

# ANTREX Electronics

Electronic Components Sourcing Information

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## Product Reference Information

**Part Number:** PEMD10,115

**Manufacturer:** Nexperia USA Inc.

**Package:** SOT-563, SOT-666

**Availability:** Please confirm with sales

### Product Page:

<https://antrexco.com/product/details/nexperia-usa-inc/pemd10-115.html>

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### Note:

This PDF includes an ANTREX product reference cover page.

The original manufacturer datasheet follows from the next page.



# PEMD10

50 V, 100 mA NPN/PNP resistor-equipped double transistor;  
R1 = 2.2 kΩ, R2 = 47 kΩ

18 January 2023

Product data sheet

## 1. General description

NPN/PNP double Resistor-Equipped Transistor (RET) in an ultra small and flat lead SOT666 Surface-Mounted Device (SMD) plastic package.

NPN/NPN complement: PEMH10

PNP/PNP complement: PEMB10

## 2. Features and benefits

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

## 3. Applications

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

## 4. Quick reference data

Table 1. Quick reference data

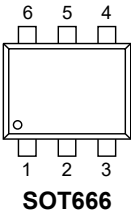
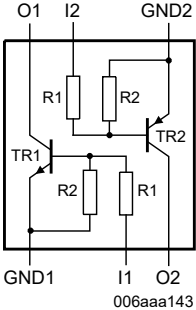
| Symbol                                                                                | Parameter                 | Conditions | Min  | Typ | Max  | Unit |
|---------------------------------------------------------------------------------------|---------------------------|------------|------|-----|------|------|
| Per transistor; for the PNP transistor (TR2) with negative polarity, where applicable |                           |            |      |     |      |      |
| V <sub>CEO</sub>                                                                      | collector-emitter voltage | open base  | -    | -   | 50   | V    |
| I <sub>O</sub>                                                                        | output current            |            | -    | -   | 100  | mA   |
| R1                                                                                    | bias resistor 1 (input)   | [1]        | 1.54 | 2.2 | 2.86 | kΩ   |
| R2/R1                                                                                 | bias resistor ratio       | [1]        | 17   | 21  | 26   |      |

[1] See section "Test information" for resistor calculation and test conditions.

50 V, 100 mA NPN/PNP resistor-equipped double transistor; R1 = 2.2 kΩ, R2 = 47 kΩ

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description            | Simplified outline                                                                | Graphic symbol                                                                      |
|-----|--------|------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | GND1   | GND (emitter) TR1      |  |  |
| 2   | I1     | input (base) TR1       |                                                                                   |                                                                                     |
| 3   | O2     | output (collector) TR2 |                                                                                   |                                                                                     |
| 4   | GND2   | GND (emitter) TR2      |                                                                                   |                                                                                     |
| 5   | I2     | input (base) TR2       |                                                                                   |                                                                                     |
| 6   | O1     | output (collector) TR1 |                                                                                   |                                                                                     |

6. Ordering information

Table 3. Ordering information

| Type number            | Package |                                                                                         |                        |
|------------------------|---------|-----------------------------------------------------------------------------------------|------------------------|
|                        | Name    | Description                                                                             | Version                |
| <a href="#">PEMD10</a> | SOT666  | plastic, surface-mounted package; 6 leads; 0.5 mm pitch; 1.6 mm x 1.2 mm x 0.55 mm body | <a href="#">SOT666</a> |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PEMD10      | D1           |

