SGM8584
Single-Supply, Quad Rail-to-Rail I/O Precision Operational Amplifier

GENERAL DESCRIPTION

The SGM8584 is a quad rail-to-rail input and output precision operational amplifier which has low input offset voltage, and bias current. It is guaranteed to operate from 2.5V to 5.5V single supply.

The rail-to-rail input and output swings provided by the SGM8584 make both high-side and low-side sensing easy. The combination of characteristics makes the SGM8584 a good choice for temperature, position and pressure sensors, medical equipment and strain gauge amplifiers, or any other 2.5V to 5.5V application requiring precision and long term stability.

The SGM8584 is specified for the extended industrial/ automotive (-40℃ to +125℃) temperature range. The SGM8584 is available in Green SOIC-14 and TSSOP-14 packages.

APPLICATIONS

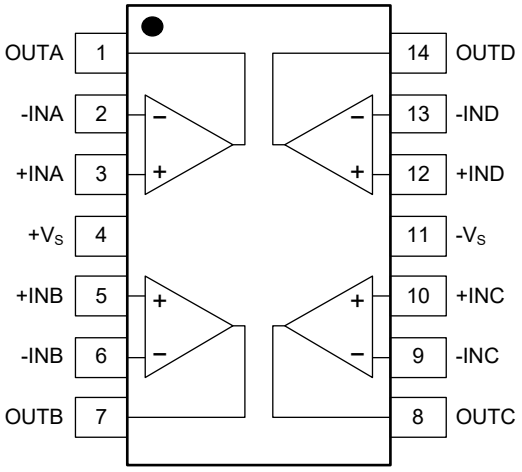
Temperature Measurements
Pressure Sensors
Precision Current Sensing
Electronic Scales
Strain Gage Amplifiers
Medical Instrumentation
Thermocouple Amplifiers
Handheld Test Equipment

FEATURES

- **Low Offset Voltage: 100μV (MAX)**
- **Rail-to-Rail Input and Output Swings**
- **2.5V to 5.5V Single Supply Operation**
- **Voltage Gain: 135dB (TYP) at 5V**
- **PSRR: 115dB (TYP)**
- **CMRR: 92dB (TYP)**
- **Low Input Bias Current: 60pA**
- **Low Supply Current: 430μA/Amplifier**
- **Overload Recovery Time: 30μs (at V_S = 5V)**
- **No External Capacitors Required**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOIC-14 and TSSOP-14 Packages**

PIN CONFIGURATIONS

(TOP VIEW)



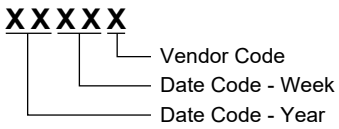
SOIC-14/TSSOP-14

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8584	SOIC-14	-40℃ to +125℃	SGM8584XS14G/TR	SGM8584XS14 XXXXX	Tape and Reel, 2500
	TSSOP-14	-40℃ to +125℃	SGM8584XTS14G/TR	SGM8584 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 (TSSOP-14) 8000V
HBM (SOIC-14) 7000V
MM 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 by ESD if you don't pay attention to ESD protection. 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 very small parametric changes could cause the device not to meet its published specifications.

DISCLAIMER

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

ELECTRICAL CHARACTERISTICS

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

PARAMETER	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics						
Input Offset Voltage (V_{OS})		+25℃		25	100	μV
		Full			110	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)		Full		150		nV/℃
Input Bias Current (I_B)		+25℃		60		pA
Input Offset Current (I_{OS})		+25℃		50		pA
Input Voltage Range		+25℃	0		5	V
Common Mode Rejection Ratio (1) (CMRR)	V_{CM} = 0V to 5V	+25℃	88	92		dB
		Full	77			
Large-Signal Voltage Gain (A_{VO})	R_L = 10kΩ, V_{OUT} = 0.3V to 4.7V	+25℃	120	135		dB
		Full	104			
Output Characteristics						
Output Voltage High (V_{OH})	R_L = 100kΩ to -V_S	+25℃	4.9	4.998		V
		Full	4.894			
	R_L = 10kΩ to -V_S	+25℃	4.9	4.994		
		Full	4.888			
Output Voltage Low (V_{OL})	R_L = 100kΩ to +V_S	+25℃		3.5	6	mV
		Full			8	
	R_L = 10kΩ to +V_S	+25℃		7	10	
		Full			23	
Short-Circuit Limit (I_{SC})	V_{OUT} = 2.5V, R_L = 10Ω to GND	+25℃	30	40		mA
		Full	22			
Power Supply						
Power Supply Rejection Ratio (1) (PSRR)	V_S = 2.5V to 5.5V	+25℃	90	115		dB
		Full	80			
Quiescent Current/Amplifier (I_Q)	V_{OUT} = V_S/2	+25℃		430	555	μA
		Full			710	
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℃		0.9		V/μs
Overload Recovery Time	A_V = -100, R_L = 10kΩ, V_{IN} = 200mV (RET to GND)	+25℃		0.03		ms
Noise						
Input Voltage Noise	0.1Hz to 10Hz	+25℃		1.4		μV_{P-P}
Input Voltage Noise Density (e_n)	f = 1kHz	+25℃		78		$nV/\sqrt{Hz}$

