



# SGM80581/SGM80582/SGM80584 220MHz, Rail-to-Rail I/O, CMOS Operational Amplifiers

## GENERAL DESCRIPTION

The SGM80581 (single), SGM80582 (dual) and SGM80584 (quad) are high speed operational amplifiers with voltage feedback function. These devices can operate from 2.5V to 5.5V single supply or from  $\pm 1.25V$  to  $\pm 2.75V$  dual supplies while consuming only 4.5mA quiescent current per amplifier.

The SGM80581/2/4 support rail-to-rail input and output operation. They have a wide input common mode voltage range and output swing within 15mV. The multi-channel version has a completely independent circuit to achieve minimum crosstalk and no interaction.

The SGM80581/2/4 feature a differential phase of  $0.1^\circ$  and a differential gain of 0.01%, which are designed to provide excellent video performance. They have a 220MHz wide bandwidth and are unity-gain stable. These devices also have high output drive capability. The SGM80581/2/4 are well suited for a wide range of applications.

The SGM80581 is available in Green SOT-23-5 and SOIC-8 packages. The SGM80582 is available in Green MSOP-8 and SOIC-8 packages. The SGM80584 is available in a Green SOIC-14 package. They are specified over the extended  $-40^\circ C$  to  $+125^\circ C$  temperature range.

## FEATURES

- **Unity-Gain Stable**
- **High Speed:**
  - Wide Bandwidth: 220MHz
  - High Gain-Bandwidth Product: 100MHz
  - High Slew Rate: 160V/ $\mu s$
- **Low Input Voltage Noise: 7nV/ $\sqrt{Hz}$  at 1MHz**
- **High Output Drive Capability: 150mA (TYP)**
- **Low Input Bias Current: 2pA**
- **Excellent Video Performance:**
  - Bandwidth for 0.1dB Gain Flatness: 30MHz
  - Differential Phase Error:  $0.1^\circ$
  - Differential Gain Error: 0.01%
- **Thermal Shutdown**
- **Rail-to-Rail Input and Output**
- **Support Single or Dual Power Supplies:**
  - 2.5V to 5.5V or  $\pm 1.25V$  to  $\pm 2.75V$
- **Quiescent Current: 4.5mA/Amplifier (TYP)**
- **$-40^\circ C$  to  $+125^\circ C$  Operating Temperature Range**
- **Small Packaging:**
  - SGM80581 Available in Green SOT-23-5 and SOIC-8 Packages
  - SGM80582 Available in Green MSOP-8 and SOIC-8 Packages
  - SGM80584 Available in a Green SOIC-14 Package

## APPLICATIONS

High-Speed Integrators  
Active Filters  
Video Processings  
Ultrasound  
ADC Input Buffers  
DAC Output Amplifiers  
Barcode Scanners

**PACKAGE/ORDERING INFORMATION**

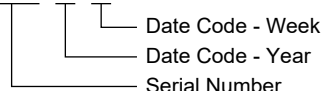
MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM80581	SOT-23-5	-40°C to +125°C	SGM80581XN5G/TR	SU1XX	Tape and Reel, 3000
	SOIC-8	-40°C to +125°C	SGM80581XS8G/TR	SGM 80581XS8 XXXXX	Tape and Reel, 2500
SGM80582	MSOP-8	-40°C to +125°C	SGM80582XMS8G/TR	SGM80582 XMS8 XXXXX	Tape and Reel, 4000
	SOIC-8	-40°C to +125°C	SGM80582XS8G/TR	SGM 80582XS8 XXXXX	Tape and Reel, 2500
SGM80584	SOIC-14	-40°C to +125°C	SGM80584XS14G/TR	SGM80584XS14 XXXXX	Tape and Reel, 2500

**MARKING INFORMATION**

NOTE: XX = Date Code. XXXXX = Date Code and Vendor Code.

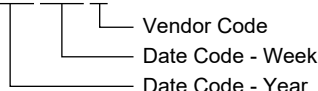
**SOT-23-5**

**YYY X X**



**SOIC-8/MSOP-8/SOIC-14**

**XXXXX**



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, +Vs to -Vs .....6V
- Input Common Mode Voltage Range  
..... (-Vs) - 0.1V to (+Vs) + 0.1V
- Signal Input Terminals Voltage Range  
..... (-Vs) - 0.3V to (+Vs) + 0.3V
- Output Short-Circuit..... Continuous
- Junction Temperature.....+150°C
- Storage Temperature Range .....-65°C to +150°C
- Lead Temperature (Soldering, 10s).....+260°C
- ESD Susceptibility
- HBM..... 6000V
- MM..... 400V
- CDM ..... 1000V

**RECOMMENDED OPERATING CONDITIONS**

- Specified Voltage Range .....2.7V 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.

