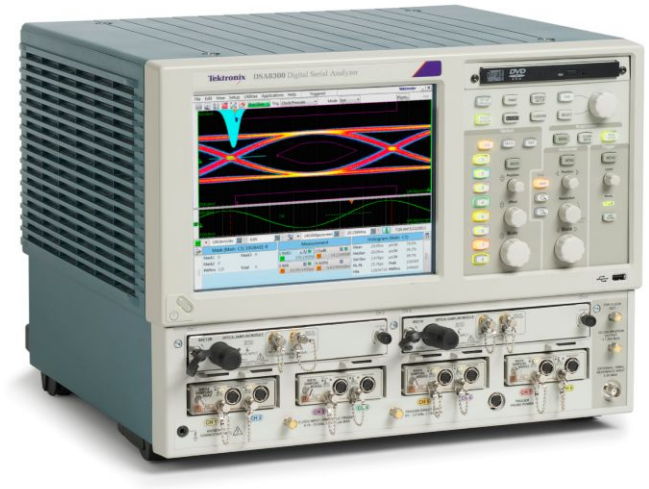
Tektronix®

DSA8300 Datasheet

Digital Serial Analyzer Sampling Oscilloscope



The DSA8300 is a state-of-the-art Equivalent Time Sampling Oscilloscope that provides the highest fidelity measurement and analysis capabilities for Communications Signal Analysis, Serial Data Network Analysis, and Serial Data Link Analysis applications.

Notice to EU customers

This product is not updated to comply with the RoHS 2 Directive 2011/65/EU and will not be shipped to the EU. Customers may be able to purchase products from inventory that were placed on the EU market prior to July 22, 2017 until supplies are depleted. Tektronix is committed to helping you with your solution needs. Please contact your local sales representative for further assistance or to determine if alternative product(s) are available. Tektronix will continue service to the end of worldwide support life.

Key performance specifications

- Low time base jitter:
  - 425 fs typical on up to 8 simultaneously acquired channels
  - <100 fs on up to 6 channels with 82A04B phase reference module
- Industry's highest vertical resolution – 16 bit A/D
- Electrical resolution: <20 µV LSB (for 1 v full range)
- Optical resolution from <20 nW for the 80C07B (1 mW full range) to <0.6 µW for the 80C10C (30 mW full range)
- Optical bandwidths to >80 GHz
- Electrical bandwidths to >70 GHz
- Over 120 automated measurements for NRZ, RZ, and pulse signal types
- Automated mask testing with over 80 industry-standard masks
- Complex jitter/noise/BER/SER analysis (80SJNB), support for complex measurements TDECQ [1], SNDR [2] (applications)

Key features

A wide variety of optical, electrical, and accessory modules support your specific testing requirements.

- **Optical modules**
  - Optical modules that support optical data rates from 155 Mb/s to 10 Gb/s to 40 Gb/s to 100 Gb/s to PAM4 for 50G/100G/200G/400G
  - Optical reference receivers (ORR) [3] support specified requirements for standards-mandated compliance testing beyond 56 GBd (PAM4 and PAM2 NRZ)(80C10C)
  - High optical sensitivity, low noise, and wide dynamic range of the optical sampling modules allows accurate testing and characterization of short-reach to long-haul optical communications standards
  - Fully calibrated clock recovery solutions – no need to manually calibrate for data pick-off losses
  - Calibrated extinction ratio measurements and variable correction ER measurement ensure accuracy and repeatability

1 Transmitter and Dispersion Eye Closure for PAM4

2 Signal-to-Noise-and-Distortion Ratio

3 Optical Reference Receiver (ORR) is a 4th-order Bessel-Thompson filter, with a frequency response and tolerances as defined by the standards. Tektronix optimizes the response for best nominal fit and highest quality mask test results.

- **Electrical modules**
  - Very low-noise electrical samplers (280 µV at 20 GHz, 450 µV at 60 GHz, typical)
  - Selectable bandwidths [4] allow the user to trade-off sampler bandwidth and noise for optimal data acquisition performance
  - Remote samplers [5] or compact sampling extender module cables minimize signal degradation by allowing the sampler to be located in close proximity to the device under test
  - High-performance integrated TDR (10 ps typical step rise time) supports exceptional impedance discontinuity characterization and high dynamic range for S-parameter measurements to 50 GHz
- **Analysis**
  - Jitter, noise, and BER analysis of high-speed PAM4 and PAM2 NRZ serial data rates from <1 GBd to 60 GBd provides insight into precise causes of eye closure
  - Analysis of PAM4 signals with comprehensive jitter, noise and BER analysis for each individual PAM eye, and a set of global measurements that assess the overall PAM4 signal attributes
  - 100G-SR4/Transmitter and Dispersion Eye Closure (TDEC) automation provides turn-key testing and debug of TX Optical properties key to the SR4 Short Reach Ethernet
  - 80STDEC streamlines high performance Transmitter and Dispersion Eye Closure (TDEC) measurement making it ideal for manufacturing and conformance validation applications
  - Automated mask testing with over 80 industry-standard masks. New masks can be imported into the DSA8300 to support new emerging standards. Users can define their own masks for automated mask testing
  - Jitter, noise, BER, mask testing, and Serial Data Link Analysis (SDLA) are provided through the 80SJNB Essentials and Advanced Software Application Options
  - Advanced TDR analysis, S-parameter measurements, simulation model extraction, and serial link simulation capabilities are provided by the IConnect® Software Application options
- **High test throughput**
  - High sample acquisition rate up to 200 kS/s per channel
  - Efficient programmatic interface (IEEE-488, Ethernet, or local processor access) enables high test throughput

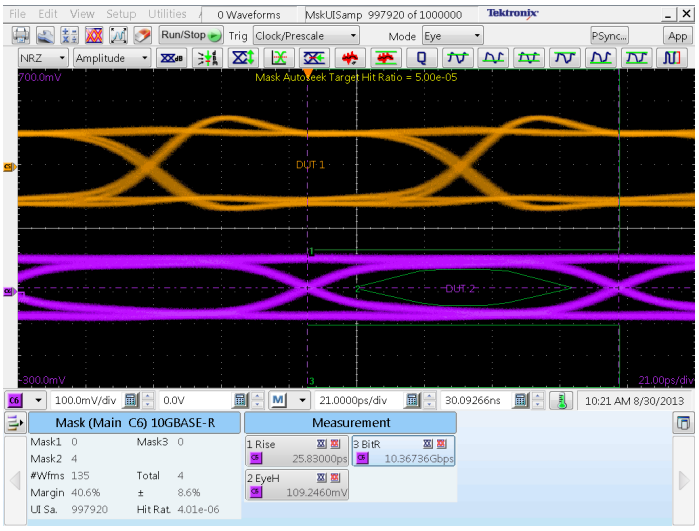
Applications

- Design/Verification of telecom and datacom components and systems
- Manufacturing/testing for ITU/ANSI/IEEE/SONET/SDH compliance
- High-performance true-differential TDR measurements
- Impedance characterization and network analysis for serial data applications including S-parameters
- Advanced jitter, noise, BER and SDLA analysis
- Channel and eye diagram simulation and measurement-based modeling with IConnect.

Superior performance with extraordinary versatility

The DSA8300 Digital Serial Analyzer is the most versatile tool for developing and testing communications, computers, and consumer electronics which use multi-gigabit data transmission. It is used for optical and electrical transmitter characterization, as well as compliance verification for devices, modules, and systems used in these products.

In addition, the DSA8300 is well-suited for electrical signal path characterization, whether for packages, PCBs, or electrical cables. With exceptional bandwidth, signal fidelity, and the most extensible modular architecture, the DSA8300 provides the highest-performance TDR and interconnect analysis, most accurate analysis of signal impairments, and BER calculations for current and emerging serial data technology.



Optical eye diagram testing

4 With 80E07 and higher.

5 80E07B and higher modules.

Passive interconnect test

Finally, with its exceptional signal fidelity and resolution, the DSA8300 is the gold standard for electrical and optical applications which require ultra-high bandwidths, very fine vertical resolution, low jitter, and/or exceptionally low noise.

The DSA8300 provides unmatched measurement system fidelity with the lowest native instrument jitter floor (425 fs RMS, typical for serial data signals at rates >1.25 Gb/s) that ensures the most accurate acquisition of up to 8 high-bandwidth signals simultaneously. You get additional analysis benefits from acquisition jitter below 100 fs RMS when using the 82A04B Phase Reference module.

The multiprocessor architecture, with dedicated per-slot digital signal processors (DSPs), provides fast waveform acquisition rates, reducing the test times necessary for reliable characterization and compliance verification.

The DSA8300's versatile modular architecture supports a large and growing family of plug-ins enabling you to configure your measurement system with a wide variety of electrical, optical, and accessory modules that best suit your application now and in the future. With 6 module slots, the DSA8300 can simultaneously accommodate a Clock Recovery module, a precision Phase Reference module, and multiple acquisition modules (electrical or optical), so you can match system performance to your evolving needs. The ability to swap sampling modules without powering down the DSA8300 (available for scopes with firmware versions 6.1 and later) provides additional flexibility in configuring your DSA8300 to changing test needs.

Featuring industry-leading signal fidelity, the family of electrical modules includes bandwidth performance from 20 GHz to >70 GHz, while the optical modules support optical testing from 125 Mb/s to 100 Gb/s and beyond with optical bandwidth exceeding 80 GHz. The DSA8300 supports all of the legacy 8000 Series electrical and optical sampling modules and accessories. [6]

In addition, specialized modules supporting features such as single-ended and differential electrical clock recovery, electrostatic protection for electrical samplers, and connectivity to the popular TekConnect® probing system brings you the performance of state-of-the-art Tektronix probes for high-impedance and differential probing. Low-impedance probes for 50 Ω probing and for TDR probing are also available.

The raw acquisition performance of the DSA8300 and its sampling modules and accessories is further augmented by the comprehensive measurement and analysis capabilities of the DSA8300 and its associated software applications. For example, the IConnect® software applications provide complete TDR, S-parameter, and signal integrity analysis for passive electrical interconnects (packages, printed circuit boards, backplanes, cable, etc.) while the 80SJNB applications provide complete jitter, noise, and bit error rate analysis as well as channel and equalization analysis and emulation for both optical and electrical serial data links.

