Features

- Single-Supply Operation from +1.8V~+6V
- Rail-to-Rail Input/Output
- Gain-Bandwidth Product: 1MHz (Typ.)
- Low Input Bias Current: 1pA (Typ.)
- Low Offset Voltage: 3.5mV (Max.)
- Quiescent Current: 75μA per Amplifier (Typ.)
- Embedded RF Anti-EMI Filter
- Operating Temperature: -40°C~+125°C

Applications

- ASIC Input or Output Amplifier
- Sensor Interface
- Medical Communication
- Smoke Detectors
- Audio Output
- Piezoelectric Transducer Amplifier
- Medical Instrumentation
- Portable Systems

Small Package

- LMV321 Available in SOT23-5 and SC70-5 Packages

General Description

The LMV321 family have a high gain-bandwidth product of 1MHz, a slew rate of 0.8V/μs, and a quiescent current of 75μA/amplifier at 5V. The LMV321 family is designed to provide optimal performance in low voltage and low noise systems. They provide rail-to-rail output swing into heavy loads. The input common mode voltage range includes ground, and the maximum input offset voltage is 3.5mV for LMV321 family. They are specified over the extended industrial temperature range (-40℃ to+125℃). The operating range is from 1.8V to 6V. The LMV321 single is available in Green SC70-5 and SOT23-5 packages

Package/Ordering Information

Part No.	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
LMV321	SOT23-5	Tape and Reel,3000	Refer to Marking rule
LMV321	SC70-5		

Pin Configuration

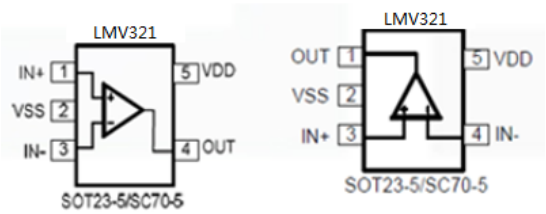


Figure 1. Pin Assignment Diagram

Absolute Maximum Ratings

Condition	Min	Max
Power Supply Voltage(V_{DD} to V_{SS})	-0.5V	+7.5V

Analog Input Voltage(IN+ or IN-)	Vss-0.5V	V_{DD}+0.5V
PDB Input Voltage	Vss-0.5V	+7V
Operating Temperature Range	-45℃	+125℃
Junction Temperature	+160℃	
Storage Temperature Range	-55℃	+150℃
Lead Temperature(soldering, 10sec)	+260℃	
Package Thermal Resistance(T_A=+25℃)		
SC70-5,θJA	242℃/W	
SOT23-5,θJA	190℃/W	
ESD Susceptibility		
HBM	6KV	
MM	400V	

Note: Stress greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is astress rating only and functional operation of the device at these or any other conditions outside those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability

Electrical Characteristics(At V_S=+5V, R_L=100kΩ connected to VS/2, and V_{OUT}=VS/2, unless otherwise noted.)

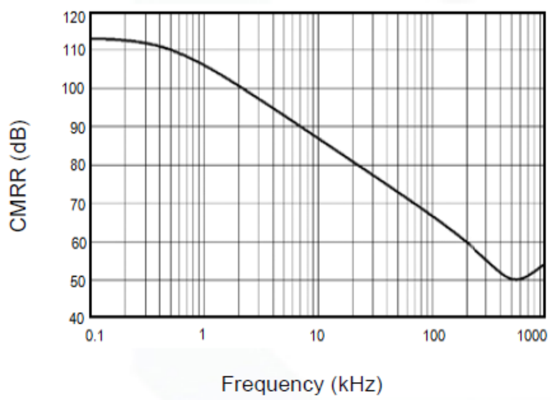
PARAMETER	SYMBOL	CONDITIONS	LMV321				
			TYP	MIN/MAX OVER TEMPERATURE			
			+25℃	+25℃	-40℃to +85℃	UNITS	MIN/ MAX
INPUT CHARACTERISTICS							
Input Offset Voltage	VOS	V_{CM}=VS/2	0.8	3.5	5.6	mV	MAX
Input Bias Current	IB		1			pA	TYP
Input Offset Current	IOS		1			pA	TYP
Common-Mode Voltage Range	VCM	V_S=5.5V	-0.1 to+5.6			V	TYP
Common-Mode Rejection Ratio	CMRR	V_S=5.5V, V_{CM}=-0.1V to 4V	70	62	62	dB	MIN
		V_S=5.5V, V_{CM}=-0.1V to 5.6V	68	56	55		
Open-Loop Voltage Gain	AOL	R_L=5kΩ, V_O=+0.1V to+4.9V	80	70	70	dB	MIN
		R_L=10kΩ, V_O=+0.1V to +4.9V	100	94	85		
Input Offset Voltage Drift	ΔVOS/ΔT		2.7			μV/℃	TYP
OUTPUT CHARACTERISTICS							
Output Voltage Swing from Rail	VOH	R_L=100kΩ	4.997	4.98	4.97	V	MIN
	VOL	R_L=100kΩ	5	20	30	mV	MAX
	VOH		4.992	4.97	4.96	V	MIN
	VOL	R_L=10kΩ	8	30	40	mV	MAX

