

74CBTLV3126

4-bit bus switch

Rev. 3 — 15 December 2011

Product data sheet

1. General description

The 74CBTLV3126 provides a 4-bit high-speed bus switch with separate output enable inputs (1OE to 4OE). The low on-state resistance of the switch allows connections to be made with minimal propagation delay. The switch is disabled (high-impedance OFF-state) when the output enable (nOE) input is LOW.

To ensure the high-impedance OFF-state during power-up or power-down, nOE should be tied to the GND through a pull-down 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
- Standard '126'-type pinout
- 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 $+125\text{ }^{\circ}\text{C}$



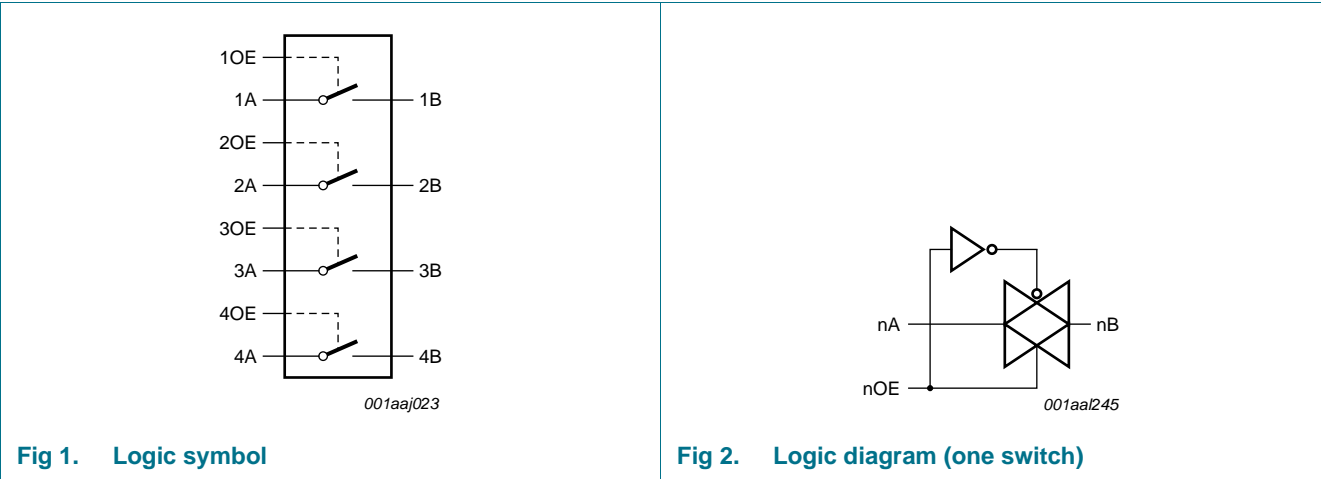
3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|---------------|-------------------|-----------------------|--|----------|
| | Temperature range | Name | Description | Version |
| 74CBTLV3126DS | −40 °C to +125 °C | SSOP16 ^[1] | plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 0.635 mm | SOT519-1 |
| 74CBTLV3126PW | −40 °C to +125 °C | TSSOP14 | plastic thin shrink small outline package; 14 leads; body width 4.4 mm | SOT402-1 |
| 74CBTLV3126BQ | −40 °C to +125 °C | DHVQFN14 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm | SOT762-1 |

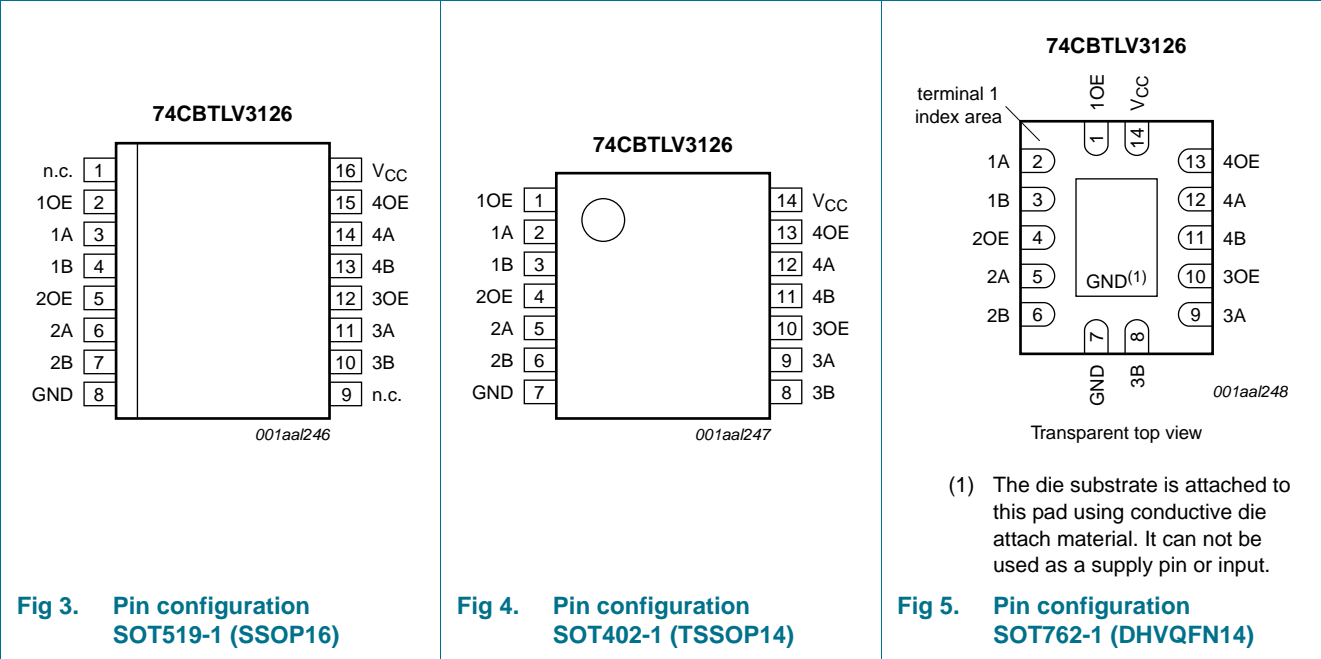
[1] Also known as QSOP16.

