

# 74LV08

## Quad 2-input AND gate

Rev. 4 — 8 December 2015

Product data sheet

### 1. General description

The 74LV08 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC08 and 74HCT08.

The 74LV08 provides a quad 2-input AND function.

### 2. Features and benefits

- 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-A114F 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
74LV08D	SO14	$-40$ °C to $+125$ °C		plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74LV08DB	SSOP14	$-40$ °C to $+125$ °C		plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1
74LV08PW	TSSOP14	$-40$ °C to $+125$ °C		plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1

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## 4. Functional diagram

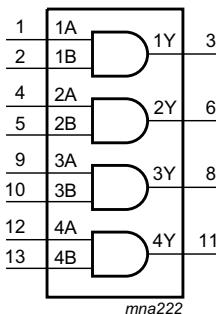


Fig 1. Logic symbol

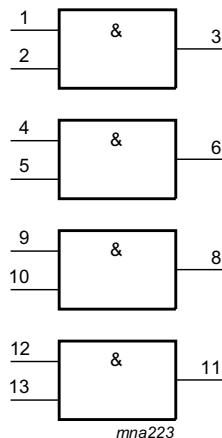


Fig 2. IEC logic symbol

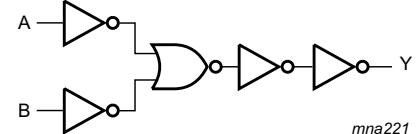


Fig 3. Logic diagram (one gate)

## 5. Pinning information

### 5.1 Pinning

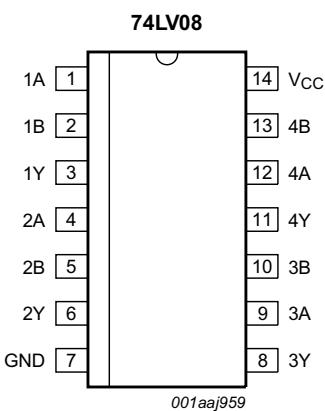


Fig 4. Pin configuration SO14

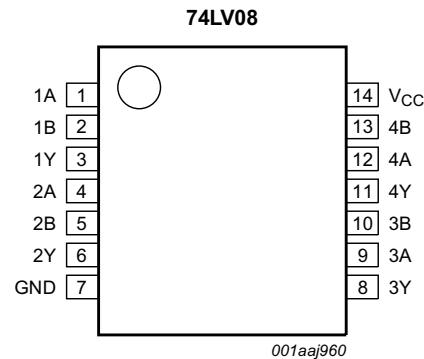


Fig 5. Pin configuration (T)SSOP14

## 5.2 Pin description

Table 2. Pin description

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

## 6. Functional description

Table 3. Function selection<sup>[1]</sup>

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

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

## 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
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	[2]		
		SO14, SSOP14, TSSOP14	-	500	mW

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

[2] For SO14 packages: above 70 °C the value of P<sub>tot</sub> derates linearly with 8 mW/K.

For (T)SSOP14 packages: above 60 °C the value of P<sub>tot</sub> derates linearly with 5.5 mW/K.

## 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 <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
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.0 \text{ V to } 2.0 \text{ V}$	-	-	500	ns/V
		$V_{CC} = 2.0 \text{ V to } 2.7 \text{ V}$	-	-	200	ns/V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	-	-	100	ns/V
		$V_{CC} = 3.6 \text{ V to } 5.5 \text{ V}$	-	-	50	ns/V

