

DATA SHEET

74LV02

Quad 2-input NOR gate

Product data
Supersedes data of 1998 Apr 20

2003 Mar 03

Quad 2-input NOR gate

74LV02

FEATURES

- Wide operating voltage: 1.0 to 5.5 V
- Optimized for low voltage applications: 1.0 to 5.5 V
- Accepts TTL input levels between $V_{CC} = 2.7$ V and $V_{CC} = 3.6$ V
- Typical V_{OLP} (output ground bounce) < 0.8 V at $V_{CC} = 3.3$ V, $T_{amb} = 25$ °C
- Typical V_{OHV} (output V_{OH} undershoot) > 2 V at $V_{CC} = 3.3$ V, $T_{amb} = 25$ °C
- Output capability: standard
- I_{CC} category: SSI

DESCRIPTION

The 74LV02 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC/HCT02.

The 74LV02 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	$C_L = 15$ pF; $V_{CC} = 3.3$ V	6	ns
C_I	Input capacitance		3.5	pF
C_{PD}	Power dissipation capacitance per gate	See Notes 1 and 2	22	pF

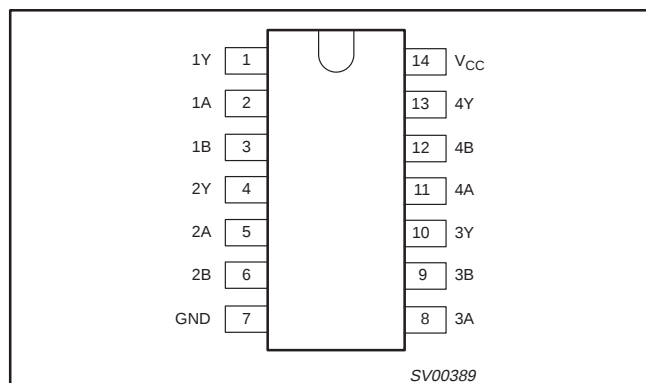
NOTES:

- 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:
 N = number of outputs switching;
 f_i = input frequency in MHz; C_L = output load capacitance in pF;
 f_o = output frequency in MHz; V_{CC} = supply voltage in V;
 $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.
- The condition is $V_I = \text{GND to } V_{CC}$.

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	PKG. DWG. #
14-Pin Plastic SO	-40 °C to $+125$ °C	74LV02D	SOT108-1

PIN CONFIGURATION



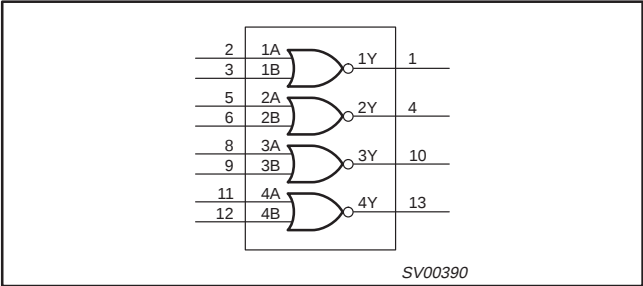
PIN DESCRIPTION

PIN NUMBER	SYMBOL	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

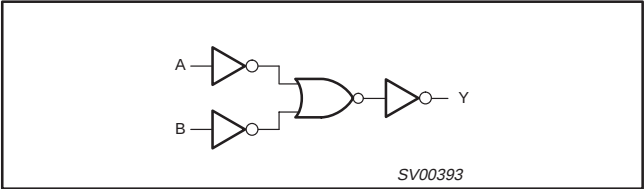
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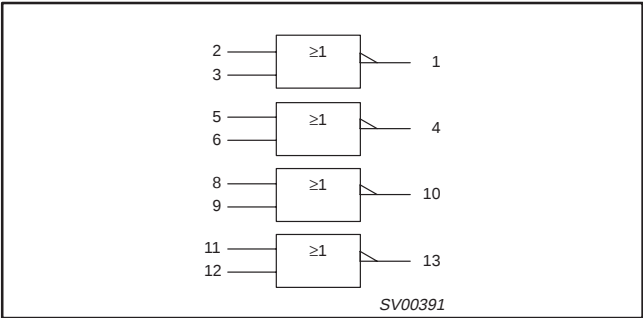
LOGIC SYMBOL



LOGIC DIAGRAM (ONE GATE)



LOGIC SYMBOL (IEEE/IEC)



