

# PDTC114T series

NPN resistor-equipped transistors; R1 = 10 k $\Omega$ , R2 = open

Rev. 08 — 9 February 2006

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 |
|-------------------------------|---------|--------|----------|----------------|
|                               | Philips | JEITA  | JEDEC    |                |
| PDTC114TE                     | SOT416  | SC-75  | -        | PDTA114TE      |
| PDTC114TK                     | SOT346  | SC-59A | TO-236   | PDTA114TK      |
| PDTC114TM                     | SOT883  | SC-101 | -        | PDTA114TM      |
| PDTC114TS <a href="#">[1]</a> | SOT54   | SC-43A | TO-92    | PDTA114TS      |
| PDTC114TT                     | SOT23   | -      | TO-236AB | PDTA114TT      |
| PDTC114TU                     | SOT323  | SC-70  | -        | PDTA114TU      |

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

### 1.2 Features

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

### 1.3 Applications

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

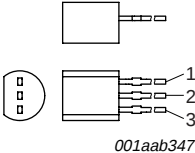
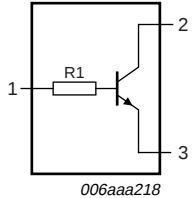
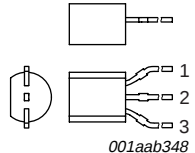
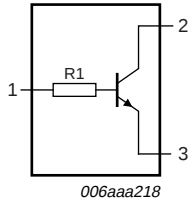
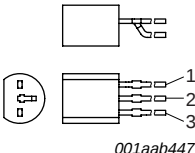
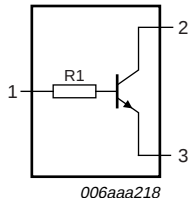
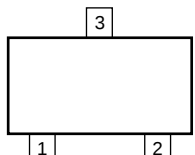
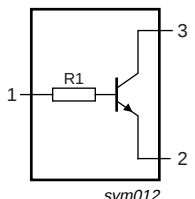
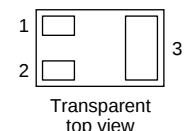
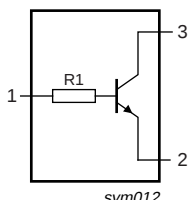
### 1.4 Quick reference data

Table 2: Quick reference data

| Symbol           | Parameter                 | Conditions | Min | Typ | Max | Unit       |
|------------------|---------------------------|------------|-----|-----|-----|------------|
| V <sub>CEO</sub> | collector-emitter voltage | open base  | -   | -   | 50  | V          |
| I <sub>O</sub>   | output current            |            | -   | -   | 100 | mA         |
| R1               | bias resistor 1 (input)   |            | 7   | 10  | 13  | k $\Omega$ |

2. Pinning information

Table 3: Pinning

| Pin                           | Description        | Simplified outline                                                                    | Symbol                                                                                |
|-------------------------------|--------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| SOT54                         |                    |                                                                                       |                                                                                       |
| 1                             | input (base)       |    |    |
| 2                             | output (collector) |                                                                                       |                                                                                       |
| 3                             | GND (emitter)      |                                                                                       |                                                                                       |
| SOT54A                        |                    |                                                                                       |                                                                                       |
| 1                             | input (base)       |    |   |
| 2                             | output (collector) |                                                                                       |                                                                                       |
| 3                             | GND (emitter)      |                                                                                       |                                                                                       |
| SOT54 variant                 |                    |                                                                                       |                                                                                       |
| 1                             | input (base)       |  |  |
| 2                             | output (collector) |                                                                                       |                                                                                       |
| 3                             | GND (emitter)      |                                                                                       |                                                                                       |
| SOT23; SOT323; SOT346; SOT416 |                    |                                                                                       |                                                                                       |
| 1                             | input (base)       |  |  |
| 2                             | GND (emitter)      |                                                                                       |                                                                                       |
| 3                             | output (collector) |                                                                                       |                                                                                       |
| SOT883                        |                    |                                                                                       |                                                                                       |
| 1                             | input (base)       |  |  |
| 2                             | GND (emitter)      |                                                                                       |                                                                                       |
| 3                             | output (collector) |                                                                                       |                                                                                       |

