



SGM9121

8MHz 5th Order Video Driver with 6dB Gain

PRODUCT DESCRIPTION

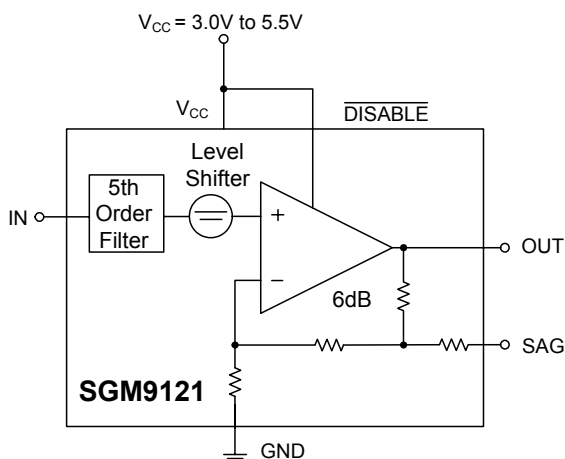
The SGM9121 is single rail-to-rail 5th order output reconstruction filter with a -3dB bandwidth of 8MHz and a slew rate of 34.8V/ μ s. Operating from single power supply ranging from 3.0V to 5.5V and sinking an ultra-low 7mA quiescent current, the SGM9121 is ideally suited for low power, battery-operated applications.

SGM9121 employs an internal level shift circuit that avoids sync-pulse clipping and allows DC-coupled output. If AC-coupling is preferred, the SGM9121 offers a sag-correction feature that significantly reduces the size of the output coupling capacitor.

SGM9121 has a power-down disable feature that reduces the supply current to 0.72 μ A, dramatically reducing power consumption and prolonging battery life.

It is specified over the extended -40°C to $+85^{\circ}\text{C}$ temperature range.

BLOCK DIAGRAM



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
SGM9121 0.72 μ A when Disabled
- Small Packaging
SGM9121 Available in SC70-6(SOT-363) Package

APPLICATIONS

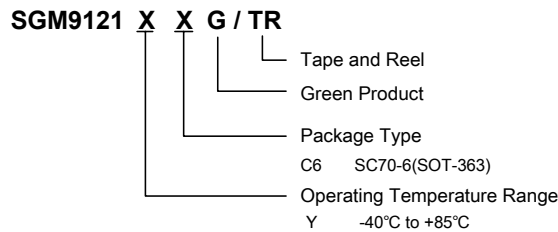
Video amplifiers
Cable and Satellite set top boxes
Communications devices
Video on demand
Portable and handheld products
Personal video recorders
DVD players
HDTV

PACKAGE/ORDERING INFORMATION

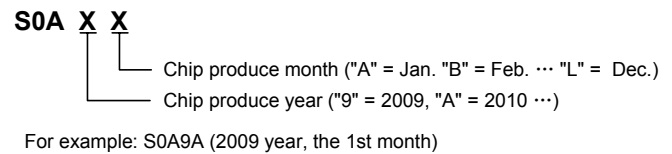
ORDER NUMBER	PACKAGE DESCRIPTION	TEMPERATURE RANGE	PACKAGE OPTION	MARKING INFORMATION
SGM9121YC6G/TR	SC70-6(SOT-363)	-40°C to +85°C	Tape and Reel, 3000	S0AXX

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

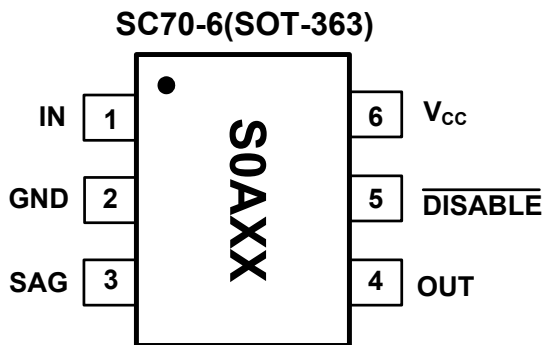
ORDER NUMBER



MARKING INFORMATION



PIN CONFIGURATION (Top View)



PIN DESCRIPTION

PIN	NAME	FUNCTION
1	IN	Signal input
2	GND	Ground.
3	SAG	SAG correction
4	OUT	Signal output
5	DISABLE	Shutdown Input.
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°C to +150°C
Junction Temperature	150°C
Operating Temperature Range.....	-40°C to +85°C
Lead Temperature Range (Soldering 10 sec).....	260°C
ESD Susceptibility	
HBM.....	7000V
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.

