

# PBSS3540E

40 V, 500 mA PNP low  $V_{CEsat}$  (BISS) transistor

Rev. 01 — 3 May 2005

Product data sheet

## 1. Product profile

### 1.1 General description

PNP low  $V_{CEsat}$  Breakthrough in Small Signal (BISS) transistor in a SOT416 (SC-75) SMD plastic package.

NPN complement: PBSS2540E.

### 1.2 Features

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability:  $I_C$  and  $I_{CM}$
- High collector current gain ( $h_{FE}$ ) at high  $I_C$
- High efficiency due to less heat generation
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors

### 1.3 Applications

- DC-to-DC conversion
- MOSFET gate driving
- Motor control
- Charging circuits
- Low power switches (e.g. motors, fans)

### 1.4 Quick reference data

Table 1: Quick reference data

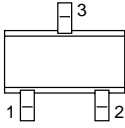
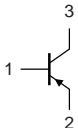
| Symbol      | Parameter                               | Conditions                         | Min | Typ | Max  | Unit       |
|-------------|---|------------------------------------|-----|-----|------|------------|
| $V_{CEO}$   | collector-emitter voltage               | open base                          | -   | -   | -40  | V          |
| $I_C$       | collector current (DC)                  |                                    | -   | -   | -500 | mA         |
| $I_{CM}$    | peak collector current                  |                                    | -   | -   | -1   | A          |
| $R_{CEsat}$ | collector-emitter saturation resistance | $I_C = -500$ mA;<br>$I_B = -50$ mA | [1] | 440 | 700  | m $\Omega$ |

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

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## 2. Pinning information

Table 2: Pinning

| Pin | Description | Simplified outline  | Symbol  |
|-----|-------------|---|---|
| 1   | base        |  | <br>sym013 |
| 2   | emitter     |   |   |
| 3   | collector   |   |   |

## 3. Ordering information

Table 3: Ordering information

| Type number | Package |  |         |
|-------------|---------|--|---------|
|             | Name    | Description                              | Version |
| PBSS3540E   | SC-75   | plastic surface mounted package; 3 leads | SOT416  |

## 4. Marking

Table 4: Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBSS3540E   | 1T           |

## 5. Limiting values

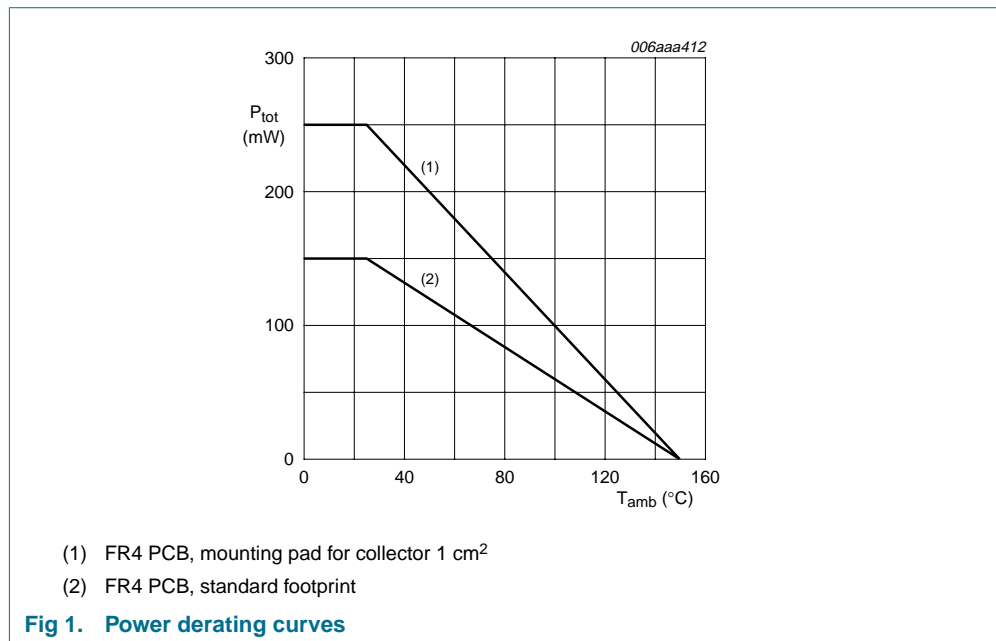
**Table 5: Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter                 | Conditions                              | Min | Max  | Unit             |    |
|-----------|---------------------------|---|-----|------|------------------|----|
| $V_{CBO}$ | collector-base voltage    | open emitter                            | -   | -40  | V                |    |
| $V_{CEO}$ | collector-emitter voltage | open base                               | -   | -40  | V                |    |
| $V_{EBO}$ | emitter-base voltage      | open collector                          | -   | -6   | V                |    |
| $I_C$     | collector current (DC)    |   | -   | -500 | mA               |    |
| $I_{CM}$  | peak collector current    |   | -   | -1   | A                |    |
| $I_{BM}$  | peak base current         |   | -   | -100 | mA               |    |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25\text{ }^\circ\text{C}$ | [1] | -    | 150              | mW |
|           |                           |   | [2] | -    | 250              | mW |
| $T_j$     | junction temperature      |   | -   | 150  | $^\circ\text{C}$ |    |
| $T_{amb}$ | ambient temperature       |   | -65 | +150 | $^\circ\text{C}$ |    |
| $T_{stg}$ | storage temperature       |   | -65 | +150 | $^\circ\text{C}$ |    |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



