

DATA SHEET

74ABT20

Dual 4-input NAND gate

Product specification

1995 Sep 22

IC23 Data Handbook

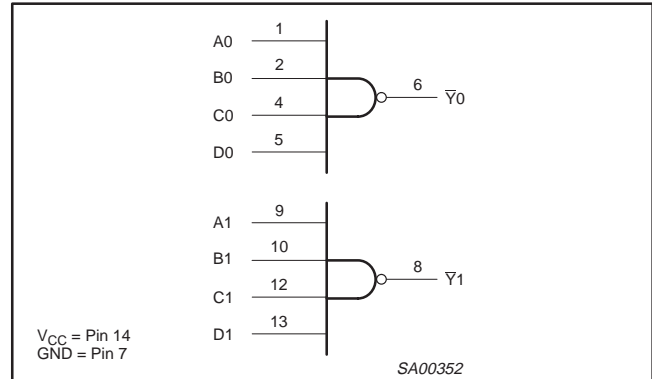
Dual 4-input NAND gate

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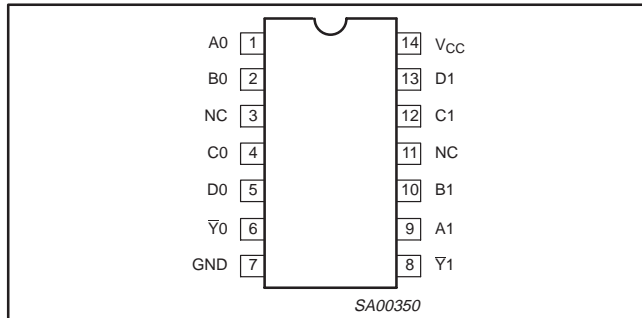
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25^{\circ}\text{C};$ $\text{GND} = 0\text{V}$	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay A_n, B_n, C_n, D_n to \bar{Y}_n	$C_L = 50\text{pF};$ $V_{CC} = 5\text{V}$	2.7 2.2	ns
t_{OSLH} t_{OSHL}	Output to Output skew		0.3	ns
C_{IN}	Input capacitance	$V_I = 0\text{V}$ or V_{CC}	3	pF
I_{CC}	Total supply current	Outputs disabled; $V_{CC} = 5.5\text{V}$	50	μA

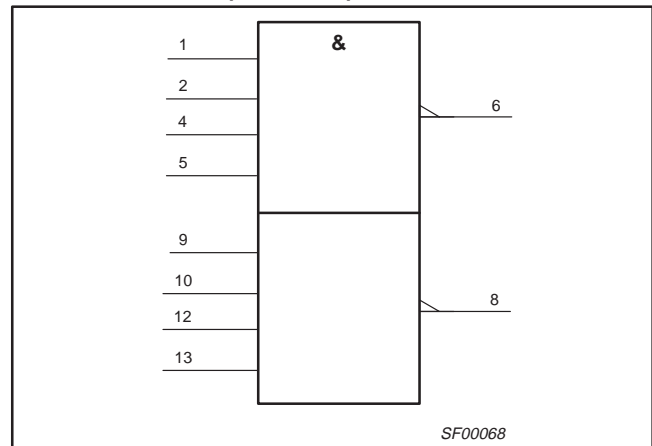
LOGIC DIAGRAM



PIN CONFIGURATION



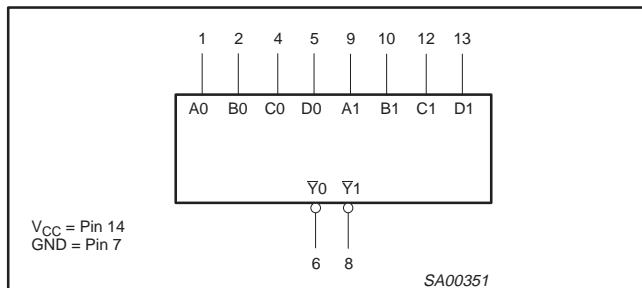
LOGIC SYMBOL (IEEE/IEC)



PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 2, 4, 5, 9, 10, 12, 13	A_n, B_n, C_n, D_n	Data inputs
6, 8	\bar{Y}_n	Data outputs
7	GND	Ground (0V)
14	V_{CC}	Positive supply voltage

