

# PBSS4240X

40 V, 2 A NPN low  $V_{CEsat}$  (BISS) transistor

15 October 2012

Product data sheet

## 1. Product profile

### 1.1 General description

NPN low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a medium power and flat lead SOT89 Surface-Mounted Device (SMD) plastic package. PNP complement: PBSS5240X.

### 1.2 Features and benefits

- Low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability  $I_C$  and  $I_{CM}$
- High efficiency due to less heat generation

### 1.3 Applications

- DC-to-DC conversion
- Supply line switching
- Battery charger
- LCD backlighting
- Driver in low supply voltage applications (e.g. lamps and LEDs)
- Inductive load driver (e.g. relays, buzzers and motors)

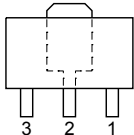
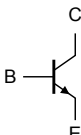
### 1.4 Quick reference data

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                       |                                                                                                                                                       | -   | -   | 2   | A          |
| $I_{CM}$    | peak collector current                  |                                                                                                                                                       | -   | -   | 3   | A          |
| $R_{CEsat}$ | collector-emitter saturation resistance | $I_C = 1\text{ A}$ ; $I_B = 100\text{ mA}$ ; pulsed;<br>$t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ | -   | -   | 260 | m $\Omega$ |
| $I_{CRM}$   | repetitive peak collector current       | $t_p \leq 20\text{ ms}$ ; $\delta \leq 0.33$ ; pulsed                                                                                                 | -   | -   | 2.5 | A          |

## 2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline                                                                         | Graphic symbol                                                                                |
|-----|--------|-------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1   | E      | emitter     | <br>SOT89 | <br>sym123 |
| 2   | C      | collector   |                                                                                            |                                                                                               |
| 3   | B      | base        |                                                                                            |                                                                                               |

## 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                                                          |         |
|-------------|---------|--------------------------------------------------------------------------|---------|
|             | Name    | Description                                                              | Version |
| PBSS4240X   | SOT89   | plastic surface-mounted package; die pad for good heat transfer; 3 leads | SOT89   |

