March 2005

FMS6417A
Selectable RGB (YUV) HD/SD Video Filter Driver with Y, C, Composite, and Modulator Outputs

Features

- YUV/RGB filters
- 2:1 Mux inputs for multiple RGB/YUV inputs
- Selectable 8MHz or 30MHz 6th order filters for RGB (YUV) applications
- 8MHz 6th order Y, C filters with composite summer
- Modulator output with FCC group delay predistortion
- AC or DC coupled input, AC coupled output
- All outputs can drive AC coupled 75Ω loads and provide 6dB of gain
- Dual multiplexed inputs
- 1% differential gain with 1° differential phase
- 36dB/octave roll-off on all channels
- Pin compatible upgrade to the award winning FMS6417

Applications

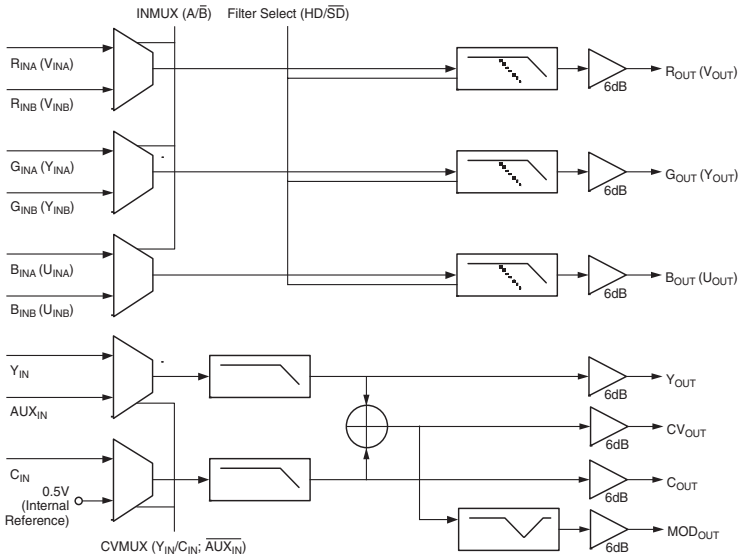
- Cable set top boxes
- Satellite set top boxes
- DVD players
- HDTV
- Personal Video Recorders (PVR)
- Video On Demand (VOD)
- Media Centers

Description

The FMS6417A offers comprehensive filtering for set top box or DVD applications. This part consists of a triple 6th order filter with selectable 30MHz or 8MHz frequencies and a dual filter for filtering Y,C with a composite summer and a modulator channel with sound-notch and FCC group delay compensation. The modulator provides sound-notching and FCC group delay compensation for NTSC.

2-to-1 multiplexers are provided on the triple filters as well as provisions for auxiliary inputs to the composite channel. The triple filters are intended for either YUV or RGB signals. All channels accept AC or DC coupled ground-referenced 1V signals. The filters output $2V_{pp}$ signals into AC coupled terminated loads. The low-pass filters are powered by 3.3V and the modulator and outputs by 5.0V.

Functional Block Diagram



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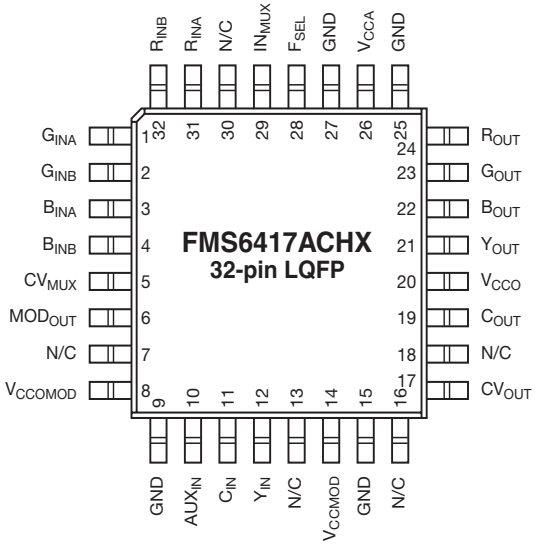
Pin Configurations



