2-Input NAND Gate / CMOS Logic Level Shifter with LSTTL-Compatible Inputs

The MC74VHC1GT00 is a single gate 2–input NAND 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 MC74VHC1GT00 input structure provides protection when voltages up to 7V are applied, regardless of the supply voltage. This allows the MC74VHC1GT00 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: $t_{PD} = 3.1 \text{ ns}$ (Typ) at $V_{CC} = 5 \text{ V}$
- Low Power Dissipation: $I_{CC} = 2\mu A$ (Max) at $T_A = 25^{\circ}C$
- 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

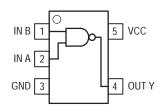


Figure 1. 5-Lead SOT-353 Pinout (Top View)

LOGIC SYMBOL



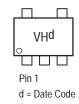


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SC-88A / SOT-353 DF SUFFIX CASE 419A

MARKING DIAGRAM



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

Inp	uts	Output
А	В	Y
L	L	Н
L	н	Н
н	L	Н
Н	Н	L

MAXIMUM RATINGS*

Characteristics	Symbol	Value	Unit
DC Supply Voltage	V _{CC}	-0.5 to +7.0	V
DC Input Voltage	VIN	-0.5 to +7.0	V
DC Output Voltage V _{CC} = 0 High or Low State	Vout	−0.5 to 7.0 −0.5 to V _{CC} + 0.5	V
Input Diode Current	Iк	-20	mA
Output Diode Current $(V_{OUT} < GND; V_{OUT} > V_{CC})$	IOK	+20	mA
DC Output Current, per Pin	IOUT	+25	mA
DC Supply Current, V_{CC} and GND	ICC	+50	mA
Power dissipation in still air, SC–88A †	PD	200	mW
Lead temperature, 1 mm from case for 10 s	ΤL	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	VCC	4.5	5.5	V
DC Input Voltage	VIN	0.0	5.5	V
DC Output Voltage V _{CC} = 0 High or Low State	Vout	0.0 0.0	5.5 V _{CC}	V
Operating Temperature Range	Т _А	-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

			Vcc	ר	A = 25°	С	T _A ≤	85°C	TA ≤ ²	125°C	
Symbol	Parameter	Test Conditions	(V)	Min	Тур	Мах	Min	Мах	Min	Мах	Unit
VIH	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
VIL	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
VOH	Minimum High–Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OH} = –50µA	3.0 4.5	2.9 4.4	3.0 4.5		2.9 4.4		2.9 4.4		V
	VIN = VIH or VIL	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -4mA$ $I_{OH} = -8mA$	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		V
VOL	Maximum Low–Level Output Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 50 \mu A$	3.0 4.5		0.0 0.0	0.1 0.1		0.1 0.1		0.1 0.1	V
	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 4mA$ $I_{OL} = 8mA$	3.0 4.5			0.36 0.36		0.44 0.44		0.52 0.52	V
IIN	Maximum Input Leakage Current	$V_{IN} = 5.5V \text{ or GND}$	0 to 5.5			±0.1		±1.0		±1.0	μA
ICC	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5			2.0		20		40	μA
ICCT	Quiescent Supply Current	Input: V _{IN} = 3.4V	5.5			1.35		1.50		1.65	mA
IOPD	Output Leakage Current	V _{OUT} = 5.5V	0.0			0.5		5.0		10	μA

DC ELECTRICAL CHARACTERISTICS

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

				I	A = 25°C	0	T _A ≤ 85°C			125°C		
Symbol	Parameter	Test Condi	tions	Min	Тур	Max	Min	Max	Min	Max	Unit	
^t PLH, ^t PHL	Maximum Propogation Delay,	$V_{CC} = 3.0 \pm 0.3 V$	C _L = 15 pF C _L = 50 pF		4.1 5.5	10.0 13.5		11.0 15.0		13.0 17.5	ns	
	Input A or B to Y	$V_{CC} = 5.0 \pm 0.5 V$	C _L = 15 pF C _L = 50 pF		3.1 3.6	6.9 7.9		8.0 9.0		9.5 10.5		
C _{IN}	Maximum Input Capacitance				5.5	10		10		10	pF	
Typical @ 25°C, V _{CC} = 5.0V									v			
C _{PD}	Power Dissipation Capa	n 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} $\bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

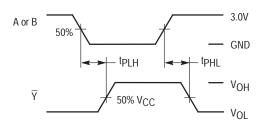
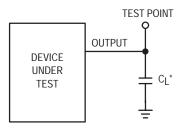


Figure 2. Switching Waveforms



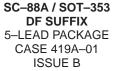
*Includes all probe and jig capacitance

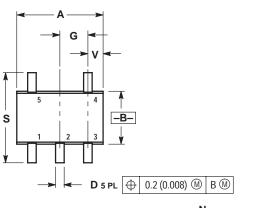
Figure 3. Test Circuit

DEVICE ORDERING INFORMATION

			Device N	Iomencl	ature				
Device Order Number	Circuit Indicator	Temp Range Identifier	Tech– nology	Input Type	Device Function	Package Suffix	Tape & Reel Suffix	Package Type	Tape and Reel Size
MC74VHC1GT00DFT1	MC	74	VHC1G	т	00	DF	T1	SC88A/ SOT353	7–Inch/3000 Unit

