

74CBTLV3125

4-bit bus switch

Rev. 3 — 15 December 2011

Product data sheet

1. General description

The 74CBTLV3125 provides a 4-bit high-speed bus switch with separate output enable inputs ($1\overline{OE}$ to $4\overline{OE}$). 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 ($n\overline{OE}$) input is HIGH.

To ensure the high-impedance OFF-state during power-up or power-down, $n\overline{OE}$ 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
- Standard '125'-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
74CBTLV3125DS	−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
74CBTLV3125PW	−40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74CBTLV3125BQ	−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

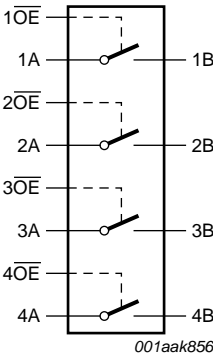


Fig 1. Logic symbol

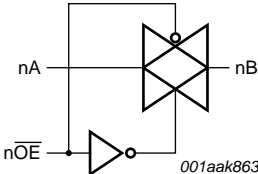


Fig 2. Logic diagram (one switch)

5. Pinning information

5.1 Pinning

74CBTLV3125

Pin 1: n.c.
Pin 2: 1OE
Pin 3: 1A
Pin 4: 1B
Pin 5: 2OE
Pin 6: 2A
Pin 7: 2B
Pin 8: GND
Pin 9: n.c.
Pin 10: 3B
Pin 11: 3A
Pin 12: 3OE
Pin 13: 4B
Pin 14: 4A
Pin 15: 4OE
Pin 16: VCC

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74CBTLV3125

Pin 1: 1OE
Pin 2: 1A
Pin 3: 1B
Pin 4: 2OE
Pin 5: 2A
Pin 6: 2B
Pin 7: GND
Pin 8: 3B
Pin 9: 3A
Pin 10: 3OE
Pin 11: 4B
Pin 12: 4A
Pin 13: 4OE
Pin 14: VCC

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74CBTLV3125

terminal 1 index area

Pin 1: 1OE
Pin 2: 1A
Pin 3: 1B
Pin 4: 2OE
Pin 5: 2A
Pin 6: 2B
Pin 7: GND
Pin 8: 3B
Pin 9: 3A
Pin 10: 3OE
Pin 11: 4B
Pin 12: 4A
Pin 13: 4OE
Pin 14: VCC

GND(1)

001aak859

Transparent top view

(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig 3. Pin configuration SOT519-1 (SSOP16)

Fig 4. Pin configuration SOT402-1 (TSSOP14)

Fig 5. Pin configuration SOT762-1 (DHVQFN14)

5.2 Pin description

Table 2. Pin description

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

6. Functional description

Table 3. Function table^[1]

Output enable input OE	Function switch
L	ON-state
H	OFF-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 \overline{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 \overline{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

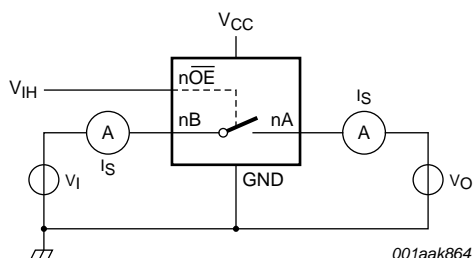
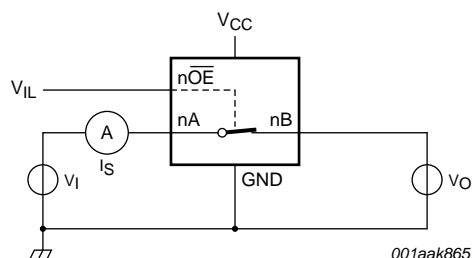
Table 6. Static characteristics ...continued

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 n $\overline{\text{OE}}$; 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 n $\overline{\text{OE}}$; 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)