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

ELECTRICAL CHARACTERISTICS (continued)

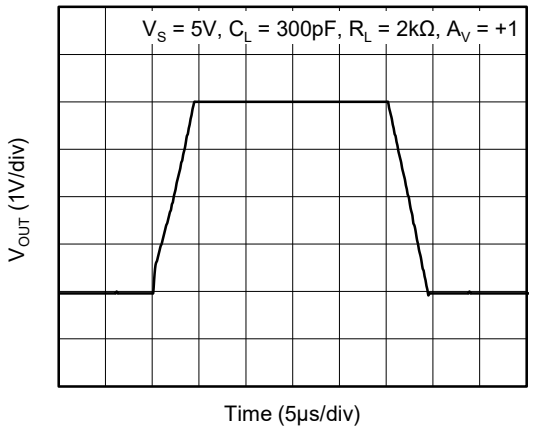
(V_S = 2.5V, V_{CM} = 1.25V, V_{OUT} = 1.25V, Full = -40℃ to +125℃, typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics						
Input Offset Voltage (V_{OS})		+25℃		25	100	μV
		Full			120	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)		Full		150		nV/℃
Input Bias Current (I_B)		+25℃		30		pA
Input Offset Current (I_{OS})		+25℃		20		pA
Input Voltage Range		+25℃	0		2.5	V
Common Mode Rejection Ratio (1) (CMRR)	V_{CM} = 0V to 2.5V	+25℃	79	85		dB
		Full	70			
Large-Signal Voltage Gain (A_{VO})	R_L = 10kΩ, V_{OUT} = 0.3V to 2.4V	+25℃	120	130		dB
		Full	104			
Output Characteristics						
Output Voltage High (V_{OH})	R_L = 100kΩ to -V_S	+25℃	2.4	2.499		V
		Full	2.38			
	R_L = 10kΩ to -V_S	+25℃	2.4	2.497		
		Full	2.389			
Output Voltage Low (V_{OL})	R_L = 100kΩ to +V_S	+25℃		4	6	mV
		Full			7	
	R_L = 10kΩ to +V_S	+25℃		6	8	
		Full			12	
Short-Circuit Limit (I_{SC})	V_{OUT} = 1.25V, R_L = 10Ω to GND	+25℃	20	28		mA
		Full	13			
Power Supply						
Power Supply Rejection Ratio (1) (PSRR)	V_S = 2.5V to 5.5V	+25℃	90	115		dB
		Full	80			
Quiescent Current/Amplifier (I_Q)	V_{OUT} = V_S/2	+25℃		430	550	μA
		Full			710	
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℃		1.0		V/μs
Overload Recovery Time	A_V = -100, R_L = 10kΩ, V_{IN} = 200mV (RET to GND)	+25℃		0.02		ms
Noise						
Input Voltage Noise	0.1Hz to 10Hz	+25℃		1.7		μV_{P-P}
Input Voltage Noise Density (e_n)	f = 1kHz	+25℃		108		$nV/\sqrt{Hz}$

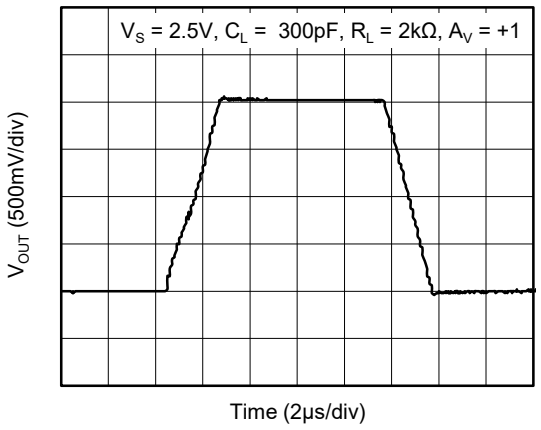
NOTE: 1. PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