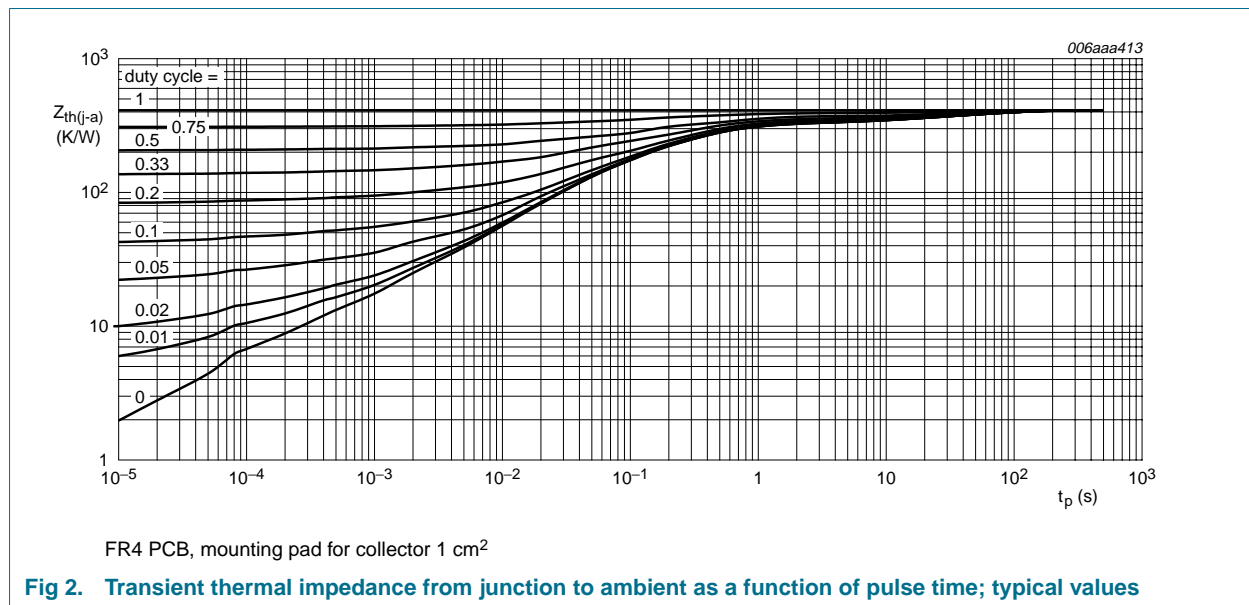
## 6. Thermal characteristics

**Table 6: Thermal characteristics**

| Symbol        | Parameter                                   | Conditions  | Min | Typ | Max | Unit |     |
|---------------|---|-------------|-----|-----|-----|------|-----|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | -   | -   | 833  | K/W |
|               |   |             | [2] | -   | -   | 500  | K/W |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



