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Kind regards,

Team Nexperia

# PEMH9; PIMH9; PUMH9

NPN/NPN resistor-equipped transistors;  
R1 = 10 k $\Omega$ , R2 = 47 k $\Omega$

Rev. 5 — 12 November 2013

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 |       | PNP/PNP complement | NPN/PNP complement | Package configuration     |
|-------------|---------|-------|--------------------|--------------------|---------------------------|
|             | NXP     | JEITA |                    |                    |                           |
| PEMH9       | SOT666  | -     | PEMB9              | PEMD9              | ultra small and flat lead |
| PIMH9       | SOT457  | SC-74 | -                  | -                  | small                     |
| PUMH9       | SOT363  | SC-88 | PUMB9              | PUMD9              | 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

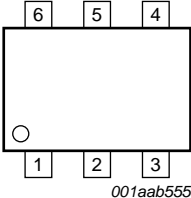
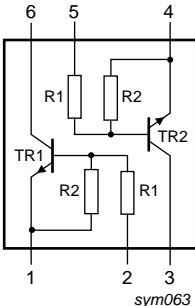
Table 2. Quick reference data

| Symbol                | Parameter                 | Conditions | Min | Typ | Max | Unit       |
|-----------------------|---------------------------|------------|-----|-----|-----|------------|
| <b>Per transistor</b> |                           |            |     |     |     |            |
| V <sub>CEO</sub>      | collector-emitter voltage | open base  | -   | -   | 50  | V          |
| I <sub>O</sub>        | output current            |            | -   | -   | 100 | mA         |
| R1                    | bias resistor 1 (input)   |            | 7   | 10  | 13  | k $\Omega$ |
| R2/R1                 | bias resistor ratio       |            | 3.7 | 4.7 | 5.7 |            |



## 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                                      |         |
| PEMH9       | -       | plastic surface-mounted package; 6 leads         | SOT666  |
| PIMH9       | SC-74   | plastic surface-mounted package (TSOP6); 6 leads | SOT457  |
| PUMH9       | SC-88   | plastic surface-mounted package; 6 leads         | SOT363  |

## 4. Marking

Table 5. Marking codes

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PEMH9       | H9                          |
| PIMH9       | H9                          |
| PUMH9       | H*9                         |

