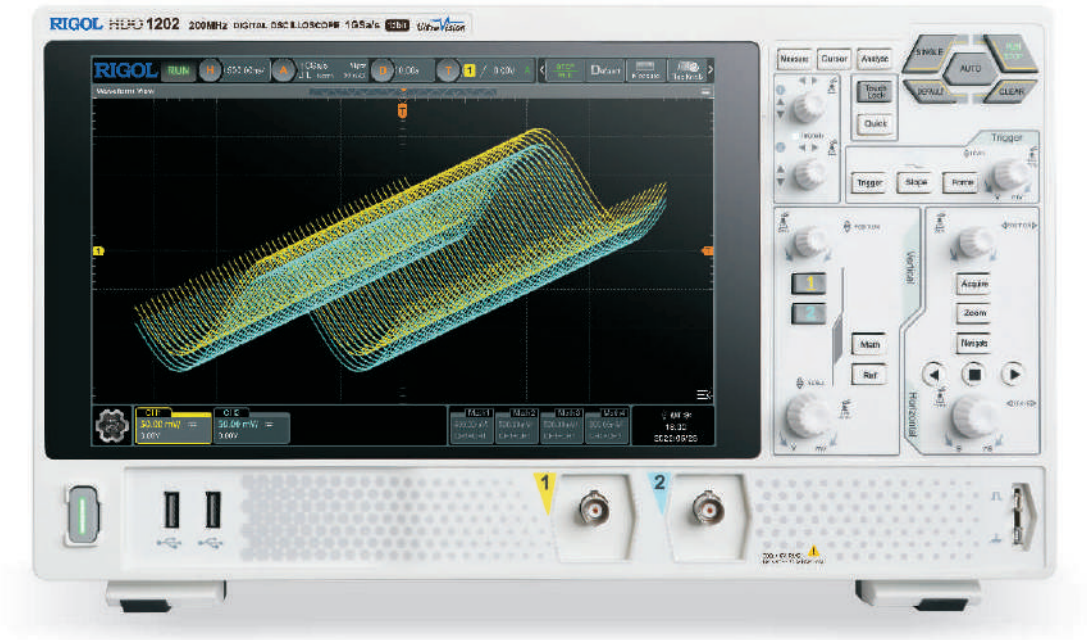
Scientech

Digital Oscilloscopes

DHO1000 Series



Bandwidth : 70/100/200 MHz

Highlights

- Ultra-low noise floor for cleaner signals, measuring small signals more accurately.
- 12-bit resolution (2^{12} = 4096) to see the most signal detail.
- Up to 2 GSa/s real-time sample rate.
- A maximum of 100 Mpts memory depth, capturing more detailed signals over longer time spans.
- Standard serial decoding: SPI, I2C, RS232/UART, CAN, and LIN.
- 10.1-inch large HD touch display (1280x800) designed for better touch interactions.
- Front panel flex knobs, bringing smoother interaction and easier measurements.

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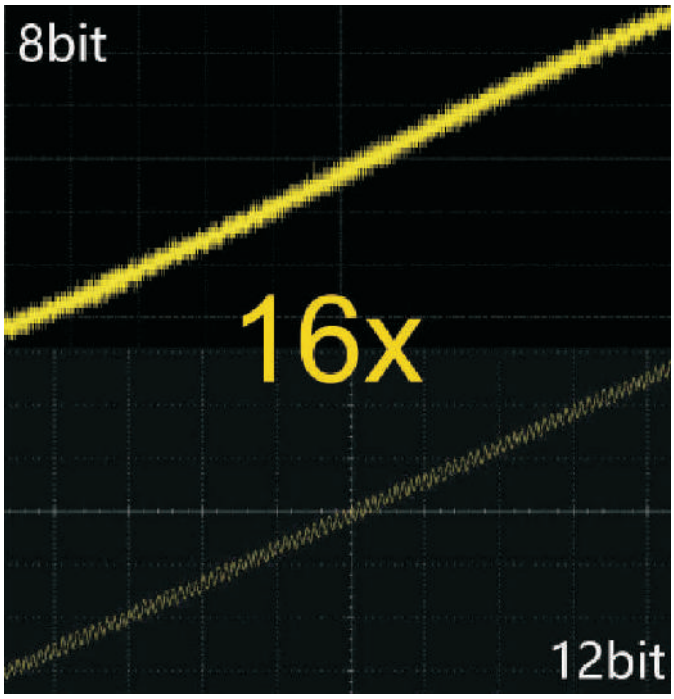


