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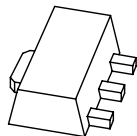
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Kind regards,

Team Nexperia



PBSS302PX

20 V, 5.1 A PNP low V_{CEsat} (BISS) transistor

Rev. 02 — 20 November 2009

Product data sheet

1. Product profile

1.1 General description

PNP 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.

NPN complement: PBSS302NX.

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

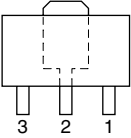
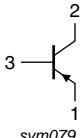
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|--|----------------------------------|-------|-----|-------|------------|
| V_{CEO} | collector-emitter voltage | open base | - | - | -20 | 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] - | 32 | 48 | 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 |  |  |
| 2 | collector | | |
| 3 | base | | |

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| PBSS302PX | 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] |
|-------------|-----------------------------|
| PBSS302PX | *5J |

- [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

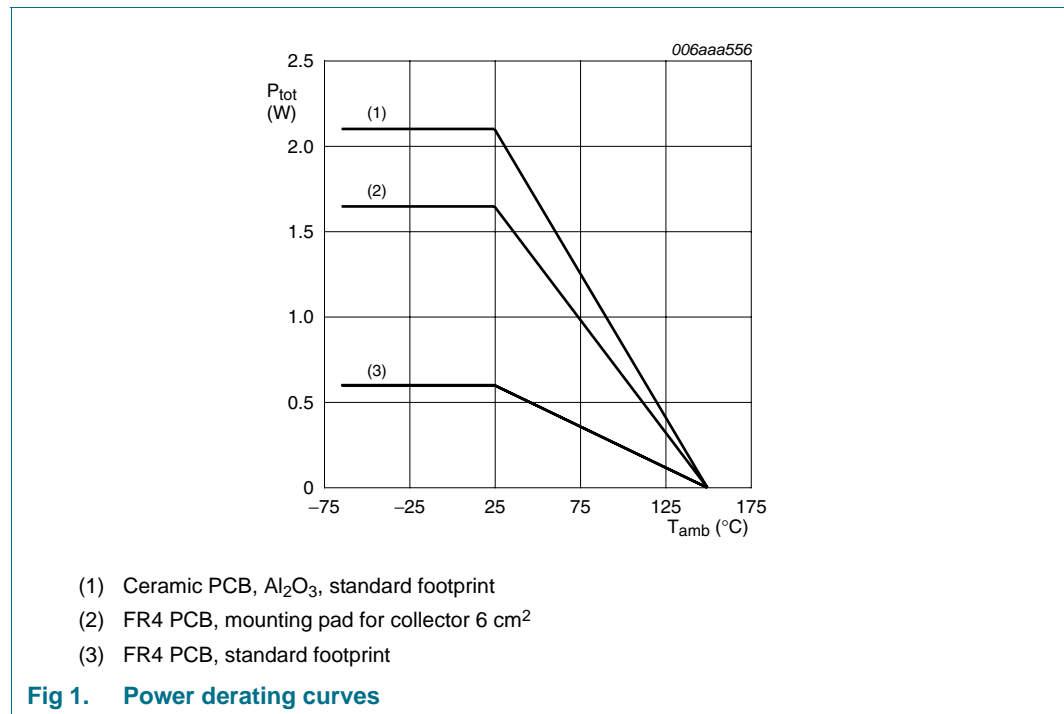
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit | |
|-----------|---------------------------|----------------------------------|-----|-------|------|---|
| V_{CBO} | collector-base voltage | open emitter | - | -20 | V | |
| V_{CEO} | collector-emitter voltage | open base | - | -20 | 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.

