

# PEMH16; PUMH16

NPN/NPN resistor-equipped transistors;

R1 = 22 k $\Omega$ , R2 = 47 k $\Omega$

Rev. 04 — 15 November 2009

Product data sheet

## 1. Product profile

### 1.1 General description

NPN/NPN Resistor-Equipped Transistors (RET).

Table 1. Product overview

| Type number | Package |       | NPN/PNP complement | PNP/PNP complement |
|-------------|---------|-------|--------------------|--------------------|
|             | NXP     | JEITA |                    |                    |
| PEMH16      | SOT666  | -     | PEMD16             | PEMB16             |
| PUMH16      | SOT363  | SC-88 | PUMD16             | PUMB16             |

### 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

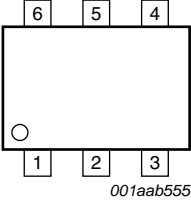
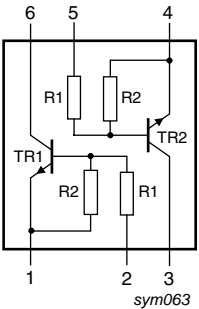
### 1.4 Quick reference data

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            |            | -    | -   | 100  | mA         |
| R1               | bias resistor 1 (input)   |            | 15.4 | 22  | 28.6 | k $\Omega$ |
| R2/R1            | bias resistor ratio       |            | 1.7  | 2.1 | 2.6  |            |

## 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                              |         |
| PEMH16      | -       | plastic surface mounted package; 6 leads | SOT666  |
| PUMH16      | SC-88   | plastic surface mounted package; 6 leads | SOT363  |

## 4. Marking

**Table 5. Marking codes**

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PEMH16      | 5K                          |
| PUMH16      | H3*                         |

[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</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                          | -      | 7    | V                |    |
| $V_I$                 | input voltage             |   |        |      |                  |    |
|                       | positive                  |   | -      | +40  | V                |    |
|                       | negative                  |   | -      | -7   | V                |    |
| $I_O$                 | output current            |   | -      | 100  | mA               |    |
| $I_{CM}$              | peak collector current    |   | -      | 100  | mA               |    |
| $P_{tot}$             | total power dissipation   | $T_{amb} \leq 25\text{ }^\circ\text{C}$ |        |      |                  |    |
|                       | SOT363                    |   | [1]    | -    | 200              | mW |
|                       | SOT666                    |   | [1][2] | -    | 200              | mW |
| $T_{stg}$             | storage temperature       |   | -65    | +150 | $^\circ\text{C}$ |    |
| $T_j$                 | junction temperature      |   | -      | 150  | $^\circ\text{C}$ |    |
| $T_{amb}$             | ambient temperature       |   | -65    | +150 | $^\circ\text{C}$ |    |
| <b>Per device</b>     |                           |   |        |      |                  |    |
| $P_{tot}$             | total power dissipation   | $T_{amb} \leq 25\text{ }^\circ\text{C}$ |        |      |                  |    |
|                       | 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.

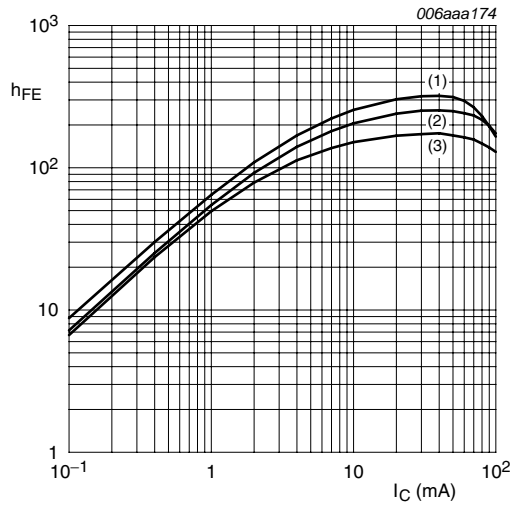
[2] Reflow soldering is the only recommended soldering method.

