

# 74LV132

## Quad 2-input NAND Schmitt trigger

Rev. 04 — 12 November 2007

Product data sheet

### 1. General description

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The 74LV132 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC132 and 74HCT132.

The 74LV132 contains four 2-input NAND gates which accept standard input signals. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

The gate switches at different points for positive and negative-going signals. The difference between the positive voltage  $V_{T+}$  and the negative voltage  $V_{T-}$  is defined as the input hysteresis voltage  $V_H$ .

### 2. Features

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- 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. Applications

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- Wave and pulse shapers for highly noisy environments
- Astable multivibrators
- Monostable multivibrators

### 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LV132N	-40 °C to +125 °C	DIP14	plastic dual in-line package; 14 leads (300 mil)	SOT27-1
74LV132D	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LV132DB	-40 °C to +125 °C	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LV132PW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74LV132BQ	-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

### 5. Functional diagram

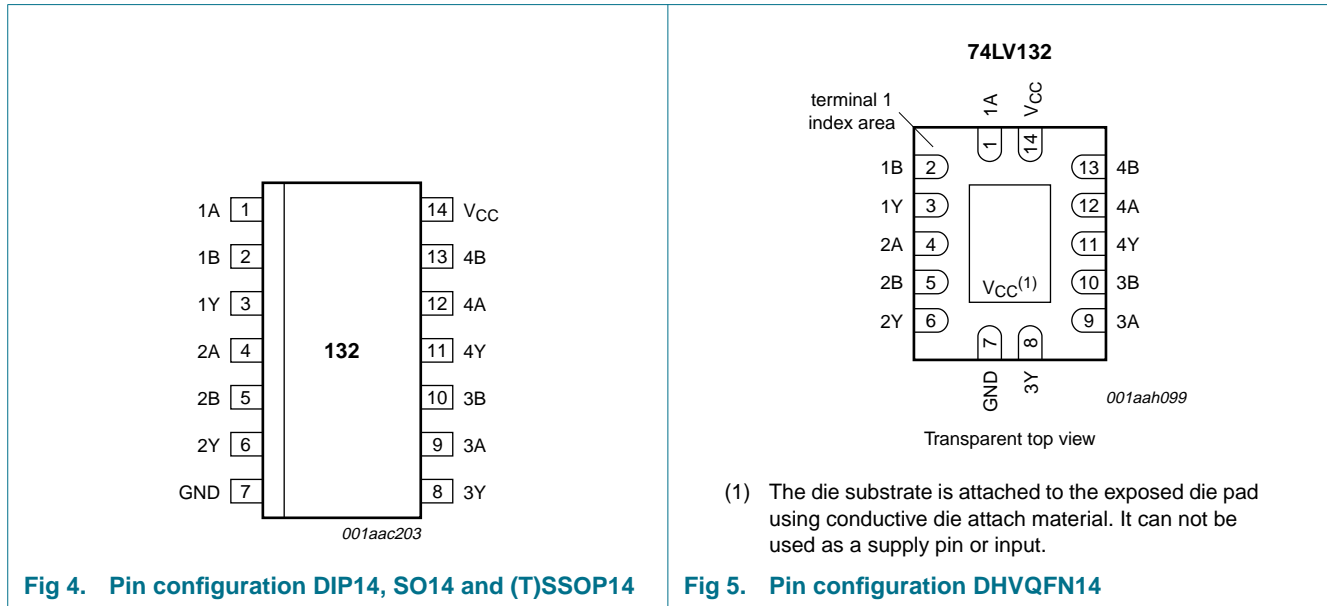
**Fig 1. Logic symbol**

**Fig 2. IEC logic symbol**

**Fig 3. Logic diagram (one gate)**

## 6. Pinning information

### 6.1 Pinning



### 6.2 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

## 7. Functional description

**Table 3. Function table**

*H = HIGH voltage level; L = LOW voltage level.*

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

## 8. 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	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	[1]	-	±20 mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	[1]	-	±50 mA
$I_O$	output current	$V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$	-	±25	mA
$I_{CC}$	supply current		-	50	mA
$I_{GND}$	ground current		-50	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40\text{ °C}$ 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]  $P_{tot}$  derates linearly with 12 mW/K above 70 °C.