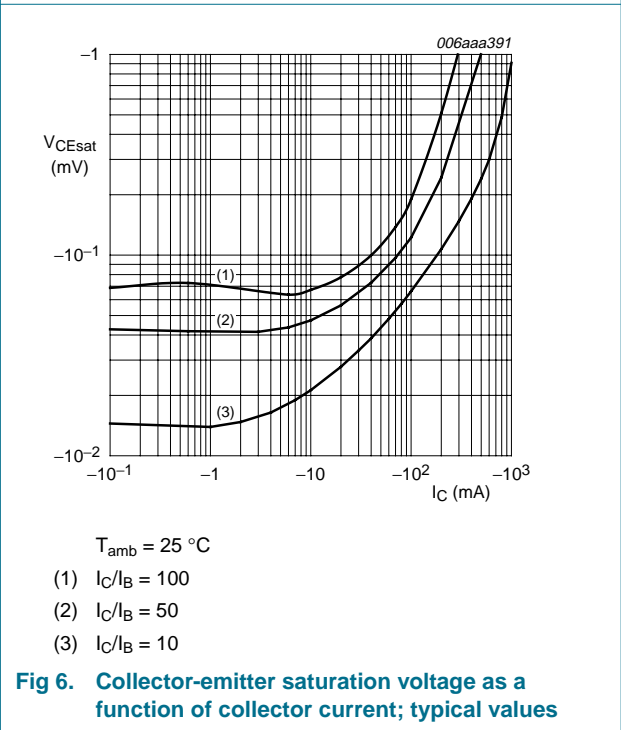
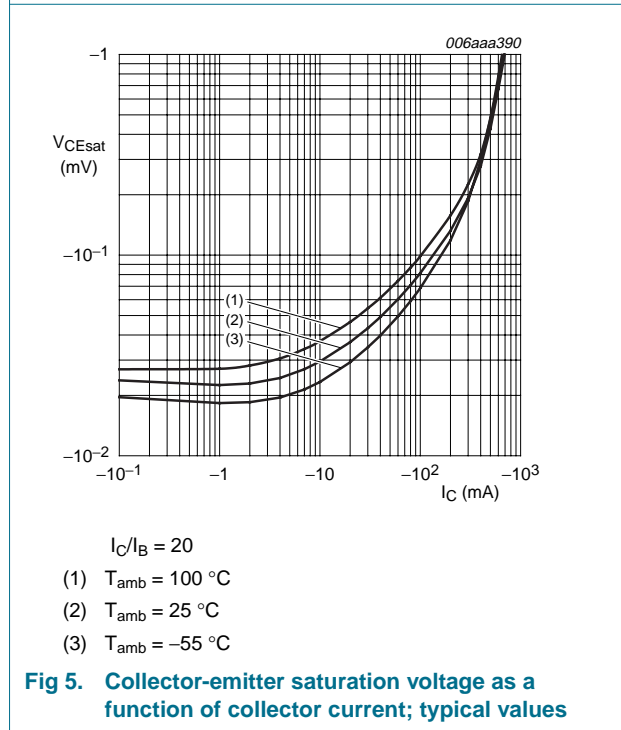
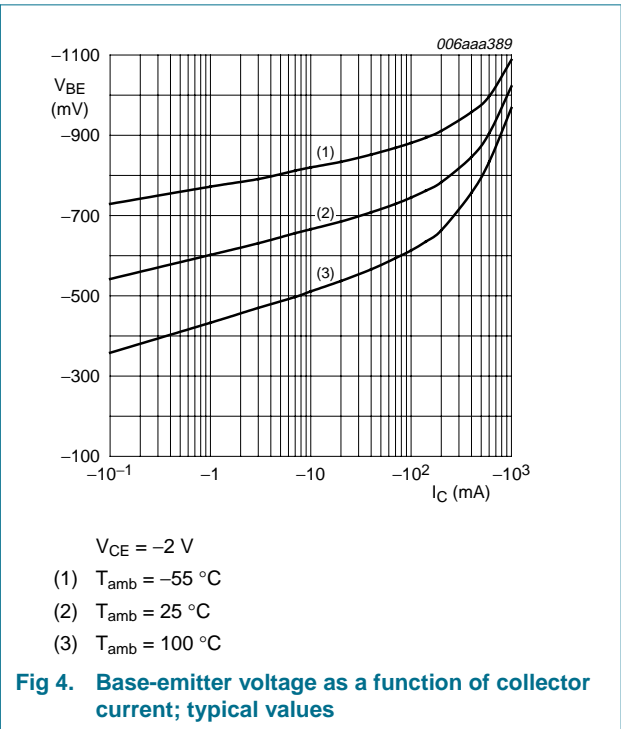
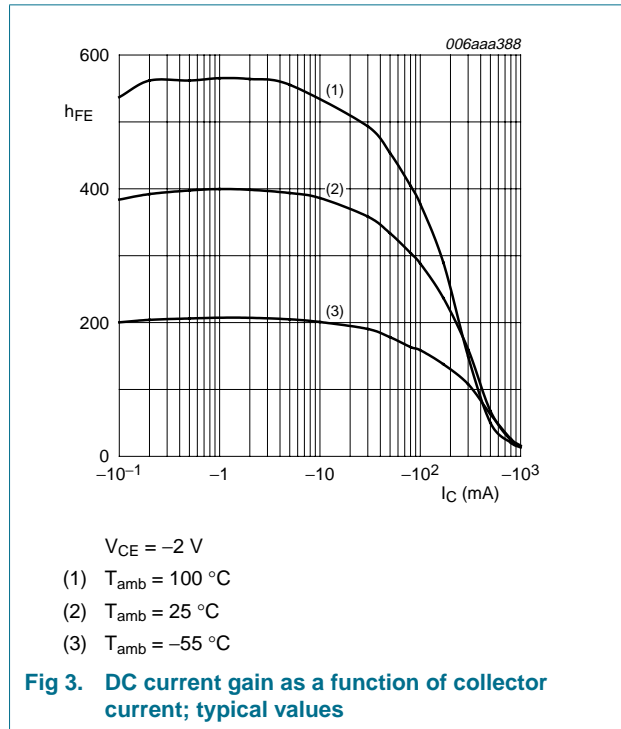
**Fig 2. Transient thermal impedance from junction to ambient as a function of pulse time; typical values**

