



SGM8301/2/4 100MHz, High Voltage, Rail-to-Rail Output Amplifiers

GENERAL DESCRIPTION

The SGM8301 (single), SGM8302 (dual) and SGM8304 (quad) are unity gain stable devices that combine high speed performance and rail-to-rail outputs. These devices are targeted for applications where an input or an output is exposed to the outside world, such as video and communications.

These devices can operate from $\pm 2.25V$ to $\pm 6V$ dual power supplies or from $+4.5V$ to $+12V$ single supplies. The common mode input voltage range extends to the negative power-supply rail (ground in single-supply applications).

The SGM8301/2/4 consume only 8.5mA of quiescent supply current per amplifier while achieving a 100MHz -3dB bandwidth, 56MHz small signal bandwidth for -0.1dB gain flatness, and a 155V/ μ s slew rate.

The SGM8301 single is available in Green SOT-23-5, MSOP-8 and SOIC-8 packages. The SGM8302 dual is available in Green SOIC-8 and MSOP-8 packages. The SGM8304 quad is available in Green SOIC-14 and TSSOP-14 packages. The SGM8301/2/4 are specified over the extended $-40^{\circ}C$ to $+85^{\circ}C$ temperature range.

FEATURES

- **+4.5V to +12V Single Supplies or $\pm 2.25V$ to $\pm 6V$ Dual Power Supplies**
- **High Speed**
 - 100MHz -3dB Bandwidth**
 - 56MHz -0.1dB Gain Flatness**
 - 155V/ μ s Slew Rate**
- **Rail-to-Rail Output**
- **Low Differential Gain/Phase: 0.02%/0.02°**
- **High Output Drive: 103mA**
- **$-40^{\circ}C$ to $+85^{\circ}C$ Operating Temperature Range**
- **Small Packaging:**
 - SGM8301 Available in SOT-23-5, SOIC-8 and MSOP-8**
 - SGM8302 Available in MSOP-8 and SOIC-8**
 - SGM8304 Available in SOIC-14 and TSSOP-14**

APPLICATIONS

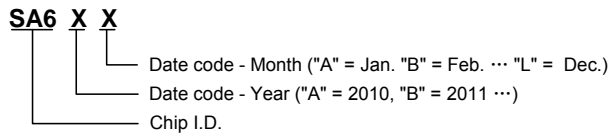
Video Line Driver
Video-on-Demand
Set-Top Boxes
Surveillance Video Systems
Analog-to-Digital Converter Interface
CCD Imaging Systems
Digital Cameras

PACKAGE/ORDERING INFORMATION

MODEL	ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
SGM8301	SGM8301YS8G/TR	SOIC-8	Tape and Reel, 2500	SGM8301YS8
	SGM8301YMS8G/TR	MSOP-8	Tape and Reel, 3000	SGM8301YMS8
	SGM8301YN5G/TR	SOT-23-5	Tape and Reel, 3000	SA6XX
SGM8302	SGM8302YS8G/TR	SOIC-8	Tape and Reel, 2500	SGM8302YS8
	SGM8302YMS8G/TR	MSOP-8	Tape and Reel, 3000	SGM8302YMS8
SGM8304	SGM8304YS14G/TR	SOIC-14	Tape and Reel, 2500	SGM8304YS14
	SGM8304YTS14G/TR	TSSOP-14	Tape and Reel, 3000	SGM8304YTS14

NOTE: Package marking is defined as the follow:

MARKING INFORMATION



For example: SA6CA (2012, January)

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (+V _S to -V _S)	-0.3V to +13.2V
IN ₊ , IN ₋ , OUT ₋	(-V _S - 0.3V) to (+V _S + 0.3V)
Differential Input Voltage	±2.5V
Operating Temperature Range	-40°C to +85°C
Junction Temperature.....	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM (SGM8301/4).....	3000V
HBM (SGM8302).....	2000V
MM.....	250V

NOTE:

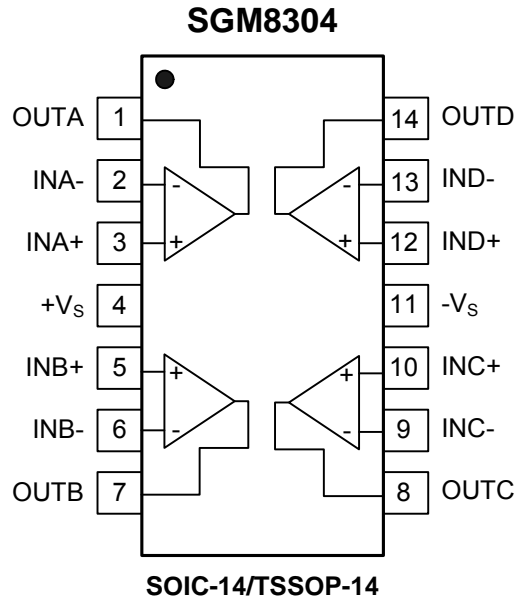
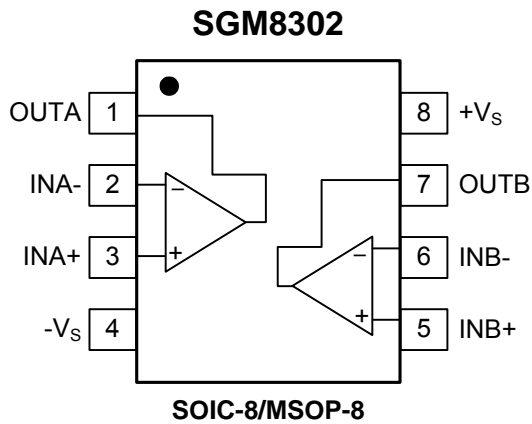
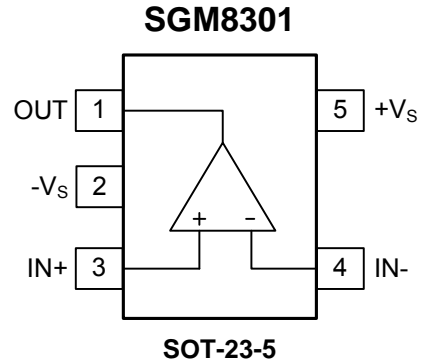
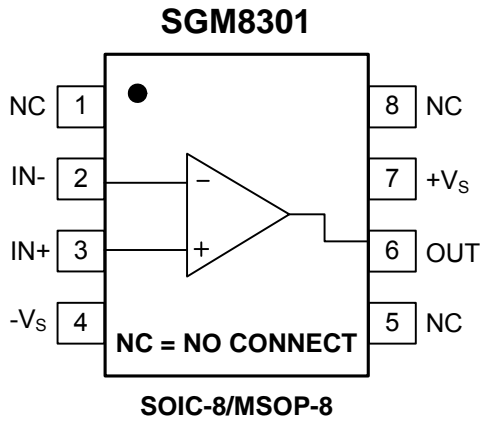
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



