

SGM9116

Triple, 35MHz, 3rd Order HDTV Video Filter Driver

PRODUCT DESCRIPTION

The SGM9116 is a video buffer which integrates triple 6dB Gain rail-to-rail output driver and triple 3rd output reconstruction filter, it has 35MHz -3dB bandwidth and 160V/ μ s slew rate. SGM9116 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 27.5mA quiescent current, the SGM9116 is ideally suited for battery powered applications.

SGM9116 can be DC-coupled or AC-coupled with input video signal, such as the output of DAC. Internal diode clamps and bias circuitry may be used if AC-coupled inputs are required. SGM9116 also integrates an internal level shift circuit which avoids sync-pulse being clipped and allows DC-coupled output. The driver in SGM9116 can drive DC or AC-coupled single (150 Ω) or dual (75 Ω) loads.

The SGM9116 has lead (Pb) free SOIC-8 package and ESD(HBM) reaches 8KV.

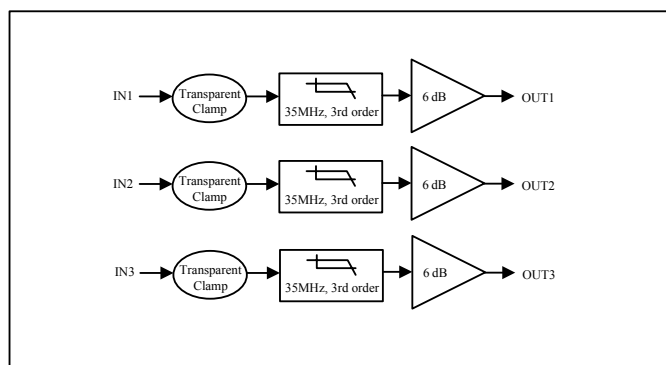
FEATURES

- Triple 3rd order 35MHz (HD) 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 2.5 V to 5.5 V Single power supply
- Low Power (9.2mA/channel)
27.5 mA total Supply Current
- Lead (Pb) Free SOIC-8 package

APPLICATIONS

Video amplifier
Cable and Satellite set- top box
Communications device
Video on demand
Portable and handheld product
Personal video recorder
DVD player
HDTV
Projector

BLOCK DIAGRAM



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)

