

DESCRIPTION

The XD620,XL620 are low cost, high accuracy instrumentation amplifiers

FEATURES

- ✚ Gain range 1 to 10,000
- ✚ Power supply range : ± 2.3 V to ± 18 V
- ✚ Package: 8-lead DIP and SOP
- ✚ Low power:1.3 mA max supply current
- ✚ Input offset voltage: 50 μ V max,
- ✚ input offset drift :0.6 μ V/ $^{\circ}$ C max,
- ✚ input bias current: 1.0 nA max
- ✚ 100 dB min common-mode rejection ratio ($G = 10$)
- ✚ Low noise:9 nV/ $\sqrt{\text{Hz}}$ @ 1 kHz, input voltage noise
- ✚ 0.28 μ V p-p noise (0.1 Hz to 10 Hz)
- ✚ Excellent ac specifications
- ✚ 120 kHz bandwidth ($G = 100$)
- ✚ 15 μ s settling time to 0.01%

Diagram

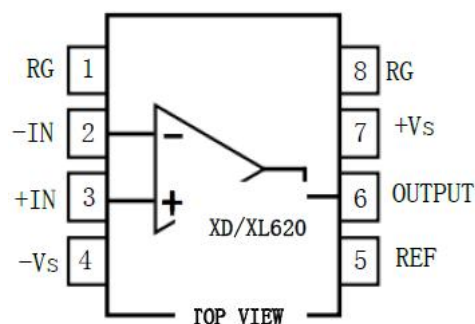


Figure 1: Top View

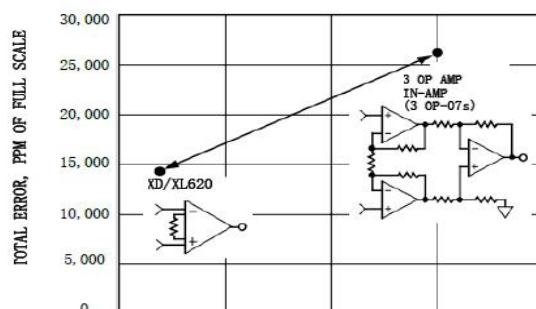


Figure 2: Three Op AMP IA Design VS XL/XD620

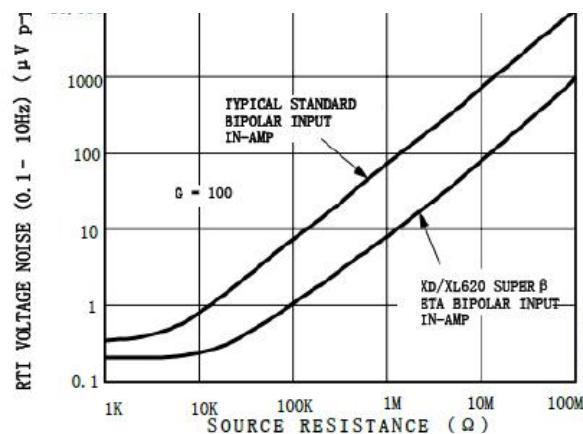


Figure 3: Total Voltage Noise VS Source Resistance

Ordering Information

Part No.	Operation Temperature Range	Package
XL620	-40~85 $^{\circ}$ C	DIP8
XD620		SOP8

SPECIFICATIONS

Typical @ 25°C, $V_S = \pm 15\text{ V}$, and $R_L = 2\text{ k}\Omega$, unless otherwise noted.

Table 1.

