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Kind regards,

Team Nexperia

# PEMH10; PUMH10

## NPN/NPN resistor-equipped transistors; R1 = 2.2 kΩ, R2 = 47kΩ

Rev. 3 — 20 December 2011 Product data sheet

## 1. Product profile

### 1.1 General description

NPN/NPN 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 | | | |
| PEMH10 | SOT666 | - | PEMD10 | PEMB10 | ultra small and flat lead |
| PUMH10 | SOT363 | SC-88 | PUMD10 | PUMB10 | 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

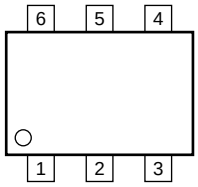
**Table 2. Quick reference data**

| 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) | | 1.54 | 2.20 | 2.86 | kΩ |
| R2/R1 | bias resistor ratio | | 17 | 21 | 26 | |

## 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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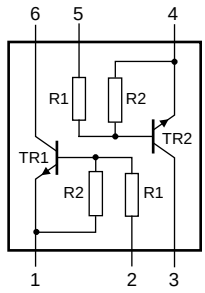

sym063

## 3. Ordering information

**Table 4. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PEMH10 | - | plastic surface-mounted package; 6 leads | SOT666 |
| PUMH10 | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code[1] |
|---|---|
| PEMH10 | 10 |
| PUMH10 | H*0 |

[1] * = placeholder for manufacturing site code.


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## 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 | | | - | +12 | V |
| | negative | | | - | –5 | V |
| $I_O$ | output current | | | - | 100 | mA |
| $I_{CM}$ | peak collector current | | | - | 100 | mA |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | [1] | | | |
| | PEMH10 (SOT666) | | [2] | - | 200 | mW |
| | PUMH10 (SOT363) | | | - | 200 | mW |
| **Per device** | | | | | | |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | [1] | | | |
| | PEMH10 (SOT666) | | [2] | - | 300 | mW |
| | PUMH10 (SOT363) | | | - | 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.


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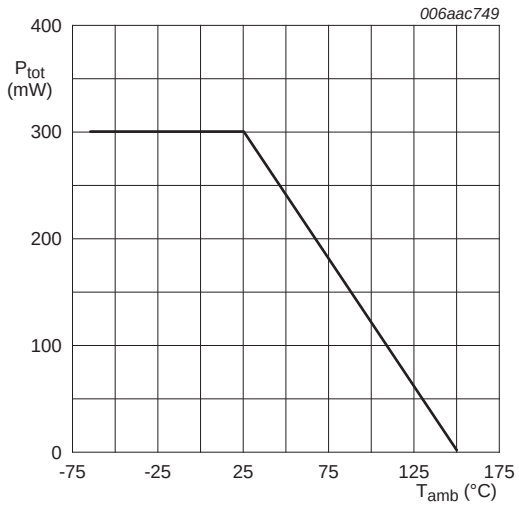


SOT363 and SOT666; FR4 PCB, standard footprint

**Fig 1. Per device: Power derating curve**

## 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] | | | | |
| | PEMH10 (SOT666) | | [2] | - | - | 625 | K/W |
| | PUMH10 (SOT363) | | | - | - | 625 | K/W |
| **Per device** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | | | | |
| | PEMH10 (SOT666) | | [2] | - | - | 417 | K/W |
| | PUMH10 (SOT363) | | | - | - | 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.


