



PBSS4032SPN

30 V NPN/PNP low V_{CEsat} (BISS) transistor

Rev. 2 — 14 October 2010

Product data sheet

1. Product profile

1.1 General description

NPN/PNP low V_{CEsat} Breakthrough In Small Signal (BISS) transistor in a SOT96-1 (SO8) medium power Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

| Type number | Package | | NPN/PNP complement | PNP/PNP complement |
|-------------|----------|------|--------------------|--------------------|
| | Nexperia | Name | | |
| PBSS4032SPN | SOT96-1 | SO8 | PBSS4032SN | PBSS4032SP |

1.2 Features and benefits

- Low collector-emitter saturation voltage V_{CEsat}
- Optimized switching time
- 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
- Battery-driven devices
- Power management
- Charging circuits

1.4 Quick reference data

Table 2. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|-------------------------------|-----------------------|-----|------|------|
| TR1; NPN low V_{CEsat} transistor | | | | | | |
| V_{CEO} | collector-emitter voltage | open base | - | - | 30 | V |
| I_C | collector current | | - | - | 5.7 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | 10 | A |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 4$ A; $I_B = 0.4$ A | [1] - | 45 | 62.5 | mΩ |

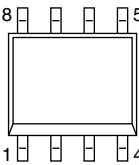
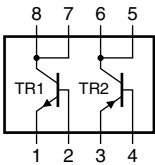
Table 2. Quick reference data ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|---|-------------------------------|-----|-----|------|------------|
| TR2; PNP low V_{CEsat} transistor | | | | | | |
| V_{CEO} | collector-emitter voltage | open base | - | - | -30 | V |
| I_C | collector current | | - | - | -4.8 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | -10 | A |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = -4$ A; $I_B = -0.4$ A | [1] | - | 65 | m Ω |

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

2. Pinning information

Table 3. Pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|---------------|--|--|
| 1 | emitter TR1 |  |  |
| 2 | base TR1 | | |
| 3 | emitter TR2 | | |
| 4 | base TR2 | | |
| 5 | collector TR2 | | |
| 6 | collector TR2 | | |
| 7 | collector TR1 | | |
| 8 | collector TR1 | | |

3. Ordering information

Table 4. Ordering information

| Type number | Package | | |
|-------------|---------|---|---------|
| | Name | Description | Version |
| PBSS4032SPN | SO8 | plastic small outline package; 8 leads; body width 3.9 mm | SOT96-1 |

4. Marking

Table 5. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBSS4032SPN | 4032SPN |

5. Limiting values

Table 6. Limiting values

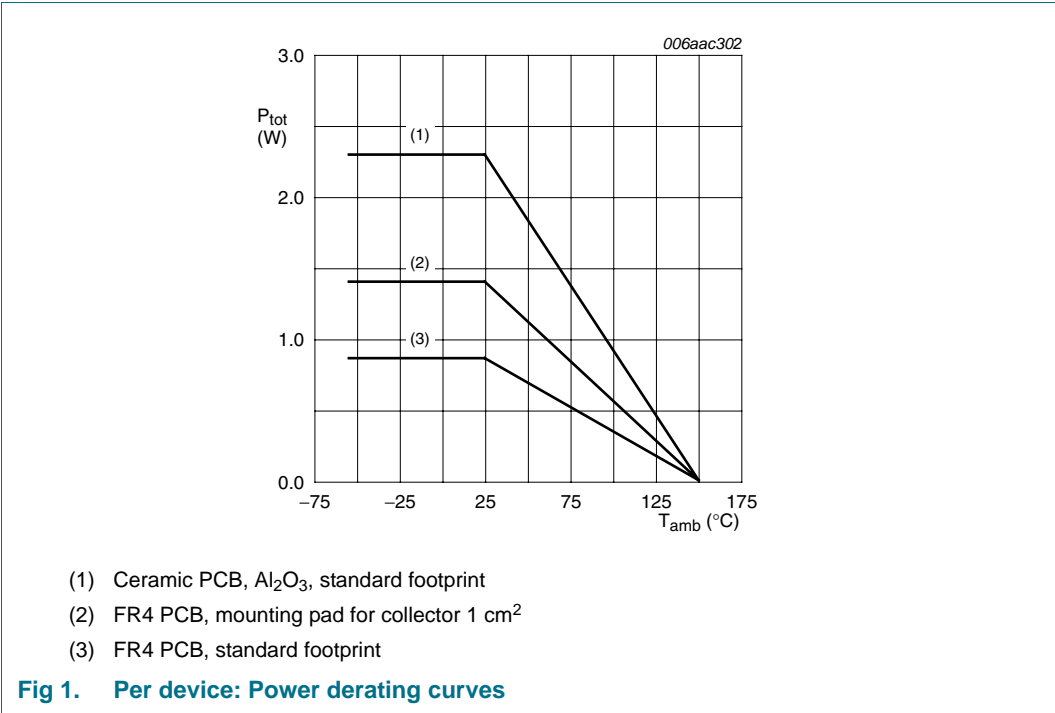
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit | |
|---|---------------------------|-------------------------------------|---------------------|------|------|---|
| TR1 (NPN) | | | | | | |
| I _C | collector current | | - | 5.7 | A | |
| TR2 (PNP) | | | | | | |
| I _C | collector current | | - | −4.8 | A | |
| Per transistor; for the PNP transistor with negative polarity | | | | | | |
| 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 _{CM} | peak collector current | single pulse; t _p ≤ 1 ms | - | 10 | A | |
| I _B | base current | | - | 1 | A | |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | [1] | - | 0.73 | W |
| | | | [2] | - | 1 | W |
| | | | [3] | - | 1.7 | W |
| Per device | | | | | | |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | [1] | - | 0.86 | W |
| | | | [2] | - | 1.4 | W |
| | | | [3] | - | 2.3 | W |
| T _j | junction temperature | | - | 150 | °C | |
| T _{amb} | ambient temperature | | −55 | +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 1 cm².

