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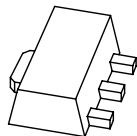
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Kind regards,

Team Nexperia



PBSS303NX

30 V, 5.1 A NPN low V_{CEsat} (BISS) transistor

Rev. 02 — 20 November 2009

Product data sheet

1. Product profile

1.1 General description

NPN low V_{CEsat} Breakthrough In Small Signal (BISS) transistor in a SOT89 (SC-62/TO-243) small and flat lead Surface-Mounted Device (SMD) plastic package.

PNP complement: PBSS303PX.

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
- Power switches (e.g. motors, fans)

1.4 Quick reference data

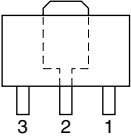
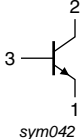
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|--|----------------------------------|-------|-----|------|------------|
| V_{CEO} | collector-emitter voltage | open base | - | - | 30 | V |
| I_C | collector current | | - | - | 5.1 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | 10.2 | A |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 4$ A; $I_B = 200$ mA | [1] - | 31 | 44 | m Ω |

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

2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline | Symbol |
|-----|-------------|---|---|
| 1 | emitter |  |  sym042 |
| 2 | collector | | |
| 3 | base | | |

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| PBSS303NX | SC-62 | plastic surface-mounted package; collector pad for good heat transfer; 3 leads | SOT89 |

4. Marking

Table 4. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PBSS303NX | *5D |

- [1] * = -: made in Hong Kong
 * = p: made in Hong Kong
 * = t: made in Malaysia
 * = W: made in China

5. Limiting values

Table 5. Limiting values

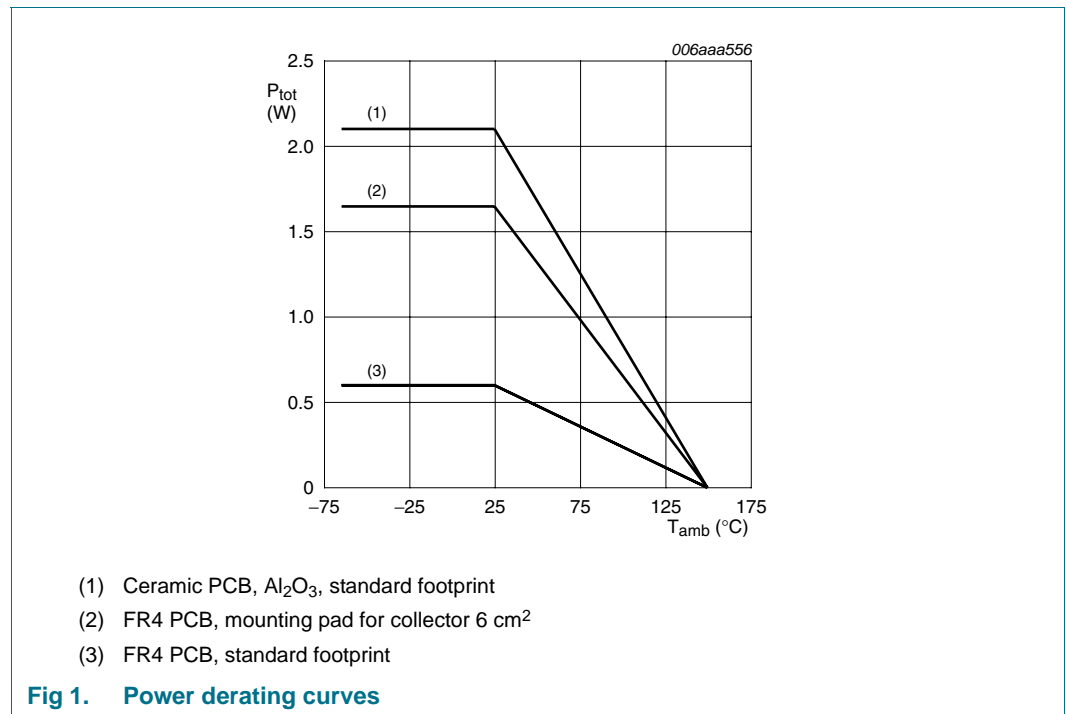
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit | |
|-----------|---------------------------|----------------------------------|-----|------|------|---|
| V_{CBO} | collector-base voltage | open emitter | - | 30 | V | |
| V_{CEO} | collector-emitter voltage | open base | - | 30 | V | |
| V_{EBO} | emitter-base voltage | open collector | - | 5 | V | |
| I_C | collector current | | - | 5.1 | A | |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | 10.2 | A | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 0.6 | W |
| | | | [2] | - | 1.65 | W |
| | | | [3] | - | 2.1 | W |
| T_j | junction temperature | | - | 150 | °C | |
| T_{amb} | ambient temperature | | -65 | +150 | °C | |
| T_{stg} | 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 6 cm².