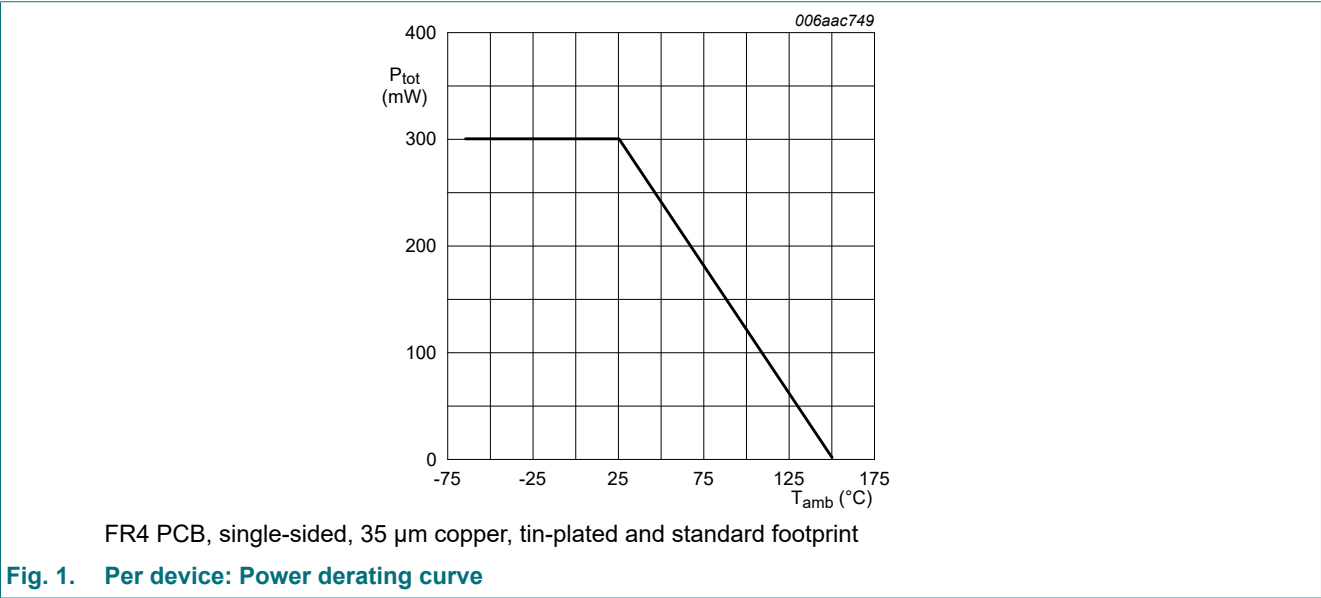
8. Limiting values

Table 5. 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, where applicable |                           |                              |         |     |     |      |
| 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               |         | -   | 5   | V    |
| V <sub>I</sub>                                                                        | input voltage             | positive (input voltage TR1) |         | -   | 12  | V    |
|                                                                                       |                           | negative (Input voltage TR1) |         | -   | -5  | V    |
|                                                                                       |                           | positive (input voltage TR2) |         | -   | 5   | V    |
|                                                                                       |                           | negative (Input voltage TR2) |         | -   | -12 | V    |
| I <sub>O</sub>                                                                        | output current            |                              |         | -   | 100 | mA   |
| P <sub>tot</sub>                                                                      | total power dissipation   | T <sub>amb</sub> ≤ 25 °C     | [1] [2] | -   | 200 | mW   |
| Per device                                                                            |                           |                              |         |     |     |      |
| P <sub>tot</sub>                                                                      | total power dissipation   | T <sub>amb</sub> ≤ 25 °C     | [1] [2] | -   | 300 | mW   |
| T <sub>j</sub>                                                                        | junction temperature      |                              |         | -   | 150 | °C   |
| T <sub>amb</sub>                                                                      | ambient temperature       |                              |         | -65 | 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.  
[2] Reflow soldering is the only recommended soldering method.

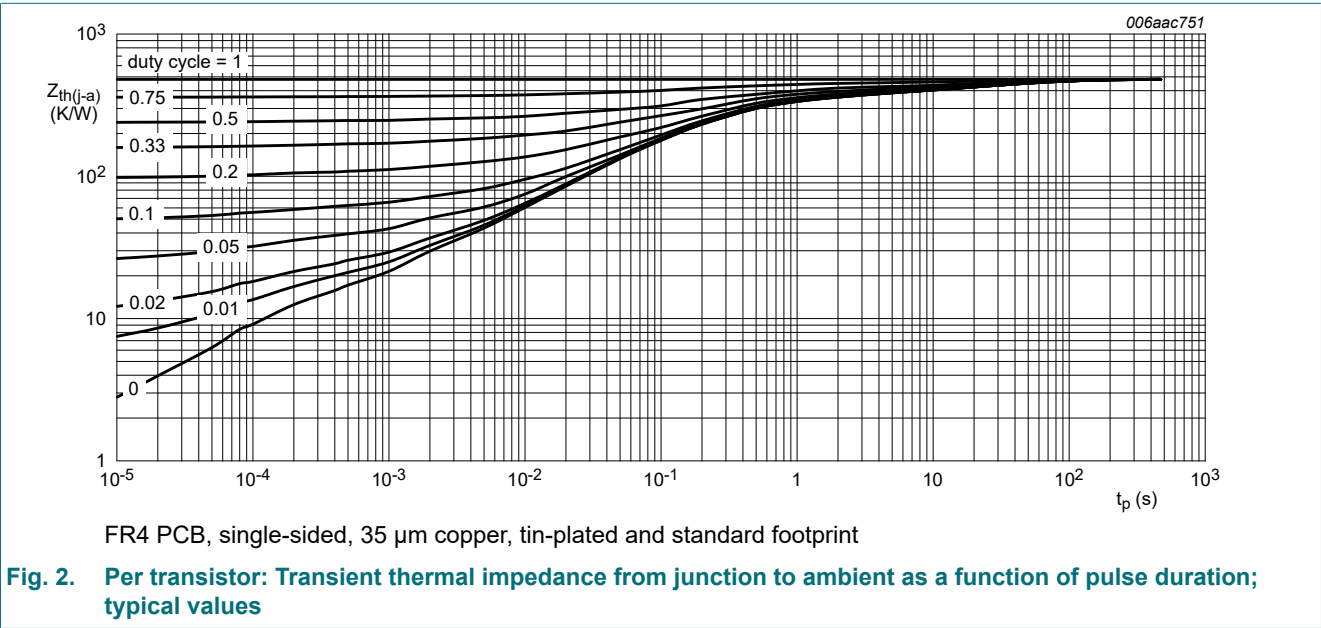


9. Thermal characteristics

Table 6. 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] [2] | -   | -   | 625 | K/W  |
| Per device     |                                             |             |         |     |     |     |      |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient | in free air | [1] [2] | -   | -   | 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.