Output Current	ISOURCE	R_L=10Ω to VS/2	84	60	45	mA	MIN
	ISINK		75	60	45		
POWER SUPPLY							
Operating Voltage Range				1.8	1.8	V	MIN
				6	6	V	MAX
Power Supply Rejection Ratio	PSRR	V_S=+2.5V to +6V, V_{CM}=+0.5V	82	60	58	dB	MIN
Quiescent Current/Amplifier	IQ		75	110	125	μA	MAX
DYNAMIC PERFORMANCE (CL = 100pF)							
Gain-Bandwidth Product	GBP		1			MHz	TYP
Slew Rate	SR	G=+1, 2V Output Step	0.8			V/μs	TYP
Settling Time to 0.1%	tS	G=+1, 2V Output Step	5.3			μs	TYP
Overload Recovery Time		V_{IN} ·Gain=VS	2.6			μs	TYP
NOISE PERFORMANCE							
Voltage Noise Density	en	f=1kHz	27			nV / Hz	TYP
		f=10kHz	20			nV / Hz	TYP

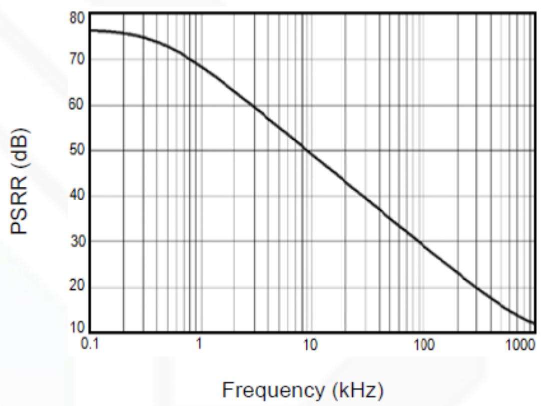
Typical Performance characteristics

(At T_A=+25℃, Vs=5V, R_L=100KΩ connected to VS/2 and V_{OUT}= VS/2, unless otherwise noted)

