



**RIGOL**

# DS70000 Series

High-End Digital Oscilloscope

DataSheet  
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# DS70000 Series

## High-End Digital Oscilloscope

### N-in-1 Integrated Digital Oscilloscope

In today's integrated design field, a highly integrated comprehensive digital oscilloscope has become an important tool for design engineers. RIGOL's DS70000 series oscilloscope **integrates 5 independent instruments into 1** including a **digital oscilloscope**, **one spectrum analyzer**, **one digital voltmeter**, **one high precision frequency counter and totalizer**, and **one protocol analyzer**. The DS70000 series provides a comprehensive instrument that meets your actual test needs.

#### Digital Oscilloscope

- Bandwidth model: **3 GHz, 5 GHz**
- Up to **20 GSa/s** real-time sample rate
- **4 analog channels** and **1 EXT channel**
- Up to **2 Gpts** memory depth
- Maximum waveform capture rate of **1,000,000 wfms/s**

#### Digital Voltmeter

- 3-digit DC/ACRMS, AC+DCRMS voltage measurement
- Sounds an alarm for reaching or exceeding the limits

#### High-precision Frequency Counter and Totalizer

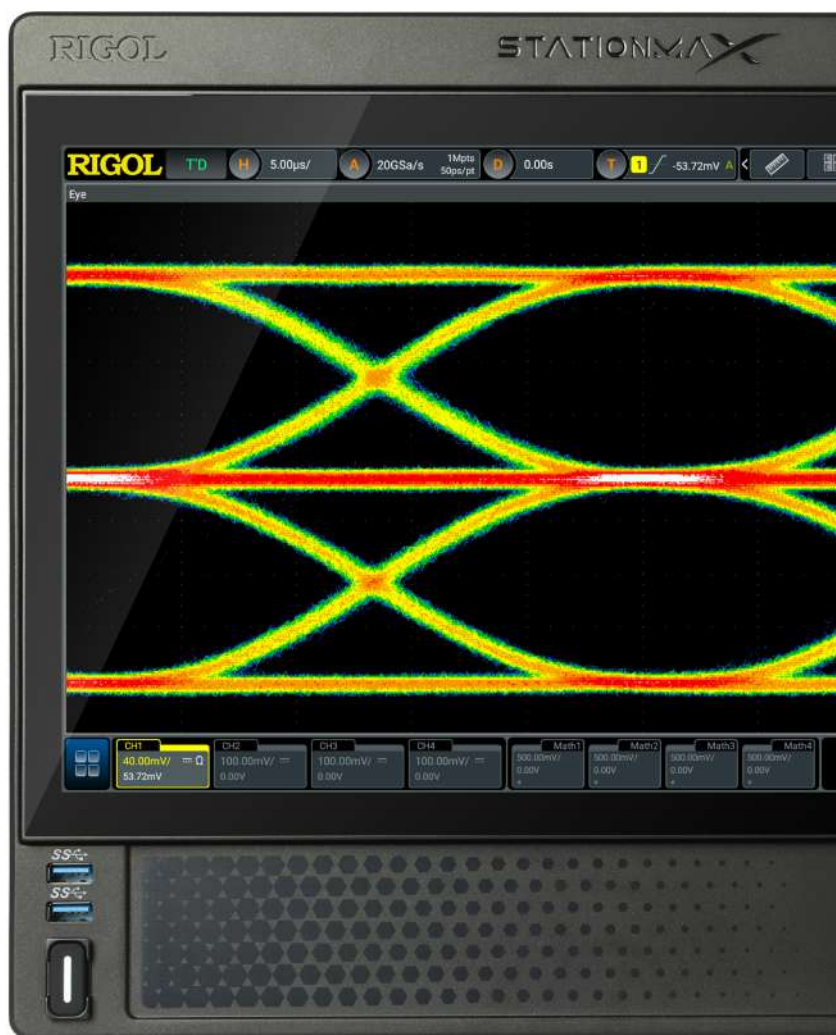
- 3 to 8-digit (selectable) high-precision frequency counter
- Supports the statistics on the maximum and minimum values of the frequency
- 48-bit totalizer (standard)

#### Real-Time Spectrum Analyzer(Optional)

- Standard configuration of enhanced FFT, real-time operation for max. 16 Mpts waveform data
- Max. frequency range: oscilloscope analog bandwidth
- Up to 4 groups of operations can be displayed at the same time
- Independent FFT color persistence view supported
- Up to 15 peaks available for the peak search function; event table available to be exported

#### Protocol Analyzer(Optional)

- Supports RS232/UART, I2C, SPI, CAN, LIN, I2S, FlexRay, and MIL-STD-1553 serial bus
- Supports analog channel trigger and decoding
- Works with waveform recording and pass/fail mask testing



### Unique UltraVision III Platform Delivers Industry-leading Performance

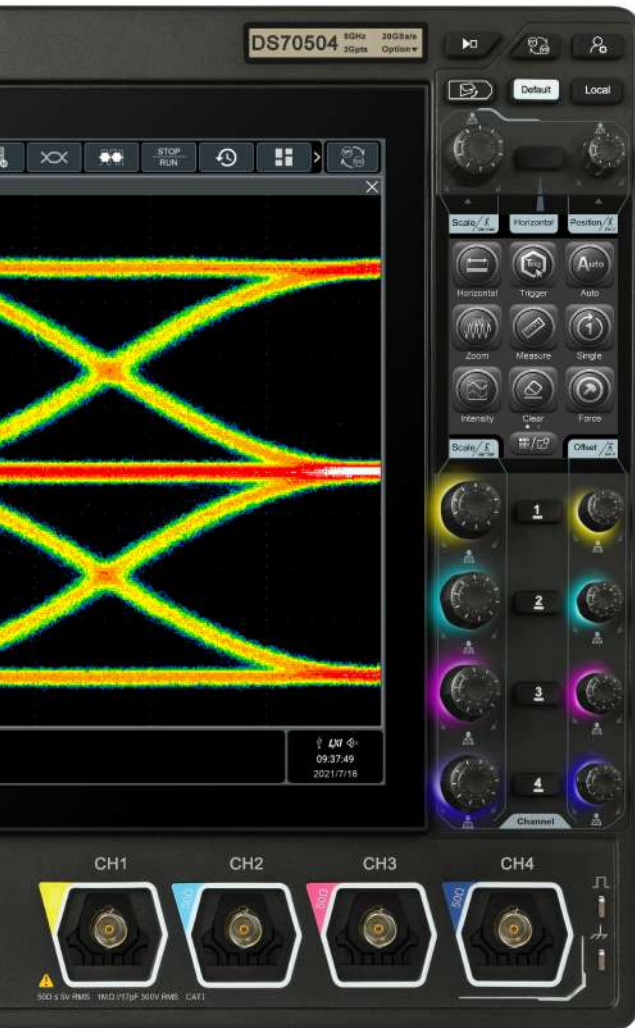
With RIGOL's unique UltraVision III platform built on our custom ASIC technology, the DS70000 series digital oscilloscope delivers industry leading performance specifications including **memory depth**, **waveform capture rate**, and **vertical resolution**. It supports analysis of serial data on computer, embedded, automotive, audio and additional bus types. UltraVision III also enables power integrity analysis as well as multi-domain debugging with simultaneous analysis of time domain and frequency domain signals. The DS70000 series fills an important need in high-speed signal integrity and debugging from R&D to industrial applications with capabilities including:

- **1 million wfms/s** update rate capable of capturing rare signal anomalies that you might otherwise miss.
- **Up to 2 Gpts memory depth** which makes long duration high speed captures possible.
- **8 to 16-bit** adjustable vertical resolution capable of accurately measuring low level signals.
- Real-time spectrum analysis (RTSA) capable of capturing up to **10,000 FFTs** per second so you don't miss small signal artifacts even in the RF domain.

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# DS70000 Series

## High-End Digital Oscilloscope



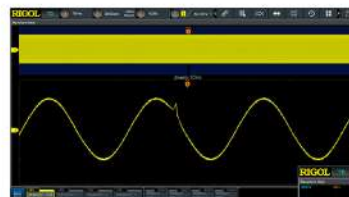
### Unique UltraVision III Platform Delivers Industry-leading Performance



