

# PBLS1502Y; PBLS1502V

15 V PNP BISS loadswitch

Rev. 03 — 24 August 2009

Product data sheet

## 1. Product profile

### 1.1 General description

Low  $V_{CEsat}$  PNP transistor and NPN resistor-equipped transistor in one package.

Table 1. Product overview

| Type number | Package |       |
|-------------|---------|-------|
|             | NXP     | JEITA |
| PBLS1502Y   | SOT363  | SC-88 |
| PBLS1502V   | SOT666  | -     |

### 1.2 Features

- Low  $V_{CEsat}$  (BISS) transistor and resistor-equipped transistor in one package
- Low 'threshold' voltage ( $< 1$  V) compared to MOSFET
- Low drive power required
- Space-saving solution
- Reduction of component count

### 1.3 Applications

- Supply line switches
- Battery charger switches
- High-side switches for LEDs, drivers and backlights
- Portable equipment

### 1.4 Quick reference data

Table 2. Quick reference data

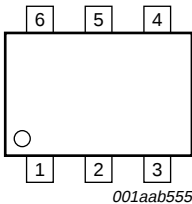
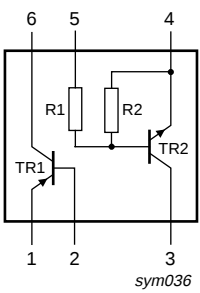
| Symbol                                                 | Parameter                 | Conditions                         | Min | Typ | Max  | Unit       |
|--------------------------------------------------------|---------------------------|------------------------------------|-----|-----|------|------------|
| <b>TR1; PNP: low <math>V_{CEsat}</math> transistor</b> |                           |                                    |     |     |      |            |
| $V_{CEO}$                                              | collector-emitter voltage | open base                          | -   | -   | -15  | V          |
| $I_C$                                                  | collector-current (DC)    |                                    | -   | -   | -500 | mA         |
| $R_{CEsat}$                                            | equivalent on-resistance  | $I_C = -500$ mA;<br>$I_B = -50$ mA | -   | 300 | 500  | m $\Omega$ |
| <b>TR2; NPN: resistor-equipped transistor</b>          |                           |                                    |     |     |      |            |
| $V_{CEO}$                                              | collector-emitter voltage | open base                          | -   | -   | 50   | V          |

Table 2. Quick reference data ...continued

| Symbol         | Parameter               | Conditions | Min | Typ | Max | Unit |
|----------------|-------------------------|------------|-----|-----|-----|------|
| I <sub>O</sub> | output current (DC)     |            | -   | -   | 100 | mA   |
| R1             | bias resistor 1 (input) |            | 3.3 | 4.7 | 6.1 | kΩ   |
| R2/R1          | bias resistor ratio     |            | 0.8 | 1   | 1.2 |      |

2. Pinning information

Table 3. Discrete pinning

| Pin | Description            | Simplified outline                                                                 | Symbol                                                                               |
|-----|------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1   | emitter TR1            |  |  |
| 2   | base TR1               |                                                                                    |                                                                                      |
| 3   | output (collector) TR2 |                                                                                    |                                                                                      |
| 4   | GND (emitter) TR2      |                                                                                    |                                                                                      |
| 5   | input (base) TR2       |                                                                                    |                                                                                      |
| 6   | collector TR1          |                                                                                    |                                                                                      |

3. Ordering information

Table 4. Ordering information

| Type number | Package |                                          |         |
|-------------|---------|------------------------------------------|---------|
|             | Name    | Description                              | Version |
| PBLS1502Y   | SC-88   | plastic surface mounted package; 6 leads | SOT363  |
| PBLS1502V   | -       | plastic surface mounted package; 6 leads | SOT666  |

4. Marking

Table 5. Marking

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PBLS1502Y   | *C2                         |
| PBLS1502V   | C2                          |

