



SGM8965A-3

50MHz, Low Distortion, Rail-to-Rail I/O, Single-Supply Operational Amplifier with Shutdown

GENERAL DESCRIPTION

The SGM8965A-3 is a high speed CMOS operational amplifier with high input impedance, zero-crossover and low distortion. The device can operate from 2.2V to 5.5V single supply. It integrates a power-down mode that limits supply current to just 800nA, making the SGM8965A-3 ideal for battery-powered equipment and portable devices.

The SGM8965A-3 features high speed and low noise. It supports rail-to-rail input and output operation. The input common mode voltage range is from $(-V_S) - 0.1V$ to $(+V_S) + 0.1V$, and the output range is from $(-V_S) + 0.006V$ to $(+V_S) - 0.006V$. Furthermore, the SGM8965A-3 provides high CMRR with zero-crossover and low distortion, which are designed to drive ADCs with high linearity. The device can be used in a variety of applications, such as audio, mobile phone and signal conditioning.

The SGM8965A-3 is available in a Green SC70-6 package. It is specified over the extended -40°C to $+125^{\circ}\text{C}$ temperature range.

FEATURES

- **Unity-Gain Stable**
- **Gain-Bandwidth Product: 50MHz**
- **Slew Rate: 30V/ μs**
- **High CMRR: 96dB (TYP)**
- **Low Offset Voltage: $\pm 350\mu\text{V}$ (MAX)**
- **Low Bias Current: $\pm 10\text{pA}$ (TYP)**
- **Low Input Voltage Noise: $6\text{nV}/\sqrt{\text{Hz}}$ at 100kHz**
- **Rail-to-Rail Input and Output**
- **Supply Voltage Range: 2.2V to 5.5V**
- **Low Quiescent Current:**
 - ♦ **Normal Mode: 5mA (TYP)**
 - ♦ **Power-Down Mode: 800nA (TYP)**
- **-40°C to $+125^{\circ}\text{C}$ Operating Temperature Range**
- **Available in a Green SC70-6 Package**

APPLICATIONS

Audio
Active Filter
Signal Conditioning
Sensor Amplification
Data Acquisition
Process Control
Test Equipment
Wideband Amplifier

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PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8965A-3	SC70-6	-40°C to +125°C	SGM8965A-3XC6G/TR	2DPXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.

YYY X X

— Date Code - Week
— Date Code - Year
— Serial Number

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, $+V_S$ to $-V_S$	6V
Input Voltage Range	$(-V_S) - 0.3V$ to $(+V_S) + 0.3V$
Input Current (All pins except power supply pins).....	$\pm 10mA$
Output Short-Circuit Current	Continuous
Package Thermal Resistance	
SC70-6, θ_{JA}	135.4°C/W
SC70-6, θ_{JB}	47.3°C/W
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility ^{(1) (2)}	
HBM	$\pm 5000V$
CDM	$\pm 1000V$

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.
2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range2.2V to 5.5V
Operating Temperature Range.....-40°C to +125°C

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

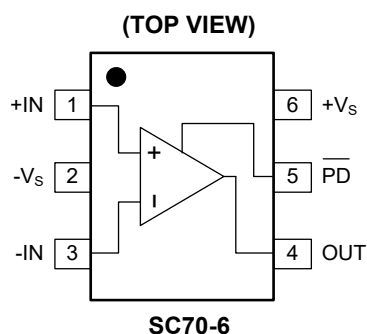
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

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PIN CONFIGURATION



PIN DESCRIPTION

PIN	NAME	TYPE	FUNCTION
1	+IN	I	Non-Inverting Input.
2	-V _S	—	Negative Power Supply or Ground (For Single-Supply Operation).
3	-IN	I	Inverting Input.
4	OUT	O	Output.
5	$\overline{\text{PD}}$	I	Power Down (Can Be Left Floating).
6	+V _S	—	Positive Power Supply.

NOTE: I = input, O = output.

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ELECTRICAL CHARACTERISTICS

($V_S = 2.2V$ to $5.5V$ or $\pm 1.1V$ to $\pm 2.75V$, $V_{CM} = V_S/2$, $V_{OUT} = V_S/2$ and $R_L = 10k\Omega$ connected to $V_S/2$, Full = $-40^\circ C$ to $+125^\circ C$, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics						
Input Offset Voltage (V _{OS})		+25°C		±50	±350	μV
		Full			±1000	
Input Offset Voltage Drift (ΔV _{OS} /ΔT)		Full		±1.4		μV/°C
Input Bias Current (I _B)		+25°C		±0.01	±0.3	nA
		Full			±6	
Input Offset Current (I _{OS})		+25°C		±0.01	±0.3	nA
		Full			±2.5	
Input Common Mode Voltage Range (V _{CM})		Full	(-V _S) - 0.1		(+V _S) + 0.1	V
Common Mode Rejection Ratio (CMRR)	(-V _S) - 0.1V ≤ V _{CM} ≤ (+V _S) + 0.1V	+25°C	77	96		dB
		Full	74			
Open-Loop Voltage Gain (A _{OL})	R _L = 10kΩ, (-V _S) + 0.1V < V _{OUT} < (+V _S) - 0.1V	+25°C	95	117		dB
		Full	92			
	R _L = 600Ω, (-V _S) + 0.2V < V _{OUT} < (+V _S) - 0.2V	+25°C	94	116		
		Full	90			
Output Characteristics						
Output Voltage Swing from Rail (V _{OUT})	V _S = 5.5V, R _L = 10kΩ	+25°C		6	10	mV
		Full			12	
Output Short-Circuit Current (I _{SC})	V _S = 5.5V	+25°C	±60	±85		mA
Open-Loop Output Impedance	f = 1MHz, I _{OUT} = 0mA	+25°C		35		Ω
Power Supply						
Specified Voltage Range (V _S)		Full	2.2		5.5	V
Quiescent Current (I _Q)	I _{OUT} = 0mA	+25°C		5	6.5	mA
		Full			6.8	
Power Supply Rejection Ratio (PSRR)		+25°C	85	106		dB
		Full	82			
Dynamic Performance						
Gain-Bandwidth Product (GBP)	R _L = 10kΩ, C _L = 10pF	+25°C		50		MHz
Phase Margin (φ _O)	R _L = 10kΩ, C _L = 10pF	+25°C		55		°
Slew Rate (SR)	G = +1	+25°C		30		V/μs
Settling Time to 0.1%	4V step, G = -1	+25°C		1.5		μs
Settling Time to 0.01%	4V step, G = -1	+25°C		2		μs
Overload Recovery Time	V _{IN} × G > V _S	+25°C		< 0.1		μs
Total Harmonic Distortion + Noise (THD+N)	R _L = 600Ω, V _{OUT} = 4V _{P-P} , G = +1, f = 1kHz	+25°C		0.00025		%
Noise						
Input Voltage Noise	f = 0.1Hz to 10Hz	+25°C		10		μV _{P-P}
Input Voltage Noise Density (e _n)	f = 100kHz	+25°C		6		nV/√Hz
Input Current Noise Density (i _n)	f = 10kHz	+25°C		90		fA/√Hz