## 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBSS4240X   | S47          |

## 5. Limiting values

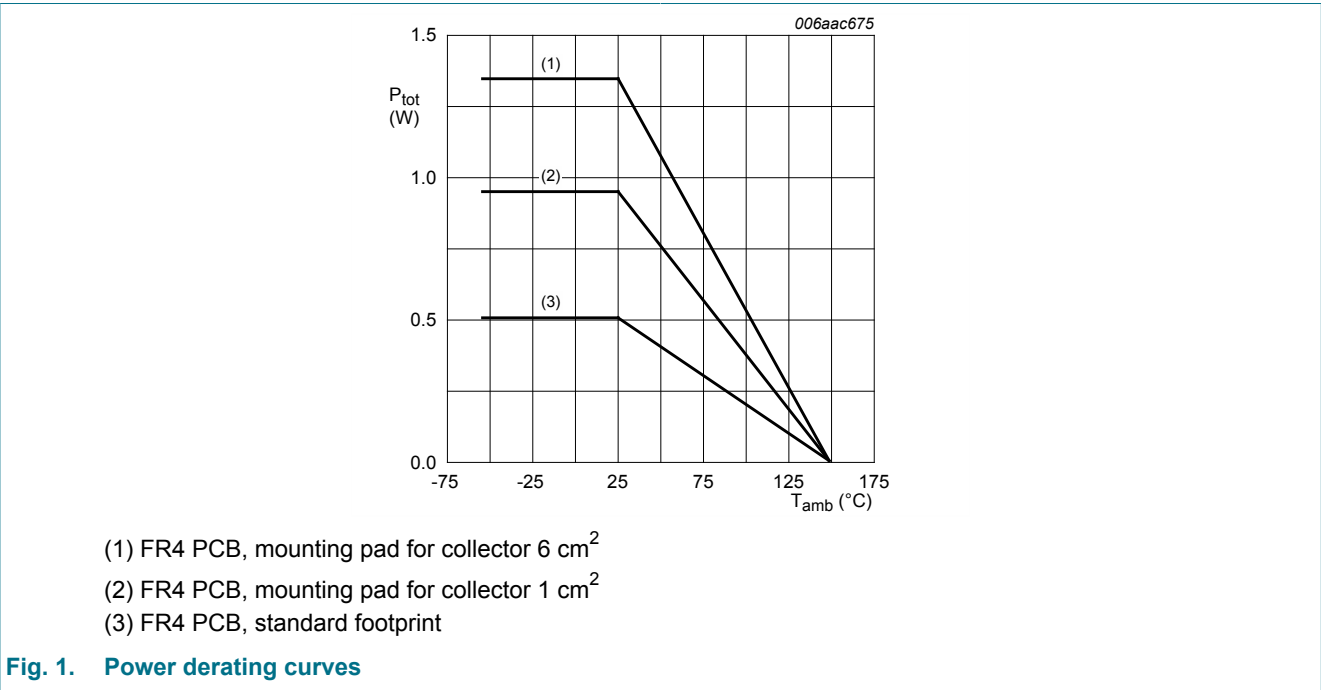
Table 5. Limiting values

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                                |     | -   | 5    | V    |
| $I_C$     | collector current                 |                                               |     | -   | 2    | A    |
| $I_{CRM}$ | repetitive peak collector current | $\delta \leq 0.33$ ; $t_p \leq 20$ ms; pulsed |     | -   | 2.5  | A    |
| $I_{CM}$  | peak collector current            |                                               |     | -   | 3    | A    |
| $I_B$     | base current                      |                                               |     | -   | 300  | mA   |
| $I_{BM}$  | peak base current                 |                                               |     | -   | 1    | A    |
| $P_{tot}$ | total power dissipation           |                                               | [1] | -   | 0.5  | W    |
|           |                                   |                                               | [2] | -   | 0.95 | W    |

| Symbol           | Parameter            | Conditions |     | Min | Max  | Unit |
|------------------|----------------------|------------|-----|-----|------|------|
|                  |                      |            | [3] | -   | 1.35 | W    |
| T <sub>j</sub>   | junction temperature |            |     | -   | 150  | °C   |
| T <sub>amb</sub> | ambient temperature  |            |     | -65 | 150  | °C   |
| T <sub>stg</sub> | storage temperature  |            |     | -65 | 150  | °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>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.



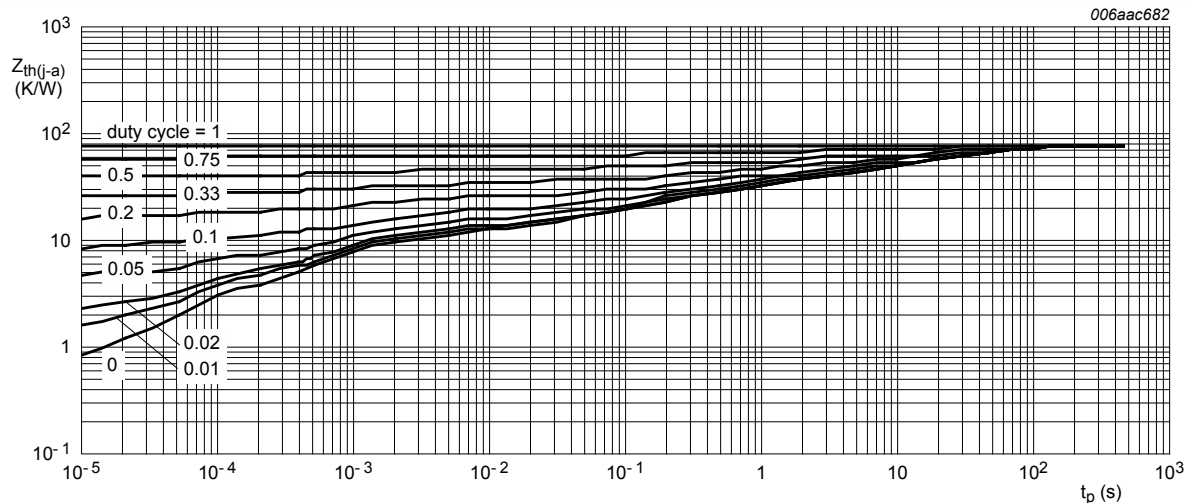
6. Thermal characteristics

Table 6. Thermal characteristics

| Symbol                | Parameter                                        | Conditions  |     | Min | Typ | Max | Unit |
|-----------------------|--------------------------------------------------|-------------|-----|-----|-----|-----|------|
| R <sub>th(j-a)</sub>  | thermal resistance from junction to ambient      | in free air | [1] | -   | -   | 250 | K/W  |
|                       |                                                  |             | [2] | -   | -   | 132 | K/W  |
|                       |                                                  |             | [3] | -   | -   | 93  | K/W  |
| R <sub>th(j-sp)</sub> | thermal resistance from junction to solder point |             |     | -   | -   | 16  | 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>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.





