Triple, 8MHz, 3rd Order SDTV Video Filter Drivers

GENERAL DESCRIPTION

SGM9123 is a video buffer which integrates triple 6dB Gain rail-to-rail output driver and triple 3rd output reconstruction filter, it has 8MHz -3dB bandwidth and 44V/μs slew rate. SGM9123 provides improved image quality compared with passive LC filters and discrete drivers solution. Operating from single supplies ranging from +2.5V to +5.5V and sinking an ultra-low 7.4mA quiescent current, the SGM9123 is ideally suited for battery powered applications.

SGM9123 can be DC-coupled or AC-coupled with input video signal, such as the output stage of DAC to eliminate out-of-band noise. Internal diode clamps and bias circuitry may be used if AC-coupled inputs are required. SGM9123 also integrates an internal level shift circuit which avoids sync-pulse being clipped and allows DC-coupled output. The drivers in SGM9123 can drive DC or AC-coupled single (150Ω) or dual (75 Ω) loads.

The SGM9123 has lead (Pb) free SO-8 package and ESD (HBM) reaches 8KV.

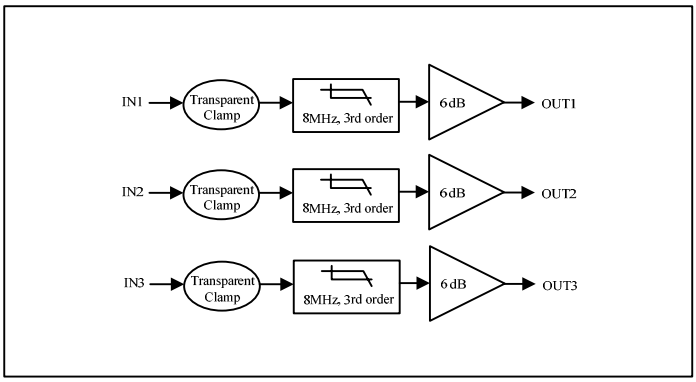
FEATURES

- **Triple 3rd order 8MHz (SD) Filters**
- **Transparent Input Clamping**
- **6dB Output Driver Gain and Drive Dual Video Load**
- **Rail-to-Rail Output**
- **Input Voltage Range Includes Ground**
- **AC or DC Coupled Inputs**
- **AC or DC Coupled Outputs**
- **Operates from 2.5V to 5.5V Single Power Supply**
- **Low Power (2.5mA/channel)**
  7.4mA Total Supply Current
- **Lead (Pb) Free SO-8 Package**

APPLICATIONS

Video Amplifiers
Cable and Satellite Set Top Boxes
Communications Devices
Video on Demand
Portable and Handheld Products
Personal Video Recorders
DVD Players
SDTVs

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS: V_S = +5.0V

(At R_L = 150Ω connected to GND, V_{IN} = 1Vpp，and C_{IN} = 0.1μF, all outputs AC coupled with 220μF，unless otherwise noted)