Parameter	Conditions	XL620/XD620			Unit
		Min	Typ	Max	
GAIN	$G = 1 + (49.4\text{ k}\Omega/R_G)$				
Gain		1		10,000	
Range	$V_{OUT} = \pm 10\text{ V}$				
Gain			0.03	0.10	%
Error ² G			0.15	0.30	%
= 1			0.15	0.30	%
G = 10			0.40	0.70	%
G = 100	$V_{OUT} = -10\text{ V to }+10\text{ V}$				
G = 1000	$R_L = 10\text{ k}\Omega$		10	40	ppm
Nonlinearit	$R_L = 2\text{ k}\Omega$		10	95	ppm
y G =	G = 1			10	ppm/°C
1–1000	Gain > 1 ²			–50	ppm/°C
G = 1–100					
Gain vs. Temperature					
VOLTAGE OFFSET					
Input Offset, V_{OSI}	$V_S = \pm 5\text{ V}$ to $\pm 15\text{ V}$		30	125	μV
Overtemperatu	$V_S = \pm 5\text{ V}$ to $\pm 15\text{ V}$			185	μV
re Average TC	$V_S = \pm 5\text{ V}$ to $\pm 15\text{ V}$		0.3	1.0	$\mu\text{V}/^\circ\text{C}$
	$V_S = \pm 15\text{ V}$		400	1000	μV
Output Offset, V_{OSO}	$V_S = \pm 5\text{ V}$			1500	μV
	$V_S = \pm 5\text{ V}$			2000	μV
Overtemperatu	$V_S = \pm 5\text{ V}$ to $\pm 15\text{ V}$		5.0	15	$\mu\text{V}/^\circ\text{C}$
re Average TC	$V_S = \pm 5\text{ V}$ to $\pm 15\text{ V}$				
Offset Referred to the Input vs. Supply (PSR)	$V_S = \pm 2.3\text{ V}$ to $\pm 18\text{ V}$				dB
G = 1		80	100		
G = 10		95	120		dB
G = 100		110	140		dB
G = 1000		110	140		dB
INPUT CURRENT					
Input Bias			0.5	2.0	nA
Current				2.5	nA
Overtemperatu			3.0		pA/°C
re Average TC			0.3	1.0	nA
Input Offset Current				1.5	nA
Overtemperature					pA/°C
Average TC					
INPUT					
Input Impedance					
Differential			10 2		$G\Omega_{\text{pF}}$
Common-Mode			10 2		$G\Omega_{\text{pF}}$

Input Voltage Range ³	$V_S = \pm 2.3\text{ V}$ to $\pm 5\text{ V}$	$-V_S + 1.9$	$+V_S - 1.2$	V
Overtemperature		$-V_S + 2.1$	$+V_S - 1.3$	V
	$V_S = \pm 5\text{ V}$ to $\pm 18\text{ V}$	$-V_S + 1.9$	$+V_S - 1.4$	V
Overtemperature		$-V_S + 2.1$	$+V_S - 1.4$	V

Parameter	Conditions	XL620 XD620			Unit
		Min	Typ	Max	
Common-Mode Rejection					
Ratio DC to 60 Hz with 1 kΩ Source Imbalance $V_{CM} = 0\text{ V to } \pm 10\text{ V}$					
G = 1		73	90		dB
G = 10		93	110		dB
G = 100		110	130		dB
G = 1000		110	130		dB
OUTPUT					
Output Swing	$R_L = 10\text{ k}\Omega$ $V_S = \pm 2.3\text{ V}$ to $\pm 5\text{ V}$	$-V_S + 1.1$		$+V_S - 1.2$	V
Overtemperature	$V_S = \pm 5\text{ V}$ to $\pm 18\text{ V}$	$-V_S + 1.4$		$+V_S - 1.3$	V
		$-V_S + 1.2$		$+V_S - 1.4$	V
Overtemperature Short Circuit Current		$-V_S + 1.6$		$+V_S - 1.5$	V
			± 18		mA
DYNAMIC RESPONSE					
Small Signal -3 dB Bandwidth					
G = 1			1000		kHz
G = 10			800		kHz
G = 100			120		kHz
G = 1000			12		kHz
Slew Rate		0.75	1.2		V/ μ s
Settling Time to 0.01%					
G = 1-100	10 V Step		15		μ s
G = 1000			150		μ s
NOISE					
Voltage Noise, 1 kHz					
$Total\ RTI\ Noise = \sqrt{(e_{ni}^2) + (e_{no}/G)^2}$					
Input, Voltage Noise, e_{ni}		9	13		nV/ $\sqrt{\text{Hz}}$
Output, Voltage Noise, e_{no}		72	100		nV/ $\sqrt{\text{Hz}}$
RTI, 0.1 Hz to 10 Hz					
G = 1		3.0			μ V p-p
G = 10		0.55			μ V p-p
G = 100-1000		0.28			μ V p-p
Current Noise					
0.1 Hz to 10 Hz	f = 1 kHz	100			fA/ $\sqrt{\text{Hz}}$
		10			pA p-p
REFERENCE INPUT					
R_{IN}	$V_{IN+}, V_{REF} = 0$	20			kΩ
I_{IN}		50	60		μ A
Voltage Range		$-V_S + 1.6$	$+V_S - 1.6$		V
Gain to Output		1 ± 0.0001			
POWER SUPPLY					
Operating Range ⁴	$V_S = \pm 2.3\text{ V}$ to $\pm 18\text{ V}$	± 2.3	± 18		V
Quiescent Current		0.9	1.3		mA
Overtemperature		1.1	1.6		mA
TEMPERATURE RANGE					
For Specified Performance		$-40\text{ to } +85$			$^{\circ}\text{C}$

¹ See Analog Devices military data sheet for 883B tested specifications.

