

PBSS5612PA

12 V, 6 A PNP low V_{CEsat} (BISS) transistor

Rev. 01 — 7 May 2010

Product data sheet

1. Product profile

1.1 General description

PNP low V_{CEsat} Breakthrough In Small Signal (BISS) transistor, encapsulated in an ultra thin SOT1061 leadless small Surface-Mounted Device (SMD) plastic package with medium power capability.

NPN complement: PBSS4612PA.

1.2 Features and benefits

- Low collector-emitter saturation voltage V_{CEsat}
- High collector current capability I_C and I_{CM}
- Smaller required Printed-Circuit Board (PCB) area than for conventional transistors
- Exposed heat sink for excellent thermal and electrical conductivity
- Leadless small SMD plastic package with medium power capability

1.3 Applications

- Loadswitch
- Battery-driven devices
- Power management
- Charging circuits
- Power switches (e.g. motors, fans)

1.4 Quick reference data

Table 1. Quick reference data

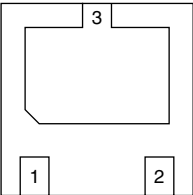
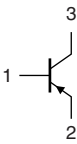
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|--|----------------------------------|-------|-----|-----|------------|
| V_{CEO} | collector-emitter voltage | open base | - | - | -12 | V |
| I_C | collector current | | - | - | -6 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | -7 | A |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = -6$ A; $I_B = -300$ mA | [1] - | 33 | 50 | 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 | Graphic symbol |
|-----|-------------|---|---|
| 1 | base |  <p>Transparent top view</p> |  <p>sym013</p> |
| 2 | emitter | | |
| 3 | collector | | |

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| PBSS5612PA | HUSON3 | plastic thermal enhanced ultra thin small outline package; no leads; three terminals; body 2 × 2 × 0.65 mm | SOT1061 |

4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBSS5612PA | A9 |

5. Limiting values

Table 5. Limiting values

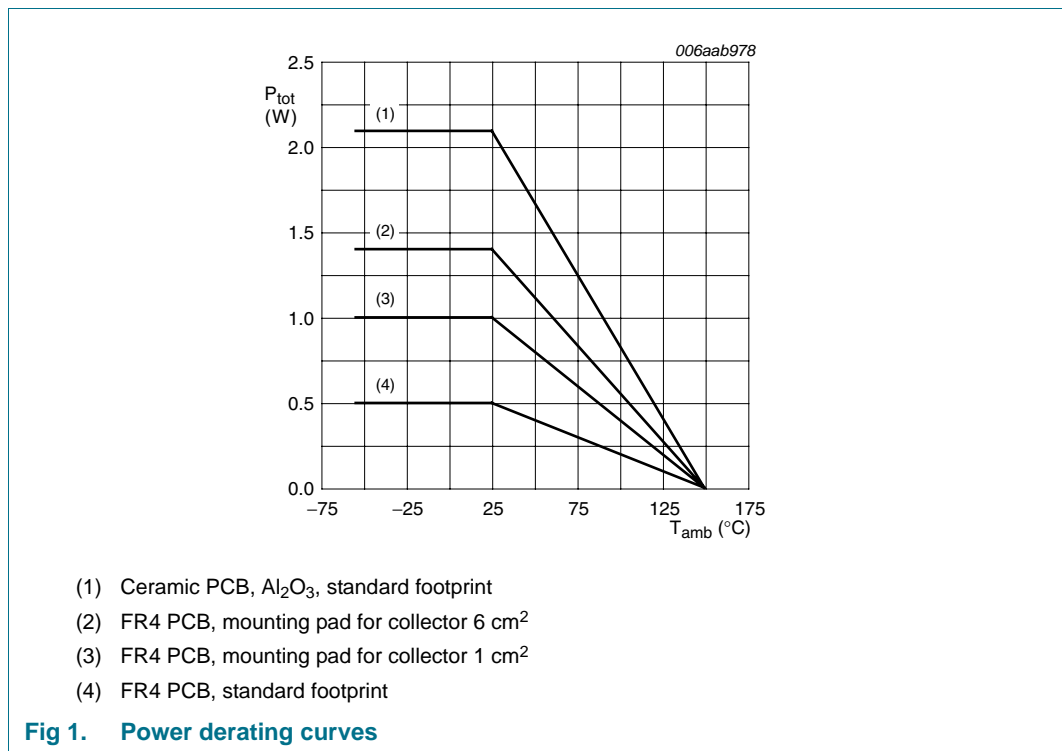
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit | |
|-----------|---------------------------|----------------------------------|-----|------|------|----|
| V_{CBO} | collector-base voltage | open emitter | - | -12 | V | |
| V_{CEO} | collector-emitter voltage | open base | - | -12 | V | |
| V_{EBO} | emitter-base voltage | open collector | - | -7 | V | |
| I_C | collector current | | - | -6 | A | |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | -7 | A | |
| I_B | base current | | - | -600 | mA | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 500 | mW |
| | | | [2] | - | 1 | W |
| | | | [3] | - | 1.4 | W |
| | | | [4] | - | 2.1 | W |

