

# 74HC32-Q100; 74HCT32-Q100

## Quad 2-input OR gate

Rev. 2 — 30 September 2019

Product data sheet

## 1. General description

The 74HC32-Q100; 74HCT32-Q100 is a quad 2-input OR gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

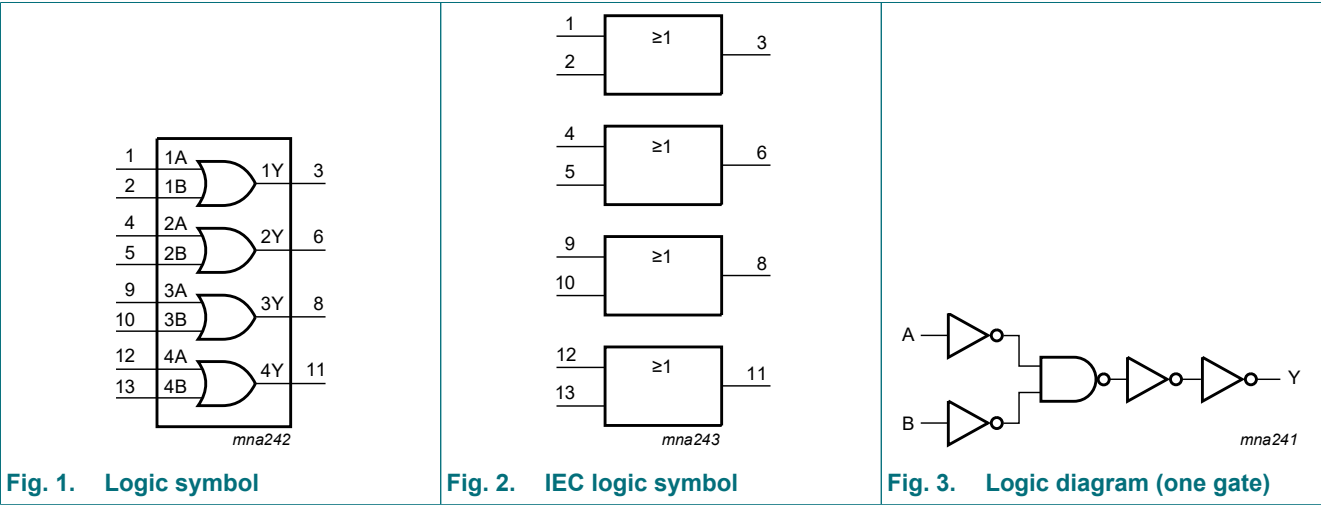
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 6.0 V
- Complies with JEDEC standard JESD7A
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Input levels:
  - For 74HC32-Q100: CMOS level
  - For 74HCT32-Q100: TTL level
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0  $\Omega$ )
- Multiple package options