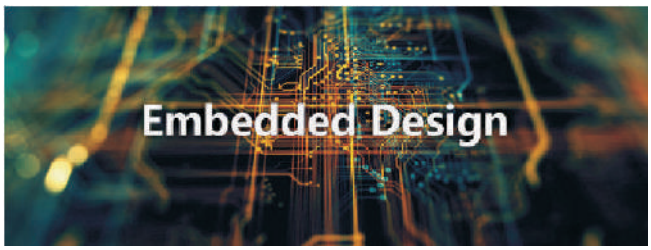
Entry Level

High Resolution
Digital Oscilloscope

Applications

An oscilloscope is an important tool for making power supply measurements. With up to 12-bit vertical resolution, the DHO 1000 series makes it easy for you to perform ripple measurement and quality test.

This series redefines what you can expect in an entry level oscilloscope by providing excellent noise performance and 12 bit high resolution, providing basic functionality for higher education.



The 10.1 inch large HD touch display enables better view of signals. Large memory depth and the Autoscale function make it ready for testing of embedded system designs.

With standard CAN and LIN serial decoding functions, it provides a more affordable solution for automotive electronics testing.

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DHO1000 Series

Features

- Ultra low noise floor for cleaner signals, measuring small signals accurately.
- 12 bit vertical resolution.
- 70/100/200 MHz analog bandwidth (selectable), 2/4 analog channels, and 1 EXT channel.
- Up to 2 GSa/s real time sample rate.
- Max. memory depth: 100 Mpts (optional).
- Vertical sensitivity range: 500 µV/div to 10 V/div.
- Up to 1,500,000 wfms/s waveform capture rate with the UltraAcquire mode.
- 10.1” 1280x800 HD touch display.
- User friendly flex knobs, bringing smoother interaction.
- Standard photoelectric encoder operating knobs, effectively prolonging its service.
- Standard USB Device & Host, LAN, and HDMI interfaces.

DHO1000 series digital oscilloscope is designed to meet the designing, debugging, and testing requirements of the mainstream oscilloscope market. This series achieves a fast waveform capture rate of 1,500,000 wfms/s with the UltraAcquire mode, 100 Mpts memory depth, 12-bit vertical resolution, all combined with excellent noise floor performance and vertical accuracy to meet your requirements for more accurate measurements, bringing extraordinary T&M experience for you.

Technical Specifications

All the specifications are guaranteed except the parameters marked with "Typical" and the oscilloscope needs to operate for more than 30 minutes under the specified operation temperature.

Overview of the DHO1000 Series Technical Specifications

Overview of the DHO1000 Series Technical Specifications						
Model	DHO1072	DHO1074	DHO1102	DHO1104	DHO1202	DHO1204
Analog Bandwidth (-3 dB)	70 MHz	70 MHz	100 MHz	100 MHz	200 MHz	200 MHz
Input Channels	2+EXT	4+EXT	2+EXT	4+EXT	2+EXT	4+EXT
Rise Time (10% to 90%, Typical)	≤5 ns	≤5 ns	≤3.5 ns	≤3.5 ns	≤1.75 ns	≤1.75 ns
Sampling Mode	Real-time sampling					
Max. Sample Rate of Analog Channels	2-channel model: 2 GSa/s (single channel[1]), 1 GSa/s (all channels[3]) 4-channel model: 2 GSa/s (single channel[1]), 1 GSa/s (half channels[2]), 500 MSa/s (all channels[3])					
Standard Memory Depth	2-channel model: 50 Mpts (single channel[1]), 25 Mpts (all channels[3]) 4-channel model: 50 Mpts (single channel[1]), 25 Mpts (half channels[2]), 12.5 Mpts (all channels[3])					
Optional Memory Depth	2-channel model: 100 Mpts (single channel[1]), 50 Mpts (all channels[3]) 4-channel model: 100 Mpts (single channel[1]), 50 Mpts (half channels[2]), 25 Mpts (all channels[3])					
Max. Waveform Capture Rate	50,000 wfms/s (Vector Mode) 1,500,000 wfms/s (UltraAcquire Mode)					
Vertical Resolution	12 bits					
Hardware Real-time Waveform Recording and Playing	Up to 500,000 frames					
Peak Detect	Capture glitches as narrow as 2 ns					

