

74ALVC00-Q100

Quad 2-input NAND gate

Rev. 1 — 16 May 2014

Product data sheet

1. General description

The 74ALVC00-Q100 is a quad 2-input NAND gate.

Schmitt trigger action on all inputs makes the device tolerant of slow rise and fall times.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 3) and is suitable for use in automotive applications.

2. Features and benefits

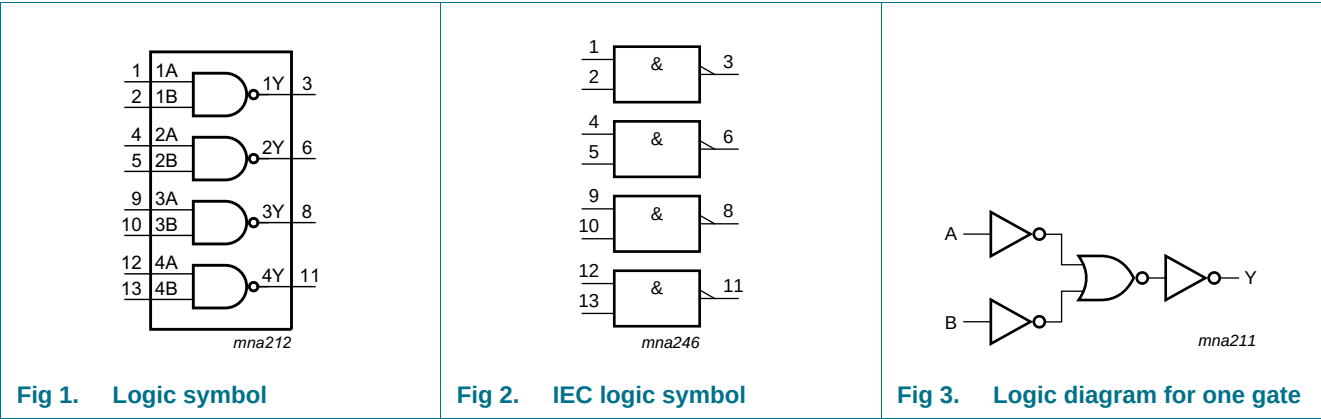
- Automotive product qualification in accordance with AEC-Q100 (Grade 3)
 - ◆ Specified from -40°C to $+85^{\circ}\text{C}$
- Wide supply voltage range from 1.65 V to 3.6 V
- 3.6 V tolerant inputs/outputs
- CMOS low power consumption
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Power-down mode
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standards:
 - ◆ JESD8-7 (1.65 V to 1.95 V)
 - ◆ JESD8-5 (2.3 V to 2.7 V)
 - ◆ JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - ◆ MIL-STD-883, method 3015 exceeds 2000 V
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V ($C = 200\text{ pF}$, $R = 0\ \Omega$)

