FAIRCHILD SEMICONDUCTOR®

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# FMS6417

## Selectable RGB HD/SD Video Filter Driver with Y, C, Composite, and Modular Outputs

### Features

- Three channel video reconstruction filter
- YUV/RGB filters
- 2:1 Mux inputs for multiple RGB/YUV inputs
- Selectable 8MHz to 30MHz 6th order filters for RGB (YUV) applications
- 8MHz 6th order Y, C filters with composite summer
- Modular output with group delay predistortion
- AC 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

### Applications

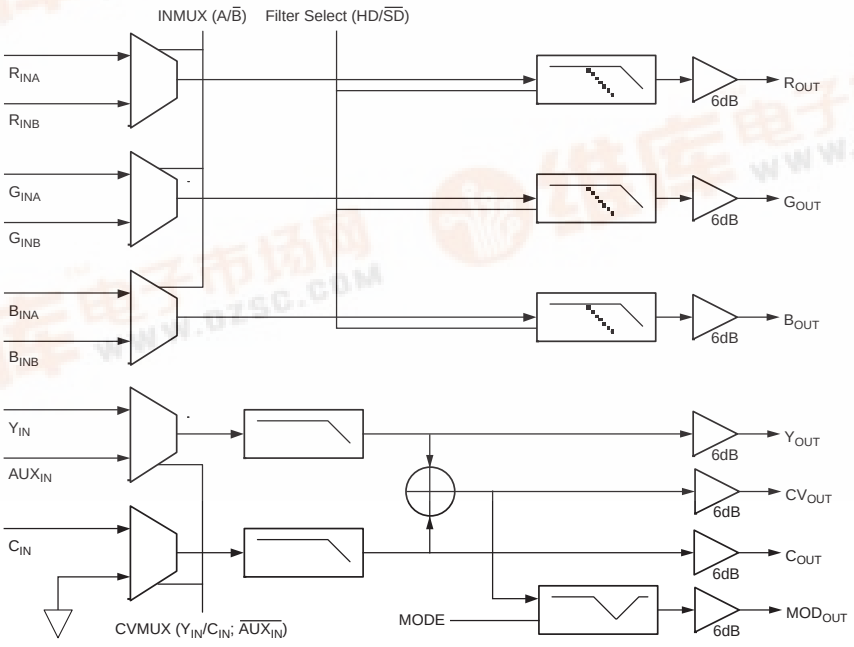
- Cable Set top boxes
- Satellite Set top boxes
- DVD players
- HDTV
- Personal Video Recorders (PVR)
- Video On Demand (VOD)

### Description

The FMS6417 offers comprehensive filtering for set top box or DVD applications. This part consists of a triple 6th order filter with selectable 30MHz to 8.0MHz frequencies and a dual filter for filtering Y,C with a composite summer and a modulator channel with notch and group delay compensation. The modulator provides notching and 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 coupled ground-referenced $1V_{pp}$ 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



## Electrical Specifications

($T_C$ = 25°C, $V_i$ = 1$V_{pp}$; $V_{CCA}$ = 3.3V, $V_{CCO}$ = 5.0V, all inputs AC coupled, all outputs AC coupled; 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 | 35 | 60 | mA |
| $I_{CCMOD}$ | Modular Supply Current[1] | $V_{CCMOD}$ no load | 5 | 10 | 15 | mA |
| $I_{CCOMOD}$ | Modular Supply Current[1] | $V_{CCOMOD}$ no load | 10 | 20 | 30 | mA |
| $V_i$ | Input Voltage Max | Reference to ground | | 1.0 | | $V_{pp}$ |
| $V_{il}$ | 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 | | 2 | | V |
| $V_{OMOD}$ | Output Voltage | During sync, MOD channel | | 1 | | V |
| PSSR | PSSR (all channels) | DC | | 46 | | dB |

