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Kind regards,

Team Nexperia

PDTC124X series

NPN resistor-equipped transistors; R1 = 22 k Ω , R2 = 47 k Ω

Rev. 07 — 16 November 2009

Product data sheet

1. Product profile

1.1 General description

NPN Resistor-Equipped Transistors (RET) family.

Table 1. Product overview

| Type number | Package | | | PNP complement |
|--------------------------|---------|--------|----------|----------------|
| | NXP | JEITA | JEDEC | |
| PDTC124XE | SOT416 | SC-75 | - | PDTA124XE |
| PDTC124XEF | SOT490 | SC-89 | - | PDTA124XEF |
| PDTC124XK | SOT346 | SC-59A | TO-236 | PDTA124XK |
| PDTC124XM | SOT883 | SC-101 | - | PDTA124XM |
| PDTC124XS ^[1] | SOT54 | SC-43A | TO-92 | PDTA124XS |
| PDTC124XT | SOT23 | - | TO-236AB | PDTA124XT |
| PDTC124XU | SOT323 | SC-70 | - | PDTA124XU |

[1] Also available in SOT54A and SOT54 variant packages (see [Section 2](#)).

1.2 Features

- Built-in bias resistors
- Reduces component count
- Simplifies circuit design
- Reduces pick and place costs

1.3 Applications

- General-purpose switching and amplification
- Circuit drivers
- Inverter and interface circuits

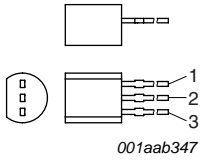
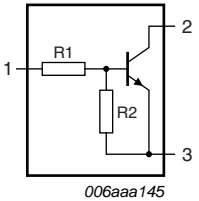
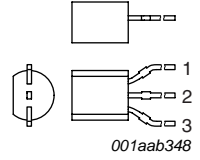
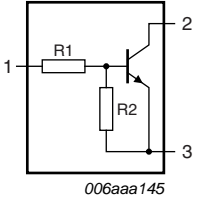
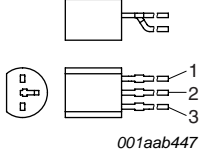
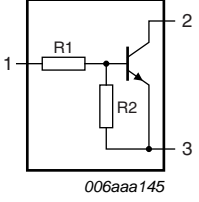
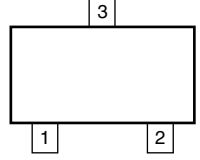
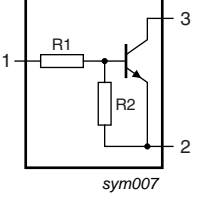
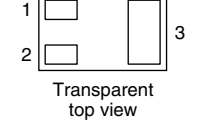
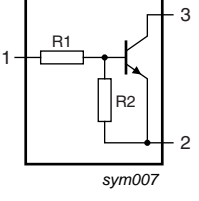
1.4 Quick reference data

Table 2. 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) | | 15.4 | 22 | 28.6 | k Ω |
| R2/R1 | bias resistor ratio | | 1.7 | 2.1 | 2.6 | |

2. Pinning information

Table 3. Pinning

| Pin | Description | Simplified outline | Symbol |
|--|--------------------|--|--|
| SOT54 | | | |
| 1 | input (base) |  <p>001aab347</p> |  <p>006aaa145</p> |
| 2 | output (collector) | | |
| 3 | GND (emitter) | | |
| SOT54A | | | |
| 1 | input (base) |  <p>001aab348</p> |  <p>006aaa145</p> |
| 2 | output (collector) | | |
| 3 | GND (emitter) | | |
| SOT54 variant | | | |
| 1 | input (base) |  <p>001aab447</p> |  <p>006aaa145</p> |
| 2 | output (collector) | | |
| 3 | GND (emitter) | | |
| SOT23; SOT323; SOT346; SOT416; SOT490 | | | |
| 1 | input (base) |  <p>006aaa144</p> |  <p>sym007</p> |
| 2 | GND (emitter) | | |
| 3 | output (collector) | | |
| SOT883 | | | |
| 1 | input (base) |  <p>Transparent top view</p> |  <p>sym007</p> |
| 2 | GND (emitter) | | |
| 3 | output (collector) | | |