[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

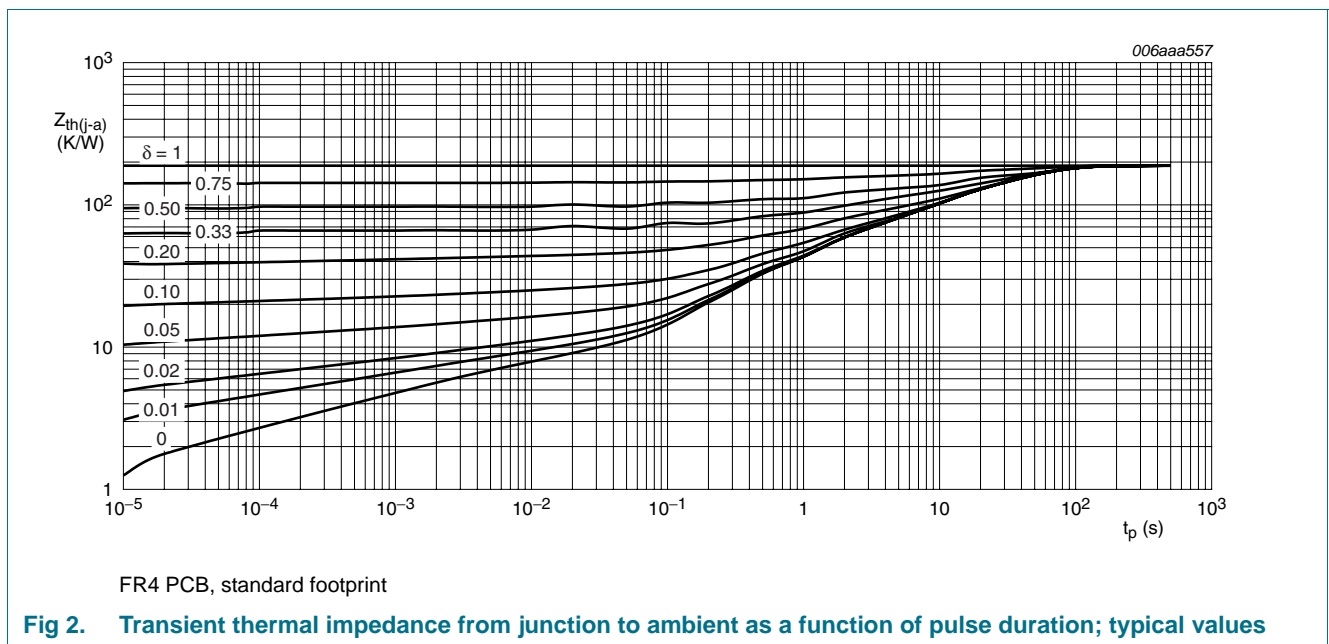


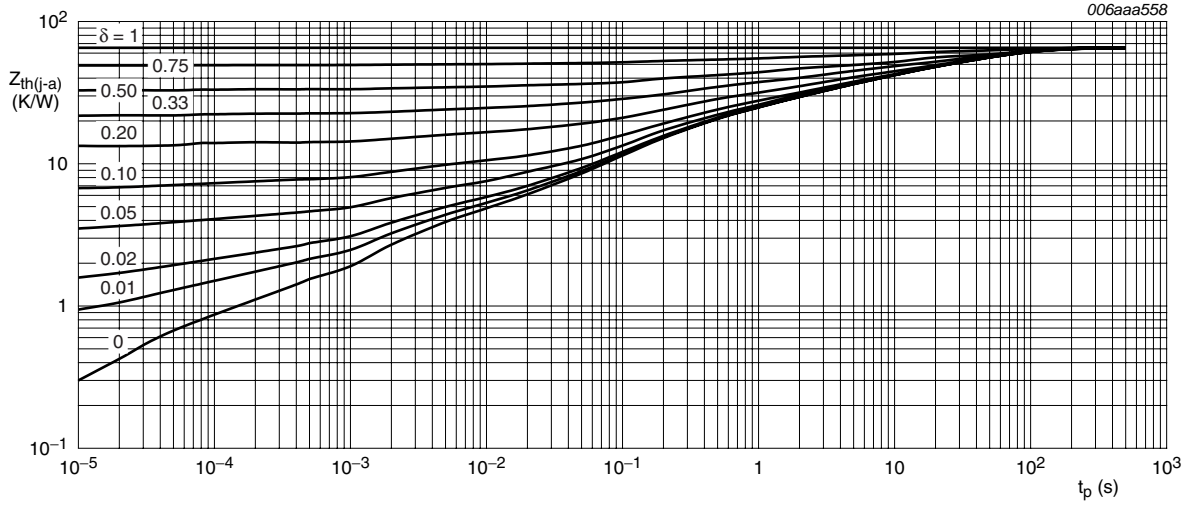
6. Thermal characteristics

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] | - | - | 208 | K/W |
| | | | [2] | - | - | 76 | K/W |
| | | | [3] | - | - | 60 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | - | - | 20 | K/W | |

