

# CBT3244A

## Octal bus switch with quad output enables

Rev. 3 — 8 September 2017

Product data sheet

## 1 General description

The CBT3244A provides eight bits of high-speed TTL-compatible bus switching in a standard '244 device pinout. The low ON-state resistance of the switch allows connections to be made with minimal propagation delay.

The CBT3244A device is organized as two 4-bit low-impedance switches with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is LOW, the switch is on and data can flow from port A to port B, or vice versa. When  $\overline{OE}$  is HIGH, the switch is open and high-impedance state exists between the two ports.

The CBT3244A is characterized for operation from -40 °C to +85 °C.

## 2 Features and benefits

- Standard '244-type pinout
- 5  $\Omega$  switch connection between two ports
- TTL compatible control input levels
- Latch-up protection exceeds 500 mA per JESD78
- ESD protection:
  - HBM JESD22-A114 exceeds 2000 V
  - MM JESD22-A115 exceeds 200 V
  - CDM JESD22-C101 exceeds 1000 V

## 3 Ordering information

Table 1. Ordering information

| Type number | Package           |          |  |          |
|-------------|-------------------|----------|--|----------|
|             | Temperature range | Name     | Description  | Version  |
| CBT3244ABQ  | -40 °C to + 85 °C | DHVQFN20 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm | SOT764-1 |
| CBT3244APW  | -40 °C to + 85 °C | TSSOP20  | plastic thin shrink small outline package; 20 leads; body width 4.4 mm   | SOT360-1 |
| CBT3244ADB  | -40 °C to + 85 °C | SSOP20   | plastic shrink small outline package; 20 leads; body width 5.3 mm  | SOT339-1 |
| CBT3244AD   | -40 °C to + 85 °C | SO20     | plastic small outline package; 20 leads; body width 7.5 mm   | SOT163-1 |

4 Marking

Table 2. Marking codes

| Type number | Marking code |
|-------------|--------------|
| CBT3244ABQ  | CT3244A      |
| CBT3244APW  | CT3244A      |
| CBT3244ADB  | CT3244A      |
| CBT3244AD   | CBT3244AD    |

5 Functional diagram

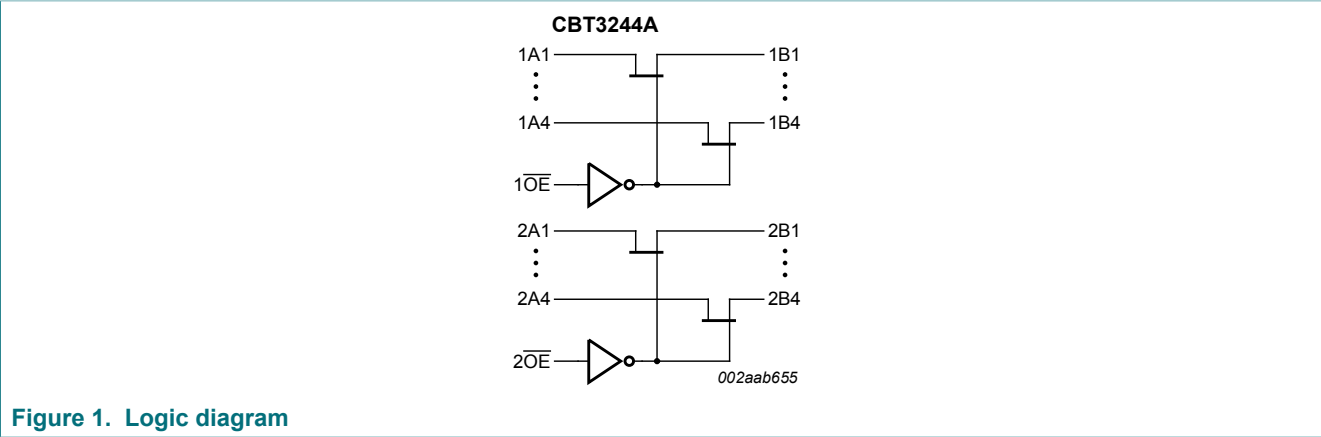
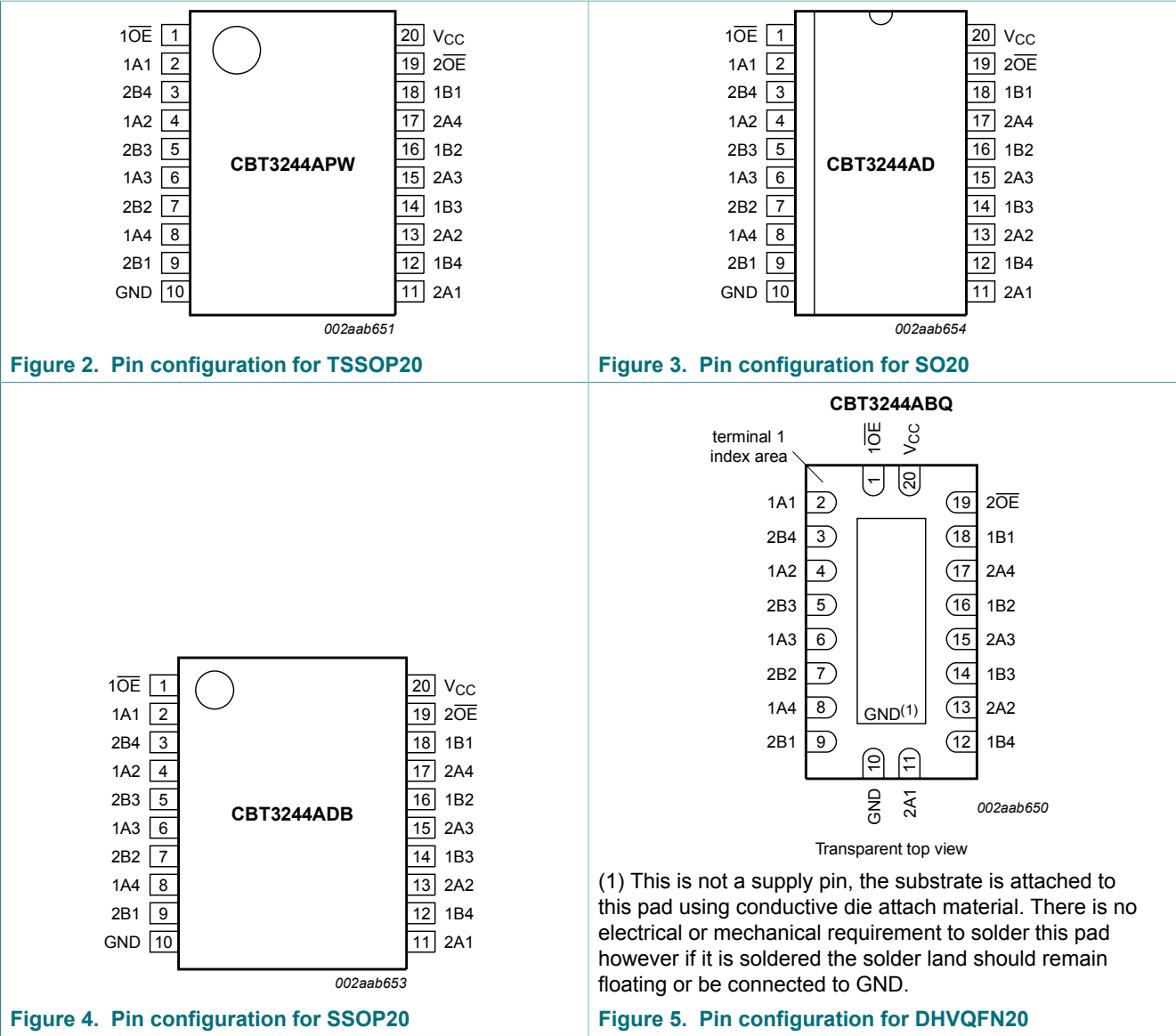


