

# CBT3245A

Octal bus switch

Rev. 4 — 30 April 2019

Product data sheet

## 1. General description

The CBT3245A provides eight bits of high-speed TTL-compatible bus switching. The low ON resistance of the switch allows connections to be made with minimal propagation delay.

The CBT3245A is organized as one 8-bit bus switches with one output enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is LOW, the switch is on and port A is connected to the B port. When  $\overline{OE}$  is HIGH, each switch is disabled.

## 2. Features and benefits

- 5  $\Omega$  switch connection between two ports
- TTL-compatible control input levels
- Multiple package options
- Latch-up protection exceeds 500 mA per JESD78
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115B exceeds 150 V
  - CDM JESD22-C101C exceeds 1000 V
- Specified from -40 °C to +85 °C

## 3. Ordering information

Table 1. Ordering information

| Type number | Package           |          |  |          |
|-------------|-------------------|----------|--|----------|
|             | Temperature range | Name     | Description  | Version  |
| CBT3245AD   | -40 °C to +85 °C  | SO20     | plastic small outline package; 20 leads;<br>body width 7.5 mm  | SOT163-1 |
| CBT3245ADB  | -40 °C to +85 °C  | SSOP20   | plastic shrink small outline package; 20 leads;<br>body width 5.3 mm   | SOT339-1 |
| CBT3245APW  | -40 °C to +85 °C  | TSSOP20  | plastic thin shrink small outline package; 20 leads;<br>body width 4.4 mm  | SOT360-1 |
| CBT3245ABQ  | -40 °C to +85 °C  | DHVQFN20 | plastic dual-in-line compatible thermal enhanced<br>very thin quad flat package; no leads; 20 terminals;<br>body 2.5 x 4.5 x 0.85 mm | SOT764-1 |

