



DESCRIPTION

The AO1369 has a high gain-bandwidth product of 14.5KHz, a slew rate of 6V/ms, and a quiescent current of 600nA/amplifier at 5V.

The AO1369 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 3mV for AO1369.

AO1369 is specified over the extended industrial temperature range (-40°C to +125°C).

The operating range is from 1.4V to 5.5V.

The AO1369 is available in SOT-25 and SC70-5, Packages.

ORDERING INFORMATION

Package Type	Part Number	
SOT-25 SPQ: 3,000pcs/Reel	E5	AO1369E5R
		AO1369E5VR
SC70-5 SPQ: 3,000pcs/Reel	C5	AO1369C5R
		AO1369C5VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

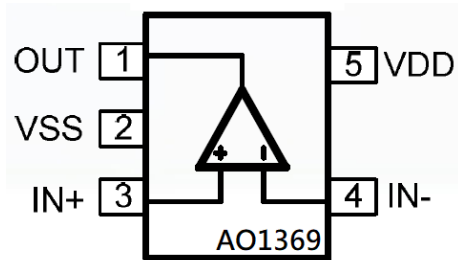
FEATURE

- Single-Supply Operation from +1.4V ~ +5.5V
- Rail-to-Rail Input / Output
- Gain-Bandwidth Product: 14.5KHz (Typ)
- Low Input Bias Current: 1pA (Typ)
- Low Offset Voltage: 3mV (Max)
- Quiescent Current: 600nA per Amplifier (Typ)
- Operating Temperature: -40°C ~ +125°C
- Embedded RF Anti-EMI Filter