Table 5. Limiting values ...continued
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|----------------------|------------|-----|------|------|
| 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 an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [4] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.

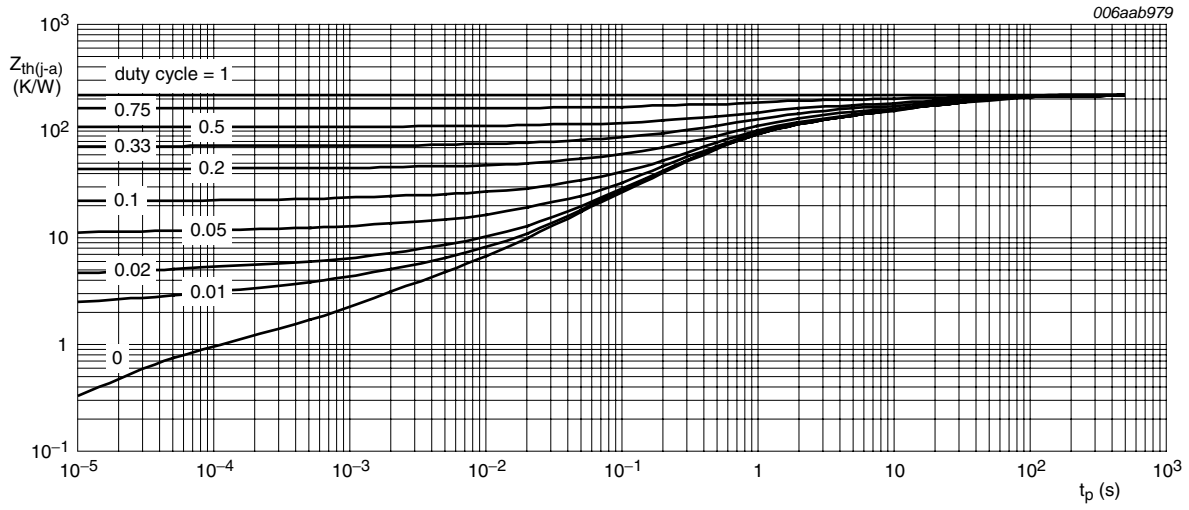


6. Thermal characteristics

Table 6. Thermal characteristics

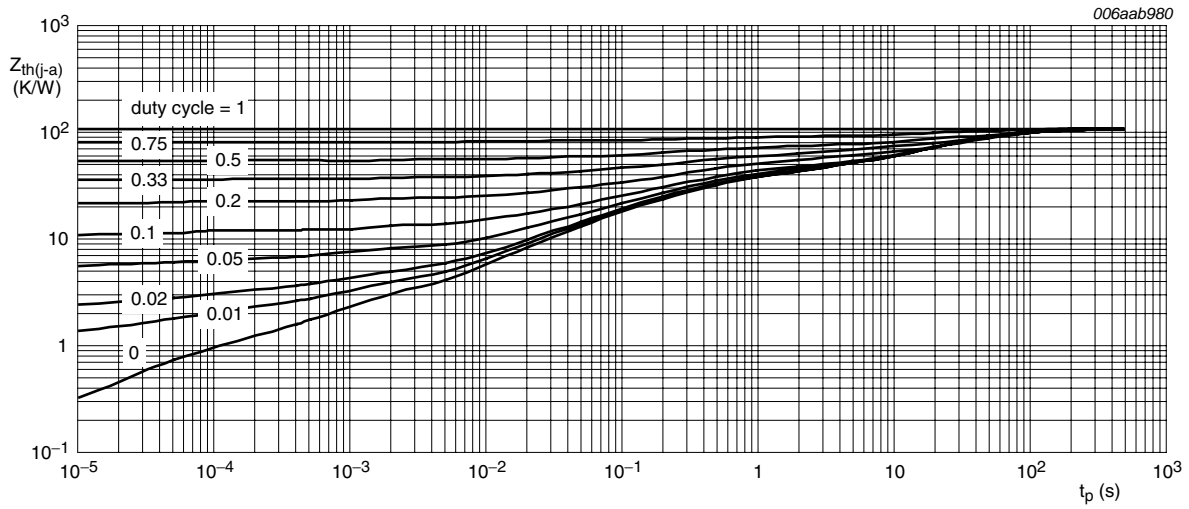
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|---------------|---|-------------|-----|-----|-----|------|-----|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 250 | K/W |
| | | | [2] | - | - | 125 | K/W |
| | | | [3] | - | - | 90 | K/W |
| | | | [4] | - | - | 60 | 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 an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [4] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.



