SGM9116
Triple, 38.5MHz, 6th-Order
HDTV Video Filter Driver

GENERAL DESCRIPTION

The SGM9116 is a video buffer which integrates triple 6dB gain rail-to-rail output drivers and triple 6th-oder output reconstruction filters with a -3dB bandwidth of 38.5MHz and 165V/μs slew rate. SGM9116 provides improved image quality compared with passive LC filters and discrete drivers solution. Operating from single power supply ranging from 3.3V to 5.5V and consuming a low 30mA quiescent current, the SGM9116 is ideally suited for battery powered applications.

The SGM9116 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. SGM9116 also integrates an internal level shift circuit which avoids sync-pulse being clipped and allows DC-coupled output. The drivers in SGM9116 can drive DC- or AC-coupled single (150Ω) or dual (75Ω) loads.

The SGM9116 is available in Green SOIC-8 package.

FEATURES

- **Triple 6th-Order 38.5MHz (HD) Filters**
- **Transparent Input Clamping**
- **6dB Output Driver Gain and Drive Dual Video Loads**
- **Rail-to-Rail Output**
- **Input Voltage Range Includes Ground**
- **AC- or DC-Coupled Inputs**
- **AC- or DC-Coupled Outputs**
- **Operates from 3.3V to 5.5V Single Power Supply**
- **Low Power**
   30mA Total Supply Current
- **Available in Green SOIC-8 Package**
- **-40℃ to +125℃ Operating Temperature Range**

APPLICATIONS

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

BLOCK DIAGRAM
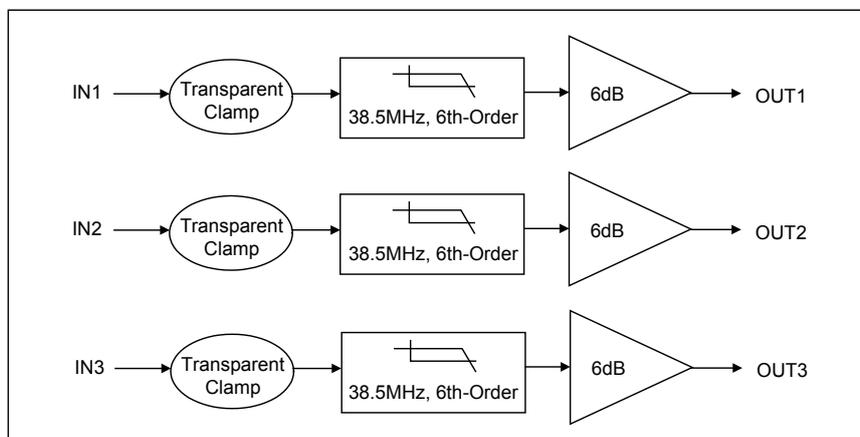
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM9116	SOIC-8	-40℃ to +125℃	SGM9116XS/TR	SGM9116XS XXXXX	Tape and Reel, 4000

NOTE: XXXXX = Date Code and Vendor Code.

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Input Voltage Range ....GND - 0.3V to V_{CC} + 0.3V
Supply Voltage, GND to $+V_S$...6.0V
Power Dissipation, P_D @ T_A = +25℃
SOIC-8..0.8W
Package Thermal Resistance
SOIC-8, θ_{JA} .... 128℃/W
Junction Temperature...+150℃
Storage Temperature Range ....-65℃ to +150℃
Lead Temperature (Soldering, 10s)............................+260℃
ESD Susceptibility
HBM..8000V
MM...400V
CDM 2000V

RECOMMENDED OPERATING CONDITIONS

Operating Voltage Range....................................3.3V to 5.5V
Operating Temperature Range ....-40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

