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FAIRCHILD
SEMICONDUCTOR®

August 2011

FMS6144A
Four-Channel, 6th-Order SD VoltagePlus™ Video Filter Driver

Features

- Four-Channel 6th-Order 8MHz (SD) Filter
- Drives Single, AC- or DC-Coupled Video Loads (150Ω)
- Transparent Input Clamping
- Supply Range: 3.3V to 5.0V
- AC- or DC-Coupled Inputs and Outputs
- Robust 9kV ESD Protection
- Lead-Free TSSOP 14-Pin Package

Applications

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

Description

The FMS6144A VoltagePlus™ video filter is intended to replace passive LC filters and drivers with a cost-effective integrated device. Four 6th-order filters provide improved image quality compared to typical 2nd and 3rd order passive solutions.

The FMS6144A 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 *(see the Applications section for details)*.

The outputs can drive AC- or DC-coupled single (150Ω) or dual (75Ω) video loads. DC coupling the outputs removes the need for large output coupling capacitors. The input DC levels are offset approximately +280mV at the output *(see the Applications section for details)*.

Related Applications Notes

AN-6024 – FMS6xxx Product Series Understanding Analog Video Signal Clamps, Bias, DC Restore, and AC or DC coupling Methods

AN-6041 – PCB Layout Considerations for Video Filter / Drivers

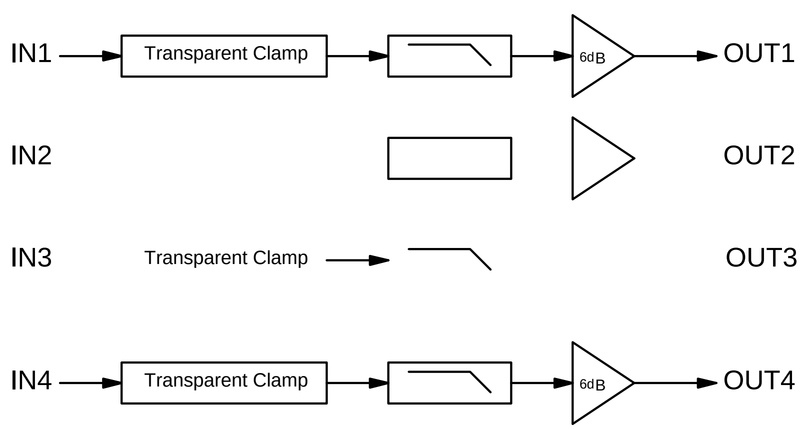

Figure 1. Block Diagram

Ordering Information

Part Number	Operating Temperature Range	Package	Packing Method
FMS6144AMTC14X	-40°C to +85°C	14-Lead TSSOP	2500 per Reel

Pin Configuration

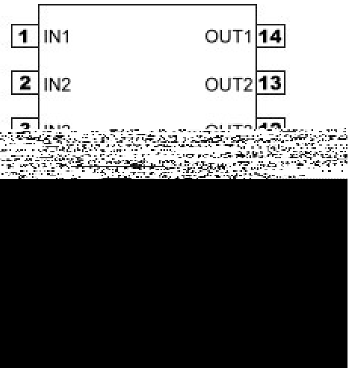

Figure 2. 14-Lead TSSOP (Top View)

Pin Definitions

Pin#	Name	Type	Description
1	IN1	Input	Video Input Channel 1
2	IN2	Input	Video Input Channel 2
3	IN3	Input	Video Input Channel 3
4	IN4	Input	Video Input Channel 4
5	GND	Input	Device Ground Connection
6	NA	NA	No Connection
7	NA	NA	No Connection
8	NA	NA	No Connection
9	NA	NA	No Connection
10	Vcc	Input	Positive Power Supply
11	OUT4	Output	Filtered Output Channel 4
12	OUT3	Output	Filtered Output Channel 3
13	OUT2	Output	Filtered Output Channel 2
14	OUT1	Output	Filtered Output Channel 1

