

**RIGOL**  
Beyond Measure



# MSO/DS1000Z Series Digital Oscilloscope

*UltraVision*

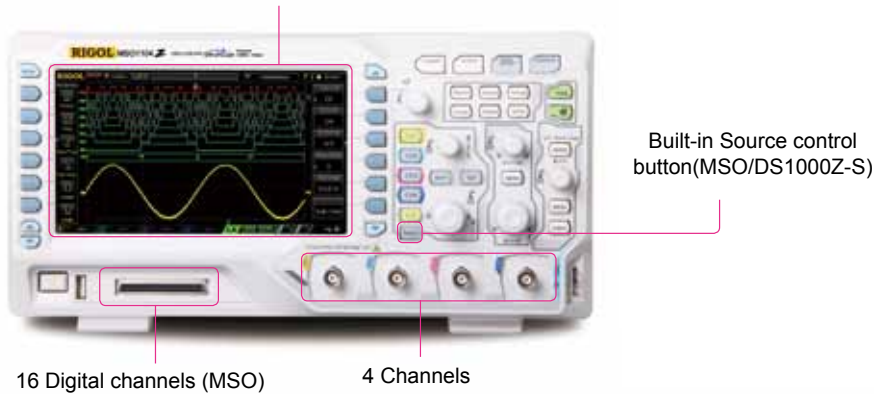
- Analog channel Bandwidth: 100MHz,70MHz,50MHz
- 4 Analog channels,16 Digital channels (MSO)
- Max. Sample Rate up to 1G Sa/s
- Memory Depth up to12Mpts /24Mpts(Opt.)
- Innovative "UltraVision" technology
- Up to 30,000wfms/s Waveform Capture Rate
- Up to 60,000frames Real-time Waveform Record(Opt.)
- Low noise floor, Dynamic Range: 1mV/div to 10V/div
- Optional Serial Buses Triggering and Decoding(RS232,I2C,SPI)
- Multi- Levels intensity grading waveform display
- Built in 2 channels 25MHz waveform Generator(MSO/DS1000Z-S)
- Complete Connectivity: LAN(LXI),USB Host & Device,AUX, USB-GPIB(Opt.)
- Compact size, light weight, easy to use
- 7 Inch WVGA (800x480), multiple intensity levels waveform display

MSO/DS1000Z Series is the new mainstream digital scope to meet the customer's applications with its innovative technology. MSO1000Z Series has 16channels, target for the embedded design and test market with its industry leading specifications, powerful trigger functions and broad analysis capabilities.



# MSO/DS1000Z Series Digital Oscilloscope

7 inch WVGA(800X480) TFT, Multiple intensity Level waveform display



Product Dimensions: Width X Height X 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 (Std.12Mpts,Opt.24Mpts)
- Higher Waveform Capture Rate (Up to 30,000 wfms/s)
- Real Time Waveform Record&Replay (Up to 60,000 frames, opt.)
- Multi-level Intensity Grading Display

## ► Models and key Specifications

Model Number	DS1054Z	DS1074Z	DS1074Z-S	DS1104Z	DS1104Z-S
		MSO1074Z	MSO1074Z-S	MSO1104Z	MSO1104Z-S
Analog BW	50 MHz	70 MHz		100MHz	
Analog Channels		4			
Digital Channel(MSO)	None	16			
Max. Sample rate		Analog channel: 1 GSa/s (single-channel), 500 MSa/s (dual-channel), 250 MSa/s (three/four-channel) Digital channel(MSO): 1 GSa/s (8-channel), 500 MSa/s (16-channel)			
Max. Memory Depth		Analog channel: standard 12M pts (single-channel), 6M pts (dual-channel), 3M pts (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		Up to 30,000 wfms/s			
Real Time waveform Record, Replay and Analysis function		Up to 60, 000 Frames(Opt.)			
Std. Probes		RP2200 150MHz BW Passive Probe:4 sets;1 set RPL1116 LA Probe(MSO only)			
Built-in 2Ch 25MHz Source	No	No	Yes	No	Yes

