

PEMD13; PUMD13

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

Rev. 3 — 7 December 2011

Product data sheet

1. Product profile

1.1 General description

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

Table 1. Product overview

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

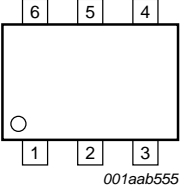
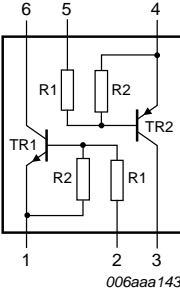
Table 2. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---------------------------|------------|-----|-----|-----|------------|
| Per transistor; for the PNP transistor (TR2) with negative polarity | | | | | | |
| 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 | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| PEMD13 | - | plastic surface-mounted package; 6 leads | SOT666 |
| PUMD13 | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |

4. Marking

Table 5. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PEMD13 | Z1 |
| PUMD13 | 3*1 |

[1] * = placeholder for manufacturing site code

5. Limiting values

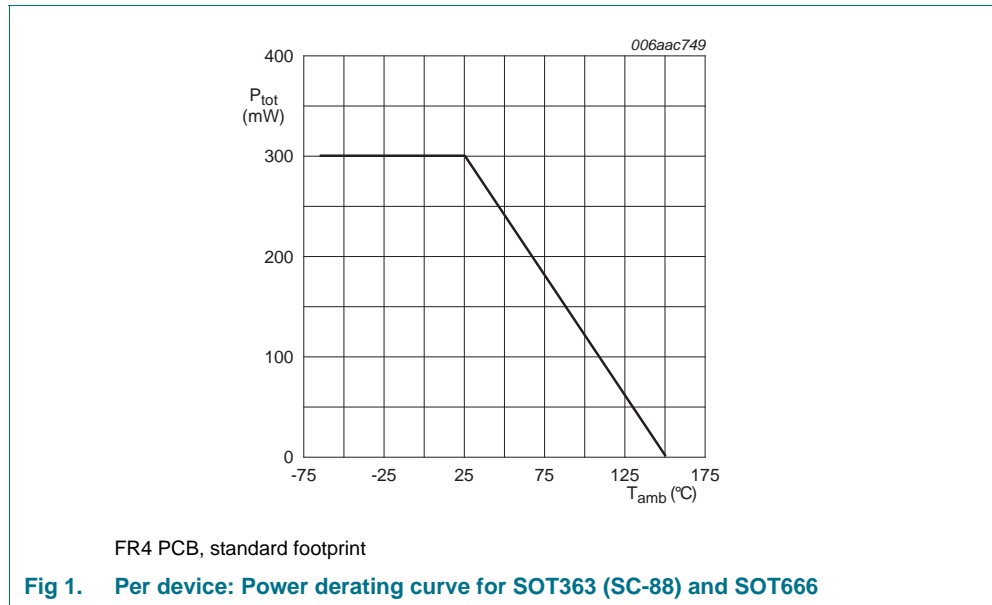
Table 6. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|--|---------------------------|--|--------|------|--------|
| Per transistor; for the PNP transistor (TR2) with negative polarity | | | | | |
| 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 TR1 | | | | |
| | positive | | - | +30 | V |
| | negative | | - | -5 | V |
| | input voltage TR2 | | | | |
| | positive | | - | +5 | V |
| | negative | | - | -30 | V |
| I _O | output current | | - | 100 | mA |
| I _{CM} | peak collector current | single pulse; t _p ≤ 1 ms | - | 100 | mA |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | | | |
| | PEMD13 (SOT666) | | [1][2] | - | 200 mW |
| | PUMD13 (SOT363) | | [1] | - | 200 mW |
| Per device | | | | | |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | | | |
| | PEMD13 (SOT666) | | [1][2] | - | 300 mW |
| | PUMD13 (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.



