# Tech Brief 12: The Effects of High-Speed Design Techniques and Test Equipment Measurement

The DS1075K EconOscillator Programming Kit was designed to provide a tool to program and evaluate DS1065, DS1073, and DS1075 EconOscillators in laboratory environments and to provide a programmer for low-volume hand programming in pre-production environments. Customers performing characterization test on these EconOscillators should be aware of the limitations on the programming board and take precautions when using the programmer as a platform to perform characterization tests on these devices. This technical brief explains these precautions and outlines test methods which optimize the use of this programmer as a test board for device characterization.
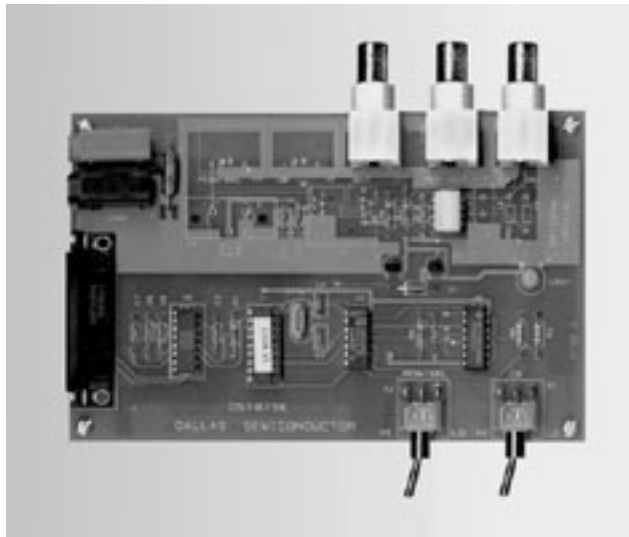
**The DS1075K Development Kit can be used to program
and reprogram devices for prototypes.**

The [DS1075K Demonstration Kit](#) (PDF, 132K) was designed as a convenient way for users to program the [DS1075 EconOscillator](#) (PDF, 255K) and to demonstrate all its functional modes.

The DS1075K is intended primarily as a tool for programming and preliminary evaluation of [EconOscillators](#). The use of sockets for convenient programming precludes the possibility of providing optimum decoupling of the device. Consequently, the output waveforms present on

the BNC sockets of the board may exhibit some distortion (rounding) or even slight frequency errors, particularly when operating at or near the maximum frequency. For optimum performance of the devices, they should be soldered directly to the application PCB, lead lengths should be kept to a minimum, and decoupling should be fitted as close to the device pins as possible using a suitable grade capacitor.

When evaluating the parametric performance, it is important to be aware of high-speed design techniques and how test equipment can affect the measurement results.
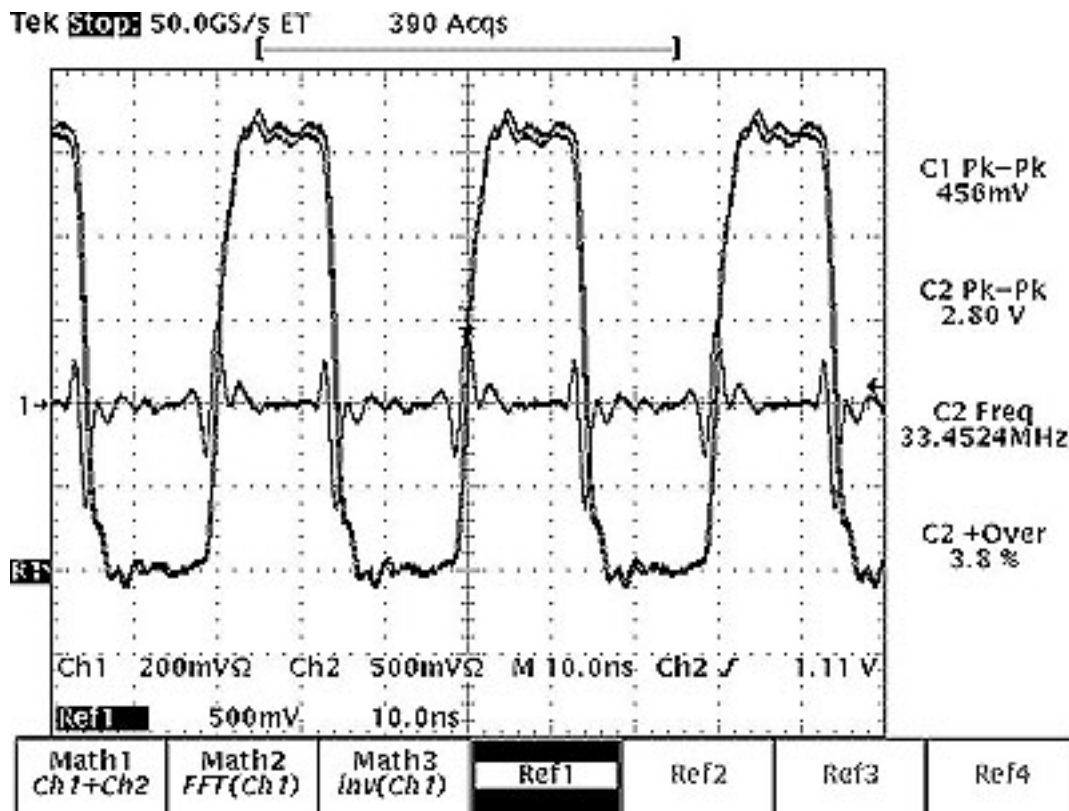

