SGM9131
3-Channel, Video Filter Driver for HD (1080i)

PRODUCT DESCRIPTION

The SGM9131 video filter is intended to replace passive LC filters and drivers with an integrated device. Three 6th-order channels offer High Definition (HDi) filters. The SGM9131 may be directly driven by a DC-coupled DAC output or an AC-coupled signal. Internal bias circuitry provides constant bias voltage for AC-coupled inputs.

The outputs can be AC- or DC-coupled. DC coupling the outputs removes the need for large output coupling capacitors.

The SGM9131 is available in Green SOIC-8 package. It operates over an ambient temperature range of -40℃ to +85℃.

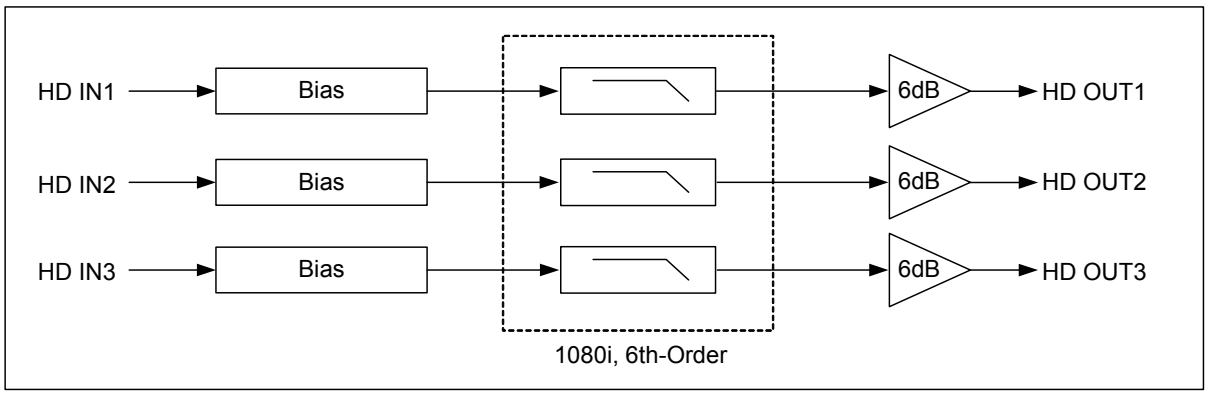
FEATURES

- **Three 6th-Order Filters for 1080i High Definition Mode**
- **Bias Mode Active with AC-Coupled Inputs**
- **Bias Mode Inactive with DC-Coupled Inputs**
- **AC- or DC-Coupled Outputs**
- **DC-Coupled Output Eliminates AC Coupling Capacitor**
- **Available in Green SOIC-8 Package**
- **-40°C to +85°C Operating Temperature Range**

APPLICATIONS

Video Amplifiers
Set-Top Boxes
Communication Devices
Video on Demand
Portable and Handheld Products
Personal Video Recorders
DVD Players
HDTV
Projectors

BLOCK DIAGRAM



PACKAGE/ORDERING INFORMATION

ORDER NUMBER	PACKAGE DESCRIPTION	TEMPERATURE RANGE	MARKING INFORMATION	PACKAGE OPTION
SGM9131YS8G/TR	SOIC-8	-40℃ to +85℃	SGM9131YS8	Tape and Reel, 2500

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, GND to V_{CC} 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.....8000V
MM..... 400V

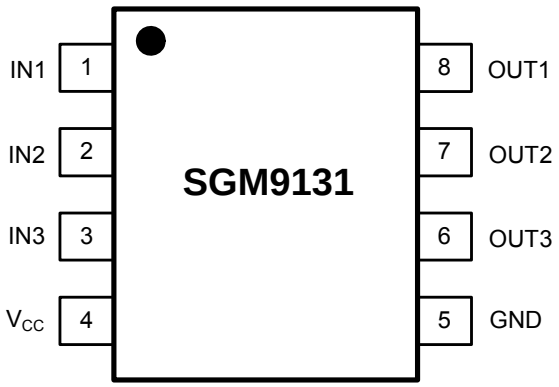
NOTE:
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. 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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

PIN CONFIGURATION (TOP VIEW)



SOIC-8

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_{CC}	Power Supply.
5	GND	Ground.
6	OUT3	Video Output. Channel 3.
7	OUT2	Video Output. Channel 2.
8	OUT1	Video Output. Channel 1.

