Single Supply Analog Switch

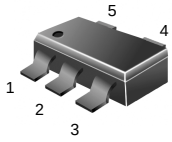
L74VHC1G66

The L74VHC1G66 is an advanced high speed CMOS bilateral analog switch fabricated with silicon gate CMOS technology. Itachieves high speed propagation delays and low ON resistances while maintaining 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).

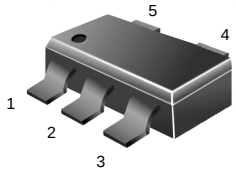
The L74VHC1G66 is compatible in function to a single gate of the High Speed CMOS L74VHC4066.The device has been designed so the ON resistances (R_{ON}) are lower and more linear over input voltage.

The ON/OFF control inputs are compatible with standard CMOS outputs. The ON/OFF control input structure provides protection when voltages between 0 V and 5.5 V are applied, regardless of the supply voltage. This input structure helps prevent device destruction caused by supply voltage – input/output voltage mismatch, battery backup, hot insertion, etc.

- High Speed: t_{PD} = 20 ns (Typ) at V_{CC} = 5.0 V
- Low Power Dissipation: I_{CC} = 1 μA (Max) at T_A = 25°C
- Diode Protection Provided on Inputs and Outputs
- Improved Linearity and Lower ON Resistance over Input Voltage

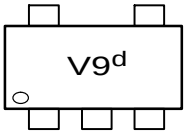


SC–88A/SOT–353/SC–70
DF SUFFIX

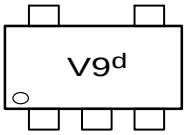


TSOP–5/SOT–23/SC–59
DT SUFFIX

MARKING DIAGRAMS



Pin 1



Pin 1

d = Date Code

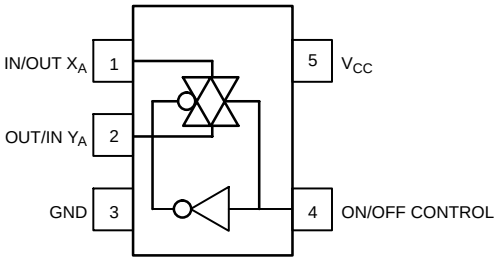


Figure 1. Pinout

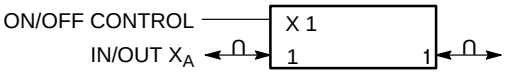


Figure 2. Logic Symbol

PIN ASSIGNMENT	
1	IN/OUT X_A
2	OUT/IN Y_A
3	GND
4	ON/OFF CONTROL
5	V_{CC}

FUNCTION TABLE

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

ORDERING INFORMATION

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

MAXIMUM RATINGS

Symbol	Characteristics		Value	Unit
V_{CC}	DC Supply Voltage		–0.5 to +7.0	V
V_{IN}	Digital Input Voltage		–0.5 to +7.0	V
V_{IS}	Analog Output Voltage		–0.5 to V_{CC} +0.5	V
I_{IK}	Digital Input Diode Current		–20	mA
I_{CC}	DC Supply Current, V_{CC} and GND		+25	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		GND	5.5	V
V_{IS}	DC Output Voltage		GND	V_{CC}	V
T_A	Operating Temperature Range		–55	+125	°C
t_r , t_f	Input Rise and Fall Time ON/OFF Control Input	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

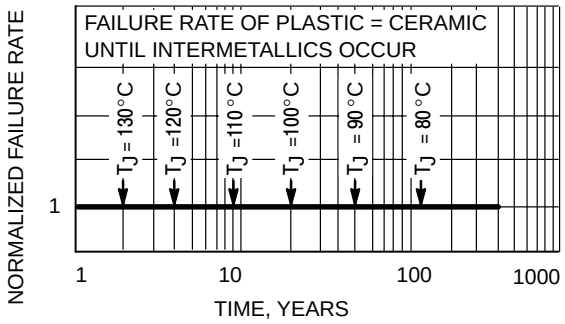


Figure 3. Failure Rate vs. Time Junction Temperature

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CC} (V)	T_A = 25°C		$T_A \le$ 85°C		–55 ≤ $T_A \le$ 125°C		Unit
				Min	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} = 0 V	5.5		1.0		20		40	μA
R_{ON}	Maximum "ON" Resistance	V_{IN} = V_{IH} V_{IS} = V_{CC} or GND $\|I_{IS}\| \le$ 5 mA (Figure 1)	3.0 4.5 5.5		60 45 40		70 50 45		100 60 55	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