ESD SENSITIVITY 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.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.
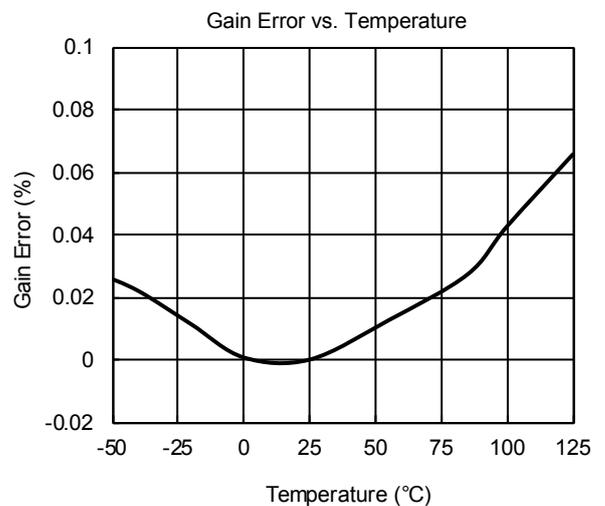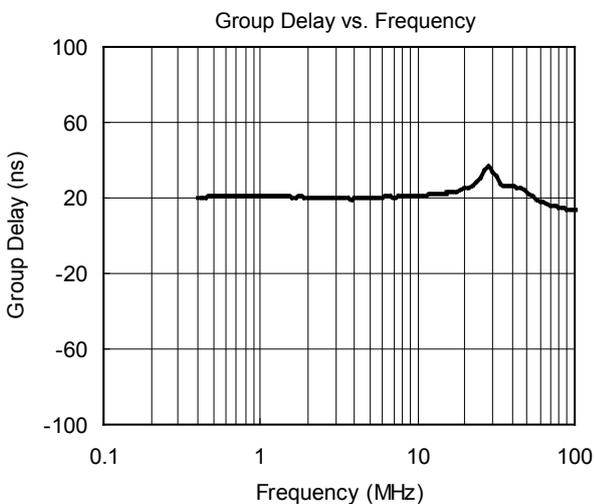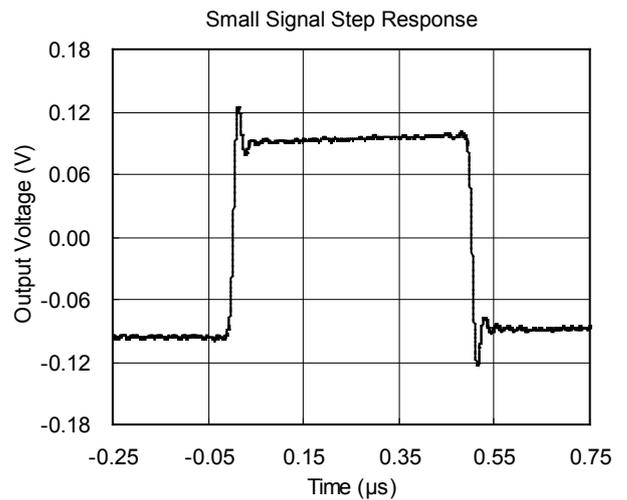
PIN CONFIGURATION

(TOP VIEW)

IN1	1	●		8	OUT1
IN2	2			7	OUT2
IN3	3			6	OUT3
+V$_S$	4			5	GND

SOIC-8
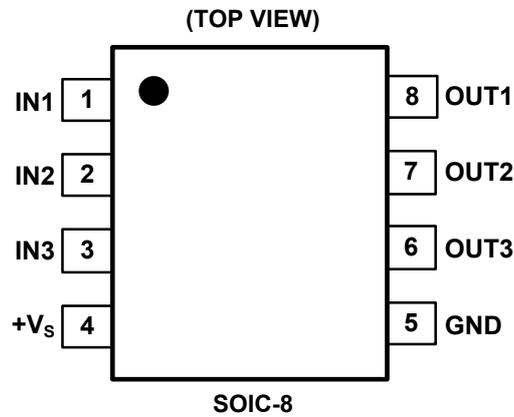
PIN DESCRIPTION

PIN	NAME	FUNCTION
1	IN1	Video Input. Channel 1.
2	IN2	Video Input. Channel 2.
3	IN3	Video Input. Channel 3.
4	+V$_S$	Power Supply.
5	GND	Ground.
6	OUT3	Filtered Output. Channel 3.
7	OUT2	Filtered Output. Channel 2.
8	OUT1	Filtered Output. Channel 1.