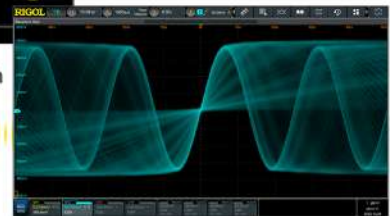
16-bit Vertical Resolution



10,000 Hardware Accelerated FFTs/s

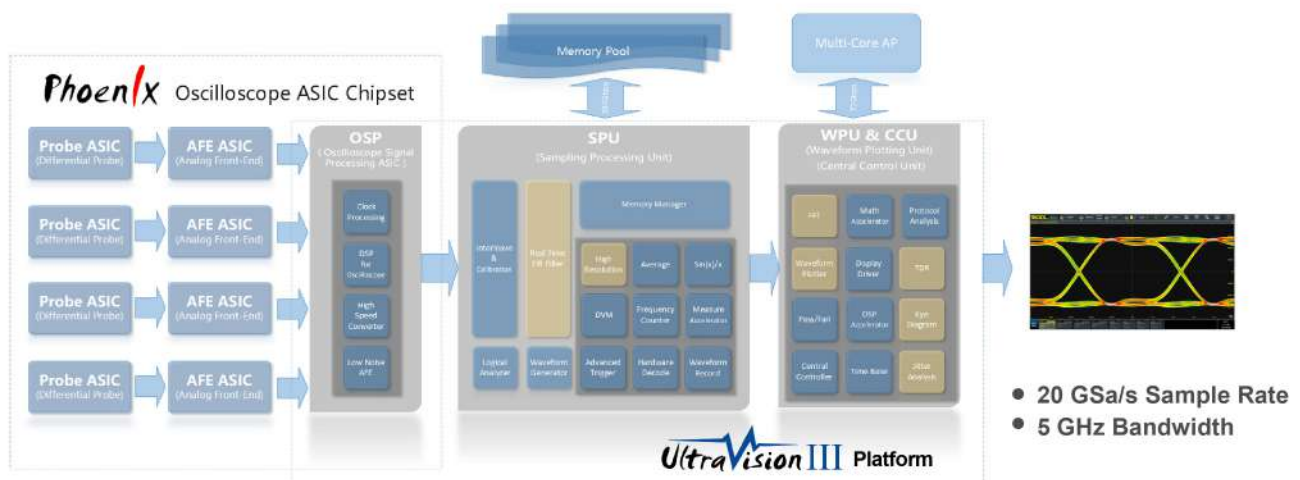


Up to 2 Gpts Memory Depth



1,000,000 wfms/s Capture Rate

### ASIC Chip Delivers Higher Bandwidth and Sample Rate



DS70000 series digital oscilloscope is equipped with "Phoenix" chip set, which delivers a max. of **20 GSa/s sample rate** and **5 GHz bandwidth** to better achieve signal fidelity, cover more application scenarios, and cater to the diversified application demands of the complex test system in the industry and R&D fields.

# DS70000 Series

## High-End Digital Oscilloscope

### Knob with Photoelectric Encoder Enables Long Service Life

The photoelectric encoder operating knob guarantees more than **100,000 times of pressing operation and 1 million times of rotation operation**, greatly improving the service life of the knob. As a frequently used component, the adjustment knobs are critical to reliability and longevity. With photoelectric encoders, you no longer have to worry about wear, ensuring reliable operation throughout the life of the instrument.



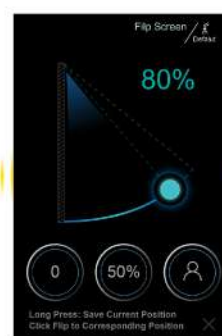
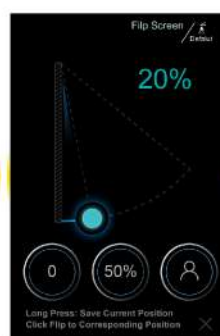
### Multiple External Interfaces

The DS70000 series provides a variety of external interfaces that improve usability and data access including **USB 3.0 Host and Device, LAN (LXI), HDMI, AUX OUT, 10 MHz IN, 10 MHz Out and GPIB (option) via the USB-GPIB adaptor**. For remote control over LAN, the DS70000 includes complete web control with web-based screen recording, a SCPI command interface, and ftp access to files stored on the instrument. The HDMI output supports use of an external monitor or video display.



### Brand New Appearance and User-friendly Design Bring an Extraordinary Human-Machine Interface Experience

The DS70000 series oscilloscope has a 7U full-rack structure that includes **two touch screens**. The main display is a 15.6-inch capacitive high-definition touch screen with one button electronic tilt. Multi-pane windowing supports a variety of simultaneous analysis tools, making it easier to view signals, measurements, and results. Meanwhile, the secondary 3.5-inch touch screen separates menus and functions from signals and analysis with a customized function and shortcut menu.



# DS70000 Series

## High-End Digital Oscilloscope

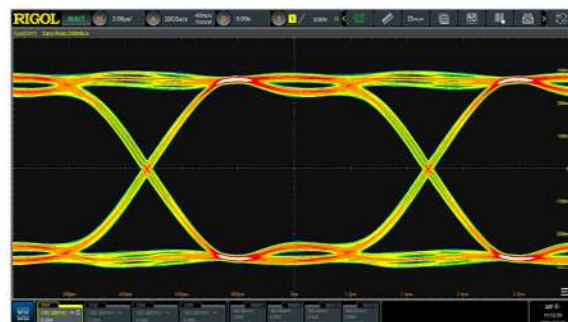


### Excellent Eye Diagram Pre-test and Jitter Analysis

#### ● Eye Diagram

Based on the excellent bandwidth and sample rate, DS70000 series oscilloscope provides the real-time eye plot and measurement with the clock recovery function, which can be applied to protocol conformance analysis.

After the DS70000-JITTER option has been purchased and activated, DS70000 series supports the eye measurement for all the analog channels, and also provides measurement for several parameters of the eye diagram: **eye height, eye width, eye amplitude, crossing percentage, and Q Factor**. It also supports various clock recovery methods, such as Constant (automatic, semi-automatic, and manual), First-order PLL, Second-order PLL, and Explicit, to meet the demands of customers for different application scenarios.



#### ● Jitter

DS70000 series oscilloscope provides flexible and convenient jitter measurement and analysis. After purchasing and activating the DS70000-JITTER option, you can accurately and quickly make deterministic jitter measurements for serial clock signals or parallel bus signals.

The jitter analysis is mainly used to measure and analyze the clock jitter. The DS70000 series can accomplish the following jitter analysis items. Among the items, TIE is the most commonly used jitter specification.

Support various clock recovery methods, including:

- **Constant:** Fully automatic, semi automatic, and manual
- **First-order PLL**
- **Second-order PLL**
- **Explicit**



To help engineers easily and conveniently resolve the jitter components within their signals, jitter measurements can be analyzed in multiple formats including the trend graph, spectrum graph, and histogram. The jitter analysis function enables **measurement and statistical analysis of uninterrupted bit sequences** to efficiently debug signal jitter on large quantities of data. The jitter trend graph and histogram create a quick view of the nature and source of signal jitter, simplifying the engineer's work.



Perform TIE measurements on the clock signal with the jitter and analyze the results through the trend graph and histogram.



### Electronic Label

The product model and its main parameters are displayed on the electronic label, sustaining its contents up to **20 years even at power-off state**. The parameters will be updated automatically after upgrade to keep the information displayed on the electronic label consistent with that of the current instrument. Users can get the updated product information in a timely manner through the electronic label.



# Product Features

## Product Features

- Analog channel bandwidth: Max. 5 GHz, 4 analog channels and 1 EXT channel
- Max. real-time sample rate: 20 GSa/s
- Max. memory depth: 2 Gpts
- Waveform capture rate >1,000,000 wfms/s
- Vertical sensitivity range: 1 mV/div~10 V/div (1 M $\Omega$ ), 1 mV/div~1 V/div (50  $\Omega$ )
- Timebase range: 50 ps/div~1000 s/div
- Up to 2,000,000 frames of hardware real-time and ceaseless waveforms recording and playback functions
- Integrates 5 independent instruments into 1, including digital oscilloscope, real-time spectrum analyzer (option), digital voltmeter, 8-digit frequency counter and totalizer, and protocol analyzer (option)
- Standard trigger functions: Edge trigger, Pulse trigger, Slope trigger, Video trigger, Pattern trigger, Duration trigger, Timeout trigger, Runt trigger, Window trigger, Delay trigger, Setup/ Hold trigger, Nth Edge trigger, RS232, I2C, SPI, CAN, FlexRay, LIN, I2S, and MIL-STD-1553
- A variety of serial decoding functions (option): RS232, I2C, SPI, CAN, FlexRay, LIN, I2S, MIL-STD-1553, and CAN-FD; supporting 4 decoding channels
- Auto measurement of 41 waveform parameters; full-memory hardware measurement function
- A variety of math operations: A+B, A-B, A $\times$ B, A/B, FFT, A&&B, A||B, A^B, !A, Intg, Diff, Lg, Ln, Exp, Sqrt, Abs, AX+B, LowPass, HighPass, BandPass, BandStop, built-in enhanced FFT analysis and peak search function
- Eye diagram and jitter analysis (option)
- Unique UltraVision III technical platform
- Multiple interfaces available: USB HOST&DEVICE, LAN(LXI), HDMI, AUX OUT; Web Control supported
- Main 15.6" HD capacitive multi-touch screen equipped with electronically controlled one-button screen inclination for signal visualization, analysis, and results; multi-window split screen display
- The photoelectric encoder operating knob prolongs its service life, guaranteeing more than 100,000 times of pressing operation and 1 million times of rotation operation, greatly improving its service life
- Secondary 3.5-inch touch screen separates menus and functions from signals and analysis with a customized function and shortcut menu
- Electronic label display of the model and main parameters of the product, sustaining the display contents up to 20 years, and capable to be updated when any option is upgraded
- Support online version upgrade
- 7 GHz high-end active differential probe PVA8700 (option)



## Product Features

DS70000 series digital oscilloscope utilizes RIGOL's chipset "Phoenix", delivering excellent performance with a maximum sample rate of 20 GSa/s, 5 GHz bandwidth. RIGOL's brand new UltraVison III technical platform guarantees the specifications to reach the advanced level in the industry, with the capture rate up to millions of waveforms per second, 2 Gpts memory depth, 8-16 bits adjustable resolution, and 10,000 FFTs/s. In addition to the improved hardware specifications, the DS70000 series digital oscilloscope has a main 15.6-inch HD capacitive multi-touch screen equipped with electronically controlled one-button screen inclination for signal visualization, analysis, and results; a secondary 3.5-inch small screen with a customized function and shortcut menu display; and other user-friendly designs, bringing users an extraordinary human-machine interface experience.

