DATA SHEET

74LVC02
Quad 2-input NOR gate

Product specification

IC24 Data Handbook

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Philips
Semiconductors

PHILIPS

Quad 2-input NOR gate 74LVC02

FEATURES

- Wide supply voltage: 1.2 V to 3.6 V
- In accordance with JEDEC standard no. 8-1A.
- Inputs accept voltages up to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels

DESCRIPTION

The 74LVC02 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 V or 5 V devices. This feature allows the use of these devices as translators in a mixed 3.3 V/5 V environment.

The 74LVC02 provides the 2-input NOR 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 nA, nB to nY	C_L = 50 pF; V_{CC} = 3.3 V	3.3	ns
C_I	Input capacitance		5.0	pF
C_{PD}	Power dissipation capacitance per gate	Notes 1 and 2	60	pF

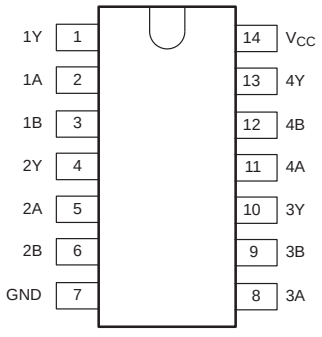
NOTES:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW)
   $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ 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 the outputs.
2. The condition is V_I = GND to V_{CC}.

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
14-Pin Plastic SO	–40°C to +85°C	74LVC02 D	74LVC02 D	SOT108-1
14-Pin Plastic SSOP Type II	–40°C to +85°C	74LVC02 DB	74LVC02 DB	SOT337-1
14-Pin Plastic TSSOP Type I	–40°C to +85°C	74LVC02 PW	74LVC02PW DH	SOT402-1

PIN CONFIGURATION



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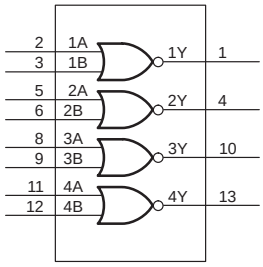
LOGIC SYMBOL



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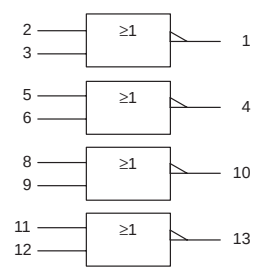
LOGIC SYMBOL (IEEE/IEC)



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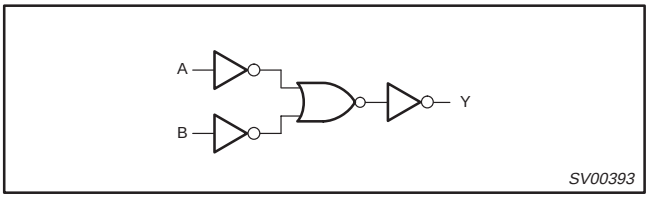
PIN DESCRIPTION

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

LOGIC DIAGRAM (ONE GATE)



FUNCTION TABLE

INPUTS		OUTPUTS
nA	nB	nY
L	L	H
L	H	L
H	L	L
H	H	L

NOTES:
H = HIGH voltage level
L = LOW voltage level

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V_{CC}	DC supply voltage (for max. speed performance)		2.7	3.6	V
V_{CC}	DC supply voltage (for low-voltage applications)		1.2	3.6	V
V_I	DC input voltage range		0	5.5	V
$V_{I/O}$	DC input voltage range for I/Os		0	V_{CC}	V
V_O	DC output voltage range		0	V_{CC}	V
T_{amb}	Operating free-air temperature range		–40	+85	°C
t_r, t_f	Input rise and fall times	V_{CC} = 1.2 to 2.7V V_{CC} = 2.7 to 3.6V	0 0	20 10	ns/V

ABSOLUTE MAXIMUM RATINGS[1]

In accordance with the Absolute Maximum Rating System (IEC 134).
Voltages are referenced to GND (ground = 0V).

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		–0.5 to +6.5	V
I_{IK}	DC input diode current	$V_I < 0$	–50	mA
V_I	DC input voltage	Note 2	–0.5 to +5.5	V
$V_{I/O}$	DC input voltage range for I/Os		–0.5 to V_{CC} +0.5	V
I_{OK}	DC output diode current	$V_O > V_{CC}$ or $V_O < 0$	±50	mA
V_{OUT}	DC output voltage	Note 2	–0.5 to V_{CC} +0.5	V
I_{OUT}	DC output source or sink current	V_O = 0 to V_{CC}	±50	mA
I_{GND}, I_{CC}	DC V_{CC} or GND current		±100	mA
T_{stg}	Storage temperature range		–60 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 above +60°C derate linearly with 5.5 mW/K	 500 500	mW