Figure 1: Scope trace

The scope trace in Figure 1 shows the REF and OUT terminal waveforms from the DS1075K. A DS1075-100 with the OUT0 pin disabled is shown. The connection to the oscilloscope is made with 50 ohm impedance coaxial cable, and oscilloscope input impedence is set at 50 ohms. Note the overshoot and ringing visible at the OUT terminal, and the nearly 500 mV peak-to-peak crosstalk on the REF terminal.

These effects are caused primarily by PCB trace inductance and parasitic inductance between the power supply terminals and the IC V_{cc} and GND pins. A new board layout was developed to minimize PCB trace lengths and provide a large, continuous ground plane. A three-capacitor bypassing scheme was used to provide a low-impedance path to ground at all transient frequencies. Highest frequency transients are shunted to ground by 1000 pF and 0.01 µF ceramic chip capacitors. These are located as close as possible to the DS1075 supply pin to minimize any series inductance and resistance. A 10 µF capacitor is placed in parallel to shunt

lower frequency transients to ground. (See Reference 1.) The result is shown in Figure 2 where the OUT terminal waveform is free from overshoot, and the crosstalk amplitude is reduced to less than 120 mV peak-to-peak.
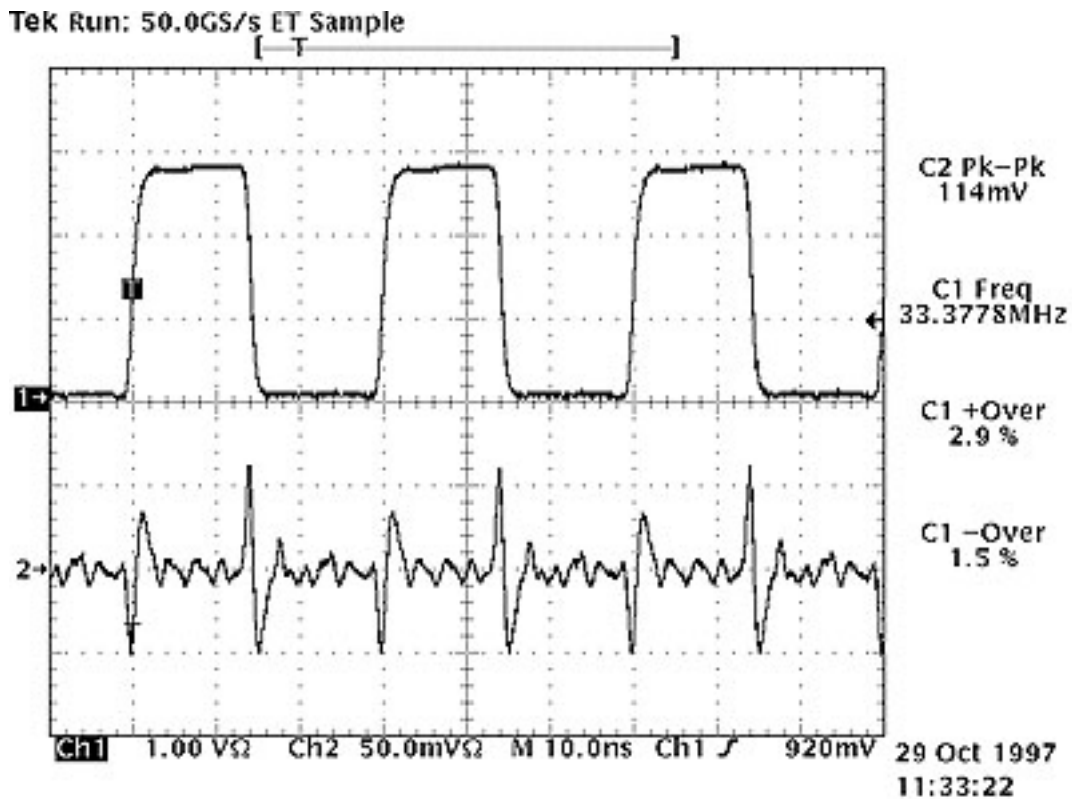