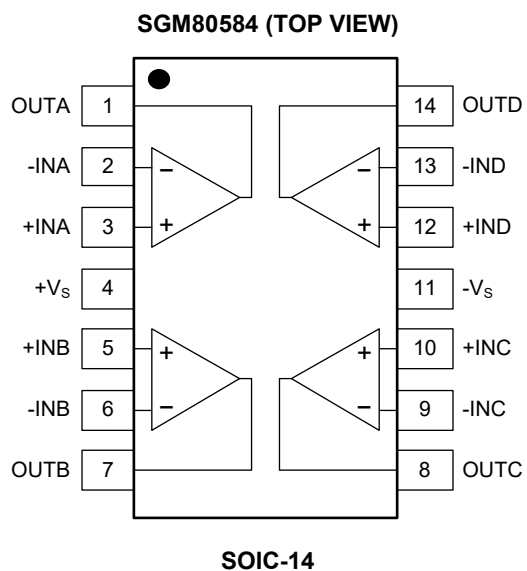
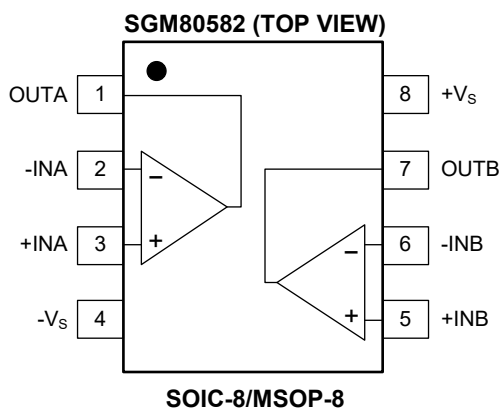
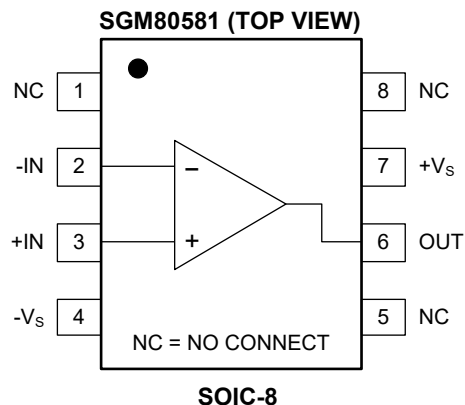
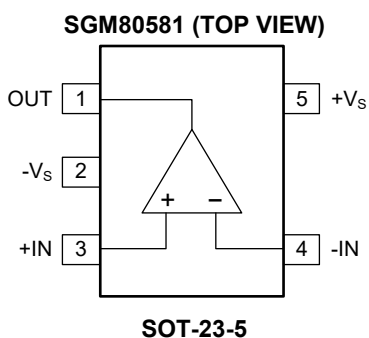
**ESD SENSITIVITY CAUTION**

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.

**PIN CONFIGURATIONS**



**ELECTRICAL CHARACTERISTICS**

(At  $T_A = +25^\circ\text{C}$ ,  $V_S = 2.7\text{V}$  to  $5.5\text{V}$ ,  $V_{CM} = V_S/2$ ,  $V_{OUT} = V_S/2$ ,  $R_L = 1\text{k}\Omega$  connected to  $V_S/2$ , unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Input Characteristics</b>					
Input Offset Voltage ( $V_{OS}$ )	$V_S = 5\text{V}$		1.0	3.0	mV
	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$			6.5	
Input Offset Voltage Drift ( $\Delta V_{OS}/\Delta T$ )	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		6.5		$\mu\text{V}/^\circ\text{C}$
Input Bias Current ( $I_B$ )			2		pA
Input Offset Voltage ( $I_{OS}$ )			0.1		pA
Input Common Mode Voltage Range ( $V_{CM}$ )		$(-V_S) - 0.1$		$(+V_S) + 0.1$	V
Common Mode Rejection Ratio (CMRR)	$V_S = 5.5\text{V}$ , $-0.1\text{V} < V_{CM} < 5.6\text{V}$	56	71		dB
	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$	53			
	$V_S = 5.5\text{V}$ , $-0.1\text{V} < V_{CM} < 3.5\text{V}$	60	71		
	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$	58			
Open-Loop Voltage Gain ( $A_{OL}$ )	$(-V_S) + 0.3\text{V} < V_{OUT} < (+V_S) - 0.3\text{V}$ , $R_L = 1\text{k}\Omega$	89	109		dB
	$(-V_S) + 0.4\text{V} < V_{OUT} < (+V_S) - 0.4\text{V}$ , $R_L = 1\text{k}\Omega$	89	109		
	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$	84			
<b>Input Impedance</b>					
Differential			$10^{12} \parallel 4$		$\Omega \parallel \text{pF}$
Common Mode			$10^{12} \parallel 6$		$\Omega \parallel \text{pF}$
<b>Output Characteristics</b>					
Output Voltage Swing from Rail	$V_S = 5\text{V}$ , $R_L = 1\text{k}\Omega$		15	62	mV
Short-Circuit Current ( $I_{SC}$ )	$V_S = 5\text{V}$	110	150		mA
	$V_S = 3\text{V}$		90		
Closed-Loop Output Impedance	$f < 100\text{kHz}$		0.1		$\Omega$
<b>Dynamic Performance</b>					
-3dB Small-Signal Bandwidth ( $f_{3dB}$ )	$G = +1$ , $V_{OUT} = 100\text{mV}_{PP}$ , $R_F = 25\Omega$		220		MHz
	$G = +2$ , $V_{OUT} = 100\text{mV}_{PP}$		106		
Gain-Bandwidth Product (GBP)	$G = +10$ , $V_{OUT} = 100\text{mV}_{PP}$		100		MHz
Bandwidth for 0.1dB Gain Flatness	$G = +2$ , $V_{OUT} = 100\text{mV}_{PP}$		30		MHz
Slew Rate (SR)	$V_S = 5\text{V}$ , $V_{OUT} = 2V_{PP}$		160		V/ $\mu\text{s}$
	$V_S = 5\text{V}$ , $V_{OUT} = 4V_{PP}$		170		
Rise-and-Fall Time	$G = +1$ , $V_{OUT} = 200\text{mV}_{PP}$ , 10% to 90%		3.5		ns
	$G = +1$ , $V_{OUT} = 2V_{PP}$ , 10% to 90%		12		
Settling Time to 0.1%	$V_{OUT} = 2V_{PP}$		75		ns
	$V_{OUT} = 4V_{PP}$		35		
Overload Recovery Time	$V_{IN} \times G = V_S$		18		ns
Crosstalk (SGM80582/4)	$f = 5\text{MHz}$		-110		dB

