74LV1T00

2-input single supply translating NAND gate

Rev. 5 — 7 December 2023

Product data sheet

1. General description

The 74LV1T00 is a single, level translating 2-input NAND gate. The low threshold inputs support 1.8 V input logic at $V_{CC} = 3.3$ V and can be used in 1.8 V to 3.3 V level up translation. In addition, the 5 V tolerant input pins enable level down translation (3.3 V to 2.5 V output at $V_{CC} = 2.5$ V). The output level is referenced to the supply voltage and supports 1.8 V, 2.5 V, 3.3 V and 5.0 V CMOS levels. The wide V_{CC} range permits the generation of output levels to connect to controllers or processors.

2. Features and benefits

- Single supply voltage translator at 1.8 V, 2.5 V, 3.3 V and 5.0 V
- Up translation
 - 1.2 V to 1.8 V at V_{CC} = 1.8 V
 - 1.5 V to 2.5 V at V_{CC} = 2.5 V
 - 1.8 V to 3.3 V at V_{CC} = 3.3 V
 - 3.3 V to 5.0 V at V_{CC} = 5.0 V
- Down translation
 - 3.3 V to 1.8 V at V_{CC} = 1.8 V
 - 3.3 V to 2.5 V at V_{CC} = 2.5 V
 - 5.0 V to 3.3 V at V_{CC} = 3.3 V
- 5 V tolerant inputs
- Latch-up performance exceeds 250 mA per JESD 78 Class II
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Applications

- · Portable applications
- PC and notebooks
- Industrial controller
- Telecom



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4. Ordering information

Table 1. Ordering information

Type number	Package						
	Temperature range	Name	Description	Version			
74LV1T00GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1			
74LV1T00GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753			
74LV1T00GX	-40 °C to +125 °C	X2SON5	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm	SOT1226-3			

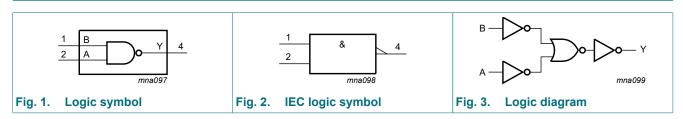
5. Marking

Table 2. Marking

Type number	Marking code[1]
74LV1T00GW	Sa
74LV1T00GV	Sa
74LV1T00GX	Sa

^[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

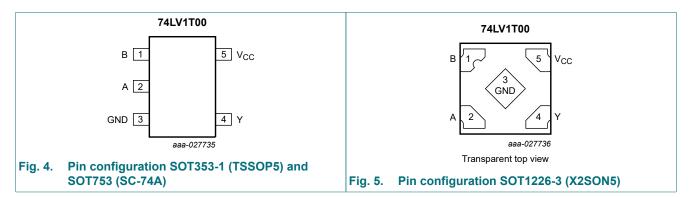
6. Functional diagram



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7. Pinning information

7.1. Pinning



7.2. Pin description

Table 3. Pin description

Symbol	Pin	Description		
В	1	data input		
A	2	data input		
GND	3	ground (0 V)		
Υ	4	data output		
V _{CC}	5	supply voltage		

8. Functional description

Table 4. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level.$

Input	Output	
Α	В	Υ
L	L	Н
L	Н	Н
Н	L	Н
Н	Н	L

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9. Limiting values

Table 5. 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	+7.0	V
VI	input voltage	[1]	-0.5	+7.0	V
Vo	output voltage	output HIGH or LOW state [2][3]	-0.5	V _{CC} + 0.5	V
		output in power-off state [2]	-0.5	4.6	V
I _{IK}	input clamping current	V _I < 0 V	-20	-	mA
I _{OK}	output clamping current	$V_O < 0 \text{ V or } V_O > V_{CC}$	-	±20	mA
Io	output current	V _O = 0 V to V _{CC}	-	±25	mA
I _{CC}	supply current		-	50	mA
I _{GND}	ground current		-50	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$ [4]	-	250	mW

^[1] If the input current ratings are observed, the minimum input voltage ratings may be exceeded.

10. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V_{CC}	supply voltage		1.6	5.0	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage	output HIGH or LOW state	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 1.8 V to 5.0 V	-	-	20	ns/V

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^[2] If the output current ratings are observed, the output voltage ratings may be exceeded.

^[3] This value is limited to 7 V maximum.

^[4] For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C. For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C. For SOT1226-3 (X2SON5) package: P_{tot} derates linearly with 3.0 mW/K above 67 °C.

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11. Static characteristics

Table 7. Static characteristics

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	Max	Min	Max	Min	Max	
V _{IH}	HIGH-level	V _{CC} = 1.65 V to 1.8 V	0.94	-	1.0	-	1.0	-	V
	input voltage	V _{CC} = 2.0 V	0.99	-	1.03	-	1.03	-	V
		V _{CC} = 2.25 V to 2.5 V	1.135	-	1.18	-	1.18	-	V
		V _{CC} = 2.75 V	1.21	-	1.23	-	1.23	-	V
		V _{CC} = 3.0 V to 3.3 V	1.35	-	1.37	-	1.37	-	V
		V _{CC} = 3.6 V	1.47	-	1.48	-	1.48	-	V
		V _{CC} = 4.5 V to 5.0 V	2.02	-	2.03	-	2.03	-	V
		V _{CC} = 5.5 V	2.10	-	2.11	-	2.11	-	V
V _{IL}	LOW-level	V _{CC} = 1.65 V to 2.0 V	-	0.58	-	0.55	-	0.55	V
	input voltage	V _{CC} = 2.25 V to 2.75 V	-	0.75	-	0.71	-	0.71	V
		V _{CC} = 3.0 V to 3.6 V	-	0.80	-	0.65	-	0.65	V
		V _{CC} = 4.5 V to 5.5 V	-	0.80	-	0.80	-	0.80	V
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL} ;							
	output voltage	V _{CC} = 1.65 V to 5.5 V; I _O = -20 μA	V _{CC} - 0.1	-	V _{CC} - 0.1	-	V _{CC} - 0.1	-	V
		V _{CC} = 1.65 V; I _O = -2 mA	1.28	-	1.21	-	1.21	-	V
		V _{CC} = 1.8 V; I _O = -2 mA	1.5	-	1.45	-	1.45	-	V
		V_{CC} = 2.3 V; I_{O} = -2.3 mA	2.0	-	2.0	-	2.0	-	V
		$V_{CC} = 2.3 \text{ V}; I_{O} = -3 \text{ mA}$	2.0	-	1.93	-	1.93	-	V
		$V_{CC} = 2.5 \text{ V}; I_{O} = -3 \text{ mA}$	2.25	-	2.15	-	2.15	-	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = -3 \text{ mA}$	2.78	-	2.7	-	2.7	-	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = -5.5 \text{ mA}$	2.6	-	2.49	-	2.49	-	V
		$V_{CC} = 3.3 \text{ V}; I_{O} = -5.5 \text{ mA}$	2.9	-	2.8	-	2.8	-	V
		$V_{CC} = 4.5 \text{ V}; I_{O} = -4 \text{ mA}$	4.2	-	4.1	-	4.1	-	V
		$V_{CC} = 4.5 \text{ V}; I_{O} = -8 \text{ mA}$	4.1	-	3.95	-	3.95	-	V
		$V_{CC} = 5.0 \text{ V}; I_{O} = -8 \text{ mA}$	4.6	-	4.5	-	4.5	-	V
V _{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}							
	output voltage	V _{CC} = 1.65 V to 5.5 V; I _O = 20 μA	-	0.1	-	0.1	-	0.1	V
		V _{CC} = 1.65 V; I _O = 2 mA	-	0.2	-	0.25	-	0.25	V
		V _{CC} = 2.3 V; I _O = 2.3 mA	-	0.1	-	0.15	-	0.15	V
		$V_{CC} = 2.3 \text{ V}; I_{O} = 3 \text{ mA}$	-	0.15	-	0.2	-	0.2	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = 3 \text{ mA}$	-	0.1	-	0.15	-	0.15	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = 5.5 \text{ mA}$	-	0.2	-	0.252	-	0.252	V
		V _{CC} = 4.5 V; I _O = 4 mA	-	0.15	-	0.2	-	0.2	V
		V _{CC} = 4.5 V; I _O = 8 mA	-	0.3	-	0.35	-	0.35	V
l _l	input leakage current	V _I = V _{CC} or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	-	±1	-	±1	μΑ
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 1.8 V, 2.5 V, 3.3 V, 5.0 V	-	1	-	10	-	10	μA

