



# SGM8924

## 9MHz, Dual Rail-to-Rail Output Operational Amplifier with Shutdown

### PRODUCT DESCRIPTION

The SGM8924 is a dual, rail-to-rail output operational amplifier that is optimized and fully specified for 5V operation. High output current allows low load impedances to be driven.

The SGM8924 has a wide input common mode voltage range and output voltage swing, running at single supply voltage from 3V to 5.5V.

The SGM8924 provides excellent overall performance. It exhibits low noise and distortion, low offset and high output current capability, making this device an excellent choice for high quality, low voltage or battery operated audio systems.

The SGM8924 is offered in Green MSOP-10 package. It is specified over the extended -40°C to +85°C temperature range.

### FEATURES

- **Rail-to-Rail Output**
- **Low Noise:**  $6\text{nV}/\sqrt{\text{Hz}}$
- **Low Distortion**
- **Output Voltage Swing High: 4.75V**  
(with 150mA Output Current)
- **Output Voltage Swing Low: 0.3V**  
(with 150mA Output Current)
- **Supply Voltage Range: 3V to 5.5V**
- **Thermal Shutdown Protection Circuitry**
- **Low Input Offset Voltage**  
**1mV MAX (SGM8924A)**
- **Gain-Bandwidth Product: 9MHz**
- **Slew Rate: 5.13V/ $\mu\text{s}$**
- **Low Supply Current**  
**5.5mA/Amplifier (TYP)**
- **Small Packaging:**  
**Available in Green MSOP-10 Package**

### APPLICATIONS

Data Acquisition  
Process Control  
Active Filters  
Test Equipment  
Mobile Phone  
Audio Processing  
Video Processing  
Headphone Amplifier  
Portable Equipment  
Broadband Communications  
A-to-D Driver  
D-to-A Driver

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## PACKAGE/ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM8924A	MSOP-10	-40°C to +85°C	SGM8924AYMS10G/TR	SGM8924YMS10	Tape and Reel, 3000
SGM8924	MSOP-10	-40°C to +85°C	SGM8924YMS10G/TR	SGM8924YMS10	Tape and Reel, 3000

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage, +V <sub>S</sub> to -V <sub>S</sub>	.....6V
Common Mode Input Voltage	..... -0.1V to 3.8V
Storage Temperature Range	.....-65°C to 150°C
Junction Temperature	.....150°C
Operating Temperature Range	..... -40°C to 85°C
Lead Temperature (Soldering 10sec)	.....260°C
ESD Susceptibility	
HBM	.....8000V
MM	.....400V

### NOTE:

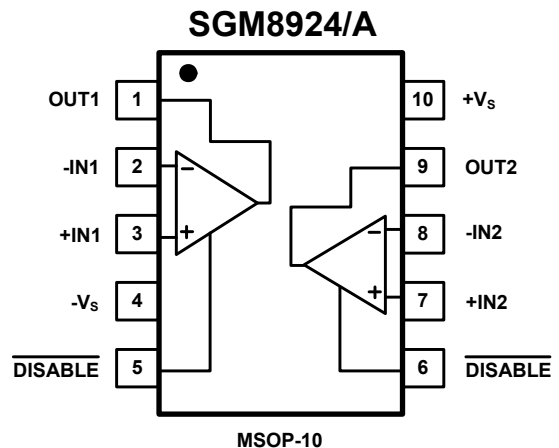
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure 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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

## PIN CONFIGURATION (TOP VIEW)



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## ELECTRICAL CHARACTERISTICS: $V_S = +5V$

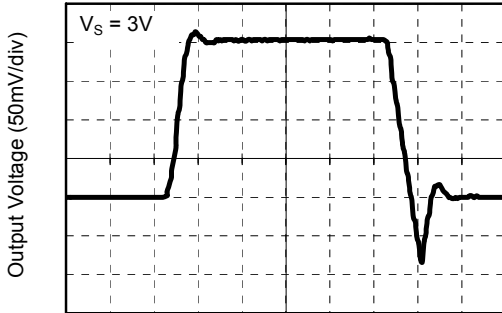
(At  $V_S = 5V$ ,  $T_A = -40^\circ C$  to  $+85^\circ C$ ,  $R_L = 600\Omega$  connected to  $V_S/2$ , unless otherwise noted.)

