

# PMBT3904VS

40 V, 200 mA NPN/NPN switching transistor

Rev. 01 — 8 July 2009

Product data sheet

## 1. Product profile

### 1.1 General description

NPN/NPN double switching transistor in a SOT666 ultra small and flat lead Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	Package		PNP/PNP complement	NPN/PNP complement
	NXP	JEITA		
PMBT3904VS	SOT666	-	PMBT3906VS	PMBT3946VPN

### 1.2 Features

- Double general-purpose switching transistor
- Board-space reduction
- Ultra small and flat lead SMD plastic package

### 1.3 Applications

- General-purpose switching and amplification

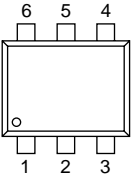
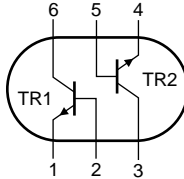
### 1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$V_{CEO}$	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 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	emitter TR1		
2	base TR1		
3	collector TR2		
4	emitter TR2		
5	base TR2		
6	collector TR1		

sym020

## 3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PMBT3904VS	-	plastic surface-mounted package; 6 leads	SOT666

## 4. Marking

Table 5. Marking codes

Type number	Marking code
PMBT3904VS	ZC

## 5. Limiting values

Table 6. Limiting values

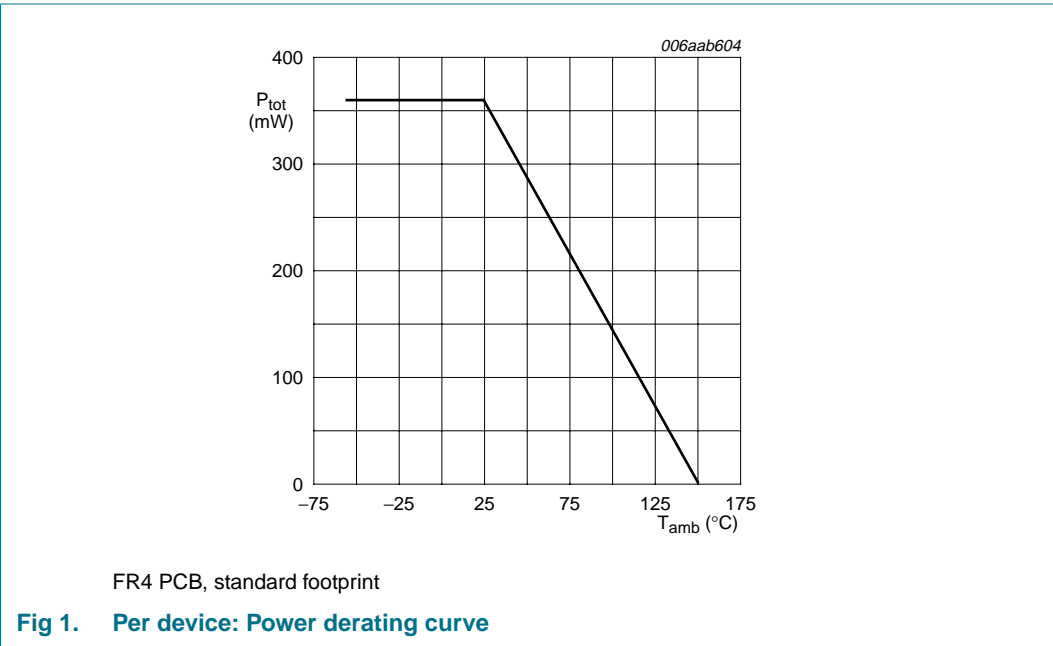
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
<b>Per transistor</b>					
$V_{CBO}$	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 <a href="#">[1][2]</a>	-	240	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C <a href="#">[1][2]</a>	-	360	mW

Table 6. Limiting values ...continued  
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
T <sub>j</sub>	junction temperature		-	150	°C
T <sub>amb</sub>	ambient temperature		-55	+150	°C
T <sub>stg</sub>	storage temperature		-65	+150	°C

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [2] Reflow soldering is the only recommended soldering method.

