# PEMB15; PUMB15

## PNP/PNP resistor-equipped transistors; R1 = 4.7 kΩ, R2 = 4.7 kΩ

Rev. 5 — 16 December 2011 Product data sheet

## 1. Product profile

### 1.1 General description

PNP/PNP double Resistor-Equipped Transistors (RET) in Surface-Mounted Device (SMD) plastic packages.

**Table 1. Product overview**

| Type number | Package | | NPN/PNP complement | NPN/NPN complement | Package configuration |
|---|---|---|---|---|---|
| | NXP | JEITA | | | |
| PEMB15 | SOT666 | - | PEMD15 | PEMH15 | ultra small and flat lead |
| PUMB15 | SOT363 | SC-88 | PUMD15 | PUMH15 | very small |

### 1.2 Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- AEC-Q101 qualified

### 1.3 Applications

- Low current peripheral driver
- Control of IC inputs
- Replaces general-purpose transistors in digital applications

### 1.4 Quick reference data

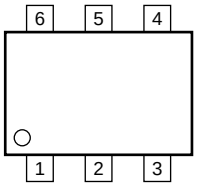
**Table 2. Quick reference data**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | |
| $V_{CEO}$ | collector-emitter voltage | open base | - | - | −50 | V |
| $I_O$ | output current | | - | - | −100 | mA |
| R1 | bias resistor 1 (input) | | 3.3 | 4.7 | 6.1 | kΩ |
| R2/R1 | bias resistor ratio | | 0.8 | 1 | 1.2 | |

## 2. Pinning information

**Table 3. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | GND (emitter) TR1 | | |
| 2 | input (base) TR1 | | |
| 3 | output (collector) TR2 | | |
| 4 | GND (emitter) TR2 | | |
| 5 | input (base) TR2 | | |
| 6 | output (collector) TR1 | | |

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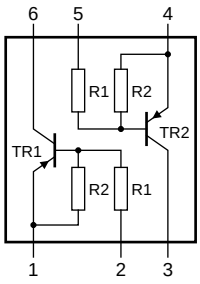


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## 3. Ordering information

**Table 4. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PEMB15 | - | plastic surface-mounted package; 6 leads | SOT666 |
| PUMB15 | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code[1] |
|---|---|
| PEMB15 | 5D |
| PUMB15 | B*6 |

[1] * = placeholder for manufacturing site code

## 5. Limiting values

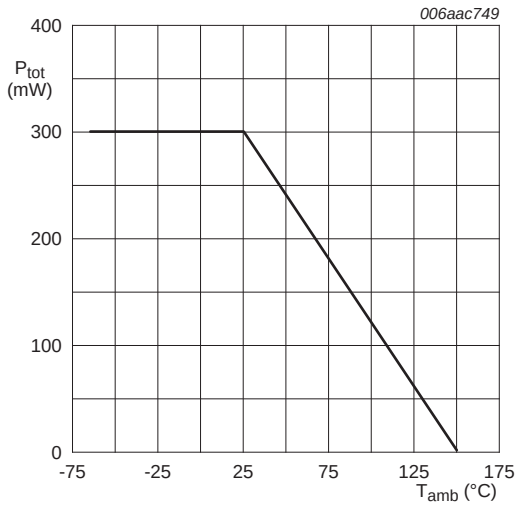
**Table 6. Limiting values**

*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 | | - | –50 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | –50 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | | - | –10 | V |
| $V_I$ | input voltage | | | | | |
| | positive | | | - | +10 | V |
| | negative | | | - | –30 | V |
| $I_O$ | output current | | | - | –100 | mA |
| $I_{CM}$ | peak collector current | single pulse; $t_p \leq 1$ ms | | - | –100 | mA |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | | | | |
| | PEMB15 (SOT666) | | [1][2] | - | 200 | mW |
| | PUMB15 (SOT363) | | [1] | - | 200 | mW |
| **Per device** | | | | | | |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | | | | |
| | PEMB15 (SOT666) | | [1][2] | - | 300 | mW |
| | PUMB15 (SOT363) | | [1] | - | 300 | mW |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | –65 | +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.




