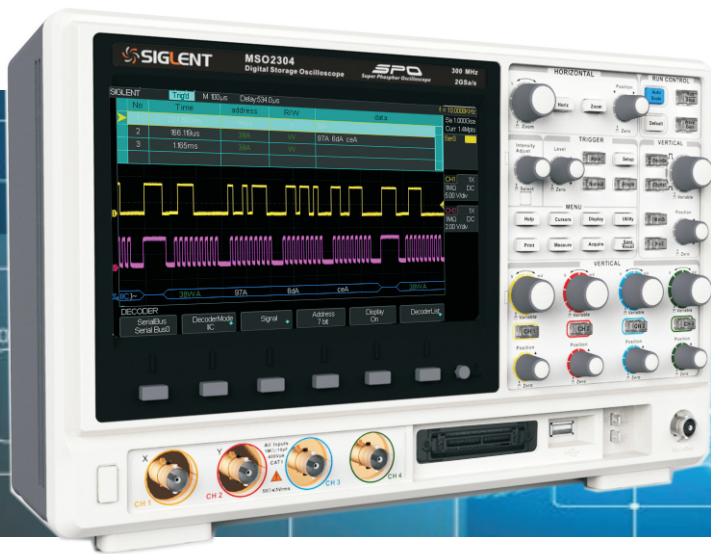


# DataSheet

## MSO/SDS2000 Series Digital Oscilloscope

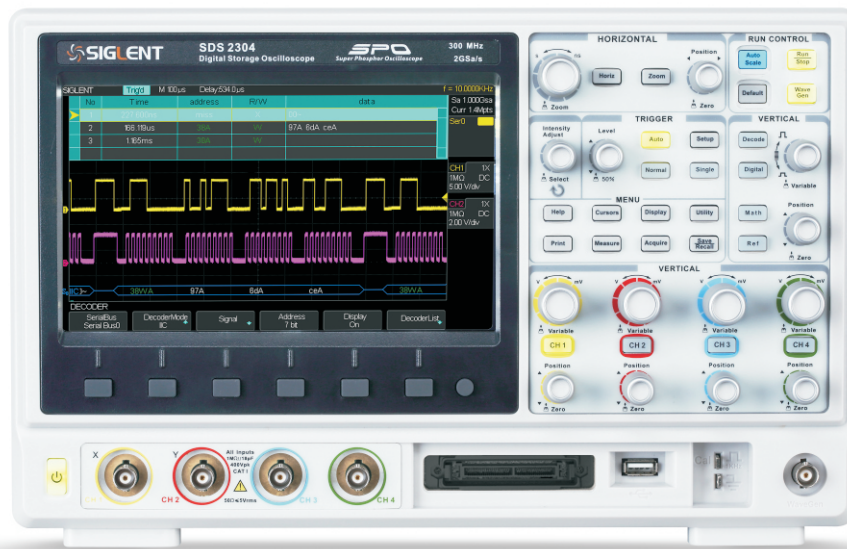


- 🌀 Innovative SPO technology
- 🌀 Long Memory Depth up to 28Mpts
- 🌀 Waveform capture rate up to 110,000 wfs/s
- 🌀 Zoom function based on the hardware technology
- 🌀 Advanced math operations (FFT, Differential, Integral, Square root)
- 🌀 Built-in 25MHz function/arbitrary waveform generator
- 🌀 Support 256 intensity grading and color temperature waveform display
- 🌀 A variety of serial trigger and decode functions (I<sup>2</sup>C, SPI, UART/RS232, CAN, LIN)
- 🌀 A variety of smart trigger functions (Pattern, Window, Interval, Dropout, Runt)

## MSO/SDS2000 Series Digital Oscilloscope

### Overview

MSO/SDS2000 Series is an advanced technology and high performance digital oscilloscope to meet customer's applications with its innovative SPO technology, powerful digital trigger function, serial decode function and logic analyzer.