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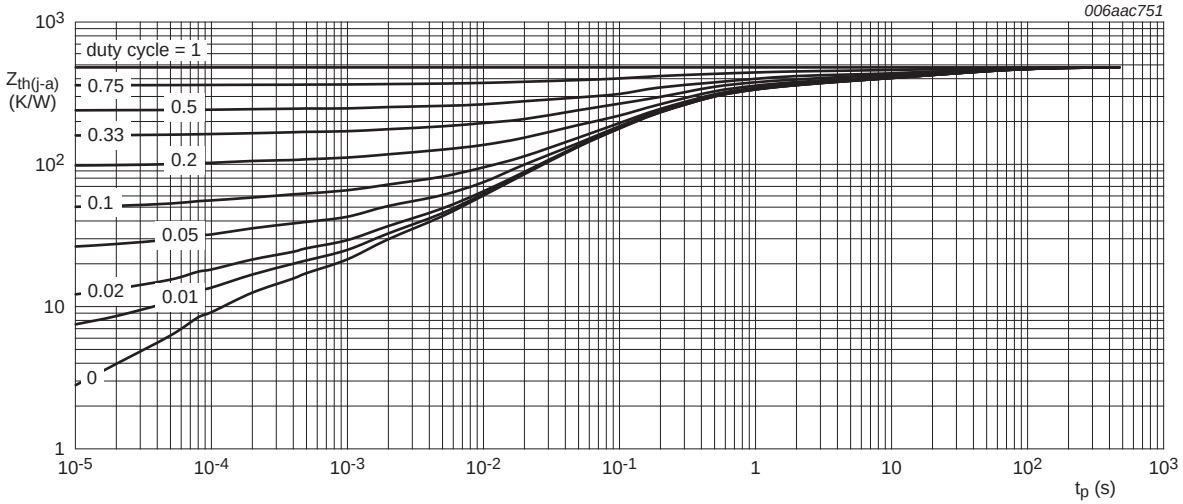
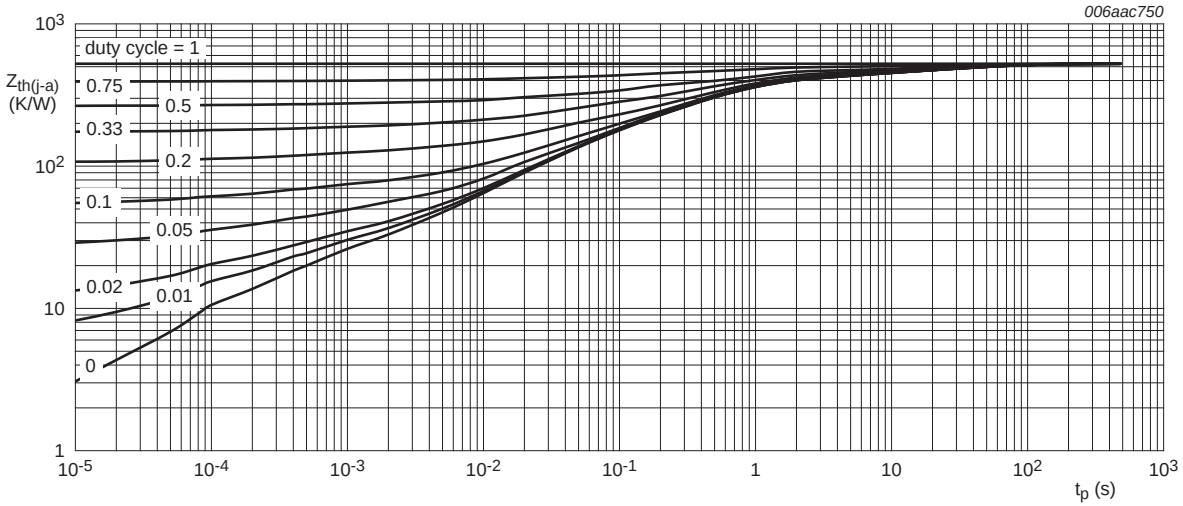