Figure 1. Logic diagram

6 Pinning information

6.1 Pinning



## 6.2 Pin description

Table 3. Pin description

| Symbol                                 | Pin                        | Description                |
|--|----------------------------|----------------------------|
| $1\overline{OE}$ , $2\overline{OE}$    | 1, 19                      | output enable (active LOW) |
| 1A1, 1A2, 1A3, 1A4, 2A1, 2A2, 2A3, 2A4 | 2, 4, 6, 8, 11, 13, 15, 17 | inputs                     |
| 1B1, 1B2, 1B3, 1B4, 2B1, 2B2, 2B3, 2B4 | 18, 16, 14, 12, 9, 7, 5, 3 | outputs                    |
| GND                                    | 10                         | ground (0 V)               |
| $V_{CC}$                               | 20                         | positive supply voltage    |

## 7 Functional description

Table 4. Function selection <sup>[1]</sup>

| Inputs           |                  | Outputs   |           |
|------------------|------------------|-----------|-----------|
| $1\overline{OE}$ | $2\overline{OE}$ | 1An, 1Bn  | 2An, 2Bn  |
| L                | L                | 1An = 1Bn | 2An = 2Bn |
| L                | H                | 1An = 1Bn | Z         |
| H                | L                | Z         | 2An = 2Bn |
| H                | H                | Z         | Z         |

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF state

## 8 Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).<sup>[1]</sup>

| Symbol    | Parameter               | Conditions                  | Min                 | Max  | Unit |
|-----------|-------------------------|-----------------------------|---------------------|------|------|
| $V_{CC}$  | supply voltage          |                             | -0.5                | +7.0 | V    |
| $V_I$     | input voltage           |                             | <sup>[2]</sup> -1.2 | +7.0 | V    |
| $V_O$     | output voltage          | output in OFF or HIGH state | <sup>[2]</sup> -0.5 | +7.0 | V    |
| $I_{IK}$  | input clamping current  | $V_I < 0$ V                 | -                   | -18  | mA   |
| $I_{OK}$  | output clamping current | $V_O < 0$ V                 | -                   | -50  | mA   |
| $I_O$     | output current          | output in LOW state         | -                   | 128  | mA   |
| $T_{stg}$ | storage temperature     |                             | -65                 | +150 | °C   |

[1] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.

