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Kind regards,

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74LV86

Quad 2-input exclusive-OR gate

Rev. 03 — 27 November 2007

Product data sheet

1. General description

The 74LV86 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC86 and 74HCT86.

The 74LV86 provides a quad 2-input exclusive-OR function.

2. Features

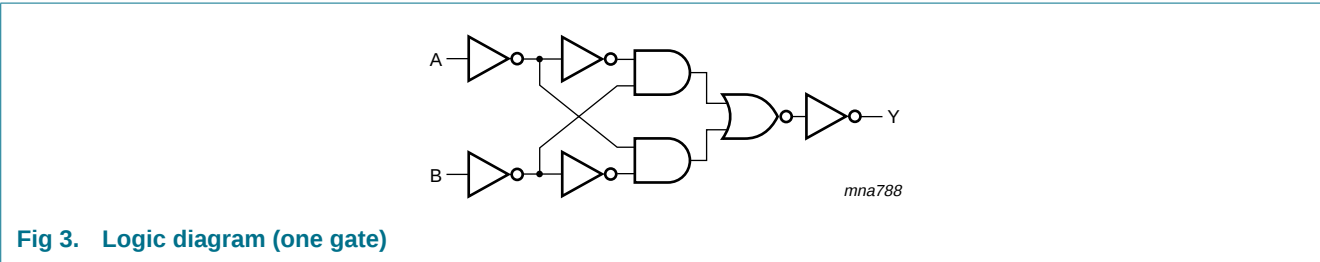
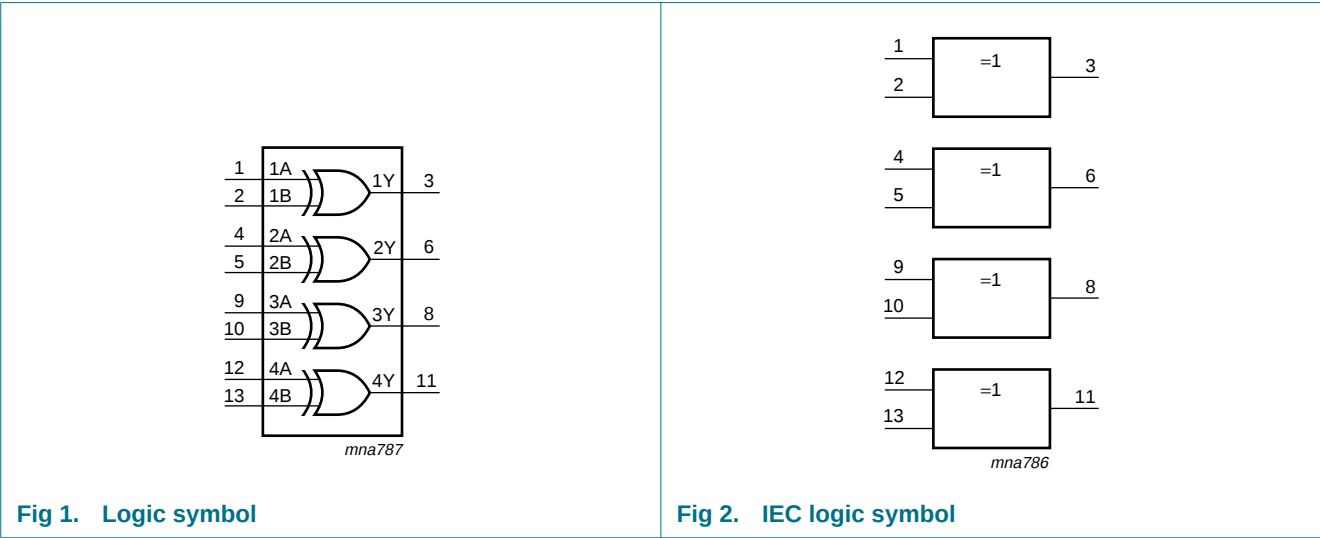
- Wide operating voltage: 1.0 V to 5.5 V
- Optimized for low voltage applications: 1.0 V to 3.6 V
- Accepts TTL input levels between $V_{CC} = 2.7$ V and $V_{CC} = 3.6$ V
- Typical output ground bounce < 0.8 V at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C
- Typical HIGH-level output voltage (V_{OH}) undershoot: > 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