### 4. Functional diagram

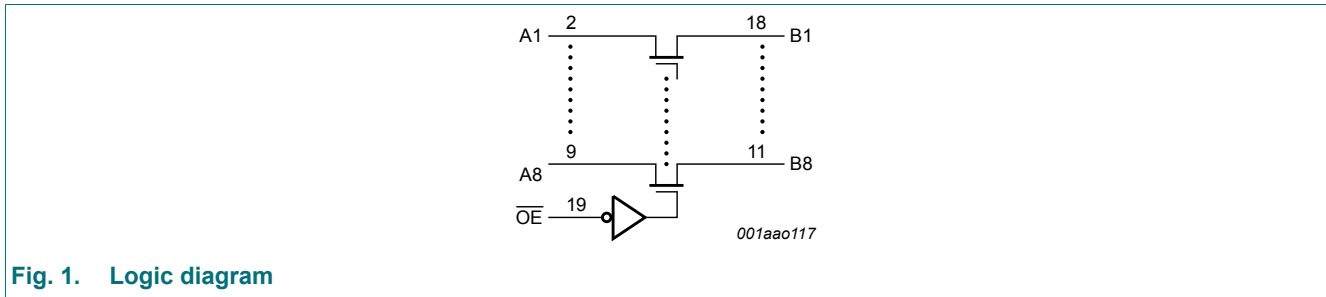


Fig. 1. Logic diagram

### 5. Pinning information

#### 5.1. Pinning

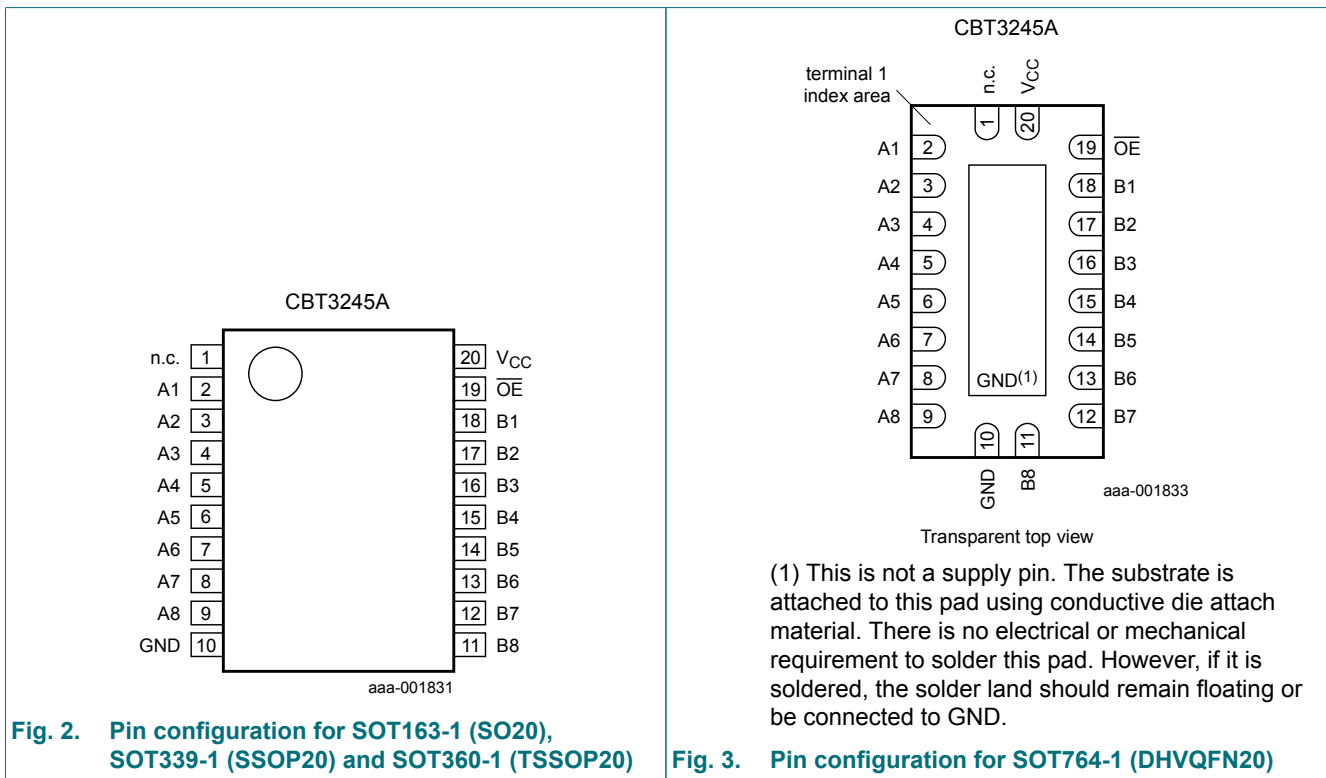


Fig. 2. Pin configuration for SOT163-1 (SO20), SOT339-1 (SSOP20) and SOT360-1 (TSSOP20)

Fig. 3. Pin configuration for SOT764-1 (DHVQFN20)

#### 5.2. Pin description

Table 2. Pin description

| Symbol          | Pin                            | Description                      |
|-----------------|--------------------------------|----------------------------------|
| n.c.            | 1                              | not connected                    |
| A1 to A8        | 2, 3, 4, 5, 6, 7, 8, 9         | data input/output (A port)       |
| GND             | 10                             | ground (0 V)                     |
| B1 to B8        | 18, 17, 16, 15, 14, 13, 12, 11 | data input/output (B port)       |
| OE              | 19                             | output enable input (active LOW) |
| V <sub>CC</sub> | 20                             | positive supply voltage          |

## 6. Functional description

**Table 3. Functional description**

*H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.*

| Input     | Input/output  |
|-----------|---------------|
| <b>OE</b> | <b>An, Bn</b> |
| L         | An = Bn       |
| H         | Z             |

## 7. Limiting values

**Table 4. Limiting values**

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

*T<sub>amb</sub> = -40 °C to +85 °C, unless otherwise specified.*

| Symbol           | Parameter               | Conditions           | Min  | Max  | Unit |
|------------------|-------------------------|----------------------|------|------|------|
| V <sub>CC</sub>  | supply voltage          |                      | -0.5 | +7.0 | V    |
| V <sub>I</sub>   | input voltage           |                      | [1]  | +7.0 | V    |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < 0 V | -50  | -    | mA   |
| V <sub>O</sub>   | output voltage          |                      | [1]  | +7.0 | V    |
| I <sub>O</sub>   | output current          | V <sub>O</sub> < 0 V | -    | ±128 | mA   |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < 0 V | -50  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                      | -65  | +150 | °C   |

[1] The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

*All unused control inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.*

| Symbol           | Parameter                | Conditions            | Min | Typ | Max | Unit |
|------------------|--------------------------|-----------------------|-----|-----|-----|------|
| V <sub>CC</sub>  | supply voltage           |                       | 4.0 | -   | 5.5 | V    |
| V <sub>IH</sub>  | HIGH-level input voltage |                       | 2.0 | -   | -   | V    |
| V <sub>IL</sub>  | LOW-level input voltage  |                       | -   | -   | 0.8 | V    |
| T <sub>amb</sub> | ambient temperature      | operating in free air | -40 | -   | +85 | °C   |

