

# MC74VHC1GT00

## 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:  $t_{PD} = 3.1ns$  (Typ) at  $V_{CC} = 5V$
- 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

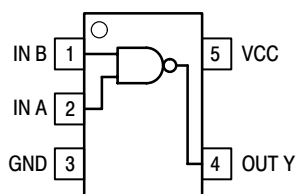


Figure 1. 5-Lead SOT-353 Pinout (Top View)

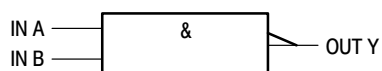


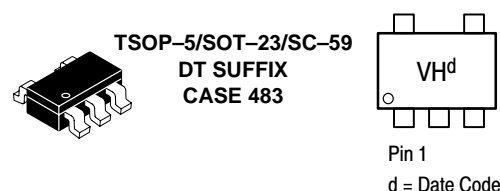
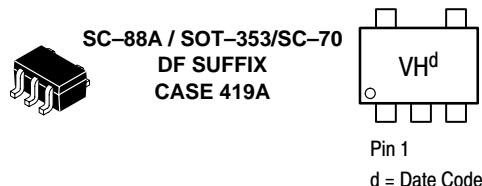
Figure 2. Logic Symbol



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### MARKING DIAGRAMS



### PIN ASSIGNMENT

	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	H
L	H	H
H	L	H
H	H	L

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## 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	$V_{CC}$	3.0	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	+125	°C
Input Rise and Fall Time $V_{CC} = 3.3V \pm 0.3V$ $V_{CC} = 5.0V \pm 0.5V$	$t_r, t_f$	0 0	100 20	ns/V

The  $\theta_{JA}$  of the package is equal to 1/Derating. Higher junction temperatures may affect the expected lifetime of the device per the table and figure below.

## 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

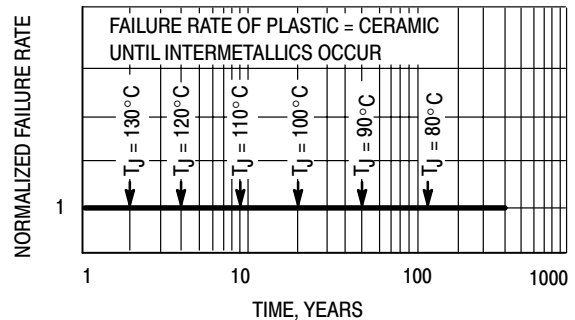


Figure 3. Failure Rate vs. Time Junction Temperature

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## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> ≤ 85°C		T <sub>A</sub> ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V <sub>IH</sub>	Minimum High-Level Input Voltage		3.0 4.5 5.5	1.4 2.0 2.0			1.4 2.0 2.0		1.4 2.0 2.0		V
V <sub>IL</sub>	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 <sub>OH</sub>	Minimum High-Level Output Voltage V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -50μA	3.0 4.5	2.9 4.4	3.0 4.5		2.9 4.4		2.9 4.4		V
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -4mA	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		V
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -8mA	3.0 4.5								V
V <sub>OL</sub>	Maximum Low-Level Output Voltage V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 50μA	3.0 4.5		0.0 0.0	0.1 0.1		0.1 0.1		0.1 0.1	V
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 4mA	3.0 4.5			0.36 0.36		0.44 0.44		0.52 0.52	V
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 8mA	3.0 4.5								V
I <sub>IN</sub>	Maximum Input Leakage Current	V <sub>IN</sub> = 5.5V or GND	0 to 5.5			±0.1		±1.0		±1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			2.0		20		40	μA
I <sub>CCT</sub>	Quiescent Supply Current	Input: V <sub>IN</sub> = 3.4V	5.5			1.35		1.50		1.65	mA
I <sub>OPD</sub>	Output Leakage Current	V <sub>OUT</sub> = 5.5V	0.0			0.5		5.0		10	μA

