

# T3DSO1000HD Data Sheet

## Digital Oscilloscope

**Debug with Confidence**  
**100 MHz – 200 MHz**  
**12-bit High Resolution**



### Tools for Improved Debugging

- 12-bit ADC** – combined with low noise front end provides excellent noise performance.
  - ✓ Get better insight on the signal being measured with minimal noise interference.
- Waveform Capture** – rate up to 120,000 wfms/s (normal mode), and 500,000 wfms/s (sequence mode).
  - ✓ Capture more time and show more waveform detail.
- Math and Measure** – 9 basic math functions plus FFT and 50+ automatic measurement parameters.
  - ✓ Extract results from waveforms and measurements.
- Built-in web server** – supports remote control over LAN port.
  - ✓ Save data for external analysis and screen images for reports.
- History** – record function, the maximum recorded waveform length is 80,000 frames.
  - ✓ Replay the changing waveform history.
- Includes Bode Plot and Power Analysis applications as standard.**
  - ✓ Common applications coverage as standard.
- MSO** – Optional 16 Digital Channel Probe available.
  - ✓ Add mixed signal debugging to your Oscilloscope.

# PRODUCT OVERVIEW

**T3DSO1104HD:** 4 Channel 100 MHz

**T3DSO1204HD:** 4 Channel 200 MHz

## About the T3DSO1000HD Series

**Teledyne Test Tools T3DSO1000HD Digital Oscilloscopes are available in bandwidths of 100 MHz and 200 MHz, have maximum record length of 100 Mpts/ch, and display 4 analog channels + optional 16 digital channels mixed signal analysis ability.**

The T3DSO1000HD series employs the latest technology which features a maximum waveform capture rate of up to 120,000 wfm/s (normal mode, up to 500,000 wfm/s in Sequence mode), 256-level intensity grading display function plus a color temperature display mode. It also employs an innovative digital trigger system with high sensitivity and low jitter. The trigger system supports multiple powerful triggering modes including serial bus triggering. Tools such as History waveform recording, Search and Navigate functions, Mask Test, Bode Plot, Power Analysis and Histogram allow for extended

waveform records to be captured, stored, and analyzed. An impressive array of measurement and math capabilities, options for a 50 MHz arbitrary waveform generator, as well as serial decoding are also features of the T3DSO1000HD.

The large 10.1" display capacitive touch screen supports multi-touch gestures, with the addition of user friendly UI design, can greatly improve the operation efficiency. It also supports mouse control, and remote web control over LAN.

### Key Features

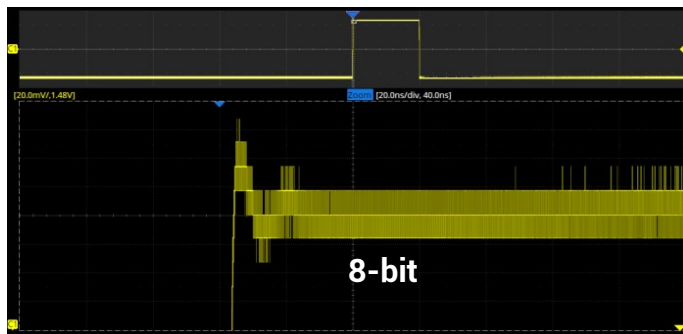
- 12-bit Analog-Digital Converters with sample rate up to 2 GS/s
- Front ends with 70  $\mu$ Vrms noise floor @ 200 MHz bandwidth and 0.5 % DC gain accuracy
- 4 analog channels, up to 200 MHz bandwidth
- Waveform capture rate up to 120,000 wfm/s (normal mode), and 500,000 wfm/s (sequence mode)
- Supports 256-level intensity grading and color temperature display modes
- Up to 100 Mpts/ch record length
- Intelligent trigger: Edge, Slope, Pulse width, Window, Runt, Interval, Dropout, Pattern, Video (HDTV supported), Qualified, Nth edge, Delay, Setup/Hold time.
- Serial bus triggering and decoder, supports protocols I<sup>2</sup>C, SPI, UART, CAN, LIN, CAN-FD (decode only), FlexRay (decode only)
- 16 digital channels (optional)
- History waveform record (History) function, the maximum recorded waveform length is 80,000 frames.
- Automatic measurements on 50+ parameters, supports statistics with histogram, track, trend, Gating measurement, and measurements on Math, History and Ref.
- 4 Math traces (2 Mpts FFT, addition, subtraction, multiplication, division, integration, differential, square root, etc.), supports formula editor.
- High Speed hardware-based Average, ERES; High Speed hardware-based Mask Test function, with Mask Editor tool for creating user-defined masks.
- 50 MHz waveform generator (optional)
- Interfaces include: USB Hosts, USB Device (USBTMC), LAN (VXI-11/Telnet/Socket), Pass/Fail, Trigger Out
- Built-in web server supports remote control over the LAN port using a web browser. Supports SCPI remote control commands. Supports external mouse and keyboard.

## Models and Key Specification

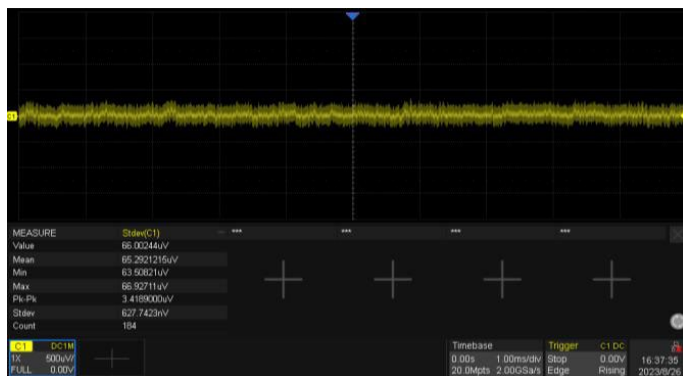
| Model                                | T3DSO1104HD                                                                                                                                                                     | T3DSO1204HD                 |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Analog channels                      | 4 + EXT (4CH Series: T3DSOxxx4HD)                                                                                                                                               |                             |
| Bandwidth                            | 100 MHz                                                                                                                                                                         | 200 MHz                     |
| Vertical resolution                  | 12-bit                                                                                                                                                                          |                             |
| Sample rate (Max.)                   | One channel mode: 2 GS/s,<br>Two channel mode: 1 GS/s,<br>Four channel mode: 500 MS/s                                                                                           |                             |
| Memory depth (Max.)                  | One channel mode: 100 Mpts/ch,<br>Two channel mode: 50 Mpts/ch,<br>Four channel mode: 25 Mpts/ch                                                                                |                             |
| Waveform capture rate (Max.)         | Normal mode: 120,000 wfm/s;<br>Sequence mode: 500,000 wfm/s                                                                                                                     |                             |
| Trigger type                         | Edge, Slope, Pulse width, Window, Runt, Interval, Dropout, Pattern, Video, Qualified, Nth edge, Delay, Setup/Hold time, Serial                                                  |                             |
| Serial trigger and decode (Standard) | I <sup>2</sup> C, SPI, UART, CAN, LIN, CAN FD (Decode Only), FlexRay (Decode Only)                                                                                              |                             |
| Measurement                          | 50+ parameters, statistics, histogram, trend, and track supported                                                                                                               |                             |
| Math                                 | 4 traces<br>2 Mpts FFT, +, -, x, ÷, fdt, d/dt, √, Identity, Negation, Absolute, Sign, ex, 10x, ln, lg, Interpolation, MaxHold, MinHold, ERES, Average. Supports formula editor. |                             |
| Data analysis                        | Search, Navigate, History, Mask Test, Counter, Bode plot, and Power Analysis                                                                                                    |                             |
| Digital channel (optional)           | 16-channel; maximum sample rate up to 1 GS/s; record length up to 10 Mpts                                                                                                       |                             |
| USB AWG module (optional)            | One channel, 50 MHz, sample rate of 125 MHz, wavelength of 16 kpts, isolated output                                                                                             |                             |
| I/O                                  | USB 2.0 Host x3, USB 2.0 Device, 10 M / 100 M LAN, External trigger, Auxiliary output (TRIG OUT, PASS/FAIL), SBUS (Digital MSO)                                                 |                             |
| Probe (Standard)                     | Four 100 MHz passive probes                                                                                                                                                     | Four 200 MHz passive probes |
| Display                              | 10.1 TFT-LCD with capacitive touch screen (1024*600)                                                                                                                            |                             |

