Product Preview

Schmitt-Trigger Inverter / CMOS Logic Level Shifter with LSTTL-Compatible Inputs

MC74VHC1GT14

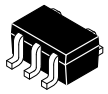
The MC74VHC1GT14 is a single gate CMOS Schmitt–trigger inverter fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

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

The device input is compatible with TTL–type input thresholds and the output has a full 5V CMOS level output swing. The input protection circuitry on this device allows overvoltage tolerance on the input, allowing the device to be used as a logic–level translator from 3.0V CMOS logic to 5.0V CMOS Logic or from 1.8V CMOS logic to 3.0V CMOS Logic while operating at the high–voltage power supply.

The MC74VHC1GT14 input structure provides protection when voltages up to 7V are applied, regardless of the supply voltage. This allows the MC74VHC1GT14 to be used to interface 5V circuits to 3V circuits. The output structures also provide protection when V_{CC} = 0V. These input and output structures help prevent device destruction caused by supply voltage – input/output voltage mismatch, battery backup, hot insertion, etc. The MC74VHC1GT14 can be used to enhance noise immunity or to square up slowly changing waveforms.

- High Speed: t_{PD} = 5.5ns (Typ) at V_{CC} = 5V
- Low Power Dissipation: I_{CC} = 2μA (Max) at T_A = 25°C
- TTL–Compatible Inputs: V_{IL} = 0.8V; V_{IH} = 2.0V
- CMOS–Compatible Outputs: $V_{OH} > 0.8V_{CC}$; $V_{OL} < 0.1V_{CC}$ @Load
- Power Down Protection Provided on Inputs and Outputs
- Balanced Propagation Delays
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300mA
- ESD Performance: HBM > 2000V; MM > 200V, CDM > 1500V
- Chip Complexity: 12 FETs or 3 Equivalent Gates



DF SUFFIX
5–LEAD SOT–353 PACKAGE
SC–88A
CASE 419A–01

FUNCTION TABLE

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

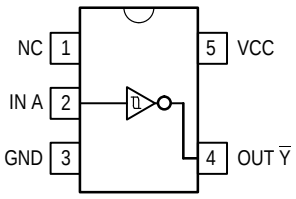


Figure 1. 5–Lead SOT–353 Pinout (Top View)

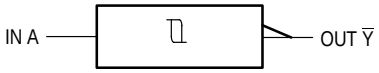
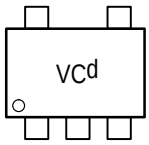


Figure 2. Logic Symbol



Marking Diagram

DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature							Package Type	Tape and Reel Size
	Motorola Circuit Indicator	Temp Range Identifier	Tech–nology	Input Type	Device Function	Package Suffix	Tape and Reel Suffix		
MC74VHC1GT14DFT1	MC	74	VHC1G	T	14	DF	T1	SC–88A	7–Inch/3000 Unit

This document contains information on a product under development. Motorola reserves the right to change or discontinue this product without notice.

MOTOROLA

MAXIMUM RATINGS*

Characteristics	Symbol	Value	Unit
DC Supply Voltage	V_{CC}	–0.5 to +7.0	V
DC Input Voltage	V_{IN}	–0.5 to +7.0	V
DC Output Voltage V_{CC} = 0 High or Low State	V_{OUT}	–0.5 to 7.0 –0.5 to V_{CC} + 0.5	V
Input Diode Current	I_{IK}	–20	mA
Output Diode Current (V_{OUT} < GND; V_{OUT} > V_{CC})	I_{OK}	+20	mA
DC Output Current, per Pin	I_{OUT}	+25	mA
DC Supply Current, V_{CC} and GND	I_{CC}	+50	mA
Power dissipation in still air, SC–88A †	P_D	200	mW
Lead temperature, 1 mm from case for 10 s	T_L	260	°C
Storage temperature	T_{stg}	–65 to +150	°C

* Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute–maximum–rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

†Derating — SC–88A Package: –5 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Min	Max	Unit
DC Supply Voltage	V_{CC}	4.5	5.5	V
DC Input Voltage	V_{IN}	0.0	5.5	V
DC Output Voltage	V_{OUT}	0.0	V_{CC}	V
Operating Temperature Range	T_A	–55	+125	°C