### Innovative SPO Technology

- Higher waveform capture rate(Up to 110,000 wfs/s)
- Memory depth up to 28Mpts
- Support 256 intensity grading and color temperature waveform display
- Hardware-based digital trigger system, lower trigger jitter and higher stability

### Main Features

- Innovative SPO technology
- Bandwidth 70MHz,100MHz,200MHz,300MHz
- Sample rate up to 2GSa/s
- Smart Trigger functions: Window,Runt,Interval,DropOut,Pattern
- Serial decode/trigger functions(I<sup>2</sup>C,SPI,UART/RS232,CAN,LIN)
- Support HDTV video trigger function

- Hardware-based zoom function and high speed PASS/FAIL function technology
- 32 kinds of automatic waveform measurements , support measurements statistics function
- Built-in 25MHz function/arbitrary waveform generator
- Advanced waveform math operations (FFT,Differential,Integral,Square root)
- Complete connectivity:USB Host,USB Device(USBTMC,PictBridge),LAN(VXI-11), EXT TRIG,PASS/FAIL,TRIG OUT
- Support SCPI remote control commands
- Multi-language user interface and built-in online help system.
- 8-inch TFT LCD(800x480)

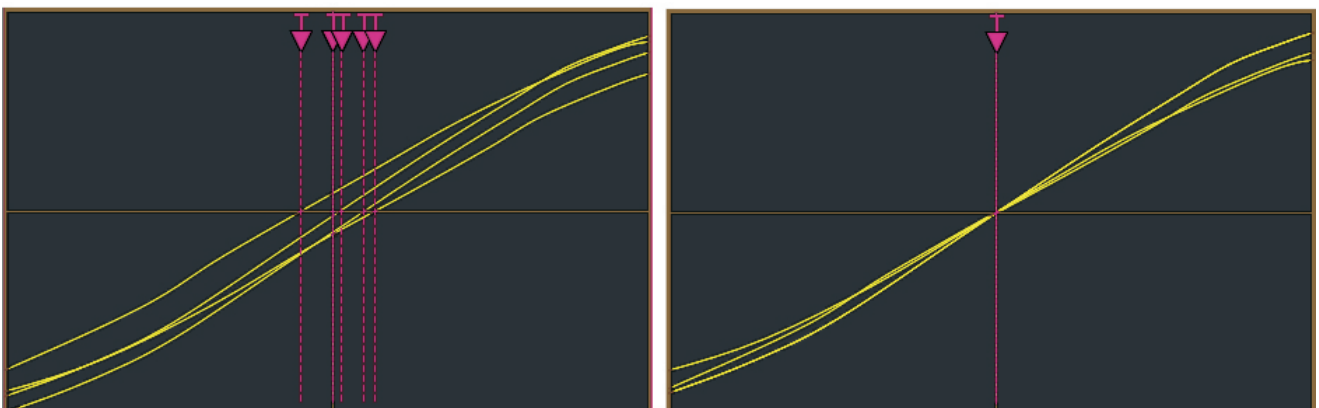
## Digital Trigger function

Based on hardware technology, MSO/SDS2000 series realizes digital trigger system with its high triggering sensitivity, low trigger jitter, and supports smart trigger function, HDTV video trigger and serial trigger function.

### Superiority

- Precise trigger
- Low trigger jitter
- High trigger sensitivity
- 1ns trigger timing
- Configurable Noise Reject
- High stability, not affected by temperature changes

### Jitter comparison between Analog and Digital trigger



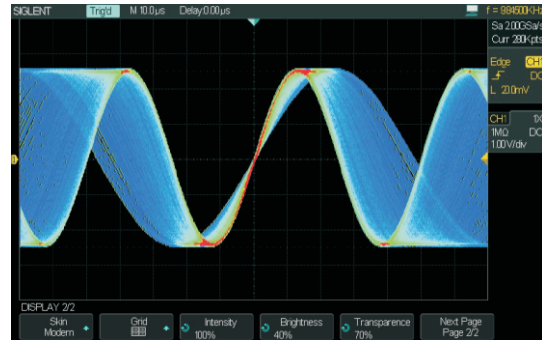
# Function & Characteristic

## Waveform capture rate up to 110,000 wf/s



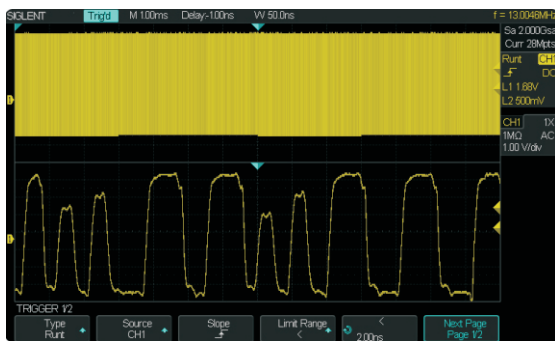
The higher capture rate can improve the ability of capturing abnormal event or low probability event.

