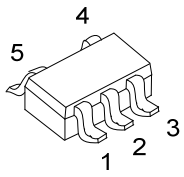
LLV321 *LINEAR INTEGRATED CIRCUIT*

GENERAL PURPOSE, LOW VOLTAGE,RAIL-TO-RAIL OUTPUT AMPLIFIERS



SOT-353

■ DESCRIPTION

The **LLV321** is a single, low cost and voltage feedback amplifier, that consumes only 80μA supply current, 1.2MHz of bandwidth and 1.5V/μs of slew rate at a low supply voltage of 2.7V. It is supplied from 2.7V (±1.35V) to 5.5V (±2.75V). The common mode voltage range extends below the negative rail and the output provides rail-to-rail performance.

The **LLV321** is fabricated on a CMOS process. The combination of low power, rail-to-rail performance, low voltage operation, and tiny package options makes the device well suited for use in personal electronics equipment such as cellular handsets, pagers, PDAs, and other battery powered applications.

The **LLV321** is also applied in portable test instruments, telephone systems, low cost general purpose applications, cellular phones, MP3 players, personal data assistants, A/D buffer, DSP interface, audio applications, smart card readers, keyless entry, Infrared receivers for remote controls, digital still cameras and hard disk drives.

■ FEATURES (at 2.7V)

* Input Voltage Varies From -0.25V to +1.5V
* Supply Current: 80μA
* Output Voltage Varies from 0.01V to 2.69V
* Gain Bandwidth: 1.2MHz
* Slew Rate: 1.5V/μs
* Fully Specified at +2.7V and +5V Supplies
* Operating Temperature Range: -40°C ~ +125°C
* Halogen Free

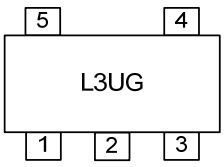
■ ORDERING INFORMATION

Ordering Number	Package	Packing
LLV321G-AL5-R	SOT-353	Tape Reel

LLV321G-AL5-R
(1)Packing Type
(2)Package Type
(3)Halogen Free

(1) R: Tape Reel
(2) AL5: SOT-353
(3) G: Halogen Free

■ MARKING



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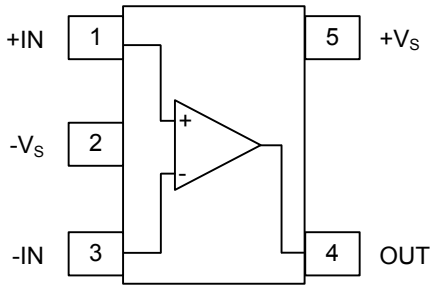
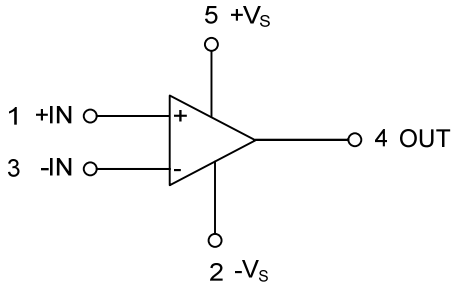
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	+IN	Positive Input
2	$-V_S$	Negative Supply Voltage
3	-IN	Negative Input
4	OUT	Output
5	$+V_S$	Positive Supply Voltage

■ LOGIC SYMBOL



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_I	$-V_S$-0.5~+V_S+0.5	V
Supply Voltages	Vs	0~+6	V
Maximum Junction Temperature	T_J	+175	°C
Storage Temperature Range	T_{STG}	-65~+150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Power Supply Operating	V_S	2.5~5.5	V
Ambient Operating Temperature	T_{OPR}	-40~+125	°C