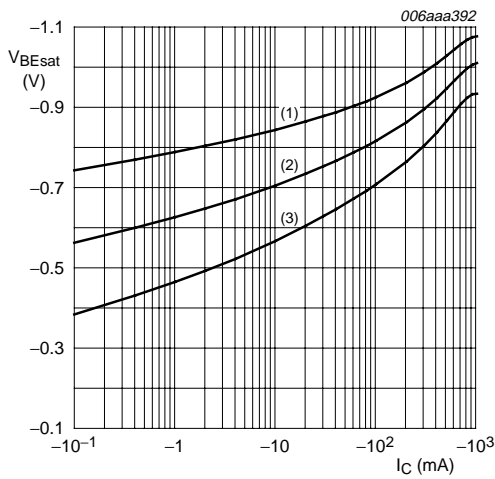
## 7. Characteristics

**Table 7: Characteristics**
 $T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| Symbol      | Parameter                               | Conditions   | Min     | Typ | Max  | Unit             |
|-------------|---|--|---------|-----|------|------------------|
| $I_{CBO}$   | collector-base cut-off current          | $V_{CB} = -40\text{ V}; I_E = 0\text{ A}$                                    | -       | -   | -100 | nA               |
|             |   | $V_{CB} = -40\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | -       | -   | -50  | $\mu\text{A}$    |
| $I_{EBO}$   | emitter-base cut-off current            | $V_{EB} = -5\text{ V}; I_C = 0\text{ A}$                                     | -       | -   | -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] 40  | -   | -    |                  |
| $V_{CEsat}$ | collector-emitter saturation voltage    | $I_C = -10\text{ mA}; I_B = -0.5\text{ mA}$                                  | -       | -   | -50  | mV               |
|             |   | $I_C = -100\text{ mA}; I_B = -5\text{ mA}$                                   | -       | -   | -130 | mV               |
|             |   | $I_C = -200\text{ mA}; I_B = -10\text{ mA}$                                  | -       | -   | -200 | mV               |
|             |   | $I_C = -500\text{ mA}; I_B = -50\text{ mA}$                                  | [1] -   | -   | -350 | mV               |
| $R_{CEsat}$ | collector-emitter saturation resistance | $I_C = -500\text{ mA}; I_B = -50\text{ mA}$                                  | [1] -   | 440 | 700  | $\text{m}\Omega$ |
| $V_{BEsat}$ | base-emitter saturation voltage         | $I_C = -500\text{ mA}; I_B = -50\text{ mA}$                                  | [1] -   | -   | -1.2 | V                |
| $V_{BEon}$  | base-emitter turn-on voltage            | $V_{CE} = -2\text{ V}; I_C = -100\text{ mA}$                                 | -       | -   | -1.1 | V                |
| $f_T$       | transition frequency                    | $V_{CE} = -5\text{ V}; I_C = -100\text{ mA}; f = 100\text{ MHz}$             | 100     | 300 | -    | MHz              |
| $C_c$       | collector capacitance                   | $V_{CB} = -10\text{ V}; I_E = I_E = 0\text{ A}; f = 1\text{ MHz}$            | -       | -   | 10   | pF               |

