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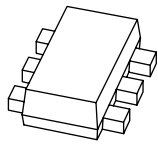
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Kind regards,

Team Nexperia



# 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/NPN 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

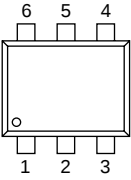
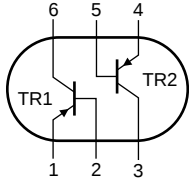
### 1.4 Quick reference data

Table 2. Quick reference data

| Symbol         | Parameter                 | Conditions                                       | Min | Typ | Max  | Unit |
|----------------|---------------------------|--------------------------------------------------|-----|-----|------|------|
| Per transistor |                           |                                                  |     |     |      |      |
| $V_{CE0}$      | collector-emitter voltage | open base                                        | -   | -   | -40  | V    |
| $I_C$          | collector current         |                                                  | -   | -   | -200 | mA   |
| $h_{FE}$       | DC current gain           | $V_{CE} = -1\text{ V};$<br>$I_C = -10\text{ mA}$ | 100 | 180 | 300  |      |

## 2. Pinning information

Table 3. Pinning

| Pin | Description   | Simplified outline                                                                  | Graphic symbol                                                                                |
|-----|---------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1   | emitter TR1   |  | <br>sym018 |
| 2   | base TR1      |                                                                                     |                                                                                               |
| 3   | collector TR2 |                                                                                     |                                                                                               |
| 4   | emitter TR2   |                                                                                     |                                                                                               |
| 5   | base TR2      |                                                                                     |                                                                                               |
| 6   | collector TR1 |                                                                                     |                                                                                               |

## 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

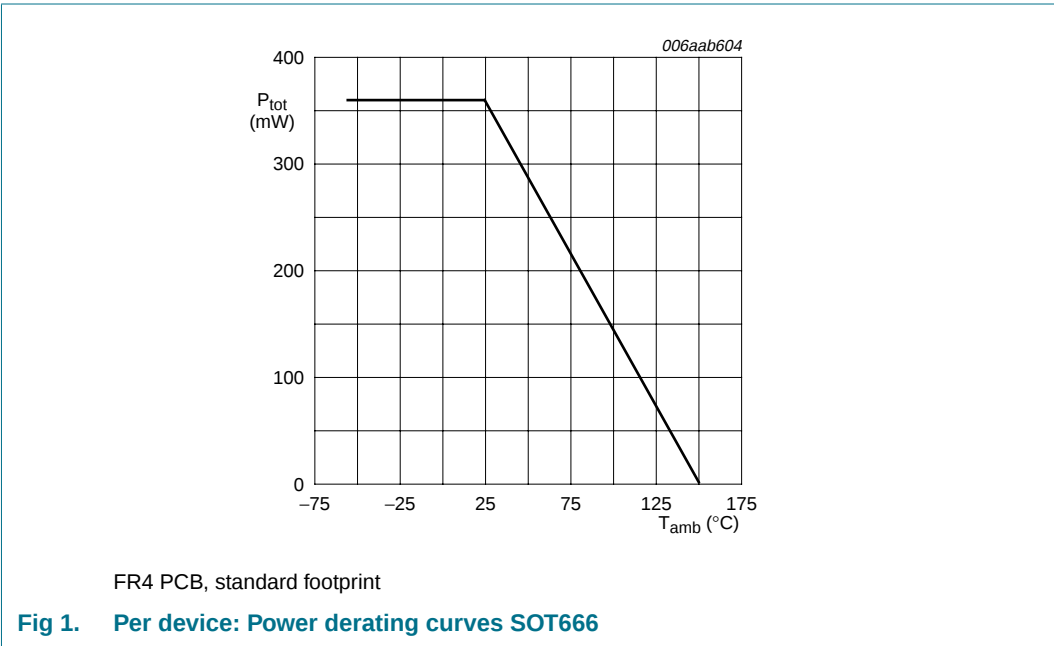
In accordance with the Absolute Maximum Rating System (IEC 60134).

| 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;<br>$t_p \leq 1$ ms            | -   | -200 | mA   |
| $I_{BM}$              | peak base current         | single pulse;<br>$t_p \leq 1$ 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.