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ELECTRICAL CHARACTERISTICS (continued)

($V_S = 2.2V$ to $5.5V$ or $\pm 1.1V$ to $\pm 2.75V$, $V_{CM} = V_S/2$, $V_{OUT} = V_S/2$ and $R_L = 10k\Omega$ connected to $V_S/2$, Full = $-40^\circ C$ to $+125^\circ C$, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Power-Down (Device Enabled When Floating)						
Power-Down Quiescent Current ⁽¹⁾	$\overline{PD} = -V_S$	$+25^\circ C$		800	1400	nA
Power-Down Pin Bias Current ⁽²⁾	$\overline{PD} = -V_S$	$+25^\circ C$	-1000	-750		nA
Enable Voltage Threshold (V_{IH})	Logic-high threshold	$+25^\circ C$			$0.7 \times V_S$	V
Disable Voltage Threshold (V_{IL})	Logic-low threshold	$+25^\circ C$	$0.2 \times V_S$			V
Turn-On Time Delay (t_{ON}) ⁽³⁾		$+25^\circ C$		40	55	μs
Turn-Off Time Delay (t_{OFF})		$+25^\circ C$		0.8		μs

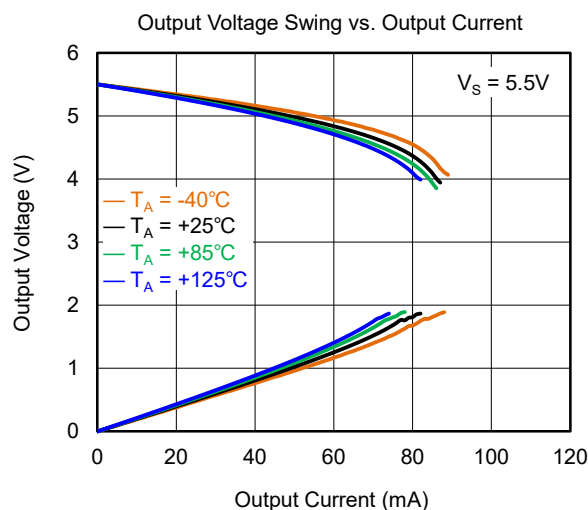
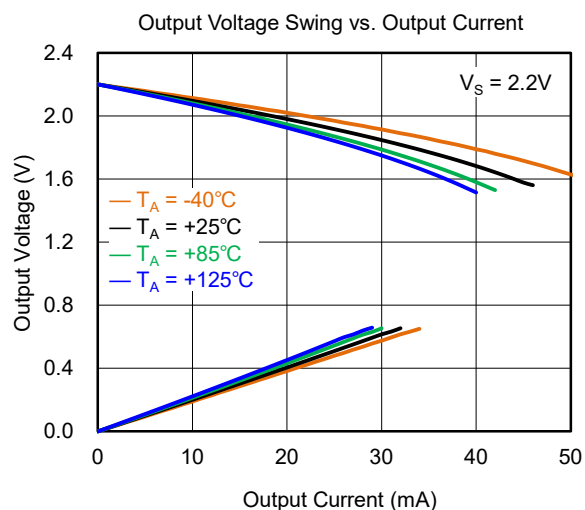
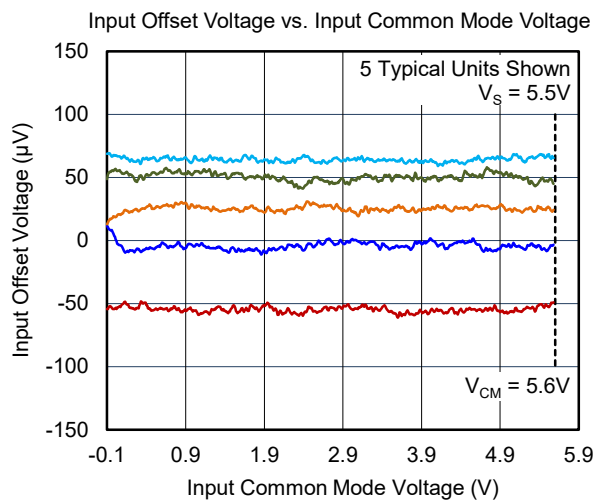
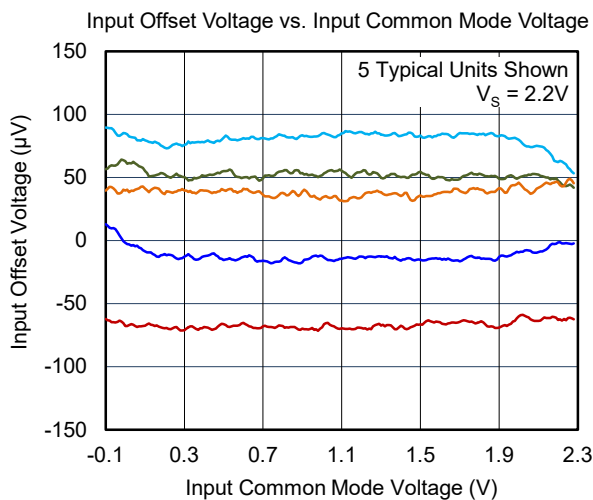
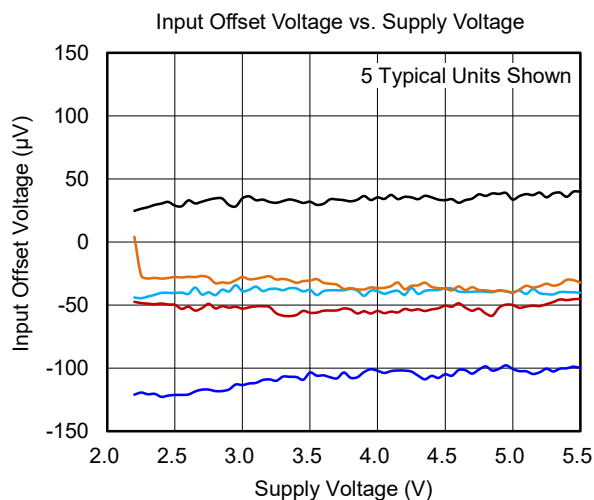
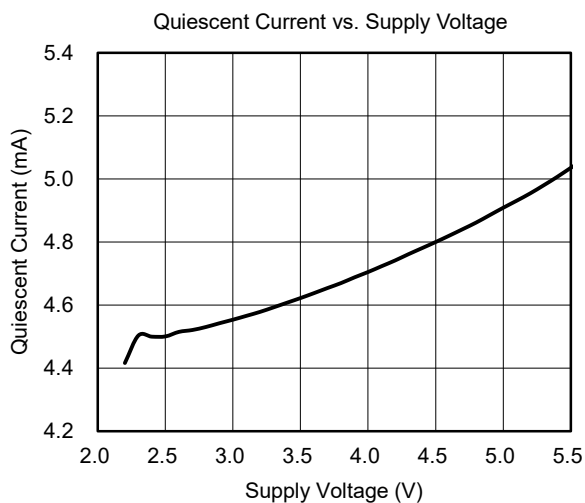
NOTES:

