

# SDS5000X Series

## Digital Storage Oscilloscope

Data Sheet

EN02B



Instruments  
**Techno Test**

SIGLENT TECHNOLOGIES CO.,LTD

2021.10

SDS5104X

SDS5054X

SDS5034X

## Product Overview

SIGLENT's SDS5000X series Digital Storage Oscilloscopes are available in bandwidths of 1 GHz, 500 MHz and 350 MHz, have a maximum sample rate of 5 GSa/s, maximum record length of 250 Mpts/ch, and display up to 4 analog channels + 16 digital channels mixed signal analysis ability.

The SDS5000X series employs Siglent's SPO technology with a maximum waveform capture rate of up to 110,000 wfm/s (normal mode, up to 500,000 wfm/s in Sequence mode), 256-level intensity grading display function plus a color temperature display mode. It also employs an innovative digital trigger system with high sensitivity and low jitter. The trigger system supports multiple powerful triggering modes including serial bus triggering. History waveform recording, Sequence acquisition, Search and Navigate functions allow for extended waveform records to be captured, stored, and analyzed. An impressive array of measurement and math capabilities, options for a 25 MHz arbitrary waveform generator, as well as serial decoding are also features of the SDS5000X.

The large 10.1" display capacitive touch screen supports multi-touch gestures, with the addition of user-friendly one-button design for most commonly used functions, can greatly improve the operation efficiency of the SDS5000X. It also supports mouse and external keyboard control.



## Key Features

- 1 GHz, 500 MHz, 350 MHz models with real-time sample rate up to 5 GSa/s
- SPO technology
  - Waveform capture rates up to 110,000 wfm/s (normal mode), and 500,000 wfm/s (sequence mode)
  - Supports 256-level intensity grading and color temperature display modes
  - Record length up to 250 Mpts/ch, 500 Mpts in total for all 4 channels
  - Digital trigger system
- Intelligent trigger: Edge, Slope, Pulse, Window, Runt, Interval, Dropout, Pattern, Qualified, Nth edge, Setup/hold, Delay and Video (HDTV supported). Trigger zone helps to simplify advanced triggering
- Serial bus triggering and decoder, supports protocols I2C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I2S, MIL-STD-1553B, SENT and Manchester
- Low background noise, supports 0.5 mV/div to 10 V/div vertical scales
- Segmented acquisition (Sequence) mode, dividing the maximum record length into multiple segments (up to 100,000), according to trigger conditions set by the user, with a very small dead time between segments to capture the qualifying event
- History waveform record (History) function, the maximum recorded waveform length is 100,000 frames
- Automatic measurement function on 50+ parameters, supports statistics with histogram, trend, Gating measurement, and measurements on Math, History and Ref
- Math function (2 Mpts FFT, addition, subtraction, multiplication, division, integration, differential, square root, etc.), supports formula editor
- Abundant data analysis functions such as Search, Navigate, Digital Voltmeter, Counter, Waveform Histogram, Bode plot and Power Analysis
- High Speed hardware-based Average, ERES (Enhanced Resolution); High Speed hardware-based Mask Test function, with Mask Editor tool for creating user-defined masks
- 16 digital channels (optional) with sample rate up to 1.25 GSa/s, record length up to 62.5 Mpts
- 25 MHz function / arbitrary waveform generator, built-in multiple predefined waveforms
- Large 10.1" TFT-LCD display with 1024 \* 600 resolution; Capacitive touch screen supports multi-touch gestures
- Multiple interfaces: USB Host, USB Device (USBTMC), LAN (VXI-11, telnet, socket, web), Pass/Fail, Trigger Out, 10 MHz In, 10 MHz Out, VGA output
- Built-in web server supports remote control by the LAN port using a web browser; Supports SCPI remote control commands; Supports external mouse and keyboard

## Models and Key Specifications

| Model                         | SDS5034X                                                                                                                                                                      | SDS5054X | SDS5104X |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|
| Analog channels               | 4 + EXT                                                                                                                                                                       |          |          |
| Bandwidth                     | 350 MHz                                                                                                                                                                       | 500 MHz  | 1 GHz    |
| Sample rate (Max.)            | 5 GSa/s (interleaving mode*), 2.5 GSa/s (non-interleaving mode**)                                                                                                             |          |          |
| Memory depth (Max.)           | 250 Mpts/ch (interleaving mode), 125 Mpts/ch (non-interleaving mode)                                                                                                          |          |          |
| Waveform capture rate (Max.)  | 110,000 wfm/s (Normal mode);<br>500,000 wfm/s (Sequence mode)                                                                                                                 |          |          |
| Trigger type                  | Edge, Slope, Pulse width, Window, Runt, Interval, Dropout, Pattern, Video, Qualified, Nth edge, Setup/hold, Delay                                                             |          |          |
| Serial trigger and decode     | Standard: I2C, SPI, UART, CAN, LIN<br>Optional: CAN FD, FlexRay, I2S, MIL-STD-1553B, SENT, Manchester (decode only)                                                           |          |          |
| Measurement                   | 50+ parameters, statistics, histogram, trend supported                                                                                                                        |          |          |
| Math                          | 2 traces<br>2 Mpts FFT, +, -, x, ÷, ∫dt, d/dt, √, Identity, Negation, Absolute, Sign, e <sup>x</sup> , 10 <sup>x</sup> , ln, lg, Interpolation, etc.; supports formula editor |          |          |
| Data analysis                 | Search, Navigate, History, Mask Test, Digital Voltmeter, Counter, Waveform Histogram, Bode plot and Power Analysis                                                            |          |          |
| Digital channel (optional)    | 16-channel; maximum sample rate up to 1.25 GSa/s; record length up to 62.5 Mpts                                                                                               |          |          |
| Waveform generator (optional) | Single channel external USB waveform generator, frequency up to 25 MHz, 125 MSa/s sample rate, 16 kpts waveform memory                                                        |          |          |
| I/O                           | USB 2.0 Host, USB 2.0 Device, LAN 10M/100M, Pass/Fail, Trigger Out, 10 MHz In, 10 MHz Out, VGA Output                                                                         |          |          |
| Probe (standard)              | SP3050A, 500 MHz, 1 probe supplied for each channel                                                                                                                           |          |          |
| Display                       | 10.1" TFT-LCD with capacitive touch screen (1024*600)                                                                                                                         |          |          |