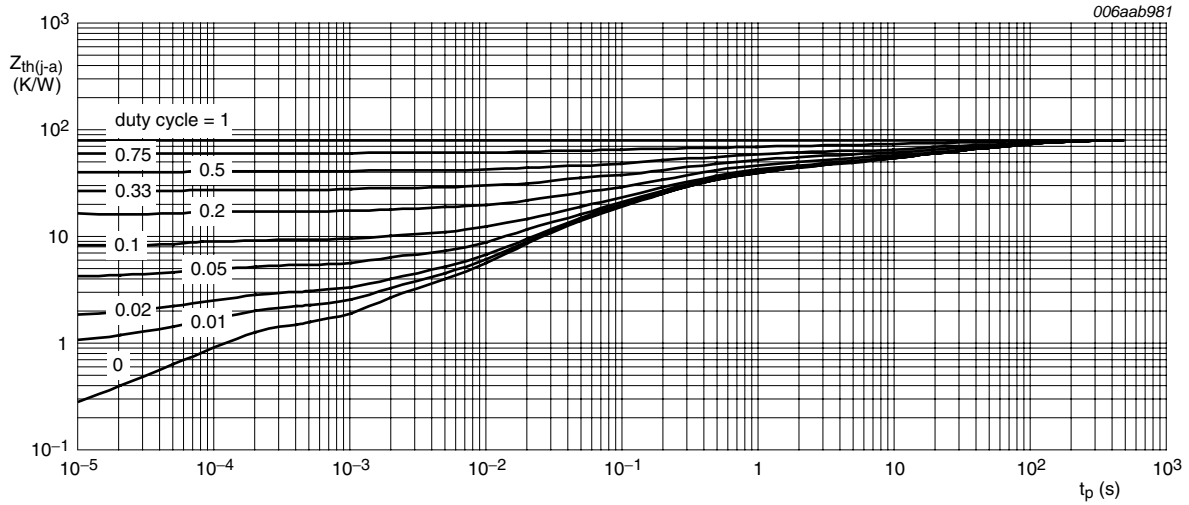
FR4 PCB, standard footprint

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



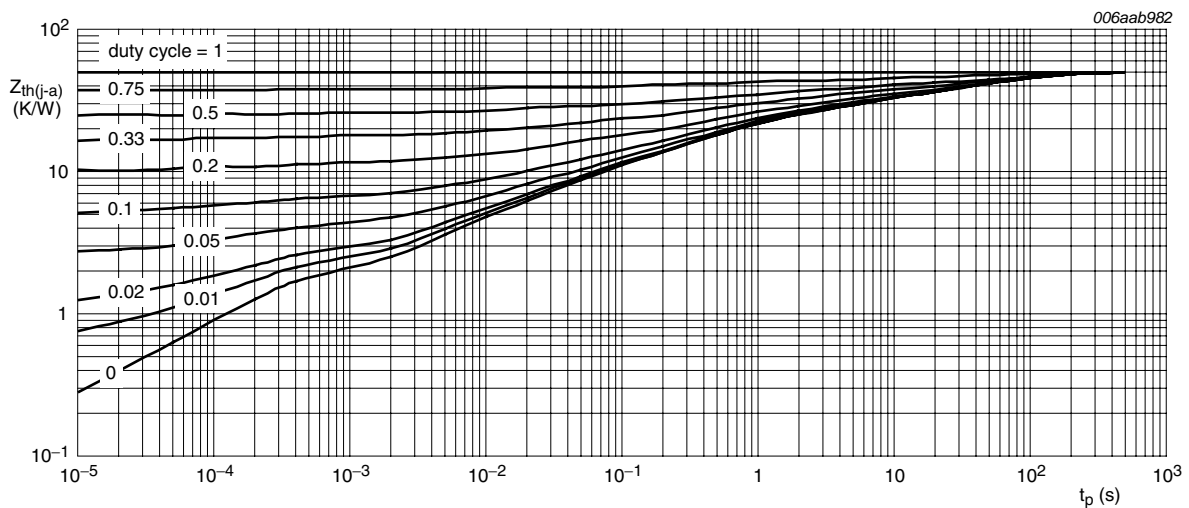
FR4 PCB, mounting pad for collector 1 cm²

