SGM9114
8MHz 5th Order Video Driver with 6dB Gain

PRODUCT DESCRIPTION

The SGM9114 is single rail-to-rail 5th order output reconstruction filter with a -3dB bandwidth of 8MHz and a slew rate of 33.7V/μs. Operating from single power supply ranging from 3.0V to 5.5V and sinking an ultra-low 7mA quiescent current, the SGM9114 is ideally suited for low power, battery-operated applications.

SGM9114 employs an internal level shift circuit that avoids sync-pulse clipping and allows DC-coupled output. If AC-coupling is preferred, the SGM9114 offers a sag-correction feature that significantly reduces the size of the output coupling capacitor.

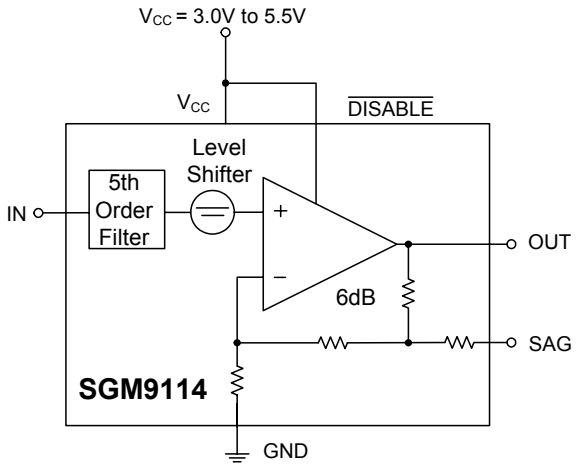
SGM9114 has a power-down disable feature that reduces the supply current to 0.72μA, dramatically reducing power consumption and prolonging battery life.

It is specified over the extended –40℃ to +85℃ temperature range.

FEATURES

- **Excellent Video Performance**
- **5th Order Reconstruction Filter**
- **Internal Gain: 6dB**
- **Rail-to-Rail Output**
- **SAG Correction Reduces AC Coupling Capacitor size**
- **Input Voltage Range Includes Ground AC-Coupled Input**
- **Operates on 3.0V to 5.5V Single Power Supply**
- **Low Power**
  7mA Typical Supply Current
  SGM9114 0.72μA when Disabled
- **Small Packaging**
  SGM9114 Available in SOT-23-6L Package

BLOCK DIAGRAM



APPLICATIONS

Video amplifiers
Cable and Satellite set top boxes
Communications devices
Video on demand
Portable and handheld products
Personal video recorders
DVD players
HDTV

PACKAGE/ORDERING INFORMATION

ORDER NUMBER	PACKAGE DESCRIPTION	TEMPERATURE RANGE	PACKAGE OPTION	MARKING INFORMATION
SGM9114YN6G/TR	SOT-23-6L	-40℃ to +85℃	Tape and Reel, 3000	S07XX

Note 1: Order number and package marking are defined as the follow:

ORDER NUMBER

SGM9114 X X G / TR

- Tape and Reel
- Green Product
- Package Type
  - N6 SOT-23-6L
- Operating Temperature Range
  - Y -40℃ to +85℃

MARKING INFORMATION

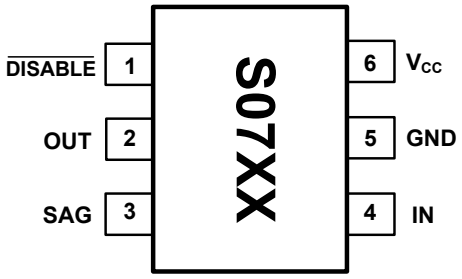
S07 X X

- Chip produce month ("A" = Jan. "B" = Feb. ⋯ "L" = Dec.)
- Chip produce year ("9" = 2009, "A" = 2010 ⋯)

For example: S079A (2009 year, the 1st month)

PIN CONFIGURATION (Top View)

SOT-23-6L



PIN DESCRIPTION

PIN	NAME	FUNCTION
1	$\overline{\text{DISABLE}}$	Shutdown Input.
2	OUT	Signal output
3	SAG	SAG correction
4	IN	Signal input
5	GND	Ground.
6	V_{CC}	Power supply.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{CC} to GND.....6V
Input Voltage..... GND - 0.3V to (V_{CC}) +0.3V
Storage Temperature Range .....–65℃ to +150℃
Junction Temperature ..... 150℃
Operating Temperature Range..... –40℃ to +85℃
Lead Temperature Range (Soldering 10 sec)
..... 260℃
ESD Susceptibility
HBM..... 5000V
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.