[2] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## 9 Recommended operating conditions

**Table 6. Operating conditions**

Voltages are referenced to GND (ground = 0 V).

| Symbol    | Parameter           | Conditions            | Min | Typ | Max | Unit |
|-----------|---------------------|-----------------------|-----|-----|-----|------|
| $V_{CC}$  | supply voltage      |                       | 4.5 | -   | 5.5 | V    |
| $T_{amb}$ | ambient temperature | operating in free-air | -40 | -   | +85 | °C   |

## 10 Static characteristics

**Table 7. Static characteristics**

$T_{amb} = -40\text{ °C to }+85\text{ °C}$ . Voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                 | Conditions  | Min | Typ <sup>[1]</sup> | Max  | Unit |
|-----------------|---------------------------|---|-----|--------------------|------|------|
| $V_{IK}$        | input clamping voltage    | $V_{CC} = 4.5\text{ V}$ ; $I_I = -18\text{ mA}$   | -   | -                  | -1.2 | V    |
| $V_{IH}$        | HIGH-state input voltage  |   | 2.0 | -                  | -    | V    |
| $V_{IL}$        | LOW-state input voltage   |   | -   | -                  | 0.8  | V    |
| $I_I$           | input leakage current     | $V_{CC} = 5.5\text{ V}$ ; $V_I = V_{CC}$ or GND   | -   | -                  | ±1   | µA   |
| $I_{CC}$        | supply current            | $V_{CC} = 5.5\text{ V}$ ; $I_O = 0\text{ mA}$ ; $V_I = V_{CC}$ or GND                                   | -   | 1                  | 3    | µA   |
| $\Delta I_{CC}$ | additional supply current | per input; $V_{CC} = 5.5\text{ V}$ ; one input at 3.4 V; other inputs at $V_{CC}$ or GND <sup>[2]</sup> | -   | -                  | 2.5  | mA   |
| $C_i$           | input capacitance         | control pins; $V_I = 3\text{ V}$ or 0 V; $n\overline{OE} = V_{CC}$                                      | -   | 3                  | -    | pF   |
| $C_{I/O}$       | input/output capacitance  | $n\overline{OE} = V_{CC} = 5.0\text{ V}$  | -   | 3                  | -    | pF   |
| $R_{on}$        | ON-state resistance       | $V_{CC} = 4.5\text{ V}$ ; $V_I = 0\text{ V}$ ; $I_I = 64\text{ mA}$ <sup>[3]</sup>                      | -   | 4                  | 7    | Ω    |
|                 |                           | $V_{CC} = 4.5\text{ V}$ ; $V_I = 0\text{ V}$ ; $I_I = 30\text{ mA}$                                     | -   | 4                  | 7    | Ω    |
|                 |                           | $V_{CC} = 4.5\text{ V}$ ; $V_I = 2.4\text{ V}$ ; $I_I = 15\text{ mA}$                                   | -   | 8                  | 15   | Ω    |

[1] All typical values are measured at  $V_{CC} = 5\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ .

[2] This is the increase in supply current for each input that is at the specified TTL voltage level rather than  $V_{CC}$  or GND.

[3] Measured by the voltage level between the A and the B terminals at the indicated current through the switch. ON-state resistance is determined by the lowest voltage of the two (A or B) terminals.

11 Dynamic characteristics

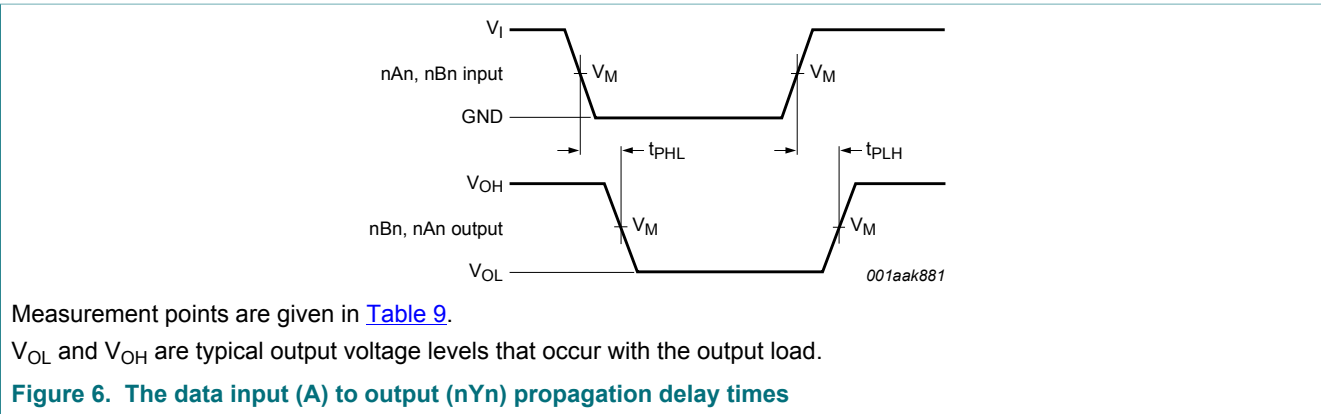
Table 8. Dynamic characteristics

$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ; Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

| Symbol    | Parameter         | Conditions  | Min | Typ | Max  | Unit |
|-----------|-------------------|---|-----|-----|------|------|
| $t_{pd}$  | propagation delay | nAn to nBn, or nBn to nAn;<br>$V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ ; see Figure 6 | -   | -   | 0.25 | ns   |
| $t_{en}$  | enable time       | nOE to nAn or nBn;<br>$V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ ; see Figure 7         | 1.0 | -   | 5.6  | ns   |
| $t_{dis}$ | disable time      | nOE to nAn or nBn;<br>$V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ ; see Figure 7         | 1.0 | -   | 6.0  | ns   |