Pin Assignments

Pin#	Pin	Description
1	G_{INA}	Analog GREEN video input for Channel <A>
2	G_{INB}	Analog GREEN video input for Channel <B>
3	B_{INA}	Analog BLUE video input for Channel <A>
4	B_{INB}	Analog BLUE video input for Channel <B>
5	CV_{MUX}	Logic input pin selects between the Y_{IN}(1) or AUX_{IN}(0) inputs as well as enabling or disabling CI_{IN}. (Do not float)
6	MOD_{OUT}	Modulator output
7	N/C	No connect
8	V_{CCOMOD}	5V V_{CC} for modulator output buffers
9	GND	Ground for modulator output buffers
10	AUX_{IN}	Filtered analog composite video or luma input
11	C_{IN}	Chrominance (Chroma) input
12	Y_{IN}	Luminance (Luma) input
13	N/C	No connect
14	V_{CCMOD}	5V V_{CC} for modulator
15	GND	Ground for modulator
16	N/C	No connect
17	CV_{OUT}	Composite video output
18	N/C	No connect
19	C_{OUT}	Chrominance (Chroma) output
20	V_{CCO}	5V power supply for output buffers of the RGB and CV drivers
21	Y_{OUT}	Luminance (Luma) output
22	B_{OUT}	Filtered analog BLUE video output from either B_{INA} or B_{INB}
23	G_{OUT}	Filtered analog GREEN video output from either G_{INA} or G_{INB}
24	R_{OUT}	Filtered analog RED video output from either R_{INA} or R_{INB}
25	GND	Ground for output buffers
26	V_{CCA}	V_{CC} analog 3.3V supply
27	GND	Analog ground
28	F_{SEL}	Select between (0) SD (8.0MHz) and (1) HD (30.0MHz) filters (Do not float)
29	IN_{MUX}	Logic input selects between Channel <A> (1) or <B> (0) of the RGB inputs. (Do not float)
30	N/C	No connect
31	R_{INA}	Analog RED video input for Channel <A>
32	R_{INB}	Analog RED video input for Channel <B>

Reliability Information

Parameter	Min.	Typ.	Max.	Unit
Junction Temperature			150	°C
Storage Temperature Range	-65		150	°C
Lead Temperature (Soldering, 10s)			300	°C
Thermal Resistance (θ_{JA}), JEDEC Standard Multi-layer Test Boards, Still Air		48		°C/W

Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
DC Supply Voltage	-0.3	6	V
Analog and Digital I/O	-0.3	V_{CC} +0.3	V
Output Current Any One Channel (Do Not Exceed)		60	mA

Note:

Functional operation under any of these conditions is NOT implied. Performance and reliability are guaranteed only if operating conditions are not exceeded. V_{CCA} can not exceed V_{CCO}

Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Unit
Operating Temperature Range	0		70	°C
V_{CCO} Range[2]	4.75	5.0	5.25	V
V_{CCA} Range	3.135	3.3	3.465	V
V_{CCMOD} Range[2]	4.75	5.0	5.25	V
V_{CCOMOD} Range[2]	4.75	5.0	5.25	V

Electrical Specifications

(T_C = 25°C, V_i = 1V_{pp}; V_{CCA} = 3.3V, V_{CCMOD} = V_{CCOMOD} = V_{CCO} = 5.0V, all inputs AC coupled with 0.1∝F, all outputs AC coupled with 220∝F into 150Ω, referenced to 400kHz; unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{CCA}	Supply Current[1]	V_{CCA} no load	50	80	120	mA
I_{CCO}	Supply Current[1]	V_{CCO} no load	10	55	70	mA
I_{CCMOD}	Modulator Supply Current[1]	V_{CCMOD} no load	10	26	40	mA
I_{CCOMOD}	Modulator Output Supply Current[1]	V_{CCOMOD} no load	0.5	4	10	mA
V_i	Input Voltage Max	Reference to ground		1.3		V_{pp}
V_{il}	Digital Input Low[1]	F_{SEL}, IN_{MUX}, CV_{MUX}	0		0.8	V
V_{ih}	Digital Input High[1]	F_{SEL}, IN_{MUX}, CV_{MUX}	2.4		V_{CCO}	V
V_{OCV}	Output Voltage	During sync, CV channel		1		V
V_{ORGB}	Output Voltage	During sync, RGB channel		1		V
V_{OMOD}	Output Voltage	During sync, MOD channel		1		V
PSSR	PSSR (all channels)	DC		-46		dB

Notes:

1. 100% tested at 25°C.
2. V_{CCO}, V_{CCMOD}, and V_{CCOMOD} all connected to same supply.