PARAMETER	CONDITIONS	SGM8924					
		TYP	MIN/MAX OVER TEMPERATURE			UNITS	MIN /MAX
		+25°C	+25°C	-40°C to +85°C			
<b>DYNAMIC PERFORMANCE</b>							
Gain-Bandwidth Product (GBP)	$R_L = 600\Omega$	8.9			MHz	TYP	
Slew Rate	2Vpp step, $A_V = 1$	5.13			V/ $\mu s$	TYP	
Crosstalk	$f = 1kHz$	-120			dB	TYP	
<b>NOISE/DISTORTION PERFORMANCE</b>							
Total Harmonic Distortion + Noise (THD)	$V_{OUT} = 2V_{pp}$ , $f = 1kHz$ , $A_V = 1$ , $R_L = 600\Omega$	0.005			%	TYP	
Input Voltage Noise ( $e_n$ )	$f = 1kHz$	6			nV/ $\sqrt{Hz}$	TYP	
Phase Margin	$R_L = 600\Omega$ , $C_L = 100pF$	45			degree	TYP	
<b>DC PERFORMANCE</b>							
Input Offset Voltage ( $V_{OS}$ )							
SGM8924	$V_{CM} = 2.5V$	-0.05	3	3.5	mV	MAX	
SGM8924A	$V_{CM} = 2.5V$	-0.05	1	1.5	mV	MAX	
Input Offset Voltage Drift		1.5			$\mu V/^\circ C$	TYP	
Large Signal Voltage Gain ( $A_{VO}$ )	$R_L = 600\Omega$ , $V_{OUT} = 0.15V$ to $4.85V$	105	100	95	dB	MIN	
	$R_L = 10k\Omega$ , $V_{OUT} = 0.05V$ to $4.95V$	105	100	96	dB	MIN	
<b>INPUT CHARACTERISTICS</b>							
Input Common Mode Voltage Range ( $V_{CM}$ )	$V_{CM} = -0.1V$ to $3.8V$	-0.1 to 3.8			V	TYP	
Common Mode Rejection Ratio (CMRR)	$V_S = 5.5V$ , $V_{CM} = -0.1V$ to $3.8V$	102	88	86	dB	MIN	
<b>OUTPUT CHARACTERISTICS</b>							
Output Voltage Swing from Rails							
High Output Voltage Swing ( $V_{OH}$ )	$I_{OUT} = 150mA$	4.84	4.8	4.75	V	MIN	
Low Output Voltage Swing ( $V_{OL}$ )	$I_{OUT} = -150mA$	0.16	0.24	0.3	V	MAX	
Output Short Circuit Current		215	212	205	mA	MIN	
<b>POWER-DOWN DISABLE</b>							
$\overline{DISABLE}$ High			2.2		V	MIN	
$\overline{DISABLE}$ Low			0.8		V	MAX	
<b>POWER SUPPLY</b>							
Operating Voltage Range			3	3	V	MIN	
			5.5	5.5	V	MAX	
Quiescent Current (per Amplifier)	$I_{OUT} = 0mA$	5.5	6.5	7.1	mA	MAX	
Shutdown Supply Current	$\overline{DISABLE} = 0.5V$	3.9	5.5	6.7	$\mu A$	MAX	
Power Supply Rejection Ratio (PSRR)	$V_S = +2.5V$ to $+5.5V$ , $V_{CM} = (-V_S) + 0.5V$	86	75	71	dB	MIN	

