



PMBT2222AQA

40 V, 600 mA NPN switching transistor

21 September 2018

Product data sheet

1. General description

NPN switching transistor in an ultra small DFN1010D-3 (SOT1215) leadless Surface-Mounted Device (SMD) plastic package with visible and solderable side pads.

PNP complement: PMBT2907AQA

2. Features and benefits

- High current (max. 600 mA)
- Low voltage (max. 40V)
- Leadless ultra small SMD plastic package
- Low package height of 0.37 mm
- Suitable for Automatic Optical Inspection (AOI) of solder joint

3. Applications

- Switching and linear applications
- Mobile applications

4. Quick reference data

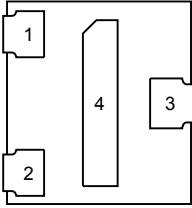
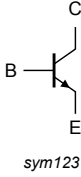
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------------------|---------------------------------|-----|-----|-----|------|
| V_{CE0} | collector-emitter voltage | open base | - | - | 40 | V |
| I_C | collector current | | - | - | 600 | mA |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | - | 800 | mA |
| h_{FE} | DC current gain | $V_{CE} = 10$ V; $I_C = 150$ mA | [1] | 100 | - | 300 |
| | | $V_{CE} = 10$ V; $I_C = 500$ mA | [1] | 40 | - | - |

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

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

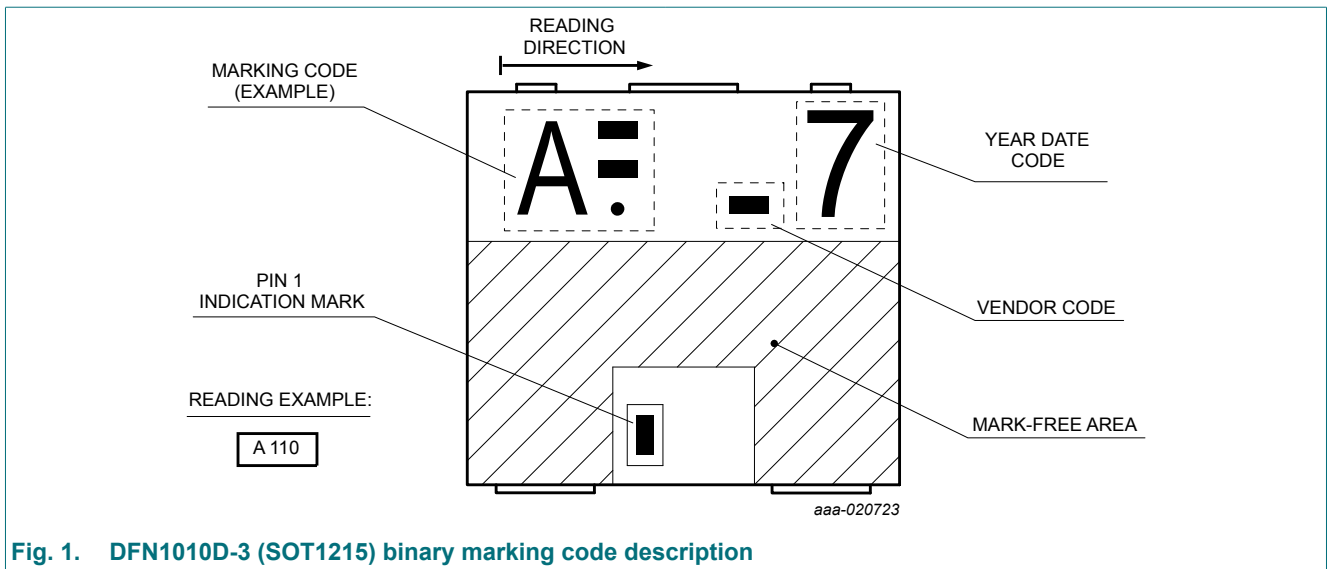
Table 3. Ordering information

| Type number | Package | | |
|-------------|------------|---|---------|
| | Name | Description | Version |
| PMBT2222AQA | DFN1010D-3 | plastic, leadless thermal enhanced ultra thin small outline package; 3 terminals; 0.75 mm pitch; 1.1 mm x 1 mm x 0.37 mm body | SOT1215 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMBT2222AQA | X 100 |



