

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

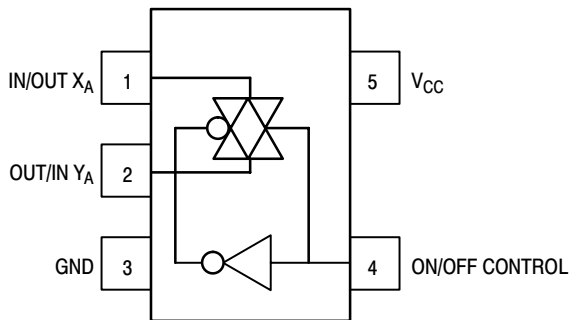


Figure 1. 5-Lead SOT-353 Pinout (Top View)

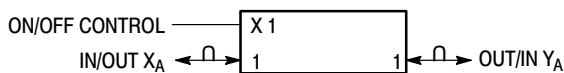


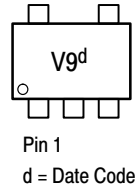
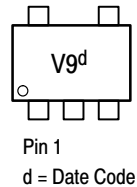
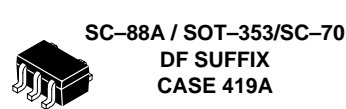
Figure 2. Logic Symbol



ON Semiconductor

<http://onsemi.com>

MARKING DIAGRAMS



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 6 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}	2.0	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	+125	°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.

The θ_{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

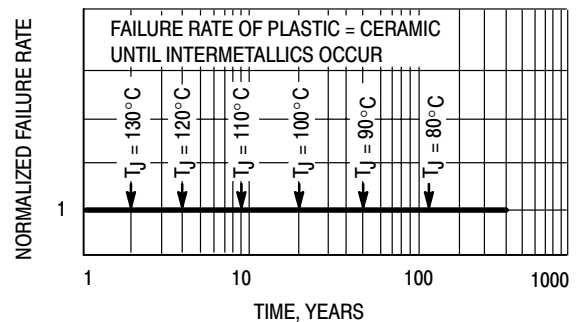


Figure 3. Failure Rate vs. Time Junction Temperature

MC74VHC1G66

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} (V)	T _A = 25°C			T _A ≤ 85°C		T _A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V _{IH}	Minimum High-Level Input Voltage ON/OFF Control Input	R _{ON} = 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 _{IL}	Maximum Low-Level Input Voltage ON/OFF Control Input	R _{ON} = 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 _{IN}	Maximum Input Leakage Current ON/OFF Control Input	V _{IN} = V _{CC} 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 V _{IO} = 0V	5.5			2.0		20		40	μA
R _{ON}	Maximum "ON" Resistance	V _{IN} = V _{IH} V _{IS} = V _{CC} or GND I _{IS} ≤ 10mA (Figure 1)	3.0 4.5 5.5		30 20 15	50 30 20		70 40 35		100 50 45	Ω
		Endpoints V _{IN} = V _{IH} V _{IS} = V _{CC} or GND I _{IS} ≤ 10mA (Figure 1)	3.0 4.5 5.5		25 12 8	50 20 15		65 26 23		90 40 32	Ω
I _{OFF}	Maximum Off-Channel Leakage Current	V _{IN} = V _{IL} V _{IS} = V _{CC} or GND Switch Off (Figure 2)	5.5			0.1		0.5		1.0	μA
I _{ON}	Maximum On-Channel Leakage Current	V _{IN} = V _{IH} V _{IS} = V _{CC} or GND Switch On (Figure 3)	5.5			0.1		0.5		1.0	μA

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

Symbol	Parameter	Test Conditions	V _{CC} (V)	T _A = 25°C			T _A ≤ 85°C		T _A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, Input X to Y	Y _A = 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 _{PLZ} , t _{PHZ}	Maximum Propagation Delay, ON/OFF Control to Analog Output	R _L = 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 _{PZL} , t _{PZH}	Maximum Propagation Delay, ON/OFF Control to Analog Output	R _L = 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 _{IN}	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 _{PD}	Power Dissipation Capacitance (Note NO TAG)	Typical @ 25°C, V _{CC} = 5.0V		pF
		18		

