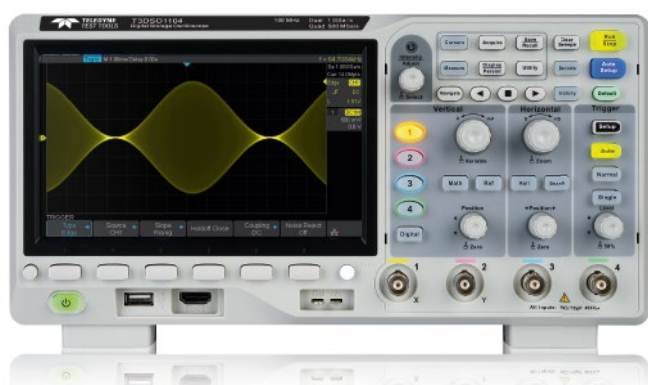


# T3DSO1000 Data Sheet

## Oscilloscopes

### Debug with Confidence

#### 100 MHz – 200 MHz



Front panel of the four channel series



Front panel of the two channel series

### Tools for Improved Debugging

- |                                                                                                         |                                                                         |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| • <b>Long Capture</b> – 7 Mpts/Ch and 14 Mpts interleaved.                                              | ✓ <b>Capture more time and show more waveform detail.</b>               |
| • <b>Math and Measure</b> – 7 basic math functions plus FFT and 38 automatic measurement parameters.    | ✓ <b>Extract results from waveforms and measurements.</b>               |
| • <b>Connectivity</b> – USB for mass storage, printing and PC control, plus LAN for fast data transfer. | ✓ <b>Save data for external analysis and screen images for reports.</b> |
| • <b>Serial Bus Trigger and Decode</b> – I2C, SPI, UART, RS232, CAN, LIN.                               | ✓ <b>Debug serial buses directly in your Oscilloscope.</b>              |
| • <b>Waveform Sequence Recorder</b> – record and play back up to 80,000 waveforms.                      | ✓ <b>Replay the changing waveform history.</b>                          |
| • <b>Optional MSO</b> – 16 Digital Channels (4 channel series only).                                    | ✓ <b>Add mixed signal debugging to your Oscilloscope.</b>               |

### Key Specifications

|              |                                                                            |
|--------------|----------------------------------------------------------------------------|
| Bandwidth    | 100 MHz, 200 MHz                                                           |
| Channels     | 2 or 4                                                                     |
| Memory       | up to 7 Mpts/Ch (14 Mpts interleaved)                                      |
| Sample Rate  | up to 1 GS/s [vergl. Fact Sheet: "up to 500 MS/s / 1 GS/s interleaved"] ?? |
| Display      | 7" Bright TFT LCD (800 x 480)                                              |
| Connectivity | USB Host, USB Device, LAN                                                  |

# PRODUCT OVERVIEW

**T3DSO1102:** 2 Channel 100 MHz

**T3DSO1104:** 4 Channel 100 MHz

**T3DSO1204:** 4 Channel 200 MHz

**Teledyne Test Tools new T3DSO1000 Oscilloscopes feature two channel and four channel models. The two channel model is available with 100 MHz or 200 MHz analog bandwidth, a single ADC with a 1 GSa/s maximum sample rate, and a single memory module with 14 Mpts of sample memory. The four channel scope is available in 100 and 200 MHz models and incorporates two 1 GSa/s ADCs and two 14 Mpts memory modules. When all channels are enabled, each channel has sample rate of 500 MSa/s and a standard record length of 7 Mpts. When only a single channel per ADC is active, the maximum sample rate is 1 GSa/s and the maximum record length is 14 Mpts. For ease-of-use, the most commonly used functions can be accessed with its user-friendly front panel design.**

The **T3DSO1000** series employs a new generation of high speed display technology that provides excellent signal clarity, fidelity and performance. The system noise floor is also lower than similar products in the industry. It comes with a minimum vertical input range of 500  $\mu$ V/div, an innovative digital trigger system with high sensitivity and low jitter, and a waveform capture rate of 400,000 frames/sec (sequence mode). The **T3DSO1000** also employs a 256-level intensity grading display function and a color temperature display mode not found in other models in this class. Teledyne Test Tools latest oscilloscope offering supports multiple powerful triggering modes including serial bus triggering. Serial bus decoding for IIC, SPI, UART, CAN, LIN bus types is included. The models also include History waveform recording, and sequential triggering that enable extended waveform recording and analysis.

Another powerful addition is the new 1 million point FFT math function that gives the **T3DSO1000** very high frequency resolution when observing signal spectra. The new digital design also includes a hardware co-processor that delivers measurements quickly and accurately without slowing acquisition and front-panel response. The features and performance of Teledyne Test Tools new **T3DSO1000** cannot be matched in this price class.

The four channel series includes even more functions, including: searching and navigating, on-screen Bode plot, 16 digital channels (Option), an external USB powered 25 MHz AWG module (Option), a USB WIFI adapter (Option), and an embedded application that allows remote control via web browser.

## Key Features

- 100 MHz, 200 MHz bandwidth models
- Two channel series have one 1 GSa/s ADC, four channel series have two 1 GSa/s ADCs. When all channels are enabled, each channel has a maximum sample rate of 500 MSa/s. When a single channel per ADC is active, it has sample rate of 1 GSa/s
- The newest generation of high speed display technology
  - Waveform capture rate up to 100,000 wfm/s (normal mode), and 400,000 wfm/s (sequence mode)
  - Supports 256-level intensity grading and color display modes Record length up to 14 Mpts
  - Digital trigger system
- Intelligent trigger: Edge, Slope, Pulse Width, Window, Runt, Interval, Time out (Dropout), Pattern
- Serial bus triggering and decoding (Standard), supports protocols IIC, SPI, UART, RS232, CAN, LIN
- Video trigger, supports HDTV
- Low background noise with voltage scales from 500  $\mu$ V/div to 10 V/div
- 10 types of one-button shortcuts, supports Auto Setup, Default, Cursors, Measure, Roll, History, Display/Persist, Clear Sweep, Zoom and Print Segmented acquisition (Sequence) mode, divides 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 segment to capture the qualifying event.
- History waveform record (History) function, maximum recorded waveform length is 80,000 frames.

