



THE DATASHEET OF PBSS4330PASX





PBSS4330PAS

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

11 September 2014

Product data sheet

1. General description

NPN low V_{CEsat} Breakthrough In Small Signal (BISS) transistor, encapsulated in an ultra thin DFN2020D-3 (SOT1061D) leadless small Surface-Mounted Device (SMD) plastic package with medium power capability and visible and solderable side pads.

PNP complement: PBSS5330PAS

2. Features and benefits

- 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
- High temperature applications up to 175 °C
- Reduced Printed-Circuit Board (PCB) area requirements
- Leadless small SMD plastic package with solderable side pads
- Exposed heat sink for excellent thermal and electrical conductivity
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- AEC-Q101 qualified

3. Applications

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

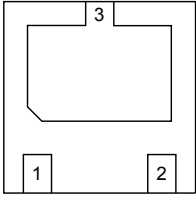
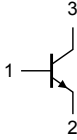
4. Quick reference data

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 DFN2020D-3 (SOT1061D)</p> |  <p>sym021</p> |
| 2 | E | emitter | | |
| 3 | C | collector | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|------------|--|----------|
| | Name | Description | Version |
| PBSS4330PAS | DFN2020D-3 | DFN2020D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 x 2 x 0.65 mm | SOT1061D |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBSS4330PAS | E1 |

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] | - | 600 | mW |
| | | | [2][3] | - | 1.2 | W |
| | | | [4] | - | 1.5 | W |
| | | | [5][6] | - | 2.5 | W |
| T_j | junction temperature | | | - | 175 | °C |
| T_{amb} | ambient temperature | | | -55 | 175 | °C |
| T_{stg} | storage temperature | | | -65 | 175 | °C |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

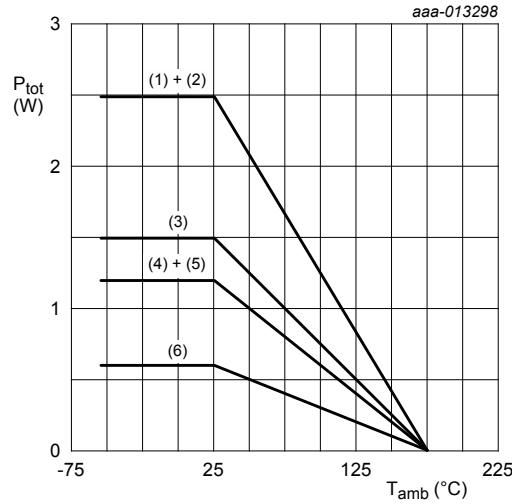
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².

[3] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².

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

[6] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm².



- (1) Ceramic PCB, single-sided copper, standard footprint
- (2) FR4 PCB, 4-layer copper, 1 cm²
- (3) FR4 PCB, single-sided copper, 6 cm²
- (4) FR4 PCB, single-sided copper, 1 cm²
- (5) FR4 PCB, 4-layer copper, standard footprint
- (6) FR4 PCB, single-sided copper, 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][3] | - | - | 125 | K/W |
| | | | [4] | - | - | 100 | K/W |
| | | | [5][6] | - | - | 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, 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [5] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.
- [6] Device mounted on a FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm².

