MC74VHC1GT86

2-Input Exclusive OR Gate / CMOS Logic Level Shifter
with LSTTL–Compatible Inputs

The MC74VHC1GT86 is an advanced high speed CMOS 2–input Exclusive OR gate 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 MC74VHC1GT86 input structure provides protection when voltages up to 7V are applied, regardless of the supply voltage. This allows the MC74VHC1GT86 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.

- High Speed: t_{PD} = 4.8ns (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

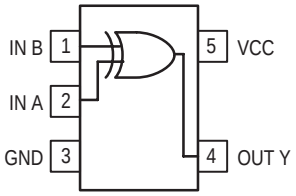
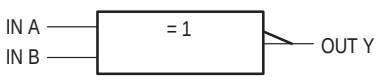
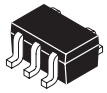


Figure 1. 5–Lead SOT–353 Pinout (Top View)

LOGIC SYMBOL

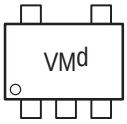


ON Semiconductor
Formerly a Division of Motorola
http://onsemi.com



SC–88A / SOT–353
DF SUFFIX
CASE 419A

MARKING DIAGRAM



Pin 1
d = Date Code

PIN ASSIGNMENT	
1	IN B
2	IN A
3	GND
4	OUT Y
5	VCC

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

FUNCTION TABLE

Inputs		Output
A	**B**	**Y**
L	L	L
L	H	H
H	L	H
H	H	L

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: –3 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_{CC} = 0 High or Low State	V_{OUT}	0.0 0.0	5.5 V_{CC}	V
Operating Temperature Range		T_A	–55	+85	°C
Input Rise and Fall Time	V_{CC} = 3.3V ± 0.3V V_{CC} = 5.0V ± 0.5V	t_r , t_f	0 0	100 20	ns/V

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_{IH}	Minimum High–Level Input Voltage		3.0 4.5 5.5	1.2 2.0 2.0			1.2 2.0 2.0		1.2 2.0 2.0		V
V_{IL}	Maximum Low–Level Input Voltage		3.0 4.5 5.5			0.53 0.8 0.8		0.53 0.8 0.8		0.53 0.8 0.8	V
V_{OH}	Minimum High–Level Output Voltage $V_{IN} = V_{IH}$ or V_{IL}	$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -50\mu A$	3.0 4.5	2.9 4.4	3.0 4.5		2.9 4.4		2.9 4.4		V
		$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -4mA$ $I_{OH} = -8mA$	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		V
V_{OL}	Maximum Low–Level Output Voltage $V_{IN} = V_{IH}$ or V_{IL}	$V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 50\mu A$	3.0 4.5		0.0 0.0	0.1 0.1		0.1 0.1		0.1 0.1	V
		$V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 4mA$ $I_{OL} = 8mA$	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} = 5.5V 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, Input A or B to Y	$V_{CC} = 3.0 \pm 0.3V$	C_L = 15 pF C_L = 50 pF		5.0 6.2	11.0 14.5		13.0 16.5		15.5 19.5	ns
		$V_{CC} = 5.0 \pm 0.5V$	C_L = 15 pF C_L = 50 pF		3.1 4.2	6.8 8.8		8.0 10.0		10.0 12.0	
C_{IN}	Maximum Input Capacitance				5.5	10		10		10	pF

		Typical @ 25°C, V_{CC} = 5.0V	
C_{PD}	Power Dissipation Capacitance (Note 1.)	11	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; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

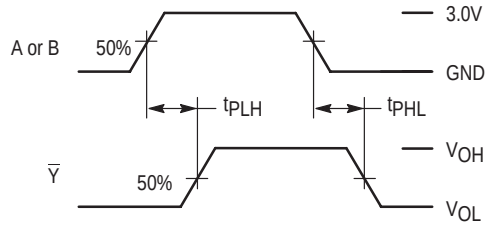
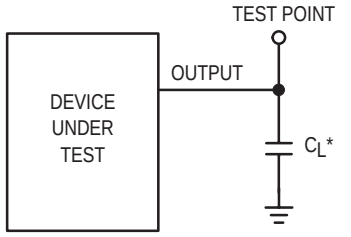