**TYPICAL PERFORMANCE CHARACTERISTICS**

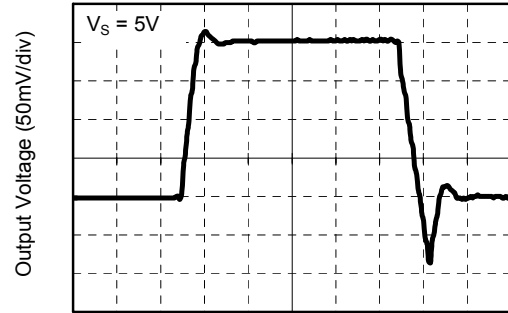
At  $T_A = +25^\circ\text{C}$ ,  $A_V = +1$ ,  $C_L = 100\text{pF}$  and  $R_L = 600\Omega$ , unless otherwise noted.

Small Signal Step Response



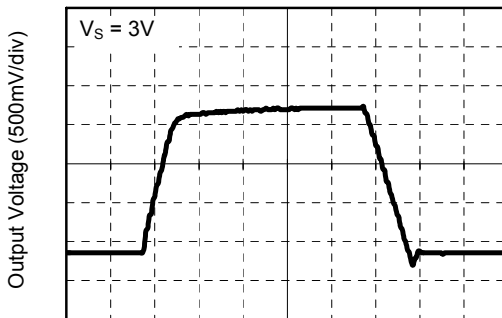
Time (100ns/div)

Small Signal Step Response



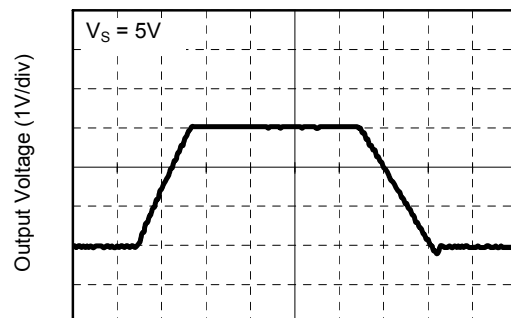
Time (100ns/div)

Large Signal Step Response



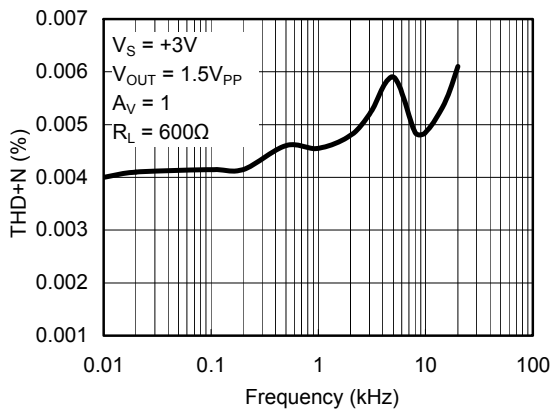
Time (500ns/div)

Large Signal Step Response

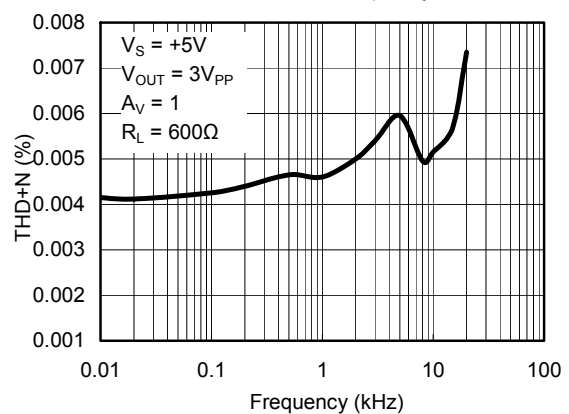


Time (500ns/div)

