

# MC74VHC1G66

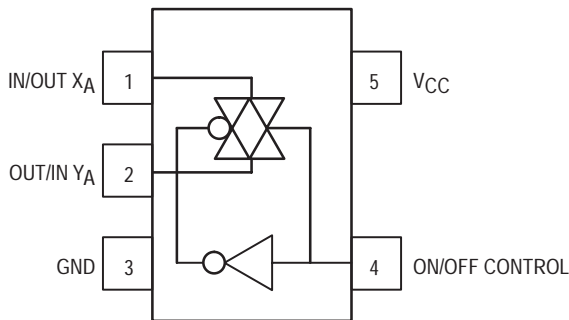
## Advance Information Analog Switch

The MC74VHC1G66 is an advanced high speed CMOS bilateral analog switch fabricated with silicon gate CMOS technology. It achieves high speed propagation delays and low ON resistances while maintaining CMOS low power dissipation. This bilateral switch controls analog and digital voltages that may vary across the full power-supply range (from  $V_{CC}$  to GND).

The MC74VHC1G66 is compatible in function to a single gate of the High Speed CMOS MC74VHC4066 and the metal-gate CMOS MC14066. The device has been designed so that the ON resistances ( $R_{ON}$ ) are much lower and more linear over input voltage than  $R_{ON}$  of the metal-gate CMOS or High Speed CMOS analog switches.

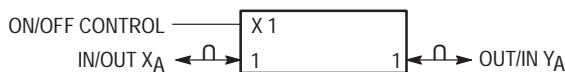
The ON/OFF control inputs are compatible with standard CMOS outputs; with pull-up resistors, it is compatible with LSTTL outputs.

- High Speed:  $t_{PD} = \mathbf{TBD}$  (Typ) at  $V_{CC} = 5\text{ V}$
- Low Power Dissipation:  $I_{CC} = 2\ \mu\text{A}$  (Max) at  $T_A = 25^\circ\text{C}$
- Diode Protection Provided on Inputs and Outputs
- Improved Linearity and Lower ON Resistance over Input Voltage than the MC14066 or the HC4066
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V; MM > 200 V, CDM > 1500 V
- Chip Complexity: 11 FETs or 3 Equivalent Gates

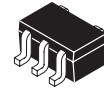


5-Lead SOT-353 Pinout (Top View)

### LOGIC SYMBOL

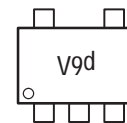


**ON Semiconductor**  
Formerly a Division of Motorola  
<http://onsemi.com>



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

### MARKING DIAGRAM



Pin 1  
d = Date Code

### PIN ASSIGNMENT

Pin	Function
1	IN/OUT $X_A$
2	OUT/IN $Y_A$
3	GND
4	ON/OFF CONTROL
5	VCC

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

### FUNCTION TABLE

On/Off Control Input	State of Analog Switch
L	Off
H	On

This document contains information on a new product. Specifications and information herein are subject to change without notice.

# MC74VHC1G66

## ABSOLUTE MAXIMUM RATINGS

Characteristics	Symbol	Value	Unit
DC Supply Voltage	$V_{CC}$	-0.5 to +7.0	V
Digital Input Voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
Analog Output Voltage	$V_{IS}$	-0.5 to $V_{CC} + 0.5$	V
Digital Input Diode Current	$I_{IK}$	-20	mA
DC Supply Current, $V_{CC}$ and GND	$I_{CC}$	+25	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

†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
Digital Input Voltage	$V_{IN}$	GND	$V_{CC}$	V
Analog Input Voltage	$V_{IS}$	GND	$V_{CC}$	V
Static or Dynamic Voltage Across Switch	$V_{IO}^*$		1.2	V
Operating Temperature Range	$T_A$	-55	+85	°C
Input Rise and Fall Time ON/OFF Control Input	$t_r, t_f$	0 0	100 20	ns/V
		$V_{CC} = 3.3V \pm 0.3V$		
		$V_{CC} = 5.0V \pm 0.5V$		

\* For voltage drops across the switch greater than 1.2V (switch on), excessive  $V_{CC}$  current may be drawn; i.e. the current out of the switch may contain both  $V_{CC}$  and switch input components. The reliability of the device will be unaffected unless the Maximum Ratings are exceeded.

