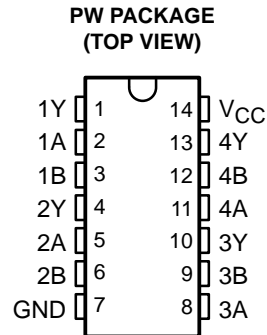


- **Controlled Baseline**
  - One Assembly/Test Site, One Fabrication Site
- **Extended Temperature Performance of –55°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree†**
- **Operating Range 2-V to 5.5-V V<sub>CC</sub>**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- **ESD Protection Exceeds JESD 22**
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.



### description/ordering information

The 'AHC02 device contains four independent 2-input NOR gates that perform the Boolean function  $Y = \overline{A} \cdot \overline{B}$  or  $Y = \overline{A + B}$  in positive logic.

### ORDERING INFORMATION

T <sub>A</sub>	PACKAGE‡		ORDERABLE PART NUMBER	TOP-SIDE MARKING
	TSSOP – PW	Tape and reel		
–55°C to 125°C	TSSOP – PW	Tape and reel	SN74AHC02MPWREP	AHC02EP

‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

### FUNCTION TABLE (each gate)

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



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



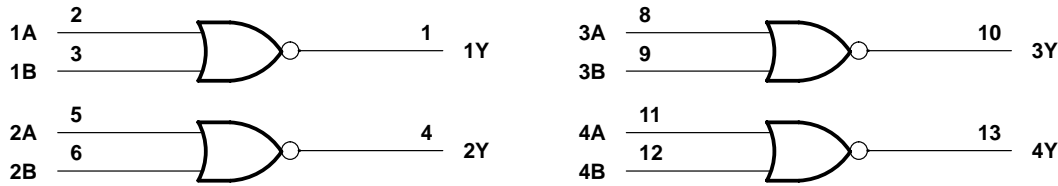
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# SN74AHC02-EP QUADRUPLE 2-INPUT POSITIVE-NOR GATES

SCLS480 – MAY 2003

## logic diagram (positive logic)



Pin numbers shown are for the PW package.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to 7 V
Output voltage range, $V_O$ (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–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	$\pm 50$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 2)	113°C/W
Storage temperature range, $T_{stg}$	–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.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions (see Note 3)

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	2	5.5	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2$ V	1.5	V
		$V_{CC} = 3$ V	2.1	
		$V_{CC} = 5.5$ V	3.85	
$V_{IL}$	Low-level input voltage	$V_{CC} = 2$ V	0.5	V
		$V_{CC} = 3$ V	0.9	
		$V_{CC} = 5.5$ V	1.65	
$V_I$	Input voltage	0	5.5	V
$V_O$	Output voltage	0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 2$ V	–50	$\mu$ A
		$V_{CC} = 3.3$ V $\pm 0.3$ V	–4	mA
		$V_{CC} = 5$ V $\pm 0.5$ V	–8	
$I_{OL}$	Low-level output current	$V_{CC} = 2$ V	50	$\mu$ A
		$V_{CC} = 3.3$ V $\pm 0.3$ V	4	mA
		$V_{CC} = 5$ V $\pm 0.5$ V	8	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 3.3$ V $\pm 0.3$ V	100	ns/V
		$V_{CC} = 5$ V $\pm 0.5$ V	20	
$T_A$	Operating free-air temperature	–55	125	°C

NOTE 3: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN74AHC02-EP		UNIT
			MIN	TYP	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	2 V	1.9	2		1.9	V	
		3 V	2.9	3		2.9		
		4.5 V	4.4	4.5		4.4		
	I <sub>OH</sub> = -4 mA	3 V	2.58		2.48			
	I <sub>OH</sub> = -8 mA	4.5 V	3.94		3.8			
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	2 V			0.1	0.1	V	
		3 V			0.1	0.1		
		4.5 V			0.1	0.1		
	I <sub>OL</sub> = 4 mA	3 V		0.36	0.5			
	I <sub>OL</sub> = 8 mA	4.5 V		0.36	0.5			
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	0 V to 5.5 V			±0.1	±1	μA	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			2	20	μA	
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V		4	10		pF	

**switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			SN74AHC02-EP		UNIT
				MIN	TYP	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 15 pF		5.6	7.9	1	9.5	ns
t <sub>PHL</sub>					5.6	7.9	1	9.5	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 50 pF		8.1	11.4	1	13	ns
t <sub>PHL</sub>					8.1	11.4	1	13	

**switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			SN74AHC02-EP		UNIT
				MIN	TYP	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 15 pF		3.6	5.5	1	6.5	ns
t <sub>PHL</sub>					3.6	5.5	1	6.5	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 50 pF		5.1	7.5	1	8.5	ns
t <sub>PHL</sub>					5.1	7.5	1	8.5	

**noise characteristics, V<sub>CC</sub> = 5 V, C<sub>L</sub> = 50 pF, T<sub>A</sub> = 25°C (see Note 4)**

PARAMETER		MIN	MAX	UNIT
V <sub>OL(P)</sub>	Quiet output, maximum dynamic V <sub>OL</sub>		0.8	V
V <sub>OL(V)</sub>	Quiet output, minimum dynamic V <sub>OL</sub>		-0.8	V
V <sub>OH(V)</sub>	Quiet output, minimum dynamic V <sub>OH</sub>	4.9		V
V <sub>IH(D)</sub>	High-level dynamic input voltage	3.5		V
V <sub>IL(D)</sub>	Low-level dynamic input voltage		1.5	V

NOTE 4: Characteristics are for surface-mount packages only.

