

Quad 2-input NAND buffer (open drain)

74AC38
74ACT38

FEATURES

- 74ACT38 has TTL-compatible inputs
- 74AC38 has CMOS-compatible inputs
- Meets or exceeds JEDEC standard standard for 74AC(T)XX family
- Superior ground bounce noise immunity
- Output source/sink 24mA

DESCRIPTION

The 74AC/T38 provides the 2-inputs NAND function..

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYPICAL			UNIT
			AC		ACT	
			V _{CC} = 3.3V	V _{CC} = 5.0V	V _{CC} = 5.0V	
t _{PHL} /t _{PLH}	Propagation delay nA to nY	C _L = 50pF	3.2	2.2	3.4	ns
C _I	Input capacitance		4.5			pF
C _{PD}	Power dissipation capacitance per gate	V _I = GND to V _{CC} ¹	11		13	pF

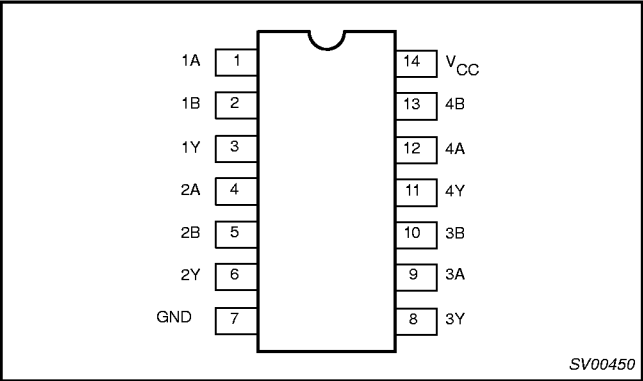
NOTE:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μ W):
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz; C_L = output load capacity in pF;
f_o = output frequency in MHz; V_{CC} = supply voltage in V;
 $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

ORDERING AND PACKAGE INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DRAWING NUMBER
14-Pin Plastic SO	−40°C to +85°C	74AC38D 74ACT38D	74AC38D 74ACT38D	SOT108-1
14-Pin Plastic SSOP Type II	−40°C to +85°C	74AC38DB 74ACT38DB	74AC38DB 74ACT38DB	SOT337-1
14-Pin Plastic TSSOP Type I	−40°C to +85°C	74AC38PW 74ACT38PW	74AC38PW DH 74ACT38PW DH	SOT402-1

PIN CONFIGURATION



PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 4, 9, 12	1A to 4A	Data inputs
2, 5, 10, 13	1B to 4B	
3, 6, 8, 11	1Y to 4Y	Data outputs
7	GND	Ground (0 V)
14	V _{CC}	Positive supply voltage

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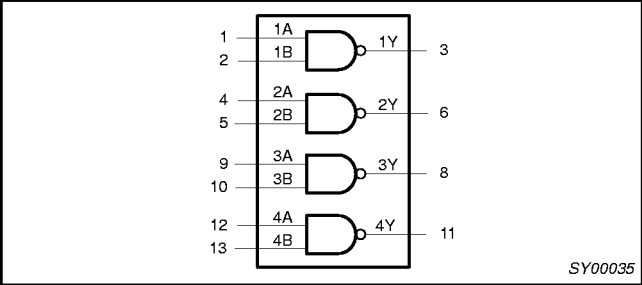
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FUNCTION TABLE

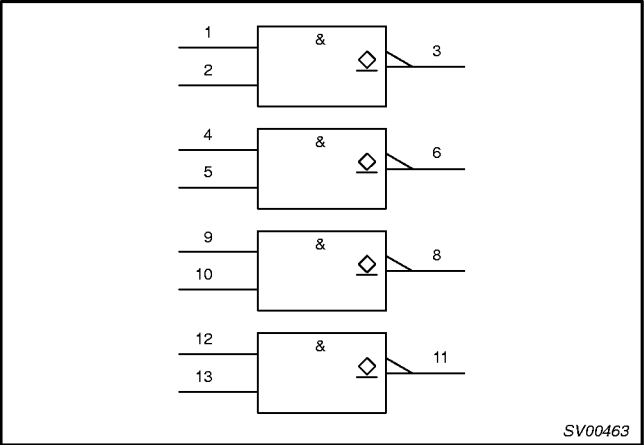
INPUTS		OUTPUT
nA	nB	nY
L	L	Z
L	H	Z
H	L	Z
H	H	L

