Low-Cost, Single-Channel,6th-Order Video Filter Driver

--------MS1651

PRODUCT DESCRIPTION

The MS1651 is a video buffer which integrates Single 6dB Gain rail-to-rail output driver and 6th output reconstruction filter, it has 10.5MHz -3dB bandwidth and 40V/μs slew rate. MS1651 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 14.5mA quiescent current, the MS1651 is ideally suited for battery powered applications.

MS1651 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. MS1651 also integrates an internal level shift circuit which avoids sync-pulse being clipped and allows DC-coupled output. The driver in MS1651 can drive DC or AC-coupled single (150Ω) or dual (75 Ω) loads.

The MS1651 has lead SOT23-6 package and ESD (HBM) reaches 8KV.

FEATURES

- Single 6th order 10.5MHz filter
- 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 14.5mA Supply Current
- Lead SOT23-6 package

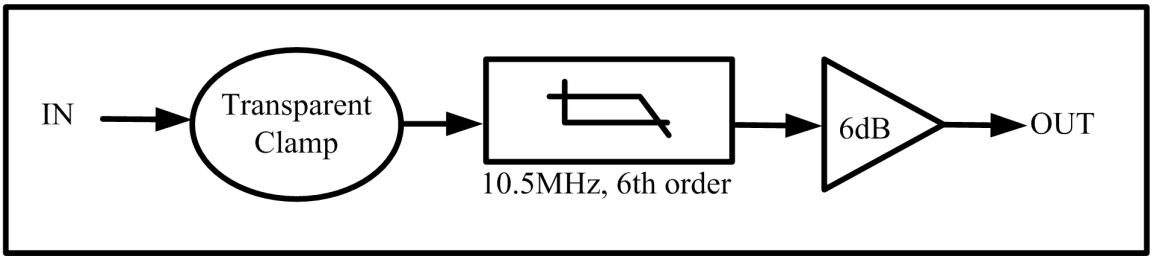
APPLICATIONS

- Video On Demand (VOD)
- Cable and Satellite Set-top Boxes
- DVD Players
- HDTV and Projector
- Personal Video Recorders (PVR)
- Communications device
- Portable and handheld product

PACKAGE/ORDERING INFORMATION

Part Number	Package	Marking
MS1651	SOT23-6	1651

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

(At RL = 150Ω connected to GND, Vin=1Vpp， and CIN = 0.1μF, all outputs AC coupled with 220μF， unless otherwise noted)。

PARAMETER	CONDITION	TYP	MIN/MAX OVER TEMPERATURE					
		+25℃	+25℃	0℃ to 70℃	-40℃ to85℃	-40℃ to125℃	UNITS	MIN/ MAX
INPUT CHARACTERISTICS								
Output Level Shift Voltage(VOLS)	Vin=0V， no load	235	327	330	340	370	mv	MAX
Input Bias Current (IB)							pA	TYP
Input Voltage Clamp (VCLAMP)	Iin= -1mA	-4.5	-15	-16	-19	-22	mV	MIN
Clamp Charge Current	Vin=Vclp-100mV	-5	-6.0	-6.1	-6.6	-7.2	mA	MIN
Voltage Gain (AV)	RL=150	2	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	VIN = 3V, R = 150Ω to GNDL	4.5	4.3	4.28	4.25	4.2	V	MIN
Output Short-Circuit Current (ISC)	VIN = 3V, to GND through 10Ω	-105	-102				mA	MAX
	VIN = 100mV, out short to VDD through 10 Ω	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	5.5	V	MAX
Power Supply Rejection Ratio	Vs=+2.7 to +5.5V	60	58	58	57	56	dB	MIN
Operating Current (I)	Vin=500mV	14.5	14.5	15.1	15.5	15.8	mA	MAX
DYNAMIC PERFORMANCE								
±0.1dB Bandwidth	Rl=150Ω	3.4					MHz	TYP
-3dB Bandwidth	Rl=150Ω	10.5					MHz	TYP
Slew Rate	Vin=1Vstep， 20% to 80%	40					V/us	TYP
Differential Gain (DG)	NTSC & PAL DC	0.02					%	TYP
	NTSC & PAL AC	0.3					%	TYP
Differential Phase (DP)	NTSC & PAL DC	0.02						TYP
	NTSC & PAL AC	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%--20%	30					ns	TYP
Rise Time	2.0V step， 80%--20%	30.5					ns	TYP

