SGM8554
Single-Supply, Quad Rail-to-Rail I/O Precision Operational Amplifier

GENERAL DESCRIPTION

The SGM8554 is a quad, precision operational amplifier which can operate from 2.5V to 5.5V single supply. The device provides rail-to-rail input and output operation.

The SGM8554 offers a low offset voltage less than 25μV and an ultra-low bias current of 10pA. The combination of characteristics makes the SGM8554 a good choice for temperature measurements, pressure and position sensors, strain gauge amplifiers and medical instrumentation, or any other 2.5V to 5.5V applications requiring precision and long-term stability.

The SGM8554 is available in Green SOIC-14 and MSOP-14 packages. It is specified over the extended industrial temperature range (-40℃ to +125℃).

FEATURES

- **Low Offset Voltage: 25μV (MAX)**
- **Ultra-Low Input Bias Current: 10pA**
- **Large-Signal Voltage Gain: 145dB (TYP) at 5V**
- **PSRR: 110dB (TYP)**
- **CMRR: 105dB (TYP)**
- **Overload Recovery Time: 60μs (at V_S = 5V)**
- **Rail-to-Rail Input and Output**
- **Supply Voltage Range: 2.5V to 5.5V**
- **Low Supply Current: 465μA/Amplifier (TYP)**
- **No External Capacitors Required**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOIC-14 and MSOP-14 Packages**

APPLICATIONS

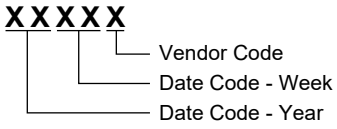
Pressure Sensors
Temperature Measurements
Precision Current Sensing
Electronic Scales
Strain Gauge Amplifiers
Handheld Test Equipment
Thermocouple Amplifiers
Medical Instrumentation

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8554	SOIC-14	-40℃ to +125℃	SGM8554XS14G/TR	SGM8554XS14 XXXXX	Tape and Reel, 2500
	TSSOP-14	-40℃ to +125℃	SGM8554XTS14G/TR	SGM8554 XTS14 XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage 6V
Input Voltage Range ..... $-V_S$ to $(+V_S)$ + 0.1V
Differential Input Voltage Range ..... -5V to 5V
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM (SOIC-14) 8000V
MM (SOIC-14) 300V
HBM (TSSOP-14) 7000V
MM (TSSOP-14) 400V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

ESD SENSITIVITY CAUTION

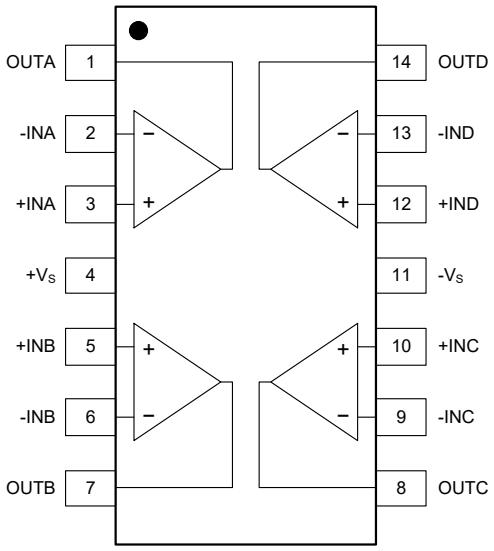
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS

(TOP VIEW)



