UMW ADA4692-2/ADA4692-4

Low Power, 3.6 MHz, Low Noise, Rail-to-Rail Output, Operational Amplifiers

1.Description

The ADA4692-2 are dual and the ADA4692-4 are the quad rail-to-rail output, single-supply amplifiers featuring low power, wide bandwidth, and low noise. The ADA4692-4 is a quad version without shutdown. These amplifiers are ideal for a wide variety of applications. Audio, filters, photodiode amplifiers, and charge amplifiers, all benefit from this combination of performance and features. Additional applications for these amplifiers include portable consumer audio players with low noise and low distortion that provide high gain and slew rate response over the audio band at low power. Industrial applications with high impedance sensors, such as pyroelectric and IR sensors, benefit from the high impedance and low 0.5 pA input bias, low offset drift, and enough bandwidth and response for low gain applications.

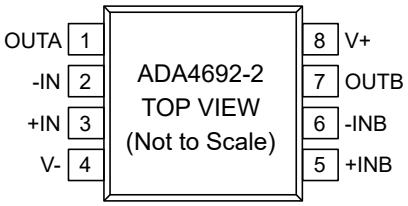
2.Features

- Low power: 180 μA typical
- Very low input bias currents: 0.5 pA typical
- Low noise: 16 nV/√Hz typical
- 3.6 MHz bandwidth
- Offset voltage: 500 μV typical
- Low offset voltage drift: 4 μV/°C maximum
- Low distortion: 0.003% THD + N
- 2.7 V to 5 V single supply or ±1.35V to ±2.5V dual supply

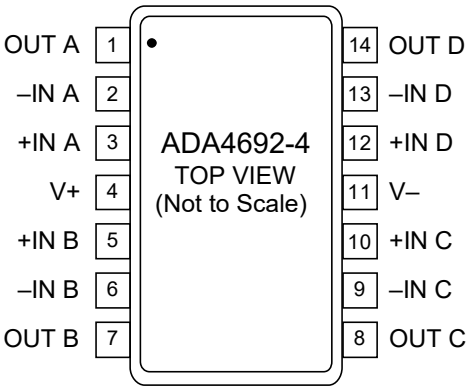
3.Applications

- Photodiode amplifiers
- Sensor amplifiers
- Portable medical and instrumentation
- Portable audio: MP3s, PDAs, and smartphones
- Communications
- Low-side current sense
- ADC drivers
- Active filters
- Sample-and-hold

4.Pinning Information



SOP-8_N (R-8)



TSSOP-14(RU-14)

5.Absolute Maximum Ratings(T_A= 25°C)

Description	Rating
Supply Voltage	6 V
Input Voltage	Vss- 0.3 Vto Vo + 0.3 V
Input Current [1]	±10 mA
Shutdown Pin Rise/Fall Times	50 us maximum
Differential input Voltage [2]	$\pm V_{SY}$
Outp ut Short -Circuit Dur ation to GND	Indefinite
Temperature	-65°C to +150°C
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-40°C to +125°C
Junction Temperature Range	-65°C to +150°C
Lead Temperature (Soldering,60 sec)	300°C

[1] Input pins have clamp diodes to the supply pins. Limit input current to 10 mA or less whenever the input signal exceeds the power supply rail by 0.3V.

[2] Differential input voltage is limited to 6V or the supply voltage, whichever is less.

6.1Electrical Characteristics

Supply voltage (V_{SY})=2.7V, common-mode voltage (V_{CM}) =V_{SY}/2, T_A=25°C, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Offset Voltage	V_{OS}	V_{CM}=−0.3V to +1.6V		0.5	2.5	mV
Dual (ADA469x -2)		V_{CM}=−0.1V to 1.6V, −40°C<T_A<125°C			3.5	mV
Quad (ADA469x -4)		V_{CM}=−0.1V to 1.6V, −40°C<T_A<125°C			4	mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C <T_A<125°C		1	4	μV/°C
Input Bias Current	I_B			0.5	5	pA
Input Offset Current	I_{OS}	−40°C <T_A<125°C			360	pA
				1	8	pA
Input Voltage Range		−40°C <T_A<125°C			225	pA
		−40°C <T_A<125°C	-0.3		1.6	V
Common -Mode Rejection Ratio	CMRR	V_{CM}=−0.3V to +1.6V	70	90		dB
Large Signal Voltage Gain	A_{VO}	V_{CM}=−0.1V to 1.6V, −40°C<T_A<125°C	62			dB
		Load resistance (R_L)=2kΩ, output voltage (V_{OUT}) = 0.5V to 2.2V	90	100		dB
		−40°C <T_A<85°C	80			dB
		−40°C <T_A<125°C	63			dB
		R_L=600Ω, V_{OUT}=0.5V to 2.2V	85	95		dB
Input Capacitance	C_{IN}					
Differentia l Mode	C_{INDM}			2.5		pF
Common Mode	C_{INCM}			7		pF
Logic High Voltage (Enabled)	V_{IH}	−40°C<T_A<125°C	1.6			V
Logic Low Voltage (Power -Down)	V_{IL}	−40°C<T_A<125°C			0.5	V
Logic input Current (Per Pin)	I_{IN}	−40°C<T_A<125°C, 0V≤ shutdown voltage (V_{SD})≤ 2.7V			1	μA
Output Voltage High	V_{OH}	R_L=2kΩ to V_{CM}	2.65	2.67		V
		−40°C<T_A<125°C	2.6			V
		R_L=600Ω to V_{CM}	2.55	2.59		V
		−40°C<T_A<125°C	2.5			V