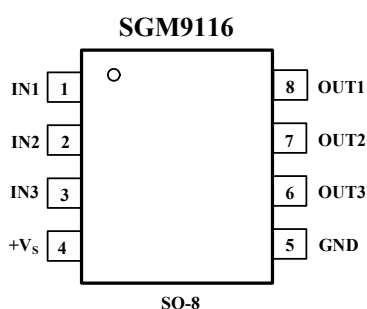
| PARAMETER | CONDITION | SGM9116 | | | | | | | |
|---|---|---------|--------------------------|----------------|------------------|-------------------|------------|-------|-------------|
| | | TYP | MIN/MAX OVER TEMPERATURE | | | | | UNITS | MIN/ MAX |
| | | +25°C | +25°C | 0°C to 70°C | -40°C to 85°C | -40°C to 125°C | | | |
| INPUT CHARACTERISTICS | | | | | | | | | |
| Output Level Shift Voltage (V_{OLS}) | $V_{IN} = 0V$, no load | 253 | 327 | 330 | 340 | 370 | mV | MAX | |
| Input Bias Current (I_B) | | | | | | | pA | TYP | |
| Input Voltage Clamp (V_{CLAMP}) | $I_{IN} = -1mA$ | -4.5 | -15 | -16 | -19 | -22 | mV | MIN | |
| Clamp Charge Current | $V_{IN} = V_{CLAMP} - 100mV$ | -5 | -6.0 | -6.1 | -6.6 | -7.2 | mA | MIN | |
| Input Resistance (R_{IN}) | $0.5V < V_{IN} < 1.0V$ | | | | | | MΩ | MIN | |
| Voltage Gain (A_V) | $R_L = 150\Omega$ | 2.0 | 1.92 | 1.90 | 1.88 | 1.85 | V/V | MIN | |
| | | | 2.04 | 2.06 | 2.08 | 2.1 | V/V | MAX | |
| OUTPUT CHARACTERISTICS | | | | | | | | | |
| Output Voltage High Swing | $V_{IN} = 3V$, $R_L = 150\Omega$ to GND | 4.5 | 4.3 | 4.28 | 4.25 | 4.2 | V | MIN | |
| Output Short-Circuit Current (I_{SC}) | $V_{IN} = 3V$, to GND through 10Ω | -105 | -102 | | | | mA | MAX | |
| | $V_{IN} = 100mV$, out short to V_{DD} through 10Ω | 115 | 103 | | | | mA | MIN | |
| POWER SUPPLY | | | | | | | | | |
| Operating Voltage Range | | | 2.5 | 2.7 | 2.7 | 2.7 | V | MIN | |
| | | | | 5.5 | 5.5 | 5.5 | V | MAX | |
| Power Supply Rejection Ratio (PSRR) | $V_S = +2.7V$ to $+5.5V$ | 60 | 58 | 58 | 57 | 56 | dB | MIN | |
| Quiescent Current (I_Q) | $V_{IN} = 500mV$, | 27.5 | 31.5 | 32 | 33 | 34 | mA | MAX | |
| DYNAMIC PERFORMANCE | | | | | | | | | |
| $\pm 0.1dB$ Bandwidth | $R_L = 150\Omega$ | 11.8 | | | | | MHz | TYP | |
| -3dB Bandwidth | $R_L = 150\Omega$ | 35 | | | | | MHz | TYP | |
| Filter Response | Normalized Gain: $f_{IN} = 44.25MHz$ $f_{IN} = 74.25MHz$ | -5.0 | | | | | dB | TYP | |
| | | -13.5 | | | | | dB | TYP | |
| Slew Rate | 20% to 80%, $V_{IN} = 1V$ Step, | 160 | | | | | V/ μs | TYP | |
| Differential Gain (DG) | NTSC & PAL DC coupled | 0.02 | | | | | % | TYP | |
| | NTSC & PAL AC coupled | 0.3 | | | | | % | TYP | |
| Differential Phase (DP) | NTSC & PAL DC coupled | 0.02 | | | | | ° | TYP | |
| | NTSC & PAL AC coupled | 0.36 | | | | | ° | TYP | |
| Group Delay Variation (D/DT) | $f = 400KHz, 26.5MHz$ | 1.2 | | | | | ns | TYP | |
| Crosstalk (channel - to - channel) | at 1MHz | -64 | | | | | dB | TYP | |
| Fall Time | $2.0V_{STEP}$, 80% to 20% | 9.8 | | | | | ns | TYP | |
| Rise Time | $2.0V_{STEP}$, 80% to 20% | 10.5 | | | | | ns | TYP | |

Specifications subject to change without notice.

PACKAGE/ORDERING INFORMATION

| ORDER NUMBER | PACKAGE DESCRIPTION | TEMPERATURE RANGE | PACKAGE OPTION | MARKING INFORMATION |
|--------------|---------------------|-------------------|---------------------|---------------------|
| SGM9116ZS/TR | SO-8 | 0°C to +70°C | Tape and Reel, 2500 | SGM9116ZS |
| SGM9116XS/TR | SO-8 | -40°C to +125°C | Tape and Reel, 2500 | SGM9116XS |

PIN CONFIGURATIONS (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 | +Vs | 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_- 7.5 V
 Input Voltage

..... GND – 0.3 V to $(+V_s) + 0.3V$

Storage Temperature Range –65°C to +150°C

Junction Temperature 160°C

Operating Temperature Range –40°C to +125°C

Power Dissipation, P_D @ $T_A = 25^\circ C$

SO-8 0.8W

Package Thermal Resistance

SO-8, θ_{JA} 128°C/W

Lead Temperature Range (Soldering 10 sec)

..... 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.