ELECTRICAL CHARACTERISTICS: $V_S = +5V$ (At $T_A = +25^\circ\text{C}$, $V_{CM} = V_S/2$, $V_{OUT} = V_S/2$ and $R_L = 100\Omega$ to $V_S/2$, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
DC PERFORMANCE					
Quiescent Current/Amplifier (I_Q)	$I_{OUT} = 0\text{mA}$		7.5	10.2	mA
Input Offset Voltage (V_{OS})		-18	5	18	mV
	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	-21.5		21.5	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			12		$\mu\text{V}/^\circ\text{C}$
Open-Loop Gain (A_{OL})	$R_L = 50\Omega$, $1.3\text{V} \leq V_{OUT} \leq 3.7\text{V}$		88		dB
	$R_L = 150\Omega$, $0.6\text{V} \leq V_{OUT} \leq 4.4\text{V}$	82	100		
	$R_L = 2\text{k}\Omega$, $0.4\text{V} \leq V_{OUT} \leq 4.6\text{V}$	85	105		
Power Supply Rejection Ratio (PSRR)	$V_S = 4.5\text{V}$ to 13.2V	65	80		dB
Common Mode Rejection Ratio (CMRR)	$V_{CM} = -0.1\text{V}$ to 2.75V	58	75		dB
High Output Voltage Swing from Rail (V_{OH})	$R_L = 2\text{k}\Omega$ to $V_S/2$		60	115	mV
	$R_L = 150\Omega$ to $V_S/2$		405	517	
	$R_L = 75\Omega$ to $V_S/2$		700		
	$R_L = 75\Omega$ to ground		1.515		V
Low Output Voltage Swing from Rail (V_{OL})	$R_L = 2\text{k}\Omega$ to $V_S/2$		33	49.5	mV
	$R_L = 150\Omega$ to $V_S/2$		340	428	
	$R_L = 75\Omega$ to $V_S/2$		600		
	$R_L = 75\Omega$ to ground		3.2		
Output Current (I_{OUT})	$R_L = 75\Omega$ to V_S , sink	39.5	50		mA
	$R_L = 75\Omega$ to ground, source	37	47		
Output Short Circuit Current (I_{SC})	$R_L = 10\Omega$ to V_S , sink		100		mA
	$R_L = 10\Omega$ to ground, source		75		
AC PERFORMANCE					
Small-Signal -3dB Bandwidth (BW_{SS})	$G = +1$		110		MHz
Large-Signal -3dB Bandwidth (BW_{LS})	$G = +1$		51		
Small-Signal Bandwidth for -0.1dB Gain Flatness ($BW_{0.1dBSS}$)	$G = +1$		52		
Large-Signal Bandwidth for -0.1dB Gain Flatness ($BW_{0.1dBLS}$)	$G = +1$		32		
Gain-Bandwidth Product (GBP)	$G = +100$		57		MHz
Phase Margin (PM)	$G = +100$		44		degrees
Channel-to-Channel Crosstalk	$V_{IN} = 200\text{mV}_{P-P}$, $f = 1\text{kHz}$		106		dB
Overload Recovery Time (ORT)	$f = 1\text{kHz}$		115		ns
Voltage Noise Density (e_n)	$f = 1\text{kHz}$		175		$\text{nV}/\sqrt{\text{Hz}}$
	$f = 10\text{kHz}$		65		
Slew Rate (SR) Up	$f = 1\text{kHz}$, $2V_{P-P}$ output		115		$\text{V}/\mu\text{s}$
Slew Rate (SR) Down	$f = 1\text{kHz}$, $2V_{P-P}$ output		140		$\text{V}/\mu\text{s}$
Settling Time to 0.1% (t_s)	$f = 1\text{kHz}$, $2V_{P-P}$ output		65		ns
Rise/Fall Time (t_R/t_F)	$f = 1\text{kHz}$, $V_{OUT} = 100\text{mV}_{P-P}$		7.8		ns
Differential Gain Error (DG)	NTSC		0.09		%
Differential Phase Error (DP)	NTSC		0.4		degrees

