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

GENERAL DESCRIPTION

The SGM80581 (single), SGM80582 (dual) and SGM80584 (quad) are voltage feedback CMOS operational amplifiers, which are optimized for high-speed operation. These devices are designed for applications requiring wide bandwidth or high continuous output current, such as video line driver. They can offer a high output current of 150mA. They are unity-gain stable and offer a wide bandwidth of 220MHz. They exhibit a differential gain of 0.01% and a differential phase of 0.1°.

The SGM80581/2/4 can operate from 2.5V to 5.5V single supply or ±1.25V to ±2.75V dual power supplies, consuming 4.5mA quiescent current per amplifier. These devices support 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 ($-V_S$) + 0.015V to ($+V_S$) - 0.015V. The circuitry of multichannel versions is fully independent, which minimizes crosstalk and avoids interaction.

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 rated over the extended -40℃ to +125℃ temperature range.

FEATURES

- **High-Speed:**
  - **Unity-Gain Bandwidth: 220MHz**
  - **Gain-Bandwidth Product: 100MHz**
  - **Slew Rate: 160V/μs**
- **Excellent Video Performance:**
  - **0.1dB Gain Flatness: 30MHz**
  - **Diff Gain Error: 0.01%**
  - **Diff Phase Error: 0.1°**
- **High Output Current: 150mA (TYP)**
- **Low Noise: 7nV/$\sqrt{Hz}$ at 1MHz**
- **Low Input Bias Current: 2pA (TYP)**
- **Rail-to-Rail Input and Output**
- **Support Single or Dual Power Supplies: 2.5V to 5.5V or ±1.25V to ±2.75V**
- **Quiescent Current: 4.5mA/Amplifier (TYP)**
- **Thermal Shutdown**
- **-40℃ to +125℃ 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

Video Line Driver
Photodiode Amplifier
ADC Input
DAC Output
High-Speed Integrator
Active Filter
Ultrasound
Barcode Scanner
Optical Network
Tunable Laser

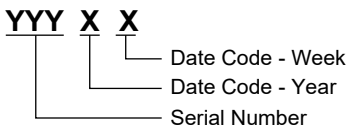
PACKAGE/ORDERING INFORMATION

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

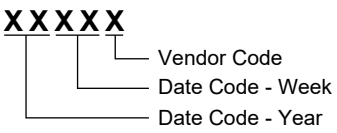
MARKING INFORMATION

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

SOT-23-5



SOIC-8/MSOP-8/SOIC-14



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 Common Mode Voltage Range
..... ($-V_S$) - 0.3V to ($+V_S$) + 0.3V
Output Short-Circuit ..... Continuous
Package Thermal Resistance
SOT-23-5, θ_{JA} ..... 158.3℃/W
SOT-23-5, θ_{JB} ..... 38.7℃/W
SOIC-8, θ_{JA} (SGM80581) ..... 143.1℃/W
SOIC-8, θ_{JB} (SGM80581) ..... 87.1℃/W
SOIC-8, θ_{JA} (SGM80582) ..... 125.7℃/W
SOIC-8, θ_{JB} (SGM80582) ..... 72.8℃/W
MSOP-8, θ_{JA} ..... 144.7℃/W
MSOP-8, θ_{JB} ..... 85.1℃/W
SOIC-14, θ_{JA} ..... 93.2℃/W
SOIC-14, θ_{JB} ..... 47.7℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
HBM ..... ±6000V
MM ..... ±400V
CDM ..... ±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

Specified Voltage Range ..... 2.7V to 5.5V
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

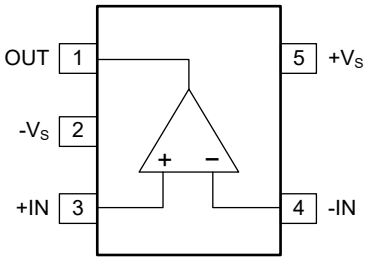
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

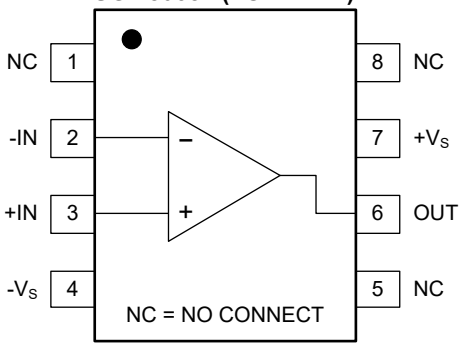
PIN CONFIGURATIONS

SGM80581 (TOP VIEW)



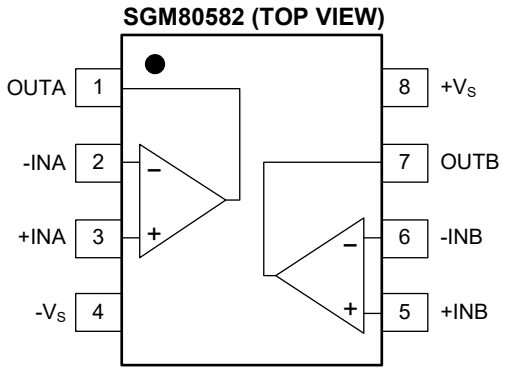
SOT-23-5

SGM80581 (TOP VIEW)



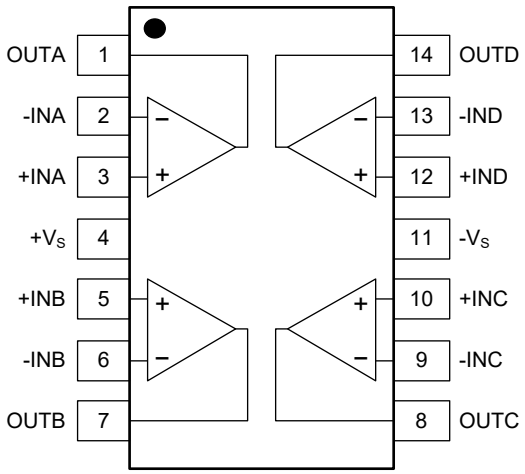
SOIC-8

SGM80582 (TOP VIEW)



SOIC-8/MSOP-8

SGM80584 (TOP VIEW)



SOIC-14

ELECTRICAL CHARACTERISTICS

(At T_A = +25℃, V_S = 2.7V to 5.5V, V_{CM} = V_S/2, V_{OUT} = V_S/2, R_L = 1kΩ connected to V_S/2, unless otherwise noted.)