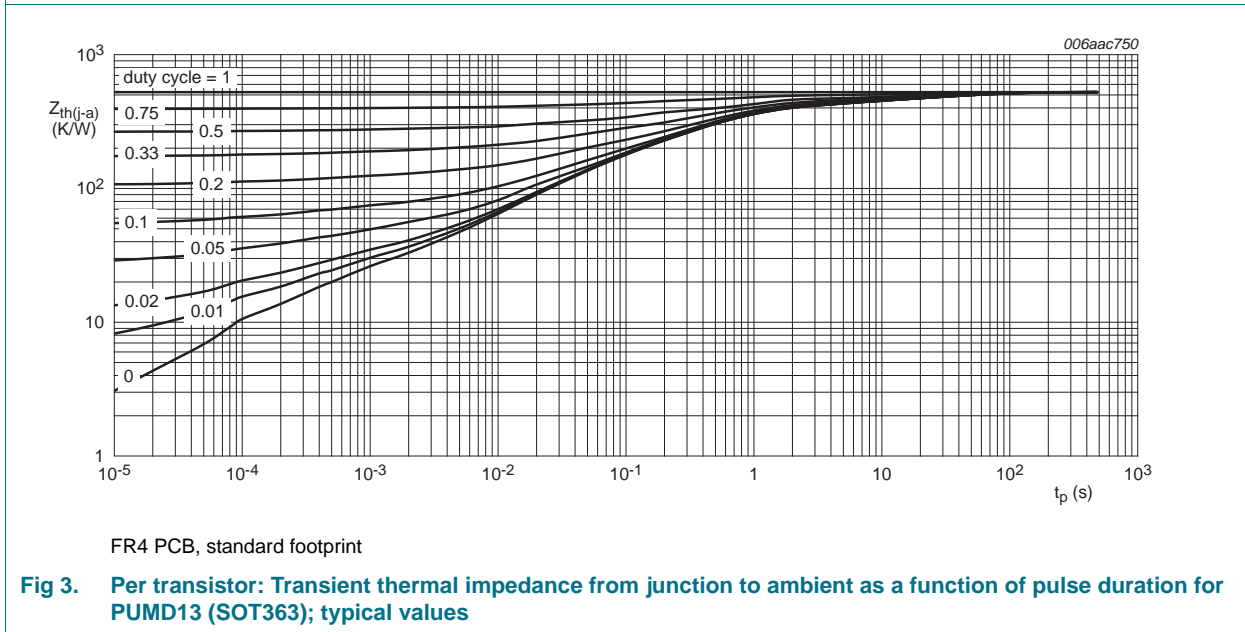
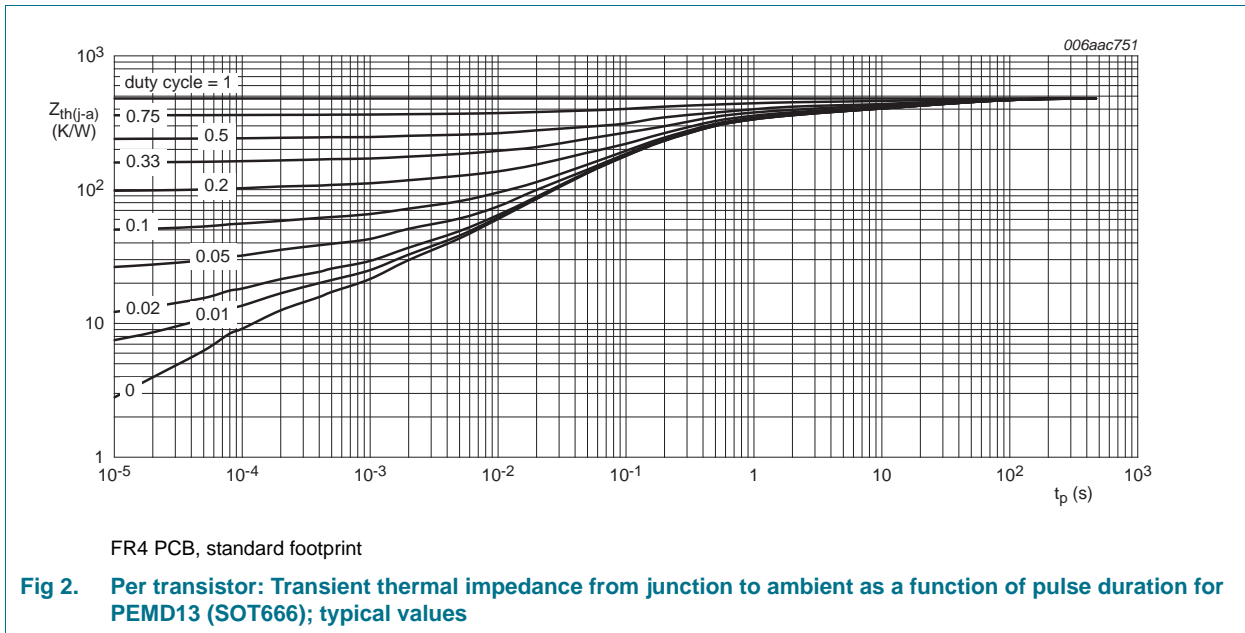
6. Thermal characteristics

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 | | | | |
| | PEMD13 (SOT666) | | [1][2] | - | 625 | K/W |
| | PUMD13 (SOT363) | | [1] | - | 625 | K/W |
| Per device | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | |
| | PEMD13 (SOT666) | | [1][2] | - | 417 | K/W |
| | PUMD13 (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.



