

# DATA SHEET

**PEMD12; PUMD12**  
NPN/PNP resistor-equipped  
transistors; R1 = 47 k $\Omega$ , R2 = 47 k $\Omega$

Product specification  
Supersedes data of 2001 Nov 7

2003 Oct 08

**NPN/PNP resistor-equipped transistors;**  
**R1 = 47 kΩ, R2 = 47 kΩ**

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**FEATURES**

- Built-in bias resistors
- Simplified circuit design
- Reduction of component count
- Reduced pick and place costs.

**APPLICATIONS**

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

**QUICK REFERENCE DATA**

| SYMBOL           | PARAMETER                 | TYP. | MAX. | UNIT |
|------------------|---------------------------|------|------|------|
| V <sub>CEO</sub> | collector-emitter voltage | –    | 50   | V    |
| I <sub>O</sub>   | output current (DC)       | –    | 100  | mA   |
| TR1              | NPN                       | –    | –    | –    |
| TR2              | PNP                       | –    | –    | –    |
| R1               | bias resistor             | 47   | –    | kΩ   |
| R2               | bias resistor             | 47   | –    | kΩ   |

**DESCRIPTION**

NPN/PNP resistor-equipped transistors (see “Simplified outline, symbol and pinning” for package details).

**PRODUCT OVERVIEW**

| TYPE NUMBER | PACKAGE |       | MARKING CODE       | PNP/PNP COMPLEMENT | NPN/PNP COMPLEMENT |
|-------------|---------|-------|--------------------|--------------------|--------------------|
|             | PHILIPS | EIAJ  |                    |                    |                    |
| PEMD12      | SOT666  |       | D2                 | PEMB2              | PEMH2              |
| PUMD12      | SOT363  | SC-88 | D*1 <sup>(1)</sup> | PUMB2              | PUMH2              |

**Note**

- \* = p: Made in Hong Kong.  
 \* = t: Made in Malaysia.  
 \* = W: Made in China.

**SIMPLIFIED OUTLINE, SYMBOL AND PINNING**

| TYPE NUMBER      | SIMPLIFIED OUTLINE AND SYMBOL | PINNING |               |
|------------------|-------------------------------|---------|---------------|
|                  |                               | PIN     | DESCRIPTION   |
| PEMD12<br>PUMD12 | <p>Top view</p> <p>MAM468</p> | 1       | emitter TR1   |
|                  |                               | 2       | base TR1      |
|                  |                               | 3       | collector TR2 |
|                  |                               | 4       | emitter TR2   |
|                  |                               | 5       | base TR2      |
|                  |                               | 6       | collector TR1 |

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**ORDERING INFORMATION**

| TYPE NUMBER | PACKAGE |  |         |
|-------------|---------|--|---------|
|             | NAME    | DESCRIPTION                              | VERSION |
| PEMD12      | –       | plastic surface mounted package; 6 leads | SOT666  |
| PUMD12      | –       | plastic surface mounted package; 6 leads | SOT363  |

**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 <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           | –    | 10   | V    |
| V <sub>I</sub>   | input voltage TR1<br>positive<br>negative |                          | –    | +40  | V    |
|  |   |                          | –    | –10  | V    |
| V <sub>I</sub>   | input voltage TR2<br>positive<br>negative |                          | –    | +10  | V    |
|  |   |                          | –    | –40  | V    |
| I <sub>O</sub>   | output current (DC)                       |                          | –    | 100  | mA   |
| I <sub>CM</sub>  | peak collector current                    |                          | –    | 100  | mA   |
| P <sub>tot</sub>   | total power dissipation                   | T <sub>amb</sub> ≤ 25 °C |      |      |      |
|  | SOT363                                    | note 1                   | –    | 200  | mW   |
|  | SOT666                                    | notes 1 and 2            | –    | 200  | mW   |
| T <sub>stg</sub>   | storage temperature                       |                          | –65  | +150 | °C   |
| T <sub>j</sub>   | junction temperature                      |                          | –    | 150  | °C   |
| T <sub>amb</sub>   | operating ambient temperature             |                          | –65  | +150 | °C   |
| <b>Per device</b>  |   |                          |      |      |      |
| P <sub>tot</sub>   | total power dissipation                   | T <sub>amb</sub> ≤ 25 °C |      |      |      |
|  | SOT363                                    | note 1                   | –    | 300  | mW   |
|  | SOT666                                    | notes 1 and 2            | –    | 300  | mW   |

**Notes**

1. Device mounted on an FR4 printed-circuit board, single-sided copper, standard footprint.
2. Reflow soldering is the only recommended soldering method.

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## THERMAL CHARACTERISTICS

| SYMBOL                | PARAMETER                                   | CONDITIONS               | VALUE | UNIT |
|-----------------------|---|--------------------------|-------|------|
| <b>Per transistor</b> |   |                          |       |      |
| R <sub>th j-a</sub>   | thermal resistance from junction to ambient | T <sub>amb</sub> ≤ 25 °C |       |      |
|                       | SOT363                                      | note 1                   | 625   | K/W  |
|                       | SOT666                                      | notes 1 and 2            | 625   | K/W  |
| <b>Per device</b>     |   |                          |       |      |
| R <sub>th j-a</sub>   | thermal resistance from junction to ambient | T <sub>amb</sub> ≤ 25 °C |       |      |
|                       | SOT363                                      | note 1                   | 416   | K/W  |
|                       | SOT666                                      | notes 1 and 2            | 416   | K/W  |

## Notes

1. Device mounted on an FR4 printed-circuit board, single-sided copper, standard footprint.
2. Reflow soldering is the only recommended soldering method.