3. Ordering information

Table 1. Ordering information

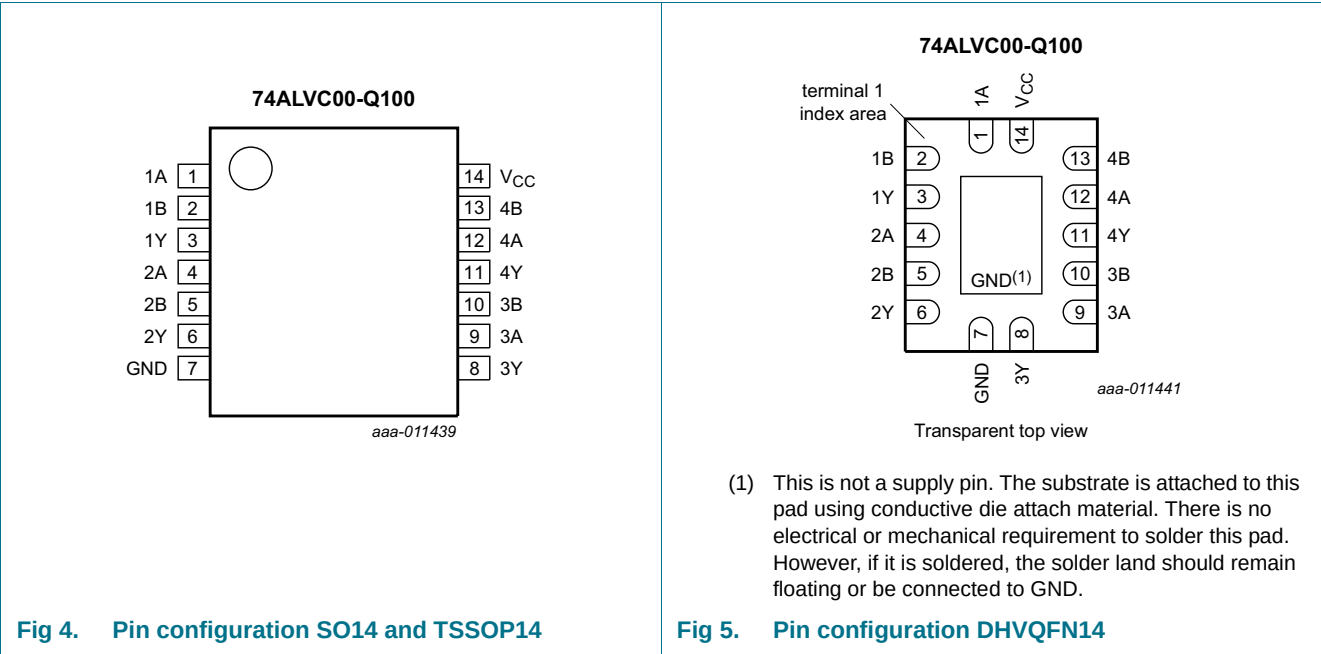
Type number	Package			
	Temperature range	Name	Description	Version
74ALVC00D-Q100	-40°C to $+85^{\circ}\text{C}$	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74ALVC00PW-Q100	-40°C to $+85^{\circ}\text{C}$	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74ALVC00BQ-Q100	-40°C to $+85^{\circ}\text{C}$	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body $2.5 \times 3 \times 0.85\text{ mm}$	SOT762-1

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 _{CC}	14	supply voltage

6. Functional description

Table 3. Function selection^[1]

Input		Output
nA	nB	nY
L	X	H
X	L	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	+4.6	V
I_{IK}	input clamping current	$V_I < 0$ V	-50	-	mA
V_I	input voltage		-0.5	+4.6	V
I_{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	±50	mA
V_O	output voltage	output HIGH or LOW state ^{[1] [2]}	-0.5	$V_{CC} + 0.5$	V
		output 3-state	-0.5	+4.6	V
		power-down mode, $V_{CC} = 0$ V ^[2]	-0.5	+4.6	V
I_O	output current	$V_O = 0$ V to V_{CC}	-	±50	mA
I_{CC}	supply current		-	100	mA
I_{GND}	ground current		-100	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +85 °C ^[3]	-	500	mW

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

[2] When $V_{CC} = 0$ V (power-down mode), the output voltage can be 3.6 V in normal operation.

[3] For SO14 packages: above 70 °C derate linearly with 8 mW/K.
 For TSSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.
 For DHVQFN14 packages: above 60 °C derate linearly with 4.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		1.65	3.6	V
V_I	input voltage		0	3.6	V
V_O	output voltage	output HIGH or LOW state	0	V_{CC}	V
		output 3-state	0	3.6	V
		power-down mode; $V_{CC} = 0$ V	0	3.6	V
T_{amb}	ambient temperature	in free air	-40	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65$ V to 2.7 V	0	20	ns/V
		$V_{CC} = 2.7$ V to 3.6 V	0	10	ns/V

