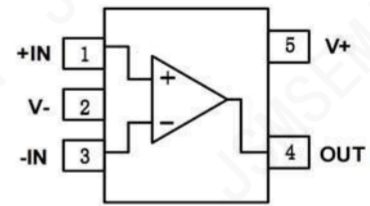
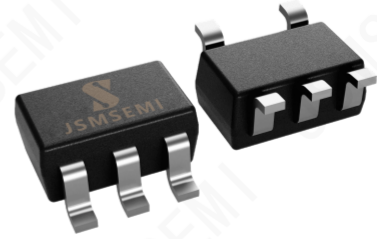


## DESCRIPTION

The LPV321M5X/NOPB of products offer low voltage operation and rail-to-rail input and output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (10MHz) and slew rate (8.5V/us). The operational amplifiers are unity gain stable and feature an ultra-low input bias current.

The LPV321M5X/NOPB has lower offset voltage, which is guaranteed not upper than 0.5mV at 25°C with  $V_s = 5V$ ,  $V_{CM} = V_s/2$ .

The LPV321M5X/NOPB of operational amplifiers under single supplies of 2.1V to 5.5V or dual power supplies of  $\pm 1.05V$  to  $\pm 2.75V$ . The devices are ideal for sensor interfaces, active filters and portable applications.



SOT23-5

## FEATURES

- HIGH GAIN BANDWIDTH: 10MHz
- EXCELLENT SLEW RATE: 8.5V/us
- RAIL-TO-RAIL INPUT AND OUTPUT
- LOWER OFFSET VOLTAGE:  $\pm 0.5mV$  Max
- INPUT VOLTAGE RANGE: -0.2V to +5.7V with  $V_s = 5.5V$
- SUPPLY RANGE: +2.1V to +5.5V
- OPERATING RANGE: -40°C TO +125°C
- Micro SIZE PACKAGES: SOT23-5/SC70

## APPLICATIONS

- SENSORS
- ACTIVE FILTERS
- TEST EQUIPMENT
- DRIVING A/D CONVERTERS
- PHOTODIODE AMPLIFICATION

## Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

PARAMETER	MIN	MAX	UNIT
Supply Voltage, $V_s=(V+) - (V-)$		7	V
Signal Input Voltage <sup>(2)</sup>	(V-)-0.5	(V+)+0.5	V
Signal Output Voltage <sup>(3)</sup>	(V-)-0.5	(V+)+0.5	V
Signal Input Current	-10	+10	mA
Signal Output Current	-150	+150	mA
Maximum Junction Temperature		+150	°C
Storage Temperature Range	-65	+150	°C

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails should be current-limited to 10mA or less.

Note 3: Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.5V beyond the supply rails should be current-limited to ±150mA or less.

## ESD Ratings

SYMBOL	PARAMETER		VALUE	UNIT
V(ESD)	Electrostatic discharge	Human-body model (HBM)	±4500	V

## Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

PARAMETER		MIN	TYP	MAX	UNIT
Supply Voltage, $V_s=(V+) - (V-)$	Signal-supply	2.1		5.5	V
	Dual-supply	1.05		2.75	V
Operating Temperature Range		-40	+25	+125	°C