Jitter, Noise, BER, and Serial Data Link analysis software for Tektronix DSA8300 sampling oscilloscopes

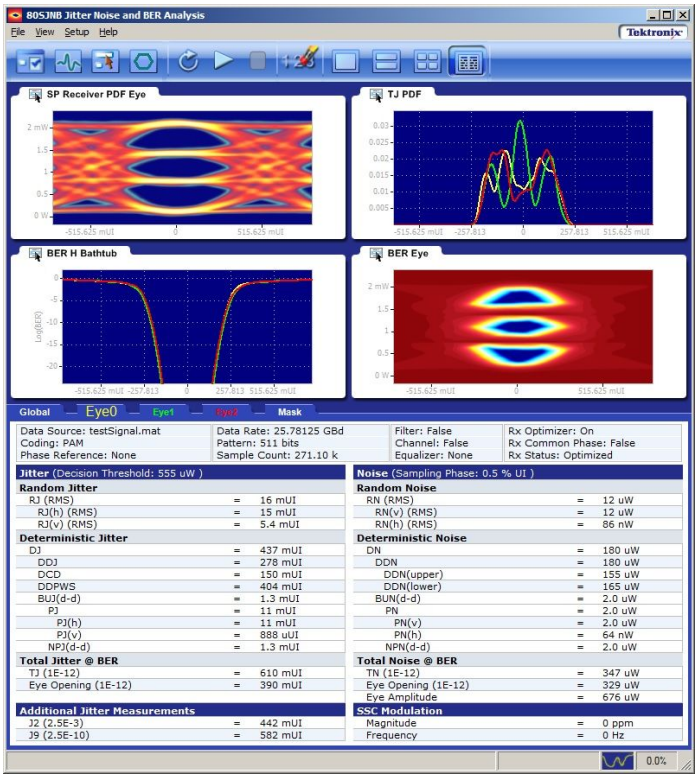
The 80SJARB, 80SJNB Essentials, 80SJNB Advanced (80SJNB02), and PAM4 option software applications support high-speed serial data link measurements and analysis with the following capabilities:

Capability	80SJNB	80SJNB JNB01/ 80SJNB JNB02 [8]	80SJNB PAM4 [8]	80SJARB
NRZ Data Supported	Repetitive pattern <100,000 UI	Repetitive pattern <100,000 UI	Repetitive pattern <100,000 UI	Any patterns (including PRBS31)
PAM4 Data Supported	No	No	Yes	No
J2 Jitter Result (settable to Jx)	Jx defaults to BER 2.5e^{-3}	Jx defaults to BER 2.5e^{-3}	Jx defaults to BER 2.5e^{-3} for each PAM eye	J2 only (on a histogram according to IEEE 802.3ba), NRZ only
J9 Jitter Result (settable to Jx)	Jy defaults to BER 2.5e^{-10}	Jy defaults to BER 2.5e^{-10}	Jy defaults to BER 2.5e^{-10} for each PAM eye	J9 only (extrapolated from a histogram according to IEEE 802.3ba)
TJ Total Jitter Result	Yes at target BER. Default BER = 1e^{-12}	Yes at target BER. Default BER = 1e^{-12}	Yes at target BER. Default BER = 1e^{-12} for each PAM eye	Yes at BER = 1e^{-12}
Jitter and Noise Analysis (RJ, DJ, BUJ, PJ, RN, DDN, BUN, PN)	Yes	Yes	Yes, for each PAM eye	RJdd, DjDD, Tj, for NRZ only

6 The DSA8300 does not support the 80A06 Pattern Synchronization module, as this capability is superseded by the integrated Advance Trigger option (Option ADVTRIG) for the DSA8300.

Capability	80SJNB	80SJNB JNB01/ 80SJNB JNB02 [8]	80SJNB PAM4 [8]	80SJARB
OMA/VMA	PI only NRZ eye	PI only NRZ eye	Yes, for each PAM eye	No
RIN, RINxOMA	Yes [7]	Yes [7]	Yes [7]	No
BER Plots	Yes	Yes	Yes	No
Global PAM4 measurements	No	No	Yes, transmitter level and receiver eye centric measurements	No
SDLA Features (Channel emulation, fixture de-embedding, equalization)	No	Yes [8]	Yes [8]	No

Jitter, noise, BER, and Serial Data Link Analysis (SDLA)



Jitter, noise and BER analysis

High-speed serial data link measurements and analysis are supported with three software solutions: 80SJARB, 80SJNB Essentials, and 80SJNB Advanced. [9]

- 80SJARB (Option JARB) is a basic jitter measurement tool capable of measuring jitter on any waveform – random or repetitive. The simplicity of acquisition limits the amount of analysis possible so only the basic (Dual Dirac) decomposition can be used; repeatability is signal dependent.
- 80SJNB Essentials (Option JNB) offers complete analysis of jitter, noise, and BER, with decomposition of components for clear understanding of a signal's problems and margins. System performance at target BER can be analyzed with mask testing. Performing mask testing on statistical data based models improves the accuracy and repeatability of overall system performance assessment. The acquisition methodology requires a repetitive pattern. Both accuracy and repeatability are improved relative to 80SJARB since the tool has access to the complete signal pattern.
- 80SJNB Advanced (Option JNB02) adds features to 80SJNB Essentials for serial data link analysis – de-embedding of fixture,

7 Available from the TekExpress® RIN application which is distributed with any version of 80SJNB applications. Currently For PAM2; for PAM4, contact Tektronix for availability.

8 JNB01 adds insertion loss emulation and FFE/DFE. JNB02 further adds SDLA Visualizer for additional CTLE and full and multi-stage de-embed and channel emulation. Only JNB01 and JNB02 can be further enhanced by option PAM4.

9 These software applications can be purchased to install on currently owned DSA8300 oscilloscopes with the DSA83UP upgrade kits.

channel emulation, FFE/DFE and CTLE equalization, and preemphasis/de-emphasis.

- Characterize jitter, noise, and BER performance of links using PAM4 signaling. Tektronix PAM4 software supports comprehensive analysis of multilevel signaling, including Pulse Amplitude Modulation (PAM4) coded data.

SDLA analysis: SDLA Visualizer and JNB signal path

JNB's Signal Path function is now complemented with the advanced features of SDLA Visualizer. SDLA Visualizer extends the de-embedding and channel emulation capabilities of JNB signal path by offering a complete 4-port de-embed and embed that models not only the effects of insertion loss, but also models the effects of return loss and cross-coupling.

SDLA Visualizer works with the Signal Path filter function built into JNB Advanced. After configuring SDLA Visualizer, selecting the desired test point, and applying the model, the application automatically loads the filter for the selected test point into the Signal Path filter block.

If CTLE, DFE or FFE equalization are required, they can be quickly entered in the JNB Signal Path and then the final measurements can be taken.

These are just a few examples of the many features available from SDLA Visualizer. For more details see the SDLA Visualizer datasheet available at www.tek.com.

Jitter analysis of arbitrary data (80SJARB)

The 80SJARB jitter measurement application software for the DSA8300 Series addresses IEEE 802.3ba applications requiring the J2 and J9 jitter measurements. It also enables basic jitter measurements for NRZ data signals including PRBS31, random traffic, and scrambled data. This provides an entry-level jitter analysis capability with simple Dual Dirac model jitter analysis and no pattern synchronization requirement.

80SJARB can acquire continuously in Free Run mode, delivering acquisitions and updates beyond the IEEE minimum requirement of 10,000 data points.

Plots include jitter and eye opening bathtub curves for both measured and extrapolated data, as well as a histogram of the acquired data.

80SJARB jitter analysis measurements

Measurement	Description
J2	Total jitter for BER = $2.5e^{-3}$
J9	Total jitter for BER = $2.5e^{-10}$
Tj	Total jitter for BER = $2.5e^{-12}$
DJ_{dd}	Deterministic jitter (Dual Dirac model)
RJ_{dd}	Random jitter (Dual Dirac model)

80SJNB mask test results

Measurement	Description
PDF Mask	Margin, Hit Ratio, Pass/Fail. Optional Horizontal Shift
BER Mask	Margin, BER Limit, Pass/Fail. Optional Horizontal Shift

80SJNB, 80SJNB02, PAM4 Advanced Jitter, Noise, BER Analysis measurements

Measurement	Description (per every eye when PAM4)
BUJ (d-d)	Bounded uncorrelated jitter (Dual Dirac)
BUN(d-d)	Bounded uncorrelated noise (Dual Dirac)
DCD	Duty cycle distortion
DDJ	Data dependent jitter
DDN	Data dependent noise
DDN (lower)	Data dependent noise on low level
DDN (upper)	Data dependent noise on high level
DDPWS	Data dependent pulse width shrinkage
DJ	Deterministic jitter
DN	Deterministic noise
Eye Opening @ BER	Horizontal eye opening
Eye Opening @ BER	Vertical eye opening at specified BER
Jx @ BER	Defaults to J2, BER = $2.5e^{-3}$
Jy @ BER	Defaults to J9, BER = $2.5e^{-10}$
NPJ(d-d)	Non periodic jitter (Dual Dirac)
NPN(d-d)	Non periodic noise (Dual Dirac)
OMA	Optical Modulation Amplitude
PJ	Periodic jitter
PJ(h)	Horizontal component of periodic jitter
PJ(v)	Vertical component of periodic jitter
PN	Periodic noise
PN(h)	Horizontal component of periodic noise
PN(v)	Vertical component of periodic noise
RJ (RMS)	Total measured random jitter
RJ(d-d)	Random jitter in Dual Dirac model
RJ(h) (RMS)	Horizontal component of random jitter
RJ(v) (RMS)	Vertical component of random jitter
RN (RMS)	Total measured random noise
RN(h) (RMS)	Horizontal component of random noise
RN(v) (RMS)	Vertical component of random noise
SSC frequency	Spread spectrum modulation frequency (limited support)
SSC magnitude	Spread spectrum modulation magnitude (limited support)
TJ @ BER	Total jitter at specified BER
TN @ BER	Total noise at specified BER

Measurement	Description (per every eye when PAM4)
VMA	Voltage modulation amplitude
80SJNB PAM4 global measurements	
Center Deviation	Position of eye centers relative to middle eye
Effective Symbol Level 1	Effective symbol relative to average (L0, L1)
Effective Symbol Level 2	Effective symbol relative to average (L2, L3)
EH6/EW6 OIF-CEI	PAM4 eye height and width, per specification
Level <e>	Symbol levels: L0, L1, L2, L3
Level Deviation	Level separation relative to peak-to-peak
Level Linearity	PAM4 level linearity
Level Mismatch ratio (R_{LM})(	Minimum level separation relative to peak-to-peak
Level Thickness	Level RMS at minimum inter-symbol interference
Level Time Deviation	Minimum inter-symbol interference level positions
Minimum Signal Level	Minimum of level separations
OMA outer	Optical modulation amplitude between L0 and L3
Transition Timing	Rise/Fall on individual PAM trajectories
Vertical Eye Closure	Minimum eye amplitude over eye opening

- **Plots**: Jitter and Noise Components Probability Distributions, Spectral Distributions, Data Dependent Jitter and Noise and DDPWS vs. Bit, Data Pattern Waveform, Bathtub Curves for Jitter and Noise, BER Probability Map, BER Contour Diagrams, Q-Eye, Probability Distribution Eye Diagrams (Data pattern can be plotted after every Signal Path (SP) processing step), SSC (Spread Spectrum Clocking) Profile. When analyzing PAM4 signals, plots for all three stacked eyes are shown. SSC support is deprecated above 12 GBd on PAM4.
- **Data Logging**: Query and Export of all Numeric Results. Export of Waveforms: Raw Acquired Pattern Waveform, Correlated Pattern Waveform, Correlated Pattern Waveform after Every Signal Path Processing Step, Probability Distribution Eye Diagrams, and Bathtub Curves.
- **Mask Testing**: Statistical mask testing in PDF or BER space. Mask hit ratio supported.