# FUNCTIONS & CHARACTERISTICS

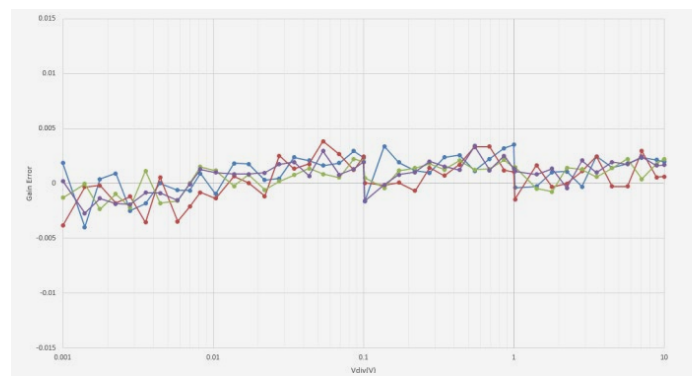
## 12-bit High Resolution



12-bit resolution shows you more details and less noise on the waveform.



Low noise floor. Only 70  $\mu$ Vrms at 200 MHz bandwidth



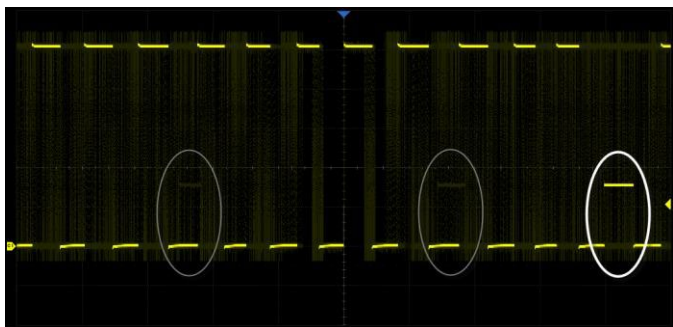
0.5 % DC gain accuracy



## Excellent User Interface and User Experience

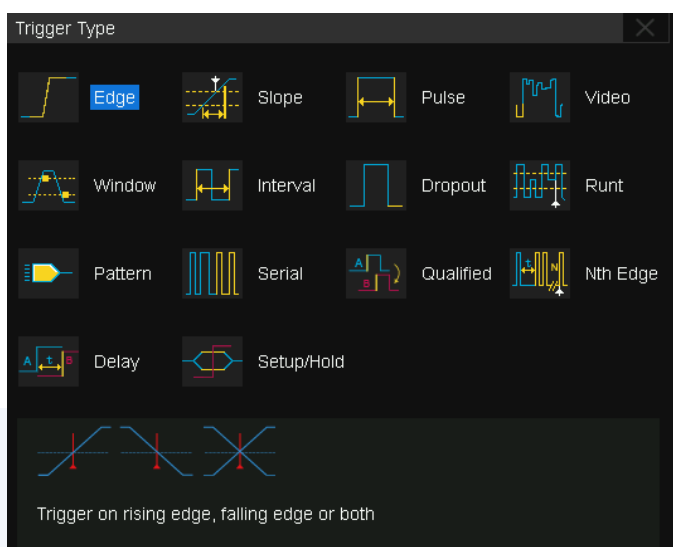
- 10.1" display with 1024x600 resolution
- Capacitive touch screen, supporting multi-touch gestures, can move or scale the waveform traces quickly by fingertouch movements, which greatly improves the operation efficiency
- Built-in WebServer supports remote control on a web page over LAN
- Supports external mouse and keyboard

## High Waveform Update Rate



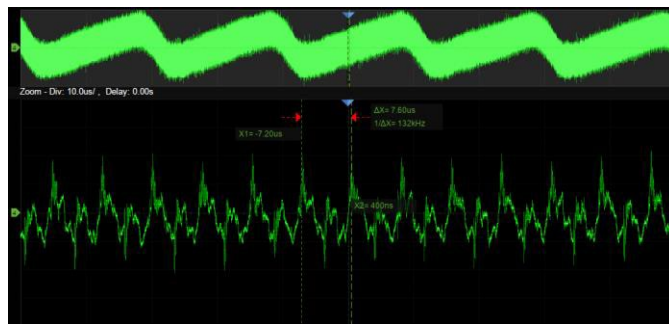
With a waveform update rate of up to 120,000 wfms/s, the oscilloscope can easily capture unusual or low-probability events. In Sequence mode, the waveform capture rate can reach 500,000 wfms/s.

## Multiple Trigger Functions



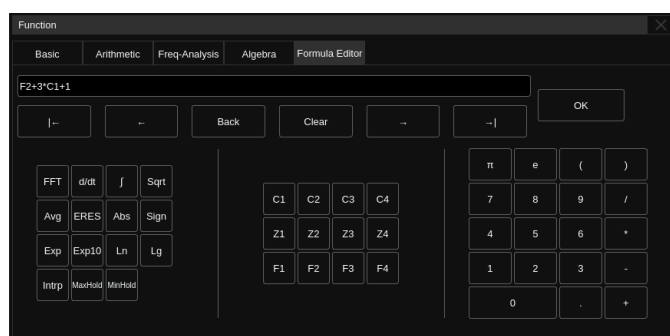
Edge, Slope, Pulse, Video, Windows, Runt, Interval, Dropout, Pattern, Qualified, Nth edge, Setup/hold, Delay, and serial trigger.

## Deep Record Length

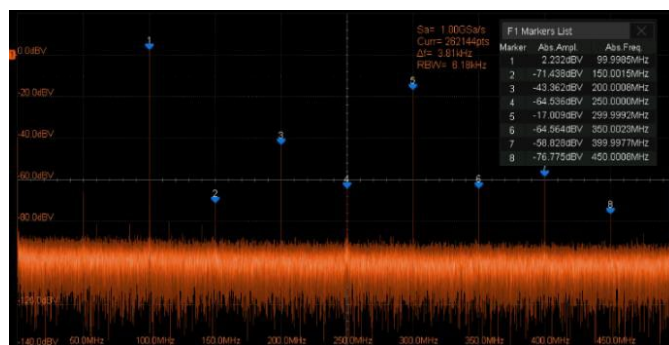


Using hardware-based Zoom technique and record length of up to 100 Mpts, users can select a slower time-base without compromising the sample rate, and then quickly zoom in to focus on the area of interest.