ELECTRICAL CHARACTERISTICS: V_{CC} = 5.0V

(At R_L = 150Ω connected to GND, V_{IN} = 1V_{PP}, and C_{IN} = 0.1μF, all outputs AC coupled, referenced to 400kHz, unless otherwise noted.)

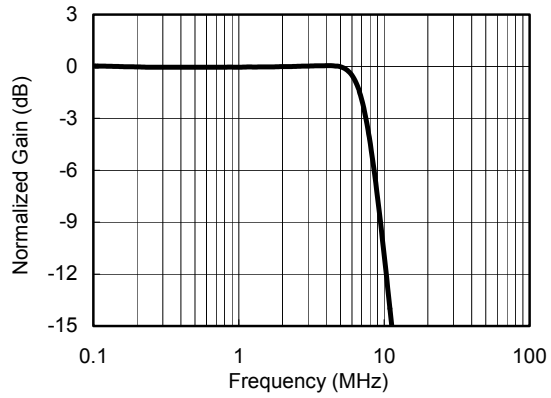
PARAMETER	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Output Level Shift Voltage (V_{OLS})	V_{IN} = 0V, no load	+25°C		336	480	mV
		-40°C to +85°C			540	
Input Voltage Clamp (V_{CLAMP})	I_{IN} = -3.5mA	+25°C	-180	-119		mV
		-40°C to +85°C	-269			
Clamp Charge Current	V_{IN} = V_{CLAMP} -100mV	+25°C	-6.0	-4.8		mA
		-40°C to +85°C	-6.8			
Clamp Discharge Current	V_{IN} = 500mV	+25°C		1.9	2.6	μA
		-40°C to +85°C			3.2	
Voltage Gain (A_V)	R_L = 150Ω	+25°C	5.6	6	6.4	dB
		-40°C to +85°C	5.3		6.5	
OUTPUT CHARACTERISTICS						
Output Voltage High Swing	V_{IN} = 3.0V, R_L = 150Ω to GND	+25°C	4.60	4.79		V
		-40°C to +85°C	4.50			
Output Short-Circuit Current (I_{SC})	V_{IN} = 0.5V, Out short to GND through 10Ω	+25°C	90	124		mA
		-40°C to +85°C	80			
	V_{IN} = 1.5V, Out short to V_{CC} through 10Ω	+25°C		-133	-100	mA
		-40°C to +85°C			-89	
POWER SUPPLY						
Operating Voltage Range		+25°C	3.0		5.5	V
Power Supply Rejection Ratio (PSRR)	V_{CC} = 3.5V to 5.0V	+25°C	45	52		dB
		-40°C to +85°C	44			
Quiescent Current (I_Q)	V_{IN} = 0.5V, $\overline{DISABLE}$ = V_{CC}, R_L = 0	+25°C		7.0	9.5	mA
		-40°C to +85°C			12.4	
Supply Current when Disabled	$\overline{DISABLE}$ = 0V	+25°C		0.72	3	μA
		-40°C to +85°C			13	
DYNAMIC PERFORMANCE						
-0.1dB Bandwidth		+25°C		5.6		MHz
-3dB Bandwidth		+25°C		7.8		MHz
Filter Response (Normalized Gain)	f_{IN} = 27MHz	+25°C		44		dB
Slew Rate	2V Output Step, 80% to 20%	+25°C		33.7		V/μs
Differential Gain Error (DG)	PAL DC coupled	+25°C		0.38		%
	PAL AC coupled	+25°C		0.27		%
Differential Phase Error (DP)	PAL DC coupled	+25°C		1.0		°
	PAL AC coupled	+25°C		1.1		°
Group Delay Variation (D/DT)	Difference between 400kHz and 6.5MHz	+25°C		30.7		ns
Fall Time	2V Output Step, 80% to 20%	+25°C		35.5		ns
Rise Time	2V Output Step, 80% to 20%	+25°C		36.5		ns
POWER-DOWN DISABLE						
DISABLE (logic-LOW Threshold)	V_{CC} = 5V	+25°C			0.4	V
$\overline{DISABLE}$ (logic-HIGH Threshold)	V_{CC} = 5V	+25°C	1.2			V

Specifications subject to change without notice.