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

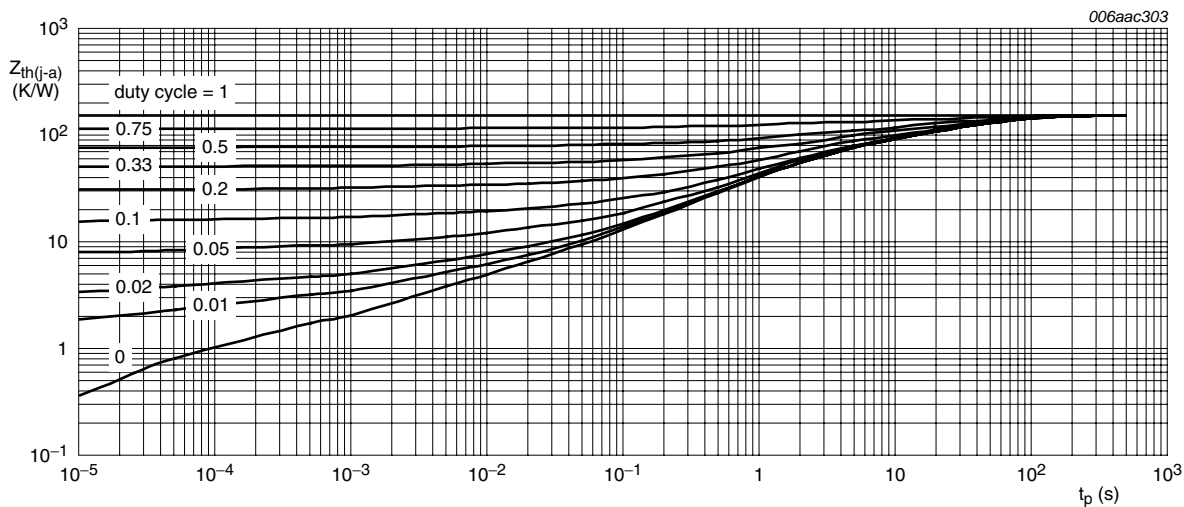


6. Thermal characteristics

Table 7. Thermal characteristics

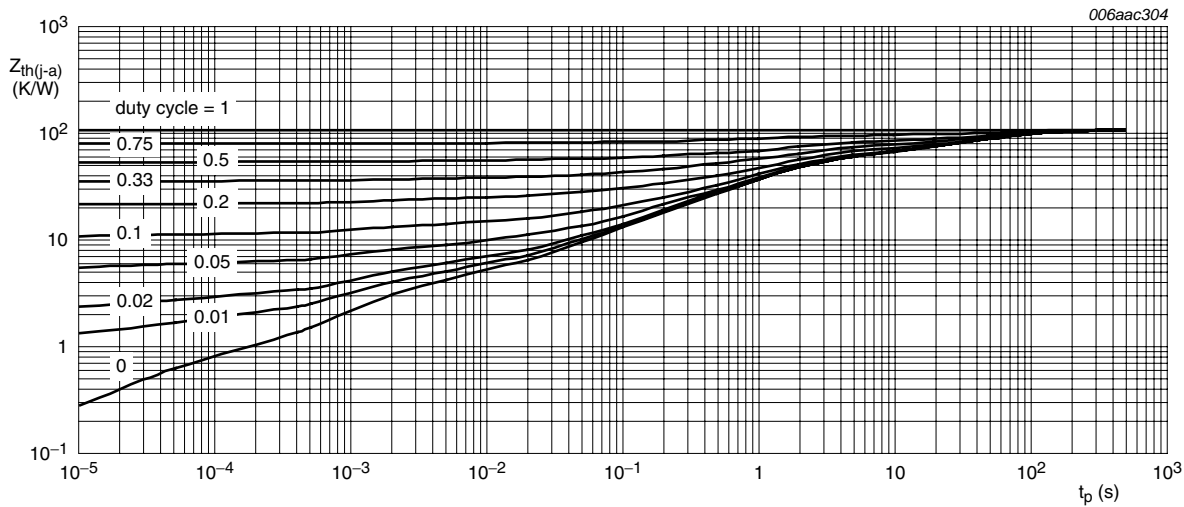
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|--|-------------|-----|-----|-----|------|
| Per transistor | | | | | | |
| R _{th(j-a)} | thermal resistance from junction to ambient | in free air | [1] | - | 170 | K/W |
| | | | [2] | - | 125 | K/W |
| | | | [3] | - | 75 | K/W |
| R _{th(j-sp)} | thermal resistance from junction to solder point | | - | - | 40 | K/W |
| Per device | | | | | | |
| R _{th(j-a)} | thermal resistance from junction to ambient | in free air | [1] | - | 145 | K/W |
| | | | [2] | - | 90 | K/W |
| | | | [3] | - | 55 | 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 cm².
[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.



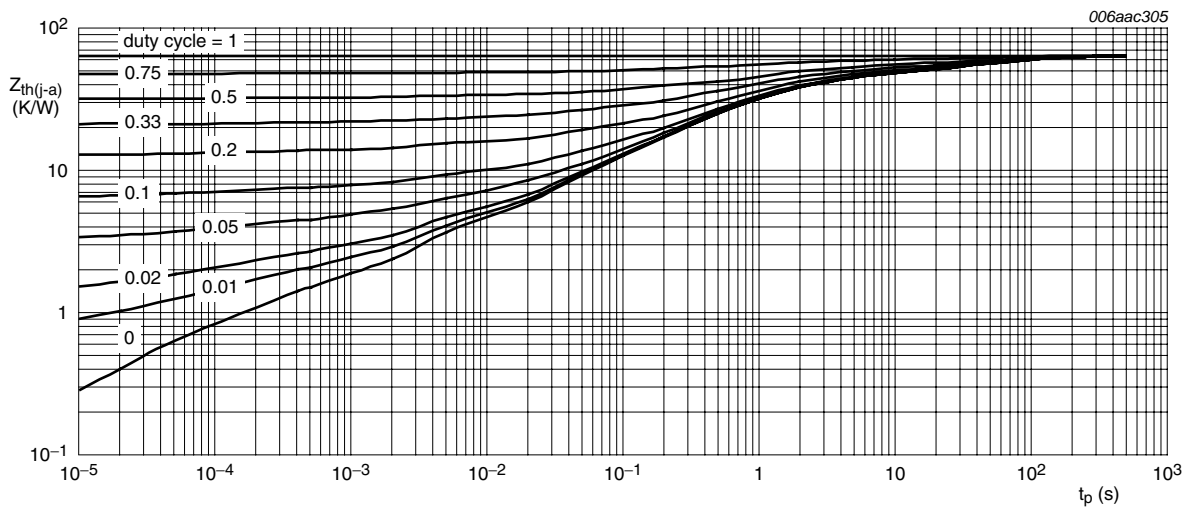
FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for collector 1 cm^2

