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 ns (Typ) at V_{CC} = 5 V
- Low Power Dissipation: I_{CC} = 1.0 µA (Max) at T_A = 25°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
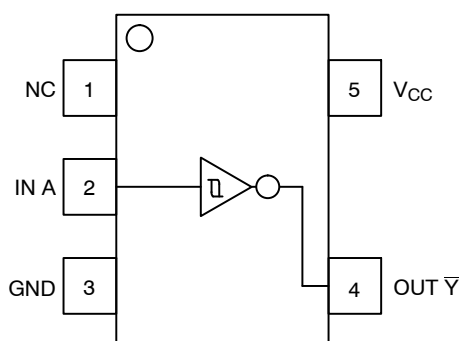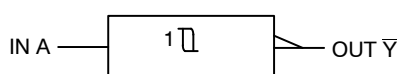
ON Semiconductor®

MARKING DIAGRAMS

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

5	VA M ∎
1	
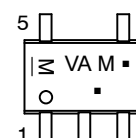
TSOP−5 / SOT−23 / SC−59
DT SUFFIX
CASE 483

5	VA M ∎
1	
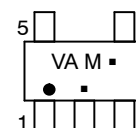
VA = Device Code
M = Date Code*
∎ = Pb−Free Package

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

Figure 1. Pinout (Top View)

Figure 2. Logic Symbol

PIN ASSIGNMENT

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

FUNCTION TABLE

A Input	$\overline{Y}$ Output
L	H
H	L

ORDERING INFORMATION

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

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	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance	SC70−5/SC−88A (Note 1) TSOP−5	350 230	°C/W
P_D	Power Dissipation in Still Air at 85°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°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	°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 3.3 V ± 0.3 V V_{CC} = 5.0 V ± 0.5 V	– –	No Limit No Limit	ns/V

Device Junction Temperature versus Time to 0.1% Bond Failures

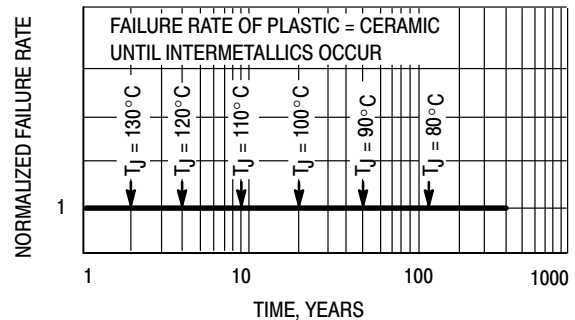| Junction Temperature °C	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

Figure 3. Failure Rate vs. Time Junction Temperature

MC74VHC1G14

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CC} (V)	$T_A = 25°C$			$T_A \leq 85°C$		$-55 \leq T_A \leq 125°C$		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V_{T+}	Positive Threshold Voltage		3.0 4.5 5.5	1.2 1.75 2.15	2.0 3.0 3.6	2.20 3.15 3.85		2.20 3.15 3.85		2.20 3.15 3.85	V
V_{T-}	Negative Threshold Voltage		3.0 4.5 5.5	0.9 1.35 1.65	1.5 2.3 2.9	1.9 2.75 3.35	0.9 1.35 1.65		0.9 1.35 1.65		V
V_H	Hysteresis Voltage		3.0 4.5 5.5	0.30 0.40 0.50	0.57 0.67 0.74	1.20 1.40 1.60	0.30 0.40 0.50	1.20 1.40 1.60	0.30 0.40 0.50	1.20 1.40 1.60	V
V_{OH}	Minimum High–Level Output Voltage	$V_{IN} \leq V_T$ – Min $I_{OH} = -50$ μA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5		1.9 2.9 4.4		1.9 2.9 4.4		V
		$I_{OH} = -4$ mA $I_{OH} = -8$ mA	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		V
V_{OL}	Maximum Low–Level Output Voltage	$V_{IN} \geq V_T$ + Max $I_{OL} = 50$ μA	2.0 3.0 4.5		0.0 0.0 0.0	0.1 0.1 0.1		0.1 0.1 0.1		0.1 0.1 0.1	V
		$I_{OL} = 4$ mA $I_{OL} = 8$ mA	3.0 4.5			0.36 0.36		0.44 0.44		0.52 0.52	V
I_{IN}	Maximum Input Leakage Current	$V_{IN} = 5.5$ V or GND	0 to 5.5			±0.1		±1.0		±1.0	μA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5			1.0		20		40	μA

AC ELECTRICAL CHARACTERISTICS Input $t_r = t_f = 3.0$ ns

Symbol	Parameter	Test Conditions		$T_A = 25°C$			$T_A \leq 85°C$		$-55 \leq T_A \leq 125°C$		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}, t_{PHL}	Maximum Propagation Delay, A to $\overline{Y}$	$V_{CC} = 3.3 \pm 0.3$ V	$C_L = 15$ pF $C_L = 50$ pF		7.0 8.5	12.8 16.3	1.0 1.0	15.0 18.5	1.0 1.0	17.0 20.5	ns
		$V_{CC} = 5.0 \pm 0.5$ V	$C_L = 15$ pF $C_L = 50$ pF		4.0 5.5	8.6 10.6	1.0 1.0	10.0 12.0	1.0 1.0	11.5 13.5	
C_{IN}	Maximum Input Capacitance				5	10		10		10	pF