[1] \* = placeholder for manufacturing site code

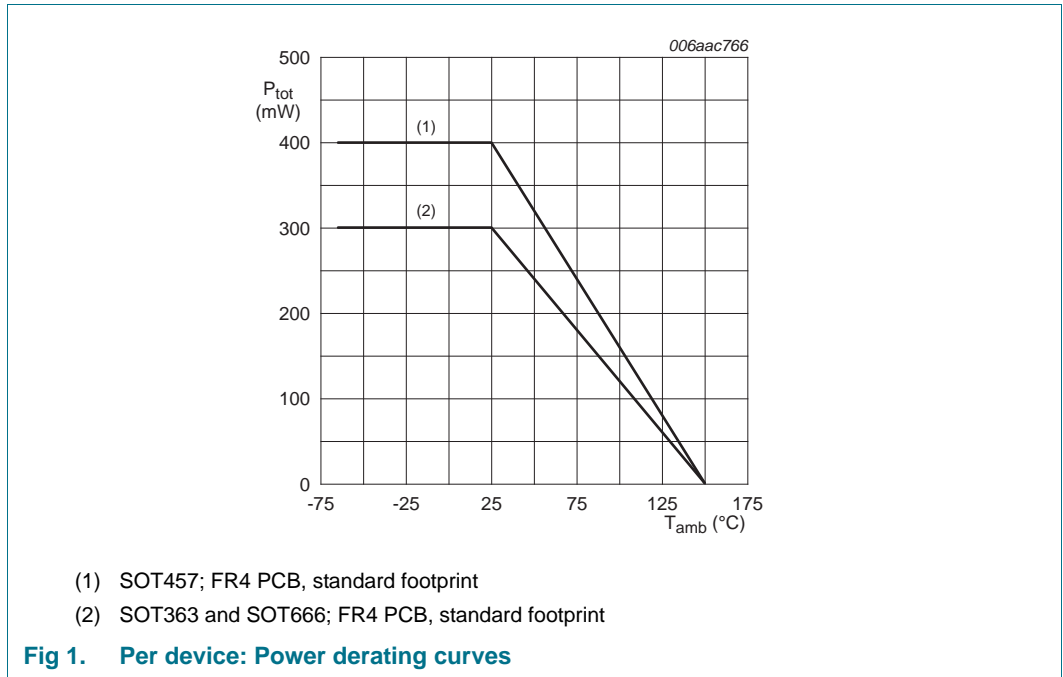
## 5. Limiting values

**Table 6. Limiting values**

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

| Symbol                | Parameter                 | Conditions                             | Min            | Max  | Unit |     |    |
|-----------------------|---------------------------|--|----------------|------|------|-----|----|
| <b>Per transistor</b> |                           |  |                |      |      |     |    |
| V <sub>CBO</sub>      | collector-base voltage    | open emitter                           | -              | 50   | V    |     |    |
| V <sub>CEO</sub>      | collector-emitter voltage | open base                              | -              | 50   | V    |     |    |
| V <sub>EBO</sub>      | emitter-base voltage      | open collector                         | -              | 6    | V    |     |    |
| V <sub>I</sub>        | input voltage             |  |                |      |      |     |    |
|                       |                           | positive                               | -              | +40  | V    |     |    |
|                       |                           | negative                               | -              | -6   | V    |     |    |
| I <sub>O</sub>        | output current            |  | -              | 100  | mA   |     |    |
| I <sub>CM</sub>       | peak collector current    | single pulse;<br>t <sub>p</sub> ≤ 1 ms | -              | 100  | mA   |     |    |
| P <sub>tot</sub>      | total power dissipation   | T <sub>amb</sub> ≤ 25 °C               |                |      |      |     |    |
|                       |                           |  | PEMH9 (SOT666) | [1]  | -    | 200 | mW |
|                       |                           |  | PIMH9 (SOT457) | [1]  | -    | 250 | mW |
|                       |                           |  | PUMH9 (SOT363) | [1]  | -    | 200 | mW |
| <b>Per device</b>     |                           |  |                |      |      |     |    |
| P <sub>tot</sub>      | total power dissipation   | T <sub>amb</sub> ≤ 25 °C               |                |      |      |     |    |
|                       |                           |  | PEMH9 (SOT666) | [1]  | -    | 300 | mW |
|                       |                           |  | PIMH9 (SOT457) | [1]  | -    | 400 | mW |
|                       |                           |  | PUMH9 (SOT363) | [1]  | -    | 300 | mW |
| 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.