ELECTRICAL CHARACTERISTICS

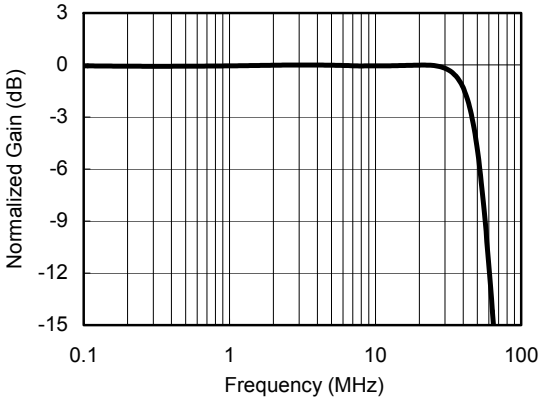
(T_A = +25℃, V_{IN} = 1V_{PP}, V_{CC} = 5V, R_{SOURCE} = 37.5Ω; all inputs are AC-coupled with 0.1μF; all outputs are AC-coupled with 220μF into 150Ω, referenced to 400kHz; unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
DC ELECTRICAL CHARACTERISTICS					
Operating Voltage Range (V_{CC})		3.1	5	5.5	V
Quiescent Current (I_Q)	V_{CC} = 5V, No load		55	70	mA
Output Level Shift Voltage (V_{OLS})	V_{IN} = 0V, No load		500	700	mV
Voltage Gain (A_V)	R_L = 150Ω	5.8	6.1	6.35	dB
Output Voltage High Swing	V_{IN} = 3V, R_L = 150Ω to GND		4.8		V
Video Input Voltage Range	Referenced to GND if DC-coupled		1.4		V_{PP}
Power Supply Rejection Ratio (PSRR)	DC (All channels)		50		dB
1080i HIGH DEFINITION MODE ELECTRICAL CHARACTERISTICS					
-0.1dB Bandwidth	R_L = 150Ω		32		MHz
-1dB Bandwidth	R_L = 150Ω		39		MHz
-3dB Bandwidth	R_L = 150Ω		46		MHz
Filter Response (Normalized Gain)	f_{IN} = 400kHz to 74.25MHz		23		dB
Slew Rate	2V Output step, 80% to 20%		190		V/μs
Group Delay Variation (D/DT)	Difference between 400kHz and 26MHz		3.5		ns
Crosstalk (channel-to-channel)	V_{OUT} = 1.4V_{PP}, f = 1MHz		-60		dB
Fall Time	2V Output step, 80% to 20%		6.2		ns
Rise Time	2V Output step, 80% to 20%		6.2		ns

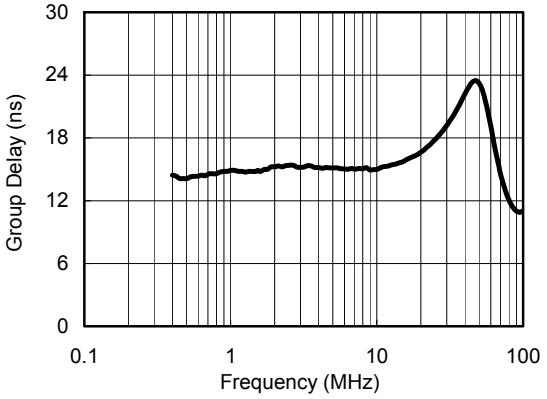
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25℃, V_{IN} = 1V_{PP}, V_{CC} = 5V, R_{SOURCE} = 37.5Ω; all inputs are AC-coupled with 0.1μF; all outputs are AC-coupled with 220μF into 150Ω, referenced to 400kHz; unless otherwise noted.