## Standard Definition Electrical Specifications

($T_C$ = 25°C, $V_i$ = 1$V_{pp}$; $V_{CCA}$ = 3.3V, $V_{CCO}$ = 5.0V, $F_{SEL}$ = 0,
all inputs AC coupled, all outputs AC coupled; unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $AV_{RGBSD}$ | RGB SD Gain[1] | R,G,B channels SD Mode | 5.3 | 6.0 | 6.6 | dB |
| $AV_{MOD}$ | Modular Gain | MOD channels | 5.1 | 5.8 | 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[1] | R,G,B,Y,C,CV channels | 6.7 | 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 | | -24 | -14 | dB |
| MCF | Modular Channel Flatness | | -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 | | ° |
| $d\phi_{MOD}$ | Modular Differential Phase | MOD channel | | 1.5 | | ° |
| THD | Output Distortion (all channels) | $V_{OUT}$ = 1.8$V_{pp}$, $Y_{OUT}/C_{OUT}$ at 3.58MHz | | 0.4 | | % |
| $X_{TALKYC}$ | Crosstalk | channel-to-channel YC | | -58 | | dB |
| $X_{TALKRGB}$ | Crosstalk | channel-to-channel RGB | | -65 | | dB |
| $IN_{MUXISO}$ | $IN_{MUX}$ Isolation | at 1MHz | | -90 | | dB |
| SNR | Signal-to-Noise Ratio | R,G,B,Y,C,CV channels, unified weighting, 100kHz highpass enabled | | -60 | | dB |
| $t_{pdSD}$ | Prop Delay for SD | Delay from input to output at 4.5MHz | | 65 | | ns |
| $\Delta t_{pdMOD}$ | Modular 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 | % |

**Notes:**

1. 100% tested at 25°C.

## High Definition Electrical Specifications

($T_C$ = 25°C, $V_i$ = 1$V_{pp}$; $V_{CCA}$ = 3.3V, $V_{CCO}$ = 5.0V, $F_{SEL}$ = 1,
all inputs AC coupled, all outputs AC coupled; 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[1] | R,G,B channels | 30 | 32 | | MHz |
| $f_{SBHD}$ | Attenuation: HD (stopband reject)[1] | R,G,B channels at f = 74.25MHz | -25 | -30 | | dB |
| $X_{TALKRGB}$ | Crosstalk | channel-to-channel RGB | | -68 | | dB |
| $IN_{MUXISO}$ | $IN_{MUX}$ Isolation | at 1MHz | | -90 | | dB |
| SNR | Signal-to-Noise Ratio | R,G,B channels, NTC-7 weighting 4.2MHz lowpass | | -65 | | dB |
| $t_{pdHD}$ | Prop Delay for HD | Delay from input to output at 4.5MHz | | 20 | | dB |
| $\Delta t_{pdHD}$ | Group Delay | from 400kHz to 30MHz | -230 | -170 | -130 | ns |