[1] \* = -: 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>Transistor TR1: PNP</b> |                           |                                              |     |      |                  |
| $V_{CBO}$                  | collector-base voltage    | open emitter                                 | -   | -15  | V                |
| $V_{CEO}$                  | collector-emitter voltage | open base                                    | -   | -15  | V                |
| $V_{EBO}$                  | emitter-base voltage      | open collector                               | -   | -6   | V                |
| $I_C$                      | collector current (DC)    |                                              | -   | -500 | mA               |
| $I_{CM}$                   | peak collector current    | $t_p \leq 1 \text{ ms}; \delta \leq 0.02$    | -   | -1   | A                |
| $I_B$                      | base current (DC)         |                                              | -   | -50  | mA               |
| $I_{BM}$                   | peak base current         | $t_p \leq 1 \text{ ms}; \delta \leq 0.02$    | -   | -100 | mA               |
| $P_{tot}$                  | total power dissipation   | $T_{amb} \leq 25 \text{ }^\circ\text{C}$ [1] | -   | 200  | mW               |
| <b>Transistor TR2: NPN</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             |                                              |     |      |                  |
|                            | positive                  |                                              | -   | +30  | V                |
|                            | negative                  |                                              | -   | -10  | V                |
| $I_O$                      | output current (DC)       |                                              | -   | 100  | mA               |
| $I_{CM}$                   | peak collector current    |                                              | -   | 100  | mA               |
| $P_{tot}$                  | total power dissipation   | $T_{amb} \leq 25 \text{ }^\circ\text{C}$ [1] | -   | 200  | mW               |
| <b>Per device</b>          |                           |                                              |     |      |                  |
| $P_{tot}$                  | total power dissipation   |                                              | -   | 300  | mW               |
| $T_{stg}$                  | storage temperature       |                                              | -65 | +150 | $^\circ\text{C}$ |
| $T_j$                      | junction temperature      |                                              | -   | 150  | $^\circ\text{C}$ |
| $T_{amb}$                  | ambient temperature       |                                              | -65 | +150 | $^\circ\text{C}$ |

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

## 6. Thermal characteristics

**Table 7. Thermal characteristics**

| Symbol            | Parameter                                   | Conditions  | Min    | Typ | Max | Unit |
|-------------------|---------------------------------------------|-------------|--------|-----|-----|------|
| <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.

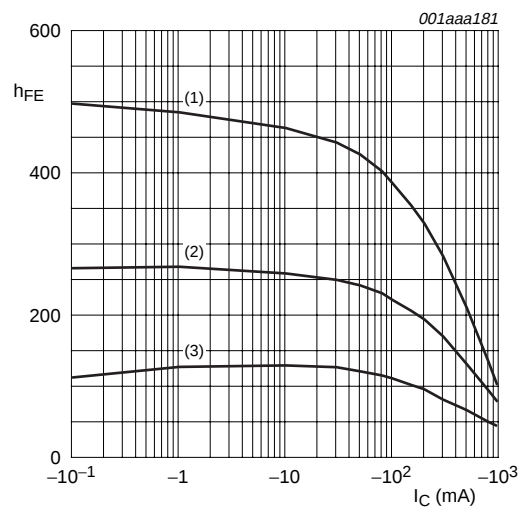
[2] Reflow soldering is the only recommended soldering method.