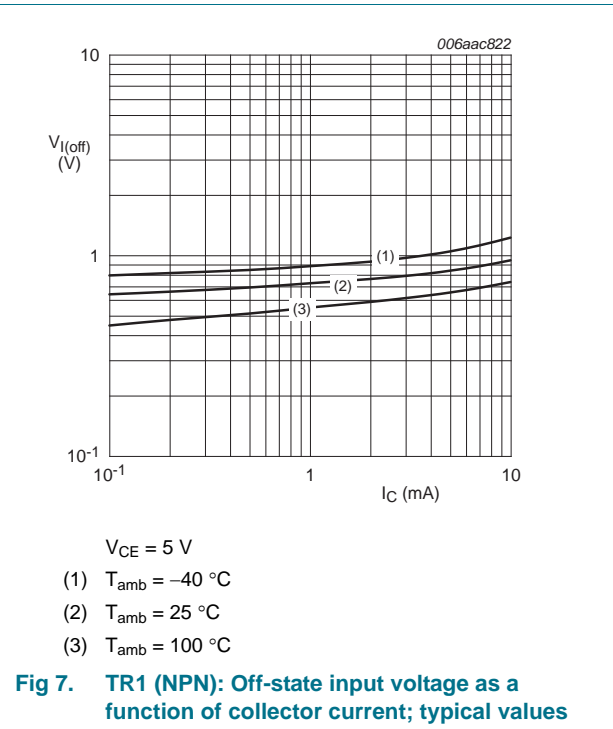
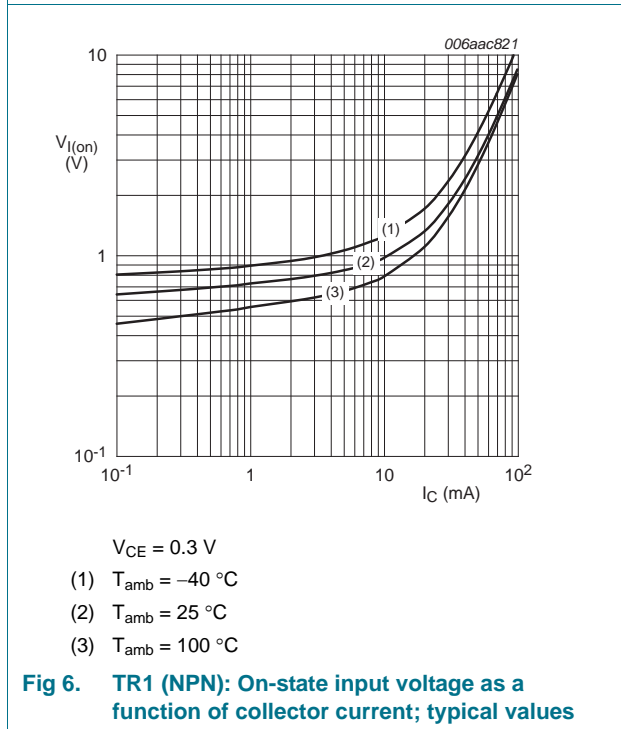
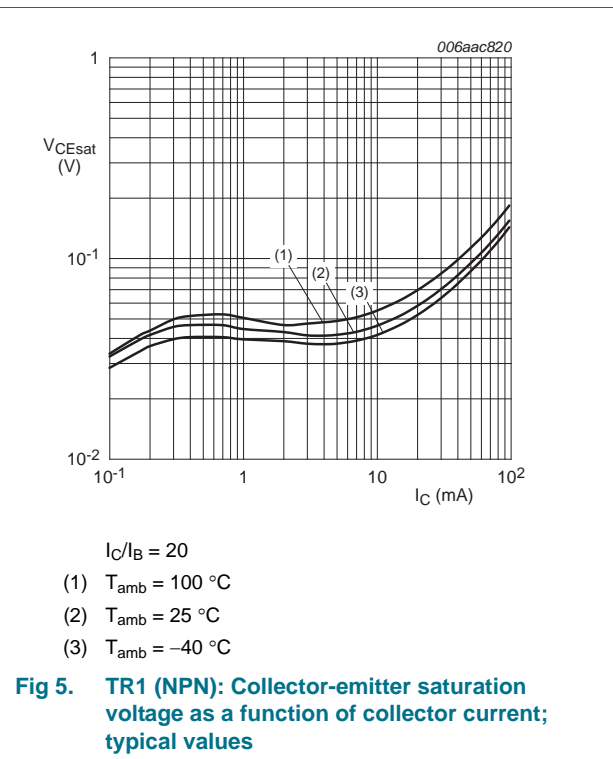
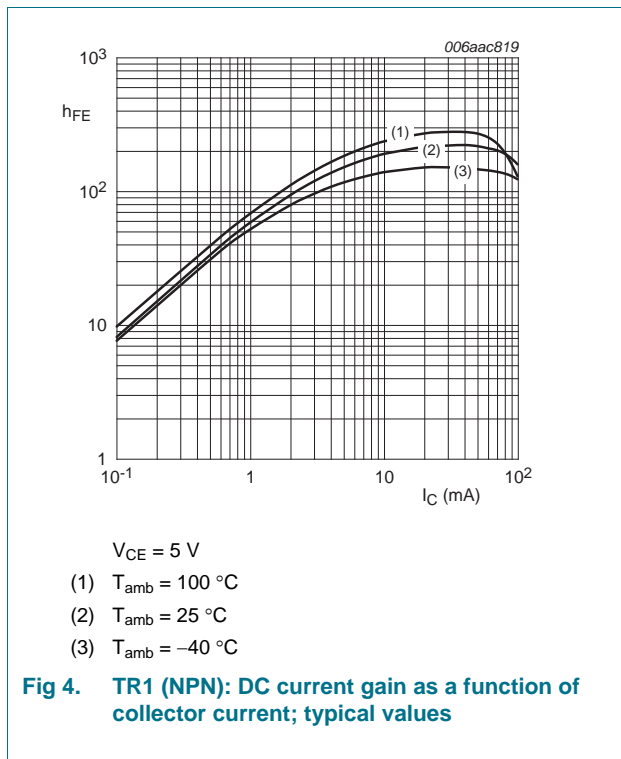
7. Characteristics

