

# 74LVT125; 74LVTH125

3.3 V quad buffer; 3-state

Rev. 06 — 6 March 2006

Product data sheet

## 1. General description

The 74LVT125; 74LVTH125 is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 3.3 V.

This device combines low static and dynamic power dissipation with high speed and high output drive. The 74LVT125; 74LVTH125 device is a quad buffer that is ideal for driving bus lines. The device features four output enable inputs ( $1\overline{OE}$ ,  $2\overline{OE}$ ,  $3\overline{OE}$  and  $4\overline{OE}$ ), each controlling one of the 3-state outputs.

## 2. Features

- Quad bus interface
- 3-state buffers
- Output capability: +64 mA and –32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Bus hold data inputs eliminate need for external pull-up resistors to hold unused inputs
- Live insertion and extraction permitted
- No bus current loading when output is tied to 5 V bus
- Power-up 3-state
- Latch-up protection:
  - ◆ JESD78: exceeds 500 mA
- ESD protection:
  - ◆ MIL STD 883 method 3015: exceeds 2000 V
  - ◆ Machine model: exceeds 200 V

## 3. Quick reference data

Table 1. Quick reference data

$GND = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{PLH}$	LOW-to-HIGH propagation delay nA to nY	$C_L = 50\text{ pF}$ ; $V_{CC} = 3.3\text{ V}$	-	2.7	-	ns
$t_{PHL}$	HIGH-to-LOW propagation delay nA to nY	$C_L = 50\text{ pF}$ ; $V_{CC} = 3.3\text{ V}$	-	2.9	-	ns

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**Table 1.** Quick reference data ...continued $GND = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_i$	input capacitance	$V_I = 0\text{ V}$ or $3.0\text{ V}$	-	4	-	pF
$C_o$	output capacitance	outputs disabled; $V_O = 0\text{ V}$ or $3.0\text{ V}$	-	8	-	pF
$I_{CC}$	quiescent supply current	outputs disabled; $V_{CC} = 3.6\text{ V}$	-	0.13	-	mA

## 4. Ordering information

**Table 2.** Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVT125D	-40 °C to +85 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LVT125DB	-40 °C to +85 °C	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LVT125PW	-40 °C to +85 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74LVT125BQ	-40 °C to +85 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body $2.5 \times 3 \times 0.85\text{ mm}$	SOT762-1
74LVTH125D	-40 °C to +85 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LVTH125DB	-40 °C to +85 °C	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LVTH125PW	-40 °C to +85 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74LVTH125BQ	-40 °C to +85 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body $2.5 \times 3 \times 0.85\text{ mm}$	SOT762-1

