

**LOW POWER SINGLE OPERATIONAL AMPLIFIER****AS321****General Description**

The AS321 is a high gain and internally frequency compensated operational amplifier specifically designed to operate from a single power supply. Operation from split power supply is also possible and the low power supply current drain is independent of the magnitude of the power supply voltages. Typical applications include battery charger, active filters, general purpose controllers and most conventional operational amplifier circuits.

The AS321 is compatible with industry standard 321.

The AS321 is available in SOT-23-5 packages.

Features

- Excellent Phase Margin: 60 deg.
- Large Voltage Gain: 100dB (Typical)
- Low Input Bias Current: 20nA (Typical)
- Low Input Offset Voltage: 2mV (Typical)
- Low Supply Current: 0.35mA at $V_{CC}=5V$
- Wide Power Supply Voltage:
 - Single Supply: 3V to 36V
 - Dual Supplies: $\pm 1.5V$ to $\pm 18V$
- Wide Input Common Mode Voltage Range: 0V to $V_{CC}-1.5V$

Applications

- Battery Charger
- Active Filters
- General Purpose Controllers, Instruments

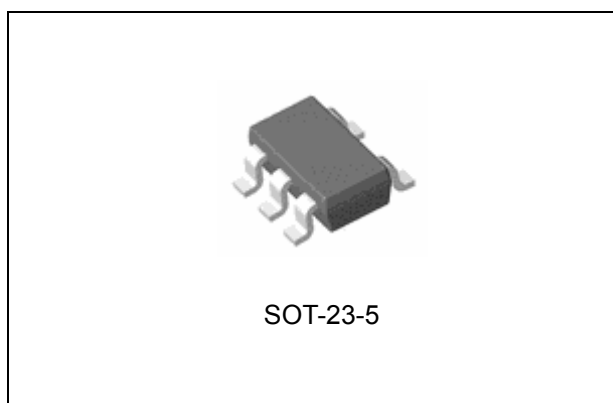


Figure 1. Package Type of AS321

LOW POWER SINGLE OPERATIONAL AMPLIFIER

AS321

Pin Configuration

K Package
(SOT-23-5)

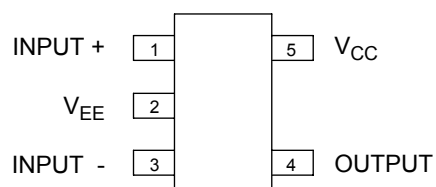


Figure 2. Pin Configuration of AS321 (Top View)

Functional Block Diagram

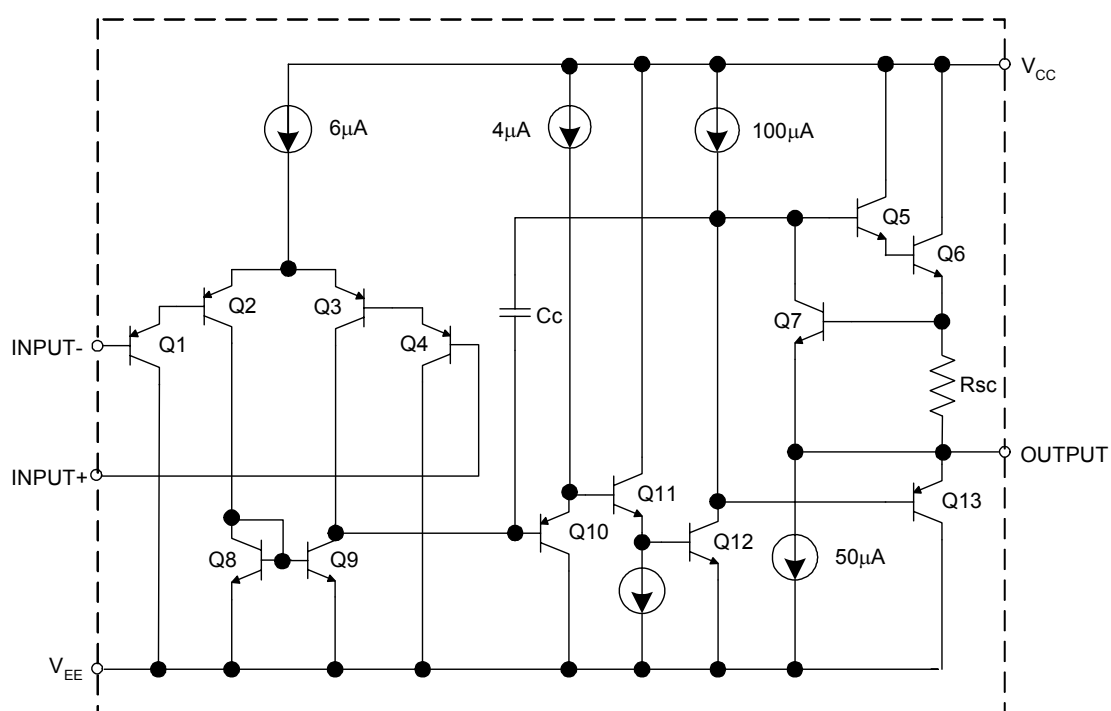
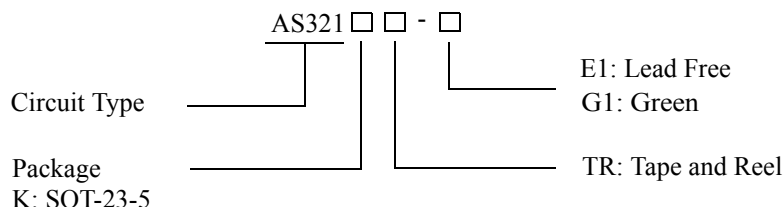


