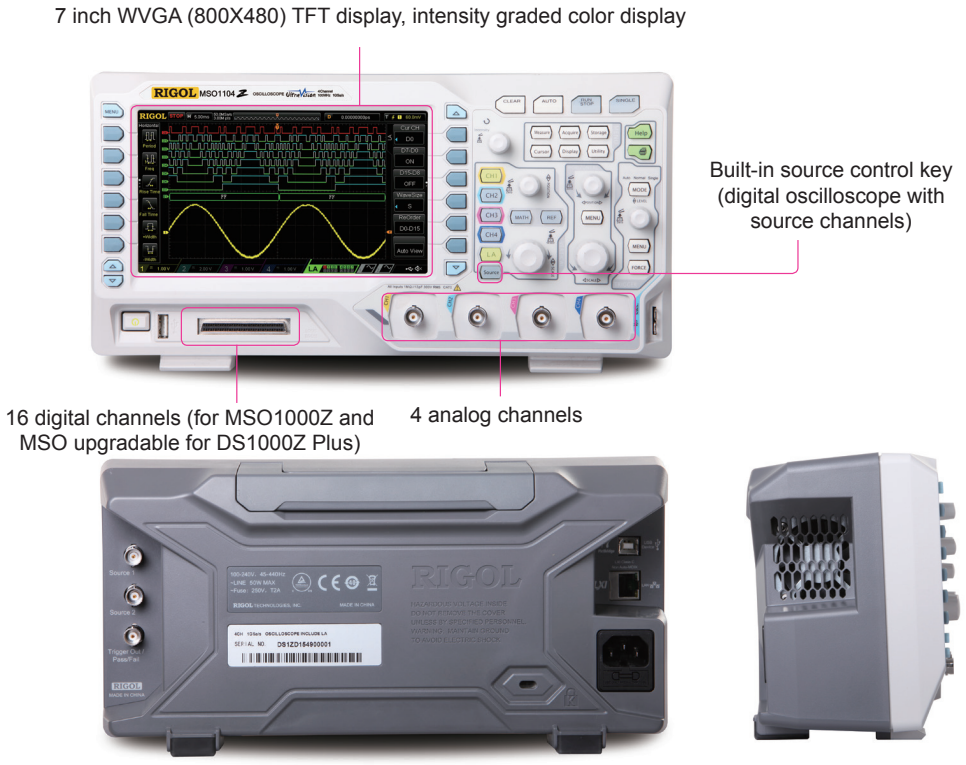
RIGOL

UltraVision

- Analog channel bandwidth: 100 MHz, 70 MHz, 50 MHz
- 4 analog channels, 16 digital channels (for MSO1000Z and MSO upgradable for DS1000Z Plus)
- Real-time sample rate up to 1 GSa/s
- Memory depth up to 12 Mpts (standard)/24 Mpts (optional)
- Up to 30,000 wfms/s waveform capture rate
- Up to 60,000 frames hardware real-time waveform recording and playback functions (optional)
- Innovative "UltraVision" technology
- MSO field upgradable with MSO1000Z upgrade package (MSO upgrade option, only for DS1000Z Plus)
- Various trigger and bus decoding functions
- Low noise floor, vertical scale range: 1 mV/div to 10 V/div
- Built-in dual-channel 25 MHz function/arbitrary waveform generator (only for digital oscilloscope with source channels)
- Various interfaces: USB Host&Device, LAN (LXI), AUX
- Compact size, light weight, easy to use
- 7 inch WVGA (800x480) TFT LCD, intensity graded color display

MSO/DS1000Z series is a high-performance and economic digital oscilloscope designed for the designing, debugging and educational requirements of the mainstream digital oscilloscope market. Wherein, the mixed signal digital oscilloscope aimed at the embedded design and test fields is equipped with 16 digital channels and allows users to measure analog and digital signals at the same time.

