



**THE DATASHEET OF
CBT3251PW,118**



CBT3251

1-of-8 FET multiplexer/demultiplexer

Rev. 5 — 18 April 2024

Product data sheet

1. General description

The CBT3251 is a single-pole, 8-throw bus switch. The device features an output enable input (\overline{OE}) and three select inputs (S0, S1 and S2). When \overline{OE} is LOW the switch is enabled and the select inputs can be used to connect the A terminal to one of the eight B 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
- I_{OFF} circuitry provides partial Power-down mode operation
- Minimal propagation delay through the switch
- Latch-up protection exceeds 100 mA per JEDEC standard JESD78 class II level A
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C

3. Ordering information

Table 1. Ordering information

| Type number | Temperature range | Package | | |
|---------------------------|-------------------|---------|---|--------------------------|
| | | Name | Description | Version |
| CBT3251D | -40 °C to +85 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| CBT3251PW | -40 °C to +85 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |

4. Functional diagram

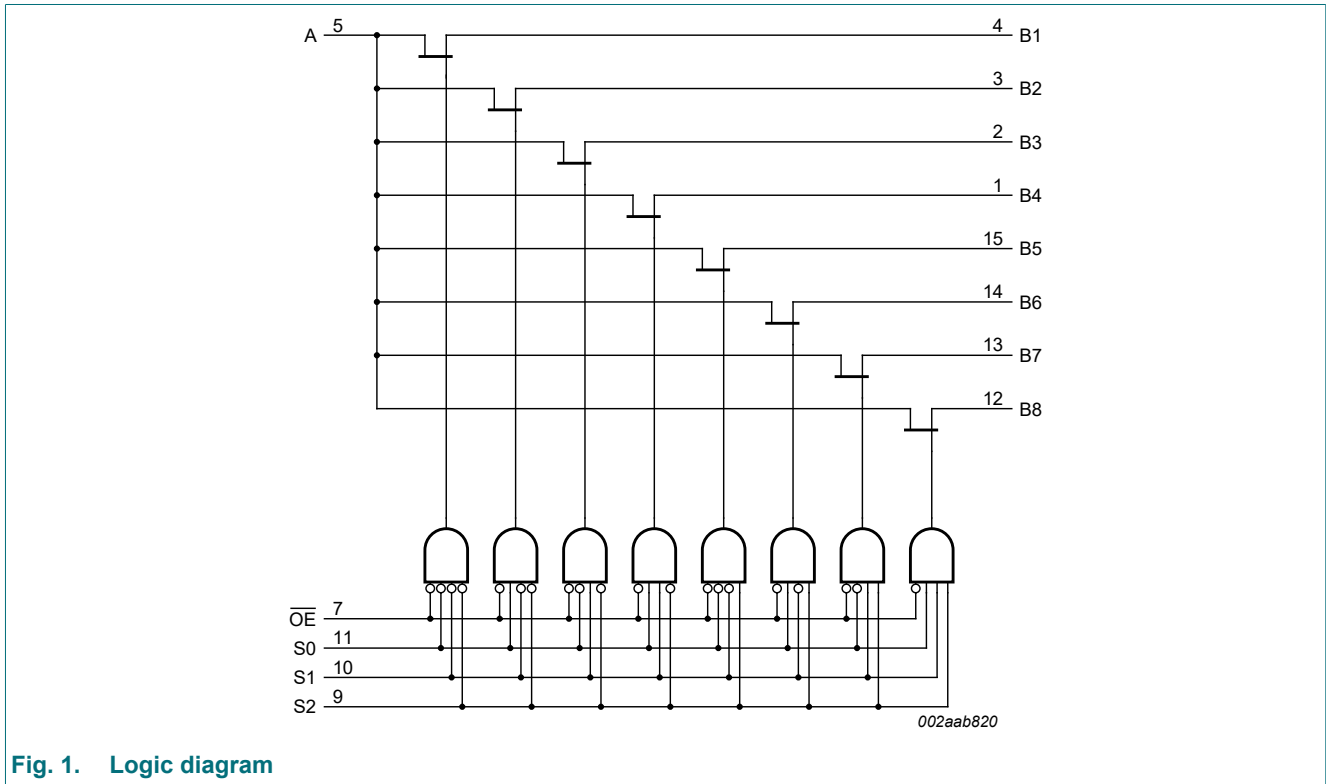
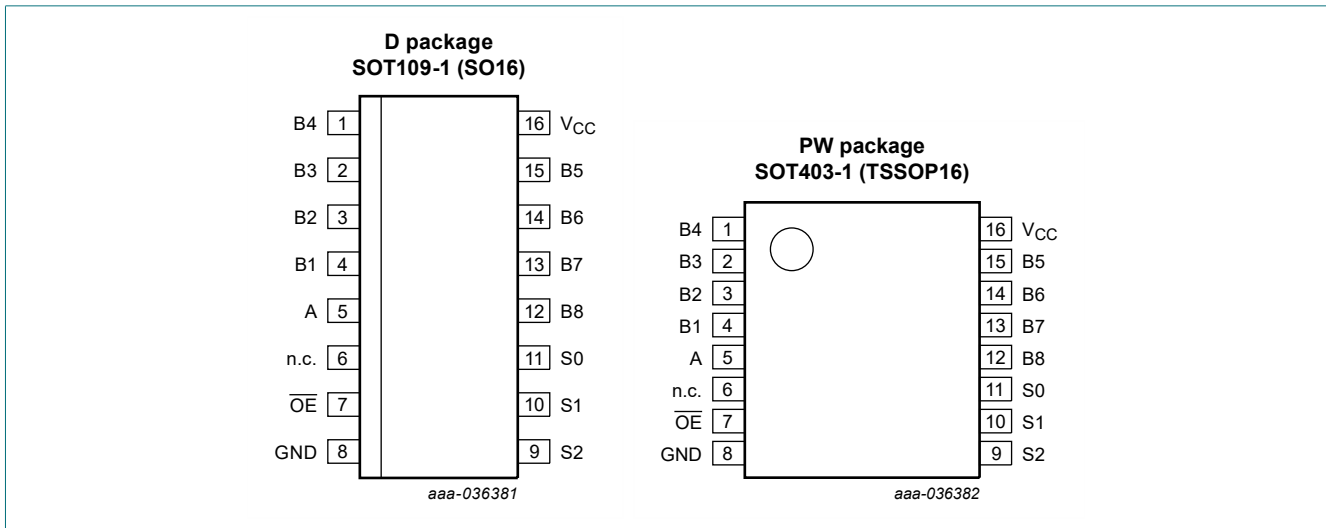