APPLICATION

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

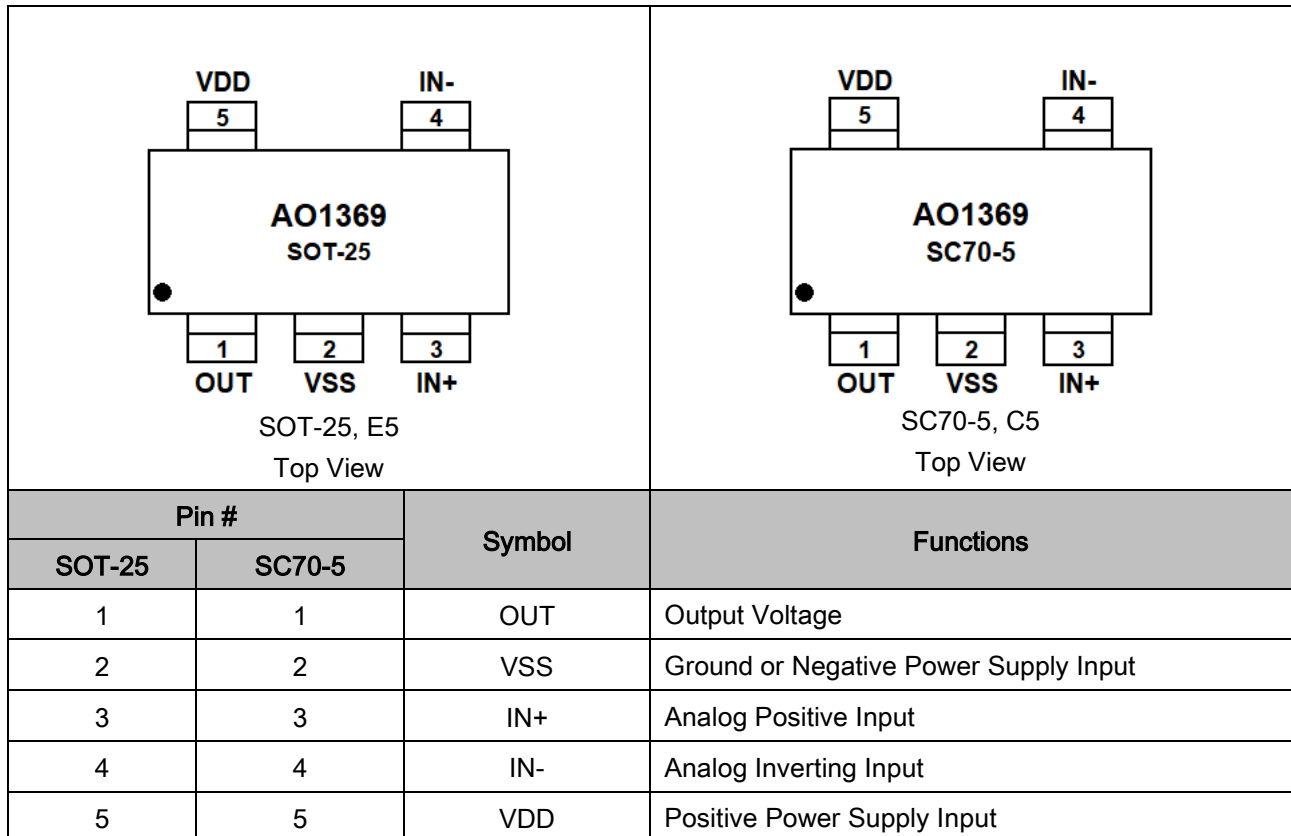
TYPICAL APPLICATION



SOT-25/SC70-5



PIN DESCRIPTION





ABSOLUTE MAXIMUM RATINGS

Power Supply Voltage (V_{DD} to V_{SS})	-0.5V ~ +7.5V	
Analog Input Voltage (IN+ or IN-)	$V_{SS}-0.5V \sim V_{DD}+0.5V$	
PDB Input Voltage	$V_{SS}-0.5V \sim +7V$	
Operating Temperature Range	-40°C ~ +125°C	
Junction Temperature	+160°C	
Storage Temperature Range	-55°C ~ +150°C	
Lead Temperature (soldering, 10sec)	+260°C	
Package Thermal Resistance θ_{JA} ($T_A=+25^\circ C$)	SOT-25	190°C/W
	SC70-5	333°C/W
ESD Susceptibility	HBM	6KV
	MM	300V

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



ELECTRICAL CHARACTERISTICS

$V_S = +5V$, $R_L = 1M\Omega$ connected to $V_S/2$, and $V_{OUT} = V_S/2$, unless otherwise noted

Parameter	Symbol	Conditions	Typ.	Min.	Max.	Unit
INPUT CHARACTERISTICS						
Input Offset Voltage	V_{OS}	$V_{CM} = V_S/2$	0.4	-	3	mV
Input Bias Current	I_B	-	1	-	-	pA
Input Offset Current	I_{OS}	-	1	-	-	pA
Common-Mode Voltage Range	V_{CM}	$V_S = 5.5V$	-0.1 to +5.6	-	-	V
Common-Mode Rejection Ratio	C_{MRR}	$V_S = 5V$, $V_{CM} = -0.1V$ to $2.5V$	78	66	-	dB
		$V_S = 5V$, $V_{CM} = -0.1V$ to $5.1V$	84	67	-	
Open-Loop Voltage Gain	A_{OL}	$V_S=1.4V$, $R_L = 50k\Omega$, $V_O = V_S-0.1V$	86	75	-	dB
		$V_S=5V$, $R_L = 50k\Omega$, $V_O = V_S-0.1V$	93	84	-	
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	-	2.5	-	-	$\mu V/^\circ C$
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	V_{OH}	$V_S=1.4V$, $R_L = 50k\Omega$	1.395	1.390	-	V
	V_{OL}		4.5	-	10	mV
	V_{OH}	$V_S=5V$, $R_L = 50k\Omega$	4.997	4.990	-	V
	V_{OL}		3.5	-	10	mV
Output Current	I_{SOURCE}	$R_L = 10\Omega$ to $V_S/2$	20	-	-	mA
	I_{SINK}		20	-	-	mA
POWER SUPPLY						
Operating Voltage Range			1.4	-	-	V
			5.5	-	-	V
Power Supply Rejection Ratio	P_{SRR}	$V_S = +1.4V$ to $+5.5V$, $V_{CM} = +0.5V$	80	77	-	dB
Quiescent Current / Amplifier	I_Q		600	-	-	nA
DYNAMIC PERFORMANCE ($C_L = 100pF$)						
Gain-Bandwidth Product	G_{BP}		14.5	-	-	KHz
Slew Rate	S_R	$G = +1$, 2V Output Step	6	-	-	V/ms



