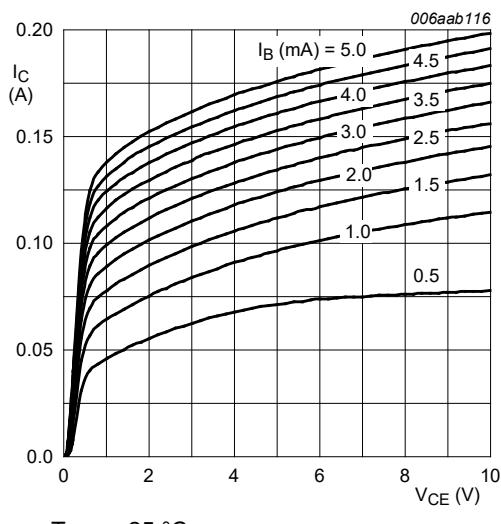


Fig. 4. Collector current as a function of collector-emitter voltage; typical values

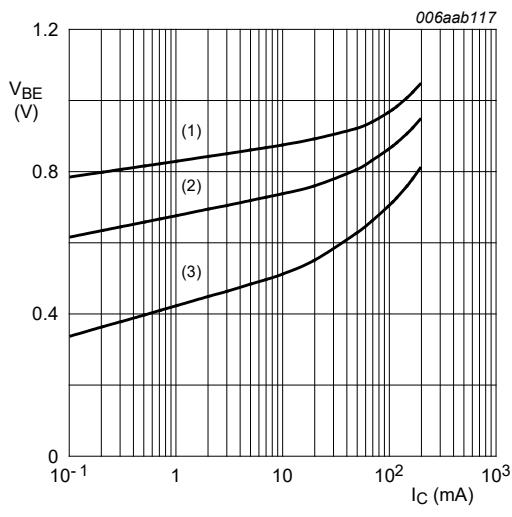


Fig. 5. Base-emitter voltage as a function of collector current; typical values

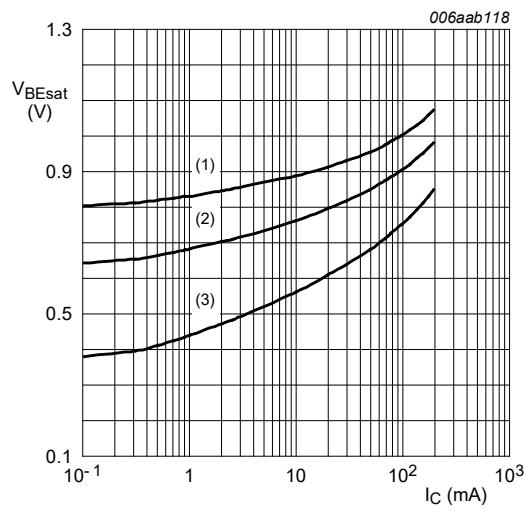
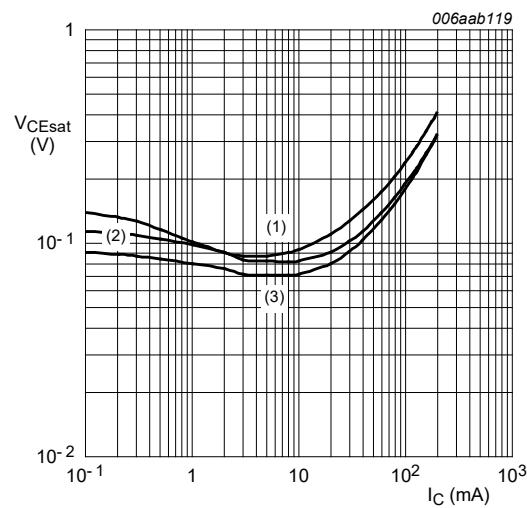


Fig. 6. Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 10$   
 (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

## 11. Test information

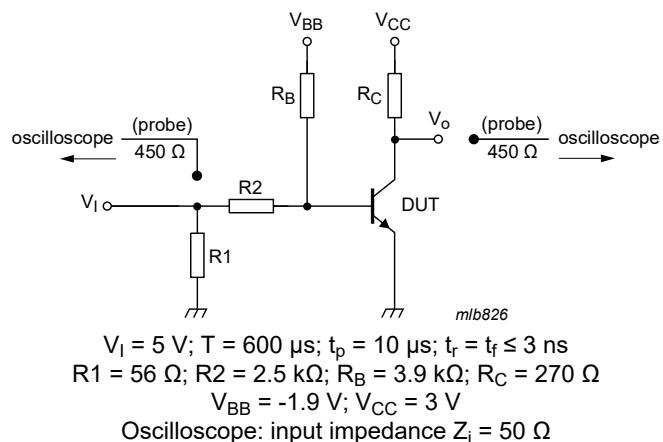
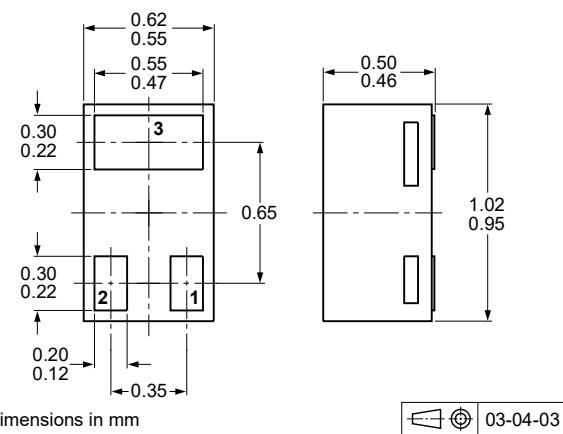


Fig. 8. Test circuit for switching times

## 12. Package outline



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

## 13. Soldering

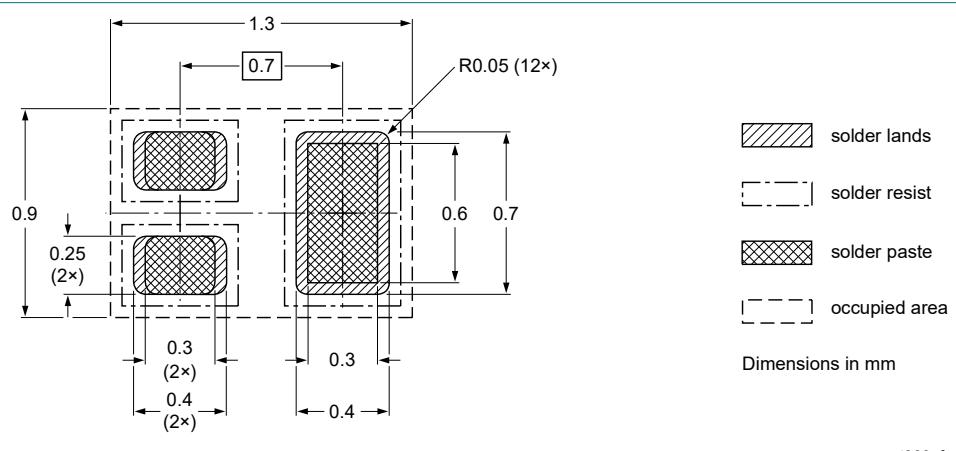


Fig. 10. Reflow soldering footprint for DFN1006-3 (SOT883)

## 14. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3904M v.2	20190502	Product data sheet	-	PMBT3904M v.1
Modifications:	<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>			
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.
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