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Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	DC Supply Voltage	-0.3	6.0	V
V_{IO}	Analog and Digital I/O	-0.3	V_{CC}+0.3	V
V_{OUT}	Maximum Output Current, Do Not Exceed		50	mA

Electrostatic Discharge Information

Symbol	Parameter	Min	Unit
ESD	Human Body Model, JESD22-A114	9	kV
	Charged Device Model, JESD22-C101	2	

DC Electrical Characteristics

T_A=25°C, V_{CC}=3.3V, R_S=37.5Ω, all inputs are AC-coupled with 0.1uF, and all outputs are AC coupled with 220µF into 150Ω load; unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Supply						
V_{CC}	Supply Voltage Range	V_S Range	3.14	3.30	5.25	V
I_{CC}	Quiescent Supply Current(1)	V_S=+3.3V, No Load		21	24	mA
		V_S=+5.0V, No Load		25	29	
V_{IN}	Video Input Voltage Range	Referenced to GND if DC Coupled		1.4		V_{PP}
PSRR	Power Supply Rejection Ratio	DC (all Channels)		-65		dB

Note:
1. 100% tested at T_A=25°C

AC Electrical Characteristics

T_A=25°C, V_{CC}=3.3V, R_S=37.5Ω, all inputs are AC-coupled with 0.1uF, and all outputs are AC coupled with 220µF into 150Ω load, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
AV	Channel Gain(2)	Active Video Input Range = 1V_{PP}	5.8	6.0	6.2	dB
$BW_{0.1dB}$	±0.1dB Bandwidth	R_{SOURCE}=75Ω, R_L=150Ω		5		MHz
$BW_{-1.0dB}$	-1.0 dB Bandwidth	R_{SOURCE}=75Ω, $R_{L=}$150Ω		7		MHz
$BW_{3.0dB}$	-3.0 dB Bandwidth	R_{SOURCE}=75Ω, $R_{L=}$150Ω		8		MHz
Att_{27M}	Normalized Stopband Attenuation(2)	R_{SOURCE}=75Ω, f=27MHz	45	60		dB
DG	Differential Gain - NTSC/PAL	Active Video Input Range = 1V_{PP}		0.6		%
DP	Differential Phase - NTSC/PAL	Active Video Input Range = 1V_{PP}		0.6		°
THD	Total Harmonic Distortion	f=1.00MHz; V_{OUT}=1.4V_{PP}		0.2		%
X_{talk}	Crosstalk (Channel to Channel)	f=1.00MHz; V_{OUT}=1.4V_{PP}		-65		dB
SNR	Peak Signal to RMS Noise	NTC-7 Weighting: 100kHz to 4.2MHz		74		dB
T_{pd}	Propagation Delay	Delay from Input to Output; 100KHz to 4.5MHz		90		ns
CLG	Chroma-Luma Gain(2)	400Khz to 3.58Mhz	95	100	105	%
CLD	Chroma-Luma Delay	400Khz to 3.58Mhz		7.5		ns

Note:
2. 100% tested at T_A=25°C

Typical Performance Characteristics

Unless otherwise noted, T_A = 25°C, V_{CC} = 2.7V, R_S = 37.5Ω, and AC-coupled output into 150Ω load.