**Notes:**
1. 100% tested at 25°C.

## Absolute Maximum Ratings (beyond which the device may be damaged)

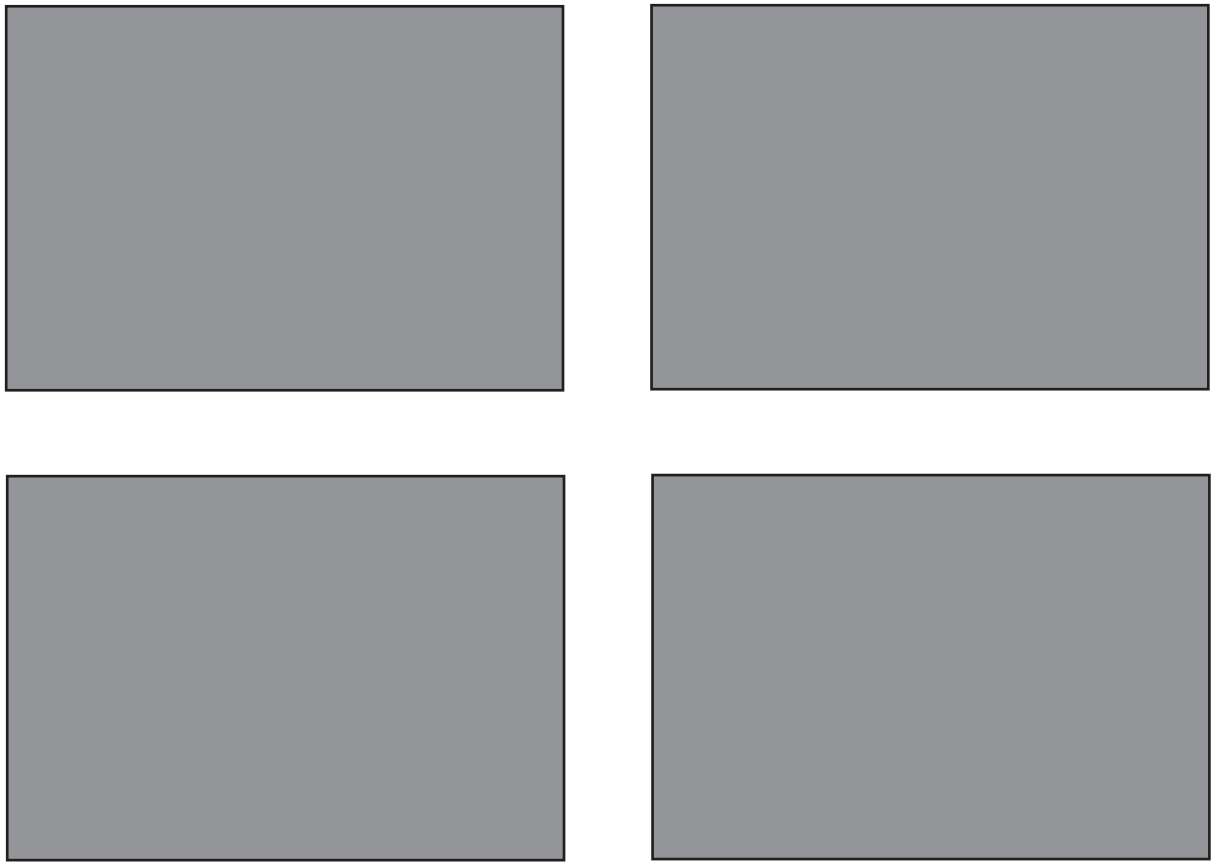
| Parameter | Min | Max | Units |
|---|---|---|---|
| DC Supply Voltage | -0.3 | 7.0 | V |
| Analog and Digital I/O | $V_{SS}$ -0.3 | $V_{SS}$ +0.3 | V |
| Output Current RGB Channels[1] | | 120 | mA |
| Output Current CV Channels[1] | | TBD | mA |
| Output Current C,Y Channels[1] | | TBD | mA |
| Junction Temperature | | 150 | °C |
| Storage Temperature Range | -65 | 150 | °C |
| Lead Temperature (Soldering, 10s) | | 260 | °C |
| Thermal Resistance ($\Theta_{JA}$) | | TBD | °C/W |

**Note:**
1. Sustained circuit protection limited to 10 seconds.

## Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|
| Operating Temperature Range | 0 | | 70 | °C |
| $V_{CCO}$ Range | 4.75 | 5.0 | 5.25 | V |
| $V_{CCA}$ Range | 3.135 | 3.3 | 3.465 | V |
| $V_{CCMOD}$ Range | 4.75 | 5.0 | 5.25 | V |
| $V_{CCOMOD}$ Range | 4.75 | 5.0 | 5.25 | V |

## Typical Performance Characteristics



## General Description

The FMS6417 offers comprehensive filtering for set top box or DVD applications. This part consists of a triple 6th order filter with selectable 30MHz to 8.0MHz frequencies and a dual filter for filtering Y,C with a composite summer and a modulator channel with notch and group delay compensation. The modulator provides notching and 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 coupled ground-referenced $1V_{pp}$ 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 FMS6417 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 to 8.0MHz on the RGB channels. Thus, the FMS6417 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.

