

CBT3253A

Dual 1-of-4 FET multiplexer/demultiplexer

Rev. 6 — 25 February 2021

Product data sheet

1. General description

The CBT3253A is a dual single-pole,4-throw bus switch. The device features two output enable inputs (\overline{nOE}) and two select inputs (S0 and S1). When \overline{nOE} are LOW the switch is enabled and the select inputs can be used to connect the nA terminal to one of the four associated nB terminals.

2. Features and benefits

- 5 Ω switch connection between two ports
- Direct interface with TTL levels
- Overvoltage tolerant control inputs to 5.5 V
- Minimal propagation delay through the switch
- Latch-up protection exceeds 100 mA per JEDEC standard JESD78 class II level A
- ESD protection:
 - HBM JESD22-A114E exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101C exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C

3. Ordering information

Table 1. Ordering information

| Type number | Temperature range | Package | | |
|-------------|-------------------|------------|--|----------|
| | | Name | Description | Version |
| CBT3253AD | -40 °C to +85 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| CBT3253ADS | -40 °C to +85 °C | SSOP16 [1] | plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 0.635 mm | SOT519-1 |
| CBT3253APW | -40 °C to +85 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |

[1] Also known as QSOP16.

4. Functional diagram

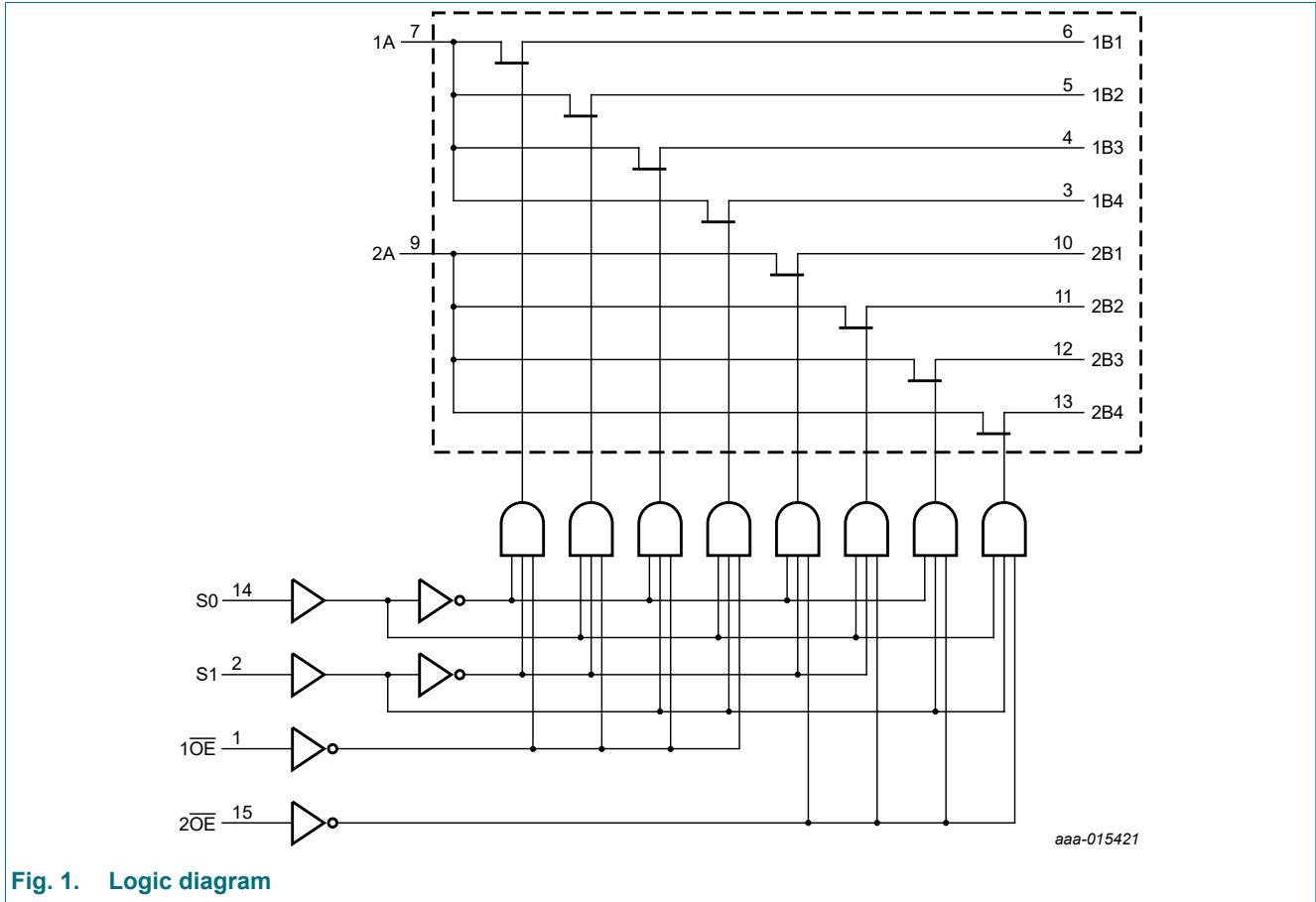


Fig. 1. Logic diagram

5. Pinning information

5.1. Pinning

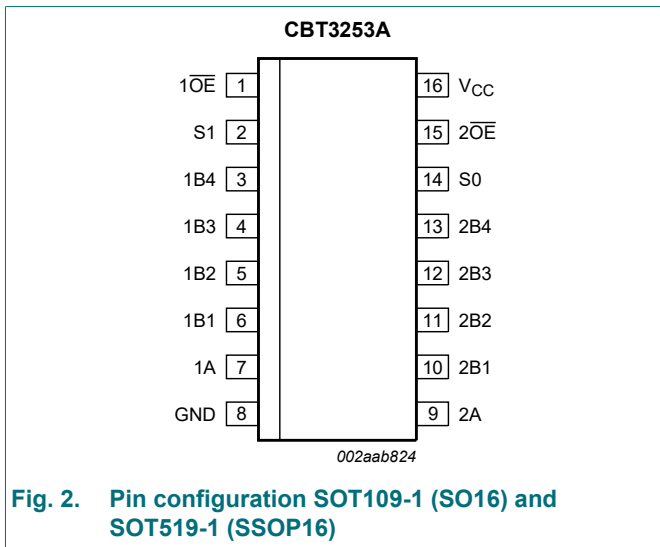


Fig. 2. Pin configuration SOT109-1 (SO16) and SOT519-1 (SSOP16)

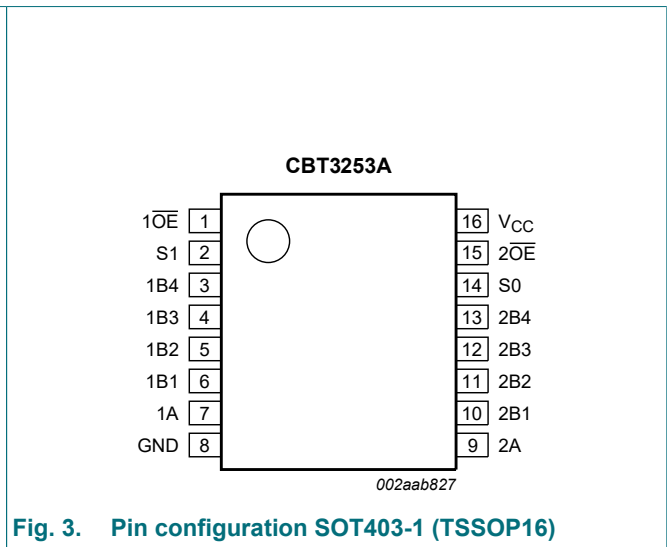


Fig. 3. Pin configuration SOT403-1 (TSSOP16)

5.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------------------|----------------|----------------------------|
| 1OE, 2OE | 1, 15 | output enable (active LOW) |
| S1, S0 | 2, 14 | select control input |
| 1B4, 1B3, 1B2, 1B1 | 3, 4, 5, 6 | 1B outputs/inputs |
| 1A | 7 | 1A input/output |
| GND | 8 | ground (0 V) |
| 2A | 9 | 2A input/output |
| 2B1, 2B2, 2B3, 2B4 | 10, 11, 12, 13 | 2B outputs/inputs |
| V _{CC} | 16 | positive supply voltage |

6. Functional description

Table 3. Function selection

H = HIGH voltage level; L = LOW voltage level; X = Don't care.