## Advanced Math Function



In addition to the traditional (+, -, X, /) operations, FFT, integration, differential, square root, and more are supported. Formula Editor is available for more complex operations. 4 math traces are available.



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

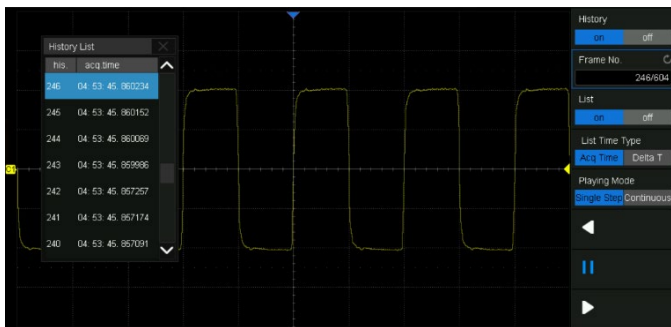
# FUNCTIONS & CHARACTERISTICS

## Measurements of a Variety of Parameters



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

## History Mode



History function can record up to 80,000 frames of waveforms. The recording is executed automatically so that the customer can playback the history waveforms at any time to observe unusual events and quickly locate the area of interest using the cursors or measurements. The failed frames of the Mask Test can be stored as history.

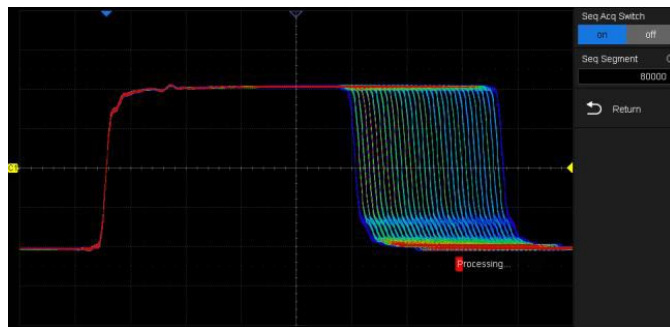
## Parameter Statistics Function



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

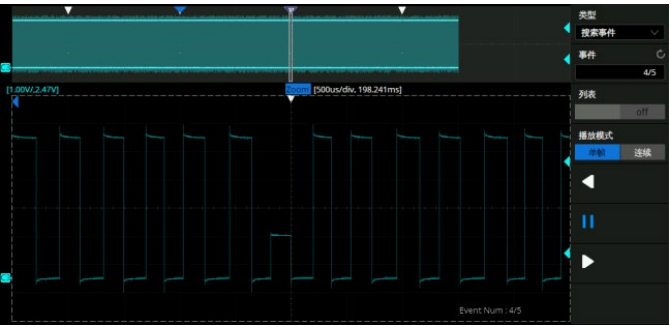
For horizontal parameters such as period, all results are extracted from a frame, instead of just calculating the first one. This accelerates statistics on horizontal measurements much more and enables distribution observation in a frame using Histogram and Track.

## Sequence Mode



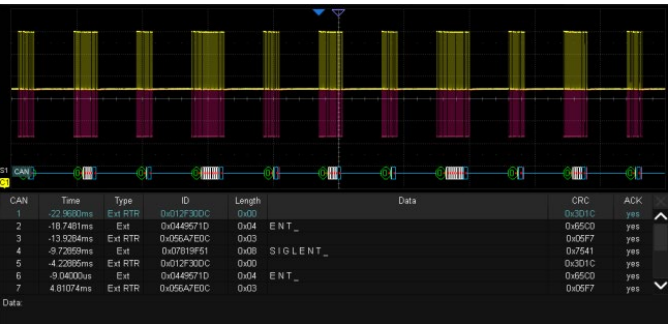
Segmented memory collection will store the waveform into multiple memory segments (up to 80,000) and each segment will store a triggered waveform as well the dead time information. The interval between segments can be as small as 2  $\mu$ s. All segments can be played back using the History function.

## Search and Navigate



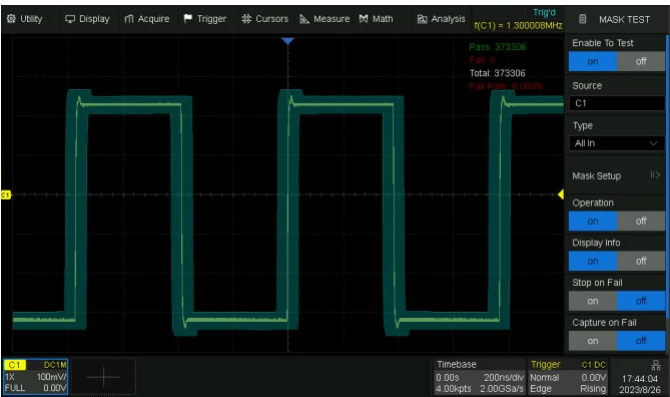
The oscilloscope can search events specified by the user in a frame. Events flagged by the Search can be recalled automatically using Navigate. It can also navigate by time (delay position) and history frames.

## Serial Bus Decode

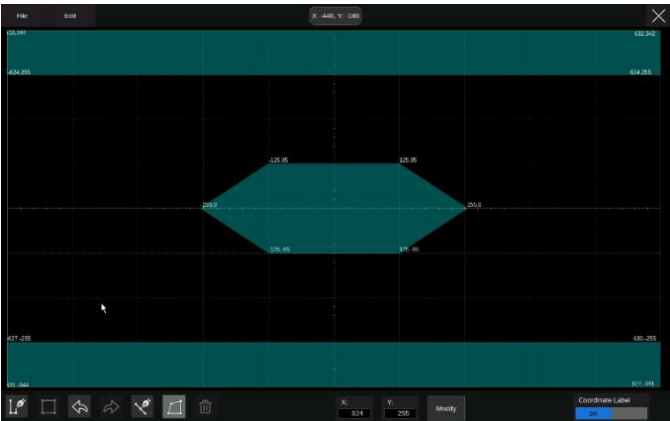


Display the decoded characters through the events list. Bus protocol information can be quickly and intuitively displayed in tabular form. I<sup>2</sup>C, SPI, UART, CAN, LIN, CAN FD, FlexRay are supported.

## Hardware-based High-Speed Mask Test Function



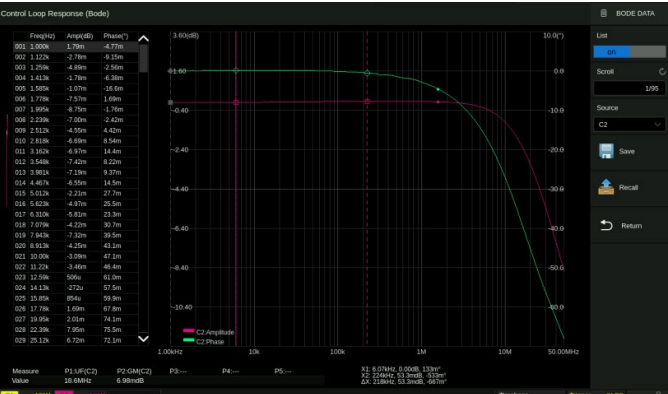
The oscilloscope utilizes a hardware-based Mask Test function, performing up to 14,000 Pass/Fail decisions each second. It is easy to generate userdefined test templates to provide trace mask comparisons, making it suitable for long-term signal monitoring or automated production line testing.



