



PBSS4230QA

30 V, 2 A NPN low V_{CEsat} (BISS) transistor

23 August 2013

Product data sheet

1. General description

NPN low V_{CEsat} Breakthrough In Small Signal (BISS) transistor in a leadless ultra small DFN1010D-3 (SOT1215) Surface-Mounted Device (SMD) plastic package with visible and solderable side pads.

PNP complement: PBSS5230QA.

2. Features and benefits

- Very 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 energy efficiency due to less heat generation
- Reduced Printed-Circuit Board (PCB) area requirements
- Solderable side pads
- AEC-Q101 qualified

3. Applications

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

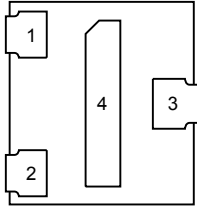
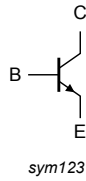
4. Quick reference data

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 | | - | - | 2 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | 3 | A |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 1$ A; $I_B = 100$ mA; pulsed; $t_p \leq 300$ μ s; $\delta \leq 0.02$; $T_{amb} = 25$ °C | - | 135 | 180 | m Ω |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|--|---|
| 1 | B | base |  <p>Transparent top view DFN1010D-3 (SOT1215)</p> |  <p>sym123</p> |
| 2 | E | emitter | | |
| 3 | C | collector | | |
| 4 | C | collector | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | Version |
|-------------|------------|--|---------|
| | Name | Description | |
| PBSS4230QA | DFN1010D-3 | plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals | SOT1215 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PBSS4230QA | 01 11 00 |

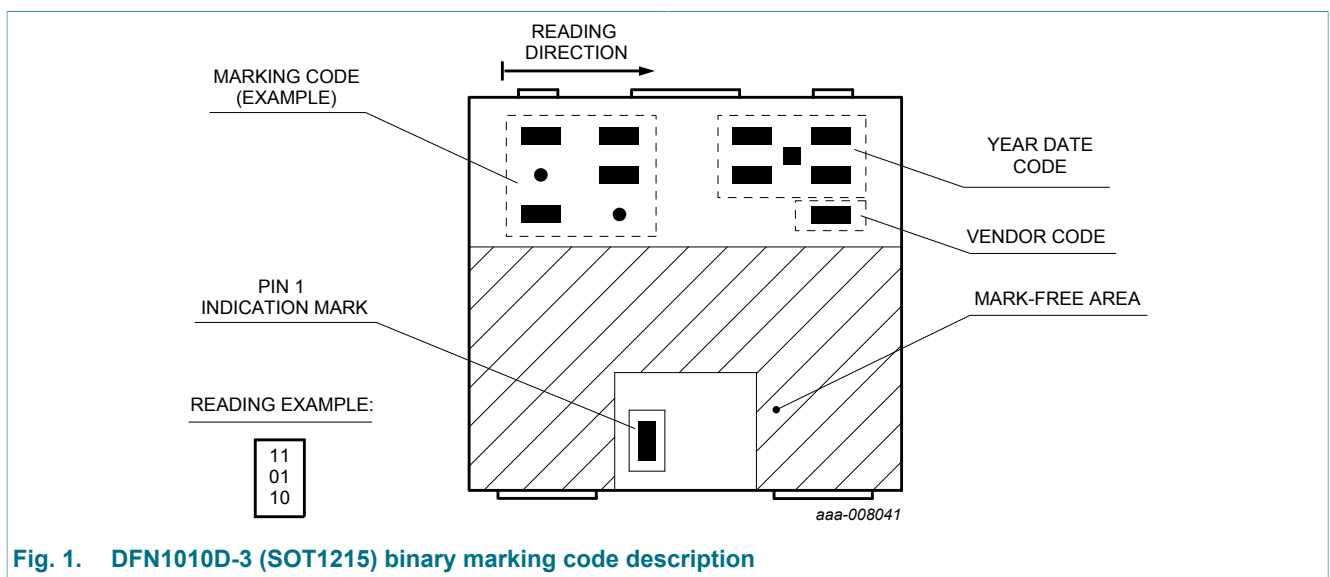


Fig. 1. DFN1010D-3 (SOT1215) binary marking code description

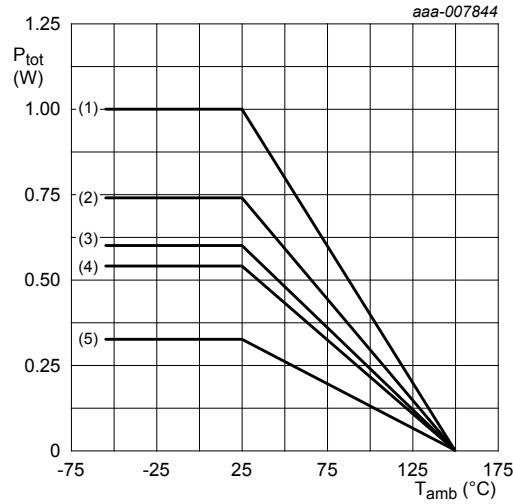
8. Limiting values

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 | | - | 30 | V |
| V_{CEO} | collector-emitter voltage | open base | | - | 30 | V |
| V_{EBO} | emitter-base voltage | open collector | | - | 7 | V |
| I_C | collector current | | | - | 2 | A |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | | - | 3 | A |
| I_B | base current | | | - | 0.3 | A |
| I_{BM} | peak base current | single pulse; $t_p \leq 1$ ms | | - | 1 | A |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 325 | mW |
| | | | [2] | - | 600 | mW |
| | | | [3] | - | 740 | mW |
| | | | [4] | - | 540 | mW |
| | | | [5] | - | 1000 | mW |
| 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 an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
 [5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated mounting pad for collector 1 cm².