5. Functional diagram

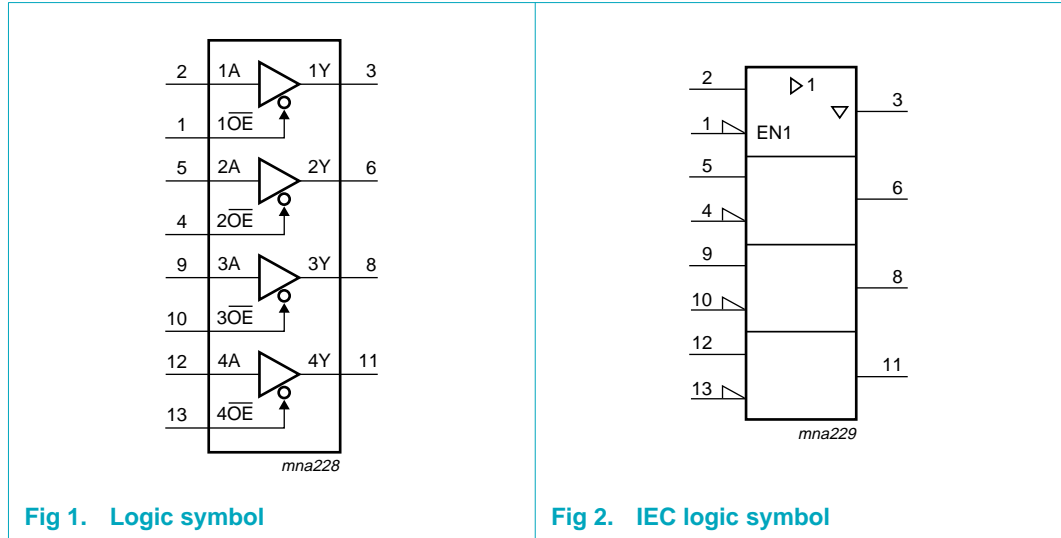


Fig 1. Logic symbol

Fig 2. IEC logic symbol

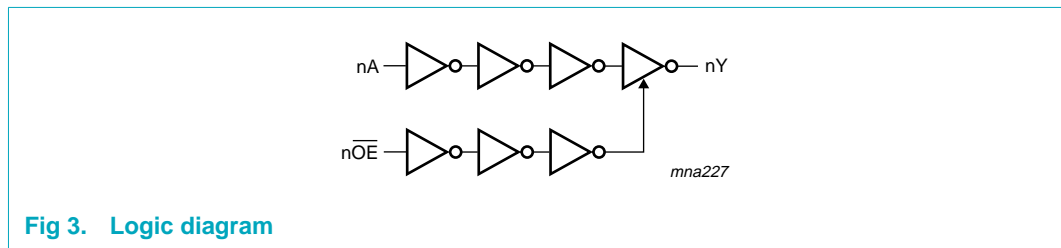


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

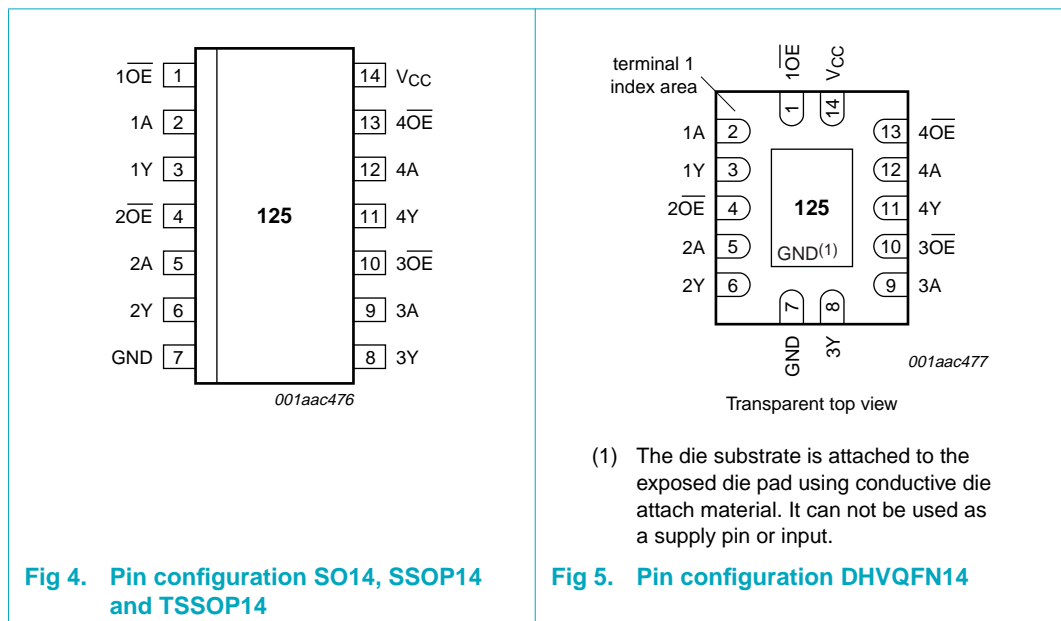


Fig 4. Pin configuration SO14, SSOP14 and TSSOP14

Fig 5. Pin configuration DHVQFN14

## 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
$1\overline{OE}$	1	1 output enable input (active LOW)
1A	2	1 data input
1Y	3	1 data output
$2\overline{OE}$	4	2 output enable input (active LOW)
2A	5	2 data input
2Y	6	2 data output
GND	7	ground (0 V)
3Y	8	3 data output
3A	9	3 data input
$3\overline{OE}$	10	3 output enable input (active LOW)
4Y	11	4 data output
4A	12	4 data input
$4\overline{OE}$	13	4 output enable input (active LOW)
$V_{CC}$	14	supply voltage

## 7. Functional description

### 7.1 Function table

Table 4. Function table<sup>[1]</sup>

Control	Input	Output
$n\overline{OE}$	nA	nY
L	L	L
	H	H
H	X	Z

- [1] H = HIGH voltage level;  
 L = LOW voltage level;  
 X = don't care;  
 Z = high-impedance OFF-state.

## 8. Limiting values

**Table 5. 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		[1] -0.5	+7.0	V
$V_O$	output voltage	output in OFF-state or HIGH-state	[1] -0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-	-50	mA
$I_{OK}$	output clamping current	$V_O < 0$ V	-	-50	mA
$I_O$	output current	output in LOW-state	-	128	mA
		output in HIGH-state	-	-64	mA
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		[2] -	150	°C

[1] The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		2.7	-	3.6	V
$V_I$	input voltage		0	-	5.5	V
$V_{IH}$	HIGH-state input voltage		2.0	-	-	V
$V_{IL}$	LOW-state input voltage		-	-	0.8	V
$I_{OH}$	HIGH-state output current		-	-	-32	mA
$I_{OL}$	LOW-state output current	none	-	-	32	mA
		current duty cycle $\leq 50$ %; $f \geq 1$ kHz	-	-	64	mA
$\Delta t/\Delta V$	input transition rise and fall rate		0	-	10	ns/V
$T_{amb}$	ambient temperature	in free air	-40	-	+85	°C

