

**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER      AZV321**

**General Description**

The AZV321 is single low voltage (2.7-5.5V) 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/ $\mu$ 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.

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.

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°C to +85°C
- Low Supply Current: 130 $\mu$ A
- Rail-to-Rail Output Swing under 10k $\Omega$  Load:  
 $V_{OH}$  up to  $V_{CC} -10mV$   
 $V_{OL}$  near to  $V_{EE} +65mV$
- $V_{CM}$ : -0.1V to  $V_{CC}-0.8V$

**Applications**

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

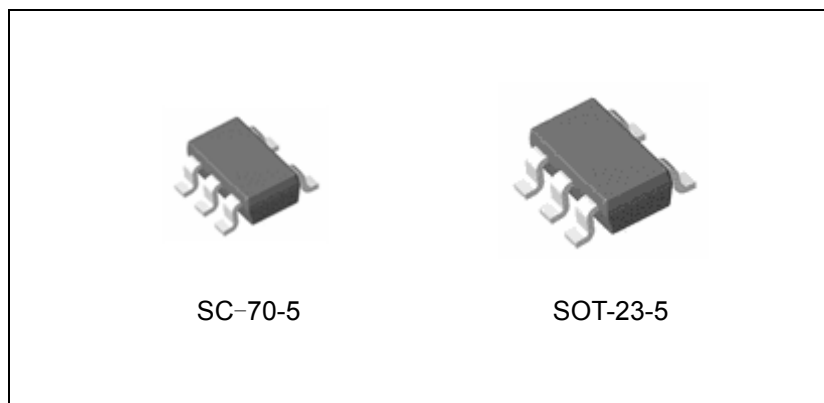


Figure 1. Package Types of AZV321

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**Pin Configuration**

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

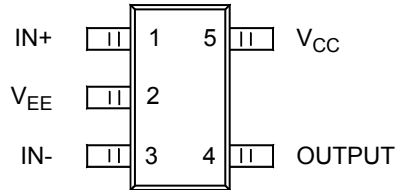


Figure 2. Pin Configuration of AZV321 (Top View)

**Functional Block Diagram**

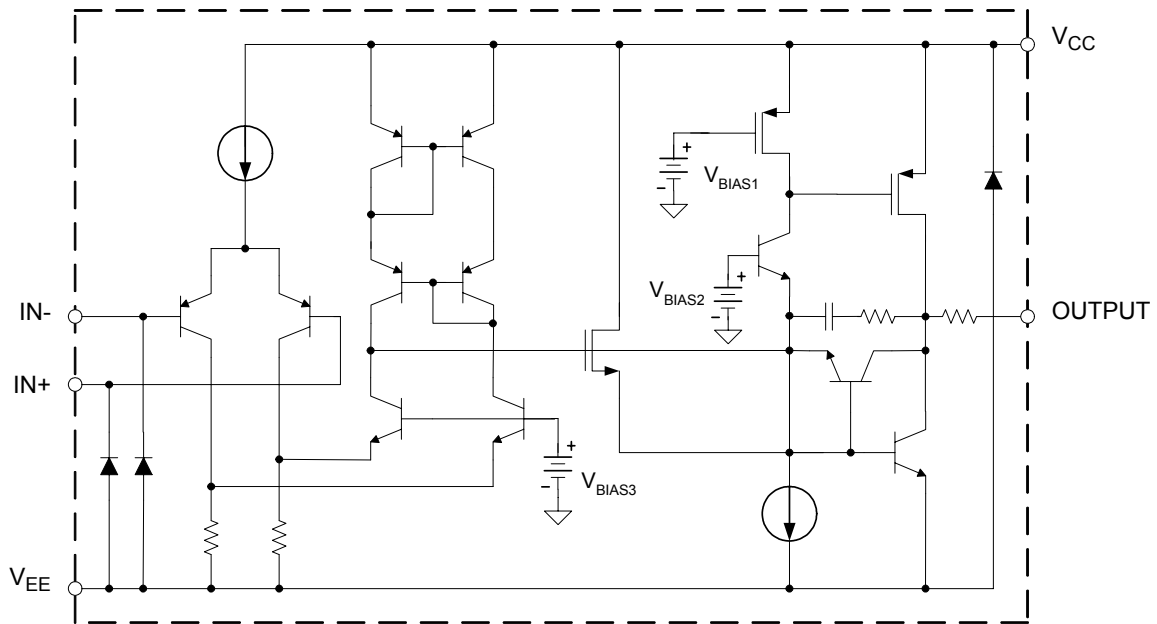
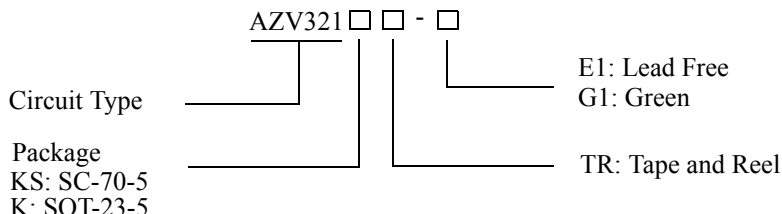