Standard Definition Electrical Specifications

(T_C = 25°C, V_i = 1V_{pp}; V_{CCA} = 3.3V, V_{CCMOD} = V_{CCOMOD} = V_{CCO} = 5.0V, F_{SEL} = 0, all inputs AC coupled with 0.1∝F, all outputs AC coupled with 220∝F into 150Ω, referenced to 400kHz; unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
AV_{SD}	SD Gain[1]	R,G,B channels SD Mode	5.3	6.0	6.6	dB
f_{1dBSD}	-1dB Bandwidth for SD[1]	R,G,B,Y,C,CV channels	4	5		MHz
f_{CSD}	-3dB Bandwidth for SD	R,G,B,Y,C,CV channels		8		MHz
f_{SBSD}	Attenuation: SD (stopband reject)[1]	R,G,B,Y,C channels at f = 27MHz	37	40		dB
f_{SBCV}	Attenuation: SD (stopband reject)[1]	CV channel at f = 27MHz	37	40		dB
f_{NA}	Notch Attenuation	at 4.425MHz	14	20		dB
MCF	Modulator Channel Flatness	at 3.75MHz	-0.75	0	+0.75	dB
dG	Differential Gain	R,G,B,Y,C,CV channels		1.0		%
dϕ	Differential Phase	R,G,B,Y,C,CV channels		1.0		°
$d\phi_{MOD}$	Modulator Differential Phase	MOD channel		1.5		°
THD	Output Distortion (all channels)	V_{OUT} = 1.8V_{pp} at 3.58MHz		0.4		%
X_{TALKYC}	Crosstalk	channel-to-channel YC at 1MHz		-58		dB
$X_{TALKRGB}$	Crosstalk	channel-to-channel RGB at 1MHz		-65		dB
IN_{MUXISO}	IN_{MUX} Isolation	at 1MHz		-75		dB
SNR	Signal-to-Noise Ratio	R,G,B,Y,C,CV channels, NTC-7 weighting, 100kHz highpass enabled		72		dB
t_{pdSD}	Prop Delay for SD	Delay from input to output at 4.5MHz (RGB, YC, CV outputs)		85		ns
Δt_{pdMOD}	Modulator Group Delay	MODE = 0, from 400kHz to 3.58MHz	-230	-170	-130	ns
t_{CLDCV}	Chroma-Luma Delay CV_{OUT}	f = 3.58MHz (referenced to 400kHz)		6	50	ns
t_{CLGCV}	Chroma-Luma Gain CV_{OUT}	f = 3.58MHz (referenced to 400kHz)	92	100	104	%

High Definition Electrical Characteristics

(T_C = 25°C, V_i = 1V_{pp}; V_{CCA} = 3.3V, V_{CCMOD} = V_{CCOMOD} = V_{CCO} = 5.0V, F_{SEL} = 1, all inputs AC coupled with 0.1∝F, all outputs AC coupled with 220∝F into 150Ω, referenced to 400kHz; unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
AV_{RGBHD}	RGB HD Gain[1]	R,G,B channels HD Mode	5.3	6.0	6.6	dB
f_{1dBHD}	-1dB Bandwidth for HD[1]	R,G,B channels	16	20		MHz
f_{CHD}	-3dB Bandwidth for HD	R,G,B channels		32		MHz
f_{SBHD}	Attenuation: HD (stopband reject)[1]	R,G,B channels at f = 74.25MHz	25	30		dB
HD2	2nd Harmonic Distortion	20MHz fundamental		-48		dBc
HD3	3rd Harmonic Distortion	20MHz fundamental		-48		dBc
$X_{TALKRGB}$	RGB Crosstalk	(channel-to-channel) at 1MHz		-68		dB
IN_{MUXISO}	IN_{MUX} Isolation	at 1MHz		-75		dB
SNR	Signal-to-Noise Ratio	R,G,B channels		72		dB
t_{pdHD}	Prop Delay for HD	Delay from input to output at 16MHz		26		ns
GD_{HD}	Group Delay	from 400kHz to 30MHz		5		ns

Notes:

1. 100% tested at 25°C.
2. V_{CCO}, V_{CCMOD}, and V_{CCOMOD} all connected to same supply.

Standard Definition Typical Performance Characteristics

(T_C = 25°C, V_i = 1V_{pp}; V_{CCA} = 3.3V, V_{CCMOD} = V_{CCOMOD} = V_{CCO} = 5.0V, F_{SEL} = 0, all inputs AC coupled with 0.1∝F, all outputs AC coupled with 220∝F into 150Ω, referenced to 400kHz; unless otherwise noted)

