

PEMD24; PUMD24

NPN/PNP resistor-equipped transistors;
R1 = 100 k Ω , R2 = 100 k Ω

Rev. 01 — 2 May 2005

Product data sheet

1. Product profile

1.1 General description

NPN/PNP Resistor-Equipped Transistors (RET).

Table 1: Product overview

| Type number | Package | | PNP/PNP complement | NPN/PNP complement |
|-------------|---------|-------|--------------------|--------------------|
| | Philips | JEITA | | |
| PEMD24 | SOT666 | - | PEMB24 | PEMH24 |
| PUMD24 | SOT363 | SC-88 | PUMB24 | PUMH24 |

1.2 Features

- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs

1.3 Applications

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

1.4 Quick reference data

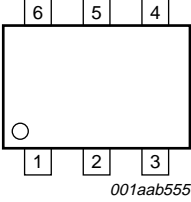
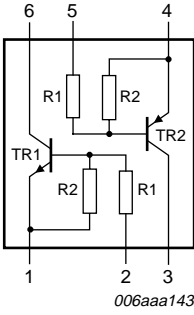
Table 2: Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|---------------------------|------------|-----|-----|-----|------------|
| V _{CEO} | collector-emitter voltage | open base | - | - | 50 | V |
| I _O | output current (DC) | | - | - | 20 | mA |
| R1 | bias resistor 1 (input) | | 70 | 100 | 130 | k Ω |
| R2/R1 | bias resistor ratio | | 0.8 | 1 | 1.2 | |

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2. Pinning information

Table 3: Pinning

| Pin | Description | Simplified outline | 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 | |
| PEMD24 | - | plastic surface mounted package; 6 leads | SOT666 |
| PUMD24 | SC-88 | plastic surface mounted package; 6 leads | SOT363 |

4. Marking

Table 5: Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PEMD24 | 6N |
| PUMD24 | T8* |

- [1] * = -: made in Hong Kong
 * = p: made in Hong Kong
 * = t: made in Malaysia
 * = W: made in China

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 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 | - | 10 | V | |
| V_I | input voltage TR1 | | | | | |
| | positive | | - | +40 | V | |
| | negative | | - | -10 | V | |
| | input voltage TR2 | | | | | |
| | positive | | - | +10 | V | |
| | negative | | - | -40 | V | |
| I_O | output current (DC) | | - | 20 | mA | |
| I_{CM} | peak collector current | | - | 100 | mA | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | | | | |
| | SOT363 | | [1] | - | 200 | mW |
| | SOT666 | | [1][2] | - | 200 | mW |
| T_{stg} | storage temperature | | -65 | +150 | °C | |
| T_j | junction temperature | | - | 150 | °C | |
| T_{amb} | ambient temperature | | -65 | +150 | °C | |
| Per device | | | | | | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | | | | |
| | SOT363 | | [1] | - | 300 | mW |
| | SOT666 | | [1][2] | - | 300 | mW |

[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 | | | | |
| | SOT363 | | [1] | - | 625 | K/W |
| | SOT666 | | [1][2] | - | 625 | K/W |
| Per device | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | |
| | SOT363 | | [1] | - | 416 | K/W |
| | SOT666 | | [1][2] | - | 416 | K/W |

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

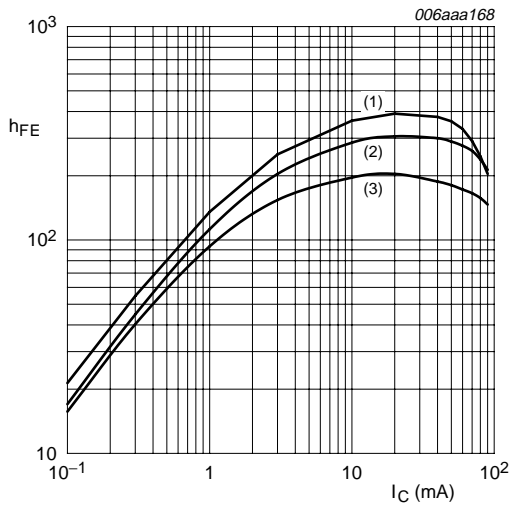
[2] Reflow soldering is the only recommended soldering method.