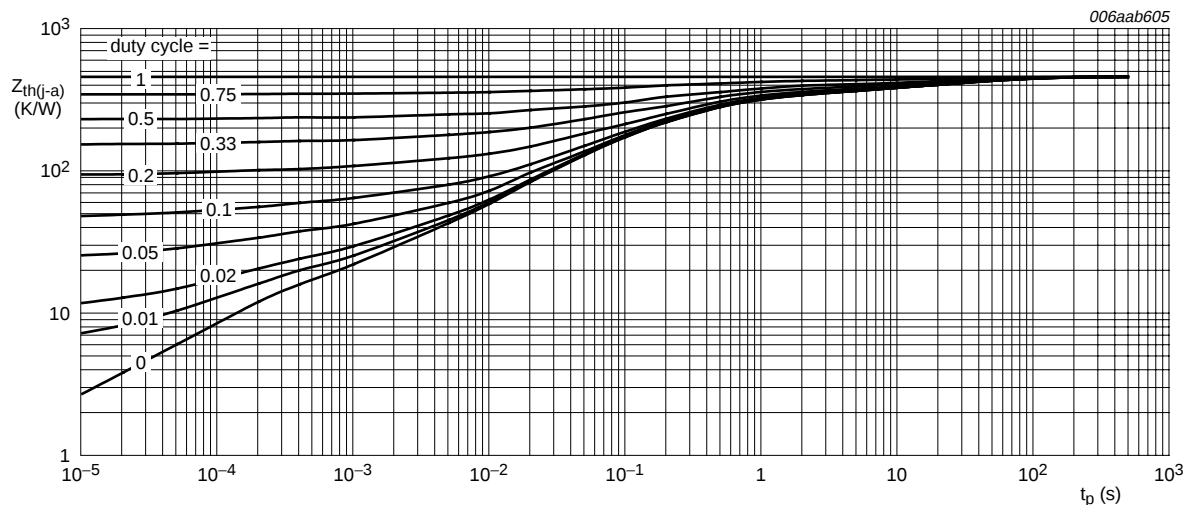


## 6. Thermal characteristics

**Table 7. Thermal characteristics**

| Symbol                | Parameter                                        | Conditions  | Min    | Typ | Max | Unit |
|-----------------------|--------------------------------------------------|-------------|--------|-----|-----|------|
| <b>Per transistor</b> |                                                  |             |        |     |     |      |
| 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  |
| <b>Per device</b>     |                                                  |             |        |     |     |      |
| 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

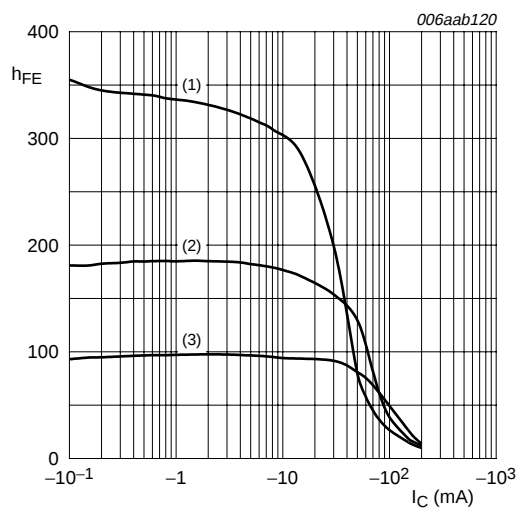
**Table 8. Characteristics**

$T_{amb} = 25^{\circ}\text{C}$  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  | 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                         | $I_{Bon} = -1\text{ mA};$                 | -   | -    | 70   | ns   |
|                       |                                      | $I_{Boff} = 1\text{ mA}$                  |     |      |      |      |
| $t_s$                 | storage time                         |                                           | -   | -    | 225  | ns   |
| $t_f$                 | fall time                            |                                           | -   | -    | 75   | ns   |
| $t_{off}$             | turn-off time                        |                                           | -   | -    | 300  | ns   |

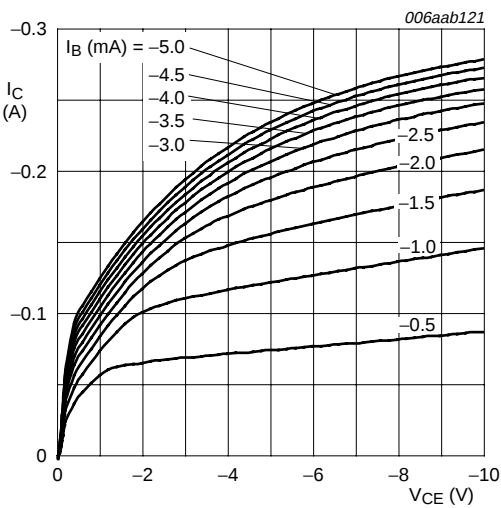
Table 8. Characteristics ...continued  
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