## 3. Ordering information

Table 1. Ordering information

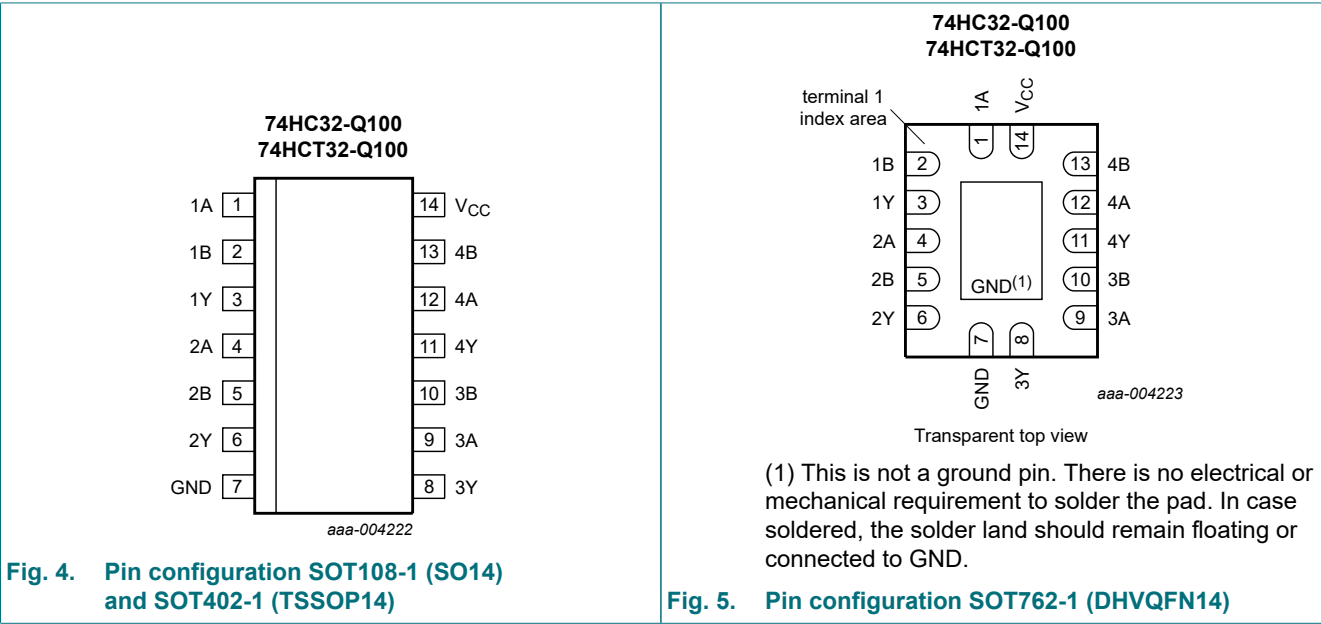
Type number	Package			
	Temperature range	Name	Description	Version
74HC32D-Q100	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74HCT32D-Q100				
74HC32PW-Q100	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74HCT32PW-Q100				
74HC32BQ-Q100	-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
74HCT32BQ-Q100				

4. Functional diagram



5. Pinning information

5.1. Pinning



## 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1A to 4A	1, 4, 9, 12	data input
1B to 4B	2, 5, 10, 13	data input
1Y to 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 table

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

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

## 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	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]	-	±20	mA
I <sub>O</sub>	output current	-0.5 V < V <sub>O</sub> < 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	[2]	-	500	mW

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

[2] For SOT108-1 (SO14) packages: P<sub>tot</sub> derates linearly with 10.1 mW/K above 100 °C.

For SOT402-1 (TSSOP14) packages: P<sub>tot</sub> derates linearly with 7.3 mW/K above 81 °C.

For SOT762-1 (DHVQFN14) packages: P<sub>tot</sub> derates linearly with 9.6 mW/K above 98 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

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

Symbol	Parameter	Conditions	74HC32-Q100			74HCT32-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	-	+125	-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	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	
74HC32-Q100										
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
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HCT32-Q100										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -20 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 20 µA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 5.2 mA	-	0.15	0.25	-	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> = 5.5 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> = 5.5 V	-	-	2.0	-	20	-	40	µA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	430	-	540	-	590	µA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

GND = 0 V; C<sub>L</sub> = 50 pF; for test circuit see Fig. 7.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Min	Typ	Max	Max	Max	
74HC32-Q100								
t <sub>pd</sub>	propagation delay	nA, nB to nY; see <a href="#">Fig. 6</a> [1]						
		V <sub>CC</sub> = 2.0 V	-	22	90	115	135	ns
		V <sub>CC</sub> = 4.5 V	-	8	18	23	27	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	6	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	6	15	20	23	ns
t <sub>t</sub>	transition time	see <a href="#">Fig. 6</a> [2]						
		V <sub>CC</sub> = 2.0 V	-	19	75	95	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	19	22	ns
		V <sub>CC</sub> = 6.0 V	-	6	13	16	19	ns
C <sub>PD</sub>	power dissipation capacitance	per package; V <sub>I</sub> = GND to V <sub>CC</sub> [3]	-	16	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Min	Typ	Max	Max	Max	
74HCT32-Q100								
t <sub>pd</sub>	propagation delay	nA, nB to nY; see <a href="#">Fig. 6</a> [1]						
		V <sub>CC</sub> = 4.5 V	-	11	24	30	36	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	9	-	-	-	ns
t <sub>t</sub>	transition time	V <sub>CC</sub> = 4.5 V; see <a href="#">Fig. 6</a> [2]	-	7	15	19	22	ns
C <sub>PD</sub>	power dissipation capacitance	per package; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [3]	-	28	-	-	-	pF