\* Interleaving mode: only one of CH1/CH2 and/or only one of CH3/CH4 activated

\*\* Non-interleaving mode: both CH1/CH2 or both CH3/CH4 activated

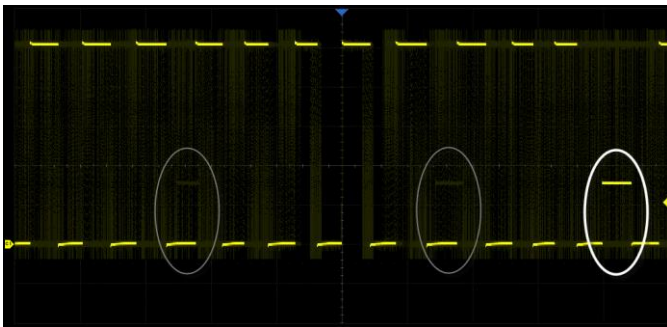
## Functions & Characteristics

### 10.1" TFT-LCD Display with Capacitive Touch Screen



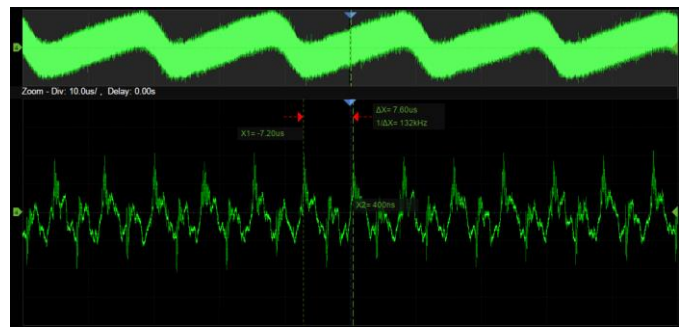
- 10.1" display with 1024\*600 resolution
- Capacitive touch screen, supporting multi-touch gestures, can move or scale the waveform traces quickly by finger-touch movements, which greatly improves the operation efficiency

### Up to 110,000 wfms/s Waveform Update Rate



With a waveform update rate of up to 110,000 wfms/s, the oscilloscope can easily capture unusual or low-probability events. In Sequence mode the waveform capture rate can reach 500,000 wfms/s

### Record Length of up to 250 Mpts/ch



Using hardware-based Zoom technique and record length of up to 250 Mpts, users can select a slower timebase without compromising the sample rate, and then quickly zoom in to focus on the area of interest

## Measurements of a Variety of Parameters



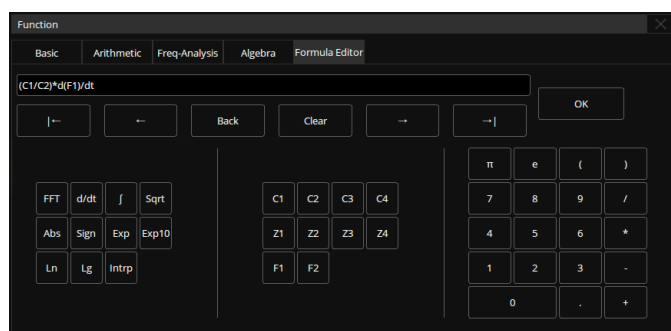
## Parameter Statistics Function



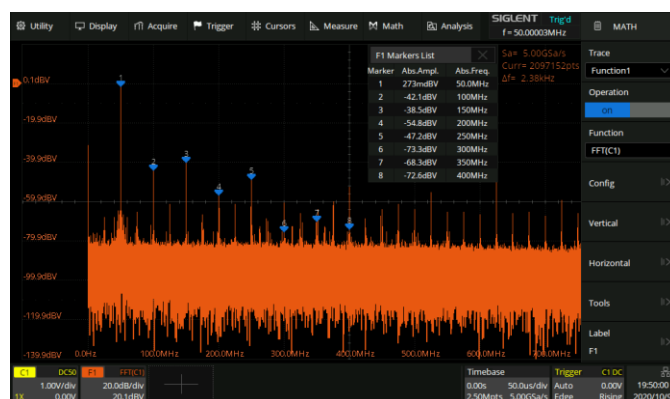
Statistics shows the current value, maximum value, minimum value, standard deviation and mean value of up to 12 parameters simultaneously. Histogram is available to show the probability distribution of a parameter. Trend is available to show the parameter value vs. time

Parameter measurements includes 4 categories: horizontal, vertical, miscellaneous and CH delay providing a total of 50+ different types of measurements. Measurements can be performed within a specified gate period. Measurements on Math, Reference and History frames are supported

## Advanced Math Function

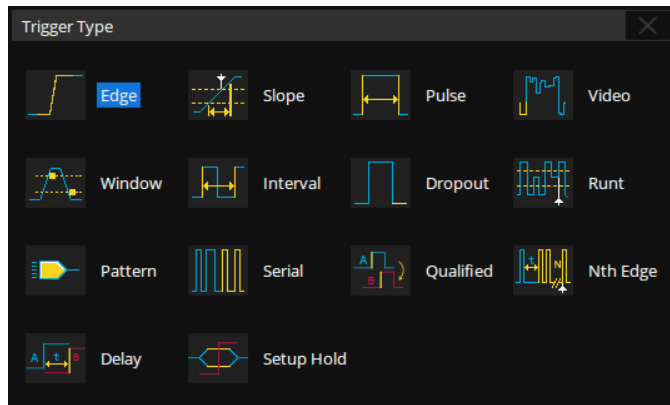


In addition to the traditional (+, -, X, /) operations, FFT, integration, differential, square root and so on are supported. Formula Editor is available for more complex operations. 2 math traces are available



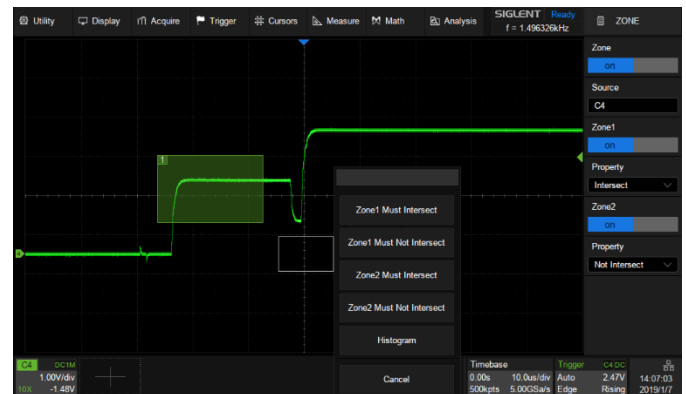
Hardware accelerated FFT supports up to 2 Mpts operation. This provides high frequency resolution with a fast refresh rate. The FFT function also supports a variety of window functions so that it can adapt to different spectrum measurement needs. Three modes (Normal, Average and Max hold) can satisfy different requirements for observing the power spectrum. Auto peak detection and markers are supported

## Multiple Trigger Functions



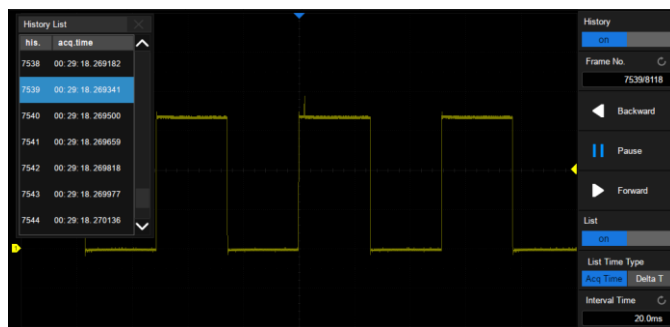
Edge, Slope, Pulse, Video, Windows, Runt, Interval, Dropout, Pattern, Qualified, Nth edge, Setup/hold, Delay and serial trigger