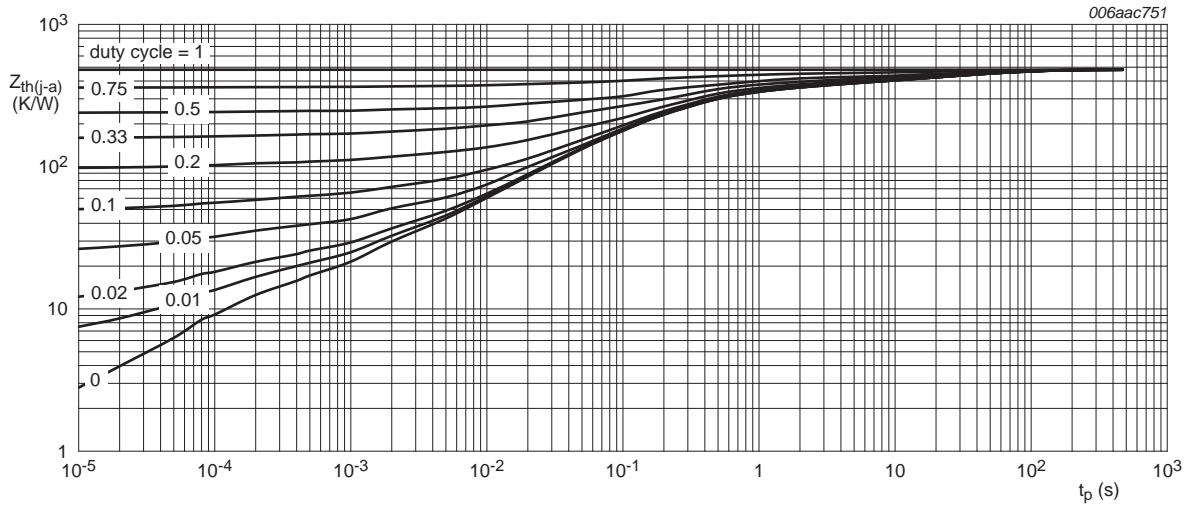


6. Thermal characteristics

Table 7. Thermal characteristics

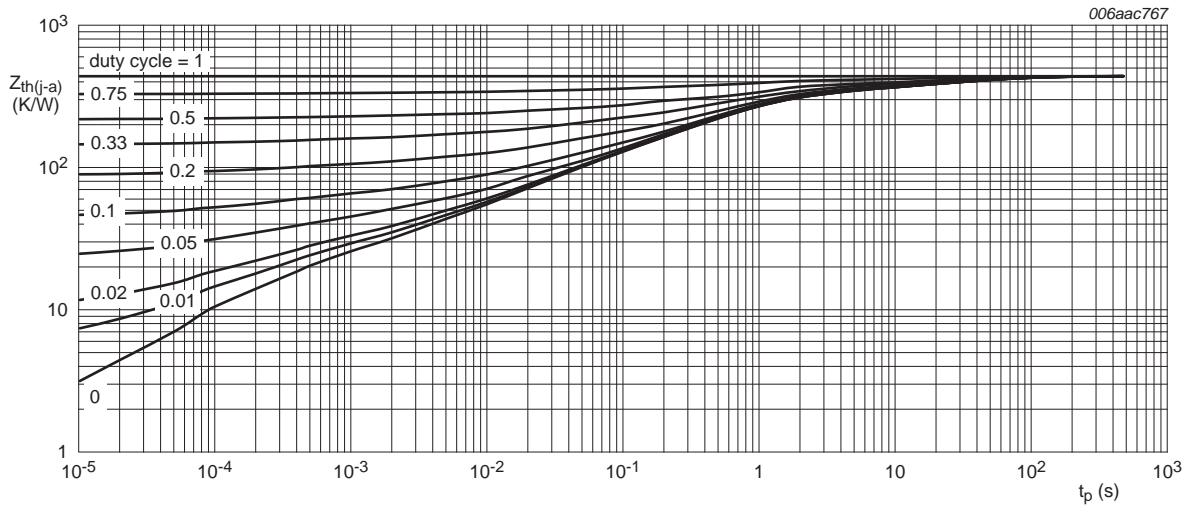
| Symbol                | Parameter                                   | Conditions  | Min | Typ | Max | Unit |
|-----------------------|---|-------------|-----|-----|-----|------|
| <b>Per transistor</b> |   |             |     |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient | in free air |     |     |     |      |
|                       | PEMH9 (SOT666)                              |             | [1] | -   | 625 | K/W  |
|                       | PIMH9 (SOT457)                              |             | [1] | -   | 500 | K/W  |
|                       | PUMH9 (SOT363)                              |             | [1] | -   | 625 | K/W  |
| <b>Per device</b>     |   |             |     |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient | in free air |     |     |     |      |
|                       | PEMH9 (SOT666)                              |             | [1] | -   | 417 | K/W  |
|                       | PIMH9 (SOT457)                              |             | [1] | -   | 313 | K/W  |
|                       | PUMH9 (SOT363)                              |             | [1] | -   | 417 | K/W  |

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



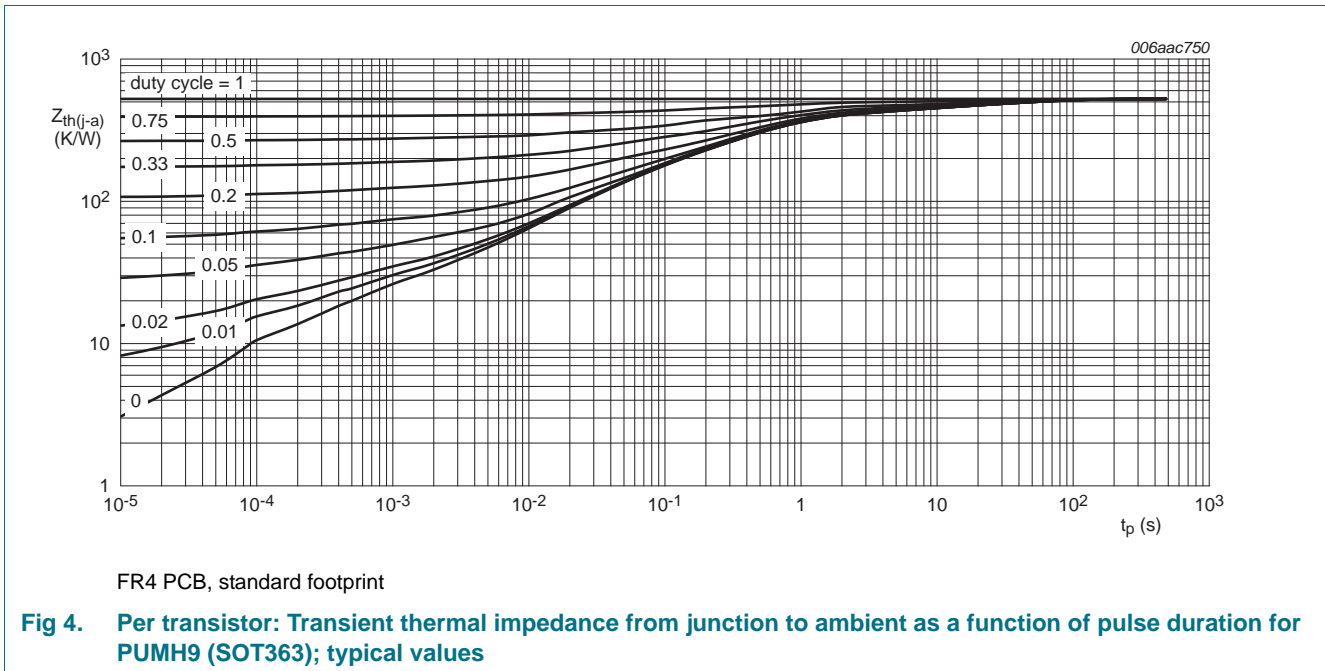
FR4 PCB, standard footprint

**Fig 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration for PEMH9 (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 PIMH9 (SOT457); typical values**