PIN CONFIGURATIONS

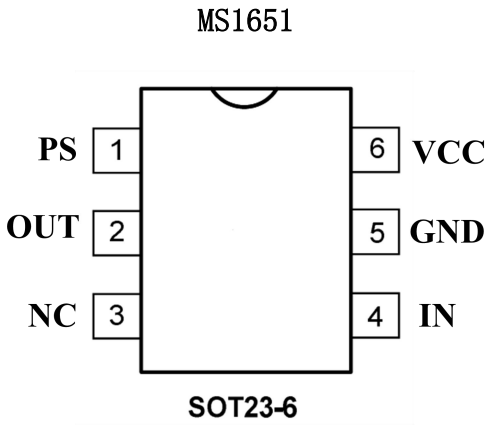


Figure1. SOT23-6

1. Pin Description

Pin	Name	Function
1	PS	Shutdown Mode (active low)
2	OUT	Video output ,
3	NC	Floating pin
4	IN	Video input
5	GND	Ground
6	VCC	Power supply

CAUTION

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

ABSOLUTE MAXIMUM RATINGS

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.

PARAMETER	MAXIMUM
Supply Voltage, V+ to V-	7.5V
Input Voltage	GND-0.3V to (+VS)+0.3V
Storage Temperature Range	-65℃ to +150℃
Junction Temperature	160℃
Operating Temperature Range	-40℃ to +125℃
Power Dissipation, PD @ TA = 25℃	0.8W
Package Thermal Resistance，θJA	128℃/W
Lead Temperature Range (Soldering 10 sec)	260℃
ESD Susceptibility HBM	8000V
MM	400V

TYPICAL PERFORMANCE CHARACTERISTICS

At VS = +5.0V, TA = +25℃, RL = 150Ω, all outputs AC coupled with 220μF, unless otherwise noted.