80SJNB Advanced (Opt. JNB02); includes SDLA Visualizer

80SJNB Advanced (Opt. JNB02) supports:

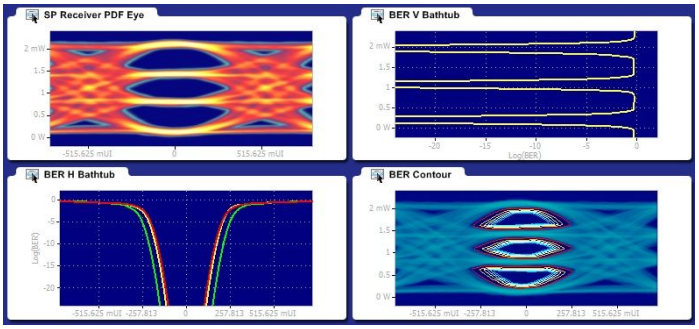
- FFE (Feed Forward Equalization) to 100 taps, DFE (Decision Feedback Equalization) to 40 taps, both with Autoset, and CTLE.
- Channel Emulation - both simple 'insertion-loss only' and (using SDLA Visualizer) complete, cascaded full-4-port with crosstalk, 8 blocks
- Filter function to support linear filters such as fixture de-embed and others. Use the SDLA Visualizer to create such filters

80SJNB PAM4 signal analysis

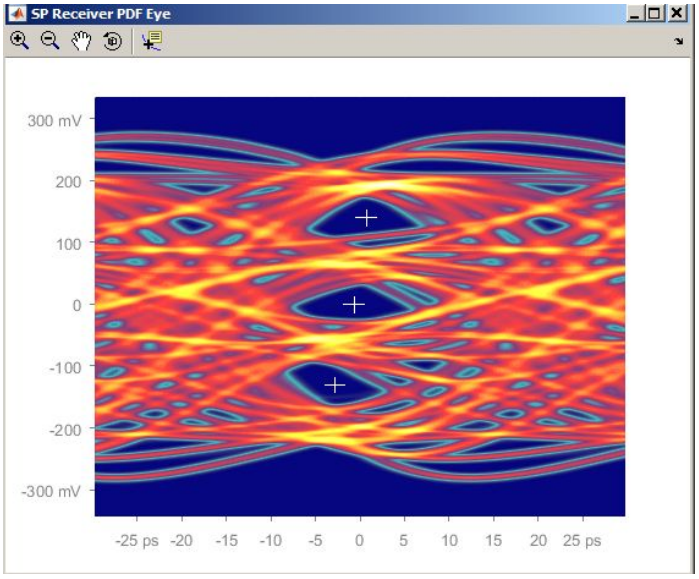
The PAM4 option for 80SJNB adds full jitter, noise and BER analysis on PAM4 modulated signals to support 100-400 Gbps electrical and optical communication links.

Signal impairment sources for PAM4 are categorized in similar ways as those for NRZ systems: uncorrelated jitter and noise sources, crosstalk, bounded, and unbounded types. 80SJNB PAM4 performs the full analysis on each PAM eye, and also performs a set of global PAM-specific measurements.

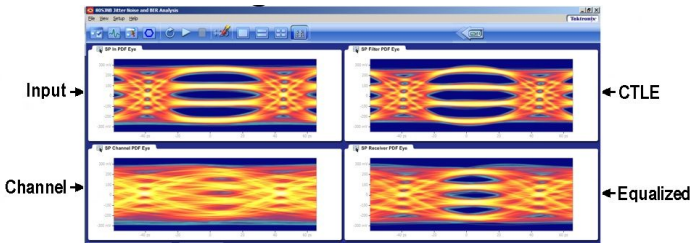
Plots show different aspects of the signal: pattern, eye diagrams, horizontal and vertical bathtub curves, BER eyes and contours are all reflecting the three stacked eyes for a PAM4 signal.



A key feature of the PAM4 tool is to optimize the eye center reflecting a receiver with maximum horizontal and vertical margins. You have the option to lock the vertical slicer to a single phase for all three eyes.



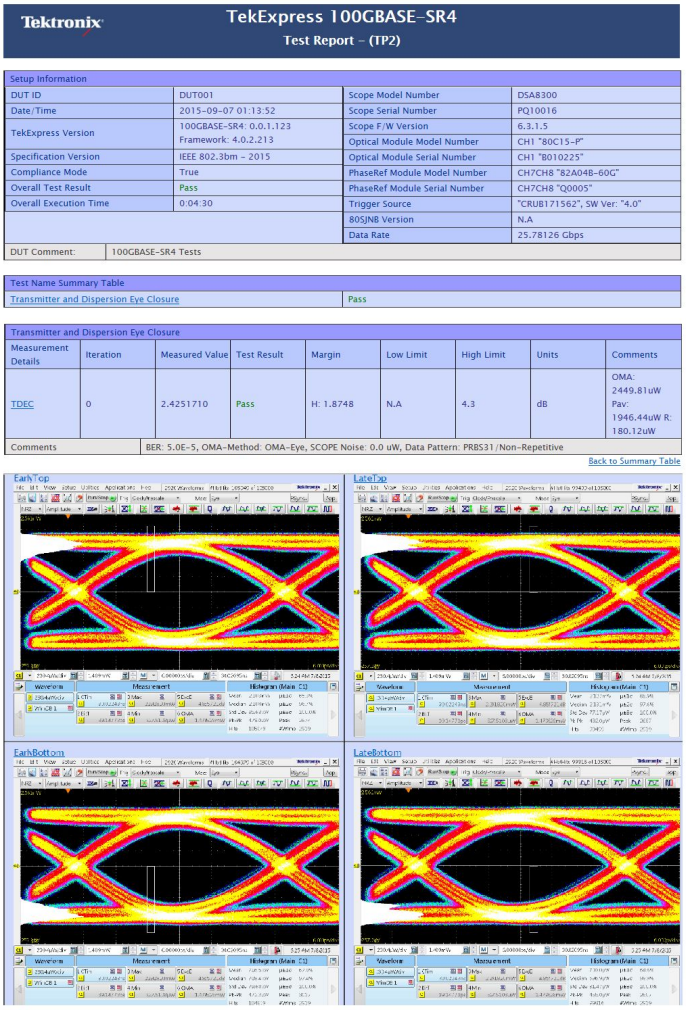
The PAM4 analysis has full signal path emulation tools that support Continuous Time Linear Equalizer (CTLE), channel emulators described by S-parameters or TDR waveforms, and receiver equalizers Feed Forward (FFE) and Decision Feedback (DFE).



Transmitter and Dispersion Eye Closure (TDEC)

The Tektronix DSA8300 Digital Serial Analyzer sampling oscilloscope based 100G-SR4/Transmitter and Dispersion Eye Closure (TDEC) automation system provides turnkey testing and debug of TX Optical properties key to the SR4 Short Reach Ethernet specifications. Automation options help customers meet their compliance needs and generate detailed reports. A user-defined mode lets customers make changes to the test limits and perform margin testing beyond compliance.

The combination of TDEC and SR4 automation in conjunction with Tektronix 80C18, 80C17 or 80C15/CRTP broad wavelength high sensitivity optical sampling modules offers the most accurate and easiest to use set of tools to perform these measurements.



Tektronix

TekExpress 100GBASE-SR4

Test Report – (TP2)

Setup Information			
DUT ID	DUT001	Scope Model Number	DSA8300
Date/Time	2015-09-07 01:13:52	Scope Serial Number	PQ10016
TekExpress Version	100GBASE-SR4: 0.0.1.123 Framework: 4.0.2.213	Scope F/W Version	6.3.1.5
		Optical Module Model Number	CH1 "80C15-P"
Specification Version	IEEE 802.3bm – 2015	Optical Module Serial Number	CH1 "B010225"
Compliance Mode	True	PhaseRef Module Model Number	CH7CH8 "82A04B-60C"
Overall Test Result	Pass	PhaseRef Module Serial Number	CH7CH8 "Q0005"
Overall Execution Time	0:04:30	Trigger Source	"CRUB171562", SW Ver: "4.0"
		80SJNB Version	N.A
		Data Rate	25.78126 Gbps
DUT Comment:	100GBASE-SR4 Tests		

Test Name Summary Table	
Transmitter and Dispersion Eye Closure	Pass

Transmitter and Dispersion Eye Closure

Measurement Details	Iteration	Measured Value	Test Result	Margin	Low Limit	High Limit	Units	Comments
TDEC	0	2.4251710	Pass	H: 1.8748	N.A	4.3	dB	OMA: 2449.81uW Pav: 1946.44uW R: 180.12uW
Comments	BER: 5.0E-5, OMA-Method: OMA-Eye, SCOPE Noise: 0.0 uW, Data Pattern: PRBS31/Non-Repetitive							

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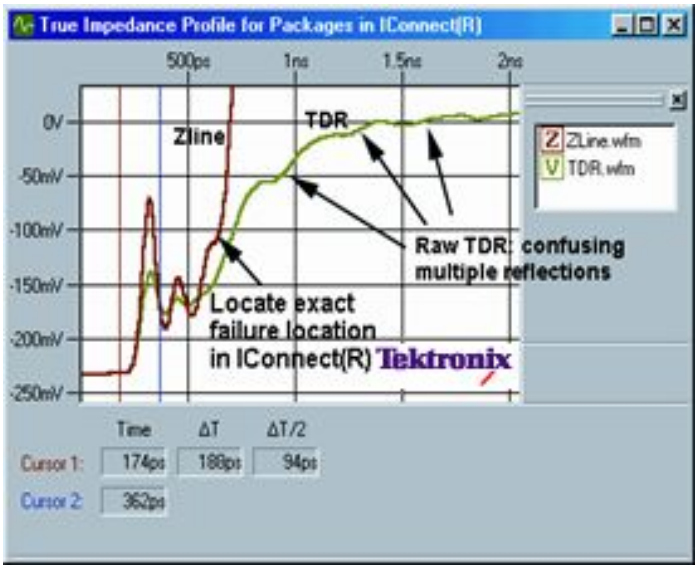
Simplified instrument setup

Setup and test execution is simple with the 100GBASE-SR4/TDEC software. The oscilloscope acquisition and analysis are all controlled through the 100GBASE-SR4/TDEC automation solution. The Graphical User Interface (GUI) provides an intuitive and easily repeatable workflow for setup and testing.

Design characterization is supported beyond 100GBASE-SR4 compliance requirements for all measurements. 80SSR4 offers flexible control over test configurations such as analysis windows and other parameters. User defined mode lets customers make changes to the test limits, and perform marginal testing beyond compliance. 80C18, 80C17, 80C15, 80C10C, or 80C14 Optical modules can be used; refer to the modules' filter and bandwidth list for the appropriate bandwidth.

TDR (Time Domain Reflectometry) applications



Quickly identify the exact location of faults with the 80E10B sub-millimeter resolution and IConnect ®True Impedance Profile

The DSA8300 is one of the industry's highest-performance fully integrated Time Domain Reflectometry (TDR) measurement system. Offering true-differential TDR measurements up to 50 GHz bandwidth with <15 ps reflected rise time and <12 ps incident rise time [10], the DSA8300 enables you to keep pace with today's most demanding Serial Data Network Analysis (SDNA) requirements.

The 80E10B and 80E08B TDR modules feature a fully integrated independent dual-channel 2-meter remote sampler system to minimize fixturing and assure optimal system fidelity. Independent sampler deskew ensures fast and easy fixture and probe de-embedding. The user can characterize differential crosstalk by using TDR steps from a differential module to drive one line pair while monitoring a second line pair with a second differential module.

The DSA8300 is the industry's most versatile TDR measurement system, accommodating up to 4 dual-channel true-differential TDR modules for fast, accurate multilane impedance and S-parameter characterization.

The P80318 True-differential TDR probe and P8018 Single-ended Passive Handheld TDR probe provide high-performance probing solutions for circuit board impedance and electrical signal characterization. The P80318, an 18 GHz 100 Ω input-impedance differential TDR hand probe, enables high-fidelity impedance measurements of differential transmission lines. The adjustable probe pitch enables a wide variety of differential line spacing and impedances. The P8018 is a 20 GHz Single-ended Passive Handheld TDR probe. Both the P80318 and P8018 can be used as stand-alone probes but are especially designed to work with the 80A02 EOS/ESD module to provide EOS/ESD protection.

Multi-gigabit signal path characterization and analysis – Serial Data Network Analysis (SDNA)

Serial data network analysis

As clock speeds and rise times of digital circuits increase, interconnect signal integrity dramatically affects digital system performance. Accurate and efficient Serial Data Network Analysis (SDNA) of the signal path and interconnects in time and frequency domains is critical to predict signal losses, jitter, crosstalk, terminations and ringing, digital bit errors, and eye diagram degradation, ensuring reliable system operation.

Tektronix offers several true-differential TDR modules, which in combination with IConnect® software allow S-parameter measurements with up to –70 dB of dynamic range. This performance assures accurate, repeatable measurements in serial data analysis, digital design, signal integrity, and electrical compliance testing applications.

