Tektronix

Electrical Sampling Modules Datasheet

80E11 • 80E11X1 • 80E10B • 80E09B • 80E08B • 80E07B • 80E04 • 80E03 • 80E03-NV

The DSA8300 Series Sampling Oscilloscope, when configured with one or more electrical sampling modules, provides complete test solutions for multi-channel, high-bandwidth electrical applications. This highly configurable solution is well suited for debugging, characterizing and analyzing components, modules and systems with signaling rates at 10, 40 and even 100 Gb/s. The 80E00 family of electrical sampling modules provide a wide variety of capabilities, allowing the user to configure a test solution specifically adapted to their application.

Notice to EU customers

The 80E10B, 80E09B, 80E08B and 80E07B modules comply with the RoHS 2 Directive 2011/65/EU and will be shipped to the EU. These modules are qualified for CE Marking.

All other 80E00 modules are 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

- Up to 70 GHz bandwidth and 5 ps measured rise time (10-90%)
- Lowest noise for analysis: 450 μV_{RMS} at 60 GHz, 300 μV_{RMS} at 30 GHz
- 15 ps reflected true differential fully integrated TDR rise time (12 ps incident) and feature resolution below 1 mm (TDR modules)
- Efficient, accurate, easy to use, and cost-effective S-parameters up to 50 GHz
- Remote samplers [1] enable location of sampler near DUT and ensure best signal fidelity

Key features

- Independent sampler deskew ensures easy fixture and probe de-embedding
- Dual channel (except 80E11X1)
- Precision Microwave Connectors (3.5 mm, 2.92 mm, 2.4 mm, and 1.85 mm)
- Probe support

Applications

- Impedance characterization and S-parameter measurements for serial data applications
- Advanced jitter, noise, and BER analysis
- Channel and eye-diagram simulation and measurement-based spice modeling
- **80E10B, 80E08B, and 80E04**
  - High-performance TDR/T measurements
  - Impedance profile, inductance, capacitance, and S-parameters
  - Transmission line quality, impedance, and crosstalk
  - True differential, common mode, and single-ended measurements
  - Efficient fault isolation
- **80E11, 80E11X1, 80E09B, 80E07B**
  - High-frequency, low-noise signal acquisition
  - Fast rise time measurements
  - Jitter analysis and waveform analysis

1 Integrated on 80E07B - 80E10B and optional on 80E03, 80E04, 80E11 and 80E11X1.

- **80E03, 80E03-NV**
  - Device characterization, transmission quality, waveform parameters
  - Low signal measurements

TDR modules: 80E10B, 80E08B, and 80E04

The 80E10B, 80E08B, and 80E04 are dual-channel Time Domain Reflectometry (TDR) sampling modules, providing up to 12 ps incident and 15 ps reflected rise time in the 80E10B (18 ps incident in 80E08B and 23 ps incident in 80E04). Each channel of these modules can generate a fast step for use in TDR mode and the acquisition portion of the sampling module monitors the incident step and any reflected energy. The polarity of each channel's step can be selected independently. This allows for differential or common mode TDR or S-parameter testing of two coupled lines, in addition to the independent testing of isolated lines. The independent step generation for each channel allows true differential measurements, which ensures measurement accuracy for differential devices.

The 80E10B and 80E08B are small form factor, fully integrated independent 2-meter remote sampler systems, enabling location of the sampler near the DUT and ensuring the best signal fidelity. The modules characterize crosstalk by using TDR steps to drive one line (or line pair for differential crosstalk) while monitoring a second line (or line pair) with the other channel (or another module for differential crosstalk). The "filter" function on the 8000 series mainframes can be used with TDR or crosstalk measurements to characterize expected system performance with slower edge rates.

All modules have independent incident step and receiver deskew to remove the effect of measurement fixtures and probes, enabling faster and easier de-embedding of test fixtures. The 80E10B sampling modules provide an acquisition rise time of 7 ps, with up to 50 GHz selectable equivalent bandwidth (with 50, 40, and 30 GHz settings). The 80E08B sampling bandwidth is 30 GHz (user selectable with 30 and 20 GHz settings) and 80E04 sampling bandwidth is 20 GHz. The 20 GHz P8018 single-ended and 18 GHz P80318 differential variable pitch TDR probes provide excellent performance and compliance, ensuring easy and accurate backplane and package measurements.