FR4 PCB, standard footprint

**Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration for PEMH10 (SOT666); typical values**




FR4 PCB, standard footprint

**Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for PUMH10 (SOT363); typical values**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# 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 | | - | - | 100 | nA |
| | | $V_{CE}$ = 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 | | - | - | 180 | μA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 10 mA | | 100 | - | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 5 mA; $I_B$ = 0.25 mA | | - | - | 100 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE}$ = 5 V; $I_C$ = 100 μA | | - | 0.6 | 0.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE}$ = 0.3 V; $I_C$ = 5 mA | | 1.1 | 0.75 | - | V |
| R1 | bias resistor 1 (input) | | | 1.54 | 2.20 | 2.86 | kΩ |
| R2/R1 | bias resistor ratio | | | 17 | 21 | 26 | |
| $C_c$ | collector capacitance | $V_{CB}$ = 10 V; $I_E$ = $i_e$ = 0 A; f = 1 MHz | | - | - | 2.5 | pF |
| $f_T$ | transition frequency | $V_{CB}$ = 5 V; $I_C$ = 10 mA; f = 100 MHz | [1] | - | 230 | - | MHz |

[1] Characteristics of built-in transistor.


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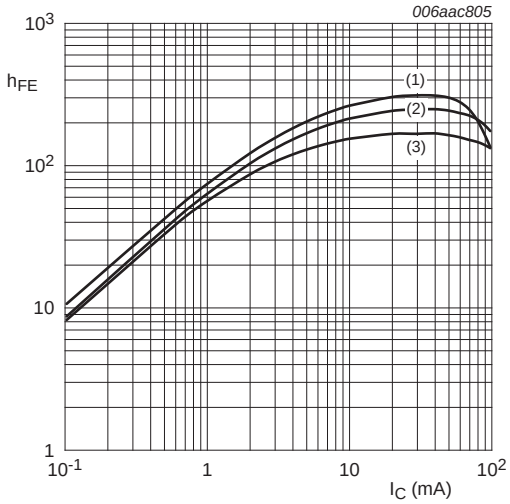