TYPICAL PERFORMANCE CHARACTERISTICS

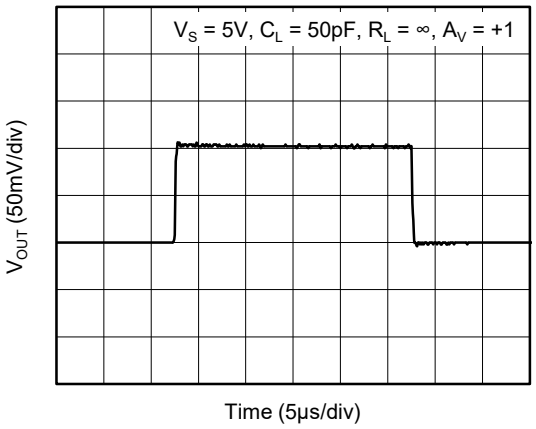
Large-Signal Step Response



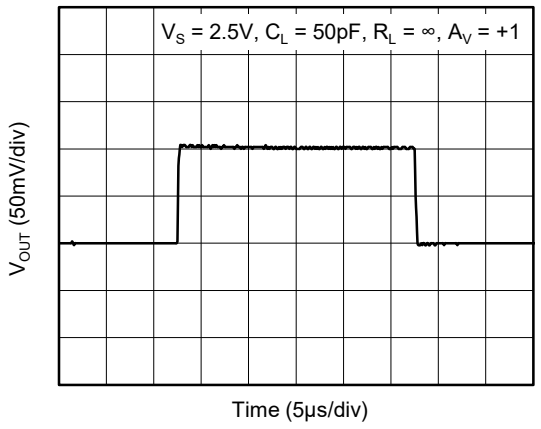
Large-Signal Step Response



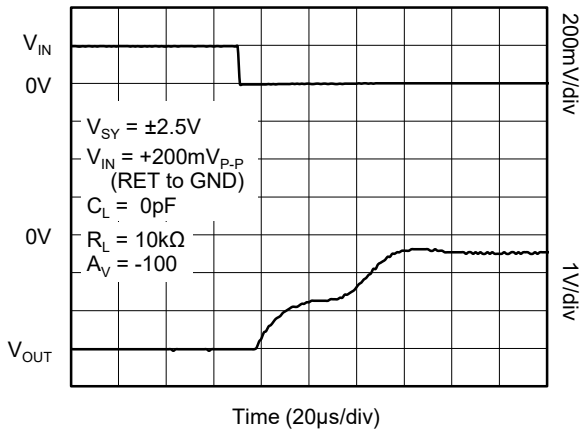
Small-Signal Step Response



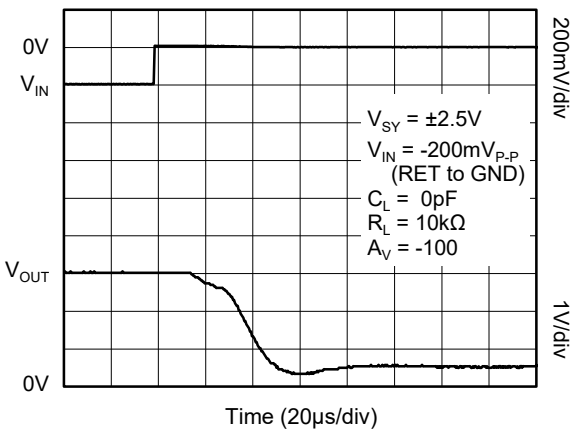
Small-Signal Step Response



Negative Over-Voltage Recovery

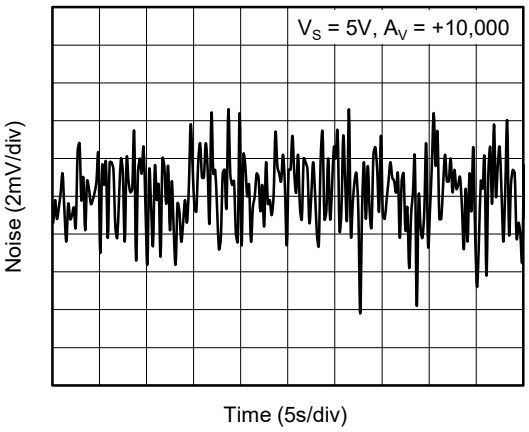


Positive Over-Voltage Recovery

