

T3DSO4000L-HD

Low Profile Oscilloscopes

Debug with Confidence
500 MHz – 2 GHz
12-bit High Resolution



Tools for Improved Debugging

- | | |
|---|--|
| <ul style="list-style-type: none"> ● Low profile form factor: 4 Channel Model: 1U High Package 8 Channel Model: 2U High Package | <ul style="list-style-type: none"> ✓ Low-profile, high-density package saves rack space for automated test applications. |
| <ul style="list-style-type: none"> ● 12-bit ADC combined with low noise front end provides excellent noise performance | <ul style="list-style-type: none"> ✓ Get better insight on the signal being measured with minimal noise interference. |
| <ul style="list-style-type: none"> ● Robust Connectivity Built-in web server supports remote control over the LAN port. Supports SCPI Commands over 1000M LAN (VXI-11/Telnet/Socket) and USBTMC interface | <ul style="list-style-type: none"> ✓ LAN connection provides very fast data acquisition for automated test applications. |
| <ul style="list-style-type: none"> ● Includes Power Analysis and Eye Diagram and Jitter analysis applications as standard | <ul style="list-style-type: none"> ✓ Powerful Data analysis applications as standard. |
| <ul style="list-style-type: none"> ● Includes Serial Bus Decoders for I²C, SPI, UART, CAN, LIN, CAN FD, I²S, MIL- STD- 1553B, FlexRay, SENT & Manchester | <ul style="list-style-type: none"> ✓ Debug serial buses directly in your Oscilloscope at no extra cost. |
| <ul style="list-style-type: none"> ● Math and Measure – 9 basic math functions plus FFT, and 50+ automatic measurement parameters | <ul style="list-style-type: none"> ✓ Extract results from waveforms and measurements. |
| <ul style="list-style-type: none"> ● Optional 16 Channel Logic Probe to enable Mixed Signal functionality | <ul style="list-style-type: none"> ✓ Add mixed signal debugging in your Oscilloscope. |

PRODUCT OVERVIEW

T3DSO4000L-HD Low Profile Oscilloscope features 4-channel (1U High) and 8-channel (2U High) models with analog bandwidth option from 500 MHz to 2 GHz. The low profile form factor combined with 12-bit high resolution ADCs and low noise front end provides an impressive noise performance to cover a wide range of measurement applications. Each model offers a maximum sample rate of 10 GS/s per channel and a maximum memory depth of 500 Mpts.

It can be remotely controlled over LAN with its built-in web server and a complete SCPI command set over the standard 1000M LAN connection. An impressive display of measurement and math functions along with a built-in 25 MHz arbitrary waveform generator and 16 Channel Logic Analyzer as standard are features of the T3DSO4000L-HD.

Models and Key Specifications

| Bandwidth | 2 GHz | 1 GHz | 500 MHz |
|-----------|---------------|---------------|---------------|
| 8 Channel | T3DSO4208L-HD | T3DSO4108L-HD | T3DSO4058L-HD |
| 4 Channel | T3DSO4204L-HD | T3DSO4104L-HD | T3DSO4054L-HD |

| Model | T3DSO4208L-HD T3DSO4204L-HD | T3DSO4108L-HD T3DSO4104L-HD | T3DSO4058L-HD T3DSO4054L-HD |
|------------------------------|---|--------------------------------|--------------------------------|
| Channel | 8/4 + EXT | | |
| Bandwidth | 2 GHz | 1 GHz | 500 MHz |
| Sample rate (Max.) | 10 GS/s with ESR per channel | | |
| Memory depth (Max.) | 500 Mpts/ch (single-channel) 250 Mpts/ch (dual-channel) 125 Mpts/ch (3 or 4 channels) | | |
| Waveform capture rate (Max.) | Normal mode: 170,000 wfm/s; Sequence mode: 750,000 wfm/s | | |
| Vertical resolution | 12-bits | | |
| Trigger type | Edge, Slope, Pulse width, Window, Runt, Interval, Dropout, Pattern, Video, Qualified, Nth edge, Setup/hold, Delay, Serial | | |
| Serial trigger and decode | I ² C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I ² S, MIL-STD-1553B, SENT, Manchester (decode only) | | |
| Measurement | 50+ parameters, statistics, histogram, trend, and tracking supported | | |
| Math | 4 traces 8 Mpts FFT, +, -, x, ÷, ∫dt, 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, Digital Voltmeter, Counter, Waveform Histogram, Power Analysis, Eye/Jitter Analysis | | |
| Digital channel (optional) | 16-channel; maximum sample rate up to 1 GS/s; record length up to 50 Mpts | | |
| USB AWG Module (optional) | One channel, 50 MHz, sample rate of 125 MHz, wavelength of 16 kpts, isolated output | | |
| Waveform generator | Single-channel built-in waveform generator, frequency up to 25 MHz, 125 MS/s sample rate, 16 kpts waveform memory | | |
| I/O | HDMI (1280*800), USB 3.0 Host x2, USB 2.0 Host x2, USB 2.0 Device (USBTMC), 1000M LAN (SCPI over VXI-11, SCPI over Telnet (port:5024), SCPI over Socket (port:5025), micro SD card, External trigger, Auxiliary output (TRIG OUT, PASS/FAIL), 10 MHz In, 10 MHz Out | | |

PANEL INTRODUCTION



- A Analog Input Connectors** 1 MΩ: ≤ 400 Vpk (DC + AC), DC~10 kHz; 50 Ω: ≤ 5 Vrms, ±10 V Peak
- B Digital Input Connector**
- C USB 3.0 Host Ports** Connect to USB storage devices for data transfer or USB mouse / keyboard for control
- D Probe Compensation / Ground Terminal**
- E Power Standby Button**
- F Acquisition status and LAN status LEDs**
- G Reset for LAN**

