InfiniiVision HD3 Series Oscilloscopes

Making precision portable

Introduction

The HD3 Series brings Keysight's industry-leading capabilities from high-performance oscilloscopes to the high-volume level, making precision portable from 200 MHz to 1 GHz. Leveraging custom hardware technology from the UXR Series, the HD3 boasts impressive resolution with four times the vertical accuracy with a 14-bit ADC and half the noise floor of other 12-bit scopes. Paired with our fast waveform update rate, digital trigger, and deep memory, the HD3 Series can capture small signals with high vertical resolution.



KEYSIGHT

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See What You've Been Missing with Portable Precision

Meet the new generation of Keysight InfiniiVision oscilloscopes, the HD3 Series. The HD3 was created with high-performance technology leveraged from our high-speed UXR Series oscilloscopes, now making precision available in a much more portable form factor.

With the all-new architecture of the HD3 (including a custom 14-bit ADC and low noise front end), you can analyze all signals in your design with high vertical accuracy. This ensures you make the most accurate measurements possible and have the most realistic view into the signals inside your device.

You can achieve even greater accuracy (5x better) with up to 16 bits of resolution using the built-in per-channel bandwidth filters. Need to use the full bandwidth to 1 GHz? You will still get extremely high accuracy at the full bandwidth, with the ability to zoom to 100 uV/div.

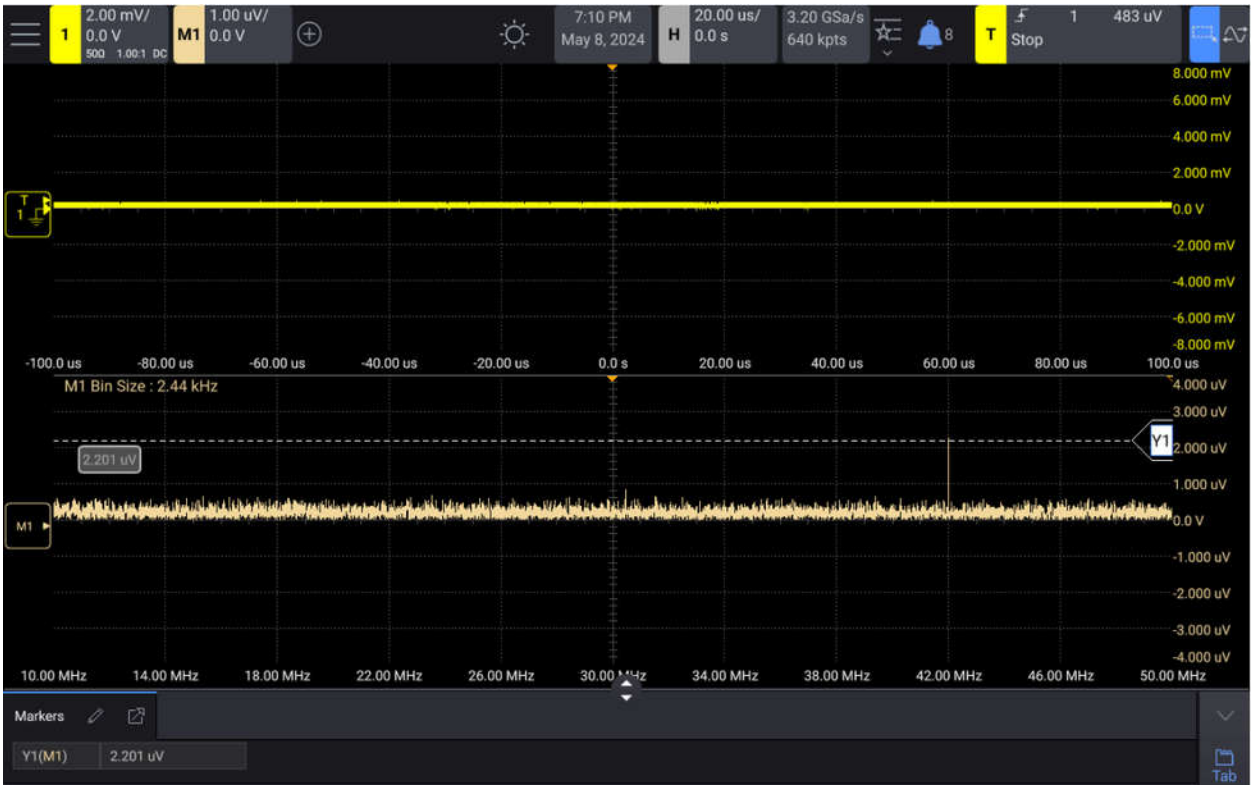


Figure 1. The oscilloscope captures a 2 uV, -100 dBm signal very clearly in our FFT. This same signal would not be viewable with a higher noise floor oscilloscope.

See What You've Been Missing with Custom Technology

The HD3 Series uses custom components optimized specifically for oscilloscope measurements. Keysight's R&D team designed a brand-new 14-bit ADC, an all-new ASIC, other support components, and an entirely new architecture for the signal to flow through. Because Keysight designs these components rather than using off-the-shelf components, our hardware works much faster and more efficiently since it is designed specifically for oscilloscopes.