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	MIN	TYP.	MAX	UNIT
V _{CC}	DC supply voltage	See Note 1	1.0	3.3	5.5	V
V _I	Input voltage		0	–	V _{CC}	V
V _O	Output voltage		0	–	V _{CC}	V
T _{amb}	Operating ambient temperature range in free air	See DC and AC characteristics	–40 –40		+85 +125	°C
t _r , t _f	Input rise and fall times	V _{CC} = 1.0 V to 2.0 V V _{CC} = 2.0 V to 2.7 V V _{CC} = 2.7 V to 3.6 V V _{CC} = 3.6 V to 5.5 V	– – – –	– – – –	500 200 100 50	ns/V

NOTE:
1. The LV is guaranteed to function down to V_{CC} = 1.0 V (input levels GND or V_{CC}); DC characteristics are guaranteed from V_{CC} = 1.2 V to V_{CC} = 5.5 V.

ABSOLUTE MAXIMUM RATINGS^{1, 2}

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

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V _{CC}	DC supply voltage		–0.5 to +7.0	V
±I _{IK}	DC input diode current	V _I < –0.5 V or V _I > V _{CC} + 0.5 V	20	mA
±I _{OK}	DC output diode current	V _O < –0.5 V or V _O > V _{CC} + 0.5 V	50	mA
±I _O	DC output source or sink current (standard outputs)	–0.5 V < V _O < V _{CC} + 0.5 V	25	mA
±I _{GND} , ±I _{CC}	DC V _{CC} or GND current	for types with standard outputs	50	mA
T _{stg}	Storage temperature range		–65 to +150	°C
P _{TOT}	Power dissipation per package – plastic mini-pack (SO)	for temperature range: –40 °C to +125 °C above +70 °C derate linearly with 8 mW/K	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.

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DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			−40 °C to +85 °C			−40 °C to +125 °C		
			MIN	TYP. ¹	MAX	MIN	MAX	
V _{IH}	HIGH level Input voltage	V _{CC} = 1.2 V	0.9			0.9		V
		V _{CC} = 2.0 V	1.4			1.4		
		V _{CC} = 2.7 V to 3.6 V	2.0			2.0		
		V _{CC} = 4.5 V to 5.5 V	0.7*V _{CC}			0.7*V _{CC}		
V _{IL}	LOW level Input voltage	V _{CC} = 1.2 V			0.3		0.3	V
		V _{CC} = 2.0 V			0.6		0.6	
		V _{CC} = 2.7 V to 3.6 V			0.8		0.8	
		V _{CC} = 4.5 V to 5.5 V			0.3*V _{CC}		0.3*V _{CC}	
V _{OH}	HIGH level output voltage; all outputs	V _{CC} = 1.2 V; V _I = V _{IH} or V _{IL} ; −I _O = 100 μA		1.2				V
		V _{CC} = 2.0 V; V _I = V _{IH} or V _{IL} ; −I _O = 100 μA	1.8	2.0		1.8		
		V _{CC} = 2.7 V; V _I = V _{IH} or V _{IL} ; −I _O = 100 μA	2.5	2.7		2.5		
		V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; −I _O = 100 μA	2.8	3.0		2.8		
		V _{CC} = 4.5 V; V _I = V _{IH} or V _{IL} ; −I _O = 100 μA	4.3	4.5		4.3		
V _{OH}	HIGH level output voltage; STANDARD outputs	V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; −I _O = 6 mA	2.40	2.82		2.20		V
		V _{CC} = 4.5 V; V _I = V _{IH} or V _{IL} ; −I _O = 12 mA	3.60	4.20		3.50		
V _{OL}	LOW level output voltage; all outputs	V _{CC} = 1.2 V; V _I = V _{IH} or V _{IL} ; I _O = 100 μA		0				V
		V _{CC} = 2.0 V; V _I = V _{IH} or V _{IL} ; I _O = 100 μA		0	0.2		0.2	
		V _{CC} = 2.7 V; V _I = V _{IH} or V _{IL} ; I _O = 100 μA		0	0.2		0.2	
		V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; I _O = 100 μA		0	0.2		0.2	
		V _{CC} = 4.5 V; V _I = V _{IH} or V _{IL} ; I _O = 100 μA		0	0.2		0.2	
V _{OL}	LOW level output voltage; STANDARD outputs	V _{CC} = 3.0 V; V _I = V _{IH} or V _{IL} ; I _O = 6 mA		0.25	0.40		0.50	V
		V _{CC} = 4.5 V; V _I = V _{IH} or V _{IL} ; I _O = 12 mA		0.35	0.55		0.65	
I _I	Input leakage current	V _{CC} = 5.5 V; V _I = V _{CC} or GND			1.0		1.0	μA
I _{CC}	Quiescent supply current; SSI	V _{CC} = 5.5 V; V _I = V _{CC} or GND; I _O = 0			20.0		40	μA
ΔI _{CC}	Additional quiescent supply current	V _{CC} = 2.7 V to 3.6 V; V _I = V _{CC} −0.6 V			500		850	μA

