Low Cost, High Speed, Rail-to-Rail Output Op Amps

ADA4851-1/ADA4851-2/ADA4851-4

FEATURES

High speed
- **130 MHz, −3 dB bandwidth**
- **375 V/μs slew rate**
- **55 ns settling time to 0.1%**

Excellent video specifications
- **0.1 dB flatness: 11 MHz**
- **Differential gain: 0.08%**
- **Differential phase: 0.09°**

Fully specified at +3 V, +5 V, and ±5 V supplies

Rail-to-rail output
- **Output swings to within 60 mV of either rail**

Low voltage offset: 0.6 mV

Wide supply range: 3 V to 10 V

Low power: 2.5 mA/amplifier

Power-down mode

Available in space-saving packages
- **SOT-23-6, TSSOP-14, and MSOP-8**

APPLICATIONS

Consumer video

Professional video

Video switchers

Active filters

PIN CONFIGURATIONS

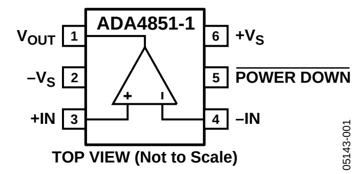

Figure 1. ADA4851-1, 6-Lead SOT-23 (RJ-6)

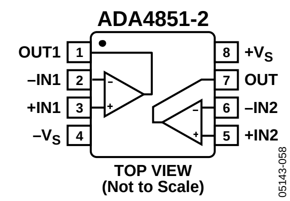

Figure 2. ADA4851-2, 8-Lead MSOP (RM-8)

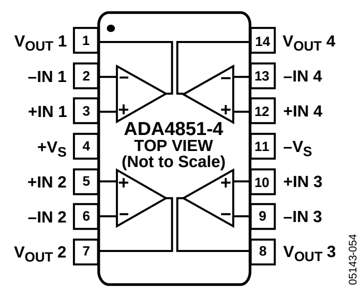

Figure 3. ADA4851-4, 14-Lead TSSOP (RU-14)

GENERAL DESCRIPTION

The ADA4851-1 (single)/ADA4851-2 (dual)/ADA4851-4 (quad) are low cost, high speed, voltage feedback rail-to-rail output op amps. Despite their low price, these parts provide excellent overall performance and versatility. The 130 MHz, −3 dB bandwidth and high slew rate make these amplifiers well-suited for many general-purpose, high speed applications.

The ADA4851 family is designed to operate at supply voltages as low as +3 V and up to ±5 V. These parts provide true single-supply capability, allowing input signals to extend 200 mV below the negative rail and to within 2.2 V of the positive rail. On the output, the amplifiers can swing within 60 mV of either supply rail.

With their combination of low price, excellent differential gain (0.08%), differential phase (0.09°), and 0.1 dB flatness out to 11 MHz, these amplifiers are ideal for consumer video applications.

The ADA4851 family is designed to work over the extended temperature range (−40°C to +125°C).

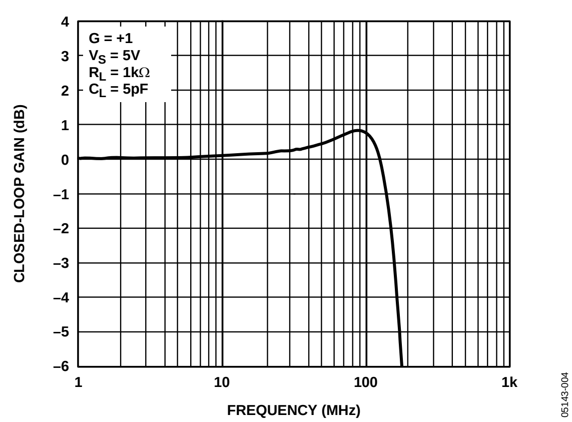

Figure 4. Small Signal Frequency Response

Rev. C

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 www.analog.com
Fax: 781.461.3113

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SPECIFICATIONS

SPECIFICATIONS WITH +3 V SUPPLY

T_A = 25°C, R_F = 0 Ω for G = +1, R_F = 1 kΩ for G > +1, R_L = 1 kΩ, unless otherwise noted.

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
−3 dB Bandwidth	G = +1, V_O = 0.1 V p-p	104	130		MHz
	G = +1, V_O = 0.5 V p-p	80	105		MHz
	G = +2, V_O = 1.0 V p-p, R_L = 150 Ω		40		MHz
Bandwidth for 0.1 dB Flatness	G = +2, V_O = 1 V p-p, R_L = 150 Ω		15		MHz
Slew Rate	G = +2, V_O = 1 V step		100		V/μs
Settling Time to 0.1%	G = +2, V_O = 1 V step, R_L = 150 Ω		50		ns
NOISE/DISTORTION PERFORMANCE					
Harmonic Distortion (dBc) HD2/HD3	f_C = 1 MHz, V_O = 1 V p-p, G = −1		−73/−79		dBc
Input Voltage Noise	f = 100 kHz		10		nV/√Hz
Input Current Noise	f = 100 kHz		2.5		pA/√Hz
Differential Gain	G = +3, NTSC, R_L = 150 Ω, V_O = 2 V p-p		0.44		%
Differential Phase	G = +3, NTSC, R_L = 150 Ω, V_O = 2 V p-p		0.41		Degrees
Crosstalk (RTI)—ADA4851-2/ADA4851-4	f = 5 MHz, G = +2, V_O = 1.0 V p-p		−70/−60		dB
DC PERFORMANCE					
Input Offset Voltage			0.6	3.3	mV
Input Offset Voltage Drift			4		μV/°C
Input Bias Current			2.3	4.0	μA
Input Bias Current Drift			6		nA/°C
Input Bias Offset Current			20		nA
Open-Loop Gain	V_O = 0.25 V to 0.75 V	80	105		dB
INPUT CHARACTERISTICS					
Input Resistance	Differential/common-mode		0.5/5.0		MΩ
Input Capacitance			1.2		pF
Input Common-Mode Voltage Range			−0.2 to +0.8		V
Input Overdrive Recovery Time (Rise/Fall)	V_{IN} = +3.5 V, −0.5 V, G = +1		60/60		ns
Common-Mode Rejection Ratio	V_{CM} = 0 V to 0.5 V	−81	−103		dB
POWER-DOWN					
Power-Down Input Voltage	Power-down		<1.1		V
	Enabled		>1.6		V
Turn-Off Time			0.7		μs
Turn-On Time			60		ns
Power-Down Bias Current					
Enabled	Power-down = 3 V		4	6	μA
Power-Down	Power-down = 0 V		−14	−20	μA
OUTPUT CHARACTERISTICS					
Output Overdrive Recovery Time (Rise/Fall)	V_{IN} = +0.7 V, −0.1 V, G = +5		70/100		ns
Output Voltage Swing		0.05 to 2.91	0.03 to 2.94		V
Short-Circuit Current	Sinking/sourcing		90/70		mA
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current per Amplifier			2.4	2.7	mA
Quiescent Current (Power-Down)	Power-down = low		0.2	0.3	mA
Positive Power Supply Rejection	$+V_S$ = +2.5 V to +3.5 V, $−V_S$ = −0.5 V	−81	−100		dB
Negative Power Supply Rejection	$+V_S$ = +2.5 V, $−V_S$ = −0.5 V to −1.5 V	−80	−100		dB

SPECIFICATIONS WITH +5 V SUPPLY

T_A = 25°C, R_F = 0 Ω for G = +1, R_F = 1 kΩ for G > +1, R_L = 1 kΩ, unless otherwise noted.