MSO/DS1000Z Series Digital Oscilloscope



Product Dimensions: Width×Height×Depth=313.1 mm×160.8 mm×122.4 mm
Weight: 3.2 kg ± 0.2 kg(Without Package)

► Innovative UltraVision Technology(Analog Channel)

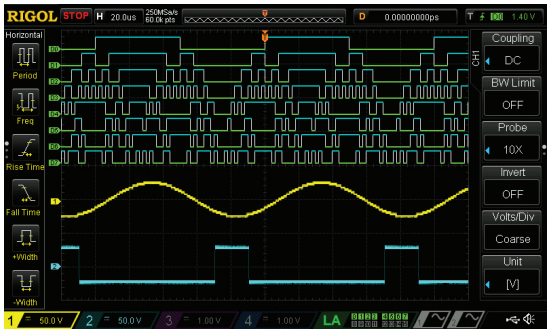
- Deeper Memory Depth (standard 12 Mpts, optional 24 Mpts)
- Higher Waveform Capture Rate (up to 30,000 wfms/s)
- Real-time Waveform Recording&Playback (up to 60,000 frames, optional)
- Intensity Graded Color Display

► Models and Key Specifications

Model	DS1054Z	DS1074Z Plus	DS1074Z-S Plus	DS1104Z Plus	DS1104Z-S Plus
		MSO1074Z	MSO1074Z-S	MSO1104Z	MSO1104Z-S
Analog BW	50 MHz	70 MHz		100 MHz	
Number of Analog Channels	4				
Number of Digital Channels	None	16 digital channels for MSO1000Z; MSO upgradable for DS1000Z Plus			
Max. Sample Rate	Analog channel: 1 GSa/s (single-channel), 500 MSa/s (dual-channel), 250 MSa/s (three/four-channel) Digital channel: 1 GSa/s (8-channel), 500 MSa/s (16-channel)				
Max. Memory Depth	Analog channel: standard 12 Mpts (single-channel), 6 Mpts (dual-channel), 3 Mpts (3/4-channel); optional 24 Mpts (single-channel), 12 Mpts (dual-channel), 6 Mpts (3/4-channel) Digital channel(MSO): standard 12 Mpts (8-channel), 6 Mpts (16-channel); optional 24 Mpts (8-channel), 12 Mpts (16-channel)				
Max. Waveform Capture Rate	30,000 wfms/s				
Hardware Real-time Waveform Recording and Playback Functions	Up to 60,000 frames (optional)				
Std. Probes	PVP2150 150 MHz Passive HighZ Probe: 4 sets; 1 set RPL1116 LA Probe for MSO1XX4Z/1XX4Z-S				
Built-in 2Ch 25MHz Source	No		Yes	No	Yes

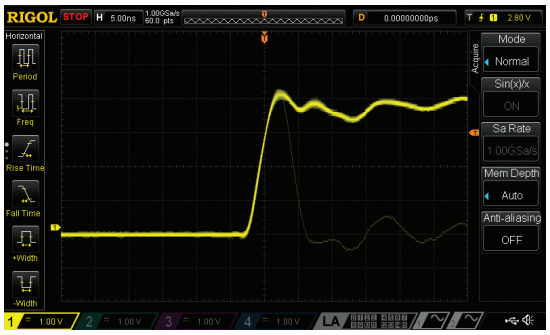
Features and Benefits

4 analog channels, 16 digital channels (for MSO1000Z and MSO upgradable for DS1000Z Plus)



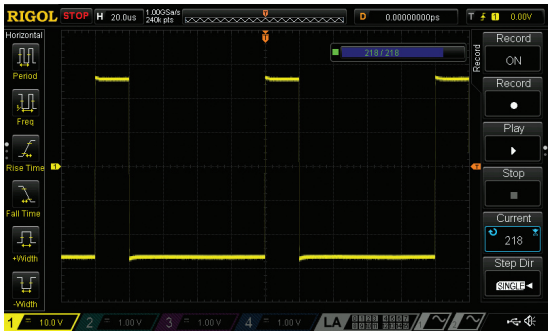
UltraVision: deeper memory (standard 12 Mpts, optional 24 Mpts)

UltraVision: up to 30,000 wfms/s waveform capture rate

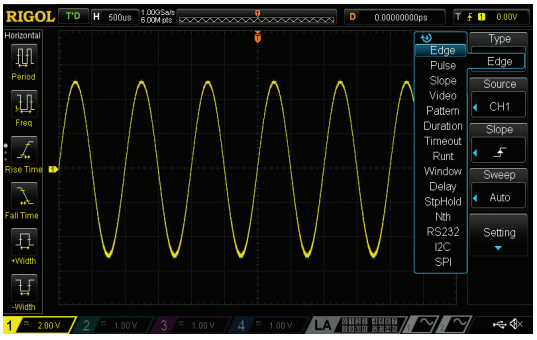


UltraVision: intensity graded color display

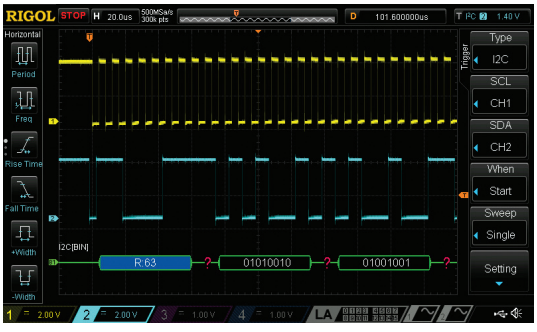
UltraVision: waveform recording and playback functions (optional)