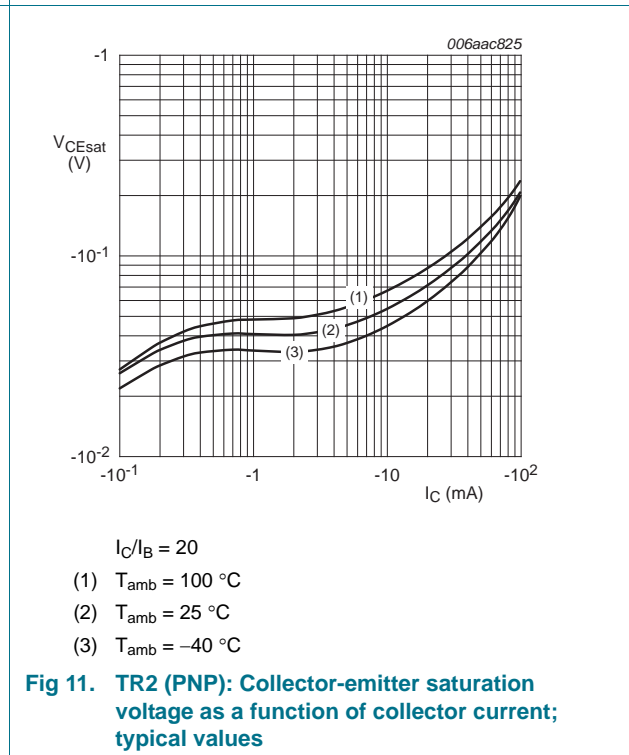
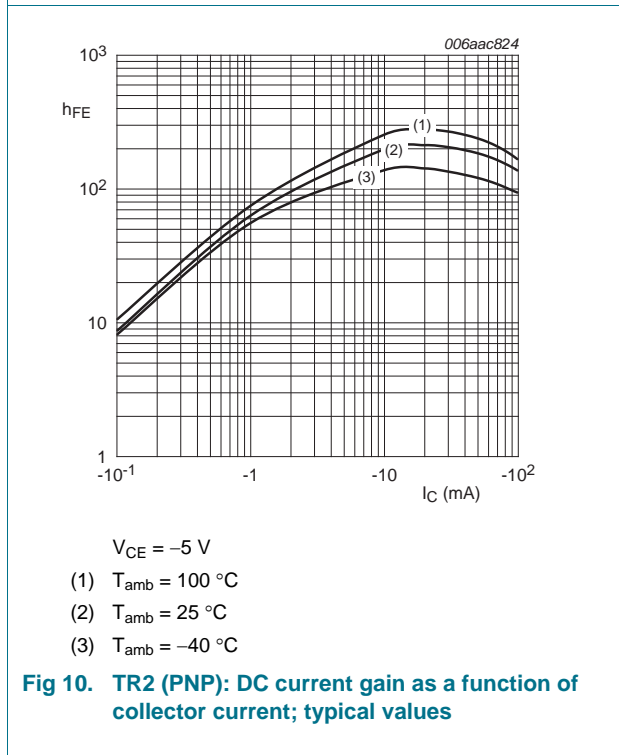
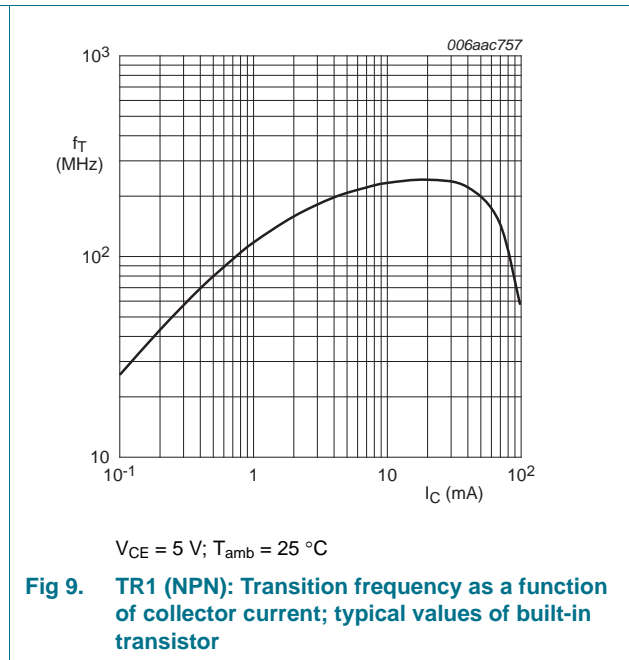
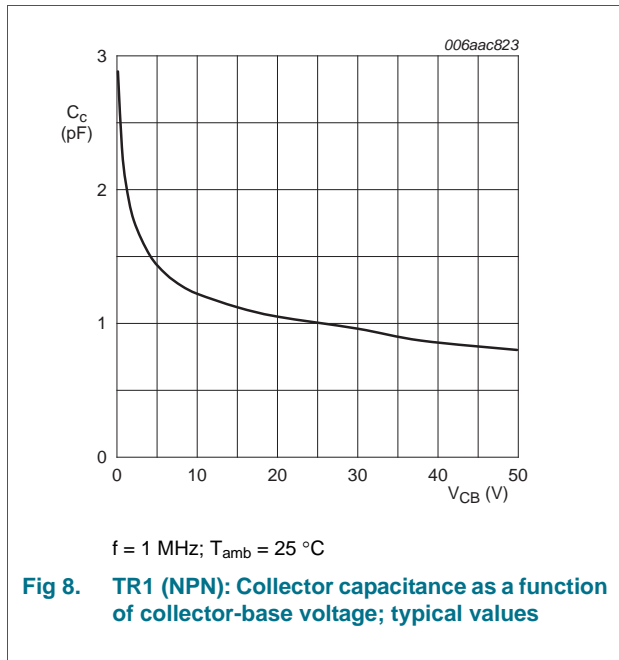
Table 8. Characteristics