Table 2.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
−3 dB Bandwidth	G = +1, V_O = 0.1 V p-p	96	125		MHz
	G = +1, V_O = 0.5 V p-p	72	96		MHz
	G = +2, V_O = 1.4 V p-p, R_L = 150 Ω		35		MHz
Bandwidth for 0.1 dB Flatness	G = +2, V_O = 1.4 V p-p, R_L = 150 Ω		11		MHz
Slew Rate	G = +2, V_O = 2 V step		200		V/μs
Settling Time to 0.1%	G = +2, V_O = 2 V step, R_L = 150 Ω		55		ns
NOISE/DISTORTION PERFORMANCE					
Harmonic Distortion (dBc) HD2/HD3	f_C = 1 MHz, V_O = 2 V p-p, G = +1		−80/−100		dBc
Input Voltage Noise	f = 100 kHz		10		nV/√Hz
Input Current Noise	f = 100 kHz		2.5		pA/√Hz
Differential Gain	G = +2, NTSC, R_L = 150 Ω, V_O = 2 V p-p		0.08		%
Differential Phase	G = +2, NTSC, R_L = 150 Ω, V_O = 2 V p-p		0.11		Degrees
Crosstalk (RTI)—ADA4851-2/ADA4851-4	f = 5 MHz, G = +2, V_O = 2.0 V p-p		−70/−60		dB
DC PERFORMANCE					
Input Offset Voltage			0.6	3.4	mV
Input Offset Voltage Drift			4		μV/°C
Input Bias Current			2.2	3.9	μA
Input Bias Current Drift			6		nA/°C
Input Bias Offset Current			20		nA
Open-Loop Gain	V_O = 1 V to 4 V	97	107		dB
INPUT CHARACTERISTICS					
Input Resistance	Differential/common-mode		0.5/5.0		MΩ
Input Capacitance			1.2		pF
Input Common-Mode Voltage Range			−0.2 to +2.8		V
Input Overdrive Recovery Time (Rise/Fall)	V_{IN} = +5.5 V, −0.5 V, G = +1		50/45		ns
Common-Mode Rejection Ratio	V_{CM} = 0 V to 2 V	−86	−105		dB
POWER-DOWN					
Power-Down Input Voltage	Power-down		<1.1		V
	Enabled		>1.6		V
Turn-Off Time			0.7		μs
Turn-On Time			50		ns
Power-Down Bias Current					
Enabled	Power-down = 5 V		33	40	μA
Power-Down	Power-down = 0 V		−22	−30	μA
OUTPUT CHARACTERISTICS					
Output Overdrive Recovery Time (Rise/Fall)	V_{IN} = +1.1 V, −0.1 V, G = +5		60/70		ns
Output Voltage Swing		0.09 to 4.91	0.06 to 4.94		V
Short-Circuit Current	Sinking/sourcing		110/90		mA
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current per Amplifier			2.5	2.8	mA
Quiescent Current (Power-Down)	Power-down = low		0.2	0.3	mA
Positive Power Supply Rejection	$+V_S$ = +5 V to +6 V, $-V_S$ = 0 V	−82	−101		dB
Negative Power Supply Rejection	$+V_S$ = +5 V, $-V_S$ = −0 V to −1 V	−81	−101		dB

SPECIFICATIONS WITH ±5 V SUPPLY

T_A = 25°C, R_F = 0 Ω for G = +1, R_F = 1 kΩ for G > +1, R_L = 1 kΩ, unless otherwise noted.

Table 3.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
−3 dB Bandwidth	G = +1, V_O = 0.1 V p-p	83	105		MHz
	G = +1, V_O = 1 V p-p	52	74		MHz
	G = +2, V_O = 2 V p-p, R_L = 150 Ω		40		MHz
Bandwidth for 0.1 dB Flatness	G = +2, V_O = 2 V p-p, R_L = 150 Ω		11		MHz
Slew Rate	G = +2, V_O = 7 V step		375		V/μs
	G = +2, V_O = 2 V step		190		V/μs
Settling Time to 0.1%	G = +2, V_O = 2 V step, R_L = 150 Ω		55		ns
NOISE/DISTORTION PERFORMANCE					
Harmonic Distortion (dBc) HD2/HD3	f_C = 1 MHz, V_O = 2 V p-p, G = +1		−83/−107		dBc
Input Voltage Noise	f = 100 kHz		10		nV/√Hz
Input Current Noise	f = 100 kHz		2.5		pA/√Hz
Differential Gain	G = +2, NTSC, R_L = 150 Ω, V_O = 2 V p-p		0.08		%
Differential Phase	G = +2, NTSC, R_L = 150 Ω, V_O = 2 V p-p		0.09		Degrees
Crosstalk(RTI)—ADA4851-2/ADA4851-4	f = 5 MHz, G = +2, V_O = 2.0 V p-p		−70/−60		dB
DC PERFORMANCE					
Input Offset Voltage			0.6	3.5	mV
Input Offset Voltage Drift			4		μV/°C
Input Bias Current			2.2	4.0	μA
Input Bias Current Drift			6		nA/°C
Input Bias Offset Current			20		nA
Open-Loop Gain	V_O = ±2.5 V	99	106		dB
INPUT CHARACTERISTICS					
Input Resistance	Differential/common-mode		0.5/5.0		MΩ
Input Capacitance			1.2		pF
Input Common-Mode Voltage Range			−5.2 to +2.8		V
Input Overdrive Recovery Time (Rise/Fall)	V_{IN} = ±6 V, G = +1		50/25		ns
Common-Mode Rejection Ratio	V_{CM} = 0 V to 4 V	−90	−105		dB
POWER-DOWN					
Power-Down Input Voltage	Power-down		< −3.9		V
	Enabled		> −3.4		V
Turn-Off Time			0.7		μs
Turn-On Time			30		ns
Power-Down Bias Current					
Enabled	Power-down = +5 V		100	130	μA
Power-Down	Power-down = −5 V		−50	−60	μA
OUTPUT CHARACTERISTICS					
Output Overdrive Recovery Time (Rise/Fall)	V_{IN} = ±1.2 V, G = +5		80/50		ns
Output Voltage Swing		−4.87 to +4.88	−4.92 to +4.92		V
Short-Circuit Current	Sinking/sourcing		125/110		mA
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current per Amplifier			2.9	3.2	mA
Quiescent Current (Power-Down)	Power-down = low		0.2	0.3	mA
Positive Power Supply Rejection	$+V_S$ = +5 V to +6 V, $-V_S$ = −5 V	−82	−101		dB
Negative Power Supply Rejection	$+V_S$ = +5 V, $-V_S$ = −5 V to −6 V	−81	−102		dB

ABSOLUTE MAXIMUM RATINGS

Table 4.

Parameter	Rating
Supply Voltage	12.6 V
Power Dissipation	See Figure 5
Common-Mode Input Voltage	$-V_S - 0.5$ V to $+V_S + 0.5$ V
Differential Input Voltage	$+V_S$ to $-V_S$
Storage Temperature	−65°C to +125°C
Operating Temperature Range	−40°C to +125°C
Lead Temperature Range	JEDEC J-STD-20
Junction Temperature	150°C

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

THERMAL RESISTANCE

θ_{JA} is specified for the worst-case conditions, that is, θ_{JA} is specified for device soldered in circuit board for surface-mount packages.

Table 5. Thermal Resistance

Package Type	θ_{JA}	Unit
6-lead SOT-23	170	°C/W
14-lead TSSOP	120	°C/W
8-lead MSOP	150	°C/W

Maximum Power Dissipation

The maximum safe power dissipation for the ADA4851-1/ ADA4851-2/ADA4851-4 is limited by the associated rise in junction temperature (T_J) on the die. At approximately 150°C, which is the glass transition temperature, the plastic changes its properties. Even temporarily exceeding this temperature limit may change the stresses that the package exerts on the die, permanently shifting the parametric performance of the amplifiers. Exceeding a junction temperature of 150°C for an extended period of time can result in changes in silicon devices, potentially causing degradation or loss of functionality.

The power dissipated in the package (P_D) is the sum of the quiescent power dissipation and the power dissipated in the die due to the amplifiers' drive at the output. The quiescent power is the voltage between the supply pins (V_S) times the quiescent current (I_S).

$$P_D = \mathit{Quiescent\ Power} + (\mathit{Total\ Drive\ Power} - \mathit{Load\ Power})$$

$$P_D = (V_S \times I_S) + \left(\frac{V_S}{2} \times \frac{V_{OUT}}{R_L}\right) - \frac{{V_{OUT}}^2}{R_L}$$

RMS output voltages should be considered. If R_L is referenced to $-V_S$, as in single-supply operation, the total drive power is $V_S \times I_{OUT}$. If the rms signal levels are indeterminate, consider the worst case, when $V_{OUT} = V_S/4$ for R_L to midsupply.

$$P_D = (V_S \times I_S) + \frac{(V_S/4)^2}{R_L}$$

In single-supply operation with R_L referenced to $-V_S$, worst case is $V_{OUT} = V_S/2$.

Airflow increases heat dissipation, effectively reducing θ_{JA}. Also, more metal directly in contact with the package leads and through holes under the device reduces θ_{JA}.

Figure 5 shows the maximum safe power dissipation in the package vs. the ambient temperature for the 6-lead SOT-23 (170°C/W), the 8-lead MSOP (150°C/W), and the 14-lead TSSOP (120°C/W) on a JEDEC standard 4-layer board. θ_{JA} values are approximations.