FR4 PCB, standard footprint

**Fig 1. Per device: Power derating curve for SOT363 (SC-88) and SOT666**

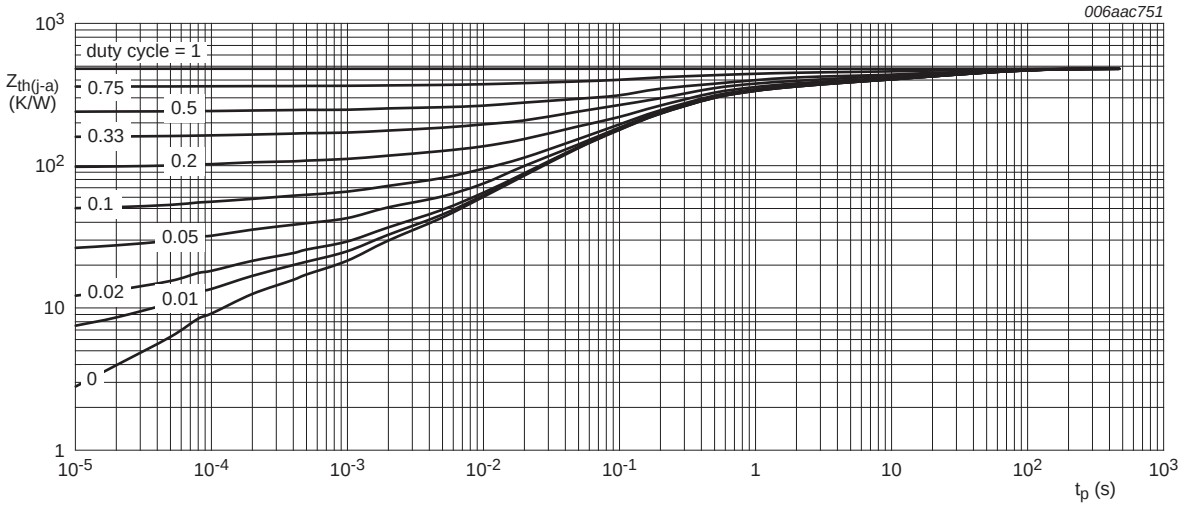
## 6. Thermal characteristics

**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 | | | | | |
| | PEMB15 (SOT666) | | [1][2] | - | - | 625 | K/W |
| | PUMB15 (SOT363) | | [1] | - | - | 625 | K/W |
| **Per device** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | | |
| | PEMB15 (SOT666) | | [1][2] | - | - | 417 | K/W |
| | PUMB15 (SOT363) | | [1] | - | - | 417 | K/W |

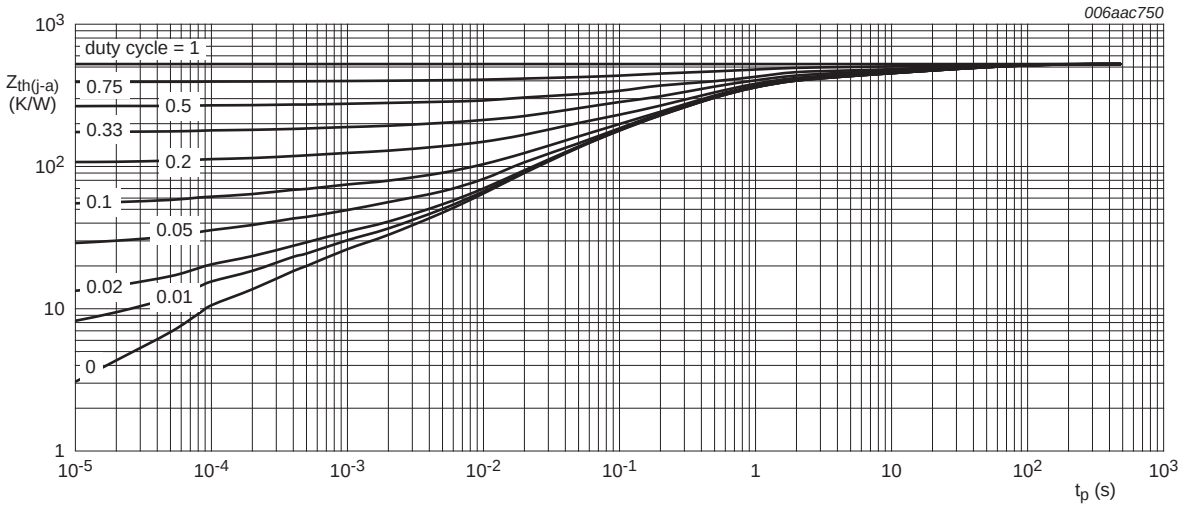
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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 for PEMB15 (SOT666); typical values**