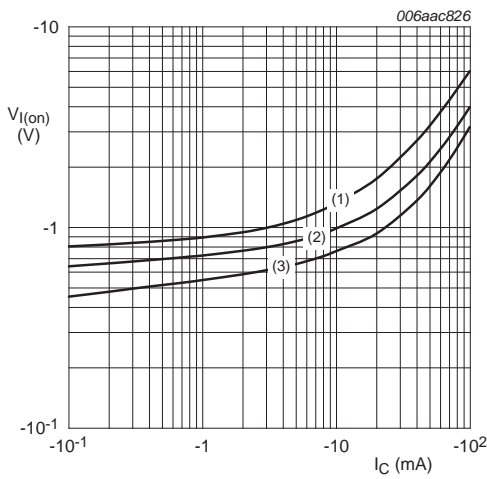
$T_{amb} = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|--------------------------------------|---|-----|-----|-----|------|
| Per transistor; for the PNP transistor (TR2) with negative polarity | | | | | | |
| 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 |
| | | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ °C}$ | - | - | 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 | $V_{CE} = 5\text{ V}; I_C = 100\text{ μA}$ | - | 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 | kΩ |
| R2/R1 | bias resistor ratio | | 8 | 10 | 12 | |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | | | | |
| | | TR1 (NPN) | - | - | 2.5 | pF |
| | | TR2 (PNP) | - | - | 3 | pF |
| f_T | transition frequency | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$ [1] | | | | |
| | | TR1 (NPN) | - | 230 | - | MHz |
| | | TR2 (PNP) | - | 180 | - | MHz |