| Inputs | | | | Switch |
|--------|-----|----|----|-------------------------|
| 1OE | 2OE | S1 | S0 | |
| X | H | X | X | disconnect 2A to 2Bn |
| H | X | X | X | disconnect 1A to 1Bn |
| L | L | L | L | 1A to 1B1 and 2A to 2B1 |
| L | L | L | H | 1A to 1B2 and 2A to 2B2 |
| L | L | H | L | 1A to 1B3 and 2A to 2B3 |
| L | L | H | H | 1A to 1B4 and 2A to 2B4 |

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------|-------------------------|--|------|------|------|
| V _{CC} | supply voltage | | -0.5 | +7.0 | V |
| V _I | input voltage | [1] | -0.5 | +7.0 | V |
| I _{SW} | switch current | continuous current through each switch | - | 128 | mA |
| I _{IK} | input clamping current | V _I < 0 V | -50 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +85 °C | - | 500 | mW |

[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. 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 | 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 |

9. Static characteristics

Table 6. Static characteristics

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

| Symbol | Parameter | Conditions | Min | Typ [1] | Max | Unit |
|-----------------|------------------------------------|--|-----|---------|---------|---------------|
| V_{IK} | input clamping voltage | $V_{CC} = 4.5\text{ V}$; $I_I = -18\text{ mA}$ | - | - | -1.2 | V |
| V_{pass} | pass voltage | $V_I = V_{CC} = 5.0\text{ V}$; $I_O = -100\text{ }\mu\text{A}$ | 3.6 | 3.9 | 4.2 | V |
| I_I | input leakage current | $V_{CC} = 5.5\text{ V}$; $V_I = \text{GND}$ or 5.5 V | - | - | ± 1 | μA |
| I_{CC} | supply current | $V_{CC} = 5.5\text{ V}$; $I_O = 0\text{ mA}$; $V_I = V_{CC}$ or GND | - | - | 3 | μA |
| ΔI_{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 [2] | - | - | 2.5 | mA |
| C_I | input capacitance | control pins; $V_I = 3\text{ V}$ or 0 V | - | 4.5 | - | pF |
| $C_{io(off)}$ | off-state input/output capacitance | A port; $V_O = 3\text{ V}$ or 0 V ; $n\overline{OE} = V_{CC}$ | - | 11.4 | - | pF |
| | | B port; $V_O = 3\text{ V}$ or 0 V ; $n\overline{OE} = V_{CC}$ | - | 3.8 | - | pF |
| $C_{io(on)}$ | on-state input/output capacitance | A port and B port | - | 18.6 | - | pF |
| R_{ON} | ON resistance | $V_{CC} = 4.5\text{ V}$ [3] | | | | |
| | | $V_I = 0\text{ V}$; $I_I = 64\text{ mA}$ | - | 5 | 7 | Ω |
| | | $V_I = 0\text{ V}$; $I_I = 30\text{ mA}$ | - | 5 | 7 | Ω |
| | | $V_I = 2.4\text{ V}$; $I_I = -15\text{ mA}$ | - | 10 | 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 drop between the A and the B terminals at the indicated current through the switch. The lowest voltage of the two (A or B) terminals determines the ON resistance.

10. Dynamic characteristics

Table 7. Dynamic characteristics

$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$; $V_{CC} = 4.5\text{ V}$ to 5.5 V ; for test circuit, see Fig. 6.

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------|---|-----|------|------|
| t_{pd} | propagation delay | Sn to nA; see Fig. 4 [1] [2] | 1.2 | 6.2 | ns |
| | | nA to nBn or nBn to nA; see Fig. 4 [1] [2] | - | 0.25 | ns |
| t_{en} | enable time | Sn to nBn; see Fig. 5 [3] | 1.3 | 6.3 | ns |
| | | n $\overline{\text{OE}}$ to nA or nBn; see Fig. 5 [3] | 1.4 | 6.4 | ns |
| t_{dis} | disable time | Sn to nBn; see Fig. 5 [4] | 1.1 | 7.2 | ns |
| | | n $\overline{\text{OE}}$ to nA or nBn; see Fig. 5 [4] | 1.0 | 7 | ns |

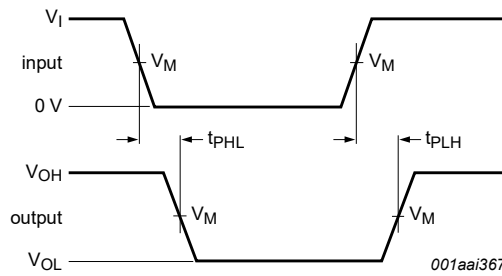
[1] This parameter is warranted but not production tested. The propagation delay is based on the RC time constant of the typical ON resistance of the switch and a load capacitance, when driven by an ideal voltage source (zero output impedance).