Figure 1. Freq. Response RGB Channels

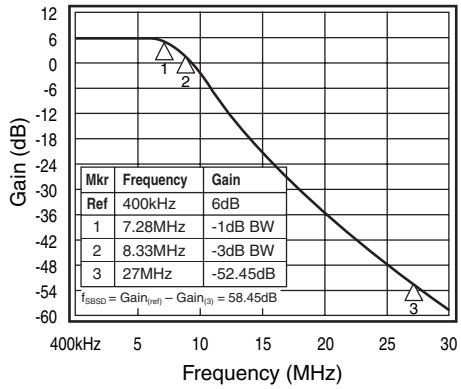


Figure 2. Freq. Response YCCV Channels

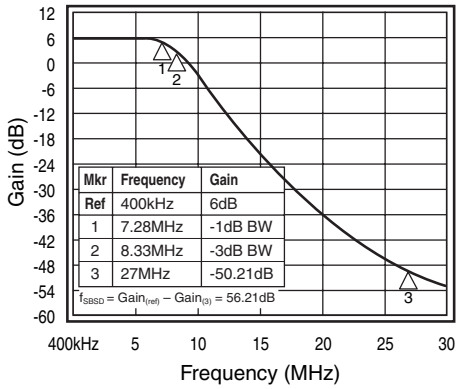


Figure 3. Group Delay vs. Freq. RGB Channels

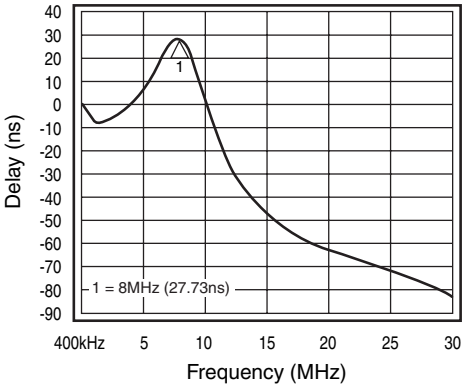


Figure 4. Group Delay vs. Freq. YCCV Channels

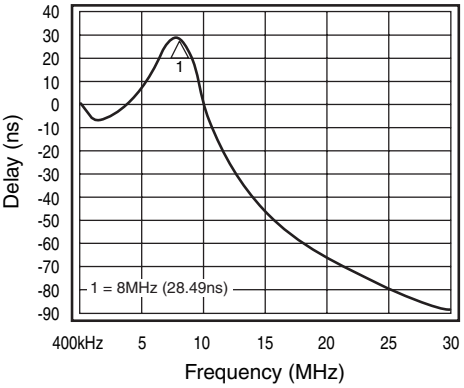


Figure 5. Modulator Output vs. Frequency

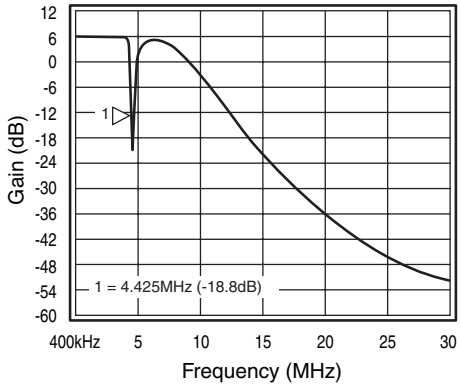
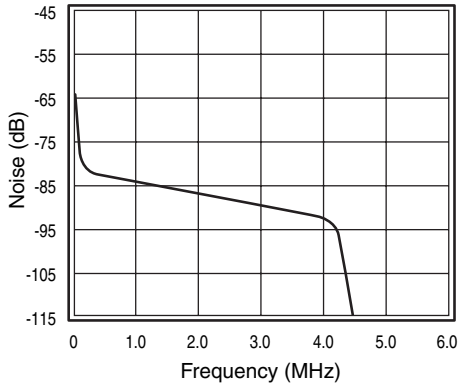


Figure 6. Noise vs. Frequency RGB Channels



Standard Definition Typical Performance Characteristics

(T_C = 25°C, V_i = 1V_{pp}; V_{CCA} = 3.3V, V_{CCMOD} = V_{CCOMOD} = V_{CCO} = 5.0V, F_{SEL} = 0, all inputs AC coupled with 0.1∝F, all outputs AC coupled with 220∝F into 150Ω, referenced to 400kHz; unless otherwise noted)