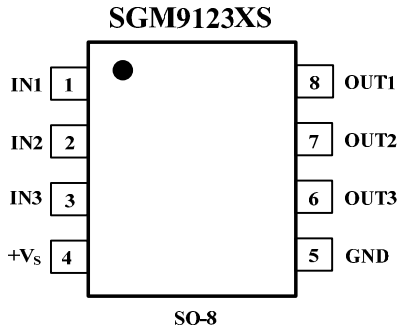
PARAMETER	CONDITIONS	SGM9123					
		TYP	MIN/MAX OVER TEMPERATURE				
		+25℃	+25℃	0℃ to+70℃	-40℃ to+85℃	UNITS	MIN/ MAX
INPUT CHARACTERISTICS							
Output Level Shift Voltage (V_{OLS})	V_{IN} = 0V, no load	258	419	423	440	mV	MAX
Input Voltage Clamp (V_{CLAMP})	I_{IN} = -1mA	-13	-27	-27.6	-28.7	mV	MIN
Clamp Charge Current	V_{IN} = V_{CLAMP} -100mV	-5.60	-8.2	-8.23	-8.24	mA	MIN
Voltage Gain (A_V)	R_L = 150Ω	2.0	1.89	1.88	1.87	V/V	MIN
			2.07	2.08	2.09	V/V	MAX
OUTPUT CHARACTERISTICS							
Output Voltage High Swing	V_{IN} = 3V, R_L = 150Ω to GND	4.42	4.15	4.13	4.12	V	MIN
Output Short-Circuit Current (I_{SC})	V_{IN} = 3V, to GND through 10Ω	110	68	65	63	mA	MIN
	V_{IN} = 100mV, out short to V_{DD} through 10Ω	162	102	92	90	mA	MIN
POWER SUPPLY							
Operating Voltage Range			2.5	2.7	2.7	V	MIN
			5.5	5.5	5.5	V	MAX
Power Supply Rejection Ratio (PSRR)	V_s = +2.7V to + 5.5V	66	51	48	46	dB	MIN
Quiescent Current (I_Q)	V_{IN} = 500mV,	7.4	9.5	10.5	10.7	mA	MAX
DYNAMIC PERFORMANCE							
±0.1dB Bandwidth	R_L = 150Ω	5.4				MHz	TYP
-3dB Bandwidth	R_L = 150Ω	8.0				MHz	TYP
Filter Response							
Normalized Gain: f_{IN} = 4.5MHz		+0.2				dB	TYP
f_{IN} = 27MHz		-25				dB	TYP
Slew Rate	20% to 80%, V_{IN} = 1V Step,	44				V/μs	TYP
Differential Gain (DG)	NTSC & PAL DC coupled	0.2				%	TYP
	NTSC & PAL AC coupled	0.52				%	TYP
Differential Phase (DP)	NTSC & PAL DC coupled	0.4				°	TYP
	NTSC & PAL AC coupled	1.0				°	TYP
Group Delay Variation (D/DT)	f = 400KHz, 6.5MHz	17.5				ns	TYP
Crosstalk (channel - to - channel)	at 1MHz	-64				dB	TYP
Fall Time	2.0V_{STEP}, 80% to 20%	36				ns	TYP
Rise Time	2.0V_{STEP}, 80% to 20%	38				ns	TYP

Specifications subject to change without notice.

PACKAGE/ORDERING INFORMATION

ORDER NUMBER	PACKAGE DESCRIPTION	TEMPERATURE RANGE	PACKAGE OPTION	MARKING INFORMATION
SGM9123XS/TR	SO-8	-40℃ to +125℃	Tape and Reel, 2500	SGM9123XS

PIN CONFIGURATION (Top View)



PIN DESCRIPTION

PIN	NAME	FUNCTION
1	IN1	Video input, channel 1
2	IN2	Video input, channel 2
3	IN3	Video input, channel 3
4	$+V_S$	Power supply
5	GND	Ground
6	OUT3	Filtered output, channel 3
7	OUT2	Filtered output, channel 2
8	OUT1	Filtered output, channel 1

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V+ to V- 6.5V
Input Voltage
..... GND – 0.3 V to ($+V_S$) +0.3V
Storage Temperature Range.....–65℃ to +150℃
Junction Temperature ..... 160℃
Operating Temperature Range ..... –40℃ to +125℃
Power Dissipation, P_D @ T_A = 25℃
SO-8 .....0.8W
Package Thermal Resistance
SO-8, θ_{JA}..... 125℃/W
Lead Temperature Range (Soldering 10sec)
..... 260℃
ESD Susceptibility
HBM.....8000V
MM.....400V

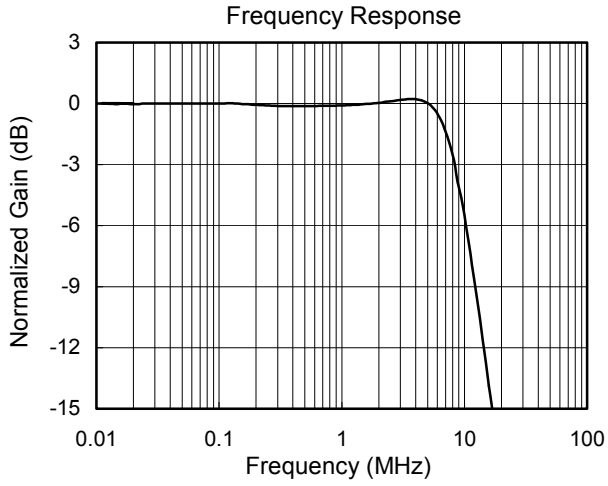
NOTES
1. Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