10. Characteristics

Table 7. Characteristics

| Symbol                                                                                | Parameter                            | Conditions                                                                                                                      |     | Min  | Typ  | Max  | Unit          |
|---------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----|------|------|------|---------------|
| Per transistor; for the PNP transistor (TR2) with negative polarity, where applicable |                                      |                                                                                                                                 |     |      |      |      |               |
| $V_{(BR)CBO}$                                                                         | collector-base breakdown voltage     | $I_C = 100\text{ }\mu\text{A}$ ; $I_E = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                    |     | 50   | -    | -    | V             |
| $V_{(BR)CEO}$                                                                         | collector-emitter breakdown voltage  | $I_C = 2\text{ mA}$ ; $I_B = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                               |     | 50   | -    | -    | V             |
| $I_{CBO}$                                                                             | collector-base cut-off current       | $V_{CB} = 50\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                            |     | -    | -    | 100  | nA            |
| $I_{CEO}$                                                                             | collector-emitter cut-off current    | $V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                            |     | -    | -    | 100  | nA            |
|                                                                                       |                                      | $V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; $T_j = 150\text{ }^{\circ}\text{C}$      |     | -    | -    | 5    | $\mu\text{A}$ |
| $I_{EBO}$                                                                             | emitter-base cut-off current         | $V_{EB} = 5\text{ V}$ ; $I_C = 0\text{ A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                             |     | -    | -    | 180  | $\mu\text{A}$ |
| $h_{FE}$                                                                              | DC current gain                      | $V_{CE} = 5\text{ V}$ ; $I_C = 10\text{ mA}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                           |     | 100  | -    | -    |               |
| $V_{CEsat}$                                                                           | collector-emitter saturation voltage | $I_C = 5\text{ mA}$ ; $I_B = 0.25\text{ mA}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                           |     | -    | -    | 100  | mV            |
| $V_{I(off)}$                                                                          | off-state input voltage              | $V_{CE} = 5\text{ V}$ ; $I_C = 100\text{ }\mu\text{A}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                 |     | -    | 0.6  | 0.5  | V             |
| $V_{I(on)}$                                                                           | on-state input voltage               | $V_{CE} = 0.3\text{ V}$ ; $I_C = 5\text{ mA}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                                          |     | 1.1  | 0.75 | -    | V             |
| R1                                                                                    | bias resistor 1 (input)              |                                                                                                                                 | [1] | 1.54 | 2.2  | 2.86 | kΩ            |
| R2/R1                                                                                 | bias resistor ratio                  |                                                                                                                                 | [1] | 17   | 21   | 26   |               |
| TR1 (NPN)                                                                             |                                      |                                                                                                                                 |     |      |      |      |               |
| $C_C$                                                                                 | collector capacitance                | $V_{CB} = 10\text{ V}$ ; $I_E = 0\text{ A}$ ; $i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$  |     | -    | -    | 2.5  | pF            |
| $f_T$                                                                                 | transition frequency                 | $V_{CE} = 5\text{ V}$ ; $I_C = 10\text{ mA}$ ; $f = 100\text{ MHz}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                    | [2] | -    | 230  | -    | MHz           |
| TR2 (PNP)                                                                             |                                      |                                                                                                                                 |     |      |      |      |               |
| $C_C$                                                                                 | collector capacitance                | $V_{CB} = -10\text{ V}$ ; $I_E = 0\text{ A}$ ; $i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$ |     | -    | -    | 3    | pF            |
| $f_T$                                                                                 | transition frequency                 | $V_{CE} = -5\text{ V}$ ; $I_C = -10\text{ mA}$ ; $f = 100\text{ MHz}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$                  | [2] | -    | 180  | -    | MHz           |

[1] See section "Test information" for resistor calculation and test conditions.

[2] Characteristics of built-in transistor

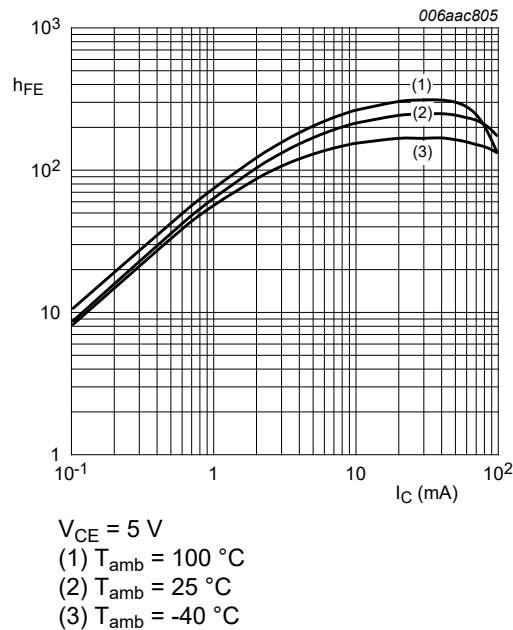


Fig. 3. NPN transistor: DC current gain as a function of collector current; typical values