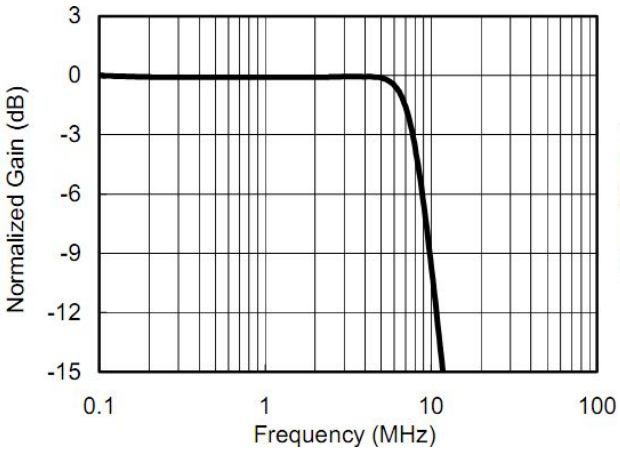


Figure 2. Frequency Response

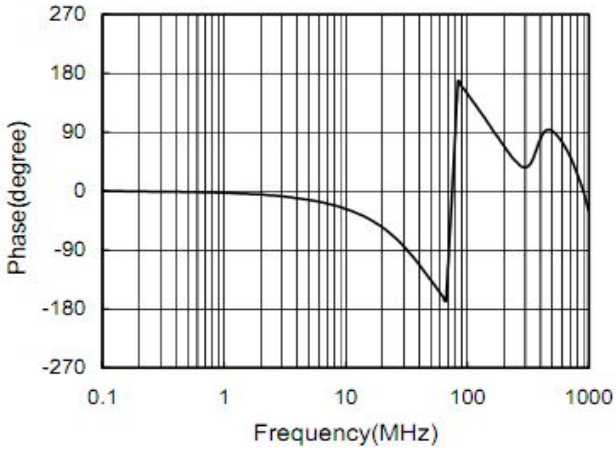


Figure 3. Phase vs. Frequency

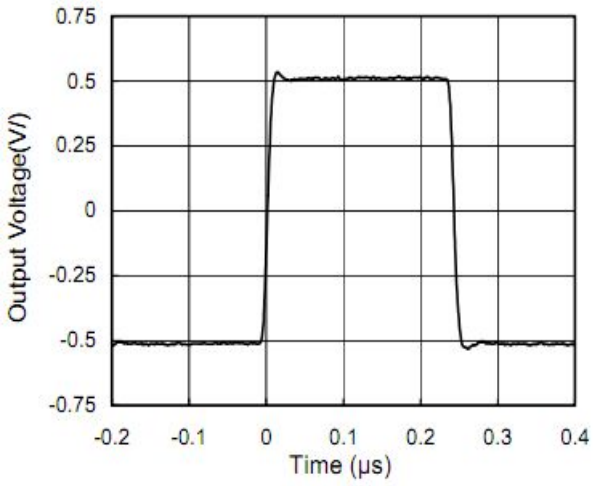


Figure 4. Large Signal Step Response

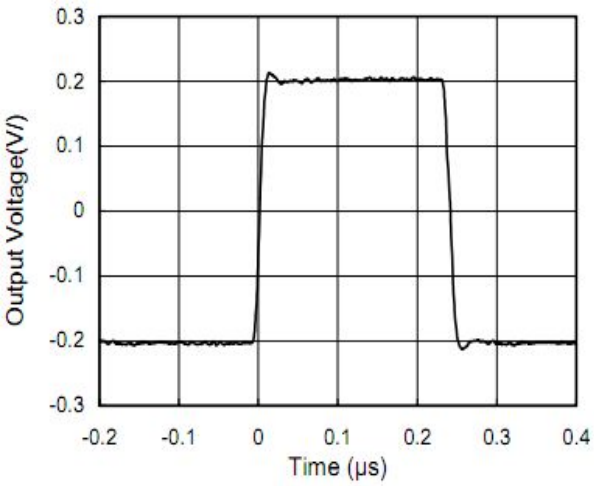


Figure 5. Large Signal Step Response

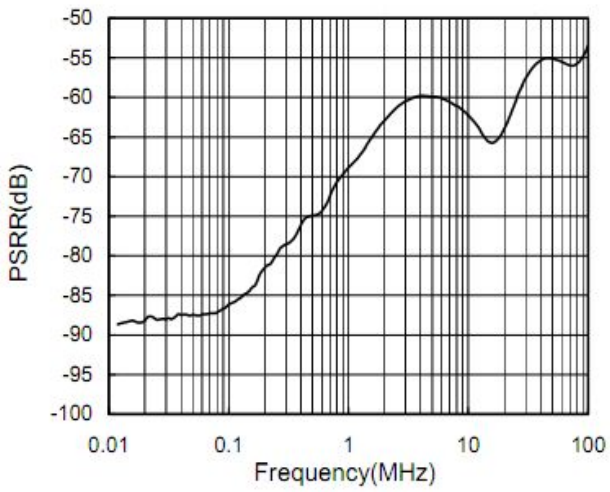


Figure 6. PSRR vs. Frequency (By pass Caps)

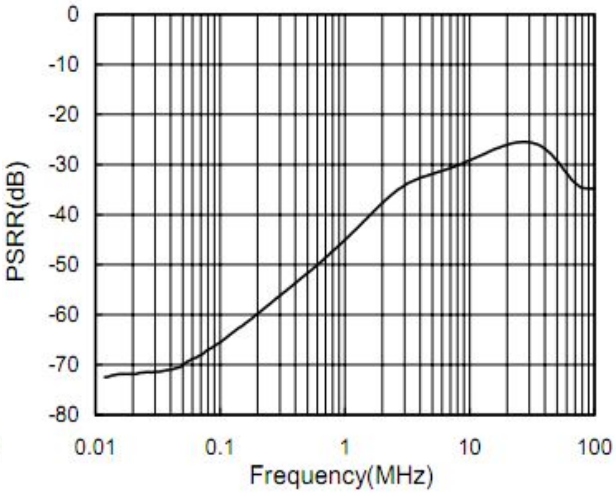


Figure 7. PSRR vs. Frequency (No by pass Caps)

