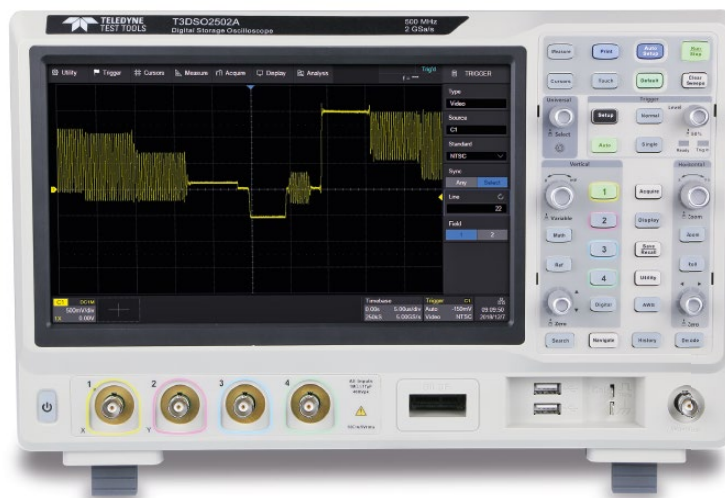


T3DSO2000A Data Sheet

Oscilloscopes

Debug with Confidence

100 MHz – 500 MHz



Tools for Improved Debugging

- **Long Capture** – 100 Mpts/Ch and 200 Mpts interleaved. ✔ **Capture more time and show more waveform detail.**
- **Math and Measure** – 9 basic math functions plus FFT and 50+ automatic measurement parameters. ✔ **Extract results from waveforms and measurements.**
- **Connectivity** – USB for mass storage, printing and PC control, plus LAN for fast data transfer. ✔ **Save data for external analysis and screen images for reports.**
- **Includes Serial Bus Trigger and Decode** – I²C, SPI, UART, CAN, LIN. Optional CAN FD, I²S, MIL-1553B, FlexRay. ✔ **Debug serial buses directly in your Oscilloscope.**
- **Waveform Sequence Recorder** – record and play back up to 90,000 waveforms. ✔ **Replay the changing waveform history.**
- **Includes Bode Plot and Power Analysis applications as standard.** ✔ **Common applications coverage as standard.**
- **Optional MSO** – 16 Digital Channels. ✔ **Add mixed signal debugging to your Oscilloscope.**

Key Specifications

| | |
|--------------|---|
| Bandwidth | 100 MHz, 200 MHz, 350 MHz, 500 MHz |
| Channels | 2 or 4 |
| Memory | 100 Mpts/Ch (200 Mpts interleaved) |
| Sample Rate | up to 2 GS/s (Interleaved) |
| Display | Large 10.1" Bright TFT LCD (1024 x 600) |
| Connectivity | USB Host, USB Device, LAN |
| Warranty | 3 Years |

PRODUCT OVERVIEW

T3DSO2104A: 4 Channel 100 MHz

T3DSO2204A: 4 Channel 200 MHz

T3DSO2354A: 4 Channel 350 MHz

T3DSO2502A: 2 Channel 500 MHz / 4 Channel 350 MHz

Teledyne Test Tools new T3DSO2000A Oscilloscopes feature two channel and four channel models with analog bandwidth options from 100 MHz to 500 MHz. Each model offers a maximum sample rate of 2 GSa/s, and a maximum memory depth of 200 Mpts in half channel mode. All models incorporate two 2 GSa/s ADCs and two 200 Mpts memory modules. When all channels are enabled, each channel has sample rate of 1 GSa/s and a standard record length of 100 Mpts. When only a single channel per ADC is active, the maximum sample rate is 2 GSa/s and the maximum record length is 200 Mpts. For ease-of-use, the most commonly used functions can be accessed with its user-friendly front panel design.

The T3DSO2000A 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 μ V/div, an innovative digital trigger system with high sensitivity and low jitter, and a waveform capture rate of 500,000 waveforms/sec (sequence mode). The T3DSO2000A also employs a 256-level intensity grading display function and a color temperature display mode which complement the high speed update rate. Teledyne Test Tools latest oscilloscope offering supports multiple powerful triggering modes including serial bus triggering. IIC, SPI, UART, CAN and LIN serial bus trigger and decode is included

as standard. There are low cost options for serial bus decoding of CAN FD, FlexRay, I²S, and MIL-STD-1553B bus types. The models also include History waveform recording, and sequential triggering that enable extended waveform recording and analysis, as well as a 50 MHz function / arbitrary waveform generator. There is also an option to add 16 channel MSO capability (user upgradable option). 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 T3DSO2000A offers outstanding value for money.