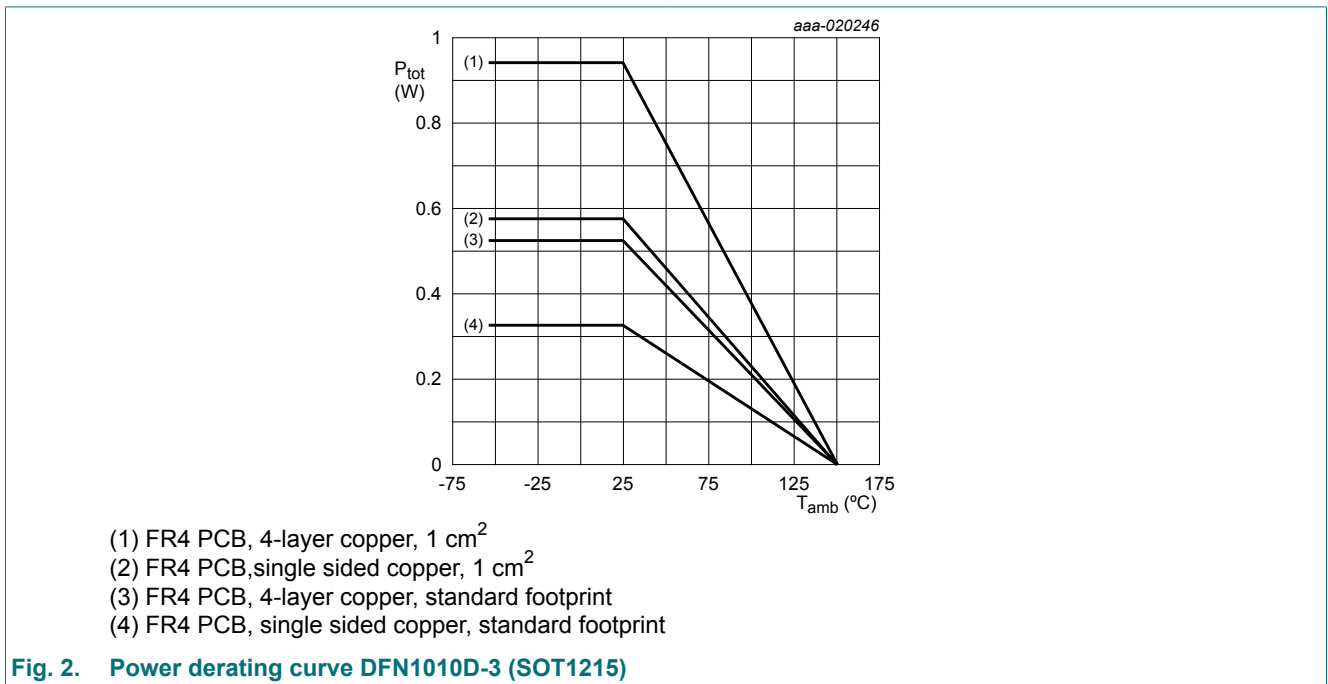
8. Limiting values

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 | | - | 75 | V |
| V_{CEO} | collector-emitter voltage | open base | | - | 40 | V |
| V_{EBO} | emitter-base voltage | open collector | | - | 6 | V |
| I_C | collector current | | | - | 600 | mA |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | | - | 800 | mA |
| I_{BM} | peak base current | | | - | 200 | mA |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 325 | mW |
| | | | [2] | - | 575 | mW |
| | | | [3] | - | 525 | mW |
| | | | [4] | - | 940 | 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 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated; mounting pad for collector 1 cm².
- [3] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated; mounting pad for collector 1 cm².



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] | - | - | 218 | K/W |
| | | | [3] | - | - | 239 | K/W |
| | | | [4] | - | - | 133 | K/W |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated; mounting pad for collector 1 cm².
- [3] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 Printed-Circuit Board (PCB), 4-layer copper, tin-plated; mounting pad for collector 1 cm².