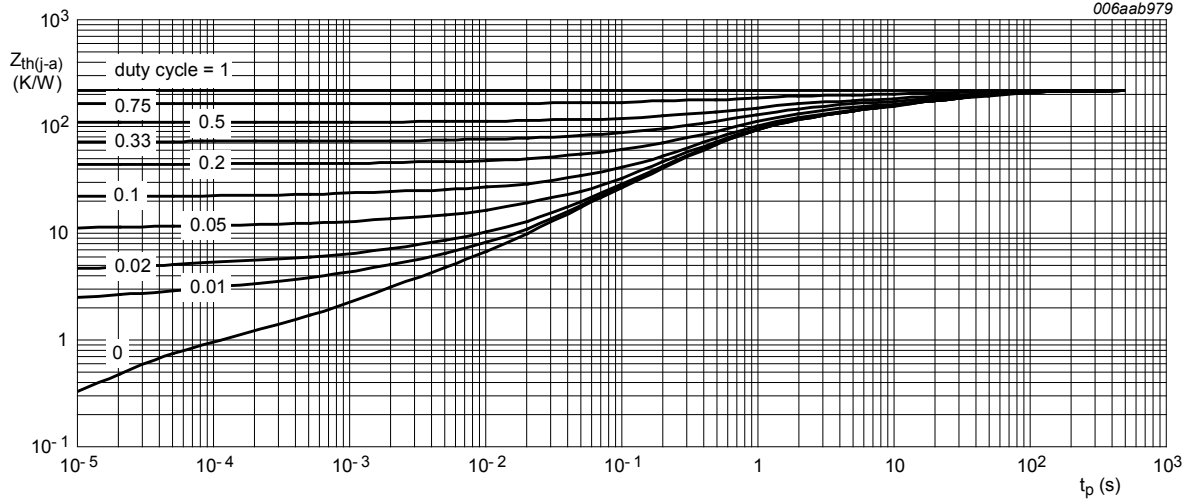


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

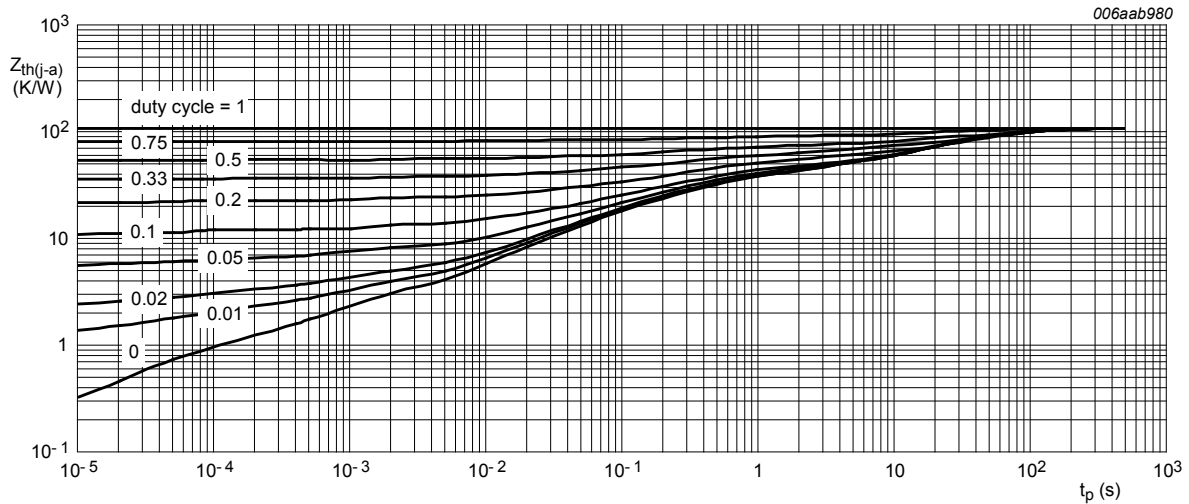
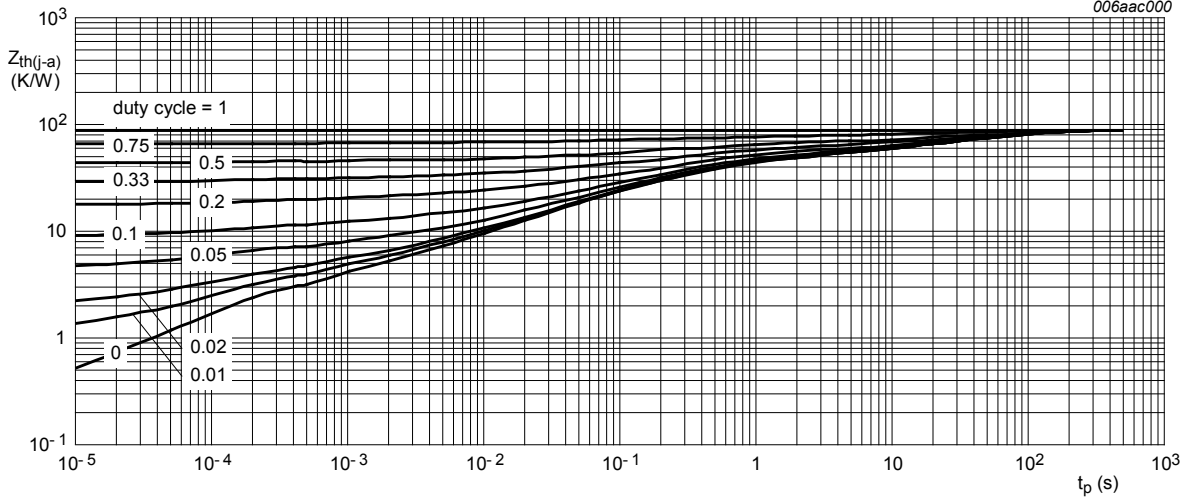
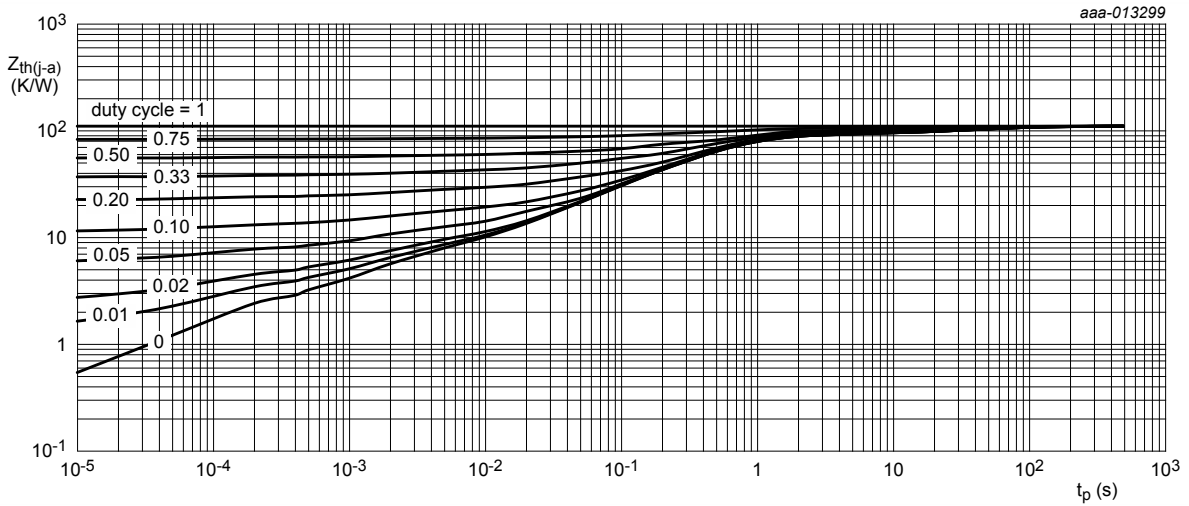


