

CBTD3306

Dual bus switch with level shifting

Rev. 9 — 15 November 2018

Product data sheet

1. General description

The CBTD3306 dual FET bus switch features independent line switches. Each switch is disabled when the associated output enable (\overline{nOE}) input is HIGH.

The CBTD3306 is characterized for operation from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$.

2. Features and benefits

- Designed to be used in 5 V to 3.3 V level shifting applications with internal diode
- $5\ \Omega$ switch connection between two ports
- TTL-compatible input levels
- Multiple package options
- Latch-up protection exceeds 100 mA per JESD78B
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - CDM JESD22-C101E exceeds 1000 V

3. Ordering information

Table 1. Ordering information

| Type number | Package | | |
|-------------|---------|---|----------|
| | Name | Description | Version |
| CBTD3306PW | TSSOP8 | plastic thin shrink small outline package; 8 leads; body width 4.4 mm | SOT530-1 |
| CBTD3306GT | XSON8 | plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm | SOT833-1 |
| CBTD3306GM | XQFN8 | plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 x 1.6 x 0.5 mm | SOT902-2 |

4. Marking

Table 2. Marking codes

| Type number | Marking code |
|-------------|--------------|
| CBTD3306PW | D306 |
| CBTD3306GT | W06 |
| CBTD3306GM | W06 |

5. Functional diagram

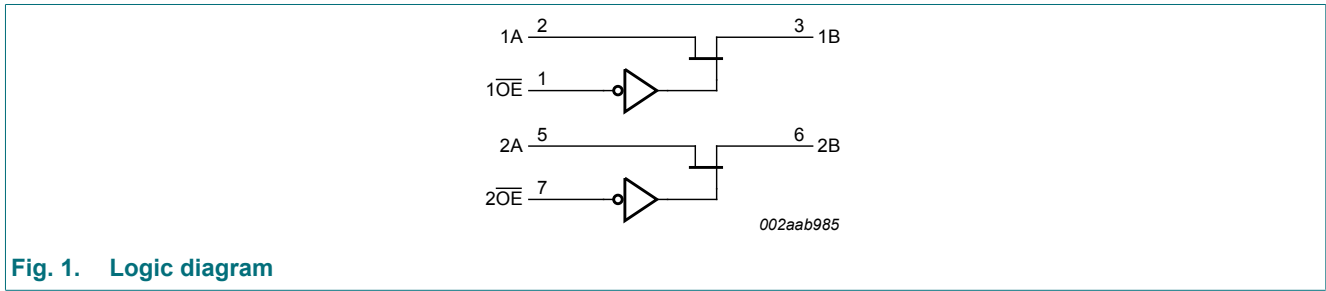


Fig. 1. Logic diagram

6. Pinning information

6.1. Pinning

001aak833

001aal404

Transparent top view

001aal405

Transparent top view

Fig. 2. Pin configuration for SOT530-1 (TSSOP8)

Fig. 3. Pin configuration SOT833-1 (XSON8)

Fig. 4. Pin configuration SOT902-2 (XQFN8)

6.2. Pin description

Table 3. Pin description

| Symbol | Pin | Description |
|----------|------|----------------------------|
| 1OE, 2OE | 1, 7 | output enable input |
| 1A, 2A | 2, 5 | data input/output (A port) |
| 1B, 2B | 3, 6 | data input/output (B port) |
| GND | 4 | ground (0 V) |
| VCC | 8 | positive supply voltage |

7. Functional description

Table 4. Function selection

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

| Input | Input/output |
|-------|--------------|
| nOE | nA, nB |
| L | nA = nB |
| H | Z |

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). [1]

T_{amb} = -40 °C to +85 °C, unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------|------------------------|------------------------|------|------|------|
| V _{CC} | supply voltage | | -0.5 | +7.0 | V |
| V _I | input voltage | [2] | -0.5 | +7.0 | V |
| I _{SW} | switch current | | - | 128 | mA |
| I _{IK} | input clamping current | V _{I/O} = 0 V | -50 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |

- [1] Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under Section 9. is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- [2] The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

9. Recommended operating conditions

Table 6. Operating conditions

All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|--------------------------|-----------------------|-----|-----|-----|------|
| V _{CC} | supply voltage | | 4.5 | - | 5.5 | V |
| V _{IH} | HIGH-level input voltage | | 2.0 | - | - | V |
| V _{IL} | LOW-level input voltage | | - | - | 0.8 | V |
| T _{amb} | ambient temperature | operating in free air | -40 | - | +85 | °C |