### 3. Ordering information

Table 4: Ordering information

| Type number              | Package |                                                                               |         |
|--------------------------|---------|-------------------------------------------------------------------------------|---------|
|                          | Name    | Description                                                                   | Version |
| PDTC114TE                | SC-75   | plastic surface mounted package; 3 leads                                      | SOT416  |
| PDTC114TK                | SC-59A  | plastic surface mounted package; 3 leads                                      | SOT346  |
| PDTC114TM                | SC-101  | leadless ultra small plastic package; 3 solder lands; body 1.0 × 0.6 × 0.5 mm | SOT883  |
| PDTC114TS <sup>[1]</sup> | SC-43A  | plastic single-ended leaded (through hole) package; 3 leads                   | SOT54   |
| PDTC114TT                | -       | plastic surface mounted package; 3 leads                                      | SOT23   |
| PDTC114TU                | 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 <sup>[1]</sup> |
|-------------|-----------------------------|
| PDTC114TE   | 24                          |
| PDTC114TK   | 24                          |
| PDTC114TM   | DT                          |
| PDTC114TS   | TC114T                      |
| PDTC114TT   | *12                         |
| PDTC114TU   | *24                         |

[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                   | -         | 5    | V    |
| $I_O$     | output current            |                                  | -         | 100  | mA   |
| $I_{CM}$  | peak collector current    | single pulse;<br>$t_p \leq 1$ ms | -         | 100  | mA   |
| $P_{tot}$ | total power dissipation   | $T_{amb} \leq 25$ °C             |           |      |      |
|           | SOT416                    |                                  | [1] -     | 150  | 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 µm 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  |
|               | 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.

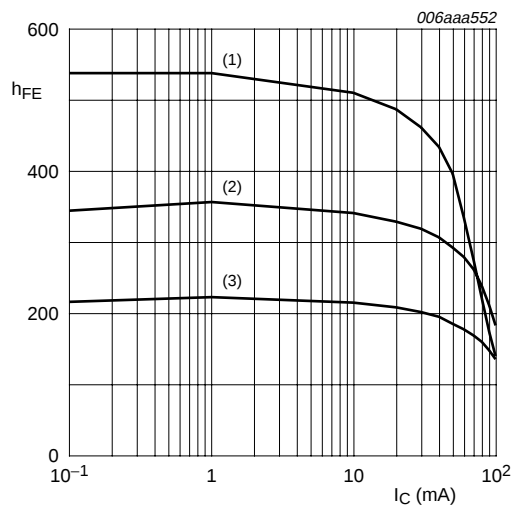
[3] Device mounted on an FR4 PCB with 60 µm copper strip line, standard footprint.

## 7. Characteristics

**Table 8: Characteristics**

$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

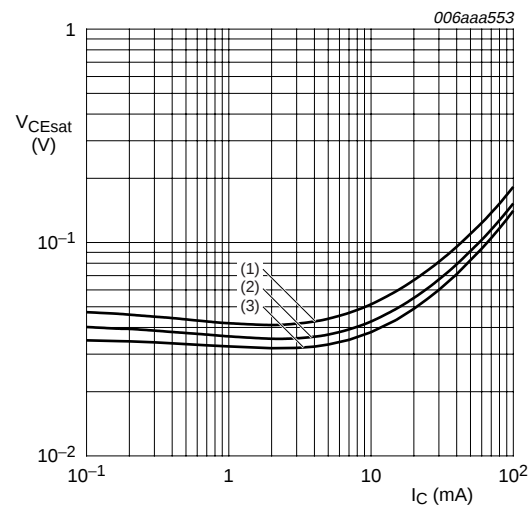
| Symbol      | Parameter                            | Conditions                                                                           | Min | Typ | Max | Unit          |
|-------------|--------------------------------------|--------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| $I_{CBO}$   | collector-base cut-off current       | $V_{CB} = 50\text{ V}$ ; $I_E = 0\text{ A}$                                          | -   | -   | 100 | nA            |
| $I_{CEO}$   | collector-emitter cut-off current    | $V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$                                          | -   | -   | 1   | $\mu\text{A}$ |
|             |                                      | $V_{CE} = 30\text{ V}$ ; $I_B = 0\text{ A}$ ;<br>$T_j = 150\text{ }^{\circ}\text{C}$ | -   | -   | 50  | $\mu\text{A}$ |
| $I_{EBO}$   | emitter-base cut-off current         | $V_{EB} = 5\text{ V}$ ; $I_C = 0\text{ A}$                                           | -   | -   | 100 | nA            |
| $h_{FE}$    | DC current gain                      | $V_{CE} = 5\text{ V}$ ; $I_C = 1\text{ mA}$                                          | 200 | -   | -   |               |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C = 10\text{ mA}$ ; $I_B = 0.5\text{ mA}$                                         | -   | -   | 150 | mV            |
| R1          | bias resistor 1 (input)              |                                                                                      | 7   | 10  | 13  | k $\Omega$    |
| $C_c$       | collector capacitance                | $V_{CB} = 10\text{ V}$ ; $I_E = i_e = 0\text{ A}$ ;<br>$f = 1\text{ MHz}$            | -   | -   | 2.5 | pF            |