LOGIC SYMBOL



FUNCTION TABLE

INPUTS				OUTPUT
A_n	B_n	C_n	D_n	\bar{Y}_n
L	X	X	X	H
X	L	X	X	H
X	X	L	X	H
X	X	X	L	H
H	H	H	H	L

NOTES:

- H = High voltage level
- L = Low voltage level
- X = Don't care

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
14-Pin Plastic DIP	-40°C to +85°C	74ABT20 N	74ABT20 N	SOT27-1
14-Pin plastic SO	-40°C to +85°C	74ABT20 D	74ABT20 D	SOT108-1
14-Pin Plastic SSOP Type II	-40°C to +85°C	74ABT20 DB	74ABT20 DB	SOT337-1
14-Pin Plastic TSSOP Type I	-40°C to +85°C	74ABT20 PW	74ABT20PW DH	SOT402-1

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ABSOLUTE MAXIMUM RATINGS^{1, 2}

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		-0.5 to +7.0	V
I_{IK}	DC input diode current	$V_I < 0$	-18	mA
V_I	DC input voltage ³		-1.2 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$	-50	mA
V_{OUT}	DC output voltage ³	output in Off or High state	-0.5 to +5.5	V
I_{OUT}	DC output current	output in Low state	40	mA
T_{stg}	Storage temperature range		-65 to 150	°C

NOTES:

- 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.
- The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V_{CC}	DC supply voltage	4.5	5.5	V
V_I	Input voltage	0	V_{CC}	V
V_{IH}	High-level input voltage	2.0		V
V_{IL}	Low-level input voltage		0.8	V
I_{OH}	High-level output current		-15	mA
I_{OL}	Low-level output current		20	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0	10	ns/V
T_{amb}	Operating free-air temperature range	-40	+85	°C

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS				UNIT	
			$T_{amb} = +25^\circ\text{C}$			$T_{amb} = -40^\circ\text{C}$ to $+85^\circ\text{C}$		
			MIN	TYP	MAX	MIN		MAX
V_{IK}	Input clamp voltage	$V_{CC} = 4.5\text{V}; I_{IK} = -18\text{mA}$		-0.9	-1.2		-1.2	V
V_{OH}	High-level output voltage	$V_{CC} = 4.5\text{V}; I_{OH} = -15\text{mA}; V_I = V_{IL}$ or V_{IH}	2.5	2.9		2.5		V
V_{OL}	Low-level output voltage	$V_{CC} = 4.5\text{V}; I_{OL} = 20\text{mA}; V_I = V_{IL}$ or V_{IH}		0.35	0.5		0.5	V
I_I	Input leakage current	$V_{CC} = 5.5\text{V}; V_I = \text{GND}$ or 5.5V		± 0.01	± 1.0		± 1.0	μA
I_{OFF}	Power-off leakage current	$V_{CC} = 0.0\text{V}; V_O$ or $V_I \leq 4.5\text{V}$		± 5.0	± 100		± 100	μA
I_{CEX}	Output High leakage current	$V_{CC} = 5.5\text{V}; V_O = 5.5\text{V}; V_I = \text{GND}$ or V_{CC}		5.0	50		50	μA
I_O	Output current ¹	$V_{CC} = 5.5\text{V}; V_O = 2.5\text{V}$	-50	-75	-180	-50	-180	mA
I_{CC}	Quiescent supply current	$V_{CC} = 5.5\text{V}; V_I = \text{GND}$ or V_{CC}		2	50		50	μA
ΔI_{CC}	Additional supply current per input pin ²	$V_{CC} = 5.5\text{V}$; One data input at 3.4V, other inputs at V_{CC} or GND		0.25	500		500	μA

NOTES:

- Not more than one output should be tested at a time, and the duration of the test should not exceed one second.
- This is the increase in supply current for each input at 3.4V.
- For valid test results, data must not be loaded into the flip-flop or latch after applying the power.