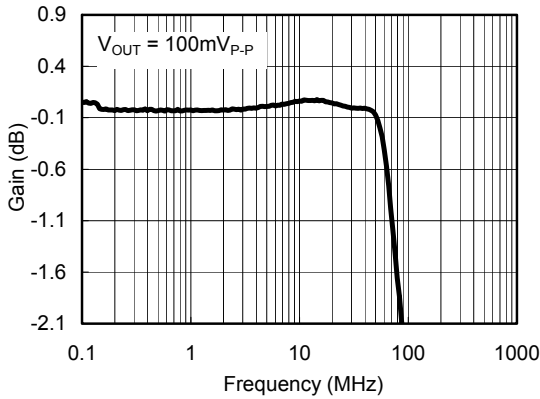
ELECTRICAL CHARACTERISTICS: $V_S = \pm 6V$ (At $T_A = +25^\circ\text{C}$, $V_{CM} = 0V$, $V_{OUT} = 0V$ and $R_L = 100\Omega$ to ground, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
DC PERFORMANCE					
Quiescent Current/Amplifier (I_Q)	$I_{OUT} = 0\text{mA}$		8.5	11.3	mA
Input Offset Voltage (V_{OS})		-18	5	18	mV
	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	-21.5		21.5	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			11		$\mu\text{V}/^\circ\text{C}$
Open-Loop Gain (A_{OL})	$R_L = 150\Omega$, $-4.5V \leq V_{OUT} \leq 4.5V$	85	94		dB
	$R_L = 2k\Omega$, $-4.9V \leq V_{OUT} \leq 4.9V$	90	110		
Common Mode Rejection Ratio (CMRR)	$V_{CM} = -6.1V$ to $3.75V$	66	82		dB
High Output Voltage Swing from Rail (V_{OH})	$R_L = 2k\Omega$ to ground		90	147	mV
	$R_L = 150\Omega$ to ground		760	956	
Low Output Voltage Swing from Rail (V_{OL})	$R_L = 2k\Omega$ to ground		87	116	mV
	$R_L = 150\Omega$ to ground		888	1080	
Output Current (I_{OUT})	$R_L = 75\Omega$ to V_S	71	103		mA
	$R_L = 75\Omega$ to $-V_S$	53	90		
AC PERFORMANCE					
Small-Signal -3dB Bandwidth (BW_{SS})	$G = +1$		100		MHz
Large-Signal -3dB Bandwidth (BW_{LS})	$G = +1$		44		
Small-Signal Bandwidth for -0.1dB Gain Flatness ($BW_{0.1dBSS}$)	$G = +1$		56		
Large-Signal Bandwidth for -0.1dB Gain Flatness ($BW_{0.1dBLs}$)	$G = +1$		30		
Gain-Bandwidth Product (GBP)	$G = +100$		60		MHz
Phase Margin (PM)	$G = +100$		42		degrees
Channel-to-Channel Crosstalk	$V_{IN} = 200\text{mV}_{P-P}$, $f = 1\text{kHz}$		106		dB
Overload Recovery Time (ORT)	$f = 1\text{kHz}$		54		ns
Voltage Noise Density (e_n)	$f = 1\text{kHz}$		174		$\text{nV}/\sqrt{\text{Hz}}$
	$f = 10\text{kHz}$		65		
Slew Rate (SR) Up	$f = 1\text{kHz}$, $2V_{P-P}$ output		145		$\text{V}/\mu\text{s}$
Slew Rate (SR) Down	$f = 1\text{kHz}$, $2V_{P-P}$ output		155		$\text{V}/\mu\text{s}$
Settling Time to 0.1% (t_s)	$f = 1\text{kHz}$, $2V_{P-P}$ output		84		ns
Rise/Fall Time (t_r/t_f)	$f = 1\text{kHz}$, $V_{OUT} = 100\text{mV}_{P-P}$		7.5		ns
Differential Gain Error (DG)	NTSC		0.02		%
Differential Phase Error (DP)	NTSC		0.02		degrees

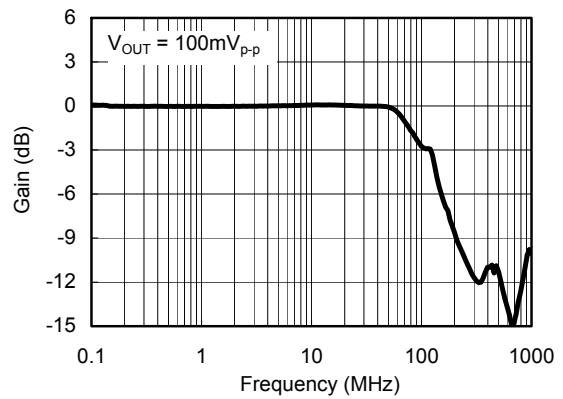
TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $+V_S = +5\text{V}$, $-V_S = -5\text{V}$, $V_{CM} = 0\text{V}$ and $R_L = 100\Omega$ to GND, unless otherwise noted.

