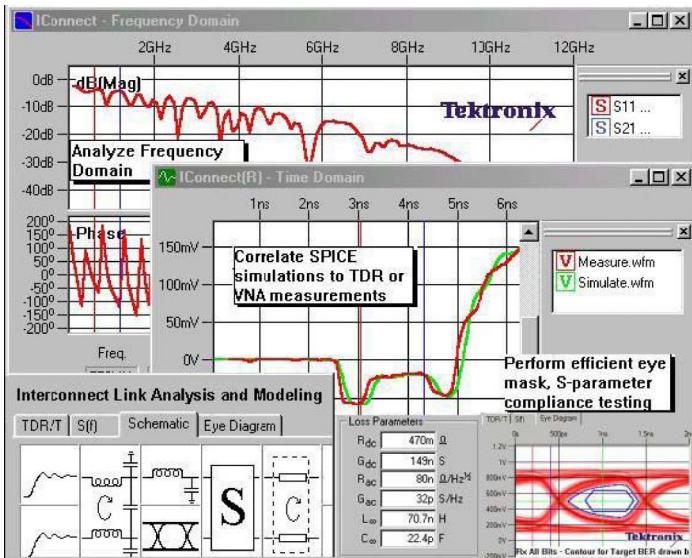# IConnect® SW for DSA8300*1 Sampling Oscilloscope

80SICMX • 80SICON • 80SSPAR Data Sheet

Features & Benefits

- Quickly Obtain S-parameters using Your TDR Oscilloscope
  - Differential, Single Ended, Mixed Mode; Insertion, Return Loss, Frequency-domain Crosstalk
  - PCI Express, Serial ATA, HDMI, Infiniband, Gigabit Ethernet, Manufacturing, and Standard Compliance Testing including Eye Mask Tests
  - Simplified Calibration Procedure Minimizes Human Errors and Makes Fixture De-embedding a Simple Task
  - Intuitive, Easy, and Accurate for Serial Data, Gigabit Digital Design, and Signal Integrity
- Gain Insight into Interconnect Link Performance through Synthesized Eye Testing
  - Apply Industry Standard (PRBS, CJTPAT, K28.5, HDMI, etc.) or User-specified Stress Patterns
  - Model Effect of Transmitter and Receiver Equalization on Signal Impairment
  - Simulate Real-World Signals through Jitter and Noise Insertion
  - Measure Computed BER, Eye Opening, Jitter and Noise and do BER Mask Testing at Any Point Along the Data Link

- Easily Analyze Sources of Interconnect Jitter, Losses, Crosstalk, Reflections, and Ringing
  - Analyze Interconnects Concurrently in Time and Frequency Domains
  - Quickly Perform Interconnect Link Analysis and Ensure System-level Simulation Accuracy
- Obtain More Accurate Impedance and S-parameter Measurements
  - Enhanced TDR Resolution using Industry-best TDR Performance and Z-Line Multi-reflection Impedance Deconvolution Algorithm
  - Fast and Easy Package and PCB Trace Failure Location
  - 50 Ω Calibration Eliminates the Need for Time-consuming Normalization
- Automate your Manufacturing Test and R&D Measurements with Scripts and Programmatic Control
  - Command-line Interface for Many Functions (S-parameters, Z-Line, Others)
- Efficiently Model PCBs, Flexboards, Connectors, Cables, Packages, and Sockets
  - Topological and Behavioral, Measurement Based, Frequency Dependent, Exact SPICE Models
  - Automatically Convert TDR/T or VNA Data into SPICE with MeasureXtractor; Model Passivity, Stability, Causality Guaranteed
- Optimized for use with DSA8300 Digital Serial Analyzer Sampling Oscilloscope with 80E10, 80E08, and 80E04 True Differential TDR Modules

Applications

- High-speed PCB, Cable Assembly, Connector, and IC Package Testing
- Serial Data Network Analysis
- Compliance Test for SATA, PCI Express, FB-DIMM, HDMI, Fibre Channel, Ethernet, and Other Serial Data Standards
- Consumer Electronics Testing
- Communications Testing
- Computer Testing

*1 Also compatible with DSA8200, TDS/CSA8200, TDS/CSA8000B, and TDS/CSA8000 sampling oscilloscopes.

Tektronix®

Software for Efficient Evaluation of Gigabit Interconnect Links and Devices

As clock speeds and rise times of digital circuits increase, interconnect signal integrity dramatically affects digital system performance. Accurate and efficient analysis of the interconnects in time and frequency domains is critical to predict signal losses, jitter, crosstalk, reflections and ringing, digital bit errors, and eye-diagram degradation, and ensure reliable system operation.

