



# SGM9123

## 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/ $\mu$ s 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 (150 $\Omega$ ) or dual (75 $\Omega$ ) loads.

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

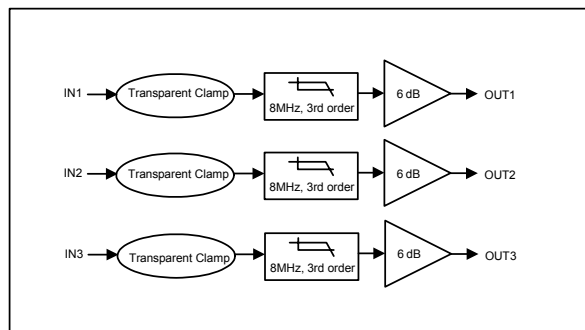
### FEATURES

- 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

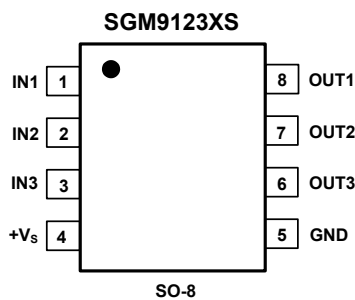
### BLOCK DIAGRAM



**PACKAGE/ORDERING INFORMATION**

| ORDER NUMBER | PACKAGE DESCRIPTION | TEMPERATURE RANGE | PACKAGE OPTION      | MARKING INFORMATION |
|--------------|---------------------|-------------------|---------------------|---------------------|
| SGM9123XS/TR | SO-8                | -40°C to +125°C   | 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 <sub>S</sub> | 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<sub>S</sub>) +0.3V  
 Storage Temperature Range.....-65°C to +150°C  
 Junction Temperature ..... 160°C  
 Operating Temperature Range ..... -40°C to +125°C  
 Power Dissipation, P<sub>D</sub> @ T<sub>A</sub> = 25°C  
 SO-8 .....0.8W  
 Package Thermal Resistance  
 SO-8, θ<sub>JA</sub>..... 125°C/W  
 Lead Temperature Range (Soldering 10sec)  
 ..... 260°C  
 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. 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.