Built-in Mask Editor application helps to create custom masks.

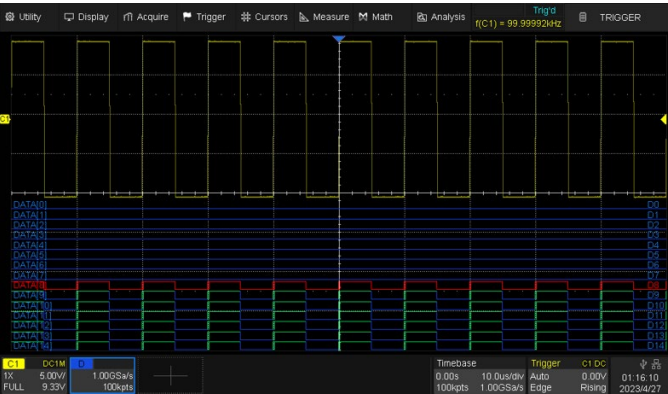
# FUNCTIONS & CHARACTERISTICS

## Bode Plot



T3DSO1000HD can control the USB AWG module, control an independent Teledyne Test Tools T3AFG scan a devices amplitude and phase frequency response, and display the data as a Bode Plot. There is also a Vari-level Mode for accurately measuring Power Supply Control Loop Response (PSRR).

## Digital Channels / MSO (Optional)



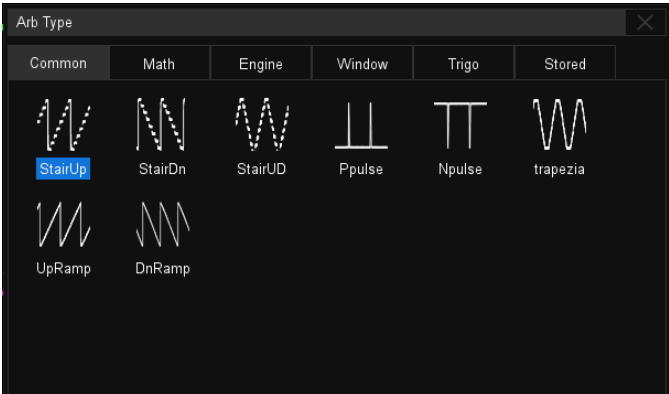
Four analog channels plus 16 digital channels enable users to acquire and trigger the waveforms then analyze the pattern, simultaneously with one instrument.

## Power Analysis



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

## USB 50 MHz AWG module (Optional)



The USB waveform generator can output waveforms with up to 50 MHz frequency and  $\pm 3$  V amplitude. Six basic waveforms together with multiple types of predefined waveforms and as user-defined arbitrary waveforms are supported.

## Complete Connectivity



USB Host 2.0 x3, USB Device 2.0 (USBTMC), LAN (VXI-11/Telnet/Socket), Auxiliary output (Pass/Fail, Trigger Out), etc.

# SPECIFICATIONS

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

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

## Acquire (analog)

|                      |                                                                                                 |
|----------------------|-------------------------------------------------------------------------------------------------|
| Sample rate          | One channel mode: 2 GS/s,<br>Two channel mode: 1 GS/s,<br>Four channel mode: 500 MS/s           |
| Memory depth         | One channel mode: 100 Mpts/ch<br>Two channel mode: 50 Mpts/ch,<br>Four channel mode: 25 Mpts/ch |
| Waveform update rate | Normal mode: up to 120,000 wfm/s<br>Sequence mode: up to 500,000 wfm/s                          |
| Intensity grading    | 256-level                                                                                       |
| Peak detect          | 2 ns                                                                                            |
| Sequence             | Up to 80,000 segments, interval between triggers = 2 $\mu$ s min.                               |
| History              | Up to 80,000 frames                                                                             |
| Interpolation        | sinx/x, x                                                                                       |

## Vertical (analog)

|                                                                   |                                                                                                                                                                                                                                                                                                               |  |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Channel                                                           | 4 + EXT (4CH Series: T3DS01xx4HD),                                                                                                                                                                                                                                                                            |  |
| Bandwidth (-3 dB) @50 $\Omega$                                    | T3DS01104HD: 100 MHz<br>T3DS01204HD: 200 MHz                                                                                                                                                                                                                                                                  |  |
| Flatness @50 $\Omega$                                             | DC - 10 % (BW): $\pm 1$ dB<br>10 % - 50 % (BW): $\pm 2$ dB<br>50 % - 100 % (BW): + 2 dB/-3 dB                                                                                                                                                                                                                 |  |
| Rise time @50 $\Omega$ (typical)                                  | Typical 3.5 ns (T3DS01104HD)<br>Typical 1.8 ns (T3DS01204HD)                                                                                                                                                                                                                                                  |  |
| Resolution                                                        | 12-bit                                                                                                                                                                                                                                                                                                        |  |
| ENOB <sup>1)</sup> (typical)                                      | 8.4-bit                                                                                                                                                                                                                                                                                                       |  |
| Noise floor <sup>2)</sup> (rms, @50 $\Omega$ , typical, 1 mV/div) | 70 $\mu$ V (Full Bandwidth)                                                                                                                                                                                                                                                                                   |  |
| Range                                                             | 8 divisions                                                                                                                                                                                                                                                                                                   |  |
| Vertical scale (probe 1X)                                         | 1 M $\Omega$ : 0.5 mV/div - 10 V/div<br>50 $\Omega$ : 0.5 mV/div - 1 V/div                                                                                                                                                                                                                                    |  |
| DC gain accuracy (typical)                                        | 0.5 mV/div ~ 4.95 mV/div: $\pm 1.5$ %;<br>5 mV/div ~ 10 V/div: $\pm 0.5$ %;                                                                                                                                                                                                                                   |  |
| Offset accuracy                                                   | $\pm (0.5$ % of the offset setting + 0.5 % of full scale + 1 mV)                                                                                                                                                                                                                                              |  |
| Offset range (probe 1X)                                           | <b>1 M<math>\Omega</math>:</b><br>0.5 mV/div ~ 5 mV/div: $\pm 1.6$ V;<br>5.1 mV/div ~ 10 mV/div: $\pm 4$ V;<br>10.2 mV/div ~ 20 mV/div: $\pm 8$ V;<br>20.5 mV/div ~ 100 mV/div: $\pm 8$ V;<br>102 mV/div ~ 200 mV/div: $\pm 80$ V;<br>205 mV/div ~ 1 V/div: $\pm 80$ V;<br>1.02 V/div ~ 10 V/div: $\pm 400$ V |  |
|                                                                   | <b>50 <math>\Omega</math>:</b><br>0.5 mV/div ~ 5 mV/div: $\pm 1.6$ V;<br>5.1 mV/div ~ 10 mV/div: $\pm 4$ V;<br>10.2 mV/div ~ 20 mV/div: $\pm 8$ V;<br>20.5 mV/div ~ 1 V/div: $\pm 8$ V                                                                                                                        |  |
| Bandwidth limit                                                   | Hardware Bandwidth limit: 20 MHz, 200 MHz                                                                                                                                                                                                                                                                     |  |
| Low frequency response (AC coupling -3 dB)                        | 2 Hz (typical)                                                                                                                                                                                                                                                                                                |  |