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

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

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

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage <sup>[1]</sup>		1.0	3.3	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	°C

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

## 10. 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	
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = -100 \mu\text{A}; V_{CC} = 1.2$ V	-	1.2	-	-	-	V
		$I_O = -100 \mu\text{A}; V_{CC} = 2.0$ V	1.8	2.0	-	1.8	-	V
		$I_O = -100 \mu\text{A}; V_{CC} = 2.7$ V	2.5	2.7	-	2.5	-	V
		$I_O = -100 \mu\text{A}; V_{CC} = 3.0$ V	2.8	3.0	-	2.8	-	V
		$I_O = -100 \mu\text{A}; V_{CC} = 4.5$ V	4.3	4.5	-	4.3	-	V
		$I_O = -6$ mA; $V_{CC} = 3.0$ V	2.4	2.82	-	2.2	-	V
		$I_O = -12$ mA; $V_{CC} = 4.5$ V	3.6	4.2	-	3.5	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = 100 \mu\text{A}; V_{CC} = 1.2$ V	-	0	-	-	-	V
		$I_O = 100 \mu\text{A}; V_{CC} = 2.0$ V	-	0	0.2	-	0.2	V
		$I_O = 100 \mu\text{A}; V_{CC} = 2.7$ V	-	0	0.2	-	0.2	V
		$I_O = 100 \mu\text{A}; V_{CC} = 3.0$ V	-	0	0.2	-	0.2	V
		$I_O = 100 \mu\text{A}; V_{CC} = 4.5$ V	-	0	0.2	-	0.2	V
		$I_O = 6$ mA; $V_{CC} = 3.0$ V	-	0.25	0.40	-	0.50	V
		$I_O = 12$ mA; $V_{CC} = 4.5$ V	-	0.35	0.55	-	0.65	V
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	1.0	-	1.0	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	20.0	-	40	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per input; $V_I = V_{CC} - 0.6$ V; $V_{CC} = 2.7$ V to 3.6 V	-	-	500	-	850	$\mu\text{A}$
$C_I$	input capacitance		-	3.5	-	-	-	pF

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

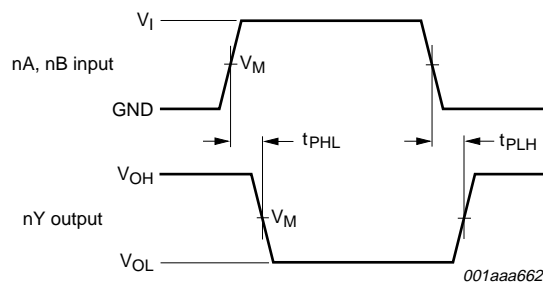
## 11. Dynamic characteristics

**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	-	65	-	-	-	ns
		V <sub>CC</sub> = 2.0 V	-	18	34	-	43	ns
		V <sub>CC</sub> = 2.7 V	-	15	24	-	30	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF <sup>[3]</sup>	-	10	-	-	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>	-	12	20	-	25	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[3]</sup>	-	9.0	14	-	17	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>	-	24	-	-	-	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 and V<sub>CC</sub> = 5.0 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.

## 12. Waveforms

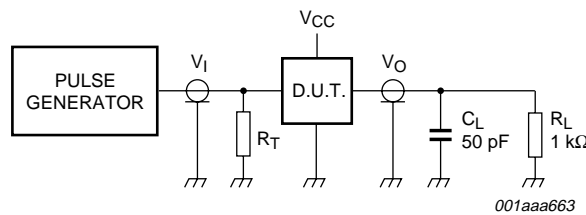


Measurement points are given in Table 8.  
 V<sub>OL</sub> and V<sub>OH</sub> are typical voltage output levels that occur with the output load.

**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

### 13. Transfer characteristics

Table 10. Transfer characteristics

$GND = 0$  V; For test circuit see [Figure 7](#).