3. Ordering information

Table 4. Ordering information

| Type number | Package | | Version |
|--------------------------|---------|---|---------|
| | Name | Description | |
| PDTC124XE | SC-75 | plastic surface mounted package; 3 leads | SOT416 |
| PDTC124XEF | SC-89 | plastic surface mounted package; 3 leads | SOT490 |
| PDTC124XK | SC-59A | plastic surface mounted package; 3 leads | SOT346 |
| PDTC124XM | SC-101 | leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm | SOT883 |
| PDTC124XS ^[1] | SC-43A | plastic single-ended leaded (through hole) package; 3 leads | SOT54 |
| PDTC124XT | - | plastic surface mounted package; 3 leads | SOT23 |
| PDTC124XU | SC-70 | plastic surface mounted package; 3 leads | SOT323 |

[1] Also available in SOT54A and SOT54 variant packages (see [Section 2](#) and [Section 9](#)).

4. Marking

Table 5. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PDTC124XE | 32 |
| PDTC124XEF | 32 |
| PDTC124XK | 51 |
| PDTC124XM | DZ |
| PDTC124XS | TC124X |
| PDTC124XT | *46 |
| PDTC124XU | *51 |

[1] * = -: made in Hong Kong
 * = p: made in Hong Kong
 * = t: made in Malaysia
 * = W: made in China

5. Limiting values

Table 6. 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 | - | 7 | V | |
| V _I | input voltage | | | | | |
| | positive | | - | +40 | V | |
| | negative | | - | -7 | V | |
| I _O | output current | | - | 100 | mA | |
| I _{CM} | peak collector current | single pulse; t _p ≤ 1 ms | - | 100 | mA | |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | | | | |
| | SOT416 | | [1] | - | 150 | mW |
| | SOT490 | | [1][2] | - | 250 | mW |
| | SOT346 | | [1] | - | 250 | mW |
| | SOT883 | | [2][3] | - | 250 | mW |
| | SOT54 | | [1] | - | 500 | mW |
| | SOT23 | | [1] | - | 250 | mW |
| | SOT323 | | [1] | - | 200 | mW |
| T _{stg} | storage temperature | | -65 | +150 | °C | |
| T _j | junction temperature | | - | 150 | °C | |
| T _{amb} | ambient temperature | | -65 | +150 | °C | |

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

[2] Reflow soldering is the only recommended soldering method.

[3] Device mounted on an FR4 PCB with 60 μ m copper strip line, standard footprint.

6. Thermal characteristics

Table 7. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|---|-------------|--------|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | | | |
| | SOT416 | | [1] | - | 833 | K/W |
| | SOT490 | | [1][2] | - | 500 | K/W |
| | SOT346 | | [1] | - | 500 | K/W |
| | SOT883 | | [2][3] | - | 500 | K/W |
| | SOT54 | | [1] | - | 250 | K/W |
| | SOT23 | | [1] | - | 500 | K/W |
| | SOT323 | | [1] | - | 625 | K/W |

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

[2] Reflow soldering is the only recommended soldering method.

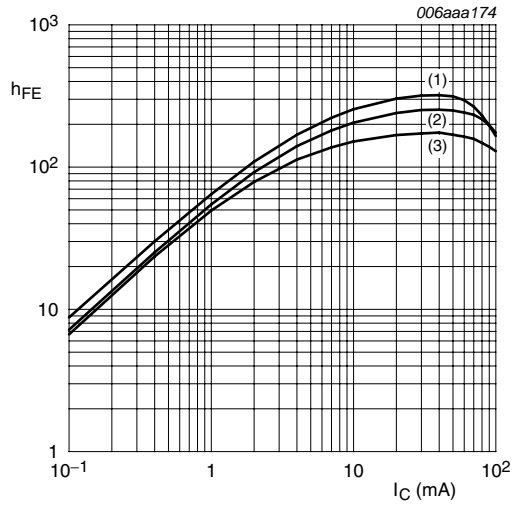
[3] Device mounted on an FR4 PCB with 60 μ m copper strip line, standard footprint.