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CC} (V)	T_A = 25°C Min	T_A = 25°C Typ	T_A = 25°C Max	$T_A \le 85°C$ Min	$T_A \le 85°C$ Max	$T_A \le 125°C$ Min	$T_A \le 125°C$ Max	Unit
V_{T+}	Positive Threshold Voltage		3.0 4.5 5.5			1.7 2.0 2.0		1.6 2.0 2.0		1.6 2.0 2.0	V
V_{T-}	Negative Threshold Voltage		3.0 4.5 5.5	0.35 0.5 0.6			0.35 0.5 0.6		0.35 0.5 0.6		V
V_H	Hysteresis Voltage		3.0 4.5 5.5	0.30 0.40 0.50		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 I_{OH} = –50μA	V_{IN} = V_{IH} or V_{IL} I_{OH} = –50μA	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} = –4mA I_{OH} = –8mA	4.5 5.5	2.58 3.94			2.48 3.80		2.34 3.66		V
V_{OL}	Maximum Low–Level Output Voltage	V_{IN} = V_{IH} or V_{IL} I_{OL} = 50μA	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} = 4mA I_{OL} = 8mA	4.5 5.5			0.36 0.36		0.44 0.44		0.52 0.52	V
I_{IN}	Maximum Input Leakage Current	V_{IN} = 5.5V 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			2.0		20		40	μA
I_{CCT}	Quiescent Supply Current	Input: V_{IN} = 3.4V	5.5			1.35		1.50		1.65	mA
I_{OPD}	Output Leakage Current	V_{OUT} = 5.5V	0.0			0.5		5.0		10	μA

AC ELECTRICAL CHARACTERISTICS (C_{load} = 50 pF, Input t_r/t_f = 3.0ns)

Symbol	Parameter	Test Conditions		T_A = 25°C Min	T_A = 25°C Typ	T_A = 25°C Max	$T_A \le 85°C$ Min	$T_A \le 85°C$ Max	$T_A \le 125°C$ Min	$T_A \le 125°C$ Max	Unit
t_{PLH}, t_{PHL}	Maximum Propogation Delay, A to $\overline{Y}$	V_{CC} = 3.3 ± 0.3V	C_L = 15 pF C_L = 50 pF		8.3 10.8	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 ± 0.5V	C_L = 15 pF C_L = 50 pF		5.5 7.0	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} = 5.0V	
C_{PD}	Power Dissipation Capacitance (Note 1.)	20	pF

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

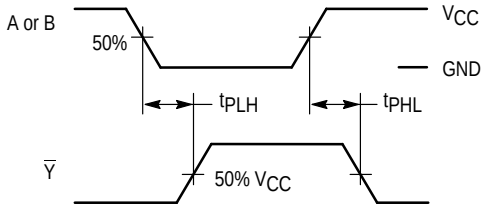
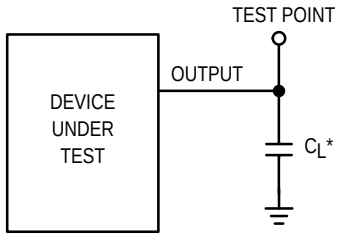


