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Kind regards,

Team Nexperia

PEMH13; PUMH13

NPN/NPN resistor-equipped transistors;
R1 = 4.7 k Ω , R2 = 47 k Ω

Rev. 4 — 6 December 2011

Product data sheet

1. Product profile

1.1 General description

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

Table 1. Product overview

| Type number | Package | | NPN/PNP complement | PNP/PNP complement | Package configuration |
|-------------|---------|-------|--------------------|--------------------|---------------------------|
| | NXP | JEITA | | | |
| PEMH13 | SOT666 | - | PEMD13 | PEMB13 | ultra small and flat lead |
| PUMH13 | SOT363 | SC-88 | PUMD13 | PUMB13 | 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

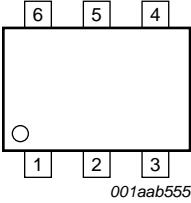
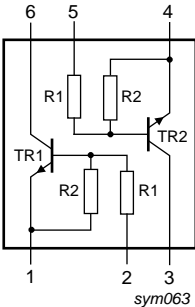
Table 2. Quick reference data

| 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 | k Ω |
| R2/R1 | bias resistor ratio | | 8 | 10 | 12 | |



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 | | |

3. Ordering information

Table 4. Ordering information

| Type number | Package | | Version |
|-------------|---------|--|---------|
| | Name | Description | |
| PEMH13 | - | plastic surface-mounted package; 6 leads | SOT666 |
| PUMH13 | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |

4. Marking

Table 5. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PEMH13 | 21 |
| PUMH13 | H0* |

[1] * = placeholder for manufacturing site code

5. Limiting values

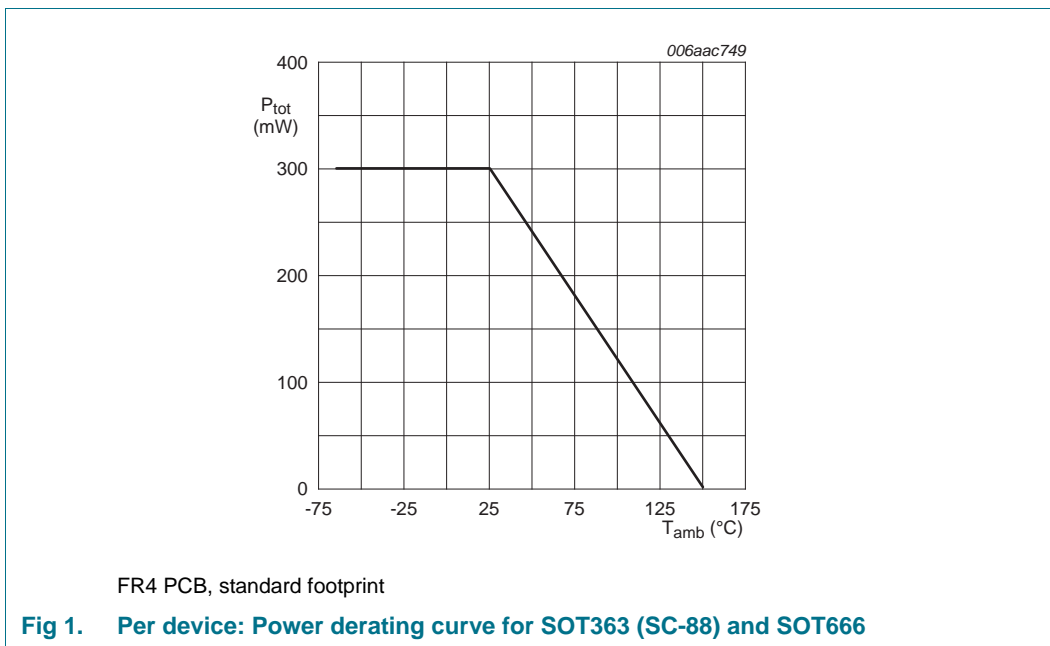
Table 6. Limiting values

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 | - | 5 | V | |
| V_I | input voltage | | | | | |
| | positive | | - | +30 | V | |
| | negative | | - | -5 | 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 | | | | |
| | PEMH13 (SOT666) | | [1][2] | - | 200 | mW |
| | PUMH13 (SOT363) | | [1] | - | 200 | mW |
| Per device | | | | | | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | | | | |
| | PEMH13 (SOT666) | | [1][2] | - | 300 | mW |
| | PUMH13 (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.



