

# MAV321

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

### General Description

The MAV321 is single low voltage (2.7-5.5V) op amp 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 MAV321 is built with BiCMOS process. It has bipolar input and output stages for improved noise performance, low input offset and higher output current drive.

### 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 $\mu$ A
- Rail-to-Rail Output Swing under 10k $\Omega$  Load:
  - $V_{OH}$  up to  $V_{CC} - 10mV$
  - $V_{OL}$  near to  $V_{EE} + 65mV$
- $V_{CM}$ :  $-0.2V$  to  $V_{CC} - 0.8V$

### Applications

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



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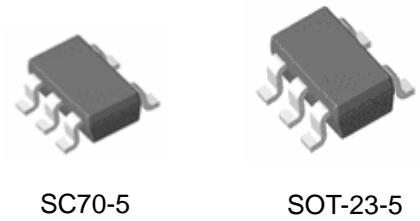


Figure 1: Package Types of MAV321

### Pin Configuration

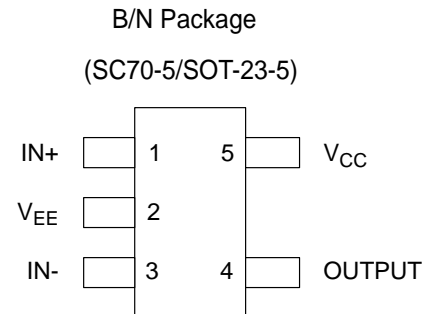
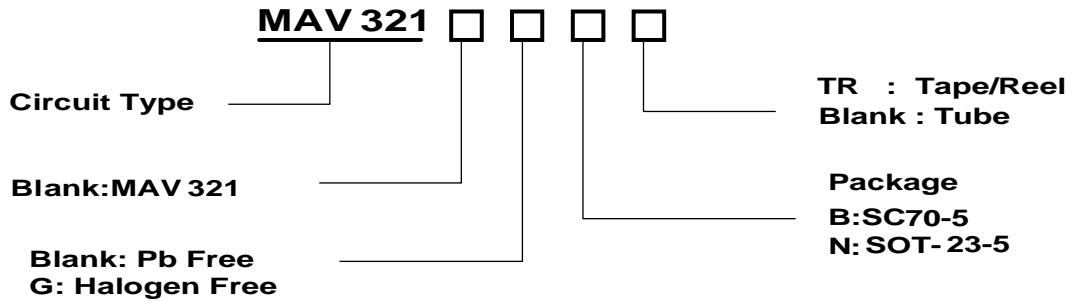


Figure 2: Pin Configuration of MAV321 (Top View)

# MAV321

## Ordering Information



Package	Condition	Part Number		Marking ID		Packing Type
		Pb-free	Halogen-Free	Pb-free	Halogen-Free	
SC70-5	3.0mV	MAV321B	MAV321GB	A21	G21	Tube
	3.0mV	MAV321BTR	MAV321GBTR	A21	G21	Tape&Reel
SOT-23-5	3.0mV	MAV321N	MAV321GN	A321	G321	Tube
	3.0mV	MAV321NTR	MAV321GNTR	A321	G321	Tape&Reel

## Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Power Supply Voltage	$V_{CC}$	6	V
Operation Junction Temperature	$T_J$	150	°C
Storage Temperature Range	$T_{STG}$	-65 to 150	°C
Lead Temperature (Soldering, 10 Seconds)	$T_{LEAD}$	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.

# MAV321

## Recommended Operating Conditions

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

## 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 $\text{CMRR}\geq 50\text{dB}$	-0.2		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.

# MAV321

## 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 $\text{CMRR}\geq 50\text{dB}$	-0.2		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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## Functional Block Diagram