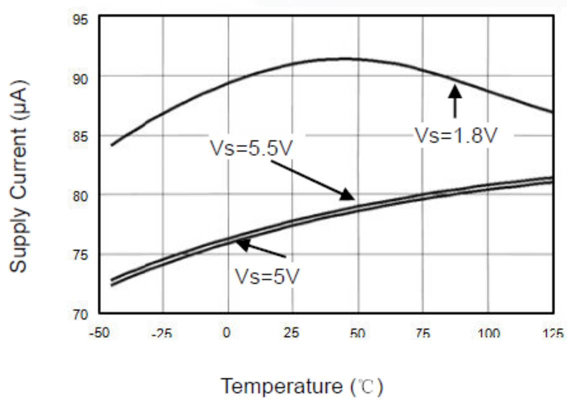
CMRR vs. Frequency



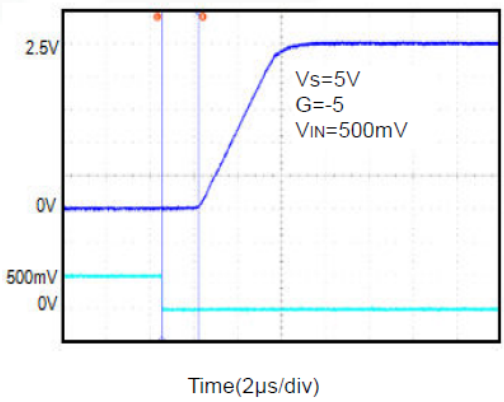
PSRR vs. Frequency



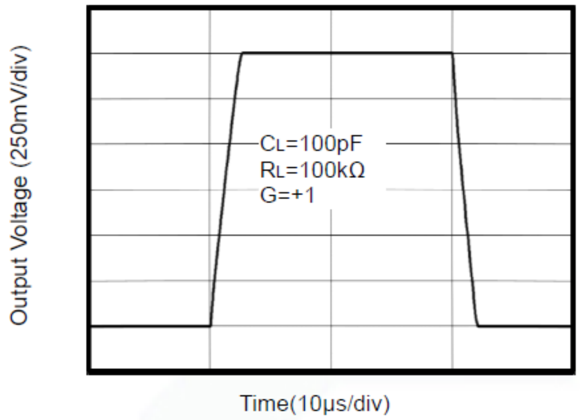
Supply Current vs. Temperature



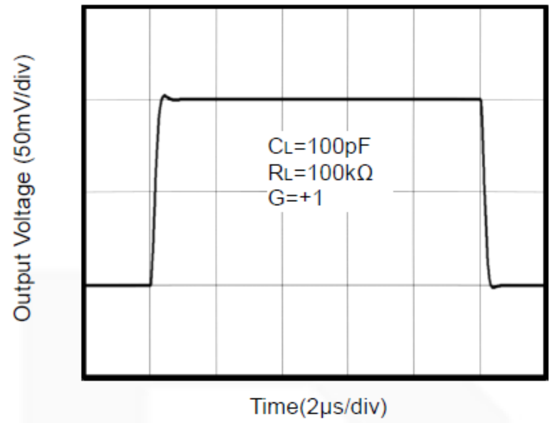
Overload Recovery Time



Large Signal Transient Response

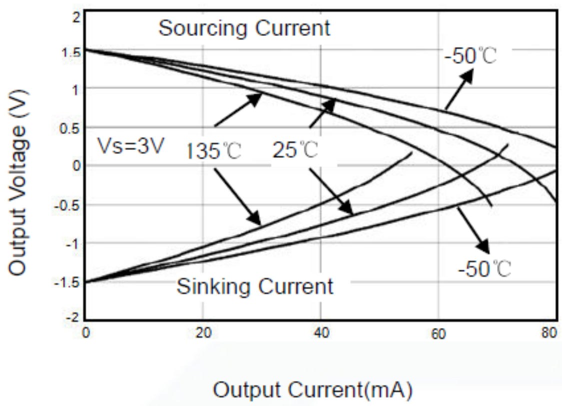


Small Signal Transient Response

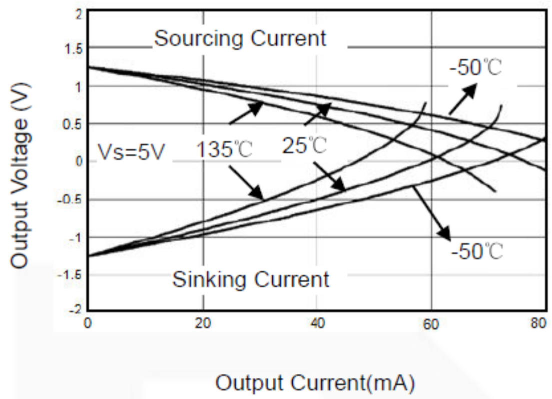


Typical Performance characteristics(At T_A=+25℃, R_L=100KΩ connected to VS/2 and V_{OUT} = VS/2, unless otherwise noted.)