## AC ELECTRICAL CHARACTERISTICS (C<sub>load</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 3.0ns)

Symbol	Parameter	Test Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> ≤ 85°C		T <sub>A</sub> ≤ 125°C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input A or B to Y	V <sub>CC</sub> = 3.0 ± 0.3V    C <sub>L</sub> = 15 pF C <sub>L</sub> = 50 pF		4.1 5.5	10.0 13.5		11.0 15.0		13.0 17.5	ns
		V <sub>CC</sub> = 5.0 ± 0.5V    C <sub>L</sub> = 15 pF C <sub>L</sub> = 50 pF		3.1 3.6	6.9 7.9		8.0 9.0		9.5 10.5	
C <sub>IN</sub>	Maximum Input Capacitance			5.5	10		10		10	pF

C <sub>PD</sub>	Power Dissipation Capacitance (Note 1.)	Typical @ 25°C, V <sub>CC</sub> = 5.0V	pF
		11	

1. C<sub>PD</sub> 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<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

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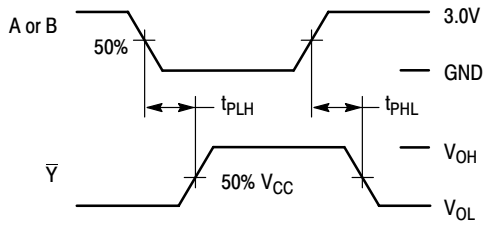
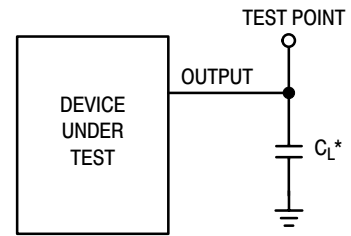


Figure 4. Switching Waveforms



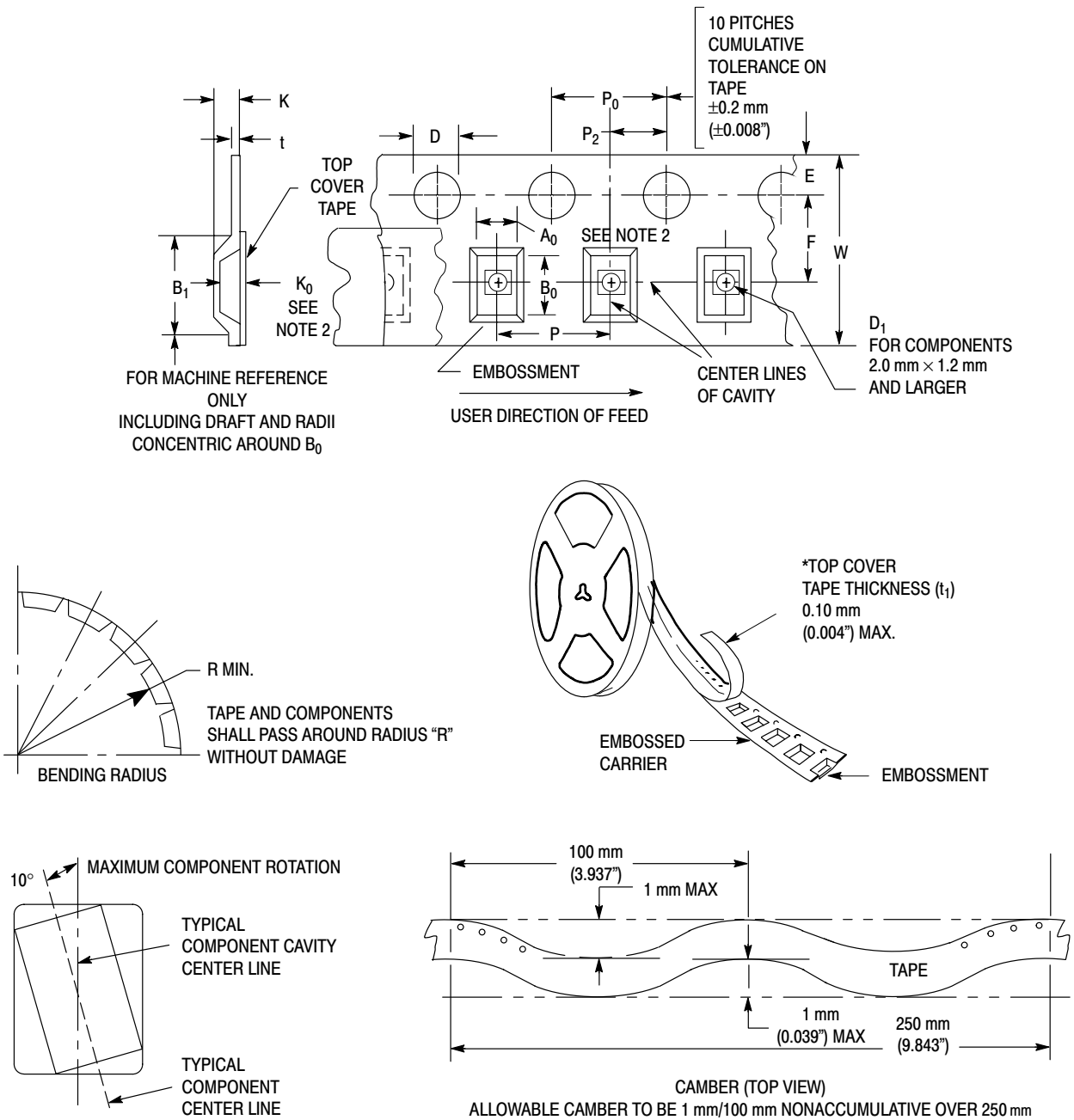
\*Includes all probe and jig capacitance