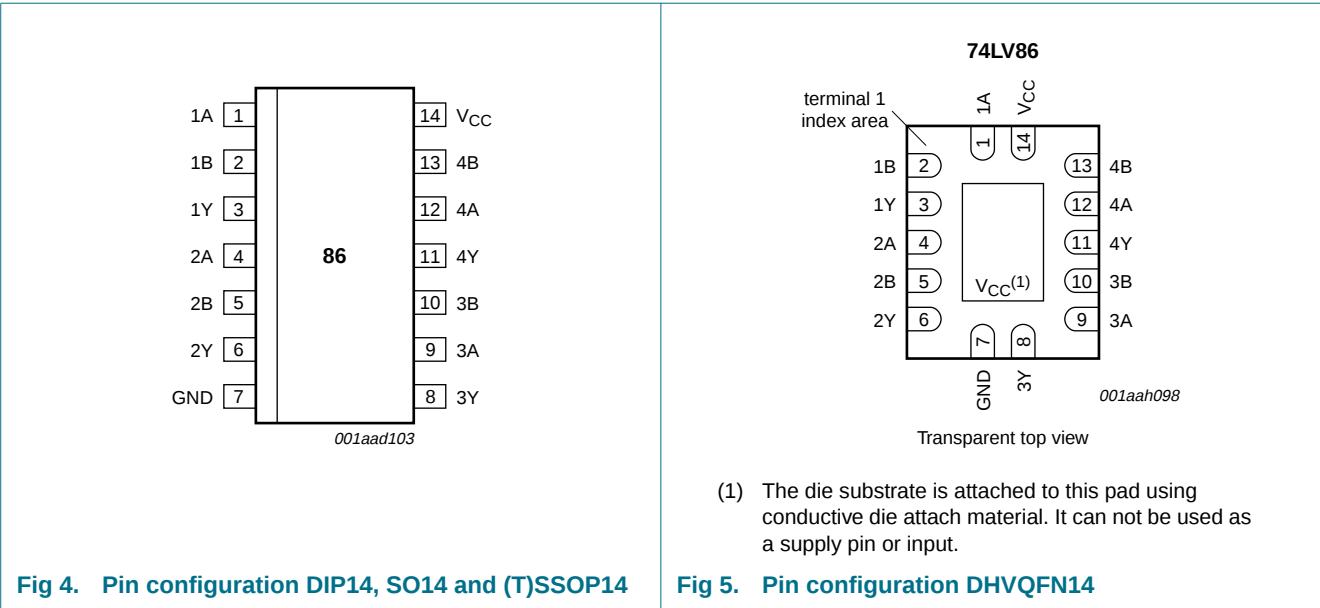
Type number	Package			
	Temperature range	Name	Description	Version
74LV86N	-40 °C to $+125$ °C	DIP14	plastic dual in-line package; 14 leads (300 mil)	SOT27-1
74LV86D	-40 °C to $+125$ °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LV86DB	-40 °C to $+125$ °C	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LV86PW	-40 °C to $+125$ °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74LV86BQ	-40 °C to $+125$ °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body $2.5 \times 3 \times 0.85$ 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 _{CC}	14	supply voltage

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level

Input		Output
nA	nB	nY
L	L	L
L	H	H
H	L	H
H	H	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 _{CC}	supply voltage		-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V or V _I > V _{CC} + 0.5 V	[1] -	±20	mA
I _{OK}	output clamping current	V _O < -0.5 V or V _O > V _{CC} + 0.5 V	[1] -	±50	mA
I _O	output current	V _O = -0.5 V to (V _{CC} + 0.5 V)	-	±25	mA
I _{CC}	supply current		-	50	mA
I _{GND}	ground current		-50	-	mA
T _{stg}	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_{tot}	total power dissipation	$T_{\text{amb}} = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$			
	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 $70\text{ }^{\circ}\text{C}$.