10. Static characteristics

Table 7. Static characteristics

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

| Symbol | Parameter | Conditions | T _{amb} = -40 °C to +85 °C | | | Unit |
|----------------------|------------------------------------|--|-------------------------------------|---------|------|------|
| | | | Min | Typ [1] | Max | |
| V _{IK} | input clamping voltage | V _{CC} = 4.5 V; I _I = -18 mA | - | - | -1.2 | V |
| I _I | input leakage current | V _{CC} = 5.5 V; V _I = GND or 5.5 V | - | - | ±1 | µA |
| I _{CC} | supply current | V _{CC} = 5.5 V; I _{SW} = 0 mA; V _I = V _{CC} or GND | - | - | 1.5 | mA |
| V _{pass} | pass voltage | see Fig. 5 to Fig. 9 | - | - | - | V |
| ΔI _{CC} | additional supply current | per input pin; V _{CC} = 5.5 V; one input at 3.4 V, other inputs at V _{CC} or GND [2] | - | - | 2.5 | mA |
| C _I | input capacitance | control pin; V _I = 3 V or 0 V | - | 3.2 | - | pF |
| C _{io(off)} | off-state input/output capacitance | port off; V _I = 3 V or 0 V; nOE = V _{CC} | - | 6.5 | - | pF |
| R _{ON} | ON resistance | V _{CC} = 4.5 V; V _I = 0 V; I _I = 64 mA [3] | - | 3.6 | 5 | Ω |
| | | V _{CC} = 4.5 V; V _I = 0 V; I _I = 30 mA [3] | - | 3.6 | 5 | Ω |
| | | V _{CC} = 4.5 V; V _I = 2.4 V; I _I = 15 mA [3] | - | 17 | 35 | Ω |

[1] All typical values are at V_{CC} = 5 V, T_{amb} = 25 °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 drop between the nA and the nB terminals at the indicated current through the switch. ON resistance is determined by the lowest voltage of the two (nA or nB) terminals.