Figure 5. Test Circuit

## DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature						Package Type (Name/SOT#/ Common Name)	Tape and Reel Size
	Circuit Indicator	Temp Range Identifier	Technology	Device Function	Package Suffix	Tape & Reel Suffix		
MC74VHC1GT00DFT2	MC	74	VHC1G	T00	DF	T2	SC-88A / SOT-353 / SC-70	178 mm (7") 3000 Unit
MC74VHC1GT00DFT4	MC	74	VHC1G	T00	DF	T4	SC-88A / SOT-353 / SC-70	330 mm (13") 10000 Unit
MC74VHC1GT00DTT1	MC	74	VHC1G	T00	DT	T1	TSOPS / SOT-23 / SC-59	178 mm (7") 3000 Unit
MC74VHC1GT00DTT3	MC	74	VHC1G	T00	DT	T3	TSOPS / SOT-23 / SC-59	330 mm (13") 10000 Unit

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**Figure 6. 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 $\pm 0.1$ mm (0.069 $\pm 0.004$ ")	3.5 $\pm 0.5$ mm (1.38 $\pm 0.002$ ")	2.4 mm (0.094")	4.0 $\pm 0.10$ mm (0.157 $\pm 0.004$ ")	4.0 $\pm 0.1$ mm (0.156 $\pm 0.004$ ")	2.0 $\pm 0.1$ mm (0.079 $\pm 0.002$ ")	25 mm (0.98")	0.3 $\pm 0.05$ mm (0.01 +0.0038/-0.0002")	8.0 $\pm 0.3$ mm (0.315 $\pm 0.012$ ")

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

# MC74VHC1GT00

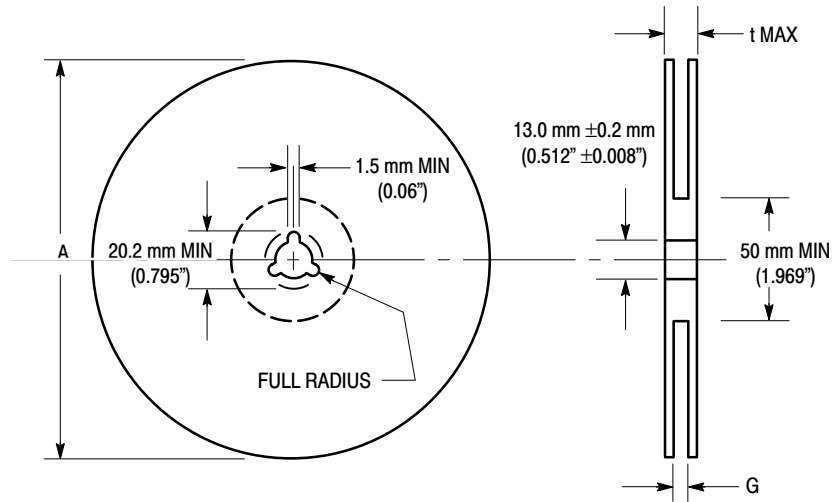


Figure 7. Reel Dimensions

## REEL DIMENSIONS

Tape Size	T&R Suffix	A Max	G	t Max
8 mm	T1, T2	178 mm (7")	8.4 mm, +1.5 mm, -0.0 (0.33" + 0.059", -0.00)	14.4 mm (0.56")
8 mm	T3, T4	330 mm (13")	8.4 mm, +1.5 mm, -0.0 (0.33" + 0.059", -0.00)	14.4 mm (0.56")