ELECTRICAL CHARACTERISTICS

(At V_S = 5.0V, R_L = 150Ω connected to GND and C_{IN} = 0.1μF, unless otherwise noted.)

PARAMETER	CONDITIONS	SGM9116				
		TYP	MIN/MAX OVER TEMPERATURE			
		+25℃	+25℃	-40℃ to +125℃	UNITS	MIN/MAX
INPUT CHARACTERISTICS						
Output Level Shift Voltage (V_{OLS})	V_{IN} = 0V, no load	325	580	715	mV	MAX
Clamp Charge Current	V_{IN} = V_{CLAMP} - 100mV	-4.7	-5.5	-6.1	mA	MIN
Voltage Gain (A_V)	R_L = 150Ω	6	5.7	5.6	dB	MIN
			6.3	6.4	dB	MAX
OUTPUT CHARACTERISTICS						
Output Voltage High Swing	V_{IN} = 3.0V, R_L = 150Ω to GND	4.79	4.68	4.62	V	MIN
POWER SUPPLY						
Operating Voltage Range (V_{CC})				3.3	V	MIN
				5.5	V	MAX
Power Supply Rejection Ratio (PSRR)	V_S = 3.5V to 5.5V	54	38	37	dB	MIN
Quiescent Current (I_Q)	V_{IN} = 0V	30	46	59	mA	MAX
DYNAMIC PERFORMANCE						
-0.1dB Bandwidth	R_L = 150Ω	30.5			MHz	TYP
-3dB Bandwidth	R_L = 150Ω	38.5			MHz	TYP
Filter Response (Normalized Gain)	f_{IN} = 74.25MHz	-31			dB	TYP
Slew Rate	2V Output step, 80% to 20%	165			V/μs	TYP
Differential Gain Error (DG)	PAL DC-coupled	0.6			%	TYP
	PAL AC-coupled	0.34			%	TYP
Differential Phase Error (DP)	PAL DC-coupled	0.89			°	TYP
	PAL AC-coupled	0.54			°	TYP
Group Delay Variation (D/DT)	f = 400kHz, 20MHz	3			ns	TYP
Crosstalk (Channel-to-Channel)	at 1MHz	-80			dB	TYP
Fall Time	2V Output step, 80% to 20%	7			ns	TYP
Rise Time	2V Output step, 80% to 20%	7.5			ns	TYP

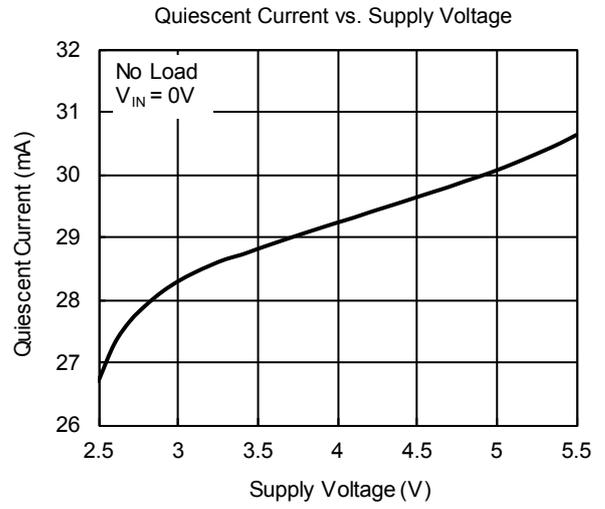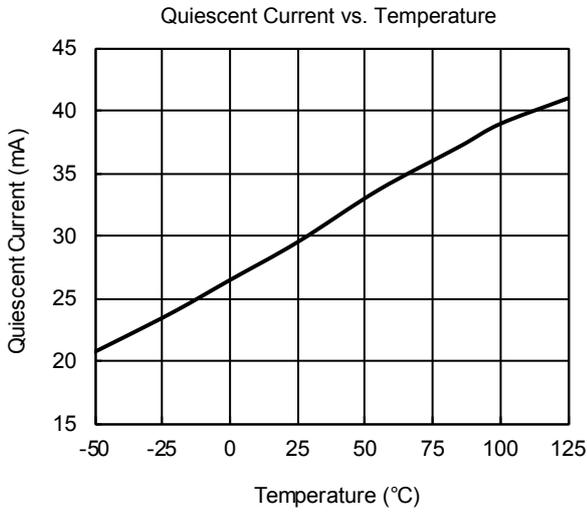# TYPICAL PERFORMANCE CHARACTERISTICS