² Does not include effects of external resistor R_G .

³ One input grounded. G = 1.

⁴ This is defined as the same supply range that is used to specify PSR.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Voltage	± 18 V
Internal Power Dissipation ¹	650 mW
Input Voltage (Common-Mode)	$\pm V_s$
Differential Input Voltage	25 V
Output Short-Circuit Duration	Indefinite
Storage Temperature Range (Q)	-65°C to +150°C
Storage Temperature Range (N, R)	-65°C to +125°C
Operating Temperature Range XL620, XD620 (A, B)	-40°C to +85°C
Lead Temperature Range (Soldering 10 seconds)	300°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.

¹ Specification is for device in free air:

8-Lead Plastic Package: $\theta_{JA} = 95^\circ\text{C}$

8-Lead SOIC Package: $\theta_{JA} = 155^\circ\text{C}$

TYPICAL PERFORMANCE CHARACTERISTICS

(@ 25°C, $V_S = \pm 15\text{ V}$, $R_L = 2\text{ k}\Omega$, unless otherwise noted.)

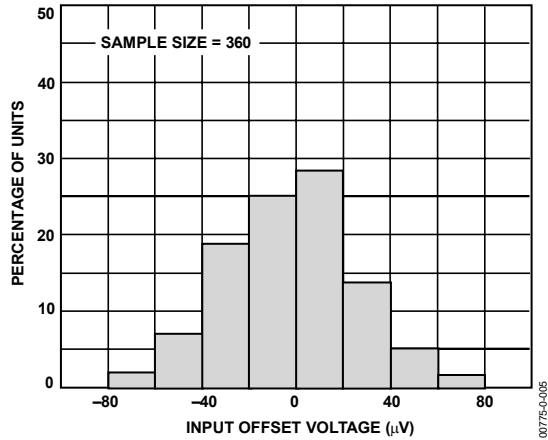


Figure 5. Typical Distribution of Input Offset Voltage

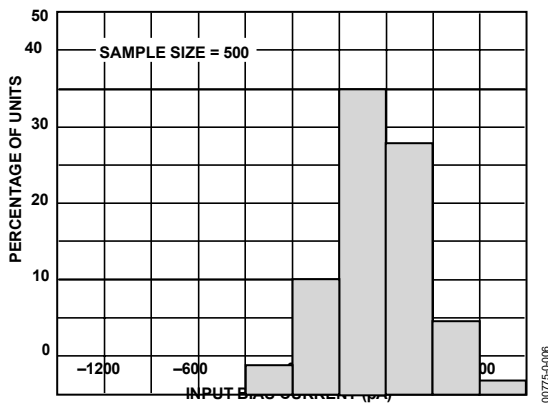


Figure 6. Typical Distribution of Input Bias Current

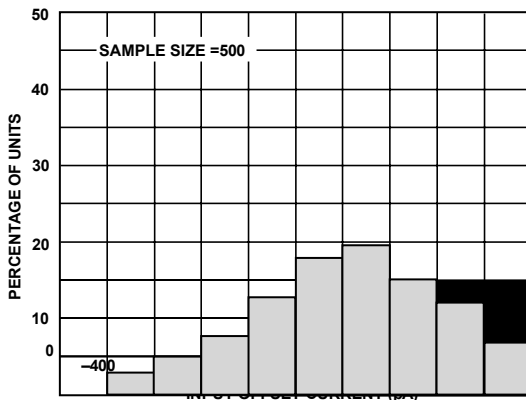


Figure 7. Typical Distribution of Input Offset Current

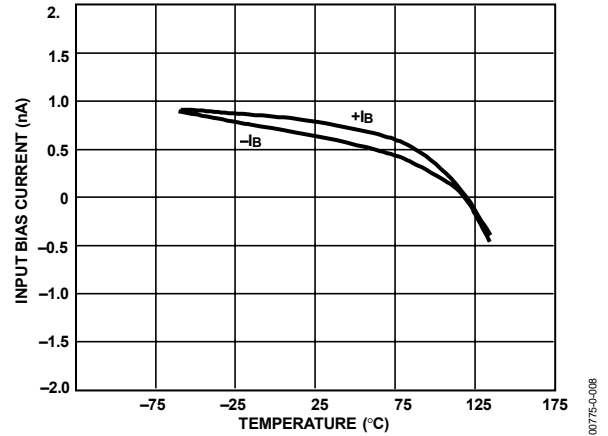


Figure 8. Input Bias Current vs. Temperature

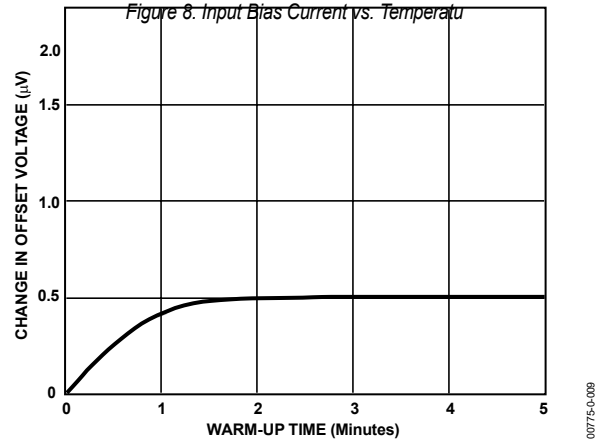


Figure 9. Change in Input Offset Voltage vs. Warm-Up Time

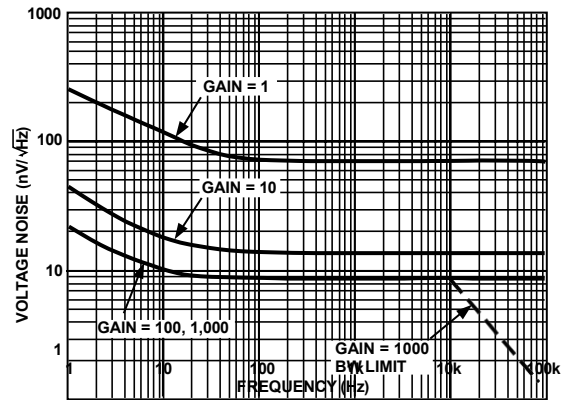


Figure 10. Voltage Noise Spectral Density vs. Frequency ($G = 1-1000$)

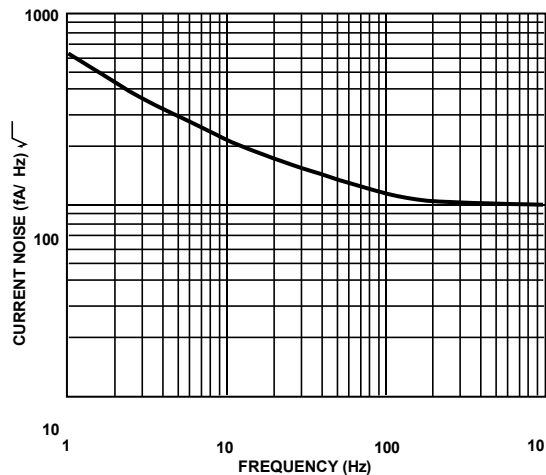


Figure 11. Current Noise Spectral Density vs. Frequency

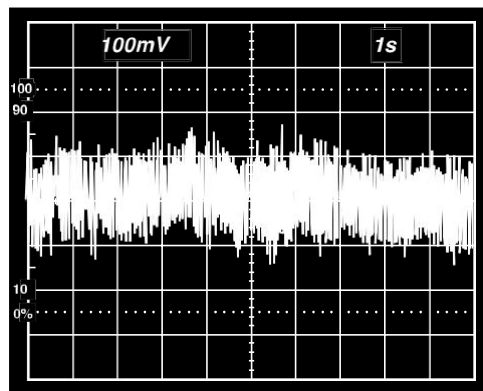


Figure 14. 0.1 Hz to 10 Hz Current Noise, 5 pA/Div

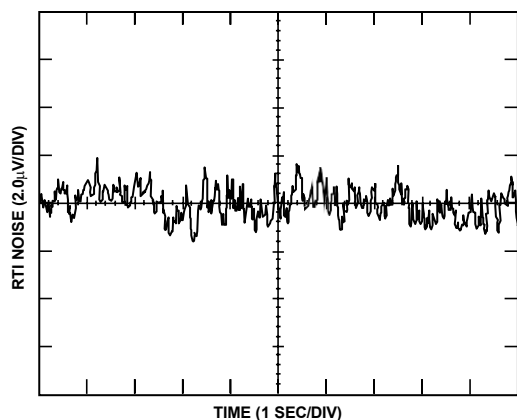


Figure 12. 0.1 Hz to 10 Hz RTI Voltage Noise (G = 1)