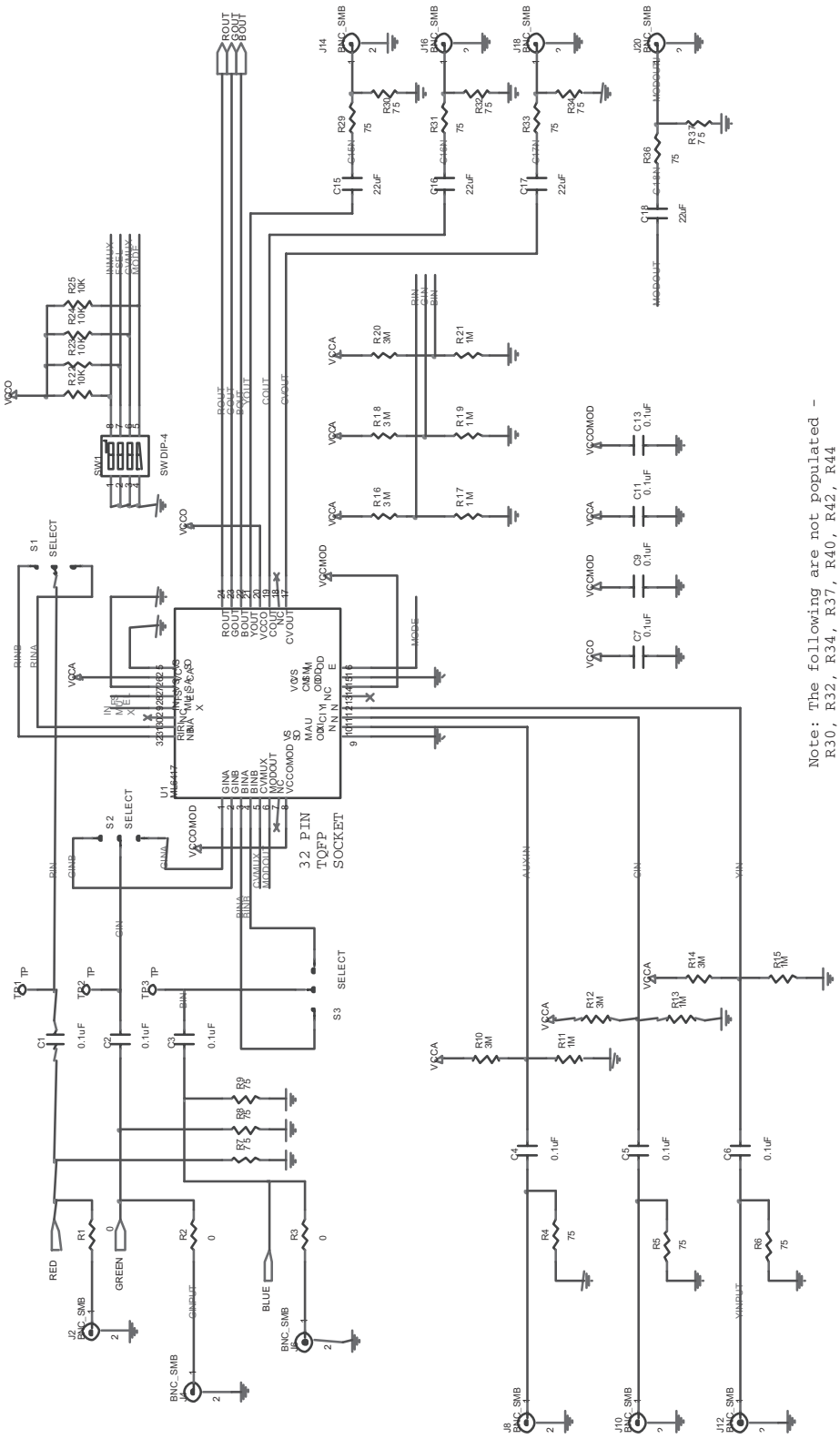
For DVD applications, the product provides filtering and output drive amplification for 7 channels of outputs. These include R, G, B, Y, C, CV, and modulator outputs.

