

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: 2 GSa/s (single-channel), 1 Gsa/s (dual-channel) Digital channel: 1 GSa/s (max)
Peak Detect	Analog channel: 500 ps (single-channel), 1 ns (dual-channel) Digital channel: 2 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, 2048, 4096 or 8192.
High Resolution	12 bits of resolution when $\geq 5 \mu\text{s}/\text{div}$ @ 1 GSa/s (or $\geq 10 \mu\text{s}/\text{div}$ @ 500 MSa/s).
Min Detect Pulse Width	Digital channel: 5 ns
Memory Depth	Analog channel: single-channel: Auto, 14k pts, 140k pts, 1.4M pts, 14M pts and 56M pts (option) are available dual-channel: Auto, 7k pts, 70k pts, 700k pts, 7M pts and 28M pts (option) are available Digital channel: 14M pts maximum

Input

Number of Channels	MSO2XX2A/2XX2A-S: 2 analog channels+16 digital channels DS2XX2A/2XX2A-S: 2 analog channels
Input Coupling	DC, AC or GND
Input Impedance	Analog channel: $(1 \text{ M}\Omega \pm 1\%) (16 \text{ pF} \pm 3 \text{ pF})$ or $50 \Omega \pm 1.5\%$ Digital channel: $(101 \text{ k}\Omega \pm 1\%) (9 \text{ pF} \pm 1 \text{ pF})$
Probe Attenuation Coefficient	Analog channel: 0.01X to 1000X, in 1-2-5 step

Maximum Input Voltage (1M Ω)	Maximum Input Voltage of the Analog Channel CAT I 300 Vrms, CAT II 100 Vrms, Transient Overvoltage 1000 Vpk with RP2200 10:1 probe: CAT II 300 Vrms with RP3300 10:1 probe: CAT II 300 Vrms with RP3500 10:1 probe: CAT II 300 Vrms with RP5600 10:1 probe: CAT II 300 Vrms Digital channel: CAT I 40Vrms, Transient Overvoltage 800 Vpk
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Horizontal

Timebase Scale	MSO/DS2302A/2302A-S: 1 ns/div to 1.000 ks/div MSO/DS2202A/2202A-S: 2.000 ns/div to 1.000 ks/div MSO/DS2102A/2102A-S/2072A/2072A-S: 5.000 ns/div to 1.000 ks/div
Deviation between Channels	1 ns (typical), 2 ns (max)
Max Record Length	14 Mpts
Timebase Accuracy ^[1]	$\leq \pm 25$ ppm
Clock Drift	$\leq \pm 5$ ppm/year
Max Delay Range	Negative delay: ≥ 1 screen width Positive delay: 1 s to 100,000 s
Timebase Mode	Y-T, X-Y, Roll
Number of XYs	1
Waveform Capture Rate ²	50,000 wfms/s (dots display)

Vertical

Bandwidth (-3dB)	MSO/DS2302A/2302A-S: DC to 300 MHz MSO/DS2202A/2202A-S: DC to 200 MHz MSO/DS2102A/2102A-S: DC to 100 MHz
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	MSO/DS2072A/2072A-S: DC to 70 MHz
Single-shot Bandwidth	MSO/DS2302A/2302A-S: DC to 300 MHz MSO/DS2202A/2202A-S: DC to 200 MHz MSO/DS2102A/2102A-S: DC to 100 MHz MSO/DS2072A/2072A-S: DC to 70 MHz
Vertical Resolution	Analog channel: 8 bit Digital channel: 1 bit
Vertical Scale	When the input impedance is 50Ω: 500 μV/div to 1 V/div When the input impedance is 1MΩ: 500 μV/div to 10 V/div
Offset Range	When the input impedance is 50Ω: 500 μV /div to 50 mV/div: ± 2 V 51 mV/div to 200 mV/div: ± 10 V 205 mV/div to 1 V/div: ± 12 V When the input impedance is 1MΩ: 500 μV /div to 50 mV/div: ± 2 V 51 mV/div to 200 mV/div: ± 10 V 205 mV/div to 2 V/div: ± 50 V 2.05 V/div to 10 V/div: ± 100 V
Bandwidth Limit ^[1]	MSO/DS2302A/2302A-S/2202A/2202A-S: 20 MHz/100 MHz MSO/DS2102A/2102A-S/2072A/2072A-S: 20 MHz
Low Frequency Response (AC Coupling, -3dB)	≤5 Hz (on BNC)
Calculated Rise Time ^[1]	MSO/DS2302A/2302A-S: 1.2ns MSO/DS2202A/2202A-S: 1.8 ns MSO/DS2102A/2102A-S: 3.5 ns MSO/DS2072A/2072A-S: 5 ns
DC Gain Accuracy	±2% 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)