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AC CHARACTERISTICS

GND = 0V; $t_R = t_F = 2.5\text{ns}$; $C_L = 50\text{pF}$, $R_L = 500\Omega$

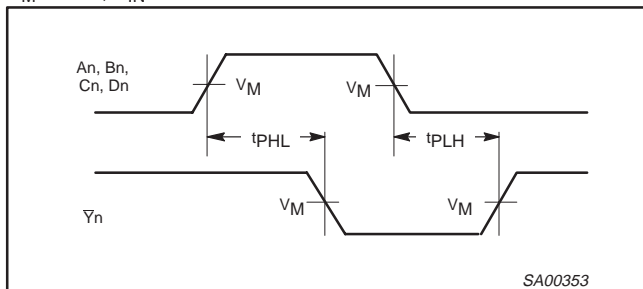
SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			$T_{\text{amb}} = +25^\circ\text{C}$ $V_{\text{CC}} = +5.0\text{V}$			$T_{\text{amb}} = -40^\circ\text{C to } +85^\circ\text{C}$ $V_{\text{CC}} = +5.0\text{V} \pm 0.5\text{V}$		
			MIN	TYP	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay An, Bn, Cn, Dn to \bar{Y}_n	1	1.0	2.7	3.9	1.0	4.6	ns
t_{OSHL} t_{OSLH}	Output to Output skew An or Bn to \bar{Y}_n	2		0.3	0.5		0.5	ns

NOTE:

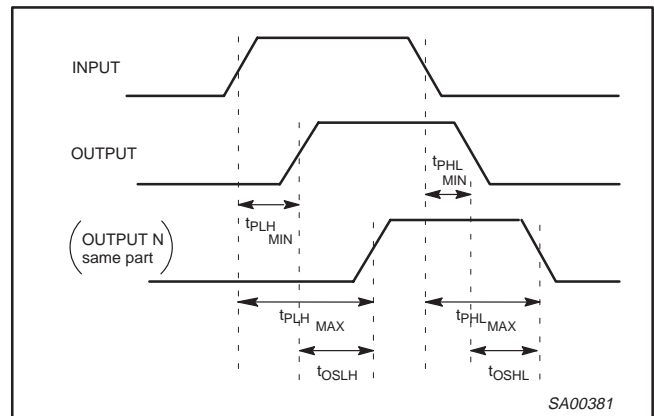
- Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the the same direction, either HIGH-to-LOW (t_{OSHL}) or LOW-to-HIGH (t_{OSLH}); parameter guaranteed by design.

AC WAVEFORMS

$V_M = 1.5\text{V}$, $V_{\text{IN}} = \text{GND to } 3.0\text{V}$



Waveform 1. Propagation Delay for Inverting Outputs



Waveform 2. Common edge skew

TEST CIRCUIT AND WAVEFORMS

Test Circuit for Outputs

Input Pulse Definition

$V_M = 1.5\text{V}$

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

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

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_w	t_R	t_F
74ABT	3.0V	1MHz	500ns	2.5ns	2.5ns

