



Data sheet acquired from Harris Semiconductor SCHS197E

August 1997 - Revised October 2003

High-Speed CMOS Logic Dual 4-Input NOR Gate

Features

- Typical Propagation Delay = 8ns at V_{CC} = 5V,
 C_L = 15pF, T_A = 25°C
- Fanout (Over Temperature Range)
- Wide Operating Temperature Range ...-55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: N_{IL} = 30%, N_{IH} = 30% of V_{CC} at V_{CC} = 5V

Description

The 'HC4002 logic gate utilizes silicon gate CMOS technology to achieve operating speeds similar to LSTTL gates with the low power consumption of standard CMOS integrated circuits. All devices have the ability to drive 10 LSTTL loads. The 'HC4002 logic family is functional as well as pin compatible with the standard LS logic family.

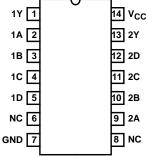
Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC4002F3A	-55 to 125	14 Ld CERDIP
CD74HC4002E	-55 to 125	14 Ld PDIP
CD74HC4002M	-55 to 125	14 Ld SOIC
CD74HC4002MT	-55 to 125	14 Ld SOIC
CD74HC4002M96	-55 to 125	14 Ld SOIC
CD74HC4002NSR	-55 to 125	14 Ld SOP
CD74HC4002PW	-55 to 125	14 Ld TSSOP
CD74HC4002PWR	-55 to 125	14 Ld TSSOP
CD74HC4002PWT	-55 to 125	14 Ld TSSOP

NOTE: When ordering, use the entire part number. The suffixes 96 and R denote tape and reel. The suffix T denotes a small-quantity reel of 250.

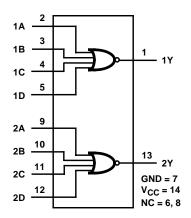
Pinout

CD54HC4002 (CERDIP) CD74HC4002 (PDIP, SOIC, SOP, TSSOP) TOP VIEW



CD54HC4002, CD74HC4002

Functional Diagram

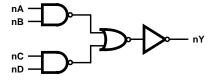


TRUTH TABLE

	INPUTS								
nA	nB	nC	nD	nY					
L	L	L	L	Н					
Н	Х	Х	Х	L					
Х	Н	Х	Х	L					
Х	Х	Н	Х	L					
Х	Х	X	Н	L					

H = High Voltage Level, L = Low Voltage Level, X = Irrelevant

Logic Symbol



CD54HC4002, CD74HC4002

Absolute Maximum Ratings

DC Supply Voltage, V _{CC} 0.5	V to 7V
DC Input Diode Current, I _{IK}	
For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$	±20mA
DC Output Diode Current, IOK	
For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$	±20mA
DC Output Source or Sink Current per Output Pin, IO	
For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$	±25mA
DC V _{CC} or Ground Current, I _{CC or} I _{GND}	±50mA

Thermal Information

Package Thermal Impedance, θ _{JA} (see Note 1):
E (PDIP) Package80°C/W
M (SOIC) Package86°C/W
NS (SOP) Package
PW (TSSOP) Package 113°C/W
Maximum Junction Temperature
Maximum Storage Temperature Range65°C to 150°C
Maximum Lead Temperature (Soldering 10s)300°C
(SOIC - Lead Tips Only)

Operating Conditions

Temperature Range (T _A)55 ⁰ C to 125 ⁰	C,
Supply Voltage Range, V _{CC}	
HC Types2V to 6	۷
HCT Types	ί۷
DC Input or Output Voltage, V _I , V _O 0V to V _C	СС
Input Rise and Fall Time	
2V	x)
4.5V 500ns (Ma	x)
6V	x)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. The package thermal impedance is calculated in accordance with JESD 51-7.

DC Electrical Specifications

		TES CONDI		v _{cc}		25°C		-40°C 1	O 85°C	-55°C TO 125°C		
PARAMETER	SYMBOL	V _I (V)	I _O (mA)	(V)	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNITS
High Level Input	V _{IH}	-	-	2	1.5	-	-	1.5	-	1.5	-	V
Voltage				4.5	3.15	-	-	3.15	-	3.15	-	V
				6	4.2	-	-	4.2	-	4.2	-	V
Low Level Input	V _{IL}	-	-	2	-	-	0.5	-	0.5	-	0.5	V
Voltage				4.5	-	-	1.35	-	1.35	-	1.35	V
				6	-	-	1.8	-	1.8	-	1.8	V
High Level Output	V _{OH}	V _{IH} or V _{IL}	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
Voltage CMOS Loads			-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
OWOO LOAGS			-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output	1		-	-	-	-	-	-	-	-	-	V
Voltage TTL Loads			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
TTE Educa			-5.2	6	5.48	-	-	5.34	-	5.2	-	V
Low Level Output	V _{OL}	V _{IH} or V _{IL}	0.02	2	-	-	0.1	-	0.1	-	0.1	V
Voltage CMOS Loads			0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
OWOO LOAGS			0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output	7		-	=	-	-	-	-	-	-	-	V
Voltage TTL Loads			4	4.5	-	-	0.26	-	0.33	-	0.4	V
TTE LUAUS			5.2	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	IĮ	V _{CC} or GND	-	6	-	-	±0.1	-	±1	-	±1	μΑ
Quiescent Device Current	lcc	V _{CC} or GND	0	6	-	-	2	-	20	-	40	μΑ