## Support 256 intensity grading and color temperature waveform display



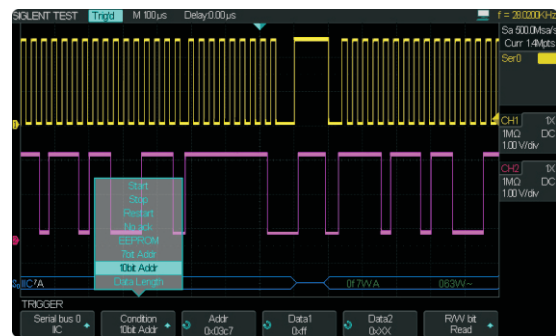
Color temperature display using a color change to reflect the probability of the waveform appears

## Memory Depth up to 28Mpts



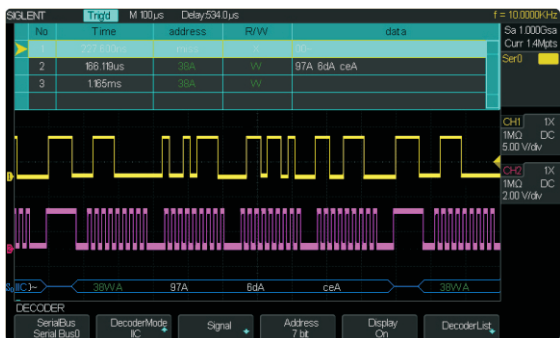
The 2GSa/s, 28Mpts Configuration provides the ability to capture a fast transient or a long acquisition.

## Serial Trigger functions



The serial trigger will quickly isolate events on a bus eliminating the need to set manual triggers and hoping to catch the right info.

## Serial Decode functions (Optional)



Serial protocol decoding show directly on the waveform with an intuitive, color-coded overlay and presented in binary, hex or ASCII.

## Various Connectivity (USB Host&Device, LAN, EXT TRIG, TRIG OUT, PASS/FAIL)





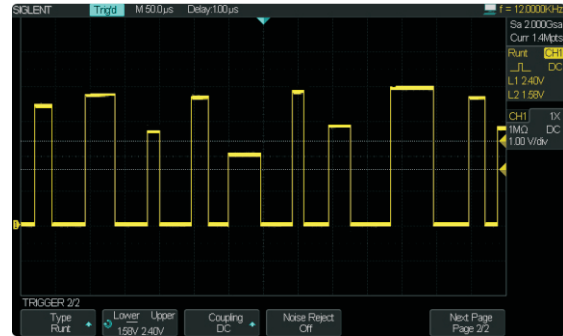
## Smart Trigger Functions

MSO/SDS2000 series support a variety of smart trigger functions, such as Window, Interval, Runt, DropOut, Pattern.