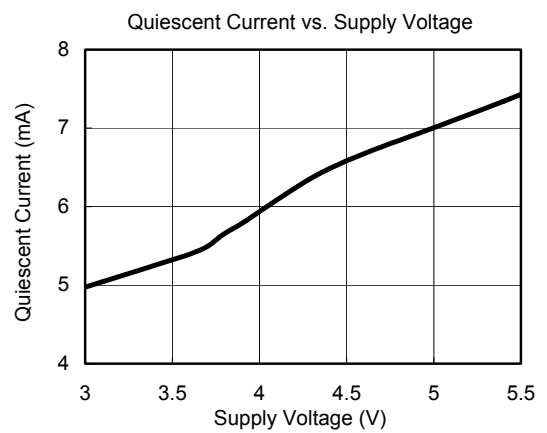
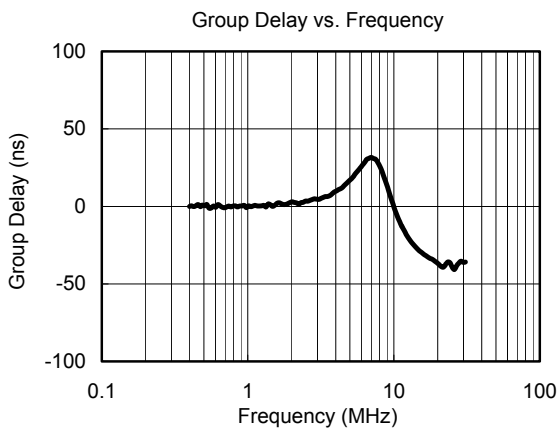
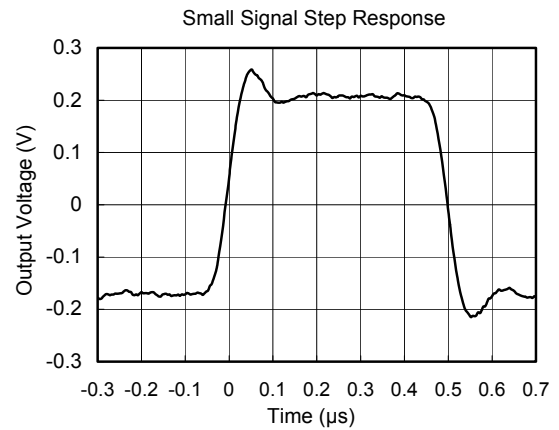
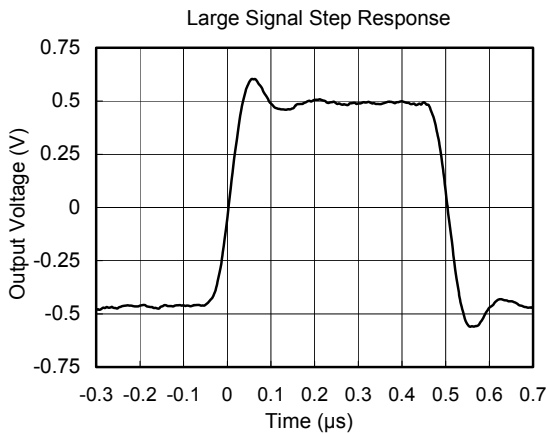
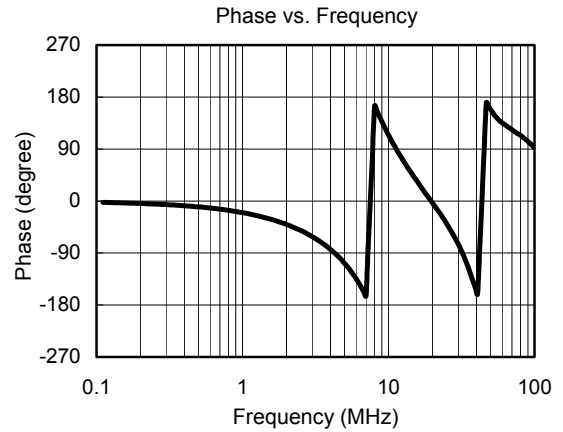
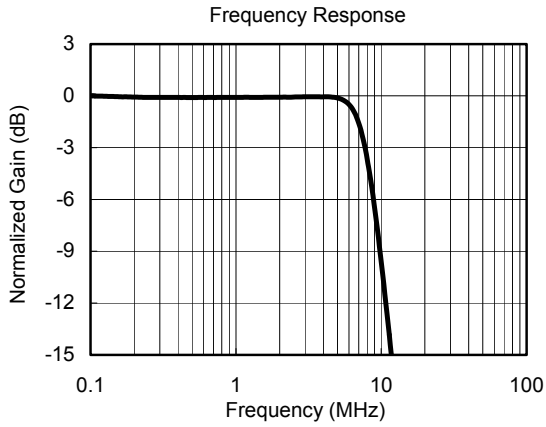
ELECTRICAL CHARACTERISTICS: $V_{CC} = 5.0V$ (At $R_L = 150\Omega$ connected to GND, $V_{IN} = 1V_{PP}$, and $C_{IN} = 0.1\mu F$, all outputs AC coupled, referenced to 400kHz, unless otherwise noted.)