Figure 7. Noise vs. Freq. YCCV Channels

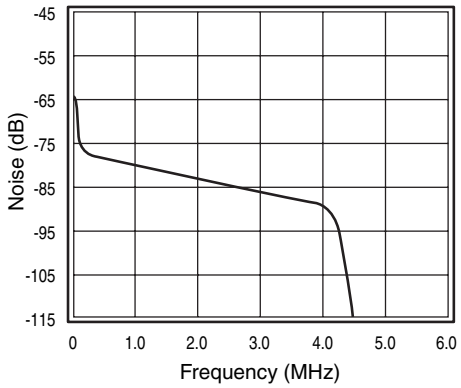


Figure 8. Noise vs. Freq. Modulator Channels

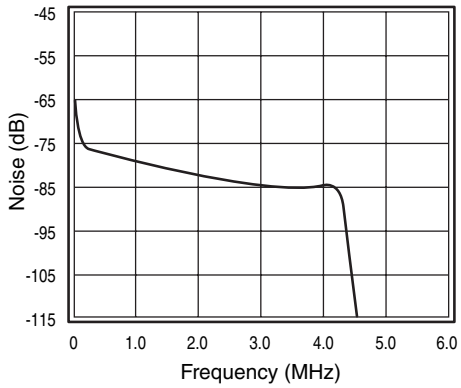


Figure 9. Differential Gain RGB Channels

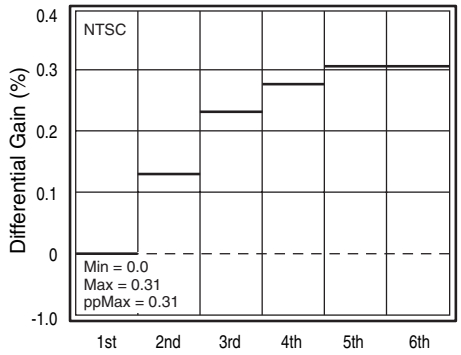


Figure 10. Differential Phase RGB Channels

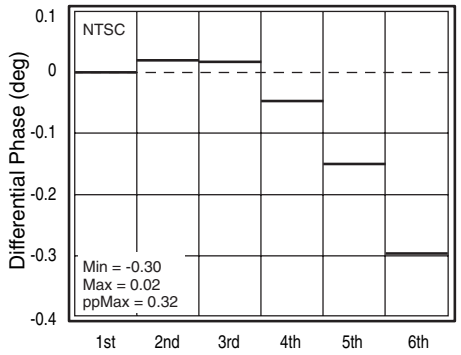


Figure 11. Differential Gain YCCV Channels

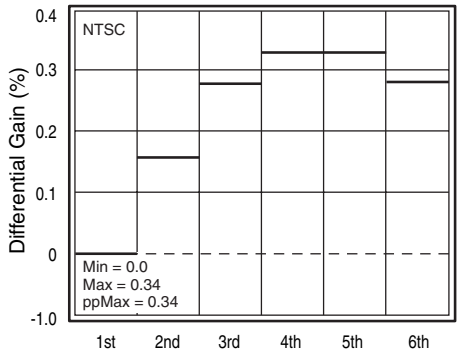
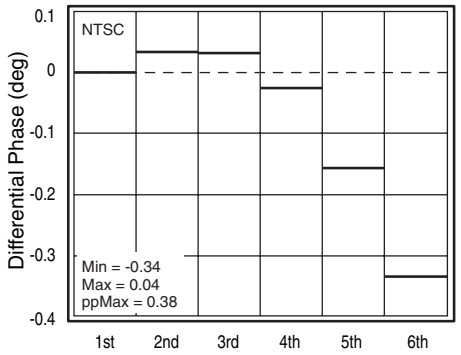


Figure 12. Differential Phase YCCV Channels



Standard Definition Typical Performance Characteristics

(T_C = 25°C, V_i = 1V_{pp}; V_{CCA} = 3.3V, V_{CCMOD} = V_{CCOMOD} = V_{CCO} = 5.0V, F_{SEL} = 0, all inputs AC coupled with 0.1∝F, all outputs AC coupled with 220∝F into 150Ω, referenced to 400kHz; unless otherwise noted)

Figure 13. Chroma Gain vs. Chroma Delay

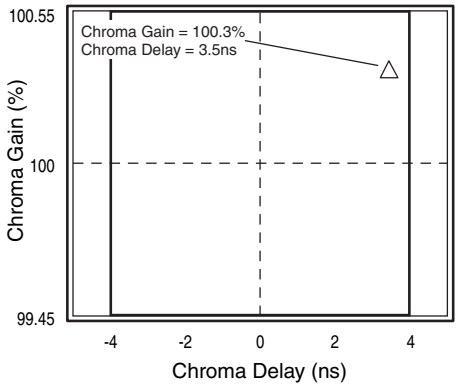
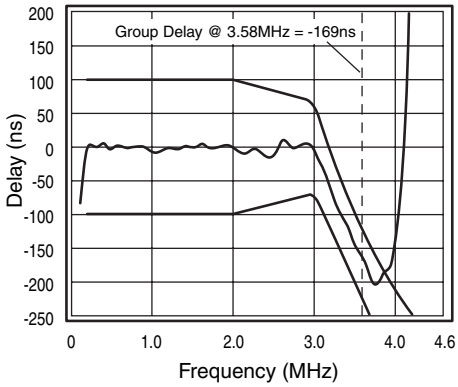


Figure 14. Modulator Group Delay vs. Freq.



High Definition Typical Performance Characteristics

(T_C = 25°C, V_i = 1V_{pp}; V_{CCA} = 3.3V, V_{CCMOD} = V_{CCOMOD} = V_{CCO} = 5.0V, F_{SEL} = 1, all inputs AC coupled with 0.1∝F, all outputs AC coupled with 220∝F into 150Ω, referenced to 400kHz; unless otherwise noted)