10.1. Typical pass voltage graphs

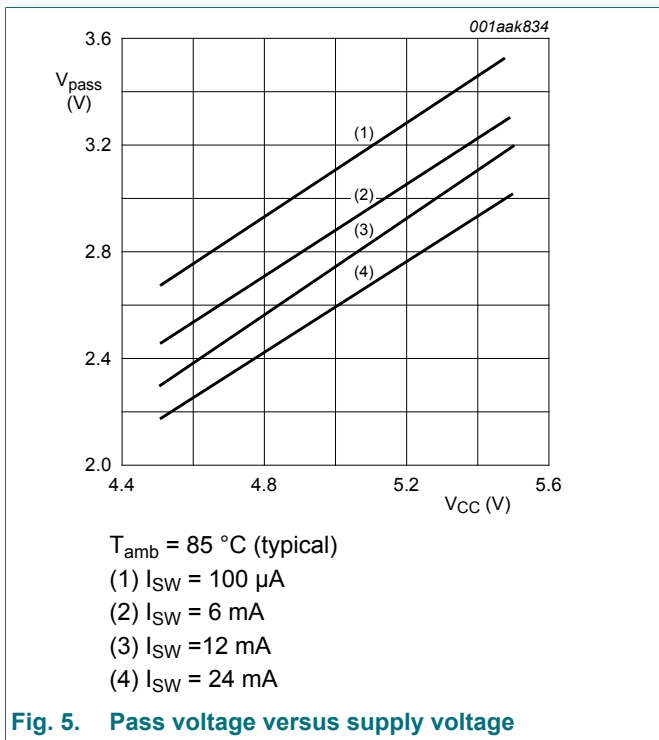


Fig. 5. Pass voltage versus supply voltage

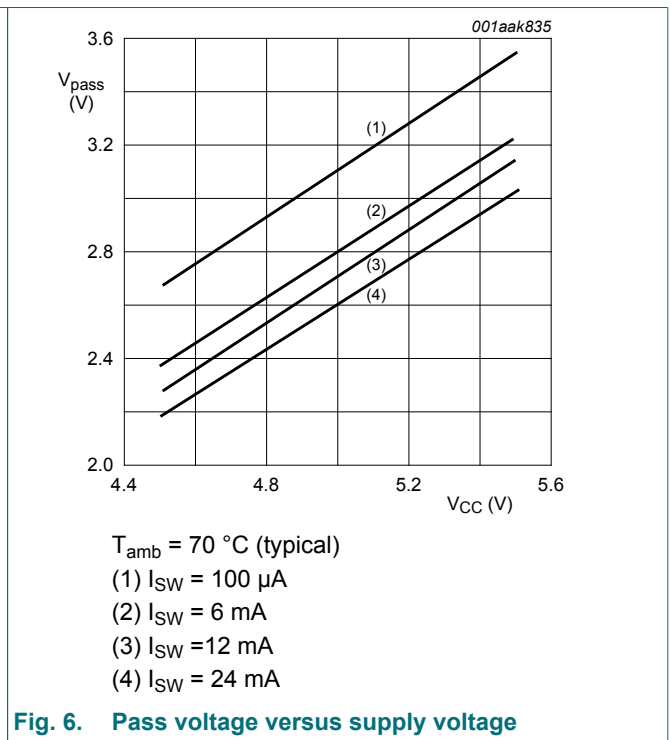


Fig. 6. Pass voltage versus supply voltage

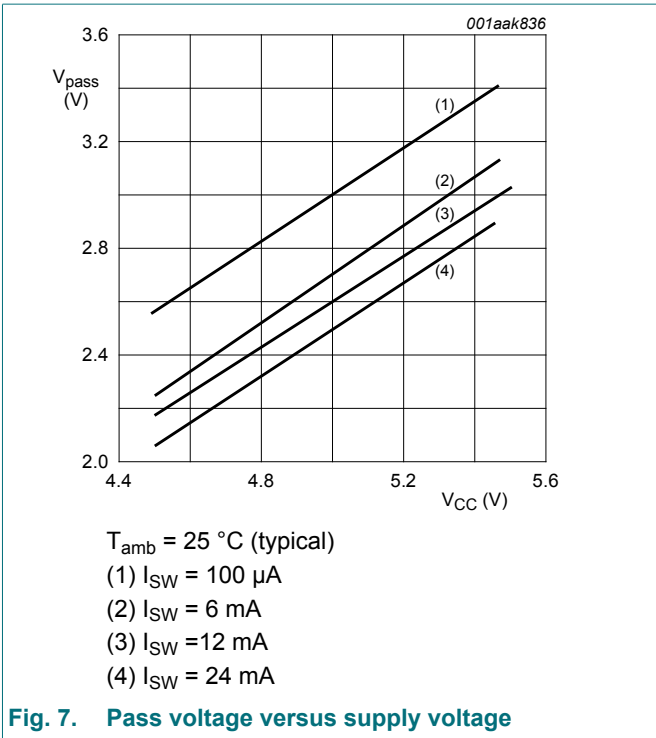


Fig. 7. Pass voltage versus supply voltage

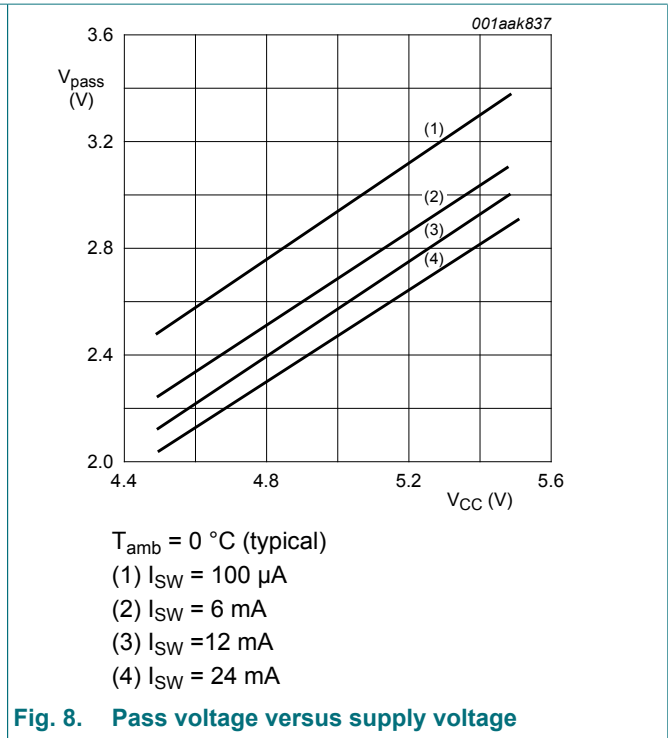


Fig. 8. Pass voltage versus supply voltage

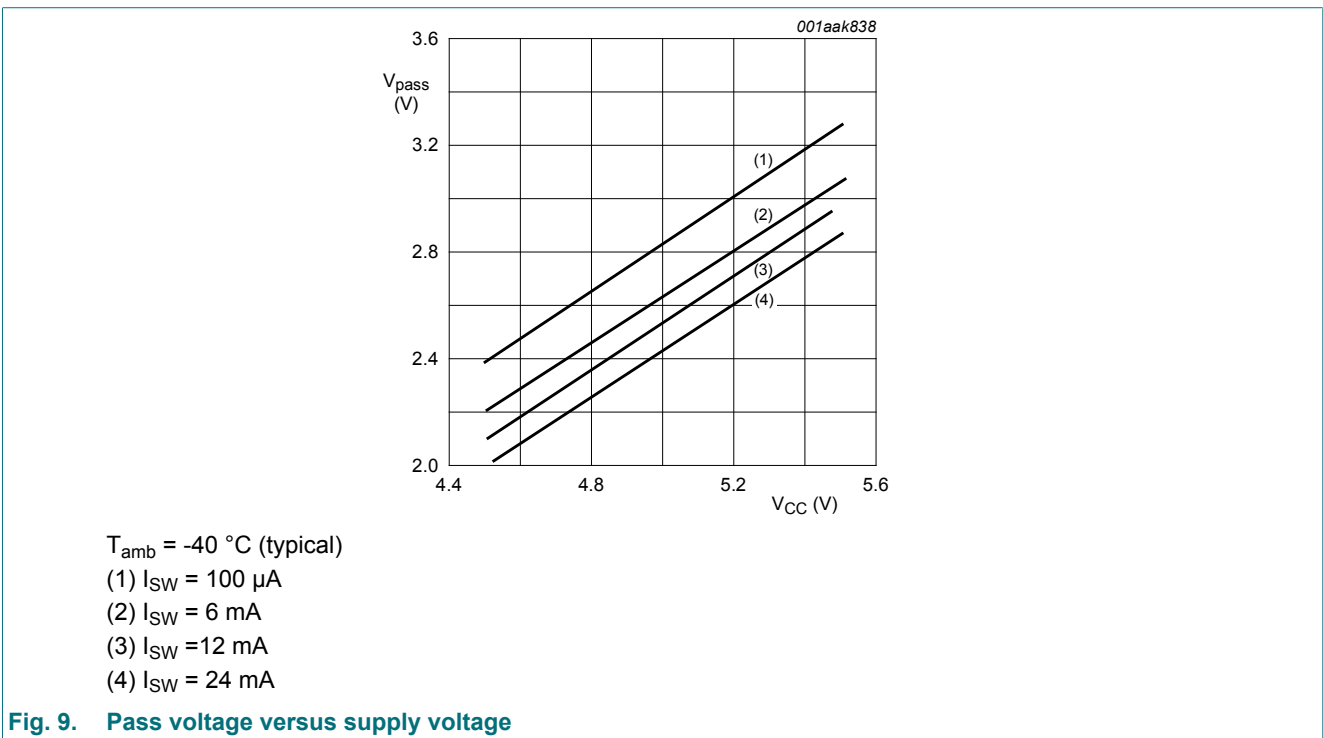


Fig. 9. Pass voltage versus supply voltage

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 12.

| Symbol | Parameter | Conditions | T _{amb} = -40 °C to +85 °C | | | Unit |
|------------------|-------------------|---|-------------------------------------|-----|------|------|
| | | | Min | Typ | Max | |
| t _{pd} | propagation delay | nA, nB to nB, nA; see Fig. 10 [1][2] V _{CC} = 5.0 V ± 0.5 V | - | - | 0.25 | ns |
| t _{en} | enable time | n \overline{OE} to nA or nB; see Fig. 11 [2] V _{CC} = 5.0 V ± 0.5 V | 1.0 | - | 5.4 | ns |
| t _{dis} | disable time | n \overline{OE} to nA or nB; see Fig. 11 [2] V _{CC} = 5.0 V ± 0.5 V | 1.0 | - | 4.9 | 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_{pd} is the same as t_{PLH} and t_{PHL}; t_{en} is the same as t_{PZL} and t_{PZH}; t_{dis} is the same as t_{PLZ} and t_{PHZ}.

