

MC74VHC1G05

Single Inverter with Open Drain Output

The MC74VHC1G05 is an advanced high speed CMOS inverter with open drain output fabricated with silicon gate CMOS technology.

The internal circuit is composed of three stages, including an open drain output which provides the capability to set output switching level. This allows the MC74VHC1G05 to be used to interface 5.0 V circuits to circuits of any voltage between V_{CC} and 7.0 V using an external resistor and power supply.

The MC74VHC1G05 input structure provides protection when voltages up to 7 V are applied, regardless of the supply voltage.

- High Speed: $t_{PD} = 3.8$ ns (Typ) at $V_{CC} = 5.0$ V
- Low Internal Power Dissipation: $I_{CC} = 1$ μ A (Max) at $T_A = 25^\circ$ C
- Power Down Protection Provided on Inputs
- Pin and Function Compatible with Other Standard Logic Families
- Chip Complexity: FET = 105

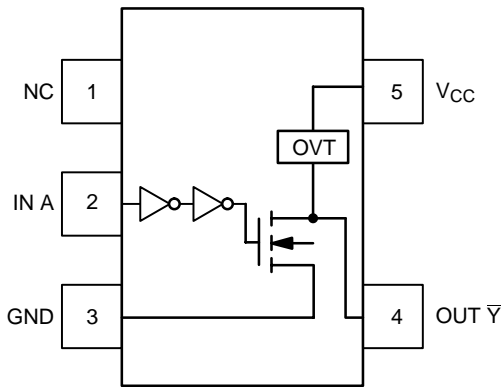


Figure 1. Pinout (Top View)

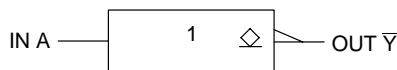


Figure 2. Logic Symbol



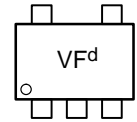
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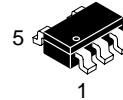


SC70-5/SC-88A/SOT-353
DF SUFFIX
CASE 419A

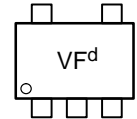
MARKING DIAGRAMS



Pin 1



SOT23-5/TSOP-5/SC59-5
DT SUFFIX
CASE 483



Pin 1

d = Date Code

PIN ASSIGNMENT

PIN ASSIGNMENT	
1	NC
2	IN A
3	GND
4	OUT \bar{Y}
5	V_{CC}

FUNCTION TABLE

A Input	\bar{Y} Output
L	Z
H	L

ORDERING INFORMATION

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

MC74VHC1G05

MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
V _{CC}	DC Supply Voltage	-0.5 to +7.0	V
V _{IN}	DC Input Voltage	0 to +7.0	V
V _{OUT}	DC Output Voltage	-0.5 to 7.0	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
T _{STG}	Storage Temperature Range	-65 to +150	°C
T _L	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
T _J	Junction Temperature Under Bias	+150	°C
θ _{JA}	Thermal Resistance	SC70-5/SC-88A/SOT-353 (Note 1) SOT23-5/TSOP-5/SC59-5 350 230	°C/W
P _D	Power Dissipation in Still Air at 85°C	SC70-5/SC-88A/SOT-353 SOT23-5/TSOP-5/SC59-5 150 200	mW
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 _{LATCH-UP}	Latch-Up Performance	Above V _{CC} and Below GND at 125°C (Note 5) ±500	mA

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.