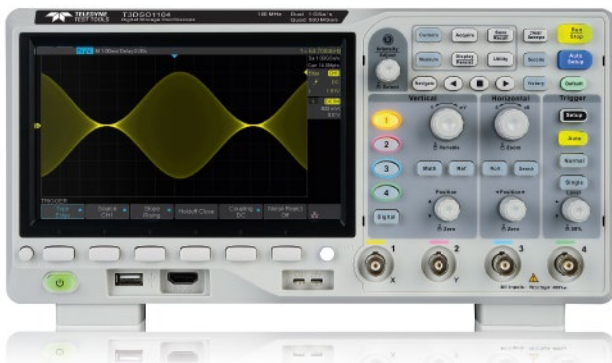
## Models and key Specification

| Model                                                             | T3DSO1102<br>T3DSO1104                                                                                                                                                                                                                                         | T3DSO1204                            |
|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| <b>Bandwidth</b>                                                  | 100 MHz                                                                                                                                                                                                                                                        | 200 MHz                              |
| <b>SamplingRate (Max.)</b>                                        | Two channel series have a single 1 GSa/s ADC, four channel series have two 1 GSa/s ADCs. When all channels are enabled, each channel has a maximum sample rate of 500 MSa/s. When a single channel per pair is active, that channel has sample rate of 1 GSa/s |                                      |
| <b>Channels</b>                                                   | 4 (four channel series)<br>2+EXT (two channel series)                                                                                                                                                                                                          |                                      |
| <b>Memory Depth (Max.)</b>                                        | 7 Mpts/CH (not interleave mode);<br>14 Mpts/CH (interleave mode)                                                                                                                                                                                               |                                      |
| <b>Waveform Capture Rate (Max.)</b>                               | 100,000 wfm/s (normal mode), 400,000 wfm/s (sequence mode)                                                                                                                                                                                                     |                                      |
| <b>Trigger Type</b>                                               | Edge, Slope, Pulse Width, Window, Runt, Interval, Dropout, Pattern, Video                                                                                                                                                                                      |                                      |
| <b>Serial Trigger and decoder (Standard)</b>                      | IIC, SPI, UART/RS232, CAN, LIN                                                                                                                                                                                                                                 |                                      |
| <b>16 Digital Channels<br/>(four channel series only, option)</b> | Maximum waveform capture rate up to 1 GSa/s, Record length up to 14 Mpts/CH                                                                                                                                                                                    |                                      |
| <b>USB AWG module<br/>(four channel series only, option)</b>      | One channel, 25 MHz, sample rate of 125 MHz, wave length of 16 kpts                                                                                                                                                                                            |                                      |
| <b>Bode plot ( four channel series only)</b>                      | Minimum start frequency of 10 Hz, minimum scan bandwidth of 500 Hz, maximum scan bandwidth of 120 MHz (dependent on Oscilloscope and AWG bandwidth), 500 maximum scan frequency points                                                                         |                                      |
| <b>USB WIFI adapter<br/>(four channel series only, option)</b>    | 802.11b/g/b, WPA-PSK, the adapter must be purchased separately by the scope user (TP-Link TL-WN725N)                                                                                                                                                           |                                      |
| <b>I/O</b>                                                        | USB Host, USB Device, LAN, Pass/Fail, Trigger Out, Sbus (Teledyne Test Tools MSO)                                                                                                                                                                              |                                      |
| <b>Probe (Std)</b>                                                | 2/4 pcs passive probe <b>T3PP300</b>                                                                                                                                                                                                                           | 2/4 pcs passive probe <b>T3PP300</b> |
| <b>Display</b>                                                    | 7 inch TFT-LCD (800 x 480)                                                                                                                                                                                                                                     |                                      |
| <b>Weight</b>                                                     | Four channel series: Without package 2.6 Kg; With package 3.8 Kg<br>Two channel series: Without package 2.5 Kg; With package 3.5 Kg                                                                                                                            |                                      |

- Automatic measurement function for 38 parameters as well as Measurement Statistics, Zoom, Gating, Math, History and Reference functions
- 1 Mpts FFT
- Math and measurement functions use all sampled data points (up to 14 Mpts)
- Math functions (FFT, addition, subtraction, multiplication, division, integration, differential, square root)
- Preset key can be customized for user settings or factory "defaults"
- Security Erase mode
- High Speed hardware based Pass/ Fail function
- MSO, 16 digital channels (four channel series only, option)
- Bode plot (four channel series only)
- Search and navigate (four channel series only)
- USB AWG module (four channel series only, option)
- USB WIFI adapter (four channel series only, option)
- Web Browser based control (four channel series only)
- Large 7 inch TFT-LCD display with 800 \* 480 resolution
- Multiple interface types: USB Host, USB Device (USB-TMC), LAN, Trigger Out
- Supports SCPI remote control commands
- Supports Multi-language display and embedded online help

# FUNCTION & CHARACTERISTICS

## 7 inch TFT-LCD display and 10 one-button menus



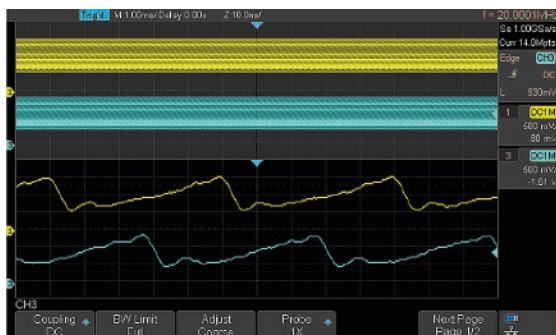
Front panel of the four channel series



Front panel of the two channel series

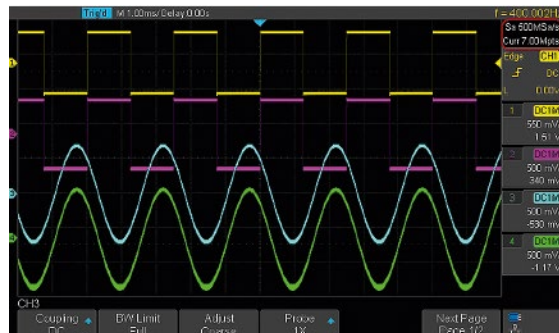
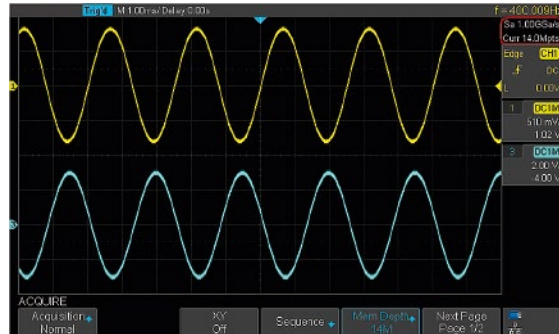
- 7-inch TFT-LCD display with 800 \* 480 resolution
- Most commonly used functions are accessible using 10 different one-button operation keys: Auto Setup, Default, Cursor, Measure, Roll, History, Persist, Clear
- Sweep, Zoom, Print

## Record Length of Up to 14 Mpts (single channel/pair mode), 7 Mpts/CH (two channels/ pair mode)



Using hardware-based Zoom technologies and max record length of up to 14 Mpts, users are able to over-sample to capture longer time periods at higher resolution and use the zoom feature to see more details within each signal.

When all channels are enabled, each channel has a maximum sample rate of 500 MSa/s. When a single channel per pair is active, that channel has sample rate of 1 GSa/s



The four channel series has two 1 GSa/s ADC chips (channel 1 and 2 share one, channel 3 and 4 share another), so that each channel can achieve sample rates up to 500 MSa/s and work on bandwidths of 200 MHz when all channels are enabled.