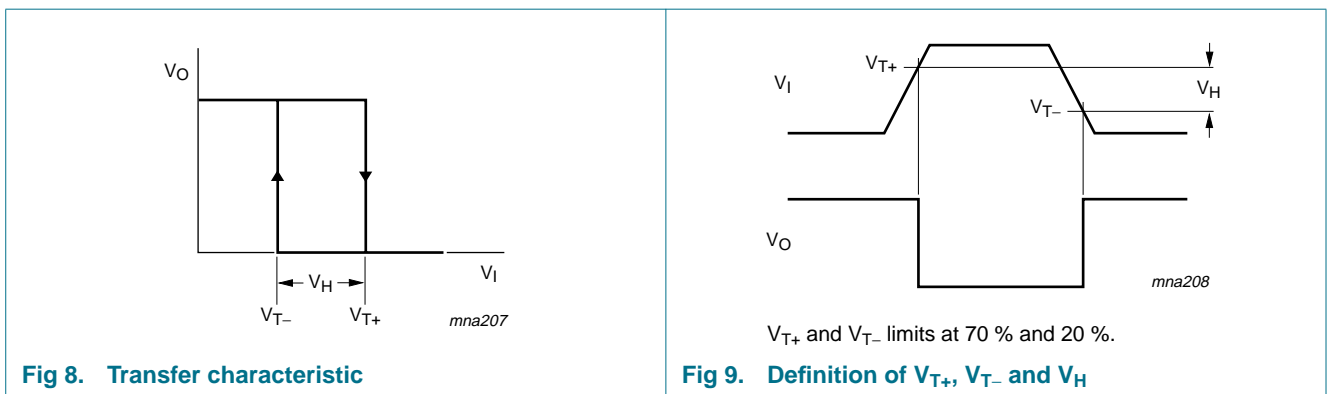
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
$V_{T+}$	positive-going threshold voltage	see <a href="#">Figure 6</a>						
		$V_{CC} = 1.2$ V	-	0.70	-	-	-	V
		$V_{CC} = 2.0$ V	0.8	1.10	1.4	0.8	1.4	V
		$V_{CC} = 2.7$ V	1.0	1.45	2.0	1.0	2.0	V
		$V_{CC} = 3.0$ V	1.2	1.60	2.2	1.2	2.2	V
		$V_{CC} = 3.6$ V	1.5	1.95	2.4	1.5	2.4	V
		$V_{CC} = 4.5$ V	1.7	2.50	3.2	1.7	3.2	V
$V_{CC} = 5.5$ V	2.1	3.00	3.9	2.1	3.9	V		

**Table 10. Transfer characteristics ...continued**  
*GND = 0 V; For test circuit see Figure 7.*

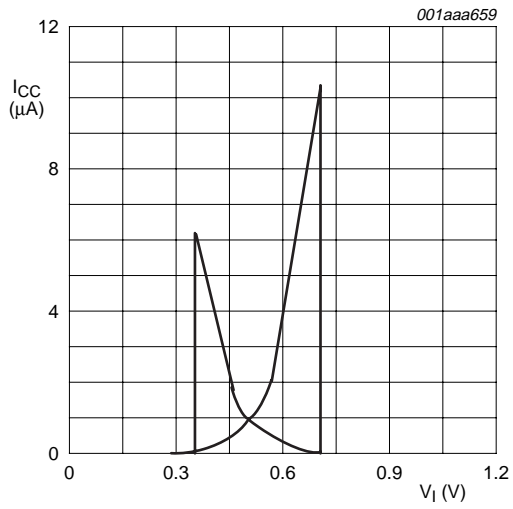
Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
V <sub>T-</sub>	negative-going threshold voltage	see <a href="#">Figure 6</a>						
		V <sub>CC</sub> = 1.2 V	-	0.34	-	-	-	V
		V <sub>CC</sub> = 2.0 V	0.3	0.65	0.9	0.3	0.9	V
		V <sub>CC</sub> = 2.7 V	0.4	0.90	1.4	0.4	1.4	V
		V <sub>CC</sub> = 3.0 V	0.6	1.05	1.5	0.6	1.5	V
		V <sub>CC</sub> = 3.6 V	0.8	1.30	1.8	0.8	1.8	V
		V <sub>CC</sub> = 4.5 V	0.9	1.60	2.0	0.9	2.0	V
V <sub>H</sub>	hysteresis voltage (V <sub>T+</sub> - V <sub>T-</sub> ); see <a href="#">Figure 6</a>	V <sub>CC</sub> = 1.2 V	-	0.3	-	-	-	V
		V <sub>CC</sub> = 2.0 V	0.2	0.55	0.8	0.2	0.8	V
		V <sub>CC</sub> = 2.7 V	0.3	0.60	1.1	0.3	1.1	V
		V <sub>CC</sub> = 3.0 V	0.4	0.65	1.2	0.4	1.2	V
		V <sub>CC</sub> = 3.6 V	0.4	0.70	1.2	0.4	1.2	V
		V <sub>CC</sub> = 4.5 V	0.4	0.80	1.4	0.4	1.4	V
		V <sub>CC</sub> = 5.5 V	0.6	1.00	1.5	0.6	1.5	V