## 7. Characteristics

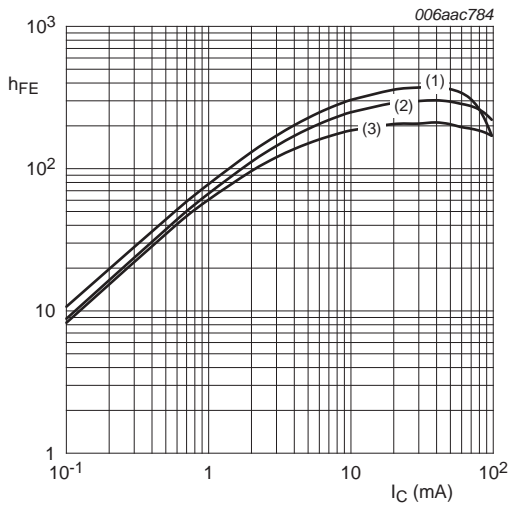
**Table 8. Characteristics**

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

| Symbol                | Parameter                            | Conditions   | Min | Typ | Max | Unit |
|-----------------------|--------------------------------------|--|-----|-----|-----|------|
| <b>Per transistor</b> |                                      |  |     |     |     |      |
| $I_{CBO}$             | collector-base cut-off current       | $V_{CB} = 50\text{ V}; I_E = 0\text{ A}$                         | -   | -   | 100 | nA   |
| $I_{CEO}$             | collector-emitter cut-off current    | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}$                         | -   | -   | 100 | nA   |
|                       |                                      | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ °C}$    | -   | -   | 5   | μA   |
| $I_{EBO}$             | emitter-base cut-off current         | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$                          | -   | -   | 150 | μA   |
| $h_{FE}$              | DC current gain                      | $V_{CE} = 5\text{ V}; I_C = 5\text{ mA}$                         | 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              | $V_{CE} = 5\text{ V}; I_C = 100\text{ μA}$                       | -   | 0.7 | 0.5 | V    |
| $V_{I(on)}$           | on-state input voltage               | $V_{CE} = 0.3\text{ V}; I_C = 1\text{ mA}$                       | 1.4 | 0.8 | -   | V    |
| R1                    | bias resistor 1 (input)              |  | 7   | 10  | 13  | kΩ   |
| R2/R1                 | bias resistor ratio                  |  | 3.7 | 4.7 | 5.7 |      |
| $C_c$                 | 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  |

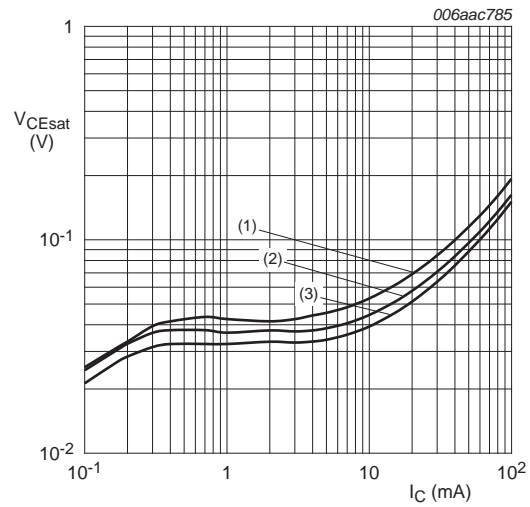
[1] Characteristics of built-in transistor





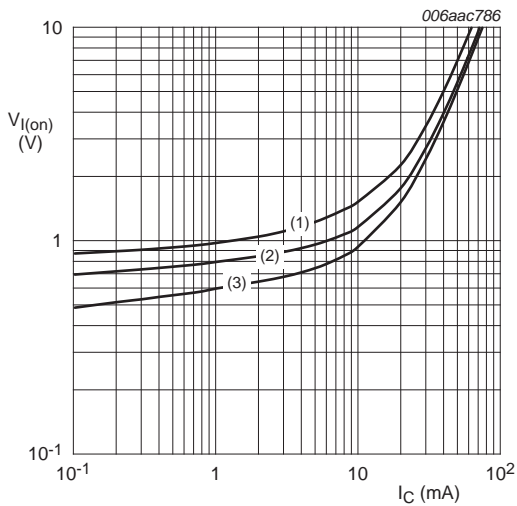
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

**Fig 5. DC current gain as a function of collector current; typical values**



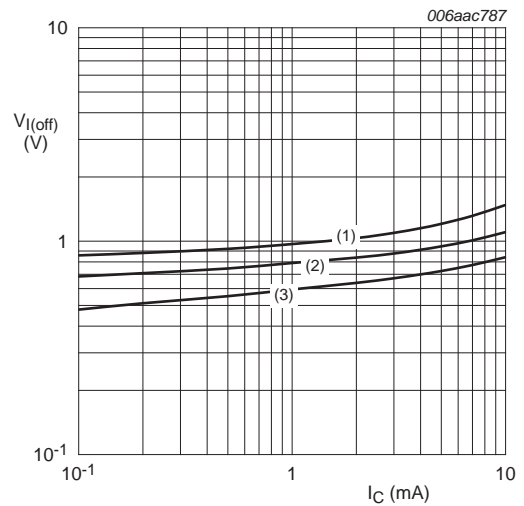
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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