Part of this new architecture also includes deep memory with dedicated memory chips for every channel (100 Mpts). This means there is no interleaving between channels. You can have all four channels turned on and still get the maximum memory and sample rate on every channel.

Our new custom ASIC (MegaZoom 5) enables the HD3 to have hardware-based functions such as zone trigger, serial decoding, and mask testing.

Custom hardware also makes it possible for us to create new custom software, such as the Fault Hunter software application. Simply run Fault Hunter and detect any glitches or errors on your signa.

See What You've Been Missing with Versatile Functionality

Dive deeper than ever before with more flexibility in the InfiniiVision user interface. Not only did we leverage the hardware from our high-performance oscilloscopes, but we also took some of the more advanced user interface capabilities and added them to the new InfiniiVision user interface. With more menus and user customization, you can set up the scope to be customized to your exact testing requirements. The custom grid display, favorites bar, and automatic actions make it even easier to dive deep into your characterization and view results quickly.

All models can be upgraded in bandwidth or memory using immediate license upgrades. There are no returns to factory required for any upgrades. All models are also already equipped with these standard functions that typically cost thousands of dollars:

- Frequency response analysis
- Fault Hunter
- Zone trigger
- Segmented memory
- MSO
- Mask testing
- Histograms
- FFT, and more

All-New Custom ASIC: MegaZoom 5

Traditionally, CPU processing was the major bottleneck for oscilloscope waveform update rate and responsiveness. This remains the case with many of our competitors. When the CPU handles things like interpolations, logic channel plotting, serial bus decoding, measurements and more, and the waveform update rate, memory, and sample rate drop dramatically as these features are turned on.

The InfiniiVision HD3 Series has an all-new MegaZoom 5 ASIC that was built from the ground up with none of the same architecture or components in our MegaZoom 4 in our previous InfiniiVision scopes. With this new custom ASIC, the HD3 oscilloscopes can do things in hardware instead of running in software through their CPU. With these functions being performed in hardware, the HD3 requires minimum support from a CPU. MegaZoom includes hardware serial decoders and hardware mask limit testing capability, plots analog and digital data directly to the display, supports GUI operation, and integrates additional instruments like the WaveGen function / arbitrary waveform generator.

The new features enabled by MegaZoom 5, combined with the supporting architecture around it, enables the HD3 Series to show the most realistic view of the signals inside your device.

Fault Hunter Software

Fault Hunter is an innovative, expert system for inspecting digital systems. It automatically evaluates your signal's characteristics against user-definable criteria, quickly finding and saving errors for your review. It's flexible, and you can define the test duration from a few minutes up to two days. Set up your device under test on a Friday afternoon and return Monday morning with a full test report to review, with billions of tests complete.



Configuring Your Oscilloscope

Step 1. Choose model with number of analog channels

All models come standard with a minimum 200 MHz bandwidth and MSO interface enabled.

HD3 Series specification overview

	HD302MSO	HD304MSO
Bandwidth (-3 dB)	200 MHz	
Calculated rise time (10 to 90%)	≤ 3.5 ns	
Input channels		
Analog	2	4
Digital	16	16

Step 2. Choose your bandwidth upgrade

Bandwidth options

Bandwidth (-3 dB)	Calculated rise time (10 to 90%)	HD302MSO	HD304MSO
200 MHz (standard)	2.0 nsec	HD302MSO-200	HD304MSO-200
350 MHz	1.3 nsec	HD302MSO-350	HD304MSO-350
500 MHz	900 psec	HD302MSO-500	HD304MSO-500
1 GHz	450 psec	HD302MSO-01G	HD304MSO-01G

Step 3. Select memory upgrades

Memory options

Capture memory	HD302MSO/HD304MSO
20 Mpts/channel (standard)	HD300MSO-020
50 Mpts/channel	HD300MSO-050
100 Mpts/channel	HD300MSO-100

Step 4. Select system upgrades

System upgrade options

Feature	HD302MSO/HD304MSO
100 MHz WaveGen	HD3WAVEGEN
Enhanced security	HD3SECURE

Step 5. Select software upgrades

Software options

License upgrade	Description	Model number
Embedded software package	I²C, SPI, UART (RS232/422/485) serial trigger and decode	HD300EMBA
Automotive software package	CAN, CAN FD, CAN XL (symbolic with .dbc file), SENT, and LIN (symbolic with .ldf file)	HD300AUTA
Aerospace and defense software package	MIL-STD 1553 and ARINC 429 triggering and analysis	HD300AERA

Step 6. Choose your accessories and additional productivity software

Recommended accessories and PC software

Model number	Description	
HD3COVER	Front panel cover for InfiniiVision HD3 Series	Optional
HD3CASE	Soft carrying case for InfiniiVision HD3 Series	Optional
HD3RACK	Rack mount kit for InfiniiVision HD3 Series	Optional

Step 7. Choose your probes

For a complete list of compatible probes, visit

https://www.keysight.com/us/en/lib/resources/selection-guides/oscilloscope-probes.html

