Other Advanced Measurements and Features

Hardware-based mask limit & measurement limit testing (standard) for quick pass/fail testing

Whether you are performing pass/fail tests to specified standards in manufacturing or testing for infrequent signal anomalies, mask limit and measurement limit testing can be a valuable productivity tool. The InfiniiVision 3000G X-Series features powerful hardware-based mask testing that can perform up to 270,000 tests per second. You can select multiple test criteria, including the ability to run tests for a specific number of acquisitions, a specified time, or until detection of a failure.

With the standard measurement limit testing capability, you can perform pass/fail testing based on user-defined maximum and minimum limits on any parametric measurement that has been selected and turned on. Stop-on-failure is also available.



Figure 32. Hardware accelerated mask testing allows testing against a golden waveform or user created mask to find violations. In this example we captured over 9M tests in only 53 seconds.

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Integrated advanced power supply measurements and analysis (optional)

When you are working with switching power supplies and power devices, the power measurements software package (D3000PWRB) provides a full suite of power measurements and analysis in the oscilloscope.

Click here to learn more about the D3000PWRB optional software package.

In addition, there are several power specific probes that make analysis of your power supplies (e.g., switch mode power supplies) and power consuming devices (e.g., batteries) easy.

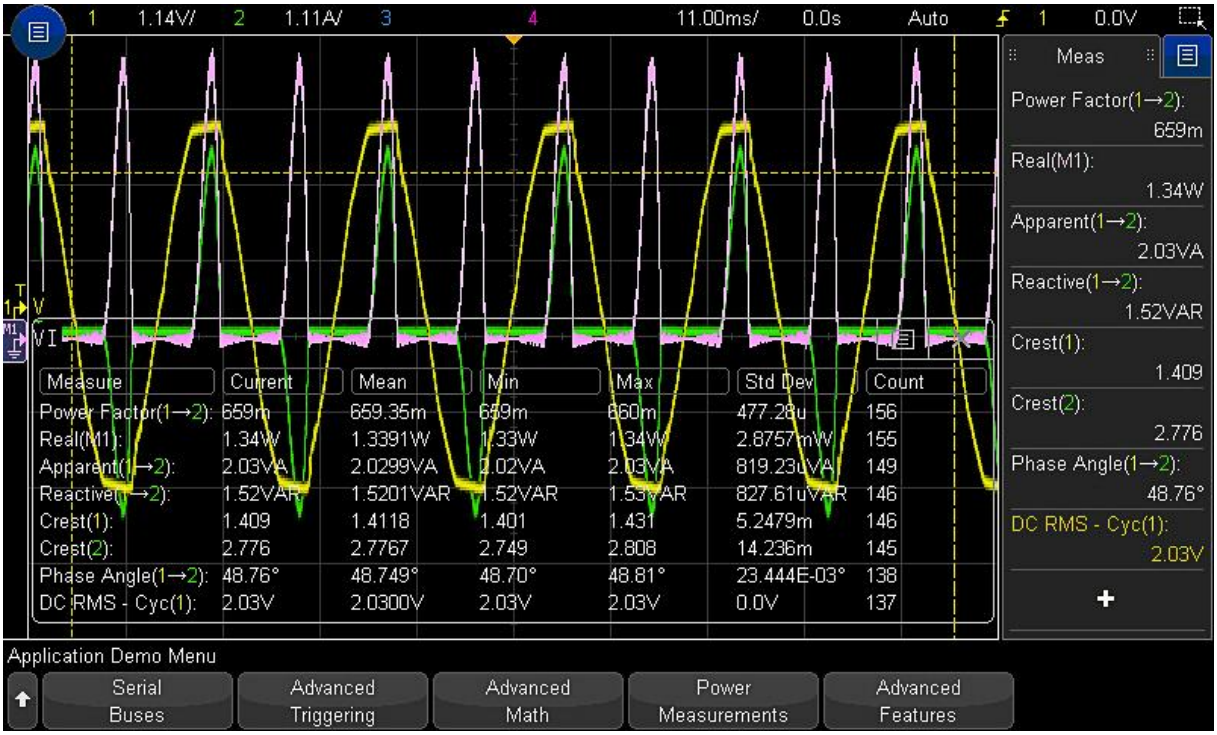


Figure 33. Integrated power measurements make quick work of analyzing power producing and power consuming devices.

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Figure 34. Control loop response analysis (bode plot) shows the gain/phase plot over frequency sweep range up to 20 MHz with automatic determination of phase margin (PM) and gain margin (GM).

