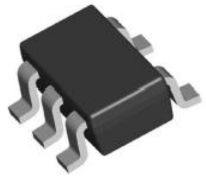
S321

General Purpose, Low Voltage, Rail-to-Rail Output Amplifiers

General Description



SOT23-5

The S321 is rail-to-rail input and output voltage feedback amplifier offering low cost. It has a wide input common-mode voltage range and output voltage swing, and take the minimum operating supply voltage down to 2.1V and the maximum recommended supply voltage is 5.5 V.

All are specified over the extended – 45°C to +85°C temperature range.

The S321 provide 1MHz bandwidth at a low current consumption. Very low input bias currents of 10pA, enable S321 to be used for integrators, photodiode amplifiers, and piezoelectric sensors. Rail-to-rail inputs and outputs are useful to designers buffering ASIC in single-supply systems.

Applications for the series amplifiers include safety monitor, portable equipment, battery and power supply control, and signal conditioning and interfacing for transducers in very low power systems

Features

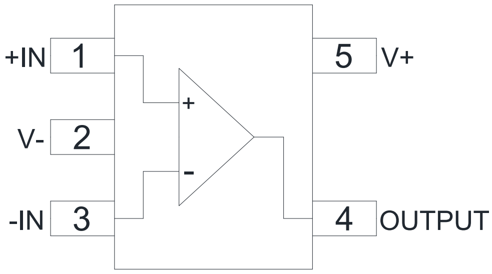
- Low Cost
- Rail-to-Rail Input and Output: 0.8mV Typical Vos
- Unity Gain Stable
- Gain Bandwidth Product: 1MHz
- Very Low Input Bias Currents: 10pA
- Operates on 2.1 V to 5.5 V Supplies
- Input Voltage Range: -0.1 V to +5.6 V with $V_S = 5.5$ V

Package Information

Part NO.	Package Description	Package Marking	Package Option
S321	SOT23-5	EXY	3000/Reel

E: S321 Part NO. X:Year Code Y:Date Code

Internal Block Diagram and Pin Connection



S321(SOT23-5)

Absolute Maximum Ratings (Ta=25 °C)

Characteristic	Min.	Max.	Unit
Power Supply Voltage	0	+7.5	V
Maximum Junction Temperature		+160	°C
Input Voltage Range	-Vs-0.5	+Vs+0.5	V
Operating Temperature Range	-45	+85	°C
Storage Temperature Range	-65	+150	°C
Lead Temperature, 10 seconds		+260	°C

Recommended Operating Conditions

Characteristic	Min.	Max.	Unit
Operating Temperature Range	-40	+85	°C
Power Supply Operating Range	2.1	5.5	V

Electrical Characteristics

(Vs=+5 V, R_L=10kΩ to Vs/2, V_{Out}=Vs/2; unless otherwise noted)

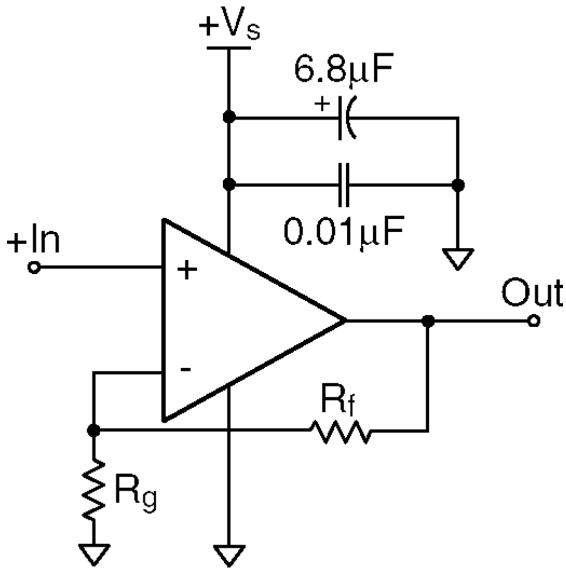
Characteristics	Test Conditions	Min.	Typ.	Max.	Unit
AC Performance					
Gain bandwidth product	C_L=100pF		1.0		MHz
Phase margin			52		Deg
Gain margin			17		dB
Slew rate	Vo=1Vpp		0.52		V/μs
Input voltage noise	>50kHz		36		nV/Hz
DC Performance					
Input offset voltage			±0.8	±5	mV
Input bias current			10		pA
Input offset current			10		pA
Power supply rejection ratio	Vs=+2.5V～+5.5V	60	82		dB
Supply current			120	240	μA
Input characteristics					
Input common mode voltage range	Vs=5.5V	-0.1		5.6	V
Common mode rejection ratio	Vs=5.5V Vo=0.1～4.9V	56	68		dB
Output characteristics					
Output voltage Swing from Rail	R_L=100kΩ		0.008		V
Output current	R_L=100kΩ	20	23		mA

Application Summary

DATA SHEET

The S321 is single supply, general purpose, voltage-feedback amplifiers that is pin-for-pin compatible and drop in replacements with other industry standard S321 amplifier. The S321 is fabricated on a CMOS process, features a rail-to-rail output, and is unity gain stable.