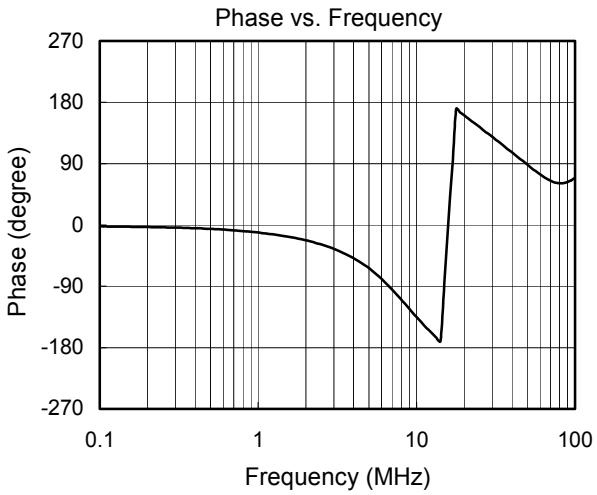
CAUTION

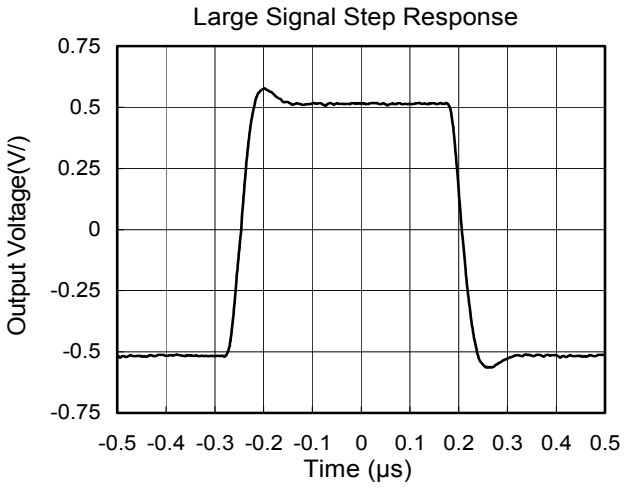
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SG Micro-electronics recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.
ESD damage can range from 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.

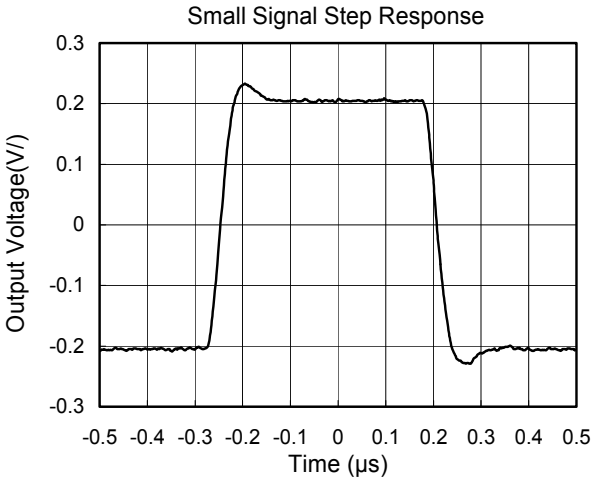
TYPICAL PERFORMANCE CHARACTERISTICS

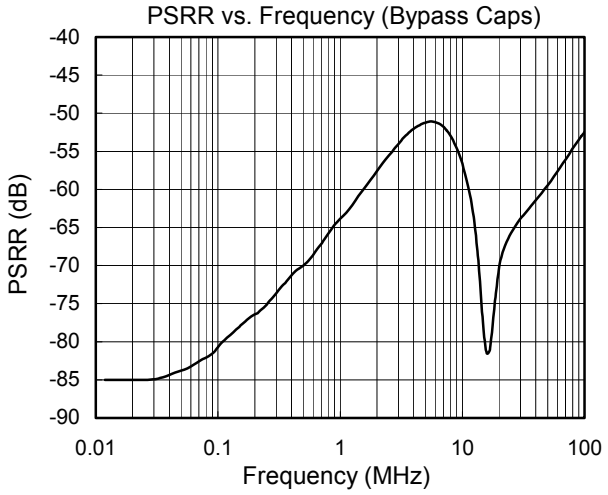
At V_S = +5.0V, T_A = +25℃, R_L = 150Ω, all outputs AC coupled with 220μF, unless otherwise noted.