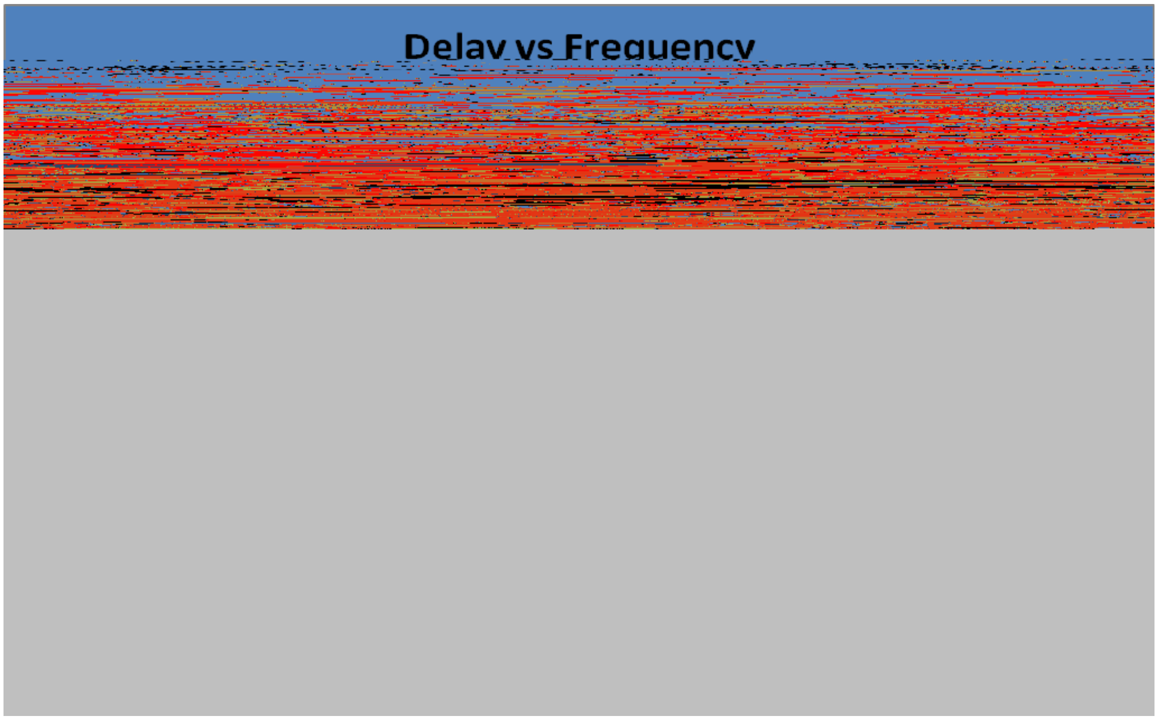

Figure 3. Delay vs. Frequency

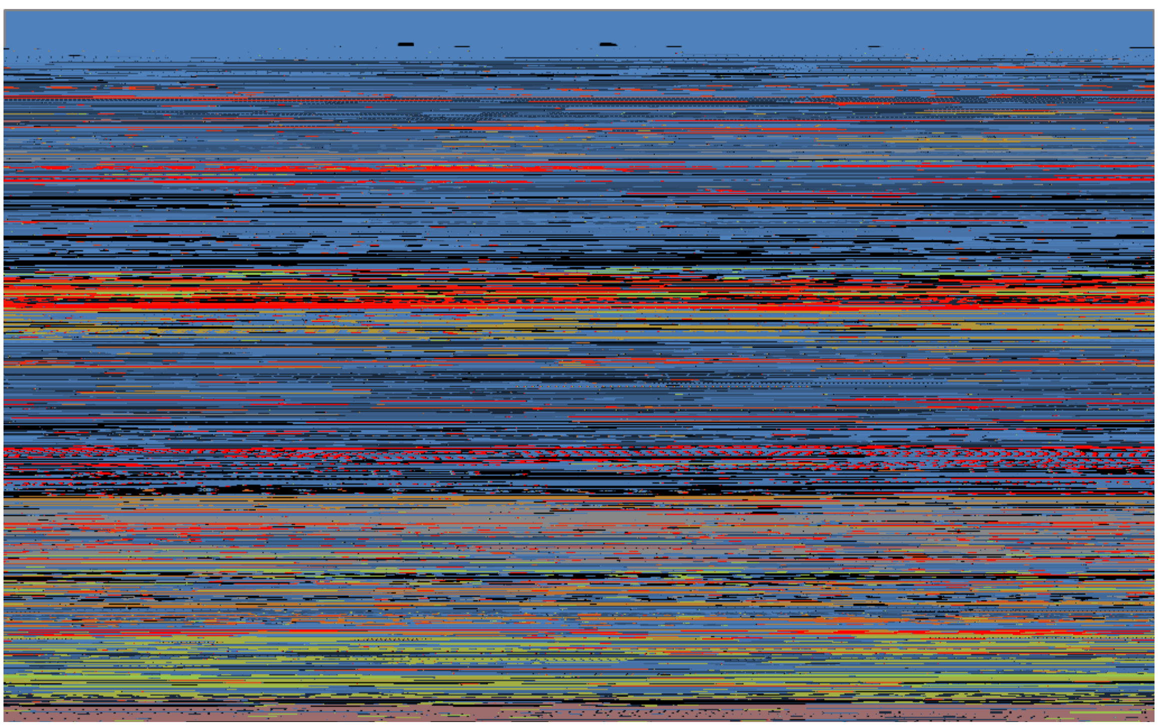

Figure 4. Frequency Response

Typical Performance Characteristics

Unless otherwise noted, T

Typical Performance Characteristics

Unless otherwise noted, T_A = 25°C, V_{CC} = 2.7V, R_S = 37.5Ω

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The same method can be used for biased signals, with the addition of a pull-up resistor to make sure the clamp never operates. The internal pull-down resistance is 800kΩ ±20%, so the external resistance should be 7.5MΩ to set the DC level to 500mV.

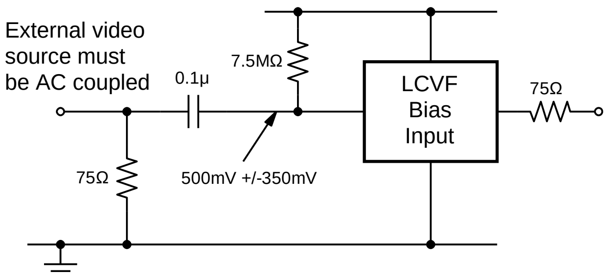