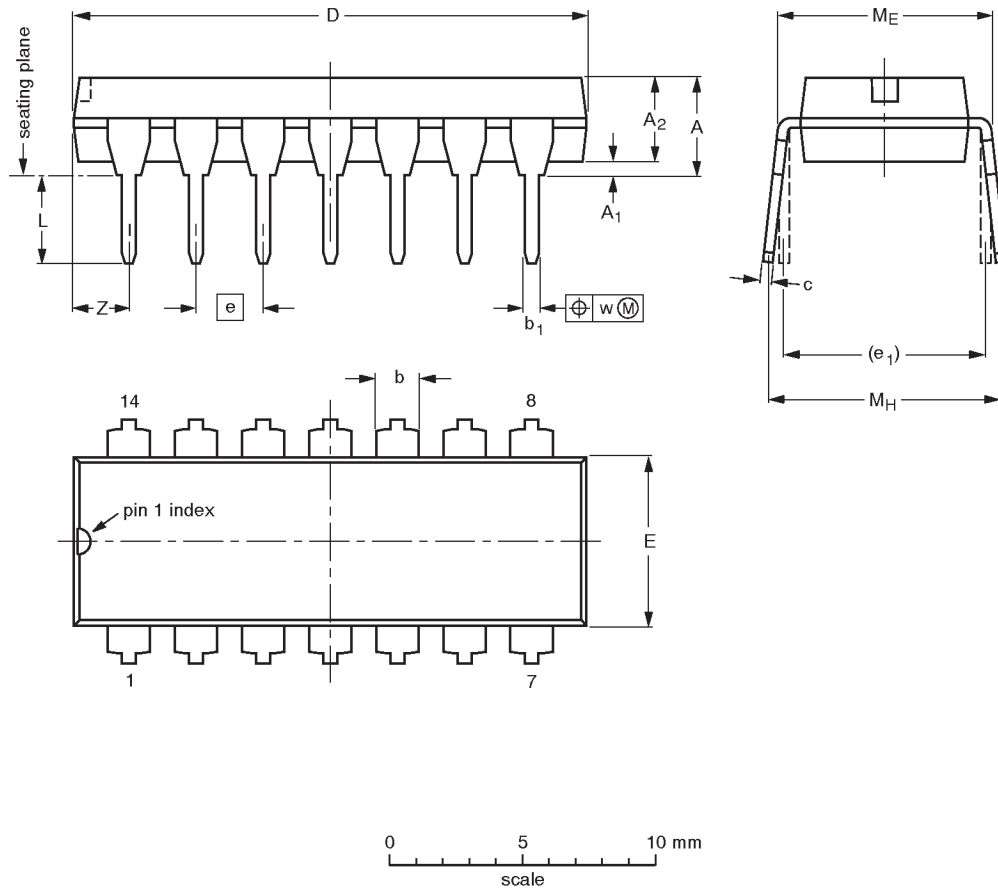
SH00067

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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 ₁ min.	A ₂ max.	b	b ₁	c	D ⁽¹⁾	E ⁽¹⁾	e	e ₁	L	M _E	M _H	w	Z ⁽¹⁾ 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	0.020	0.13	0.068 0.044	0.021 0.015	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	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 maximum per side are not included.

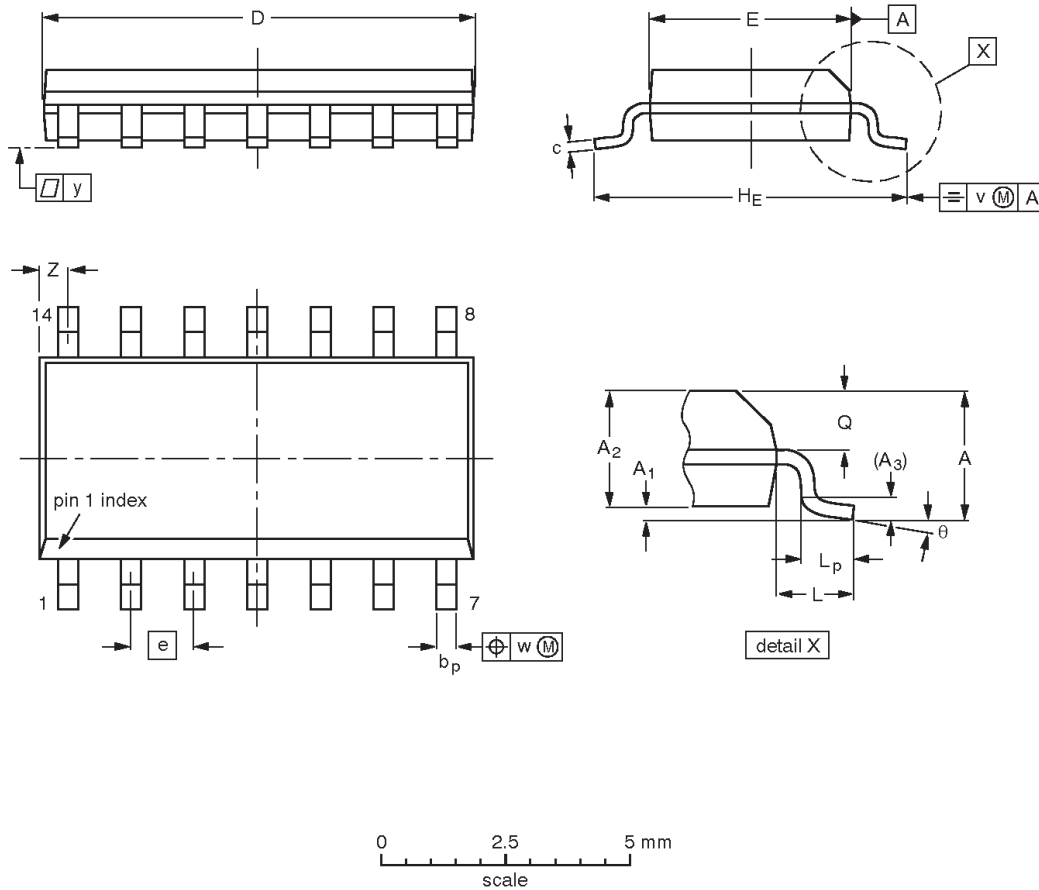
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT27-1	050G04	MO-001AA				92-11-17 95-03-11

