

74CBTLV3253

Dual 1-of-4 multiplexer/demultiplexer

Rev. 5 — 11 November 2016

Product data sheet

1. General description

The 74CBTLV3253 provides a dual 1-of-4 high-speed multiplexer/demultiplexer with two common select inputs (S0, S1) and two output enable inputs ($\overline{1OE}$, $\overline{2OE}$). The low ON resistance of the switch allows inputs to be connected to outputs without adding propagation delay or generating additional ground bounce noise. When pin \overline{nOE} = LOW, one of the four switches is selected (low-impedance ON-state) with pins S0 and S1. When pin \overline{nOE} = HIGH, all switches are in the high-impedance OFF-state, independent of pins S0 and S1.

To ensure the high-impedance OFF-state during power-up or power-down, \overline{nOE} should be tied to the V_{CC} through a pull-up resistor. The minimum value of the resistor is determined by the current-sinking capability of the driver.

Schmitt trigger action at control input makes the circuit tolerant to slower input rise and fall times across the entire V_{CC} range from 2.3 V to 3.6 V.

This device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

2. Features and benefits

- Supply voltage range from 2.3 V to 3.6 V
- High noise immunity
- Complies with JEDEC standard:
 - ◆ JESD8-5 (2.3 V to 2.7 V)
 - ◆ JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
 - ◆ CDM AEC-Q100-011 revision B exceeds 1000 V
- 5 Ω switch connection between two ports
- Rail to rail switching on data I/O ports
- CMOS low power consumption
- Latch-up performance exceeds 250 mA per JESD78B Class I level A
- I_{OFF} circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$



3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|---------------|-------------------|-----------------------|--|----------|
| | Temperature range | Name | Description | |
| 74CBTLV3253D | -40 °C to +125 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| 74CBTLV3253DS | -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 |
| 74CBTLV3253PW | -40 °C to +125 °C | TSSOP16 | plastic thin shrink small outline package; 16 leads; body width 4.4 mm | SOT403-1 |
| 74CBTLV3253BQ | -40 °C to +125 °C | DHVQFN16 | plastic dual-in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm | SOT763-1 |

[1] Also known as QSOP16.

4. Functional diagram

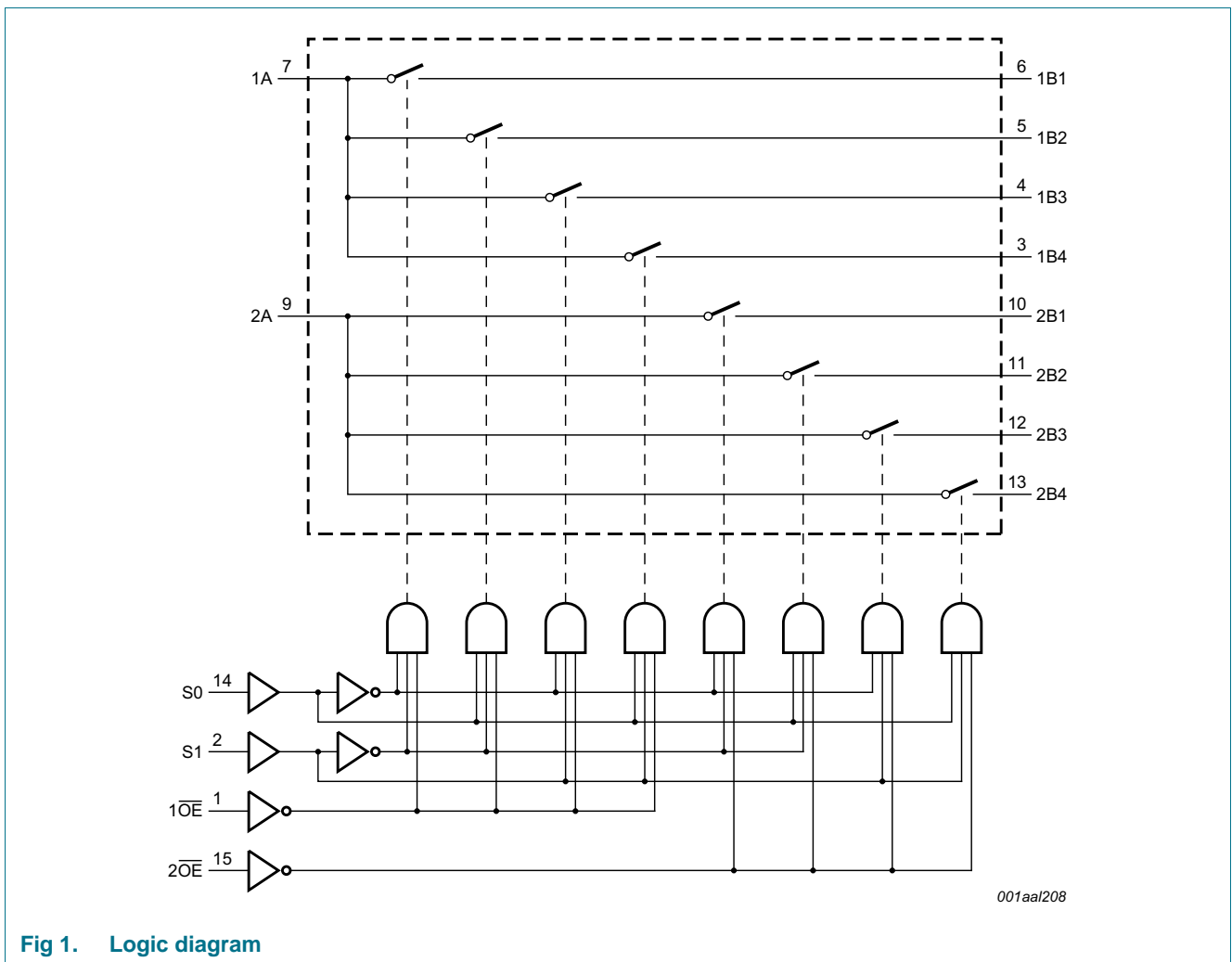


Fig 1. Logic diagram

5. Pinning information

5.1 Pinning

74CBTLV3253

001aal209

74CBTLV3253

001aal210

74CBTLV3253

Transparent top view

001aal211

(1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

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

Fig 3. Pin configuration SOT403-1 (TSSOP16)