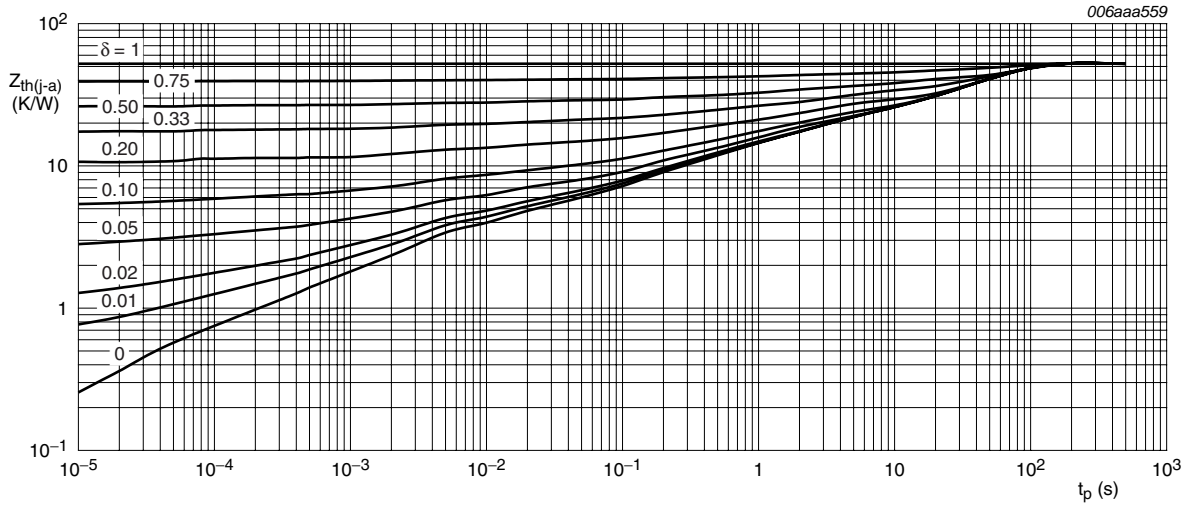
- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.





FR4 PCB, mounting pad for collector 6 cm²

Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



Ceramic PCB, Al₂O₃, standard footprint

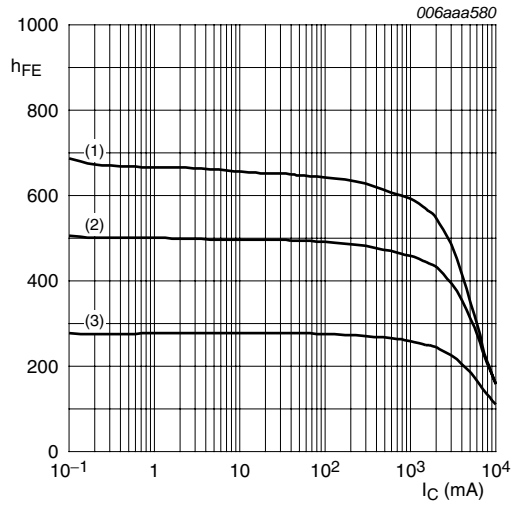
Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