IConnect® software is the efficient, easy to use, and cost-effective solution for measurement-based performance evaluation of gigabit interconnect links and devices, including signal integrity analysis, impedance, S-parameter, and eye-diagram tests and fault isolation. With the help of IConnect and the built-in IConnect Linear Simulator, you can complete interconnect analysis tasks in minutes instead of days, resulting in faster system design time and lower design costs.

The Easiest Way to Perform Interconnect S-parameter Measurements for Serial Data Network Analysis Applications

IConnect® S-parameters is the efficient and easy-to-use tool for digital designers, operating at gigabit speeds, to perform single-ended, differential, and mixed-mode S-parameter measurements of interconnects, measure insertion loss, return loss, and frequency-domain crosstalk, and conduct interconnect electrical standard compliance testing.

Efficiency

Operating on the DSA8300 TDR platform, IConnect S-parameters is the most cost-effective and highest throughput approach for S-parameter measurements in digital design, signal integrity analysis, and interconnect compliance testing. It provides as much as a 50% cost savings compared to similar bandwidth VNAs, and dramatically speeds up measurements. You can also take advantage of the IConnect S-parameters command-line interface to add S-parameter measurements to the overall suite of manufacturing tests you perform using your TDR instrument.

Calibration and Measurement Simplicity

The simplicity of S-parameter calibration using a reference (open, short, or through) and an optional 50 Ω load make the measurement itself, fixture de-embedding, and moving the reference plane a snap. Calibration simplicity minimizes human errors during the measurement. Touchstone file format output enables easy S-parameter file sharing for further data analysis and simulations.

With the addition of the IConnect® S-parameter Wizard, calibration and acquisition of one to four-port single-ended and differential S-parameters is even easier. This "mini-application" guides the user through setup, calibration (including channel deskew) and acquisition of S-parameters and automatically generates Touchstone files for one or multiple DUTs.

Performance

Tektronix offers several true differential TDR modules, which in combination with IConnect allow S-parameters measurements with up to –70 dB of dynamic range. This performance is suitable for serial data analysis, digital design, and signal integrity applications, resolving better than 1% (–40 dB) of crosstalk, and electrical compliance test masks that typically call for the measurements in the –10 to –30 dB range. The table below summarizes the performance characteristics of these true differential TDR modules. Adding a wider-bandwidth module on the receiver end (e.g., using an 80E09 as a receiver with an 80E10 as a stimulus) will ensure the highest bandwidth for insertion loss measurements.

**Performance Characteristics of
True Differential TDR Modules**

Module	Typical Rise Time (10-90%)		S-parameter Bandwidth
	Incident	Reflected	
80E10	12 ps	15 ps	50 GHz
80E08	18 ps	20 ps	30 GHz
80E04	23 ps	28 ps	20 GHz

With the long record length acquisitions, IConnect® provides great flexibility for obtaining the desired frequency range and frequency step when performing S-parameter measurements. Up to 1,000,000 points can be acquired.

Efficient and Easy Interconnect Signal Integrity Analysis and SPICE Modeling

IConnect software allows you to quickly and easily generate SPICE and IBIS models for your PCBs, flexboards, connectors, cables, packages, sockets, and I/O buffer inputs directly from TDR/T or VNA S-parameter measurements. IConnect allows you to rapidly analyze eye-diagram degradation, jitter, loss, crosstalk, reflections, and ringing in your digital system. IConnect Linear Simulator allows you to link several interconnect components together to evaluate the total time, frequency-domain performance, and eye diagram of the overall channel. IConnect® substantially simplifies the signal integrity analysis of the interconnect link, equalization and emphasis component design, and analysis of the interconnect link with transmitter and receiver.

Package, Socket, and Connector Designers

IConnect provides the capability to quickly and easily compute your package, socket, and connector L and C using either the JEDEC or IBIS industry-standard computation procedure, the IConnect MeasureXtractor automatic modeling tool, or additional differential and single-ended TDR modeling procedures. To measure the input or output capacitance of the IC I/O buffer, the same modeling procedures can be applied. These JEDEC L and C measurements can also be automated in manufacturing using the IConnect command line interface.

Cable and Connector Manufacturers

IConnect® offers the fastest, most cost-effective eye mask, insertion and return loss, and frequency-domain crosstalk specification compliance testing. Impedance, time domain, and S-parameter compliance testing can be performed in manufacturing using the IConnect command-line interface. Eye mask testing allows you to include the effects of crosstalk on the eye. In addition, IConnect has the capability to easily extract models that include skin effect and dielectric loss, insertion and return loss, eye-diagram degradation, and frequency-dependent RLGC parameters, and analyze the effect of equalization and pre-emphasis on cable assembly performance.

