**SIGLENT**®

# DataSheet

## SDS/MSO2000 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, d/dt, intergrate, square root)
- Built-in waveform generator with the max.frequency 25MHz
- Support 256 intensity grading and color temperature waveform display
- A variety of serial trigger and decode functions ($I^2C$, SPI, UART/RS232, CAN, LIN)
- A variety of smart trigger functions (Pattern, Window, Interval, Dropout, Runt)

# SDS/MSO2000 Series Digital Oscilloscope

## Overview

SDS/MSO2000 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.
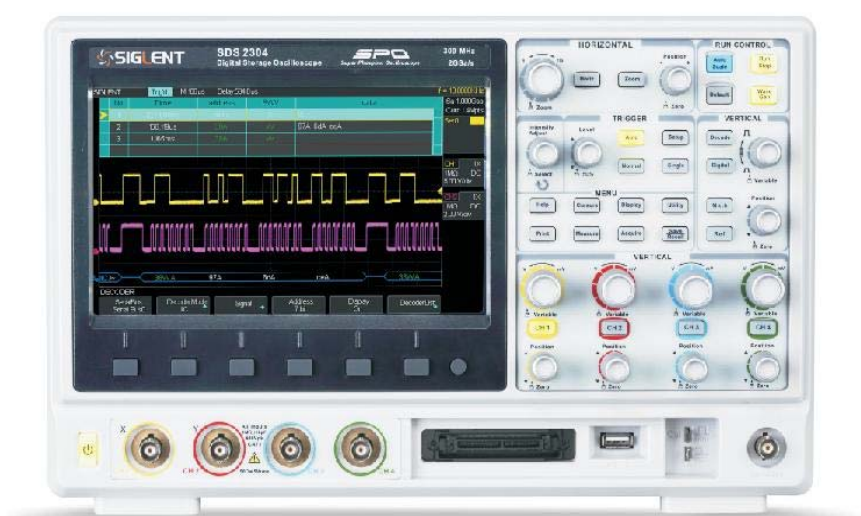
## Innovative SPO Technology

- 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($I^2$C,SPI,UART/RS232,CAN,LIN)
- Support HDTV video trigger function

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- 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 operators (FFT,d/dt,intergrate,square root)
- Complete connectivities: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, SDS/MSO2000 series realizes digital triggersystem with its high triggering sensitivity, low trigger jitter, and supports smart trigger function, HDTV video trigger and serial trigger function.
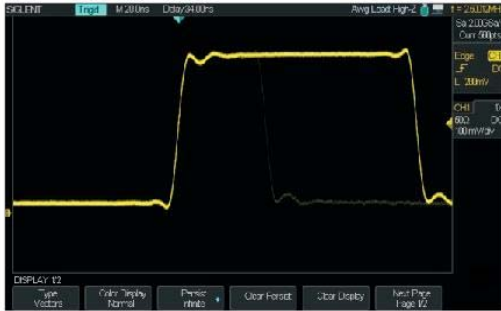
### Superiority

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

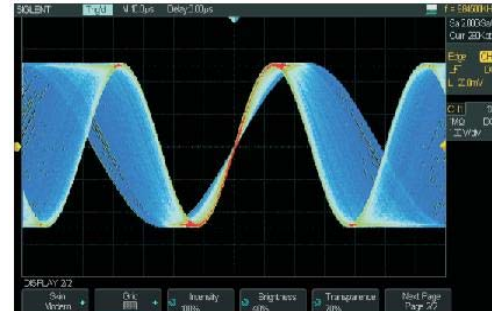### Jitter compare between Analog and Digital trigger
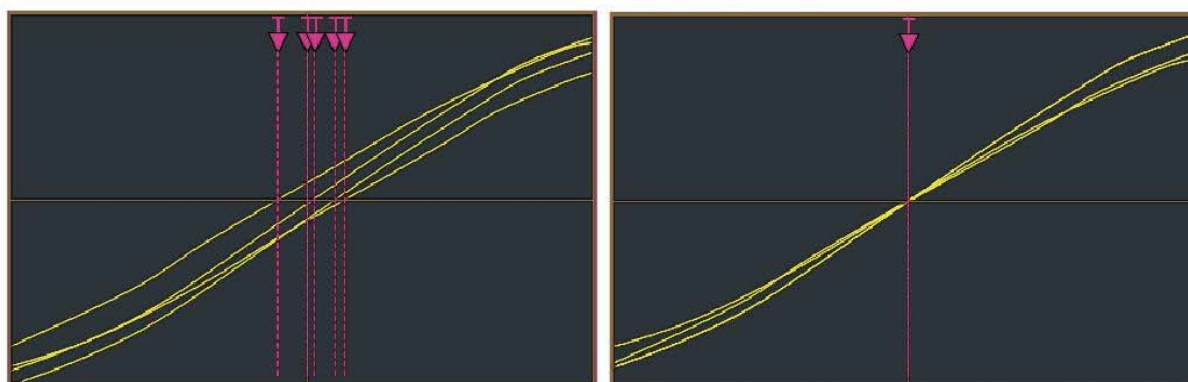
# Function & Characteristic
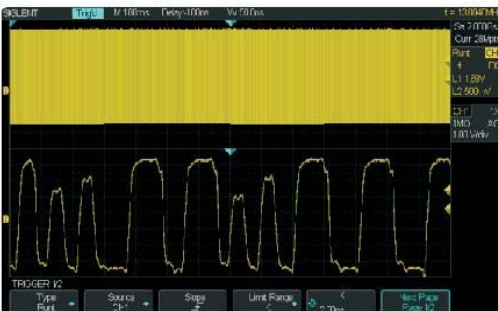
## Waveform capture rate up to 110,000 wfs/s

