



PBSS4330PA

30 V, 3 A NPN low V_{CEsat} (BISS) transistor

7 April 2015

Product data sheet

1. General description

NPN 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.

PNP complement: PBSS5330PA.

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

3. Applications

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

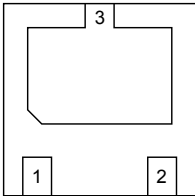
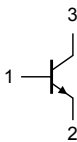
4. Quick reference data

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 | | - | - | 3 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | 5 | A |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 3$ A; $I_B = 300$ mA; pulsed; $t_p \leq 300$ μ s; $\delta \leq 0.02$; $T_{amb} = 25$ °C | - | 75 | 100 | m Ω |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|--|---|
| 1 | B | base |  <p>Transparent top view DFN2020-3 (SOT1061)</p> |  <p>sym021</p> |
| 2 | E | emitter | | |
| 3 | C | collector | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|-----------|---|---------|
| | Name | Description | Version |
| PBSS4330PA | DFN2020-3 | DFN2020-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 x 2 x 0.65 mm | SOT1061 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBSS4330PA | AH |

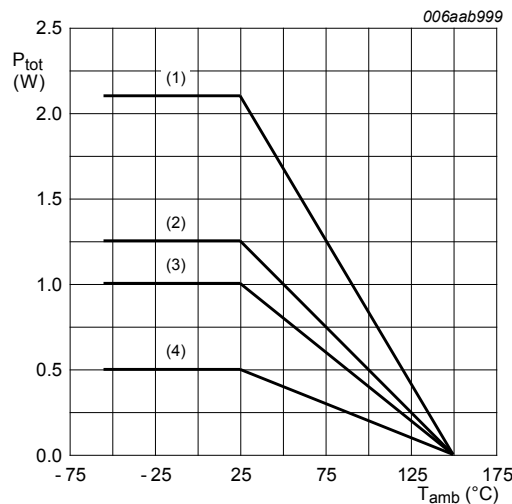
8. Limiting values

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 | | - | 50 | V |
| V_{CEO} | collector-emitter voltage | open base | | - | 30 | V |
| V_{EBO} | emitter-base voltage | open collector | | - | 6 | V |
| I_C | collector current | | | - | 3 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | | - | 5 | A |
| I_B | base current | | | - | 500 | mA |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 500 | mW |
| | | | [2] | - | 1 | W |
| | | | [3] | - | 1.25 | W |
| | | | [4] | - | 2.1 | 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 an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [4] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.



- (1) Ceramic PCB, Al₂O₃, standard footprint
- (2) FR4 PCB, mounting pad for collector 6 cm²
- (3) FR4 PCB, mounting pad for collector 1 cm²
- (4) FR4 PCB, standard footprint

Fig. 1. Power derating curves

9. 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] | - | - | 100 | 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.

