

DATA SHEET

74LVC1G00

Single 2-input NAND gate

Product specification
Supersedes data of 2002 Nov 15

2004 Sep 07

Single 2-input NAND gate

74LVC1G00

FEATURES

- Wide supply voltage range from 1.65 V to 5.5 V
- High noise immunity
- Complies with JEDEC standard:
 - 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).
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- Multiple package options
- ESD protection:
 - HBM EIA/JESD22-A114-B exceeds 2000 V
 - MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C.

DESCRIPTION

The 74LVC1G00 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

Input can be driven from either 3.3 V or 5 V devices. These features allow the use of these devices in a mixed 3.3 V and 5 V environment.

Schmitt trigger action at all inputs makes the circuit tolerant for slower input rise and fall time.

This device is fully specified for partial power-down applications using I_{off} . The I_{off} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

The 74LVC1G00 provides the single 2-input NAND function.

QUICK REFERENCE DATA

GND = 0 V; $T_{amb} = 25$ °C; $t_r = t_f \leq 2.5$ ns.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	propagation delay inputs A, B to output Y	$V_{CC} = 1.8$ V; $C_L = 30$ pF; $R_L = 1$ k Ω	3.3	ns
		$V_{CC} = 2.5$ V; $C_L = 30$ pF; $R_L = 500$ Ω	2.2	ns
		$V_{CC} = 2.7$ V; $C_L = 50$ pF; $R_L = 500$ Ω	2.8	ns
		$V_{CC} = 3.3$ V; $C_L = 50$ pF; $R_L = 500$ Ω	2.2	ns
		$V_{CC} = 5.0$ V; $C_L = 50$ pF; $R_L = 500$ Ω	1.8	ns
C_I	input capacitance		5	pF
C_{PD}	power dissipation capacitance per buffer	$V_{CC} = 3.3$ V; notes 1 and 2	14	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μ W).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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 Volts;

N = total switching outputs;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

2. The condition is $V_I = \text{GND to } V_{CC}$.

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FUNCTION TABLE

See note 1.

INPUT		OUTPUT
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

Note

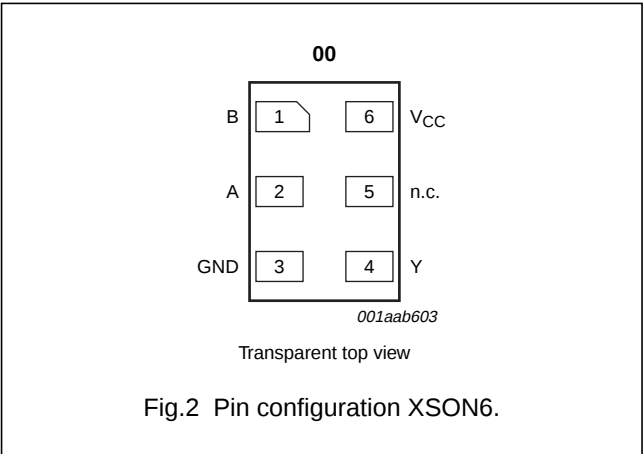
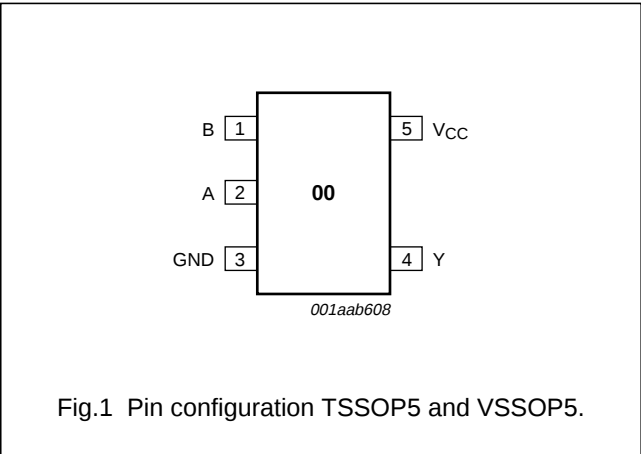
1. H = HIGH voltage level;
L = LOW voltage level.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74LVC1G00GW	−40 °C to +125 °C	5	SC-88A	plastic	SOT353	VA
74LVC1G00GV	−40 °C to +125 °C	5	SC-74A	plastic	SOT753	V00
74LVC1G00GM	−40 °C to +125 °C	6	XSON6	plastic	SOT886	VA