**ELECTRICAL CHARACTERISTICS**

 (At  $T_A=+25^{\circ}\text{C}$ ,  $V_S=5\text{V}$ ,  $R_L=10\text{k}\Omega$  connected to  $V_S/2$ , and  $V_{OUT}=V_S/2$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	LPV321M5X/NOPB			
			MIN	TYP	MAX	UNIT
<b>POWER SUPPLY</b>						
Operating Voltage Range	$V_S$		2.1		5.5	V
Quiescent Current/Amplifier	$I_Q$			0.4		mA
Power-Supply Rejection Ratio	PSRR	$V_S=2.5\text{V to }5.5\text{V}$ , $V_{CM}=(V_-)+0.5\text{V}$	75			dB
Turn-on Time	$t_{ON}$			12		$\mu\text{s}$
<b>INPUT</b>						
Input Offset Voltage	$V_{OS}$	$V_{CM}=V_S/2$ ,	-3	$\pm 0.2$	+3	mV
Input Offset Voltage Average Drift	$V_{OS\ TC}$	$T_A=-40^{\circ}\text{C}\sim+125^{\circ}\text{C}$		$\pm 2.6$		$\mu\text{V}/^{\circ}\text{C}$
Input Bias Current	$I_B$		-10	$\pm 1$	+10	pA
Input Offset Current	$I_{OS}$		-10	$\pm 1$	+10	pA
Common-Mode Voltage Range	$V_{CM}$	$V_S=5.5\text{V}$	-0.2		5.7	V
Common-Mode Rejection Ratio	CMRR	$V_S=5.5\text{V}$ , $V_{CM}=-0.2\text{V to }4\text{V}$	70			dB
		$V_S=5.5\text{V}$ , $V_{CM}=-0.2\text{V to }5.7\text{V}$	65			dB
<b>OUTPUT</b>						
Open-Loop Voltage Gain	$A_{OL}$	$R_L=2\text{k}\Omega$ , $V_O=0.15\text{V to }4.85\text{V}$	86			dB
		$R_L=10\text{k}\Omega$ , $V_O=0.05\text{V to }4.95\text{V}$	96			dB
Output Swing From Rail		$R_L=2\text{k}\Omega$		50		mV
		$R_L=10\text{k}\Omega$		10		mV
Output Current Source	$I_{OUT}$			140		mA
<b>FREQUENCY RESPONSE</b>						
Slew Rate	SR			8.5		$\text{V}/\mu\text{s}$
Gain-Bandwidth Product	GBP			10		MHz
Phase Margin	PM			62		$^{\circ}$
Setting Time,0.1%	$t_s$			0.5		$\mu\text{s}$
Overload Recovery Time		$V_{IN}\cdot\text{Gain}\geq V_S$		3.2		$\mu\text{s}$
<b>NOISE</b>						
Input Voltage Noise Density	$e_n$	$f=1\text{KHz}$		9.5		$\text{nV}/\sqrt{\text{Hz}}$
		$f=10\text{KHz}$		6.5		$\text{nV}/\sqrt{\text{Hz}}$

### TYPICAL CHARACTERISTICS

At  $T_A=+25^{\circ}\text{C}$ ,  $V_S=5\text{V}$ ,  $R_L = 10\text{k}\Omega$  connected to  $V_S/2$ ,  $V_{OUT}=V_S/2$ , unless otherwise noted.