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

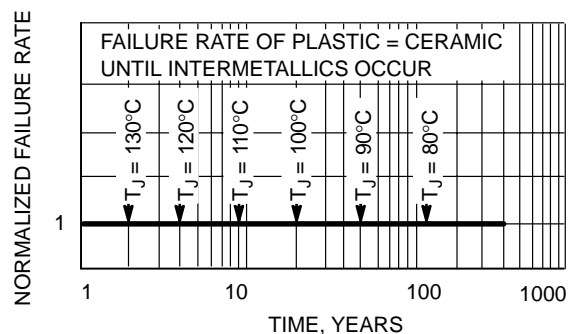


Figure 3. Failure Rate vs. Time Junction Temperature

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DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} (V)	T _A = 25°C			T _A ≤ 85°C		-55 ≤ T _A ≤ 125°C		Unit	
				Min	Typ	Max	Min	Max	Min	Max		
V _{IH}	Minimum High-Level Input Voltage		2.0	1.5			1.5		1.5		V	
			3.0	2.1			2.1		2.1			
			4.5	3.15			3.15		3.15			
			5.5	3.85			3.85		3.85			
V _{IL}	Maximum Low-Level Input Voltage		2.0			0.5		0.5		0.5	V	
			3.0			0.9		0.9		0.9		
			4.5			1.35		1.35		1.35		
			5.5			1.65		1.65		1.65		
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		0.0	0.1		0.1		0.1	V	
			3.0		0.0	0.1		0.1		0.1		
		3.0	V _{IN} = V _{IH} or V _{IL} I _{OL} = 4 mA				0.36		0.44		0.52	V
				4.5			0.36		0.44		0.52	
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 _{OPD}	Maximum Off-stat Leakage Current	V _{OUT} = 5.5 V	0			0.25		2.5		5.0	μA	

AC ELECTRICAL CHARACTERISTICS Input t_r = t_f = 3.0 ns

Symbol	Parameter	Test Conditions	T _A = 25°C			T _A ≤ 85°C		-55 ≤ T _A ≤ 125°C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t _{PZL}	Maximum Output Enable Time, Input A to \bar{Y}	V _{CC} = 3.3 ± 0.3 V R _L = R _I = 500 Ω		5.0	7.1		8.5		10.0	ns
		C _L = 15 pF C _L = 50 pF		7.5	10.6		12.0		14.5	
t _{PLZ}	Maximum Output Disable Time	V _{CC} = 5.0 ± 0.5 V R _L = R _I = 500 Ω		3.8	5.5		6.5		8.0	ns
		C _L = 15 pF C _L = 50 pF		5.3	7.5		8.5		10.0	
C _{IN}	Maximum Input Capacitance	V _{CC} = 3.3 ± 0.3 V R _L = R _I = 500 Ω		7.5	10.6		12.0		14.5	ns
		C _L = 50 pF		5.3	7.5		8.5		10.0	
C _{PD}	Power Dissipation Capacitance (Note 6)			4	10		10		10	pF

C _{PD}	Power Dissipation Capacitance (Note 6)	Typical @ 25°C, V _{CC} = 5.0 V	

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} • 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}.

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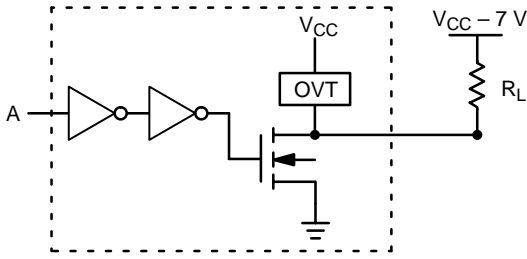


Figure 4. Output Voltage Mismatch Application

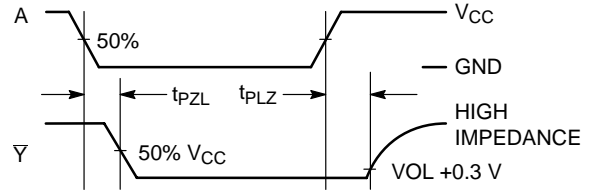
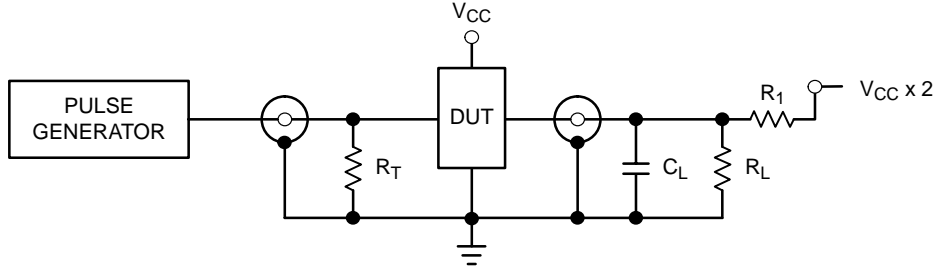