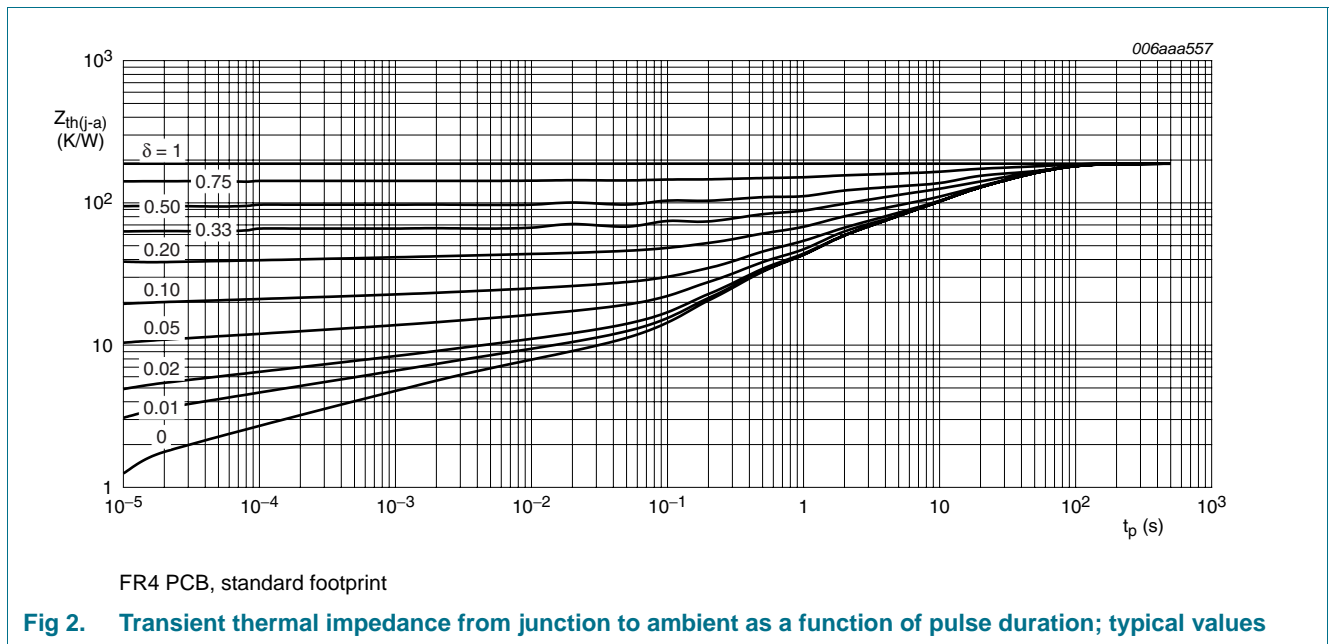
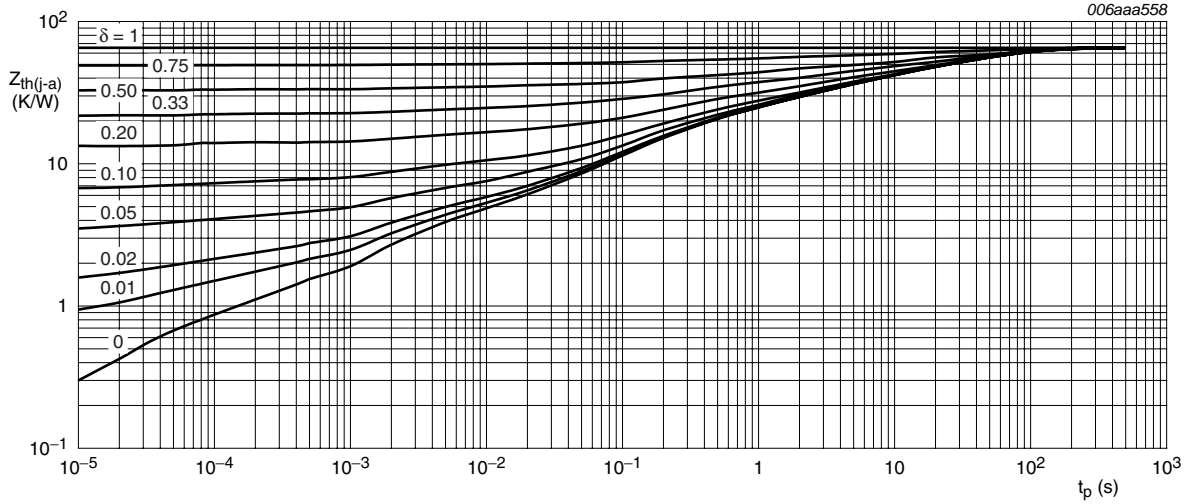
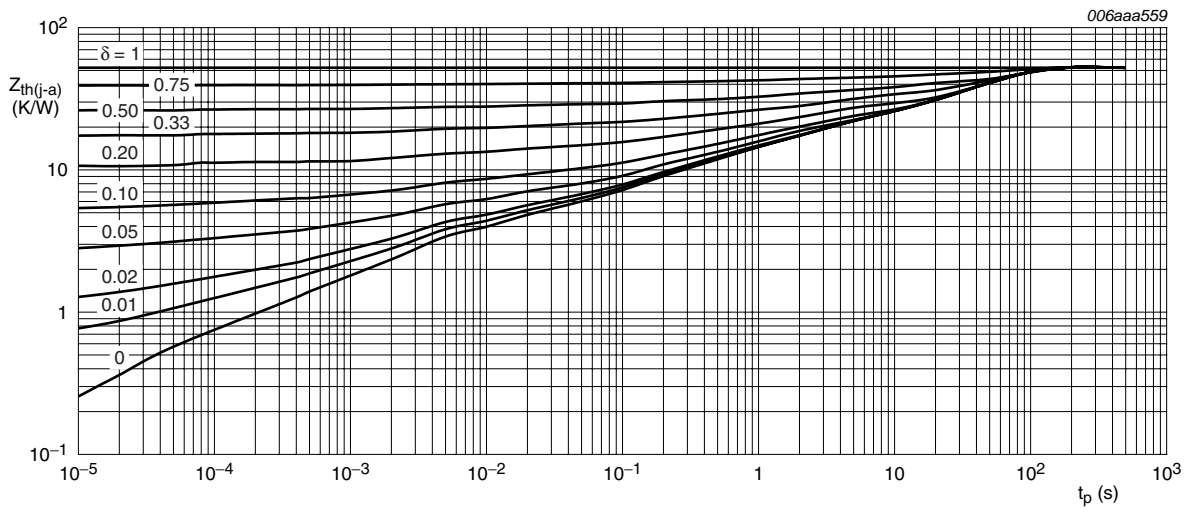