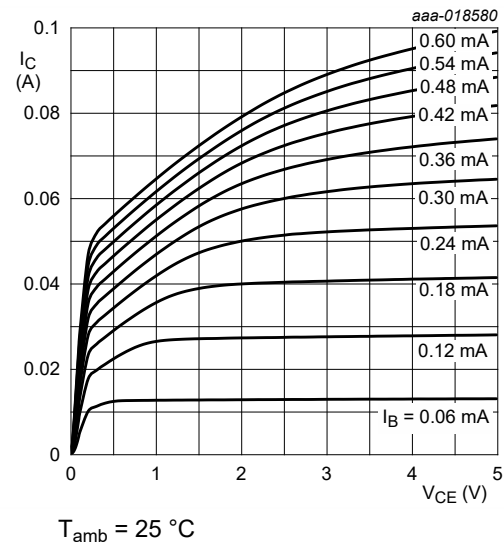


Fig. 4. NPN transistor: Collector current as a function of collector-emitter voltage; typical values

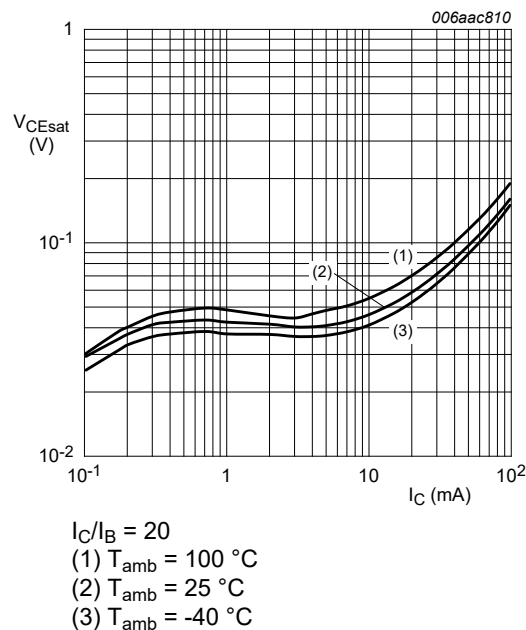


Fig. 5. NPN transistor: Collector-emitter saturation voltage as a function of collector current; typical values

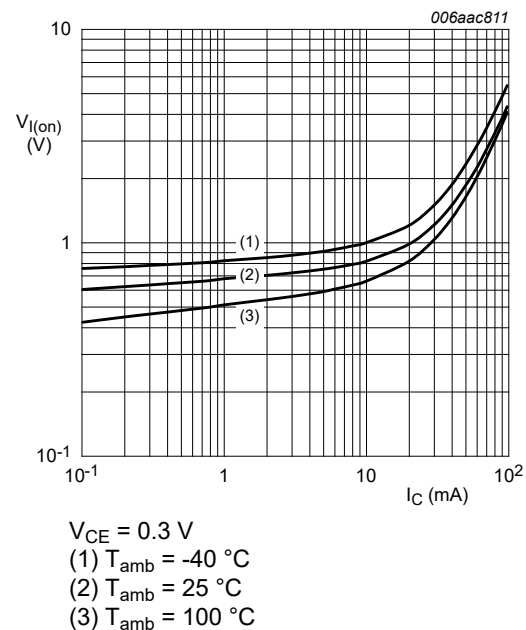


Fig. 6. NPN transistor: On-state input voltage as a function of collector current; typical values

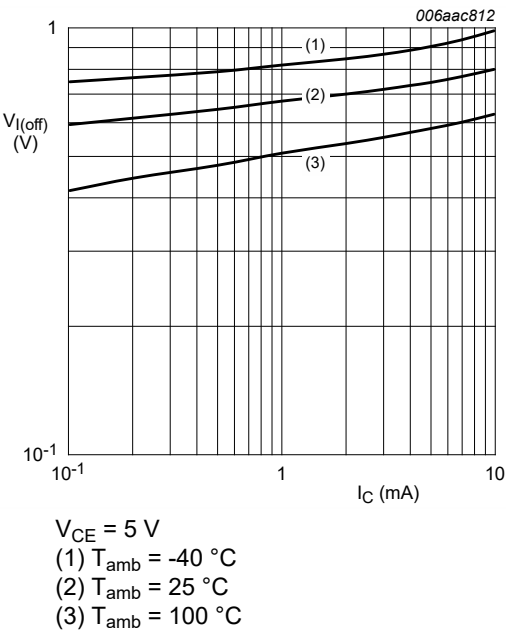


Fig. 7. NPN transistor: Off-state input voltage as a function of collector current; typical values