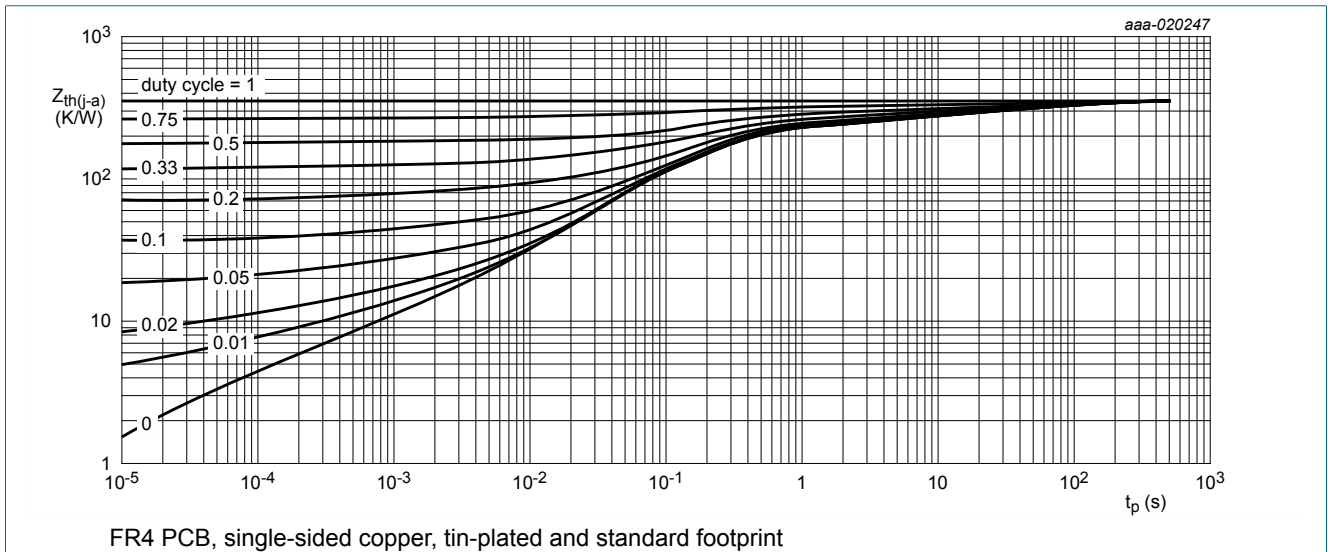


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

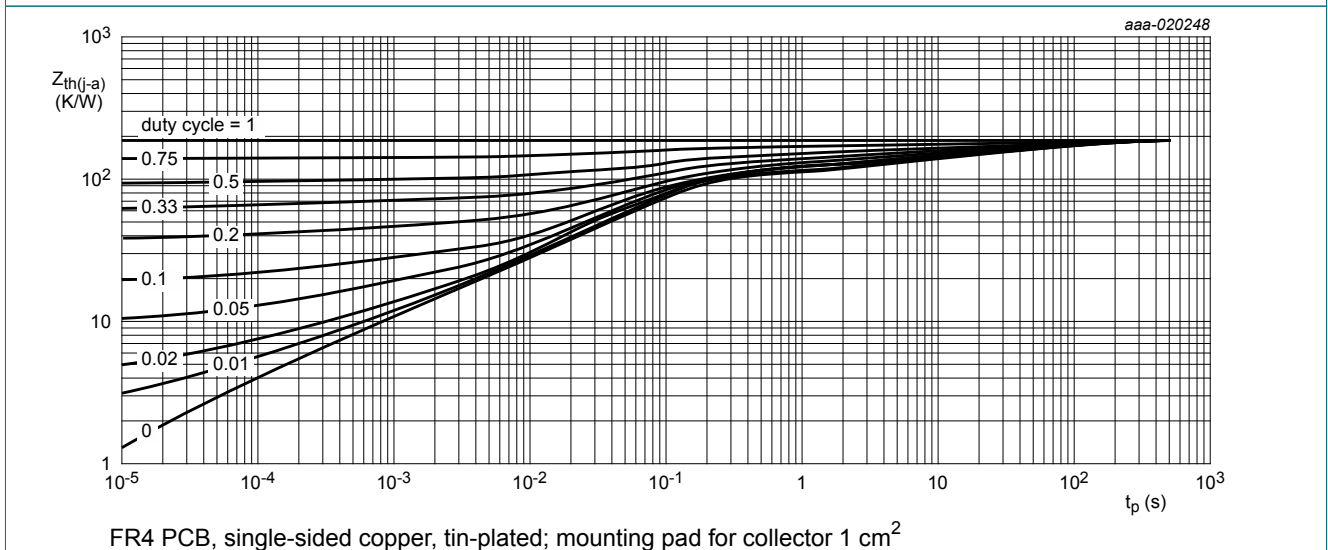


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