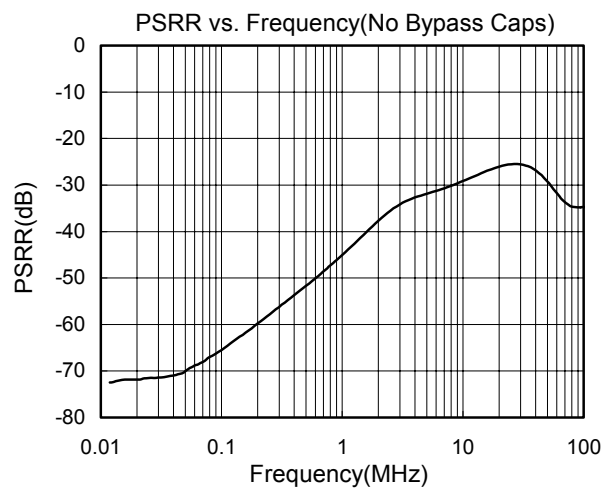
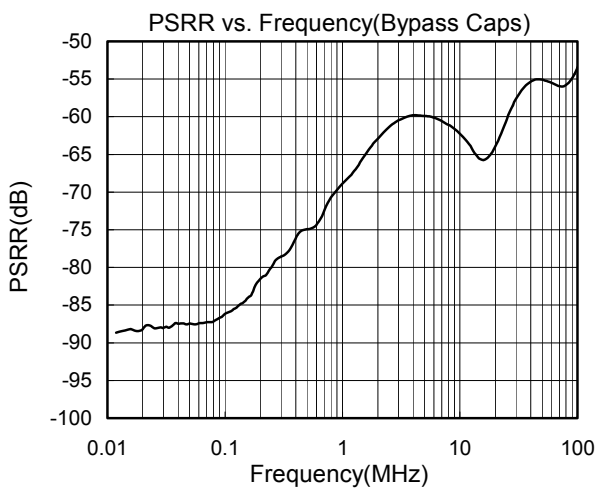
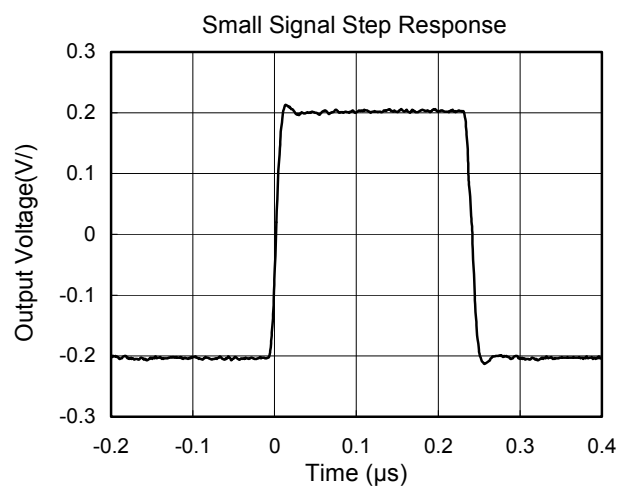
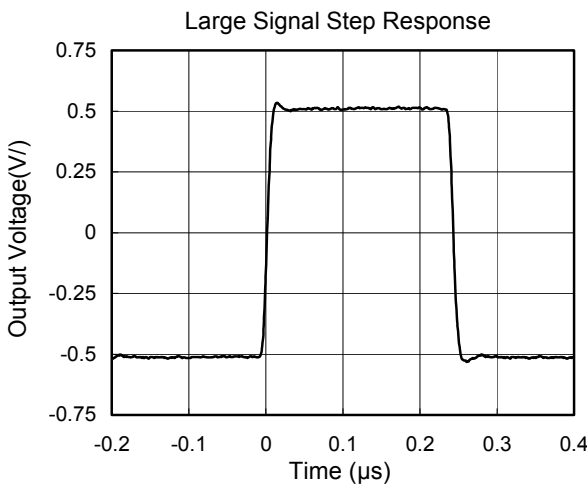
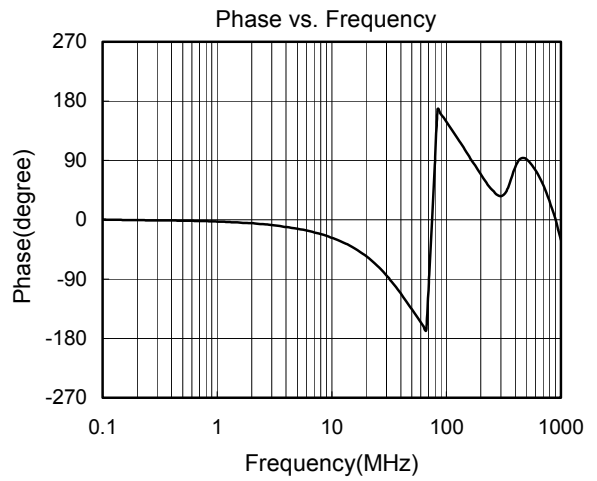
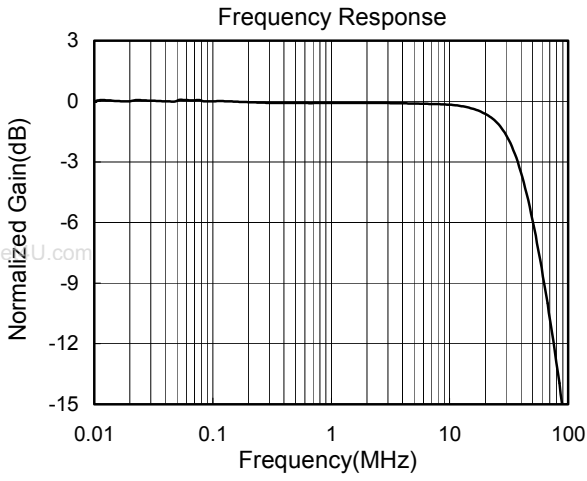
CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. Shengbang 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.