[2] t_{PLH} and t_{PHL} are the same as t_{pd} .

[3] t_{PZL} and t_{PZH} are the same as t_{en} .

[4] t_{PLZ} and t_{PHZ} are the same as t_{dis} .

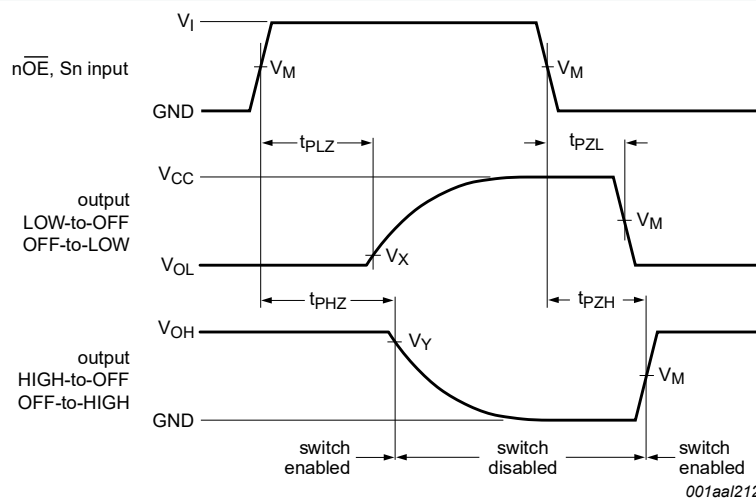
10.1. Waveforms and test circuit



Measurement points are given in Table 8.

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 4. The input (nA; nBn) to output (nBn; nA) or input (Sn) to output (nA) propagation delay times



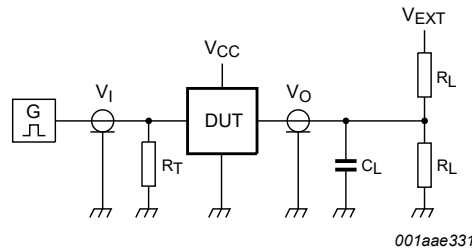
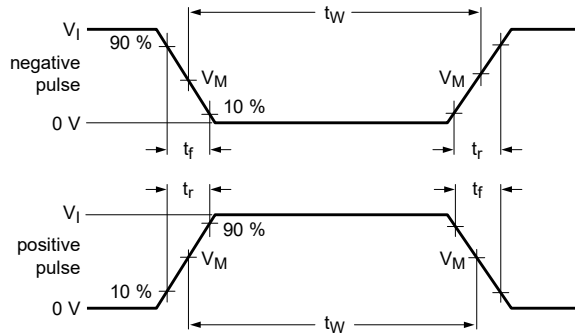
Measurement points are given in Table 8.

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig. 5. Enable and disable times

Table 8. Measurement points

| Supply voltage | Input | | Output | | |
|----------------|--------------|-------|--------|------------------|------------------|
| V_{CC} | V_I | V_M | V_M | V_X | V_Y |
| 4.5 V to 5.5 V | GND to 3.0 V | 1.5 V | 1.5 V | $V_{OL} + 0.3 V$ | $V_{OH} - 0.3 V$ |



Test data is given in [Table 9](#).

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 the output impedance Z_o of the pulse generator.

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

Fig. 6. Test circuit for measuring switching times

Table 9. Test data

| Supply voltage | Input | | Load | | V_{EXT} | | |
|----------------|--------------|-----------------------|-------|--------------|--------------------|--------------------|--------------------|
| V_{CC} | V_I | t_r, t_f | C_L | R_L | t_{PLH}, t_{PHL} | t_{PLZ}, t_{PZL} | t_{PHZ}, t_{PZH} |
| 4.5 V to 5.5 V | GND to 3.0 V | $\leq 2.5 \text{ ns}$ | 50 pF | 500 Ω | open | 7.0 V | open |

11. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

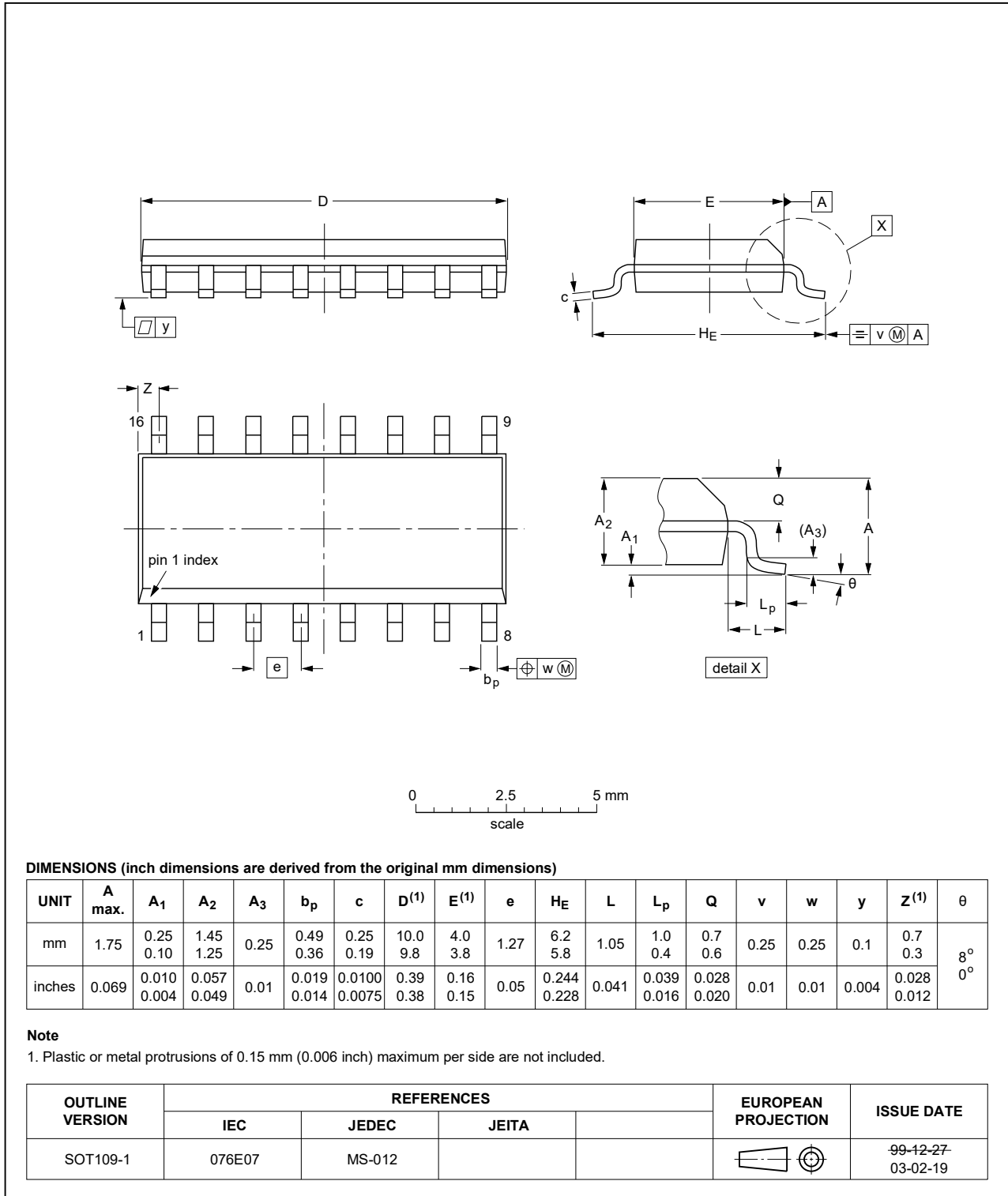


Fig. 7. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 0.635 mm SOT519-1