Dual 4-input NAND gate

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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 ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	z ⁽¹⁾	θ
mm	1.75	0.25 0.10	1.45 1.25	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	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.35 0.34	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

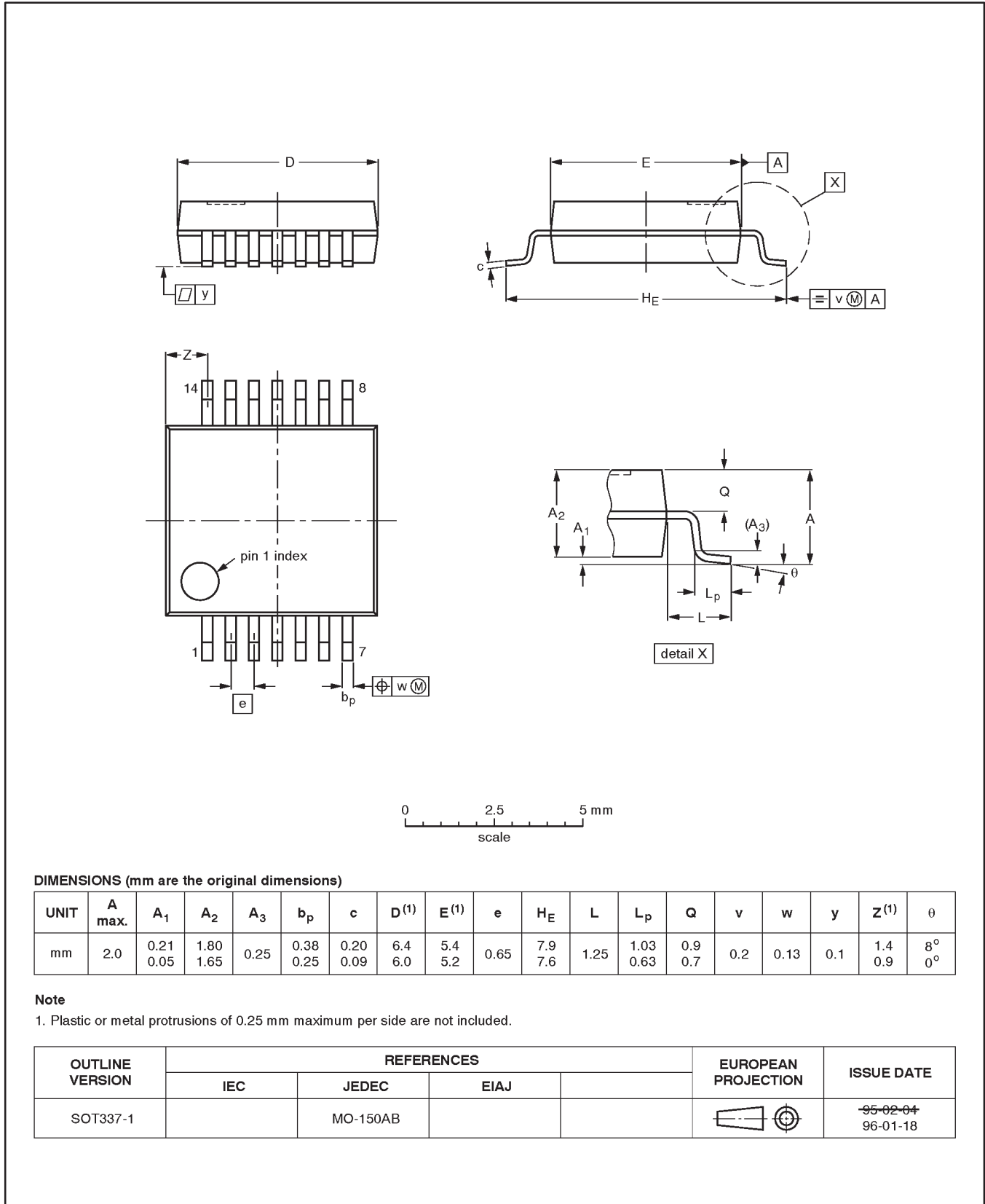
OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT108-1	076E06S	MS-012AB			95-01-29 97-05-22

