AXOP36062/1S

60V RRIO Operational Amplifiers

Datasheet – Apr 2023

Description

The AXOP3606x is a high voltage (3V to 60V) operational amplifier (opamp) series with rail-to-rail input and output swing capabilities. These devices are very suitable for applications where high voltage operation, a small footprint, and high capacitive load drive are required. AXOP36061S is single opamp with Shutdown function. AXOP36062 is dual opamp without Shutdown function.

Features

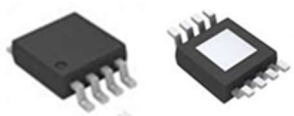
- Supply voltages from 3V to 60V
- Rail-to-rail input and output
- Low input offset voltage: ±1mV typ
- Unity-gain bandwidth: 17MHz
- Slew rate: 15V/μs
- THD 105dB
- SNR 105dB
- Low quiescent current (per opamp): 2.2mA typ @60V
- Easier to stabilize with higher capacitive load due to resistive open-loop output impedance
- Shutdown function (AXOP36061S only)

Applications

- Test equipment
- High voltage regulators and power amplifiers
- Industrial control
- Piezo drivers
- Active filters
- High-V current sensing
- Data acquisition system

Table 1 Device Summary

Order code	Package	Packing
AXOP36061S	eSOP8	Tube
AXOP36062	eSOP8	Tube



eSOP8

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Figure 1 Block Diagram

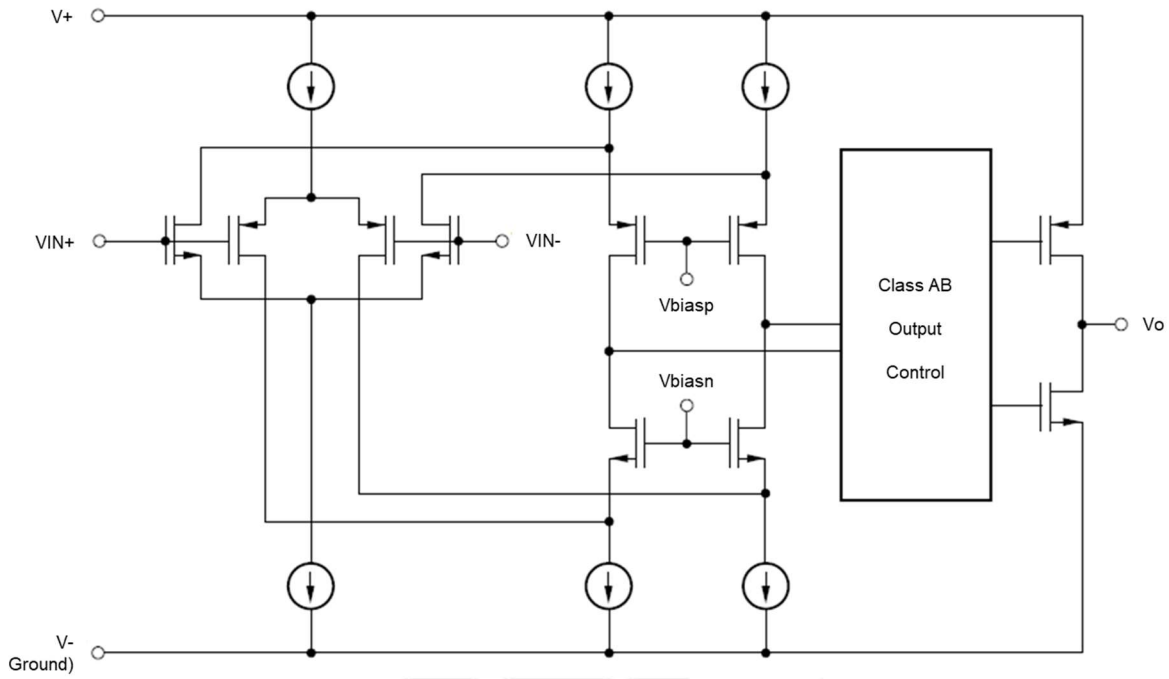
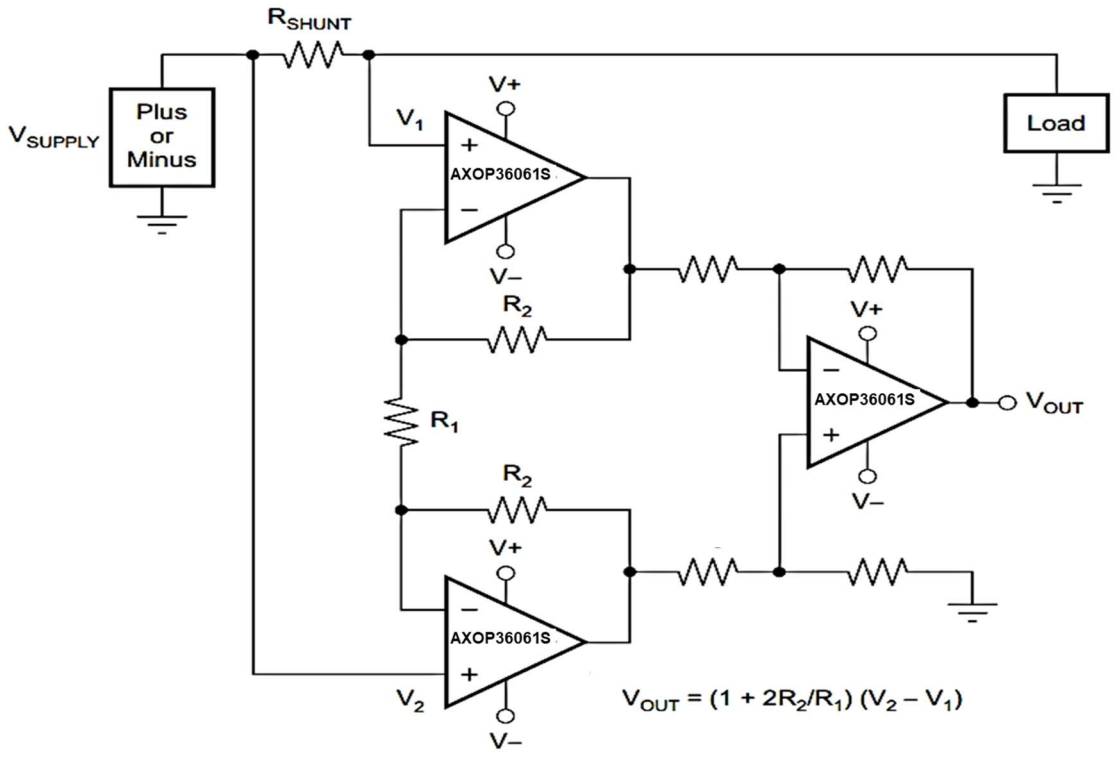