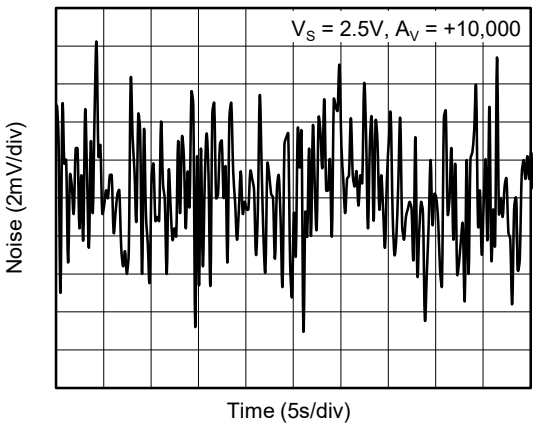


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

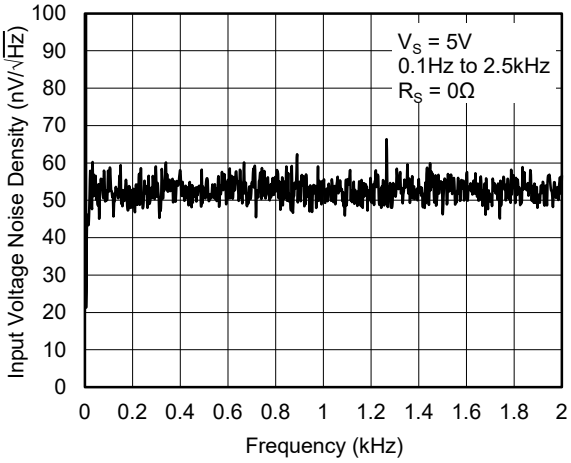
0.1Hz to 10Hz Input Voltage Noise



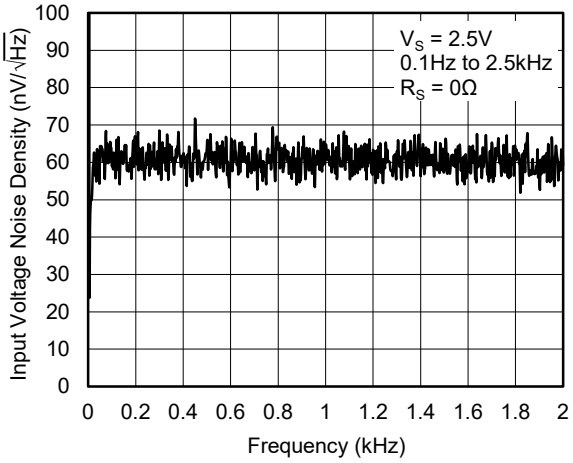
0.1Hz to 10Hz Input Voltage Noise



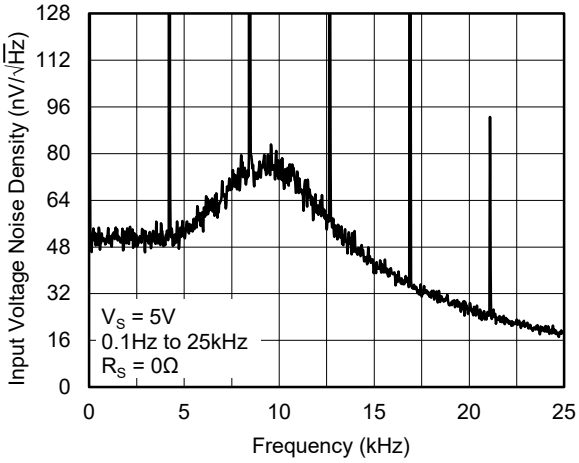
Input Voltage Noise Density vs. Frequency



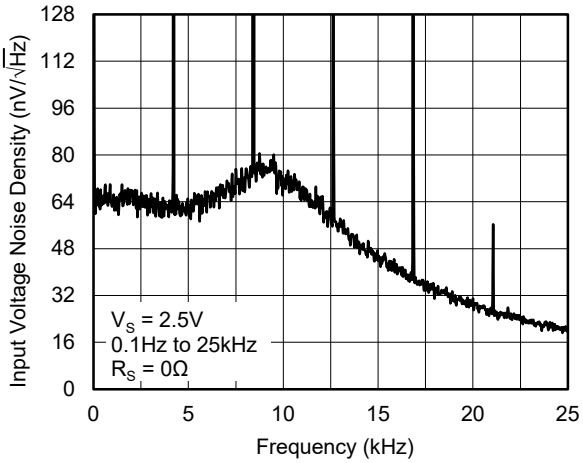
Input Voltage Noise Density vs. Frequency