PINNING

PIN (TSSOP5, VSSOP5)	PIN (XSON6)	SYMBOL	DESCRIPTION
1	1	B	data input B
2	2	A	data input A
3	3	GND	ground (0 V)
4	4	Y	data output Y
-	5	n.c.	not connected
5	6	V _{CC}	supply voltage



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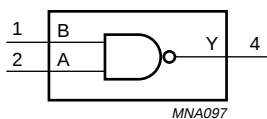


Fig.3 Logic symbol.



Fig.4 IEEE/IEC logic symbol.

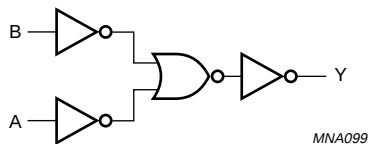


Fig.5 Logic diagram.

Single 2-input NAND gate

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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	supply voltage		1.65	5.5	V
V_I	input voltage		0	5.5	V
V_O	output voltage	active mode	0	V_{CC}	V
		$V_{CC} = 0$ V; Power-down mode	0	5.5	V
T_{amb}	operating ambient temperature		-40	+125	°C
t_r, t_f	input rise and fall times	$V_{CC} = 1.65$ V to 2.7 V	0	20	ns/V
		$V_{CC} = 2.7$ V to 5.5 V	0	10	ns/V

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	+6.5	V
I_{IK}	input diode current	$V_I < 0$ V	—	-50	mA
V_I	input voltage	note 1	-0.5	+6.5	V
I_{OK}	output diode current	$V_O > V_{CC}$ or $V_O < 0$ V	—	±50	mA
V_O	output voltage	active mode; notes 1 and 2	-0.5	$V_{CC} + 0.5$	V
		Power-down mode; notes 1 and 2	-0.5	+6.5	V
I_O	output diode current	$V_O = 0$ V to V_{CC}	—	±50	mA
I_{CC}, I_{GND}	V_{CC} or GND current		—	±100	mA
T_{stg}	storage temperature		-65	+150	°C
P_D	power dissipation per package	for temperature range from -40 °C to +125 °C	—	250	mW

Notes

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 5.5 V in normal operation.

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DC CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. ⁽¹⁾	MAX.	UNIT
		OTHER	V _{CC} (V)				
T _{amb} = −40 °C to +85 °C							
V _{IH}	HIGH-level input voltage		1.65 to 1.95	0.65 × V _{CC}	−	−	V
			2.3 to 2.7	1.7	−	−	V
			2.7 to 3.6	2.0	−	−	V
			4.5 to 5.5	0.7 × V _{CC}	−	−	V
V _{IL}	LOW-level input voltage		1.65 to 1.95	−	−	0.35 × V _{CC}	V
			2.3 to 2.7	−	−	0.7	V
			2.7 to 3.6	−	−	0.8	V
			4.5 to 5.5	−	−	0.3 × V _{CC}	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = 100 μA	1.65 to 5.5	−	−	0.1	V
		I _O = 4 mA	1.65	−	−	0.45	V
		I _O = 8 mA	2.3	−	−	0.3	V
		I _O = 12 mA	2.7	−	−	0.4	V
		I _O = 24 mA	3.0	−	−	0.55	V
		I _O = 32 mA	4.5	−	−	0.55	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = −100 μA	1.65 to 5.5	V _{CC} − 0.1	−	−	V
		I _O = −4 mA	1.65	1.2	−	−	V
		I _O = −8 mA	2.3	1.9	−	−	V
		I _O = −12 mA	2.7	2.2	−	−	V
		I _O = −24 mA	3.0	2.3	−	−	V
		I _O = −32 mA	4.5	3.8	−	−	V
I _{LI}	input leakage current	V _I = 5.5 V or GND	5.5	−	±0.1	±5	μA
I _{off}	power OFF leakage current	V _I or V _O = 5.5 V	0	−	±0.1	±10	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A	5.5	−	0.1	10	μA
ΔI _{CC}	additional quiescent supply current per pin	V _I = V _{CC} − 0.6 V; I _O = 0 A	2.3 to 5.5	−	5	500	μA