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	$T_{amb} = -40\text{ °C to }+85\text{ °C}$			Unit
			Min	Typ ^[1]	Max	
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		$V_{CC} = 2.3$ V to 2.7 V	1.7	-	-	V
		$V_{CC} = 2.7$ V to 3.6 V	2.0	-	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3$ V to 2.7 V	-	-	0.7	V
		$V_{CC} = 2.7$ V to 3.6 V	-	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100\text{ }\mu\text{A}$; $V_{CC} = 1.65$ V to 3.6 V	$V_{CC} - 0.2$	-	-	V
		$I_O = -6\text{ mA}$; $V_{CC} = 1.65$ V	1.25	1.51	-	V
		$I_O = -12\text{ mA}$; $V_{CC} = 2.3$ V	1.8	2.10	-	V
		$I_O = -18\text{ mA}$; $V_{CC} = 2.3$ V	1.7	2.01	-	V
		$I_O = -12\text{ mA}$; $V_{CC} = 2.7$ V	2.2	2.53	-	V
		$I_O = -18\text{ mA}$; $V_{CC} = 3.0$ V	2.4	2.76	-	V
		$I_O = -24\text{ mA}$; $V_{CC} = 3.0$ V	2.2	2.68	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 100\text{ }\mu\text{A}$; $V_{CC} = 1.65$ V to 3.6 V	-	-	0.2	V
		$I_O = 6\text{ mA}$; $V_{CC} = 1.65$ V	-	0.11	0.3	V
		$I_O = 12\text{ mA}$; $V_{CC} = 2.3$ V	-	0.17	0.4	V
		$I_O = 18\text{ mA}$; $V_{CC} = 2.3$ V	-	0.25	0.6	V
		$I_O = 12\text{ mA}$; $V_{CC} = 2.7$ V	-	0.16	0.4	V
		$I_O = 18\text{ mA}$; $V_{CC} = 3.0$ V	-	0.23	0.4	V
		$I_O = 24\text{ mA}$; $V_{CC} = 3.0$ V	-	0.30	0.55	V
I_I	input leakage current	$V_{CC} = 3.6$ V; $V_I = 3.6$ V or GND	-	± 0.1	± 5	μA
I_{OFF}	power-off leakage current	$V_{CC} = 0$ V; V_I or $V_O = 0$ V to 3.6 V	-	± 0.1	± 10	μA

Table 6. Static characteristics ...continued

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

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ ^[1]	Max	
I _{CC}	supply current	V _{CC} = 3.6 V; V _I = V _{CC} or GND; I _O = 0 A	-	0.2	20	μA
ΔI _{CC}	additional supply current	per input pin; V _{CC} = 3.0 V to 3.6 V; V _I = V _{CC} - 0.6 V; I _O = 0 A	-	5	750	μA
C _I	input capacitance		-	3.5	-	pF

[1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) and T_{amb} = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristicsVoltages are referenced to GND (ground = 0 V). For test circuit, see [Figure 7](#).

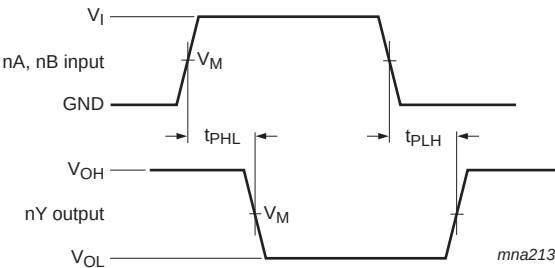
Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			Unit
			Min	Typ ^[1]	Max	
t _{pd}	propagation delay	nA, nB to nY; see Figure 6 ^[2]				
		V _{CC} = 1.65 V to 1.95 V	1.0	2.8	4.4	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.1	2.8	ns
		V _{CC} = 2.7 V	1.0	2.6	3.2	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.1	3.0	ns
C _{PD}	power dissipation capacitance	per gate; V _I = GND to V _{CC} ; V _{CC} = 3.3 V ^[3]	-	28	-	pF

[1] Typical values are measured at T_{amb} = 25 °C[2] t_{pd} is the same as t_{PHL} and t_{PLH}.[3] 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 MHzC_L = output load capacitance in pFV_{CC} = supply voltage in Volts

N = number of inputs switching

Σ(C_L × V_{CC}² × f_o) = sum of the outputs

11. Waveforms

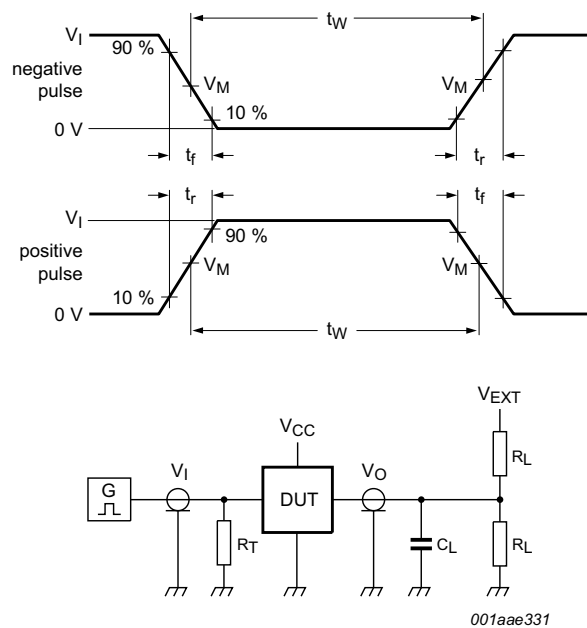


Measurement points are given in [Table 8](#).