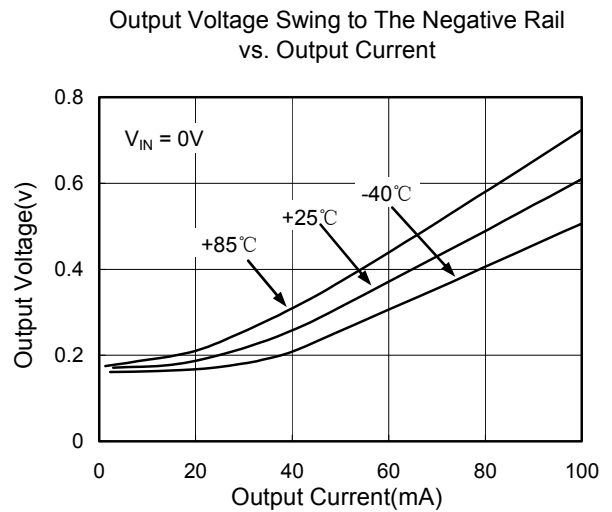
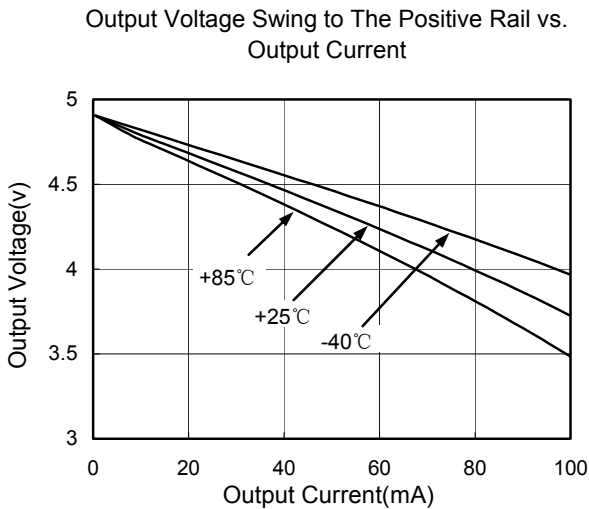
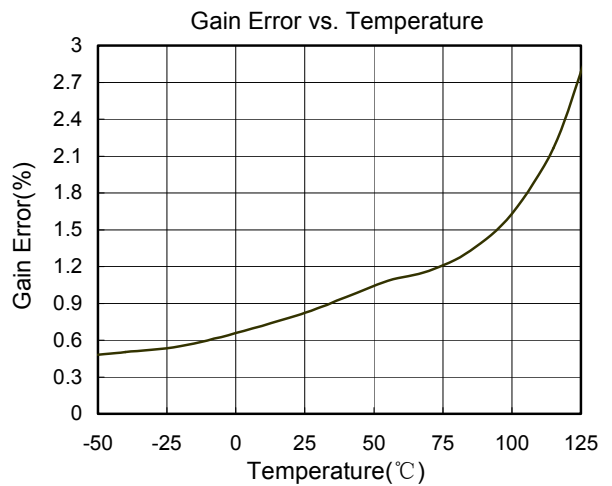
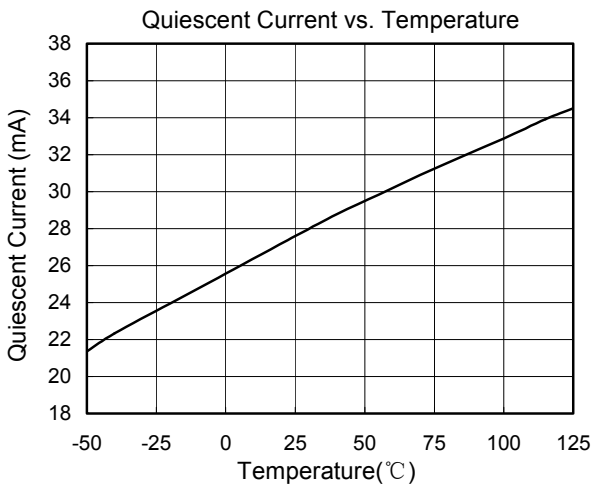
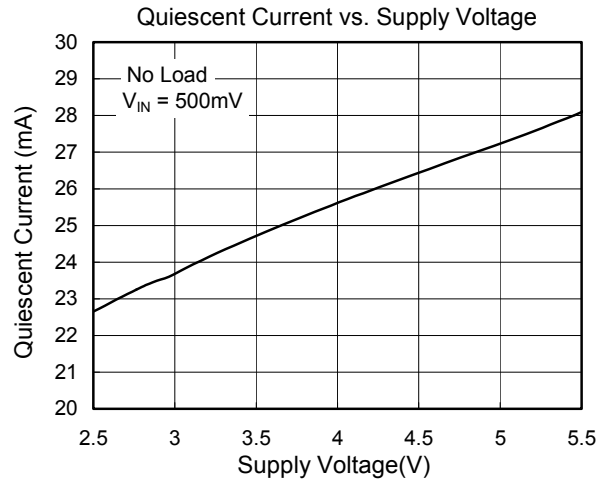
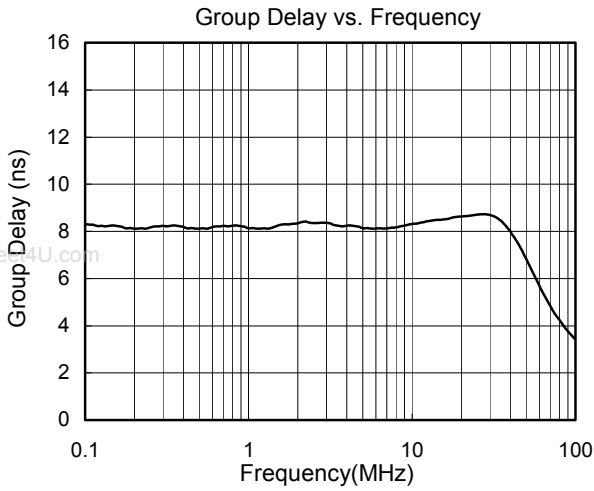
TYPICAL PERFORMANCE CHARACTERISTICS

