

**SINGLE LOW VOLTAGE RAIL-TO-RAIL
OUTPUT OPERATIONAL AMPLIFIER**

Description

The AZV321 is single low voltage (2.7V to 5.5V) operational amplifier which has rail-to-rail output swing capability. The input common-mode voltage range includes ground. The chip exhibits excellent speed-power ratio, achieving 1MHz of bandwidth and 1V/ μ s of slew rate with low supply current.

The AZV321 is built with BiCMOS process. It has bipolar input and output stages for improved noise performance, low input offset and higher output current drive.

The AZV321 is available in the package of SC-70-5, which is approximately half the size of SOT-23-5. The small package saves space on pc boards, and enables the design of small portable electronic devices. It also allows the designer to place the device closer to the signal source to reduce noise pickup and increase signal integrity.

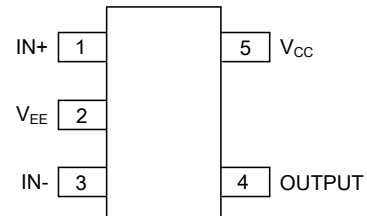
The AZV321 is also available in standard SOT-23-5 package.

Features (For $V_{CC}=5V$ and $V_{EE}=0V$, Typical unless Otherwise Noted)

- Guaranteed 2.7V to 5.5V Performance
- No Crossover Distortion
- Gain-Bandwidth Product 1MHz
- Industrial Temperature Range: $-40^{\circ}C$ to $+85^{\circ}C$
- Low Supply Current: 130 μ A
- Rail-to-Rail Output Swing under 10k Ω Load:
 V_{OH} up to $V_{CC}-10mV$
 V_{OL} near to $V_{EE}+65mV$
- V_{CM} : $-0.1V$ to $V_{CC}-0.8V$

Pin Assignments

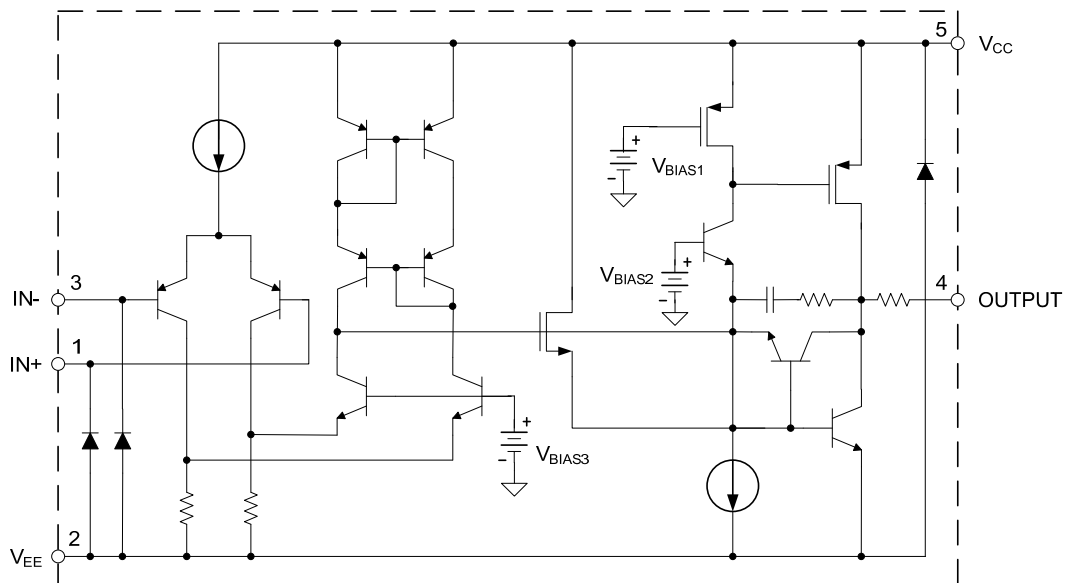
KS/K Package
(SC-70-5/SOT-23-5)



Applications

- Active Filters
- Low Power, Low Voltage Applications
- General Purpose Portable Devices
- Cellular Phone, Cordless Phone
- Battery-Powered Systems

Functional Block Diagram



Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Rating	Unit
V_{CC}	Power Supply Voltage	6	V
T_J	Operation Junction Temperature	150	°C
T_{STG}	Storage Temperature Range	-65 to 150	°C
T_{LEAD}	Lead Temperature (Soldering, 10 Seconds)	260	°C
	ESD (Machine Model)	200	V
	ESD (Human Body Model)	2000	V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” 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 under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	2.7	5.5	V
T_A	Ambient Operating Temperature Range	-40	85	°C