Figure 18. Biased SCART with DC-Coupled Outputs

The same circuits can be used with AC-coupled outputs if desired.

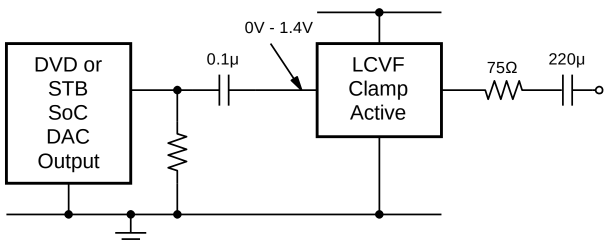


Figure 19. DC-Coupled Inputs, AC-Coupled Outputs

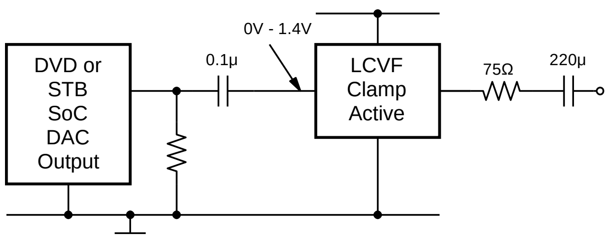
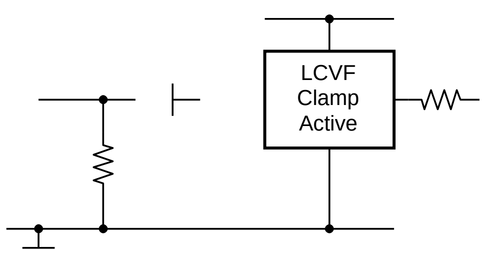


Figure 20. AC-Coupled Inputs and Outputs



Layout Considerations

General layout and supply bypassing play a major role in high-frequency performance and thermal characteristics. Fairchild offers a four-layer board with full power and ground planes 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 best results, follow the steps and recommended routing rules below.