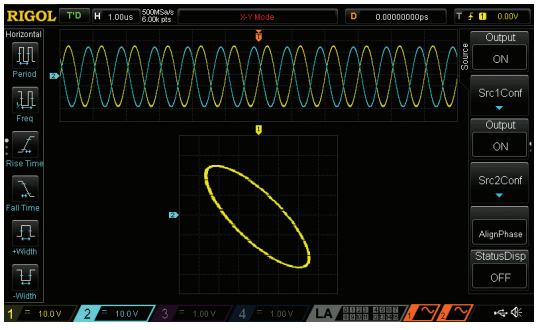
A variety of trigger functions



Built-in dual-channel 25 MHz source (MSO1XX4Z-S and DS1XX4Z-S Plus)

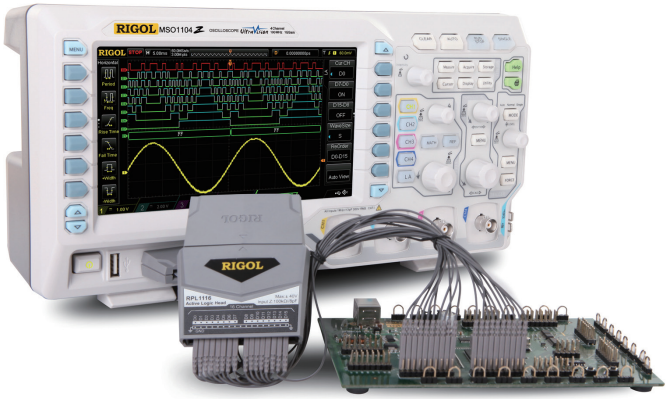


Optional serial bus trigger and decoding functions (RS232/UART, I2C, SPI)



***Do not include the 50 MHz bandwidth model**

▶ Mixed Signal Digital Oscilloscope



***Do not include the 50 MHz bandwidth model**

The mixed signal digital oscilloscope also provides the following functions:

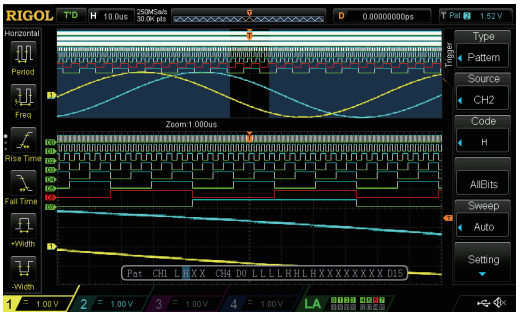
- 16 digital channels for MSO1000Z and MSO upgradable for DS1000Z Plus
- Sample rate of digital channel up to 1 GSa/s
- Memory depth of digital channel up to 24 Mpts
- Waveform capture rate of digital channel up to 30,000 wfms/s
- Hardware real-time waveform recording and playback functions, up to 60,000 frames can be recorded
- Trigger and decoding of the analog and digital channels at the same time
- Easy grouping and group operation of the digital channels
- Support a variety of logic levels
- Trigger across the analog and digital channels
- Time correlated display and analysis for both the analog and digital channel waveforms

Innovative UltraVision Technology (Digital Channel)

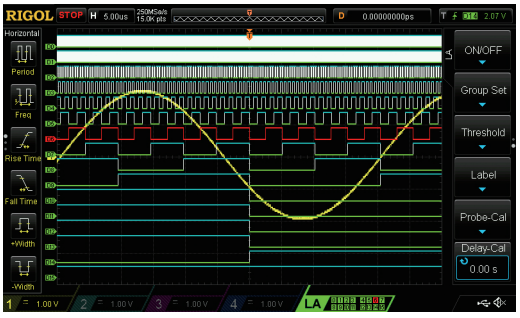
UltraVision

- Deeper memory depth (up to 24 Mpts)
- Higher waveform capture rate (up to 30,000 wfms/s)
- Real-time waveform recording and playback functions (up to 60,000 frames)
- Intensity graded color display

