

BOTTOM VIEW

PMBT3904M

40 V, 200 mA NPN switching transistor

Rev. 01 — 21 July 2009

Product data sheet

1. Product profile

1.1 General description

NPN single switching transistor in a SOT883 (SC-101) leadless ultra small Surface-Mounted Device (SMD) plastic package.

PNP complement: PMBT3906M.

1.2 Features

- Single general-purpose switching transistor
- Board-space reduction
- Ultra small SMD plastic package

1.3 Applications

- General-purpose switching and amplification

1.4 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	$V_{CE} = 1 \text{ V};$ $I_C = 10 \text{ mA}$	100	180	300	

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	base	Transparent top view	sym021
2	emitter		
3	collector		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMBT3904M	SC-101	leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm	SOT883

4. Marking

Table 4. Marking codes

Type number	Marking code
PMBT3904M	6P

5. Limiting values

Table 5. Limiting values

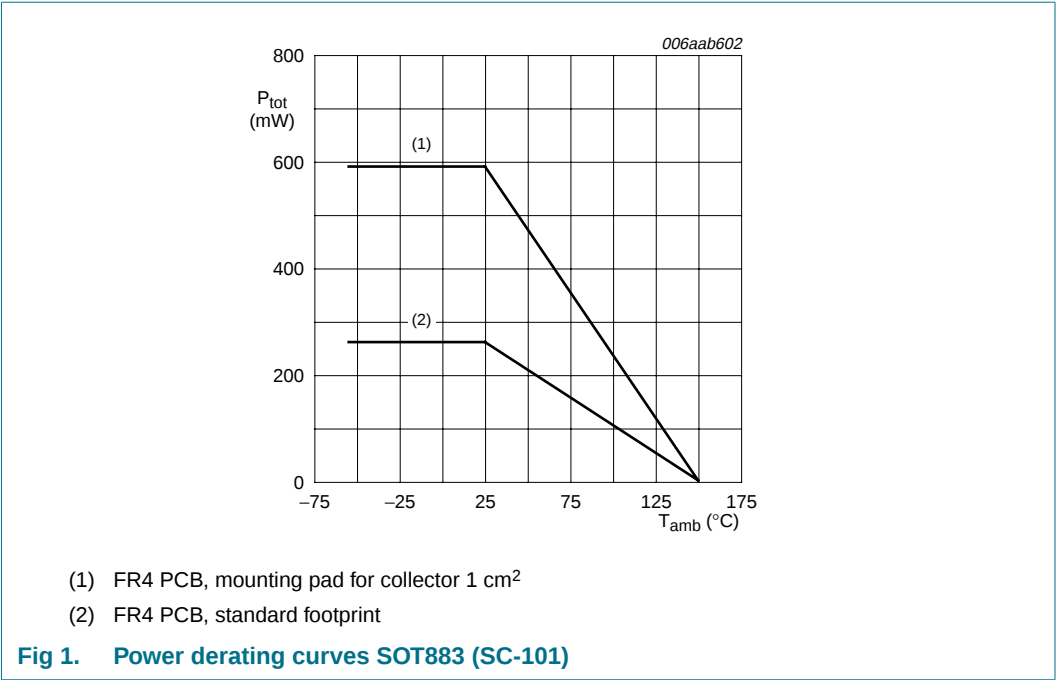
In accordance with the Absolute Maximum Rating System (IEC 60134).

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 ≤ 1 ms	-	200	mA	
I _{BM}	peak base current	single pulse; t _p ≤ 1 ms	-	100	mA	
P _{tot}	total power dissipation	T _{amb} ≤ 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 cm².



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]	-	-	481 K/W
			[1][3]	-	-	212 K/W

[1]