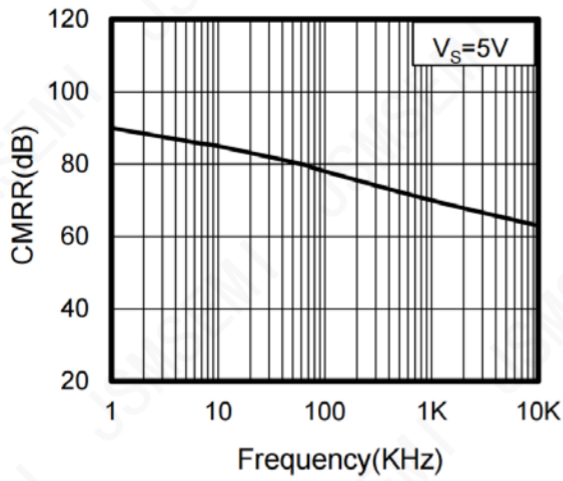


Figure 1. Common-Mode Rejection Ratio vs Frequency

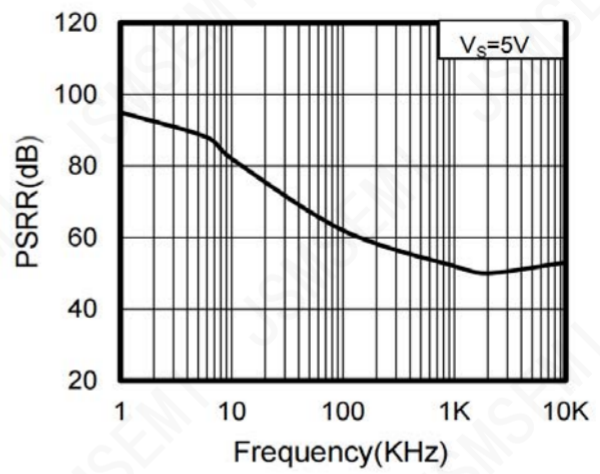


Figure 2. Power-Supply Rejection Ratio vs Frequency

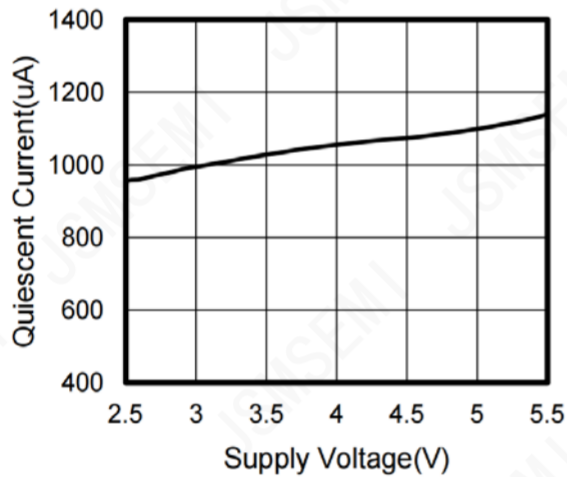


Figure 3. Quiescent Current vs Supply Voltage

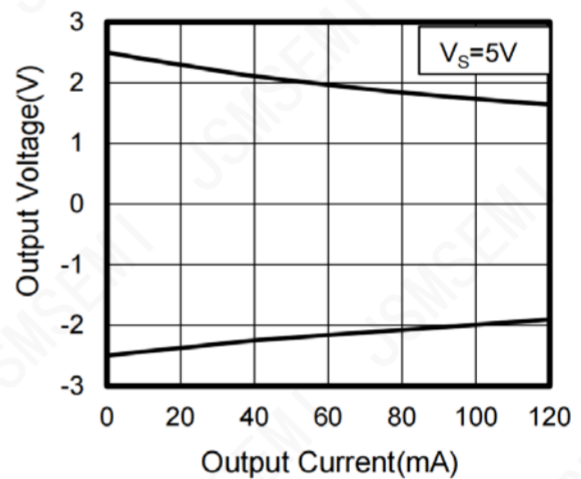


Figure 4. Output Voltage vs Output Current

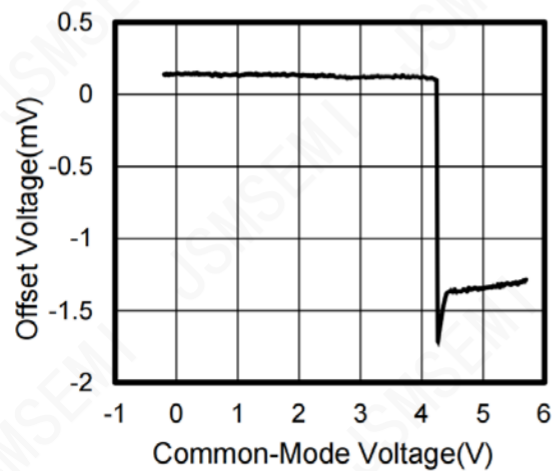


Figure 5. Offset Voltage vs Common-Mode Voltage

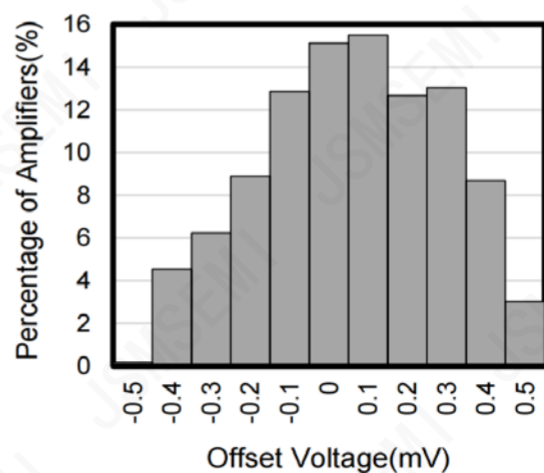


Figure 6. Offset Voltage Production Distribution

## LAYOUT

### Layout Guideline

Attention to good layout practices is always recommended. Keep traces short. When possible, use a PCB ground plane with surface-mount components placed as close to the device pins as possible. Place a 0.1uF capacitor closely across the supply pins.

These guidelines should be applied throughout the analog circuit to improve performance and provide benefits such as reducing the EMI susceptibility.