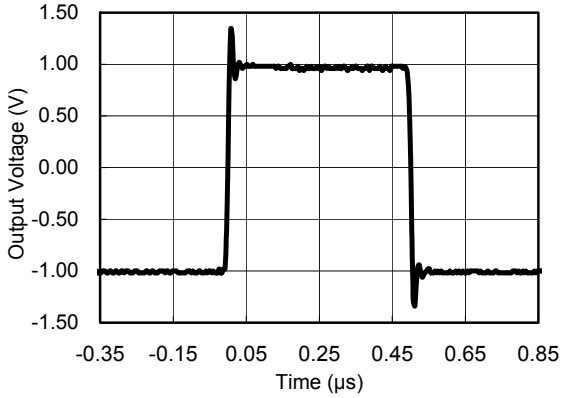
Gain vs. Frequency



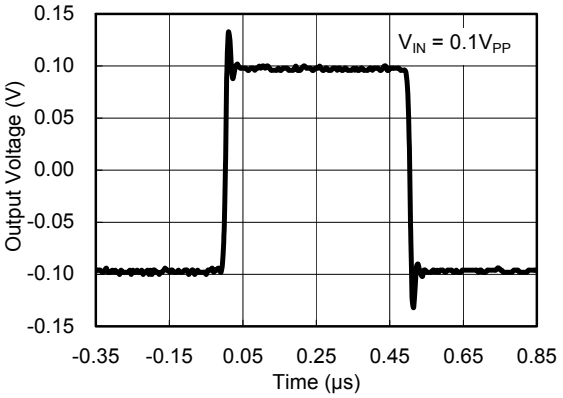
Group Delay vs. Frequency



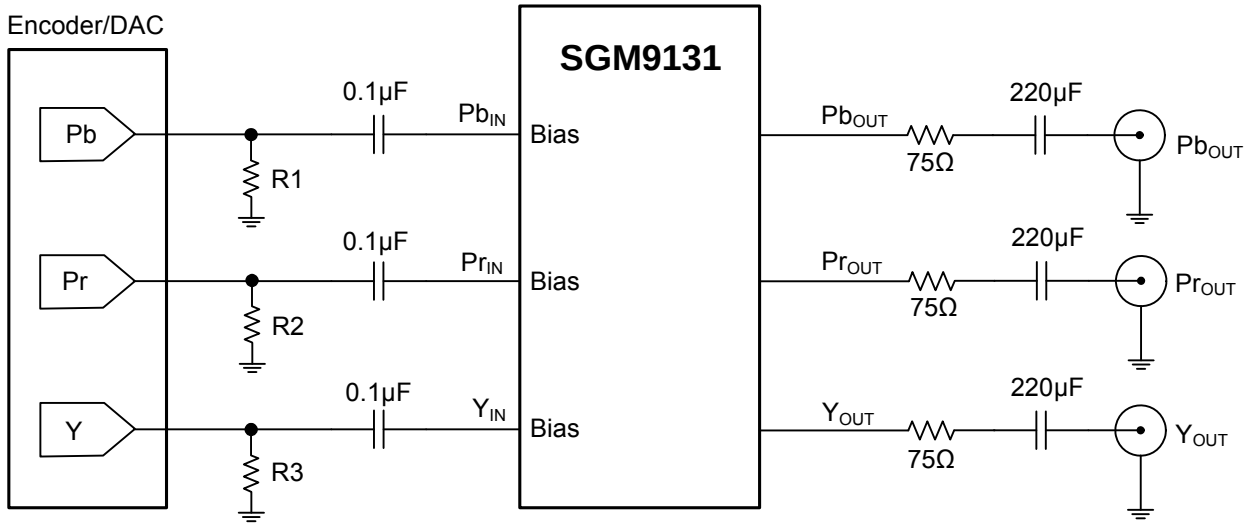
Large Signal Step Response



Small Signal Step Response



TYPICAL APPLICATION CIRCUIT



APPLICATION INFORMATION

Application Circuits

The SGM9131 video filter provides 6dB gain from input to output. In addition, the input is slightly offset to optimize the output driver performance. The offset is held to the minimum required value to decrease the standing DC current into the load.