[1] Characteristics of built-in transistor

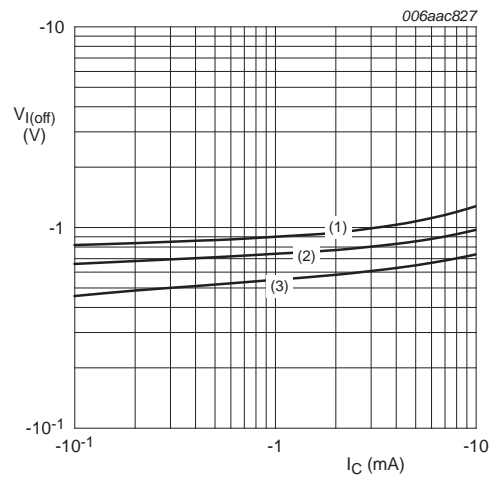






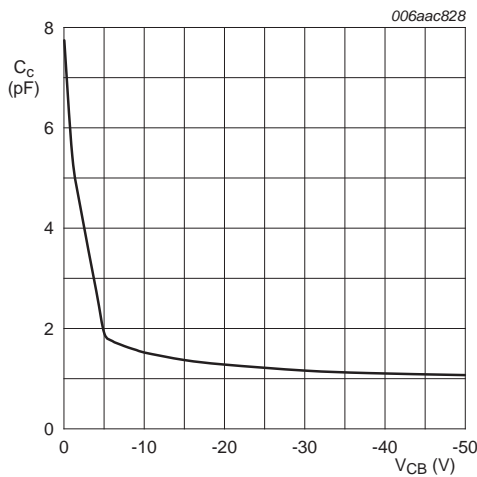
$V_{CE} = -0.3 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig 12. TR2 (PNP): On-state input voltage as a function of collector current; typical values



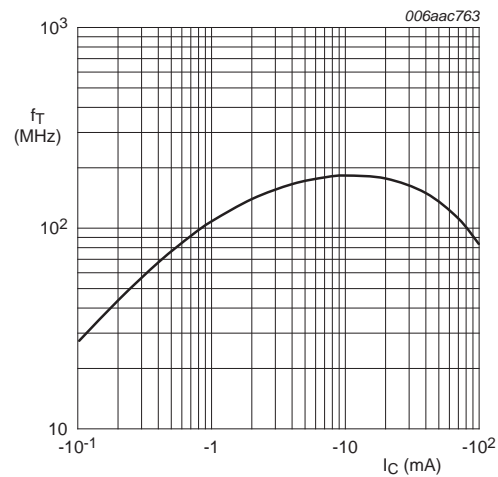
$V_{CE} = -5 \text{ V}$
 (1) $T_{amb} = -40 \text{ }^\circ\text{C}$
 (2) $T_{amb} = 25 \text{ }^\circ\text{C}$
 (3) $T_{amb} = 100 \text{ }^\circ\text{C}$

Fig 13. TR2 (PNP): Off-state input voltage as a function of collector current; typical values



$f = 1 \text{ MHz}; T_{amb} = 25 \text{ }^\circ\text{C}$

Fig 14. TR2 (PNP): Collector capacitance as a function of collector-base voltage; typical values