11.1. Waveforms and test circuit

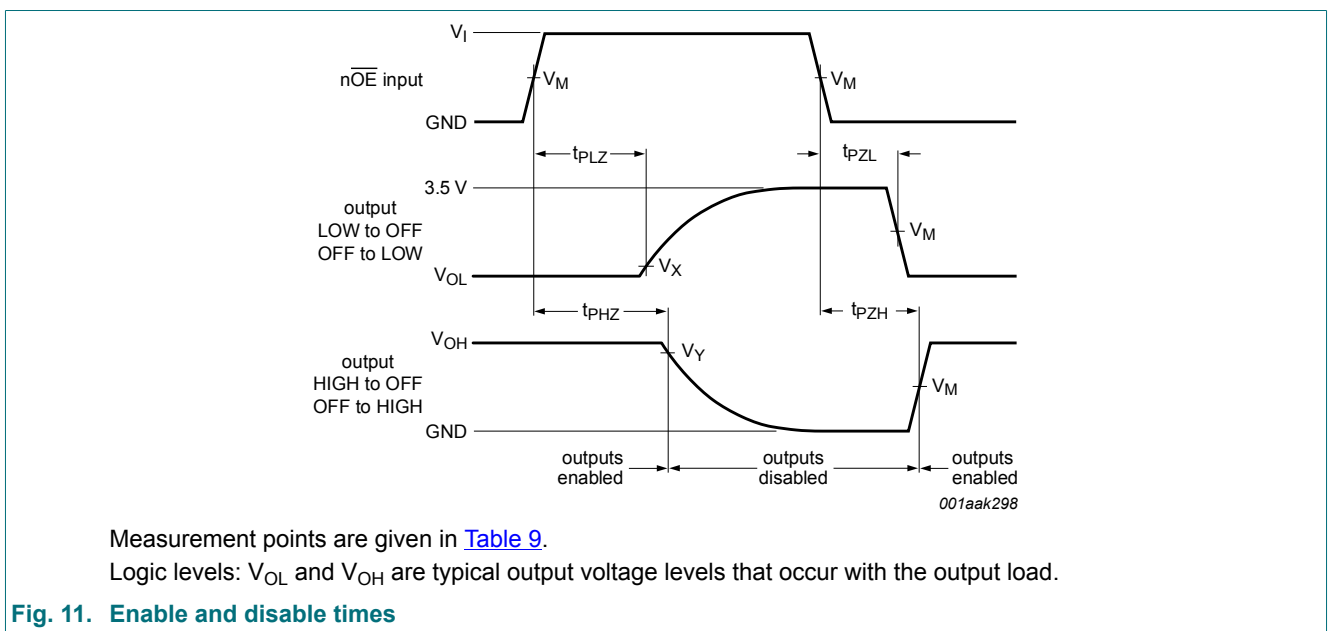
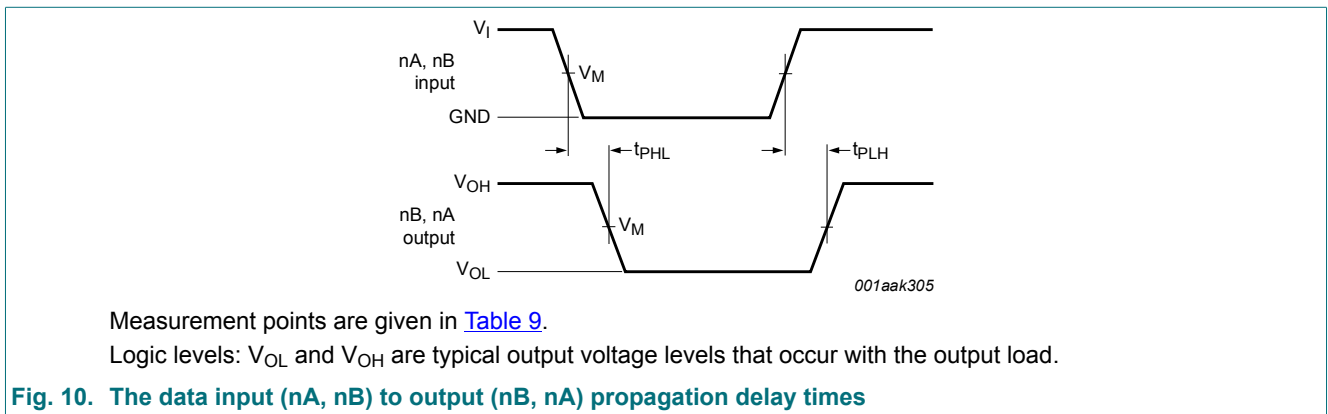
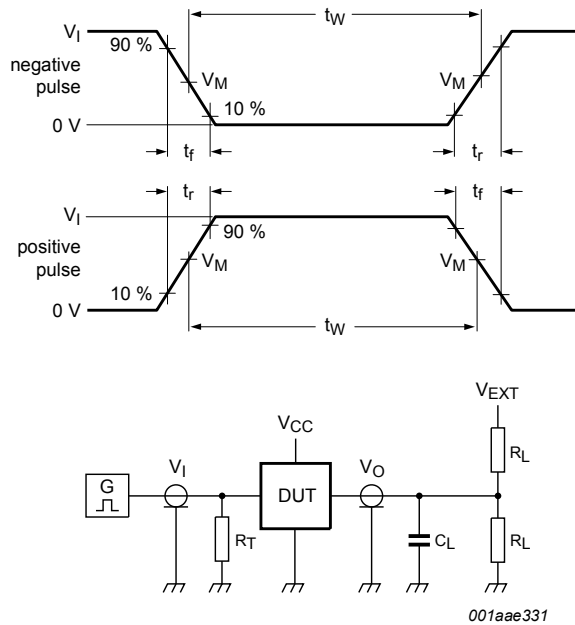


Table 9. Measurement points

| 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 10](#).