## 7. Characteristics

**Table 8. Characteristics**
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

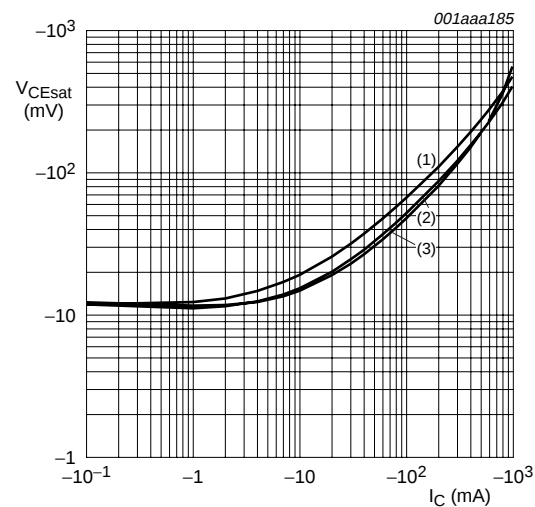
| Symbol                     | Parameter                            | Conditions                                                                   | Min     | Typ | Max  | Unit          |
|----------------------------|--------------------------------------|------------------------------------------------------------------------------|---------|-----|------|---------------|
| <b>Transistor TR1: PNP</b> |                                      |                                                                              |         |     |      |               |
| $I_{CBO}$                  | collector-base cut-off current       | $V_{CB} = -15\text{ V}; I_E = 0\text{ A}$                                    | -       | -   | -100 | nA            |
|                            |                                      | $V_{CB} = -15\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | -       | -   | -50  | $\mu\text{A}$ |
| $I_{CES}$                  | collector-emitter cut-off current    | $V_{CE} = -15\text{ V}; V_{BE} = 0\text{ V}$                                 | -       | -   | -100 | nA            |
| $I_{EBO}$                  | emitter-base cut-off current         | $V_{EB} = -5\text{ V}; I_C = 0\text{ A}$                                     | -       | -   | -100 | nA            |
| $h_{FE}$                   | DC current gain                      | $V_{CE} = -2\text{ V}; I_C = -10\text{ mA}$                                  | 200     | -   | -    |               |
|                            |                                      | $V_{CE} = -2\text{ V}; I_C = -100\text{ mA}$                                 | [1] 150 | -   | -    |               |
|                            |                                      | $V_{CE} = -2\text{ V}; I_C = -500\text{ mA}$                                 | [1] 90  | -   | -    |               |
| $V_{CEsat}$                | collector-emitter saturation voltage | $I_C = -10\text{ mA}; I_B = -0.5\text{ mA}$                                  | -       | -   | -25  | mV            |
|                            |                                      | $I_C = -200\text{ mA}; I_B = -10\text{ mA}$                                  | -       | -   | -150 | mV            |
|                            |                                      | $I_C = -500\text{ mA}; I_B = -50\text{ mA}$                                  | [1] -   | -   | -250 | mV            |
| $R_{CEsat}$                | equivalent on-resistance             | $I_C = -500\text{ mA}; I_B = -50\text{ mA}$                                  | [1] -   | 300 | 500  | m $\Omega$    |
| $V_{BEsat}$                | base-emitter saturation voltage      | $I_C = -500\text{ mA}; I_B = -50\text{ mA}$                                  | [1] -   | -   | -1.1 | V             |
| $V_{BEon}$                 | base-emitter turn-on voltage         | $V_{CE} = -2\text{ V}; I_C = -100\text{ mA}$                                 | [1] -   | -   | -0.9 | V             |
| $f_T$                      | transition frequency                 | $V_{CE} = -5\text{ V}; I_C = -100\text{ mA}; f = 100\text{ MHz}$             | 100     | 280 | -    | MHz           |
| $C_c$                      | collector capacitance                | $V_{CB} = -10\text{ V}; I_E = I_E = 0\text{ A}; f = 1\text{ MHz}$            | -       | -   | 10   | pF            |
| <b>Transistor TR2: NPN</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    | $\mu\text{A}$ |
|                            |                                      | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$  | -       | -   | 50   | $\mu\text{A}$ |
| $I_{EBO}$                  | emitter-base cut-off current         | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$                                      | -       | -   | 900  | $\mu\text{A}$ |
| $h_{FE}$                   | DC current gain                      | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}$                                    | 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              | $V_{CE} = 5\text{ V}; I_C = 100\text{ }\mu\text{A}$                          | -       | 1.1 | 0.5  | V             |
| $V_{I(on)}$                | on-state input voltage               | $V_{CE} = 0.3\text{ V}; I_C = 20\text{ mA}$                                  | 2.5     | 1.9 | -    | V             |
| R1                         | bias resistor 1 (input)              |                                                                              | 3.3     | 4.7 | 6.1  | k $\Omega$    |
| R2/R1                      | bias resistor ratio                  |                                                                              | 0.8     | 1   | 1.2  |               |
| $C_c$                      | collector capacitance                | $V_{CB} = 10\text{ V}; I_E = I_E = 0\text{ A}; f = 1\text{ MHz}$             | -       | -   | 2.5  | pF            |