Threshold	Adjustable threshold of 8 channels per group
Threshold Selection	TTL (700 mV)
	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 (+900 mV)
	ECL (-650 mV)
	PECL (+1.85 V)
	LVDS (+600 mV)
	0 V
	User
Threshold Range	± 20.0 V, 10 mV step
Threshold Accuracy	$\pm (100 \text{ mV} + 3\% \text{ threshold setting})$
Dynamic Range	$\pm 10 \text{ V} + \text{Threshold}$
Minimum Voltage Swing	500 mVpp
Input Resistance	//101 K Ω
Probe Load	≈ 8 pF
Vertical Resolution	1 bit

Trigger

Trigger Level Range	Internal	± 5 div from center of the screen
	EXT	± 4 V
Trigger Mode	Auto, Normal, Single	
Holdoff Range	100 ns to 10 s	
High Frequency Rejection ^[1]	75 kHz	
Low Frequency Rejection ^[1]	75 kHz	

Trigger	1 div (below 10 mV or noise rejection is enabled)
Sensitivity	0.3 div (above 10 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 Range	2 ns to 4 s
Runt Trigger	
Pulse Width Condition	None, >, <, <>
Pulse Polarity	Positive, Negative
Pulse Width Range	2 ns to 4 s
Windows Trigger (Option)	
Windows Type	Rising, Falling, Rising/Falling
Trigger Position	Enter, Exit, Time
Windows Time	16 ns to 4 s
Nth Edge Trigger (Option)	
Edge Type	Rising, Falling
Idle Time	16 ns to 4 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	10 ns to 1 s
Video Trigger (HDTV Option)	
Signal Standard	NTSC, PAL/SECAM, 480P, 576P (Standard) 720P, 1080P and 1080I (Option)
Pattern Trigger	
Pattern	H, L, X, Rising, Falling

Setting	
Delay Trigger (Option)	
Edge Type	Rising, Falling
Delay Type	>, <, <>, ><
Delay Time	2 ns to 4 s
TimeOut Trigger (Option)	
Edge Type	Rising, Falling, Rising/Falling
Timeout time	16 ns to 4 s
Duration Trigger (Option)	
Pattern	H, L, X
Trigger Condition	>, <, <>
Duration Time	2 ns to 4 s
Setup/Hold Trigger	
Edge Type	Rising, Falling
Data Type	H, L
Setup Time	2 ns to 1 s
Hold Time	2 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, User
Data Bits	5 bit, 6 bit, 7 bit, 8 bit
I2C Trigger	
Trigger Condition	Start, Restart, Stop, Missing ACK, Address, Data, A&D
Address Bits	7 bit, 8 bit, 10 bit
Address Range	0 to 127, 0 to 255, 0 to 1023
Byte Length	1 to 5
SPI Trigger	
Trigger Condition	Timeout
Timeout Value	100 ns to 1 s

Data Bits	4 bit to 32 bit
Data Line Setting	H, L, X
CAN Trigger (Option)	
Signal Type	Rx, Tx, CAN_H, CAN_L, Differential
Trigger Condition	SOF, EOF, FrameType, FrameError
Signal Rate	10 kbps, 20 kbps, 33.3 kbps, 50 kbps, 62.5 kbps, 83.3 kbps, 100 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1 Mbps, User
Sample Points	5% to 95%
Frame Type	Data, Remote, Error, OverLoad
Error Type	Bit Fill, AnswerError, CheckError, FormatError, RandomError
USB Trigger (Option)	
Signal Speed	Low Speed, Full Speed
Trigger condition	SOP, EOP, RC, Suspend, Exit Suspend

Measure

Cursor	Manual Mode	Voltage Deviation between Cursors (ΔV) Time Deviation between Cursors (ΔT) Reciprocal of ΔT (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: Maximum, Minimum, Peak-Peak Value, Top Value, Bottom Value, Amplitude, Average, Mean Square Root on Whole Signal, Mean Square Root on Single Period, Overshoot, Pre-shoot, Area, Period Area, Frequency, Period, Rise Time, Fall Time, Positive Pulse Width, Negative Pulse Width, Positive Duty Cycle, Negative Duty Cycle, Delay $1f \rightarrow 2f$, Delay $1t \rightarrow 2t$, Delay $1f \rightarrow 2t$, Delay $1t \rightarrow 2f$, Phase $1f \rightarrow 2f$, Phase $1t \rightarrow 2t$, Phase $1f \rightarrow 2t$, Phase $1t \rightarrow 2f$ Digital channel:	