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Low	V_{OL}	R_L=2kΩ to V_{CM}		24	33	mV
		−40°C<T_A<125°C			43	mV
		R_L=600Ω to V_{CM}		78	103	mV
		−40°C<T_A<125°C			138	mV
Short-Circuit Current	I_{SC}	V_{OUT}=V_{SY} or GND		±15		mA
Closed-Loop Output Impedance	Z_{OUT}	Frequency (f)=1MHz voltage gain (A_V)=−100		372		Ω
Output Pin Leakage Current		−40°C<T_A<125°C, shutdown active V_{SD}=negative supply voltage (V_{SS})		10		nA
Power Supply Rejection Ratio	PSRR	V_{SY}= 2.7V to 5.5V	80	90		dB
Supply Current Per Amplifier	I_{SY}	−40°C<T_A<125°C	75			dB
		V_{OUT}=V_{SY}/2		165	200	μA
		−40°C<T_A<125°C			240	μA
Supply Current Shutdown Mode	I_{SD}	All amplifiers shut down, V_{SD}=V_{SS}		10		nA
		−40°C<T_A<125°C			2	μA
Slew Rate	SR	R_L=600Ω, load capacitance (C_L)=20pF, A_V=+1		1.1		V/μs
		R_L=2kΩ, C_L=20pF, A_V=+1		1.4		V/μs
Settling Time to 0.1%	t_S	Step=0.5V, R_L=2kΩ, 600Ω		1		μs
Gain Bandwidth Product	GBP	R_L=1MΩ, C_L=35pF, A_V=+1		3.6		MHz
Phase Margin	ΦM	R_L=1MΩ, C_L=35pF, A_V=+1		49		Degrees
Turn-On/Turn-Off Time		R_L=600Ω		1		μs

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Distortion	THD+ N	A_V=−1, R_L=2 kΩ, f=1kHz, input voltage (V_{IN}) rms=0.15Vrms		0.009		%
		A_V=−1, R_L= 600Ω, f=1kHz V_{IN}rms=0.15Vrms		0.01		%
		A_V=+1, R_L=2kΩ, f=1kHz V_{IN}rms=0.15Vrms		0.006		%
		A_V=+1, R_L= 600Ω, f=1kHz V_{IN}rms=0.15Vrms		0.009		%
Voltage Noise	e_np-p	f=0.1Hz to 10Hz		3.1		μV_{p-p}
Voltage Noise Density	e_n	f=1kHz		16		nV/√Hz
		f=10kHz		13		nV/√Hz

6.2Electrical Characteristics

V_{SY}=5V, V_{CM}=V_{SY}/2, T_A=25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Offset Voltage	V_{OS}	V_{CM}=−0.3V to +3.9V		0.5	2.5	mV
Dual (ADA4692-2)		V_{CM}=−0.1V to 3.9V, −40°C<T_A<125°C			3.5	mV
Quad (ADA4692-4)		V_{CM}=−0.1V to 3.9V, −40°C<T_A<125°C			4	mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C <T_A<125°C		1	4	μV/°C
Input Bias Current	I_B			0.5	5	pA
Input Offset Current	I_{OS}	−40°C <T_A<125°C			360	pA
				1	8	pA
Input Voltage Range		−40°C <T_A<125°C			260	pA
		−40°C <T_A<125°C	-0.3		±3.9	V
Common -Mode Rejection Ratio	CMRR	V_{CM}=−0.3V to +3.9V	75	98		dB
		V_{CM}=−0.1V to 3.9V, −40°C<T_A<125°C	68			dB
Large Signal Voltage Gain	A_{VO}	R_L=2kΩ, V_{OUT}=0.5V to 4.5V V_{CM}=0 V	95	110		dB
		−40°C <T_A<85°C	80			dB
		−40°C <T_A<125°C	70			dB
		R_L=600Ω, V_{OUT}=0.5V to 2.2V, V_{CM}=0V	90	100		dB
Differentia l Mode	C_{INDM}			2.5		pF
Common Mode	C_{INCM}			7		pF
Logic High Voltage (Enabled)	V_{IH}	−40°C<T_A<125°C	2			V
Logic Low Voltage (Power -Down)	V_{IL}	−40°C<T_A<125°C			0.8	V
Logic input Current (Per Pin)	I_{IN}	−40°C<T_A<125°C, 0V≤V_{SD}≤2.7V			1	μA
Output Voltage High	V_{OH}	R_L=2kΩ to V_{CM}	4.95	4.97		V
		−40°C<T_A<125°C	4.9			V
		R_L=600Ω to V_{CM}	4.85	4.88		V
		−40°C<T_A<125°C	4.8			V

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage Low	V_{OL}	R_L=2kΩ to V_{CM}		30	40	mV
		−40°C<T_A<125°C			55	mV
		R_L=600Ω to V_{CM}		100	128	mV
		−40°C<T_A<125°C			173	mV
Short-Circuit Current	I_{SC}	V_{OUT}=V_{SY} or GND		±55		mA
Closed-Loop Output Impedance	Z_{OUT}	ADA4691 -2, f=1MHz, A_V=−100		364		Ω
		ADA4691 -2, f=1MHz, A_V=−100		246		
Output Pin Leakage Current		−40°C<T_A<125°C, shutdown active V_{SD}=V_{SS}		10		nA
Power Supply Rejection Ratio	PSRR	V_{SY}= 2.7V to 5.5V	80	90		dB
		−40°C<T_A<125°C	75			dB
Supply Current Per Amplifier	I_{SY}	V_{OUT}=V_{SY}/2		180	225	μA
		−40°C<T_A<125°C			275	μA
Supply Current Shutdown Mode	I_{SD}	All amplifiers shut down, V_{SD}=V_{SS}		10		nA
		−40°C<T_A<125°C			2	μA
Slew Rate	SR	R_L=2kΩ, 600Ω, C_L=20pF, A_V= +1		1.3		V/μs
Settling Time to 0.1%	t_S	V_{IN}=2V step, R_L=2kΩ or 600Ω		1.5		μs
Gain Bandwidth Product	GBP	R_L=1MΩ, C_L=35pF, A_V=+1		3.6		MHz
Phase Margin	ΦM	R_L=1MΩ, C_L=35pF, A_V=+1		52		Degrees
Turn-On/Turn-Off Time		R_L=600Ω		1		μs