[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$



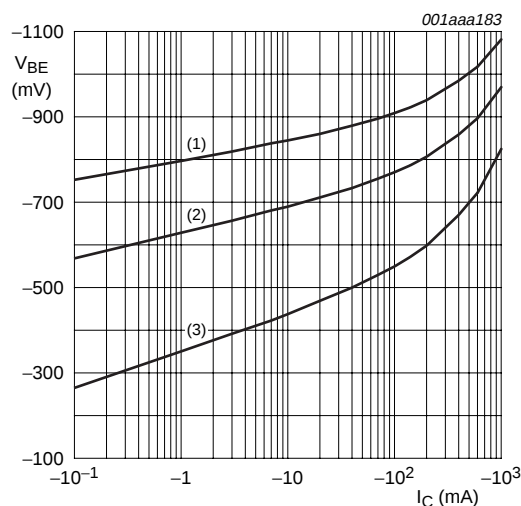
- $V_{CE} = -2$  V
- (1)  $T_{amb} = 150$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = -55$  °C

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



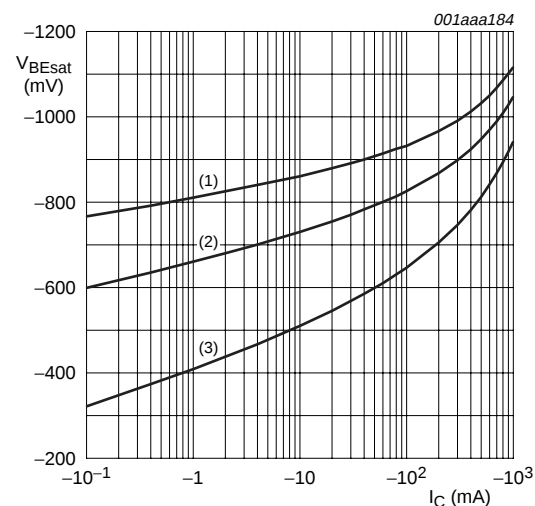
- $I_C/I_B = 20$
- (1)  $T_{amb} = 150$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = -55$  °C

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



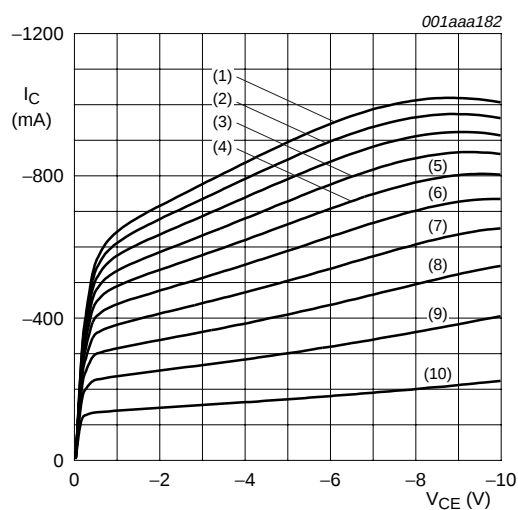
- $V_{CE} = -2$  V
- (1)  $T_{amb} = -55$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = 150$  °C

Fig 3. TR1(PNP): Base-emitter voltage as a function of collector current; typical values



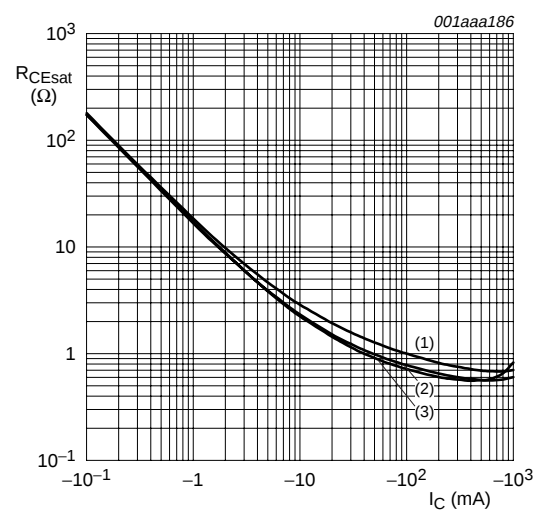
- $I_C/I_B = 20$
- (1)  $T_{amb} = 150$  °C
  - (2)  $T_{amb} = 25$  °C
  - (3)  $T_{amb} = -55$  °C