Figure 15. HD Freq. Response RGB Channels

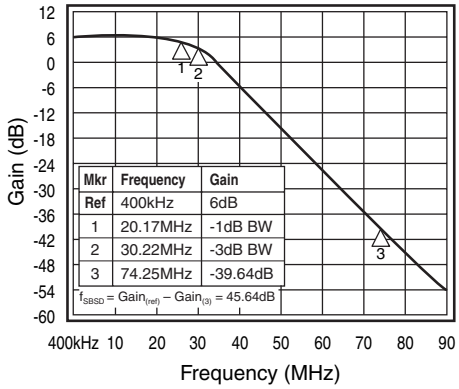


Figure 16. HD Group Delay RGB Channels

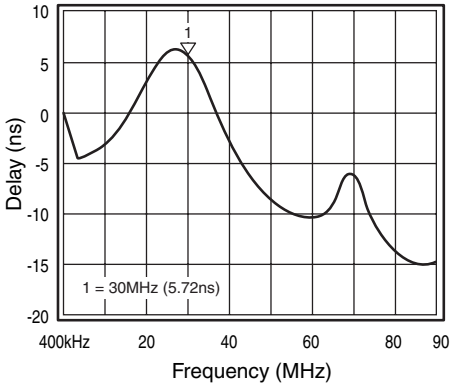
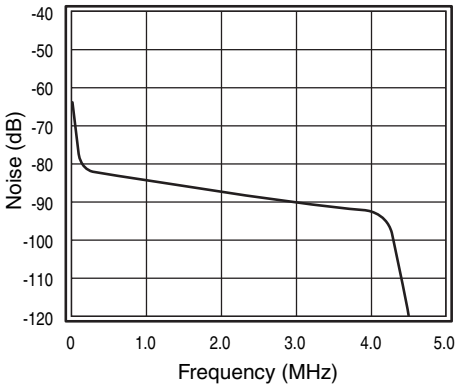


Figure 17. Noise vs. Freq. RGB Channels



General Description

The FMS6417A offers comprehensive filtering for set top box or DVD applications. This part consists of a triple 6th order filter with selectable 30MHz or 8MHz frequencies and a dual filter for filtering Y,C with a composite summer and a modulator channel with sound-notch and FCC group delay compensation. The modulator provides sound-notching and FCC group delay compensation for NTSC. 2-to-1 multiplexers are provided on the triple filters as well as provisions for auxiliary inputs to the composite channel. The triple filters are intended for either YUV or RGB signals. All channels accept DC coupled ground-referenced 1V signals. The filters output $2V_{pp}$ signals into AC coupled terminated loads. The low-pass filters are powered by 3.3V and the modulator and outputs by 5.0V.

The FMS6417A is a next generation filter solution from Fairchild Semiconductor, addressing the expanding filtering needs for set top boxes, and DVD players. The product provides selectable filtering from 30MHz or 8MHz on the RGB channels. Thus, the FMS6417A addresses the requirement for a single set top box to be compatible with a variety of resolution standards. Additionally, the product provides additional filters for Y, C, CV, and modulator outputs. Multiplexers on the RGB and CV channel provide further flexibility.

For DVD applications, the product provides filtering and output drive amplification for 7 channels of outputs. These include R, G, B, Y, C, CV, and modulator outputs.

For set top boxes, this product provides for 2 channels of video to be filtered, as well as the flexibility of selectable high order filtering for multiple resolution standards. Additional flexibility is provided by the additional Y,C filterswith composite summers.

All channels provide 6dB gain, accept 1V ground referenced inputs, and drive AC coupled loads. The filters for the R, G, B, Y, C, and CV channels are powered from a 3.3V supply and the modulator channel and outputs from 5V.

The modulator channel has sound-notch and FCC group delay compensation set for NTSC specifications.