Innovative power rail probe (option) provides insights for DC output integrity

The power rail noise, ripple, and transient measurements can be challenging due to required offset range and mV sensitivity. With its ± 24 V offset range, ultra-low noise 1:1 attenuation ratio, and 2-GHz bandwidth, the N7020A power rail probe is for users making critical power integrity measurements that need mV sensitivity on their DC power rails.



Figure 35. N7020A Power Rail Probe.

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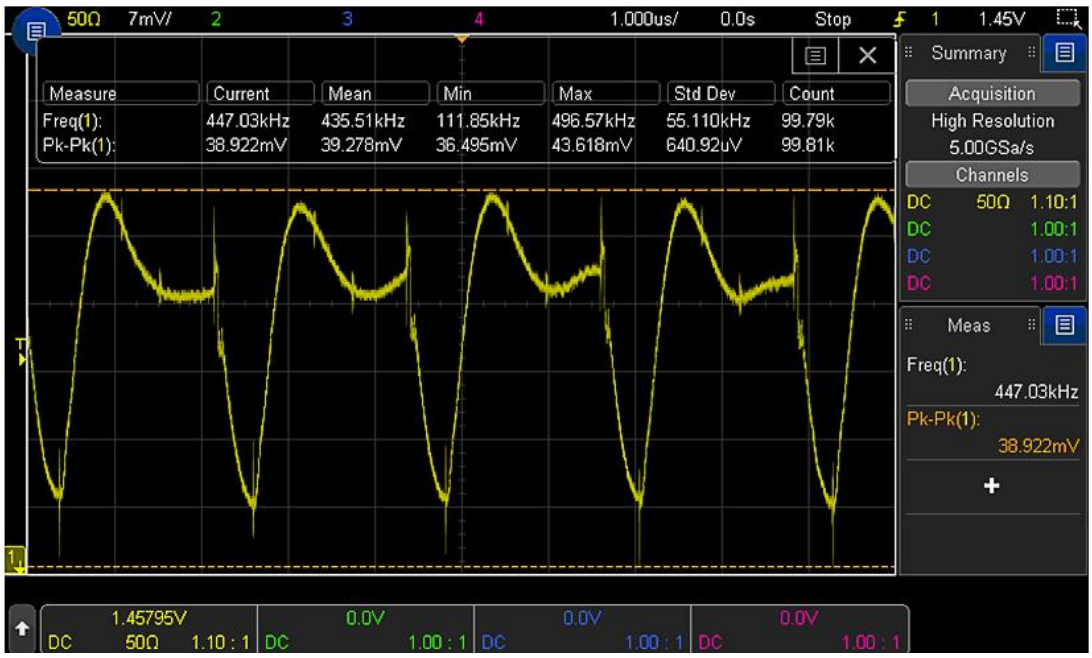


Figure 36. 3000G X-Series and N7020A acquire not only the power rail ripples but the high frequency transients as well.

Enhanced HDTV video analysis (standard)

Whether you are debugging consumer electronics with HDTV or characterizing a design, Enhanced Video Analysis (optional) provides support for a variety of HDTV standards for triggering and analysis.