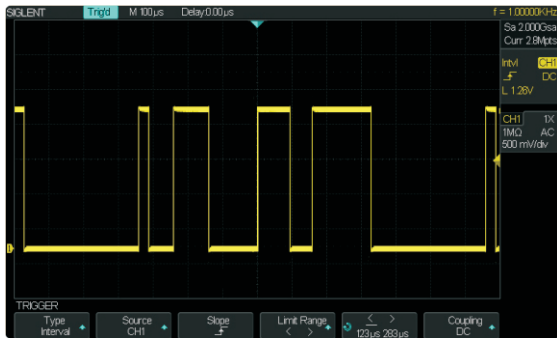
### Pattern trigger



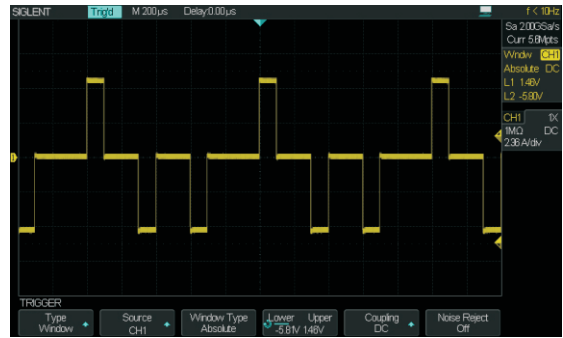
### Runt trigger



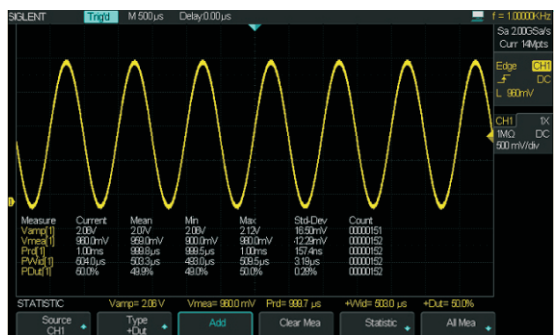
### Interval trigger



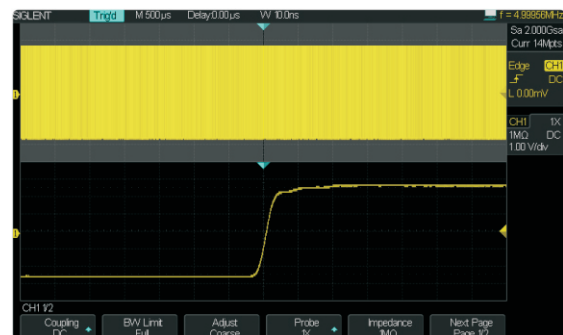
### Window trigger



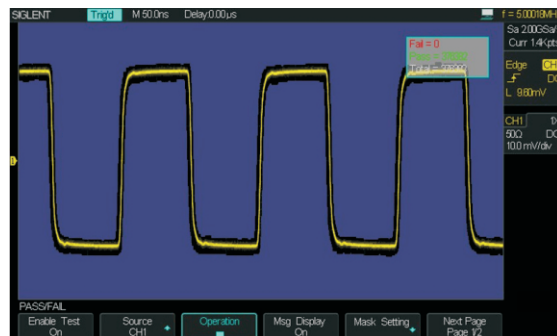
### Automatic measurements with statistics



### ZOOM function based on hardware technology



### High speed Pass/Fail Test Function



### Built-in Waveform Generator (Optional)



## Specifications

Input	
Channels	2/4
Coupling	AC, DC, GND
Impedance	(1MΩ±2%)   (23pF ±4pF)
	50Ω: 50Ω±2%
Max.Input voltage	400Vrms, CAT I, 10X, 1MΩ
CH to CH Isolation	>100:1
Probe attenuator	1X, 10X, 50X, 100X, 500X,1000X
Vertical System	
Bandwidth	300MHz (MSO/SDS2304、MSO/SDS2302)
	200MHz (MSO/SDS2204、MSO/SDS2202)
	100MHz (MSO/SDS2104、MSO/SDS2102)
	70MHz (MSO/SDS2074、MSO/SDS2072)
Vertical Resolution	8 bit
Vertical Scale	2 mV/div ~ 10 V/div
Offset Range	2mV ~ 100mV: ± 1V
	1.02mV ~ 1V: ± 10V
	1.02V ~ 10V: ± 100V
Hardware Bandwidth Limits	20MHz ±40%
Bandwidth Flatness	DC ~ 10% of BW: ± 1dB
	10% ~ 50% of BW: ± 2dB
	50% ~ 100% of BW: + 2dB/-3dB
Low Frequency Response (AC - 3dB)	≤10Hz
Noise	≤0.6 Div for average of 10 Pk-Pk readings, Fixed gain settings
	≤1.0 Div for average of 10 Pk-Pk readings (152mV/div~198mV/div,1.52V/div ~ 1.98V/div)
	≤0.7 Div for average of 10 Pk-Pk readings, variable gain settings
SFDR including harmonics	≥35dB (≥10mV/div) ;    ≥30dB (<10mV/div)