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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

MC74VHC1G66

ADDITIONAL APPLICATION CHARACTERISTICS (Voltages Referenced to GND Unless Noted)

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

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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

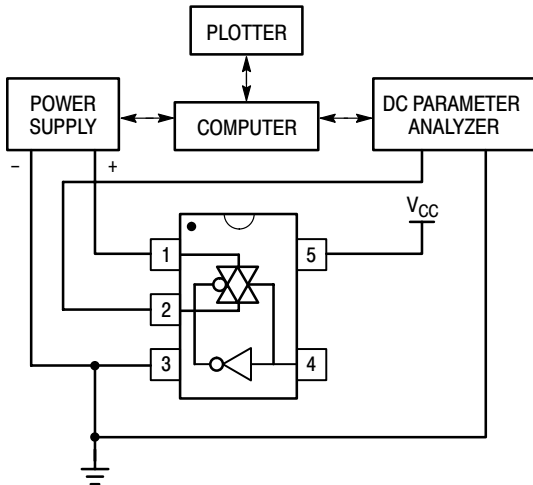


Figure 4. On Resistance Test Set-Up

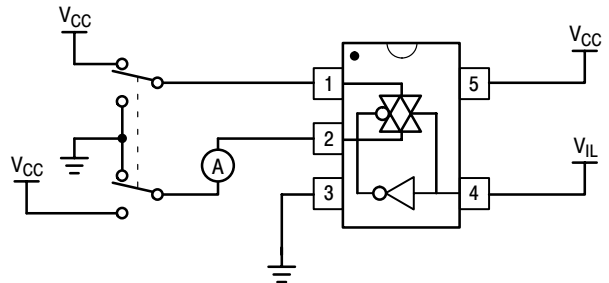


Figure 5. Maximum Off-Channel Leakage Current Test Set-Up

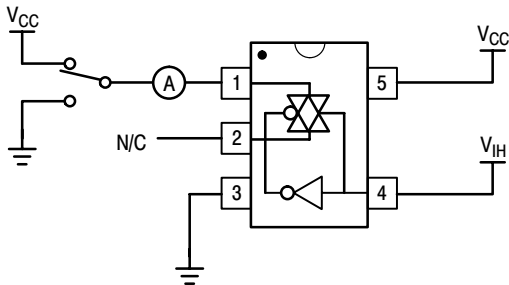


Figure 6. Maximum On-Channel Leakage Current Test Set-Up

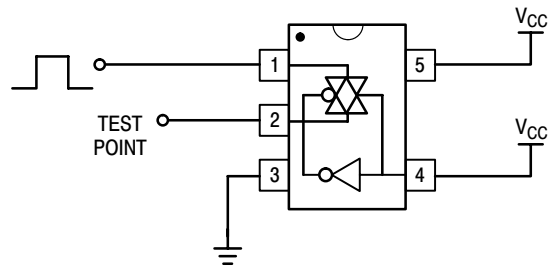


Figure 7. Propagation Delay Test Set-Up

MC74VHC1G66

Switch to Position 1 when testing t_{PLZ} and t_{PZL}
 Switch to Position 2 when testing t_{PHZ} and t_{PZH}