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

### 14. Waveforms transfer characteristics

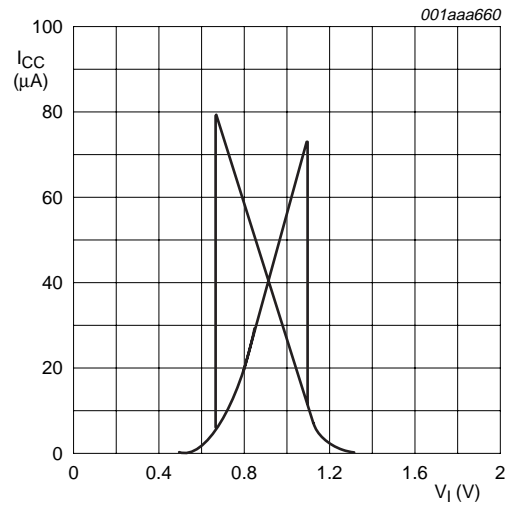






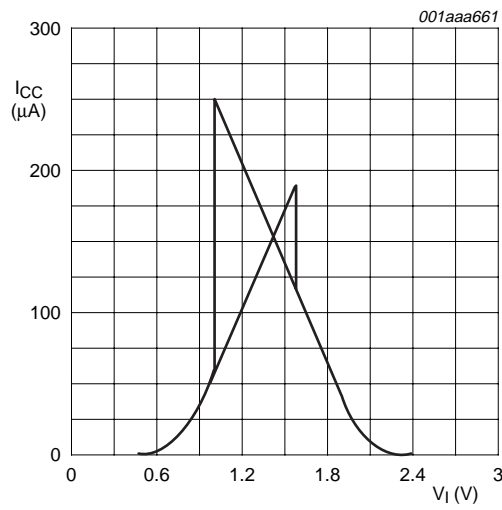
$V_{CC} = 1.2$  V.

Fig 10. Typical 74LV132 transfer characteristics



$V_{CC} = 2.0$  V.

Fig 11. Typical 74LV132 transfer characteristics



$V_{CC} = 3.0$  V.

