SGM9346
6-Channel, 6th-Order Video Filter Driver for SD/HD

PRODUCT DESCRIPTION

The SGM9346 Low Cost Video Filter (LCVF) is intended to replace passive LC filters and drivers with a low-cost integrated device. Six 6th-order Butterworth filters provide improved image quality compared to typical passive solutions. The combination of low power Standard Definition (SD) and High Definition (HD) filters greatly simplifies DVD video output circuitry. Three channels offer fixed SD filters while the other three are selectable between SD and HD filters.

The SGM9346 offers a fixed gain of 6dB. It may be directly driven by a DC-coupled DAC output or an AC-coupled signal. Internal diode clamps and bias circuitry may be used if AC-coupled inputs are required.

The outputs can drive AC- or DC-coupled single (150Ω) video load. DC coupling the output removes the need for output coupling capacitors. The input DC levels will be offset approximately 503mV at the output.

SGM9346 is available in Green TSSOP-20 package. It operates over an ambient temperature range of -40℃ to +85℃.

FEATURES

- **Three Selectable 6th-Order SD/HD Filters**
- **Three Fixed 6th-Order Standard Definition Filters**
- **Transparent Input Clamping**
- **Single Video Load Drive ($2V_{PP}$, 150Ω, A_V = 6dB)**
- **AC- or DC-Coupled Inputs**
- **Single Supply Range: 3.3V to 5.5V**
- **Available in Green TSSOP-20 Package**
- **-40°C to +85°C Operating Temperature Range**

APPLICATIONS

Cable and Satellite Set-Top Boxes
DVD Players
HDTV
Personal Video Recorders (PVR)
Video On Demand (VOD)

PACKAGE/ORDERING INFORMATION

ORDER NUMBER	PACKAGE DESCRIPTION	TEMPERATURE RANGE	PACKAGE OPTION	MARKING INFORMATION
SGM9346YTS20G/TR	TSSOP-20	-40℃ to +85℃	Tape and Reel, 3000	SGM9346YTS20

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage 6V
Analog and Digital Input/Output 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

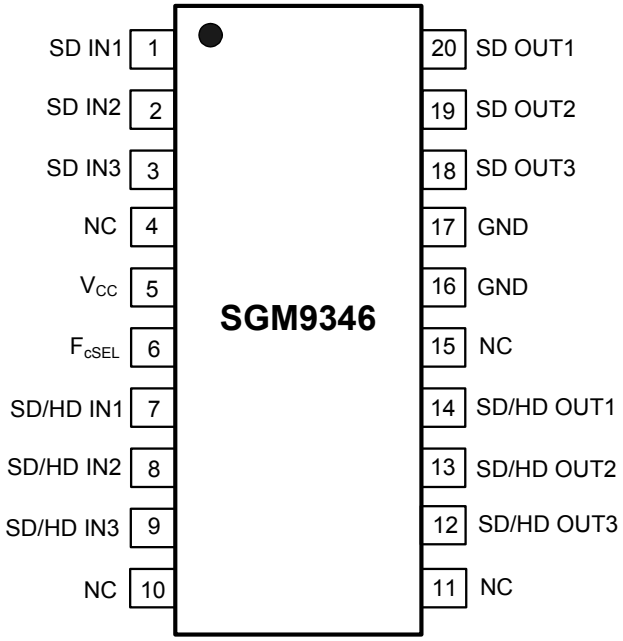
NOTE:
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied.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