Applications

Typical Application Diagrams

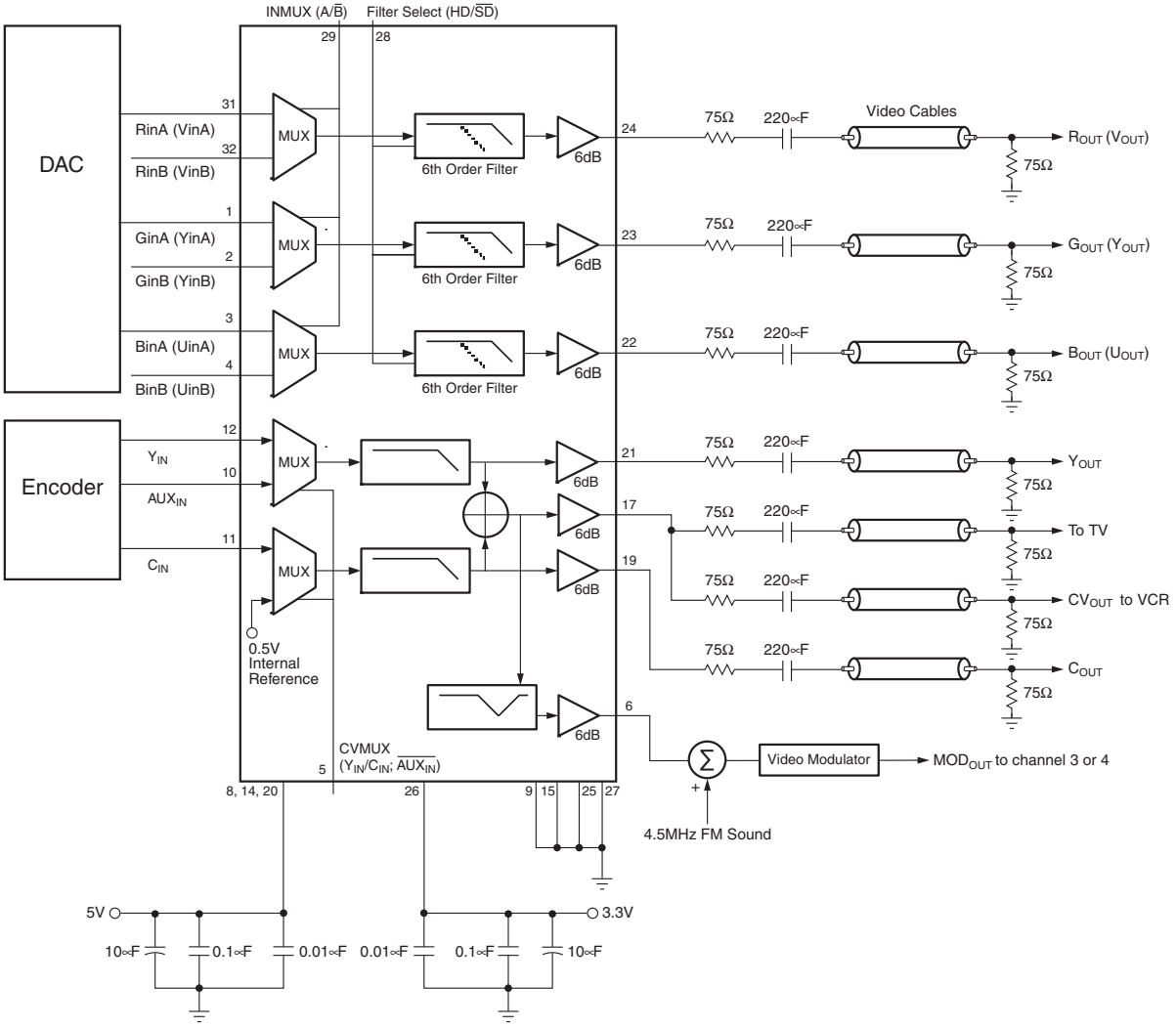


Figure 18. Typical application diagram (DC-coupled input)

Applications

Typical Application Diagrams (Continued)