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Distortion	THD+ N	A_V=−1, R_L=2kΩ, f=1kHz V_{IN}rms=0.8Vrms		0.006		%
		A_V=−1, R_L=600Ω, f=1kHz V_{IN}rms=0.8Vrms		0.008		%
		A_V=−1, R_L=2kΩ, f=1kHz V_{IN}rms=0.8Vrms		0.001		%
		A_V=−1, R_L=600Ω, f=1kHz V_{IN}rms=0.8Vrms		0.003		%
Voltage Noise	e_np-p	f=0.1Hz to 10Hz		3.2		μV_{p-p}
Voltage Noise Density	e_n	f=1kHz		16		nV/√Hz
		f=10kHz		13		nV/√Hz

7.1Typical Characteristic

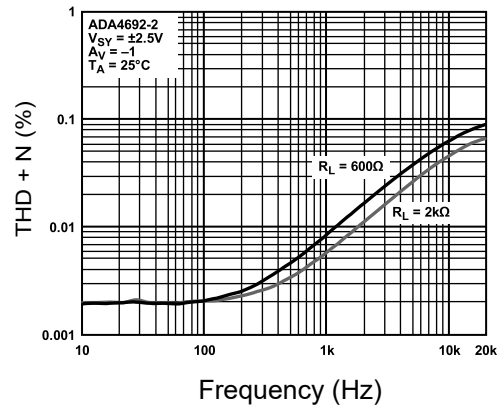


Figure 1: THD + Noise vs. Frequency

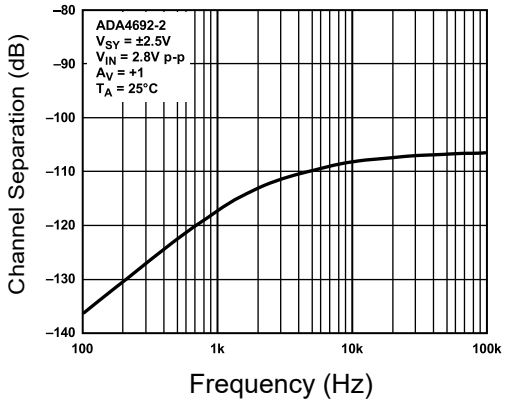


Figure 2: Channel Separation vs. Frequency

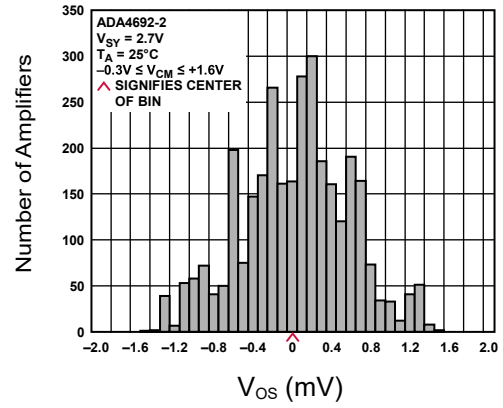


Figure 3: Input Offset Voltage Distr ibution

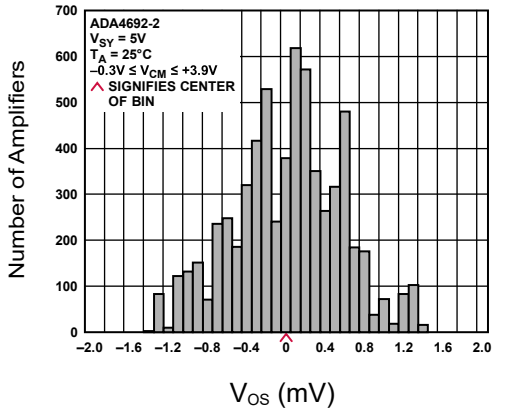


Figure 4: Input Offset Voltage Distribution

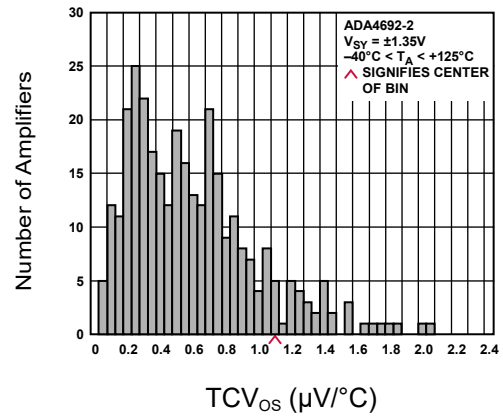


