

# 74HC30; 74HCT30

## 8-input NAND gate

Rev. 6 — 27 December 2012

Product data sheet

### 1. General description

The 74HC30; 74HCT30 is an 8-input NAND gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### 2. Features and benefits

- Complies with JEDEC standard JESD7A
- Input levels:
  - ◆ For 74HC30: CMOS level
  - ◆ For 74HCT30: TTL level
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$

### 3. Ordering information

Table 1. Ordering information

Type number	Package				Version
	Temperature range	Name	Description		
74HC30N	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	DIP14	plastic dual in-line package; 14 leads (300 mil)		SOT27-1
74HCT30N					
74HC30D	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	SO14	plastic small outline package; 14 leads; body width 3.9 mm		SOT108-1
74HCT30D					
74HC30DB	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm		SOT337-1
74HCT30DB					
74HC30PW	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm		SOT402-1
74HCT30PW					



#### 4. Functional diagram

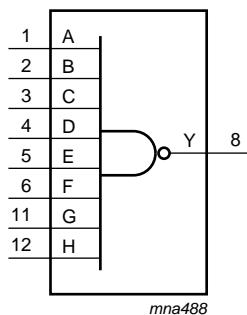


Fig 1. Logic symbol

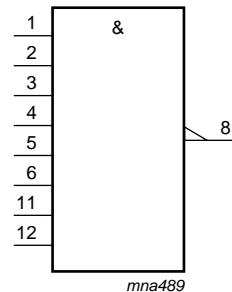


Fig 2. IEC logic symbol

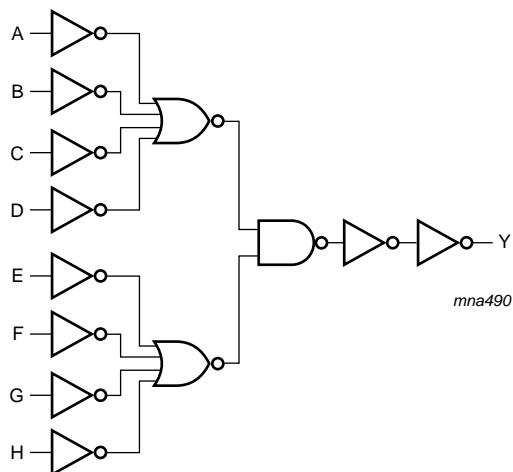


Fig 3. Logic diagram

## 5. Pinning information

### 5.1 Pinning

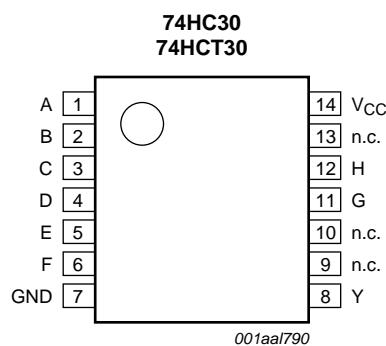


Fig 4. Pin configuration DIP14, SO14 and (T)SSOP14

### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
A	1	data input
B	2	data input
C	3	data input
D	4	data input
E	5	data input
F	6	data input
GND	7	ground (0 V)
Y	8	data output
n.c.	9	not connected
n.c.	10	not connected
G	11	data input
H	12	data input
n.c.	13	not connected
VCC	14	supply voltage

## 6. Functional description

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

Input								Output
A	B	C	D	E	F	G	H	Y
L	X	X	X	X	X	X	X	H
X	L	X	X	X	X	X	X	H
X	X	L	X	X	X	X	X	H
X	X	X	L	X	X	X	X	H
X	X	X	X	L	X	X	X	H
X	X	X	X	X	L	X	X	H
X	X	X	X	X	X	L	X	H
X	X	X	X	X	X	X	L	H
H	H	H	H	H	H	H	H	L

[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
$V_{CC}$	supply voltage		-0.5	+7	V
$I_{IK}$	input clamping current	$V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$	<sup>[1]</sup> -	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5 \text{ V}$ or $V_O > V_{CC} + 0.5 \text{ V}$	<sup>[1]</sup> -	$\pm 20$	mA
$I_O$	output current	$-0.5 \text{ V} < V_O < V_{CC} + 0.5 \text{ V}$	-	$\pm 25$	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				
	DIP14 package		<sup>[2]</sup> -	750	mW
	SO14, (T)SSOP14 packages		<sup>[2]</sup> -	500	mW

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

[2] For DIP14 package:  $P_{tot}$  derates linearly with 12 mW/K above 70 °C.