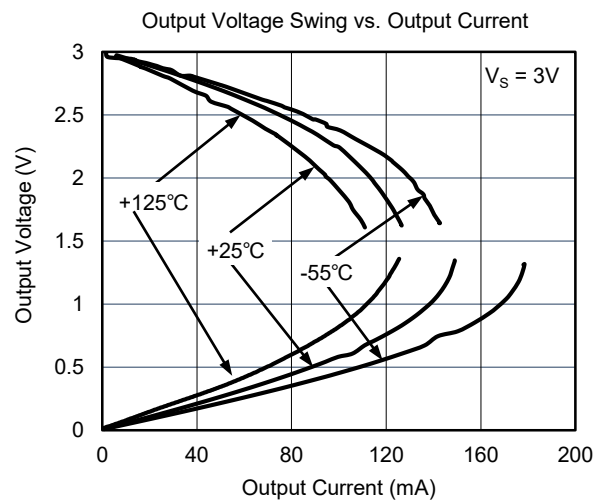
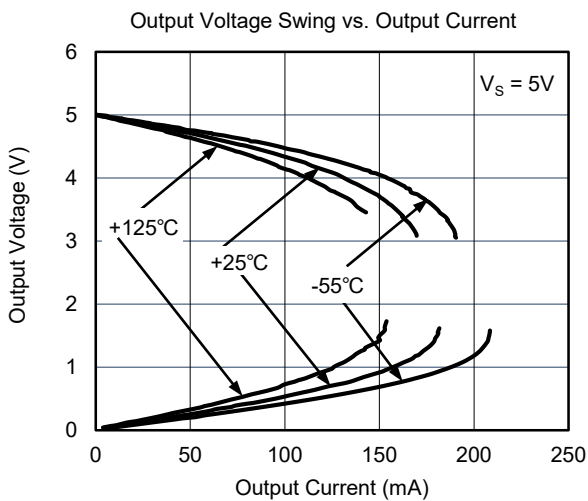
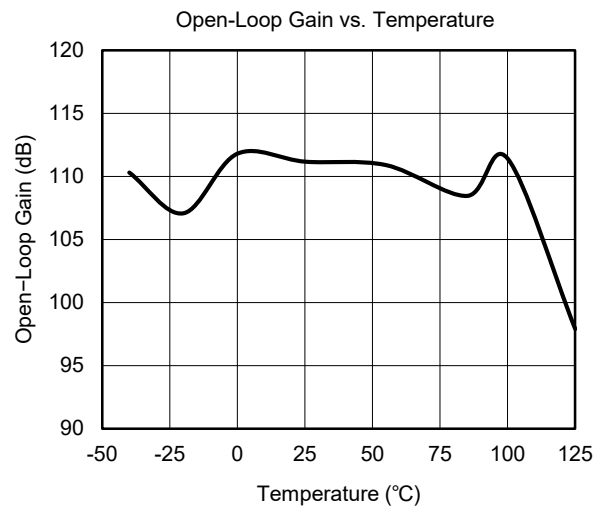
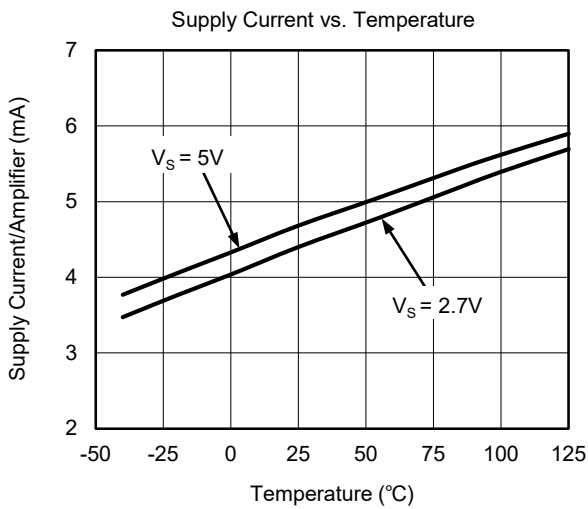
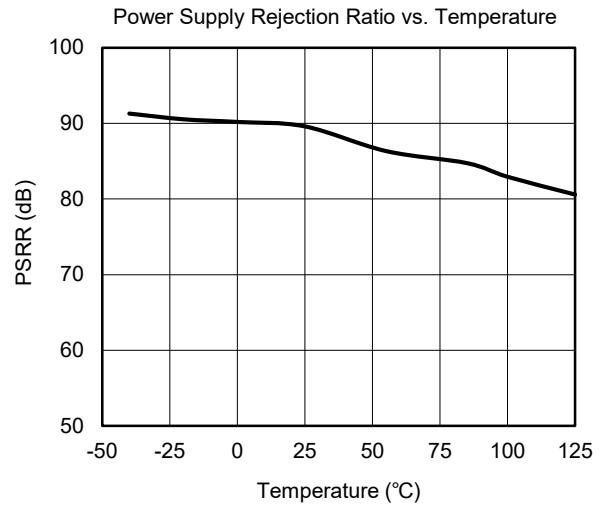
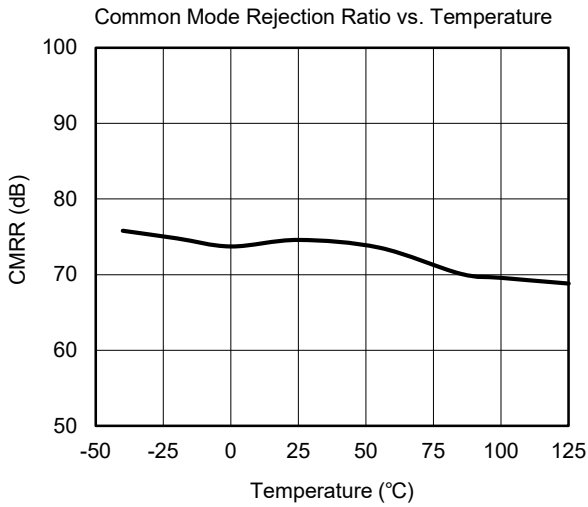
**ELECTRICAL CHARACTERISTICS (continued)**