Designers of Large Computer and Server Motherboards and Communications Backplanes

Backplane and motherboard designers can analyze the signal integrity performance of their board, connector, and package interconnects in detail, or predict the eye-diagram degradation in the interconnects due to frequency-dependent transmission line losses and crosstalk using either the built-in links to SPICE simulators, or the IConnect Linear Simulator.

## MeasureXtractor™: The Fastest Way from TDR/T or VNA Measurements to Simulations

MeasureXtractor is an automated model extraction tool, allowing you to obtain an accurate measurement-based SPICE model of the interconnect, with the press of a button. MeasureXtractor will guide you through the data acquisition process, help you acquire TDR/T or VNA S-parameter data, and will automatically produce an accurate model that matches both the time and frequency response of your interconnect.

Losses, dispersion, jitter, crosstalk, reflections, and ringing are predicted accurately, up to the highest frequency of operation of your instrument. Passivity of models must be explicitly enforced during model extraction, and MeasureXtractor model passivity is assured through proprietary algorithms. This means that interconnect models generated with MeasureXtractor™ will not artificially amplify the signal, oscillate, or produce noncausal results when used in system-level simulations.

MeasureXtractor produces what is known as a behavioral model. Such a model does not take into account the actual topology of the interconnect, but instead accurately represents the time and frequency behavior of the interconnect in the most simulation-efficient manner; in the case of MeasureXtractor with the minimum number of components and with guaranteed passivity.

Comparison of Behavioral and Topological Modeling Approaches

| Characteristic	Behavioral	Topological
Measurement Requirements	Requires full-port measurement	Just TDR (reflection) may be sufficient
Topology Selection	Automatic, no user intervention	User-controlled (easy and intuitive from TDR measurements)
Model Extraction	Automatic, no user intervention	User-driven; more labor intensive and requires more skill
Type of Models	"Black-box", no internal changes allowed	Intuitive, topology correlates to model
Limitations	Large model size for long interconnects (backplanes, cable assemblies)	Efficient model extraction processes exist for large lossy interconnects
Application	Quick inclusion of S-parameter or TDR/T measurements into simulation; the "do-it-all" modeling tool	Comprehensive modeling, "what-if" scenarios analysis, signal integrity troubleshooting, and fault finding
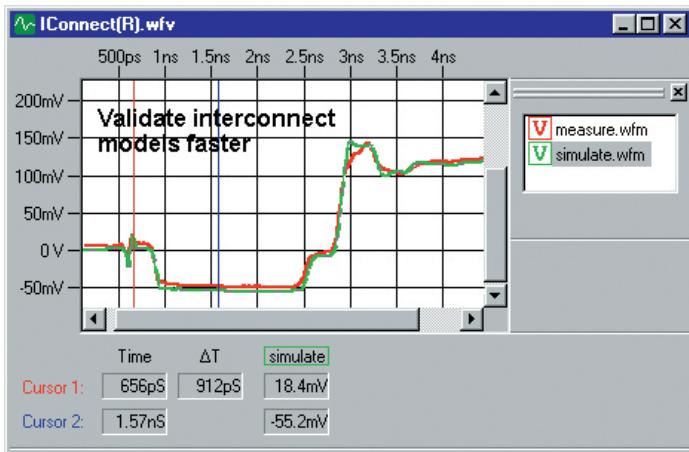
IConnect Simulate-and-Verify

IConnect Z-Line vs. TDR

Efficient and Easy Signal Integrity Modeling and Design Validation

IConnect® TDR and S-parameter software provides you with an integrated simulate-and-compare link between SPICE simulators, and TDR or S-parameter measurements, allowing you to quickly validate models produced by IConnect or by outside tools, such as field solvers. You can validate your own models for your board-trace, package, or connector, or the models provided by your vendor. The whole design can be validated using an external SPICE simulator or IConnect Linear Simulator, ensuring that your design works reliably and the eye diagram is within specifications.