## 9. Static characteristics

**Table 6. Static characteristics**

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

| Symbol               | Parameter                          | Conditions   | T <sub>amb</sub> = -40 °C to +85 °C |        |      | Unit |
|----------------------|------------------------------------|--|-------------------------------------|--------|------|------|
|                      |                                    |  | Min                                 | Typ[1] | Max  |      |
| V <sub>IK</sub>      | input clamping voltage             | V <sub>CC</sub> = 4.5 V; I <sub>I</sub> = -18 mA   | -                                   | -      | -1.2 | V    |
| I <sub>I</sub>       | input leakage current              | V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = GND or 5.5 V   | -                                   | -      | ±5   | µA   |
| I <sub>CC</sub>      | supply current                     | V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 0 mA;<br>V <sub>I</sub> = V <sub>CC</sub> or GND             | -                                   | 1      | 3    | µA   |
| ΔI <sub>CC</sub>     | additional supply current          | per input pin; V <sub>CC</sub> = 5.5 V; one input at 3.4 V, other inputs at V <sub>CC</sub> or GND [2] | -                                   | -      | 3.5  | mA   |
| C <sub>I</sub>       | input capacitance                  | control pins; V <sub>I</sub> = 3 V or 0 V  | -                                   | 3.2    | -    | pF   |
| C <sub>io(off)</sub> | off-state input/output capacitance | port off; V <sub>I</sub> = 3 V or 0 V; $\overline{OE} = V_{CC}$  | -                                   | 6.6    | -    | pF   |
| R <sub>ON</sub>      | ON resistance                      | V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = 0 V; I <sub>I</sub> = 64 mA [3]                              | -                                   | 5      | 7    | Ω    |
|                      |                                    | V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = 0 V; I <sub>I</sub> = 30 mA [3]                              | -                                   | 5      | 7    | Ω    |
|                      |                                    | V <sub>CC</sub> = 4.5 V; V <sub>I</sub> = 2.4 V; I <sub>I</sub> = -15 mA [3]                           | -                                   | 10     | 15   | Ω    |

[1] All typical values are measured at V<sub>CC</sub> = 5 V and T<sub>amb</sub> = 25 °C.

[2] This is the increase in supply current for each input that is at the specified TTL voltage level rather than V<sub>CC</sub> or GND.

[3] Measured by the voltage drop between the An and the Bn terminals at the indicated current through the switch. ON resistance is determined by the lowest voltage of the two (An or Bn) terminals.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 6.

| Symbol           | Parameter         | Conditions                                  | T <sub>amb</sub> = -40 °C to +85 °C |      | Unit |
|------------------|-------------------|---|-------------------------------------|------|------|
|                  |                   |   | Min                                 | Max  |      |
| t <sub>pd</sub>  | propagation delay | An, Bn to Bn, An; see Fig. 4 [1][2]         |                                     |      |      |
|                  |                   | V <sub>CC</sub> = 5.0 V ± 0.5 V             | -                                   | 0.25 | ns   |
| t <sub>en</sub>  | enable time       | $\overline{OE}$ to An or Bn; see Fig. 5 [2] |                                     |      |      |
|                  |                   | V <sub>CC</sub> = 5.0 V ± 0.5 V             | 1.0                                 | 5.9  | ns   |
| t <sub>dis</sub> | disable time      | $\overline{OE}$ to An or Bn; see Fig. 5 [2] |                                     |      |      |
|                  |                   | V <sub>CC</sub> = 5.0 V ± 0.5 V             | 1.0                                 | 6.0  | ns   |

[1] The propagation delay is the calculated RC time constant of the typical ON resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