FR4 PCB, mounting pad for collector 6 cm<sup>2</sup>

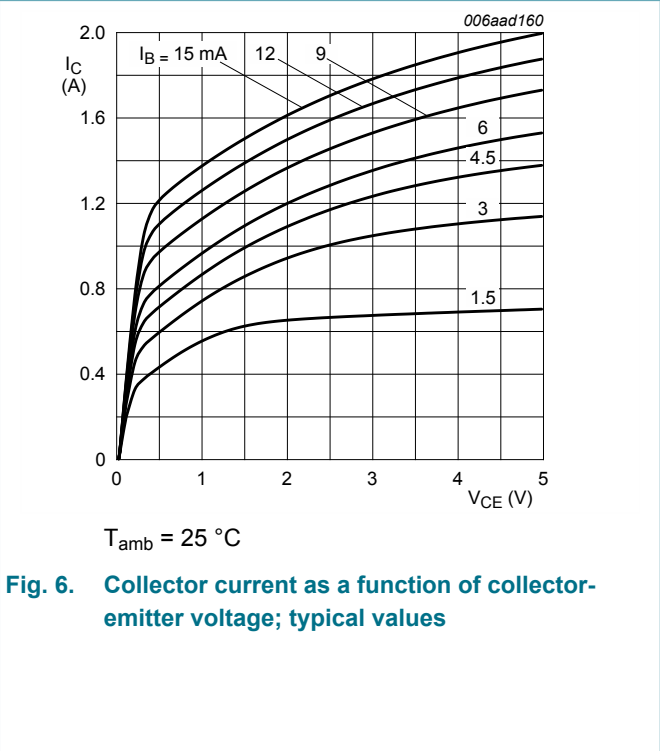
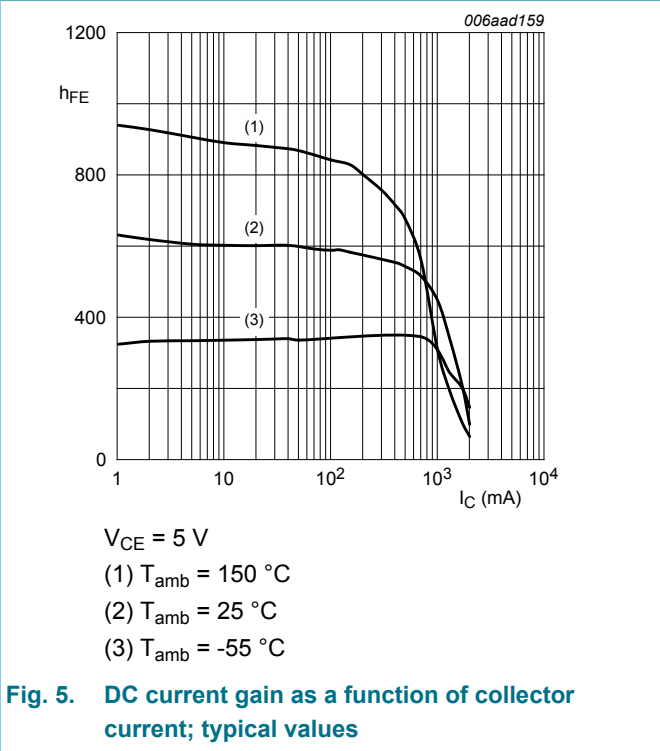
Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