TDR module performance with IConnect®

TDR Module	S-parameter measurement bandwidth performance
80E10B	50 GHz
80E08B	30 GHz
80E04	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.

When you use IConnect® Signal Integrity TDR and S-parameter software with the DSA8300 you have an efficient, easy-to-use, and cost-effective solution for measurement-based performance evaluation of multi-gigabit interconnect links and devices, including signal integrity analysis, impedance, S-parameter, and eye-diagram tests, and fault isolation.

10 Rise times are 10-90%. Typical rise times at the connector end of the 80E10B are significantly faster.

IConnect® can help you complete interconnect analysis tasks in minutes instead of days, resulting in faster system design time and lower design costs. IConnect® also enables impedance, S-parameters, and eye-diagram compliance testing as required by many serial data standards, as well as full channel analysis, Touchstone (SnP) file output, and SPICE modeling for multi-gigabit interconnects.

Failure analysis – quickly identify fault location

The 80E10B, with its <15 ps TDR reflected rise time, provides superior resolution to enable the fastest and most efficient fault isolation in package, circuit board, and on-chip failure analysis applications.

IConnect® Signal Integrity TDR and S-parameter software

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, providing as much as 50% cost savings compared to similar bandwidth VNAs, and dramatically speeding up measurements.

You can also take advantage of the IConnect® S-parameters command-line interface, which automates the S-parameter measurements to the overall suite of manufacturing tests you perform using your TDR instrument, significantly reducing test time while increasing measurement repeatability. The simplicity of S-parameter calibration using a reference (open, short, or through), and an optional 50 Ω load makes measurements, fixture de-embedding, and moving the reference plane a snap. Touchstone file format output enables easy S-parameter file sharing for further data analysis and simulations.

Tektronix offers several true-differential TDR modules, which in combination with IConnect® offers S-parameter measurements up to 50 GHz with up to –70 dB of dynamic range. This performance exceeds requirements for serial data analysis, digital design, and signal integrity applications, resolving down to 1% (–40 dB) accuracy of crosstalk, while electrical compliance testing masks typically call for measurements in the –10 to –30 dB range.

IConnect® software lets you:

- Quickly and easily generate SPICE and IBIS models for your PCBs, flex boards, connectors, cables, packages, sockets, and I/O buffer inputs directly from TDR/T or VNA S-parameter measurements
- Display eye diagram degradation, jitter, loss, crosstalk, reflections, and ringing in your digital system
- Substantially simplify the signal integrity analysis of the interconnect link, equalization and emphasis component design, and analysis of the interconnect link with transmitter and receiver
- IConnect® Linear Simulator lets the designer link several interconnect channels together to evaluate the total time, frequency domain performance, and eye diagram of the overall channel

For more information regarding the IConnect® software applications, see the *IConnect® Signal Integrity, TDR, and S-Parameter SW – 80SICMX • 80SICON • 80SSPAR* datasheet.

Measurement and analysis tools for optical testing applications

The DSA8300 includes a wide variety of measurement and analysis tools which specifically address optical testing applications. In addition to the standard amplitude and timing parametric measurements (such as rise/fall times, amplitude, RMS jitter, RMS noise, frequency, period, and so on), the measurement suite for the DSA8300 includes measurements specifically tailored to measuring optical signals (average optical power, extinction ratio, eye height, eye width, optical modulation amplitude (OMA), and so on). For a complete list of measurements, see the *Measurement* section of this datasheet.

The DSA8300 also includes standard compliance testing masks for all of the common optical standards from 155 Mb/s to 100 Gb/s. The DSA8300 mask testing system includes the ability to automatically fit standard and user masks to data acquired into a waveform database. The mask test system can also automatically determine the mask margin based either on the total number of mask violations or the "hit ratio" of mask violation to the number of samples acquired in the mask test unit interval. Users can also create custom masks for automated mask testing. Histograms and cursor measurements are also available to analyze optical signals acquired by the DSA8300.

Finally, the 80SJNB applications support complete jitter, noise, and BER analysis for optical signals. 80SJNB extends the DSA8300 mask testing functions to include mask testing on statistical models in PDF (probability density function) and CDF (cumulative distribution function) spaces. This approach is more accurate as the test is done on a larger and statistically more relevant population, in a shorter amount of time than traditional mask testing. The advanced version of this software (Option JNB02) supports mask test and evaluation of emphasis and equalization on impaired signals.

Sampling modules

High speed optical test solutions

The DSA8300 with its highly configurable mainframe and a wide variety of optical modules provide complete optical test solutions with superior system fidelity from 125 Mb/s to 100 Gb/s and beyond. The modules cover a range of wavelengths for both single- and multi-mode fibers. Each module can be optionally configured with several selectable Optical Reference Receiver [11] (ORR) filters and/or a full bandwidth path. Each module also supports fully calibrated clock recovery solutions (whether integrated into the module or through a data pick-off routed to an external clock recovery module or stand-alone clock recovery instrument).

See the *Optical sampling modules* table for a brief description of each available optical sampling module. See the *Optical sampling module selection guide* table for key specifications for each module. For more complete information on these modules, see the *Optical Sampling Modules – 80C07B • 80C08D • 80C10C • 80C11B • 80C12B• 80C14 • 80C15 • 80C17 • 80C18* datasheet.

Optical sampling modules

Module	Description
80C07B Broad wavelength multi-mode and single-mode high sensitivity <2.6 Gb/s	The 80C07B module is a broad-wavelength (700 to 1650 nm) multirate optical sampling module optimized for testing datacom/telecom signals from 125 Mb/s to 2.5 Gb/s. With its amplified O/E converter design, this module provides excellent signal-to-noise performance, allowing users to examine low-power optical signals. The 80C07B can be optionally configured with fully calibrated internal clock recovery that supports 125, 155, 622, 1063, 1250, 2125, 2488, 2500, and 2666 Mb/s rates.
80C08D Broad wavelength multi-mode and single-mode high sensitivity 10 Gb/s	The 80C08D module is a broad-wavelength (700 to 1650 nm) multirate optical sampling module providing datacom rate testing for 10GbE, 40GbE-R4, 100GbE-SR10 applications at 9.953, 10.3125, 11.0957 Gb/s and 10G Fibre Channel applications at 10.51875 and 11.317 Gb/s. The 80C08D also provides telecom rate testing at 9.953, 10.664, and 10.709 Gb/s. With its amplified O/E converter design, this module provides excellent signal-to-noise performance and high optical sensitivity, allowing users to examine low power level optical signals. The 80C08D can be optionally configured with an integrated clock recovery option that supports acquiring signals at any standard- or user-specified rate from 9.8 to 12.6 Gb/s.

11 Optical Reference Receiver (ORR) is a 4th-order Bessel-Thompson filter, with a nominal response and other details defined by standards. Details of the definition differ; Tektronix optimizes the response for best nominal fit and highest quality mask test results.

Module	Description
80C10C Ultra High Bandwidth single mode for 25G, 40G, and 56G	The 80C10C module provides integrated and selectable optical reference receiver [11] filtering, enabling conformance testing at either 1310 nm or 1550 nm of all standard 25, 40 and 100 (4 x 25) Gb/s standard rates. There are three configurations for the 80C10C: **Option F1**: Provides standard compliant optical reference receivers [11] for the following rates (standards): • 25.781 Gb/s (100GBase-LR4 and 100GBase-ER4) • 26.5625 (PAM4 50G per lane) • 27.952 Gb/s (OTU4) • 39.813 Gb/s (OC-768/STM-256, VSR2000 G.693, 40G NRZ G.959.1) • 41.25 Gb/s (40GBase-FR) • 43.018 Gb/s (G.709 FEC, OTU3 4×10G LAN PHY) • 44.5 Gb/s (OTU3) • 53.125 GBd (PAM4 Ethernet) • 57.8 GBd (64GFC) **Option F2**: Provides standard compliant optical reference receivers [11] for the following rates (standards): • 25.781 Gb/s (100GBase-LR4 and 100GBase-ER4) • 26.5625 (PAM4 50G per lane) • 27.952 Gb/s (OTU4) **Option F3**: Provides standard compliant optical reference receivers [11] for the following rates (standards): • 39.813 Gb/s (OC-768/STM-256, VSR2000 G.693, 40G NRZ G.959.1) • 41.25 Gb/s (40GBase-FR) • 43.018 Gb/s (G.709 FEC, OTU3 4×10G LAN PHY) • 44.5 Gb/s (OTU3) • 53.125 GBd (PAM4 Ethernet) • 57.8 GBd (64GFC) In addition to the filter rates, the user may also select bandwidths for the 80C10C for optimal noise vs. bandwidth performance for accurate signal characterization. When equipped with **Option CRTP** an electrical signal pickoff is provided for clock recovery. Clock recovery, to 28.6 Gb/s, for the 80C10C is provided using the CR286A clock recovery instrument (sold separately). When equipped with **Option HSPR**, a separate high-sensitivity photo receiver is provided with independent electrical outputs that can be used with external equipment (such as a Tektronix BERTScope) for high accuracy optical measurements. The 80C10C is also optionally available in a bundled ordering configuration which includes a single-channel 70+ GHz electrical sampling module.
80C11B Multirate Single mode 10 G	The 80C11B module is a long-wavelength (1100 to 1650 nm) multirate optical sampling module optimized for testing 10 Gb/s datacom and telecom standard rates at 9.953, 10.3125, 10.51875, 10.664, 10.709, 11.0957, 11.317, and 14.025 Gb/s. With its high optical bandwidth of up to 30 GHz (typical) it is well-suited for general-purpose high-performance 10 Gb/s optical component testing. The 80C11B can be optionally configured with clock recovery that can support any standard or user-defined rate in the continuous range from 9.8 to 12.6 Gb/s.
80C12B Multirate Broad wavelength multi-mode and single module high sensitivity up to 12.5 G	The 80C12B module is a broad wavelength (700 to 1650 nm) multirate optical sampling module providing telecom and datacom testing for standards from 155 Mb/s to 2.5 Gb/s. This highly flexible module can be configured to support a wide variety of 10 Gb/s applications, lower data rate applications (155 Mb/s to 7.4 Gb/s), or a combination of 10G and lower data rate standards. The low data rate applications include: Telecom applications from 155 to 2666 Mb/s, 1G, 2G, and 4G Fibre Channel, multilane standards such as 10GBASE-X4 and 4-Lane 10 Gb/s Fibre Channel, and Infiniband SDR and DDR rates. The supported 10 Gb/s application includes both datacom and telecom standards. The supported 10 Gb/s datacom applications include 10GbE, 40GbE-R4, 100GbE-SR10 applications at 9.953, 10.3125, 11.0957 Gb/s, and 10G Fibre Channel applications at 10.51875 Gb/s and 11.317 Gb/s. The 80C12B also provides telecom rate testing at 9.953, 10.664, and 10.709 Gb/s. With its amplified O/E converter design, this module provides excellent signal-to-noise performance and high optical sensitivity, allowing users to examine low-power optical signals. Clock recovery for the 80C12B is provided using the 80A05 module or CR125A clock recovery instrument (sold separately).