For SO14 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

For (T)SSOP14 packages:  $P_{tot}$  derates linearly with 5.5 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	74HC30			74HCT30			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	ns/V

## 9. Static characteristics

**Table 6. Static characteristics**

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

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HC30</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	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> = −20 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = −20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = −20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I <sub>O</sub> = −4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I <sub>O</sub> = −5.2 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	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> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1	-	±1	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> = 6.0 V	-	-	2.0	-	20	-	40	μA

**Table 6. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$C_I$	input capacitance		-	3.5	-	-	-	-	-	pF
<b>74HCT30</b>										
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	1.6	-	2.0	-	2.0	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	1.2	0.8	-	0.8	-	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5 \text{ V}$								
		$I_O = -20 \mu\text{A}$	4.4	4.5	-	4.4	-	4.4	-	V
$V_{OL}$	LOW-level output voltage	$I_O = -4.0 \text{ mA}$	3.98	4.32	-	3.84	-	3.7	-	V
		$I_O = 20 \mu\text{A}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}$	-	0.15	0.26	-	0.33	-	0.4	V
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	$\pm 0.1$	-	$\pm 1$	-	$\pm 1$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$ ; $V_{CC} = 5.5 \text{ V}$	-	-	2.0	-	20	-	40	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = V_{CC} - 2.4 \text{ V}$ ; $I_O = 0 \text{ A}$ ; other inputs at $V_{CC}$ or GND; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	60	216	-	275	-	294	$\mu\text{A}$
$C_I$	input capacitance		-	3.5	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics** $GND = 0 \text{ V}$ ;  $C_L = 50 \text{ pF}$ ; for load circuit see [Figure 6](#).

Symbol	Parameter	Conditions	25 °C			−40 °C to +125 °C		Unit
			Min	Typ	Max	Max (85 °C)	Max (125 °C)	
<b>74HC30</b>								
$t_{pd}$	propagation delay	A, B, C, D, E, F, G, H to Y; see <a href="#">Figure 5</a>	[1]					
		$V_{CC} = 2.0 \text{ V}$	-	41	130	165	195	ns
		$V_{CC} = 4.5 \text{ V}$	-	15	26	33	39	ns
		$V_{CC} = 5.0 \text{ V}$ ; $C_L = 15 \text{ pF}$	-	12	-	-	-	ns
		$V_{CC} = 6.0 \text{ V}$	-	12	22	28	33	ns
$t_t$	transition time	see <a href="#">Figure 5</a>	[2]					
		$V_{CC} = 2.0 \text{ V}$	-	19	75	95	110	ns
		$V_{CC} = 4.5 \text{ V}$	-	7	15	19	22	ns
		$V_{CC} = 6.0 \text{ V}$	-	6	13	16	19	ns

**Table 7. Dynamic characteristics ...continued**GND = 0 V;  $C_L$  = 50 pF; for load circuit see [Figure 6](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Max (85 °C)	Max (125 °C)	
$C_{PD}$	power dissipation capacitance	per package; $V_I$ = GND to $V_{CC}$	[3]	-	15	-	-	pF
<b>74HCT30</b>								
$t_{pd}$	propagation delay	A, B, C, D, E, F, G, H to Y; see <a href="#">Figure 5</a>	[1]					
		$V_{CC} = 4.5$ V		-	16	28	35	42
		$V_{CC} = 5.0$ V; $C_L = 15$ pF		-	12	-	-	ns
$t_t$	transition time	$V_{CC} = 4.5$ V; see <a href="#">Figure 5</a>	[2]	-	7	15	19	22
$C_{PD}$	power dissipation capacitance	per package; $V_I$ = GND to $V_{CC} - 1.5$ V	[3]	-	15	-	-	pF

[1]  $t_{pd}$  is the same as  $t_{PHL}$  and  $t_{PLH}$ .[2]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W):

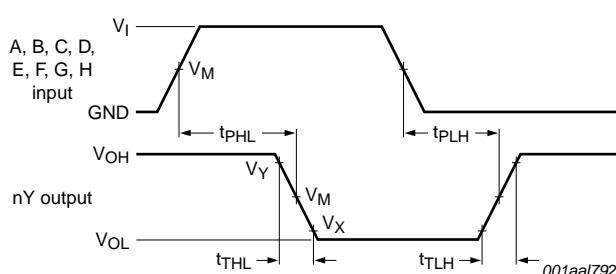
$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