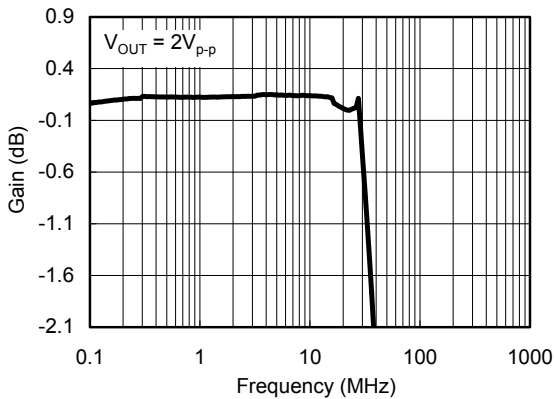
Small Signal Gain Flatness vs. Frequency



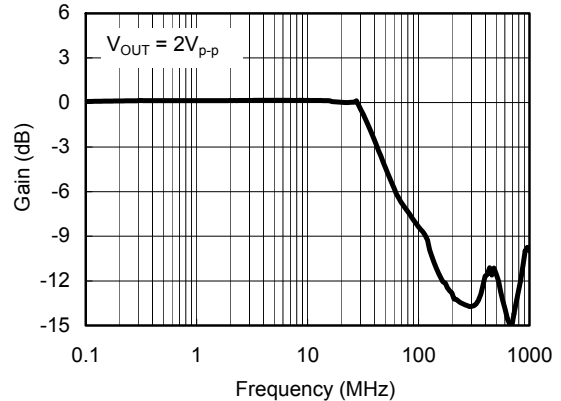
Small Signal Gain vs. Frequency



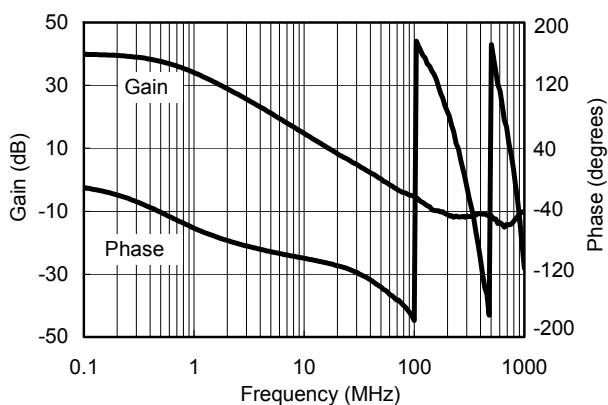
Large Signal Gain Flatness vs. Frequency



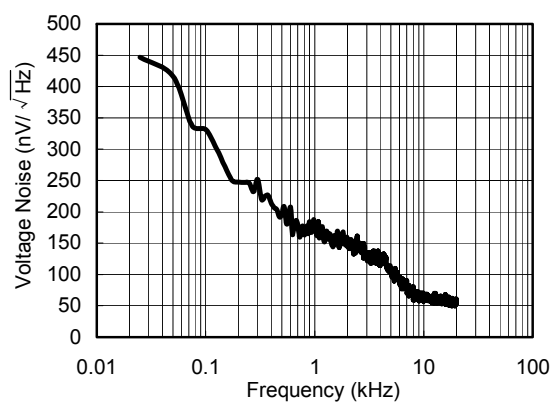
Large Signal Gain vs. Frequency



Gain and Phase vs. Frequency



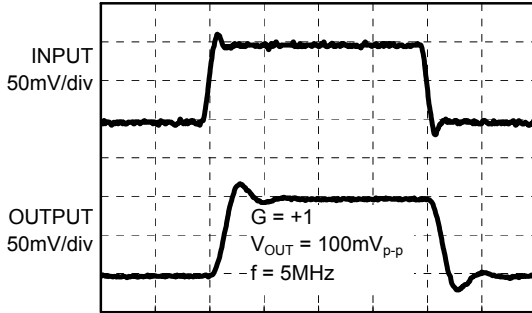
Voltage Noise vs. Frequency



TYPICAL PERFORMANCE CHARACTERISTICS

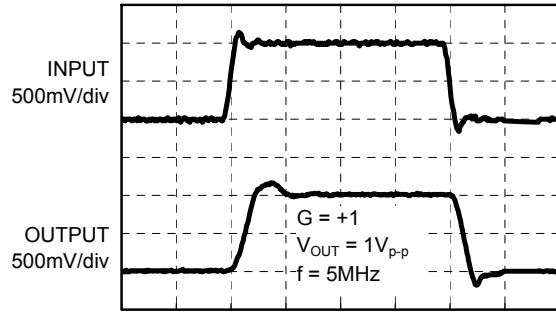
At $T_A = +25^\circ\text{C}$, $+V_S = +5\text{V}$, $-V_S = -5\text{V}$, $V_{CM} = 0\text{V}$ and $R_L = 100\Omega$ to GND, unless otherwise noted.

Small Signal Pulse Response



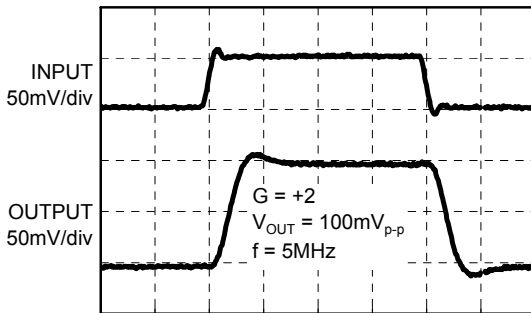
Time (25ns/div)

Large Signal Pulse Response



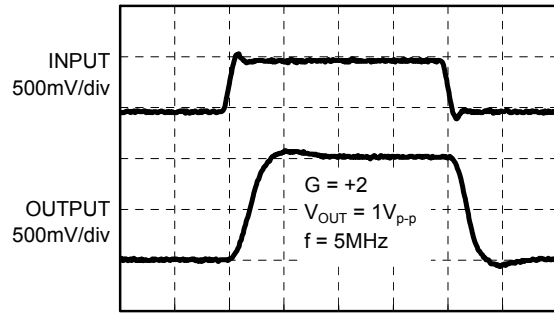
Time (25ns/div)