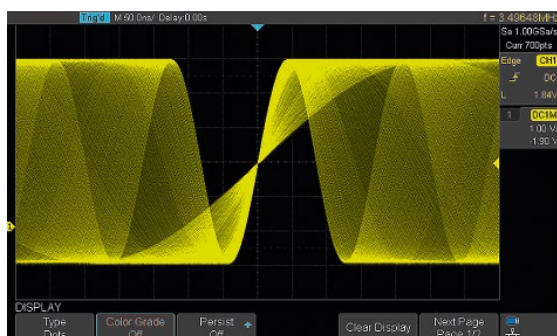
## Waveform Capture Rate Up to 400,000 wfms/s



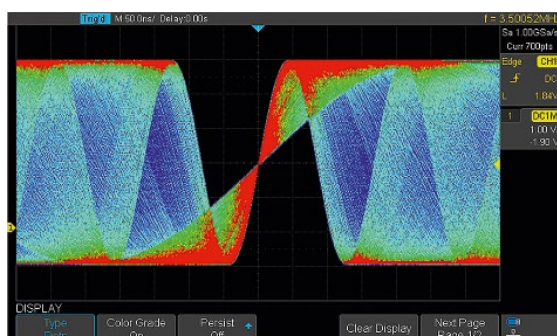
With a waveform capture rate of up to 400,000 wfms/s (sequence mode), the oscilloscope can easily capture the unusual or low-probability events.



## 256-Level Intensity Grading and Color Temperature Display

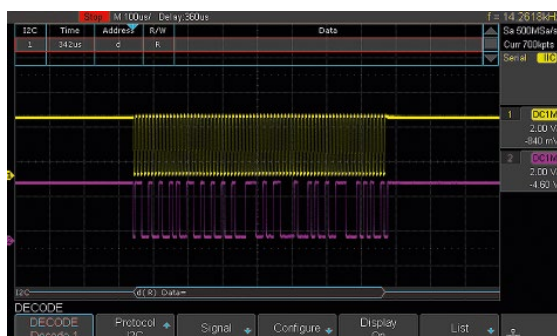


New display technology provides for fast refresh rates. The resulting intensity-graded trace is brighter for events that occur with more frequency and dims when the events occur with less frequency.



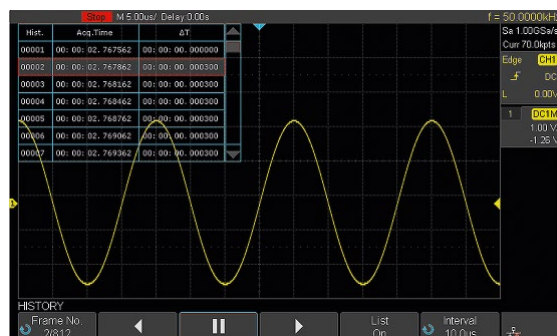
The color temperature display is similar to the intensity-graded trace function, but the trace occurrence is represented by different colors (color "temperature") as opposed to changes in the intensity of one color. Red colors represents the more frequent events, while blue is used to mark points that occur least frequently.

## Serial Bus Decoding Function (Standard)



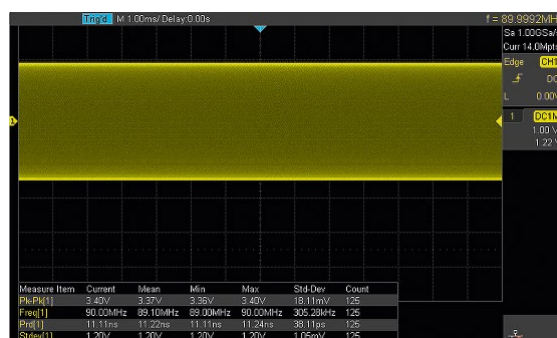
**T3DSO1000** displays the decoding through the events list. Bus protocol information can be quickly and intuitively displayed in a tabular format.

## History Waveforms (History) Mode and Segmented Acquisition (Sequence)



Playback the latest triggered events using the history function. Segmented memory collection will store trigger events into multiple (Up to 80,000) memory segments, each segment will store triggered waveforms and timestamp each frame.

## True measurement to 14 M points



At any one timebase, **T3DSO1000** can measure using all 14 M sample points. This ensures the accuracy of measurements while the math coprocessor decreases measurement time and increases ease-of-use.

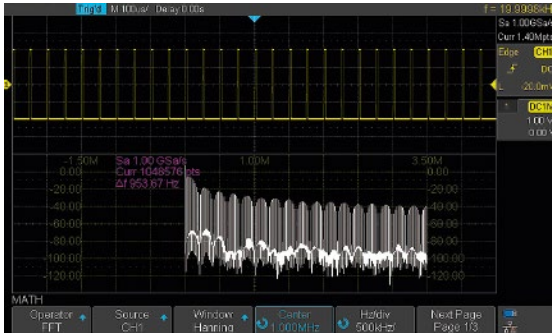
## Gate and Zoom Measurement



Through Gate and Zoom measurement, the user can specify an arbitrary interval of waveform data analysis and statistics. This helps avoid measurement errors that can be caused by invalid or extraneous data, greatly enhancing the measurements' validity and flexibility.

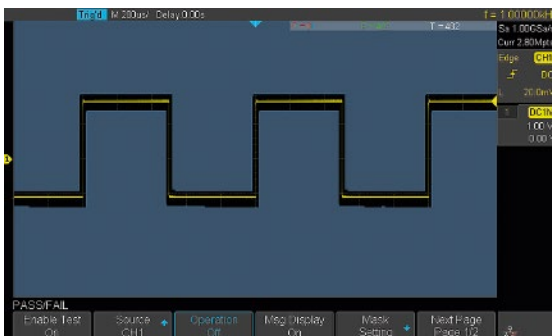
# FUNCTION & CHARACTERISTICS

## 1 M points FFT



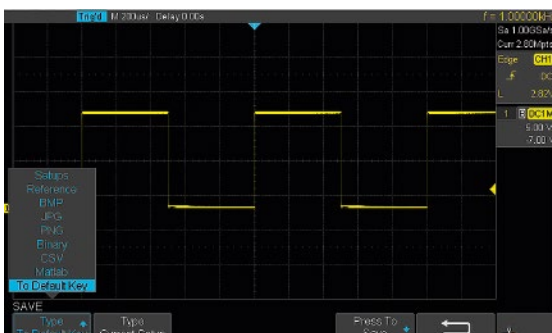
The new math co-processor enables FFT analysis of incoming signals using up to 1 M samples per waveform. This provides high frequency resolution with a fast refresh rate. The FFT function also supports a variety of window functions so that it can adapt to different spectrum measurement needs.