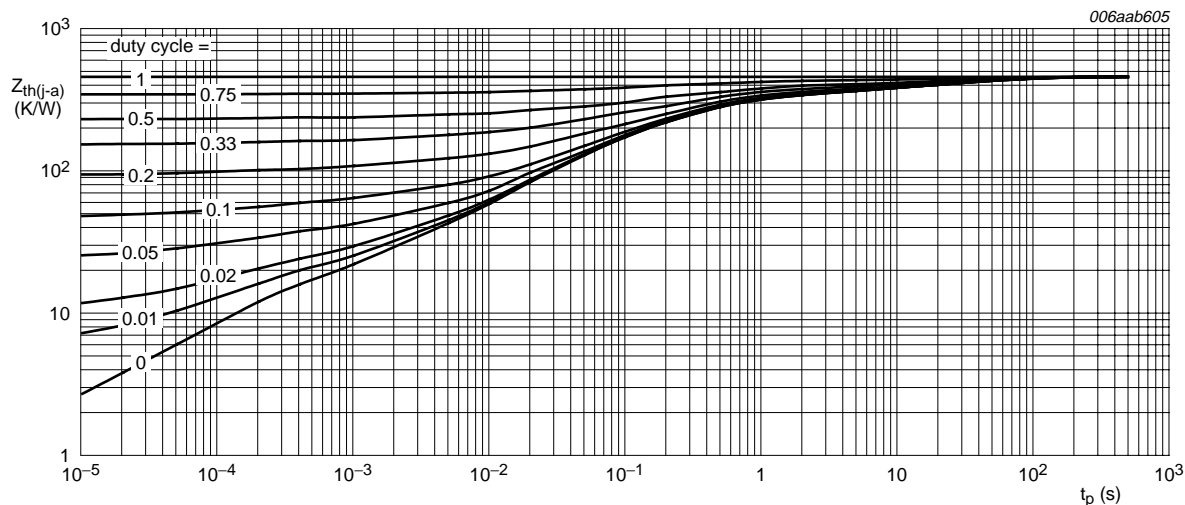


6. Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per transistor						
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1][2]	-	521	K/W
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point		-	-	100	K/W
Per device						
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1][2]	-	347	K/W

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Reflow soldering is the only recommended soldering method.



FR4 PCB, standard footprint

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

## 7. Characteristics

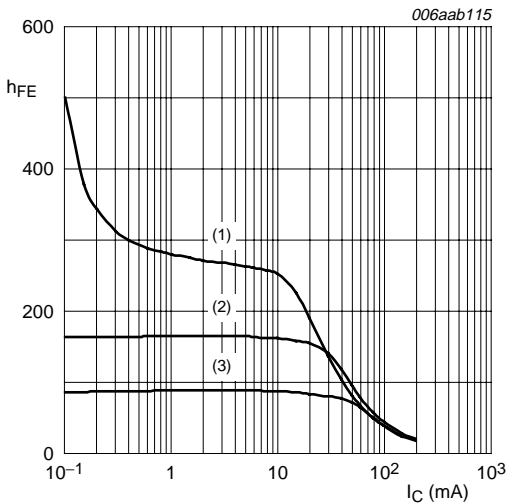
**Table 8. Characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$I_{CBO}$	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	-	
		$I_C = 100\text{ mA}$	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	$V_{CC} = 3\text{ V}; I_C = 10\text{ mA};$	-	-	35	ns
$t_r$	rise time	$I_{Bon} = 1\text{ mA};$	-	-	35	ns
$t_{on}$	turn-on time	$I_{Boff} = -1\text{ mA}$	-	-	70	ns
$t_s$	storage time		-	-	200	ns
$t_f$	fall time		-	-	50	ns
$t_{off}$	turn-off time		-	-	250	ns