Using Tektronix IConnect® TDR and VNA software with these modules enables acquiring up to 1,000,000 data points and obtaining up to 50 GHz differential, mixed mode, and single-ended S-parameters. IConnect also enables impedance, S-parameters, and eye-diagram compliance testing as required by various serial data standards, and full channel analysis, Touchstone (SnP) file output, and SPICE modeling for gigabit interconnects.

Sampling modules: 80E11, 80E11X1, 80E09B, 80E07B, 80E03, and 80E03-NV

The 80E09B and 80E07B are dual-channel modules with remote samplers, capable of 450 μV_{RMS} noise at 60 GHz sampling bandwidth, and 300 µV at 30 GHz sampling bandwidth. Each small form factor remote sampler is attached to a 2-meter cable to minimize the effects of cables, probes, and fixtures, allow close location of the sampler to the DUT, and enable best signal fidelity. User-selectable bandwidth settings (60/40/30 GHz on 80E09B and 30/20 GHz on 80E07B) offer optimal noise/bandwidth trade-off.

The 80E11 and 80E11X1 are dual and single channel, 70+ GHz bandwidth sampling modules. These modules provide the widest measurement bandwidth and fastest rise time measurements with world class signal fidelity. User-selectable bandwidth settings (70/60/40 GHz) enable optimal noise/bandwidth trade-off.

You can use optional one- and two-meter module extender cables (80X01, 80X02) with the 80E11 and 80E11X1 modules to enable superior signal fidelity and measurement flexibility by placing the sampling module closer to the DUT.

The 80E03 and 80E03-NV are dual-channel, 20 GHz sampling modules. These sampling modules provide an acquisition rise time of 17.5 ps or less. Optional one- and two-meter extender cables are available.

When used with Tektronix 80SJNB Jitter, Noise, and BER software, these modules enable separation of both jitter and noise into their components, understanding precise causes of eye closure, and obtaining highly accurate extrapolation of BER and 3-D eye contour. When used with the 82A04B phase reference module, time-base accuracy can be improved down to <100 fs_{RMS} jitter, which together with the 300 µV noise floor and 16 bits of resolution ensures the highest signal fidelity for the measured signals.

Performance you can count on

Depend on Tektronix to provide you with performance you can count on. In addition to industry-leading service and support, this product comes backed by a one-year warranty as standard.

Specifications

All specifications are guaranteed unless noted otherwise.

Model overview

Module	Application	Bandwidth [2]	Channels	Input impedance	Input connector
80E11 80E11X1	High-frequency, low-noise, signal acquisition and jitter characterization	70/60/(40) GHz [3]	2/1	50 ±1.0 Ω	1.85 mm female
80E10B	True differential TDR, S-parameters, and fault isolation	50/40/(30) GHz [3]	2	50 ±1.0 Ω	1.85 mm female
80E09B	High-frequency, low-noise signal acquisition and jitter characterization	60/40/(30) GHz [3]	2	50 ±1.0 Ω	1.85 mm female
80E08B	True differential TDR and S-parameters	30/(20) GHz [3]	2	50 ±1.0 Ω	2.92 mm female
80E07B	Optimal noise/performance trade-off for jitter characterization	30/(20) GHz [3]	2	50 ±1.0 Ω	2.92 mm female
80E04	TDR impedance and crosstalk characterization	20 GHz [4]	2	50 ±0.5 Ω	3.5 mm female
80E03 80E03-NV	Device characterization	20 GHz [5]	2	50 ±0.5 Ω	3.5 mm female

80E11, 80E11X1

Rise time	5 ps (calculated from 0.35 bandwidth rise time product)
Dynamic range	800 mV_{p-p}
Offset range	±1.1 V
Maximum operating voltage	±1.1 V
Maximum Nondestruct Voltage, DC + AC_{p-p}	2.0 V
Vertical number of digitized bits	16 bits full scale
Vertical sensitivity range	8 mV to 800 mV full scale
DC vertical voltage accuracy, single point, within ±2 °C of compensated temperature	±2 mV ± 0.007 * (Assigned Offset) ± 0.02 * (Vertical Value - Assigned Offset)

2 Normal text is warranted values. Values in parenthesis are typical (unwarranted) value to which the instrument will typically perform.