Input Voltage Noise Density vs. Frequency

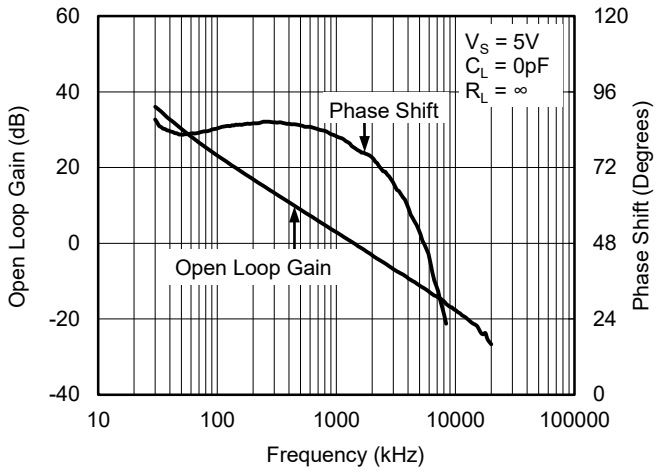


Input Voltage Noise Density vs. Frequency

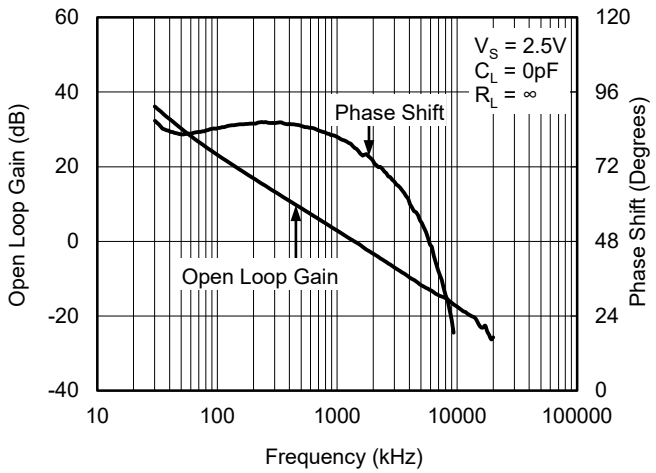


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

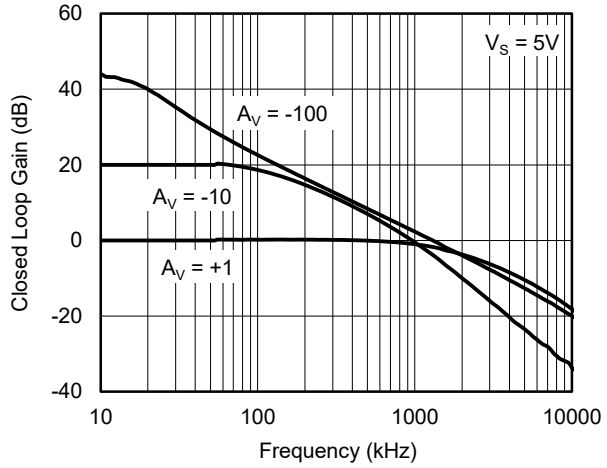
Open-Loop Gain and Phase Shift vs. Frequency



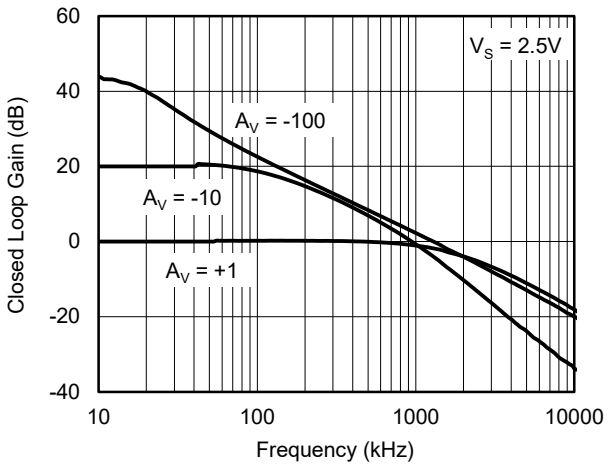
Open-Loop Gain and Phase Shift vs. Frequency



