

# 74LV32

## Quad 2-input OR gate

Rev. 03 — 9 November 2007

Product data sheet

### 1. General description

The 74LV32 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC32 and 74HCT32.

The 74LV32 provides a quad 2-input OR function.

### 2. Features

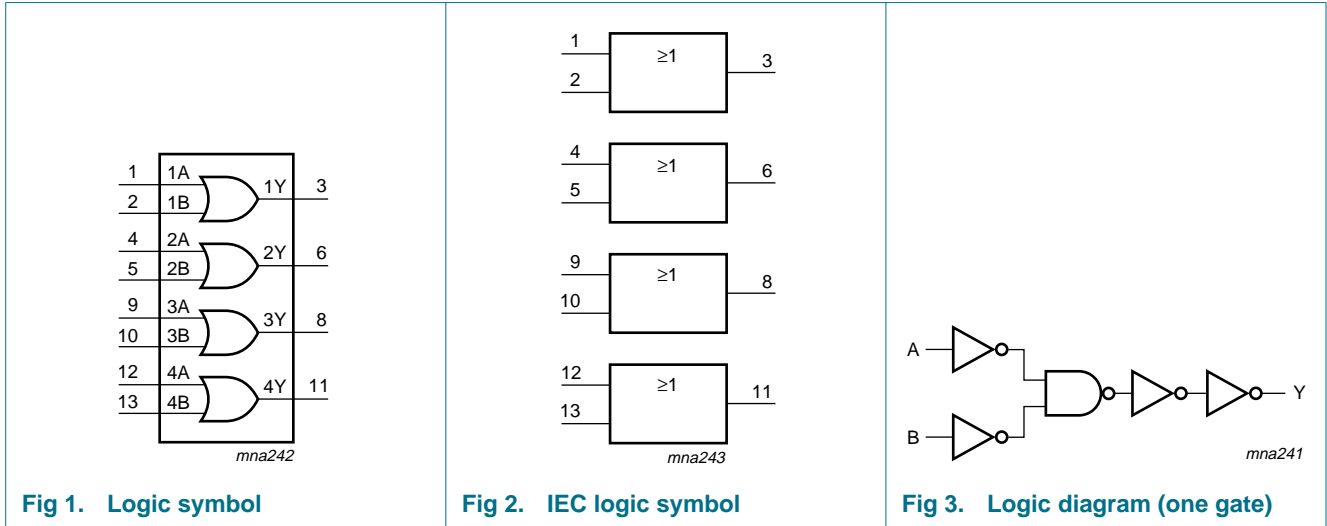
- Wide operating voltage: 1.0 V to 5.5 V
- Optimized for low voltage applications: 1.0 V to 3.6 V
- Accepts TTL input levels between  $V_{CC} = 2.7$  V and  $V_{CC} = 3.6$  V
- Typical output ground bounce < 0.8 V at  $V_{CC} = 3.3$  V and  $T_{amb} = 25$  °C
- Typical HIGH-level output voltage ( $V_{OH}$ ) undershoot: > 2 V at  $V_{CC} = 3.3$  V and  $T_{amb} = 25$  °C
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