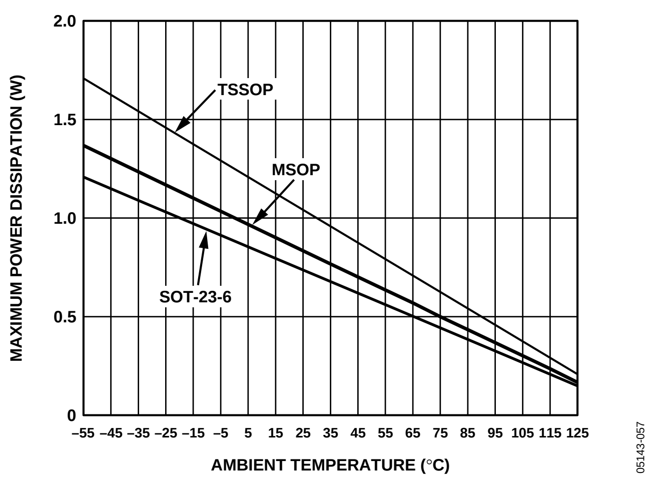


Figure 5. Maximum Power Dissipation vs. Temperature for a 4-Layer Board

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

WARNING!
ESD SENSITIVE DEVICE

TYPICAL PERFORMANCE CHARACTERISTICS

$T_A = 25°C$, $R_F = 0\ \Omega$ for $G = +1$, $R_F = 1\ k\Omega$ for $G > +1$, $R_L = 1\ k\Omega$, unless otherwise noted.

