



SGM8301/SGM8302/SGM8304 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 targeting 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 supply. The input common mode 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°C to +85°C temperature range.

FEATURES

- **4.5V to 12V Single Supply 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°C to +85°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 Box
Video Surveillance System
Analog-to-Digital Converter Interface
CCD Imaging System
Digital Camera

PACKAGE/ORDERING INFORMATION

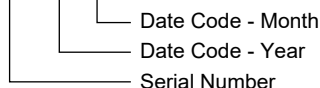
MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8301	SOT-23-5	-40°C to +85°C	SGM8301YN5G/TR	SA6XX	Tape and Reel, 3000
	SOIC-8	-40°C to +85°C	SGM8301YS8G/TR	SGM 8301YS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40°C to +85°C	SGM8301YMS8G/TR	SGM8301 YMS8 XXXXX	Tape and Reel, 3000
SGM8302	SOIC-8	-40°C to +85°C	SGM8302YS8G/TR	SGM 8302YS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40°C to +85°C	SGM8302YMS8G/TR	SGM8302 YMS8 XXXXX	Tape and Reel, 3000
SGM8304	SOIC-14	-40°C to +85°C	SGM8304YS14G/TR	SGM8304YS14 XXXXX	Tape and Reel, 2500
	TSSOP-14	-40°C to +85°C	SGM8304YTS14G/TR	SGM8304 YTS14 XXXXX	Tape and Reel, 3000

MARKING INFORMATION

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

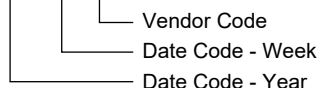
SOT-23-5

YYY X X



SOIC-8/MSOP-8/SOIC-14/TSSOP-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 (+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
Package Thermal Resistance @ T _A = +25°C	
SOT-23-5, θ _{JA}	232°C/W
SOIC-8, θ _{JA}	160°C/W
MSOP-8, θ _{JA}	216°C/W
SOIC-14, θ _{JA}	120°C/W
TSSOP-14, θ _{JA}	154°C/W
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

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range	-40°C to +85°C
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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.

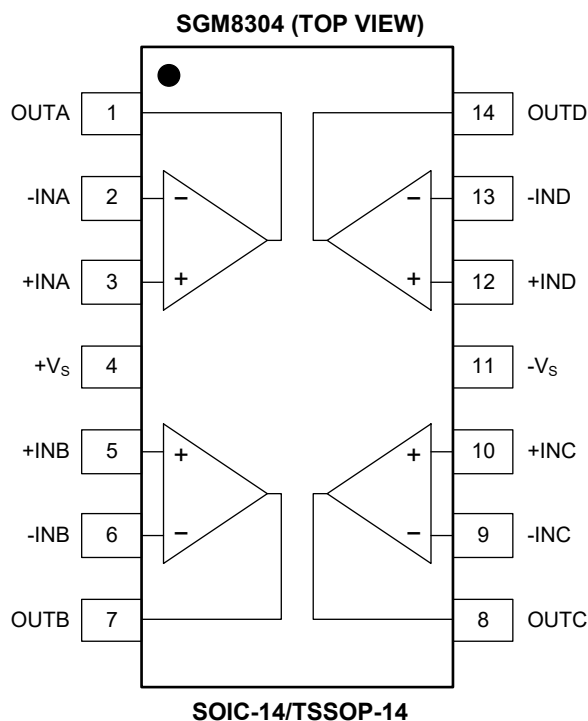
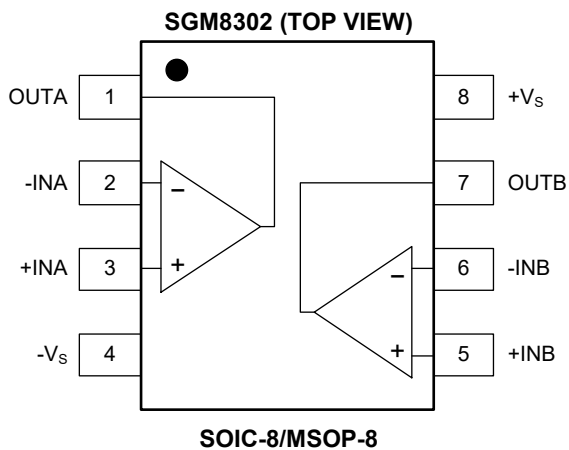
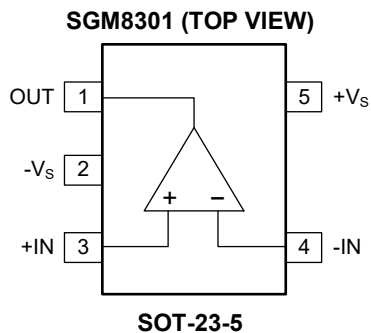
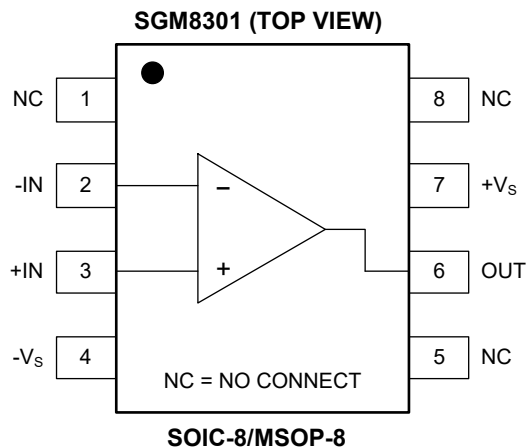
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged 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.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