Fig. 1. Logic diagram

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------------------------------|----------------------------|----------------------------|
| B1, B2, B3, B4, B5, B6, B7, B8 | 1, 2, 3, 4, 12, 13, 14, 15 | B outputs/inputs |
| A | 5 | A input/output |
| n.c. | 6 | not connected |
| $\overline{\text{OE}}$ | 7 | output enable (active LOW) |
| S2, S1, S0 | 9, 10, 11 | select control input |
| GND | 8 | ground (0 V) |
| 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 |
|------------------------|----|----|----|------------|
| $\overline{\text{OE}}$ | S2 | S1 | S0 | |
| L | L | L | L | A to B1 |
| L | L | L | H | A to B2 |
| L | L | H | L | A to B3 |
| L | L | H | H | A to B4 |
| L | H | L | L | A to B5 |
| L | H | L | H | A to B6 |
| L | H | H | L | A to B7 |
| L | H | H | H | A to B8 |
| H | X | X | X | switch off |

7. Limiting values

Table 4. Limiting values

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

| 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

| Symbol | Parameter | Conditions | $T_{amb} = -40\text{ °C to }+85\text{ °C.}$ | | | Unit |
|-----------------|------------------------------------|---|---|------|---------|---------------|
| | | | Min | Typ | Max | |
| V_{IK} | input clamping voltage | $V_{CC} = 4.5\text{ V}; I_I = -18\text{ mA}$ | - | - | -1.2 | V |
| V_{pass} | pass voltage | $V_I = V_{CC} = 5.0\text{ V}; I_O = -100\text{ }\mu\text{A}$ [1] | 3.6 | 3.9 | 4.2 | V |
| I_I | input leakage current | $V_{CC} = 5.5\text{ V}; V_I = \text{GND or } 5.5\text{ V}$ | - | - | ± 1 | μA |
| I_{CC} | supply current | $V_{CC} = 5.5\text{ V}; I_O = 0\text{ mA}; V_I = V_{CC}\text{ or GND}$ | - | - | 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; $V_I = 3\text{ V or } 0\text{ V}$ [1] | - | 3.5 | - | pF |
| $C_{io(off)}$ | off-state input/output capacitance | A port; $V_O = 3\text{ V or } 0\text{ V}; \overline{OE} = V_{CC}$ [1] | - | 17.5 | - | pF |
| | | B port; $V_O = 3\text{ V or } 0\text{ V}; \overline{OE} = V_{CC}$ [1] | - | 4.0 | - | pF |
| R_{ON} | ON resistance | $V_{CC} = 4.5\text{ V}$ [3] | | | | |
| | | $V_I = 0\text{ V}; I_I = 64\text{ mA}$ [1] | - | 5 | 7 | Ω |
| | | $V_I = 0\text{ V}; I_I = 30\text{ mA}$ [1] | - | 5 | 7 | Ω |
| | | $V_I = 2.4\text{ V}; I_I = -15\text{ mA}$ [1] | - | 10 | 15 | Ω |

[1] Typical value is 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 Bn terminals at the indicated current through the switch. The lowest voltage of the two (A or Bn) terminals determines the ON resistance.

10. Dynamic characteristics

Table 7. Dynamic characteristics

$V_{CC} = 4.5\text{ V to }5.5\text{ V}$; for test circuit, see Fig. 4.

| Symbol | Parameter | Conditions | $T_{amb} = -40\text{ °C to }+85\text{ °C}$ | | Unit |
|-----------|-------------------|--|--|------|------|
| | | | Min | Max | |
| t_{pd} | propagation delay | A to Bn or Bn to A; see Fig. 2 [1] [2] | - | 0.25 | ns |
| | | Sn to A; see Fig. 2 [1] [2] | 1.5 | 5.5 | ns |
| t_{en} | enable time | \overline{OE} to A or Bn; see Fig. 3 [2] | 1.5 | 5.6 | ns |
| | | Sn to Bn; see Fig. 3 [2] | 1.6 | 5.8 | ns |
| t_{dis} | disable time | \overline{OE} to A or Bn; see Fig. 3 [2] | 1.9 | 6.4 | ns |
| | | Sn to Bn; see Fig. 3 [2] | 2.3 | 6.2 | 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} .
 t_{PZL} and t_{PZH} are the same as t_{en} .
 t_{PLZ} and t_{PHZ} are the same as t_{dis} .