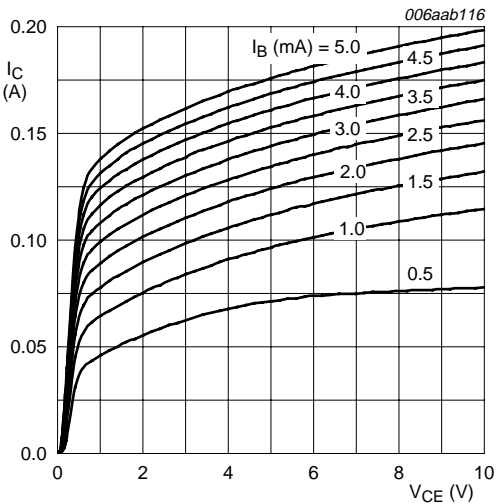
Table 8. Characteristics ...continued  
*T<sub>amb</sub> = 25 °C unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = 5 V; I <sub>E</sub> = i <sub>e</sub> = 0 A; f = 1 MHz	-	-	4	pF
C <sub>e</sub>	emitter capacitance	V <sub>EB</sub> = 500 mV; I <sub>C</sub> = i <sub>c</sub> = 0 A; f = 1 MHz	-	-	8	pF
f <sub>T</sub>	transition frequency	V <sub>CE</sub> = 20 V; I <sub>C</sub> = 10 mA; f = 100 MHz	300	-	-	MHz
NF	noise figure	V <sub>CE</sub> = 5 V; I <sub>C</sub> = 100 μA; R <sub>S</sub> = 1 kΩ; f = 10 Hz to 15.7 kHz	-	-	5	dB



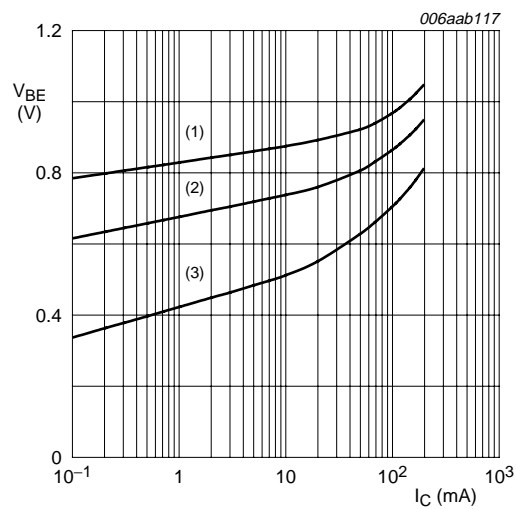
V<sub>CE</sub> = 1 V  
(1) T<sub>amb</sub> = 150 °C  
(2) T<sub>amb</sub> = 25 °C  
(3) T<sub>amb</sub> = -55 °C

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

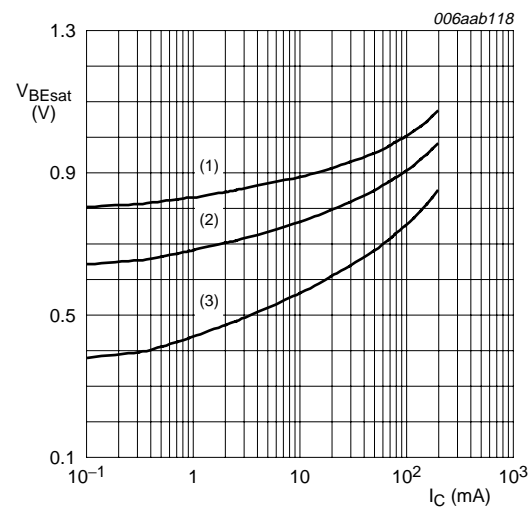


T<sub>amb</sub> = 25 °C

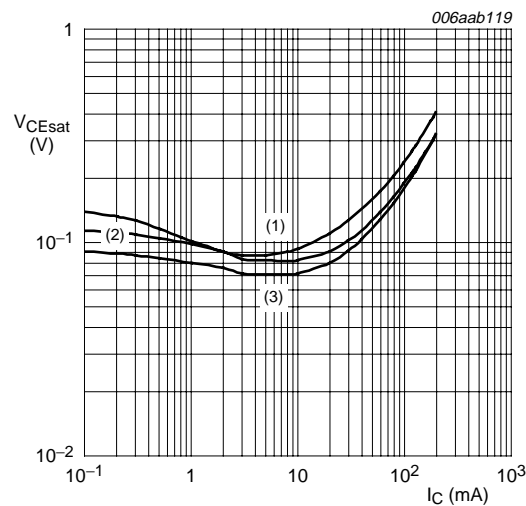
Fig 4. Per transistor:  
Collector current as a function of collector-emitter voltage; typical values