Key Features

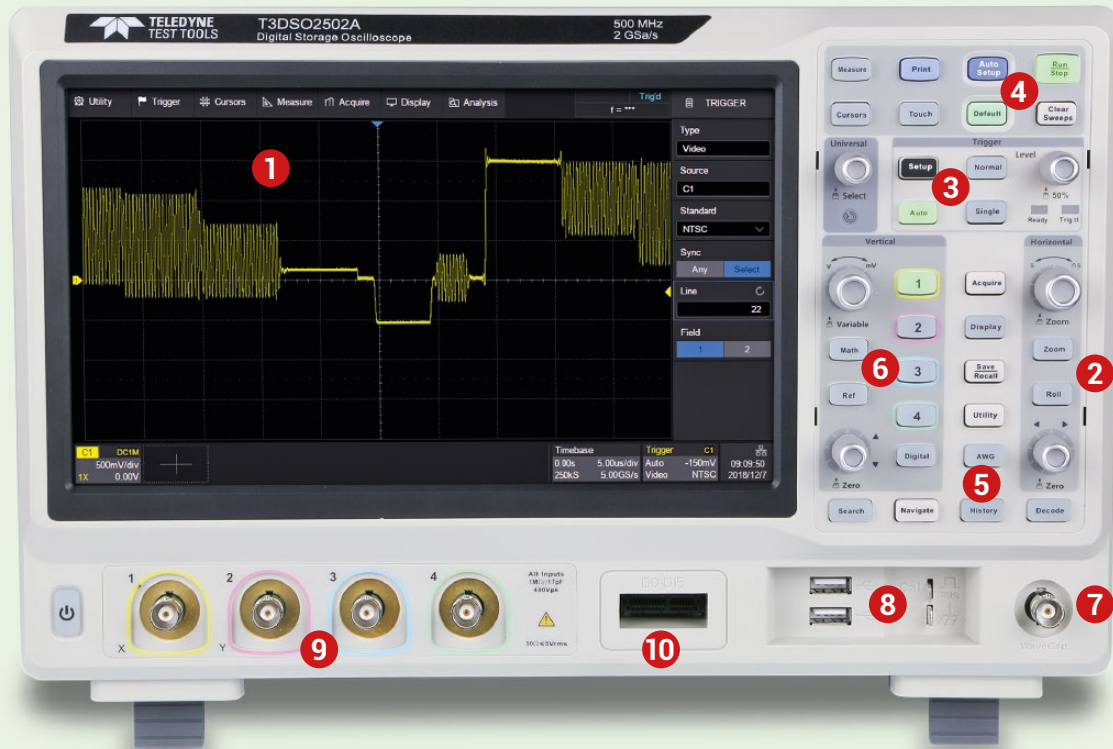
- 100 MHz, 200 MHz, 350 MHz and 500 MHz bandwidth models
- Real-time sampling rate up to 2 Gsa/s
- New generation of high speed display technology
 - › Waveform capture rate up to 120,000 wfm/s (normal mode), and 500,000 wfm/s (sequence mode)
 - › Supports 256-level intensity grading and color display modes Record length up to 200 Mpts
 - › Digital trigger system
- Intelligent trigger: Edge, Slope, Pulse Width, Window, Runt, Interval, Time out, Dropout, Pattern, Serial and Video
- Zone trigger: Up to 2 zones with user defined Intersect / Not Intersect events.
- Standard serial bus triggering and decoding, supports protocols IIC, SPI, UART, CAN, LIN. Optionally CAN FD, FlexRay, I²S, MIL-STD-1553B
- Video trigger, supports HDTV
- Low background noise with voltage scales from 500 μ V/div to 10 V/div
- High performance 10-bit mode with typically 100 MHz bandwidth.
- Segmented acquisition (Sequence) mode, divides the maximum record length into multiple segments (up to 90,000), 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 90,000 waveforms.