4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

| Symbol | Pin | | Description |
|-----------------|-----------------------|--------------|-------------------------|
| | SOT402-1 and SOT762-1 | SOT519-1 | |
| 1OE to 4OE | 1, 4, 10, 13 | 2, 5, 12, 15 | output enable input |
| 1A to 4A, | 2, 5, 9, 12 | 3, 6, 11, 14 | A input/output |
| 1B to 4B | 3, 6, 8, 11 | 4, 7, 10, 13 | B output/input |
| GND | 7 | 8 | ground (0 V) |
| V _{CC} | 14 | 16 | positive supply voltage |
| n.c. | - | 1, 9 | not connected |

6. Functional description

Table 3. Function table^[1]

| Output enable input OE | Function switch |
|------------------------|-----------------|
| L | OFF-state |
| H | ON-state |

[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 TSSOP14 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.
For DHVQFN14 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 | control inputs | 0 | 3.6 | V |
| V_{SW} | switch voltage | enable and disable mode | 0 | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | pin nOE; $V_{CC} = 2.3$ V to 3.6 V | 0 | 200 | ns/V |

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 | - | - | ± 1.0 | - | ± 20 | μA |
| $I_{S(OFF)}$ | OFF-state leakage current | $V_{CC} = 3.6$ V; see Figure 6 | - | - | ± 1 | - | ± 20 | μA |

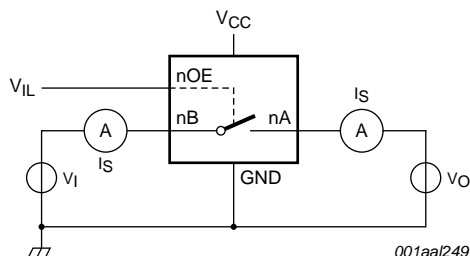
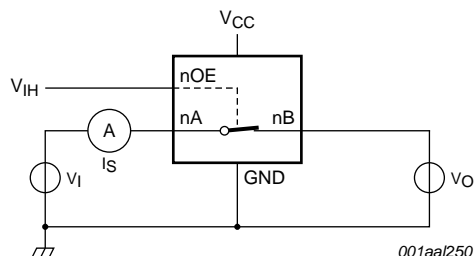
Table 6. Static characteristics ...continued

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 | |
| I _{S(ON)} | ON-state leakage current | V _{CC} = 3.6 V; see Figure 7 | - | - | ±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; [2] V _{SW} = GND or V _{CC} ; V _{CC} = 3.6 V | - | - | 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 | - | 14.3 | - | - | - | 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 6.** Test circuit for measuring OFF-state leakage current (one switch)V_I = V_{CC} or GND and V_O = open circuit.**Fig 7.** Test circuit for measuring ON-state leakage current (one switch)

