

PMBT3904YS

40 V, 200 mA NPN/NPN general-purpose double transistor

Rev. 01 — 12 May 2009

Product data sheet

1. Product profile

1.1 General description

NPN/NPN general-purpose double transistor in a SOT363 (SC-88) very small Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

| Type number | Package | | PNP/PNP complement | NPN/PNP complement | Package configuration |
|-------------|---------|-------|--------------------|--------------------|-----------------------|
| | NXP | JEITA | | | |
| PMBT3904YS | SOT363 | SC-88 | PMBT3906YS | PMBT3946YPN | very small |

1.2 Features

- General-purpose double transistor
- Board-space reduction

1.3 Applications

- General-purpose switching and amplification

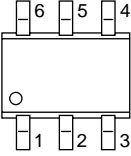
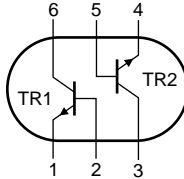
1.4 Quick reference data

Table 2. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|---------------------------|--|-----|-----|-----|------|
| Per transistor | | | | | | |
| V_{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 |  |  <i>sym020</i> |
| 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 |
| PMBT3904YS | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |

4. Marking

Table 5. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PMBT3904YS | BC* |

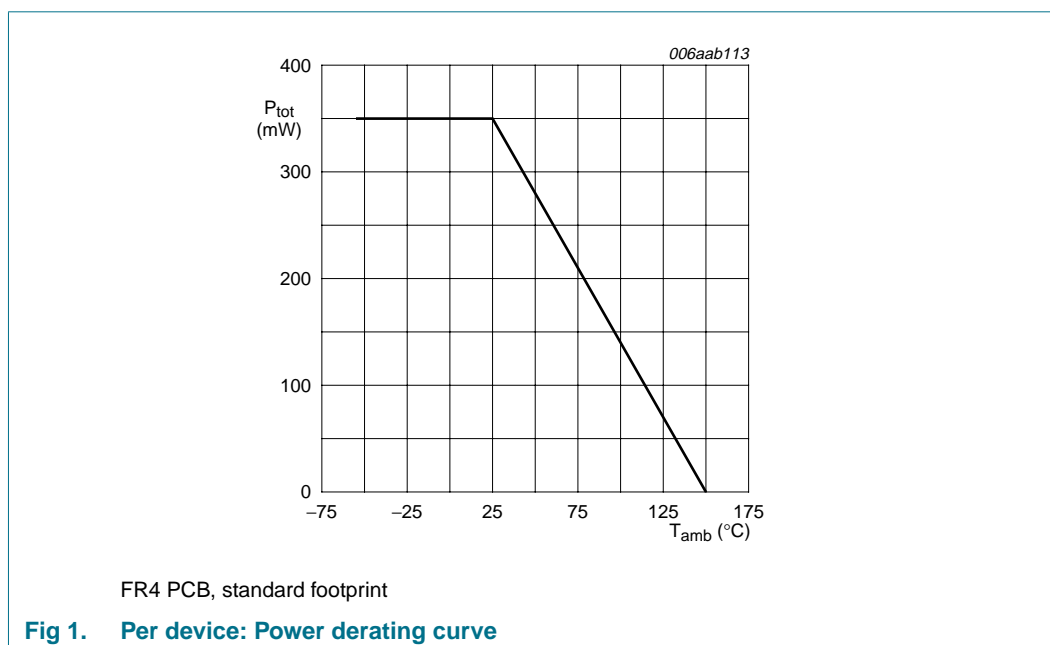
- [1] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Malaysia
* = W: made in China

5. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------|---------------------------|----------------------------------|-----|------|------|
| Per transistor | | | | | |
| 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 | [1] | 230 | mW |
| Per device | | | | | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | 350 | mW |
| 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.