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



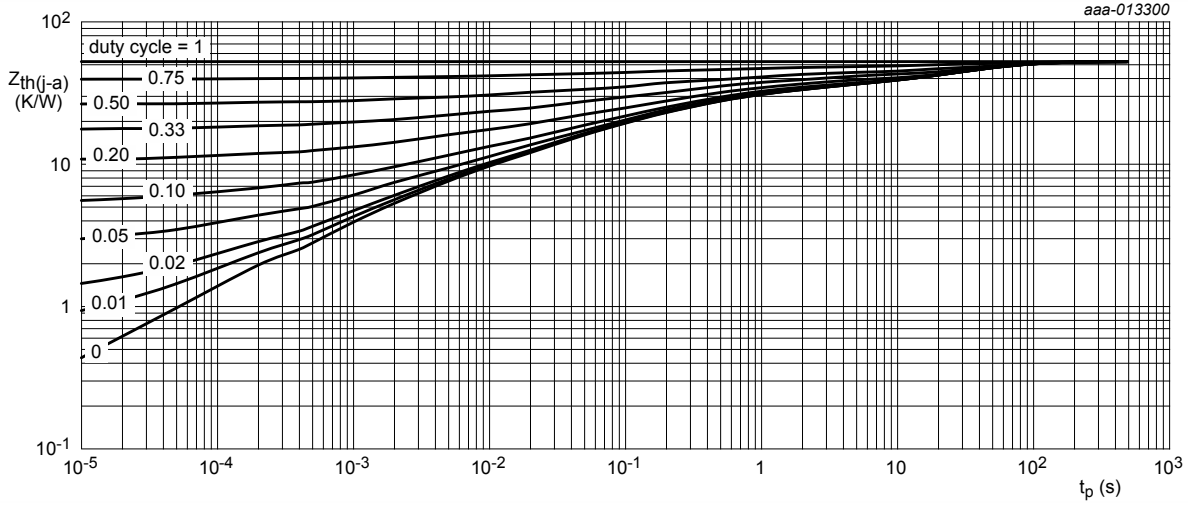
FR4 PCB, mounting pad for collector 6 cm²

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



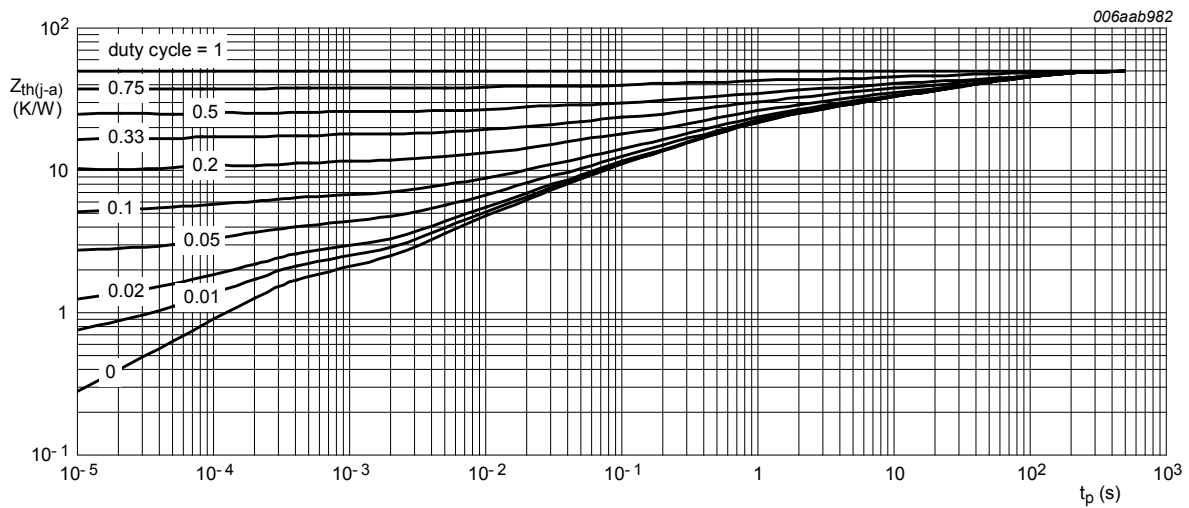
FR4 PCB, 4-layer copper, standard footprint