### 3. Ordering information

Table 1. Ordering information

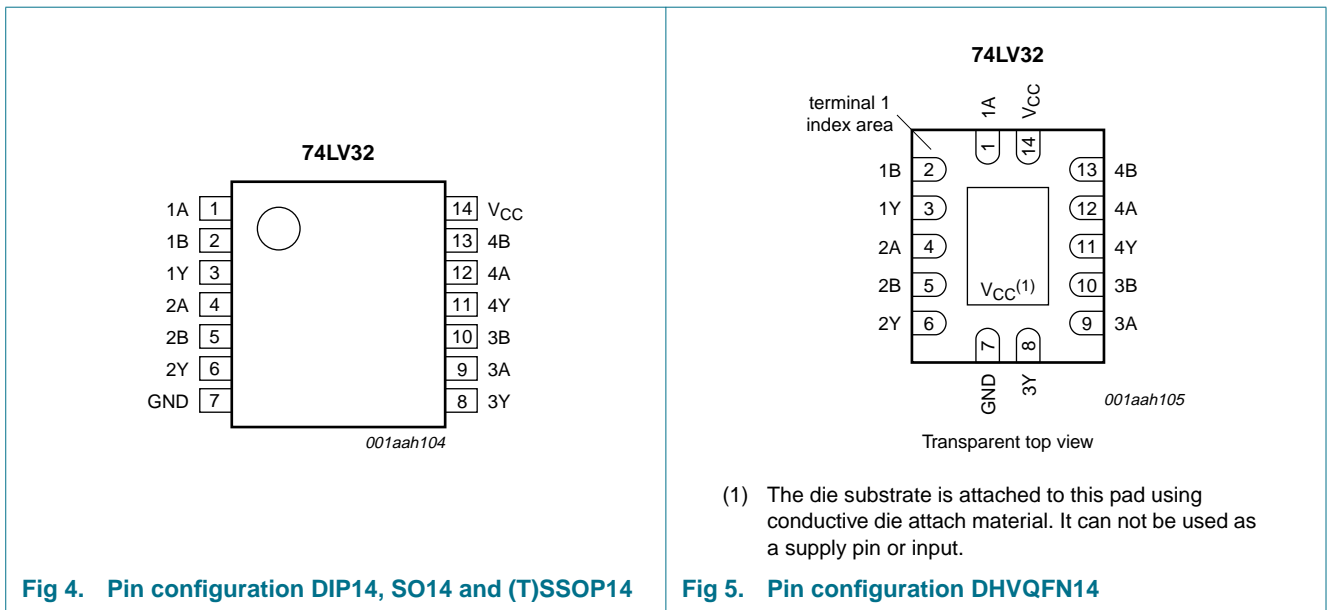
Type number	Package			
	Temperature range	Name	Description	Version
74LV32N	-40 °C to +125 °C	DIP14	plastic dual in-line package; 14 leads (300 mil)	SOT27-1
74LV32D	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LV32DB	-40 °C to +125 °C	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LV32PW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74LV32BQ	-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

### 4. Functional diagram



### 5. Pinning information

#### 5.1 Pinning



## 5.2 Pin description

**Table 2.** Pin description

Symbol	Pin	Description
1A	1	data input
1B	2	data input
1Y	3	data output
2A	4	data input
2B	5	data input
2Y	6	data output
GND	7	ground (0 V)
3Y	8	data output
3A	9	data input
3B	10	data input
4Y	11	data output
4A	12	data input
4B	13	data input
V <sub>CC</sub>	14	supply voltage

## 6. Functional description

**Table 3.** Function selection

H = HIGH voltage level; L = LOW voltage level; X = don't care

Input		Output
nA	nB	nY
H	X	H
X	H	H
L	L	L

## 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 <sub>CC</sub>	supply voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V	[1]	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V	[1]	±50	mA
I <sub>O</sub>	output current	V <sub>O</sub> = -0.5 V to (V <sub>CC</sub> + 0.5 V)	-	±25	mA
I <sub>CC</sub>	supply current		-	50	mA
I <sub>GND</sub>	ground current		-50	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C

**Table 4.** Limiting values ...continued

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$P_{\text{tot}}$	total power dissipation	$T_{\text{amb}} = -40\text{ °C to }+125\text{ °C}$			
	DIP14 package		[2] -	750	mW
	SO14 package		[3] -	500	mW
	(T)SSOP14 package		[4] -	500	mW
	DHVQFN14 package		[5] -	500	mW

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

[2]  $P_{\text{tot}}$  derates linearly with 12 mW/K above 70 °C.

[3]  $P_{\text{tot}}$  derates linearly with 8 mW/K above 70 °C.

[4]  $P_{\text{tot}}$  derates linearly with 5.5 mW/K above 60 °C.

[5]  $P_{\text{tot}}$  derates linearly with 4.5 mW/K above 60 °C.