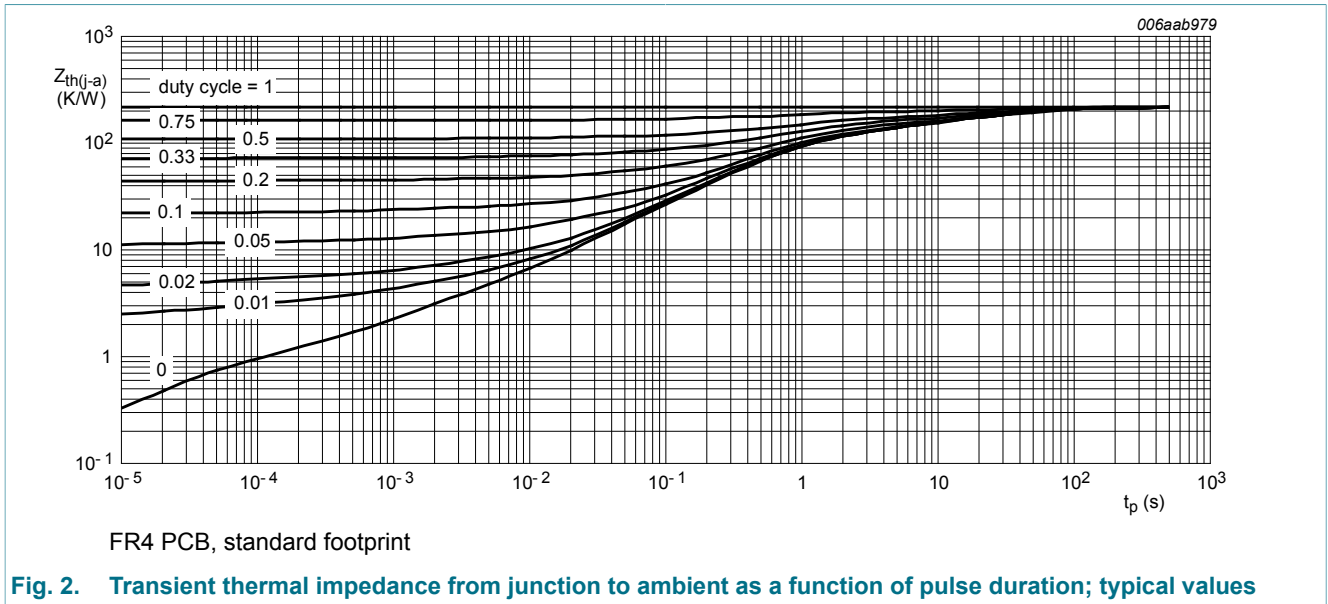
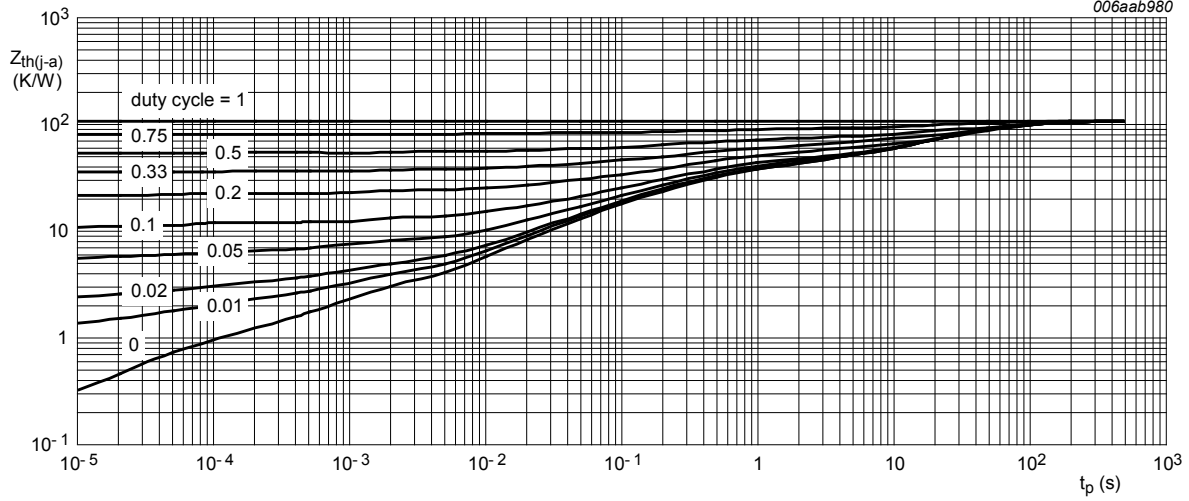
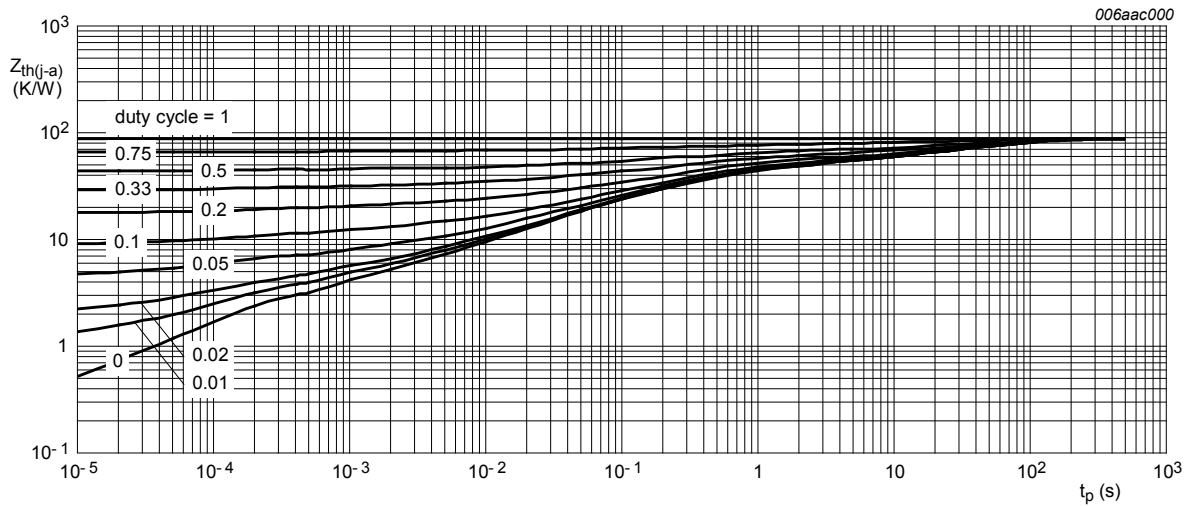