Overview of the DHO1000 Series Technical Specifications	
Display Size and Type	10.1-inch capacitive multi-touch display
Display Resolution	1280 × 800

Vertical System Analog Channels

Vertical System Analog Channels		
Input Coupling		DC, AC, or GND
Input Impedance		1 MΩ ± 1%
Input Capacitance		19 pF ± 3 pF
Probe Attenuation Ratio		0.001X, 0.002X, 0.005X, 0.01X, 0.02X, 0.05X, 0.1X, 0.2X, 0.5X, 1X, 2X, 5X, 10X, 20X, 50X, 100X, 200X, 500X, 1000X, 2000X, 5000X
Maximum Input Voltage		CAT I 300 V_{rms}, 400 V_{pk} (DC + V_{peak})
	Remarks	No transient overvoltage allowed whether the probe is used or not. Use this instrument only for measurements within its specified measurement category (not rated for CAT II, III, IV).
Vertical Resolution		12 bits
Effective Number of Bits (ENOB, Typical)		>8
Input Sensitivity Range[4]		500 μV/div to 10 V/div
Offset Range		±1 V(≤65 mV/div) ±10 V (>65 mV/div, ≤270 mV/div) ±20 V (>270 mV/div, ≤2.75 V/div) ±100 V (>2.75 V/div, ≤10 V/div)
Dynamic Range		±4 div (12 bits)
Bandwidth Limit (Typical)		20 MHz, FULL; selectable for each channel

Vertical System Analog Channels	
DC Vertical Gain Accuracy[4]	±2% full scale
DC Vertical Offset Accuracy	≤200 mV/div (± 0.1 div ± 2 mV ± 1.5% of offset setting) >200 mV/div (± 0.1 div ± 2 mV ± 1.0% of offset setting)
Channel-to-channel Isolation	≥100:1
ESD Tolerance	±8 kV (for input BNC)

Horizontal System Analog Channels

Horizontal System Analog Channels		
Time Base Range		2 ns/div to 1 ks/div
		Time base fine adjustment setting available
Time Base Resolution		400 ps
Time Base Accuracy		±5 ppm ± 1 ppm/year
Time-base Delay Time Range	Pre-trigger	-5 div
	Post-trigger	1 s or 100 div, whichever is greater
Δ Time Accuracy		± (time base accuracy x reading) ± (0.001 x screen width) ± 50 ps
Channel-to-channel Deskew		Channel-to-channel deskew range: ±100 ns, accuracy: ±1 ps
Analog Channel-to-Channel Delay (Typical)		≤2 ns[5]
Horizontal Mode	YT	Default mode
	XY	On channel 1/2/3/4
	SCAN	Time base ≥ 200 ms/div
	ROLL	Time base ≥ 50 ms/div or ≥ 100 ms/div (selectable), available to enter or exit the ROLL mode by turning the horizontal timebase knob

Acquisition System

Acquisition System		
Max. Sample Rate of Analog Channels	2-channel model: 2 GSa/s (single channel[1]), 1 GSa/s (all channels[3]) 4-channel model: 2 GSa/s (single channel[1]), 1 GSa/s (half channels[2]), 500 MSa/s (all channels[3])	
Max. Memory Depth of Analog Channels	2-channel model (standard): 50 Mpts (single channel[1]), 25 Mpts (all channels[3]) 2-channel model (optional): 100 Mpts (single channel[1]), 50 Mpts (all channels[3]) 4-channel model (standard): 50 Mpts (single channel[1]), 25 Mpts (half channels[2]), 12.5 Mpts (all channels[3]) 4-channel model (optional): 100 Mpts (single channel[1]), 50 Mpts (half channels[2]), 25 Mpts (all channels[3])	
Acquisition Mode	Normal	Default mode
	Peak Detect	Capture glitches as narrow as 2 ns
	Average	Selectable from 2, 4, 8, 16...to 65,536
	High Resolution	14 bits, 16 bits
	UltraAcquire	Up to 1,500,000 wfms/s waveform capture rate

