MC74VHC1G03

Single 2-Input NOR Gate with Open Drain Output

The MC74VHC1G03 is an advanced high speed CMOS 2−input NOR gate with an open drain output fabricated with silicon gate CMOS technology.

The internal circuit is composed of multiple stages, including an open drain output which provides the capability to set output switching level. This allows the MC74VHC1G03 to be used to interface 5 V circuits to circuits of any voltage between V_{CC} and 7 V using an external resistor and power supply.

The MC74VHC1G03 input structure provides protection when voltages up to 7 V are applied, regardless of the supply voltage.

Features

- High Speed: t_{PD} = 3.6 ns (Typ) at V_{CC} = 5 V
- Low Internal Power Dissipation: I_{CC} = 1 μA (Max) at T_A = 25°C
- Power Down Protection Provided on Inputs
- Pin and Function Compatible with Other Standard Logic Families
- Chip Complexity: FETs = 62
- Pb−Free Packages are Available

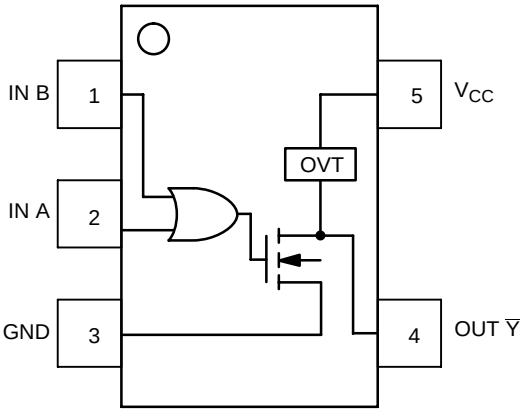


Figure 1. Pinout (Top View)

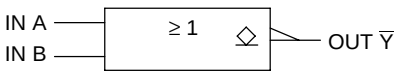


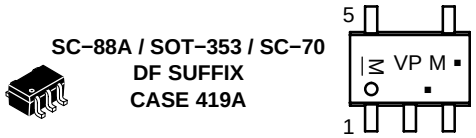
Figure 2. Logic Symbol

ON Semiconductor®

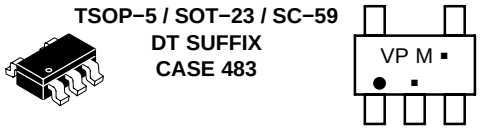
http://onsemi.com

MARKING DIAGRAMS

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



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



VP = 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	IN B
2	IN A
3	GND
4	OUT $\overline{Y}$
5	V_{CC}

FUNCTION TABLE

Inputs		Output
A	**B**	**$\overline{Y}$**
L	L	Z
L	H	L
H	L	L
H	H	L

ORDERING INFORMATION

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

MAXIMUM RATINGS

Symbol	Characteristics		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	V_{CC} = 0 High or Low State	−0.5 to 7.0 −0.5 to V_{CC} + 0.5	V
I_{IK}	Input Diode Current		−20	mA
I_{OK}	Output Diode Current	V_{OUT} < GND; V_{OUT} > V_{CC}	+20	mA
I_{OUT}	DC Output Current, per Pin		+25	mA
I_{CC}	DC Supply Current, V_{CC} and GND		+50	mA
P_D	Power Dissipation in Still Air at 85°C	SC70−5/SC−88A TSOP−5	150 200	mW
θ_{JA}	Thermal Resistance	SC70−5/SC−88A (Note 1) TSOP−5	350 230	°C/W
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature Under Bias		+150	°C
T_{STG}	Storage Temperature Range		−65 to +150	°C
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 Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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	Characteristics		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	7.0	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	0 0	100 20	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

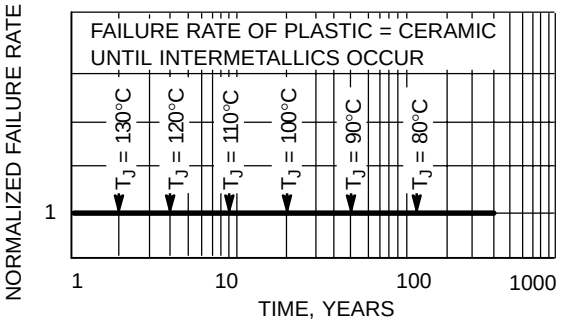


Figure 3. Failure Rate vs. Time Junction Temperature

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	$-55 \le T_A \le 125°C$ Min	$-55 \le T_A \le 125°C$ Max	Unit
V_{IH}	Minimum High−Level Input Voltage		2.0 3.0 4.5 5.5	1.5 2.1 3.15 3.85			1.5 2.1 3.15 3.85		1.5 2.1 3.15 3.85		V
V_{IL}	Maximum Low−Level Input Voltage		2.0 3.0 4.5 5.5			0.5 0.9 1.35 1.65		0.5 0.9 1.35 1.65		0.5 0.9 1.35 1.65	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 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
		$V_{IN} = V_{IH}$ or V_{IL} 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_{LKG}	Z−State Output Leakage Current	$V_{IN} = V_{IL}$ $V_{OUT} = V_{CC}$ or GND	5.5			±5		±10		±10	μA
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
I_{OFF}	Power Off−Output Leakage Current	V_{OUT} = 5.5 V V_{IN} = 5.5 V	0			0.25		2.5		5	μA