## 8. Recommended operating conditions

**Table 5.** Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{CC}}$	supply voltage[1]		1.0	3.3	5.5	V
$V_{\text{I}}$	input voltage		0	-	$V_{\text{CC}}$	V
$V_{\text{O}}$	output voltage		0	-	$V_{\text{CC}}$	V
$T_{\text{amb}}$	ambient temperature		-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{\text{CC}} = 1.0\text{ V to }2.0\text{ V}$	-	-	500	ns/V
		$V_{\text{CC}} = 2.0\text{ V to }2.7\text{ V}$	-	-	200	ns/V
		$V_{\text{CC}} = 2.7\text{ V to }3.6\text{ V}$	-	-	100	ns/V
		$V_{\text{CC}} = 3.6\text{ V to }5.5\text{ V}$	-	-	50	ns/V

[1] The static characteristics are guaranteed from  $V_{\text{CC}} = 1.2\text{ V}$  to  $V_{\text{CC}} = 5.5\text{ V}$ , but LV devices are guaranteed to function down to  $V_{\text{CC}} = 1.0\text{ V}$  (with input levels GND or  $V_{\text{CC}}$ ).

## 9. Static characteristics

**Table 6. Static characteristics**

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.2 V	V <sub>CC</sub>	0.6	-	V <sub>CC</sub>	-	V
		V <sub>CC</sub> = 2.0 V	1.4	-	-	1.4	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.2 V	-	0.4	GND	-	GND	V
		V <sub>CC</sub> = 2.0 V	-	-	0.6	-	0.6	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.3V <sub>CC</sub>	-	0.3V <sub>CC</sub>	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.2 V	-	1.2	-	-	-	V
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 2.0 V	1.8	2.0	-	1.8	-	V
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 2.7 V	2.5	2.7	-	2.5	-	V
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 3.0 V	2.8	3.0	-	2.8	-	V
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 4.5 V	4.3	4.5	-	4.3	-	V
		I <sub>O</sub> = -6 mA; V <sub>CC</sub> = 3.0 V	2.4	2.82	-	2.2	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 4.5 V	3.6	4.2	-	3.5	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 1.2 V	-	0	-	-	-	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 2.0 V	-	0	0.2	-	0.2	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 2.7 V	-	0	0.2	-	0.2	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 3.0 V	-	0	0.2	-	0.2	V
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 4.5 V	-	0	0.2	-	0.2	V
		I <sub>O</sub> = 6 mA; V <sub>CC</sub> = 3.0 V	-	0.25	0.40	-	0.50	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 4.5 V	-	0.35	0.55	-	0.65	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	1.0	-	1.0	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	20.0	-	40	μA
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	500	-	850	μA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**  
*GND = 0 V; For test circuit see Figure 7.*

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nA, nB to nY; see Figure 6 <sup>[2]</sup>						
		V <sub>CC</sub> = 1.2 V	-	40	-	-	-	ns
		V <sub>CC</sub> = 2.0 V	-	14	22	-	28	ns
		V <sub>CC</sub> = 2.7 V	-	10	16	-	20	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup>	-	6.0	-	-	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>	-	8.0	13	-	16	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	10	-	13	ns
C <sub>PD</sub>	power dissipation capacitance	C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[4]</sup>	-	16	-	-	-	pF

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 3.3 V).

[4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:

f<sub>i</sub> = input frequency in MHz, f<sub>o</sub> = output frequency in MHz

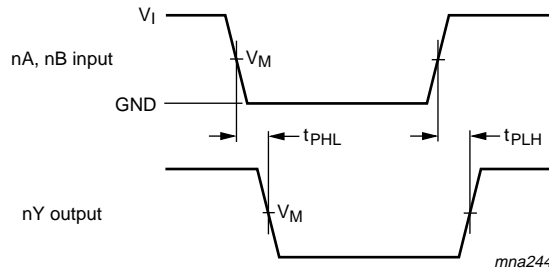
C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in V

N = number of inputs switching

$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

### 11. Waveforms



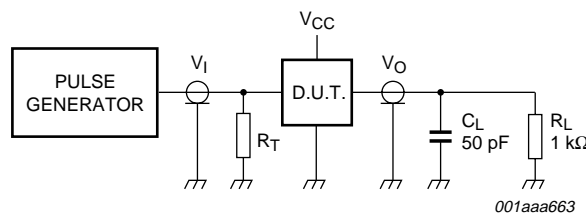
Measurement points are given in [Table 8](#).

$V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 6. The input (nA, nB) to output (nY) propagation delays**

**Table 8. Measurement points**

Supply voltage $V_{CC}$	Input $V_M$	Output $V_M$
< 2.7 V	$0.5V_{CC}$	$0.5V_{CC}$
2.7 V to 3.6 V	1.5 V	1.5 V
$\geq 4.5$ V	$0.5V_{CC}$	$0.5V_{CC}$



Test data is given in [Table 9](#).