ELECTRICAL CHARACTERISTICS

($V_S = 5V$, $V_{CM} = V_S/2$, $V_{OUT} = V_S/2$ and $R_L = 100\Omega$ to $V_S/2$, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
DC Performance					
Quiescent Current/Amplifier (I_Q)	$I_{OUT} = 0mA$		7.5	10.2	mA
Input Offset Voltage (V_{OS})		-18	5	18	mV
	$T_A = -40^\circ C$ to $+85^\circ C$	-21.5		21.5	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			12		$\mu V/^\circ C$
Open-Loop Gain (A_{OL})	$R_L = 50\Omega$, $1.3V \leq V_{OUT} \leq 3.7V$		88		dB
	$R_L = 150\Omega$, $0.6V \leq V_{OUT} \leq 4.4V$	82	100		
	$R_L = 2k\Omega$, $0.4V \leq V_{OUT} \leq 4.6V$	85	105		
Power Supply Rejection Ratio (PSRR)	$V_S = 4.5V$ to $13.2V$	65	80		dB
Common Mode Rejection Ratio (CMRR)	$V_{CM} = -0.1V$ to $2.75V$	58	75		dB
High Output Voltage Swing from Rail (V_{OH})	$R_L = 2k\Omega$ 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})	$R_L = 2k\Omega$ 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		$^\circ$
Channel-to-Channel Crosstalk	$V_{IN} = 200mV_{P-P}$, $f = 1kHz$		106		dB
Overload Recovery Time (ORT)	$f = 1kHz$		115		ns
Input Voltage Noise Density (e_n)	$f = 1kHz$		175		nV/\sqrt{Hz}
	$f = 10kHz$		65		
Slew Rate (SR) Up	$f = 1kHz$, $2V_{P-P}$ output		115		$V/\mu s$
Slew Rate (SR) Down	$f = 1kHz$, $2V_{P-P}$ output		140		$V/\mu s$
Settling Time to 0.1% (t_s)	$f = 1kHz$, $2V_{P-P}$ output		65		ns
Rise/Fall Time (t_R/t_F)	$f = 1kHz$, $V_{OUT} = 100mV_{P-P}$		7.8		ns
Differential Gain Error (DG)	NTSC		0.09		%
Differential Phase Error (DP)	NTSC		0.4		$^\circ$