The typical non-inverting circuit schematic is shown in Figure below:



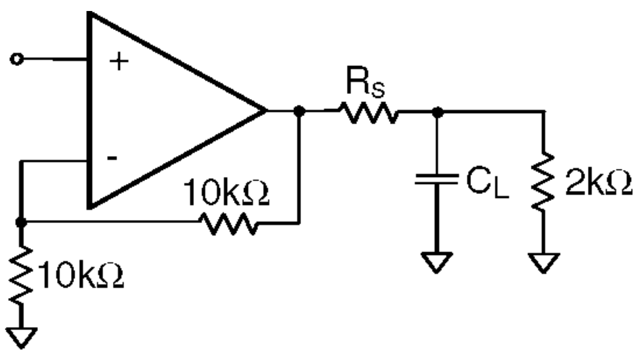
Typical Non-inverting configuration

Power Dissipation

The maximum internal power dissipation allowed is directly related to the maximum junction temperature. If the maximum junction temperature exceeds 150°C, some performance degradation will occur. If the maximum junction temperature exceeds 175°C for an extended time, device failure may occur.

Driving Capacitive Loads

The Frequency Response vs CL plot illustrates the response of the S321 . A small series resistance (Rs) at the output of the amplifier, illustrated in Figure below, will improve stability and settling performance. Rs values in the

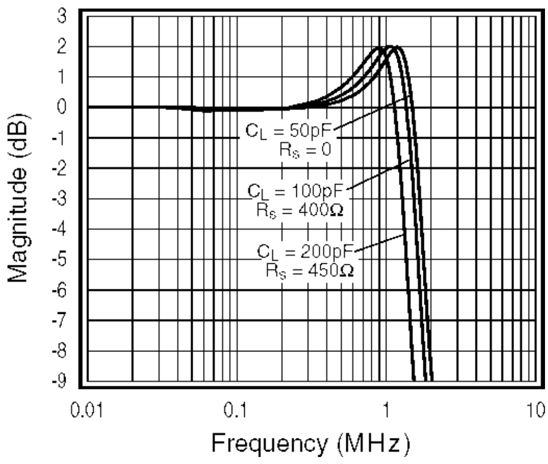


Frequency Response vs CL plot were chosen to achieve maximum bandwidth with less than 1dB of peaking. For maximum flatness, use a larger Rs. As the plot indicates, the

S321 family can easily drive a 200pF capacitive load without a series resistance.

Driving a capacitive load introduces phase-lag into the output signal, which reduces phase margin in the amplifier. The unity gain follower is the most sensitive configuration.

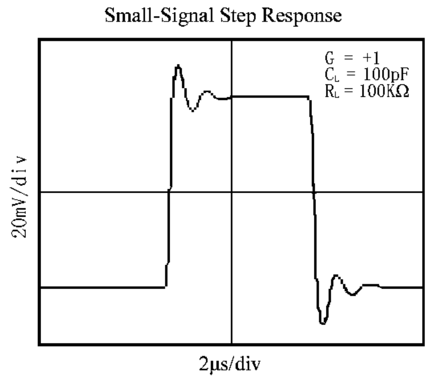
The response is illustrated in Figure below:

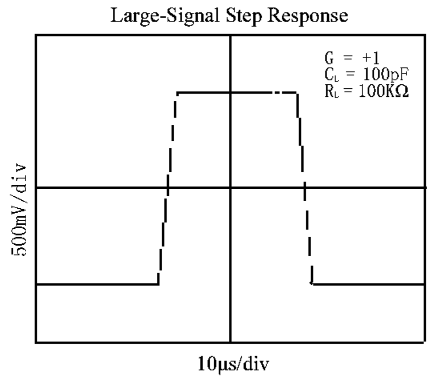


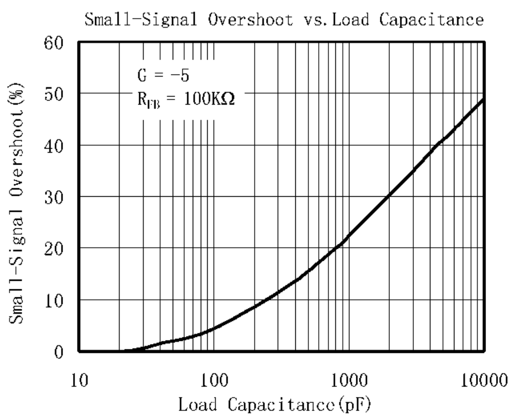
Frequency Response vs C_L for unity gain configuration