The higher capture rate can improve the ability of capturing abnormal eventor low probabilityevent.

## Support 256 intensity grading andcolor 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
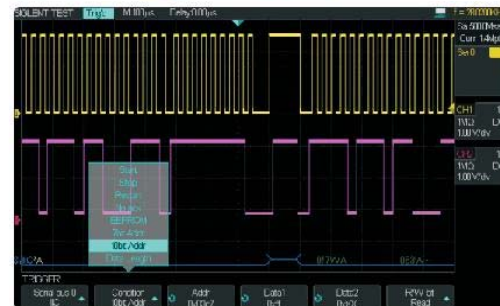
The serial trigger will quickly isolate events on a bus eliminating the need to set manual triggers and hoping to catch the right info.

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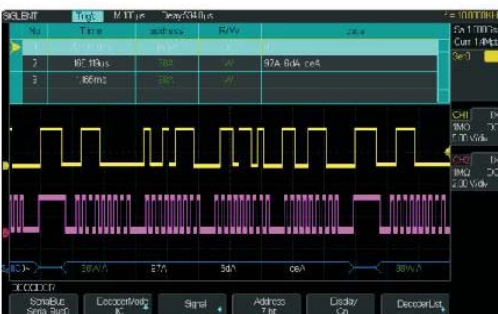
Serial protocol decoding show directly on the waveform with an intuitive,color-coded overlay and presented in binary, hex or ASCII.

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

## Smart Trigger Functions

SDS/MSO2000 series support a variety of smart trigger functions, such as Window, Interval, Runt, DropOut, Pattern.