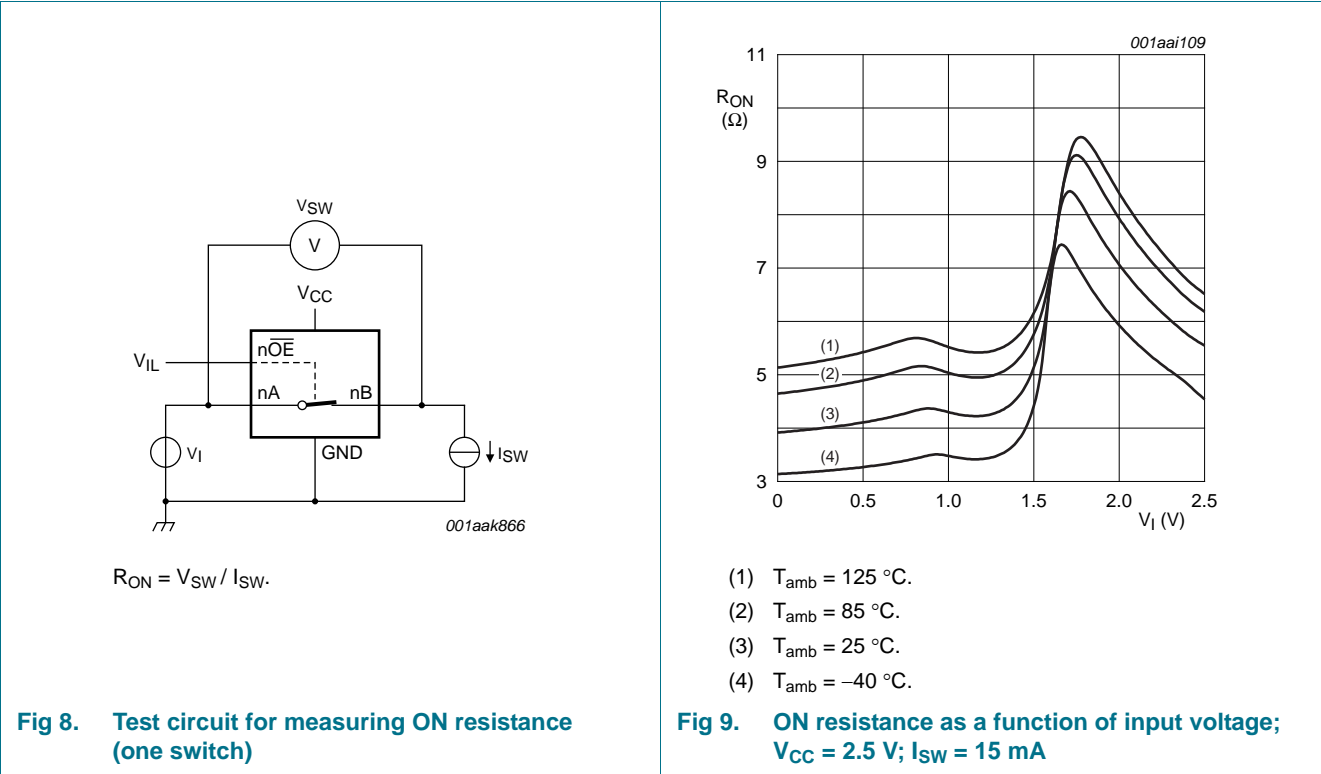
9.2 ON resistance

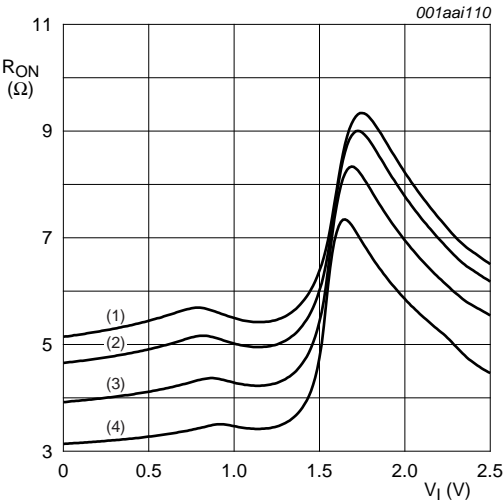
Table 7. Resistance R_{ON}
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

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.