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

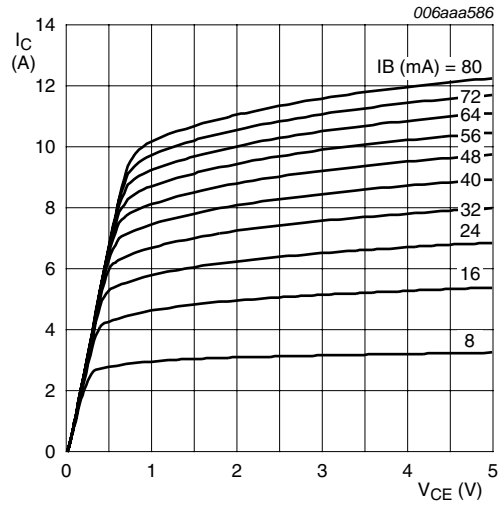
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|-------------|---|--|-----|-----|------|---------------|------------------|
| I_{CBO} | collector-base cut-off current | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}$ | - | - | 100 | nA | |
| | | $V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | - | - | 50 | μA | |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$ | - | - | 100 | nA | |
| h_{FE} | DC current gain | $V_{CE} = 2\text{ V}; I_C = 0.5\text{ A}$ | [1] | 300 | 480 | - | |
| | | $V_{CE} = 2\text{ V}; I_C = 1\text{ A}$ | [1] | 300 | 460 | - | |
| | | $V_{CE} = 2\text{ V}; I_C = 2\text{ A}$ | [1] | 250 | 430 | - | |
| | | $V_{CE} = 2\text{ V}; I_C = 4\text{ A}$ | [1] | 200 | 360 | - | |
| | | $V_{CE} = 2\text{ V}; I_C = 6\text{ A}$ | [1] | 180 | 270 | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 0.5\text{ A}; I_B = 50\text{ mA}$ | [1] | - | 20 | 30 | mV |
| | | $I_C = 1\text{ A}; I_B = 50\text{ mA}$ | [1] | - | 40 | 60 | mV |
| | | $I_C = 1\text{ A}; I_B = 10\text{ mA}$ | [1] | - | 60 | 90 | mV |
| | | $I_C = 2\text{ A}; I_B = 40\text{ mA}$ | [1] | - | 80 | 110 | mV |
| | | $I_C = 4\text{ A}; I_B = 200\text{ mA}$ | [1] | - | 125 | 175 | mV |
| | | $I_C = 4\text{ A}; I_B = 400\text{ mA}$ | [1] | - | 120 | 170 | mV |
| | | $I_C = 4\text{ A}; I_B = 40\text{ mA}$ | [1] | - | 160 | 250 | mV |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 4\text{ A}; I_B = 200\text{ mA}$ | [1] | - | 31 | 44 | $\text{m}\Omega$ |
| | | $I_C = 4\text{ A}; I_B = 40\text{ mA}$ | [1] | - | 40 | 63 | $\text{m}\Omega$ |
| V_{BEsat} | base-emitter saturation voltage | $I_C = 1\text{ A}; I_B = 100\text{ mA}$ | [1] | - | 0.81 | 0.9 | V |
| | | $I_C = 4\text{ A}; I_B = 400\text{ mA}$ | [1] | - | 0.95 | 1.05 | V |
| V_{BEon} | base-emitter turn-on voltage | $V_{CE} = 2\text{ V}; I_C = 2\text{ A}$ | [1] | - | 0.75 | 0.85 | V |
| t_d | delay time | $V_{CC} = 12.5\text{ V}; I_C = 3\text{ A}; I_{Bon} = 0.15\text{ A}; I_{Boff} = -0.15\text{ A}$ | - | 15 | - | ns | |
| t_r | rise time | | - | 50 | - | ns | |
| t_{on} | turn-on time | | - | 65 | - | ns | |
| t_s | storage time | | - | 305 | - | ns | |
| t_f | fall time | | - | 70 | - | ns | |
| t_{off} | turn-off time | | - | 375 | - | ns | |
| f_T | transition frequency | $V_{CE} = 10\text{ V}; I_C = 0.1\text{ A}; f = 100\text{ MHz}$ | - | 130 | - | MHz | |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$ | - | 60 | 100 | pF | |

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



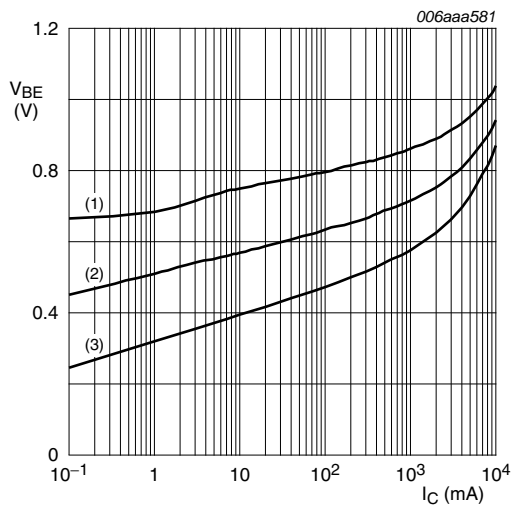
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