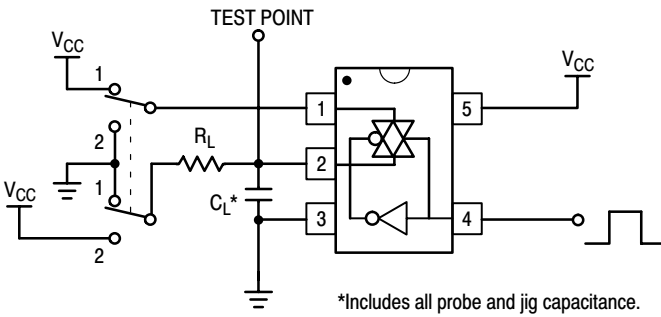


Figure 8. Propagation Delay Output Enable/Disable Test Set-Up

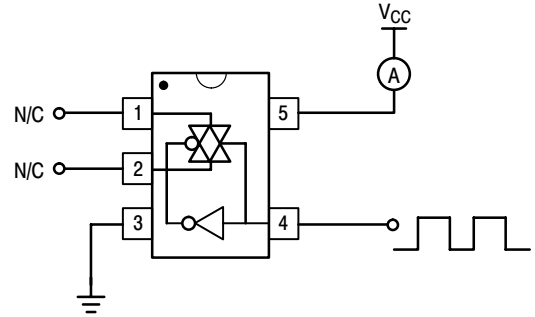


Figure 9. Power Dissipation Capacitance Test Set-Up

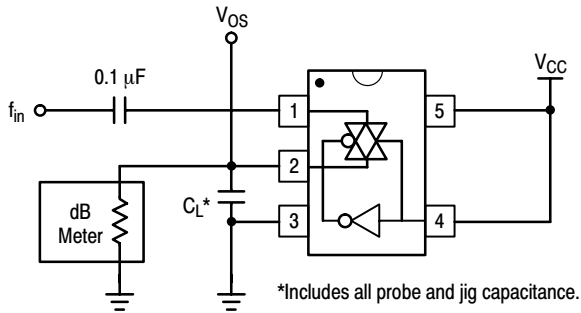


Figure 10. Maximum On-Channel Bandwidth Test Set-Up

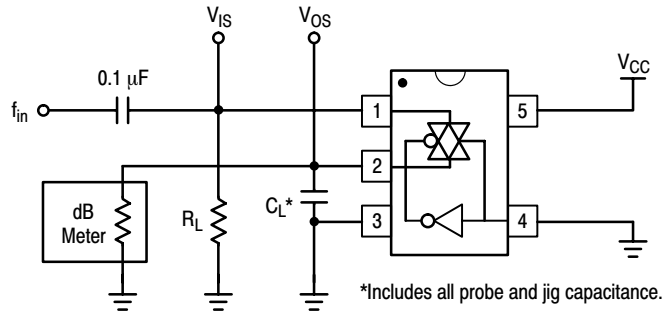


Figure 11. Off-Channel Feedthrough Isolation Test Set-Up

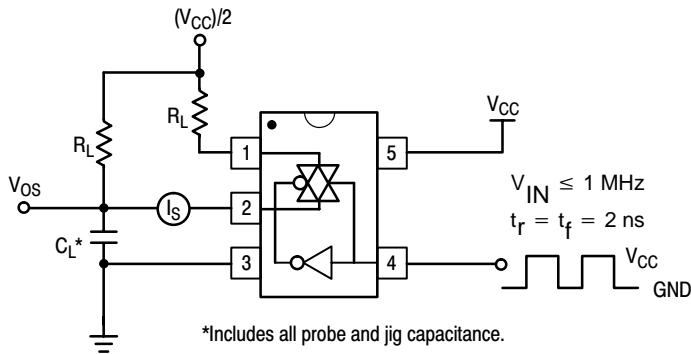


Figure 12. Feedthrough Noise, ON/OFF Control to Analog Out, Test Set-Up

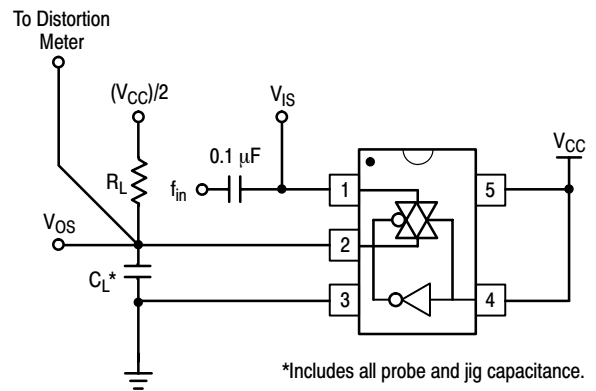


Figure 13. Total Harmonic Distortion Test Set-Up

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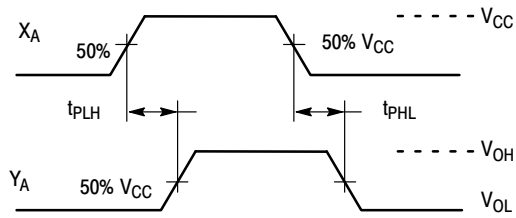