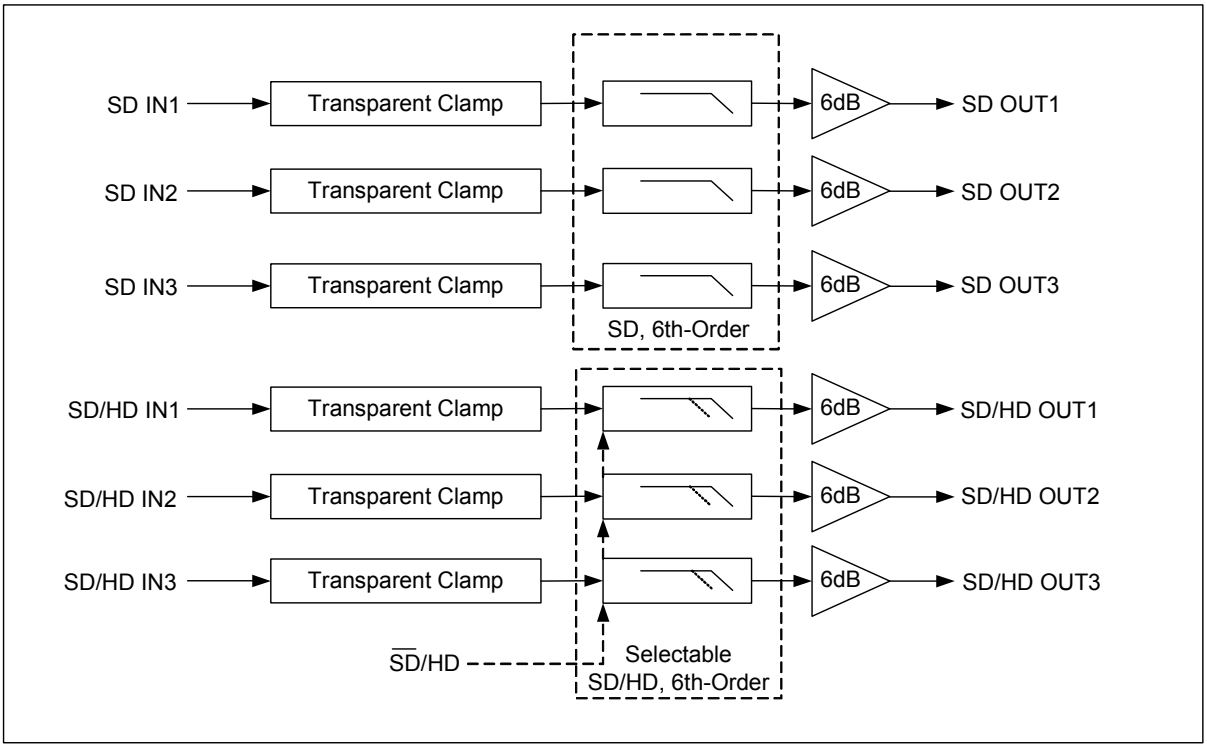


TSSOP-20

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	SD IN1	SD Video Input. Channel 1.
2	SD IN2	SD Video Input. Channel 2.
3	SD IN3	SD Video Input. Channel 3.
4, 10, 11, 15	NC	No Connection.
5	V_{CC}	Power Supply.
6	F_{cSEL}	Selects Filter Corner Frequency for Pins 7, 8 and 9. “0” = SD, “1” = HD.
7	SD/HD IN1	Selectable SD or HD Video Input. Channel 1.
8	SD/HD IN2	Selectable SD or HD Video Input. Channel 2.
9	SD/HD IN3	Selectable SD or HD Video Input. Channel 3.
12	SD/HD OUT3	Filtered SD or HD Video Output. Channel 3.
13	SD/HD OUT2	Filtered SD or HD Video Output. Channel 2.
14	SD/HD OUT1	Filtered SD or HD Video Output. Channel 1.
16, 17	GND	Ground.
18	SD OUT3	Filtered SD Video Output. Channel 3.
19	SD OUT2	Filtered SD Video Output. Channel 2.
20	SD OUT1	Filtered SD Video Output. Channel 1.