10.1. Waveforms and test circuit

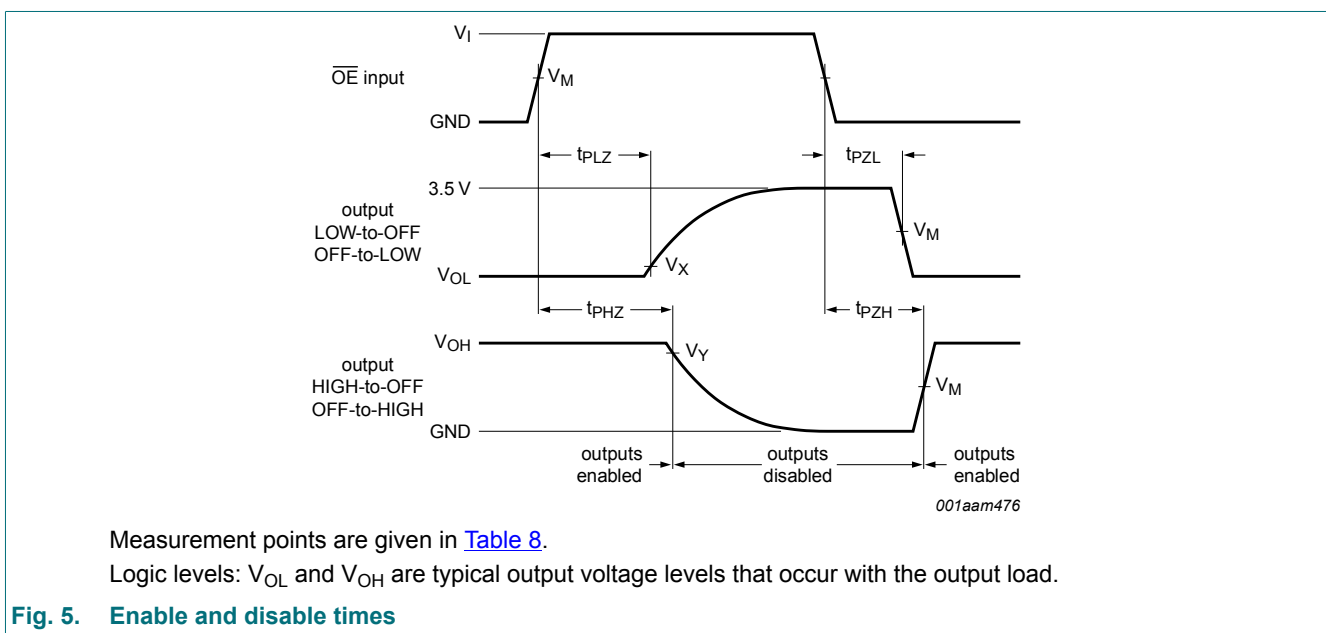
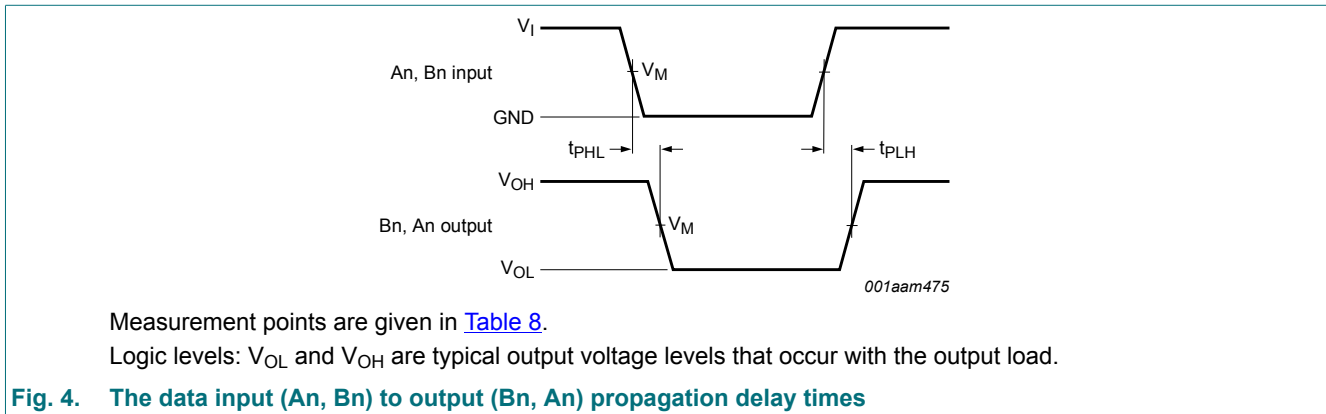
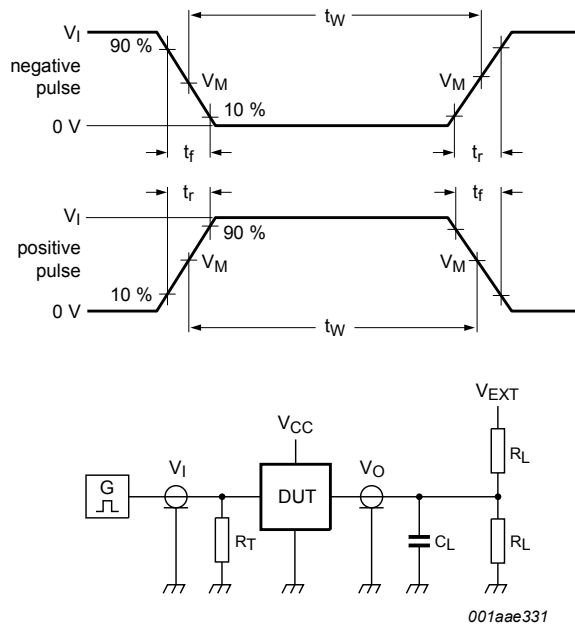