<sup>1)</sup> 24.99 MHz input, -0.25 dBFS, 20 mV/div, 50  $\Omega$  input impedance

<sup>2)</sup> Use the "Stdev" measurement

# SPECIFICATIONS

## Vertical (analog)

|                                                |                                                                                                      |
|------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Overshoot (150 ps edge @50 $\Omega$ , typical) | 10 %                                                                                                 |
| Coupling                                       | DC, AC, GND                                                                                          |
| Impedance                                      | 1 M $\Omega$ : (1 M $\Omega$ $\pm$ 2 %)    (17 pF $\pm$ 2 pF)<br>50 $\Omega$ : 50 $\Omega$ $\pm$ 1 % |
| Max. input voltage                             | 1 M $\Omega$ $\leq$ 400 Vpk (DC + AC), DC $\sim$ 10 kHz<br>50 $\Omega$ $\leq$ 5 V rms                |
| SFDR                                           | $\geq$ 35 dBc                                                                                        |
| CH to CH Isolation (@50 $\Omega$ )             | DC $\sim$ Max BW: >40 dB                                                                             |
| Probe Attenuation                              | 1X, 10X, 100X, custom                                                                                |

## Horizontal

|                       |                       |
|-----------------------|-----------------------|
| Time scale            | 1 ns/div – 1000 s/div |
| Range                 | 10 divisions          |
| Display mode          | Y-T, X-Y, Roll        |
| Roll mode             | $\geq$ 50 ms/div      |
| Skew (CH1 $\sim$ CH4) | < 100 ps              |
| Time base Accuracy    | $\pm$ 25 ppm          |

## Trigger

|                                              |                                       |                                                                                 |
|----------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------|
| Mode                                         | Auto, Normal, Single                  |                                                                                 |
| Level                                        | Internal:                             | $\pm$ 4.1 div from the center of the screen                                     |
|                                              | EXT:                                  | $\pm$ 0.61 V                                                                    |
|                                              | EXT/5:                                | $\pm$ 3.05 V                                                                    |
| Hold off range                               | By time: 8 ns $\sim$ 30 s (8 ns step) |                                                                                 |
| Coupling                                     | AC<br>DC<br>LFRJ<br>HFRJ<br>Noise RJ  |                                                                                 |
| Coupling Frequency Response (CH1 $\sim$ CH4) | DC:                                   | Passes all components of the signal                                             |
|                                              | AC:                                   | Blocks DC components and attenuates signals below 8 Hz                          |
|                                              | LFRJ:                                 | Blocks the DC component and attenuates the low-frequency components below 2 MHz |
|                                              | HFRJ:                                 | Attenuates the high-frequency components above 2.4 MHz                          |
| Coupling Frequency Response (EXT)            | DC:                                   | Passes all components of the signal                                             |
|                                              | AC:                                   | Blocks DC components and attenuates signals below 18 Hz                         |
|                                              | LFRJ:                                 | Attenuates the frequency components below 7.5 kHz                               |
|                                              | HFRJ:                                 | Attenuates the frequency components above 250 kHz                               |
| Accuracy (typical)                           | CH1 $\sim$ CH4:                       | $\pm$ 0.2 div                                                                   |
|                                              | EXT:                                  | $\pm$ 0.3 div                                                                   |
| Sensitivity                                  | CH1 $\sim$ CH4:                       | DC $\sim$ Max BW : 0.6div                                                       |
|                                              | EXT:                                  | 200 mVpp, DC $\sim$ 200 MHz                                                     |
|                                              | EXT/5:                                | 1 Vpp, DC $\sim$ 200 MHz                                                        |
| Jitter                                       | CH1 $\sim$ CH4:                       | <100 ps                                                                         |
|                                              | EXT:                                  | < 200 ps rms                                                                    |
| Displacement                                 | Pre-Trigger:                          | 0 $\sim$ 100 % memory                                                           |
|                                              | Delay-Trigger:                        | 0 $\sim$ 10,000 div                                                             |

|                            |                                                                             |
|----------------------------|-----------------------------------------------------------------------------|
| <b>Edge Trigger</b>        |                                                                             |
| Source                     | CH1 ~ CH4 / EXT / (EXT/5) / AC Line / D0 ~ D15                              |
| Slope                      | Rising, Falling, Rising & Falling                                           |
| <b>Slope Trigger</b>       |                                                                             |
| Source                     | CH1 ~ CH4                                                                   |
| Slope                      | Rising, Falling                                                             |
| Limit range                | <, >, in range, out of range                                                |
| Time range                 | 2 ns ~ 20 s, Resolution = 1 ns                                              |
| <b>Pulse Width Trigger</b> |                                                                             |
| Source                     | CH1 ~ CH4 / D0 ~ D15                                                        |
| Polarity                   | +width, -width                                                              |
| Limit range                | <, >, in range, out of range                                                |
| Time range                 | 2 ns ~ 20 s, Resolution = 1 ns                                              |
| <b>Video Trigger</b>       |                                                                             |
| Source                     | CH1 ~ CH4                                                                   |
| Standard                   | NTSC, PAL, 720p/50, 720p/60, 1080p/50, 1080p/60, 1080i/50, 1080i/60, Custom |
| Synchronization            | Any, Select                                                                 |
| Trigger Condition          | Line, Field                                                                 |
| <b>Window Trigger</b>      |                                                                             |
| Source                     | CH1 ~ CH4                                                                   |
| Window type                | Absolute, Relative                                                          |
| <b>Interval Trigger</b>    |                                                                             |
| Source                     | CH1 ~ CH4 / D0 ~ D15                                                        |
| Slope                      | Rising, Falling                                                             |
| Limit range                | <, >, in range, out of range                                                |
| Time range                 | 2 ns ~ 20 s, Resolution = 1 ns                                              |
| <b>Dropout Trigger</b>     |                                                                             |
| Source                     | CH1 ~ CH4 / D0 ~ D15                                                        |
| Timeout type               | Edge, State                                                                 |
| Slope                      | Rising, Falling                                                             |
| Time range                 | 2 ns ~ 20 s, Resolution = 1 ns                                              |
| <b>Runt Trigger</b>        |                                                                             |
| Source                     | CH1 ~ CH4                                                                   |
| Polarity                   | Positive, Negative                                                          |
| Limit range                | <, >, in range, out of range                                                |
| Time range                 | 2 ns ~ 20 s, Resolution = 1 ns                                              |
| <b>Pattern Trigger</b>     |                                                                             |
| Source                     | CH1 ~ CH4 / D0 ~ D15                                                        |
| Pattern Setting            | Don't Care, Low, High                                                       |
| Logic                      | AND, OR, NAND, NOR                                                          |
| Limit range                | <, >, in range, out of range                                                |
| Time range                 | 2 ns ~ 20 s, Resolution = 1 ns                                              |