Electrical Characteristics

AZV321-2.7V Electrical Characteristics (All limits are guaranteed for $T_A=25^\circ\text{C}$, $V_{CC}=2.7\text{V}$, $V_{EE}=0\text{V}$, $V_{CM}=1.0\text{V}$, $V_O=V_{CC}/2$ and $R_L>1\text{M}\Omega$, limits in **bold types** are guaranteed for $T_A=-40^\circ\text{C}$ to 85°C , unless otherwise specified. Note 2)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage			1.7	7	mV
					9	
I_B	Input Bias Current			11	250	nA
					500	
I_{IO}	Input Offset Current			5	50	nA
					150	
V_{CM}	Input Common Mode Voltage Range	for $CMRR \geq 50\text{dB}$	-0.1		1.9	V
I_{CC}	Supply Current	$V_O=V_{CC}/2$, $A_{VCL}=1$, no load		80	170	μA
					270	
CMRR	Common Mode Rejection Ratio	$0 \leq V_{CM} \leq 1.7\text{V}$	50	65		dB
PSRR	Power Supply Rejection Ratio	$2.7\text{V} \leq V_{CC} \leq 5\text{V}$, $V_O=1\text{V}$	50	60		dB
I_{SOURCE}	Output Short Circuit Current	$V_O=0\text{V}$	5	20		mA
I_{SINK}		$V_O=2.7\text{V}$	10	30		mA
V_{OH}	Output Voltage Swing	$R_L=10\text{k}\Omega$ to 1.35V	2.60	2.69		V
V_{OL}				60	180	mV
GBWP	Gain Bandwidth Product	$C_L=200\text{pF}$		1		MHz
ϕ_M	Phase Margin			60		Deg
G_M	Gain Margin			10		dB

Note 2: Limits over the full temperature are guaranteed by design, but not tested in production.

Electrical Characteristics (Cont.)

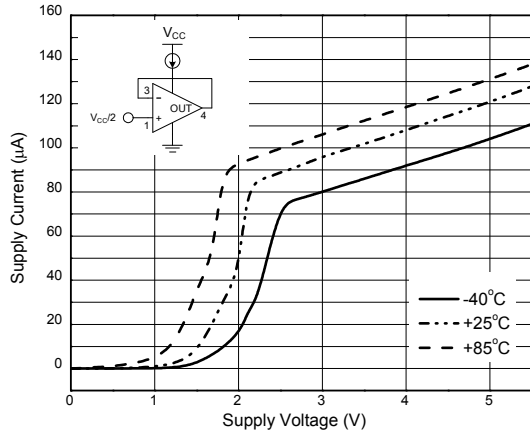
AZV321-5V Electrical Characteristics (All limits are guaranteed for $T_A=25^\circ\text{C}$, $V_{CC}=5\text{V}$, $V_{EE}=0\text{V}$, $V_{CM}=2.0\text{V}$, $V_O=V_{CC}/2$ and $R_L>1\text{M}\Omega$, limits in **bold types** are guaranteed for $T_A=-40^\circ\text{C}$ to 85°C , unless otherwise specified. Note 2)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage			1.7	7	mV
					9	
I_B	Input Bias Current			11	250	nA
					500	
I_{IO}	Input Offset Current			5	50	nA
					150	
V_{CM}	Input Common Mode Voltage Range	for $CMRR \geq 50\text{dB}$	-0.1		4.2	V
I_{CC}	Supply Current	$V_O=V_{CC}/2$, $A_{VCL}=1$, no load		130	250	μA
					350	
G_V	Large Signal Voltage Gain	$R_L=2\text{k}\Omega$	84	100		dB
			80			
CMRR	Common Mode Rejection Ratio	$0 \leq V_{CM} \leq 4\text{V}$	50	65		dB
PSRR	Power Supply Rejection Ratio	$2.7\text{V} \leq V_{CC} \leq 5\text{V}$, $V_O=1\text{V}$, $V_{CM}=1\text{V}$	50	60		dB
I_{SOURCE}	Output Short Circuit Current	$V_O=0\text{V}$	5	60		mA
I_{SINK}		$V_O=5\text{V}$	10	160		mA
V_{OH}	Output Voltage Swing	$R_L=2\text{k}\Omega$ to 2.5V	4.7	4.96		V
			4.6			
		$R_L=10\text{k}\Omega$ to 2.5V	4.9	4.99		
			4.8			
V_{OL}	Output Voltage Swing	$R_L=2\text{k}\Omega$ to 2.5V		120	300	mV
					400	
		$R_L=10\text{k}\Omega$ to 2.5V		65	180	
					280	
SR	Slew Rate		1		$\text{V}/\mu\text{S}$	
GBWP	Gain Bandwidth Product	$C_L=200\text{pF}$		1		MHz
ϕ_M	Phase Margin			60		Deg
G_M	Gain Margin			10		dB