At V_S = 5.0V, R_L = 150Ω connected to GND and C_{IN} = 0.1μF, unless otherwise noted.

Gain vs. Frequency

Phase vs. Frequency

Large Signal Step Response

Small Signal Step Response

Group Delay vs. Frequency

Gain Error vs. Temperature
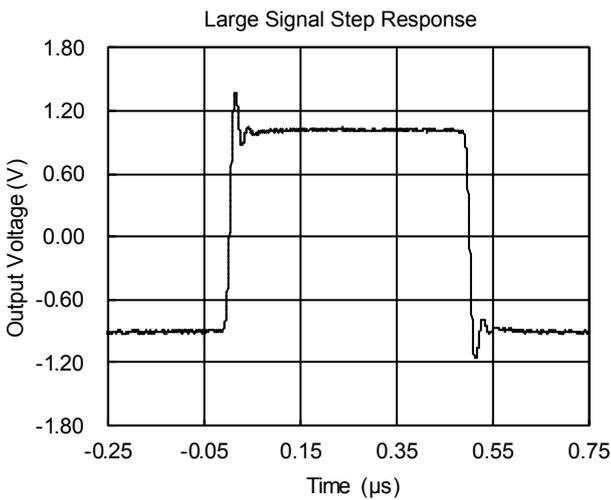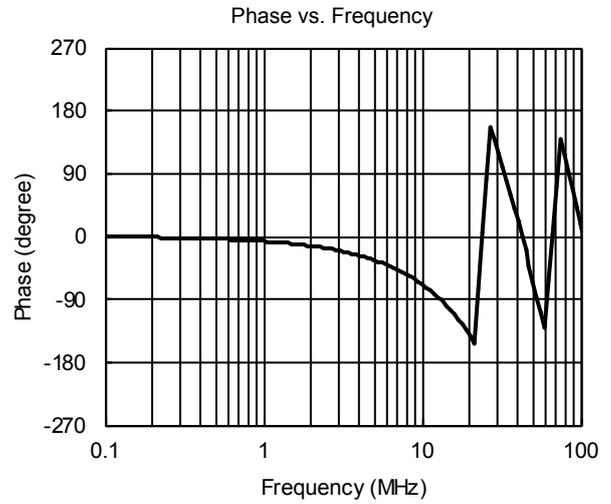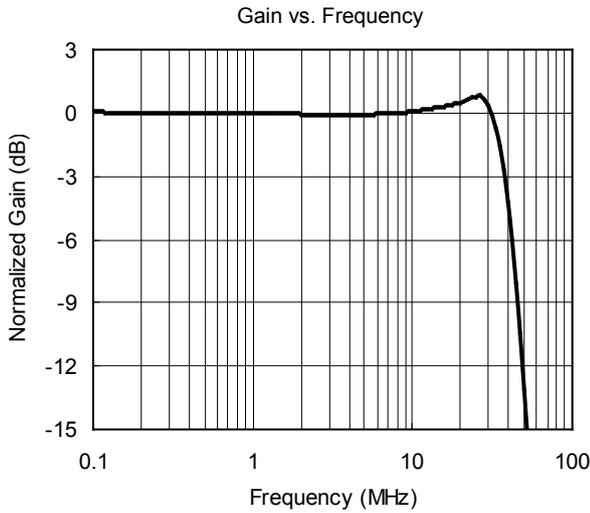
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At V_S = 5.0V, R_L = 150Ω connected to GND and C_{IN} = 0.1µF, unless otherwise noted.