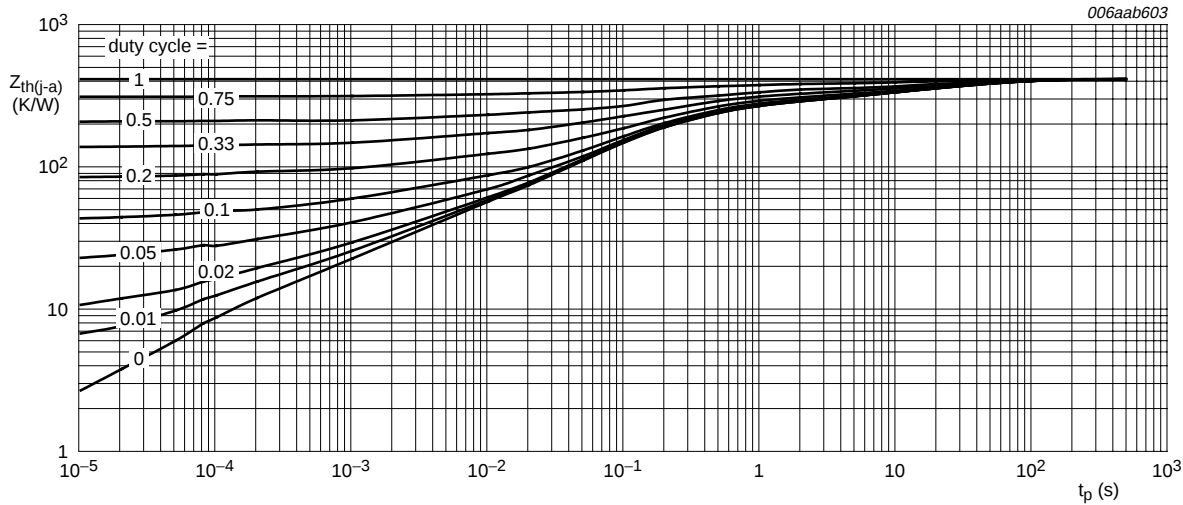
Reflow soldering is the only recommended soldering method.

[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 cm².



FR4 PCB, standard footprint

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

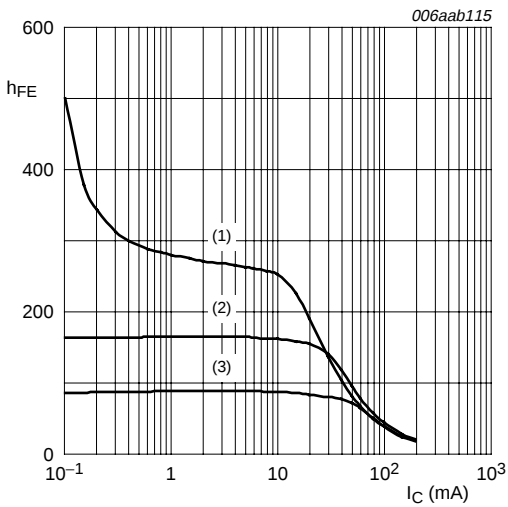
7. Characteristics

Table 7. Characteristics
T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I _{CBO}	collector-base cut-off current	V _{CB} = 30 V; I _E = 0 A	-	-	50	nA
I _{EBO}	emitter-base cut-off current	V _{EB} = 6 V; I _C = 0 A	-	-	50	nA
h _{FE}	DC current gain	V _{CE} = 1 V				
		I _C = 0.1 mA	60	180	-	
		I _C = 1 mA	80	180	-	
		I _C = 10 mA	100	180	300	
		I _C = 50 mA	60	105	-	
		I _C = 100 mA	30	50	-	
V _{CEsat}	collector-emitter saturation voltage	I _C = 10 mA; I _B = 1 mA	-	75	200	mV
		I _C = 50 mA; I _B = 5 mA	-	120	300	mV
V _{BEsat}	base-emitter saturation voltage	I _C = 10 mA; I _B = 1 mA	650	750	850	mV
		I _C = 50 mA; I _B = 5 mA	-	850	950	mV
t _d	delay time	V _{CC} = 3 V; I _C = 10 mA;	-	-	35	ns
t _r	rise time	I _{Bon} = 1 mA;	-	-	35	ns
t _{on}	turn-on time	I _{Boff} = -1 mA	-	-	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 V; I _E = i _e = 0 A; f = 1 MHz	-	-	4	pF