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



Ceramic PCB, Al_2O_3 , standard footprint

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

7. Characteristics

Table 8. Characteristics

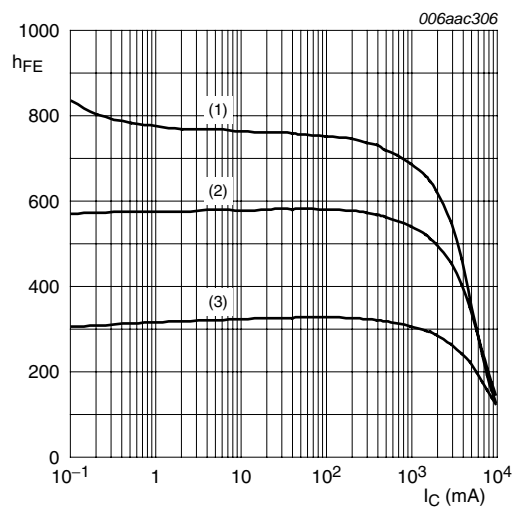
$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|---|---|-----|------|------|-----------------------|
| TR1; NPN low V_{CEsat} transistor | | | | | | |
| 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_{CES} | collector-emitter cut-off current | $V_{CE} = 24\text{ V}; V_{BE} = 0\text{ V}$ | - | - | 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 | $V_{CE} = 2\text{ V}$ | [1] | | | |
| | | $I_C = 500\text{ mA}$ | 300 | 500 | - | |
| | | $I_C = 1\text{ A}$ | 300 | 500 | - | |
| | | $I_C = 2\text{ A}$ | 250 | 450 | - | |
| | | $I_C = 4\text{ A}$ | 200 | 400 | - | |
| | | $I_C = 6\text{ A}$ | 150 | 300 | - | |
| V_{CEsat} | collector-emitter saturation voltage | | [1] | | | |
| | | $I_C = 1\text{ A}; I_B = 50\text{ mA}$ | - | 90 | 125 | mV |
| | | $I_C = 1\text{ A}; I_B = 10\text{ mA}$ | - | 130 | 180 | mV |
| | | $I_C = 2\text{ A}; I_B = 40\text{ mA}$ | - | 150 | 210 | mV |
| | | $I_C = 4\text{ A}; I_B = 400\text{ mA}$ | - | 185 | 250 | mV |
| | | $I_C = 4\text{ A}; I_B = 40\text{ mA}$ | - | 250 | 375 | mV |
| | | $I_C = 6\text{ A}; I_B = 300\text{ mA}$ | - | 300 | 450 | mV |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 4\text{ A}; I_B = 400\text{ mA}$ | [1] | - | 45 | 62.5 $\text{m}\Omega$ |
| V_{BEsat} | base-emitter saturation voltage | | [1] | | | |
| | | $I_C = 1\text{ A}; I_B = 100\text{ mA}$ | - | 0.76 | 0.9 | V |
| | | $I_C = 4\text{ A}; I_B = 400\text{ mA}$ | - | 0.91 | 1.05 | V |
| V_{BEon} | base-emitter turn-on voltage | $V_{CE} = 2\text{ V}; I_C = 2\text{ A}$ | [1] | - | 0.77 | 0.85 V |
| t_d | delay time | $V_{CC} = 12.5\text{ V}; I_C = 1\text{ A};$ | - | 35 | - | ns |
| t_r | rise time | $I_{Bon} = 0.05\text{ A}; I_{Boff} = -0.05\text{ A}$ | - | 30 | - | ns |
| t_{on} | turn-on time | | - | 65 | - | ns |
| t_s | storage time | | - | 150 | - | ns |
| t_f | fall time | | - | 65 | - | ns |
| t_{off} | turn-off time | | - | 215 | - | ns |
| f_T | transition frequency | $V_{CE} = 10\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}$ | - | 140 | - | MHz |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | - | 65 | - | pF |

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

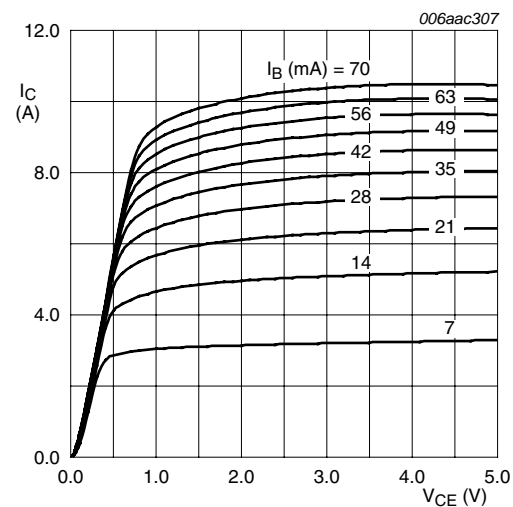
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | | |
|-------------------------------------|---|--|---------------------------------|---|------|---------------|------------------|------|
| TR2; PNP low V_{CEsat} transistor | | | | | | | | |
| I_{CBO} | collector-base cut-off current | $V_{CB} = -30\text{ V}; I_E = 0\text{ A}$ | - | - | -100 | nA | | |
| | | $V_{CB} = -30\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | - | - | -50 | μA | | |
| I_{CES} | collector-emitter cut-off current | $V_{CE} = -24\text{ V}; V_{BE} = 0\text{ V}$ | - | - | -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 | $V_{CE} = -2\text{ V}$ | [1] | | | | | |
| | | $I_C = -500\text{ mA}$ | 200 | 380 | - | | | |
| | | $I_C = -1\text{ A}$ | 200 | 330 | - | | | |
| | | $I_C = -2\text{ A}$ | 150 | 250 | - | | | |
| | | $I_C = -4\text{ A}$ | 60 | 100 | - | | | |
| | | $I_C = -5\text{ A}$ | 40 | 60 | - | | | |
| V_{CEsat} | collector-emitter saturation voltage | [1] | | | | | | |
| | | $I_C = -1\text{ A}; I_B = -50\text{ mA}$ | - | -115 | -165 | mV | | |
| | | $I_C = -1\text{ A}; I_B = -10\text{ mA}$ | - | -170 | -240 | mV | | |
| | | $I_C = -2\text{ A}; I_B = -40\text{ mA}$ | - | -210 | -300 | mV | | |
| | | $I_C = -4\text{ A}; I_B = -400\text{ mA}$ | - | -260 | -390 | mV | | |
| | | $I_C = -4\text{ A}; I_B = -200\text{ mA}$ | - | -300 | -450 | mV | | |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = -5\text{ A}; I_B = -250\text{ mA}$ | - | -340 | -510 | mV | | |
| | | $I_C = -4\text{ A}; I_B = -400\text{ mA}$ | [1] | - | 65 | 98 | $\text{m}\Omega$ | |
| | | V_{BEsat} | base-emitter saturation voltage | [1] | | | | |
| | | | | $I_C = -1\text{ A}; I_B = -100\text{ mA}$ | - | -0.8 | -0.9 | V |
| | | | | $I_C = -4\text{ A}; I_B = -400\text{ mA}$ | - | -0.99 | -1.1 | V |
| | | V_{BEon} | base-emitter turn-on voltage | $V_{CE} = -2\text{ V}; I_C = -2\text{ A}$ | [1] | - | -0.81 | -0.9 |
| t_d | delay time | $V_{CC} = -12.5\text{ V}; I_C = -1\text{ A}; I_{Bon} = -0.05\text{ A}; I_{Boff} = 0.05\text{ A}$ | - | 30 | - | ns | | |
| t_r | rise time | | - | 60 | - | ns | | |
| t_{on} | turn-on time | | - | 90 | - | ns | | |
| t_s | storage time | | - | 140 | - | ns | | |
| t_f | fall time | | - | 80 | - | ns | | |
| t_{off} | turn-off time | | - | 220 | - | ns | | |
| f_T | transition frequency | $V_{CE} = -10\text{ V}; I_C = -100\text{ mA}; f = 100\text{ MHz}$ | - | 115 | - | MHz | | |
| C_C | collector capacitance | $V_{CB} = -10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | - | 85 | - | pF | | |