- [1] This parameter is warranted but not production tested. The propagation delay is based on the RC time constant of the typical ON-state resistance of the switch and a load capacitance of 50 pF, when driven by an ideal voltage source (zero output impedance).
- [2]  $t_{pd}$  is the same as  $t_{PHL}$  and  $t_{PLH}$ .
- [3]  $t_{en}$  is the same as  $t_{PZH}$  and  $t_{PZL}$ .
- [4]  $t_{dis}$  is the same as  $t_{PHZ}$  and  $t_{PLZ}$ .

11.1 Waveforms and test circuit



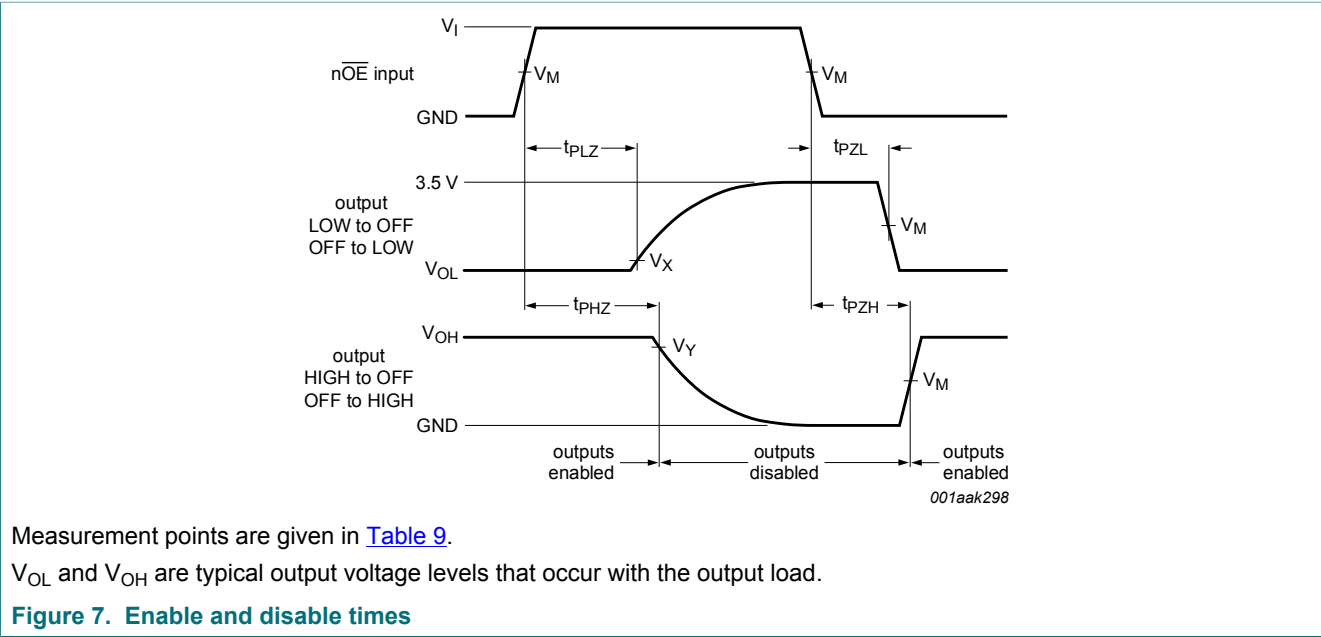
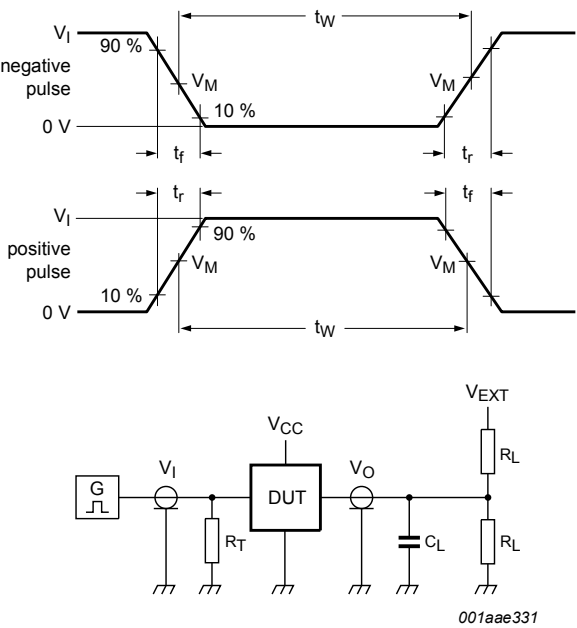


Table 9. Measurement points

| Input |       | Output |                          |                          |
|-------|-------|--------|--------------------------|--------------------------|
| $V_I$ | $V_M$ | $V_M$  | $V_X$                    | $V_Y$                    |
| 3.0 V | 1.5 V | 1.5 V  | $V_{OL} + 0.3 \text{ V}$ | $V_{OH} - 0.3 \text{ V}$ |



Test data is given in [Table 10](#)

All input pulses are supplied by generators having the following characteristics:  $\text{PRR} \leq 10 \text{ MHz}$ ;  $Z_o = 50 \text{ }\Omega$

The outputs are measured one at a time with one transition per measurement.