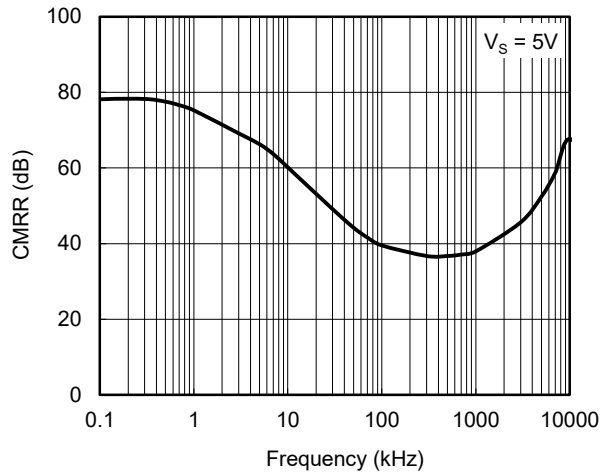
Closed-Loop Gain vs. Frequency



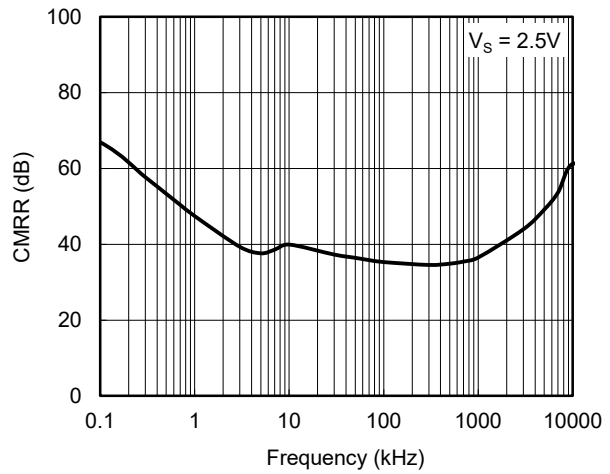
Closed-Loop Gain vs. Frequency



CMRR vs. Frequency

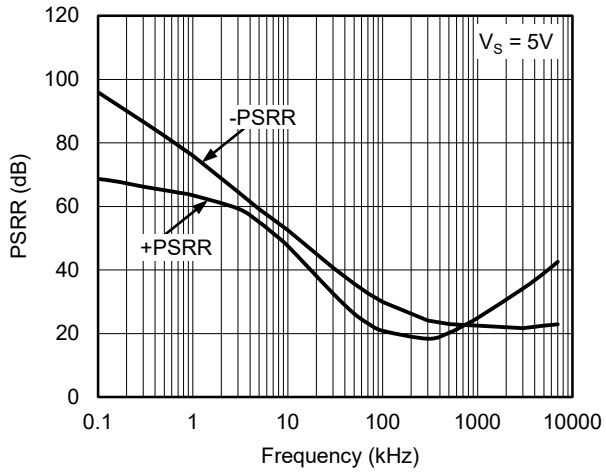


CMRR vs. Frequency

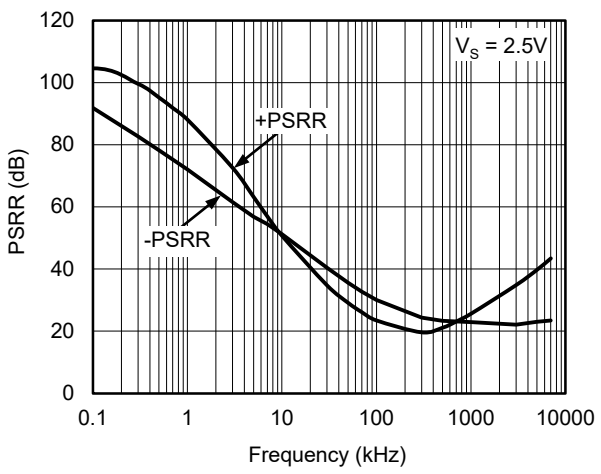


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

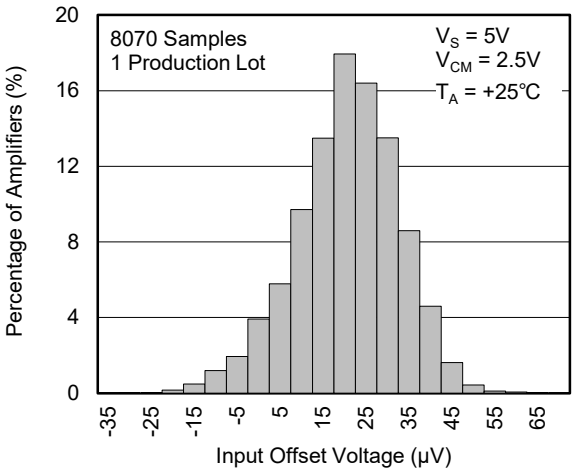
PSRR vs. Frequency



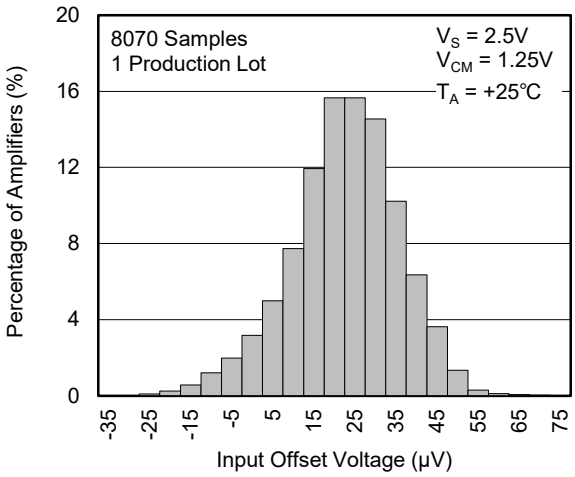
PSRR vs. Frequency



Input Offset Voltage Production Distribution



Input Offset Voltage Production Distribution



REVISION HISTORY

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

JUNE 2019 – REV.A.3 to REV.A.4	Page
Updated Typical Performance Characteristics section	8

JANUARY 2013 – REV.A.2 to REV.A.3	Page
Added Tape and Reel Information section	11, 12