## CHARACTERISTICS

T<sub>amb</sub> = 25 °C unless otherwise specified.

| SYMBOL   | PARAMETER                            | CONDITIONS   | MIN. | TYP. | MAX. | UNIT       |
|--|--------------------------------------|--|------|------|------|------------|
| <b>Per transistor; for the PNP transistor with negative polarity</b> |                                      |  |      |      |      |            |
| I <sub>CBO</sub>   | collector-base cut-off current       | V <sub>CB</sub> = 50 V; I <sub>E</sub> = 0                             | –    | –    | 100  | nA         |
| I <sub>CEO</sub>   | collector-emitter cut-off current    | V <sub>CE</sub> = 30 V; I <sub>B</sub> = 0                             | –    | –    | 1    | $\mu$ A    |
|  |                                      | V <sub>CE</sub> = 30 V; I <sub>B</sub> = 0; T <sub>j</sub> = 150 °C    | –    | –    | 50   | $\mu$ A    |
| I <sub>EBO</sub>   | emitter-base cut-off current         | V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0                              | –    | –    | 90   | $\mu$ A    |
| h <sub>FE</sub>  | DC current gain                      | V <sub>CE</sub> = 5 V; I <sub>C</sub> = 5 mA                           | 80   | –    | –    |            |
| V <sub>CEsat</sub>   | collector-emitter saturation voltage | I <sub>C</sub> = 10 mA; I <sub>B</sub> = 0.5 mA                        | –    | –    | 150  | mV         |
| V <sub>i(off)</sub>  | input-off voltage                    | I <sub>C</sub> = 100 $\mu$ A; V <sub>CE</sub> = 5 V                    | –    | 1.2  | 0.8  | V          |
| V <sub>i(on)</sub>   | input-on voltage                     | I <sub>C</sub> = 2 mA; V <sub>CE</sub> = 0.3 V                         | 3    | 1.6  | –    | V          |
| R1   | input resistor                       |  | 33   | 47   | 61   | k $\Omega$ |
| $\frac{R2}{R1}$  | resistor ratio                       |  | 0.8  | 1    | 1.2  |            |
| C <sub>c</sub>   | collector capacitance                | I <sub>E</sub> = i <sub>e</sub> = 0; V <sub>CB</sub> = 10 V; f = 1 MHz |      |      |      |            |
|  | TR1 (NPN)                            |  | –    | –    | 2.5  | pF         |
|  | TR2 (PNP)                            |  | –    | –    | 3    | pF         |

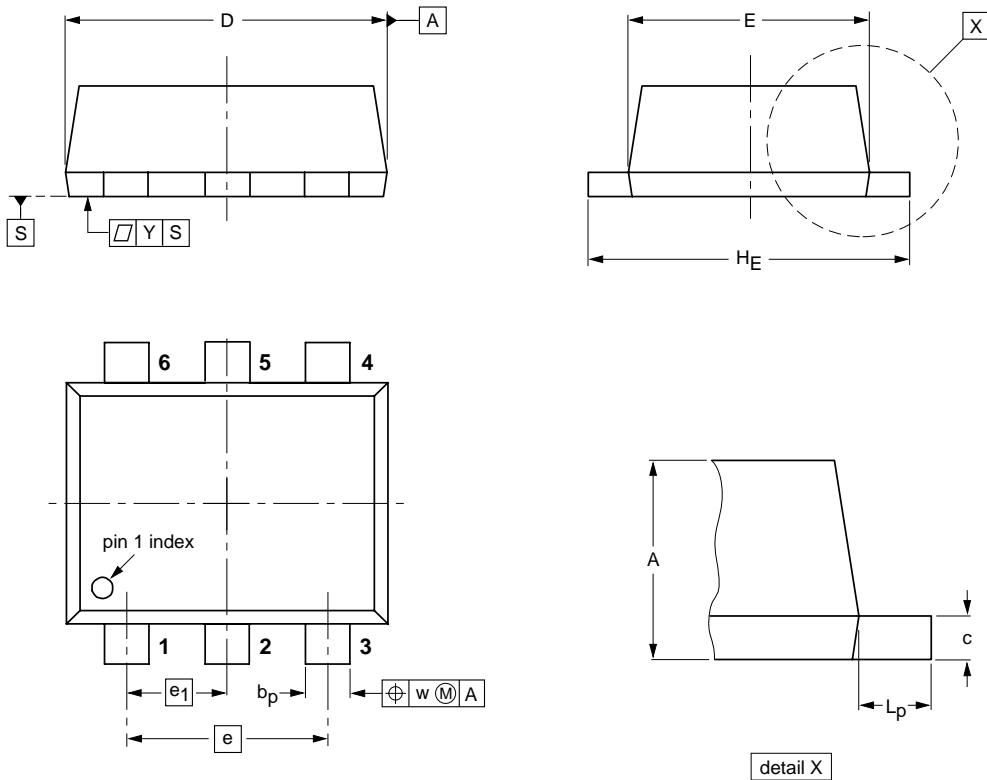
NPN/PNP resistor-equipped transistors;  
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PACKAGE OUTLINES