(At  $T_A = +25^\circ\text{C}$ ,  $V_S = 2.7\text{V}$  to  $5\text{V}$ ,  $V_{CM} = V_S/2$ ,  $V_{OUT} = V_S/2$ ,  $R_L = 1\text{k}\Omega$  connected to  $V_S/2$ , unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Power Supply</b>					
Specified Voltage Range ( $V_S$ )		2.7		5.5	V
Operating Voltage Range		2.5		5.5	V
Power Supply Rejection Ratio (PSRR)	$V_S = 2.7\text{V}$ to $5.5\text{V}$ , $V_{CM} = (V_S/2) - 0.55\text{V}$		100	540	$\mu\text{V/V}$
	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$			620	
Quiescent Current/Amplifier ( $I_Q$ )	$V_S = 5\text{V}$ , $I_{OUT} = 0$		4.5	7	mA
	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$			9	
<b>Noise/Distortion Performance</b>					
Input Voltage Noise Density ( $e_n$ )	$f = 1\text{MHz}$		7		$\text{nV}/\sqrt{\text{Hz}}$
Input Current Noise Density ( $i_n$ )	$f = 1\text{MHz}$		10		$\text{fA}/\sqrt{\text{Hz}}$
Differential Gain Error	PAL, $R_L = 150\Omega$		0.01		%
Differential Phase Error	PAL, $R_L = 150\Omega$		0.1		$^\circ$
Harmonic Distortion (2nd-Harmonic)	$G = +1$ , $f = 1\text{MHz}$ , $V_{OUT} = 2V_{PP}$ , $R_L = 200\Omega$ , $V_{CM} = 1.5\text{V}$		-66		$\text{dBc}$
Harmonic Distortion (3rd-Harmonic)	$G = +1$ , $f = 1\text{MHz}$ , $V_{OUT} = 2V_{PP}$ , $R_L = 200\Omega$ , $V_{CM} = 1.5\text{V}$		-76		$\text{dBc}$
<b>Thermal Shutdown</b>					
Thermal Shutdown			150		$^\circ\text{C}$
Reset from Shutdown			130		$^\circ\text{C}$

**TYPICAL PERFORMANCE CHARACTERISTICS**

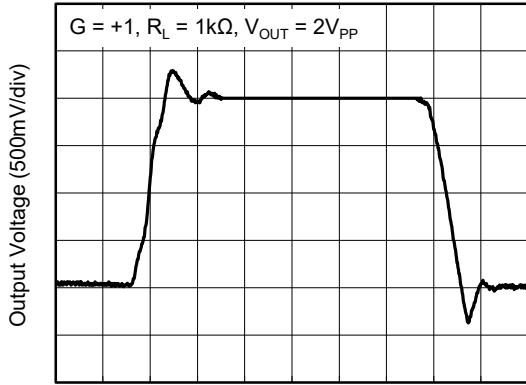
At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$ ,  $G = +1$ ,  $R_L = 1\text{k}\Omega$  and connected to  $V_S/2$ , unless otherwise noted.