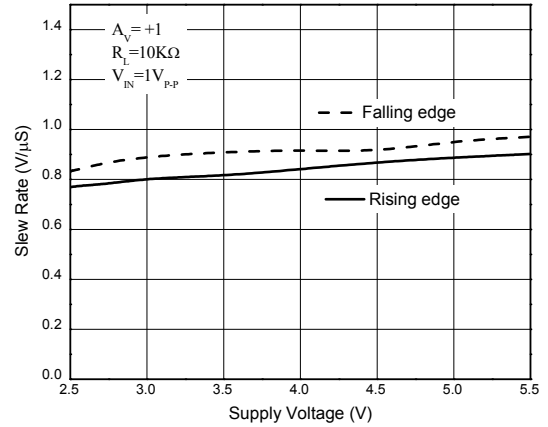
Note 2: Limits over the full temperature are guaranteed by design, but not tested in production.

Performance Characteristics

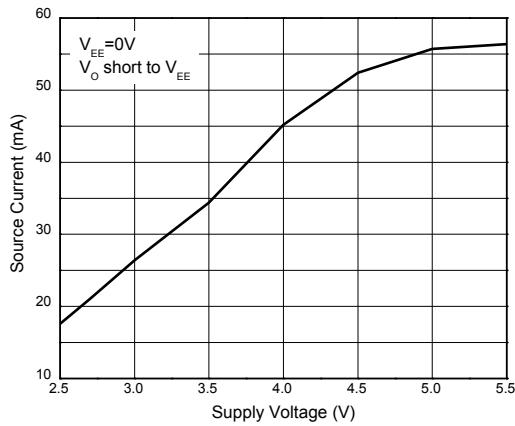
Supply Current vs. Supply Voltage



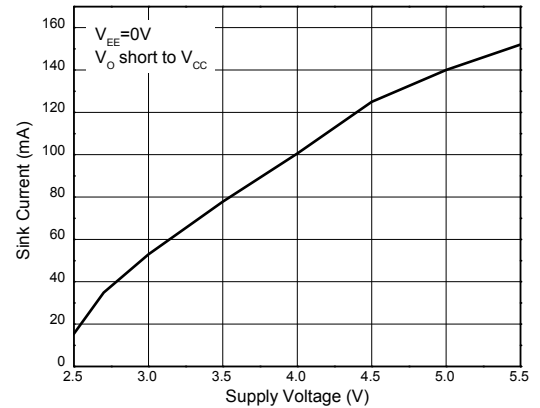
Slew Rate vs. Supply Voltage



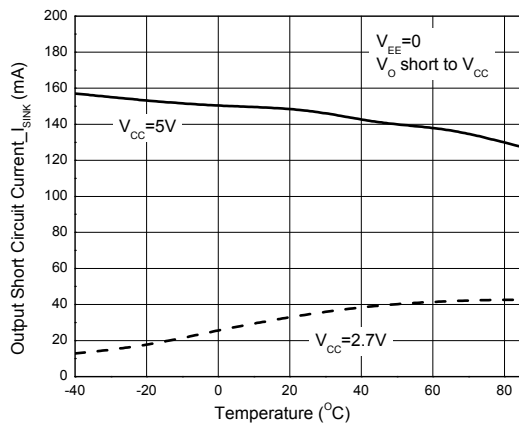
Output Source Current vs. Supply Voltage



