

MC74VHC1G14

Single Schmitt-Trigger Inverter

The MC74VHC1G14 is a single gate CMOS Schmitt-trigger inverter fabricated with silicon gate CMOS technology.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output.

The MC74VHC1G14 input structure provides protection when voltages up to 7 V are applied, regardless of the supply voltage. This allows the MC74VHC1G14 to be used to interface 5 V circuits to 3 V circuits.

The MC74VHC1G14 can be used to enhance noise immunity or to square up slowly changing waveforms.

Features

- High Speed: $t_{PD} = 4 \text{ ns}$ (Typ) at $V_{CC} = 5 \text{ V}$
- Low Power Dissipation: $I_{CC} = 1.0 \mu\text{A}$ (Max) at $T_A = 25^\circ\text{C}$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Pin and Function Compatible with Other Standard Logic Families
- Chip Complexity: FETs = 101
- These Devices are Pb-Free and are RoHS Compliant
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

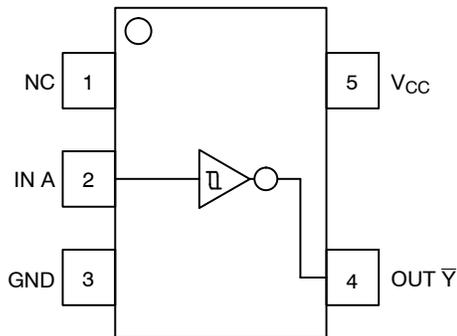


Figure 1. Pinout (Top View)

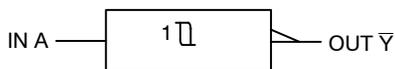


Figure 2. Logic Symbol



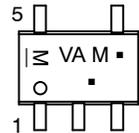
ON Semiconductor®

www.onsemi.com

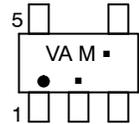
MARKING DIAGRAMS



SC-88A / SOT-353 / SC-70
DF SUFFIX
CASE 419A



TSOP-5 / SOT-23 / SC-59
DT SUFFIX
CASE 483



VA = Device Code
M = Date Code*
▪ = Pb-Free Package

(Note: Microdot may be in either location)
*Date Code orientation and/or position may vary depending upon manufacturing location.

PIN ASSIGNMENT

1	NC
2	IN A
3	GND
4	OUT \bar{Y}
5	V_{CC}

FUNCTION TABLE

A Input	\bar{Y} Output
L	H
H	L

ORDERING INFORMATION

See detailed ordering and shipping information on page 4 of this data sheet.

MC74VHC1G14

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	-0.5 to +7.0	V
V_{IN}	DC Input Voltage	-0.5 to +7.0	V
V_{OUT}	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
I_{IK}	DC Input Diode Current	-20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_{OUT}	DC Output Sink Current	± 12.5	mA
I_{CC}	DC Supply Current per Supply Pin	± 25	mA
T_{STG}	Storage Temperature Range	-65 to +150	$^{\circ}C$
T_L	Lead Temperature, 1 mm from Case for 10 Seconds	260	$^{\circ}C$
T_J	Junction Temperature Under Bias	+150	$^{\circ}C$
θ_{JA}	Thermal Resistance	SC70-5/SC-88A (Note 1) TSOP-5 350 230	$^{\circ}C/W$
P_D	Power Dissipation in Still Air at 85 $^{\circ}C$	SC70-5/SC-88A TSOP-5 150 200	mW
MSL	Moisture Sensitivity	Level 1	
F_R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in
V_{ESD}	ESD Withstand Voltage	Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4) > 2000 > 200 N/A	V
$I_{Latchup}$	Latchup Performance	Above V_{CC} and Below GND at 125 $^{\circ}C$ (Note 5)	± 500 mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.
5. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage	2.0	5.5	V
V_{IN}	DC Input Voltage	0.0	5.5	V
V_{OUT}	DC Output Voltage	0.0	V_{CC}	V
T_A	Operating Temperature Range	-55	+125	$^{\circ}C$
t_r, t_f	Input Rise and Fall Time	$V_{CC} = 3.3 V \pm 0.3 V$ $V_{CC} = 5.0 V \pm 0.5 V$	No Limit No Limit	ns/V

Device Junction Temperature versus Time to 0.1% Bond Failures

Junction Temperature $^{\circ}C$	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