H = HIGH voltage level
L = LOW voltage level
Z = High impedance OFF-state

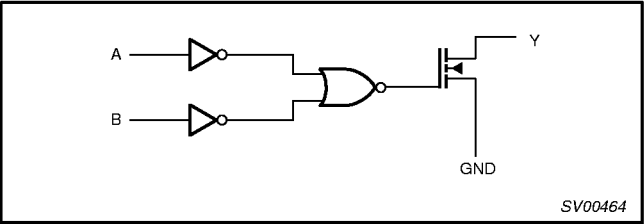
LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



LOGIC DIAGRAM



RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V _{CC}	DC supply voltage for 'AC	2.0	6.0	V
V _{CC}	DC supply voltage for 'ACT	4.5	5.5	V
V _{IN}	DC input voltage range	0	V _{CC}	V
V _O	DC output voltage range	0	V _{CC}	V
T _{amb}	Operating in free-air temperature range	-40	+85	°C
ΔV/Δt	Minimum input edge rate — AC devices V _{IN} from 30% to 70% of V _{CC} V _{CC} @ 3.3V, 4.5V, 5.5V	125		mV/ns
	— ACT devices V _{IN} from 0.8V to 2.0V V _{CC} @ 4.5V, 5.5V	125		

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74ACT38**ABSOLUTE MAXIMUM RATINGS¹**

in accordance with the Absolute Maximum Rating System (IEC134)

Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		-0.5 to +7.0	V
I_{IK}	DC input diode current	$V_{IN} = -0.5V$	-20	mA
		$V_{IN} = V_{CC} + 0.5V$	+20	
V_{IN}	DC input voltage		-0.5 to $V_{CC} + 0.5$	V
I_{OK}	DC output diode current	$V_O = -0.5V$	-20	mA
		$V_O = V_{CC} + 0.5V$	+20	
V_O	DC output voltage		-0.5 to $V_{CC} + 0.5$	V
I_O	DC output source or sink current		± 50	mA
I_{CC}, I_{GND}	DC V_{CC} or GND current per output		± 50	mA
I_{CC}, I_{GND}	DC V_{CC} or GND current		± 200	mA
T_{stg}	Storage temperature range		-65 to +150	°C
P_{TOT}	Power dissipation per package – plastic mini-pack (SO) – plastic shrink mini-pack (SSOP and TSSOP)	above +70°C derate linearly with 8 mW/K	500	mW
		above +60°C derate linearly with 5.5 mW/K	500	

NOTES:

1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

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DC CHARACTERISTICS FOR THE AC FAMILY

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	V _{CC} (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP	MAX	
V _{IH}	HIGH level Input voltage	V _{OUT} = 0.1V or (V _{CC} – 0.1V)	3.0	2.1	1.5		V
			4.5	3.15	2.25		
			5.5	3.85	2.75		
V _{IL}	LOW level Input voltage	V _{OUT} = 0.1V or (V _{CC} – 0.1V)	3.0		1.5	0.9	V
			4.5		2.25	1.35	
			5.5		2.75	1.65	
V _{OH}	HIGH level output voltage	I _{OUT} = –50 μA	3.0	2.9	2.99		V
			4.5	4.4	4.49		
			5.5	5.4	5.49		
		V _{IN} = V _{IL} or V _{IH} , I _{OH} = –12mA ¹	3.0	2.46			
		V _{IN} = V _{IL} or V _{IH} , I _{OH} = –24mA ¹	4.5	3.76			
		V _{IN} = V _{IL} or V _{IH} , I _{OH} = –24mA ¹	5.5	4.76			
V _{OL}	LOW level output voltage	I _{OUT} = 50 μA	3.0		0.01	0.1	V
			4.5		0.01	0.1	
			5.5		0.01	0.1	
		V _{IN} = V _{IL} or V _{IH} , I _{OL} = 12mA ¹	3.0			0.44	
		V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ¹	4.5			0.44	
		V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ¹	5.5			0.44	
I _{IN}	Input leakage current	V _{IN} = V _{CC} or GND	5.5			± 1.0	μA
I _{OZ}	3-State output OFF-state current	V _{IN} = V _{IL} or V _{IH} V _{IN} = V _{CC} or GND V _{OUT} = V _{CC} or GND	5.5			± 2.5	μA
I _{OLD}	Dynamic output current ²	V _{OLD} = 1.65V max	5.5	75			mA
I _{OHD}	Dynamic output current ²	V _{OHD} = 3.85V min	5.5			–75	mA
I _{CC}	Quiescent supply current	V _{IN} = V _{CC} or GND	5.5			40	μA

NOTES:

1. All outputs loaded
2. Maximum test duration 2.0 ms; one output loaded at a time

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74ACT38**DC CHARACTERISTICS FOR THE ACT FAMILY**