Figure 3. Switching Waveforms

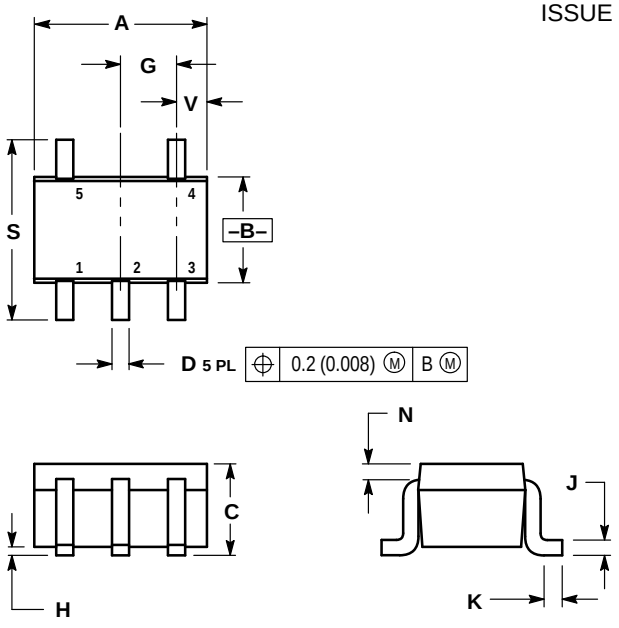


* Includes all probe and jig capacitance

Figure 4. Test Circuit

OUTLINE DIMENSIONS

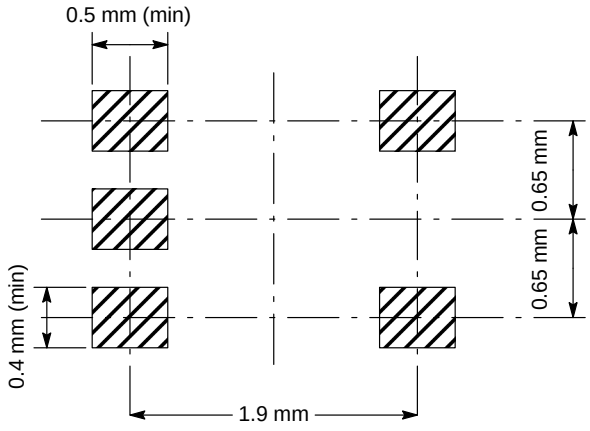
DF SUFFIX
5–LEAD SOT–353 PACKAGE
SC–88A
CASE 419A–01
ISSUE B



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	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
V	0.012	0.016	0.30	0.40