## 10. Static characteristics

**Table 7. Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>T<sub>amb</sub> = -40 °C to +85 °C<sup>[1]</sup></b>							
V <sub>IK</sub>	input clamping voltage	I <sub>IK</sub> = -18 mA; V <sub>CC</sub> = 2.7 V	-	-0.9	-1.2	V	
V <sub>OH</sub>	HIGH-state output voltage	I <sub>OH</sub> = -100 μA; V <sub>CC</sub> = 2.7 V to 3.6 V	V <sub>CC</sub> - 0.2	V <sub>CC</sub> - 0.1	-	V	
		I <sub>OH</sub> = -8 mA; V <sub>CC</sub> = 2.7 V	2.4	2.5	-	V	
		I <sub>OH</sub> = -32 mA; V <sub>CC</sub> = 3.0 V	2.0	2.2	-	V	
V <sub>OL</sub>	LOW-state output voltage	V <sub>CC</sub> = 2.7 V					
		I <sub>OL</sub> = 100 μA	-	0.1	0.2	V	
		I <sub>OL</sub> = 24 mA	-	0.3	0.5	V	
		V <sub>CC</sub> = 3.0 V					
		I <sub>OL</sub> = 16 mA	-	0.25	0.4	V	
		I <sub>OL</sub> = 32 mA	-	0.3	0.5	V	
I <sub>LI</sub>	input leakage current						
		all input pins	V <sub>CC</sub> = 0 V or 3.6 V; V <sub>I</sub> = 5.5 V	-	1	10	μA
		control pins	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND	-	±0.1	±1	μA
		data pins	V <sub>CC</sub> = 3.6 V	<sup>[2]</sup>			
		V <sub>I</sub> = V <sub>CC</sub>	-	0.1	1	μA	
		V <sub>I</sub> = 0 V	-	-1	-5	μA	
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 0 V to 4.5 V	-	1	±100	μA	
I <sub>HOLD</sub>	bus hold current data input	V <sub>CC</sub> = 3 V	<sup>[3]</sup>				
		V <sub>I</sub> = 0.8 V	75	150	-	μA	
		V <sub>I</sub> = 2.0 V	-75	-150	-	μA	
		V <sub>CC</sub> = 0 V to 3.6 V					
		V <sub>I</sub> = 3.6 V	±500	-	-	μA	
I <sub>EX</sub>	external current into output	output in HIGH-state when V <sub>O</sub> > V <sub>CC</sub> ; V <sub>O</sub> = 5.5 V and V <sub>CC</sub> = 3.0 V	-	60	125	μA	
I <sub>O(pu/pd)</sub>	power-up/power-down output current	V <sub>CC</sub> ≤ 1.2 V; V <sub>O</sub> = 0.5 V to V <sub>CC</sub> ; V <sub>I</sub> = GND or V <sub>CC</sub> ; nOE = don't care	<sup>[4]</sup> -	±1	±100	μA	
I <sub>OZ</sub>	OFF-state output current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		output HIGH: V <sub>O</sub> = 3.0 V	-	1	5	μA	
		output LOW: V <sub>O</sub> = 0.5 V	-	-1	-5	μA	
I <sub>CC</sub>	quiescent supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A					
		outputs HIGH	-	0.13	0.19	mA	
		outputs LOW	-	2	7	mA	
		outputs disabled	<sup>[5]</sup> -	0.13	0.19	mA	

**Table 7. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\Delta I_{CC}$	additional quiescent supply current	per input pin; $V_{CC} = 3.3 \text{ V}$ to $3.6 \text{ V}$ ; [6] - one input at $V_{CC} - 0.6 \text{ V}$ and other inputs at $V_{CC}$ or GND	-	0.1	0.2	mA
$C_i$	input capacitance	$V_I = 0 \text{ V}$ or $3.0 \text{ V}$	-	4	-	pF
$C_o$	output capacitance	outputs disabled; $V_O = 0 \text{ V}$ or $3.0 \text{ V}$	-	8	-	pF

[1] Typical values are measured at  $V_{CC} = 3.3 \text{ V}$  and  $T_{amb} = 25 \text{ }^\circ\text{C}$ .[2] Unused pins at  $V_{CC}$  or GND.

[3] This is the bus hold overdrive current required to force the input to the opposite logic state.

[4] This parameter is valid for any  $V_{CC}$  between 0 V and 1.2 V with a transition time of up to 10 ms. From  $V_{CC} = 1.2 \text{ V}$  to  $V_{CC} = 3.0 \text{ V}$  to 3.6 V a transition time of 100  $\mu\text{s}$  is permitted. This parameter is valid for  $T_{amb} = 25 \text{ }^\circ\text{C}$  only.[5]  $I_{CC}$  is measured with outputs pulled to  $V_{CC}$  or GND.[6] This is the increase in supply current for each input at the specified voltage level other than  $V_{CC}$  or GND.