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

ELECTRICAL CHARACTERISTICS (continued)

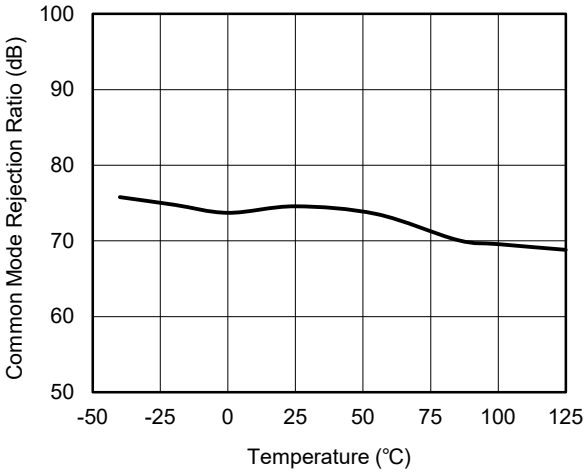
(At T_A = +25℃, V_S = 2.7V to 5.5V, V_{CM} = V_S/2, V_{OUT} = V_S/2, R_L = 1kΩ connected to V_S/2, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Power Supply					
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 = 2.7V to 5.5V, V_{CM} = (V_S/2) - 0.55V		100	540	μV/V
	-40℃ ≤ T_A ≤ +125℃			620	
Quiescent Current/Amplifier (I_Q)	V_S = 5V, I_{OUT} = 0A		4.5	7	mA
	-40℃ ≤ T_A ≤ +125℃			9	
Noise/Distortion Performance					
Input Voltage Noise Density (e_n)	f = 1MHz		7		nV/$\sqrt{Hz}$
Input Current Noise Density (i_n)	f = 1MHz		10		fA/$\sqrt{Hz}$
Differential Gain Error	PAL, R_L = 150Ω		0.01		%
Differential Phase Error	PAL, R_L = 150Ω		0.1		°
Harmonic Distortion (2nd-Harmonic)	G = +1, f = 1MHz, V_{OUT} = $2V_{P-P}$, V_{CM} = 1.5V, R_L = 200Ω		-66		dBc
Harmonic Distortion (3rd-Harmonic)	G = +1, f = 1MHz, V_{OUT} = $2V_{P-P}$, V_{CM} = 1.5V, R_L = 200Ω		-76		dBc
Thermal Shutdown					
Thermal Shutdown			150		℃
Reset from Shutdown			130		℃

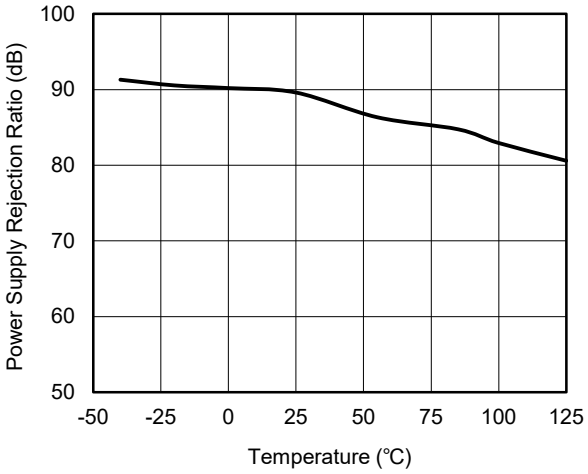
TYPICAL PERFORMANCE CHARACTERISTICS

At T_A = +25℃, V_S = 5V, G = +1, R_L = 1kΩ and connected to V_S/2, unless otherwise noted.

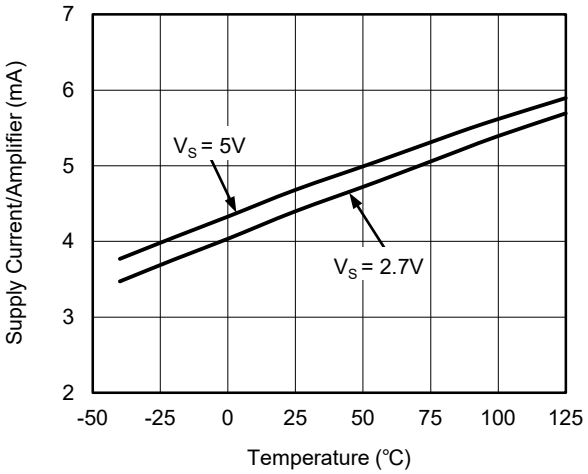
CMRR vs. Temperature



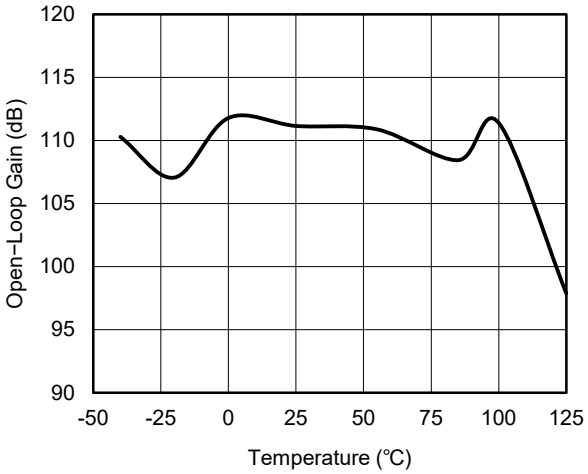
PSRR vs. Temperature



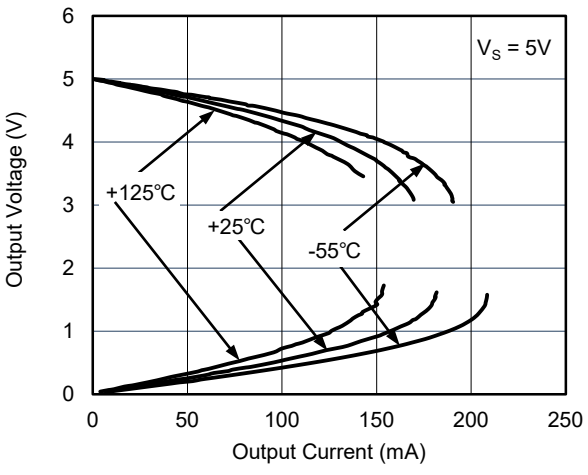
Supply Current vs. Temperature



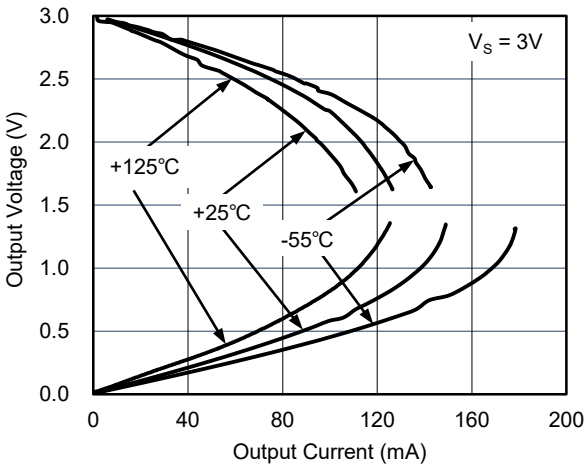
Open-Loop Gain vs. Temperature



Output Voltage Swing vs. Output Current



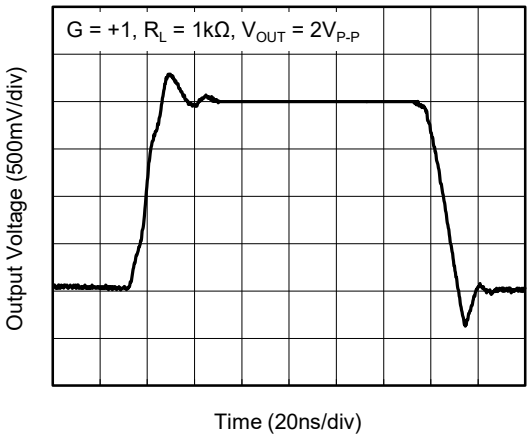
Output Voltage Swing vs. Output Current



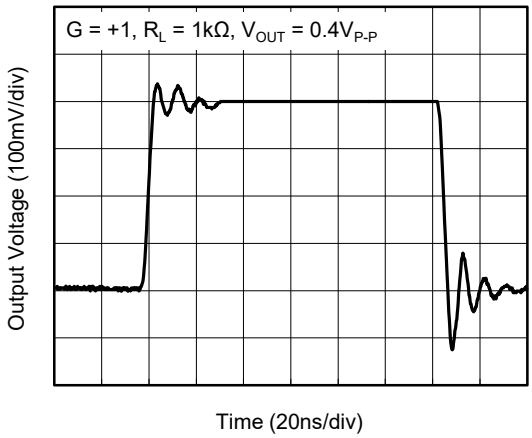
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_S = 5V, G = +1, R_L = 1kΩ and connected to V_S/2, unless otherwise noted.

