



SGM8048

690nA, Non-Unity Gain, Quad Rail-to-Rail Input/Output Operational Amplifier

PRODUCT DESCRIPTION

The SGM8048 operates with a single supply voltage as low as 1.4V, while drawing less than 690nA (TYP) of quiescent current per amplifier. This device is also designed to support rail-to-rail input and output operation. This combination of features supports battery-powered and portable applications.

The SGM8048 has a gain-bandwidth product of 100kHz (TYP) and is stable for gains ≥ 10 . The combination of characteristics makes the SGM8048 ideal for low frequency applications, such as battery current monitoring and sensor conditioning.

The SGM8048 operational amplifier is offered in quad configuration and it is specified for the extended industrial (-40°C to $+85^{\circ}\text{C}$) temperature range. The SGM8048 is available in the Green SOP14, TSSOP14 packages.

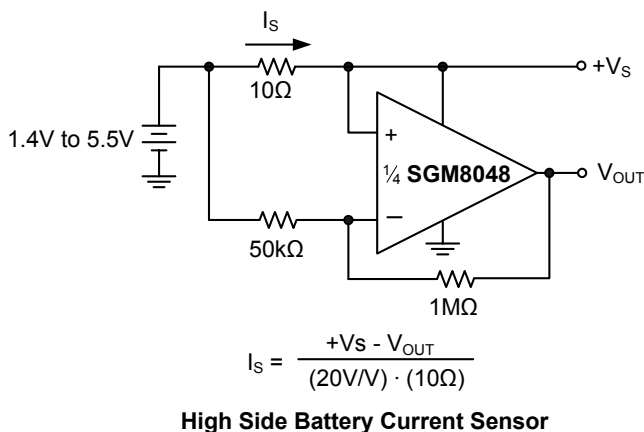
FEATURES

- **Low Quiescent Current: 690nA/Amplifier (TYP)**
- **Rail-to-Rail Input and Output**
- **Gain Bandwidth Product: 100kHz (TYP)**
- **Stable for Gains ≥ 10**
- **Wide Supply Voltage Range: 1.4V to 5.5V**
- **-40°C to $+85^{\circ}\text{C}$ Operating Temperature Range**
- **Available in Green SOP14, TSSOP14 Packages**

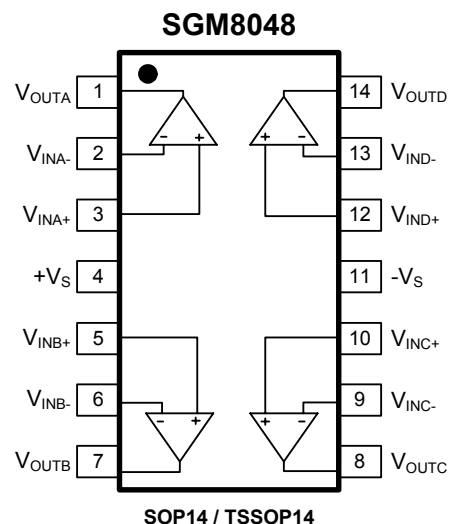
APPLICATIONS

Toll Booth Tags
Wearable Products
Temperature Measurement
Battery Powered System

TYPICAL APPLICATION



PIN CONFIGURATIONS (Top View)



PACKAGE/ORDERING INFORMATION

MODEL	ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
SGM8048	SGM8048YS14G/TR	SOP14	Tape and Reel, 2500	SGM8048YS14
	SGM8048YTS14G/TR	TSSOP14	Tape and Reel, 3000	SGM8048YTS14

ABSOLUTE MAXIMUM RATINGS

Supply Voltage 6V
 Analog Inputs (V_{IN+} , V_{IN-}) $(-V_S) - 0.1V$ to $(+V_S) + 0.1V$
 Differential Input Voltage $|(-V_S) - (+V_S)|$
 Storage Temperature Range $-65^{\circ}C$ to $+150^{\circ}C$
 Junction Temperature $150^{\circ}C$
 Operating Temperature Range $-40^{\circ}C$ to $+85^{\circ}C$
 Lead Temperature Range (Soldering 10 sec)
 $260^{\circ}C$
 ESD Susceptibility
 HBM 4000V
 MM 400V

NOTE:

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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.