Fig 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



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

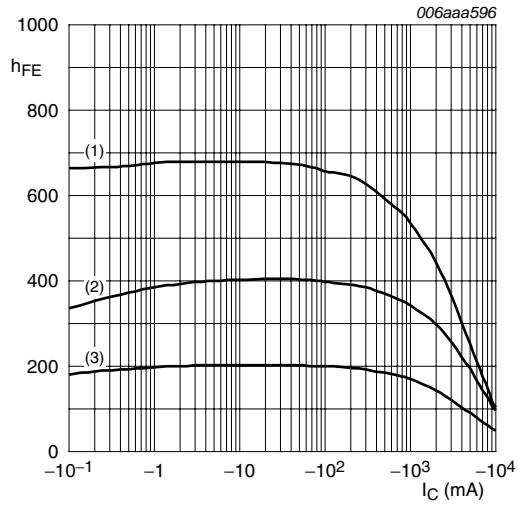
Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

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

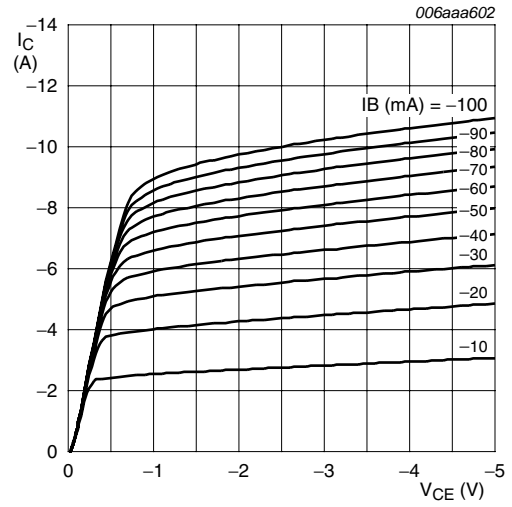
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|---|--|---------|-------|-------|------------------|
| I_{CBO} | collector-base cut-off current | $V_{CB} = -20\text{ V}; I_E = 0\text{ A}$ | - | - | -100 | nA |
| | | $V_{CB} = -20\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | - | - | -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] 250 | 370 | - | |
| | | $V_{CE} = -2\text{ V}; I_C = -1\text{ A}$ | [1] 250 | 340 | - | |
| | | $V_{CE} = -2\text{ V}; I_C = -2\text{ A}$ | [1] 200 | 290 | - | |
| | | $V_{CE} = -2\text{ V}; I_C = -4\text{ A}$ | [1] 150 | 220 | - | |
| | | $V_{CE} = -2\text{ V}; I_C = -6\text{ A}$ | [1] 100 | 160 | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = -0.5\text{ A}; I_B = -50\text{ mA}$ | [1] - | -25 | -35 | mV |
| | | $I_C = -1\text{ A}; I_B = -50\text{ mA}$ | [1] - | -45 | -65 | mV |
| | | $I_C = -1\text{ A}; I_B = -10\text{ mA}$ | [1] - | -70 | -100 | mV |
| | | $I_C = -2\text{ A}; I_B = -40\text{ mA}$ | [1] - | -90 | -130 | mV |
| | | $I_C = -4\text{ A}; I_B = -200\text{ mA}$ | [1] - | -130 | -190 | mV |
| | | $I_C = -4\text{ A}; I_B = -400\text{ mA}$ | [1] - | -120 | -175 | mV |
| | | $I_C = -4\text{ A}; I_B = -40\text{ mA}$ | [1] - | -200 | -300 | mV |
| | | $I_C = -5.1\text{ A}; I_B = -255\text{ mA}$ | [1] - | -160 | -230 | mV |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = -4\text{ A}; I_B = -200\text{ mA}$ | [1] - | 32 | 48 | $\text{m}\Omega$ |
| | | $I_C = -4\text{ A}; I_B = -40\text{ mA}$ | [1] - | 50 | 75 | $\text{m}\Omega$ |
| V_{BEsat} | base-emitter saturation voltage | $I_C = -1\text{ A}; I_B = -100\text{ mA}$ | [1] - | -0.82 | -0.9 | V |
| | | $I_C = -4\text{ A}; I_B = -400\text{ mA}$ | [1] - | -0.93 | -1.05 | V |
| V_{BEon} | base-emitter turn-on voltage | $V_{CE} = -2\text{ V}; I_C = -2\text{ A}$ | [1] - | -0.76 | -0.85 | V |
| t_d | delay time | $V_{CC} = -12.5\text{ V}; I_C = -3\text{ A}; I_{Bon} = -0.15\text{ A}; I_{Boff} = 0.15\text{ A}$ | - | 10 | - | ns |
| t_r | rise time | | - | 55 | - | ns |
| t_{on} | turn-on time | | - | 65 | - | ns |
| t_s | storage time | | - | 205 | - | ns |
| t_f | fall time | | - | 145 | - | ns |
| t_{off} | turn-off time | | - | 350 | - | 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 | $V_{CB} = -10\text{ V}; I_E = I_E = 0\text{ A}; f = 1\text{ MHz}$ | - | 130 | 160 | pF |