Table 7. Characteristics

| Symbol      | Parameter                               | Conditions                                                                                                               | Min | Typ | Max | Unit |
|-------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $I_{CBO}$   | collector-base cut-off current          | $V_{CB} = 40\text{ V}; I_E = 0\text{ A}; T_{amb} = 25\text{ °C}$                                                         | -   | -   | 100 | nA   |
|             |                                         | $V_{CB} = 40\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ °C}$                                                            | -   | -   | 50  | μA   |
| $I_{CEO}$   | collector-emitter cut-off current       | $V_{CE} = 30\text{ V}; I_B = 0\text{ A}; T_{amb} = 25\text{ °C}$                                                         | -   | -   | 100 | nA   |
| $I_{EBO}$   | emitter-base cut-off current            | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ °C}$                                                          | -   | -   | 100 | nA   |
| $h_{FE}$    | DC current gain                         | $V_{CE} = 5\text{ V}; I_C = 1\text{ mA}; T_{amb} = 25\text{ °C}$                                                         | 300 | -   | -   |      |
|             |                                         | $V_{CE} = 5\text{ V}; I_C = 500\text{ mA}; T_{amb} = 25\text{ °C}$                                                       | 300 | -   | 900 |      |
|             |                                         | $V_{CE} = 5\text{ V}; I_C = 1\text{ A}; T_{amb} = 25\text{ °C}$                                                          | 200 | -   | -   |      |
|             |                                         | $V_{CE} = 5\text{ V}; I_C = 2\text{ A}; \text{pulsed}; t_p \leq 300\text{ μs}; \delta \leq 0.02; T_{amb} = 25\text{ °C}$ | 75  | -   | -   |      |
| $V_{CEsat}$ | collector-emitter saturation voltage    | $I_C = 100\text{ mA}; I_B = 1\text{ mA}; T_{amb} = 25\text{ °C}$                                                         | -   | -   | 80  | mV   |
|             |                                         | $I_C = 500\text{ mA}; I_B = 50\text{ mA}; T_{amb} = 25\text{ °C}$                                                        | -   | -   | 140 | mV   |
|             |                                         | $I_C = 1\text{ A}; I_B = 100\text{ mA}; \text{pulsed}; t_p \leq 300\text{ μs}; \delta \leq 0.02; T_{amb} = 25\text{ °C}$ | -   | -   | 260 | mV   |
|             |                                         | $I_C = 2\text{ A}; I_B = 200\text{ mA}; \text{pulsed}; t_p \leq 300\text{ μs}; \delta \leq 0.02; T_{amb} = 25\text{ °C}$ | -   | -   | 510 | mV   |
| $R_{CEsat}$ | collector-emitter saturation resistance | $I_C = 1\text{ A}; I_B = 100\text{ mA}; \text{pulsed}; t_p \leq 300\text{ μs}; \delta \leq 0.02; T_{amb} = 25\text{ °C}$ | -   | -   | 260 | mΩ   |

| Symbol      | Parameter                       | Conditions                                                                                                                                         | Min | Typ | Max | Unit |
|-------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C = 1\text{ A}$ ; $I_B = 100\text{ mA}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ | -   | -   | 1.2 | V    |
| $V_{BEon}$  | base-emitter turn-on voltage    | $V_{CE} = 5\text{ V}$ ; $I_C = 1\text{ A}$ ; pulsed; $t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ | -   | -   | 1.1 | V    |
| $f_T$       | transition frequency            | $V_{CE} = 10\text{ V}$ ; $I_C = 50\text{ mA}$ ; $f = 100\text{ MHz}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$                                        | 150 | -   | -   | MHz  |
| $C_c$       | collector capacitance           | $V_{CB} = 10\text{ V}$ ; $I_E = 0\text{ A}$ ; $i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$                       | -   | -   | 10  | pF   |