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



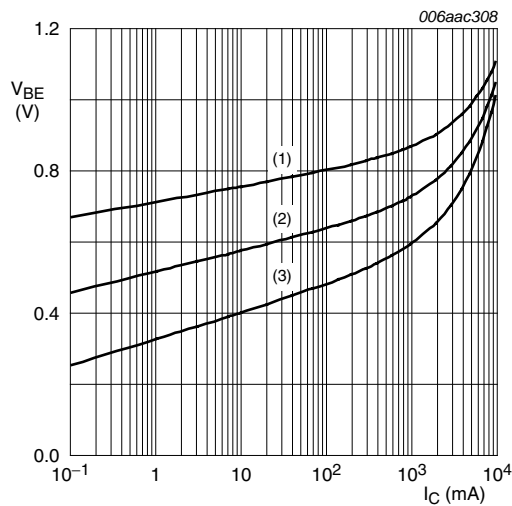
$V_{CE} = 2\text{ V}$
(1) $T_{amb} = 100\text{ }^{\circ}\text{C}$
(2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
(3) $T_{amb} = -55\text{ }^{\circ}\text{C}$

Fig 5. TR1 (NPN): DC current gain as a function of collector current; typical values



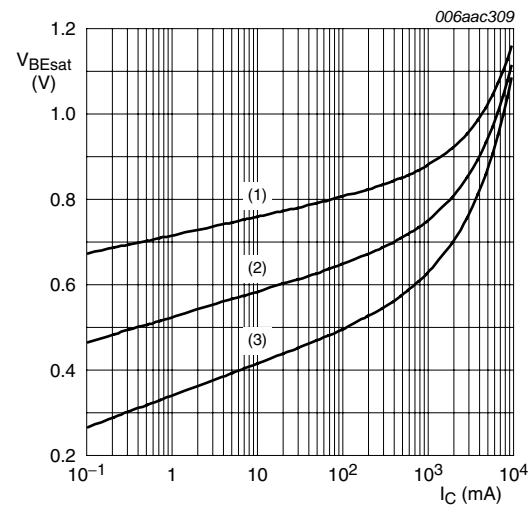
$T_{amb} = 25\text{ }^{\circ}\text{C}$

Fig 6. TR1 (NPN): 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. TR1 (NPN): 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. TR1 (NPN): Base-emitter saturation voltage as a function of collector current; typical values

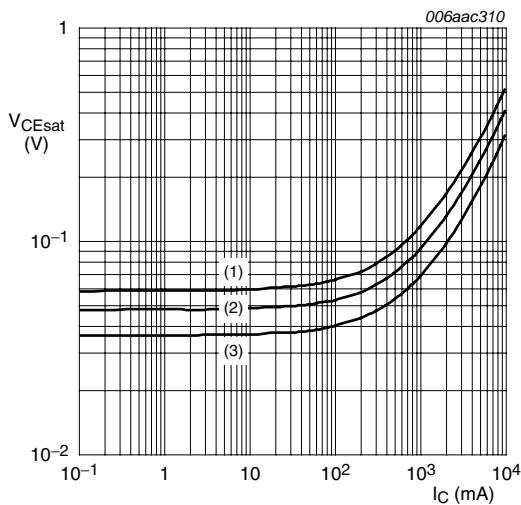


Fig 9. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values

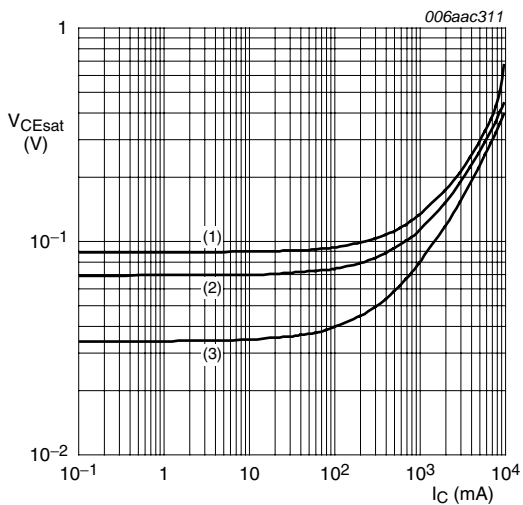


Fig 10. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values

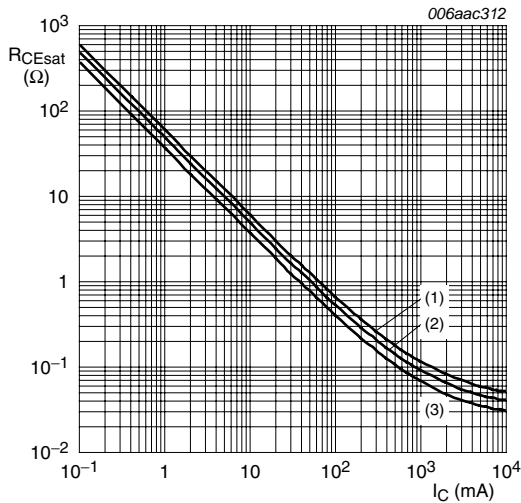


Fig 11. TR1 (NPN): Collector-emitter saturation resistance as a function of collector current; typical values