1. When the operational amplifier operates in power-down mode, the current it draws is equivalent to the bias current supplied via the $\overline{PD}$ pin.
2. A negative power-down bias current means the operational amplifier's $\overline{PD}$ pin sources current to the external circuit.
3. Specified by design and characterization or both, not production tested.

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TYPICAL PERFORMANCE CHARACTERISTICS

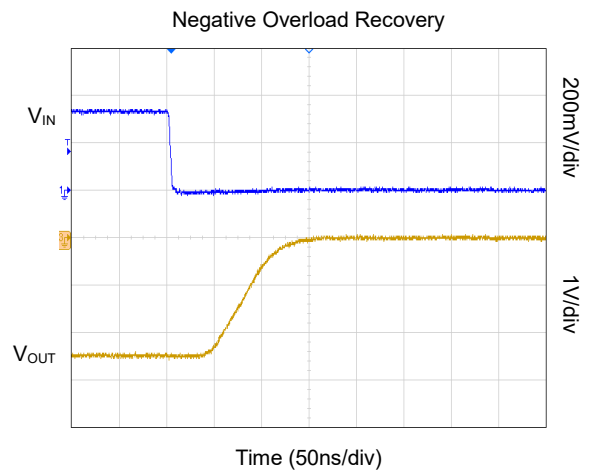
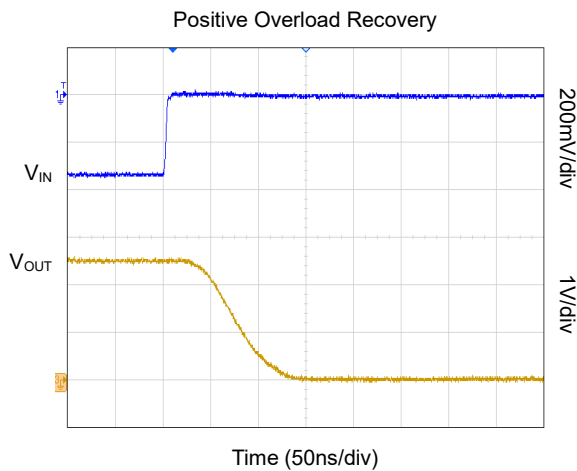
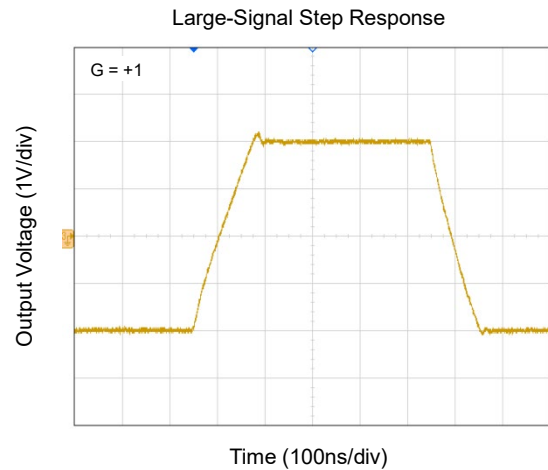
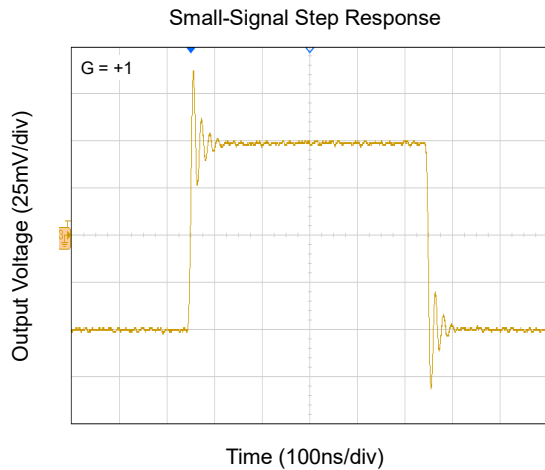
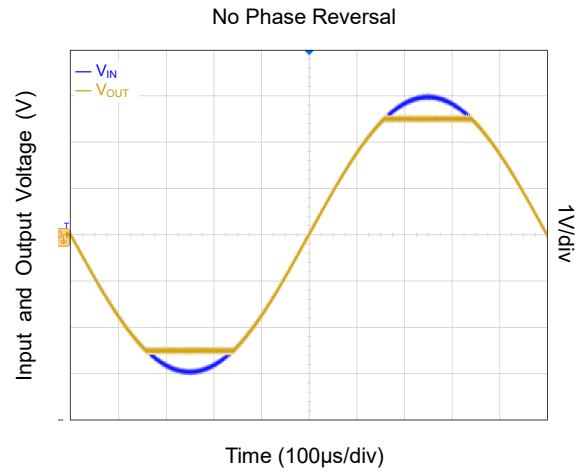
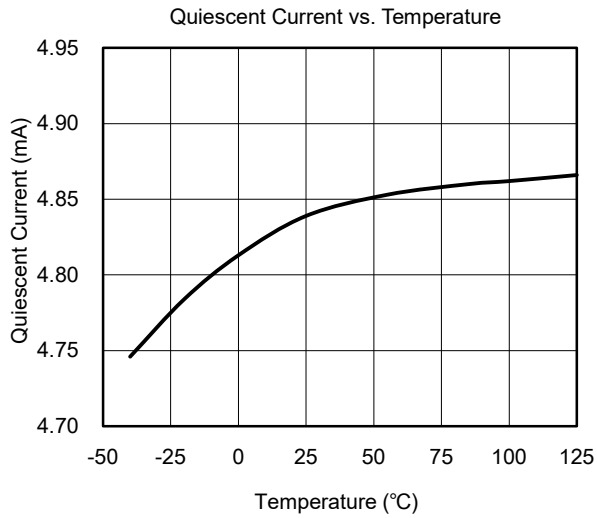
At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 10\text{k}\Omega$ and $C_L = 10\text{pF}$, unless otherwise noted.



SGM8965A-3 50MHz, Low Distortion, Rail-to-Rail I/O, Single-Supply Operational Amplifier with Shutdown

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 10\text{k}\Omega$ and $C_L = 10\text{pF}$, unless otherwise noted.

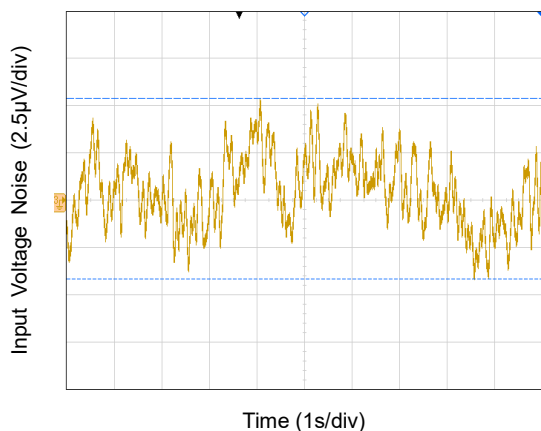


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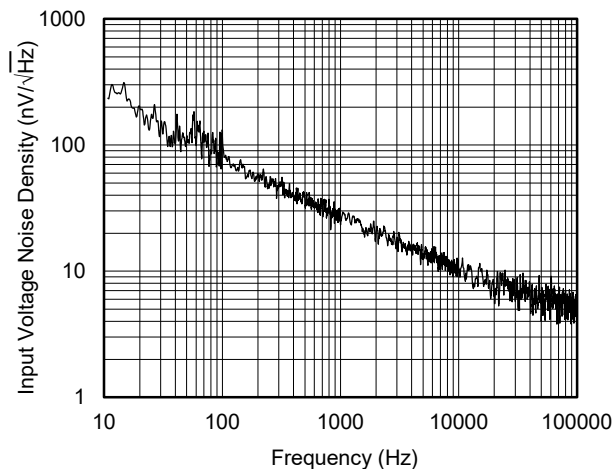
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 10\text{k}\Omega$ and $C_L = 10\text{pF}$, unless otherwise noted.