 $f_i$  = input frequency in MHz; $f_o$  = output frequency in MHz; $C_L$  = output load capacitance in pF; $V_{CC}$  = supply voltage in V;

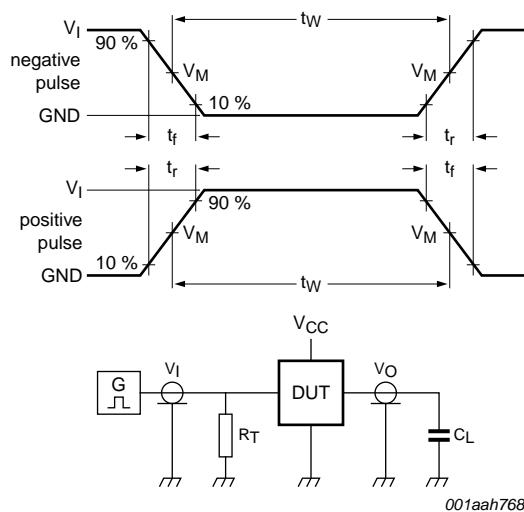
N = number of inputs switching;

 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of 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 5. Input to output propagation delays****Table 8. Measurement points**

Type	Input	Output		
		$V_M$	$V_M$	$V_X$
74HC30	0.5 $V_{CC}$	0.5 $V_{CC}$	0.1 $V_{CC}$	0.9 $V_{CC}$
74HCT30	1.3 V	1.3 V	0.1 $V_{CC}$	0.9 $V_{CC}$



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

Definitions for test circuit:

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

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

**Fig 6. Test circuit for measuring switching times**

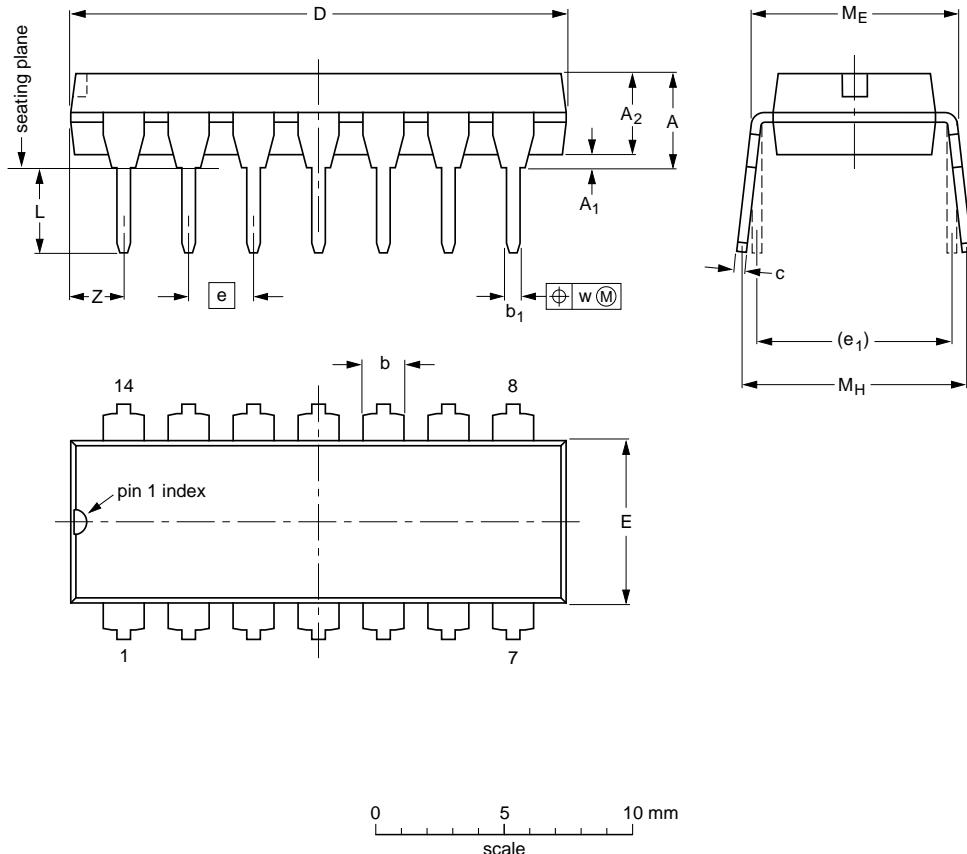
**Table 9. Test data**

Type	Input		Load	Test
	$V_I$	$t_r, t_f$		
74HC30	$V_{CC}$	6.0 ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$
74HCT30	3.0 V	6.0 ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$