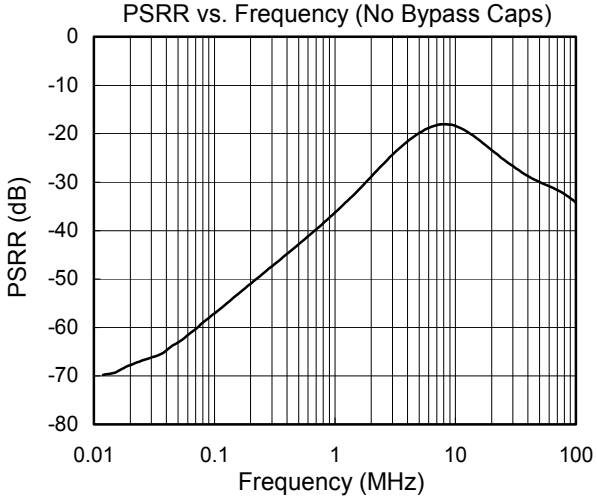






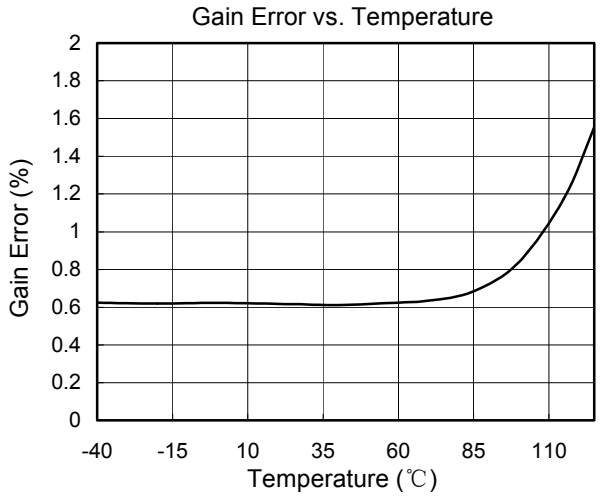


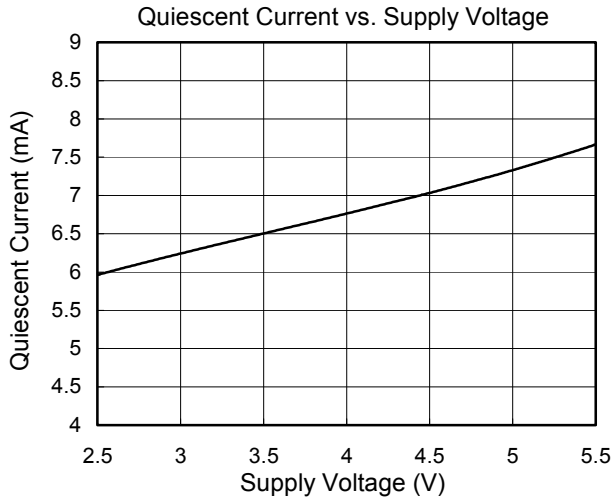


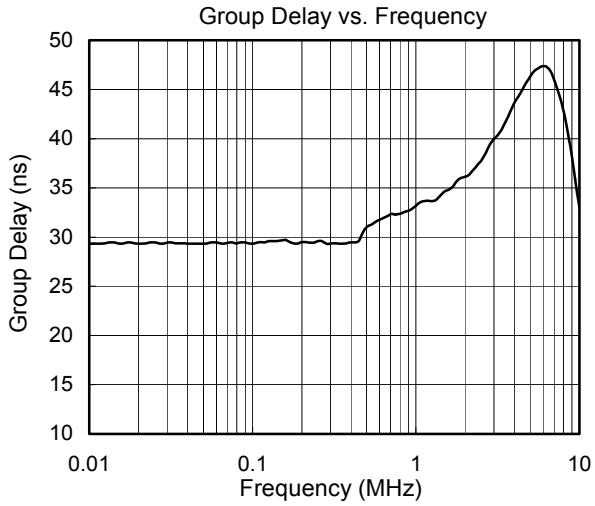


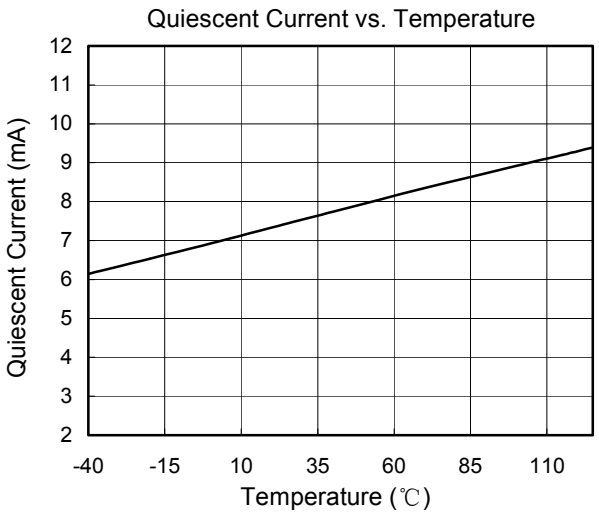
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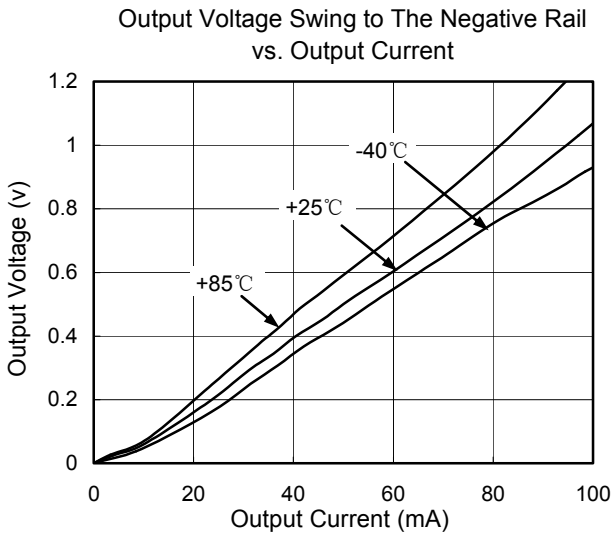
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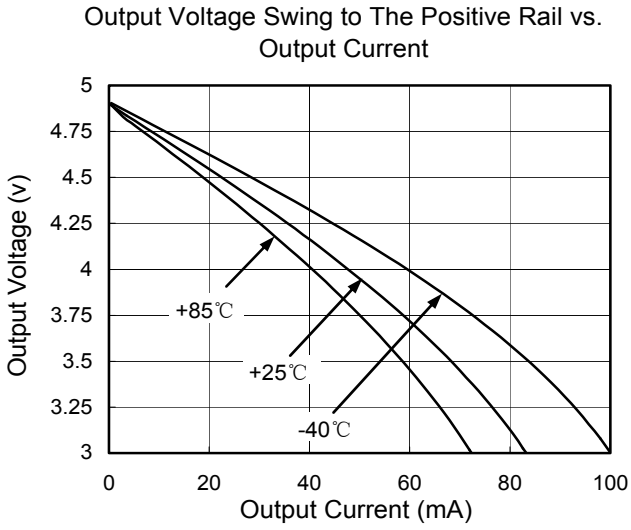












Applications Information

Functional Description

SGM9123 operates from a single +2.5V to +5V supply. In application, SGM9123 is a fully integrated solution for filtering and buffering SDTV signals in front of video decoder or behind video encoder. For example, SGM9123 can replace three passive LC filters and three amplifier drivers at CVBS and S-video output side in set-top box and DVD player, this solution can help you save PCB size and production cost, it also improves video signal performance comparing with traditional design using discrete components. SGM9123 features a DC-coupled input buffer, 3-pole low-pass filter to eliminate out-of-band noise of video encoder, and a gain of +6dB in the output amplifier to drive 75Ω load. The AC or DC-coupled input buffer eliminates sync crush, droop, and field tilt. The output of SGM9123 also can be DC-coupled or AC-coupled.

Input Considerations

Besides AC coupling, the SGM9123 inputs also can be DC-coupled. In DC coupling application, No input coupling capacitors are needed because the amplitude of input video signal from DAC includes ground and extends up to 1.4V, then SGM9123 can be directly connected to the output of a single-supply, current-output DAC without any external bias network. Some time, if DAC's output level exceeds the range of 0V to 1.4V, or SGM9123 is driven by an unknown external source or a SCART switch which has its own clamping circuit, AC coupling is needed in such applications.