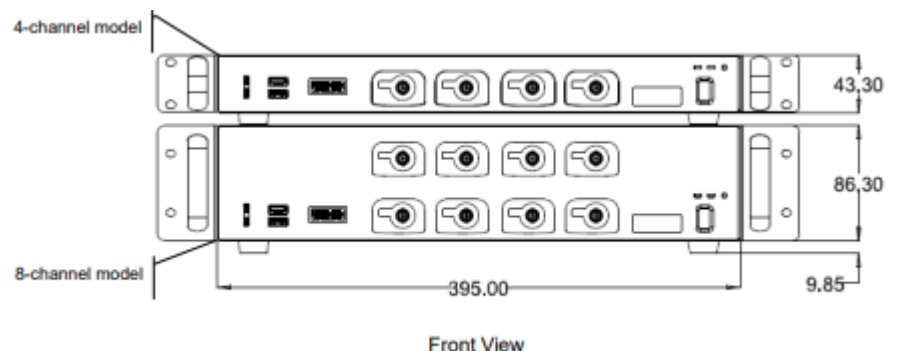
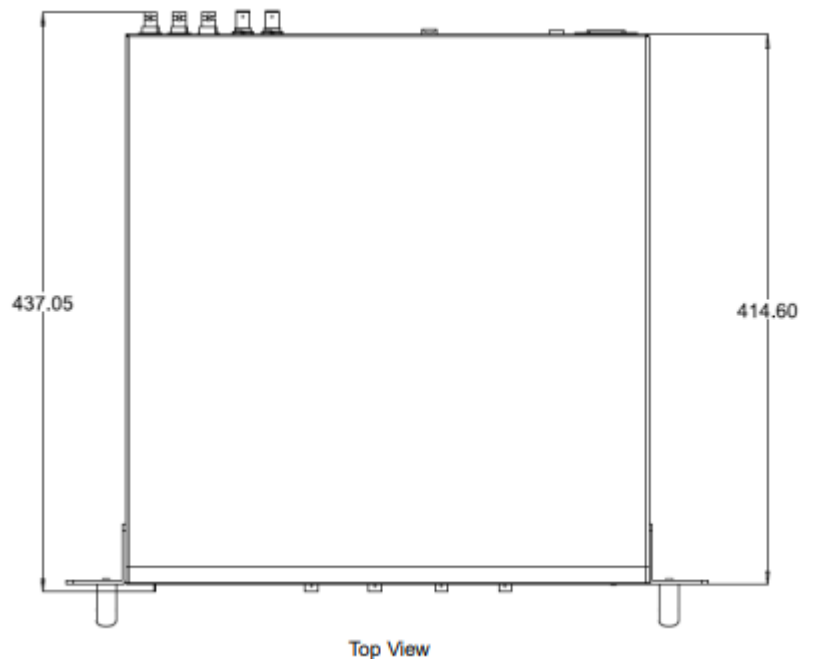


- A AC Power Input and Power Switch**
- B SD Card Slot**
- C HDMI Video Output** Connect the port to an external monitor. The resolution is 1280 * 800
- D 1000M LAN Port** Connect the port to the network for remote control
- E USB 2.0 Hosts** Connect with a USB storage device or USB mouse/keyboard
- F USB 2.0 Device** Connects with a PC for remote control
- G Auxiliary Out** Outputs the trigger indicator. When Mask Test is enabled, outputs the pass/fail signal
- H Ext Trigger Input**
- I 10 MHz Out and 10 MHz In**
- J Built-in AWG Output**

FEATURES

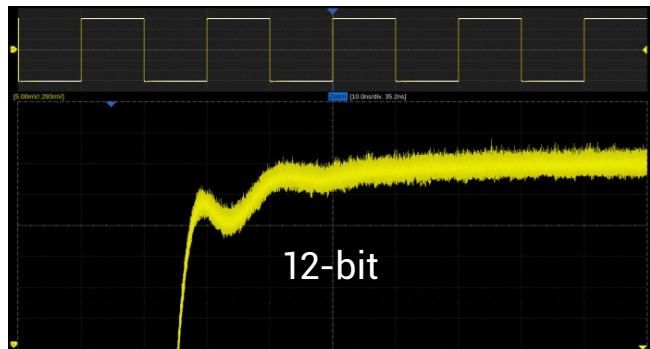
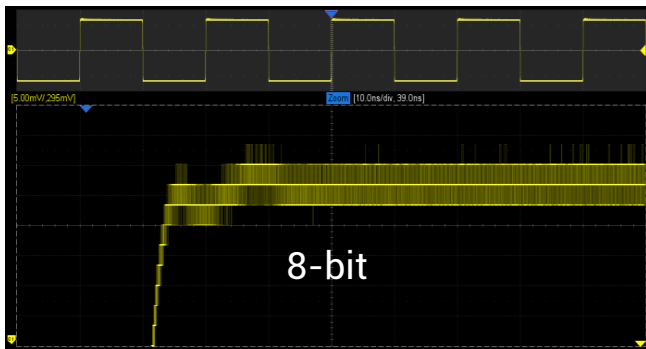
Key Features

- 8/4 analog channels + 1 external trigger.
- Analog channel bandwidth: up to 2 GHz; real-time sampling rate of up to 10 GS/s
- Vertical resolution: 12-bits
- Low noise floor: 153 μ Vrms at full bandwidth of 2 GHz
- New generation of high speed display technology
 - Waveform capture rates up to 170,000 wfm/s (normal mode), and 750,000 wfm/s (sequence mode)
 - Supports 256-level intensity grading and color temperature display modes
 - Memory depth up to 500 Mpts/channel
 - Digital trigger system
- Intelligent trigger: Edge, Slope, Pulse, Window, Runt, Interval, Dropout, Pattern, Qualified, Nth edge, Setup/hold, Delay and Video (HDTV supported).
- Serial bus triggering and decoder, supports protocols I²C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I²S, MIL-STD-1553B, SENT and Manchester
- Segmented acquisition (Sequence) mode, dividing the maximum record length into multiple segments (up to 80,000), according to trigger conditions set by the user, with a very small dead time between segments to capture the qualifying event
- History waveform record (History) function, the maximum recorded waveform length is 80,000 frames
- Automatic measurements on 50+ parameters, supports statistics with histogram, track, trend, Gating measurement, and measurements on Math, History, Memory and Ref
- 4 Math traces (8 Mpts FFT, addition, subtraction, multiplication, division, integration, differential, square root, etc.), supports formula editor
- Abundant data analysis functions such as Search, Navigate, Digital Voltmeter, Counter, Waveform Histogram, Power Analysis and Eye/Jitter Analysis
- 16 digital channels (optional)
- 50 MHz waveform generator (optional)
- Built-in 25 MHz function / arbitrary waveform generator with multiple predefined waveforms
- Interfaces include: 4x USB Hosts, USB Device (USBTMC), 1000M LAN (VXI-11/ Telnet/ Socket), micro SD card, Pass/Fail, Trigger Out, HDMI, 10 MHz In, 10 MHz 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.