[1] The static characteristics are guaranteed from  $V_{CC} = 1.2 \text{ V to } V_{CC} = 5.5 \text{ V}$ , but LV devices are guaranteed to function down to  $V_{CC} = 1.0 \text{ V}$  (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			Unit
			Min	Typ <sup>[1]</sup>	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.2 \text{ V}$	0.9	-	-	V
		$V_{CC} = 2.0 \text{ V}$	1.4	-	-	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2.0	-	-	V
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	$0.7V_{CC}$	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.2 \text{ V}$	-	-	0.3	V
		$V_{CC} = 2.0 \text{ V}$	-	-	0.6	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	-	-	0.8	V
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	$0.3V_{CC}$	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = -100 \mu\text{A}; V_{CC} = 1.2 \text{ V}$	-	1.2	-	V
		$I_O = -100 \mu\text{A}; V_{CC} = 2.0 \text{ V}$	1.8	2.0	-	V
		$I_O = -100 \mu\text{A}; V_{CC} = 2.7 \text{ V}$	2.5	2.7	-	V
		$I_O = -100 \mu\text{A}; V_{CC} = 3.0 \text{ V}$	2.8	3.0	-	V
		$I_O = -100 \mu\text{A}; V_{CC} = 4.5 \text{ V}$	4.3	4.5	-	V
		$I_O = -6 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.4	2.82	-	V
		$I_O = -12 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.6	4.2	-	V

**Table 6. Static characteristics ...continued**  
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>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 <a href="#">Figure 6</a> [2]						
		V <sub>CC</sub> = 1.2 V	-	45	-	-	-	ns
		V <sub>CC</sub> = 2.0 V	-	15	26	-	33	ns
		V <sub>CC</sub> = 2.7 V	-	11	17	-	21	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF [3]	-	7	-	-	-	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V [3]	-	9.0	15	-	19	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	11	-	14	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> [4]	-	10	-	-	-	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<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> × N + Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) where:

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

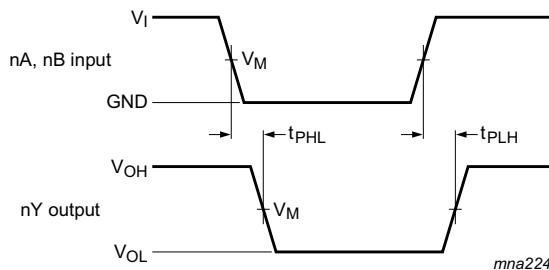
C<sub>L</sub> = output load capacitance in pF

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

N = number of inputs switching

Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

## 11. Waveforms



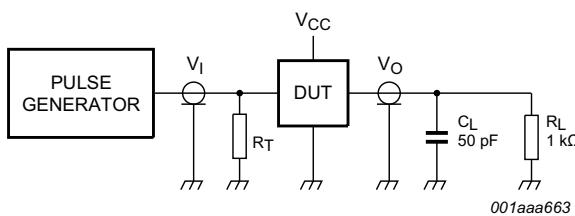
Measurement points are given in [Table 8](#).

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



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

Definitions test circuit:

$R_T$  = Termination resistance should be equal to output impedance  $Z_0$  of the pulse generator.

$R_L$  = Load resistance.