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

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	$-55 \le T_A \le 125°C$ Min	$-55 \le T_A \le 125°C$ Max	Unit
t_{PZL}	Maximum Output Enable Time, Input A or B to Y	V_{CC} = 3.3 ± 0.3 V C_L = 15 pF $R_L = R_I$ = 500 Ω C_L = 50 pF		5.6 8.1	7.9 11.4		9.5 13.0		11.0 15.5	ns
		V_{CC} = 5.0 ± 0.5 V C_L = 15 pF $R_L = R_I$ = 500 Ω C_L = 50 pF		3.6 5.1	5.5 7.5		6.5 8.5		8.0 10.0	
t_{PLZ}	Maximum Output Disable Time	V_{CC} = 3.3 ± 0.3 V C_L = 50 pF $R_L = R_I$ = 500 Ω		8.1	11.4		13.0		15.5	ns
		V_{CC} = 5.0 ± 0.5 V C_L = 50 pF $R_L = R_I$ = 500 Ω		5.1	7.5		8.5		10.0	
C_{IN}	Maximum Input Capacitance			4	10		10		10	pF

		Typical @ 25°C, V_{CC} = 5.0V	
C_{PD}	Power Dissipation Capacitance (Note 6)	18	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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no−load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

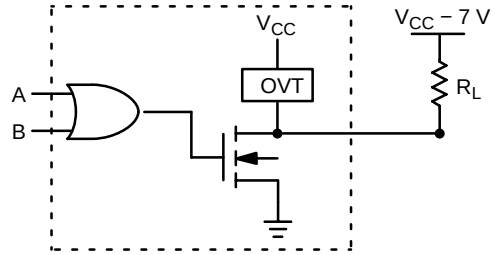


Figure 4. Output Voltage Mismatch Application

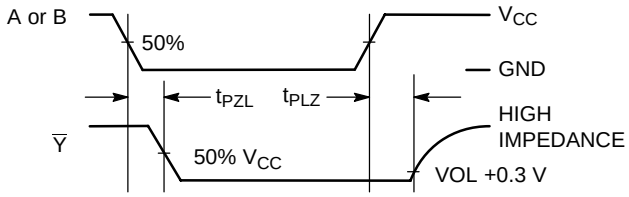
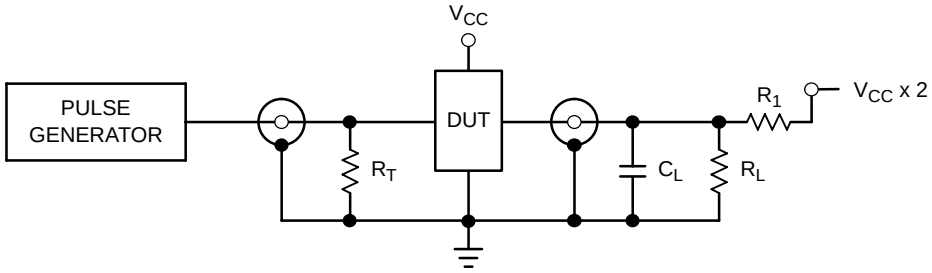


Figure 5. Switching Waveforms



C_L = 50 pF equivalent (Includes jig and probe capacitance)
$R_L = R_1$ = 500 Ω or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50 Ω)