7. Characteristics

Table 8. Characteristics

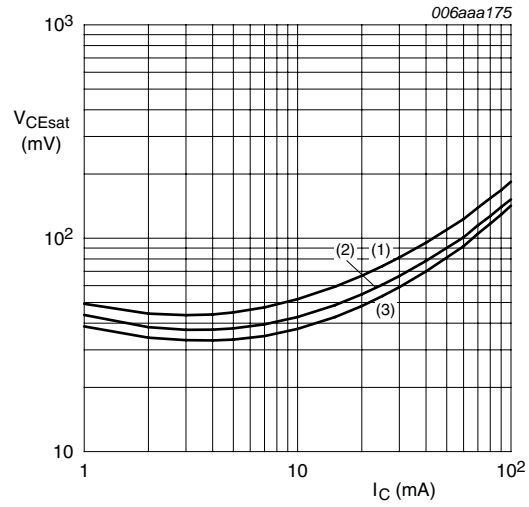
$T_{amb} = 25$ °C unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------|--------------------------------------|--|------|-----|------|------------|
| I_{CBO} | collector-base cut-off current | $V_{CB} = 50$ V; $I_E = 0$ A | - | - | 100 | nA |
| I_{CEO} | collector-emitter cut-off current | $V_{CE} = 30$ V; $I_B = 0$ A | - | - | 1 | μ A |
| | | $V_{CE} = 30$ V; $I_B = 0$ A; $T_j = 150$ °C | - | - | 50 | μ A |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5$ V; $I_C = 0$ A | - | - | 120 | μ A |
| h_{FE} | DC current gain | $V_{CE} = 5$ V; $I_C = 5$ mA | 80 | - | - | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 10$ mA; $I_B = 0.5$ mA | - | - | 150 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE} = 5$ V; $I_C = 100$ μ A | - | 0.8 | 0.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE} = 300$ mV; $I_C = 2$ mA | 2 | 1.1 | - | V |
| R1 | bias resistor 1 (input) | | 15.4 | 22 | 28.6 | k Ω |
| R2/R1 | bias resistor ratio | | 1.7 | 2.1 | 2.6 | |
| C_c | collector capacitance | $V_{CB} = 10$ V; $I_E = i_e = 0$ A; $f = 1$ MHz | - | - | 2.5 | pF |



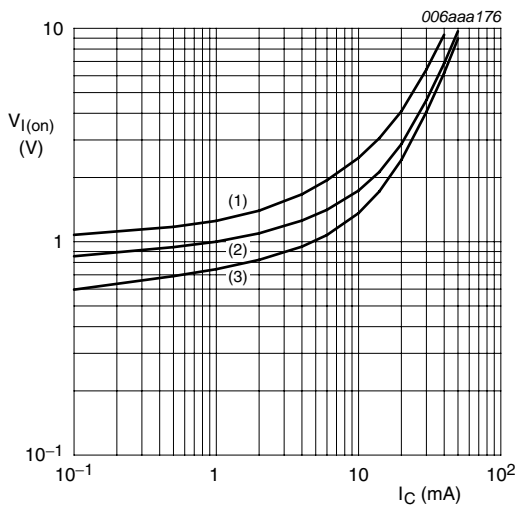
$V_{CE} = 5\text{ V}$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -40\text{ }^\circ\text{C}$