7. Characteristics

Table 8: Characteristics

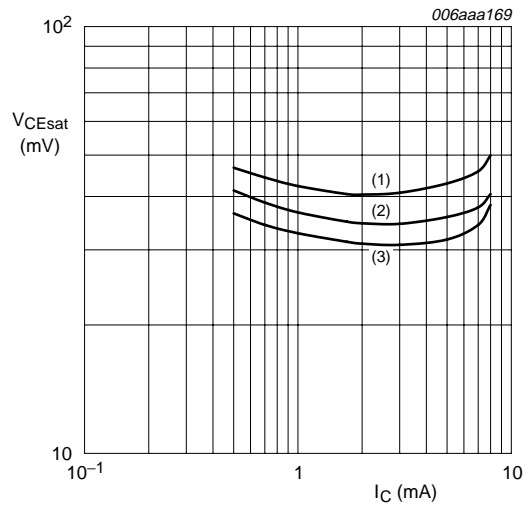
$T_{amb} = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|--|--------------------------------------|--|-----------|-----|-----|------|----|
| Per transistor; for the PNP transistor 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 | |
| | | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ °C}$ | - | - | 50 | μA | |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$ | - | - | 50 | μA | |
| h_{FE} | DC current gain | $V_{CE} = 5\text{ V}; I_C = 5\text{ mA}$ | 80 | - | - | | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 5\text{ mA}; I_B = 0.25\text{ mA}$ | - | - | 150 | mV | |
| $V_{I(off)}$ | off-state input voltage | $V_{CE} = 5\text{ V}; I_C = 100\text{ μA}$ | - | 1.1 | 0.5 | V | |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 0.3\text{ V}; I_C = 1\text{ mA}$ | 3 | 1.5 | - | V | |
| R1 | bias resistor 1 (input) | | 70 | 100 | 130 | kΩ | |
| R2/R1 | bias resistor ratio | | 0.8 | 1 | 1.2 | | |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = I_C = 0\text{ A}; f = 1\text{ MHz}$ | | | | | |
| | | | TR1 (NPN) | - | - | 2.5 | pF |
| | | | TR2 (PNP) | - | - | 3 | pF |



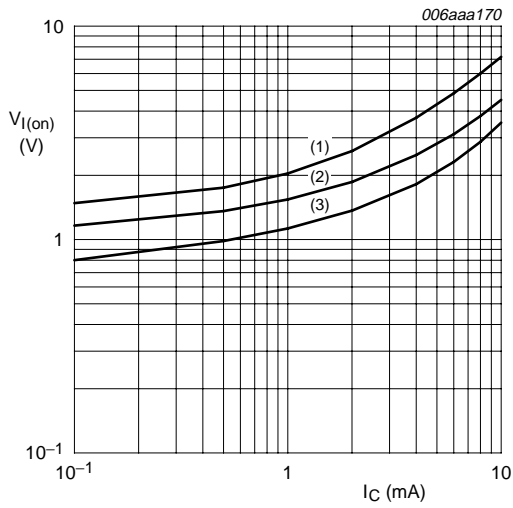
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -40\text{ °C}$

Fig 1. TR1 (NPN): DC current gain as a function of collector current; typical values



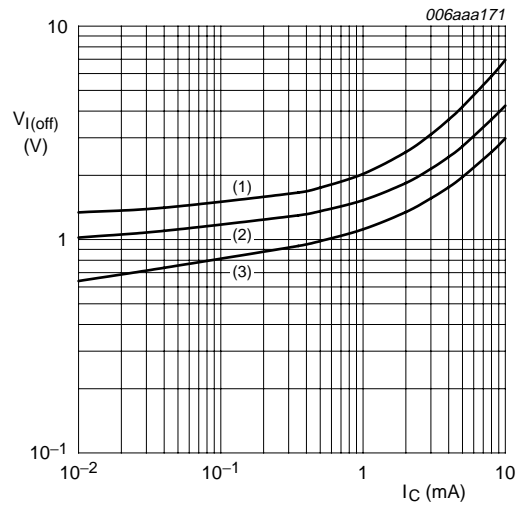
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -40\text{ °C}$