Table 8. Measurement points

| Supply voltage                           | Input        |       | Output |                         |                         |
|--|--------------|-------|--------|-------------------------|-------------------------|
| $V_{CC}$                                 | $V_I$        | $V_M$ | $V_M$  | $V_X$                   | $V_Y$                   |
| $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ | GND to 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 9](#).

All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz; Z<sub>o</sub> = 50 Ω.

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

Definitions for test circuit:

R<sub>L</sub> = Load resistance.

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

R<sub>T</sub> = Termination resistance should be equal to output impedance Z<sub>o</sub> of the pulse generator.

V<sub>EXT</sub> = External voltage for measuring switching times.

**Fig. 6. Test circuit for measuring switching times**

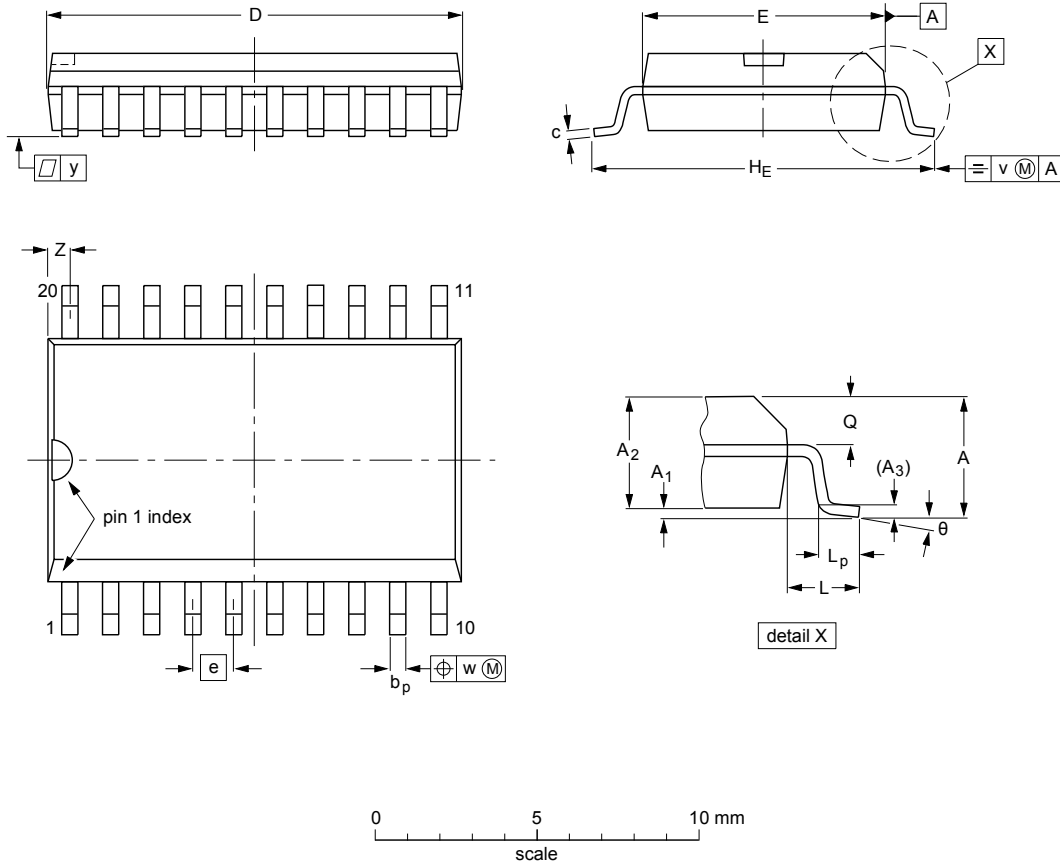
**Table 9. Test data**

| Supply voltage                  | Input          |                                 | Load           |                | V <sub>EXT</sub>                    |                                     |                                     |
|---------------------------------|----------------|---------------------------------|----------------|----------------|-------------------------------------|-------------------------------------|-------------------------------------|
|                                 | V <sub>I</sub> | t <sub>r</sub> , t <sub>f</sub> | C <sub>L</sub> | R <sub>L</sub> | t <sub>PLH</sub> , t <sub>PHL</sub> | t <sub>PLZ</sub> , t <sub>PZL</sub> | t <sub>PHZ</sub> , t <sub>PZH</sub> |
| V <sub>CC</sub> = 5.0 V ± 0.5 V | GND to 3.0 V   | ≤ 2.5 ns                        | 50 pF          | 500 Ω          | open                                | 7.0 V                               | open                                |

