

# DESIGN NOTES

## High Resolution Video Solutions Using Single 5V Power

Design Note 396

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### Introduction

Video cable driver amplifier output stages traditionally require a supply voltage of at least 6V in order to provide the required output swing. This requirement is usually met with 5V supplies by adding a boost regulator or a small local negative rail, say via the popular LT<sup>®</sup>1983-3. Such additional circuitry is unnecessary in typical 1V<sub>P-P</sub> video connections, such as HD component video, if the cable driver amplifiers simply offer near rail-to-rail output capability when powered from 5V.

Standard definition and SVGA (800 × 600 pixel) low voltage devices have been available from Linear Technology for some time (see Design Note 327), but a number of recent device developments have made it possible to produce high resolution video devices that operate on a single 5V

power supply. Some parts that fit this mold include the LT6556, a UXGA-resolution (1600 × 1200 pixel) RGB 2:1 input-port buffered multiplexer (MUX); the LT6557 and LT6558 UXGA fixed gain triple amplifiers that include on-chip biasing to minimize external part count; and the LT6559 triple amplifier that provides flexible, cost effective solutions in SXGA (1280 × 1024 pixel) products.

### High Resolution Video Input-Port Multiplexer

High performance multimedia video display systems usually include a multiple-input feature to select between a VESA-compliant D-type PC connection and consumer component video that uses RCA jacks. The incoming video signal is at most 1V<sub>P-P</sub> nominal (Y-channel,

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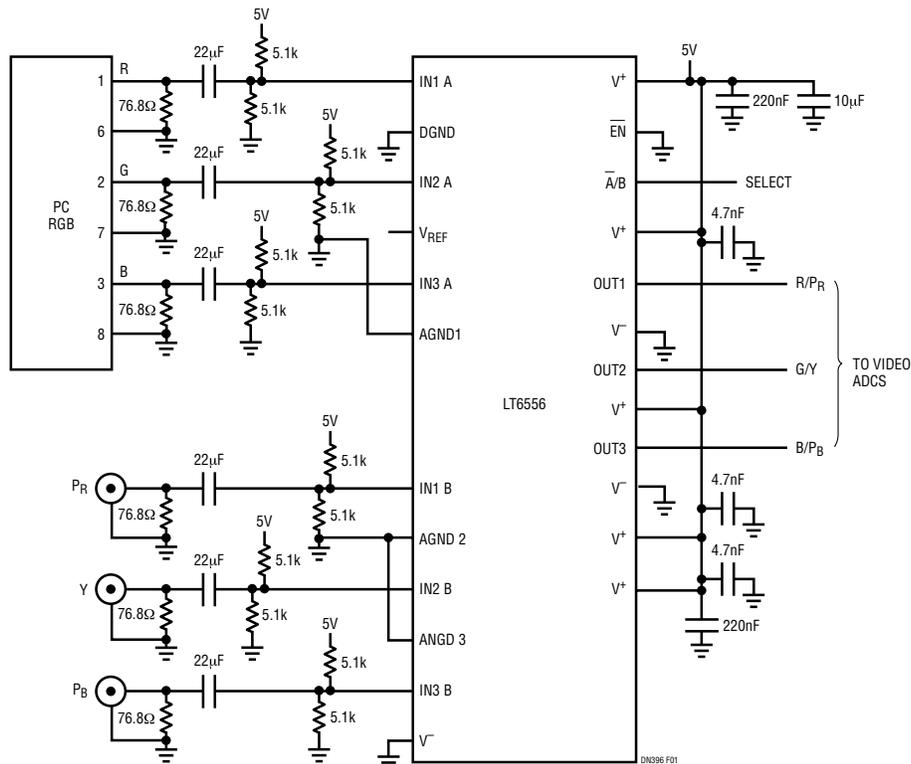


Figure 1. LT6556 Provides Input Video Selector and ADC Driver for Multimedia Display System

1.5V<sub>P-P</sub> worst-case when AC-coupled) and the required gain is unity for digitizing by an analog-to-digital converter set (ADC) or other signal routing. This input selection function is readily implemented with the LT6556 on 5V as shown in Figure 1, supporting all video resolutions including UXGA by virtue of its 750MHz bandwidth and 6.5ns settling time. The part is available in either SSOP-24 or QFN-24 packaging and includes layout-friendly flow through pinouts. For the AC-coupling shown, the outputs swing approximately ±0.7V about the mid-supply level, within an available range of 2.6V<sub>P-P</sub>. Though not explicitly shown in Figure 1, coupling to the ADC inputs usually involves series resistances to reduce capacitive loading of the amplifiers to preserve the smoothest frequency response and optimal settling.