Mixed signal analysis with analog and digital channels

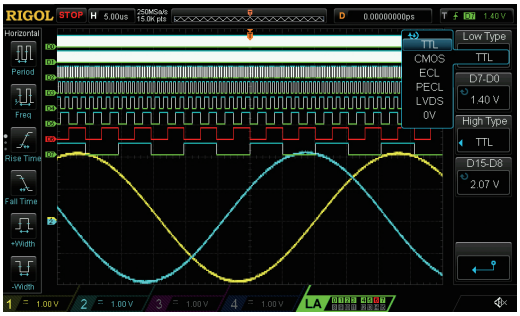


Easy to be grouped and labeled for digital channels



Deeper memory depth for the digital channels, serial bus trigger and decoding on digital channels

Supports a variety of logic levels



RIGOL Probes and Accessories Supported by MSO/DS1000Z Series

RIGOL Passive Probes

Model Number	Type	Description
PVP2150	High Z Probe	1X: DC to 35 MHz 10X: DC to 150 MHz Compatibility: all **RIGOL** scopes.
PVP2350	High Z Probe	1X: DC to 35 MHz 10X: DC to 350 MHz Compatibility: all **RIGOL** scopes.
RP3500A	High Z Probe	DC to 500 MHz Compatibility: all **RIGOL** scopes.
RP1300H	High Voltage Probe	DC to 300 MHz CAT I 2000 V (DC+AC), CAT II 1500 V (DC+AC) Compatibility: all **RIGOL** scopes.
RP1010H	High Voltage Probe	DC to 40 MHz DC: 0 to 10 kV DC, AC: pulse ≤20 kVp-p, AC: sine wave ≤7 kVrms Compatibility: all **RIGOL** scopes.
RP1018H	High Voltage Probe	DC to 150 MHz DC+AC Peak: 18 kV CAT II AC RMS: 12 kV CAT II Compatibility: all **RIGOL** scopes.
RPL1116	Logic Analysis Probe	Logic analysis probe (for mixed signal digital oscilloscope)
RT50J	Adapter	50 Ω impedance adapter (2 W, 1 GHz)

RIGOL Active & Current Probes

Model Number	Type	Description
RP1001C	Current Probe	BW: DC to 300 kHz Max. input DC: ±100 A, AC P-P: 200 A, AC RMS: 70 A Compatibility: all **RIGOL** scopes.
RP1002C	Current Probe	BW: DC to 1 MHz Max. input DC: ±70 A, AC P-P: 140 A, AC RMS: 50 A Compatibility: all **RIGOL** scopes.
RP1003C	Current Probe	BW: DC to 50 MHz Max. input AC P-P: 50 A (Noncontinuous), AC RMS: 30 A Compatibility: all **RIGOL** scopes. Must order RP1000P power supply.
RP1004C	Current Probe	BW: DC to 100 MHz Max. input AC P-P: 50 A (Noncontinuous), AC RMS: 30 A Compatibility: all **RIGOL** scopes. Must order RP1000P power supply.
RP1005C	Current Probe	BW: DC to 10 MHz Max. input AC P-P: 300 A (Noncontinuous), 500 A (@pulse width ≤30 us), AC RMS: 150 A Compatibility: all **RIGOL** scopes. Must order RP1000P power supply.
RP1000P	Power Supply	Power supply for RP1003C, RP1004C and RP1005C, support 4 channels.
RP1025D	High Voltage Differential Probe	BW: 25 MHz Max. Voltage ≤1400 Vpp Compatibility: all **RIGOL** scopes.
RP1050D	High Voltage Differential Probe	BW: 50 MHz Max. Voltage ≤7000 Vpp Compatibility: all **RIGOL** scopes.
RP1100D	High Voltage Differential Probe	BW: 100 MHz Max. Voltage ≤7000 Vpp Compatibility: all **RIGOL** scopes.