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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 ON/OFF Control Input	R <sub>ON</sub> = Per Spec	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 <sub>IL</sub>	Maximum Low-Level Input Voltage ON/OFF Control Input	R <sub>ON</sub> = Per Spec	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
I <sub>IN</sub>	Maximum Input Leakage Current ON/OFF Control Input	V <sub>IN</sub> = V <sub>CC</sub> 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 V <sub>IO</sub> = 0V	5.5			2.0		20		40	μA
R <sub>ON</sub>	Maximum "ON" Resistance	V <sub>IN</sub> = V <sub>IH</sub> V <sub>IS</sub> = V <sub>CC</sub> or GND  I <sub>IS</sub>   ≤ 10mA (Figure 1)	3.0 4.5 5.5		30 20 15	50 30 20		70 40 35		100 50 45	Ω
		Endpoints V <sub>IN</sub> = V <sub>IH</sub> V <sub>IS</sub> = V <sub>CC</sub> or GND  I <sub>IS</sub>   ≤ 10mA (Figure 1)	3.0 4.5 5.5		25 12 8	50 20 15		65 26 23		90 40 32	Ω
I <sub>OFF</sub>	Maximum Off-Channel Leakage Current	V <sub>IN</sub> = V <sub>IL</sub> V <sub>IS</sub> = V <sub>CC</sub> or GND Switch Off (Figure 2)	5.5			0.1		0.5		1.0	μA
I <sub>ON</sub>	Maximum On-Channel Leakage Current	V <sub>IN</sub> = V <sub>IH</sub> V <sub>IS</sub> = V <sub>CC</sub> or GND Switch On (Figure 3)	5.5			0.1		0.5		1.0	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	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	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input X to Y	Y <sub>A</sub> = Open Figure 4	2.0 3.0 4.5 5.5		1 0 0 0	5 2 1 1		6 3 1 1		7 4 2 1	ns
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Propagation Delay, ON/OFF Control to Analog Output	R <sub>L</sub> = 1000 Ω Figure 5	2.0 3.0 4.5 5.5		15 8 6 4	35 15 10 7		46 20 13 9		57 25 17 11	ns
t <sub>PZL</sub> , t <sub>PZH</sub>	Maximum Propagation Delay, ON/OFF Control to Analog Output	R <sub>L</sub> = 1000 Ω Figure 5	2.0 3.0 4.5 5.5		15 8 6 4	35 15 10 7		46 20 13 9		57 25 17 11	ns
C <sub>IN</sub>	Maximum Input Capacitance	ON/OFF Control Input	0.0		3	10		10		10	pF
		Control Input = GND Analog I/O Feedthrough	5.0		4 4	10 10		10 10		10 10	

C <sub>PD</sub>	Power Dissipation Capacitance (Note NO TAG)	Typical @ 25°C, V <sub>CC</sub> = 5.0V		pF
		18		

- 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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## ADDITIONAL APPLICATION CHARACTERISTICS (Voltages Referenced to GND Unless Noted)

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	Limit 25°C	Unit
BW	Maximum On-Channel Bandwidth or Minimum Frequency Response Figure 7	f <sub>in</sub> = 1 MHz Sine Wave Adjust f <sub>in</sub> voltage to obtain 0 dBm at V <sub>OS</sub> Increase f <sub>in</sub> = frequency until dB meter reads -3dB R <sub>L</sub> = 50Ω, C <sub>L</sub> = 10 pF	3.0	150	MHz
			4.5	175	
			5.5	200	
ISO <sub>off</sub>	Off-Channel Feedthrough Isolation Figure 8	f <sub>in</sub> = Sine Wave Adjust f <sub>in</sub> voltage to obtain 0 dBm at V <sub>IS</sub> f <sub>in</sub> = 10 kHz, R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50 pF  f <sub>in</sub> = 1.0 kHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 10 pF	3.0	-50	dB
			4.5	-50	
			5.5	-50	
			3.0	-40	
			4.5	-40	
			5.5	-40	
NOISE <sub>feed</sub>	Feedthrough Noise Control to Switch Figure 9	V <sub>in</sub> ≤ 1 MHz Square Wave (t <sub>r</sub> = t <sub>f</sub> = 2ns) Adjust R <sub>L</sub> at setup so that I <sub>S</sub> = 0 A R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50 pF  R <sub>L</sub> = 50Ω, C <sub>L</sub> = 10 pF	3.0	45	mV <sub>pp</sub>
			4.5	60	
			5.5	130	
			3.0	25	
			4.5	30	
			5.5	60	
THD	Total Harmonic Distortion Figure 10	f <sub>in</sub> = 1 kHz, R <sub>L</sub> = 10kΩ, C <sub>L</sub> = 50 pF THD = THD <sub>Measured</sub> - THD <sub>Source</sub> V <sub>IS</sub> = 3.0 V <sub>pp</sub> sine wave V <sub>IS</sub> = 4.0 V <sub>pp</sub> sine wave V <sub>IS</sub> = 5.0 V <sub>pp</sub> sine wave	3.3	0.20	%
			4.5	0.10	
			5.5	0.06	