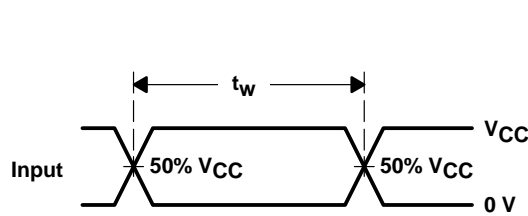
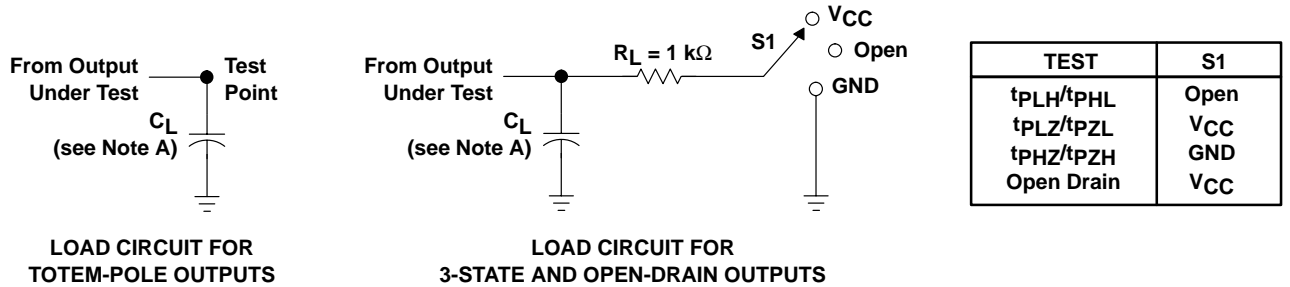
# SN74AHC02-EP QUADRUPLE 2-INPUT POSITIVE-NOR GATES

SCLS480 – MAY 2003

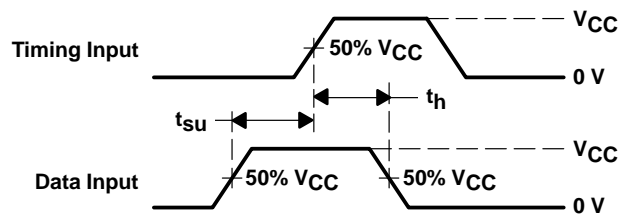
operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance	No load, $f = 1\text{ MHz}$	15	pF

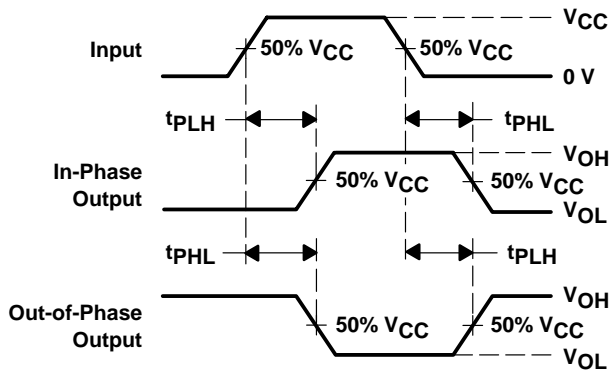
## PARAMETER MEASUREMENT INFORMATION



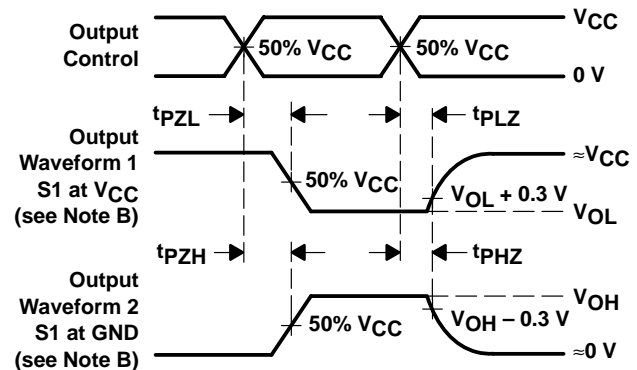
VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES  
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES  
LOW- AND HIGH-LEVEL ENABLING

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
 C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$ .  
 D. The outputs are measured one at a time with one input transition per measurement.  
 E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AHC02MPWREP	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AHC02EP	<a href="#">Samples</a>
V62/03645-01XE	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AHC02EP	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF SN74AHC02-EP :**

- Catalog: [SN74AHC02](#)
- Automotive: [SN74AHC02-Q1](#)
- Military: [SN54AHC02](#)

## NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military - QML certified for Military and Defense Applications

## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AHC02MPWREP	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AHC02MPWREP	TSSOP	PW	14	2000	853.0	449.0	35.0



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