Module	Description
80C14 Broad wavelength multi-mode and single module high sensitivity to 16 G	The 80C14 module is a broad-wavelength (700 to 1650 nm) multirate optical sampling module providing 8G, 10G, and 16G telecom and datacom testing. The supported 10 Gb/s datacom applications include: 10GbE, 40GbE-R4, 100GbE-SR10 applications at 9.953, 10.3125, and 11.0957 Gb/s. Fibre Channel applications include: 8.500, 10.51875, 11.317, 14.025, and 14.063 Gb/s. The 80C14 also provides telecom rate testing at 9.953, 10.664, 10.709, and 12.5 Gb/s. With its amplified O/E converter design, this module provides excellent signal-to-noise performance and high optical sensitivity, allowing users to examine low power level optical signals. Clock recovery for the 80C14 is provided by the CR175A or CR286A (sold separately).
80C15 Broad wavelength multi-mode and single module high sensitivity up to 25 G	The 80C15 module provides integrated and selectable optical reference receiver [11] filtering, enabling conformance testing for single- and multi-mode optical signals at 850 nm, 1310 nm or 1550 nm of all standard 25-32 Gb/s standard rates. This module provides bandwidth filters for the following rates (standards): • 12.6 GHz el./16.8 GHz op. (100GBASE SR4 TDEC) • 25.781 Gb/s (100GBase-ER4, 100GBase-LR4, 100GBase-SR4, Infiniband EDR) • 26.5625 (PAM4 50G per lane) • 27.952 Gb/s (OTU4) • 28.050 Gb/s (32G Fibre Channel) • TDECQ (PAM4 standards) In addition to the filter rates, the user may also select bandwidths for the 80C15 for optimal noise vs. bandwidth performance for accurate signal characterization. **80C15 Option CRTP** provides a second, high-sensitivity optical input to drive Clock Recovery Trigger Pickoff (CRTP) electrical differential outputs for clock recovery functions or error detection.
80C17/18 Broad wavelength multi-mode and single module high sensitivity up to 25 G	The 80C17 (1-channel) and 80C18 (2-channel) modules provide integrated and selectable optical reference receiver filtering, enabling conformance testing for single- and multi-mode optical signals at 850 nm, 1310 nm or 1550 nm of all standard 25-32 Gb/s standard rates. This module provides bandwidth filters for the following rates (standards): • 12.6 GHz el./16.8 GHz op. (100GBASE SR4 TDEC) • 25.781 Gb/s (100GBase-ER4, 100GBase-LR4, 100GBase-SR4, Infiniband EDR) • 26.5625 (PAM4 50G per lane) • 27.952 Gb/s (OTU4) • 28.050 Gb/s (32G Fibre Channel) • TDECQ (PAM4 standards) In addition to the filter rates, the user may also select bandwidths for the 80C17/18 for optimal noise versus bandwidth performance for accurate signal characterization.

Optical sampling module selection guide

Character-istic	80C07B [12]	80C08D	80C10C [13] Opt F1	80C10C Opt F2	80C10C Opt F3	80C11B	80C12B [14] Opt. F0-F12	80C12B [14] Opt. 10G/ 10GP	80C14	80C15	80C17/18
Wavelength Range (nm)	700-1650	700-1650	1290-1330 1520-1620	1290-1330 1520-1620	1290-1330 1520-1620	1100-1650	700-1650	700-1650	700-1650	700-1650	800-1650
Unfiltered Optical Bandwidth (GHz)	2.5	12.5	70	55	80	30	12 [15]	12 [15]	12	32	30

12 There are specific reference receiver groupings supported for the 80C07B. See the 80Cxx Optical Module datasheet for detailed information.

13 The clock recovery trigger pick-off (Option CRTP) for the 80C10C can support trigger pick-off for data rates to >43 Gb/s.

14 There are specific reference receiver groupings supported for the 80C12B. See the 80Cxx Optical Module datasheet for detailed information.

15 The full 12 GHz bandwidth for the 80C12B is only available with Option F0, 10G, or 10GP.

Character-istic	80C07B [12]	80C08D	80C10C [13] Opt F1	80C10C Opt F2	80C10C Opt F3	80C11B	80C12B [14] Opt. F0-F12	80C12B [14] Opt. 10G/ 10GP	80C14	80C15	80C17/18
Fiber Input (µm)	9, 50, 62.5	9, 50, 62.5	9	9	9	9	9, 50, 62.5	9, 50, 62.5	9, 50, 62.5	9, 50, 62.5	9, 50
Mask Test Sensitivity (dBm) [16]	–22	–16 [17]	–8 [18]	–8	–8	–9	–19	–15	–15	–9	–14
Optical reference receivers [11] supported. For NRZ/PAM2, Gb/s & GBd are the same number; for PAM4, Gb/s is twice the number as GBd											
155 Mb/s	■						■				
622 Mb/s	■						■				
1.063 Gb/s	■						■				
1.250 Gb/s	■						■				
2.125 Gb/s	■						■				
2.488 Gb/s	■						■				
2.500 Gb/s	■						■				
2.66 Gb/s							■				
3.125 Gb/s							■				
3.188 Gb/s							■				
4.250 Gb/s							■				
5.000 Gb/s							■				
6.144 Gb/s							■				
7.373 Gb/s							■				
8.500 Gb/s						■	■	■	■		
9.953 Gb/s		■				■		■	■		
10.31 Gb/s		■				■		■	■		
10.51 Gb/s		■				■		■	■		
10.66 Gb/s		■				■		■	■		
10.71 Gb/s		■				■		■	■		
11.1 Gb/s		■				■		■	■		
11.3 Gb/s		■				■		■	■		
14.025 Gb/s						■			■		
14.063 Gb/s						■			■		
25.78 Gb/s			■	■						■	■
26.5625 Gb/s			■	■	■					■	■
27.74 Gb/s			■	■						■	■
28.05 Gb/s										■	■

12 There are specific reference receiver groupings supported for the 80C07B. See the 80Cxx Optical Module datasheet for detailed information.

13 The clock recovery trigger pick-off (Option CRTP) for the 80C10C can support trigger pick-off for data rates to >43 Gb/s.

14 There are specific reference receiver groupings supported for the 80C12B. See the 80Cxx Optical Module datasheet for detailed information.

16 All Mask Margins used by the oscilloscope are best conditions, ideal DUT.

17 Mask test sensitivity of the 80C08D reduced by ~1 dBm with internal clock recovery options.

18 Mask test sensitivity of the 80C10C reduced by ~0.6 dBm with internal clock recovery trigger pick-off (Option CRTP).

Characteristic	80C07B [12]	80C08D	80C10C [13] Opt F1	80C10C Opt F2	80C10C Opt F3	80C11B	80C12B [14] Opt. F0-F12	80C12B [14] Opt. 10G/ 10GP	80C14	80C15	80C17/18
39.81 Gb/s			■		■						
41.25 Gb/s			■		■						
43.02 Gb/s			■		■						
44.5 Gb/s			■		■						
53.125 GBd			■		■						
57.8 GBd			■		■						
TDECQ			■	■	■					■	■

Clock recovery for optical testing

In many optical applications, there is no data clock directly available to provide a reference signal for acquiring the signals from the device under test. In these situations, it is necessary to recover the clock from the data signal. The Tektronix 8000 Series of sampling oscilloscope products provides a complete complement of clock recovery solutions to meet this need. Each of these solutions is fully calibrated so that users do not need to do any manual calibration of the system to take into account any losses due to data pick-off being routed to the input of the clock recovery unit.

Shown below is a clock recovery solutions selection guide with the key specifications for each solution to help you select the solution(s) most appropriate for your application. For more detailed information on these solutions, see the 80Cxx Optical Sampling Modules datasheet (for clock recovery options integrated into the 80C07B, 80C08D, or 80C11B) or the appropriate clock recovery datasheets for stand-alone clock recovery modules or instruments.

Note: The stand-alone clock recovery modules/instruments have electrical inputs and can be used to recover clocks from electrical signals as well as from the electrical data pick-off outputs from the 80CXX Series optical sampling modules.

Note: Clock recovery is integrated into the optical module and controlled from the Trigger Setup menu of the 8000 Series oscilloscope.

Integrated clock recovery options

Characteristic	80C07B	80C08D Opt. CR4	80C11B Opt. CR3	80C11B Opt. CR4
Continuously Variable Rate Range (Gb/s)	Fixed Rates	9.8 - 12.6	Fixed Rates	9.8 - 12.6
Clock Recovery Sensitivity (dBm) [19]	–22	–15	–9	–9
Standard rates supported				
125, 155 Mb/s	■			
622 Mb/s	■			
1063 Mb/s	■			
1250 Mb/s	■			
2125 Mb/s	■			
2488, 2500 Mb/s	■			
9.95 Gb/s		■	■	■
10.31 Gb/s		■		■
10.52 Gb/s		■		■
10.66 Gb/s		■		■
10.71 Gb/s		■	■	■

12 There are specific reference receiver groupings supported for the 80C07B. See the 80Cxx Optical Module datasheet for detailed information.

13 The clock recovery trigger pick-off (Option CRTP) for the 80C10C can support trigger pick-off for data rates to >43 Gb/s.

14 There are specific reference receiver groupings supported for the 80C12B. See the 80Cxx Optical Module datasheet for detailed information.

19 Electrical clock recovery sensitivity is for differential input and varies with the input clock rate. See clock recovery datasheets for more information.

Characteristic	80C07B	80C08D Opt. CR4	80C11B Opt. CR3	80C11B Opt. CR4
11.10 Gb/s		■		■
11.30 Gb/s		■		■
14.025 Gb/s				
14.063 Gb/s				
25.78 Gb/s				
27.74 Gb/s				

Stand-alone (electrical) clock recovery modules/instruments

Characteristic	80A05 Std. [20]	80A05 Opt. 10G [20]	CR125A [21]	CR175A [21]	CR286A with Opt. HS [21]
Continuously Variable Rate Range (Gb/s)	50 - 3.188 4.25	50 - 3.188 3.267 - 4.25 4.900 - 6.375 9.8 - 12.6	0.1 - 12.5	0.1 - 17.5	0.1 - 28.6
Clock Recovery Sensitivity (mV_{p-p}) [22]	≤15	≤15	15	15	15
Adjustable Clock Recovery Loop Bandwidth and Peaking [23]			■	■	■
Standard rates supported					
125, 155 Mb/s	■	■	■	■	■
622 Mb/s	■	■	■	■	■
1063 Mb/s	■	■	■	■	■
1250 Mb/s	■	■	■	■	■
2125 Mb/s	■	■	■	■	■
2488, 2500 Mb/s	■	■	■	■	■
2.66 Gb/s	■	■	■	■	■
3.125, 3.188 Gb/s	■	■	■	■	■
4.25 Gb/s	■	■	■	■	■
5.00 Gb/s		■	■	■	■
6.14 Gb/s		■	■	■	■
7.37 Gb/s		■	■	■	■
8.5 Gb/s		■	■	■	■
9.95 Gb/s		■	■	■	■
10.31 Gb/s		■	■	■	■
10.52 Gb/s		■	■	■	■
10.66 Gb/s		■	■	■	■
10.71 Gb/s		■	■	■	■
11.10 Gb/s		■	■	■	■
11.30 Gb/s		■	■	■	■
12.50 Gb/s			■	■	■

20 The clock recovery module plugs into one of the 8000 Series large module slots and is controlled from the Trigger Setup menu.

21 Stand-alone clock recovery instrument; controllable from the BERTScope clock recovery instrument control application, accessible from the App menu of the 8000 Series oscilloscope.

22 Electrical clock recovery sensitivity is for differential input and varies with the input clock rate. See clock recovery datasheets for more information.

23 For more information on clock recovery loop bandwidth and peaking, see clock recovery datasheets.

Characteristic	80A05 Std. [20]	80A05 Opt. 10G [20]	CR125A [21]	CR175A [21]	CR286A with Opt. HS [21]
14.025 Gb/s			■	■	■
14.063 Gb/s			■	■	■
25.78 Gb/s					■
27.74 Gb/s					■

High-performance electrical test solutions

The DSA8300 is also well-suited for a variety of high-performance electrical applications. With the modular system, users can configure their DSA8300 with a variety of electrical modules that are best suited to their requirements. the following table provides key specifications for the current electrical sampling modules available for use with the DSA8300, to help you select the electrical module(s) most appropriate for your application. Detailed specifications are available in the 80E00 Electrical Sampling Modules datasheet.