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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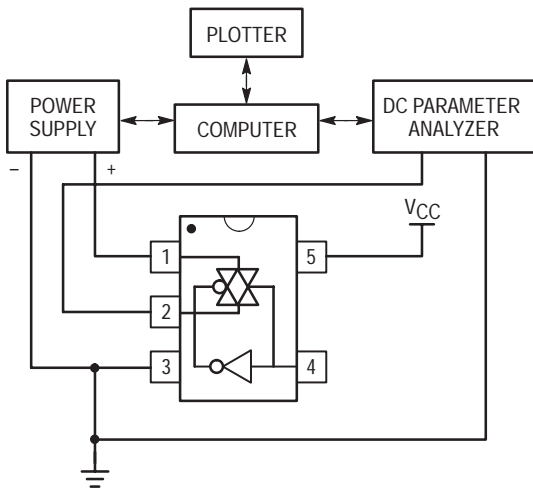


Figure 1. On Resistance Test Set-Up

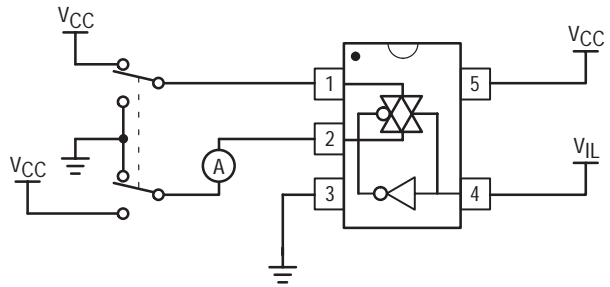


Figure 2. Maximum Off-Channel Leakage Current Test Set-Up

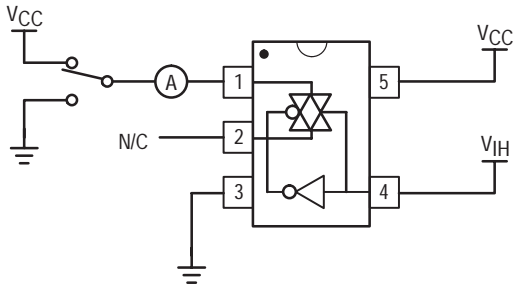


Figure 3. Maximum On-Channel Leakage Current Test Set-Up

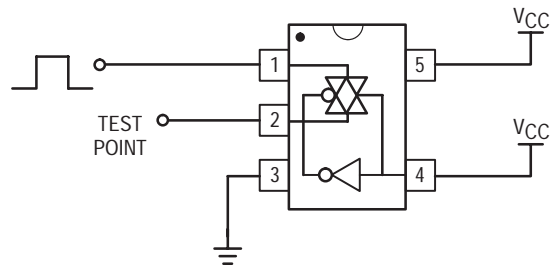
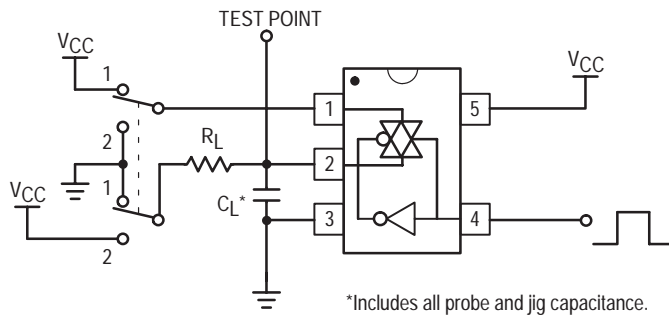


Figure 4. Propagation Delay Test Set-Up

Switch to Position 1 when testing  $t_{pLZ}$  and  $t_{pZL}$   
 Switch to Position 2 when testing  $t_{pHZ}$  and  $t_{pZH}$



\*Includes all probe and jig capacitance.