SOIC-14/TSSOP-14

ELECTRICAL CHARACTERISTICS

(At T_A = +25℃, V_S = 5V, V_{CM} = 2.5V, V_{OUT} = 2.5V, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER		CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2	+25℃		12	25	μV
			Full			40	
Input Bias Current (I_B)			+25℃		10		pA
Input Offset Current (I_{OS})			+25℃		5		pA
Input Voltage Range			+25℃	0		5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0V to 5V	+25℃	90	105		dB
			Full	88			
Large-Signal Voltage Gain (A_{VO})		R_L = 10kΩ, V_{CM} = V_S/2, V_{OUT} = 0V to 5V	+25℃	100	145		dB
			Full	98			
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			Full		70		nV/℃
Output Characteristics							
Output Voltage High (V_{OH})		R_L = 100kΩ to GND	+25℃	4.99	4.998		V
			Full	4.982			
		R_L = 10kΩ to GND	+25℃	4.985	4.996		
			Full	4.98			
Output Voltage Low (V_{OL})		R_L = 100kΩ to V_S	+25℃		2	10	mV
			Full			15	
		R_L = 10kΩ to V_S	+25℃		6	15	
			Full			20	
Output Short-Circuit Limit	I_{SOURCE}	R_L = 10Ω to GND	+25℃	29	48		mA
			Full	19			
	I_{SINK}	R_L = 10Ω to V_S	+25℃	39	48		
			Full	23			
Power Supply							
Power Supply Rejection Ratio (1) (PSRR)		V_S = 2.5V to 5.5V	+25℃	87	110		dB
			Full	85			
Quiescent Current/Amplifier (I_Q)		V_{CM} = V_S/2, I_{OUT} = 0	+25℃		465	650	μA
			Full			767	
Dynamic Performance							
Gain-Bandwidth Product (GBP)		A_V = +100	+25℃		1.5		MHz
Slew Rate (SR)		A_V = +1, R_L = 10kΩ, 2V output step	+25℃		1		V/μs
Overload Recovery Time		A_V = -100, R_L = 10kΩ, V_{IN} = 200mV (RET to GND)	+25℃		0.06		ms
Noise Performance							
Input Voltage Noise ($e_{n\ P-P}$)		0.1Hz to 10Hz	+25℃		1.6		μV_{P-P}
Input Voltage Noise Density (e_n)		f = 1kHz	+25℃		63		nV/$\sqrt{Hz}$

NOTE: 1. PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

ELECTRICAL CHARACTERISTICS (continued)

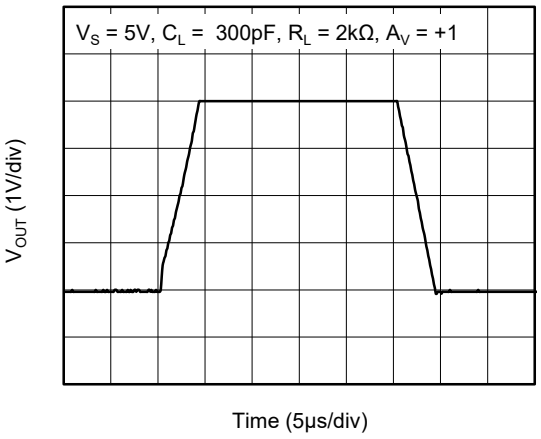
(At T_A = +25℃, V_S = 2.5V, V_{CM} = 1.25V, V_{OUT} = 1.25V, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER		CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2	+25℃		9	20	μV
			Full			40	
Input Bias Current (I_B)			+25℃		10		pA
Input Offset Current (I_{OS})			+25℃		10		pA
Input Voltage Range			+25℃	0		2.5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0V to 2.5V	+25℃	90	105		dB
			Full	85			
Large-Signal Voltage Gain (A_{VO})		R_L = 10kΩ, V_{CM} = V_S/2, V_{OUT} = 0V to 2.5V	+25℃	100	135		dB
			Full	98			
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			Full		76		nV/℃
Output Characteristics							
Output Voltage High (V_{OH})		R_L = 100kΩ to GND	+25℃	2.49	2.499		V
			Full	2.482			
		R_L = 10kΩ to GND	+25℃	2.485	2.498		
			Full	2.48			
Output Voltage Low (V_{OL})		R_L = 100kΩ to V_S	+25℃		1	10	mV
			Full			15	
		R_L = 10kΩ to V_S	+25℃		3	15	
			Full			.20	
Output Short-Circuit Limit	I_{SOURCE}	R_L = 10Ω to GND	+25℃	16	28		mA
			Full	10			
	I_{SINK}	R_L = 10Ω to V_S	+25℃	24	28		
			Full	12			
Power Supply							
Power Supply Rejection Ratio (1) (PSRR)		V_S = 2.5V to 5.5V	+25℃	87	110		dB
			Full	85			
Quiescent Current/Amplifier (I_Q)		V_{CM} = V_S/2, I_{OUT} = 0	+25℃		500	650	μA
			Full			767	
Dynamic Performance							
Gain-Bandwidth Product (GBP)		A_V = +100	+25℃		1.6		MHz
Slew Rate (SR)		A_V = +1, R_L = 10kΩ, 2V output step	+25℃		1		V/μs
Overload Recovery Time		A_V = -100, R_L = 10kΩ, V_{IN} = 200mV (RET to GND)	+25℃		0.02		ms
Noise Performance							
Input Voltage Noise ($e_{n\ P-P}$)		0.1Hz to 10Hz	+25℃		1.7		μV_{P-P}
Input Voltage Noise Density (e_n)		f = 1kHz	+25℃		86		nV/$\sqrt{Hz}$