### Layout Example

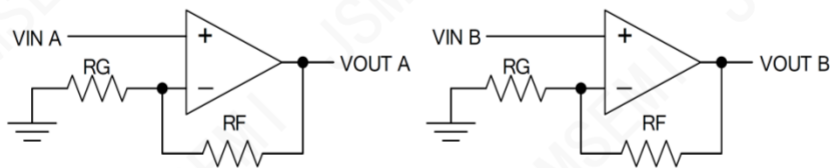


Figure 7. Schematic Representation

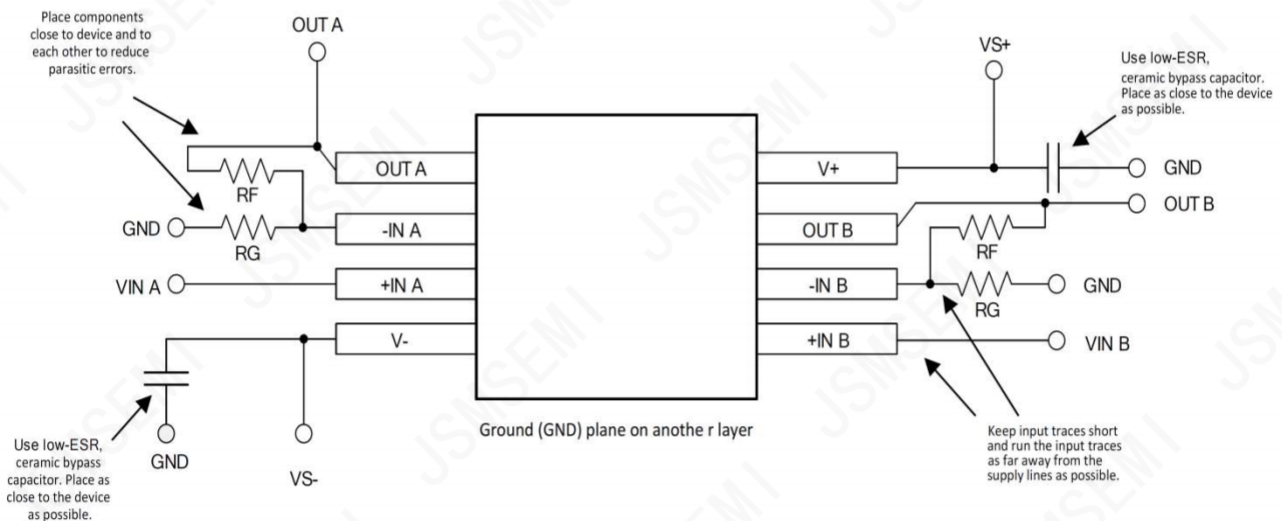
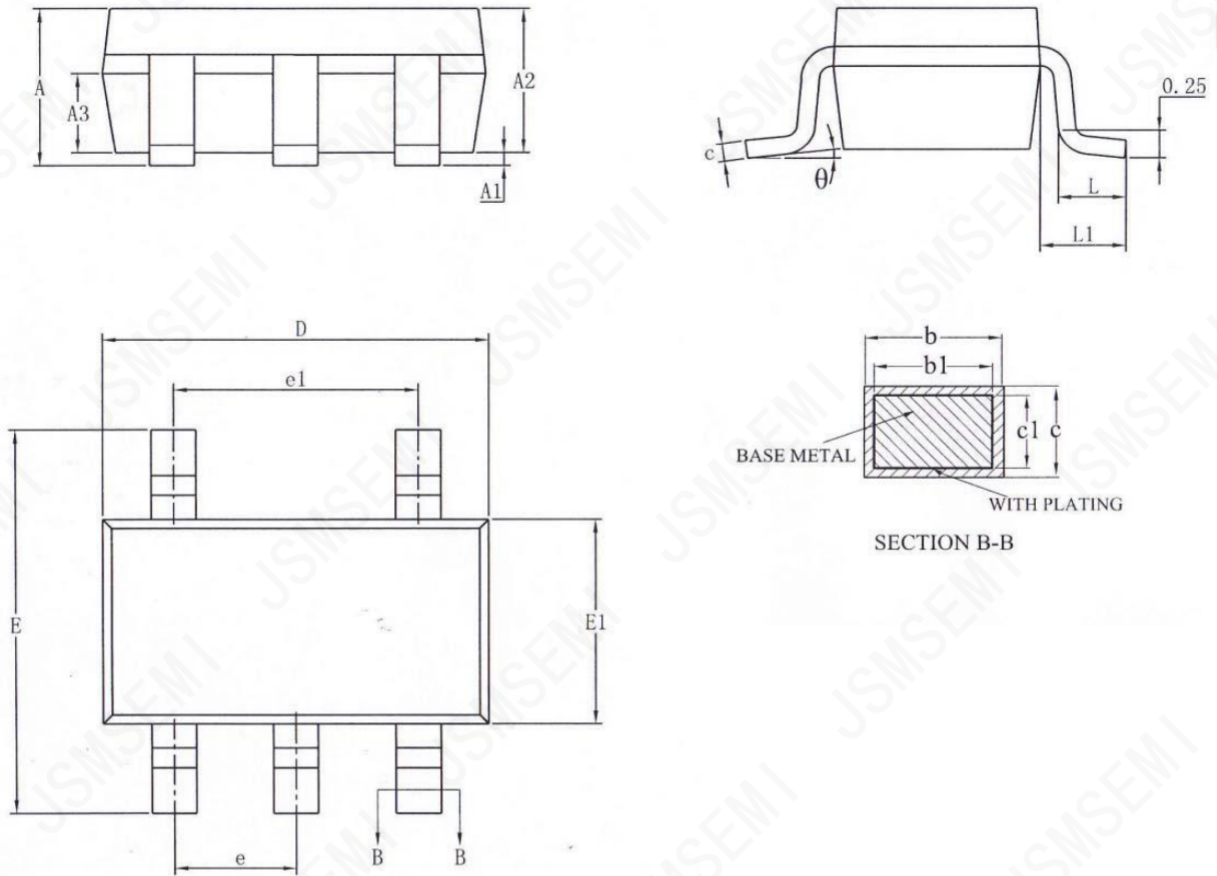


Figure 8. Layout Example

**PACKAGE OUTLINE DIMENSIONS**
**SOT23-5**


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.25
A1	0.04	—	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	—	0.41
b1	0.32	0.35	0.38
C	0.15	—	0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
e1	1.90BSC		
L	0.30	—	0.60
L1		0.60REF	
theta	0	—	8°

## Revision History

Rev.	Change	Date
V1.0	Initial version	6/27/2021

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