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SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. ⁽¹⁾	MAX.	UNIT
		OTHER	V _{CC} (V)				
T _{amb} = −40 °C to +125 °C							
V _{IH}	HIGH-level input voltage		1.65 to 1.95	0.65 × V _{CC}	—	—	V
			2.3 to 2.7	1.7	—	—	V
			2.7 to 3.6	2.0	—	—	V
			4.5 to 5.5	0.7 × V _{CC}	—	—	V
V _{IL}	LOW-level input voltage		1.65 to 1.95	—	—	0.35 × V _{CC}	V
			2.3 to 2.7	—	—	0.7	V
			2.7 to 3.6	—	—	0.8	V
			4.5 to 5.5	—	—	0.3 × V _{CC}	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = 100 μA	1.65 to 5.5	—	—	0.1	V
		I _O = 4 mA	1.65	—	—	0.70	V
		I _O = 8 mA	2.3	—	—	0.45	V
		I _O = 12 mA	2.7	—	—	0.60	V
		I _O = 24 mA	3.0	—	—	0.80	V
		I _O = 32 mA	4.5	—	—	0.80	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}					
		I _O = −100 μA	1.65 to 5.5	V _{CC} − 0.1	—	—	V
		I _O = −4 mA	1.65	0.95	—	—	V
		I _O = −8 mA	2.3	1.7	—	—	V
		I _O = −12 mA	2.7	1.9	—	—	V
		I _O = −24 mA	3.0	2.0	—	—	V
		I _O = −32 mA	4.5	3.4	—	—	V
I _{LI}	input leakage current	V _I = 5.5 V or GND	5.5	—	—	±100	μA
I _{off}	power OFF leakage current	V _I or V _O = 5.5 V	0	—	—	±200	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A	5.5	—	—	200	μA
ΔI _{CC}	additional quiescent supply current per pin	V _I = V _{CC} − 0.6 V; I _O = 0 A	2.3 to 5.5	—	—	5000	μA

Note

1. All typical values are measured at V_{CC} = 3.3 V and T_{amb} = 25 °C.

Single 2-input NAND gate

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AC CHARACTERISTICS

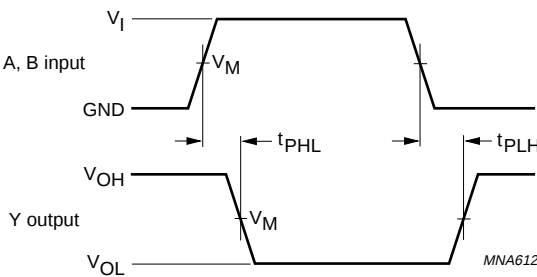
GND = 0 V; $t_r = t_f \leq 2.0$ ns.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V _{CC} (V)				
T _{amb} = −40 °C to +85 °C							
t _{PHL} /t _{PLH}	propagation delay A, B to Y	see Figs 6 and 7	1.65 to 1.95	1.0	3.3	8.0	ns
			2.3 to 2.7	0.5	2.2	5.5	ns
			2.7	0.5	2.6	5.8	ns
			3.0 to 3.6	0.5	2.2	4.7	ns
			4.5 to 5.5	0.5	1.8	4.0	ns
T _{amb} = −40 °C to +125 °C							
t _{PHL} /t _{PLH}	propagation delay A, B to Y	see Figs 6 and 7	1.65 to 1.95	1.0	–	10.5	ns
			2.3 to 2.7	0.5	–	7.0	ns
			2.7	0.5	–	7.5	ns
			3.0 to 3.6	0.5	–	6.0	ns
			4.5 to 5.5	0.5	–	5.5	ns

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AC WAVEFORMS



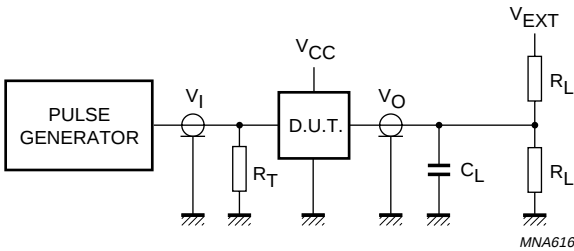
V_{CC}	V_M	INPUT	
		V_I	$t_r = t_f$
1.65 V to 1.95 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.0 ns
2.3 V to 2.7 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 V to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns
4.5 V to 5.5 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.5 ns

V_{OL} and V_{OH} are typical output voltage drop that occur with the output load.

