Circuit & Design Ideas

Multi-channel CRO Adaptor

Extend the versatility of your single-or dual-trace CRO with this analog multiplexer circuit. The circuit comprises up to eight independent preamplifier stages which are switched in sequence to a common output amplifier stage. With the output connected to a CRO input, up to eight traces can be displayed simultaneously.

The preamp circuits are identical for all channels so only one is shown in detail. To minimise circuit cost and complexity, there are no switched input attenuators. Instead, the input signal to each channel is attentuated by a fixed 10:1 ratio (with frequency compensation). Input signal levels up to about 80V p-p can be handled without overload.

An input capacitor (not shown) can be included if desired for AC coupling. The input impedance for each channel is 1MΩ shunted by approximately 10pF (plus input cable and stray capacitances). The small signal frequency response is from DC to over 1MHz for one channel, but as the number of channels is increased the high frequency response will be reduced due to the increased capacitive loading imposed by the switching circuitry.

The gain of the output amplifier can be adjusted by a small amount (about 10%), if necessary, to compensate for "on" resistances of the CMOS switches employed in the switching circuitry. A low-level, buffered (and inverted) signal is taken from a low impedance point in the "channel 1" preamplifier for connection to the CRO "ext sync" input.

Channel switching is controlled by a 4022 CMOS octal counter. Each Q output controls a pair of CMOS switches associated with a corresponding channel preamplifier. An 8-position "channel select" switch selects the number of channels to be displayed.

The circuit may be operated in either a "chop", "alternate" or "manual" mode, depending on how the clock pulses to the pin 14 input of the 4022 are derived. For "chop" mode you can use the square wave output of an astable CMOS oscillator. For the "alternate" mode, the clock pulses will have to be derived from the internal sweep circuit of the CRO. The "manual" mode may be achieved by using a pushbutton switch to feed clock pulses one at a time, and is useful if you want to display one channel at a time.

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