Figure 3. Functional Block Diagram of AS321

**LOW POWER SINGLE OPERATIONAL AMPLIFIER****AS321****Ordering Information**

Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
SOT-23-5	-40 to 85°C	AS321KTR-E1	AS321KTR-G1	E6T	G6T	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_S ($V_{CC}-V_{EE}$)	40	V
Differential Input Voltage	V_{ID}	40	V
Input Voltage	V_{IN}	-0.3 to 40	V
Thermal Resistance to Ambient	$R_{\theta JA}$	260	°C/W
Operating Junction Temperature	T_J	150	°C
Storage Temperature Range	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10 Seconds)	T_{LEAD}	260	°C

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_{CC}	3	36	V
Ambient Operating Temperature Range	T_A	-40	85	°C



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Electrical Characteristics

Limits in standard typeface are for $T_A=25^{\circ}\text{C}$, **bold** typeface applies over -40°C to 85°C (Note 2), $V_{CC}=5\text{V}$, $V_{EE}=0\text{V}$, $V_O=1.4\text{V}$ unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	$V_O=1.4\text{V}$, $R_S=0\Omega$, $V_{CC}=5\text{V}$ to 30V (Note 3)		2	5	mV
					7	
Average Temperature Coefficient of Input Offset Voltage	$\Delta V_{IO}/\Delta T$	$T_A=-40$ to 85°C		7		$\mu\text{V}/^{\circ}\text{C}$
Input Bias Current	I_{BIAS}	I_{IN+} or I_{IN-} , $V_{CM}=0\text{V}$		20	100	nA
					200	
Input Offset Current	I_{IO}	$I_{IN+} - I_{IN-}$, $V_{CM}=0\text{V}$		5	30	nA
					100	
Input Common Mode Voltage Range (Note 4)	V_{CM}	$V_{CC}=30\text{V}$, $\text{CMRR} \geq 50\text{dB}$	0		$V_{CC}-1.5$	V
Supply Current	I_{CC}	$R_L=\infty$, $V_{CC}=5\text{V}$		0.35	0.80	mA
				0.45	1.0	
		$R_L=\infty$, $V_{CC}=30\text{V}$		0.45	1.2	mA
				0.65	1.5	
Large Signal Voltage Gain	G_V	$V_{CC}=15\text{V}$, $V_O=1\text{V}$ to 11V , $R_L \geq 2\text{k}\Omega$	85	100		dB
			80			
Common Mode Rejection Ratio	CMRR	$V_{CM}=0\text{V}$ to $(V_{CC}-1.5)\text{V}$, $R_S \leq 10\text{k}\Omega$	60	70		dB
			60			
Power Supply Rejection Ratio	PSRR	$V_{CC}=5\text{V}$ to 30V , $R_S \leq 10\text{k}\Omega$	70	100		dB
			60			
Output Current	Source	I_{SOURCE} , $V_{IN+}=1\text{V}$, $V_{IN-}=0\text{V}$, $V_{CC}=15\text{V}$, $V_O=2\text{V}$	20	40		mA
			20			
	Sink	I_{SINK} , $V_{IN+}=0\text{V}$, $V_{IN-}=1\text{V}$, $V_{CC}=15\text{V}$, $V_O=2\text{V}$	10	15		mA
			5			
		$V_{IN+}=0\text{V}$, $V_{IN-}=1\text{V}$, $V_{CC}=15\text{V}$, $V_O=0.2\text{V}$	12	50		μA
Output Short Circuit Current to Ground	I_{SC}	$V_{CC}=15\text{V}$		40	60	mA
Output Voltage Swing	V_{OH}	$V_{CC}=30\text{V}$, $R_L=2\text{k}\Omega$	26			V
			26			
		$V_{CC}=30\text{V}$, $R_L=10\text{k}\Omega$	27	28		
			27			
	V_{OL}	$V_{CC}=5\text{V}$, $R_L=10\text{k}\Omega$		5	20	mV
					30	