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

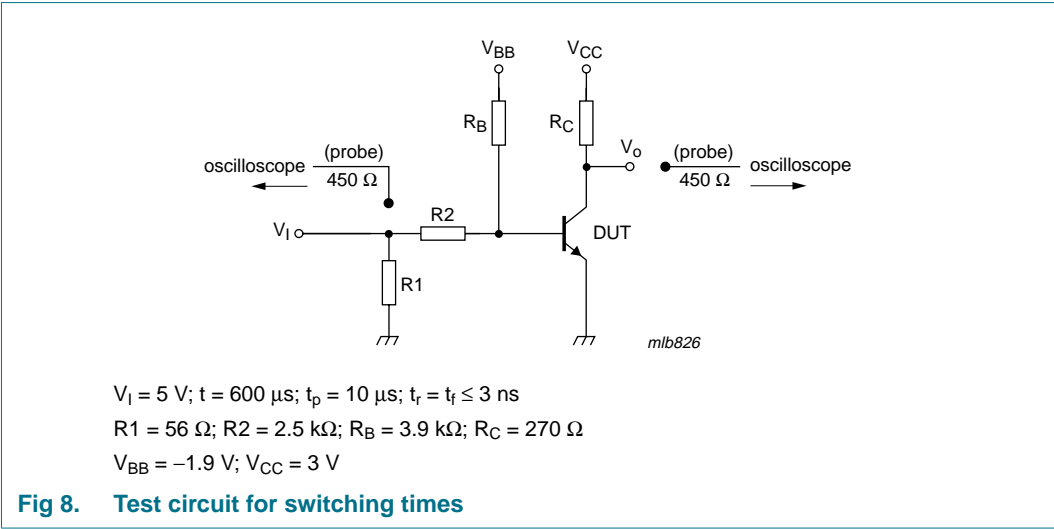


**Fig 6. Per transistor: Base-emitter saturation voltage as a function of collector current; typical values**

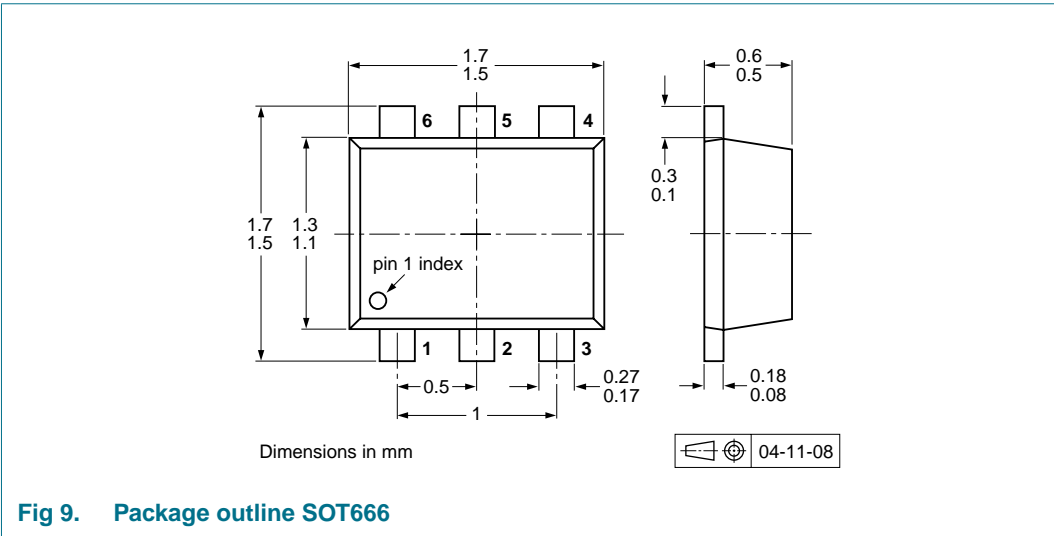


**Fig 7. Per transistor: Collector-emitter saturation voltage as a function of collector current; typical values**

8. Test information



9. Package outline



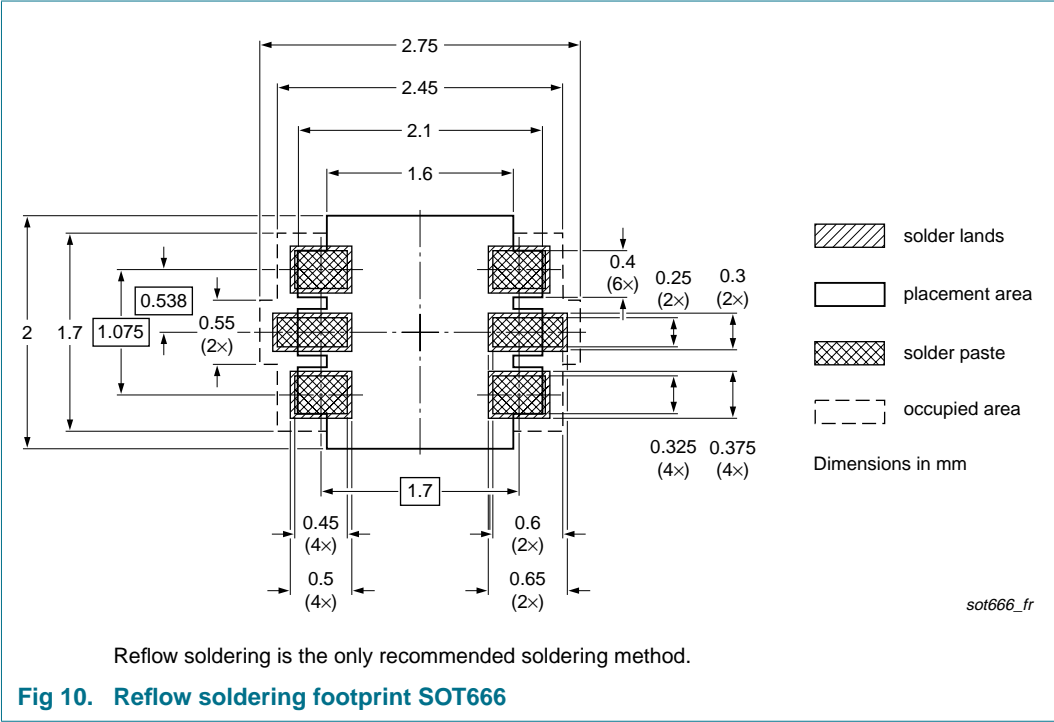
10. Packing information

Table 9. Packing methods  
The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

Type number	Package	Description	Packing quantity	
			4000	8000
PMBT3904VS	SOT666	2 mm pitch, 8 mm tape and reel	-	-315
		4 mm pitch, 8 mm tape and reel	-115	-

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

11. Soldering





12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3904VS_1	20090708	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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## 15. Contents

<b>1</b>	<b>Product profile</b>	<b>1</b>
1.1	General description	1
1.2	Features	1
1.3	Applications	1
1.4	Quick reference data	1
<b>2</b>	<b>Pinning information</b>	<b>2</b>
<b>3</b>	<b>Ordering information</b>	<b>2</b>
<b>4</b>	<b>Marking</b>	<b>2</b>
<b>5</b>	<b>Limiting values</b>	<b>2</b>
<b>6</b>	<b>Thermal characteristics</b>	<b>3</b>
<b>7</b>	<b>Characteristics</b>	<b>4</b>
<b>8</b>	<b>Test information</b>	<b>7</b>
<b>9</b>	<b>Package outline</b>	<b>7</b>
<b>10</b>	<b>Packing information</b>	<b>8</b>
<b>11</b>	<b>Soldering</b>	<b>8</b>
<b>12</b>	<b>Revision history</b>	<b>9</b>
<b>13</b>	<b>Legal information</b>	<b>10</b>
13.1	Data sheet status	10
13.2	Definitions	10
13.3	Disclaimers	10
13.4	Trademarks	10
<b>14</b>	<b>Contact information</b>	<b>10</b>
<b>15</b>	<b>Contents</b>	<b>11</b>

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