- (1) FR4 PCB, 4-layer copper, 1 cm²
- (2) FR4 PCB, single-sided copper, 6 cm²
- (3) FR4 PCB, single-sided copper, 1 cm²
- (4) FR4 PCB, 4-layer copper, standard footprint
- (5) FR4 PCB, single-sided copper, standard footprint

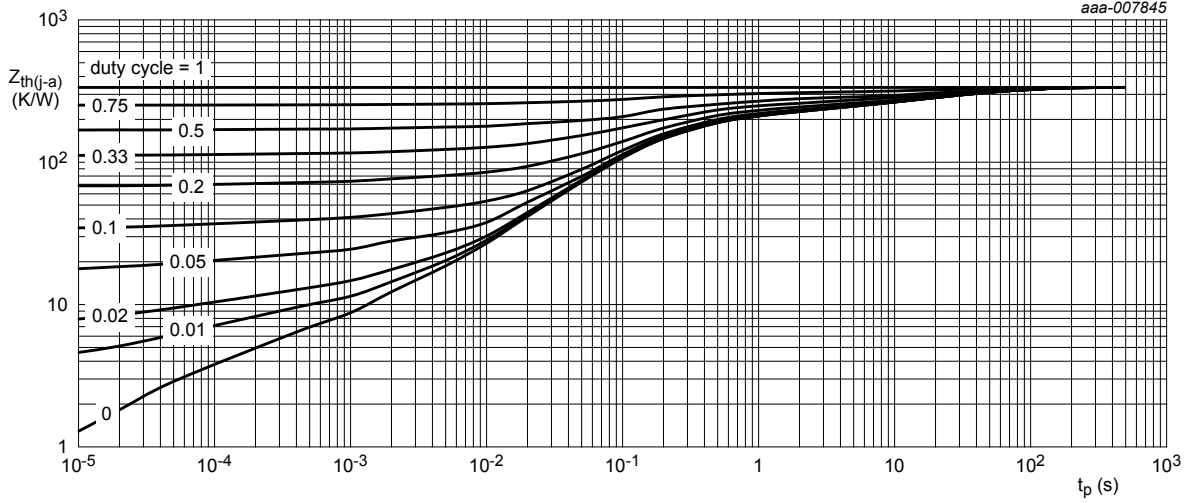
Fig. 2. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

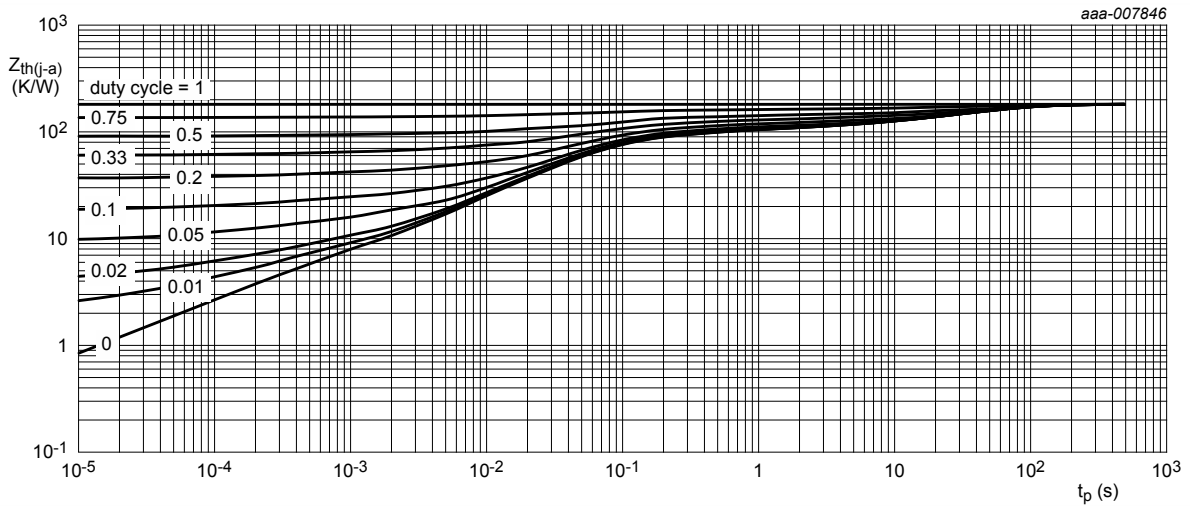
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|----------------------|---|-------------|-----|-----|-----|-----|------|
| R _{th(j-a)} | thermal resistance from junction to ambient | in free air | [1] | - | - | 385 | K/W |
| | | | [2] | - | - | 209 | K/W |
| | | | [3] | - | - | 169 | K/W |
| | | | [4] | - | - | 232 | K/W |
| | | | [5] | - | - | 125 | 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 an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
- [5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated mounting pad for collector 1 cm².