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

(T_A = 25℃, V_{CC} = 5V, at R_L = 150Ω connected to GND, V_{IN} = 1V_{PP}, all outputs AC-coupled with 220μF, Full = -40°C to +85°C, 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		503	630	mV
		Full			739	
Input Voltage Clamp (V_{CLAMP})	I_{IN} = -3.5mA	+25°C	-163	-131		mV
		Full	-243			
Clamp Charge Current	V_{IN} = V_{CLAMP} - 100mV	+25°C	-5.43	-5		mA
		Full	-6.5			
Voltage Gain (A_V)	R_L = 150Ω	+25°C	5.89	6.13	6.32	dB
		Full	5.85		6.4	
OUTPUT CHARACTERISTICS						
Output Voltage High Swing	V_{IN} = 3V, R_L = 150Ω to GND	+25°C	4.71	4.77		V
		Full	4.65			
POWER SUPPLY						
Operating Voltage Range		+25°C	3.3		5.5	V
Power Supply Rejection Ratio (PSRR)	V_{CC} = 3.5V to 5.0V	+25°C	47	59		dB
		Full	40.5			
Quiescent Current (I_Q)	V_{IN} = 0V, No load	+25°C		64.5	83	mA
		Full			95	
AC PERFORMANCE (STANDARD DEFINITION MODE)						
-0.1dB Bandwidth	R_L = 150Ω	+25°C		5.36		MHz
-3dB Bandwidth	R_L = 150Ω	+25°C		8.18		MHz
Filter Response (Normalized Gain)	f_{IN} = 27MHz	+25°C		-45.5		dB
Slew Rate	2V Output step, 80% to 20%	+25°C		39.5		V/μs
Differential Gain (DG)	PAL DC-coupled	+25°C		0.15		%
	PAL AC-coupled	+25°C		0.66		
Differential Phase (DP)	PAL DC-coupled	+25°C		1.10		°
	PAL AC-coupled	+25°C		1.75		
Group Delay Variation (D/DT)	Difference between 400kHz and 4.5MHz	+25°C		10.5		ns
Crosstalk (channel-to-channel)	f = 1MHz	+25°C		-68		dB
Fall Time	2V Output step, 80% to 20%	+25°C		30.5		ns
Rise Time	2V Output step, 80% to 20%	+25°C		30.4		ns
Output Distortion (THD)	V_{OUT} = 1.4V_{PP}, 3.58MHz	+25°C		1.00		%

ELECTRICAL CHARACTERISTICS

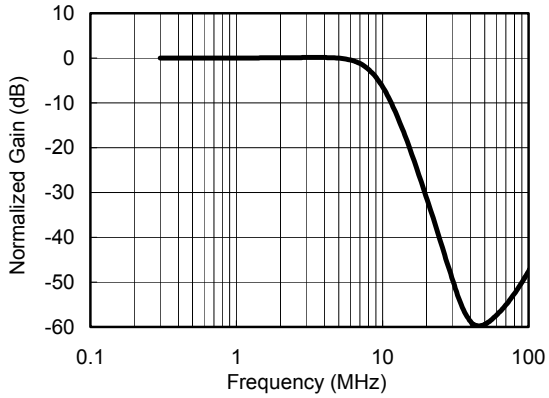
(T_A = 25℃, V_{CC} = 5V, at R_L = 150Ω connected to GND, V_{IN} = 1V_{PP}, all outputs AC-coupled with 220μF, Full = -40°C to +85°C, unless otherwise noted.)

PARAMETER	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
AC PERFORMANCE (HIGH DEFINITION MODE)						
-0.1dB Bandwidth	R_L = 150Ω	+25°C		28.2		MHz
-3dB Bandwidth	R_L = 150Ω	+25°C		35.5		MHz
Filter Response (Normalized Gain)	f_{IN} = 74.25MHz	+25°C		-37.5		dB
Slew Rate	2V Output step, 80% to 20%	+25°C		140		V/μs
Differential Gain (DG)	PAL DC-coupled	+25°C		0.06		%
	PAL AC-coupled	+25°C		0.37		
Differential Phase (DP)	PAL DC-coupled	+25°C		0.40		°
	PAL AC-coupled	+25°C		0.53		
Group Delay Variation (D/DT)	Difference between 400kHz and 20MHz	+25°C		4.90		ns
Crosstalk (channel-to-channel)	f = 1MHz	+25°C		-71		dB
Fall Time	2V Output step, 80% to 20%	+25°C		8.50		ns
Rise Time	2V Output step, 80% to 20%	+25°C		8.40		ns
Output Distortion (THD)	V_{OUT} = 1.4V_{PP}, 22MHz	+25°C		2.30		%