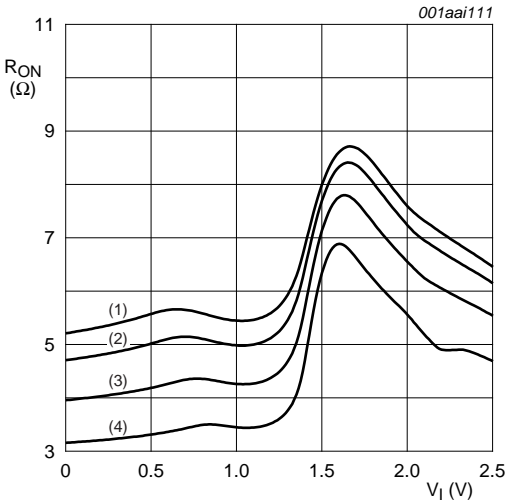
9.3 ON resistance test circuit and graphs





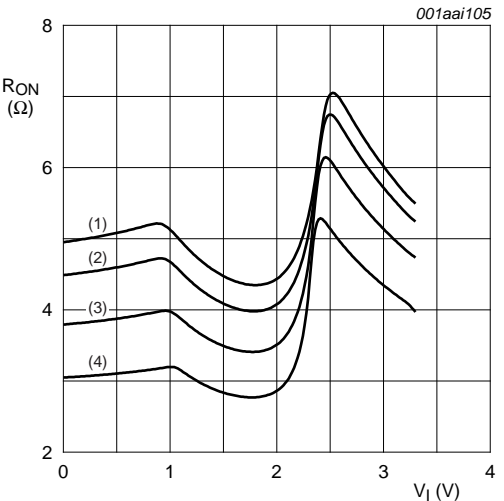
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

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



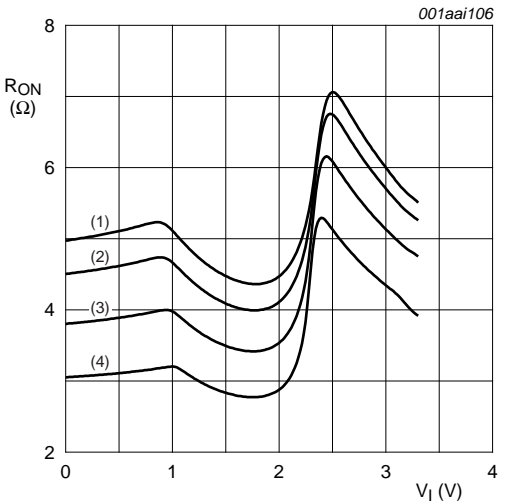
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

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



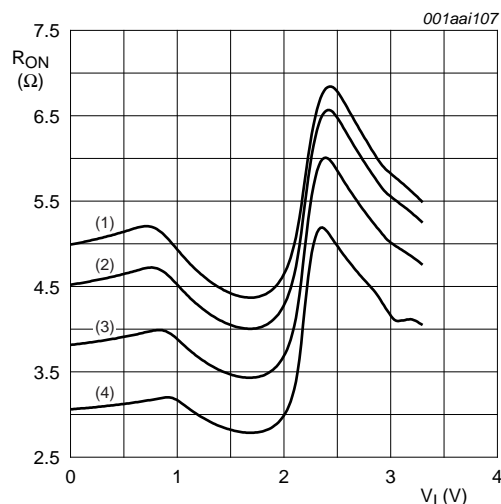
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}.$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}.$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}.$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}.$

