

# PEMD24; PUMD24

NPN/PNP resistor-equipped transistors;  
R1 = 100 k $\Omega$ , R2 = 100 k $\Omega$

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

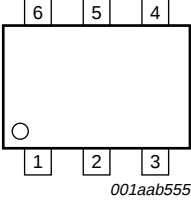
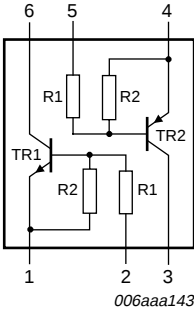
Table 2: Quick reference data

| Symbol           | Parameter                 | Conditions | Min | Typ | Max | Unit       |
|------------------|---------------------------|------------|-----|-----|-----|------------|
| V <sub>CEO</sub> | collector-emitter voltage | open base  | -   | -   | 50  | V          |
| I <sub>O</sub>   | output current (DC)       |            | -   | -   | 20  | mA         |
| R1               | bias resistor 1 (input)   |            | 70  | 100 | 130 | k $\Omega$ |
| 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      | <br>001aab555 | <br>006aaa143 |
| 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 |
| 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 <a href="#">[1]</a> |
|-------------|----------------------------------|
| 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 |
|----------------------------------------------------------------------|---------------------------|-----------------------------|-----------|------|------|
| <b>Per transistor; for the PNP transistor with negative polarity</b> |                           |                             |           |      |      |
| $V_{CBO}$                                                            | 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   |
| <b>Per device</b>                                                    |                           |                             |           |      |      |
| $P_{tot}$                                                            | 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 |
|-----------------------|---------------------------------------------|-------------|---------|-----|-----|------|
| <b>Per transistor</b> |                                             |             |         |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient | in free air |         |     |     |      |
|                       | SOT363                                      |             | [1]     | -   | 625 | K/W  |
|                       | SOT666                                      |             | [1] [2] | -   | 625 | K/W  |
| <b>Per device</b>     |                                             |             |         |     |     |      |
| $R_{th(j-a)}$         | 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.

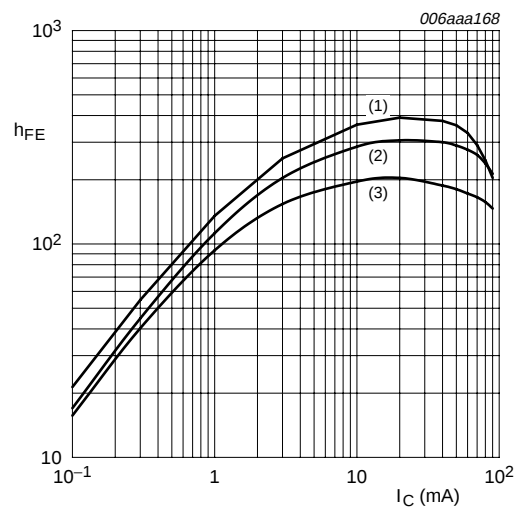
[2] Reflow soldering is the only recommended soldering method.

## 7. Characteristics

Table 8: Characteristics

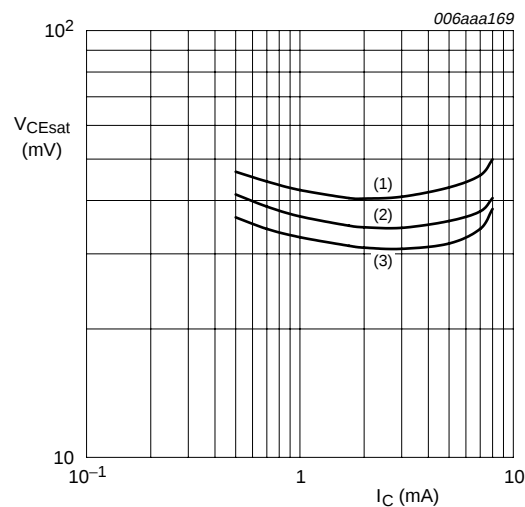
 $T_{amb} = 25^\circ\text{C}$  unless otherwise specified.

| Symbol                                                               | Parameter                            | Conditions                                                        | Min | Typ | Max | Unit          |
|----------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------|-----|-----|-----|---------------|
| <b>Per transistor; for the PNP transistor with negative polarity</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    | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}$                          | -   | -   | 1   | $\mu\text{A}$ |
|                                                                      |                                      | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150^\circ\text{C}$ | -   | -   | 50  | $\mu\text{A}$ |
| $I_{EBO}$                                                            | emitter-base cut-off current         | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$                           | -   | -   | 50  | $\mu\text{A}$ |
| $h_{FE}$                                                             | 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              | $V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}$               | -   | 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            |