Trigger System

Trigger System		
Trigger Sources		Analog channel (1~4), EXT TRIG, AC Line
Trigger Mode		Auto, Normal, and Single
Trigger Coupling	DC	DC coupled trigger
	AC	AC coupled trigger
	HF Reject	High frequency reject, cutoff frequency ~75 kHz (internal trigger only)
	LF Reject	Low frequency reject, cutoff frequency ~75 kHz (internal trigger only)

Trigger System		
Noise Rejection		Increase delay for the trigger circuit (internal trigger only), on/off
Trigger Holdoff Range		8 ns to 10 s
Trigger Bandwidth	Internal	Analog bandwidth
	External	200 MHz
Trigger Sensitivity	Internal	0.50 div, ≥50 mV/div 0.7 div (with noise rejection enabled)
	External	200 mVpp, from DC to 100 MHz 500 mVpp, from 100 MHz to 200 MHz
EXT TRIG	Input Impedance	1 MΩ±1%, BNC connector
	Trigger Jitter (Typical)	< 1 ns_{rms} Normal acquisition, Edge trigger, trigger level located near 50% of EXT input signal
Trigger Level Range	Internal	±5 div from center screen
	External	±5 V
	AC Line	fixed 40%-60%

Trigger Type

Trigger Type	
Trigger Type	Edge trigger, Pulse trigger, Slope trigger, Video trigger, Pattern trigger, Duration trigger, Timeout trigger, Runt trigger, Window trigger, Delay trigger, Setup/Hold trigger, Nth Edge trigger, I2C, SPI, RS232/UART, CAN, LIN
Edge	Triggers on the threshold of the specified edge of the input signal. The edge types can be Rising, Falling, or Either. Source channel: CH1~CH4, EXT, or AC Line
Pulse Width	Triggers on the positive or negative pulse, whose time duration is less than a value, greater than a value, or inside a time range. Source channel: CH1~CH4

Trigger Type	
Slope	Triggers on the positive or negative slope of the specified time, whose time is less than a value, greater than a value, or inside a time range. Source channel: CH1~CH4
Video	Trigger on all lines, specified line, odd/even fields that conform to the video standards. The supported video standards include NTSC, PAL/SECAM, 480p/60Hz, 576p/50Hz, 720p/60Hz, 720p/50Hz, 720p/30Hz, 720p/25Hz, 720p/24Hz, 1080p/60Hz, 1080p/50Hz, 1080p/25Hz, 1080p/24Hz, 1080i/60Hz, and 1080i/50Hz. Source channel: CH1~CH4
Pattern	Identifies a trigger condition by searching for a specified pattern. The pattern is a combination of multiple selected channel sources. The logic pattern of each channel is H, L, X, Rising, or Falling. Source channel: CH1~CH4
Duration	Triggers when the specified pattern meets the specified duration condition. The pattern is a combination of multiple selected channel sources. The logic pattern of each channel is H, L, and X. The duration is less than a value, greater than a value, inside a time range, or outside a time range. Source channel: CH1~CH4
Timeout	Triggers when duration of a certain event exceeds the specified time. The event can be specified as Rising, Falling, or Either. Source channel: CH1~CH4
Runt	Triggers when the pulses pass through one threshold but fail to pass through another threshold. Source channel: CH1~CH4
Window	Triggers in a specified window state when the rising edge of the signal crosses the upper threshold or the falling edge crosses the lower threshold. The window state can be Enter, Exit, or Time. Source channel: CH1~CH4
Delay	Triggers when the time difference between the specified edges of Source A and Source B meets the preset time. The delay time is less than a value, greater than a value, inside a time range, or outside a time range. Source channel: CH1~CH4
Setup/Hold	When the setup time or hold time between the input clock signal and the data signal is smaller than the specified time. Source channel: CH1~CH4
Nth Edge	Triggers on the Nth edge after the specified idle time. The edge can be specified as Rising or Falling. Source channel: CH1~CH4