TYPICAL PERFORMANCE CHARACTERISTICS

Fig.1 Large Signal Inverting Pulse Response

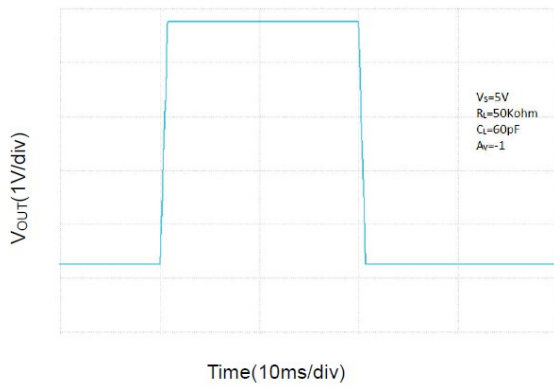


Fig.2 Large Signal Non-Inverting Pulse Response

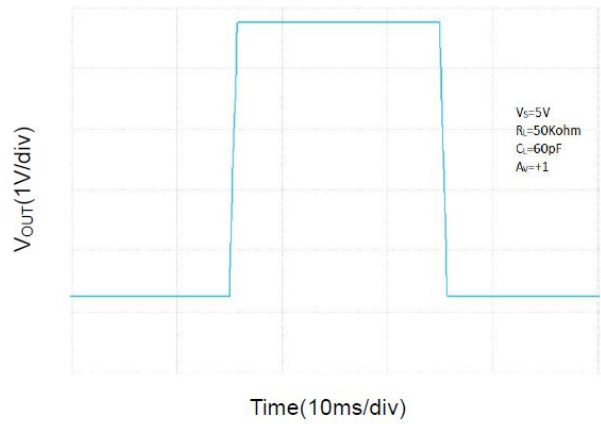


Fig.3 Small Signal Inverting Pulse Response

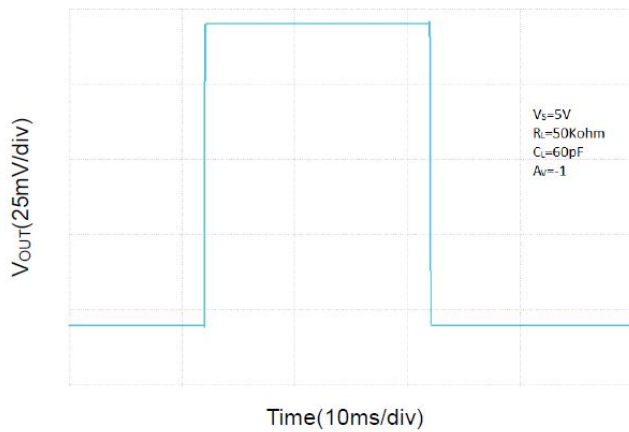


Fig.4 Small Signal Non-Inverting Pulse Response

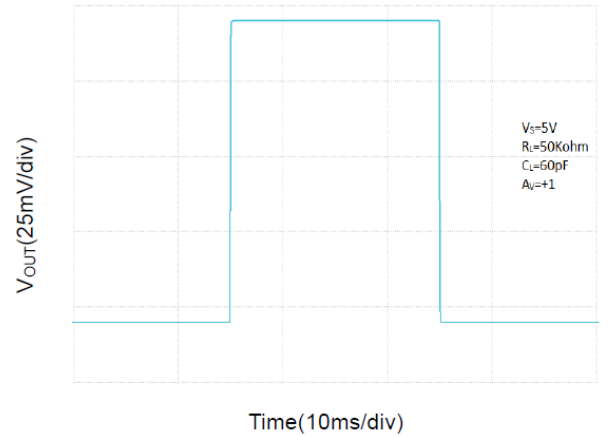


Fig.5 No Phase Reversal

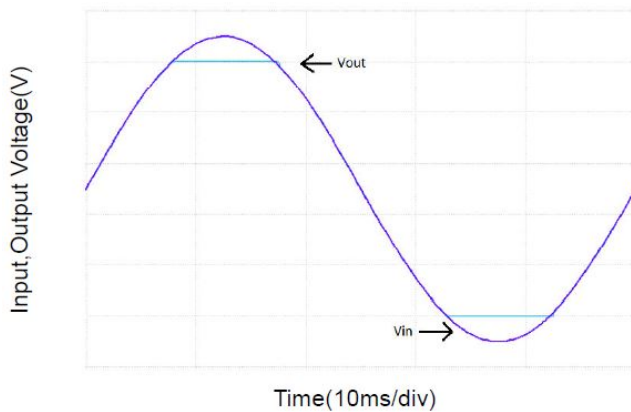
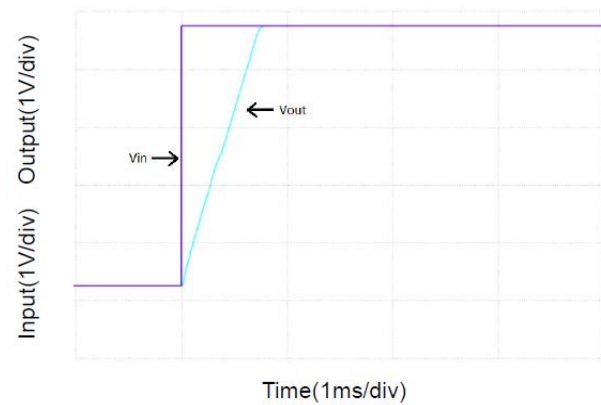
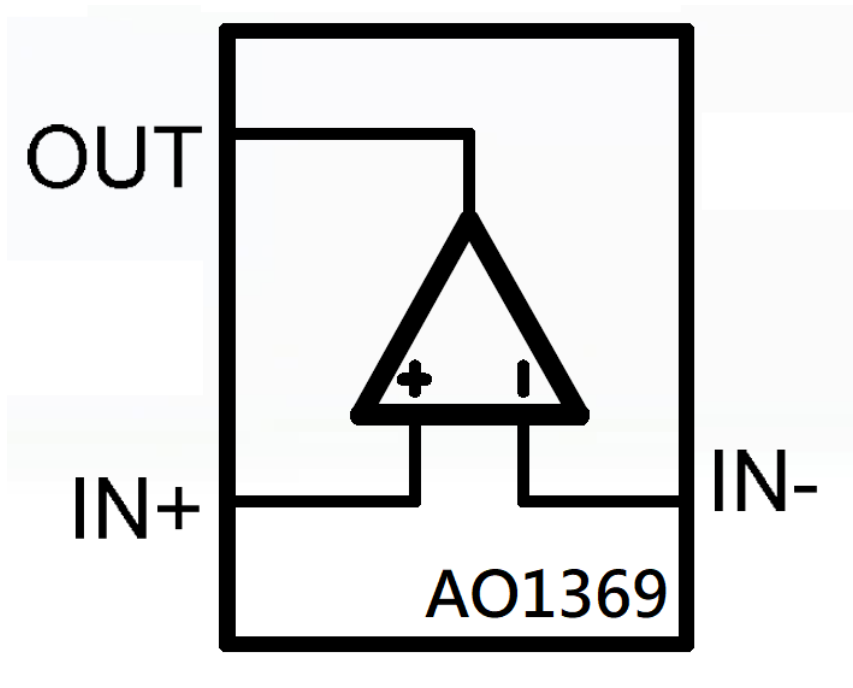


Fig.6 Output Settling Time





BLOCK DIAGRAM



DETAILED INFORMATION

The AO1369 op amp is unity-gain stable and suitable for a wide range of general-purpose applications.

The small footprints of the AO1369 packages save space on printed circuit boards and enable the design of smaller electronic products.

Power Supply Bypassing and Board Layout

The AO1369 operates from a single 1.4V to 5.5V supply or dual $\pm 0.7V$ to $\pm 2.75V$ supplies. For best performance, a 0.1 μF 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 0.1 μF ceramic capacitors.

Low Supply Current