Figure 5. Propagation Delay Output Enable/Disable Test Set-Up

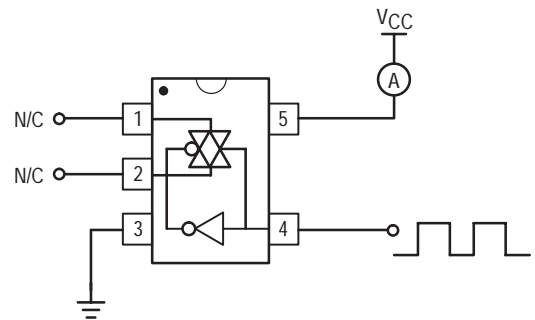
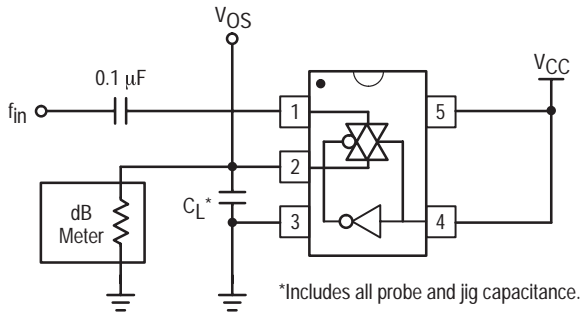
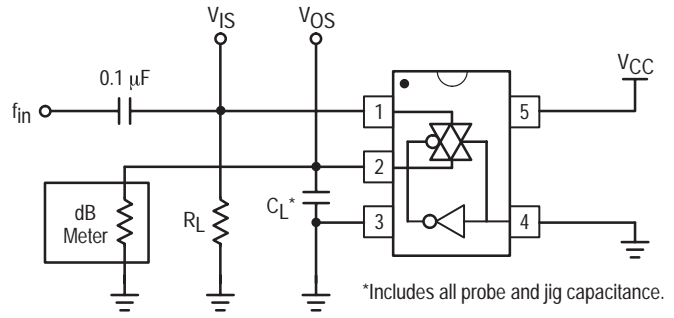


Figure 6. Power Dissipation Capacitance Test Set-Up

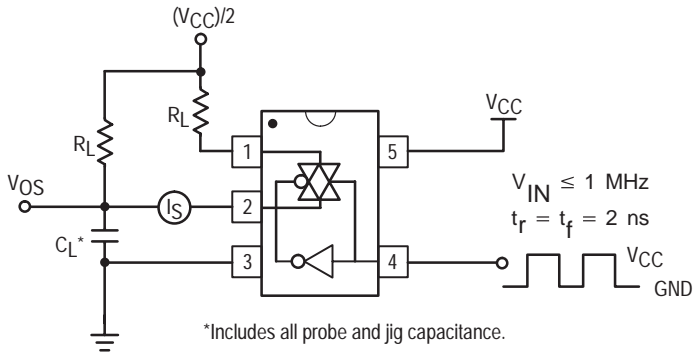
# MC74VHC1G66



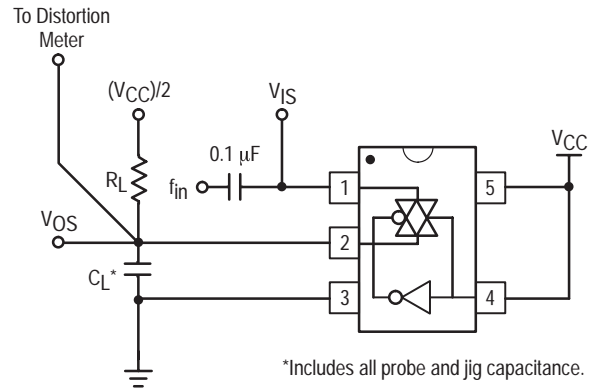
**Figure 7. Maximum On-Channel Bandwidth Test Set-Up**