Fig 4. TR1(PNP): Base-emitter saturation voltage as a function of collector current; typical values



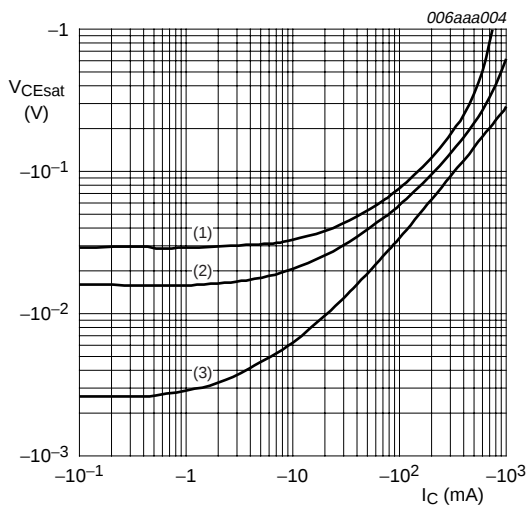
- $T_{amb} = 25^\circ\text{C}$
- (1)  $I_B = -7.0\text{ mA}$
  - (2)  $I_B = -6.3\text{ mA}$
  - (3)  $I_B = -5.6\text{ mA}$
  - (4)  $I_B = -4.9\text{ mA}$
  - (5)  $I_B = -4.2\text{ mA}$
  - (6)  $I_B = -3.5\text{ mA}$
  - (7)  $I_B = -2.8\text{ mA}$
  - (8)  $I_B = -2.1\text{ mA}$
  - (9)  $I_B = -1.4\text{ mA}$
  - (10)  $I_B = -0.7\text{ mA}$

Fig 5. TR1(PNP): Collector current as a function of collector-emitter voltage; typical values



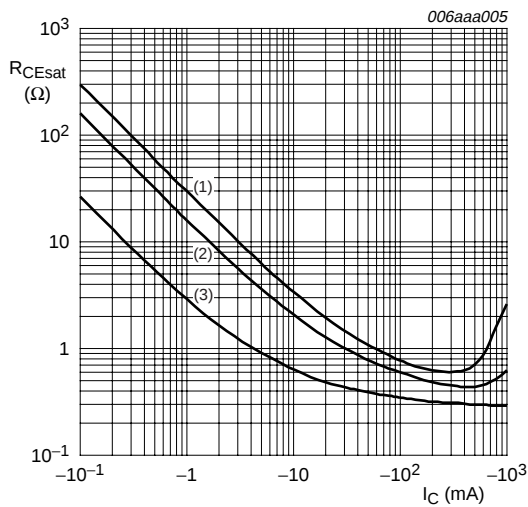
- $I_C/I_B = 20$
- (1)  $T_{amb} = -55^\circ\text{C}$
  - (2)  $T_{amb} = 25^\circ\text{C}$
  - (3)  $T_{amb} = 150^\circ\text{C}$

Fig 6. TR1(PNP): Equivalent on-resistance as a function of collector current; typical values



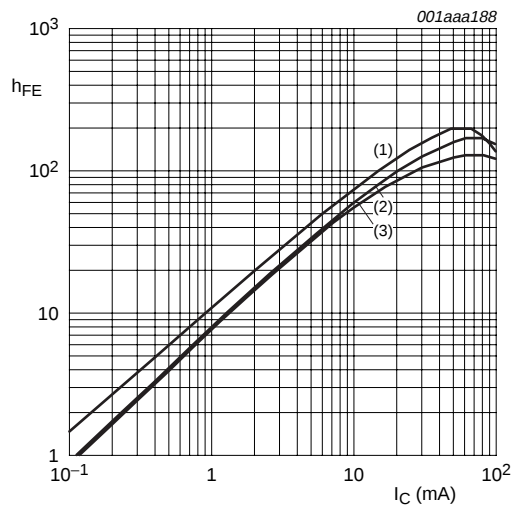
- $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

Fig 7. TR1; PNP: Collector-emitter saturation voltage as a function of collector current; typical values