Definitions test circuit:

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

**Fig 7. Load circuit for switching times**

**Table 9. Test data**

Supply voltage $V_{CC}$	Input $V_I$	$t_r, t_f$
< 2.7 V	$V_{CC}$	$\leq 2.5$ ns
2.7 V to 3.6 V	2.7 V	$\leq 2.5$ ns
$\geq 4.5$ V	$V_{CC}$	$\leq 2.5$ ns

12. Package outline

DIP14: plastic dual in-line package; 14 leads (300 mil)

SOT27-1

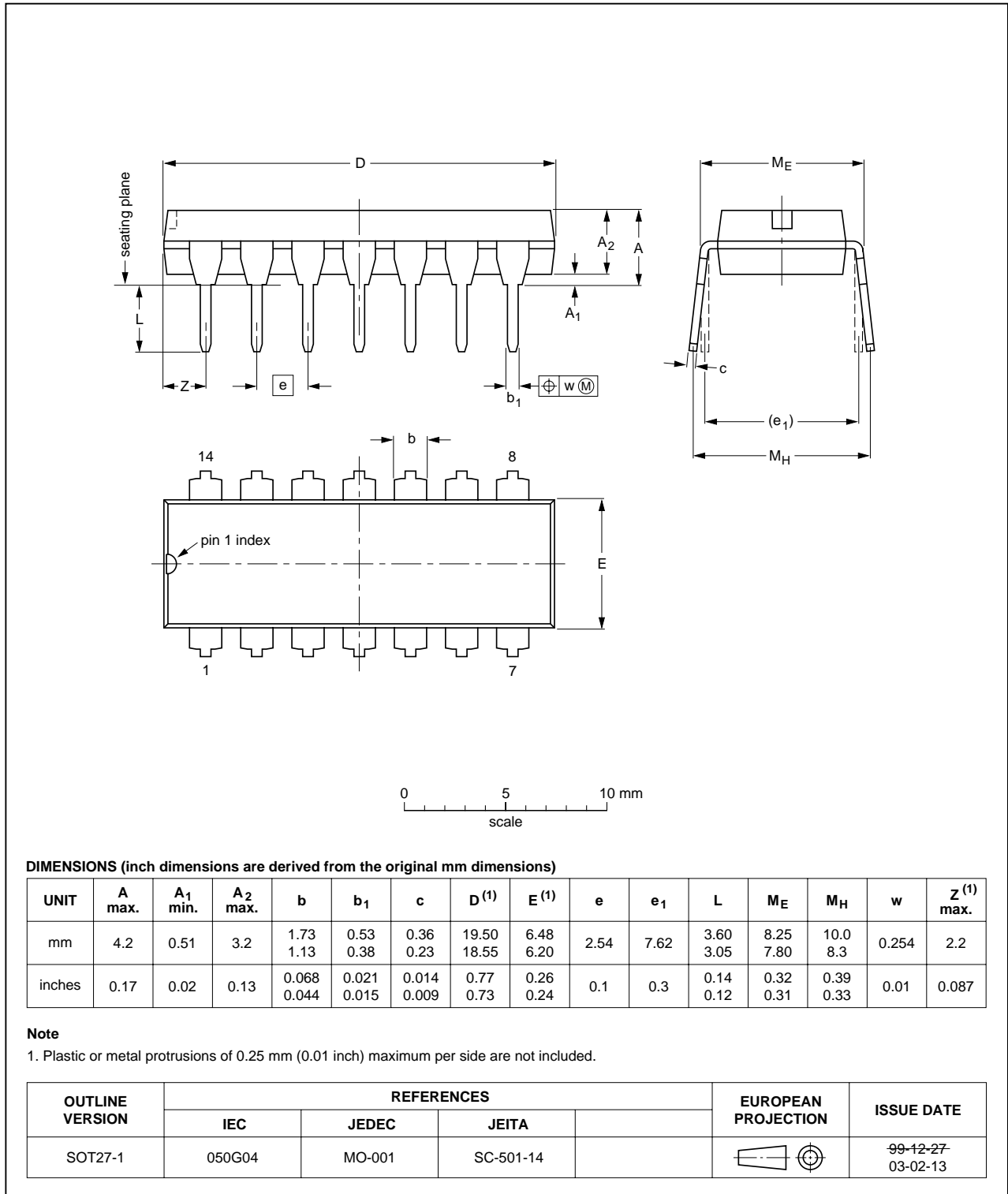


Fig 8. Package outline SOT27-1 (DIP14)