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



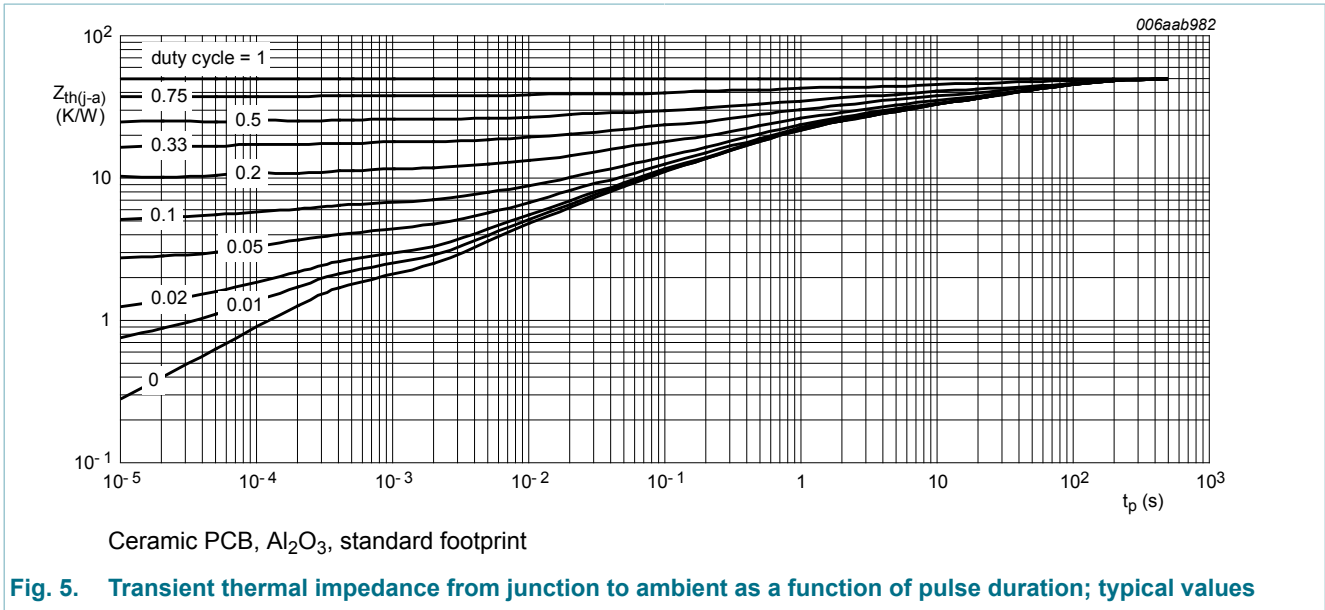
FR4 PCB, mounting pad for collector 1 cm²