$V_{CE} = 5\text{ V}$

- (1)  $T_{amb} = 150\text{ }^{\circ}\text{C}$
- (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**

8. Package outline

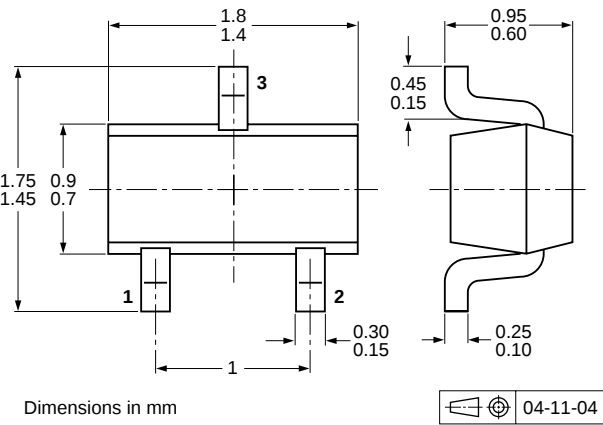


Fig 3. Package outline SOT416 (SC-75)

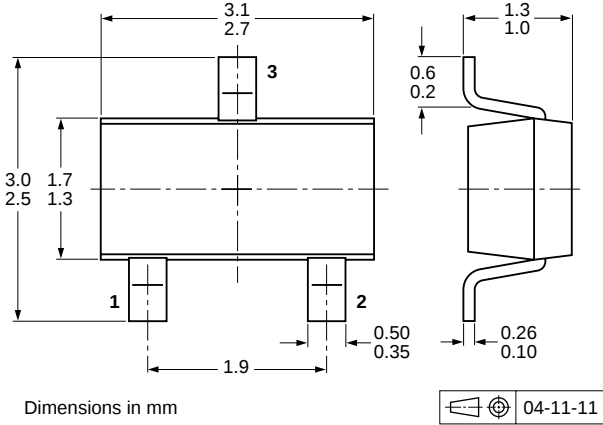


Fig 4. Package outline SOT346 (SC-59A/TO-236)

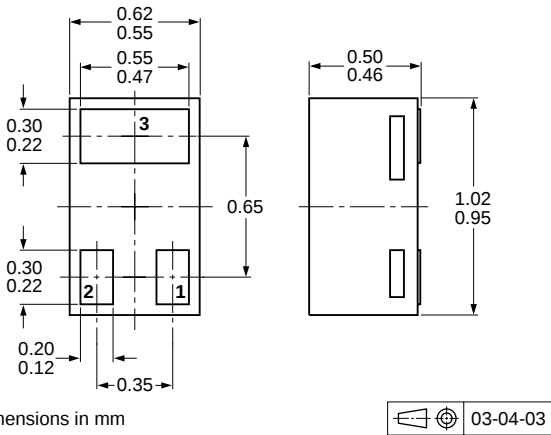


Fig 5. Package outline SOT883 (SC-101)

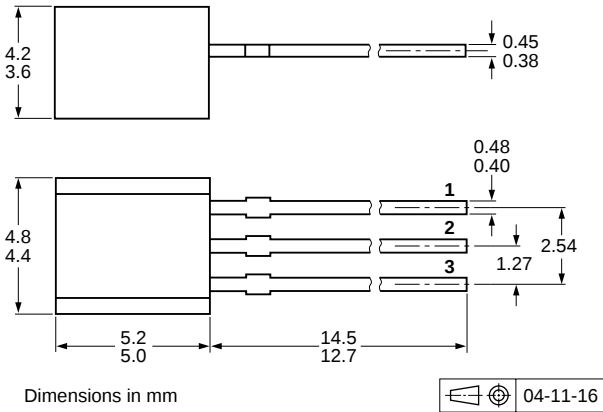


Fig 6. Package outline SOT54 (SC-43A/TO-92)