SOT–353



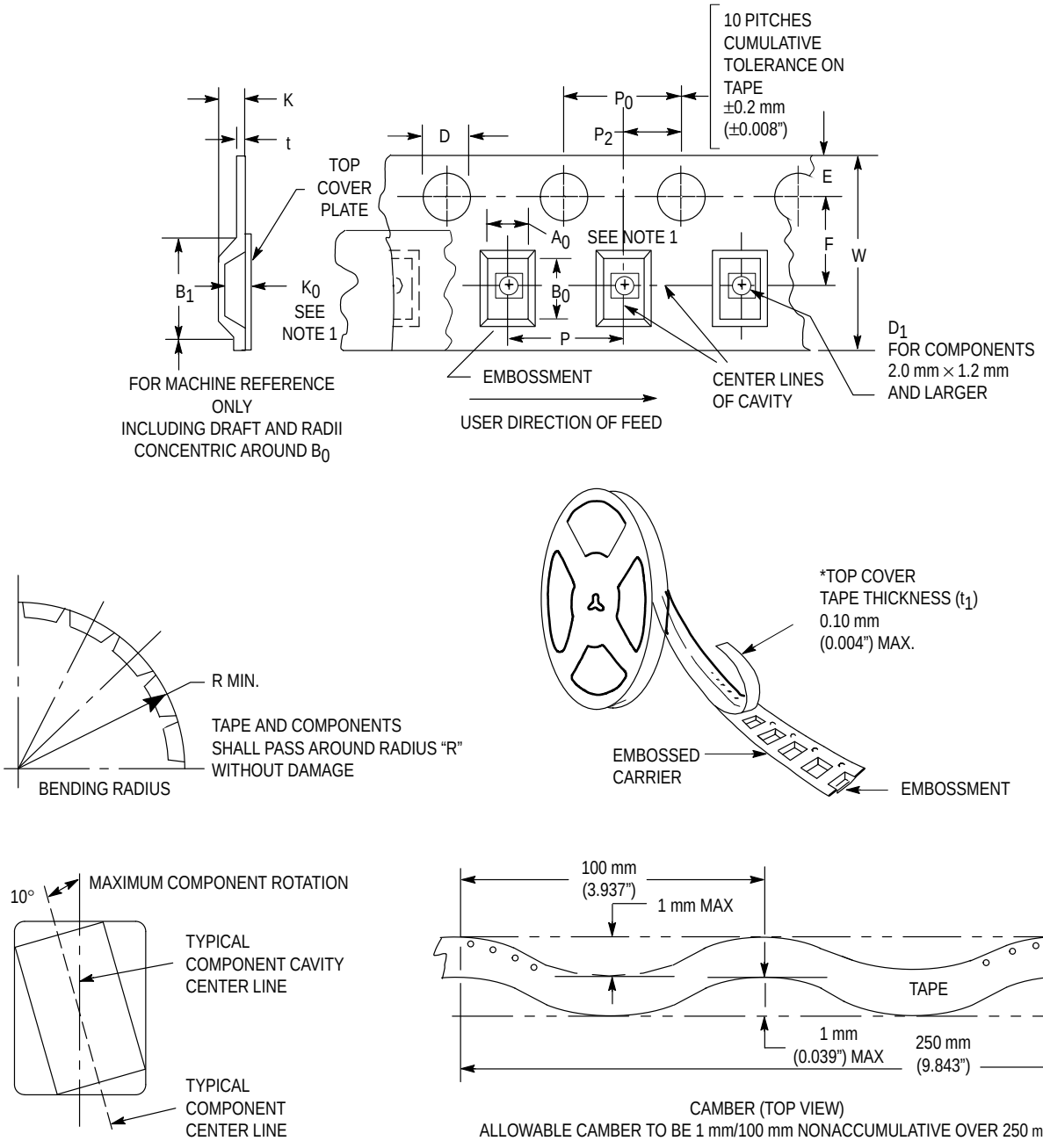


Figure 5. Carrier Tape Specifications

EMBOSSED CARRIER DIMENSIONS (See Notes 1 and 2)

Tape Size	B_1 Max	D	D_1	E	F	K	P	P_0	P_2	R	T	W
8 mm	4.55 mm (0.179")	1.5 +0.1/ –0.0 mm (0.059 +0.004/ –0.0")	1.0 mm Min (0.039")	1.75 ±0.1 mm (0.069 ±0.004")	3.5 ±0.5 mm (1.38 ±0.002")	2.4 mm (0.094")	4.0 ±0.10 mm (0.157 ±0.004")	4.0 ±0.1 mm (0.156 ±0.004")	2.0 ±0.1 mm (0.079 ±0.002")	25 mm (0.98")	0.3 ±0.05 mm (0.01 +0.0038/ –0.0002")	8.0 ±0.3 mm (0.315 ±0.012")

1. Metric Dimensions Govern–English are in parentheses for reference only.
2. A_0, B_0, and K_0 are determined by compnent size. The clearance between the components and the cavity must be within 0.05 mm min to 0.50 mm max. The component cannot rotate more than 10° within the determined cavity

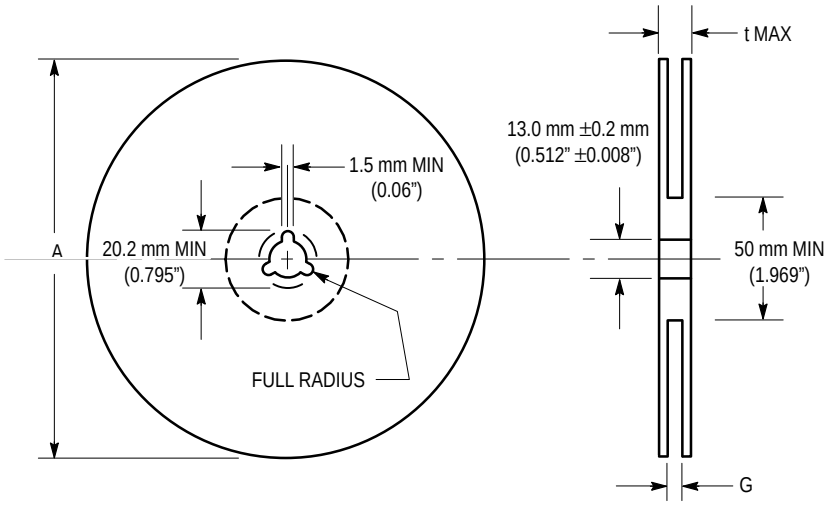


Figure 6. Reel Dimensions

REEL DIMIENSIONS

Tape Size	A Max	G	t Max
8 mm	330 mm (14.1")	8.400 mm, +1.5 mm, –0.0 (0.33", +0.059", –0.00)	14.4 mm (0.56")