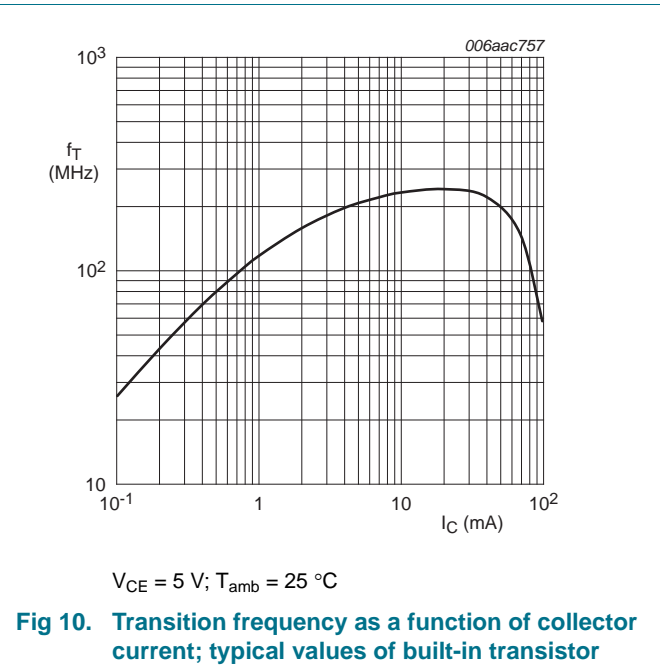
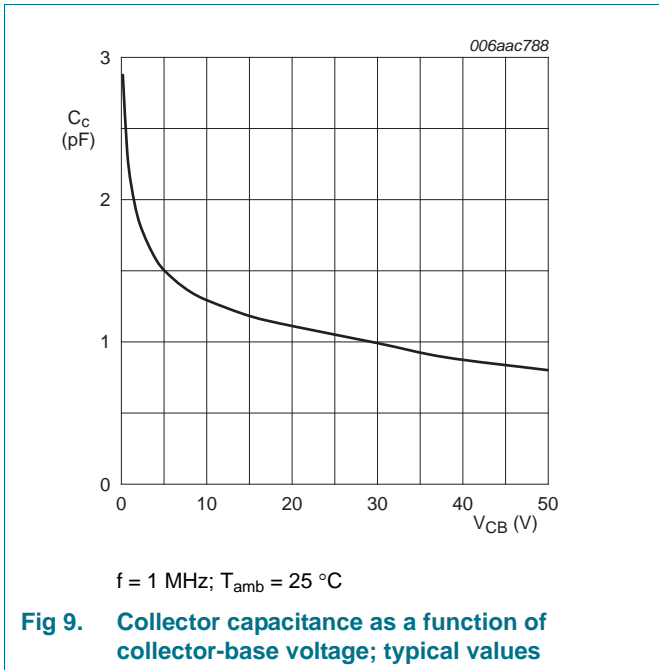
$V_{CE} = 0.3\text{ V}$   
 (1)  $T_{amb} = -40\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = 100\text{ }^{\circ}\text{C}$

**Fig 7. 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 8. Off-state input voltage as a function of collector current; typical values**