Figure 2. Switching Waveforms



*Includes all probe and jig capacitance

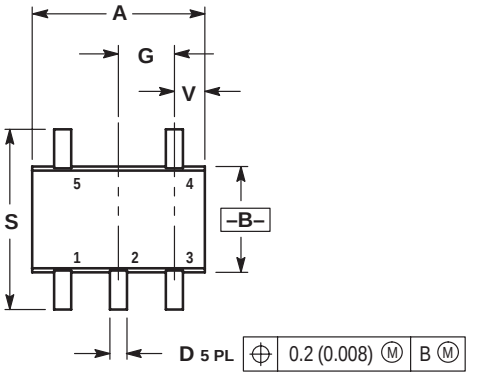
Figure 3. Test Circuit

DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature							Package Type	Tape and Reel Size
	Circuit Indicator	Temp Range Identifier	Tech–nology	Input Type	Device Function	Package Suffix	Tape & Reel Suffix		
MC74VHC1GT86DFT1	MC	74	VHC1G	T	86	DF	T1	SC–88A/ SOT–353	7–Inch/3000 Unit

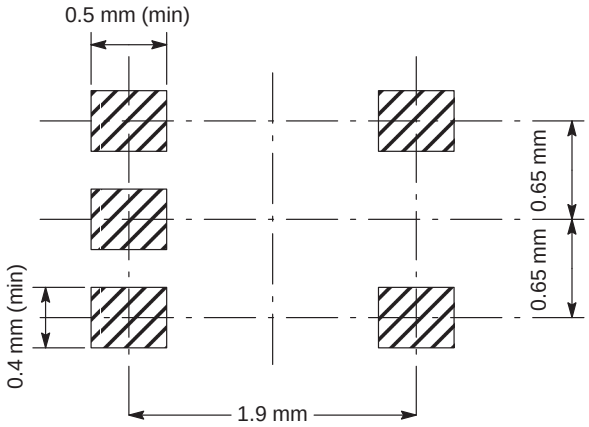
PACKAGE DIMENSIONS

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



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

