High-speed peak detector uses ECL comparator

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Professional electronics designers often use peak-detector circuit in such applications as amplitude measurement, automatic gain control, and data regeneration. You can build a simple and fast peak detector from a serial diode and a shunt capacitor, but it suffers from serious inaccuracy that stems from the diode's forward-voltage drop. On the other hand, precise detectors based on op amps are rather slow. They are therefore not well-suited for measuring pulses of a few nanoseconds' duration. The circuit in Figure 1 offers both good accuracy and good dynamic performance. The main part of the detector is the ultrafast MAX9690 (www.maxim-ic.com), ECL-output comparator. Because the circuit does not internally pull down the output emitter follower, you can use the circuit as a rectifier that charges capacitor C1. The circuit amplifies and level-shifts the voltage from the capacitor and feeds it back to the negative input of the comparator. When the signal appears at the peak detector's input, capacitor C1 charges until the feedback voltage at the comparator's negative input becomes equal to the peak value of the signal under measurement; thus, the peak detection occurs. The second op amp forms an output buffer.

In this design, the measured peak voltage should be 0 to 2.5V. The detector's accuracy depends on the pulse duration and duty cycle. For example, 1V rectangular pulses having 3-nsec duration and 5% duty cycle produce 5%-low readings. Similar inaccuracy occurs for 10-nsec pulses having 0.1% duty cycle. The accuracy is much better for longer pulse durations, greater duty cycles, or both. The circuit measures pulses lasting for some tens of nanoseconds and having repetition frequency of approximately 1 MHz. To deal with pulses having a lower repetition rate, you should increase the values of C1 and C2. That increase would, however, result in longer settling time. Another important element is the discharging resistor, R1. A value of 100 kΩ for R1 is appropriate for operation with low-duty-cycle pulses, but you may need lower values for fast tracking with varying input-signal amplitudes. You can also configure a minimum-value peak detector. In this case, you should use the inverting output of the comparator and also reconfigure the amplifier/shifter for inverting operation. Figure 2 shows an example of the circuit's operation. The circuit correctly measures the peak value of the applied input signal, although the input pulses are quite short and have nearly triangular tips.