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



FR4 PCB, mounting pad for collector 6 cm²

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



Ceramic PCB, Al₂O₃, standard footprint

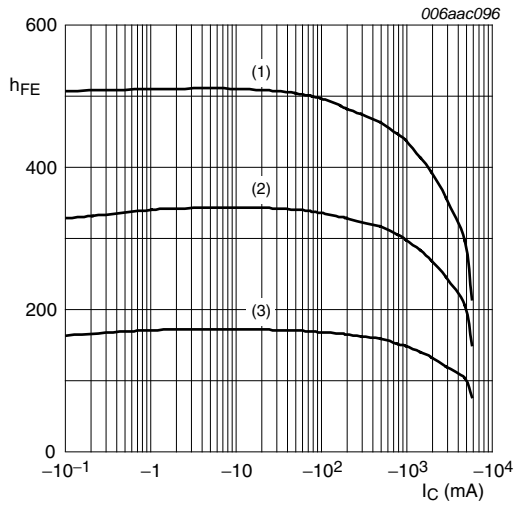
Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

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

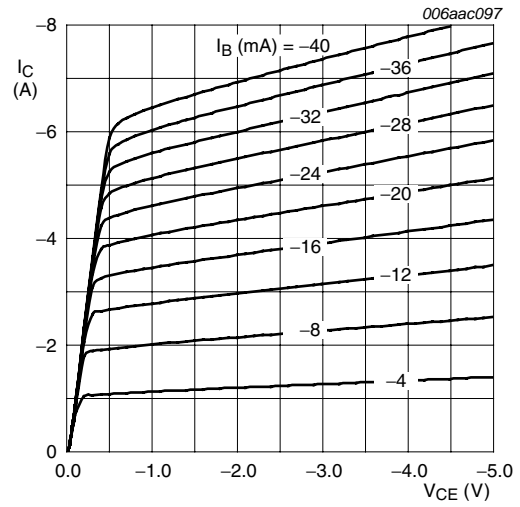
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|-------------|---|---|-----|-----|-------|---------------|------------------|
| I_{CBO} | collector-base cut-off current | $V_{CB} = -9.6\text{ V}; I_E = 0\text{ A}$ | - | - | -100 | nA | |
| | | $V_{CB} = -9.6\text{ V}; I_E = 0\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$ | - | - | -50 | μA | |
| I_{CES} | collector-emitter cut-off current | $V_{CE} = -9.6\text{ V}; V_{BE} = 0\text{ V}$ | - | - | -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] | | | | |
| | | $I_C = -0.5\text{ A}$ | 220 | 335 | - | | |
| | | $I_C = -1\text{ A}$ | 200 | 320 | - | | |
| | | $I_C = -2\text{ A}$ | 190 | 285 | - | | |
| | | $I_C = -6\text{ A}$ | 130 | 190 | - | | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = -0.5\text{ A}; I_B = -50\text{ mA}$ | [1] | - | -20 | -35 | 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 |
| | | $I_C = -2\text{ A}; I_B = -20\text{ mA}$ | [1] | - | -95 | -150 | mV |
| | | $I_C = -3\text{ A}; I_B = -30\text{ mA}$ | [1] | - | -135 | -200 | mV |
| | | $I_C = -4\text{ A}; I_B = -400\text{ mA}$ | [1] | - | -130 | -200 | mV |
| | | $I_C = -6\text{ A}; I_B = -300\text{ mA}$ | [1] | - | -200 | -300 | mV |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = -6\text{ A}; I_B = -300\text{ mA}$ | [1] | - | 33 | 50 | $\text{m}\Omega$ |
| V_{BEsat} | base-emitter saturation voltage | $I_C = -1\text{ A}; I_B = -10\text{ mA}$ | [1] | - | -0.75 | -0.9 | V |
| | | $I_C = -6\text{ A}; I_B = -300\text{ mA}$ | [1] | - | -0.95 | -1.1 | V |
| V_{BEon} | base-emitter turn-on voltage | $V_{CE} = -2\text{ V}; I_C = -2\text{ A}$ | [1] | - | -0.74 | -0.9 | V |
| t_d | delay time | $V_{CC} = -9\text{ V}; I_C = -2\text{ A};$ | - | 23 | - | ns | |
| t_r | rise time | $I_{Bon} = -0.1\text{ A};$ | - | 61 | - | ns | |
| t_{on} | turn-on time | $I_{Boff} = 0.1\text{ A}$ | - | 84 | - | ns | |
| t_s | storage time | | - | 185 | - | ns | |
| t_f | fall time | | - | 60 | - | ns | |
| t_{off} | turn-off time | | - | 245 | - | ns | |
| f_T | transition frequency | $V_{CE} = -10\text{ V};$ $I_C = -100\text{ mA};$ $f = 100\text{ MHz}$ | 40 | 60 | - | MHz | |
| C_c | collector capacitance | $V_{CB} = -10\text{ V};$ $I_E = I_e = 0\text{ A}; f = 1\text{ MHz}$ | - | 140 | 175 | pF | |