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

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: $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$. C_{PD} is used to determine the no–load dynamic power consumption; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.
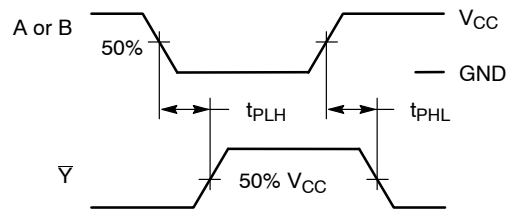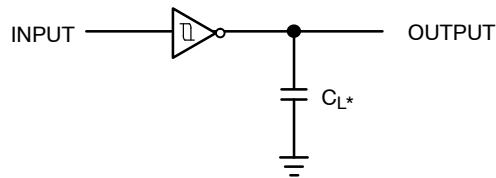
MC74VHC1G14

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.

PACKAGE DIMENSIONS

SC−88A (SC−70−5/SOT−353)
CASE 419A−02
ISSUE L
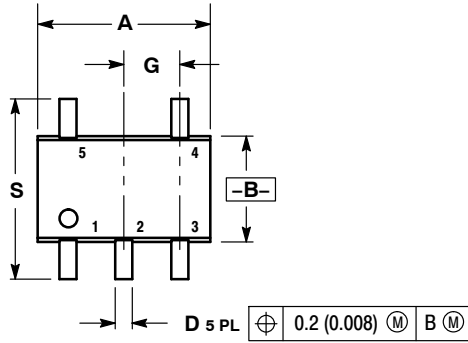
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A−01 OBSOLETE. NEW STANDARD 419A−02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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
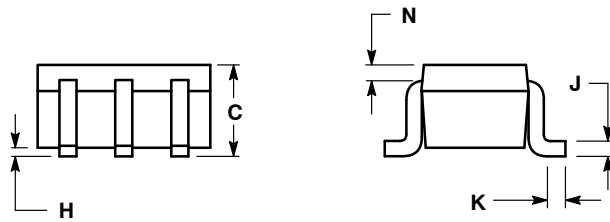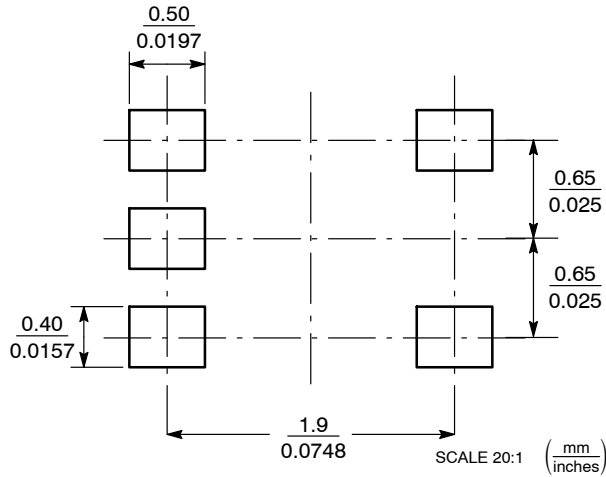
D 5 PL ⊕ 0.2 (0.008) Ⓜ B Ⓜ

SOLDER FOOTPRINT*

$\frac{0.50}{0.0197}$

$\frac{0.65}{0.025}$

$\frac{0.65}{0.025}$

$\frac{0.40}{0.0157}$

$\frac{1.9}{0.0748}$

SCALE 20:1 $\left(\frac{mm}{inches}\right)$

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

PACKAGE DIMENSIONS

TSOP−5
CASE 483
ISSUE M
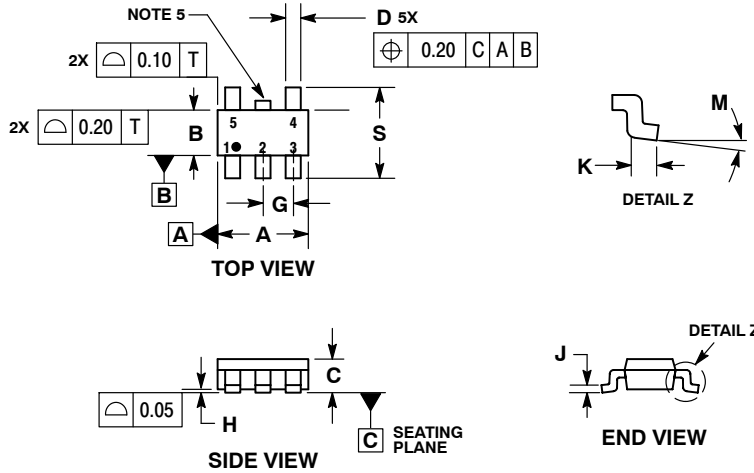
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. 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.

TOP VIEW

DETAIL Z

SIDE VIEW

SEATING PLANE

END VIEW

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*

$\frac{1.9}{0.074}$

$\frac{0.95}{0.037}$

$\frac{2.4}{0.094}$

$\frac{1.0}{0.039}$

$\frac{0.7}{0.028}$

SCALE 10:1 $\left(\frac{mm}{inches}\right)$

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