10.1. Waveforms and test circuit

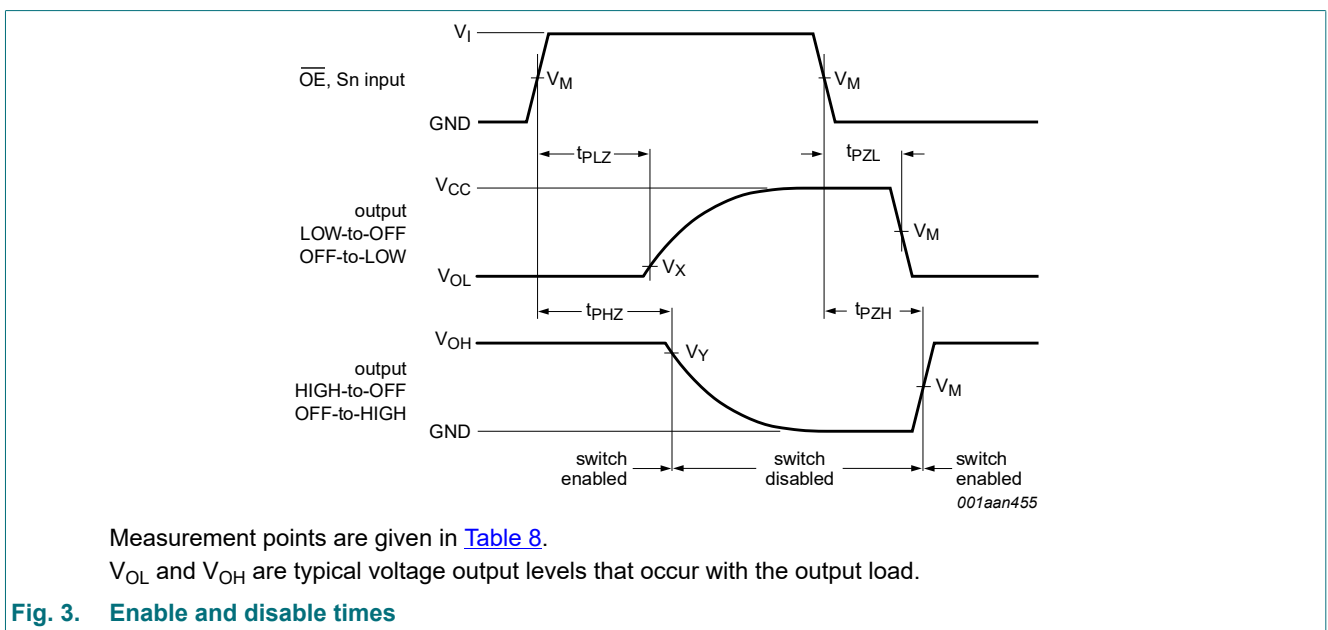
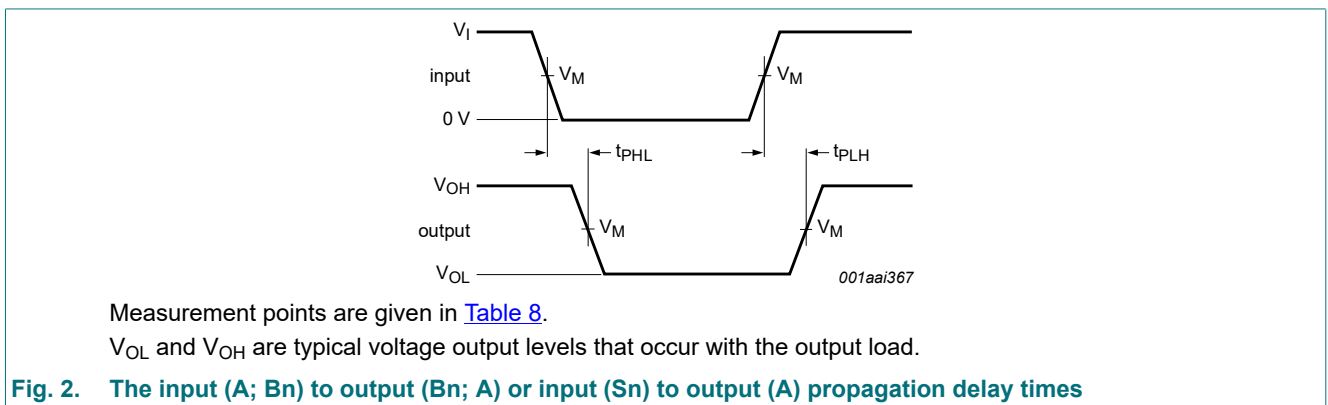
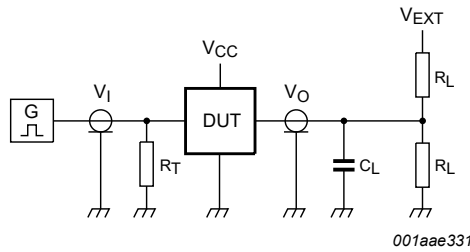
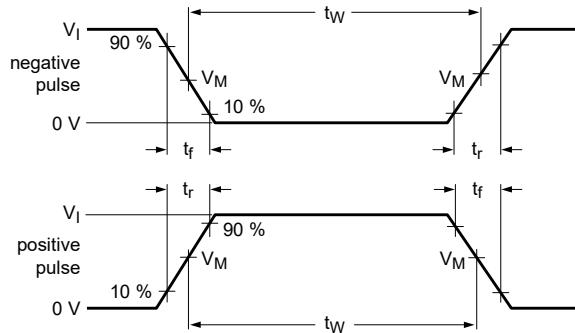


Table 8. Measurement points

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



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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. 4. 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