Trigger Type	
RS232/UART	Triggers on the Start, Error, Check Error, or Data frame of the RS232/UART bus (up to 20 Mb/s). Source channel: CH1~CH4
I2C	Triggers on the Start, Stop, Restart, MissedACK, Address (7 bits, 8 bits, or 10 bits), Data, or Address Data of the I2C bus. Source channel: CH1~CH4
SPI	Triggers on the specified pattern of the specified data width (4 to 32) of SPI bus. CS and Timeout are supported. Source channel: CH1~CH4
CAN	Triggers on the start of a frame, end of a frame, Remote ID, Overload, Frame ID, Frame Data, Data&ID, Frame Error, Bit Fill, Answer Error, Check Error, Format Error, and Random of the CAN signal (up to 5 Mb/s). The supported CAN bus signal types include CAN_H, CAN_L, TX/RX, and DIFF. Source channel: CH1~CH4
LIN	Triggers on the Sync, ID, Data (length settable), Data&ID, Wakeup, Sleep, and Error of the LIN bus signal (up to 20 Mb/s). Source channel: CH1~CH4

Search & Navigate

Search & Navigate	
Type	Edge, pulse width
Source	Analog channels
Copy	Copy to/from trigger; independent settings including threshold and trigger condition setup
Result Display	Event list or be exported to external/internal memory
Navigate	Time: view acquired waveforms in time order
	Event: use the navigation controls to go to found search events
	Segments: use the navigation controls to play through the acquired segments in UltraAcquire mode

Waveform Measurement

Waveform Measurement		
Cursor	Number of Cursors	2 pairs of XY cursors
	Manual Mode	Voltage deviation between cursors (ΔY) Time deviation between cursors (ΔX) Reciprocal of ΔX (Hz) (1/ΔX)
	Track Mode	Fix Y-axis to track X-axis waveform point's voltage and time values Fix X-axis to track Y-axis waveform point's voltage and time values
	Auto Measurement	Allow to display cursors during auto measurement
	XY Mode	Measures the voltage parameters of the corresponding channel waveforms in XY time base mode X = Channel 1, Y = Channel 2

Waveform Measurement		
Auto Measurement	Number of Measurements	41 auto measurements; and up to 14 measurements can be displayed at a time.
	Measurement Source	CH1 to CH4, Math1 to Math4
	Measurement Range	Main, Zoom
	All Measurements	Displays 33 measurement items (vertical and horizontal) for the current measurement channel; the measurement results are updated continuously.
	Vertical	Vmax, Vmin, Vpp, Vtop, Vbase, Vamp, Vupper, Vmid, Vlower, Vavg, VRMS, Per. VRMS, Overshoot, Preshoot, Area, Period Area, and AC RMS.
	Horizontal	Period, Frequency, Rise Time, Fall Time, +Width, -Width, +Duty, -Duty, Positive Pulse Count, Negative Pulse Count, Rising Edge Count, Falling Edge Count, Tvmax, Tvmin, +Slew Rate, and -Slew Rate
	Others	Delay (A↑-B↑), Delay (A↑-B↓), Delay (A↓-B↑), Delay (A↓-B↓), Phase (A↑-B↑), Phase (A↑-B↓), Phase (A↓-B↑), and Phase (A↓-B↓)
	Statistics	Items: Current, Average, Max, Min, Standard Deviation, Count Statistical times settable

Waveform Math

Waveform Math	
Number of Math Functions	4, displays 4 math functions simultaneously
Arithmetic	A+B, A-B, A×B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Lg, Ln, Exp, Sqrt, Abs, AX+B, LowPass, HighPass, BandPass, and BandStop
Color Grade	FFT supported

Waveform Math		
FFT	Record Size	Up to 1 Mpts
	Window Type	Rectangular, Blackman-Harris, Hanning (default), Hamming, Flattop, and Triangle
	Peak Search	A maximum of 15 peaks, confirmed by the settable threshold and offset threshold set by users