Fig 12. Typical 74LV132 transfer characteristics

15. Package outline

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

SOT27-1

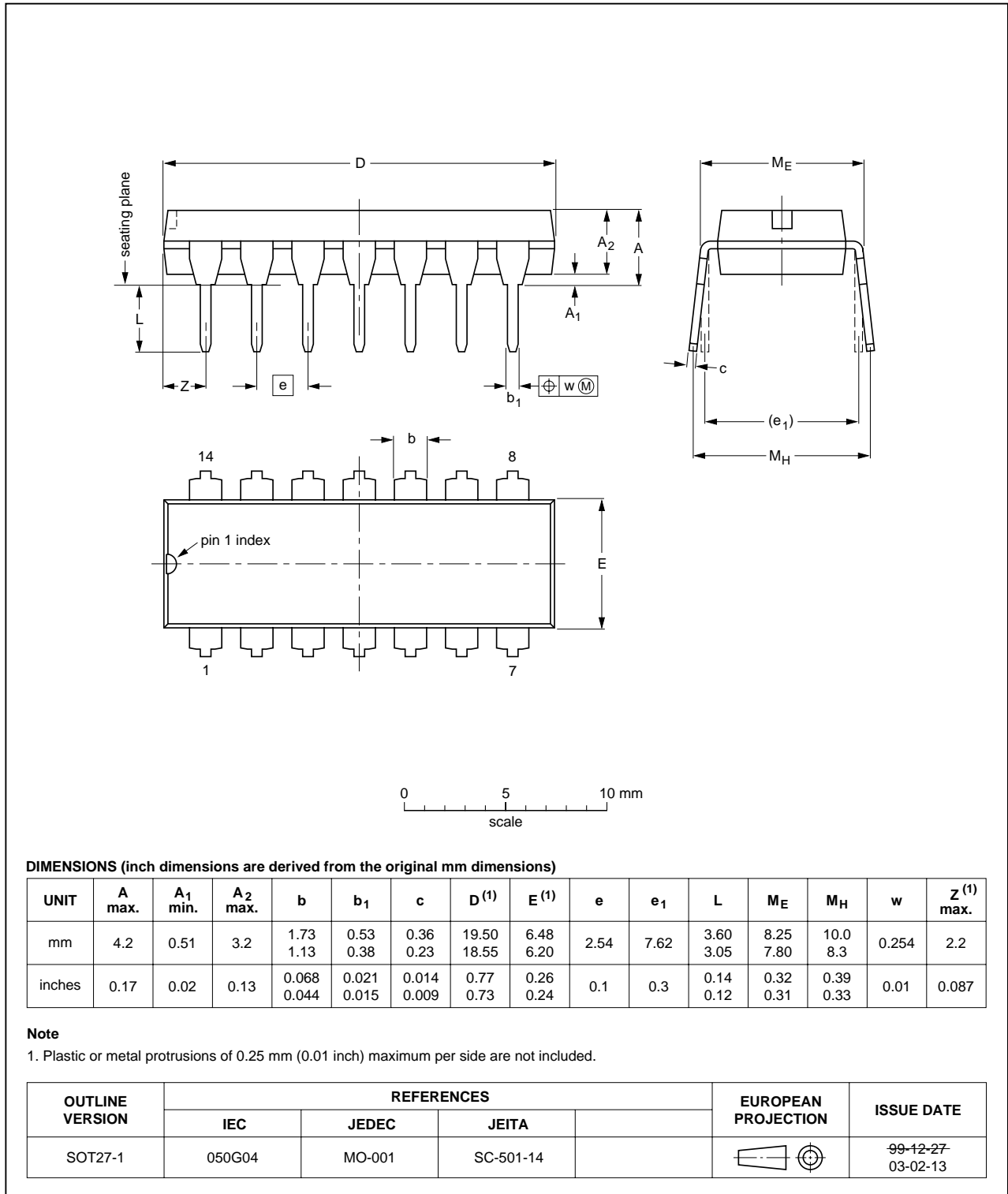


Fig 13. Package outline SOT27-1 (DIP14)