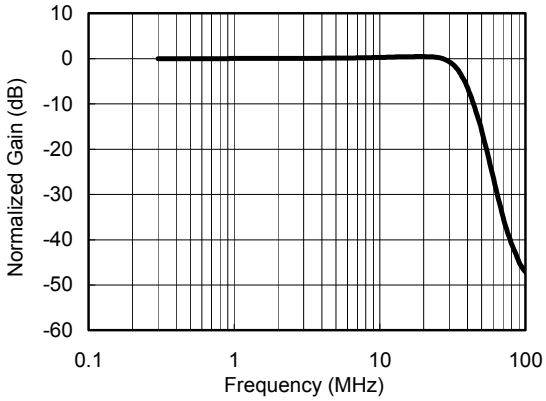
TYPICAL PERFORMANCE CHARACTERISTICS

At V_{CC} = 5V, T_A = +25℃, R_L = 150Ω, all outputs AC-coupled with 220μF, unless otherwise noted.

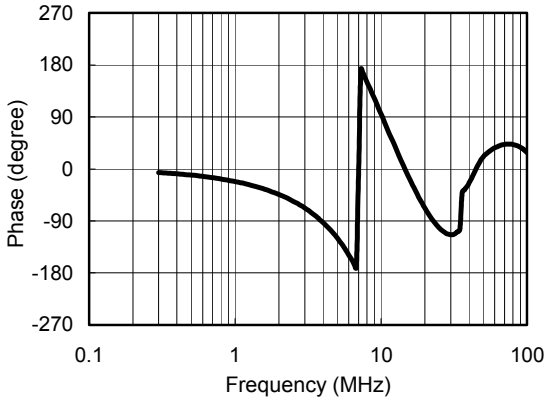
SD Frequency Response



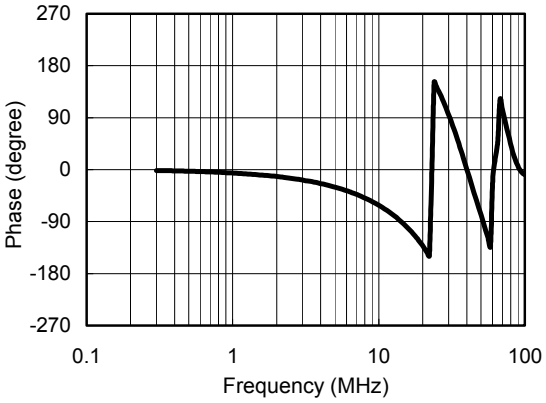
HD Frequency Response



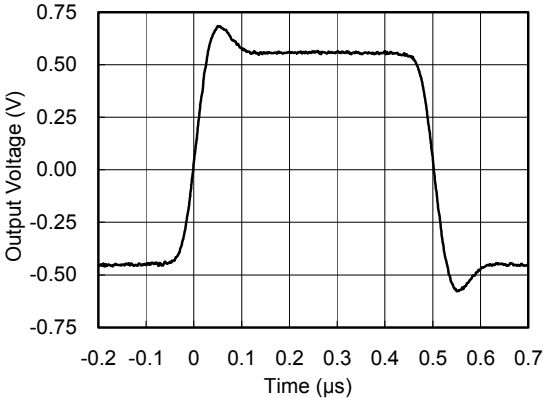
SD Phase vs. Frequency



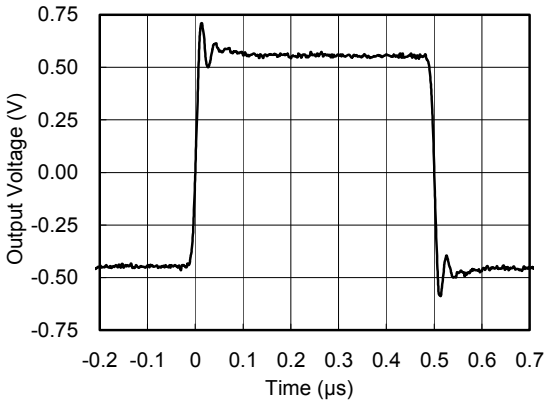
HD Phase vs. Frequency



SD Large Signal Step Response



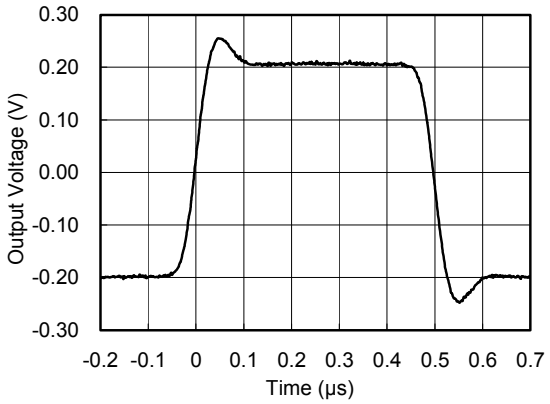
HD Large Signal Step Response



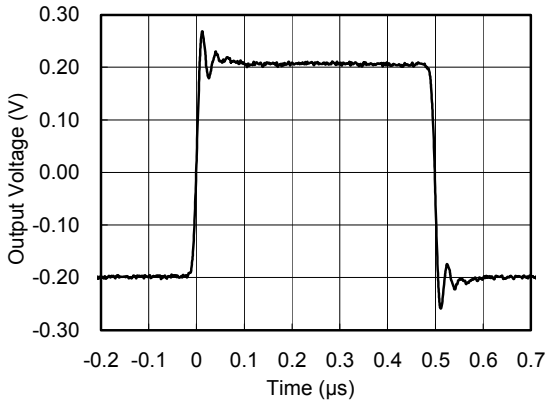
TYPICAL PERFORMANCE CHARACTERISTICS

At V_{CC} = 5V, T_A = +25℃, R_L = 150Ω, all outputs AC-coupled with 220μF, unless otherwise noted.