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Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	Min	Max	
ΔI _{CC}	additional supply current	per input pin; V_{CC} = 1.8 V; V_I = 0.3 V or 1.1 V; I_O = 0 A; other pins at V_{CC} or GND	-	10	-	10	-	10	μΑ
		per input pin; V_{CC} = 5.5 V; V_I = 0.3 V or 3.4 V; I_O = 0 A; other pins at V_{CC} or GND	-	1.35	-	1.5	-	1.5	mA

12. Dynamic characteristics

Table 8. Dynamic characteristics

GND = 0 V. For test circuit, see Fig. 7.

Symbol	Parameter	Conditions		25 °C		-40 °C to	+85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
t _{pd}	propagation	A, B to Y; see <u>Fig. 6</u> [1]								
	delay	V _{CC} = 1.8 V; C _L = 15 pF	-	6.4	10.2	-	11.5	-	12.3	ns
		V _{CC} = 1.8 V; C _L = 30 pF	-	7.5	12.0	-	13.4	-	14.4	ns
		V _{CC} = 2.5 V; C _L = 15 pF	-	4.5	6.9	-	7.8	-	8.4	ns
		V _{CC} = 2.5 V; C _L = 30 pF	-	5.3	8.0	-	9.1	-	9.7	ns
		V _{CC} = 3.3 V; C _L = 15 pF	-	3.7	5.6	-	6.2	-	6.6	ns
		V _{CC} = 3.3 V; C _L = 30 pF	-	4.3	6.4	-	7.1	-	7.6	ns
		V _{CC} = 5.0 V; C _L = 15 pF	-	3.1	4.2	-	4.6	-	4.8	ns
		V _{CC} = 5.0 V; C _L = 30 pF	-	3.6	4.8	-	5.2	-	5.5	ns
Cı	input capacitance	$V_I = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	1.5	10	-	10	-	10	pF
Co	output capacitance	$V_O = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	2.5	-	-	-	-	-	pF
C _{PD}	power dissipation	per buffer; V_I = GND to V_{CC} ; [2] C_L = 30 pF; f = 10 MHz								
	capacitance	V _{CC} = 1.8 V	-	4.0	-	-	-	-	-	pF
		V _{CC} = 2.5 V	-	5.3	-	-	-	-	-	pF
		V _{CC} = 3.3 V	-	7.1	-	-	-	-	-	pF
		V _{CC} = 5.0 V	-	11.2	-	-	-	-	-	pF

 t_{pd} is the same as t_{PLH} and t_{PHL} . C_{PD} is used to determine the dynamic power dissipation (P_D in μ W). $P_D = C_{PD} \times V_{CC}^{\ \ 2} \times f_i \times N + \sum (C_L \times V_{CC}^{\ \ 2} \times f_o)$ where:

 f_i = input frequency in MHz;

f_o = output frequency in MHz;

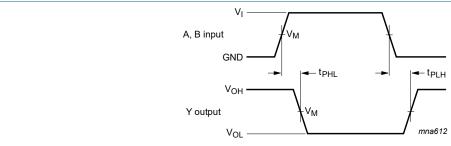
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching; $\sum (C_L \times V_{CC}^2 \times f_o) = \text{sum of the outputs.}$

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12.1. Waveforms and test circuit



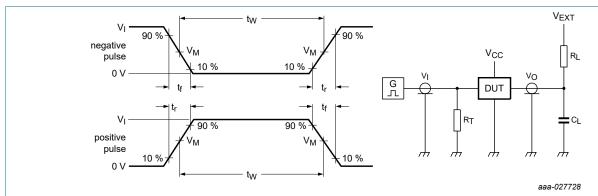
Measurement points are given in Table 9.

