

# SN54HC4002, SN74HC4002 DUAL 4-INPUT POSITIVE-NOR GATES

SCLS157

D2684, DECEMBER 1982—REVISED SEPTEMBER 1987

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

## description

These devices contain two independent 4-input positive NOR gates. They perform the Boolean functions:

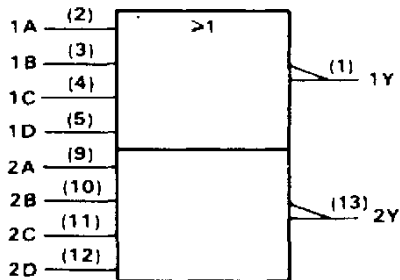
$Y = \overline{A + B + C + D}$  or  $Y = \overline{A} \cdot \overline{B} \cdot \overline{C} \cdot \overline{D}$   
in positive logic.

The SN54HC4002 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74HC4002 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

FUNCTION TABLE

INPUTS				OUTPUT
A	B	C	D	Y
H	X	X	X	L
X	H	X	X	L
X	X	H	X	L
X	X	X	H	L
L	L	L	L	H

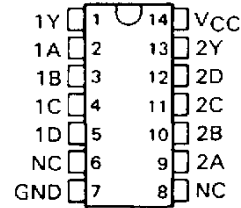
## logic symbol†



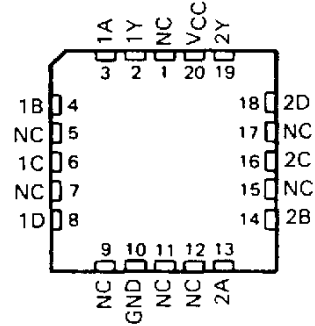
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for D, J, and N packages.

SN54HC4002 . . . J PACKAGE  
SN74HC4002 . . . D OR N PACKAGE  
(TOP VIEW)

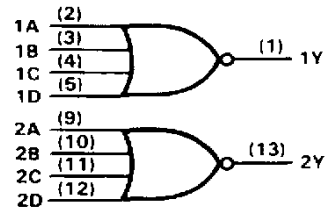


SN54HC4002 . . . FK PACKAGE  
(TOP VIEW)



NC—No internal connection

## logic diagram (positive logic)



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TEXAS  
INSTRUMENTS

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**SN54HC4002, SN74HC4002**  
**DUAL 4-INPUT POSITIVE-NOR GATES**

**absolute maximum ratings over operating free-air temperature range†**

Supply voltage range, $V_{CC}$ .....	-0.5 V to 7 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) .....	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) .....	$\pm 20$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 25$ mA
Continuous current through $V_{CC}$ or GND pins .....	$\pm 50$ mA
Lead temperature 1,6 mm (1/16 in) from case for 60 s: FK or J package .....	300°C
Lead temperature 1,6 mm (1/16 in) from case for 10 s: D or N package .....	260°C
Storage temperature range .....	-65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" 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.

**recommended operating conditions**

		SN54HC4002			SN74HC4002			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	2	5	6	2	5	6	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2$ V	1.5		1.5			V
		$V_{CC} = 4.5$ V	3.15		3.15			
		$V_{CC} = 6$ V	4.2		4.2			
$V_{IL}$	Low-level input voltage	$V_{CC} = 2$ V	0	0.3	0	0.3		V
		$V_{CC} = 4.5$ V	0	0.9	0	0.9		
		$V_{CC} = 6$ V	0	1.2	0	1.2		
$V_I$	Input voltage	0		$V_{CC}$	0		$V_{CC}$	V
$V_O$	Output voltage	0		$V_{CC}$	0		$V_{CC}$	V
$t_t$	Input transition (rise and fall) times	$V_{CC} = 2$ V	0	1000	0	1000		ns
		$V_{CC} = 4.5$ V	0	500	0	500		
		$V_{CC} = 6$ V	0	400	0	400		
$T_A$	Operating free-air temperature	-55		125	-40		85	°C

**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HC4002		SN74HC4002		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$V_{OH}$	$V_I = V_{IH}$ or $V_{IL}$ , $I_{OH} = -20 \mu\text{A}$	2 V	1.9	1.998		1.9		1.9	V	
		4.5 V	4.4	4.499		4.4		4.4		
		6 V	5.9	5.999		5.9		5.9		
	4.5 V	3.98	4.30		3.7		3.84			
$V_{OL}$	$V_I = V_{IH}$ or $V_{IL}$ , $I_{OL} = 20 \mu\text{A}$	2 V		0.002	0.1		0.1		0.1	
		4.5 V		0.001	0.1		0.1		0.1	
		6 V		0.001	0.1		0.1		0.1	
	4.5 V		0.17	0.26		0.4		0.33		
	$V_I = V_{IH}$ or $V_{IL}$ , $I_{OL} = 5.2 \text{ mA}$	6 V		0.15	0.26		0.4		0.33	
$I_I$	$V_I = V_{CC}$ or 0	6 V		$\pm 0.1$	$\pm 100$		$\pm 1000$		$\pm 1000$	nA
$I_{CC}$	$V_I = V_{CC}$ or 0, $I_O = 0$	6 V			2		40		20	$\mu\text{A}$
$C_i$		2 to 6 V		3	10		10		10	pF