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# Overview of RIGOL's Medium and High-end Series Products

|                                       | MSO5000                                                                           | MSO/DS7000                                                                        | MSO8000                                                                            | DS70000                                                                             |
|---------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                       |  |  |  |  |
| Analog Channel                        | 2/4                                                                               | 4                                                                                 | 4                                                                                  | 4                                                                                   |
| Digital Channel                       | 16                                                                                | 16                                                                                | 16                                                                                 | N/A                                                                                 |
| Analog Bandwidth                      | 70 MHz to 350 MHz                                                                 | 100 MHz to 500 MHz                                                                | 600 MHz to 2 GHz                                                                   | 3 GHz to 5 GHz                                                                      |
| Max. Sample Rate                      | 8 GSa/s                                                                           | 10 GSa/s                                                                          | 10 GSa/s                                                                           | 20 GSa/s                                                                            |
| Max. Memory Depth                     | 200 Mpts (option)                                                                 | 500 Mpts (option)                                                                 | 500 Mpts                                                                           | 2 Gpts (option)                                                                     |
| Waveform Capture Rate                 | >500,000 wfms/s                                                                   | >600,000 wfms/s                                                                   | >600,000 wfms/s                                                                    | ≥1,000,000 wfms/s                                                                   |
| Max. Frames of Waveform Recording     | 450,000                                                                           | 450,000                                                                           | 450,000                                                                            | 2,000,000                                                                           |
| LCD                                   | 9" capacitive multi-touch screen                                                  | 10.1" capacitive multi-touch screen                                               | 10.1" capacitive multi-touch screen                                                | 15.6" capacitive multi-touch flip screen                                            |
| Hardware Mask Test                    | Standard                                                                          | Standard                                                                          | Standard                                                                           | Standard                                                                            |
| Built-in Arbitrary Waveform Generator | 2 CH, 25 MHz (option)                                                             | 2 CH, 25 MHz (option)                                                             | 2 CH, 25 MHz (option)                                                              | N/A                                                                                 |
| Built-in Digital Voltmeter            | Standard                                                                          | Standard                                                                          | Standard                                                                           | Standard                                                                            |
| Built-in Hardware Counter             | 6-digit frequency counter + totalizer                                             | 6-digit frequency counter + totalizer                                             | 6-digit frequency counter + totalizer                                              | 8-digit frequency counter + totalizer                                               |
| Search and Navigation                 | Standard, supporting table display                                                | Standard, supporting table display                                                | Standard, supporting table display                                                 | N/A                                                                                 |
| Power Analysis                        | Built-in UPA (option) + PC                                                        | Built-in UPA (option) + PC                                                        | Built-in UPA (option) + PC                                                         | N/A                                                                                 |
| Real-time Eye Diagram                 | N/A                                                                               | N/A                                                                               | Option                                                                             | Option                                                                              |
| Jitter Analysis                       | N/A                                                                               | N/A                                                                               | Option                                                                             | Option                                                                              |
| Serial Protocol Analysis              | RS232/UART, I2C, SPI, CAN, LIN, FlexRay, I2S, and MIL-STD-1553                    | RS232/UART, I2C, SPI, CAN, LIN, FlexRay, I2S, and MIL-STD-1553                    | RS232/UART, I2C, SPI, CAN, LIN, FlexRay, I2S, and MIL-STD-1553                     | RS232/UART, I2C, SPI, CAN, CAN-FD, LIN, FlexRay, I2S, MIL-STD-1553                  |
| Waveform Color Persistence            | Standard                                                                          | Standard                                                                          | Standard                                                                           | Standard                                                                            |
| Histogram                             | Standard                                                                          | Standard                                                                          | Standard                                                                           | N/A                                                                                 |



|                     | <b>MSO5000</b>                                   | <b>MSO/DS7000</b>                                | <b>MSO8000</b>                                   | <b>DS70000</b>                                   |
|---------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| <b>FFT</b>          | FFT, standard                                    | FFT, standard                                    | FFT, standard                                    | FFT, standard                                    |
| <b>MATH</b>         | Displays 4 functions at the same time            | Displays 4 functions at the same time            | Displays 4 functions at the same time            | Displays 4 functions at the same time            |
| <b>Connectivity</b> | standard: USB, LAN, and HDMI<br>option: USB-GPIB | standard: USB, LAN, and HDMI<br>option: USB-GPIB | standard: USB, LAN, and HDMI<br>option: USB-GPIB | standard: USB, LAN, and HDMI<br>option: USB-GPIB |



# RIGOL Probes and Accessories Supported by the DS70000 Series

## RIGOL Passive Probes

| Model                                                                                          | Type                 | Description                                                                                                                                                               |
|------------------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>PVP2150   | High-impedance Probe | <ul style="list-style-type: none"> <li>1X BW: DC~35 MHz</li> <li>10X BW: DC~150 MHz</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul> |
| <br>PVP2350   | High-impedance Probe | <ul style="list-style-type: none"> <li>1X BW: DC~35 MHz</li> <li>10X BW: DC~350 MHz</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul> |
| <br>RP3500A | High-impedance Probe | <ul style="list-style-type: none"> <li>BW: DC~500 MHz</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul>                               |
| <br>RP5600A | High-impedance Probe | <ul style="list-style-type: none"> <li>BW: DC~600 MHz</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul>                      |
| <br>RP6150A | Low-impedance Probe  | <ul style="list-style-type: none"> <li>BW: DC~1.5 GHz</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul>                      |



| Model                                                                                        | Type               | Description                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>RP1300H | High-Voltage Probe | <ul style="list-style-type: none"> <li>BW: DC~300 MHz</li> <li>CAT I 2000 V (DC+AC)</li> <li>CAT II 1500 V (DC+AC)</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul>                      |
| <br>RP1010H | High-Voltage Probe | <ul style="list-style-type: none"> <li>BW: DC~40 MHz</li> <li>DC: 0~10 kV DC</li> <li>AC: pulse≤20 kVp-p</li> <li>AC: sine wave≤7 kVrms</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul> |
| <br>RP1018H | High-Voltage Probe | <ul style="list-style-type: none"> <li>BW: DC~150 MHz</li> <li>DC+AC Peak: 18 kV CAT II</li> <li>AC RMS: 12 kV CAT II</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul>                   |

#### RIGOL Active&Current Probes

| Model                                                                                          | Type                                       | Description                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>PVA8700 | Bandwidth Differential Probe               | <ul style="list-style-type: none"> <li>BW: DC~7 GHz</li> <li>30 V peak CAT I</li> <li>Compatibility: All models of DS70000 series</li> </ul>                                  |
| <br>PVA7250 | Single-ended/<br>Differential Active Probe | <ul style="list-style-type: none"> <li>BW: DC~2.5 GHz</li> <li>30 V peak CAT I</li> <li>Compatibility: MSO/DS7000, MSO8000, and DS70000 series</li> </ul>                     |
| <br>RP7150  | Single-ended/<br>Differential Active Probe | <ul style="list-style-type: none"> <li>BW: DC~1.5 GHz</li> <li>30 V peak CAT I</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul> |



| Model                                                                                          | Type                                          | Description                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>RP7080    | Single-ended/<br>Differential Active<br>Probe | <ul style="list-style-type: none"> <li>BW: DC~0.8 GHz</li> <li>30 V peak CAT I</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul>                                                                                                |
| <br>RP1000D   | High-Voltage<br>Differential Probe            | <ul style="list-style-type: none"> <li>BW: DC~25 MHz</li> <li>Max. voltage <math>\leq 7000</math> Vpp</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul>                                                                                  |
| <br>PHA0150   | High-Voltage<br>Differential Probe            | <ul style="list-style-type: none"> <li>BW: DC~70 MHz</li> <li>Max. voltage <math>\leq 1500</math> Vpp</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul>                                                                                  |
| <br>PHA1150 | High-Voltage<br>Differential Probe            | <ul style="list-style-type: none"> <li>BW: DC~100 MHz</li> <li>Max. voltage <math>\leq 1500</math> Vpp</li> <li>Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul>                                                                                 |
| <br>RP7150S | Single-ended Active<br>Probe                  | <ul style="list-style-type: none"> <li>BW: DC~1.5 GHz</li> <li>30 V peak CAT I</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul>                                                                                                |
| <br>RP7080S | Single-ended Active<br>Probe                  | <ul style="list-style-type: none"> <li>BW: DC~0.8 GHz</li> <li>30 V peak CAT I</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul>                                                                                                |
| <br>PCA1030 | Current Probe                                 | <ul style="list-style-type: none"> <li>BW: DC to 50 MHz (-3 dB)</li> <li>Max. continuous input range: 30ARMS</li> <li>Max. peak-peak current value: 50 A peak, non-continuous</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul> |