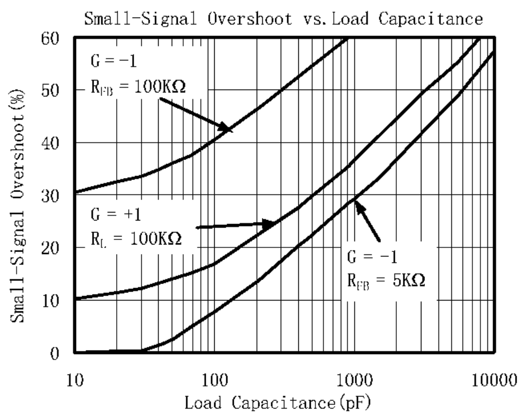
Characteristic Curves

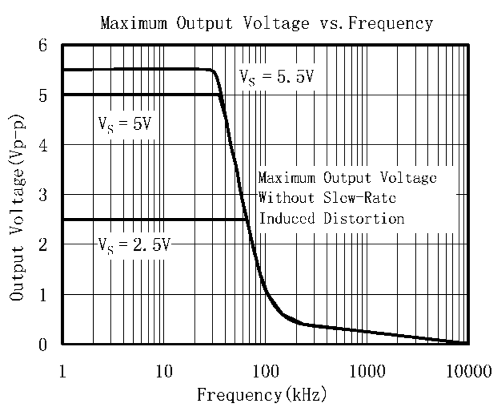
(Ta=+25 ℃ , Vs=+5V, RL=100k Ω connected to Vs/2)