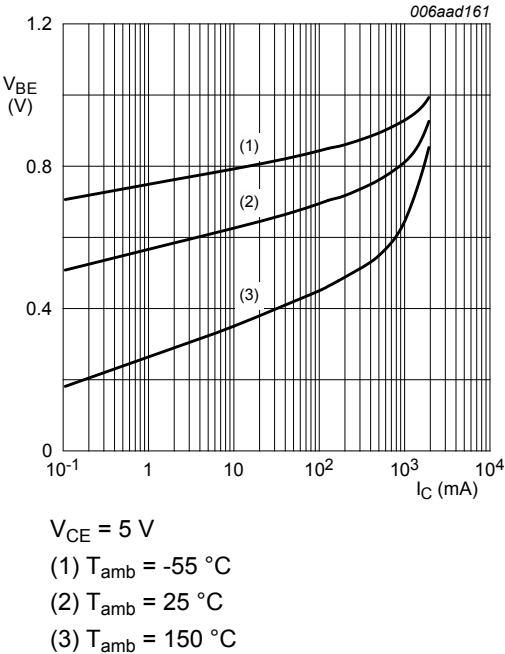


Fig. 7. Base-emitter voltage as a function of collector current; typical values

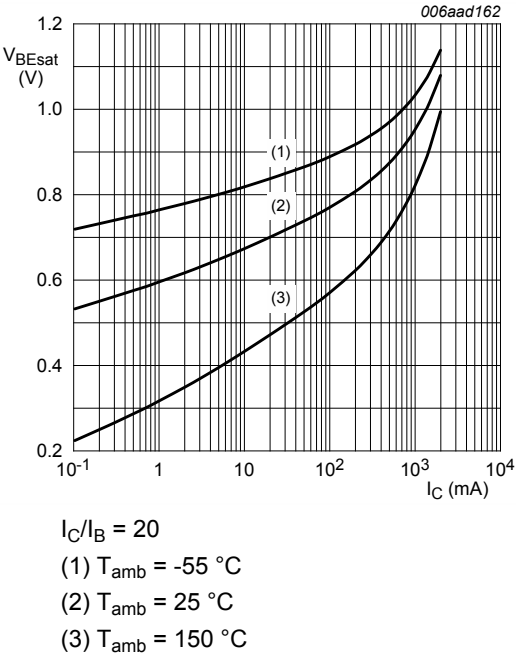


Fig. 8. Base-emitter saturation voltage as a function of collector current; typical values