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

SOT108-1

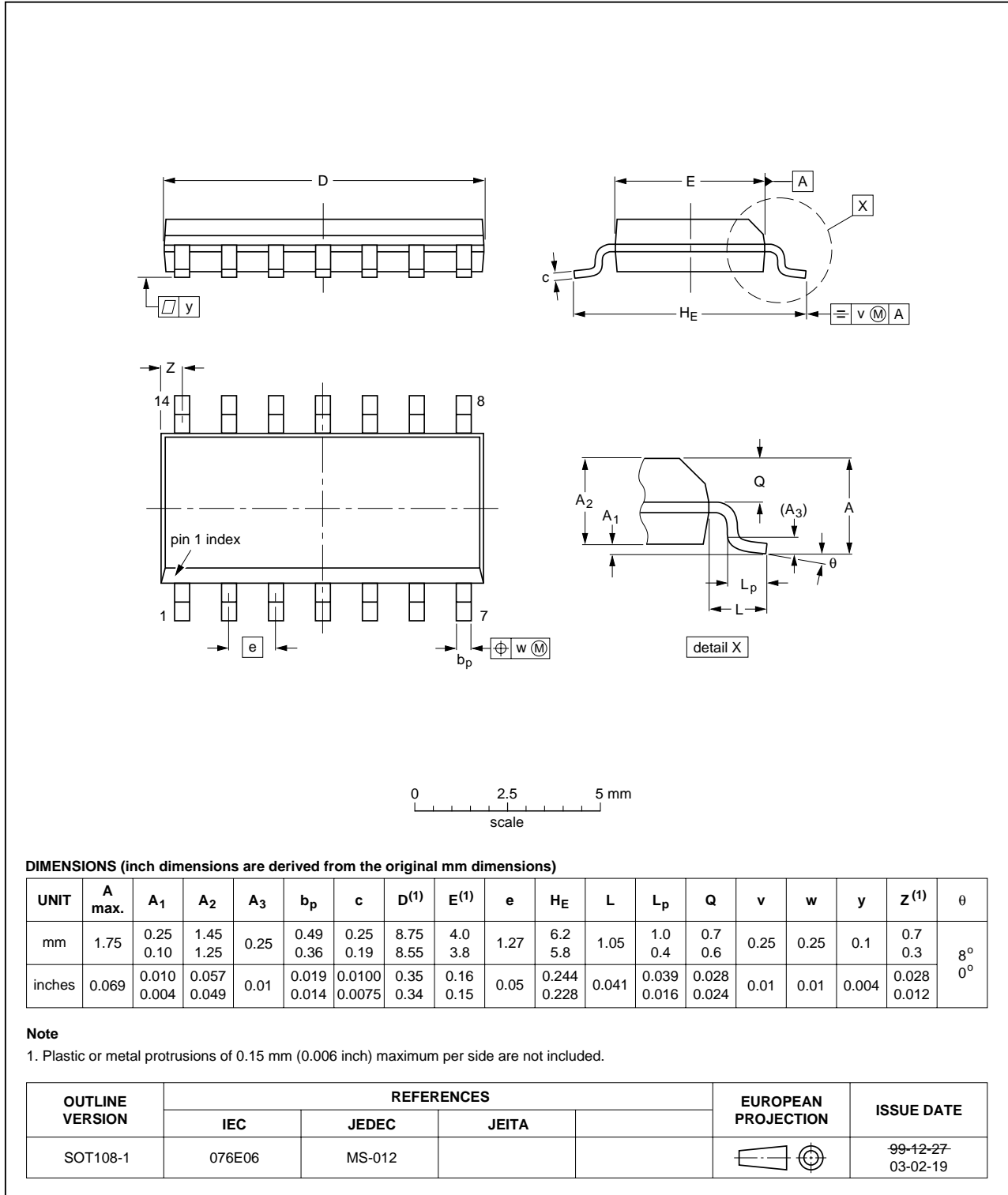


Fig 14. Package outline SOT108-1 (SO14)

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

SOT337-1

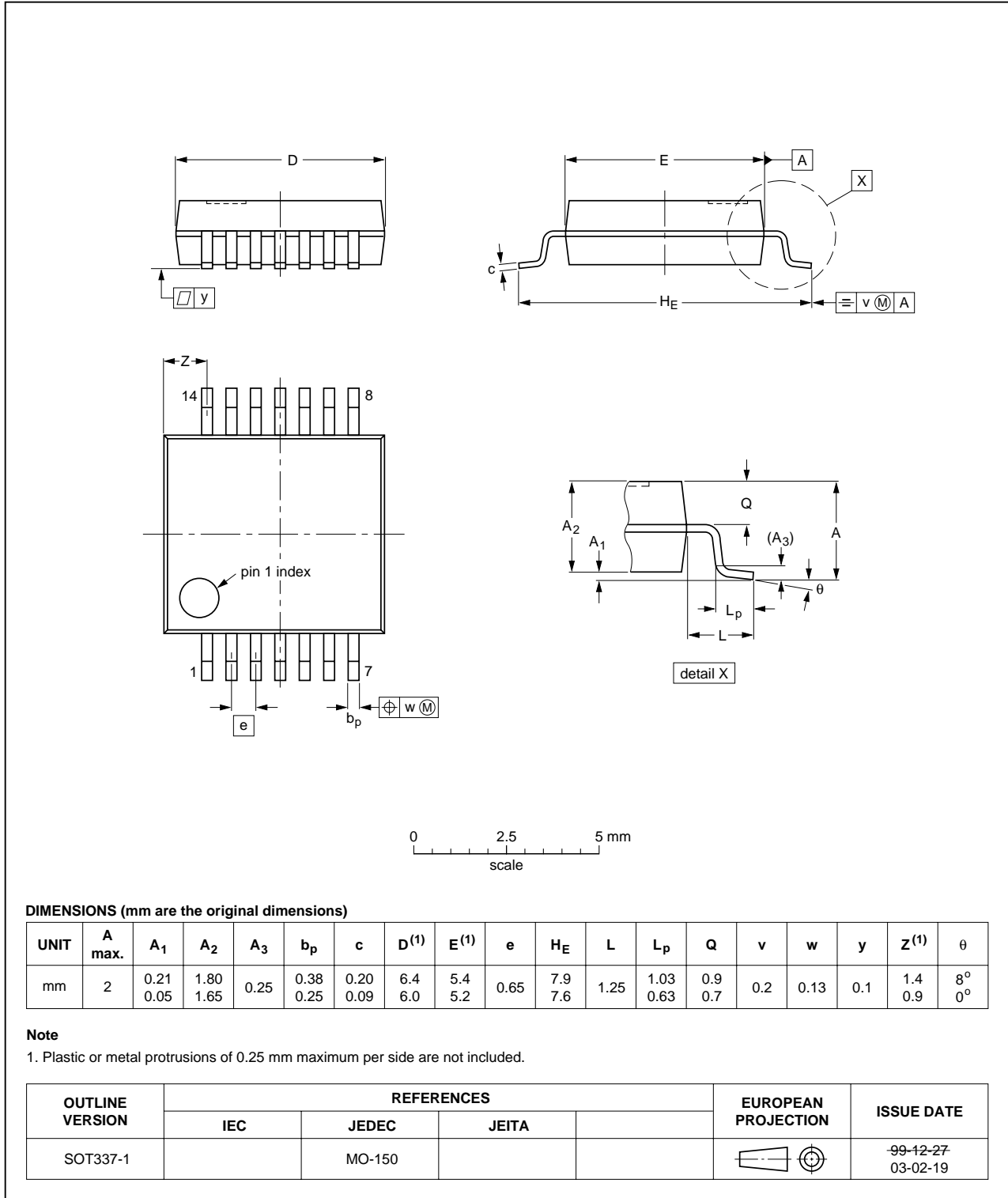


Fig 15. Package outline SOT337-1 (SSOP14)

