DATA SHEET

74LVC2G00

Dual 2-input NAND gate

Product specification

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FEATURES

- Wide supply voltage range from 1.65 to 5.5 V
- 5 V tolerant outputs for interfacing with 5 V logic
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-7 (1.65 to 1.95 V)
  - JESD8-5 (2.3 to 2.7 V)
  - JESD8B/JESD36 (2.7 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
- SOT505-2 and SOT 765-1 package
- ESD protection:
  - HBM EIA/JESD22-A114-A exceeds 2000 V
  - MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from –40 to +85 °C and –40 to +125 °C.

DESCRIPTION

The 74LVC2G00 is a high-performance, low-power, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3 or 5 V devices. These feature allows the use of these devices as translators in a mixed 3.3 and 5 V environment.

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 74LVC2G00 provides the 2-input NAND gate.

QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	propagation delay inputs nA, nB to output nY	V_{CC} = 1.8 V; C_L = 30 pF; R_L = 1 kΩ	3.5	ns
		V_{CC} = 2.5 V; C_L = 30 pF; R_L = 500 Ω	2.3	ns
		V_{CC} = 2.7 V; C_L = 50 pF; R_L = 500 Ω	3.0	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		2.5	pF
C_{PD}	power dissipation capacitance per gate	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 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 MHz;

   C_L = output load capacitance in pF;

   V_{CC} = supply voltage in Volts;

   N = total load switching outputs;

   $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.
2. The condition is V_I = GND to V_{CC}.

FUNCTION TABLE

See note 1.

INPUT		OUTPUT
nA	**nB**	**nY**
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
74LVC2G00DP	–40 to +125 °C	8	TSSOP8	plastic	SOT505-2	V00
74LVC2G00DC	–40 to +125 °C	8	VSSOP8	plastic	SOT765-1	V00

PINNING

PIN	SYMBOL	DESCRIPTION
1	1A	data input 1A
2	1B	data input 1B
3	2Y	data output 2Y
4	GND	ground (0 V)
5	2A	data input 2A
6	2B	data input 2B
7	1Y	data output 1Y
8	V_{CC}	supply voltage

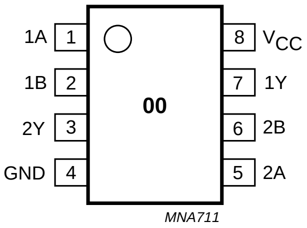


Fig.1 Pin configuration.

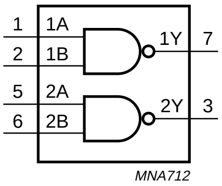


Fig.2 Logic symbol.

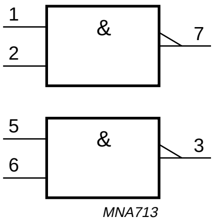


Fig.3 IEC logic symbol.

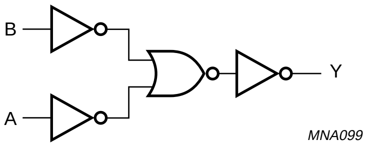


Fig.4 Logic diagram (one gate).

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} = 1.65 to 5.5 V; disable mode	0	5.5	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 to 2.7 V	0	20	ns/V
		V_{CC} = 2.7 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	$V_I < 0$	–	–50	mA
V_I	input voltage	note 1	–0.5	+6.5	V
I_{OK}	output diode current	$V_O > V_{CC}$ or $V_O < 0$	–	±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 source or sink current	V_O = 0 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	T_{amb} = –40 to +125 °C	–	300	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.

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 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	–	0.08	0.45	V
		I_O = 8 mA	2.3	–	0.14	0.3	V
		I_O = 12 mA	2.7	–	0.19	0.4	V
		I_O = 24 mA	3.0	–	0.37	0.55	V
		I_O = 32 mA	4.5	–	0.43	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	1.53	–	V
		I_O = –8 mA	2.3	1.9	2.13	–	V
		I_O = –12 mA	2.7	2.2	2.50	–	V
		I_O = –24 mA	3.0	2.3	2.60	–	V
		I_O = –32 mA	4.5	3.8	4.10	–	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	5.5	–	0.1	10	µA
ΔI_{CC}	additional quiescent supply current per pin	$V_I = V_{CC}$ – 0.6 V; I_O = 0	2.3 to 5.5	–	5	500	µA

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.(1)	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = –40 to +125 °C							
V_{IH}	HIGH-level input voltage		1.65 to 1.95	$0.65 \times V_{CC}$	–	–	V
			2.3 to 2.7	1.7	–	–	V
			2.7 to 3.6	2.0	–	–	V
			4.5 to 5.5	$0.7 \times V_{CC}$	–	–	V
V_{IL}	LOW-level input voltage		1.65 to 1.95	–	–	$0.35 \times V_{CC}$	V
			2.3 to 2.7	–	–	0.7	V
			2.7 to 3.6	–	–	0.8	V
			4.5 to 5.5	–	–	$0.3 \times V_{CC}$	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	–	–	±20	μA
I_{off}	power OFF leakage current	V_I or V_O = 5.5 V	0	–	–	±20	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$	5.5	–	–	40	μA
ΔI_{CC}	additional quiescent supply current per pin	$V_I = V_{CC} - 0.6$ V; $I_O = 0$	2.3 to 5.5	–	–	5000	μA