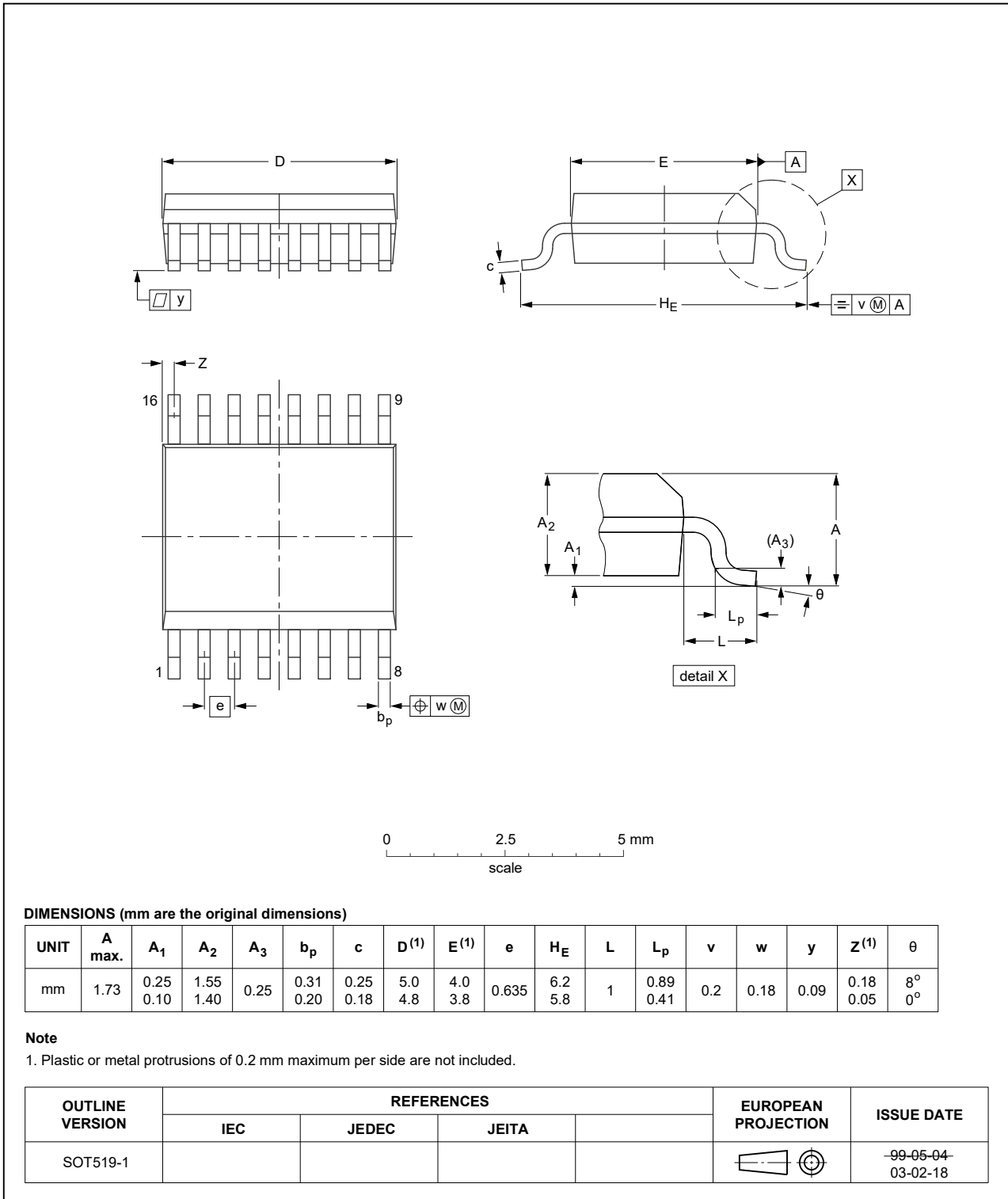


Fig. 8. Package outline SOT519-1 (SSOP16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