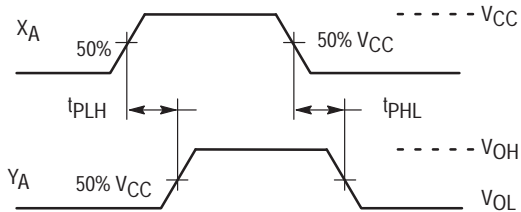
**Figure 8. Off-Channel Feedthrough Isolation Test Set-Up**



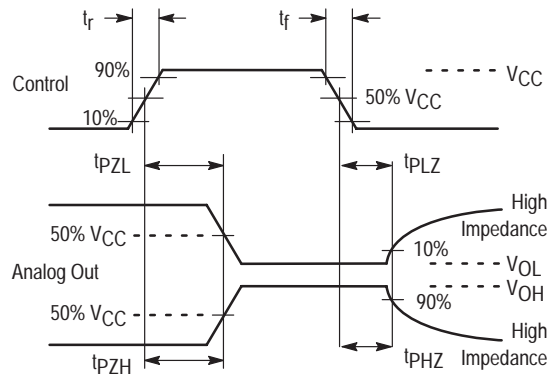
**Figure 9. Feedthrough Noise, ON/OFF Control to Analog Out, Test Set-Up**



**Figure 10. Total Harmonic Distortion Test Set-Up**



**Figure 11. Propagation Delay, Analog In to Analog Out Waveforms**



**Figure 12. Propagation Delay, ON/OFF Control**

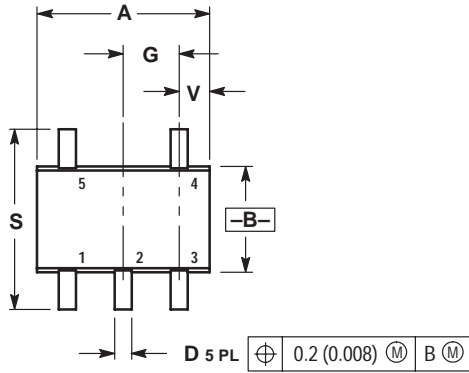
# MC74VHC1G66

## DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature						Package Type	Tape and Reel Size
	Circuit Indicator	Temp Range Identifier	Technology	Device Function	Package Suffix	Tape & Reel Suffix		
MC74VHC1G66DFT1	MC	74	VHC1G	66	DF	T1	SC-88A / SOT-353	7-Inch/3000 Unit

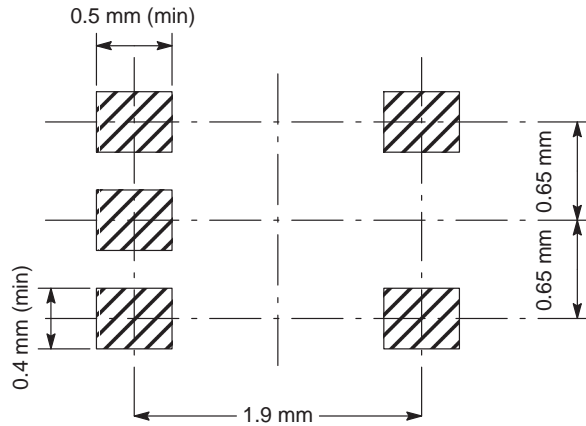
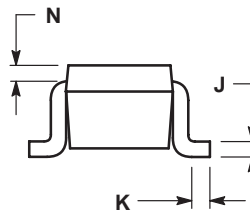
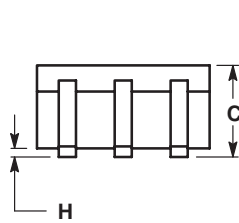
## PACKAGE DIMENSIONS