The low supply current (typical 600nA per channel) of the AO1369 will help to maximize battery life. AO1369 is ideal for battery powered systems.



Operating Voltage

The AO1369 operates under wide input supply voltage (1.4V to 5.5V). In addition, all temperature specifications apply from -40°C to +125°C. 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 AO1369 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 AO1369 family can typically swing to less than 50mV from supply rail in light resistive loads (>50kΩ).

Capacitive Load Tolerance

The AO1369 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 first, using a small resistor in series with the amplifier's output and the load capacitance and reducing the bandwidth of the amplifier's feedback loop by increasing the overall noise gain. Figure 1. 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.

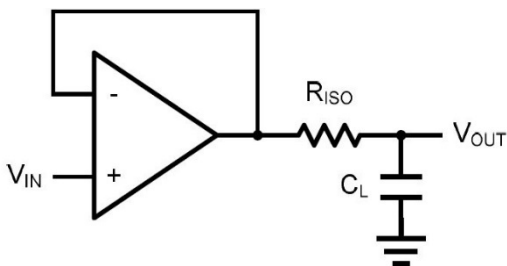


Figure 1. Indirectly Driving a Capacitive Load Using Isolation Resistor

The bigger the R_{ISO} resistor value, the more stable V_{OUT} will be. However, if there is a resistive load R_L in parallel with the capacitive load, a voltage divider (proportional to R_{ISO}/R_L) is formed, this will result in a gain error.