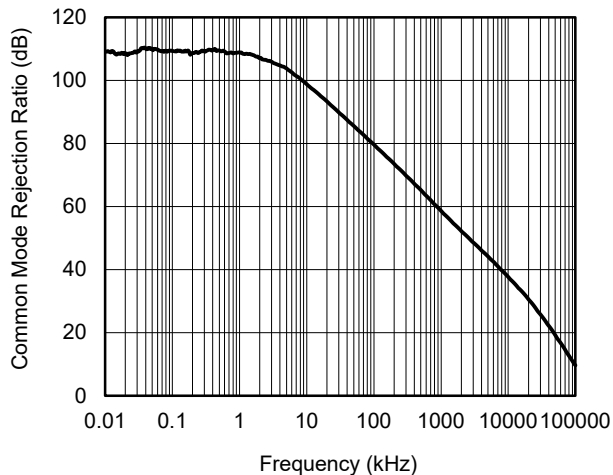
0.1Hz to 10Hz Input Voltage Noise



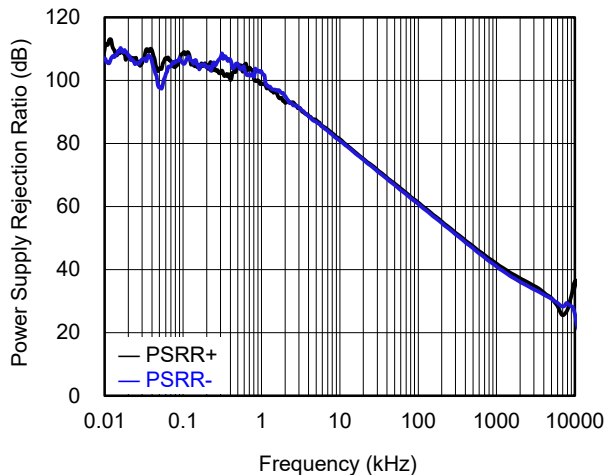
Input Voltage Noise Density vs. Frequency



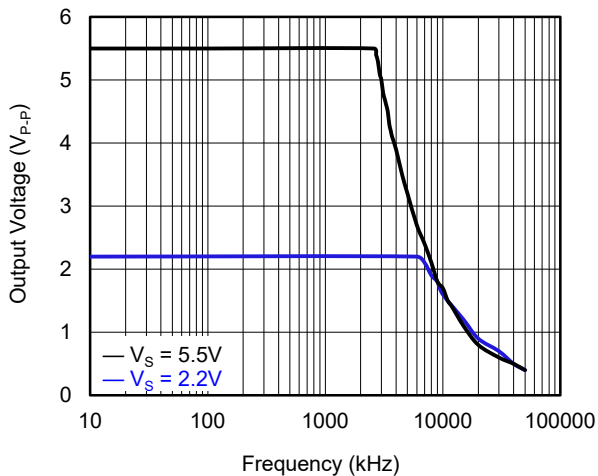
CMRR vs. Frequency (Referred-to-Input)



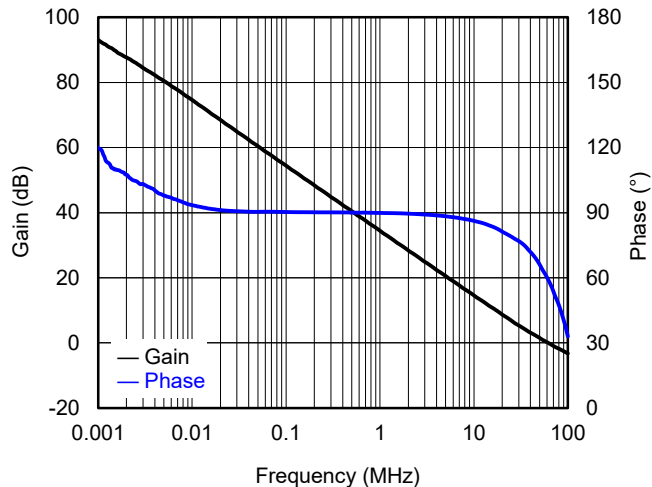
PSRR vs. Frequency (Referred-to-Input)