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 filters with 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.

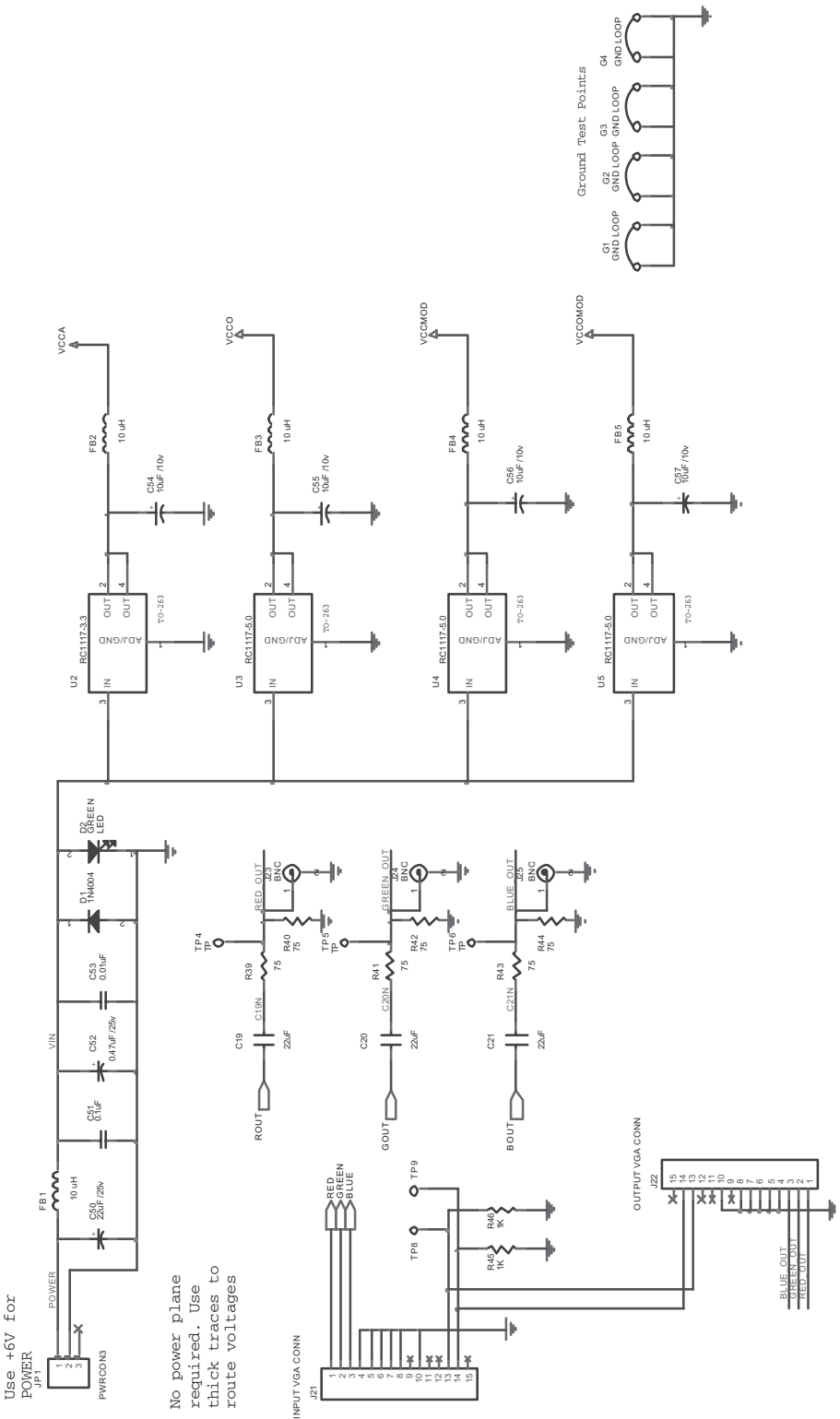
The modulator channel has notch and group delay compensation set for NTSC specifications.