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

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

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

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_{CC}	supply voltage [1]		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	$^{\circ}\text{C}$
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{\text{CC}} = 1.0\text{ V}$ to 2.0 V	-	-	500	ns/V
		$V_{\text{CC}} = 2.0\text{ V}$ to 2.7 V	-	-	200	ns/V
		$V_{\text{CC}} = 2.7\text{ V}$ to 3.6 V	-	-	100	ns/V
		$V_{\text{CC}} = 3.6\text{ V}$ to 5.5 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_{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 ^[1]	Max	Min	Max	
V _{IH}	HIGH-level input voltage	V _{CC} = 1.2 V	0.9	-	-	0.9	-	V
		V _{CC} = 2.0 V	1.4	-	-	1.4	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
		V _{CC} = 4.5 V to 5.5 V	0.7V _{CC}	-	-	0.7V _{CC}	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.2 V	-	-	0.3	-	0.3	V
		V _{CC} = 2.0 V	-	-	0.6	-	0.6	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
		V _{CC} = 4.5 V to 5.5 V	-	-	0.3V _{CC}	-	0.3V _{CC}	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = –100 µA; V _{CC} = 1.2 V	-	1.2	-	-	-	V
		I _O = –100 µA; V _{CC} = 2.0 V	1.8	2.0	-	1.8	-	V
		I _O = –100 µA; V _{CC} = 2.7 V	2.5	2.7	-	2.5	-	V
		I _O = –100 µA; V _{CC} = 3.0 V	2.8	3.0	-	2.8	-	V
		I _O = –100 µA; 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 µA; V _{CC} = 1.2 V	-	0	-	-	-	V
		I _O = 100 µA; V _{CC} = 2.0 V	-	0	0.2	-	0.2	V
		I _O = 100 µA; V _{CC} = 2.7 V	-	0	0.2	-	0.2	V
		I _O = 100 µA; V _{CC} = 3.0 V	-	0	0.2	-	0.2	V
		I _O = 100 µA; 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	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	20.0	-	40	µA
ΔI _{CC}	additional supply current	per input; V _I = V _{CC} – 0.6 V; V _{CC} = 2.7 V to 3.6 V	-	-	500	-	850	µA
C _I	input capacitance		-	3.5	-	-	-	pF

[1] Typical values are measured at T_{amb} = 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 ^[1]	Max	Min	Max	
t _{pd}	propagation delay	nA, nB to nY; see Figure 6 ^[2]						
		V _{CC} = 1.2 V	-	70	-	-	-	ns
		V _{CC} = 2.0 V	-	24	32	-	41	ns
		V _{CC} = 2.7 V	-	18	24	-	30	ns
		V _{CC} = 3.0 V to 3.6 V; C _L = 15 pF ^[3]	-	11	-	-	-	ns
		V _{CC} = 3.0 V to 3.6 V ^[3]	-	13	19	-	24	ns
		V _{CC} = 4.5 V to 5.5 V	-	-	16	-	20	ns
C _{PD}	power dissipation capacitance	C _L = 50 pF; f _i = 1 MHz; V _i = GND to V _{CC} ^[4]	-	30	-	-	-	pF

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

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] Typical values are measured at nominal supply voltage (V_{CC} = 3.3 V).

[4] C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = input frequency in MHz, f_o = output frequency in MHz

C_L = output load capacitance in pF

V_{CC} = 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

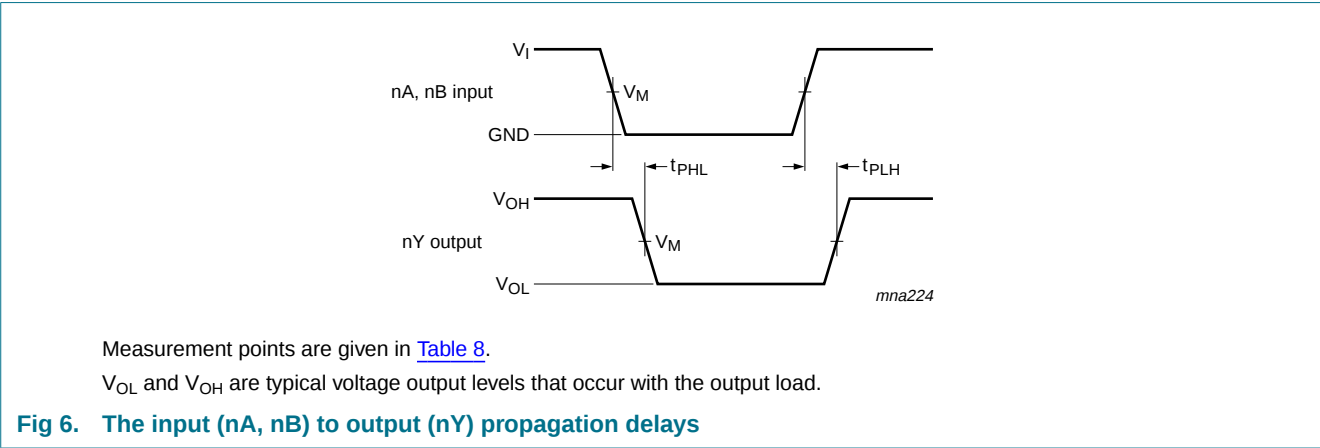


Table 8. Measurement points

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
≥ 4.5 V	$0.5V_{CC}$	$0.5V_{CC}$