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ELECTRICAL CHARACTERISTICS

$+V_S = +1.4V$ to $+5.0V$, $-V_S = GND$, $T_A = +25^\circ C$, $A_V = 10$, $V_{CM} = +V_S / 2$, $V_{OUT} \approx +V_S / 2$ and $R_L = 1M\Omega$ to $+V_S / 2$ ⁽¹⁾, unless otherwise noted.

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
DC ELECTRICAL CHARACTERISTICS						
Input Offset Voltage (V _{OS})		V _{CM} = +V _S /2		0.8	2.5	mV
Input Offset Voltage Drift (ΔV _{OS} /ΔT)		V _{CM} = +V _S /2, -40°C ≤ T _A ≤ +85°C		2.5		μV/°C
Power Supply Rejection Ratio (PSRR)		+V _S = 1.4V to 5.5V	74	80		dB
Common-Mode Input Range (V _{CMR})			-V _S - 0.1		+V _S + 0.1	V
Common-Mode Rejection Ratio (CMRR)		+V _S = 5.0V, V _{CM} = -0.1V to 5.1V	68	83		dB
		+V _S = 5.0V, V _{CM} = 2.5V to 5.1V	65	81		
		+V _S = 5.0V, V _{CM} = -0.1V to 2.5V	70	79		
Large Signal Voltage Gain (A _{VO})		+V _S = 1.4V, R _L = 50kΩ, V _{OUT} = +V _S - 0.1V	70	79		dB
		+V _S = 2.5V, R _L = 50kΩ, V _{OUT} = +V _S - 0.1V		88		
		+V _S = 5.0V, R _L = 50kΩ, V _{OUT} = +V _S - 0.1V	83	92		
Input Bias Current (I _B)				1		pA
Input Offset Current (I _{OS})				1		pA
Maximum Output Voltage Swing	V _{OH}	+V _S = 1.4V, R _L = 50kΩ	1.390	1.395		V
		+V _S = 2.5V, R _L = 50kΩ		2.497		
		+V _S = 5.0V, R _L = 50kΩ	4.990	4.996		
	V _{OL}	+V _S = 1.4V, R _L = 50kΩ		5.4	10	mV
		+V _S = 2.5V, R _L = 50kΩ		3.4		
		+V _S = 5.0V, R _L = 50kΩ		3.7	10	
Short Circuit Current (I _{SC})		+V _S = 2.5V		5.3		mA
		+V _S = 5.0V	22	23		
Supply Voltage			1.4		5.5	V
Quiescent Current / per Amplifier (I _Q)		+V _S = 1.4V		550		nA
		+V _S = 2.5V		680		
		+V _S = 5.0V		690	1500	

Specifications subject to changes without notice.

ELECTRICAL CHARACTERISTICS

$+V_S = +1.4V$ to $+5.0V$, $-V_S = GND$, $T_A = +25^\circ C$, $A_V = 10$, $V_{CM} = +V_S / 2$, $V_{OUT} \approx +V_S / 2$ and $R_L = 1M\Omega$ to $+V_S / 2$, $C_L = 60pF$ ⁽¹⁾, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
AC ELECTRICAL CHARACTERISTICS					
Gain-Bandwidth Product			100		kHz
Slew Rate (SR)	$+V_S = 1.4V$, $V_{OUT} = 1V$ Step		8		V/ms
	$+V_S = 2.5V$, $V_{OUT} = 1V$ Step		13.5		
	$+V_S = 5.0V$, $V_{OUT} = 2V$ Step		14.5		
Phase Margin (PM)	$+V_S = 1.4V$ to $5.5V$		60		°
Input Voltage Noise (e_n p-p)	$+V_S = 1.4V$, $f = 0.1Hz$ to $10Hz$		3.7		μV_{P-P}
	$+V_S = 2.5V$, $f = 0.1Hz$ to $10Hz$		3.7		
	$+V_S = 5.0V$, $f = 0.1Hz$ to $10Hz$		3.5		
Input Voltage Noise Density (e_n)	$+V_S = 1.4V$, $f = 1kHz$		240		nV/ $\sqrt{Hz}$
	$+V_S = 2.5V$, $f = 1kHz$		190		
	$+V_S = 5.0V$, $f = 1kHz$		205		

NOTE1: Refer to Figure 1 and Figure 2.