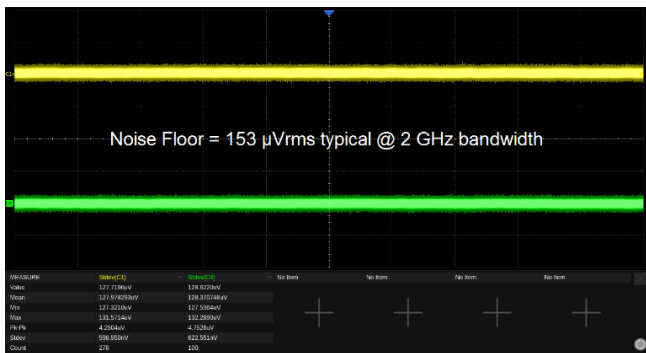
FUNCTIONS AND CHARACTERISTICS

High-resolution to meet high precision test requirements



When compared to waveforms acquired and displayed using conventional 8-bit oscilloscopes, waveforms captured with 12-bit technology are cleaner and provides more signal detail. This is helpful for wide dynamic range signals in which a full-scale signal must be acquired while at the same time very small amplitude signal details must be analyzed.

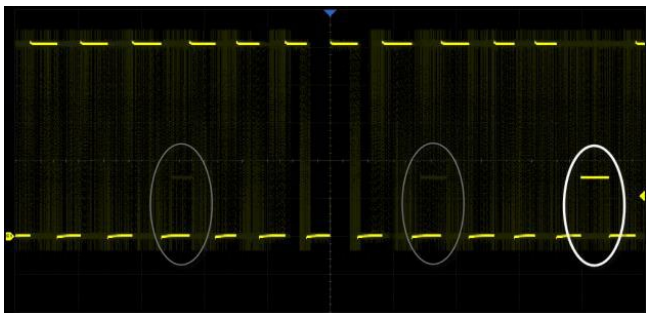
High Performance front-end



The noise floor value is:

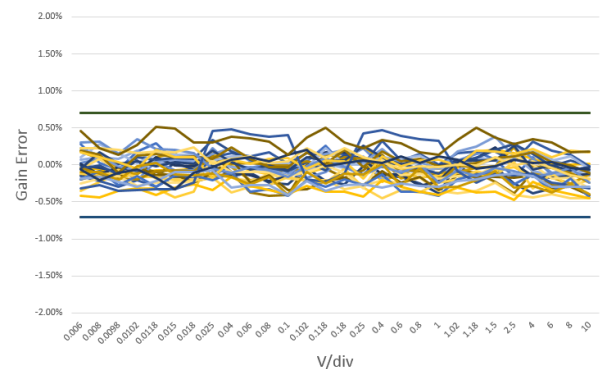
- 153 μ Vrms at full bandwidth of 2 GHz
- 125 μ Vrms at bandwidth of 1 GHz

High Waveform Update Rate



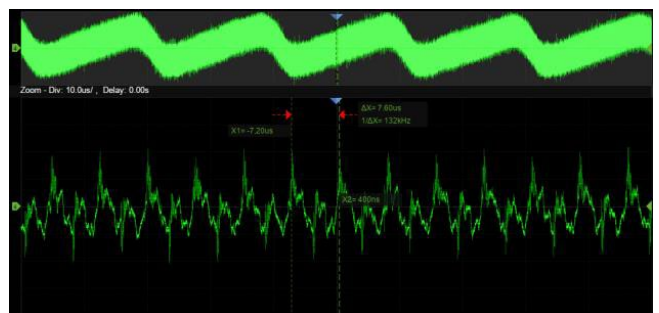
With a waveform update rate of up to 170,000 wfm/s, the oscilloscope can easily capture unusual or low-probability events. In Sequence mode, the waveform capture rate can reach 750,000 wfm/s.

Superb DC Gain Accuracy



A typical DC Gain Accuracy 0.5 % combined with low noise floor provides the capability to perform sensitive measurement required for wide range of applications.

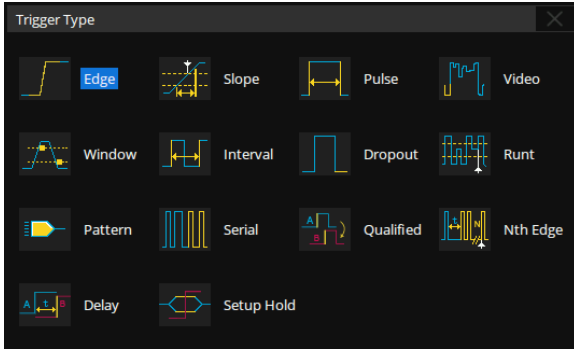
Deep Record Length



Using a hardware-based Zoom technique and record length of up to 500 Mpts, users can select a slower timebase without compromising the sample rate, and then quickly zoom in to focus on the area of interest.

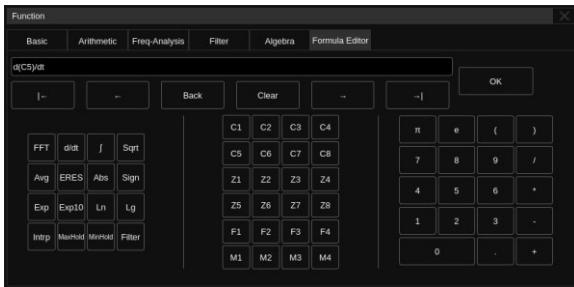
FUNCTIONS AND CHARACTERISTICS

Multiple Trigger Functions

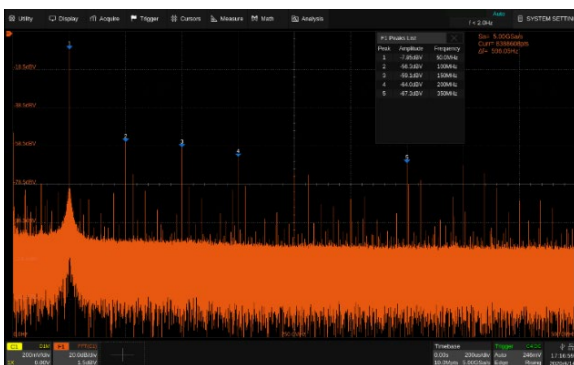


Edge, Slope, Pulse, Video, Windows, Runt, Interval, Dropout, Pattern, Qualified, Nth edge, Setup/ hold, Delay, and serial trigger.

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.