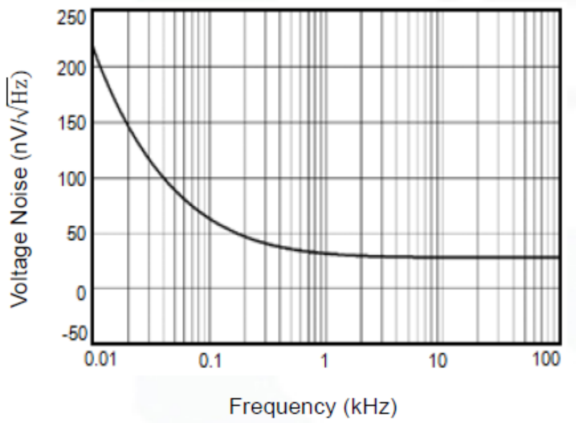
Output Voltage Swing vs.Output Current



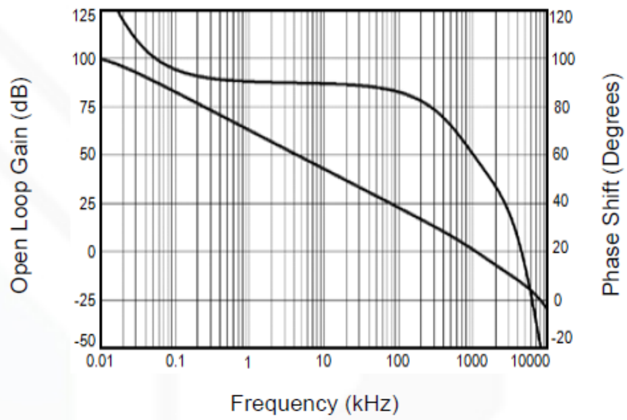
Output Voltage Swing vs.Output Current



Input Voltage Noise Spectral Density vs. Frequency



Open Loop Gain, Phase Shift vs. Frequency



Application Note/Size

LMV321 family series op amps are unity-gain stable and suitable for a wide range of general-purpose applications. The small footprints of the LMV321 family packages save space on printed circuit boards and enable the design of smaller electronic products.

Power Supply Bypassing and Board Layout

LMV321 family series operates from a single 1.8V to 6V supply or dual ±0.9V to ±3V supplies. For best performance, a 0.1μF ceramic capacitor should be placed close to the V_{DD} pin in single supply operation. For dual supply operation, both V_{DD} and V_{SS} supplies should be bypassed to ground with separate 0.1μF ceramic capacitors.

Low Supply Current

The low supply current (typical 75μA per channel) of LMV321 family will help to maximize battery life. They are ideal for battery powered systems

Operating Voltage

LMV321 family operates under wide input supply voltage (1.8V to 6V). In addition, all temperature specifications apply from-40℃to+125℃. Most behavior remains unchanged throughout the full operating voltage range. These guarantees ensure operation throughout the single Li-Ion battery lifetime

Rail-to-Rail Input

The input common-mode range of LMV321 family extends 100mV beyond the supply rails (V_{SS}-0.1V to V_{DD}+0.1V). This is achieved by using complementary input stage. For normal operation, inputs should be limited to this range.

Rail-to-Rail Output

Rail-to-Rail output swing provides maximum possible dynamic range at the output. This is particularly important when operating in low supply voltages. The output voltage of LMV321 family can typically swing to less than 10mV from supply rail in light resistive loads (>100kΩ), and 60mV of supply rail in moderate resistive loads (10kΩ).

Capacitive Load Tolerance

The LMV321 family is optimized for bandwidth and speed, not for driving capacitive loads. Output capacitance will create a pole in the amplifier’s feedback path, leading to excessive peaking and potential oscillation. If dealing with load capacitance is a requirement of the application, the two strategies to consider are (1) using a small resistor in series with the amplifier’s output and the load capacitance and (2) reducing the bandwidth of the amplifier’ s feedback loop by increasing the overall noise gain. Figure 2 shows a unity gain follower using the series resistor strategy. The resistor isolates the output from the capacitance and, more importantly, creates a zero in the feedback path that compensates for the pole created by the output capacitance.

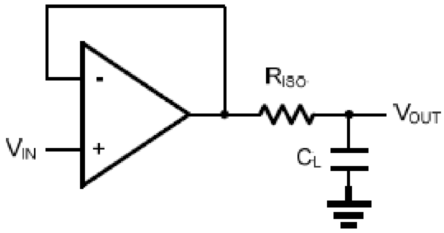


Figure 2 Indirectly Driving a Capacitive Load Using Isolation Resistor

The bigger the RISO resistor value, the more stable V_{OUT} will be. However, if there is a resistive load RL in parallel with the capacitive load, a voltage divider (proportional to RISO/RL) is formed, this will result in a gain error. The circuit in Figure 3 is an improvement to the one in Figure 2. RF provides the DC accuracy by feed-forward the VIN to RL. CF and RISO serve to counteract the loss of phase margin by feeding the high frequency component of the output signal back to the amplifier’ s inverting input, thereby preserving the phase margin in the overall feedback loop. Capacitive drive can be increased by increasing the value of CF. This in turn will slow down the pulse response.