Quiescent Current vs. Temperature

Quiescent Current vs. Supply Voltage

APPLICATION INFORMATION

Functional Description

SGM9116 operates from a single 3.3V to 5.5V 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 reduce PCB size and production cost, and it also improves video signal performance comparing with traditional design using discrete components. SGM9116 features a DC-coupled input buffer, a 6th-order 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, and SGM9116 can be directly connected to the output of a single-supply, current-output DAC without any external bias network. In applications where DAC's output level exceeds the range from 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.

Output Considerations

The SGM9116 outputs can be DC-coupled or AC-coupled. When input is 0V, the SGM9116 output voltage is 494mV typically. In DC coupling design, one 75Ω resistor is used to connect SGM9116's output pin with external load directly, and 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, at least 220µF 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 $+V_S$ pin of SGM9116. Place these two capacitors as close to the SGM9116 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 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 of the cable connecting external load. In design, 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.

APPLICATION INFORMATION (continued)

Typical Application Diagram

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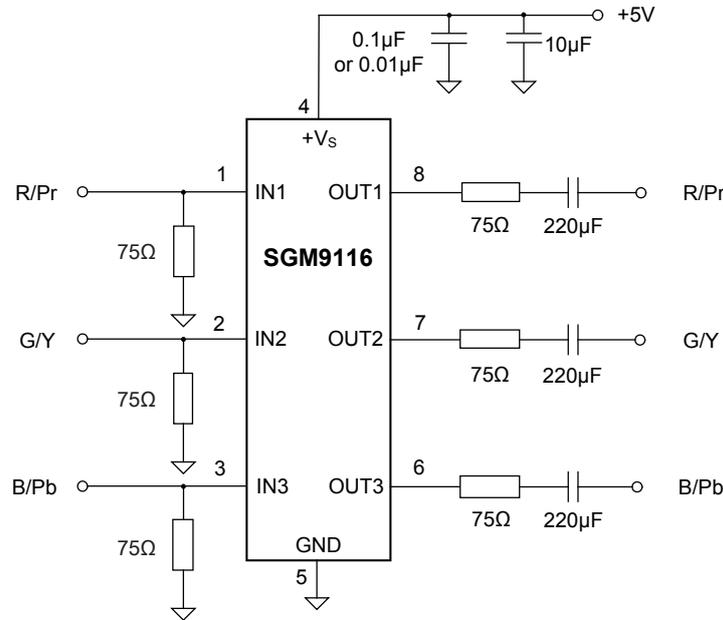