### Pattern trigger
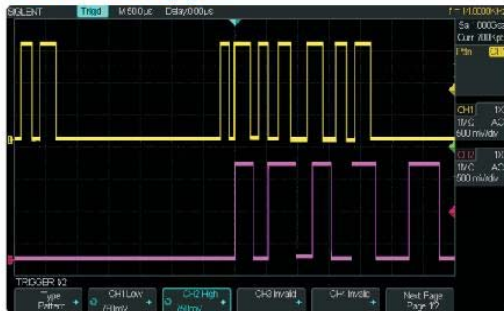


### Runt trigger
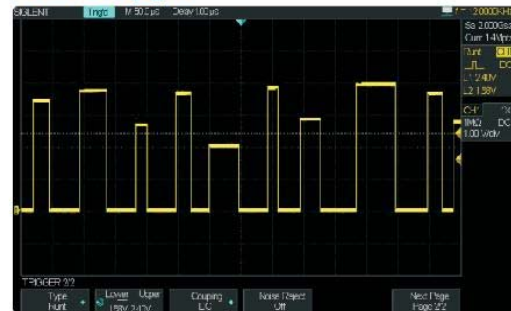


### Interval trigger
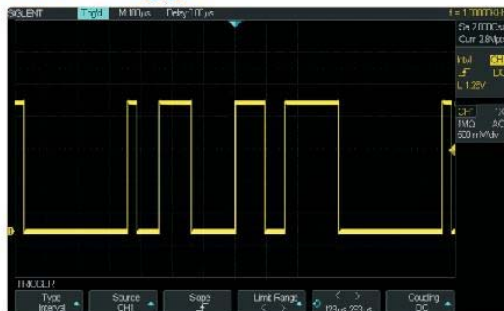


### Window trigger
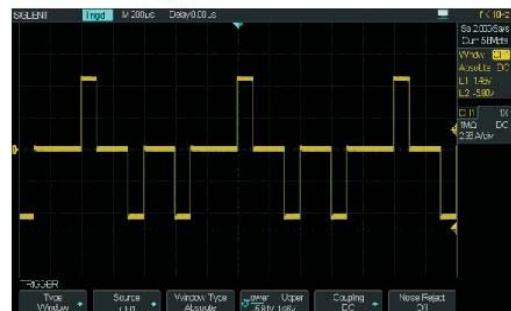


### Automatic measurements with statistics
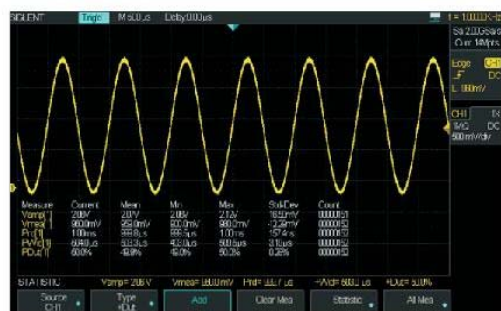


### ZOOM function based on hardware technology



### 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 (SDS/MSO2304、 SDS/MSO2302) |
| | 200MHz (SDS/MSO2204、 SDS/MSO2202) |
| | 100MHz (SDS/MSO2104、 SDS/MSO2102) |
| | 70MHz (SDS/MSO2074、 SDS/MSO2072) |
| 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 | ≤±3.0%: 5mV/div ~10V/div |
| | ≤±4.0%: 2mV/div |
| DC Measurement Accuracy | ±[3%× (\|Reading\|+\|Offset\|) +1%×\|Offset\| +0.2div+2mV] , ≤100mV/div |
| | ±[3%× (\|Reading\|+\|Offset\|) +1%×\|Offset\| +0.2div+100mV] , > 100mV/div) |
| Offset Accuracy | ± ( 1%*Offset+1%*8*div+2mV) |
| Rise time | <1.2ns (SDS2304/ MSO2304/SDS2302/MSO2302) |
| | <1.7ns (SDS2204/ MSO2204/SDS2202/MSO2202) |
| | <3.5ns (SDS2104/ MSO2104/SDS2102/MSO2102) |
| | <5.0ns (SDS2074/ MSO2074/SDS2072/MSO2072) |
| Overshoot | <10% |
| Channel Skew | <200ps |

## Math Function

| Operation | +, -, *, /, FFT, d/dt , ∫dt,√ |
| FFT | Window: Rectangular, Blackman, Hanning, Hamming |
| | Sample points：1024 |

## Horizontal System

| 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 | ±25ppm |
| Roll mode | 100ms/div ~ 50s/div (1-2-5 step) |

## Trigger System

| Trigger Mode | Auto, Normal, Single |
| Trigger Level | Internal: ±4.5 div from the center of the screen |
| Range | EXT: ±1.2V ; EXT/5: ±6v |
| 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<br>300mVpp 10MHz ~ BW |
| | EXT/5: 1Vpp DC ~ 10MHz<br>1.5Vpp 10MHz ~ BW |
| **Trigger Jitter** | <200ps |
| Trigger Displacement | Pre-Trigger: 7 divisions |
| | Delay Trigger: 10s ~ 1,000,000,000s |

### Edge Trigger

| | |
|---|---|
| Slope | Rising, Falling, Rising&Falling |
| Source | CH1/CH2/CH3/CH4/EXT/(EXT/5)/AC Line |

### Slope Trigger

| | |
|---|---|
| Slope | Rising, Falling |
| Limit Range | < , > , < > , > < |
| Source | CH1/CH2/CH3/CH4 |
| Time Range | 2ns ~ 4.2s |
| Resolution | 1ns |

### Pulse Trigger

| | |
|---|---|
| Polarity | +wid , -wid |
| Limit Range | < , > , < > , > < |
| Source | CH1/CH2/CH3/CH4 |
| Pulse Range | 2ns ~ 4.2s |
| Resolution | 1ns |

### Video Trigger

| | |
|---|---|
| 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 |

## Window Trigger

| Window Type | Absolute,Relative |
|---|---|
| Source | CH1/CH2/CH3/CH4 |

## Interval Trigger

| Slope | Rising,Falling |
|---|---|
| Limit Range | $<,\ >,\ <\ >,\ >\ <$ |
| Source | CH1/CH2/CH3/CH4 |
| Time Range | 2ns ~ 4.2s |

## Dropout Trigger

| Timeout Type | Edge, State |
|---|---|
| Source | CH1/CH2/CH3/CH4 |
| Slope | Rising,Falling |
| Time Range | 2ns ~ 4.2s |
| Resolution | 1ns |