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



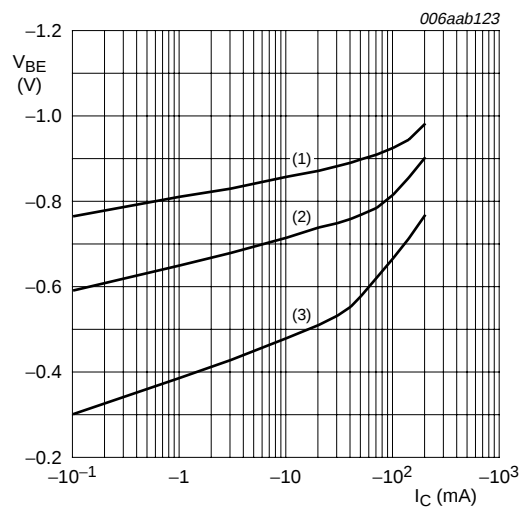
$V_{CE} = -1\text{ V}$   
(1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



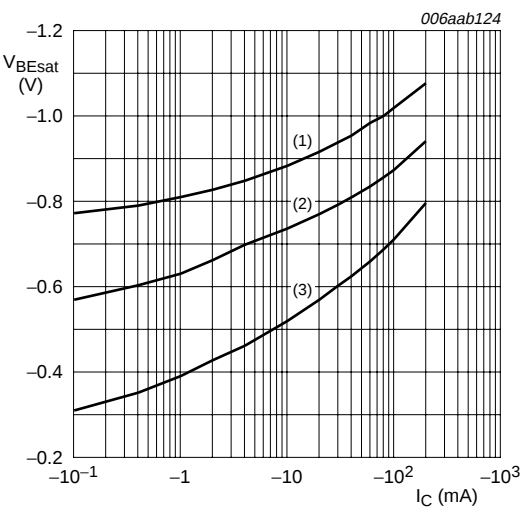
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



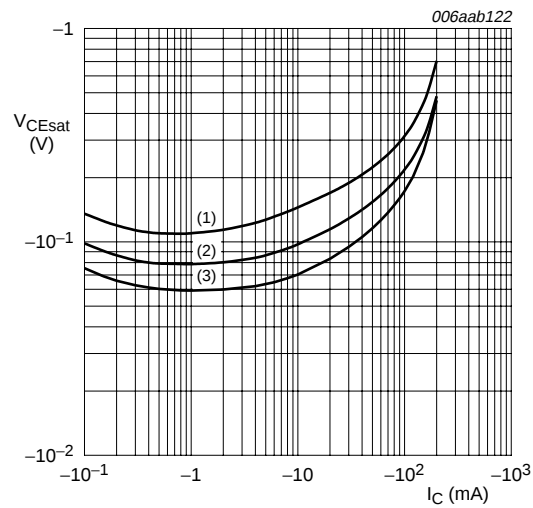
$V_{CE} = -1\text{ V}$   
(1)  $T_{amb} = -55\text{ }^{\circ}\text{C}$   
(2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
(3)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

**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)  $T_{amb} = 150\text{ }^{\circ}\text{C}$

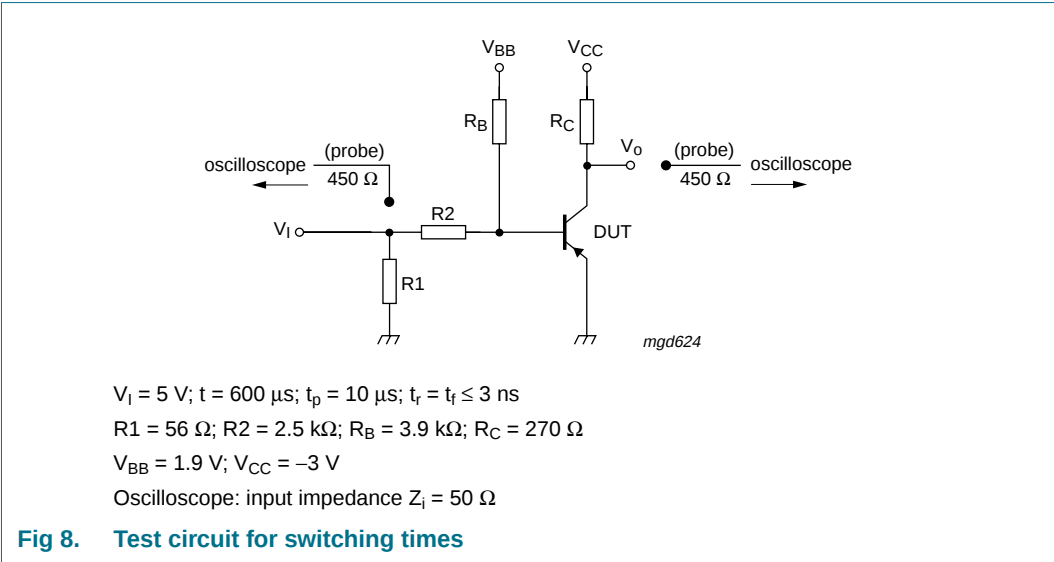
**Fig 6. Per transistor:**  
Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 10$   
(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