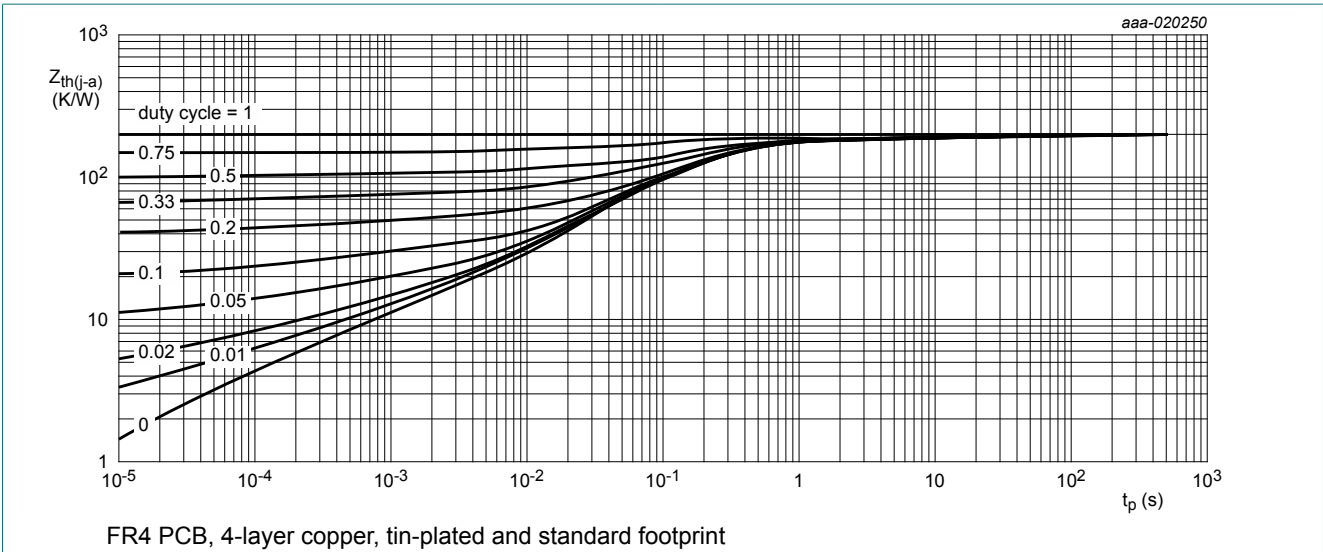


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

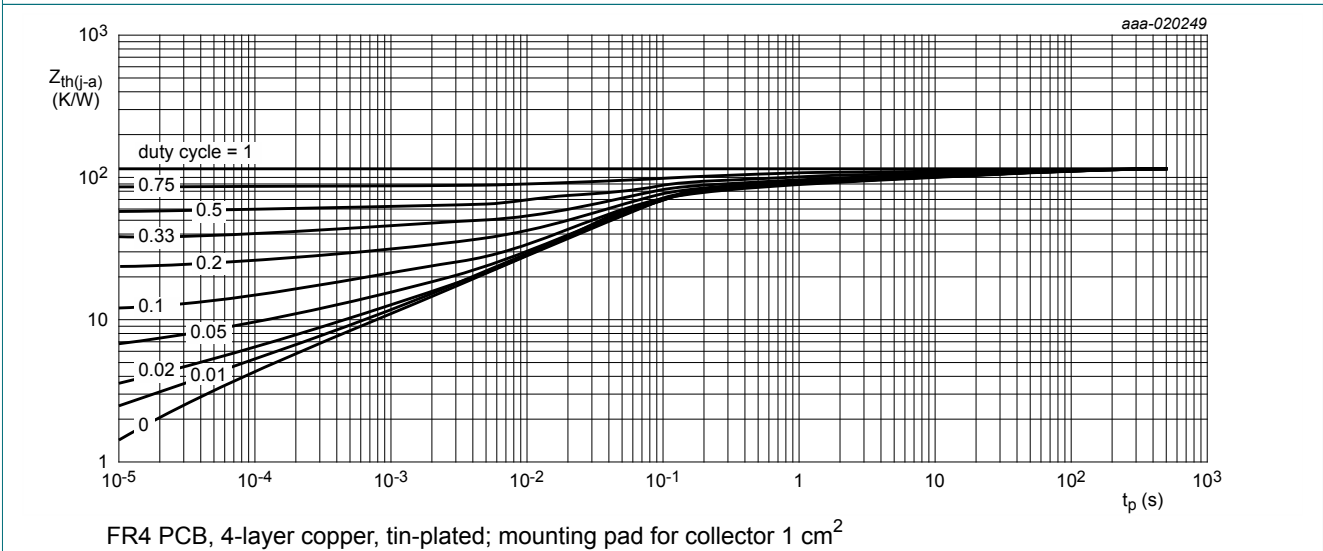


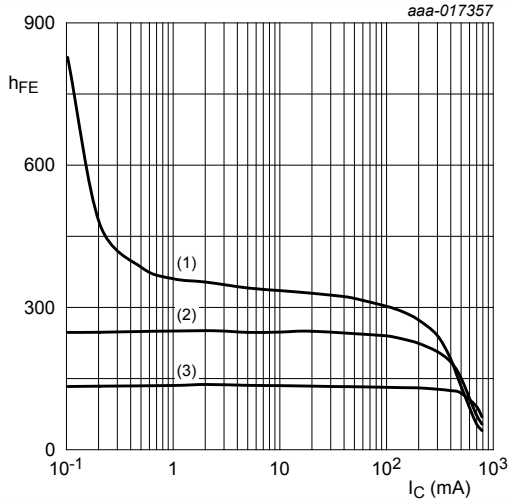
Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