NOTE:1. All typical values are measured at $T_{amb} = 25 \text{ }^\circ\text{C}$.

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AC CHARACTERISTICS

GND = 0 V; $t_r = t_f \leq 2.5$ ns; $C_L = 50$ pF; $R_L = 1$ k Ω

SYMBOL	PARAMETER	WAVEFORM	CONDITION	LIMITS					UNIT
				−40 °C to +85 °C			−40 °C to +125 °C		
			V _{CC} (V)	MIN	TYP. ¹	MAX	MIN	MAX	
t _{PHL} /t _{PLH}	Propagation delay nA, nB to nY	Figures 1, 2	1.2		40				ns
			2.0		14	21		26	
			2.7		10	15		19	
			3.0 to 3.6		7.5 ²	12		15	
			4.5 to 5.5		6.0 ³	10		13	

- NOTES:
- 1. Unless otherwise stated, all typical values are measured at $T_{amb} = 25$ °C
 - 2. Typical values are measured at $V_{CC} = 3.3$ V.
 - 3. Typical values are measured at $V_{CC} = 5.0$ V.

AC WAVEFORMS

$V_M = 1.5$ V at $V_{CC} \geq 2.7$ V and ≤ 3.6 V;
 $V_M = 0.5 \times V_{CC}$ at $V_{CC} < 2.7$ V and ≥ 4.5 V;
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

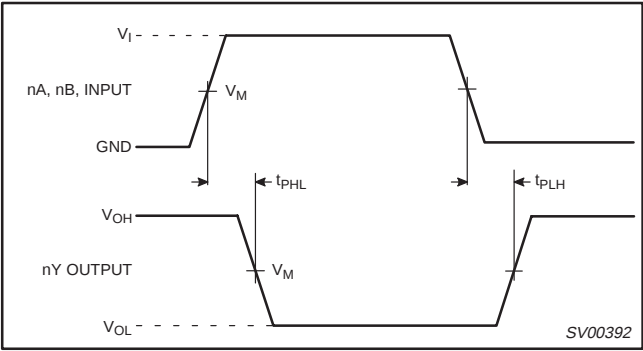


Figure 1. Input (nA, nB) to output (nY) propagation delays.