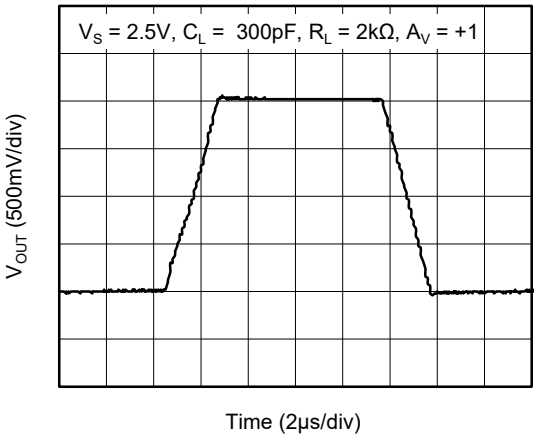
NOTE: 1. PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

TYPICAL PERFORMANCE CHARACTERISTICS

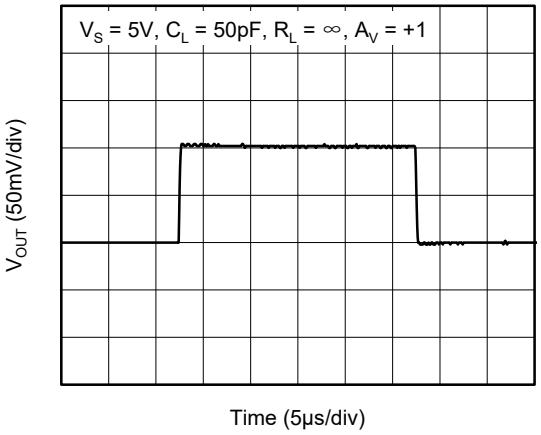
Large-Signal Transient Response



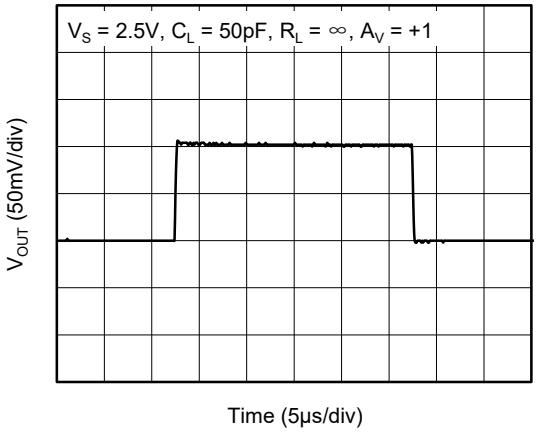
Large-Signal Transient Response



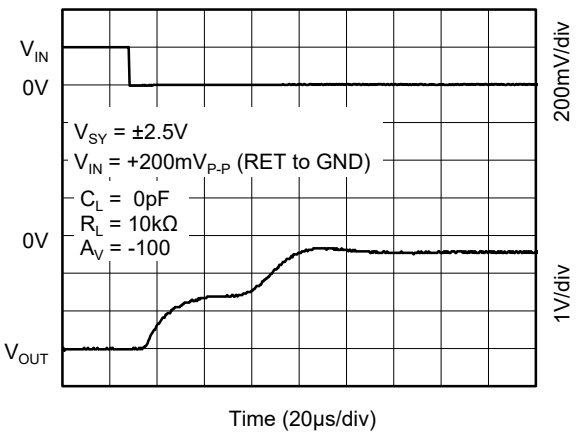