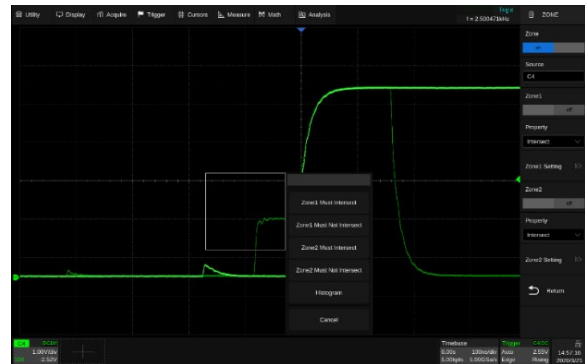
Hardware-accelerated FFT supports up to 8 Mpts operation. This provides high-frequency resolution with a fast refresh rate. The FFT function also supports a variety of window functions so that it can adapt to different spectrum measurement needs. Three modes (Normal, Average, and Max hold) can satisfy different requirements for observing the power spectrum. Auto peak detection and markers are supported.

History Mode



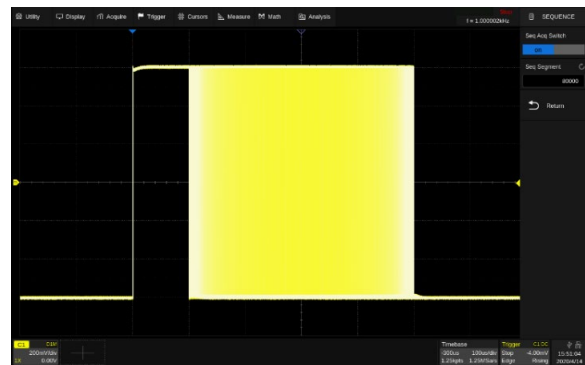
The history function can record up to 80,000 frames of waveforms. The recording is executed automatically so that the customer can playback the history waveforms at any time to observe unusual events and quickly locate the area of interest using cursors or measurements. The failed frames of the Mask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

Trigger Zone



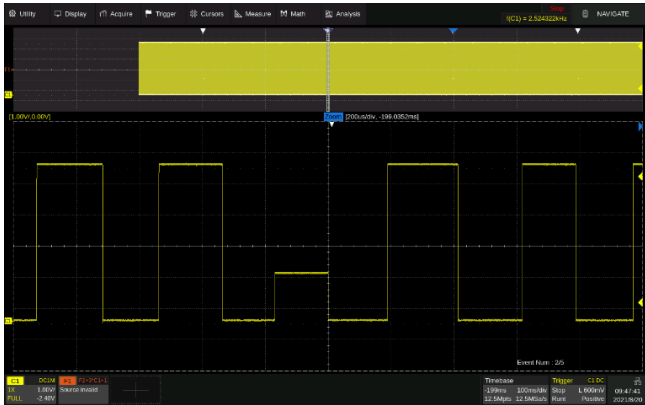
Trigger Zone is available for advanced triggering.

Sequence Mode



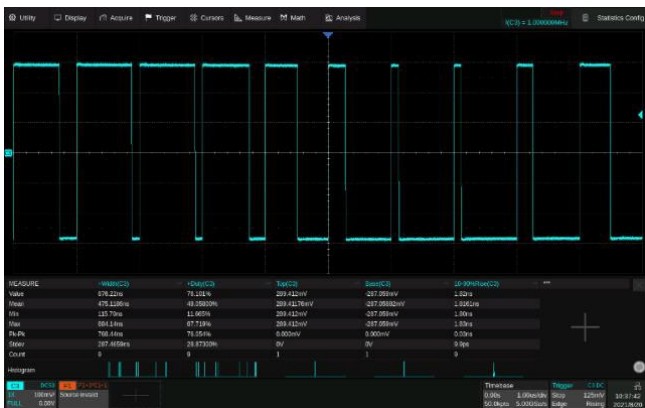
Segmented memory collection will store the waveform into multiple memory segments (up to 80,000) and each segment will store a triggered waveform as well as the dead time information. The interval between segments can be as small as 1.3 μs. All of the segments can be played back using the History function.

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.

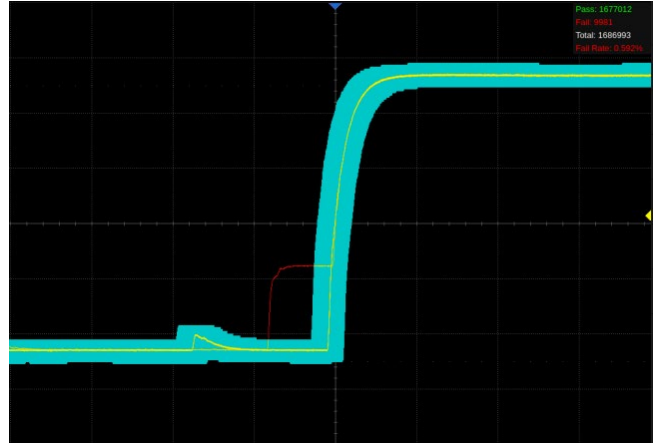
Parameter Statistics Function



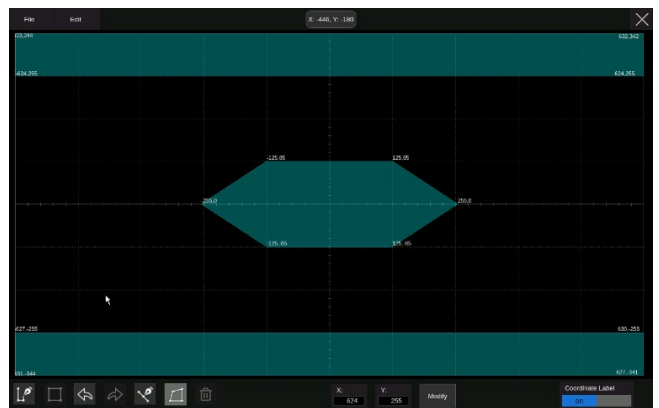
Statistics show the current value, maximum value, minimum value, standard deviation, and mean value of up to 12 parameters simultaneously. A histogram is available to show the probability distribution of a parameter. Trend and Track are available to show the parameter value vs. time.

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.

Hardware-based Mask Test Function



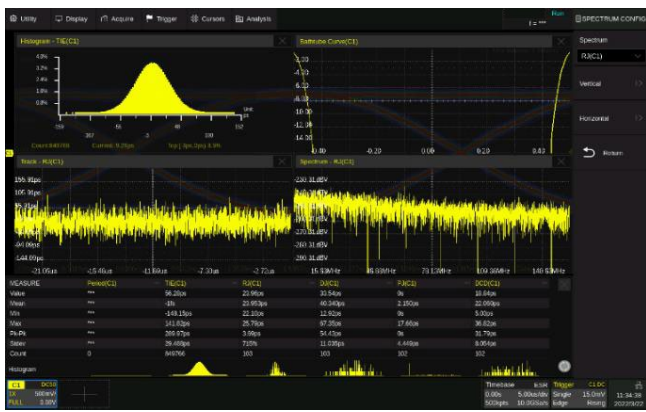
The oscilloscope utilizes a hardware-based Mask Test function, performing up to 18,000 Pass/Fail decisions each second. It is easy to generate userdefined test templates to provide trace mask comparisons, making it suitable for long-term signal monitoring or automated production line testing.