**LOW POWER SINGLE OPERATIONAL AMPLIFIER****AS321****Electrical Characteristics (Continued)**

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Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Total Harmonic Distortion	THD	$f=1\text{kHz}$, $AV=20\text{dB}$, $R_L=2\text{k}\Omega$, $V_O=2\text{V}_{p-p}$, $C_L=100\text{pF}$, $V_{CC}=30\text{V}$		0.015		%
Phase Margin	ϕ_M			60		Deg
Thermal Resistance (Junction to Case)	θ_{JC}	SOT-23-5		101		$^{\circ}\text{C/W}$

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

Note 3: Over the full input common-mode range 0V to $V_{CC}-1.5\text{V}$ (at 25°C).

Note 4: The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at 25°C). The upper end of the common-mode voltage range is $V_{CC}-1.5\text{V}$ (at 25°C), but either or both inputs can go to $+36\text{V}$ without damages, independent of the magnitude of the V_{CC} .

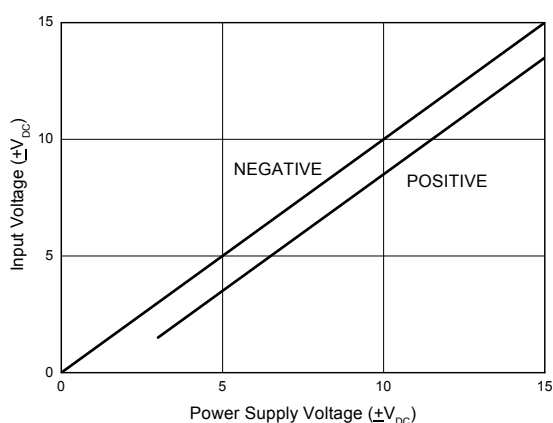
Typical Performance Characteristics

Figure 4. Input Voltage Range

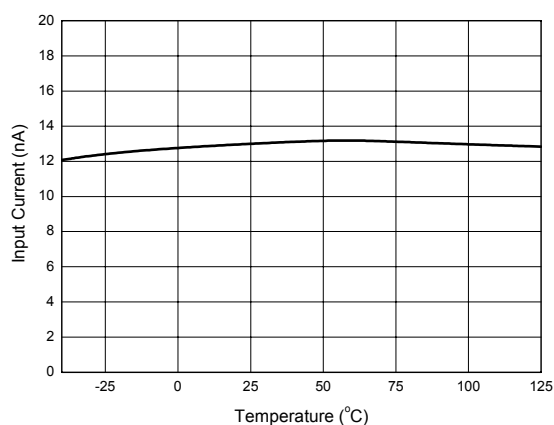


Figure 5. Input Current

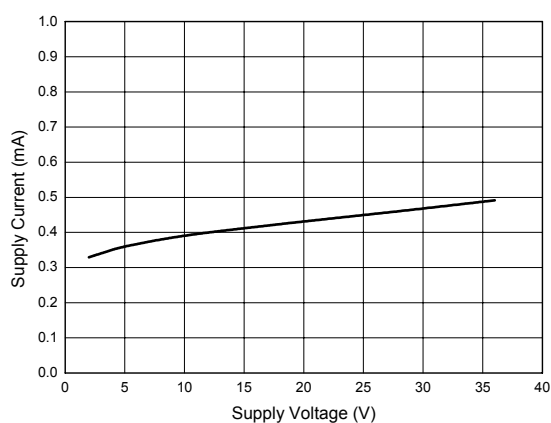
**LOW POWER SINGLE OPERATIONAL AMPLIFIER****AS321****Electrical Characteristics (Continued)**