### High Resolution Single-Supply Cable Driver

The LT6557 is a triple video amplifier specifically engineered to provide UXGA level performance on a single 5V power supply. A quasi rail-to-rail output stage and an almost slew-unlimited 400MHz large signal bandwidth make this the part of choice for the most performance-critical applications.

The LT6557 has internal gain-setting resistors to establish a nominal gain of two and incorporates a single-resistor-programmable input biasing system to eliminate the usual input divider resistors used in single supply applications. As seen in Figure 2, the entire cable driver function is largely reduced to the IC and blocking capacitors. The

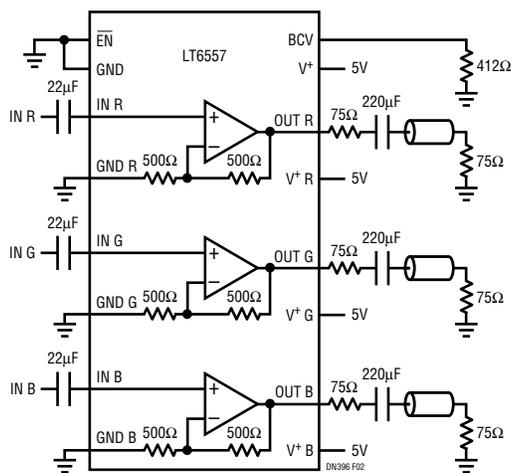


Figure 2. LT6557 Provides Low Part Count UXGA-Resolution Cable Driver on 5V Supply

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internal input biasing may be defeated for DC-coupled applications, such as with direct digital-to-analog converter (DAC) output applications where a software controlled offset is introduced to set the signal dynamics. A unity gain version, the LT6558, is also available.

### Economical SXGA/HD Cable Driver

In cost sensitive applications like consumer video-playback equipment, the LT6559 provides excellent bang-for-the-buck in a tiny QFN-16 (3mm × 3mm) package. As a basic triple current-feedback op amp (CFA) with individual channel enables, the LT6559 offers great flexibility in forming various multiplexer, cable driver, and ADC driver functions at low cost. Even though the LT6559 is not a true rail-to-rail output device, there remains approximately 3V<sub>P-P</sub> of available output swing on 5V due to its high performance output stage design. Figure 3 shows a typical AC-coupled application as an economical HD or SXGA-grade triple cable driver (one channel shown for brevity). As a general purpose CFA, the feedback resistor value (301Ω) optimizes the frequency response. This circuit is ideal as an output buffer/driver for following passive reconstruction filters such as for the increasingly popular 1080p HD format (i.e. 60MHz lowpass).

### Conclusion

As system designers continue to reduce the number of supply voltages used within their products, pressure to maximize analog performance on available 5V logic supplies has led to the need for viable low voltage high performance video solutions. For high resolution applications, Linear Technology offers the LT6556 buffered MUX, the LT6557/LT6558 AC-coupled amps, and the economical LT6559 triple CFA—all well suited to operate in the 5V environment.

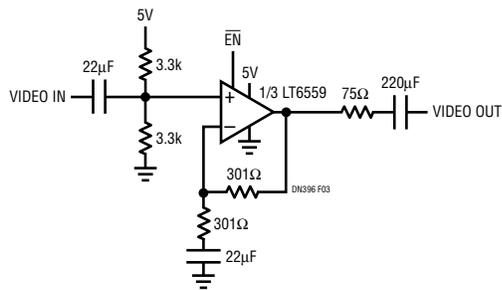


Figure 3. HD Video Cable Driver Using Economical LT6559 (Depicting One Channel of Three)

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