PARAMETER	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Output Level Shift Voltage (V_{OLS})	$V_{IN} = 0V$, no load	+25°C		344	480	mV
		-40°C to +85°C			587	
Input Voltage Clamp (V_{CLAMP})	$I_{IN} = -3.5mA$	+25°C	-180	-111		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	-6.4			
Clamp Discharge Current	$V_{IN} = 500mV$	+25°C		1.9	3	μA
		-40°C to +85°C			7	
Voltage Gain (A_v)	$R_L = 150\Omega$	+25°C	5.6	6	6.4	dB
		-40°C to +85°C	5.5		6.5	
OUTPUT CHARACTERISTICS						
Output Voltage High Swing	$V_{IN} = 3.0V$, $R_L = 150\Omega$ to GND	+25°C	4.60	4.79		V
		-40°C to +85°C	4.57			
Output Short-Circuit Current (I_{SC})	$V_{IN} = 0.5V$, Out short to GND through 10 Ω	+25°C	90	122		mA
		-40°C to +85°C	80			
	$V_{IN} = 1.5V$, Out short to V_{CC} through 10 Ω	+25°C		-131	-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			11	
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		5.56		MHz
-3dB Bandwidth		+25°C		7.76		MHz
Filter Response (Normalized Gain)	$f_{IN} = 27MHz$	+25°C		42.4		dB
Slew Rate	2V Output Step, 80% to 20%	+25°C		34.8		V/ μs
Differential Gain Error (DG)	PAL DC coupled	+25°C		0.53		%
	PAL AC coupled	+25°C		0.27		%
Differential Phase Error (DP)	PAL DC coupled	+25°C		1.30		°
	PAL AC coupled	+25°C		1.09		°
Group Delay Variation (D/DT)	Difference between 400kHz and 6.5MHz	+25°C		30.3		ns
Fall Time	2V Output Step, 80% to 20%	+25°C		34.5		ns
Rise Time	2V Output Step, 80% to 20%	+25°C		35.7		ns
POWER-DOWN DISABLE						
$\overline{DISABLE}$ (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.