Small-Signal Transient Response



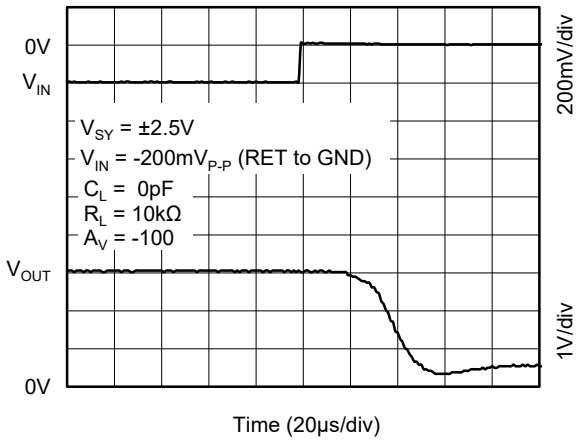
Small-Signal Transient Response



Negative Over-Voltage Recovery

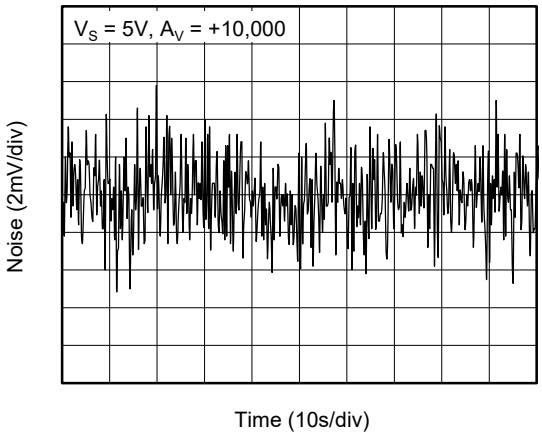


Positive Over-Voltage Recovery

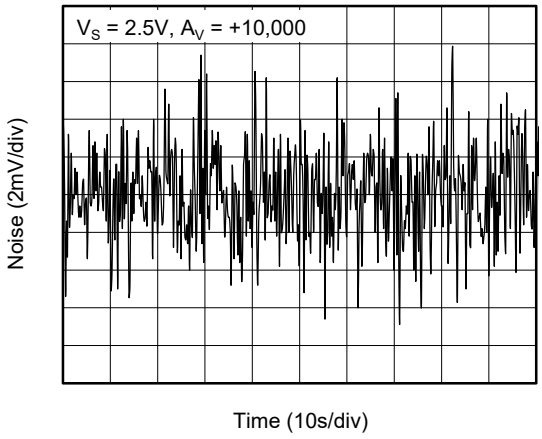


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