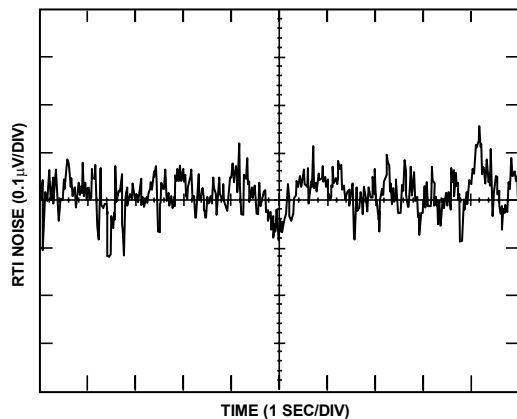


Figure 13. 0.1 Hz to 10 Hz RTI Voltage Noise (G = 1000)

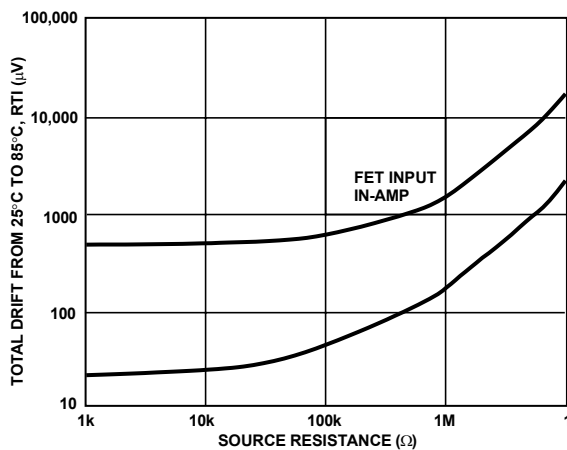


Figure 15. Total Drift vs. Source Resistance

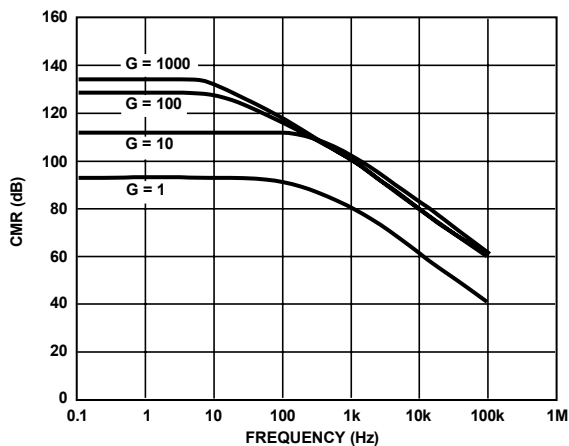


Figure 16. Typical CMR vs. Frequency, RTI, Zero to 1 kΩ Source Imbalance

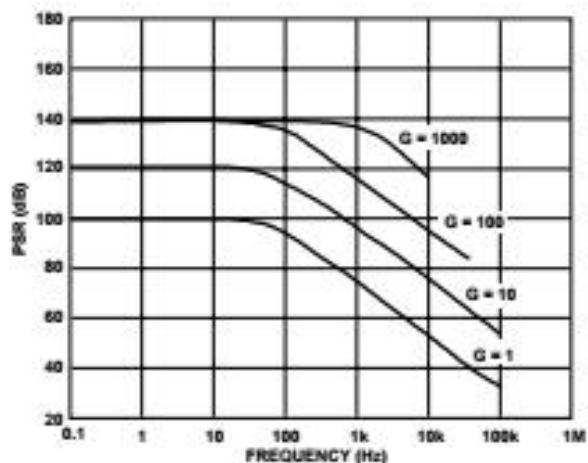


Figure 17. Positive PSR vs. Frequency, RTI (G = 1–1000)