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



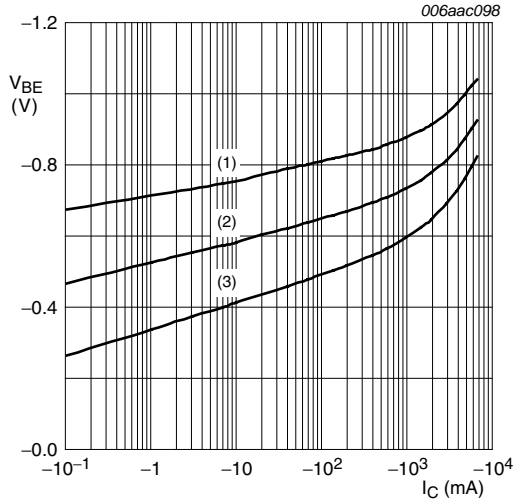
$V_{CE} = -2\text{ V}$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig 6. DC current gain as a function of collector current; typical values



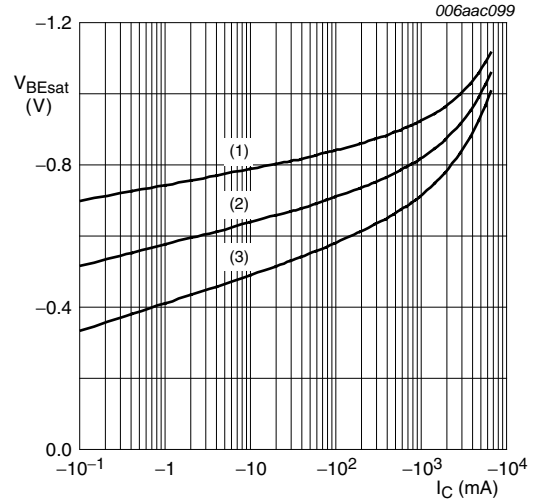
$T_{amb} = 25\text{ °C}$

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



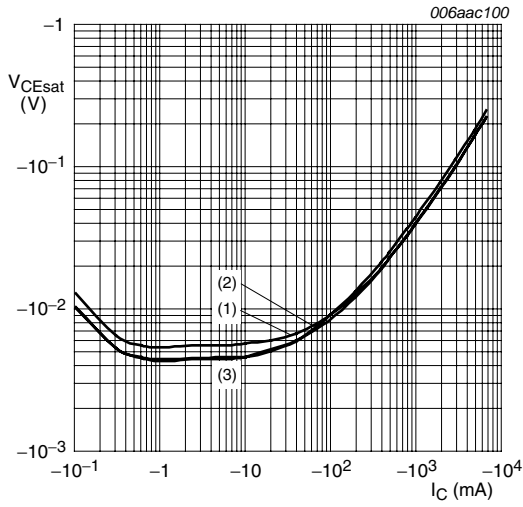
$V_{CE} = -2\text{ V}$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



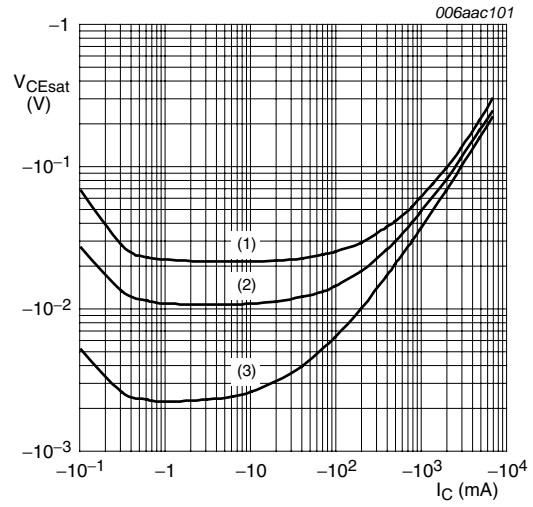
$I_C/I_B = 20$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