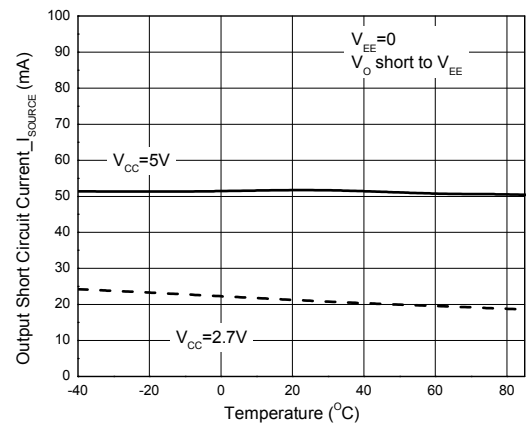
Output Sink Current vs. Supply Voltage



Short Circuit Current I_{SINK} vs. Temperature

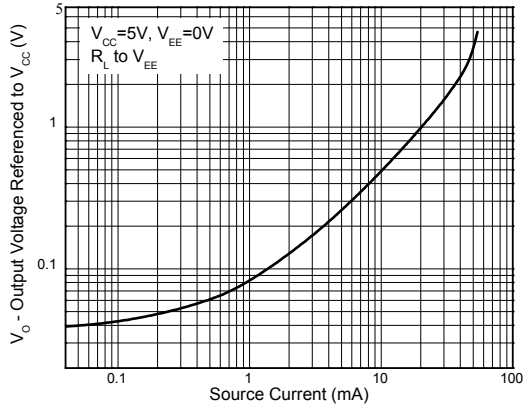


Short Circuit Current I_{SOURCE} vs. Temperature

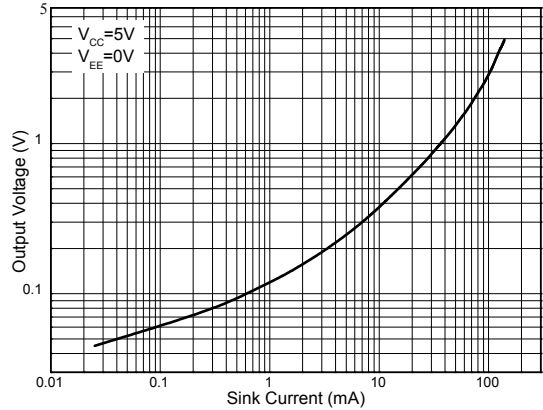


Performance Characteristics (Cont.)