Fig 5. DC current gain as a function of collector current; typical values



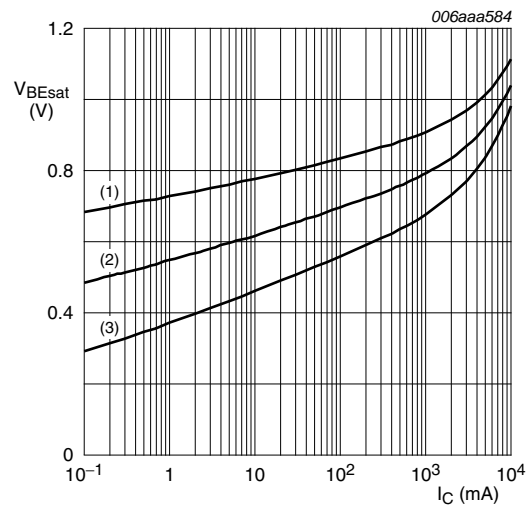
$T_{amb} = 25\text{ }^\circ\text{C}$

Fig 6. Collector current as a function of collector-emitter voltage; typical values



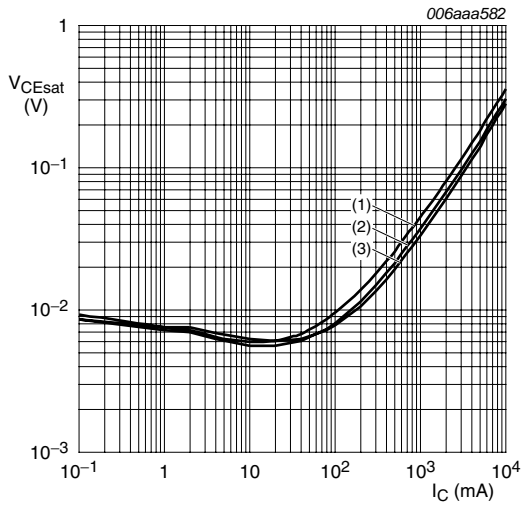
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



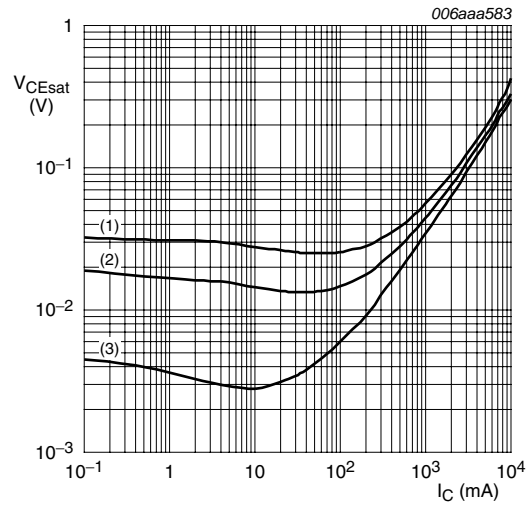
$I_C/I_B = 20$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



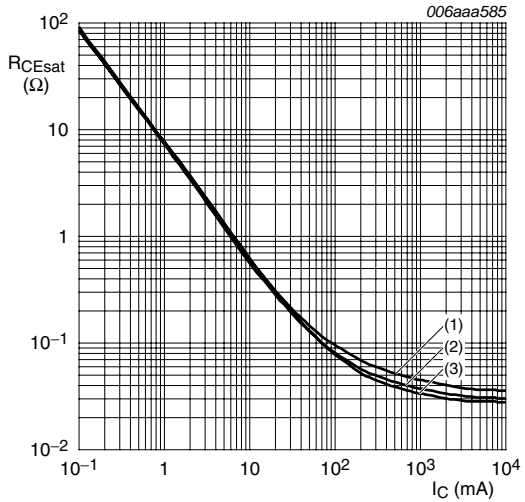
- $I_C/I_B = 20$
- (1) $T_{amb} = 100\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = -55\text{ °C}$

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



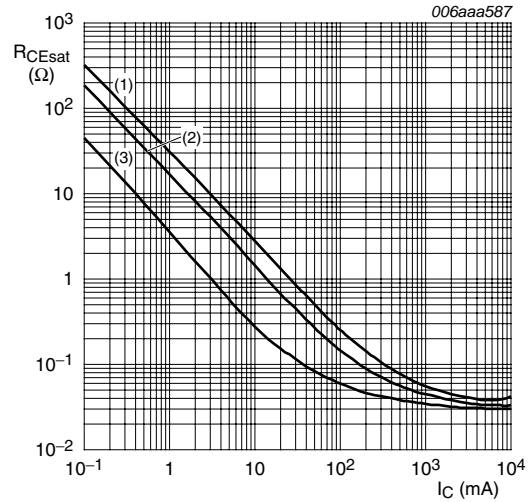
- $T_{amb} = 25\text{ °C}$
- (1) $I_C/I_B = 100$
 - (2) $I_C/I_B = 50$
 - (3) $I_C/I_B = 10$