Specifications

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

Sample

Sample Mode	Real-time sample
Real-time Sample Rate	**Analog channel**: 1 GSa/s (single-channel), 500 MSa/s (dual-channel), 250 MSa/s (three/four-channel) **Digital channel**: 1 GSa/s (8-channel), 500 MSa/s (16-channel)
Peak Detect	**Analog channel**: 4 ns **Digital channel**: 4 ns
Averaging	After all the channels finish N samples at the same time, N can be 2, 4, 8, 16, 32, 64, 128, 256, 512 or 1024.
High Resolution	12 bit (max.)
Interpolation	Sin(x)/x (optional)
Minimum Detect Pulse Width	**Digital channel**: 10 ns
Memory Depth	**Analog channel:** standard 12 Mpts (single-channel), 6 Mpts (dual-channel), 3 Mpts (three/four-channel); optional 24 Mpts (single-channel), 12 Mpts (dual-channel), 6 Mpts (three/four-channel) **Digital channel:** standard 12 Mpts (8-channel), 6 Mpts (16-channel); optional 24 Mpts (8-channel), 12 Mpts (16-channel)

Input

Number of Channels	MSO1XX4Z/1XX4Z-S: 4 analog channels, 3 analog channels+8 digital channels, 2 analog channels+16 digital channels DS1XX4Z Plus/1XX4Z-S Plus: 4 analog channels, MSO upgradable DS1054Z: 4 analog channels
Input Coupling	DC, AC or GND
Input Impedance	**Analog channel**: (1 MΩ±1%) || (15 pF±3 pF) **Digital channel**: (100 kΩ±1%) || 8 pF±3 pF)
Probe Attenuation Coefficient	**Analog channe:** 0.01X to 1000X, in 1-2-5 step
Maximum Input Voltage (1 MΩ)	**Analog channel**: CAT I 300 Vrms, CAT II 100 Vrms, transient overvoltage 1000 Vpk **Digital channel**: CAT I 40 Vrms, transient overvoltage 800 Vpk

Horizontal

Timebase Scale	5 ns/div to 50 s/div
Maximum Record Length	24 Mpts (optional)
Timebase Accuracy[1]	≤ ± 25 ppm
Clock Drift	≤ ± 5 ppm/year
Maximum Delay Range	Negative delay: 1/2 (Memory Depth/Sample Rate) Positive delay: 1 s to 500 s
Timebase Mode	YT, XY, Roll
Number of X-Ys	1
Waveform Capture Rate[2]	30,000 wfms/s (dots display)
Zero Offset	±0.5div*minimum time base scale

Vertical

Bandwidth (-3dB)	MSO1104Z/1104Z-S and DS1104Z Plus/1104Z-S Plus: DC to 100 MHz MSO1074Z/1074Z-S and DS1074Z Plus/1074Z-S Plus: DC to 70 MHz DS1054Z: DC to 50 MHz

Single-shot Bandwidth	MSO1104Z/1104Z-S and DS1104Z Plus/1104Z-S Plus: DC to 100 MHz MSO1074Z/1074Z-S and DS1074Z Plus/1074Z-S Plus: DC to 70 MHz DS1054Z: DC to 50 MHz
Vertical Resolution	**Analog channel**: 8 bits **Digital channel**: 1 bit
Vertical Scale (Probe ratio is 1X)	1 mV/div to 10 V/div
Offset Range (Probe ratio is 1X)	1 mV/div to 499 mV/div: ± 2 V 500 mV/div to 10 V/div: ± 100 V
Bandwidth Limit[1]	20 MHz
Low Frequency Response (AC coupling, -3dB)	≤5 Hz (on BNC)
Calculated Rise Time[1]	MSO1104Z/1104Z-S and DS1104Z Plus/1104Z-S Plus: 3.5 ns MSO1074Z/1074Z-S and DS1074Z Plus/1074Z-S Plus: 5 ns DS1054Z: 7 ns
DC Gain Accuracy	<10 mV: ±4% full scale ≥10 mV: ±3% full scale
DC Offset Accuracy	±0.1 div ± 2 mV ± 1% offset
Channel to Channel Isolation	DC to maximum bandwidth: >40 dB

Vertical (Digital Channel)(Applicable to MSO1000Z and DS1000Z Plus with MSO Upgrade Option)

Threshold	Adjustable threshold of 8 channels per group
Threshold Selection	TTL (1.4 V)
	5.0 V CMOS (+2.5 V), 3.3 V CMOS (+1.65 V)
	2.5 V CMOS (+1.25 V), 1.8 V CMOS (+0.9 V)
	ECL (-1.3 V)
	PECL (+3.7 V)
	LVDS (+1.2 V)
	0 V
	User
Threshold Range	±15.0 V, in 10 mV step
Threshold Accuracy	±(100 mV + 3% of threshold setting)
Dynamic Range	±10.0 V + threshold
Minimum Voltage Swing	500 mVpp
Vertical Resolution	1 bit