### 11. Package outline

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 max. | 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**

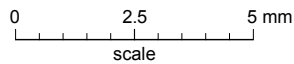
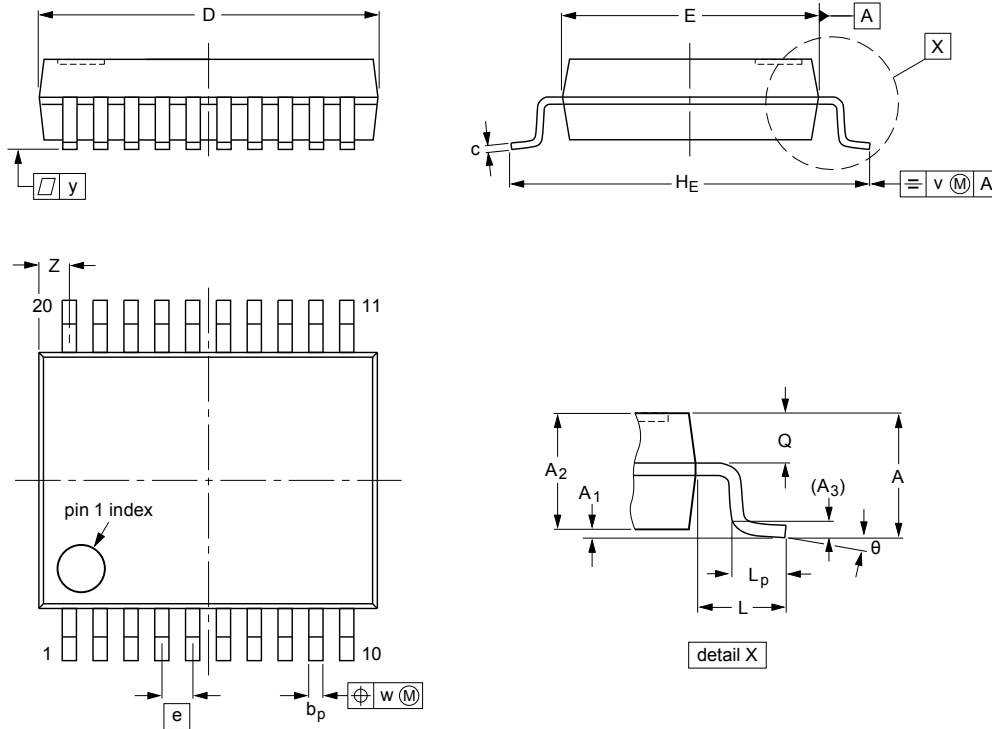
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

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

**Fig. 7. Package outline SOT163-1 (SO20)**

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

SOT339-1



**DIMENSIONS (mm are the original dimensions)**

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

Fig. 8. Package outline SOT339-1 (SSOP20)