Figure 2: Using a 10 M input impedance probe with a 4-inch ground lead

It is also important to realize how equipment can degrade the measurement results. Figure 3 shows the results of using a 10 M input impedance probe with a 4-inch ground lead on the same circuit as used in Figure 2. The impedance mismatch creates signal reflections which appear as additional transients on the scope trace, and the long ground lead adds parasitic inductance and resistance. A detailed treatment can be found in Reference 2.
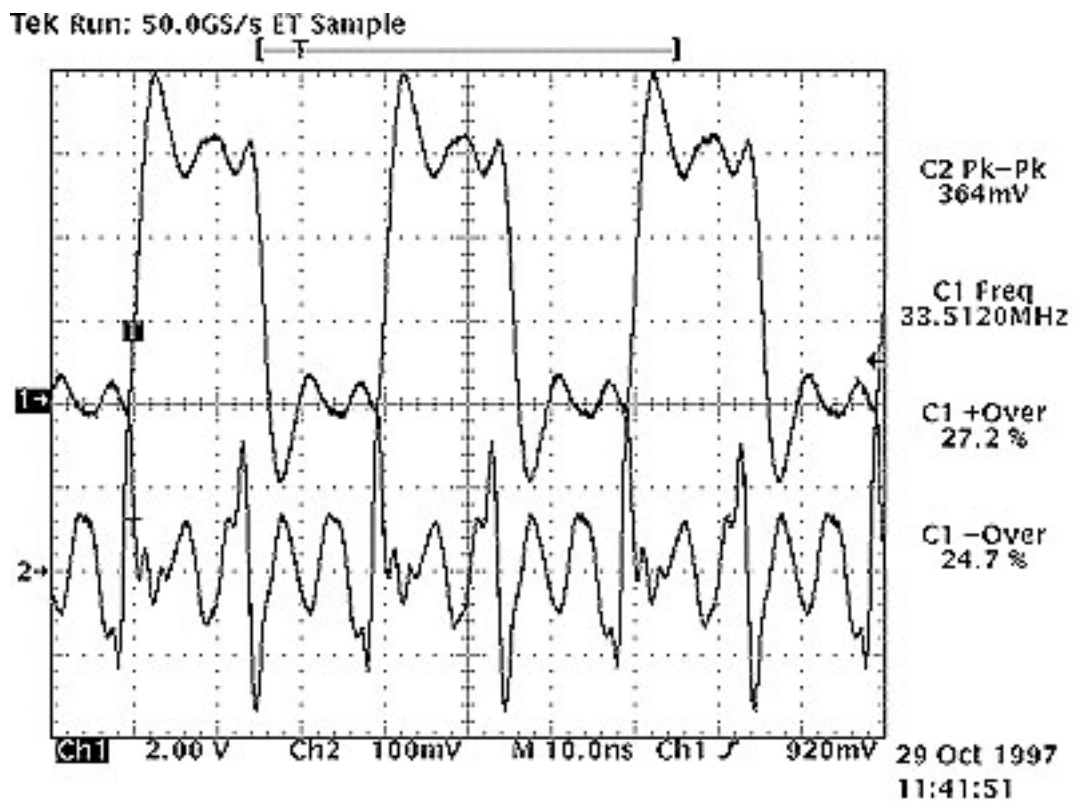
Figure 3: Results of using a 10 M input impedance probe

References
1. Walt Kester, "Evaluation Boards," Analog Devices High-Speed Design Techniques, 1996
2. Jim Williams, "High-Speed Amplifier Techniques," Linear Technology Applicatin Note 47, August 1991

More Information

DS1065:   QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1073:   QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1075:   QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1075K: QuickView -- Full (PDF) Data Sheet