Figure 5: Input Offset Voltage Drift Distribution

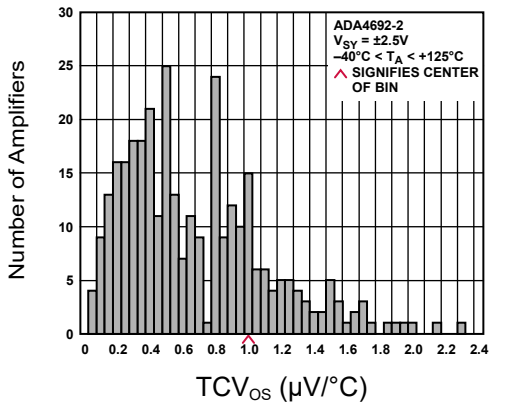


Figure 6: Input Offset Voltage Drift Distribution

7.2Typical Characteristic

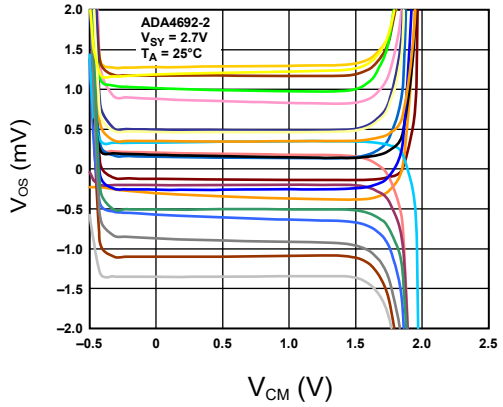


Figure 7: Input Offset Voltage vs. Common -Mode Voltage

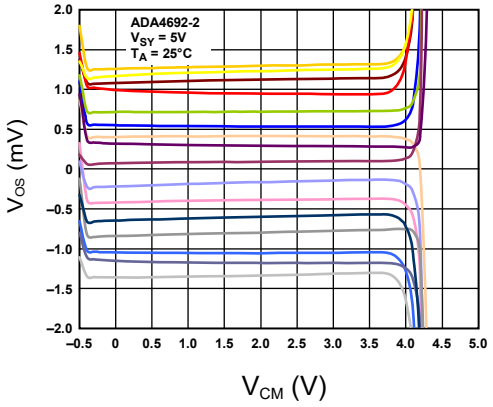


Figure 8: Input Offset Voltage vs. Common -Mode Voltage

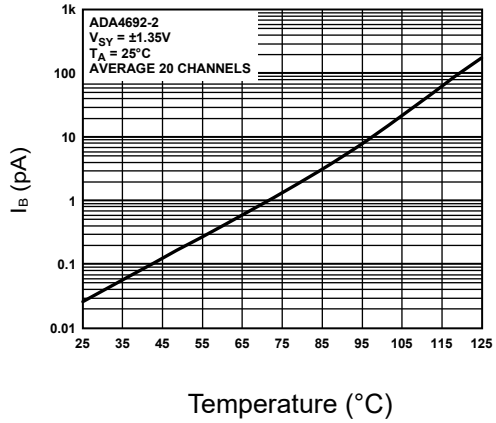


Figure 9: Input Bias Current vs. Temperature

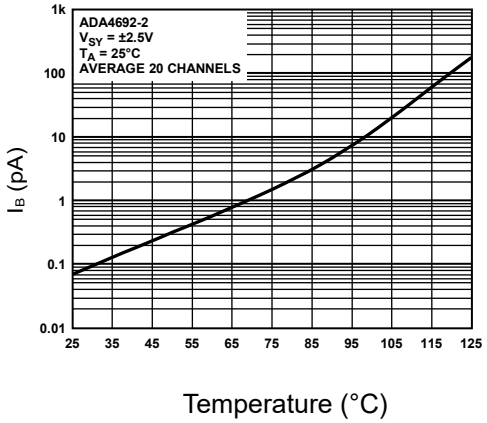


Figure 10: Input Bias Current vs. Temperature

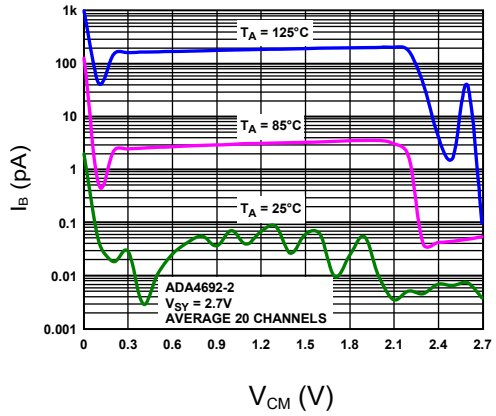


Figure 11: Input Bias Current vs. Common-Mode Voltage

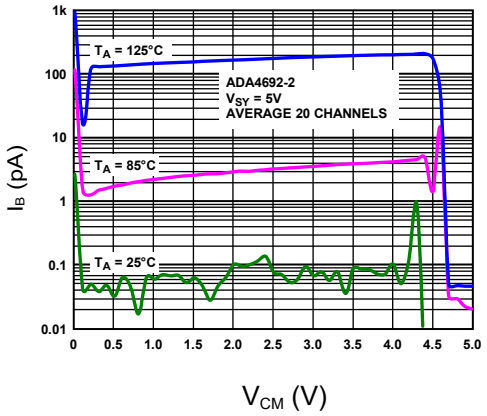


Figure 12: Input Bias Current vs. Common-Mode Voltage

7.3Typical Characteristic