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



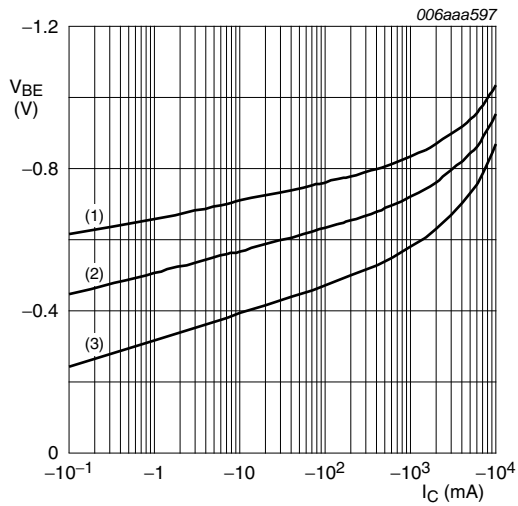
$V_{CE} = -2\text{ V}$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -55\text{ }^\circ\text{C}$

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



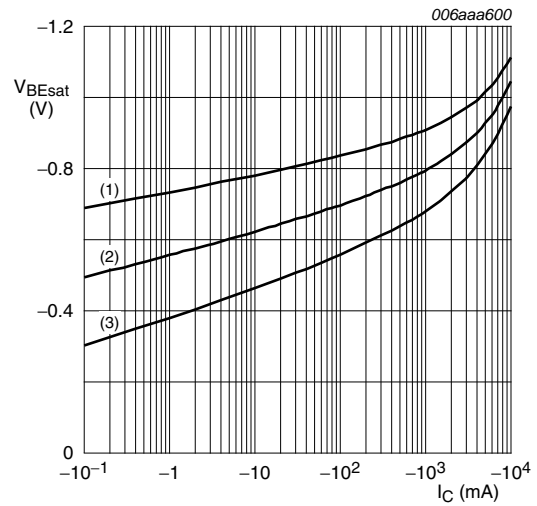
$T_{amb} = 25\text{ }^\circ\text{C}$

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



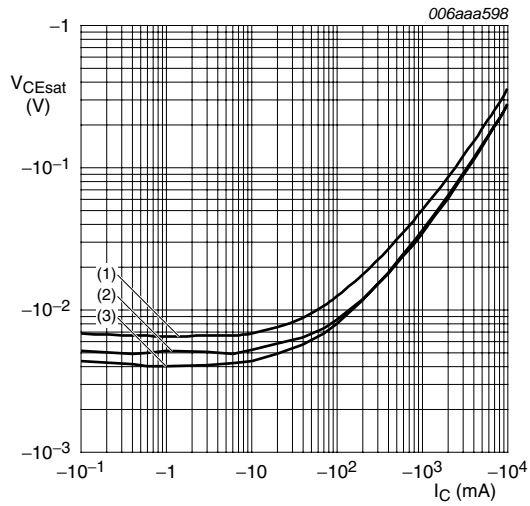
$V_{CE} = -2\text{ V}$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



