

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 7.0 V are applied, regardless of the supply voltage. This allows the MC74VHC1G14 to be used to interface 5.0 V circuits to 3.0 V circuits.

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

Features

- High Speed: $t_{PD} = 4.0$ ns (Typ) at $V_{CC} = 5.0$ V
- Low Power Dissipation: $I_{CC} = 1.0$ μ A (Max) at $T_A = 25^\circ$ C
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Pin and Function Compatible with Other Standard Logic Families
- Chip Complexity: FETs = 101
- Pb-Free Packages are Available

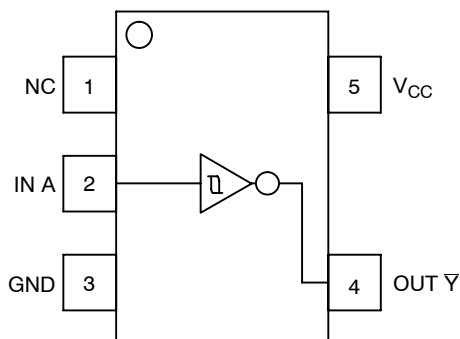


Figure 1. Pinout (Top View)

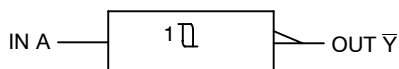


Figure 2. Logic Symbol



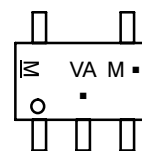
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MARKING DIAGRAMS



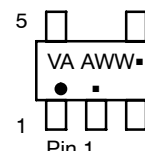
SC70-5/SC-88A/SOT-353
DF SUFFIX
CASE 419A



Pin 1



SOT23-5/TSOP-5/SC59-5
DT SUFFIX
CASE 483



Pin 1

VA = Specific Device Code
A = Assembly Location
WW = Work Week
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 in the package dimensions section on page 4 of this data sheet.

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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
$I_{Latchup}$	Latch-Up Performance	Above V_{CC} and Below GND at 125 $^{\circ}C$ (Note 5)	± 500 mA

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, 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

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

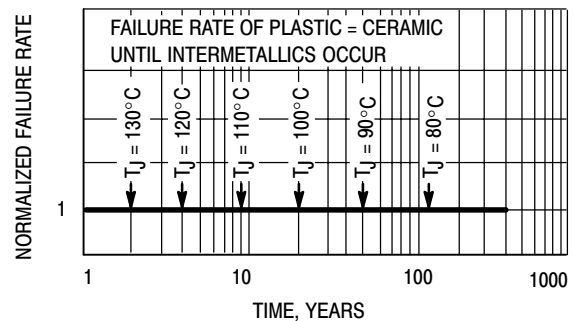


Figure 3. Failure Rate vs. Time Junction Temperature

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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	1.85	2.0	2.20		2.20		2.20	V
			4.5	2.86	3.0	3.15		3.15		3.15	
			5.5	3.50	3.6	3.85		3.85		3.85	
V _{T-}	Negative Threshold Voltage		3.0	0.9	1.5	1.65	0.9		0.9		V
			4.5	1.35	2.3	2.46	1.35		1.35		
			5.5	1.65	2.9	3.05	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 C _L = 50 pF		7.0	12.8	1.0	15.0	1.0	17.0	ns
		V _{CC} = 5.0 ± 0.5 V C _L = 15 pF C _L = 50 pF		4.0	8.6	1.0	10.0	1.0	11.5	
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}.

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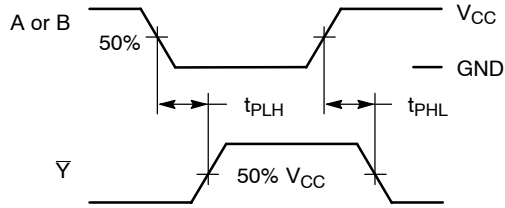
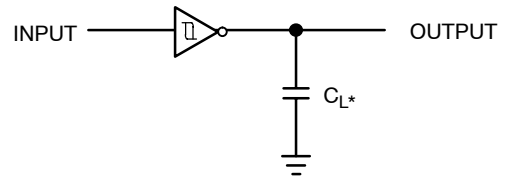


