


# PDTC114YT

## 50 V, 100 mA NPN resistor-equipped transistor; R1 = 10 kΩ, R2 = 47 kΩ

25 April 2023 **Product data sheet**

## 1. General description

NPN Resistor-Equipped Transistor (RET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

PNP complement: PDTA114YT

## 2. Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs

## 3. Applications

- Digital application in industrial segments
- Cost-saving alternative for BC847 series in digital applications
- Controlling IC inputs
- Switching loads

## 4. Quick reference data

**Table 1. Quick reference data**

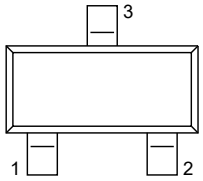
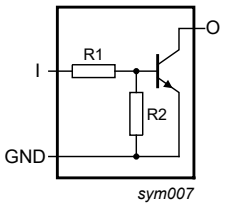
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | open base | | - | - | 50 | V |
| $I_O$ | output current | | | - | - | 100 | mA |
| R1 | bias resistor 1 (input) | | [1] | 7 | 10 | 13 | kΩ |
| R2/R1 | bias resistor ratio | | [1] | 3.7 | 4.7 | 5.7 | |

[1] See "Section 11: Test information" for resistor calculation and test conditions.

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# 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | I | input (base) |   SOT23 |   sym007 |
| 2 | GND | ground (emitter) | | |
| 3 | O | output (collector) | | |

# 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PDTC114YT | SOT23 | plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body | SOT23 |

# 7. Marking

**Table 4. Marking codes**

| Type number | Marking code[1] |
|---|---|
| PDTC114YT | %27 |

[1] % = placeholder for manufacturing site code

# 8. Limiting values

**Table 5. Limiting values**

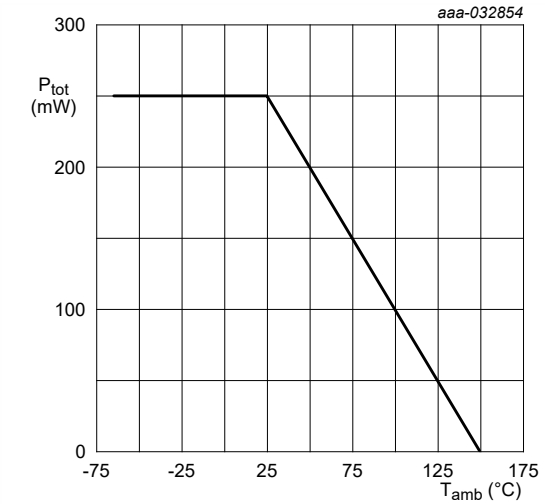
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | | - | 50 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | 50 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | | - | 6 | V |
| $V_I$ | input voltage | | | -6 | 40 | V |
| $I_O$ | output current | | | - | 100 | mA |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 250 | mW |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | -65 | 150 | °C |
| $T_{stg}$ | storage temperature | | | -65 | 150 | °C |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 µm copper, tin-plated and standard footprint.


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FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint

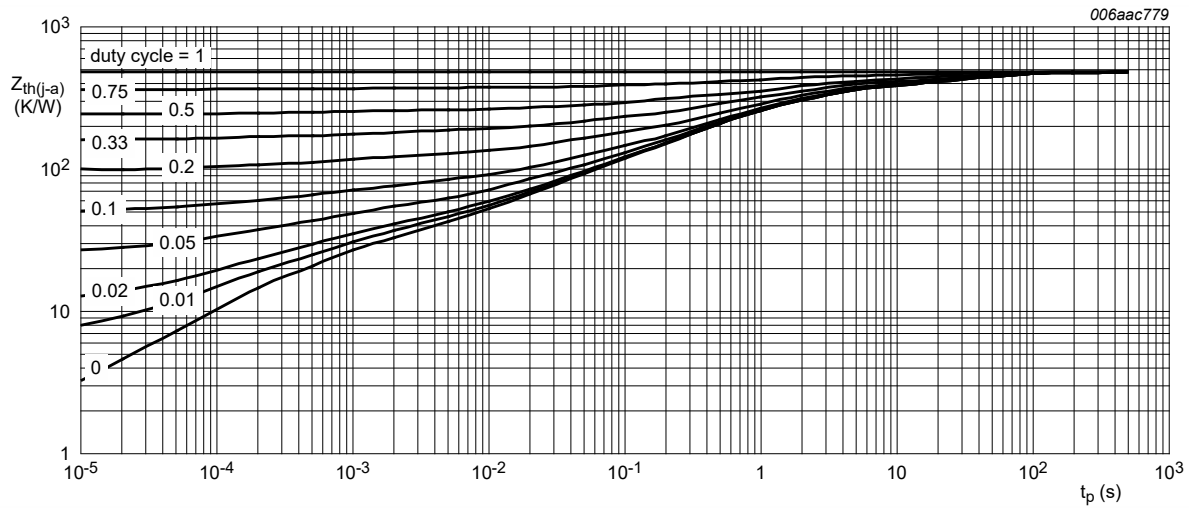
**Fig. 1. Power derating curve**

## 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] | - | - | 500 | K/W |

[1] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint.




FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint.

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


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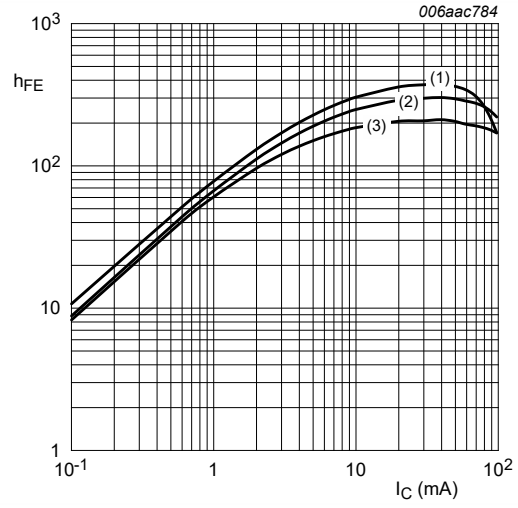
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# 10. Characteristics

**Table 7. Characteristics**

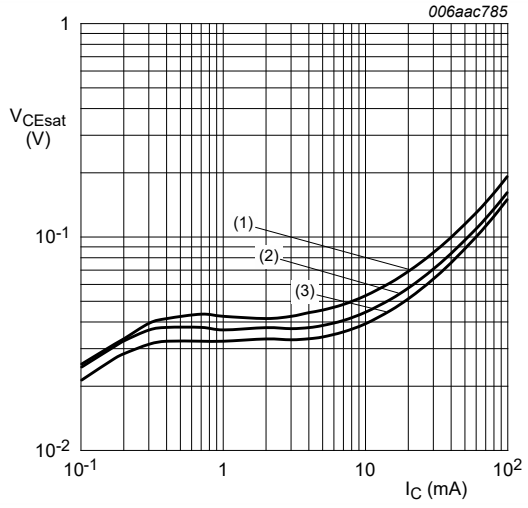
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C$ = 100 µA; $I_E$ = 0 A; $T_{amb}$ = 25 °C | | 50 | - | - | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C$ = 2 mA; $I_B$ = 0 A; $T_{amb}$ = 25 °C | | 50 | - | - | V |
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 50 V; $I_E$ = 0 A; $T_{amb}$ = 25 °C | | - | - | 100 | nA |
| $I_{CEO}$ | collector-emitter cut-off current | $V_{CE}$ = 30 V; $I_B$ = 0 A; $T_{amb}$ = 25 °C | | - | - | 100 | nA |
| | | $V_{CE}$ = 30 V; $I_B$ = 0 A; $T_j$ = 150 °C | | - | - | 5 | µA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = 5 V; $I_C$ = 0 A; $T_{amb}$ = 25 °C | | - | - | 150 | µA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 5 mA; $T_{amb}$ = 25 °C | | 100 | - | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 5 mA; $I_B$ = 0.25 mA; $T_{amb}$ = 25 °C | | - | - | 100 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE}$ = 5 V; $I_C$ = 100 µA; $T_{amb}$ = 25 °C | | - | 0.7 | 0.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE}$ = 0.3 V; $I_C$ = 1 mA; $T_{amb}$ = 25 °C | | 1.4 | 0.8 | - | V |
| R1 | bias resistor 1 (input) | | [1] | 7 | 10 | 13 | kΩ |
| R2/R1 | bias resistor ratio | | [1] | 3.7 | 4.7 | 5.7 | |
| $C_c$ | collector capacitance | $V_{CB}$ = 10 V; $I_E$ = 0 A; $i_e$ = 0 A; f = 1 MHz; $T_{amb}$ = 25 °C | | - | - | 2.5 | pF |
| $f_T$ | transition frequency | $V_{CE}$ = 5 V; $I_C$ = 10 mA; f = 100 MHz; $T_{amb}$ = 25 °C | [2] | - | 230 | - | MHz |

[1] See "Section 11: Test information" for resistor calculation and test conditions.
[2] Characteristics of built-in transistor.