Output Considerations

The SGM9123 outputs can be DC-coupled or AC-coupled. When 0V is input, the SGM9123 output voltage is 260mV typically. In DC coupling design, one 75Ω resistor is used to Connect SGM9123's output pin with external load directly, this serial back-termination resistor is used to match the impedance of the transmission line between SGM9123 and external load to cancel the signal reflection. The SGM9123 outputs can sink and source current allowing the device to be AC-coupled with external load, in AC coupling, 220μF at least capacitor will be used in order to eliminate field tilt.

Power-Supply Bypassing and Layout

Correct power supply bypassing is very important for optimizing video performance in design. One 0.1μF and one 10μF capacitors are always used to Bypass V_{CC} pin of SGM9123, please place these two capacitors as close to the SGM9123 output pin as possible, a large ground plane is also needed to ensure optimum performance. The input and output termination resistors should be placed as close to the related pin of SGM9123 as possible to avoid performance degradation. The PCB traces at the output side should have 75Ω characteristic impedance in order to match the 75Ω characteristic impedance cable connecting external load. In design, please keep the board trace at the inputs and outputs of the SGM9123 as short as possible to minimize the parasitic stray capacitance and noise pickup.

Typical Application Diagram

The following schematic in Figure 3 is normally used for AC coupled output and DC-coupled input with DAC which has an output voltage range of 0V to 1.4V. AC coupled output offer slightly lower power dissipation and high ESD protection ability. The schematics in Figure 1 and Figure 2 are also popular in design. Figure 4 is a kind of special application in STB.