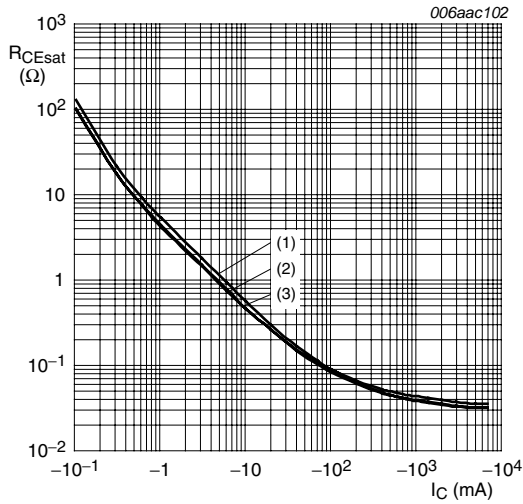
- $I_C/I_B = 20$
- (1) $T_{amb} = 100\text{ °C}$
 - (2) $T_{amb} = 25\text{ °C}$
 - (3) $T_{amb} = -55\text{ °C}$

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



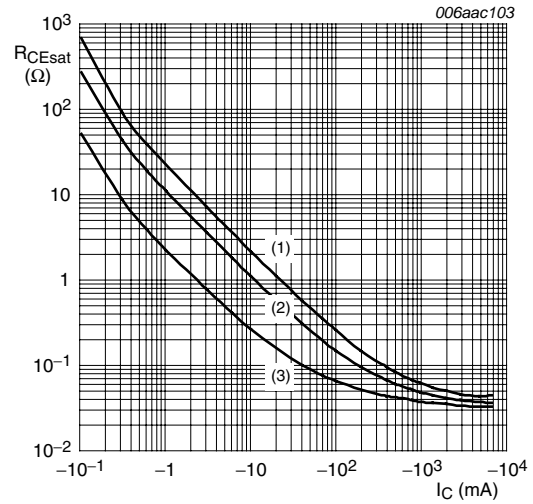
- $T_{amb} = 25\text{ °C}$
- (1) $I_C/I_B = 100$
 - (2) $I_C/I_B = 50$
 - (3) $I_C/I_B = 10$

Fig 11. 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 12. 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 13. Collector-emitter saturation resistance as a function of collector current; typical values