Figure 6. Supply Current

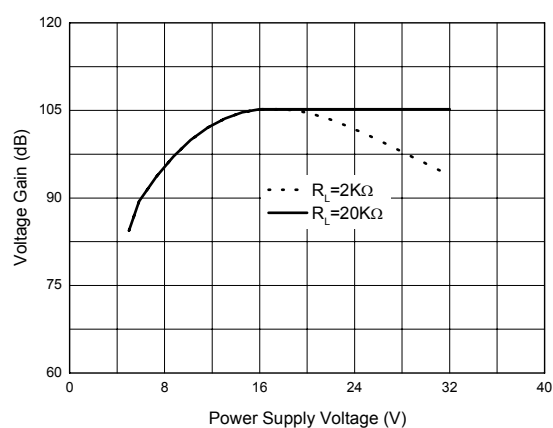


Figure 7. Voltage Gain

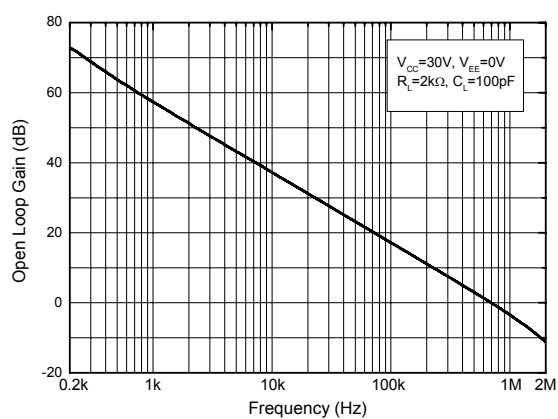


Figure 8. Open Loop Gain vs. Frequency

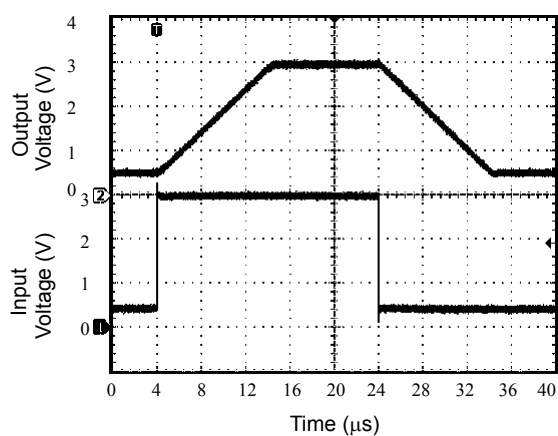


Figure 9. Voltage Follower Pulse Response

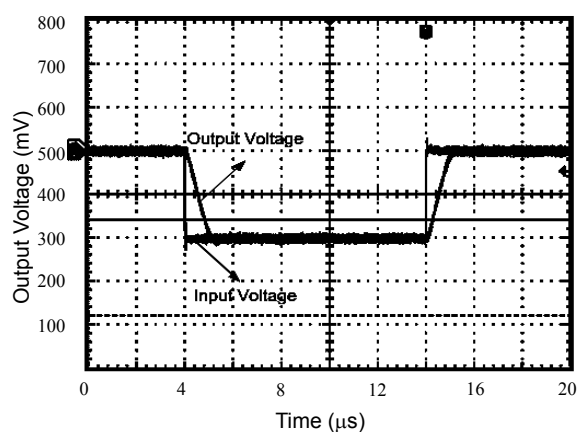
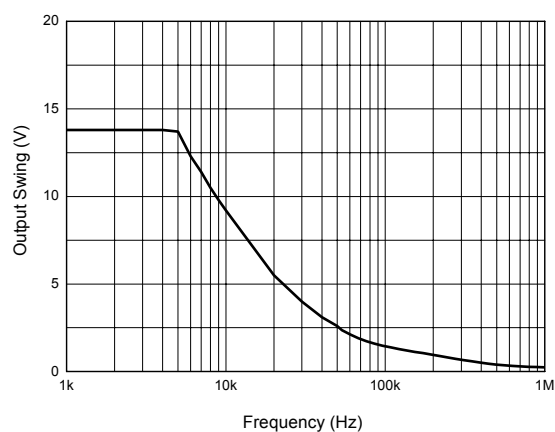
**LOW POWER SINGLE OPERATIONAL AMPLIFIER****AS321****Typical Performance Characteristics (Continued)**Figure 10. Voltage Follower Pulse Response
(Small Signal)

