850MHz Video Multiplexer Delivers Lower Signal Degradation (EL5166)

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Video multiplexers pose a difficult design challenge. They must perform several functions, such as matching the input line impedance, signal amplification, signal switching, and driving the output line, without degrading or adding noise and transients to the signal. Typically, the signal flows through the multiplexer where it's degraded by the multiplexers errors. In this design, the signal flows through the op amp and thus isn't degraded by the multiplexer.

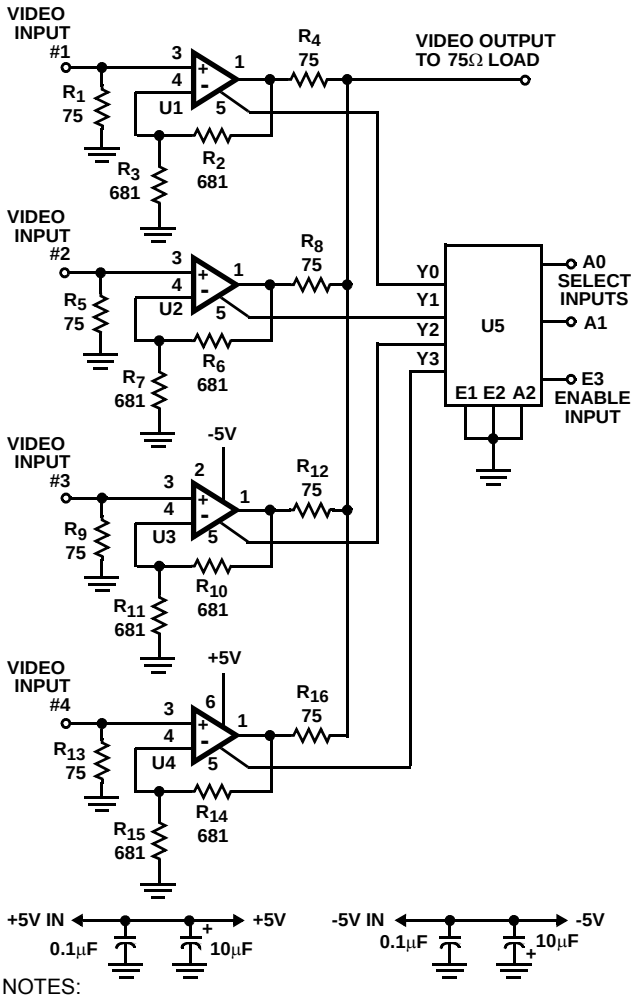
This circuit can multiplex several sources like VCRs, tuners, or cameras into a single monitor, see Figure 1. The EL5166 performs all of the multiplexer and amplification functions with the aid of the TTL decoder. It exceeds the gain flatness, differential phase, and differential gain specifications for NTSC video, without adding the offset voltages, gain variability, or transients associated with multiplexers.

Turning our attention to op amp U1, R_1 terminates the input cable in its characteristic impedance, which usually is 75Ω in video systems. R_4 back terminates the output cable in its characteristic impedance of 75Ω. Because the cable termination is 75Ω, it forms a voltage divider with R_4, which has a gain of 0.5. The op amp is configured for a gain of two, therefore the circuit has an overall gain of one when driving a double terminated cable. The value of R_3 can be changed according to the formula $G = 0.5 (1 + R_2/R_3)$. R_2 determines the video performance of the op amp, so it should not be changed. The circuits U2 through U4, perform similarly.

If more than one video output is needed, R_4, R_8, R_{12}, and R_{16} can be paralleled with 75Ω resistors. Each resistor is connected from the respective op amp output to a second video output that can drive another 75Ω cable.

U5 is configured as a two-to-four line decoder, with A0 and A1 acting as the select inputs and E3 as the enable input. All of the amplifiers are disabled when E3 is low, so there's no output signal. When E3 is high, the select inputs determine the video input that's connected to the video output. If E3 is used to disable the outputs when the select inputs are changed, there will be minimal bus contention transients during switching. However, if hot switching is desired, a break-before-make delay circuit should be placed in series with the Y_X lines. Because all of the signal switching occurs within the EL5166, the amplifier's differential phase and gain parameters (0.03 degrees and 0.03%, respectively) determine the circuit's performance.

It's easy to multiplex any number of channels with this scheme because the single and dual versions of the op amp help minimize the number of ICs required for a given design. In addition, the decoder can be easily extended to 3 to 8 using the same IC or 4 to 16 using a different decoder. The circuit given here switches in less than a microsecond.



NOTES:

1. U1, U2, U3, U4 are EL5166
2. All resistors in Ω
3. U5 is CD74HC238
4. Use ground plane

FIGURE 1. SEVERAL DIFFERENT SOURCES, SUCH AS VCRs, TUNERS, OR CAMERAS, CAN BE MULTIPLEXED INTO A SINGLE MONITOR USING THIS VIDEO MULTIPLEXER. WITH THE AID OF TTL DECODER, THE EL5166 PERFORMS ALL MULTIPLEXER AND AMPLIFICATION FUNCTIONS.