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Applications Information

Functional Description

SGM9116 operates from a single +2.5V to +5V supply. In application, SGM9116 is a fully integrated solution for filtering and buffering HDTV signals in front of video decoder or behind video encoder. For example, SGM9116 can replace three passive LC filters and three amplifier drivers at R\G\B and Y\Pb\Pr 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. SGM9116 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 SGM9116 also can be DC-coupled or AC-coupled.

Input Considerations

Besides AC coupling, the SGM9116 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 SGM9116 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 SGM9116 is driven by an unknown external source or a SCART switch which has its own clamping circuit, AC coupling is needed in such application.

Output Considerations

The SGM9116 outputs can be DC-coupled or AC-coupled. While 0V is input, the SGM9116 output voltage is 260mV typically. In DC coupling design, one 75Ω resistor is used to Connect SGM9116's output pin with external load directly, this serial back-termination resistor is used to match the impedance of the transmission line between SGM9116 and external load to cancel the signal reflection. The SGM9116 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 cancel 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 SGM9116, please place these two capacitors as close to the SGM9116 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 SGM9116 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 SGM9116 as short as possible to minimize the parasitic stray capacitance and noise pickup.

Typical Application Diagram

The following schematic in Figure 2 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 is are also popular in design. Figure 3 is a kind of special application in STB.