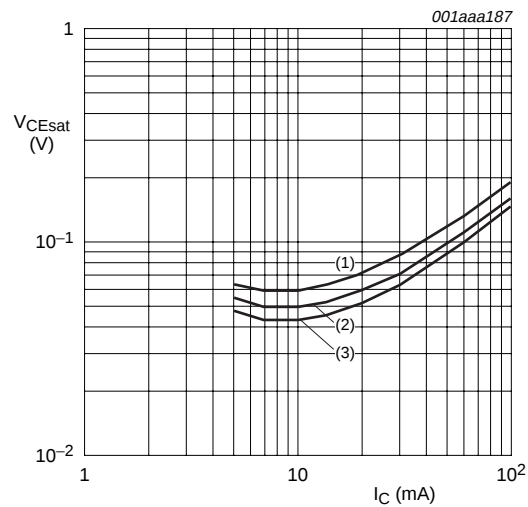
- $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (1)  $I_C/I_B = 100$
  - (2)  $I_C/I_B = 50$
  - (3)  $I_C/I_B = 10$

Fig 8. TR1; PNP: Equivalent on-resistance as a function of collector current; typical values



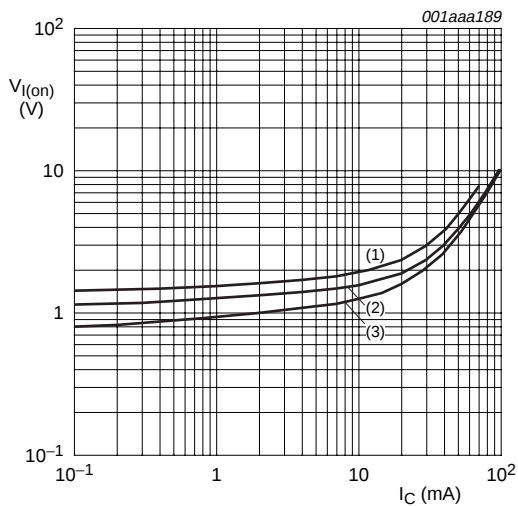
- $V_{CE} = 5\text{ V}$
- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

Fig 9. TR2(NPN): DC current gain as a function of collector current; typical values



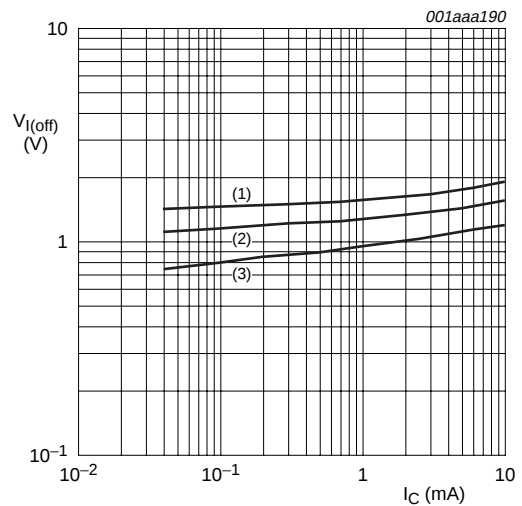
- $I_C/I_B = 20$
- (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$
  - (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$
  - (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

Fig 10. TR2(NPN): 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 11. TR2(NPN): 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 12. TR2(NPN): Off-state input voltage as a function of collector current; typical values