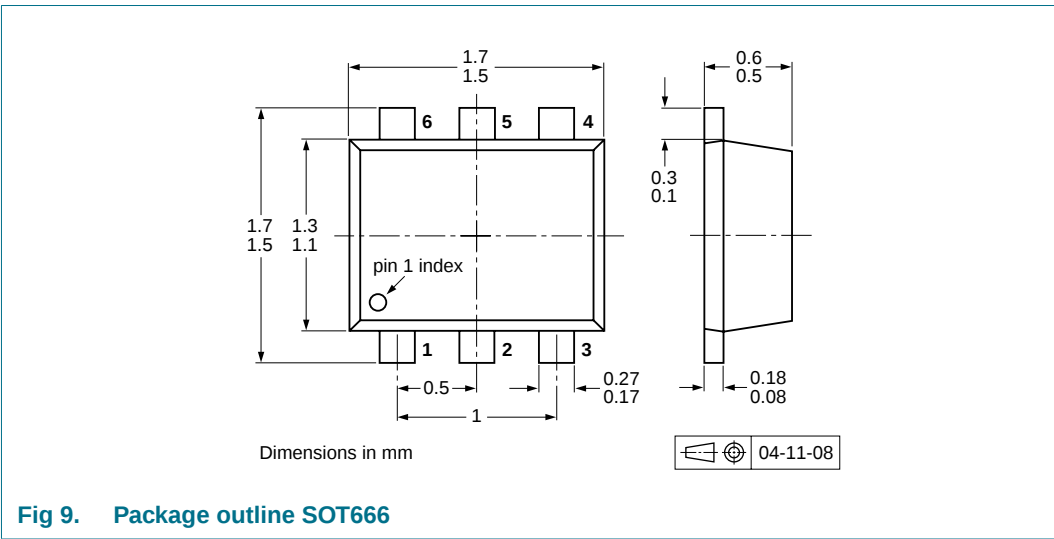
8. Test information



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



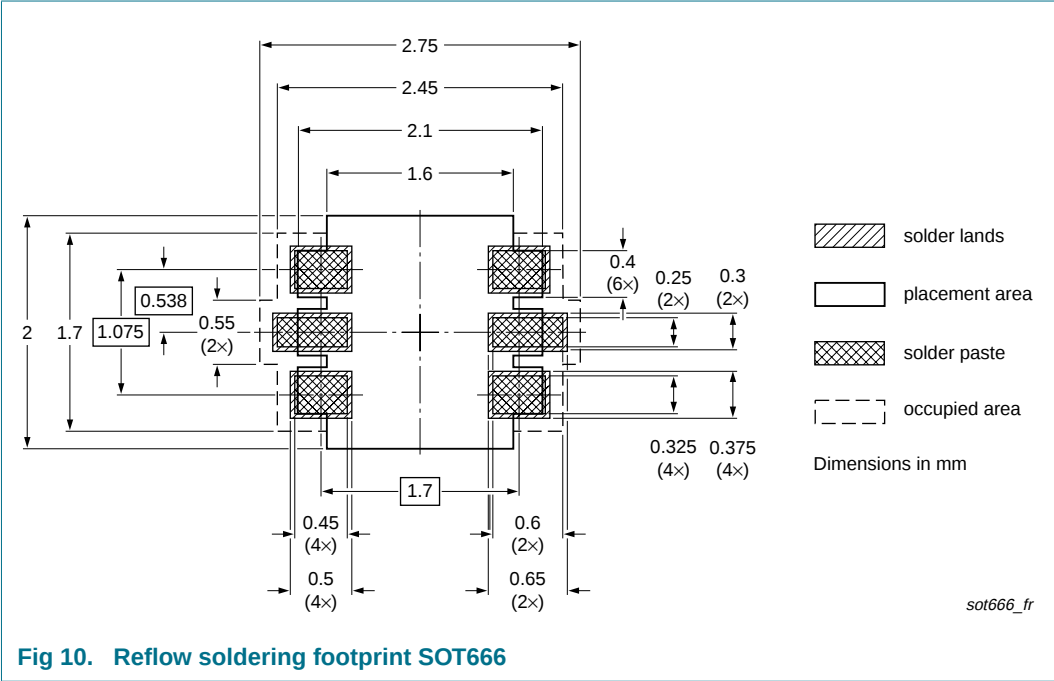
10. Packing information

Table 9. Packing methods  
The indicated -xxx are the last three digits of the 12NC ordering code.[\[1\]](#)

| 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



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.                                     |

[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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