Fig 4. Pin configuration SOT763-1 (DHVQFN16)

5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|------------|----------------|----------------------------------|
| 1OE, 2OE | 1, 15 | output enable input (active LOW) |
| S0, S1 | 14, 2 | select input |
| 1B1 to 1B4 | 6, 5, 4, 3 | B input/output |
| 2B1 to 2B4 | 10, 11, 12, 13 | B input/output |
| GND | 8 | ground (0 V) |
| 1A, 2A | 7, 9 | A input/output |
| VCC | 16 | supply voltage |

6. Functional description

Table 3. Function table^[1]

| Inputs | | | | Function switch |
|--------|-----|----|----|-------------------------|
| 1OE | 2OE | S1 | S0 | |
| X | H | X | X | disconnect 2A and 2Bn |
| H | X | X | X | disconnect 1A and 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 |

[1] H = HIGH voltage level; L = LOW voltage level.

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 | +4.6 | V |
| V _I | input voltage | control inputs ^[1] | -0.5 | +4.6 | V |
| V _{SW} | switch voltage | enable and disable mode ^[2] | -0.5 | V _{CC} + 0.5 | V |
| I _{IK} | input clamping current | V _I < -0.5 V | -50 | - | mA |
| I _{SK} | switch clamping current | V _I < -0.5 V | -50 | - | mA |
| I _{SW} | switch current | V _{SW} = 0 V to V _{CC} | - | ±128 | mA |
| I _{CC} | supply current | | - | +100 | mA |
| I _{GND} | ground current | | -100 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +125 °C ^[3] | - | 500 | mW |

[1] The minimum input voltage rating may be exceeded if the input clamping current ratings are observed.

[2] The switch voltage ratings may be exceeded if switch clamping current ratings are observed

[3] For SSOP16 and TSSOP16 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.

For DHVQFN16 packages: P_{tot} derates linearly with 4.5 mW/K above 60 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------|-------------------------------------|---|-----|-----------------|------|
| V _{CC} | supply voltage | | 2.3 | 3.6 | V |
| V _I | input voltage | | 0 | 3.6 | V |
| V _{SW} | switch voltage | enable and disable mode | 0 | V _{CC} | V |
| T _{amb} | ambient temperature | | -40 | +125 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 2.3 V to 3.6 V ^[1] | 0 | 200 | ns/V |

[1] Applies to control signal levels.

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | T _{amb} = -40 °C to +85 °C | | | T _{amb} = -40 °C to +125 °C | | Unit |
|---------------------|---------------------------|--|-------------------------------------|--------------------|-----|--------------------------------------|------|------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.3 V to 2.7 V | 1.7 | - | - | 1.7 | - | V |
| | | V _{CC} = 3.0 V to 3.6 V | 2.0 | - | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | - | 0.7 | V |
| | | V _{CC} = 3.0 V to 3.6 V | - | - | 0.9 | - | 0.9 | V |
| I _I | input leakage current | pin nOE; V _I = GND to V _{CC} ; V _{CC} = 3.6 V | - | - | ±1 | - | ±20 | μA |
| I _{S(OFF)} | OFF-state leakage current | V _{CC} = 3.6 V; see Figure 5 | - | - | ±1 | - | ±20 | μA |
| I _{S(ON)} | ON-state leakage current | V _{CC} = 3.6 V; see Figure 6 | - | - | ±1 | - | ±20 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 0 V to 3.6 V; V _{CC} = 0 V | - | - | ±10 | - | ±50 | μA |
| I _{CC} | supply current | V _I = GND or V _{CC} ; I _O = 0 A; V _{SW} = GND or V _{CC} ; V _{CC} = 3.6 V | - | - | 10 | - | 50 | μA |
| ΔI _{CC} | additional supply current | pin nOE; V _I = V _{CC} - 0.6 V; V _{SW} = GND or V _{CC} ; V _{CC} = 3.6 V [2] | - | - | 300 | - | 2000 | μA |
| C _I | input capacitance | pin nOE; V _{CC} = 3.3 V; V _I = 0 V to 3.3 V | - | 0.9 | - | - | - | pF |
| C _{S(OFF)} | OFF-state capacitance | V _{CC} = 3.3 V; V _I = 0 V to 3.3 V | - | 5.2 | - | - | - | pF |
| C _{S(ON)} | ON-state capacitance | V _{CC} = 3.3 V; V _I = 0 V to 3.3 V | - | 20.0 | - | - | - | pF |

[1] All typical values are measured at T_{amb} = 25 °C.

[2] One input at 3 V, other inputs at V_{CC} or GND.

9.1 Test circuits



V_I = V_{CC} or GND and V_O = GND or V_{CC}.

Fig 5. Test circuit for measuring OFF-state leakage current (one switch)



V_I = V_{CC} or GND and V_O = open circuit.