► Features and Benefits

4 Channels



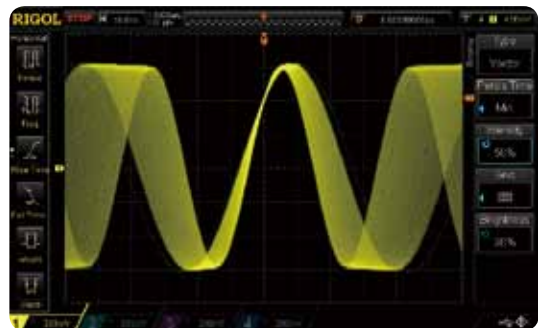
UltraVision: Deeper memory(Std.12Mpts,Opt.24Mpts)



UltraVision: Up to 30,000 wfms/s Waveform capture rate



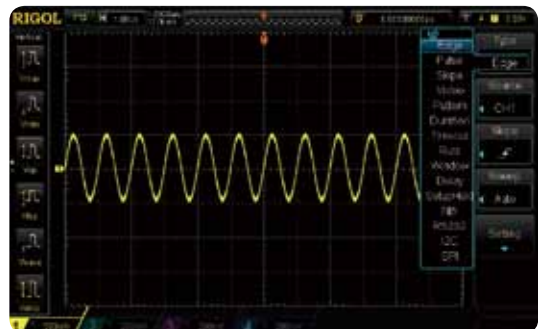
UltraVision: Multi-Level intensity grading display



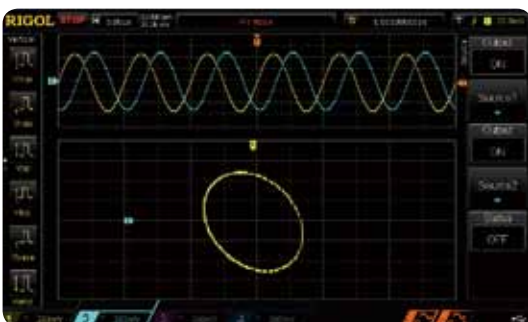
UltraVision:Realtime waveform Record,Replay, function (Opt.)



A variety of Trigger Functions



Built in 2 channel 25MHz Signal Source(MSO/ DS1000Z-S)



Optional Serial Bus Triggering and Decoding functions(RS232,I2C,SPI)



\* only for 70MHz and 100MHz bandwidth model

## ► MSO1000Z Series Mixed Signal Oscilloscope



• only for 70MHz and 100MHz bandwidth model

**Besides the powerful functions of DS1000Z, you could get more from MSO1000Z with:**

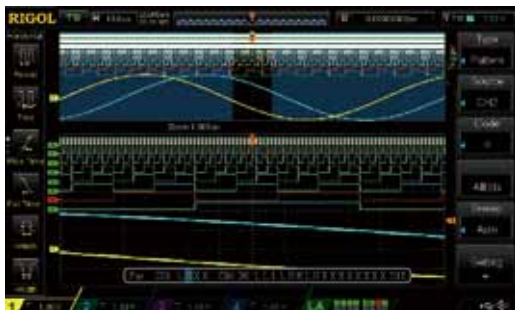
- 16 Digital channels
- Sample rate of Digital channel up to 1 GSa/s
- Memory depth of Digital channel up to 24Mpts
- Waveform capture rate of Digital channel up to 30,000wfms/s
- Real Time Waveform Record, Replay and analysis functions, up to 60,000 frames
- Triggering and Decoding across Analog and Digital channels
- Easy to be grouped for digital channels
- Support a variety of logic levels
- Time correlation display for both analog and digital signals

**Innovative UltraVision technology(Digital Channel)**

*UltraVision*

- Deeper Memory Depth( Up to 24Mpts )
- Higher Waveform capture rate(Up to 30,000wfms/s)
- Real Time waveform record & replay(Up to 60,000 frames)
- Multi-level intensity grading display

Mixed Signal Analysis with analog and digital channels



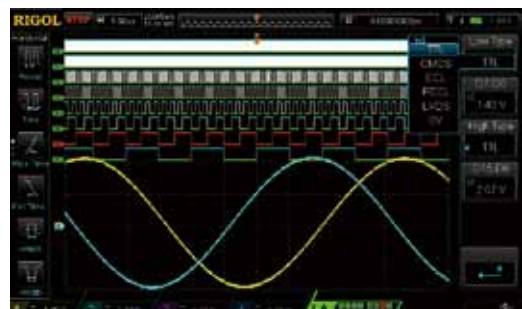
Easy to be grouped and labeled for digital channels