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to the output impedance  $Z_o$  of the pulse generator.

$V_{\text{EXT}}$  = External voltage for measuring switching times.

Figure 8. Test circuit for measuring switching times

Table 10. Test data

| Input           |                       | Load            |                      | $V_{\text{EXT}}$                 |                                  |                                  |
|-----------------|-----------------------|-----------------|----------------------|----------------------------------|----------------------------------|----------------------------------|
| $V_I$           | $t_r, t_f$            | $C_L$           | $R_L$                | $t_{\text{PLH}}, t_{\text{PHL}}$ | $t_{\text{PZH}}, t_{\text{PHZ}}$ | $t_{\text{PZL}}, t_{\text{PLZ}}$ |
| $V_{\text{CC}}$ | $\leq 2.5 \text{ ns}$ | $50 \text{ pF}$ | $500 \text{ }\Omega$ | open                             | open                             | $7 \text{ V}$                    |



12 Package outline

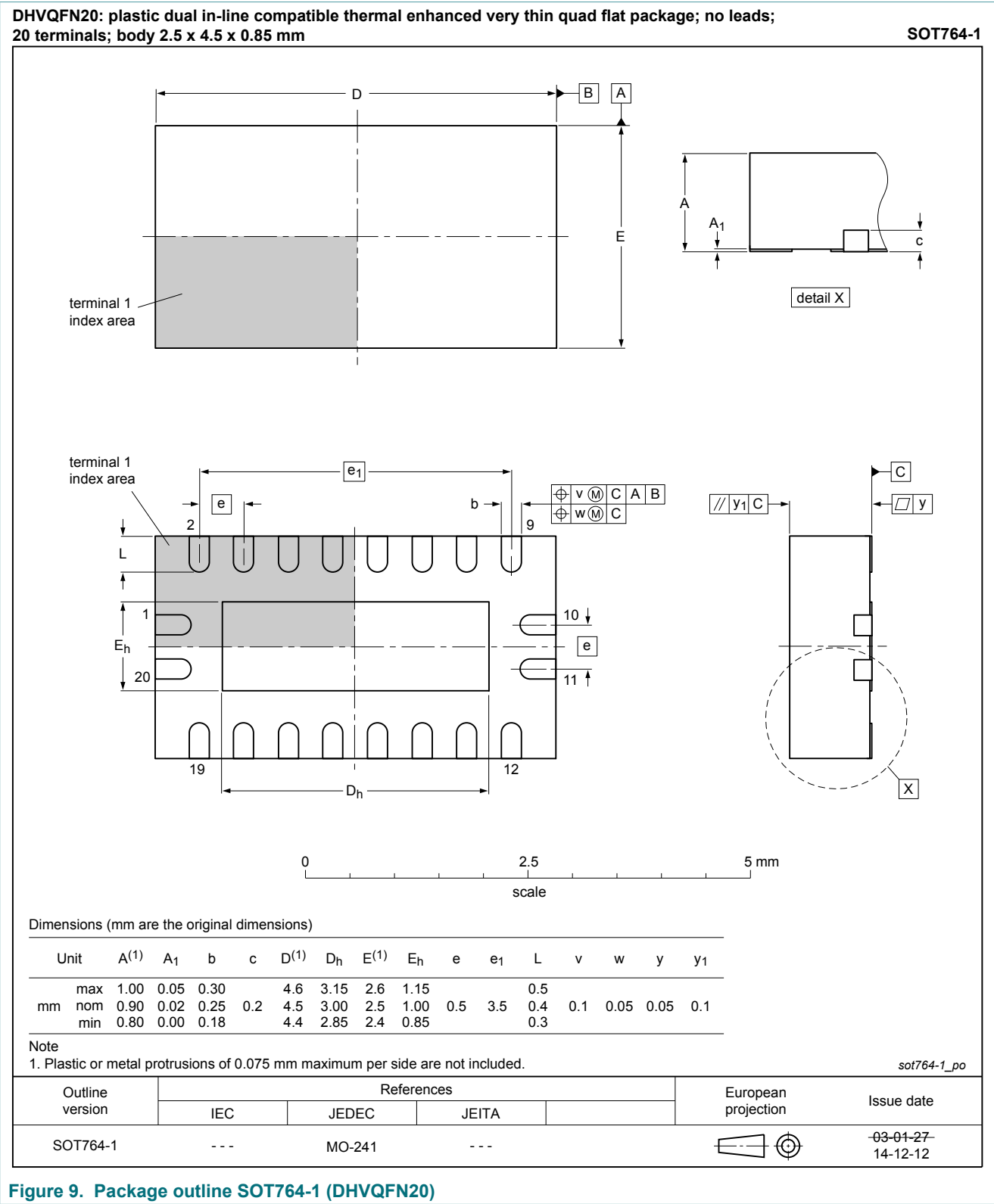


Figure 9. Package outline SOT764-1 (DHVQFN20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