Fig 6. Test circuit for measuring ON-state leakage current (one switch)

9.2 ON resistance

Table 7. Resistance R_{ON}

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7.

| Symbol | Parameter | Conditions | $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ | | | $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | | Unit |
|----------|--|---|--|--------------------|------|---|----------|----------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| R_{ON} | ON resistance | $V_{CC} = 2.3\text{ V}$ to 2.7 V ; see Figure 8 to Figure 10 ^[2] | | | | | | |
| | | $I_{SW} = 64\text{ mA}$; $V_I = 0\text{ V}$ | - | 4.2 | 8.0 | - | 15.0 | Ω |
| | | $I_{SW} = 24\text{ mA}$; $V_I = 0\text{ V}$ | - | 4.2 | 8.0 | - | 15.0 | Ω |
| | | $I_{SW} = 15\text{ mA}$; $V_I = 1.7\text{ V}$ | - | 8.4 | 40.0 | - | 60.0 | Ω |
| | | $V_{CC} = 3.0\text{ V}$ to 3.6 V ; see Figure 11 to Figure 13 | | | | | | |
| | | $I_{SW} = 64\text{ mA}$; $V_I = 0\text{ V}$ | - | 4.0 | 7.0 | - | 11.0 | Ω |
| | | $I_{SW} = 24\text{ mA}$; $V_I = 0\text{ V}$ | - | 4.0 | 7.0 | - | 11.0 | Ω |
| | $I_{SW} = 15\text{ mA}$; $V_I = 2.4\text{ V}$ | - | 6.2 | 15.0 | - | 25.5 | Ω | |

[1] Typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$ and nominal V_{CC} .

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

9.3 ON resistance test circuit and graphs

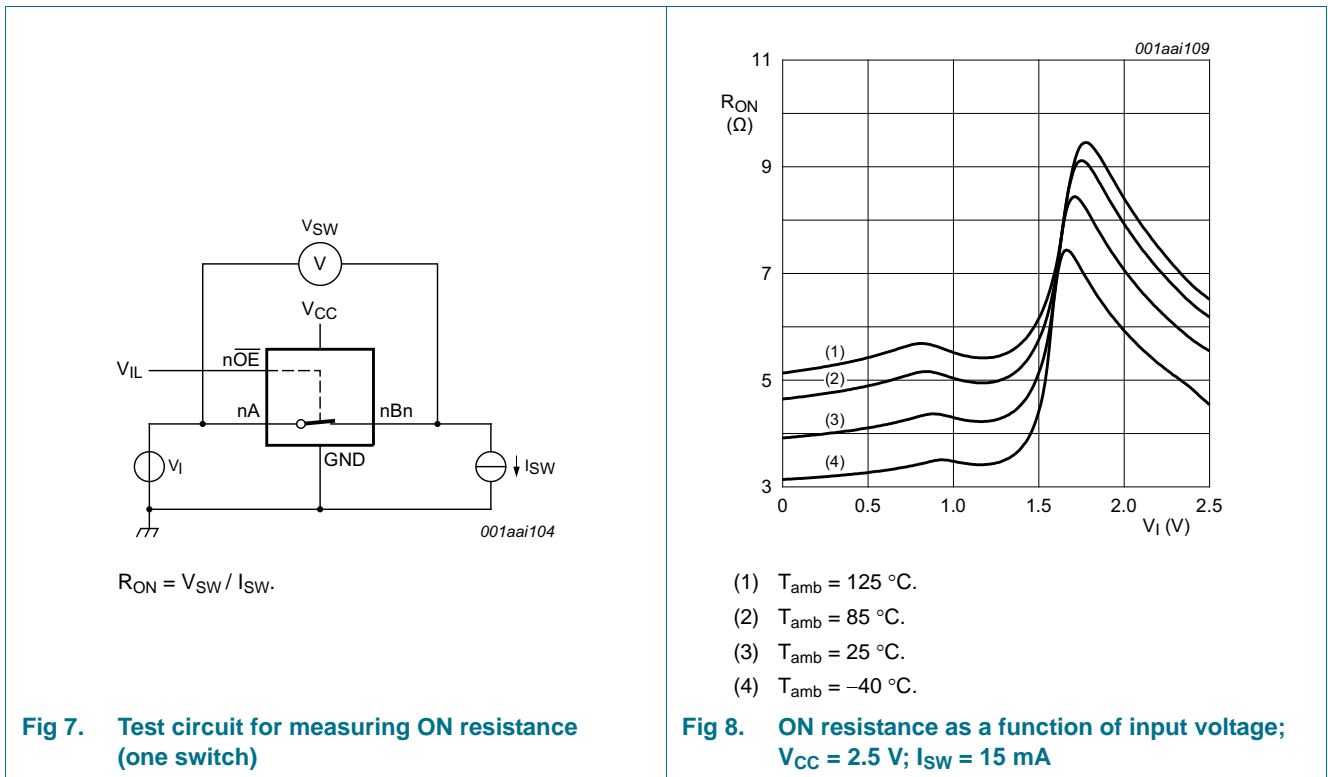
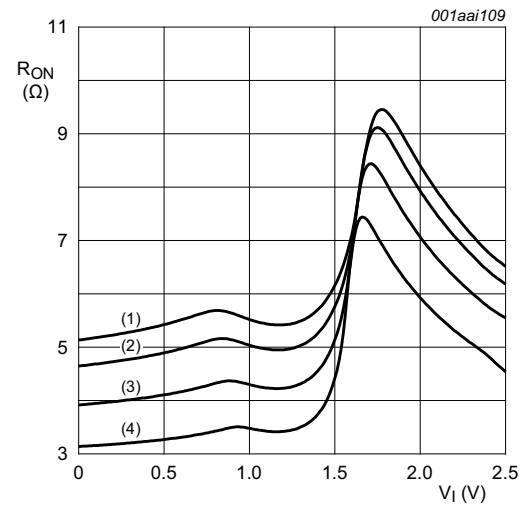
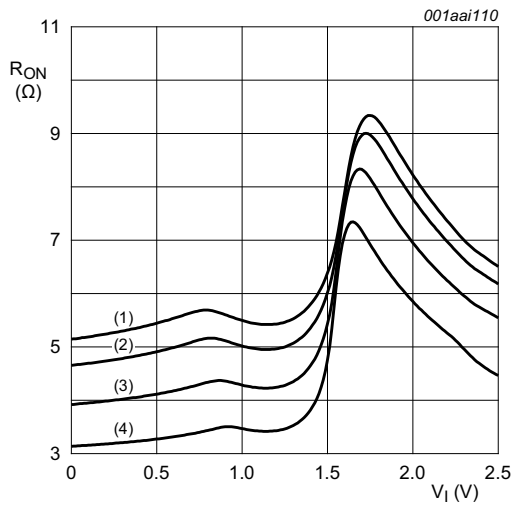