Serial bus triggering and decoding on digital channels











Support a variety of logic levels












## RIGOL Probes and Accessories supported by MSO/DS1000Z Series:

### ► RIGOL Passive Probes

Model Number	Type	Description
 RP2200	High Z Probe	1X: DC~7MHz 10X:DC~150MHz Compatibility: All RIGOL Scopes.
 RP3300A	High Z Probe	10X:DC~350MHz Compatibility: All RIGOL Scopes.
 RP3500A	High Z Probe	DC~500MHz Compatibility: All RIGOL Scopes.
 RP1300H	High Voltage Probe	DC~300MHz CATI 2000V(DC+AC), CATII 1500 V(DC+AC) Compatibility: All RIGOL Scopes.
 RP1010H	High Voltage Probe	DC~50MHz DC:0~10KV DC,AC:pulse <=20KVp-p, AC:sine wave <=7KVrms Compatibility: All RIGOL Scopes.
 RP1018H	High Voltage Probe	DC~150MHz DC+AC Peak:18KV CAT II AC RMS : 12KVrms CAT II Compatibility: All RIGOL Scopes.
 RPL1116	Logic analysis Probe	Logic analysis Probe(For MSO1000Z)
 RT50J	Adapter	50ohm Impedance adapter(2W,1GHz)

### ► RIGOL Active & Current Probes

Model Number	Type	Description
 RP1001C	Current Probe	BW:DC~300kHz, Max.DC:±100A, AC P-P:200A,AC RMS:70A Compatibility: All RIGOL Scopes.
 RP1002C	Current Probe	BW:DC~1MHz, Max.DC:±70A, AC P-P:140A,AC RMS:50A Compatibility: All RIGOL Scopes.
 RP1003C	Current Probe	BW:DC~50MHz, Max.AC RMS:30A AC Peak:50A(Noncontinuous) Compatibility: All RIGOL Scopes. Must order RP1000P Power supply.
 RP1004C	Current Probe	BW:DC~100MHz, Max. AC RMS:30A, AC Peak:50A(Noncontinuous) Compatibility: All RIGOL Scopes. Must order RP1000P Power supply.
 RP1005C	Current Probe	BW:DC~10MHz, Max.150 A rms, 300 A peak (Noncontinuous), 500 A peak (@pulse width <=30 ms) Compatibility: All RIGOL Scopes. Must order RP1000P Power supply.
 RP1000P	Power Supply	Power supply for RP1003C,RP1004C,RP1005C, support 4 channels.
 RP1025D	High Voltage Differential Probe	BW:25MHz; Max. Voltage ≤1400Vpp Compatibility: All RIGOL Scopes.
 RP1050D	High Voltage Differential Probe	BW:50MHz; Max. Voltage ≤7000Vpp Compatibility: All RIGOL Scopes.
 RP1100D	High Voltage Differential Probe	BW:100MHz; Max. Voltage ≤7000Vpp 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	<b>Analog channel:</b> 1 GSa/s (single-channel), 500 MSa/s (dual-channel), 250 MSa/s (three/four-channel) <b>Digital channel:</b> 1 GSa/s (8-channel), 500 MSa/s (16-channel)
Peak Detect	<b>Analog channel:</b> 4 ns <b>Digital channel:</b> 4 ns
Averaging	After both the channels finish N samples at the same time, N can be 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024.
High Resolution	12 bit (max)
Interpolation	Sin(x)/x (optional)
Minimum Detectable Pulse Width	<b>Digital channel:</b> 10 ns
Memory Depth	<b>Analog channel:</b> standard 12M pts (single-channel), 6M pts (dual-channel), 3M pts (3/4-channel); optional 24 Mpts (single-channel), 12 Mpts (dual-channel), 6 Mpts (3/4-channel) <b>Digital channel:</b> 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-channel + 16-digital-channel DS1XX4Z/1XX4Z-S: 4-analog-channel
Input Coupling	DC, AC or GND
Input Impedance	<b>Analog channel:</b> (1 MΩ±1%)    (15 pF±3 pF) <b>Digital channel:</b> (100 kΩ±1%)    8 pF±3 pF
Probe Attenuation Coefficient	<b>Analog channel:</b> 0.01X-1000X, 1-2-5 step
Max Input Voltage (1MΩ)	<b>Analog channel:</b> CAT I 300 Vrms, CAT II 100 Vrms, transient overvoltage 1000 Vpk With RP2200 10:1 probe: CAT II 300 Vrms <b>Digital channel:</b> CAT I 40 Vrms, transient overvoltage 800 Vpk