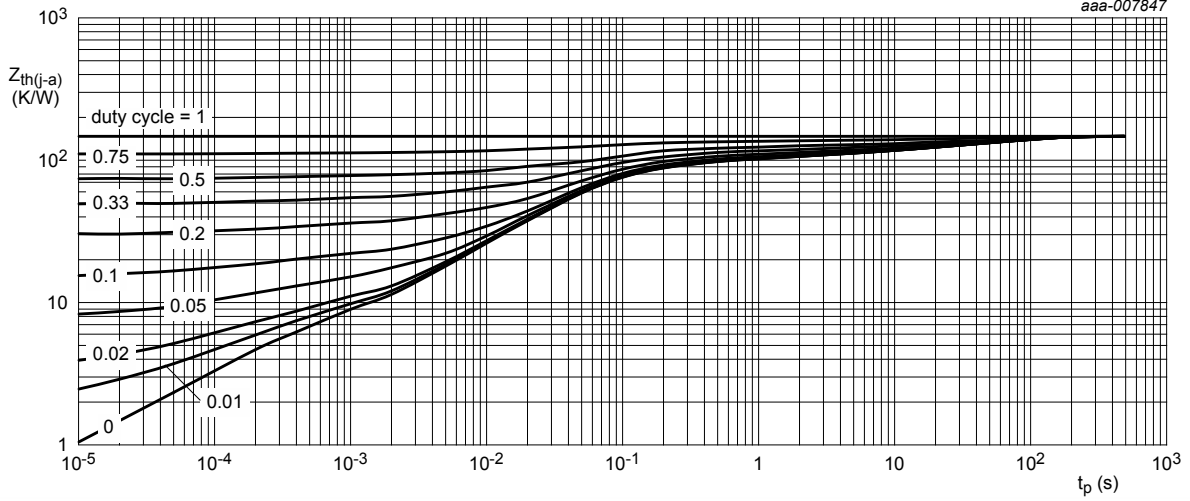
FR4 PCB, single-sided copper, standard footprint