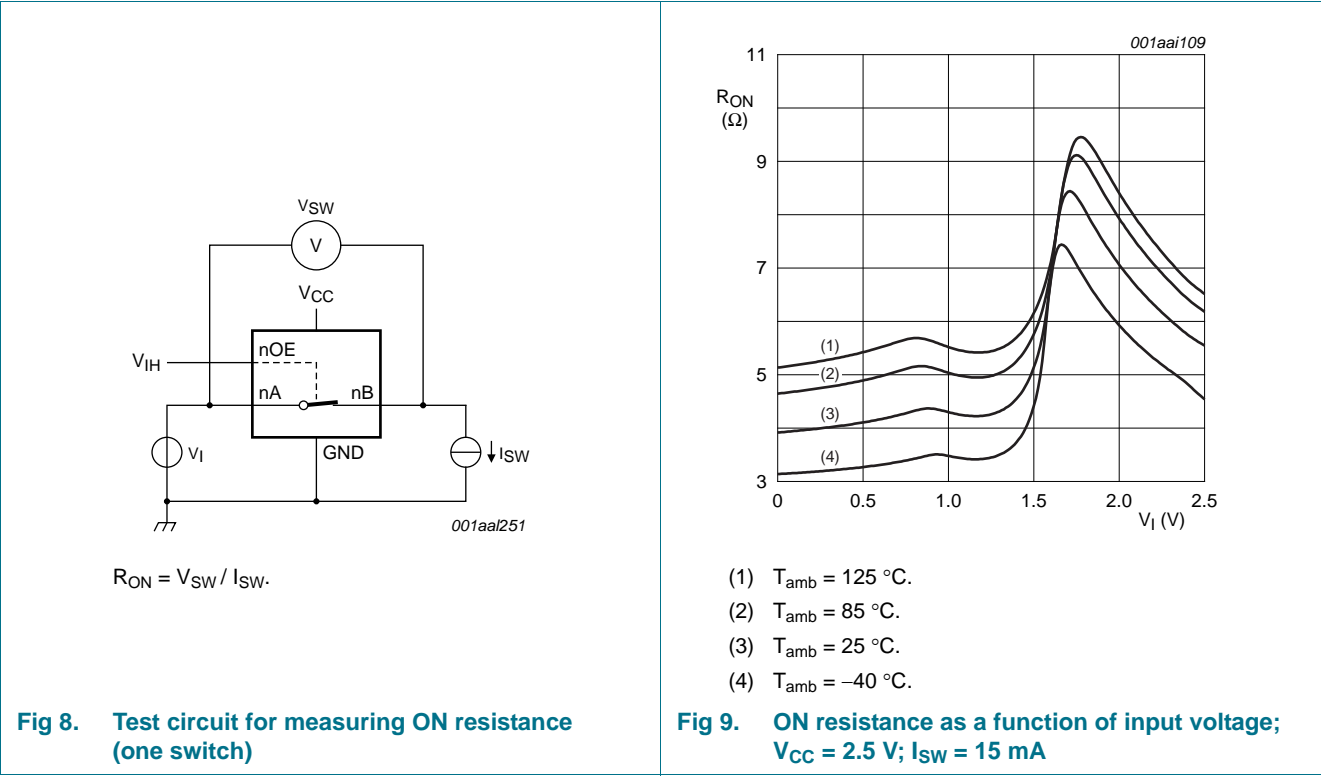
9.2 ON resistance

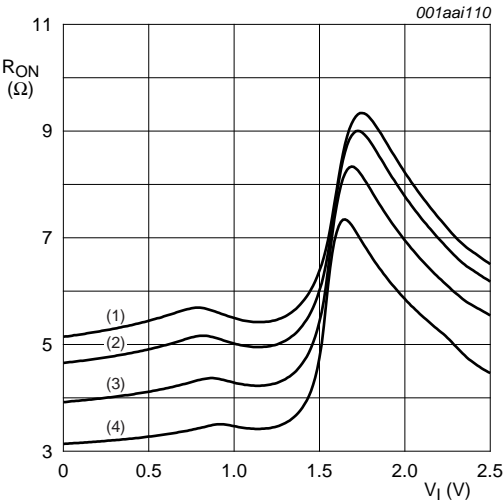
Table 7. Resistance R_{ON}
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

| Symbol | Parameter | Conditions | T _{amb} = −40 °C to +85 °C | | | T _{amb} = −40 °C to +125 °C | | Unit |
|-----------------|---------------|--|-------------------------------------|--------------------|------|--------------------------------------|------|------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| R _{ON} | ON resistance | V _{CC} = 2.3 V to 2.7 V; see Figure 9 to Figure 11 | | | | | | |
| | | I _{SW} = 64 mA; V _I = 0 V | - | 4.2 | 8.0 | - | 15.0 | Ω |
| | | I _{SW} = 24 mA; V _I = 0 V | - | 4.2 | 8.0 | - | 15.0 | Ω |
| | | I _{SW} = 15 mA; V _I = 1.7 V | - | 8.4 | 40.0 | - | 60.0 | Ω |
| | | V _{CC} = 3.0 V to 3.6 V; see Figure 12 to Figure 14 | | | | | | |
| | | I _{SW} = 64 mA; V _I = 0 V | - | 4.0 | 7.0 | - | 11.0 | Ω |
| | | I _{SW} = 24 mA; V _I = 0 V | - | 4.0 | 7.0 | - | 11.0 | Ω |
| | | I _{SW} = 15 mA; V _I = 2.4 V | - | 6.2 | 15.0 | - | 25.5 | Ω |
| | | | | | | | | |

- [1] Typical values are measured at T_{amb} = 25 °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.