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

SOT402-1

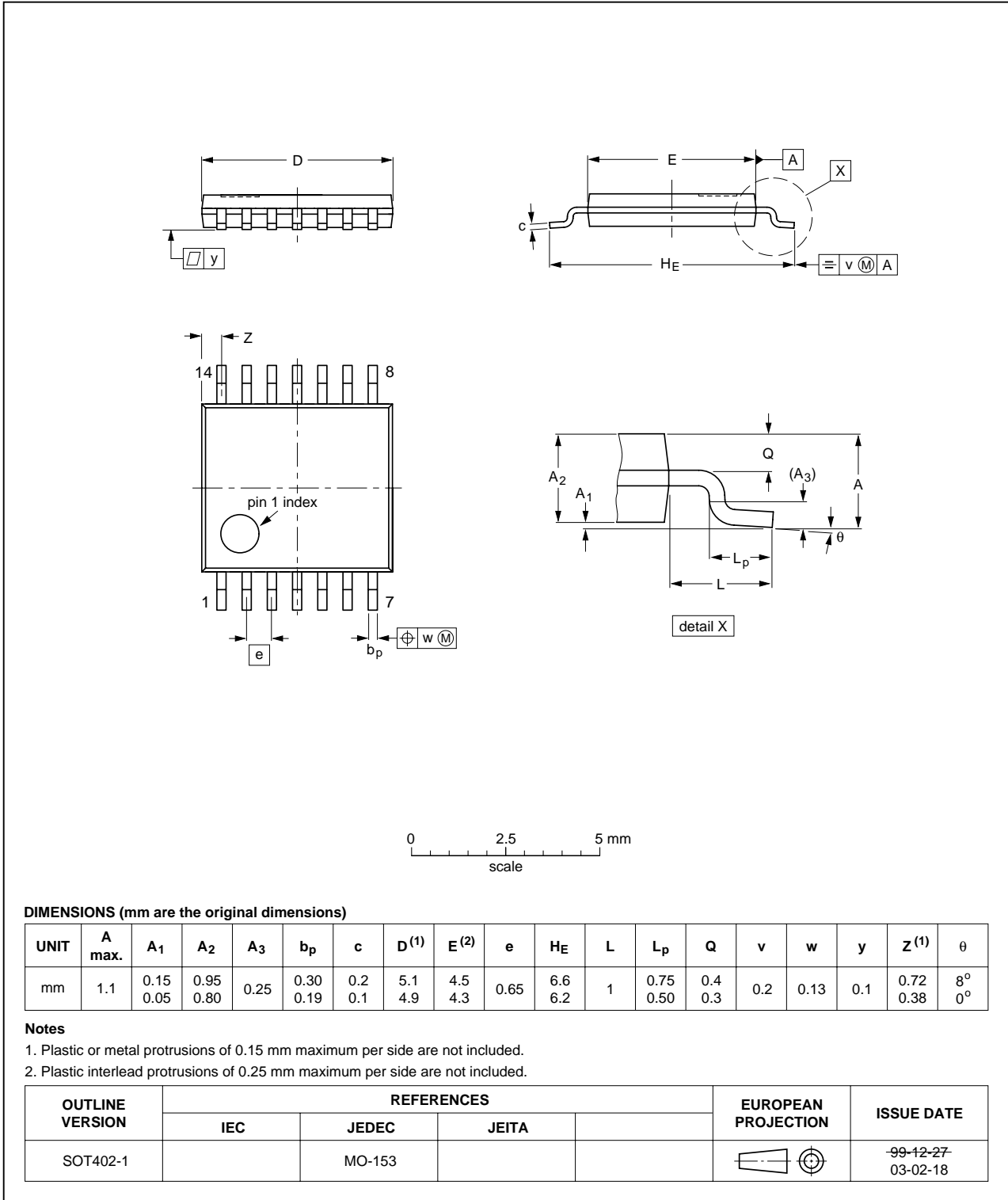


Fig 16. Package outline SOT402-1 (TSSOP14)