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

**Fig 7. Test circuit for measuring switching times**

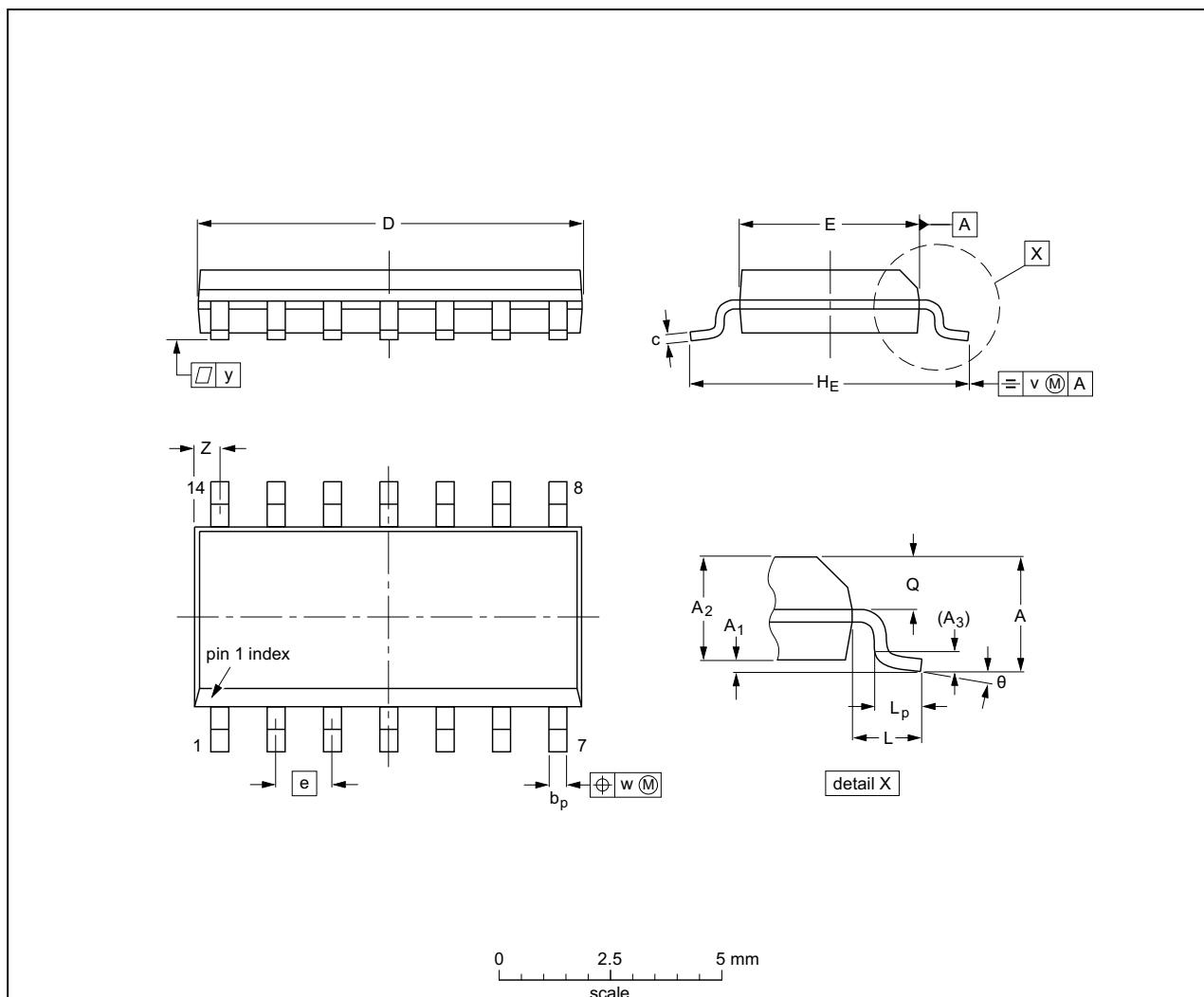
**Table 9. Test data**

Supply voltage	Input	
$V_{CC}$	$V_I$	$t_r, t_f$
< 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

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

SOT108-1



### DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.75 0.10	0.25 1.25	1.45	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069 0.004	0.010 0.049	0.057	0.01	0.019 0.014	0.0100 0.0075	0.35 0.34	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	0° 0°

### Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT108-1	076E06	MS-012				99-12-27 03-02-19

Fig 8. Package outline SOT108-1 (SO14)