Figure 11. Large Signal Frequency Response

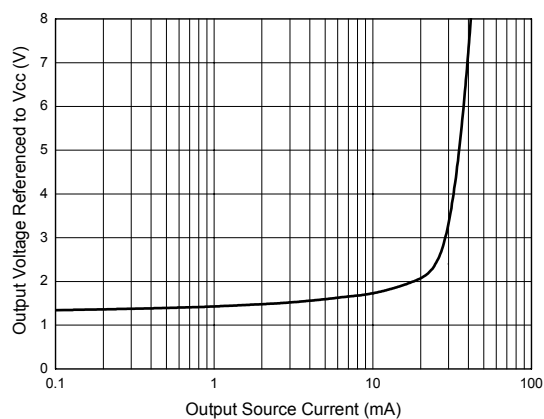


Figure 12. Output Characteristics: Current Sourcing

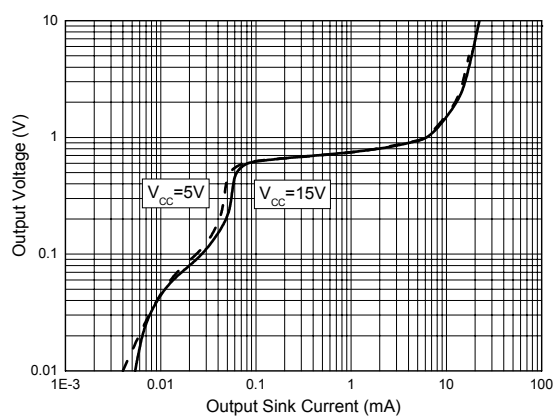


Figure 13. Output Characteristics: Current Sinking

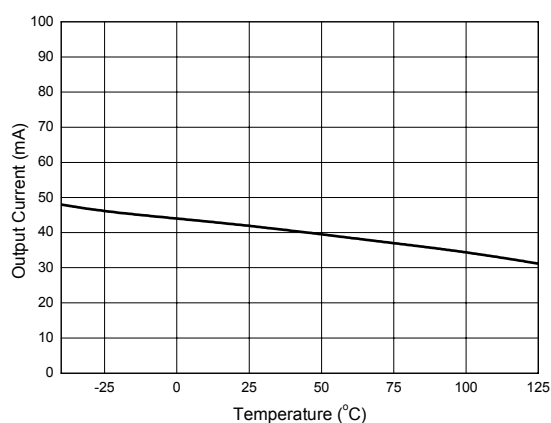
**LOW POWER SINGLE OPERATIONAL AMPLIFIER****AS321****Typical Performance Characteristics (Continued)**

Figure 14. Current Limiting

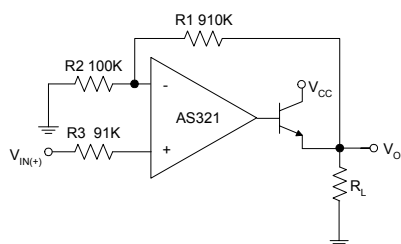
Typical Application

Figure 16. Power Amplifier

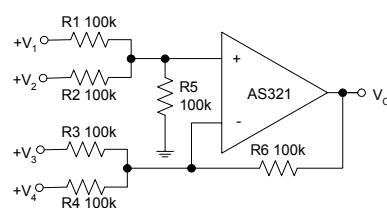


Figure 17. DC Summing Amplifier



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Typical Application (Continued)