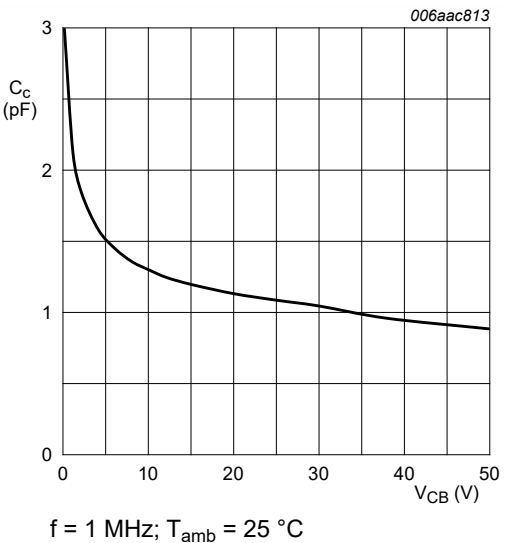


Fig. 8. NPN transistor: Collector capacitance as a function of collector-base voltage; typical values

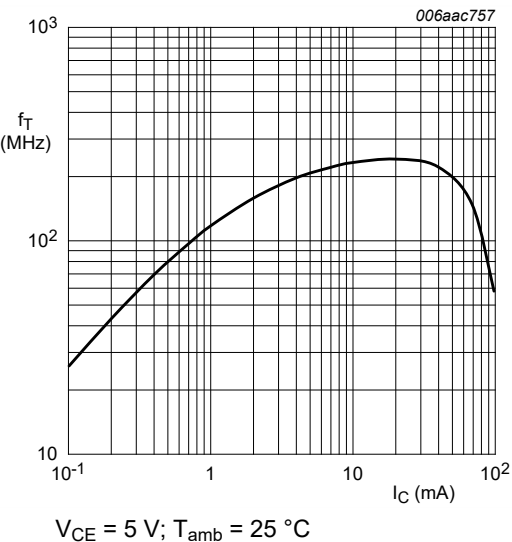


Fig. 9. NPN transistor: Transition frequency as a function of collector current; typical values of built-in transistor

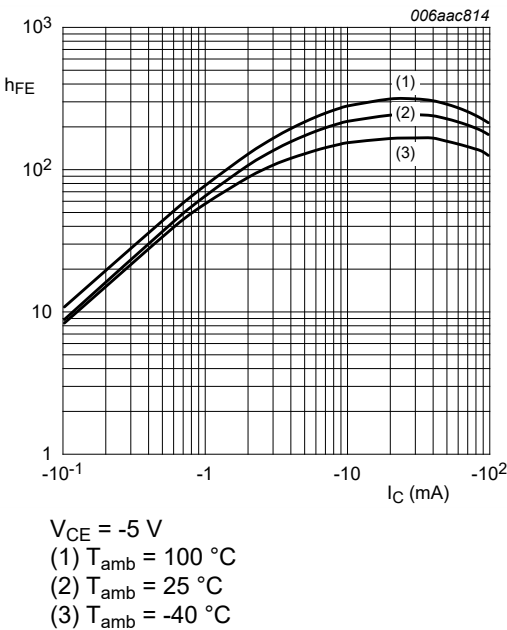
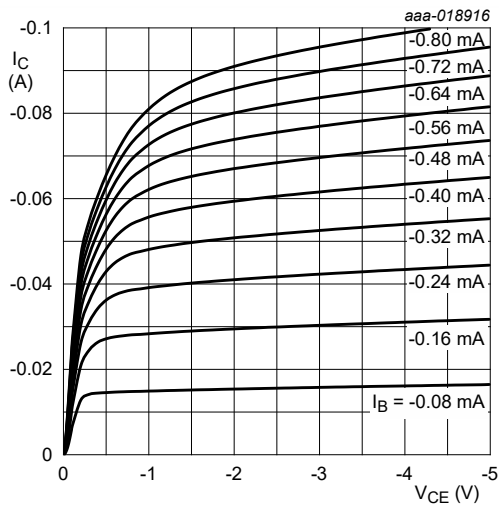
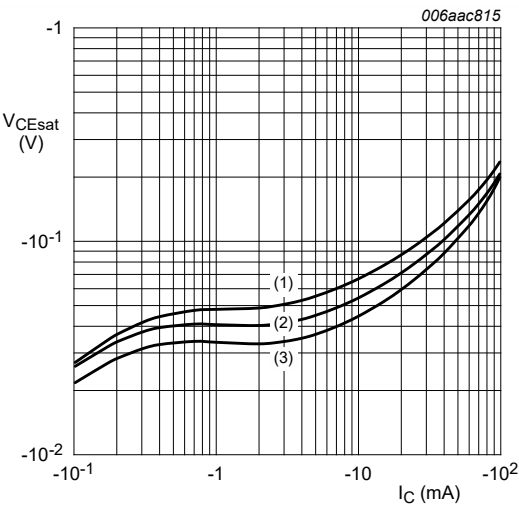


Fig. 10. PNP transistor: DC current gain as a function of collector current; typical values