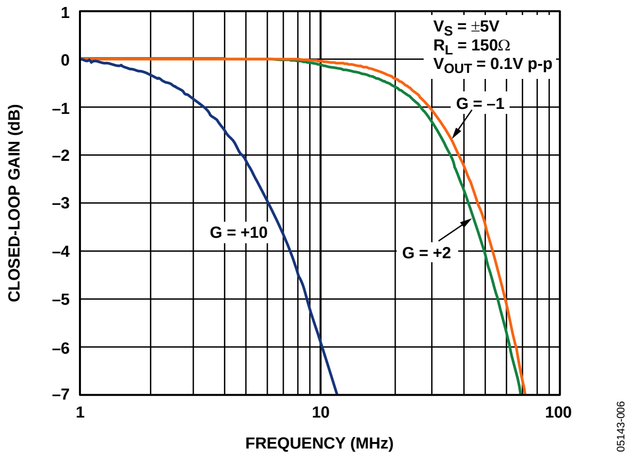


Figure 6. Small Signal Frequency Response for Various Gains

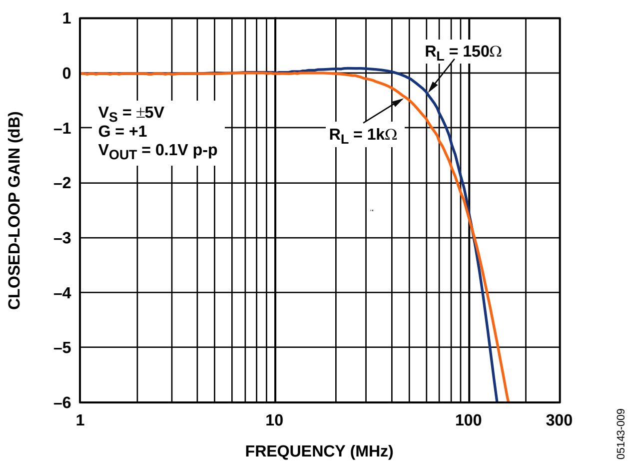


Figure 7. Small Signal Frequency Response for Various Loads

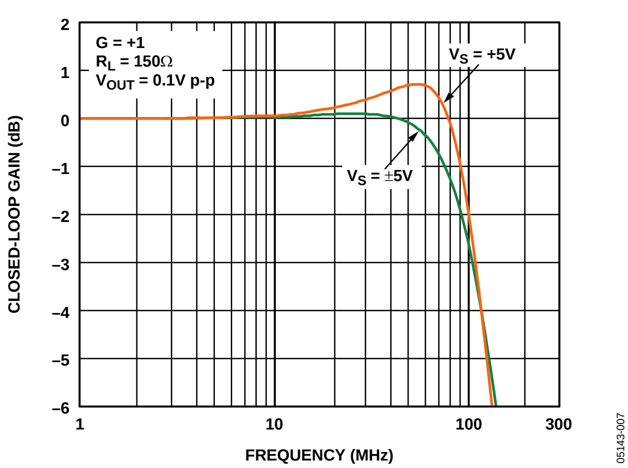


Figure 8. Small Signal Frequency Response for Various Supplies

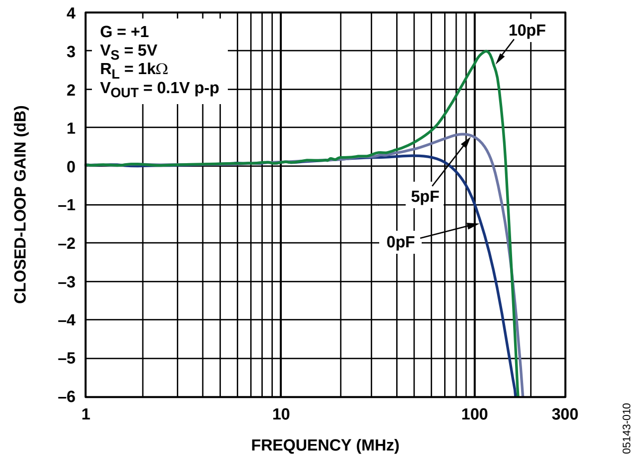


Figure 9. Small Signal Frequency Response for Various Capacitor Loads

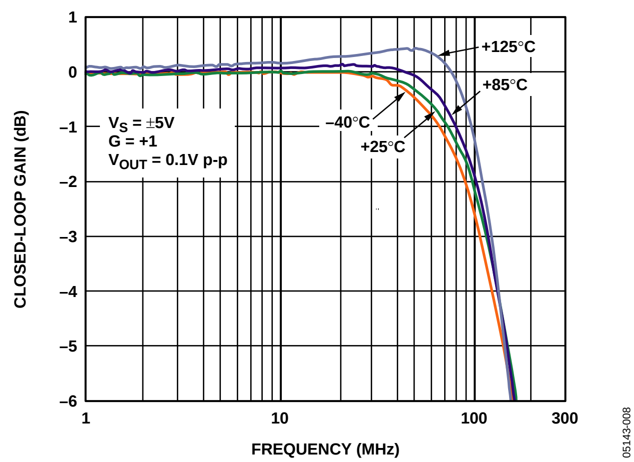


Figure 10. Small Signal Frequency Response for Various Temperatures

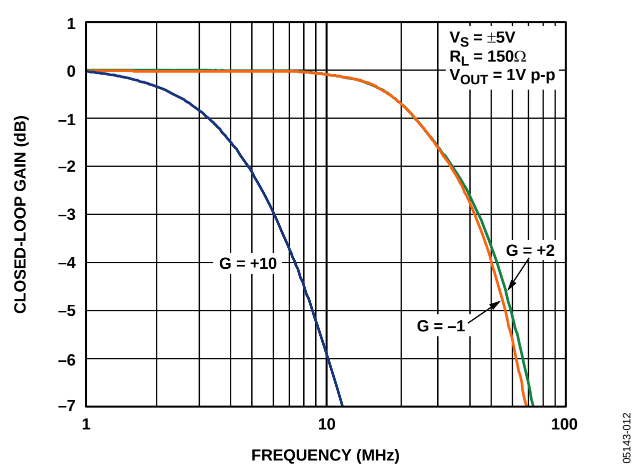


Figure 11. Large Signal Frequency Response for Various Gains

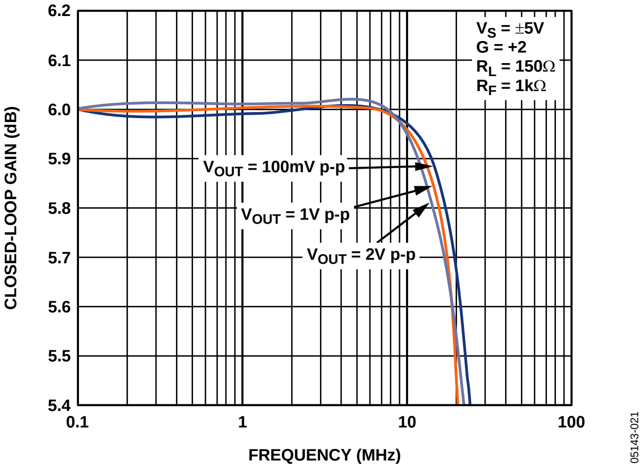


Figure 12. 0.1 dB Flatness Response

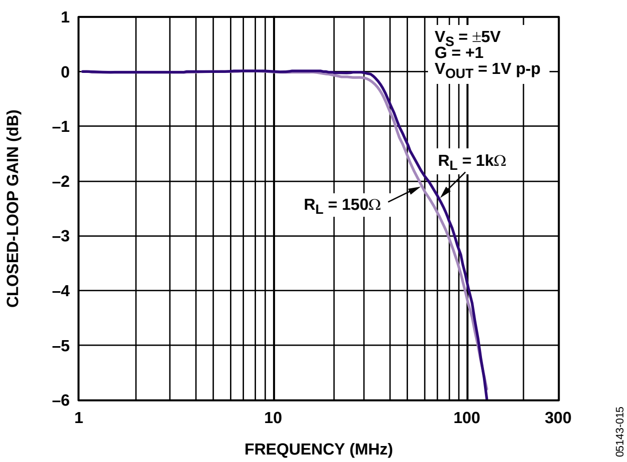


Figure 13. Large Frequency Response for Various Loads

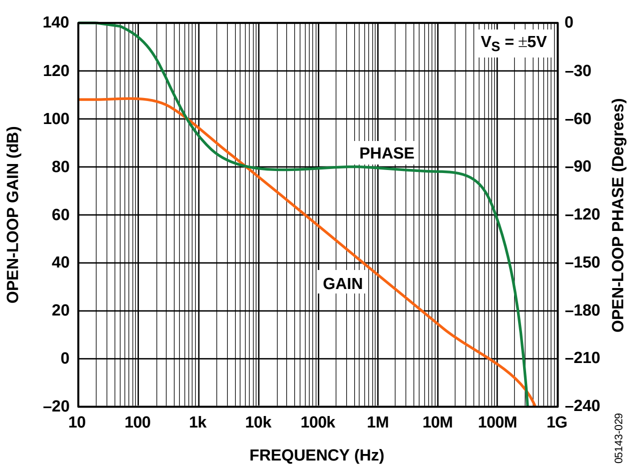


Figure 14. Open-Loop Gain and Phase vs. Frequency

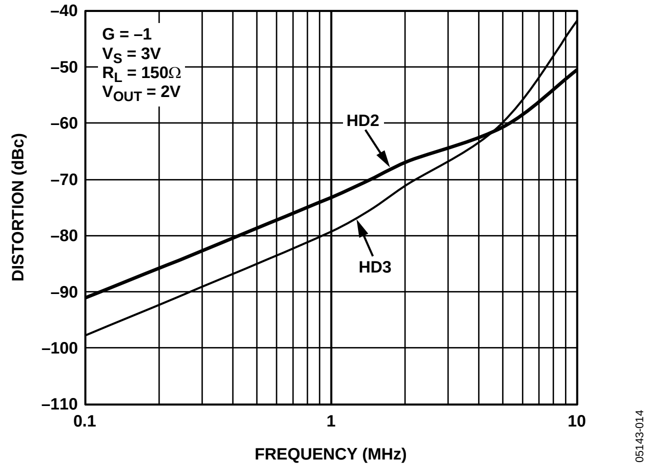


Figure 15. Harmonic Distortion vs. Frequency

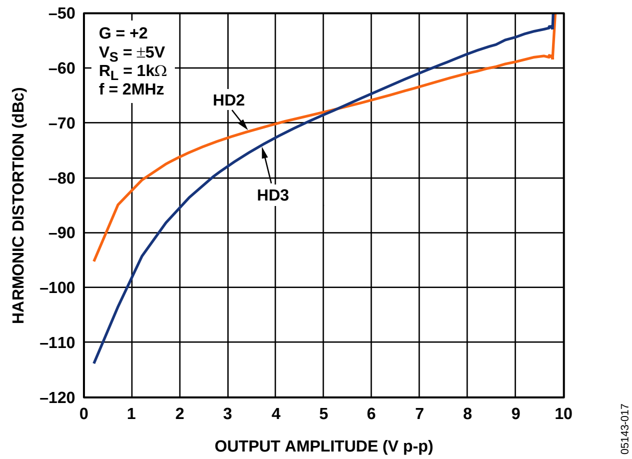


Figure 16. Harmonic Distortion vs. Output Voltage

