

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

## Power

The bulk capacitor (Tantalum or Electrolytic) should be placed reasonably close to the device. If used, a linear regulator for analog  $V_{CC}$  should be close to the power area of the device. Use separate analog and digital power planes.

## Decoupling Capacitors

Placement of bypass capacitors is important to maintain proper function. Every supply pin should connect to a ceramic decoupling capacitor. The distance from the device pin should be no greater than 0.1 inches, as shown in Figure 1. Place high-frequency decoupling capacitors as close to the device power supply pin as possible; without series vias between the capacitor and the device pin. This is normally done for the smallest capacitor, closest to the supply pin. Board space does not always allow for all bypass capacitors to be on the same plane; second and third capacitors may need vias to connect to the power supply pin.

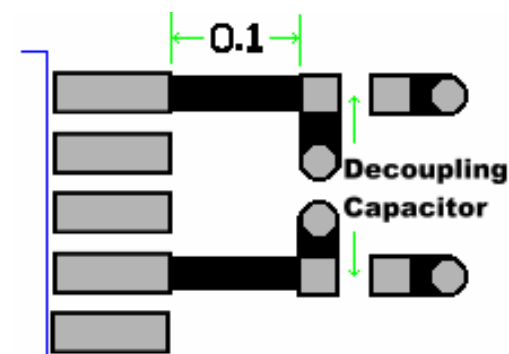


Figure 1. Decoupling Capacitor Placement

## Analog GND and Digital GND

The ground plane is the most important layer in the PCB layout; it greatly affects the performance of analog components and signals. Proper layout of the ground plane keeps the board noise level within acceptable margins. Avoid long current loops, especially when mixing analog and digital signals. The best way to achieve this is to partition analog and digital ground very carefully and clearly so that signal and return current paths can be localized in their sections. If analog and digital circuitry is partitioned well, there is no need to split the ground. In most cases, a single solid ground plane is the best choice because it keeps ground potential lower between every ground point and helps reduce EMI. In a complex digital intensive design, it may be difficult to keep the analog area free from digital return current. In that case, there may be some benefit from cutting ground between the digital and analog and tying the two together under the device. Avoid any traces running across the split.

## Input Interface

Figure 2 shows a typical AC-coupled input configuration for driving the filter/driver. In this configuration, use a  $0.1\mu\text{F}$  ceramic capacitor to AC couple the input signal. The coupling capacitor and the input termination resistor at the input to the filter/driver should be placed close to the input pin for optimal signal integrity. If the input signal does not go below ground, the clamp is inactive; but if the input signal goes below ground, the clamp circuitry sets the bottom of the sync tip (or lowest voltage) to just below ground. The input level set by the clamp, combined with the internal DC offset, keeps the output signal within acceptable range. This clamp feature allows the input to be directly driven (DC-coupled) by a ground-referenced DAC output.

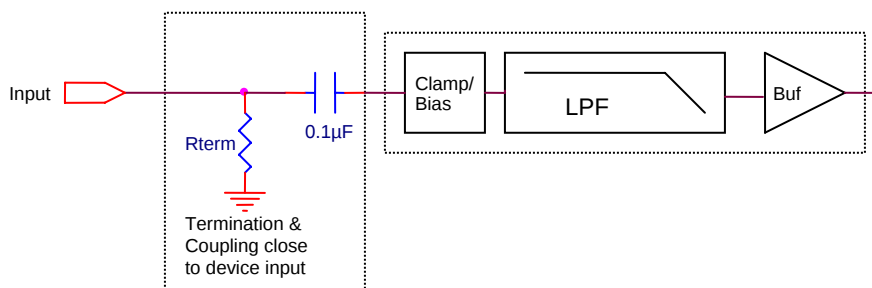


Figure 2. Typical AC-Coupled Input Configuration for Driving the Filter / Driver

## Output Interface

To obtain the highest quality output signal, the series termination resistor must be placed as close to the device output pin as possible. This greatly reduces the parasitic capacitance and inductance effect on the output of the driver. The distance from device pin to the series termination resistor should be no greater than 0.1 inches, as shown in Figure 3. Figure 4 is the schematic representation of a video filter/driver used in a system as the output driver to a media device. Figure 4 shows the composite video signal terminated by the media device and the S-video output terminations open. It is very critical, in this case, to have the series termination resistors close to the output pin of the device to minimize the effects of parasitic capacitance on the filter output driver, which may show up as noise on the CV output.