## Hardware-Based High Speed Pass/Fail function



The T3DSO1000 utilizes a hardware-based Pass/Fail function, performing up to 40,000 Pass/Fail decisions each second. Easily generate user defined test templates provide trace mask comparison making it suitable for long-term signal monitoring or automated production line testing.

## Customizable Default Key



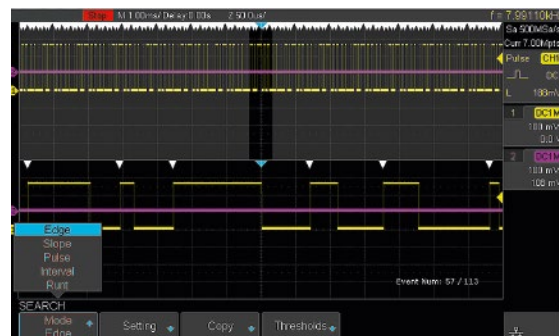
The current parameters of the oscilloscope can be preset to Default Key through the Save menu.

## 16 Digital Channels/MSO (four channel series only, option)



16 digital channels enables users to acquire and trigger on the waveforms then analyze the pattern, simultaneously with one instrument. Color coded logic levels clearly differentiate high and low states.

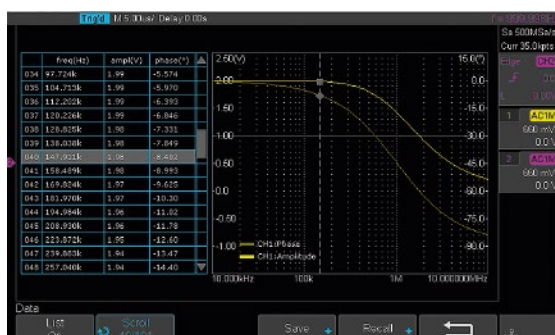
## Search and Navigate (four channel series only)



The T3DSO1000 4 channel series can search events specified by the user in a frame. It can also navigate by time (delay position) and historical frames.

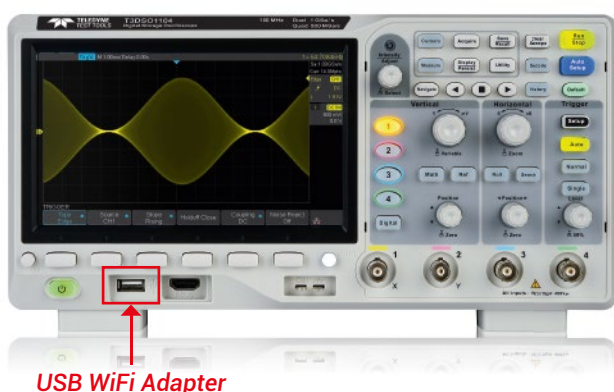


## Bode Plot (four channel series only)



**T3DSO1000** can control the USB AWG module, control an independent Teledyne Test Tools **T3AFG** instrument, scan an object's amplitude and phase frequency response, and display the data as a Bode Plot. It can also show the result lists, and export the data to a USB disk.

## USB WiFi Adapter (four channel series only, option)



WiFi control of instrumentation can provide a convenient and safe method of configuring and collecting data. This new feature works with a Teledyne Test Tools approved WiFi adapter to provide wireless control and communications with Teledyne Test Tools 4 channel scopes. The approved adapter is the TP-Link TL-WN725N (not supplied).

## USB 25 MHz AWG Module (four channel series only, option)



The four channel series supports an optional USB 25 MHz function/arbitrary waveform generator that is operated from the USB host connection. Functions include Sine, Square, Ramp, Pulse, Noise, DC and 45 built-in waveforms. The arbitrary waveforms can be accessed and edited by the Teledyne Test Tools PC software.

## Complete Connectivity



*Back panel of the four channel series*



*Back panel of the two channel series*

**T3DSO1000** supports USB Host, USB Device (USB-TMC), LAN(VXI-11), Pass/Fail and Trigger Out.

## Web control (four channel series only)



With the new embedded web server, users can control the 4 channel scopes from a simple web page. This provides remote troubleshooting and monitoring capabilities.

# SPECIFICATIONS

## Acquire System

|                        |                                                                     |
|------------------------|---------------------------------------------------------------------|
| Sampling Rate          | 1 GSa/s (single channel/pair), 500 MSa/s (two channels/pair)        |
| Memory Depth           | Max 14 Mpts/Ch (single channel/pair), 7 Mpts/Ch (two channels/pair) |
| Peak Detect            | 2 nsec (Four channel series)<br>4 nsec (Two channel series)         |
| Average                | Averages: 4, 16, 32, 64, 128, 256, 512, 1024                        |
| Eres                   | Enhance bits: 0.5, 1.5, 2, 2.5, 3; Selectable                       |
| Waveform interpolation | Sin(x)/x, Linear                                                    |

## Input

|                    |                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------|
| Channels           | 4 (Four channel series)<br>2+EXT (Two channel series)                                                               |
| Coupling           | DC, AC, GND                                                                                                         |
| Impedance          | DC: (1 MΩ ± 2 %)    (15 pF ± 2 pF) (Four channel series)<br>DC: (1 MΩ ± 2 %)    (18 pF ± 2 pF) (Two channel series) |
| Max.Input voltage  | 1 MΩ ≤ 400 Vpk (DC + Peak AC ≤ 10 kHz)                                                                              |
| CH to CH Isolation | DC-Max BW > 40 dB                                                                                                   |
| Probe attenuation  | 0.1X, 0.2X, 0.5X, 1X, 2X, 5X, 10X.....1000X, 2000X, 5000X, 10000X                                                   |

## Vertical System

|                                    |                                                                                                                  |
|------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Bandwidth (– 3 dB)                 | 200 MHz ( <b>T3DSO1204</b> )<br>100 MHz ( <b>T3DSO1102</b> / <b>T3DSO1104</b> )                                  |
| Vertical Resolution                | 8-bit                                                                                                            |
| Vertical Scale (Probe 1X)          | 500 μV/div – 10 V/div (1-2-5 sequence)                                                                           |
| Offset Range (Probe 1X)            | 500 μV – 150 mV: ± 2 V<br>152 mV – 1.5 V: ± 20 V                                                                 |
| Bandwidth Limit                    | 20 MHz ± 40%<br>DC – 10 % (BW): ± 1 dB                                                                           |
| Bandwidth Flatness                 | 10 % – 50 % (BW): ± 2 dB<br>50 % – 100 % (BW): + 2 dB/-3 dB                                                      |
| Low Frequency Response (AC – 3 dB) | ≤ 10 Hz (at input BNC)                                                                                           |
| Noise                              | ST-DEV ≤ 0.5 division (< 1 mV/div)<br>ST-DEV ≤ 0.2 division (< 2 mV/div)<br>ST-DEV ≤ 0.1 division (≥ 2 mV/div)   |
| SFDR including harmonics           | ≥ 35 dB                                                                                                          |
| DC Gain Accuracy                   | ≤ ± 3.0%: 5 mV/div – 10 V/div<br>≤ ± 4.0%: ≤ 2 mV/div                                                            |
| Offset Accuracy                    | ± (1 % * Offset + 1.5 % * 8 * div + 2 mV): ≥ 2 mV/div<br>± (1 % * Offset + 1.5 % * 8 * div + 500 uV): ≤ 1 mv/div |
| Risetime                           | Typical 1.8 ns ( <b>T3DSO1204</b> )<br>Typical 3.5 ns ( <b>T3DSO1102</b> / <b>T3DSO1104</b> )                    |
| Overshoot (500 ps Pulse)           | < 10 %                                                                                                           |