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

SOT108-1

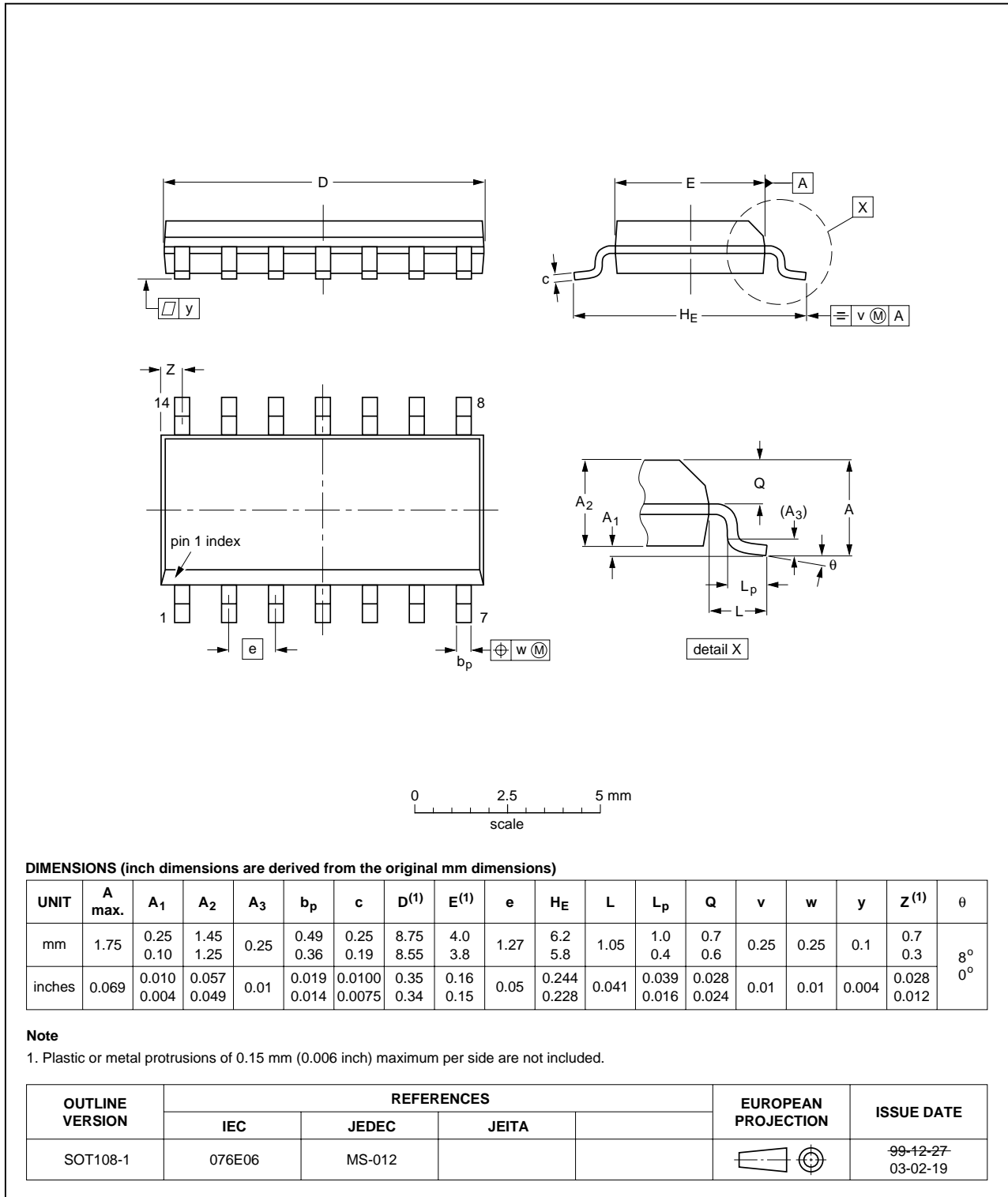


Fig 9. Package outline SOT108-1 (SO14)