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
V	0.012	0.016	0.30	0.40



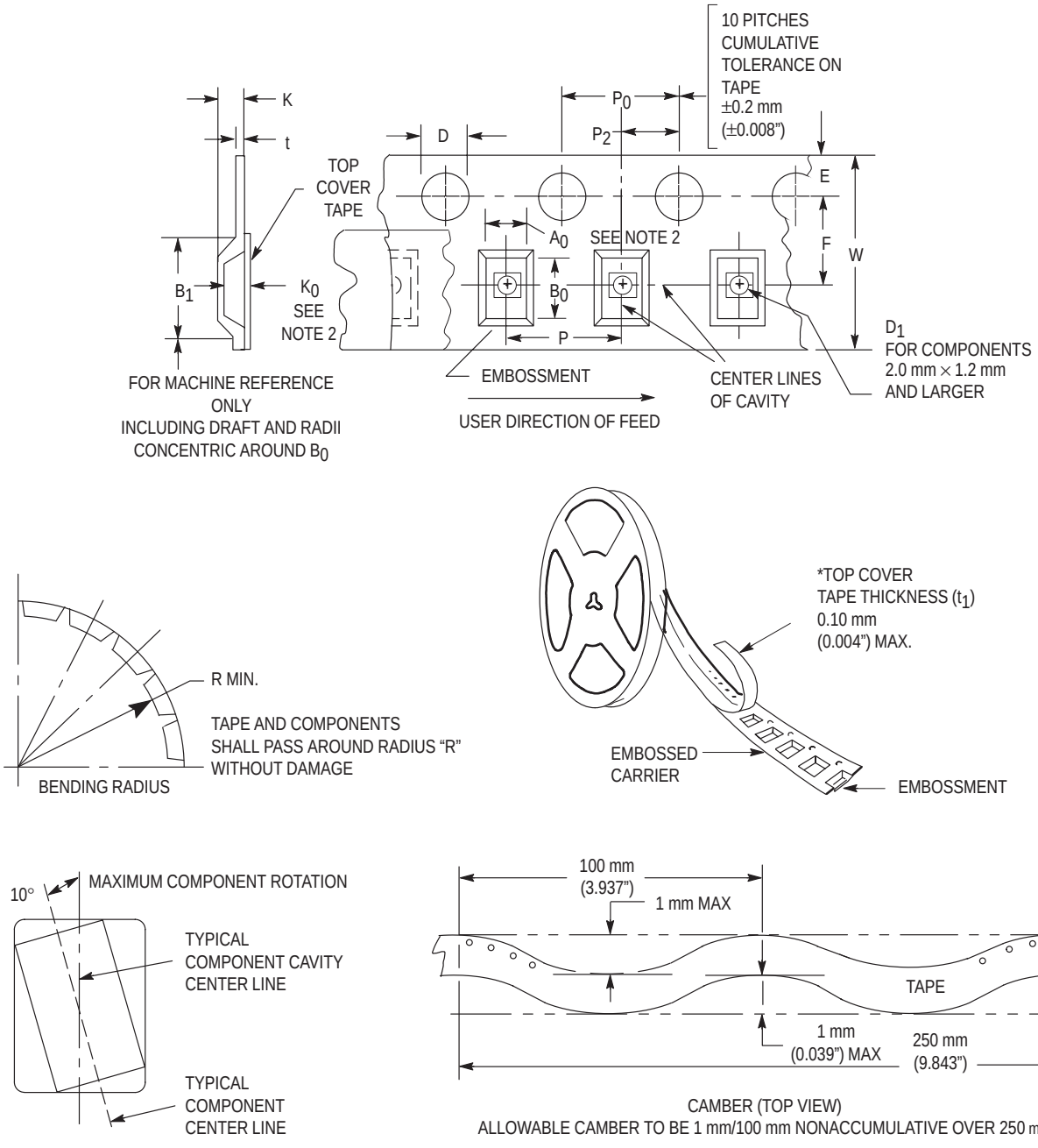


Figure 4. Carrier Tape Specifications

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	4.35 mm (0.171")	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 component 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

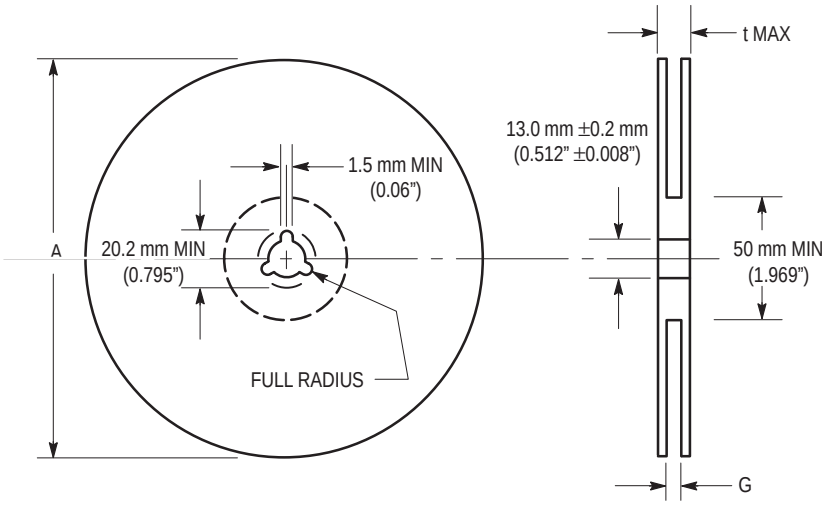


Figure 5. Reel Dimensions

REEL DIMENSIONS

Tape Size	A Max	G	t Max
8 mm	330 mm (13")	8.400 mm, +1.5 mm, –0.0 (0.33", +0.059", –0.00)	14.4 mm (0.56")