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

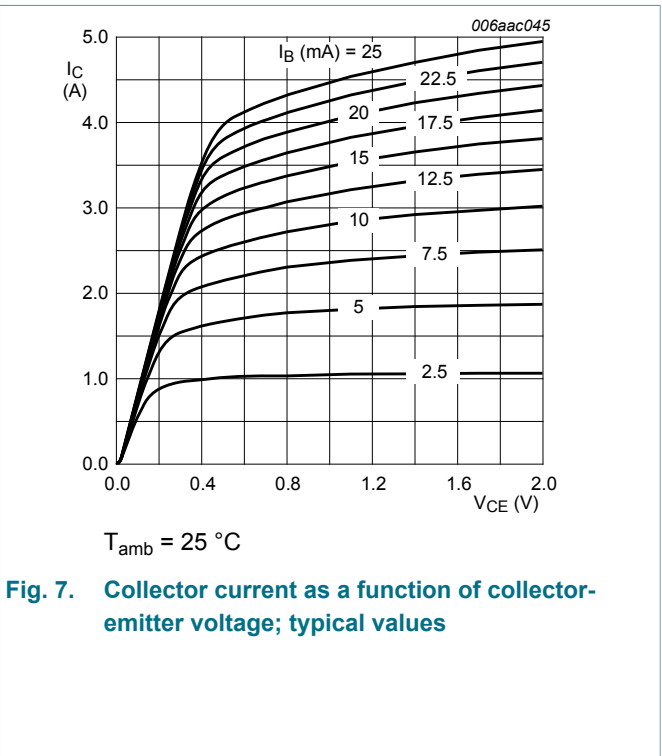
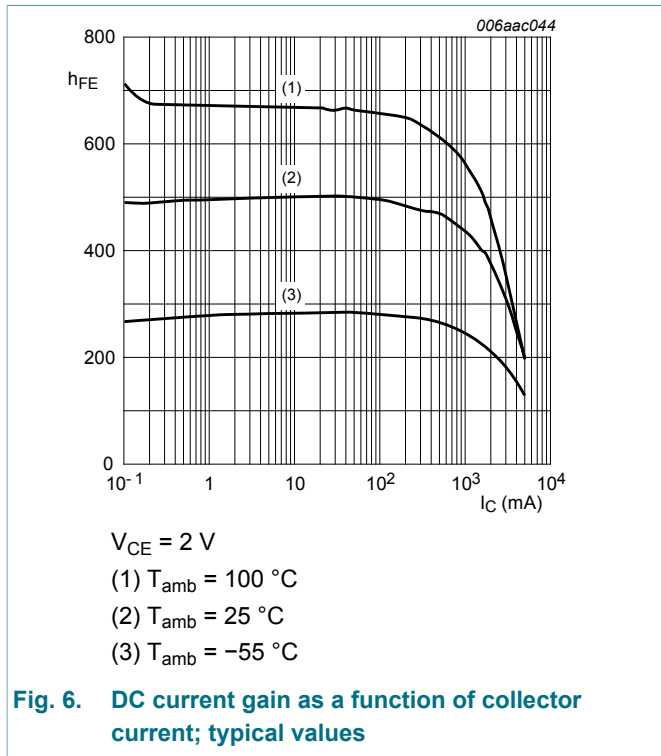


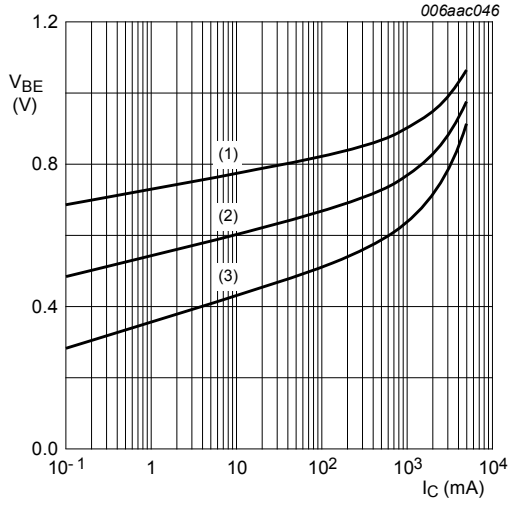
10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------|---|---|-----|------|-----|------|
| I _{CBO} | collector-base cut-off current | V _{CB} = 30 V; I _E = 0 A; T _{amb} = 25 °C | - | - | 100 | nA |
| | | V _{CB} = 30 V; I _E = 0 A; T _j = 150 °C | - | - | 50 | μA |
| I _{CES} | collector-emitter cut-off current | V _{CE} = 24 V; V _{BE} = 0 V; T _{amb} = 25 °C | - | - | 100 | nA |
| I _{EBO} | emitter-base cut-off current | V _{EB} = 5 V; I _C = 0 A; T _{amb} = 25 °C | - | - | 100 | nA |
| h _{FE} | DC current gain | V _{CE} = 2 V; I _C = 0.5 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | 300 | 465 | - | |
| | | V _{CE} = 2 V; I _C = 1 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | 270 | 435 | 700 | |
| | | V _{CE} = 2 V; I _C = 2 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | 230 | 370 | - | |
| | | V _{CE} = 2 V; I _C = 3 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | 180 | 310 | - | |
| V _{CEsat} | collector-emitter saturation voltage | I _C = 0.5 A; I _B = 50 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | - | 40 | 60 | mV |
| | | I _C = 1 A; I _B = 50 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | - | 80 | 110 | mV |
| | | I _C = 2 A; I _B = 100 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | - | 155 | 220 | mV |
| | | I _C = 3 A; I _B = 300 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | - | 220 | 300 | mV |
| R _{CEsat} | collector-emitter saturation resistance | t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | - | 75 | 100 | mΩ |
| V _{BEsat} | base-emitter saturation voltage | I _C = 2 A; I _B = 100 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | - | 0.95 | 1.1 | V |
| | | I _C = 3 A; I _B = 300 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | - | 1.07 | 1.2 | V |
| V _{BEon} | base-emitter turn-on voltage | V _{CE} = 2 V; I _C = 1 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02 ; T _{amb} = 25 °C | - | 0.76 | 1 | V |
| t _d | delay time | V _{CC} = 9 V; I _C = 2 A; I _{Bon} = 0.1 A; I _{Boff} = -0.1 A; T _{amb} = 25 °C | - | 11 | - | ns |
| t _r | rise time | | - | 52 | - | ns |
| t _{on} | turn-on time | | - | 63 | - | ns |
| t _s | storage time | | - | 230 | - | ns |
| t _f | fall time | | - | 40 | - | ns |
| t _{off} | turn-off time | | - | 270 | - | ns |