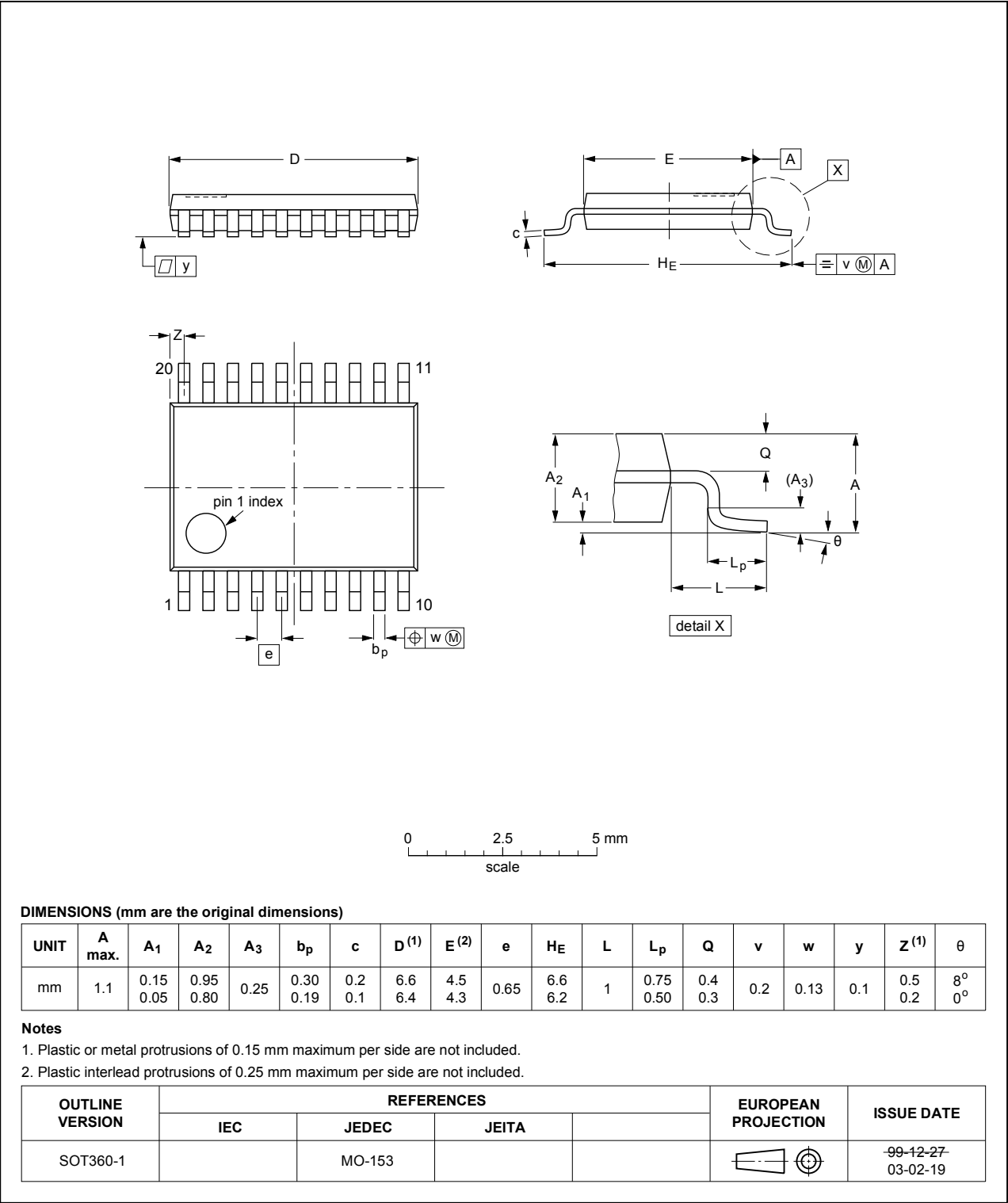
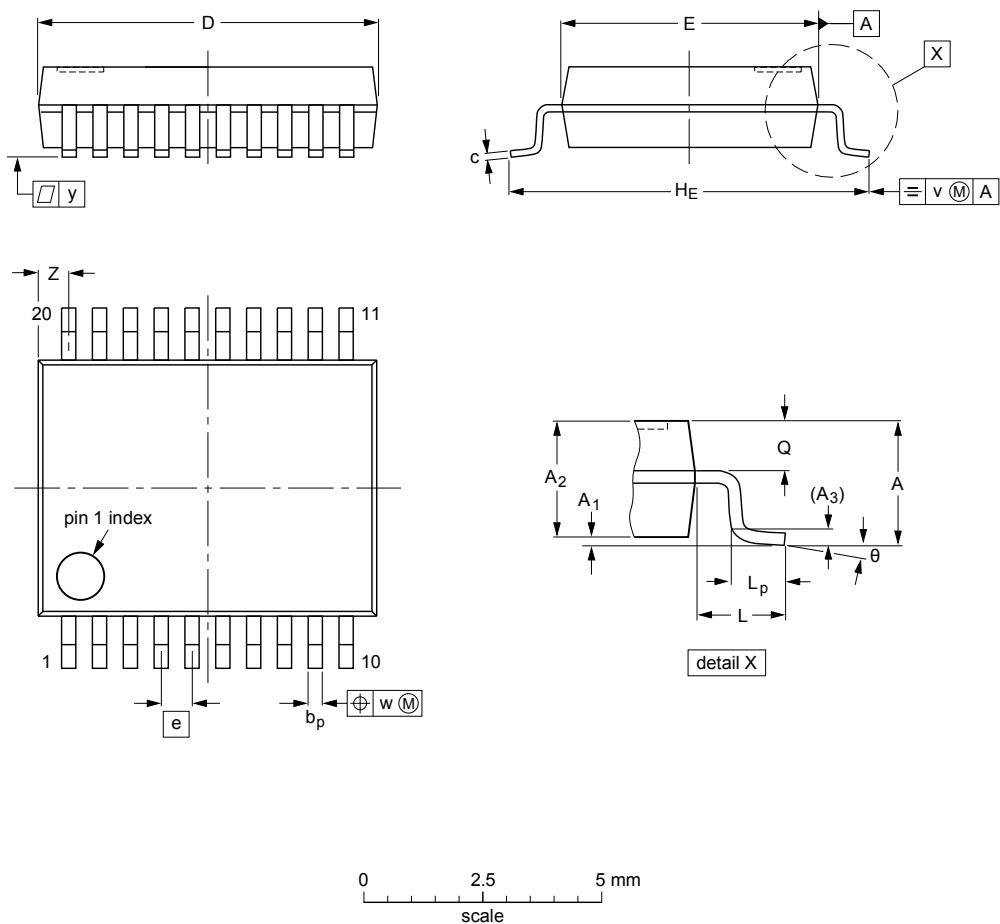