Fig 6. Inputs nA, nB to output nY propagation delay times

Table 8. Measurement points

Supply voltage V_{CC}	Input V_I	V_M
1.65 V to 1.95 V	V_{CC}	$0.5V_{CC}$
2.3 V to 2.7 V	V_{CC}	$0.5V_{CC}$
2.7 V	2.7 V	1.5 V
3.0 V to 3.6 V	2.7 V	1.5 V



Test data is given in [Table 9](#).
Definitions for test circuit:
 R_L = Load resistance.
 C_L = Load capacitance including jig and probe capacitance.
 R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.
 V_{EXT} = External voltage for measuring switching times.

Fig 7. Test circuit for measuring switching times

Table 9. Test data

Supply voltage V_{CC}	Input		Load		V_{EXT}		
	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PLZ}, t_{PZL}	t_{PHZ}, t_{PZH}
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	30 pF	500 Ω	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	6 V	GND
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	6 V	GND

12. Package outline

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

SOT108-1

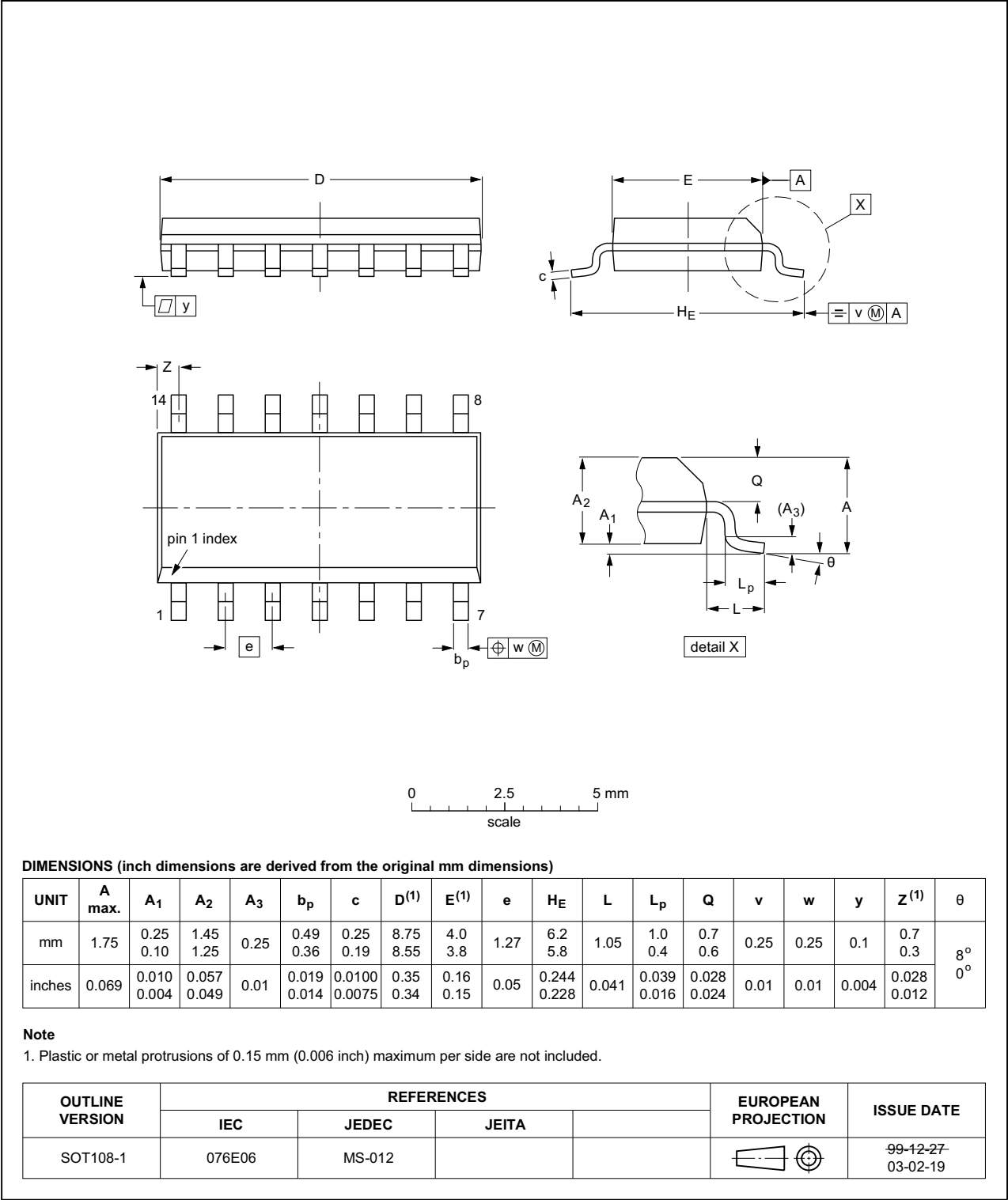


Fig 8. Package outline SOT108-1 (SO14)

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

SOT402-1

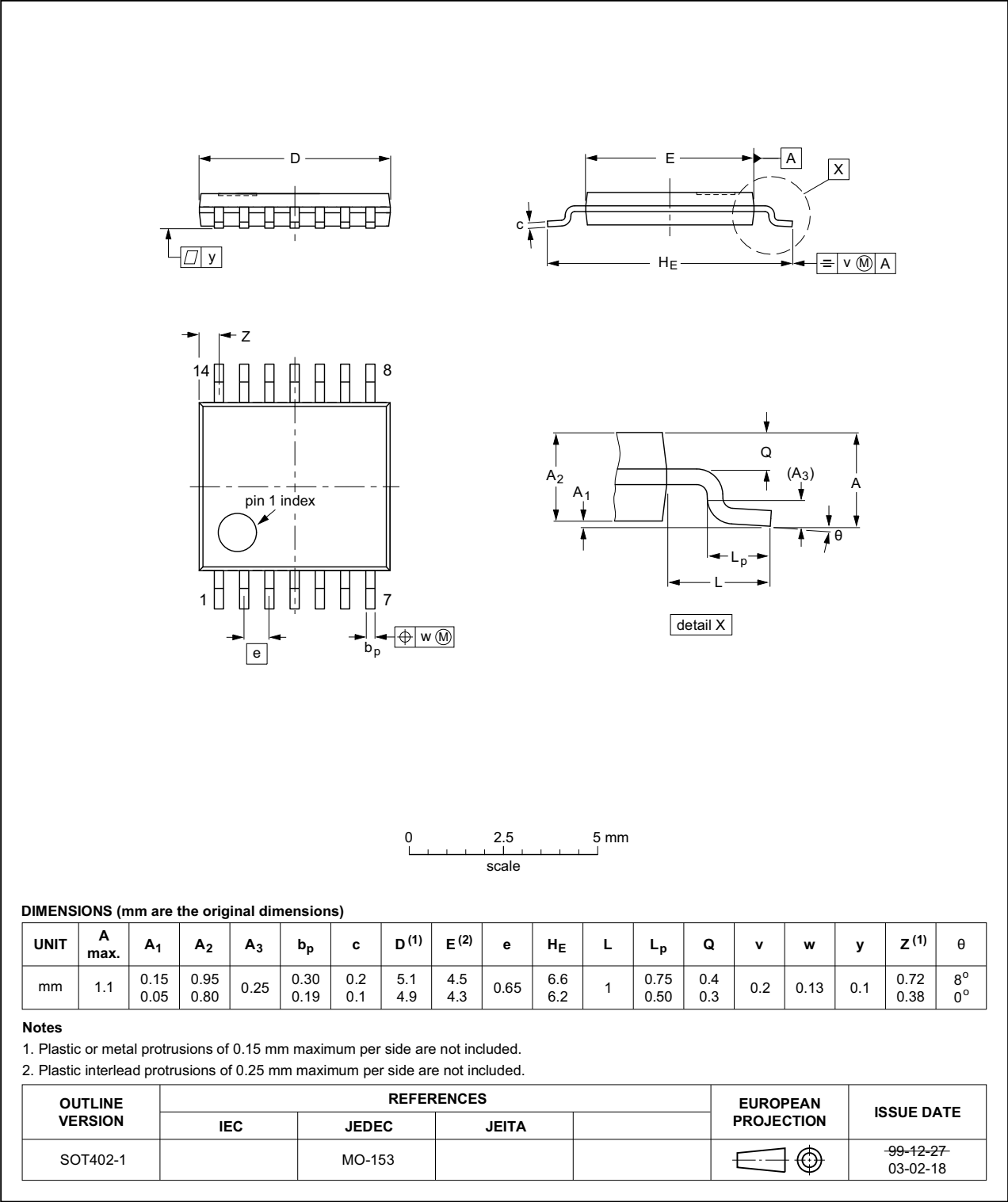


Fig 9. Package outline SOT402-1 (TSSOP14)