# SPECIFICATIONS

## Qualified Trigger

|                     |                                                |
|---------------------|------------------------------------------------|
| Type                | State, State with Delay, Edge, Edge with Delay |
| Qualified Source    | CH1 ~ CH4                                      |
| Edge Trigger Source | CH1 ~ CH4                                      |

## Nth Edge Trigger

|             |                                |
|-------------|--------------------------------|
| Source      | CH1 ~ CH4                      |
| Slope       | Rising, Falling                |
| Idle time   | 8 ns ~ 20 s, Resolution = 1 ns |
| Edge Number | 1 ~ 65535                      |

## Delay Trigger

|             |                                |
|-------------|--------------------------------|
| Source A    | CH1 ~ CH4                      |
| Source B    | CH1 ~ CH4                      |
| Slope       | Rising, Falling                |
| Limit range | <, >, in range, out of range   |
| Time range  | 2 ns ~ 20 s, Resolution = 1 ns |

## Serial Trigger

|                  |                                                                         |
|------------------|-------------------------------------------------------------------------|
| Source           | CH1 ~ CH4 / D0 ~ D15                                                    |
| Protocol         | I <sup>2</sup> C, SPI, UART, CAN, LIN                                   |
| I <sup>2</sup> C | Type: Start, Stop, Restart, No Ack, EEPROM, Address & Data, Data Length |
| SPI              | Type: Data                                                              |
| UART             | Type: Start, Stop, Data, Parity Error                                   |
| CAN              | Type: All, Remote, ID, ID+Data, Error                                   |
| LIN              | Type: Break, Frame ID, ID+Data, Error                                   |

## Serial Decoder

|                       |                                                                    |
|-----------------------|--------------------------------------------------------------------|
| Decoders              | 2                                                                  |
| Threshold             | -4.1 ~ 4.1 div                                                     |
| List                  | 1 ~ 7 lines                                                        |
| Decoder type          | Full duplex                                                        |
| <b>I<sup>2</sup>C</b> |                                                                    |
| Source                | CH1 ~ CH4 / D0 ~ D15                                               |
| Signal                | SCL, SDA                                                           |
| Address               | 7-bit, 10-bit                                                      |
| <b>SPI</b>            |                                                                    |
| Source                | CH1 ~ CH4 / D0 ~ D15                                               |
| Signal                | CLK, MISO, MOSI, CS                                                |
| Edge Select           | Rising, Falling                                                    |
| Chip select           | Active high, Active low, Clock timeout                             |
| Bit Order             | LSB, MSB                                                           |
| <b>UART</b>           |                                                                    |
| Source                | CH1 ~ CH4 / D0 ~ D15                                               |
| Signal                | RX, TX                                                             |
| Data Width            | 5-bit, 6-bit, 7-bit, 8-bit                                         |
| Parity Check          | None, Odd, Even, Mark, Space                                       |
| Stop Bit              | 1-bit, 1.5-bit, 2-bit                                              |
| Idle Level            | Low, High                                                          |
| Bit Order             | LSB, MSB                                                           |
| <b>CAN</b>            |                                                                    |
| Source                | CH1 ~ CH4 / D0 ~ D15                                               |
| <b>LIN</b>            |                                                                    |
| LIN Version           | Ver 1.3, Ver 2.0                                                   |
| Source                | CH1 ~ CH4 / D0 ~ D15                                               |
| Baud Rate             | 600 bps, 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, Custom |
| <b>CAN FD</b>         |                                                                    |
| Source                | CH1 ~ CH4                                                          |
| Nominal Baud Rate     | 10 kbps, 25 kbps, 50 kbps, 100 kbps, 250 kbps, 1 Mbps, Custom      |
| Data Baud Rate        | 500 kbps, 1 Mbps, 2 Mbps, 5 Mbps, 8 Mbps, 10 Mbps, Custom          |
| <b>FlexRay</b>        |                                                                    |
| Source                | CH1 ~ CH4                                                          |
| Baud Rate             | 2.5 Mbps, 5 Mbps, 10 Mbps, Custom                                  |

# SPECIFICATIONS

## Measurement

| Automatic Measurement    |                                                                                                                                                                                                                 |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source                   | CH1 ~ CH4, D0 ~ D15, Z1 ~ Z4, F1 ~ F2, Ref, History                                                                                                                                                             |
| Mode                     | Simple, Advanced                                                                                                                                                                                                |
| Range                    | Screen<br>Gated: inside screen, definable with separate Gate cursors                                                                                                                                            |
| Custom Threshold         | Upper, Middle, Lower                                                                                                                                                                                            |
| No. of Measurements      | Display 12 measurements at the same time (Display mode = M2)                                                                                                                                                    |
| Vertical Parameters      | Max, Min, Pk-Pk, Top, Base, Amplitude, Mean, Cycle Mean, Stdev, Cycle Stdev, RMS, Cycle RMS, Median, Cycle Median, FOV, FPRE, ROV, RPRE, Level@Trigger                                                          |
| Horizontal Parameters    | Period, Frequency, Time@max, Time@min, +Width, -Width, 10-90 % Rise time, 90-10 % Fall time, Rise time, Fall time, +Burst Width, -Burst Width, +Duty Cycle, -Duty Cycle, Delay, Time@Middle, Cycle-Cycle jitter |
| Miscellaneous Parameters | +Area@DC, -Area@DC, Area@DC, Absolute Area@DC, +Area@AC, -Area@AC, Area@AC, Absolute Area@AC, Cycles, Rising Edges, Falling Edges, Edges, Positive pulses, Negative pulses, Positive Slope, Negative Slope      |
| Delay Parameters         | Phase, FRFR, FRFF, FFFR, FFFF, FRLR, FRLF, FFLR, FFLF, Skew, Tsu@R, Tsu@F, Th@R, Th@F                                                                                                                           |
| Statistics               | Current, Mean, Min, Max, Sdev, Count, Histogram, Trend, Track                                                                                                                                                   |
| Statistics Count         | Unlimited, 1 ~ 1024                                                                                                                                                                                             |
| Cursors                  |                                                                                                                                                                                                                 |
| Source                   | CH1 ~ CH4, D0 ~ D15, F1 ~ F4, Ref, Histogram                                                                                                                                                                    |
| Type                     | Manual: Time X1, X2, (X1-X2), (1/ΔT); Vertical Y1, Y2, (Y1-Y2)<br>Track: Time X1, X2, (X1-X2)<br>Measure: indicates the measurement on specific parameter                                                       |

## Math

|           |                                                                                                                                                                                                                                                                           |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trace     | F1 ~ F4                                                                                                                                                                                                                                                                   |
| Source    | CH1 ~ CH4, Z1 ~ Z4, F1 ~ F4                                                                                                                                                                                                                                               |
| Operation | FFT, +, -, x, ÷, ∫dt, d/dt, √, Identity, Negation,  x , Sign, ex, 10x, ln, lg, Interpolation, Max hold, Min hold, ERES, Average, Formula Editor                                                                                                                           |
| FFT       | Length: 2 Mpts, 1 Mpts, 512 kpts, 256 kpts, 128 kpts, 64 kpts, 32 kpts, 16 kpts, 8 kpts, 4 kpts, 2 kpts<br>Window: Rectangular, Blackman, Hanning, Hamming, Flattop<br>Display: Full Screen, Split, Exclusive<br>Mode: Normal, Max hold, Average<br>Tools: Peaks, Markers |