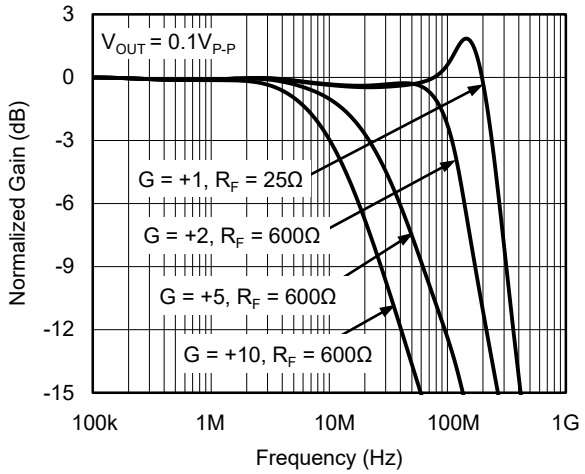
Non-Inverting Large-Signal Step Response



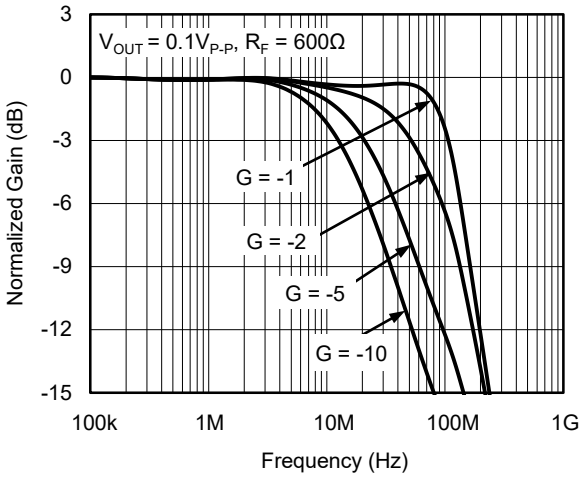
Non-Inverting Small-Signal Step Response



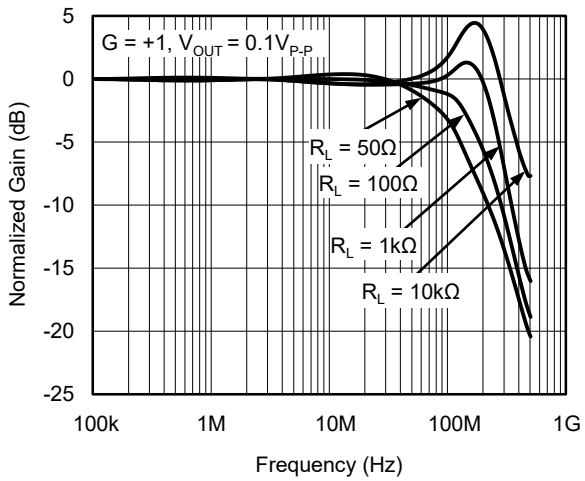
Non-Inverting Small-Signal Frequency Response



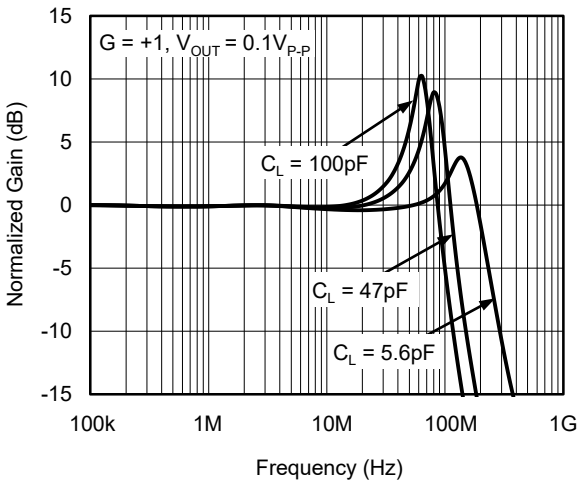
Inverting Small-Signal Frequency Response



Frequency Response for Various R_L



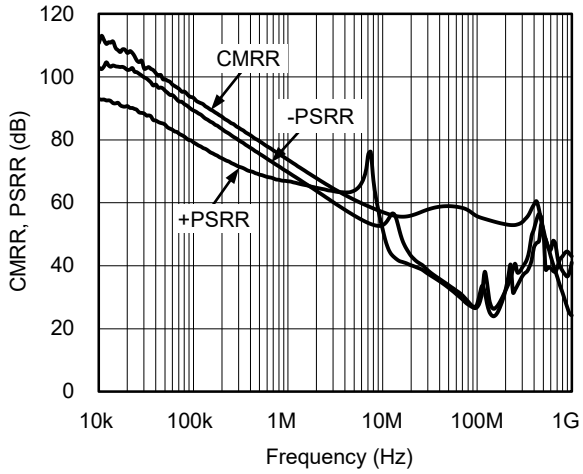
Frequency Response for Various C_L



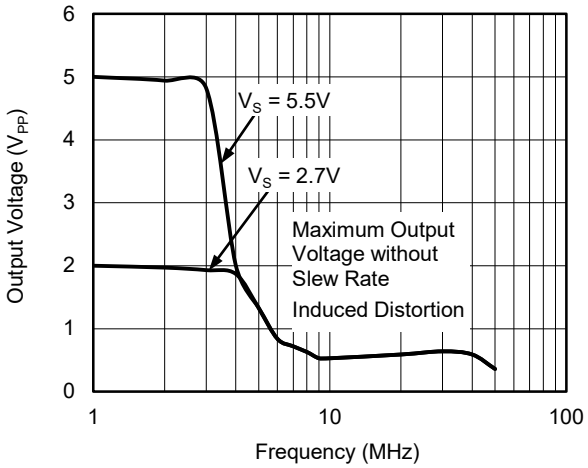
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_S = 5V, G = +1, R_L = 1kΩ and connected to V_S/2, unless otherwise noted.