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



FR4 PCB, 4-layer copper, mounting pad for collector 1 cm^2

Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



Ceramic PCB, Al_2O_3 , standard footprint

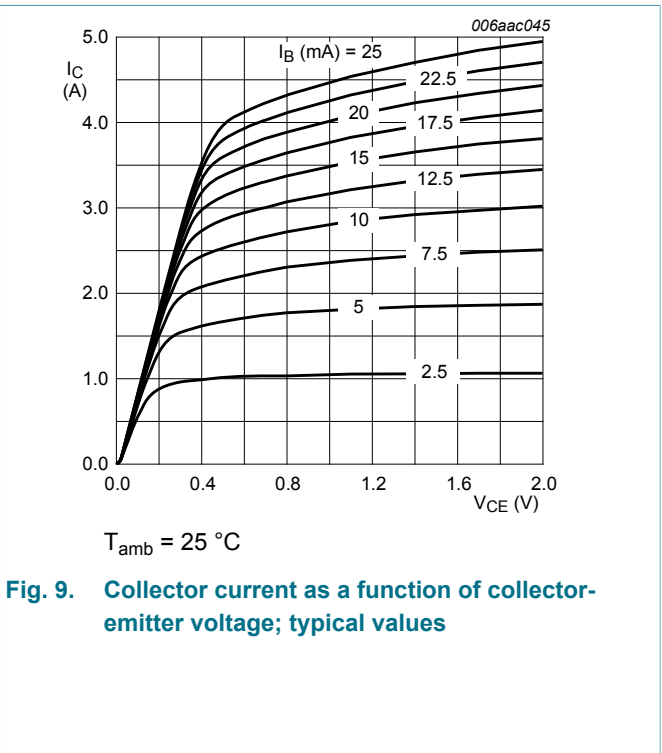
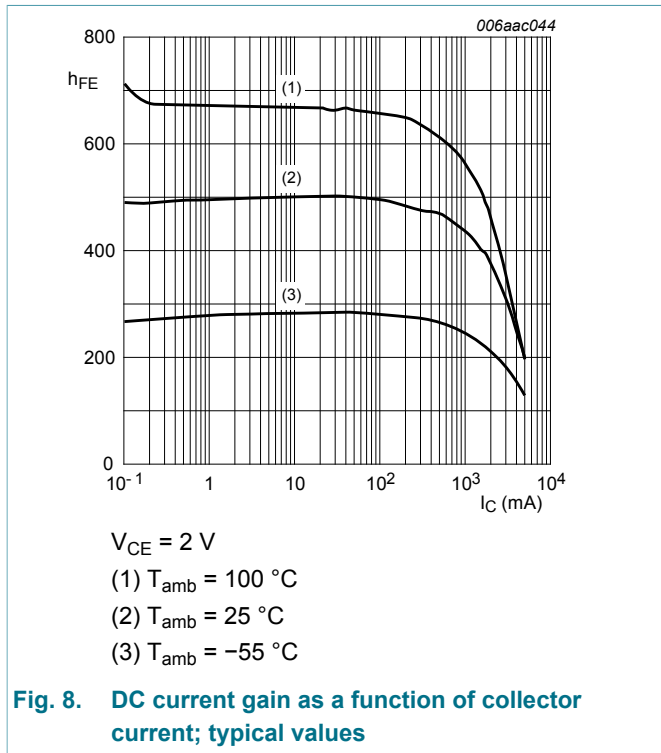
Fig. 7. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------|---|---|-----|------|-----|------|
| I _{CBO} | collector-base cut-off current | V _{CB} = 24 V; I _E = 0 A; T _{amb} = 25 °C | - | - | 100 | nA |
| | | V _{CB} = 24 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 |