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

SOT337-1

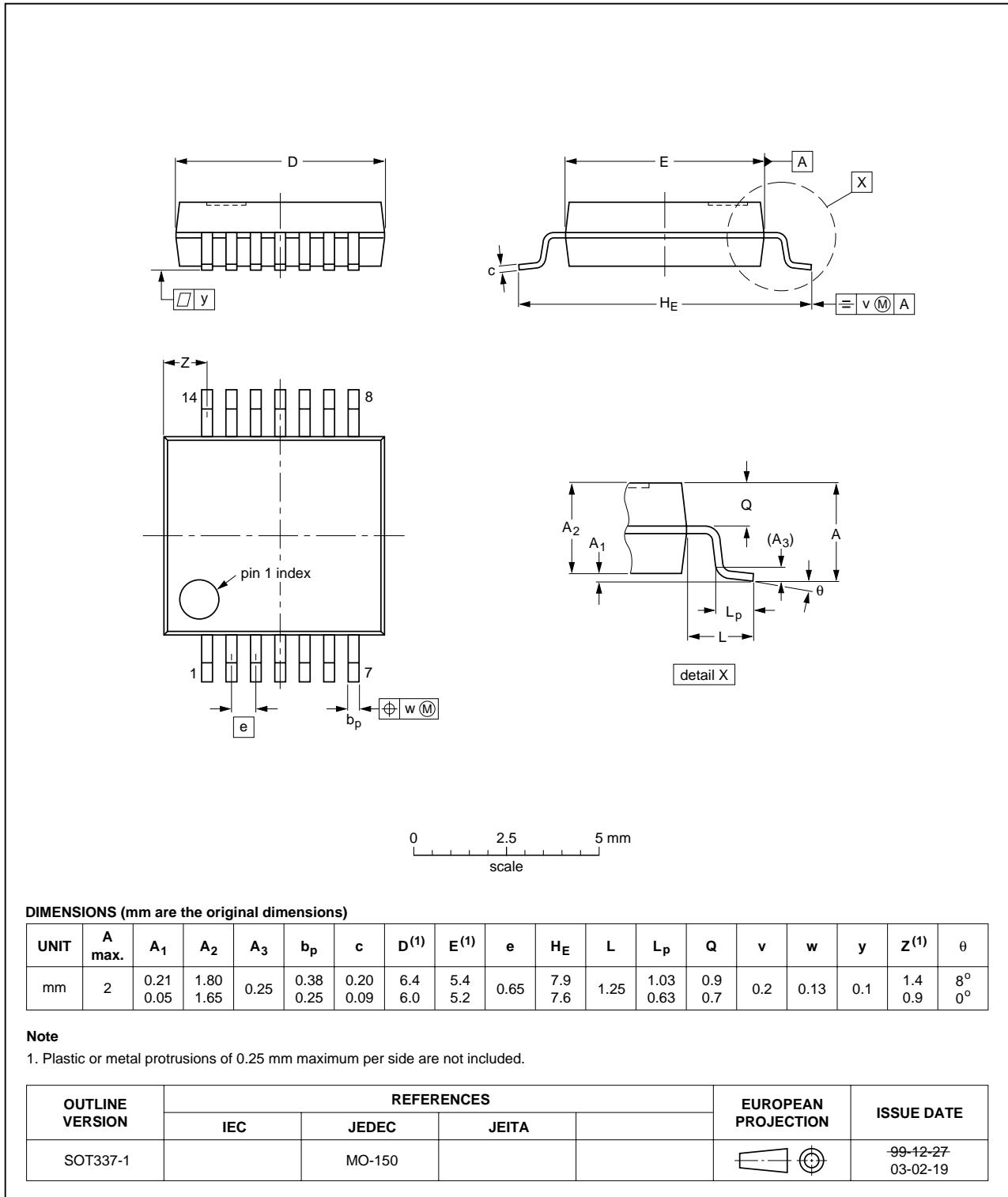


Fig 10. Package outline SOT337-1 (SSOP14)