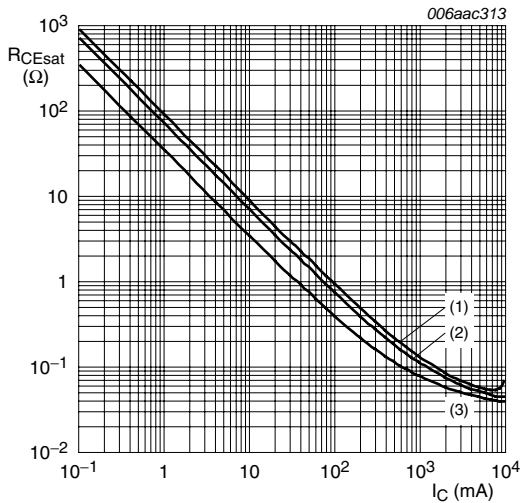
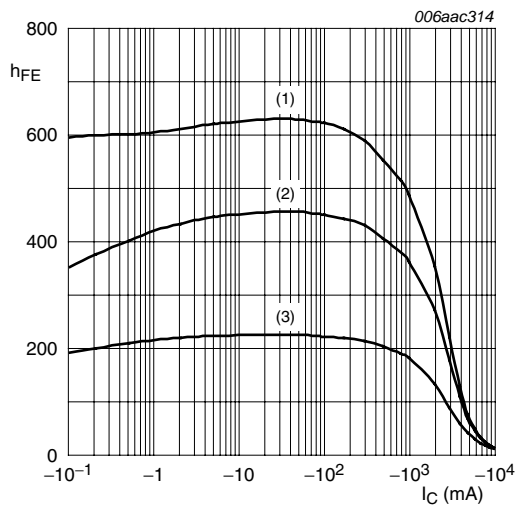
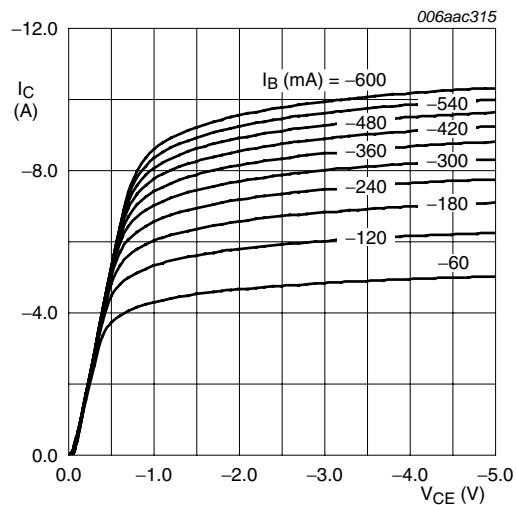


Fig 12. TR1 (NPN): Collector-emitter saturation resistance as a function of collector current; typical values



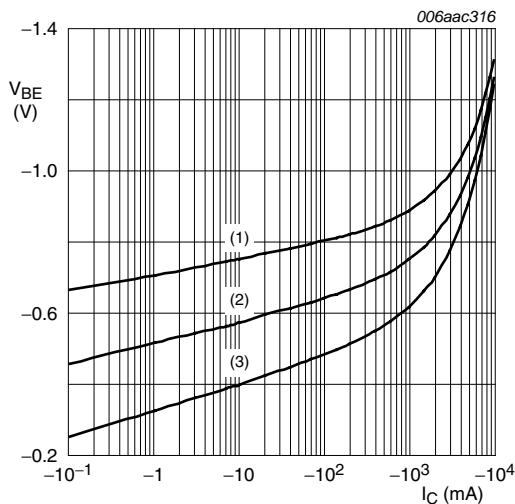
- $V_{CE} = -2\text{ V}$
- (1) $T_{amb} = 100\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = -55\text{ °C}$

Fig 13. TR2 (PNP): DC current gain as a function of collector current; typical values



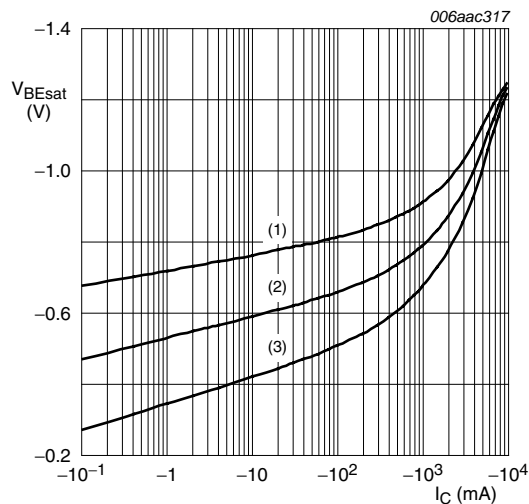
$T_{amb} = 25\text{ °C}$

Fig 14. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values



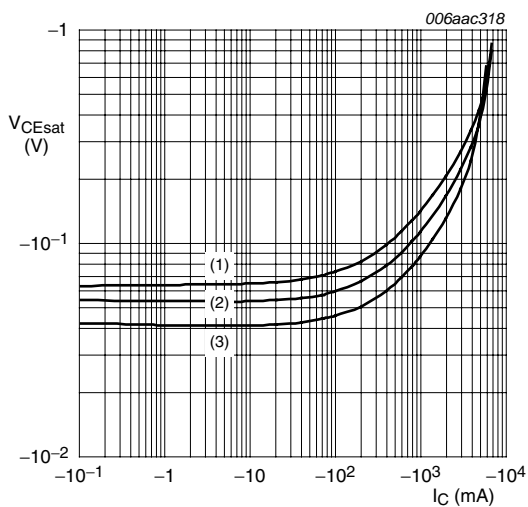
- $V_{CE} = -2\text{ V}$
- (1) $T_{amb} = -55\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = 100\text{ °C}$

Fig 15. TR2 (PNP): Base-emitter voltage as a function of collector current; typical values



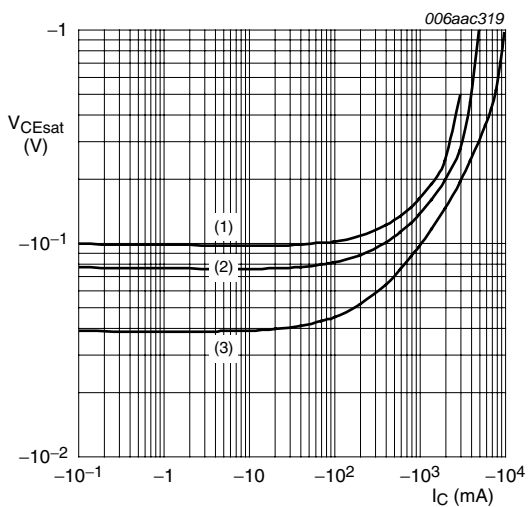
- $I_C/I_B = 20$
- (1) $T_{amb} = -55\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = 100\text{ °C}$