8. Test information

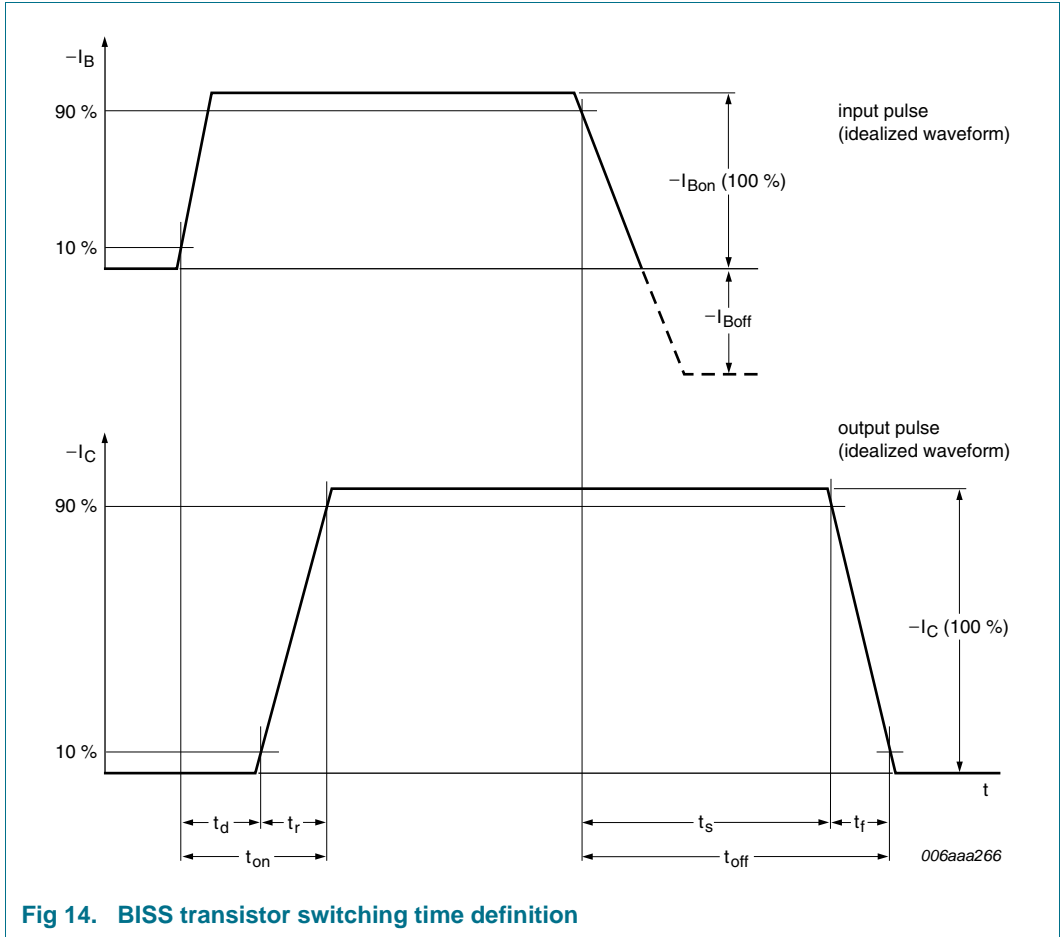
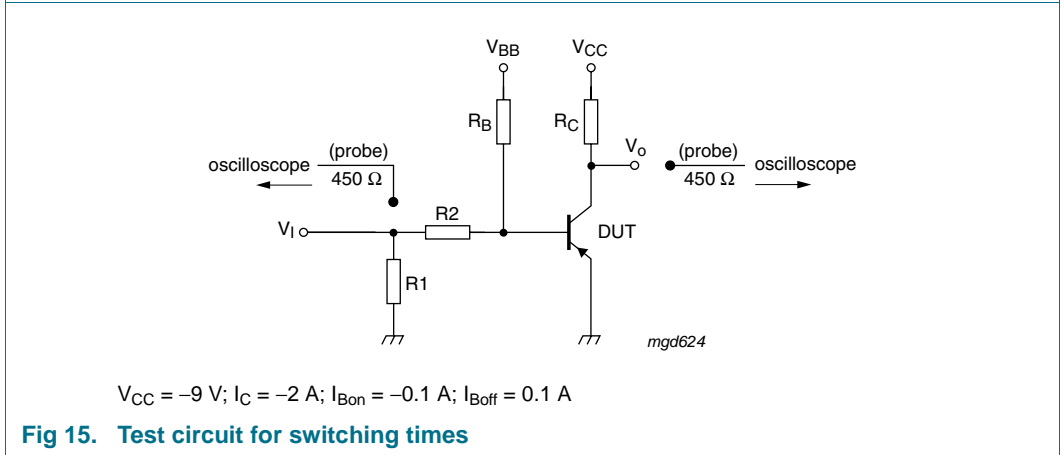


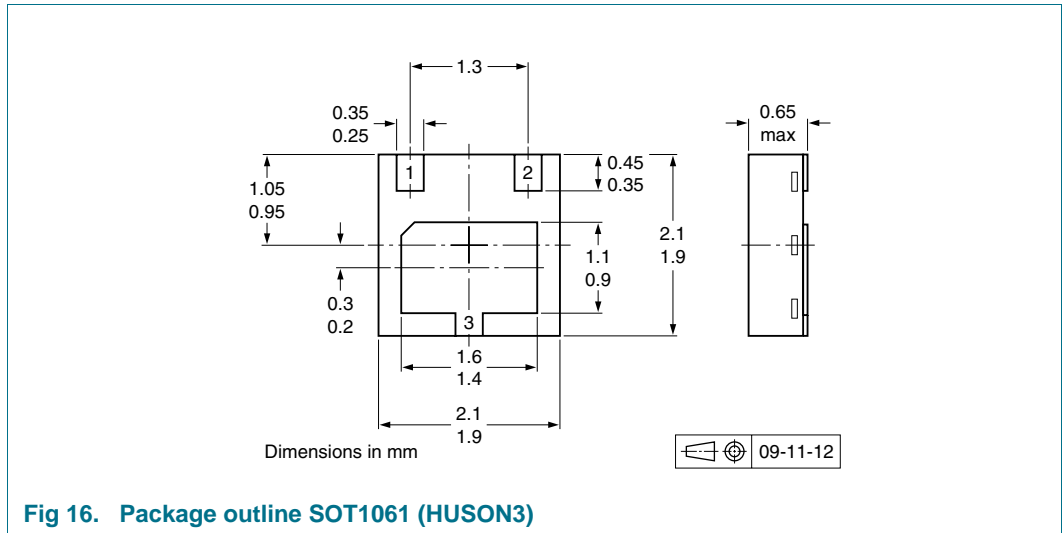
Fig 14. BISS transistor switching time definition