Specifications subject to changes without notice.

TEST CIRCUITS

The test circuits used for the DC and AC tests are shown in Figure 1 and Figure 2. The bypass capacitors are laid out according to the rules discussed in “Supply Bypass”.

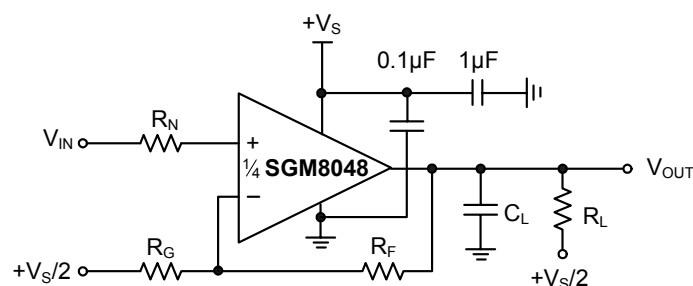


Figure 1. AC and DC Test Circuit for Most Non-Inverting Gain Conditions.

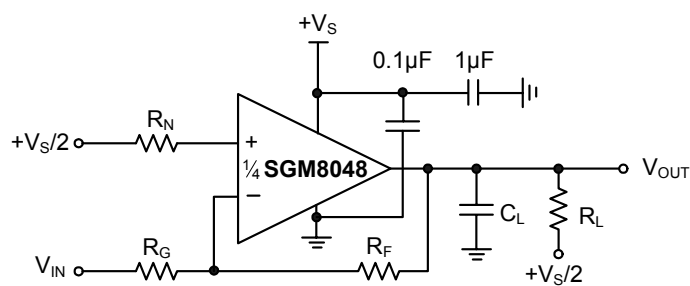
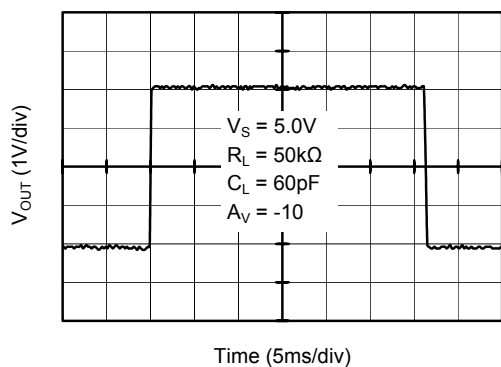


Figure 2. AC and DC Test Circuit for Most Inverting Gain Conditions.

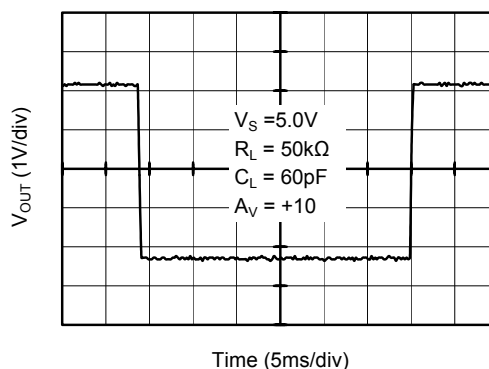
TYPICAL PERFORMANCE CHARACTERISTICS

$T_A = +25^\circ\text{C}$, $+V_S = +1.4\text{V}$ to $+5.0\text{V}$, $-V_S = \text{GND}$, $A_V = 10$, $V_{CM} = +V_S / 2$, $V_{OUT} \approx +V_S / 2$ and $R_L = 1\text{M}\Omega$ to $+V_S / 2$, $C_L = 60\text{pF}$, unless otherwise noted.