Fig 1. DC current gain as a function of collector current; typical values



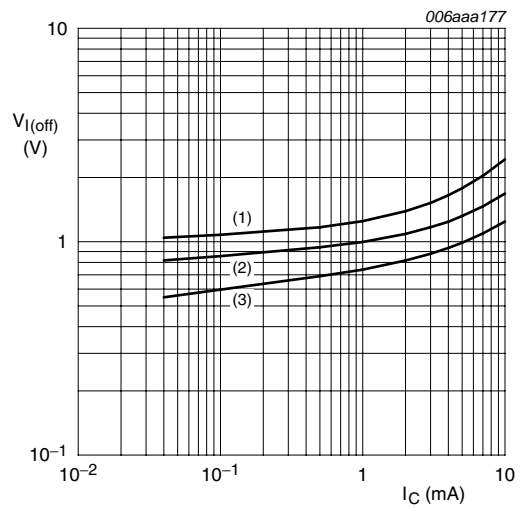
$I_C/I_B = 20$
 (1) $T_{amb} = 100\text{ }^\circ\text{C}$
 (2) $T_{amb} = 25\text{ }^\circ\text{C}$
 (3) $T_{amb} = -40\text{ }^\circ\text{C}$

Fig 2. Collector-emitter saturation voltage as a function of collector current; typical values



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

Fig 3. On-state input voltage as a function of collector current; typical values



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

Fig 4. Off-state input voltage as a function of collector current; typical values

8. Package outline

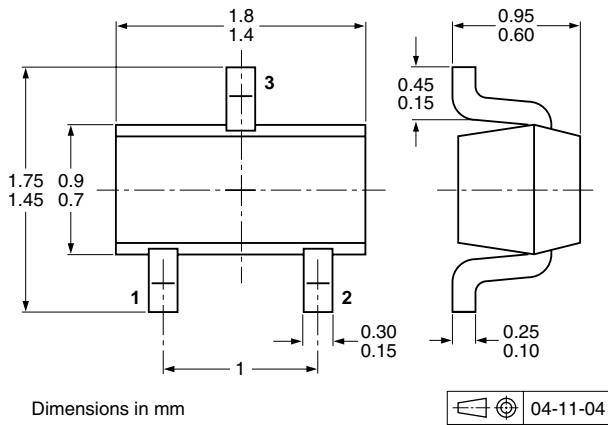


Fig 5. Package outline SOT416 (SC-75)

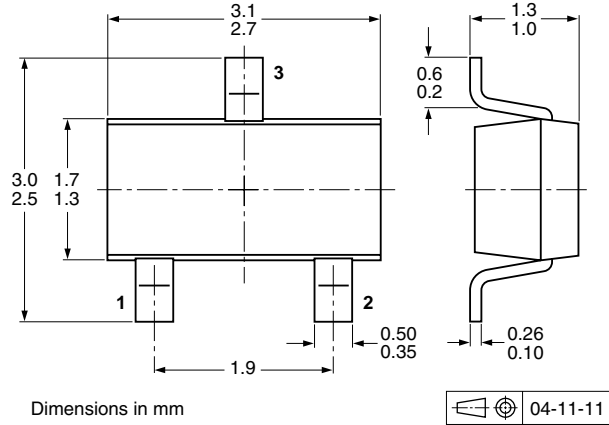


Fig 6. Package outline SOT346 (SC-59A/TO-236)

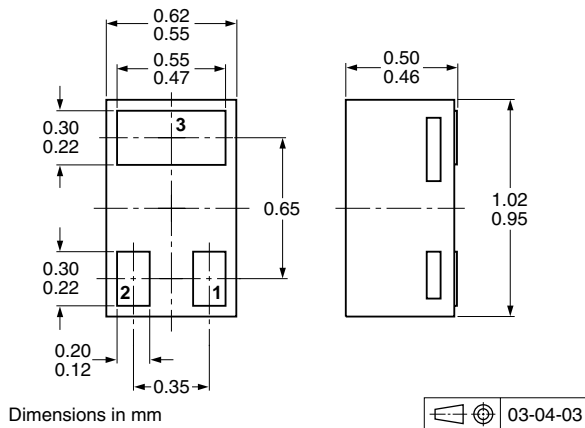


Fig 7. Package outline SOT883 (SC-101)