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

SOT337-1

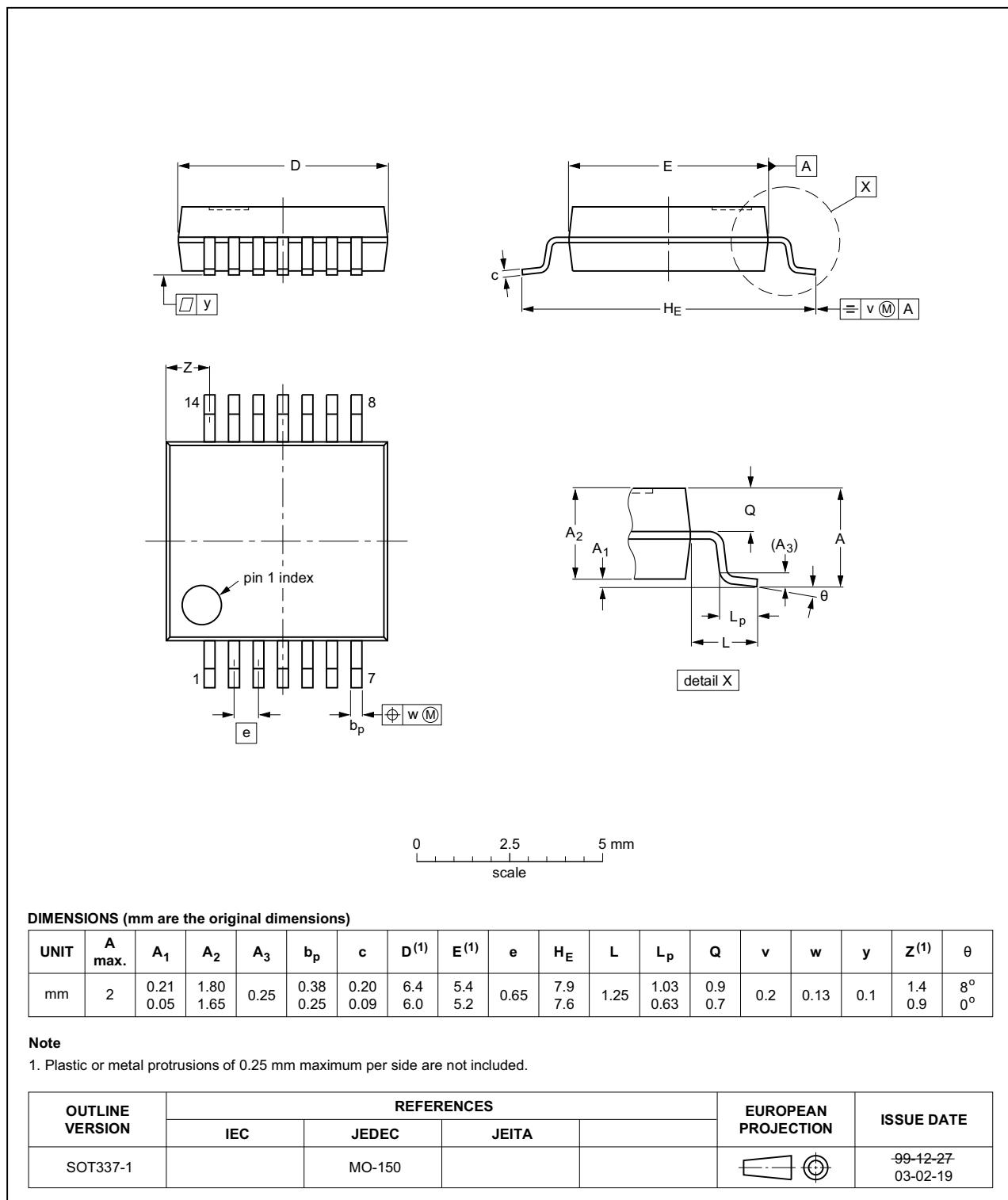


Fig 9. Package outline SOT337-1 (SSOP14)