## 12. Package outline

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

SOT27-1



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

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.13	0.53 0.38	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.2
inches	0.17	0.02	0.13	0.068 0.044	0.021 0.015	0.014 0.009	0.77 0.73	0.26 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.087

### Note

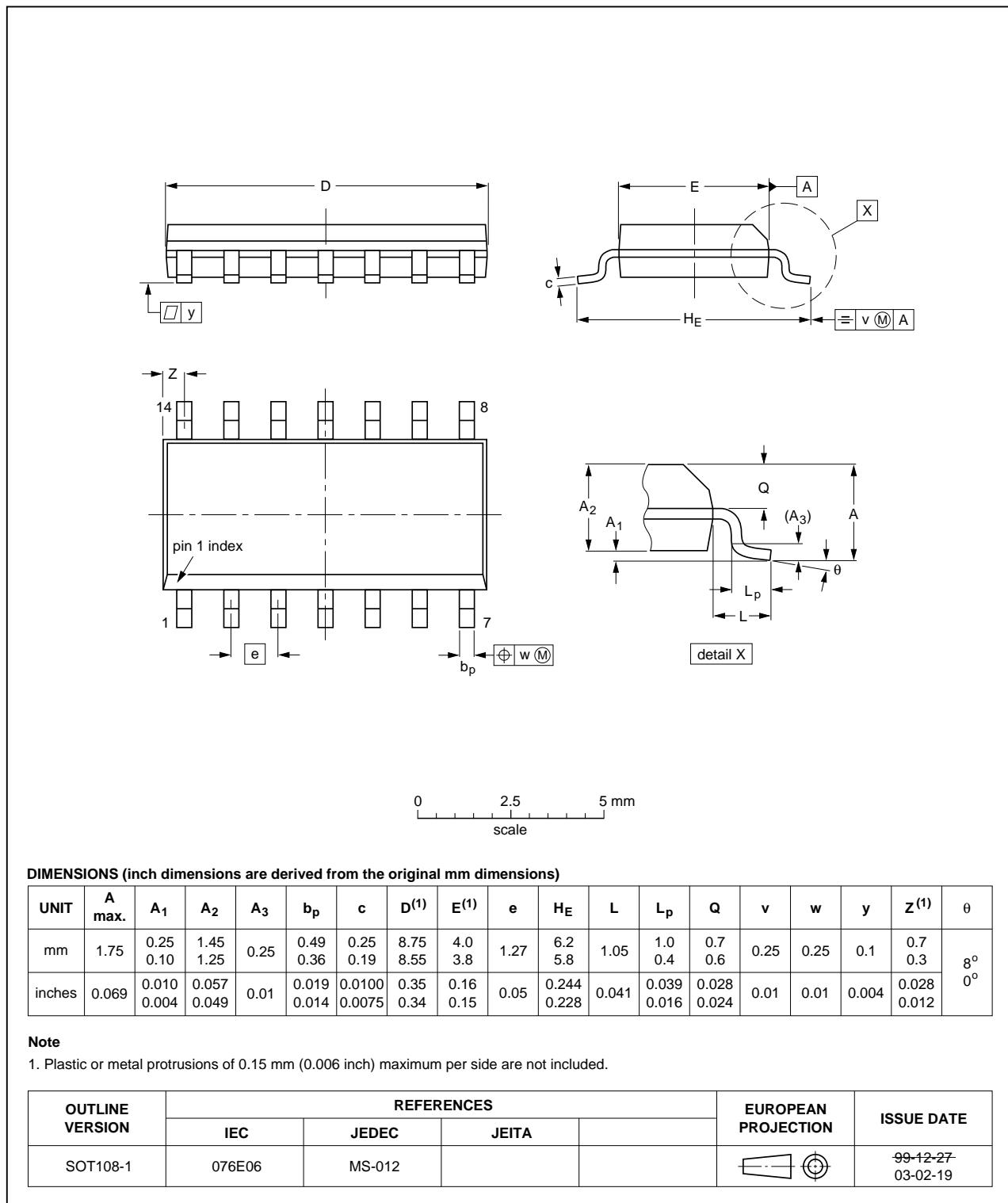
1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT27-1	050G04	MO-001	SC-501-14			99-12-27 03-02-13