## Trigger Zone



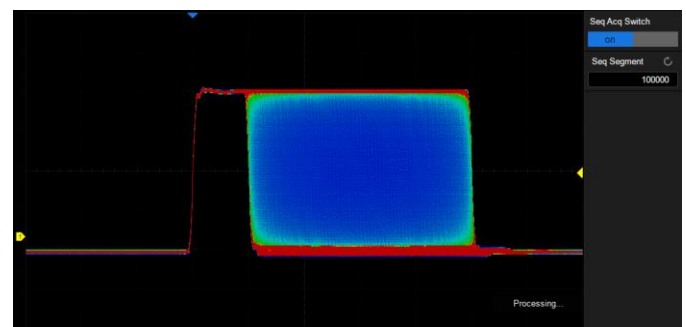
Trigger Zone is available for advanced triggering

## History Mode



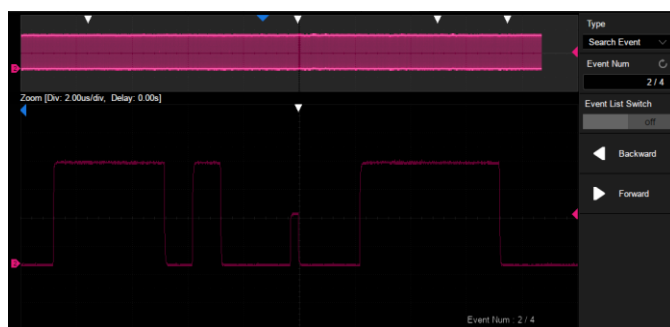
History function can record up to 100,000 frames of waveforms. The recording is executed automatically, so that the customer can play back the history waveforms at any time in order to observe unusual events and quickly locate the area of interest using the cursors or measurements. The failed frames of Mask Test can be stored as history

## Sequence Mode



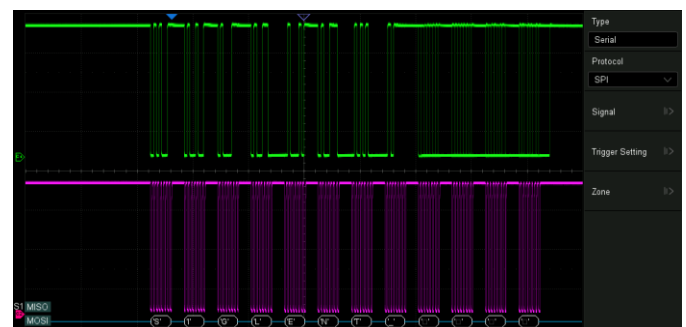
Segmented memory collection will store the waveform into multiple memory segments (up to 100,000) and each segment will store a triggered waveform as well the dead time information. The interval between segments can be as small as 2  $\mu$ s. All of the segments can be played back using the History function

## Search and Navigate



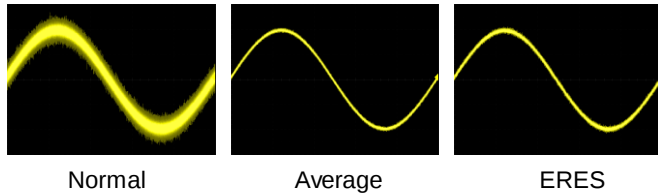
The SDS5000X can search events specified by the user in a frame. Events flagged by the Search can be recalled automatically using Navigate. It can also navigate by time (delay position) and history frames

## Serial Bus Decode



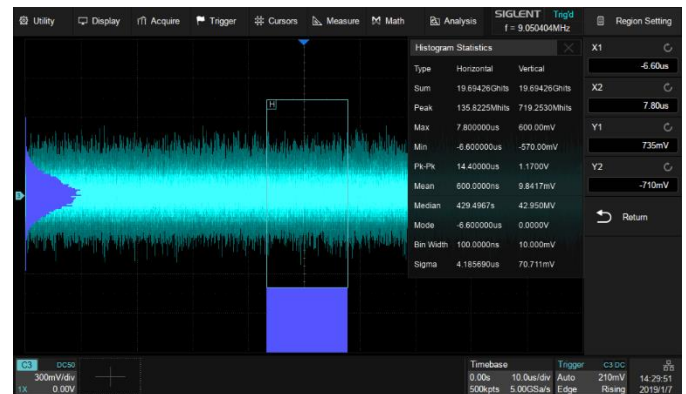
Display the decoded characters through the events list. Bus protocol information can be quickly and intuitively displayed in tabular form. I<sup>2</sup>C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I<sup>2</sup>S, MIL-STD-1553B, SENT and Manchester are supported

## Hardware-based Average and ERES Acquisition



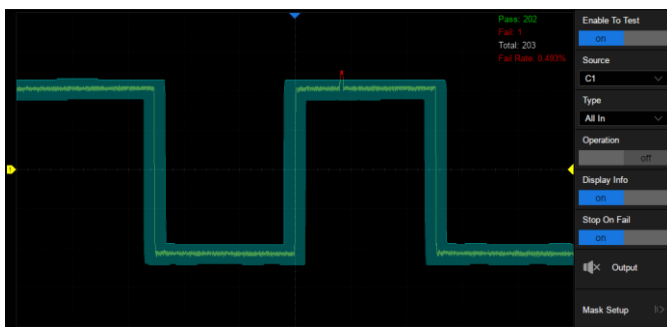
Average and ERES (Enhanced Resolution) acquisition modes are hardware-based, allowing the waveforms to be captured at a faster rate

## Waveform Histogram

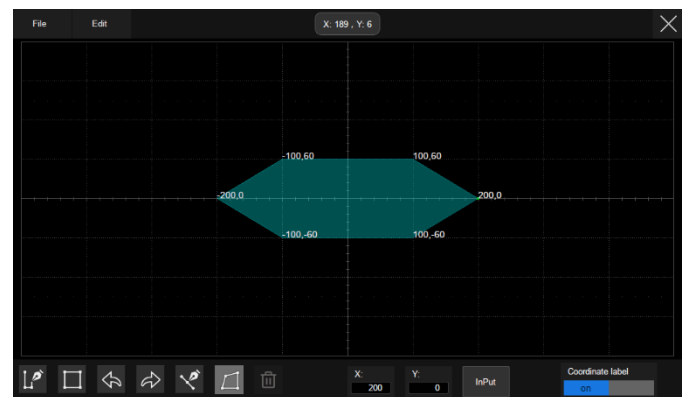


The Waveform Histogram feature provides a statistics view of the waveform in horizontal and vertical directions

## Hardware-based High Speed Mask Test Function



The SDS5000X utilizes a hardware-based Mask Test function, performing up to 18,000 Pass / Fail decisions each second. It is easy to generate user-defined test templates in order to provide trace mask comparisons, making it suitable for long-term signal monitoring or automated production line testing



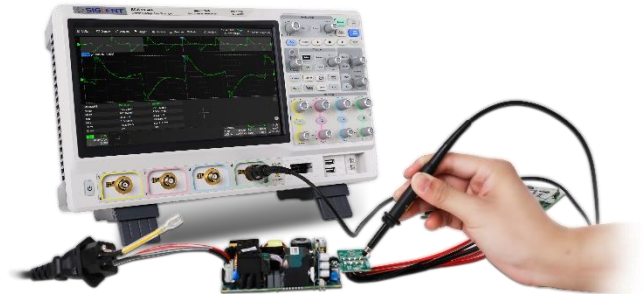
Built-in Mask Editor application helps to create custom masks