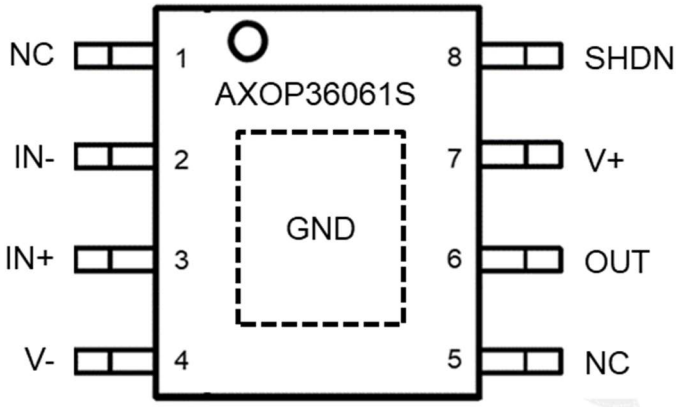
Figure 2 Typical Application Circuit **(High Voltage High Side Current Sense)**



2 Pin Description

2.1 AXOP36061S Pinouts

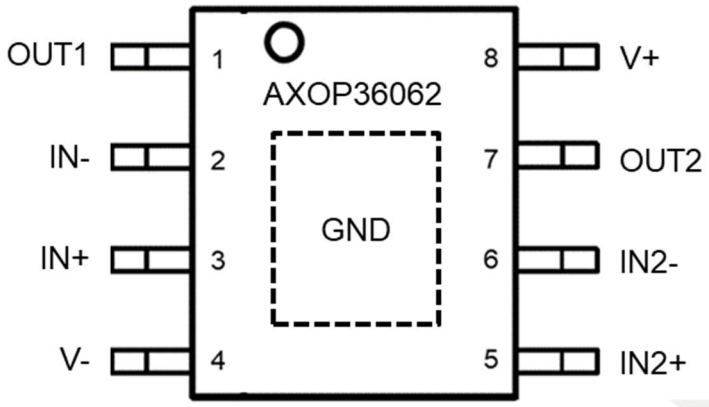
Figure 3 AXOP36061S Pinouts



Pin number	Pin name	Description
1	NC	Non connected pin
2	IN-	Inverting input
3	IN+	Non-inverting input
4	V-	Negative supply or ground
5	NC	Non connected pin
6	OUT	Output
7	V+	Positive supply
8	SHDN	Shutdown: “High” = opamp disabled Shutdown: “Low” = opamp enabled Shutdown: “Float” = opamp enabled

2.2 AXOP36062 Pinouts

Figure 4 AXOP36062 Pinouts



Pin number	Pin name	Description
1	OUT1	Output 1
2	IN1-	Inverting input 1
3	IN1+	Non-inverting input 1
4	V-	Negative supply or ground
5	IN2+	Non-inverting input 2
6	IN2-	Inverting input 2
7	OUT2	Output 2
8	V+	Positive supply

3 Electrical Specifications

3.1 Absolute Maximum Ratings

Table 2 Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
Vs	Supply voltage (V+) - (V-)	-0.3 to +70	V
IN+, IN-, SHDN	Input pin voltage	(V-) - 0.5 to (V+) +0.5	V
OUT	Output pin voltage	(V-) - 0.5 to (V+) +0.5	V
Tj	Junction temperature	150	°C
Tstg	Storage temperature	-55 to +150	°C

3.2 Thermal Data

Table 3 Thermal Data

Symbol	Parameter	Value	Unit
Rth j-case	Thermal resistance junction-to-case Max.	10	°C/W

3.3 ESD

Table 4 ESD

Symbol	Parameter	Value	Unit
All pins	ESD (HBM) ESD (CDM)	±2,000 ±500	V V

3.4 Electrical Characteristics

For Vs = (V+) - (V-) = 60V at Ta = 25°C, RL connected to Vs/2, Vcm = Vs/2, and Vout = Vs/2 (unless otherwise noted).

Table 5 Electrical Characteristics

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
Vs	Supply voltage (V+) - (V-)		3		60	V
Ta	Operating ambient temperature		-40		85	°C
Power Supply						
Iq	Quiescent current	Vs=60V, Io=0mA		2.2	3.0	mA
		all temp			4.0	
Offset Voltage						
Vos	Input offset voltage			±1	±3	mV
		all temp			±5	mV
dVos/dT	Drift	all temp		±2		μV/°C
PSRR	Power-supply rejection ratio	At DC		120		dB
Input Voltage Range						
Vcm	Common mode voltage range	Vs=5V to 60V	(V-)-0.1		(V+)+0.1	V
CMRR	Common mode rejection ratio	At DC		120		dB
Input Bias Current						
Ib	Input bias current			±0.5		pA
Ios	Input offset current			±0.05		pA
Noise						
En	Input voltage noise	f=20Hz to 20kHz		5		μV
Input Capacitance						
Cid	Differential			2		pF
Cic	Common mode			4		pF
Open Loop Gain						
Aol	Open loop voltage gain			130		dB
Frequency Response						
GBP	Gain bandwidth product	G=+1, CL=10pF		17		MHz
Cload	Capacitive load	G=+1			1	nF
SR	Slew rate	G=+1, CL=100pF		15		V/μs
Ts	Settling time	To 0.1%, 30V step, G=+1, CL=100pF		2		μs
THD	Total harmonic distortion	Vs=60V, Vcm=30V, Vo=58Vpp, G=+1, f=1kHz		105		dB