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

SOT360-1

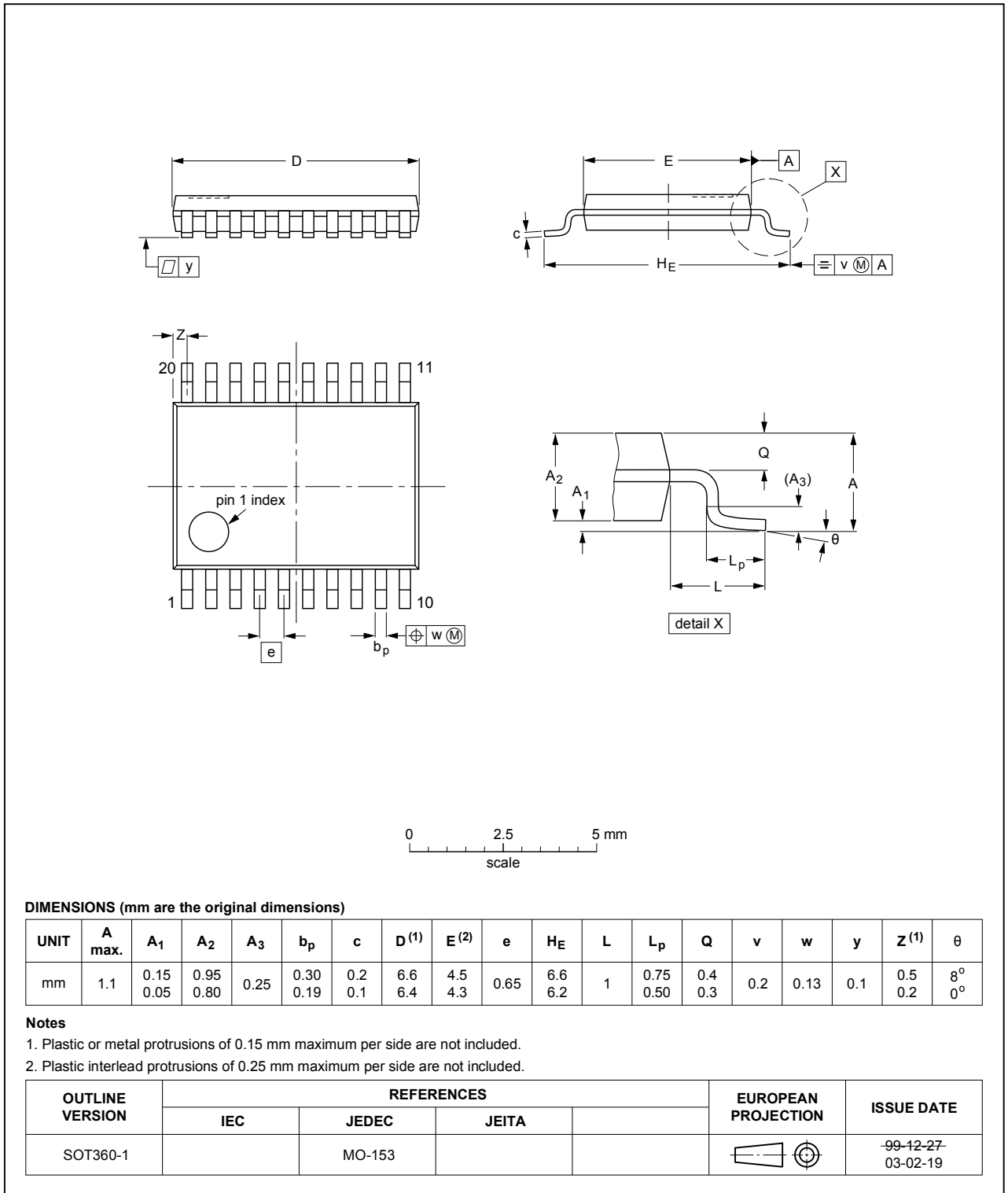
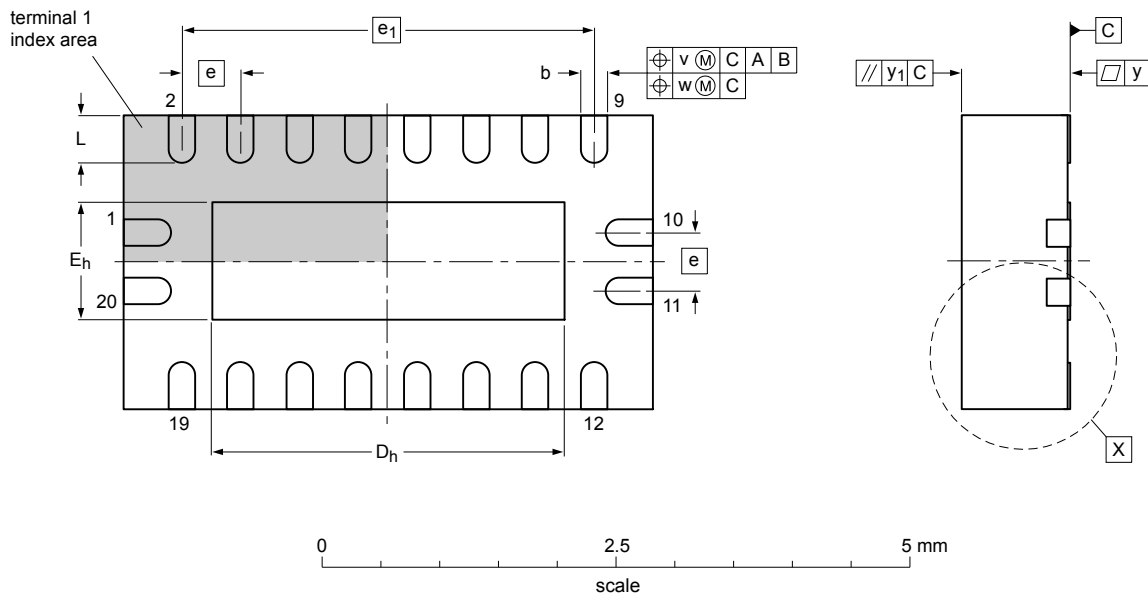
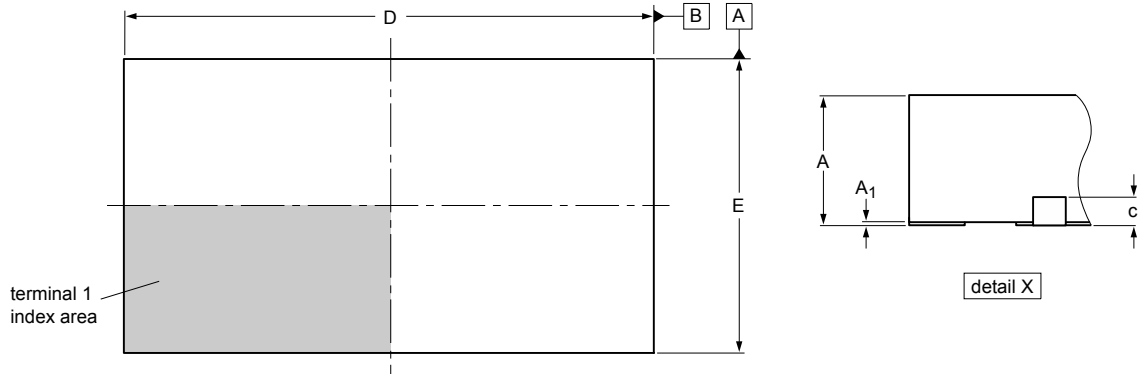