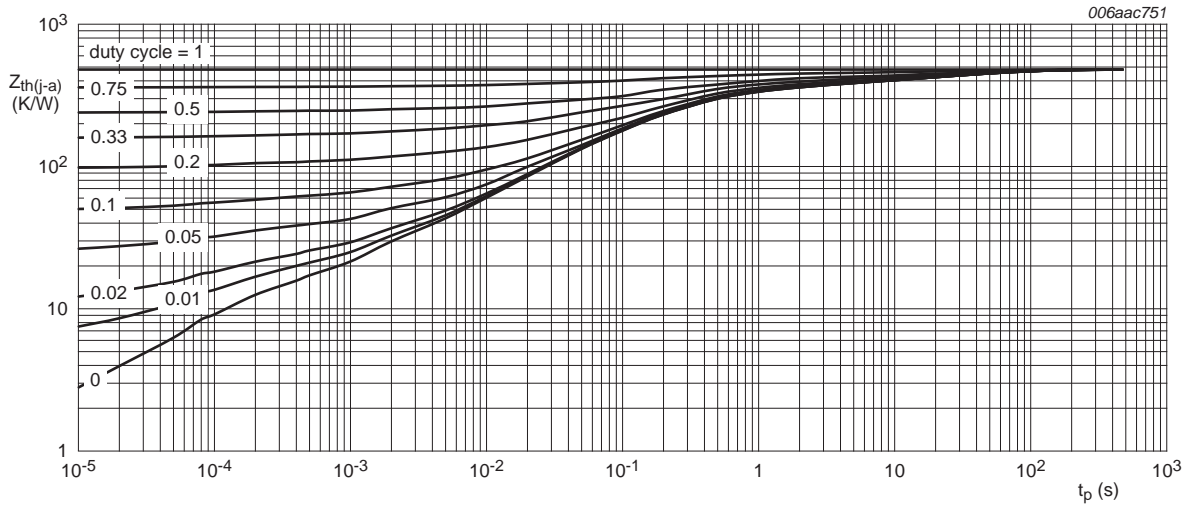
6. Thermal characteristics

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 | | | | |
| | PEMH13 (SOT666) | | [1][2] | - | 625 | K/W |
| | PUMH13 (SOT363) | | [1] | - | 625 | K/W |
| Per device | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | |
| | PEMH13 (SOT666) | | [1][2] | - | 417 | K/W |
| | PUMH13 (SOT363) | | [1] | - | 417 | K/W |