- [1] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.  
[2] t<sub>t</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.  
[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$  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;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

10.1. Waveforms

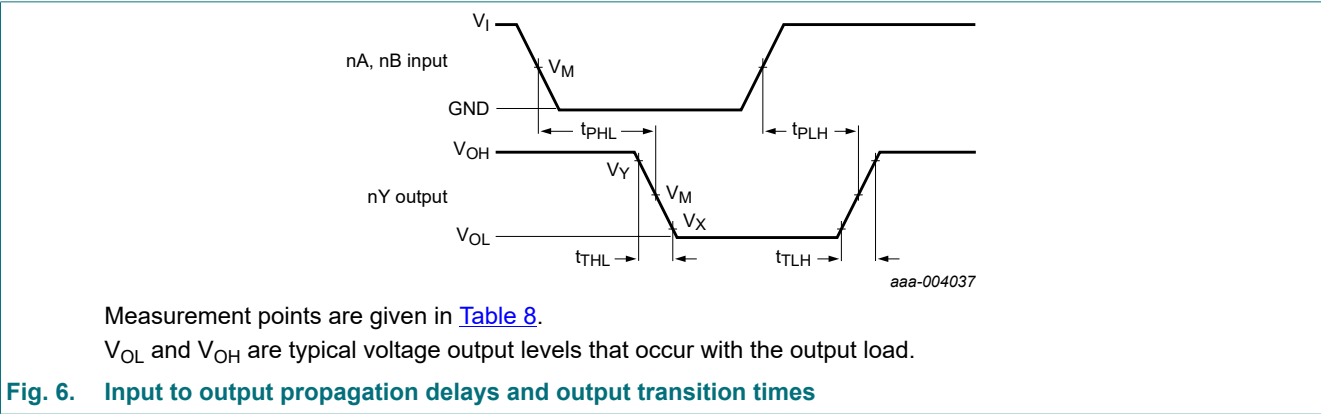
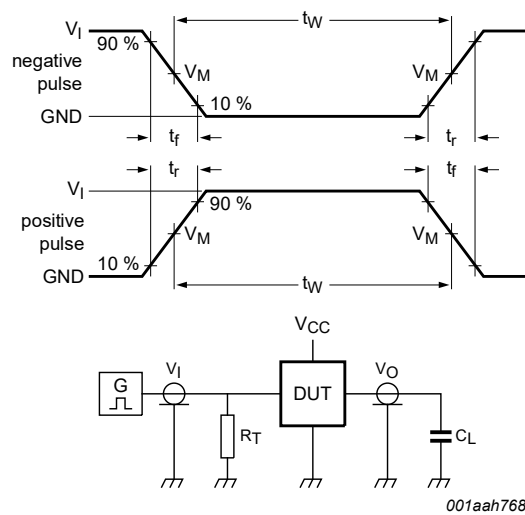


Table 8. Measurement points

Type	Input	Output		
	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
74HC32-Q100	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	0.1V <sub>CC</sub>	0.9V <sub>CC</sub>
74HCT32-Q100	1.3 V	1.3 V	0.1V <sub>CC</sub>	0.9V <sub>CC</sub>



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

Fig. 7. Test circuit for measuring switching times

Table 9. Test data

Type	Input		Load	Test
	$V_I$	$t_r, t_f$	$C_L$	
74HC32-Q100	$V_{CC}$	6.0 ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$
74HCT32-Q100	3.0 V	6.0 ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$

11. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm SOT108-1

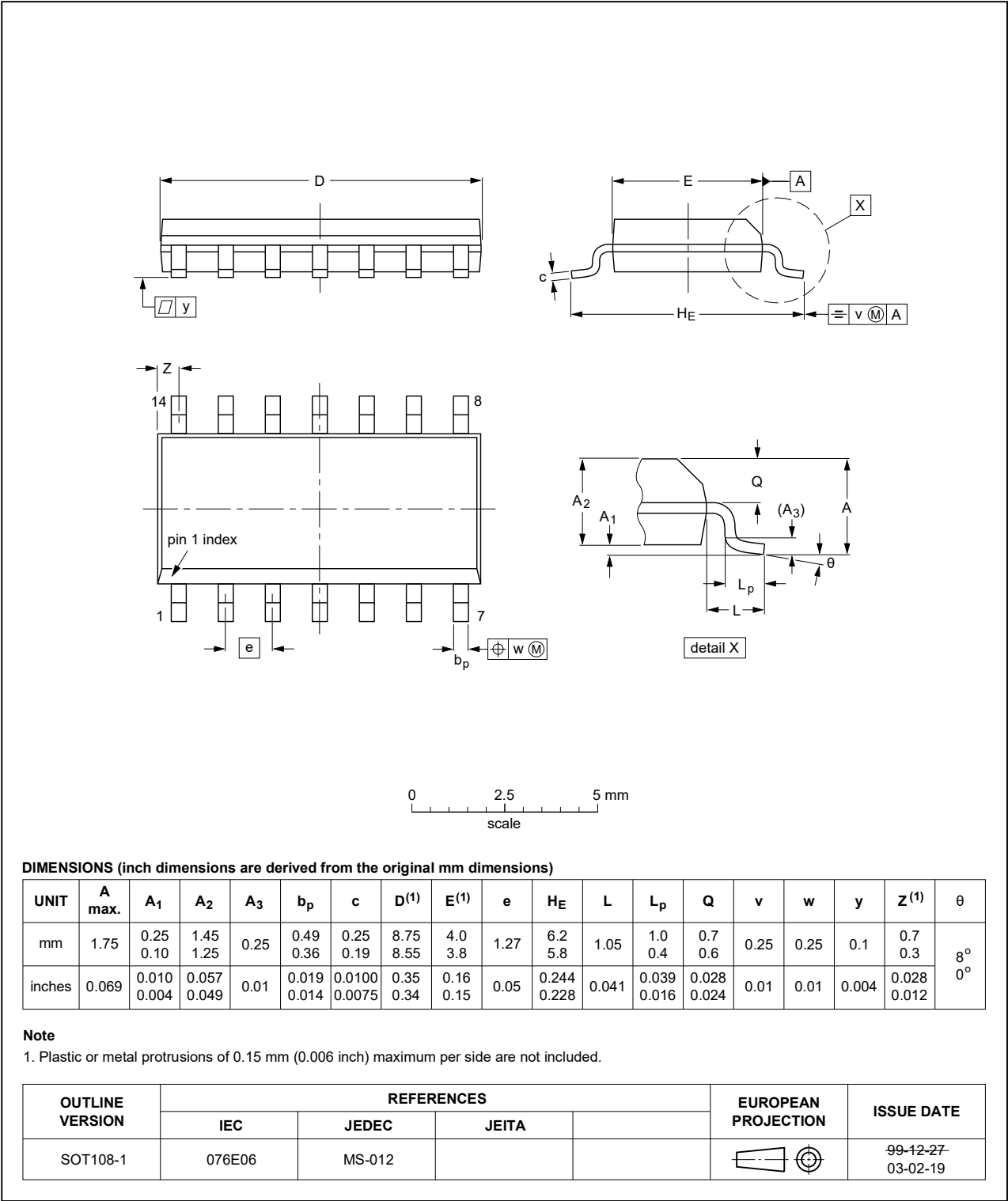


Fig. 8. Package outline SOT108-1 (SO14)