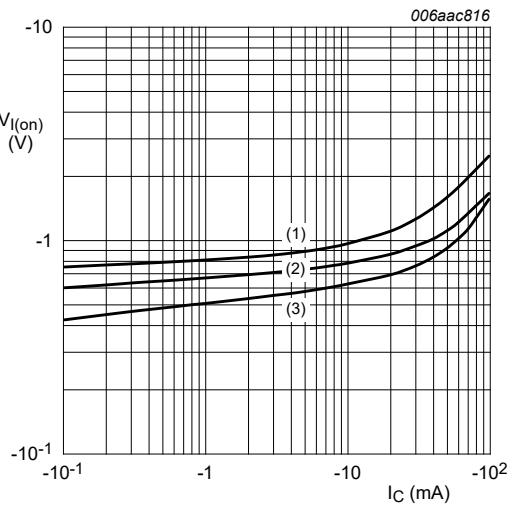
$T_{amb} = 25\text{ °C}$

Fig. 11. PNP transistor: Collector current as a function of collector-emitter voltage; typical values



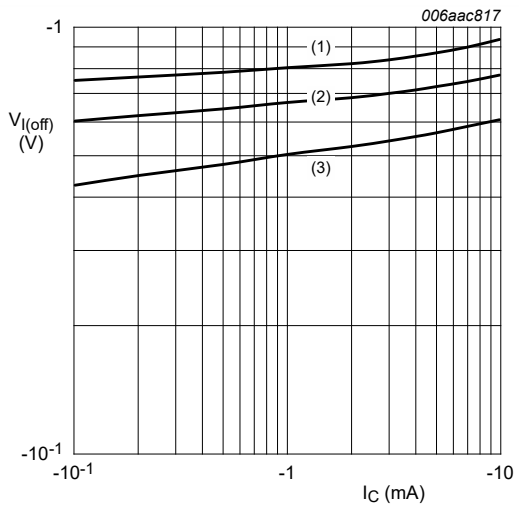
$I_C/I_B = 20$   
(1)  $T_{amb} = 100\text{ °C}$   
(2)  $T_{amb} = 25\text{ °C}$   
(3)  $T_{amb} = -40\text{ °C}$

Fig. 12. PNP transistor: Collector-emitter saturation voltage as a function of collector current; typical values



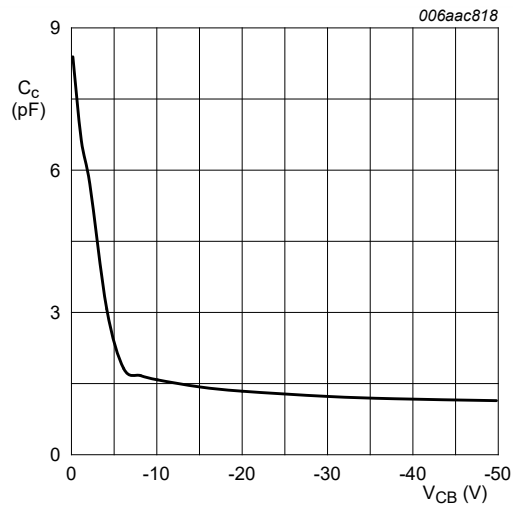
$V_{CE} = -0.3\text{ V}$   
(1)  $T_{amb} = -40\text{ °C}$   
(2)  $T_{amb} = 25\text{ °C}$   
(3)  $T_{amb} = 100\text{ °C}$

Fig. 13. PNP transistor: On-state input voltage as a function of collector current; typical values



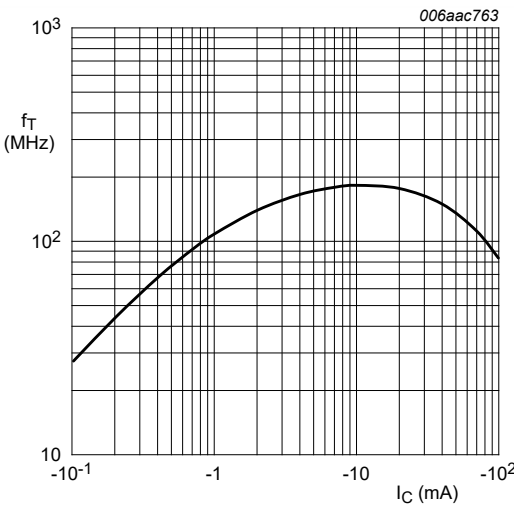
$V_{CE} = -5\text{ V}$   
(1)  $T_{amb} = -40\text{ °C}$   
(2)  $T_{amb} = 25\text{ °C}$   
(3)  $T_{amb} = 100\text{ °C}$

Fig. 14. PNP transistor: Off-state input voltage as a function of collector current; typical values



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

Fig. 15. PNP transistor: Collector capacitance as a function of collector-base voltage; typical values



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

Fig. 16. PNP transistor: Transition frequency as a function of collector current; typical values of built-in transistor

11. Test information

Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R_1 = \frac{V(I_2) - V(I_1)}{I_2 - I_1}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R_2}{R_1} = \frac{V(I_3)}{R_1 \cdot I_3} - 1$$