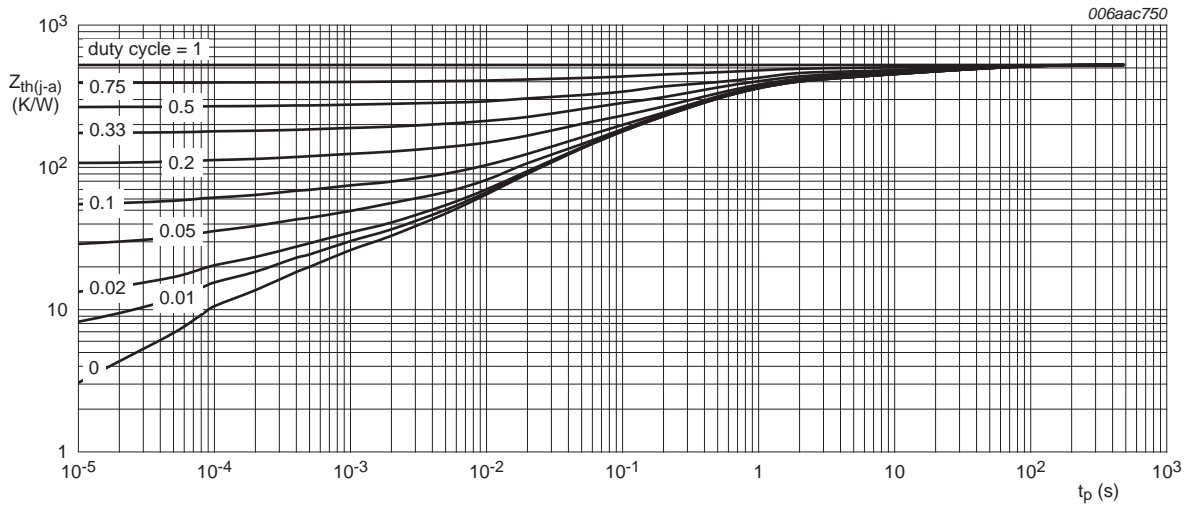
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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 PEMH13 (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 PUMH13 (SOT363); typical values

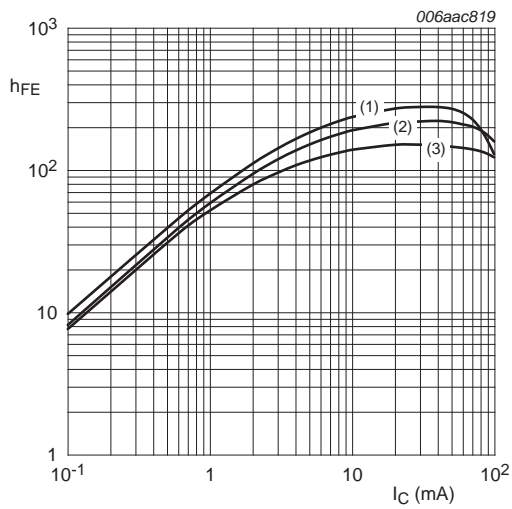
7. Characteristics

Table 8. Characteristics

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

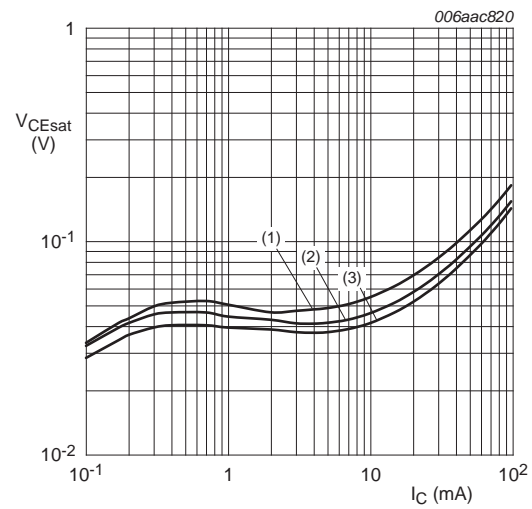
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|--------------------------------------|---|-----|-----|-----|---------------|
| Per transistor | | | | | | |
| I_{CBO} | collector-base cut-off current | $V_{CB} = 50\text{ V}; I_E = 0\text{ A}$ | - | - | 100 | nA |
| I_{CEO} | collector-emitter cut-off current | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}$ | - | - | 1 | μA |
| | | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | - | - | 5 | μA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$ | - | - | 170 | μA |
| h_{FE} | DC current gain | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}$ | 100 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 5\text{ mA}; I_B = 0.25\text{ mA}$ | - | - | 100 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}$ | - | 0.6 | 0.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 0.3\text{ V}; I_C = 5\text{ mA}$ | 1.3 | 0.9 | - | V |
| R1 | bias resistor 1 (input) | | 3.3 | 4.7 | 6.1 | k Ω |
| R2/R1 | bias resistor ratio | | 8 | 10 | 12 | |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | - | - | 2.5 | pF |
| f_T | transition frequency | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$ | [1] | 230 | - | MHz |