| Model                                                                                          | Type                            | Description                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>PCA2030   | Current Probe                   | <ul style="list-style-type: none"> <li>BW: DC to 100 MHz (-3 dB)</li> <li>Max. continuous input range: 30ARMS</li> <li>Max. peak-peak current value: 50 A peak, non-continuous</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul>                                            |
| <br>PCA1150   | Current Probe                   | <ul style="list-style-type: none"> <li>BW: DC to 10 MHz (-3 dB)</li> <li>Max. continuous input range: 150 A</li> <li>Max. peak-peak current value: 300 A (non-continuous), 500 A (pulse width <math>\leq 30 \mu s</math>)</li> <li>Compatibility: MSO/DS4000, DS6000, MSO/DS7000, MSO8000, and DS70000 series</li> </ul> |
| <br>RP1001C   | Current Probe                   | <ul style="list-style-type: none"> <li>BW: DC~300 kHz</li> <li>Maximum Input<br/>AC: <math>\pm 100</math> A<br/>AC P-P: 200 A<br/>AC RMS: 70 A</li> <li>Compatibility: All models of <b>RIGOL's</b> digital oscilloscopes</li> </ul>                                                                                     |
| <br>RP1002C | Current Probe                   | <ul style="list-style-type: none"> <li>BW: DC~1 MHz</li> <li>Maximum Input<br/>AC: <math>\pm 70</math> A<br/>AC P-P: 140 A<br/>AC RMS: 50 A</li> <li>Compatibility: All models of <b>RIGOL's</b> digital oscilloscopes</li> </ul>                                                                                        |
| <br>RP1025D | High-Voltage Differential Probe | <ul style="list-style-type: none"> <li>BW: 25 MHz</li> <li>Max. voltage <math>\leq 1400</math> Vpp</li> <li>Compatibility: All models of <b>RIGOL's</b> digital oscilloscopes</li> </ul>                                                                                                                                 |
| <br>RP1050D | High-Voltage Differential Probe | <ul style="list-style-type: none"> <li>BW: 50 MHz</li> <li>Max. voltage <math>\leq 7000</math> Vpp</li> <li>Compatibility: All models of <b>RIGOL's</b> digital oscilloscopes</li> </ul>                                                                                                                                 |



| Model                                                                                            | Type                            | Description                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>RP1100D</p> | High-Voltage Differential Probe | <ul style="list-style-type: none"> <li>• BW: 100 MHz</li> <li>• Max. voltage <math>\leq 7000</math> Vpp</li> <li>• Compatibility: All models of <b>RIGOL</b>'s digital oscilloscopes</li> </ul> |



# Specifications

All the specifications are guaranteed except the parameters marked with "Typical" and the oscilloscope needs to operate for more than 30 minutes under the specified operation temperature.

## Overview of the DS70000 Series Technical Specifications

| Overview of the DS70000 Series Technical Specifications                                      |                                                                                                                             |               |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------|
| Model                                                                                        | DS70504                                                                                                                     | DS70304       |
| Analog bandwidth (50 $\Omega$ , -3 dB) <sup>[1]</sup>                                        | 5 GHz                                                                                                                       | 3 GHz         |
| Analog bandwidth (1 M $\Omega$ , -3 dB)                                                      | 500 MHz                                                                                                                     |               |
| Calculated Rising Time under 50 $\Omega$<br>(single-channel <sup>[1]</sup> 10%-90%, typical) | $\leq 108$ ps                                                                                                               | $\leq 130$ ps |
| No. of Input Channels                                                                        | 4 analog channel inputs<br>1 EXT channel input                                                                              |               |
| Sampling Mode                                                                                | Real-time Sampling                                                                                                          |               |
| Max. Sample Rate of Analog Channel                                                           | single-channel <sup>[1]</sup> : 20 GSa/s<br>half-channel <sup>[2]</sup> /all-channel: 10 GSa/s                              |               |
| Max. Memory Depth                                                                            | Standard: 500 Mpts<br>Option: 2 Gpts (single-channel <sup>[1]</sup> ), 1 Gpts (half-channel <sup>[2]</sup> /all-channel)    |               |
| Max. Waveform Capture Rate <sup>[3]</sup>                                                    | $\geq 1,000,000$ wfms/s                                                                                                     |               |
| Vertical Resolution                                                                          | (selectable) 8-16 bits                                                                                                      |               |
| Hardware Real-time Waveform Recording and Playing                                            | Max. 2,000,000 frames (single-channel <sup>[1]</sup> )                                                                      |               |
| Peak Detection                                                                               | capture 200 ps glitches                                                                                                     |               |
| LCD Size and Type                                                                            | 15.6-inch capacitive multi-touch flip screen/gesture enabled operation, 3.5-inch user-defined keyboard control touch screen |               |
| Display Resolution                                                                           | 1920×1080, 480×320                                                                                                          |               |



## Vertical System Analog Channel

| Vertical System Analog Channel            |                                                                                                                                                             |                                                                                                                                                                            |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Coupling                            | DC, AC, or GND                                                                                                                                              |                                                                                                                                                                            |
| Input Impedance                           | 1 M $\Omega$ $\pm$ 1%, 50 $\Omega$ $\pm$ 2.5%                                                                                                               |                                                                                                                                                                            |
| Input Capacitance                         | 17 pF $\pm$ 3 pF                                                                                                                                            |                                                                                                                                                                            |
| Probe Attenuation Coefficient             | 0.001X, 0.002X, 0.005X, 0.01X, 0.02X, 0.05X, 0.1X, 0.2X, 0.5X, 1X, 2X, 5X, 10X, 20X, 50X, 100X, 200X, 500X, 1000X, 2000X, 5000X, 10000X, 20000X, and 50000X |                                                                                                                                                                            |
| Probe Recognition                         | Auto-recognized RIGOL probe                                                                                                                                 |                                                                                                                                                                            |
| Maximum Input Voltage                     | 1 M $\Omega$                                                                                                                                                | 30 V <sub>rms</sub> or $\pm$ 40 V <sub>max</sub> (DC + V <sub>peak</sub> )                                                                                                 |
|                                           | 50 $\Omega$                                                                                                                                                 | 5 V <sub>rms</sub>                                                                                                                                                         |
|                                           |                                                                                                                                                             | The probe allows a higher voltage test technically. The standard probe RP3500A 10:1 supports 300 V <sub>rms</sub> or $\pm$ 400 V <sub>max</sub> (DC + V <sub>peak</sub> ). |
|                                           | Remarks                                                                                                                                                     | Whether the probe is used, the 50 $\Omega$ or 1 M $\Omega$ route does not allow transient overvoltage to occur.                                                            |
|                                           |                                                                                                                                                             | Please use the instrument dedicated for the specified measurement category (not applicable to CAT II, III, and IV)                                                         |
| Vertical Resolution                       | 8 bits                                                                                                                                                      |                                                                                                                                                                            |
|                                           | 9-16 bits (selectable) (high-resolution sample mode)                                                                                                        |                                                                                                                                                                            |
| Vertical Sensitivity Range <sup>[4]</sup> | 1 M $\Omega$                                                                                                                                                | 1 mV/div~10 V/div                                                                                                                                                          |
|                                           | 50 $\Omega$                                                                                                                                                 | 1 mV/div~1 V/div                                                                                                                                                           |
| Offset Range                              |                                                                                                                                                             | $\pm$ 1 V (1 mV/div ~ 50 mV/div)                                                                                                                                           |
|                                           | 1 M $\Omega$                                                                                                                                                | $\pm$ 30 V (51 mV/div ~ 260 mV/div)                                                                                                                                        |
|                                           |                                                                                                                                                             | $\pm$ 100 V (265 mV/div ~ 10 V/div)                                                                                                                                        |
|                                           | 50 $\Omega$                                                                                                                                                 | $\pm$ 1 V (1 mV/div~100 mV/div)<br>$\pm$ 4 V (102 mV/div~1 V/div)                                                                                                          |
| Dynamic Range                             | $\pm$ 5 div (8 bits)                                                                                                                                        |                                                                                                                                                                            |
| Bandwidth Limit (Typical)                 | 1 M $\Omega$                                                                                                                                                | 20 MHz, 250 MHz                                                                                                                                                            |
|                                           | 50 $\Omega$                                                                                                                                                 | 20 MHz, 250 MHz, 1 GHz or 2 GHz                                                                                                                                            |



## Vertical System Analog Channel

|                                 |                                                  |
|---------------------------------|--------------------------------------------------|
| DC Gain Accuracy <sup>[4]</sup> | ± 2% of full scale                               |
| DC Offset Accuracy              | >200 mV/div (±0.1 div±2 mV±1.5% of offset value) |
|                                 | >200 mV/div (±0.1 div±2 mV±1.0% of offset value) |
| Channel-to-Channel Isolation    | ≥100:1 (from DC to 1 GHz), ≥30:1 (> 1 GHz)       |
| ESD Tolerance                   | ±8 kV                                            |

## Horizontal System--Analog Channel

### Horizontal System--Analog Channel

|                                               |                                                                  |                                                                                                          |
|-----------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Range of Time Base                            | 50 ps/div~1 ks/div                                               | 100 ps/div~1 ks/div                                                                                      |
|                                               | Fine                                                             |                                                                                                          |
| Time Base Resolution                          | 0.5 ps                                                           |                                                                                                          |
| Time Base Accuracy                            | ±0.5 ppm ± 1 ppm/year                                            |                                                                                                          |
| Time Base Delay Range                         | before triggering                                                | ≥ 1/2 screen width                                                                                       |
|                                               | after triggering                                                 | 1 s or 100 div, whichever is greater                                                                     |
| Time Interval (ΔT) Measurement (using Cursor) | ±(Time Base Accuracy x Readout) ± (0.001 x Screen Width) ± 20 ps |                                                                                                          |
| Inter-channel Offset Correction Range         | Inter-channel Offset Calibration Range ±100 ns, Accuracy±1 ps    |                                                                                                          |
| Analog Channel-to-Channel Delay (Typical)     | ≤50 ps <sup>[5]</sup>                                            |                                                                                                          |
| Horizontal Mode                               | YT                                                               | Default                                                                                                  |
|                                               | XY                                                               | Channel 1/2/3/4                                                                                          |
|                                               | SCAN                                                             | Time base ≥200 ms/div                                                                                    |
|                                               | ROLL                                                             | Time base ≥50 ms/div, available to enter or exit the ROLL mode by adjusting the horizontal timebase knob |