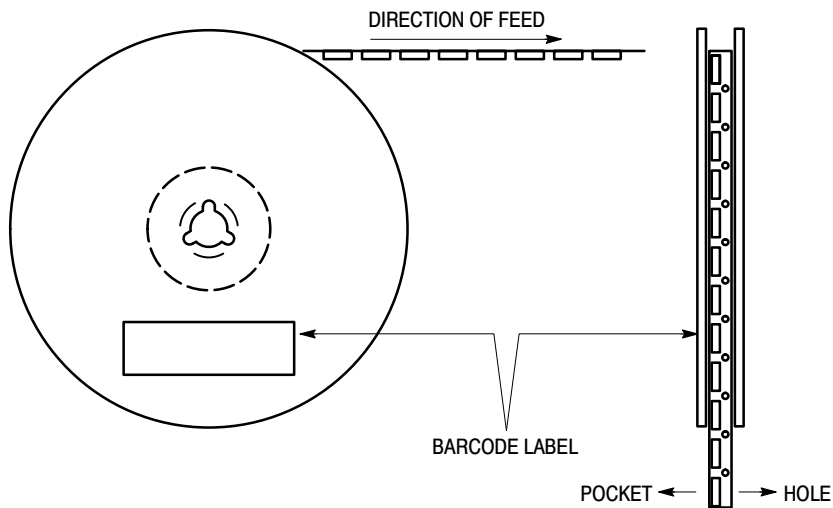
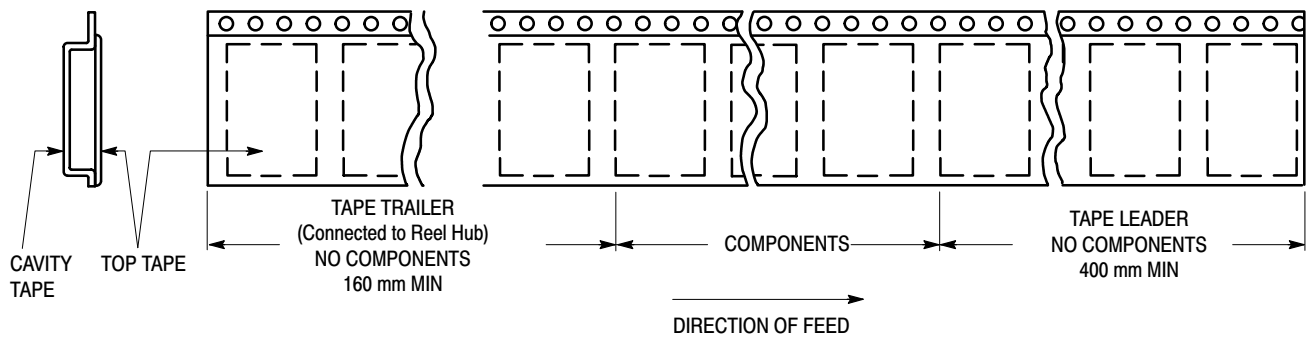
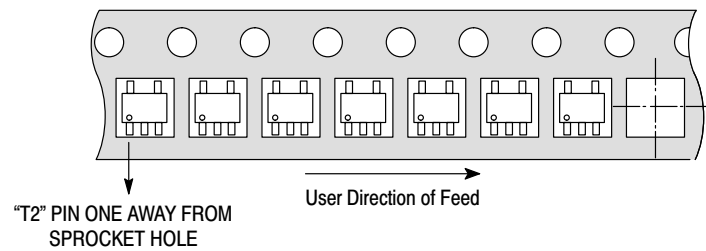