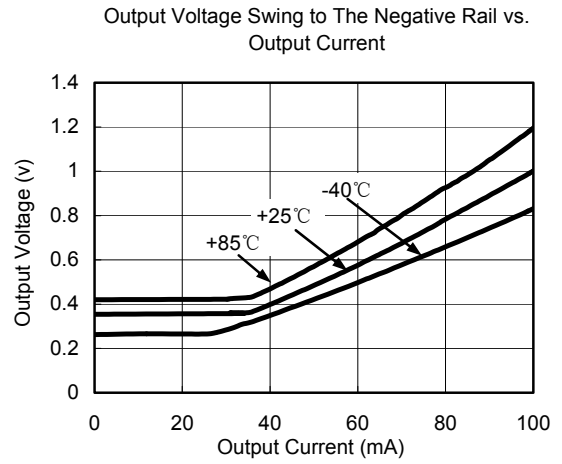
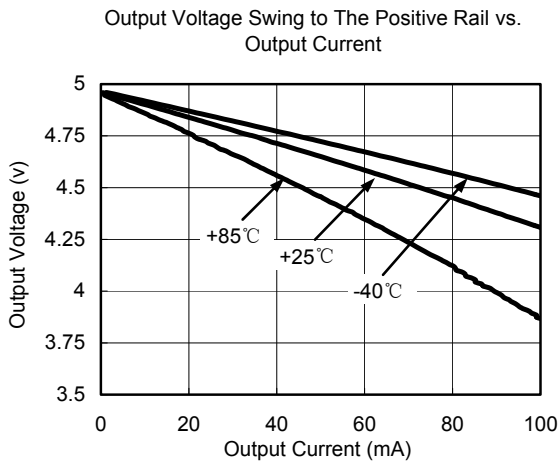
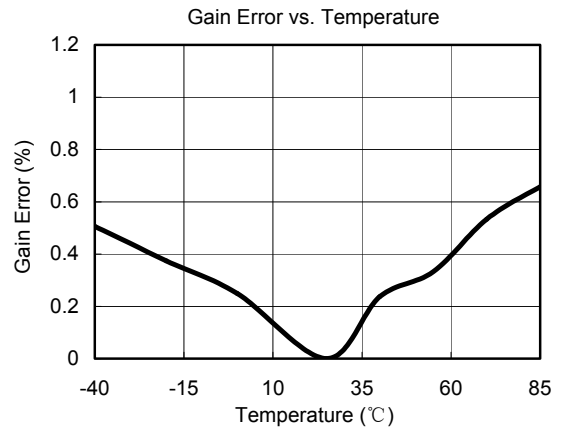
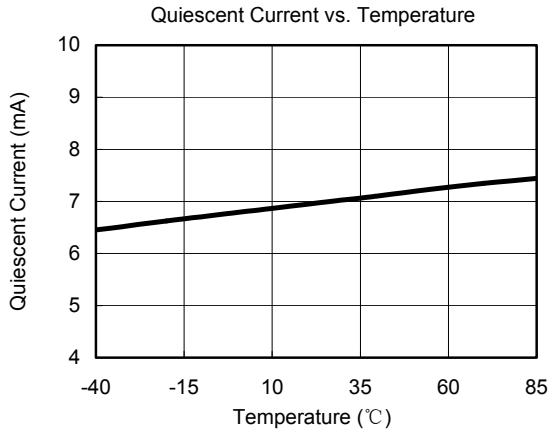
TYPICAL PERFORMANCE CHARACTERISTICS

At $V_{CC} = 5V$, $T_A = +25^{\circ}C$, $R_L = 150\Omega$, all outputs AC coupled, unless otherwise noted.



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Application Information

The SGM9121 low cost, integrated, 5th order, video filter is intended to replace passive LC filters and drivers in low voltage portable video applications.

The SGM9121 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 SGM9121 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 SGM9121 well suited for space sensitive applications such as digital cameras, cellular phones and other portable devices.

Enable/Shutdown

The SGM9121 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 SGM9121 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 SGM9121 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.