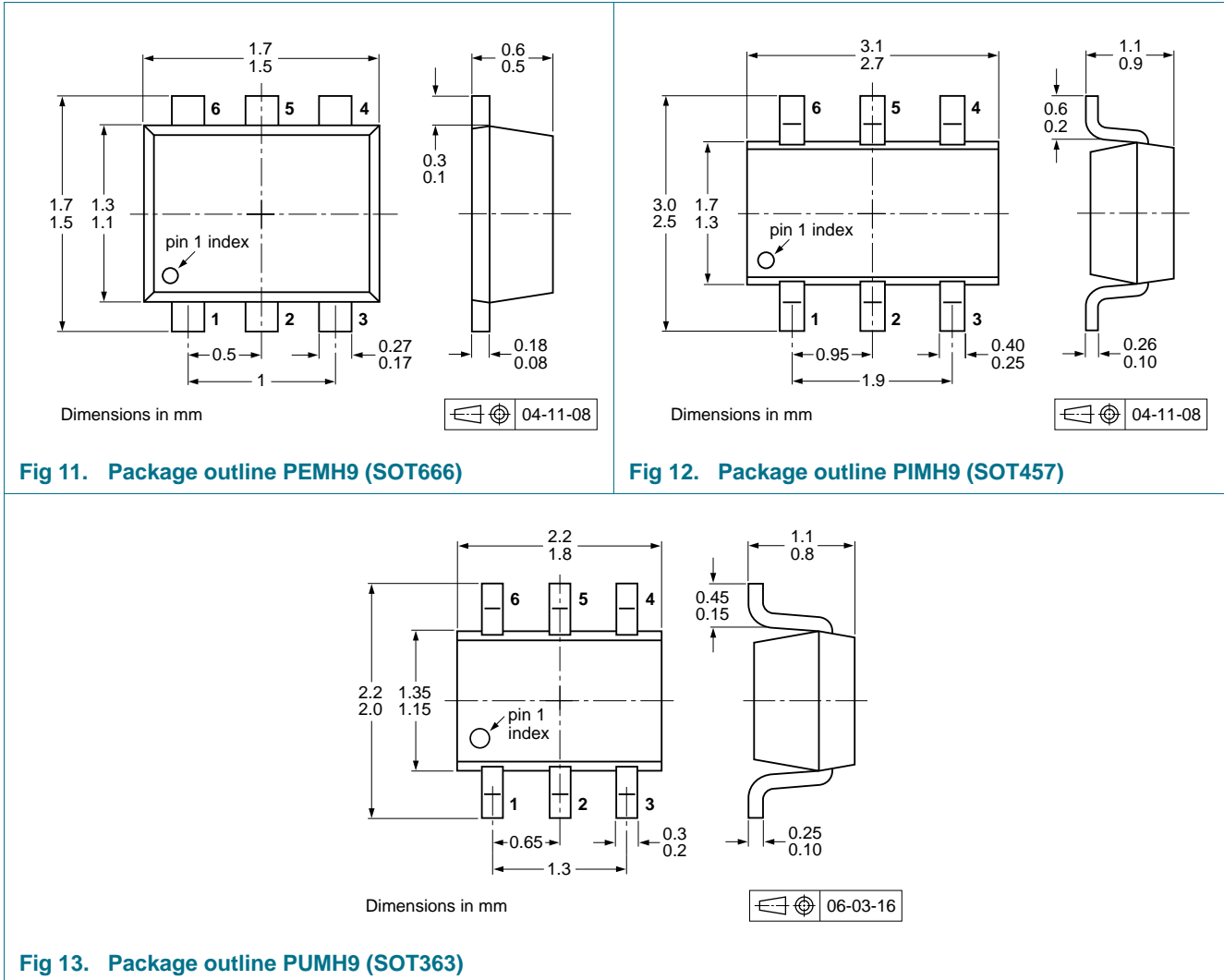


## 8. Test information

### 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. Soldering

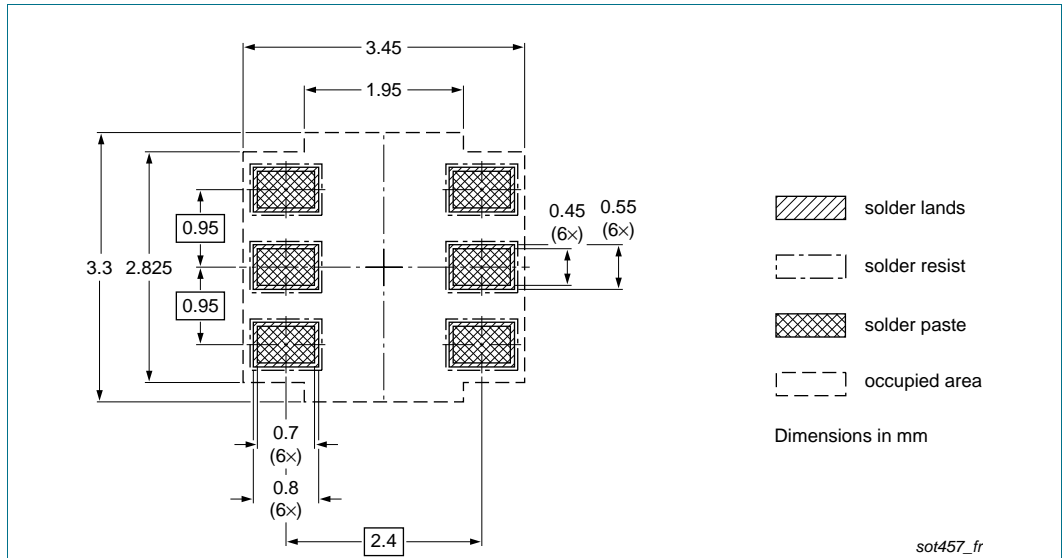


Fig 14. Reflow soldering footprint PIMH9 (SOT457)