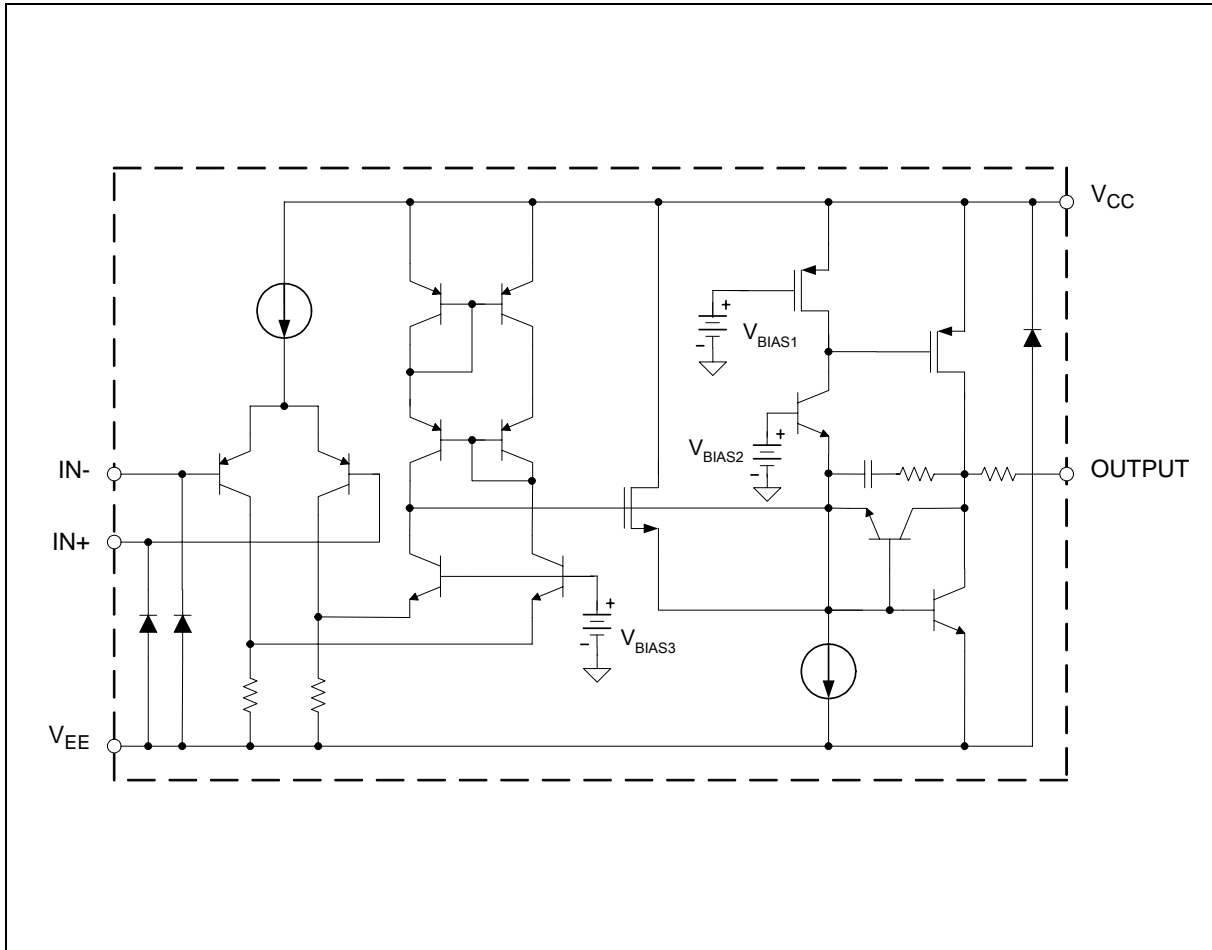


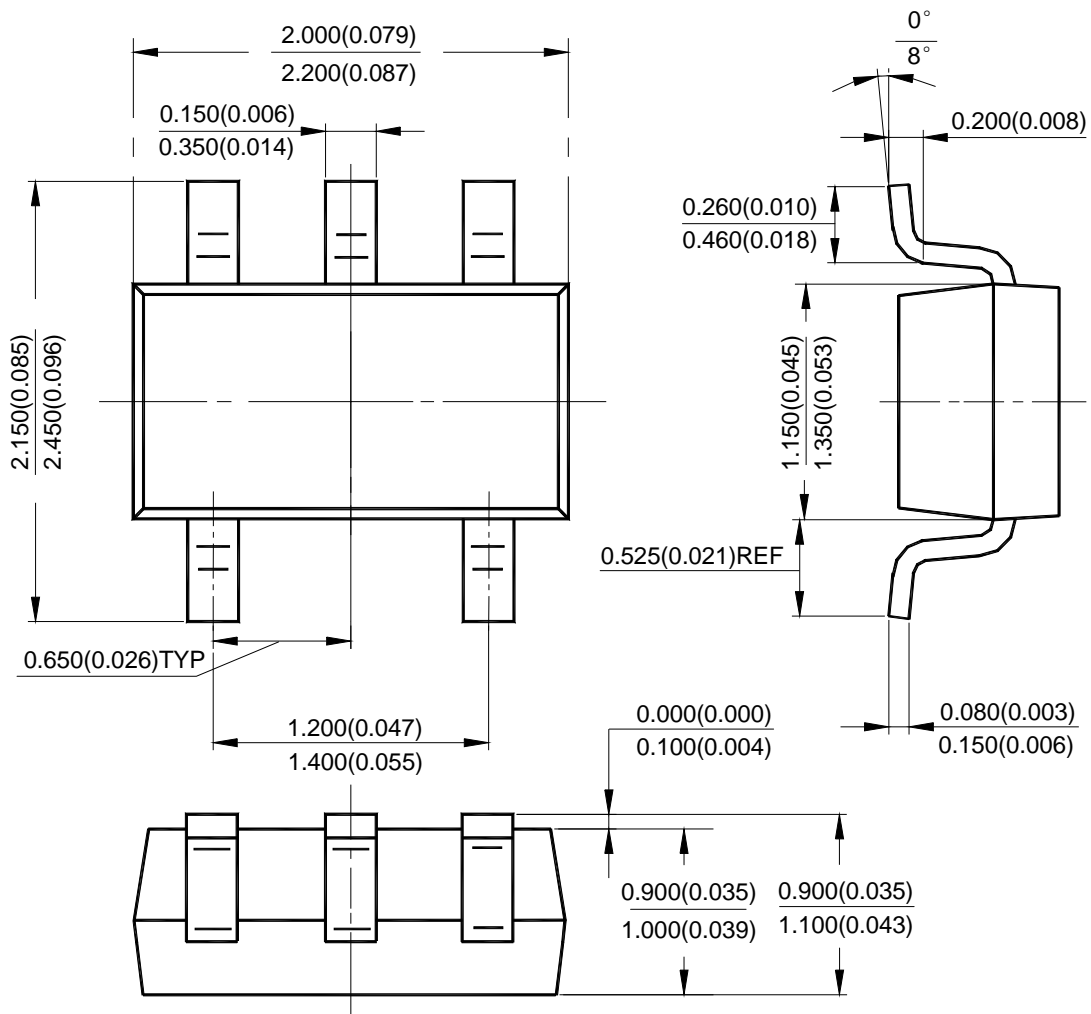
Figure 3 : Functional Block Diagram of MAV321 (Each Amplifier)