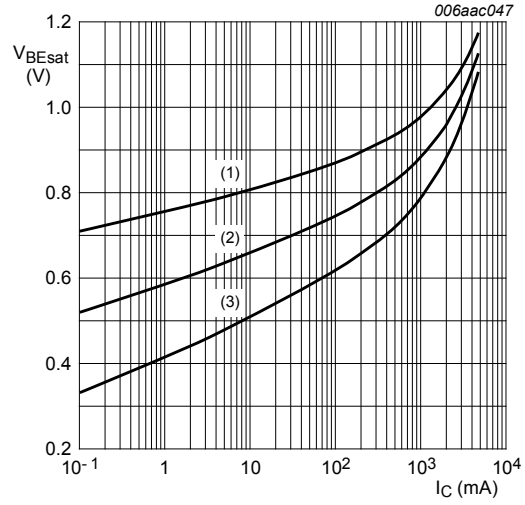
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------|-----------------------|--|-----|-----|-----|------|
| f_T | transition frequency | $V_{CE} = 5\text{ V}; I_C = 100\text{ mA}; f = 100\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$ | 100 | 210 | - | MHz |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$ | - | 21 | 30 | pF |





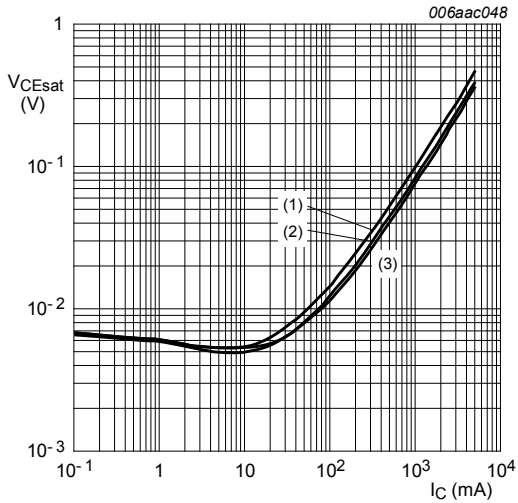
$V_{CE} = 2\text{ V}$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



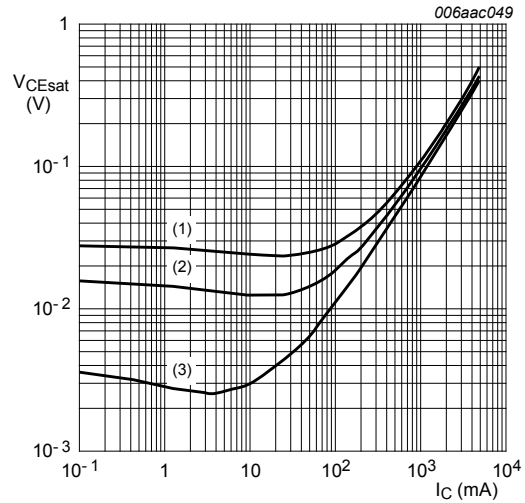
$I_C/I_B = 20$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 100\text{ °C}$

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



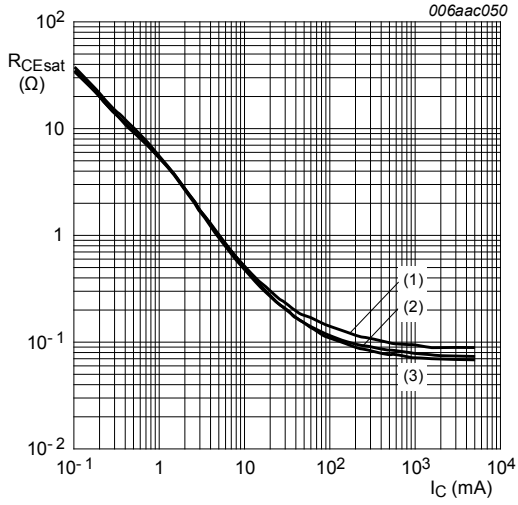
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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) $I_C/I_B = 10$