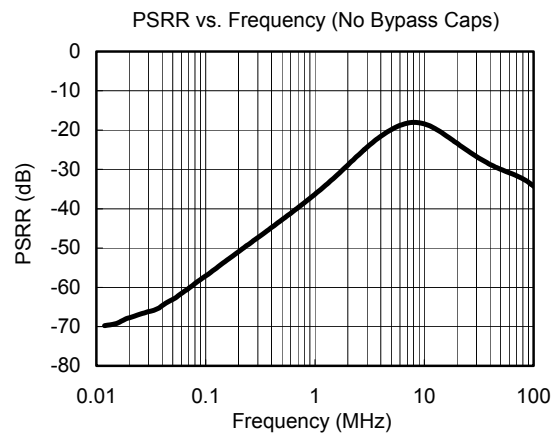
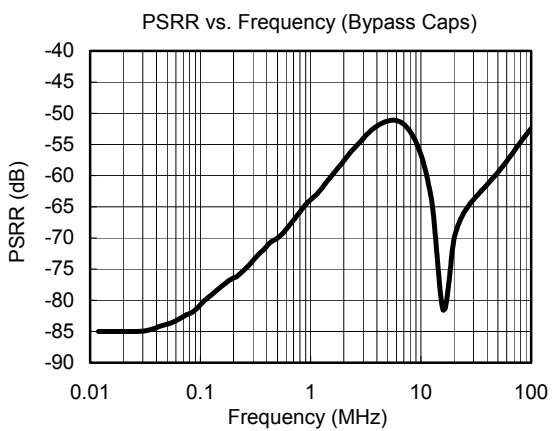
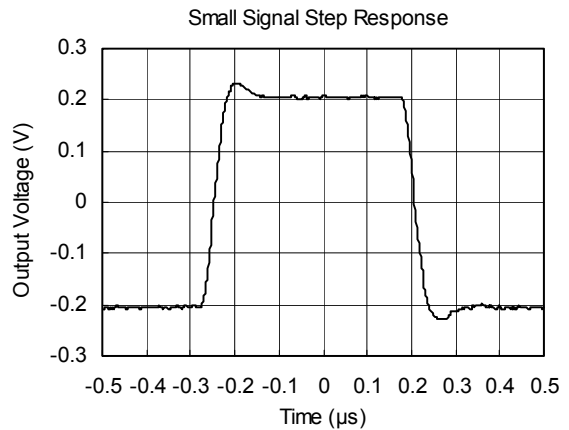
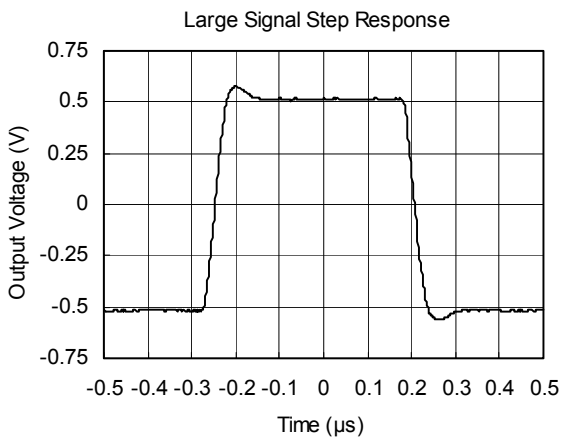
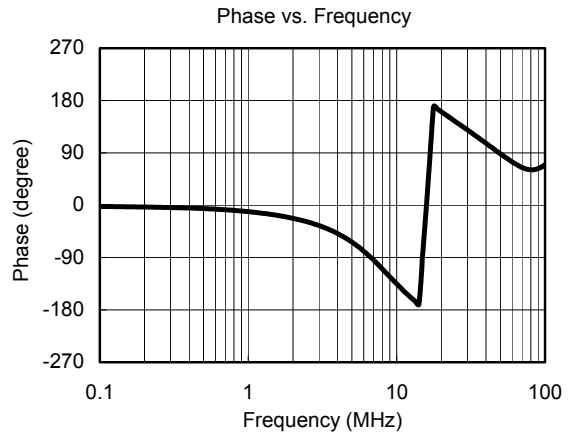
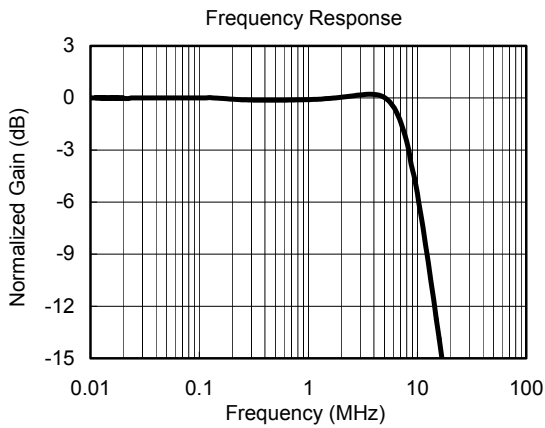
**ELECTRICAL CHARACTERISTICS:  $V_S = +5.0V$** (At  $R_L = 150\Omega$  connected to GND,  $V_{IN} = 1V_{pp}$ , and  $C_{IN} = 0.1\mu F$ , all outputs AC coupled with  $220\mu F$ , unless otherwise noted)