Trigger

Trigger Level Range	±5 div from the center of the screen
Trigger Mode	Auto, Normal, Single
Holdoff Range	16 ns to 10 s
High Frequency Rejection[1]	75 kHz
Low Frequency Rejection[1]	75 kHz
Trigger Sensitivity[1]	1.0 div (below 5 mV or noise rejection is enabled) 0.3 div (above 5 mV and noise rejection is disabled)
Edge Trigger	
Edge Type	Rising, Falling, Rising/Falling
Pulse Trigger	
Pulse Condition	Positive Pulse Width (greater than, lower than, within specified interval) Negative Pulse Width (greater than, lower than, within specified interval)
Pulse Width	8 ns to 10 s
Runt Trigger (Optional)	
Pulse Width Condition	None, >, <, <>
Polarity	Positive, Negative
Pulse Width Range	8 ns to 10 s
Window Trigger (Optional)	
Windows Type	Rising, Falling, Rising/Falling

Trigger Position	Enter, Exit, Time
Windows Time	8 ns to 10 s
Nth Edge Trigger (Optional)	
Edge Type	Rising, Falling
Idle Time	16 ns to 10 s
Edge Number	1 to 65535
Slope Trigger	
Slope Condition	Positive Slope (greater than, lower than, within specified interval) Negative Slope (greater than, lower than, within specified interval)
Time Setting	8 ns to 10 s
Video Trigger	
Signal Standard	NTSC, PAL/SECAM, 480P, 576P
Pattern Trigger	
Pattern Setting	H, L, X, Rising, Falling
Delay Trigger (Optional)	
Edge Type	Rising, Falling
Delay Type	>, <, <>, ><
Delay Time	8 ns to 10 s
TimeOut Trigger (Optional)	
Edge Type	Rising, Falling, Rising/Falling
TimeOut Value	16 ns to 10 s
Duration Trigger	
Pattern	H, L, X
Trigger Condition	>, <, <>
Duration Time	8 ns to 10 s
Setup/Hold Trigger (Optional)	
Edge Type	Rising, Falling
Data Pattern	H, L,X
Setup Time	8 ns to 1 s
Hold Time	8 ns to 1 s
RS232/UART Trigger (Optional)	
Polarity	Normal, Invert
Trigger Condition	Start, Error, Check Error, Data
Baud Rate	2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, 230400 bps, 460800 bps, 921600 bps, 1 Mbps and User
Data Bits	5 bits, 6 bits, 7 bits, 8 bits
I2C Trigger (Optional)	
Trigger Condition	Start, Restart, Stop, Missing Ack, Address, Data, A&D
Address Bits	7 bits, 8 bits, 10 bits
Address Range	0 to 127, 0 to 255, 0 to 1023
Byte Length	1 to 5
SPI Trigger (Optional)	
Trigger Condition	Timeout, CS
Timeout Value	16 ns to 10 s
Data Bits	4 bit to 32 bit
Data Line Setting	H, L, X

Measure

Cursor	Manual mode	Voltage deviation between cursors (△V) Time deviation between cursors (△T) Reciprocal of △T (Hz) (1/ △T)
	Track mode	Voltage and time values of the waveform point
	Auto mode	Allow to display cursors during auto measurement
Auto Measurement	Analog channel: Period, Frequency, Rise Time, Fall Time, Positive Pulse Width, Negative Pulse Width, Positive Duty Cycle, Negative Duty Cycle, tVmax, tVmin, Positive Rate, Negative Rate, Delay 1→2↓ , Delay 1→2↑ , Phase 1→2↓ , Phase 1→2↑ , Maximum, Minimum, Peak-Peak Value, Top Value, Bottom Value, Amplitude, Upper Value, Middle Value, Lower Value, Average, Vrms, Overshoot, Pre-shoot, Area, Period Area, Period Vrms, Variance Digital channel: Period, Frequency, Positive Pulse Width, Negative Pulse Width, Positive Duty Cycle, Negative Duty Cycle, Delay 1→2↓ , Delay 1→2↑ , Phase 1→2↓ , Phase 1→2↑	
Number of Measurements	Display 5 measurements at the same time	
Measurement Range	Screen or cursor	
Measurement Statistic	Average, Max, Min, Standard Deviation, Number of Measurements	
Counter	Hardware 6 bits counter (channels are selectable)	

