

# PEMH20; PUMH20

NPN/NPN resistor-equipped transistors;

R1 = 2.2 k $\Omega$ , R2 = 2.2 k $\Omega$

Rev. 04 — 15 November 2009

Product data sheet

## 1. Product profile

### 1.1 General description

NPN/NPN resistor-equipped transistors.

Table 1. Product overview

| Type number | Package |       | NPN/PNP complement | PNP/PNP complement |
|-------------|---------|-------|--------------------|--------------------|
|             | NXP     | JEITA |                    |                    |
| PEMH20      | SOT666  | -     | PEMD20             | PEMB20             |
| PUMH20      | SOT363  | SC-88 | PUMD20             | PUMB20             |

### 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

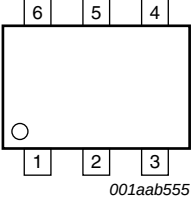
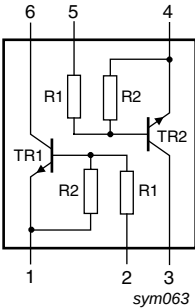
### 1.4 Quick reference data

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)       |            | -    | -   | 100  | mA         |
| R1               | bias resistor 1 (input)   |            | 1.54 | 2.2 | 2.86 | k $\Omega$ |
| R2/R1            | bias resistor ratio       |            | 0.8  | 1   | 1.2  |            |

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 |                                                                                     |                                                                                     |

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3. Ordering information

Table 4. Ordering information

| Type number | Package |                                          |         |
|-------------|---------|------------------------------------------|---------|
|             | Name    | Description                              | Version |
| PEMH20      | -       | plastic surface mounted package; 6 leads | SOT666  |
| PUMH20      | SC-88   | plastic surface mounted package; 6 leads | SOT363  |

4. Marking

Table 5. Marking codes

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PEMH20      | 6K                          |
| PUMH20      | H7*                         |

[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 <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             |                          |          |      |      |
|                       | positive                  |                          | -        | +12  | V    |
|                       | negative                  |                          | -        | -10  | 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                    |                          | [1] -    | 200  | mW   |
|                       | SOT666                    |                          | [1][2] - | 200  | mW   |
| T <sub>stg</sub>      | storage temperature       |                          | -65      | +150 | °C   |
| T <sub>j</sub>        | junction temperature      |                          | -        | 150  | °C   |
| T <sub>amb</sub>      | ambient temperature       |                          | -65      | +150 | °C   |
| <b>Per device</b>     |                           |                          |          |      |      |
| P <sub>tot</sub>      | total power dissipation   | T <sub>amb</sub> ≤ 25 °C |          |      |      |
|                       | SOT363                    |                          | [1] -    | 300  | mW   |
|                       | SOT666                    |                          | [1][2] - | 300  | mW   |

[1] Device mounted on a FR4 printed-circuit board, 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 a FR4 printed-circuit board, single-sided copper, tin-plated and standard footprint.

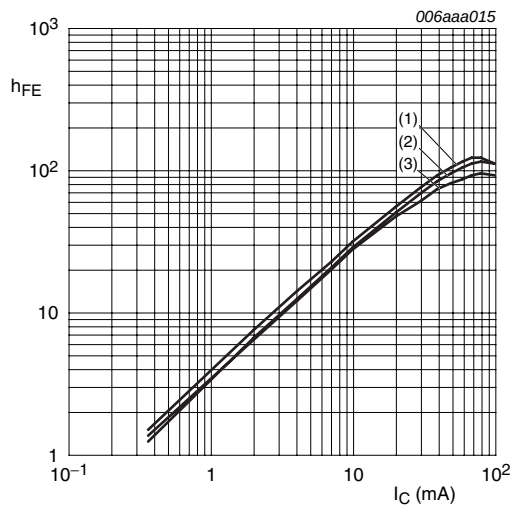
[2] Reflow soldering is the only recommended soldering method.