Small Signal Pulse Response



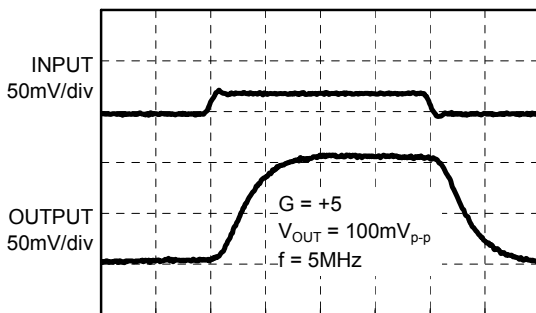
Time (25ns/div)

Large Signal Pulse Response



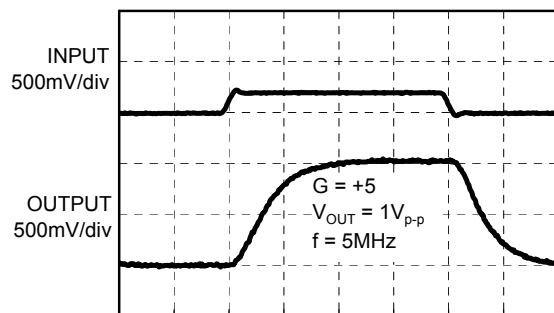
Time (25ns/div)

Small Signal Pulse Response



Time (25ns/div)

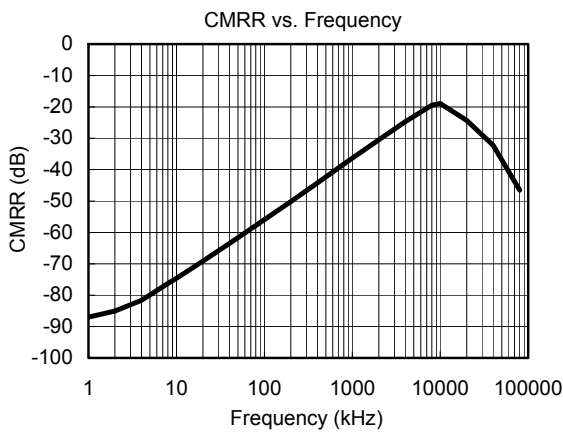
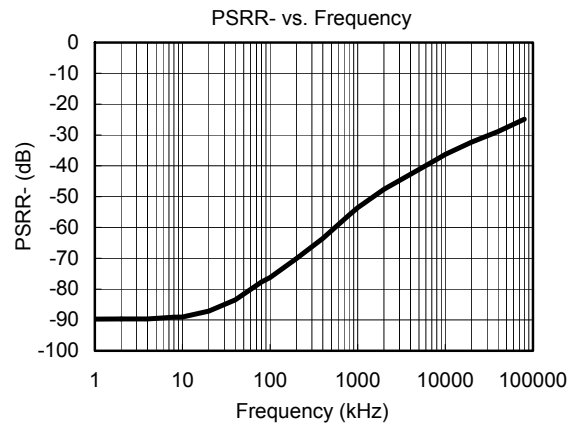
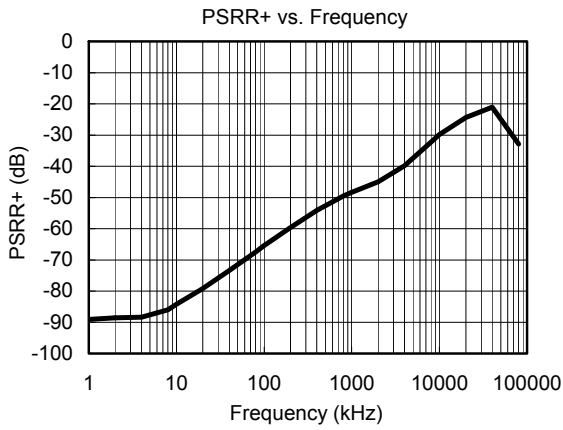
Large Signal Pulse Response



Time (25ns/div)

TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $+V_S = +5\text{V}$, $-V_S = -5\text{V}$, $V_{CM} = 0\text{V}$ and $R_L = 100\Omega$ to GND, unless otherwise noted.