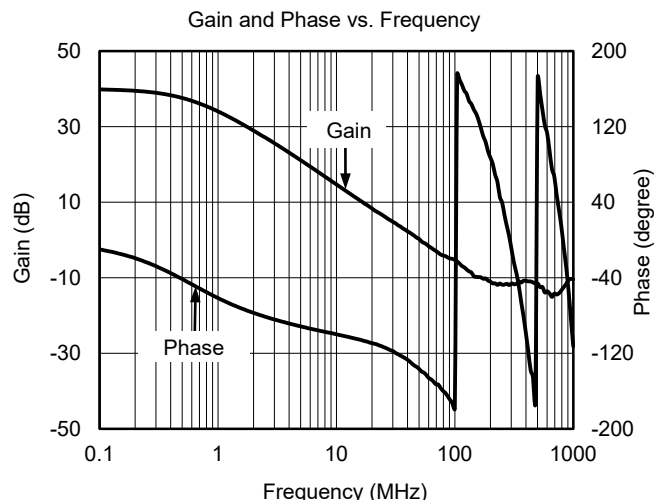
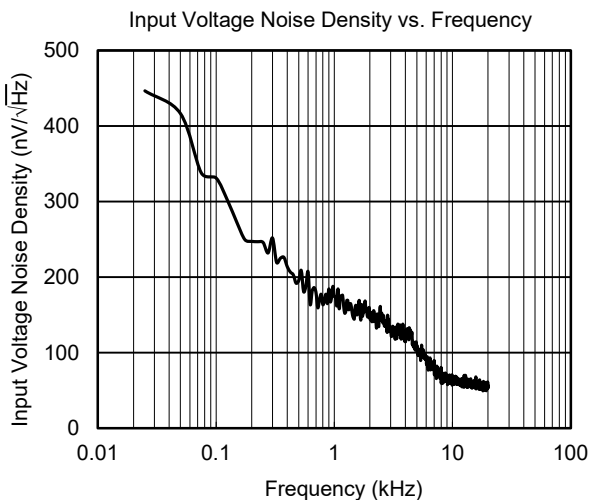
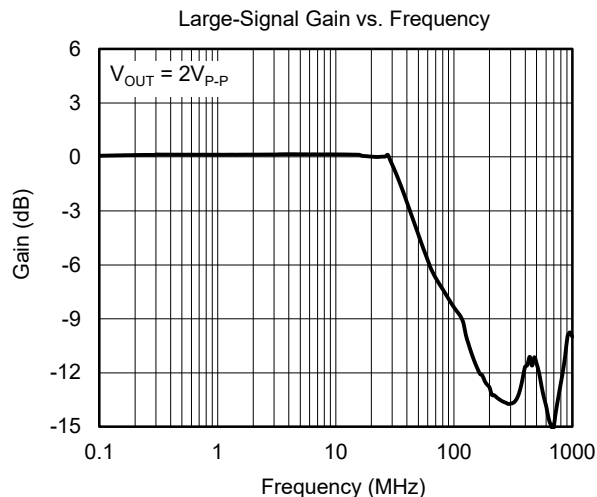
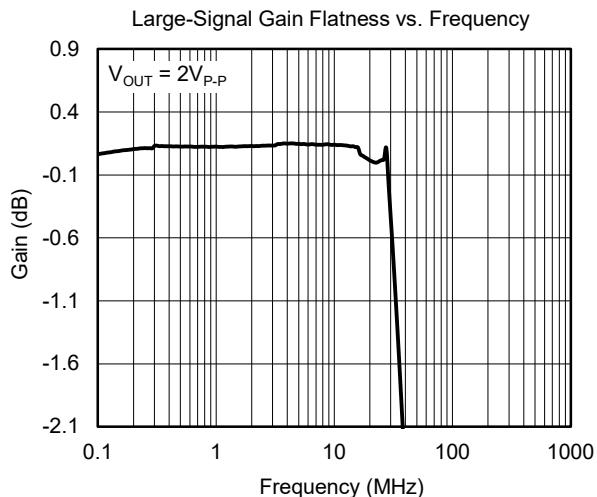
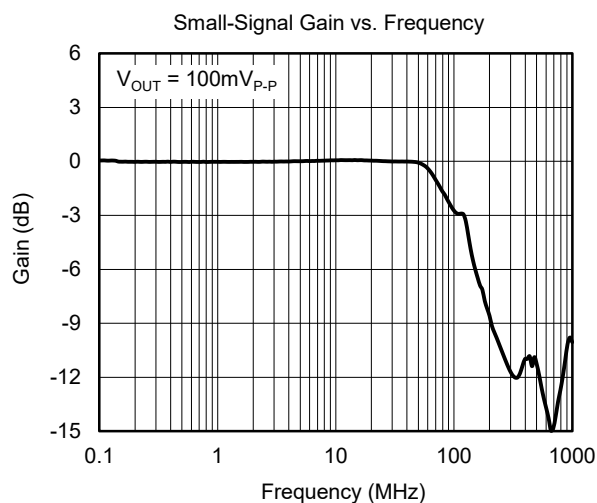
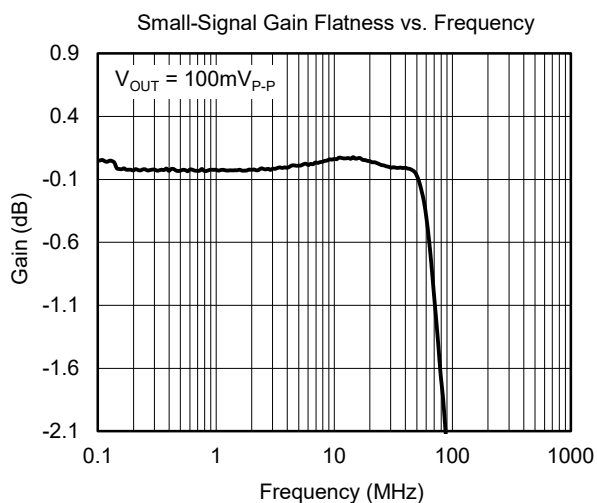
ELECTRICAL CHARACTERISTICS (continued)

($V_S = \pm 6V$, $V_{CM} = 0V$, $V_{OUT} = 0V$ and $R_L = 100\Omega$ to ground, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
DC Performance					
Quiescent Current/Amplifier (I_Q)	$I_{OUT} = 0mA$		8.5	11.3	mA
Input Offset Voltage (V_{OS})		-18	5	18	mV
	$T_A = -40^\circ C$ to $+85^\circ C$	-21.5		21.5	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			11		$\mu V/^\circ C$
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		$^\circ$
Channel-to-Channel Crosstalk	$V_{IN} = 200mV_{P-P}$, $f = 1kHz$		106		dB
Overload Recovery Time (ORT)	$f = 1kHz$		54		ns
Input Voltage Noise Density (e_n)	$f = 1kHz$		174		nV/\sqrt{Hz}
	$f = 10kHz$		65		
Slew Rate (SR) Up	$f = 1kHz$, $2V_{P-P}$ output		145		$V/\mu s$
Slew Rate (SR) Down	$f = 1kHz$, $2V_{P-P}$ output		155		$V/\mu s$
Settling Time to 0.1% (t_s)	$f = 1kHz$, $2V_{P-P}$ output		84		ns
Rise/Fall Time (t_R/t_F)	$f = 1kHz$, $V_{OUT} = 100mV_{P-P}$		7.5		ns
Differential Gain Error (DG)	NTSC		0.02		%
Differential Phase Error (DP)	NTSC		0.02		$^\circ$