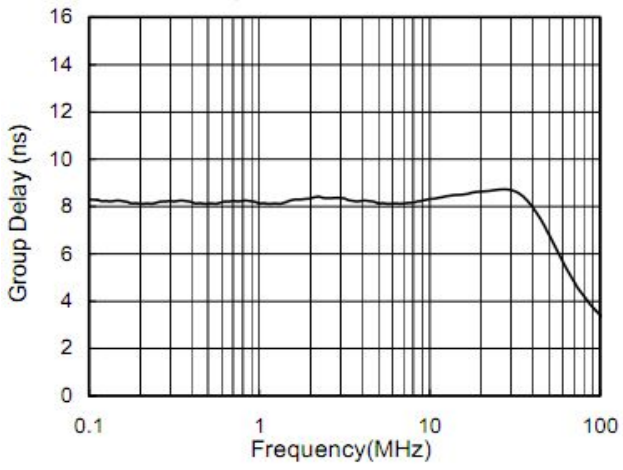


Figure 8. Group Delay vs. Frequency

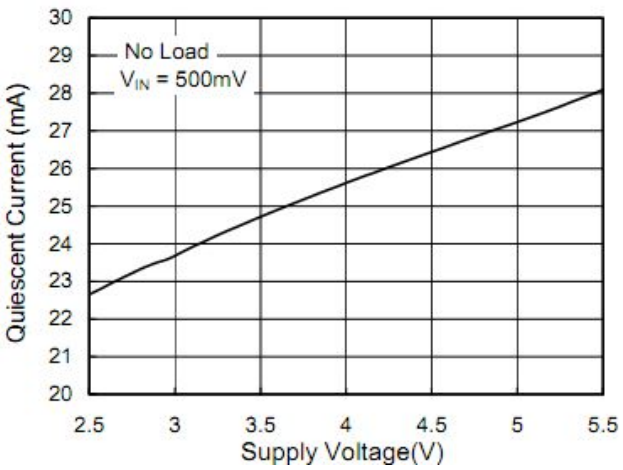


Figure 9. Group Delay vs. Frequency

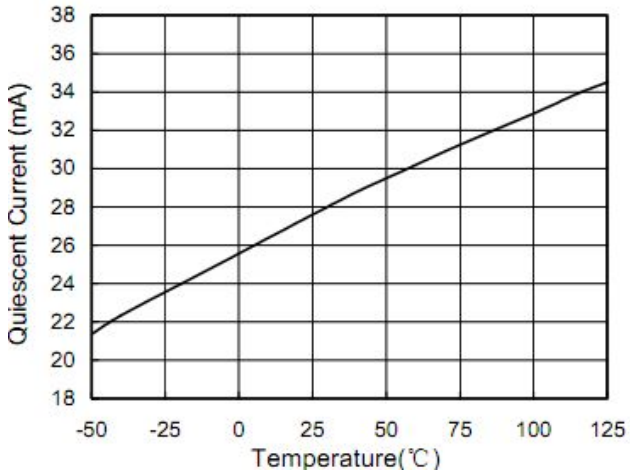


Figure 10. Quiescent Current vs. Temperature

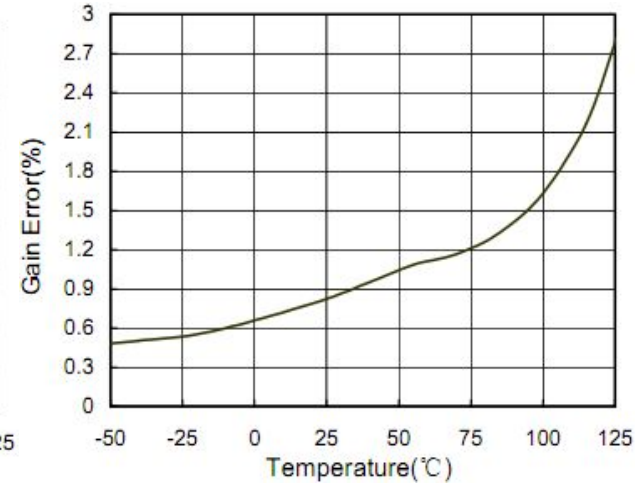


Figure 11. Gain Error vs. Temperature

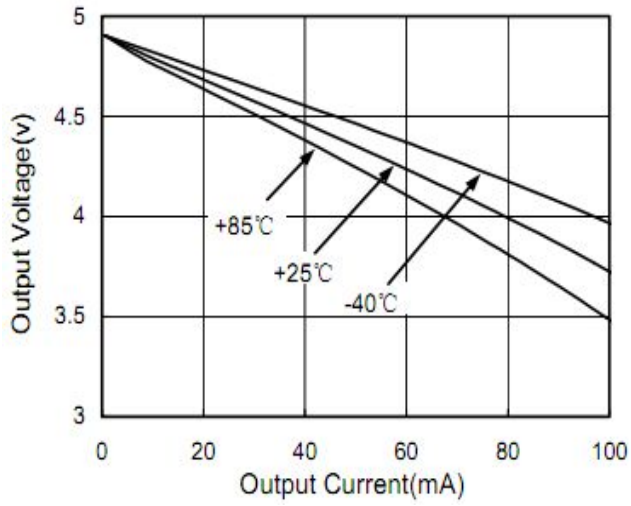


Figure 12. Output Voltage Swing to The Positive Rail vs. Output Current

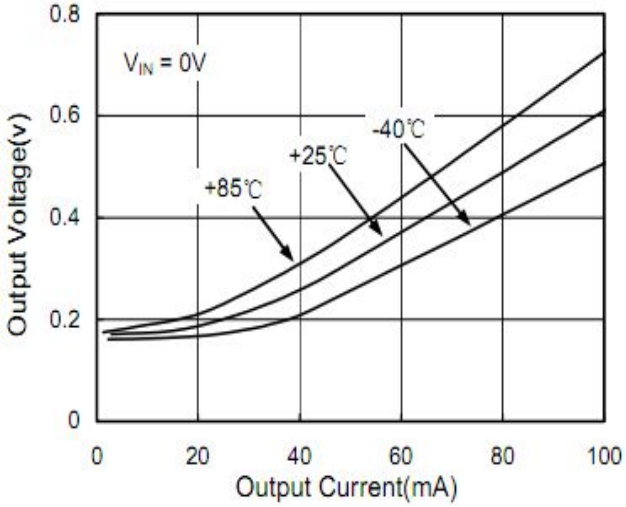


Figure 13. Output Voltage Swing to The Negative Rail vs. Output Current

APPLICATIONS INFORMATION

Functional Description

MS1651 operates from a single +2.5V to +5V supply. In application, MS1651 is a fully integrated solution for filtering and buffering HDTV signals in front of video decoder or behind video encoder. MS1651's solution can help you save PCB size and production cost, it also improves video signal performance comparing with traditional design using discrete components. MS1651 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 MS1651 also can be DC-coupled or AC-coupled.

Input Considerations

Besides AC coupling, the MS1651 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 MS1651 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 MS1651 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 MS1651 outputs can be DC-coupled or AC-coupled. While 0V is input, the MS1651 output voltage is 260mV typically. In DC coupling design, one 75Ω resistor is used to Connect MS1651's output pin with external load directly, this serial back-termination resistor is used to match the impedance of the transmission line between MS1651 and external load to cancel the signal reflection. The MS1651 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 VCC pin of MS1651, please place these two capacitors as close to the MS1651 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 MS1651 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 MS1651 as short as possible to minimize the parasitic stray capacitance and noise pickup.