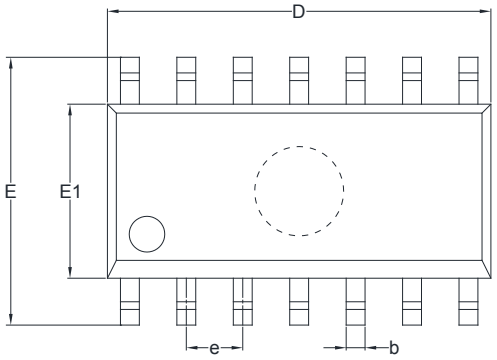
DECEMBER 2011 – REV.A.1 to REV.A.2	Page
Updated Electrical Characteristics section	3, 4
Updated Typical Performance Characteristics section	7

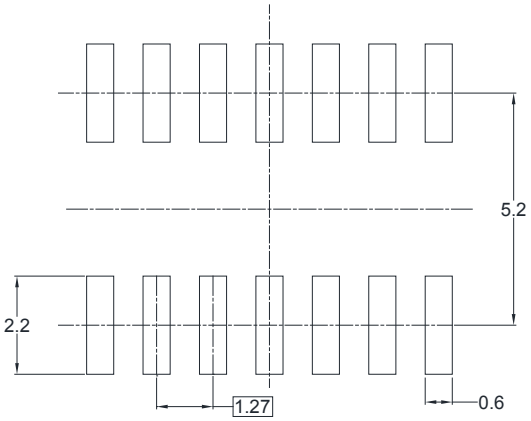
MAY 2011 – REV.A to REV.A.1	Page
Changed package's name	All

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

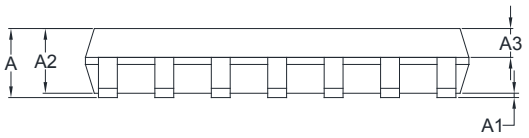
PACKAGE OUTLINE DIMENSIONS

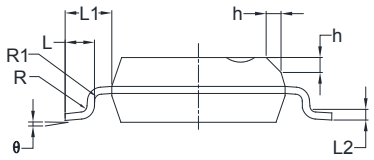
SOIC-14





RECOMMENDED LAND PATTERN (Unit: mm)

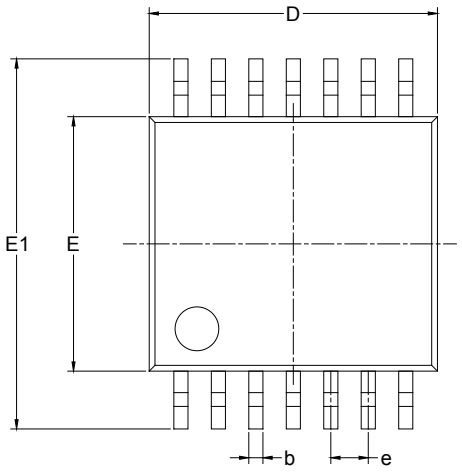


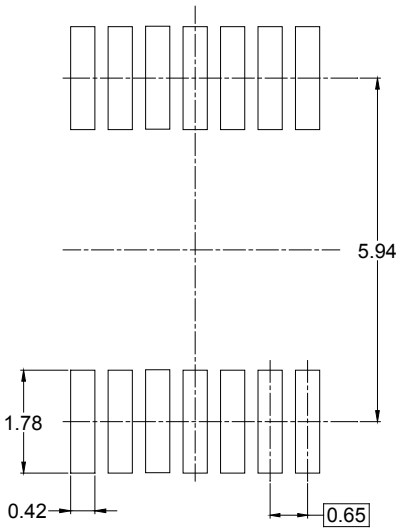


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80	0.018	0.032
L1	1.04 REF		0.040 REF	
L2	0.25 BSC		0.01 BSC	
R	0.07		0.003	
R1	0.07		0.003	
h	0.30	0.50	0.012	0.020
θ	0°	8°	0°	8°