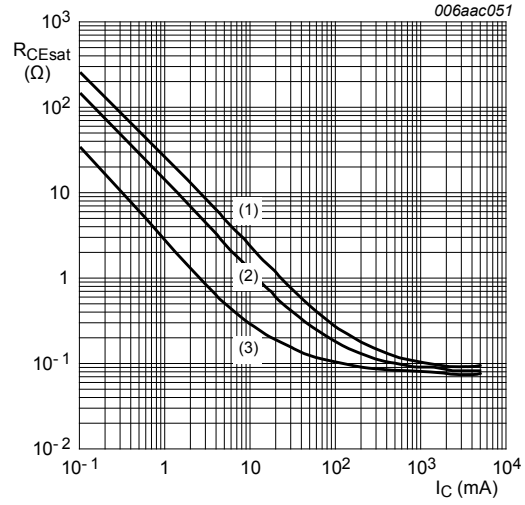
Fig. 11. Collector-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

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

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



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

- (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

11. Test information

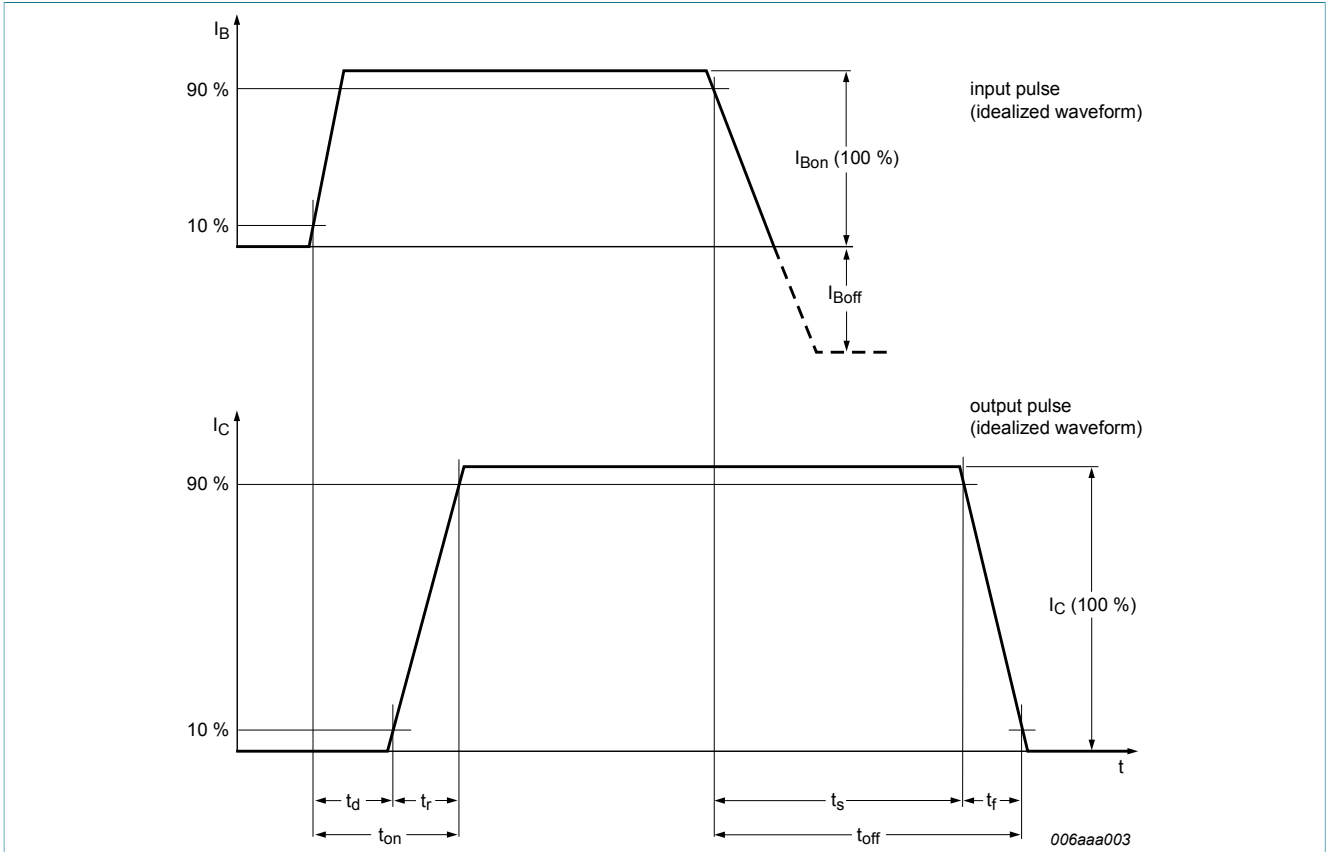


Fig. 14. BISS transistor switching time definition

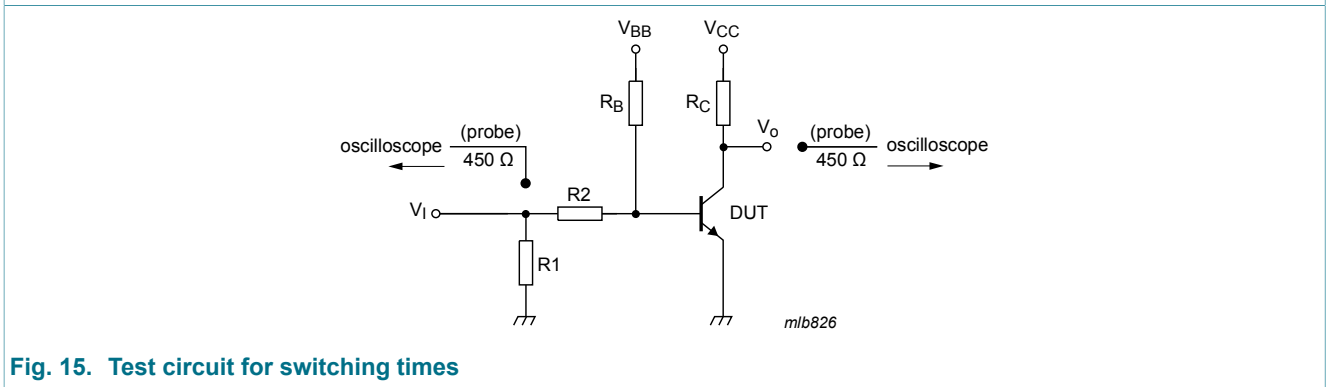


Fig. 15. Test circuit for switching times

12. Package outline

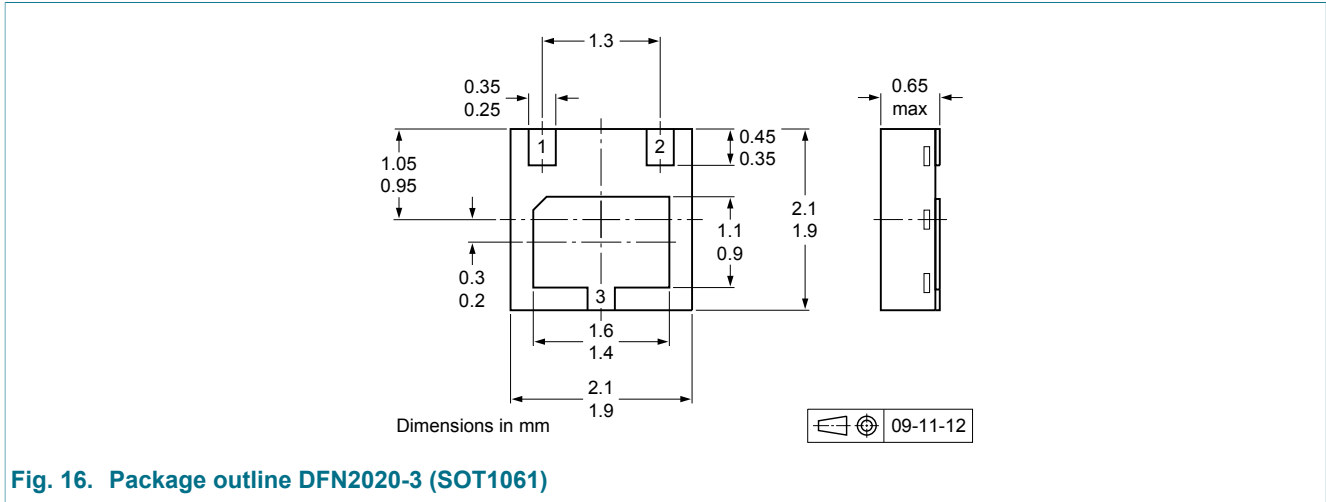


Fig. 16. Package outline DFN2020-3 (SOT1061)