## Acquisition System

### Acquisition System

|                                     |                                                                                                                          |                                                     |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Max. Sample Rate of Analog Channel  | 20 GSa/s (single-channel <sup>[1]</sup> ), 10 GSa/s (half-channel <sup>[2]</sup> /all-channel)                           |                                                     |
| Max. Memory Depth of Analog Channel | Standard: 500 Mpts<br>Option: 2 Gpts (single-channel <sup>[1]</sup> ), 1 Gpts (half-channel <sup>[2]</sup> /all-channel) |                                                     |
| Acquisition Mode                    | Normal                                                                                                                   | Default                                             |
|                                     | Peak Detection                                                                                                           | capture 200 ps glitches                             |
|                                     | Average Type                                                                                                             | 2, 4, 8, 16...65536 are available for you to choose |
|                                     | High Resolution                                                                                                          | 9-16 bits                                           |

## Vertical Resolution

### Vertical Resolution

| Resolution |          | 9 bits | 10 bits | 12 bits | 14 bits | 16 bits |
|------------|----------|--------|---------|---------|---------|---------|
| Bandwidth  | 20 GSa/s | 2 GHz  | 1 GHz   | 500 MHz | 200 MHz | 75 MHz  |
|            | 10 GSa/s | 1 GHz  | 500 MHz | 250 MHz | 100 MHz | 50 MHz  |

## Trigger System

### Trigger System

|                  |                                         |                                                                            |
|------------------|-----------------------------------------|----------------------------------------------------------------------------|
| Trigger Source   | Analog channel (1~4), EXT TRIG, AC Line |                                                                            |
| Trigger Mode     | Auto, Normal, Single                    |                                                                            |
| Trigger Coupling | DC                                      | DC coupling trigger                                                        |
|                  | AC                                      | AC coupling trigger                                                        |
|                  | High Frequency Rejection                | High frequency rejection, cut-off frequency~75 kHz (internal trigger only) |
|                  | Low Frequency Rejection                 | Low frequency rejection, cut-off frequency~75 kHz (internal trigger only)  |



## Trigger System

|                     |                          |                                                                                                                                                          |
|---------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Noise Rejection     |                          | Increase delay for the trigger circuit (internal trigger only), on/off                                                                                   |
| Holdoff Range       |                          | 8 ns to 10 s                                                                                                                                             |
| Trigger Bandwidth   | Internal Trigger         | Analog Bandwidth                                                                                                                                         |
|                     | External Trigger         | 200 MHz                                                                                                                                                  |
| Trigger Sensitivity | Internal Trigger         | 0.5 div, $\geq 50$ mV/div<br>enable the noise rejection, 0.7 div                                                                                         |
|                     | External Trigger         | 200 mVpp, DC~100 MHz<br>500 mVpp, 100 MHz~200 MHz                                                                                                        |
| EXT TRIG            | Input Impedance          | $1\text{M}\Omega \pm 1\%$ , SMA connector                                                                                                                |
|                     | Trigger Jitter (Typical) | $< 200 \text{ pS}_{\text{RMS}}$ (single-channel <sup>[1]</sup> )<br>Normal acquisition, Edge trigger, trigger level located near 50% of EXT input signal |
| Trigger Level Range | Internal Trigger         | $\pm 5$ div from the center of the screen                                                                                                                |
|                     | External Trigger         | $\pm 5 \text{ V}$                                                                                                                                        |
|                     | AC Line                  | fixed 40%-60%                                                                                                                                            |

## Trigger Type

### Trigger Type

|              |                                                                                                                                                                                                                                                                                      |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trigger Type | Standard: Edge trigger, Pulse trigger, Slope trigger, Video trigger, Pattern trigger, Duration trigger, Timeout trigger, Runt trigger, Window trigger, Delay trigger, Setup/Hold trigger, Nth Edge trigger<br>Option: RS232/UART, I2C, SPI, CAN, FlexRay, LIN, I2S, and MIL-STD-1553 |
| Edge         | Triggers on the threshold of the specified edge of the input signal. The edge types can be Rising, Falling, or Either.<br>Source channel: CH1~CH4, EXT, or AC Line                                                                                                                   |



## Trigger Type

|            |                                                                                                                                                                                                                                                                                                                                                              |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pulse      | Triggers on the positive or negative pulse with a specified width. The pulse width is greater or smaller than a certain value or within a certain time range.<br>Source channel: CH1~CH4                                                                                                                                                                     |
| Slope      | Triggers on the positive or negative slope of the specified time. The slew time is greater or smaller than a certain value or within a certain time range (200 ps~10 s).<br>Source channel: CH1~CH4                                                                                                                                                          |
| Video      | Triggers on all lines, specified line, add field, or even field that conforms to the video standards. The supported video standards include NTSC, PAL/SECAM, 480p/60Hz, 576p/50Hz, 720p/60Hz, 720p/50Hz, 720p/30Hz, 720p/25Hz, 720p/24Hz, 1080p/60Hz, 1080p/50Hz, 1080p/30Hz, 1080p/25Hz, 1080p/24Hz, 1080i/60Hz, and 1080i/50Hz.<br>Source channel: CH1~CH4 |
| Pattern    | Identifies a trigger condition by searching for a specified pattern. The pattern is a combination of multiple selected channel sources. The logic pattern of each channel is H, L, X, Rising, or Falling.<br>Source channel: CH1~CH4                                                                                                                         |
| Duration   | Triggers when the specified pattern meets the specified duration condition. The pattern is a combination of multiple selected channel sources. The logic pattern of each channel is H, L, and X. The duration is greater or smaller than a certain value, or within a certain time range, or outside a certain time range.<br>Source channel: CH1~CH4        |
| Timeout    | Triggers when duration of a certain event exceeds the specified time (200 ps~10 s). The event can be specified as Rising, Falling, or Either.<br>Source channel: CH1~CH4                                                                                                                                                                                     |
| Runt       | Triggers when the pulses pass through one threshold but fail to pass through another threshold.<br>Source channel: CH1~CH4                                                                                                                                                                                                                                   |
| Window     | Triggers in a specified window state when the rising edge of the signal crosses the upper threshold or the falling edge crosses the lower threshold. The window state can be Enter, Exit, or Time.<br>Source channel: CH1~CH4                                                                                                                                |
| Delay      | Triggers when the time difference between the specified edges of Source A and Source B meets the preset time. The duration is greater or smaller than a certain value, or within a certain time range, or outside a certain time range.<br>Source channel: CH1~CH4                                                                                           |
| Setup/Hold | When the setup time or hold time between the input clock signal and the data signal is smaller than the specified time (200 ps~10 s).<br>Source channel: CH1~CH4                                                                                                                                                                                             |



| Trigger Type        |                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nth Edge            | <p>Triggers on the Nth edge that appears after the specified idle time. The edge can be specified as Rising or Falling.</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                                                          |
| RS232/UART (Option) | <p>DS70000-EMBDA option</p> <p>Triggers on the Start, Error, Check Error, or Data frame of the RS232/UART bus (up to 20 Mb/s).</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                                                   |
| I2C (Option)        | <p>DS70000-EMBDA option</p> <p>Triggers on the Start, Stop, Restart, MissedACK, Address (7 bits, 8 bits, or 10 bits), Data, or Address Data of the I2C bus.</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                      |
| SPI (Option)        | <p>DS70000-EMBDA option</p> <p>Triggers on the specified pattern of the specified data width (4~32) of SPI bus. CS and Timeout are supported.</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                                    |
| CAN (Option)        | <p>DS70000-AUTOA option</p> <p>Triggers on the start of a frame, end of a frame, Remote ID, Overload, Frame ID, Frame Data, Data&amp;ID, Frame Error, Bit Fill, Answer Error, Check Error, Format Error, and Random of the CAN signal (up to 10 Mb/s). The supported CAN bus signal types include CAN_H, CAN_L, TX/RX, and DIFF.</p> <p>Source channel: CH1~CH4</p> |
| FlexRay (Option)    | <p>DS70000-AUTOA option</p> <p>Triggers on the specified position (TSS End, FSS_BSS End, FES End, DTS End), frame (null, Syn, Start, All), symbol (CAS/MTS and WUS), error (Head CRC Err, Tail CRC Err, Decode Err, and Random Err) of the FlexRay signal (up to 10 Mb/s).</p> <p>Source channel: CH1~CH4</p>                                                       |
| LIN (Option)        | <p>DS70000-AUTOA option</p> <p>Triggers on the Sync, ID, Data (length settable), Data&amp;ID, Wakeup, Sleep, and Error of the LIN bus signal (up to 20 Mb/s).</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                    |
| I2S (Option)        | <p>DS70000-AUDIOA option</p> <p>Triggers on 2's complement data of audio left channel, right channel, or either channel (=, ≠, &gt;, &lt;, &lt;&gt;, &gt;&lt;). The available alignment modes include I2S, LJ, and RJ.</p> <p>Source channel: CH1~CH4</p>                                                                                                           |

## Trigger Type

|                          |                                                                                                                                                                                                        |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MIL-STD-1553<br>(Option) | DS70000-AEROA option<br>Triggers on Sync (Data Sync, Cmd/Status Sync, and All Sync), Data, RTA, RTA +11Bit, and Error (Sync Error and Check Error) of the MIL-STD-1553 bus.<br>Source channel: CH1~CH4 |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Noise Floor