The circuit in Figure 2 is an improvement to the one in Figure 1. 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.

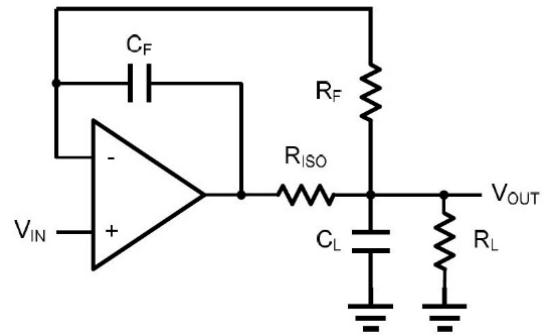


Figure 2. Indirectly Driving a Capacitive Load with DC Accuracy

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 3. shown the differential amplifier using AO1369.

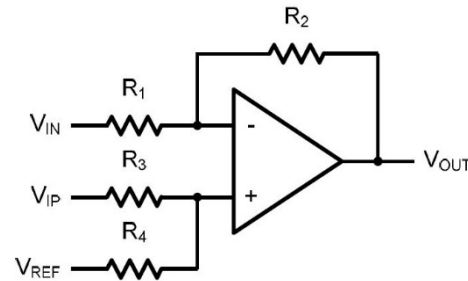


Figure 3. Differential Amplifier

$$V_{OUT} = \left(\frac{R_1+R_2}{R_3+R_4}\right) \frac{R_4}{R_1} V_{IN} - \frac{R_2}{R_1} V_{IP} + \left(\frac{R_1+R_2}{R_3+R_4}\right) \frac{R_3}{R_1} V_{REF}$$

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

$$V_{OUT} = \frac{R_2}{R_1} (V_{IP} - V_{IN}) + V_{REF}$$

Low Pass Active Filter

The low pass active filter is shown in Figure 4. The DC gain is defined by -R2/R1. The filter has a -20dB/decade roll-off after its corner frequency $f_c = 1/(2\pi R_3 C_1)$.

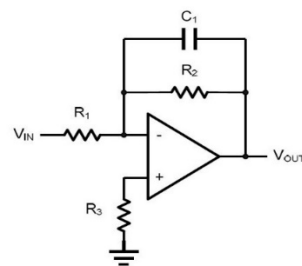


Figure 4. Low Pass Active Filter

Instrumentation Amplifier

The triple AO1369 family can be used to build a three-op-amp instrumentation amplifier as shown in Figure 5. The amplifier in Figure 5 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.

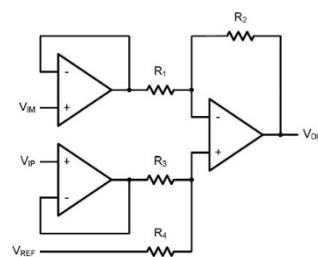
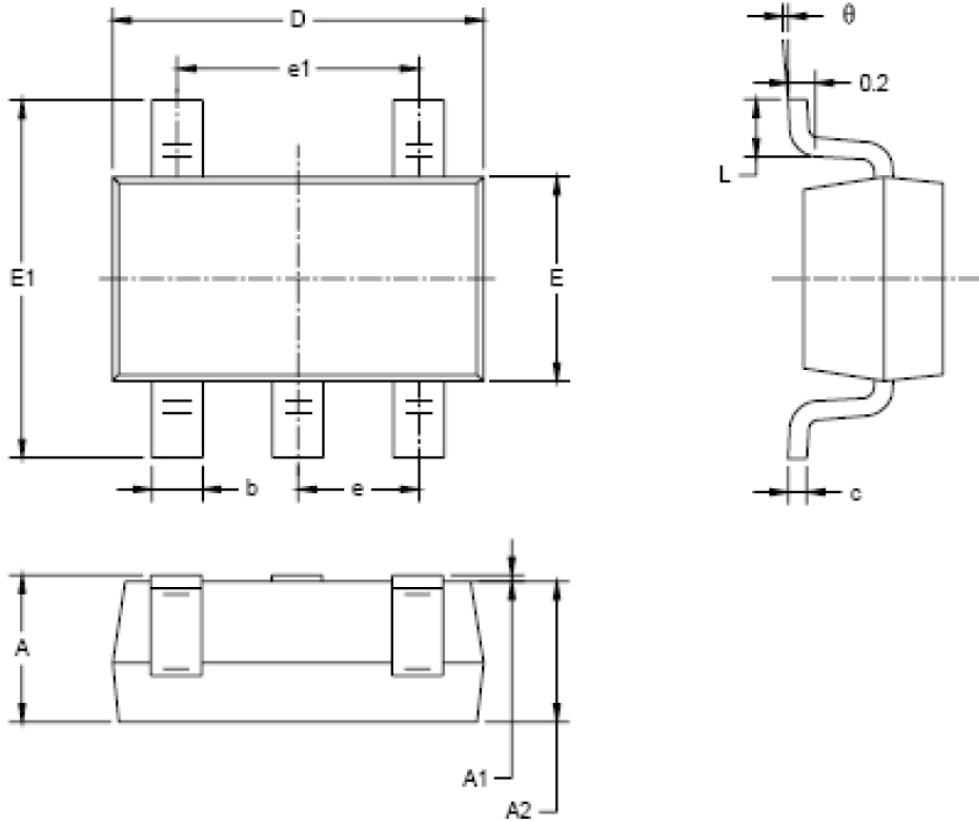