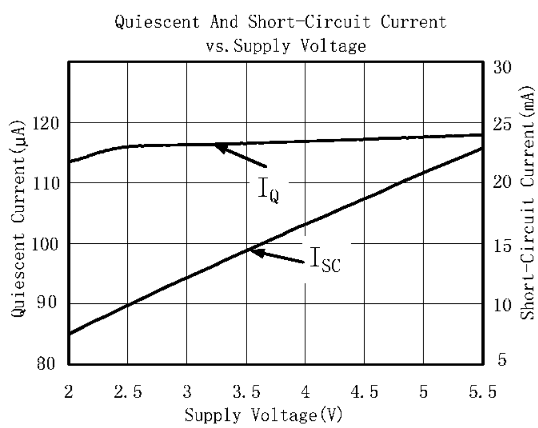


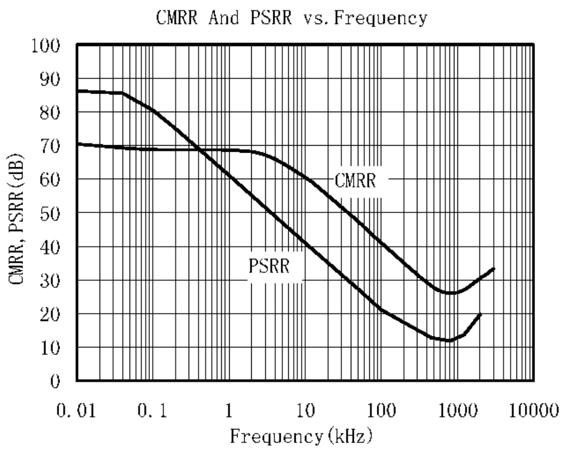


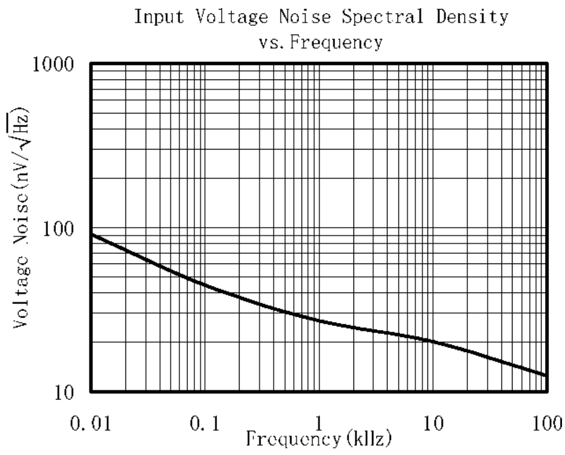


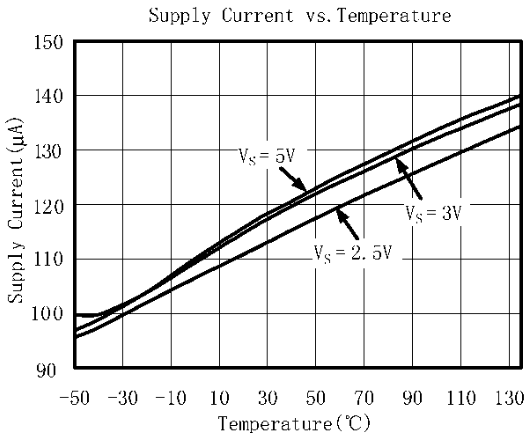


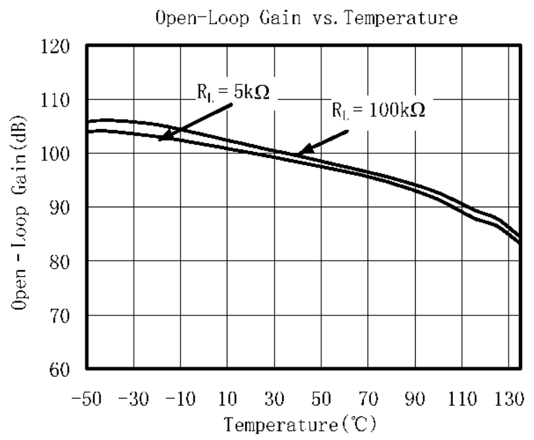


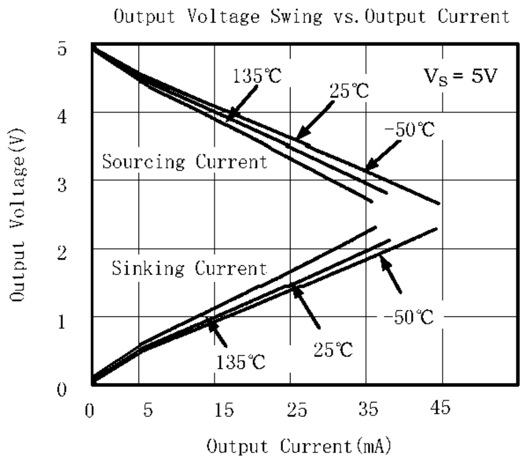


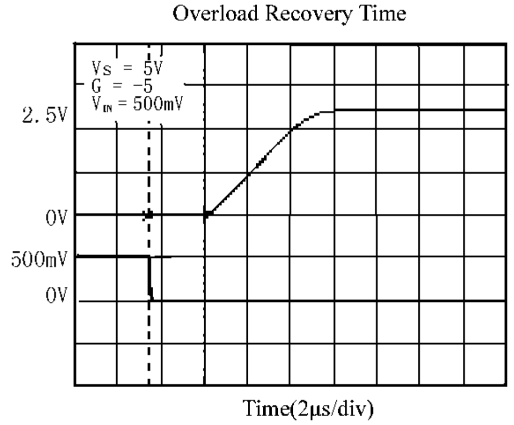

CMRR And PSRR vs. Frequency
CMRR, PSRR (dB)
100
90
80
70
60
50
40
30
20
10
0
CMRR
PSRR
0.01
0.1
1
10
100
1000
10000
Frequency (kHz)

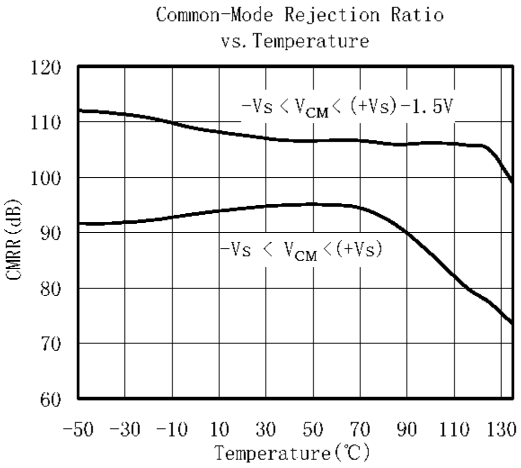

Input Voltage Noise Spectral Density
vs. Frequency
Voltage Noise (nV/√Hz)
1000
100
10
0.01
0.1
1
10
100
Frequency (kHz)