Note

1. All typical values are measured at T_{amb} = 25 °C.

AC CHARACTERISTICS

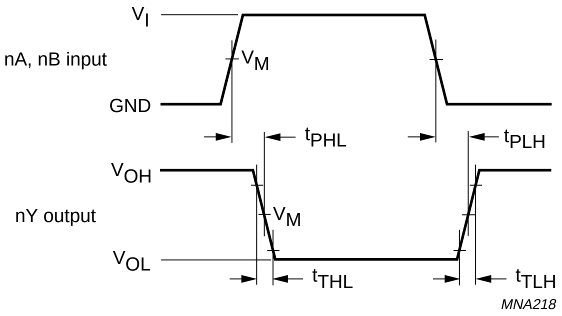
GND = 0 V.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.(1)	MAX.	UNIT
		WAVEFORMS	V_{CC} (V)				
T_{amb} = –40 to +85 °C							
t_{PHL}/t_{PLH}	propagation delay nA, nB to nY	see Figs 5 and 6	1.65 to 1.95	1.2	3.5	8.6	ns
			2.3 to 2.7	0.7	2.3	4.8	ns
			2.7	0.7	3.0	5.6	ns
			3.0 to 3.6	0.7	2.2	4.3	ns
			4.5 to 5.5	0.5	1.8	3.3	ns
T_{amb} = –40 to +125 °C							
t_{PHL}/t_{PLH}	propagation delay nA, nB to nY	see Figs 5 and 6	1.65 to 1.95	1.2	–	10.8	ns
			2.3 to 2.7	0.7	–	6.0	ns
			2.7	0.7	–	7.0	ns
			3.0 to 3.6	0.7	–	5.4	ns
			4.5 to 5.5	0.5	–	4.2	ns

Note

1. All typical values are measured at T_{amb} = 25 °C.

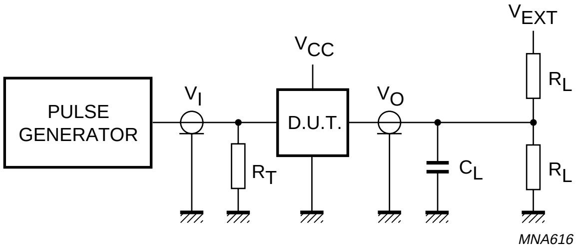
AC WAVEFORMS



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

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

Fig.5 The input (nA, nB) to output (nY) propagation delays.



V_{CC}	V_I	C_L	R_L	V_{EXT}		
				t_{PLH}/t_{PHL}	t_{PZH}/t_{PHZ}	t_{PZL}/t_{PLZ}
1.65 to 1.95 V	V_{CC}	30 pF	1 kΩ	open	GND	2 × V_{CC}
2.3 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 to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	6 V
4.5 to 5.5 V	V_{CC}	50 pF	500 Ω	open	GND	2 × V_{CC}

Definitions for test circuit:

R_L = Load resistor.

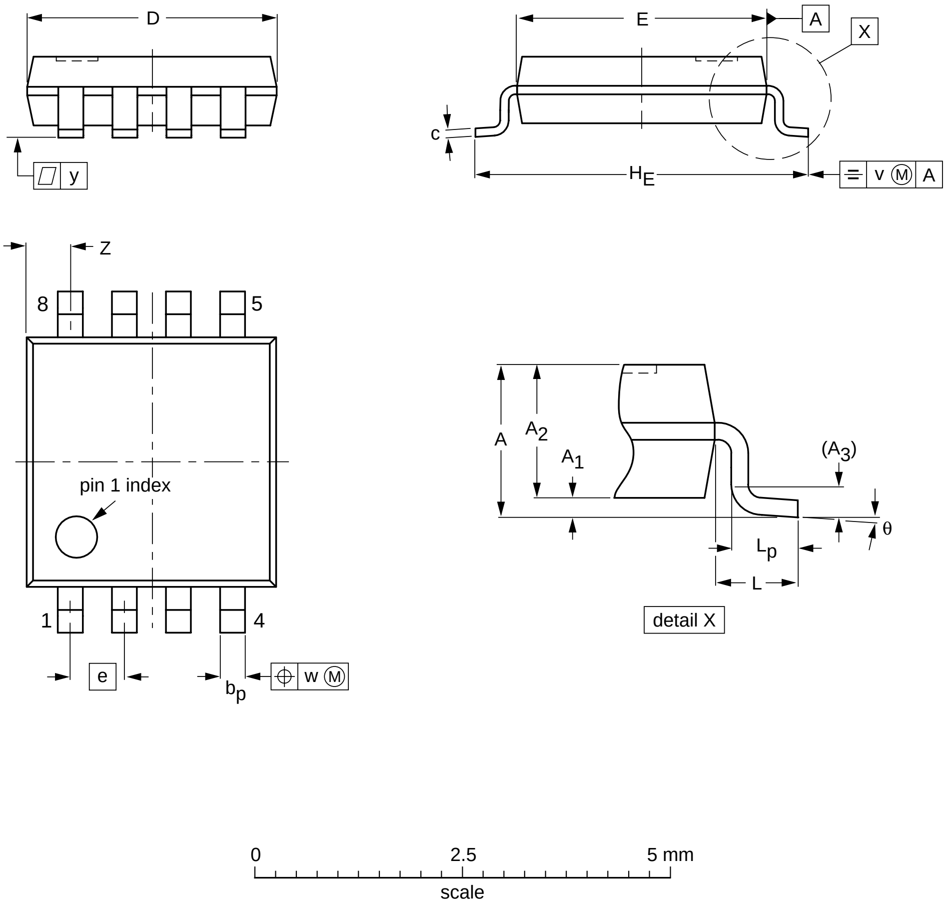
C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance should be equal to the output impedance Z_o of the pulse generator.