Fig.6 A, B to Y propagation delay times.

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V _{CC}	V _I	C _L	R _L	V _{EXT}		
				t _{PLH} /t _{PHL}	t _{PZH} /t _{PHZ}	t _{PZL} /t _{PLZ}
1.65 V to 1.95 V	V _{CC}	30 pF	1 kΩ	open	GND	2 × V _{CC}
2.3 V to 2.7 V	V _{CC}	30 pF	500 Ω	open	GND	2 × V _{CC}
2.7 V	2.7 V	50 pF	500 Ω	open	GND	6 V
3.0 V to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	6 V
4.5 V to 5.5 V	V _{CC}	50 pF	500 Ω	open	GND	2 × V _{CC}

Definitions for test circuit:
R_L = Load resistor.
C_L = Load capacitance including jig and probe capacitance.
R_T = Termination resistance should be equal to the output impedance Z_o of the pulse generator.

Fig.7 Load circuitry for switching times.

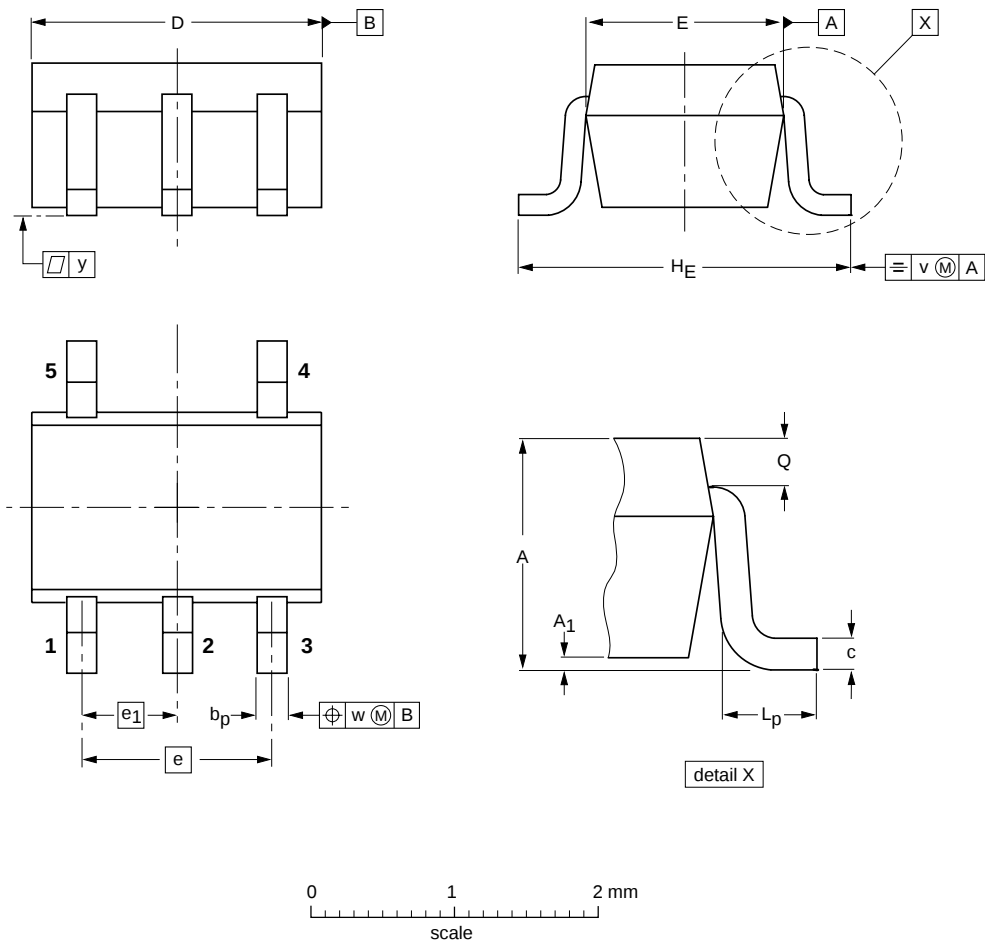
Single 2-input NAND gate

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PACKAGE OUTLINES

Plastic surface mounted package; 5 leads

SOT353



DIMENSIONS (mm are the original dimensions)