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	2.7	4.6	1.0	6.0	ns
		$V_{CC} = 3.0\text{ V to } 3.6\text{ V}$	1.0	2.4	4.4	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	2.2	3.9	1.0	5.5	ns
		$V_{CC} = 3.0\text{ V to } 3.6\text{ V}$	1.0	2.9	4.2	1.0	5.5	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

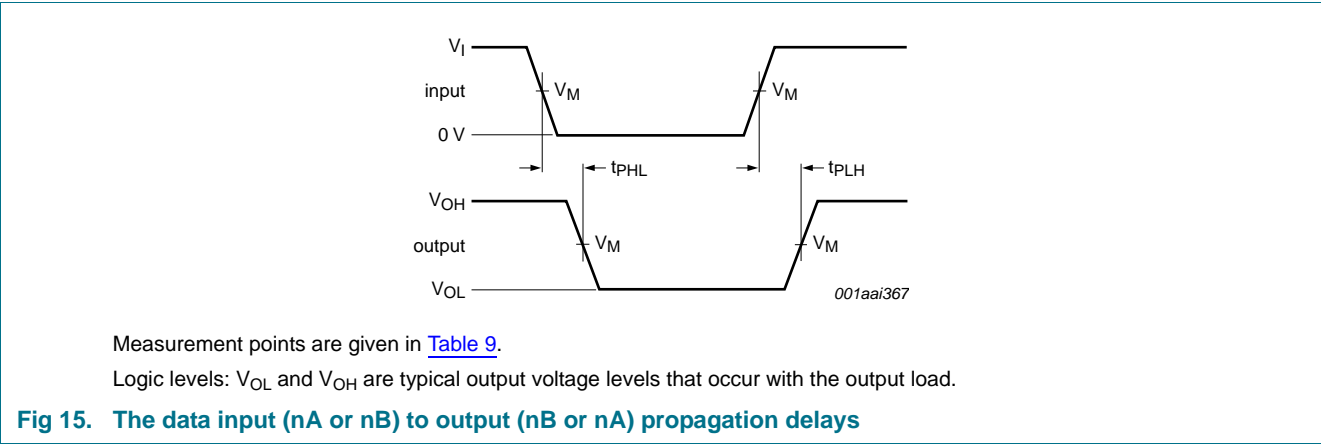
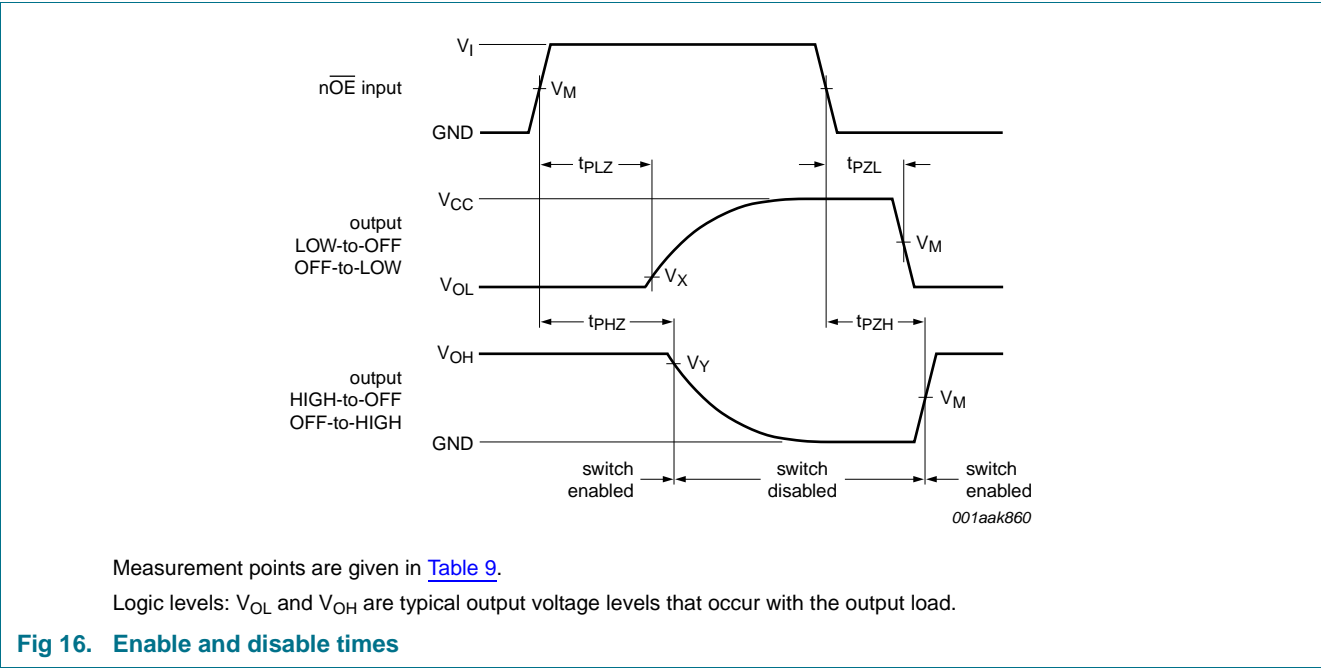
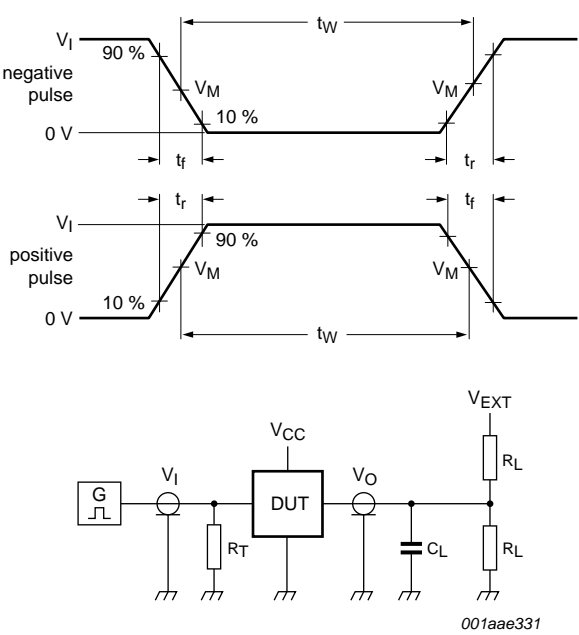


