

# 74HCT14

## Hex Schmitt-Trigger Inverter with LSTTL Compatible Inputs

### High-Performance Silicon-Gate CMOS

The 74HCT14 may be used as a level converter for interfacing TTL or NMOS outputs to high-speed CMOS inputs.

The HCT14 is useful to “square up” slow input rise and fall times. Due to the hysteresis voltage of the Schmitt trigger, the HCT14 finds applications in noisy environments.

#### Features

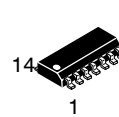
- Output Drive Capability: 10 LSTTL Loads
- TTL/NMOS-Compatible Input Levels
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 4.5 to 5.5 V
- Low Input Current: 1.0  $\mu$ A
- In Compliance With the JEDEC Standard No. 7A Requirements
- ESD Performance: HBM > 2000 V; Machine Model > 200 V
- Chip Complexity: 72 FETs or 18 Equivalent Gates
- These are Pb-Free Devices



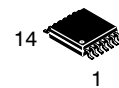
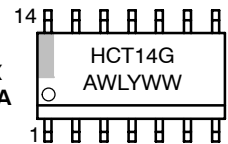
ON Semiconductor®

<http://onsemi.com>

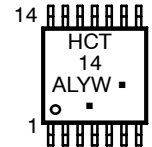
#### MARKING DIAGRAMS



SOIC-14  
D SUFFIX  
CASE 751A



TSSOP-14  
DT SUFFIX  
CASE 948G



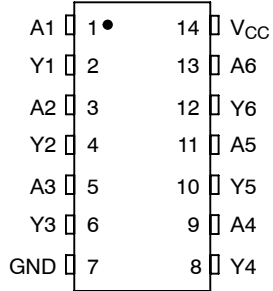
HCT14 = Device Code  
A = Assembly Location  
L, WL = Wafer Lot  
Y = Year  
W, WW = Work Week  
G or ■ = Pb-Free Package  
(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# 74HCT14

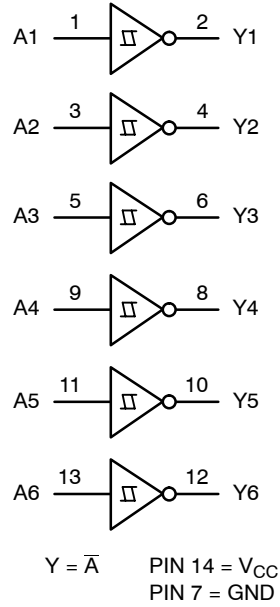
## PIN ASSIGNMENT



## FUNCTION TABLE

Input A	Output Y
L	H
H	L

## LOGIC DIAGRAM



## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
74HCT14DR2G	SOIC-14 (Pb-Free)	2500 / Tape & Reel
74HCT14DTR2G	TSSOP-14*	

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*This package is inherently Pb-Free.

# 74HCT14

## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage (Referenced to GND)	- 0.5 to + 7.0	V
V <sub>I</sub>	DC Input Voltage (Referenced to GND)	- 0.5 to V <sub>CC</sub> + 0.5	V
V <sub>O</sub>	DC Output Voltage (Referenced to GND)	- 0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	DC Input Diode Current	± 20	mA
I <sub>OK</sub>	DC Output Diode Current	± 25	mA
I <sub>O</sub>	DC Output Sink Current	± 25	mA
I <sub>CC</sub>	DC Supply Current per Supply Pin	± 50	mA
I <sub>GND</sub>	DC Ground Current per Ground Pin	± 50	mA
T <sub>STG</sub>	Storage Temperature Range	- 65 to + 150	°C
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
T <sub>J</sub>	Junction Temperature under Bias	+ 150	°C
θ <sub>JA</sub>	Thermal Resistance	SOIC TSSOP 125 170	°C/W
P <sub>D</sub>	Power Dissipation in Still Air at 85°C	SOIC TSSOP 500 450	mW
MSL	Moisture Sensitivity	Level 1	
F <sub>R</sub>	Flammability Rating	Oxygen Index: 30% - 35% UL 94 V-0 @ 0.125 in	
V <sub>ESD</sub>	ESD Withstand Voltage	Human Body Model (Note 1) Machine Model (Note 2) >2000 >200	V
I <sub>Latchup</sub>	Latchup Performance	Above V <sub>CC</sub> and Below GND at 85°C (Note 3)	± 300 mA

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Tested to EIA/JESD22-A114-A.
2. Tested to EIA/JESD22-A115-A.
3. Tested to EIA/JESD78.
4. For high frequency or heavy load considerations, see the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage (Referenced to GND)	4.5	5.5	V
V <sub>I</sub> , V <sub>O</sub>	DC Input Voltage, Output Voltage (Referenced to GND)	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature, All Package Types	- 55	+ 125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time (Figure 1)	-	(Note 5)	ns

5. No Limit when V<sub>I</sub> ≈ 50% V<sub>CC</sub>, I<sub>CC</sub> > 1 mA.
6. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