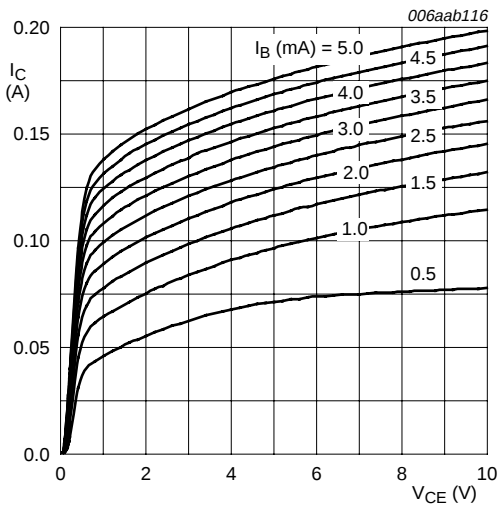
Table 7. Characteristics ...continued
T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C _e	emitter capacitance	V _{EB} = 500 mV; I _C = i _c = 0 A; f = 1 MHz	-	-	8	pF
f _T	transition frequency	V _{CE} = 20 V; I _C = 10 mA; f = 100 MHz	300	-	-	MHz
NF	noise figure	V _{CE} = 5 V; I _C = 100 μA; R _S = 1 kΩ; f = 10 Hz to 15.7 kHz	-	-	5	dB



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

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



T_{amb} = 25 °C

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

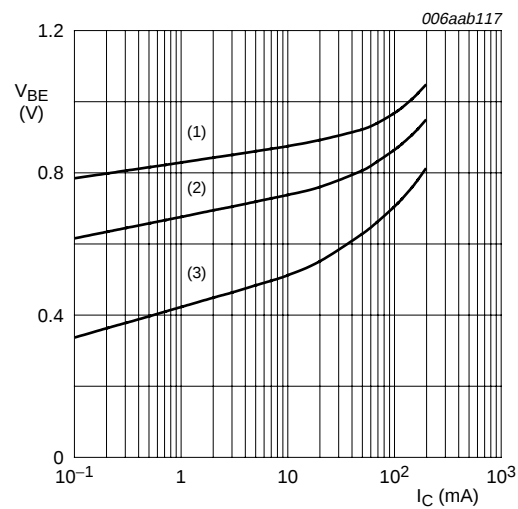


Fig 5. Base-emitter voltage as a function of collector current; typical values

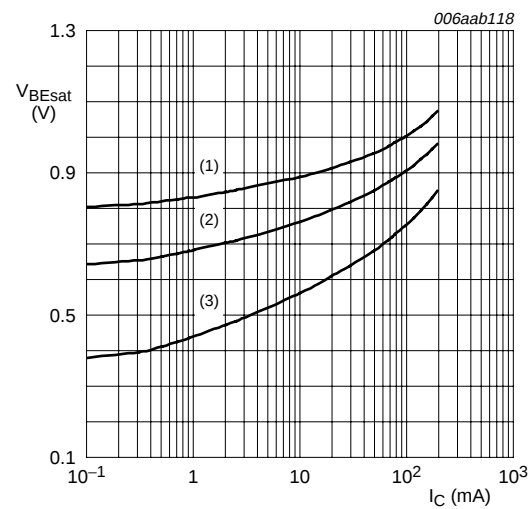


Fig 6. Base-emitter saturation voltage as a function of collector current; typical values

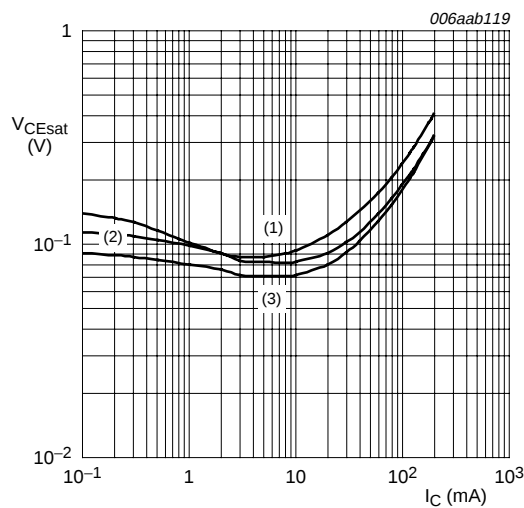
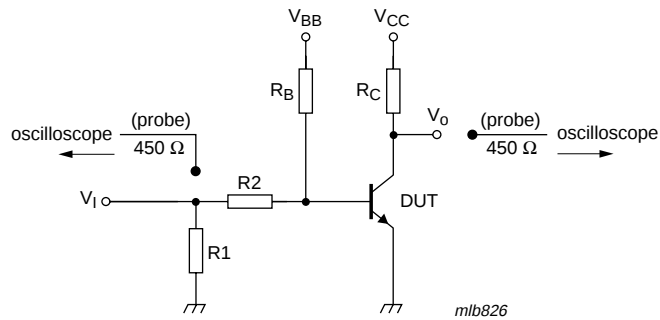


Fig 7. Collector-emitter saturation voltage as a function of collector current; typical values