**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

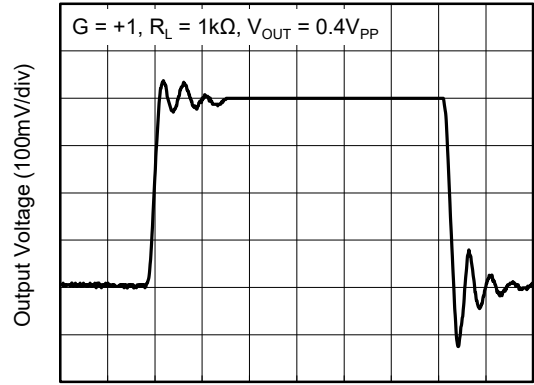
At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$ ,  $G = +1$ ,  $R_L = 1\text{k}\Omega$  and connected to  $V_S/2$ , unless otherwise noted.

Non-Inverting Large-Signal Step Response



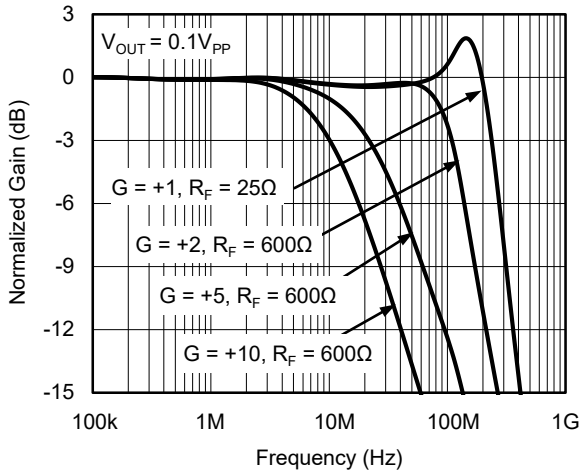
Time (20ns/div)

Non-Inverting Small-Signal Step Response

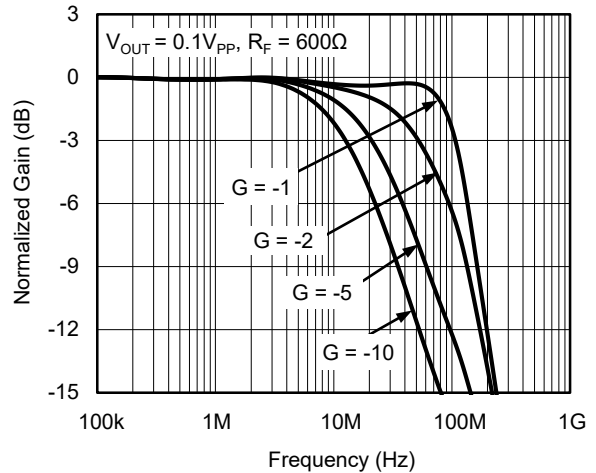


Time (20ns/div)

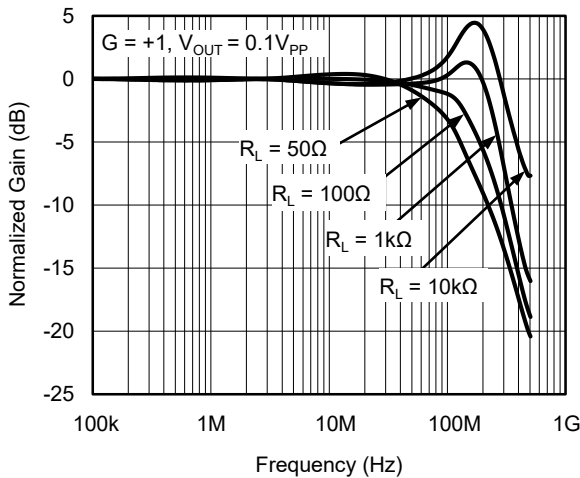
Non-Inverting Small-Signal Frequency Response



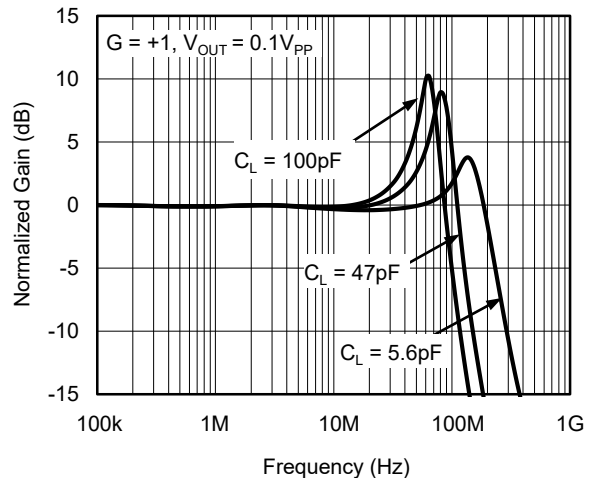
Inverting Small-Signal Frequency Response