SNR	Signal to Noise Ratio	Vin=1Vrms, G=+1, f=1kHz		105		dB
Output						
Vo	Voltage output swing from supply rails	RL=10kΩ		0.5	1.0	V
Isc	Short circuit current	AXOP36061S		±30 (±100)		mA
		AXOP36062		±50		mA
Shutdown (AXOP36061S only)						
Iqsd	Quiescent current per amplifier	Vs=3V to 60V, amplifier disabled, SHDN = “High”		80	120	μA
Vsd	Shutdown threshold	Vs=3V to 60V, amplifier disabled, SHDN = “High”	4			V
		Vs=3V to 60V, amplifier enabled, SHDN = “Float” or SHDN = “Low”			1	V
ton	Amplifier enable time	Vs=3V to 60V, full shutdown; G=+1, Vo = 0.9×Vs/2, RL connected to V-		2		μs
toff	Amplifier disable time	Vs=3V to 60V, G=+1, Vo=0.1×Vs/2, RL connected to V-		2		μs

Disable time (toff) and enable time (ton) are defined as the time interval between the 50% point of the signal applied to the SHDN pin and the point at which the output voltage reaches the 10% (disable) or 90% (enable) level.

3.5 Typical Electrical Characteristics

Figure 5 Vos Distribution

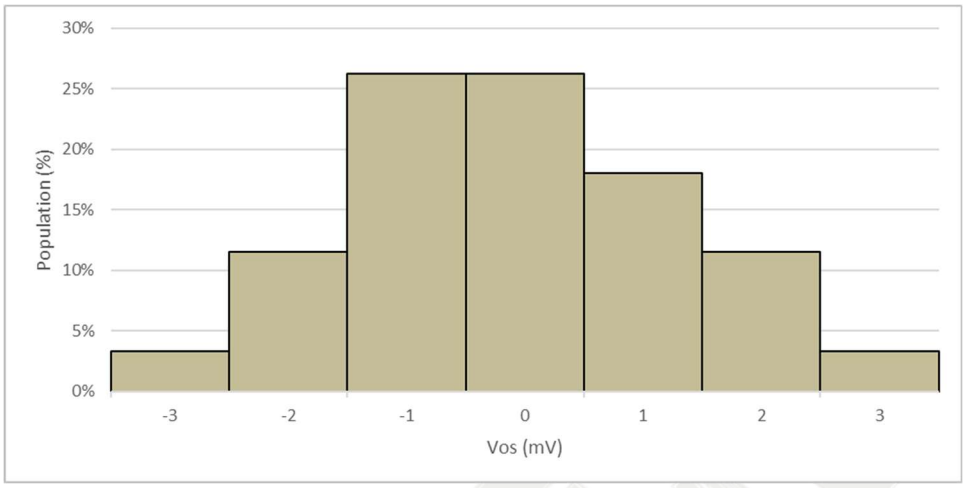


Figure 6 Vos vs Input Common Mode Voltage

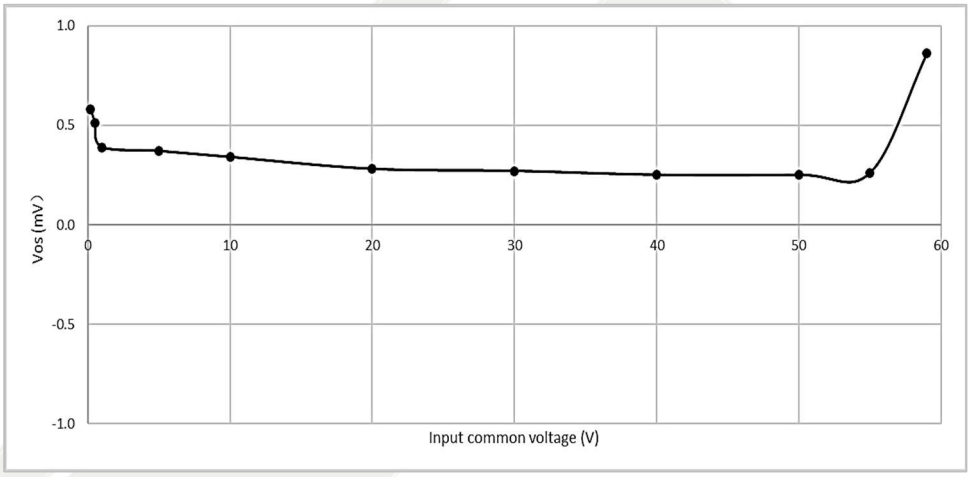


Figure 7 Vos vs Vs

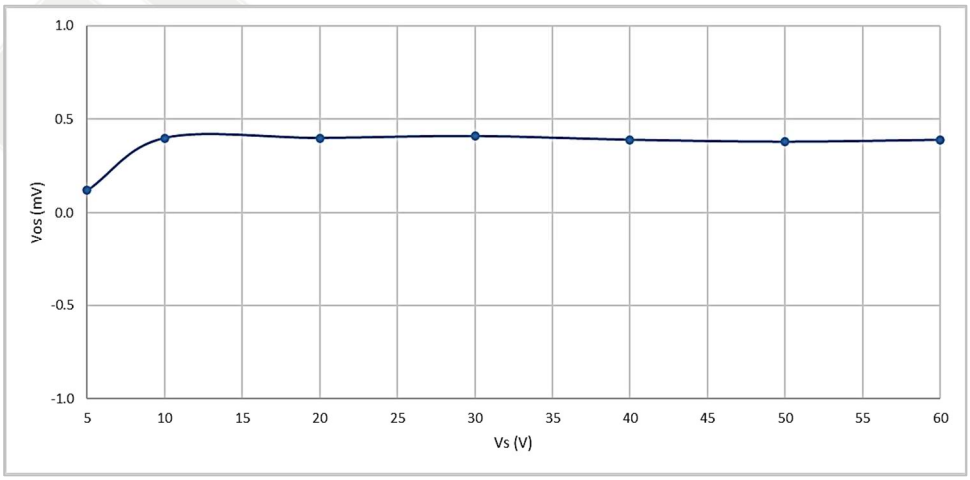


Figure 8 Iq (per opamp) vs Input Common Mode Voltage

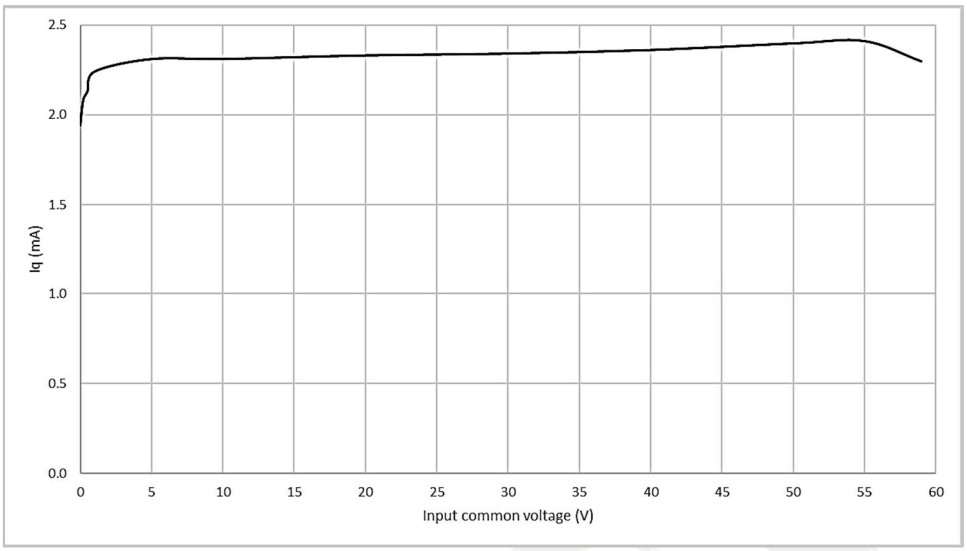


Figure 9 Iq (per opamp) vs Vs

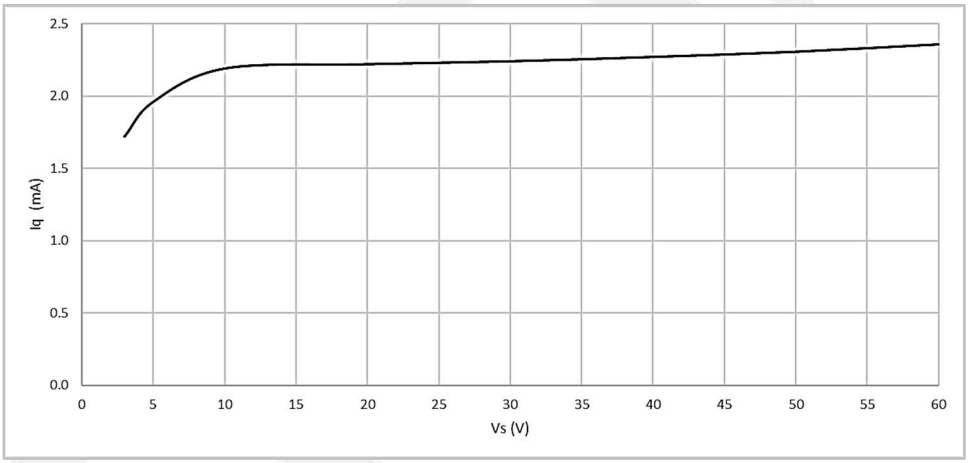


Figure 10 THD+N vs Frequency

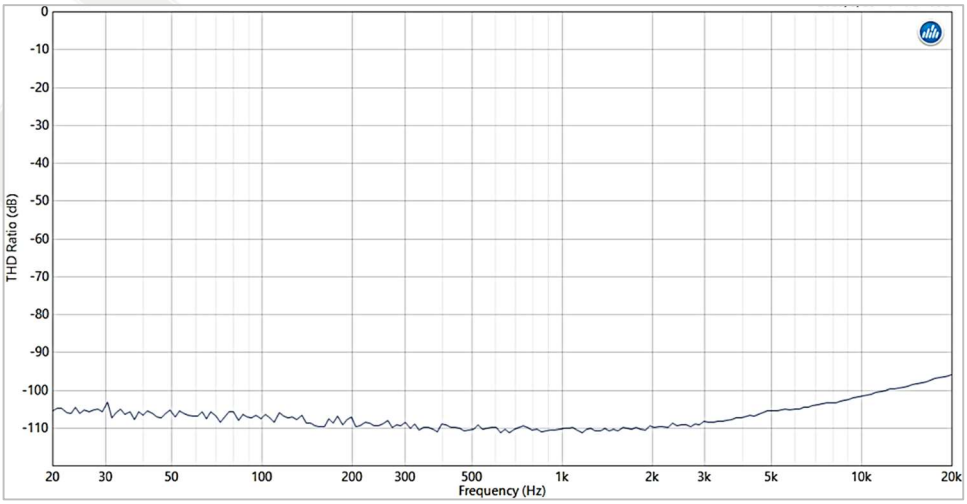


Figure 11 Large Signal Step Response

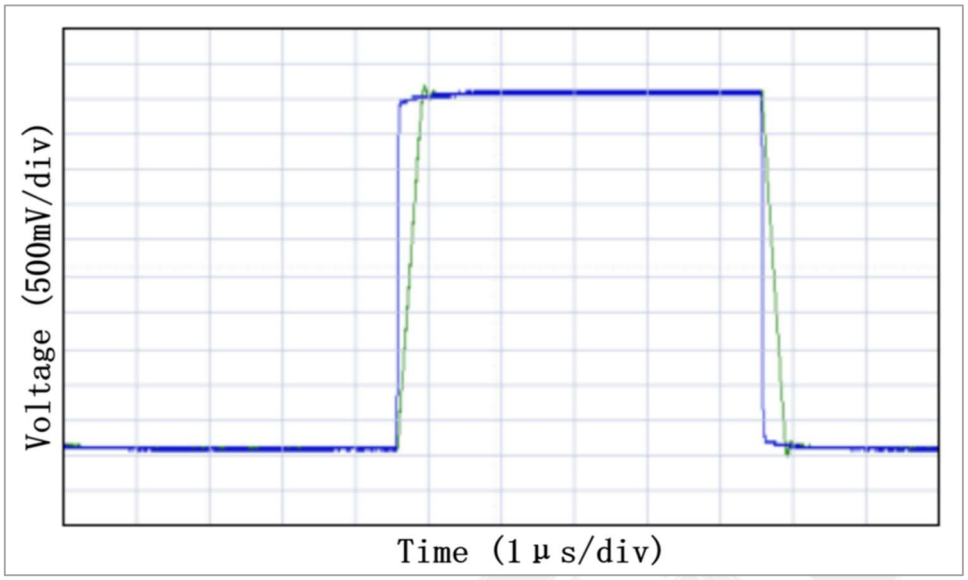
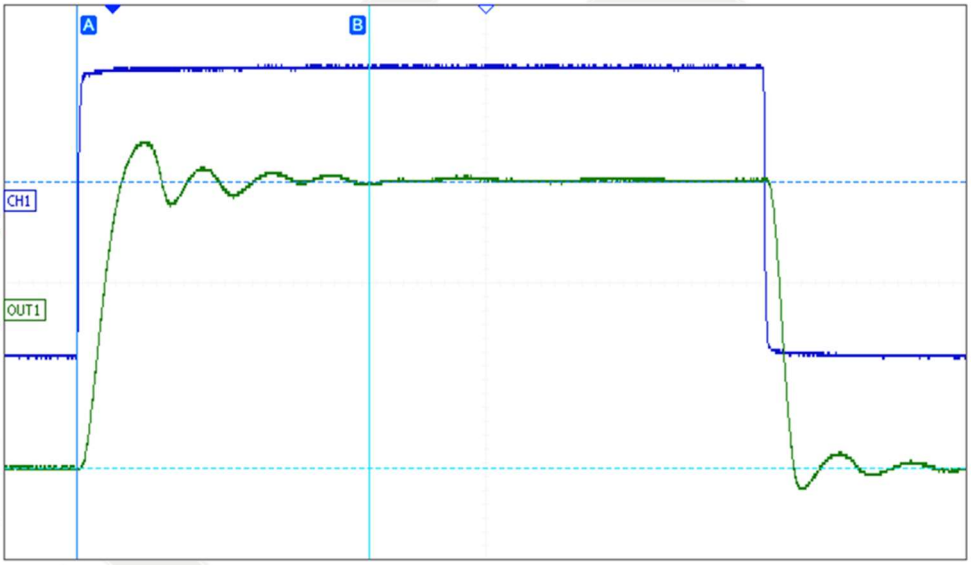


Figure 12 Sep Response with CL=1nF



4 Functional Description

4.1 Overview