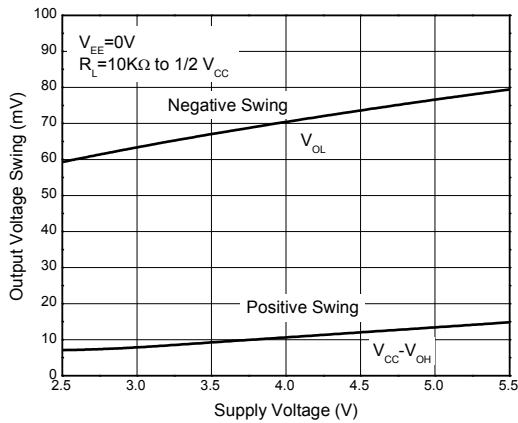
Output Voltage vs. Source Current



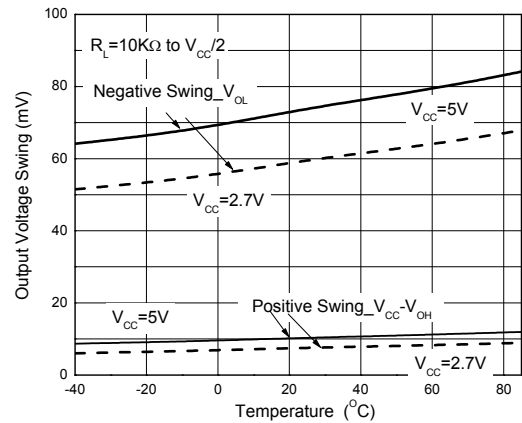
Output Voltage vs. Sink Current



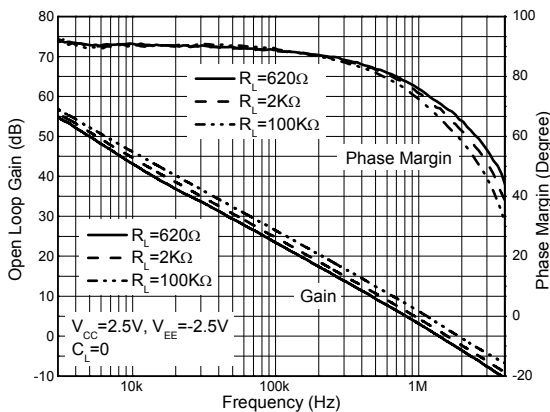
Output Voltage Swing vs. Supply Voltage



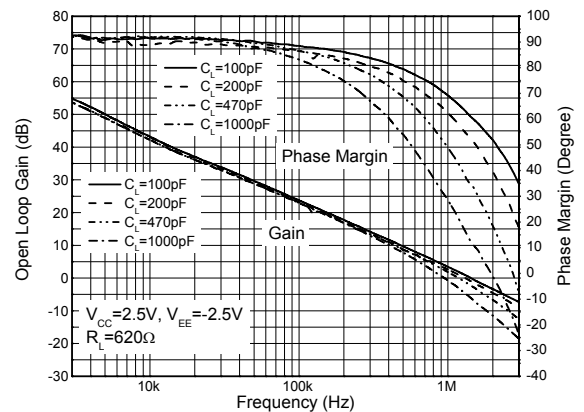
Output Voltage Swing vs. Temperature



Gain and Phase vs. Frequency and Resistive Load

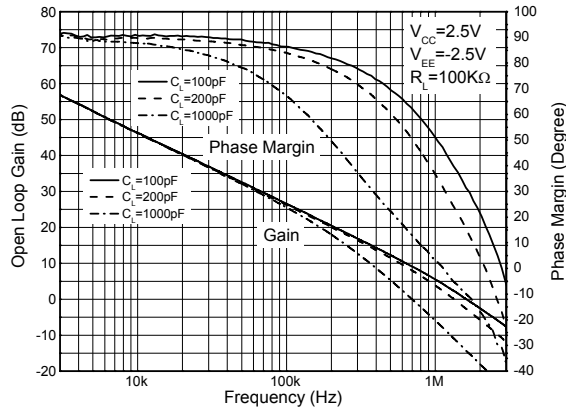


Gain and Phase vs. Frequency and Capacitive Load

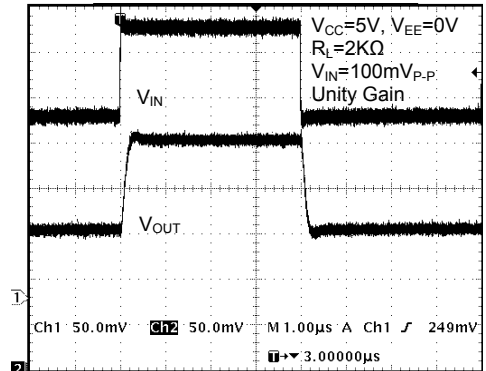


Performance Characteristics (Cont.)

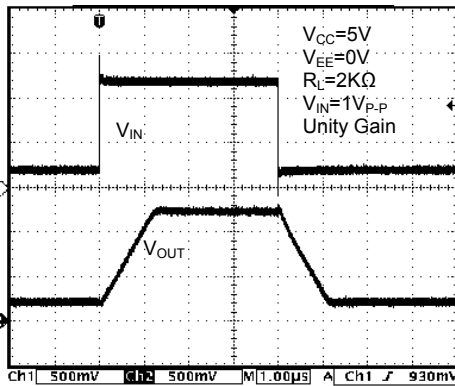
Gain and Phase vs. Frequency and Capacitive Load



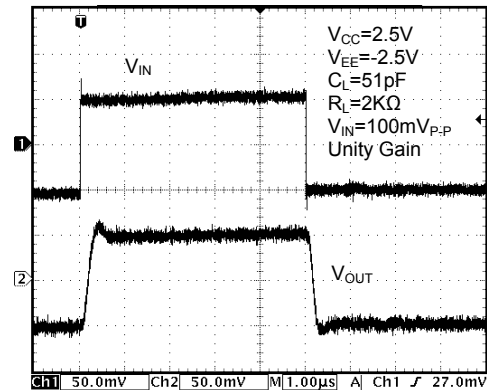
Non-Inverting Input Small Signal Pulse Response



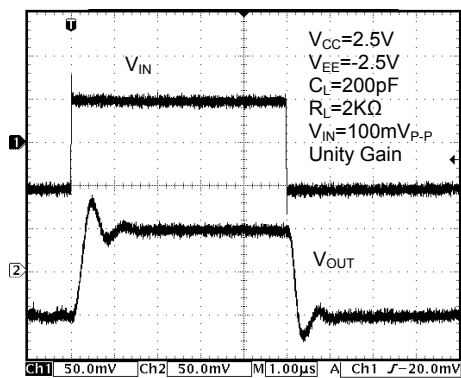
Non-Inverting Input Large Signal Pulse Response