Fig 2. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



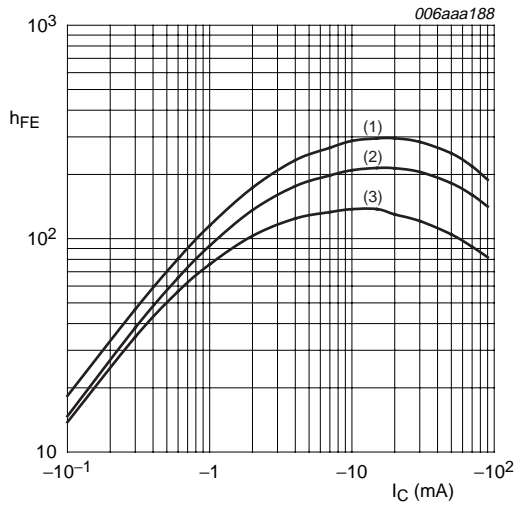
$V_{CE} = 0.3\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

Fig 3. TR1 (NPN): On-state input voltage as a function of collector current; typical values



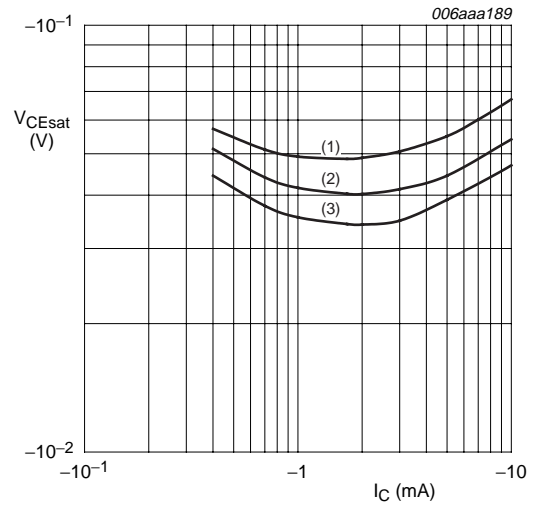
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = -40\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

Fig 4. TR1 (NPN): Off-state input voltage as a function of collector current; typical values



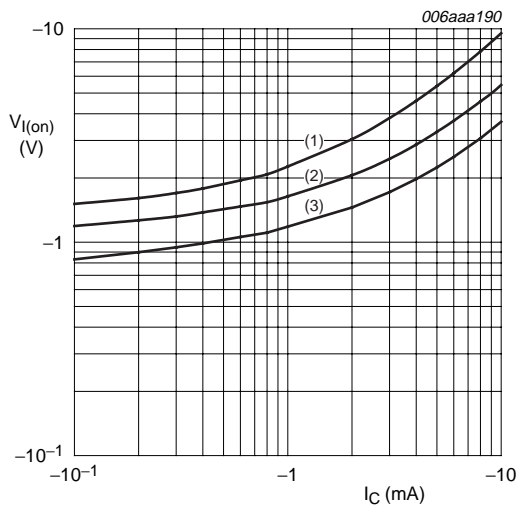
$V_{CE} = -5\text{ V}$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -40\text{ °C}$

Fig 5. TR2 (PNP): DC current gain as a function of collector current; typical values



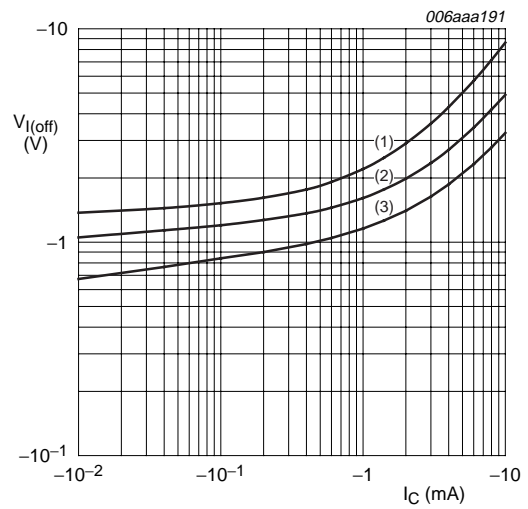
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -40\text{ °C}$