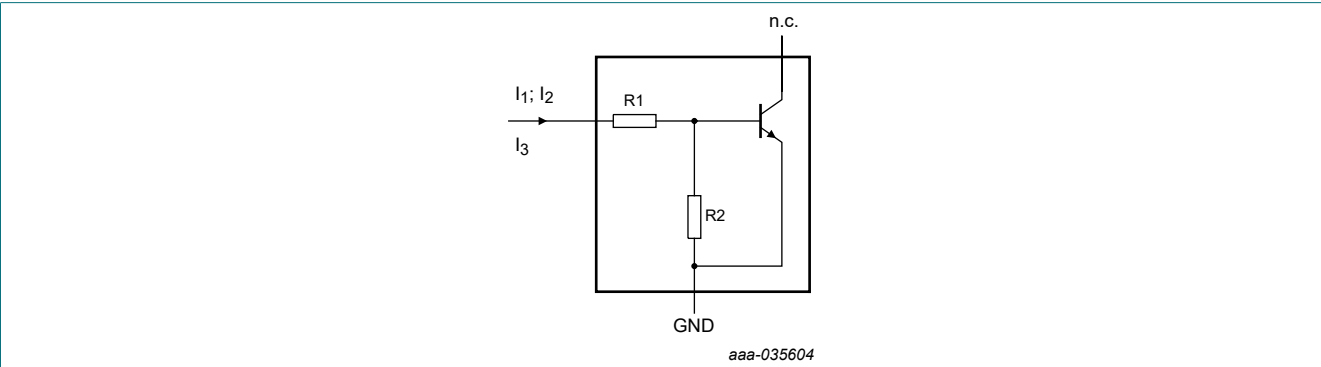


Fig. 17. TR1 (NPN): Resistor test circuit

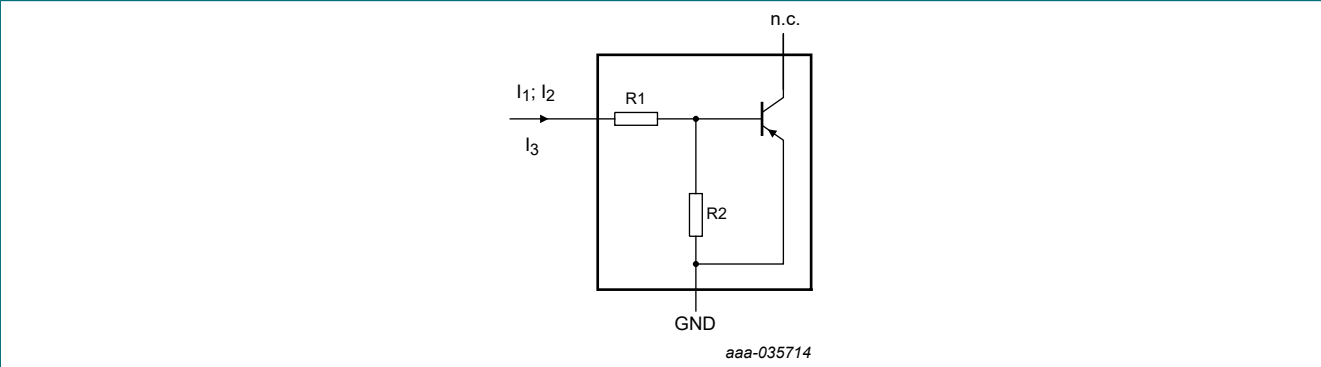


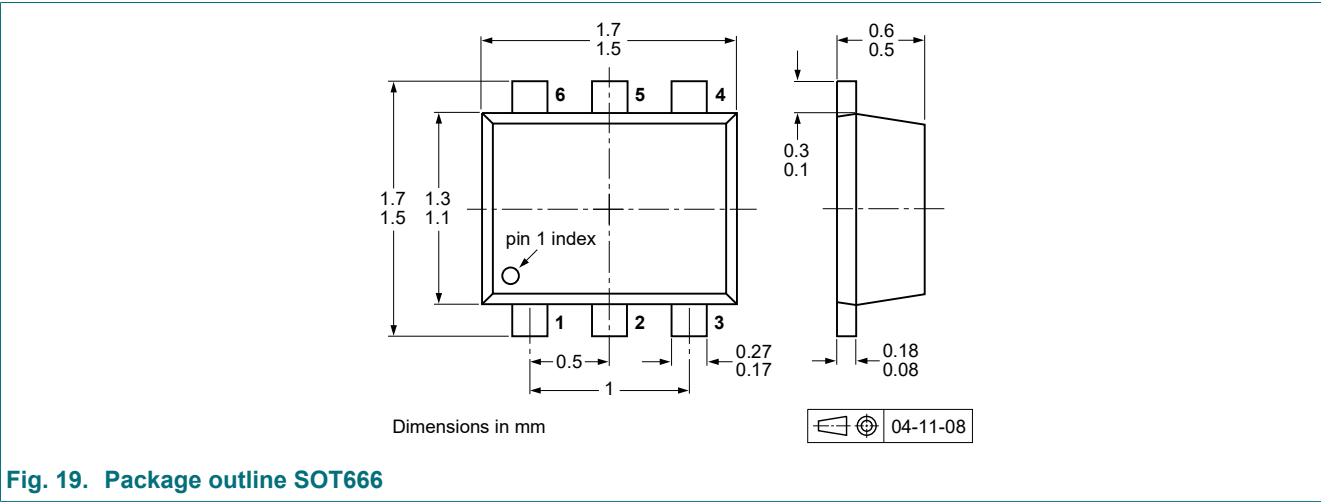
Fig. 18. TR2 (PNP): Resistor test circuit