| PARAMETER                                 | CONDITIONS  | SGM9123 |                          |                 |                   |            |             |
|---|---|---------|--------------------------|-----------------|-------------------|------------|-------------|
|   |   | TYP     | MIN/MAX OVER TEMPERATURE |                 |                   |            | MIN/<br>MAX |
|   |   | +25°C   | +25°C                    | 0°C<br>to +70°C | -40°C<br>to +85°C | UNITS      |             |
| <b>INPUT CHARACTERISTICS</b>              |   |         |                          |                 |                   |            |             |
| 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 ( $A_V$ )                    | $R_L = 150\Omega$   | 2.0     | 1.89                     | 1.88            | 1.87              | V/V        | MIN         |
|   |   |         | 2.07                     | 2.08            | 2.09              | V/V        | MAX         |
| <b>OUTPUT CHARACTERISTICS</b>             |   |         |                          |                 |                   |            |             |
| Output Voltage High Swing                 | $V_{IN} = 3V$ , $R_L = 150\Omega$ to GND                    | 4.42    | 4.15                     | 4.13            | 4.12              | V          | MIN         |
| Output Short-Circuit Current ( $I_{SC}$ ) | $V_{IN} = 3V$ , to GND through $10\Omega$                   | 110     | 68                       | 65              | 63                | mA         | MIN         |
|   | $V_{IN} = 100mV$ , out short to $V_{DD}$ through $10\Omega$ | 162     | 102                      | 92              | 90                | mA         | MIN         |
| <b>POWER SUPPLY</b>                       |   |         |                          |                 |                   |            |             |
| 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         |
| <b>DYNAMIC PERFORMANCE</b>                |   |         |                          |                 |                   |            |             |
| $\pm 0.1dB$ Bandwidth                     | $R_L = 150\Omega$   | 5.4     |                          |                 |                   | MHz        | TYP         |
| -3dB Bandwidth                            | $R_L = 150\Omega$   | 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/ $\mu s$ | 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 changes without notice.

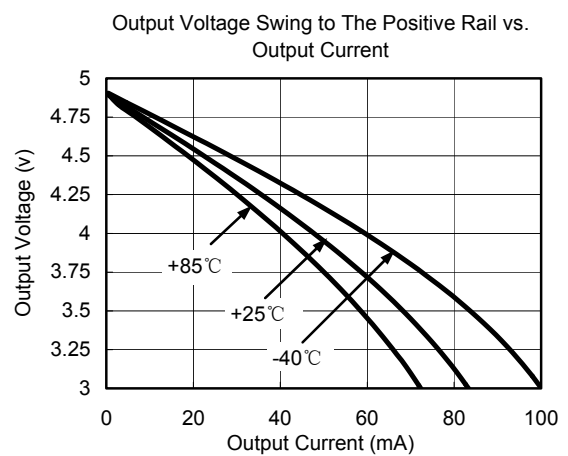
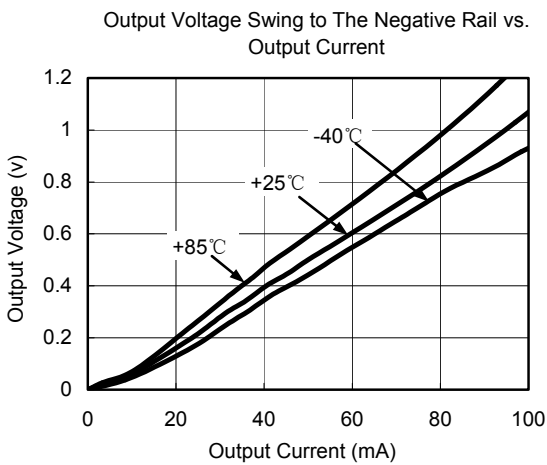
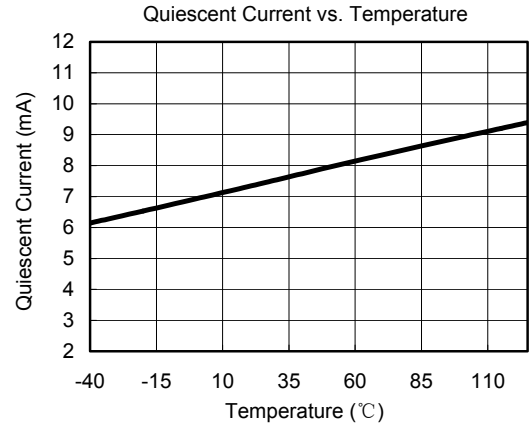
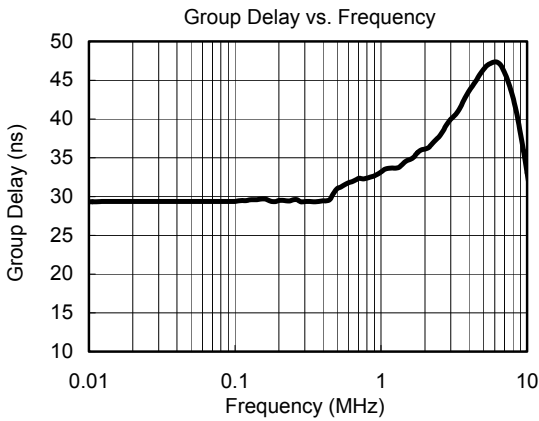
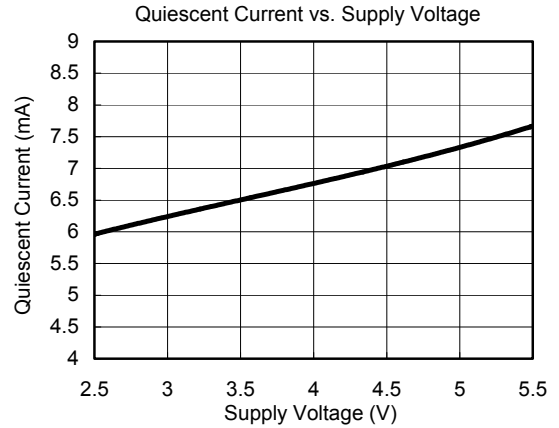
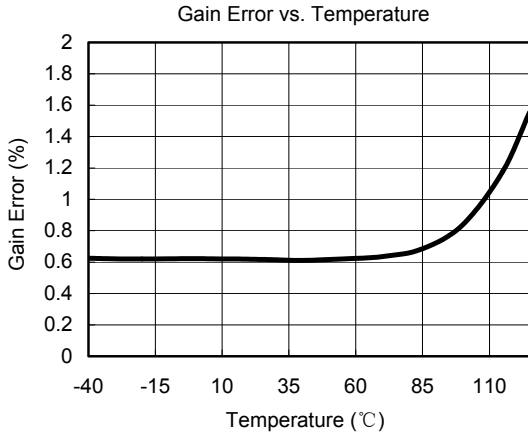
**TYPICAL PERFORMANCE CHARACTERISTICS**