Electrical sampling module selection guide

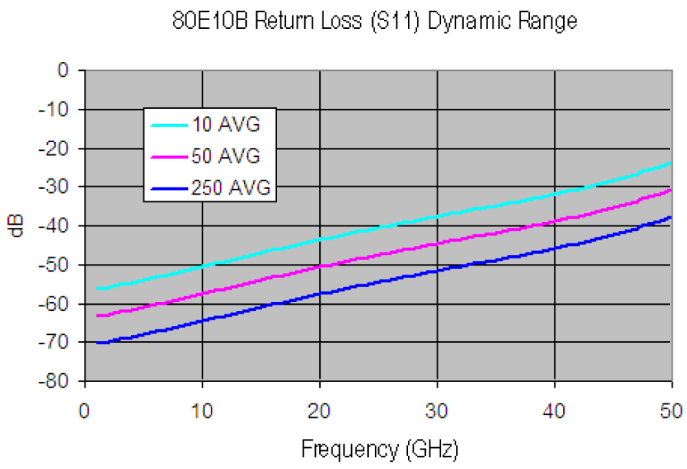
Characteristic	80E01	80E03	80E07B	80E09B	80E11, 80E11X1	80E04 (TDR Module)	80E08B (TDR Module)	80E10B (TDR Module)
Channels	1	2	2	2	2 (80E11) 1 (80E11X1)	2	2	2
Bandwidth	50 GHz	20 GHz	20/30 GHz (user selectable)	30/40/60 GHz (user selectable)	40/60/70 GHz (user selectable)	20 GHz	20/30 GHz (user selectable)	30/40/50 GHz (user selectable)
Step response at full bandwidth (10-90%)	7 ps	17.5 ps	11.7 ps	5.8 ps	5.0 ps	17.5 ps	11.7 ps	7 ps
RMS Noise	1.8 mV	600 µV	280 µV at 20 GHz 300 µV at 30 GHz	300 µV at 30 GHz 330 µV at 40 GHz 450 µV at 60 GHz	330 µV at 40 GHz 450 µV at 60 GHz 950 µV at 70 GHz	600 µV	280 µV at 20 GHz 300 µV at 30 GHz	300 µV at 30 GHz 370 µV at 40 GHz 600 µV at 50 GHz
Incident TDR Step Rise Time (10-90%), typical	-	-	-	-	-	23 ps	18 ps	12 ps
Reflected TDR Step Rise Time (10-90%), typical	-	-	-	-	-	28 ps	20 ps	15 ps
Remote Sampling Capability	w/ optional 80X01 or 80X02 extender cable	w/ optional 80X01 or 80X02 extender cable	Fully integrated 2 m remote cable	Fully integrated 2 m remote cable	w/ optional 80X01 or 80X02 extender cable	w/ optional 80X01 or 80X02 extender cable	Fully integrated 2 m remote cable	Fully integrated 2 m remote cable

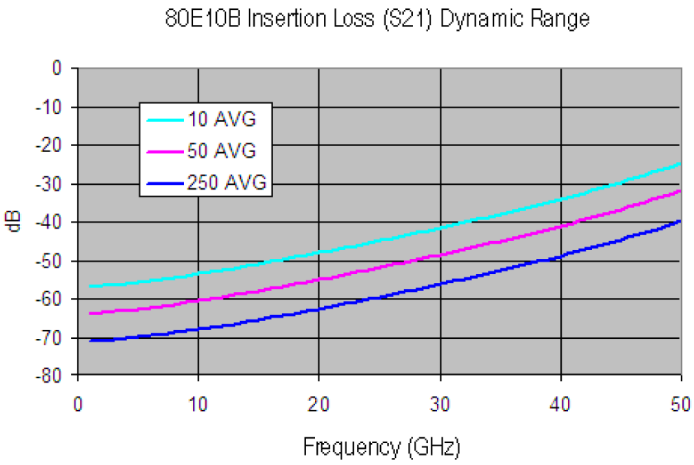
S-parameter performance characteristics (80E10B)

- All measurements were performed after proper warm up as specified in the DSA8300 manual
- Standard S-parameter dynamic range measurement practices were used to determine the dynamic range of the module
- Uncertainty results were derived from a wide range of devices, with 250 averages
- Better dynamic range can be achieved by selecting lower bandwidth settings on the 80E10B module due to a lower RMS noise floor
- Results apply to single-ended or differential measurements

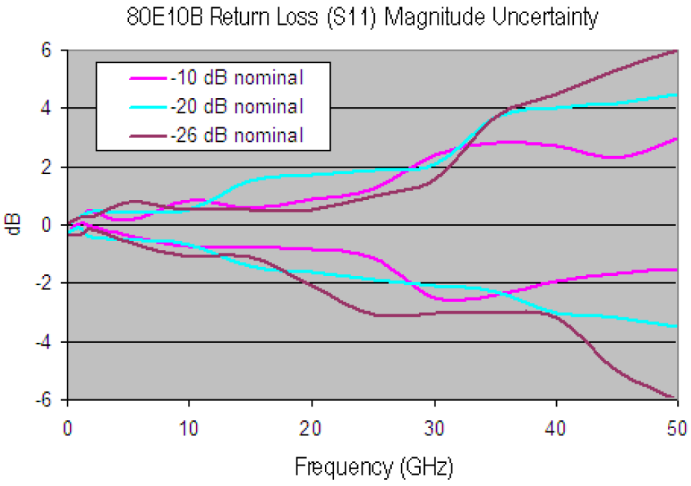
20 The clock recovery module plugs into one of the 8000 Series large module slots and is controlled from the Trigger Setup menu.

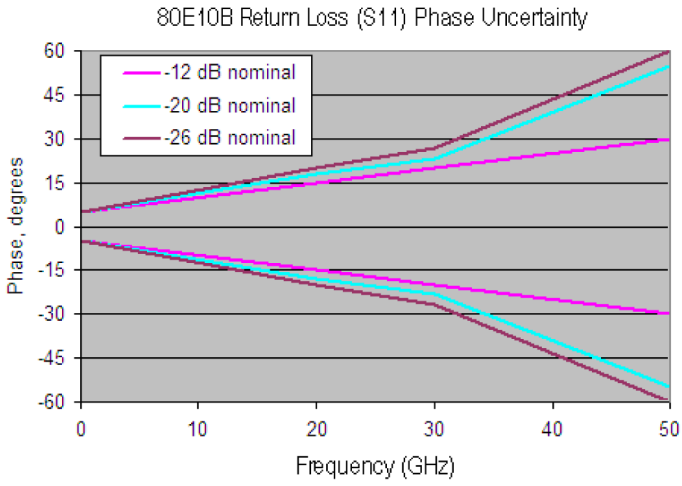
21 Stand-alone clock recovery instrument; controllable from the BERTScope clock recovery instrument control application, accessible from the App menu of the 8000 Series oscilloscope.





80E10B dynamic range





80E10B uncertainty

Test solutions for 100 Gb/s (4 x 25 Gb/s) electrical standards

With the continued increase in high-bandwidth applications, the need to test electrical components, modules and systems at high data rates is proliferating. An example of such data rates is the CEI 3.0 VSR-28 interface. This interface transfers data over multiple electrical channel at rates up to 28.6 Gb/s. Such signals place significant performance challenges on the test and measurement equipment used to acquire and analyze the devices under test.

Some of these challenges include:

- The need to acquire the signal with excellent signal fidelity - this requirement has several implications for the test instrumentation:
  - Low instrumentation noise
  - Low instrumentation jitter
  - The need to acquire the signal as close to the DUT as possible - thereby reducing signal degradation and potential inter-symbol interference
- The need to recover the clock from the data stream to acquire signals under test and to do detailed analysis of these signals.

The DSA8300 with its modular architecture, and its associated modules and accessories, provides all of the components necessary to fully test multi-lane high bit-rate signals. To simplify configuring a system to test such devices, Tektronix offers the following product bundle:

80B28G - a DSA8300 product bundle for 28 Gb/s applications

This bundle, when used with a DSA8300, provides all of the electrical sampling modules, accessories, and clock recovery capabilities needed to test applications at rates from 10 Gb/s to 28.6 Gb/s per lane. The bundle includes the following products:

- 1 ea. 80E09B: dual channel, 70 GHz Remote Electrical Sampling Module
- 1 ea. 82A04B: Phase Reference Module that supports sub-100 fs instrumentation jitter when used with the 80E09B
- 1 ea. CR286A with Option HS: 28.6 GHz clock recovery instrument that supports clock recovery at rates from 150 Mb/s to 28.6 Gb/s
- 1 ea. 80X01: 1-meter sampling module extender cable used to extend the phase reference module to connect directly to the clock recovery module
- 1 ea. 80A08 : accessory kit with all of the necessary cables, adapters, DC blocks and other accessories to configure a complete test solution

To extend this solution to test additional lanes in a multi-lane application, simply install additional 80E09B dual channel remote sampling modules.

Specifications

Product specifications and descriptions in this document are subject to change without notice.

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise.

Vertical system

Rise Time / Bandwidth	Determined by the sampling modules used
Vertical Resolution	16 bits over the sampling modules' dynamic range Electrical Resolution: <20 µV LSB (for 1 V full range) Optical resolution depends on the dynamic range of the optical module – ranges from <20 nW for the 80C07B (1 mW full range) to <0.6 µW for the 80C10C (30 mW full range)

Horizontal system

Main and Magnification View Time Bases, Horizontal Scale	100 fs/div to 1 ms/div, in 1-2-5 sequence or 100 fs increments
Time Interval Accuracy	
Trigger Direct (Front Panel) Input	Horizontal scale >20 ps/div, right-most point of measurement interval <150 ns; Mean Accuracy: 0.1% of interval, STDEV: ≤1 ps Horizontal scale ≤20 ps/div, right-most point of measurement interval <150 ns; Mean Accuracy: 1 ps + 0.5% of interval
Clock Input/Prescale Trigger (Front Panel), Eye or Pattern Mode	Mean accuracy determined by clock input accuracy STDEV: <0.7 ps (max); <0.1 ps (typical)
Clock Input/Prescale Trigger (Front Panel), Other Mode	Horizontal scale >20 ps/div, right-most point of measurement interval <150 ns; Mean Accuracy: 0.1% of interval, STDEV: ≤3 ps Horizontal scale ≤20 ps/div, right-most point of measurement interval <150 ns; Mean Accuracy: 1 ps + 0.5% of interval
TDR Clock Trigger (Lock to External 10 MHz Clock)	Horizontal scale >20 ps/div, right-most point of measurement interval <150 ns; Mean Accuracy: 0.01% of interval, STDEV: ≤1 ps (0.1 ps typical)
Random Phase Corrected Mode (Clock Input to 82A04B)	Maximum timing deviation 0.1% of phase reference signal period, typical, relative to phase reference signal For more information on phase reference modes of operation, see the “Phase Reference Module for the DSA8300 Sampling Oscilloscope” datasheet.
Triggered Phase Corrected Mode (Clock Input to 82A04B)	Maximum timing deviation relative to phase reference signal: >40 ns after trigger event: 0.2% of phase reference signal period, typical ≤40 ns after trigger event: 0.4% of phase reference signal period, typical
Horizontal Deskew Range Available	SW: –500 ps to +100 ns on any individual channel in 100 fs increments, some limitations apply to software deskew TDR and sampling modules. Note that SW deskew implies acquiring another waveform, at a different horizontal position; a throughput penalty exists. Mainframe channel delay (HW deskew): Sample mode: 80E11 and 80E11x1: ±35 ps 80E07B, 80E08B, 80E09B, and 80E10B: ±150 ps 80C17, 80C18: +/- 65 ps TDR mode: 80E08B and 80E10B: ±200 ps