Figure 5. Switching Waveforms



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

Figure 6. Test Circuit

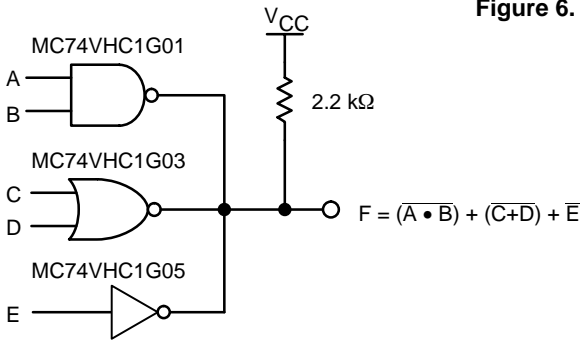


Figure 7. Complex Boolean Functions

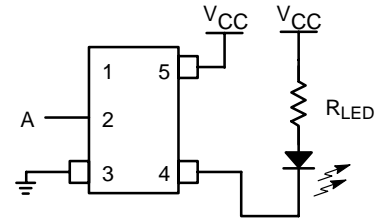


Figure 8. LED Driver

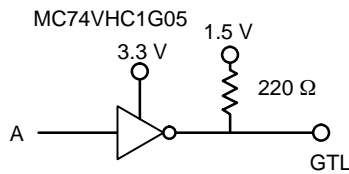


Figure 9. GTL Driver

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		
MC74VHC1G05DFT1	MC	74	VHC1G	05	DF	T1	SC70-5/SC-88A/SOT-353	178 mm (7 in) 3000 Unit
MC74VHC1G05DFT2	MC	74	VHC1G	05	DF	T2	SC70-5/SC-88A/SOT-353	178 mm (7 in) 3000 Unit
MC74VHC1G05DTT1	MC	74	VHC1G	05	DT	T1	SOT23-5/TSOP-5/SC59-5	178 mm (7 in) 3000 Unit

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Figure 10. Tape Ends for Finished Goods