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

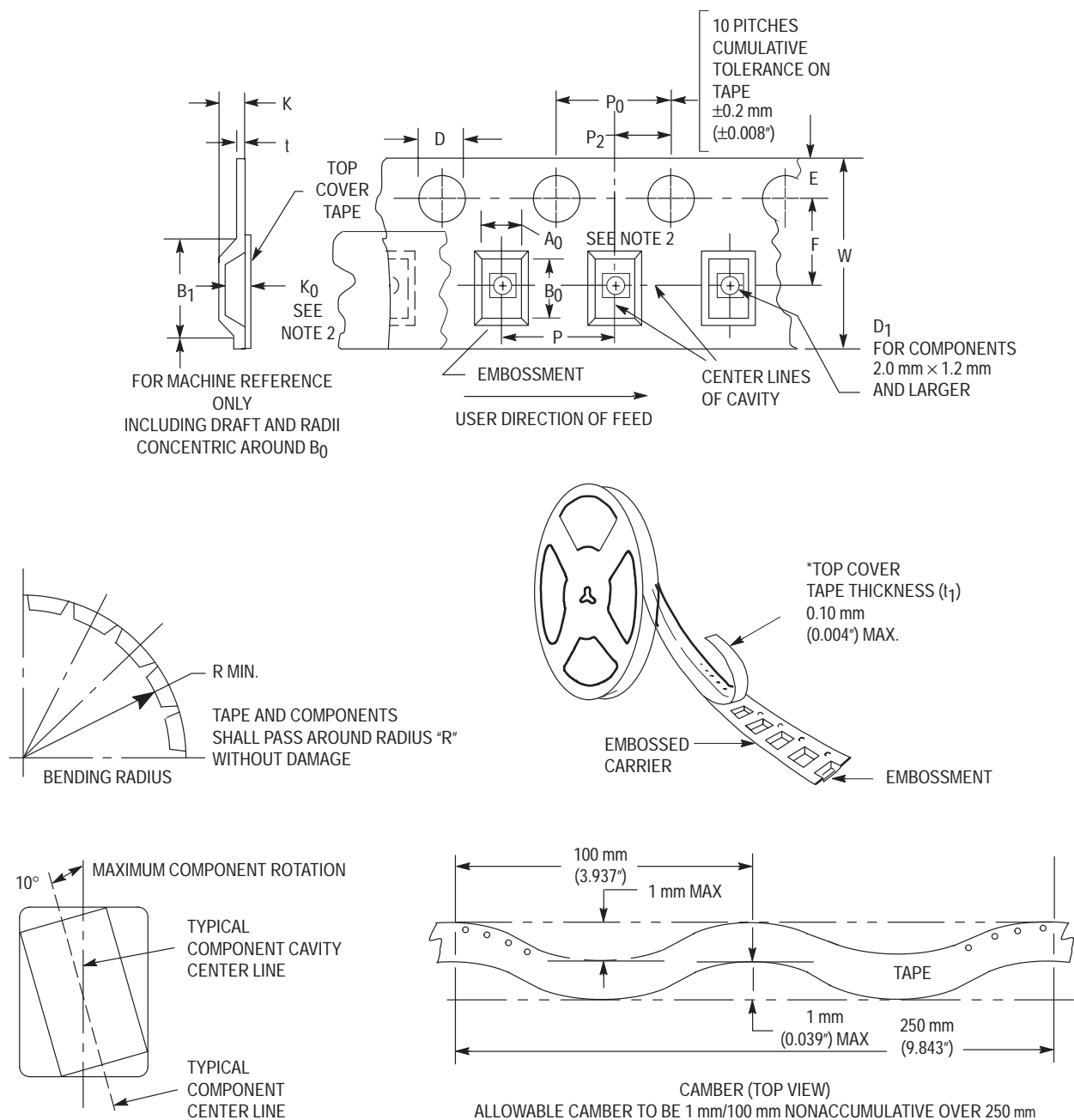


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: MM.

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



# MC74VHC1G66



**Figure 13. 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



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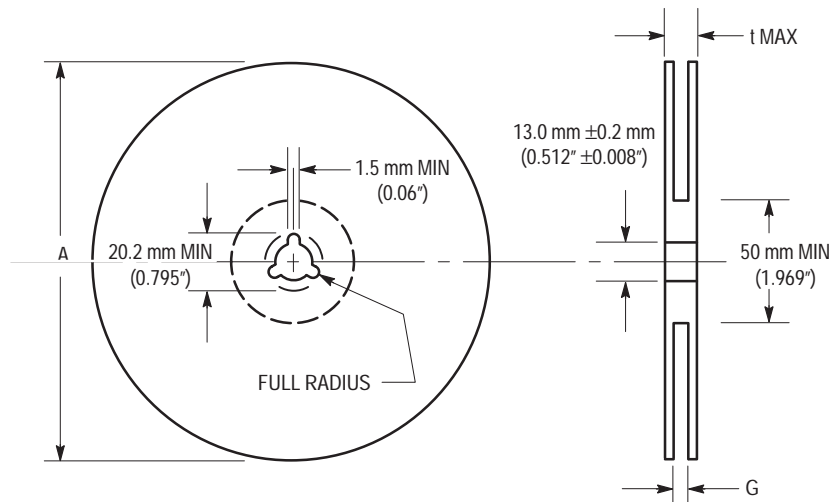