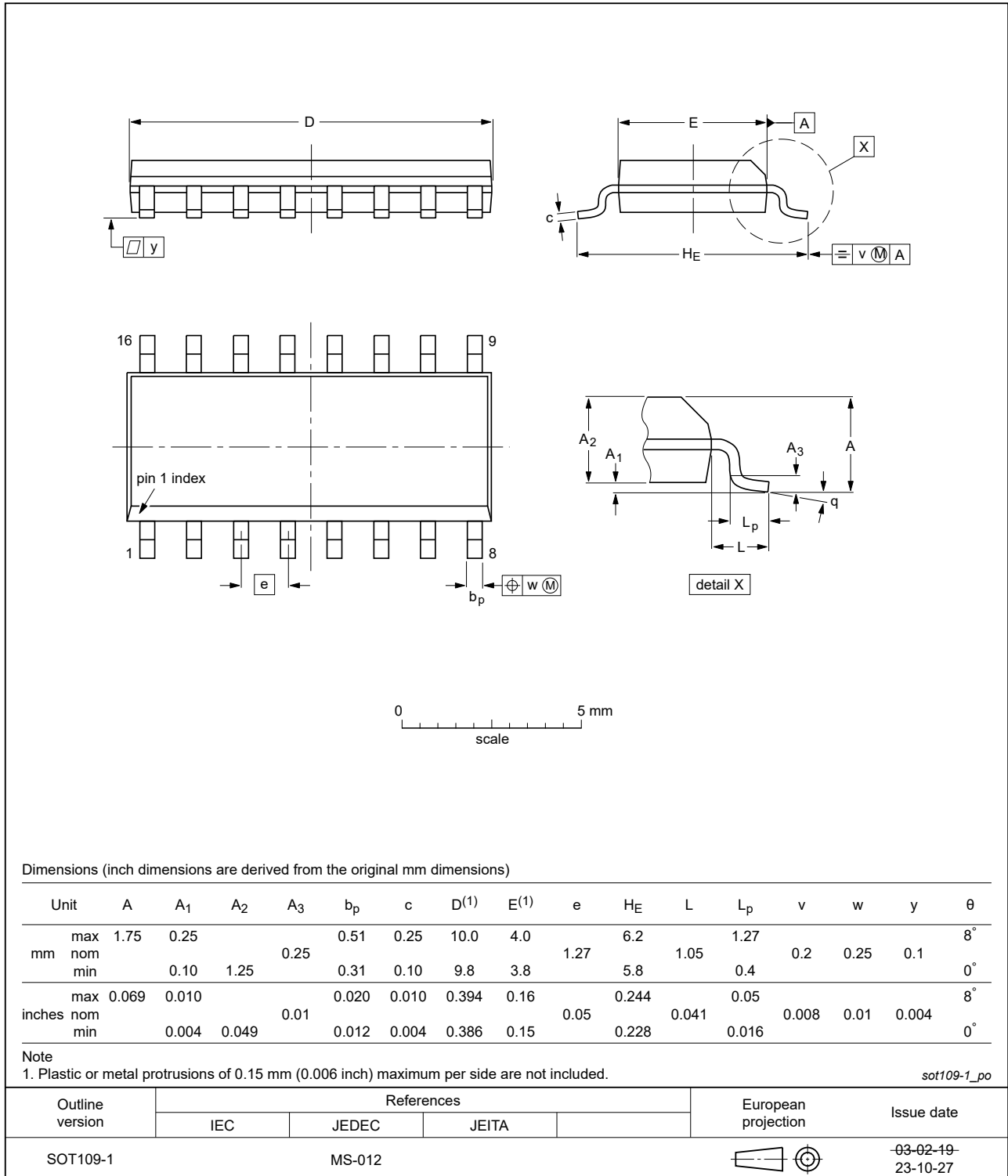


Fig. 5. Package outline SOT109-1 (SO16)