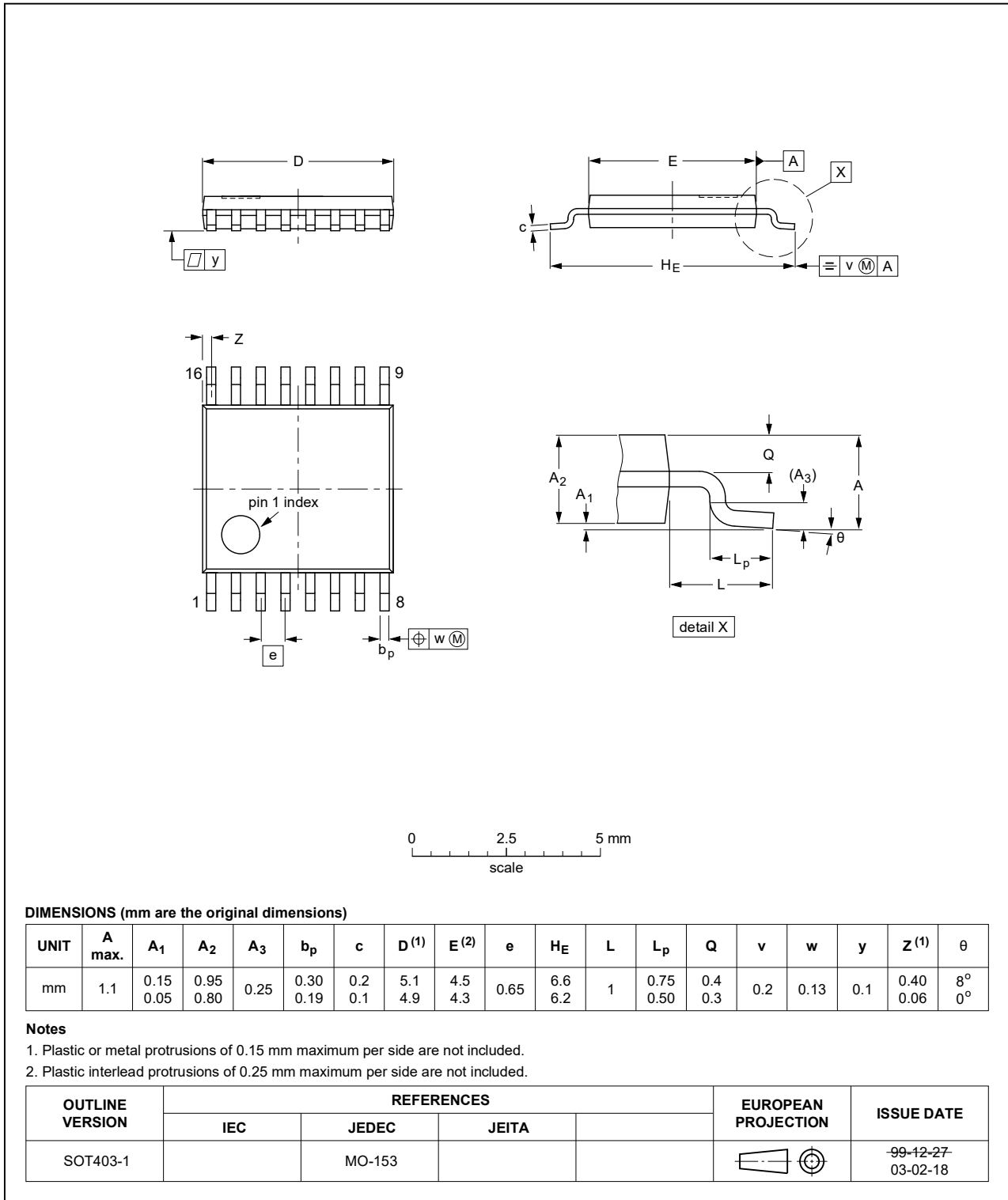


Fig. 9. Package outline SOT403-1 (TSSOP16)

12. Abbreviations

Table 10. Abbreviations

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

13. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|--------------------|---------------|--------------|
| CBT3253A v.6 | 20210225 | Product data sheet | - | CBT3253A v.5 |
| Modifications: | <ul style="list-style-type: none"> Type number CBT3253ADB (SOT338-1 / SSOP16) removed. | | | |
| CBT3253A v.5 | 20170509 | Product data sheet | - | CBT3253A v.4 |
| 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. | | | |
| CBT3253A v.4 | 20141031 | Product data sheet | - | CBT3253A v.3 |
| Modifications: | <ul style="list-style-type: none"> Section 1: text changed to align with the function of the device. Fig. 1: schematic changed. Section 6: switch description changed to align with the function of the device. Section 10: typo corrected, the conditions for enable and disable times are swapped. | | | |
| CBT3253A v.3 | 20130924 | Product data sheet | - | CBT3253A v.2 |
| Modifications: | <ul style="list-style-type: none"> Section 9: values for pass voltage modified. | | | |
| CBT3253A v.2 | 20070208 | Product data sheet | - | CBT3253A v.1 |
| CBT3253A v.1 | 20051024 | Product data sheet | - | - |

14. Legal information

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| 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. |

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