TYPICAL APPLICATION CIRCUIT

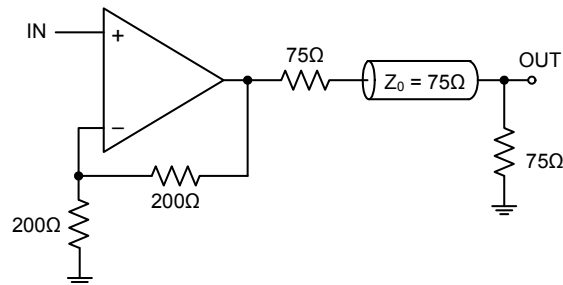


Figure 1. Video Line Driver

APPLICATION

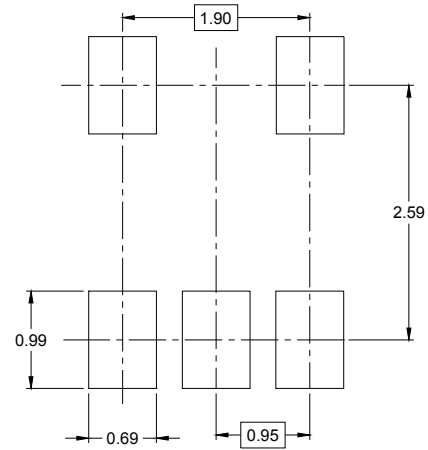
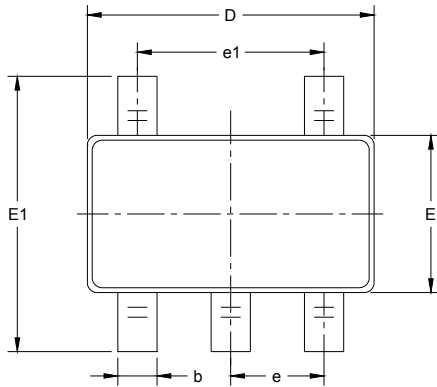
Layout and Power Supply Bypassing

The SGM8301/2/4 operate from single +4.5V to +12V or from dual $\pm 2.25\text{V}$ to $\pm 6\text{V}$ supplies. Bypass each supply with a $0.1\mu\text{F}$ capacitor as close to the pin as possible. SGMC recommends using micro-strip and stripline techniques to obtain full bandwidth. To ensure that the PC board does not degrade the amplifier's performance, design it for a frequency greater than 1GHz. Pay careful attention to inputs and outputs to avoid large parasitic capacitance. Whether or not you use a constant impedance board, observe the following design guidelines:

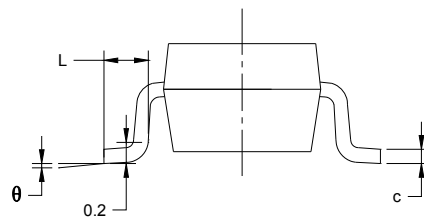
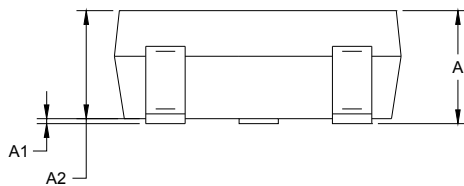
- Do not use wire-wrap boards; they are too inductive.
- Do not use IC sockets; they increase parasitic capacitance and inductance.
- Use surface-mount instead of through-hole components for better, high frequency performance.
- Use a PC board with at least two layers; it should be as free from voids as possible.
- Keep signal lines as short and as straight as possible. Do not make 90° turns; round all corners.

PACKAGE OUTLINE DIMENSIONS

SOT-23-5



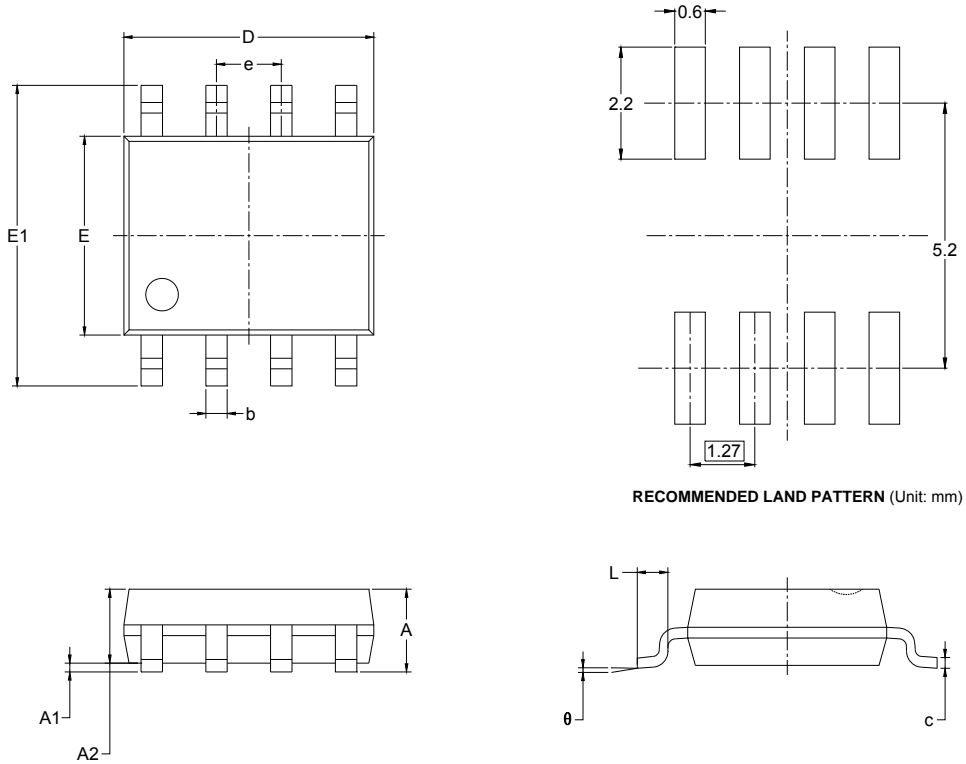
RECOMMENDED LAND PATTERN (Unit: mm)