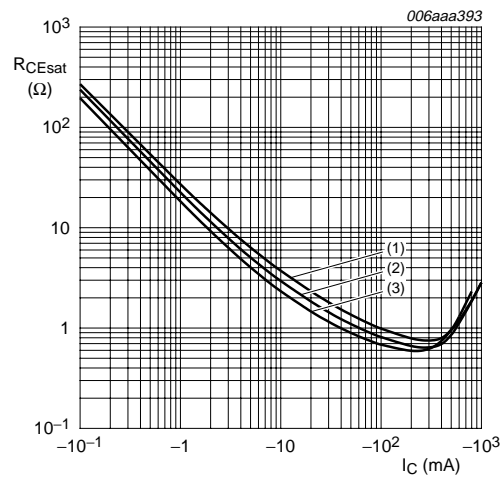
[1] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$ .





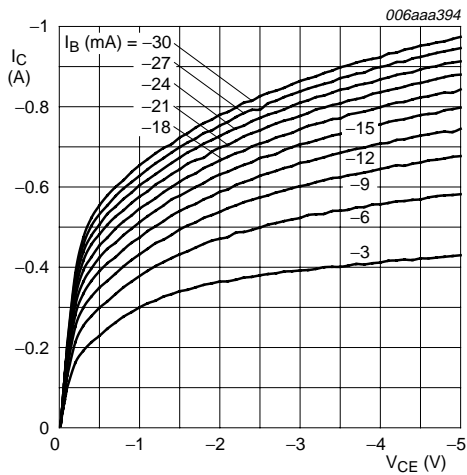
$I_C/I_B = 20$   
 (1)  $T_{amb} = -55\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = 100\text{ °C}$

**Fig 7. Base-emitter saturation voltage as a function of collector current; typical values**



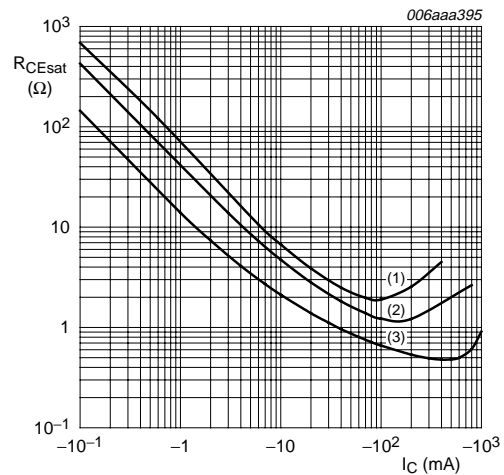
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ °C}$   
 (2)  $T_{amb} = 25\text{ °C}$   
 (3)  $T_{amb} = -55\text{ °C}$