[1] Characteristics of built-in transistor



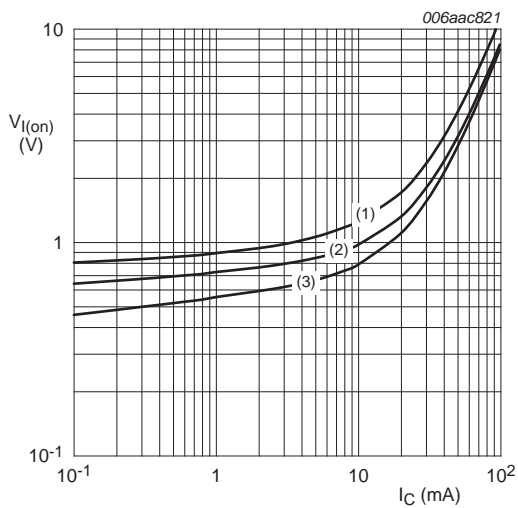
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



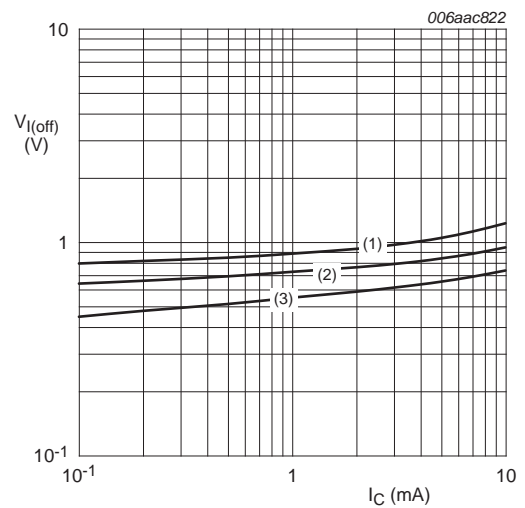
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



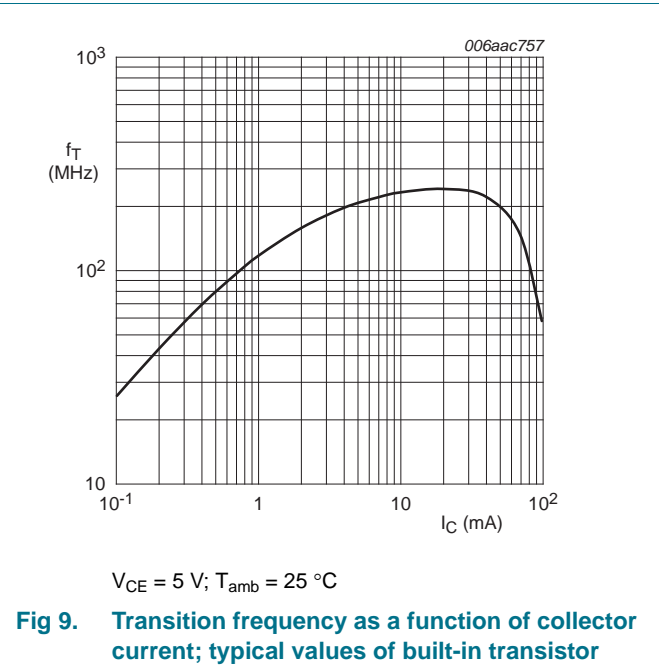
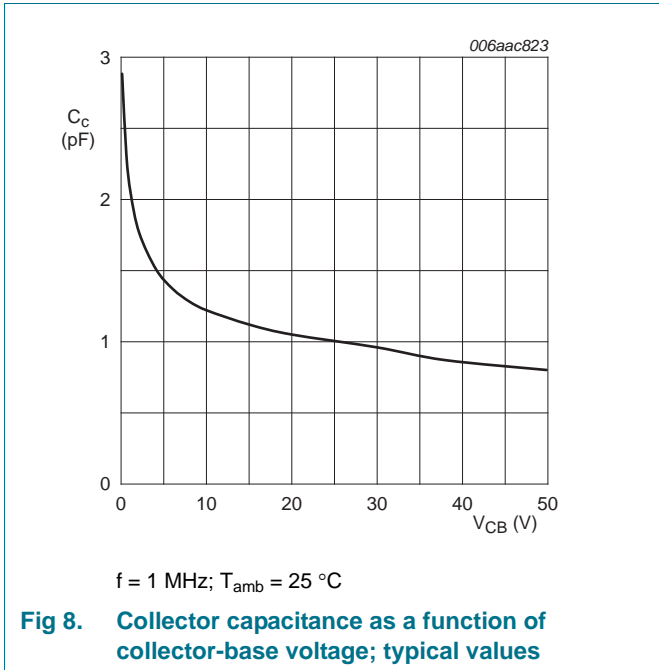
$V_{CE} = 0.3\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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