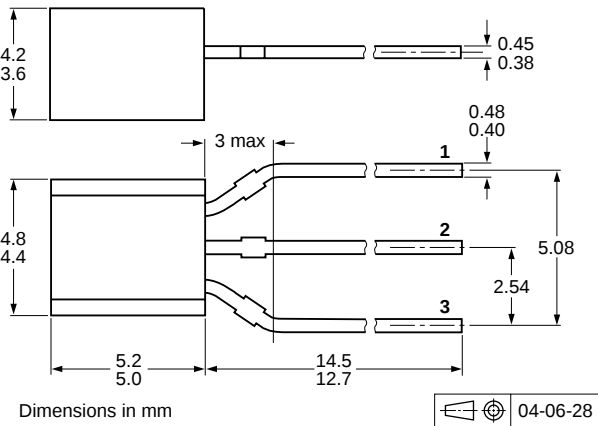


Fig 7. Package outline SOT54A

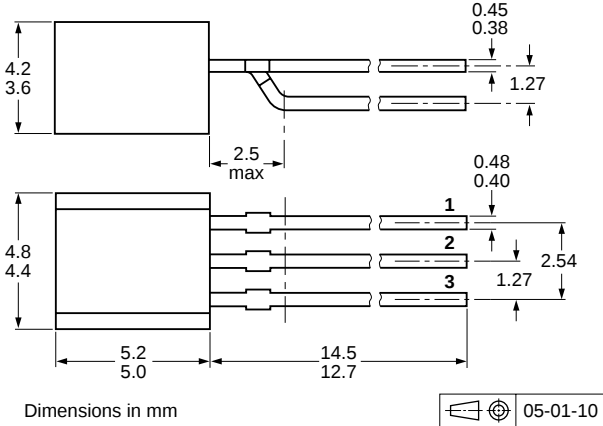
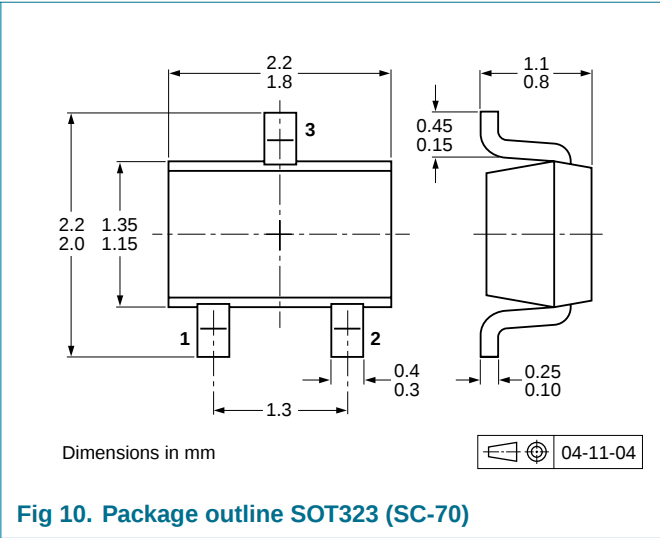
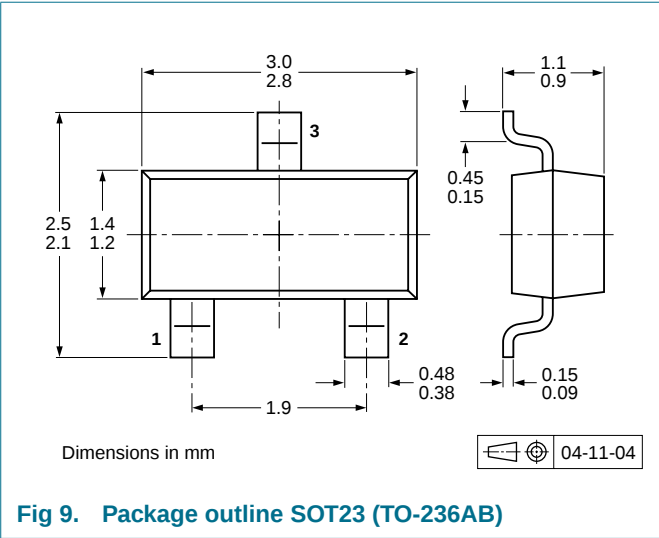