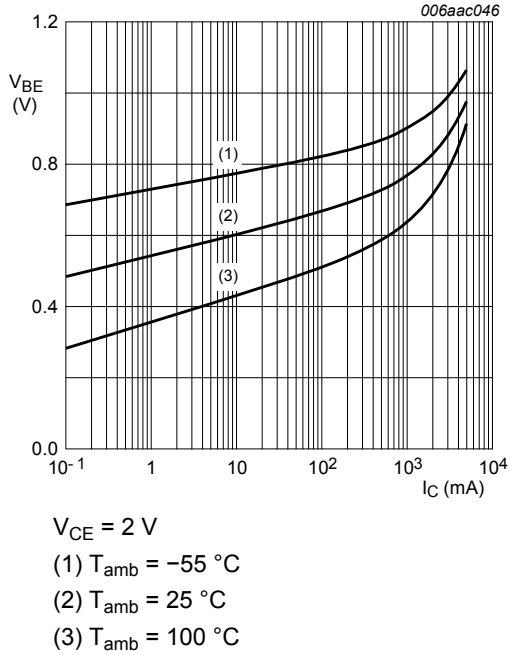


Fig. 10. Base-emitter voltage as a function of collector current; typical values

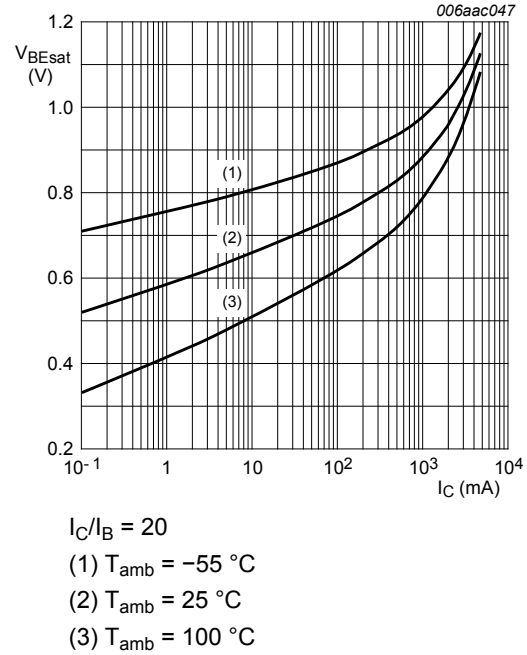


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values

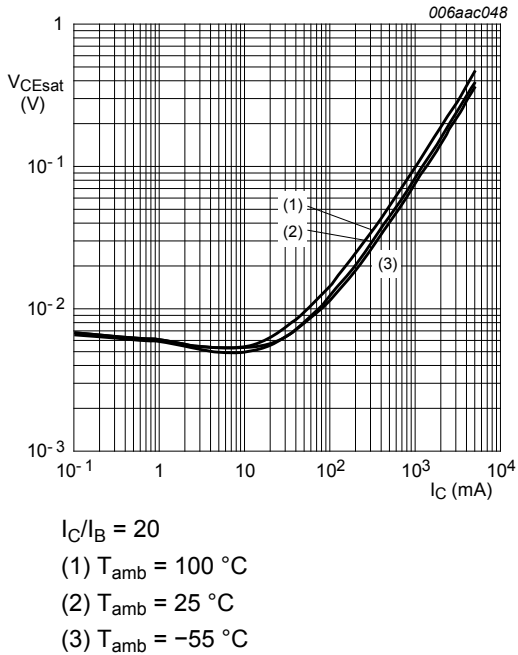


Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values

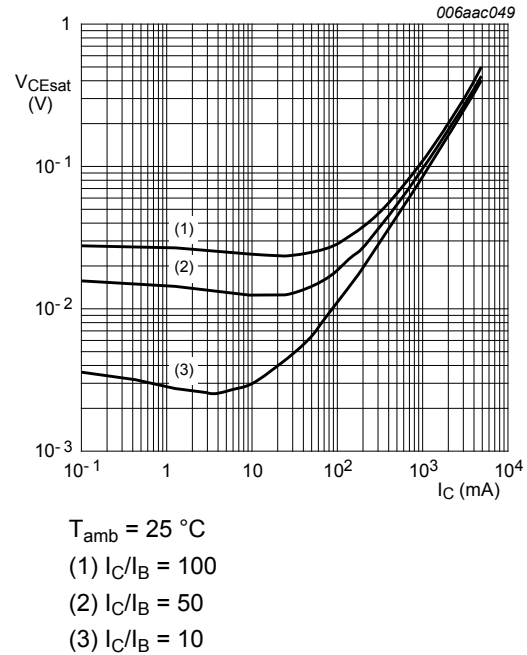
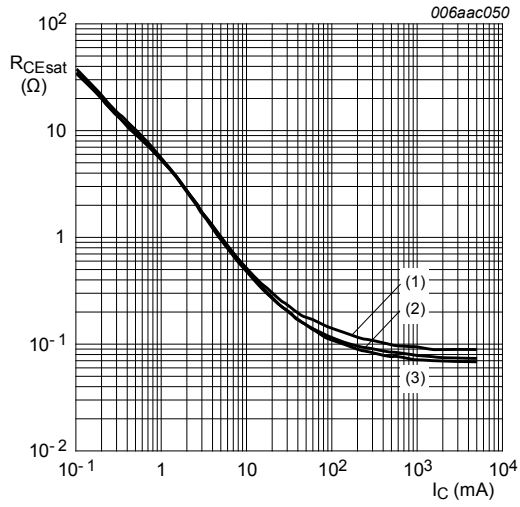


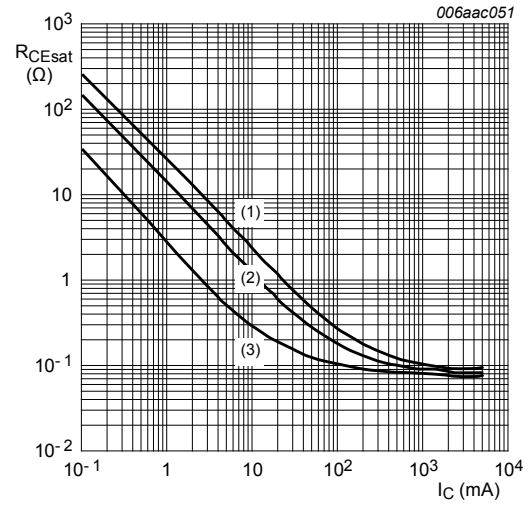
Fig. 13. Collector-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$