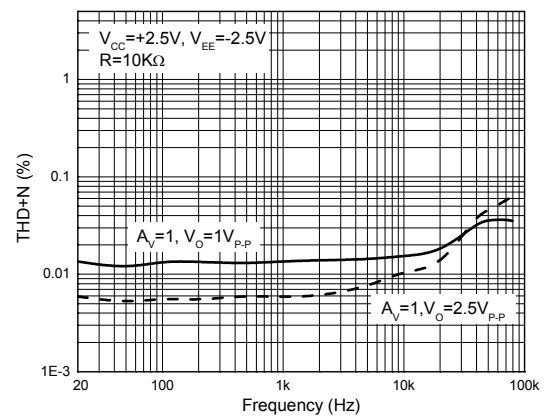
Output with Excessive Capacitive Load



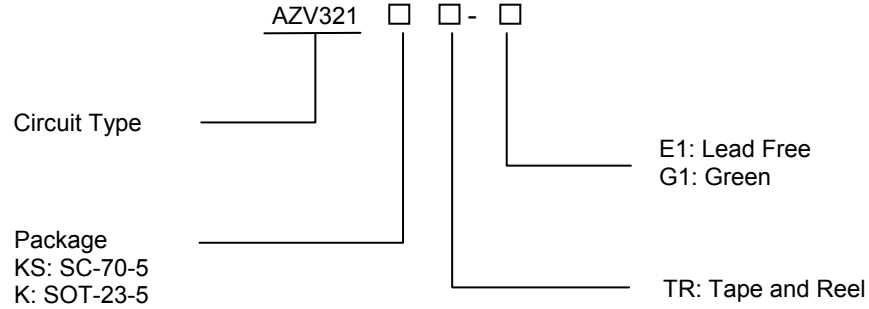
Output with Excessive Capacitive Load



THD+N vs. Frequency



Ordering Information

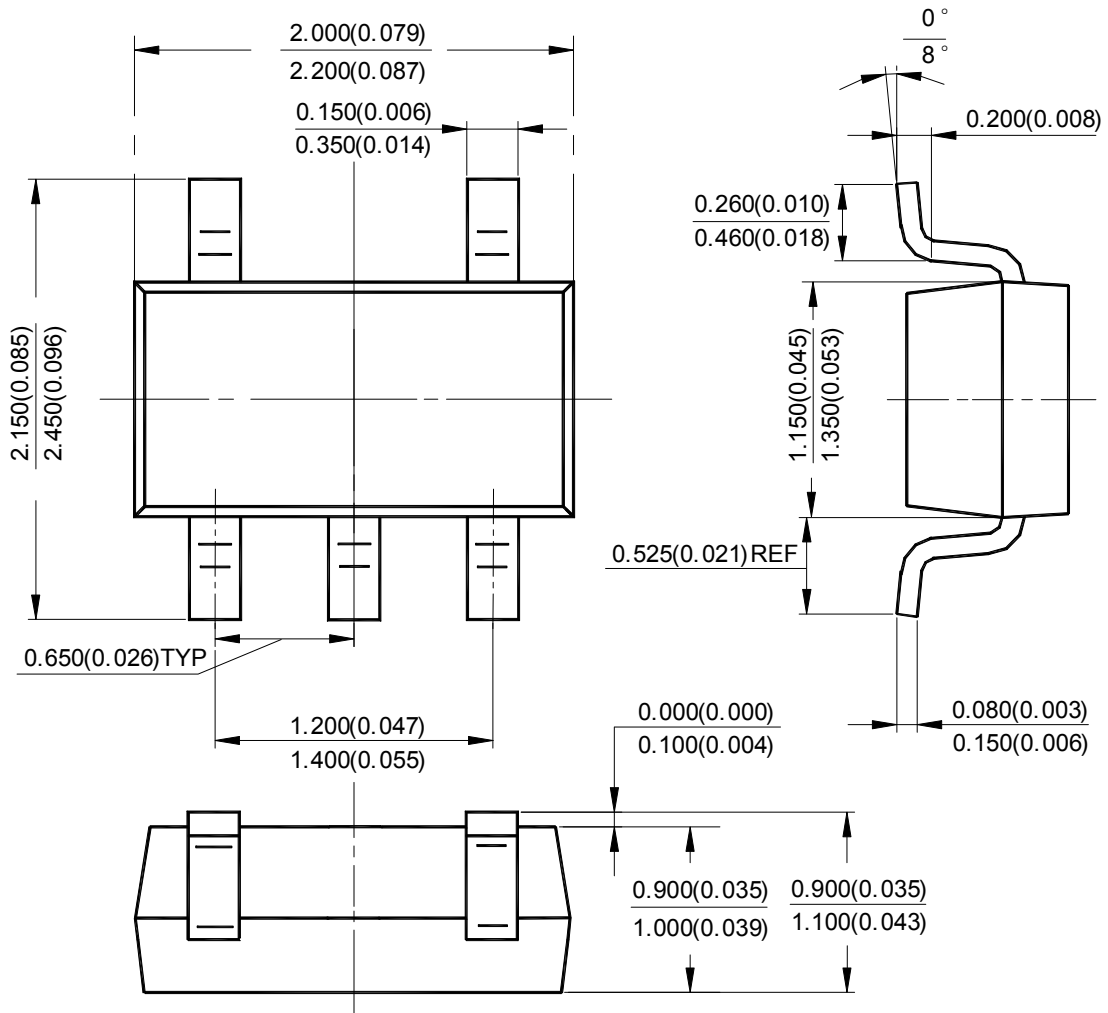


Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