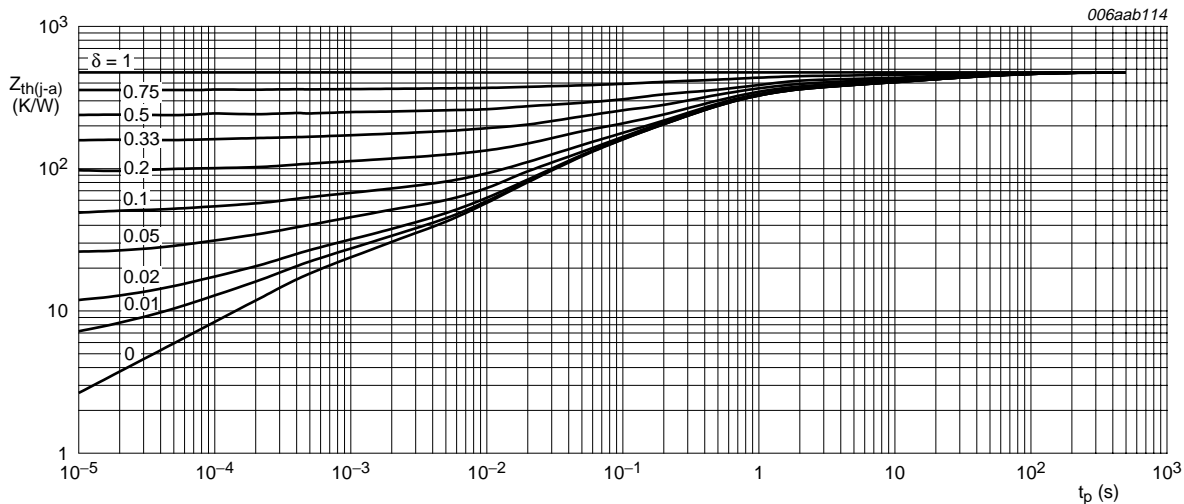


6. Thermal characteristics

Table 7. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|--|-------------|-----|-----|-----|------|
| Per transistor | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | 543 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | - | - | 290 | K/W |
| Per device | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | 357 | K/W |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.



FR4 PCB, standard footprint

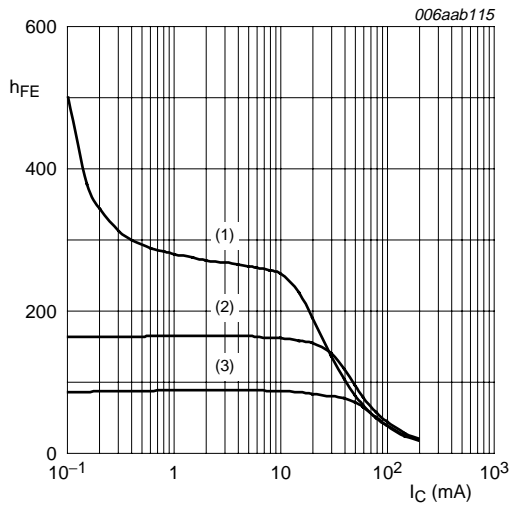
Fig 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

Table 8. Characteristics

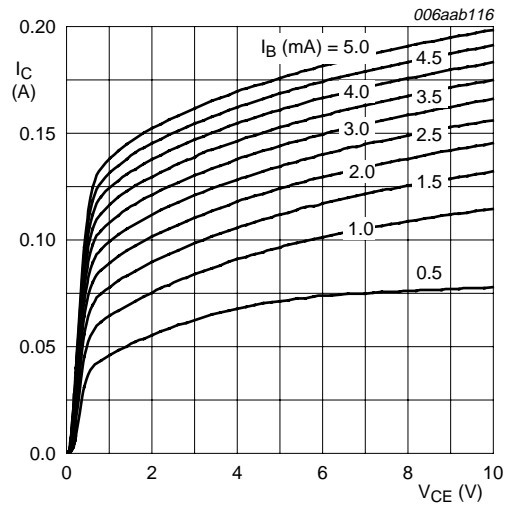
$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|--------------------------------------|--|-----|-----|-----|------|
| Per transistor | | | | | | |
| 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 | - | |
| 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 |
| f_T | transition frequency | $V_{CE} = 20\text{ V}; I_C = 10\text{ mA};$ $f = 100\text{ MHz}$ | 300 | - | - | MHz |
| C_c | collector capacitance | $V_{CB} = 5\text{ V}; I_E = i_e = 0\text{ A};$ $f = 1\text{ MHz}$ | - | - | 4 | pF |
| C_e | emitter capacitance | $V_{BE} = 0.5\text{ V}; I_C = i_c = 0\text{ A};$ $f = 1\text{ MHz}$ | - | - | 8 | pF |
| NF | noise figure | $V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A};$ $R_S = 1\text{ k}\Omega;$ $f = 10\text{ Hz to }15.7\text{ kHz}$ | - | - | 5 | dB |
| t_d | delay time | $V_{CC} = 3\text{ V}; I_C = 10\text{ mA};$ | - | - | 35 | ns |
| t_r | rise time | $I_{Bon} = 1\text{ mA}; I_{Boff} = -1\text{ mA}$ | - | - | 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 |



