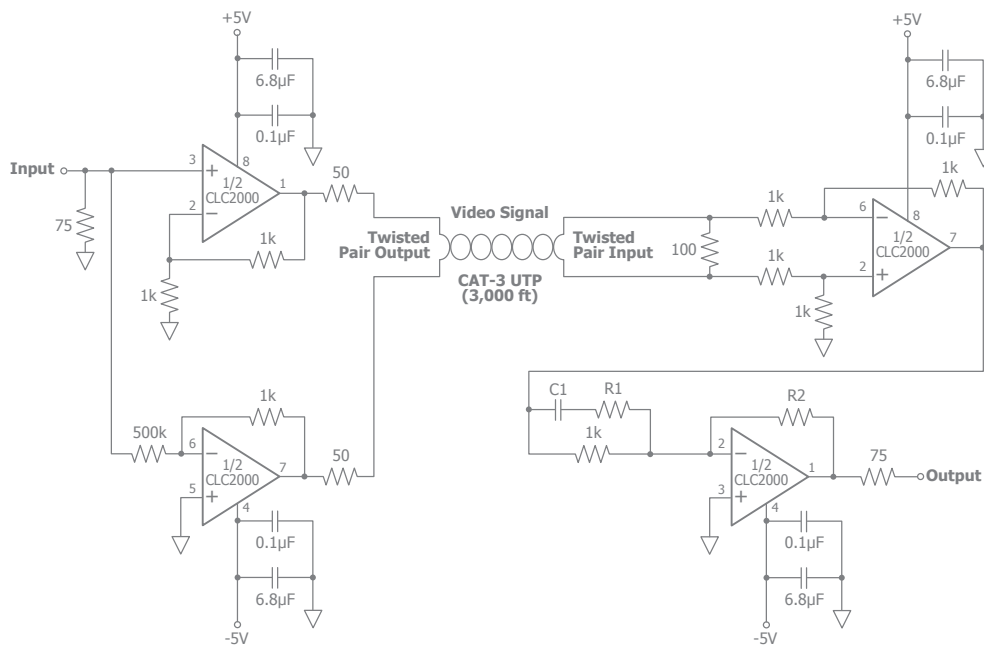


# AN-4

## Driving CAT-3 UTP Cable



Many applications, like video surveillance systems utilize Category-3 (CAT-3) or CAT-5 unshielded twisted pair (UTP) cable to transmit signals from point A to point B. As the signal is transmitted over the cable, the cable introduces a loss. CAT-3 cable is more economical but introduces more loss than CAT-5 or coaxial cable. In video applications that utilize CAT-3 or CAT-5 cable, three twisted pairs are used to carry the red, green, and blue (RGB) video signals.



The left portion of Figure 1 illustrates a typical configuration for a low cost twisted pair driver using the CLC2000, dual voltage feedback amplifier. The CLC2000 offers 200mA of output current, which is more than enough for driving the 100Ω impedance of the twisted pair cable. The CLC2000 also has low differential gain and phase (0.009% / 0.06°) and 0.1dB gain flatness to 32MHz, excellent specifications for standard definition video. The CLC2000 is used to convert a single-ended signal to a differential signal to drive the twisted pair. Two 50Ω series resistors are used at the outputs of both CLC2000s in order to match the characteristic impedance of the UTP.

The right portion of Figure 1 shows a typical twisted pair receiver, again using the CLC2000 dual amplifier. The two amplifiers are used for differential to single-ended signal conversion and to compensate for the attenuation caused by the cable. The resistor, R2, compensates for the signal loss caused by the twisted pair. For the examples listed in this application note, a 1V<sub>pp</sub> signal was applied to the INPUT. R2 was adjusted so 1V<sub>pp</sub> was present at the OUTPUT, this equates to an overall system gain of unity (G=1). The twisted pair cable also introduces high frequency attenuation, a simple equalizer created by C1 and R1 provide adequate compensation.



Figure 3 shows the response after a  $1V_{pp}$  square wave is applied to the INPUT and the signal is driven over 1,000ft of CAT-3 UTP cable. For this example,  $C1= 220\mu F$  and  $R1=750\Omega$ .

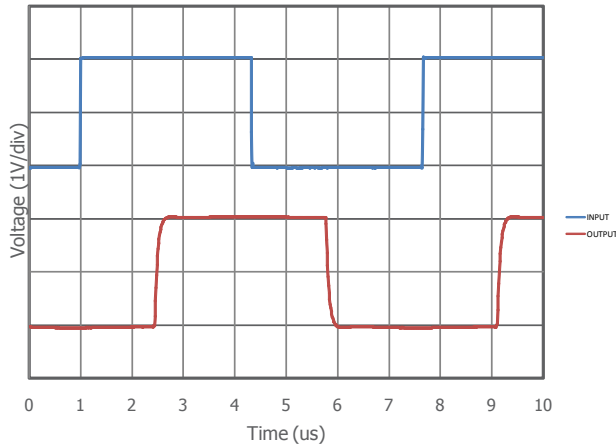


Figure 3: After 1,000ft of CAT-3 UTP Cable

Figure 5 shows the response after a  $1V_{pp}$  square wave is applied to the INPUT and the signal is driven over 3,000ft of CAT-3 UTP cable. For this example,  $C1= 780\mu F$  and  $R1=201\Omega$ .

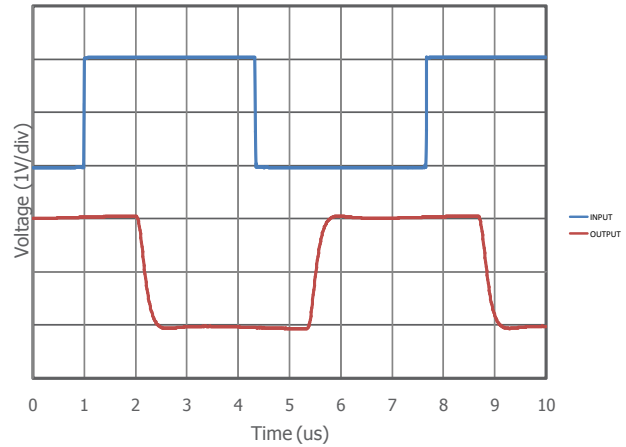


Figure 5: After 3,000ft of CAT-3 UTP Cable

Figure 4 shows the response after a  $1V_{pp}$  square wave is applied to the INPUT and the signal is driven over 2,000ft of CAT-3 UTP cable. For this example,  $C1= 503\mu F$  and  $R1=303\Omega$ .

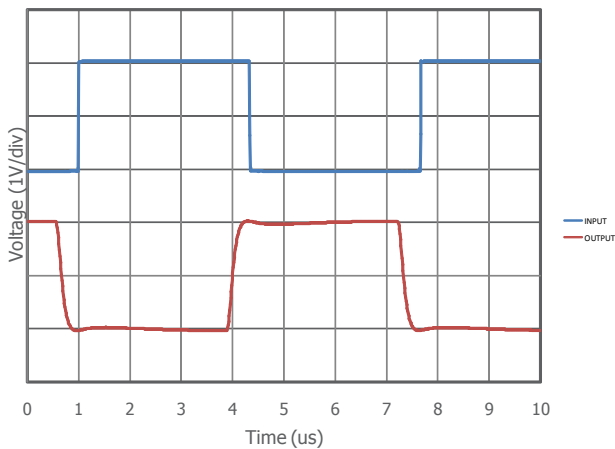


Figure 4: After 2,000ft of CAT-3 UTP Cable

In all three examples, the component values were selected to provide optimal rise/fall times, magnitude, and damping of a  $1V_{pp}$  square wave.

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