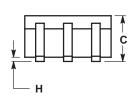
PACKAGE DIMENSIONS

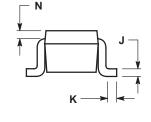


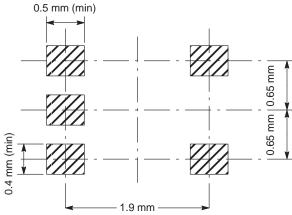


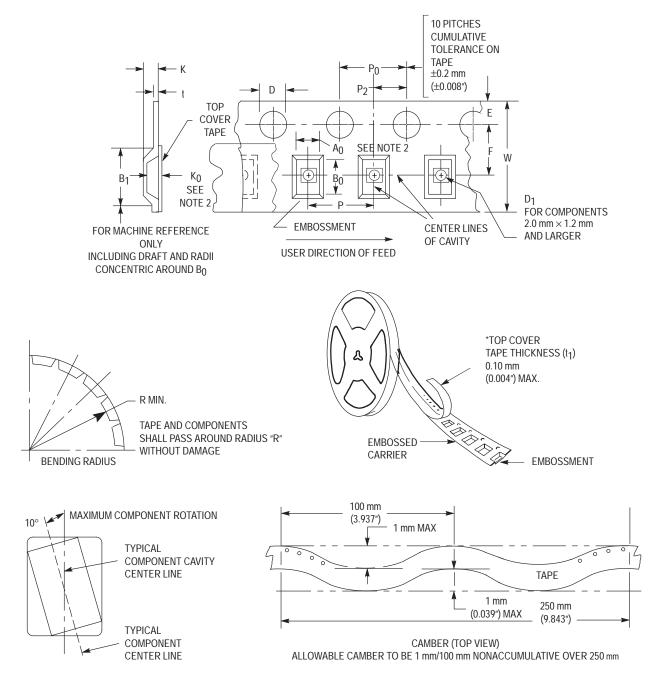
NOTES: 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. 2. CONTROLLING DIMENSION: MM.

	INC	HES	MILLIM	IETERS
DIM	MIN	MAX	MIN	MAX
Α	0.071	0.087	1.80	2.20
В	0.045	0.053	1.15	1.35
С	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026	BSC	0.65	BSC
Н		0.004		0.10
J	0.004	0.010	0.10	0.25
К	0.004	0.012	0.10	0.30
Ν	0.008	REF	0.20	REF
S	0.079	0.087	2.00	2.20
V	0.012	0.016	0.30	0.40











Tape Size	B ₁ Max	D	D ₁	E	F	к	Р	P ₀	P ₂	R	т	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")

FMBOSSED	CARRIER	DIMENSIONS	(See	Notes	1	and 2)
LINDOOOLD	OANIEN	DIMENSION	1000	110100		

Metric Dimensions Govern–English are in parentheses for reference only.
A₀, B₀, and K₀ 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

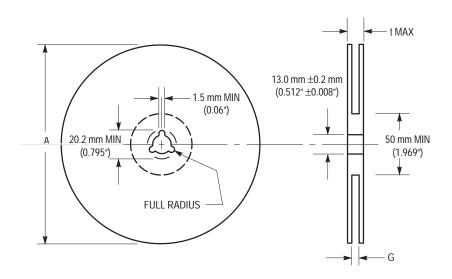
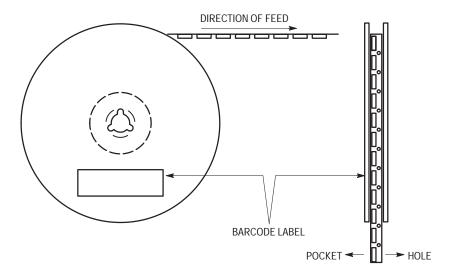


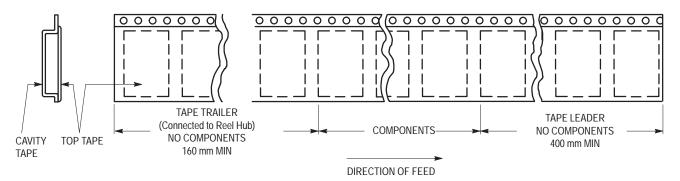
Figure 5. Reel Dimensions

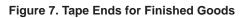
REEL DIMENSIONS

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









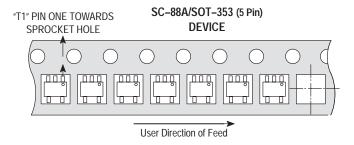


Figure 8. Reel Configuration

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