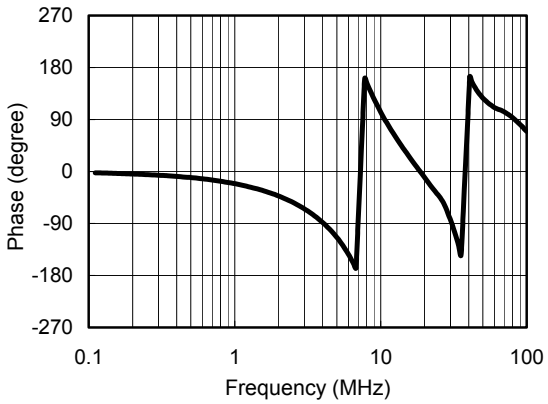
TYPICAL PERFORMANCE CHARACTERISTICS

At V_{CC} = 5V, T_A = +25℃, R_L = 150Ω, all outputs AC coupled, unless otherwise noted.

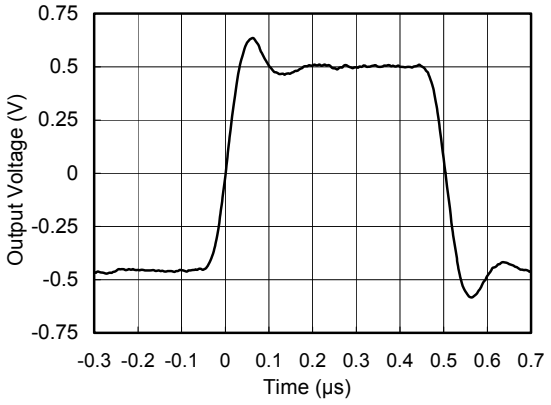
Frequency Response



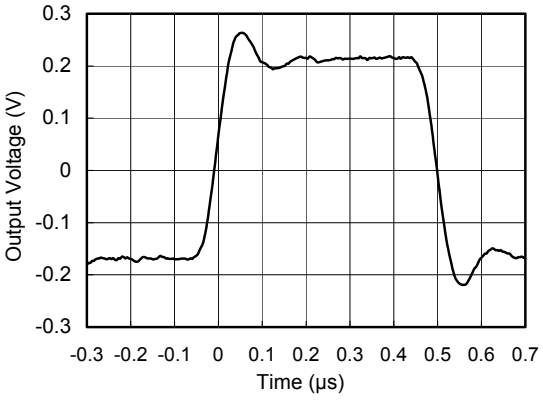
Phase vs. Frequency



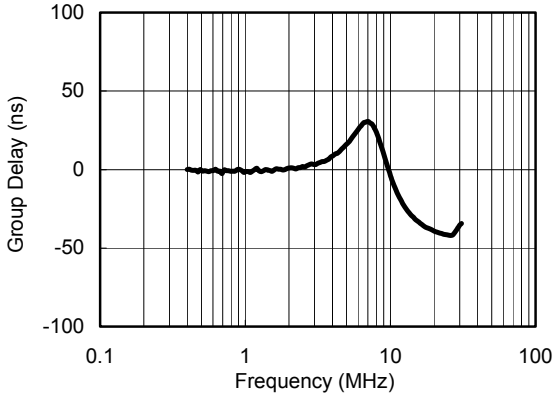
Large Signal Step Response



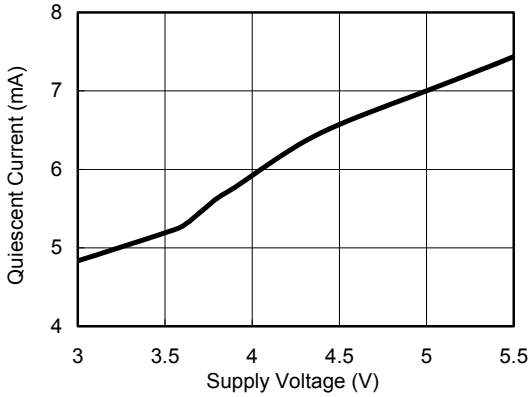
Small Signal Step Response



Group Delay vs. Frequency



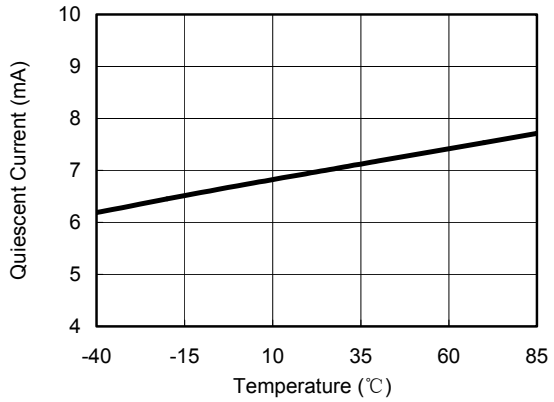
Quiescent Current vs. Supply Voltage



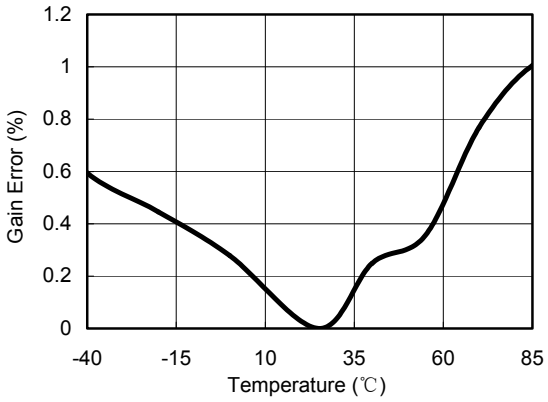
TYPICAL PERFORMANCE CHARACTERISTICS

At V_{CC} = 5V, T_A = +25℃, R_L = 150Ω, all outputs AC coupled, unless otherwise noted.

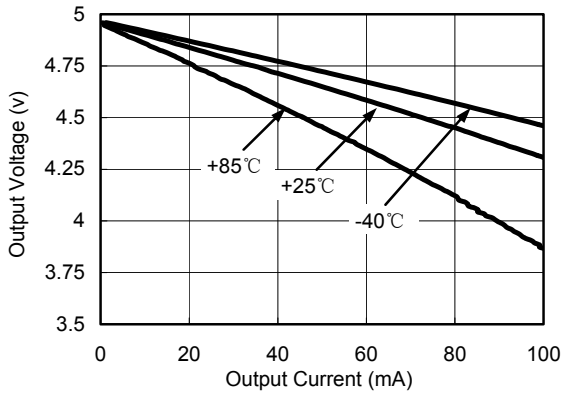
Quiescent Current vs. Temperature



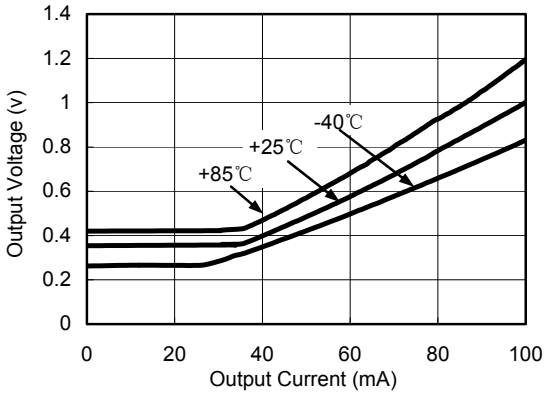
Gain Error vs. Temperature



Output Voltage Swing to The Positive Rail vs. Output Current



Output Voltage Swing to The Negative Rail vs. Output Current



Application Information

The SGM9114 low cost, integrated, 5th order, video filter is intended to replace passive LC filters and drivers in low voltage portable video applications.

The SGM9114 input must be AC-coupled because the input capacitor stores the clamp voltage. It needs a typical value of 0.1μF for the input clamp to meet the Line Droop specification. The SGM9114 output can drive an AC or DC-coupled doubly terminated coax (150Ω) load (see Figure 1) . DC-coupling the output removes the need for an expensive and large output coupling capacitor (see Figure 2) . If an AC-coupled output is needed, the SAG correction circuit can be used to reduce the AC output coupling capacitor value.

Offering SAG correction, fixed gain of 6dB, and a 5th order low pass filter in a tiny space saving package makes the SGM9114 well suited for space sensitive applications such as digital cameras, cellular phones and other portable devices.

Enable/Shutdown

The SGM9114 has a shutdown feature that disables the output and reduces the quiescent current to 0.72μA. This feature is particularly useful in portable applications, such as video cameras, hand held gaming devices, cellular phones and requiring video filtering and drive capability.