Waveform Analysis

Waveform Analysis		
Waveform Recording		Store the signal under test in segments according to the trigger events, i.e. save all the sampled waveform data as a segment to the RAM for each trigger event. The maximum number of the sampled segments reaches 500,000.
	Source	All enabled analog channels
	Analysis	Support playing frame by frame or continuous playing; capable of calculating, measuring, and decoding the played waveforms
Pass/Fail Test		Compare the signal under test with the user-defined mask to provide the test results: the number of successful tests, failed tests, and the total number of tests. The pass/fail event can enable immediate stop, beeper, and the screenshot.
	Source	Any analog channel
Color Grade		A dimensional view for color grade waveforms, color grade >16, 256-level color scale display
	Source	Any analog channel
	Color Theme	Temperature and intensity
	Mode	All modes available

Serial Decoding

Serial Decoding	
No. of Decodings	4, decodes and enables/disables four protocol types simultaneously
Decoding Type	Standard: Parallel, RS232/UART, I2C, SPI, LIN, CAN

Serial Decoding	
Parallel	Up to 4 bits of Parallel decoding, available for any analog channel. User-defined clock and auto clock settings are supported. Source channel: CH1~CH4
RS232/UART	Decodes the RS232/UART (up to 20 Mb/s) bus's TX/RX data (5 to 9 bits), parity (Odd, Even, or None), and stop bits (1 to 2 bits) Source channel: CH1~CH4
I2C	Decodes the address (with or without the R/W bit) of the I2C bus, data, and ACK. Source channel: CH1~CH4
SPI	Decodes the MISO/MOSI data (4 to 32 bits) of the SPI bus. Timeout and CS are supported. Source channel: CH1~CH4
CAN	Decodes the remote frame (ID, byte number, CRC), overload frame, and data frame (standard/extended ID, control domain, data domain, CRC, and ACK) of the CAN bus (up to 5 Mb/s). The supported CAN bus signal types include CAN_H, CAN_L, TX/RX, and DIFF. Source channel: CH1~CH4
LIN	Decodes the protocol version (1.X or 2.X) of the LIN bus (up to 20 Mb/s). The decoding displays sync, ID, data, and check sum. Source channel: CH1~CH4

Auto

Auto	
AutoScale	Minimum voltage greater than 10 mVpp, duty cycle greater than 1%, and frequency over 35 Hz

Digital Voltmeter

Digital Voltmeter	
Source	Any analog channel
Function	DC, AC+DC_{rms}, AC_{rms}
Resolution	ACV/DCV: 4 bits
Limits Beeper	Support upper/lower limit settings; sounds an alarm when the voltage value is inside or outside of the limit range

Precision Counter

Precision Counter		
Source		Any analog channel and EXT
Measurement		Frequency, period, totalize
Totalizer	Resolution	3 to 6 digits, user-defined
	Max. Frequency	Maximum analog bandwidth
Totalizer		48-bit totalizer
		Counts the number of the rising edges
Time Reference		Internal Reference

Command Set

Command Set	
Common Commands Support	Standard SCPI commands
Error Message Definition	Error Message
Support Status Report Mechanism	Status Reporting
Support Sync Mechanism	Synchronization

Display

Display	
LCD	10.1-inch capacitive multi-touch gesture-enabled display
Resolution	1280 x 800 (Screen Region) 16:9
Graticule	10 horizontal divisions x 8 vertical divisions
Persistence	Off, Infinite, variable persistence (100 ms to 10 s)
Brightness	256 intensity levels (LCD, HDMI)

Processor System

Processor System	
Processor	Cortex-A72, 1.8 GHz, hexa-core
System Memory	4 GB RAM