DC Gain Accuracy	$\leq \pm 3.0\%$ : 5mV/div ~10V/div
	$\leq \pm 4.0\%$ : 2mV/div
DC Measurement Accuracy	$\pm [3\% \times ( \text{Reading}  +  \text{Offset} ) + 1\% \times  \text{Offset}  + 0.2\text{div} + 2\text{mV}]$ , $\leq 100\text{mV/div}$
	$\pm [3\% \times ( \text{Reading}  +  \text{Offset} ) + 1\% \times  \text{Offset}  + 0.2\text{div} + 100\text{mV}]$ , $> 100\text{mV/div}$
Offset Accuracy	$\pm ( 1\% \times \text{Offset} + 1\% \times 8 \times \text{div} + 2\text{mV} )$
Rise time	<1.2ns (MSO/SDS2304、MSO/SDS2302)
	<1.7ns (MSO/SDS2204、MSO/SDS2202)
	<3.5ns (MSO/SDS2104、MSO/SDS2102)
	<5.0ns (MSO/SDS2074、MSO/SDS2072)
Overshoot	<10%
Channel Skew	<200ps
<b>Math Function</b>	
Operation	+, -, *, /, FFT, d/dt, ∫dt, √
FFT	Window: Rectangular, Blackman, Hanning, Hamming
	Sample points: 1024
<b>Horizontal System</b>	
Time base Scale	1.0ns/div ~ 50s/div
Waveform Capture	110,000 wfm/s
intensity grading	256 Levels
Display Format	Y-T, Zoom, Roll, X-Y
Time base Accuracy	$\pm 25\text{ppm}$
Roll mode	100ms/div ~ 50s/div (1-2-5 step)
<b>Trigger System</b>	
Trigger Mode	Auto, Normal, Single
Trigger Level	Internal: $\pm 4.5$ div from the center of the screen
Range	EXT: $\pm 1.2\text{V}$ ; EXT/5: $\pm 6\text{v}$
Holdoff Range	100ns ~ 1.5s
Trigger Coupling	AC, DC, LF Rej, HF Rej
	DC: Passes all components of the signal
	AC: Blocks DC components and attenuates signals below 5.8Hz

Trigger Coupling	LF Rej: Blocks the DC component and attenuates the low-frequency components below 2.08MHz
	HF Rej: Attenuates the high-frequency components above 1.27MHz
Trigger Accuracy	±0.2div
Trigger Sensitivity	Internal: 0.5 div
	EXT: 200mVpp DC ~ 10MHz 300mVpp 10MHz ~ BW
	EXT/5: 1Vpp DC ~ 10MHz 1.5Vpp 10MHz ~ BW
Trigger Jitter	<200ps
Trigger Displacement	Pre-Trigger: 7 divisions
	Delay Trigger: 10s ~ 1,000,000,000s
<b>Edge Trigger</b>	
Slope	Rising, Falling, Rising&Falling
Source	CH1/CH2/CH3/CH4/EXT/(EXT/5)/AC Line
<b>Slope Trigger</b>	
Slope	Rising, Falling
Limit Range	< , > , < > , > <
Source	CH1/CH2/CH3/CH4
Time Range	2ns ~ 4.2s
Resolution	1ns
<b>Pulse Trigger</b>	
Polarity	+wid , -wid
Limit Range	< , > , < > , > <
Source	CH1/CH2/CH3/CH4
Pulse Range	2ns ~ 4.2s
Resolution	1ns
<b>Video Trigger</b>	
Signal Standard	NTSC,PAL/Secam,720p/50,720p/60,1080p/50,1080p/60, 1080i/50, 1080i/60,Custom
Source	CH1/CH2/CH3/CH4
Sync	ANY,Select



<b>Window Trigger</b>	
Window Type	Absolute,Relative
Source	CH1/CH2/CH3/CH4
<b>Interval Trigger</b>	
Slope	Rising,Falling
Limit Range	<, >, < >, > <
Source	CH1/CH2/CH3/CH4
Time Range	2ns ~ 4.2s
<b>Dropout Trigger</b>	
Timeout Type	Edge, State
Source	CH1/CH2/CH3/CH4
Slope	Rising,Falling
Time Range	2ns ~ 4.2s
Resolution	1ns
<b>Runt Trigger</b>	
Slope	+wid , -wid
Limit Range	< , > , < > , > <
Source	CH1/CH2/CH3/CH4
Time Range	2ns ~ 4.2s
Resolution	1ns
<b>Pattern Trigger</b>	
Pattern Setting	Invalid, Low, High
Logic	AND, OR, NAND, NOR
Source	CH1/CH2/CH3/CH4
Limit Range	< , > , < > , > <
Time Range	2ns ~ 4.2s
Resolution	1ns
<b>Serial Trigger I<sup>2</sup>C Trigger</b>	
Condition	Start, Stop, Restart, No Ack, EEPROM, 7bits Address& Data, 10bits Address&Data, Data Length
<b>SPI Trigger</b>	