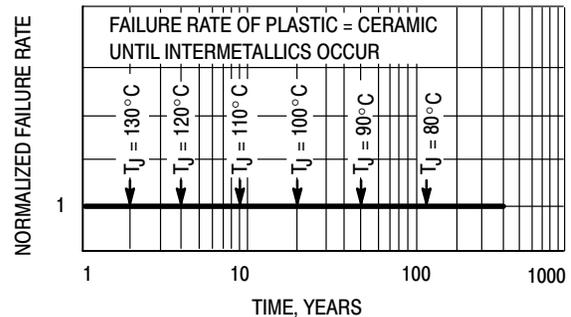


Figure 3. Failure Rate vs. Time Junction Temperature

MC74VHC1G14

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} (V)	T _A = 25°C			T _A ≤ 85°C		-55 ≤ T _A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V _{T+}	Positive Threshold Voltage		3.0	1.2	2.0	2.20		2.20		2.20	V
			4.5	1.75	3.0	3.15		3.15		3.15	
			5.5	2.15	3.6	3.85		3.85		3.85	
V _{T-}	Negative Threshold Voltage		3.0	0.9	1.5	1.9	0.9		0.9		V
			4.5	1.35	2.3	2.75	1.35		1.35		
			5.5	1.65	2.9	3.35	1.65		1.65		
V _H	Hysteresis Voltage		3.0	0.30	0.57	1.20	0.30	1.20	0.30	1.20	V
			4.5	0.40	0.67	1.40	0.40	1.40	0.40	1.40	
			5.5	0.50	0.74	1.60	0.50	1.60	0.50	1.60	
V _{OH}	Minimum High-Level Output Voltage	V _{IN} ≤ V _{T-} - Min I _{OH} = -50 μA	2.0	1.9	2.0		1.9		1.9		V
		I _{OH} = -4 mA I _{OH} = -8 mA	3.0	2.9	3.0		2.9		2.9		
V _{OL}	Maximum Low-Level Output Voltage	V _{IN} ≥ V _{T+} + Max I _{OL} = 50 μA	2.0		0.0	0.1		0.1		0.1	V
		I _{OL} = 4 mA I _{OL} = 8 mA	3.0		0.0	0.1		0.1		0.1	
I _{IN}	Maximum Input Leakage Current	V _{IN} = 5.5 V or GND	0 to 5.5			±0.1		±1.0		μA	
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND	5.5			1.0		20		μA	

AC ELECTRICAL CHARACTERISTICS Input t_r = t_f = 3.0 ns

Symbol	Parameter	Test Conditions	T _A = 25°C			T _A ≤ 85°C		-55 ≤ T _A ≤ 125°C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, A to \bar{Y}	V _{CC} = 3.3 ± 0.3 V C _L = 15 pF		7.0	12.8	1.0	15.0	1.0	17.0	ns
		C _L = 50 pF		8.5	16.3	1.0	18.5	1.0	20.5	
		V _{CC} = 5.0 ± 0.5 V C _L = 15 pF		4.0	8.6	1.0	10.0	1.0	11.5	
		C _L = 50 pF		5.5	10.6	1.0	12.0	1.0	13.5	
C _{IN}	Maximum Input Capacitance			5	10		10		10	pF

C _{PD}	Power Dissipation Capacitance (Note 6)	Typical @ 25°C, V _{CC} = 5.0 V		pF
		7.0		

6. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

MC74VHC1G14

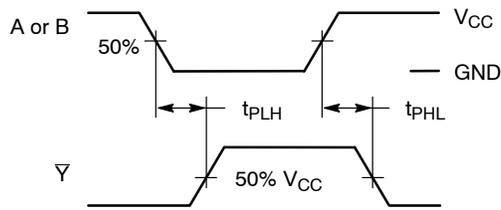
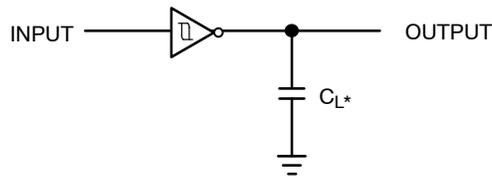


Figure 4. Switching Waveforms



*Includes all probe and jig capacitance.
A 1-MHz square input wave is recommended for propagation delay tests.