## Horizontal System

|                       |                                                                  |
|-----------------------|------------------------------------------------------------------|
| Timebase Scale        | 1.0 ns/div – 100 s/div                                           |
| Channel Skew          | < 100 ps                                                         |
| Waveform Capture Rate | Up to 100,000 wfm/s (normal mode), 400,000 wfm/s (sequence mode) |
| Intensity grading     | 256 Levels                                                       |
| Display Format        | Y-T, X-Y, Roll                                                   |
| Timebase Accuracy     | ± 25 ppm                                                         |
| Roll Mode             | 50 ms/div – 100 s/div (1-2-5 step)                               |



## Trigger System

|                             |                                                                                                                                                                                                                                                                |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trigger Mode                | Auto, Normal, Single                                                                                                                                                                                                                                           |
| Trigger Level               | Internal: $\pm 4.5$ div from the center of the screen<br>EXT: $\pm 0.6$ V (Two channel series)<br>EXT/5: $\pm 3$ V (Two channel series)                                                                                                                        |
| Holdoff Range               | 80 ns – 1.5 s                                                                                                                                                                                                                                                  |
| Trigger Coupling            | AC<br>DC<br>LFRJ<br>HFRJ<br>Noise RJ                                                                                                                                                                                                                           |
| Coupling Frequency Response | DC: Passes all components of the signal<br>AC: Blocks DC components and attenuates signals below 8 Hz<br>LFRJ: Blocks the DC component and attenuates the low-frequency components below 2 MHz<br>HFRJ: Attenuates the high-frequency components above 1.2 MHz |
| Coupling Frequency Response | DC: Passes all components of the signal<br>LFRJ: Blocks the DC component and attenuates the low-frequency components below 10 KHz<br>HFRJ: Attenuates the high-frequency components above 500 KHz                                                              |
| components below 10 KHz     | Internal: $\pm 0.2$ div<br>EXT (Two channel series): $\pm 0.4$ div                                                                                                                                                                                             |
| Trigger Sensitivity         | DC – Max BW 0.6 div<br>EXT (Two channel series): 200 mVpp DC – 10 MHz<br>300 mVpp 10 MHz – BW frequency<br>EXT/5 (Two channel series): 1 Vpp DC – 10 MHz<br>1.5 Vpp 10 MHz – BW frequency                                                                      |
| Trigger Jitter              | < 100 ps                                                                                                                                                                                                                                                       |
| Trigger Displacement        | Pre-Trigger: 0 – 100 % Memory<br>Delay Trigger: 0 to 10,000 div                                                                                                                                                                                                |

## Edge Trigger

|        |                                                                                                         |
|--------|---------------------------------------------------------------------------------------------------------|
| Slope  | Rising, Falling, Rising & Falling                                                                       |
| Source | All channels/ EXT/ (EXT/5)/ AC Line (Two channel series)<br>All channels/ AC Line (Four channel series) |

## Slope Trigger

|            |                   |
|------------|-------------------|
| Slope      | Rising, Falling   |
| LimitRange | < , > , < > , > < |
| Source     | All channels      |
| TimeRange  | 2 ns – 4.2 s      |
| Resolution | 1 ns              |

## Pulse Trigger

|             |                   |
|-------------|-------------------|
| Polarity    | +wid , -wid       |
| Limit Range | < , > , < > , > < |
| Source      | All channels      |
| Pulse Range | 2 ns ~ 4.2 s      |
| Resolution  | 1 ns              |

## Video Trigger

|                   |                                                                             |
|-------------------|-----------------------------------------------------------------------------|
| Signal Standard   | NTSC, PAL, 720p/50, 720p/60, 1080p/50, 1080p/60, 1080i/50, 1080i/60, Custom |
| Source            | All channels                                                                |
| Sync              | Any, Select                                                                 |
| Trigger condition | Line, Field                                                                 |

# SPECIFICATIONS

## Window Trigger

|             |                    |
|-------------|--------------------|
| Window Type | Absolute, Relative |
| Source      | All channels       |

## Interval Trigger

|             |                   |
|-------------|-------------------|
| Slope       | Rising, Falling   |
| Limit Range | < , > , < > , > < |
| Source      | All channels      |
| Time Range  | 2 ns ~ 4.2 s      |
| Resolution  | 1 ns              |

## Dropout Trigger

|              |                 |
|--------------|-----------------|
| Timeout Type | Edge, State     |
| Source       | All channels    |
| Slope        | Rising, Falling |
| Time Range   | 2 ns ~ 4.2 s    |
| Resolution   | 1 ns            |

## Runt Trigger

|             |                   |
|-------------|-------------------|
| Polarity    | +wid , -wid       |
| Limit Range | < , > , < > , > < |
| Source      | All channels      |
| Time Range  | 2 ns ~ 4.2 s      |
| Resolution  | 1 ns              |

## Pattern Trigger

|                 |                    |
|-----------------|--------------------|
| Pattern Setting | Invalid, Low, High |
| Logic           | AND, OR, NAND, NOR |
| Source          | All channels       |
| Limit Range     | < , > , < > , > <  |
| Time Range      | 2 ns ~ 4.2 s       |
| Resolution      | 1 ns               |

## Serial Trigger

### I2C Trigger

|                  |                                                                                                  |
|------------------|--------------------------------------------------------------------------------------------------|
| Condition        | Start, Stop, Restart, No Ack, EEPROM, 7 bits Address & Data, 10 bits Address & Data, Data Length |
| Source (SDA/SCL) | All channels                                                                                     |
| Data format      | Hex                                                                                              |
| Limit Range      | EEPROM: =, >, <                                                                                  |
| Data Length      | EEPROM: 1 byte<br>Addr & Data: 1 ~ 2 byte<br>Data Length: 1 ~ 12 byte                            |
| R/W bit          | Addr & Data: Read, Write, Don't care                                                             |