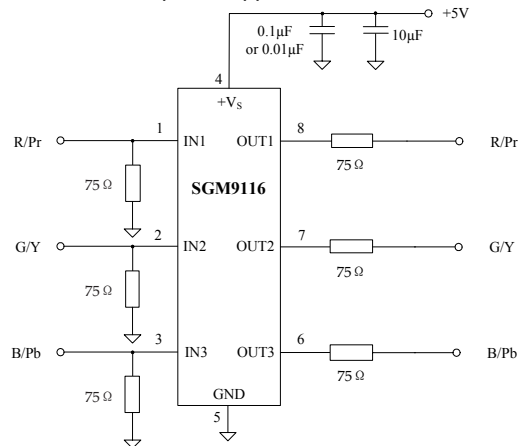


Figure 1. DC Coupling Application Schematic

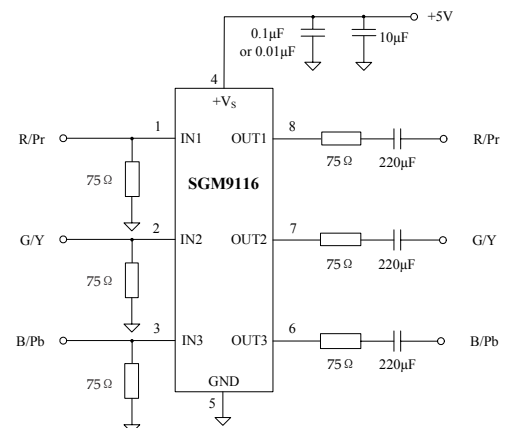


Figure 2. Input DC Coupling and Output AC Coupling Application Schematic

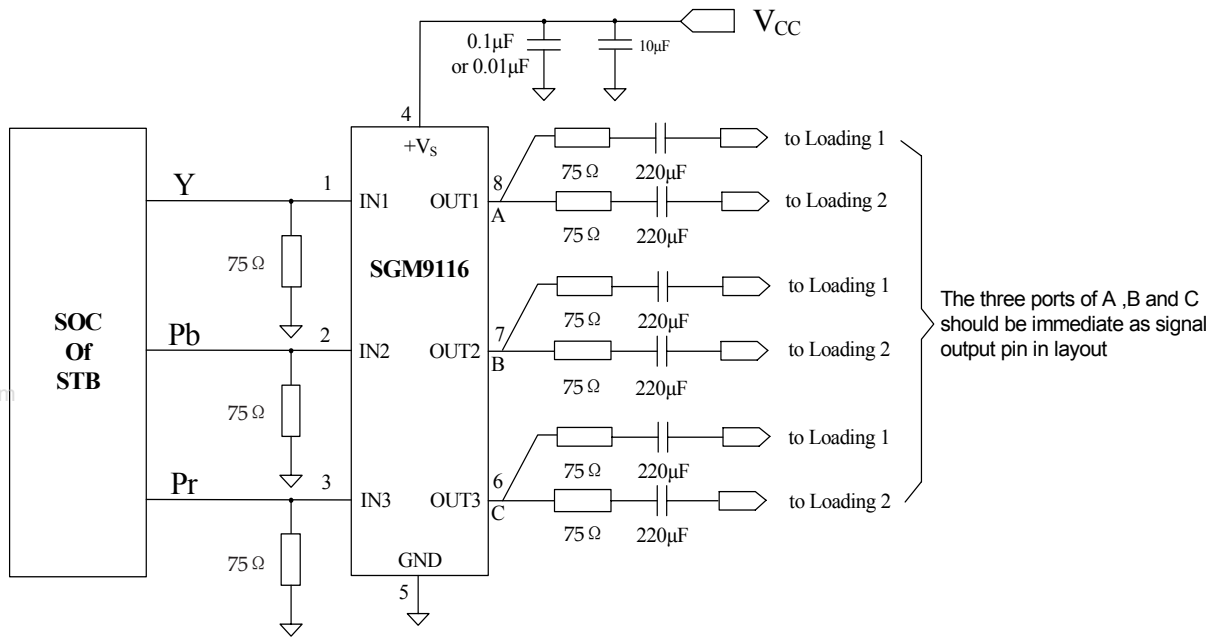
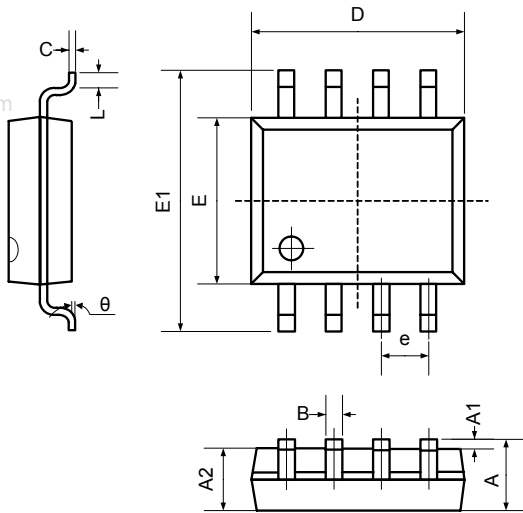


Figure 3. The DC Coupling Circuit Schematic is recommended in applications of STB

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 |
|---|------|
| 11/06— Data Sheet changed from preliminary to REV. A | |
| Changes to ABSOLUTE MAXIMUM RATINGS | 3 |
| 06/07— Data Sheet changed from REV. A to REV. B | |
| Adds applications information | 7 |

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