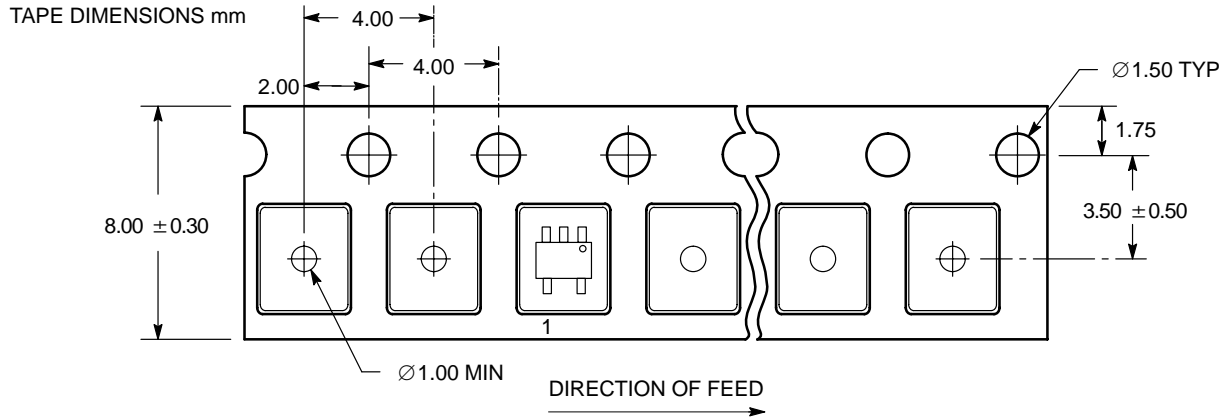


Figure 11. SC-70-5/SC-88A/SOT-353 DFT1 Reel Configuration/Orientation

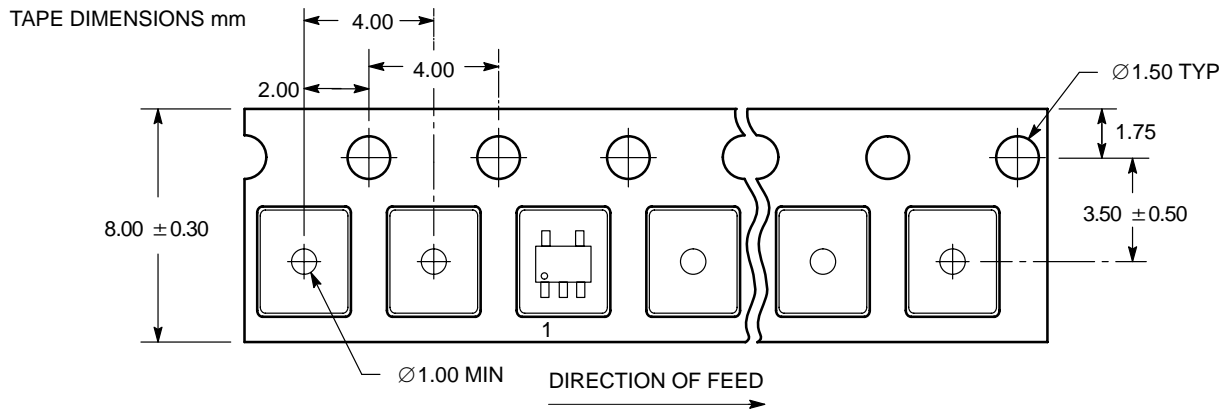


Figure 12. SC-70/SC-88A/SOT-353 DFT2 and SOT23-5/TSOP-5/SC59-5 DTT1 Reel Configuration/Orientation

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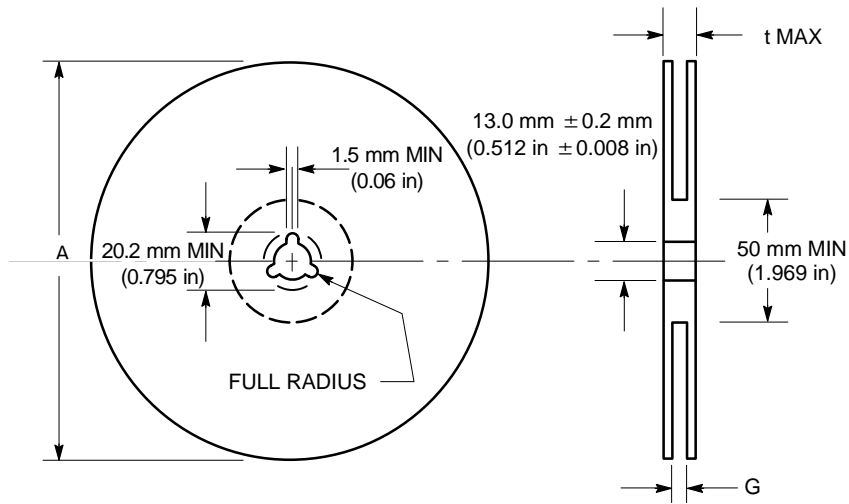


Figure 13. Reel Dimensions

REEL DIMENSIONS

Tape Size	T and R Suffix	A Max	G	t Max
8 mm	T1, T2	178 mm (7 in)	8.4 mm, + 1.5 mm, -0.0 (0.33 in + 0.059 in, -0.00)	14.4 mm (0.56 in)

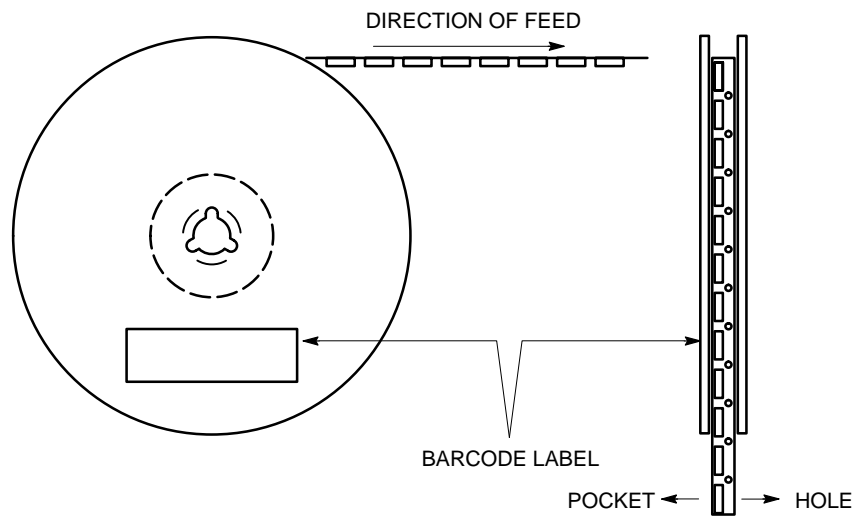
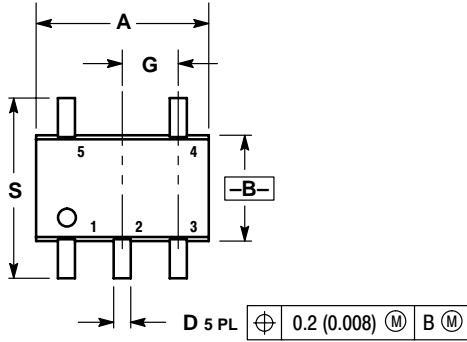