At  $V_S = +5.0V$ ,  $T_A = +25^\circ C$ ,  $R_L = 150\Omega$ , all outputs AC coupled with  $220\mu F$ , unless otherwise noted.



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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<sub>CC</sub> 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.

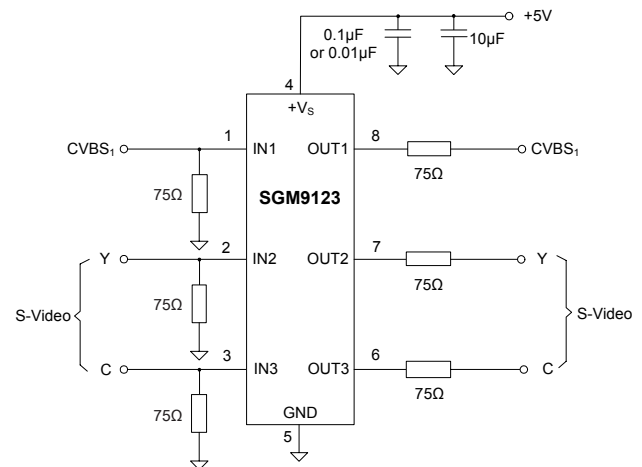


Figure 1. DC Coupling Application Schematic

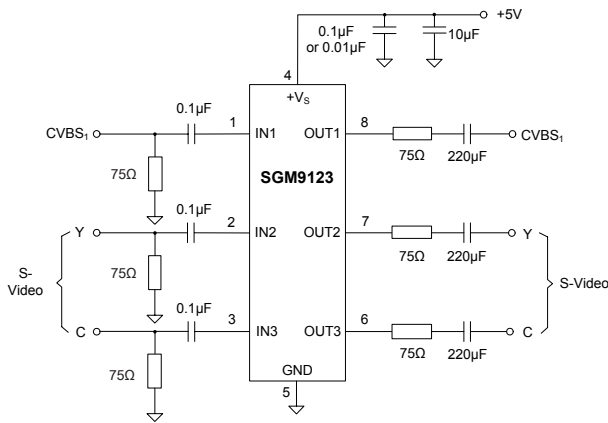