Internal Sync Clamp

The typical embedded video DAC operates from a ground referenced single supply. This becomes an issue because the lower level of the sync pulse output may be at a 0V reference level to some positive level. The problem is presenting a 0V input to most single supply driven amplifiers will saturate the output stage of the amplifier resulting in a clipped sync tip and degrading the video image. A larger positive reference may offset the input above its positive range.

The SGM9114 features an internal sync clamp and offset function to level shift the entire video signal to the best level before it reaches the input of the amplifier stage. These features are also helpful to avoid saturation of the output stage of the amplifier by setting the signal closer to the best voltage range.

The typical Application diagram of the SGM9114 in Figure 1 is divided into four sections. The first, Section A is the Sync Clamp. The AC coupled video sync signal is pulled negative by a current source at the input of the comparator amplifier. When the sync tip goes below the comparator threshold the output comparator is driven negative, The PMOS device turns on clamping sync tip to near ground level. The network triggers on the sync tip of video signal.

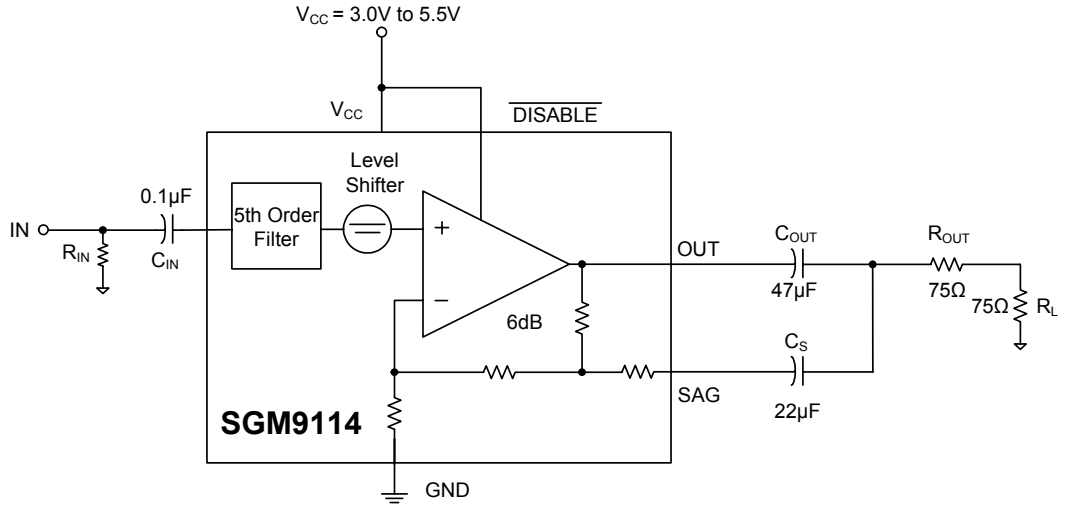


Figure 1. Typical Application Diagram

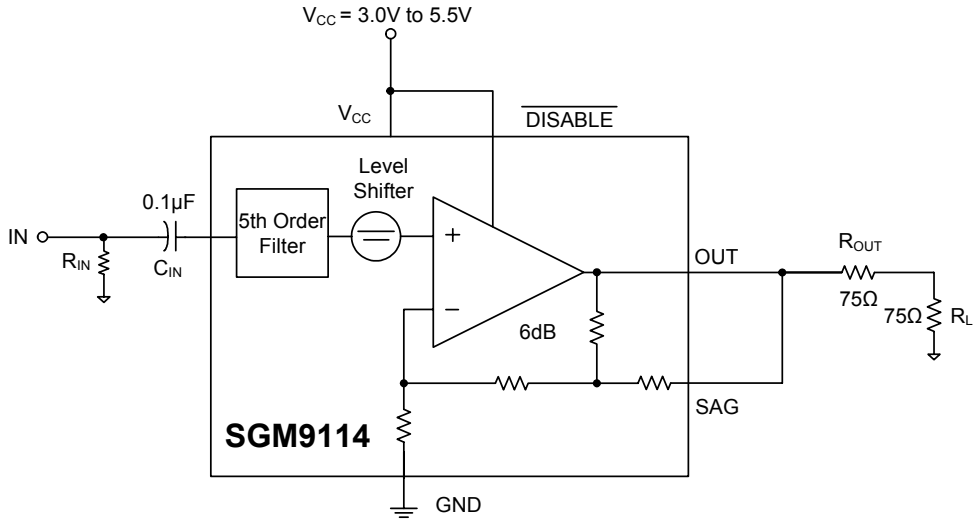


Figure 2. AC-Coupled Input/DC-Coupled Output

SAG Correction