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

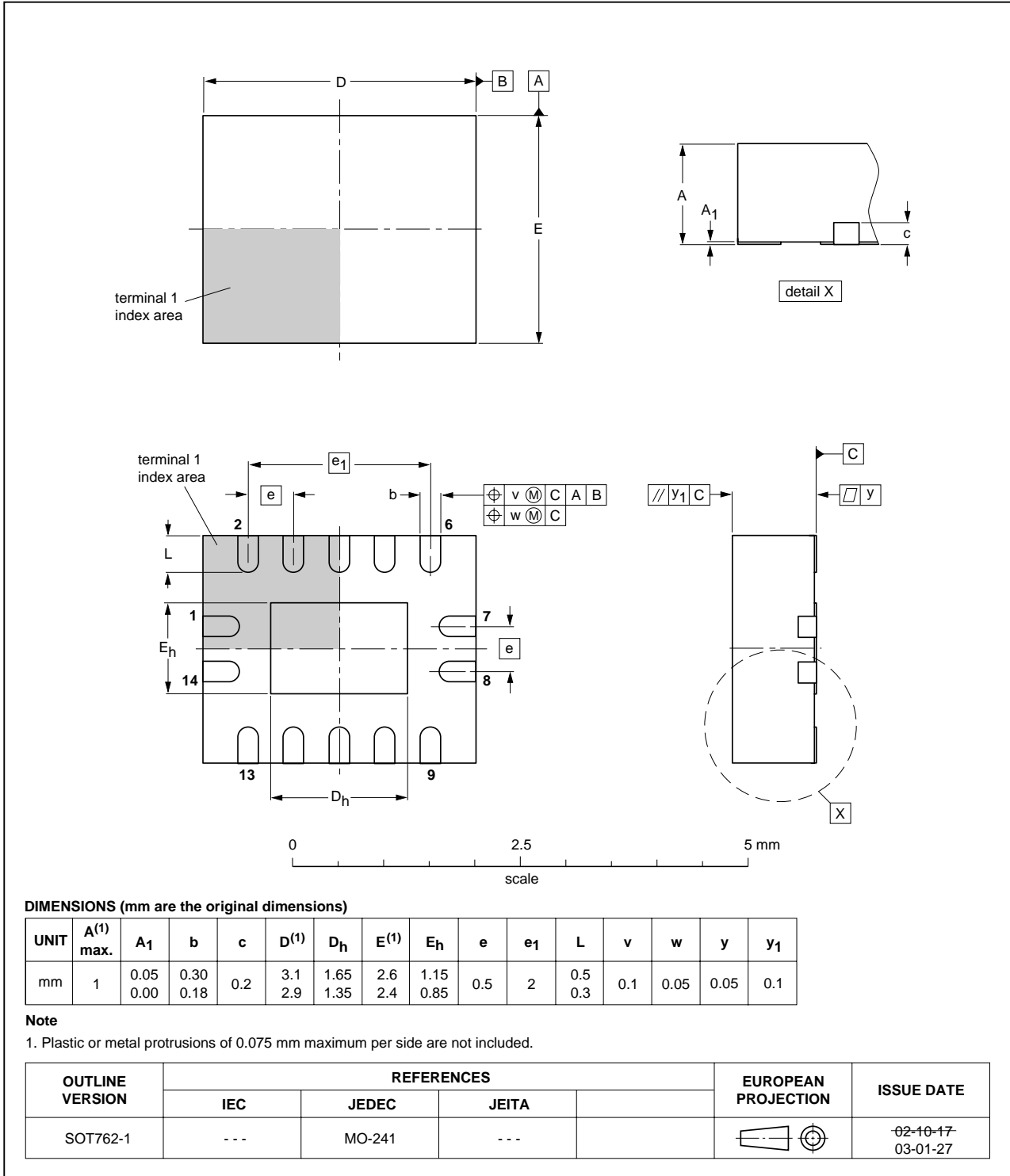


Fig 17. Package outline SOT762-1 (DHVQFN14)

## 16. Abbreviations

Table 11. 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

## 17. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV132_4	20071112	Product data sheet	-	74LV132_3
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 4</a>: DHVQFN14 package added.</li><li>• <a href="#">Section 9</a>: derating values added for DHVQFN14 package.</li><li>• <a href="#">Section 15</a>: outline drawing added for DHVQFN14 package.</li></ul>			
74LV132_3	20040415	Product specification	-	74LV132_2
74LV132_2	19980428	Product specification	-	74LV132_1
74LV132_1	19970204	Product specification	-	-

## 18. Legal information

### 18.1 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.
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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