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

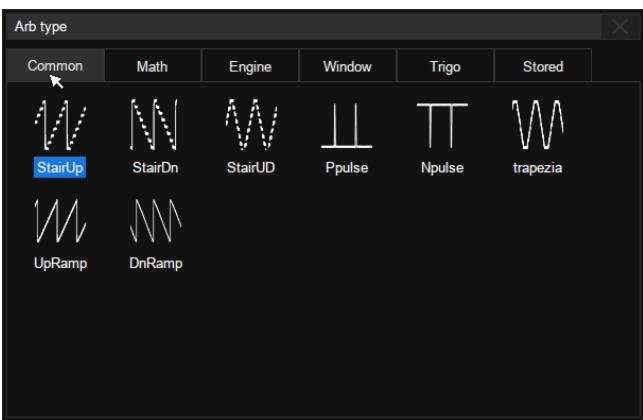
FUNCTION & CHARACTERISTICS

Eye/Jitter Analysis



Supports eye diagram and jitter analysis/measurement. It can automatically extract the embedded reference clock from serial data and create an eye diagram. Measurement on multiple eye/jitter parameters is provided and mask testing of eye diagrams is supported.

25 MHz Function/Arbitrary Waveform Generator



The built-in Function/Arbitrary waveform generator can output waveform with up to 25 MHz frequency and ± 3 V amplitude. Six basic waveforms plus multiple types of arbitrary waveforms are built-in. (Optional 50 MHz USB AWG waveform generator module: T3DSO-FGMOD)

Power Analysis



The Power Analysis application provides a full suite of power measurement and analysis tools. These tools enable an improvement in the efficiency of measurements made on switching power supplies and power devices. The Power Analysis application can measure Power Quality, Current Harmonics, Inrush Current, Switching Loss, Slew Rate, Modulation, Output Ripple, Turn On/ Turn Off, Transient Response, PSRR and Efficiency. Each measurement has a help screen showing a connection diagram with notes.

Digital Channels (T3DSO2000-LS)



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

SPECIFICATIONS

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 | 10 GS/s with ESR ¹⁾ per channel |
| Memory depth ^{2) 3)} | 500 Mpts/ch (single-channel) 250 Mpts/ch (dual-channel) 125 Mpts/ch (4 channels) |
| Waveform update rate | Normal mode: up to 170,000 wfm/s Sequence mode: up to 750,000 wfm/s |
| Intensity grading | 256-level |
| Peak detect | 200 ps |
| Average | 4, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192 |
| ERES | Enhanced bit: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4 bit |
| Sequence | Up to 80,000 segments, interval between triggers = 1.3 μ s min. |
| History | Up to 80,000 frames |
| Interpolation | sinx/x, x |

¹⁾ ESR: Enhanced Sample Rate provides better measurement accuracy by using 2x interpolation

²⁾ In Average and ERES modes, the memory depth is 25 Mpts/ch

³⁾ C1 – C4 as a group and C5-C8 as another group. In a group:

Single-channel: Only one channel is enabled in a group

Dual-channel: Two channels are enabled in a group

Vertical (analog)

| Model | T3DSO4208L-HD T3DSO4204L-HD | T3DSO4108L-HD T3DSO4104L-HD | T3DSO4058L-HD T3DSO4054L-HD |
|--|--|--------------------------------|--------------------------------|
| Channel | 8/4 + EXT | | |
| Resolution | 12-bits | | |
| Bandwidth (-3 dB) @ 50 Ω | 2 GHz ¹⁾ | 1 GHz | 500 MHz |
| Rise time @ 50 Ω (typical) | 230 ps | 350 ps | 550 ps |
| Bandwidth (-3 dB) @ 1M Ω , with probe | 500 MHz | | |
| Effective number of bits (ENOB) | 8.1 bits | 8.3 bits | 8.5 bits |
| Noise Floor ²⁾ (rms, 50 Ω , typ) | | | |
| 0.5 mV/div – 5 mV/div | 153 μ V | 125 μ V | 90 μ V |
| 10 mV/div | 185 μ V | 130 μ V | 95 μ V |
| 20 mV/div | 214 μ V | 160 μ V | 115 μ V |
| 50 mV/div | 427 μ V | 280 μ V | 210 μ V |
| 100 mV/div | 738 μ V | 465 μ V | 350 μ V |
| 200 mV/div | 2.12 mV | 1.65 mV | 1.10 mV |
| 500 mV/div | 4.41 mV | 2.75 mV | 2.10 mV |
| 1 V/div | 7.39 mV | 4.70 mV | 3.50 mV |
| Vertical scale range | 8 divisions | | |
| Vertical scale (probe 1X) | 1 M Ω : 0.5 mV/div – 10 V/div 50 Ω : 0.5 mV/div – 1 V/div | | |
| DC gain accuracy | 0.5 mV/div – 4.95 mV/div: \pm 1.5%; 5 mV/div – 10 V/div: \pm 0.5% | | |
| DC Offset accuracy | \pm (1% of the offset setting + 0.5% of full scale + 0.02% of max offset + 1 mV) | | |

¹⁾ The bandwidth is 1 GHz below 2.3 mV/div

²⁾ Take the standard deviation (Stdev)

