PVOA201

Ultralow Power / Low Noise, Negative Rail Input, Rail-to-Rail Output Fully Differential Operational Amplifier and ADC Driver

The PVOA201 is a low power, low noise, fully-differential op amp with a rail-to-rail output and an input common-mode range including the negative power supply rail. This amplifier is an ideal candidate for low power data acquisition systems, handhelds, and other portable devices where low power dissipation is important.

The amplifier features an adjustable output common mode control for optimizing the common mode level, ideal for driving analog-to-digital converters. The device allows easy translation from single-ended signals to differential signals on the input or on the output. The PVOA201 is also ideal for level shifting ground referenced signals to common mode levels within the output common mode range of the amplifier.

With a low input referred voltage noise of 3.5nV/$\sqrt{Hz}$ and single supply operation from +2.5V to +3.6V, the PVOA201 is well suited for a variety of low power / low noise data acquisition and signal processing applications.

General Features

- Fully Differential
- Bandwidth: 165MHz, G=1
- Slew Rate: 58 V/µs
- Input Voltage Noise: 3.5nV/$\sqrt{\text{Hz}}$
- Rail-to-Rail Output
- Negative Rail Input
- Output Common Mode Control
- Power Supply:
  Single Supply: +2.5V to +3.6V
  Dual Supply: +/-1.25V to +/-1.8V
  Supply Current: 1.15mA
- Small PCB area and layout
  Package: TSSOP-8 lead
- Temp range: -40 to +85 °C

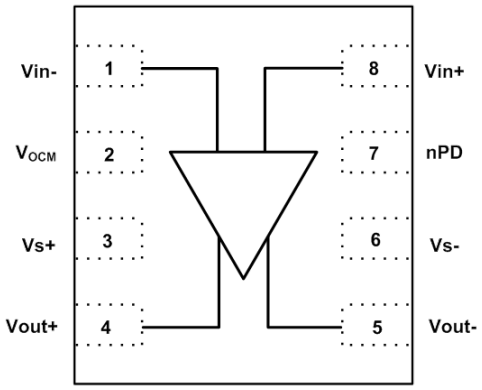


Figure 1: PVOA201

Applications

- ADC and SAR Drivers
- Portable Instrumentation and handhelds
- Battery Powered Applications
- Single-Ended to Differential Conversion
- Common Mode Level Shifter
- Audio Amplifier
- Differential Active Filters

Contents

Pin Description

Pin Number	Pin Name	Description
1	Vin-	Inverting input
2	Vocm	Common–mode control input
3	Vs+	Positive power supply input
4	Vout+	Non-inverting output
5	Vout-	Inverting output
6	Vs-	Negative power supply input
7	nPD	Amplifier power down input. Logic “low” places the device in sleep mode
8	Vin+	Non-inverting input

8-Lead TSSOP Package, Top View

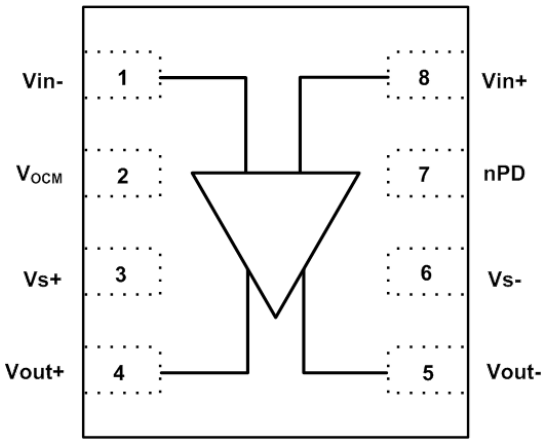


Figure 2: PVOA201 Pin Diagram

Absolute Minimum and Maximum Ratings

Parameter	Symbol	Conditions	Min	Max	Unit
PVOA201 Supply Voltage		V_{S-} to V_{S+}		+3.6	V
Input / Output Voltage	$V_{IN+/-}$, $V_{OUT+/-}$, V_{OCM}		(V_{S-}) - 0.3	(V_{S+}) + 0.3	V
Differential Input Voltage	V_{ID}			V_{S-} to V_{S+}	V
ESD	Human Body (HBM)				V
Max Junction Temperature	T_J	Operating		+125	°C
Storage Temp	T_{STG}		-40	+150	°C