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

Symbol	Parameter	Test Conditions	V_{CC} (V)	T_A = 25°C			$T_A \le$ 85°C		–55 ≤ $T_A \le$ 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 14	2.0 3.0 4.5 5.5		1 0.6 0.6 0.6	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 15	2.0 3.0 4.5 5.5		32 28 24 20	40 35 30 25		45 40 35 30		50 45 40 35	ns
t_{PZL}, t_{PZH}	Maximum Propagation Delay, ON/OFF Control to Analog Output	R_L = 1000 Ω Figure 15	2.0 3.0 4.5 5.5		32 28 24 20	40 35 30 25		45 40 35 30		50 45 40 35	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	

		Typical @ 25°C, V_{CC} = 5.0 V	
C_{PD}	Power Dissipation Capacitance (Note 6)	18	pF

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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no–load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

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 –3 dB R_L = 50 Ω, C_L = 10 pF	3.0 4.5 5.5	150 175 180	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 = 600 Ω, C_L = 50 pF	3.0 4.5 5.5	–80 –80 –80	dB
$NOISE_{feed}$	Feedthrough Noise Control to Switch Figure 9	$V_{in} \le$ 1 MHz Square Wave ($t_r = t_f$ = 2 ns) R_L = 600 Ω, C_L = 50 pF	3.0 4.5 5.5	45 60 130	mV_{PP}
THD	Total Harmonic Distortion Figure 10	f_{in} = 1 kHz, R_L = 10 kΩ, C_L = 50 pF $THD = THD_{Measured} - THD_{Source}$ V_{IS} = 3.0 V_{PP} sine wave V_{IS} = 5.0 V_{PP} sine wave	 3.3 5.5	 0.30 0.15	%