Recommended probes

Model number	Description	
N2843A	Passive probe 500 MHz, 10:1, 1 MΩ, 11 pF	Standard (1 per channel)
N2756A	16 digital channel MSO cable	Optional
PP0001A	Performance Hi-Z probe for up to 1 GHz, 300Vrms, < 4pF	Optional
PP0002A	Performance Hi-Z probe for up to 800 MHz, 1200Vrms, < 2pF	Optional
PP0003A	Performance Hi-Z probe for up to 1 GHz, 30Vrms, <4pF, MMCX connector	Optional
N2870A	Passive probe 35 MHz, 1:1, 1 MΩ	Optional
N2795A	1.0 GHz 10:1 single-ended active probe, 1 MΩ / 1 pF, ±8 V	Optional
N2797A	1.5 GHz 10:1 single-ended active probe, 1 MΩ / 1 pF, ±8 V, extreme temperature	Optional
N2790A	100 MHz 50:1/500:1 HV differential probe, 8 MΩ /3.5 pF, ±1,400 V	Optional
DP0010A	250 MHz 17:1/85:1 differential probe, 1.7 MΩ / 1.5 pF, ±42 V	Optional
DP0011A	500 MHz 17:1/85:1 differential probe, 1.7 MΩ / 1.5 pF, ±42 V	Optional
DP0012A	1.0 GHz 17:1/85:1 differential probe, 1.7 MΩ / 1.5 pF, ±42 V	Optional
DP0013A	1.8 GHz 17:1/85:1 differential probe, 1.7 MΩ / 1.5 pF, ±42 V	Optional
DP0021A-009	Automotive sub-DB9 accessory for DP001xA differential active probes	Optional
N2750A	1.5 GHz 2:1/10:1 differential active probe, 200 kΩ / 0.7 pF, ±5 V	Optional
N7020A	2 GHz 1:1 power rail probe, ±24 V offset range, 50 kΩ, ±850 mV ripple range	Optional
1147B	50 MHz, 15 Amp AC/DC current probe	Optional
N2893A	100 MHz, 15 Amp AC/DC current probe	Optional
N7026A	150 MHz, 40 Amp AC/DC high-sensitivity current probe	Optional
N2820A	2-channel high-sensitivity current probe 50 µA to 5 A	Optional
N2821A	1-channel high-sensitivity current probe 50 µA to 5 A	Optional

Performance Characteristics

HD3 Series specification overview

Bandwidth[1] (-3 dB)	200 MHz	350 MHz	500 MHz	1 GHz
Calculated rise time (10 to 90%)	≤ 2.0 ns	≤ 1.3 ns	≤ 900 ps	≤ 450 ps
Maximum sample rate	3.2 GSa/s per channel			
Maximum memory depth	100 Mpts per channel			
Display size and type	10.1-inch capacitive touch gesture-enabled display			
Waveform update rate	Uncompromised > 1,300,000 waveforms per second			

Vertical system analog channels

Hardware bandwidth limits	20, 40, 50, 100, 200, 350 MHz (selectable), per-channel 5, 10, 20, 40, 50, 100, 200, 350 MHz (selectable), global
Input coupling	AC, DC
Input impedance	50 Ω ± 1.5%[2] 1 MΩ ± 1% ll ~24pF
Input sensitivity range	50 Ω 100 uV/div to 1 V/div
	1 MΩ 100 uV/div to 10 V/div
Vertical resolution	14 bits (16 bits using bandwidth limits)
Maximum input voltage	1MΩ: 135 Vrms, 190 Vpk. Derate at 20dB/decade from 250 kHz to 10 MHz. Above 10 MHz: 5Vrms
	50Ω: ≤ 104 mV/div: ±1.5 Vpk > 104 mV/div: 5 Vrms, 15 Vpk
	When using Keysight PP0001A, PP0002A, or PP0003A probes, input voltages at the oscilloscope are ≤ 30 Vrms
	For the 1MΩ input, probing technology allows testing of higher voltages (for example, the included N2843A 10:1 probe supports testing up to 300Vrms).
	Use this instrument only for measurements within its specified measurement category (not rated for CAT II, III, IV). No transient overvoltage allowed
DC vertical gain accuracy[1]	±1.5% full scale[3]
DC voltage measurement accuracy	Dual cursor: ± [(DC gain accuracy) + 0.16% full scale][1] Single cursor: ± [(DC gain accuracy) + (offset accuracy) + 0.08% full scale]
DC vertical offset accuracy	± 0.1 div ± 1 mV ± 1.5% of offset setting
Channel-to-channel isolation	> 100:1 from DC to maximum specified bandwidth of each model (measured with same V/div and coupling on channels)
Offset range	50Ω: 100uV/div to 100mV/div: ±1.5V > 100mV/div to 1V/div: ±5V
	1MΩ: 100uV/div to 100mV/div: ±1.5V > 100mV/div to 1V/div: ±15V > 1V/div to 10V/div: ±150V
Noise density	Measured at 101 MHz, span 1 MHz and 15 kHz RBW Range (dBM): Noise Density (dBm/Hz) -38 dBm: -161.2 dBm/Hz 0 dBm: -141.5 dBm/Hz 6 dBm: -133.1 dBm/Hz
Signal-to-noise dynamic range	96 dB (0 dBm 100 MHz input carrier, 0 dBm input range (80 mV/div), 100 MHz CF, 50 MHz span, 15 kHz RBW, measurement at +15 MHz from CF)
Spurious Free Dynamic Range (SFDR)	79 dB (0 dBm 100 MHz input carrier, 0 dBm input range (80 mV/div), 500 MHz span, 300 MHz CF, 150 kHz RBW)
Amplitude accuracy	±0.3 dB (0 to 1 GHz)
Deviation from linear phase	10° (0 to 1 GHz)

1 Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and ±10 °C from firmware calibration temperature
2 Valid for input voltage within ±8 divisions from offset setting.
3 Full scale is defined as 8 vertical divisions. 100 uV/div and 1 mV/div are a magnification of 2 mV/div setting. For vertical accuracy calculations, use full scale of 16 mV for 500 uV/div and 1 mV/div.

Vertical system digital channels

Digital input channels	16 digital (D0 to D15. pod 1: D3 ~ D0, Pod 2: D7 ~ D4, Pod 3: D11 ~ D8, Pod 4: D15 ~ D12)
Thresholds	Threshold per pod
Threshold selections	TTL (+1.4 V), 5 V CMOS (+2.5 V), ECL (–1.3 V), user-defined (selectable by pod)
User-defined threshold range	± 8.0 V in 10 mV steps
Maximum input voltage	± 40 V peak
Threshold accuracy[1]	± (100 mV + 3% of threshold setting)
Maximum input dynamic range	± 10 V about threshold
Minimum voltage swing	500 mVpp
Input impedance	100 kΩ ± 2% at probe tip
Input capacitance	~8 pF
Vertical resolution	1 bit

RMS noise floor ($V_{RMS\ AC}$) on 50 Ω inputs

Vertical setting	20 MHz	100 MHz	200 MHz	350 MHz	500 MHz	1 GHz
500 uV/div, 2 mV/div	13 u	20 u	26 u	30 u	35 u	48 u
5 mV/div	16 u	25 u	33 u	38 u	44 u	59 u
10 mV/div	24 u	35 u	49 u	56 u	67 u	87 u
20 mV/div	44u	63 u	89 u	104 u	124 u	159 u
50 mV/div	92 u	141 u	202 u	239 u	286 u	366 u
100 mV/div	189 u	278 u	399 u	474 u	568 u	723 u
200 mV/div	442 u	638 u	898 u	1.06 m	1.26 m	1.60 m
500 mV/div	942 u	1.41 m	2.03 m	2.41 m	2.88 m	3.66 m
1 V/div	1.78 m	2.82 m	4.04 m	4.79 m	5.74 m	7.26 m

RMS noise floor ($V_{RMS\ AC}$) on 1M Ω inputs

Vertical setting	20 MHz	100 MHz	200 MHz	350 MHz	500 MHz
500 uV/div, 2 mV/div	21 u	34 u	50 u	76 u	96 u
5 mV/div	24 u	37 u	53 u	80 u	100 u
10 mV/div	31 u	46 u	64 u	92 u	112 u
20 mV/div	51 u	72 u	97 u	132 u	154 u
50 mV/div	150 u	146 u	198 u	263 u	295 u
100 mV/div	204 u	280 u	330 u	505 u	560 u
200 mV/div	454 u	686 u	947 u	1.29 m	1.51 m
500 mV/div	926 u	1.42 m	1.95 m	2.60 m	2.92 m
1 V/div	1.96 m	2.77 m	3.78 m	5.01 m	5.58 m
2 V/div	4.42 m	6.76 m	9.42 m	13.0 m	15.1 m
5 V/div	9.63 m	14.2 m	19.5 m	26.1 m	29.2 m
10 V/div	20.2 m	27.9 m	38.0 m	50.3 m	55.9 m

ENOB (normal sample mode 100 mV/div, 1M Ohm) on a 10 MHz 90% full-screen sine wave

Input	20 MHz	50 MHz	100 MHz	200 MHz	350 MHz	500 MHz	1 GHz
50 Ω	10.4	9.9	9.5	9.0	8.8	8.5	8.2
1M Ω	10.3	9.9	9.5	8.9	8.8	8.4	N/A

Horizontal system analog channels

Time base range		500 ps/div to 50 s/div
Time base accuracy[1]		±1.6 ppm + aging factor (1 year: ±0.5 ppm, 2 years: ±0.7 ppm, 5 years: ±1.5 ppm, 10 years: ±2.0 ppm)
Time base delay time range	Pre-trigger	Maximum of 20M/sample rate, no more than 200s
	Post-trigger	Up to 500 sec
Channel-to-channel deskew range		±100 ns
Δ Time accuracy (using cursors)		Same channel: ± (time base accuracy x reading) ± (0.0016 x screen width) ±50 ps Channel-to-channel: ± (time base accuracy x reading) ± (0.0016 x screen width) ±100 ps
Modes		Main, zoom, roll, XY
XY		On channels 1 and 2 only. Z blanking on ext trigger input, 1.4V threshold

Horizontal system digital channels

Minimum detectable pulse width	5 ns
Channel-to-channel skew	2 ns (typical); 3 ns (maximum)

Acquisition system

Maximum analog channels sample rate		3.2 GSa/s all channel
Maximum analog channels record length every channel		20 Mpt with standard license 50 Mpt with 50 Mpt memory license 100 Mpt with 100 Mpt memory license
Maximum digital channels sample rate		1.6 GSa/s all pods
Maximum digital channels record length		20 Mpt
High Resolution		As bandwidth is decreased using the built-in per-channel or global bandwidth filters, resolution increases up to 16 bits for high definition. To adjust bandwidth, use the Channel Setup menu.
Acquisition mode	Normal	Default mode
	Peak detect	Capture glitches as narrow as 156.25 ps at all timebase settings
	Averaging	Selectable from 2, 4, 8, 16, 64, ... to 65,536
	Segmented	Segmented memory optimizes available memory for data streams that have long dead times between activity. Maximum segments = 2000. Re-arm time – 700 ns (minimum time between trigger events)
	Manual	Allows independent selection of sample rate and memory depth
Time mode	Normal	Default mode

Trigger system

Trigger sources	Analog channel (1 ~ 4), digital channel (D0 ~ D15), line, external
Trigger modes	Normal (triggered): Requires trigger event for scope to trigger
	Auto: Triggers automatically in absence of trigger event
	Single: Triggers only once on a trigger event, press [Single] again for scope to find another trigger event, or press [Run] to trigger continuously in either Auto or Normal mode
	Force: front panel button that forces a trigger
Trigger coupling	DC: DC coupled trigger
	AC: AC coupled trigger, cutoff frequency: < 10 Hz (internal); <50 Hz (external)
	LF reject: Low frequency reject, cutoff frequency ~ 50 kHz
	HF reject: High frequency reject, cutoff frequency ~50 kHz
	Noise reject: Selectable OFF or ON, decreases sensitivity 2x
Trigger holdoff range	60 ns to 10.00 s

Trigger sensitivity

Internal (noise reject off)	50Ω: 1 LSB resolution, subject to the noise floor of the measurement
	1MΩ: 1 LSB resolution, subject to the noise floor of the measurement
External[1]	200 mVpp from DC to 100 MHz
	350 mVpp 100 MHz to 500 MHz

Trigger level range

Any channel	±6 div from center screen
External	±5 V

Trigger type selections

Zone (HW zone qualifier)	Trigger on user-defined zones drawn on the display. Up to four zones. A single zone can apply to any one analog channel at a time. Specify zones as either "must intersect" or "must not intersect." > 300,000 scans/sec update rate
	Supported modes: normal, peak detect
	Also works simultaneously with the serial trigger and mask limit test
Edge	Trigger on a rising, falling, alternating or either edge of any source
Edge-then-Edge	Trigger when the trigger edge occurs after an arming edge within the minimum and maximum delay times without any intervening arming or triggering edges (an edge followed by another edge)
Pulse width	Trigger on a pulse on a selected channel, whose time duration is less than a value, greater than a value, or inside a time range
	Minimum duration setting: 1 ns (500 MHz, 1 GHz), 4 ns (350 MHz), 6 ns (200 MHz), 10 ns (100 MHz)
	Maximum duration setting: 10 s
	Range difference minimum: 5 ns
Runt	Trigger on a positive runt pulse that fails to exceed a high-level threshold. Trigger on a negative runt pulse that fails to exceed a low-level threshold. Runt triggering can also be time-qualified (< or >) with a minimum time setting of 1 ns and maximum time setting of 10 s
	Minimum time setting: 1 ns (500 MHz, 1 GHz), 4 ns (350 MHz), 6 ns (200 MHz)
	10 ns (100 MHz)
Setup and hold	Trigger and clock/data setup and/or hold time violation. Setup time can be set from 0 to 10 s. Hold time can be set from 0 s to 10 S. Setup and hold window can be 3ns minimum.
Rise/fall time	Trigger on rise-time or fall-time edge speed violations (< or >) based on user-selectable threshold
	Select from (< or >) and time settings range between
	Minimum: 500 ps (500 MHz, 1 GHz), 2 ns (350 MHz), 3 ns (200 MHz), 5 ns (100 MHz)
	Maximum: 10 s
Pattern	Trigger when a specified pattern of high, low, and don't care levels on any combination of analog, digital, or trigger channels is [entered | exited]. Pattern must have stabilized for a minimum of 2 ns to qualify as a valid trigger condition
	Minimum duration setting: 1 ns (500 MHz, 1 GHz), 4 ns (350 MHz), 6 ns (200 MHz), 10 ns (100 MHz)
	Maximum duration setting: 10 s
	Range difference minimum: 5 ns
Or	Trigger on any selected edge across multiple analog or digital channels
I2C (optional)	Trigger at a start/stop condition or user defined frame with address and/or data values. Also trigger on missing acknowledge, address with no ack, restart, EEPROM read, and 10-bit write
SPI (optional)	Trigger on SPI (Serial Peripheral Interface) data pattern during a specific framing period. Supports positive and negative Chip Select framing as well as clock Idle framing and user-specified number of bits per frame. Supports MOSI and MISO data
RS-232/422/485/UART (optional)	Trigger on Rx or Tx start bit, stop bit or data content or parity error
CAN, CAN FD, CAN XL (optional)	Trigger on CAN (controller area network) version 2.0A, 2.0B, and CAN-FD (Flexible Data-rate) signals. Trigger on the Start of Frame (SOF), the end of frame (EOF), data frame ID, data frame ID and data (non-FD), data frame ID and data (FD), remote frame ID, remote or data frame ID, error frame, acknowledge error, from error, stuff error, CRC error, spec error (ack or form or stuff or CRC), all errors, BRS Bit (FD), CRC delimiter bit (FD), ESI bit active (FD), ESI bit passive (FD), overload frame., message, message and signal (non-FD), message and signal (FD, first 8 bytes only)
LIN (optional)	Trigger on LIN (Local Interconnect Network) sync break, sync frame ID, or frame ID and data, parity error, checksum error, frame (symbolic), frame and signal (symbolic)
SENT (optional)	Trigger on SENT bus. start of fast channel message, start of slow channel message, fast channel SC and data, slow channel message ID, slow channel message ID and data, tolerance violation, fast channel CRC error, slow channel CRC error, all CRC errors, pulse period error, successive sync pulses error (1/64)