Table 9. Measurement points

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

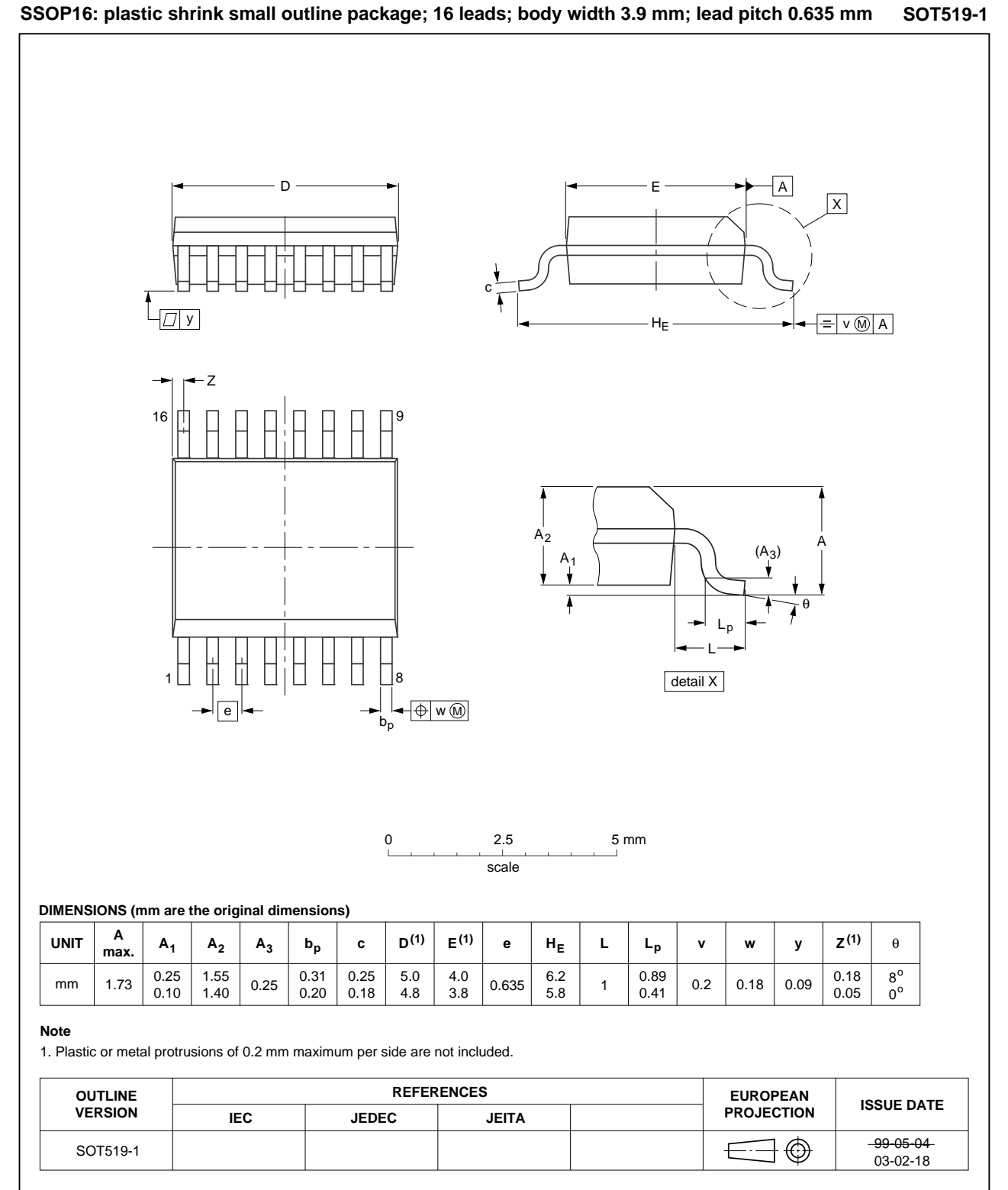


Fig 18. Package outline SOT519-1 (SSOP16)