CD54HC4002, CD74HC4002

Switching Specifications Input t_r , $t_f = 6ns$

		TEST		25	°C	-40°C TO 85°C	-55°C TO 125°C	
PARAMETER	SYMBOL	CONDITIONS	V _{CC} (V)	TYP	MAX	MAX	MAX	UNITS
HC TYPES								
Propagation Delay,	t _{PLH} , t _{PHL}	C _L = 50pF	2	Ī	100	125	150	ns
nA, nB, nC, nD to nY			4.5	i	20	25	30	ns
			6	-	17	21	26	ns
		C _L = 15pF	5	8	-	-	-	ns
Output Transition Times	t _{TLH} , t _{THL}	C _L = 50pF	2	-	75	95	110	ns
(Figure 1)			4.5	-	15	19	22	ns
			6	=	13	16	19	ns
Input Capacitance	C _{IN}	-	-	=	10	10	10	pF
Power Dissipation Capacitance (Notes 2, 3)	C _{PD}	C _L = 15pF	5	22	-	-	-	pF

NOTES:

- 2. $C_{\mbox{\scriptsize PD}}$ is used to determine the dynamic power consumption, per gate.
- 3. $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$ where $f_i = \text{Input Frequency}$, $C_L = \text{Output Load Capacitance}$, $V_{CC} = \text{Supply Voltage}$.

Test Circuit and Waveform

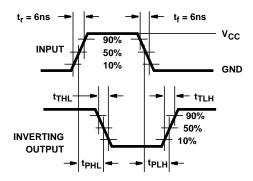


FIGURE 1. HC AND HCU TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC



28-Aug-2010

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
CD54HC4002F3A	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	Contact TI Distributo or Sales Office
CD74HC4002E	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Purchase Samples
CD74HC4002EE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Purchase Samples
CD74HC4002M	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002M96	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002M96E4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002M96G4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002ME4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002MG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002MT	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002MTE4	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002MTG4	ACTIVE	SOIC	D	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002PW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002PWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002PWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002PWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002PWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002PWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples



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Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
CD74HC4002PWT	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002PWTE4	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples
CD74HC4002PWTG4	ACTIVE	TSSOP	PW	14	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Purchase Samples

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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OTHER QUALIFIED VERSIONS OF CD54HC4002, CD74HC4002:

Catalog: CD74HC4002

Military: CD54HC4002





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NOTE: Qualified Version Definitions:

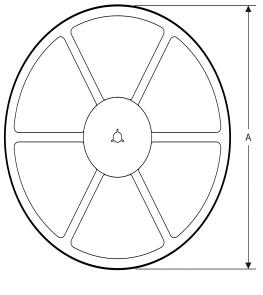
- Catalog TI's standard catalog product
- Military QML certified for Military and Defense Applications

PACKAGE MATERIALS INFORMATION

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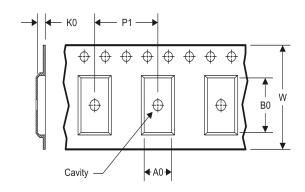
TAPE AND REEL INFORMATION

REEL DIMENSIONS





TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
В0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

All difficusions are nominal												
Device		Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD74HC4002M96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CD74HC4002MT	SOIC	D	14	250	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CD74HC4002PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD74HC4002PWT	TSSOP	PW	14	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

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*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74HC4002M96	SOIC	D	14	2500	367.0	367.0	38.0
CD74HC4002MT	SOIC	D	14	250	367.0	367.0	38.0
CD74HC4002PWR	TSSOP	PW	14	2000	367.0	367.0	35.0
CD74HC4002PWT	TSSOP	PW	14	250	367.0	367.0	35.0

14 LEADS SHOWN



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
- E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- The 20 pin end lead shoulder width is a vendor option, either half or full width.



D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.



D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M—1994.
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO-153



PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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