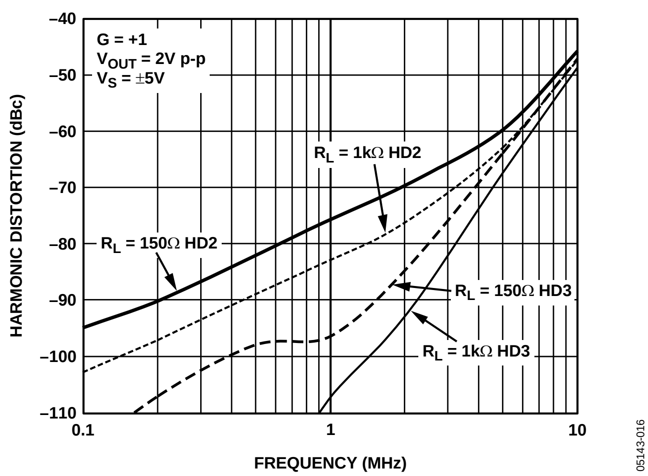


Figure 17. Harmonic Distortion vs. Frequency for Various Loads

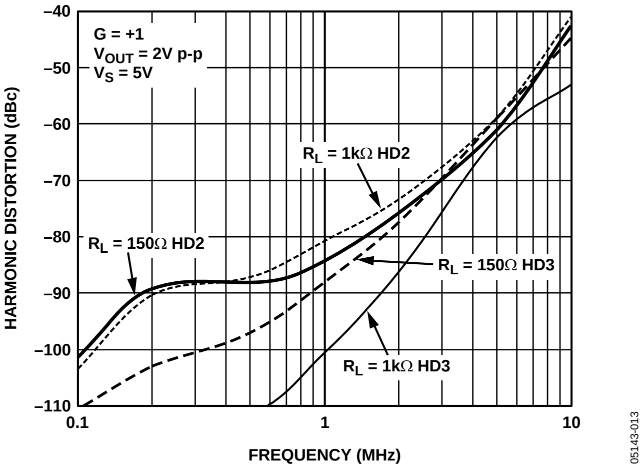


Figure 18. Harmonic Distortion vs. Frequency for Various Loads

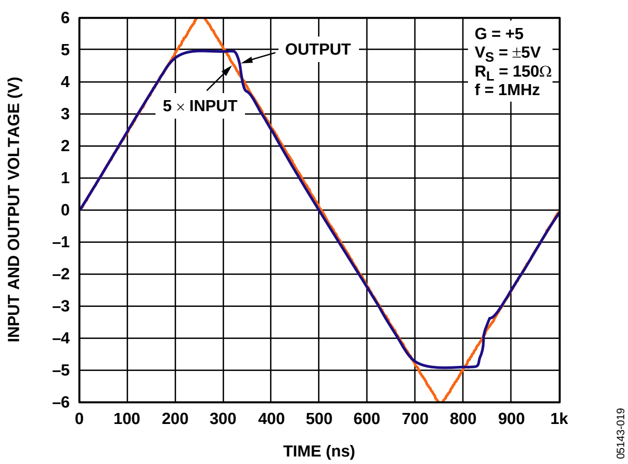


Figure 19. Output Overdrive Recovery

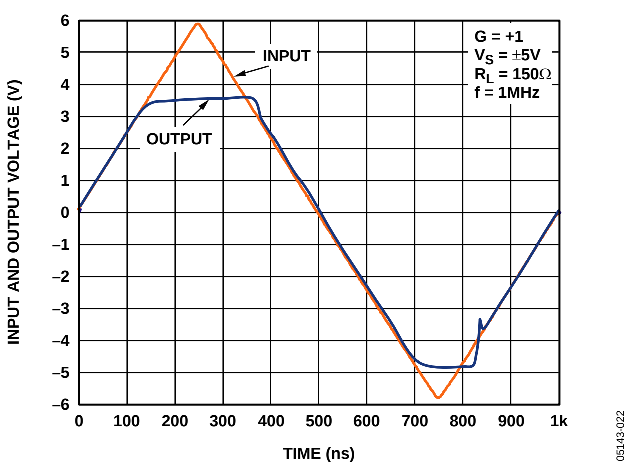


Figure 20. Input Overdrive Recovery

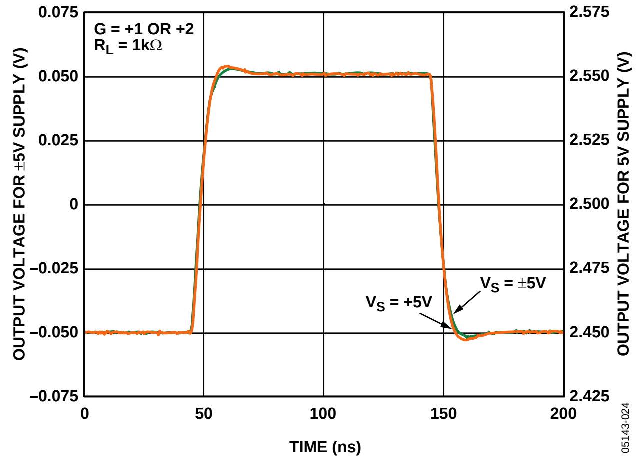


Figure 21. Small Signal Transient Response for Various Supplies

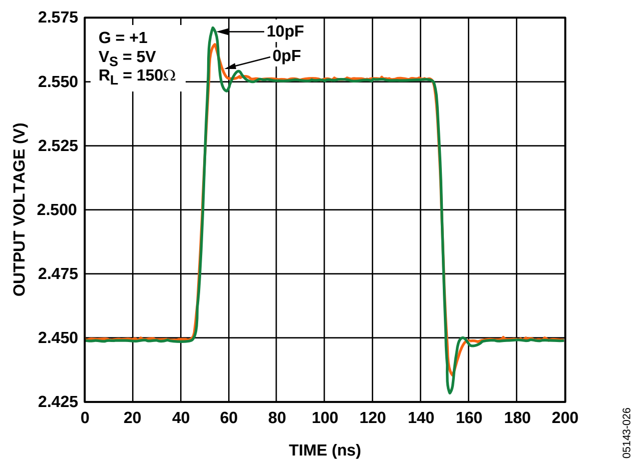


Figure 22. Small Signal Transient Response for Capacitive Load

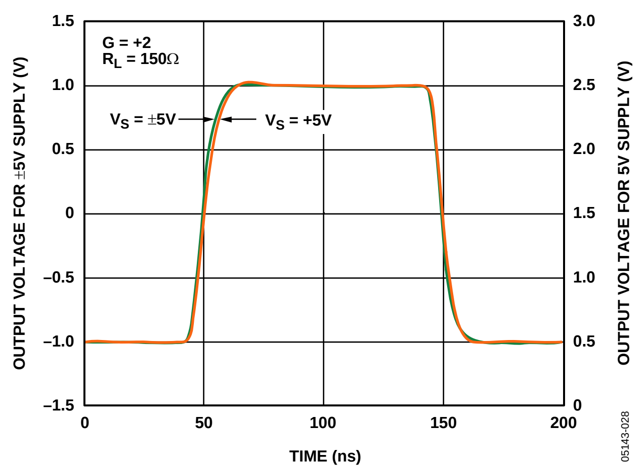


Figure 23. Large Signal Transient Response for Various Supplies

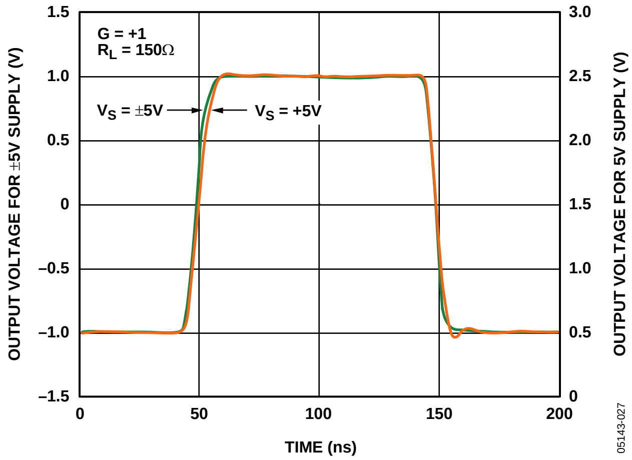


Figure 24. Large Signal Transient Response for Various Supplies

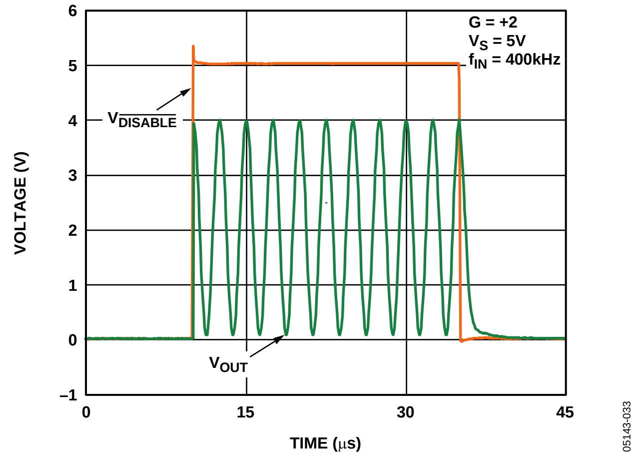


Figure 27. Enable/Disable Time

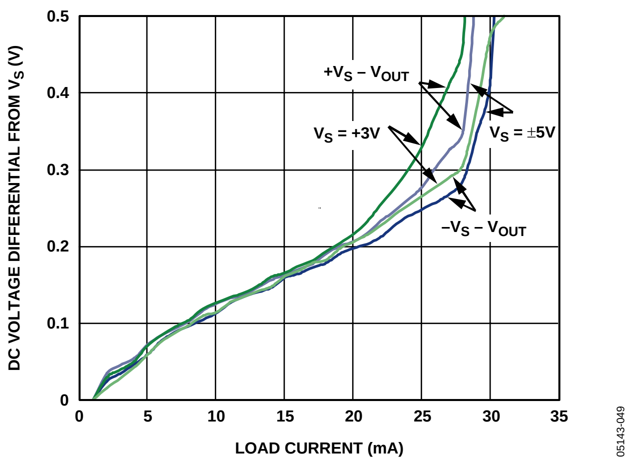


Figure 25. Output Saturation Voltage vs. Load Current

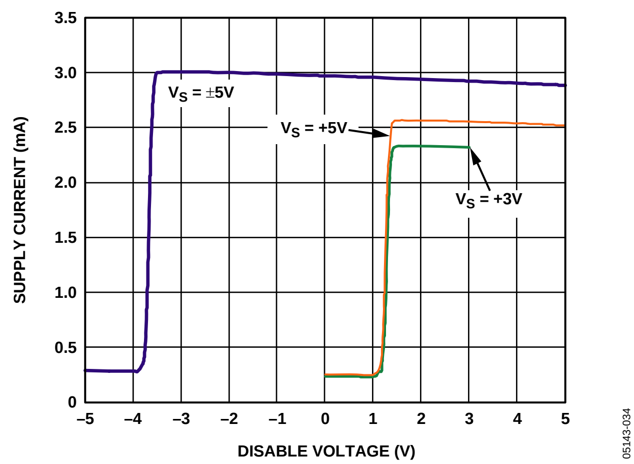


Figure 28. ADA4851-1, Supply Current vs. $\overline{\text{POWER DOWN}}$ Pin Voltage