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

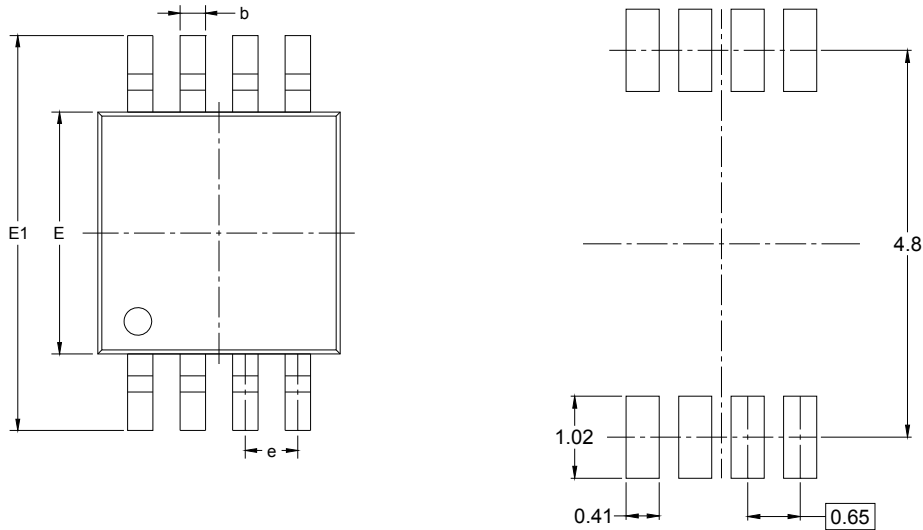


RECOMMENDED LAND PATTERN (Unit: mm)

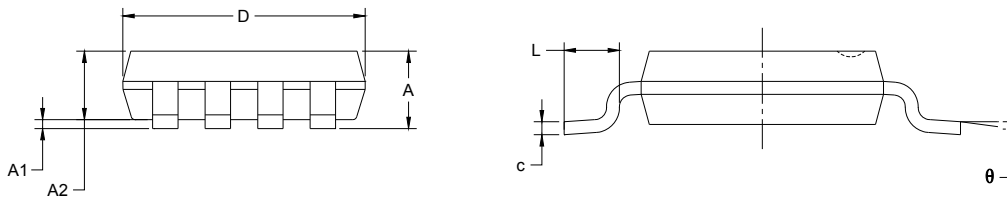
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

MSOP-8



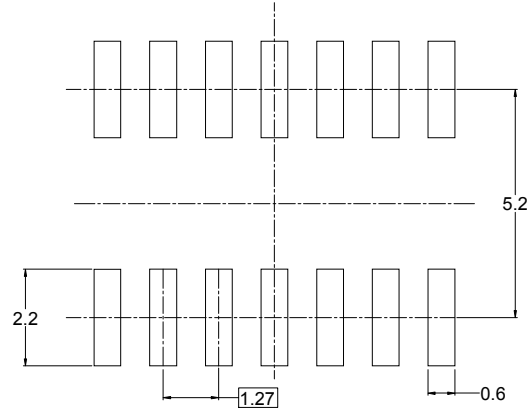
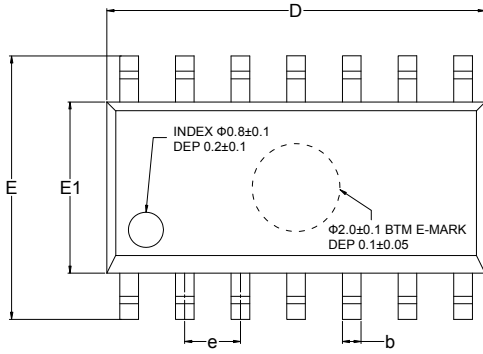
RECOMMENDED LAND PATTERN (Unit: mm)



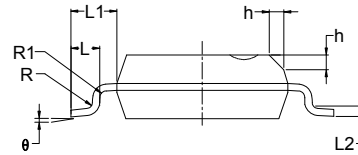
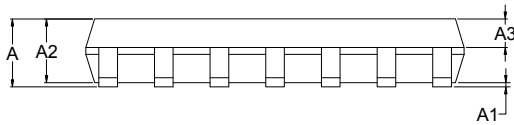
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

PACKAGE OUTLINE DIMENSIONS

SOIC-14



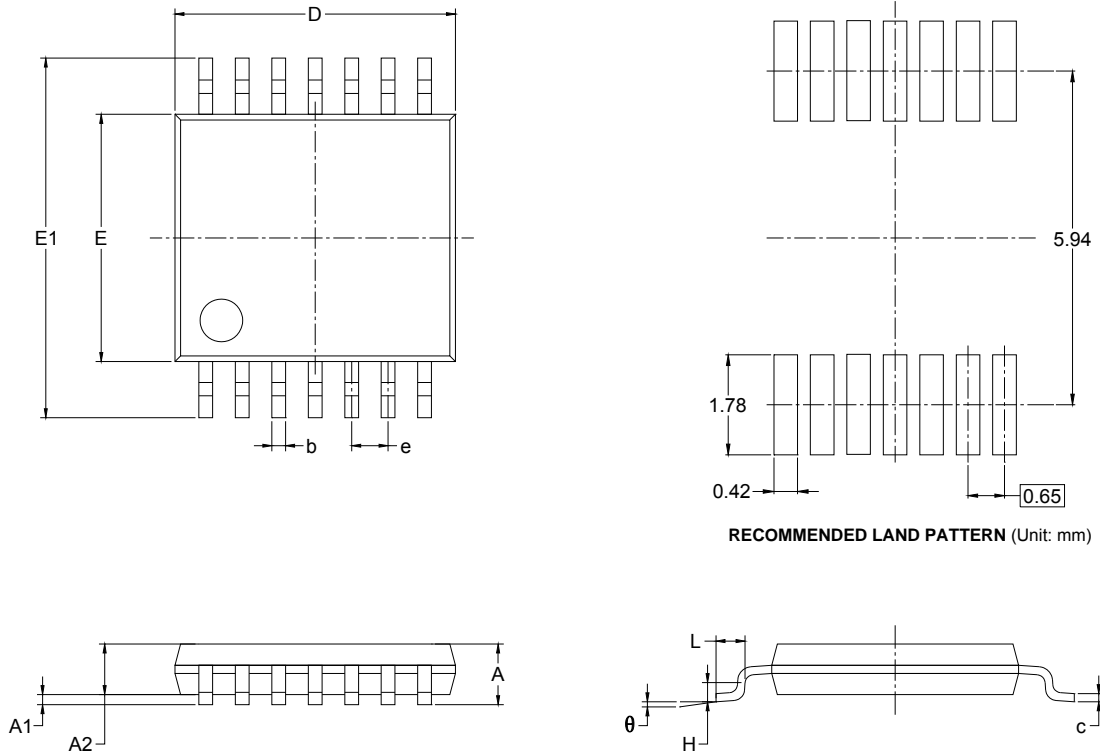
RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	MIN	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
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 OUTLINE DIMENSIONS