SPECIFICATIONS

| Model | T3DSO4208L-HD T3DSO4204L-HD | T3DSO4108L-HD T3DSO4104L-HD | T3DSO4058L-HD T3DSO4054L-HD |
|---|--|--------------------------------|--------------------------------|
| Offset range (probe 1X) | 1 M Ω : 0.5 mV/div – 5 mV/div: ± 1.6 V 5.1 mV/div – 10 mV/div: ± 4 V 10.2 mV/div – 20 mV/div: ± 8 V 20.5 mV/div – 100 mV/div: ± 16 V 102 mV/div – 200 mV/div: ± 80 V 205 mV/div – 1 V/div: ± 160 V 1.02 V/div – 10 V/div: ± 400 V 50 Ω : 0.5 mV/div – 5 mV/div: ± 1.6 V 5.1 mV/div – 10 mV/div: ± 4 V 10.2 mV/div – 20 mV/div: ± 8 V 20.5 mV/div – 1 V/div: ± 10 V | | |
| Bandwidth limit | Hardware Bandwidth limit: 20 MHz, 200 MHz | | |
| Low-frequency response (AC coupling -3 dB) | 6 Hz (typical) | | |
| Overshoot (100 mV/div, 150 ps edge @ 50 Ω , typical) | 15 % | 10 % | 5 % |
| Coupling | DC, AC, GND | | |
| Impedance | (1 M Ω \pm 2 %) (20 pF \pm 3 pF) 50 Ω : 50 Ω \pm 2 % | | |
| Max. Input voltage | 1 M Ω < 400 Vpk (DC + AC), DC-10 kHz 50 Ω < 5 Vrms, ± 10 V Peak | | |
| SFDR | > 45 dBc | | |
| CH to CH Isolation (@ 50 Ω) | 70 dB up to 200 MHz 60 dB up to 500 MHz 50 dB up to 1 GHz 40 dB up to 2 GHz | | |
| Probe Attenuation | 1X, 10X, 100X, custom | | |

Horizontal

| | | | |
|--------------------|--|-------------------------|-------------------------|
| Time scale | 0.1 ns/div – 1000 s/div | 0.2 ns/div – 1000 s/div | 0.5 ns/div – 1000 s/div |
| Range | 10 divisions | | |
| Display mode | Y-T, X-Y, Roll | | |
| Roll mode | ≥ 50 ms/div | | |
| Skew (CH1 – CH8) | < 100 ps | | |
| Time base Accuracy | ± 2 ppm initial (0–50 $^{\circ}$ C); ± 0.5 ppm 1st year aging; ± 3 ppm 20-year aging | | |

Trigger

| | | | |
|----------------------------|--|---|----------------|
| Mode | Auto, Normal, Single | | |
| Level | Internal: ± 4.5 div from the center of the screen EXT: ± 0.61 V EXT/5: ± 3.05 V | | |
| Hold off range | By time: 4 ns – 30 s (4 ns step) By event: 1 – 108 | | |
| Coupling | CH1 – CH8 DC: Passes all components of the signal AC: Blocks DC components and attenuates signals below 15 Hz LFRJ: Attenuates the frequency components below 2.4 MHz HFRJ: Attenuates the frequency components above 1.3 MHz Noise RJ: Increases the trigger hysteresis EXT DC: Passes all components of the signal AC: Blocks DC components and attenuates signals below 15 Hz LFRJ: Attenuates the frequency components below 2.5 MHz HFRJ: Attenuates the frequency components above 1.3 MHz | | |
| Accuracy (typical) | CH1 – CH8: ± 0.2 div EXT: ± 0.3 div | | |
| Sensitivity | | Noise RJ = OFF | Noise RJ = ON |
| | CH1 ~ CH8: | >10 mV/div: ± 0.26 div | ± 0.33 div |
| | | 5 mV/div – 10 mV/div: ± 0.26 div | ± 0.33 div |
| | | ≤ 2 mV/div: ± 0.5 div | ± 0.5 div |
| | EXT: | 200 mVpp, DC – 10 MHz 300 mVpp, 10 MHz – bandwidth (300 MHz) | |
| | EXT/5: | 1 Vpp, DC – 10 MHz 1.5 Vpp, 10 MHz – bandwidth (300 MHz) | |
| Jitter | CH1 – CH8: <100 ps pk-pk EXT: < 200 ps rms | | |
| Displacement | Pre-Trigger: 0–100 % memory Delay-Trigger: 0–5000 div | | |
| Zone | Up to 2 zones Source: CH1 – CH8 Property: Intersect, Not Intersect | | |
| Edge Trigger | | | |
| Source | CH1 – CH8 / EXT / (EXT/5) / AC Line / D0 – D15 | | |
| Slope | Rising, Falling, Rising & Falling | | |
| Slope Trigger | | | |
| Source | CH1 – CH8 | | |
| Slope | Rising, Falling | | |
| Limit range | <, >, in range, out of range | | |
| Time range | 2 ns – 20 s, Resolution = 1 ns | | |
| Pulse Width Trigger | | | |
| Source | CH1 – CH8 / D0 – D15 | | |
| Polarity | +wid, -wid | | |
| Limit range | <, >, in range, out of range | | |
| Time range | 2 ns – 20 s, Resolution = 1 ns | | |
| Video Trigger | | | |
| Source | CH1 – CH8 | | |
| Standard | NTSC, PAL, 720p/50, 720p/60, 1080p/50, 1080p/60, 1080i/50, 1080i/60, Custom | | |
| Synchronization | Any, Select | | |
| Trigger Condition | Line, Field | | |
| Window Trigger | | | |
| Source | CH1 – CH8 | | |
| Window type | Absolute, Relative | | |

SPECIFICATIONS

| Interval Trigger | |
|--------------------------|---|
| Source | CH1 – CH8 / D0 – D15 |
| Slope | Rising, Falling |
| Limit range | <, >, in range, out of range |
| Time range | 2 ns – 20 s, Resolution = 1 ns |
| Dropout Trigger | |
| Source | CH1 – CH8 / D0 – D15 |
| Timeout type | Edge, State |
| Slope | Rising, Falling |
| Time range | 2 ns – 20 s, Resolution = 1 ns |
| Runt Trigger | |
| Source | CH1 – CH8 |
| Polarity | Positive, Negative |
| Limit range | <, >, in range, out of range |
| Time range | 2 ns – 20 s, Resolution = 1 ns |
| Pattern Trigger | |
| Source | CH1 – CH8 / 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 |
| Qualified Trigger | |
| Type | State, State with Delay, Edge, Edge with Delay |
| Qualified Source | CH1 – CH8 / D0 – D15 |
| Edge Trigger Source | CH1 – CH8 / D0 – D15 |
| Nth Edge Trigger | |
| Source | CH1 – CH8 / D0 – D15 |
| Slope | Rising, Falling |
| Idle time | 8 ns – 20 s, Resolution = 1 ns |
| Edge Number | 1 – 65535 |
| Delay Trigger | |
| Source A | CH1 – CH8 / D0 – D15 |
| Source B | CH1 – CH8 / D0 – D15 |
| Slope | Rising, Falling |
| Limit range | <, >, in range, out of range |
| Time range | 2 ns – 20 s, Resolution = 1 ns |
| Serial Trigger | |
| Source | CH1 – CH8 / D0 – D15 |
| Protocol | I ² C, SPI, UART, CAN, LIN, CAN FD, FlexRay, I ² S, MIL-STD-1553B, SENT |
| I ² C | Type: Start, Stop, Restart, No Ack, EEPROM, Address & Data, Data Length |
| SPI | Type: Data |
| UART | Type: Start, Stop, Data, Parity Error |
| CAN | Type: All, Remote, ID, ID+Data, Error |
| LIN | Type: Break, Frame ID, ID+Data, Error |
| CAN FD | Type: Start, Remote, ID, ID+Data, Error |
| FlexRay | Type: TSS, Frame, Symbol, Errors |
| I ² S | Type: Data, Mute, Clip, Glitch, Rising Edge, Falling Edge |
| MIL-STD-1553B | Type: Transfer, Word, Error, Timing |
| SENT | Type: Start, Slow channel, Fast channel, Error |