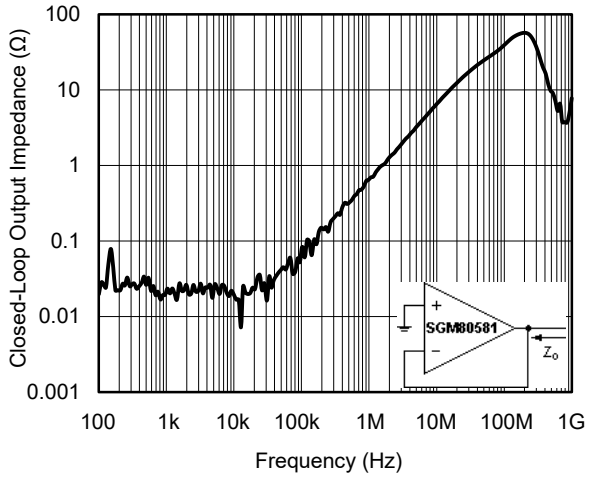
CMRR, PSRR vs. Frequency



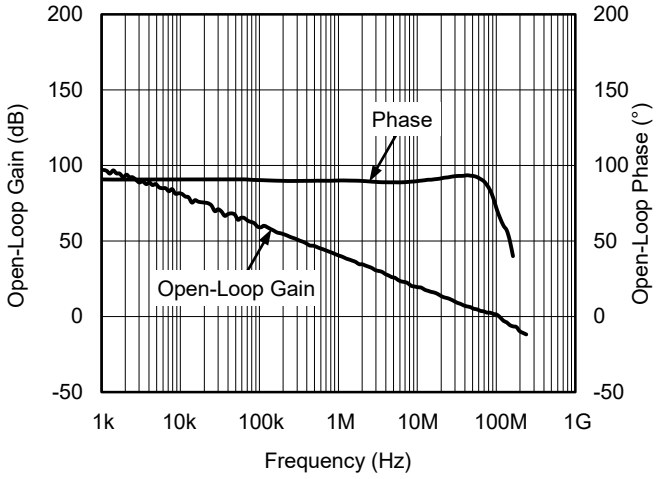
Maximum Output Voltage vs. Frequency



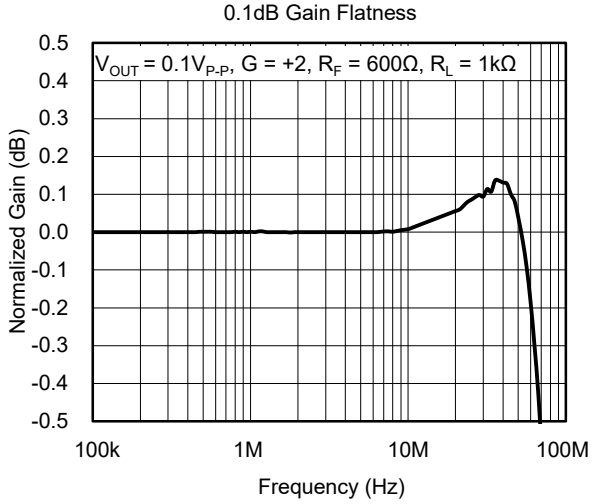
Closed-Loop Output Impedance vs. Frequency



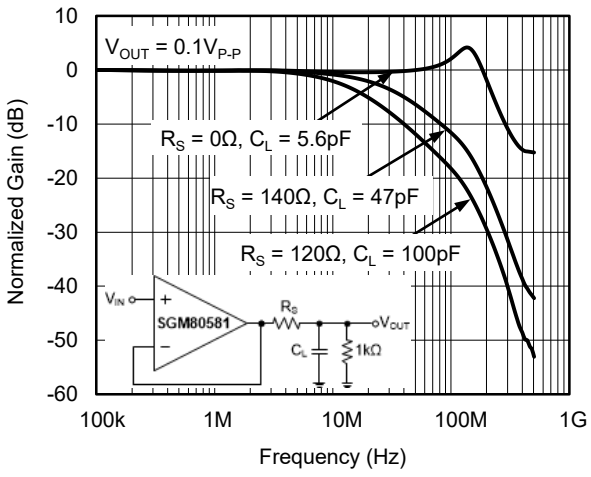
Open-Loop Gain and Phase vs. Frequency



0.1dB Gain Flatness



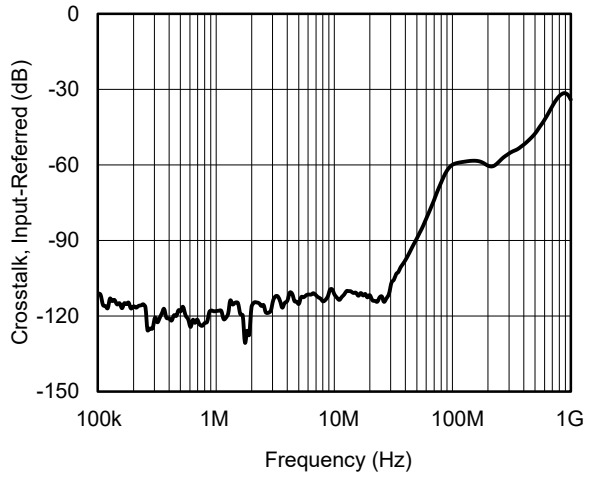
Frequency Response vs. Capacitive Load



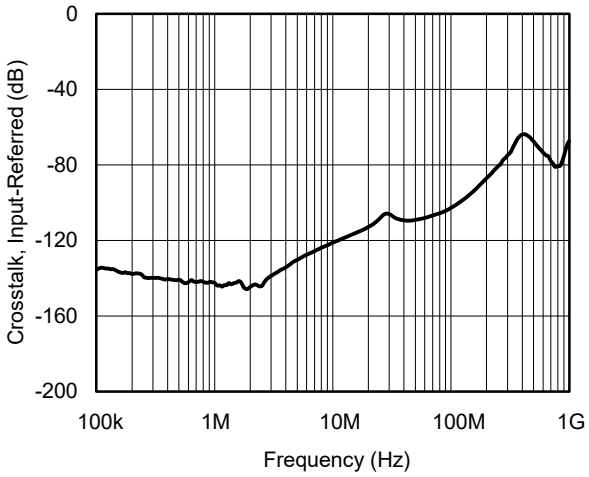
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_S = 5V, G = +1, R_L = 1kΩ and connected to V_S/2, unless otherwise noted.

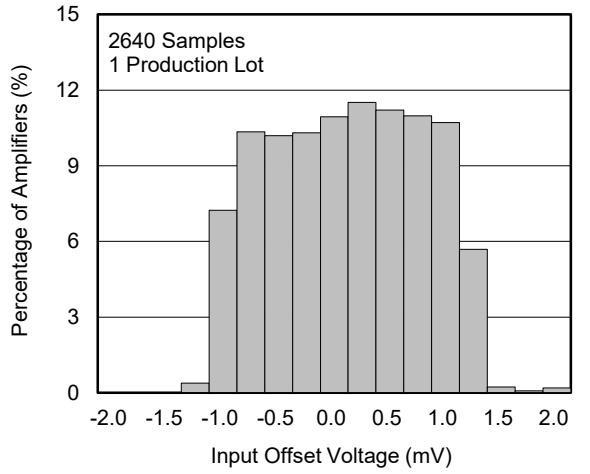
Channel-to-Channel Crosstalk (SGM80582)



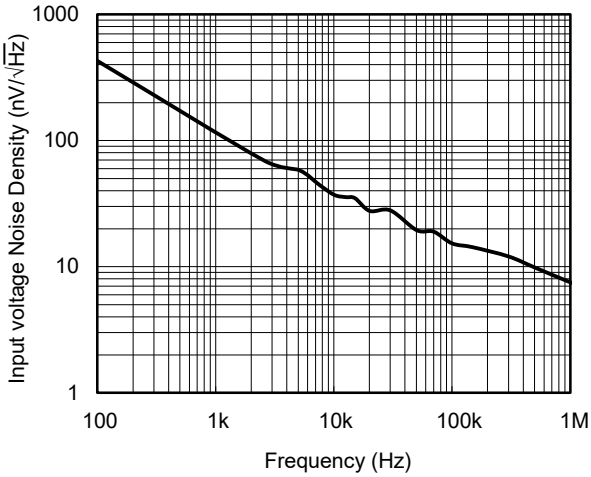
Channel-to-Channel Crosstalk (SGM80584)



Input Offset Voltage Production Distribution



Input Voltage Noise Density vs. Frequency



APPLICATION INFORMATION

The SGM80581/2/4 are high-speed, voltage-feedback CMOS operational amplifiers with rail-to-rail input and output capability. These devices are well-suited for applications, such as video processing, medium-to-high-speed ADC driving, as well as a variety of other uses.