Typical Application Diagram

The following schematic in Figure 15 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 Figure14 are also popular in design. Figure 18 is a kind of special application in STB.

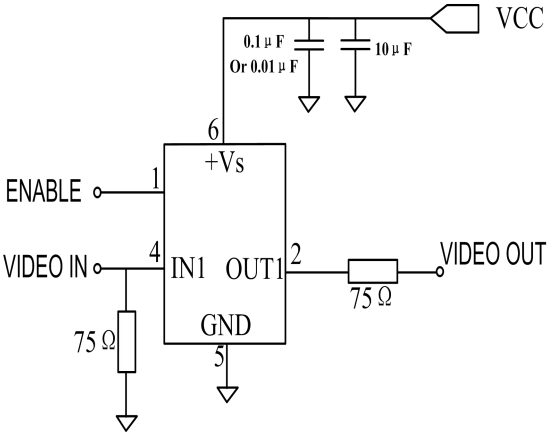


Figure 14. DC Coupling Application Schematic

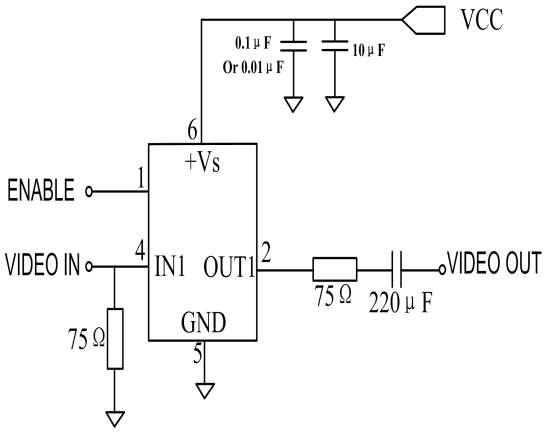


Figure 15. Input DC Coupling and Output AC Coupling Application Schematic

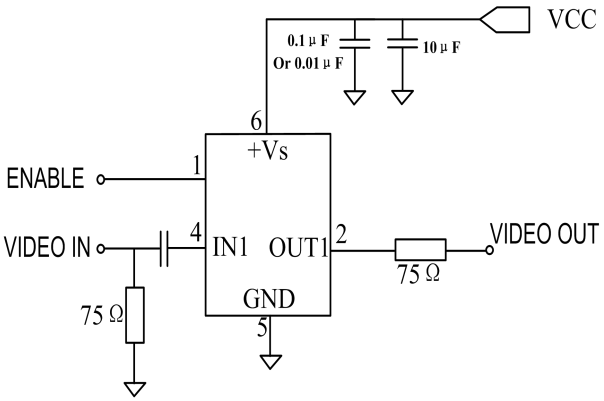


Figure 16. Input AC Coupling and Output DC Coupling Application Schematic

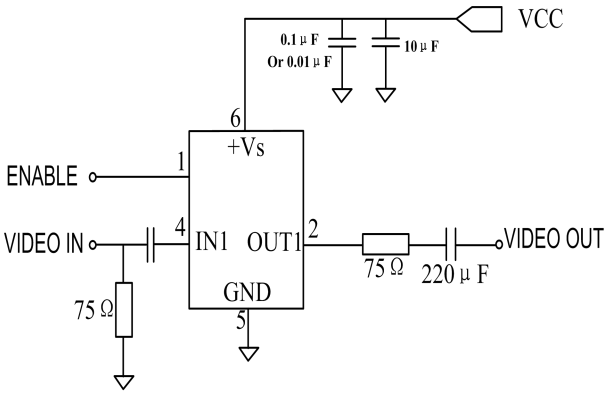


Figure 17. Input AC Coupling and Output AC Coupling Application Schematic

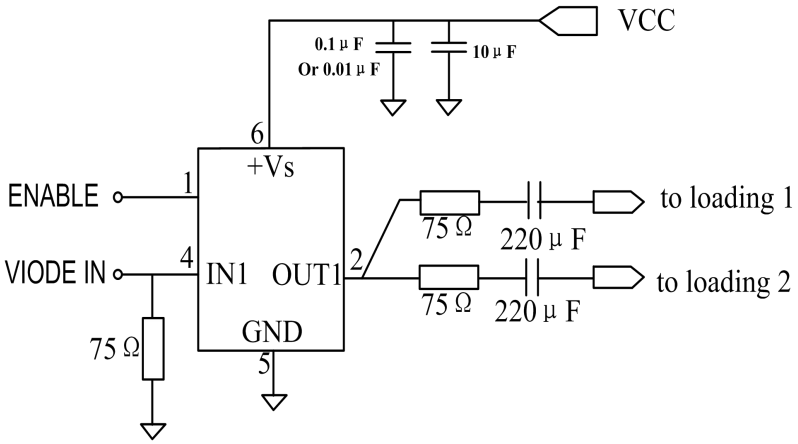