FR4 PCB, standard footprint

**Fig 3. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration for PUMB15 (SOT363); typical values**

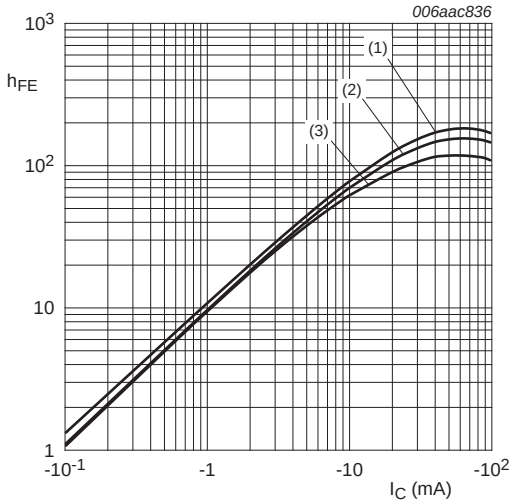
# 7. Characteristics

**Table 8. Characteristics**

*$T_{amb}$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | |
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = –50 V; $I_E$ = 0 A | - | - | –100 | nA |
| $I_{CEO}$ | collector-emitter cut-off current | $V_{CE}$ = –30 V; $I_B$ = 0 A | - | - | –1 | μA |
| | | $V_{CE}$ = –30 V; $I_B$ = 0 A; $T_j$ = 150 °C | - | - | –5 | μA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = –5 V; $I_C$ = 0 A | - | - | –900 | μA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = –5 V; $I_C$ = –10 mA | 30 | - | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = –10 mA; $I_B$ = –0.5 mA | - | - | –150 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE}$ = –5 V; $I_C$ = –100 μA | - | –1.1 | –0.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE}$ = –0.3 V; $I_C$ = –20 mA | –2.5 | –1.9 | - | V |
| R1 | bias resistor 1 (input) | | 3.3 | 4.7 | 6.1 | kΩ |
| R2/R1 | bias resistor ratio | | 0.8 | 1 | 1.2 | |
| $C_c$ | collector capacitance | $V_{CB}$ = –10 V; $I_E$ = $i_e$ = 0 A; f = 1 MHz | - | - | 3 | pF |
| $f_T$ | transition frequency | $V_{CE}$ = –5 V; $I_C$ = –10 mA; f = 100 MHz [1] | - | 180 | - | MHz |