## Bode Plot



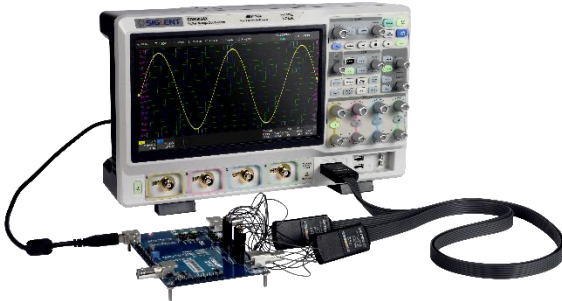
The SDS5000X can control the USB AWG module or a stand-alone SIGLENT SDG generator, to scan the amplitude and phase frequency response of the DUT, and display the data as a Bode Plot. This makes it possible to replace expensive network analyzer in some applications

## Power Analysis (Optional)



The Power Analysis option provides a full suite of power measurements and analysis, which greatly improve the measurement efficiency in switching power supplies and power devices design

## Digital Channels / MSO (Optional)



Four analog channels plus 16 digital channels enable users to acquire and trigger on the waveforms then analyze the pattern, simultaneously with one instrument

## 25 MHz Function/Arbitrary Waveform Generator (Optional)



The SDS5000X can control the SAG1021I USB Function/Arbitrary waveform generator to output waveform with up to 25 MHz frequency and  $\pm 3$  V amplitude. Six basic waveforms plus multiple types of arbitrary waveforms are built-in

## Complete Connectivity



USB 2.0 Host, USB 2.0 Device (USBTMC), LAN 10M/100M (VXI-11, telnet, socket, web), Pass/ Fail, Trigger Out, 10 MHz In/Out and VGA output

## Web Control



With the embedded web server, users can control the oscilloscope from a simple web page. This provides wonderful remote troubleshooting and monitoring capabilities

## Specifications

All specifications are not guaranteed unless the following conditions are met:

- The oscilloscope calibration period is current
- The oscilloscope has been working continuously for at least 30 minutes at the specified temperature (18°C ~ 28°C )

| Acquire System (analog channel) |                                                                           |
|---------------------------------|---------------------------------------------------------------------------|
| Sample rate                     | 5 GSa/s (interleaving mode), 2.5 GSa/s (non-interleaving mode)            |
| Memory depth                    | 250 Mpts (interleaving mode), 125 Mpts (non-interleaving mode)            |
| Peak detect                     | 400 ps                                                                    |
| Average                         | 4, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768, 65536 |
| ERES                            | Enhanced bit: 0.5, 1, 1.5, 2, 2.5, 3                                      |
| Sequence                        | Up to 100,000 segments, interval between triggers = 2 $\mu$ s min         |
| History                         | Up to 100,000 frames                                                      |
| Interpolation                   | sinx/x, x                                                                 |

| Vertical System (analog channel)           | SDS5034X                                                                                                                                                           | SDS5054X                                                                                                                                                               | SDS5104X       |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Bandwidth (-3dB) @50 Ω                     | 350 MHz*                                                                                                                                                           | 500 MHz**                                                                                                                                                              | 1 GHz**        |
| Rise time (typical) @50 Ω                  | 1.0 ns                                                                                                                                                             | 0.7 ns                                                                                                                                                                 | 0.4 ns         |
| Vertical range                             | 8 divisions                                                                                                                                                        |                                                                                                                                                                        |                |
| Vertical scale (probe 1X)                  | 1 MΩ: 500 μV/div – 10 V/div(setting range), 1 mV/div – 10 V/div(specified range)<br>50 Ω: 500 μV/div – 1 V/div(setting range), 1 mV/div – 1 V/div(specified range) |                                                                                                                                                                        |                |
| DC gain accuracy                           | < 1.5%, ≥5mV/div<br>< 3.0%, <5mV/div                                                                                                                               |                                                                                                                                                                        |                |
| Offset accuracy                            | ±(1.5%*offset+1.5%*full scale+1mV)                                                                                                                                 |                                                                                                                                                                        |                |
| Offset range (probe 1X)                    | 0.5mV/div~100mV/div: ±2V;<br>102mV/div~1V/div: ±20V;<br>1.02V/div~10V/div: ±200V                                                                                   | 0.5mV/div~20mV/div: ±2V;<br>20.5mV/div~100mV/div: ±5V;<br>102mV/div~200mV/div: ±20V;<br>205mV/div~1V/div: ±50V;<br>1.02V/div~2V/div: ±200V<br>2.05V/div~10V/div: ±400V |                |
| Bandwidth flatness (>2 mV/div, @50 Ω)      | 50 kHz ~ BW/10: ±0.5 dB<br>BW/10 ~ BW/3: ±0.8 dB<br>BW/3 ~ BW2/3: +1.0 dB, -1.2 dB<br>BW2/3 ~ BW: +2.0 dB, -2.5 dB                                                 |                                                                                                                                                                        |                |
| Bandwidth limit                            | 20 MHz (±40%)<br>200 MHz (±40%)                                                                                                                                    |                                                                                                                                                                        |                |
| Low frequency response (AC coupling -3 dB) | 5 Hz (typical)                                                                                                                                                     |                                                                                                                                                                        |                |
| Overshoot (150 ps pulse @50 Ω)             | <10% (typical)                                                                                                                                                     | <10% (typical)                                                                                                                                                         | <15% (typical) |
| Coupling                                   | DC, AC, GND                                                                                                                                                        |                                                                                                                                                                        |                |
| Impedance                                  | DC1M: (1 MΩ±2%)    (16 pF±2 pF)<br>AC1M: (1.2 MΩ±2%)    (16 pF±2 pF)<br>50 Ω: 50 Ω±1%                                                                              |                                                                                                                                                                        |                |
| Max. Input voltage                         | 1MΩ ≤ 400Vpk(DC + AC), DC~10kHz<br>50Ω ≤ 5Vrms, ±10V Peak                                                                                                          |                                                                                                                                                                        |                |
| SFDR                                       | ≥ 32 dBc                                                                                                                                                           |                                                                                                                                                                        |                |
| CH to CH Isolation (@50Ω)                  | DC ~ 100 MHz >40 dB<br>100 MHz ~ BW: ≥34 dB                                                                                                                        |                                                                                                                                                                        |                |
| Probe Attenuation                          | 1X, 10X, 100X, custom                                                                                                                                              |                                                                                                                                                                        |                |

\* Below 1 mV/div (included) the bandwidth is limited to 200 MHz

\*\* Below 2.45 mV/div (included) the bandwidth is limited to 200 MHz

| Horizontal System    | SDS5034X              | SDS5054X                | SDS5104X                |
|----------------------|-----------------------|-------------------------|-------------------------|
| Time scale           | 1 ns/div – 1000 s/div | 500 ps/div – 1000 s/div | 200 ps/div – 1000 s/div |
| Waveform update rate | Up to 110,000 wfm/s   |                         |                         |
| Intensity grading    | 256-level             |                         |                         |
| Display mode         | Y-T, X-Y, Roll        |                         |                         |
| Roll mode            | $\geq$ 50 ms/div      |                         |                         |
| Skew (CH1~CH4)       | < 150 ps              |                         |                         |

