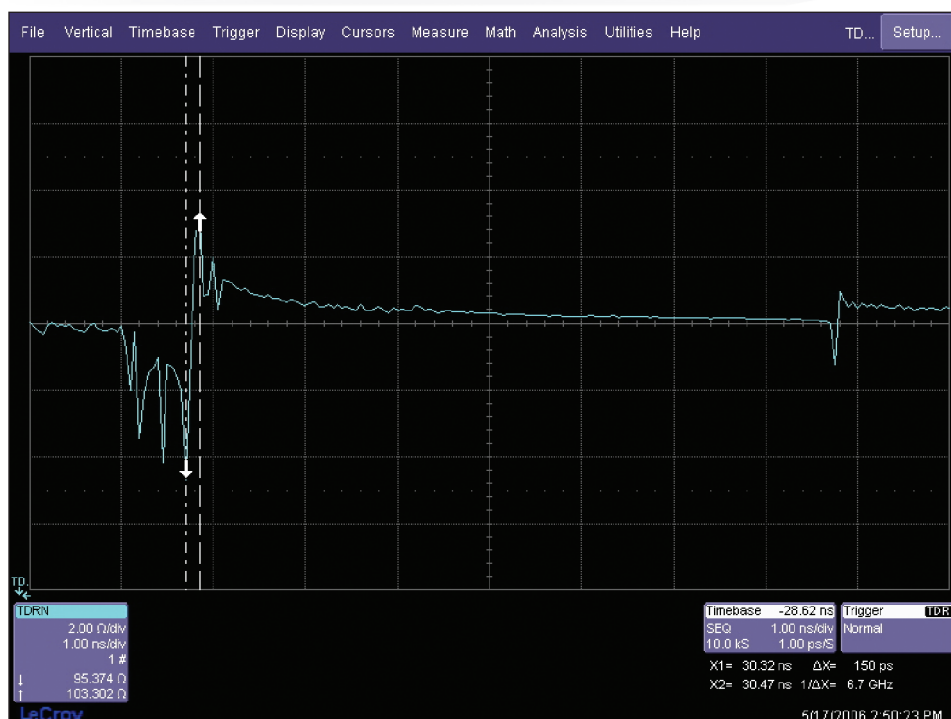


TDR/S-PARAMETER MEASUREMENTS

Using the WaveExpert® Sampling Oscilloscopes

Features

- Single-ended and Differential Time Domain Reflectometry (TDR) measurements
- Reference Plane calibrations (Short-Load)
- Guided measurement setup and calibrations
- Fast Step Rise Time $\approx 20\text{ps}$
- Sub millimeter measurement resolution
- Automated Deskew procedure for Differential TDR measurements
- TRUE differential drive to Device Under Test (DUT)
- Accurate S-parameter measurements to 20 GHz
- Data Output in Voltage, Impedance or S-parameter (SnP) format



TDR measurements accurately depict closely spaced discontinuities.

The advent of fast rates in serial data applications has created a need to characterize the impedance profile of high-speed data channels to verify Signal Integrity. Time Domain Reflectometry (TDR) and S-parameter (frequency domain analysis) measurements have become the standard for characterizing serial transmission networks, and are part of current and emerging serial data standards such as PCI-Express®, SAS, Serial ATA, etc.

The WaveExpert® Series sampling oscilloscopes include a TDR package for signal integrity measurements for both Single-ended and Differential

devices. A 20 GHz TDR module (ST-20) is available, which can be accommodated in any of the four available channels on the WaveExpert oscilloscopes, to make Single-ended or Differential TDR/TDT measurements.