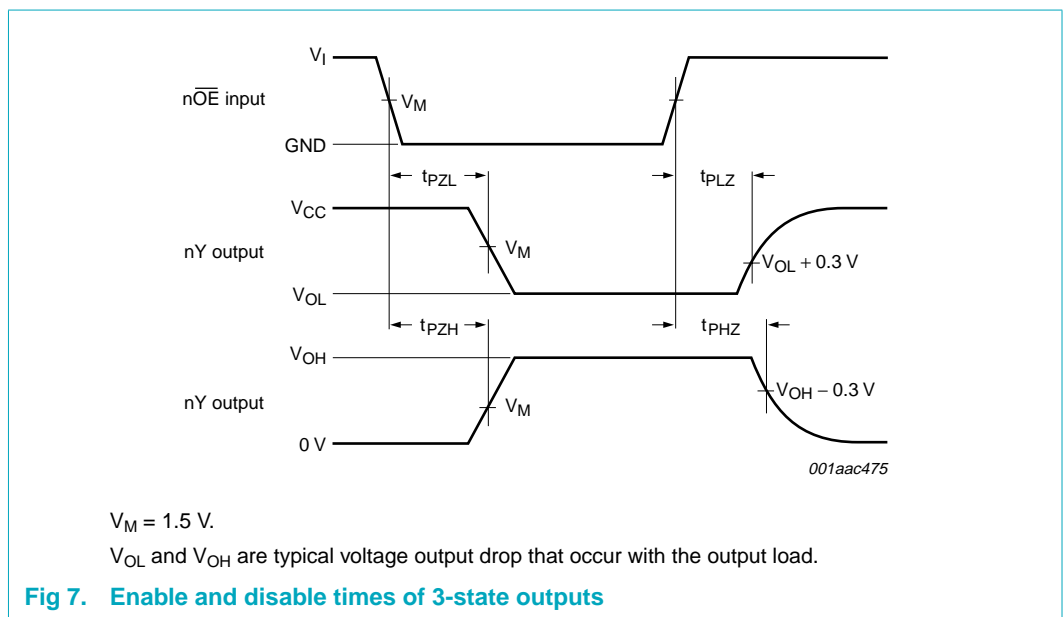
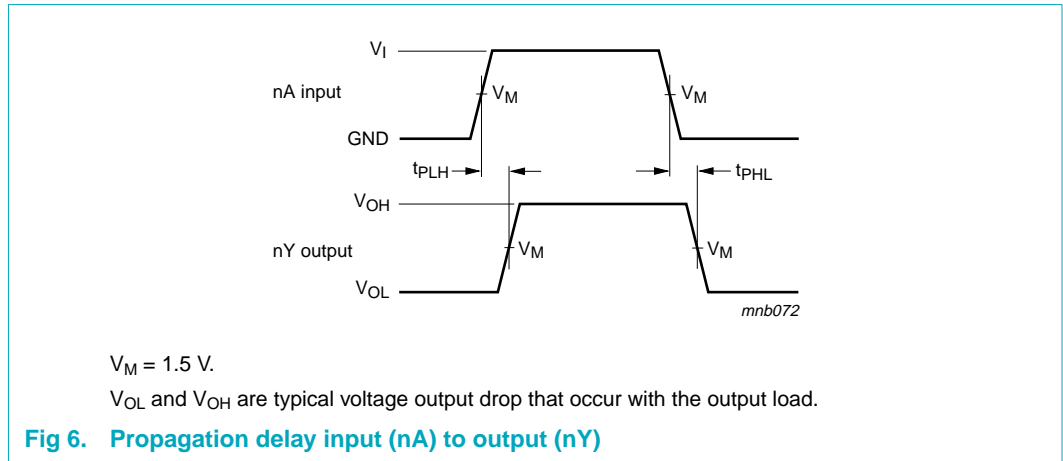
## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#).