Math Operation

Waveform Operation	A+B, A-B, A×B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs, Filter
FFT Window	Rectangle, Hanning, Blackman, Hamming,Flat Top,Triangle
FFT Mode	Trace, Memory
FFT Display	Half, Full
FFT Vertical Scale	dB/dBm, Vrms
Filter	Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop Filter
Number of Buses for Decoding	2
Decoding Type	Parallel (standard), RS232/UART (optional), I2C (optional), SPI (optional)

Display

Display Type	7.0 inch TFT LCD display
Display Resolution	800 horizontal × RGB × 480 vertical pixel
Display Color	16 million color (24 bit true color)
Persistence Time	Min, 100 ms, 200 ms, 500 ms, 1 s, 5 s, 10 s, Infinite
Display Type	Dots, Vectors

I/O

Standard Ports	USB Host, USB Device, LAN, Aux Output (TrigOut/PassFail)

Signal Source ((Applicable to Digital Oscilloscopes with Source Channels))

Number of Channels	2
Sample Rate	200 MSa/s
Vertical Resolution	14 bits
Max. Frequency	25 MHz
Standard Waveform	Sine, Square, Pulse, Ramp, Noise, DC
Arbitrary Waveform	Since, Exp.Rise, EXP.Fall, ECG, Gauss, Lorentz, Haversine

Sine	Frequency Range	0.1 Hz to 25 MHz
	Flatness	±0.5 dB (relative to 1 kHz)
	Harmonic Distortion	-40 dBc
	Stray (Non-harmonic)	-40 dBc
	Total Harmonic Distortion	1%
	S/N Ratio	40 dB
Square /Pulse	Frequency Range	Square: 0.1 Hz to 15 MHz Pulse: 0.1 Hz to 1 MHz
	Rise/Fall time	<15 ns
	Overshoot	<5%
	Duty Cycle	Square: always be 50% Pulse: 10% to 90% adjustable
	Duty Cycle Resolution	1% or 10 ns (the larger of the two)
	Min. Pulse Width	20 ns
	Pulse Width Resolution	10 ns or 5 bits (the larger of the two)
	Jitter	500 ps
Ramp	Frequency Range	0.1 Hz to 100 kHz
	Linearity	1%
	Symmetry	0 to 100%
Noise[1]	Bandwidth	25 MHz
Built-in Waveforms	Frequency Range	0.1 Hz to 1 MHz
Arbitrary Waveforms	Frequency Range	0.1 Hz to 10 MHz
	Waveform Length	2 to 16k pts
Frequency	Accuracy	100 ppm (lower than 10 kHz) 50 ppm (greater than 10 kHz)
	Resolution	0.1 Hz or 4 bit, the larger of the two
Amplitude	Output Range	20 mVpp to 5 Vpp, High-resistance 10 mVpp to 2.5 Vpp, 50 Ω
	Resolution	100 μV or 3 bit, select the greater one
	Accuracy	2% (1 kHz)
DC Offset	Range	±2.5 V, HighZ ±1.25 V, 50 Ω
	Resolution	100 μV or 3 bit, the larger of the two
	Accuracy	2% (1 kHz)
Modulation	AM, FM	

General Specifications

Probe Compensation Output	
Output Voltage[1]	About 3 V, peak-peak
Frequency[1]	1 kHz
Power	
Power Voltage	100 V to 240 V, 45 Hz to 440 Hz
Power	Maximum 50 W
Fuse	2 A, T degree, 250 V
Environment	
Temperature Range	Operating: 0℃ to +50℃
	Non-operating: -40℃ to +70℃
Cooling Method	Fan cooling
Humidity Range	0℃ to +30℃ : ≤95℃ relative humidity
	+35℃ to +40℃ : ≤75℃ relative humidity
	+40℃ to +50℃ : ≤45℃ relative humidity

Altitude	Operating: under 3,000 meters	
	Non-operating: under 15,000 meters	
Mechanical		
Dimensions[3]	Width × Height × Depth = 313.1 mm × 160.8 mm × 122.4 mm	
Weight[4]	Without package	3.2 kg ± 0.2 kg
	With package	3.8 kg ± 0.5 kg
Calibration Interval		
The recommended calibration interval is one year.		
Regulation Standards		
Electromagnetic Compatibility	2004/108/EC Execution standard EN 61326-1:2006 EN 61326-2-1:2006	
Safety	UL 61010-1:2004; CAN/CSA-C22.2 NO. 61010-1-2004; EN 61010-1:2001; IEC 61010-1:2001	