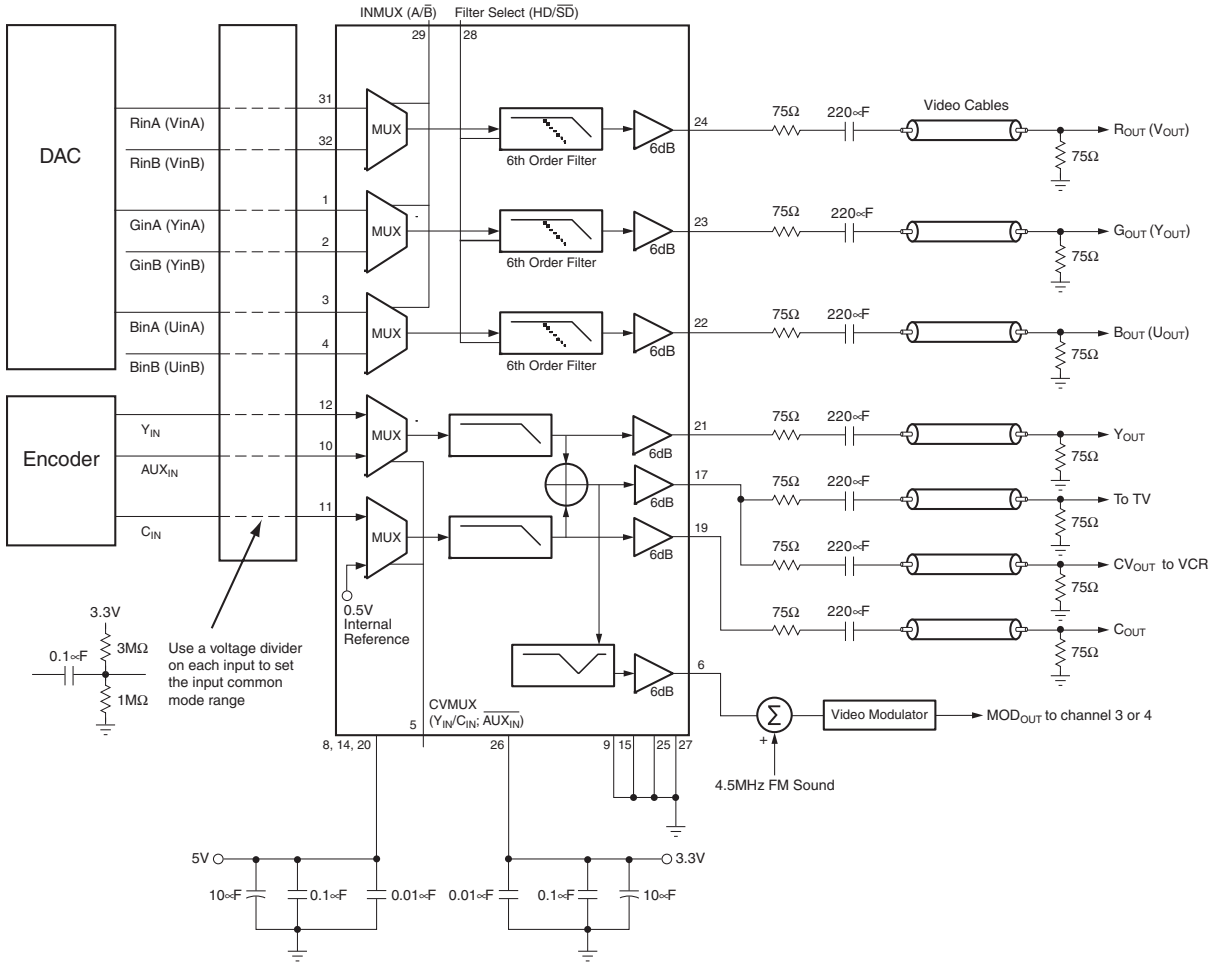
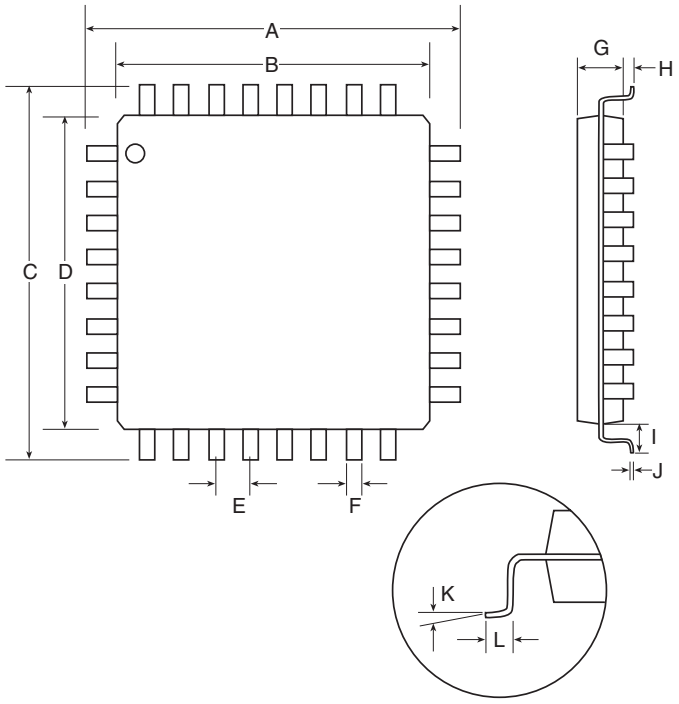


Figure 19. Typical application diagram (AC-coupled input)

Mechanical Dimensions

LQFP-32



	MILLIMETERS	
Symbol	**Min**	**Max**
A	8.80	9.20
B	6.90	7.10
C	8.80	9.20
D	6.90	7.10
E	0.80 BSC	
F	0.30	0.47
G	1.35	1.45
H	0.05	0.15
I	0.95	1.05
J	0.09	0.2
K	0°	7°
L	0.45	0.75

Ordering Information

Model	Part Number	Lead Free	Package	Container	Pack Qty.
FMS6417A	FMS6417ACH_NL	Yes	32-pin LQFP	Tray	250
FMS6417A	FMS6417ACHX_NL	Yes	32-pin LQFP	Tape and Reel	1,000

Temperature Range: 0°C to +70°C

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CoolFET™	FRFET™	MICROCOUPLER™	PowerSaver™	SuperSOT™-3
CROSSVOLT™	GlobalOptoisolator™	MicroFET™	PowerTrench®	SuperSOT™-6
DOME™	GTO™	MicroPak™	QFET®	SuperSOT™-8
EcoSPARK™	HiSeC™	MICROWIRE™	QS™	SyncFET™
E²CMOS™	I²C™	MSX™	QT Optoelectronics™	TinyLogic®
EnSigna™	*i-Lo*™	MSXPro™	Quiet Series™	TINYOPTO™
FACT™	ImpliedDisconnect™	OCX™	RapidConfigure™	TruTranslation™
FACT Quiet Series™		OCXPro™	RapidConnect™	UHC™
Across the board. Around the world.™		OPTOLOGIC®	µSerDes™	UltraFET®
The Power Franchise®		OPTOPLANAR™	SILENT SWITCHER®	UniFET™
Programmable Active Droop™		PACMAN™	SMART START™	VCX™

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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