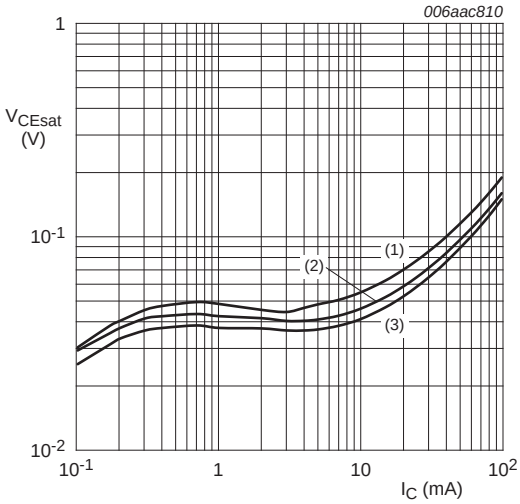

$V_{CE}$ = 5 V

(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**



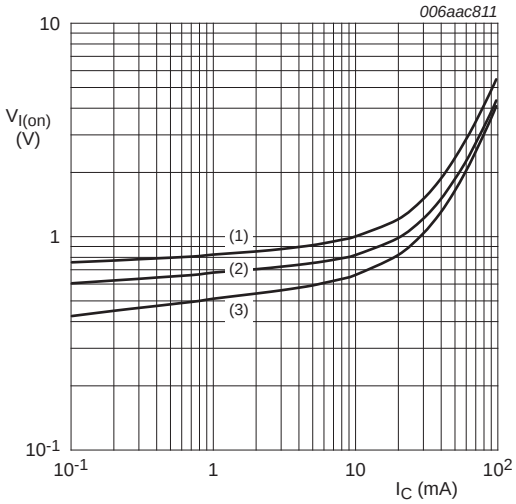

$I_C/I_B$ = 20

(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**



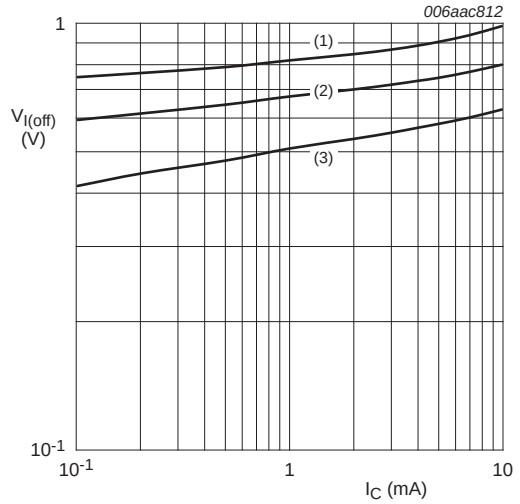

$V_{CE}$ = 0.3 V

(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**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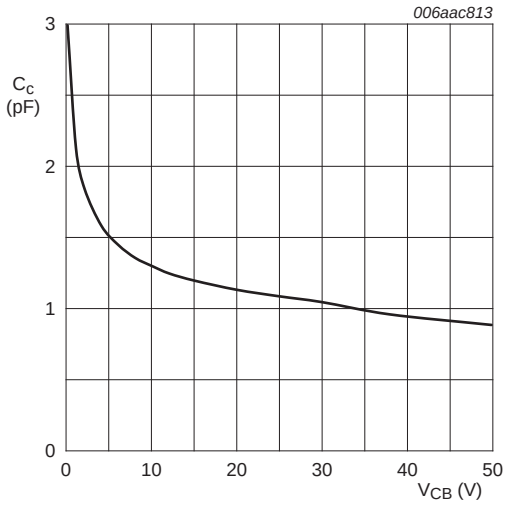
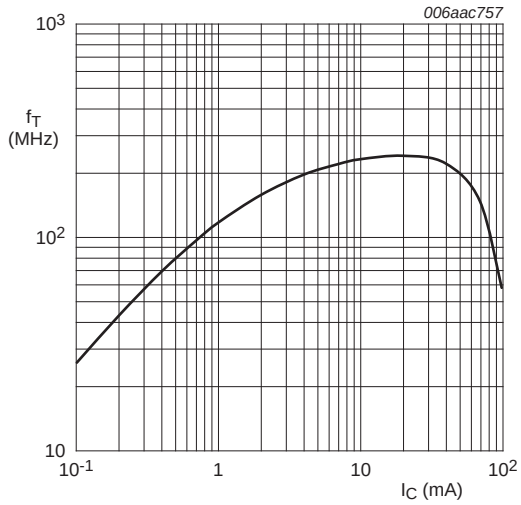



f = 1 MHz; $T_{amb}$ = 25 °C

**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.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## 9. Package outline