TYPICAL PERFORMANCE CHARACTERISTICS

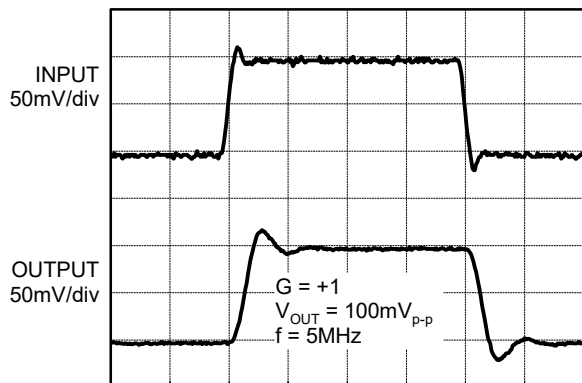
At $T_A = +25^\circ\text{C}$, $+V_S = 5\text{V}$, $-V_S = -5\text{V}$, $V_{CM} = 0\text{V}$ and $R_L = 100\Omega$ to GND, unless otherwise noted.



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

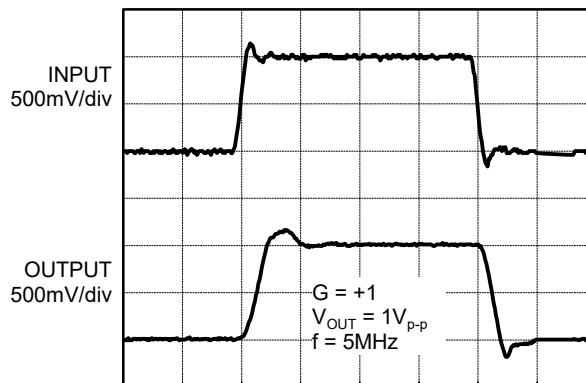
At $T_A = +25^\circ\text{C}$, $+V_S = 5\text{V}$, $-V_S = -5\text{V}$, $V_{CM} = 0\text{V}$ and $R_L = 100\Omega$ to GND, unless otherwise noted

Small-Signal Pulse Response



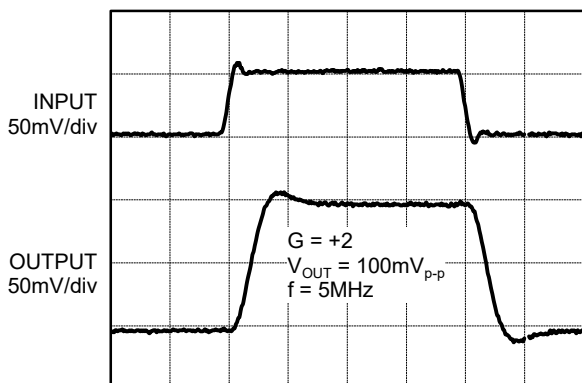
Time (25ns/div)

Large-Signal Pulse Response



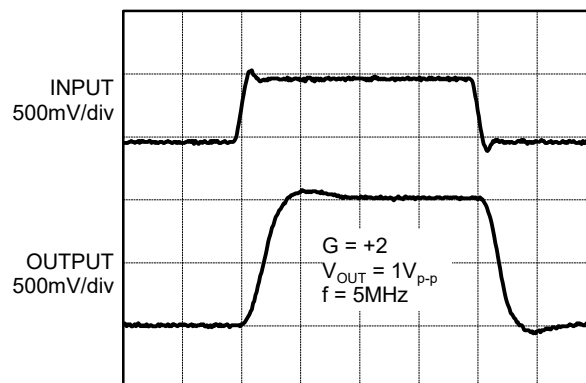
Time (25ns/div)

Small-Signal Pulse Response



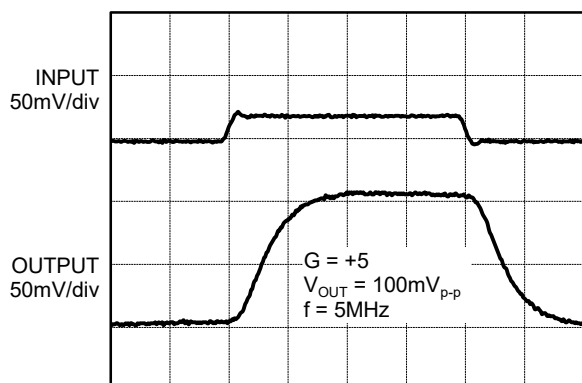
Time (25ns/div)