**Fig 8. Collector-emitter saturation resistance as a function of collector current; typical values**



$T_{amb} = 25\text{ °C}$

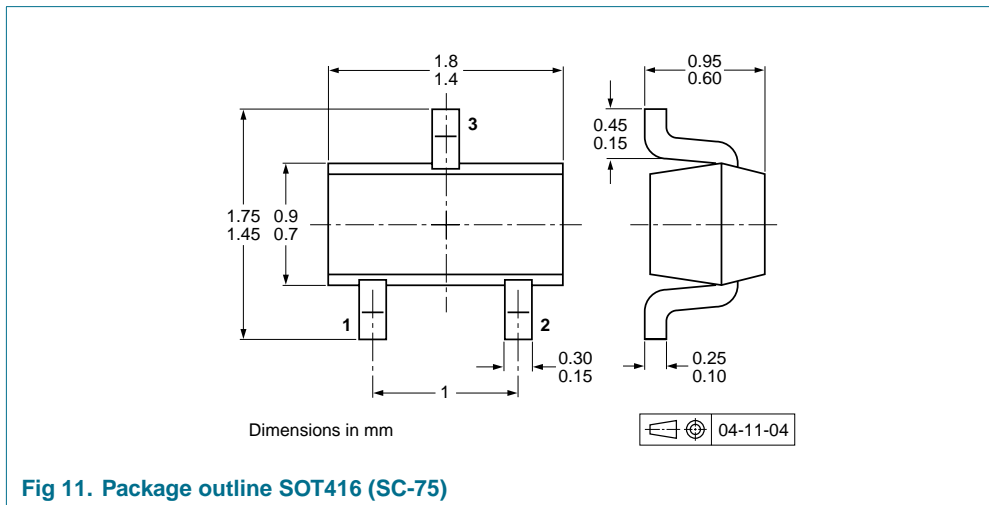
**Fig 9. Collector current as a function of collector-emitter voltage; typical values**



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

**Fig 10. Collector-emitter saturation resistance as a function of collector current; typical values**

## 8. Package outline



## 9. Packing information

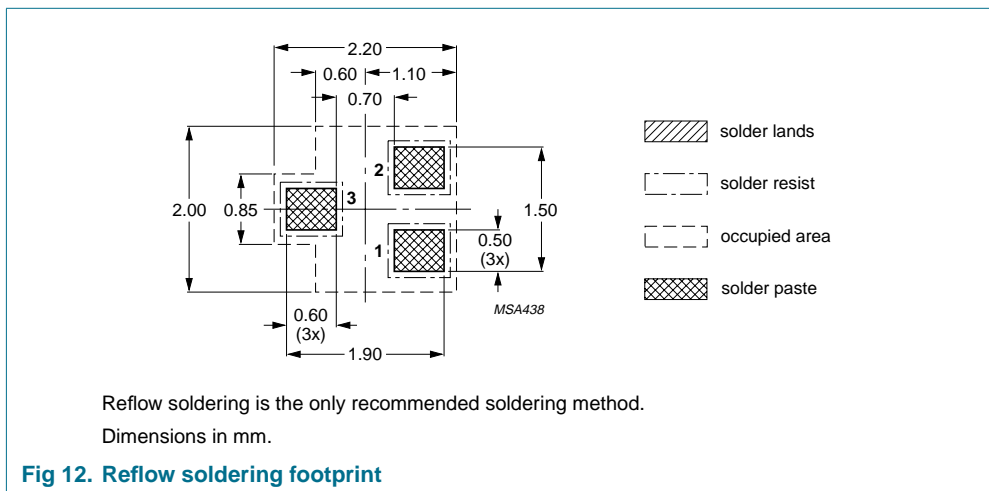
**Table 8: Packing methods**

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

| Type number | Package | Description                    | Packing quantity |       |
|-------------|---------|--------------------------------|------------------|-------|
|             |         |                                | 3000             | 10000 |
| PBSS3540E   | SOT416  | 4 mm pitch, 8 mm tape and reel | -115             | -135  |

[1] For further information and the availability of packing methods, see [Section 16](#).

## 10. Soldering







## 11. Revision history

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**Table 9:** Revision history

| Document ID | Release date | Data sheet status  | Change notice | Doc. number    | Supersedes |
|-------------|--------------|--------------------|---------------|----------------|------------|
| PBSS3540E_1 | 20050503     | Product data sheet | -             | 9397 750 15062 | -          |

## 12. Data sheet status

| Level | Data sheet status [1] | Product status [2] [3] | 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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[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.

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**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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