8. Test information



$V_I = 5 \text{ V}$; $t = 600 \mu\text{s}$; $t_p = 10 \mu\text{s}$; $t_r = t_f \leq 3 \text{ ns}$
 $R_1 = 56 \Omega$; $R_2 = 2.5 \text{ k}\Omega$; $R_B = 3.9 \text{ k}\Omega$; $R_C = 270 \Omega$
 $V_{BB} = -1.9 \text{ V}$; $V_{CC} = 3 \text{ V}$
 Oscilloscope: input impedance $Z_i = 50 \Omega$

Fig 8. Test circuit for switching times

9. Package outline

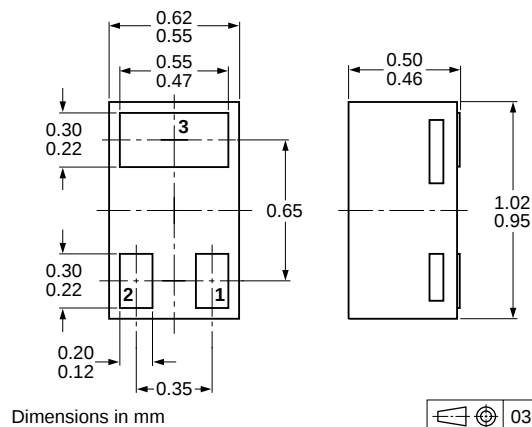


Fig 9. Package outline SOT883 (SC-101)

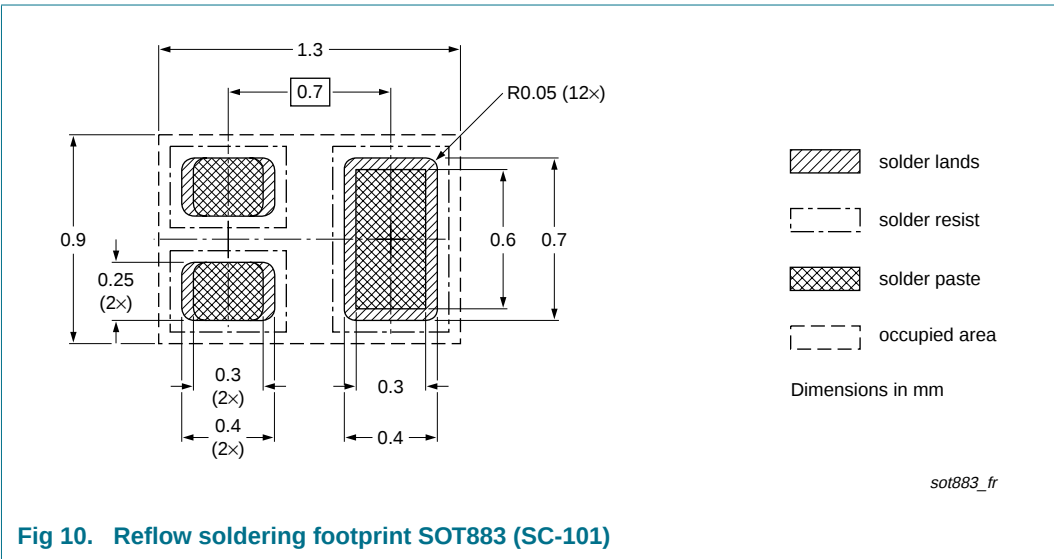
10. Packing information

Table 8. Packing methods
The indicated -xxx are the last three digits of the 12NC ordering code.[\[1\]](#)

Type number	Package	Description	Packing quantity
			10000
PMBT3904M	SOT883	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
PMBT3904M_1	20090721	Product data sheet	-	-

13. Legal information

13.1 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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15. Contents

1 Product profile 1

1.1 General description..... 1

1.2 Features 1

1.3 Applications 1

1.4 Quick reference data..... 1

2 Pinning information..... 1

3 Ordering information..... 2

4 Marking 2

5 Limiting values..... 2

6 Thermal characteristics..... 3

7 Characteristics..... 4

8 Test information..... 7

9 Package outline 7

10 Packing information..... 8

11 Soldering 8

12 Revision history..... 9

13 Legal information..... 10

13.1 Data sheet status 10

13.2 Definitions..... 10

13.3 Disclaimers..... 10

13.4 Trademarks..... 10

14 Contact information..... 10

15 Contents 11



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