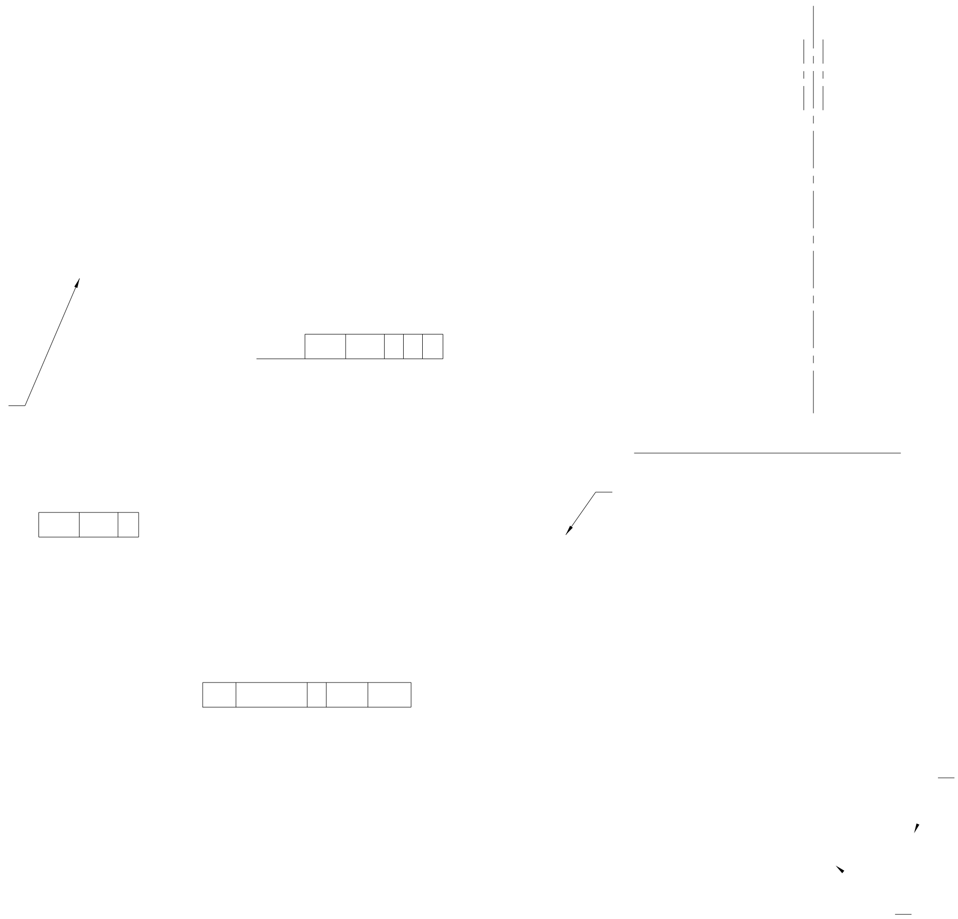
Recommended Routing / Layout Rules

- Do not run analog and digital signals in parallel.
- Use separate analog and digital power planes to supply power.
- Traces should run on top of the ground plane at all times.
- No trace should run over ground/power splits.
- Avoid routing at 90-degree angles.
- Minimize clock and video data trace length differences.
- Include 10µF and 0.1µF ceramic power supply bypass capacitors.
- Place the 0.1µF capacitor within 2.54mm (0.1in) of the device power pin.
- Place the 10µF capacitor within 19.05mm (0.75in) 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 12.7mm (0.5in) on all sides. Include a metal paddle under the device on the top layer.
- Minimize all trace lengths to reduce series inductance.

Output Considerations

The outputs are DC offset from the input by 150mV therefore $V_{OUT} = 2 \cdot V_{IN}$ DC + 150mV. This offset is required for optimal performance from the output driver and is held at the minimum value to decrease the standing DC current into the load. Since the FMS6144A has a 2x (6dB) gain, the output is typically connected via a 75Ω series back-matching resistor followed by the 75Ω video cable. Because of the inherent divide by two of this configurati

Physical Dimensions



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