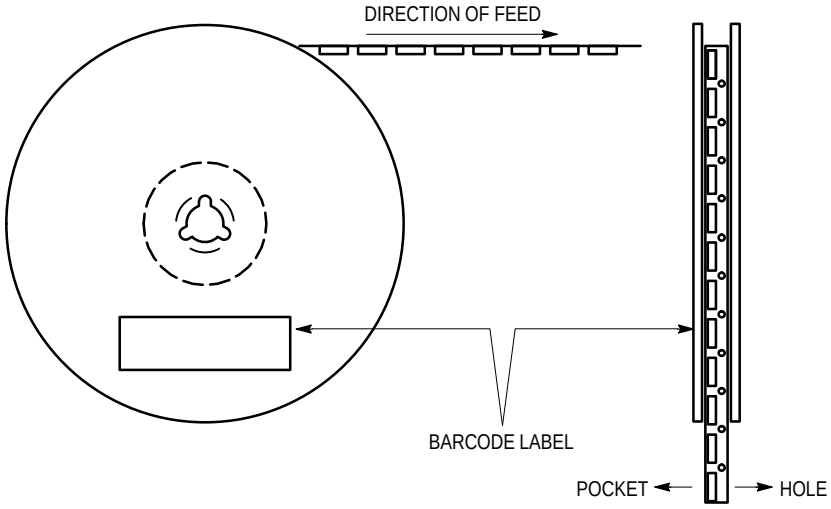


Figure 7. Reel Winding Direction

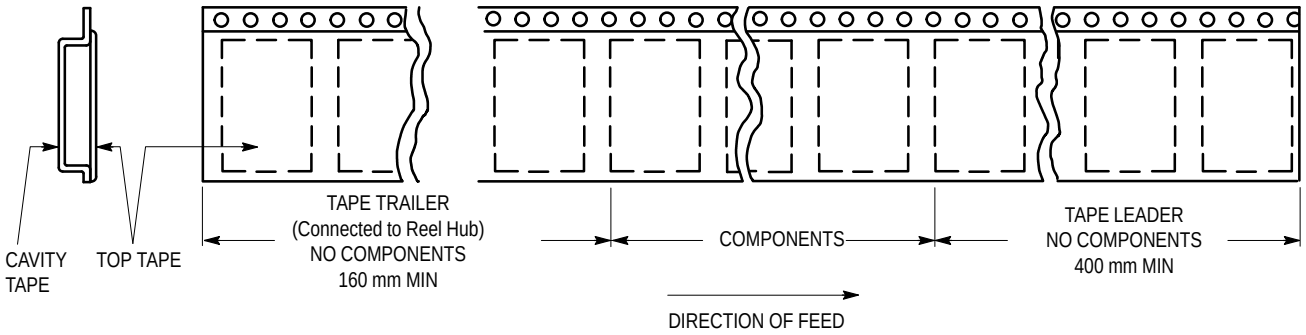


Figure 8. Tape Ends for Finished Goods

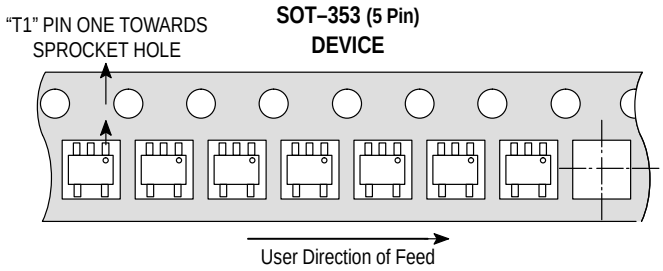


Figure 9. Reel Configuration

Mfax is a trademark of Motorola, Inc.

How to reach us:
USA / EUROPE / Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 1–303–675–2140 or 1–800–441–2447

Customer Focus Center: 1–800–521–6274

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1–602–244–6609
Motorola Fax Back System – US & Canada ONLY 1–800–774–1848
– http://sps.motorola.com/mfax/

HOME PAGE: http://motorola.com/sps/

JAPAN: Nippon Motorola Ltd.; SPD, Strategic Planning Office, 141,
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan. 81–3–5487–8488

ASIA / PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852–26629298