Figure 10. Package outline SOT360-1 (TSSOP20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A <sub>max.</sub> | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c            | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L    | L <sub>p</sub> | Q          | v   | w    | y   | Z <sup>(1)</sup> | θ        |
|------|-------------------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|------|----------------|------------|-----|------|-----|------------------|----------|
| mm   | 2                 | 0.21<br>0.05   | 1.80<br>1.65   | 0.25           | 0.38<br>0.25   | 0.20<br>0.09 | 7.4<br>7.0       | 5.4<br>5.2       | 0.65 | 7.9<br>7.6     | 1.25 | 1.03<br>0.63   | 0.9<br>0.7 | 0.2 | 0.13 | 0.1 | 0.9<br>0.5       | 8°<br>0° |

Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

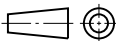
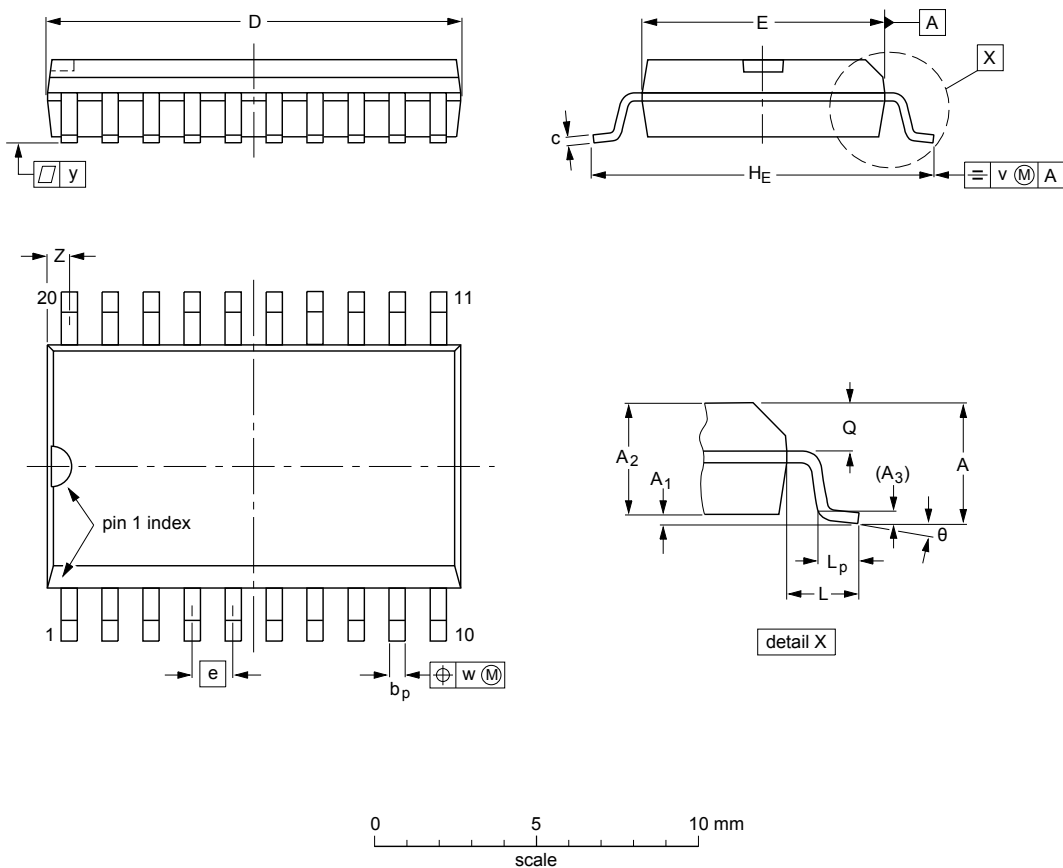
| OUTLINE<br>VERSION | REFERENCES |        |       |  | EUROPEAN<br>PROJECTION  | ISSUE DATE            |
|--------------------|------------|--------|-------|--|---|-----------------------|
|                    | IEC        | JEDEC  | JEITA |  |   |                       |
| SOT339-1           |            | MO-150 |       |  |  | 99-12-27-<br>03-02-19 |

Figure 11. Package outline SOT339-1 (SSOP20)

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT   | A <sub>max.</sub> | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c              | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | Z <sup>(1)</sup> | θ        |
|--------|-------------------|----------------|----------------|----------------|----------------|----------------|------------------|------------------|------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm     | 2.65              | 0.3<br>0.1     | 2.45<br>2.25   | 0.25           | 0.49<br>0.36   | 0.32<br>0.23   | 13.0<br>12.6     | 7.6<br>7.4       | 1.27 | 10.65<br>10.00 | 1.4   | 1.1<br>0.4     | 1.1<br>1.0     | 0.25 | 0.25 | 0.1   | 0.9<br>0.4       | 8°<br>0° |
| inches | 0.1               | 0.012<br>0.004 | 0.096<br>0.089 | 0.01           | 0.019<br>0.014 | 0.013<br>0.009 | 0.51<br>0.49     | 0.30<br>0.29     | 0.05 | 0.419<br>0.394 | 0.055 | 0.043<br>0.016 | 0.043<br>0.039 | 0.01 | 0.01 | 0.004 | 0.035<br>0.016   |          |

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.


| OUTLINE<br>VERSION | REFERENCES |        |       |  | EUROPEAN<br>PROJECTION  | ISSUE DATE            |
|--------------------|------------|--------|-------|--|---|-----------------------|
|                    | IEC        | JEDEC  | JEITA |  |   |                       |
| SOT163-1           | 075E04     | MS-013 |       |  |  | -99-12-27<br>03-02-19 |

Figure 12. Package outline SOT163-1 (SO20)

## 13 Abbreviations

Table 11. Abbreviations

| Acronym | Description                 |
|---------|-----------------------------|
| CDM     | Charged Device Model        |
| DUT     | Device Under Test           |
| ESD     | ElectroStatic Discharge     |
| HBM     | Human Body Model            |
| MM      | Machine Model               |
| PRR     | Pulse Rate Repetition       |
| TTL     | Transistor-Transistor Logic |

## 14 Revision history

Table 12. Revision history

| Document ID    | Release date   | Data sheet status  | Change notice | Supersedes   |
|----------------|--|--------------------|---------------|--------------|
| CBT3244A v.3   | 20170908   | Product data sheet | -             | CBT3244A v.2 |
| Modifications: | <ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• Type number CBT3244ADS removed.</li></ul>   |                    |               |              |
| CBT3244A v.2   | 20050915   | Product data sheet | -             | CBT3244A v.1 |
| 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>• added DHVQFN20 package option.</li><li>• <a href="#">Section 2</a>, 5th bullet: changed from 'exceeds 1000 V HBM ...' to 'exceeds 2000 V HBM ...'</li><li>• added <a href="#">Section 13</a> Abbreviations</li></ul> |                    |               |              |
| CBT3244A v.1   | 20040526   | Product data sheet | -             | -            |

## 15 Legal information

### 15.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

### 15.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet** — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification** — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

### 15.3 Disclaimers

**Limited warranty and liability** — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia. In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory. Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

**Right to make changes** — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical

systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification. Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products. Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

**Terms and conditions of commercial sale** — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nexperia.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

**No offer to sell or license** — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Export control** — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

**Non-automotive qualified products** — Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications. In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer

design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

**Translations** — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

## 15.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Contents

1 General description ..... 1

2 Features and benefits .....1

3 Ordering information ..... 1

4 Marking .....2

5 Functional diagram .....2

6 Pinning information ..... 3

6.1 Pinning .....3

6.2 Pin description .....4

7 Functional description .....4

8 Limiting values .....4

9 Recommended operating conditions .....5

10 Static characteristics .....5

11 Dynamic characteristics .....6

11.1 Waveforms and test circuit .....6

12 Package outline .....9

13 Abbreviations ..... 13

14 Revision history ..... 13

15 Legal information ..... 14

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.