■ ELECTRICAL CHARACTERISTICS

(T_C= 25°C, V_S = +2.7V, G = 2, R_L = 10kΩ to V_S/2, R_F = 10kΩ, $V_{O(DC)}$ = V_{CC}/2; unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
AC Performance						
Gain Bandwidth Product	GBWP	C_L = 50pF, R_L =2kΩ to V_S/2		1.2		MHz
Phase Margin	Φ_m			52		deg
Gain Margin	G_m			17		dB
Slew Rate	SR	V_O= 1V_{PP}		1.5		V/μs
Input Voltage Noise	en	>50kHz		36		nV/√Hz
DC Performance						
Input Offset Voltage (Note 1)	V_{OS}			1.7	7	mV
Average Drift	TCV_{OS}			8		μV/°C
Input Bias Current (Note 2)	I_B			<1		nA
Input Offset Current (Note 2)	I_{OS}			<1		nA
Power Supply Rejection Ratio (Note 1)	PSRR	DC	50	65		dB
Supply Current	I_S			80	120	μA
Input Characteristics						
Input Common Mode Voltage Range (Note 1)	V_{CML}	Low	0	-0.25		V
	V_{CMH}	High		1.5	1.3	V
Common Mode Rejection Ratio (Note 1)	CMRR		50	70		dB
Output Characteristics						
Output Voltage Swing (Note 1)	V_{OL}	R_L = 10kΩ to V_S/2; Low	0.1	0.01		V
	V_{OH}	R_L = 10kΩ to V_S/2; High		2.69	2.6	V

Note: 1. Guaranteed by testing or statistical analysis at +25°C.
2. +IN and -IN are gates to CMOS transistors with typical input bias current of <1nA. CMOS leakage is too small to practically measure.
3. Min/Max ratings are based on product characterization and simulation. Individual parameters are tested as noted. Outgoing quality levels are determined from tested parameters.

■ ELECTRICAL CHARACTERISTICS (Cont.)

(T_C= 25°C, V_S = +5V, G = 2, R_L = 10kΩ to V_S/2, R_F = 10kΩ, $V_{O(DC)}$ = V_{CC}/2; unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
AC Performance						
Gain Bandwidth Product	GBWP	C_L = 50pF, R_L =2kΩ to V_S/2		1.4		MHz
Phase Margin	Φ_m			73		deg
Gain Margin	G_m			12		dB
Slew Rate	SR			1.5		V/μs
Input Voltage Noise	en	>50kHz		33		nV/√Hz
DC Performance						
Input Offset Voltage (Note 1)	V_{OS}			1	7	mV
Average Drift	TCV_{OS}			6		μV/°C
Input Bias Current (Note 2)	I_B			<1		nA
Input Offset Current (Note 2)	I_{OS}			<1		nA
Power Supply Rejection Ratio (Note 1)	PSRR	DC	50	65		dB
Open Loop Gain (Note 1)	Av		50	70		dB
Supply Current	I_S			100	150	μA
Input Characteristics						
Input Common Mode Voltage Range (Note 1)	V_{CML}	Low	0	-0.4		V
	V_{CMH}	High		3.8	3.6	V
Common Mode Rejection Ratio (Note 1)	CMRR		50	75		dB
Output Characteristics						
Output Voltage Swing	V_O	R_L = 2kΩ to V_S/2; Low/High		0.036~4.95		V
	V_{OL}	R_L = 10kΩ to V_S/2; Low (Note 1)	0.1	0.013		V
	V_{OH}	R_L = 10kΩ to V_S/2; High (Note 1)		4.98	4.9	V
Short Circuit Output Current (Note 1)	I_o	Sourcing; V_O=0V	5	+34		mA
	I_o	Sinking; V_O=5V	10	-23		mA

Note: 1. Guaranteed by testing or statistical analysis at +25°C.
2. +IN and -IN are gates to CMOS transistors with typical input bias current of <1nA. CMOS leakage is too small to practically measure.
3. Min/max ratings are based on product characterization and simulation. Individual parameters are tested as noted. Outgoing quality levels are determined from tested parameters.

■ APPLICATION INFORMATION

General Description

The UTC **LLV321** is a low cost, single supply, low voltage and voltage feedback amplifier which is characterized a rail- to- rail output. It is designed to operate on a CMOS process, and is unity gain stable. Figure 1 shows the typical non-inverting circuit schematic

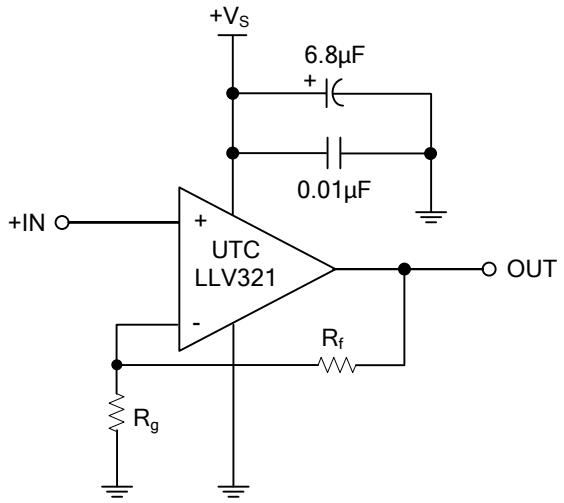


Figure 1. Typical Non-Inverting Configuration

Power Dissipation

For the UTC **LLV321**, the maximum internal power dissipation is directly depending on the maximum junction temperature. If the maximum junction temperature is higher than 150°C, some performances are declined. If the maximum junction temperature becomes higher than 175°C for an extended time, device failure may be cause.