## 7. Characteristics

**Table 8. Characteristics**

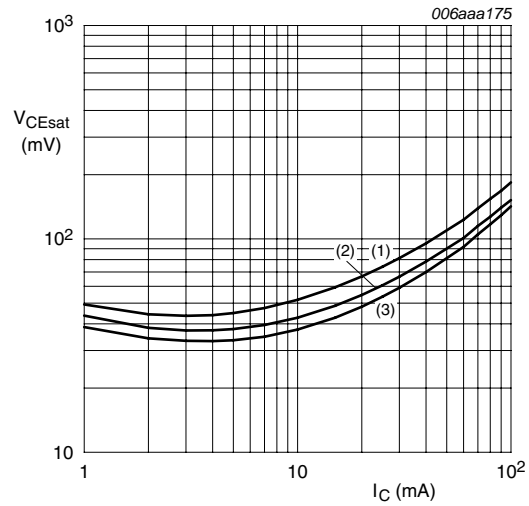
$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol                | Parameter                            | Conditions   | Min  | Typ | Max  | Unit          |
|-----------------------|--------------------------------------|--|------|-----|------|---------------|
| <b>Per transistor</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    | $\mu\text{A}$ |
|                       |                                      | $V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$ ;<br>$T_j = 150\text{ }^{\circ}\text{C}$ | -    | -   | 50   | $\mu\text{A}$ |
| $I_{EBO}$             | emitter-base cut-off current         | $V_{EB} = 5\text{ V}$ ; $I_C = 0\text{ A}$   | -    | -   | 120  | $\mu\text{A}$ |
| $h_{FE}$              | DC current gain                      | $V_{CE} = 5\text{ V}$ ; $I_C = 5\text{ mA}$  | 80   | -   | -    |               |
| $V_{CEsat}$           | collector-emitter saturation voltage | $I_C = 10\text{ mA}$ ; $I_B = 0.5\text{ mA}$   | -    | -   | 150  | mV            |
| $V_{I(off)}$          | off-state input voltage              | $V_{CE} = 5\text{ V}$ ; $I_C = 100\text{ }\mu\text{A}$                               | -    | 0.8 | 0.5  | V             |
| $V_{I(on)}$           | on-state input voltage               | $V_{CE} = 0.3\text{ V}$ ; $I_C = 2\text{ mA}$  | 2    | 1.1 | -    | V             |
| R1                    | bias resistor 1 (input)              |  | 15.4 | 22  | 28.6 | k $\Omega$    |
| R2/R1                 | bias resistor ratio                  |  | 1.7  | 2.1 | 2.6  |               |
| $C_c$                 | collector capacitance                | $V_{CB} = 10\text{ V}$ ; $I_E = i_e = 0\text{ A}$ ;<br>$f = 1\text{ MHz}$            | -    | -   | 2.5  | pF            |



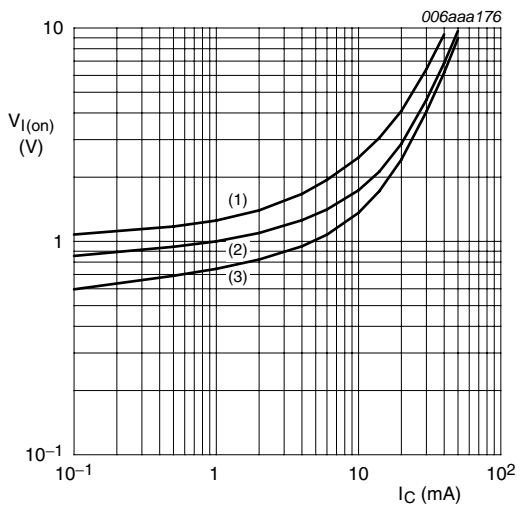
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

**Fig 1. DC current gain as a function of collector current; typical values**



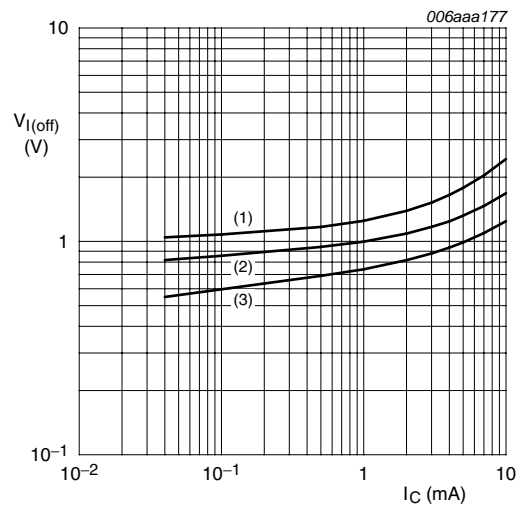
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