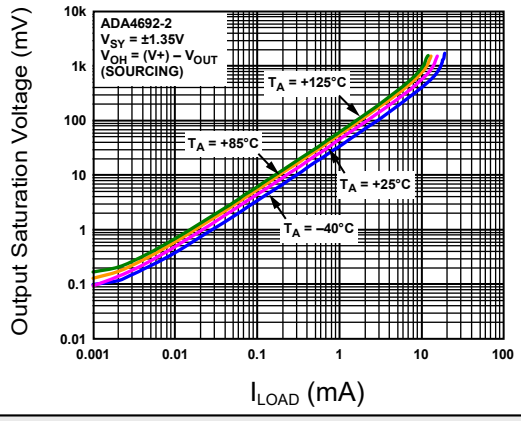


Figure 13: Output Voltage (V_{OH}) to Supply Rail vs. Load Current

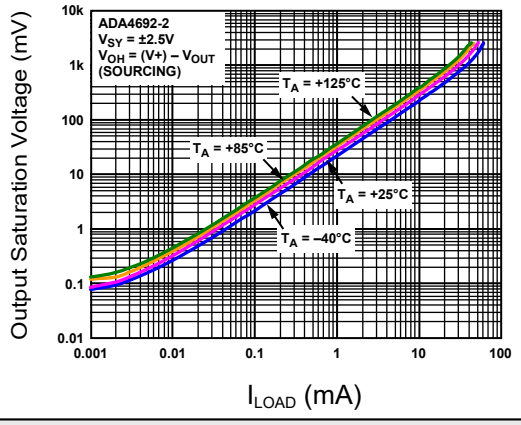


Figure 14: Output Voltage (V_{OL}) to Supply Rail vs. Load Current

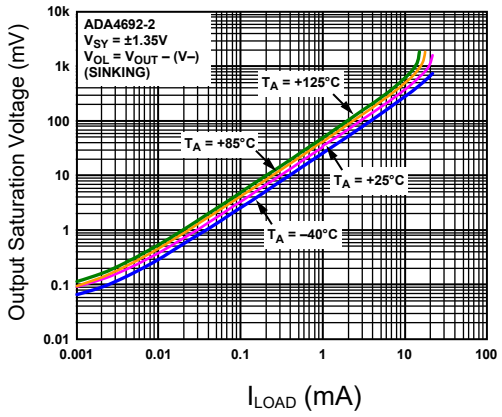


Figure 15: Output Voltage (V_{OL}) to Supply Rail vs. Load Current

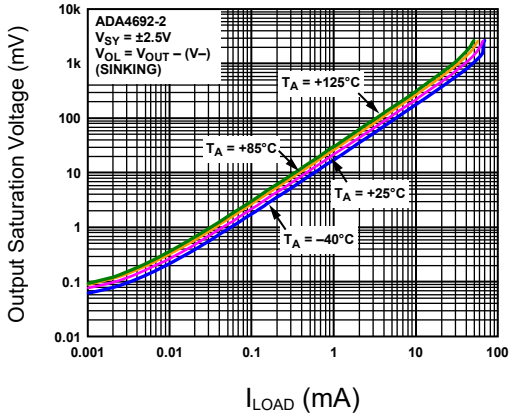


Figure 16: Output Voltage (V_{OL}) to Supply Rail vs. Load Current

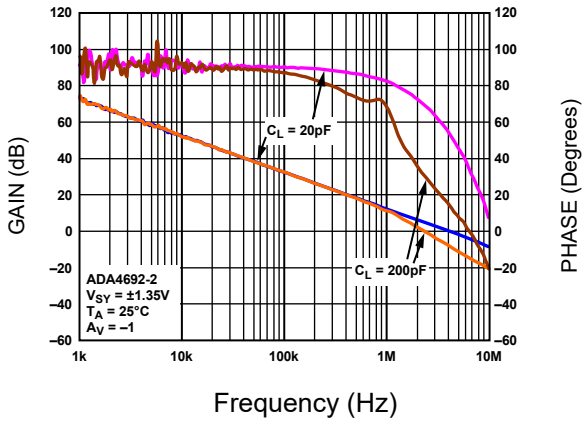


Figure 17: Open-Loop Gain and Phase vs. Frequency

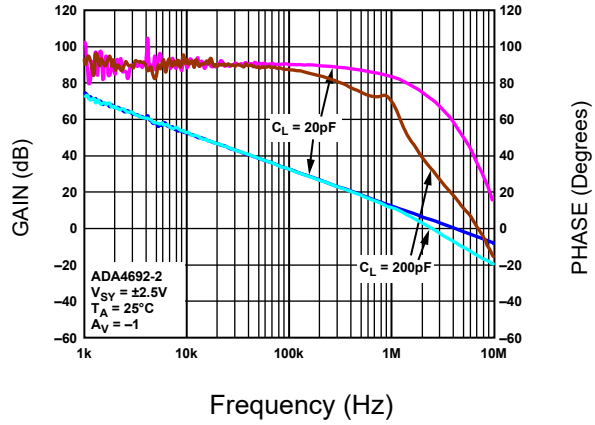


Figure 18: Open-Loop Gain and Phase vs. Frequency

7.4Typical Characteristic

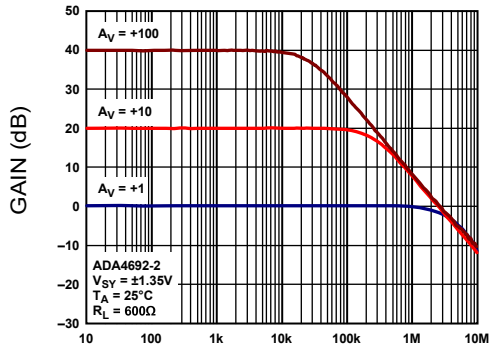


Figure 19: Closed-Loop Gain vs. Frequency

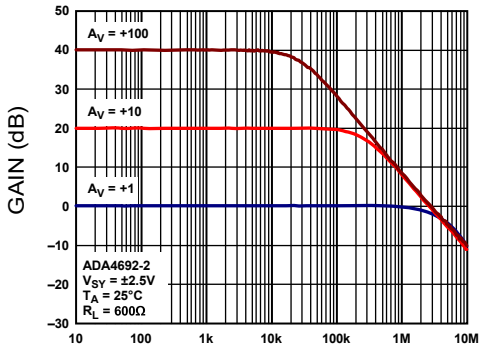


Figure 20: Closed-Loop Gain vs. Frequency