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

SOT402-1

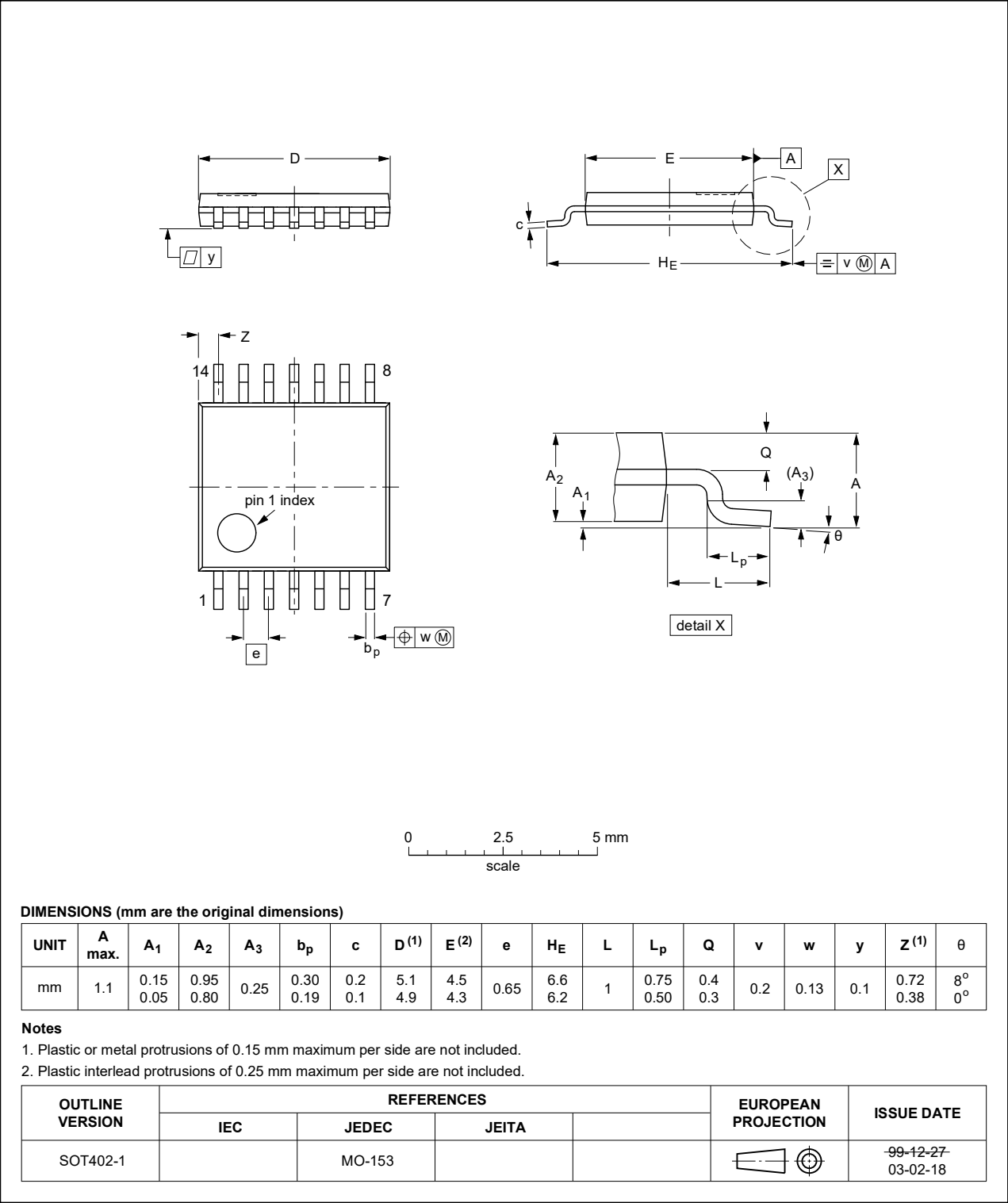


Fig. 9. Package outline SOT402-1 (TSSOP14)