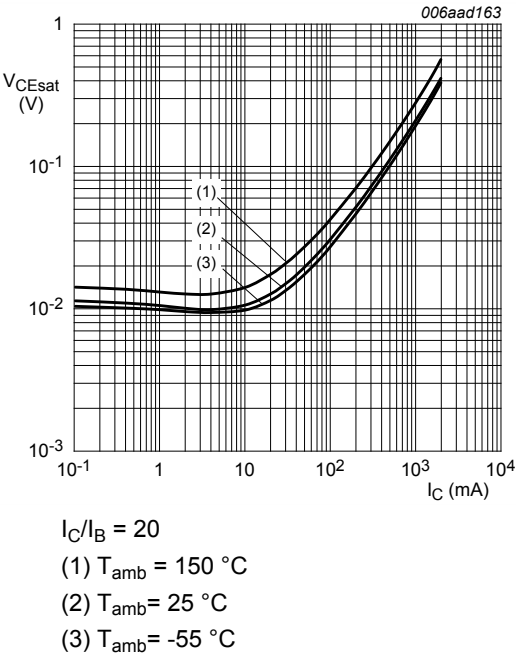


Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

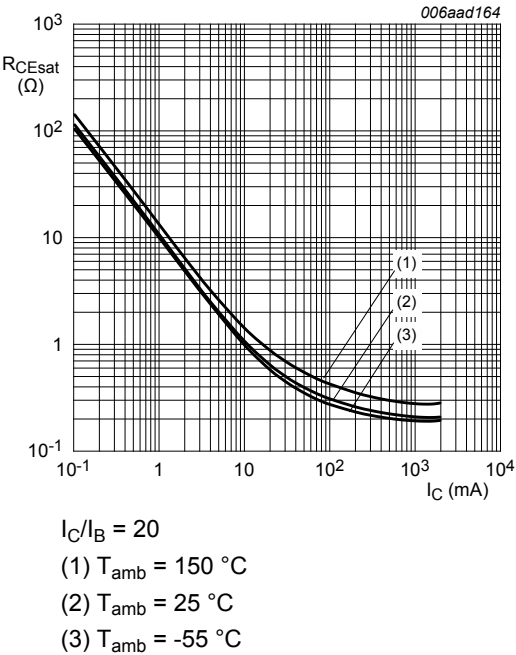
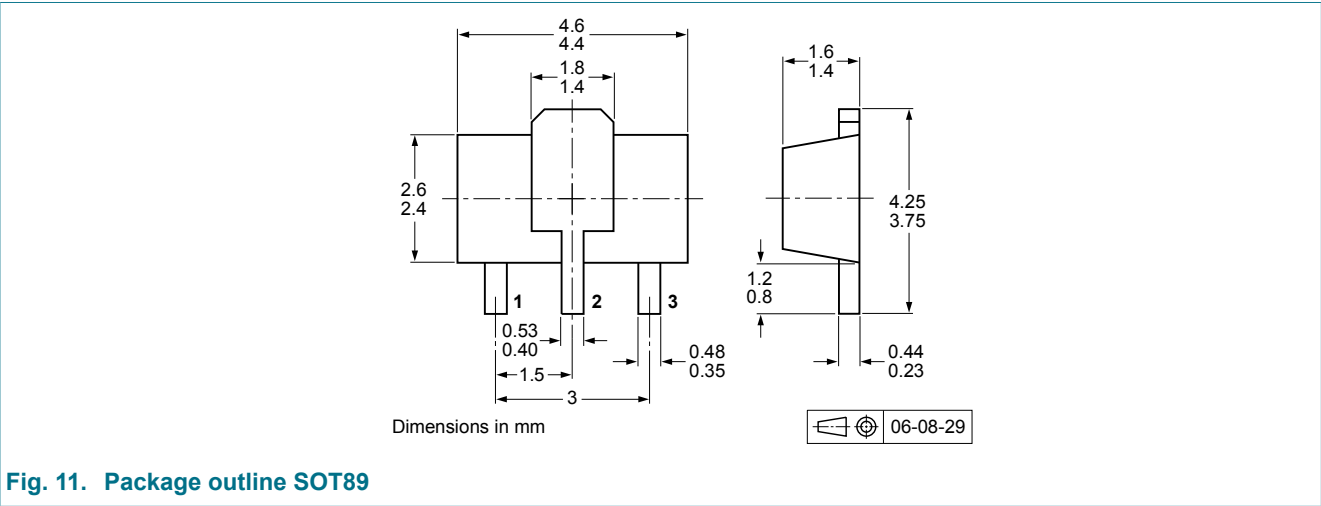
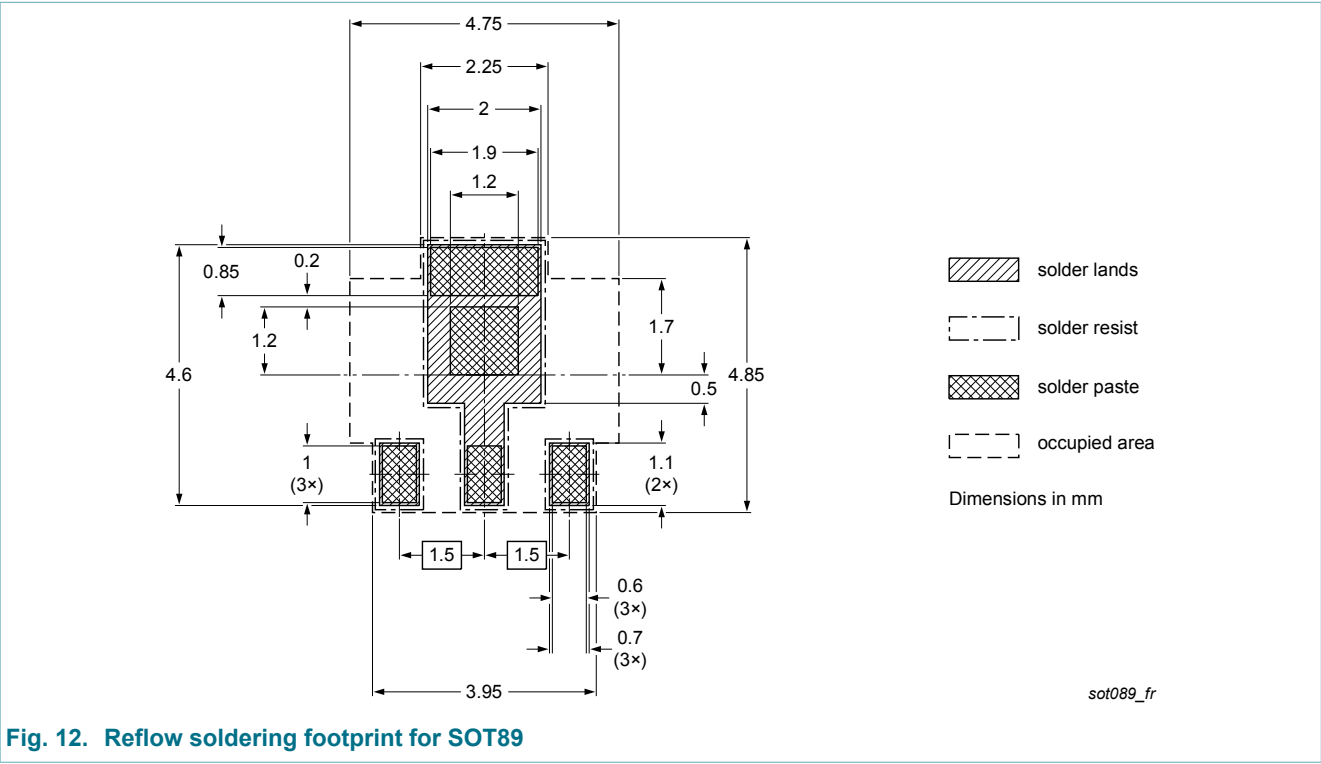