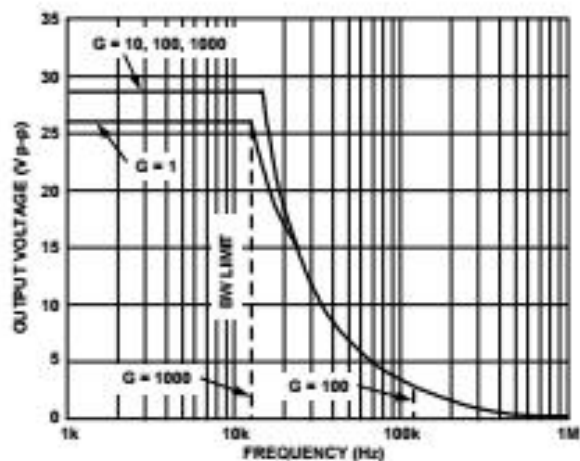


Figure 20. Large Signal Frequency Response

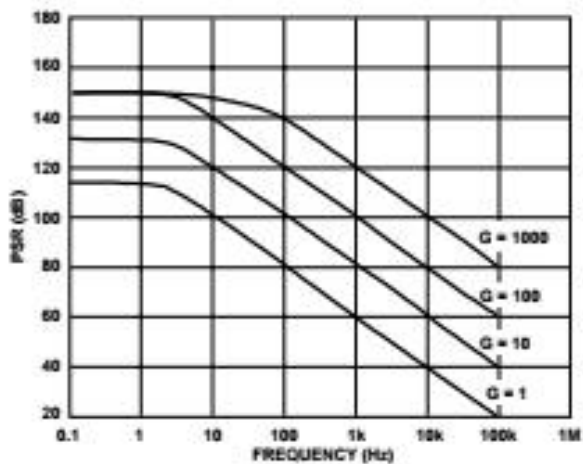


Figure 18. Negative PSR vs. Frequency, RTI (G = 1–1000)