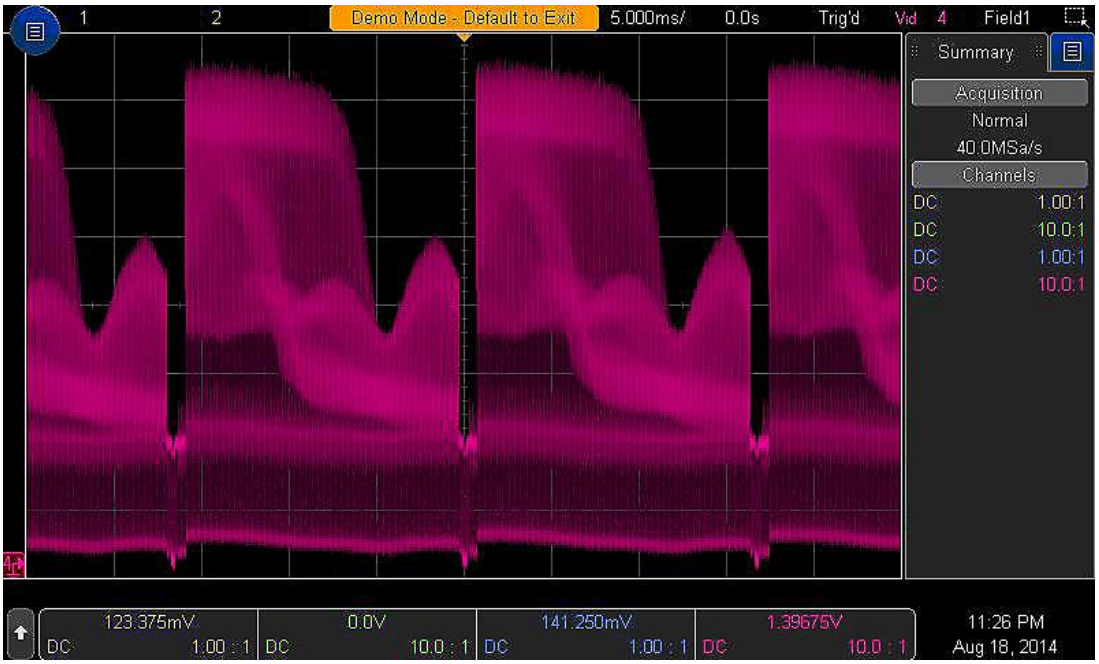


Figure 37. Trigger on and display HDTV signals with enhanced HDTV video analysis (standard).

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While the “Touch, Discover, & Solve” elements of the scope highlight the key features that will make it easy to and troubleshoot your device, there are other features that you may also want to consider when choosing your next oscilloscope.

Total Cost of Ownership

The InfiniiVision 3000G X-Series offers an extremely low cost of ownership. Between an industry leading mean time between failure (MTBF) of over 250,000 hours and a market-leading calibration period of 3 years, you can rest assured that your investment in a 3000G X-Series will be protected for years to come. In addition, because needs change over time, you can purchase just what you need today and then upgrade the scope’s bandwidth or application-specific software packages easily over time as your projects evolve.

Educator’s Training Kit

Have new hires that need to quickly become familiar with the scope? Or are you a professor that wants to teach your students what an oscilloscope is and how to perform basic measurements? The Educator’s Oscilloscope Training Kit (standard) makes that easy. It includes training tools created specifically for electrical engineering and physics undergraduate students and professors. It contains an array of built-in training signals (built into the scope), a comprehensive oscilloscope lab guide and tutorial written specifically for the undergraduate student and an oscilloscope fundamentals PowerPoint slide set for professors and lab assistants. The built-in training signals are included standard in the oscilloscope, while the lab guide, slide set, as well as other valuable technical resources for students and professors are available to download at www.keysight.com/find/edk.

Built-in Features to Help the Infrequent User

In addition to the educator’s training kit, the oscilloscope includes a localized front panel and GUI available in 15 languages, along with an integrated (and localized) help system. Just press & hold down any front panel key or soft panel button and a brief overview will appear that explains how to use that feature.

30-day Trial License

The InfiniiVision 3000G X-Series comes with a one-time 30-day, all optional-features trial license. You can choose to start the 30-day trial at any time. In addition, you can redeem individual optional feature 30-day trial licenses at any time by visiting www.keysight.com/find/30daytrial. This enables you to receive in effect 60 days of trial license of each optional feature.

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Localized GUI and Front Panel Overlays

The InfiniiVision 3000G X-Series oscilloscope supports 15 different languages:

- English
- Japanese
- Simplified Chinese
- Traditional Chinese
- Thai
- Korean
- German
- French
- Spanish
- Russian
- Portuguese
- Italian
- Polish
- Czech
- Turkish

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"Designed for Touch". **8.5-inch capacitive touch screen with gesture support.**

7-in-1 instruments helps you solve your problems: oscilloscope channels digital channels, frequency response analysis, serial protocol analysis, WaveGen, DVM, and 8-digit counter-totalizer. **Fully upgradeable** including bandwidth.

Reconfigurable Docking panels with the capacitive touch screen adds a new dimension to the usability.

Zone touch trigger, if you can see it, you can trigger on it by drawing a box.

Standard **Gated FFT** for your time correlated analog, digital, and frequency domain signal



Uncompromised 1,000,000 waveform per second update rate minimize the dead-time for maximum probability of capturing infrequent events and anomalies.

Built-in features to help the infrequent user - ***GUI available in 15 languages.***

Display up to ***8 measurements*** simultaneously, without compromising other key info. 44 automatic measurements. ***Gated by cursors*** supported.

Integrated DVM and ***8-digit counter with totalizer.*** Wide coverage of application and serial protocol solutions including ***CAN-FD and SENT trigger and decode.***

Both ***USB keyboard and mouse*** are supported in 3000G X-Series for additional ease of use.

Standard segment memory with event lister powered by ***MegaZoom IV*** smart memory technology intelligent capture of just the signals of interest.