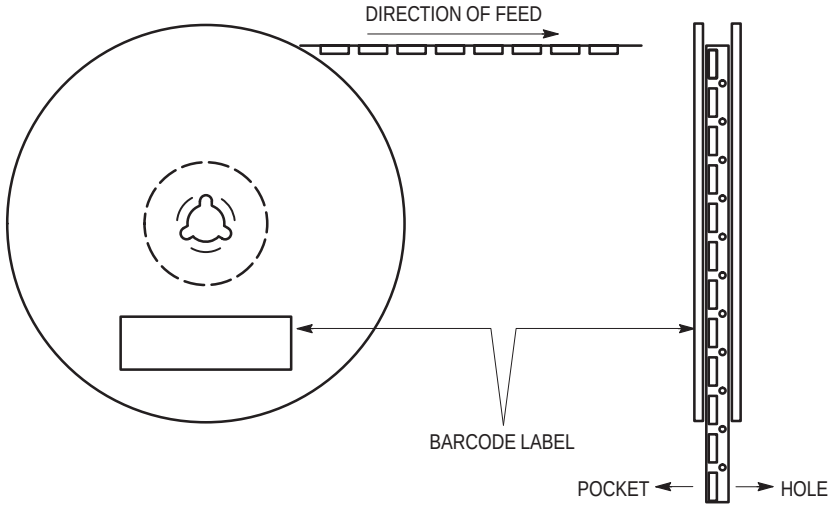


Figure 6. Reel Winding Direction

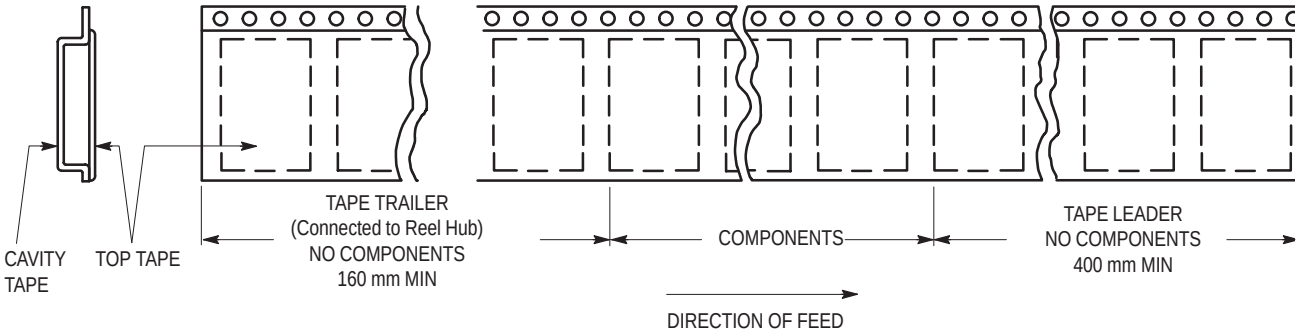


Figure 7. Tape Ends for Finished Goods

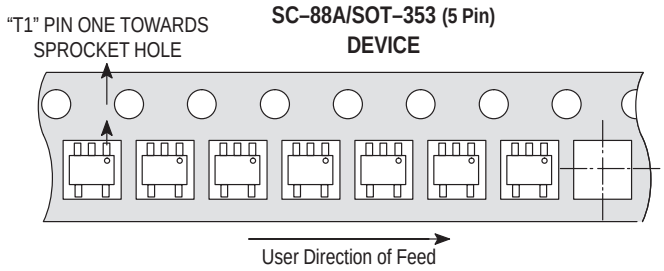


Figure 8. Reel Configuration

PUBLICATION ORDERING INFORMATION

USA/EUROPE 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: ONlit@hibbertco.com

Fax Response Line*: 303–675–2167
800–344–3810 Toll Free USA/Canada
*To receive a Fax of our publications

N. America Technical Support: 800–282–9855 Toll Free USA/Canada

ASIA/PACIFIC: LDC for ON Semiconductor – Asia Support
Phone: 303–675–2121 (Tue–Fri 9:00am to 1:00pm, Hong Kong Time)
Email: ONlit–asia@hibbertco.com

JAPAN: ON Semiconductor, Japan Customer Focus Center
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan 141–8549
Phone: 81–3–5487–8345
Email: r14153@onsemi.com

ON Semiconductor Website: http://onsemi.com

For additional information, please contact your local Sales Representative.