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



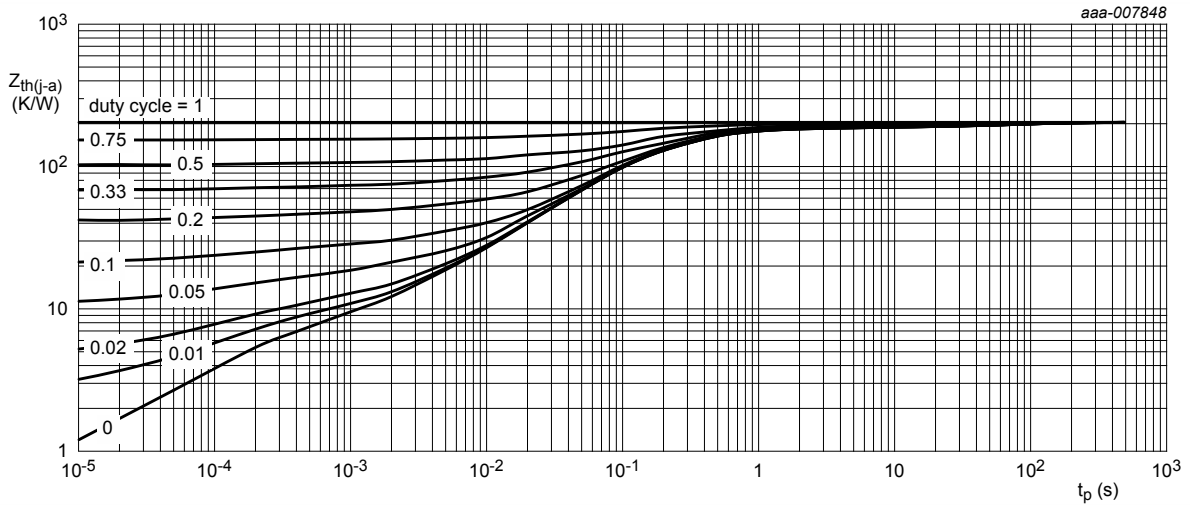
FR4 PCB, single-sided copper, 1 cm²

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



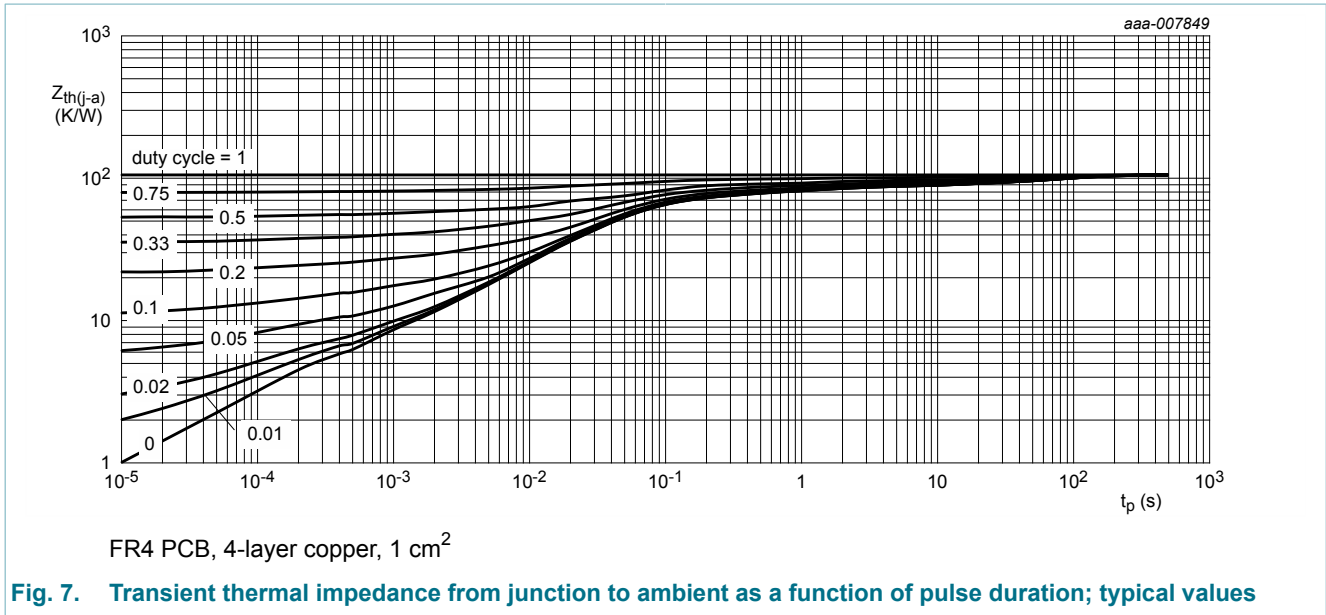
FR4 PCB, single-sided copper, 6 cm²

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



FR4 PCB, 4-layer copper, standard footprint

Fig. 6. 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 = 100 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C | 250 | 430 | - | |
| | | V _{CE} = 2 V; I _C = 500 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C | 230 | 380 | - | |
| | | V _{CE} = 2 V; I _C = 1 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C | 180 | 290 | - | |
| | | V _{CE} = 2 V; I _C = 2 A; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C | 100 | 160 | - | |
| V _{CEsat} | collector-emitter saturation voltage | I _C = 500 mA; I _B = 50 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C | - | 75 | 100 | mV |
| | | I _C = 1 A; I _B = 50 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C | - | 140 | 190 | mV |
| | | I _C = 1 A; I _B = 100 mA; pulsed; t _p ≤ 300 μs; δ ≤ 0.02; T _{amb} = 25 °C | - | 135 | 180 | mV |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------|---|---|---|------|------|------------|
| | | $I_C = 2\text{ A}; I_B = 100\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 265 | 360 | mV |
| | | $I_C = 2\text{ A}; I_B = 200\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 255 | 350 | mV |
| R_{CEsat} | collector-emitter saturation resistance | $I_C = 1\text{ A}; I_B = 100\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 135 | 180 | m Ω |
| V_{BEsat} | base-emitter saturation voltage | $I_C = 500\text{ mA}; I_B = 50\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 0.86 | 1 | V |
| | | $I_C = 1\text{ A}; I_B = 50\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 0.9 | 1.05 | V |
| | | $I_C = 2\text{ A}; I_B = 100\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 1 | 1.15 | V |
| | | $I_C = 2\text{ A}; I_B = 200\text{ mA};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 1.05 | 1.2 | V |
| V_{BEon} | base-emitter turn-on voltage | $V_{\text{CE}} = 2\text{ V}; I_C = 0.5\text{ A};$ pulsed; $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 0.75 | 0.9 | V |
| t_d | delay time | $V_{\text{CC}} = 10\text{ V}; I_C = 0.5\text{ A}; I_{\text{Bon}} = 25\text{ mA};$ $I_{\text{Boff}} = -25\text{ mA}; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 15 | - | ns |
| t_r | rise time | | - | 30 | - | ns |
| t_{on} | turn-on time | | - | 45 | - | ns |
| t_s | storage time | | - | 425 | - | ns |
| t_f | fall time | | - | 65 | - | ns |
| t_{off} | turn-off time | | - | 490 | - | ns |
| f_T | transition frequency | | $V_{\text{CE}} = 10\text{ V}; I_C = 50\text{ mA}; f = 100\text{ MHz};$ $T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | 130 | 190 | - |
| C_c | collector capacitance | $V_{\text{CB}} = 10\text{ V}; I_E = 0\text{ A}; i_e = 0\text{ A};$ $f = 1\text{ MHz}; T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | - | 8 | 10 | pF |