Figure 1. Input DC Coupling and Output AC Coupling Application Schematic
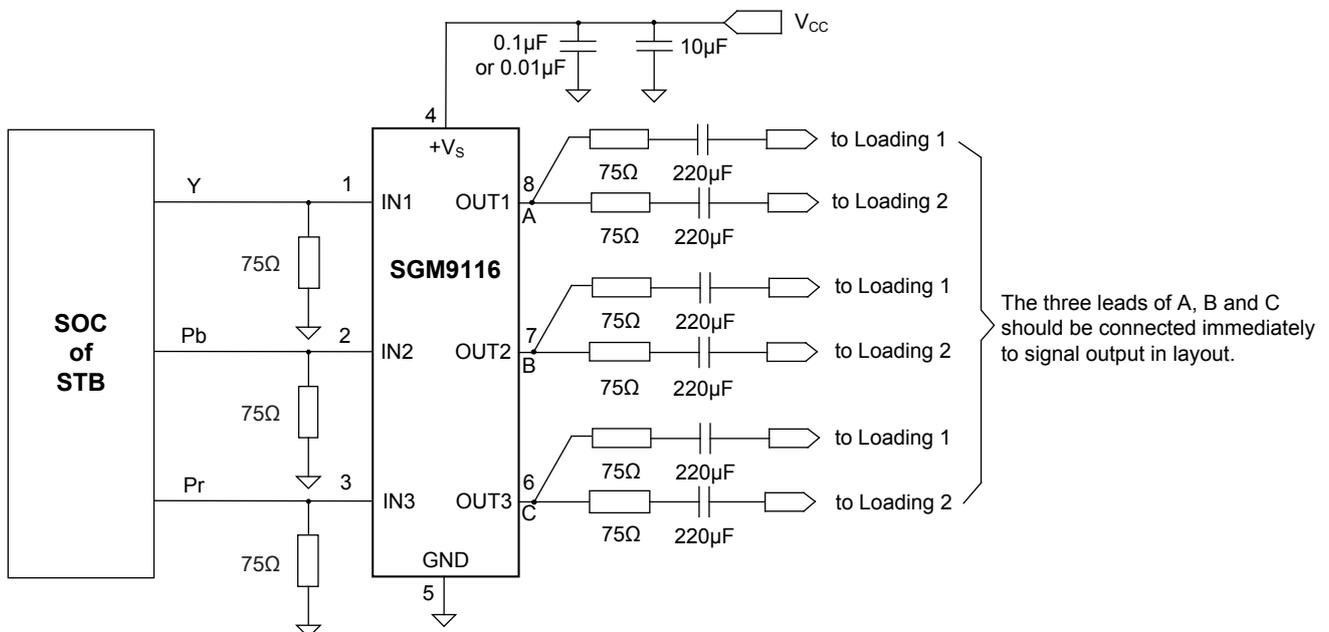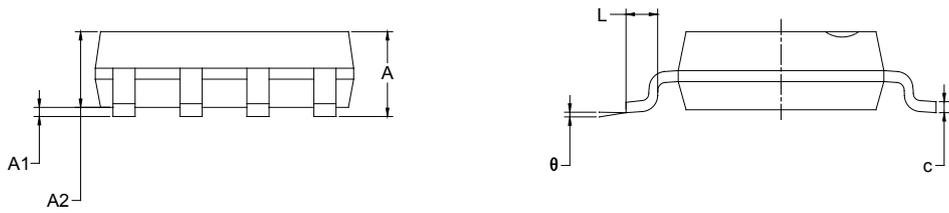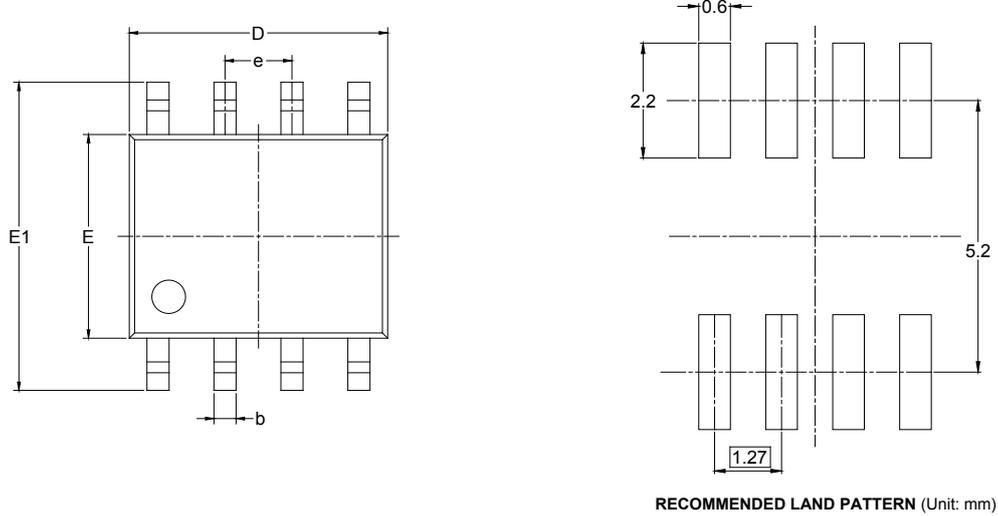