Fig 16. TR2 (PNP): Base-emitter saturation voltage as a function of collector current; typical values



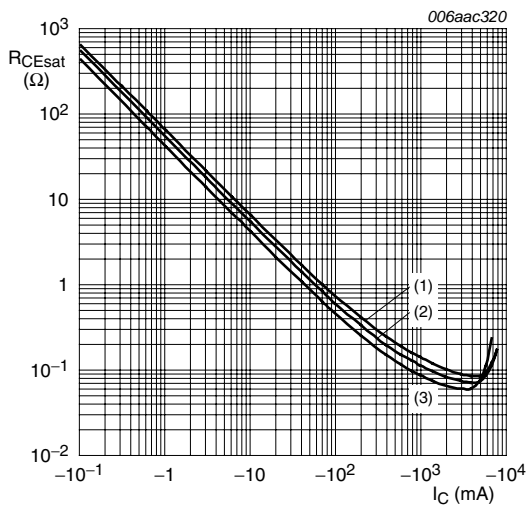
- $I_C/I_B = 20$
- (1) $T_{amb} = 100\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = -55\text{ °C}$

Fig 17. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



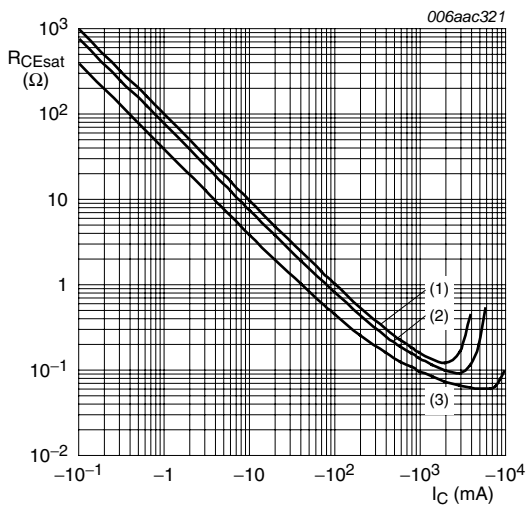
- $T_{amb} = 25\text{ °C}$
- (1) $I_C/I_B = 100$
 - (2) $I_C/I_B = 50$
 - (3) $I_C/I_B = 10$

Fig 18. TR2 (PNP): 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 19. TR2 (PNP): 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 20. TR2 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values

8. Test information

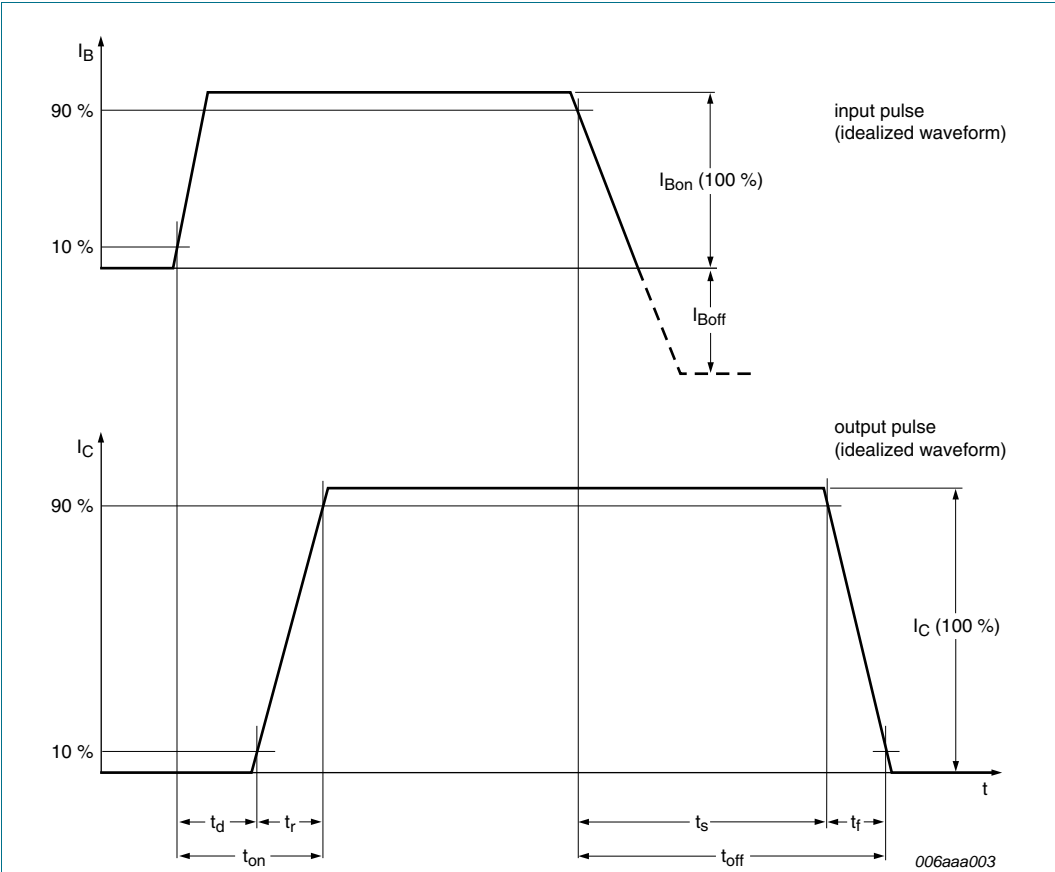
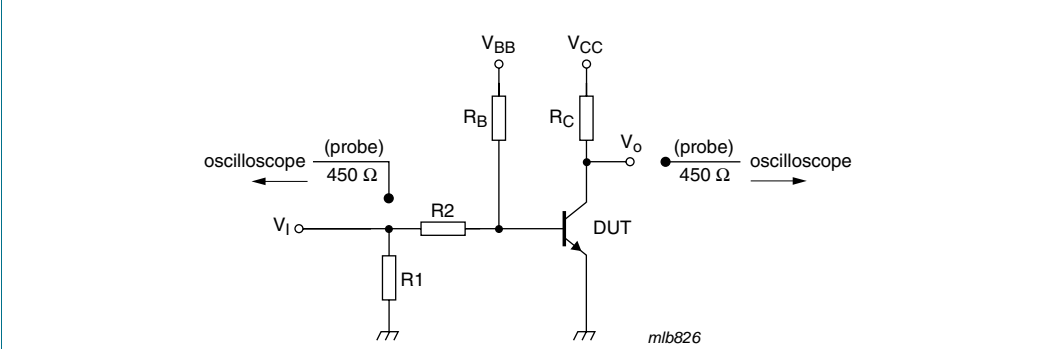