Over recommended operating conditions voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	V _{CC} (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP	MAX	
V _{IH}	HIGH level Input voltage	V _{OUT} = 0.1V or (V _{CC} – 0.1V)	4.5	2.0	1.5		V
			5.5	2.0	1.5		
V _{IL}	LOW level Input voltage	V _{OUT} = 0.1V or (V _{CC} – 0.1V)	4.5		1.5	0.8	V
			5.5		1.5	0.8	
V _{OH}	HIGH level output voltage	I _{OUT} = –50 μA	4.5	4.4	4.49		V
			5.5	5.4	5.49		
		V _{IN} = V _{IL} or V _{IH} , I _{OH} = –24mA ¹	4.5	3.76			
		V _{IN} = V _{IL} or V _{IH} , I _{OH} = –24mA ¹	5.5	4.76			
V _{OL}	LOW level output voltage	I _{OUT} = 50 μA	4.5		0.01	0.1	V
			5.5		0.01	0.1	
		V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ¹	4.5			0.44	
		V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ¹	5.5			0.44	
I _{IN}	Input leakage current	V _{IN} = V _{CC} , GND	5.5			± 1.0	μA
I _{OZ}	3-State output OFF-state current	V _{IN} = V _{IL} or V _{IH} V _{IN} = V _{CC} or GND V _{OUT} = V _{CC} or GND	5.5			± 2.5	μA
ΔI _{CC}	Additional quiescent supply current per input pin	V _{IN} = V _{CC} – 2.1V Other inputs at V _{CC} or GND; I _{OUT} = 0	5.5			1.5	mA
I _{OLD}	Dynamic output current ²	V _{OLD} = 1.65V max	5.5	75			mA
I _{OHD}	Dynamic output current ²	V _{OHD} = 3.85V min	5.5			–75	mA
I _{CC}	Quiescent supply current	V _{IN} = V _{CC} or GND	5.5			40	μA

NOTES:

1. All outputs loaded
2. Maximum test duration 2.0ms, one output loaded at a time

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AC CHARACTERISTICS FOR 74AC38

GND = 0V; $t_r = t_f \leq 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 500\Omega$; .

SYMBOL	PARAMETER	V _{CC} ¹	LIMITS					UNIT	WAVEFORM
			T _{amb} = +25°C			T _{amb} = −40°C to +85°C			
			MIN	TYP	MAX	MIN	MAX		
t _{PLH}	Propagation delay nA, nB to nY	3.3 5.0	2.0 1.5	3.3 2.0	6.5 4.5	1.5 1.0	7.0 5.0	ns	1, 2
t _{PHL}	Propagation delay nA, nB to nY	3.3 5.0	2.0 1.5	3.0 2.2	6.5 4.5	1.5 1.0	7.0 5.0	ns	

NOTE:

1. Voltage range 3.3V is V_{CC} = 3.3V ± 0.3V
Voltage range 5.0V is V_{CC} = 5.0V ± 0.5V

AC CHARACTERISTICS FOR 74ACT38

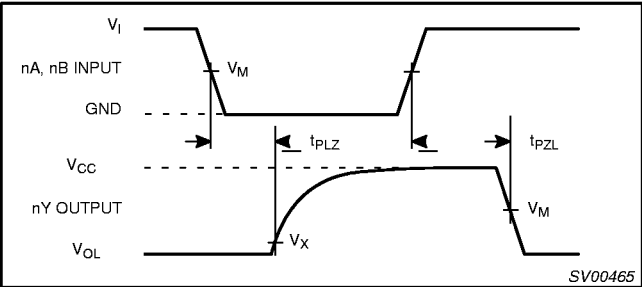
GND = 0V; $t_r = t_f \leq 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 500\Omega$; .

SYMBOL	PARAMETER	V _{CC} ¹	LIMITS					UNIT	WAVEFORM
			T _{amb} = +25°C			T _{amb} = −40°C to +85°C			
			MIN	TYP	MAX	MIN	MAX		
t _{PLH}	Propagation delay nA, nB to nY	5.0	2.0	3.2	6.0	1.5	7.0	ns	1, 2
t _{PHL}	Propagation delay nA, nB to nY	5.0	2.0	3.5	6.0	1.5	7.0	ns	

NOTE:

1. Voltage range 5.0V is V_{CC} = 5.0V ± 0.5V

AC WAVEFORMS

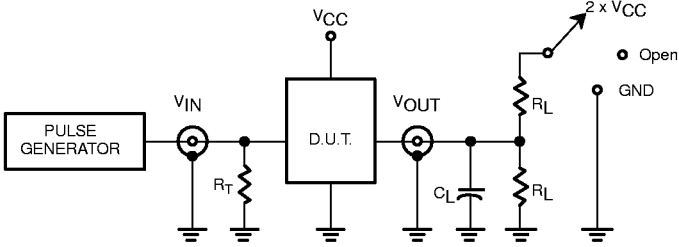


Waveform 1. Inputs (nA, nB) to output (nY) propagation delays

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TEST CIRCUIT



The diagram shows a test circuit for a 3-state output. A pulse generator is connected to the input V_{IN} of a D.U.T. (Device Under Test) through a termination resistor R_T . The output V_{OUT} is connected to a load capacitor C_L and a load resistor R_L to ground. A switch can connect the output to either ground or a load resistor R_L connected to $2 \times V_{CC}$. A legend indicates that a solid circle represents 'Open' and an open circle represents 'GND'.

Test Circuit for 3-State Outputs

SWITCH POSITION	
TEST	SWITCH
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	Open

FAMILY	V_{IN} Input Requirements	V_m Input	V_m Output
AC	GND to V_{CC}	50% V_{CC}	50% V_{CC}
ACT	GND to 3.0V	1.5V	50% V_{CC}

DEFINITIONS

R_L = Load resistor; see AC characteristics for value.

C_L = Load capacitance, see AC characteristics

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

SV00451

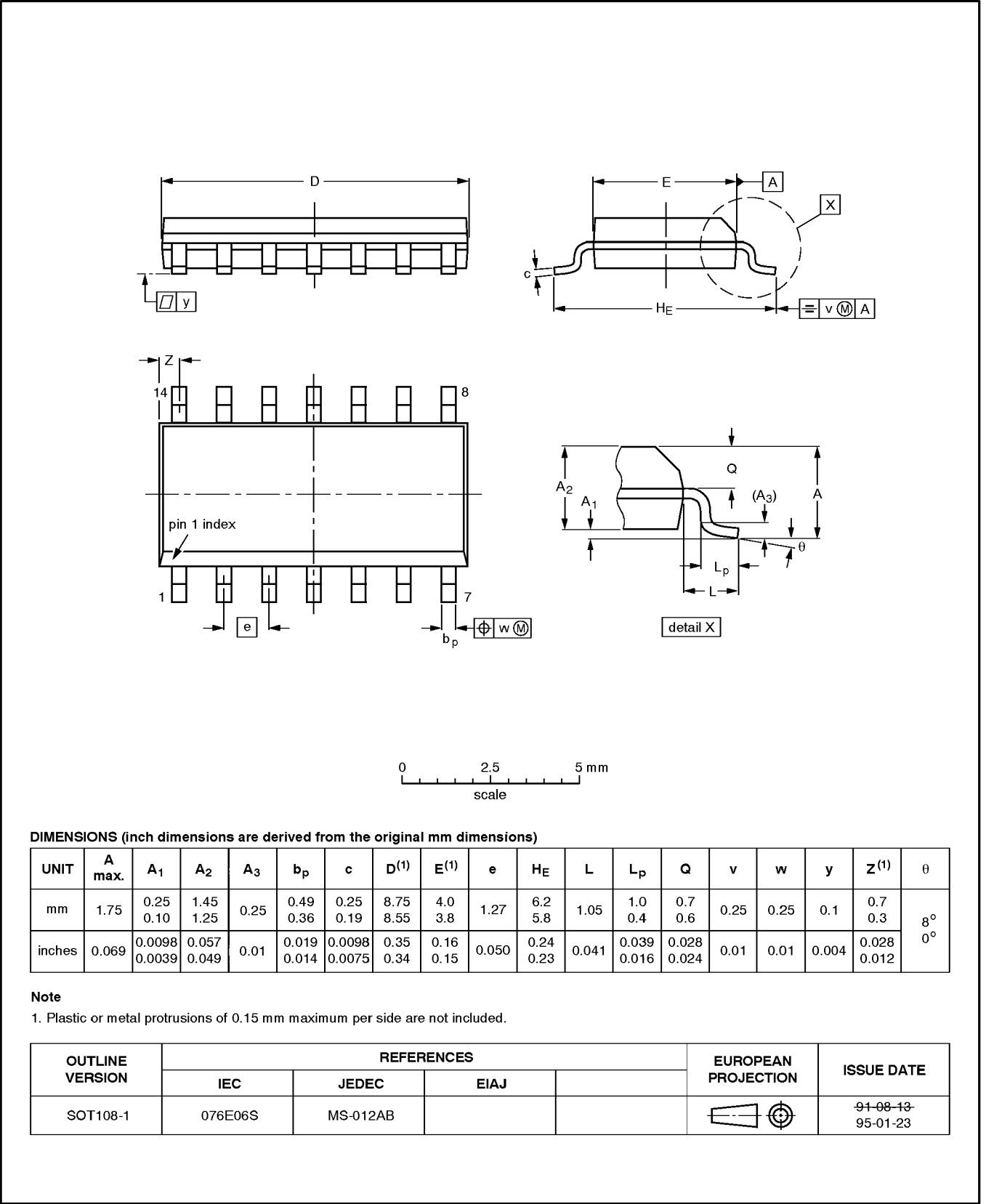
Waveform 2. Load circuitry for switching times

