

# PMBT3906VS

40 V, 200 mA PNP/PNP switching transistor

Rev. 01 — 20 August 2009

Product data sheet

## 1. Product profile

### 1.1 General description

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

Table 1. Product overview

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

### 1.2 Features

- Double general-purpose switching transistor
- Board-space reduction
- AEC-Q101 qualified
- Ultra small and flat lead SMD plastic package

### 1.3 Applications

- General-purpose switching and amplification

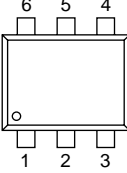
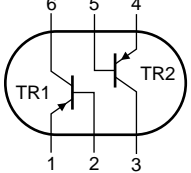
### 1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Per transistor</b>						
$V_{CE0}$	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	

## 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		

*sym018*

## 3. Ordering information

**Table 4. Ordering information**

Type number	Package		
	Name	Description	Version
PMBT3906VS	-	plastic surface-mounted package; 6 leads	SOT666

## 4. Marking

**Table 5. Marking codes**

Type number	Marking code
PMBT3906VS	ZD

## 5. Limiting values

**Table 6. Limiting values**

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

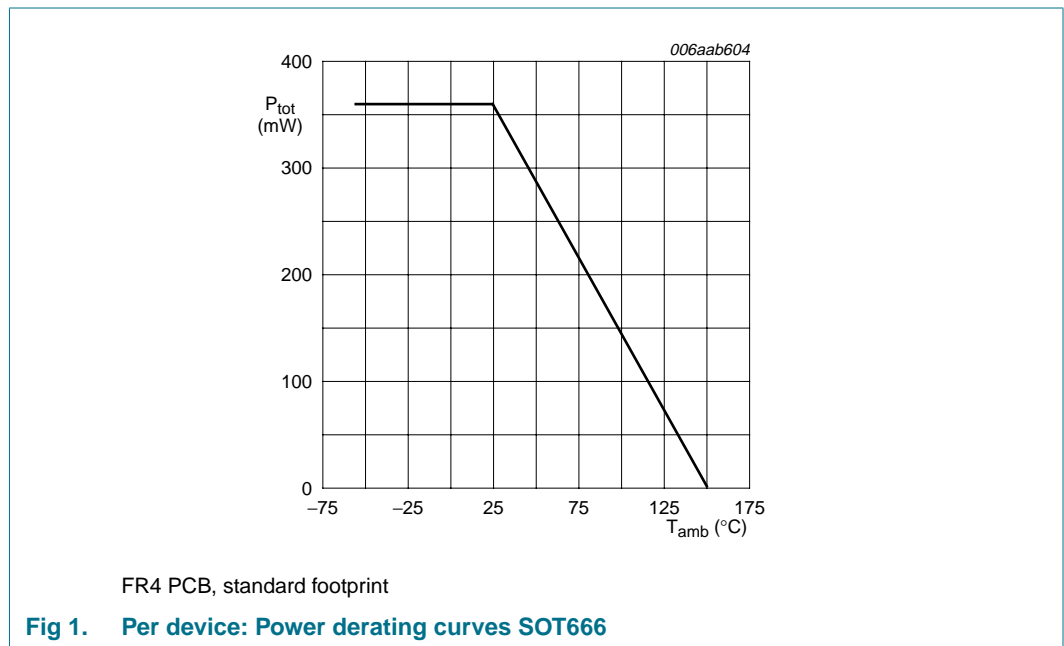
Symbol	Parameter	Conditions	Min	Max	Unit
<b>Per transistor</b>					
$V_{CBO}$	collector-base voltage	open emitter	-	-40	V
$V_{CEO}$	collector-emitter voltage	open base	-	-40	V
$V_{EBO}$	emitter-base voltage	open collector	-	-6	V
$I_C$	collector current		-	-200	mA
$I_{CM}$	peak collector current	single 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]	240	mW
<b>Per device</b>					
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[1][2]	360	mW

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

Symbol	Parameter	Conditions	Min	Max	Unit
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-55	+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.