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------|---------------|
| Time base Accuracy  | ±1ppm initial; ±1ppm 1st year aging; ±3.5ppm 10-year aging                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                     |                |               |
| Trigger System      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |
| Mode                | Auto, Normal, Single                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                     |                |               |
| Level               | Internal: ±4.1 div from the center of the screen<br>EXT: ±0.61 V<br>EXT/5: ±3.05 V                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                     |                |               |
| Hold off range      | By time: 8 ns ~ 30 s (8 ns step)<br>By event: 1 ~ 10 <sup>8</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |                |               |
| Coupling            | CH1~CH4<br>DC: Passes all components of the signal<br>AC: Blocks DC components and attenuates signals below 8 Hz<br>LFRJ: Attenuates the frequency components below 1.2 MHz<br>HFRJ: Attenuates the frequency components above 740 kHz<br>Noise RJ: Increases the trigger hysteresis<br>EXT<br>DC: Passes all components of the signal<br>AC: Blocks DC components and attenuates signals below 10 Hz<br>LFRJ: Attenuates the frequency components below 400 kHz<br>HFRJ: Attenuates the frequency components above 1.6 MHz |                                                                     |                |               |
| Accuracy (typical)  | CH1 ~ CH4: ±0.2div<br>EXT: ±0.3div                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                     |                |               |
| Sensitivity         | CH1 ~ CH4:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                     | Noise RJ = OFF | Noise RJ = ON |
|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | >10mV/div:                                                          | ±0.15div       | ±0.35div      |
|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5mV/div~10mV/div:                                                   | ±0.25 div      | ±0.35 div     |
|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ≤ 2mV/div:                                                          | ±0.5 div       | ±0.75 div     |
|                     | EXT:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 200mVpp, DC ~ 10MHz<br>300mVpp, 10MHz ~ bandwidth (300 MHz typical) |                |               |
|                     | EXT/5:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1Vpp, DC ~ 10MHz<br>1.5Vpp, 10MHz ~ bandwidth (300 MHz typical)     |                |               |
| Jitter              | <9ps RMS (typical) for ≥300MHz sine and ≥6 divisions peak to peak amplitude for vertical gain settings from 2.5mV/div to 10V/div<br><5ps RMS (typical) for ≥500MHz sine and ≥6 divisions peak to peak amplitude for vertical gain settings from 2.5mV/div to 10V/div                                                                                                                                                                                                                                                        |                                                                     |                |               |
| Displacement        | Pre-Trigger: 0 ~ 100% memory<br>Delay-Trigger: 0 ~ 5,000 div                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                     |                |               |
| Zone                | Up to 2 zones<br>Source: CH1~CH4<br>Property: Intersect, Not Intersect                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                     |                |               |
| Edge Trigger        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |
| Source              | CH1~CH4/EXT/(EXT/5)/AC Line/D0~D15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                     |                |               |
| Slope               | Rising, Falling, Rising & Falling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |                |               |
| Slope Trigger       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |
| Source              | CH1~CH4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                     |                |               |
| Slope               | Rising, Falling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |
| Limit range         | <, >, in range, out of range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                     |                |               |
| Time range          | 2ns ~ 20s, Resolution = 1 ns                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                     |                |               |
| Pulse Width Trigger |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |
| Source              | CH1~CH4/D0~D15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                     |                |               |
| Polarity            | +wid, -wid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                     |                |               |
| Limit range         | <, >, in range, out of range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                     |                |               |
| Time range          | 2ns ~ 20s, Resolution = 1 ns                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                     |                |               |
| Video Trigger       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |
| Source              | CH1~CH4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                     |                |               |
| Standard            | NTSC, PAL, 720p/50, 720p/60, 1080p/50, 1080p/60, 1080i/50, 1080i/60, Custom                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                     |                |               |
| Synchronization     | Any, Select                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                     |                |               |
| Trigger Condition   | Line, Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                     |                |               |
| Window Trigger      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |
| Source              | CH1~CH4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                     |                |               |
| Window type         | Absolute, Relative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                     |                |               |
| Interval Trigger    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                |               |

|                             |                                                                                                                     |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------|
| Source                      | CH1~CH4/D0~D15                                                                                                      |
| Slope                       | Rising, Falling                                                                                                     |
| Limit range                 | <, >, in range, out of range                                                                                        |
| Time range                  | 2ns ~ 20s, Resolution = 1 ns                                                                                        |
| <b>Dropout Trigger</b>      |                                                                                                                     |
| Source                      | CH1~CH4/D0~D15                                                                                                      |
| Timeout type                | Edge, State                                                                                                         |
| Slope                       | Rising, Falling                                                                                                     |
| Time range                  | 2ns ~ 20s, Resolution = 1 ns                                                                                        |
| <b>Runt Trigger</b>         |                                                                                                                     |
| Source                      | CH1~CH4                                                                                                             |
| Polarity                    | Positive, Negative                                                                                                  |
| Limit range                 | <, >, in range, out of range                                                                                        |
| Time range                  | 2ns ~ 20s, Resolution = 1 ns                                                                                        |
| <b>Pattern Trigger</b>      |                                                                                                                     |
| Source                      | CH1~CH4/D0~D15                                                                                                      |
| Pattern Setting             | Don't Care, Low, High                                                                                               |
| Logic                       | AND, OR, NAND, NOR                                                                                                  |
| Limit range                 | <, >, in range, out of range                                                                                        |
| Time range                  | 2ns ~ 20s, Resolution = 1 ns                                                                                        |
| <b>Qualified Trigger</b>    |                                                                                                                     |
| Type                        | State, State with Delay, Edge, Edge with Delay                                                                      |
| Qualified Source            | CH1~CH4/D0~D15                                                                                                      |
| Edge Trigger Source         | CH1~CH4/D0~D15                                                                                                      |
| <b>Nth Edge Trigger</b>     |                                                                                                                     |
| Source                      | CH1~CH4/D0~D15                                                                                                      |
| Slope                       | Rising, Falling                                                                                                     |
| Idle time                   | 8ns ~ 20s, Resolution = 1 ns                                                                                        |
| Edge Number                 | 1 ~ 65535                                                                                                           |
| <b>Delay Trigger</b>        |                                                                                                                     |
| Source A                    | CH1~CH4/D0~D15                                                                                                      |
| Source B                    | CH1~CH4/D0~D15                                                                                                      |
| Slope                       | Rising, Falling                                                                                                     |
| Limit range                 | <, >, in range, out of range                                                                                        |
| Time range                  | 2ns ~ 20s, Resolution = 1 ns                                                                                        |
| <b>Serial Trigger</b>       |                                                                                                                     |
| Source                      | CH1~CH4/D0~D15                                                                                                      |
| Protocol                    | Standard: I <sup>2</sup> C, SPI, UART, CAN, LIN<br>Optional: CAN FD, FlexRay, I <sup>2</sup> S, MIL-STD-1553B, SENT |
| I <sup>2</sup> C            | Type: Start, Stop, Restart, No Ack, EEPROM, Address & Data, Data Length                                             |
| SPI                         | Type: Data                                                                                                          |
| UART                        | Type: Start, Stop, Data, Parity Error                                                                               |
| CAN                         | Type: All, Remote, ID, ID+Data, Error                                                                               |
| LIN                         | Type: Break, Frame ID, ID+Data, Error                                                                               |
| CAN FD (Optional)           | Type: Start, Remote, ID, ID+Data, Error                                                                             |
| FlexRay (Optional)          | Type: TSS, Frame, Symbol, Errors                                                                                    |
| I <sup>2</sup> S (Optional) | Type: Data, Mute, Clip, Glitch, Rising Edge, Falling Edge                                                           |
| MIL-STD-1553B (Optional)    | Type: Transfer, Word, Error, Timing                                                                                 |
| SENT (Optional)             | Type: Start, Slow channel, Fast channel, Error                                                                      |