THD+N vs. Frequency

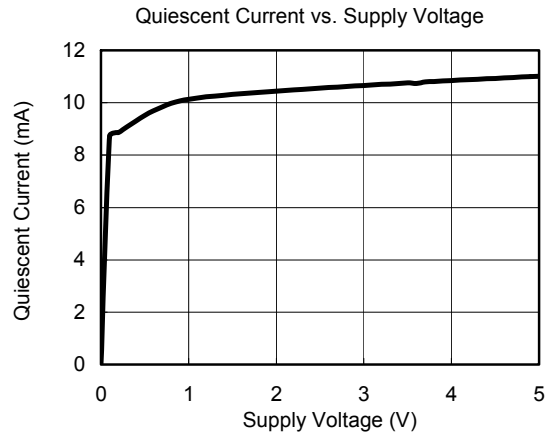
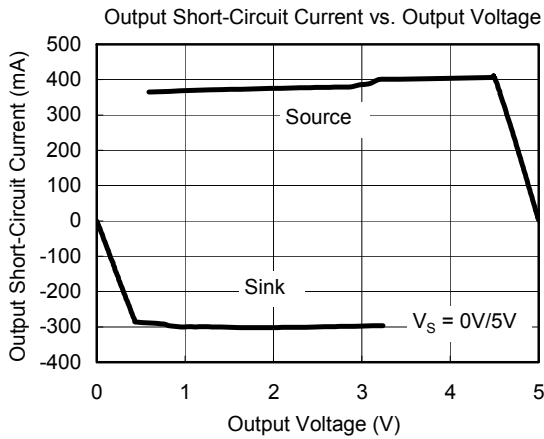


THD+N vs. Frequency



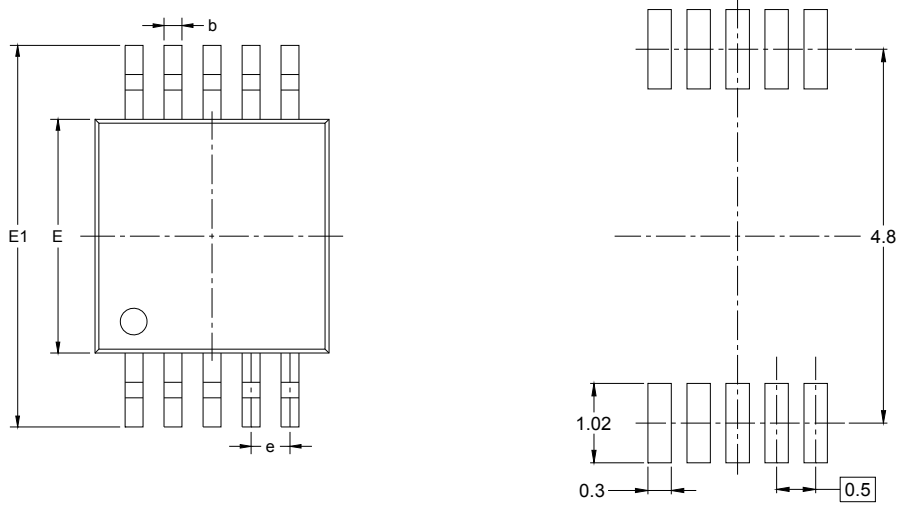
TYPICAL PERFORMANCE CHARACTERISTICS

At  $T_A = +25^\circ\text{C}$ ,  $A_V = +1$ ,  $C_L = 100\text{pF}$  and  $R_L = 600\Omega$ , unless otherwise noted.