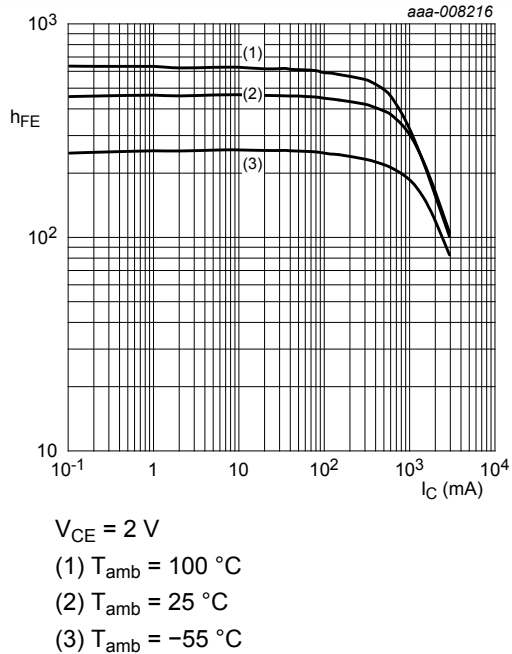


Fig. 8. DC current gain as a function of collector current; typical values

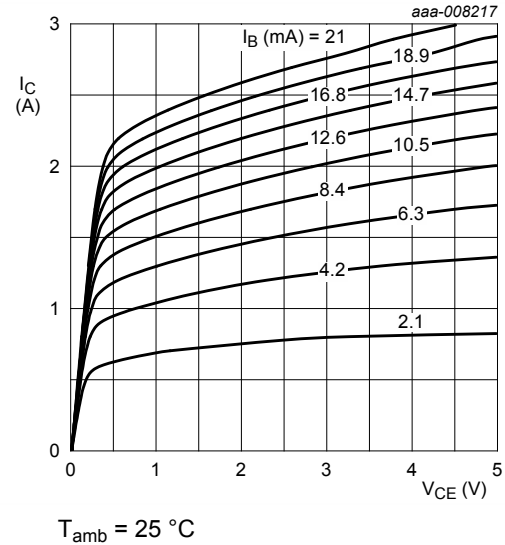


Fig. 9. Collector current as a function of collector-emitter voltage; typical values

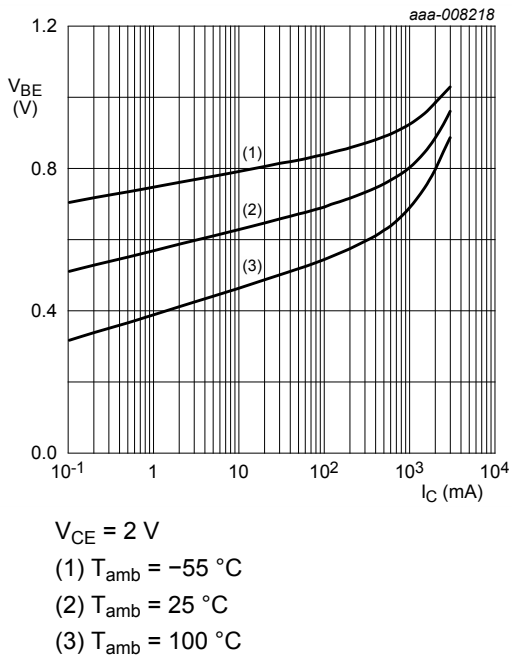


Fig. 10. Base-emitter voltage as a function of collector current; typical values

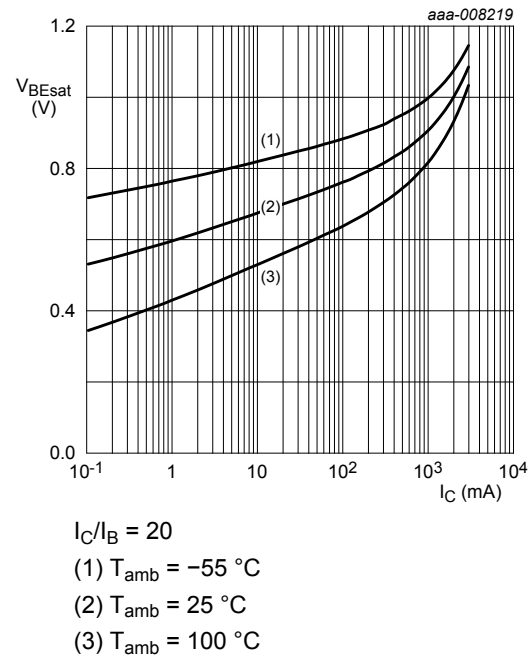
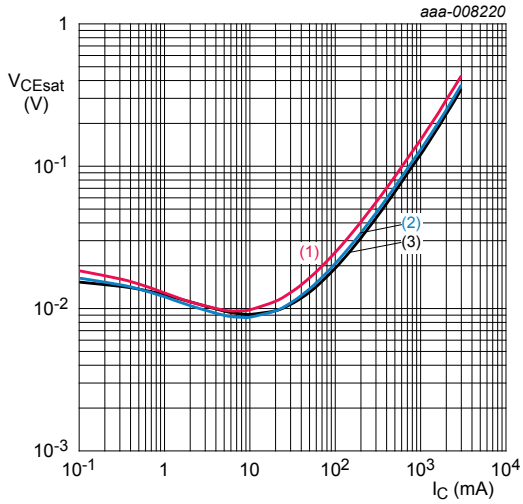
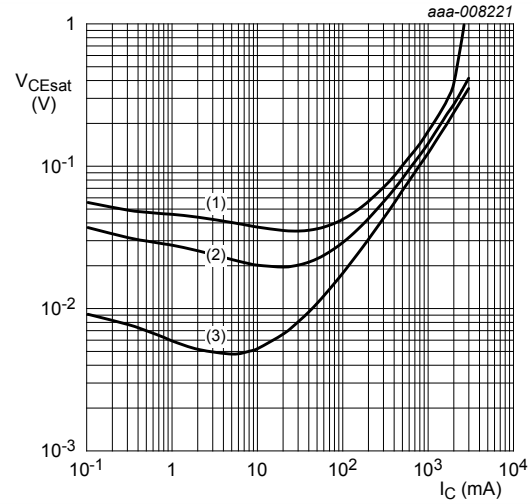