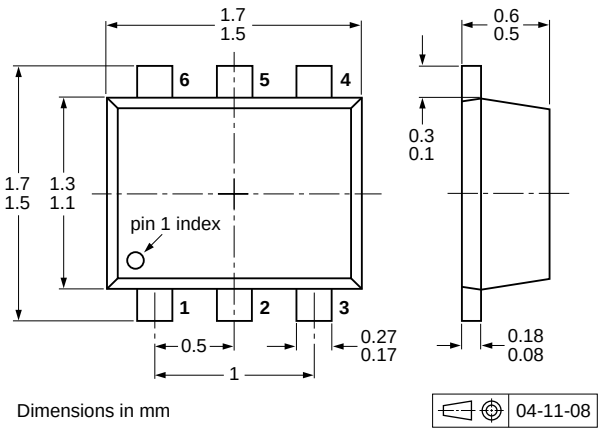


**Fig 10. Package outline PEMH10 (SOT666)**

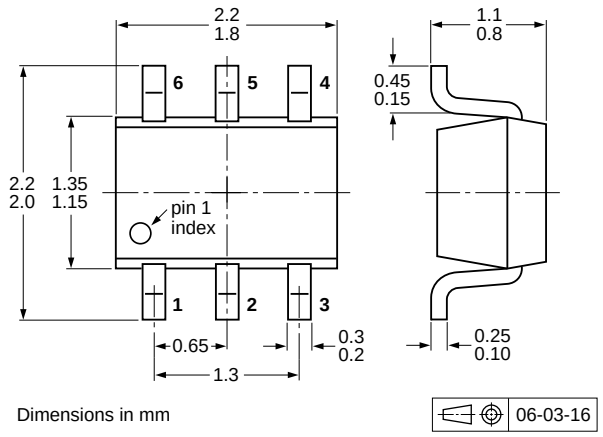


**Fig 11. Package outline PUMH10 (SOT363/SC-88)**


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## 10. Packing information

**Table 9. Packing methods**

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

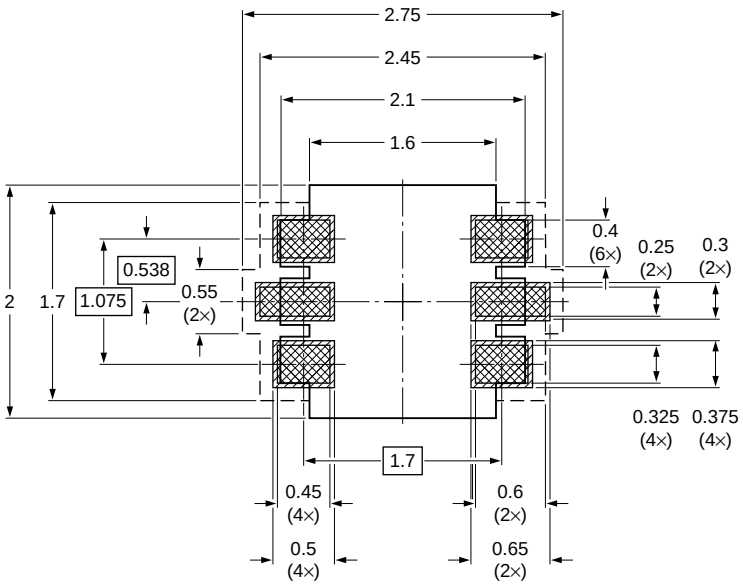
| Type number | Package | Description | Packing quantity | | | |
|---|---|---|---|---|---|---|
| | | | 3000 | 4000 | 8000 | 10000 |
| PEMH10 | SOT666 | 2 mm pitch, 8 mm tape and reel | - | - | -315 | - |
| | | 4 mm pitch, 8 mm tape and reel | - | -115 | - | - |
| PUMH10 | SOT363 | 4 mm pitch, 8 mm tape 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 PEMH10 (SOT666)**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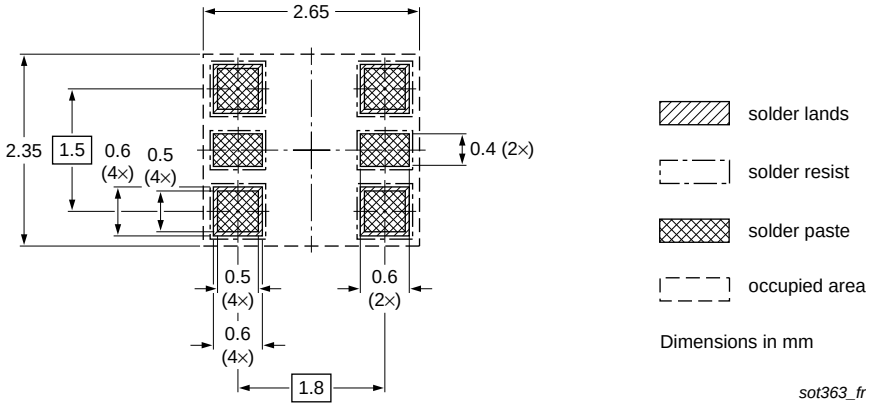