Fig 8. Package outline SOT54 variant



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             | 5000 | 10000 |
| PDTC114TE   | SOT416        | 4 mm pitch, 8 mm tape and reel | -115             | -    | -135  |
| PDTC114TK   | SOT346        | 4 mm pitch, 8 mm tape and reel | -115             | -    | -135  |
| PDTC114TM   | SOT883        | 2 mm pitch, 8 mm tape and reel | -                | -    | -315  |
| PDTC114TS   | SOT54         | bulk, straight leads           | -                | -412 | -     |
|             | SOT54A        | tape and reel, wide pitch      | -                | -    | -116  |
|             |               | tape ammopack, wide pitch      | -                | -    | -126  |
|             | SOT54 variant | bulk, delta pinning            | -                | -112 | -     |
| PDTC114TT   | SOT23         | 4 mm pitch, 8 mm tape and reel | -215             | -    | -235  |
| PDTC114TU   | SOT323        | 4 mm pitch, 8 mm tape and reel | -115             | -    | -135  |

[1] For further information and the availability of packing methods, see Section 15.

## 10. Revision history

Table 10: Revision history

| Document ID       | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Data sheet status         | Change notice | Doc. number    | Supersedes                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------|----------------|-------------------------------------------------------------------------|
| PDTC114T_SER_8    | 20060209                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Product data sheet        | -             | -              | PDTC114T_SER_7                                                          |
| Modifications:    | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li> <li>Type number PDTC114TEF removed</li> <li><a href="#">Table 1 "Product overview"</a>: EIAJ in table header amended to JEITA</li> <li><a href="#">Section 1.2 "Features"</a>: amended</li> <li><a href="#">Section 1.3 "Applications"</a>: amended</li> <li><a href="#">Figure 1, 2, 7 and 8</a>: added</li> <li><a href="#">Figure 3, 4, 5, 6, 9 and 10</a>: superseded by minimized package outline drawings</li> <li><a href="#">Section 9 "Packing information"</a>: added</li> <li><a href="#">Section 14 "Trademarks"</a>: added</li> </ul> |                           |               |                |                                                                         |
| PDTC114T_SER_7    | 20041011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Product specification     | -             | 9397 750 14186 | PDTC114T_SERIES_6                                                       |
| PDTC114T_SERIES_6 | 20040817                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Product specification     | -             | 9397 750 13664 | PDTC114T_SERIES_5                                                       |
| PDTC114T_SERIES_5 | 20040119                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Product specification     | -             | 9397 750 11731 | PDTC114T_SERIES_4                                                       |
| PDTC114T_SERIES_4 | 20030414                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Product specification     | -             | 9397 750 11011 | PDTC114TE_2<br>PDTC114TK_2<br>PDTC114TS_2<br>PDTC114TT_3<br>PDTC114TU_3 |
| PDTC114TU_3       | 19990416                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Preliminary specification | -             | 9397 750 05599 | PDTC114TU_2                                                             |
| PDTC114TU_2       | 19980519                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Preliminary specification | -             | 9397 750 03908 | PDTC114TU_1                                                             |
| PDTC114TU_1       | 19970716                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Preliminary specification | -             | 9397 750 01149 | -                                                                       |
| PDTC114TT_3       | 19990416                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Objective specification   | -             | 9397 750 05598 | PDTC114TT_2                                                             |
| PDTC114TT_2       | 19980519                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Objective specification   | -             | 9397 750 03912 | PDTC114TT_1                                                             |
| PDTC114TT_1       | 19970714                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Objective specification   | -             | 9397 750 01371 | -                                                                       |
| PDTC114TS_2       | 19980518                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Product specification     | -             | 9397 750 03891 | PDTC114TS_1                                                             |
| PDTC114TS_1       | 19970703                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Product specification     | -             | 9397 750 02297 | -                                                                       |
| PDTC114TK_2       | 19980519                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Product specification     | -             | 9397 750 03899 | PDTC114TK_1                                                             |

Table 10: Revision history ...continued

| Document ID | Release date | Data sheet status     | Change notice | Doc. number    | Supersedes  |
|-------------|--------------|-----------------------|---------------|----------------|-------------|
| PDTC114TK_1 | 19970528     | Product specification | -             | 9397 750 01367 | -           |
| PDTC114TE_2 | 19980803     | Product specification | -             | 9397 750 04123 | PDTC114TE_1 |
| PDTC114TE_1 | 19970711     | Product specification | -             | 9397 750 02628 | -           |

## 11. Data sheet status

| Level | Data sheet status <sup>[1]</sup> | Product status <sup>[2] [3]</sup> | Definition                                                                                                                                                                                                                                                                                     |
|-------|----------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I     | Objective data                   | Development                       | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.                                                                                                    |
| II    | Preliminary data                 | Qualification                     | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.             |
| III   | Product data                     | Production                        | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

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

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 12. Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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