# 74HCT14

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	Temperature Limit						Unit
				-55°C to 25°C		≤ 85°C		≤ 125°C		
				Min	Max	Min	Max	Min	Max	
V <sub>T+</sub> max	Maximum Positive-Going Input Threshold Voltage	V <sub>O</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>out</sub>   ≤ 20 μA	4.5 5.5		1.9 2.1		1.9 2.1		1.9 2.1	V
V <sub>T+</sub> min	Minimum Positive-Going Input Threshold Voltage	V <sub>O</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>out</sub>   ≤ 20 μA	4.5 5.5	1.2 1.4		1.2 1.4		1.2 1.4		V
V <sub>T-</sub> max	Maximum Negative-Going Input Threshold Voltage	V <sub>O</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>out</sub>   ≤ 20 μA	4.5 5.5		1.2 1.4		1.2 1.4		1.2 1.4	
V <sub>T-</sub> min	Minimum Negative-Going Input Threshold Voltage	V <sub>O</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>out</sub>   ≤ 20 μA	4.5 5.5	0.5 0.6		0.5 0.6		0.5 0.6		
V <sub>H</sub> max	Maximum Hysteresis Voltage	V <sub>O</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>out</sub>   ≤ 20 μA	4.5 5.5		1.4 1.5		1.4 1.5		1.4 1.5	
V <sub>H</sub> min	Minimum Hysteresis Voltage	V <sub>O</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>out</sub>   ≤ 20 μA	4.5 5.5	0.4 0.4		0.4 0.4		0.4 0.4		
V <sub>OH</sub>	Minimum High-Level Output Voltage	V <sub>I</sub> < V <sub>T-</sub> min  I <sub>out</sub>   ≤ 20 μA	4.5 5.5	4.4 5.4		4.4 5.4		4.4 5.4		V
		V <sub>I</sub> < V <sub>T-</sub> min  I <sub>out</sub>   ≤ 4.0 mA	4.5	3.98		3.84		3.7		
V <sub>OL</sub>	Maximum Low-Level Output Voltage	V <sub>I</sub> ≥ V <sub>T+</sub> max  I <sub>out</sub>   ≤ 20 μA	4.5 5.5		0.1 0.1		0.1 0.1		0.1 0.1	V
		V <sub>I</sub> ≥ V <sub>T+</sub> max  I <sub>out</sub>   ≤ 4.0 mA	4.5		0.26		0.33		0.4	
I <sub>IK</sub>	Maximum Input Leakage Current	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5		±0.1		±1.0		±1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current (per package)	V <sub>I</sub> = V <sub>CC</sub> or GND I <sub>out</sub> = 0 μA	5.5		2.0		20		40	μA
ΔI <sub>CC</sub>	Additional Quiescent Supply Current	V <sub>I</sub> = 2.4 V, Any One Input V <sub>I</sub> = V <sub>CC</sub> or GND, Other Inputs I <sub>out</sub> = 0 μA	5.5	≥ -55°C		25°C to 125°C				mA
				2.9		2.4				

7. Information on typical parametric values can be found in the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

## AC CHARACTERISTICS (C<sub>L</sub> = 50 pF; Input t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

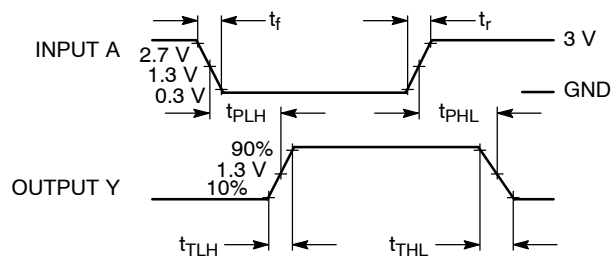
Symbol	Parameter	Test Conditions	Figures	Guaranteed Limit						Unit
				-55°C to 25°C		≤ 85°C		≤ 125°C		
				Min	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input A to Output Y (L to H)	V <sub>CC</sub> = 5.0 V ± 10% C <sub>L</sub> = 50 pF, Input t <sub>r</sub> = t <sub>f</sub> = 6.0 ns	1 & 2		32		40		48	ns
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output	V <sub>CC</sub> = 5.0 V ± 10% C <sub>L</sub> = 50 pF, Input t <sub>r</sub> = t <sub>f</sub> = 6.0 ns	1 & 2		15		19		22	ns

8. For propagation delays with loads other than 50 pF, and information on typical parametric values, see the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

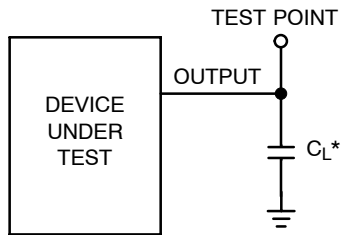
C <sub>PD</sub>	Power Dissipation Capacitance, per Inverter (Note 9)	Typical @ 25°C, V <sub>CC</sub> = 5.0 V		pF
		32		

9. Used to determine the no-load dynamic power consumption: P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup>f + I<sub>CC</sub> V<sub>CC</sub>. For load considerations, see the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

# 74HCT14



**Figure 1. Switching Waveforms**



\*Includes all probe and jig capacitance.