For symmetric signals like Chroma, U, V, Pb and Pr, the average DC bias is fairly constant and the inputs can be AC-coupled. DAC outputs can also drive these same signals without the AC coupling capacitor.

I/O Configurations

For an AC-coupled DAC drive with AC-coupled outputs, use the configuration in Figure 1.

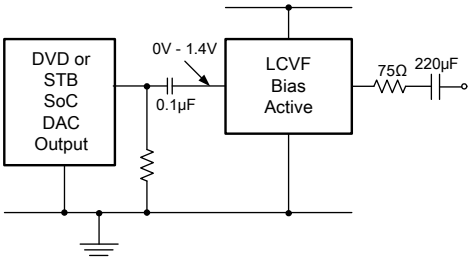


Figure 1. AC-Coupled Inputs and Outputs

Alternatively, if the DAC's average DC output level causes the signal to exceed the range from 0V to 1.4V, it can be AC-coupled as shown in Figure 2.

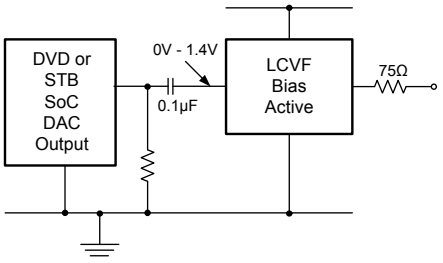


Figure 2. AC-Coupled Inputs, DC-Coupled Outputs

For a DC-coupled DAC drive with DC-coupled outputs, use the configuration in Figure 3.

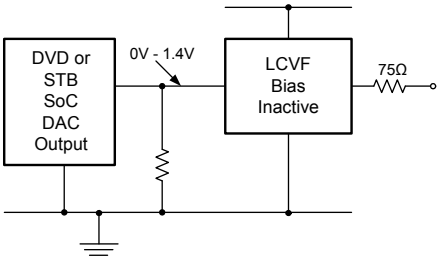


Figure 3. DC-Coupled Inputs and Outputs

NOTE: The video tilt or line time distortion is dominated by the AC coupling capacitor. The value may need to be increased beyond 220µF to obtain satisfactory operation in some applications.

Power Dissipation

The SGM9131 output drive configuration must be considered when calculating overall power dissipation. Care must be taken not to exceed the maximum die junction temperature. The following equations can be used to calculate the power dissipation and internal temperature rise.

$$T_J = T_A + P_D \bullet \theta_{JA} \quad (1)$$

where:

$$P_D = P_{CH1} + P_{CH2} + P_{CH3} \quad (2)$$

$$P_{CHX} = V_{CC} \bullet I_{CH} - (V_O^2/R_L) \quad (3)$$

where:

$$V_O = 2V_{IN} + 0.5V \quad (4)$$

$$I_{CH} = (I_{CC}/3) + (V_O/R_L) \quad (5)$$

V_{IN} = RMS value of input signal

I_{CC} = 55mA

V_{CC} = 5.0V

R_L = channel load resistance

Board layout can also affect thermal characteristics. Refer to the Layout Considerations section for details.

The SGM9131 is specified to operate with output currents typically less than 50mA, more than sufficient for a dual (75Ω) video load. Internal amplifiers are current limited to a maximum of 100mA and should withstand brief-duration short-circuit conditions. This capability is not guaranteed.

APPLICATION INFORMATION

Output Considerations

The selection of the coupling capacitor is a function of the subsequent circuit input impedance and the leakage current of the input being driven. In order to obtain the highest quality output video signal the series termination resistor must be placed as close to the device output pin as possible. This greatly reduces the parasitic capacitance and inductance effect on the SGM9131 output driver. Recommended distance from device pin to series termination resistor should be no greater than 0.1 inches.