**Serial Decoder**

|           |                |
|-----------|----------------|
| Decoders  | 2              |
| Threshold | -4.1 ~ 4.1 div |
| List      | 1 ~ 7 lines    |

## SDS5000X Series Digital Storage Oscilloscope

|                                  |                                                               |
|----------------------------------|---------------------------------------------------------------|
| Decoder type                     | Full duplex                                                   |
| <b>I<sup>2</sup>C</b>            |                                                               |
| Source                           | CH1~CH4/D0~D15                                                |
| Signal                           | SCL, SDA                                                      |
| Address                          | 7bit, 10bit                                                   |
| <b>SPI</b>                       |                                                               |
| Source                           | CH1~CH4/D0~D15                                                |
| Signal                           | CLK, MISO, MOSI, CS                                           |
| Edge Select                      | Rising, Falling                                               |
| Chip select                      | Active high, Active low, Clock timeout                        |
| Bit Order                        | LSB, MSB                                                      |
| <b>UART</b>                      |                                                               |
| Source                           | CH1~CH4/D0~D15                                                |
| Signal                           | RX, TX                                                        |
| Data Width                       | 5 bit, 6 bit, 7 bit, 8 bit                                    |
| Parity Check                     | None, Odd, Even, Mark, Space                                  |
| Stop Bit                         | 1 bit, 1.5 bit, 2 bit                                         |
| Idle Level                       | Low, High                                                     |
| Bit Order                        | LSB, MSB                                                      |
| <b>CAN</b>                       |                                                               |
| Source                           | CH1~CH4/D0~D15                                                |
| <b>LIN</b>                       |                                                               |
| LIN Version                      | Ver1.3, Ver2.0                                                |
| Source                           | CH1~CH4/D0~D15                                                |
| Baud Rate                        | 600bps, 1200bps, 2400bps, 4800bps, 9600bps, 19200bps, Custom  |
| <b>CAN FD (Optional)</b>         |                                                               |
| Source                           | CH1~CH4/D0~D15                                                |
| Nominal Baud Rate                | 10 kbps, 25 kbps, 50 kbps, 100 kbps, 250 kbps, 1 Mbps, Custom |
| Data Baud Rate                   | 500 kbps, 1 Mbps, 2 Mbps, 5 Mbps, 8 Mbps, 10 Mbps, Custom     |
| <b>FlexRay (Optional)</b>        |                                                               |
| Source                           | CH1~CH4/D0~D15                                                |
| Baud Rate                        | 2.5 Mbps, 5 Mbps, 10 Mbps, Custom                             |
| <b>I<sup>2</sup>S (Optional)</b> |                                                               |
| Source                           | CH1~CH4/D0~D15                                                |
| Signal                           | BCLK, WS, DATA                                                |
| Audio Variant                    | Audio-I2S, Audio-LJ, Audio-RJ                                 |
| Start Bits                       | 0~31                                                          |
| Data Bits                        | 1~32                                                          |
| <b>MIL-STD-1553B (Optional)</b>  |                                                               |
| Source                           | CH1~CH4                                                       |
| <b>SENT (Optional)</b>           |                                                               |
| Source                           | CH1~CH4/D0~D15                                                |
| <b>Manchester (Optional)</b>     |                                                               |
| Source                           | CH1~CH4                                                       |
| Baud Rate                        | 500 bps~5 Mbps                                                |

## Measurement

### Automatic Measurement

|                     |                                                                                                                                                        |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source              | CH1~CH4, D0~D15, Math, Ref, History, Zoom                                                                                                              |
| Mode                | Simple, Advanced                                                                                                                                       |
| Range               | Screen, Gating                                                                                                                                         |
| Custom Threshold    | Upper, Middle, Lower                                                                                                                                   |
| No. of Measurements | Display 12 measurements at the same time (Display mode = M2)                                                                                           |
| Vertical Parameters | Max, Min, Pk-Pk, Top, Base, Amplitude, Mean, Cycle Mean, Stdev, Cycle Stdev, RMS, Cycle RMS, Median, Cycle Median, FOV, FPPE, ROV, RPPE, Level@Trigger |

|                          |                                                                                                                                                                                                             |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Horizontal Parameters    | Period, Frequency, Time@max, Time@min, +Width, -Width, 10-90%Rise time, 90-10%Fall time, Rise time, Fall time, +Burst Width, -Burst Width, +Duty Cycle, -Duty Cycle, Delay, Time@Middle, Cycle-Cycle jitter |
| Miscellaneous Parameters | +Area@DC, -Area@DC, Area@DC, Absolute Area@DC, +Area@AC, -Area@AC, Area@AC, Absolute Area@AC, Cycles, Rising Edges, Falling Edges, Edges, Positive pulses, Negative pulses                                  |
| Delay Parameters         | Phase, FRFR, FRFF, FFFR, FFFF, FRLR, FRLF, FFLR, FFLF, Skew                                                                                                                                                 |
| Statistics               | Current, Mean, Min, Max, Sdev, Count, Histogram, Trend                                                                                                                                                      |
| Statistics Count         | Unlimited, 1~1024                                                                                                                                                                                           |
| <b>Cursors</b>           |                                                                                                                                                                                                             |
| Source                   | CH1~CH4, D0~D15, Math, Ref, Histogram                                                                                                                                                                       |
| Type                     | Manual : Time X1, X2, (X1-X2), (1/ΔT); Vertical Y1, Y2, (Y1-Y2)<br>Track: Time X1, X2, (X1-X2)                                                                                                              |

|             |                                                                                                                                                                                                                                                                           |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Math</b> |                                                                                                                                                                                                                                                                           |
| Trace       | F1, F2                                                                                                                                                                                                                                                                    |
| Source      | CH1~CH4, F1~F2, Z1~Z4                                                                                                                                                                                                                                                     |
| Operation   | FFT, +, -, x, ÷, ∫dt, d/dt, √, Identity, Negation,  x , Sign, e <sup>x</sup> , 10 <sup>x</sup> , ln, lg, Interpolation, Formula Editor                                                                                                                                    |
| FFT         | Length: 2 Mpts, 1 Mpts, 512 kpts, 256 kpts, 128 kpts, 64 kpts, 32 kpts, 16 kpts, 8 kpts, 4 kpts, 2 kpts<br>Window: Rectangular, Blackman, Hanning, Hamming, Flattop<br>Display: Full Screen, Split, Exclusive<br>Mode: Normal, Max hold, Average<br>Tools: Peaks, Markers |

|                                  |                                                                                                                                                                |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Analysis</b>                  |                                                                                                                                                                |
| <b>Search</b>                    |                                                                                                                                                                |
| Source                           | CH1~CH4, History                                                                                                                                               |
| Mode                             | Edge, Slope, Pulse, Interval, Runt                                                                                                                             |
| Copy setting                     | Copy from trigger, Copy to trigger                                                                                                                             |
| <b>Navigate</b>                  |                                                                                                                                                                |
| Type                             | Search event, Time, History frame                                                                                                                              |
| <b>Mask Test</b>                 |                                                                                                                                                                |
| Source                           | CH1~CH4, Z1~Z4                                                                                                                                                 |
| Mask creating                    | Auto (Create mask), Customized (Mask Editor)                                                                                                                   |
| Mask test speed                  | Up to 18,000 frames/s                                                                                                                                          |
| <b>DVM</b>                       |                                                                                                                                                                |
| Source                           | CH1~CH4                                                                                                                                                        |
| Mode                             | DC mean, DC RMS, AC RMS, Peak-peak, Amplitude                                                                                                                  |
| Plot                             | Bar, Histogram, Trend                                                                                                                                          |
| <b>Bode Plot</b>                 |                                                                                                                                                                |
| Source                           | CH1~CH4                                                                                                                                                        |
| Supported signal sources         | SAG1021I (Connection: USB),<br>SDG series waveform generators (Connection: USB, LAN)                                                                           |
| Sweep type                       | Simple, Vari-level                                                                                                                                             |
| Frequency                        | Mode: Linear, Logarithmic<br>Range: 10 Hz ~ 120 MHz                                                                                                            |
| Measure                          | Upper cutoff frequency, Lower cutoff frequency, Bandwidth, Gain margin, Phase margin                                                                           |
| <b>Power Analysis (Optional)</b> |                                                                                                                                                                |
| Measure                          | Power quality, Current Harmonics, Inrush current, Switching loss, Slew rate, Modulation, Output ripple, Turn on/turn off, Transient response, PSRR, Efficiency |
| <b>Histogram</b>                 |                                                                                                                                                                |
| Source                           | CH1~CH4                                                                                                                                                        |
| Type                             | Horizontal, Vertical, Both                                                                                                                                     |
| <b>Counter</b>                   |                                                                                                                                                                |
| Source                           | CH1~CH4                                                                                                                                                        |
| Frequency resolution             | 7 digits                                                                                                                                                       |
| Totalizer                        | Counter on edges, supports Gate and Trigger                                                                                                                    |

|                                    |              |
|------------------------------------|--------------|
| <b>Digital Channels (Optional)</b> |              |
| No. of Channels                    | 16           |
| Max. Sampling Rate                 | 1.25 GSa/s   |
| Memory Depth                       | 62.5 Mpts/ch |
| Min. Detectable Pulse              | 3.3 ns       |

## SDS5000X Series Digital Storage Oscilloscope

|             |                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------|
| Width       |                                                                                                            |
| Level Group | D0~D7, D8~D15                                                                                              |
| Level Range | -10V~10V                                                                                                   |
| Logic Type  | TTL, CMOS, LVCMOS3.3, LVCMOS2.5, Custom                                                                    |
| Skew        | D0~D15: $\pm 1$ sampling interval<br>Digital to Analog: $\pm (1 \text{ sampling interval} + 1 \text{ ns})$ |

### SAG1021I Waveform Generator (optional)

|                          |                                                                             |
|--------------------------|-----------------------------------------------------------------------------|
| Channels                 | 1                                                                           |
| Max. Output Frequency    | 25 MHz                                                                      |
| Sampling Rate            | 125 MSa/s                                                                   |
| Frequency Resolution     | 1 $\mu$ Hz                                                                  |
| Frequency Accuracy       | $\pm 50$ ppm                                                                |
| Vertical Resolution      | 14 bit                                                                      |
| Amplitude Range          | -1.5 V ~ +1.5 V (into 50 $\Omega$ )<br>-3 V ~ +3 V (into High-Z)            |
| Waveforms                | Sine, Square, Ramp, Pulse, DC, Noise, 45 Arbitrary                          |
| Output Impedance         | 50 $\Omega \pm 2\%$                                                         |
| Protection               | Over voltage protection, Current limit                                      |
| Insulation Voltage       | $\pm 42$ Vpk                                                                |
| <b>Sine</b>              |                                                                             |
| Frequency                | 1 $\mu$ Hz ~ 25 MHz                                                         |
| Offset accuracy (10 kHz) | $\pm (1\% \text{ offset setting value} + 3 \text{ mVpp})$                   |
| Amplitude flatness       | $\pm 0.3$ dB, compare to 10 kHz, 5 Vpp                                      |
| SFDR                     | DC ~ 1 MHz -60 dBc<br>1 MHz ~ 5 MHz -55 dBc<br>5 MHz ~ 25 MHz -50 dBc       |
| Harmonic distortion      | DC ~ 5 MHz -50 dBc<br>5 MHz ~ 25 MHz -45 dBc                                |
| <b>Square/Pulse</b>      |                                                                             |
| Frequency                | 1 $\mu$ Hz ~ 10 MHz                                                         |
| Duty cycle               | 1% ~ 99%                                                                    |
| Edge                     | < 24 ns (10% ~ 90%)                                                         |
| Overshoot                | < 3% (typical, 1 kHz, 1 Vpp)                                                |
| Pulse width              | > 50 ns                                                                     |
| Jitter (cycle-cycle)     | < 500 ps + 10 ppm                                                           |
| <b>Ramp</b>              |                                                                             |
| Frequency                | 1 $\mu$ Hz ~ 300 kHz                                                        |
| Linearity                | < 0.1% of Pk-Pk (typical, 1 kHz, 1 Vpp, 50% symmetry)                       |
| Channels                 | 0% ~ 100%                                                                   |
| <b>DC</b>                |                                                                             |
| Offset range             | $\pm 1.5$ V (into 50 $\Omega$ )<br>$\pm 3$ V (into Hi-Z)                    |
| Accuracy                 | $\pm ( \text{setting value}  * 1\% + 3 \text{ mV})$                         |
| <b>Noise</b>             |                                                                             |
| Bandwidth (-3 dB)        | > 25 MHz                                                                    |
| <b>Arb</b>               |                                                                             |
| Frequency                | 1 $\mu$ Hz ~ 5 MHz                                                          |
| Waveform memory          | 16 kpts                                                                     |
| Sample rate              | 125 MSa/s                                                                   |
| Wave import              | From EasyWaveX, from U-disk, directly from waveform data of analog channels |

### I/O

|                     |                                                                                              |
|---------------------|----------------------------------------------------------------------------------------------|
| Standard            | 3 USB 2.0 Hosts, 1 USB 2.0 Device, 10M/100M LAN, AUX (Pass/Fail+Trigger Out), 10 MHz In/ Out |
| Pass/Fail           | 3.3 V TTL output                                                                             |
| Ext Trigger Channel | Ext $\leq 1.5$ Vrms, Ext/5 $\leq 7.5$ Vrms                                                   |

### Display

|              |                                            |
|--------------|--------------------------------------------|
| Display Type | 10.1" TFT LCD with capacitive touch screen |
|--------------|--------------------------------------------|

|            |                 |
|------------|-----------------|
| Resolution | 1024×600        |
| Contrast   | 500:1 typical   |
| Backlight  | 500 nit typical |

### Display Setting

|                      |                                                                                                                   |
|----------------------|-------------------------------------------------------------------------------------------------------------------|
| Range                | 8 x 10 grid                                                                                                       |
| Display Type         | Dot, vector                                                                                                       |
| Persistence Time     | OFF, 1 s, 5 s, 10 s, 30 s, infinite                                                                               |
| Color Display        | Normal, Color; Supports customer trace color                                                                      |
| Language             | Simplified Chinese, Traditional Chinese, English, French, Japanese, German, Spanish, Russian, Italian, Portuguese |
| Built-in Help System | Simplified Chinese, English                                                                                       |

### Environmental

|                               |                                                                                                                                    |                              |                                                                                                                                                        |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature                   | Operating: 0 °C ~ 40 °C<br>Non-operating: -20 °C ~ 60 °C                                                                           |                              |                                                                                                                                                        |
| Humidity                      | Operating: 85% RH, 40 °C , 24 hours<br>Non-operating: 85% RH, 65 °C, 24 hours                                                      |                              |                                                                                                                                                        |
| Altitude                      | Operating: ≤3,000 m<br>Non-operating: ≤15,000 m                                                                                    |                              |                                                                                                                                                        |
| Electromagnetic Compatibility | Meets EMC directive (2014/30/EU), meets or exceeds IEC 61326-1:2012/EN61326-1:2013 (Basic)                                         |                              |                                                                                                                                                        |
|                               | Conducted disturbance                                                                                                              | CISPR 11/EN 55011            | CLASS A group 1, 150kHz-30MHz                                                                                                                          |
|                               | Radiated disturbance                                                                                                               | CISPR 11/EN 55011            | CLASS A group 1, 30MHz-1GHz                                                                                                                            |
|                               | Electrostatic discharge (ESD)                                                                                                      | IEC 61000-4-2/EN 61000-4-2   | 4.0 kV (Contact) , 8.0 kV (Air)                                                                                                                        |
|                               | Radio-frequency electromagnetic field Immunity                                                                                     | IEC 61000-4-3/EN 61000-4-3   | 10 V/m (80 MHz to 1 GHz) ;<br>3 V/m (1.4 GHz to 2 GHz) ;<br>1 V/m (2.0 GHz to 2.7GHz)                                                                  |
|                               | Electrical fast transients (EFT)                                                                                                   | IEC 61000-4-4/EN 61000-4-4   | 2kV (Input AC Power Ports)                                                                                                                             |
|                               | Surges                                                                                                                             | IEC 61000-4-5/EN 61000-4-5   | 1kV (Line to line)<br>2kV (Line to ground)                                                                                                             |
|                               | Radio-frequency continuous conducted Immunity                                                                                      | IEC 61000-4-6/EN 61000-4-6   | 3 V, 0.15-80MHz                                                                                                                                        |
|                               | Voltage dips and interruptions                                                                                                     | IEC 61000-4-11/EN 61000-4-11 | Voltage Dips:<br>0% UT during half cycle;<br>0% UT during 1 cycle;<br>70% UT during 25/30 cycles<br>Voltage interruptions: 0% UT during 250/300 cycles |
| Safety                        | UL 61010-1:2012/R: 2018-11; CAN/CSA-C22.2 No. 61010-1:2012/A1:2018-11.<br>UL 61010-2-030:2018; CAN/CSA-C22.2 No. 61010-2-030:2018. |                              |                                                                                                                                                        |

### Power Supply

|                           |                                                       |
|---------------------------|-------------------------------------------------------|
| Input Voltage & Frequency | 100 ~ 240 Vrms 50/60Hz                                |
| Power consumption         | 100 W max., 70 W typical, 4 W typical in standby mode |

### Mechanical

|            |                                                |
|------------|------------------------------------------------|
| Dimensions | Length x Width x Height = 370 mm×144 mm×231 mm |
| Weight     | Net Weight: 4.0 kg<br>Gross Weight: 5.6 kg     |

## Ordering Information

| Model    | Description                   |
|----------|-------------------------------|
| SDS5104X | 1 GHz, 4 CH, 5 GSa/s (Max.)   |
| SDS5054X | 500 MHz, 4 CH, 5 GSa/s (Max.) |
| SDS5034X | 350 MHz, 4 CH, 5 GSa/s (Max.) |

| Standard Accessories       | Quantity  |
|----------------------------|-----------|
| USB cable                  | 1         |
| Quick start                | 1         |
| Passive probe (SP3050A)    | 1/channel |
| Certificate of calibration | 1         |
| Power cord                 | 1         |

| Optional Accessories                                           | Part No.                                                          |
|----------------------------------------------------------------|-------------------------------------------------------------------|
| 350 MHz to 500 MHz bandwidth upgrade (4-ch model) * (software) | SDS-5000X-4BW05                                                   |
| 500 MHz to 1 GHz bandwidth upgrade (4-ch model) (software)     | SDS-5000X-4BW10                                                   |
| Waveform generator (software)                                  | SDS-5000X-FG                                                      |
| 25 MHz isolated USB function/arbitrary waveform generator      | SAG1021I                                                          |
| 16 digital channels (software)                                 | SDS-5000X-16LA                                                    |
| 16-channel logic probe                                         | SPL2016                                                           |
| Power Analysis (software)                                      | SDS-5000X-PA                                                      |
| Power Analysis deskew fixture                                  | DF2001A                                                           |
| I2S trigger & decode (software)                                | SDS-5000X-I2S                                                     |
| MIL-STD-1553B trigger & decode (software)                      | SDS-5000X-1553B                                                   |
| FlexRay trigger & decode (software)                            | SDS-5000X-FlexRay                                                 |
| CAN FD trigger & decode (software)                             | SDS-5000X-CANFD                                                   |
| SENT trigger & decode (software)                               | SDS-5000X-SENT                                                    |
| Manchester decode (software)                                   | SDS-5000X-Manch                                                   |
| STB3 demo signal source                                        | STB3                                                              |
| 1 GHz active probe                                             | SAP1000                                                           |
| High voltage probe                                             | HPB4010                                                           |
| High voltage differential probe                                | DPB1300/DPB4080/DPB5150/DPB5150A/DPB5700/DPB5700A                 |
| Current probe                                                  | CPL5100/CP4020/CP4050/CP4070/CP4070A/CP5030/CP5030A/CP5150/CP5500 |
| Bag                                                            | BAG-S2                                                            |

\* SDS5034X cannot be upgraded to SDS5104X

## About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, isolated handheld oscilloscopes, function/arbitrary waveform generators, RF/MW signal generators, spectrum analyzers, vector network analyzers, digital multimeters, DC power supplies, electronic loads and other general purpose test instrumentation. Since its first oscilloscope was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement.

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