UNIT	A	A1 max	bp	c	D	E (2)	e	e1	HE	Lp	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

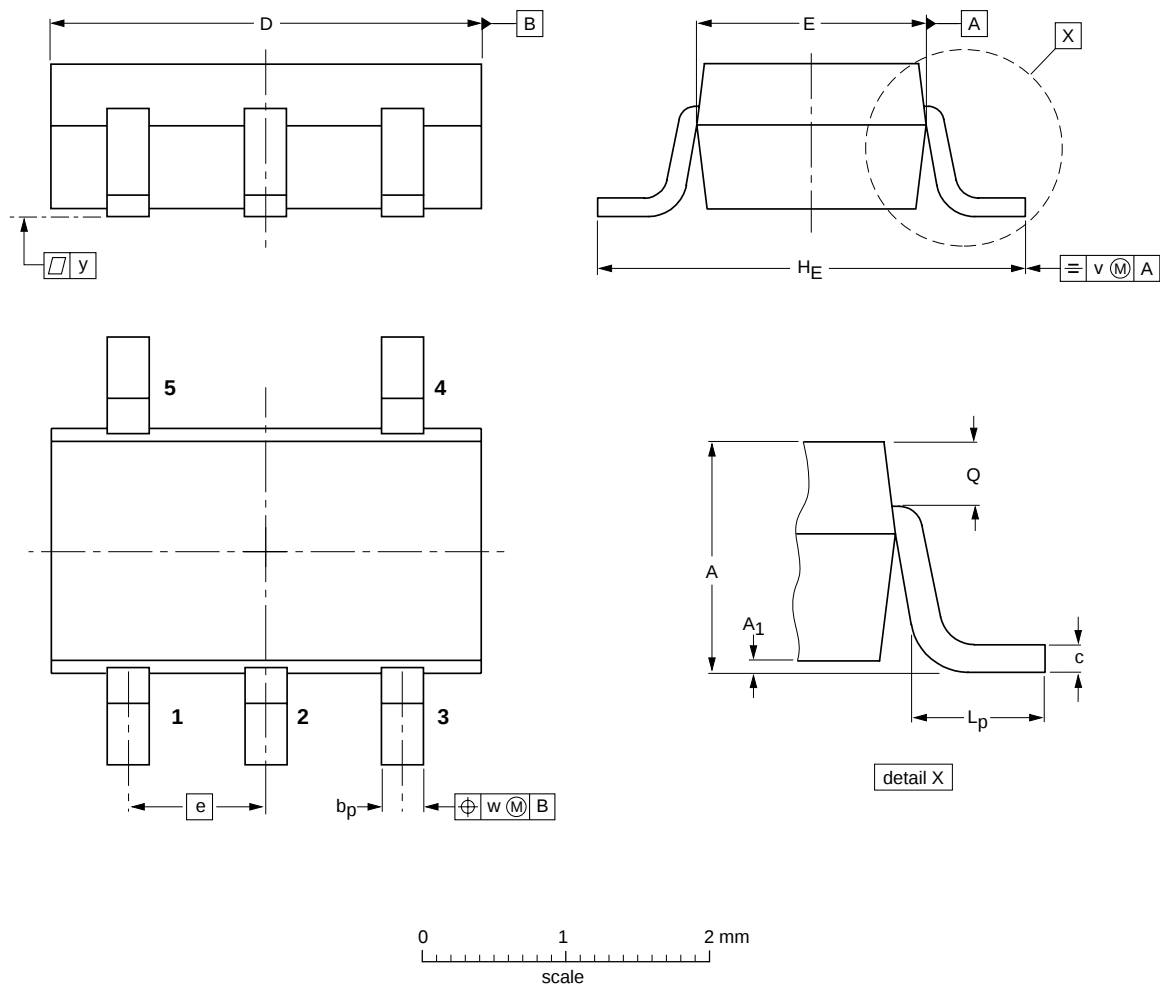
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT353			SC-88A			97-02-28