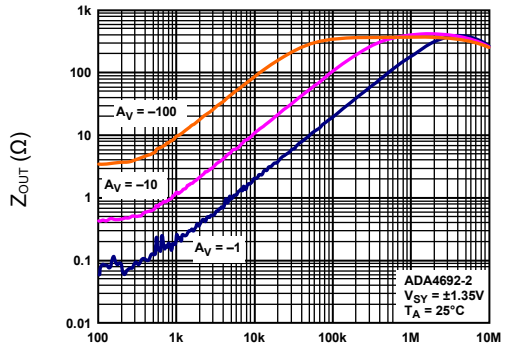


Figure 21: Output Impedance vs. Frequency

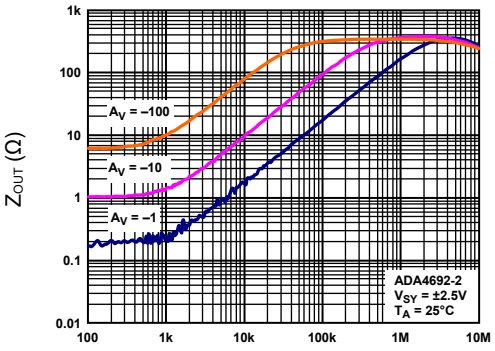


Figure 22: Output Impedance vs. Frequency

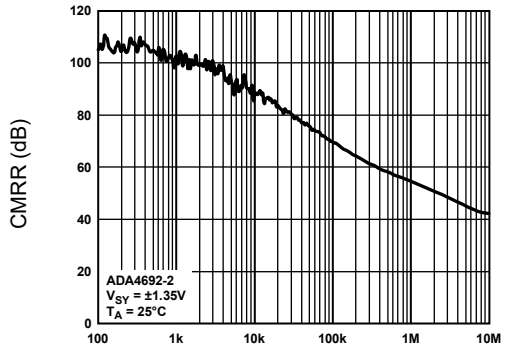


Figure 23: CMRR vs. Frequency

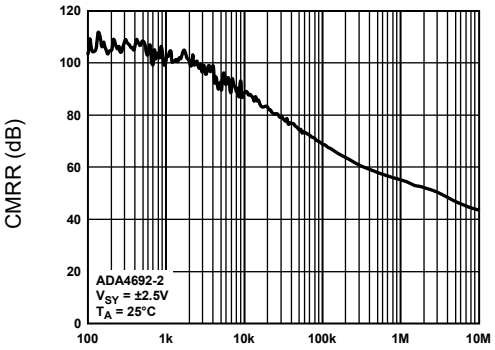


Figure 24: CMRR vs. Frequency

7.5Typical Characteristic

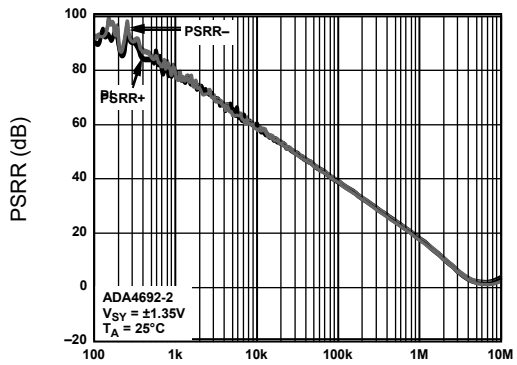


Figure 25: PSRR vs. Frequency

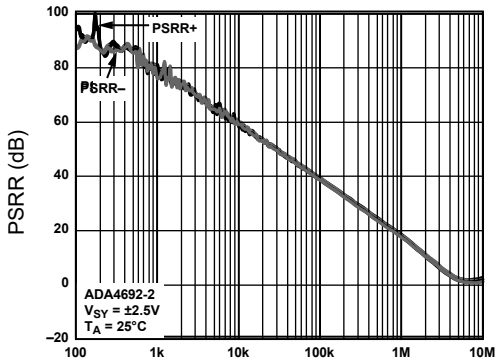


Figure 26: PSRR vs. Frequency

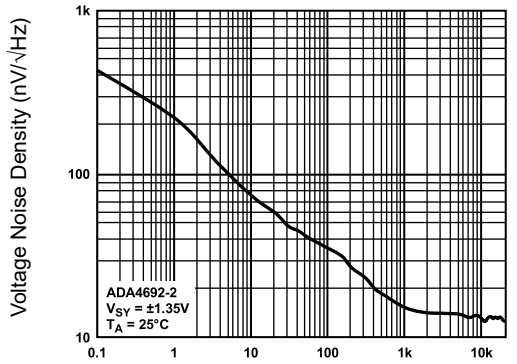


Figure 27: Voltage Noise Density vs. Frequency

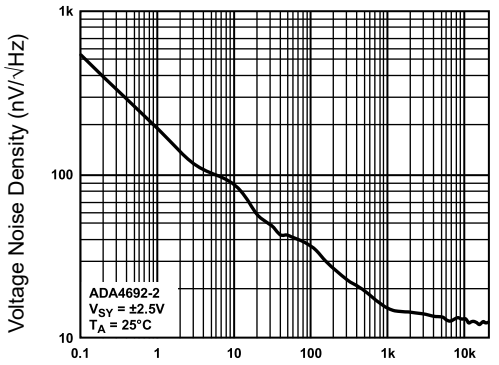


Figure 28: Voltage Noise Density vs. Frequency

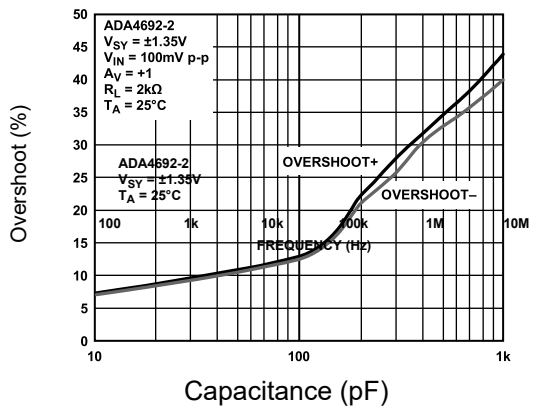


Figure 29: Small Signal Overshoot vs. Load Capacitance

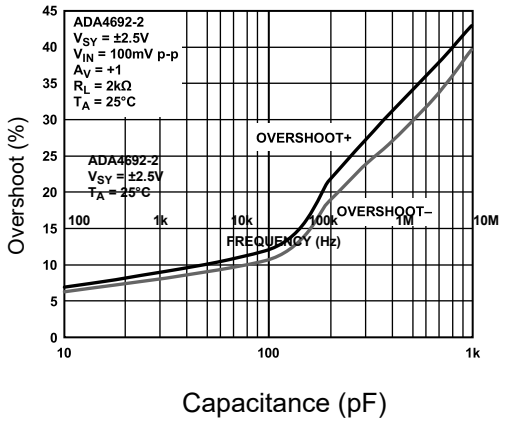