Figure 14. Propagation Delay, Analog In to Analog Out Waveforms

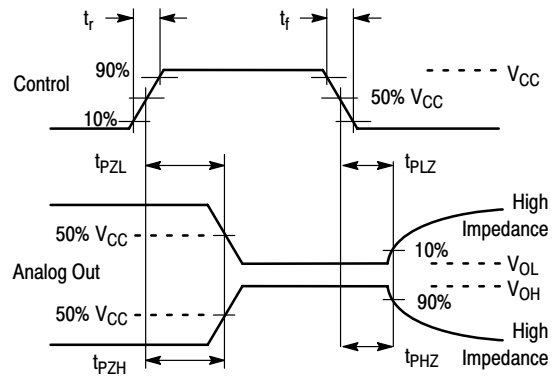


Figure 15. Propagation Delay, ON/OFF Control

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		
MC74VHC1G66DFT2	MC	74	VHC1G	66	DF	T2	SC-88A/ SOT-353 /SC-70	178mm (7") 3000 Unit
MC74VHC1G66DFT4	MC	74	VHC1G	66	DF	T4	SC-88A/ SOT-353 /SC-70	330mm (13") 100000 Unit
MC74VHC1G66DTT1	MC	74	VHC1G	66	DT	T1	TSOP5/ SOT-23 /SC-59	178mm (7") 3000 Unit
MC74VHC1G66DTT3	MC	74	VHC1G	66	DT	T3	TSOP5/ SOT-23 /SC-59	330mm (13") 100000 Unit