### Horizontal

Time Base Scale	5 ns/div to 50 s/div
Time Base Accuracy <sup>[1]</sup>	≤ ± 25 ppm
Time Base Drift	≤ ± 5 ppm/year
Max Delay Range	Negative delay: ≥1/2 screen width Positive delay: 1 s to 5,000 s
Time Base Mode	Y-T, X-Y, Roll
Number of X-Ys	1 path
Waveform Capture Rate <sup>[2]</sup>	30,000 wfms/s (dots display)
Zero Offset	±0.5div*minimum time base scale

### Vertical

Bandwidth (-3dB)	MSO1104Z/1104Z-S/DS1104Z/1104Z-S: DC to 100 MHz MSO1074Z/1074Z-S/DS1074Z/1074Z-S: DC to 70 MHz DS1054Z: DC to 50 MHz
Single Bandwidth	MSO1104Z/1104Z-S/DS1104Z/1104Z-S: DC to 100 MHz MSO1074Z/1074Z-S/DS1074Z/1074Z-S: DC to 70 MHz DS1054Z: DC to 50 MHz
Vertical Resolution	<b>Analog channel:</b> 8 bits <b>Digital channel:</b> 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 <sup>[1]</sup>	20 MHz
Low Frequency Response (AC coupling, -3dB)	≤5 Hz (on BNC)

Calculated Rise Time <sup>[1]</sup>	M501074Z/1074Z-S/DS1074Z/1074Z-S: 3.5 ns M501074Z/1074Z-S/DS1074Z/1074Z-S: 5 ns DS1054Z: 7 ns
DC Gain Accuracy	<10 mV: $\pm 4\%$ full scale $\geq 10$ mV: $\pm 3\%$ full scale
DC Offset Accuracy	$\pm 0.1$ div $\pm 2$ mV $\pm 1\%$ offset
Channel to Channel Isolation	DC to maximum bandwidth: >40 dB

### Vertical (Digital Channel)

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	$\pm 15.0$ V, in 10 mV step
Threshold Accuracy	$\pm (100$ mV + 3% of threshold setting)
Dynamic Range	$\pm 10$ V + threshold
Min Voltage Swing	500 mVpp
Vertical Resolution	1 bit

### Trigger

Trigger Level Range	$\pm 5$ div from the center of the screen
Trigger Mode	Auto, Normal, Single
Holdoff Range	16 ns to 10 s
High Frequency Rejection <sup>[1]</sup>	75 kHz
Low Frequency Rejection <sup>[1]</sup>	75 kHz
Trigger Sensitivity <sup>[1]</sup>	1.0div (below 5mV or noise rejection is enabled) 0.3div (above 5mV and noise rejection is disabled)
<b>Edge Trigger</b>	
Edge Type	Rising, Falling, Rising/Falling
<b>Pulse Trigger</b>	
Pulse Condition	Positive Pulse Width (greater than, lower than, within specified interval) Negative Pulse Width (greater than, lower than, within specified interval)
Pulse Width Range	8 ns to 10 s
<b>Runt Trigger</b>	
Pulse Condition	None, > (greater than), < (lower than), <> (within the specified interval)
Polarity	Positive, Negative
Pulse Width Range	8 ns to 4 s
<b>Windows Trigger</b>	
Windows Type	Rising, Falling, Rising/Falling
Trigger Position	Enter, Exit, Time
Windows Time	8 ns to 10 s
<b>Nth Edge Trigger</b>	
Edge Type	Rising, Falling
Idle Time	16 ns to 10 s
Number of Edges	1 to 65535
<b>Slope Trigger</b>	
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
<b>Video Trigger</b>	
Signal Standard	Support standard NTSC, PAL and SECAM broadcasting standards Support 480P, 576P HDTV standards
<b>Pattern Trigger</b>	
Pattern Setting	H, L, X, Rising Edge, Falling Edge
<b>Delay Trigger</b>	
Edge Type	Rising, Falling
Delay Type	> (greater than), < (lower than), <> (within the specified interval), >< (outside the specified interval)
Delay Time	8 ns to 10 s
<b>TimeOut Trigger</b>	
Edge Type	Rising, Falling, Rising&Falling
TimeOut Value	16 ns to 10 s
<b>Duration Trigger</b>	
Pattern Setting	H, L, X
Trigger Condition	> (greater than), < (lower than), <> (within the specified interval)
Duration Time	8 ns to 10 s