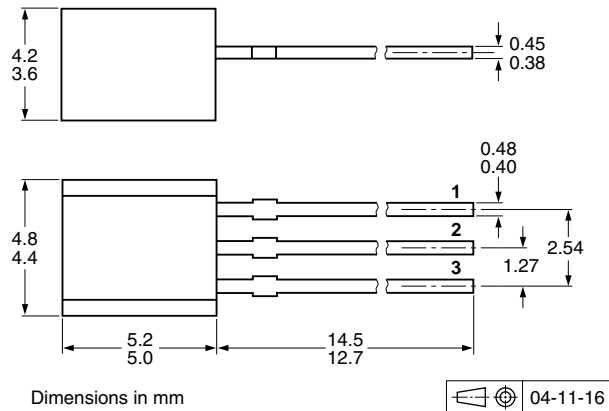


Fig 8. Package outline SOT54 (SC-43A/TO-92)

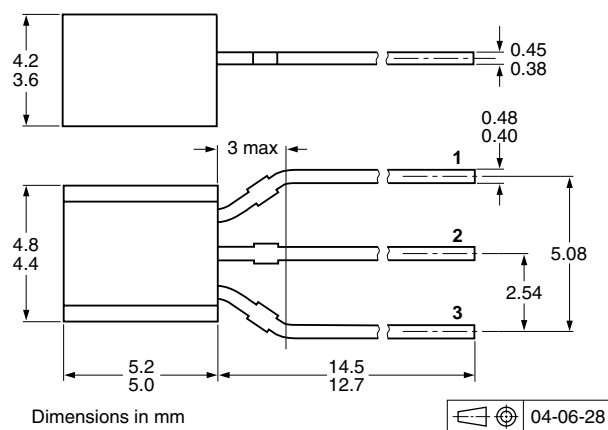


Fig 9. Package outline SOT54A

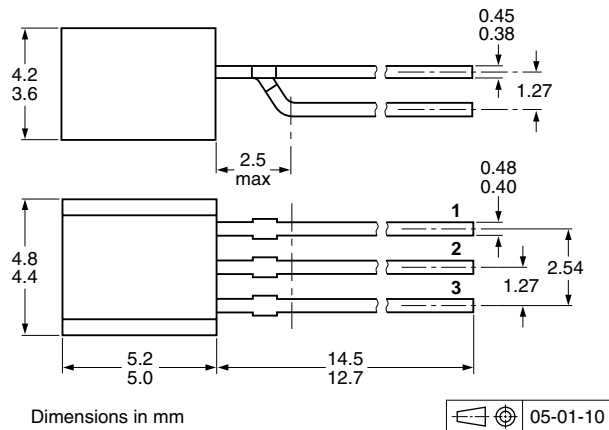
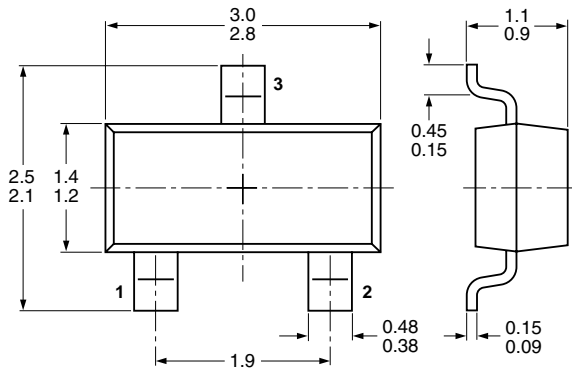
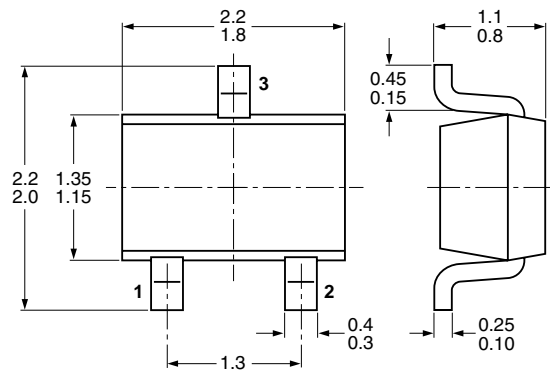
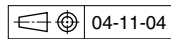