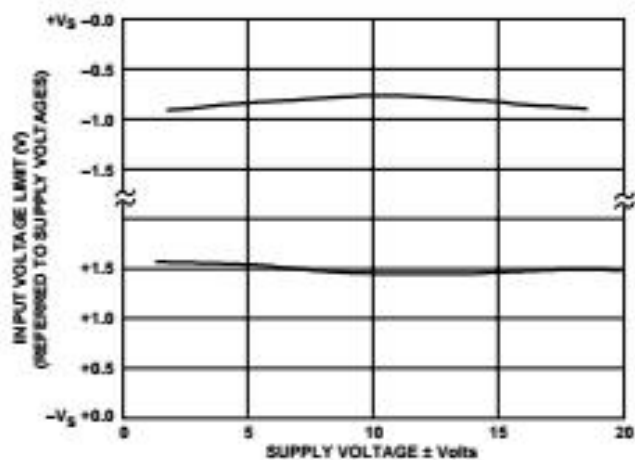


Figure 21. Input Voltage Range vs. Supply Voltage, G = 1

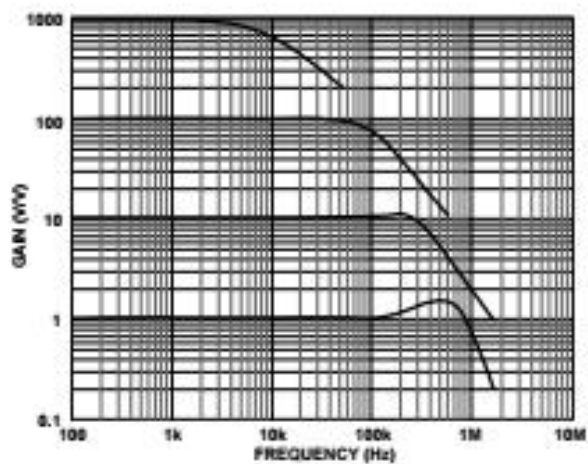


Figure 19. Gain vs. Frequency

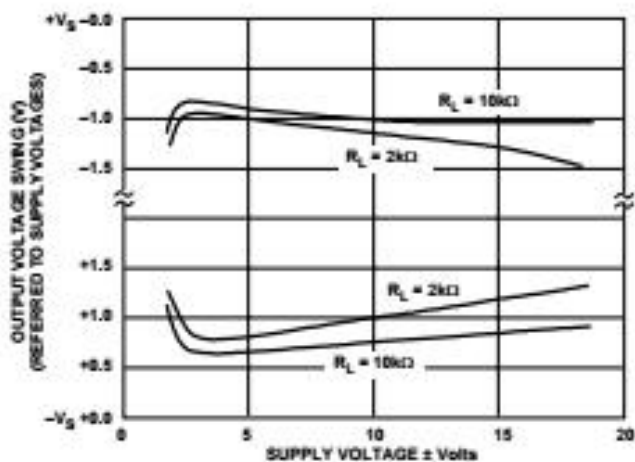


Figure 22. Output Voltage Swing vs. Supply Voltage, G = 10

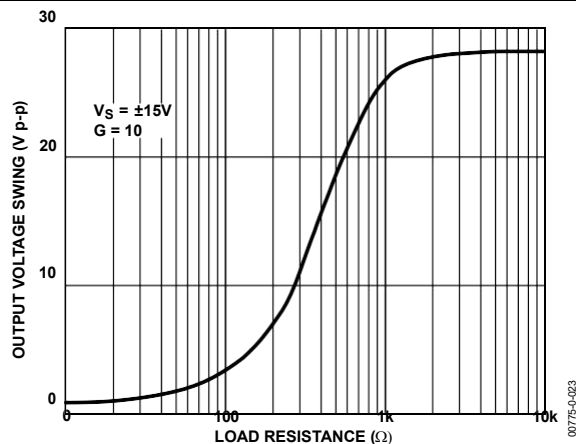


Figure 23. Output Voltage Swing vs. Load Resistance

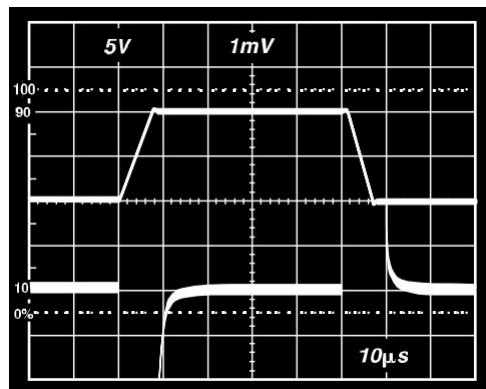


Figure 26. Large Signal Response and Settling Time, $G = 10$ ($0.5 \text{ mV} = 0.01\%$)

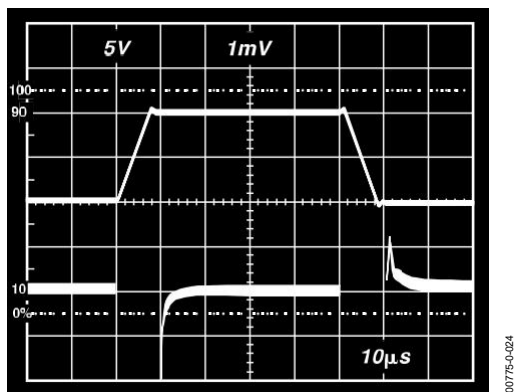


Figure 24. Large Signal Pulse Response and Settling Time
 $G = 1$ ($0.5 \text{ mV} = 0.01\%$)

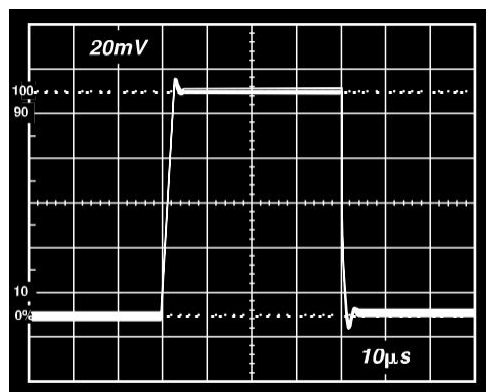


Figure 27. Small Signal Response, $G = 10$, $R_L = 2 \text{ k}\Omega$, $C_L = 100 \text{ pF}$

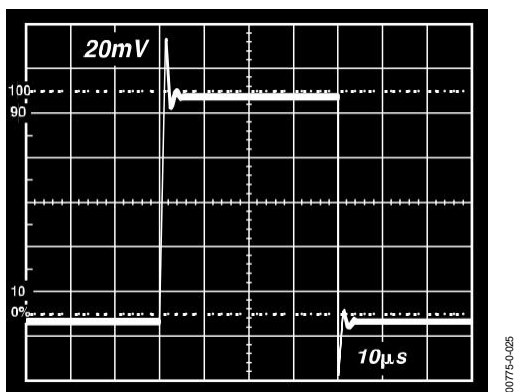


Figure 25. Small Signal Response, $G = 1$, $R_L = 2 \text{ k}\Omega$, $C_L = 100 \text{ pF}$

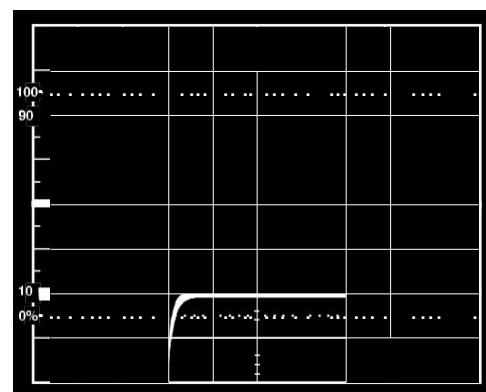


Figure 28. Large Signal Response and Settling Time, $G = 100$ ($0.5 \text{ mV} = 0.01\%$)

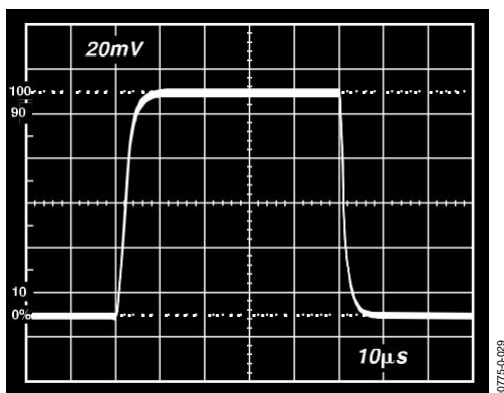


Figure 29. Small Signal Pulse Response, $G = 100$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$