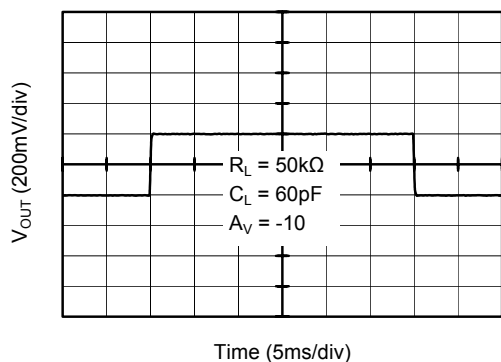
Large Signal Inverting Pulse Response



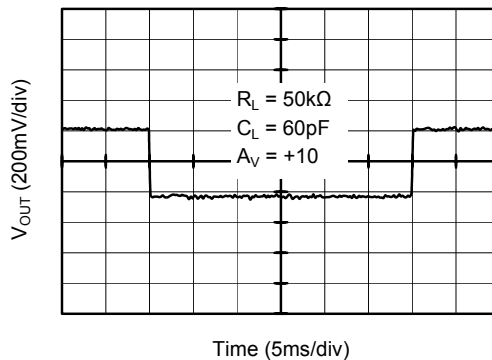
Large Signal Non-Inverting Pulse Response



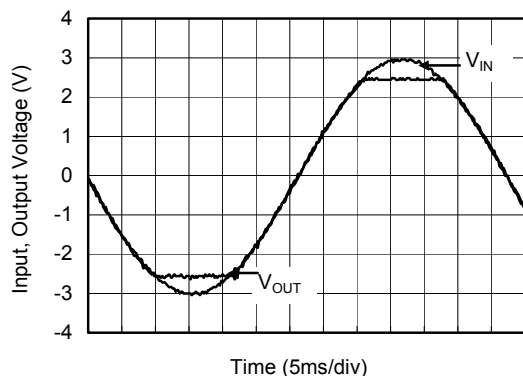
Small Signal Inverting Pulse Response



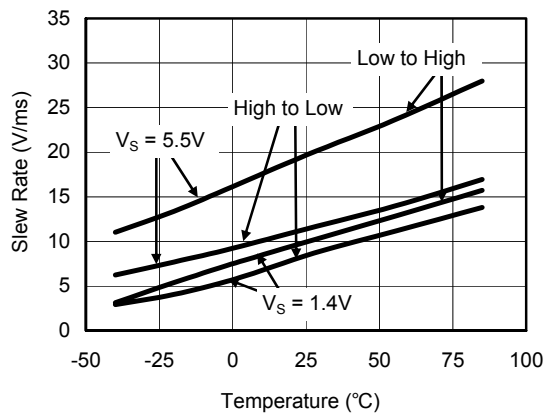
Small Signal Non-Inverting Pulse Response



No Phase Reversal

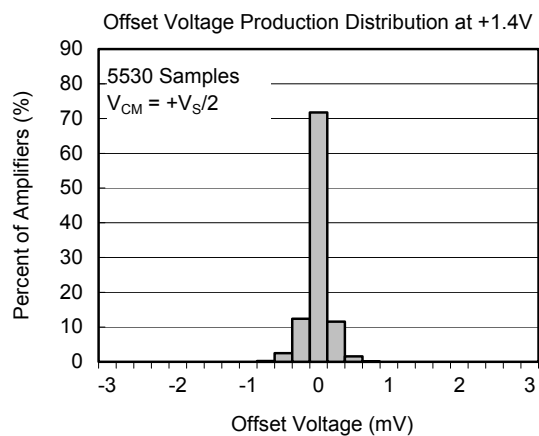
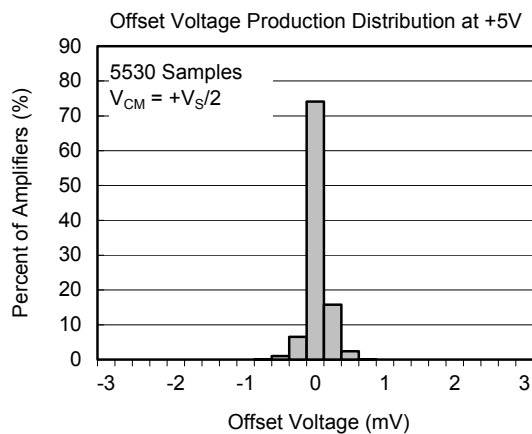