# FMS6417 Demo Board Schematics



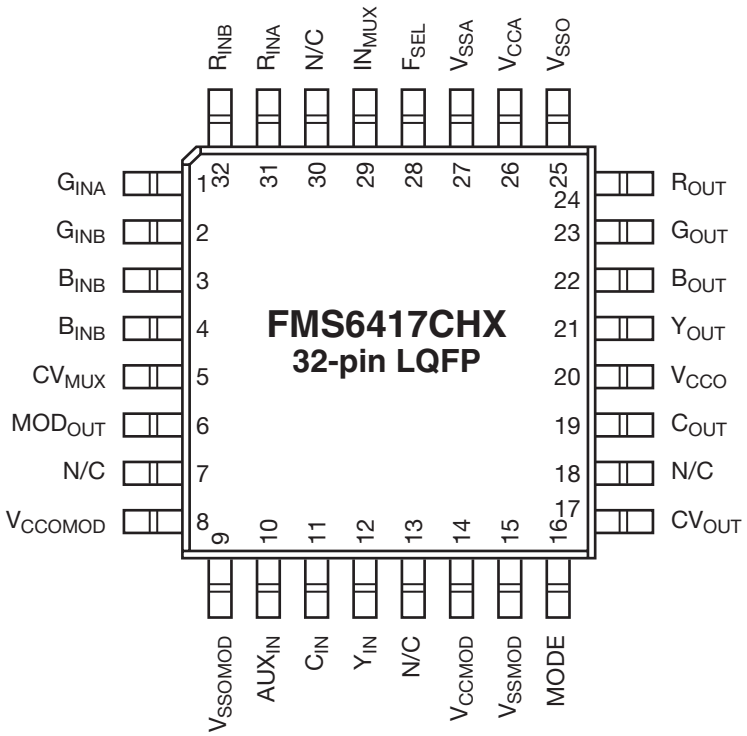

**NOTE:** Schematic illustration is being redrawn for legibility.

# FMS6417 Demo Board Schematics (Continued)




**NOTE:** Schematic illustration is being redrawn for legibility.

## Pin Configuration




## Pin Assignments

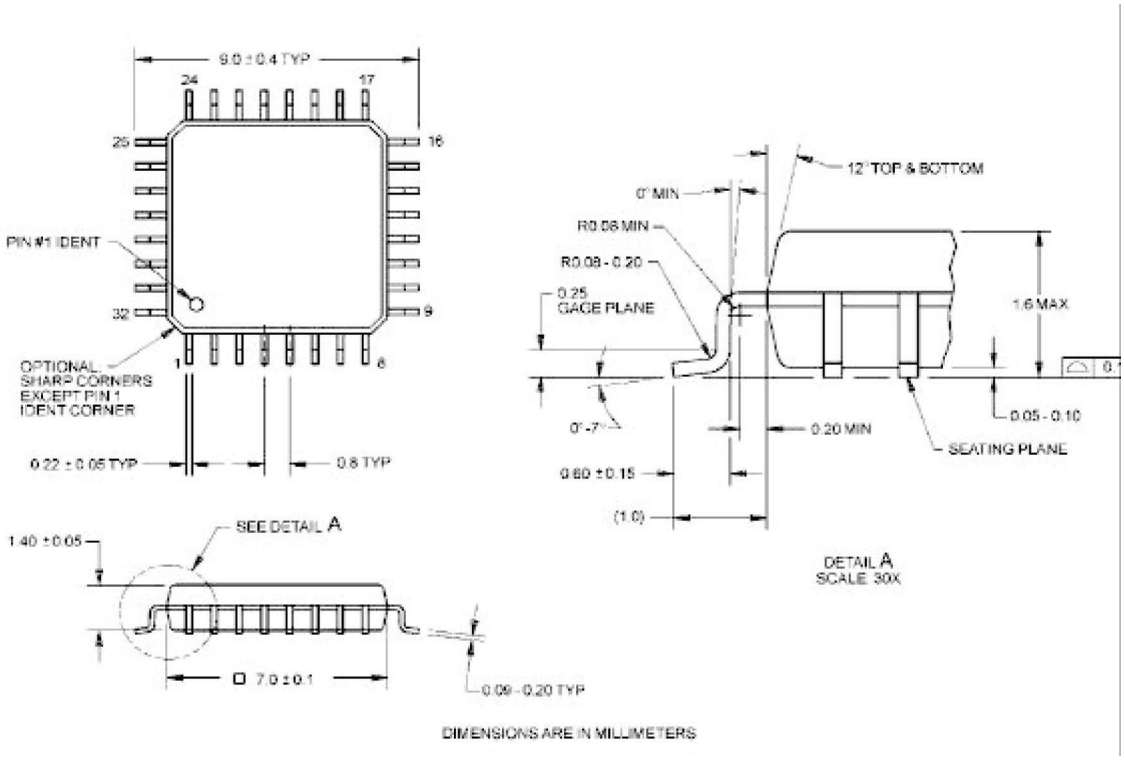
| Pin # | Pin Name | Description |
|---|---|---|
| 1 | $G_{INA}$ | Filtered analog GREEN video input for Channel <A> |
| 2 | $G_{INB}$ | Filtered analog GREEN video input for Channel <B> |
| 3 | $B_{INA}$ | Filtered analog BLUE video input for Channel <A> |
| 4 | $B_{INB}$ | Filtered analog BLUE video input for Channel <B> |
| 5 | $CV_{MUX}$ | Logic input pin selects between the $Y_{IN}$ or $AUX_{IN}$ inputs as well as enabling or disabling $CI_{IN}$ |
| 6 | $MOD_{OUT}$ | Modular output |
| 7 | N/C | No connect |
| 8 | $V_{CCOMOD}$ | 5V $V_{CC}$ for modular output buffers |
| 9 | $V_{SSOMOD}$ | Ground for modular 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 | $V_{CCMOD}$ | $V_{CC}$ for modulator |
| 15 | $V_{SSMOD}$ | Ground for modulator |

## Pin Assignments (Continued)

| Pin # | Pin Name | Description |