$V_{CE} = -5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

Fig 15. TR2 (PNP): 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

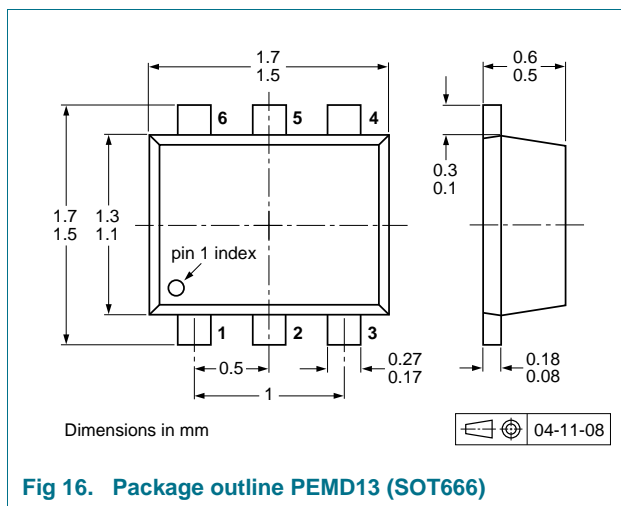


Fig 16. Package outline PEMD13 (SOT666)

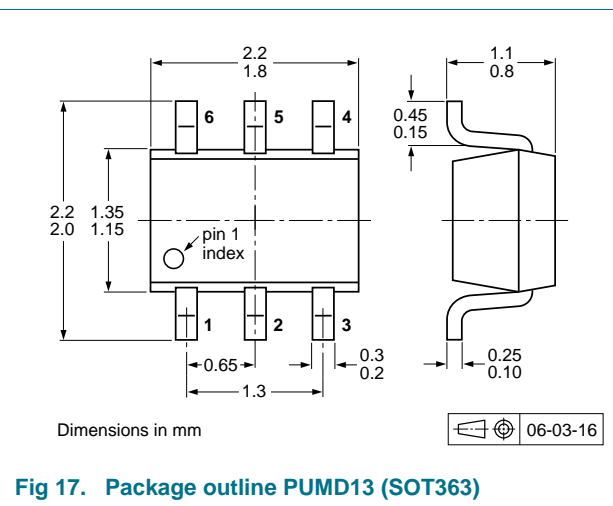


Fig 17. Package outline PUMD13 (SOT363)

10. Packing information

Table 9. Packing methods

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

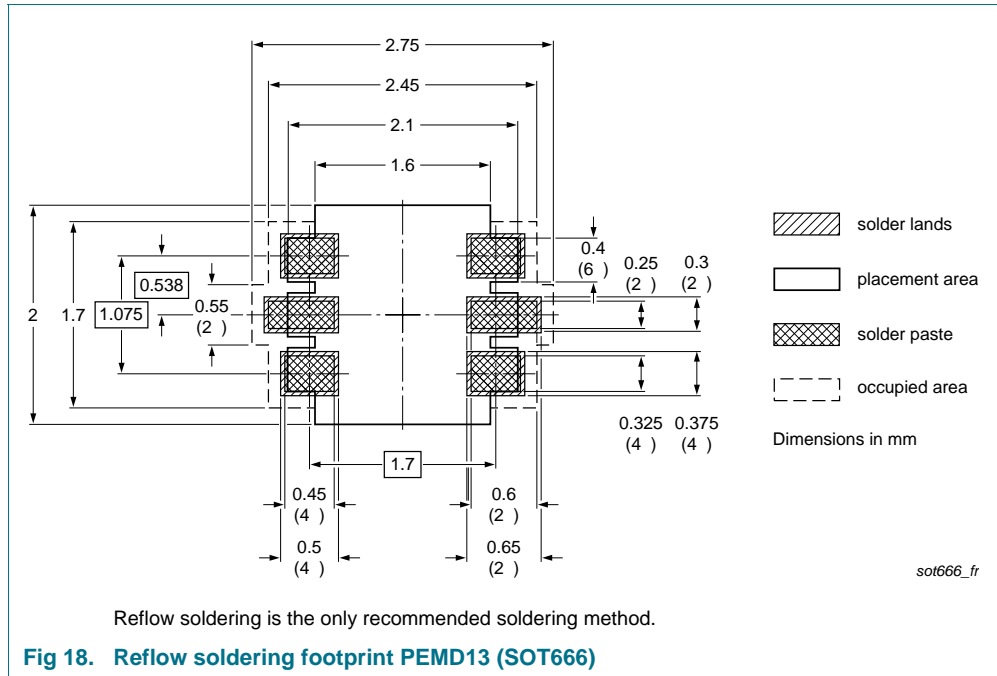
| Type number | Package | Description | Packing quantity | | | |
|-------------|---------|---|------------------|------|------|-------|
| | | | 3000 | 4000 | 8000 | 10000 |
| PEMD13 | SOT666 | 2 mm pitch, 8 mm tape and reel | - | - | -315 | - |
| | | 4 mm pitch, 8 mm tape and reel | - | -115 | - | - |
| PUMD13 | 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