Fig 21. TR1 (NPN): BISS transistor switching time definition



$V_{CC} = 12.5 \text{ V}$; $I_C = 1 \text{ A}$; $I_{Bon} = 0.05 \text{ A}$; $I_{Boff} = -0.05 \text{ A}$

Fig 22. TR1 (NPN): Test circuit for switching times

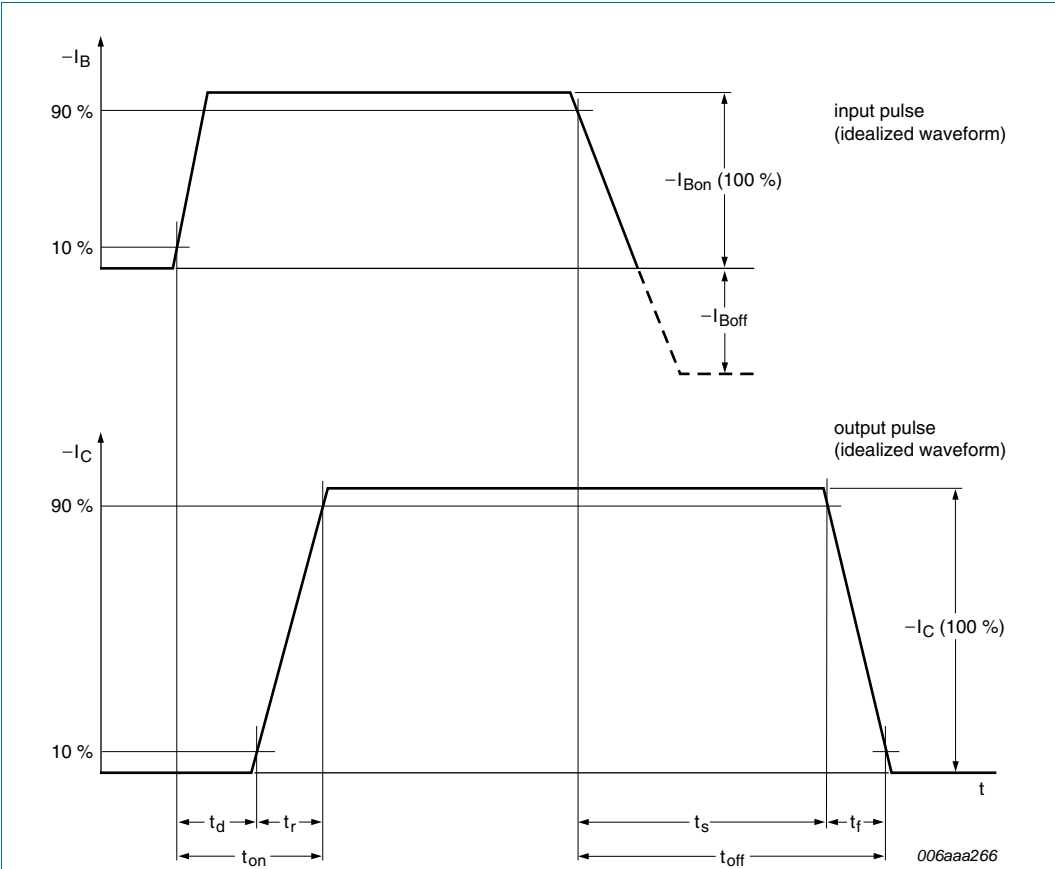


Fig 23. TR2 (PNP): BISS transistor switching time definition

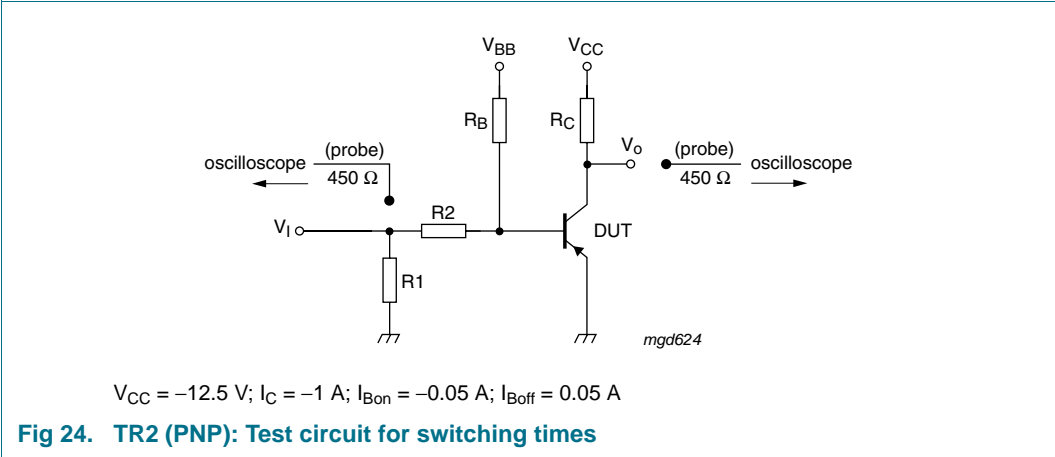
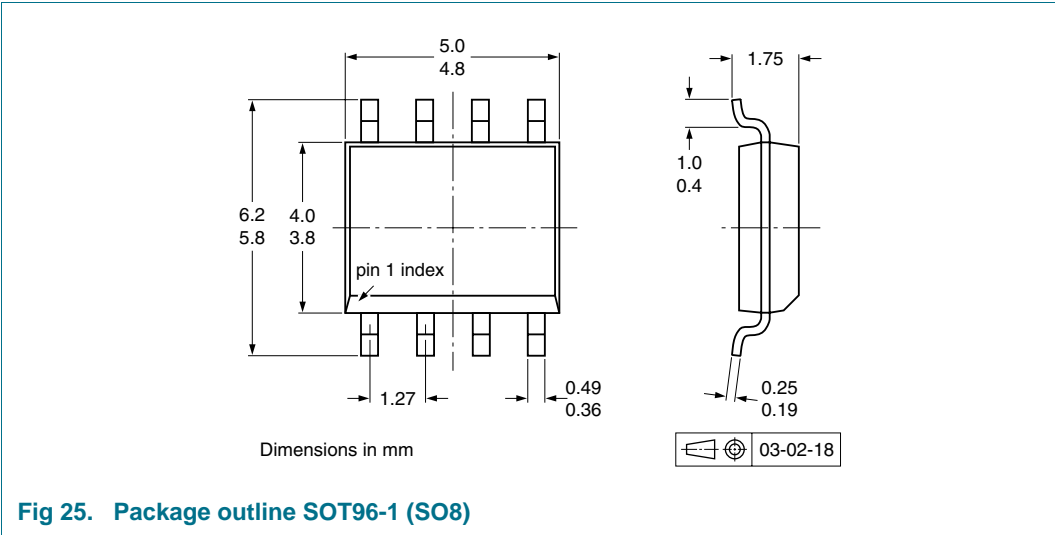