Maximum Output Voltage vs. Frequency



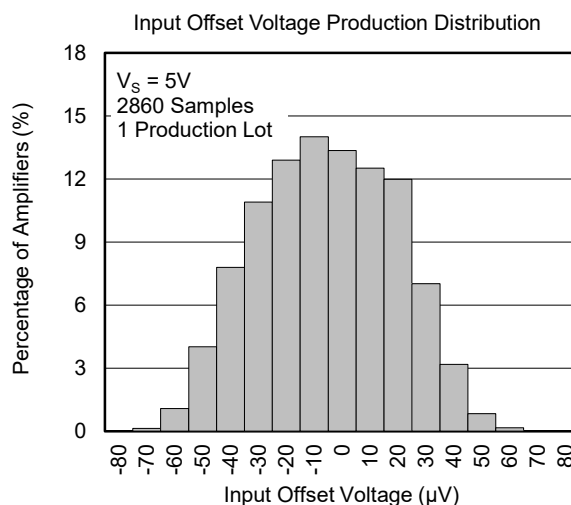
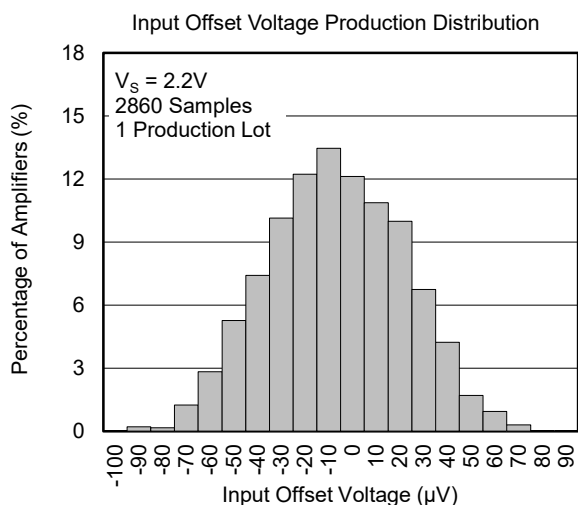
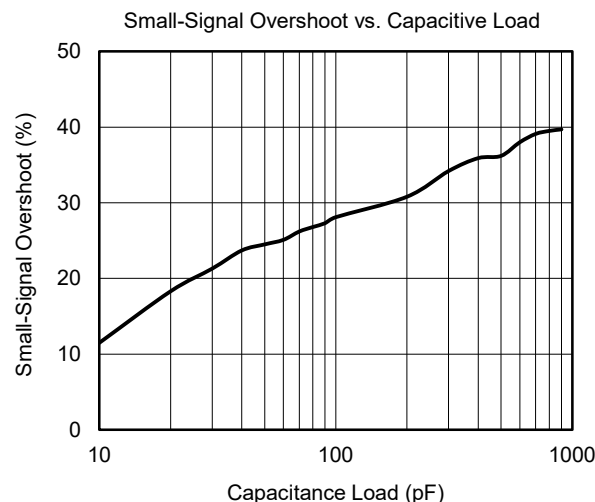
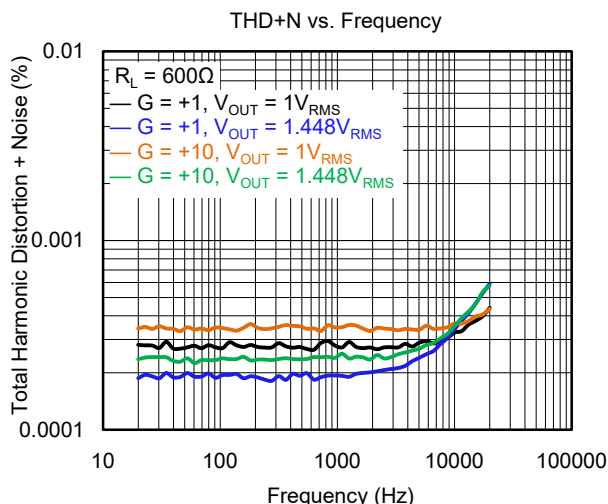
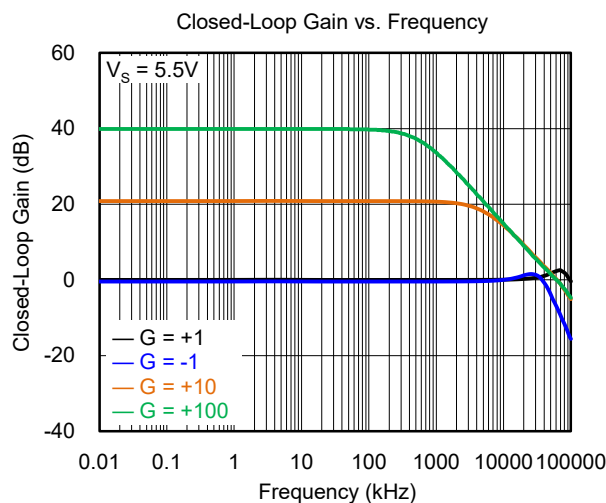
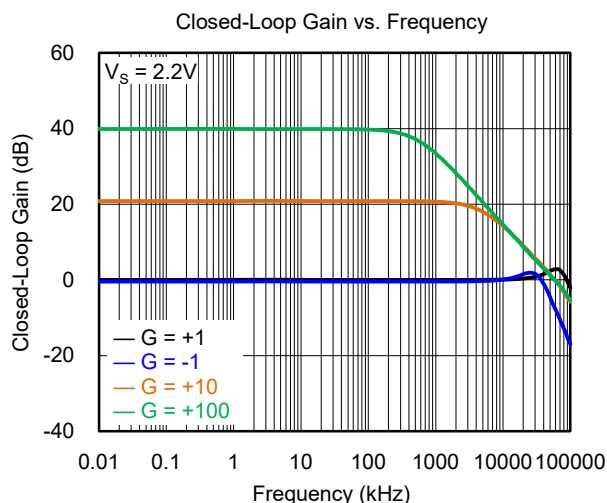
Open-Loop Gain and Phase vs. Frequency



SGM8965A-3 50MHz, Low Distortion, Rail-to-Rail I/O, Single-Supply Operational Amplifier with Shutdown