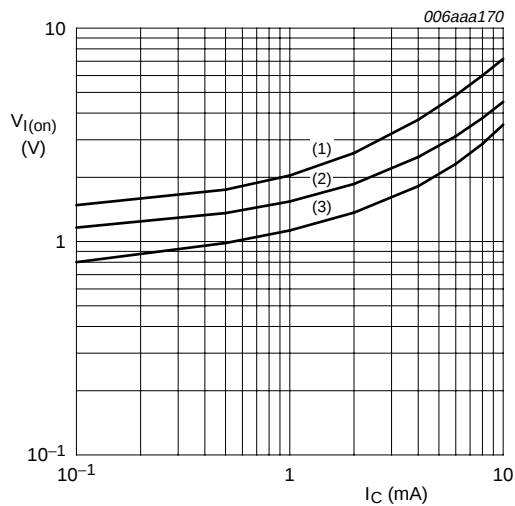
- $V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = 100^\circ\text{C}$   
(2)  $T_{amb} = 25^\circ\text{C}$   
(3)  $T_{amb} = -40^\circ\text{C}$

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



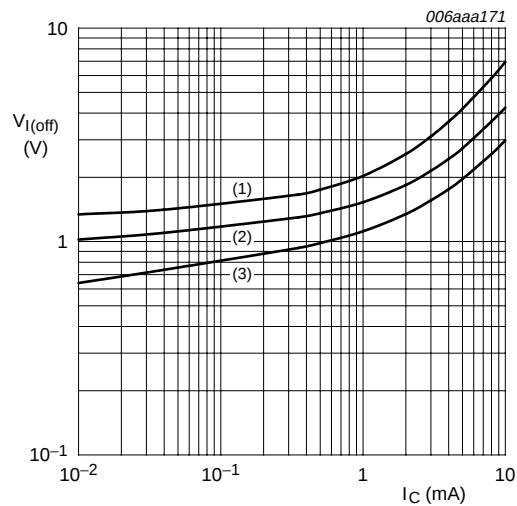
- $I_C/I_B = 20$   
(1)  $T_{amb} = 100^\circ\text{C}$   
(2)  $T_{amb} = 25^\circ\text{C}$   
(3)  $T_{amb} = -40^\circ\text{C}$

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



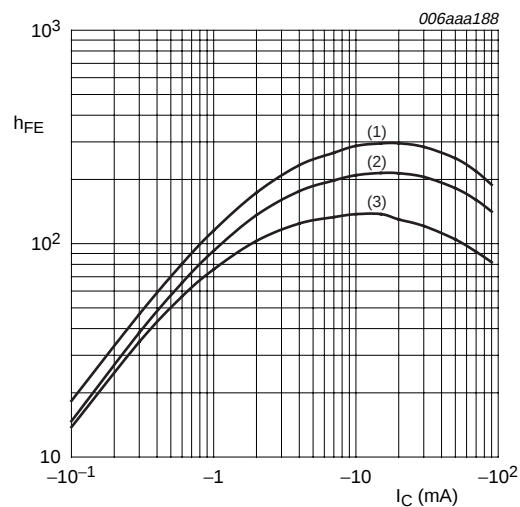
- $V_{CE} = 0.3\text{ V}$   
(1)  $T_{amb} = -40^\circ\text{C}$   
(2)  $T_{amb} = 25^\circ\text{C}$   
(3)  $T_{amb} = 100^\circ\text{C}$

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



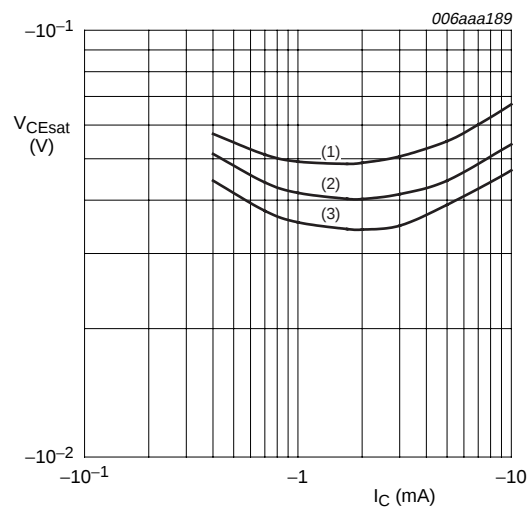
- $V_{CE} = 5\text{ V}$   
(1)  $T_{amb} = -40^\circ\text{C}$   
(2)  $T_{amb} = 25^\circ\text{C}$   
(3)  $T_{amb} = 100^\circ\text{C}$

