# GS321LV

## Single Low Voltage, Low Noise, 2.2MHz, Rail-to-Rail Input/Output, General Purpose CMOS Operational Amplifiers

### Product Description

The GS321LV are low voltage CMOS operational amplifiers, low power, low noise, internally frequency compensated CMOS operational amplifiers. It also features wider bandwidth, lower quiescent and lower offset than legacy LMV operational amplifier family.

They operate from a single power supply ranging from +1.8V to +7.0V. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

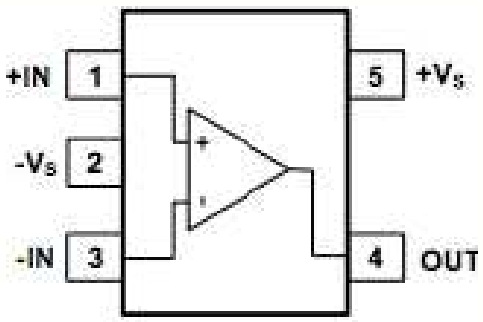
### Features

- Wide power supply range : +1.8V to +7.0V
- Gain-bandwidth product, GBP(typ)=2.2MHz
- Low Noise Voltage Density : 17nV/$\sqrt{Hz}$
- Low quiescent current per amplifier : 60μA
- Low input bias current : 1pA
- Low Offset : $V_{OS}$(typ)=1mV, $I_{OS}$(typ)=1pA
- Unity Gain Stable
- Packages : SOT-23-5L
- RoHS Compliant, 100%Pb & Halogen Free

### Applications

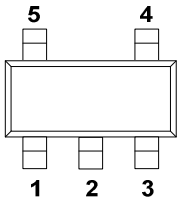
- Chargers
- Power supplies
- Industrial: controls, instruments
- Desktops
- Communications infrastructure

### Block Diagram



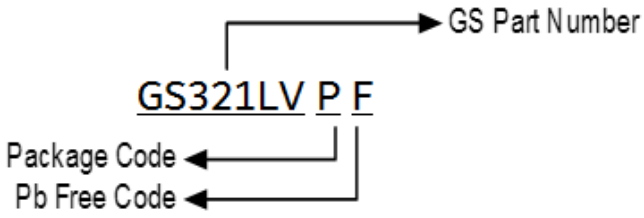
## Pin Assignments

**GS321LVLF (SOT-23-5L)**
**Top View**



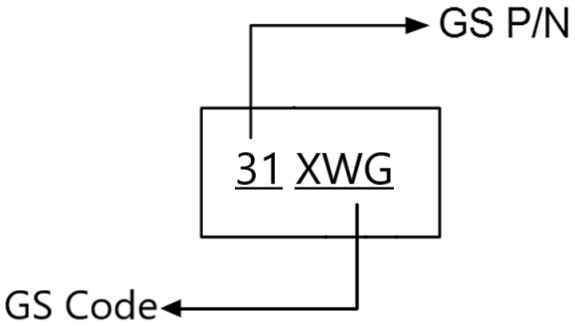

| Pin No | Pin Name |
|---|---|
| 1 | +IN |
| 2 | $-V_S$ |
| 3 | -IN |
| 4 | OUT |
| 5 | $+V_S$ |

## Ordering Information




| Device | Package | Quantity Reel |
|---|---|---|
| GS321LVLF | SOT-23-5L | 3000PCS |

## Marking Information



## Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | Supply voltage | 7.5 | V |
| $V_{IN}$ | Input voltage | -0.5 to 7.5 | V |
| | Output short-circuit duration | Infinite | |
| $I_{IN}$ | Input current : $V_{IN}$ driven negative<br>Input current : $V_{IN}$ driven positive above | 5mA in DC or 50mA in AC (duty cycle=10%, T=1s) | mA |
| $T_{OPA}$ | Operating free-air temperature range | -40 to +85 | ºC |
| $T_{STG}$ | Storage temperature range | -65 to +150 | ºC |
| $T_J$ | Maximum junction temperature | 150 | ºC |
| $\theta_{JA}$ | Thermal resistance junction to ambient | 190 | ºC/W |
| ESD | Human body mode (HBM) | 8000 | V |
| | Machine mode (MM) | 400 | |

Note 1. Stresses beyond 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-rated conditions for extended periods may affect device reliability.