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

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

Definitions for test circuit:

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

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

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

Fig. 12. Test circuit for measuring switching times

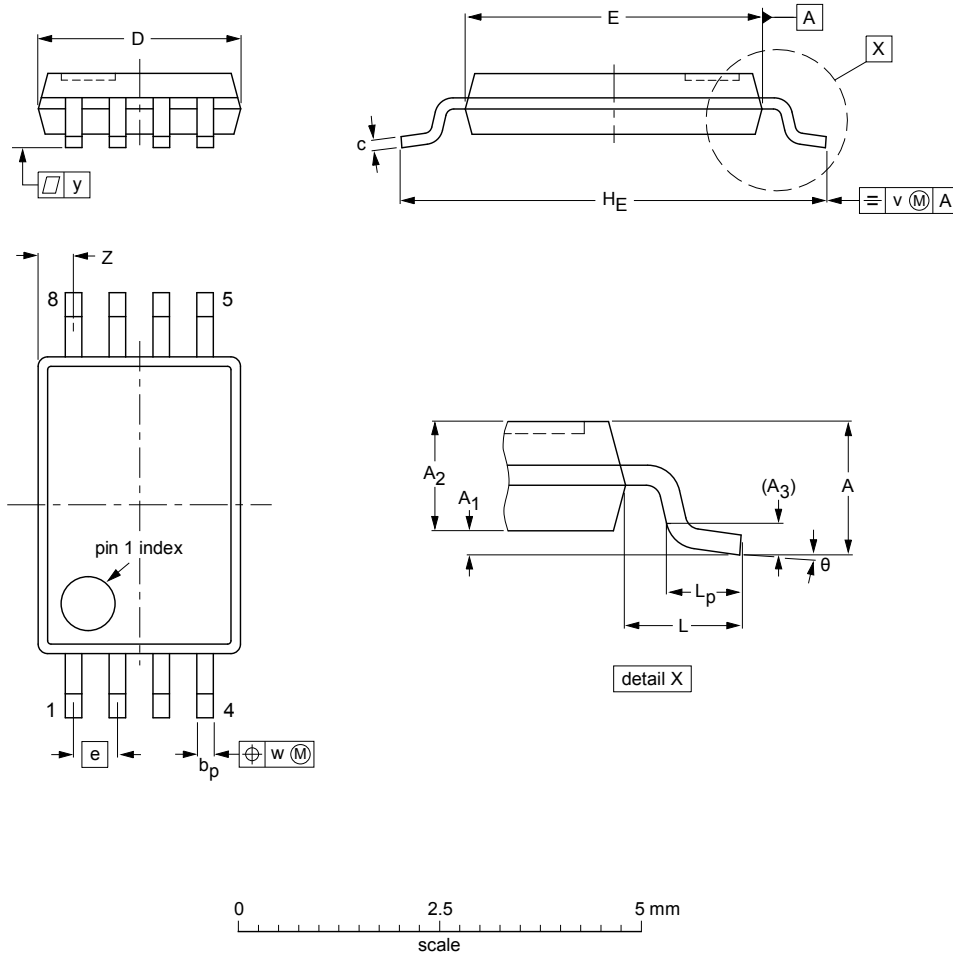
Table 10. Test data

| Supply voltage | Input | | Load | | V_{EXT} | | |
|--|--------------|----------------------|-------|--------------|--------------------|--------------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | t_{PLH}, t_{PHL} | t_{PLZ}, t_{PZL} | t_{PHZ}, t_{PZH} |
| $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ | GND to 3.0 V | $\leq 2.5\text{ ns}$ | 50 pF | 500 Ω | open | 7.0 V | open |

12. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 4.4 mm

SOT530-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽²⁾ | e | H _E | L | L _p | v | w | y | Z ⁽¹⁾ | θ |
|------|--------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|------|----------------|-----|-----|-----|------------------|----------|
| mm | 1.1 | 0.15 0.05 | 0.95 0.85 | 0.25 | 0.30 0.19 | 0.20 0.13 | 3.1 2.9 | 4.5 4.3 | 0.65 | 6.5 6.3 | 0.94 | 0.7 0.5 | 0.1 | 0.1 | 0.1 | 0.70 0.35 | 8° 0° |