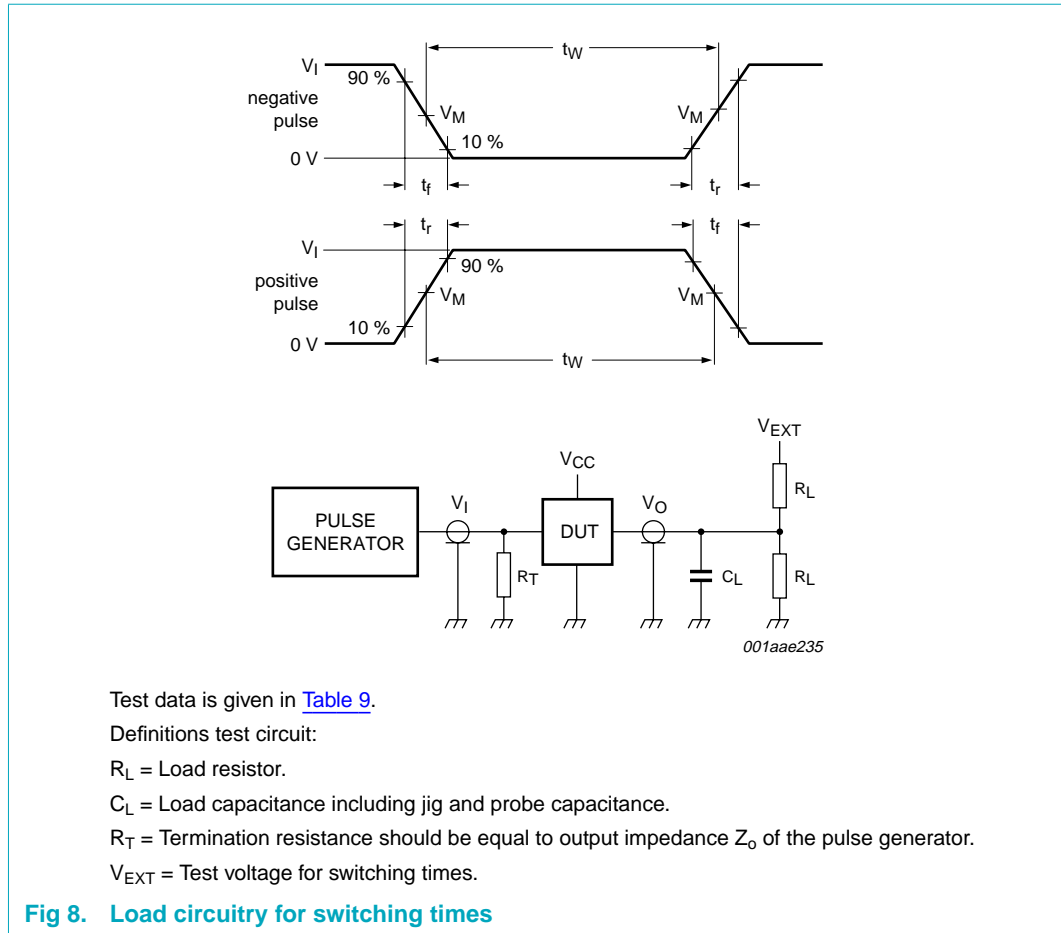
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = -40 \text{ }^\circ\text{C}$ to $+85 \text{ }^\circ\text{C}$ [1]						
$t_{PLH}$	LOW-to-HIGH propagation delay nAn to nY	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.7 \text{ V}$	-	-	4.5	ns
		$V_{CC} = 3.0 \text{ V}$ to $3.6 \text{ V}$	1.0	2.7	4.0	ns
$t_{PHL}$	HIGH-to-LOW propagation delay nAn to nY	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.7 \text{ V}$	-	-	4.9	ns
		$V_{CC} = 3.0 \text{ V}$ to $3.6 \text{ V}$	1.0	2.9	3.9	ns
$t_{PZH}$	output enable time $\overline{nOE}$ to nY	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7 \text{ V}$	-	-	6.0	ns
		$V_{CC} = 3.0 \text{ V}$ to $3.6 \text{ V}$	1.0	3.4	4.7	ns
$t_{PZL}$	output enable time $\overline{nOE}$ to nY	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7 \text{ V}$	-	-	6.5	ns
		$V_{CC} = 3.0 \text{ V}$ to $3.6 \text{ V}$	1.1	3.4	4.7	ns
$t_{PHZ}$	output disable time $\overline{nOE}$ to nY	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7 \text{ V}$	-	-	5.7	ns
		$V_{CC} = 3.0 \text{ V}$ to $3.6 \text{ V}$	1.8	3.7	5.1	ns
$t_{PLZ}$	output disable time $\overline{nOE}$ to nY	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.7 \text{ V}$	-	-	4.0	ns
		$V_{CC} = 3.0 \text{ V}$ to $3.6 \text{ V}$	1.3	2.6	4.5	ns

[1] Typical values are at  $V_{CC} = 3.3 \text{ V}$  and  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

12. Waveforms







**Table 9. Test data**

Input				Load		$V_{EXT}$		
$V_I$	$f_i$	$t_w$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHZ}, t_{PZH}$	$t_{PLZ}, t_{PZL}$	$t_{PLH}, t_{PHL}$
2.7 V	$\leq 10$ MHz	500 ns	$\leq 2.5$ ns	50 pF	500 $\Omega$	GND	6 V	open

13. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1

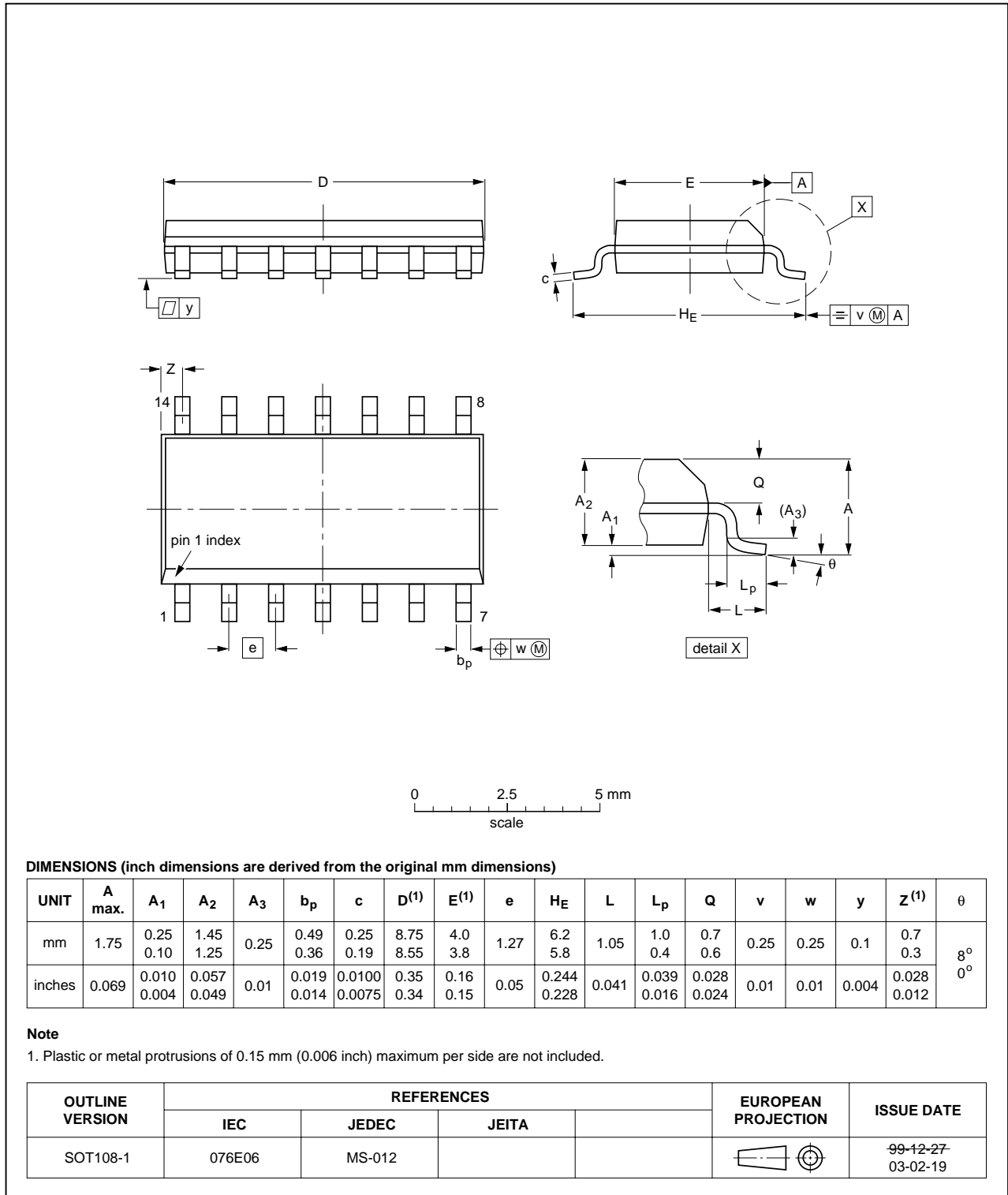


Fig 9. Package outline SOT108-1 (SO14)