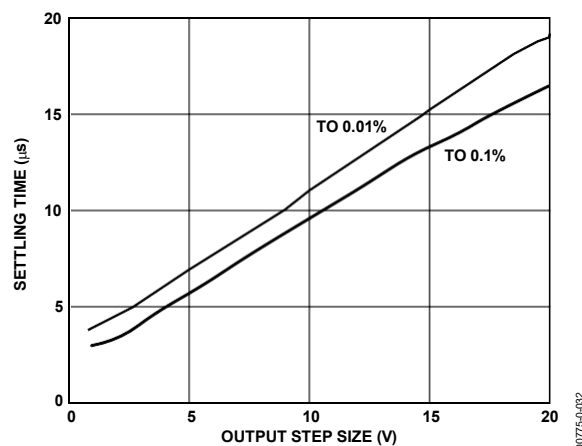


Figure 32. Settling Time vs. Step Size ($G = 1$)

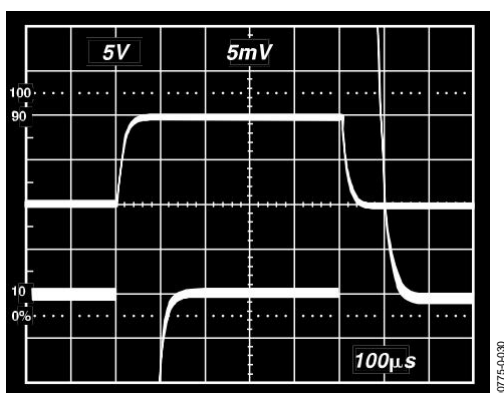


Figure 30. Large Signal Response and Settling Time,
 $G = 1000$ ($0.5\text{ mV} = 0.01\%$)

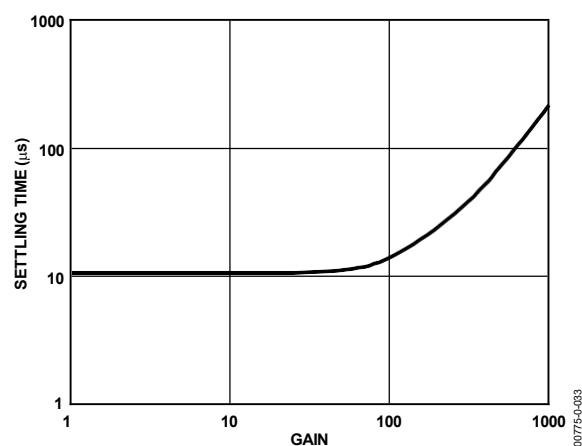


Figure 33. Settling Time to 0.01% vs. Gain, for a 10 V Step

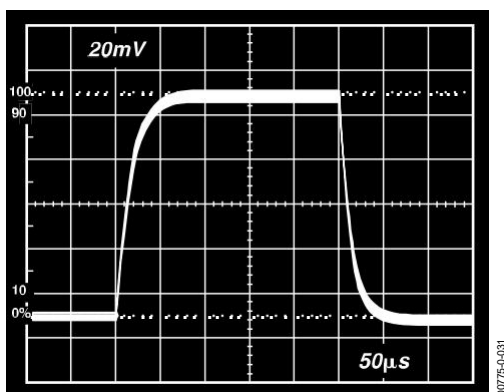


Figure 31. Small Signal Pulse Response, $G = 1000$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$

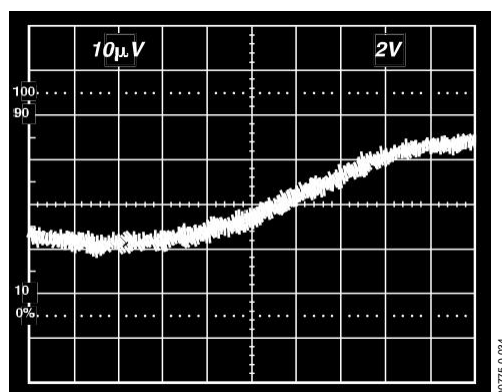


Figure 34. Gain Nonlinearity, $G = 1$, $R_L = 10\text{ k}\Omega$ ($10\text{ }\mu\text{V} = 1\text{ ppm}$)