### SPI Trigger

|                     |              |
|---------------------|--------------|
| Condition           | Data         |
| Source (CS/CL/Data) | All channels |
| Data format         | Binary       |
| Data Length         | 4 ~ 96 bit   |
| Bit Value           | 0, 1, X      |
| Bit Order           | LSB, MSB     |

|                             |                                                            |
|-----------------------------|------------------------------------------------------------|
| <b>UART / RS232 Trigger</b> |                                                            |
| Condition                   | Start, Stop, Data, Parity Error                            |
| Source (RX/TX)              | All channels                                               |
| Data format                 | Hex                                                        |
| Limit Range                 | =, >, <                                                    |
| Data Length                 | 1 byte                                                     |
| Data Width                  | 5 bit, 6 bit, 7 bit, 8 bit                                 |
| Parity Check                | None, Odd, Even                                            |
| Stop Bit                    | 1 bit, 1.5 bit, 2 bit                                      |
| Idle Level                  | High, Low                                                  |
| Baud (Selectable)           | 600/1200/2400/4800/9600/19200/38400/57600/115200 bit/s     |
| (Custom)                    | 300 bit/s ~ 334000 bit/s                                   |
| <b>CAN Trigger</b>          |                                                            |
| Condition                   | All, Remote, ID, ID + Data, Error                          |
| Source                      | All channels                                               |
| ID                          | STD (11 bit), EXT (29 bit)                                 |
| Data Format                 | Hex                                                        |
| Data Length                 | 1~2 byte                                                   |
| Baud Rate (Selectable)      | 5 k/10 k/20 k/50 k/100 k/125 k/250 k/500 k/800 k/1 M bit/s |
| Baud Rate (Custom)          | 5 kbit/s ~ 1 Mbit/s                                        |
| <b>LIN Trigger</b>          |                                                            |
| Condition                   | Break, Frame ID, ID+Data, Error                            |
| Source                      | All channels                                               |
| ID                          | 1 byte                                                     |
| Data Format                 | Hex                                                        |
| Data Length                 | 1 ~ 2 byte                                                 |
| Baud Rate (Selectable)      | 600/1200/2400/4800/9600/19200 bit/s                        |
| Baud Rate (Custom)          | 300 bit/s ~ 20 kbit/s                                      |

## Serial Decoder

|                                    |                                                                               |
|------------------------------------|-------------------------------------------------------------------------------|
| <b>I2C Decoder</b>                 |                                                                               |
| Signal                             | SCL, SDA                                                                      |
| Address                            | 7 bits, 10 bits                                                               |
| Threshold                          | -4.5 ~ 4.5 div                                                                |
| List                               | 1 ~ 7 lines                                                                   |
| <b>SPI Decoder</b>                 |                                                                               |
| Signal                             | SCL, MISO, MOSI, CS * NOTE 2 channel scopes can only use 2 signal identifiers |
| Edge Select                        | Rising, Falling                                                               |
| Idle Level                         | Low, High                                                                     |
| Bit Order                          | MSB, LSB                                                                      |
| Threshold                          | -4.5 ~ 4.5 div                                                                |
| List                               | 1 ~ 7 lines                                                                   |
| <b>UART / RS232 Decoder</b>        |                                                                               |
| Signal                             | RX, TX                                                                        |
| Data Width                         | 5 bit, 6 bit, 7 bit, 8 bit                                                    |
| Parity Check                       | None, Odd, Even                                                               |
| Stop Bit                           | 1 bit, 1.5 bit, 2 bit                                                         |
| Idle Level                         | Low, High                                                                     |
| Threshold                          | -4.5 ~ 4.5 div                                                                |
| List                               | 1 ~ 7 lines                                                                   |
| <b>CAN Decoder</b>                 |                                                                               |
| Signal                             | CAN_H, CAN_L                                                                  |
| Source                             | CAN_H, CAN_L, CAN_H-CAN_L                                                     |
| Threshold                          | -4.5 ~ 4.5 div                                                                |
| List                               | 1 ~ 7 lines                                                                   |
| <b>LIN Decoder</b>                 |                                                                               |
| LIN Specification Package Revision | Ver1.3, Ver2.0                                                                |
| Threshold                          | -4.5 ~ 4.5 div                                                                |
| List                               | 1 ~ 7 lines                                                                   |