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values



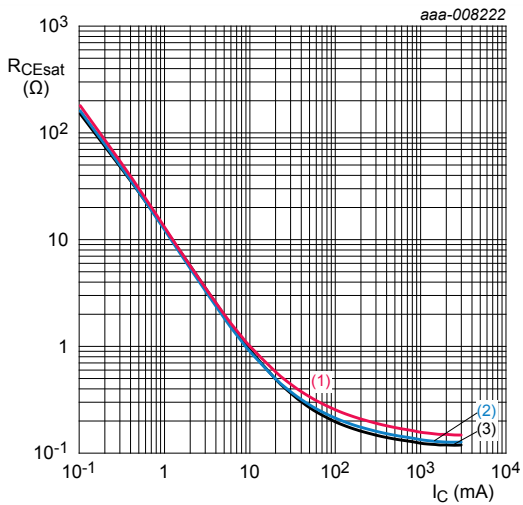
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

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



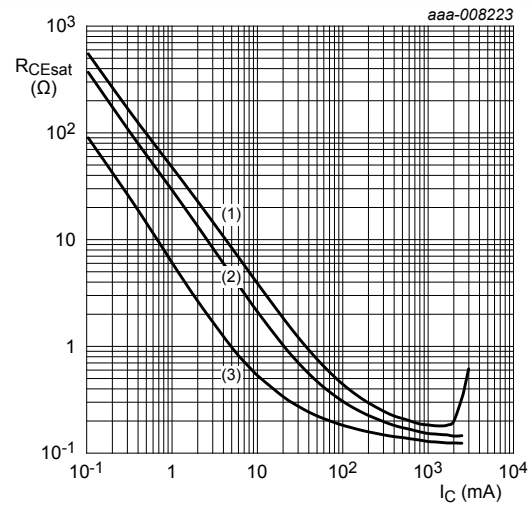
$T_{amb} = 25\text{ °C}$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 10$

Fig. 13. 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. 14. 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. 15. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