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

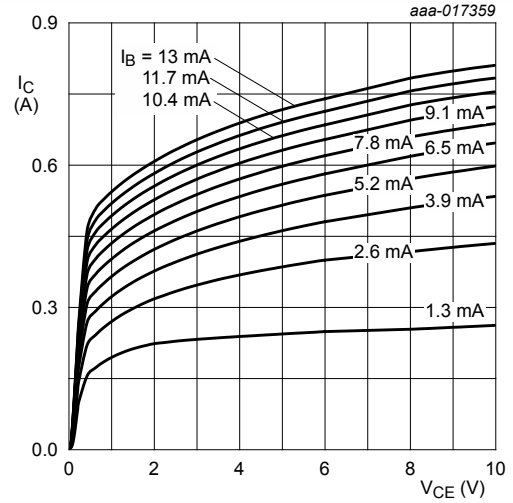
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|---------------|--------------------------------------|--|---|-----|-----|---------------|----|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C = 100\ \mu\text{A}$; $I_E = 0\ \text{A}$ | 75 | - | - | V | |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C = 2\ \text{mA}$; $I_B = 0\ \text{A}$ | 40 | - | - | V | |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | $I_C = 0\ \text{A}$; $I_E = 100\ \mu\text{A}$ | 6 | - | - | V | |
| I_{CBO} | collector-base cut-off current | $V_{CB} = 60\ \text{V}$; $I_E = 0\ \text{A}$ | - | - | 10 | nA | |
| | | $V_{CB} = 60\ \text{V}$; $I_E = 0\ \text{A}$; $T_J = 125\text{ °C}$ | - | - | 10 | μA | |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\ \text{V}$; $I_C = 0\ \text{A}$ | - | - | 10 | nA | |
| h_{FE} | DC current gain | $V_{CE} = 10\ \text{V}$; $I_C = 100\ \mu\text{A}$ | 35 | - | - | | |
| | | $V_{CE} = 10\ \text{V}$; $I_C = 1\ \text{mA}$ | 50 | - | - | | |
| | | $V_{CE} = 10\ \text{V}$; $I_C = 10\ \text{mA}$ | 75 | - | - | | |
| | | $V_{CE} = 10\ \text{V}$; $I_C = 10\ \text{mA}$; $T_{amb} = -55\text{ °C}$ | 35 | - | - | | |
| | | $V_{CE} = 10\ \text{V}$; $I_C = 150\ \text{mA}$ | [1] | 100 | - | 300 | |
| | | $V_{CE} = 1\ \text{V}$; $I_C = 150\ \text{mA}$ | [1] | 50 | - | - | |
| | | $V_{CE} = 10\ \text{V}$; $I_C = 500\ \text{mA}$ | [1] | 40 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 150\ \text{mA}$; $I_B = 15\ \text{mA}$ | [1] | - | - | 300 mV | |
| | | $I_C = 500\ \text{mA}$; $I_B = 50\ \text{mA}$ | [1] | - | - | 1 V | |
| V_{BEsat} | base-emitter saturation voltage | $I_C = 150\ \text{mA}$; $I_B = 15\ \text{mA}$ | [1] | 0.6 | - | 1.2 V | |
| | | $I_C = 500\ \text{mA}$; $I_B = 50\ \text{mA}$ | [1] | - | - | 2 V | |
| t_d | delay time | $I_C = 150\ \text{mA}$; $I_{B(on)} = 15\ \text{mA}$; $I_{B(off)} = -15\ \text{mA}$ | - | - | 15 | ns | |
| t_r | rise time | | - | - | 20 | ns | |
| t_{on} | turn-on time | | - | - | 35 | ns | |
| t_s | storage time | | - | - | 200 | ns | |
| t_f | fall time | | - | - | 60 | ns | |
| t_{off} | turn-off time | | - | - | 260 | ns | |
| C_c | collector capacitance | | $V_{CB} = 10\ \text{V}$; $I_E = 0\ \text{A}$; $i_e = 0\ \text{A}$; $f = 1\ \text{MHz}$ | - | - | 8 | pF |
| C_e | emitter capacitance | $V_{EB} = 500\ \text{mV}$; $I_C = 0\ \text{A}$; $i_c = 0\ \text{A}$; $f = 1\ \text{MHz}$ | - | - | 25 | pF | |
| f_T | transition frequency | $V_{CE} = 20\ \text{V}$; $I_C = 20\ \text{mA}$; $f = 100\ \text{MHz}$ | [1] | - | 340 | MHz | |

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



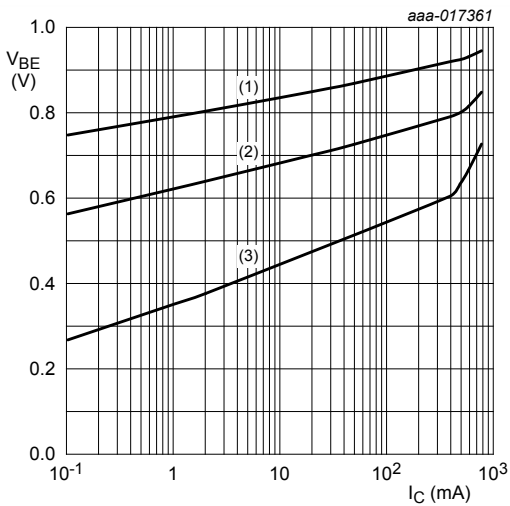
$V_{CE} = 10\text{ V}$
 (1) $T_{amb} = 100^\circ C$
 (2) $T_{amb} = 25^\circ C$
 (3) $T_{amb} = -55^\circ C$

Fig. 7. DC current gain as a function of collector current; typical values



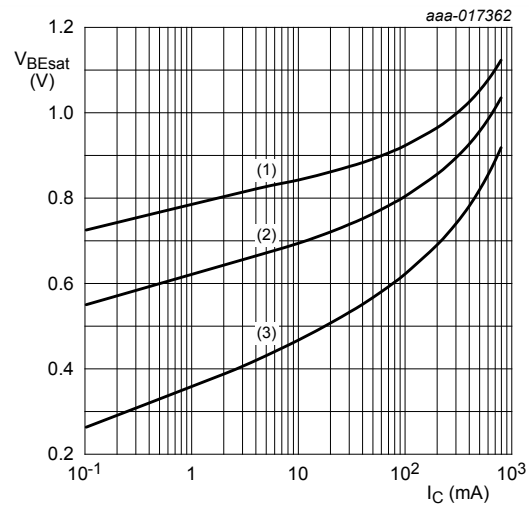
$T_{amb} = 25^\circ C$

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



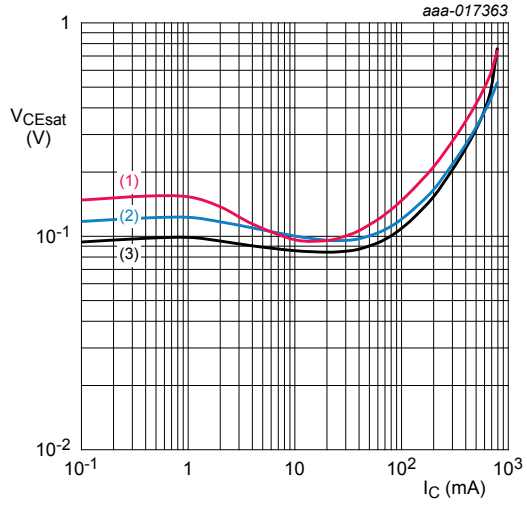
$V_{CE} = 10\text{ V}$
 (1) $T_{amb} = -55^\circ C$
 (2) $T_{amb} = 25^\circ C$
 (3) $T_{amb} = 150^\circ C$