## 7. Characteristics

**Table 8. Characteristics**

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

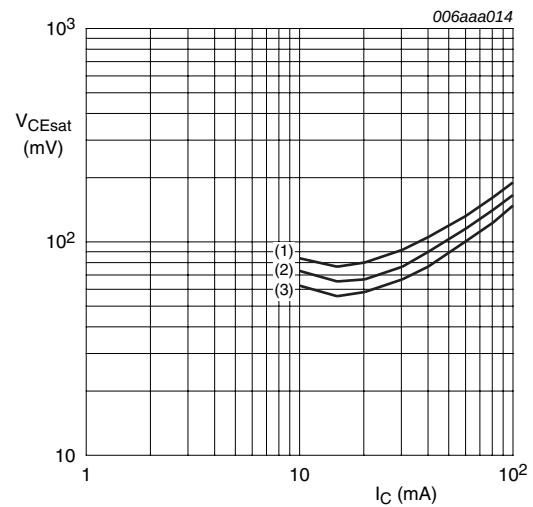
| Symbol                | Parameter                            | Conditions                                                                           | Min  | Typ | Max  | Unit          |
|-----------------------|--------------------------------------|--------------------------------------------------------------------------------------|------|-----|------|---------------|
| <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         | $V_{EB} = 5\text{ V}$ ; $I_C = 0\text{ A}$                                           | -    | -   | 2    | mA            |
| $h_{FE}$              | DC current gain                      | $V_{CE} = 5\text{ V}$ ; $I_C = 20\text{ mA}$                                         | 30   | -   | -    |               |
| $V_{CEsat}$           | collector-emitter saturation voltage | $I_C = 10\text{ mA}$ ; $I_B = 0.5\text{ mA}$                                         | -    | -   | 150  | mV            |
| $V_{I(off)}$          | off-state input voltage              | $V_{CE} = 5\text{ V}$ ; $I_C = 1\text{ mA}$                                          | -    | 1.2 | 0.5  | V             |
| $V_{I(on)}$           | on-state input voltage               | $V_{CE} = 0.3\text{ V}$ ; $I_C = 20\text{ mA}$                                       | 2    | 1.6 | -    | V             |
| R1                    | bias resistor1 (input)               |                                                                                      | 1.54 | 2.2 | 2.86 | k $\Omega$    |
| R2/R1                 | bias resistor ratio                  |                                                                                      | 0.8  | 1   | 1.2  |               |
| $C_c$                 | collector capacitance                | $V_{CB} = 10\text{ V}$ ; $I_E = i_e = 0\text{ A}$ ;<br>$f = 1\text{ MHz}$            | -    | -   | 2.5  | pF            |



$V_{CE} = 5$  V

- (1)  $T_{amb} = 150$  °C
- (2)  $T_{amb} = 25$  °C
- (3)  $T_{amb} = -40$  °C

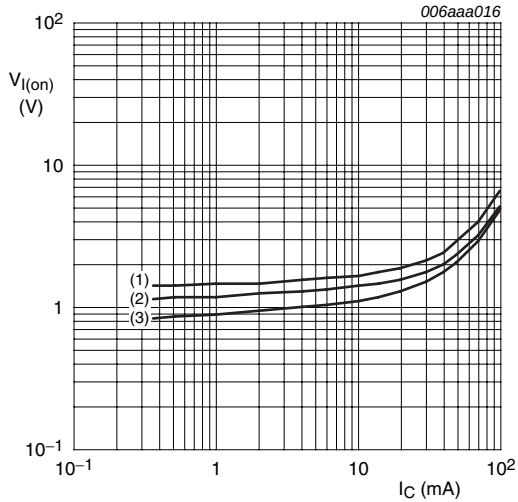
**Fig 1. DC current gain as a function of collector current; typical values**



$I_C/I_B = 20$

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

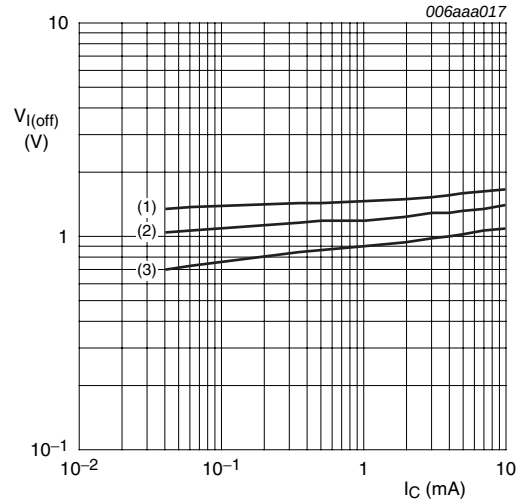
**Fig 2. Collector-emitter saturation voltage as a function of collector current; typical values**



