Chapter 18 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.

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 (3/4-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)
Min Detect Pulse Width	Digital channel: 10 ns
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: 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 channel: 0.01X to 1000X, in 1-2-5 step
Maximum Input Voltage (1MΩ)	Analog Channel: CAT I 300 Vrms, CAT II 100 Vrms, Transient Overvoltage 1000 Vpk Digital channel: CAT I 40Vrms, Transient Overvoltage 800 Vpk

Horizontal

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

Vertical

Bandwidth (-3 dB)	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 bit 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 value
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, 10 mV step
Threshold Accuracy	±(100 mV+3% threshold setting)
Dynamic Range	±10.0 V + threshold
Minimum Voltage Swing	500 mVpp
Vertical Resolution	1 bit

Trigger

Trigger Level Range	± 5 div from 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 specific interval) Negative Pulse Width (greater than, lower than, within specific interval)
Pulse Width	8 ns to 10 s
Runt Trigger (Optional)	
Pulse Width Condition	None, >, <, <>
Pulse Polarity	Positive, Negative
Pulse Width Range	8 ns to 10 s
Window Trigger (Optional)	
Window Type	Rising, Falling, Rising/Falling
Trigger Position	Enter, Exit, Time
Window 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 specific interval) Negative Slope (greater than, lower than, within specific 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 time	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 Type	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 bit, 6 bit, 7 bit, 8 bit
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, Positive Pulse Count, Negative Pulse Count, Rising Edge Count, Falling Edge Count, 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
Frequency Counter	Hardware 6 bit frequency 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 Function	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

Screen Type	7.0 inch (203 mm) 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)

Channels	2
Sample Rate	200 MSa/s
Vertical Resolution	14 bits
Max. Frequency	25 MHz

Standard Waveform	Sine, Square, Pulse, Ramp, Noise, DC	
Built-in Waveform	Sinc, Exponential Rise, Exponential 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 Waveform	Frequency Range	0.1 Hz to 1 MHz
Arbitrary Waveform	Frequency Range	0.1 Hz to 10 MHz
	Waveform Length	2 to 16k points
Frequency	Accuracy	100 ppm (lower than 10 kHz) 50 ppm (higher than 10 kHz)
	Resolution	0.1 Hz or 4 bits, the larger of the two
Amplitude	Output Range	20 mVpp to 5 Vpp, HighZ 10 mVpp to 2.5 Vpp, 50 Ω
	Resolution	100 μV or 3 bits, the larger of the two
	Accuracy	2% (1 kHz)
DC Offset	Range	±2.5 V, HighZ ±1.25 V, 50 Ω
	Resolution	100 μV or 3 bits, the larger of the two
	Accuracy	2% (1 kHz)

General Specifications

Probe Compensation Output		
Output Voltage[1]	About 3 V, peak-peak	
Frequency[1]	1 kHz	
Power		
Power Voltage	100 V-240 V, 45 Hz-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	
	+30 ℃ to +40 ℃: ≤75% Relative Humidity	
	+40 ℃ to +50 ℃: ≤45% Relative Humidity	
Altitude	Operating: under 3,000 meters	
	Non-operating: under 15,000 meters	
Physical Characteristics		
Size[3]	Width×Height×Depth=313.1 mm×160.8 mm×122.4 mm	
Weight[4]	Package Excluded	3.2 kg±0.2 kg
	Package Included	3.8 kg±0.5 kg
Calibration Interval		
The recommended calibration interval is one year.		
Regulatory Information		
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. 50ns, single-channel mode, dots display, auto memory depth.
Note[3]: Supporting legs and handle folded, knob height included.
Note[4]: Standard configuration.