**Fig 13. Reflow soldering footprint PUMH10 (SOT363/SC-88)**

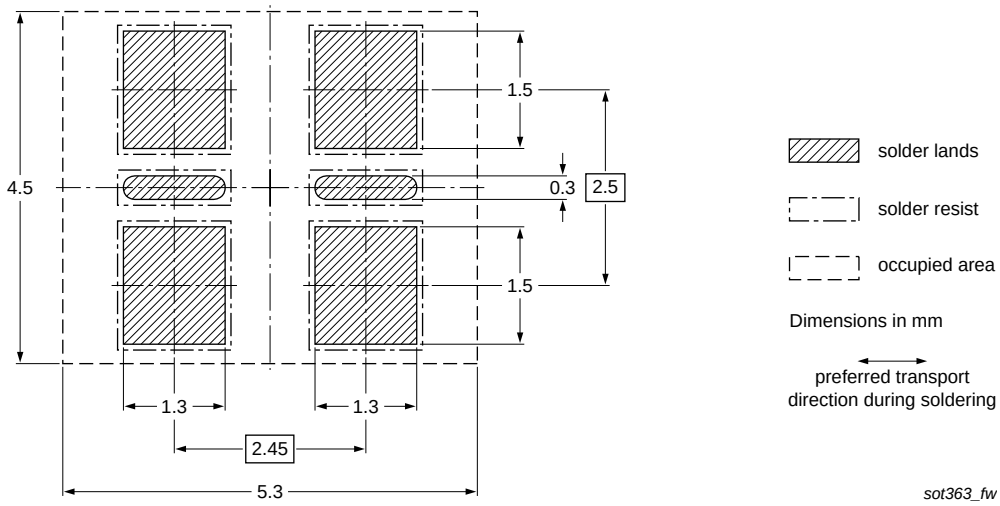


**Fig 14. Wave soldering footprint PUMH10 (SOT363/SC-88)**


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## 12. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PEMH10_ PUMH10 v.3 | 20111220 | Product data sheet | - | PEMH10_ PUMH10 v.2 |
| Modifications: | • The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Section 1 “Product profile”: updated<br>• Section 4 “Marking”: updated<br>• Table 7 “Thermal characteristics”: updated according to the latest measurements<br>• Table 8 “Characteristics”: $I_{CEO}$ updated according to the latest measurements, $f_T$ added, $V_{i(off)}$ redefined to $V_{I(off)}$ off-state input voltage, $V_{i(on)}$ redefined to $V_{I(on)}$ on-state input voltage.<br>• Figure 1 to 9: added<br>• Section 8 “Test information”: added<br>• Figure 10 and 11: replaced by minimized package outline drawings<br>• Section 10 “Packing information”: added<br>• Section 11 “Soldering”: added<br>• Section 13 “Legal information”: updated | | | |
| PEMH10_ PUMH10 v.2 | 20031020 | Product data sheet | - | PEMH10 v.1<br>PUMH10 v.1 |
| PEMH10 v.1 | 20011022 | Preliminary specification | - | - |
| PUMH10 v.1 | 20000801 | Product specification | | - |


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# 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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## 15. Contents

**1 Product profile . . . . . 1**
1.1 General description . . . . . 1
1.2 Features and benefits . . . . . 1
1.3 Applications . . . . . 1
1.4 Quick reference data . . . . . 1
**2 Pinning information . . . . . 2**
**3 Ordering information . . . . . 2**
**4 Marking . . . . . 2**
**5 Limiting values . . . . . 3**
**6 Thermal characteristics . . . . . 4**
**7 Characteristics . . . . . 6**
**8 Test information . . . . . 8**
8.1 Quality information . . . . . 8
**9 Package outline . . . . . 9**
**10 Packing information . . . . . 10**
**11 Soldering . . . . . 10**
**12 Revision history . . . . . 12**
**13 Legal information . . . . . 13**
13.1 Data sheet status . . . . . 13
13.2 Definitions . . . . . 13
13.3 Disclaimers . . . . . 13
13.4 Trademarks . . . . . 14
**14 Contact information . . . . . 14**
**15 Contents . . . . . 15**

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