Electrical Specifications

TA = +25 ° C, V_{S+} - V_{S-} = +3.3V, V_{OCM} = (V_{S+} - V_{S-}) / 2, R_F=R_G=2K unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Power Supply						
Temperature Range			-40		125	°C
Power Supply Supply Voltage Supply Current	 V_{DD3p3} I_{DD3p3}		 2.5	 3.3 1.15	 3.6	 V mA
Power Supply Rejection	+PSRR -PSRR					dB dB
Power Down Current				10		µA
Enable Voltage	nPD	PVOA201 “on” PVOA201 “off”	2.25		 0.5	V V
AC Performance						
Small Signal Bandwidth		G=1 G=2 G=5 G=10		160 98 40 19		MHz MHz MHz MHz
Large Signal Bandwidth		G=1, Vout=2Vp-p		9		MHz
Differential Rising Slew Rate		2V Step		58		V/µs
Differential Falling Slew Rate		2V Step		58		V/µs
Settling Time to 0.1%		Vout_diff=2Vp-p		43		ns
Harmonic Distortion						
Input Characteristics						
Input Voltage Noise		F=10kHz		3.5		nV/$\sqrt{Hz}$
Input Current Noise		F=10kHz		0.72		pA/$\sqrt{Hz}$
Input Bias Current				808		nA
Input Bias Current Drift		T_{MIN} to T_{MAX}		2.2		nA/°C
Input Offset Voltage				52		µV
Input Offset Voltage Drift		T_{MIN} to T_{MAX}				
Input Resistance		Differential Common Mode		64 9		kΩ MΩ
Input Capacitance				1		pF
Open-Loop Gain		R_G=R_F=4k		91		dB
Common Mode Input Range			(Vs-)-0.3		(Vs+)-0.9	V
Common Mode Rejection Ratio				120		dB
Output Characteristics						
Output Voltage Swing		Each single-ended output		(Vs-) +0.15 to (Vs+)-0.15		V
Output Current Drive				+/-14		mA

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
V_{OCM} Control						
Gain				1		
Common-mode Offset			-10		+10	mV
Input Bias Current				250		pA
Input Impedance				50		kΩ
V_{OCM} Voltage Range				(Vs-) +0.9 to (Vs+)-0.8		V

Applications Information

Differential Input to Differential Output Amplifier

The PVOA201 is a fully differential operational amplifier that can be configured in several different ways depending on application. One of the most common uses for the amplifier is to process differential input signals and amplify these signals to differential outputs. In the following diagram for simplicity, the V_{OCM} and nPD pins are not shown. The closed loop gain of the circuit is simply R_F / R_G.

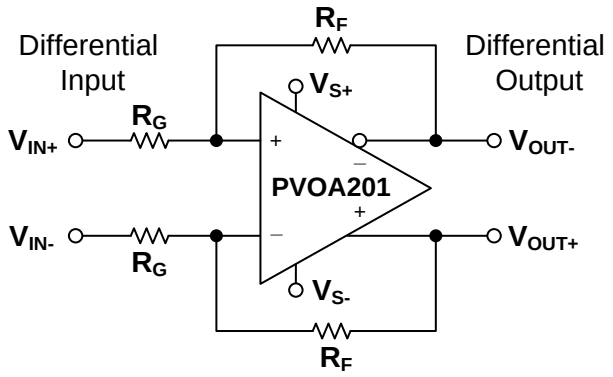


Figure 3: Differential Input to Differential Output Amplifier

Single-Ended Input to Differential Output Amplifier

Another application of the PVOA201 is to convert single ended input signals to differential output signals. The signals can be ground referenced as illustrated in Figure 4 below. Once again, the gain of the circuit is set by the ratio R_F / R_G. V_{OCM} and nPD pins are not shown for simplicity.

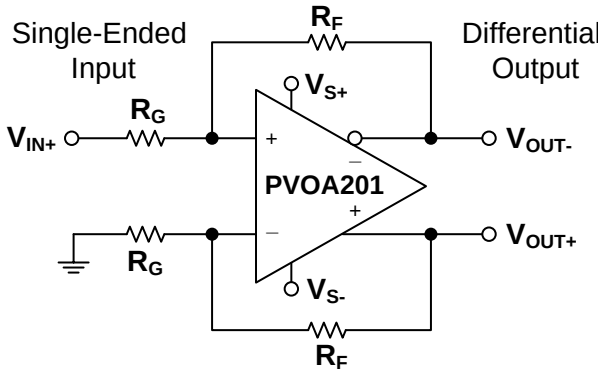


Figure 4: Single-Ended Input to Differential Output Amplifier

Setting the Output Common Mode Voltage at Pin 2 V_{OCM}.