Fig. 9. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1



Dimensions (mm are the original dimensions)

| Unit   | A <sup>(1)</sup> | A <sub>1</sub> | b    | c   | D <sup>(1)</sup> | D <sub>h</sub> | E <sup>(1)</sup> | E <sub>h</sub> | e   | e <sub>1</sub> | L   | v   | w    | y    | y <sub>1</sub> |
|--------|------------------|----------------|------|-----|------------------|----------------|------------------|----------------|-----|----------------|-----|-----|------|------|----------------|
| max    | 1.00             | 0.05           | 0.30 |     | 4.6              | 3.15           | 2.6              | 1.15           |     |                | 0.5 |     |      |      |                |
| mm nom | 0.90             | 0.02           | 0.25 | 0.2 | 4.5              | 3.00           | 2.5              | 1.00           | 0.5 | 3.5            | 0.4 | 0.1 | 0.05 | 0.05 | 0.1            |
| min    | 0.80             | 0.00           | 0.18 |     | 4.4              | 2.85           | 2.4              | 0.85           |     |                | 0.3 |     |      |      |                |

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot764-1\_po

| Outline version | References |        |       | European projection | Issue date            |
|-----------------|------------|--------|-------|---------------------|-----------------------|
|                 | IEC        | JEDEC  | JEITA |                     |                       |
| SOT764-1        | ---        | MO-241 | ---   |                     | 03-01-27-<br>14-12-12 |

Fig. 10. Package outline SOT764-1 (DHVQFN20)

## 12. Abbreviations

Table 10. Abbreviations

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

## 13. Revision history

Table 11. Revision history

| Document ID    | Release date  | Data sheet status  | Change notice | Supersedes   |
|----------------|---|--------------------|---------------|--------------|
| CBT3245A v.4   | 20190430  | Product data sheet | -             | CBT3245A v.3 |
| 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 CBT3245ADS (SOT724-1/SSOP20) removed.</li> <li>Package outline drawing SOT764-1 updated.</li> </ul>   |                    |               |              |
| CBT3245A v.3   | 20120105  | Product data sheet | -             | CBT3245A v.2 |
| Modifications: | <ul style="list-style-type: none"> <li>The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Marking code removed from order information section.</li> <li>Description of <math>C_1</math> and <math>C_{I/O}</math> corrected (errata).</li> </ul> |                    |               |              |
| CBT3245A v.2   | 20020627  | Product data sheet | -             | CBT3245A v.1 |
| CBT3245A v.1   | 20020218  | Product data sheet | -             | -            |

## 14. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | Definition  |
|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [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 <https://www.nexperia.com>.

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