Figure 6. Test Circuit

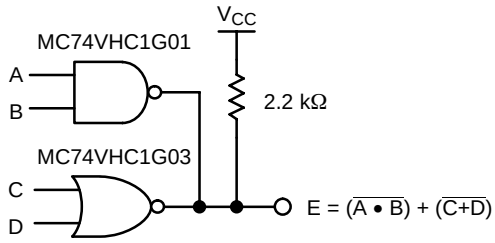


Figure 7. Complex Boolean Functions

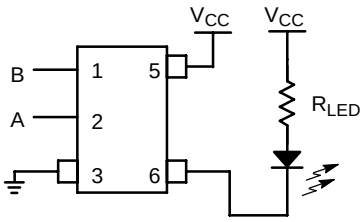


Figure 8. LED Driver

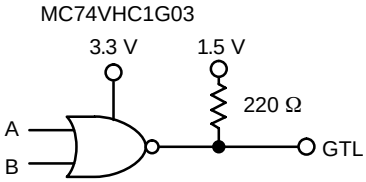


Figure 9. GTL Driver

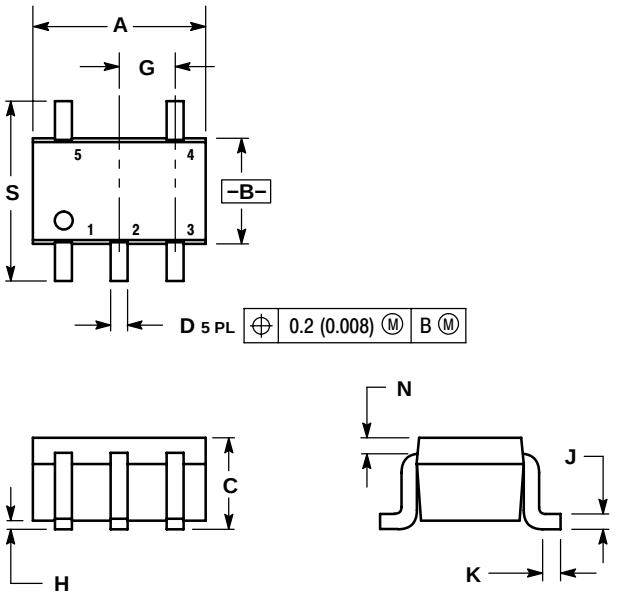
ORDERING INFORMATION

Device	Package	Shipping†
MC74VHC1G03DFT1	SC70−5 / SC−88A / SOT−353	3000/Tape & Reel
MC74VHC1G03DFT1G	SC70−5 / SC−88A / SOT−353 (Pb−Free)	
MC74VHC1G03DFT2	SC70−5 / SC−88A / SOT−353	
MC74VHC1G03DFT2G	SC70−5 / SC−88A / SOT−353 (Pb−Free)	
MC74VHC1G03DTT1	SOT23−5 / TSSOP−5 / SC59−5	
MC74VHC1G03DTT1G	SOT23−5 / TSSOP−5 / SC59−5 (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.

PACKAGE DIMENSIONS

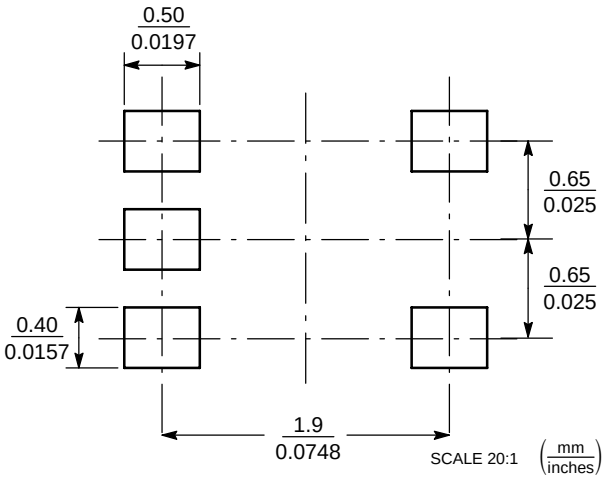
SC−88A, SOT−353, SC−70
CASE 419A−02
ISSUE J



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.

	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

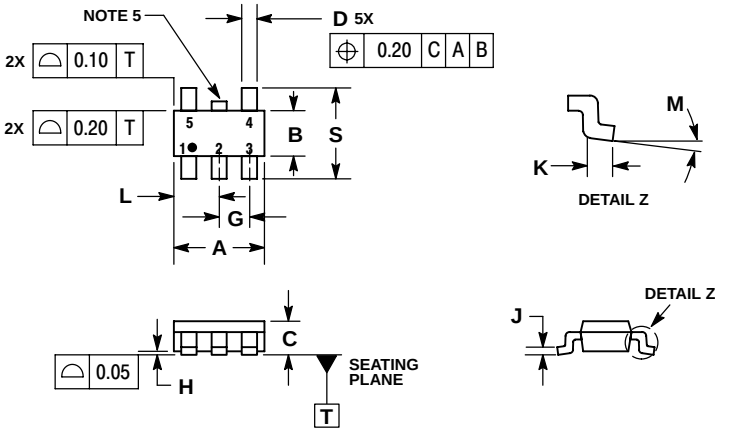
SOLDERING FOOTPRINT*



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

PACKAGE DIMENSIONS

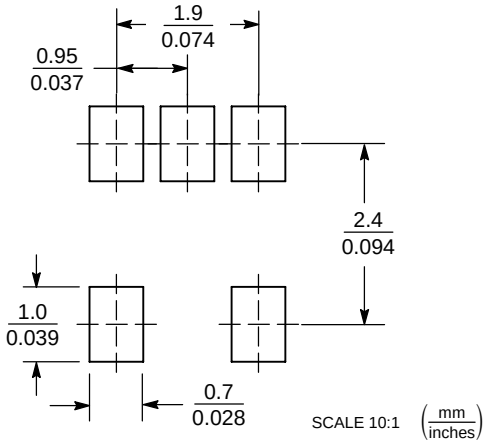
TSOP−5
CASE 483−02
ISSUE F



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.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

	MILLIMETERS	
DIM	MIN	MAX
A	3.00 BSC	
B	1.50 BSC	
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
L	1.25	1.55
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.

PUBLICATION ORDERING INFORMATION

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Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

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MC74VHC1G03/D

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