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Configuring Your Oscilloscope

Step 1

Choose your bandwidth and number of channels

3000 X-Series Specification Overview											
		3012G	3014G	3022G	3024G	3032G	3034G	3052G	3054G	3102G	3104G
Bandwidth (–3 dB)		100 MHz		200 MHz		350 MHz		500 MHz		1 GHz	
Calculated rise time (10 to 90%)		≤ 3.5 ns		≤ 1.75 ns		≤ 1 ns		≤ 700 ps		≤ 450 ps	
Input channels	DSOX	2	4	2	4	2	4	2	4	2	4
	MSOX	2 + 16	4 + 16	2 + 16	4 + 16	2 + 16	4 + 16	2 + 16	4 + 16	2 + 16	4 + 16

For example, if you chose 1 GHz, 4+16 channels, the model number will be MSOX3104G

Step 2

Select hardware upgrades

Hardware Upgrade	Description	Model Number to Order
Enhanced Security Option	Disable non-volatile memory, USB, LAN, and firmware upgrades	DSOXG3SECA
GP-IB module	Plug-in module to support GP-IB connectivity	DSOXGPIB

Step 3

Select software upgrades

License Upgrade	Description	Model Number to Order
Embedded software package	I^2C, SPI, UART (RS232/422/485), I^2S, and USB PD serial trigger and decode, plus Measurement Limit Testing, Mask Limit Testing, Frequency Response Analysis (Bode plots), and Enhanced HDTV Video Analysis	Standard
Automotive software package	CAN (symbolic with .dbc file), CAN FD (symbolic with .dbc file), LIN (symbolic with .ldf file), FlexRay, SENT, CXPI, PSI5 (user-definable Manchester), and User-definable NRZ serial trigger & decode (CAN/CAN FD mask files available to download)	D3000AUTB
Aero software package	MIL-STD 1553 and ARINC 429 serial trigger & decode (standard mask files available to download)	D3000AERB

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USB software package	USB 2.0 Low- & Full-speed	D3000USBB
Power software package	Power quality, current harmonics, switching loss, transient response, turn-on/off time, output ripple, efficiency, control loop response, PSRR, etc.	D3000PWRB
Ultimate bundle software package	CAN, CAN FD, LIN, FlexRay, CXPI, PSI5 (User-definable Manchester), User-definable NRZ, MIL-STD 1553, and ARINC 429 serial trigger & decode, and Power Analysis	D3000BDLB

Step 4

Choose your probes

For a complete list of compatible probes, visit http://www.keysight.com/find/scope_probes. In general, the InfiniiVision 3000G X-Series supports up to two active probes simultaneously with some exceptions. Contact Keysight for more detail.

Probes		
N2843A	Passive probe 500 MHz, 10:1, 1 MΩ, 11 pF	Standard (1 per channel)
N2756A	16 digital channel MSO cable	Standard on MSOX models and with DSOXG3MSO MSO upgrade
N2870A	Passive probe 35 MHz, 1:1, 1 MΩ	Optional
10076C	Passive probe 500 MHz 100:1 attenuation (4 kV)	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
N2791A	25 MHz 10:1/100:1 HV differential active probe, 8 MΩ / 8 pF, ± 700 V	Optional
N2790A	100 MHz 50:1/500:1 HV differential probe, 8 MΩ /3.5 pF, ± 1,400 V	Optional
N2805A	200 MHz 50:1 HV differential active probe, 4 MΩ / 4 pF, ± 100 V	Optional
N2804A	300 MHz 100:1 HV differential active probe, 8 MΩ / 10 pF, ± 300 V	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

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N2821A	1-channel high-sensitivity current probe 50 µA to 5 A	Optional
N7040A	23 MHz, 3 kA, Rogowski coil AC current probe	Optional
N7041A	30 MHz, 600 A, Rogowski coil AC current probe	Optional
N7042A	30 MHz, 300 A, Rogowski coil AC current probe	Optional

Step 5

Choose your accessories and additional productivity software

Recommended Accessories and PC Software		
DSOXBODE	Bode plot training kit	Optional
N2167A	Front panel cover	Optional
N2168A	Front panel cover and soft carrying case	Optional
N2169A	Rack mount kit	Optional
Hard transit case	CaseCruzer 3F1112-1510J (available from http://www.casecruzer.com/)	Optional
BV0004B	BenchVue Oscilloscope Application PC software	Standard
33503B	BenchLink Waveform Builder Pro and Basic PC Software	Optional
D9010BSEO	Infiniium Offline Oscilloscope Analysis PC Software	Optional
D9010UDAA	User-definable Application (UDA) software	Optional
89601B (version 2020 and higher)	Vector Signal Analyzer (VSA) software	Optional

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Step 6

Calibration plans[1]

Calibration		
DSOX3000G-1A7	Calibration + uncertainties + guardbanding certificate (not accredited)	Optional
DSOX3000G-AMG	Calibration + uncertainties + guardbanding certificate (accredited)	Optional

1. The InfiniiVision 3000G X-Series oscilloscope come from the factory calibrated with a standard calibration certificate. Additional calibration testing with uncertainties and guardbanding can be purchased as an option.