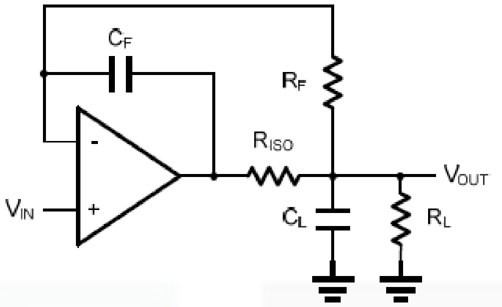


Figure 3. Indirectly Driving a Capacitive Load with DC Accuracy

Typical Application Circuits/Differential amplifier

The differential amplifier allows the subtraction of two input voltages or cancellation of a signal common the two inputs. It is useful as a computational amplifier in making a differential to single-end conversion or in rejecting a common mode signal. Figure 4.shown the differential amplifier using LMV321 family

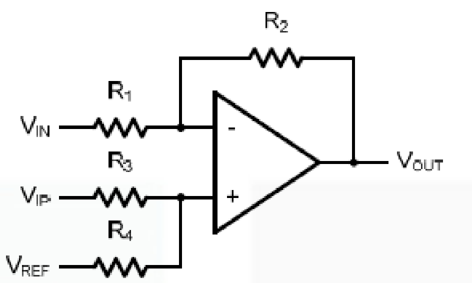


Figure 4. Differential Amplifier

$$V_{OUT}=(\frac{R1+R2}{R3+R4})\frac{R4}{R1}V_{IN}-\frac{R2}{R1}V_{IP}+(\frac{R1+R2}{R3+R4})\frac{R3}{R1}V_{REF}$$

If the resistor ratios are equal (i.e. R1=R3 and R2=R4), then

$$V_{OUT}=\frac{R2}{R1}(V_{IP}-V_{IN})+V_{REF}$$

Low Pass Active Filter

The low pass active filter is shown in Figure 5. The DC gain is defined by –R2/R1. The filter has a -20dB/decade roll-off after its corner frequency ƒC=1/(2πR3C1).

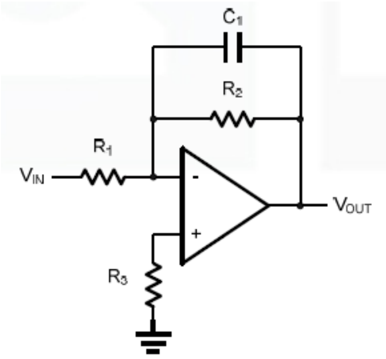


Figure 5. Low Pass Active Filter

Instrumentation Amplifier

The triple LMV321 family can be used to build a three-op-amp instrumentation amplifier as shown in Figure 6. The amplifier in Figure 6 is a high input impedance differential amplifier with gain of R2/R1. The two differential voltage followers assure the high input impedance of the amplifier.