3 User selectable.

4 Calculated from 0.35 bandwidth rise time product.

5 The 80E03 bandwidth is calculated from 0.35 bandwidth rise time product. The 80E03-NV bandwidth is directly verified.

80E11, 80E11X1

Step response aberrations, typical	±1% or less over the zone 10 ns to 20 ps before step transition +6%, –10% or less for the first 400 ps following step transition +0%, –4% or less over the zone 400 ps to 3 ns following step transition +1%, –2% or less over the zone 3 ns to 100 ns following step transition ±1% after 100 ns following step transition
RMS noise, maximum (warranted, typical)	70 GHz: ≤1100 µV (950 µV) 60 GHz: ≤600 µV (450 µV) 40 GHz: ≤480 µV (330 µV) Value in parenthesis is typical value to which the instrument will normally perform.

80E10B

Rise time	7 ps (calculated from 0.35 bandwidth rise time product)
Dynamic range	1.0 V_{p-p}
Offset range	±1.1 V
Maximum operating voltage	±1.1 V
Maximum Nondestruct Voltage, DC + AC_{p-p}	2.0 V
Vertical number of digitized bits	16 bits full scale
Vertical sensitivity range	10 mV to 1.0 v full scale
DC vertical voltage accuracy, single point, within ±2 °C of compensated temperature	±2 mV ± 0.007 * (Assigned Offset) ± 0.02 * (Vertical Value - Assigned Offset)
Step response aberrations, typical	±1% or less over the zone 10 ns to 20 ps before step transition +6%, –10% or less for the first 400 ps following step transition +0%, –4% or less over the zone 400 ps to 3 ns following step transition +1%, –2% or less over the zone 3 ns to 100 ns following step transition ±1% after 100 ns following step transition
RMS noise, maximum (warranted, typical)	50 GHz: ≤700 µV (600 µV) 40 GHz: ≤480 µV (370 µV) 30 GHz: ≤410 µV (300 µV) Value in parenthesis is typical value to which the instrument will normally perform.
TDR step amplitude	250 mV (polarity of either step may be inverted)
TDR system reflected rise time	15 ps
TDR system incident rise time	12 ps

80E10B

TDR step deskew range	±250 ps
TDR sampler deskew range	±250 ps
TDR step maximum repetition rate	300 kHz The TDR step maximum repetition rate is 200 kHz when this module is used in a DSA8200, TDS/CSA8200, TDS/CSA800B, or TDS/CSA8000 mainframe

80E09B

Rise time	5.8 ps (calculated from 0.35 bandwidth rise time product)
Dynamic range	1.0 V_{p-p}
Offset range	±1.1 V
Maximum operating voltage	±1.1 V
Maximum Nondestruct Voltage, DC + AC_{p-p}	2.0 V
Vertical number of digitized bits	16 bits full scale
Vertical sensitivity range	10 mV to 1.0 v full scale
DC vertical voltage accuracy, single point, within ±2 °C of compensated temperature	±2 mV ± 0.007 * (Assigned Offset) ± 0.02 * (Vertical Value - Assigned Offset)
Step response aberrations, typical	±1% or less over the zone 10 ns to 20 ps before step transition +6%, –10% or less for the first 400 ps following step transition +0%, –4% or less over the zone 400 ps to 3 ns following step transition +1%, –2% or less over the zone 3 ns to 100 ns following step transition ±1% after 100 ns following step transition
RMS noise, maximum (warranted, typical)	60 GHz: ≤600 µV (450 µV) 40 GHz: ≤480 µV (330 µV) 30 GHz: ≤410 µV (300 µV) Value in parenthesis is typical value to which the instrument will normally perform.