Performance Characteristics

3000G X-Series Specification Overview											
		3012G	3014G	3022G	3024G	3032G	3034G	3052G	3054G	3102G	3104G
Bandwidth 1 (–3 dB)		100 MHz		200 MHz		350 MHz		500 MHz		1 GHz	
Calculated rise time (10 to 90%)		≤ 3.5 ns		≤ 1.75 ns		≤ 1 ns		≤ 700 ps		≤ 450 ps	
Input channels	DSOX	2	4	2	4	2	4	2	4	2	4
	MSOX	2 + 16	4 + 16	2 + 16	4 + 16	2 + 16	4 + 16	2 + 16	4 + 16	2 + 16	4 + 16
Maximum sample rate		5 GSa/s half channels, 2.5 GSa/s all channels									
Maximum memory depth		4 Mpts half channels, 2 Mpts all channels									
Display size and type		8.5-inch capacitive touch gesture-enabled display									
Waveform update rate		> 1,000,000 waveforms per second									
Vertical System Analog Channels											
Hardware bandwidth limits		Approximately 20 MHz (selectable)									
Input coupling		AC, DC									
Input impedance		Selectable: 1 MΩ ± 1% (14 pF), 50 Ω ± 1.5%									
Input sensitivity range		100 MHz ~ 500 MHz models: 1 mV/div to 5 V/div 2 (1 MΩ and 50 Ω)									
		1 GHz models: 1 mV/div to 5 V/div 2 (1 MΩ), 1 mV/div to 1 V/div (50 Ω)									
Vertical resolution		8 bits (measurement resolution is 12 bits with averaging)									

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Maximum input voltage	125 Vrms; 190 Vpk
	Probing technology allows testing of higher voltages. For example, the included N2843A 10:1 probe supports testing up to 300 Vrms
	Use this instrument only for measurements within its specified measurement category (not rated for CAT II, III, IV). No transient overvoltage allowed
DC vertical accuracy	± [DC vertical gain accuracy + DC vertical offset accuracy + 0.25% full scale] [2]
DC vertical gain accuracy [1]	± 2.0% full scale [2]
DC vertical offset accuracy	± 0.1 div ± 2 mV ± 1% 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	± 2 V (1 mV/div to 200 mV/div)
	± 50 V (> 200 mV/div to 5 V/div)
Vertical System Digital Channels	
Digital input channels	16 digital (D0 to D15. pod 1: D7 ~ D0, Pod 2: D15 ~ D8)
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

1. Denotes warranted specifications, all others are typical.
2. Specifications are valid after a 30-minute warm-up period and ± 10 °C from firmware calibration temperature. 1 mV/div and 2 mV/div are a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 1 mV div and 2 mV/div sensitivity setting.

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Horizontal System Analog Channels										
		3012G	3014G	3022G	3024G	3032G	3034G	3052G	3054G	3102G	3104G
Time base range		5 ns/div to 50 s/div		2 ns/div to 50 s/div				1 ns/div to 50 s/div		500 ps/div to 50 s/div	
Time base accuracy [1]		± 1.6 ppm + aging factor (1st year: ± 0.5 ppm, 2nd year: ± 0.7 ppm, 5 years: ± 1.5 ppm, 10 years: ± 2.0 ppm)									
Time base delay time range	Pre-trigger	Greater of 1 screen width or 250 µs									
	Post-trigger	1 s to 500 s									
Channel-to-channel deskew range		± 100 ns									
Δ Time accuracy (using cursors)		± (time base acc. 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, 1.4 V threshold									
		Bandwidth: Maximum bandwidth. Phase error at 1 MHz: < 0.5 degree									
Horizontal System Digital Channels											
Minimum detectable pulse width		5 ns									
Channel-to-channel skew		2 ns (typical); 3 ns (maximum)									
Maximum analog channels sample rate		5 GSa/s half channel interleaved, 2.5 GSa/s all channel									
Maximum analog channels record length		4 Mpts half channel interleaved, 2 Mpts all channel									
Maximum digital channels sample rate		1.25 GSa/s all pods									
Maximum digital channels record length		2 Mpts (with digital channels only)									
Acquisition mode	Normal	Default mode									
	Peak detect	Capture glitches as narrow as 250 ps at all time base settings									
	Averaging	Selectable from 2, 4, 8, 16, 64, ... to 65,536									