### Noise floor at 50Ω

|            | 5 GHz                          | 3 GHz                          |
|------------|--------------------------------|--------------------------------|
| 1 mV/div   | 500 $\mu\text{V}_{\text{rms}}$ | 400 $\mu\text{V}_{\text{rms}}$ |
| 2 mV/div   | 500 $\mu\text{V}_{\text{rms}}$ | 400 $\mu\text{V}_{\text{rms}}$ |
| 5 mV/div   | 800 $\mu\text{V}_{\text{rms}}$ | 600 $\mu\text{V}_{\text{rms}}$ |
| 10 mV/div  | 900 $\mu\text{V}_{\text{rms}}$ | 680 $\mu\text{V}_{\text{rms}}$ |
| 20 mV/div  | 2 $\text{mV}_{\text{rms}}$     | 1.4 $\text{mV}_{\text{rms}}$   |
| 50 mV/div  | 5 $\text{mV}_{\text{rms}}$     | 3.5 $\text{mV}_{\text{rms}}$   |
| 100 mV/div | 8 $\text{mV}_{\text{rms}}$     | 5.6 $\text{mV}_{\text{rms}}$   |
| 200 mV/div | 20 $\text{mV}_{\text{rms}}$    | 15 $\text{mV}_{\text{rms}}$    |
| 500 mV/div | 40 $\text{mV}_{\text{rms}}$    | 28 $\text{mV}_{\text{rms}}$    |
| 1 V/div    | 60 $\text{mV}_{\text{rms}}$    | 35 $\text{mV}_{\text{rms}}$    |

### Noise floor at 1MΩ

|            |                                |
|------------|--------------------------------|
| 1 mV/div   | 500 $\mu\text{V}_{\text{rms}}$ |
| 2 mV/div   | 500 $\mu\text{V}_{\text{rms}}$ |
| 5 mV/div   | 600 $\mu\text{V}_{\text{rms}}$ |
| 10 mV/div  | 900 $\mu\text{V}_{\text{rms}}$ |
| 20 mV/div  | 2 $\text{mV}_{\text{rms}}$     |
| 50 mV/div  | 4 $\text{mV}_{\text{rms}}$     |
| 100 mV/div | 8 $\text{mV}_{\text{rms}}$     |
| 200 mV/div | 25 $\text{mV}_{\text{rms}}$    |



### Noise floor at 1M $\Omega$

|            |                       |
|------------|-----------------------|
| 500 mV/div | 30 mV <sub>rms</sub>  |
| 1 V/div    | 60 mV <sub>rms</sub>  |
| 2 V/div    | 110 mV <sub>rms</sub> |
| 5 V/div    | 300 mV <sub>rms</sub> |
| 10 V/div   | 600 mV <sub>rms</sub> |

### Waveform Measurement

#### Waveform Measurement

|                  |                   |                                                                                                                                            |
|------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Cursor           | Number of Cursors | 2 pairs of XY cursors                                                                                                                      |
|                  | Manual Mode       | Voltage deviation between cursors ( $\Delta Y$ )                                                                                           |
|                  |                   | Time deviation between cursors ( $\Delta X$ )                                                                                              |
|                  |                   | Reciprocal of $\Delta X$ (Hz) ( $1/\Delta X$ )                                                                                             |
|                  | Track Mode        | Fix Y-axis to track X-axis waveform point's voltage and time values<br>Fix X-axis to track Y-axis waveform point's voltage and time values |
| Auto Measurement |                   | Allow to display cursors during auto measurement                                                                                           |
| XY Mode          |                   | Measures the voltage parameters of the corresponding channel waveforms in XY time base mode.<br>X = Channel 1, Y = Channel 2               |



## Waveform Measurement

|                     |                        |                                                                                                                                                                                                    |
|---------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Auto<br>Measurement | Number of Measurements | 41 auto measurements; and up to 14 measurements can be displayed at a time.                                                                                                                        |
|                     | Measurement Source     | CH1-CH4, Math1-Math4                                                                                                                                                                               |
|                     | Measurement Mode       | Normal (realized by software, $\geq 1$ Mpts) and Precision (W); for Precision, only supported by analog channel                                                                                    |
|                     | Measurement Range      | Main, Zoom, Full-memory                                                                                                                                                                            |
|                     | All Measurement        | Displays 41 measurement items for the current measurement channel; the measurement results are updated continuously; you can switch the measurement channel.                                       |
|                     | Vertical               | Vmax, Vmin, Vpp, Vtop, Vbase, Vamp, Vupper, Vmid, Vlower, Vavg, VRMS, Per. VRMS, Overshoot, Preshoot, Area, and Period Area.                                                                       |
|                     | Horizontal             | Period, Frequency, Rise Time, Fall Time, +Width, -Width, +Duty, -Duty, Positive Pulse Count, Negative Pulse Count, Rising Edge Count, Falling Edge Count, Tvmax, Tvmin, +Slew Rate, and -Slew Rate |
|                     | Others                 | Delay(A↑-B↑), Delay(A↑-B↓), Delay(A↓-B↑), Delay(A↓-B↓), Phase(A↑-B↑), Phase(A↑-B↓), Phase(A↓-B↑), and Phase(A↓-B↓)                                                                                 |
|                     | Statistics             | Items: Current, Average, Max, Min, Standard Deviation, Count<br>Statistical times settable                                                                                                         |

## Waveform Calculation

### Waveform Calculation

|                       |                                                                                                                                   |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| No. of Math Functions | 4; 4 math functions available to be displayed at a time                                                                           |
| Operation             | A+B, A-B, A×B, A/B, FFT, A&&B, A  B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs, AX+B, LowPass, HighPass, BandPass, and BandStop |
| Color Grade           | Supporting FFT                                                                                                                    |



## Waveform Calculation

|     |               |                                                                                              |
|-----|---------------|----------------------------------------------------------------------------------------------|
| FFT | Record Length | Max. 1 Mpts                                                                                  |
|     | Window Type   | Rectangular, Blackman-Harris, Hanning (default), Hamming, Flattop, and Triangle.             |
|     | Peak Search   | A maximum of 15 peaks, confirmed by the settable threshold and offset threshold set by users |

## Enhanced FFT

### Enhanced FFT

|                  |                                                                                              |
|------------------|----------------------------------------------------------------------------------------------|
| Record Length    | Max. 64 Kpts                                                                                 |
| FFT Capture Rate | 10,000 wfms/s                                                                                |
| RBW              | Manual/Auto Set                                                                              |
| Window Type      | Rectangular, Blackman-Harris, Hanning (default), Hamming, Flattop, and Triangle.             |
| Peak Search      | A maximum of 15 peaks, confirmed by the settable threshold and offset threshold set by users |

## Waveform Analysis

### Waveform Analysis

|                    |                                                                                                                                                                                                                                                |                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Waveform Recording | Store the signal under test in segments according to the trigger events, i.g. save all the sampled waveform data as a segment to the RAM for each trigger event. The maximum number of the sampled segments reaches 2 million.                 |                                                                                                                            |
|                    | Source                                                                                                                                                                                                                                         | All enabled analog channels                                                                                                |
|                    | Analysis                                                                                                                                                                                                                                       | Support playing frame by frame or continuous playing; capable of calculating, measuring, and decoding the played waveforms |
| Pass/Fail Test     | Compare the signal under test with the user-defined mask to provide the test results: the number of successful tests, failed tests, and the total number of tests. The pass/fail event can enable immediate stop, beeper, and the screenshot.. |                                                                                                                            |
|                    | Source                                                                                                                                                                                                                                         | Any analog channel                                                                                                         |



## Waveform Analysis

|                                |                      |                                                                                                                                                                                                                                          |
|--------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                |                      | Provide a dimensional view for color grade waveforms, color grade >16, 256-level color scale display                                                                                                                                     |
| Color Grade                    | Source               | Any analog channel                                                                                                                                                                                                                       |
|                                | Color Theme          | Temperature and intensity                                                                                                                                                                                                                |
|                                | Mode                 | Support all modes                                                                                                                                                                                                                        |
| Real-time Eye Diagram (Option) | Source               | Any analog channel                                                                                                                                                                                                                       |
|                                | Clock Recovery       | Clock recovery for software, constant clock, first-order PLL, second-order PLL, and explicit clock                                                                                                                                       |
|                                | Type                 | Fully automatic, semi automatic, and manual                                                                                                                                                                                              |
|                                | Data Rate            | 1Mpts                                                                                                                                                                                                                                    |
|                                | Eye Measurement Item | one level, zero level, eye height, eye width, eye amplitude, crossing percentage, Q Factor, etc.                                                                                                                                         |
|                                |                      | Make measurements for the clock or data signal over time, analyze the variance of the technical specifications.                                                                                                                          |
| Jitter Analysis (Option)       | Source               | Any analog channel                                                                                                                                                                                                                       |
|                                | Clock Recovery       | Constant, PLL, and Explicit                                                                                                                                                                                                              |
|                                | Type                 | Fully automatic, semi automatic, and manual                                                                                                                                                                                              |
|                                | Jitter Analysis      | Jitter separation, including TJ (Total Jitter), RJ (Random Jitter), DJ (Deterministic Jitter), PJ (Periodic Jitter), DDJ (Data Dependent Jitter), DCD (Duty Cycle Distortion), ISI (Inter-symbol Interference), BR (Bit Ratio), and TIE. |
|                                | Measurement Display  | Trend, histogram, and spectrum                                                                                                                                                                                                           |

## Serial Decoding

### Serial Decoding

|                     |                                                                                                      |
|---------------------|------------------------------------------------------------------------------------------------------|
| Number of Decodings | 4, four protocol types can be decoded and enabled at the same time                                   |
| Decoding Type       | Standard: Parallel<br>Option: RS232/UART, I2C, SPI, LIN, CAN, CAN-FD, FlexRay, I2S, and MIL-STD-1553 |