Frequency Response for Various  $R_L$

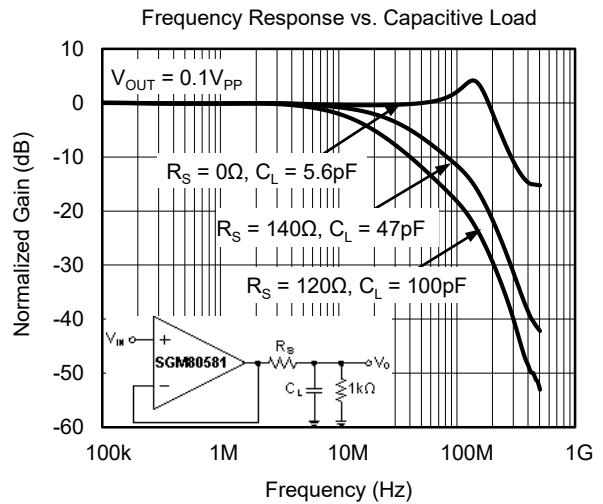
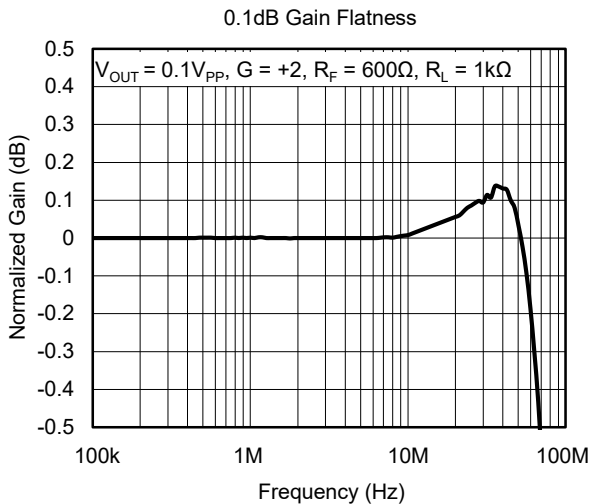
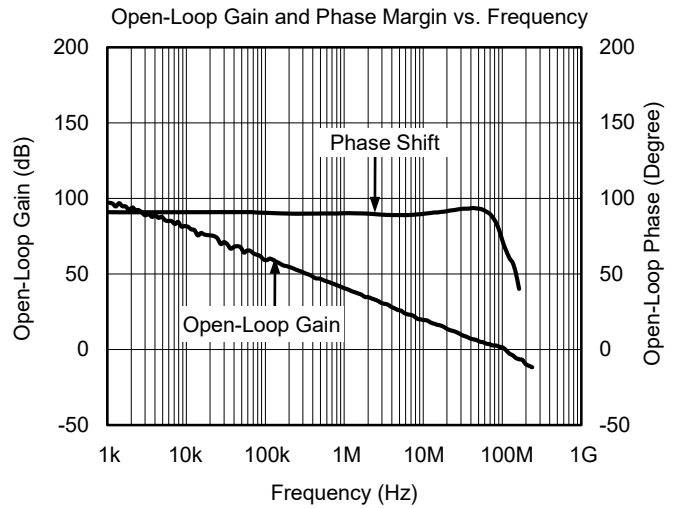
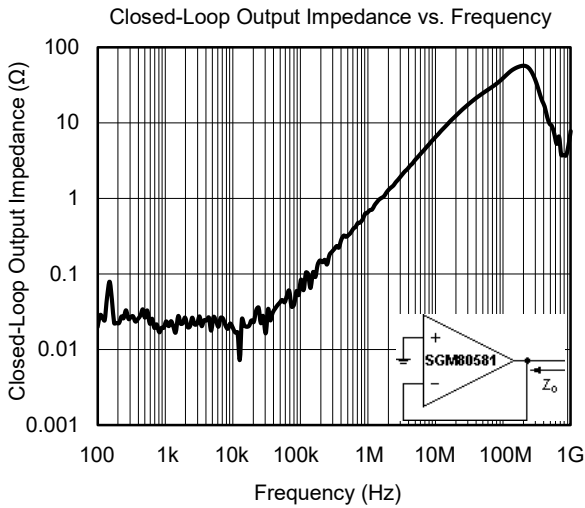
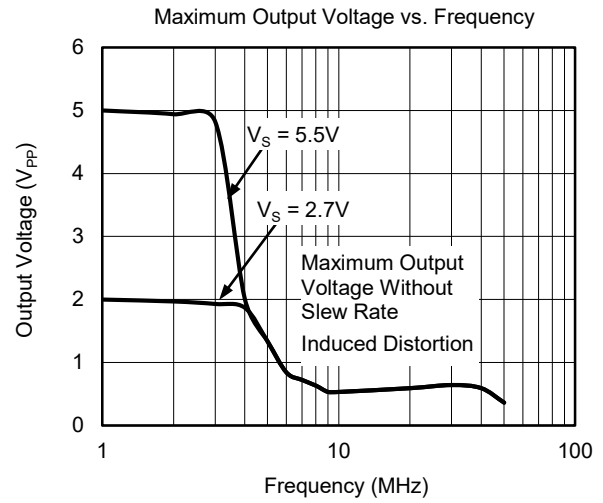
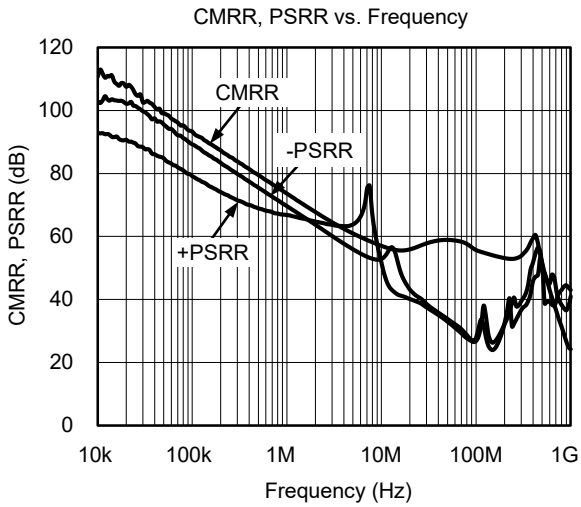