Large-Signal Pulse Response



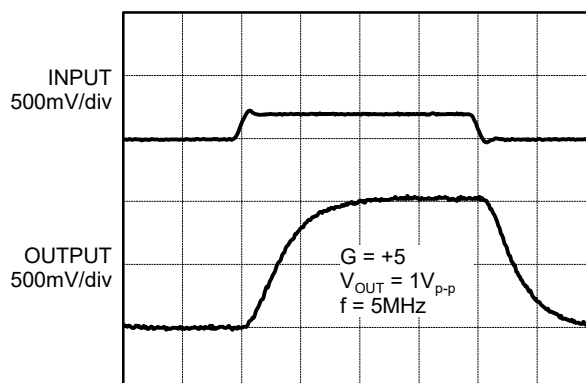
Time (25ns/div)

Small-Signal Pulse Response



Time (25ns/div)

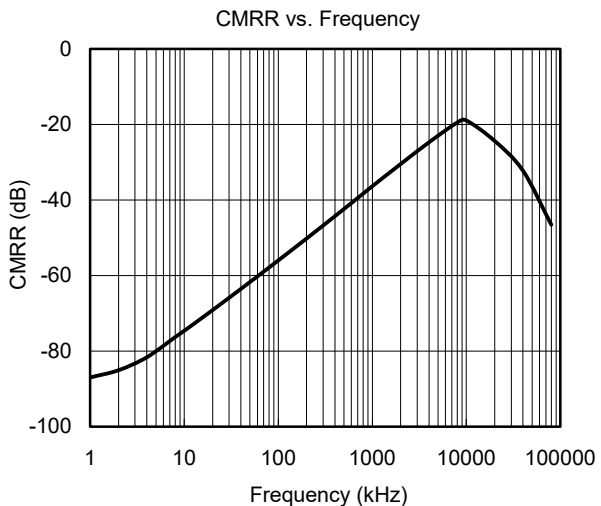
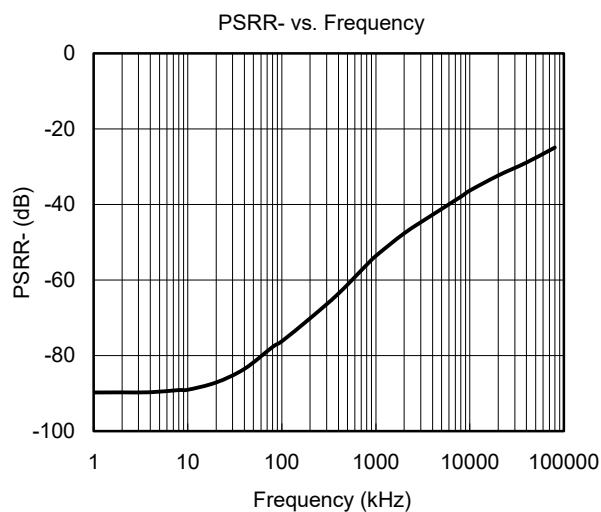
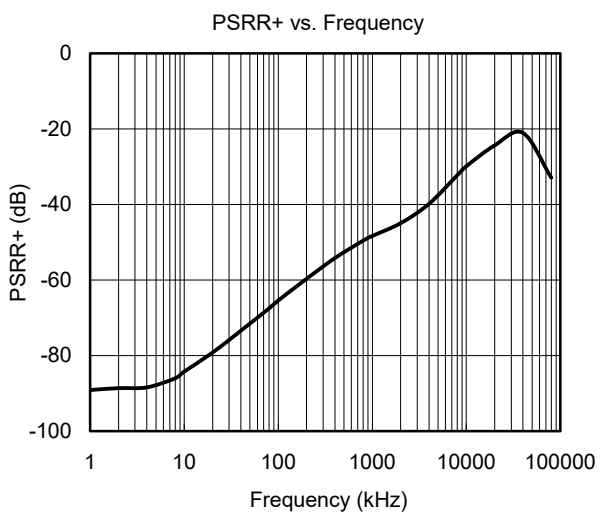
Large-Signal Pulse Response



Time (25ns/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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

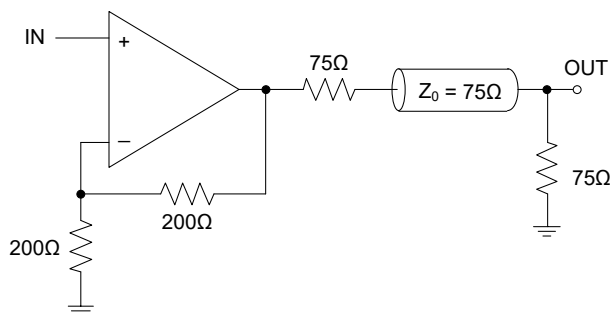


Figure 1. Video Line Driver

APPLICATION

Layout and Power Supply Bypassing

The SGM8301/2/4 operate from single 4.5V to 12V or from dual $\pm 2.25V$ to $\pm 6V$ supplies. Bypass each supply with a 0.1 μF capacitor as close to the pin as possible. It is recommended to use 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 a constant impedance board is used, 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.