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



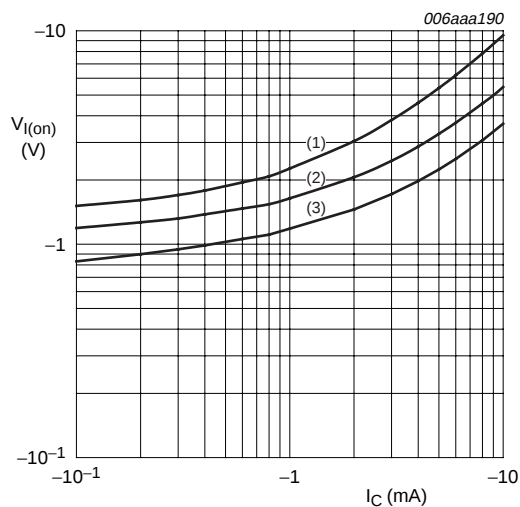
- $V_{CE} = -5$  V
- (1)  $T_{amb} = 100$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = -40$  °C

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



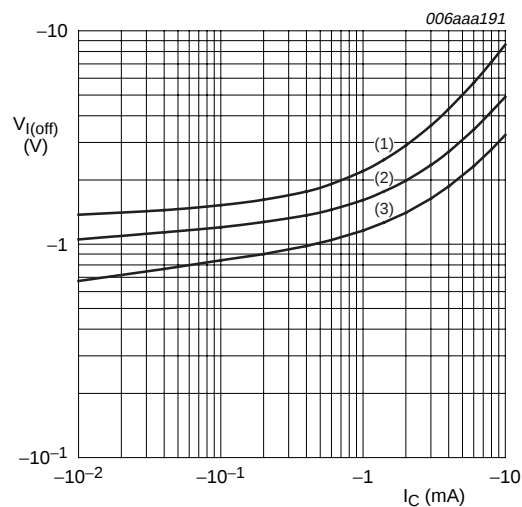
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = -40$  °C

Fig 6. TR2 (PNP): 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

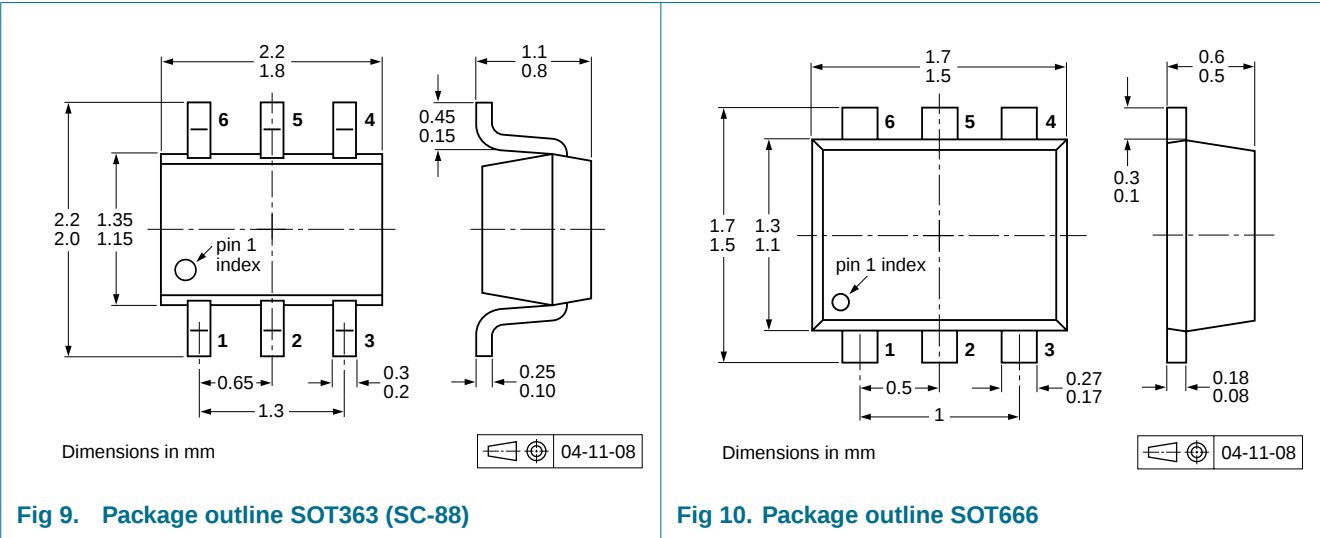
Fig 7. TR2 (PNP): On-state input voltage as a function of collector current; typical values



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

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

8. Package outline



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 <sup>[1]</sup> | Product status <sup>[2] [3]</sup> | 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.                                                                                                    |
| II    | Preliminary data                 | Qualification                     | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.             |
| III   | Product data                     | Production                        | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 12. Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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