$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

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

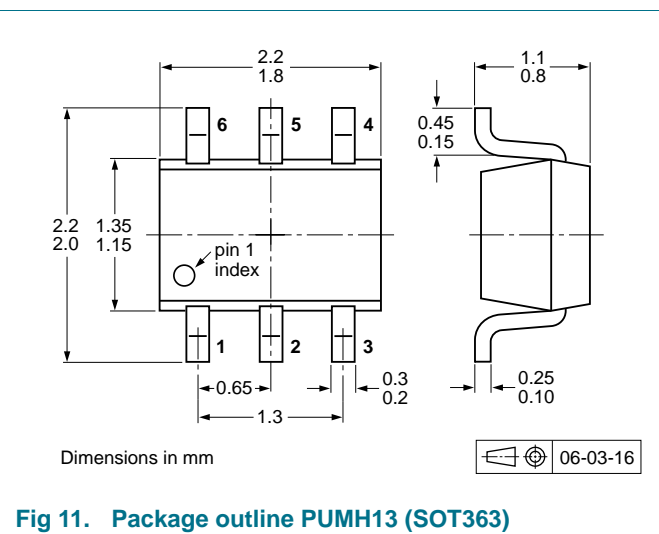
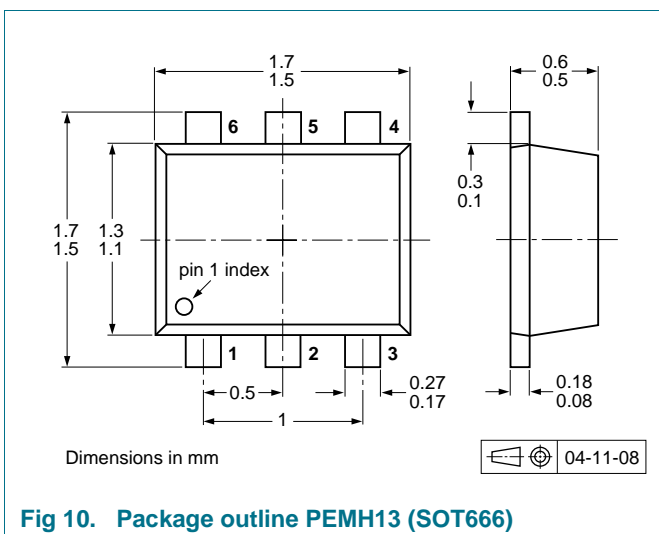