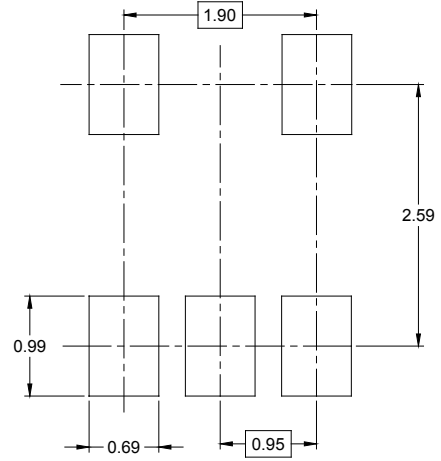
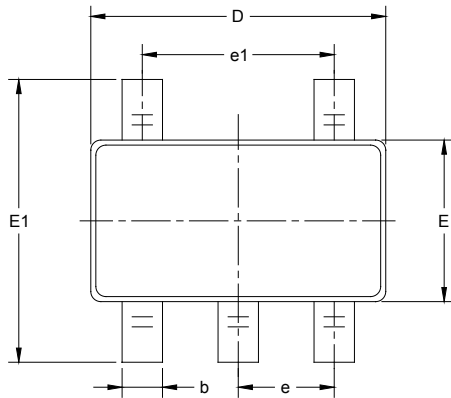
REVISION HISTORY

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

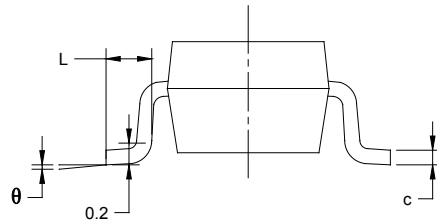
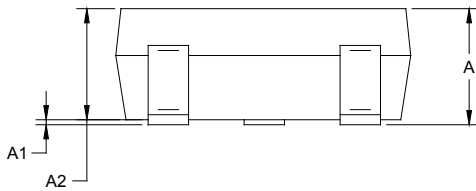
JUNE 2017 – REV.A.2 to REV.A.3	Page
Added Package Thermal Resistance.....	3
MAY 2013 – REV.A.1 to REV.A.2	Page
Changed supply voltage range from 5V to 12V to 4.5V to 12V.....	1, 9
JANUARY 2013 – REV.A to REV.A.1	Page
Added Tape and Reel Information section.....	15~16
Changes from Original (JULY 2012) to REV.A	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

SOT-23-5



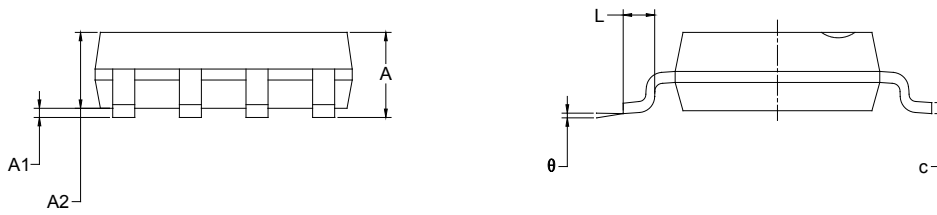
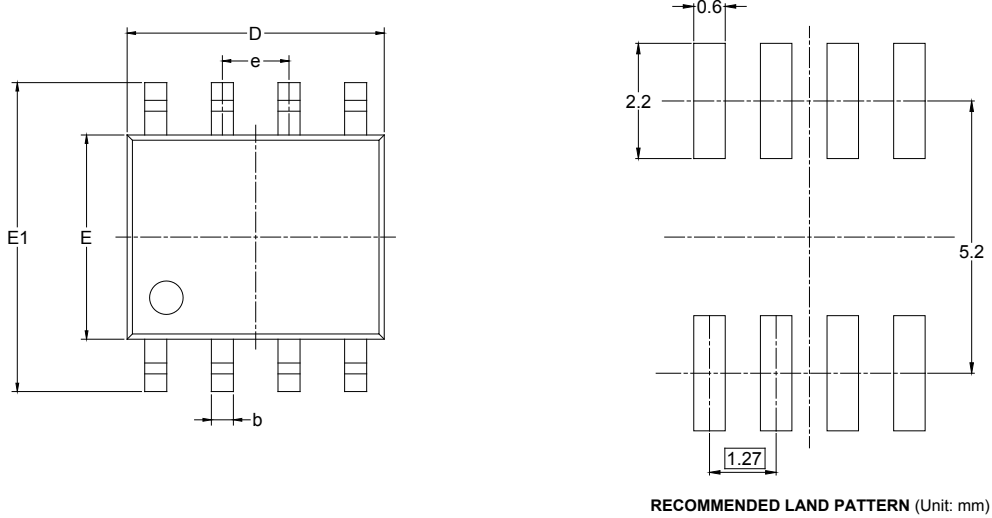
RECOMMENDED LAND PATTERN (Unit: mm)