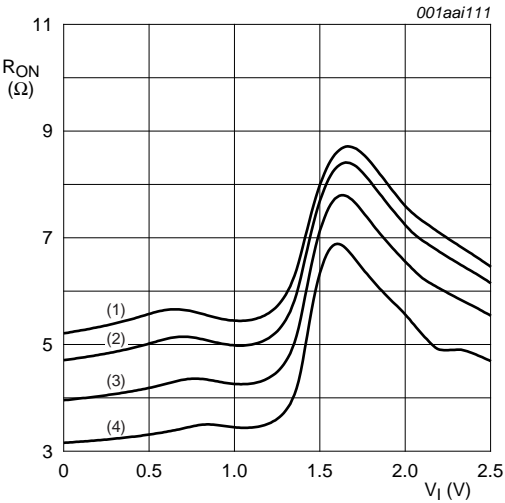
9.3 ON resistance test circuit and graphs





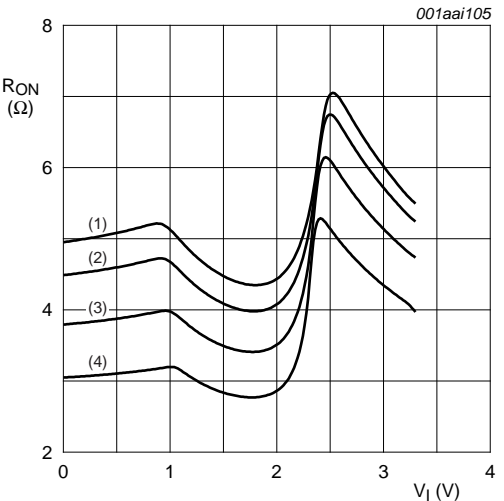
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 10. ON resistance as a function of input voltage;
 $V_{CC} = 2.5\text{ V}; I_{SW} = 24\text{ mA}$



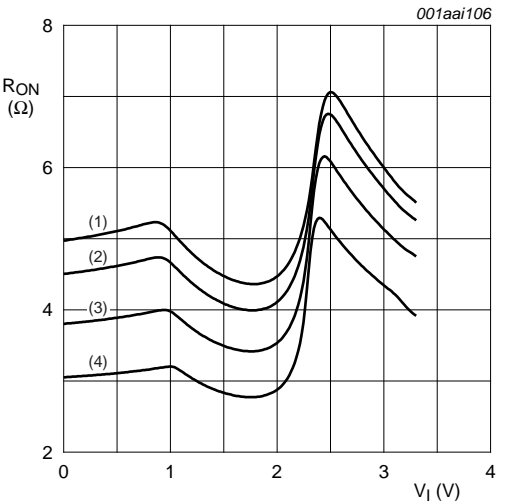
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 11. ON resistance as a function of input voltage;
 $V_{CC} = 2.5\text{ V}; I_{SW} = 64\text{ mA}$



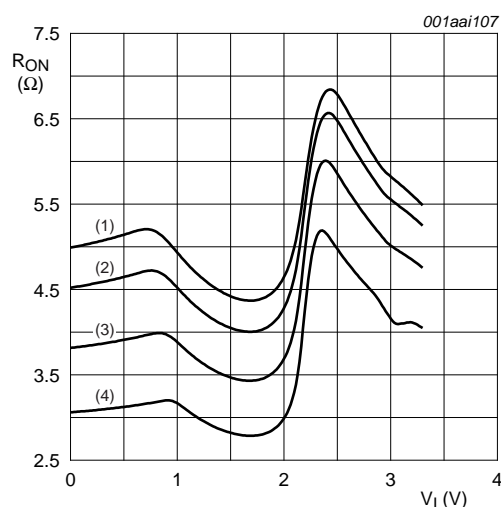
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

Fig 12. 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 13. ON resistance as a function of input voltage;
 $V_{CC} = 3.3\text{ V}; I_{SW} = 24\text{ mA}$



- (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 14. 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

$GND = 0\text{ V}$; for test circuit see [Figure 17](#)

| 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 | |
| t_{pd} | propagation delay | nA to nB or nB to nA; see Figure 15 | | | | | | |
| | | $V_{CC} = 2.3\text{ V to } 2.7\text{ V}$ | - | - | 0.13 | - | 0.20 | ns |
| | | $V_{CC} = 3.0\text{ V to } 3.6\text{ V}$ | - | - | 0.20 | - | 0.31 | ns |
| t_{en} | enable time | nOE to nA or nB; see Figure 16 | | | | | | |
| | | $V_{CC} = 2.3\text{ V to } 2.7\text{ V}$ | 1.0 | 2.5 | 4.5 | 1.0 | 6.0 | ns |
| | | $V_{CC} = 3.0\text{ V to } 3.6\text{ V}$ | 1.0 | 2.2 | 4.2 | 1.0 | 6.0 | ns |
| t_{dis} | disable time | nOE to nA or nB; see Figure 16 | | | | | | |
| | | $V_{CC} = 2.3\text{ V to } 2.7\text{ V}$ | 1.0 | 2.6 | 4.7 | 1.0 | 6.5 | ns |
| | | $V_{CC} = 3.0\text{ V to } 3.6\text{ V}$ | 1.0 | 3.4 | 4.8 | 1.0 | 6.5 | ns |