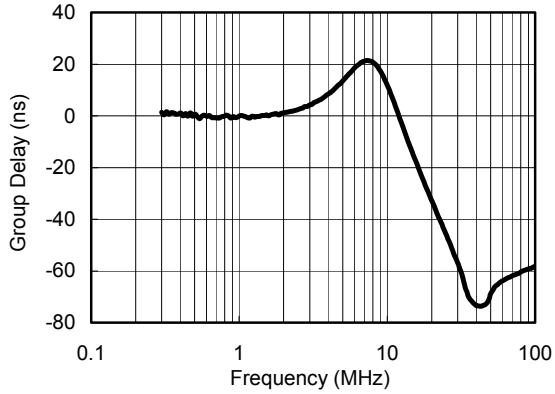
SD Small Signal Step Response



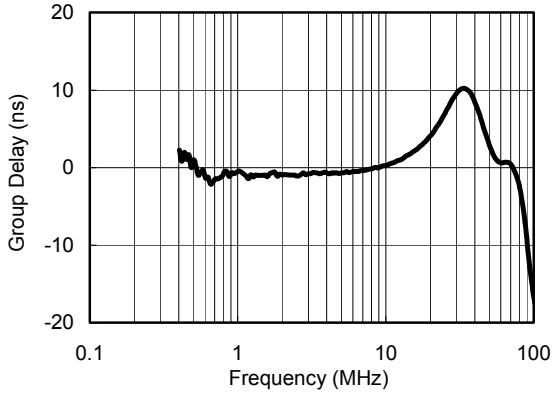
HD Small Signal Step Response



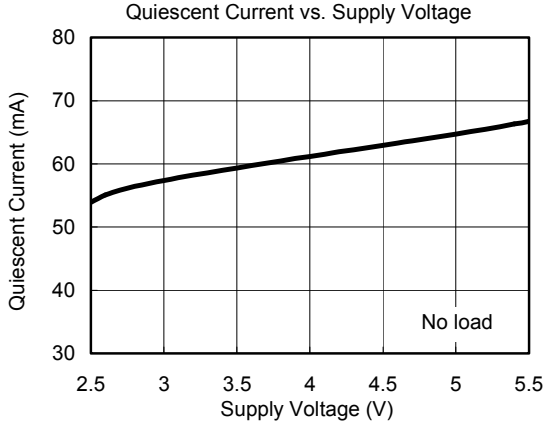
SD Group Delay vs. Frequency



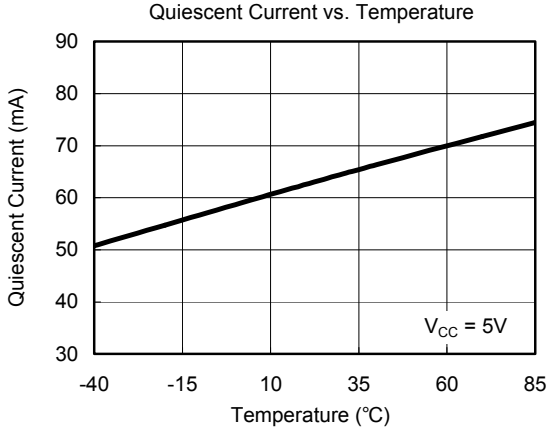
HD Group Delay vs. Frequency



Quiescent Current vs. Supply Voltage



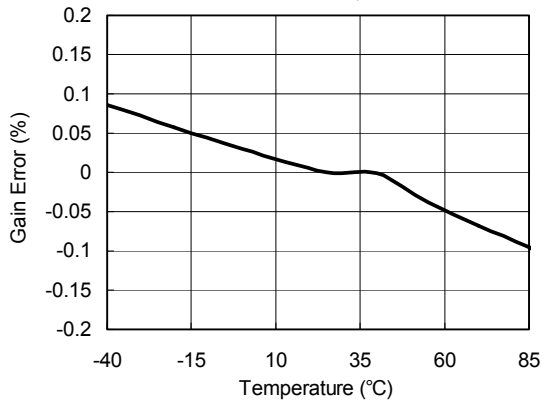
Quiescent Current vs. Temperature



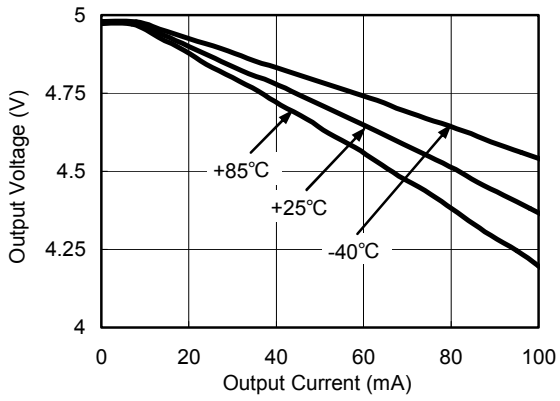
TYPICAL PERFORMANCE CHARACTERISTICS

At V_{CC} = 5V, T_A = +25℃, R_L = 150Ω, all outputs AC-coupled with 220μF, unless otherwise noted.

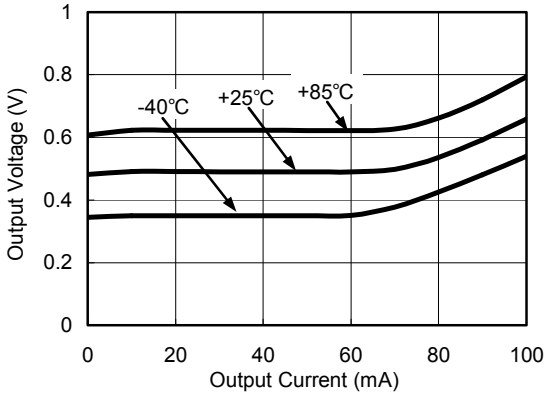
Gain Error vs. Temperature



Output Voltage Swing to the Positive Rail vs. Output Current



Output Voltage Swing to the Negative Rail vs. Output Current



APPLICATION INFORMATION

Functional Description

The SGM9346 Low Cost Video Filter (LCVF) provides 6dB gain from input to output, and the input will be 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.