Frequency Response for Various  $C_L$



**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

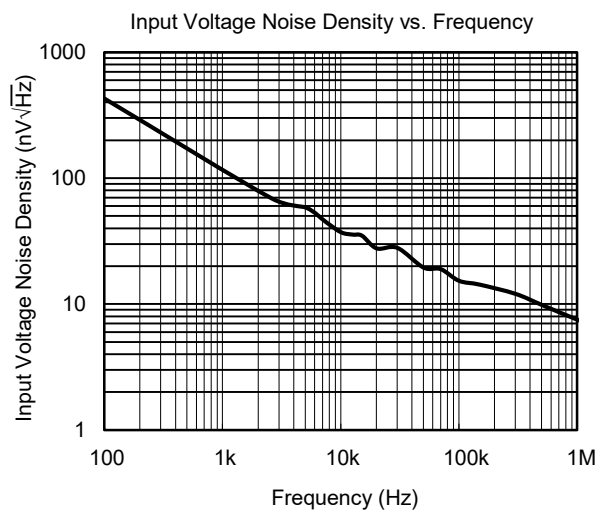
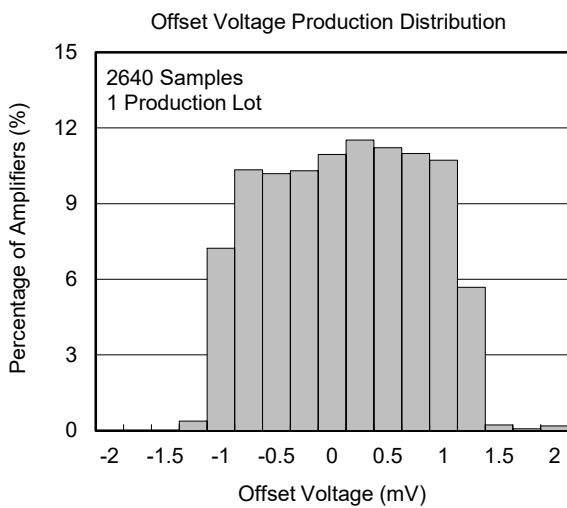
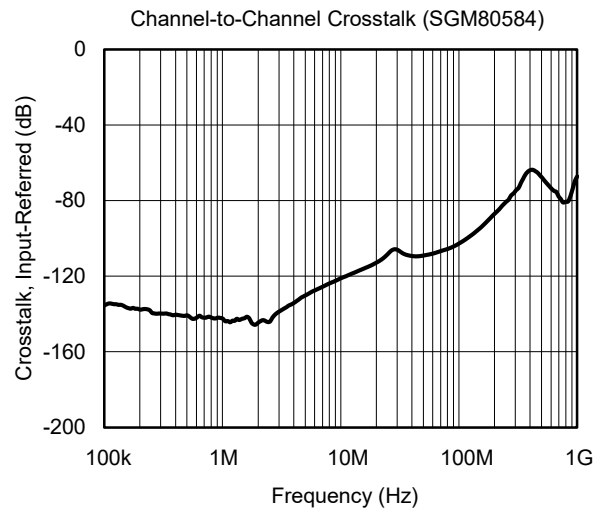
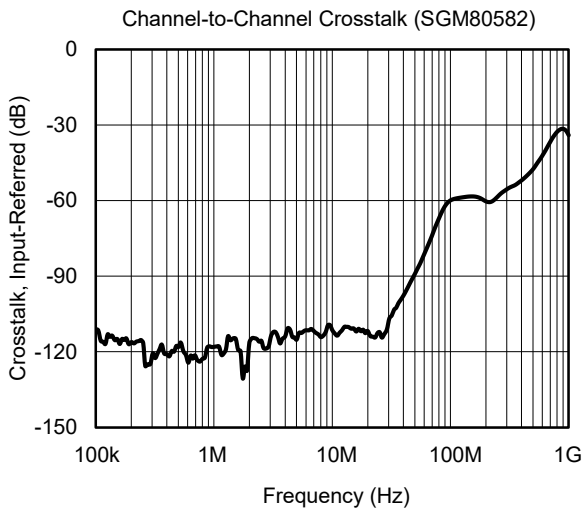
At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$ ,  $G = +1$ ,  $R_L = 1\text{k}\Omega$  and connected to  $V_S/2$ , unless otherwise noted.





**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$ ,  $G = +1$ ,  $R_L = 1\text{k}\Omega$  and connected to  $V_S/2$ , unless otherwise noted.