- (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. 14. 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. 15. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

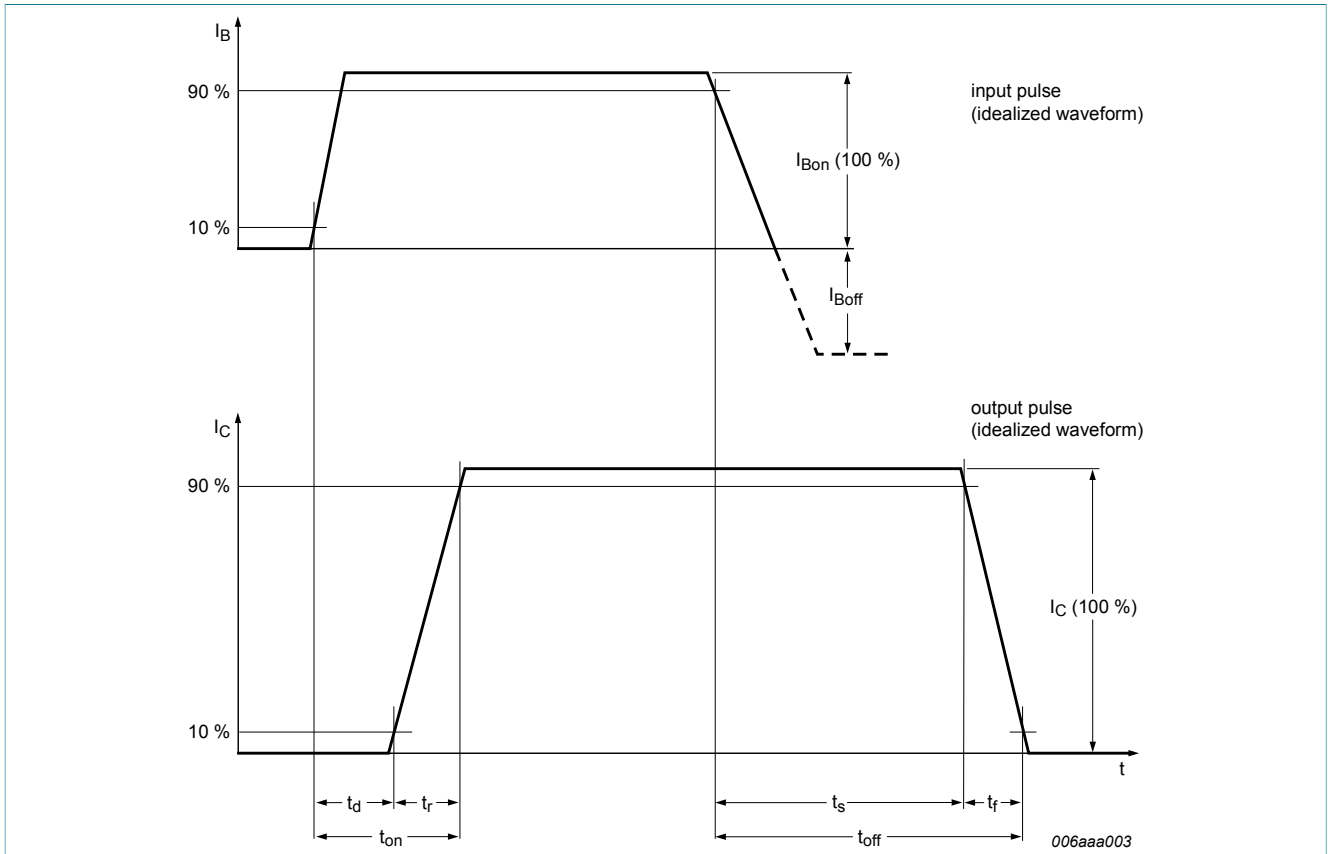