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°

PACKAGE OUTLINE DIMENSIONS

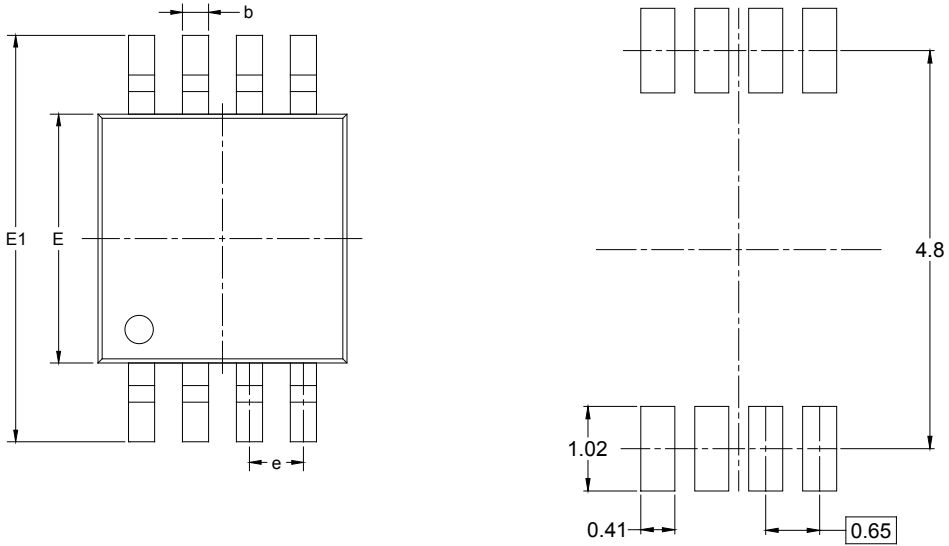
SOIC-8



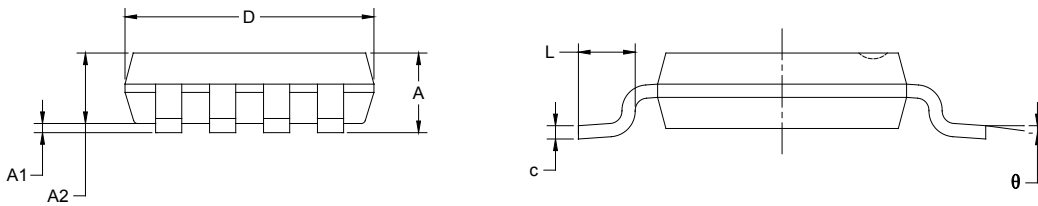
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

MSOP-8



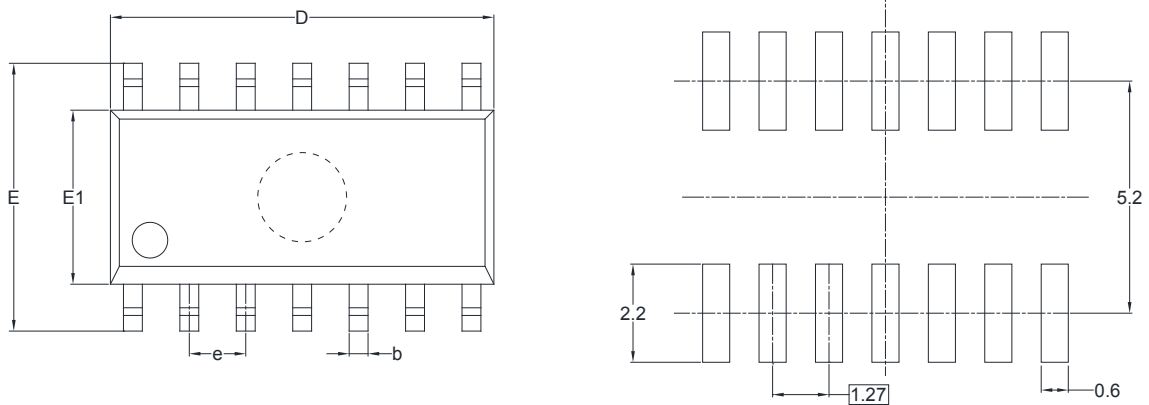
RECOMMENDED LAND PATTERN (Unit: mm)