Fig.6 Load circuitry for switching times.

PACKAGE OUTLINES

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2



DIMENSIONS (mm are the original dimensions)

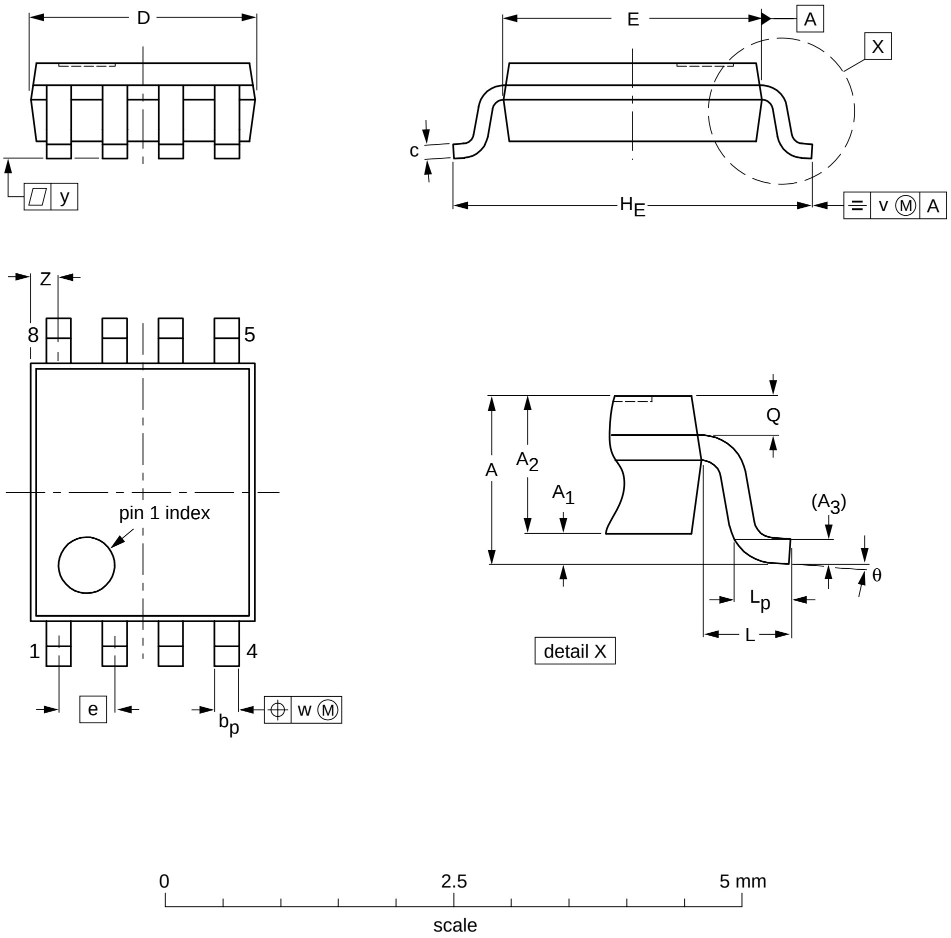
UNIT	A max.	A_1	A_2	A_3	b_p	c	D(1)	E(1)	e	H_E	L	L_p	v	w	y	Z(1)	θ
mm	1.1	0.15 0.00	0.95 0.75	0.25	0.38 0.22	0.18 0.08	3.1 2.9	3.1 2.9	0.65	4.1 3.9	0.5	0.47 0.33	0.2	0.13	0.1	0.70 0.35	8° 0°

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	JEITA			
SOT505-2		- - -				02-01-16

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm SOT765-1



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	0.15 0.00	0.85 0.60	0.12	0.27 0.17	0.23 0.08	2.1 1.9	2.4 2.2	0.5	3.2 3.0	0.4	0.40 0.15	0.21 0.19	0.2	0.13	0.1	0.4 0.1	8° 0°

Notes

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT765-1		MO-187				02-06-07

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LEVEL	DATA SHEET STATUS[1]	PRODUCT STATUS[2][3]	DEFINITION
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Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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