The SGM9114 can use the SAG configuration if an AC-coupled output video signal is needed. SAG correction refers to the low-frequency compensation for the high pass filter formed by the 150Ω load and the output capacitor. In video applications, the cutoff frequency must be low enough to pass the vertical sync interval to avoid field tilt. This cutoff frequency should be less than 5Hz, and the coupling capacitor must be very large in normal configuration, typically is 220µF. In SAG configuration, the SGM9114 removes the need for large coupling capacitors, and instead needs one 22µF and one 47µF capacitors (Figure 1) to reach the same performance as the large capacitor.

The Sallen Key Low Pass Filter

The Sallen Key in a classic low pass configuration illustrated in Figure 1. The filter provides a very stable low pass function, and in the case of the SGM9114, a 5th order roll-off at around 8MHz. The 5th order function is accomplished with an RC low pass network placed in series with and before the Sallen Key. One pole provided by the RC network and poles two and three provided by the Sallen Key for a nice 5th order roll-off at around 8MHz.

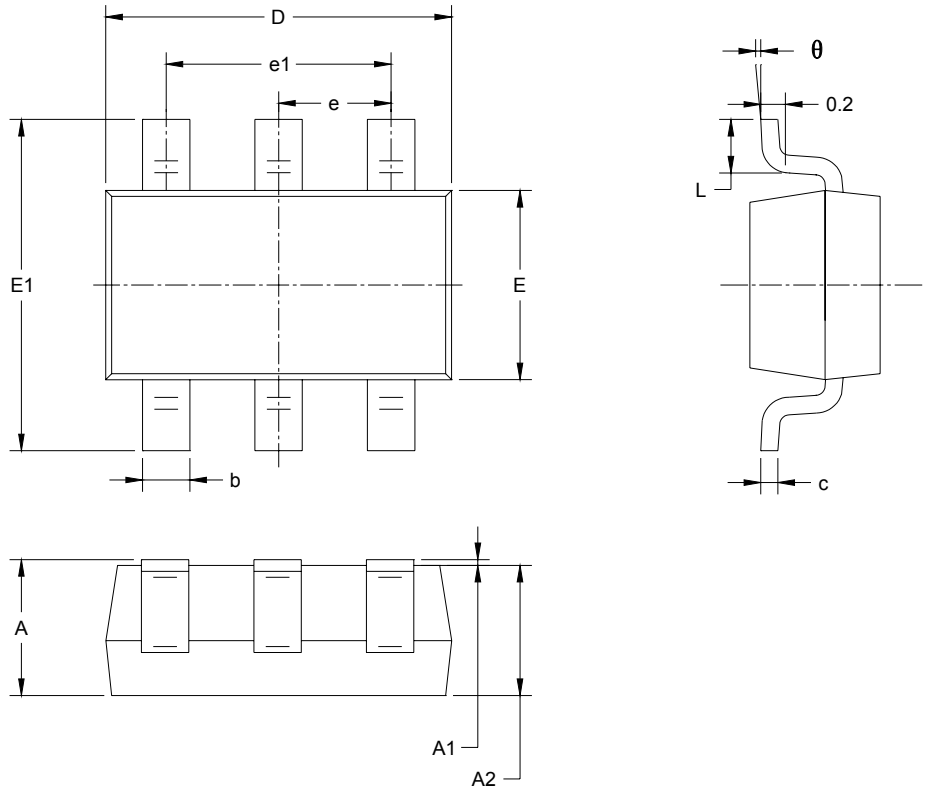
Layout and Power-Supply Bypassing

The SGM9114 operates from single 3.0V to 5.5V supply. Bypass the supply with a 0.1µF capacitor as close to the pin as possible. SGMC recommends using microstrip and stripline techniques to obtain full bandwidth. To ensure that the PC board does not degrade the device'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 IC sockets; they increase parasitic capacitance and inductance.
- Do not use wire-wrap boards; they are too inductive.
- 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-23-6L



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	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

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