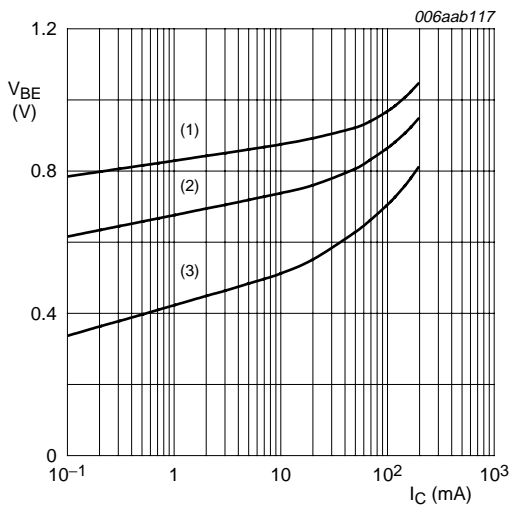
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = 150\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

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



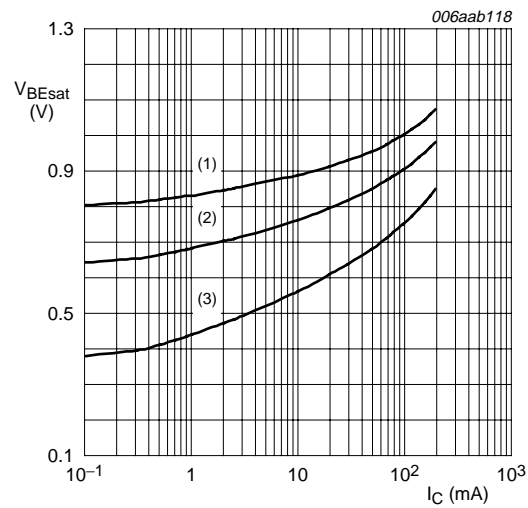
$T_{amb} = 25\text{ }^{\circ}\text{C}$

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



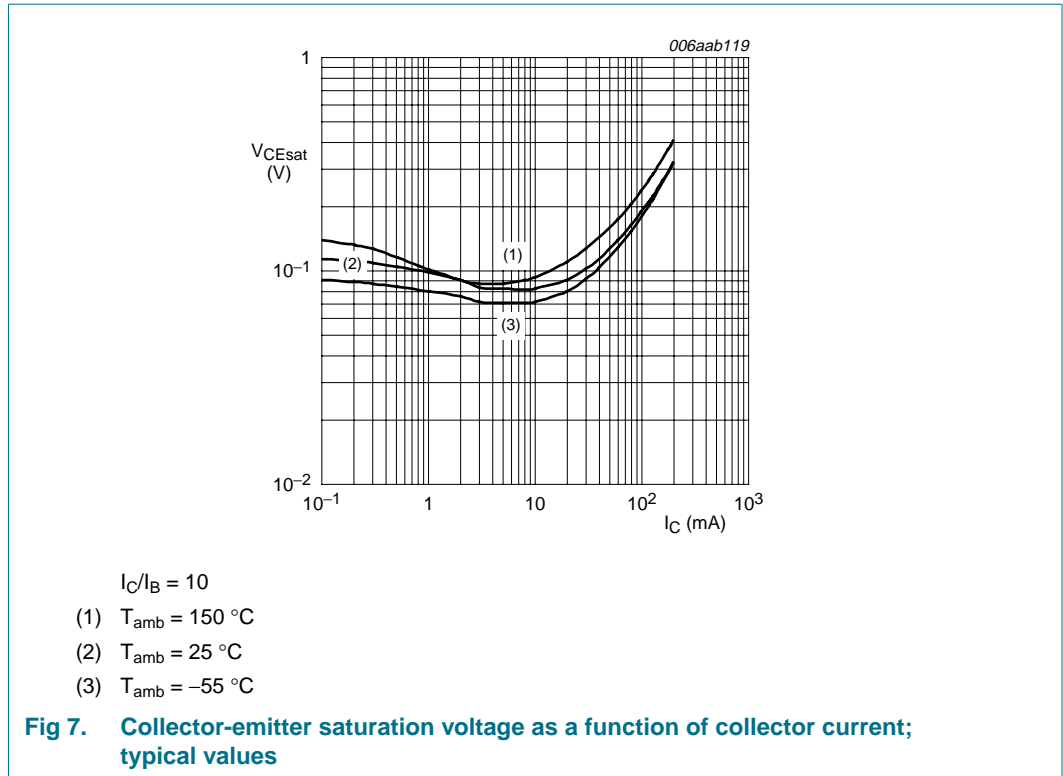
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = -55\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 150\text{ }^{\circ}\text{C}$