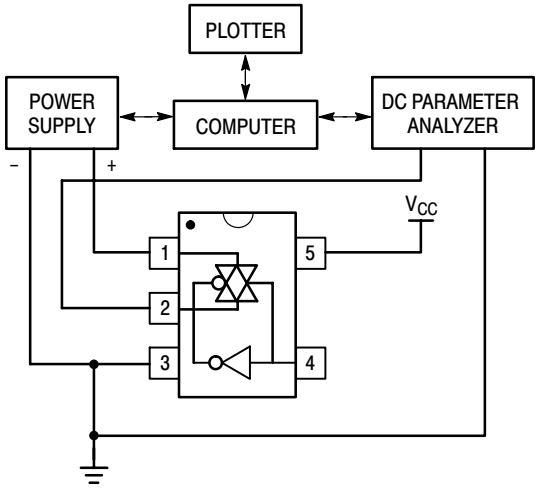


Figure 4. On Resistance Test Set–Up

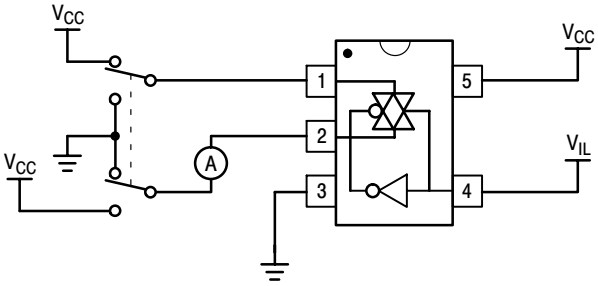


Figure 5. Maximum Off–Channel Leakage Current Test Set–Up

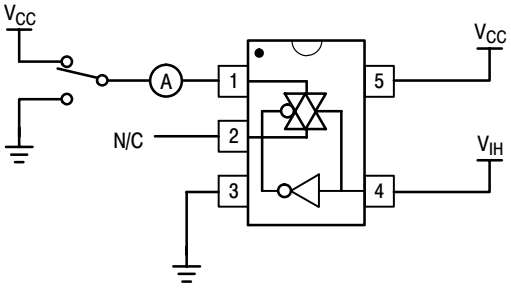


Figure 6. Maximum On–Channel Leakage Current Test Set–Up

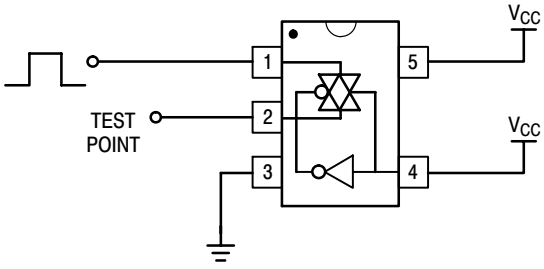


Figure 7. Propagation Delay Test Set–Up

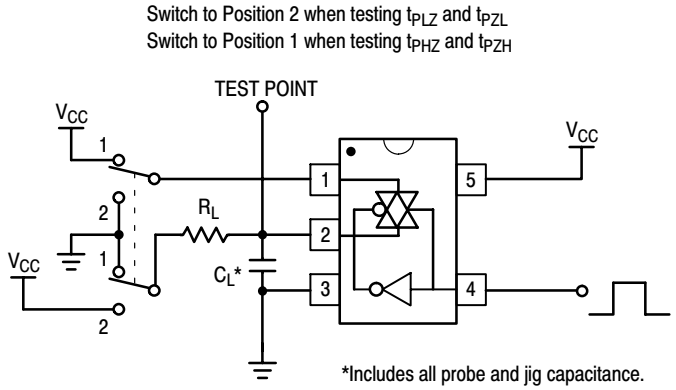


Figure 8. Propagation Delay Output Enable/Disable Test Set–Up

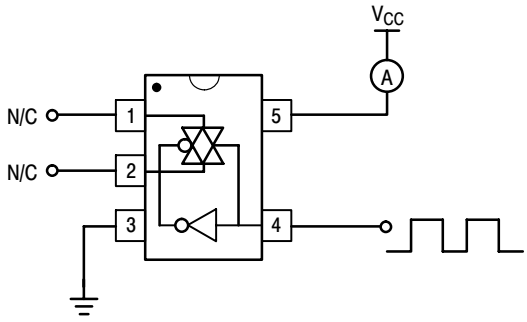


Figure 9. Power Dissipation Capacitance Test Set–Up

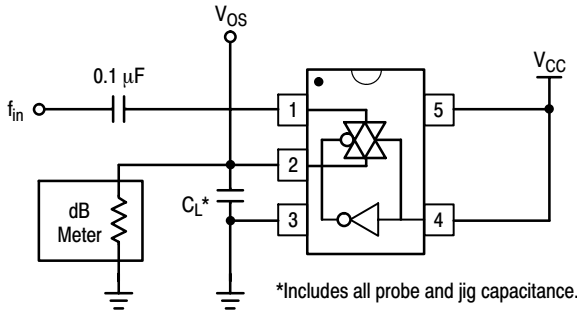


Figure 10. Maximum On–Channel Bandwidth Test Set–Up

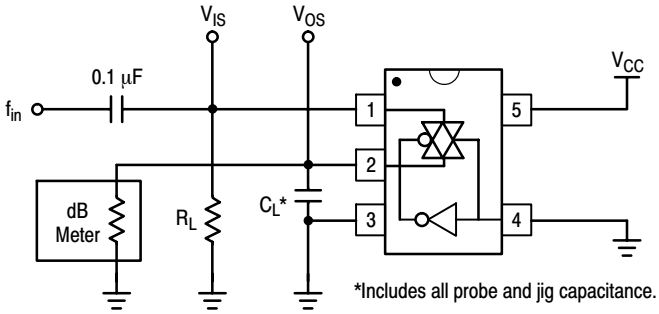


Figure 11. Off–Channel Feedthrough Isolation Test Set–Up

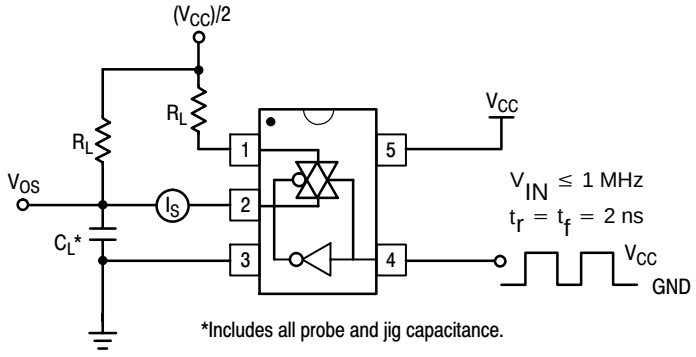


Figure 12. Feedthrough Noise, ON/OFF Control to Analog Out, Test Set–Up

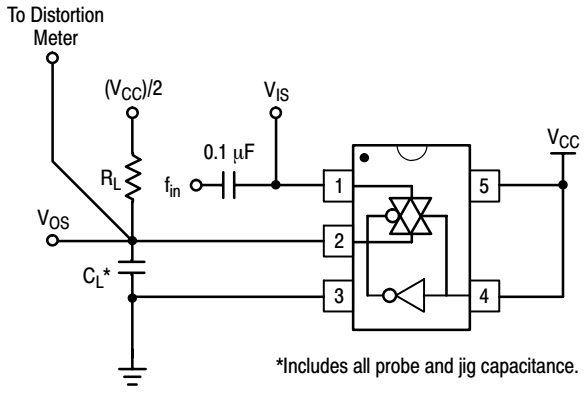


Figure 13. Total Harmonic Distortion Test Set–Up

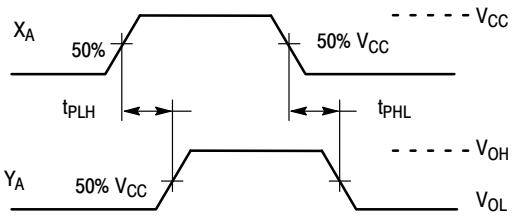


Figure 14. Propagation Delay, Analog In to Analog Out Waveforms

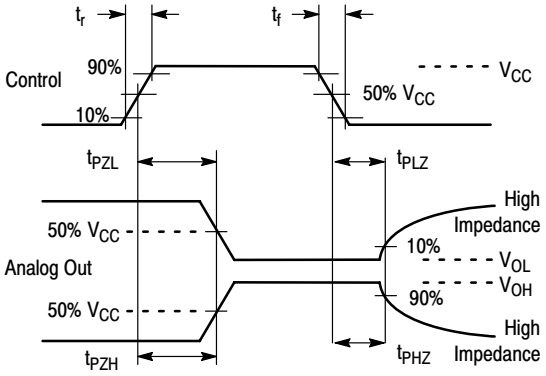


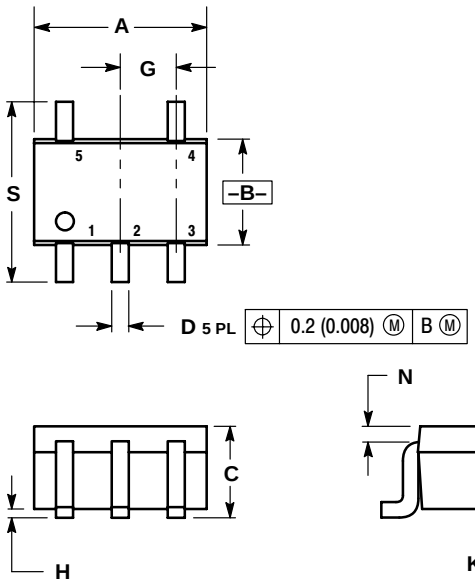