The amplifiers exhibit a gain-bandwidth product of 100MHz and a slew rate of 160V/μs. They are unity-gain stable and can function as voltage followers.

Supply Voltage

The SGM80581/2/4 are specified to operate from 2.7V to 5.5V single supply or from ±1.35V to ±2.75V dual power supplies. However, the operating supply voltage range can extend from 2.5V to 5.5V (±1.25V to ±2.75V). The maximum supply voltage of these amplifiers cannot exceed 6V.

Rail-to-Rail I/O

The input stage of the SGM80581/2/4 achieves rail-to-rail input through a configuration consisting of an NMOS differential pair and a PMOS differential pair. Subsequently, the SGM80581/2/4 combine the signals from these input pairs utilizing a double-folded cascade architecture, which effectively transmits the amplified differential signals to the class AB output stage. The rail-to-rail output is achieved by using common-source transistors in the class AB output stage.

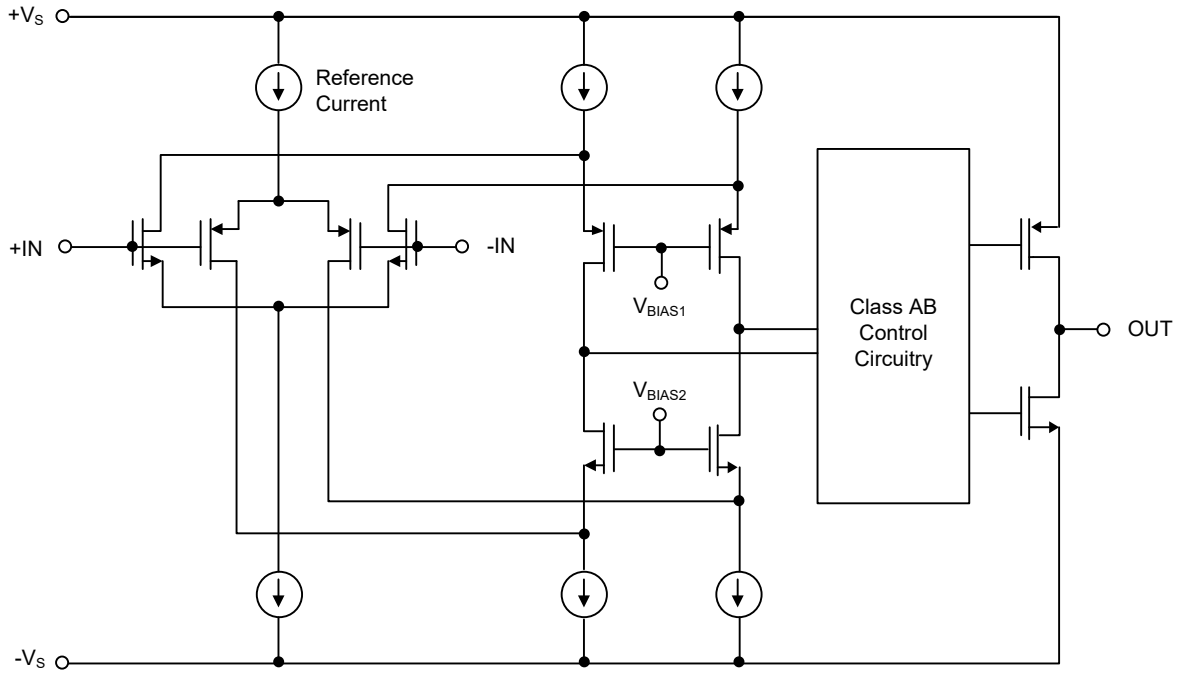


Figure 1. Simplified Schematic

APPLICATION INFORMATION (continued)

Output Drive

The output stage of the SGM80581/2/4 is designed to provide a continuous output current of ±100mA. A typical application circuit is illustrated in Figure 2. For reliability, the continuous DC output current of the SGM80581/2/4 should not exceed ±110mA in applications. If a continuous output current greater than ±110mA is needed, the SGM80581/2/4 can be paralleled to increase the overall output current capability of the circuit, as illustrated in Figure 3.

The built-in thermal shutdown circuit of the chip can provide protection for SGM80581/2/4 when the junction temperature is too high. When the temperature reaches +150℃, the protection circuit will disable the operational amplifier. Normal operation will restart once the junction temperature drops below +130℃.

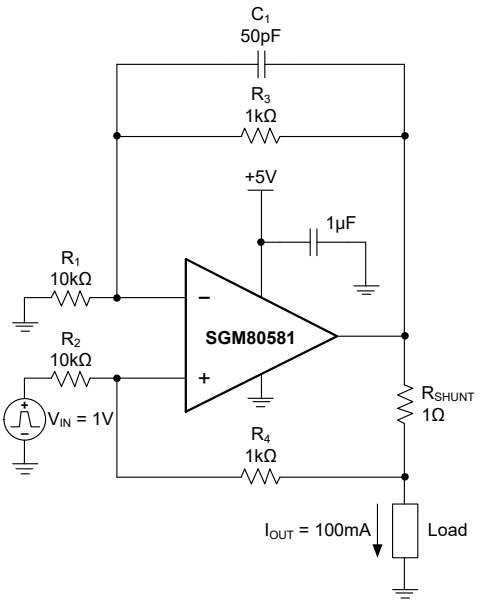


Figure 2. Transconductance Amplifier

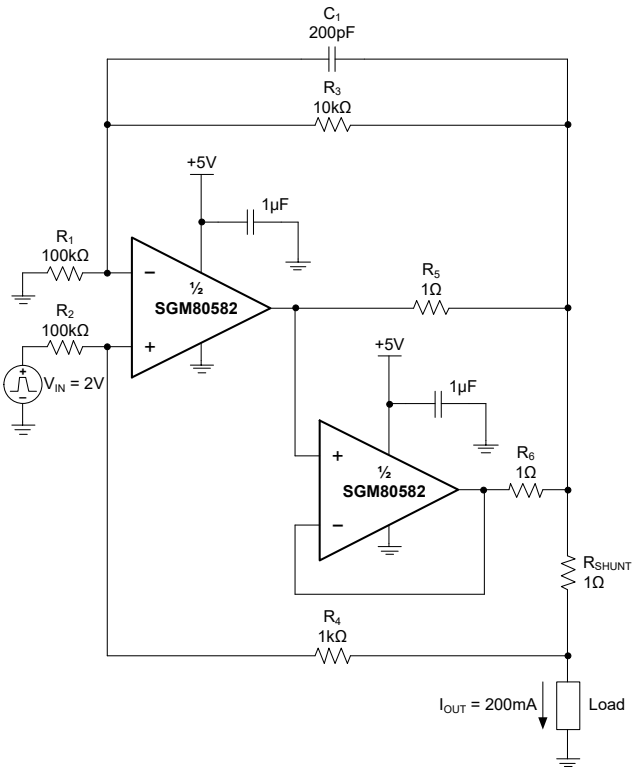


Figure 3. Parallel Operation

Video

The output stage of the SGM80581/2/4 is designed to effectively drive standard back-terminated 75Ω video cables, as illustrated in Figure 4. Additionally, the SGM80581/2/4 can serve as amplifiers for RGB graphic signals. This functionality is achieved by offset adjustment and AC coupling of the signal. For further details, please refer to Figure 5.