Waveform measurements

Markers		Single Marker accuracy: ± [DC vertical gain accuracy + DC vertical offset accuracy + 0.08% full scale]
		Dual Marker accuracy: ± [DC vertical gain accuracy + 0.16% full scale][4]
		Units: Seconds(s), Hz (1/s), phase (degrees), ratio (%)
		Modes: Manual, Measure, Track Waveform, Binary, Hex
		Types: X1, X2, Y1, Y2, ΔX, ΔY
Automatic measurements		Measurements continuously updated with statistics. Cursors track last selected measurement. Select up to ten measurements from the list below: Vertical: Peak-to-peak, maximum, minimum, amplitude, top, base, overshoot, pre-shoot, average- N cycles, average- full screen, DC RMS- N cycles, DC RMS- full screen, AC RMS- N cycles, AC RMS- full screen (std deviation), ratio- N cycle, ratio- full screen, Y at X Time: Period, frequency, counter, T at edge, + width, - width, burst width, +duty cycle, -duty cycle, bit rate, rise time, fall time, delay, phase, X at min Y, X at max Y, Count: Positive pulse count, negative pulse count, rising edge count, falling edge count Mixed: Area- N cycles, area- full screen, slew rate Power: Channel power, occupied bandwidth, adjacent power ratio, total harmonic distortion
Automatic measurement logging		Available via BenchVue
Automatic measurement Gating		Main, Zoom, Markers
Counter (A, B)		Built-in frequency counters
		Source: On any analog or digital channel or Trigger Qualified Event (non-Edge Trigger Modes)
		Resolution: 8 digits
		Maximum frequency: Bandwidth of scope

Waveform math

Number of math functions		Four math
Arithmetic		Add, subtract, multiply, divide, differentiate, integrate, FFT, Ax + B, squared, square root, absolute value, common logarithm, natural logarithm, exponential, base 10 exponential, low pass filter, high pass filter, averaged value, smoothing, envelope, magnify, max hold, min hold, measurement trend
Enhanced FFT	Record size	Up to 64 kpts resolution default, can be extended to 32 Mpts
	Window types	Hanning, Flat Top, Rectangular, Blackman-Harris, Bartlett
	Time gated FFT	Gate the time range of data for FFT analysis in the zoom view. For time and frequency domain correlated analysis.
	Waveforms	FFT, max hold, min hold, average
	Peak search	Max 15 peaks, threshold and excursion control

Search, navigate, and lister

Type		Edge, pulse width, rise/fall, runt, frequency peak, serial bus 1, serial bus 2
Copy		Copy to trigger, copy from trigger
Frequency peak	Source	Math functions
	Max # of peaks	15
	Control	Results order in frequency or amplitude
Result display		Event lister or navigation. Manual or auto scroll via navigation or touch event lister entry to jump to a specific event

Display characteristics

Display	10.1-inch color 1280x800 (WXGA, TFT-LCD)
Resolution	1280 (H) x 800 (V) pixel format (screen area)
Format	YT, color-graded XY, roll, and Bode
Graticules	8 vertical divisions by 10 horizontal divisions with intensity controls
Maximum waveform update rate	> 1,300,000 waveforms/sec
Persistence	Off, infinite, variable persistence (100 ms to 60 s)
Intensity gradation	256 intensity levels

4 500 uV/div and 1 mV/div is a magnification of 2 mV/div setting. For vertical accuracy calculations, use full scale of 16 mV for 500 uV/div and 1 mV/div.