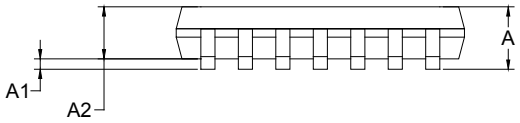
PACKAGE OUTLINE DIMENSIONS

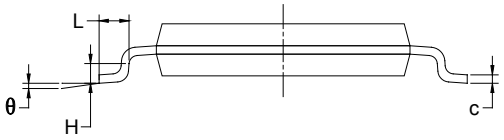
TSSOP-14





RECOMMENDED LAND PATTERN (Unit: mm)

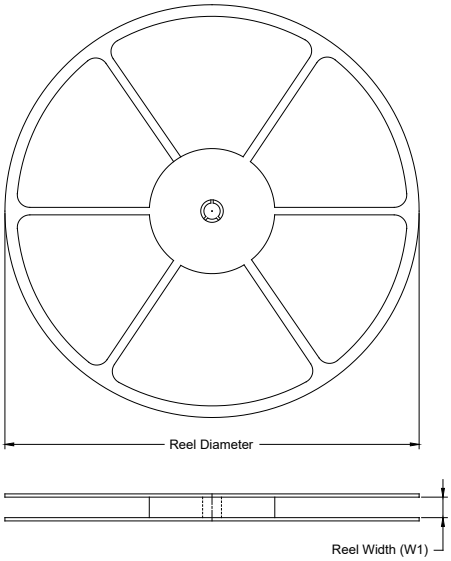




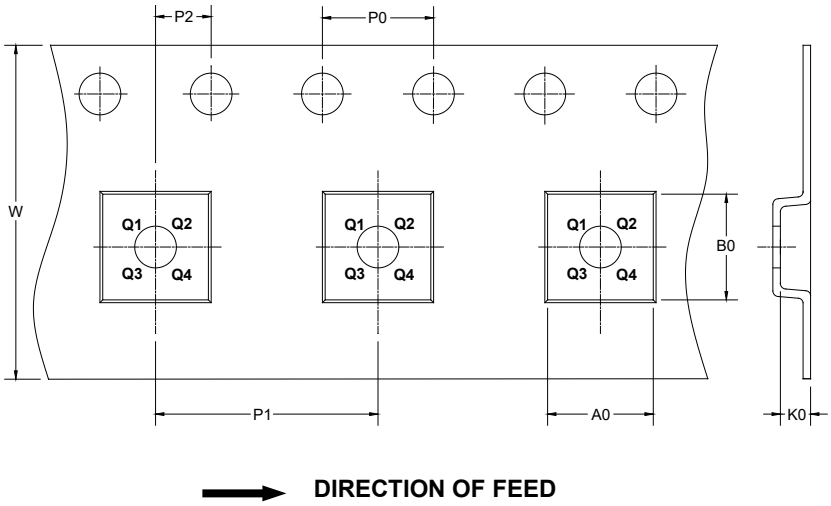
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

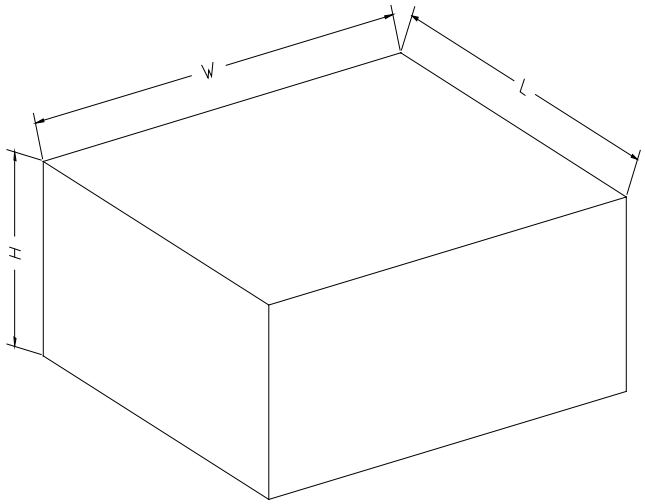
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOIC-14	13″	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1
TSSOP-14	13″	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	Q1

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13″	386	280	370	5

DD0002