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

SOT402-1

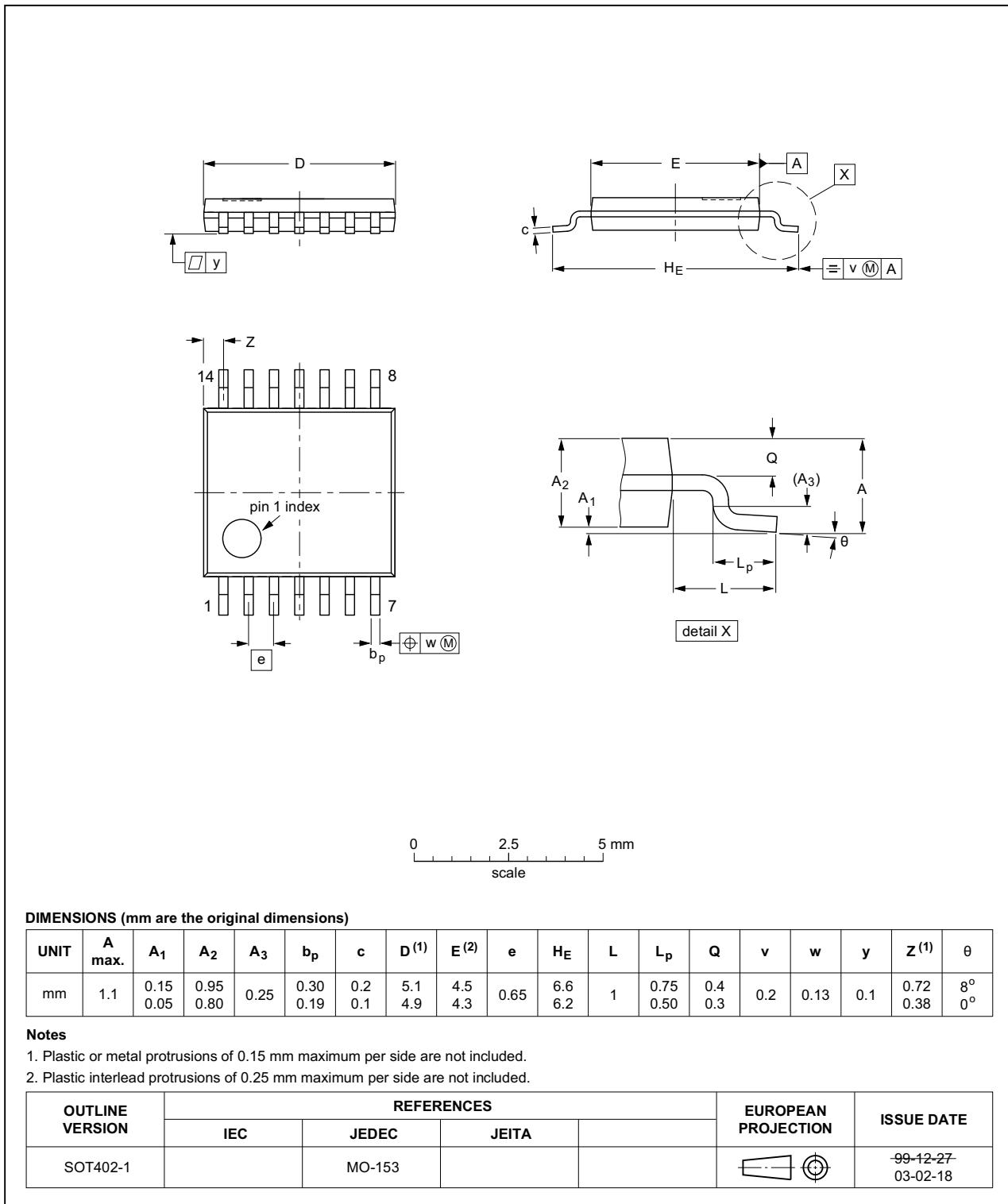


Fig 10. Package outline SOT402-1 (TSSOP14)

## 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
74LV08 v.4	20151208	Product data sheet	-	74LV08 v.3
Modifications:	<ul style="list-style-type: none"><li>• Type number 74LV08N (SOT27-1) removed.</li></ul>			
74LV08 v.3	20090406	Product data sheet	-	74LV08 v.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 when appropriate.</li></ul>			
74LV08 v.2	19980420	Product specification	-	74LV08 v.1
74LV08 v.1	19970203	Product specification	-	-

## 15. Legal information

### 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.
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".

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