Fig 7. Test circuit for measuring ON resistance (one switch)



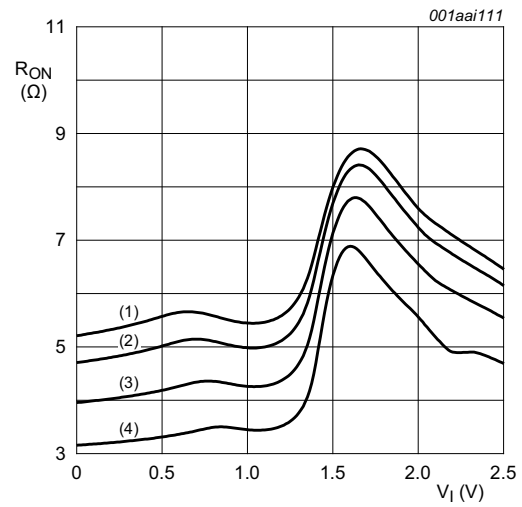
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}$.
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$.
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$.
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$.

Fig 8. ON resistance as a function of input voltage; $V_{CC} = 2.5\text{ V}$; $I_{SW} = 15\text{ mA}$



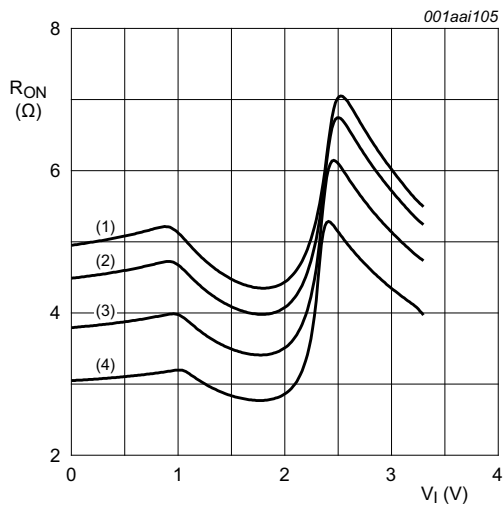
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 9. ON resistance as a function of input voltage;
 $V_{CC} = 2.5\text{ V}; I_{SW} = 24\text{ mA}$



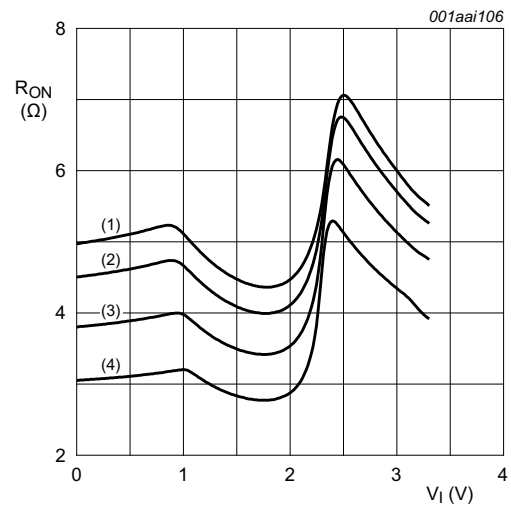
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 10. ON resistance as a function of input voltage;
 $V_{CC} = 2.5\text{ V}; I_{SW} = 64\text{ mA}$



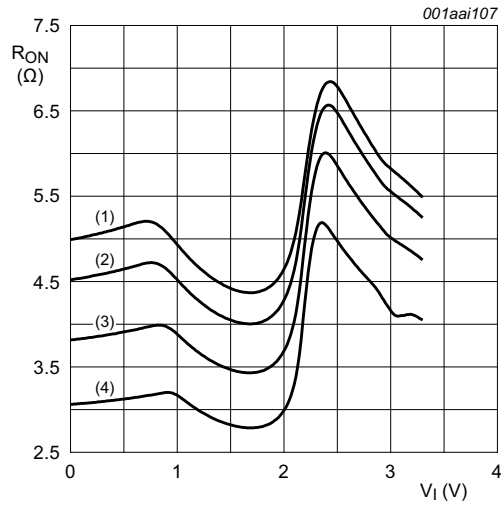
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 11. ON resistance as a function of input voltage;
 $V_{CC} = 3.3\text{ V}; I_{SW} = 15\text{ mA}$



- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 12. ON resistance as a function of input voltage;
 $V_{CC} = 3.3\text{ V}; I_{SW} = 24\text{ mA}$



- (1) $T_{amb} = 125\text{ °C}$.
- (2) $T_{amb} = 85\text{ °C}$.
- (3) $T_{amb} = 25\text{ °C}$.
- (4) $T_{amb} = -40\text{ °C}$.