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

SOT403-1

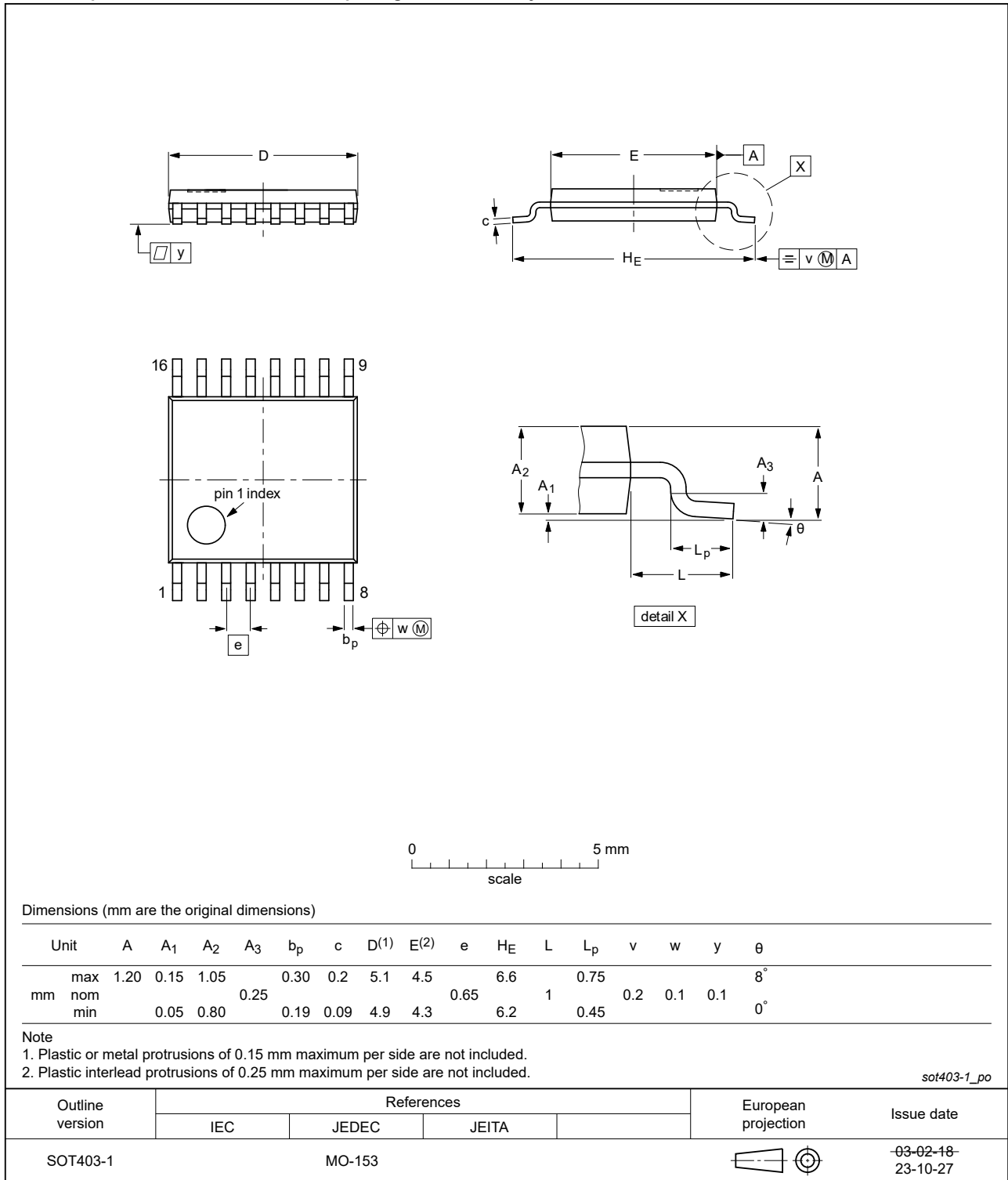


Fig. 6. Package outline SOT403-1 (TSSOP16)

12. Abbreviations

Table 10. Abbreviations

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

13. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|---|--------------------|---------------|-------------|
| CBT3251 v.5 | 20240418 | Product data sheet | - | CBT3251 v.4 |
| Modifications: | <ul style="list-style-type: none"> • Fig. 5, Fig. 6: Aligned SO and TSSOP package outline drawings to JEDEC MS-012 and MO-153. • Section 2: ESD specification updated according to the latest JEDEC standard. • Section 9: R_{ON} specification updated in line with CBT family. | | | |
| CBT3251 v.4 | 20210324 | Product data sheet | - | CBT3251 v.3 |
| 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. • Section 1 and Section 2 updated. • Type number CBT3251DB (SOT338-1 / SSOP16) removed. | | | |
| CBT3251 v.3 | 20160316 | Product data sheet | - | CBT3251 v.2 |
| Modifications: | <ul style="list-style-type: none"> • Type number CBT3251DS removed | | | |
| CBT3251 v.2 | 20130916 | Product data sheet | - | CBT3251 v.1 |
| Modifications: | <ul style="list-style-type: none"> • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Table 6 pass voltage modified. | | | |
| CBT3251 v.1 | 20051221 | 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. |
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| Product [short] data sheet | Production | This document contains the product specification. |

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