[1] Characteristics of built-in transistor



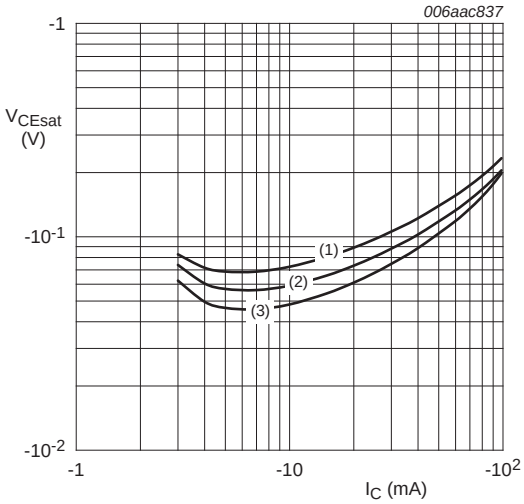

$V_{CE}$ = −5 V

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −40 °C

**Fig 4. DC current gain as a function of collector current; typical values**



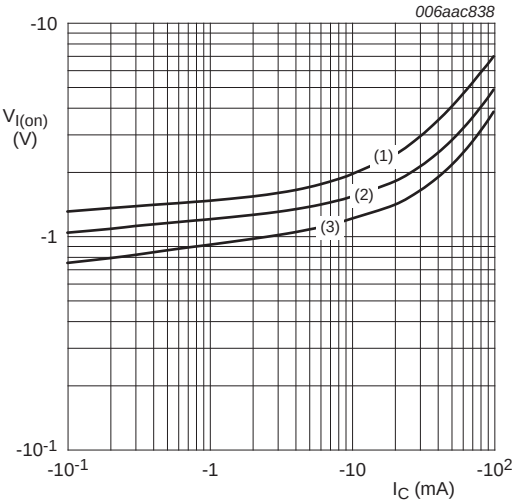

$I_C/I_B$ = 20

(1) $T_{amb}$ = 100 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = −40 °C