Fig. 16. BISS transistor switching time definition

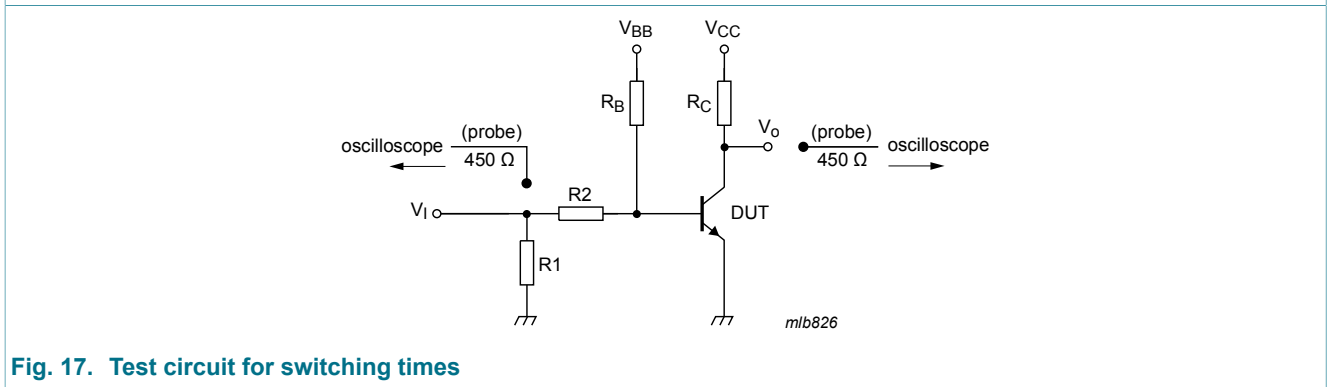


Fig. 17. Test circuit for switching times

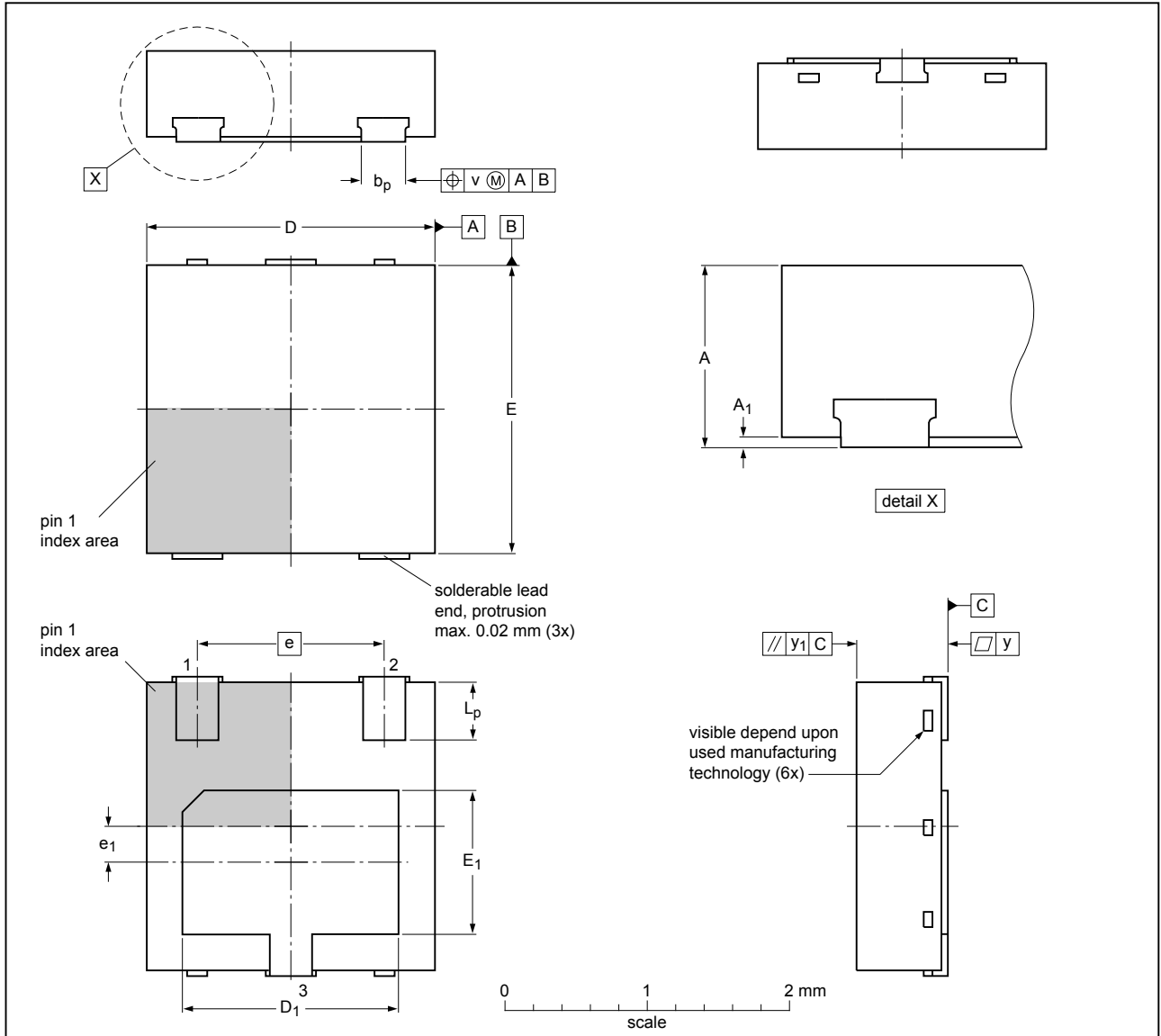
11.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