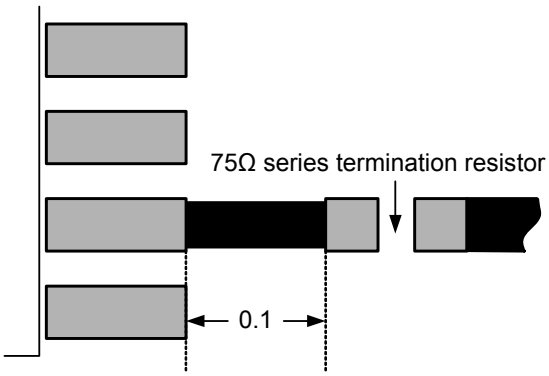


Figure 4. Distance from Device Pin to Series Termination Resistor

Thermal Considerations

Since the interior of systems such as set-top boxes, TVs and DVD players are at +70℃, consideration must be given to providing an adequate heat sink for the device package for maximum heat dissipation. When designing a system board, determine how much power each device dissipates. Ensure that devices of high power are not placed in the same location, such as directly above (top plane) or below (bottom plane) each other on the PCB.

Layout Considerations

General layout and supply bypassing play a major role in high-frequency performance and thermal characteristics. We offer a demonstration board to guide layout and aid device evaluation. The demo board is a four-layer board with full power and ground planes. Following this layout configuration provides optimum performance and thermal characteristics for the device. For the best results, follow the steps and recommended routing rules listed below.

Recommended Routing/Layout Rules

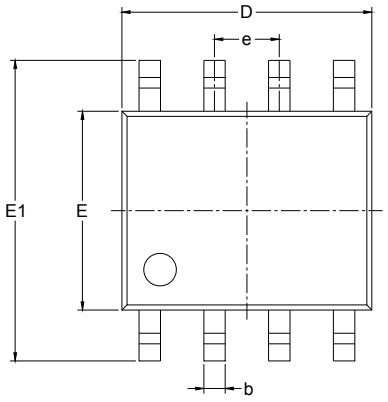
- Do not run analog and digital signals in parallel.
- Use separate analog and digital power planes to supply power.
- Do not run traces on top of the ground plane.
- Run no traces over ground/power splits.
- Avoid routing at 90-degree angles.
- Minimize clock and video data trace length differences.
- Include 0.01μF and 0.1μF ceramic power supply bypass capacitors.
- Place the 0.1μF capacitor within 0.1 inches of the device power pin.
- Place the 0.01μF capacitor within 0.75 inches of the device power pin.
- For multi-layer boards, use a large ground plane to help dissipate heat.
- For two-layer boards, use a ground plane that extends beyond the device body at least 0.5 inches on all sides. Include a metal paddle under the device on the top layer.
- Minimize all trace lengths to reduce series inductance.
- Place a 75Ω series resistor within 0.5 inches of the output pin to isolate the output driver from board parasitics.

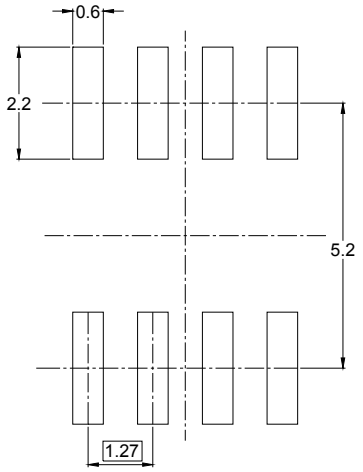
PCB Thermal Layout Considerations

- Understand the system power requirements and environmental conditions.
- Maximize thermal performance of the PCB.
- Consider using 70μm of copper for high-power designs.
- Make the PCB as thin as possible by reducing FR4 thickness.
- Use vias in the power pad to tie adjacent layers together.
- Remember that baseline temperature is a function of board area, not copper thickness.
- Consider modeling techniques a first-order approximation.

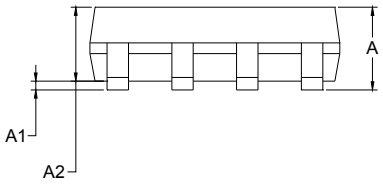
PACKAGE OUTLINE DIMENSIONS

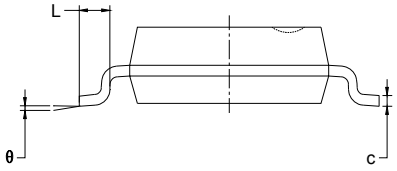
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)





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	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°