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



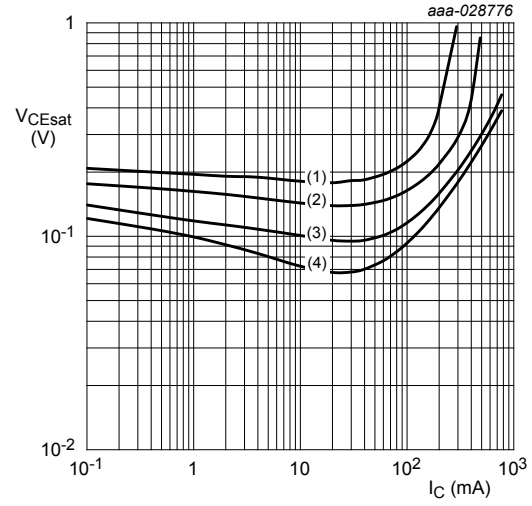
$I_C/I_B = 10$
 (1) $T_{amb} = -55^\circ C$
 (2) $T_{amb} = 25^\circ C$
 (3) $T_{amb} = 150^\circ C$

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



$I_C/I_B = 20$
 (1) $T_{amb} = 150^\circ C$
 (2) $T_{amb} = 25^\circ C$
 (3) $T_{amb} = -55^\circ C$

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



$T_{amb} = 25^\circ C$
 (1) $I_C/I_B = 100$
 (2) $I_C/I_B = 50$
 (3) $I_C/I_B = 20$
 (4) $I_C/I_B = 10$