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

SOT402-1

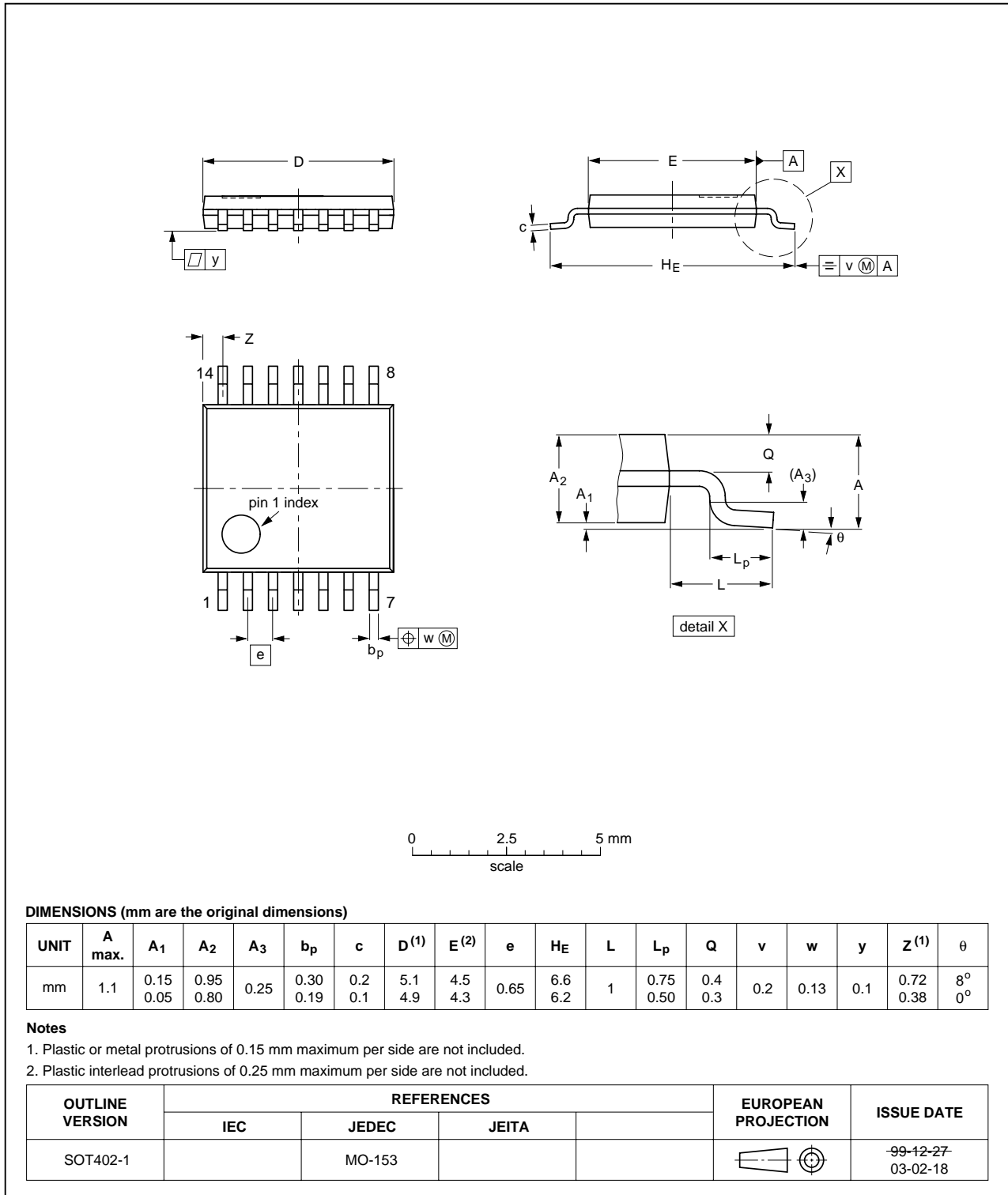


Fig 11. Package outline SOT402-1 (TSSOP14)