The AXOP3606X is a 60V high voltage, rail-to-rail input and output opamp series. It operates from 3V to 60V, are unity gain stable, and are designed for a wide range of applications and used in virtually any single supply application.

4.2 Rail to Rail Input

The input common mode voltage range of AXOP3606X extends 100mV beyond the supply rails for the full supply voltage range of 3V to 60V. This performance is achieved with a complementary input stage: a N-channel input differential pair in parallel with a P-channel differential pair, as shown in Figure 1. The N-channel pair is active for input voltages close to the positive rail, typically (V+)-1.4V to 200mV above the positive supply, whereas the P-channel pair is active for inputs from 200mV below the negative supply to approximately (V+)-1.4V. There is a transition region, in which both pairs are on. Within this transition region, PSRR, CMRR, offset voltage, offset drift, and THD can degrade compared to device operation outside this region.

4.3 Rail to Rail Output

Designed as a high voltage operational amplifier, AXOP3606X delivers a robust output drive capability. A class AB output stage with common source Mosfets achieves full rail-to-rail output swing capability. For resistive loads of 10kΩ, the output swings to within 0.5V (typ) of either supply rail, regardless of the applied power supply voltage. Different load conditions change the ability of the amplifier to swing close to the rails.

4.4 EMI Rejection

The AXOP3606X uses integrated electromagnetic interference (EMI) filtering to reduce the effects of EMI from sources such as wireless communications and densely populated boards with a mix of analog signal chain and digital components.