TEST CIRCUIT

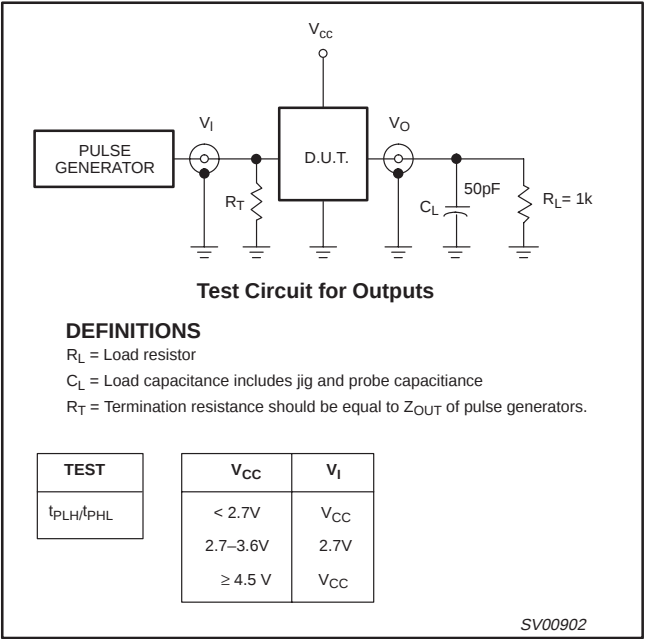


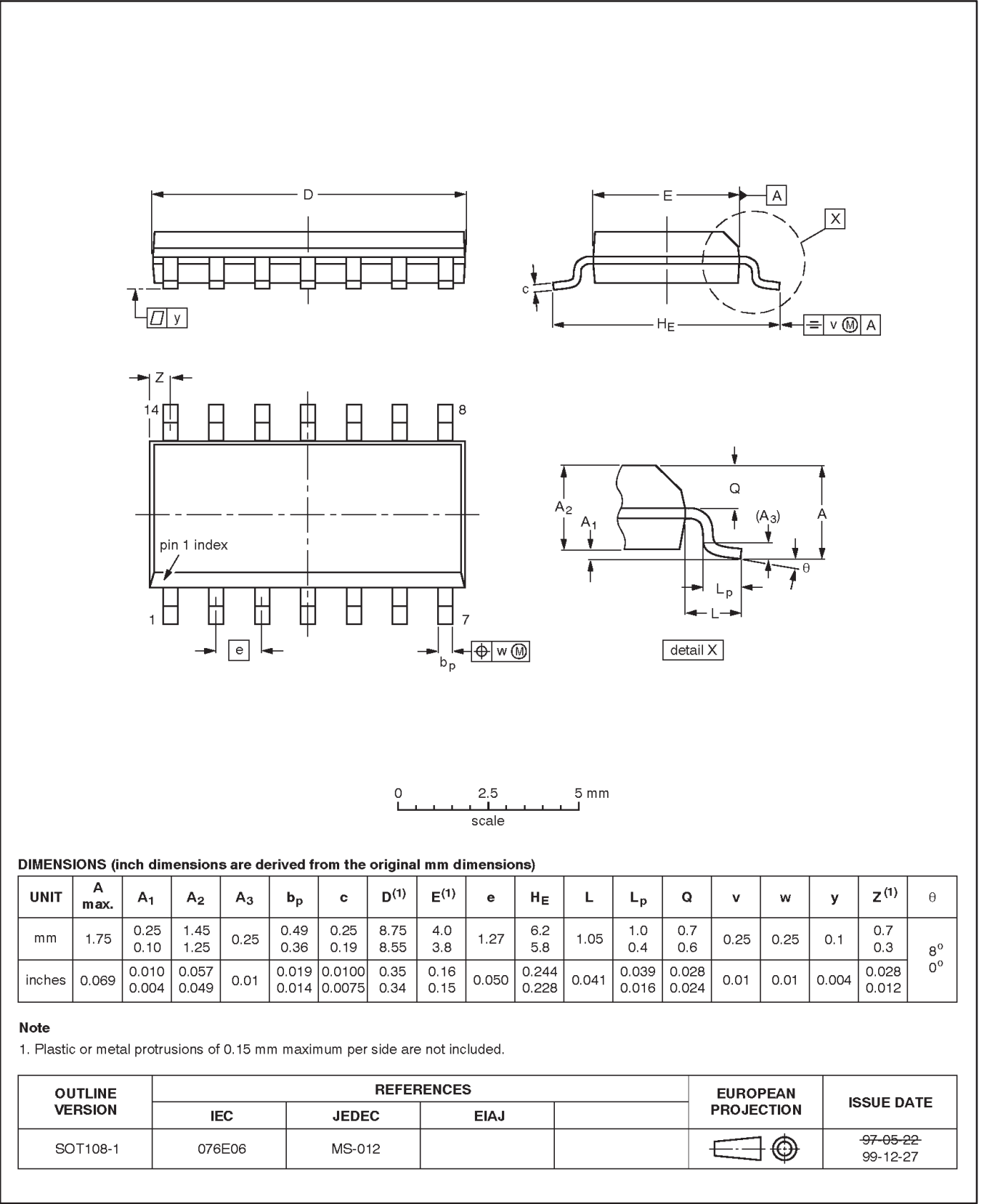
Figure 2. Load circuitry for switching times.

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SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



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REVISION HISTORY

Rev	Date	Description
_3	20030303	Product data (9397 750 11189). ECN 853-1899 29489 of 07 February 2003. Supersedes data of 1998 Apr 20 (9397 750 04402). Modifications: • Delete DIL, SSOP and TSSOP package ordering and package outlines (discontinued options). • Correct power dissipation formula.
_2	19980420	Product data (9397 750 04402). ECN 853-1899 19257 of 20 April 1998. Supersedes data of 1997 Feb 03.

Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	Definitions
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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