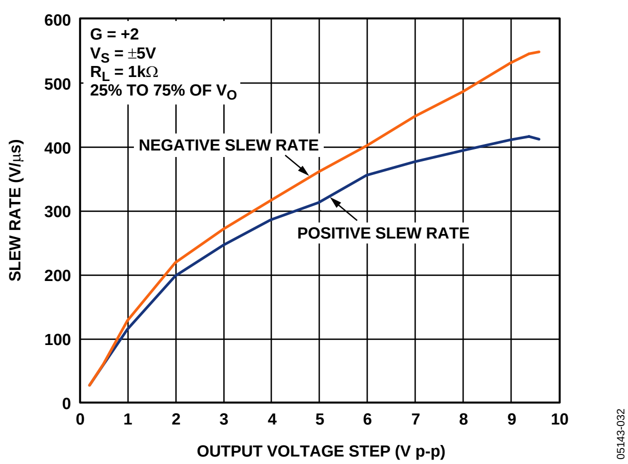


Figure 26. Slew Rate vs. Output Voltage

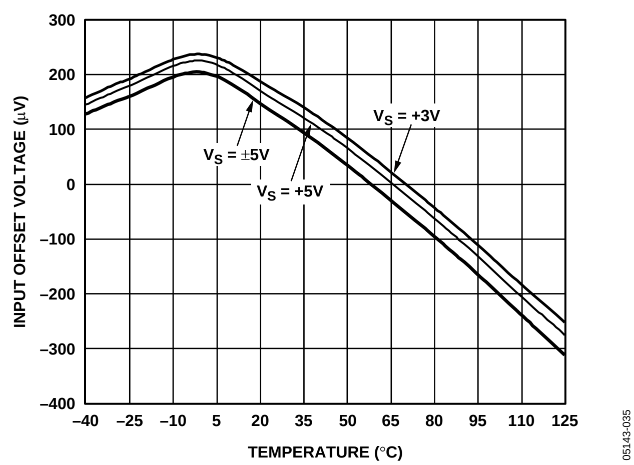


Figure 29. Input Offset Voltage vs. Temperature for Various Supplies

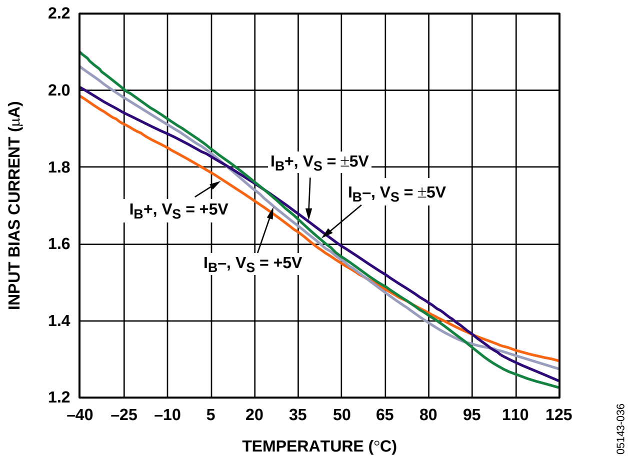


Figure 30. Input Bias Current vs. Temperature for Various Supplies

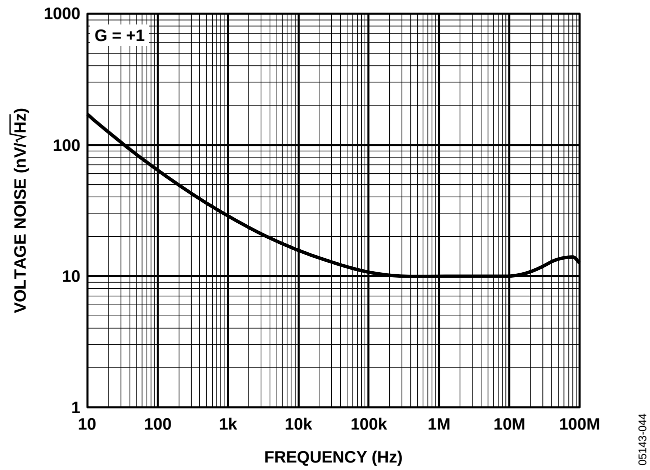


Figure 33. Voltage Noise vs. Frequency

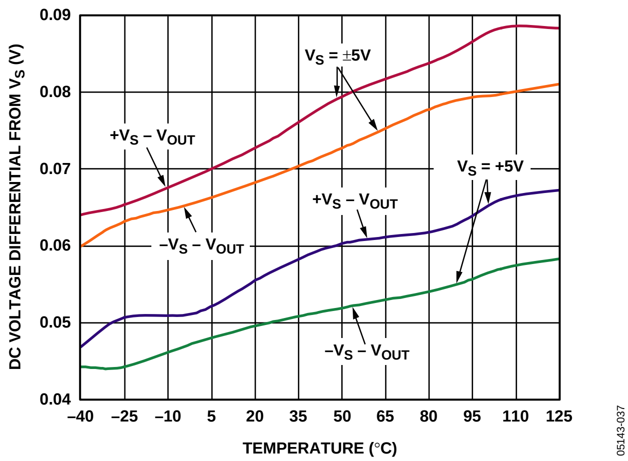


Figure 31. Output Saturation vs. Temperature for Various Supplies

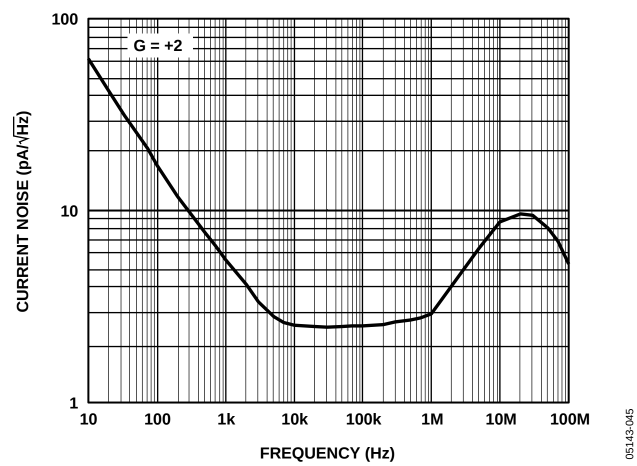


Figure 34. Current Noise vs. Frequency

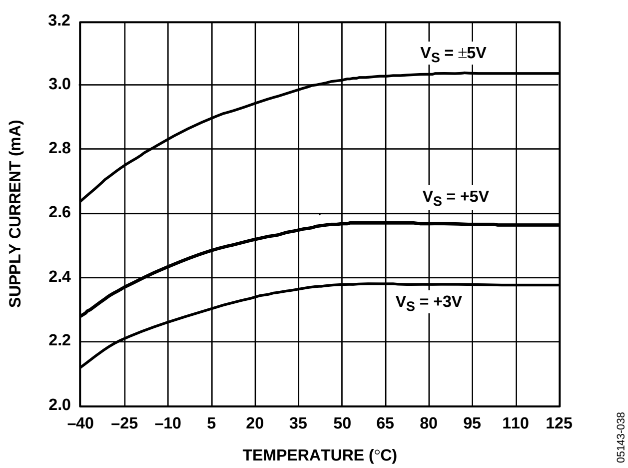


Figure 32. Supply Current vs. Temperature for Various Supplies

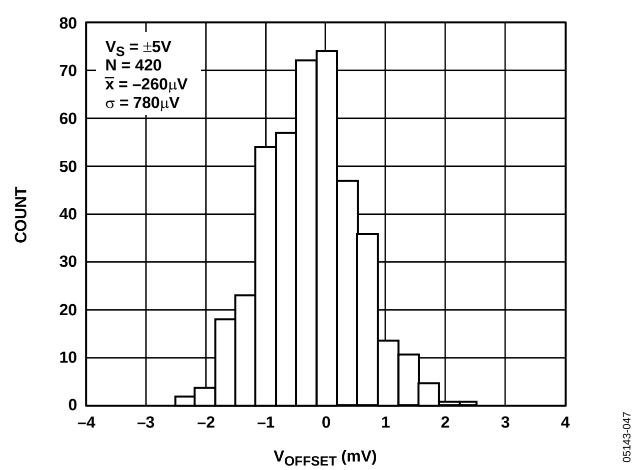


Figure 35. Input Offset Voltage Distribution

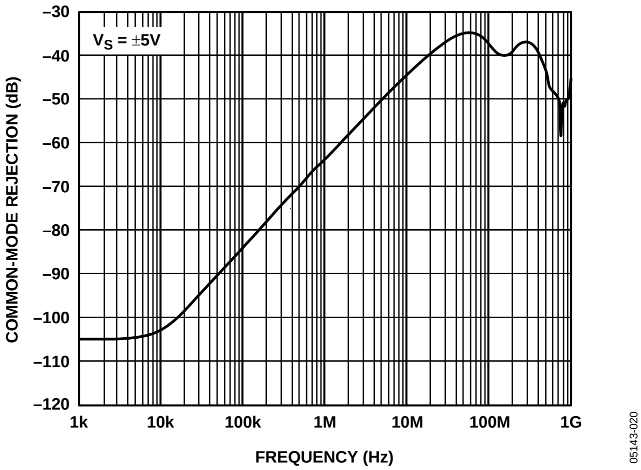


Figure 36. Common-Mode Rejection Ratio (CMRR) vs. Frequency

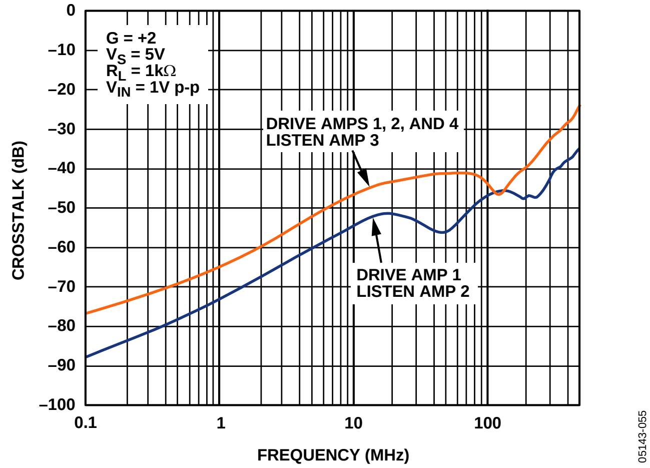


Figure 38. ADA4851-4, RTI Crosstalk vs. Frequency

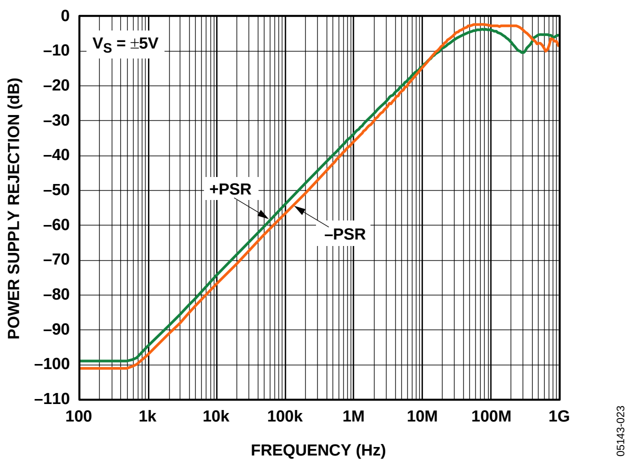


Figure 37. Power Supply Rejection (PSR) vs. Frequency

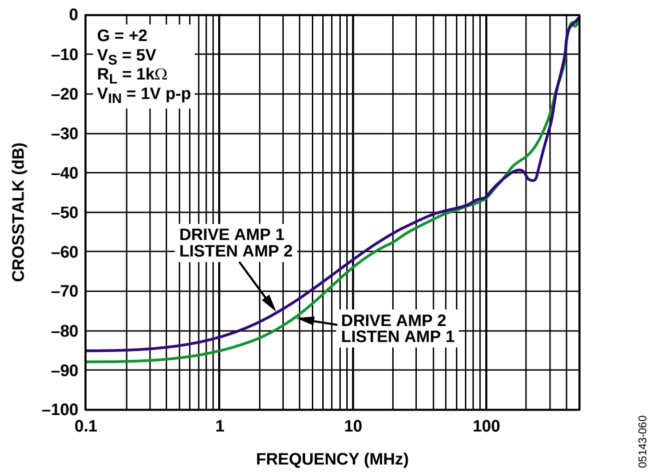


Figure 39. ADA4851-2, RTI Crosstalk vs. Frequency

CIRCUIT DESCRIPTION

The ADA4851-1, ADA4851-2, and ADA4851-4 feature a high slew rate input stage that is a true single-supply topology, capable of sensing signals at or below the minus supply rail. The rail-to-rail output stage can pull within 60 mV of either supply rail when driving light loads and within 0.17 V when driving 150 Ω. High speed performance is maintained at supply voltages as low as 2.7 V.

HEADROOM CONSIDERATIONS

These amplifiers are designed for use in low voltage systems. To obtain optimum performance, it is useful to understand the behavior of the amplifiers as input and output signals approach the amplifiers' headroom limits. The amplifiers' input common-mode voltage range extends from the negative supply voltage (actually 200 mV below this), or from ground for single-supply operation, to within 2.2 V of the positive supply voltage. Therefore, at a gain of 3, the amplifiers can provide full rail-to-rail output swing for supply voltages as low as 3.3 V and down to 3 V for a gain of 4.

Exceeding the headroom limit is not a concern for any inverting gain on any supply voltage, as long as the reference voltage at the amplifier's positive input lies within the amplifier's input common-mode range.