Figure 14. Reel Dimensions

## 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")

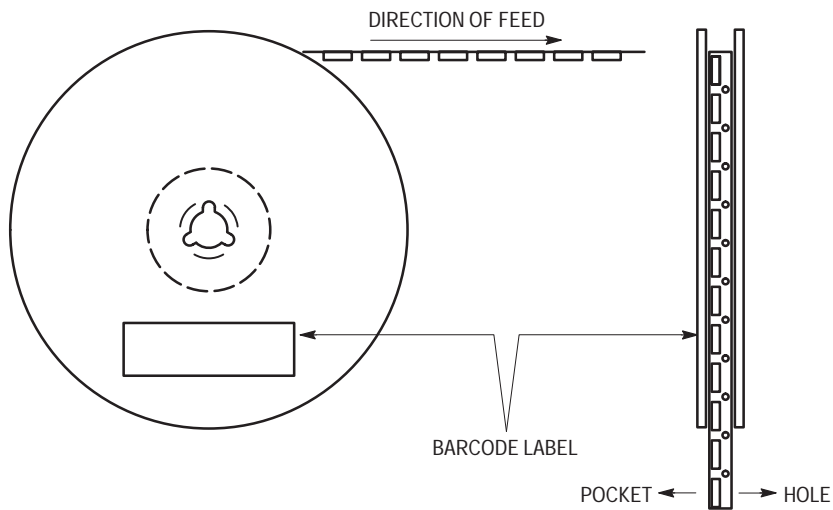


Figure 15. Reel Winding Direction

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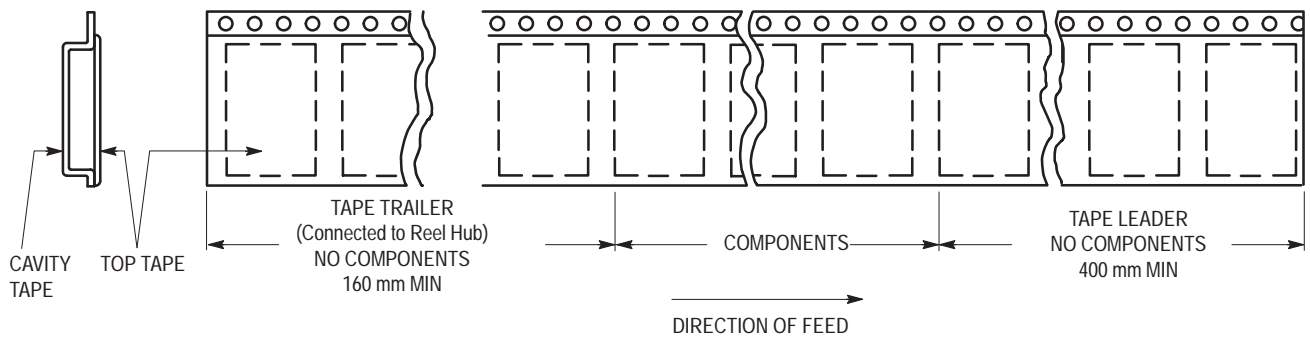


Figure 16. Tape Ends for Finished Goods

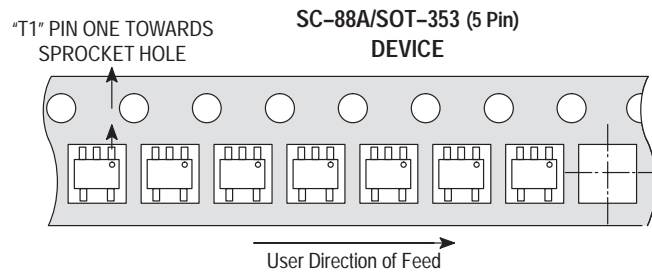



Figure 17. Reel Configuration

## Notes

# MC74VHC1G66

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