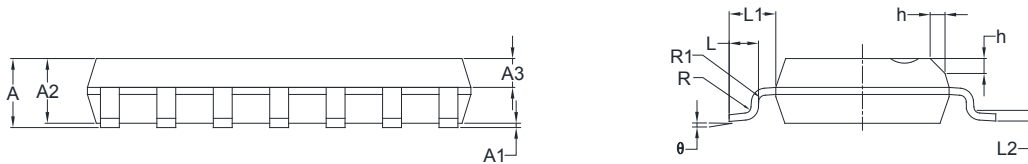
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

PACKAGE OUTLINE DIMENSIONS

SOIC-14



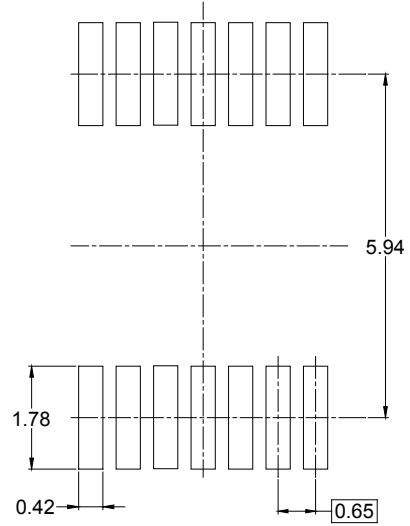
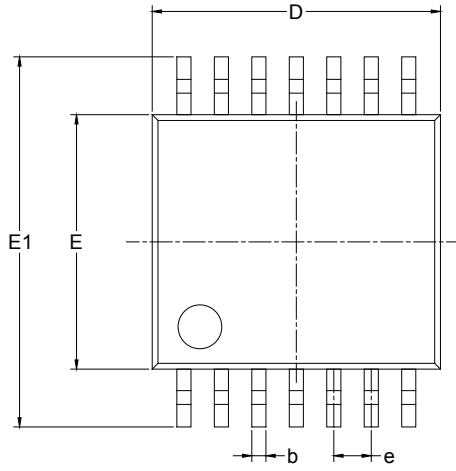
RECOMMENDED LAND PATTERN (Unit: mm)



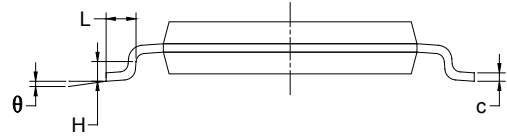
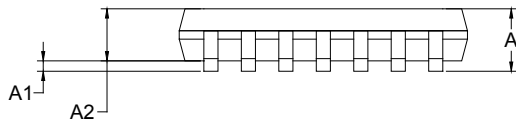
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80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

TSSOP-14



RECOMMENDED LAND PATTERN (Unit: mm)

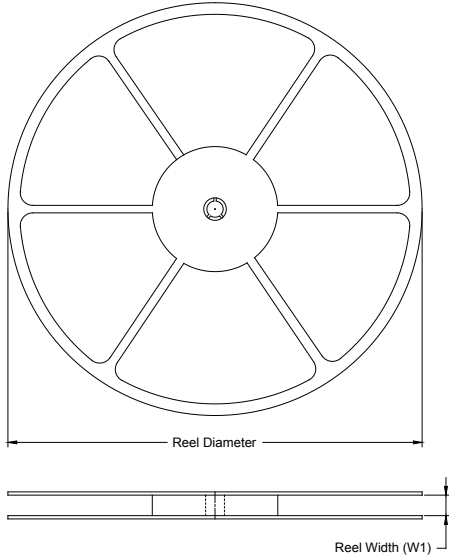


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

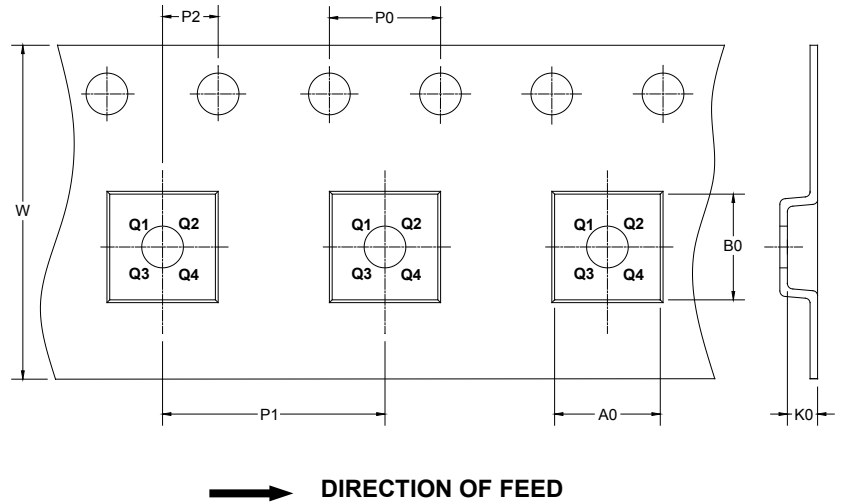
PACKAGE INFORMATION

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
TSSOP-14	13"	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	Q1

D20001

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

DD0002