The SGM9346 provides an internal diode clamp to support AC-coupled input signals. If the input signal does not go below ground, the input clamp will not operate. This allows DAC outputs to directly drive the SGM9346 without an AC coupling capacitor. The worst-case sync tip compression due to the clamp will not exceed 7mV. The input level set by the clamp combined with the internal DC offset will keep the output within its acceptable range. When the input is AC-coupled, the diode clamp will set the sync tip (or lowest voltage) just below ground.

I/O Configuration

The Figure1 and Figure 2 can be used with AC-coupled outputs if desired.

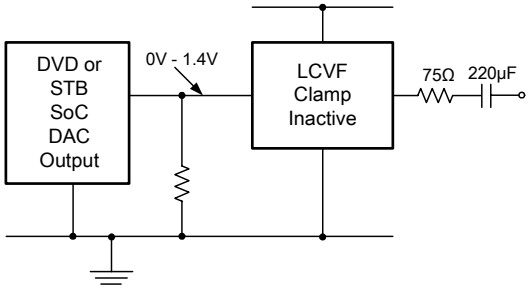


Figure 1. DC-coupled Inputs, AC-coupled Outputs

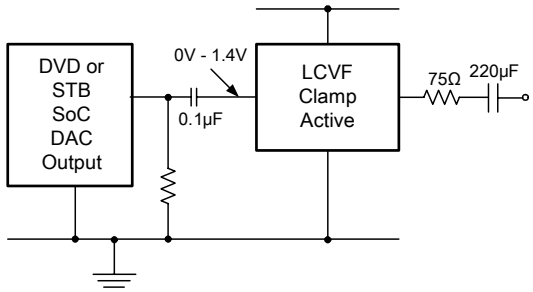


Figure 2. AC-coupled Inputs, AC-coupled Outputs

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

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 SGM9346. Place these two capacitors as close to the SGM9346 supply 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 pins of SGM9346 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 of the cable connecting external load. In design, keep the board trace at the inputs and outputs of the SGM9346 as short as possible to minimize the parasitic stray capacitance and noise pickup.

TYPICAL APPLICATION DIAGRAM

The following circuit may be used for direct DC-coupled drive by DACs with an output voltage range from 0V to 1.4V. AC-coupled or DC-coupled outputs may be used with AC-coupled outputs offering slightly lower power dissipation.