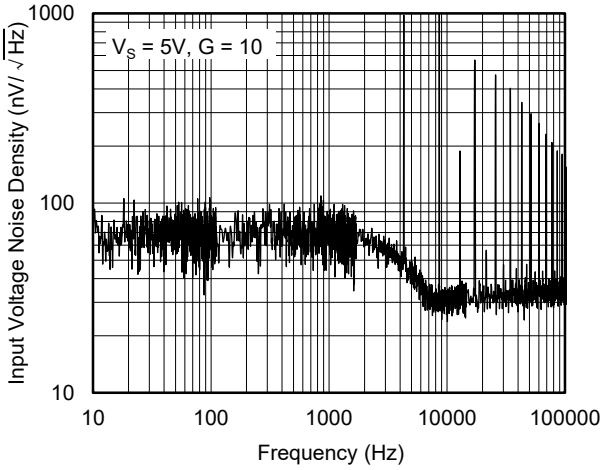
0.1Hz to 10Hz Input Voltage Noise



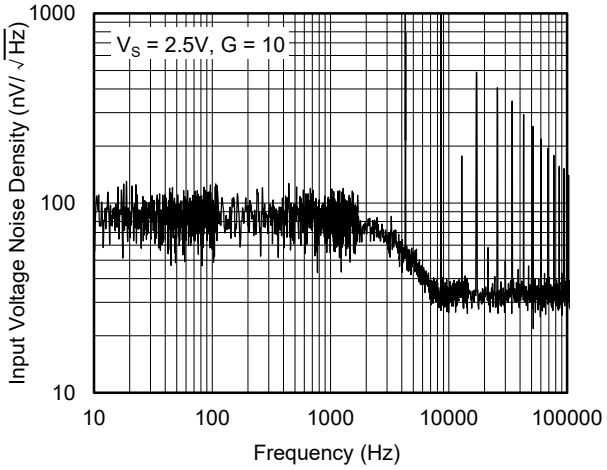
0.1Hz to 10Hz Input Voltage Noise



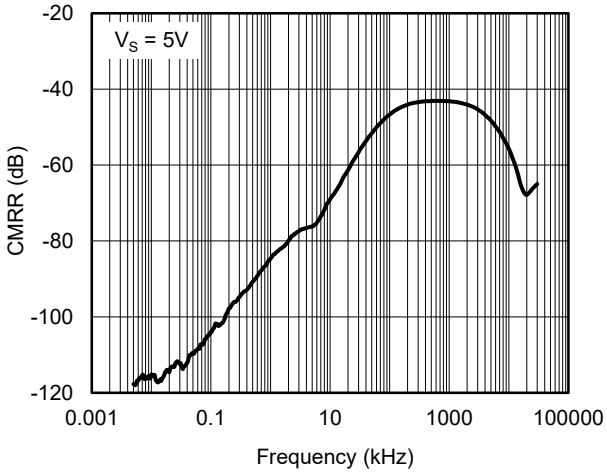
Input Voltage Noise Density vs. Frequency



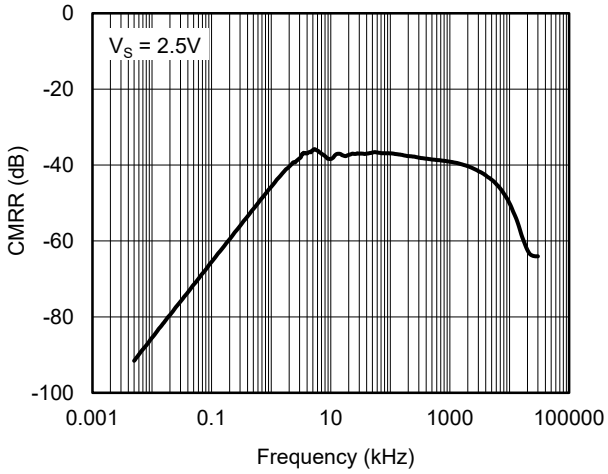
Input Voltage Noise Density vs. Frequency