Plastic surface mounted package; 6 leads

SOT666



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | b <sub>p</sub> | c            | D          | E          | e   | e <sub>1</sub> | H <sub>E</sub> | L <sub>p</sub> | w   | y   |
|------|------------|----------------|--------------|------------|------------|-----|----------------|----------------|----------------|-----|-----|
| mm   | 0.6<br>0.5 | 0.27<br>0.17   | 0.18<br>0.08 | 1.7<br>1.5 | 1.3<br>1.1 | 1.0 | 0.5            | 1.7<br>1.5     | 0.3<br>0.1     | 0.1 | 0.1 |

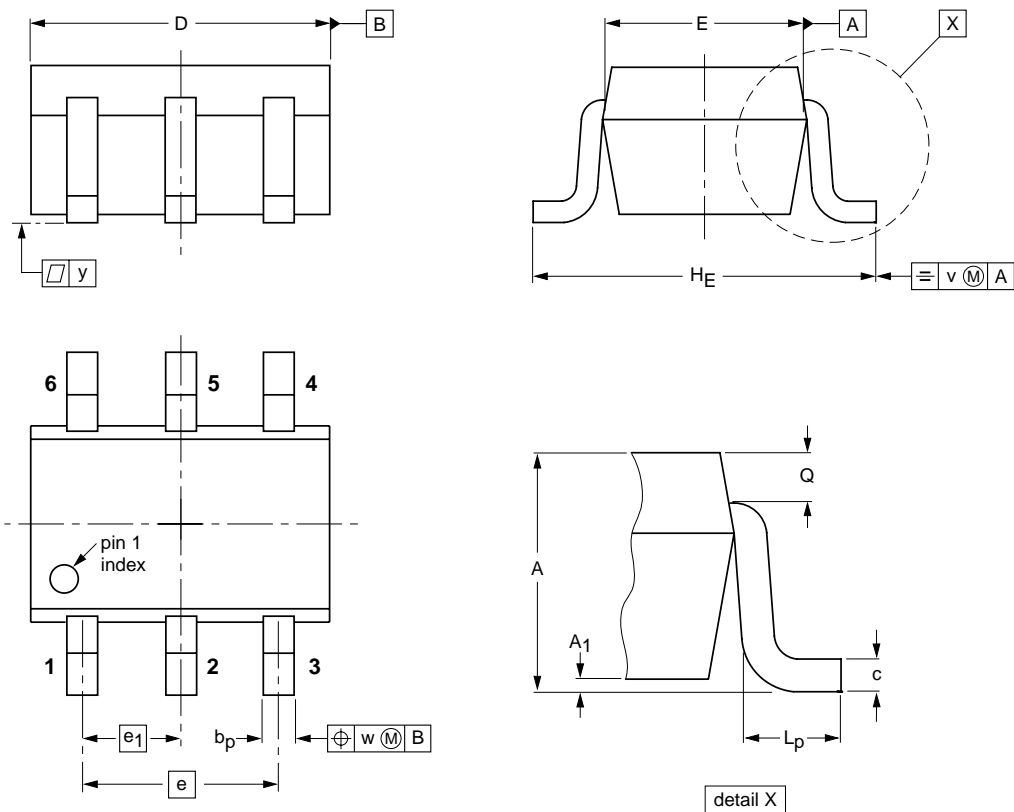
| OUTLINE VERSION | REFERENCES |       |      | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|-------|------|---------------------|----------------------|
|                 | IEC        | JEDEC | EIAJ |                     |                      |
| SOT666          |            |       |      |                     | 01-01-04<br>01-08-27 |

NPN/PNP resistor-equipped transistors;  
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SOT363



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A1<br>max | bp           | c            | D          | E            | e   | e1   | HE         | Lp           | Q            | v   | w   | y   |
|------|------------|-----------|--------------|--------------|------------|--------------|-----|------|------------|--------------|--------------|-----|-----|-----|
| mm   | 1.1<br>0.8 | 0.1       | 0.30<br>0.20 | 0.25<br>0.10 | 2.2<br>1.8 | 1.35<br>1.15 | 1.3 | 0.65 | 2.2<br>2.0 | 0.45<br>0.15 | 0.25<br>0.15 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES |       |       |  | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|-------|--|---------------------|------------|
|                 | IEC        | JEDEC | EIAJ  |  |                     |            |
| SOT363          |            |       | SC-88 |  |                     | 97-02-28   |

NPN/PNP resistor-equipped transistors;  
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#### 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.  |
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Printed in The Netherlands

R75/03/pp8

Date of release: 2003 Oct 08

Document order number: 9397 750 11861

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