# SPECIFICATIONS

## Measurement

|                                   |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
|-----------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Source                            | All channels, All channels in Zoom, Math, All References, History                            |                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
| Number of Measurements            | Display 5 measurements at the same time                                                      |                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
| Measurement Range                 | Screen region, Gate region                                                                   |                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
| Measurement Parameters (38 Types) |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
| Vertical (Voltage)                | Max                                                                                          | Highest value in input waveform                                                                                                                                                                                                                                                                                                                                       |                                                         |
|                                   | Min                                                                                          | Lowest value in input waveform                                                                                                                                                                                                                                                                                                                                        |                                                         |
|                                   | Pk-Pk                                                                                        | Difference between maximum and minimum data values                                                                                                                                                                                                                                                                                                                    |                                                         |
|                                   | Ampl                                                                                         | Difference between top and base in a bimodal signal, or between max and min in an unimodal signal                                                                                                                                                                                                                                                                     |                                                         |
|                                   | Top                                                                                          | Value of most probable higher state in a bimodal waveform                                                                                                                                                                                                                                                                                                             |                                                         |
|                                   | Base                                                                                         | Value of most probable lower state in a bimodal waveform                                                                                                                                                                                                                                                                                                              |                                                         |
|                                   | Mean                                                                                         | Average of all data values                                                                                                                                                                                                                                                                                                                                            |                                                         |
|                                   | Cmean                                                                                        | Average of data values in the first cycle                                                                                                                                                                                                                                                                                                                             |                                                         |
|                                   | Stdev                                                                                        | Standard deviation of all data values                                                                                                                                                                                                                                                                                                                                 |                                                         |
|                                   | Cstd                                                                                         | Standard deviation of all data values in the first cycle                                                                                                                                                                                                                                                                                                              |                                                         |
|                                   | VRMS                                                                                         | Root mean square of all data values                                                                                                                                                                                                                                                                                                                                   |                                                         |
|                                   | Crms                                                                                         | Root mean square of all data values in the first cycle                                                                                                                                                                                                                                                                                                                |                                                         |
|                                   | FOV                                                                                          | Overshoot after a falling edge; (base-min)/Amplitude                                                                                                                                                                                                                                                                                                                  |                                                         |
|                                   | FPRE                                                                                         | Overshoot before a falling edge; (max-top)/Amplitude                                                                                                                                                                                                                                                                                                                  |                                                         |
|                                   | ROV                                                                                          | Overshoot after a rising edge; (max-top)/Amplitude                                                                                                                                                                                                                                                                                                                    |                                                         |
|                                   | RPRE                                                                                         | Overshoot before a rising edge; (base-min)/Amplitude                                                                                                                                                                                                                                                                                                                  |                                                         |
|                                   | Level@X                                                                                      | the voltage value of the trigger point                                                                                                                                                                                                                                                                                                                                |                                                         |
| Horizontal( Time)                 | Period                                                                                       | Period for every cycle in waveform at the 50 % level, and positive slope                                                                                                                                                                                                                                                                                              |                                                         |
|                                   | Freq                                                                                         | Frequency for every cycle in waveform at the 50 % level, and positive slope                                                                                                                                                                                                                                                                                           |                                                         |
|                                   | +Wid                                                                                         | Width measured at 50 % level and positive slope                                                                                                                                                                                                                                                                                                                       |                                                         |
|                                   | -Wid                                                                                         | Width measured at 50 % level and negative slope                                                                                                                                                                                                                                                                                                                       |                                                         |
|                                   | Rise Time                                                                                    | Duration of rising edge from 10 – 90 %                                                                                                                                                                                                                                                                                                                                |                                                         |
|                                   | Fall Time                                                                                    | Duration of falling edge from 90 – 10 %                                                                                                                                                                                                                                                                                                                               |                                                         |
|                                   | Bwid                                                                                         | Time from the first rising edge to the last falling edge, or the first falling edge to the last rising edge at the 50 % crossing                                                                                                                                                                                                                                      |                                                         |
|                                   | +Dut                                                                                         | Ratio of positive width to period                                                                                                                                                                                                                                                                                                                                     |                                                         |
|                                   | -Dut                                                                                         | Ratio of negative width to period                                                                                                                                                                                                                                                                                                                                     |                                                         |
|                                   | Delay                                                                                        | Time from the trigger to the first transition at the 50 % crossing                                                                                                                                                                                                                                                                                                    |                                                         |
|                                   | Time@Level                                                                                   | Time from the trigger to each rising edge at the 50 % crossing.<br>When Statistics is Off, it shows the time from the trigger to the last rising edge at the 50 % crossing.<br>When Statistics is On, it shows the Current, Mean, Min, Max, Standard Deviation of time from the trigger to each rising edge at the 50 % crossing in multiple frames (number = Count). |                                                         |
|                                   | Delay                                                                                        | Phase                                                                                                                                                                                                                                                                                                                                                                 | Calculate the phase difference between two edges        |
|                                   |                                                                                              | FRR                                                                                                                                                                                                                                                                                                                                                                   | Time between the first rising edges of the two channels |
| FRF                               |                                                                                              | Time from the first rising edge of channel A to the first falling edge of channel B                                                                                                                                                                                                                                                                                   |                                                         |
| FFR                               |                                                                                              | Time from the first falling edge of channel A to the first rising edge of channel B                                                                                                                                                                                                                                                                                   |                                                         |
| FFF                               |                                                                                              | Time from the first falling edge of channel A to the first falling edge of channel B                                                                                                                                                                                                                                                                                  |                                                         |
| LRR                               |                                                                                              | Time from the first rising edge of channel A to the last rising edge of channel B                                                                                                                                                                                                                                                                                     |                                                         |
| LRF                               |                                                                                              | Time from the first rising edge of channel A to the last falling edge of channel B                                                                                                                                                                                                                                                                                    |                                                         |
| LFR                               |                                                                                              | Time from the first falling edge of channel A to the last rising edge of channel B                                                                                                                                                                                                                                                                                    |                                                         |
| LFF                               |                                                                                              | Time from the first falling edge of channel A to the last falling edge of channel B                                                                                                                                                                                                                                                                                   |                                                         |
| Skew                              |                                                                                              | Time of source A edge minus time of nearest source B edge                                                                                                                                                                                                                                                                                                             |                                                         |
| Cursors                           | Manual : Time X1, X2, (X1-X2), (1/ΔT) Voltage Y1, Y2, (Y1-Y2)<br>Track: Time X1, X2, (X1-X2) |                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
| Statistics                        | Current, Mean, Min, Max, Stdev, Count                                                        |                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
| Counter                           | Hardware 6 bit counter( channels are selectable)                                             |                                                                                                                                                                                                                                                                                                                                                                       |                                                         |



## Math Function

|                    |                                                  |
|--------------------|--------------------------------------------------|
| Operation          | + , - , * , / , FFT , d/dt , fdt , √             |
| FFT window         | Rectangular, Blackman, Hanning, Hamming, Flattop |
| FFT display        | Full Screen, Split, Exclusive                    |
| Number of Decoders | 2                                                |

## USB AWG Module (four channel series only, option)

|                       |                                                                |
|-----------------------|----------------------------------------------------------------|
| Channel               | 1                                                              |
| Max. Output Frequency | 25 MHz                                                         |
| Sampling Rate         | 125 MSa/s                                                      |
| Frequency Resolution  | 1 $\mu$ Hz                                                     |
| Frequency Accuracy    | $\pm 50$ ppm                                                   |
| Vertical Resolution   | 14-bits                                                        |
| AmplitudeRange        | -1.5 ~ +1.5 V (50 $\Omega$ )<br>-3 ~ +3 V (High-Z)             |
| Waveform Type         | Sine, Square, Ramp, pulse, Noise, DC and 45 built-in waveforms |
| Output impedance      | 50 $\Omega \pm 2\%$                                            |
| Protection            | Over-Voltage Protection, Current-Limiting Protection           |

## Sine

|                                    |                                                                       |
|------------------------------------|-----------------------------------------------------------------------|
| Frequency                          | 1 $\mu$ Hz ~ 25 MHz                                                   |
| Offset Accuracy (10 kHz)           | $\pm (1\% * \text{Offset Setting Value} + 1 \text{ mVpp})$            |
| Amplitude flatness (10 kHz, 5 Vpp) | $\pm 0.3$ dB                                                          |
| SFDR                               | DC ~ 1 MHz -60 dBc<br>1 MHz ~ 5 MHz -55 dBc<br>5 MHz ~ 25 MHz -50 dBc |
| HD                                 | DC ~ 5 MHz -50 dBc<br>5 MHz ~ 25 MHz -45 dBc                          |

## Square/Pulse

|                                   |                              |
|-----------------------------------|------------------------------|
| Frequency                         | 1 $\mu$ Hz ~ 10 MHz          |
| Duty Cycle                        | 1 % ~ 99 %                   |
| Rise/Fall time                    | < 24 ns (10 % ~ 90 %)        |
| Overshoot (1 kHz, 1 Vpp, Typical) | < 3 % (typical 1 kHz, 1 Vpp) |
| Pulse Width                       | > 50 ns                      |
| Jitter                            | < 500 ps + 10 ppm            |

## Ramp

|                     |                                                          |
|---------------------|----------------------------------------------------------|
| Frequency           | 1 $\mu$ Hz ~ 300 kHz                                     |
| Linearity (Typical) | < 0.1 % of Pk-Pk (Typical, 1 kHz, 1 Vpp, 100 % Symmetry) |
| Symmetry            | 0 % ~ 100 % (Adjustable)                                 |

## DC

|              |                                                  |
|--------------|--------------------------------------------------|
| Offset range | $\pm 1.5$ V (50 $\Omega$ )<br>$\pm 3$ V (High-Z) |
| Accuracy     | $\pm ( \text{offset}  * 1\% + 3 \text{ mV})$     |