Driving Capacitive Loads

In figure 2, a small series resistance (R_S) at the output of the amplifier, will improve stability and settling performance. 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. In a unity gain follower configuration, the UTC **LLV321** requires a 450Ω series resistor to drive a 200pF load. The response is as seen in TYPICAL CHARACTERISTIC.

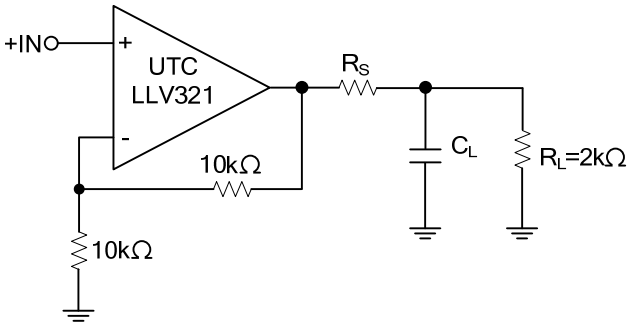
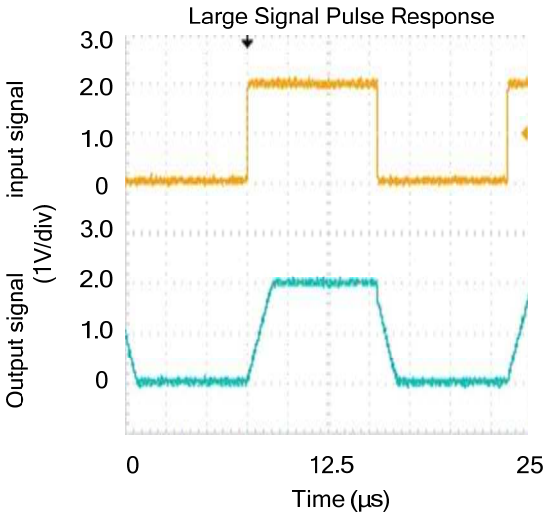
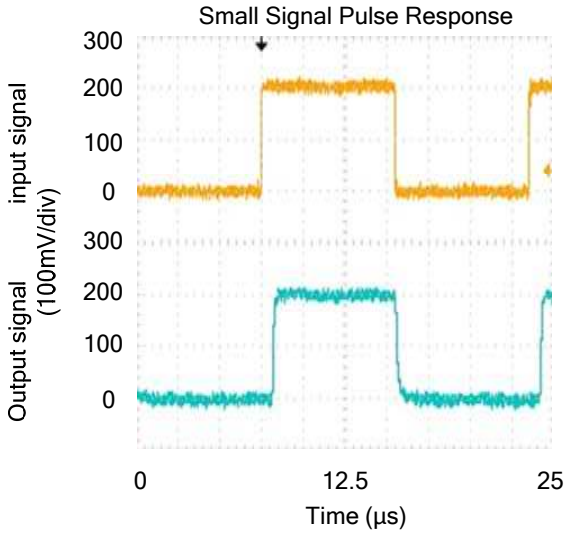
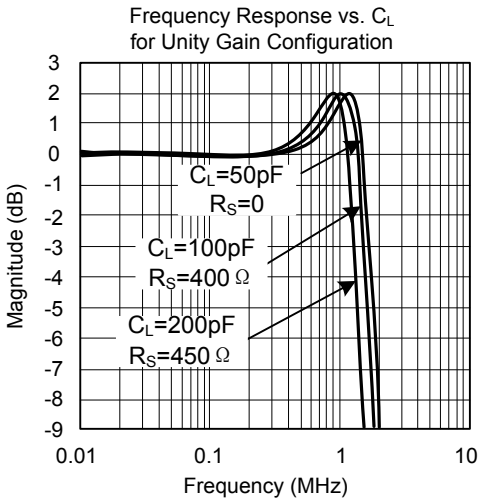


Figure 2. Typical Topology for Driving a Capacitive Load

■ TYPICAL CHARACTERISTIC







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