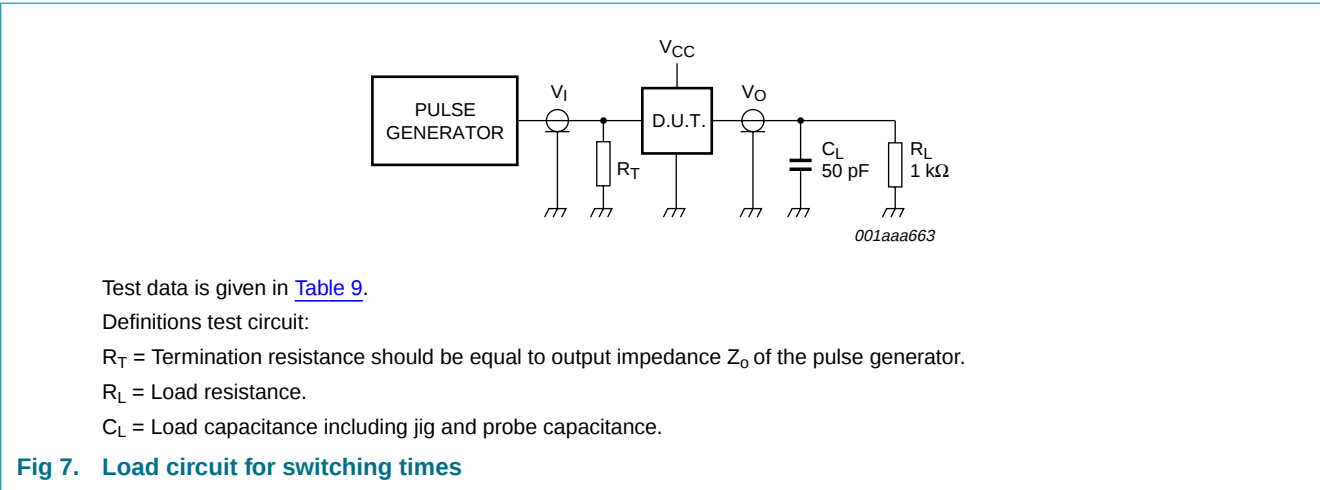


Table 9. Test data

Supply voltage V_{CC}	Input V_i	t_r, t_f
< 2.7 V	V_{CC}	≤ 2.5 ns
2.7 V to 3.6 V	2.7 V	≤ 2.5 ns
≥ 4.5 V	V_{CC}	≤ 2.5 ns