$V_{CE} = 0.3$  V

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

**Fig 3. On-state input voltage as a function of collector current; typical values**

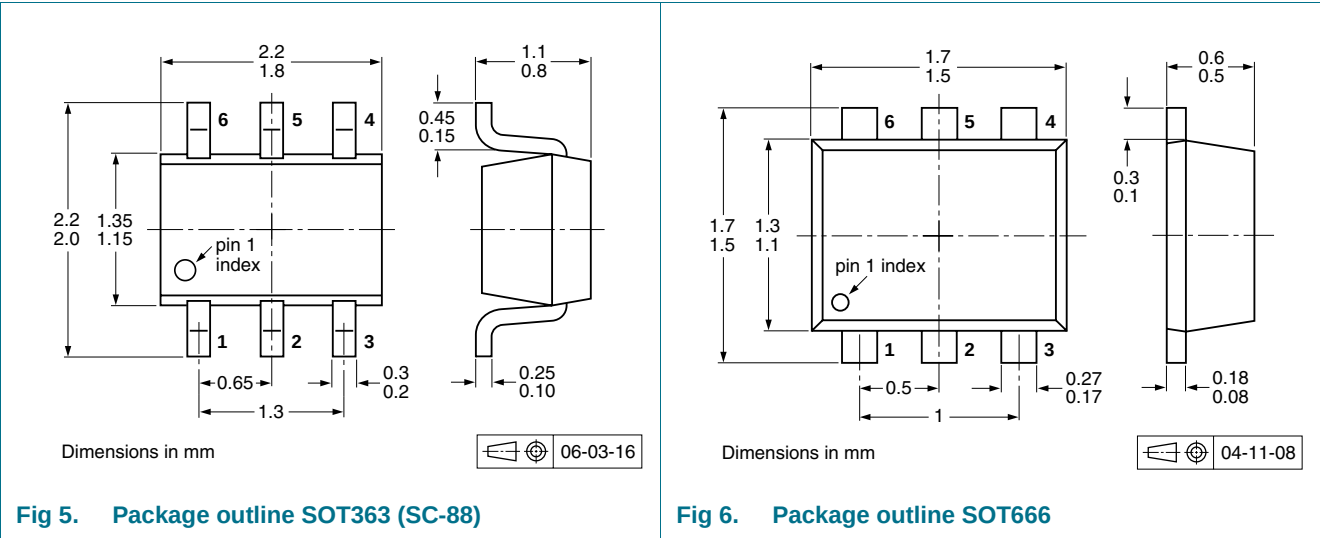


$V_{CE} = 5$  V

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

**Fig 4. 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.<sup>[1]</sup>

| Type number | Package | Description                                       | Packing quantity |      |      |       |
|-------------|---------|---------------------------------------------------|------------------|------|------|-------|
|             |         |                                                   | 3000             | 4000 | 8000 | 10000 |
| PEMH20      | SOT666  | 2 mm pitch, 8 mm tape and reel                    | -                | -    | -315 | -     |
|             |         | 4 mm pitch, 8 mm tape and reel                    | -                | -115 | -    | -     |
| PUMH20      | 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      |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|-----------------|
| PEMH20_PUMH20_4 | 20091115                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | PEMH20_PUMH20_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)"</a>: updated</li></ul> |                       |               |                 |
| PEMH20_PUMH20_3 | 20050214                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | PUMH20_2        |
| PUMH20_2        | 20040414                                                                                                                                                                                                                                                                                                   | Product specification | -             | PUMH20_1        |
| PUMH20_1        | 20031016                                                                                                                                                                                                                                                                                                   | Product specification | -             | -               |

## 11. Legal information

### 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".

[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 URL <http://www.nxp.com>.

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