Note 2. This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. Recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## Electrical Characteristics

$V_S$=+5V, $T_A$=25°C, $V_{CM}$=$V_S$/2, $R_L$=600Ω, unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OS}$ | Input offset voltage | | | 1 | 3.7 | mV |
| $I_B$ | Input bias current | | | 1 | | pA |
| $I_{OS}$ | Input offset current | | | 1 | | pA |
| $V_{CM}$ | Common-mode voltage range | $V_S$=6.6V | | -0.1 to +6.7 | | V |
| CMRR | Common-mode rejection ratio | $V_S$=5.5V, $V_{CM}$=-0.1V to 4.8V | 75 | 80 | | dB |
| | | $V_S$=5.5V, $V_{CM}$=-0.1V to 5.6V | 64 | 75 | | dB |
| $A_{OL}$ | Open-loop voltage gain | $R_L$=600Ω, $V_O$=0.15V to 4.85V | 70 | 80 | | dB |
| | | $R_L$=10KΩ, $V_O$=0.05V to 4.95V | 75 | 85 | | dB |
| $\Delta V_{OS}/\Delta_T$ | input offset voltage drift | | | 2.1 | | μV/ºC |
| | Output voltage swing from rail | $R_L$=600Ω | | 0.1 | | V |
| | | $R_L$=100KΩ | | 0.015 | | V |
| $I_{OUT}$ | Output current | | 20 | 25 | | mA |
| | Operating voltage range | | 1.8 | | 7.0 | V |
| PSRR | Power supply rejection ratio | $V_S$=+2.5V to +5.5V<br>$V_{CM}$=(-$V_S$)+0.5V | 70 | 80 | | dB |
| $I_Q$ | Quiescent current | $I_{OUT}$=0A | 60 | 85 | | μA |

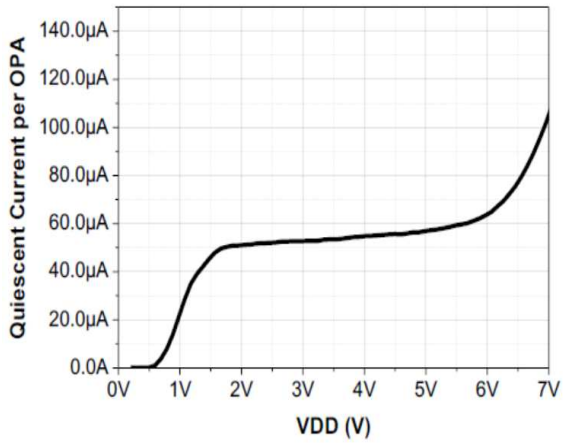
## Electrical Characteristics (Continue)

$V_S$=+5V, $T_A$=25°C, $V_{CM}$=$V_S$/2, $R_L$=600Ω, unless otherwise noted

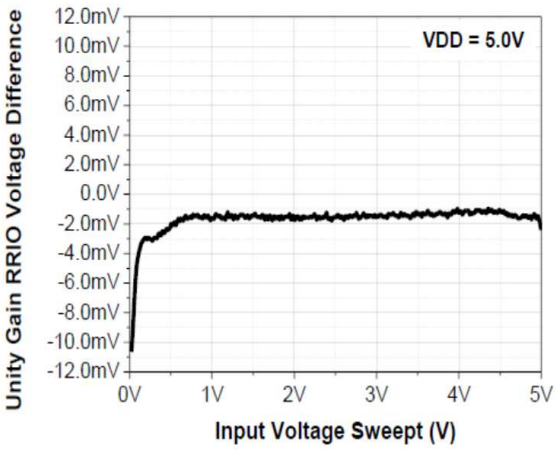
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| GBP | Gain-bandwidth product | $R_L$=600Ω | | 2.2 | | MHz |
| Φo | Phase margin | | | 63.5 | | deg |
| $BW_P$ | Full power bandwidth | <1% distortion | | 400 | | KHz |
| SR | Slew rate | G=+1,2V Output step | | 1.04 | | V/μs |
| ts | Settling time to 0.1% | G=+1,2V Output step | | 0.36 | | μs |
| | Overload recovery time | $V_{IN}$ Gain=$V_S$ | | 0.4 | | μs |
| | Voltage noise density | f=1KHz | | 17 | | nV/√Hz |
| | | f=10KHz | | 11 | | nV/√Hz |