	Frequency, Period, Positive Pulse Width, Negative Pulse Width, Positive Duty Cycle, Negative Duty Cycle, Delay $1f \rightarrow 2f$, Delay $1\tau \rightarrow 2\tau$, Delay $1f \rightarrow 2\tau$, Delay $1\tau \rightarrow 2f$, Phase $1f \rightarrow 2f$, Phase $1\tau \rightarrow 2\tau$, Phase $1f \rightarrow 2\tau$, Phase $1\tau \rightarrow 2f$
Number of Measurements	Display 5 measurements at the same time.
Measurement Range	Screen or cursor
Measurement Statistic	Current Value, Average, Max, Min, Standard Deviation, Number of Measurements
Frequency Counter	Hardware 6 bits frequency counter (channels are selectable)

Math Operation

Waveform Operation	$A+B$, $A-B$, $A \times B$, $A \div B$, FFT, Editable Advanced Operation, Logic Operation
FFT Window Function	Rectangle, Hanning, Blackman, Hamming
FFT Display	Split, Full Screen
FFT Vertical Scale	Vrms, dB
Logic Operation	AND, OR, NOT, XOR
Math Function	Intg, Diff, Log, Exp, Sqrt, Sine, Cosine, Tangent
Number of Buses for Decoding	2
Decoding Type	Parallel (standard), RS232/UART (option), I2C (option), SPI (option), CAN (option)

Display

Screen Type	8.0 inches (203 mm) TFT LCD display
Display Resolution	800 Horizontal \times RGB \times 480 Vertical Pixel

Display Color	160,000 Color (TFT)
Persistence Time	Min, 50ms, 100ms, 200ms, 500ms, 1 s, 2 s, 5 s, 10 s, 20 s, Infinite
Display Type	Dots, Vectors
Real-time Clock	Time and Date (user adjustable)

Signal Source (MSO2000A-S/DS2000A-S)

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	100 mHz 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: 100 mHz to 15 MHz Pulse: 100 mHz to 1 MHz
	Rise/Fall Time	<15 ns
	Overshoot	<5%
	Duty Cycle	Square: 50% Pulse: 10% to 90% (user adjustable)
	Duty Cycle Resolution	1% or 10 ns (the larger of the two)

	Min. Pulse Width	20ns
	Pulse Width Resolution	10 ns or 5 bits (the larger of the two)
	Jitter	500 ps
	Ramp	Frequency Range
	Linearity	1%
	Symmetry	0 to 100%
	Noise	Bandwidth
Built-in Waveform	Frequency Range	100 mHz to 1 MHz
Arbitrary Waveform	Frequency Range	100 mHz to 10 MHz
	Waveform Length	2 to 16 k points
	Internal Storage Location	10
Frequency	Accuracy	100 ppm (lower than 10 kHz) 50 ppm (higher than 10 kHz)
	Resolution	100 mHz 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 μ V or 3 bits, the larger of the two
	Accuracy	2% (1 kHz)
DC Offset	Range	\pm 2.5 V, HighZ \pm 1.25 V, 50 Ω
	Resolution	100 μ V or 3 bits, the larger of the two
	Accuracy	Offset setting Value \pm 2%

I/O

Standard Ports	USB HOST (support USB-GPIB), USB DEVICE, LAN, Aux Output (TrigOut/PassFail)
Printer Compatibility	PictBridge

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 °C to +50 °C
	Non-operating: -40 °C to +70 °C
Cooling Method	Fan cooling
Humidity Range	0°C to +30°C: ≤95% Relative Humidity
	+30°C to +40°C: ≤75% Relative Humidity
	+40°C to +50°C: ≤45% Relative Humidity
Altitude	Operating: under 3,000 meters
	Non-operating: under 15,000 meters

Physical Characteristics

Size ^[3]	Width×Height×Depth = 361.6 mm× 179.6 mm×130.8 mm	
Weight ^[4]	Package Excluded	3.9 kg ± 0.5 kg
	Package Included	4.5 kg ± 0.5 kg

Calibration Interval

The recommended calibration interval is one year.

Regulatory Information

Electromagnetic Compatibility	2004/108/EC
Safety	Execution standard EN 61326-1:2006 EN 61326-2-1:2006 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. 20ns, single-channel mode, dots display, auto memory depth.

Note^[3]: Supporting legs and handle folded, knob height included.

Note^[4]: Standard configuration.