Models and key Specification

| Model | T3DSO2104A | T3DSO2204A | T3DSO2354A | T3DSO2502A |
|---|---|------------|------------|--|
| Bandwidth | 100 MHz | 200 MHz | 350 MHz | 500 MHz |
| SamplingRate (Max.) | All models have two 2 GSa/s ADCs. When all channels are enabled, each channel has a maximum sample rate of 1 GSa/s. When a single channel per pair is active, that channel has sample rate of 2 GSa/s | | | The T3DSO2502A has one 2 Gsa/s ADC per channel in 2 channel > 350 MHz mode, and one 2 Gsa/s ADC per pair of channels in ≤ 350 MHz four channel mode. |
| Channels | T3DSO2104A 4 + EXT, T3DSO2204A 4 + EXT, T3DSO2354A 4 + EXT, T3DSO2502A ≤ 350 MHz: 4 + EXT, > 350 MHz: 2 + EXT | | | |
| Memory Depth (Max.) | 100 Mpts/Ch (not interleave mode); 200 Mpts/Ch (interleave mode) | | | |
| Waveform Capture Rate (Max.) | 120,000 wfm/s (normal mode), 500,000 wfm/s (sequence mode) | | | |
| Trigger Type | Edge, Slope, Pulse, Window, Runt, Interval, Dropout, Pattern, Video, Zone | | | |
| Serial Trigger and decoder | IIC, SPI, UART, CAN, LIN. Optional: CAN FD, FlexRay, I ² S, MIL-STD-1553B | | | |
| 16 Digital Channels (MSO option) | Maximum waveform capture rate up to 500 MSa/s, Record length up to 50 Mpts/Ch | | | |
| Waveform Generator | One channel, 50 MHz, sample rate of 125 MHz, wave length of 16 kpts | | | |
| I/O | USB Host, USB Device, LAN 100M, Pass/Fail, Trigger In/Out | | | |
| Probe (Std) | 1 for each Channel | | | |
| Display | 10.1 inch Touch Screen TFT-LCD (1024 x 600) | | | |

- Automatic measurement function for more than 50 parameters as well as Measurement Statistics, Zoom, Gating, Math, History and Reference functions
- 10 Math functions (FFT, addition, subtraction, multiplication, division, integration, differential, square root, average, Enhanced Resolution and formula editor)
- 2 Math operators allowing 2 math functions to be used at the same time.
- High Speed hardware based Pass/Fail function
- Optional MSO, 16 digital channels. Record Length up to 50 Mpts/Ch
- 50 MHz function/arbitrary waveform generator included as standard. Built-in 6 waveform types (Sine, Square, Ramp, Pulse, DC, Noise) and 45 Arbitrary waveforms
- Bode Plot from 10 Hz to 50 MHz using the T3DSO2000A 50 MHz function/arbitrary waveform generator, or 10 Hz to 120 MHz using the T3AFG120 arbitrary function generator.
- Power Analysis application included as standard, measuring power quality, current harmonics, inrush current, switching loss, slew rate, modulation, output ripple, turn on / turn off, transient response, PSRR, efficiency.
- T3DSO2502A supports 2 channels at up to 500 MHz and 4 channels at ≤ 350 MHz
- Large 10.1 inch capacitive touch screen TFT-LCD display with 1024 x 600 resolution
- Multiple interface types: USB Host, USB Device (USB-TMC), LAN, Trigger In/Out
- Supports SCPI remote control commands
- Supports Multi-language display and embedded online help