CMRR vs. Frequency

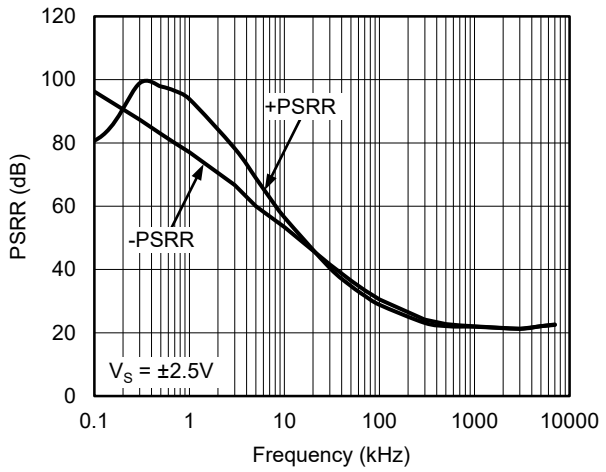


CMRR vs. Frequency

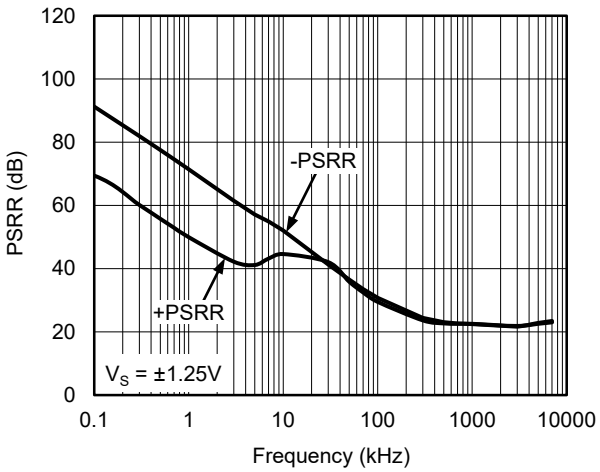


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

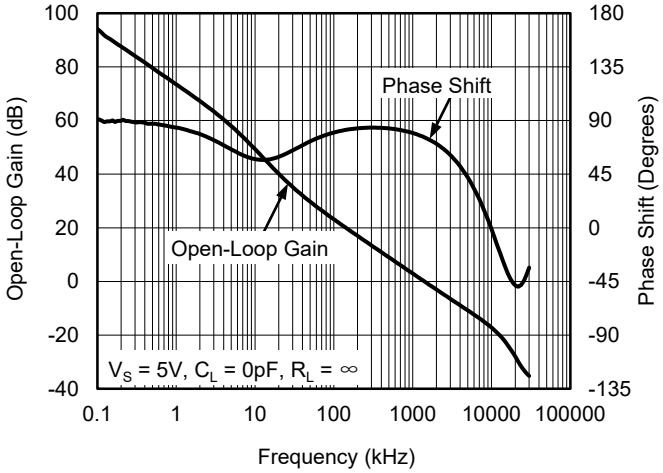
PSRR vs. Frequency



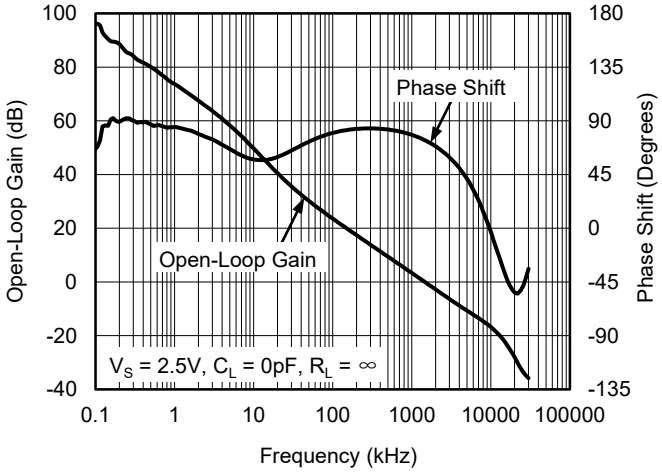
PSRR vs. Frequency



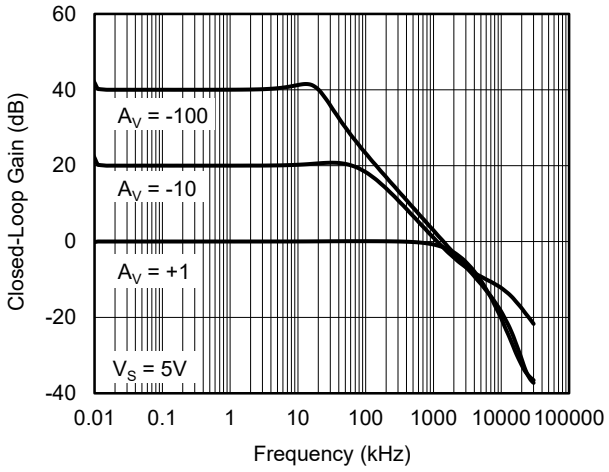
Open-Loop Gain and Phase Shift vs. Frequency