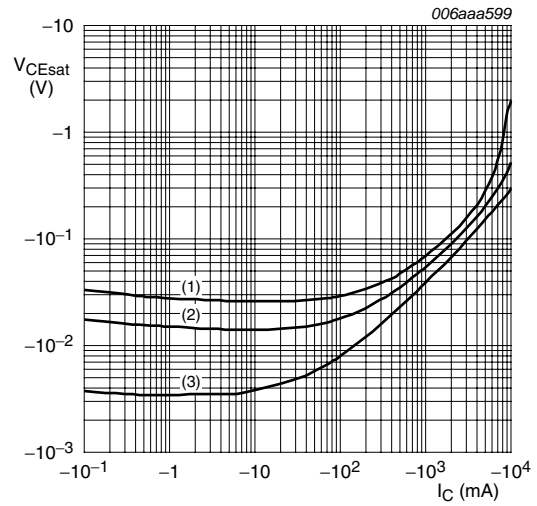
$I_C/I_B = 20$
 (1) $T_{amb} = -55\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = 100\text{ }^\circ\text{C}$

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



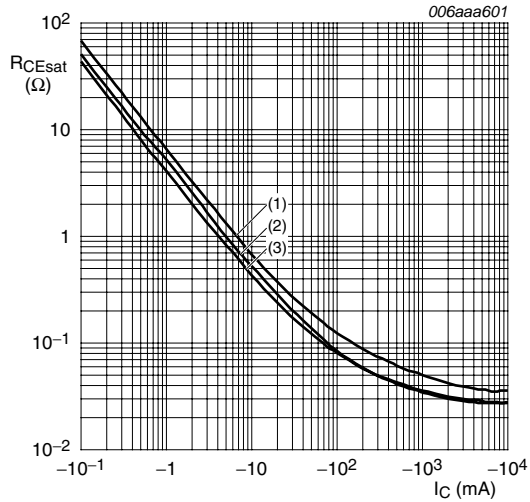
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



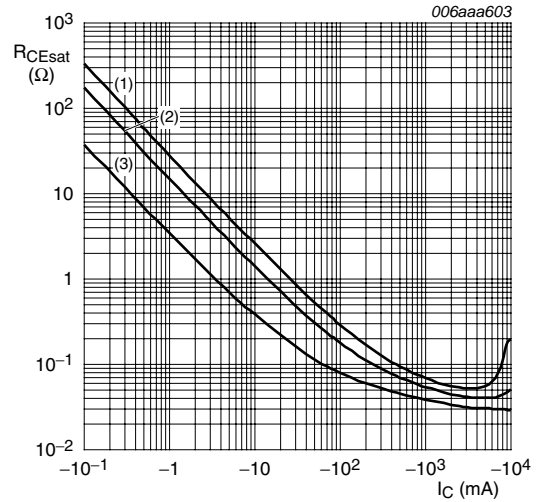
$T_{amb} = 25\text{ °C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 10$