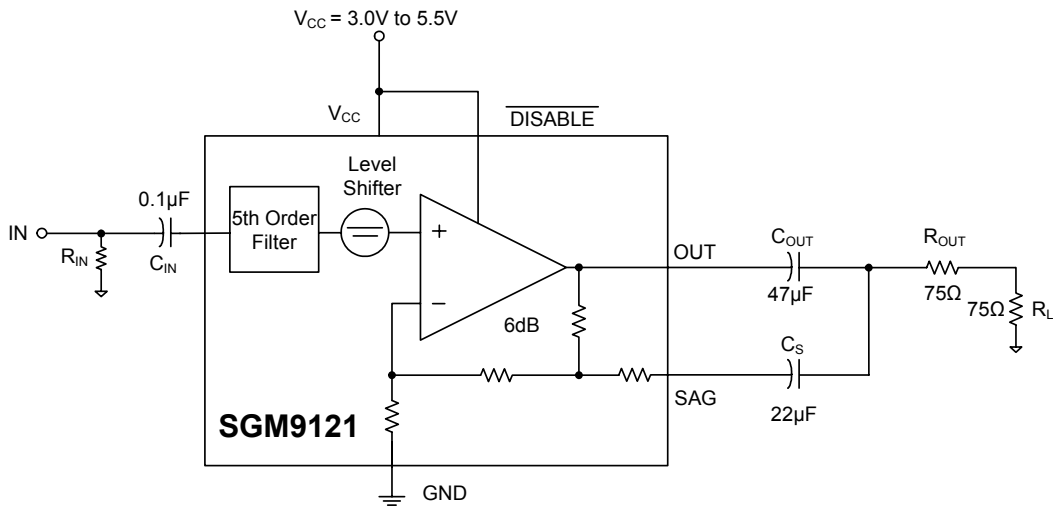


Figure 1. Typical Application Diagram

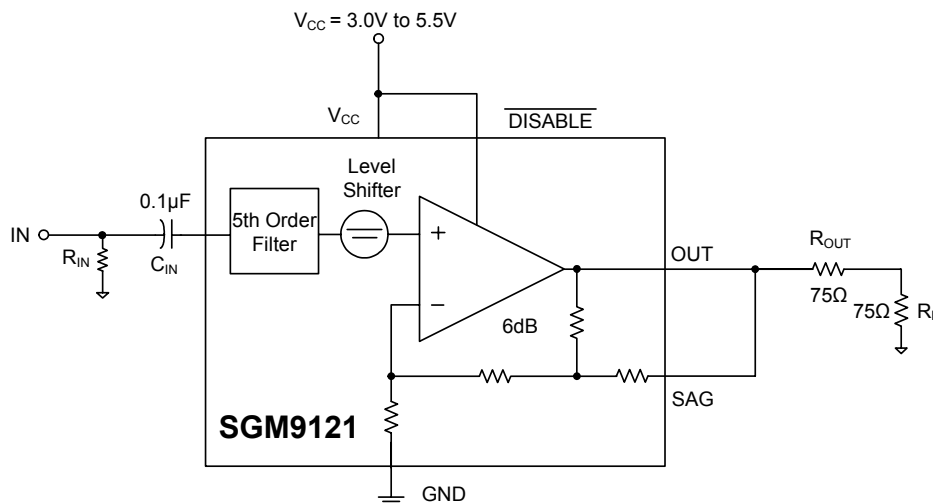


Figure 2. AC-Coupled Input/DC-Coupled Output

SAG Correction

The SGM9121 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 SGM9121 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 SGM9121, 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.

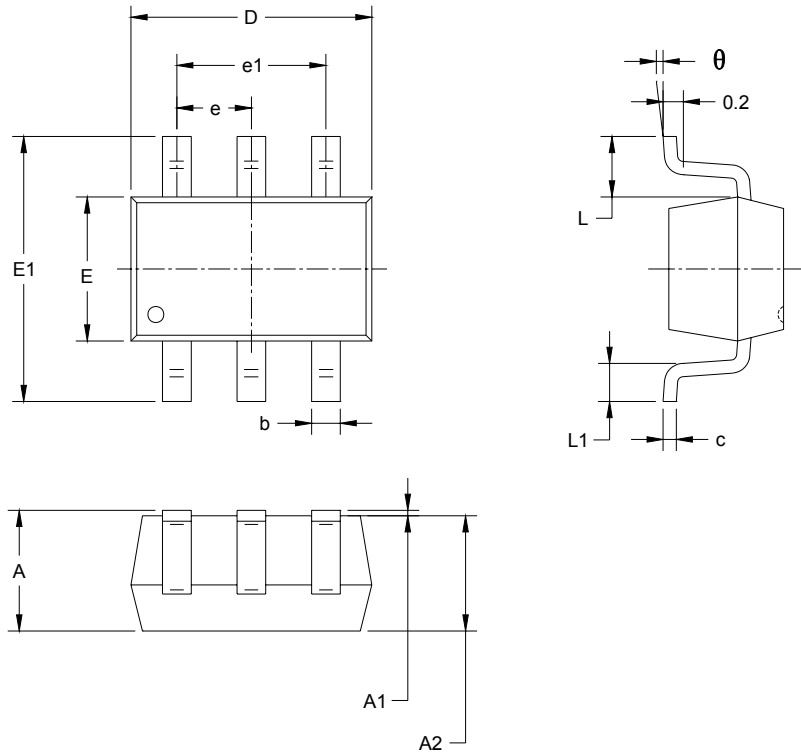
Layout and Power-Supply Bypassing

The SGM9121 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

SC70-6 (SOT-363)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

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