Processor System		
Operating System		Android
Internal Non-volatile Memory		8 GB

I/O

I/O		
USB3.0 Host		2 on the front panel
USB3.0 Device		1 on the rear panel
LAN Port		1 on the rear panel, 10/100/1000 Base-T, supporting LXI-C
Web Control		Support Web Control interface (input the IP address of the oscilloscope into the Web browser to display the operation interface of the oscilloscope)
AUX Out		BNC output on the rear panel Vo (H) ≥ 2.5 V open circuit, ≥ 1.0 V 50 Ω to GND Vo (L) ≤ 0.7 V to load ≤ 4 mA; ≤ 0.25 V 50 Ω to GND
	Trig Out	Output a pulse signal when the oscilloscope is triggered
	Pass/Fail	Output a pulse signal when a pass/fail event occurs. Support user-defined pulse polarity and pulse time (100 ns to 10 ms)
	Rise Time	≤ 1.5 ns
10 MHz Reference Clock In/Out	Input Interface	1, BNC connector on the rear panel
	Output Interface	1, BNC connector on the rear panel
	Input Mode	50 Ω, with the amplitude 130 mVpp to 4.1 Vpp (-10 dBm, 20 dBm), frequency 10 MHz ± 10 ppm
	Output Mode	50 Ω, 1.5 Vpp sine waveform
HDMI Video Output		1 on the rear panel, HDMI 1.4, A plug; used to connect an external monitor or projector
Probe Compensation Output		1 kHz frequency, 0 to 3 V amplitude, Square

Power

Power	
Power Voltage	AC 100 to 240 V, 50 to 60 Hz
Power	400 VA maximum (connect various interfaces, USB storage device, and active probes)
Fuse	3.15 A, T degree, 250 V

Environment

Environment		
Temperature Range	Operating	0℃ to +50℃
	Non-operating	-30℃ to +60℃

Mechanical Characteristics

Mechanical Characteristics	
Dimensions	358.14 mm (W) x 214.72 mm (H) x 120.62 mm (D)
Rack Mount Kit	4U
Weight[6]	Net: 3.8 kg
	Shipping: 5.37 kg

Non-volatile Memory

Non-volatile Memory		
Data/File Storage	Setup/Image	setup (*.stp), image (*.png, *.bmp, *.jpg)
	Waveform Data	CSV waveform data (*.csv), binary waveform data (*.bin,), list data (*.csv), and reference waveform data (*.ref, *.csv, *.bin)
Internal Capacity		8 GB
Reference Waveform		Displays 10 internal waveforms
Setting		Limited by size of USB drive
USB Capacity		Industry standard flash drives

NOTE:

[1]: If any one of the channels is enabled, it is called single channel mode.

[2]: For 4-channel models, if two of the channels are enabled, it is called half channels mode.

[3]: For 2-channel models, if two channels are enabled, it is called all channels mode. For 4-channel models, if any three channels or all four channels are enabled, it is called all channels mode.

[4]: 500 µV/div is a magnification of 1 mV/div setting. For vertical accuracy calculations, use full scale of 8 mV for sensitivity setting.

[5]: For any channel, under the same input impedance with DC-coupled, the Volts/div setting is the same for 100 mV/div and 200 mV/div setting.

Order Information

Order Information	Order No.
Model	
70 MHz, 2 GSa/s, 50 Mpts, 2CH DHO	DHO1072
70 MHz, 2 GSa/s, 50 Mpts, 4CH DHO	DHO1074
100 MHz, 2 GSa/s, 50 Mpts, 2CH DHO	DHO1102
100 MHz, 2 GSa/s, 50 Mpts, 4CH DHO	DHO1104
200 MHz, 2 GSa/s, 50 Mpts, 2CH DHO	DHO1202
200 MHz, 2 GSa/s, 50 Mpts, 4CH DHO	DHO1204
Standard Accessories	
Power cord (based on destination country)	— —
USB Cable	— —
4 Passive HighZ Probes (350 MHz) Standard for DHO1204, 2 Passive HighZ Probes (350 MHz) Standard for DHO1202	PVP2350
4 Passive HighZ Probes (150 MHz), Standard for DHO1104/ DHO1074	PVP3150
2 Passive HighZ Probes (150 MHz), Standard for DHO1102/ DHO1072	PVP3150
Bandwidth Upgrade Option	
70 MHz to 100 MHz Upgrade Option	DHO1000-BWU7T10
70 MHz to 200 MHz Upgrade Option	DHO1000-BWU7T20
100 MHz to 200 MHz Upgrade Option	DHO1000-BWU10T20
Memory Depth Upgrade Option	
100 Mpts Memory Depth Upgrade Option	DHO1000-RLU-01