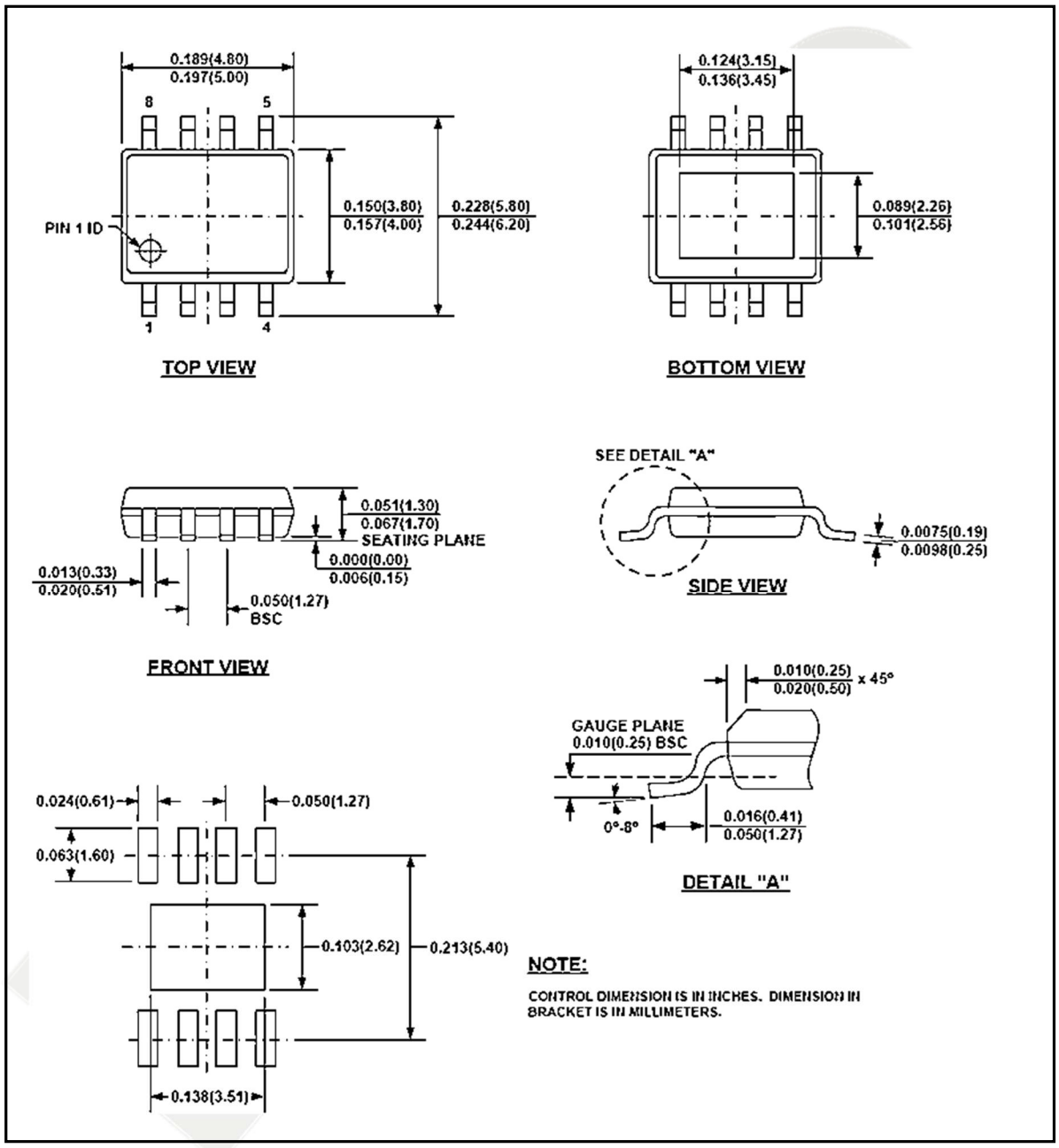
4.5 Shutdown

The AXOP36061S has shutdown function. The amplifiers can be shut down by pulling the shutdown (SHDN) pin to “High”.

5 Package Information

5.1 Package Dimensions

Figure 13 eSOP8 Mechanical Data and Package Dimensions



5.2 Marking Information

Figure 14 eSOP8 Marking Information

Laser mark circle to indicate pin 1

2 lines of alphanumeric coding:

Line 1: “36061S” characters to indicate AXOP36061S

Line 2: “yy” to indicate year of production

“ww” to indicate week of production

“C” to indicate the location of assembly

Laser mark circle to indicate pin 1

2 lines of alphanumeric coding:

Line 1: “36062” characters to indicate AXOP36062

Line 2: “yy” to indicate year of production

“ww” to indicate week of production

“C” to indicate the location of assembly

6 Packing Information

Figure 15 Packing Information

7 Revision History

Table 6 Document Revision History

Date	Version	Description
Apr 2023	1.00	V1.00 version.