$V_{CE}$ = 5 V
(1) $T_{amb}$ = 100 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -40 °C

**Fig. 3. DC current gain as a function of collector current; typical values**

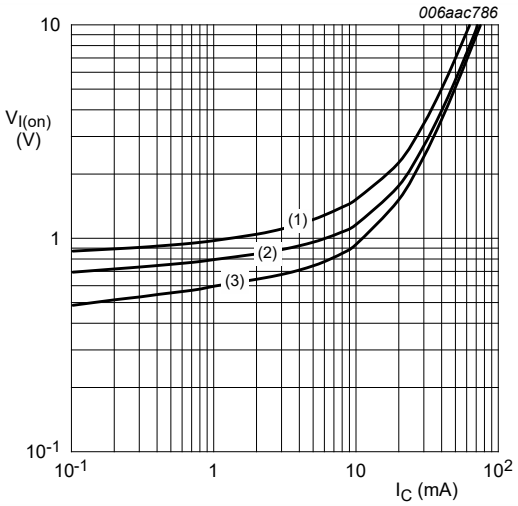



$I_C/I_B$ = 20
(1) $T_{amb}$ = 100 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -40 °C

**Fig. 4. Collector-emitter saturation voltage as a function of collector current; typical values**

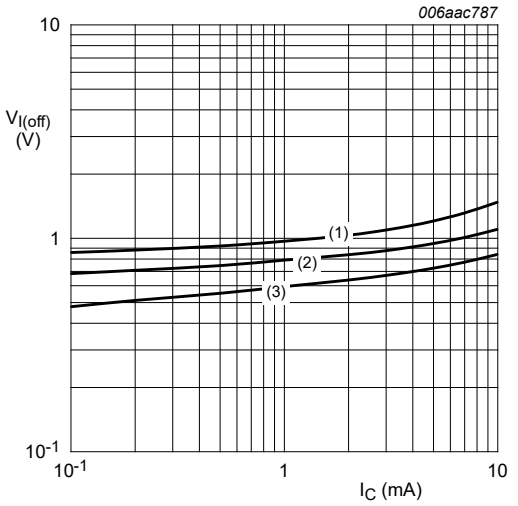

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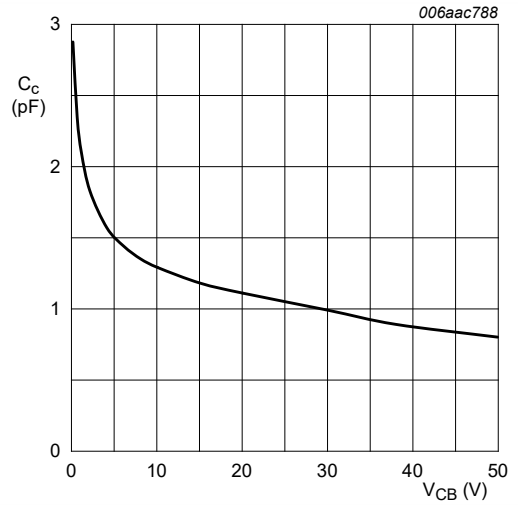

$V_{CE}$ = 0.3 V
(1) $T_{amb}$ = -40 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 100 °C