WaveGen – Built-in function/Arbitrary waveform generator (typical)

WaveGen out	Rear-panel BNC connector	
Waveforms	Sine, Square, Ramp, Pulse, DC, Noise, Sine Cardinal (Sinc), Exponential Rise, Exponential Fall, Cardiac, Gaussian Pulse, and Arbitrary	
Modulation	Modulation types: AM, FM Carrier waveforms: sine, ramp, sine cardinal, exponential rise, exponential fall, and cardiac Modulation source: internal (no external modulation capability)	
	AM:	Modulation: sine Modulation frequency: 1 Hz to 20 kHz Depth: 0% to 100%
	FM:	Modulation: sine Modulation frequency: 1 Hz to 20 kHz Minimum carrier frequency: 10 Hz Deviation: 1 Hz to carrier frequency or (2e12 / carrier frequency), whichever is smaller
Sine	Frequency range: 0.01 Hz to 100 MHz	
	Amplitude flatness: ±0.5 dB (relative to 1 kHz)	
	Harmonic distortion: –40 dBc	
	Spurious (non-harmonics): –40 dBc	
	Total harmonic distortion: 1%	
	SNR (50 Ω load, 500 MHz BW): 40 dB (Vpp > = 0.1 V); 30 dB (Vpp < 0.1 V)	
Square wave/pulse	Frequency range: 0.01 Hz to 50 MHz	
	Duty cycle: 20 to 80%	
	Duty cycle resolution: Larger of 1% or 10 ns	
	Pulse width: 10 ns minimum	
	Rise/fall time: 2.5 ns (10 to 90%)	
	Pulse width resolution: 5 ns	
	Overshoot: < 10%	
	Asymmetry (at 50% DC): ±1% ±5 ns	
Ramp/triangle wave	Frequency range: 0.3 Hz to 5 MHz	
	Linearity: 1%	
	Variable symmetry: 0 to 100%	
	Symmetry resolution: 1%	
DC	Precise (-1 to 1V) Hi Z	
	Wide Range (-8 to 8V)	
Noise	Bandwidth: 150 MHz typical	
Sine Cardinal (Sinc)	Frequency range: 0.3 Hz to 5 MHz	
Exponential Rise/Fall	Frequency range: 0.3 Hz to 5 MHz	
Cardiac	Frequency range: 0.3 Hz to 200.0 kHz	
Gaussian pulse	Frequency range: 0.3 Hz to 5.0 MHz	
Arbitrary	Waveform length: 2 to 8,192 points	
	Amplitude resolution: 14 bits (including sign bit)[5]	
	Repetition rate: 0.3 Hz to 12 MHz	
	Sample rate: 400 MSa/s	
Frequency	Sine wave accuracy: Timebase accuracy ±1 ppm	
Amplitude	Range:	
	2 mVpp to 10 Vpp into Hi-Z [6,7]	
	1 mVpp to 5 Vpp into 50 Ω [6,7]	
	Resolution: 100 µV or 3 digits, whichever is higher	
	Accuracy: 2% (frequency = 1 kHz)	
DC offset	Range: ±8 V into Hi-Z [6,7], ±4 V into 50 Ω [6,7]	
	Resolution: 100 µV or 3 digits, whichever is higher	
Trigger output	Trigger output available on Aux Out BNC	
Main output	Impedance: 50 Ω typical	
	Isolation: Not available, main output BNC is grounded	
Output mode	Normal	
	Single shot (arbitrary, sine, ramp, sine cardinal, exp rise/fall, cardiac, Gaussian pulse)	

5 Full resolution is not available at output due to internal attenuator stepping.
6 Gaussian Pulse, Sin, Cardiac: 4 Vpp maximum into Hi-Z; 2 Vpp maximum into 50 Ω.
7 Maximum high level of 8V and minimum low level of -8V into Hi-Z (4V and -4V into 50 Ω) of combined signal amplitude and offset.

Digital voltmeter (typical)

Functions	ACrms, DC, DCrms
Resolution	ACV/DCV: 3 digits
Measuring rate	100 times/second
Autoranging	Automatic adjustment of vertical amplification to maximize the dynamic range of measurements
Range meter	Graphical display of most recent measurement, plus extrema over the previous 3 seconds

Precision counter/Totalizer (typical)

Counter	Source	Any analog channel or trigger qualified event (non-edge trigger modes)
	Resolution	8 digits maximum
	Max frequency	1 GHz (any analog channel)
	Trig qual events	1/ (trigger hold off time) for trigger qualified events (max 25 MHz, minimum dead time of 40 ns)
Measurement		Frequency, period, totalize
Totalizer	Counter size	64-bit
	Edge	Rise or fall

Connectivity

Standard ports	One USB 2.0 hi-speed device port on rear panel. Supports USBTMC protocol
	Two USB 3.0 super-speed host ports, front and rear panel. Support memory devices, mouse, and keyboards
	LAN (10/100/1000Base-T)
Aux out	BNC connector on the rear panel. Supported modes: triggers, mask, and waveform generator sync pulse