Trigger Source	MOSI, MISO
Data Length	4 ~ 96bits
Value	0, 1, X
Bit Order	LSB, MSB
<b>UART/ RS232 Trigger</b>	
Trigger Setting	Trigger Source RX, TX
	Condition Start, Stop, Data, Check Error
Bus Configure	Baud 600/1200/2400/4800/9600/19200/38400/ 57600/115200/Custom
	Data Length 5bits, 6bits, 7bits, 8bits
	Parity Check No, odd, even
	Stop Bit 1, 1.5, 2
	Idle Level Low, High
<b>CAN Trigger</b>	
Trigger Setting	Condition Start, Remote Frame, Data Frame, ID&DATA
Bus Configure	Baud 5kb/s, 10kb/s, 20kb/s, 50kb/s, 100kb/s, 125kb/s, 250kb/s, 500kb/s, 800kb/s, 1Mb/s, Custom
<b>LIN Trigger</b>	
Trigger Setting	Condition Start, ID, ID&DATA, Error
Bus Configure	Baud 600/1200/2400/4800/9600/19200/Custom
<b>Serial Decode</b>	
<b>I<sup>2</sup>C</b>	
Signal	SCL, SDA
Address	7bits, 10bits
List	1 ~ 7 lines
<b>SPI</b>	
Signal	CLK, MISO, MOSI, CS
Edge Select	Rising, Falling
Idle Level	Low, High
Bit Order	MSB, LSB
Data Length	4 ~ 96 bits
List	1 ~ 7 lines

<b>UART/RS232</b>	
Signal	RX, TX
Configure	Baud 600/1200/2400/4800/9600/19200/38400/ 57600/115200/Custom
	Parity Check No, odd, even
	Stop Bit 1, 1.5, 2
	Idle Level Low, High
	Data Length 5bits, 6bits, 7bits, 8bits
List	1 ~ 7 lines
<b>CAN</b>	
Signal	CAN_H, CAN_L
Configure	Baud 5kb/s, 10kb/s, 20kb/s, 50kb/s, 100kb/s, 125kb/s, 250kb/s, 500kb/s, 800kb/s, 1Mb/s, Custom
Decode Source	CAN_H, CAN_L, CAN_H – CAN_L
List	1 ~ 7 lines
<b>LIN</b>	
Configure	Baud 600/1200/2400/4800/9600/19200/Custom
List	1 ~ 7 lines
<b>Measure System</b>	
Auto Measurement (32 Types)	Vpp, Vmax, Vmin, Vamp, Vtop, Vbase, Vavg, Mean, Crms Vrms, ROV, FOV, RPRE, FPRE, Rise time, Fall time, Freq Period, + Wid, - Wid, + Dut, - Dut, BWid, Phase, FRR FRF, FFR, FFF, LRR, LRF, LFR, LFF
Cursor	Time (X1, X2), (X1X2)
	Voltage (Y1, Y2), (Y1Y2)
Statistics	Current, Mean, Min, Max, Std-Dev, Count
<b>Sample System</b>	
Sample Mode	Real Time sample
Sample Rate	2GSa/s
Memory Depth	Max.28Mpts, available
Acquisition	Sample, Peak Detect, Average, High Res
Averages	4, 16, 32, 64, 128, 256, 512, 1024
<b>Waveform Generator</b>	

Channels	1
Max. Frequency	25MHz
Sample Rate	125 MSa/s
Arb waveform length	16 kpts
Frequency Resolution	1 $\mu$ Hz
Vertical Resolution	14 bits
Amplitude Range	2 mVpp ~ 3 Vpp (50 $\Omega$ )
	4 mVpp ~ 6 Vpp (High-z)