MC74VHC1G66

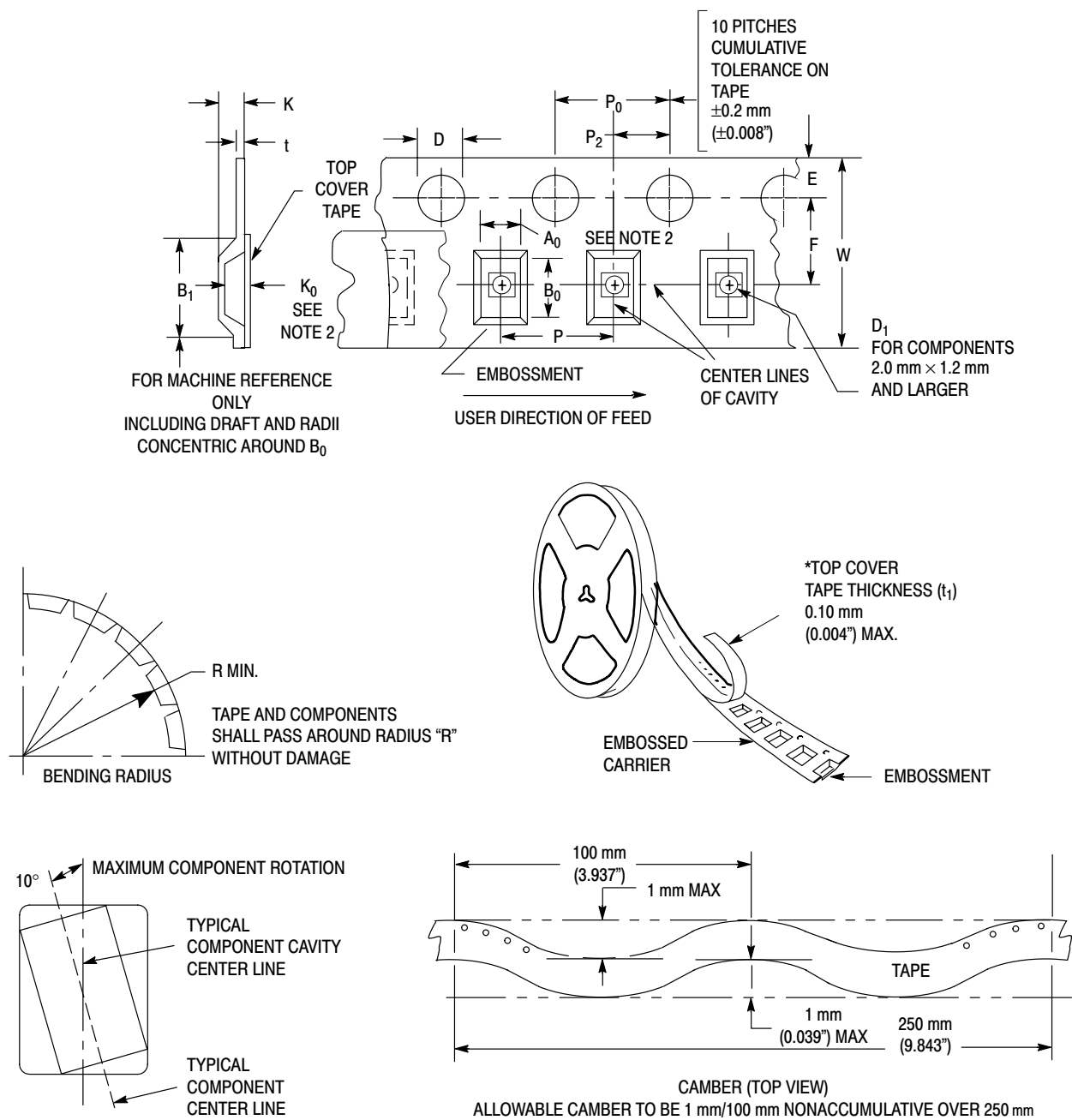


Figure 16. Carrier Tape Specifications

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

MC74VHC1G66

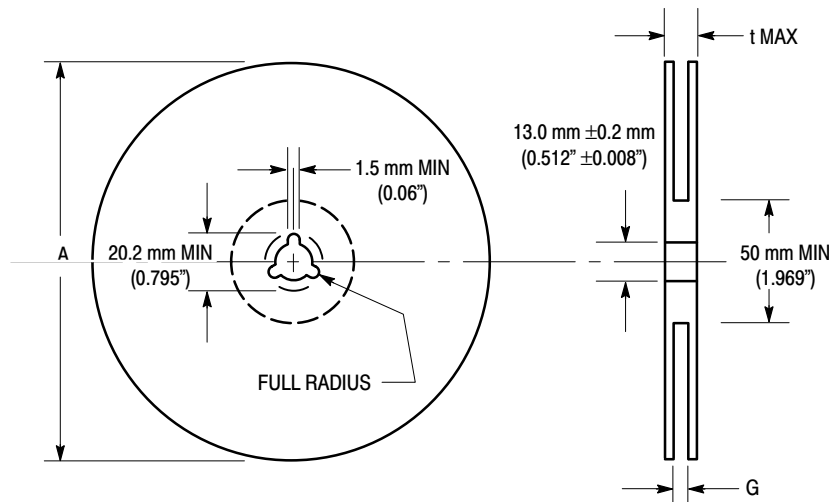


Figure 17. Reel Dimensions

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")