Notes

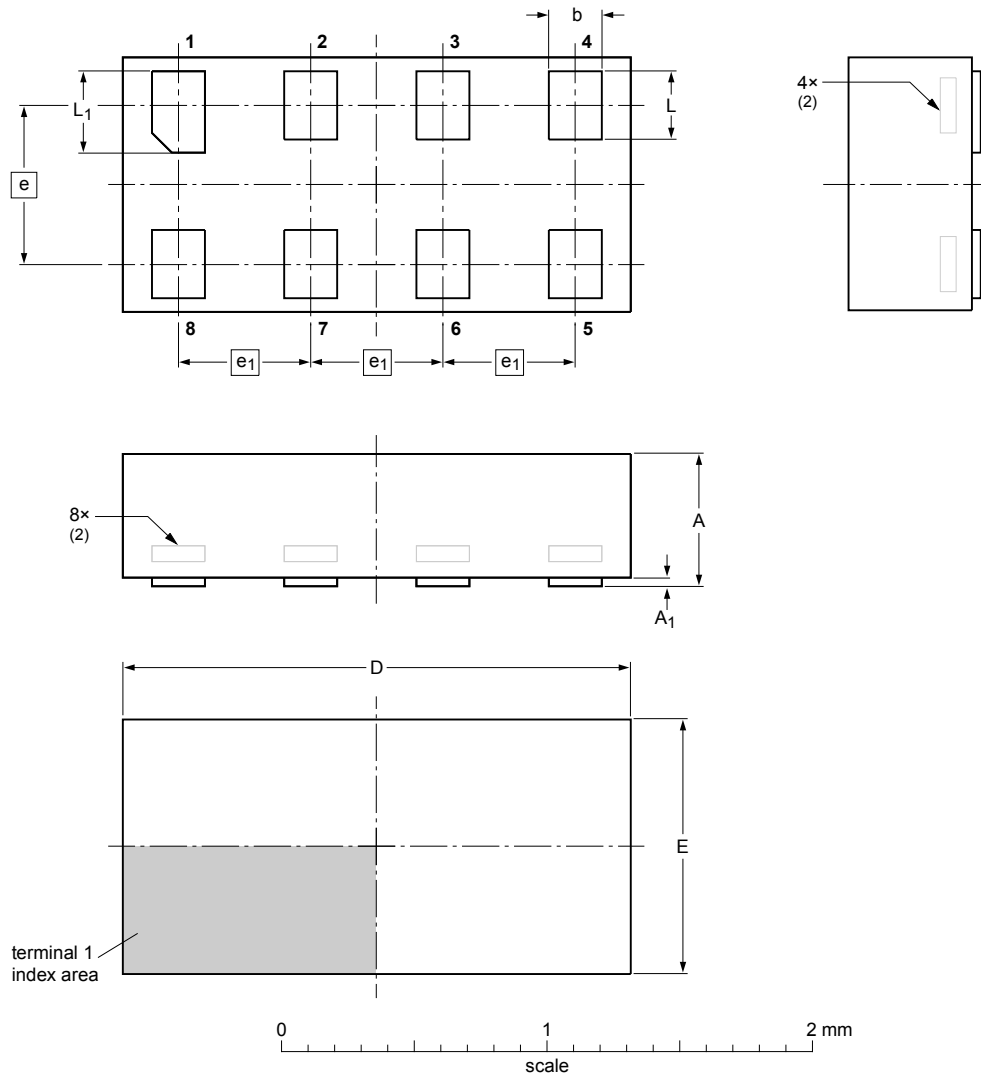
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|-------|--|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT530-1 | | MO-153 | | | | 00-02-24 03-02-18 |

Fig. 13. Package outline SOT530-1 (TSSOP8)

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm

SOT833-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A ⁽¹⁾ max | A ₁ max | b | D | E | e | e ₁ | L | L ₁ |
|------|-------------------------|-----------------------|--------------|------------|--------------|-----|----------------|--------------|----------------|
| mm | 0.5 | 0.04 | 0.25 0.17 | 2.0 1.9 | 1.05 0.95 | 0.6 | 0.5 | 0.35 0.27 | 0.40 0.32 |