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

SOT402-1

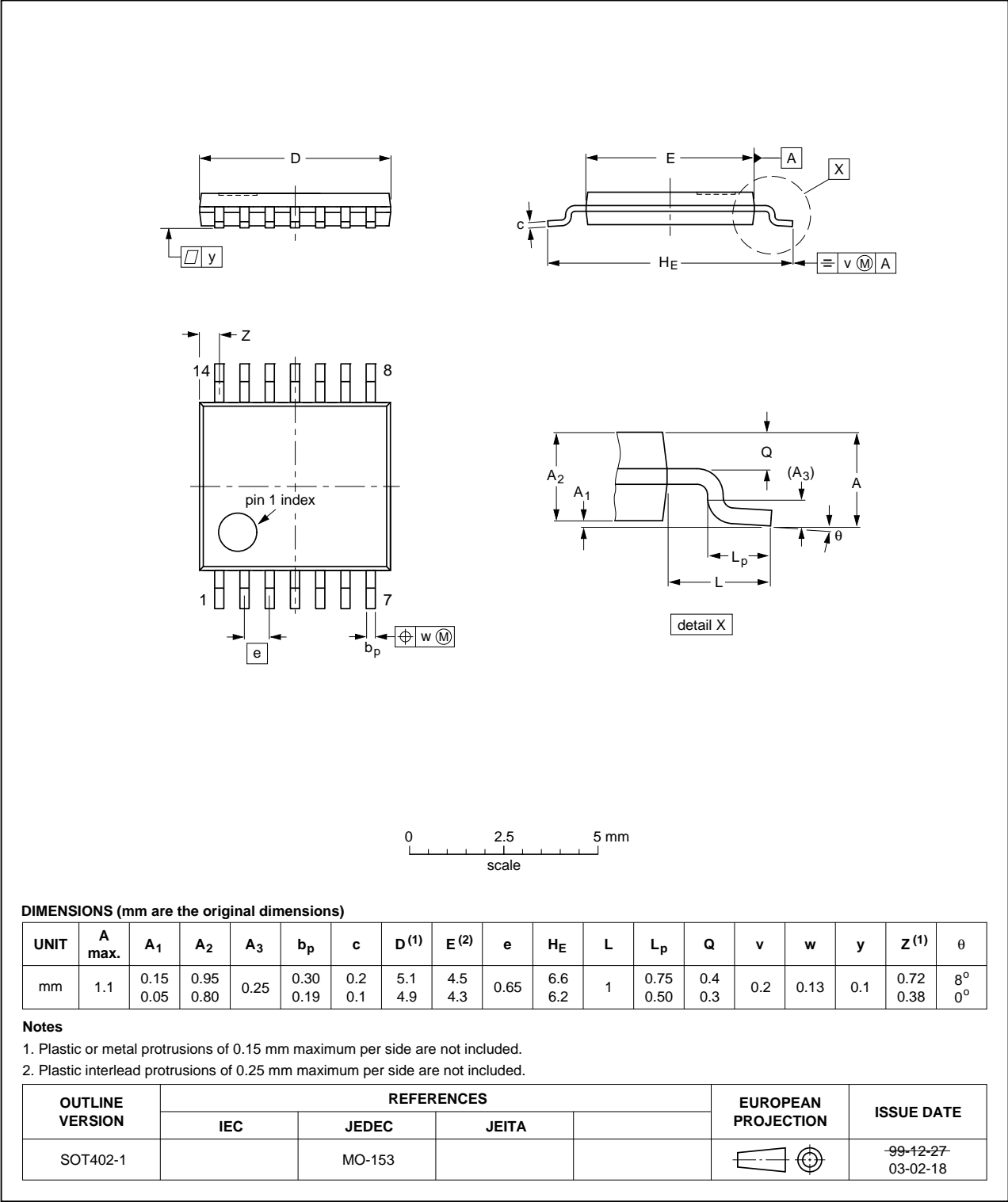


Fig 19. Package outline SOT402-1 (TSSOP14)