12. Package outline

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

SOT27-1

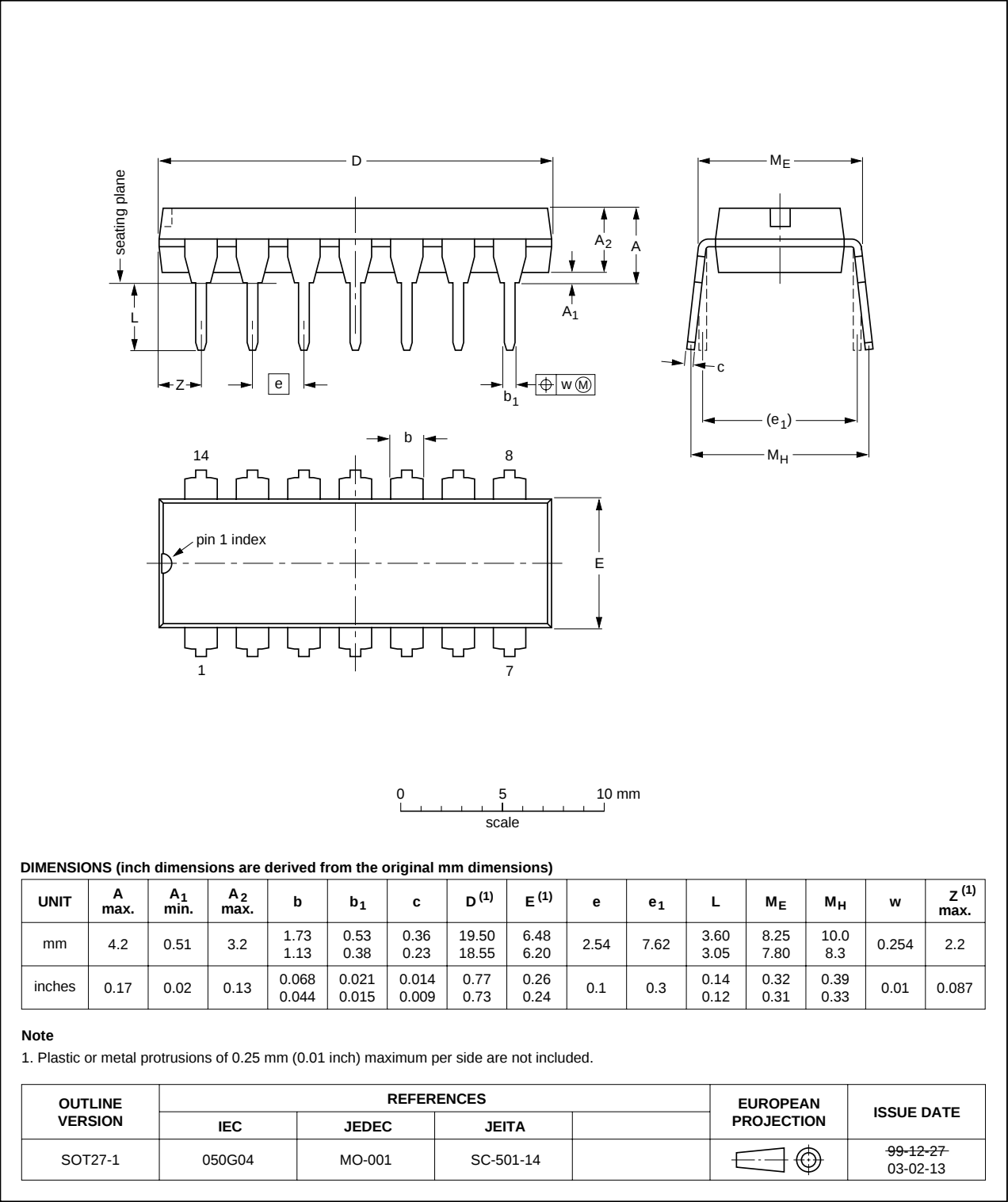


Fig 8. Package outline SOT27-1 (DIP14)