**Fig 5. Collector-emitter saturation voltage as a function of collector current; typical values**



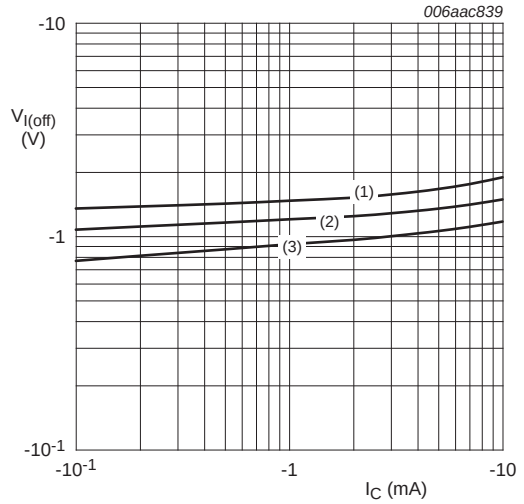

$V_{CE}$ = −0.3 V

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = 25 °C

(3) $T_{amb}$ = 100 °C

**Fig 6. On-state input voltage as a function of collector current; typical values**



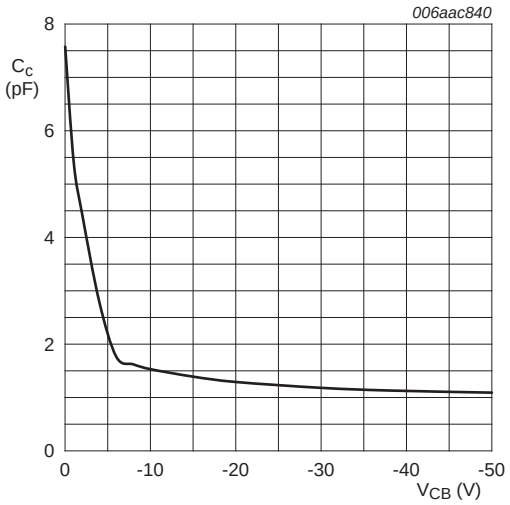

$V_{CE}$ = −5 V

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = 25 °C

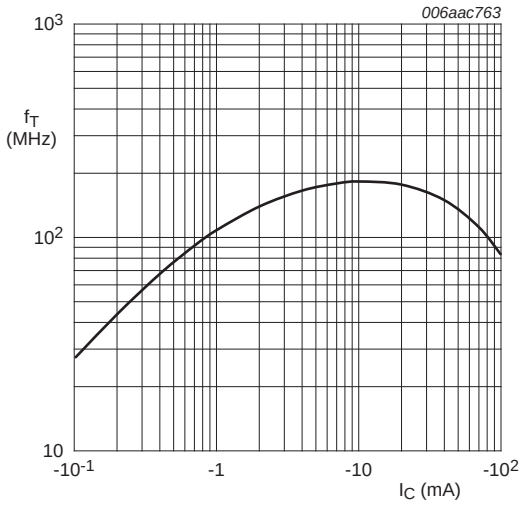
(3) $T_{amb}$ = 100 °C

**Fig 7. Off-state input voltage as a function of collector current; typical values**




f = 1 MHz; $T_{amb}$ = 25 °C

**Fig 8. Collector capacitance as a function of collector-base voltage; typical values**




$V_{CE}$ = −5 V; $T_{amb}$ = 25 °C

**Fig 9. Transition frequency as a function of collector current; typical values of built-in transistor**

# 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

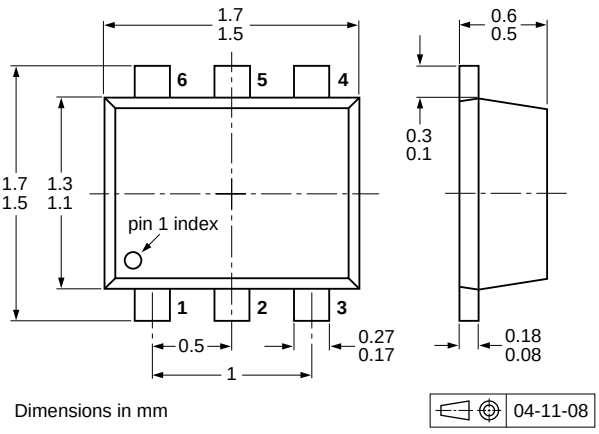



**Fig 10. Package outline PEMB15 (SOT666)**

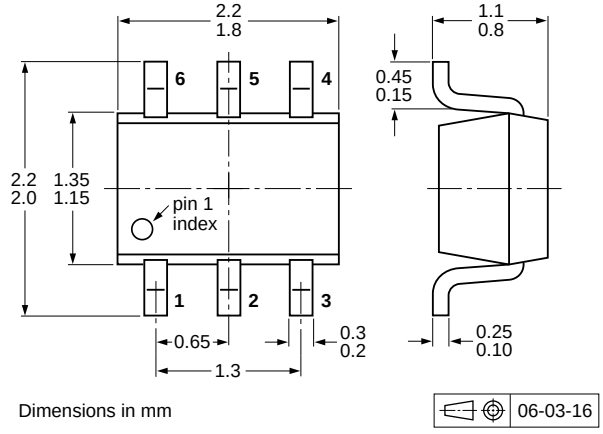



**Fig 11. Package outline PUMB15 (SOT363)**

## 10. Packing information

**Table 9. Packing methods**

*The indicated -xxx are the last three digits of the 12NC ordering code.*[1]

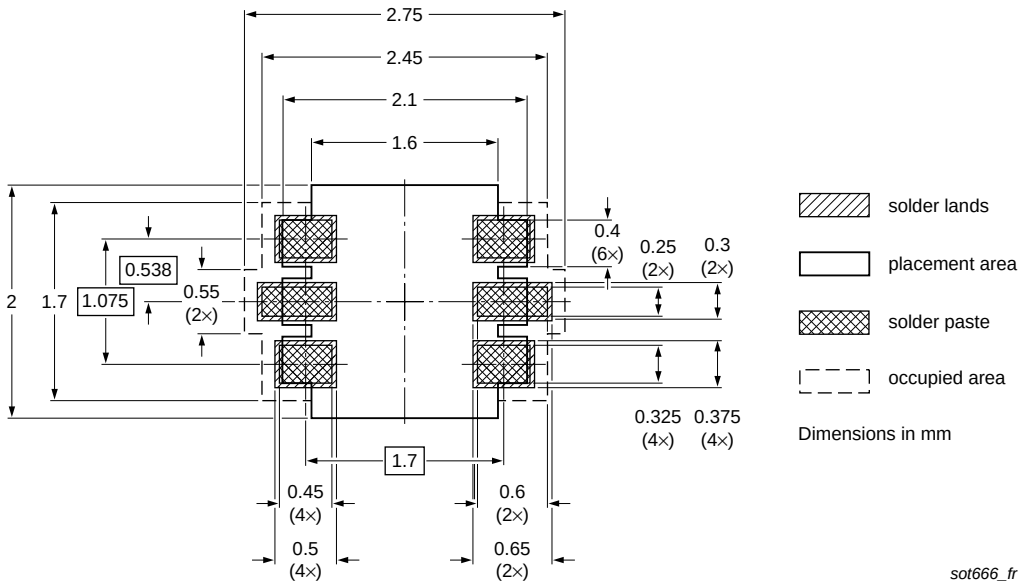
| Type number | Package | Description | Packing quantity | | | |
|---|---|---|---|---|---|---|
| | | | 3000 | 4000 | 8000 | 10000 |
| PEMB15 | SOT666 | 2 mm pitch, 8 mm tape and reel | - | - | -315 | - |
| | | 4 mm pitch, 8 mm tape and reel | - | -115 | - | - |
| PUMB15 | SOT363 | 4 mm pitch, 8 mm tape 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




Reflow soldering is the only recommended soldering method.