Horizontal system

DSA8300 Record Length	50, 100, 250, 500, 1000, 2000, 4000, 8000, or 16000 samples (magnification views have maximum record length of 4000 samples)
Longer Records Available	IConnect®: 1M samples
	80SJNB Jitter, Noise, and BER Analysis Software: 10M samples (100k unit intervals, 100 samples per unit interval)

Trigger system

Trigger Sources	Clock Input/Prescale Trigger (front panel)
	TDR clock (generated internally)
	Clock recovery triggers from Optical Sampling modules and Electrical Clock Recovery modules (internally connected)
	Phase Reference (when using the 82A04B Phase Reference module) time base supports acquisitions without a trigger signal in its Free Run mode
	Trigger Direct Input (front panel)
Clock Input / Prescale Trigger Input	
Clock Input Sensitivity	150 mV_{p-p} to 1 V_{p-p}, 0.15 GHz to 20 GHz (typical)
	200 mV_{p-p} to 1 V_{p-p}, 0.8 GHz to 15 GHz (guaranteed)
Minimum Slew Rate	≥2 V/ns
Clock Input Range	1.0 V_{p-p} (max) – AC coupled
Pattern Lengths Supported (for Pattern Triggering with ADVTRIG Option)	2 to 2^{23} (8,388,608) inclusive
Clock Input Jitter in Clock-eye and Clock-pattern Trigger Modes (Typical)	0.15 - 0.40 GHz: 900 fs (RMS)
	0.40 - 1.25 GHz: 800 fs
	1.25 - 20 GHz: 425 fs
Clock Input Jitter in Clock-eye and Clock-pattern Trigger Modes (Max)	0.80 - 1.25 GHz: 900 fs (RMS)
	1.25 - 11.20 GHz: 500 fs
	11.20 - 15.0 GHz: 600 fs
TDR Trigger	
TDR Step Rate	Selectable from 25 to 300 kHz in 1 kHz steps
	Actual TDR step rate may vary up to 2% from requested rate
TDR Trigger Jitter	1.3 ps RMS (typical) 1.8 ps RMS (max)
Phase Reference Time Base	
Phase Reference Input Range	Standard 82A04B: 8 - 32 GHz (guaranteed), 2 - 32 GHz (typical)
	82A04B Option 60G: 8 - 60 GHz (guaranteed), 2 - 70 GHz (typical)
	For non-sinusoidal clock at frequencies <8 GHz, it may be necessary to filter the clock input to eliminate harmonics from the clock signal (see accessories 020-2566-xx, 020-2567-xx, and 020-2568-xx)
Phase Reference Input Sensitivity	Best jitter performance is with the clock input to the 82A04B in the following range: 0.6 - 1.8 V. The phase reference time base remains operational to 100 mV (typical) with increased jitter
Jitter	f ≥8 GHz: 100 fs RMS, on a 10 GHz or faster sampling module
	2 GHz ≤ f ≤ 8 GHz: 140 fs RMS, typical on a 10 GHz or faster acquisition module

Trigger system

Trigger Direct Input

Trigger Sensitivity	50 mV, DC - 4 GHz (typical) 100 mV, DC - 3 GHz (guaranteed)
Trigger Level Range	±1.0 V
Trigger Input Range	±1.5 V
Trigger Holdoff	Adjustable 5 µs to 50 ms in 0.5 ns increments
Trigger Direct Input Jitter	1.1 ps RMS + 5 ppm of horizontal position (typical) 1.5 ps RMS + 10 ppm of horizontal position (max)

Acquisition system

Acquisition modes	Sample (Normal), Envelope, and Average
Number of sampling modules accommodated	Up to 4 dual-channel electrical; up to 2 optical sampling modules. Population of the CH1/CH2 large slot with any module other than one requiring power only displaces functionality of the CH1/CH2 small slot; population of the CH3/CH4 large slot with any module other than one requiring power only displaces functionality of the CH3/CH4 small slot.
Number of simultaneously acquired inputs	8 channels maximum
Maximum acquisition rate	300 kS/s per channel in TDR mode 200 kS/s per channel in all other nonphase reference modes 120 kS/s per channel in phase reference modes

Waveform measurements

System Measurement Rate	The DSA8300 supports up to 8 simultaneous measurements, updated 3 times per second with optional display of per-measurement statistics (min, max, mean, and standard deviation)
Measurement Set	Over 120 automated measurements include RZ, NRZ, and pulse signal types, and the following measurement types:
Amplitude Measurements	High, Low, Amplitude, Peak-to-Peak, Max, Mid, Min, Mean, +Overshoot, –Overshoot, P-P, Average Optical Power (dBm, watts), Noise, RMS Noise, SNR, Eye Height, Eye Opening Factor, Extinction Ratio (Ratio, %, dB), Suppression Ratio (Ratio, %, dB), OMA, Q-factor, RMS, AC RMS, Cycle RMS, Cycle Mean, Gain, Crossing %, Crossing Level OMA, VMA
Timing Measurements	Rise, Fall, Period, Bit Rate, Bit Time, Frequency, Crossing Time, +Cross, –Cross, Jitter (P-P, RMS), Eye Width, +Width, –Width, Burst Width, +Duty Cycle, –Duty Cycle, Duty Cycle Distortion, Delay, Phase, Pulse Symmetry
Area Measurements	Area, Cycle Area
Cursors	Dot, vertical bar, and horizontal bar cursors
Waveform Processing	Up to 8 math waveforms can be defined and displayed using the following math functions: Add, Subtract, Multiply, Divide, Average, Differentiate, Exponential, Integrate, Natural Log, Log, Magnitude, Min, Max, Square Root, and Filter. In addition, measurement values can be utilized as scalars in math waveform definitions
Mask Testing	For many applications, standard masks are available as predefined, built-in masks. Many of the most commonly used standard masks are shown in the following supported standards list. Contact your local Tektronix representative to get a list of all available masks. Unless otherwise noted, file-based masks are used to distribute new, Tektronix factory-created, updated masks as a file loadable by the firmware. User-defined masks allow the user to create (through UI or PI) user masks

Waveform measurements

Supported standards

Type	Standard
Ethernet	100BASE-LX10 125.0 Mb/s 100BASE-BX10 125.0 Mb/s Gigabit Ethernet 1.250 Gb/s 1000BASE-KX 1.250 Gb/s 2 GBE 2.500 Gb/s 10GBASE-X4 3.125 Gb/s 10GBASE-W 9.95328 Gb/s 10GBASE-R 10.3125 Gb/s FEC11.10 11.095728 Gb/s 10GBASE-LRM 10.31250 Gb/s 40GBASE-FR 41.25 Gb/s 40GBASE-LR4 10.3125 Gb/s 40GBASE-SR4 10.3125 Gb/s 100GBASE-ER4 25.71825 Gb/s 100GBASE-LR4 25.71825 Gb/s 100GBASE-SR10 10.3125 Gb/s 100GBASE-SR4 25.7185 Gb/s
SONET/SDH	OC-1/STM-0 51.84 Mb/s OC-3/STM-1 155.52 Mb/s OC-12/STM-4 622.08 Mb/s OC-48/STM-16 2.48832 Gb/s FEC2.666 2.6660571 Gb/s OC-192/STM-64 9.95328 Gb/s FEC10.66 10.6642 Gb/s FEC10.71 10.709225 Gb/s OTU4 27.95 Gb/s OC-768/STM-256 39.81312 Gb/s FEC42.66 42.6569 Gb/s FEC43.02 43.018414 Gb/s
Fibre Channel Optical	FC133 132.81 Mb/s FC266 265.6 Mb/s FC531 531.2 Mb/s FC1063 1.0625 Gb/s FC2125 2.125 Gb/s FC4250 4.250 Gb/s 8GFC 8.500 Gb/s 10GFC 10.518750 Gb/s FC11317 11.3170 Gb/s 16GFC MM r6.1 14.025 Gb/s 16GFC SM r6.1 14.025 Gb/s 32GFC 28.05 Gb/s
Fibre Channel Electrical	FC133 132.81 Mb/s FC266 265.6 Mb/s FC531 531.2 Mb/s FC1063 1.0625 Gb/s FC2125E 2.125 Gb/s: Abs, Beta, Tx/Rx; Abs, Gamma, Tx/Rx FC4250E 4.250 Gb/s: Abs, Beta, Tx/Rx; Abs, Gamma, Tx/Rx FC8500E 8.500 Gb/s: Abs, Beta, Tx/Rx; Abs, Gamma, Tx/Rx
SATA	G1 1.500 Gb/s Tx, Rx G2 3.000 Gb/s Tx, Rx G3 6.000 Gb/s Tx, Rx

Display system

Touch Screen Display	264 mm / 10.4 in. diagonal, color, LCD
Colors	16,777,216 (24 bits)
Video Resolution	1024 horizontal by 768 vertical displayed pixels
Magnification Views	In addition to the main time base, the DSA8300 supports two magnification views. These magnifications are independently acquired using separate time-base settings which allow same or faster time/div than that of the main time base

Input output ports

Front Panel

USB 2.0 Port(s)	One USB 2.0 connector (instruments shipped after 12/2012 have 3 USB ports on the front panel)
Anti-static Connection	Banana-jack connector, 1 MΩ
Trigger Direct Input	See Trigger System specification
Clock Input / Prescale Trigger	See Trigger System specification
TDR Clock Output	See Trigger System specification
DC Calibration Output	±1.25 V maximum

Rear Panel

USB Ports	4 USB 2.0 connectors
LAN Port	RJ-45 connector, supports 10/100/1000BASE-T
Serial Ports	DB-9 COM1, COM2 ports
GPIB	IEEE488.2 connector
DVI-I Video Port	DVI connector, female
	Connect to show the oscilloscope display, including live waveforms on an external monitor or projector. The primary Windows desktop can also be displayed on an external monitor using these ports.
	Alternatively, the DVI-I port can be configured to show the secondary Windows desktop (also called extended desktop or dual-monitor display).
	DVI to VGA 15-pin D-sub connector adapter provided
PS2 Serial Ports	Mouse and keyboard inputs
Audio Ports	1/8 in. microphone input and line output

Data storage

Waveform Databases	4 independently accumulated waveform records of up to 4M waveform points each. Variable waveform database mode with true first-in/first-out of up to 2000 waveforms available on each of 4 waveform databases (2M samples maximum / waveform database)
Hard Disk Drive	Rear-panel, removable hard disk drive, 500 GB capacity
Optical Drive	Front-panel DVD Read Only / CD Read-Write drive with CD-creation software application
Nonvolitile storage	USB 2.0 flash memory

Computer system

Operating System	Microsoft Windows 7 Ultimate (32-bit)
CPU	3 GHz Intel Core™ 2 Duo CPU

Power source

Line voltage and frequency	90 V to 250 V 50 Hz to 400 Hz
Power Consumption	205 W, typical, mainframe only 330 W, typical, fully loaded 600 W, maximum

Physical characteristics

Dimensions

	mm	Inches
Width	475	18.0
Height	343	13.5
Depth	419	16.5

	kg	lb
Weight	21	46

EMC, environment and safety

Temperature	
Operating	+10 to +40 °C
Nonoperating	–22 to +60 °C
Altitude	
Operating	3,048 m (10,000 ft.)
Nonoperating	12,190 m (40,000 ft.)
Relative Humidity	
Operating (CD-ROM not installed)	20% to 80% at or below 40 °C (upper limit de-rates to 45% relative humidity at 40 °C)
Electromagnetic compatibility	2004/108/EC
Safety	UL3111-1, CSA1010.1, EN61010-1, IEC61010-1

Ordering information

For more detailed information about the DSA8300 Digital Serial Analyzer sampling oscilloscope, download the *DSA8300 Digital Serial Analyzer, 80C00 Series Sampling Modules, 80E00 Series Sampling Modules, 80A00 Modules Specifications Technical Reference* (Tektronix part number 077-0571-xx) from www.tek.com.