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

Fig. 6. The input A, B to output Y propagation delays

Table 9. Measurement points

Input	Output
V _M	V_{M}
0.5 × V _I	0.5 × V _{CC}



Test data is given in Table 10.

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;

R_L = Load resistance;

V_{EXT} = External voltage for measuring switching times.

Fig. 7. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Supply voltage Input		Load		V _{EXT}			
V _{CC}	V _I	Δt/ΔV [1]	f _{max}	CL	R _L	t _{PLH} , t _{PHL}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}
1.8 V	V _{CC}	≤ 1.0 ns/V	15 MHz	15 pF, 30 pF	1ΜΩ	GND	GND	V _{CC}
2.5 V	V_{CC}	≤ 1.0 ns/V	25 MHz	15 pF, 30 pF	1ΜΩ	GND	GND	V _{CC}
3.3 V	3 V	≤ 1.0 ns/V	50 MHz	15 pF, 30 pF	1ΜΩ	GND	GND	V _{CC}
5.0 V	3 V	≤ 1.0 ns/V	50 MHz	15 pF, 30 pF	1ΜΩ	GND	GND	V _{CC}

[1] $dV/dt \ge 1.0 V/ns$

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13. Package outline

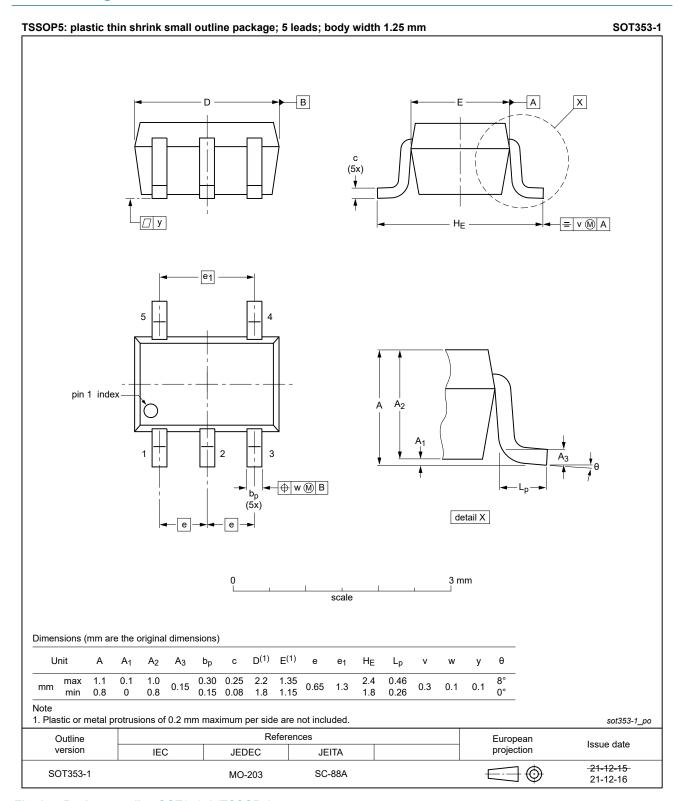


Fig. 8. Package outline SOT353-1 (TSSOP5)