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1

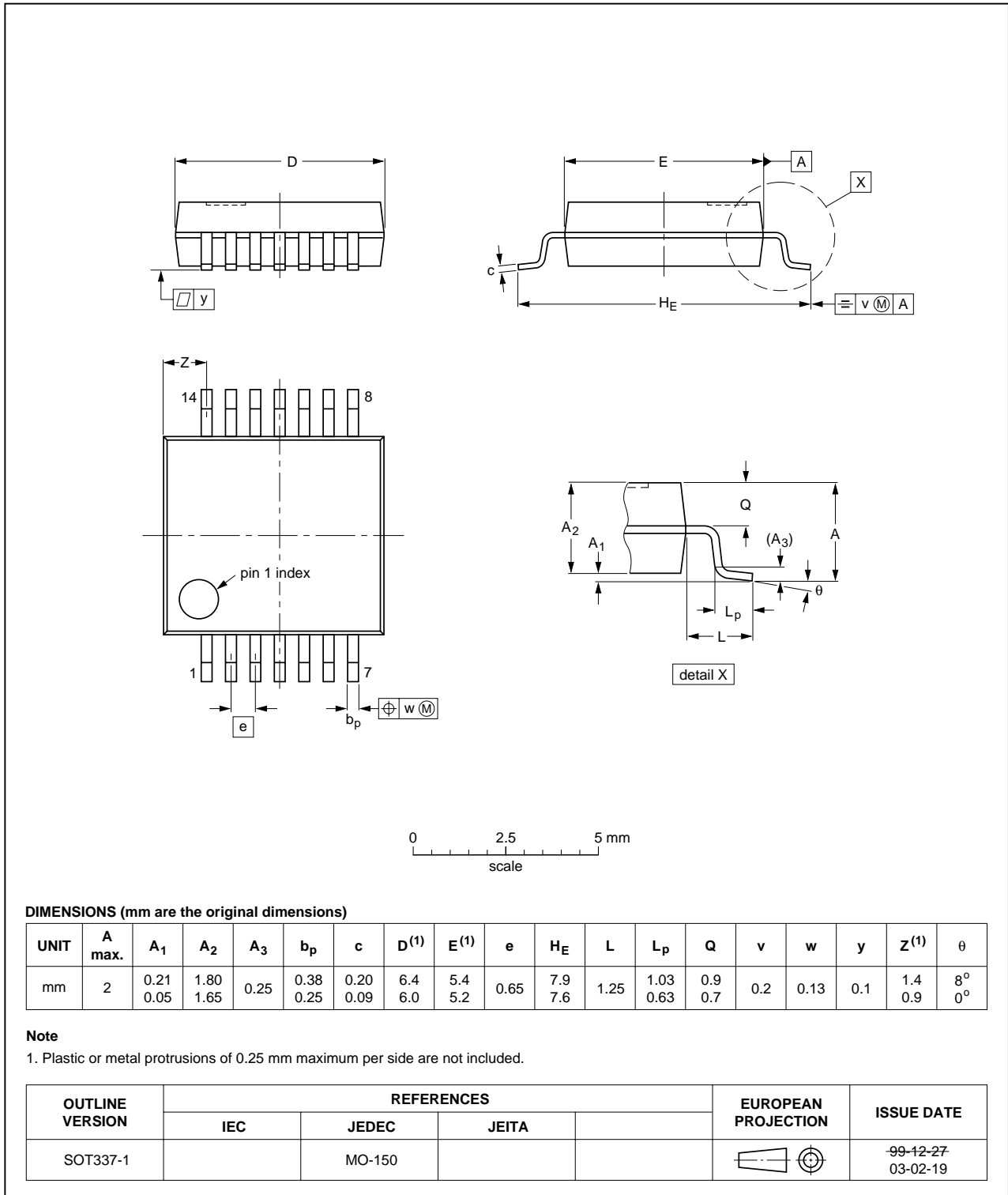


Fig 10. Package outline SOT337-1 (SSOP14)

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

SOT402-1

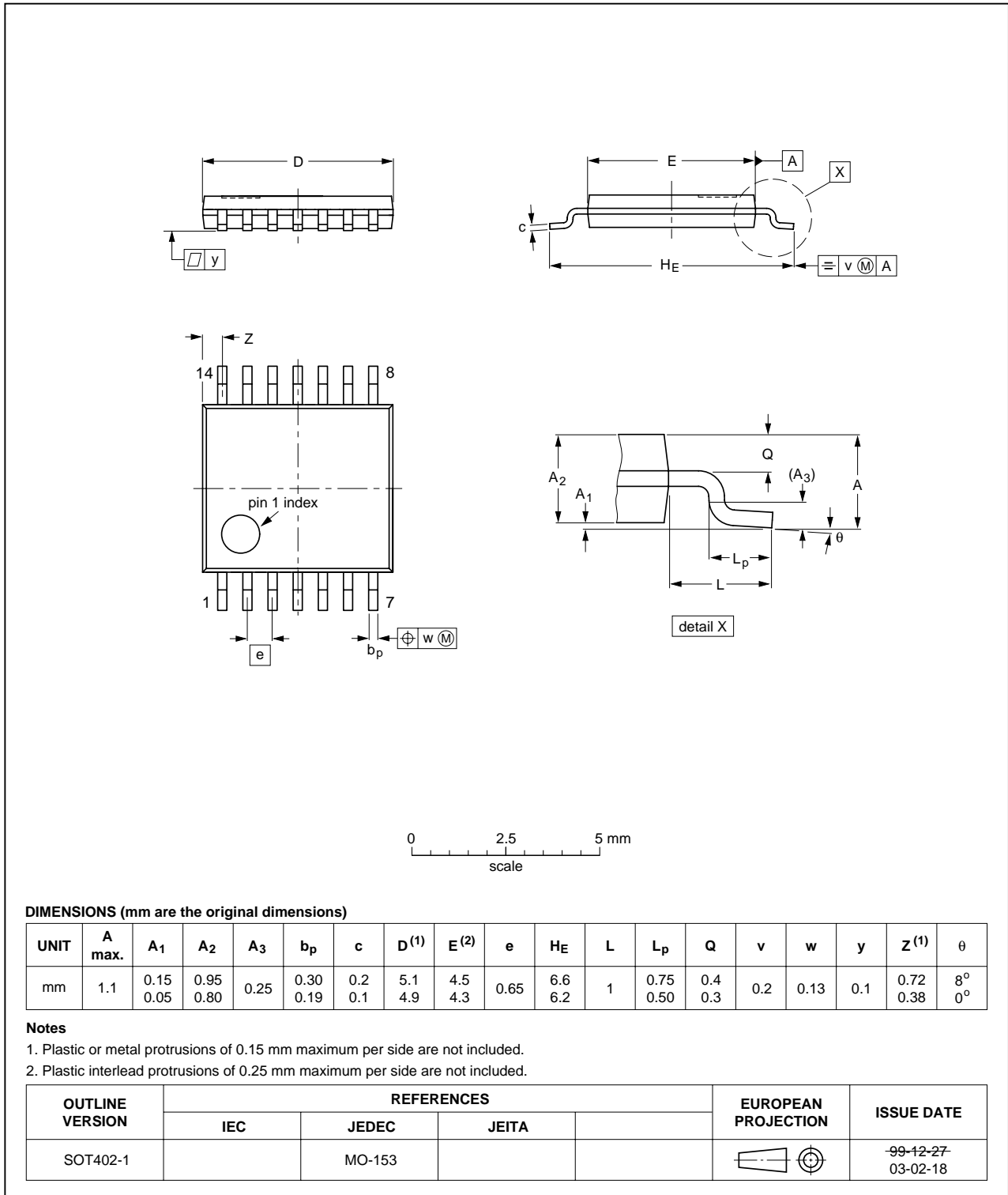


Fig 11. Package outline SOT402-1 (TSSOP14)