The Accurate Way to Measure Impedance

IConnect® software uses an impedance deconvolution (Z-Line) algorithm, which further enhances the impedance computation feature in the DSA8300. The Z-Line algorithm efficiently takes care of multiple reflections in the TDR impedance measurement and produces the True Impedance Profile. As a result, you can measure PCB trace impedance more accurately and improve correlation of your data between measurements, including the correlation between such measurements performed by your coworkers or customers in another part of the world. The True Impedance Profile produced by IConnect Z-Line allows you to improve not only the TDR oscilloscope impedance measurement accuracy, but also to increase
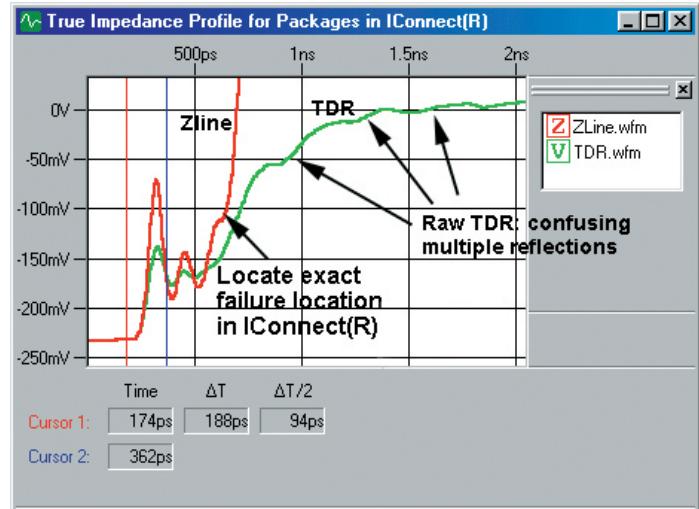
the TDR oscilloscope resolution. The EZ Z-Line user interface, providing single-button Z-Line computation for any number of waveforms, and enabling easy waveform manipulation and analysis, makes TDR data much easier to interpret.

Package and Board Failure Analysis with TDR

TDR is a reliable nondestructive approach for locating the position of failures in BGA and similar packages and printed circuit boards. IConnect software Z-Line algorithm improves the resolution of TDR, facilitating easier location of open and short faults. When IConnect Z-Line algorithm is used with the 80E10 TDR module with 12 ps incident TDR rise time it enables sub-millimeter resolution for package and on-chip failure analysis. IConnect® EZ Z-Line user interface is specifically designed with a failure analyst in mind, providing single-button Z-Line computation for any number of waveforms, and quick and easy comparison between known good device traces and pins and suspect devices. This makes the TDR data much easier to interpret. Finding the location of open faults and signal-to-ground shorts becomes a simple task, and finding location of plane-to-plane shorts, signal-to-signal shorts, resistive shorts, and faults in fan-outs become realistic tasks.

Feature Summary

Feature	80SSPAR	80SICON	80SICMX
Long Records (up to 1,000,000 points)	X	X	X
Z-Line	X	X	X
L-C Readouts	X	X	X
50 Ω Calibration (not required)	X	X	X
S-parameters	X	X	X
True differential	X	X	X
Flexible calibration: short, open or thru	X	X	X
50 Ω calibration (not required)	X	X	X
Amplitude and phase display	X	X	X
Touchstone (SnP) file export	X	X	X
L and C Computation using JEDEC Method	X	X	X
Command Line Interface to Z-Line, S-parameters, L-C Computation, Step Spectrum, Eye Diagram, Limit Testing, and Compliance Testing	X	X	X
Eye Diagram		X	X
From TDR/T or S-parameters		X	X
From SPICE models		X	X
Eye diagram with crosstalk effects		X	X
Industry-standard or user-specified data patterns		X	X
Transmitter and receiver equalization		X	X
Jitter/Noise insertion		X	X
BER, jitter, noise measurements		X	X
BER eye mask testing		X	X
Automatic mask shift to fit asymmetric eyes		X	X
Eye-diagram Compliance Tests for HDMI, PCIe, and SATA Standards		X	X
Auto jitter to close transmitter eye		X	X
Standard specified patterns		X	X
Standard specific equalization		X	X
Step Spectrum		X	X
Topological Modeling		X	X
Lossy and lossy coupled		X	X
Z-Line/Lossless, lumped, or distributed		X	X
Complete topological modeling system		X	X
PSpice, HSpice, and Berkeley SPICE3 Output Formats		X	X
Integrated Link to Simulators		X	X
IConnect Linear Simulator		X	X
Behavioral Modeling (MeasureXtractor)			X
Fully automatic modeling, no user intervention			X
Use TDR/T or VNA S-parameter data for modeling			X
Model concurrently in time and frequency domains			X

Characteristics

Circuit Simulator Interface

- Integrated link to HSpice, PSpice, and Berkeley SPICE3
- IConnect Linear Simulator

