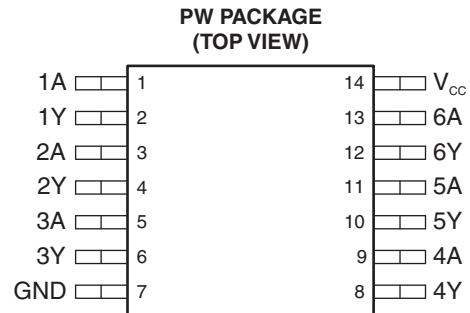


HIGH-SPEED CMOS LOGIC HEX INVERTER

Check for Samples: [CD74HCU04-Q1](#)

FEATURES

- Qualified for Automotive Applications
- Wide Operating Temperature Range:
-40°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HCU Types
 - 2-V to 6-V Operation
- CMOS Input Compatibility: $I_I \leq 1\mu\text{A}$ at V_{OL} , V_{OH}



DESCRIPTION

The CD74HCU04 unbuffered hex inverter utilizes silicon-gate CMOS technology to achieve operation speeds similar to LSTTL gates, with the low power consumption of standard CMOS integrated circuits. These devices especially are useful in crystal oscillator and analog applications.

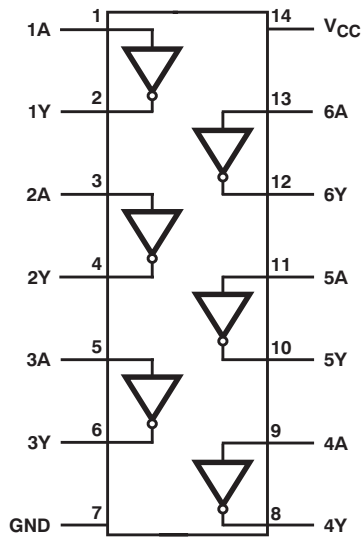
ORDERING INFORMATION

T _A	PACKAGE		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 125°C	TSSOP – PW	Reel of 2000	CD74HCU04QPWRQ1	HJU04Q

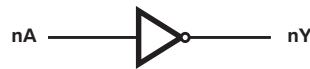


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

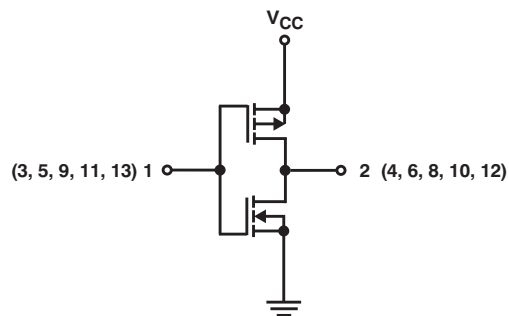
Functional Diagram



Logic Symbol



Schematic Diagram



ABSOLUTE MAXIMUM RATINGS⁽¹⁾⁽²⁾

V_{CC}	DC supply voltage	-0.5V to +7V
I_{IK}	DC input diode current, $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$	$\pm 20mA$
I_{OK}	DC output diode current, $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$	$\pm 20mA$
I_O	DC drain current per output, $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$	$\pm 25mA$
I_{CC}	DC VCC or ground current	$\pm 50mA$
θ_{JA}	Thermal impedance, junction to free air ⁽³⁾	112.6°C/W
T_J	Maximum junction temperature	150°C
T_{Stg}	Storage temperature range	-65°C to 150°C

- (1) 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.
- (2) All voltages are referenced to ground.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS

		MIN	MAX	UNIT
V_{CC}	Supply voltage	2	6	V
V_I	Input voltage	0	V_{CC}	V
V_O	Output voltage	0	V_{CC}	V
T_A	Operating free-air temperature	-40	125	°C

ELECTRICAL CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS		V_{CC}	$T_A = 25^\circ C$		$T_A = -40$ to $125^\circ C$		UNIT
	V_I (V)	I_O (mA)		MIN	MAX	MIN	MAX	
V_{IH}	High level input voltage	—	—	2	1.7	1.7		V
				4.5	3.6	3.6		
				6	4.8	4.8		
V_{IL}	Low level input voltage	—	—	2	0.3	0.3		V
				4.5	0.8	0.8		
				6	1.1	1.1		
$V_{OH(CMOS)}$	High level output voltage, CMOS loads	V_{IH} or V_{IL}	-0.02	2	1.8	1.8		V
				4.5	4	4		
				6	5.5	5.5		
$V_{OH(TTL)}$	High level output voltage, TTL loads	V_{CC} or GND	-4	4.5	3.98	3.7		V
			-5.2	6	5.48	5.2		
$V_{OL(CMOS)}$	Low level output voltage, CMOS loads	V_{IH} or V_{IL}	0.02	2	0.2	0.2		V
				4.5	0.5	0.5		
				6	0.5	0.5		
$V_{OL(TTL)}$	Low level output voltage, TTL loads	V_{CC} or GND	4	4.5	0.26	0.4		V
			5.2	6	0.26	0.4		
I_I	Input leakage current	V_{CC} or GND	—	6	± 0.1	± 1		μA
I_{CC}	Quiescent device current	V_{CC} or GND	0	6	2	40		μA