## Noise

|           |                  |
|-----------|------------------|
| Bandwidth | > 25 MHz (-3 dB) |
|-----------|------------------|

## Arbitrary Wave

|                |                         |
|----------------|-------------------------|
| Frequency      | 1 $\mu$ Hz ~ 5 MHz      |
| Wave Length    | 16 kpts                 |
| Sampling Rate  | 125 MSa/s               |
| Waveform Entry | EasyScope and USB-Stick |

# SPECIFICATIONS

## Digital Channels (four channel series only, option)

|                             |                                                                                                            |
|-----------------------------|------------------------------------------------------------------------------------------------------------|
| No. of Channels             | 16                                                                                                         |
| Max. Sampling Rate          | 1 GSa/s                                                                                                    |
| Memory Depth                | 14 Mpts/CH                                                                                                 |
| Min. Detectable Pulse Width | 4 ns                                                                                                       |
| Level Group                 | D0~D7, D8~D15                                                                                              |
| Level Range                 | -8 V ~ 8 V                                                                                                 |
| Logic Type                  | TTL, CMOS, LVCMOS3.3, LVCMOS2.5, custom                                                                    |
| Skew[2]                     | D0~D15: $\pm 1$ sampling interval<br>Analog To Digital: $\pm (1 \text{ sampling interval} + 1 \text{ ns})$ |

## I/O

|           |                                                   |
|-----------|---------------------------------------------------|
| Standard  | USB Host, USB Device, LAN, Pass/Fail, Trigger Out |
| Pass/Fail | 3.3 V TTL Output                                  |

## Display (Screen)

|                    |                  |
|--------------------|------------------|
| Display Type       | 7-inch TFT LCD   |
| Display Resolution | 800 × 480        |
| Display Color      | 24 bit           |
| Contrast (Typical) | 500:1            |
| Backlight          | 300 nit          |
| Range              | 8 x 14 divisions |

## Display (Waveform)

|               |                                                                                                                  |
|---------------|------------------------------------------------------------------------------------------------------------------|
| Display Mode  | Dot, Vector                                                                                                      |
| Persist Time  | Off, 1 Sec, 5 Sec, 10 Sec, 30 Sec, Infinite                                                                      |
| Color Display | Normal, Color                                                                                                    |
| Screen Saver  | 1 min, 5 min, 10 min, 30 min, 1 hour, Off                                                                        |
| Language      | Simplified Chinese, Traditional Chinese, English, French, Japanese, Korean, German, Russian, Italian, Portuguese |

## Environments

|                               |                                                                                                      |
|-------------------------------|------------------------------------------------------------------------------------------------------|
| Temperature                   | Operating: 10 ~ +40<br>Non-operating: -20 ~ +60                                                      |
| Humidity                      | Operating: 85 % RH, 40 Deg C, 24 hours<br>Non-operating: 85 % RH, 65 Deg C, 24 hours                 |
| Height                        | Operating: $\leq 3000 \text{ m}$<br>Non-operating: $\leq 15,266 \text{ m}$                           |
| Electromagnetic Compatibility | 2004/108/EC)<br>Execution Standard EN 61326-1:2006<br>EN 61000-3-2:2006 + A2:2009, EN 61000-3-3:2008 |
| Safety                        | 2006/95/EC<br>Execution Standard EN 61010-1:2010 / EN 61010-2-030:2010                               |

## Power Supply

|               |                                       |
|---------------|---------------------------------------|
| Input Voltage | 100 ~ 240 VAC, CAT II, Auto selection |
| Frequency     | 50/60/400 Hz                          |
| Power         | 25 W Max                              |

## Mechanical (Four channel series)

|            |                                                   |
|------------|---------------------------------------------------|
| Dimensions | Length: 312 mm / Width: 132.6 mm / Height: 151 mm |
| Weight     | N.W: 2.6 kg; G.W: 3.8 kg                          |

## Mechanical (Two channel series)

|            |                                                 |
|------------|-------------------------------------------------|
| Dimensions | Length: 312 mm / Width: 134 mm / Height: 150 mm |
| Weight     | N.W: 2.5 Kg; G.W: 3.5 Kg                        |

## Probes and Accessories

| Probe                       | Model           | Picture                                                                            | Description                                                                                                                                                                                                       |
|-----------------------------|-----------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Passive Probes              | T3PP300         |   | Passive Probe, Bandwidth: 300 MHz                                                                                                                                                                                 |
| Current Probes              | T3CP50          |   | Bandwidth: 50 MHz, Max. continuous current: 30 Arms, Peak current: 50 A<br>Switch Ratio: 100 mV/A, 1 V/A, Accuracy: 1 V/A ( $\pm 1\%$ $\pm 1$ mA), 100 mV/A ( $\pm 1\%$ $\pm 10$ mA), DC 12 V/1.2 A power adapter |
| Differential Voltage Probes | T3DP7000        |   | Bandwidth: 100 MHz<br>Differential Range: 7000 V (DC + Peak AC), 100X/1000X, Accuracy: $\pm 2\%$ , DC 5 V/1 A USB adapter                                                                                         |
| High Voltage Probe          | T3HVP100        |   | Bandwidth: 40 MHz<br>Voltage Range: DC 10 KV, AC (rms): 7 KV (sine), AC (Vpp): 20 KV (Pulse) 1000X, Accuracy: $\leq 3\%$                                                                                          |
| USB AWG Module              | T3DSO1000-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

|                      |                                                           |                                               |
|----------------------|-----------------------------------------------------------|-----------------------------------------------|
| Product Name         | T3DSO1102 100 MHz Two Channels                            |                                               |
|                      | T3DSO1104 100 MHz Four Channels                           |                                               |
|                      | T3DSO1204 200 MHz Four Channels                           |                                               |
| Standard Accessories | USB Cable -1                                              |                                               |
|                      | Quick Start -1                                            |                                               |
|                      | Passive Probe -4 / 2                                      |                                               |
|                      | Certification -1                                          |                                               |
|                      | Power Cord -1                                             |                                               |
| Optional Accessories | 16 Channel MSO Software (four channel series only)        | T3DSO1000-MSO                                 |
|                      | 16 Channel Logic Analyzer Lead (four channel series only) | T3DSO1000-LS<br>(Requires T3MSO1000 Software) |
|                      | AWG Software (four channel series only)                   | T3DSO1000-FG                                  |
|                      | USB AWG Module Hardware (four channel series only)        | T3DSO1000-FGMOD<br>(Requires T3DSO1000-FG)    |
|                      | WIFI Software (four channel series only)                  | T3DSO1000-WIFI                                |
|                      | High Voltage Probe                                        | T3HVP100                                      |
|                      | Current Probes                                            | T3CP50                                        |
|                      | Differential Probes                                       | T3DP7000                                      |

# 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.

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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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- Техническая поддержка проекта;
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