Figure 3. Functional Block Diagram of AZV321



**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER      AZV321**

**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	-40 to 85°C	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.

**Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Power Supply Voltage	V <sub>CC</sub>	6	V
Operation Junction Temperature	T <sub>J</sub>	150	°C
Storage Temperature Range	T <sub>STG</sub>	-65 to 150	°C
Lead Temperature (Soldering, 10 Seconds)	T <sub>LEAD</sub>	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**

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V <sub>CC</sub>	2.7	5.5	V
Ambient Operating Temperature Range	T <sub>A</sub>	-40	85	°C



**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER 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  $T_A=-40$  to  $85^{\circ}\text{C}$ , unless otherwise specified. (Note 2)

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

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



**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER 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  $T_A=-40$  to  $85^{\circ}\text{C}$ , unless otherwise specified. (Note 2)

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

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

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**Typical Performance Characteristics**

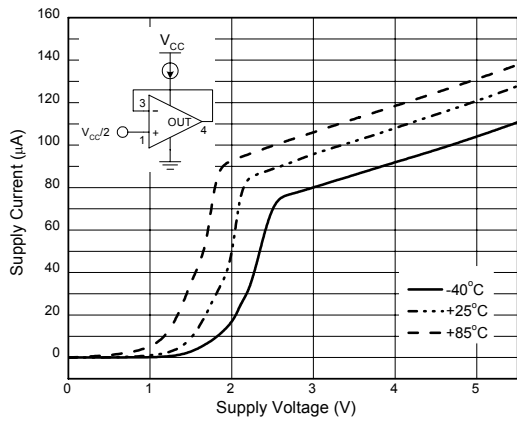


Figure 4. Supply Current vs. Supply Voltage

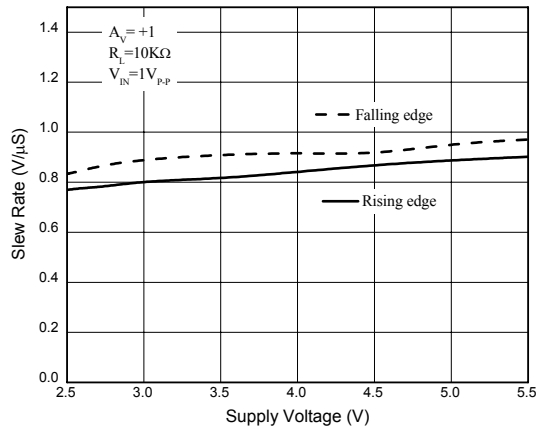


Figure 5. Slew Rate vs. Supply Voltage

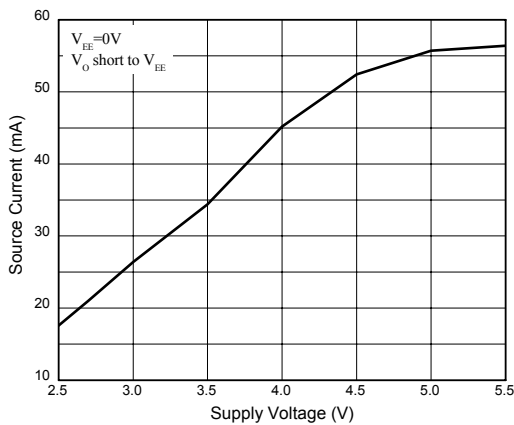


Figure 6. Output Source Current vs. Supply Voltage

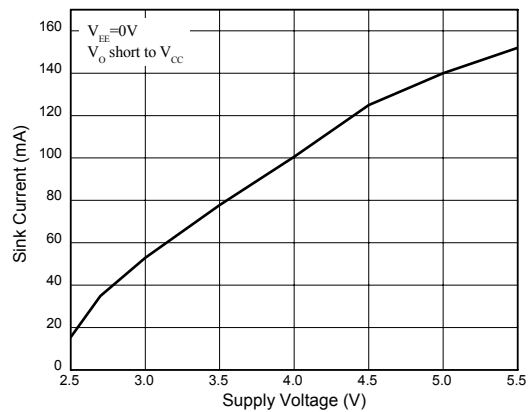


Figure 7. Output Sink Current vs. Supply Voltage



**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER AZV321**

**Typical Performance Characteristics (Continued)**

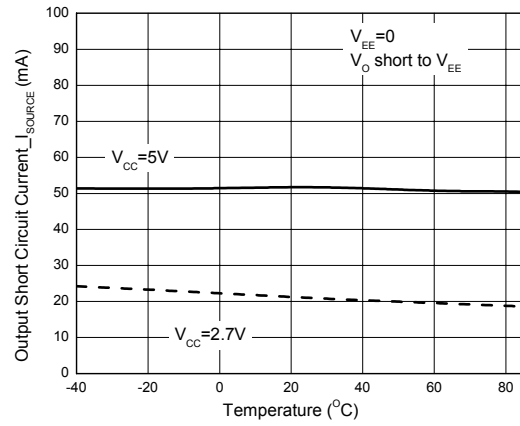
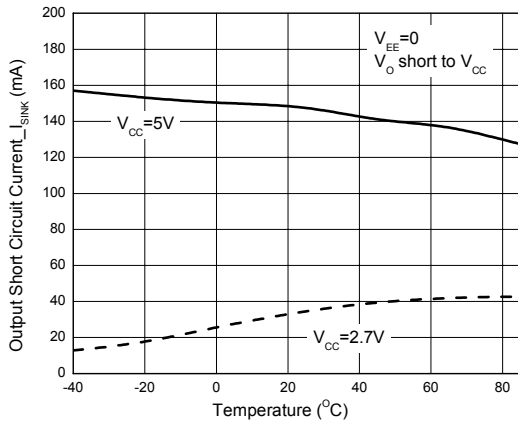


Figure 8. Short Circuit Current<sub>I<sub>SINK</sub></sub> vs. Temperature      Figure 9. Short Circuit Current<sub>I<sub>SOURCE</sub></sub> vs. Temperature