Figure 3. Proper Termination Resistor Placement

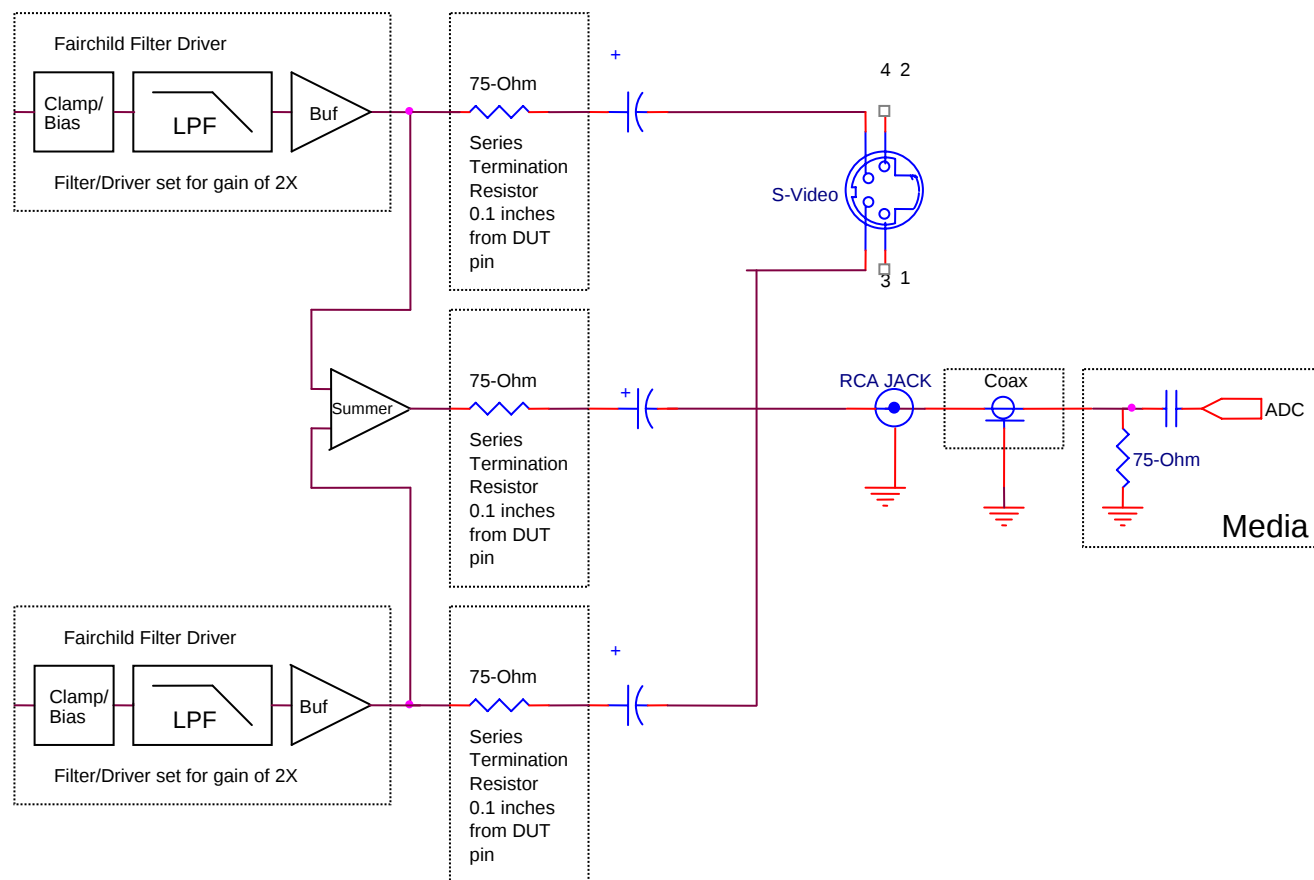


Figure 4. Schematic Representation of a Video Filter / Driver in a System

## Printed Circuit Board (PCB) Layers

It is best to use, as a minimum, a four-layer PCB. Assign one inner layer to the dedicated signal ground plane and one inner layer to the single or split power plane, as shown in Figure 5.