8. Package outline

Plastic surface-mounted package; 6 leadsSOT363

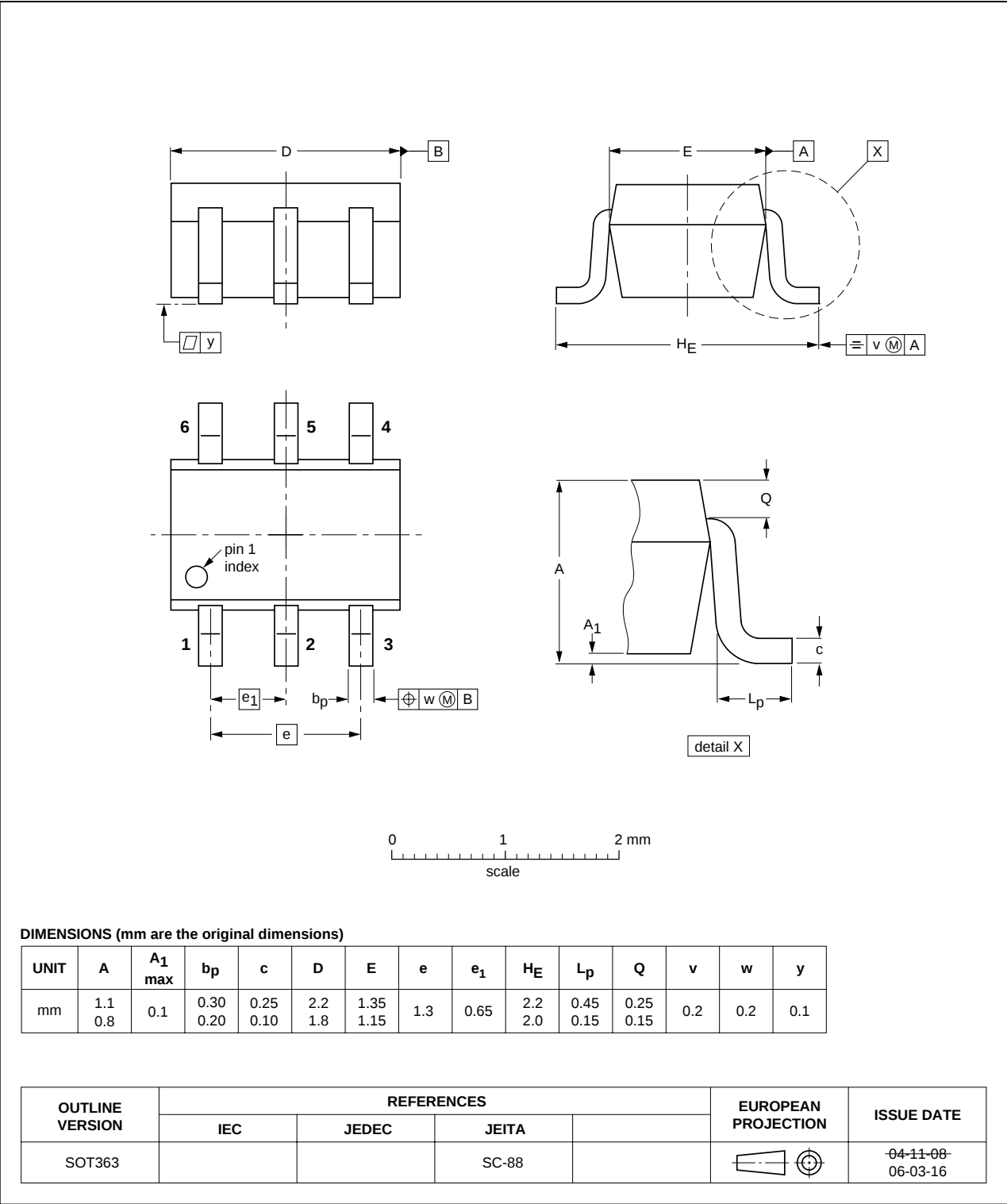


Fig 13. Package outline SOT363 (SC-88)