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

SOT108-1

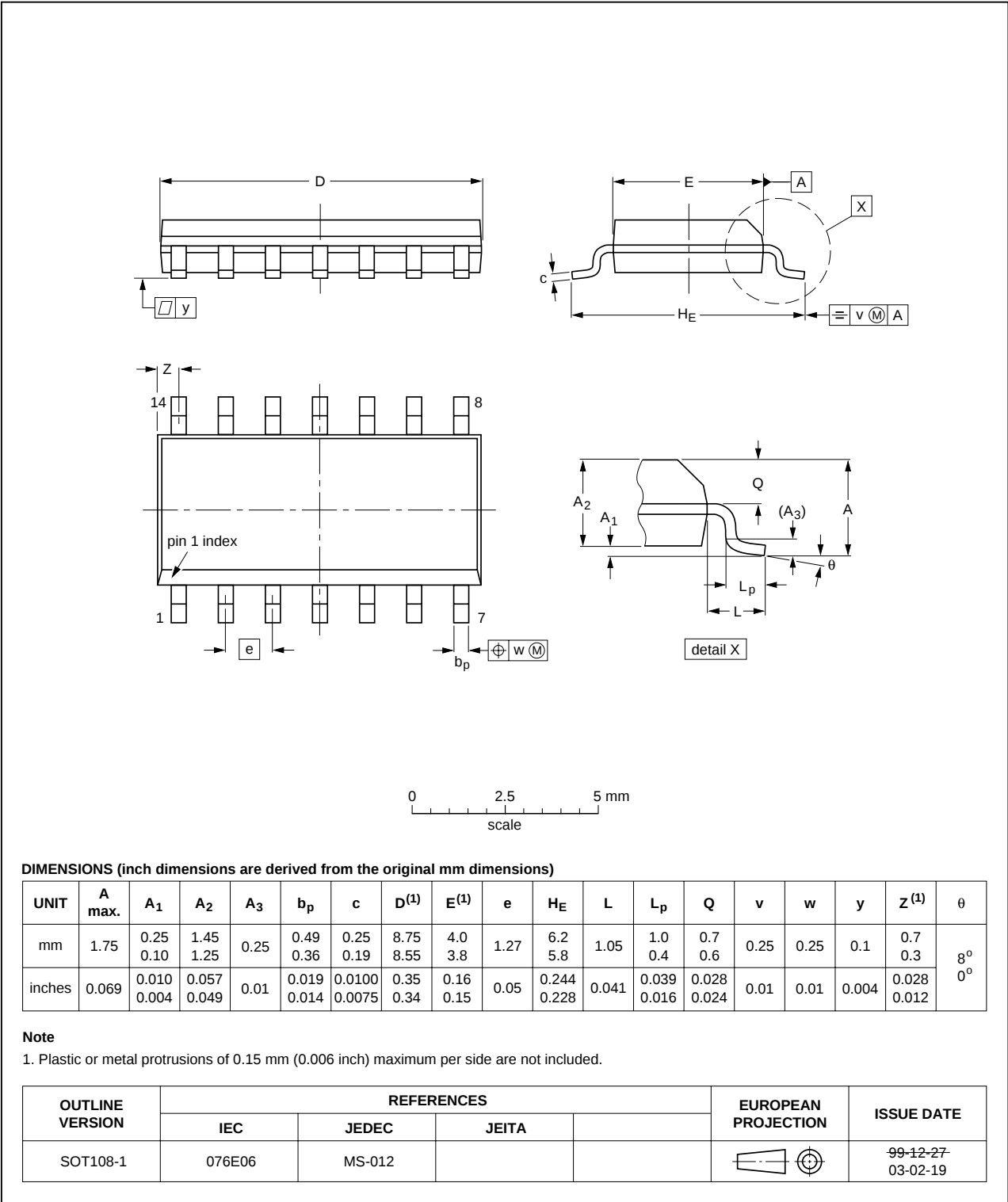


Fig 9. Package outline SOT108-1 (SO14)