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

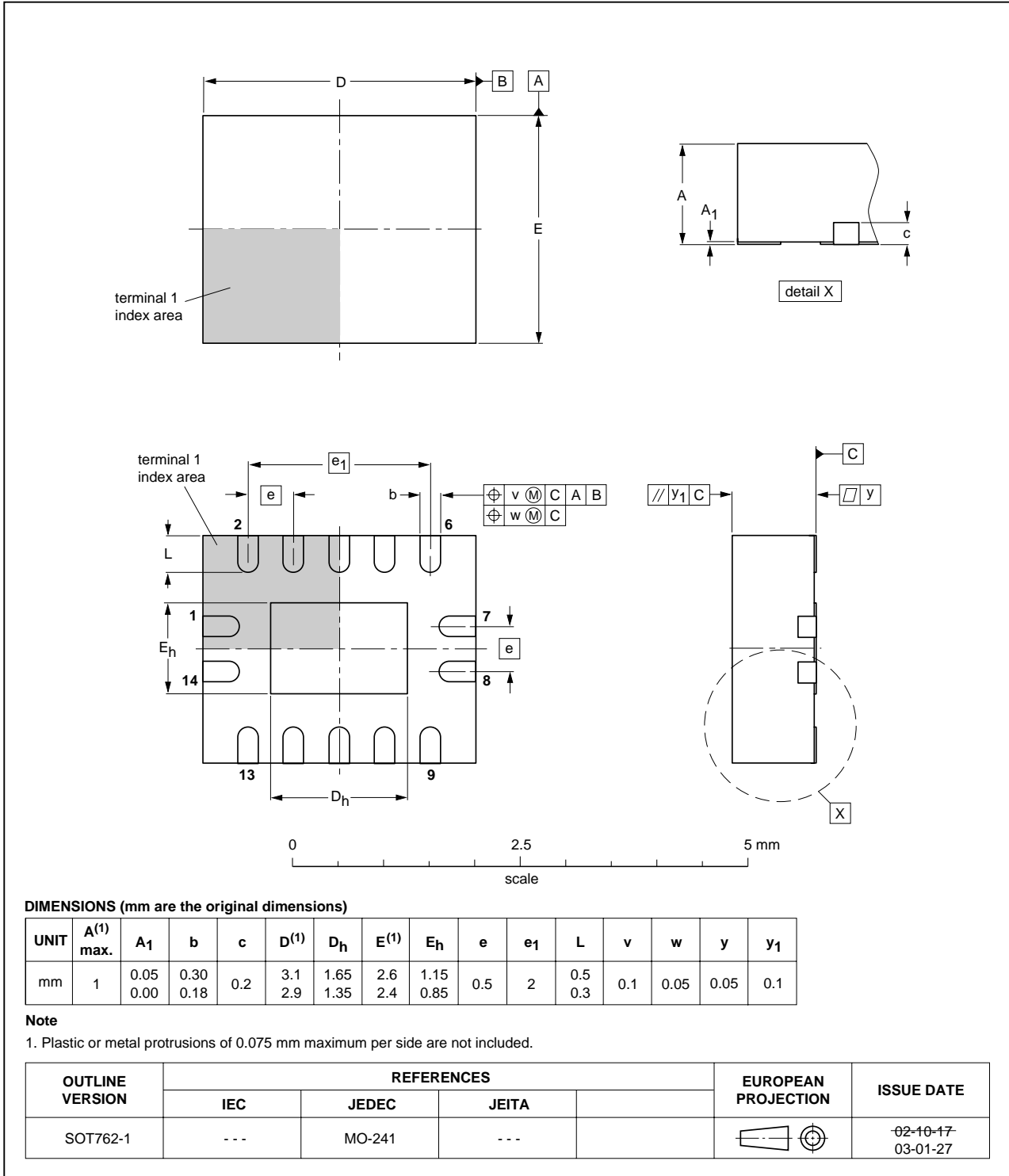


Fig 12. Package outline SOT762-1 (DHVQFN14)

## 13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV32_3	20071109	Product data sheet	-	74LV32_2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 3</a>: DHVQFN14 package added.</li> <li><a href="#">Section 8</a>: derating values added for DHVQFN14 package.</li> <li><a href="#">Section 12</a>: outline drawing added for DHVQFN14 package.</li> </ul>			
74LV32_2	19980420	Product specification	-	74LV32_1
74LV32_1	19970203	Product specification	-	-

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### 15.1 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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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[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".

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