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

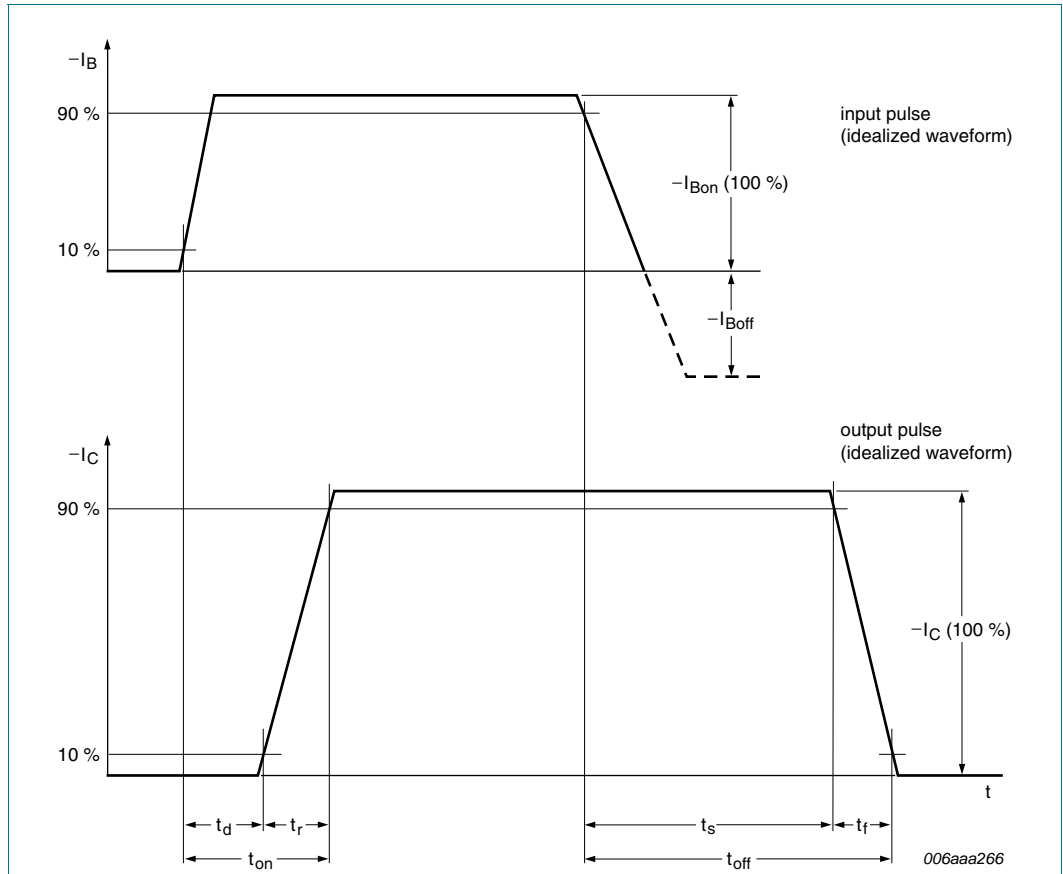
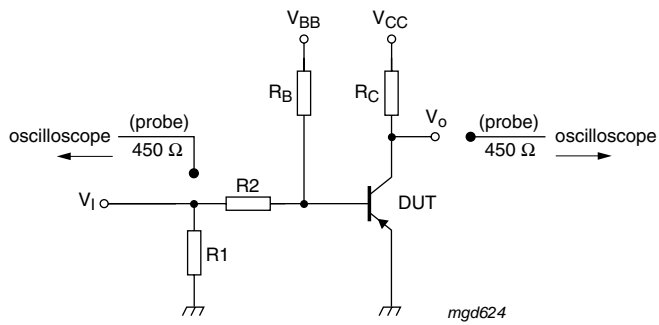


Fig 13. BISS transistor switching time definition



$V_{CC} = -12.5\text{ V}$; $I_C = -3\text{ A}$; $I_{Bon} = -0.15\text{ A}$; $I_{Boff} = 0.15\text{ A}$

Fig 14. Test circuit for switching times

9. Package outline

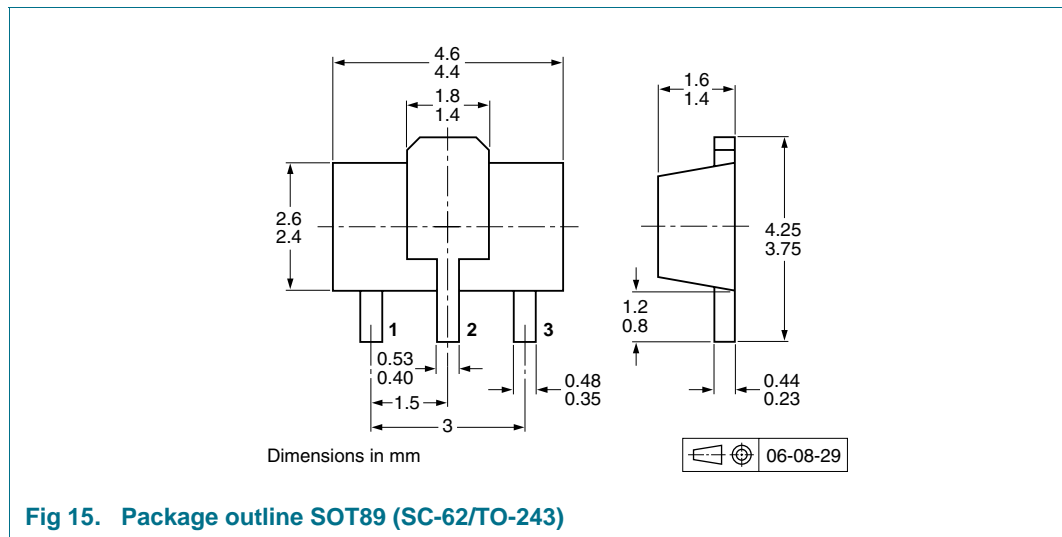


Fig 15. Package outline SOT89 (SC-62/TO-243)