Dual 4-input NAND gate

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

SOT337-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

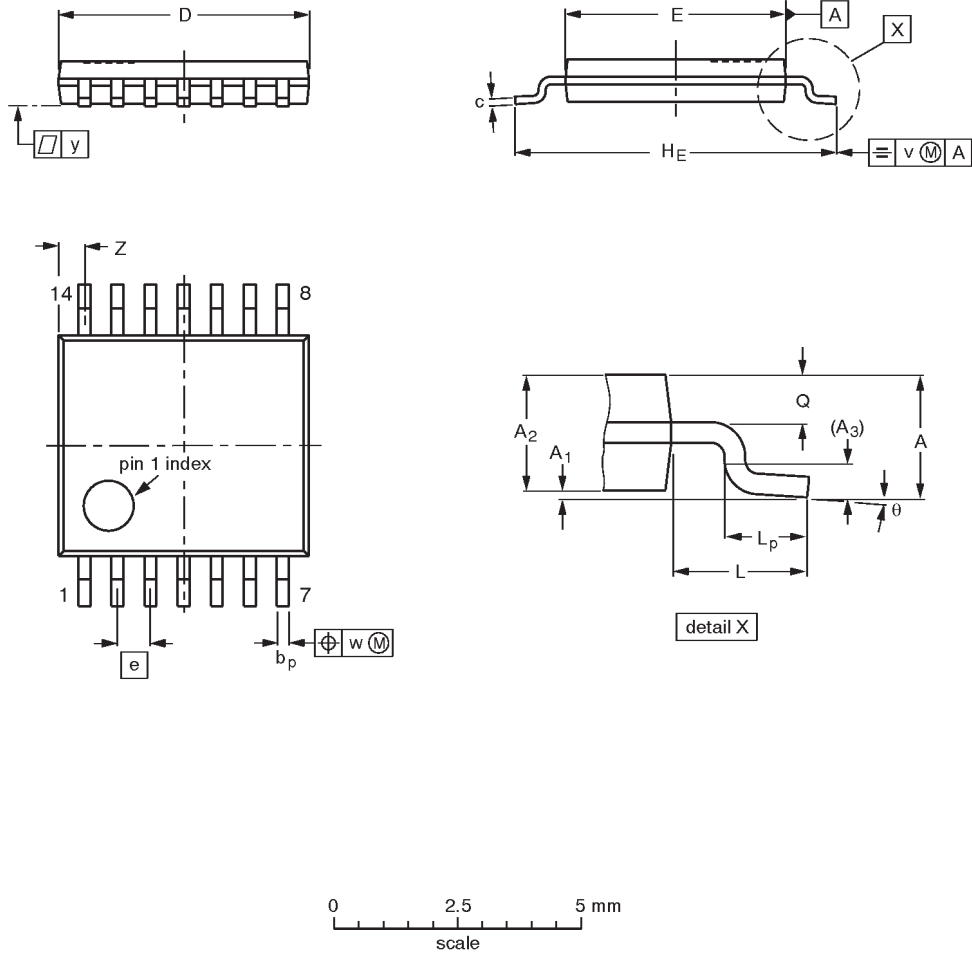
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT337-1		MO-150AB				95-02-04 96-01-18

Dual 4-input NAND gate

74ABT20

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

SOT402-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	e	H _E	L	L _p	Q	v	w	y	z ⁽¹⁾	θ
mm	1.10	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT402-1		MO-153				-94-07-12- 95-04-04

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NOTES

Dual 4-input NAND gate

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DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	Formative or in Design	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	Preproduction Product	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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