Fig 13. ON resistance as a function of input voltage; $V_{CC} = 3.3\text{ V}$; $I_{SW} = 64\text{ mA}$

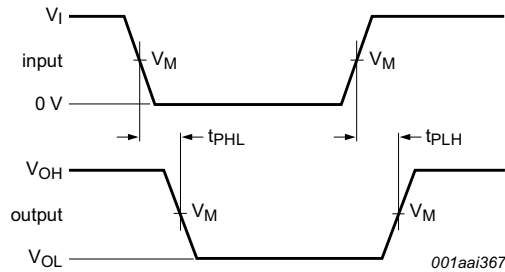
10. Dynamic characteristics

Table 8. Dynamic characteristics
GND = 0 V; for test circuit see Figure 16

| Symbol | Parameter | Conditions | T _{amb} = -40 °C to +85 °C | | | T _{amb} = -40 °C to +125 °C | | Unit |
|------------------|-------------------|---|-------------------------------------|--------------------|------|--------------------------------------|------|------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| t _{pd} | propagation delay | nA to nBn or nBn to nA; see Figure 14 ^{[2][3]} | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.15 | - | 0.25 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | - | - | 0.15 | - | 0.25 | ns |
| | | Sn to nA; see Figure 14 ^[3] | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.0 | 2.2 | 6.8 | 1.0 | 7.5 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | 2.0 | 5.5 | 1.0 | 6.1 | ns |
| t _{en} | enable time | nOE to nA or nBn; see Figure 15 ^[4] | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.0 | 2.1 | 5.0 | 1.0 | 5.5 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | 1.9 | 4.8 | 1.0 | 5.3 | ns |
| | | Sn to nBn; see Figure 15 ^[4] | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.0 | 2.1 | 4.3 | 1.0 | 4.7 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | 1.9 | 4.0 | 1.0 | 4.4 | ns |
| t _{dis} | disable time | nOE to nA or nBn; see Figure 15 ^[5] | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.0 | 2.6 | 5.5 | 1.0 | 6.1 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | 3.2 | 5.4 | 1.0 | 5.9 | ns |
| | | Sn to nBn; see Figure 15 ^[5] | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | 0.8 | 2.0 | 4.8 | 0.8 | 5.3 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | 2.0 | 4.5 | 1.0 | 5.0 | ns |

- [1] All typical values are measured at T_{amb} = 25 °C and at nominal V_{CC}.
- [2] The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the load capacitance, when driven by an ideal voltage source (zero output impedance).
- [3] t_{pd} is the same as t_{PLH} and t_{PHL}.
- [4] t_{en} is the same as t_{PZH} and t_{PZL}.
- [5] t_{dis} is the same as t_{PHZ} and t_{PLZ}.

11. Waveforms

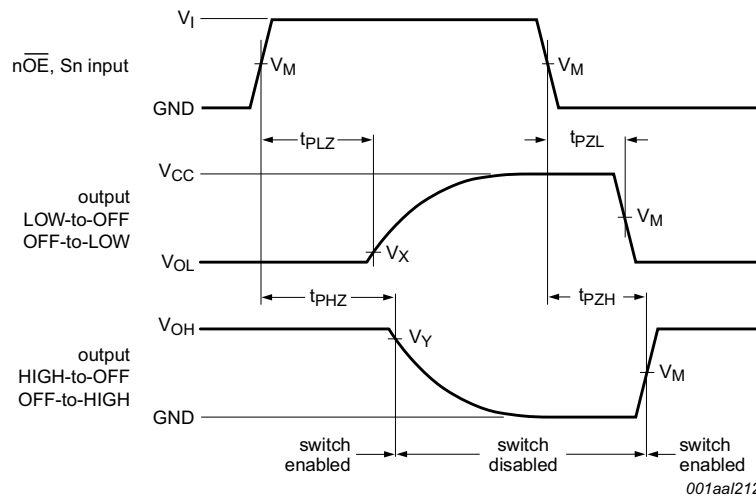


Measurement points are given in [Table 9](#).
 Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 14. The data input (nA or nBn) to output (nBn or nA) propagation delays

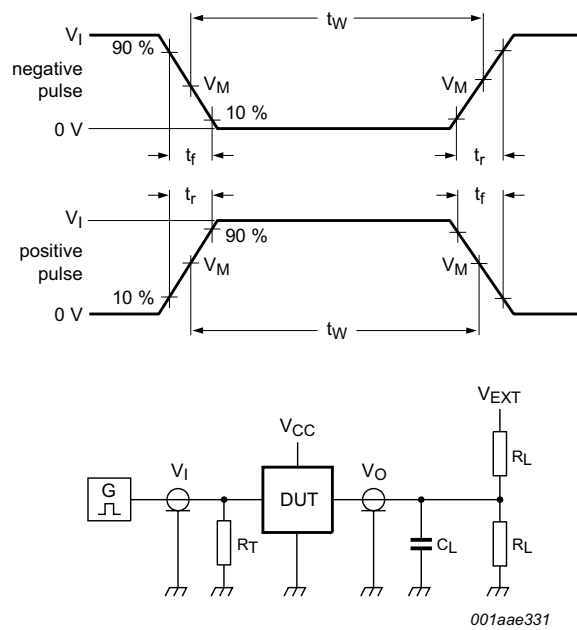
Table 9. Measurement points

| Supply voltage | Input | | | Output | | |
|----------------|-------------|----------|---------------|-------------|-------------------|-------------------|
| V_{CC} | V_M | V_I | $t_r = t_f$ | V_M | V_X | V_Y |
| 2.3 V to 2.7 V | $0.5V_{CC}$ | V_{CC} | ≤ 2.0 ns | $0.5V_{CC}$ | $V_{OL} + 0.15$ V | $V_{OH} - 0.15$ V |
| 3.0 V to 3.6 V | $0.5V_{CC}$ | V_{CC} | ≤ 2.0 ns | $0.5V_{CC}$ | $V_{OL} + 0.3$ V | $V_{OH} - 0.3$ V |