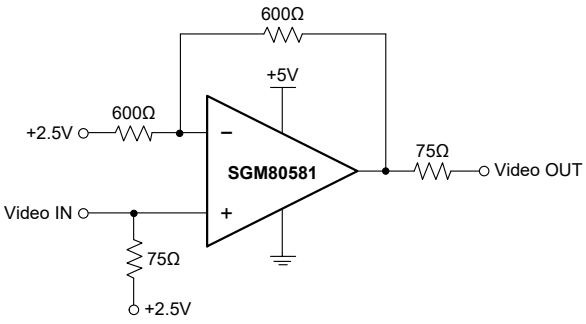


Figure 4. Video Line Driver

APPLICATION INFORMATION (continued)

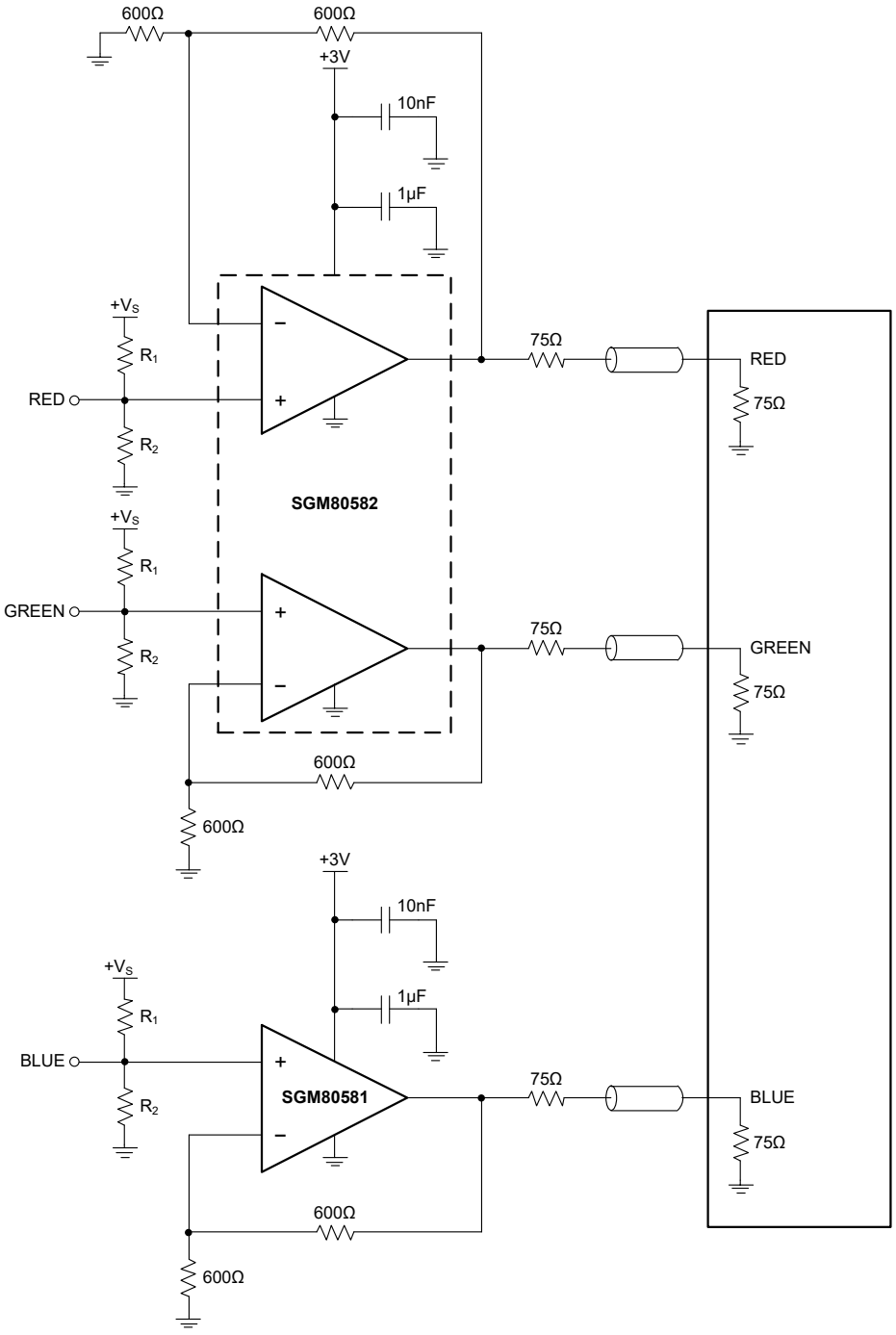


Figure 5. RGB Cable Driver

APPLICATION INFORMATION (continued)

ADC Input Driver

The SGM80581/2/4 have a settling time of 75ns to within 0.1% for 2V output step. They are well-suited for interfacing with medium- and high-speed sampling analog-to-digital converters, as well as reference circuits. Figure 6 shows a typical ADC driver circuit using the SGM80581/2/4. In this configuration, the feedback capacitor, connected in parallel with the feedback resistor, effectively reduces high-frequency noise.

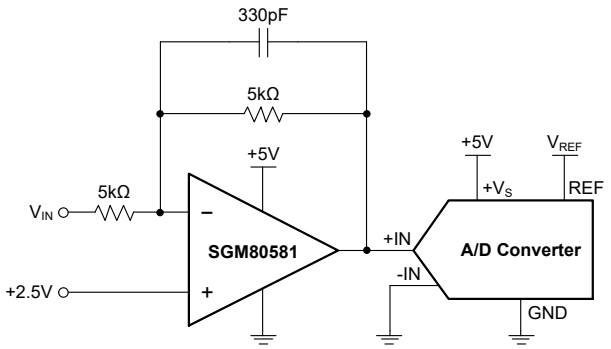


Figure 6. ADC Driver Circuit

Driving Capacitive Loads

The SGM80581/2/4 are capable of driving a wide variety of capacitive loads. For further details, refer to the typical characteristic curve that illustrates the frequency response across various capacitive loads.

The output performance of the circuit can be improved by incorporating an isolation resistor R_{ISO} in series at the output terminal of the operational amplifier when driving a large capacitive load in a unity-gain configuration, as illustrated in Figure 7. Typically, the value of this isolation resistor ranges from several ohms to tens of ohms. However, it is crucial to note that if a resistive load is connected in parallel with a capacitive load, the added isolation resistor will cause a voltage drop across the resistive load, resulting in a DC error at the output. In general, when the isolation resistor is very small, this error remains negligible.