80E08B

Rise time	11.7 ps (calculated from 0.35 bandwidth rise time product)
Dynamic range	1.0 V_{p-p}
Offset range	±1.1 V
Maximum operating voltage	±1.1 V
Maximum Nondestruct Voltage, DC + AC_{p-p}	2.0 V
Vertical number of digitized bits	16 bits full scale
Vertical sensitivity range	10 mV to 1.0 v full scale
DC vertical voltage accuracy, single point, within ±2 °C of compensated temperature	±2 mV ± 0.007 * (Assigned Offset) ± 0.02 * (Vertical Value - Assigned Offset)
Step response aberrations, typical	±1% or less over the zone 10 ns to 20 ps before step transition +6%, –10% or less for the first 400 ps following step transition +0%, –4% or less over the zone 400 ps to 3 ns following step transition +1%, –2% or less over the zone 3 ns to 100 ns following step transition ±1% after 100 ns following step transition
RMS noise, maximum (warranted, typical)	30 GHz: ≤410 µV (300 µV) 20 GHz: ≤380 µV (280 µV) Value in parenthesis is typical value to which the instrument will normally perform.
TDR step amplitude	250 mV (polarity of either step may be inverted)
TDR system reflected rise time	20 ps
TDR system incident rise time	18 ps
TDR step deskew range	±250 ps
TDR sampler deskew range	±250 ps
TDR step maximum repetition rate	300 kHz The TDR step maximum repetition rate is 200 kHz when this module is used in a DSA8200, TDS/CSA8200, TDS/CSA800B, or TDS/CSA8000 mainframe

80E07B

Rise time	11.7 ps (calculated from 0.35 bandwidth rise time product)
Dynamic range	1.0 V_{p-p}
Offset range	±1.1 V
Maximum operating voltage	±1.1 V
Maximum Nondestruct Voltage, DC + AC_{p-p}	2.0 V
Vertical number of digitized bits	16 bits full scale
Vertical sensitivity range	10 mV to 1.0 v full scale
DC vertical voltage accuracy, single point, within ±2 °C of compensated temperature	±2 mV ± 0.007 * (Assigned Offset) ± 0.02 * (Vertical Value - Assigned Offset)
Step response aberrations, typical	±1% or less over the zone 10 ns to 20 ps before step transition +6%, –10% or less for the first 400 ps following step transition +0%, –4% or less over the zone 400 ps to 3 ns following step transition +1%, –2% or less over the zone 3 ns to 100 ns following step transition ±1% after 100 ns following step transition
RMS noise, maximum (warranted, typical)	30 GHz: ≤410 µV (300 µV) 20 GHz: ≤380 µV (280 µV) Value in parenthesis is typical value to which the instrument will normally perform.

80E04

Rise time	≤17.5 ps (calculated from 0.35 bandwidth rise time product)
Dynamic range	1.0 V_{p-p}
Offset range	±1.6 V
Maximum operating voltage	±1.6 V
Maximum nondestruct voltage, DC + AC_{p-p}	3.0 V
Vertical number of digitized bits	16 bits full scale
Vertical sensitivity range	10 mV to 1.0 v full scale
DC vertical voltage accuracy, single point, within ±2 °C of compensated temperature	±2 mV ± 0.007 * (Assigned Offset) ± 0.02 * (Vertical Value - Assigned Offset)

80E04

Step response aberrations, typical	±3% or less over the zone 10 ns to 20 ps before step transition +10%, –5% or less for the first 300 ps following step transition ±3% or less over the zone 300 ps to 5 ns following step transition ±1% or less over the zone 5 ns to 100 ns following step transition ±0.5% after 100 ns following step transition
RMS noise, maximum (warranted, typical)	20 GHz: ≤1.2 mV (600 µV) Value in parenthesis is typical value to which the instrument will normally perform.
TDR step amplitude	250 mV (polarity of either step may be inverted)
TDR system reflected rise time	28 ps
TDR system incident rise time	23 ps
TDR step deskew range	±50 ps
TDR sampler deskew range	+100 ns, –500 ps (slot deskew only)
TDR step maximum repetition rate	300 kHz The TDR step maximum repetition rate is 200 kHz when this module is used in a DSA8200, TDS/CSA8200, TDS/CSA800B, or TDS/CSA8000 mainframe

80E03, 80E03-NV

Rise time	≤17.5 ps (calculated from 0.35 bandwidth rise time product)
Dynamic range	1.0 V_{p-p}
Offset range	±1.6 V
Maximum operating voltage	±1.6 V
Maximum nondestruct voltage, DC + AC_{p-p}	3.0 V
Vertical number of digitized bits	16 bits full scale
Vertical sensitivity range	10 mV to 1.0 v full scale
DC vertical voltage accuracy, single point, within ±2 °C of compensated temperature	±2 mV ± 0.007 * (Assigned Offset) ± 0.02 * (Vertical Value - Assigned Offset)

80E03, 80E03-NV

Step response aberrations, typical	±3% or less over the zone 10 ns to 20 ps before step transition +10%, –5% or less for the first 300 ps following step transition ±3% or less over the zone 300 ps to 5 ns following step transition ±1% or less over the zone 5 ns to 100 ns following step transition ±0.5% after 100 ns following step transition
RMS noise, maximum (warranted, typical)	20 GHz: ≤1.2 mV (600 µV) Value in parenthesis is typical value to which the instrument will normally perform.

Physical characteristics

	Width	Height	Depth	Weight
80E11 80E11X1 80E04 80E03 80E03-NV	79.0 mm (3.1 in)	25.0 mm (1.0 in)	135 mm (5.3 in)	0.4 kg (0.87 lb)
80E10B 80E09B 80E08B 80E07B [6]	55 mm (2.2 in)	25.0 mm (1.0 in)	75 mm (3.0 in)	0.175 kg (0.37 lb)

6 Remote sampler module characteristics for 80E10B, 80E09B, 80E08B, and 80E07B)

Ordering information

For more detailed information about the 80E00 Electrical Sampling Modules, 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.Tektronix.com.

Models

80E11	Dual channel, 70+ GHz sampling module
80E11X1	Single channel version of 80E11
80E10B	Dual-channel, 50 GHz true differential TDR sampling module with remote samplers
80E09B	Dual-channel, 60 GHz sampling module
80E08B	Dual-channel, 30 GHz true differential TDR sampling module with remote samplers
80E07B	Dual-channel, 30 GHz sampling module
80E04	Dual-channel, 20 GHz true differential TDR sampling module
80E03/80E03-NV	Dual-channel, 20 GHz sampling module [7]

Instrument options

80E04 Opt. 09	Include two 80A09 EOS/ESD Protection Devices with the 80E04 module

Service options

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
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. G3	Complete Care 3 Years (includes loaner, scheduled calibration, and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration, and more)
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

7 For the 80E03-NV, bandwidth is directly verified and the Calibration Certification Report includes test data on the module's bandwidth test results.

Recommended accessories

80E04UP Opt. 09	80E04 Upgrade kit that provides two 80A09 EOS/ESD Protection Devices in a case that can hold an 80E04 module
015-1001-xx	2X attenuator (SMA Male-to-Female)
015-1002-xx	5X attenuator (SMA Male-to-Female)
011-0157-xx	Adapter (2.4 mm male to 2.92 mm female – can also be used as 1.85 mm male to 2.92 mm female)
P8018	20 GHz single-ended TDR probe. 80A02 module (below) recommended for static protection of the sampling or TDR module
P80318	18 GHz differential TDR probe. 80A02 module (below) recommended for static protection of each channel of the sampling or TDR module
80A09	26 GHz ESD Protection Accessory
80A02	EOS/ESD isolation module (1 channel). P8018 or P80318 TDR probe (above) recommended
80X01	One-meter sampling module extender cable (for 80E11, 80E11X1, 80E04, 80E03, 80E03-NV)
80X02	Two-meter sampling module extender cable (for 80E11, 80E11X1, 80E04, 80E03, 80E03-NV)

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