## Runt Trigger

| Slope | +wid , -wid |
|---|---|
| Limit Range | $<\ ,\ >\ ,\ <\ >\ ,\ >\ <$ |
| Source | CH1/CH2/CH3/CH4 |
| Time Range | 2ns ~ 4.2s |
| Resolution | 1ns |

## Pattern Trigger

| Pattern Setting | Invalid, Low, High |
|---|---|
| Logic | AND, OR, NAND, NOR |
| Source | CH1/CH2/CH3/CH4 |
| Limit Range | $<\ ,\ >\ ,\ <\ >\ ,\ >\ <$ |
| Time Range | 2ns ~ 4.2s |
| Resolution | 1ns |

## Serial Trigger
## I²C Trigger

| Condition | Start, Stop, Restart, No Ack, EEPROM, 7bits Address& Data, 10bits Address&Data, Data Length |
|---|---|

## SPI Trigger

| Trigger Source | MOSI, MISO |
|---|---|
| Data Length | 4 ~ 96bits |
| Value | 0, 1, X |
| Bit Order | LSB, MSB |

## UART/ RS232 Trigger

| 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 |

## CAN Trigger

| 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 |

## LIN Trigger

| Trigger Setting | Condition  Start, ID, ID&DATA, Error |
|---|---|
| Bus Configure | Baud    600/1200/2400/4800/9600/19200/Custom |

## Serial Decode I²C

| Signal | SCL, SDA |
|---|---|
| Address | 7bits, 10bits |
| List | 1 ~ 7 lines |

## SPI

| 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 |

## UART/RS232

| Signal | RX, TX |
|---|---|
| **Configure** | Baud   600/1200/2400/4800/960019200/38400/ 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 |

## CAN

| 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 |

## LIN

| Configure | Baud  600/1200/2400/4800/9600/19200/Custom |
|---|---|
| List | 1 ~ 7 lines |

## Measure System

| 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 |

## Sample System

| 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 |

## Waveform Generator

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

| **Sine Wave** | |
|---|---|
| Frequency | 1μHz ~ 25MHz |
| Offset Accuracy （100 kHz） | ± （0.3dB of Setting Value + 1mVpp） |
| Amplitude flatness (100 kHz, 5Vpp) | ±0.3 dB |
| SFDR | DC ~ 1 MHz    -60dBc |
| | 1 MHz ~ 5 MHz   -53dBc |
| | 5 MHz ~ 25 MHz  -35dBc |

| **Square/Pulse Wave** | |
|---|---|
| Frequency | 1μHz ~ 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 | 1μHz ~ 300kHz |
| Linearity | < 0.1% of Pk-Pk value |
| Symmetry | 0% ~ 100% |

| **DC Offset** | |
|---|---|
| Range | ±1.5 V （50Ω） |
| | ±3.0 V （High） |
| Offset Accuracy | ± （|setting value|*1%+3 mV ） |

| Noise | |
|---|---|
| Bandwidth | >20MHz (-3dB) |
| **Cardiac** | |
| Frequency | 1μHz ~ 5MHz |
| **Gaus Pulse** | |
| Frequency | 1μHz ~ 5MHz |
| **Exp Rise** | |
| Frequency | 1μHz ~ 5MHz |
| **Exp Fall** | |
| Frequency | 1μHz ~ 5MHz |
| **I/O** | |
| 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℃ ~ +40℃ |
| | Non-operating: -20℃ ~ +60℃ |
| Humidity | Operating: 85%RH, 40℃, 24 Hours |
| | Non-Operating: 85%RH, 65℃, 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 |
| Power | Net    6.2kg |
| | Shipping  8.2kg |

# Ordering information

| Description | | |
|---|---|---|
| **Model** | SDS2072/MSO2072(70MHz, 2 Channels) | |
| | SDS2102/MSO2102(100MHz, 2 Channels) | |
| | SDS2202/MSO2202(200MHz, 2 Channels) | |
| | SDS2302/MSO2302(300MHz, 2 Channels) | |
| | SDS2074/MSO2074(70MHz, 4 Channels) | |
| | SDS2104/MSO2104(100MHz, 4 Channels) | |
| | SDS2204/MSO2204(200MHz, 4 Channels) | |
| | SDS2304/MSO2304(300MHz, 4 Channels) | |
| **Standard Accessories** | 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 | |
| **Optional Accessories** | 25MHz function/Arb Generator option | SDS-2000-FG |
| | I²C、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 |

# Contact SIGLENT