Fig 7. Package outline SOT27-1 (DIP14)

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

SOT108-1



**Fig 8. Package outline SOT108-1 (SO14)**

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

SOT337-1

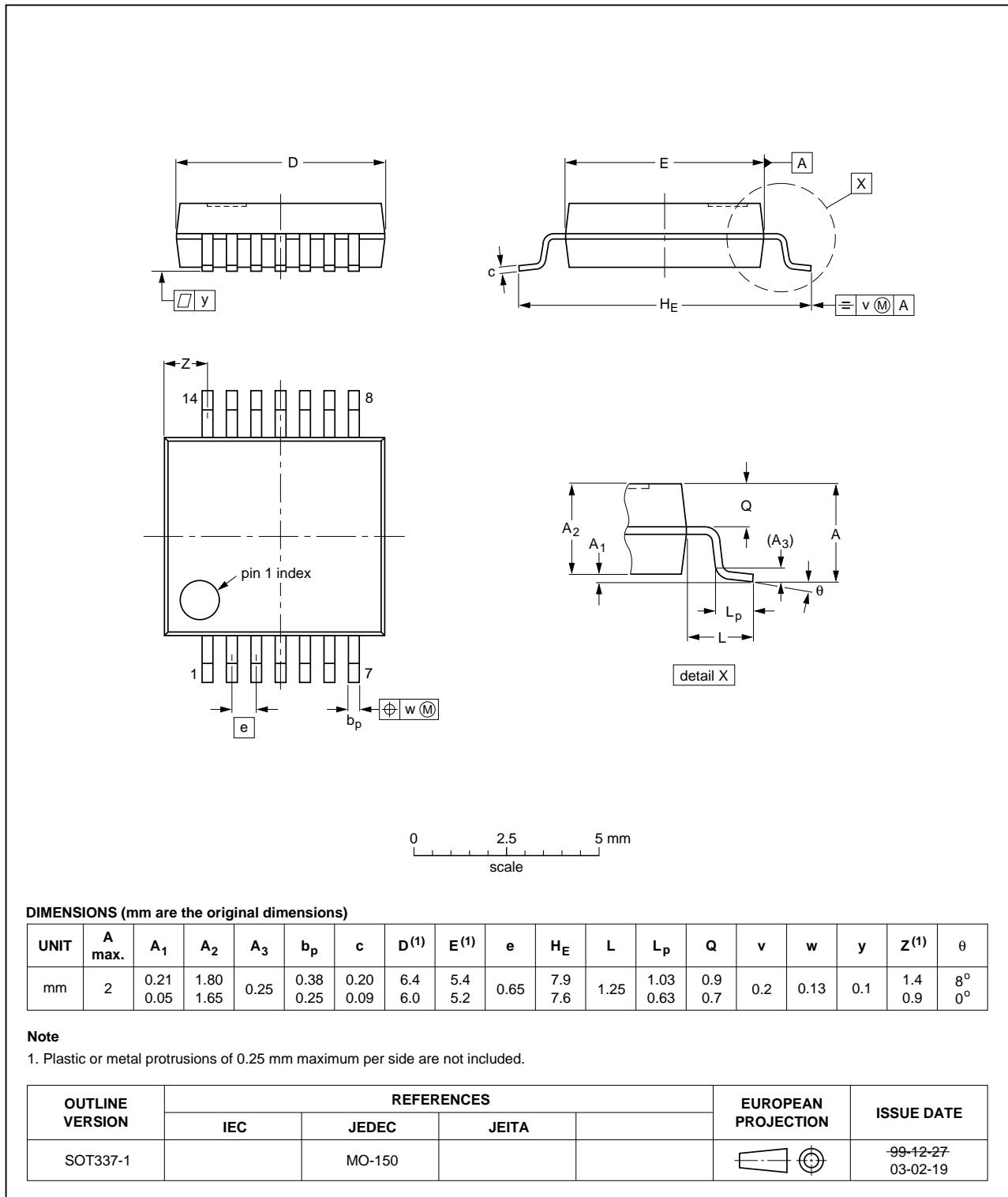


Fig 9. Package outline SOT337-1 (SSOP14)