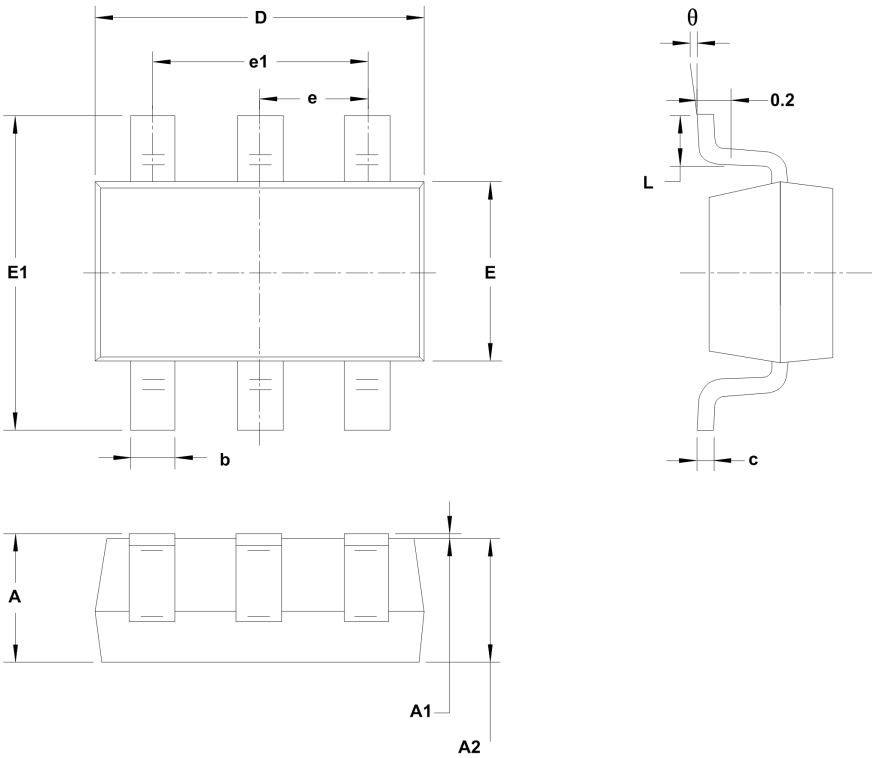


Figure 18. The DC Coupling Circuit Schematic is recommended in applications of STB

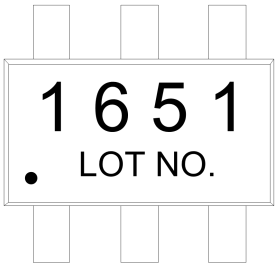
PACKAGE OUTLINE DIMENSIONS

SOT23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8 °	0 °	8 °

SEAL SPECIFICATION



Seal content

1651：The product model

Production batch number：

Example：L5H1

L 5 H 1

- 1 — Order to distinguish between batches of the month(1-9) ；
- H — 1-12 months, respectively written to A/B/C/D/E/F/G/H/J/K/L/M；
- 5 — Years number，2014 written to 4,2015 written to 5 and so on；
- L — The supplier code；

Seal specification

1. Using laser printing, overall center and use of Arial font.