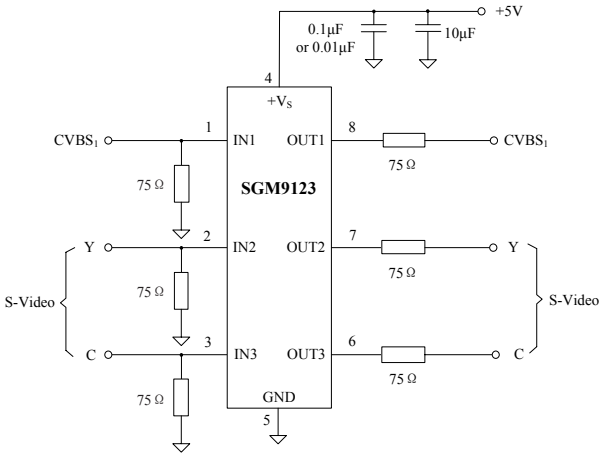


Figure 1. DC Coupling Application Schematic

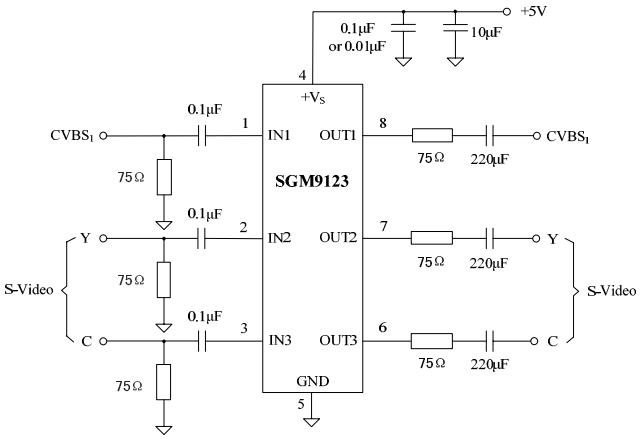


Figure 2. AC Coupling Application Schematic

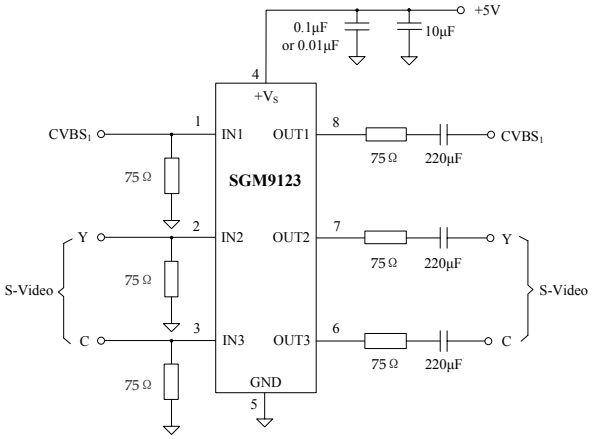


Figure 3. Input DC Coupling and Output AC Coupling Application Schematic

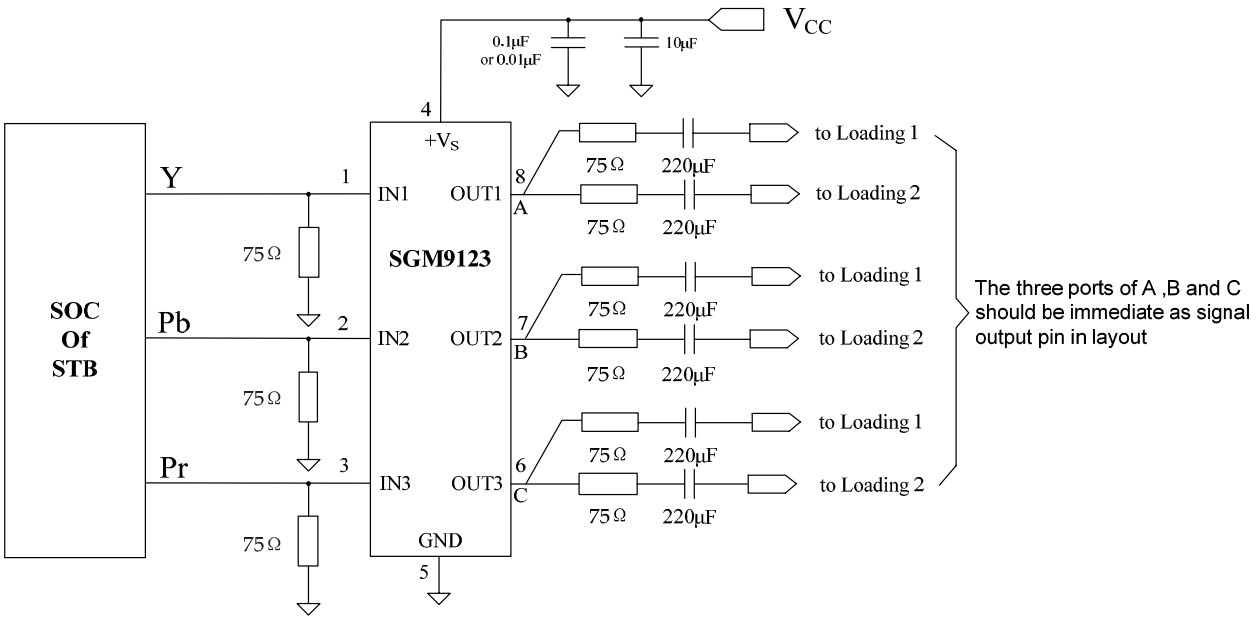
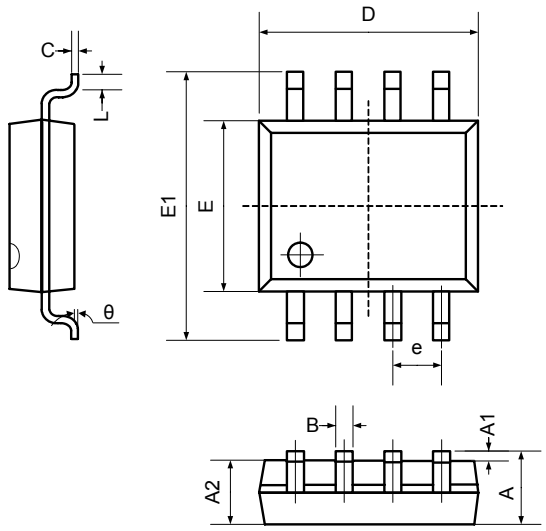


Figure 4. Input DC Coupling and Output AC Coupling Application Schematic in STB

PACKAGE OUTLINE DIMENSIONS

SO-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	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

REVISION HISTORY

Location	Page

11/2007— Preliminary Data Sheet

01/2008— Data Sheet REV.A

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