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.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP[1]	MAX	
V_{IH}	HIGH level Input voltage	V_{CC} = 1.2V	V_{CC}			V
		V_{CC} = 2.7 to 3.6V	2.0			
V_{IL}	LOW level Input voltage	V_{CC} = 1.2V			GND	V
		V_{CC} = 2.7 to 3.6V			0.8	
V_{OH}	HIGH level output voltage	V_{CC} = 2.7V; V_I = V_{IH} or V_{IL}; I_O = –12mA	V_{CC} – 0.5			V
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = –100µA	V_{CC} – 0.2	V_{CC}		
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = –12mA	V_{CC} – 0.6			
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = –24mA	V_{CC} – 1.0			
V_{OL}	LOW level output voltage	V_{CC} = 2.7V; V_I = V_{IH} or V_{IL}; I_O = 12mA			0.40	V
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = 100µA		GND	0.20	
		V_{CC} = 3.0V; V_I = V_{IH} or V_{IL}; I_O = 24mA			0.55	
I_I	Input leakage current	V_{CC} = 3.6V; V_I = 5.5V or GND Not for I/O pins		±0.1	±5	µA
I_{IHZ}/I_{ILZ}	Input current for common I/O pins	V_{CC} = 3.6V; V_I = V_{CC} or GND		±0.1	±15	µA
I_{OZ}	3-State output OFF-state current	V_{CC} = 3.6V; V_I = V_{IH} or V_{IL}; V_O = V_{CC} or GND		0.1	±10	µA
I_{CC}	Quiescent supply current	V_{CC} = 3.6V; V_I = V_{CC} or GND; I_O = 0		0.1	20	µA
ΔI_{CC}	Additional quiescent supply current per input pin	V_{CC} = 2.7V to 3.6V; V_I = V_{CC} –0.6V; I_O = 0		5	500	µA

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

AC CHARACTERISTICS

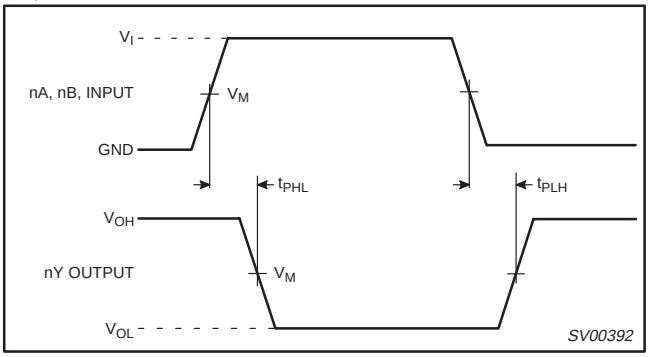
GND = 0 V; $t_r = t_f \leq$ 2.5 ns; C_L = 50 pF; R_L = 500Ω; T_{amb} = –40°C to +85°C

SYMBOL	PARAMETER	WAVEFORM	LIMITS							UNIT
			V_{CC} = 3.3V ±0.3V			V_{CC} = 2.7V			V_{CC} = 1.2V	
			MIN	TYP[1]	MAX	MIN	TYP[1]	MAX	TYP	
t_{PHL}/t_{PLH}	Propagation delay nA, nB to nY	Figures 1, 2	1.5	3.5	6.0	1.5	4.0	6.5	20	ns

NOTE:
1. These typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.

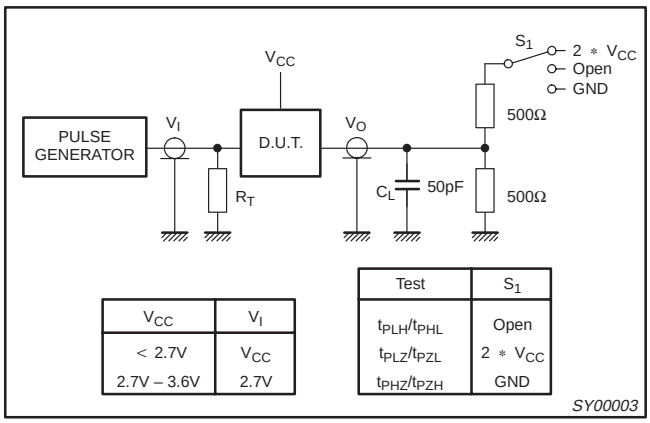
AC WAVEFORMS

V_M = 1.5 V at $V_{CC} \geq$ 2.7 V
V_M = 0.5 • V_{CC} at V_{CC} < 2.7 V
V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.



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

TEST CIRCUIT



Waveform 2. Load circuitry for switching times.

SO14: plastic small outline package; 14 leads; body width 3.9 mm **SOT108-1**

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm **SOT337-1**

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm SOT402-1

DEFINITIONS

Data Sheet Identification	Product Status	Definition
Objective Specification	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.
Preliminary Specification	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.
Product Specification	Full Production	This data sheet contains Final Specifications. 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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