Measurement points are given in [Table 9](#).
 Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 15. Enable and disable times



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

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 16. Test circuit for measuring switching times

Table 10. Test data

| Supply voltage | Load | | V_{EXT} | | |
|----------------|-------|--------------|--------------------|--------------------|--------------------|
| V_{CC} | C_L | R_L | t_{PLH}, t_{PHL} | t_{PZH}, t_{PHZ} | t_{PZL}, t_{PLZ} |
| 2.3 V to 2.7 V | 30 pF | 500 Ω | open | GND | $2V_{CC}$ |
| 3.0 V to 3.6 V | 50 pF | 500 Ω | open | GND | $2V_{CC}$ |

11.1 Additional dynamic characteristics

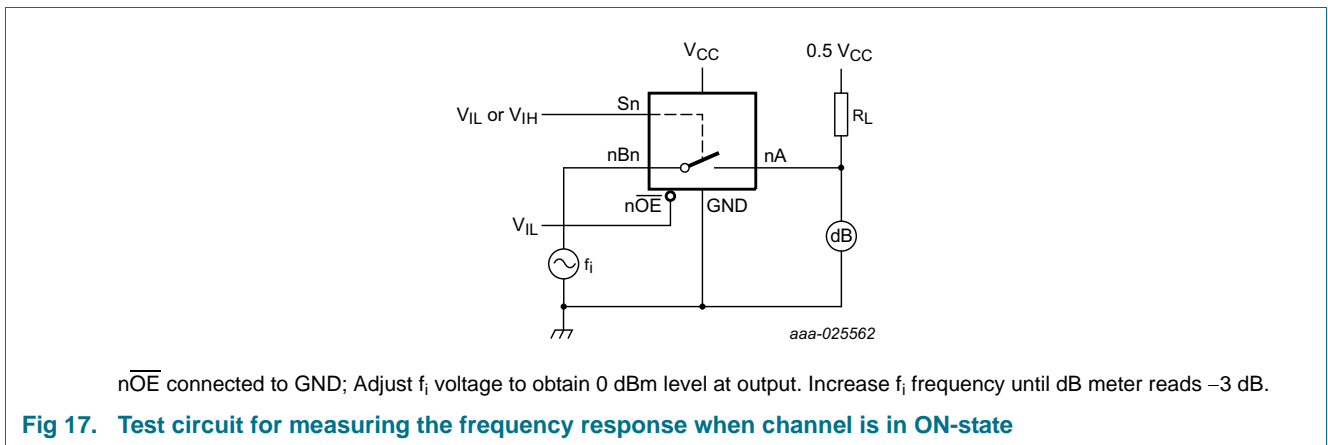
Table 11. Additional dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); $V_I = \text{GND}$ or V_{CC} (unless otherwise specified); $t_r = t_f \leq 2.5 \text{ ns}$.

| Symbol | Parameter | Conditions | $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | | | Unit | |
|---------------------|--------------------------|---|--|-----|-----|------|-----|
| | | | Min | Typ | Max | | |
| $f_{(-3\text{dB})}$ | -3 dB frequency response | $V_{CC} = 3.3 \text{ V}$; $R_L = 50 \text{ } \Omega$; see Figure 17 | [1] | - | 302 | - | MHz |

[1] f_i is biased at $0.5V_{CC}$.