[2] Reflow soldering is the only recommended soldering method.



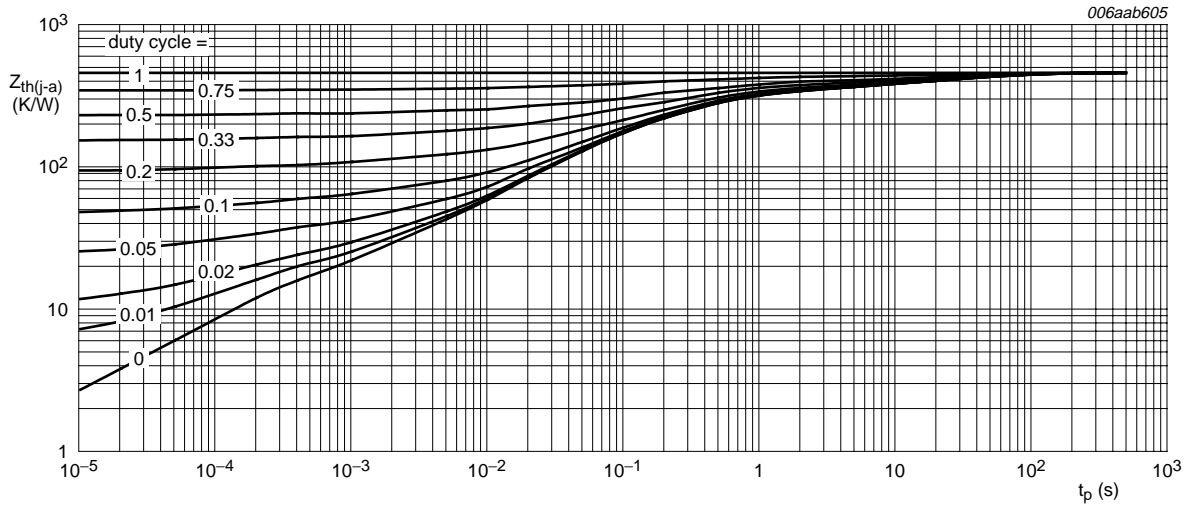
## 6. Thermal characteristics

**Table 7. Thermal characteristics**

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

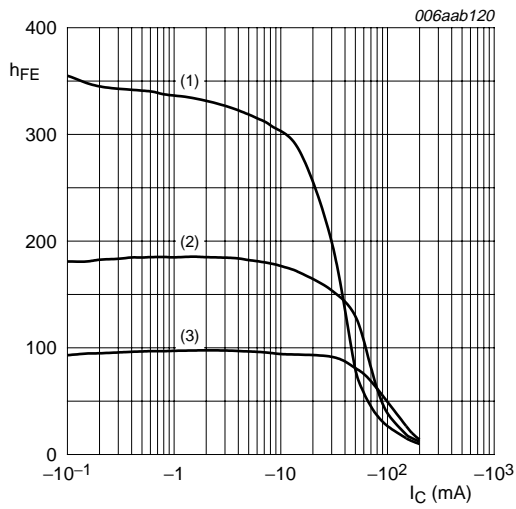
$T_{amb} = 25^{\circ}C$  unless otherwise specified.

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	130	-	
		$I_C = -100\text{ mA}$	30	50	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -10\text{ mA}; I_B = -1\text{ mA}$	-	-100	-250	mV
		$I_C = -50\text{ mA}; I_B = -5\text{ mA}$	-	-165	-400	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -10\text{ mA}; I_B = -1\text{ mA}$	-	-750	-850	mV
		$I_C = -50\text{ mA}; I_B = -5\text{ mA}$	-	-850	-950	mV
$t_d$	delay time	$V_{CC} = -3\text{ V};$	-	-	35	ns
$t_r$	rise time	$I_C = -10\text{ mA};$	-	-	35	ns
$t_{on}$	turn-on time	$I_{Bon} = -1\text{ mA};$ $I_{Boff} = 1\text{ mA}$	-	-	70	ns
$t_s$	storage time		-	-	225	ns
$t_f$	fall time		-	-	75	ns
$t_{off}$	turn-off time		-	-	300	ns