**Fig. 5. On-state input voltage as a function of collector current; typical values**



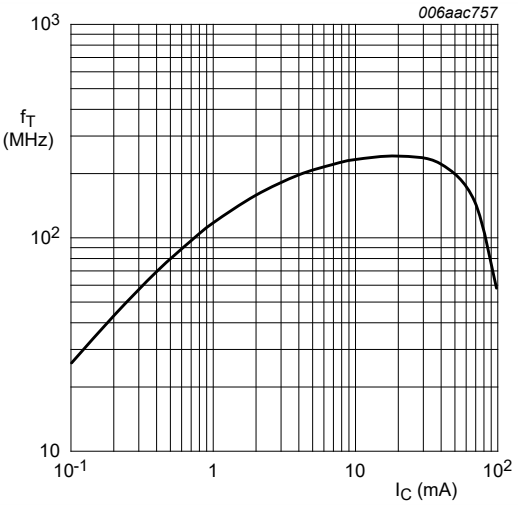

$V_{CE}$ = 5 V
(1) $T_{amb}$ = -40 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 100 °C

**Fig. 6. Off-state input voltage as a function of collector current; typical values**




f = 1 MHz
$T_{amb}$ = 25 °C

**Fig. 7. Collector capacitance as a function of collector-base voltage; typical values**




$V_{CE}$ = 5 V; $T_{amb}$ = 25 °C

**Fig. 8. Transition frequency as a function of collector current; typical values of built-in transistor**


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# 11. Test information

## Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R_1 = \frac{V(I_2) - V(I_1)}{I_2 - I_1}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I_4) - V(I_3)}{R1 \cdot (I_4 - I_3)} - 1$$

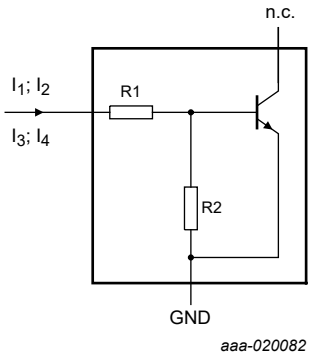



**Fig. 9. Resistor test circuit**

## Resistor test conditions

**Table 8. Resistor test conditions**

| Type number | R1 (kΩ) | R2 (kΩ) | Test conditions | | | |
|---|---|---|---|---|---|---|
| | | | $I_1$ | $I_2$ | $I_3$ | $I_4$ |
| PDTC114YT | 10 | 47 | 90 µA | 140 µA | -55 µA | -105 µA |