13. Soldering

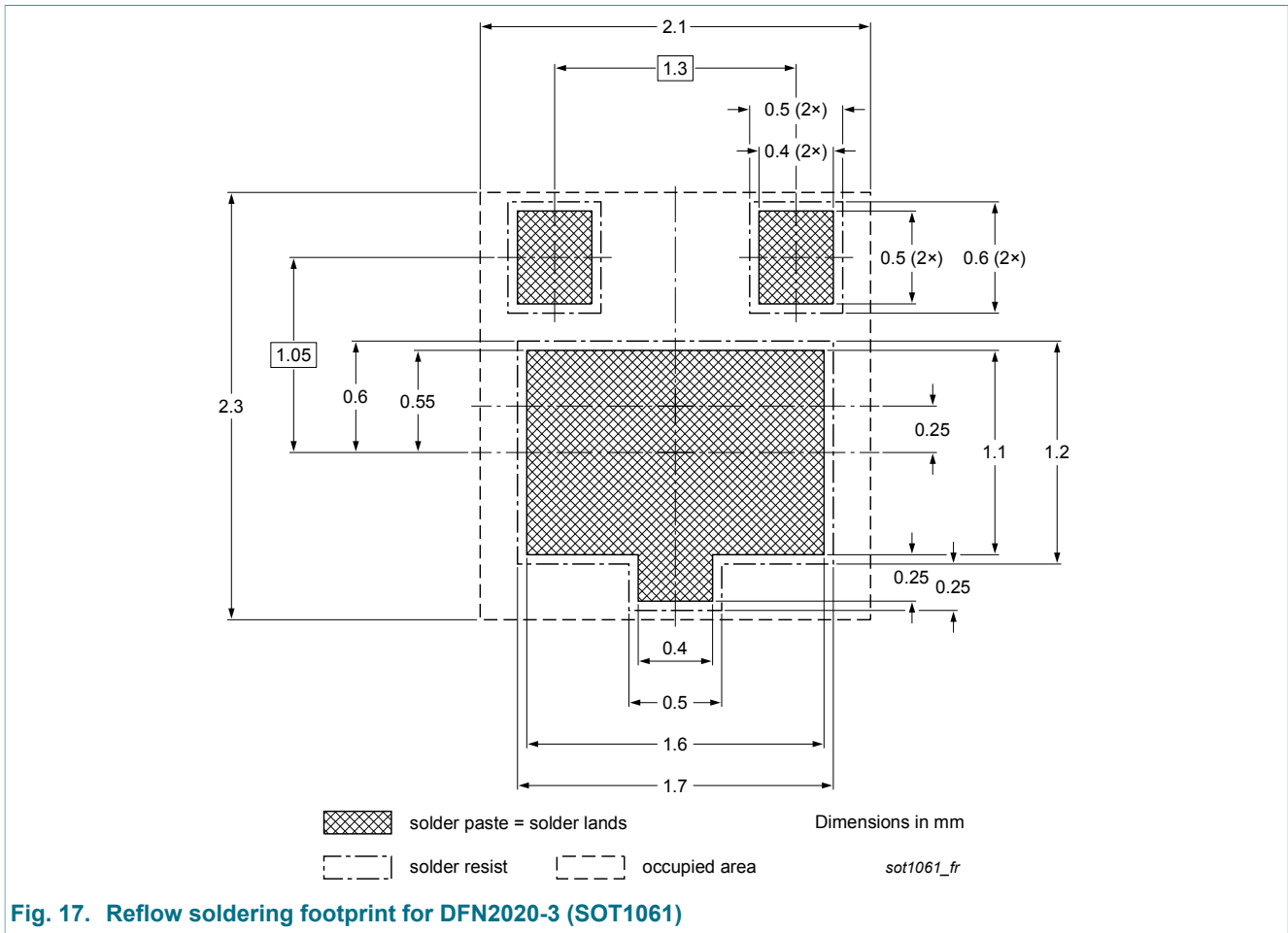


Fig. 17. Reflow soldering footprint for DFN2020-3 (SOT1061)

14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|--------------------|---------------|----------------|
| PBSS4330PA v.2 | 20150407 | Product data sheet | - | PBSS4330PA v.1 |
| Modifications: | <ul style="list-style-type: none">Condition V_{CE} changed for parameter I_{CES} in Table 7, Characteristics | | | |
| PBSS4330PA v.1 | 20100419 | Product data sheet | - | - |

15. Legal information

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|--------------------------------|--------------------|---|
| 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. |

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- [2] The term 'short data sheet' is explained in section "Definitions".
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