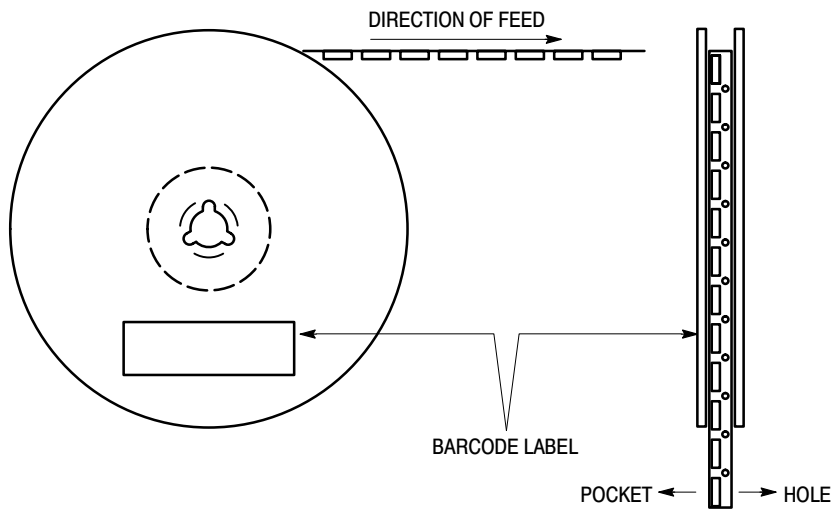


Figure 18. Reel Winding Direction

MC74VHC1G66

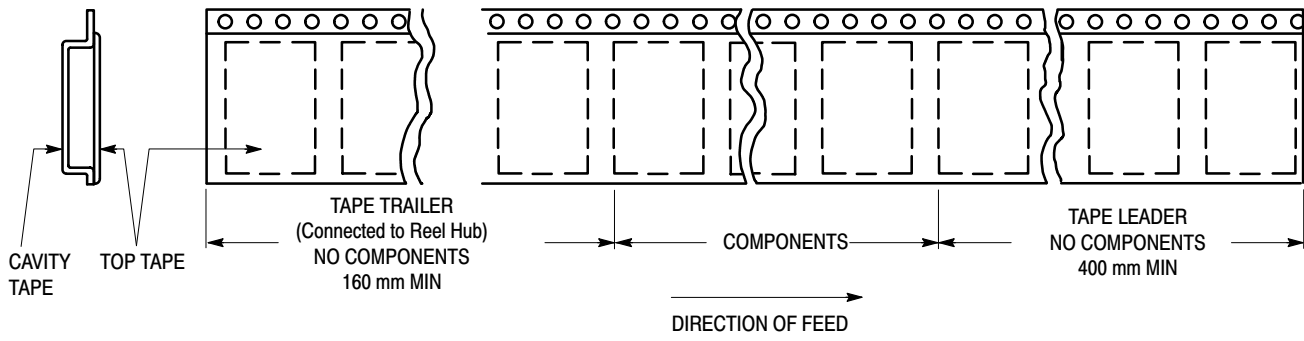


Figure 19. Tape Ends for Finished Goods

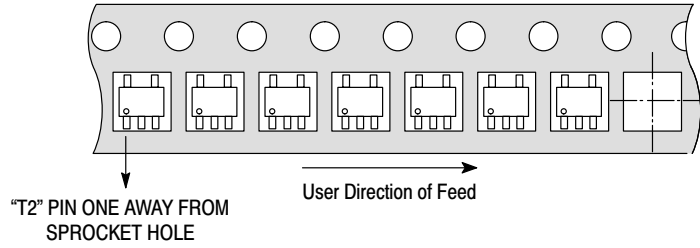


Figure 17. DFT2 and DFT4 (SC88A) Reel Configuration/Orientation

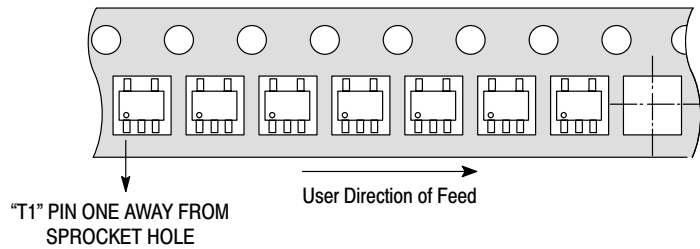
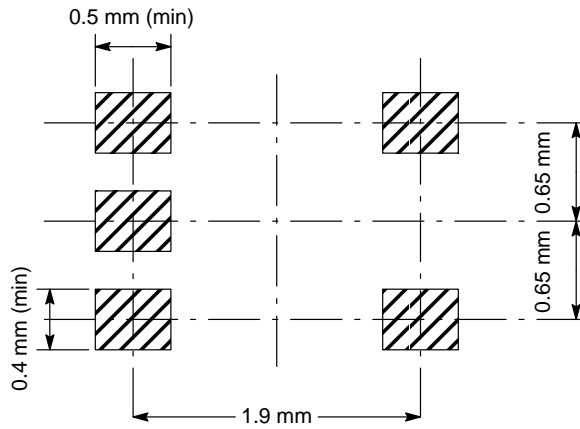
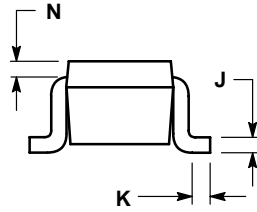
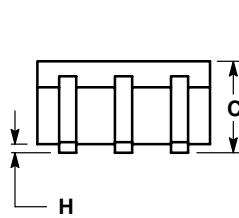
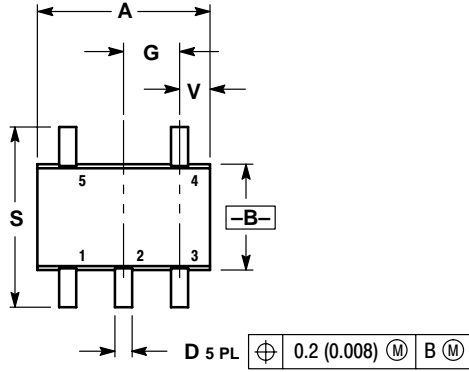


Figure 18. DTT1 and DTT3 (TSOP5) Reel Configuration/Orientation