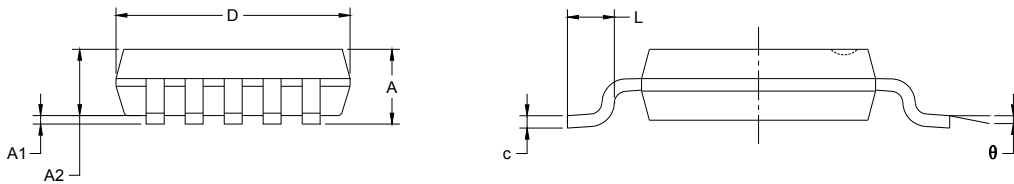


PACKAGE OUTLINE DIMENSIONS

MSOP-10



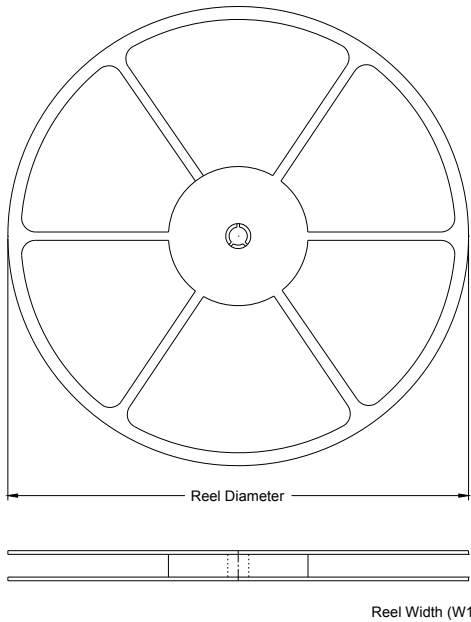
RECOMMENDED LAND PATTERN (Unit: mm)



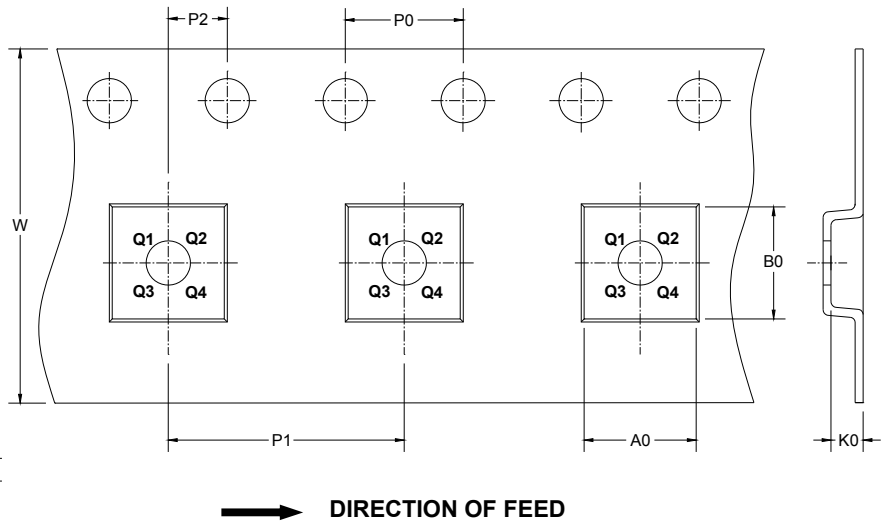
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.500 BSC		0.020 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

**TAPE AND REEL INFORMATION**

**REEL DIMENSIONS**



**TAPE DIMENSIONS**



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

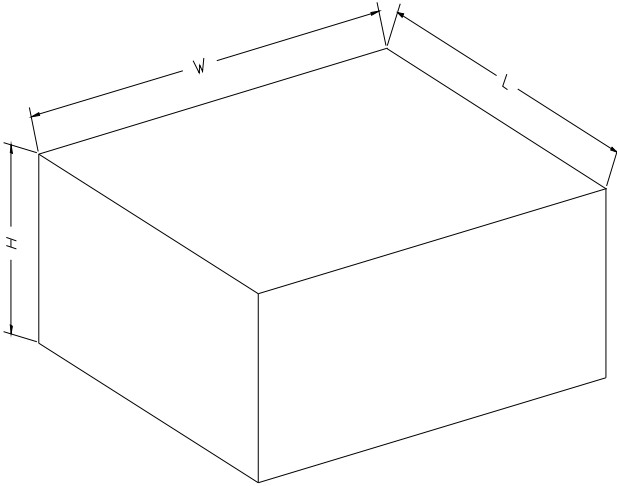
**KEY PARAMETER LIST OF TAPE AND REEL**

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
MSOP-10	13"	12.4	5.2	3.3	1.2	4.0	8.0	2.0	12.0	Q1

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## 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