Figure 5. Test Circuit

ORDERING INFORMATION

Device	Package	Shipping†
MC74VHC1G14DFT1G	SC-88A/SOT-353 (Pb-Free)	3000/Tape & Reel
NLVVHC1G14DFT1G*		
MC74VHC1G14DFT2G		
NLVVHC1G14DFT2G*		
MC74VHC1G14DTT1G	SOT-23/TSOP-5 (Pb-Free)	

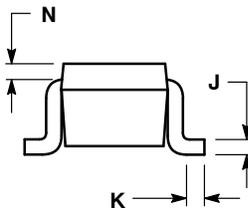
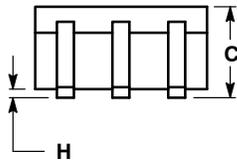
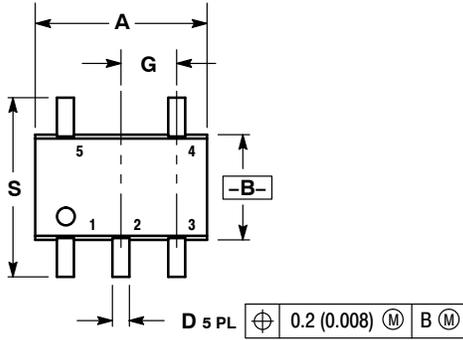
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

MC74VHC1G14

PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353)
CASE 419A-02
ISSUE L

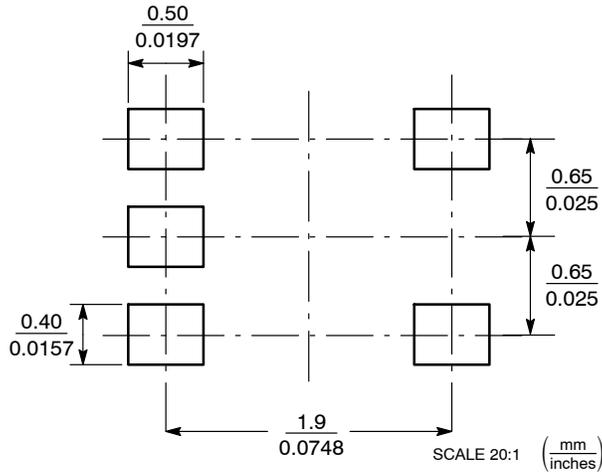


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

SOLDER FOOTPRINT*

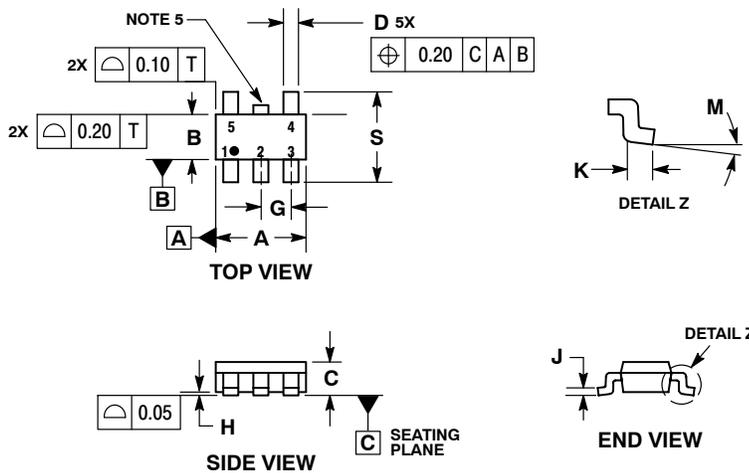


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MC74VHC1G14

PACKAGE DIMENSIONS

TSOP-5
CASE 483
ISSUE M

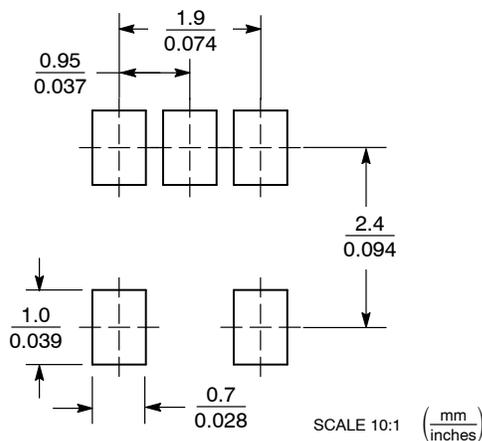


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION A.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

DIM	MILLIMETERS	
	MIN	MAX
A	2.85	3.15
B	1.35	1.65
C	0.90	1.10
D	0.25	0.50
G	0.95 BSC	
H	0.01	0.10
J	0.10	0.26
K	0.20	0.60
M	0°	10°
S	2.50	3.00

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 are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor 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
19521 E. 32nd Pkwy, Aurora, Colorado 80011 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

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: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative