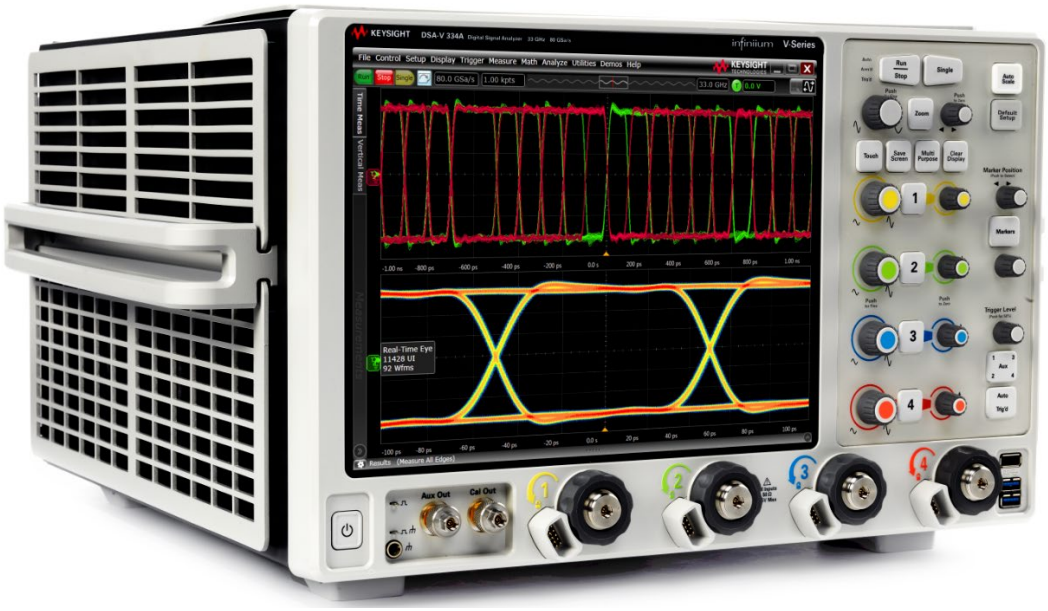
Infiniium V-Series Oscilloscopes

Achieve clarity faster

Introduction

The Infiniium V-Series oscilloscopes incorporate innovative technology designed to deliver superior measurements. Whether you are testing multiple high-speed serial lanes or a massive parallel bus, the new 12.5 Gb/s, longest 160-bit hardware serial trigger and the world's fastest 20 GSa/s digital channels will provide timely validation and debug– enabling you to develop the next generation of technology and research more quickly.



KEYSIGHT

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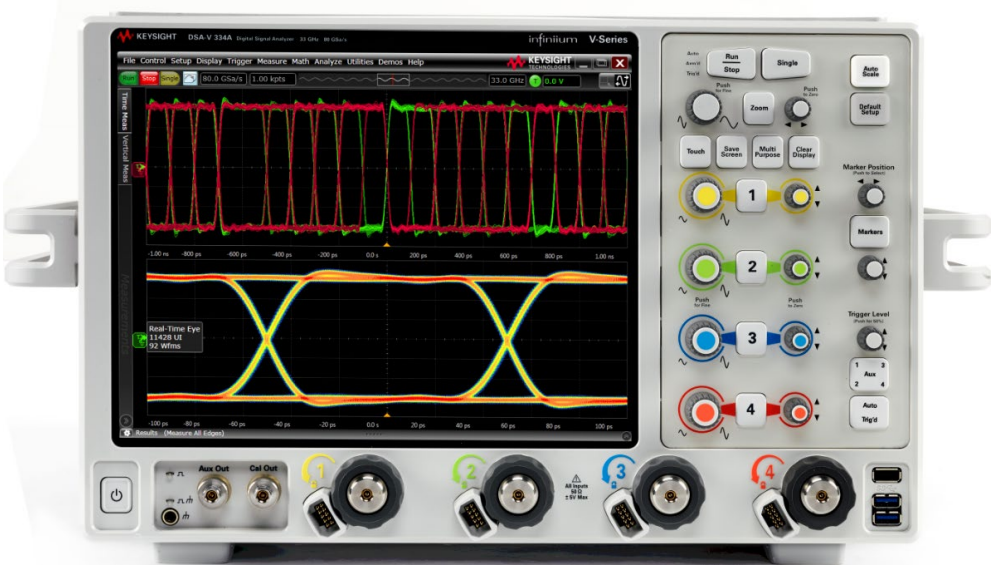
Introduction and Model Overview

The Keysight Technologies, Inc. Infiniium V-Series oscilloscopes incorporate innovative technology designed to deliver superior measurements. Whether you are testing multiple high-speed serial lanes or a massive parallel bus, the new 12.5 Gb/s, industry's longest 160-bit hardware serial trigger and world's fastest 20 GSa/s digital channels will provide timely validation and debug. Our oscilloscope's low-noise front end technology, advanced InfiniiMax Ultra probe delivers up to 25 GHz bandwidth with an RC input impedance profile, providing the extremely low mid-band loading necessary to address modern high-speed probing requirements. It also supports InfiniiMode and has a user-defined AC calibration mode, a wider input voltage range, more accuracy with unique S-parameter characterization, lower capacitive loading, a wider input voltage range, micro / socketed probe heads for smaller density probing, and more bandwidths. Together with the broadest software solution coverage, the V-Series helps you achieve clarity faster in your design characterization to ensure your product ships on time.



DSO models	DSA models	MSO models	Analog bandwidth/Sample Rate		Max memory
4 analog channels	4 analog channels	4 analog/16 digital channels	2 channels	4 channels	4 channels
DSOV334A	DSAV334A	MSOV334A	33 GHz/80 GSa/s	16 GHz/40 GSa/s	2 Gpts
DSOV254A	DSAV254A	MSOV254A	25 GHz/80 GSa/s	16 GHz/40 GSa/s	2 Gpts
DSOV204A	DSAV204A	MSOV204A	20 GHz/80 GSa/s	16 GHz//40 GSa/s	2 Gpts
DSOV164A	DSAV164A	MSOV164A	16 GHz/80 GSa/s	16 GHz/40 GSa/s	2 Gpts
DSOV134A	DSAV134A	MSOV134A	13 GHz/80 GSa/s	13 GHz/40 GSa/s	2 Gpts
DSOV084A	DSAV084A	MSOV084A	8 GHz/80 GSa/s	8 GHz/40 GSa/s	2 Gpts

Each model is upgradable to each higher bandwidth step or the max bandwidth of 33 GHz.

Vertical System Specifications

Specification	V084A	V134A	V164A	V204A	V254A	V334A
Input Channels	DSO/DSA models - 4 analog MSO models - 4 analog + 16 digital					
Analog bandwidth(-3 dB)						
2 channel [1]	8 GHz	13 GHz	16 GHz	20 GHz	25 GHz	32 GHz
2 channel (typical)	8.4 GHz	13.6 GHz	16.8 GHz	21 GHz	26.2 GHz	33 GHz
4 channel [1]	8 GHz	13 GHz	16 GHz	16 GHz	16 GHz	16 GHz
4 channel (typical)	8.4 GHz	13.6 GHz	16.8 GHz	16.8 GHz	16.8 GHz	16.8 GHz
Rise time/fall time						
10 to 90% [5]	55.0 ps	33.8 ps	27.5 ps	22.0 ps	17.6 ps	13.3 ps
20 to 80% [6]	38.9 ps	23.9 ps	19.4 ps	15.6 ps	12.4 ps	9.4 ps
Input impedance [2]	50 Ω, ± 3%					
Input sensitivity [3]	1 mV/div to 1 V/div					
Full scale hardware	60 mV to 8 V (oscilloscope only)					
Sensitivity	60 mV to 1.2 V (oscilloscope with N7010A voltage termination adapter)					
Input coupling	DC					
Vertical resolution [3, 4]	8 bits, ≥ 12 bits with high-resolution mode or averaging					
Channel to channel Isolation (any two channels with equal V/div settings)	Channel-to-channel: 1-3, 1-4, 2-3, and 2-4 DC to BW: 70 dB					
	Channel-to-channel: 1-2 and 3-4 DC to 4 GHz: 50 dB 4 to 12 GHz: 40 dB 12 to BW: 35 dB					
DC gain accuracy [1, 2, 3, 4]	± 2% of full scale at full resolution channel scale (± 2.5% for ≤ 5 mV/div)					
Offset range	**Vertical sensitivity** / **Available offset** / **Available offset(with N7010A)** 1 to 49 mV/div / ± 0.4 V / Additional ± 4 V 50 to 79 mV/div / ± 0.7 V / Additional ± 4 V 80 to 134 mV/div / ± 1.2 V / Additional ± 4 V 135 to 239 mV/div / ± 2.2 V / Additional ± 4 V 240 mV/div to 1 V/div / ± 4.0 V / Additional ± 4 V					
Offset accuracy [1]	≤ 3.5 V: ± (2% of channel offset + 1% of full scale + 1 mV) > 3.5 V: ± (2% of channel offset + 1% of full scale)					
Dynamic range	± 4 div from center screen					
DC voltage	Dual cursor: ± [(DC gain accuracy) + (resolution)]					
measurement accuracy	Single cursor: ± [(DC gain accuracy) + (offset accuracy) + (resolution/2)]					

1. Denotes warranted specifications, all others are typical. Specifications are valid after 30-minute warm up period and ± 5% from oscilloscope firmware calibration temperature.
2. Input impedance is valid when V/div scaling is adjusted to show all waveform vertical values within scope display.
3. Full scale is defined as eight vertical divisions. Magnification is used below 7.5 mV/div. Below 7.5 mV/div, full scale is defined as 60 mV/div. The major scale settings are 1 mV/div, 2 mV/div, 5 mV/div, 10 mV/div, 20 mV/div, 50 mV/div, 100 mV/div, 200 mV/div, 500 mV/div and 1V/div.
4. Vertical resolution for 8 bits = 0.4% of full scale, for 12 bits = 0.024% of full scale.
5. Calculation based on Tr = 0.44/BW.
6. Calculation based on Tr = 0.31/BW.

RMS Noise Floor – Performance Characteristics (Measured)

RMS noise floor (oscilloscope only) Vertical setting (mVrms)	V084A 8 GHz	V134A 13 GHz	V164A 16 GHz	V204A 20 GHz	V254A 25 GHz	V334A 33 GHz
5 mV/div	0.21 mV	0.27 mV	0.31 mV	0.37 mV	0.45 mV	0.58 mV
10 mV/div	0.23 mV	0.28 mV	0.36 mV	0.42mV	0.49 mV	0.60 mV
20 mV/div	0.46 mV	0.57 mV	0.65 mV	0.74 mV	0.83 mV	1.04 mV
50 mV/div	1.04 mV	1.09 mV	1.32 mV	1.54 mV	1.73 mV	2.09 mV
100 mV/div	1.92 mV	2.30 mV	2.63 mV	3.02 mV	3.39 mV	3.98 mV
200 mV/div	4.39 mV	5.52 mV	6.14 mV	6.92 mV	8.16 mV	9.88 mV
500 mV/div	10.07 mV	12.42 mV	13.68 mV	15.05 mV	17.08 mV	20.25 mV
1V/div	18.47mV	21.36mV	26.12 mV	30.15 mV	34.36 mV	39.35 mV

RMS noise floor (with N7010A) Vertical setting (mVrms)	V084A 8 GHz	V134A 13 GHz	V164A 16 GHz	V204A 20 GHz	V254A 25 GHz	V334A 33 GHz
5 mV/div	0.28 mV	0.41 mV	0.44 mV	0.51 mV	0.65 mV	0.84 mV
10 mV/div	0.30 mV	0.42 mV	0.48 mV	0.57 mV	0.70 mV	0.86 mV
20 mV/div	0.54 mV	0.74 mV	0.84 mV	0.99 mV	1.20 mV	1.48 mV
50 mV/div	1.21 mV	1.64 mV	1.86 mV	2.18 mV	2.64 mV	3.21 mV
100 mV/div	2.42 mV	3.25 mV	3.68 mV	4.30 mV	5.16 mV	6.21 mV
200 mV/div	4.84 mV	6.48 mV	7.33 mV	8.53 mV	10.18 mV	12.18 mV
500 mV/div	12.16 mV	16.39 mV	18.64 mV	21.89 mV	26.42 mV	32.06 mV
1V/div	24.21mV	32.50 mV	36.80 mV	42.99 mV	51.55 mV	61.98 mV

Vertical System – Performance Characteristics

ENOB (Effective number of Bits) (Signal 80% of full Scale)	V084A 8 GHz	V134A 13 GHz	V164A 16 GHz	V204A 20 GHz	V254A 25 GHz	V334A 33 GHz
7 mV/div	5.9	5.7	5.5	5.4	5.1	5.0
10 mV/div	6.1	5.9	5.8	5.7	5.5	5.2
20 mV/div	6.3	6.1	6.0	5.8	5.6	5.4
50 mV/div	6.4	6.2	6.2	6.0	5.8	5.6
100 mV/div	6.6	6.4	6.2	6.0	5.8	5.6

Digital Channels	All MSO models
Input Channels	16 digital channels
Threshold groupings	Two individual threshold settings (one for channels 0 to 7 and one for channels 8 to 15)
Threshold selections	TTL (1.4 V), CMOS (2.5 V), ECL (—1.3 V), PECL (3.7 V), custom (± 3.75 V in 10 mV increments)
Maximum input voltage	± 40 V peak CAT I
Threshold accuracy	± (100 mV + 3% of threshold setting)
Input dynamic range	± 10 V about threshold
Minimum input voltage swing	200 mV peak-to-peak
Input impedance (flying leads)	20 kΩ ± 2% (~0.7 pF) at probe tip
Resolution	1 bit
Analog bandwidth	3 GHz (depends on probing)

Horizontal System – Performance Characteristics

Characteristic	Measured performance – All oscilloscope channels	
Main timebase range	2 ps/div to 200 s/div	
Main timebase delay range	200 s to -200 s real-time	
Reference position	Continuously adjustable across horizontal display range	
Zoom timebase range	1 ps/div to current main timescale setting	
Channel de-skew range	± 1 ms range, 10 fs resolution	
Time scale accuracy[1,8]	± (0.1 ppm initial + 0.1 ppm/year aging)	
Oscilloscope channel de-skew range	± 1 ms range, 10 fs resolution	
Intrinsic jitter[6], acquired time range/delta-time interval	**Internal reference**	**External reference**
< 1 µs (100 ns/div) 10 µs (1 µs/div) 100 µs (10 µs/div) 1 ms (100 µs/div)	100 fs rms 200 fs rms 500 fs rms 2 ps rms	100 fs rms 200 fs rms 200 fs rms 500 fs rms
Inter-channel intrinsic jitter[3]	< 100 fs rms	
Inter-channel skew drift[3,7]	< 50 fs rms	
Jitter measurement floor[2] (sec rms)		
Time interval error (sec rms)	$\sqrt{\left(\frac{\text{Noise floor}}{\text{Slew rate}}\right)^2 + (\text{Intrinsic jitter})^2}$	
Period jitter (sec rms)	$\sqrt{2} * \sqrt{\left(\frac{\text{Noise floor}}{\text{Slew rate}}\right)^2 + (\text{Intrinsic jitter})^2}$	
Cycle-cycle / N-cycle jitter (sec rms)	$\sqrt{3} * \sqrt{\left(\frac{\text{Noise floor}}{\text{Slew rate}}\right)^2 + (\text{Intrinsic jitter})^2}$	
Inter-channel jitter[2,3,5] (sec rms)	$\sqrt{\left(\begin{matrix}\text{Time interval}\\ \text{error (Edge Chan1)}\end{matrix}\right)^2 + \left(\begin{matrix}\text{Time interval}\\ \text{error (Edge Chan2)}\end{matrix}\right)^2 + \left(\begin{matrix}\text{Inter channel}\\ \text{intrinsic jitter}\end{matrix}\right)^2}$	

* Denotes warranted specification, all others are typical. Specs are valid after a 30-minute warm-up period and ± 5 °C from calibration temp.

1. Sample rate at maximum. Noise and slew rate determined at fixed-voltage measurement threshold, near middle of signal. Displayed signal not vertically clipped. Slew rate of sine wave = (peak signal amplitude) • 2 • π • f, slew rate of fast step ~= (10 to 90% rise time).
3. Intra-channel = both edges on the same channel, Inter-channel = two edges on different channels. Time Interval Error(Edge1) = time-interval error measurement floor of first edge, Time Interval Error(Edge2) = time-interval error measurement floor of second edge.
4. Reading is the displayed Delta Time Measurement Accuracy measurement value. Do not double the listed Time Scale Accuracy value in Delta Time Measurement Accuracy formula.
5. Scope channels and signal interconnect de-skewed prior to measurement.
6. External timebase reference values measured using a Wenzel 501-04608A 10 MHz reference. Intrinsic jitter value depends on acquisition time range for Time Interval Error formula and depends on delta-time between edges for all two-edge formulas.
7. Skew between channels caused by ± 5 °C temperature change.
8. Initial = immediately after factory or user calibration.

Horizontal System – Performance Characteristics (continued)

Characteristic	All oscilloscope channels
Delta-time measurement accuracy[2,3,4,5]	
Intra-channel no averaging	$\pm\left[5 * \sqrt{\left(\begin{matrix}\text{Time interval}\\ \text{error (Edge1)}\end{matrix}\right)^2 + \left(\begin{matrix}\text{Time interval}\\ \text{error (Edge2)}\end{matrix}\right)^2} + \left(\left(\begin{matrix}\text{Time scale}\\ \text{accuracy}\end{matrix}\right) * \left(\begin{matrix}\text{Delta}\\ \text{time}\end{matrix}\right)\right)\right]$
Intra-channel 256 averages	$\pm\left[\frac{5}{16} * \sqrt{\left(\begin{matrix}Time\ interval\\ error\ (Edge1)\end{matrix}\right)^2 + \left(\begin{matrix}Time\ interval\\ error\ (Edge2)\end{matrix}\right)^2} + \left(\left(\begin{matrix}Time\ scale\\ accuracy\end{matrix}\right) * \left(\begin{matrix}Delta\\ time\end{matrix}\right)\right)\right]$
Inter-channel no averaging	$\pm\left[5 * \sqrt{\left(\begin{matrix}\text{Time interval}\\ \text{error (Edge1)}\end{matrix}\right)^2 + \left(\begin{matrix}\text{Time interval}\\ \text{error (Edge2)}\end{matrix}\right)^2 + \left(\begin{matrix}\text{Inter channel}\\ \text{intrinsic jitter}\end{matrix}\right)^2} + \left(\left(\begin{matrix}\text{Time scale}\\ \text{accuracy}\end{matrix}\right) * \left(\begin{matrix}\text{Delta}\\ \text{time}\end{matrix}\right)\right) + \left(\begin{matrix}\text{Inter channel}\\ \text{skew drift}\end{matrix}\right)\right]$
Inter-channel 256 averages	$\pm\left[\frac{5}{16} * \sqrt{\left(\begin{matrix}\text{Time interval}\\ \text{error (Edge1)}\end{matrix}\right)^2 + \left(\begin{matrix}\text{Time interval}\\ \text{error (Edge2)}\end{matrix}\right)^2 + \left(\begin{matrix}\text{Inter channel}\\ \text{intrinsic jitter}\end{matrix}\right)^2} + \left(\left(\begin{matrix}\text{Time scale}\\ \text{accuracy}\end{matrix}\right) * \left(\begin{matrix}\text{Delta}\\ \text{time}\end{matrix}\right)\right) + \left(\begin{matrix}\text{Inter channel}\\ \text{skew drift}\end{matrix}\right)\right]$

2. Sample rate at maximum. Noise and slew rate determined at fixed-voltage measurement threshold, near middle of signal. Displayed signal not vertically clipped. Slew rate of sine wave = (peak signal amplitude) • 2 • π • f, slew rate of fast step ~= (10 to 90% rise time).
3. Intra-channel = both edges on the same channel, Inter-channel = two edges on different channels. Time Interval Error(Edge1) = time-interval error measurement floor of first edge, Time Interval Error(Edge2) = time-interval error measurement floor of second edge.
4. Reading is the displayed Delta Time Measurement Accuracy measurement value. Do not double the listed Time Scale Accuracy value in Delta Time Measurement Accuracy formula.
5. Scope channels and signal interconnect de-skewed prior to measurement.

Acquisition System – Performance Characteristics

Acquisition characteristic	V084A 8 GHz	V134A 13 GHz	V164A 16 GHz	V204A 20 GHz	V254A 25 GHz	V334A 33 GHz
Maximum real-time sample rate						
2 channels	80 GSa/s	80 GSa/s	80 GSa/s	80 GSa/s	80 GSa/s	80 GSa/s
4 channels	40 GSa/s	40 GSa/s	40 GSa/s	40 GSa/s	40 GSa/s	40 GSa/s
Memory depth per channel		**4 channels**			**2 channels**	
standard		100 Mpts			100 Mpts	
option 200		200 Mpts			500 Mpts	
option 500		500 Mpts			1 Gpts	
option 01G		1 Gpts			1 Gpts	
option 02G		2 Gpts			2 Gpts	
Maximum acquired time at highest real-time resolution		**40 GSa/s**			**80 GSa/s**	
standard		2.5 ms			2.5 ms	
option 200		5 ms			5 ms	
option 500		12.5 ms			12.5 ms	
option 01G		25 ms			12.5 ms	
option 02G		50 ms			25 ms	
Maximum waveform update rate	> 400,000 waveforms per second (when in segmented memory mode)					
Sampling modes -oscilloscope channels						
Real-time	Successive single shot acquisitions					
Real-time with averaging	Selectable from 2 to 65,534					
Real-time with peak detect	80 GSa/s in 2-channel mode, 40 GSa/s in 4-channel mode					
Real-time with high resolution	Real-time boxcar averaging reduces random noise and increases resolution					
Equivalent time	Resolution 338 fs					
Gaussian magnitude, linear phase	Slow filter roll off while maintaining linear phase					
Roll mode	Scrolls sequential waveform points across the display in a right-to-left rolling motion. Works at sample rates up to 10 MSa/s with a maximum record length of 40 Mpts.					
Segmented memory	Captures bursting signals at max sample rate without consuming memory during periods of inactivity					
Max # of segments	Independent of memory option					
	Memory depth:	100 Mpts	200 Mpts	500 Mpts	1 Gpts	2 Gpts
	Max # of segments:	16,384	32,768	65,536	131,072	131,072
Max time between triggers	562,950 seconds					
Filters – Sin(x)/x	On/off selectable FIR digital filter. Digital signal process adds points between acquired data points to enhance measurement accuracy and waveform display.					
Acquisition - digital channels						
Maximum real-time sample rate	10 GSa/s with 16 channels, 20 GSa/s with 8 channels					
Maximum memory per channel	Up to 1 Gpts					
Minimum width glitch detection	50 ps					

Trigger System – Performance Characteristics

Hardware trigger	
Trigger sources	All channel inputs, 1 auxiliary trigger input
Sensitivity	Internal low: 2.0 div p-p for 0 to 22 GHz
	Internal high: 0.3 div p-p for 0 to 18 GHz, 1.0 div p-p for > 18 to 22 GHz
	Auxiliary: 2.5 GHz
Edge trigger bandwidth	> 20 GHz
Minimum pulse width trigger Hardware Software (InfiniiScan)	 250 ps 40 ps
Level range Internal Auxiliary	 ± 4 div from center screen or ± 4 V, whichever is smaller ± 5 V (into 50 Ω), 5 V_{pp} maximum input signal swing
Sweep modes	Auto, triggered, single, segmented
Display jitter [2, 3, 4] (Trigger jitter)	230 fs rms
Trigger holdoff range	100 ns to 10 s
Trigger qualification (AND qualifier)	Single and multiple channels may be logically qualified with any other trigger mode
Trigger actions	Specify an action to occur (and the frequency of the action) when a trigger conditions occurs. Actions include email on trigger and execute "multipurpose" user setting.
Trigger sequences	Three stage trigger sequences including two-stage hardware (find event (A) and trigger event (B)) and one-stage InfiniiScan software trigger. Supports all hardware trigger modes except “edge then edge” and “video” and "Gbit serial." Supports “delay (by time)” and “reset (by time or event)” between two hardware sequences. The minimum latency between “find event (A)” and “trigger event (B)” is 3 ns.
Trigger - digital channels MSO models	
Threshold range (user-defined)	± 3.75 V in 10 mV increments
Threshold accuracy	± (100 mV + 3% of threshold setting)
Protocol triggering	All MSO models come standard with protocol trigger for DDR, LPDDR, DDR2, LPDDR2, DDR3, LPDDR3, DDR4, and LPDDR4

1. Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and ± 5 °C from firmware calibration temperature.
2. Internal edge trigger mode with JitterFree correction. Value depends on scope settings and trigger signal characteristics, and is equal to TIE value expressed in the formula above using the minimum Time Scale Accuracy value.
3. Value shown represents typical Display jitter for DSOV164A at 100 mV/div triggering on 500 mVpp 8 GHz sin wave signal.
4. Sample rate at maximum. Noise and slew rate determined at fixed-voltage trigger threshold, near middle of signal. Displayed signal not vertically clipped.

Trigger System – Performance Characteristics (continued)

Trigger modes – hardware	
Edge (analog and digital)	Triggers on a specified slope (rising, falling, or alternating between rising and falling) & voltage level on any channel or auxiliary trigger.
Edge transition (analog)	Trigger on rising or falling edges that cross two voltage levels in > or < the amount of time specified. Edge transition setting from 250 ps.
Edge then edge (time)(analog and digital)	The trigger is qualified by an edge. After a specified time-delay between 10 ns to 10 s, a rising or falling edge on any one selected input will generate the trigger.
Edge then edge (event)(analog and digital)	The trigger is qualified by an edge. After a specified delay between 1 to 16,,000,000 rising or falling edges, another rising or falling edge on any one selected input will generate the trigger.
Glitch (analog and digital)	Triggers on glitches narrower than the other pulses in your waveform by specifying a width less than your narrowest pulse and a polarity. Triggers on glitches as narrow as 125 ps. Glitch range settings from 250 ps to < 10 s.
Pulse width (analog and digital)	Trigger on a pulse that is wider or narrower than other pulses in waveform by specifying a pulse width & a polarity. Triggers on pulse widths as narrow as 125 ps. Pulse width range settings 250 ps to 10 s. Trigger point can be configured for “end of pulse” or “time out”.
Runt (analog)	Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Can be time qualified with minimum setting of 250 ps.
Timeout (analog and digital)	Triggers the oscilloscope when the waveform has been at a higher voltage than the voltage specified by the Level control for too long (High Too Long), when the waveform has been at a lower voltage than the Level voltage for too long (Low Too Long), or when the waveform has taken too long to pass through the Level voltage (Unchanged Too Long). Timeout settings from 250 ps to 10 s.
Pattern/state (analog and digital)	Identifies a trigger condition by looking for a specified pattern or a pattern and an edge (state) across the input channels.
Setup and hold (analog)	Trigger on setup, hold or setup and hold violations in your circuit. Requires a clock and data signal on any two inputs (except aux or line) channels as trigger sources. Setup and/or hold time must then be specified
Window (analog)	Specify a voltage range and then trigger when the waveform either exits this range, enters this range, stays outside the range for too long or too short, or stays inside the range for too long or too short. Range setting from 250 ps to 10 s.
Gbit serial (analog) [1]	• Triggers on bit patterns at rates from 480 Mb/s to 12.5 Gb/s • Generic mode - Trigger up to 160-bit sequence of arbitrary NRZ data (high, low, don’t care) • 8b/10b mode - Trigger up to 10 “K” and “D” code symbols. Alignment character is K28.5 (either disparity) • PRBS errors mode - Count accumulated bits and errors, and trigger bit error for PRBS 7, 15, 23, and 31
Video (analog)	Triggers from negative sync composite video, field 1, field 2, or alternating fields for interlaced systems, any field, specified line or any line for interlaced or non-interlaced systems. Support NTSC, PAL-M (525/60), PAL, SECAM (625/50), EDTV (480p/60), EDTV (576p/50), HDTV (720p/60), HDTV (720p/50), HDTV (1080i/60), HDTV (1080i/50), HDTV (1080p/60), HDTV (1080p/50), HDTV (1080p/30), HDTV (1080p/25), HDTV (1080p/24) and user-defined formats
Protocol	Trigger on certain packets or patterns in protocol-based data.

1. Models with hardware serial trigger option.

Trigger modes – software	(Requires D9020SCNA InfiniiScan event identification software)
Zone qualify	Software triggers on the user-defined zones on screen. Zones can be specified as either “must intersect” or “must not intersect.” Up to eight zones can be defined across multiple channels.
Generic serial	Software triggers on NRZ-encoded data up to 8.0 Gbps, up to 80-bit pattern. Support multiple clock data recovery methods including constant frequency, 1st-order PLL, 2nd-order PLL, explicit clock, explicit 1st-order PLL, explicit 2nd-order PLL, Fibre Channel, FlexRay receiver, FlexRay transmitter
Measurement limit	Software triggers on the results of the measurement values. For example, when the “pulse width” measurement is turned on, InfiniiScan measurement software trigger triggers on a glitch as narrow as 40 ps. When the “time interval error (TIE)” is measured, InfiniiScan can trigger on a specific TIE value.
Non-monotonic edge	Software triggers on the non-monotonic edge. The non-monotonic edge is specified by setting a hysteresis value.
Runt	Software triggers on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Unlike hardware runt trigger, InfiniiScan runt trigger can be further qualified via a hysteresis value.

Measurements and Math

Oscilloscope measurements	
Number of measurements	Up to 40 simultaneous measurements (can be made on either main, zoom or gated region)
Measurement update rate	> 50,000 measurement/sec (one measurement turned on)
	> 250,000 measurement/sec/measurement (ten measurements turned on)
Measurement modes	Standard, measure all edges mode
Statistics	Displays the current, mean, minimum, maximum, range (max-min), standard deviation, number of measurements value for the displayed automatic measurements. Also shows Fail Min and Fail Max when measurement limit test is enabled
Level qualification	Any channels that are not involved in a measurement can be used to level-qualify all timing measurements
Waveform measurements	
Voltage (analog)	V peak-peak, V min, V max, V upper, V middle, V lower, V overshoot, V preshoot, V time, peak-peak contrast, average, RMS, amplitude, base, top, overshoot, preshoot, crossing, pulse top, pulse base, pulse amplitude
Time (analog)	Rise time, fall time, period, frequency, positive width, negative width, duty cycle, Tmin, Tmax, Tvolt, channel-to-channel delta time, channel-to-channel phase, count pulses, burst width, burst period, burst interval, setup time, hold time, edge-edge, edge time, slew rate
Time (digital)	Period, frequency, positive width, negative width, duty cycle, delta time
Clock (analog)	Period, frequency, duty cycle, phase, time interval error (TIE), cross-corelated TIE, N-period, period to period, positive width to positive width, neg width to neg width, duty cycle to duty cycle
Data (analog)	Setup time, hold time, unit interval, N Unit Interval, unit interval to unit interval, noise, data rate, pattern length, CDR clock recovery rate, deemphasis, BER (cumulative), BER (per acq)
Mixed (analog)	Area, slew rate
Frequency domain (analog)	FFT frequency, FFT magnitude, FFT delta frequency, FFT delta magnitude, FFT channel power, FFT power spectral density, FFT occupied bandwidth, peak detect mode
Eye-diagram (analog)	Eye height, eye width, eye one level, eye zero level, eye jitter, eye skew, eye level, crossing percentage, Q factor, duty-cycle distortion
Jitter analysis measurements – Requires D9020JITA EZJIT complete analysis application	
Clock	Time interval error, N-period, period to period, positive width to positive width, neg width to neg width, duty cycle to duty cycle
Data	Time interval error, noise, unit interval, N Unit Interval, unit interval to unit interval, data rate, clock recovery rate, CDR, de-emphasis
Phase noise	Phase jitter
PAMn measurements – Requires D9020PAMA PAM4 analysis application	
PAMn measurements	Level mean, level RMS, level skew, level thickness, eye height, eye width, eye skew, eye level, VEC, BER (Cumulative), BER (Per Acq), SER (Cumulative), SER (Per Acq), clock recovery rate, pattern length, rise time, fall time, and time interval error (TIE), composite histograms
Edge jitter measurements	PAM-4 12 Edge Jitter, J3U, J4U J5U, Jrms, J6U, and EOJ (PRBS9, PRBS13Q, PRBS31Q, PCIe Gen6 (52 symbols) and user defined pattern support up to PRBS23)
PAM formats	PAM-3, PAM-4, PAM-6, PAM-8, grey coded, uncoded

Oscilloscope measurements (continued)

Histograms	
Source	Waveform or measurement
Orientation	Vertical (for timing and jitter measurements) or horizontal (noise and amplitude change) modes, regions are defined using waveform markers
Measurements (available as a function)	Mean, standard deviation, mean ± 1, 2, and 3 sigma, median, mode, peak-to-peak, min, max, total hits, peak (area of most hits), X scale hits, X offset hits, full width at half maximum (FWHM), bin width
Mask testing	Allows pass/fail testing to user-defined or Keysight-supplied waveform templates. Automask lets you create a mask template from a captured waveform and define a tolerance range in time/voltage or screen divisions. Test modes (run until) include test forever, test to specified time or event limit, and stop on failure. Executes "multipurpose" user setting on failure
Waveform math	
Number of functions	16
Hardware accelerated math operations	Differential and common mode
Math functions	Absolute value, add, amplitude demodulation (radar envelope), average, bus chart, Butterworth[1], common mode, delay, differentiate, divide, envelope, FFT magnitude, FFT phase, FIR[1], gating, high pass filter, histogram, InfiniiSim[2] (2 port, 4 port 1 src, 4 port CM, 4 port diff, 4 port src1, 4 port src2), horizontal gating, integrate, invert, LFE[1], low pass filter (4th-order Bessel Thompson filter), magnify / duplicate, max, measurement trend, measurement log, min, multiply, pattern average, power, power efficiency, RT Eye[1], smoothing, SqrtSumOfSquare[1], square, square root, subtract, versus (XY), versus (XYZ qualified) and optional user defined function[1] 1 Requires MATLAB® software option 2 Requires D9020ASIA software option
FFT	
Frequency range	DC to scope's maximum bandwidth
Frequency resolution	Sample rate/memory depth = resolution
Window modes	Hanning, flattop, rectangular, Blackman-Harris, Hamming
Measurement modes	
Automatic measurements	Measure menu access to all measurements, up to 40 measurements can be displayed simultaneously
Multipurpose	Front-panel button activates up to ten pre-selected or up to ten user-defined automatic measurements
Drag-and-drop measurement toolbar	Measurement toolbar with common measurement icons that can be dragged and dropped onto the displayed waveforms
Marker modes	Manual markers, track waveform data, track measurements, track RF (on FFT math function waveforms)
Bookmarks and callouts	Supports callouts for measurements and FFT peaks. Supports bookmarks for team collaboration

Platform Characteristics

Computer system, peripherals and accessories	
Operating system	Microsoft Windows 10 64-bit or newer Microsoft Windows release
CPU	Intel i5-3550S quad-core CPU at 3.00 GHz or higher performance CPU
PC system memory	16 GB DDR3 RAM or higher capacity/performance RAM
PC ports	USB 2.0 hi-speed (host), USB 2.0 hi-speed (device), VGA, DisplayPort, USB 3.0 (host), USB 3.0 (device), dual-monitor video output, 10/100/1000 LAN, LXI LAN, GPIB (IEEE-488)
Drives (SSD)	500GB Enterprise grade internal SSD removable hard drive or higher capacity/performance SSD
Peripherals	Optical USB mouse, compact USB keyboard supplied. All Infiniium models support any Windows-compatible input device with a USB interface
File types	
Analog Waveforms	Compressed internal format (*.wfm (200 Mpts)), Comma-separated values (*.csv (2 Gpts)), Tab-separated values (*.tsv (2 Gpts)), Public binary format (.bin (500 Mpts)), Y value files (*.txt (2 Gpts)), hierarchal data file (*.hf5 (2 Gpts)), Composite setup and data file (*.osc (2 Gpts))
Digital Waveforms	Hierarchal data file (*.hf5 (2 Gpts)), Composite setup and data file (*.osc (2 Gpts))
Images	BMP, PNG, TIFF, GIF, JPG or OSC file format
Included accessories	
All models	Country-specific power cord, front cover, mini USB keyboard, USB optical mouse, and an ESD wrist strap Five coax adapters (female-to-female) • 8, 13, and 16 GHz models come with 3.5 mm female-to-female adapters rated to 25 GHz (part number 1250-3758). • All other models (20, 25, 33 GHz) come with 3.5 mm female-to-female adapters rated to 35 GHz (part number 5061-5311) The 8 and 13 GHz models come standard with two N5442A precision BNC adapters.
I/O ports	
Aux in	External trigger input, 50 Ω impedance
Aux out	100 MHz, square wave, PRBS 27-1, PRBS 215-1, PRBS 223-1, and PRBS 231-1
Cal out	DC (± 2.4 V), 100 MHz, square wave, PRBS 2^7-1, PRBS 2^{15}-1, PRBS 2^{23}-1, and PRBS 2^{31}-1
Reference clock input	External clock reference input to the hardware serial trigger Peak-to-peak amplitude: 0.8 V to 3.6 V. Voltage range: -0.1V to 3.7V Clock rise and fall time (10 to 90%): 1 ns or faster
Reference clock output	Sub-rate clock output generated by the hardware serial trigger Peak-to-peak amplitude into 50 Ω: 1 V, offset: 0 V
Digital channels connector (MSO only)	Digital channel inputs
Pattern generator[1]	Demo pattern output from the hardware serial trigger Peak-to-peak amplitude into 50 Ω: 400 mV, offset: 400 mV
Timebase reference input[1]	Input frequency lock range: 10 MHz ±5 ppm, 50 Ω impedance Amplitude, sine wave input: 178 mV_{pp} to 1 V_{pp}
Timebase reference output[1]	Peak-to-peak amplitude into 50 Ω: 750 mV, offset: 0 V when derived from the internal reference Signal amplitude follows reference input when derived from external reference
Trig out	Peak-to-peak amplitude into 50 Ω: 2.4 V, offset: 0 V

1. Models with hardware serial trigger option

Display	
Display	15.4-inch color XGA TFT-LCD with capacitive touch screen
Intensity grayscale	256-level intensity-graded display
Resolution XGA	1024 pixels horizontally x 768 pixels vertically
Annotation	Up to 100 bookmarks can be inserted into the waveform window. Each can float or be tied to a specific waveform
Grids	Choose between 1-16 grids per waveform area, 8-bit vertical resolution
Waveform areas	Supports eight waveform areas plus chart mode for EZJIT, InfiniiSim, protocol, and PrecisionProbe
Waveform styles	Connected dots, dots, infinite persistence, color graded infinite persistence. Includes up to 256 levels of intensity-graded waveforms, variable persistence

General Characteristics

General characteristics	
Temperature	Operating: 5 to +40 °C
	Non-operating: –20 to +65 °C
Humidity	Operating: Up to 95% relative humidity (non-condensing) at +40 °C
	Non-operating: Up to 90% relative humidity at +65 °C
Altitude	Operating: Up to 4,000 meters (12,000 feet
	Non-operating: Up to 15,300 meters (50,000 feet)
Vibration	Operating random vibration 5 to 500 Hz, 10 minutes per axis,0.21 g(rms)
	Non-operating random vibration 5 to 500 Hz, 10 minutes per axis, 2.0 g(rms); resonant search 5 to 500 Hz
	Swept sine, 1 octave/minute sweep rate, (0.50 g), 5 minute resonant dwell at 4 resonances per axis
Power	100 to 240 VAC at 50/60 Hz; input power 800 Watts
Weight	Frame: 52.2 lbs. (23.7 kg); shipping: 71.7 lbs. (32.5 kg)
Dimensions	Height: 10.5 in (26.6 cm); width: 17.2 in (43.6 cm); depth: 19.4 in (49.2 cm)
Safety	IEC 61010-1:2010/EN 61010-1 3rd Edition CAN/CSA-C22.2 No. 61010-1-12 UL Std. No. 61010-1(3rd Edition)
Pollution degree	2
Installation category	2
Environment	For indoor use only

Definitions

Measured (meas)

An attribute measured during development for purposes of communicating the expected performance. This data is not warranted, does not include measurement uncertainty, and is measured at room temperature (approximately 23°C).

Nominal (nom)

The mean or average characteristic performance, or the value of an attribute that is determined by design such as a connector type, physical dimension, or operating speed. This data is not warranted and is measured at room temperature (approximately 23°C).

Specification (spec)

The warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 5 – 40°C and after a 30-minute warm up period.

Typical (typ)

The characteristic performance, which 80% or more of manufactured instruments will meet. This data is not warranted, does not include measurement uncertainty, and is valid only at room temperature (approximately 23°C).

Operating frequency range

The operating frequency range is the frequency range of corrected signal spectral components by deembeding for frequency and phase characteristics of the individual hardware.

Analog bandwidth

The analog bandwidth describes the 3 dB bandwidth of the full opto-electronic input path without any frequency or phase corrections.

Sensitivity

The sensitivity limit corresponds to the received signal power at the input interface for which a 32 GBaud DP-QPSK exhibits an EVM of 32.5% or less. An EVM of 32.5% corresponds to a BER of 1E-3 for assumed added Gaussian white noise (AWGN) according to =0.5*ERFC(1/(SQRT (2)* (EVM²+1))).

Effective Number of Bits (ENOB)

Definition in accordance with IEEE 1057: “For an input sinewave of specified frequency and amplitude, ENOB is the number of bits of an ideal waveform recorder for which the rms quantization error is equal to the rms NAD of the waveform recorder under test.” ENOB is determined by equation.

Confidently Covered by Keysight Services

Prevent delays caused by technical questions, or system downtimes due to instrument maintenance and repairs with Keysight Services. Keysight Services are here to support your test needs with expert technical support, instrument repair and calibration, software support, training, alternative acquisition program options, and more.

A KeysightCare agreement provides dedicated, proactive support through a single point of contact for instruments, software, and solutions. KeysightCare covers an extensive group of instruments, application software, and solutions and ensures optimal uptime, faster response, faster access to experts, and faster resolution.

Keysight Services

Offering	Benefits
KeysightCare	KeysightCare provides elevated support for Keysight instruments and software, with access to technical support experts that respond within a specified time and ensure committed repair and calibration turnaround times (TAT). KeysightCare offers multiple service agreement tiers, including KeysightCare Assured, Enhanced, and Application Software Support. See the KeysightCare data sheet for details.
KeysightCare Assured	KeysightCare Assured goes beyond basic warranty with repair services that include committed TAT and unlimited access to technical experts.
KeysightCare Enhanced	KeysightCare Enhanced includes all the benefits of KeysightCare Assured plus Keysight's accurate and reliable calibration services, accelerated, and committed TAT, and technical response.
Keysight Support Portal & Knowledge Center	All KeysightCare tiers include access to the Keysight Support Portal where you can manage support and service resources related to your assets such as service requests, and status, or browse the Knowledge Center.
Education Services	Build confidence and gain new skills to make accurate measurements, with flexible Education Services developed by Keysight experts. Including Start-up Assistance.
Alternative acquisition options	
KeysightAccess	Reduce budget challenges with a subscription service enabling you to get the instruments, software, and technical support you want for your test needs.

Recommended Services

Maximize your test system up-time by securing technical support, repair, and calibration services with committed response and turnaround times. 1-year KeysightCare Assured is included in every new instrument purchase Obtain multi-year KeysightCare upfront to eliminate the need for lengthy and tedious paperwork and yearly requests for maintenance budget. Plus, you benefit from secured service for 2, 3, or 5 years.

Service	Function
KeysightCare Enhanced*	**Includes Tech Support, Warranty and Calibration**
R-55B-001-1	KeysightCare Enhanced – Upgrade 1 year
R-55B-001-2	KeysightCare Enhanced – Extend to 2 years
R-55B-001-3	KeysightCare Enhanced – Extend to 3 years (Recommended)
R-55B-001-5	KeysightCare Enhanced – Extend to 5 years (Recommended)
KeysightCare Assured	**Includes Tech Support and Warranty**
R-55A-001-2	KeysightCare Assured – Extend to 2 years
R-55A-001-3	KeysightCare Assured – Extend to 3 years
R-55A-001-5	KeysightCare Assured – Extend to 5 years
Start-Up Assistance	
PS-S10	Included – instrument fundamentals and operations starter
PS-S20	Optional, technology & measurement science standard learning

* Available in select countries. For details, please view the datasheet. R-55B-001-2/3/5 must be ordered with R-55B-001-1.

More Information

Thank you for choosing a Keysight UXR-Series Oscilloscope. Keysight Infiniium UXR-Series oscilloscopes set a new standard for real-time oscilloscope accuracy, performance and upgradability, with models ranging from 5 GHz to 110 GHz. Proven industry best signal integrity, 10-bits of vertical resolution and ultra-low noise floor specifications allow for the truest representation of signals. Invest with confidence today, knowing you have the ability to meet the needs and technology advancements of tomorrow. For more information on the Keysight Infiniium UXR-Series, check out the following:

- Infiniium V-Series Technical Overview
- Infiniium V-Series Configuration Guide
- Infiniium V-Series Product Fact Sheet