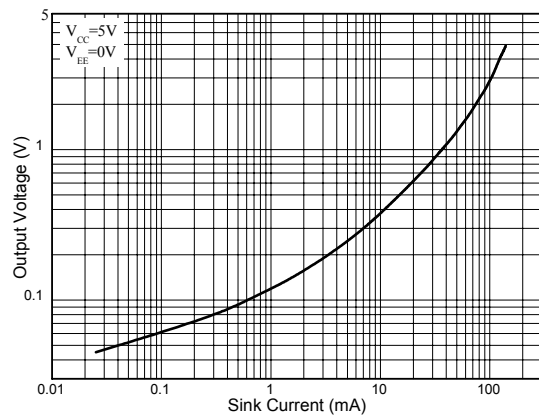
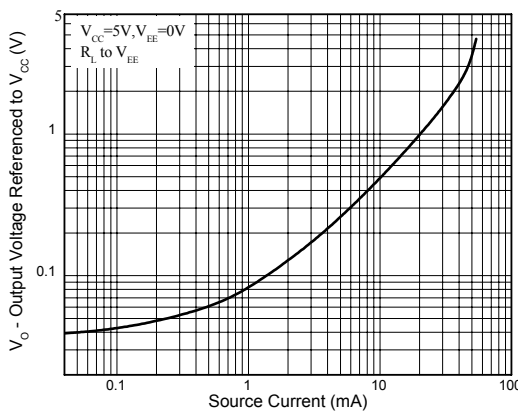