**SN54HC4002, SN74HC4002**  
**DUAL 4-INPUT POSITIVE-NOR GATES**

switching characteristics over recommended operating free-air temperature range (unless otherwise noted),  $C_L = 50 \text{ pF}$  (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC4002		SN74HC4002		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A thru D	Y	2 V		44	110		165		140	ns
			4.5 V		12	22		33		28	
			6 V		11	19		28		24	
t <sub>t</sub>		Y	2 V		38	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	

C <sub>pd</sub>	Power dissipation capacitance per gate	No load, T <sub>A</sub> = 25°C	25 pF typ
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Note 1: Load circuits and voltage waveforms are shown in Section 1.



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## SN54HC4002, Dual 4-Input Positive-NOR Gates

DEVICE STATUS: **ACTIVE**

PARAMETER NAME	SN54HC4002
Voltage Nodes (V)	6, 5, 2
Vcc range (V)	2.0 to 6.0
Input Level	CMOS
Output Level	CMOS
No. of Gates	2

### FEATURES

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- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

### DESCRIPTION

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These devices contain two independent 4-input positive NOR gates. They perform the Boolean functions:  $Y = (A + B + C + D)$  or  $Y = A \cdot B \cdot C \cdot D$  in positive logic.

The SN54HC4002 is characterized for operation over the full military temperature range of -55°C to 125°C. The SN74HC4002 is characterized for operation from -40°C to 85°C.

### TECHNICAL DOCUMENTS

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### DATASHEET

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Full datasheet in Acrobat PDF: [scls157.pdf](#) (76 KB) (Updated: 09/01/1987)

Full datasheet in Zipped PostScript: [scls157.psz](#) (143 KB)

### APPLICATION NOTES

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View Application Reports for [Digital Logic](#)

- [CMOS Power Consumption and CPD Calculation](#) (SCAA035B - Updated: 06/01/1997)
- [Designing With Logic](#) (SDYA009C - Updated: 06/01/1997)
- [HCMOS Design Considerations](#) (SCLA007 - Updated: 04/01/1996)
- [Implications of Slow or Floating CMOS Inputs](#) (SCBA004C - Updated: 02/01/1998)
- [Input and Output Characteristics of Digital Integrated Circuits](#) (SDYA010 - Updated: 10/01/1996)
- [Live Insertion](#) (SDYA012 - Updated: 10/01/1996)
- [SN54/74HCT CMOS Logic Family Applications And Restrictions](#) (SCLA011 - Updated: 05/01/1996)
- [Using High Speed CMOS and Advanced CMOS in Systems With Multiple Vcc](#) (SCLA008 - Updated: 04/01/1996)

## RELATED DOCUMENTS

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- [Documentation Rules \(SAP\) And Ordering Information](#) (SZZU001B, 4 KB - Updated: 05/06/1999)
- [Logic Selection Guide Second Half 2000](#) (SDYU001N, 5035 KB - Updated: 04/17/2000)
- [MicroStar Junior BGA Design Summary](#) (SCET004, 167 KB - Updated: 07/28/2000)
- [More Power In Less Space - Technical Article](#) (SCAU001A, 850 KB - Updated: 03/01/1996)

## PRICING/ AVAILABILITY

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<u>ORDERABLE DEVICE</u>	<u>PACKAGE</u>	<u>PINS</u>	<u>TEMP (°C)</u>	<u>STATUS</u>	<u>BUDGETARY PRICE US\$/UNIT QTY= 1000+</u>	<u>PACK QTY</u>	<u>DSCC NUMBER</u>	<u>PRICING/AVAILABILITY</u>
JM38510/65104BCA	<u>J</u>	14	-55 TO 125	ACTIVE	6.22	1		<u>Check stock or order</u>
SN54HC4002J	<u>J</u>	14	-55 TO 125	ACTIVE	0.94	500		<u>Check stock or order</u>
SNJ54HC4002FK	<u>FK</u>	20	-55 TO 125	ACTIVE	6.71	165	84044012A	<u>Check stock or order</u>
SNJ54HC4002J	<u>J</u>	14	-55 TO 125	ACTIVE	1.12	1		<u>Check stock or order</u>

Table Data Updated on: 11 / 21 / 2000