Setup/Hold Trigger	
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	
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, 1Mbps and User
Data Bits	5 bits, 6 bits, 7 bits, 8 bits
I2C Trigger	
Trigger Condition	Start, Restart, Stop, Missing Ack, Address, Data, A&D
Address Bits	7 bits, 8 bits, 10 bits
Address Range	0x0 to 0x7F, 0x0 to 0xFF, 0x0 to 0x3FF
Byte Length	1 to 5
SPI Trigger	
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 ( $\Delta V$ ) Time deviation between cursors ( $\Delta T$ ) Reciprocal of $\Delta T$ (Hz) ( $1/\Delta T$ )
	Track mode	Voltage and time values of the waveform point
	Auto mode	Allow to display cursors during auto measurement
Auto Measurement	Analog channel: Measurements of Period, Frequency, Rise Time, Fall Time, Positive Pulse Width, Negative Pulse Width, Positive Duty Cycle, Negative Duty Cycle, Time of Vmax, Time of Vmin, Positive SlewRate, Negative SlewRate, Delay 1→2f, Delay 1→2T, Phase 1→2f, Phase 1→BT, Maximum, Minimum, Peak-Peak Value, Top Value, Bottom Value, Amplitude, Upper, Middle, Lower, Average, RMS, Overshoot, Pre-shoot, Area, Period Area, Period RMS, Variance Digital channel: Period, Frequency, Positive Pulse Width, Negative Pulse Width, Positive Duty Cycle, Negative Duty Cycle, Delay 1→2f, Delay 1→2T, Phase 1→2f, Phase 1→2T	
Number of Measurements	Display 5 measurements at the same time	
Measurement Range	Screen Region or Cursor Region	
Measurement Statistic	Average, Max, Min, Standard Deviation, Number of Measurements	
Counter	Hardware 6 bits counter (channels are selectable)	

## Math

Waveform Operation	A+B, A-B, A×B, A/B, FFT, &&,   , ^, !, intg, diff, sqrt, lg, ln, exp, abs
FFT Window	Rectangle, Hanning, Blackman, Hamming, Flat Top, Triangle
FFT Display	Split, Full Screen
FFT Vertical Scale	dB/dBm, Vrms
Number of Buses for Decoding	2
Decoding Type	Parallel (standard), RS232/UART (option), I2C (option), SPI (option)

## Display

Display Type	7.0 inches TFT LCD display
Display Resolution	800 horizontal×RGB×480 vertical pixel
Display Color	16 million color (24bit true color)
Persistence Time	Min, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s, Infinite
Display Type	Dots, Vectors

## I/O

Standard Ports	USB HOST, USB DEVICE, LAN, Aux (TrigOut /PassFail)
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## Signal Source (MSO/DS1000Z-S)

Number of Channels	2	
Sample Rate	200 MSa/s	
Vertical Resolution	14 bits	
Highest Frequency	25 MHz	
Standard Waveform	Sine, Square, Pulse, Triangle, Noise, DC	
Arbitrary Waveform	Sine, 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%
	Signal-to-Noise ratio	40 dB
Square /Pulse	Frequency Range	0.1 Hz to 15 MHz
	Rise/Fall time	<15 ns
	Overshoot	<5%
	Duty Cycle	10% to 90%
	Duty Cycle Resolution	1% to 10 ns (select the greater one)
	Minimum Pulse Width	20 ns
	Pulse Width Resolution	10 ns or 5 bits (select the greater one)
Triangle	Jitter	500 ps
	Frequency Range	0.1 Hz to 100 kHz
	Linearity	1%
Noise <sup>[1]</sup>	Symmetry	0 to 100%
	Bandwidth	25 MHz
Internal Generated 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, select the greater one
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, High-resistance ±1.25 V, 50 Ω
	Resolution	100 μV or 3 bit, select the greater one
	Accuracy	2% (1 kHz)
Modulation	AM, FM	