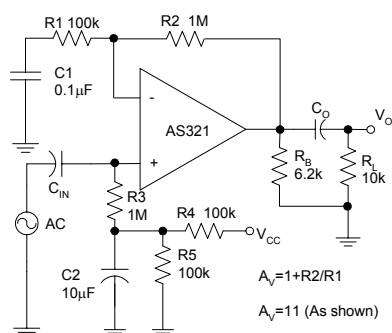


Figure 18. AC Coupled Non-Inverting Amplifier

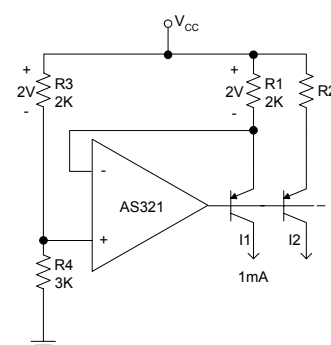


Figure 19. Fixed Current Sources

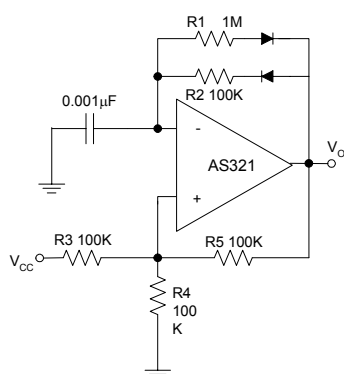


Figure 20. Pulse Generator

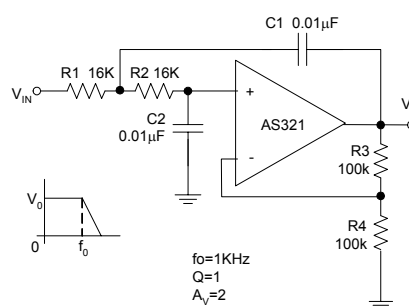
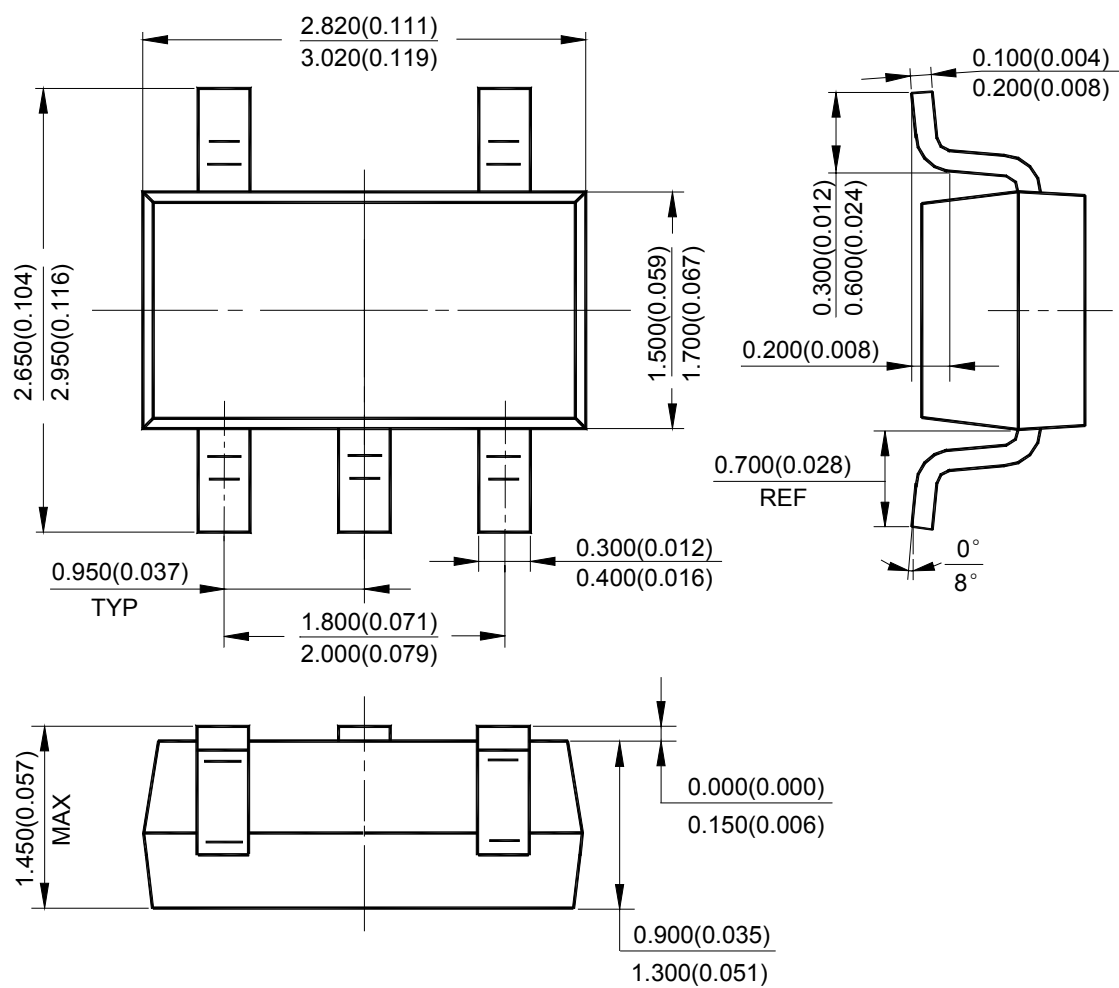


Figure 21. DC Coupled Low-Pass Active Filter

**LOW POWER SINGLE OPERATIONAL AMPLIFIER****AS321****Mechanical Dimensions****SOT-23-5****Unit: mm(inch)**



BCD Semiconductor Manufacturing Limited

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