Fig 10. Collector-emitter saturation 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 11. Collector-emitter saturation resistance as a function of collector current; typical values



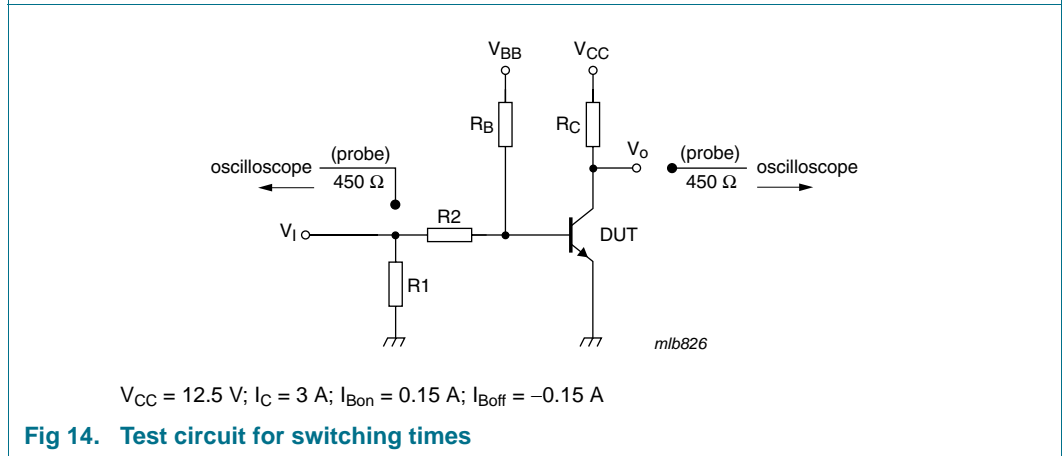
- $T_{amb} = 25\text{ °C}$
- (1) $I_C/I_B = 100$
 - (2) $I_C/I_B = 50$
 - (3) $I_C/I_B = 10$

Fig 12. Collector-emitter saturation resistance as a function of collector current; typical values

8. Test information



Fig 13. BISS transistor switching time definition



$V_{CC} = 12.5 \text{ V}$; $I_C = 3 \text{ A}$; $I_{B_{on}} = 0.15 \text{ A}$; $I_{B_{off}} = -0.15 \text{ A}$

Fig 14. Test circuit for switching times

9. Package outline

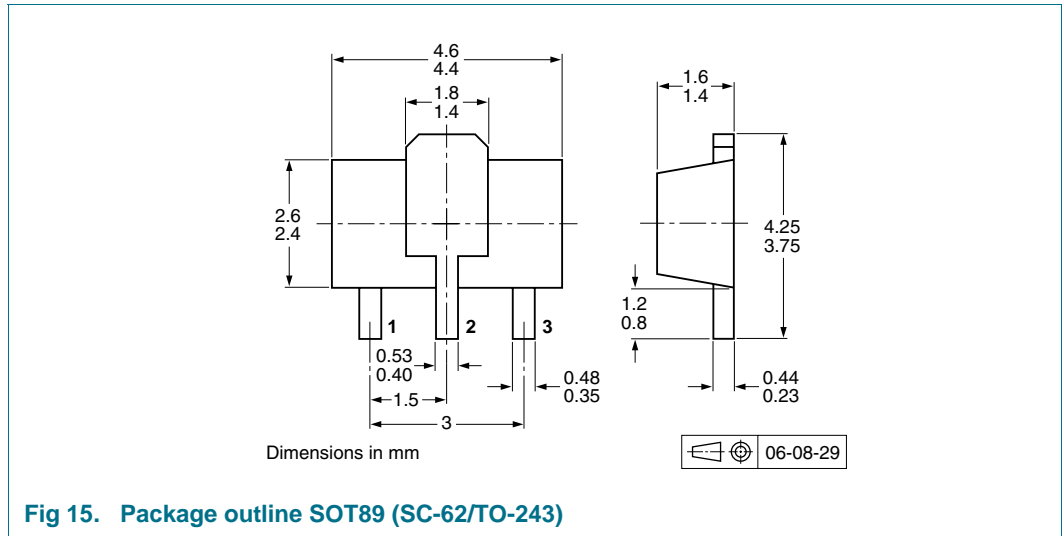


Fig 15. Package outline SOT89 (SC-62/TO-243)

10. 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 | |
|-------------|---------|---------------------------------|------------------|------|
| | | | 1000 | 4000 |
| PBSS303NX | SOT89 | 8 mm pitch, 12 mm tape and reel | -115 | -135 |

[1] For further information and the availability of packing methods, see [Section 15](#).