## Analysis

### Search

|              |                                    |
|--------------|------------------------------------|
| Source       | CH1 ~ CH4, History                 |
| Mode         | Edge, Slope, Pulse, Interval, Runt |
| Copy setting | Copy from trigger, Copy to trigger |

### Navigate

|      |                                   |
|------|-----------------------------------|
| Type | Search event, Time, History frame |
|------|-----------------------------------|

### Mask Test

|                 |                                              |
|-----------------|----------------------------------------------|
| Source          | CH1 ~ CH4, Z1 ~ Z4                           |
| Mask creating   | Auto (Create mask), Customized (Mask Editor) |
| Mask test speed | Up to 80,000 frames/s                        |

### Bode Plot

|                          |                                                                                         |
|--------------------------|-----------------------------------------------------------------------------------------|
| Source                   | CH1 ~ CH4                                                                               |
| Supported signal sources | USB AWG Module, Connection: USB, T3AFG series waveform generators, Connection: USB, LAN |
| Sweep type               | Simple, Vari-level                                                                      |
| Frequency                | Mode: Linear, Logarithmic<br>Range: 10 Hz ~ 120 MHz                                     |
| Measure                  | Upper cutoff frequency, Lower cutoff frequency, Bandwidth, Gain margin, Phase margin    |

### Power Analysis

|         |                                                                                                                                                                     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measure | Power quality, Current Harmonics, Inrush current, Switching loss, Slew rate, Modulation, Output ripple, Turn on/turn off, Transient response, PSRR, Efficiency, SOA |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Counter

|                      |                                             |
|----------------------|---------------------------------------------|
| Source               | CH1 ~ CH4                                   |
| Frequency resolution | 7 digits                                    |
| Totalizer            | Counter on edges, supports Gate and Trigger |

## Digital Channels (optional)

|                             |                                                                                                                                                                                                    |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Max. Sampling Rate          | 1 GS/s                                                                                                                                                                                             |
| Memory Depth                | 10 Mpts/ch                                                                                                                                                                                         |
| Min. Detectable Pulse Width | 3.3 ns                                                                                                                                                                                             |
| Level Group                 | D0 ~ D7, D8 ~ D15                                                                                                                                                                                  |
| Level Range                 | -8 V ~ 8 V                                                                                                                                                                                         |
| Logic Type                  | TTL, CMOS, LVCMOS3.3, LVCMOS2.5, Custom                                                                                                                                                            |
| Skew                        | D0 ~ D15: $\pm 1$ sampling interval<br>Analog to Digital (Triggered On Digital): $\pm (1 \text{ sampling interval} + 1 \text{ ns})$<br>Digital to Analog (Triggered On Analog): $\pm 4 \text{ ns}$ |

# SPECIFICATIONS

## USB AWG Module (optional)

|                       |                                                                  |
|-----------------------|------------------------------------------------------------------|
| Channels              | 1                                                                |
| Max. Output Frequency | 50 MHz                                                           |
| Sampling Rate         | 125 MS/s                                                         |
| Frequency Resolution  | 1 $\mu$ Hz                                                       |
| Frequency Accuracy    | $\pm 50$ ppm                                                     |
| Vertical Resolution   | 14 bit                                                           |
| Amplitude Range       | -1.5 V ~ +1.5 V (into 50 $\Omega$ )<br>-3 V ~ +3 V (into High-Z) |
| Waveforms             | Sine, Square, Ramp, Pulse, DC, Noise, 45 Arbitrary               |
| Output Impedance      | 50 $\Omega \pm 2\%$                                              |
| Protection            | Over voltage protection, Current limit                           |

### Sine

|                          |                                                                                 |
|--------------------------|---------------------------------------------------------------------------------|
| Frequency                | 1 $\mu$ Hz ~ 50 MHz                                                             |
| Offset accuracy (10 kHz) | $\pm(1\% \times \text{offset setting value} + 3 \text{ mVpp})$                  |
| Amplitude flatness       | $\pm 0.3$ dB, compare to 10 kHz, 2.5 Vpp into 50 $\Omega$                       |
| SFDR                     | DC ~ 1 MHz      -60 dBc<br>1 MHz ~ 5 MHz    -55 dBc<br>5 MHz ~ 25 MHz   -50 dBc |
| Harmonic distortion      | DC ~ 5 MHz      -50 dBc<br>5 MHz ~ 25 MHz   -45 dBc                             |

### Square/Pulse

|                      |                               |
|----------------------|-------------------------------|
| Frequency            | 1 $\mu$ Hz ~ 10 MHz           |
| Duty cycle           | 1 % ~ 99 %                    |
| Edge                 | < 24 ns (10 % ~ 90 %)         |
| Overshoot            | < 3 % (typical, 1 kHz, 1 Vpp) |
| Pulse width          | > 50 ns                       |
| Jitter (cycle-cycle) | < 500 ps + 10 ppm             |

### Ramp

|           |                                                         |
|-----------|---------------------------------------------------------|
| Frequency | 1 $\mu$ Hz ~ 300 kHz                                    |
| Linearity | < 0.1 % of Pk-Pk (typical, 1 kHz, 1 Vpp, 50 % symmetry) |
| Channels  | 0 % ~ 100 %                                             |

### DC

|              |                                                          |
|--------------|----------------------------------------------------------|
| Offset range | $\pm 1.5$ V (into 50 $\Omega$ )<br>$\pm 3$ V (into Hi-Z) |
| Accuracy     | $\pm( \text{setting value}  \times 1\% + 3 \text{ mV})$  |

### Noise

|                   |         |
|-------------------|---------|
| Bandwidth (-3 dB) | >50 MHz |
|-------------------|---------|

### Arbitrary Wave

|                 |                                                                             |
|-----------------|-----------------------------------------------------------------------------|
| Frequency       | 1 $\mu$ Hz ~ 5 MHz                                                          |
| Waveform memory | 16 kpts                                                                     |
| Sample rate     | 125 MS/s                                                                    |
| Wave import     | From EasyWaveX, from U-disk, directly from waveform data of analog channels |

## I/O

|       |                                                                                                                                                                                                           |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Front | USB 2.0 Host x2,<br>SBUS: Digital MSO,<br>Calibration Signal: 1 kHz, 3 V Square                                                                                                                           |
| Rear  | USB 2.0 Host,<br>USB 2.0 Device,<br>LAN: 10/100 MbaseT (RJ45),<br>External Trigger, EXT: $\leq 1.5$ Vrms, EXT/5: $\leq 7.5$ Vrms,<br>Auxiliary Output: TRIG OUT (3.3 V LVCMOS), PASS/FAIL OUT (3.3 V TTL) |

## Display

|                     |                                           |
|---------------------|-------------------------------------------|
| Display Type        | 10.1 TFT LCD with capacitive touch screen |
| Resolution          | 1024 × 600                                |
| Contrast (typical)  | 500 : 1                                   |
| Backlight (typical) | 500 nit                                   |