# MAV321

## Mechanical Dimensions

SC70-5

Unit: mm(inch)

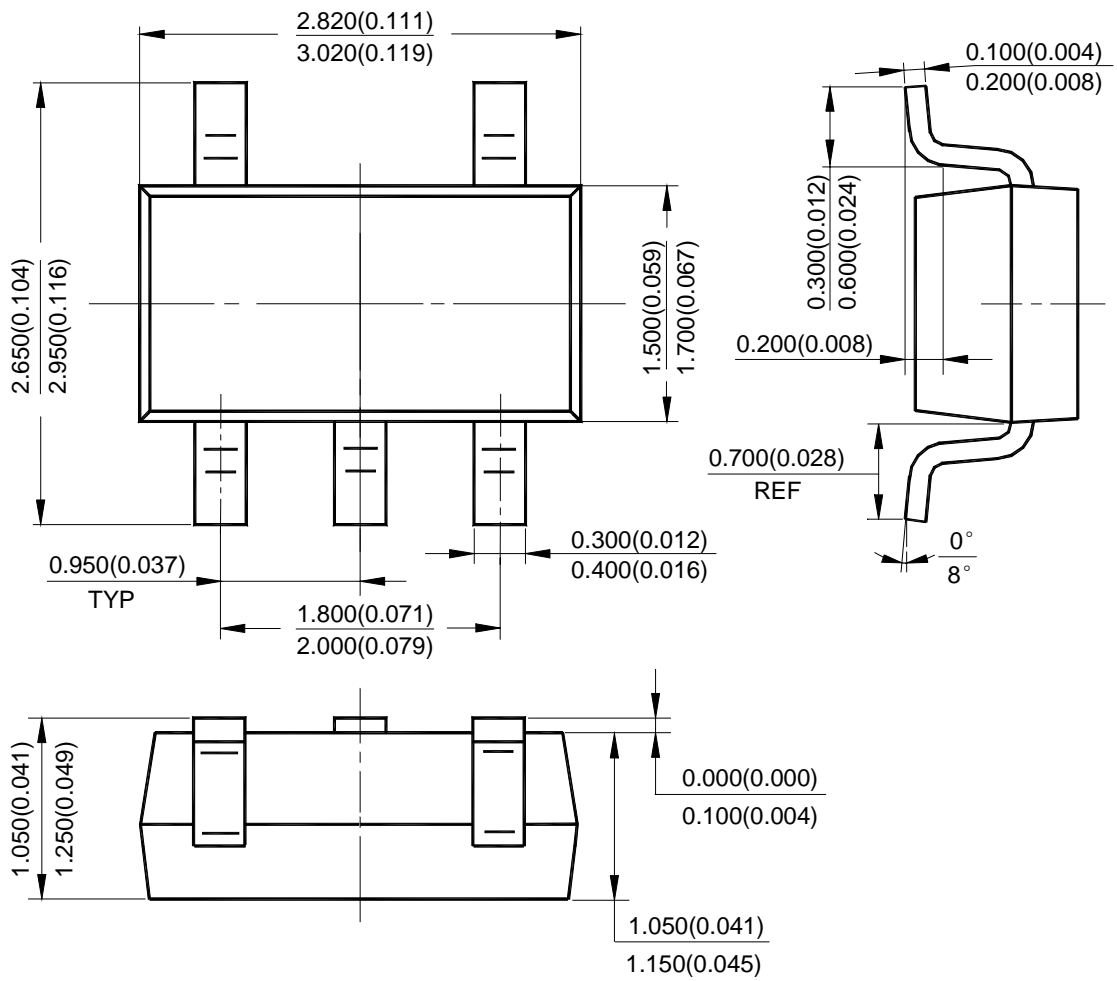


# MAV321

## Mechanical Dimensions (Cont'd)

SOT-23-5

Unit: mm(inch)



MAV321

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