- [1] All typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$ and at nominal V_{CC} .
 [2] The propagation delay is the calculated RC time constant of the 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

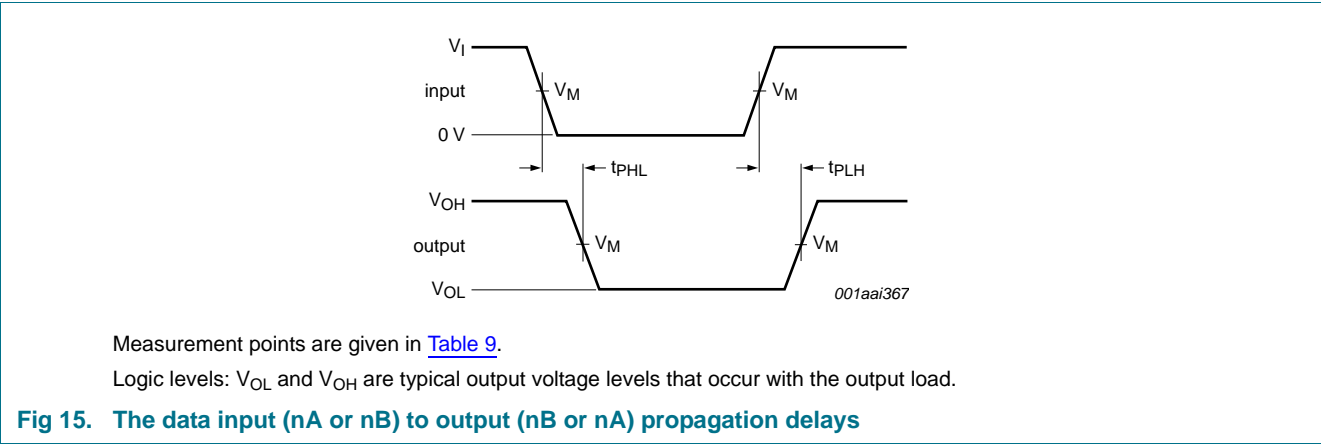
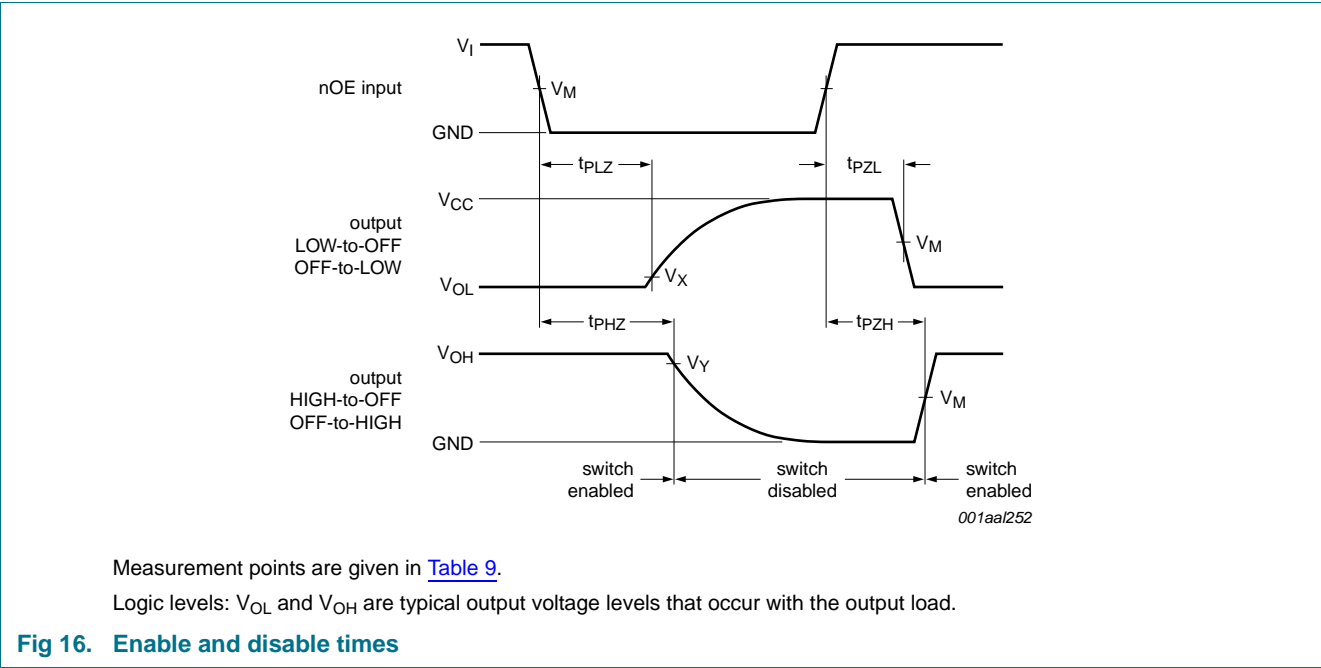
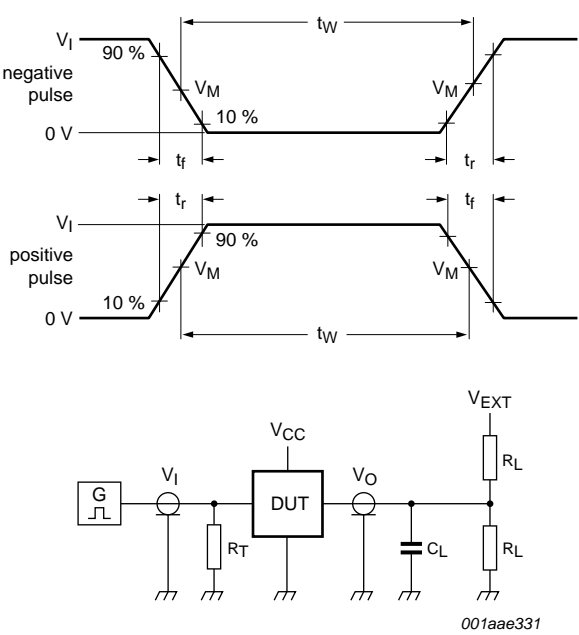