## Typical Performance Characteristics

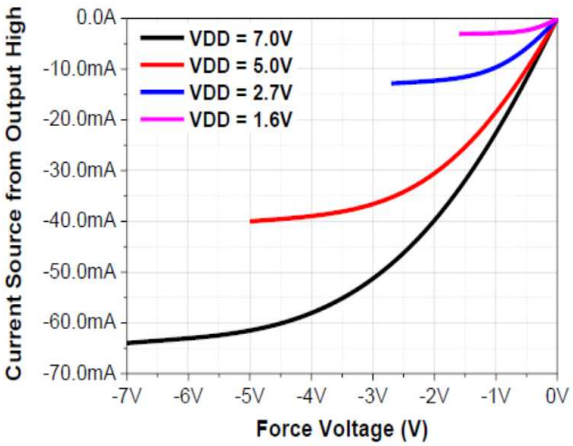
Quiescent Current vs. Supply Voltage



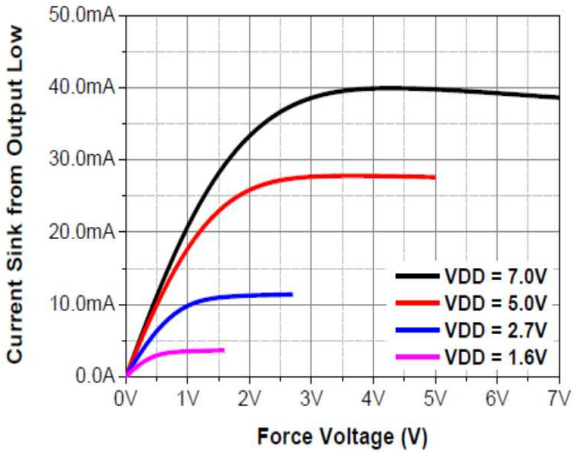

Rail Input to Rail Output Difference




Output Voltage vs. Output Current Source

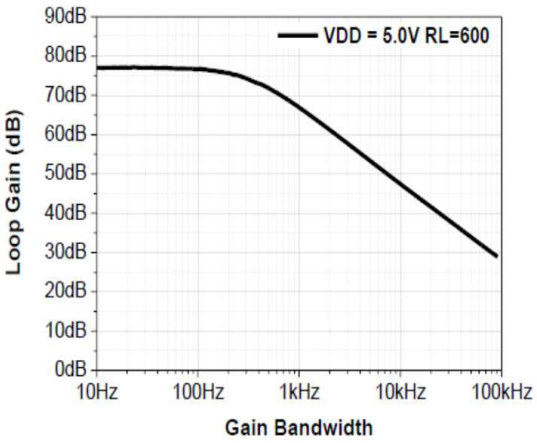



Output Voltage vs. Output Current Sink

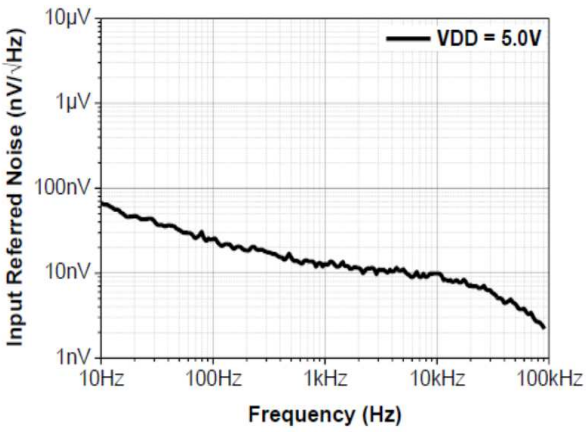


## Typical Performance Characteristics (Continue)

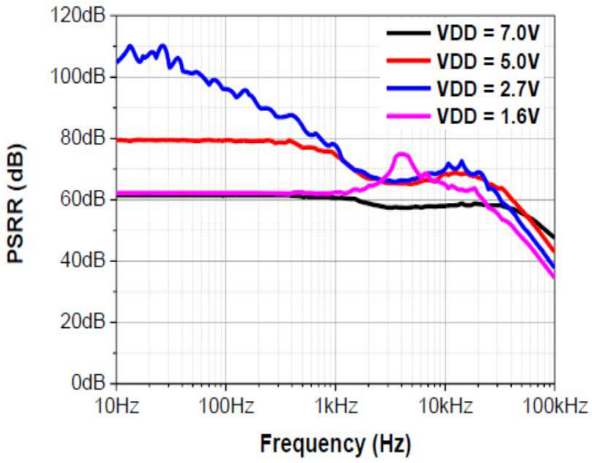
Loop Gain Bandwidth vs. Frequency



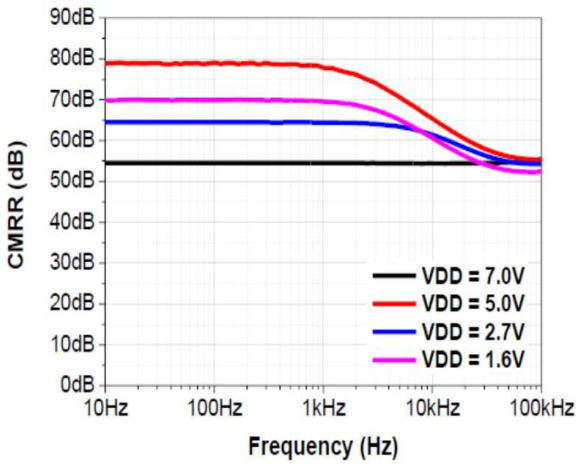

Input Referred Noise vs. Frequency




PSRR vs. Frequency

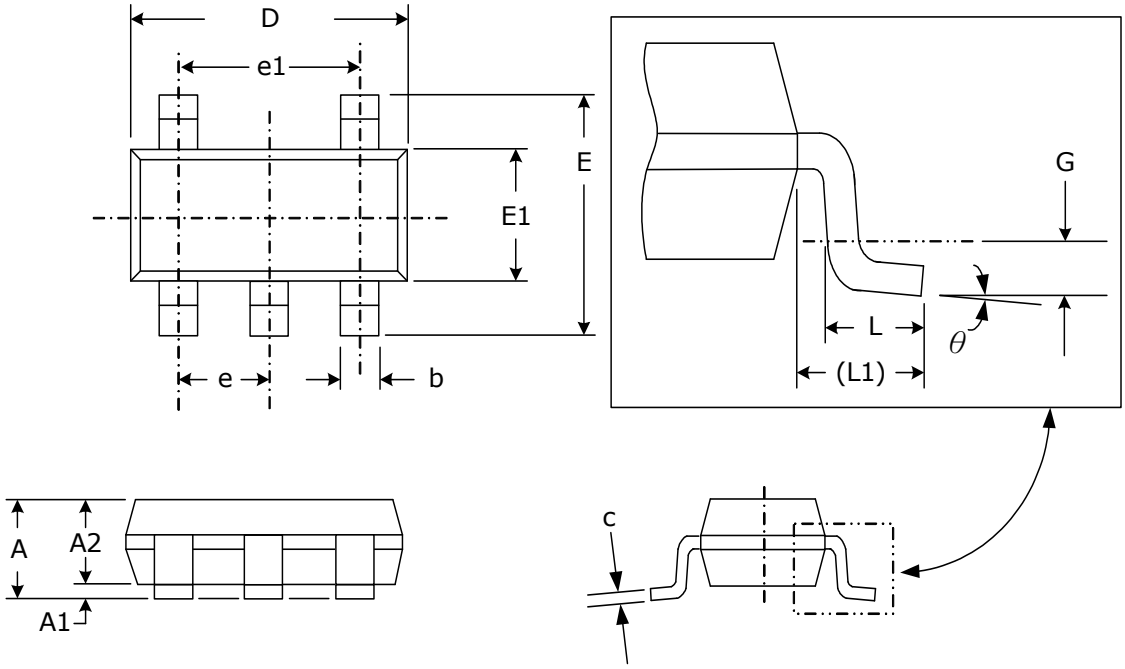



CMRR vs. Frequency



## Package Dimension

# SOT-23-5L




| Dimensions | | | | |
|---|---|---|---|---|
| SYMBOL | Millimeters | | Inches | |
| | MIN | MAX | MIN | MAX |
| A | 0.95 | 1.45 | .037 | .057 |
| A1 | 0.05 | 0.15 | .002 | .006 |
| A2 | 0.90 | 1.30 | .035 | .051 |
| b | 0.30 | 0.50 | .012 | .020 |
| c | 0.08 | 0.20 | .003 | .008 |
| D | 2.80 | 3.00 | .110 | .118 |
| E | 2.60 | 3.00 | .102 | .118 |
| E1 | 1.50 | 1.70 | .059 | .067 |
| e | 0.95 (TYP) | | .037 (TYP) | |
| e1 | 1.90 (TYP) | | .075 (TYP) | |
| L | 0.35 | 0.55 | .014 | .022 |
| L1 | 0.60 (TYP) | | .024 (TYP) | |
| G | 0.25 (TYP) | | .010 (TYP) | |
| Y | 0° | 8° | 0° | 8° |

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