Figure 10. Output Voltage vs. Source Current

Figure 11. Output Voltage vs. Sink Current



**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER AZV321**

**Typical Performance Characteristics (Continued)**

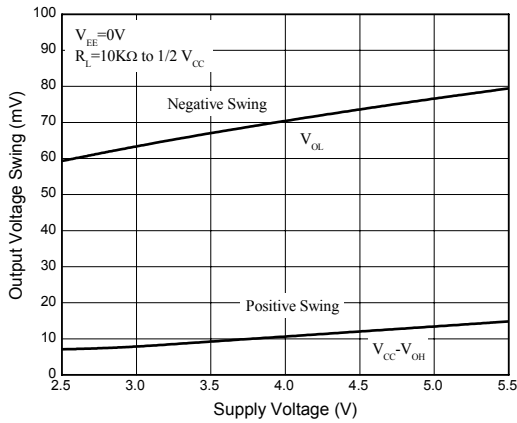


Figure 12. Output Voltage Swing vs. Supply Voltage

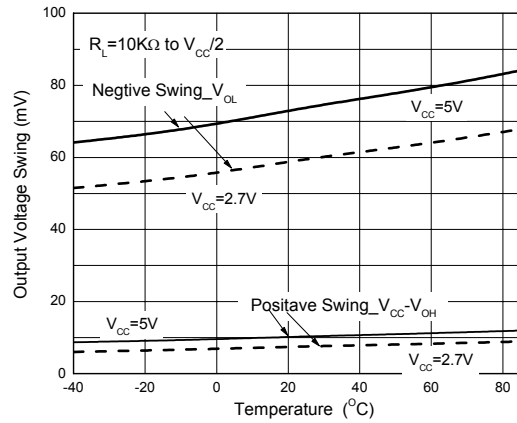


Figure 13. Output Voltage Swing vs. Temperature

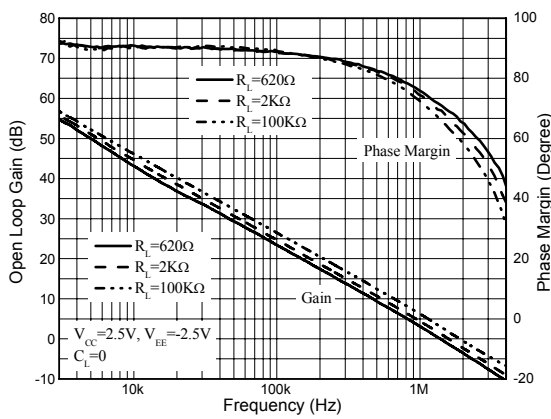


Figure 14. Gain and Phase vs. Frequency and Resistive Load





**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER AZV321**

**Typical Performance Characteristics (Continued)**

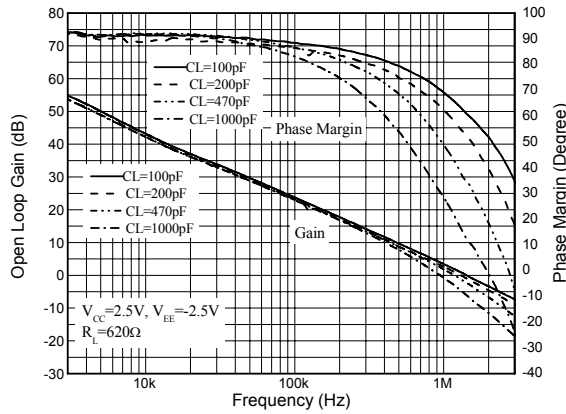