**Table 8. Characteristics ...continued**

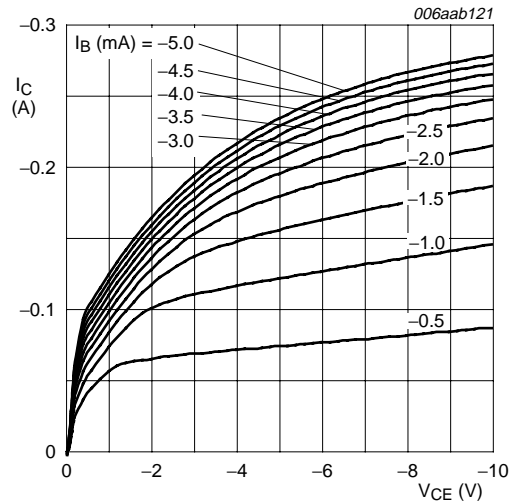
$T_{amb} = 25\text{ }^\circ\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_c$	collector capacitance	$V_{CB} = -5\text{ V}; I_E = i_e = 0\text{ A};$ $f = 1\text{ MHz}$	-	-	4.5	pF
$C_e$	emitter capacitance	$V_{EB} = -500\text{ mV};$ $I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$	-	-	10	pF
$f_T$	transition frequency	$V_{CE} = -20\text{ V};$ $I_C = -10\text{ mA};$ $f = 100\text{ MHz}$	250	-	-	MHz
NF	noise figure	$V_{CE} = -5\text{ V};$ $I_C = -100\text{ }\mu\text{A}; R_S = 1\text{ k}\Omega;$ $f = 10\text{ Hz to }15.7\text{ kHz}$	-	-	4	dB



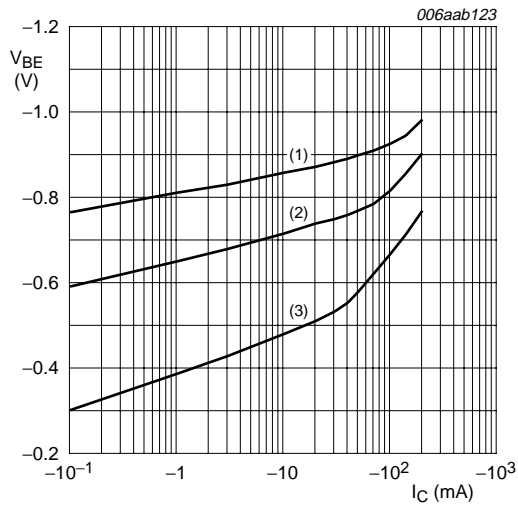
- $V_{CE} = -1\text{ V}$
- (1)  $T_{amb} = 150\text{ }^\circ\text{C}$
  - (2)  $T_{amb} = 25\text{ }^\circ\text{C}$
  - (3)  $T_{amb} = -55\text{ }^\circ\text{C}$