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

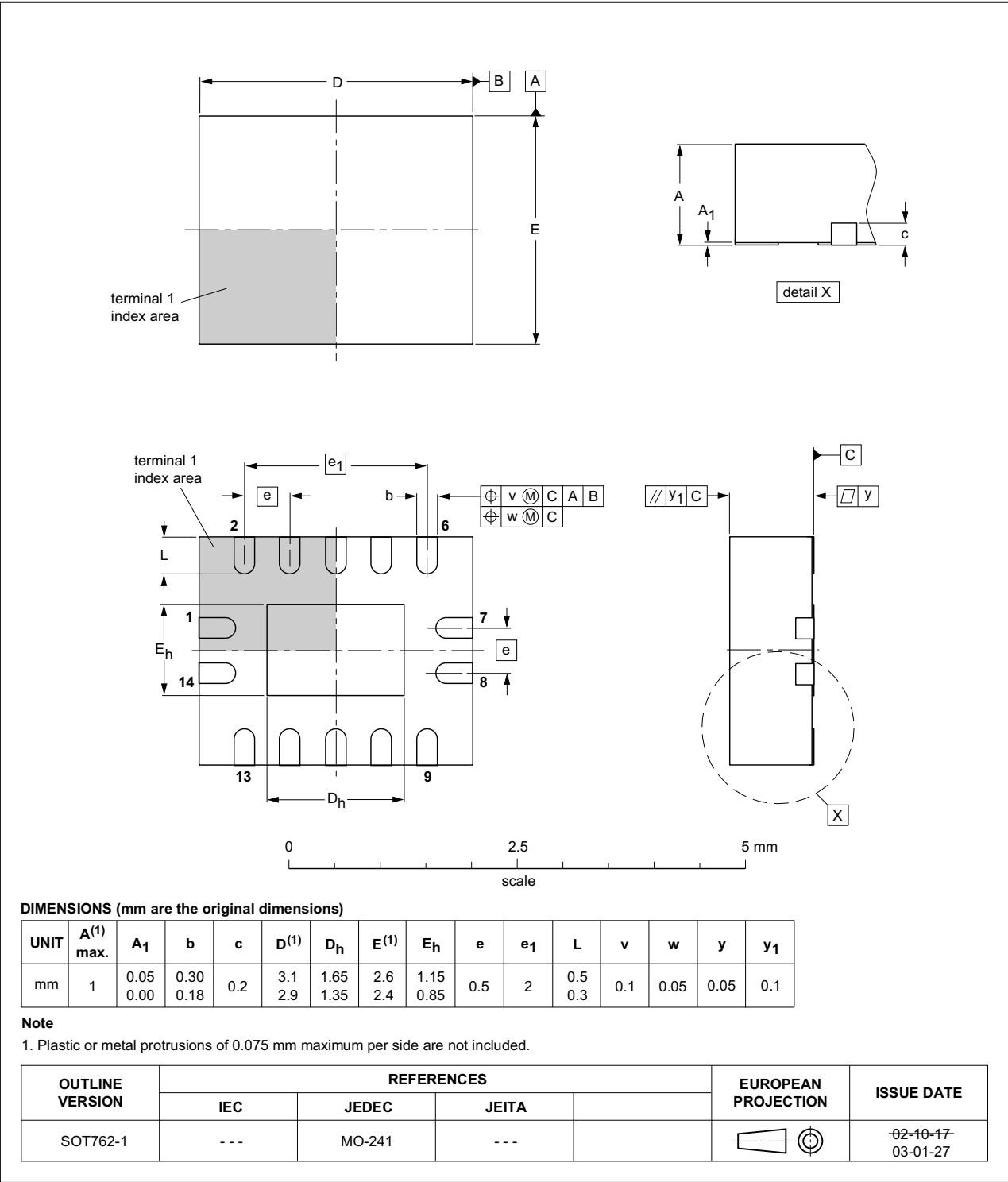


Fig 10. Package outline SOT762-1 (DHVQFN14)

13. Abbreviations

Table 10. Abbreviations

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

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74ALVC00_Q100 v.1	20140516	Product data sheet	-	-

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.

[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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