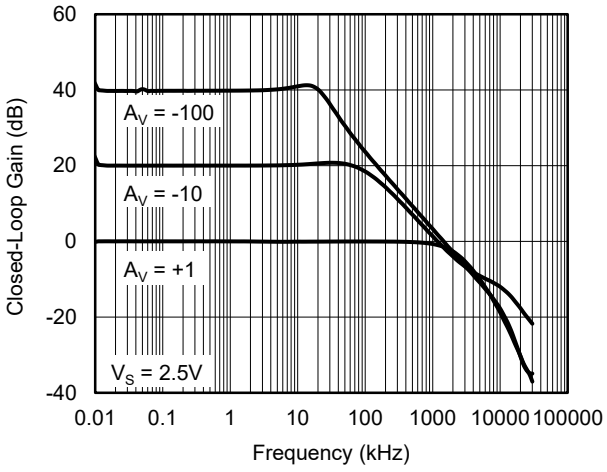
Open-Loop Gain and Phase Shift vs. Frequency



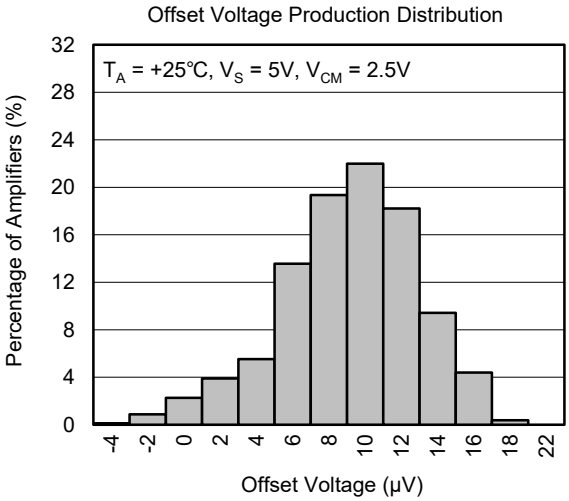
Closed-Loop Gain vs. Frequency

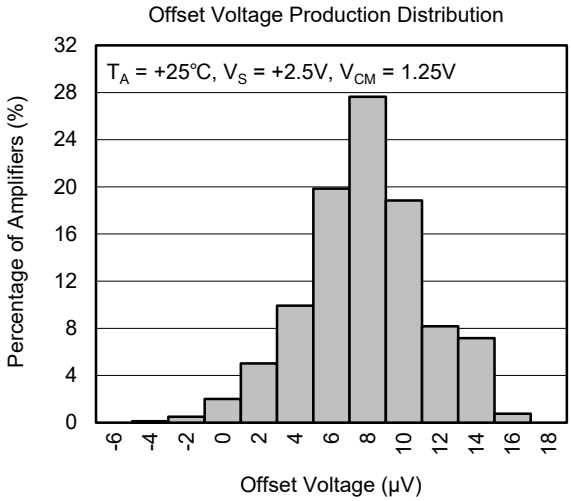


Closed-Loop Gain vs. Frequency



TYPICAL PERFORMANCE CHARACTERISTICS (continued)





REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

SEPTEMBER 2020 – REV.A.4 to REV.B	Page
Updated Electrical Characteristics section	3, 4
Updated Typical Performance Characteristics section	6, 7

JANUARY 2013 – REV.A.3 to REV.A.4	Page
Added Tape and Reel Information section	12, 13

DECEMBER 2011 – REV.A.2 to REV.A.3	Page
Changed packages' name	All
Changed Electrical Characteristics section	3, 4
Changed Typical Performance Characteristics section	7
Changed Package Outline Dimensions section	9, 10

APRIL 2010 – REV.A.1 to REV.A.2	Page
Changed Electrical Characteristics section	3, 4

APRIL 2010 – REV.A to REV.A.1	Page
Changed Typical Performance Characteristics section	8

Changes from Original (MARCH 2010) to REV.A	Page
Changed from product preview to production data	All