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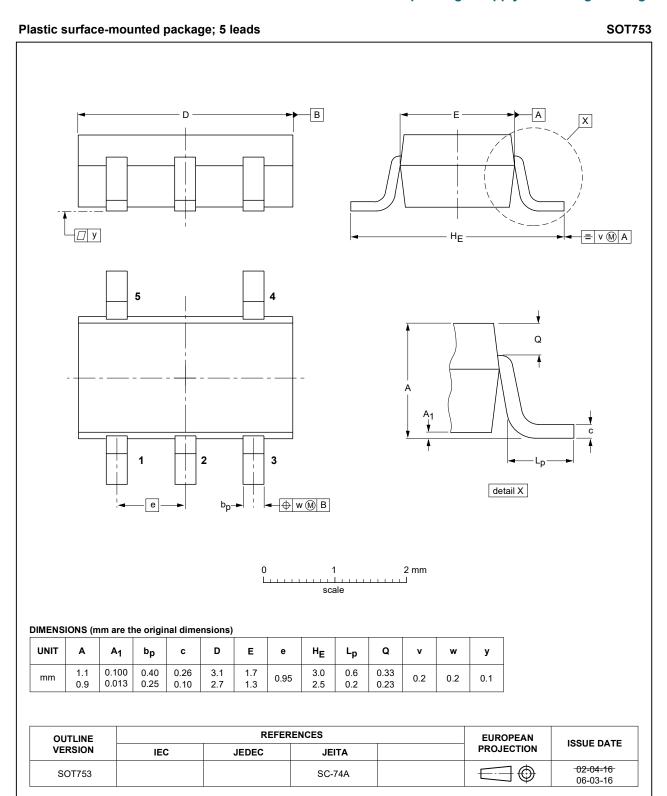


Fig. 9. Package outline SOT753 (SC-74A)

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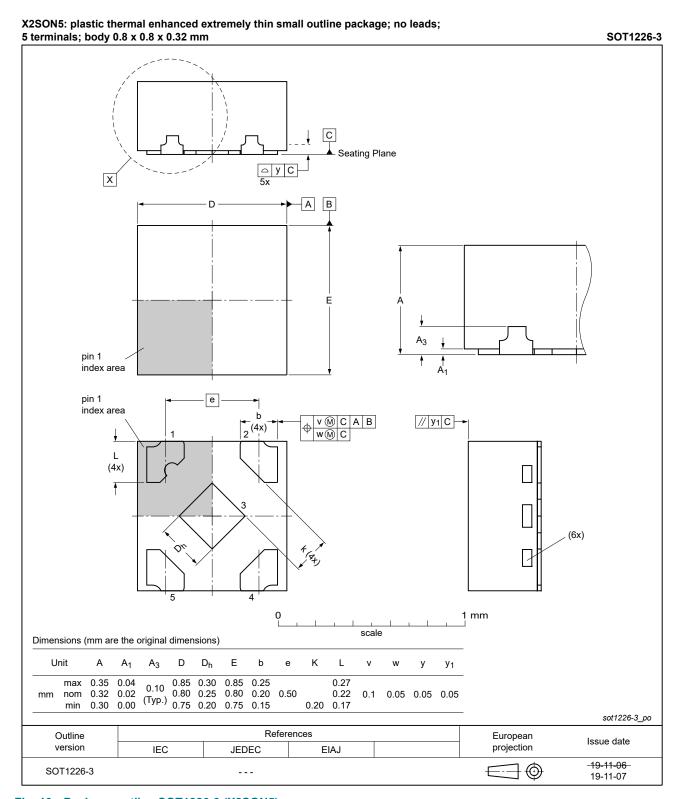


Fig. 10. Package outline SOT1226-3 (X2SON5)

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14. Abbreviations

Table 11. Abbreviations

Acronym	Description				
CDM	Charge Device Model				
CMOS	mplementary Metal Oxide Semiconductor				
DUT	Device Under Test				
ESD	ElectroStatic Discharge				
HBM	Human Body Model				

15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74LV1T00 v.5	20231207	Product data sheet	-	74LV1T00 v.4	
Modifications:	<u>Section 2</u> : ESD specification updated according to the latest JEDEC standard.				
74LV1T00 v.4	20220204	Product data sheet	-	74LV1T00 v.3	
Modifications:	Fig. 8: Package outline drawing for SOT353-1 (TSSOP5) has changed.				
74LV1T00 v.3	20210518	Product data sheet	-	74LV1T00 v.2	
Modifications:	SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package.				
74LV1T00 v.2	20191203	Product data sheet	-	74LV1T00 v.1	
Modifications:	 Type number 74LV1T00GV (SOT753/SC-74A) added. Table 5: Derating values for P_{tot} total power dissipation updated. 				
74LV1T00 v.1	20171122	Product data sheet	-	-	

16. 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.
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