Slew Rate vs. Temperature



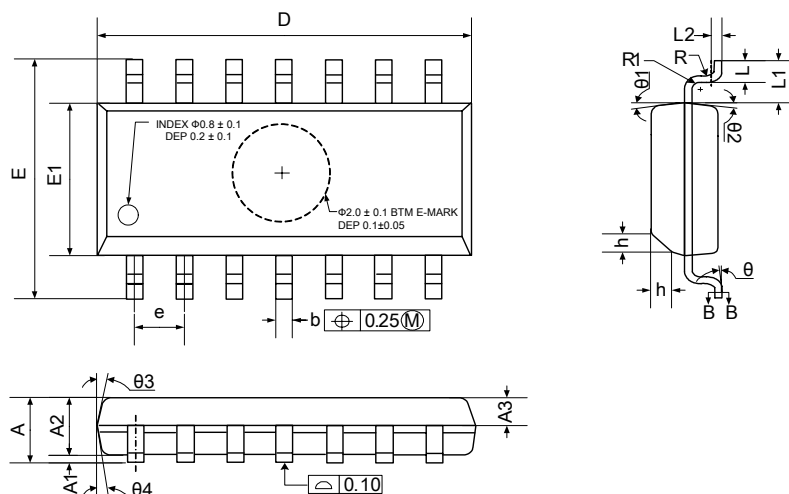
TYPICAL PERFORMANCE CHARACTERISTICS

$T_A = +25^\circ\text{C}$, $+V_S = +1.4\text{V}$ to $+5.0\text{V}$, $-V_S = \text{GND}$, $A_V = 10$, $V_{CM} = +V_S / 2$, $V_{OUT} \approx +V_S / 2$ and $R_L = 1\text{M}\Omega$ to $+V_S / 2$, $C_L = 60\text{pF}$, unless otherwise noted.



PACKAGE OUTLINE DIMENSIONS

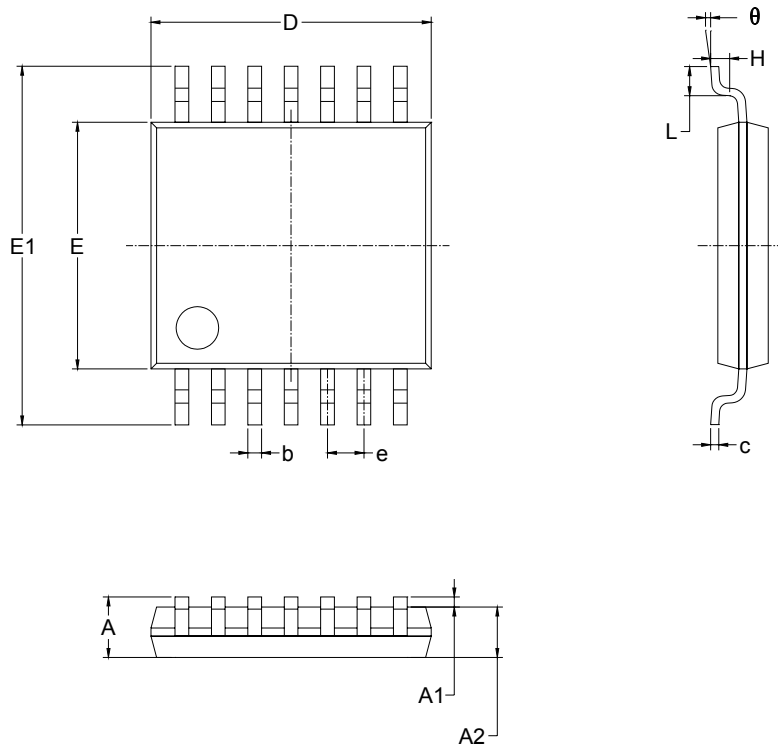
SOP14



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	MIN	MOD	MAX	MIN	MOD	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
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°
θ1	6°	8°	10°	6°	8°	10°
θ2	6°	8°	10°	6°	8°	10°
θ3	5°	7°	9°	5°	7°	9°
θ4	5°	7°	9°	5°	7°	9°

PACKAGE OUTLINE DIMENSIONS

TSSOP14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	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°

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SGMICRO is dedicated to provide high quality and high performance analog IC products to customers. All SGMICRO products meet the highest industry standards with strict and comprehensive test and quality control systems to achieve world-class consistency and reliability.

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