Figure 2. AC Coupling Application Schematic

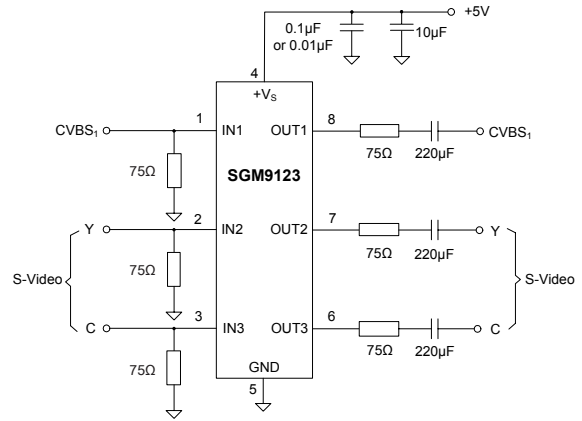


Figure 3. Input DC Coupling and Output AC Coupling Application Schematic

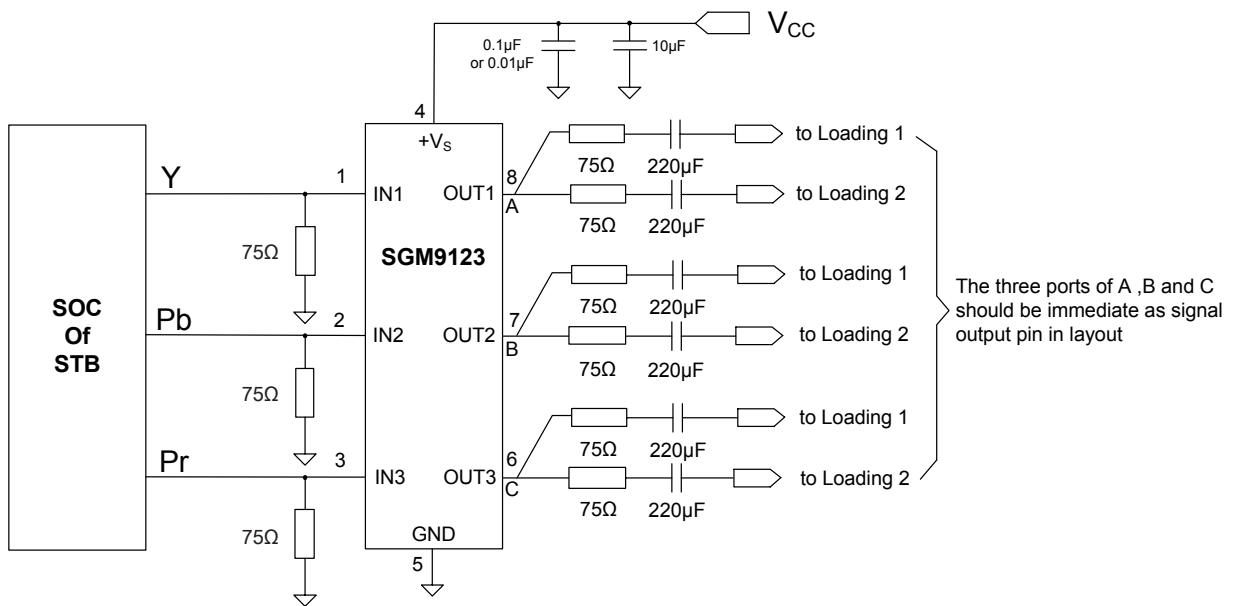
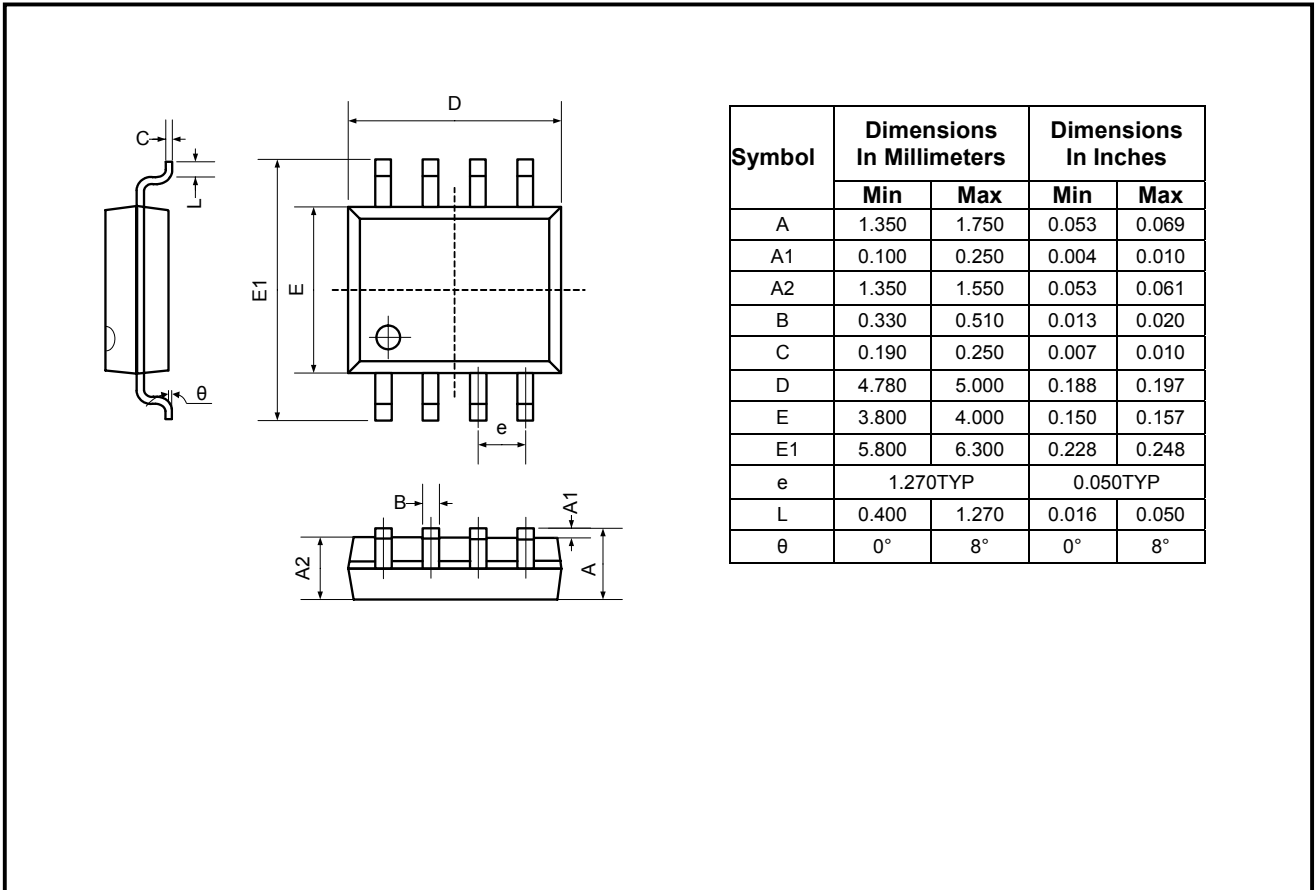


Figure 4. Input DC Coupling and Output AC Coupling Application Schematic in STB

PACKAGE OUTLINE DIMENSIONS

SO-8



01/2008 REV. A

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