$V_{CC} = -9\text{ V}; I_C = -2\text{ A}; I_{Bon} = -0.1\text{ A}; I_{Boff} = 0.1\text{ A}$

Fig 15. Test circuit for switching times

9. Package outline



10. Packing information

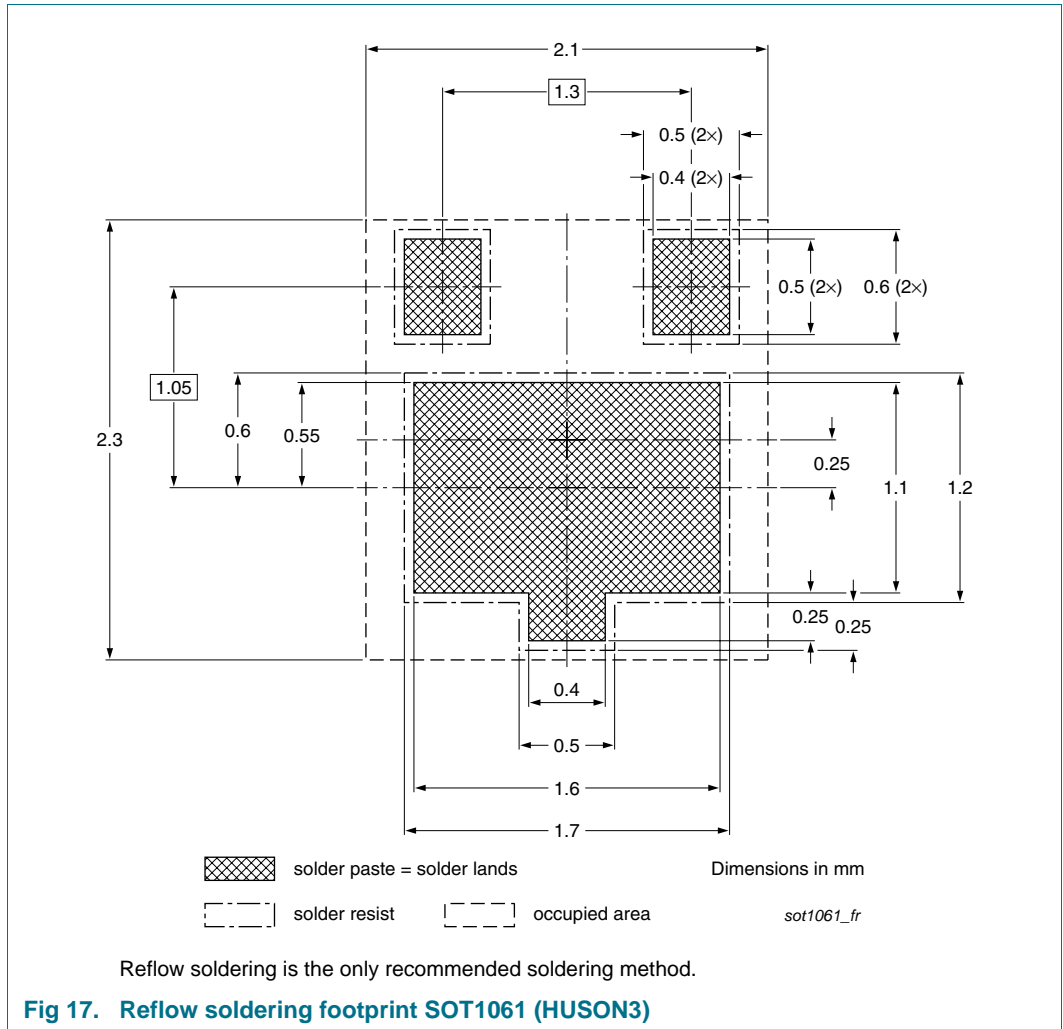
Table 8. Packing methods

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

| Type number | Package | Description | Packing quantity |
|-------------|---------|--------------------------------|------------------|
| PBSS5612PA | SOT1061 | 4 mm pitch, 8 mm tape and reel | 3000 |
| | | | -115 |

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

11. Soldering



12. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--------------|--------------------|---------------|------------|
| PBSS5612PA v.1 | 20100507 | 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".

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

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