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

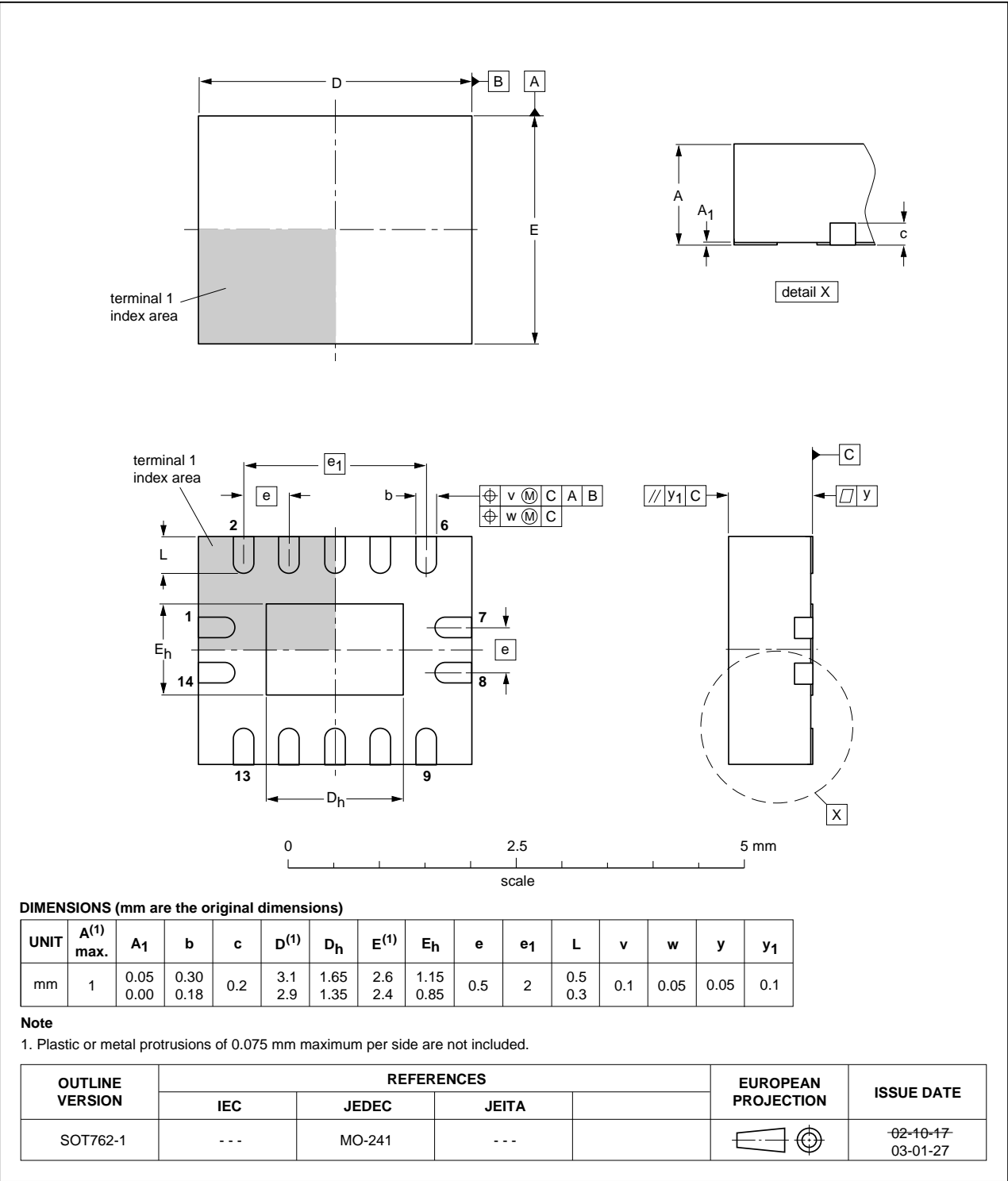


Fig 20. Package outline SOT762-1 (DHVQFN14)

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
74CBTLV3125 v.3	20111215	Product data sheet	-	74CBTLV3125 v.2
Modifications:	• Legal pages updated.			
74CBTLV3125 v.2	20110104	Product data sheet	-	74CBTLV3125 v.1
74CBTLV3125 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.
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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17. Contents

1	General description	1
2	Features and benefits	1
3	Ordering information	2
4	Functional diagram	2
5	Pinning information	3
5.1	Pinning	3
5.2	Pin description	3
6	Functional description	3
7	Limiting values	4
8	Recommended operating conditions	4
9	Static characteristics	4
9.1	Test circuits	5
9.2	ON resistance	6
9.3	ON resistance test circuit and graphs	6
10	Dynamic characteristics	8
11	Waveforms	9
12	Package outline	11
13	Abbreviations	14
14	Revision history	14
15	Legal information	15
15.1	Data sheet status	15
15.2	Definitions	15
15.3	Disclaimers	15
15.4	Trademarks	16
16	Contact information	16
17	Contents	17

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