The output common mode voltage of the operational amplifier tracks the voltage at the V_{OCM} pin. The V_{OCM} pin can be left unconnected. In this case, the output common mode level of the amplifier will be held to mid-supply.

V_{OCM} (pin 2) can be driven by connecting an external voltage source to the pin. When externally driving the pin, the guidelines detailed in the electrical specification section should be followed as to not exceed the V_{OCM} range of (Vs-) +0.9Vdc to (Vs+)-0.8Vdc. For instance, using a single supply voltage of +3.3V allows the user to adjust the output common mode level between the limits +0.9V to +2.5V. An external current is required to drive the V_{OCM} given by the following equation:

$$I_{VOCM} = \frac{2V_{OCM} - (V_{S+} - V_{S-})}{50k\Omega}$$

A decoupling capacitor of at least 0.1uF is recommended on the V_{OCM} pin for noise reduction.

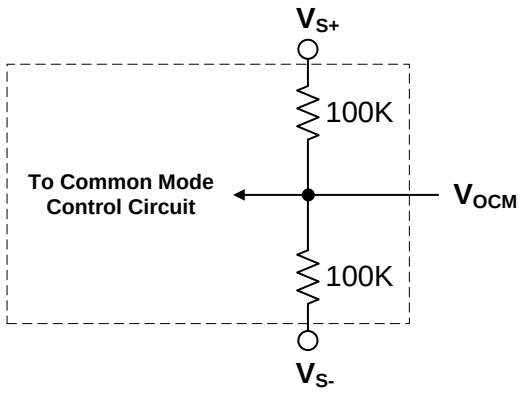
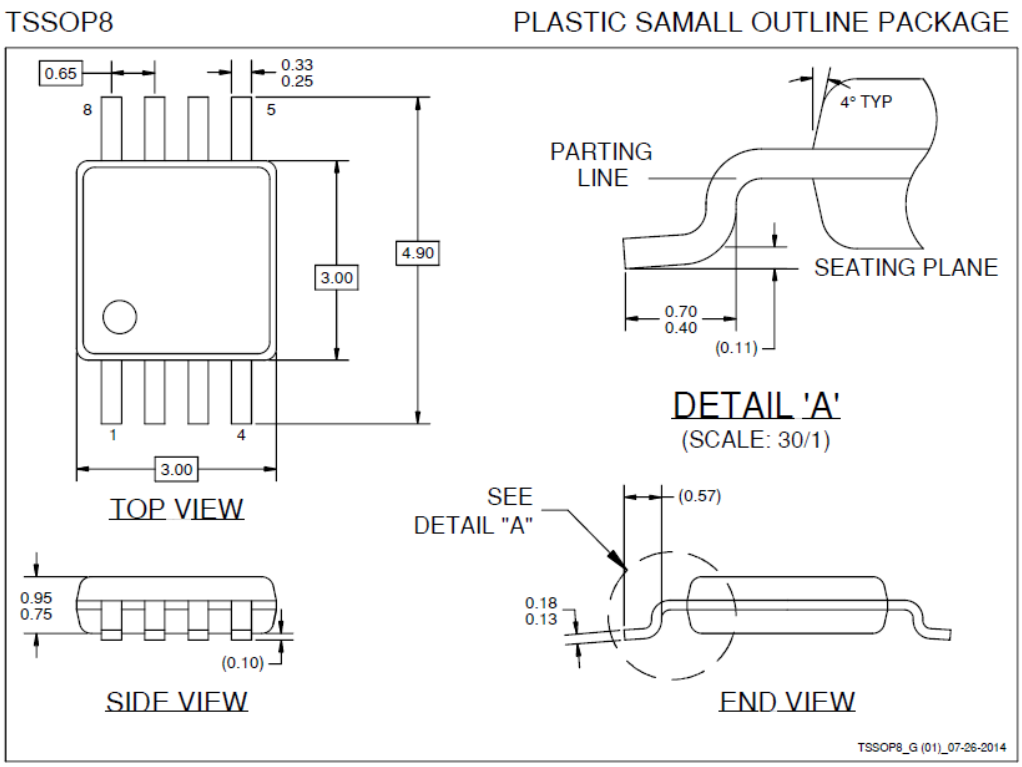


Figure 5: Simplified V_{OCM} Input

Package Information

8-Lead Plastic TSSOP



NOTES:
A. ALL LINEAR DIMENSIONS ARE IN MILLIMETERS
B. DRAWING IS NOT TO SCALE
C. THIS DRAWING IS SUBJECT TO CHANGE WITHOUT NOTICE