11. Soldering

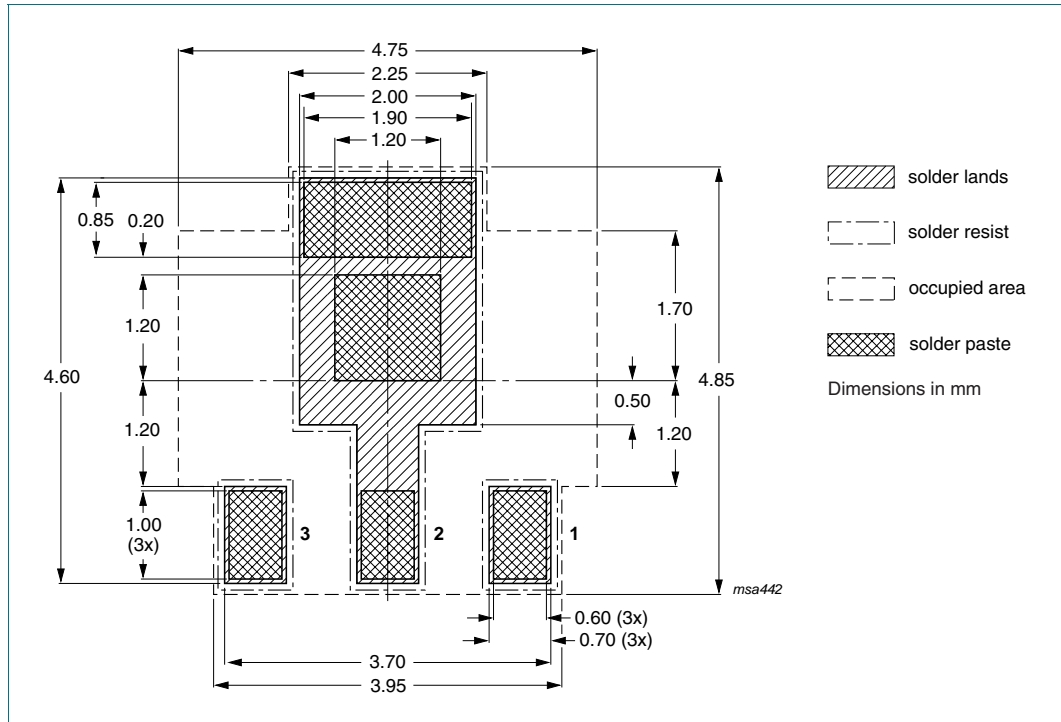


Fig 16. Reflow soldering footprint SOT89 (SC-62)