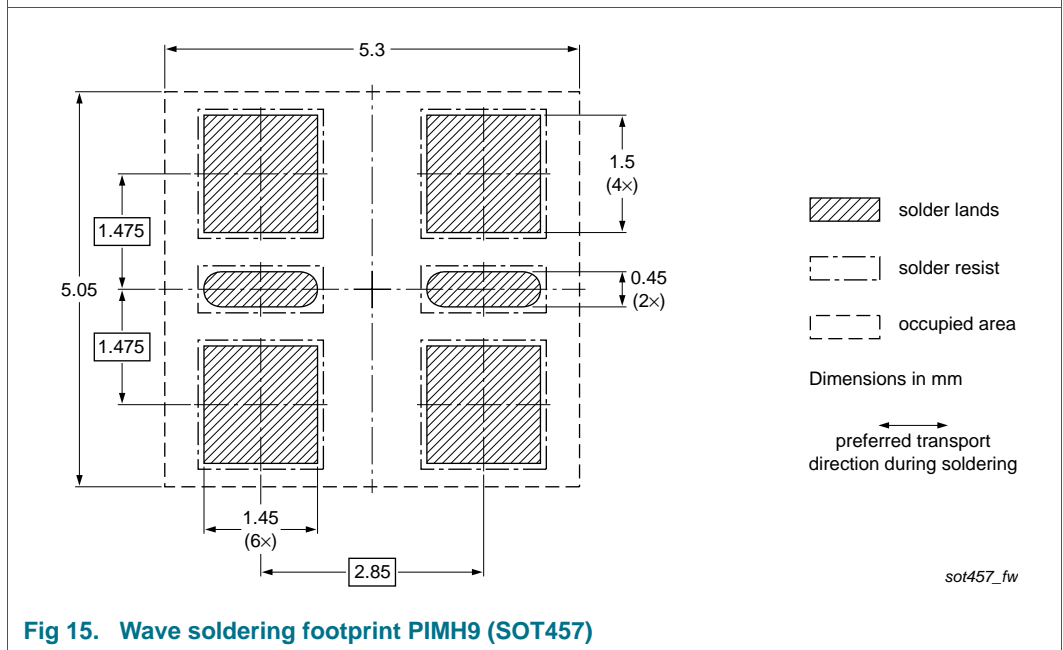


Fig 15. Wave soldering footprint PIMH9 (SOT457)

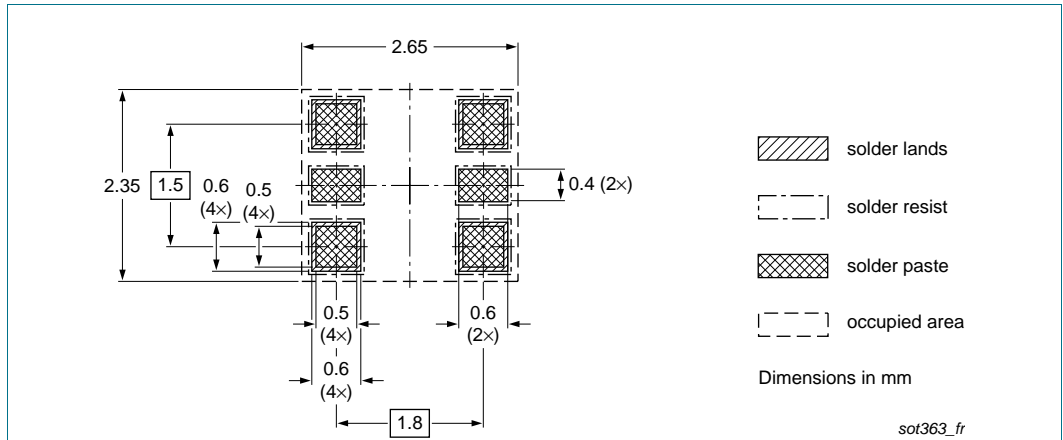


Fig 16. Reflow soldering footprint PUMH9 (SOT363)