## Serial Decoding

|            |                                                                                                                                                                                                                                                                                                                                                               |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parallel   | <p>Up to 4 bits of Parallel decoding, supporting any analog channel Support user-defined clock and auto clock settings.</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                                                    |
| RS232/UART | <p>DS70000-EMBDA option</p> <p>Decodes the RS232/UART (up to 20 Mb/s) bus's TX/RX data (5-9 bits), parity (Odd, Even, or None), and stop bits (1-2 bits)</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                   |
| I2C        | <p>DS70000-EMBDA option</p> <p>Decodes the address (with or without the R/W bit) of the I2C bus, data, and ACK.</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                                                            |
| SPI        | <p>DS70000-EMBDA option</p> <p>Decodes the MISO/MOSI data (4-32 bits) of the SPI bus. The available mode includes "Timeout" and "CS".</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                                                      |
| LIN        | <p>DS70000-AUTOA option</p> <p>Decodes the protocol version (1.X or 2.X) of the LIN bus (up to 20 Mb/s). The decoding displays sync, ID, data, and check sum.</p> <p>Source channel: CH1~CH4</p>                                                                                                                                                              |
| CAN        | <p>DS70000-AUTOA option</p> <p>Decodes the remote frame (ID, byte number, CRC), overload frame, and data frame (standard/extended ID, control domain, data domain, CRC, and ACK) of the CAN bus (up to 5 Mb/s). The supported CAN bus signal types include CAN_H, CAN_L, TX/RX, and DIFF.</p> <p>Supports CAN-FD decoding.</p> <p>Source channel: CH1~CH4</p> |
| FlexRay    | <p>DS70000-AUTOA option</p> <p>Decodes the frame ID, PL (payload), Header CRC, Cycle Count, Data, Tail CRC, and DTS of the FlexRay bus (up to 10 Mb/s). The supported signal types include BP, BM, and RX/TX.</p> <p>Source channel: CH1~CH4</p>                                                                                                              |



## Serial Decoding

|              |                                                                                                                                    |  |
|--------------|------------------------------------------------------------------------------------------------------------------------------------|--|
| I2S          | DS70000-AUDIOA option                                                                                                              |  |
|              | Decodes I2S audio bus left channel data and right channel data, supporting 4-32 bits. The alignment modes include I2S, LJ, and RJ. |  |
|              | Source channel: CH1~CH4                                                                                                            |  |
| MIL-STD-1553 | DS70000-AEROA option                                                                                                               |  |
|              | Decodes the MIL-STD-1553 bus signal's data word, command word, and status word (address+last 11 bits).                             |  |
|              | Source channel: CH1~CH4                                                                                                            |  |

## Auto

### Auto

|           |                                                                       |
|-----------|-----------------------------------------------------------------------|
| AutoScale | Min voltage greater than 10 mVpp, duty cycle 1%, frequency over 35 Hz |
|-----------|-----------------------------------------------------------------------|

## Digital Voltmeter

### Digital Voltmeter

|                   |                                                                                                                                  |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Source            | Any analog channel                                                                                                               |
| Function          | DC, AC+DC <sub>RMS</sub> , AC <sub>RMS</sub>                                                                                     |
| Resolution        | ACV/DCV: 3 bits                                                                                                                  |
| Limits Beeper     | Sounds an alarm when the voltage value is within or outside of the limit range                                                   |
| Range Measurement | Displays the latest measurement results in the form of a diagram, and display the extrema over the last 3 seconds; support Trend |

## High-precision Frequency Counter

### High-precision Frequency Counter

|                |                                       |                         |
|----------------|---------------------------------------|-------------------------|
| Source         | Any analog channel and EXT            |                         |
| Measure        | Frequency, period, totalizer          |                         |
| Counter        | Resolution                            | 3-8 digit, user-defined |
|                | Max. Frequency                        | Max. analog bandwidth   |
| Totalizer      | 48-bit totalizer                      |                         |
|                | Counts the number of the rising edges |                         |
| Time Reference | Internal reference                    |                         |



## Command Set

| Command Set                     |                    |
|---------------------------------|--------------------|
| Common Commands Support         | IEEE488.2 Standard |
| Error Message Definition        | Error messages     |
| Support Status Report Mechanism | Status Reporting   |
| Support Syn Mechanism           | Synchronization    |

## Display

| Display     |                                                                        |
|-------------|------------------------------------------------------------------------|
| LCD         | 15.6-inch capacitive multi-touch flip screen/gesture enabled operation |
| Resolution  | 1920×1080 (Screen Region) 16:9                                         |
| Graticule   | (10 vertical divisions) x 8 horizontal divisions                       |
| Persistence | Off, Infinite, variable persistence (100 ms to 10 s)                   |
| Brightness  | 256 intensity levels (LCD, HDMI)                                       |

## I/O

| I/O                |                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| USB3.0 Host        | 4 (2 on the front panel and 2 on the rear panel)                                                                                                     |
| USB3.0 Device      | 1, supporting TMC protocol                                                                                                                           |
| LAN                | 1 on the rear panel, 10/100/1000 Mbps, supporting LXI-C                                                                                              |
| Web Remote Control | Support Web Control interface (input the IP address of the oscilloscope into the Web browser to display the operation interface of the oscilloscope) |



## I/O

|                                 |                  |                                                                                                                                                                                                                           |
|---------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUX Out                         |                  | SMA output on the rear panel<br>$V_o (H) \geq 2.5 \text{ V}$ open circuit, $\geq 1.0 \text{ V}$ $50 \Omega$ to GND<br>$V_o (L) \leq 0.7 \text{ V}$ to load $\leq 4 \text{ mA}$ ; $\leq 0.25 \text{ V}$ $50 \Omega$ to GND |
|                                 | Trig Out         | Output a pulse signal when the oscilloscope is triggered                                                                                                                                                                  |
|                                 | Pass/Fail        | Output a pulse signal when a pass/fail event occurs.<br>Support user-defined pulse polarity and pulse time (10 ns~ 10 ms)                                                                                                 |
|                                 | Rise Time        | $\leq 1 \text{ ns}$                                                                                                                                                                                                       |
| 10 M<br>In/Out                  | Input Interface  | 1, SMA connector on the rear panel                                                                                                                                                                                        |
|                                 | Output Interface | 1, SMA connector on the rear panel                                                                                                                                                                                        |
|                                 | Input Mode       | $50 \Omega$ , with the amplitude 130 mVpp to 4.1 Vpp (-10 dBm, 20 dBm), the input accuracy $10 \text{ MHz} \pm 10 \text{ ppm}$                                                                                            |
|                                 | Output Mode      | $50 \Omega$ , 1.5 Vpp sine waveform                                                                                                                                                                                       |
| HDMI<br>Video Output            |                  | 1 on the rear panel, HDMI 1.4, A plug. used to connect to an external monitor or projector                                                                                                                                |
| Probe<br>Compensation<br>Output |                  | 1 kHz, 3Vpp Square                                                                                                                                                                                                        |

## Power

### Power

|               |                                                                |
|---------------|----------------------------------------------------------------|
| Power Voltage | 100 V-240 V, 45 Hz-440 Hz                                      |
| Power         | Max. 500 W (connect to various interfaces, USB, active probes) |
| Fuse          | 3.15 A, T degree, 250 V                                        |

## Environment

### Environment

|                      |               |                                                |
|----------------------|---------------|------------------------------------------------|
| Temperature<br>Range | Operating     | $-0^{\circ}\text{C} \sim +50^{\circ}\text{C}$  |
|                      | Non-operating | $-30^{\circ}\text{C} \sim +70^{\circ}\text{C}$ |



## Environment

|                |               |                                                |
|----------------|---------------|------------------------------------------------|
| Humidity Range | Operating     | below +30°C: ≤90% RH (without condensation)    |
|                |               | +30°C to +40°C, ≤75% RH (without condensation) |
|                |               | +40°C to +50°C, ≤45% RH (without condensation) |
| Altitude       | Non-operating | below 65°C: ≤90% RH (without condensation)     |
|                | Operating     | below 3,000                                    |
|                | Non-operating | below 15,000                                   |

## Warranty and Calibration Interval

### Warranty and Calibration Interval

|                                  |                                                                      |
|----------------------------------|----------------------------------------------------------------------|
| Warranty                         | Three years for the mainframe, excluding the probes and accessories. |
| Recommended Calibration Interval | 18 months                                                            |