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

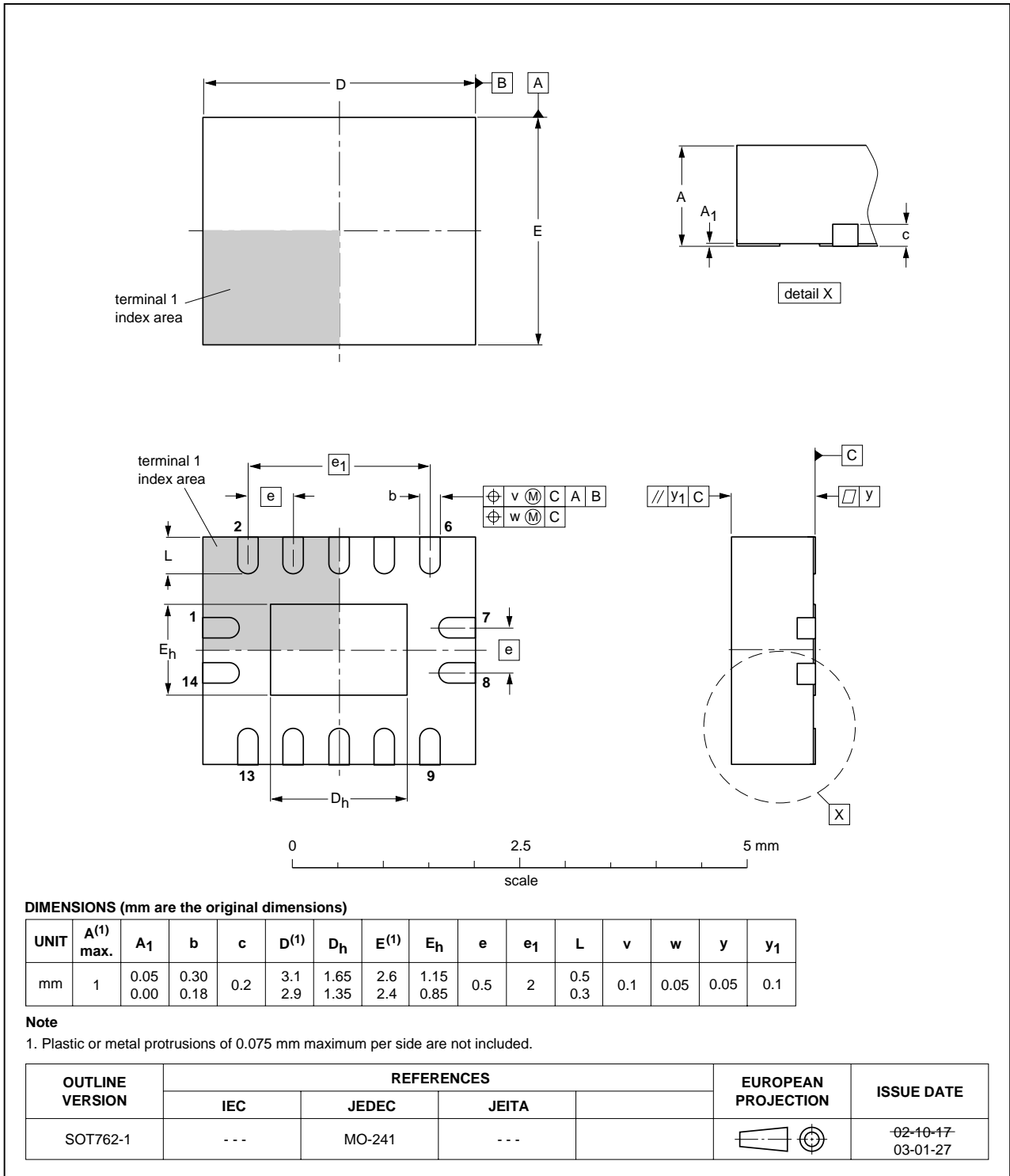


Fig 12. Package outline SOT762-1 (DHVQFN14)

## 14. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
TTL	Transistor-Transistor Logic

## 15. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT_LVTH125_6	20060306	Product data sheet	-	74LVT125_5 (9397 750 14703)
Modifications:	<ul style="list-style-type: none"> <li>Section 4: Added type numbers 74LVTH125D, 74LVTH125DB, 74LVTH125PW and 74LVTH125BQ.</li> </ul>			
74LVT125_5	20050210	Product data sheet	-	74LVT125_4 (9397 750 14552)
74LVT125_4	20050207	Product data sheet	-	74LVT125_3 (9397 750 13535)
74LVT125_3	20040624	Product data sheet	-	74LVT125_2 (9397 750 03514)
74LVT125_2	19980219	Product specification	-	74LVT125_1
74LVT125_1	-	-	-	-

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### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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[2] The term 'short data sheet' is explained in section "Definitions".

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