Fig. 10. Collector-emitter saturation resistance as a function of collector current; typical values

8. Package outline



9. Soldering



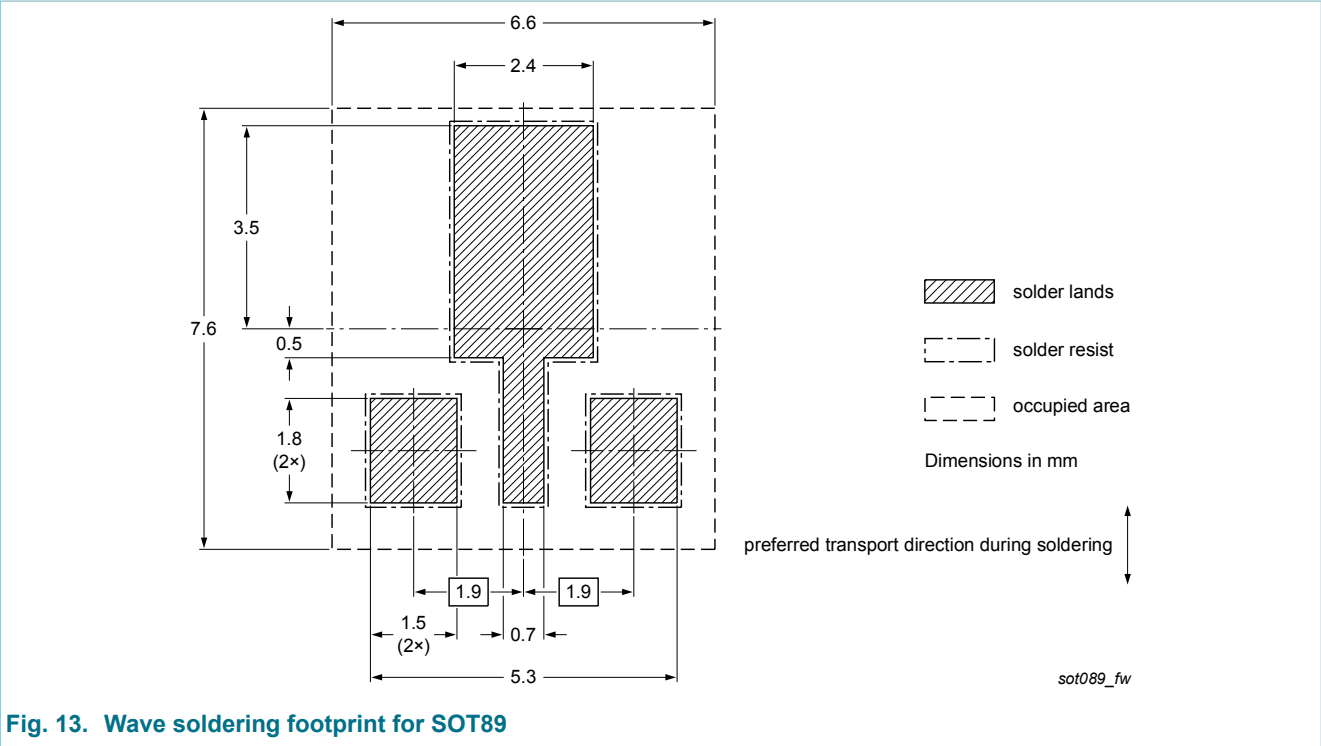


Fig. 13. Wave soldering footprint for SOT89

## 10. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PBSS4240X v.1 | 20121015     | Product data sheet | -             | -          |

## 11. Legal information

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|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
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Date of release: 15 October 2012

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