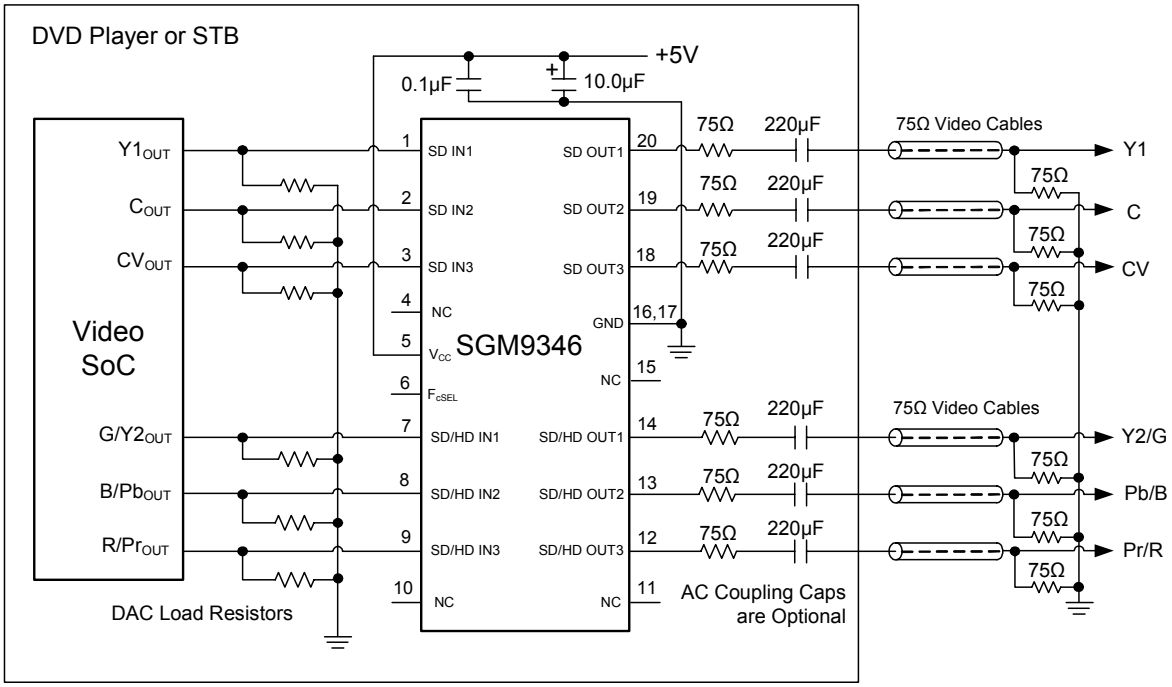
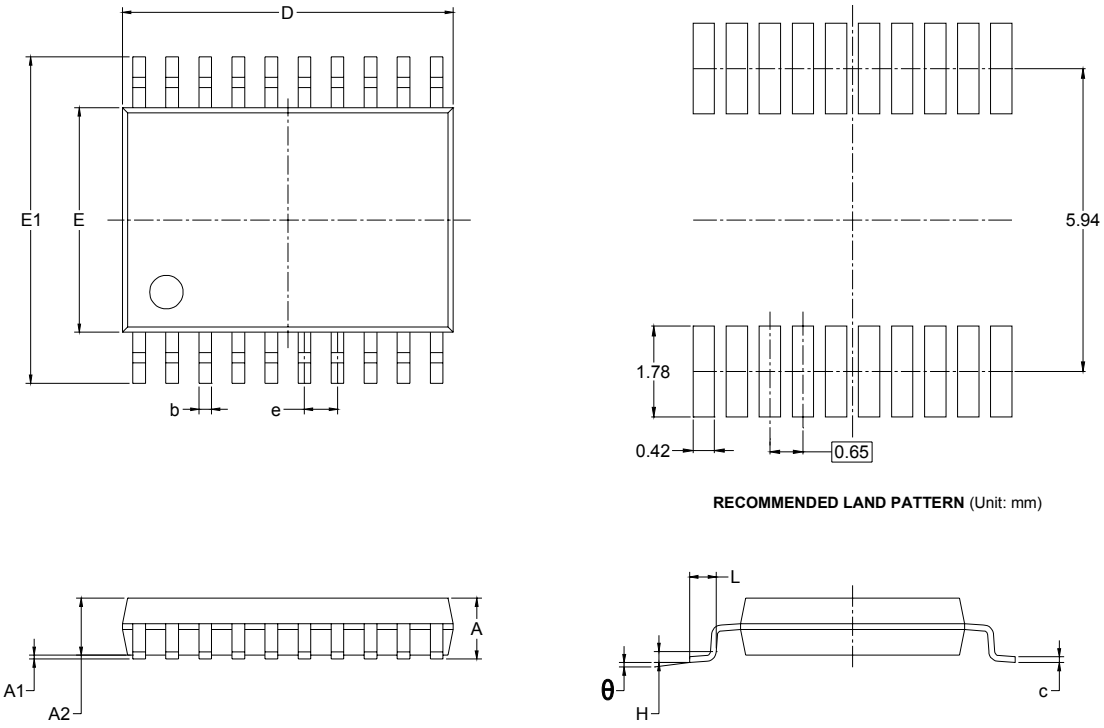


Figure 3. Typical Application Diagram

PACKAGE OUTLINE DIMENSIONS

TSSOP-20



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	6.400	6.600	0.252	0.259
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°