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



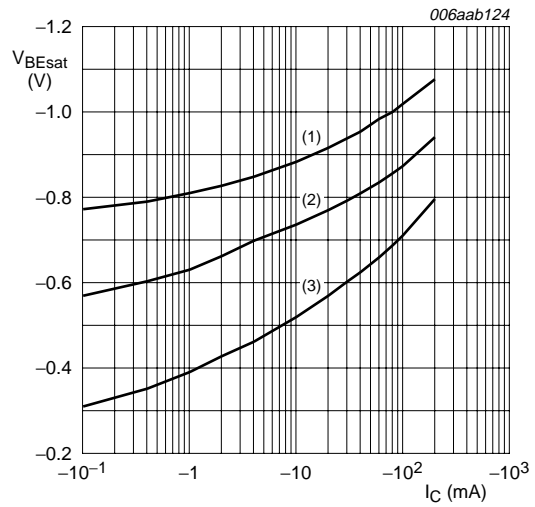
$T_{amb} = 25\text{ }^\circ\text{C}$

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



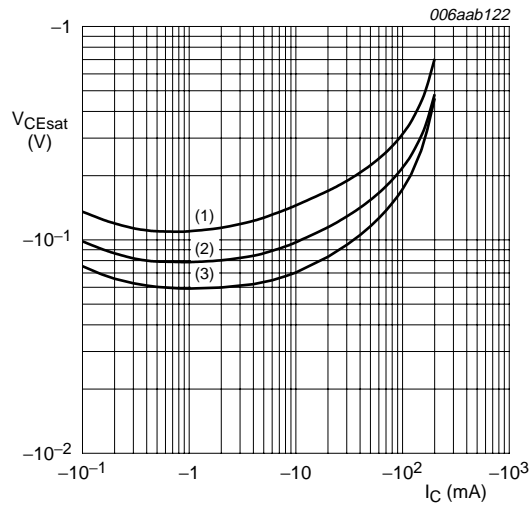
- $V_{CE} = -1\text{ V}$
- (1)  $T_{amb} = -55\text{ }^\circ\text{C}$
  - (2)  $T_{amb} = 25\text{ }^\circ\text{C}$
  - (3)  $T_{amb} = 150\text{ }^\circ\text{C}$

**Fig 5. Per transistor: 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)  $T_{amb} = 150\text{ }^\circ\text{C}$

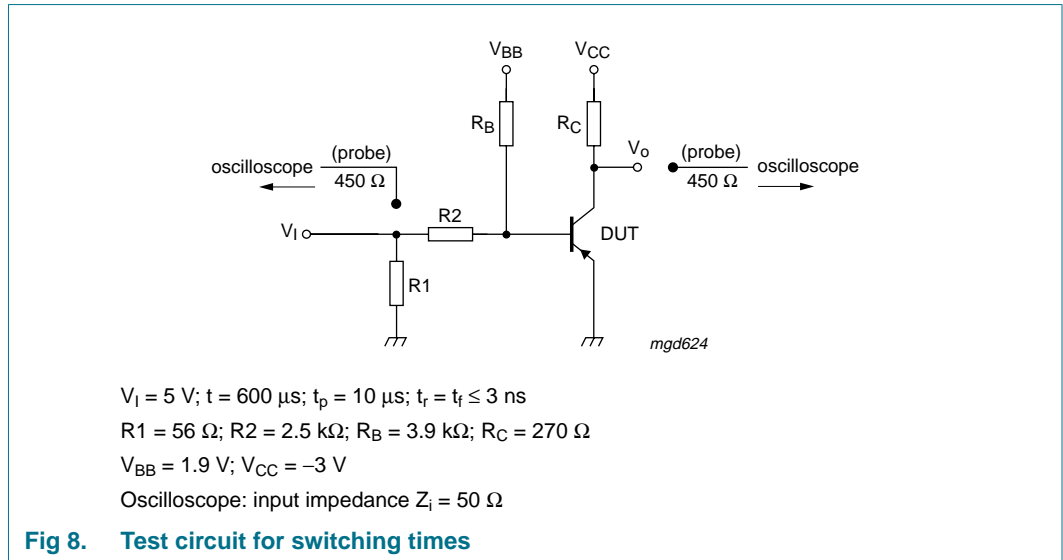
**Fig 6. Per transistor: Base-emitter saturation voltage as a function of collector current; typical values**



- $I_C/I_B = 10$
- (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. Per transistor: Collector-emitter saturation voltage as a function of collector current; typical values**