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

SOT402-1

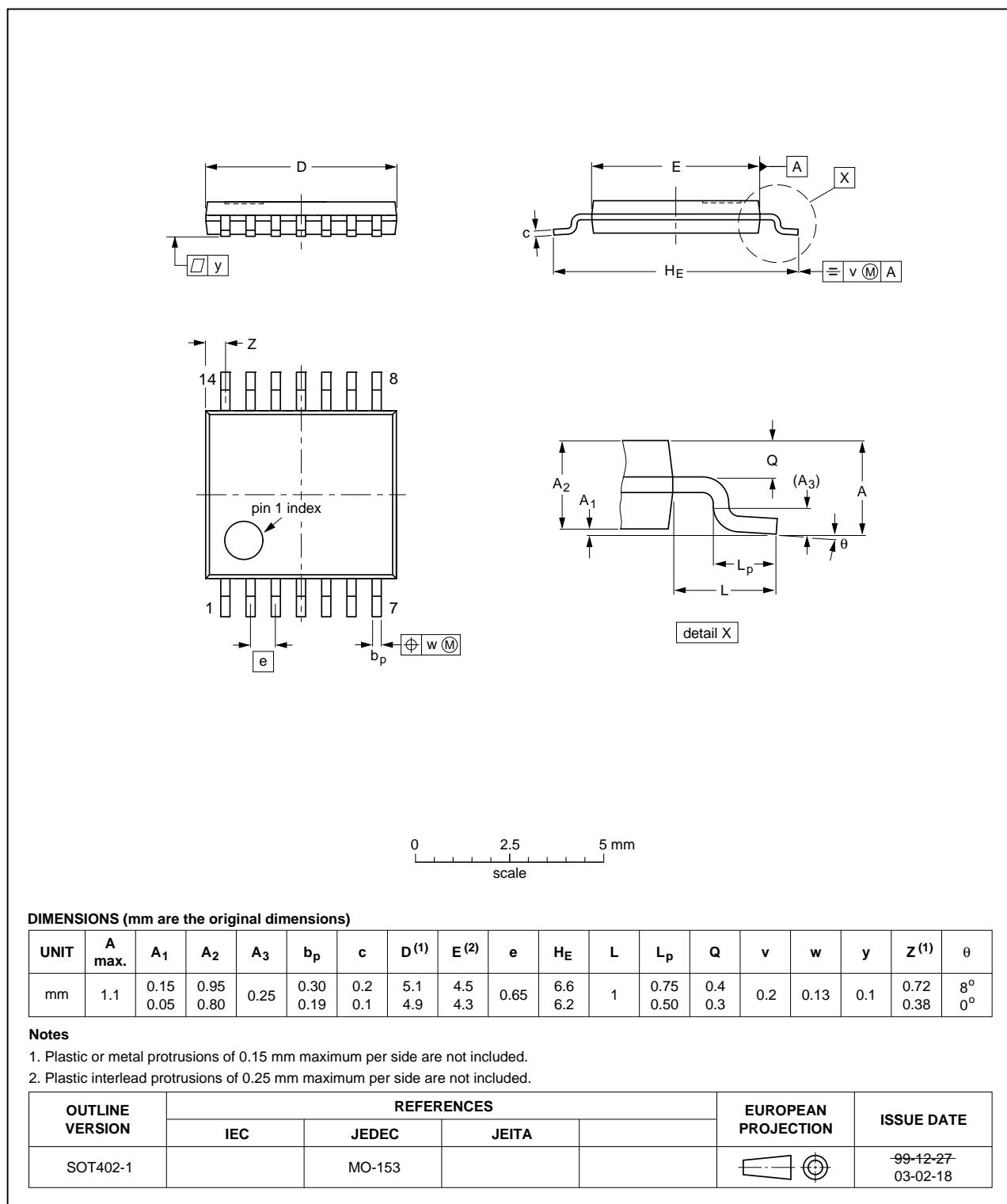


Fig 10. Package outline SOT402-1 (TSSOP14)

## 13. Abbreviations

**Table 10. Abbreviations**

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

## 14. Revision history

**Table 11. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT30 v.6	20121227	Product data sheet	-	74HC_HCT30 v.5
Modifications:		• New general description.		
74HC_HCT30 v.5	20111213	Product data sheet	-	74HC_HCT30 v.4
Modifications:		• Legal pages updated.		
74HC_HCT30 v.4	20100504	Product data sheet	-	74HC_HCT30 v.3
74HC_HCT30 v.3	20100420	Product data sheet	-	74HC_HCT30 v.2
74HC_HCT30 v.2	19970829	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".

[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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Date of release: 27 December 2012  
Document identifier: 74HC\_HCT30

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