Figure 5. Instrument Amplifier



PACKAGE INFORMATION

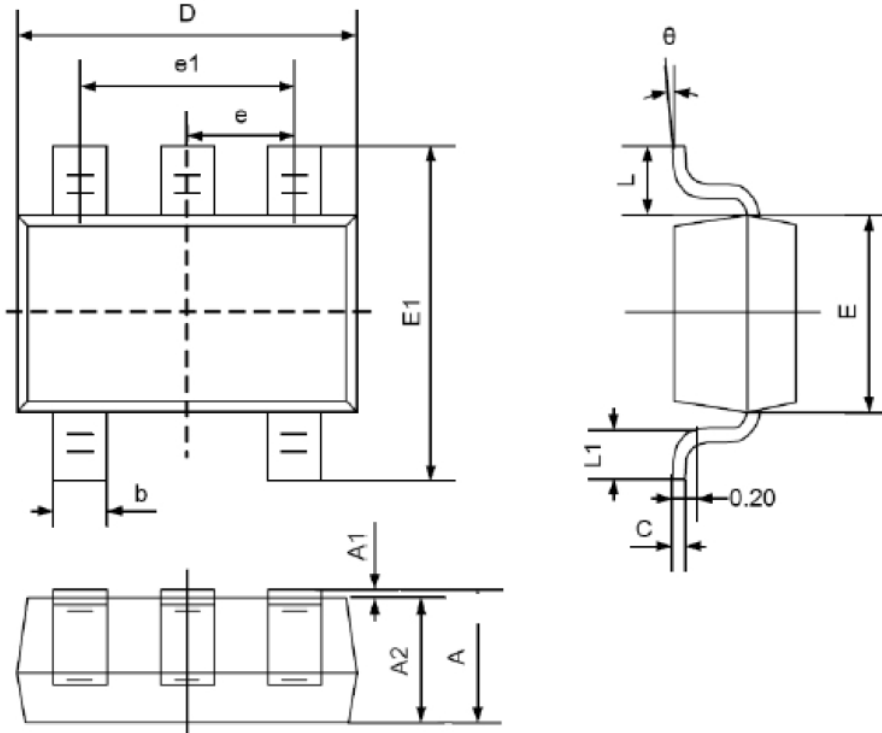
Dimension in SOT23-5 (Unit: mm)



Symbol	MILLIMETERS	
	Min.	Max.
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
E	1.500	1.700
E1	2.650	2.950
e	0.950 BSC	
e1	1.900 BSC	
L	0.300	0.600
θ	0°	8°



Dimension in SC70-5 (Unit: mm)



Symbol	Min.	Max.
A	0.900	1.100
A1	0.000	0.100
A2	0.900	1.000
b	0.150	0.350
C	0.080	0.150
D	2.000	2.200
E	1.150	1.350
E1	2.150	2.450
e	0.650TYP	
e1	1.200	1.400
L	0.525REF	
L1	0.260	0.460
θ	0°	8°



IMPORTANT NOTICE

AiT Semiconductor Inc. (AiT) reserves the right to make changes to any its product, specifications, to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

AiT Semiconductor Inc. integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices or systems or other critical applications. Use of AiT products in such applications is understood to be fully at the risk of the customer. As used herein may involve potential risks of death, personal injury, or server property, or environmental damage. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

AiT Semiconductor Inc. assumes to no liability to customer product design or application support. AiT warrants the performance of its products of the specifications applicable at the time of sale.