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

SOT108-1

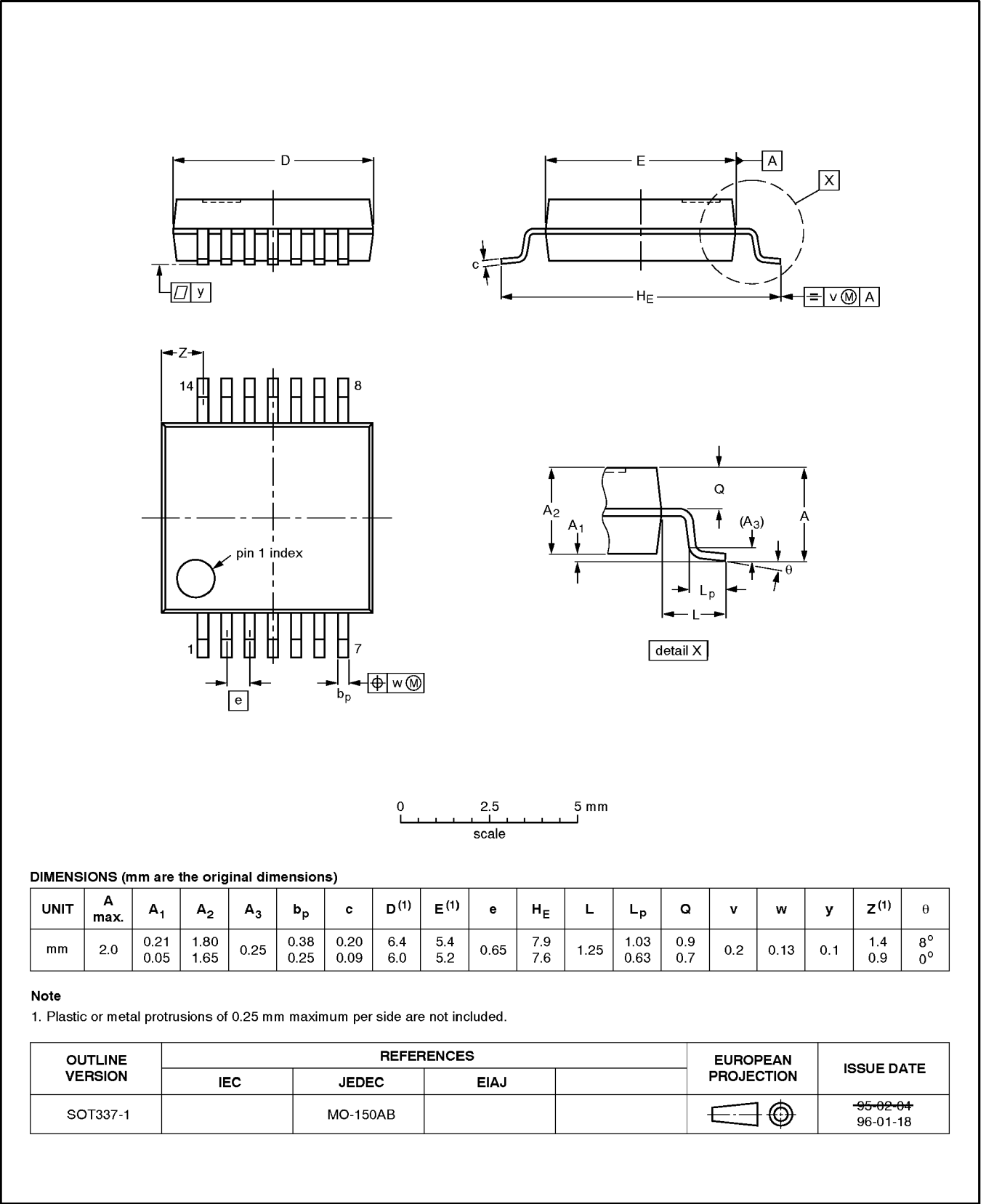


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SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



Quad 2-input NAND buffer (open drain)

74AC38
74ACT38

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

SOT402-1