Serial Decoder

| | |
|-----------------------|--|
| Decoders | 2 |
| Threshold | -4.1 to 4.1 div |
| List | 1–7 lines |
| Decoder type | Full duplex |
| I²C | |
| Source | CH1–CH8 / D0–D15 |
| Signal | SCL, SDA |
| Address | 7-bit, 10-bit |
| SPI | |
| Source | CH1–CH8 / D0–D15 |
| Signal | CLK, MISO, MOSI, CS |
| Edge Select | Rising, Falling |
| Chip select | Active high, Active low, Clock timeout |
| Bit Order | LSB, MSB |
| UART | |
| Source | CH1–CH8 / 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 |
| CAN | |
| Source | CH1–CH8 / D0–D15 |
| LIN | |
| LIN Version | Ver 1.3, Ver 2.0 |
| Source | CH1–CH8 / D0–D15 |
| Baud Rate | 600 bps, 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, Custom |
| CAN FD | |
| Source | CH1–CH8 / D0–D15 |
| Nominal Baud Rate | 10 kbps, 25 kbps, 50 kbps, 100 kbps, 250 kbps, 1 Mbps, Custom |
| Data Baud Rate | 500 kbps, 1 Mbps, 2 Mbps, 5 Mbps, 8 Mbps, 10 Mbps, Custom |
| FlexRay | |
| Source | CH1–CH8 / D0–D15 |
| Baud Rate | 2.5 Mbps, 5 Mbps, 10 Mbps, Custom |
| I²S | |
| Source | CH1–CH8 / D0–D15 |
| Signal | BCLK, WS, DATA |
| Audio Variant | Audio-I ² S, Audio-LJ, Audio-RJ |
| Start Bits | 0 – 31 |
| Data Bits | 1 – 32 |
| MIL-STD-1553B | |
| Source | CH1–CH8 |
| SENT | |
| Source | CH1–CH8 / D0–D15 |
| Manchester | |
| Source | CH1–CH8 |
| Baud Rate | 500 bps – 5 Mbps |

SPECIFICATIONS

Measurement

Automatic Measurement

| | |
|--------------------------|--|
| Source | CH1 – CH8, D0 – D15, Math, Ref, History, Zoom |
| Mode | Simple, Advanced |
| Range | Screen 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, FPPE, 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 – CH8, D0 – D15, Math, Ref, Histogram |
| Type | Manual: Time X1, X2, (X1-X2), (1/ΔT); Vertical Y1, Y2, (Y1-Y2) Track: Time X1, X2, (X1-X2) Measure: Indicates the measurement of a specific parameter |

Math

| | |
|-----------|---|
| Trace | F1, F2, F3, F4 |
| Source | CH1 – CH8, Z1 – Z8, 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: 8 Mpts, 4 Mpts, 2 Mpts, 1 Mpts, 512 kpts, 256 kpts, 128 kpts, 64 kpts, 32 kpts, 16 kpts, 8 kpts, 4 kpts, 2 kpts Window: Rectangular, Blackman, Hanning, Hamming, Flattop Display: Full Screen, Split, Exclusive Mode: Normal, Max hold, Average Tools: Peaks, Markers |

Analysis

Search

| | |
|--------------|------------------------------------|
| Source | CH1 – CH8, 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 – CH8, Z1 – Z8 |
| Mask creating | Auto (Create mask), Customized (Mask Editor) |
| Mask test speed | Up to 18,000 frames/s |

DVM

| | |
|--------|---|
| Source | CH1 – CH8 |
| Mode | DC mean, DC RMS, AC RMS, Peak-peak, Amplitude |
| Plot | Bar, Histogram, Trend |
| Gate | 20 ms |

Power Analysis

| | |
|---------|---|
| Source | CH1 – CH4 |
| Measure | Power quality, Current Harmonics, Inrush current, Switching loss, Slew rate, Modulation, Output ripple, Turn on/turn off, Transient response, PSRR, Efficiency, SOA |

| Histogram | |
|------------------------|--|
| Source | CH1 – CH8 |
| Type | Horizontal, Vertical, Both |
| Counter | |
| Source | CH1 – CH8 |
| Frequency resolution | 7 digits |
| Totalizer | Counter on edges, supports Gate and Trigger |
| Eye Diagram | |
| Source | CH1 – CH8 |
| Clock recovery | Constant frequency, PLL |
| Measure | Eye height, "1" level, "0" level, Eye amplitude, Eye width, Eye crossing, Average power, Q factor, TIE |
| Mask Test | Supported |
| Jitter Analysis | |
| Source | CH1 – CH8 |
| Clock recovery | Constant frequency, PLL |
| Measure | Period, Frequency, +Width, -Width, +Duty cycle, -Duty cycle, Cycle-cycle jitter, Cycle-cycle +width, Cycle-cycle -Width, Cycle-cycle +Duty cycle, Cycle-cycle -Duty cycle, Bit Rate, Unit interval |
| Jitter decomposition | TIE, RJ, DJ, DCD, DDJ, PJ, TJ@BER Statistics: Histogram, Track, Spectrum |

Digital Channels

| | |
|-----------------------------|--|
| Max. Sampling Rate | 1 GS/s |
| Memory Depth | 50 Mpts/ch |
| Min. Detectable Pulse Width | 3.3 ns |
| Level Group | D0 – D7, D8 – D15 |
| Level Range | -10 V – 10 V |
| Logic Type | TTL, CMOS, LVCMOS3.3, LVCMOS2.5, Custom |
| Skew | D0-D15: ±1 sampling interval Digital to Analog: ± (1 sampling interval +1 ns) |