Fig 10. Package outline SOT54 variant



Dimensions in mm



Dimensions in mm

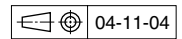
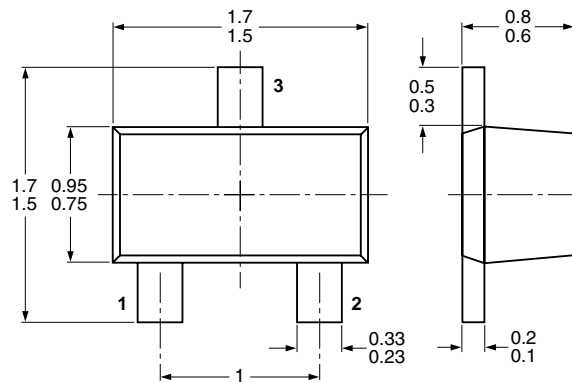


Fig 11. Package outline SOT23 (TO-236AB)

Fig 12. Package outline SOT323 (SC-70)



Dimensions in mm

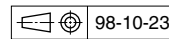


Fig 13. Package outline SOT490 (SC-89)

9. Packing information

Table 9. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.^[1]

| Type number | Package | Description | Packing quantity | | | |
|-------------|---------------|--------------------------------|------------------|------|------|-------|
| | | | 3000 | 4000 | 5000 | 10000 |
| PDTC124XE | SOT416 | 4 mm pitch, 8 mm tape and reel | -115 | - | - | -135 |
| PDTC124XEF | SOT490 | 4 mm pitch, 8 mm tape and reel | - | -115 | - | - |
| PDTC124XK | SOT346 | 4 mm pitch, 8 mm tape and reel | -115 | - | - | -135 |
| PDTC124XM | SOT883 | 2 mm pitch, 8 mm tape and reel | - | - | - | -315 |
| PDTC124XS | SOT54 | bulk, straight leads | - | - | -412 | - |
| | SOT54A | tape and reel, wide pitch | - | - | - | -116 |
| | | tape ammopack, wide pitch | - | - | - | -126 |
| | SOT54 variant | bulk, delta pinning | - | - | -112 | - |
| PDTC124XT | SOT23 | 4 mm pitch, 8 mm tape and reel | -215 | - | - | -235 |
| PDTC124XU | SOT323 | 4 mm pitch, 8 mm tape and reel | -115 | - | - | -135 |

[1] For further information and the availability of packing methods, see [Section 12](#).

10. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|---|---------------------------|---------------|-----------------------------|
| PDTC124X_SER_7 | 20091116 | Product data sheet | - | PDTC124X_SER_6 |
| Modifications: | <ul style="list-style-type: none"> This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content. | | | |
| PDTC124X_SER_6 | 20050714 | Product data sheet | - | PDTC124X_SERIES_5 |
| PDTC124X_SERIES_5 | 20040813 | Product specification | - | PDTC124X_SERIES_4 |
| PDTC124X_SERIES_4 | 20030410 | Product specification | - | PDTC124XEF_2 PDTC124XE_3 |
| PDTC124XE_3 | 19990518 | Product specification | - | PDTC124XE_2 |
| PDTC124XE_2 | 19980921 | Product specification | - | PDTC124XE_1 |
| PDTC124XE_1 | 19971215 | Product specification | - | - |
| PDTC124XEF_2 | 19990518 | Preliminary specification | - | PDTC124XEF_1 |
| PDTC124XEF_1 | 19981111 | Preliminary specification | - | - |

11. Legal information

11.1 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. |

[1] Please consult the most recently issued document before initiating or completing a design.

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

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