## **REVISION HISTORY**

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

<b>OCTOBER 2019 – REV.A.1 to REV.A.2</b>	<b>Page</b>
Updated Marking Information section.....	2

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<b>JUNE 2019 – REV.A to REV.A.1</b>	<b>Page</b>
Updated Electrical Characteristics section.....	4

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<b>Changes from Original (DECEMBER 2016) to REV.A</b>	<b>Page</b>
Changed from product preview to production data.....	All

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PACKAGE OUTLINE DIMENSIONS

SOT-23-5



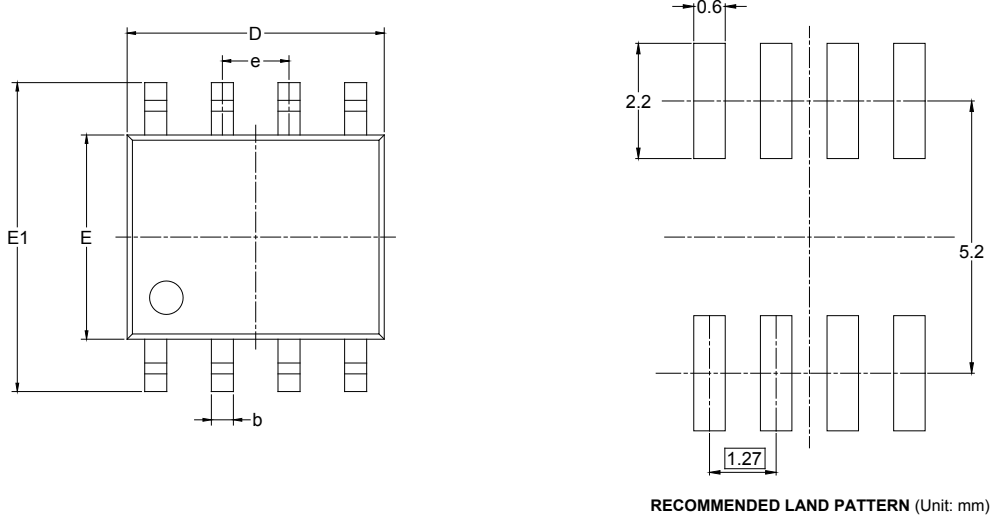
RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

SOIC-8



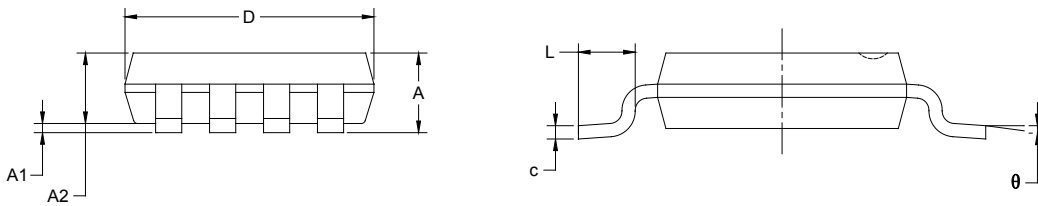
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
$\theta$	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

MSOP-8



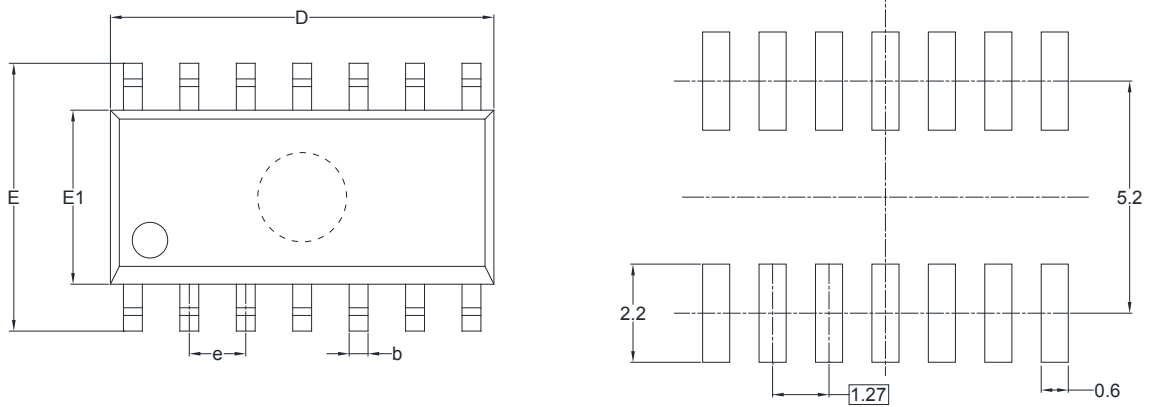
RECOMMENDED LAND PATTERN (Unit: mm)



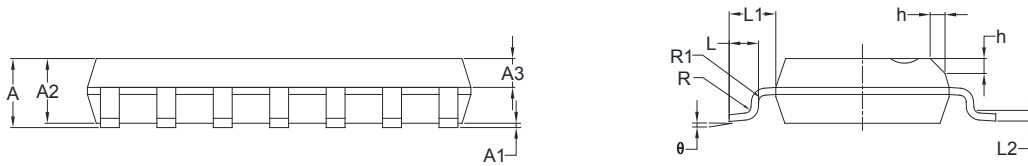
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

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 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
SOT-23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP-8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
SOIC-14	13"	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1

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# 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
13"	386	280	370	5

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