The input stage is the headroom limit for signals approaching the positive rail. Figure 40 shows a typical offset voltage vs. the input common-mode voltage for the ADA4851-1/ADA4851-2/ADA4851-4 amplifiers on a ±5 V supply. Accurate dc performance is maintained from approximately 200 mV below the minus supply to within 2.2 V of the positive supply. For high speed signals, however, there are other considerations. Figure 41 shows −3 dB bandwidth vs. dc input voltage for a unity-gain follower. As the common-mode voltage gets within 2 V of positive supply, the amplifier responds well but the bandwidth begins to drop as the common-mode voltage approaches the positive supply. This can manifest itself in increased distortion or settling time. Higher frequency signals require more headroom than the lower frequencies to maintain distortion performance.

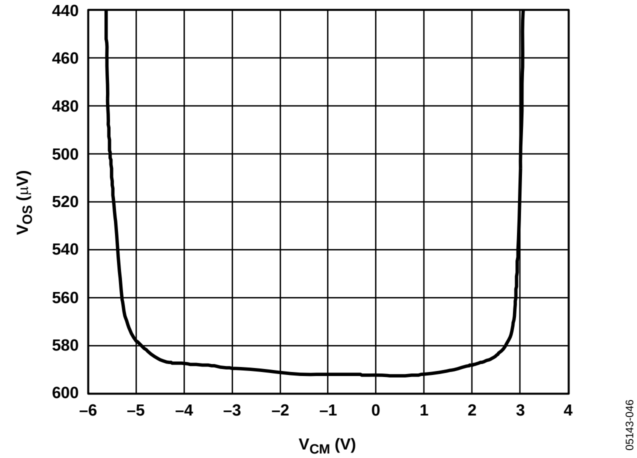


Figure 40. V_{OS} vs. Common-Mode Voltage, V_S = ±5 V

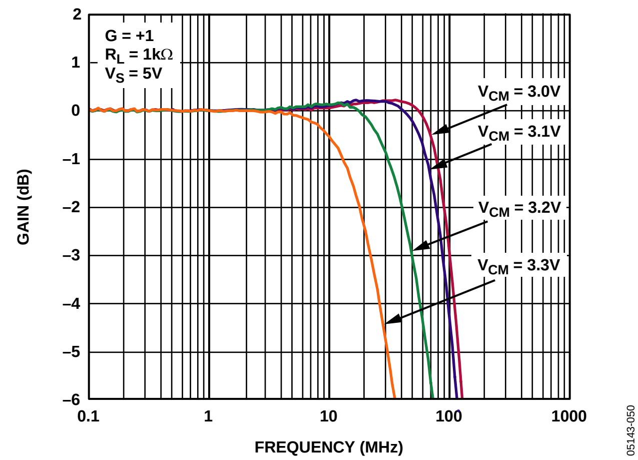


Figure 41. Unity-Gain Follower Bandwidth vs. Input Common-Mode

Figure 42 illustrates how the rising edge settling time for the amplifier is configured as a unity-gain follower, stretching out as the top of a 1 V step input that approaches and exceeds the specified input common-mode voltage limit.

For signals approaching the minus supply and inverting gain and high positive gain configurations, the headroom limit is the output stage. The ADA4851-1/ADA4851-2/ADA4851-4 amplifiers use a common emitter output stage. This output stage maximizes the available output range, limited by the saturation voltage of the output transistors. The saturation voltage increases with the drive current that the output transistor is required to supply due to the output transistor's collector resistance.

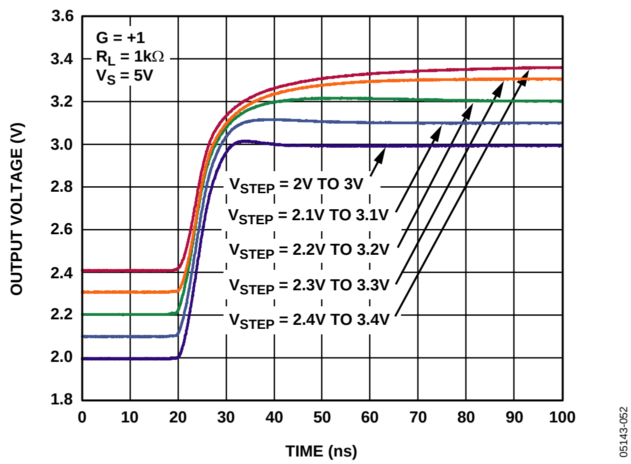


Figure 42. Output Rising Edge for 1 V Step at Input Headroom Limits

As the saturation point of the output stage is approached, the output signal shows increasing amounts of compression and clipping. As in the input headroom case, higher frequency signals require a bit more headroom than the lower frequency signals. Figure 16 illustrates this point by plotting the typical distortion vs. the output amplitude.

OVERLOAD BEHAVIOR AND RECOVERY

Input

The specified input common-mode voltage of the ADA4851-1/ ADA4851-2/ADA4851-4 is 200 mV below the negative supply to within 2.2 V of the positive supply. Exceeding the top limit results in lower bandwidth and increased rise time, as seen in Figure 41 and Figure 42. Pushing the input voltage of a unity-gain follower to less than 2 V from the positive supply leads to the behavior shown in Figure 43—an increasing amount of output error as well as a much increased settling time. The recovery time from input voltages 2.2 V or closer to the positive supply is approximately 55 ns, which is limited by the settling artifacts caused by transistors in the input stage coming out of saturation.

The amplifiers do not exhibit phase reversal, even for input voltages beyond the voltage supply rails. Going more than 0.6 V beyond the power supplies turns on protection diodes at the input stage, which greatly increases the current draw of the devices.