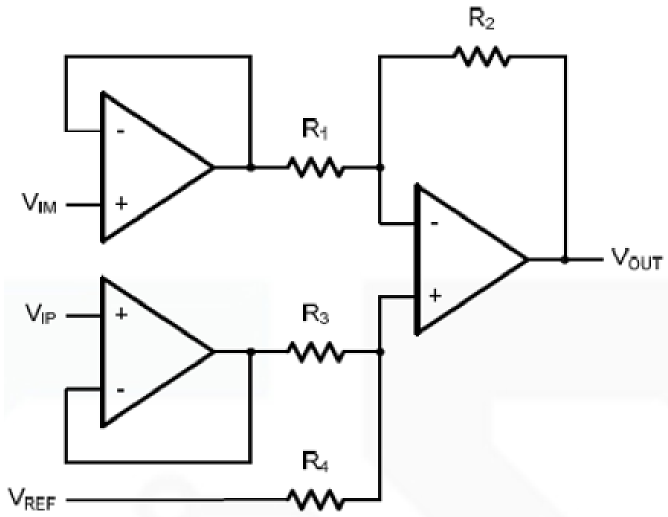
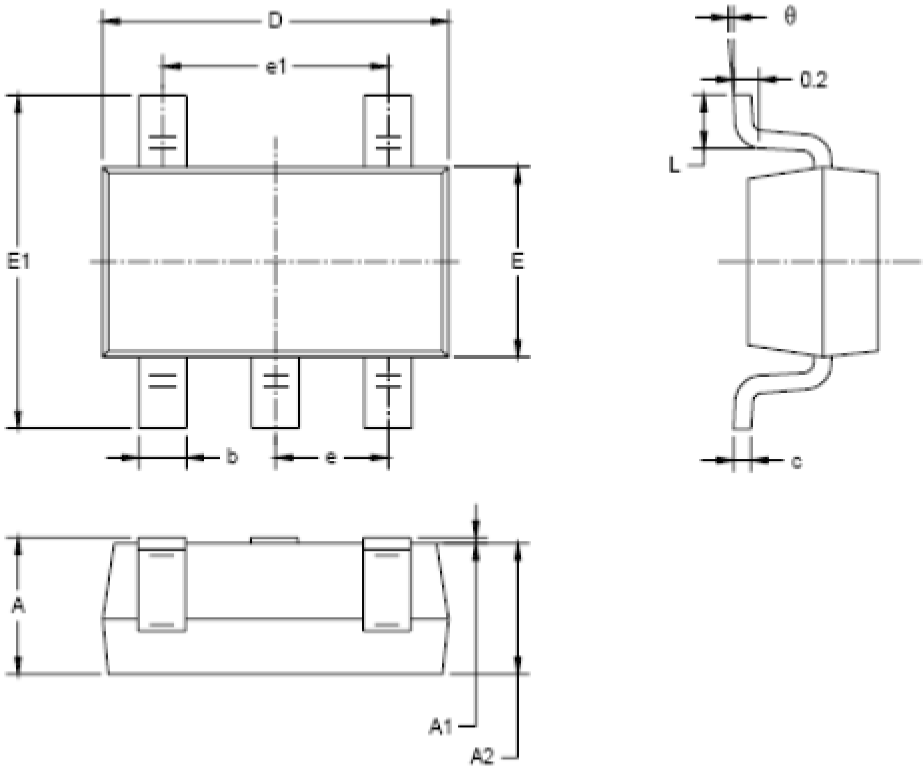


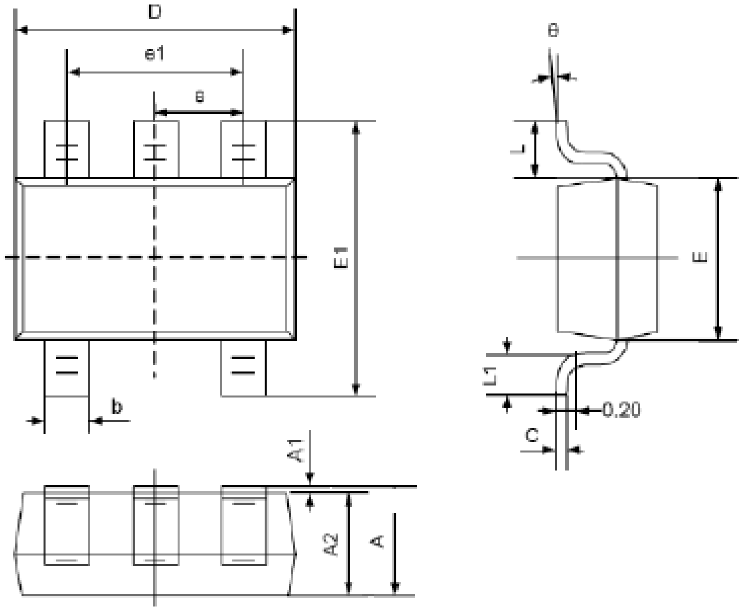
Figure 6. Instrument Amplifier

SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SC70-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.9	1.1	0.035	0.043
A1	0	0.1	0	0.004
A2	0.9	1	0.035	0.039
b	0.15	0.35	0.006	0.014
C	0.08	0.15	0.003	0.006
D	2	2.2	0.079	0.087
E	1.15	1.35	0.045	0.053
E1	2.15	2.45	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.2	1.4	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.26	0.46	0.01	0.018
θ	0°	8°	0°	8°