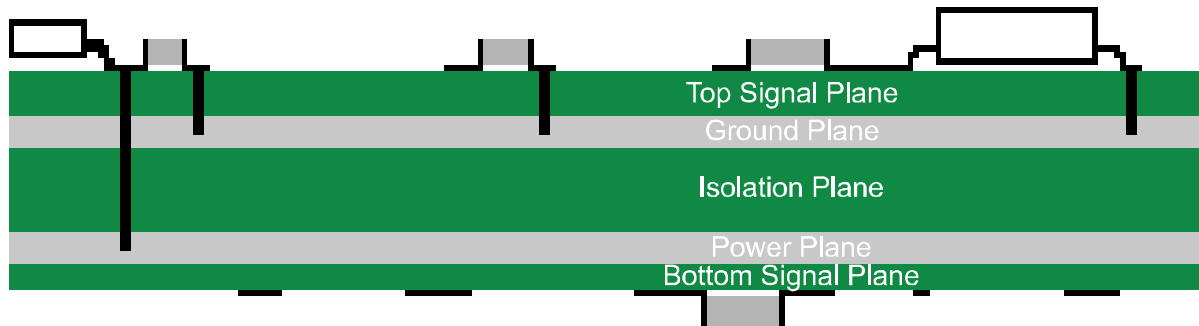


Figure 5. Recommended PCB Layers

## Layout Considerations

General layout and supply bypassing play major roles in high-frequency performance and thermal characteristics. Fairchild offers a demonstration board for each product to guide layout and aid device evaluation. The demo boards are four-layer boards with full power and ground planes. Following this layout configuration provides the optimum performance and thermal characteristics for the device. For the best results, follow the steps and recommended routing rules listed 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.

### Thermal Considerations

Since the interior of most systems, such as set-top boxes, TVs, and DVD players are at +70°C; adequate heat sink must be provided for the device package for heat

dissipation. When designing a system board, determine how much power each device dissipates. Make sure devices of high power are not placed in the same location, such as directly above (top plane) and below (bottom plane) each other on the PCB.

### PCB Thermal Layout Considerations

- Understand the system power requirements and environmental conditions.
- Maximize thermal performance of the PCB.
- Consider using 70μm of copper for high-power designs.
- Make the PCB as thin as possible by reducing FR4 thickness.
- Use vias in power pad to tie adjacent layers together.
- Remember that baseline temperature is a function of board area, not copper thickness.
- Modeling techniques can provide a first-order approximation.

## Related Products

|              |                                                                                                |
|--------------|------------------------------------------------------------------------------------------------|
| FHP3130      | Single, High Speed, 2.5V to 12V, Rail to Rail Amplifier                                        |
| FHP3230      | Dual, High Speed, 2.7V to 12V, Rail to Rail Amplifier                                          |
| FHP3430      | Quad, High Speed, 2.7V to 12V, Rail to Rail Amplifier                                          |
| FHP3450      | High Performance Amplifier                                                                     |
| FHP3350      | High Performance Amplifier                                                                     |
| FHP3194      | High Performance Multiplexer                                                                   |
| FMS6143      | Three Channel 4th Order Standard Definition Video Filter Driver                                |
| FMS6146      | Six Channel 4th Order Standard Definition Video Filter Driver                                  |
| FMS6406      | Precision S-Video Filter with Summed Composite Output, Sound Trap and Group Delay Compensation |
| FMS6400-1    | Dual Channel Video Drivers with Integrated Filters and Composite Video Summer                  |
| FMS6363      | Three Channel 6th Order High Definition Video Filter Driver                                    |
| FMS3818      | 180MHz Triple Video 8-Bit D/A Converter                                                        |
| FMS3110      | 100MHz Triple 10-Bit Video D/A Converters                                                      |
| FMS3810      | 100MHz Triple Video 8-Bit D/A Converters                                                       |
| FMS3815      | 150MHz Triple Video 8-Bit D/A Converters                                                       |
| FMS7401      | Integrated Controller for Ballast and Power Conversion Applications                            |
| FMS6G20US60  | Compact & Complex Module                                                                       |
| FMS7G15US60  | Compact & Complex Module                                                                       |
| FMS6G20US60S | Compact & Complex Module                                                                       |
| FMS6G15US60S | Compact & Complex Module                                                                       |
| FMS6G15US60  | Compact & Complex Module                                                                       |
| FMS6501      | 12 Input, 9 Output Video Switch Matrix                                                         |

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