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

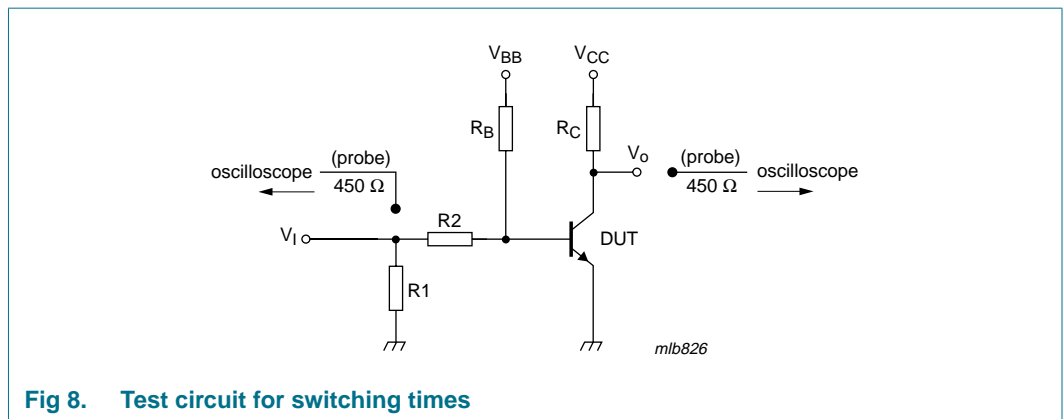


$I_C/I_B = 10$
 (1) $T_{amb} = -55\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 150\text{ }^{\circ}\text{C}$

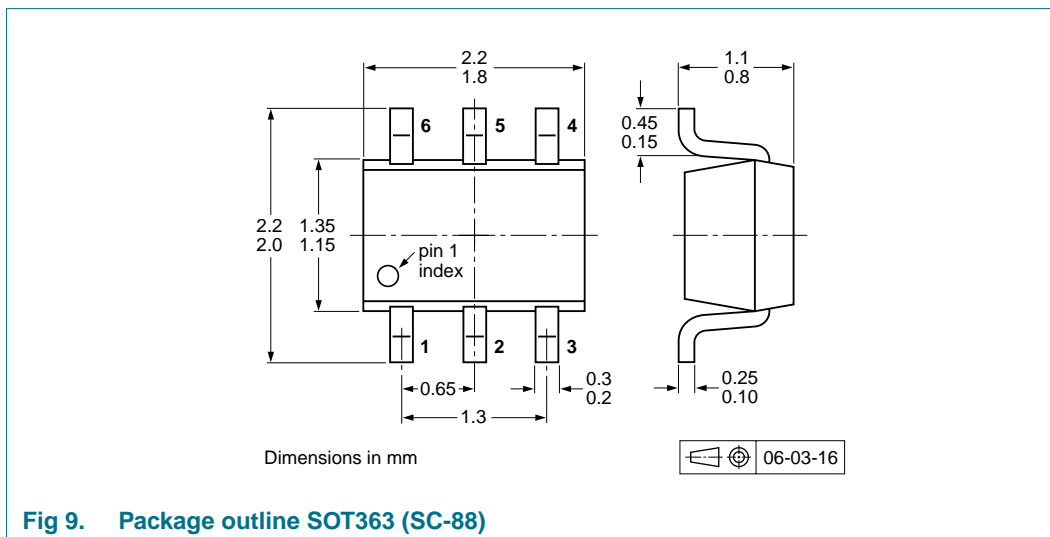
Fig 6. Base-emitter saturation voltage as a function of collector current; typical values