8. Test information

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

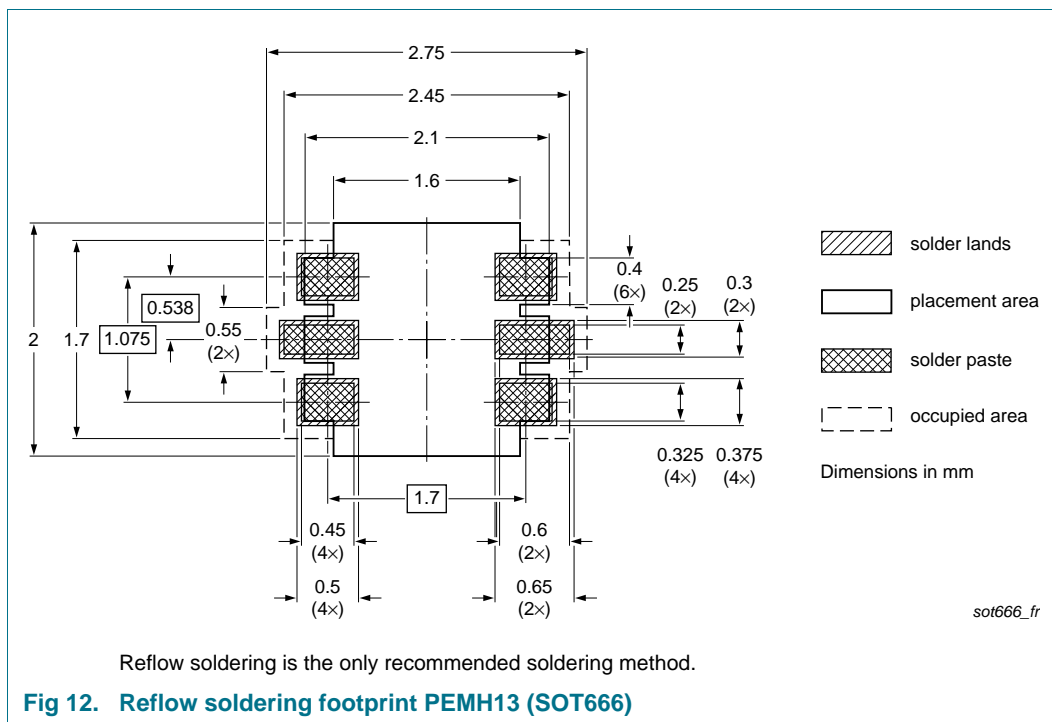
Table 9. Packing methods

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

| Type number | Package | Description | Packing quantity | | | |
|-------------|---------|---|------------------|------|------|-------|
| | | | 3000 | 4000 | 8000 | 10000 |
| PEMH13 | SOT666 | 2 mm pitch, 8 mm tape and reel | - | - | -315 | - |
| | | 4 mm pitch, 8 mm tape and reel | - | -115 | - | - |
| PUMH13 | 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



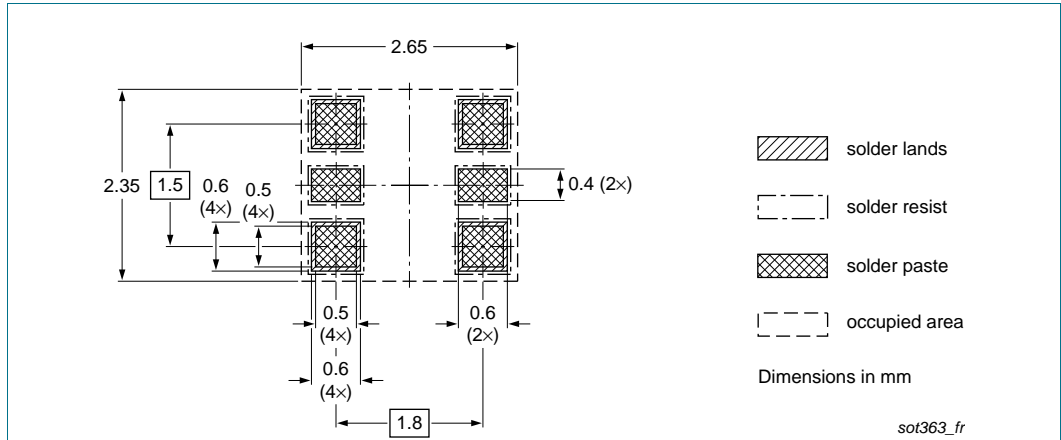


Fig 13. Reflow soldering footprint PUMH13 (SOT363)