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

11. Test information

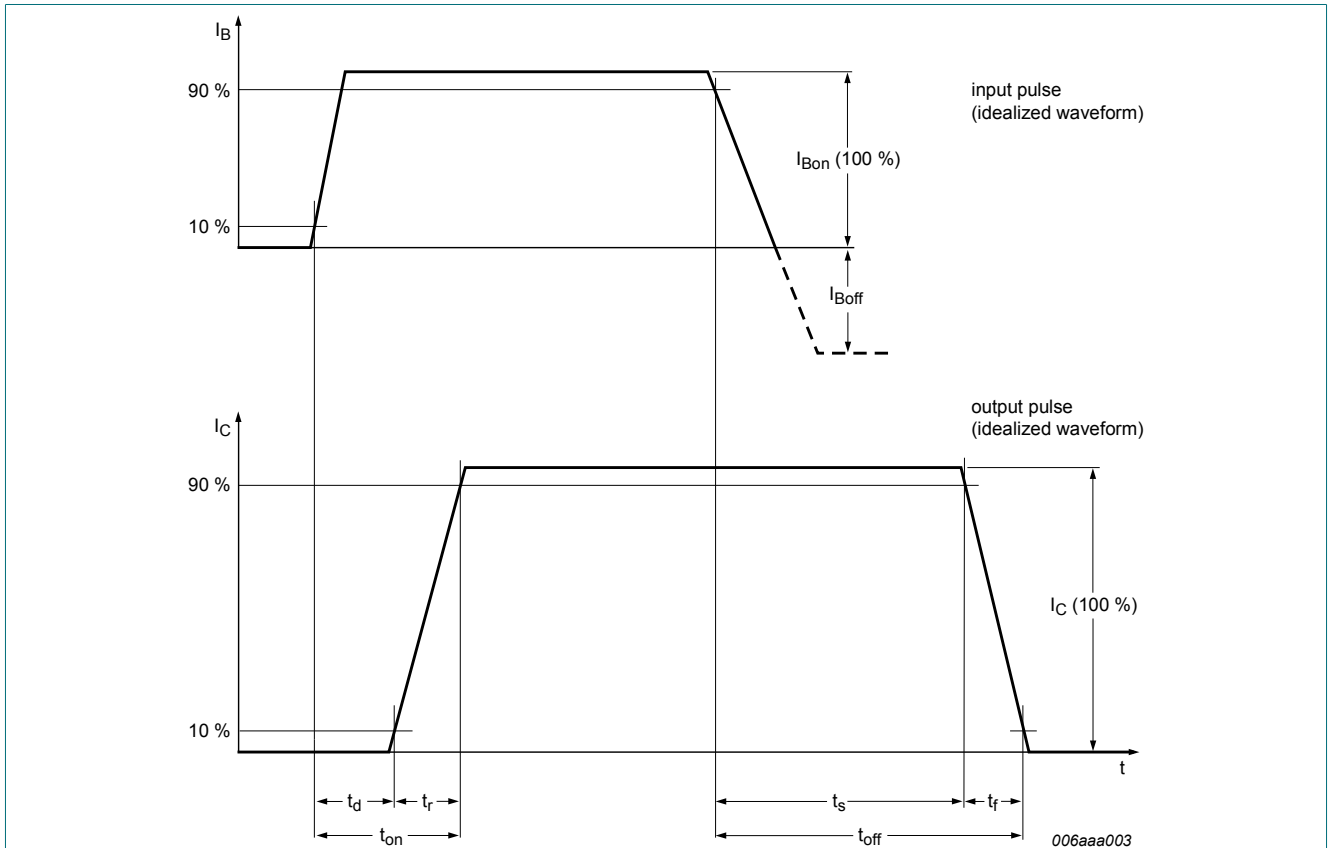


Fig. 13. Transistor switching time definition

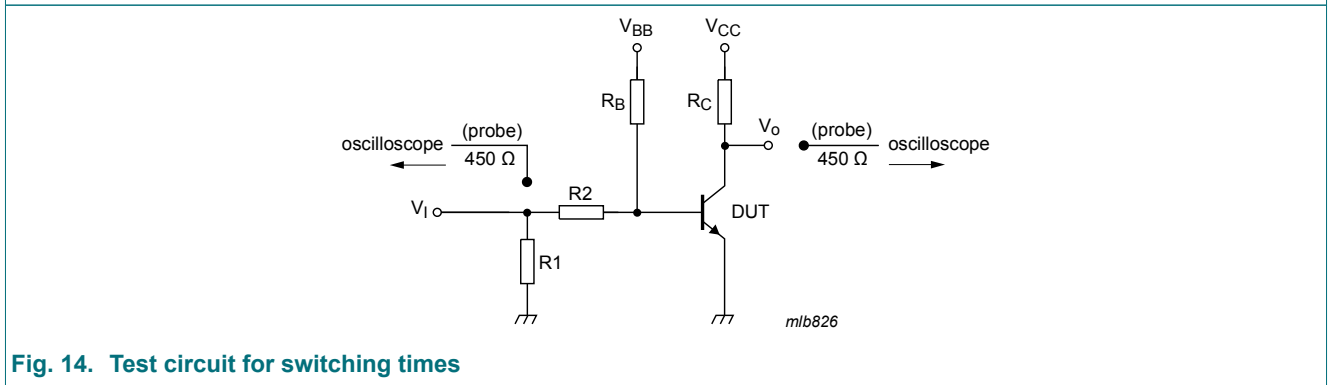


Fig. 14. Test circuit for switching times

12. Package outline

DFN1010D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body: 1.1 x 1.0 x 0.37 mm