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

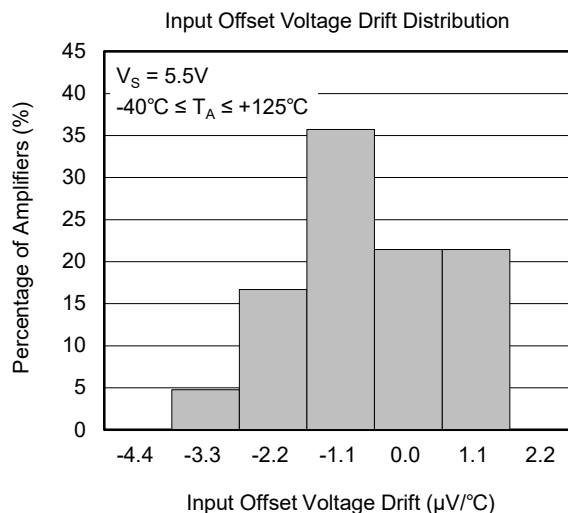
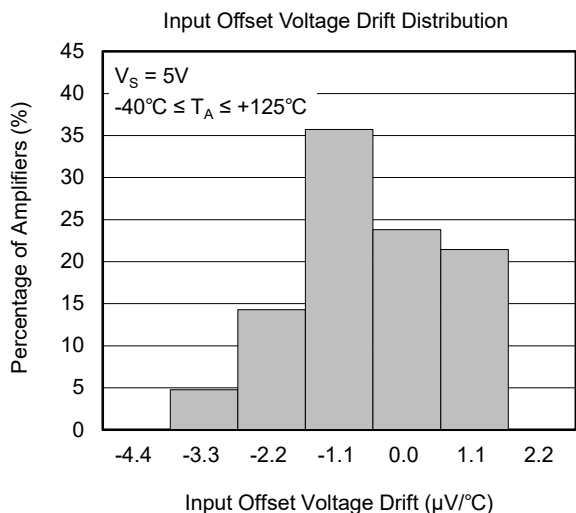
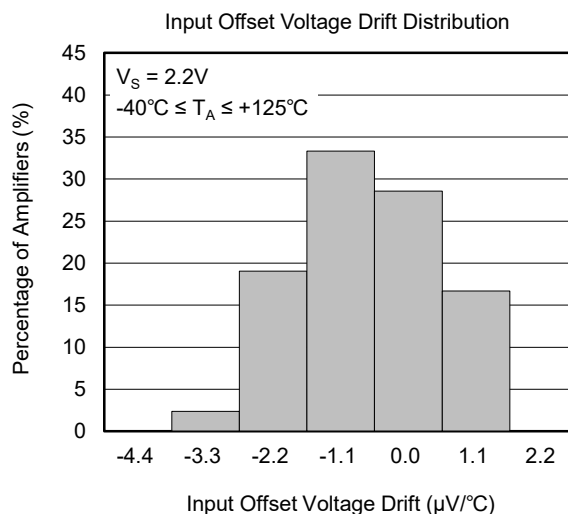
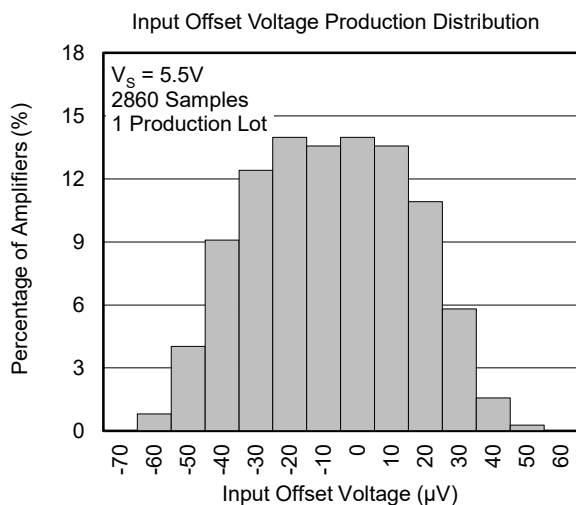
At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 10\text{k}\Omega$ and $C_L = 10\text{pF}$, unless otherwise noted.



50MHz, Low Distortion, Rail-to-Rail I/O, SGM8965A-3 Single-Supply Operational Amplifier with Shutdown

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 10\text{k}\Omega$ and $C_L = 10\text{pF}$, unless otherwise noted.



SGM8965A-3 50MHz, Low Distortion, Rail-to-Rail I/O, Single-Supply Operational Amplifier with Shutdown

APPLICATION INFORMATION

Basic Connection

The SGM8965A-3 can operate on single supply or dual power supplies, as shown in Figure 1. The device is designed to be basic inverting amplifiers, whose gain is -10V/V . For single-supply operation, the output voltage takes input common mode voltage (V_{CM}) as the center

voltage, which is 1.5V as shown in the following circuit connection. Moreover, the input common mode voltage (V_{CM}) is from $(-V_S) - 0.1\text{V}$ to $(+V_S) + 0.1\text{V}$. For dual-supply operation, the output voltage takes 0V as the center voltage.