Fig 6. TR2 (PNP): 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 7. TR2 (PNP): 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 8. TR2 (PNP): Off-state input voltage as a function of collector current; typical values

8. Package outline

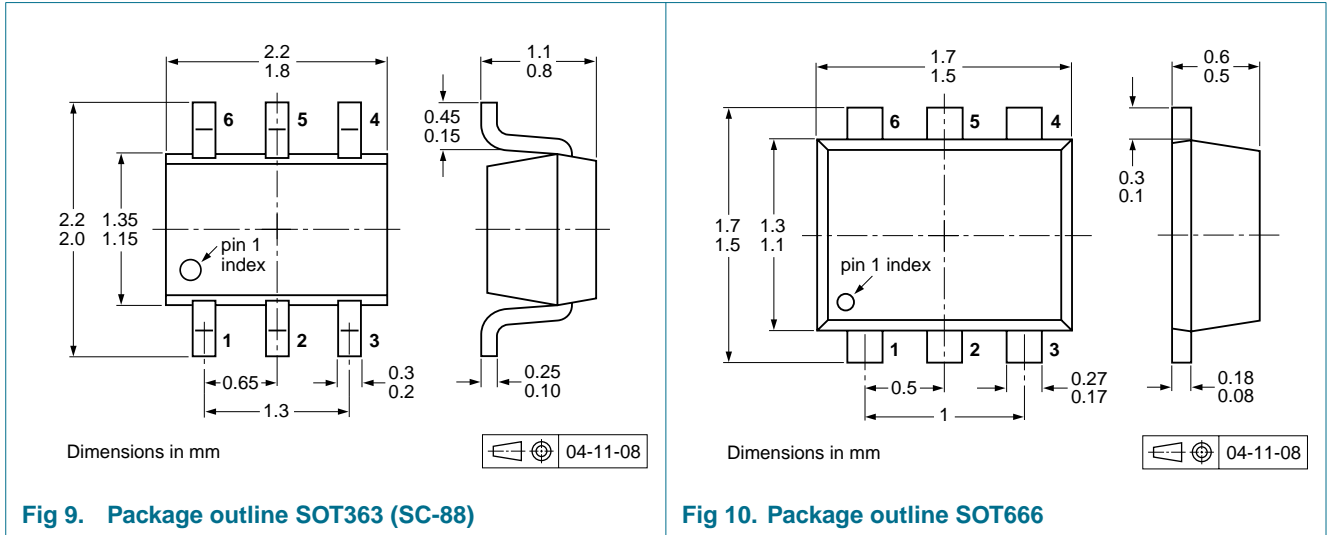


Fig 9. Package outline SOT363 (SC-88)

Fig 10. Package outline SOT666

9. 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 |
| PEMD24 | SOT666 | 2 mm pitch, 8 mm tape and reel | - | - | -315 | - |
| | | 4 mm pitch, 8 mm tape and reel | - | -115 | - | - |
| PUMD24 | 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 15](#).

[2] T1: normal taping

[3] T2: reverse taping

10. Revision history

Table 10: Revision history

| Document ID | Release date | Data sheet status | Change notice | Doc. number | Supersedes |
|-----------------|--------------|--------------------|---------------|----------------|------------|
| PEMD24_PUMD24_1 | 20050502 | Product data sheet | - | 9397 750 14457 | - |

11. Data sheet status

| Level | Data sheet status ^[1] | Product status ^{[2] [3]} | Definition |
|-------|----------------------------------|-----------------------------------|--|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Date of release: 2 May 2005
Document number: 9397 750 14457

Published in The Netherlands