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	High resolution	Real time boxcar averaging reduces random noise and effectively increases vertical resolution 12 bits of resolution when ≥ 10 µs/div at 5 GSa/s or ≥ 20-µs/div at 2.5 GSa/s
	Segmented	Segmented memory optimizes available memory for data streams that have long dead times between activity. Maximum segments = 1000. Re-arm time = 1 µs (minimum time between trigger events)
	Digitizer	Allows independent selection of sample rate and memory depth
Time mode	Normal	Default mode
	Roll	Displays the waveform moving across the screen from right to left. Available at the time base 50 ms/div or slower
	XY	Displays the volts-versus-volts display. Time base can be set from 200 ns/div to 50 ms/div

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Trigger System	
Trigger sources	Analog channel (1 ~ 4), digital channel (D0 ~ D15), line, external, WaveGen (1 or mod) (FM/FSK)
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)
	HF reject: High frequency reject, cutoff frequency ~ 50 kHz
	LF reject: Low frequency reject, cutoff frequency ~ 50 kHz
	Noise reject: Selectable OFF or ON, decreases sensitivity 2x
Trigger holdoff range	40 ns to 10.00 s
Trigger Sensitivity	
Internal [1]	< 10 mV/div: Greater of 1 div or 5 mV; ≥ 10 mV/div: 0.6 div
External [1]	200 mVpp from DC to 100 MHz
	350 mVpp 100 MHz to 200 MHz
Trigger Level Range	
Any channel	± 6 div from center screen
External[2]	± 8 V
Trigger Type Selections	
Zone (HW zone qualifier)	Trigger on user-defined zones drawn on the display. Applies to one analog channel at a time. Specify zones as either “must intersect” or “must not intersect.” Up to two zones. > 200,000 scans/sec update rate
	Supported modes: normal, peak detect, high resolution
	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 (B trigger)	Arm on a selected edge, wait a specified time, then trigger on a specified count of another selected 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: 2 ns (500 MHz, 1 GHz), 4 ns (350 MHz), 6 ns (200 MHz), 10 ns (100 MHz)
	Maximum duration setting: 10 s
	Range minimum: 10 ns
Runt	Trigger on a position runt pulse that fails to exceed a high-level threshold. Trigger on a negative runt pulse that fails to exceed a low-level threshold. Trigger on either polarity runt pulse based on two threshold settings. Runt triggering can also be time-qualified (< or >) with a minimum time setting of 2 ~ 10 ns and maximum time setting of 10 s

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	Minimum time setting: 2 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 –7 to 10 s. Hold time can be set from 0 s to 10 ns
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: 1 ns (500 MHz, 1 GHz), 2 ns (350 MHz), 3 ns (200 MHz), 5 ns (100 MHz)
	Maximum: 10 s

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. 1 mV/div and 2 mV/div is a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 1 mV/div and 2 mV/div sensitivity setting.

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Trigger Type Selections	
N^{th} edge burst	Trigger on the Nth (1 to 65535) edge of a pulse burst. Specify idle time (10 ns to 10 s) for framing
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: 2 ns (500 MHz, 1 GHz), 4 ns (350 MHz), 6 ns (200 MHz), 10 ns (100 MHz)
	Maximum duration setting: 10 s
	Range minimum: 10 ns
Or	Trigger on any selected edge across multiple analog or digital channels
Video	Trigger on all lines or individual lines, odd/even or all fields from composite video, or broadcast standards (NTSC, PAL, SECAM, PAM-M)
Enhanced Video (standard)	Trigger on lines and fields of enhanced and HDTV standards (480p/60, 567p/50, 720p/50, 720p/60, 1080p/24, 1080p/25, 1080p/30, 1080p/50, 1080p/60, 1080i/50, 1080i/60)
USB	Trigger on start of packet, end of packet, reset complete, enter suspend, or exit suspend. Support USB low-speed and full-speed
I^2C (standard)	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 (standard)	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 (standard)	Trigger on Rx or Tx start bit, stop bit or data content or parity error
I^2S (standard)	Trigger on 2's complement data of audio left channel or right channel (=, ≠, <, >, > <, < >, increasing value, or decreasing value)
CAN (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)