## Display Setting

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

## Environmental

|                               |                                                                                                                                                                                                                                                                         |                              |                                                                                                                                                               |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature                   | Operating: 0 °C ~ 50 °C<br>Non-operating: -30 °C ~ 70 °C                                                                                                                                                                                                                |                              |                                                                                                                                                               |
| Humidity                      | Operating: 5 % ~ 90 % RH up to 30 °C, derates linearly to 50 % RH at 50 °C<br>Non-operating: 5 % ~ 95 %                                                                                                                                                                 |                              |                                                                                                                                                               |
| Altitude                      | Operating: ≤ 3,000 m, 25 °C<br>Non-operating: ≤ 15,000 m                                                                                                                                                                                                                |                              |                                                                                                                                                               |
| Electromagnetic Compatibility | Meets EMC directive (2014/30/EU), meets or exceeds EN IEC 61326-1:2021, EN IEC 61326-2-1:2021 (Basic)                                                                                                                                                                   |                              |                                                                                                                                                               |
|                               | Conducted disturbance                                                                                                                                                                                                                                                   | CISPR 11/EN 55011            | CLASS A group 1<br>150 kHz – 30 MHz                                                                                                                           |
|                               | Radiated disturbance                                                                                                                                                                                                                                                    | CISPR 11/EN 55011            | CLASS A group 1<br>30 MHz – 1 GHz                                                                                                                             |
|                               | Electrostatic discharge (ESD)                                                                                                                                                                                                                                           | IEC 61000-4-2/EN 61000-4-2   | 4.0 kV (Contact), 8.0 kV (Air)                                                                                                                                |
|                               | Radio-frequency electromagnetic field Immunity                                                                                                                                                                                                                          | IEC 61000-4-3/EN 61000-4-3   | 10 V/m (80 MHz to 1 GHz);<br>3 V/m (1.4 GHz to 2 GHz);<br>1 V/m (2.0 GHz to 2.7 GHz)                                                                          |
|                               | Electrical fast transients (EFT)                                                                                                                                                                                                                                        | IEC 61000-4-4/EN 61000-4-4   | 2 kV (Input AC Power Ports)                                                                                                                                   |
|                               | Surges                                                                                                                                                                                                                                                                  | IEC 61000-4-5/EN 61000-4-5   | 1 kV (Line to line)<br>2 kV (Line to ground)                                                                                                                  |
|                               | Radio-frequency continuous conducted Immunity                                                                                                                                                                                                                           | IEC 61000-4-6/EN 61000-4-6   | 3 V, 0.15 – 80 MHz                                                                                                                                            |
|                               | Voltage dips and interruptions                                                                                                                                                                                                                                          | IEC 61000-4-11/EN 61000-4-11 | Voltage Dips:<br>0 % UT during 1 cycle;<br>40 % UT during 10/12 cycles;<br>70 % UT during 25/30 cycles<br>Voltage interruptions: 0 % UT during 250/300 cycles |
| Safety                        | TUV Certified. Conforms to: UL 61010-1:2012/R: 2018-11; UL 61010-2-030:2018<br>CAN/CSA-C22.2 No. 61010-1:2012/A1:2018-11; CAN/CSA-C22.2 No. 61010-2-030:2018<br>Meets Low Voltage Directive (2014/35/EU). Conforms to: EN 61010-1:2010+A1:2019; EN IEC 61010-2-030:2021 |                              |                                                                                                                                                               |
| RoHS                          | EU 2015/863                                                                                                                                                                                                                                                             |                              |                                                                                                                                                               |

## Power Supply

|                           |                                                       |
|---------------------------|-------------------------------------------------------|
| Input Voltage & Frequency | 100 ~ 240 Vrms 50/60 Hz                               |
| Power consumption         | 120 W max., 70 W typical, 4 W typical in standby mode |

## Mechanical

|            |                                                                                                |
|------------|------------------------------------------------------------------------------------------------|
| Dimensions | Length × Height × Width = 317.2 mm × 236.0 mm × 149.0 mm (including knobs and supporting legs) |
| Weight     | Net Weight 4.1 kg, Gross Weight 5.6 kg                                                         |

All T3DS01000HD Series Oscilloscopes come with a 3 year Teledyne LeCroy warranty.

# ORDERING INFORMATION

## T3DSO1000HD Optional Accessories

| Probe type     | Model           | Picture                                                                            | Description                                                                                                                                            |
|----------------|-----------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Passive        | T3PP350         |   | 350 MHz bandwidth, 10 MΩ, 10X Passive Probe. Replacement probe for the T3DSO1000HD series.                                                             |
| Logic Probe    | T3DSO1000-LS    |   | Optional 16 Channel Logic Probe.                                                                                                                       |
| USB AWG Module | T3DSO-FGMOD     |   | Output Sine, Square, Ramp, pulse, Noise, DC and 45 built-in waveforms. The arbitrary waveforms can be accessed and edited by the EasyScope PC software |
| Rackmount      | T3DSOHD-RACK    |   | The rackmount occupies a height of 5U. Support the oscilloscope for rack installation.                                                                 |
| Soft Case      | WS4KHD-SOFTCASE |  | Oscilloscope Soft Carrying Case.                                                                                                                       |

## Ordering information

|                      |                                                                                        |                        |
|----------------------|----------------------------------------------------------------------------------------|------------------------|
| Description          | 12-bit, 100 MHz, 2 GS/s, 4-CH, 100 Mpts/ch memory depth, 10.1" capacitive touch screen | <b>T3DSO1104HD</b>     |
|                      | 12-bit, 200 MHz, 2 GS/s, 4-CH, 100 Mpts/ch memory depth, 10.1" capacitive touch screen | <b>T3DSO1204HD</b>     |
| Standard Accessories | Standard Passive Probe appropriate to the oscilloscope bandwidth x 4                   |                        |
|                      | USB Cable                                                                              |                        |
|                      | Power Cord                                                                             |                        |
|                      | Quick Start Guide                                                                      |                        |
|                      | Certificate of Calibration                                                             |                        |
| Optional Accessories | 350 MHz Passive Probe, 10:1, 10 MΩ                                                     | <b>T3PP350</b>         |
|                      | 16 Channel MSO Probe                                                                   | <b>T3DSO1000-LS</b>    |
|                      | USB AWG Module                                                                         | <b>T3DSO-FGMOD</b>     |
|                      | Rackmount                                                                              | <b>T3DSOHD-RACK</b>    |
|                      | Soft Case                                                                              | <b>WS4KHD-SOFTCASE</b> |

# ABOUT TELEDYNE TEST TOOLS



## Company Profile

Teledyne LeCroy is a leading provider of oscilloscopes, protocol analyzers and related test and measurement solutions that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively. Oscilloscopes are tools used by designers and engineers to measure and analyze complex electronic signals in order to develop high-performance systems and to validate electronic designs in order to improve time to market.

The Teledyne Test Tools brand extends the Teledyne LeCroy product portfolio with a comprehensive range of test equipment solutions. This new range of products delivers a broad range of quality test solutions that enable engineers to rapidly validate product and design and reduce time-to-market. Designers, engineers and educators rely on Teledyne Test Tools solutions to meet their most challenging needs for testing, education and electronics validation.

## Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy has sales, service and development subsidiaries in the US and throughout Europe and Asia. Teledyne Test Tools and Teledyne LeCroy products are employed across a wide variety of industries, including semiconductor, computer, consumer electronics, education, military/aerospace, automotive/industrial, and telecommunications.

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<https://teledynelecroy.com/support/contact/#>

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