SOT1215

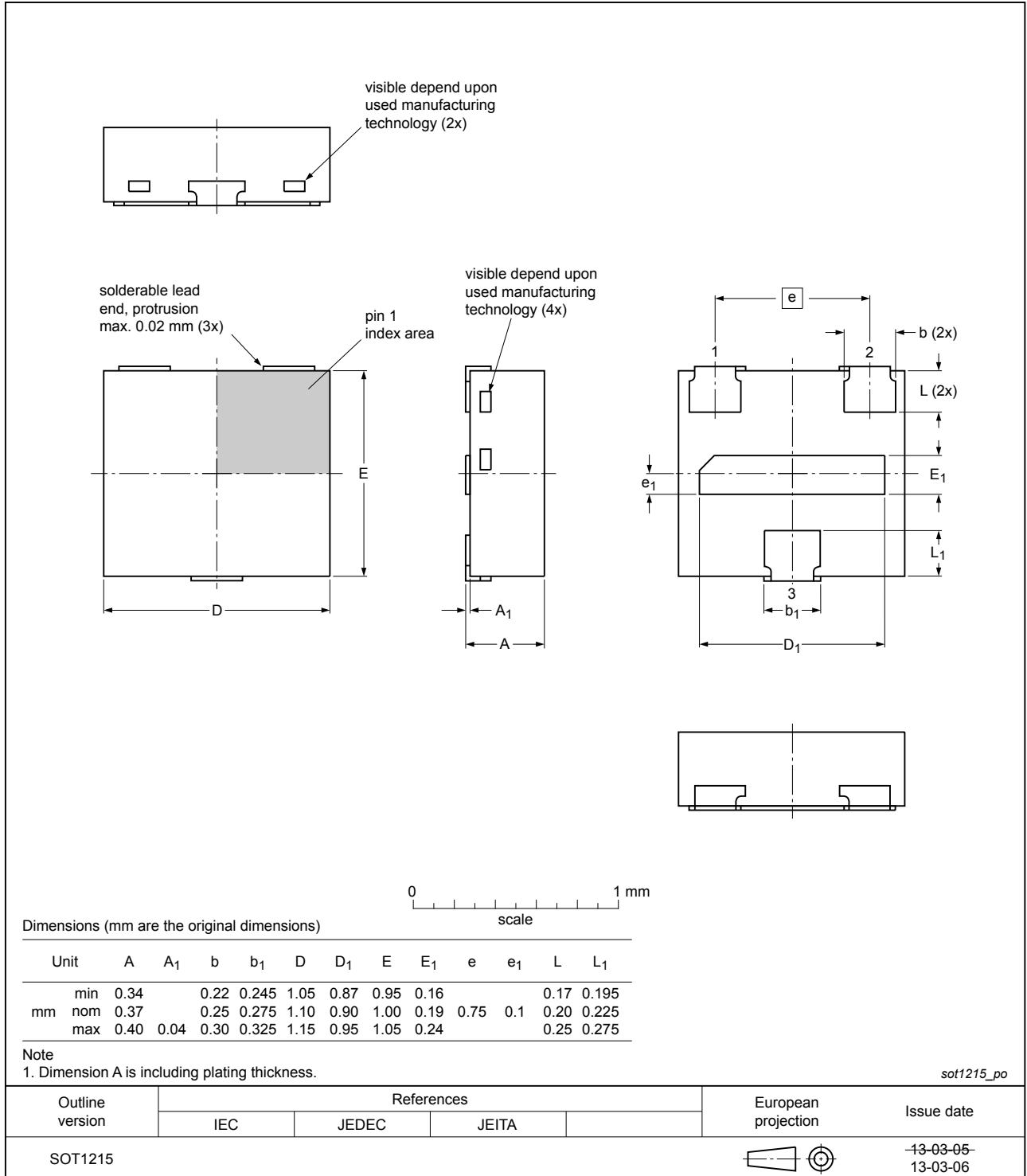


Fig. 15. Package outline DFN1010D-3 (SOT1215)

13. Soldering

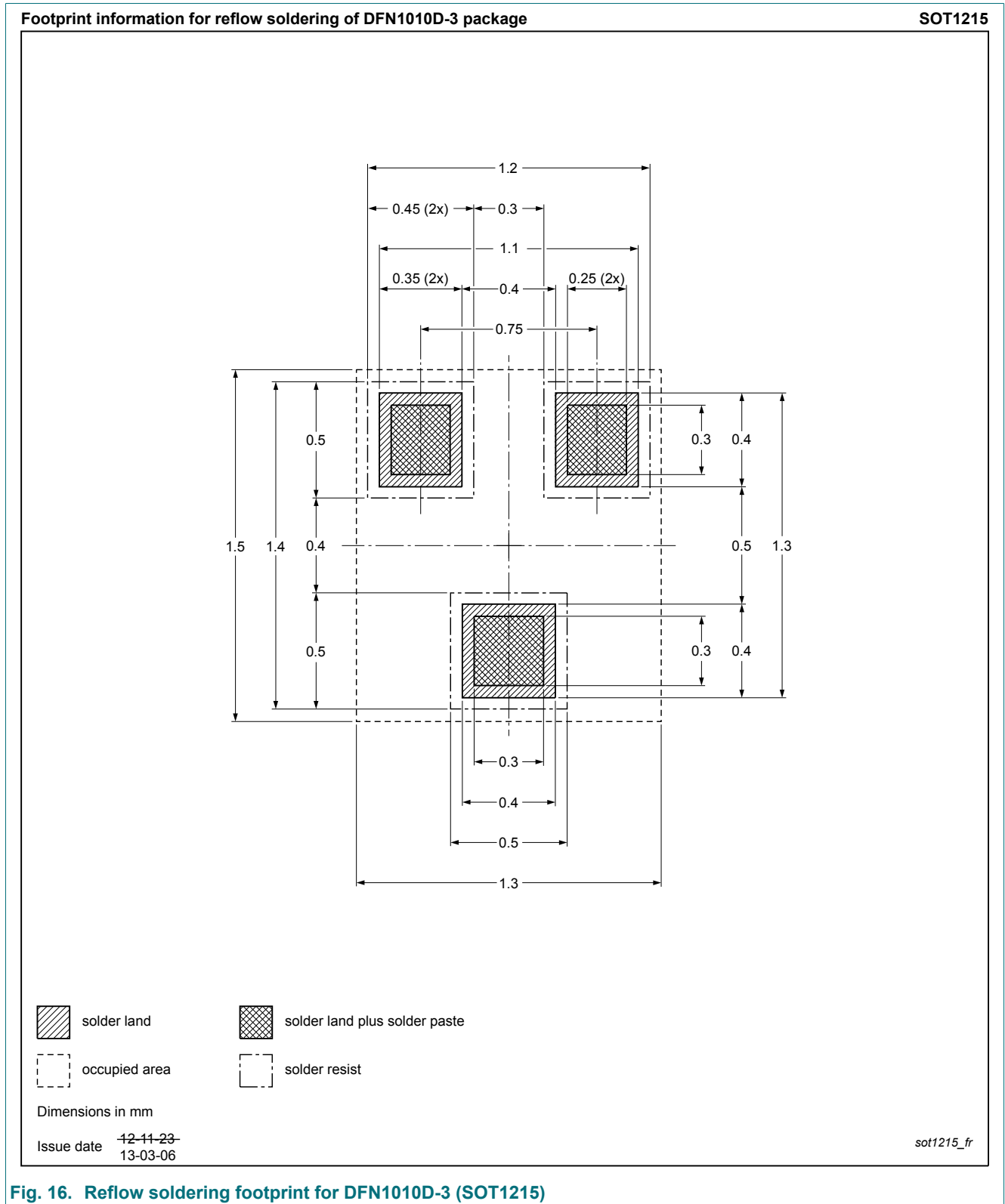


Fig. 16. Reflow soldering footprint for DFN1010D-3 (SOT1215)

14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| PMBT2222AQA v.1 | 20180921 | Product data sheet | - | - |

15. Legal information

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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