Figure 15. Propagation Delay, ON/OFF Control

DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature						Package Type (Name/SOT#/ Common Name)	Tape and Reel Size
	Circuit Indicator	Temp Range Identifier	Technology	Device Function	Package Suffix	Tape & Reel Suffix		
L74VHC1G66DFT1	L	74	VHC1G	66	DF	T1	SC–70/SC–88A/ SOT–353	178 mm (7 in) 3000 Unit
L74VHC1G66DFT2	L	74	VHC1G	66	DF	T2	SC–70/SC–88A/ SOT–353	178 mm (7 in) 3000 Unit
L74VHC1G66DFT4	L	74	VHC1G	66	DF	T4	SC–70/SC–88A/ SOT–353	330 mm (13 in) 10,000 Unit
L74VHC1GT66DTT1	L	74	VHC1G	66	DT	T1	SOT–23/TSOPS/ SC–59	178 mm (7 in) 3000 Unit
L74VHC1G66DTT3	L	74	VHC1G	66	DT	T3	SOT–23/TSOPS/ SC–59	330 mm (13 in) 10,000 Unit

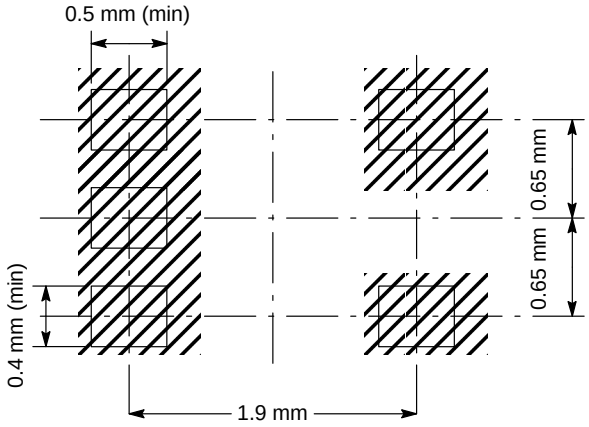
PACKAGE DIMENSIONS

SC70–5/SC–88A/SOT–353
DF SUFFIX



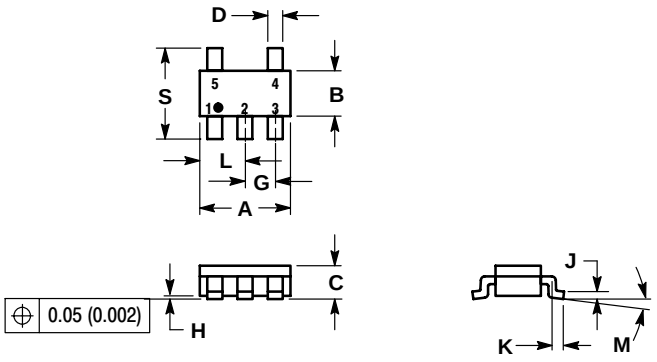
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A–01 OBSOLETE. NEW STANDARD 419A–02.

	INCHES		MILLIMETERS	
DIM	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



PACKAGE DIMENSIONS

SOT23–5/TSOP–5/SC59–5
DT SUFFIX



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.

	MILLIMETERS		INCHES	
DIM	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