**Figure 2. Test Circuit**

# 74HCT14

## PACKAGE DIMENSIONS

SOIC-14  
CASE 751A-03  
ISSUE H

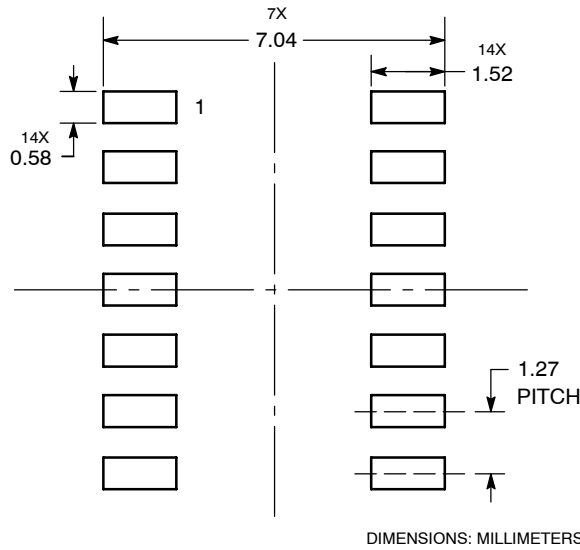


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

**SOLDERING FOOTPRINT\***

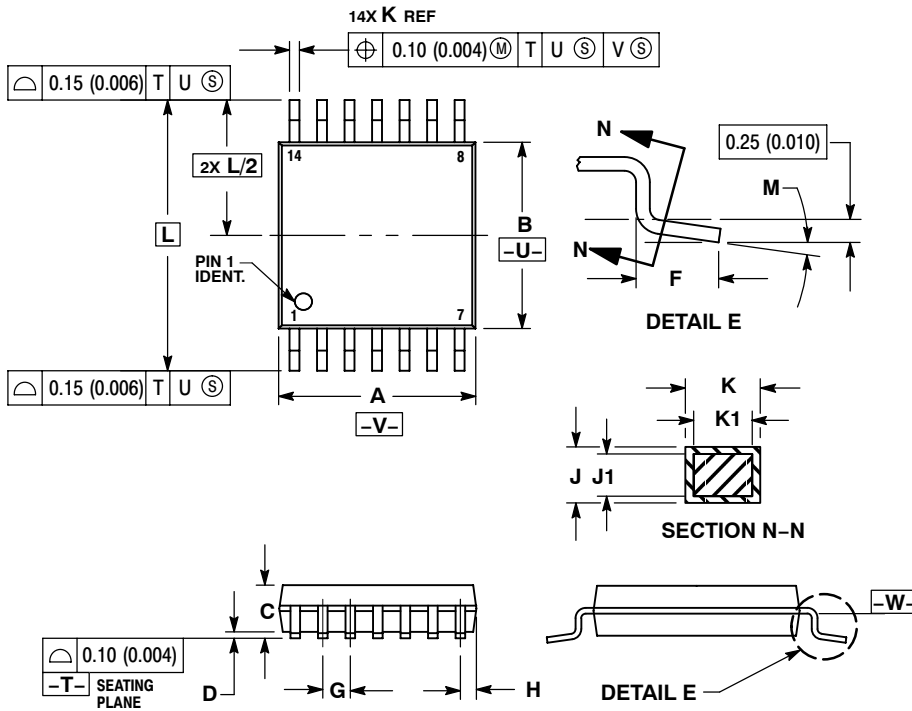


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# 74HCT14

## PACKAGE DIMENSIONS

TSSOP-14  
CASE 948G-01  
ISSUE B

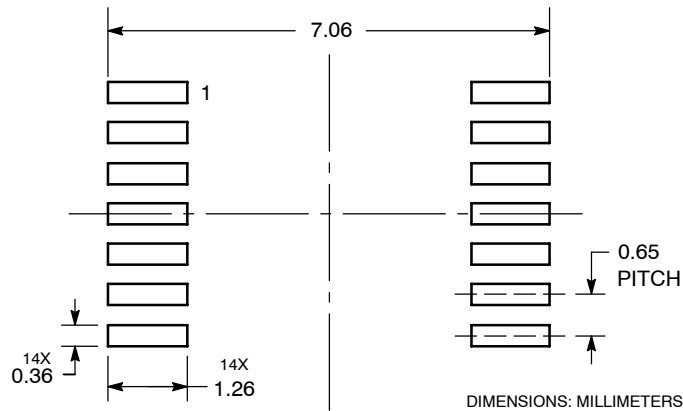


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0° - 8°		0° - 8°	

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**ON Semiconductor** and **ON** are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5773-3850

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local  
Sales Representative