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

SOT337-1

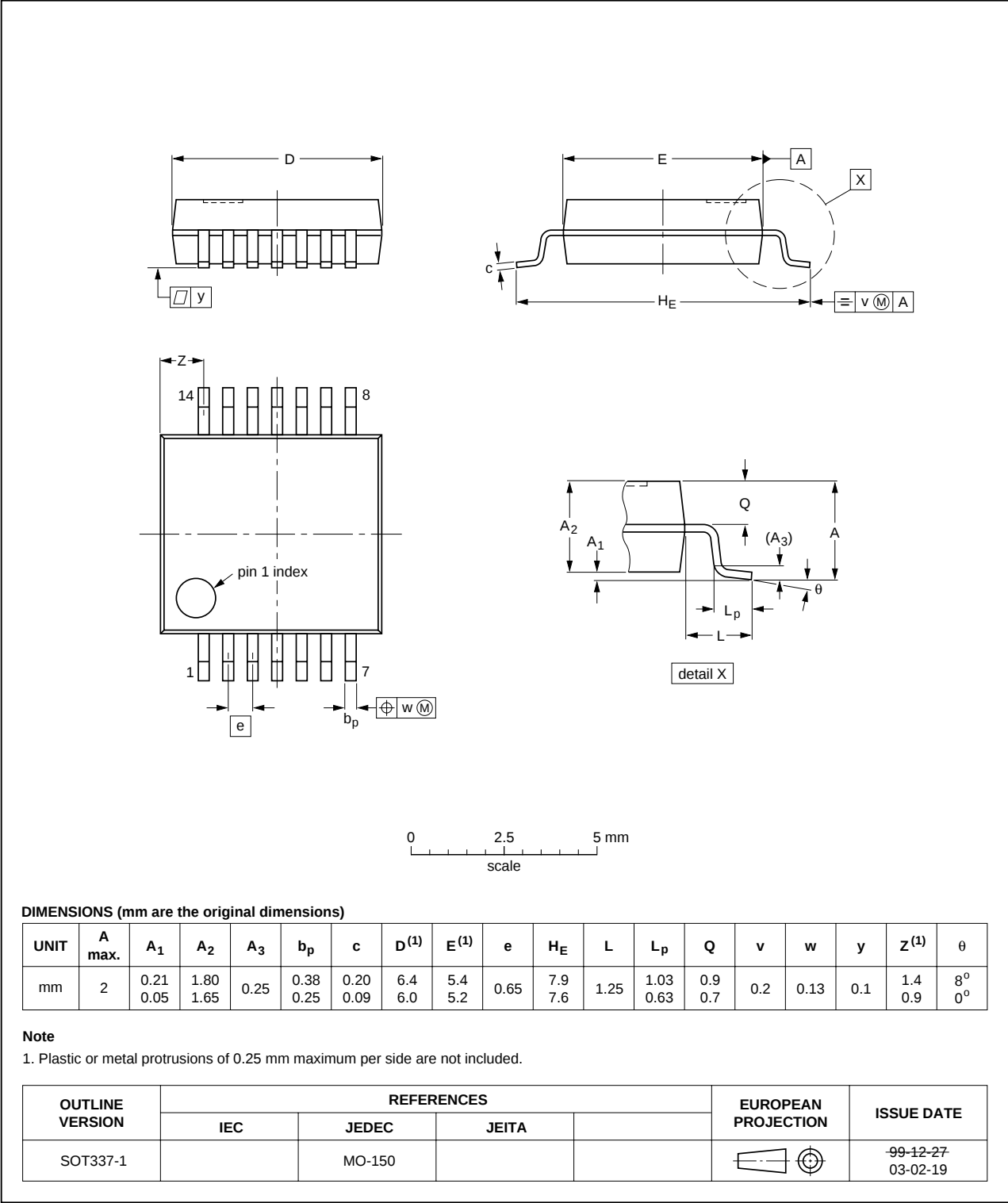


Fig 10. Package outline SOT337-1 (SSOP14)

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

SOT402-1

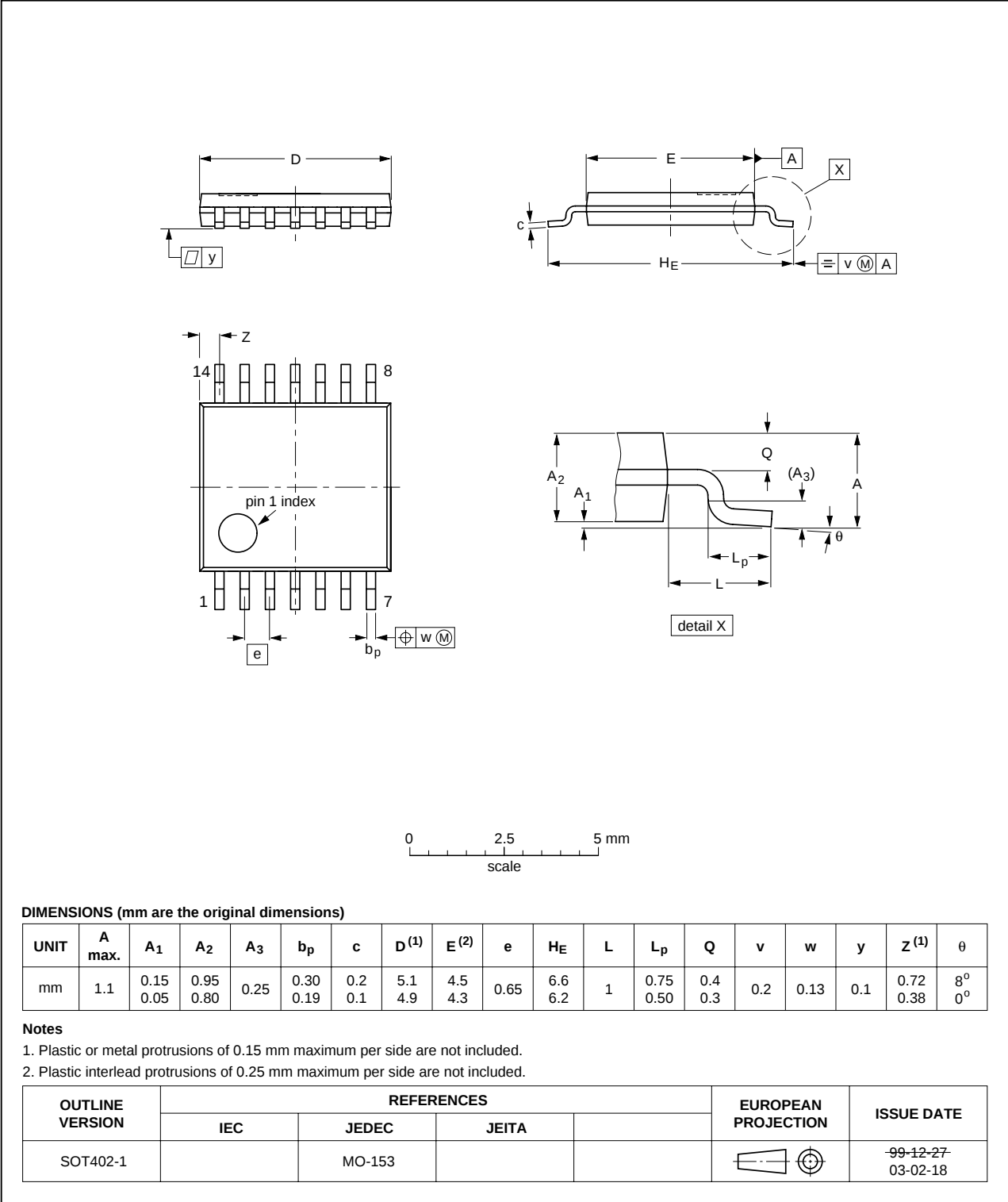


Fig 11. Package outline SOT402-1 (TSSOP14)