TSSOP-14

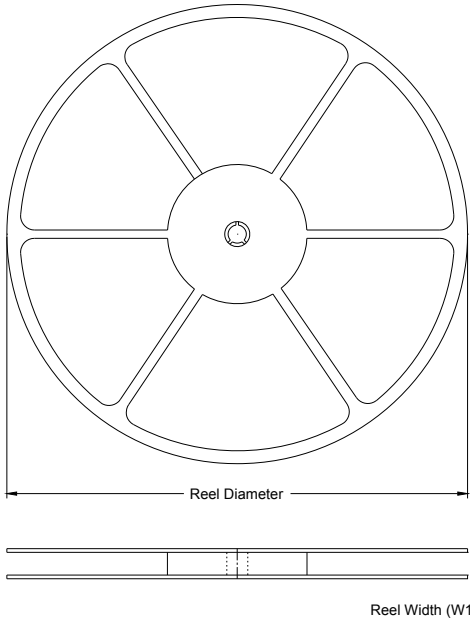


RECOMMENDED LAND PATTERN (Unit: mm)

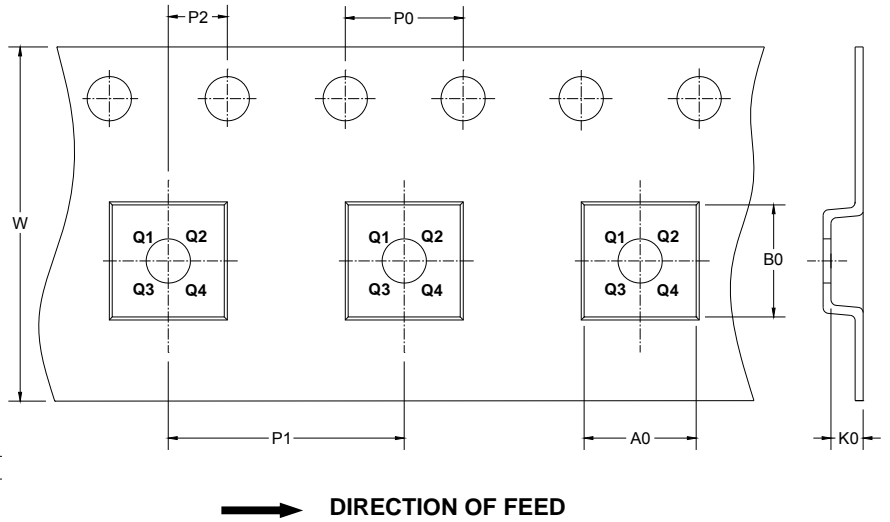
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



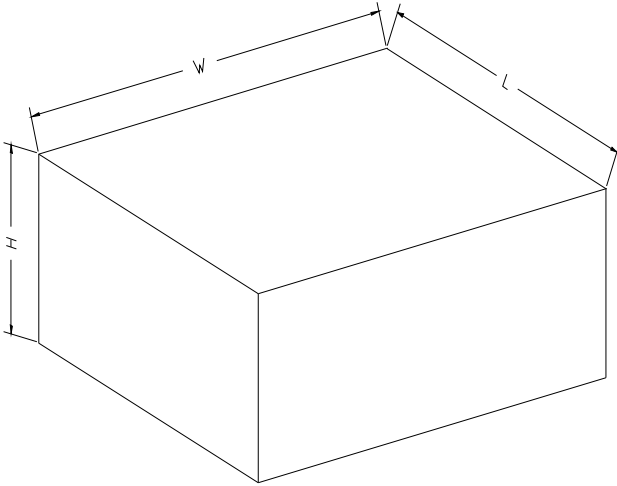
TAPE DIMENSIONS



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	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3
SOIC-8	13"	12.4	6.4	5.4	2.1	4.0	8.0	2.0	12.0	Q1
MSOP-8	13"	12.4	5.2	3.3	1.5	4.0	8.0	2.0	12.0	Q1
SOIC-14	13"	16.4	6.6	9.3	2.1	4.0	8.0	2.0	16.0	Q1
TSSOP-14	13"	12.4	6.95	5.6	1.2	4.0	8.0	2.0	12.0	Q1

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