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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)
CXPI (optional)	Trigger on the start of frame (SOF), the end of frame (EOF), PTYPE, frame ID, data and info frame ID, data and info frame ID (long frame), CRC field error, parity error, inter-byte space error, inter-frame space error, framing error, data length error, sample error, all errors, sleep frame, wakeup pulse
FlexRay (optional)	Trigger on frame ID, frame type (sync, start-up, null, normal), cycle-repetitive, cycle-base, and errors.
MIL-STD 1553 (optional)	Trigger on MIL-STD 1553 signals based on word type (Data or Command/Status), Remote Terminal Address, data, and errors (parity, sync, Manchester encoding)
ARINC 429 (optional)	Trigger on ARINC429 data. Trigger on word start/stop, label, label + bits, label range, error conditions (parity, word, gap, word or gap, all), all bits (eye), all 0 bits, all 1 bits
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)
User-definable Manchester/NRZ (optional)	Trigger on start-of-frame (SOF), bus value, and Manchester errors
USB PD (standard)	Trigger on preamble, EDP, ordered sets, preamble errors, CRC errors, header content (control messages, data messages, extended messages, and value in HEX)
NFC (standard)	NFC-A: SENS_REQ, ALL_REQ, or Either NFC-B: SENSB_REQ, ALLB_REQ, or Either NFC-F (212 kbps): SENSF_REQ or ATR_REQ NFC-F (242 kbps): SENSF_REQ or ATR_REQ

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Waveform Measurements		
Cursors [2]		Single cursor accuracy: ± [DC vertical gain accuracy + DC vertical offset accuracy + 0.25% full scale]
		Dual cursor accuracy: ± [DC vertical gain accuracy + 0.5% full scale] [1]
		Units: Seconds(s), Hz (1/s), phase (degrees), ratio (%)
Automatic measurements		Measurements continuously updated with statistics. Cursors track last selected measurement. Select up to eight measurements from the list below: Snapshot All: Measure all single waveform measurements (31) **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
Counter		Built-in frequency counter
		Source: On any analog or digital channel
		Resolution: 5 digits
		Maximum frequency: Bandwidth of scope
Waveform Math		
Number of math functions		Two, displays FFT and one math simultaneously. Can be cascaded
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, chart logic bus (Timing or State), chart serial signal (CAN, CAN FD, LIN, and SENT)
Enhanced FFT	Record size	Up to 64 kpts resolution
	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.

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Waveform Measurements		
	Waveforms	FFT, max hold, min hold, average
	Peak search	Max 11 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	11
	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		8.5-inch capacitive touch/gesture enabled TFT LCD
Resolution		800 (H) x 480 (V) pixel format (screen area)
Graticules		8 vertical divisions by 10 horizontal divisions with intensity controls
Format		YT, XY, and Roll
Maximum waveform update rate		> 1,000,000 waveforms/sec
Persistence		Off, infinite, variable persistence (100 ms to 60 s)
Intensity gradation		64 intensity levels

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. 1 mV/div and 2 mV/div is a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 1 mV/div and 2 mV/div sensitivity setting.

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WaveGen – Built-in Function/Arbitrary Waveform Generator (specifications are typical)		
WaveGen out	Front-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, FSK Carrier waveforms: sine, ramp, sine cardinal, exponential rise, exponential fall, and cardiac Modulation source: internal (no external modulation capability)	
	AM:	Modulation: sine, square, ramp Modulation frequency: 1 Hz to 20 kHz Depth: 0% to 100%
	FM:	Modulation: sine, square, ramp 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
	FSK:	Modulation: 50% duty cycle square wave FSK rate: 1 Hz to 20 kHz Hop frequency: 2 x FSK rate to 10 MHz
Sine	Frequency range: 0.1 Hz to 20 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 < 0.1V)	
Square wave /pulse	Frequency range: 0.1 Hz to 10 MHz	
	Duty cycle: 20 to 80%	
	Duty cycle resolution: Larger of 1% or 10 ns	
	Pulse width: 20 ns minimum	
	Rise/fall time: 18 ns (10 to 90%)	
	Pulse width resolution: 10 ns or 5 digits, whichever is larger	
	Overshoot: < 2%	
	Asymmetry (at 50% DC): ± 1% ± 5 ns	
	Jitter (TIE RMS): 500 ps	
Ramp/triangle wave	Frequency range: 0.1 Hz to 200 kHz	

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WaveGen – Built-in Function/Arbitrary Waveform Generator (specifications are typical)	
	Linearity: 1%
	Variable symmetry: 0 to 100%
	Symmetry resolution: 1%
Noise	Bandwidth: 20 MHz typical
Sine Cardinal (Sinc)	Frequency range: 0.1 Hz to 1.0 MHz
Exponential Rise/Fall	Frequency range: 0.1 Hz to 5.0 MHz
Cardiac	Frequency range: 0.1 Hz to 200.0 kHz
Gaussian Pulse	Frequency range: 0.1 Hz to 5.0 MHz
Arbitrary	Waveform length: 1 to 8k points
	Amplitude resolution: 10 bits (including sign bit) [1]
	Repetition rate: 0.1 Hz to 12 MHz
	Sample rate: 100 MSa/s
	Filter bandwidth: 20 MHz