**Fig 2. Collector-emitter saturation voltage as a function of collector current; typical values**



$V_{CE} = 0.3\text{ V}$   
 (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 3. 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 4. Off-state input voltage as a function of collector current; typical values**

8. Package outline

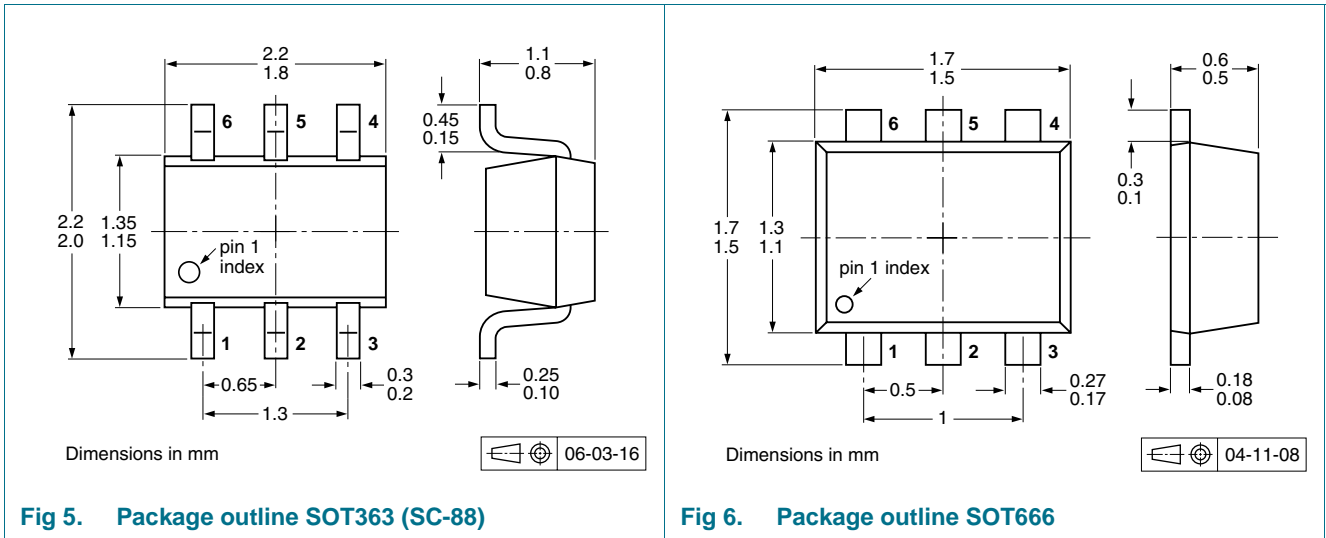


Fig 5. Package outline SOT363 (SC-88)

Fig 6. Package outline SOT666

9. Packing information

Table 9. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

| Type number | Package | Description                                       | Packing quantity |      |      |       |
|-------------|---------|---|------------------|------|------|-------|
|             |         |   | 3000             | 4000 | 8000 | 10000 |
| PEMH16      | SOT666  | 2 mm pitch, 8 mm tape and reel                    | -                | -    | -315 | -     |
|             |         | 4 mm pitch, 8 mm tape and reel                    | -                | -115 | -    | -     |
| PUMH16      | SOT363  | 4 mm pitch, 8 mm tape and reel; T1 <sup>[2]</sup> | -115             | -    | -    | -135  |
|             |         | 4 mm pitch, 8 mm tape and reel; T2 <sup>[3]</sup> | -125             | -    | -    | -165  |

[1] For further information and the availability of packing methods, see [Section 12](#).

[2] T1: normal taping

[3] T2: reverse taping

## 10. Revision history

Table 10. Revision history

| Document ID     | Release date  | Data sheet status     | Change notice | Supersedes      |
|-----------------|---|-----------------------|---------------|-----------------|
| PEMH16_PUMH16_4 | 20091115  | Product data sheet    | -             | PEMH16_PUMH16_3 |
| Modifications:  | <ul style="list-style-type: none"> <li>This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content.</li> <li><a href="#">Figure 5 "Package outline SOT363 (SC-88)"; updated</a></li> </ul> |                       |               |                 |
| PEMH16_PUMH16_3 | 20050607  | Product data sheet    | -             | PUMH16_2        |
| PUMH16_2        | 20040414  | Product specification | -             | PUMH16_1        |
| PUMH16_1        | 20031009  | Product specification | -             | -               |

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### 11.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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".

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