|---|---|---|
| 16 | MODE | Set group delay mode for NTSC. Set to 0. |
| 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 | $B_{OUT}$ | Analog BLUE video output from either $B_{INA}$ or $B_{INB}$ |
| 23 | $G_{OUT}$ | Analog GREEN video output from either $G_{INA}$ or $G_{INB}$ |
| 24 | $R_{OUT}$ | Analog RED video output from either $R_{INA}$ or $R_{INB}$ |
| 25 | $V_{SSO}$ | Ground for output buffers |
| 26 | $V_{CCA}$ | $V_{CC}$ analog 3.3V supply |
| 27 | $V_{SSA}$ | Analog ground |
| 28 | $F_{SEL}$ | Select between (0) SD (8.0MHz) and (1) HD (30.0MHz) filters |
| 29 | $IN_{MUX}$ | Logic input selects between Channel <A> or <B> of the RGB inputs. Internally pulled high. |
| 30 | N/C | No connect |
| 31 | $R_{INA}$ | Filtered analog RED video input for Channel <A> |
| 32 | $R_{INB}$ | Filtered analog RED video input for Channel <B> |

# Package Dimensions

## TQFP-32




**NOTE:** Package illustration is being redrawn for legibility.

# Ordering Information

| Model | Part Number | Package | Container | Pack Qty |
|---|---|---|---|---|
| FMS6417 | FMS6417CHX | 32-pin TQFP | Tape & Reel | TBD |

Temperature range for all parts: 0°C to +70°C.