# 12. Package outline

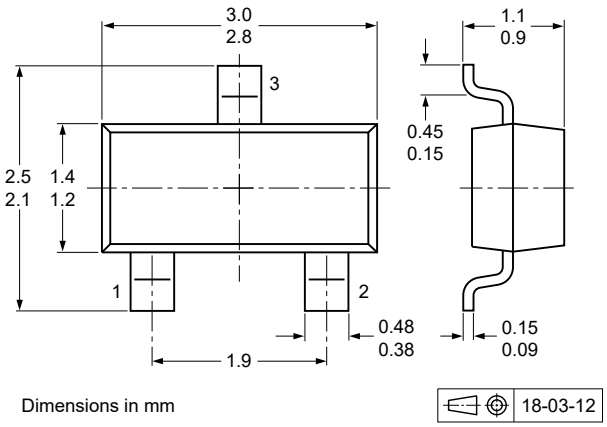



**Fig. 10. Package outline SOT23**


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## 13. Soldering

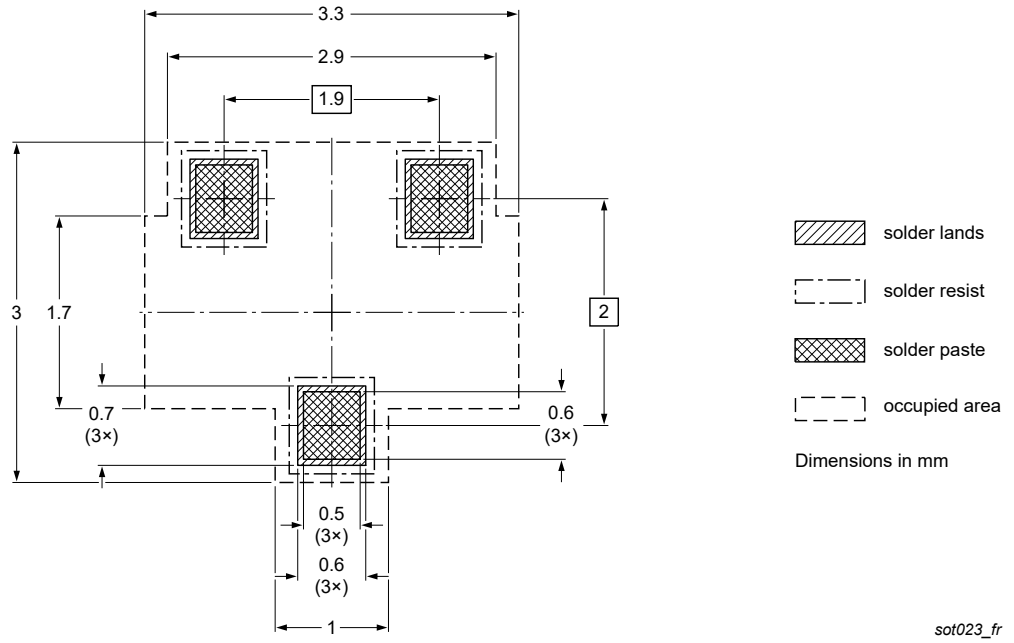



**Fig. 11. Reflow soldering footprint for SOT23**

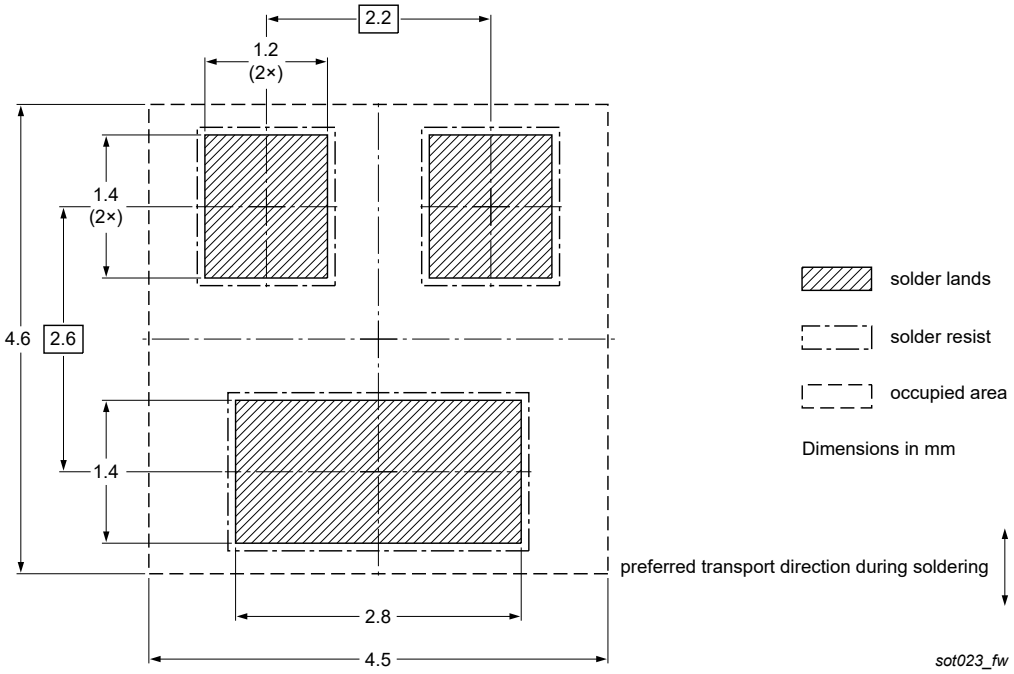



**Fig. 12. Wave soldering footprint for SOT23**


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# 14. Revision history

**Table 9. Revision history**

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PDTC114YT v.8 | 20230425 | Product data sheet | - | PDTC114Y_SER v.7 |
| Modification: | • Family data sheet reduced to single type data sheet.<br>• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Product changed to non automotive. Please refer to the automotive product(s) with -Q.<br>• Packing information removed.<br>• Characteristics: Value corrected for $I_{CEO}$ at 25°C. | | | |
| PDTC114Y_SER v.7 | 20111118 | Product data sheet | - | PDTC114Y_SERIES v.6 |
| PDTC114Y_SERIES v.6 | 20040817 | Product data sheet | - | PDTC114Y_SERIES v.5 |
| PDTC114Y_SERIES v.5 | 20040910 | Product specification | - | PDTC114Y_SERIES v.4 |
| PDTC114Y_SERIES v.4 | 20030414 | Product specification | - | - |


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