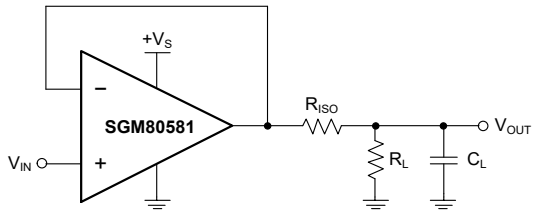


Figure 7. Unity-Gain Buffer with R_{ISO} Stability Compensation

Wideband Transimpedance Amplifier

The SGM80581/2/4 are highly suitable for wideband photodiode transimpedance amplifiers, due to their excellent broadband performance, low input bias current, low input voltage noise, and low current noise. A typical application circuit of the transimpedance amplifier is illustrated in Figure 8.

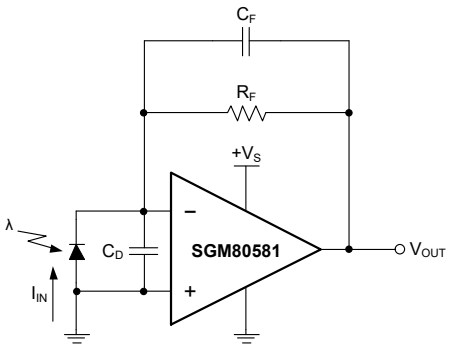


Figure 8. Transimpedance Amplifier

At high frequencies, the parasitic capacitance C_D at the amplifier input introduces a zero in the noise gain of the SGM80581/2/4, resulting in a peak in the closed-loop frequency response. To attain a flat frequency response, a capacitor C_F can be added in parallel with R_F to introduce an additional pole. The feedback pole can be calculated using the following equation.

$$\frac{1}{2\pi R_F C_F} = \sqrt{\frac{GBP}{4\pi R_F C_D}} \quad (1)$$

This results in a cutoff frequency f_{-3dB} of approximately.

$$f_{-3dB} = \sqrt{\frac{GBP}{2\pi R_F C_D}} Hz \quad (2)$$

Board Layout

- Use ground planes extensively and ensure signal traces are short and routed directly.
- Place appropriate bypass capacitors close to the power supply pin.
- Cover large areas with copper to enhance heat dissipation.
- Sockets are not recommended for use on printed circuit boards (PCBs).

Power Dissipation

To minimize power dissipation, select the lowest viable power supply voltage that ensures the requisite output voltage swing. In the case of resistive loads, maximum power dissipation takes place when the DC output voltage is equal to half of the power supply voltage.

REVISION HISTORY

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

JULY 2025 – REV.A.2 to REV.A.3	Page
Updated Absolute Maximum Ratings section	3

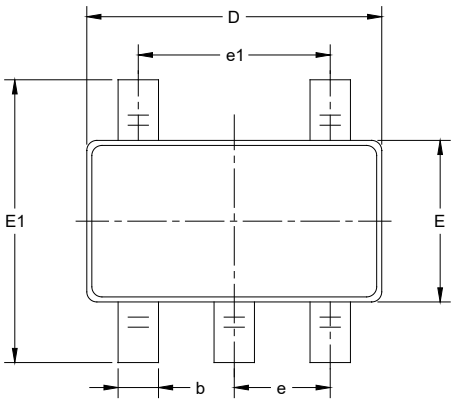
OCTOBER 2019 – REV.A.1 to REV.A.2	Page
Updated Marking Information section	2

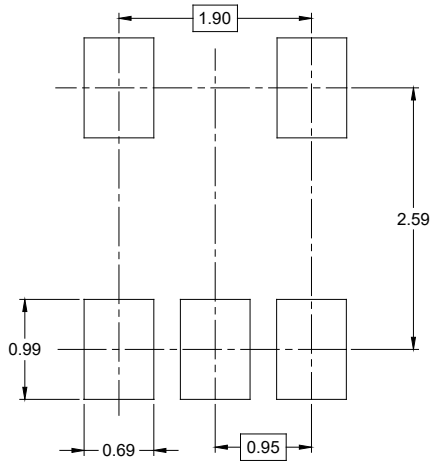
JUNE 2019 – REV.A to REV.A.1	Page
Updated Electrical Characteristics section	4

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

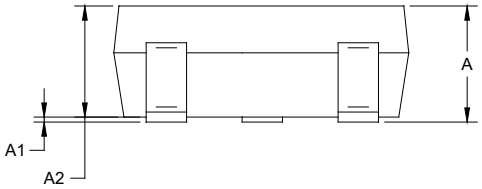
PACKAGE OUTLINE DIMENSIONS

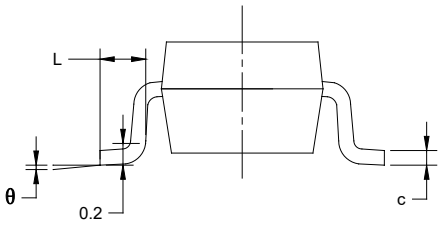
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)



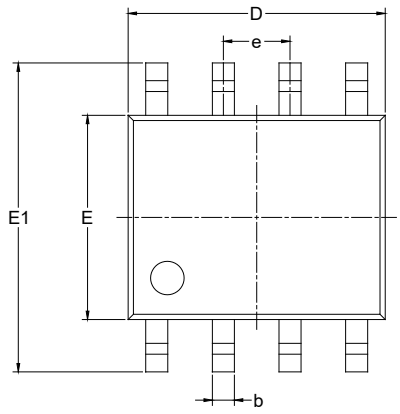


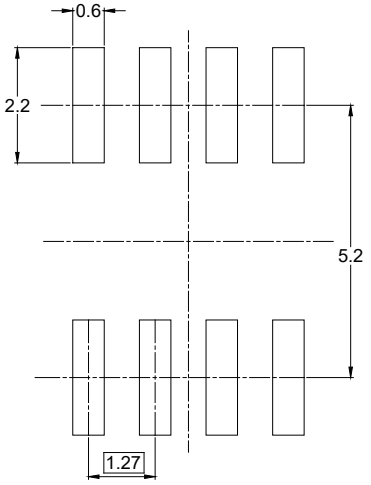
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

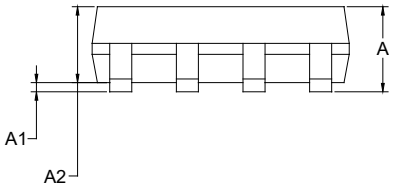
PACKAGE OUTLINE DIMENSIONS

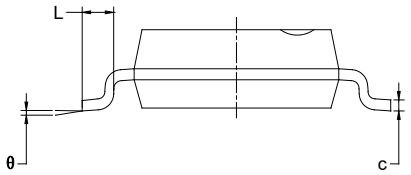
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)