Plastic surface-mounted package; 6 leads

SOT666

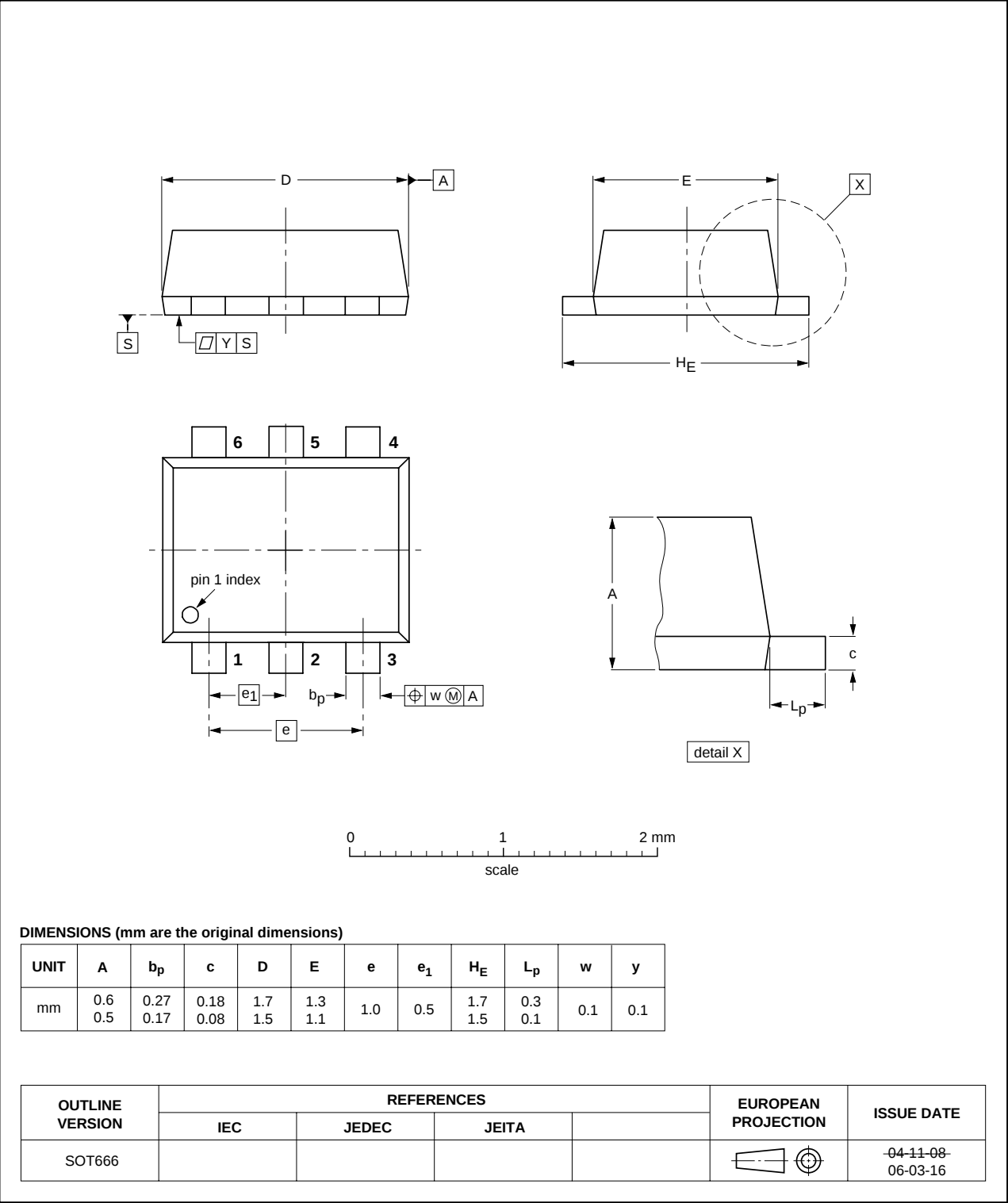


Fig 14. Package outline SOT666

## 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 | 10000 |
| PBL1501Y    | 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  |
| PBL1501V    | SOT666  | 4 mm pitch, 8 mm tape and reel     | -                   | -115 | -     |

[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            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------|---------------|-----------------------|
| PBLS1502Y_PBLS1502V_3                                                                                                                                                                                                                                                                                                                                                                                                                               | 20090824     | Product data sheet    | -             | PBLS1502Y_PBLS1502V_2 |
| 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="#">Table 3 "Discrete pinning"</a>: amended</li><li>• <a href="#">Figure 13 "Package outline SOT363 (SC-88)"</a>: updated</li><li>• <a href="#">Figure 14 "Package outline SOT666"</a>: updated</li></ul> |              |                       |               |                       |
| PBLS1502Y_PBLS1502V_2                                                                                                                                                                                                                                                                                                                                                                                                                               | 20041104     | Product data sheet    | -             | PBLS1502V_1           |
| PBLS1502V_1                                                                                                                                                                                                                                                                                                                                                                                                                                         | 20040119     | 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>.

### 11.2 Definitions

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