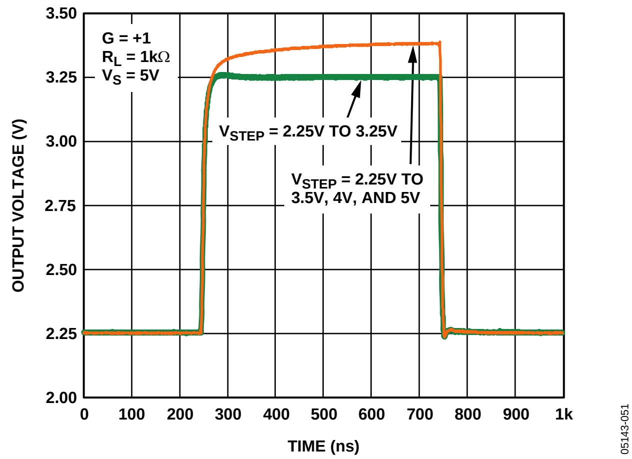


Figure 43. Pulse Response of G = 1 Follower, Input Step Overloading the Input Stage

Output

Output overload recovery is typically within 35 ns after the amplifier's input is brought to a nonoverloading value. Figure 44 shows output recovery transients for the amplifier configured in an inverting gain of 1 recovering from a saturated output from the top and bottom supplies to a point at midsupply.

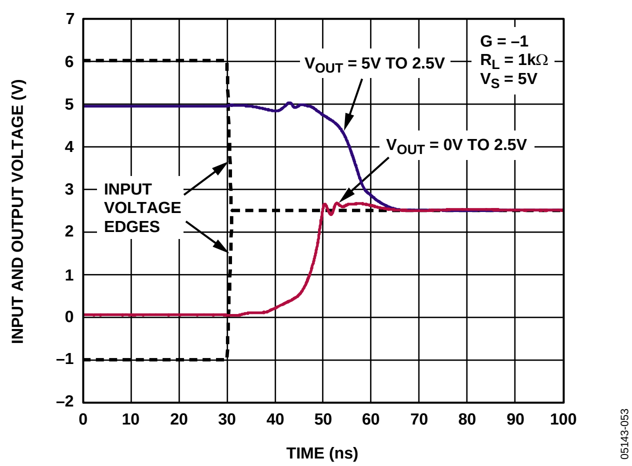


Figure 44. Overload Recovery

SINGLE-SUPPLY VIDEO AMPLIFIER

The ADA4851 family of amplifiers is well-suited for portable video applications. When operating in low voltage single-supply applications, the input signal is limited by the input stage headroom. For additional information, see the Headroom Considerations section. Table 6 illustrates the effects of supply voltage, input signal, various gains, and output signal swing for the typical video amplifier shown in Figure 45.

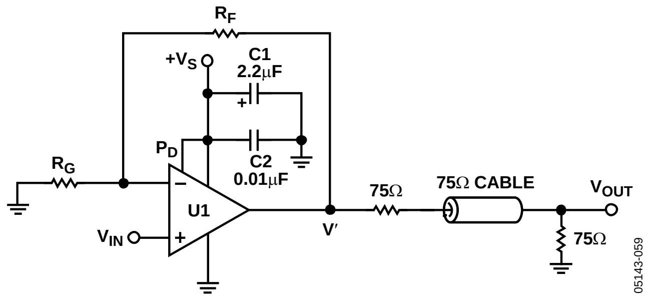
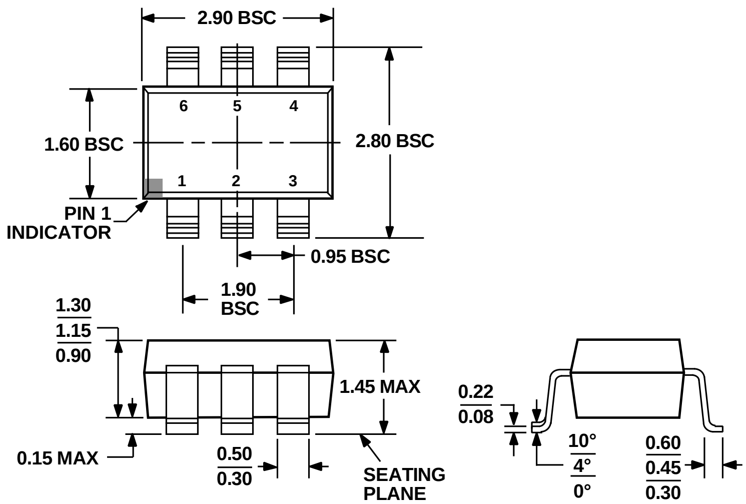


Figure 45. Video Amplifier

Table 6. Recommended Values

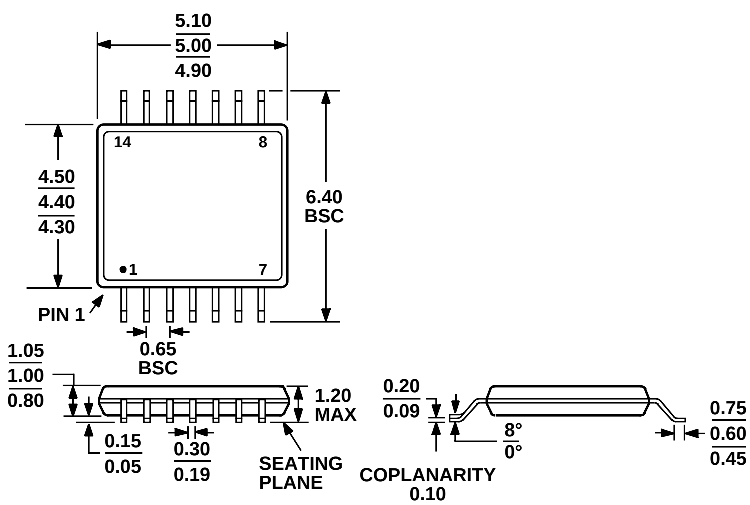
Supply Voltage (V)	Input Range (V)	R_G (kΩ)	R_F (kΩ)	Gain (V/V)	V′ (V)	V_{OUT} (V)
3	0 to 0.8	1	1	2	1.6	0.8
3	0 to 0.8	0.499	1	3	2.4	1.2
5	0 to 2.8	1	1	2	4.9	2.45

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-178-AB

Figure 46. 6-Lead Small Outline Transistor Package [SOT-23]
(RJ-6)
Dimensions shown in millimeters



COMPLIANT TO JEDEC STANDARDS MO-153-AB-1

Figure 47. 14-Lead Thin Shrink Small Outline Package [TSSOP]
(RU-14)
Dimensions shown in millimeters

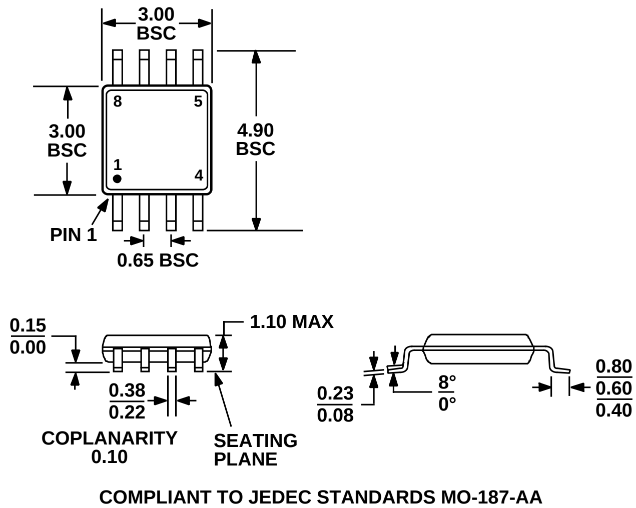


Figure 48. 8-Lead Mini Small Outline Package [MSOP]
(RM-8)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Outline	Branding
ADA4851-1YRJZ-R2[1]	−40°C to +125°C	6-Lead Small Outline Transistor Package (SOT-23)	RJ-6	HHB
ADA4851-1YRJZ-RL[1]	−40°C to +125°C	6-Lead Small Outline Transistor Package (SOT-23)	RJ-6	HHB
ADA4851-1YRJZ-RL7[1]	−40°C to +125°C	6-Lead Small Outline Transistor Package (SOT-23)	RJ-6	HHB
ADA4851-2YRMZ[1]	−40°C to +125°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	HSB
ADA4851-2YRMZ-RL[1]	−40°C to +125°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	HSB
ADA4851-2YRMZ-RL7[1]	−40°C to +125°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	HSB
ADA4851-4YRUZ[1]	−40°C to +125°C	14-Lead Thin Shrink Small Outline Package (TSSOP)	RU-14	
ADA4851-4YRUZ-RL[1]	−40°C to +125°C	14-Lead Thin Shrink Small Outline Package (TSSOP)	RU-14	
ADA4851-4YRUZ-R7[1]	−40°C to +125°C	14-Lead Thin Shrink Small Outline Package (TSSOP)	RU-14	

[1] Z = Pb-free part.

NOTES

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