Fig 24. TR2 (PNP): Test circuit for switching times

9. Package outline



10. Packing information

Table 9. Packing methods

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

| Type number | Package | Description | Packing quantity | |
|-------------|---------|---------------------------------|------------------|------|
| | | | 1000 | 2500 |
| PBSS4032SPN | SOT96-1 | 8 mm pitch, 12 mm tape and reel | -115 | -118 |

[1] For further information and the availability of packing methods, see [Section 14](#).

11. Soldering

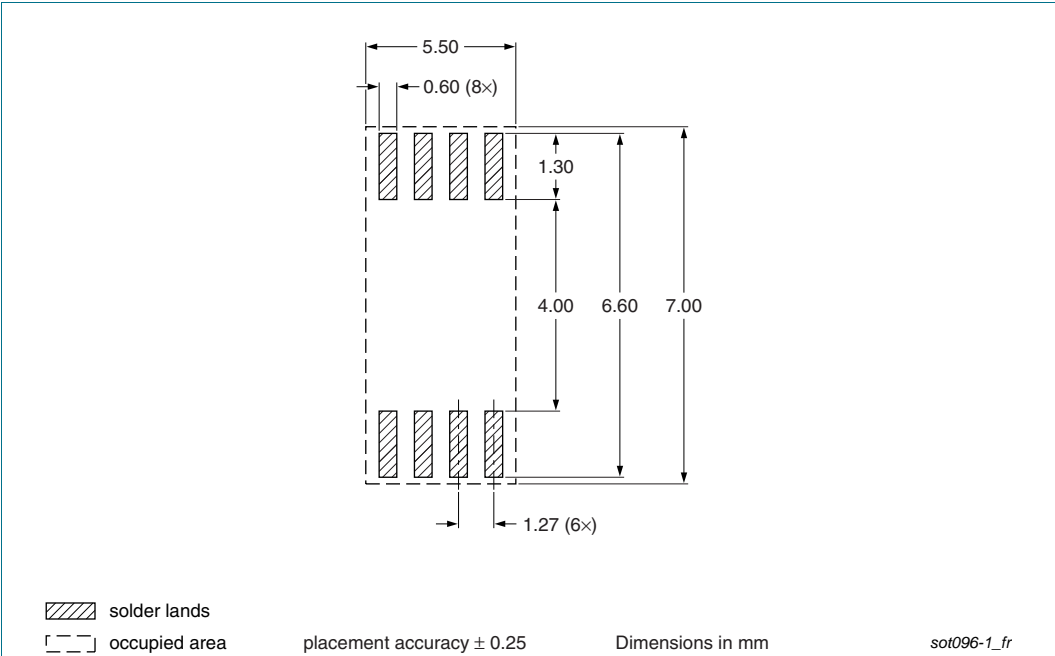


Fig 26. Reflow soldering footprint SOT96-1 (SO8)

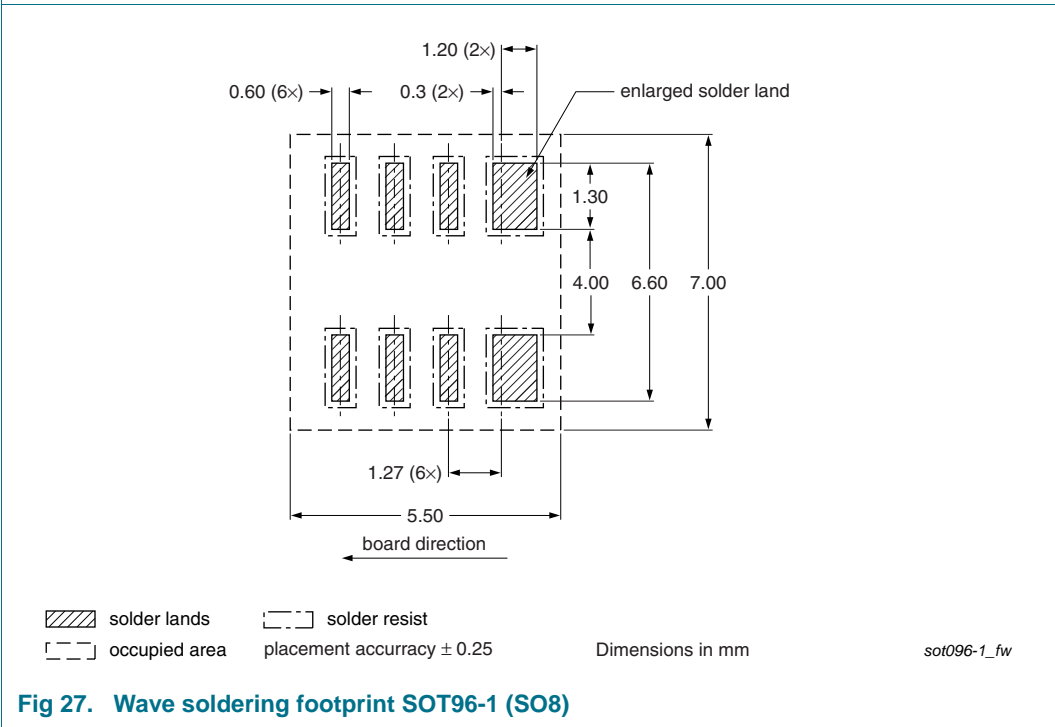


Fig 27. Wave soldering footprint SOT96-1 (SO8)

12. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|---|--------------------|---------------|-----------------|
| PBSS4032SPN v.2 | 20101014 | Product data sheet | - | PBSS4032SPN v.1 |
| Modifications: | • Figure 1 "Per device: Power derating curves" : updated. | | | |
| PBSS4032SPN v.1 | 20100714 | Product data sheet | - | - |

13. Legal information

13.1 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. |
| 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.nexperia.com>.

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For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: salesaddresses@nexperia.com

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