**Fig 12. Reflow soldering footprint PEMB15 (SOT666)**

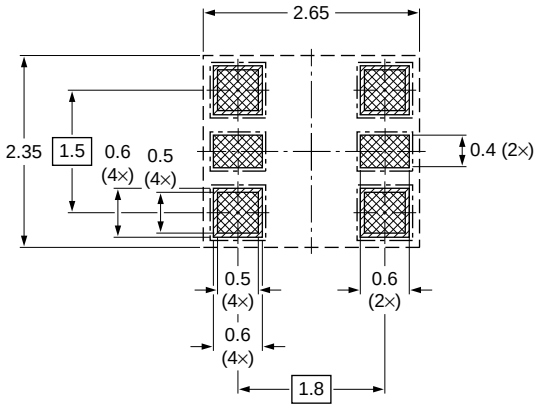



**Fig 13. Reflow soldering footprint PUMB15 (SOT363)**

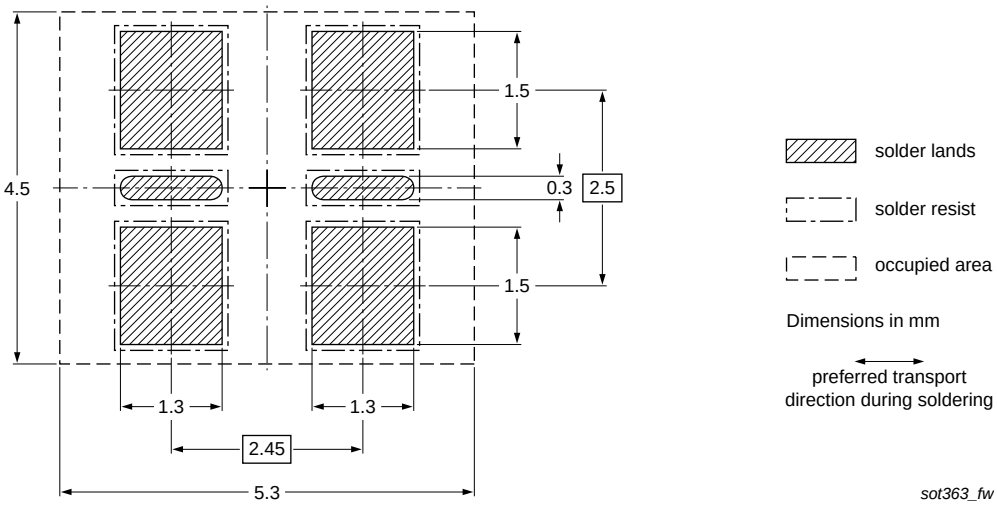



**Fig 14. Wave soldering footprint PUMB15 (SOT363)**

## 12. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PEMB15_PUMB15 v.5 | 20111216 | Product data sheet | - | PEMB15_PUMB15 v.4 |
| Modifications: | • Section 1 “Product profile”: updated<br>• Section 4 “Marking”: updated<br>• Figure 1 to 3: added<br>• Section 6 “Thermal characteristics”: updated<br>• Figure 4 to 9: updated<br>• Table 8 “Characteristics”: $I_{CEO}$ updated, $f_T$ added<br>• Section 8 “Test information”: added<br>• Section 9 “Package outline”: superseded by minimized package outline drawings<br>• Section 11 “Soldering”: added<br>• Section 13 “Legal information”: updated | | | |
| PEMB15_PUMB15 v.4 | 20090831 | Product data sheet | - | PEMB15_PUMB15 v.3 |
| PEMB15_PUMB15 v.3 | 20050203 | Product data sheet | - | PUMB15 v.2 |
| PUMB15 v.2 | 20040414 | Product specification | - | PUMB15 v.1 |
| PUMB15 v.1 | 20031107 | Product specification | - | - |

# 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





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**Date of release: 16 December 2011**
**Document identifier: PEMB15_PUMB15**