Resistor test conditions

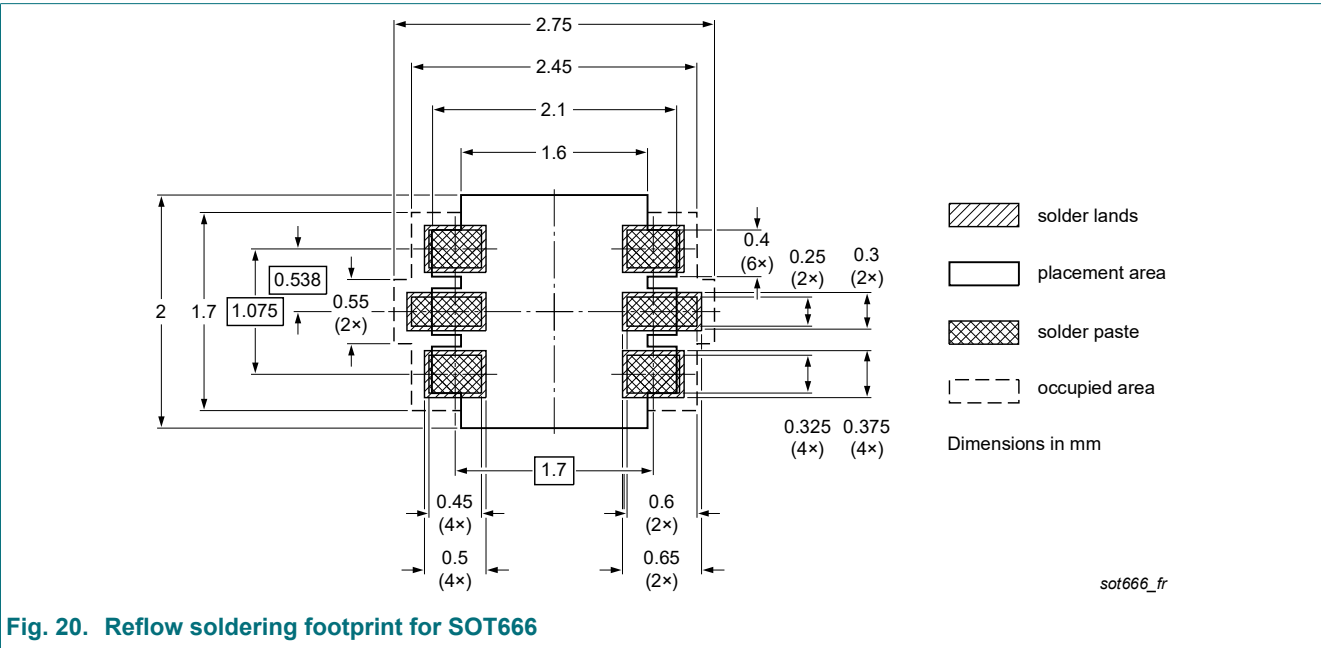
Table 8. Resistor test conditions

| PEMD10    | R1 (kΩ) | R2 (kΩ) | Test conditions |                |                |
|-----------|---------|---------|-----------------|----------------|----------------|
|           |         |         | I <sub>1</sub>  | I <sub>2</sub> | I <sub>3</sub> |
| TR1 (NPN) | 2.2     | 47      | 600 μA          | 700 μA         | -100 μA        |
| TR2 (PNP) | 2.2     | 47      | -600 μA         | -700 μA        | 100 μA         |

12. Package outline



13. Soldering



14. Revision history

Table 9. Revision history

| Data sheet ID     | Release date                                                                                                                                                                                                                                                                                                                                                    | Data sheet status     | Change notice | Supersedes        |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|-------------------|
| PEMD10 v.7        | 20230118                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | PEMD10_PUMD10 v.6 |
| Modifications:    | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Family data sheet reduced to single type data sheet.</li><li>Product(s) changed to non-automotive qualification.</li></ul> |                       |               |                   |
| PEMD10_PUMD10 v.6 | 20120104                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | PEMD10_PUMD10 v.5 |
| PEMD10_PUMD10 v.5 | 20040415                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | PEMD10_PUMD10 v.4 |
| PEMD10_PUMD10 v.4 | 20031104                                                                                                                                                                                                                                                                                                                                                        | Product specification | -             | -                 |

# 15. Legal information

## 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 <https://www.nexperia.com>.

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