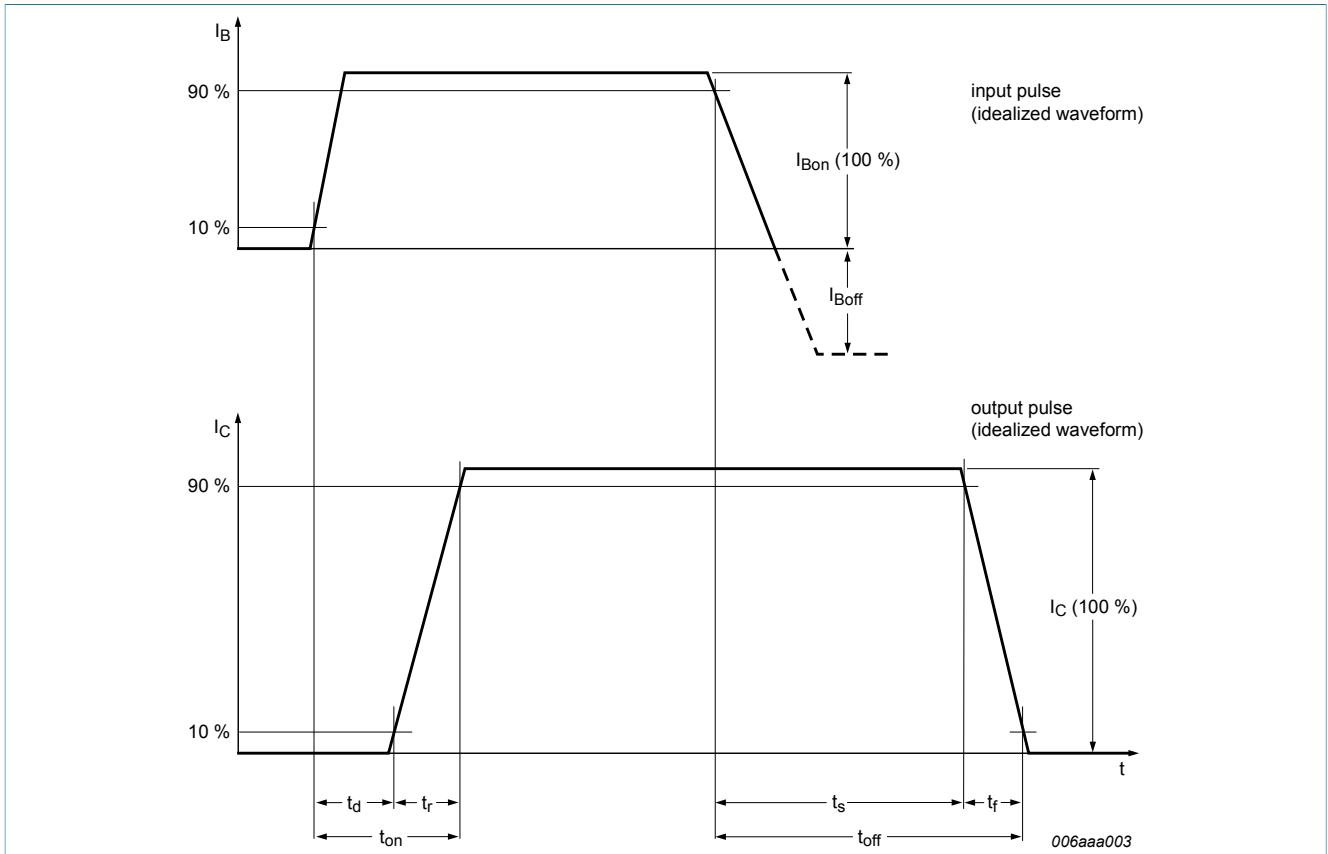


Fig. 16. BISS transistor switching time definition

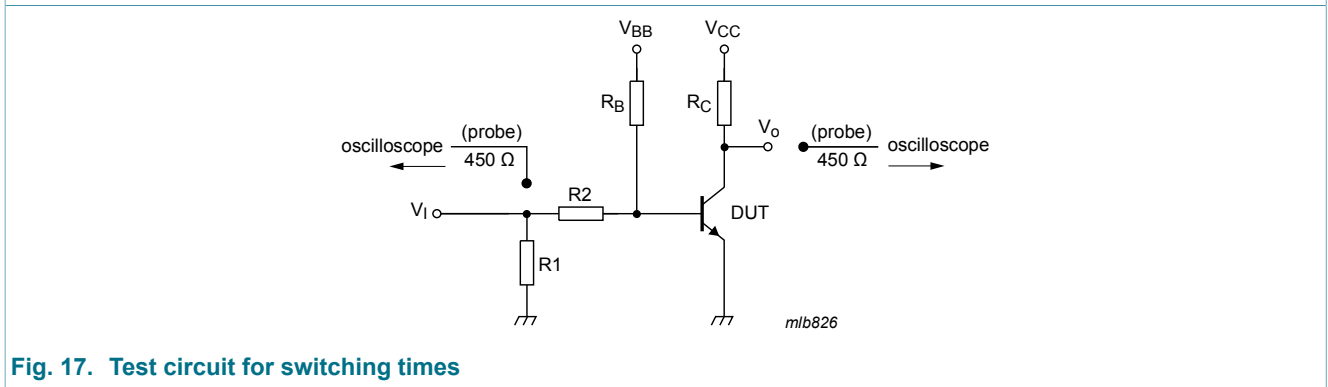


Fig. 17. Test circuit for switching times

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

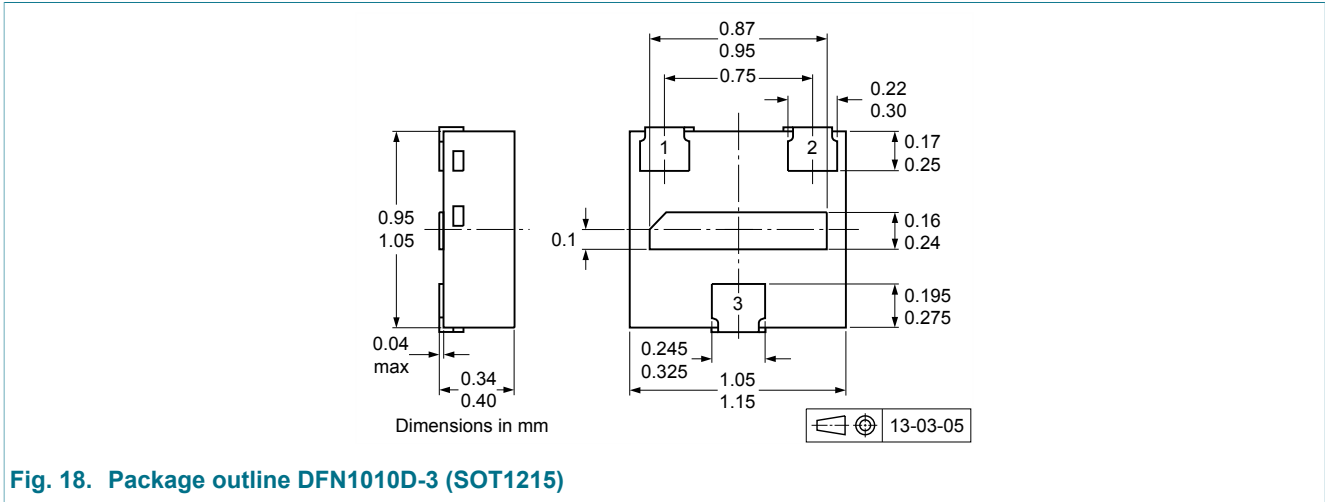


Fig. 18. Package outline DFN1010D-3 (SOT1215)

13. Soldering

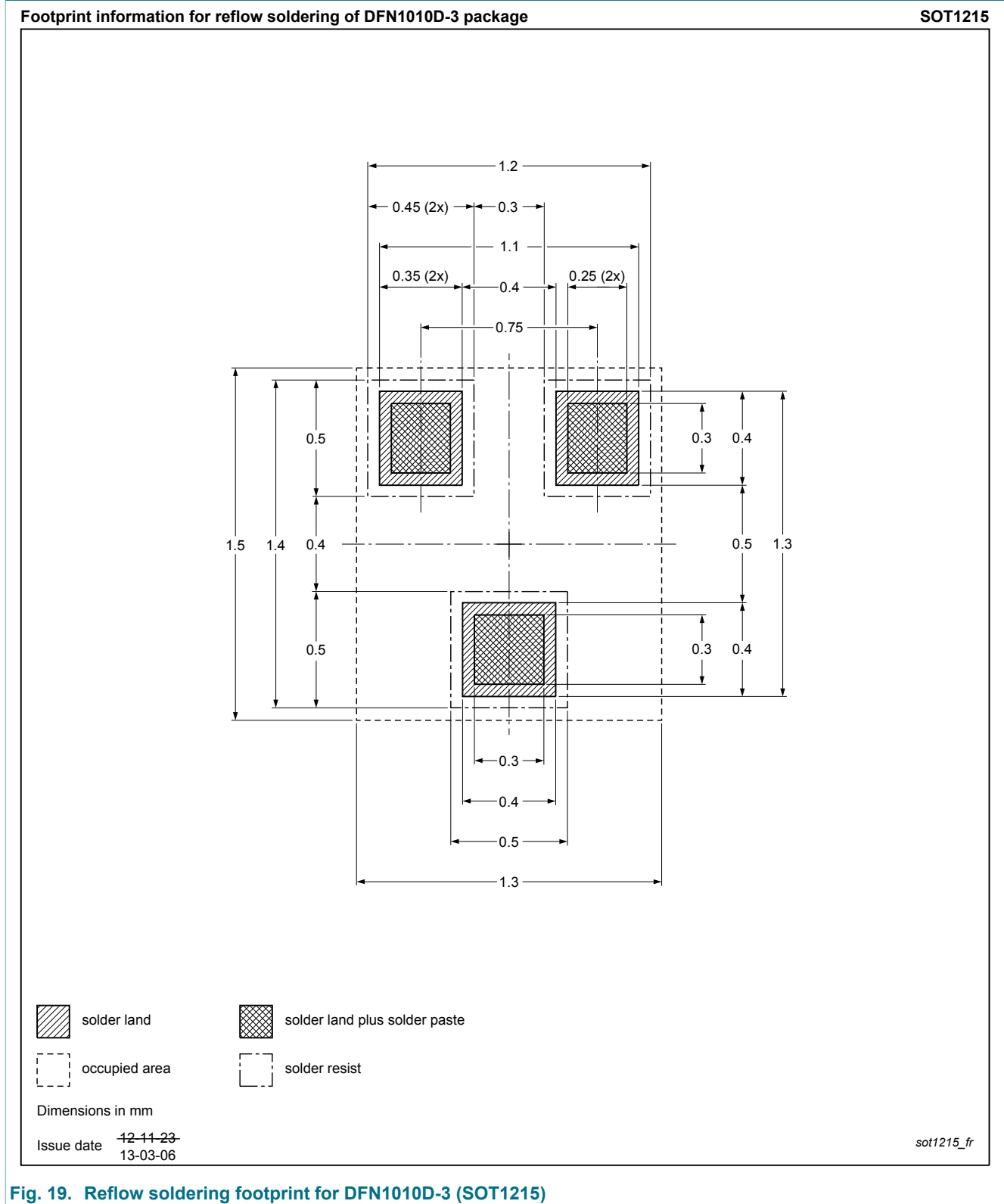


Fig. 19. Reflow soldering footprint for DFN1010D-3 (SOT1215)

14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--------------|--------------------|---------------|------------|
| PBSS4230QA v.1 | 20130823 | 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. |
| 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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