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

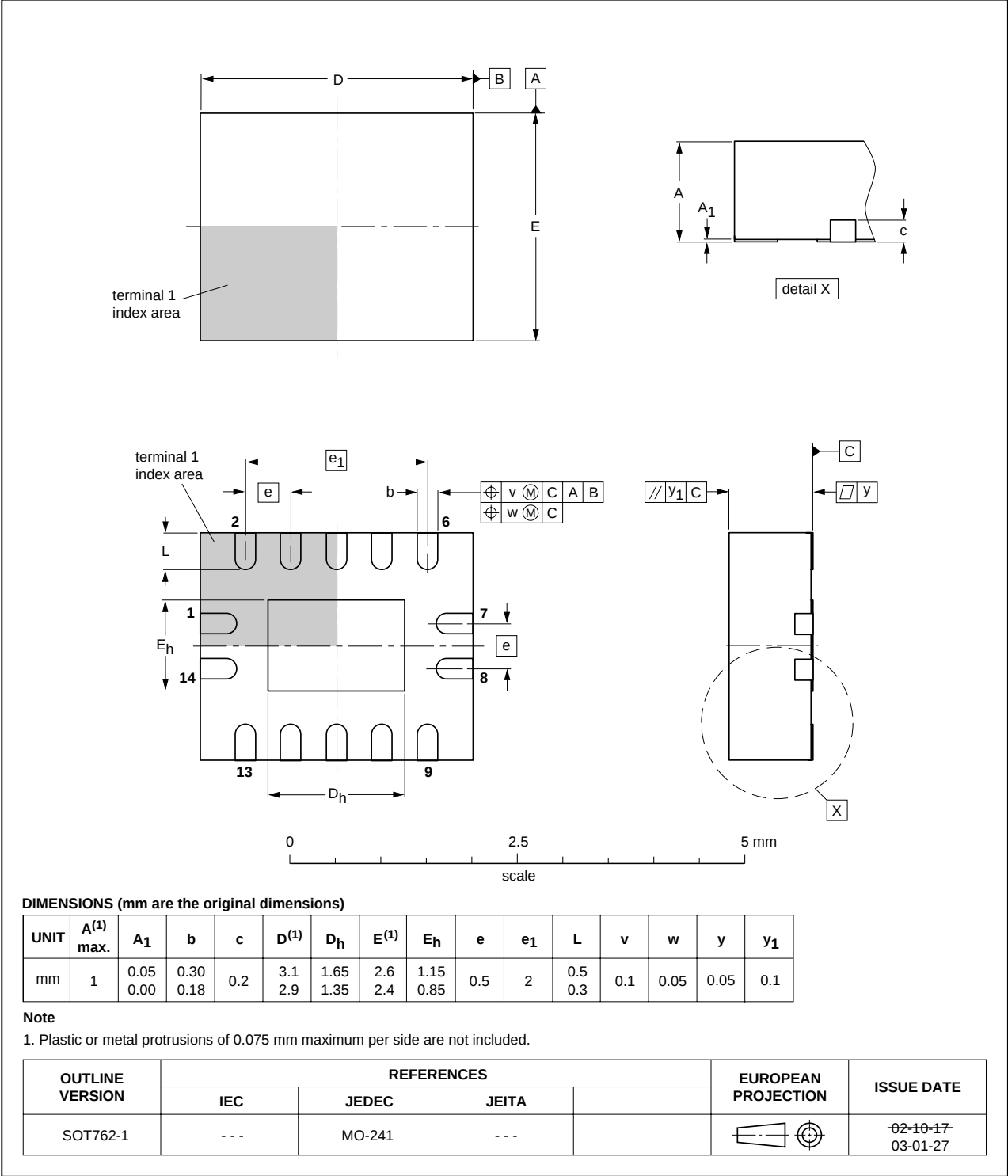


Fig 12. Package outline SOT762-1 (DHVQFN14)

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
74LV86_3	20071127	Product data sheet	-	74LV86_2
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Section 3: DHVQFN14 package added. • Section 8: derating values added for DHVQFN14 package. • Section 12: outline drawing added for DHVQFN14 package.			
74LV86_2	19980420	Product specification	-	74LV86_1
74LV86_1	19970203	Product specification	-	-

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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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