Figure 14. Reel Winding Direction

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PACKAGE DIMENSIONS

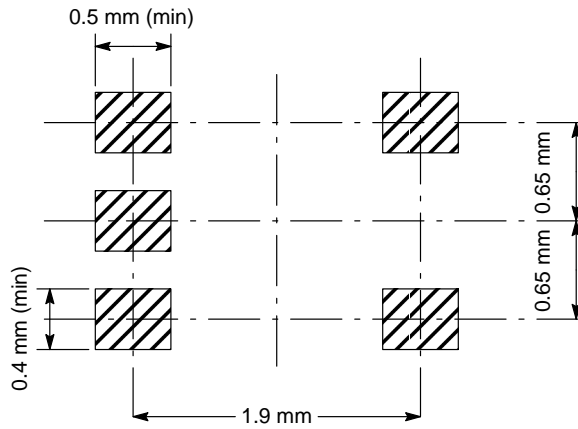
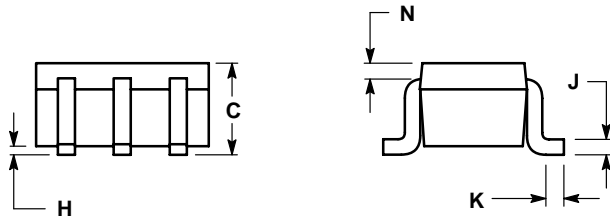
SC70-5/SC-88A/SOT-353
 DF SUFFIX
 5-LEAD PACKAGE
 CASE 419A-02
 ISSUE F



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.

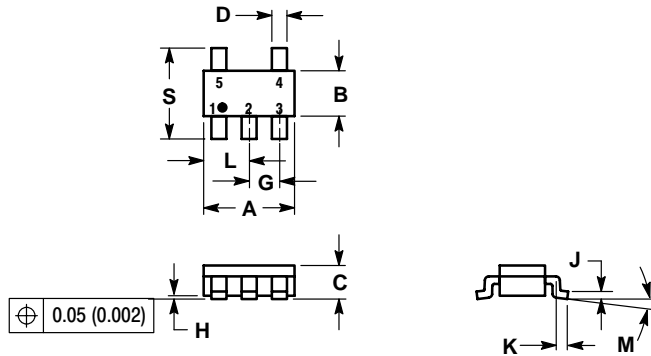
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20



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PACKAGE DIMENSIONS

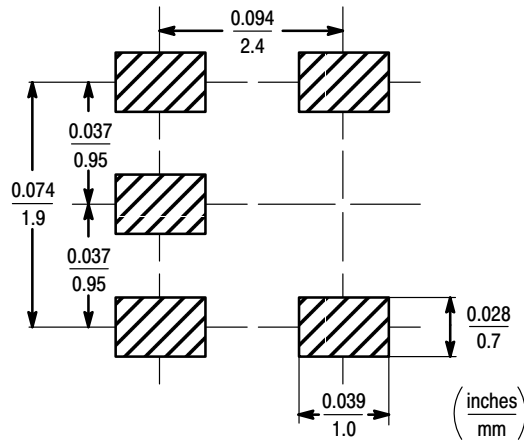
SOT23-5/TSOP-5/SC59-5
DT SUFFIX
5-LEAD PACKAGE
CASE 483-01
ISSUE B




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	1.05	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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