General and environmental characteristics

Power line consumption	Max 275 W
Power voltage range	100 to 120 V, 50/60/400 Hz; 100 to 240 V, 50/60 Hz
Environmental rating	0 to 50 °C with 3000m max Operating: 80% RH, non-condensing, up to +40 °C Non-operating: 95% RH, non-condensing, up to +40 °C; decreasing linearly to 50% RH at +65 °C
Electromagnetic compatibility	Meets EMC directive (2004/108/EC), meets or exceeds IEC 61326-1:2012/EN 61326-1:2013 CISPR 11/EN 55011 IEC 61000-4-2/EN 61000-4-2 IEC 61000-4-3/EN 61000-4-3 IEC 61000-4-4/EN 61000-4-4 IEC 61000-4-5/EN 61000-4-5 IEC 61000-4-6/EN 61000-4-6 IEC 61000-4-11/EN 61000-4-11 Canada: ICES-001:2004 Australia/New Zealand: AS/NZS
Safety	ANSI/UL Std. No. 61010-1:2012; CAN/CSA-C22.2 No. 61010-1-12
	ANSI/UL Std. No. 61010-2-030:2012; CAN/CSA-C22.2 No. 61010-2-030-12
Vibration	Meets IEC60068-2-6 and MIL-PRF-28800; class 3 random
Shock	Meets IEC 60068-2-27 and MIL-PRF-28800; class 3 random; (Operating 30 g, ½ sine. 11 ms duration, 3 shocks/axis along major axis, total of 18 shocks)
Dimensions (W x H x D)	33.5 cm (13.2 in) x 26.2 cm (10.3 in) x 16.8 cm (6.6 in)
Weight	Net: 5.25 kg (11.6 lbs)

Nonvolatile storage		
Reference waveform display		Two internal waveforms or USB thumb drive.
Data/file save	Setup/image	Setup (*.scp 24-bit Bitmap image (*.bmp), PNG 24-bit image (*.png)
	Waveform data	CSV data (*.csv), ASCII XY data (*.csv), Binary data (*.bin), Lister data (*.csv), Reference waveform data (*.h5), multi-channel waveform data (*.h5), Arbitrary Waveform data (*.csv)
	Application data	Mask (*.msk)
	Analysis results (*.csv)	Cursor data, measurement results, mask test statistics, search, segmented timestamps
Max USB flash drive size		Supports industry standard flash drives
Internal data storage		Up to 10 GB open for data storage of oscilloscope files. Secure Erase and save control are available with HD3SECURE
Set ups with USB flash drive		Limited by size of USB drive

Included standard with oscilloscope	
Calibration	Soft copy of Certificate of Calibration (CoC) downloadable from https://service.keysight.com/infoline/public/details.aspx?i=DOC, 3-year calibration interval
N2843A Passive probe 500 MHz 10:1 attenuation	1 per channel
Interface and built-in help language support	English, Chinese (simplified), Chinese (traditional), French, German, Italian, Japanese, Korean
Localized overlay	English, Chinese (simplified), Chinese (traditional), French, German, Italian, Japanese, Korean

After-Purchase License-Only Upgrades

Bandwidth upgrades

Bandwidth upgrade	Model number
2 channel HD302MSO from 200 MHz to 350 MHz	HD3BW-001
2 channel HD302MSO from 200 MHz to 500 MHz	HD3BW-002
2 channel HD302MSO from 200 MHz to 1 GHz	HD3BW-003
2 channel HD302MSO from 350 MHz to 500 MHz	HD3BW-004
2 channel HD302MSO from 350 MHz to 1 GHz	HD3BW-005
2 channel HD302MSO from 500 MHz to 1 GHz	HD3BW-006
4 channel HD304MSO from 200 MHz to 350 MHz	HD3BW-007
4 channel HD304MSO from 200 MHz to 500 MHz	HD3BW-008
4 channel HD304MSO from 200 MHz to 1 GHz	HD3BW-009
4 channel HD304MSO from 350 MHz to 500 MHz	HD3BW-010
4 channel HD304MSO from 350 MHz to 1 GHz	HD3BW-011
4 channel HD304MSO from 500 MHz to 1 GHz	HD3BW-012

Software upgrades

License Upgrade	Description	Model number
Embedded software package	I^2C, SPI, UART (RS232/422/485) serial trigger and decode	HD300EMBA
Automotive software package	CAN, CAN FD, CAN XL (symbolic with .dbc file), SENT, and LIN (symbolic with .ldf file)	HD300AUTA
Aerospace and defense software package	MIL-STD 1553 and ARINC 429 triggering and analysis	HD300AERA
Enhanced security	Add more stringent security features, including disabling non-volatile memory, disabling USB and LAN ports, disabling firmware upgrades, and password protection	HD3SECURE

Memory upgrades

Model number	Description
HD3MEM-050	Memory Upgrade, 20 Mpts to 50 Mpts/Channel
HD3MEM-100	Memory Upgrade, 20 Mpts to 100 Mpts/Channel
HD3MEM-101	Memory Upgrade, 50 Mpts to 100 Mpts/Channel

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