Notes

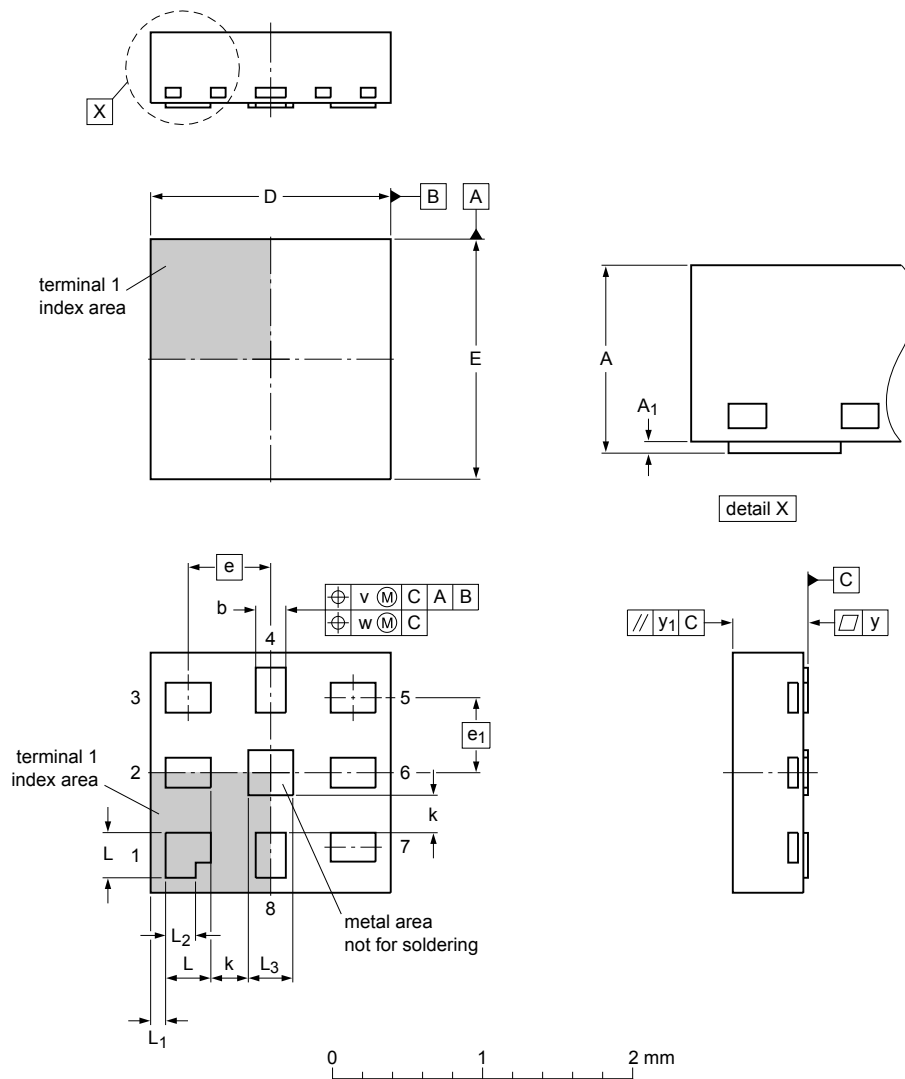
- Including plating thickness.
- Can be visible in some manufacturing processes.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|--------------------|------------|--------|-------|--|------------------------|------------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT833-1 | --- | MO-252 | --- | | | -07-11-14- 07-12-07 |

Fig. 14. Package outline SOT833-1 (XSON8)

XQFN8: plastic, extremely thin quad flat package; no leads;
8 terminals; body 1.6 x 1.6 x 0.5 mm

SOT902-2



Dimensions

| Unit ⁽¹⁾ | A | A ₁ | b | D | E | e | e ₁ | k | L | L ₁ | L ₂ | L ₃ | v | w | y | y ₁ |
|---------------------|-----|----------------|------|------|------|------|----------------|-----|------|----------------|----------------|----------------|-----|------|------|----------------|
| max | 0.5 | 0.05 | 0.25 | 1.65 | 1.65 | | | | 0.35 | 0.15 | 0.25 | 0.35 | | | | |
| mm | nom | | 0.20 | 1.60 | 1.60 | 0.55 | 0.5 | | 0.30 | 0.10 | 0.20 | 0.30 | 0.1 | 0.05 | 0.05 | 0.05 |
| min | | 0.00 | 0.15 | 1.55 | 1.55 | | | 0.2 | 0.25 | 0.05 | 0.15 | 0.25 | | | | |

Note

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

sot902-2_po

| Outline version | References | | | European projection | Issue date |
|-----------------|------------|--------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT902-2 | --- | MO-255 | --- | | 16-07-14 16-11-08 |

Fig. 15. Package outline SOT902-2 (XQFN8)

13. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|-----------------------------|
| CDM | Charged Device Model |
| ESD | ElectroStatic Discharge |
| FET | Field Effect Transistor |
| HBM | Human Body 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 |
|----------------|---|--------------------|---------------|--------------|
| CBTD3306 v.9 | 20181115 | Product data sheet | - | CBTD3306 v.8 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Type number CBTD3306D (SOT96-1/SO8) removed. | | | |
| CBTD3306 v.8 | 20120501 | Product data sheet | - | CBTD3306 v.7 |
| Modifications: | <ul style="list-style-type: none"> For type number CBTD3306GM the SOT code has changed to SOT902-2. | | | |
| CBTD3306 v.7 | 20120103 | Product data sheet | - | CBTD3306 v.6 |
| Modifications: | <ul style="list-style-type: none"> Marking code for type number CBTD3306D changed. | | | |
| CBTD3306 v.6 | 20111121 | Product data sheet | - | CBTD3306 v.5 |
| Modifications: | <ul style="list-style-type: none"> Legal pages updated. | | | |
| CBTD3306 v.5 | 20110428 | Product data sheet | - | CBTD3306 v.4 |
| CBTD3306 v.4 | 20100325 | Product data sheet | - | CBTD3306 v.3 |
| CBTD3306 v.3 | 20100223 | Product data sheet | - | CBTD3306 v.2 |
| CBTD3306 v.2 | 20091015 | Product data sheet | - | CBTD3306 v.1 |
| CBTD3306 v.1 | 20011108 | Product data | - | - |

15. 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".
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