SWITCHING CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			T _A = -40 to 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	
t _{PLH} , t _{PHL} Propagation delay, input to output Y (see Figure 1)	C _L = 50pF	2			70		105	ns
	C _L = 50pF	4.5			14		21	
	C _L = 50pF	6			12		18	
t _{TLH} , t _{THL} Transition times (see Figure 1)	C _L = 50pF	2			75		110	ns
		4.5			15		22	
		6			13		19	
C _I	Input capacitance	—	—	See Figure 3				
C _{PD}	Power dissipation capacitance ⁽¹⁾⁽²⁾	—	5	14			pF	

- (1) C_{PD} is used to determine the dynamic power consumption, per inverter.
- (2) P_D = V_{CC2} × f_i (C_{PD} + C_L), where f_i = input frequency, C_L = output load capacitance, V_{CC} = supply voltage

TEST WAVEFORMS

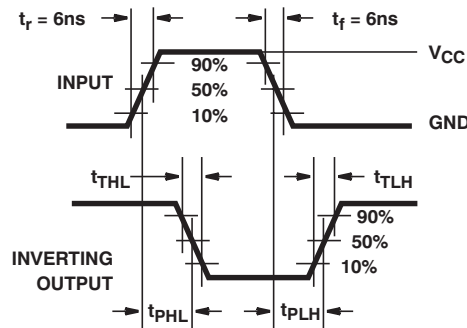


Figure 1. HC and HCU Transition Times and Propagation Delay Times, Combination Logic

TYPICAL PERFORMANCE CURVES

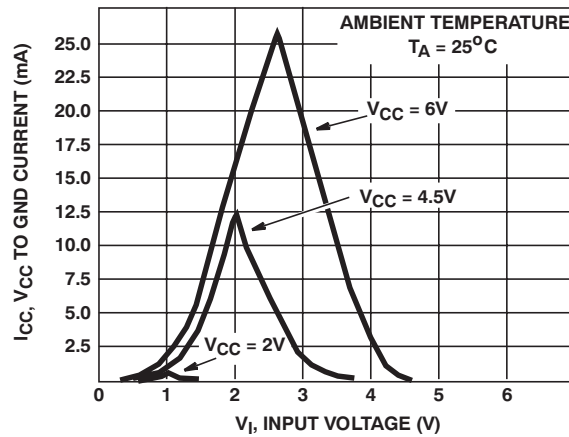


Figure 2. Typical Inverter Supply Current as a Function of Input Voltage

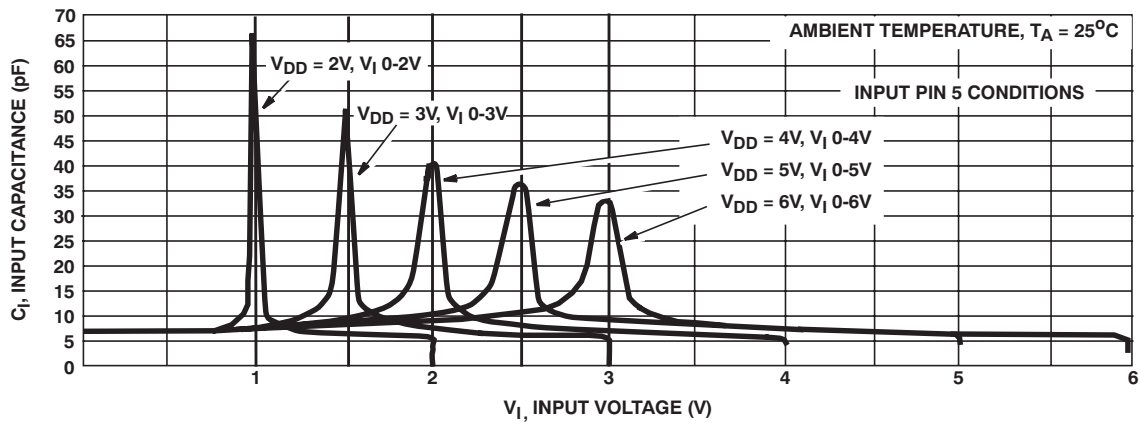


Figure 3. Input Capacitance as a Function of Input Voltage

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
CD74HCU04QPWRQ1	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HJU04Q	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.

(4) Only one of markings shown within the brackets will appear on the physical device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF CD74HCU04-Q1 :

- Catalog: [CD74HCU04](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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
CD74HCU04QPWRQ1	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)
CD74HCU04QPWRQ1	TSSOP	PW	14	2000	367.0	367.0	35.0

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 - D. 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



- NOTES:
- 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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com