## Regulations

| Regulations                   |                                                                                                                                                    |                                                                                                                                     |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Electromagnetic Compatibility | Compliant with EMC DIRECTIVE 2014/30/EU, compliant with or higher than the standards specified in IEC 61326-1:2013/EN 61326-1:2013 Group 1 Class A |                                                                                                                                     |
|                               | CISPR 11/EN 55011                                                                                                                                  |                                                                                                                                     |
|                               | IEC 61000-4-2:2008/EN 61000-4-2                                                                                                                    | ±4.0 kV (contact discharge), ±8.0 kV (air discharge)                                                                                |
|                               | IEC 61000-4-3:2002/EN 61000-4-3                                                                                                                    | 3 V/m (80 MHz to 1 GHz); 3 V/m (1.4 GHz to 2 GHz); 1 V/m (2.0 GHz to 2.7 GHz)                                                       |
|                               | IEC 61000-4-4:2004/EN 61000-4-4                                                                                                                    | 1 kV power line                                                                                                                     |
|                               | IEC 61000-4-5:2001/EN 61000-4-5                                                                                                                    | 0.5 kV (phase-to-neutral voltage); 1 kV (phase-to-earth voltage); 1 kV (neutral-to-earth voltage)                                   |
|                               | IEC 61000-4-6:2003/EN 61000-4-6                                                                                                                    | 3 V, 0.15-80 MHz                                                                                                                    |
|                               | IEC 61000-4-11:2004/EN 61000-4-11                                                                                                                  | Voltage dip: 0% UT during half cycle; 0% UT during 1 cycle ; 70% UT during 25 cycles<br>short interruption: 0% UT during 250 cycles |
| Safety                        | EN 61010-1:2019                                                                                                                                    |                                                                                                                                     |
|                               | EN 61010-031:2015                                                                                                                                  |                                                                                                                                     |
|                               | IEC 61010-1:2016                                                                                                                                   |                                                                                                                                     |
|                               | IEC 61010-2-030:2017                                                                                                                               |                                                                                                                                     |
|                               | UL 61010-1:2012 R7                                                                                                                                 |                                                                                                                                     |
|                               | UL 61010-2-31:2017 R2                                                                                                                              |                                                                                                                                     |
|                               | CAN/CSA-22.2 No. 61010-1-12:2017                                                                                                                   |                                                                                                                                     |
|                               | CAN/CSA-22.2 No. 61010-2-30:2018                                                                                                                   |                                                                                                                                     |
| Vibration                     | CAN/CSA-22.2 No. 61010-031-07:201                                                                                                                  |                                                                                                                                     |
|                               | Meets GB/T 6587; class 2 random<br>Meets MIL-PRF-28800F and IEC60068-2-6; class 3 random                                                           |                                                                                                                                     |



## Regulations

|       |                                                                                                                     |
|-------|---------------------------------------------------------------------------------------------------------------------|
| Shock | Meets GB/T 6587-2012; class 2 random                                                                                |
|       | Meets MIL-PRF-28800F and IEC 60068-2-27; class 3 random                                                             |
|       | In non-operating conditions: 30 g, half-sine wave, 11 ms duration, 3 shocks along the main axis, total of 18 shocks |

## Mechanical Characteristics

### Mechanical Characteristics

|      |                                 |
|------|---------------------------------|
| Size | 439mm (W)×310 mm (H)×491 mm (D) |
|------|---------------------------------|

|                |    |
|----------------|----|
| Rack Mount Kit | 7U |
|----------------|----|

|                       |                            |
|-----------------------|----------------------------|
| Weight <sup>[6]</sup> | Package excluded: <22.5 kg |
|                       | Package included: <29.5 kg |

## Non-volatile Memory

### Non-volatile Memory

|                    |               |                                                                                                                               |
|--------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------|
|                    | Setup/Image   | setup (*.stp), image (*.png, *.bmp, *.jpg)                                                                                    |
| Data/File Storage  | Waveform Data | CSV waveform data (*.csv), binary waveform data (*.bin), list data (*.csv), and reference waveform data (*.ref, *.csv, *.bin) |
| Reference Waveform |               | Displays 10 internal waveforms                                                                                                |
| Setting            |               | Storage is limited by the capacity                                                                                            |
| USB Capacity       |               | Supports the USB storage device that conforms to the industry standard                                                        |

## Note:

[1]: 5 GHz bandwidth is only applicable to single-channel mode. CH1 and CH2 are considered as a group; CH3 and CH4 are considered as another group. If one of the two channels in each group is enabled, it is called single-channel mode.

[2]: CH1 and CH2 are considered as a group; CH3 and CH4 are considered as another group. If two channels in either one of the groups are enabled, it is called half-channel mode.

[3]: Maximum value. single-channel, 5 ns horizontal time base, set a sine wave signal with 1 kpts memory depth, 4 div input amplitude, 10 MHz frequency. Others are default settings.

[4]: 1 mV/div and 2 mV/div are a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 1 mV/div and 2 mV/div sensitivity setting.



[5]: For any channel, under the same input impedance with DC-coupled, the Volts/div setting is the same for 100mV/div and 200mV/div.

[6]: Standard configuration.



# Order Information and Warranty Period

## Order Information

| Order Information                                                   | Order No.      |
|---------------------------------------------------------------------|----------------|
| <b>Model</b>                                                        |                |
| 3 GHz, 20 GSa/s, 500 Mpts, 4CH High-End DS                          | DS70304        |
| 5 GHz, 20 GSa/s, 500 Mpts, 4CH High-End DS                          | DS70504        |
| <b>Standard Accessories</b>                                         |                |
| Power Cord Conforming to the Standard of the Destination Country    | — —            |
| USB Cable                                                           | — —            |
| 4 Passive HighZ Probes (500 MHz)                                    | RP3500A        |
| <b>Recommended Accessories</b>                                      |                |
| Active Differential Probe (3.5 GHz BW)                              | PVA8350        |
| Active Differential Probe (5 GHz BW)                                | PVA8500        |
| Active Differential Probe (7 GHz BW)                                | PVA8700        |
| Current Probe (50 MHz, 30A)                                         | PCA1030        |
| Current Probe (100 MHz, 30A)                                        | PCA2030        |
| Current Probe (100 MHz, 150A)                                       | PCA1150        |
| High-Voltage Differential Probe (75 MHz, 1400 V)                    | PHA0150        |
| High-Voltage Differential Probe (100 MHz, 1400 V)                   | PHA1150        |
| USB-GPIB Interface Converter                                        | USB-GPIB       |
| <b>Upgrade Option</b>                                               |                |
| 2 Gpts Memory Depth Upgrade Option                                  | DS70000-RL-20  |
| <b>Serial Protocol Analysis Option</b>                              |                |
| Embedded Serial Bus Trigger and Analysis (RS232/UART, I2C, and SPI) | DS70000-EMBDA  |
| Auto Serial Bus Trigger and Analysis (CAN, CAN-FD, LIN, FlexRay)    | DS70000-AUTOA  |
| Audio Serial Bus Trigger and Analysis (I2S)                         | DS70000-AUDIOA |
| Aerospace Serial Bus Trigger and Analysis (MIL-STD-1553)            | DS70000-AEROA  |
| <b>Measurement Application Option</b>                               |                |
| Advanced Eye Diagram and Jitter Analysis (Option)                   | DS70000-JITTA  |
| <b>Pre-compliance Test Software</b>                                 |                |
| USB2.0 Pre-compliance Test                                          | DS70000-USBC   |
| 100Base-T Ethernet Pre-compliance Test                              | DS70000-ENETC  |



## Order Information

## Order No.

### Real-Time Spectrum Analysis (RTSA)

RTSA

DS70000-RTSA

### Note:

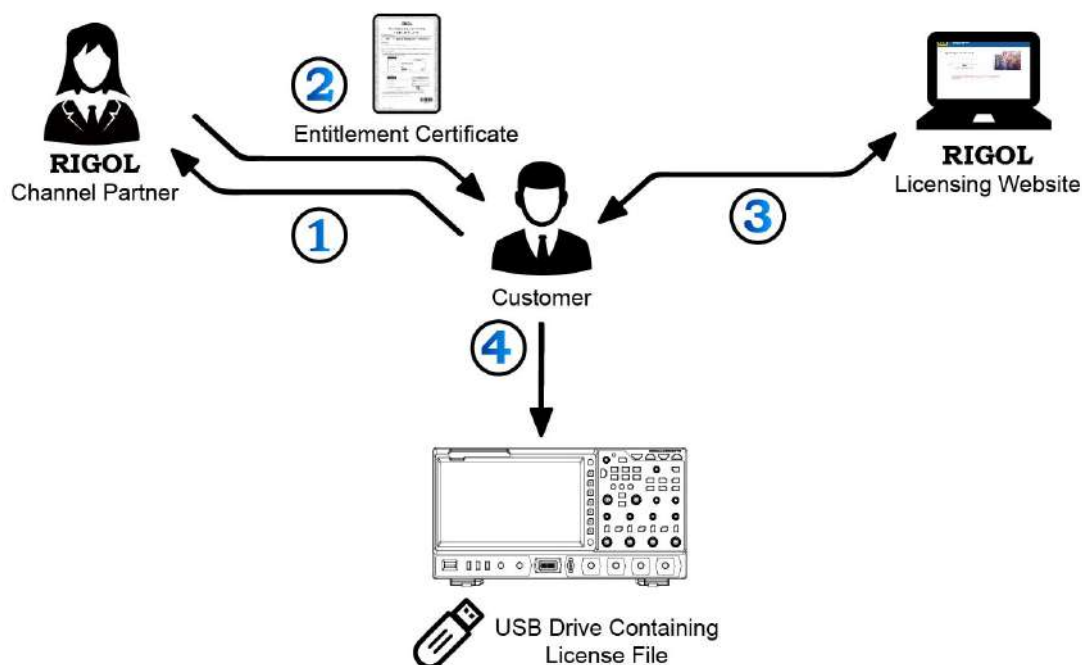
For all the mainframes, accessories and options, please contact the local office of **RIGOL**.

## Warranty Period

Three years for the mainframe, excluding the probes and accessories.



# Option Ordering and Installation Process



1. According to the usage requirements, please purchase the corresponding functional options from your local **RIGOL Channel Partner**, and provide the serial number of the instrument that needs to install the option.
2. After receiving the option order, the RIGOL factory will mail the paper software product entitlement certificate to the address provided in the order.
3. Log in to **RIGOL** official website ([www.rigol.com](http://www.rigol.com)) for registration. Use the software key and oscilloscope serial number provided in the entitlement certificate to obtain the option license code and the option license file.
4. Download the option license file to the root directory of the USB storage device, and connect the USB storage device to the oscilloscope properly. After the USB storage device is successfully recognized, the **Option install** key is activated. Press this menu key to start installing the option.

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