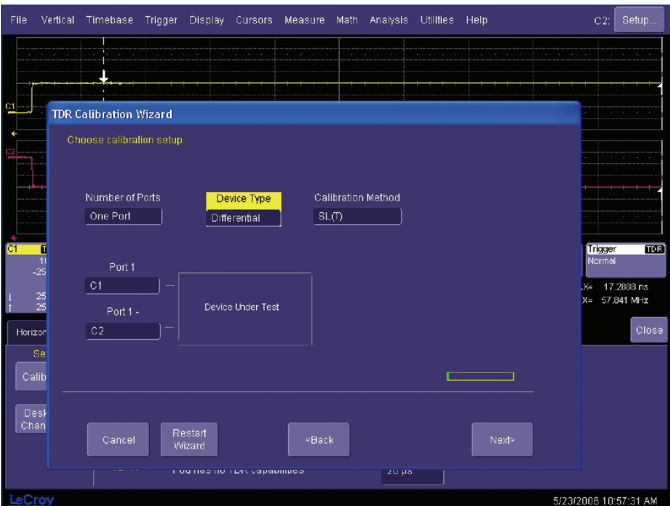
High Measurement Resolution Using a Fast Step

The accuracy of TDR measurements is highly dependent on the quality of the step pulse generated from the TDR module. The ST-20 (20 GHz module) generates a fast step with a Rise Time of **20 ps**, which can help quantify closely spaced discontinuities in backplanes, PC boards, etc.

Since the time domain data is also converted to frequency domain data using a Fast Fourier Transform (FFT), the fast rise time of the step results in high quality S-parameter measurements up to 20 GHz in bandwidth.

Accurate Impedance Analysis of Longer DUTs – Backplanes

The WaveExpert Series oscilloscopes are capable of acquiring up to 100,000 points in TDR mode. This enables testing of Backplanes etc., which usually require a large time acquisition window, with high resolution in the time domain. This ensures that you capture the discontinuities that otherwise would be lost if only a few thousand data points were available in a large time acquisition.



Simple guided calibration menu.

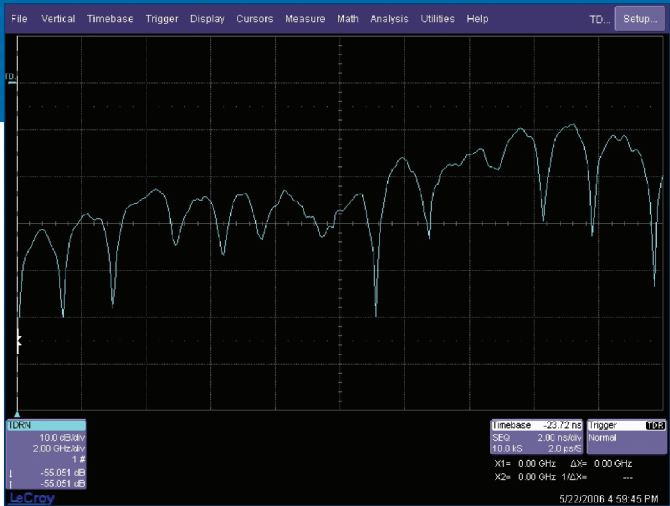
Improved Measurements Using Reference Plane Calibration

The WaveExpert Series oscilloscopes now include Reference plane calibration techniques in TDR mode for making accurate measurements of the device under test (DUT). Occasionally the accuracy of TDR measurements can be compromised by the quality of the cables, adapters, etc. used in the setup to



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SDD11 (Return Loss) measurement of a Differential Test fixture.

connect the scope channels to the DUT. But these cables can now be calibrated out of the measurement using two reference standards: a Short and a Load measurement at the reference plane. The simple intuitive menus guide you through the **Short-Load (SL)** calibration process for either Single-ended or Differential TDR measurements.

S-parameter Measurements

The beta version of TDR software enables conversion of single-ended or differential TDR data into Return Loss measurements (S_{11} or S_{DD11}) for frequency domain analysis of the measured device. Once a reference plane calibration is performed in the time domain, the calibrated data can then be represented either as an *Impedance over time* or as an *S-parameter* display over the 20 GHz bandwidth.

The resulting data, saved in touchstone format (.s1p), can then be imported into simulation software packages for comparison and further analysis of the performance of the serial data network.

Standard Measurement Capability

Displays: Voltage (V), Impedance (Z), Reflection Coefficient (p), S-parameter (included in Beta version)

ST-20 (20 GHz/TDR) Specifications	
Connector Type	2.92 mm
Rise Time	20 ps
Bandwidth	20 GHz
TDR Step Voltage	250 mV
Aberrations	First 40 ps: ±10% 40 ps–200 ps: ±5%, 200 ps–10 ns: ±2%