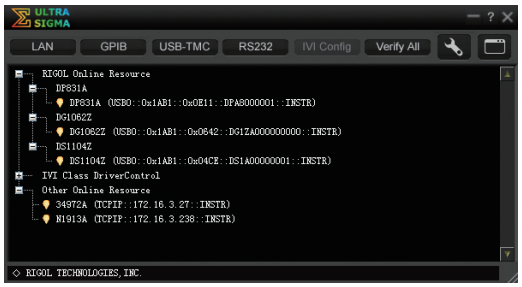
Note[1]: Typical.
Note[2]: Maximum value. 50 ns, single-channel mode, dots display, auto memory depth.
Note[3]: Supporting legs and handle folded, knob height included.
Note[4]: Standard configuration.

Ordering Information

	Description	Order Number
Models	DS1104Z Plus (100 MHz, 4 analog channels, MSO ready)	DS1104Z Plus
	DS1104Z-S Plus (100 MHz, 4 analog channels, 2-channel 25 MHz signal source, MSO ready)	DS1104Z-S Plus
	DS1074Z Plus (70 MHz, 4 analog channels, MSO ready)	DS1074Z Plus
	DS1074Z-S Plus (70 MHz, 4 analog channels, 2-channel 25 MHz signal source, MSO ready)	DS1074Z-S Plus
	MSO1104Z (100 MHz, 4 analog channels, 16 digital channels)	MSO1104Z
	MSO1104Z-S (100 MHz, 4 analog channels, 16 digital channels, 2-channel 25 MHz signal source)	MSO1104Z-S
	MSO1074Z (70 MHz, 4 analog channels, 16 digital channels)	MSO1074Z
	MSO1074Z-S (70 MHz, 4 analog channels, 16 digital channels, 2-channel 25 MHz signal source)	MSO1074Z-S
	DS1054Z (50 MHz, 4 analog channels)	DS1054Z
Standard Accessories	Power Cord conforming to the standard of the country	-
	USB Cable	CB-USBA-USBB-FF-150
	4 Passive Probes (150 MHz)	PVP2150
	1 Logic Analyzer Probe (only for MSO1000Z)	RPL1116
	Quick Guide (Hard Copy)	-
MSO Upgrade Option	MSO upgrade package for DS1000Z Plus only, including logic analyzer probe (RPL1116) and model label	MSO1000Z Upgrade Package
Optional Accessory	Rack Mount Kit	RM-DS1000Z
Memory Depth Option	Analog channel: 24 Mpts (single channel)/12 Mpts (dual-channel)/6 Mpts (three/four-channel) Digital channel: 24 Mpts (8-channel)/12 Mpts (16-channel)	MEM-DS1000Z
Waveform Record Option	This option provides the waveform recording and playback function.	REC-DS1000Z
Advanced Trigger Option	RS232/UART trigger, I2C trigger, SPI trigger, Runt trigger, Window trigger, Nth edge trigger, delay trigger, timeout trigger, Setup/Hold trigger	AT-DS1000Z
Serial Protocol Analysis Option	RS232/UART, I2C and SPI trigger and decoding functions	SA-DS1000Z

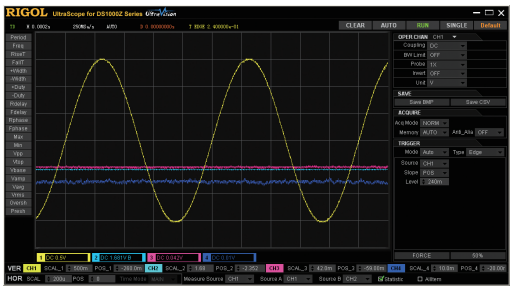
▶ Standard Software

Ultra Sigma



- **RIGOL** general PC software platform
- Multi-instrument and multi-interface resource management
- With SCPI remote command tool

Ultra Scope



- Real-time monitoring of waveform and status; supports multi-instrument and multi-window display
- With virtual panel feature
- Supports multi-interface remote control

Warranty

Three –year warranty, excluding probes and accessories.

RIGOL

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Aug 2016