11.2 Test circuits



12. Package outline

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

SOT109-1

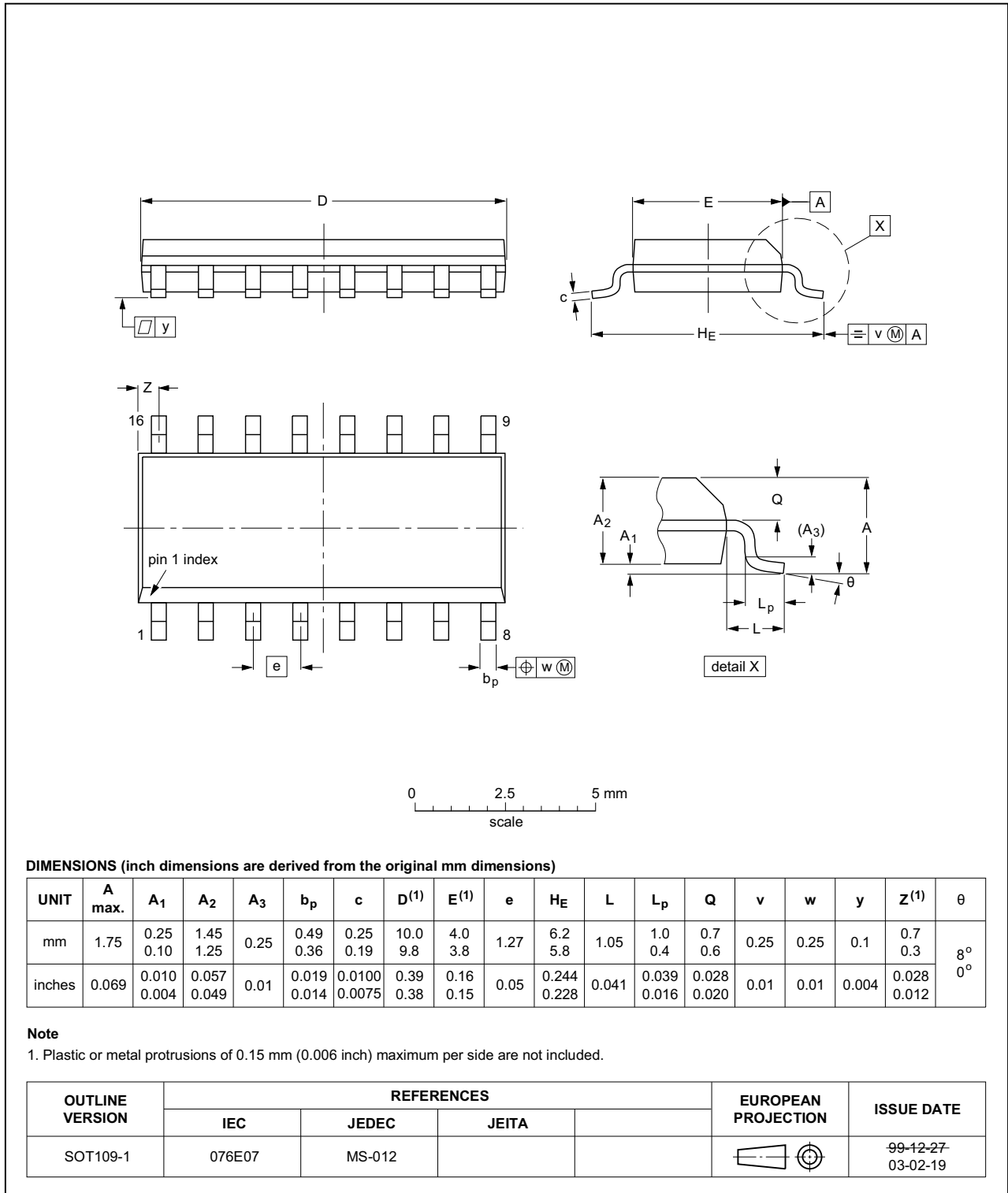


Fig 18. Package outline SOT109-1 (SO16)

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

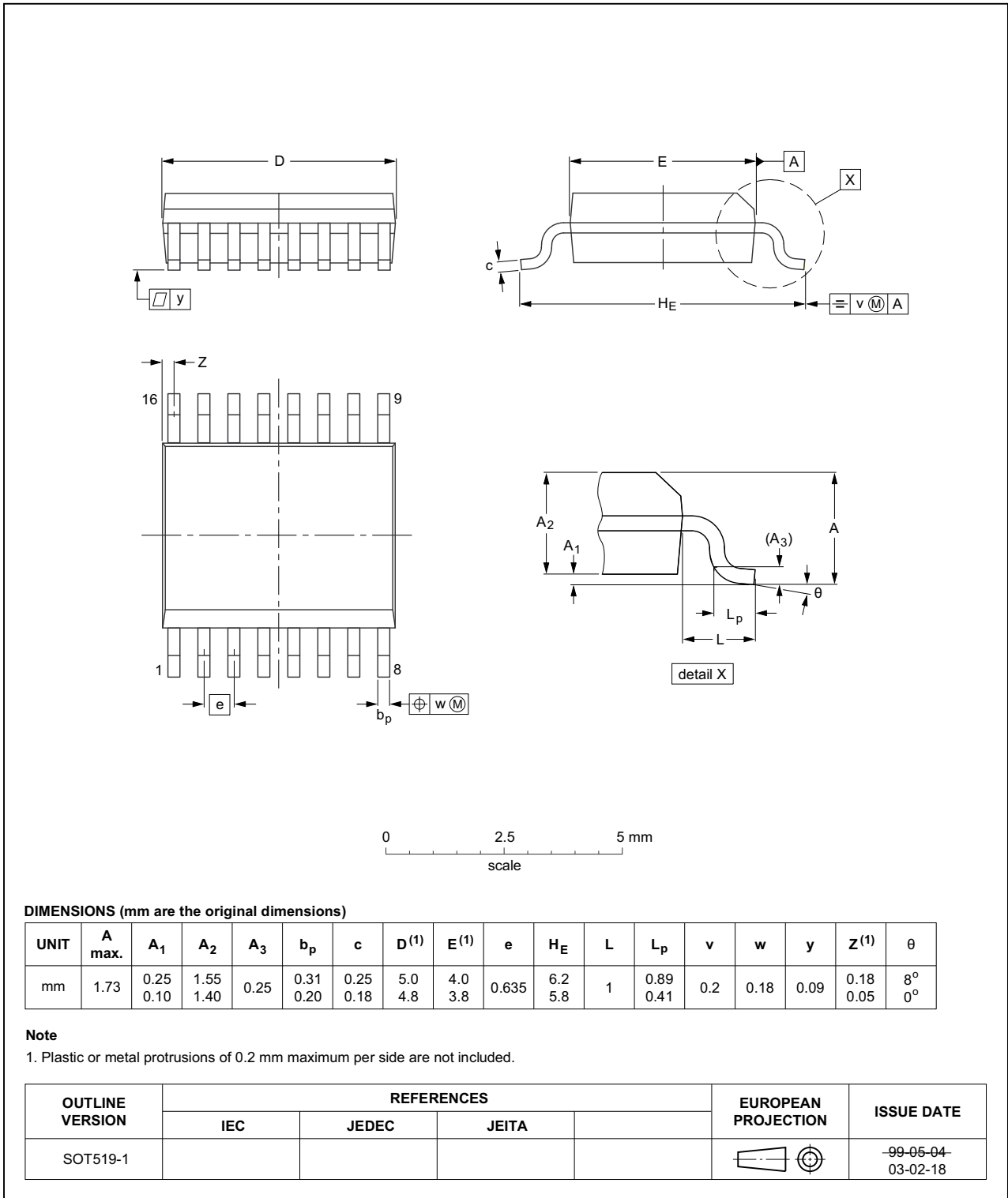


Fig 19. Package outline SOT519-1 (SSOP16)