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.^[1]

| Type number | Package | Description | Packing quantity | |
|-------------|---------|------------------------------------|---------------------|-------|
| | | | 3000 | 10000 |
| PMBT3904YS | SOT363 | 4 mm pitch, 8 mm tape and reel; T1 | ^[2] -115 | -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | ^[3] -125 | -165 |

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

[2] T1: normal taping

[3] T2: reverse taping

11. Soldering

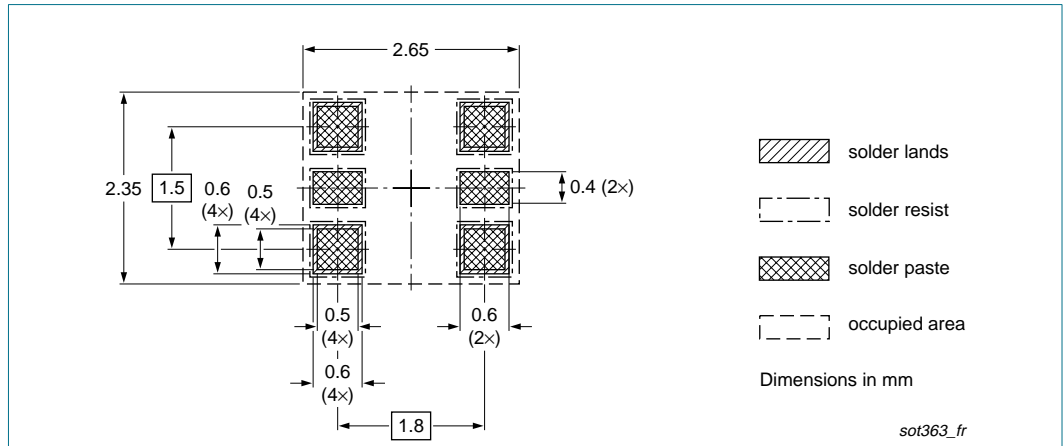


Fig 10. Reflow soldering footprint SOT363 (SC-88)

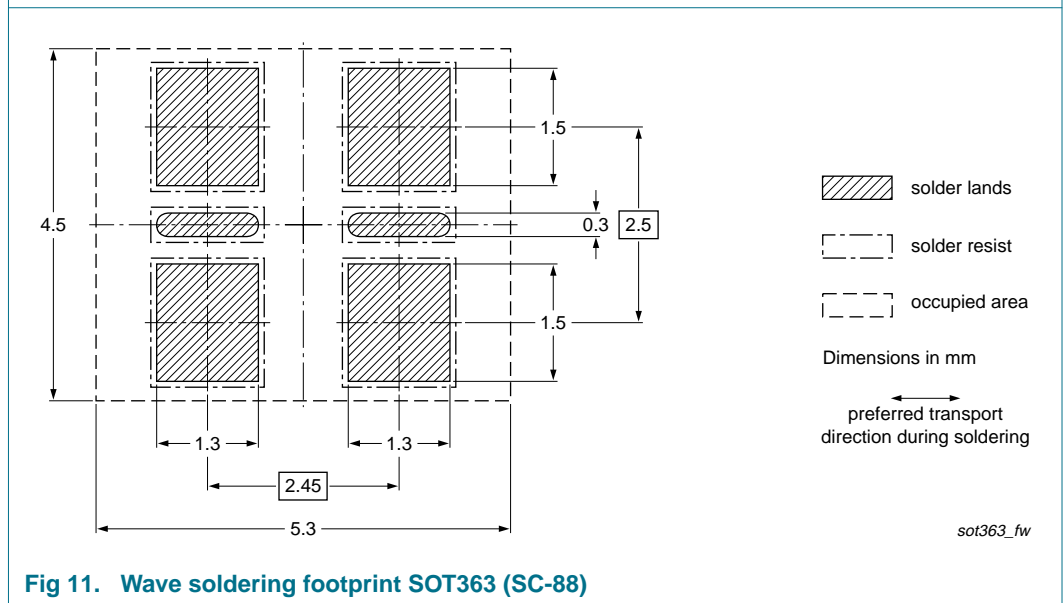


Fig 11. Wave soldering footprint SOT363 (SC-88)

12. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------|--------------|--------------------|---------------|------------|
| PMBT3904YS_1 | 20090512 | 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. |
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[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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