MC74VHC1G66

PACKAGE DIMENSIONS

SC-88A / SOT-353 / SC-70
 DF SUFFIX
 5-LEAD PACKAGE
 CASE 419A-01
 ISSUE B



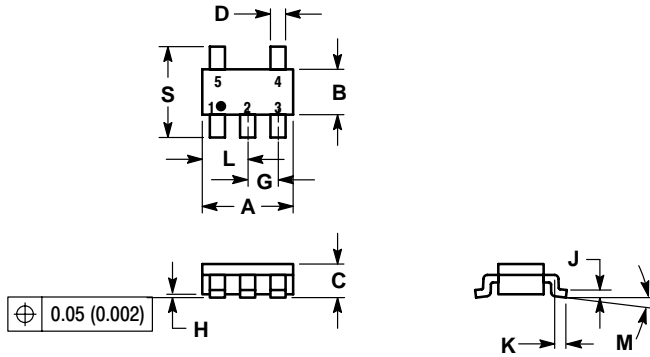
- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MM.

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

MC74VHC1G66

PACKAGE DIMENSIONS

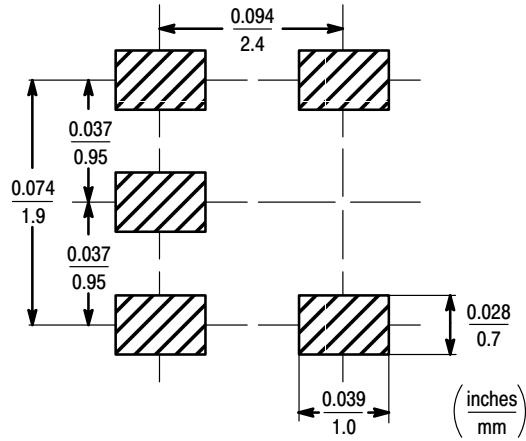
TSOP-5 / SOT-23 / SC-59
 DT SUFFIX
 5-LEAD PACKAGE
 CASE 483-01
 ISSUE A



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



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