Figure 4. Switching Waveforms



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

Figure 5. Test Circuit

DEVICE ORDERING INFORMATION

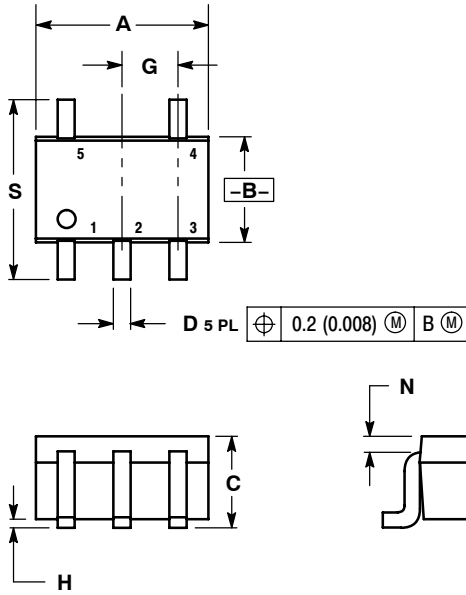
Device Order Number	Device Nomenclature						Package Type	Tape and Reel Size [†]
	Circuit Indicator	Temp Range Identifier	Technology	Device Function	Package Suffix	Tape & Reel Suffix		
MC74VHC1G14DFT1	MC	74	VHC1G	14	DF	T1	SC-88A/SOT-353	178 mm (7 in) 3000 Unit
MC74VHC1G14DFT1G	MC	74	VHC1G	14	DF	T1	SC-88A/SOT-353 (Pb-Free)	178 mm (7 in) 3000 Unit
MC74VHC1G14DFT2	MC	74	VHC1G	14	DF	T2	SC-88A/SOT-353	178 mm (7 in) 3000 Unit
MC74VHC1G14DFT2G	MC	74	VHC1G	14	DF	T2	SC-88A/SOT-353 (Pb-Free)	178 mm (7 in) 3000 Unit
MC74VHC1G14DTT1	MC	74	VHC1G	14	DT	T1	SOT-23/TSOP-5	178 mm (7 in) 3000 Unit
MC74VHC1G14DTT1G	MC	74	VHC1G	14	DT	T1	SOT-23/TSOP-5 (Pb-Free)	178 mm (7 in) 3000 Unit

[†]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.

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PACKAGE DIMENSIONS

SC-88A, SOT-353, SC-70
CASE 419A-02
ISSUE J



NOTES:

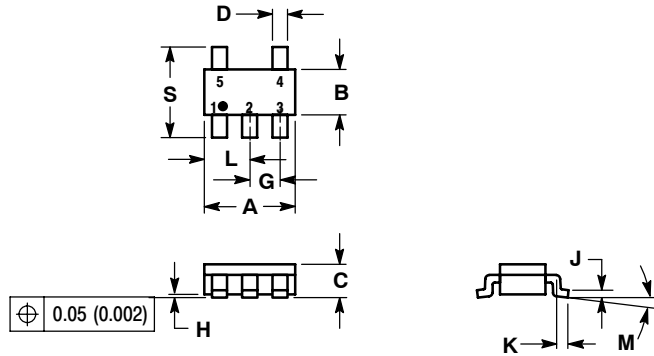
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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

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PACKAGE DIMENSIONS

TSOP-5
CASE 483-02
ISSUE D

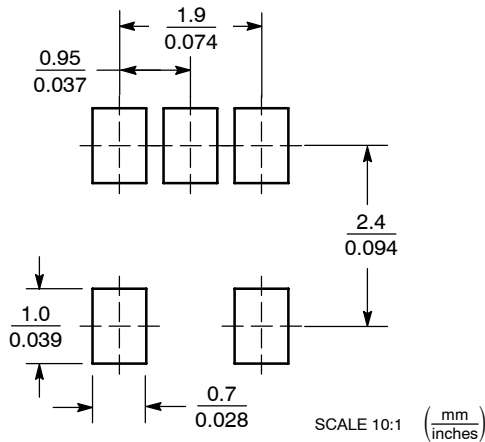


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. A AND B DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.05	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0°	10°	0°	10°
S	2.50	3.00	0.0985	0.1181

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.

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