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

SOT403-1



Fig 20. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1

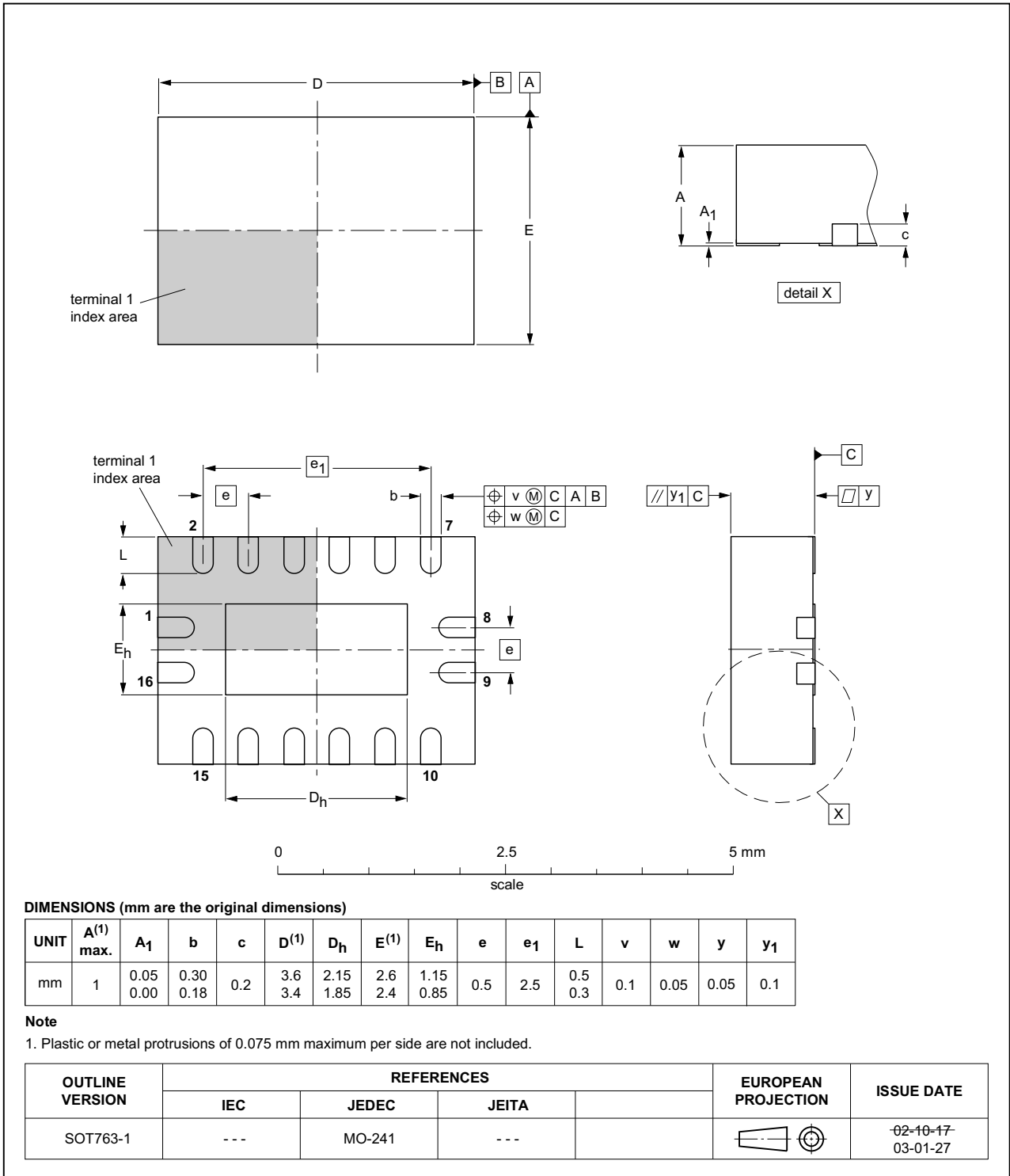


Fig 21. Package outline SOT763-1 (DHVQFN16)

13. Abbreviations

Table 12. Abbreviations

| Acronym | Description |
|---------|---|
| CDM | Charged Device Model |
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |

14. Revision history

Table 13. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|--|--------------------|---------------|-----------------|
| 74CBTLV3253 v.5 | 20161111 | Product data sheet | - | 74CBTLV3253 v.4 |
| Modifications: | <ul style="list-style-type: none"> Section 11.1 and Section 11.2 added. | | | |
| 74CBTLV3253 v.4 | 20111215 | Product data sheet | - | 74CBTLV3253 v.3 |
| Modifications: | <ul style="list-style-type: none"> Legal pages updated. | | | |
| 74CBTLV3253 v.3 | 20110107 | Product data sheet | - | 74CBTLV3253 v.2 |
| 74CBTLV3253 v.2 | 20101125 | Product data sheet | - | 74CBTLV3253 v.1 |
| 74CBTLV3253 v.1 | 20100108 | Product data sheet | - | - |

15. Legal information

15.1 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. |
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