12. Package outline

DFN2020D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 x 2 x 0.65 mm

SOT1061D



Dimensions (mm are the original dimensions)

| Unit | A ⁽¹⁾ | A ₁ | b _p | D | D ₁ | E | E ₁ | e | e ₁ | L _p | v | y | y ₁ |
|------|------------------|----------------|----------------|------|----------------|-----|----------------|-----|----------------|----------------|-----|------|----------------|
| mm | max | 0.65 | 0.04 | 0.35 | 2.1 | 1.6 | 2.1 | 1.1 | 0.3 | 0.45 | | | |
| | nom | | | | | | | 1.3 | | | 0.1 | 0.05 | 0.05 |
| | min | | 0.25 | 1.9 | 1.4 | 1.9 | 0.9 | | 0.2 | 0.35 | | | |

Note

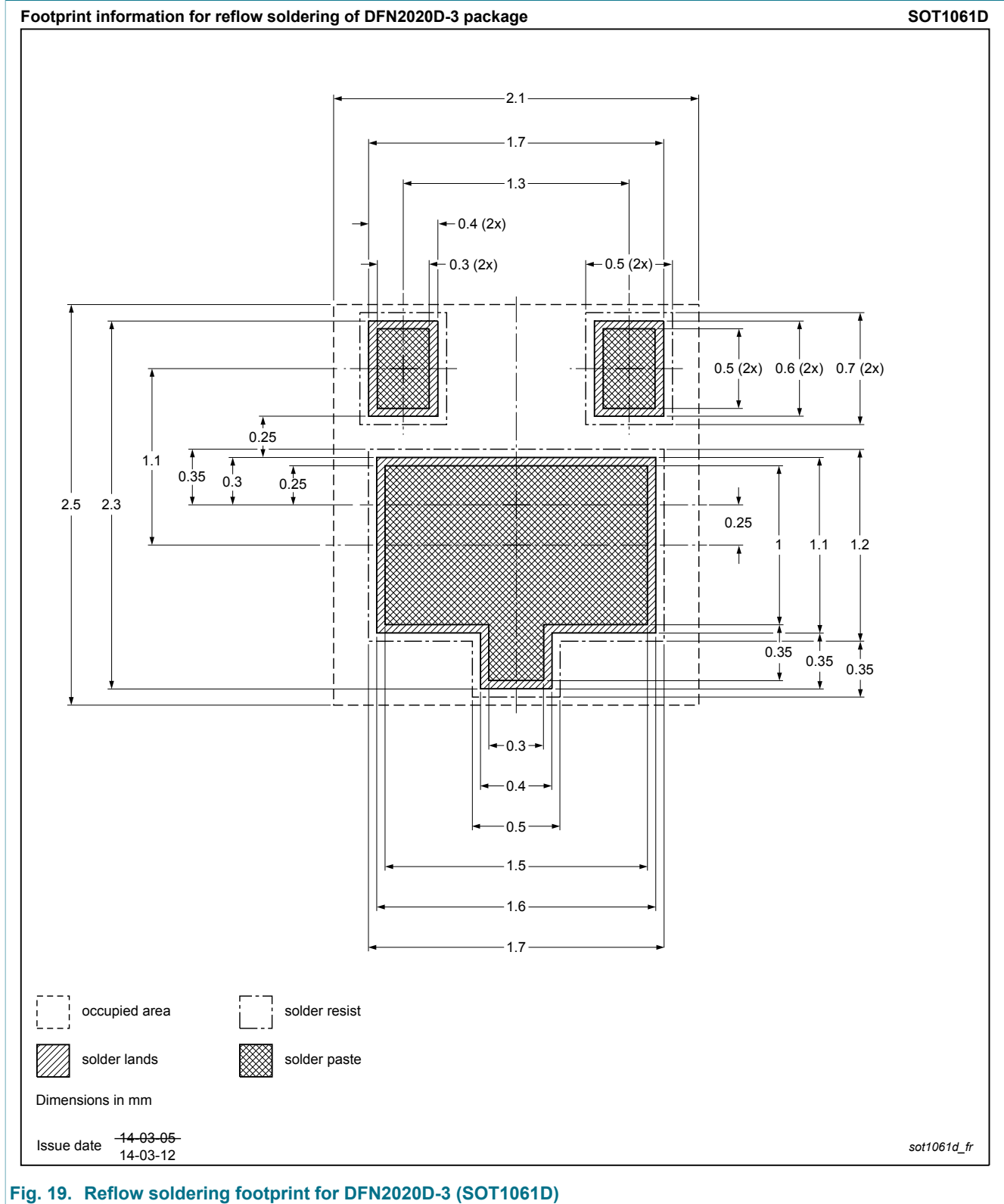
1. Dimension A is including plating thickness

sot1061d_po

| Outline version | References | | | European projection | Issue date |
|-----------------|------------|-------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT1061D | | --- | | | 14-03-11 14-03-12 |

Fig. 18. Package outline DFN2020D-3 (SOT1061D)

13. Soldering



14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| PBSS4330PAS v.1 | 20140911 | Product data sheet | - | - |

15. Legal information

15.1 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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Date of release: 11 September 2014

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