Figure 15. Gain and Phase vs. Frequency and Capacitive Load

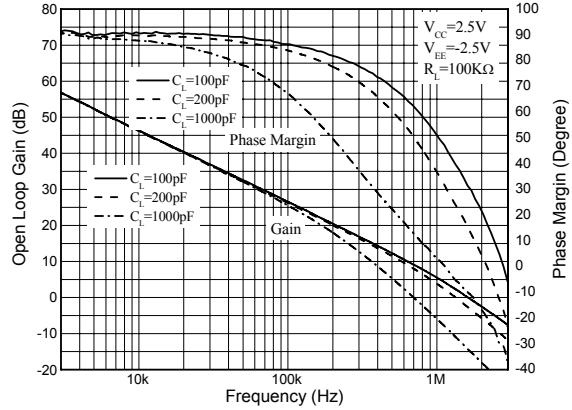


Figure 16. Gain and Phase vs. Frequency and Capacitive Load

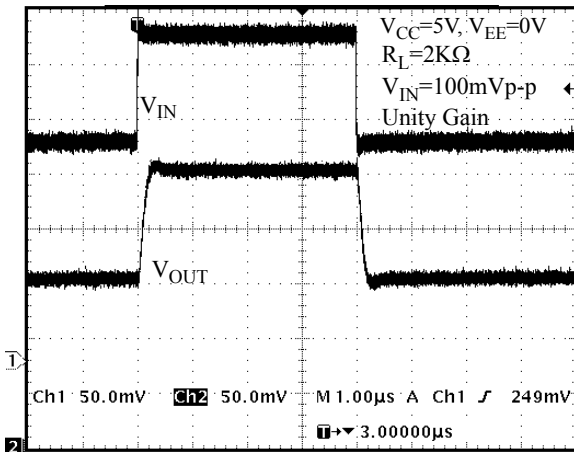


Figure 17. Non-Inverting Input Small Signal Pulse Response

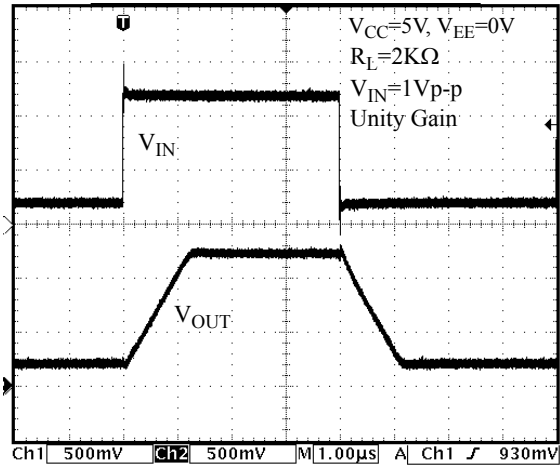


Figure 18. Non-Inverting Input Large Signal Pulse Response

**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER AZV321**

**Typical Performance Characteristics (Continued)**

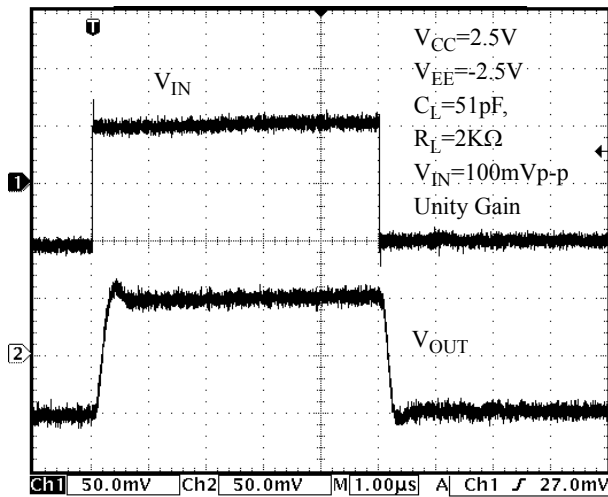