FUNCTION & CHARACTERISTICS

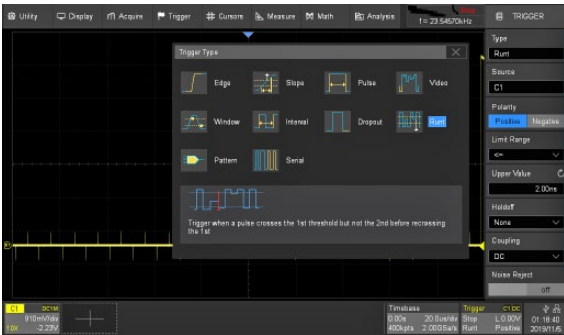


- 1 High Resolution 10.1-inch TFT-LCD touch screen display for clear images.
- 2 Horizontal controls of Timebase, Zoom, Roll and trigger position.
- 3 Advanced Triggering controls including Edge, Pulse, Interval, Window, Slope, DropOut, Runt and Pattern trigger types.
- 4 Easy to use Auto Setup, Run / Stop and Default Controls.
- 5 Multi-functional controls for AWG, Search, Navigate, History and Decode.
- 6 Individual color coded channels, Math and Digital inputs.
- 7 50 MHz built in arbitrary waveform generator.
- 8 Probe compensation calibrator.
- 9 Color coded input channels.
- 10 Digital lead set socket.

10.1 inch TFT-LCD display and 15 one-button menus

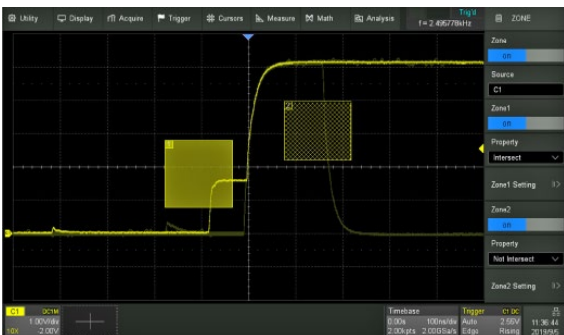
- 10.1 inch TFT-LCD capacitive touch screen display with 1024 x 600 resolution
- Most commonly used functions are accessible using 15 different one-button operation keys Auto Setup, Default, Cursors, Measure, Roll, History, Persist, Clear Sweeps, Zoom, Print, Math, Measure, Search / Navigate, Decode, AWG, and more.

A Wide Range Of Trigger Functions



A wide range of powerful triggering functions including Edge, Slope, Pulse, Video, Window, Runt, Interval, Dropout, Pattern, Serial, etc, allows users to debug complex hardware issues with ease.

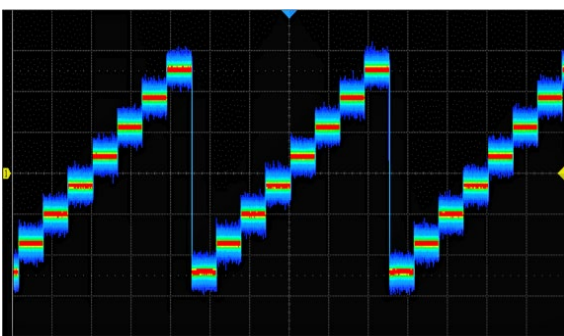
Powerful User Set Zone Trigger Extends Trigger Capability



Set up to 2 zones defining each as Intersect or Not Intersect. Trigger occurs when conditions are met. Zone Trigger helps to simplify advanced triggering.

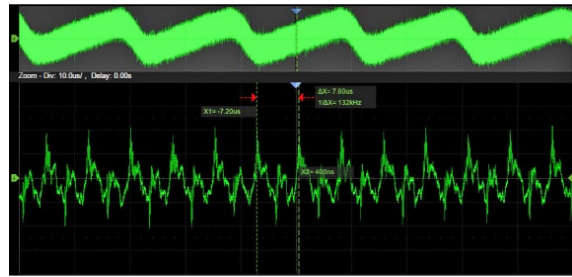
256-level Intensity Grading and Color Temperature Display

256-level intensity graded waveform display is ideal for viewing modulated and changing waveforms.



The Color temperature display clearly shows noise and jitter with infrequently occurring waveforms shown in blue through to the most frequently occurring waveforms shown in red.

Record Length of up to 200 Mpts



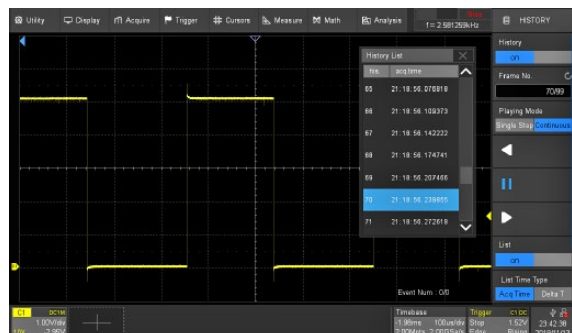
The record length of up to 200 Mpts (interleaved) or up to 100 Mpts (non-interleaved) allows use of a higher sampling rate to capture more signal detail. The hardware-based Zoom then allows quick zoom in to any area of interest.