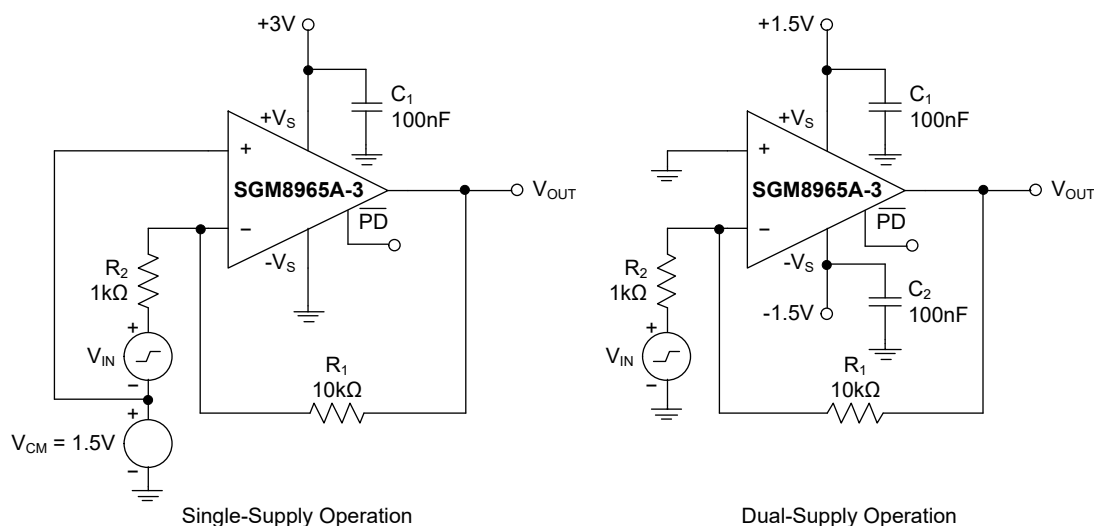


Figure 1. Basic Connections

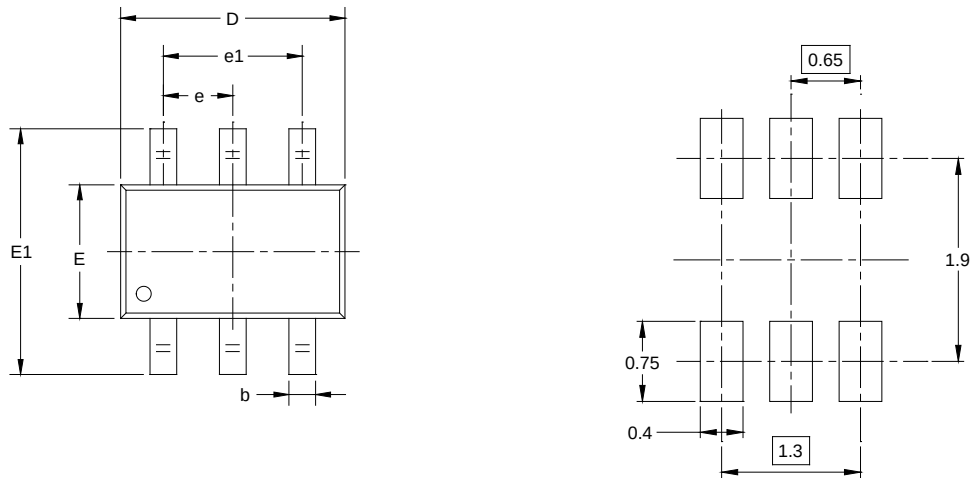
REVISION HISTORY

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

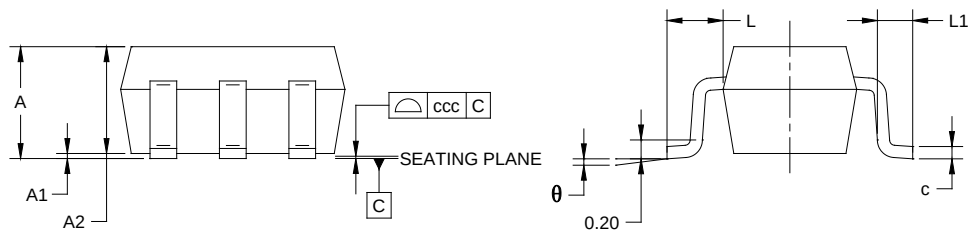
Changes from Original to REV.A (SEPTEMBER 2026)	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

SC70-6



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.800	-	1.100
A1	0.000	-	0.100
A2	0.800	-	1.000
b	0.150	-	0.350
c	0.080	-	0.220
D	2.000	-	2.200
E	1.150	-	1.350
E1	2.150	-	2.450
e	0.600	0.650	0.700
e1	1.200	1.300	1.400
L	0.525 REF		
L1	0.260	-	0.460
ccc	0.100		