### Sine Wave

Frequency	1 $\mu$ Hz ~ 25MHz
Offset Accuracy (100 kHz)	$\pm$ ( 0.3dB of Setting Value + 1mVpp)
Amplitude flatness (100 kHz, 5Vpp)	$\pm$ 0.3 dB
SFDR	DC ~ 1 MHz -60dBc
	1 MHz ~ 5 MHz -53dBc
	5 MHz ~ 25 MHz -35dBc

### Square/Pulse Wave

Frequency	1 $\mu$ Hz ~ 10MHz
Duty Cycle	20% ~ 80%
Rise/Fall time	< 24 ns (10% ~ 90%)
Overshoot	< 5%(1kHz, 1Vpp, Typeical )
Pulse Width	48ns~1ms
Jitter	8ns

### Ramp Wave

Frequency	1 $\mu$ Hz ~ 300kHz
Linearity	< 0.1% of Pk-Pk value
Symmetry	0% ~ 100%

### DC Offset

Range	$\pm$ 1.5 V ( 50 $\Omega$ )
	$\pm$ 3.0 V (High)
Offset Accuracy	$\pm$ (  setting value *1%+3 mV )



<b>Noise</b>	
Bandwidth	>20MHz (-3dB)
<b>Cardiac</b>	
Frequency	1μHz ~ 5MHz
<b>Gaus Pulse</b>	
Frequency	1μHz ~ 5MHz
<b>Exp Rise</b>	
Frequency	1μHz ~ 5MHz
<b>Exp Fall</b>	
Frequency	1μHz ~ 5MHz
<b>I/O</b>	
Standard Ports	USB Host, USB Device, LAN, Pass/Fail, Trigger Out
Pass/Fail	3.3V TTL Output

## General Specifications

Display	
Display Type	8.0 inch color TFT-LCD
Resolution	800 (Horizontal) × 480 (Vertical) pixel
Color	24 bit
Contrast	500:1
Backlight	300nit
Range	8 x 14 div
Display Mode	Dot, Vector
Persist	Off, 1 sec, 5 sec, 10 sec, 30 sec, Infinite
Color Display	Normal, Color
Screen Saver	1min, 5min, 10min, 30min, 1h, Offset
Language	Chinese, English
Environments	
Temperature	Operating: 10°C ~ +40°C
	Non-operating: -20°C ~ +60°C
Humidity	Operating: 85%RH, 40°C, 24 Hours
	Non-Operating: 85%RH, 65°C, 24 Hours
Height	Operating: ≤3000m
	Non-Operating: ≤15,266m
Power Supply	
Input Voltage	100 ~ 240 VAC, CAT II, Auto selection
Frequency	45Hz ~ 400Hz
Power	50VA Max
Mechanical	
Dimensions	Length 352mm
	Width 112mm
	Height 224mm
Weight	Net 2CH : 3.4kg, 4CH : 3.5kg
	Shipping 2CH : 4.9kg, 4CH : 5.1kg

## Ordering information

Description		
<b>Model</b>	MSO/SDS2072(70MHz, 2 Channels)	
	MSO/SDS2102(100MHz, 2 Channels)	
	MSO/SDS2202(200MHz, 2 Channels)	
	MSO/SDS2302(300MHz, 2 Channels)	
	MSO/SDS2074(70MHz, 4 Channels)	
	MSO/SDS2104(100MHz, 4 Channels)	
	MSO/SDS2204(200MHz, 4 Channels)	
	MSO/SDS2304(300MHz, 4 Channels)	
<b>Standard Accessories</b>	A Quick Start	
	1:1/10:1 probe (2/4 PCS based on channels)	
	A Certification	
	An CD(including EasyScopeX computer software system)	
	A Power Cord that fits the standard of destination country	
	A USB Cable	
<b>Optional Accessories</b>	25MHz function/Arb Generator option	SDS-2000-FG
	I <sup>2</sup> C、SPI、UART/RS232、CAN、LIN decoding option	SDS-2000-DC
	Power analysis option	SDS-2000-PA
	USB-GPIB communication module	USB-GPIB
	Isolated Front End	ISFE
	High Voltage Probe	HPB4015
	Current Probe	CP4060/CP4200/CP5050/CP5300
	Differential Probe	DPB4050/DPB3050