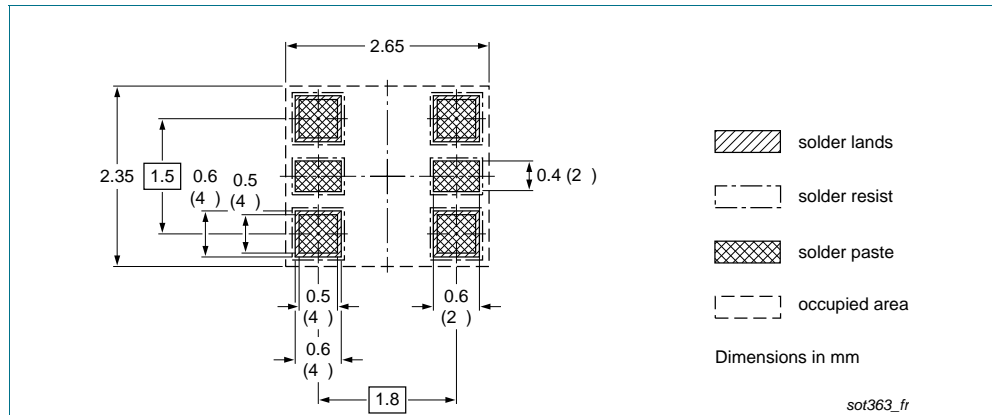


Fig 19. Reflow soldering footprint PUMD13 (SOT363)

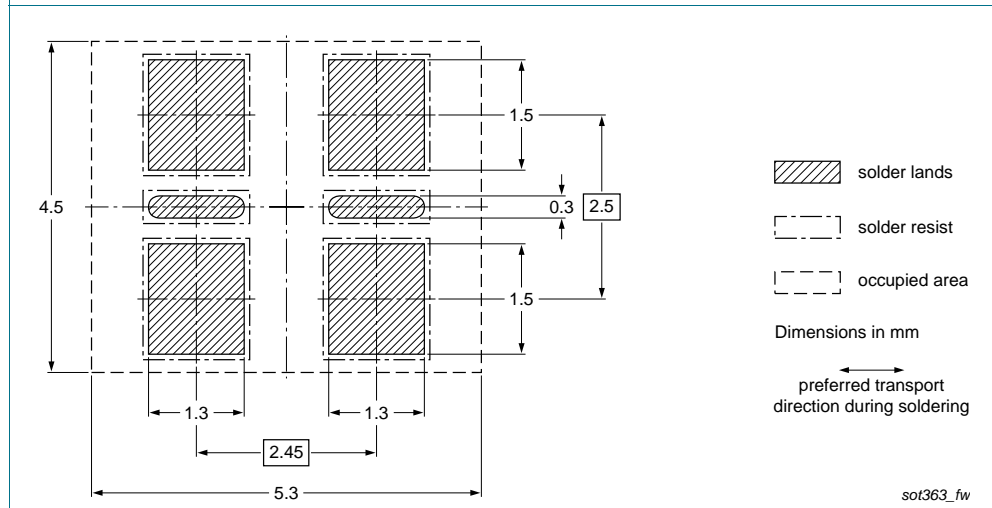


Fig 20. Wave soldering footprint PUMD13 (SOT363)

12. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|---|---------------------------|---------------|--------------------------|
| PEMD13_PUMD13 v.3 | 20111207 | Product data sheet | - | PEMD13_PUMD13 v.2 |
| 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 15: 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 drawings • Section 10 "Packing information": added • Section 11 "Soldering": added • Section 13 "Legal information": updated | | | |
| PEMD13_PUMD13 v.2 | 20031008 | Product data sheet | - | PEMD13 v.1 PUMD13 v.1 |
| PEMD13 v.1 | 20010911 | Preliminary specification | - | - |
| PUMD13 v.1 | 20010227 | 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".

[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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