SC-70-5	-40 to 85°C	AZV321KSTR-E1	AZV321KSTR-G1	21	B1	Tape & Reel
SOT-23-5		AZV321KTR-E1	AZV321KTR-G1	E6D	G6D	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

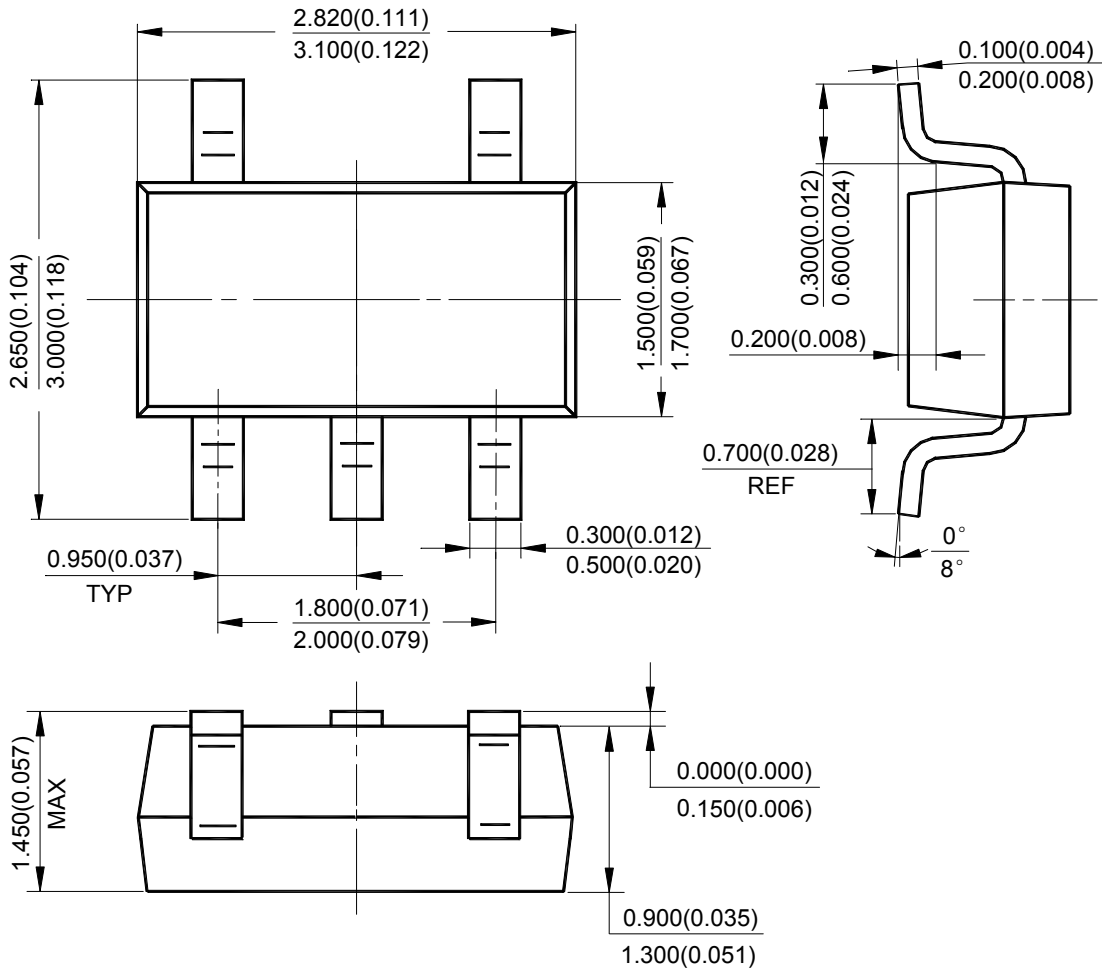
Package Outline Dimensions (All dimensions in mm(inch).)