Figure 2. Input DC Coupling and Output AC Coupling Application Schematic in STB

NOTE:

1. Power supply $+V_S$ must be sequenced on first before input video signals.
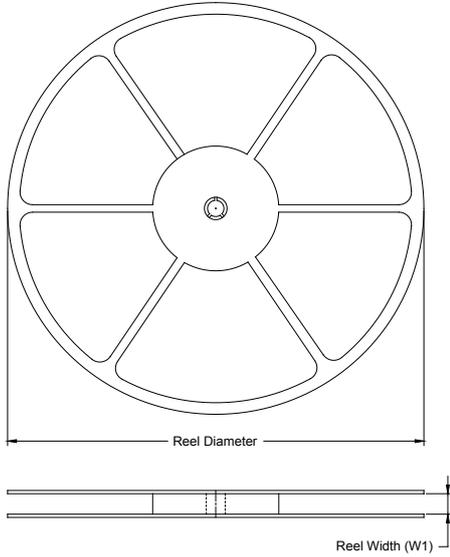
PACKAGE OUTLINE DIMENSIONS

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°

TAPE AND REEL INFORMATION

REEL DIMENSIONS
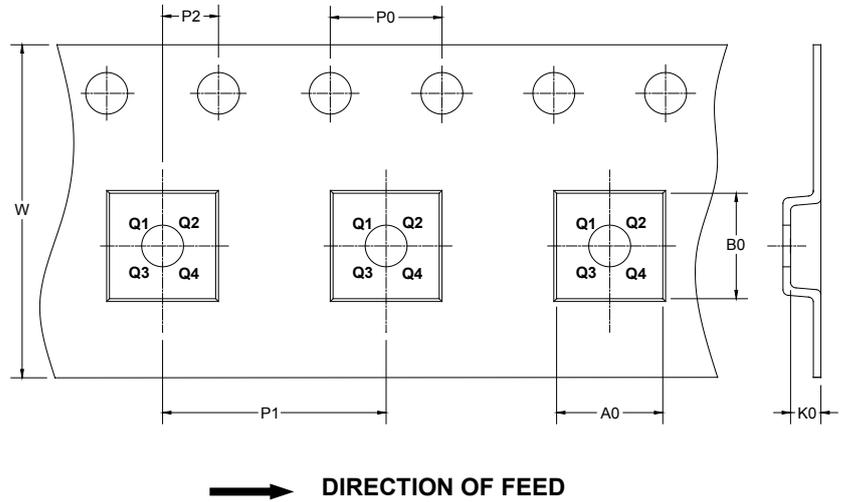
Reel Diameter

Reel Width (W1)

TAPE DIMENSIONS

DIRECTION OF FEED

NOTE: The picture is only for reference. Please make the object as the standard.
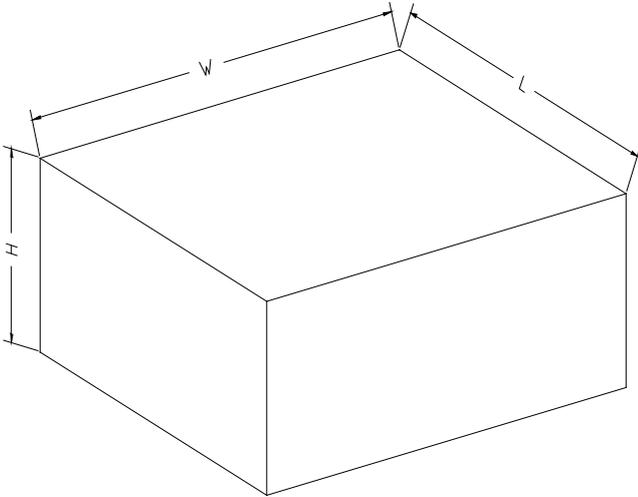
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOIC-8	13″	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1

DD0001

CARTON BOX DIMENSIONS

NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13″	386	280	370	5

DD0002