Models

DSA8300	Digital Serial Analyzer Sampling Oscilloscope

Standard accessories

071-2897-XX	DSA8300 Digital Serial Analyzer Quick Start User Manual
119-7083-XX	Keyboard
119-7054-XX	Mouse
200-4519-XX	Instrument front cover
016-1441-XX	Accessory pouch
119-6107-XX	Touch screen styluses (2)
006-3415-XX	ESD wrist strap with 6 foot coiled cord
063-4356-XX	DSA8300 Product Documentation CD
Not orderable	DSA8300 Online Help (part of application software)
Not orderable	DSA8300 Programmer Online Manual (part of application software)
020-3088-XX	DSA8300 TekScope Product Software Install Kit
Type dependent on selection during order placement	Power cord
013-0347-XX	VGA female to DVI male adapter

Instrument options

Options

ADVTRG	Add Advanced Trigger with Pattern Sync
80SSR4	100GBASE-SR4 Comprehensive Transmitter compliance testing
80STDEC	100GBASE-SR4 Transmitter and Dispersion Eye Closure (TDEC) testing
80S400G-TXO	PAM4 Optical transmitter compliance package. Also enables the TDECQ measurement feature in the 80SJNB opt. PAM4 opt. Advanced.
PAM4	PAM4 Transmitter Analysis Software (requires option JNB01 (80SJNB Advanced) or option JNB02 (80SJNB Advanced with SDLA Visualizer) software)
CEI-VSR	OIF CEI 3.0 Compliance Solution for DSA8300
JNB	Add 80SJNB Essentials. Any version of 80SJNB also includes 80SJARB and the RIN/RINxOMA applications.
JNB01	Add 80SJNB Advanced
JNB02	Add 80SJNB Advanced with SDLA Visualizer
JARB	Add 80SJARB (included with Option JNB, JNB01, or JNB02)
ICMX	IConnect® and MeasureXtractor Signal Integrity and Failure Analysis Software

ICON	IConnect® Signal Integrity and Failure Analysis Software
SPAR	IConnect® S-parameters Software

Power plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A4	North America power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A12	Brazil power plug (60 Hz)
Opt. A99	No power cord

Language options

Opt. L0	English manual
Opt. L7	Simplified Chinese manual
Opt. L8	Traditional Chinese manual
Opt. L10	Russian manual

Language options include translated front-panel overlay for the selected language(s).

Service options

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. CA1	Single Calibration or Functional Verification
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. IF	Upgrade Installation Service
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

Probes and accessories are not covered by the oscilloscope warranty and Service Offerings. Refer to the datasheet of each probe and accessory model for its unique warranty and calibration terms.

DSA83UP - DSA8300 upgrade kit

ADVTRIG	Add Advanced Trigger with Pattern Sync
HDD8	Additional hard disk drive complete with assembled mounting bracket, operating system, and oscilloscope application
JARB	Add 80SJARB (included with Option JNB, JNB01, or JNB02)
JNB	Add 80SJNB Essentials
JNB01	Add 80SJNB Advanced
JNB02	Add 80SJNB Advanced with SDLA Visualizer
JNBTOJNB01	Upgrade from JNB to JNB Advanced
JNBTOJNB02	Upgrade from JNB to JNB Advanced with SDLA Visualizer
JNB01TOJNB02	Upgrade JNB01 to JNB02 (Adds SDLA Visualizer)
80SSR4	100GBASE-SR4 Comprehensive Transmitter compliance testing (Includes TDEC); recommend sampling modules 80C18 or 80C17, or 80C15 with Opt. CRTP
80STDEC	100GBASE-SR4 Transmitter and Dispersion Eye Closure (TDEC); recommend sampling modules 80C18 or 80C17, or 80C15 with Opt. CRTP
80S400G-TXO	For PAM4 optical compliance tests and TDECQ measurement
PAM4	Upgrade 80SJNB: add PAM4 Transmitter Analysis capability; requires 80SJNB Advanced (JNB01) or 80SJNB Advanced+SDLA (JNB02) software
CEI-VSR	OIF CEI 3.0 Compliance Solution for DSA8300

DSA8300 Rack Mount

016-1791-02	DSA8300 Rack Mount Kit

Optional Accessories

Optical modules

Optical modules plug directly into the large slot of the DSA8300 sampling oscilloscope mainframe. See the *Optical Sampling Modules – 80C07B • 80C08D • 80C10C • 80C11B • 80C12B • 80C14 • 80C15• 80C17• 80C18* datasheet for more details.

All optical modules have FC/PC connectors installed. Other connector adapters available as options are: ST/PC, D4/PC, Biconic, SMA 2.5, SC/PC, DIN/PC, HP/PC, SMA, DIAMOND 3.5.

80C07B	2.5 GHz single-mode and multi-mode, amplified (750 to 1650 nm) optical module for multirate datacom and telecom applications w/ optional integrated clock recovery
80C08D	9 GHz optical channel; single-mode and multi-mode, amplified (750 to 1650 nm) optical module optimized for 8.5 to 12.5 Gb/s applications with optional integrated clock recovery
80C10C	55/70/80 GHz; single-mode (1290 to 1330 nm and 1520 to 1620 nm) optical module with reference receiver [24] filters for multirate datacom and telecom 40 Gb/s and 100 Gb/s (4 × 25 Gb/s) and PAM4 50G/100G/200G/400G at 25+GBd and 53+GBd applications with optional calibrated trigger pick-off for use with external clock recovery instruments (such as the CR286A)
80C11B	30 GHz, single-mode (100 to 1650 nm) optical module with reference receiver [24] filters for 8.5 to 14.1 Gb/s telecom and datacom standards. Optional, integrated clock recovery for 8.5 to 12.6 Gb/s applications
80C12B	12 GHz optical channel; single-mode and multi-mode, amplified (750 to 1650 nm) optical module with optical reference receivers [24] to support 155 Mb/s to 12.5 Gb/s applications with calibrated trigger pick-off for use with external clock recovery instruments (such as the 80A05 or CR125A)

[24] Optical Reference Receiver (ORR) is a 4th-order Bessel-Thompson filter, with a nominal response and other details defined by standards. Details of the definition differ; Tektronix optimizes the response for best nominal fit and highest quality mask test results.

80C14	12 GHz optical channel; single-mode and multi-mode, amplified (750 to 1650 nm) optical module optimized for 8.5 to 12.5 Gb/s applications with calibrated trigger pick-off for use with external clock recovery instruments (such as the CR175A or CR286A)
80C15	32 GHz, single-mode and multi-mode optical module with bandwidth filters for multirate datacom and telecom 25, 100 (4x25) Gb/s, and PAM4 for 50G/100G/200G/400G applications. Option CRTP provides a second, high-sensitivity optical input to drive Clock Recovery Trigger Pickoff (CRTP) electrical differential outputs for clock recovery (using the Tektronix CR286A) or error detection functions (using the Tektronix PED4001).
80C17, 80C18	32 GHz, single-mode and multi-mode, 1 and 2 channel, optical modules with bandwidth filters for multirate datacom and telecom 25, 100 (4x25) Gb/s, and PAM4 for 50G/100G/200G/400G applications.

Electrical modules

Electrical modules plug directly into one of four small slots of the DSA8300 sampling oscilloscope mainframe. See the "Electrical Sampling Modules – 80E11 • 80E11X1 • 80E10B • 80E09B • 80E08B • 80E07B • 80E04 • 80E03 • 80E01" datasheet for more details.

80E11	70/60/40 [25] GHz electrical sampler, dual channel
80E11X1	70/60/40 [25] GHz electrical sampler, single channel
80E10B	Remote [26] Sampling Module – 50/40/30 [25] GHz electrical, dual-channel with true-differential TDR capabilities
80E09B	Remote [26] Sampling Module – 60/40/30 [25] GHz electrical, dual-channel
80E08B	Remote [26] Sampling Module – 30/20 [25] GHz electrical, dual-channel with true-differential TDR capabilities
80E07B	Remote [26] Sampling Module – 30/20 [25] GHz electrical, dual-channel
80E04	20 GHz electrical sampler, dual-channel with true-differential TDR capabilities. For remote sampling use the 80X01 or 80X02 Electrical Sampling Module Extender Cables
80E03	20 GHz electrical sampler, dual-channel. For remote sampling use the 80X01 or 80X02 Electrical Sampling Module Extender Cables
80E01	50 GHz, single-channel electrical sampler. For remote sampling use the 80X01 or 80X02 Electrical Sampling Module Extender Cables

Phase reference module

The 82A04B Phase Reference module, when installed in the DSA8300 and provided with a clock synchronous with the data to be acquired, provides a very low-jitter time base for acquiring signals from the device under test. It can accommodate clocks from 2 GHz [27] to >60 GHz.

82A04B	Phase Reference Module – Standard module supports clocks up to 32 GHz. With Option 60G it supports clocks to >60 GHz

Clock recovery module/instrument

CR125A	Electrical Clock Recovery instrument. CR125A recovers clocks from serial data streams for all of the most common electrical standards in the continuous 100 Mb/s to 12.5 Gb/s range. Applicable to electrical signals and for 80C12B
CR175A	Electrical Clock Recovery instrument. CR175A recovers clocks from serial data streams for all of the most common electrical standards in the continuous 100 Mb/s to 17.5 Gb/s range. Applicable to electrical signals and for 80C12B and 80C14
CR286A-HS	Electrical Clock Recovery instrument. CR286A recovers clocks from serial data streams for all of the most common electrical standards in the continuous 100 Mb/s to 28.6 Gb/s range. Applicable to electrical signals and for 80C12B, 80C14, and 80C10B/ 80C10C (for rates up to 28.6 Gb/s). Note: Option HS (High Sensitivity) is needed for most usage.

25 User-selectable bandwidth.

26 Each remote sampler/TDR generator is on a separate 2-meter remote cable for easy co-location with the device under test and best acquired signal fidelity.

27 For clock frequencies <8 GHz, it may be necessary to filter the clock input to eliminate harmonics from the clock signal (see Other Accessories 020-2566-xx, 020-2567-xx, and 020-2568-xx).

Product bundle for 10-28 Gb/s applications

80B28G	Product bundle which includes one each of the following products: 80E09B Electrical Sampling Module; 82A04B Phase Reference Module; CR286A-HS 28.6 GHz Clock Recovery instrument; 80X01: 1-meter sampling module extender cable; and 80A08 28 Gb/s Measurements Accessory Kit.

Recommended Accessories

80A09	26 GHz ESD Protection Device (in-line always active)
80A02	EOS/ESD isolation module for electrical static isolation of electrical sampling modules
80A03	TEKConnect probe interface module
80A08	Accessory kit for electrical measurements up to 28 Gb/s; includes electrical trigger pick-off with cables for CRU, all in 2.4 mm.
80X01	1-meter electrical sampling module extender cable
80X02	2-meter electrical sampling module extender cable

Calibration kits and accessories (3rd party)

For best S-parameter measurement results with the 80E10B, 80E08B, and 80E04 electrical TDR modules and IConnect® software, we recommend precision calibration kits, adapter kits, connector savers, airlines, torque wrenches, and connector gauges from Maury Microwave.

These components are compatible with the 2.92 mm, 2.4 mm, and 1.85 mm connectors of the 80E00 modules. Contact Maury Microwave (www.maurymw.com/tektronix.htm) to order calibration kits and other components.

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

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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.tek.com.

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