Table 9. Measurement points

| 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 |





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 17. 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 | $2V_{CC}$ |

12. Package outline

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

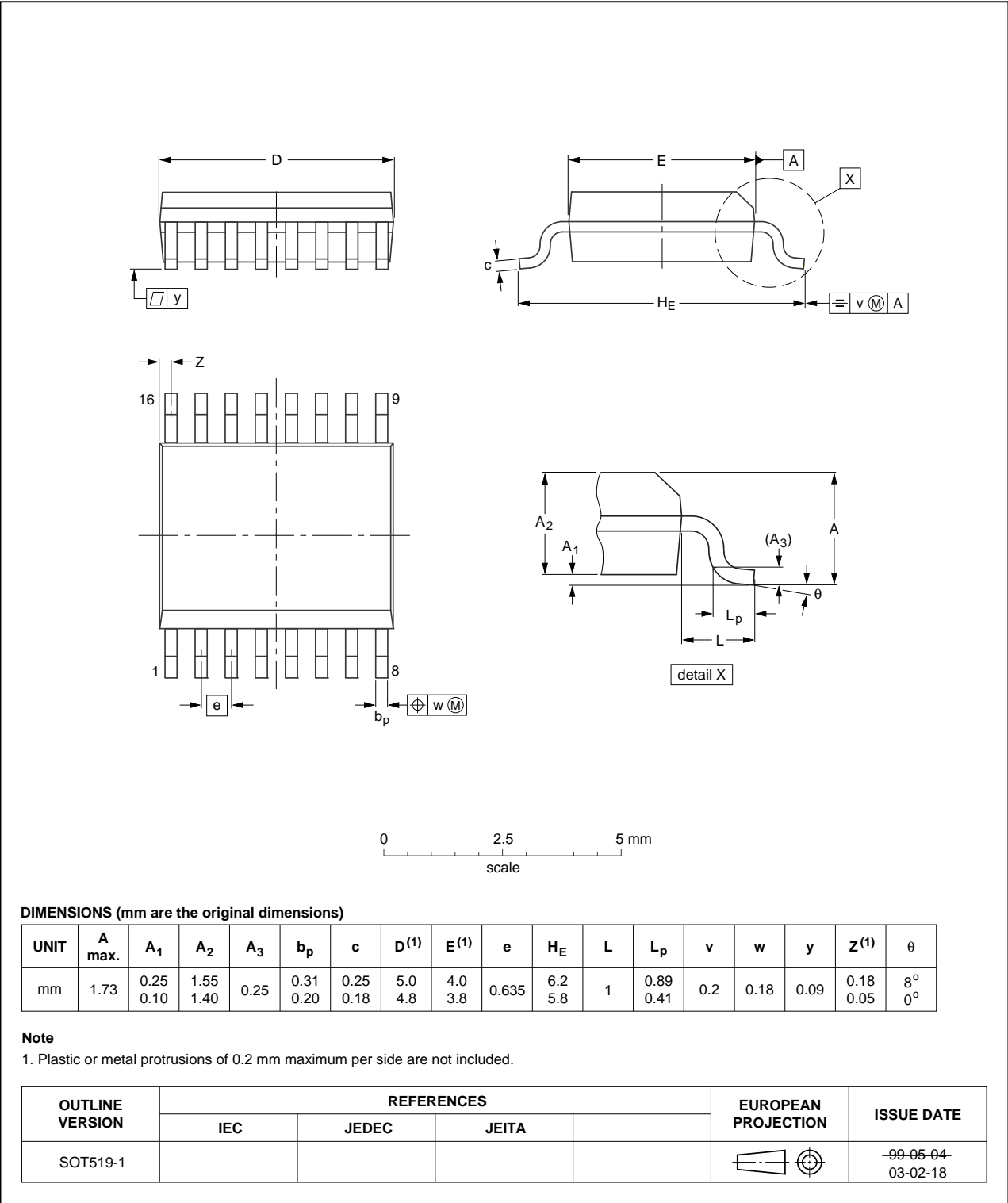


Fig 18. Package outline SOT519-1 (SSOP16)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1

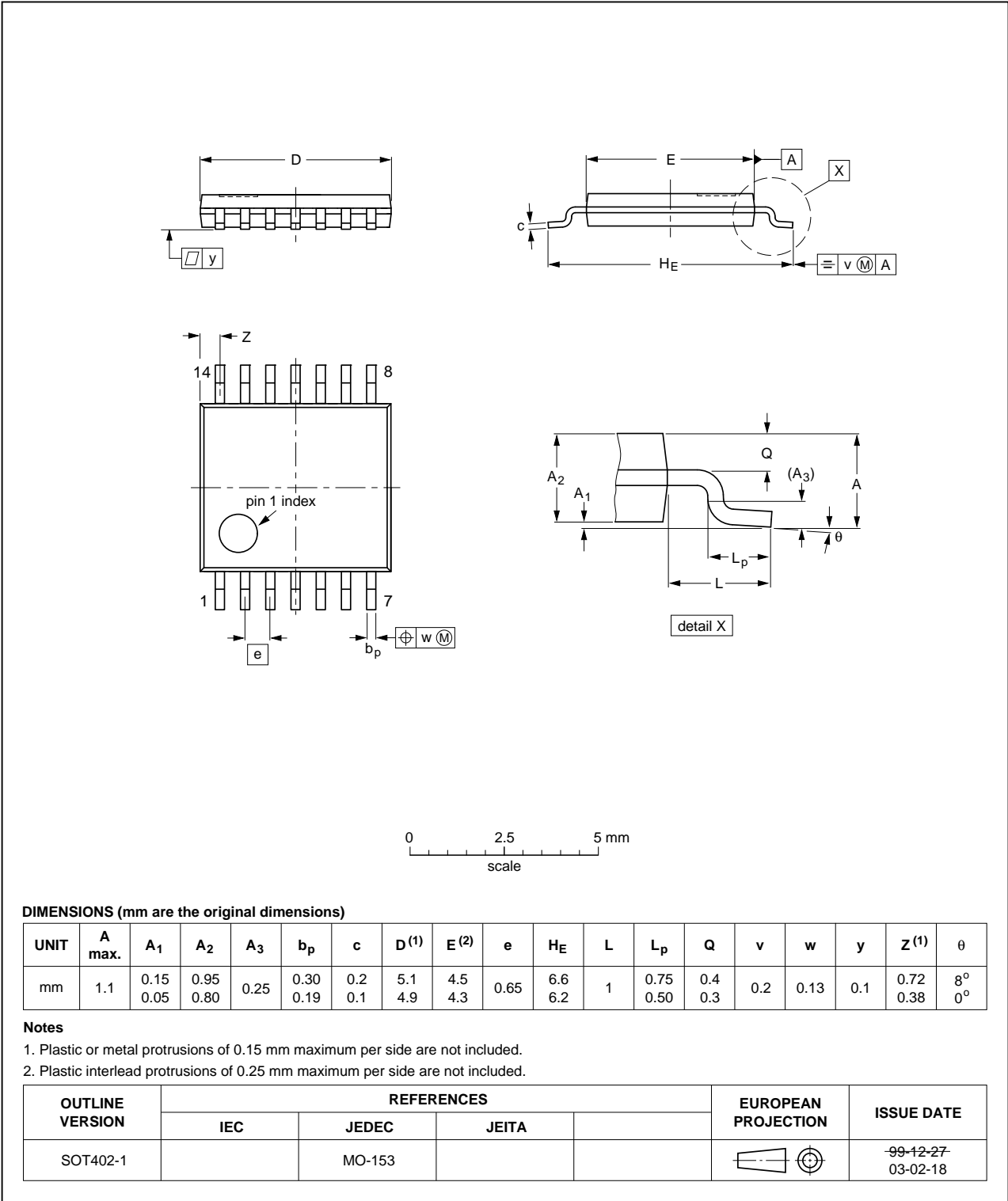


Fig 19. Package outline SOT402-1 (TSSOP14)