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 |
| PBSS302PX | 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

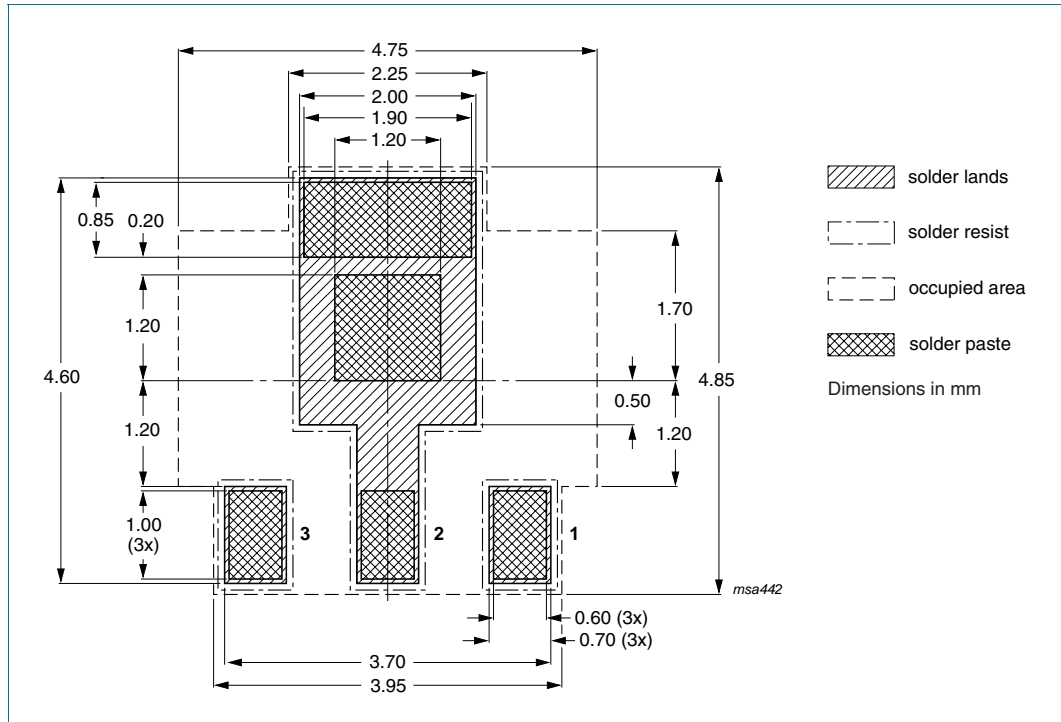


Fig 16. Reflow soldering footprint SOT89 (SC-62)