Waveform Generator

| Channels | 1 |
|--------------------------|--|
| Max. Output Frequency | 25 MHz |
| Sampling Rate | 125 MS/s |
| Frequency Resolution | 1 µHz |
| Frequency Accuracy | ± 50 ppm |
| Vertical Resolution | 14-bit |
| Amplitude Range | -1.5 V – +1.5 V (into 50 Ω) -3 V – +3 V (into High-Z) |
| Waveforms | Sine, Square, Ramp, Pulse, DC, Noise, 45 Arbitrary |
| Output Impedance | 50 Ω ± 2 % |
| Protection | Over-voltage protection, Current limit |
| Sine | |
| Frequency | 1 µHz – 25 MHz |
| Offset accuracy (10 kHz) | ± (1 %*offset setting value +3 mVpp) |
| Amplitude flatness | ± 0.3 dB, compared to 10 kHz, 2.5 Vpp into 50 Ω |
| SFDR | DC – 1 MHz -60 dBc 1 MHz – 5 MHz -55 dBc 5 MHz – 25 MHz -50 dBc |
| Harmonic distortion | DC – 5 MHz -50 dBc 5 MHz – 25 MHz -45 dBc |

SPECIFICATIONS

| Square / Pulse | |
|-----------------------|---|
| Frequency | 1 μ 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 μ 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 Ω) \pm 3 V (into Hi-Z) |
| Accuracy | \pm (setting value *1% + 3 mV) |
| Noise | |
| Bandwidth (-3 dB) | >25 MHz |
| Arb | |
| Frequency | 1 μ 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 3.0 Host x2, Calibration Signal: 1 kHz, 3 V Square |
| Rear | USB 2.0 Host x2, USB 2.0 Device, LAN: 10 / 100M / 1000M BaseT (RJ45), Micro SD Card, External Trigger, EXT: \leq 1.5 Vrms, EXT/5: \leq 7.5Vrms, Auxiliary Output: TRIG OUT (3.3 V LVCMOS), PASS/FAIL OUT (3.3 V TTL), HDMI 10 MHz In, 10 MHz Out AWG |

Display Setting

| | |
|----------------------|---|
| Range | 8 x 10 grid |
| Display Type | Dot, Vector |
| Persistence Time | OFF, 0.1 s, 0.2 s, 0.5 s, 1 s, 5 s, 10 s, 30 s, infinite |
| Color Display | Normal, Color; Supports customer trace color |
| Language | Simplified Chinese, Traditional Chinese, English, French, Japanese, German, Spanish, Russian, Italian, Portuguese |
| Built-in Help System | Simplified Chinese, English |




Environmental

| | | |
|----------------------------------|---|---|
| Temperature | Operating: 0 °C – 50 °C Non-operating: -30 °C– -70 °C | |
| Humidity | Operating: 5 % – 90 % RH, 30 °C, degraded to 50 % RH at 40 °C Non-operating: 5 % – 95 % | |
| Altitude | Operating: ≤ 3,048 m, 25 °C Non-operating: ≤ 12,192 m | |
| Electromagnetic Compatibility | Meets EMC directive (2014/30/EU), meets or exceeds IEC 61326-1:2012/EN61326-1:2013 (Basic) | |
| | Conducted disturbance | CISPR 11 / EN 55011 CLASS A group 1 150 kHz – 30 MHz |
| | Radiated disturbance | CISPR 11 / EN 55011 CLASS A group 1 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 electro- magnetic field Immunity | IEC 61000-4-3 / EN 61000-4-3 10 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) |
| | Electrical fast transients (EFT) | IEC 61000-4-4 / EN 61000-4-4 2kV (Input AC Power Ports) |
| | Surges | IEC 61000-4-5 / EN 61000-4-5 1kV (Line to line) 2kV (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: 0 % UT during 1 cycle; 40 % UT during 10/12 cycles; 70 % UT during 25/30 cycles Voltage interruptions: 0 % UT during 250/300 cycles |
| | Safety | UL 61010-1:2012/R: 2018-11; CAN/CSA-C22.2 No. 61010-1:2012/A1:2018-11. UL 61010-2-030:2018; CAN/CSA-C22.2 No. 61010-2-030:2018. |
| RoHS | EU 2015/863 | |

SPECIFICATIONS

| Power Supply | 8-channel | 4-channel |
|---------------------------|---|---|
| Input Voltage & Frequency | 100 – 240 Vrms 50/60Hz 100 – 120 Vrms 400 Hz | |
| Power consumption | 380 W max., 240 W typical, 8 W typical in standby mode | 190 W max., 120 W typical, 4 W typical in standby mode |
| Mechanical | 8-channel | 4-channel |
| Dimensions | Length × Height × Width = 391 mm × 86 mm × 421 mm | Length × Height × Width = 391 mm × 43 mm × 421 mm |
| Weight | Net Weight 9.1 kg | Net Weight 6.1 kg |

T3DSO4000L-HD Optional Accessories

| Probe type | Model | Picture | Description |
|----------------|--------------|---|--|
| Passive | T3PP500 |  | 500 MHz bandwidth, 10 MΩ, 10X Probe, 1 supplied per channel. Replacement probe for the T3DSO4000L-HD Low Profile Oscilloscope. |
| Logic Probe | T3DSO2000-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 |

Ordering information

| | | |
|-----------------------------|---|----------------------|
| Description | 2 GHz bandwidth, 5 GS/s sample rate, 12-Bit, 500 Mpts memory depth, 8-channel | T3DSO4208L-HD |
| | 2 GHz bandwidth, 5 GS/s sample rate, 12-Bit, 500 Mpts memory depth, 4-channel | T3DSO4204L-HD |
| | 1 GHz bandwidth, 5 GS/s sample rate, 12-Bit, 500 Mpts memory depth, 8-channel | T3DSO4108L-HD |
| | 1 GHz bandwidth, 5 GS/s sample rate, 12-Bit, 500 Mpts memory depth, 4-channel | T3DSO4104L-HD |
| | 500 MHz bandwidth, 5 GS/s sample rate, 12-Bit, 500 Mpts memory depth, 8-channel | T3DSO4058L-HD |
| | 500 MHz bandwidth, 5 GS/s sample rate, 12-Bit, 500 Mpts memory depth, 4-channel | T3DSO4054L-HD |
| Standard Accessories | Passive Probe 1/CH | |
| | USB Cable | |
| | Power Cord | |
| | Wireless mouse | |
| | Quick Start Guide | |
| | Certificate of Calibration | |
| | Rackmount Kit | |
| Optional Accessories | 16 Channel MSO Probe | T3DSO2000-LS |
| | 500 MHz Passive Probe, 10:1, 10 MΩ | T3PP500 |
| | USB AWG Module | T3DSO-FGMOD |

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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teledynelecroy.com



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