**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

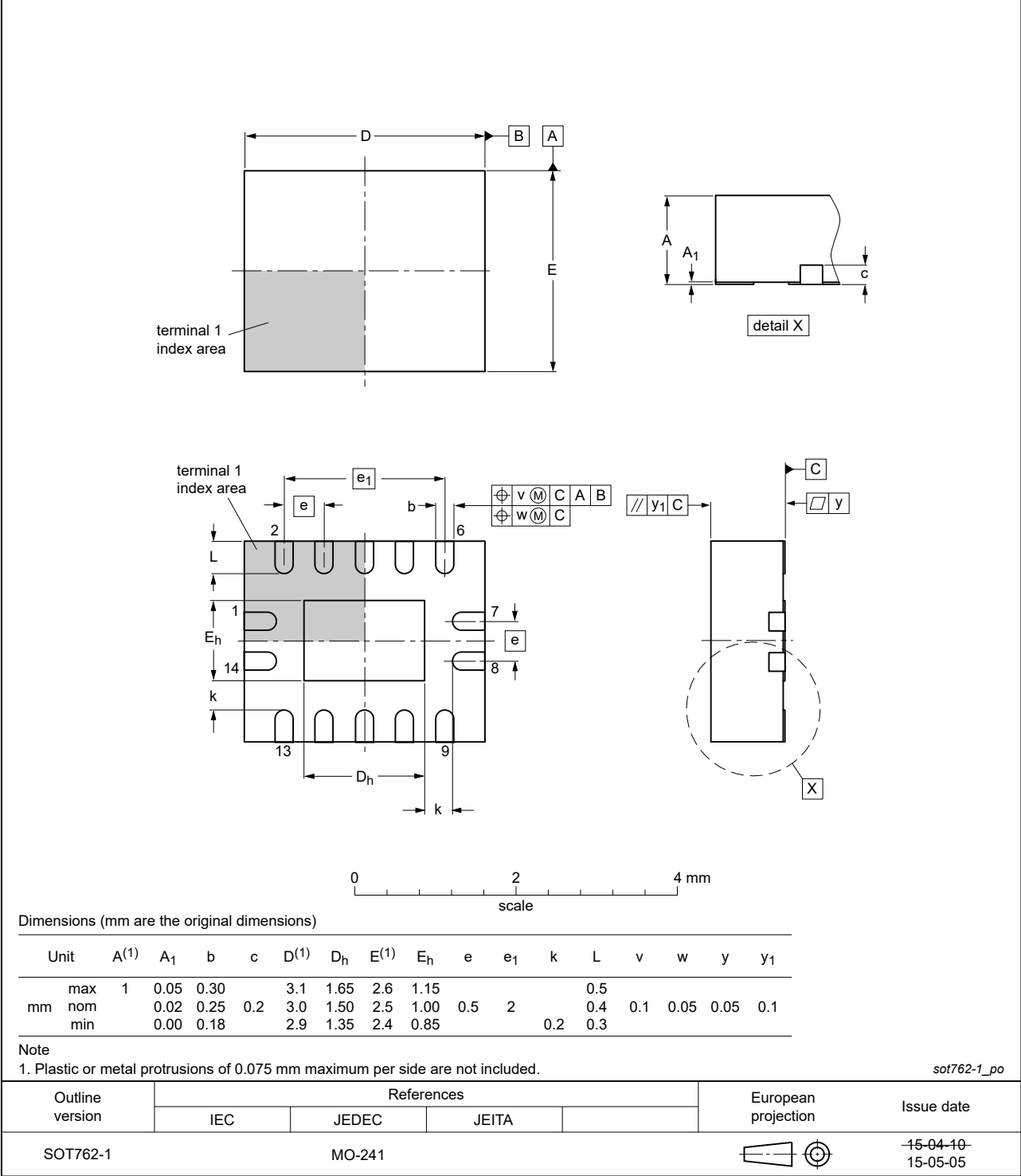


Fig. 10. Package outline SOT762-1 (DHVQFN14)

## 12. Abbreviations

Table 10. Abbreviations

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

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT32_Q100 v.2	20190930	Product data sheet	-	74HC_HCT32_Q100 v.1
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation have changed.</li><li>Package outline drawing <a href="#">SOT762-1</a> (DHVQFN14) updated.</li></ul>			
74HC_HCT32_Q100 v.1	20120801	Product data sheet	-	-

## 14. Legal information

### 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.

- [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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Date of release: 30 September 2019