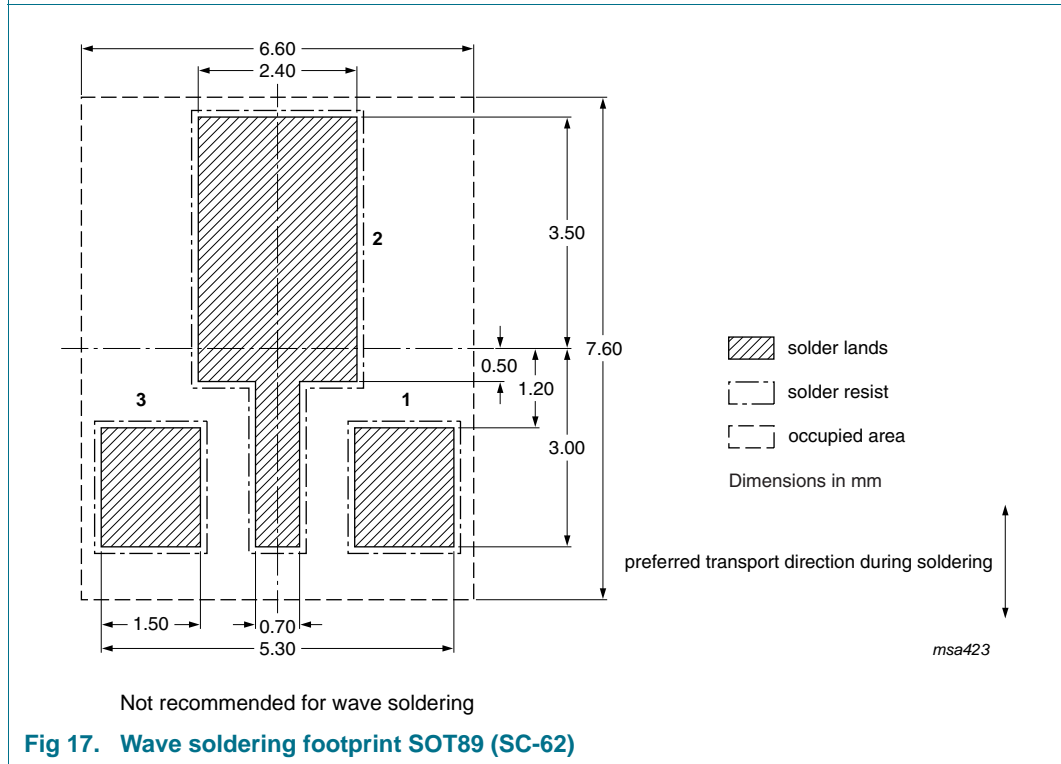
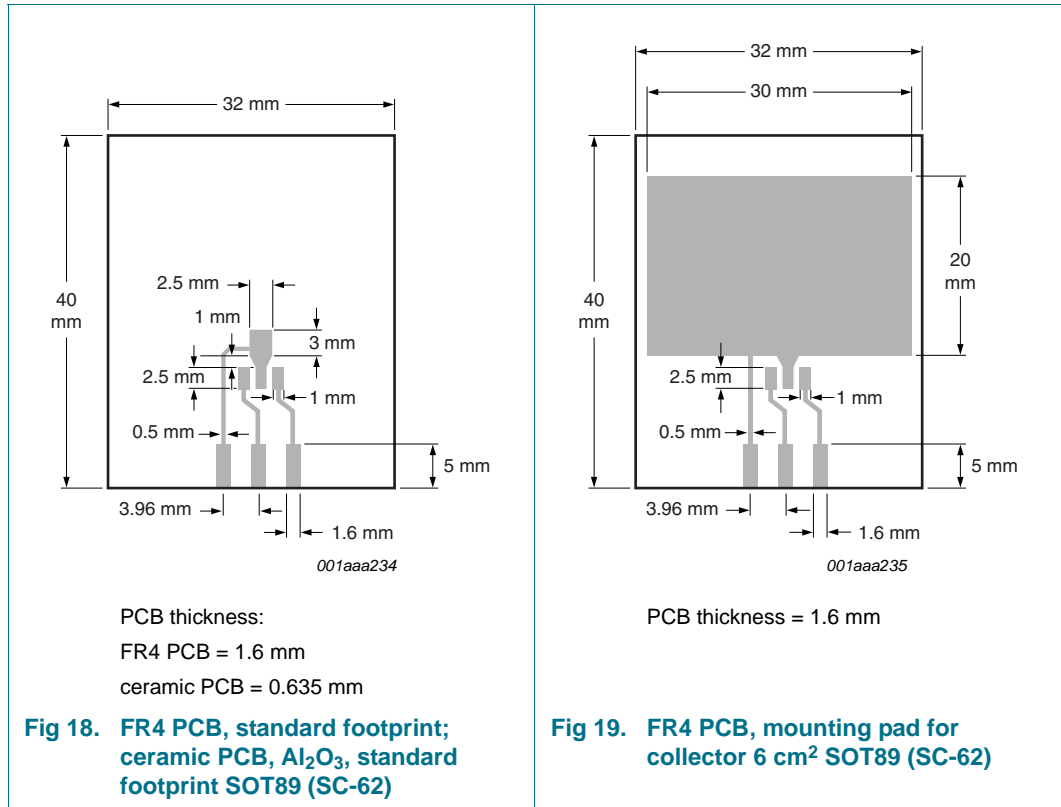


Fig 17. Wave soldering footprint SOT89 (SC-62)

12. Mounting



13. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|--------------------|---------------|-------------|
| PBSS302PX_2 | 20091120 | Product data sheet | - | PBSS302PX_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 | | | |
| PBSS302PX_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. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
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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: PBSS302PX_2