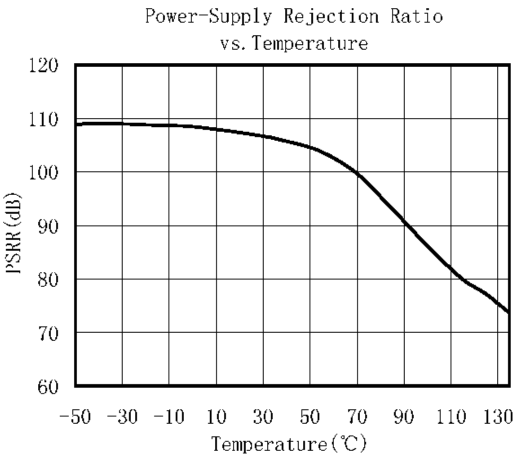

Supply Current vs. Temperature
Supply Current (μA)
150
140
130
120
110
100
90
VS = 5V
VS = 3V
VS = 2.5V
-50
-30
-10
10
30
50
70
90
110
130
Temperature (℃)


Open-Loop Gain vs. Temperature
Open - Loop Gain (dB)
120
110
100
90
80
70
60
RL = 5kΩ
RL = 100kΩ
-50
-30
-10
10
30
50
70
90
110
130
Temperature (℃)


Output Voltage Swing vs. Output Current
Output Voltage (V)
5
4
3
2
1
0
135℃
25℃
VS = 5V
-50℃
Sourcing Current
Sinking Current
-50℃
25℃
135℃
0
5
15
25
35
45
Output Current (mA)

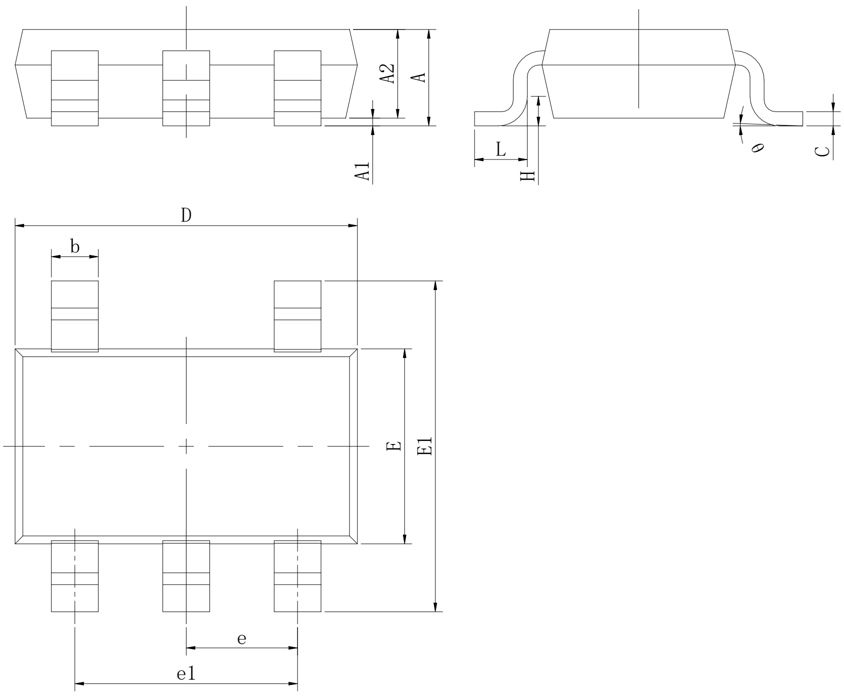

Overload Recovery Time
Vs = 5V
G = -5
VIN = 500mV
2.5V
0V
500mV
0V
Time(2μs/div)


Common-Mode Rejection Ratio
vs. Temperature
CMRR (dB)
120
110
100
90
80
70
60
-Vs < VCM < (+Vs)-1.5V
-Vs < VCM <(+Vs)
-50 -30 -10 10 30 50 70 90 110 130
Temperature(℃)


Power-Supply Rejection Ratio
vs. Temperature
PSRR (dB)
120
110
100
90
80
70
60
-50 -30 -10 10 30 50 70 90 110 130
Temperature(℃)

Outline Dimensions

SOT23-5 Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.130	0.000	0.005
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.95（BSC）		0.037(BSC)	
e1	1.90（BSC）		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

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