Figure 30: Small Signal Overshoot vs. Load Capacitance

7.6Typical Characteristic

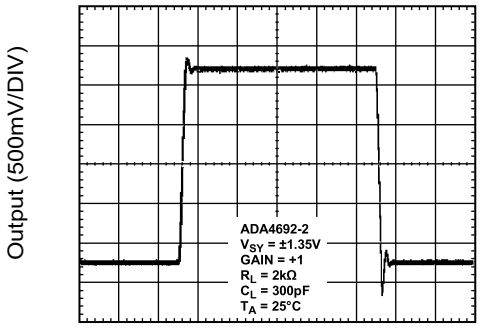


Figure 31: Large Signal Transient Response

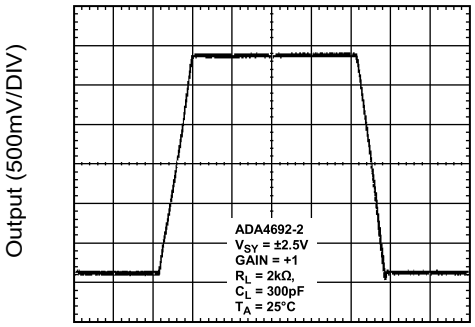


Figure 32: Large Signal Transient Response

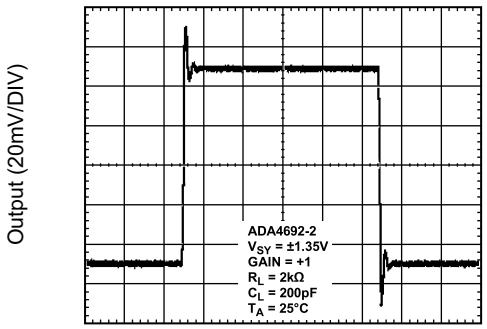


Figure 33: Small Signal Transient Response

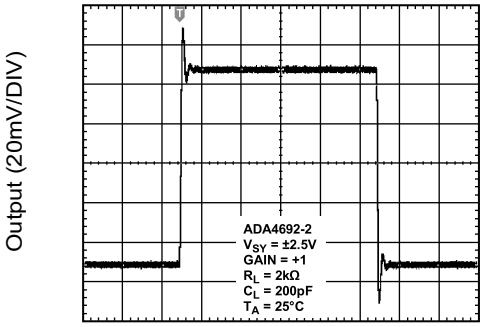


Figure 34: Small Signal Transient Response

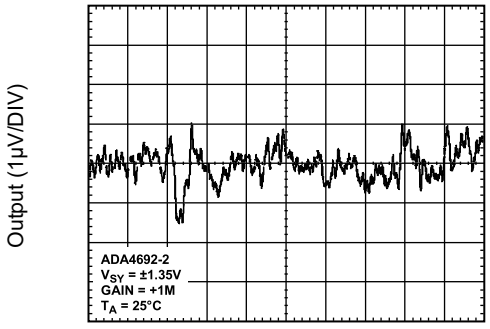


Figure 35: 0.1 Hz to 10 Hz Noise

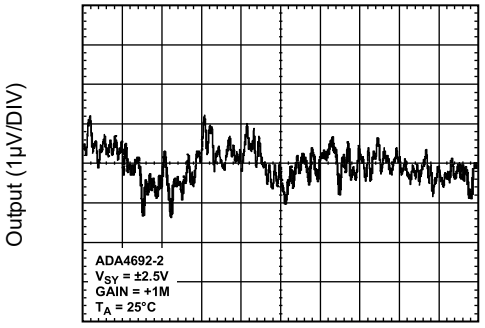


Figure 36: 0.1 Hz to 10 Hz Noise

7.7Typical Characteristic

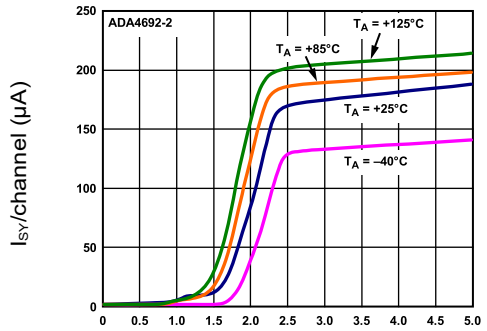


Figure 37: Supply Current vs. Supply Voltage

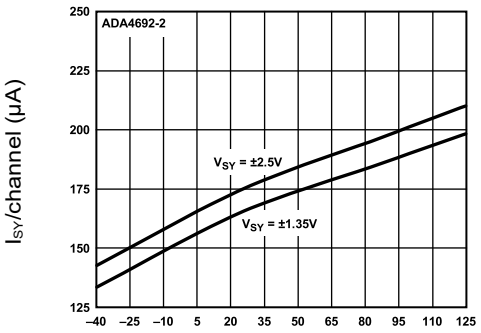
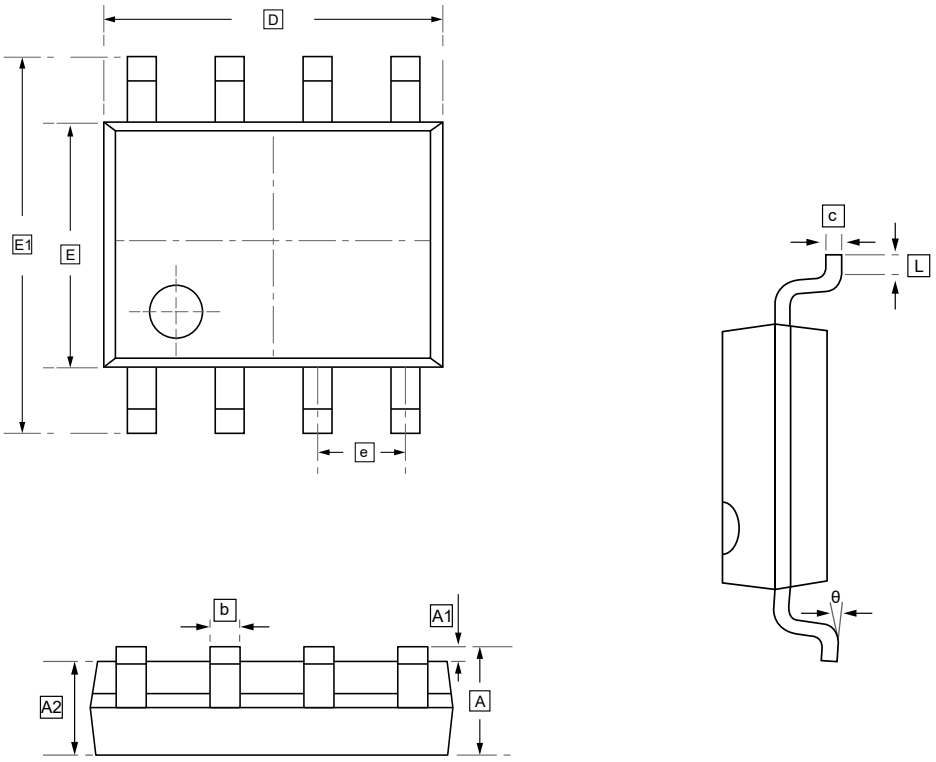