Figure 8. Reel Winding Direction

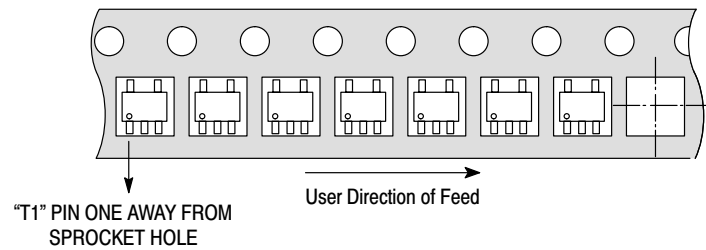
## MC74VHC1GT00



**Figure 9. Tape Ends for Finished Goods**



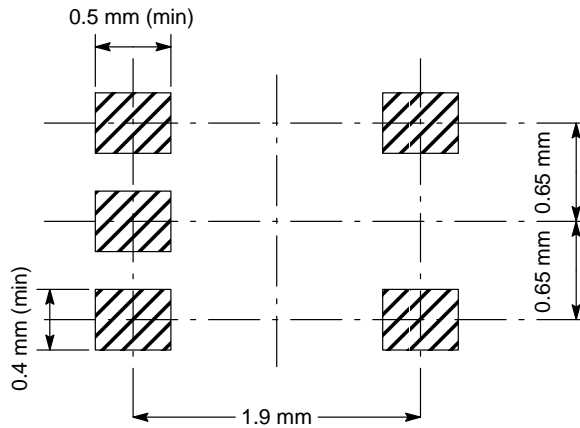
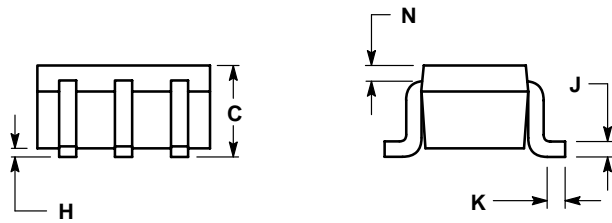
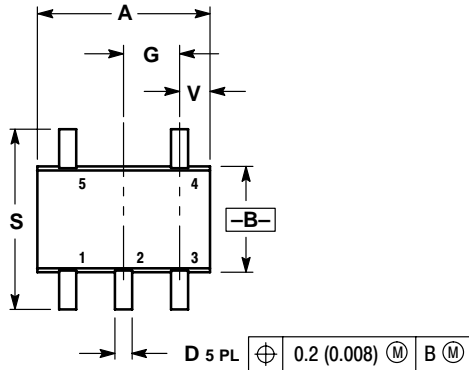
**Figure 10. DFT2 AND DFT4 (SC88A) Reel Configuration/Orientation**



**Figure 11. DTT1 and DTT3 (TSOP5) Reel Configuration/Orientation**

# MC74VHC1GT00

SC-88A / SOT-353 / SC-70  
 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



# MC74VHC1GT00

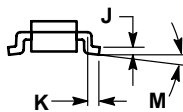
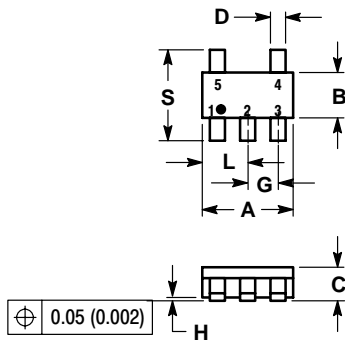
TSOP-5 / SOT-23 / SC-59

DT SUFFIX

5-LEAD PACKAGE

CASE 483-01

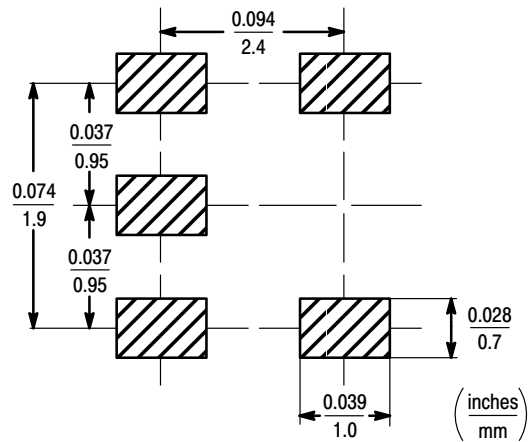
ISSUE A



## 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.

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	1.00	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



## **Notes**

## **Notes**

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