## General Specifications

Probe Compensation Output	
Output Voltage <sup>[1]</sup>	About 3 V, peak-peak
Frequency <sup>[1]</sup>	1 kHz
Power	
Power Voltage	100-240 V, 45-440 Hz
Power	Maximum 50 W
Fuse	2 A, T degree, 250 V
Environment	
Temperature Range	In operation: 0°C to +50°C
	Out of operation: -40°C to +70°C
Cooling Method	Fan cooling
Humidity Range	0°C to +30°C : ≤95°C relative humidity
	+35°C to +40°C : ≤75°C relative humidity
	+40°C to +50°C : ≤45°C relative humidity
Altitude	In operation: under 3,000 meters
	Out of operation: under 15,000 meters
Mechanical	
Dimensions <sup>[3]</sup>	Width×Height×Depth =313.1 mm× 160.8 mm×122.4 mm

Weight <sup>[4]</sup>	Without package	3.2 kg ± 0.2 kg
	With package	3.8 kg ± 0.5 kg
Adjustment 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	

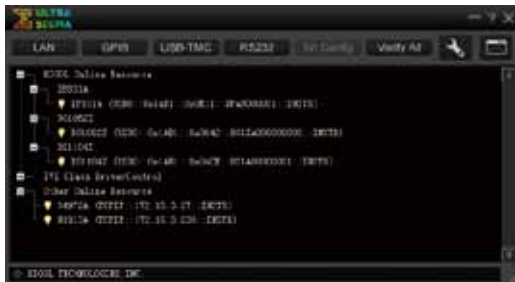
Note [1]:Typical.  
[2]:Maximum value with 50 ns, single-channel, dots display and auto memory depth.  
[3]:Tilt tabs and handle folded, knob height included.  
[4]:Standard configuration.

## ► Ordering Information

	Description	Order Number
Model	DS1104Z (100 MHz, 4-analog-channel)	DS1104Z
	DS1104Z-S (100 MHz, 4-analog-channel+2-channel, 25MHz signal source)	DS1104Z-S
	DS1074Z (70 MHz, 4-analog-channel)	DS1074Z
	DS1074Z-S (70 MHz, 4-analog-channel+2-channel, 25MHz signal source)	DS1074Z-S
	MSO1104Z (100 MHz, 4-analog-channel + 16-digital-channel)	MSO1104Z
	MSO1104Z-S (100 MHz, 4-analog-channel + 16-digital-channel+2-channel, 25MHz signal source)	MSO1104Z-S
	MSO1074Z (70 MHz, 4-analog-channel + 16-digital-channel)	MSO1074Z
	MSO1074Z-S (70 MHz, 4-analog-channel + 16-digital-channel+2-channel, 25MHz signal source)	MSO1074Z-S
	DS1054Z (50 MHz, 4-analog-channel)	DS1054Z
Standard Accessory	Power cord conforming to the standard of the country	-
	USB cable	CB-USBA-USBB-FF-150
	4 passive probes (150 MHz)	RP2200
	1 logic analyzer probe (MSO only)	RPL1116
	Quick Guide	-
	Resource CD (include User's Guide and application software)	-
Optional Accessories	Rack Mount Kit	RM-DS1000Z
Memory Depth Option	Analog channel: 24 Mpts (single-channel)/12 Mpts (dual-channel)/ 6 Mpts (four-channel) Digital channel: 24 Mpts (8-channel)/12 Mpts (16-channel)	MEM-DS1000Z
Waveform Record Option	The option supports waveform record and waveform playback	REC-DS1000Z
Advanced Trigger Option	The option includes these trigger functions: RS232/UART , I2C , SPI, Runt, Windows, Nth edge, Delay, Timeout, Setup/Hold	AT-DS1000Z
Serial Analysis Option	The option includes 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
- With virtual panel feature
- support multi interface

## Warranty

Three –year warranty, excluding probes and accessories.

**RIGOL**

### Headquarter

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