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm SOT762-1

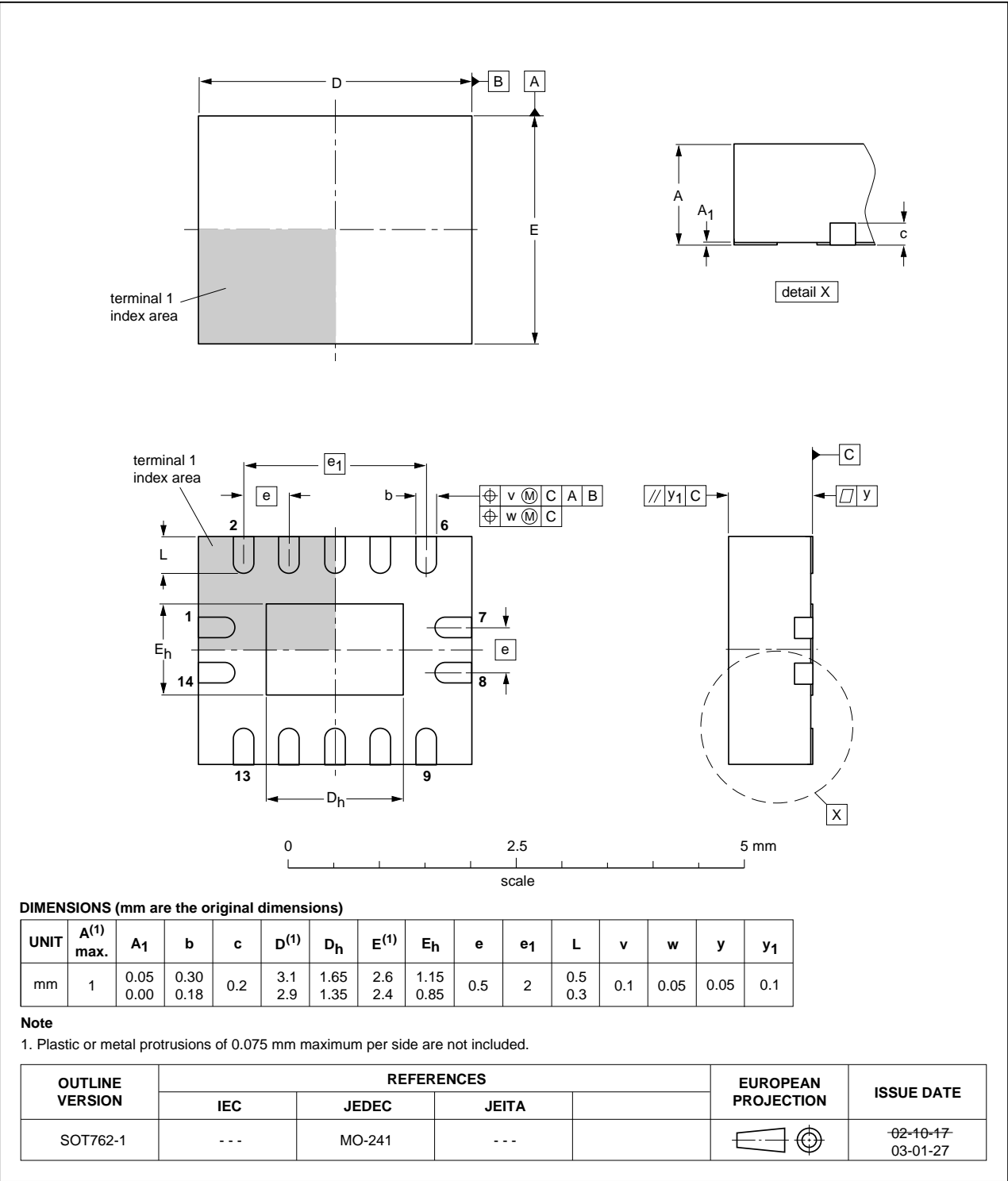


Fig 20. Package outline SOT762-1 (DHVQFN14)

13. Abbreviations

Table 11. 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 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|------------------------|--------------------|---------------|-----------------|
| 74CBTLV3126 v.3 | 20111215 | Product data sheet | - | 74CBTLV3126 v.2 |
| Modifications: | • Legal pages updated. | | | |
| 74CBTLV3126 v.2 | 20110104 | Product data sheet | - | 74CBTLV3126 v.1 |
| 74CBTLV3126 v.1 | 20100105 | 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. |
| 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 URL <http://www.nxp.com>.

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