SC-70-5



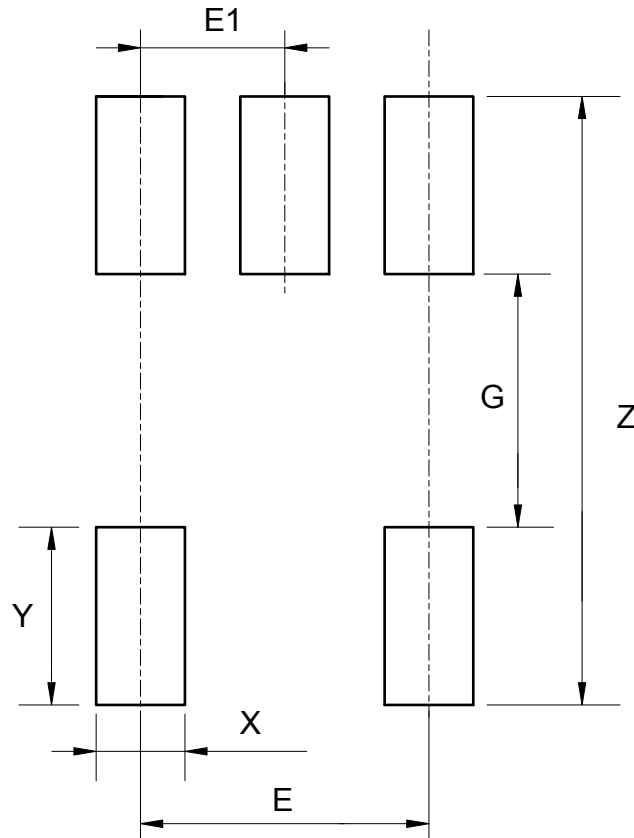
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

SOT-23-5



Suggested Pad Layout

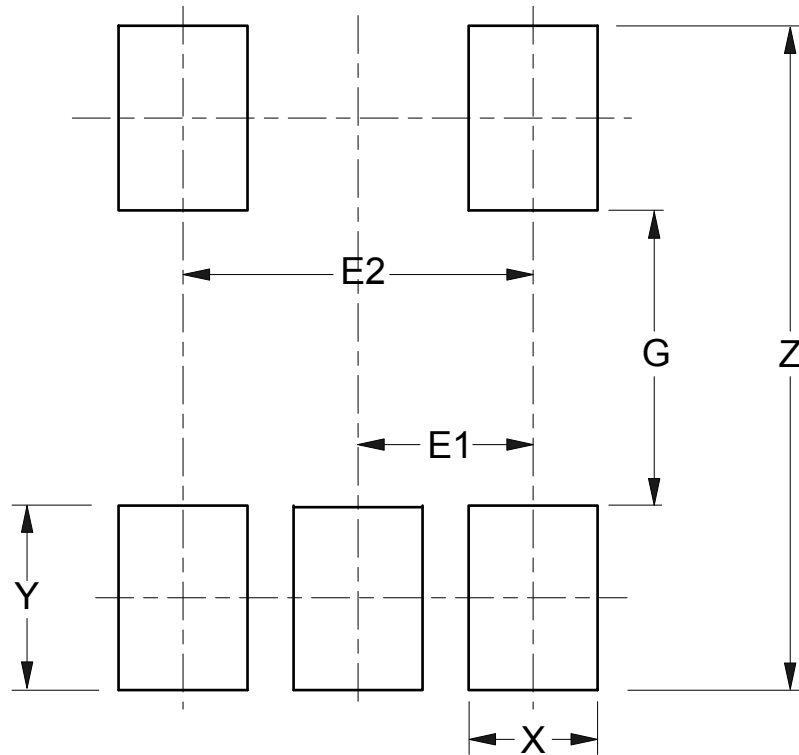
SC-70-5



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)	E1 (mm)/(inch)
Value	2.740/0.108	1.140/0.045	0.400/0.016	0.800/0.031	1.300/0.051	0.650/0.026

Suggested Pad Layout (Cont.)

SOT-23-5



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075