Figure 19. Output with Excessive Capacitive Load

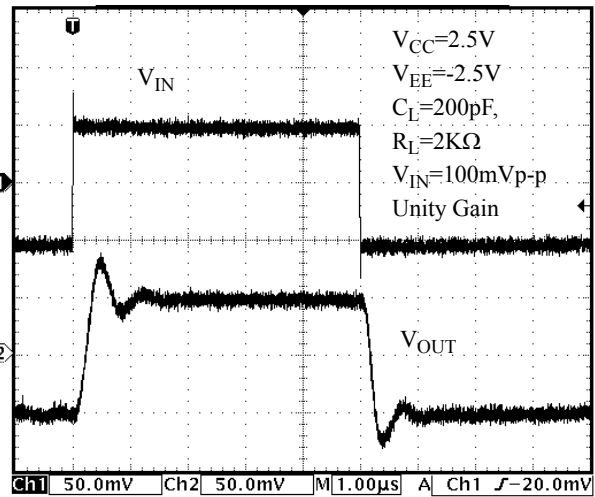


Figure 20. Output with Excessive Capacitive Load

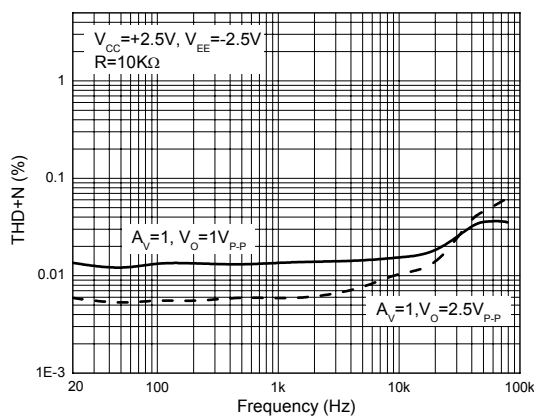


Figure 21. THD+N vs. Frequency

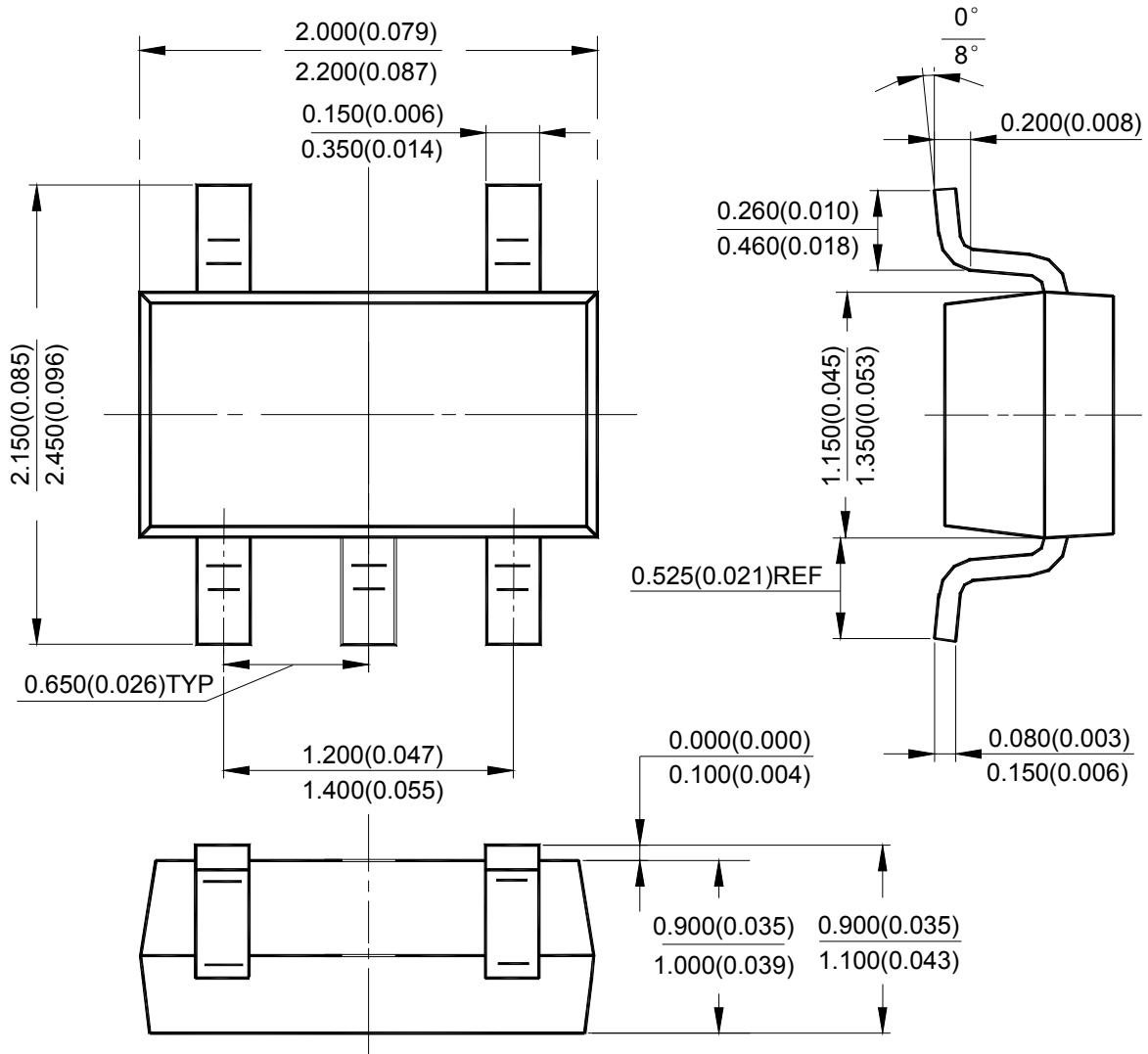


**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER      AZV321**

**Mechanical Dimensions**

**SC-70-5**

**Unit: mm(inch)**



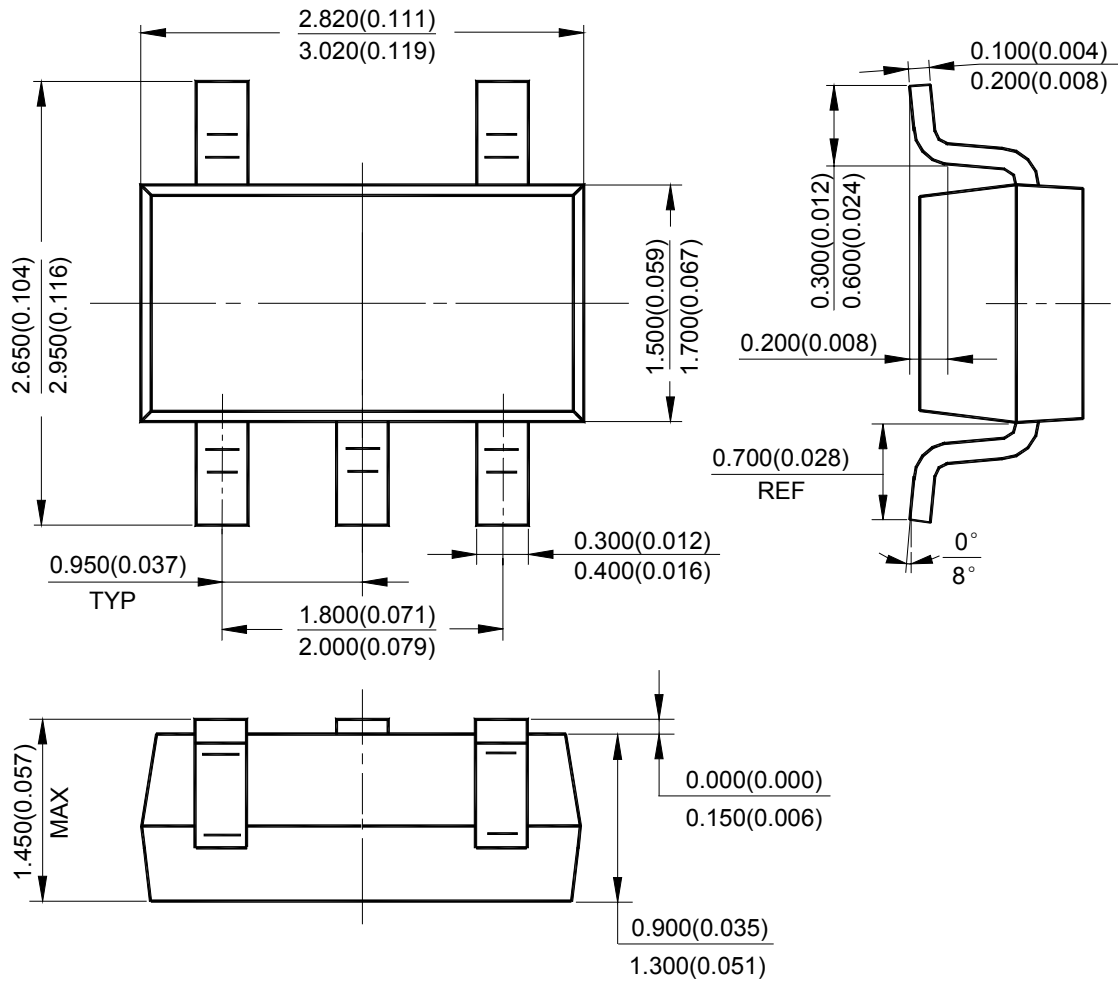


**SINGLE LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIER      AZV321**

**Mechanical Dimensions**

**SOT-23-5**

**Unit: mm(inch)**





## **BCD Semiconductor Manufacturing Limited**

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#### **MAIN SITE**

##### **- Headquarters**

##### **BCD Semiconductor Manufacturing Limited**

No. 1600, Zi Xing Road, Shanghai Zizhu Science-based Industrial Park, 200241, China  
Tel: +86-21-24162266, Fax: +86-21-24162277

##### **- Wafer Fab**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd.**

800 Yi Shan Road, Shanghai 200233, China  
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

#### **REGIONAL SALES OFFICE**

##### **Shenzhen Office**

##### **Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd., Shenzhen Office**

Unit A Room 1203, Skyworth Bldg., Gaoxin Ave. 1.S., Nanshan District, Shenzhen, China  
Tel: +86-755-8826 7951  
Fax: +86-755-8826 7865

##### **Taiwan Office**

##### **BCD Semiconductor (Taiwan) Company Limited**

4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei, Taiwan  
Tel: +886-2-2656 2808  
Fax: +886-2-2656 2806

##### **USA Office**

##### **BCD Semiconductor Corp.**

30920 Huntwood Ave. Hayward, CA 94544, USA  
Tel : +1-510-324-2988  
Fax: +1-510-324-2788

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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А