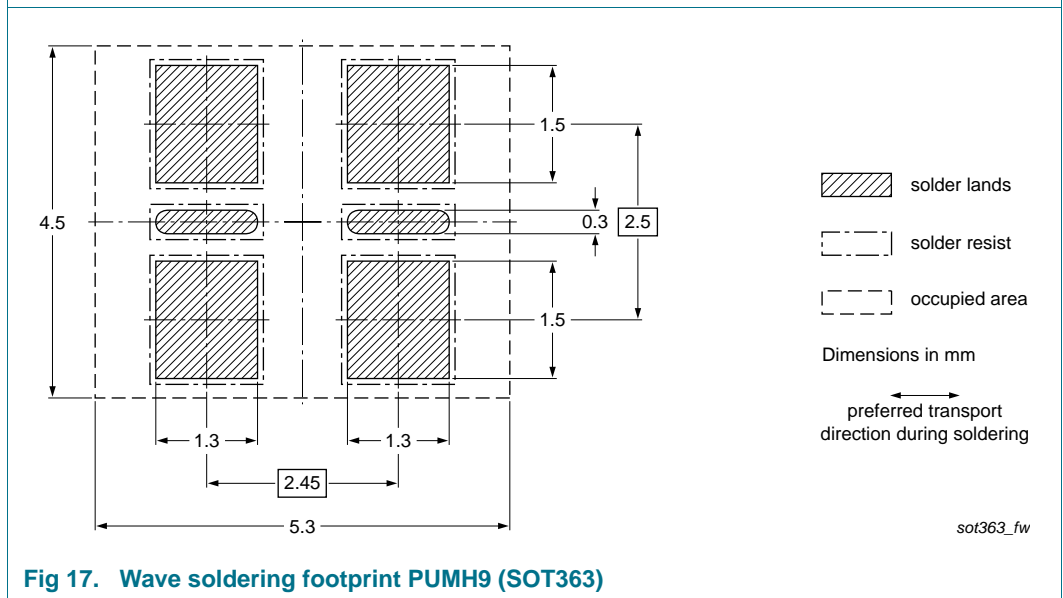
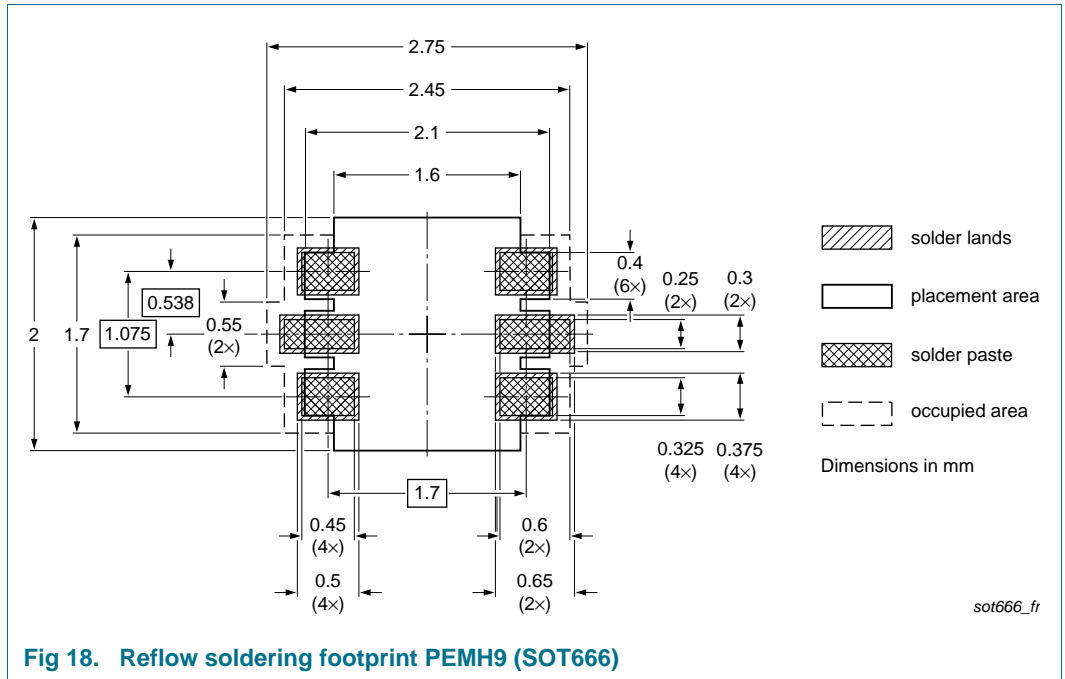


Fig 17. Wave soldering footprint PUMH9 (SOT363)



## 11. Revision history

Table 9. Revision history

| Document ID           | Release date   | Data sheet status     | Change notice | Supersedes            |
|-----------------------|--|-----------------------|---------------|-----------------------|
| PEMH9_PIMH9_PUMH9 v.5 | 20131112   | Product data sheet    | -             | PIMH9_PUMH9_PEMH9 v.4 |
| Modifications:        | <ul style="list-style-type: none"> <li>• The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Section 1 “Product profile”</a>: updated</li> <li>• <a href="#">Section 4 “Marking”</a>: updated</li> <li>• <a href="#">Figure 1 to 10</a>: added</li> <li>• <a href="#">Section 5 “Limiting values”</a>: updated</li> <li>• <a href="#">Section 6 “Thermal characteristics”</a>: updated</li> <li>• <a href="#">Table 8 “Characteristics”</a>: <math>V_{i(on)}</math> redefined to <math>V_{I(on)}</math> on-state input voltage, <math>V_{i(off)}</math> redefined to <math>V_{I(off)}</math> off-state input voltage, <math>I_{CEO}</math> updated, <math>f_T</math> added</li> <li>• <a href="#">Section 8 “Test information”</a>: added</li> <li>• <a href="#">Section 9 “Package outline”</a>: superseded by minimized package outline drawings</li> <li>• <a href="#">Section 10 “Soldering”</a>: added</li> <li>• <a href="#">Section 12 “Legal information”</a>: updated</li> </ul> |                       |               |                       |
| PIMH9_PUMH9_PEMH9 v.4 | 20040414   | Product data sheet    | -             | PIMH9_PUMH9_PEMH9 v.3 |
| PIMH9_PUMH9_PEMH9 v.3 | 20030915   | Product specification | -             | -                     |

## 12. Legal information

### 12.1 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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