Figure 38: Supply Current per Channel vs. Temperature

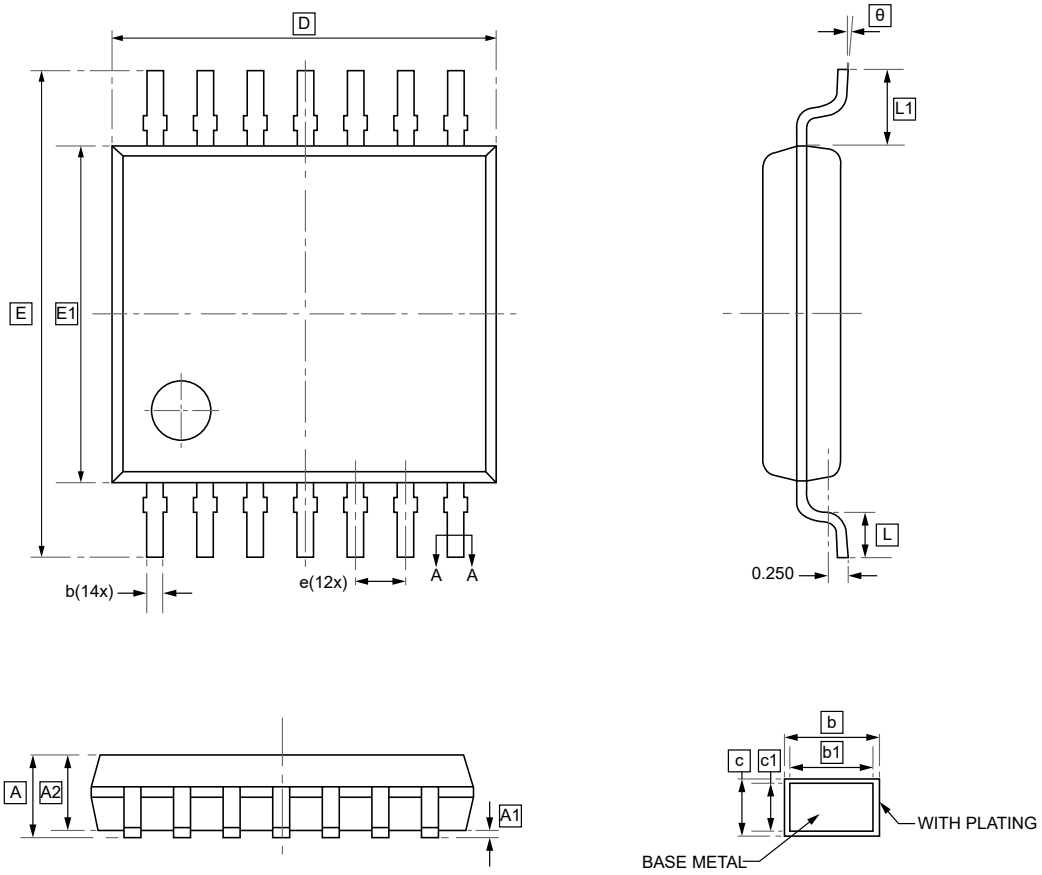
8.1SOP-8 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	L	θ
Min	1.350	0.000	1.350	0.330	0.170	4.700	3.800	5.800	1.270	0.400	0°
Max	1.750	0.100	1.550	0.510	0.250	5.100	4.000	6.200	BSC	1.270	8°

8.2TSSOP-14 Package Outline Dimensions



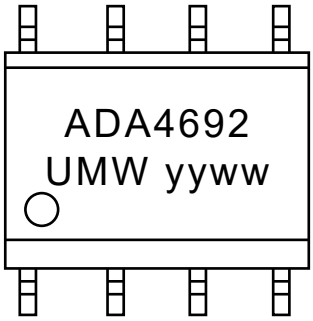
DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	b1	c	c1	D	E	E1	e	L1
Min	-	0.05	0.90	0.20	0.19	0.13	0.120	4.90	6.20	4.30	0.65	0.85
Max	1.20	0.15	1.05	0.28	0.25	0.17	0.14	5.10	6.60	4.50	BSC	1.15

Symbol	L	θ
Min	0.45	0°
Max	0.75	8°

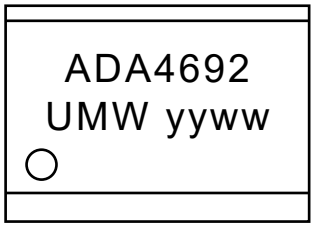
9.Ordering information

SOP-8



yy: Year Code
ww: Week Code

TSSOP-14



yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW ADA4692-2ARZ	ADA4692	SOP-8	2500	Tape and reel
UMW ADA4692-4ARUZ	ADA4692	TSSOP-14	4000	Tape and reel

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