Simulators Included

- Full version of Berkeley SPICE3
- IConnect Linear Simulator

Computer Requirements

Characteristic	Description
Processor	1 GHz Intel Pentium (or equivalent)
RAM	1 GB (1 GB recommended for large MeasureXtractor™ runs)
Hard Drive	40 MB free space
Operating System	Microsoft Windows XP / Vista / 7
Monitor	1024/768 or higher resolution. (Additional high-resolution monitor recommended when running IConnect® directly on CSA/TDS8000, CSA/TDS8000B, or CSA/DSA/TDS8200 sampling oscilloscopes)
Others	National Instruments GPIB board, version 2.1 (not required for DSA/CSA/TDS8xxx local TekVISA™ interface)

Ordering Information*²

80SSPAR
IConnect® S-parameter and Z-Line software.
Includes: First year of maintenance and support from date of purchase.

80SICON
IConnect® Signal Integrity TDR and S-parameter Software.
Includes: First year of maintenance and support from date of purchase. 80SICON includes all 80SSPAR functionality.

80SICMX
IConnect® and MeasureXtractor™ Signal Integrity TDR and S-parameter Software.
Includes: First year of maintenance and support from date of purchase. 80SICMX includes all 80SICON functionality plus MeasureXtractor (also includes all 80SSPAR functionality).

*² Also available as an option on the DSA8300 sampling oscilloscope. See the DSA8300 data sheet for more information.

Standard Options to 80SSPAR, 80SICON, and 80SICMX

Option	Description
Opt. USB	USB hardware key (dongle)
Opt. PPD	Parallel port hardware key (dongle)

Standard IConnect Extensions to Existing Maintenance Agreements

Option	Description
80SSPAR SWS1	Extend 80SSPAR maintenance agreement by 1 year
80SSPAR CUR	Renew an 80SSPAR license that is out of support – contact your account manager or product line to obtain pricing
80SICON SWS1	Extend 80SICON maintenance agreement by 1 year
80SICON CUR	Renew an 80SICON license that is out of support – contact your account manager or product line to obtain pricing
80SICMX SWS1	Extend 80SICMX maintenance agreement by 1 year
80SICMX CUR	Renew an 80SICMX license that is out of support – contact your account manager or product line to obtain pricing

Upgrade Options

Option	Description
Upgrade to 80SICON	
80SSPARUP	Upgrade from 80SSPAR to 80SICON
Opt. ICONUSB	Add USB hardware key (dongle)
Opt. ICONPPD	Add parallel port hardware key (dongle)
Upgrade to 80SICMX	
80SICMX	Upgrade from 80SSPAR to 80SICMX
Opt. ICMXUSB	Upgrade with USB hardware key (dongle)
Opt. ICMXPPD	Upgrade with parallel port hardware key (dongle)
80SICONUP	Upgrade from 80SICON to 80SICMX
Opt. ICMXUSB	Upgrade with USB hardware key (dongle)
Opt. ICMXPPD	Upgrade with parallel port hardware key (dongle)

Recommended Hardware Compatibility

- DSA8300, DSA8200, CSA/TDS8200, or CSA/TDS8000, with 80E10, 80E08, or 80E04 TDR sampling modules (local TekVISA interface is supported; install and run directly on the instrument)

- P80318 – 18 GHz Differential TDR Probe. 80A02 module recommended for static protection of each channel of the sampling or TDR module

- P8018 – 20 GHz Single-ended TDR Probe. 80A02 module recommended for static protection of the sampling or TDR module

- 80A02 – EOS/ESD Protection Module (1 channel). P8018 or P80318 TDR probe recommended

Interconnect Cables (3rd Party)

Tektronix recommends using quality high-performance interconnect cables with these high-bandwidth products in order to minimize measurement degradation and variations. The W.L. Gore & Associates' cable assemblies, accessible at www.gore.com/tektronix, are compatible with the 2.92 mm, 2.4 mm, and 1.85 mm connector interface of the 80Exx modules. Assemblies can be ordered by contacting Gore.

Calibration Kits and Accessories (3rd Party)

To facilitate S-parameter measurements with these electrical modules and IConnect software, we recommend precision calibration kits, adapter kits, connector savers, airlines, torque wrenches, and connector gauges from Maury Microwave. These components, accessible at www.maurymw.com/tektronix.htm, are compatible with the 2.92 mm, 2.4 mm, and 1.85 mm connector interface of the 80Exx modules. Cal kits and other components can be ordered by contacting Maury Microwave.

CE

Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

GPIB
IEEE-488
Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

Data Sheet

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

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