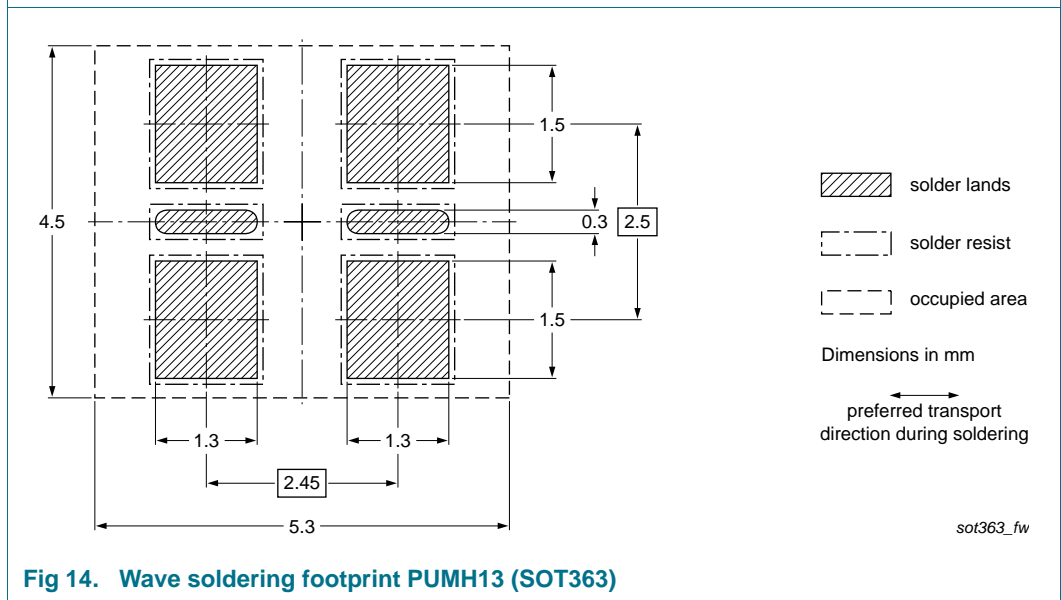


Fig 14. Wave soldering footprint PUMH13 (SOT363)

12. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|---|---------------------------|---------------|-------------------|
| PEMH13_PUMH13 v.4 | 20111206 | Product data sheet | - | PEMH13_PUMH13 v.3 |
| Modifications: | <ul style="list-style-type: none"> • The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Section 1 "Product profile": updated • Section 4 "Marking": updated • Figure 1 to 9: added • Section 5 "Limiting values": updated • Section 6 "Thermal characteristics": updated • Table 8 "Characteristics": $V_{i(on)}$ redefined to $V_{I(on)}$ on-state input voltage, $V_{i(off)}$ redefined to $V_{I(off)}$ off-state input voltage, I_{CEO} updated, f_T added • Section 8 "Test information": added • Section 9 "Package outline": superseded by minimized package outline drawing • Section 10 "Packing information": added • Section 11 "Soldering": added • Section 13 "Legal information": updated | | | |
| PEMH13_PUMH13 v.3 | 20040414 | Product data sheet | - | PEMH13_PUMH13 v.2 |
| PEMH13_PUMH13 v.2 | 20031107 | Product specification | - | PEMH13 v.1 |
| PEMH13 v.1 | 20011213 | Preliminary 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. |

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[2] The term 'short data sheet' is explained in section "Definitions".

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Date of release: 6 December 2011

Document identifier: PEMH13_PUMH13

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