Single 2-input NAND gate

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Plastic surface mounted package; 5 leads

SOT753



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b _p	c	D	E	e	H _E	L _p	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

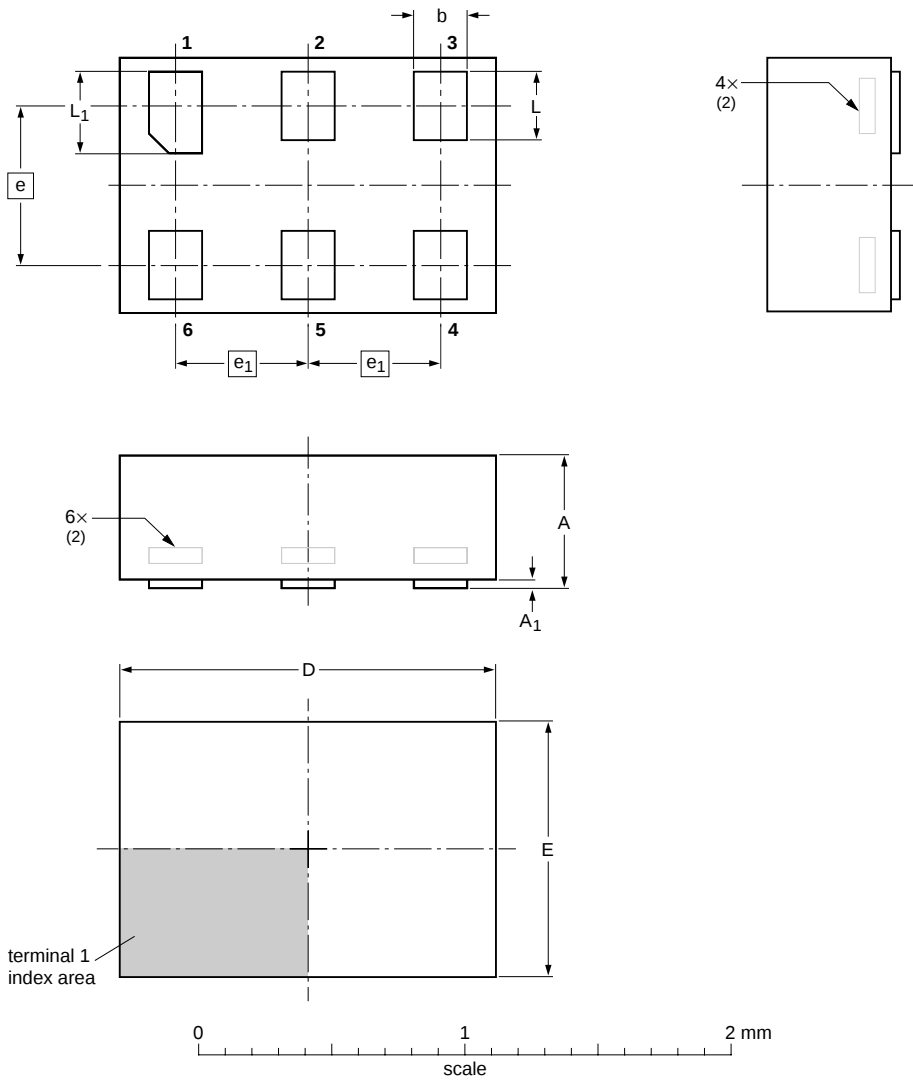
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	IEC	JEDEC	JEITA			
SOT753			SC-74A			02-04-16

Single 2-input NAND gate

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XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886



DIMENSIONS (mm are the original dimensions)

UNIT	A ⁽¹⁾ max	A ₁ max	b	D	E	e	e ₁	L	L ₁
mm	0.5	0.04	0.25 0.17	1.5 1.4	1.05 0.95	0.6	0.5	0.35 0.27	0.40 0.32

- Notes
- 1. Including plating thickness.
 - 2. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT886		MO-252				04-07-15 04-07-22

Single 2-input NAND gate

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DATA SHEET STATUS

LEVEL	DATA SHEET STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾⁽³⁾	DEFINITION
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