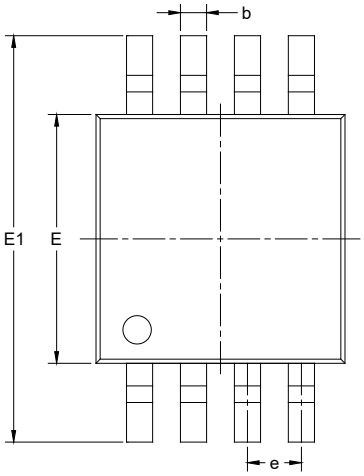


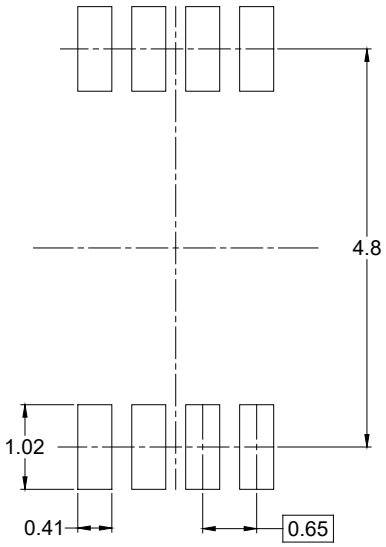
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

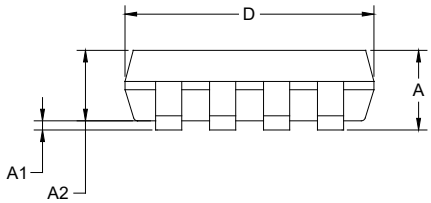
PACKAGE OUTLINE DIMENSIONS

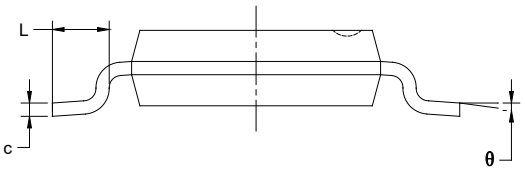
MSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)



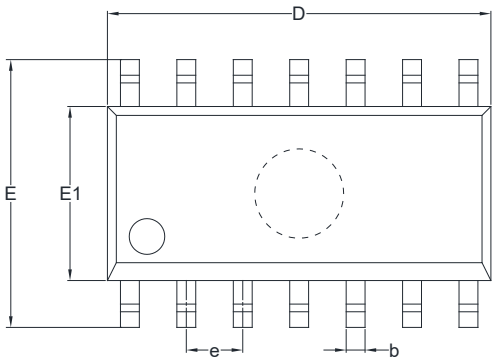


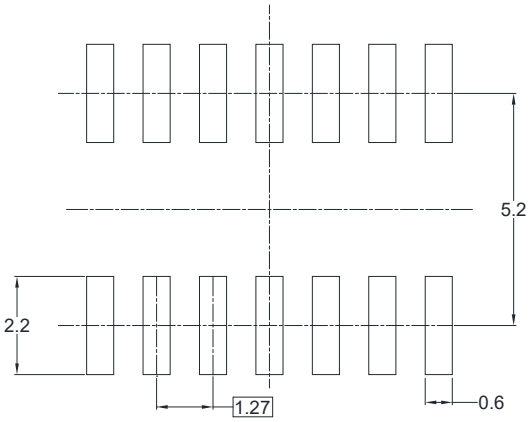
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

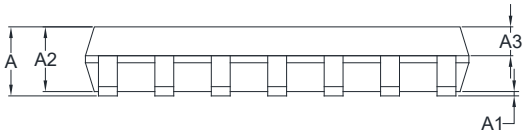
PACKAGE OUTLINE DIMENSIONS

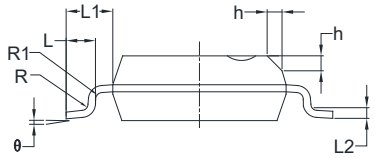
SOIC-14





RECOMMENDED LAND PATTERN (Unit: mm)



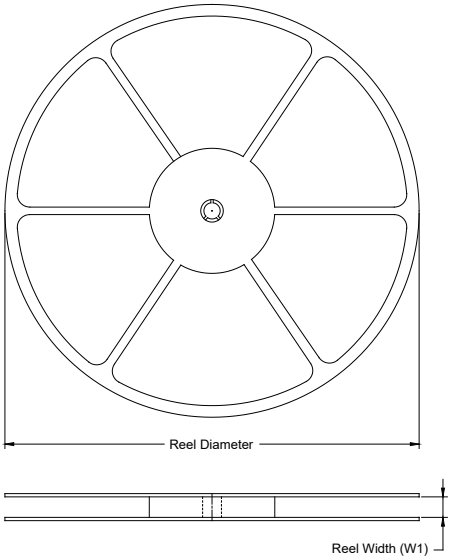


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80	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°

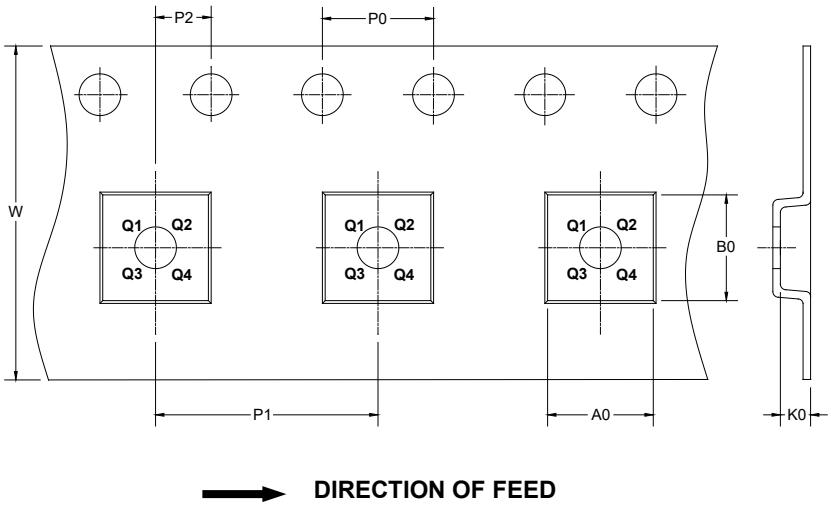
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



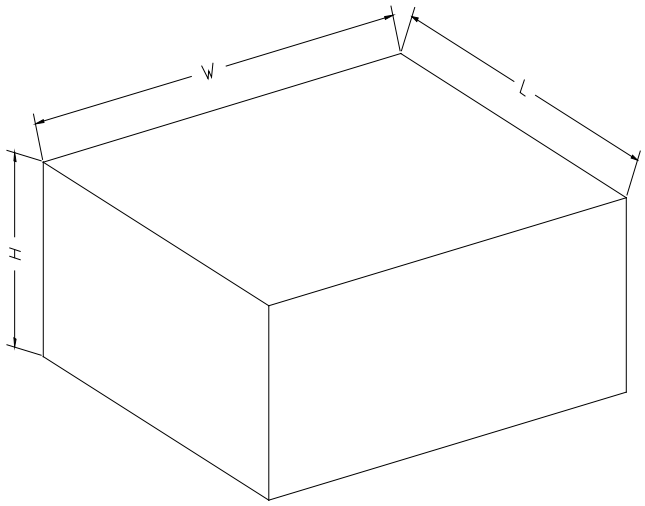
NOTE: The picture is only for reference. Please make the object as the standard.

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

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
7″ (Option)	368	227	224	8
7″	442	410	224	18
13″	386	280	370	5

DD0002