1. Full resolution is not available at output due to internal attenuator stepping.

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WaveGen – Built-in Function/Arbitrary Waveform Generator (specifications are typical) (continued)	
Frequency	Sine wave and ramp accuracy:
	130 ppm (frequency < 10 kHz)
	50 ppm (frequency > 10 kHz)
	Square wave and pulse accuracy:
	[50+frequency/200] ppm (frequency < 25 kHz)
	50 ppm (frequency ≥ 25 kHz)
	Resolution: 0.1 Hz or 4 digits, whichever is larger
Amplitude	Range:
	20 mVpp to 5 Vpp into Hi-Z [1]
	10 mVpp to 2.5 Vpp into 50 Ω [1]
	Resolution: 100 µV or 3 digits, whichever is higher
	Accuracy: 2% (frequency = 1 kHz)
DC offset	Range:
	± 2.5 V into Hi-Z [1]
	± 1.25 V into 50 Ω [1]
	Resolution: 100 µV or 3 digits, whichever is higher
	Accuracy (waveform modes): ± 1.5% of offset setting ± 1% of amplitude ± 1 mV
	Accuracy (DC mode): ± 1.5% of offset setting ± 3 mV
Trigger output	Trigger output available on Trig out BNC
Main output	Impedance: 50 Ω typical
	Isolation: Not available, main output BNC is grounded
	Protection: Overload automatically disables output
Output mode	Normal
	Single-shot (arbitrary, sine, ramp, sine cardinal, exp rise/fall, cardiac, Gaussian pulse)
Digital Voltmeter (specifications are 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

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WaveGen – Built-in Function/Arbitrary Waveform Generator (specifications are typical) (continued)		
Range meter		Graphical display of most recent measurement, plus extrema over the previous 3 seconds
Precision Counter/Totalizer (specification are typical)		
Counter	Source	Any analog channel or trigger qualified event
	Resolution	8 digits (8 digits for trigger qualified event)
	Max frequency	1 GHz
	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 totalizing counter
	Edge	Rise or fall
	Gating	Positive or negative level. Select from analog channels except the source

1. Gaussian Pulse: 4 Vpp maximum into Hi-Z; 2 Vpp maximum into 50 Ω.

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Connectivity	
Standard ports	One USB 2.0 hi-speed device port on rear panel. Supports USBTMC protocol
	Two USB 2.0 hi-speed host ports, front and rear panel. Support memory devices, printers, and keyboards
	LAN (10/100Base-T)
	WVGA video out
Optional ports	GPIB
Trigger out	BNC connector on the rear panel. Supported modes: triggers, mask, and waveform generator sync pulse
General and Environmental Characteristics	
Power line consumption	Max 100 W
Power voltage range	100 to 120 V, 50/60/400 Hz; 100 to 240 V, 50/60 Hz
Environmental rating	5 to 50 °C with 4000m max Maximum Relative Humidity: 95%RH up to 40 °C From 40°C to 50°C, the maximum % Relative Humidity follows the line of constant dew point
Electromagnetic compatibility	Meets EMC directive (2004/108/EC), meets or exceeds IEC 61326-1:2005/EN 61326-1:2006 Group 1 Class A requirement 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)	381 mm (15 in) x 204 mm (8 in) x 142 mm (5.6 in)
Weight	Net: 4.2 kg (9.3 lbs.), shipping: 4.4 kg (9.5 lbs.)

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Nonvolatile Storage		
Reference waveform display		Two internal waveforms or USB thumb drive. Displays 1 reference waveform at a time
Data/file save	Setup/image	Setup (*.scp), 8 or 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), Power harmonics data (*.csv), USB signal quality (*.html & *.bmp)
	Analysis results (*.csv)	Cursor data, measurement results, mask test statistics, search, segmented timestamps
Max USB flash drive size		Supports industry standard flash drives
Set ups without USB flash drive		10 internal setups
Set ups with USB flash drive		Limited by size of USB drive
Included Standard with Oscilloscope		
Calibration		Soft copy of Certificate of Calibration (CoC) with measurement results downloadable from https://service.keysight.com/infoline/public/details.aspx?i=DOC, 3-year calibration interval
Mean time before failure (MTBF)		> 250,000 hours
Standard secure erase		
Probes		
N2843A Passive probe 500 MHz 10:1 attenuation		1 per channel
N2756A 16 digital channel MSO cable		1 per scope included on all MSO models and DSOXT3MSO
Interface and built-in help language support		English, Chinese (simplified), Chinese (traditional), Czech, French, German, Italian, Japanese, Korean, Portuguese, Russian, Spanish, Polish, Thai, Turkish
Localized power cord and overlay		

For MET/CAL procedures, click on the Cal Labs solutions link https://www.callabsolutions.com/procedures/. These procedures are FREE to customers

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