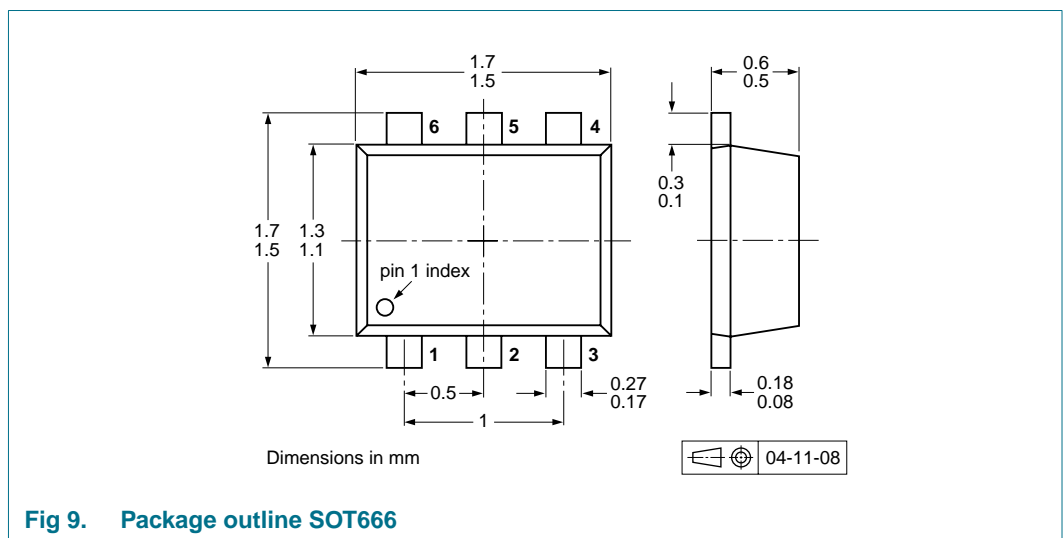
## 8. Test information



### 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

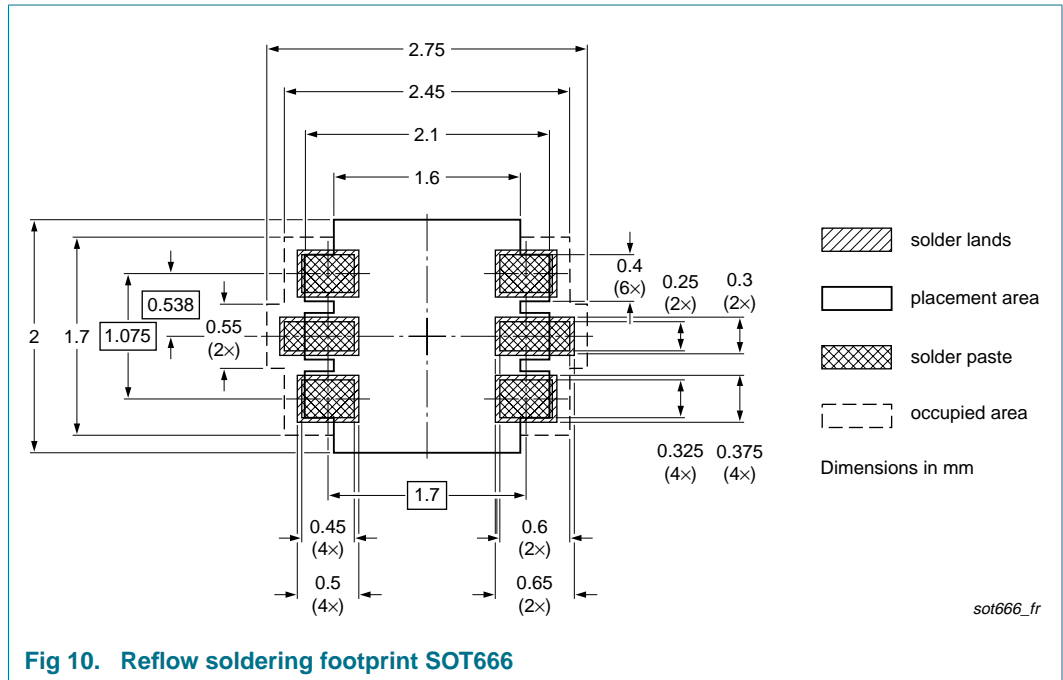
**Table 9. Packing methods**

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

Type number	Package	Description	Packing quantity	
			4000	8000
PMBT3906VS	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



**Fig 10. Reflow soldering footprint SOT666**



## 12. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMBT3906VS_1	20090820	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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