θ	0°	-	8°

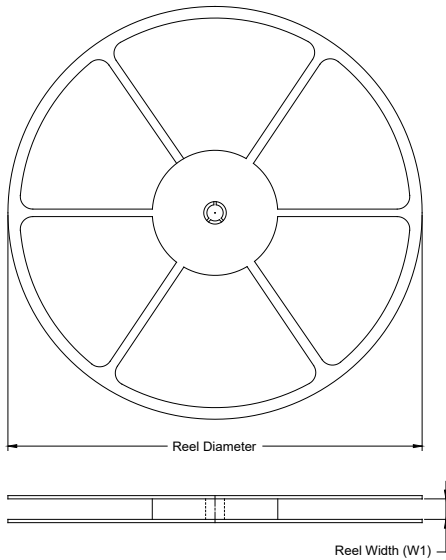
NOTES:

1. This drawing is subject to change without notice.
2. This dimension does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.2mm per side.
3. Reference JEDEC MO-203.

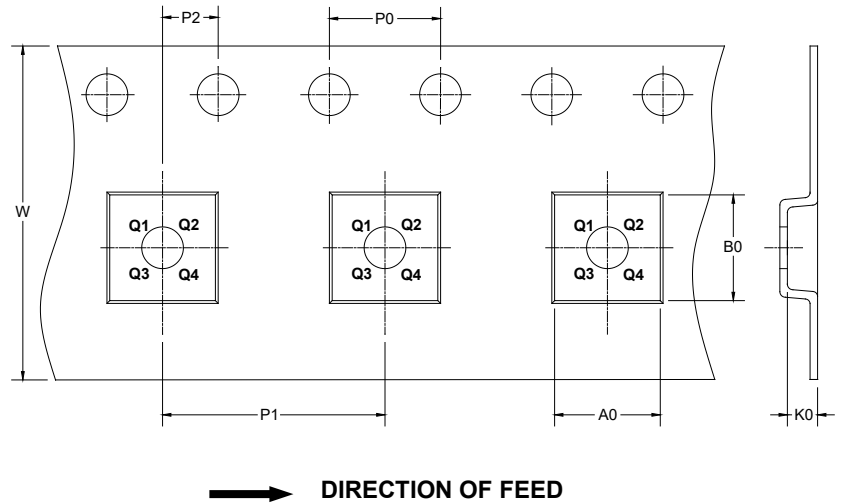
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

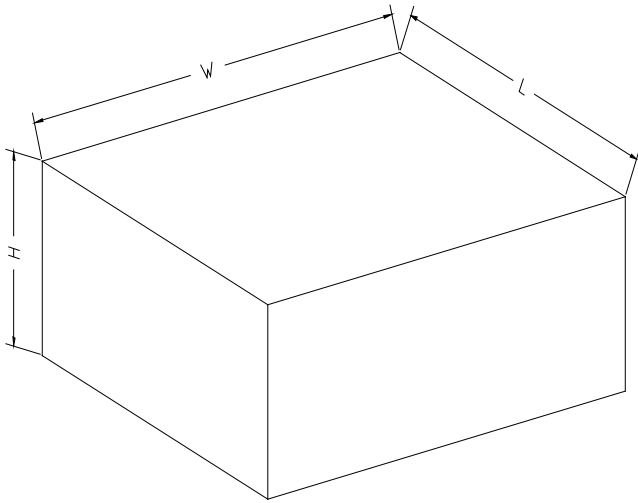
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SC70-6	7"	9.5	2.40	2.50	1.20	4.0	4.0	2.0	8.0	Q3

DD00001

PACKAGE INFORMATION

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
7" (Option)	368	227	224	8
7"	442	410	224	18

DD0002