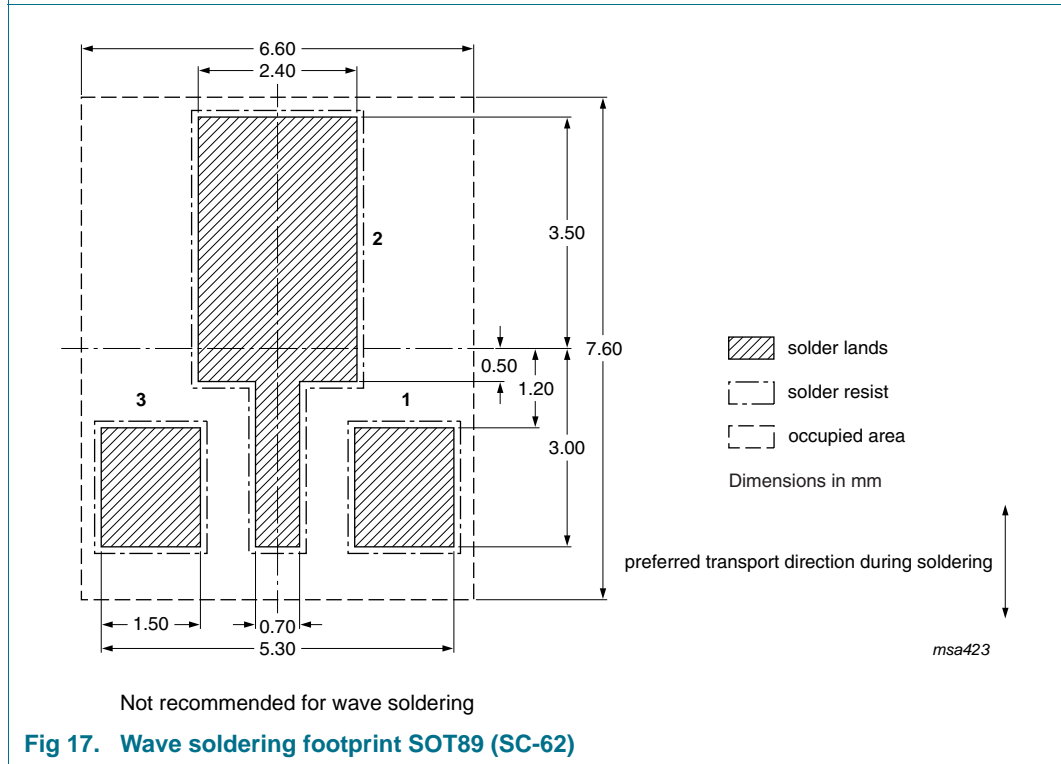
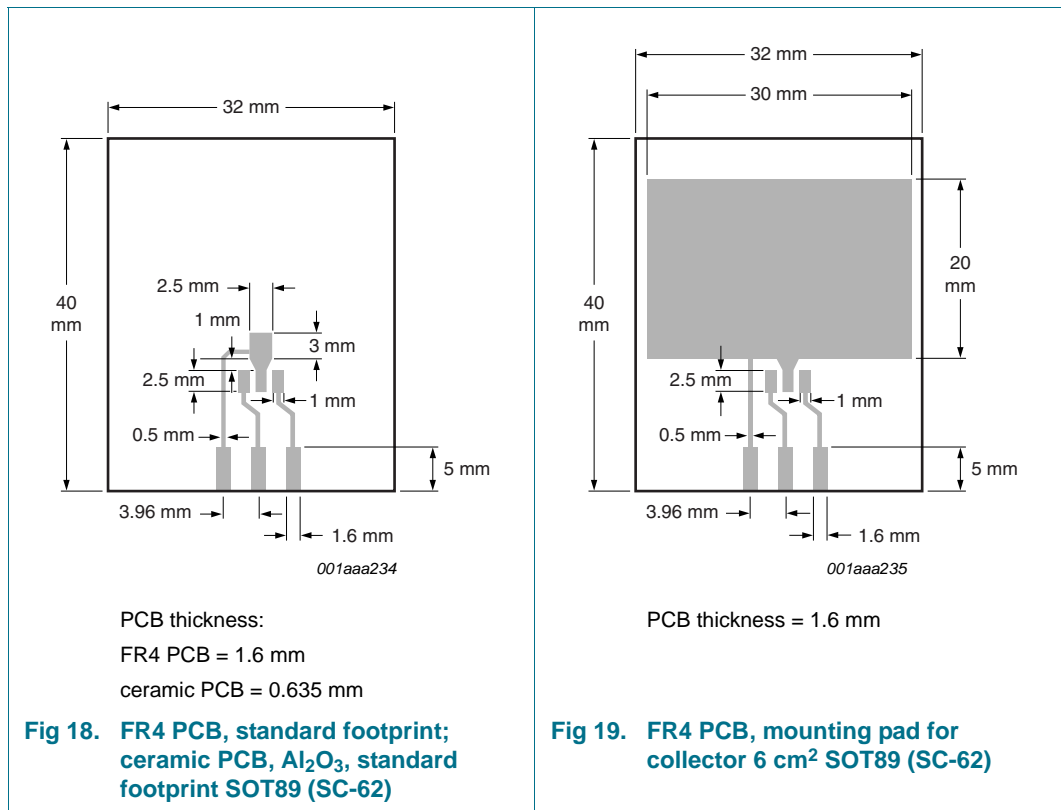


Fig 17. Wave soldering footprint SOT89 (SC-62)

12. Mounting



13. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|--------------------|---------------|-------------|
| PBSS303NX_2 | 20091120 | Product data sheet | - | PBSS303NX_1 |
| Modifications: | <ul style="list-style-type: none"> • 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. • Figure 15 "Package outline SOT89 (SC-62/TO-243)": updated • Figure 16 "Reflow soldering footprint SOT89 (SC-62)": updated • Figure 17 "Wave soldering footprint SOT89 (SC-62)": updated | | | |
| PBSS303NX_1 | 20060823 | Product data sheet | - | - |

14. Legal information

14.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
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[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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Date of release: 20 November 2009

Document identifier: PBSS303NX_2

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[>>Nexperia\(安世\)](#)