Waveform Capture Rate up to 500,000 wfm/s



With a waveform capture rate of up to 500,000 wfm/s (sequence mode) and 120,000 wfm/s (standard mode) the T3DSO2000A can easily capture glitches, infrequent anomalies and other low-probability events.

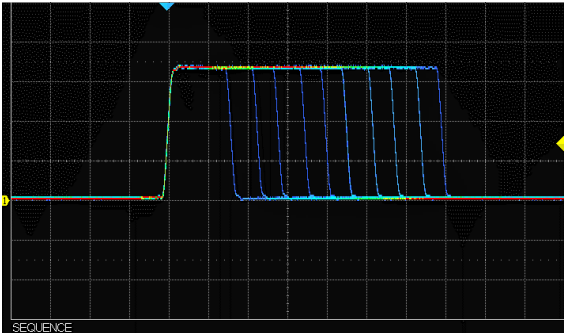
History Mode



The always enabled History mode records up to 90,000 waveforms allowing users to scroll back through previous acquisitions to analyze past events and locate anomalies quickly. Serial decode, zoom and cursor measurements can be used.

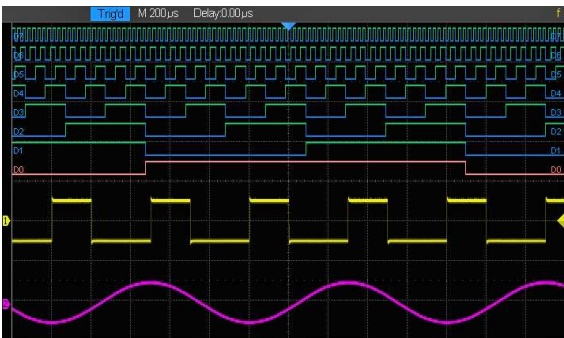
FUNCTION & CHARACTERISTICS

Sequence Mode



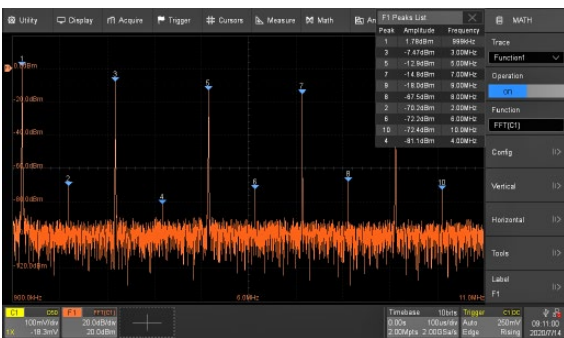
Segmented memory mode can store up to 90,000 waveforms into memory segments for capturing fast pulses in quick succession. Combine SequenceMode with advanced triggers to isolate rare events. All the segments can be play back using the History function.

16 Digital Channels/MSO (Optional)



The MSO option adds 16 digital channels to the T3DSO2000A analog channels enabling users to trigger and acquire digital as well as analog waveforms in a mixed signal debug environment.

Advanced Math Function



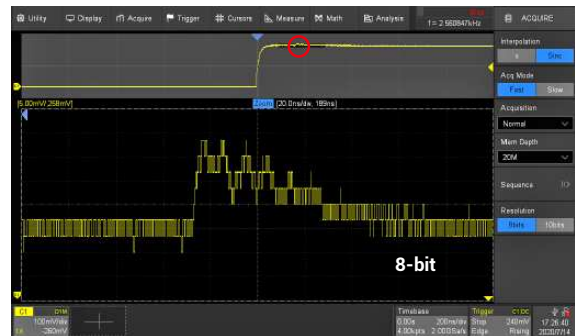
Two Math traces support Plus, Minus, Multiply, Divide, FFT, integration, differential, square root, average, Eres and formula editor, for quick insight into waveform characteristics.

Eres Mode



Enhanced Resolution (Eres) function reveals hidden Waveform detail by using a linear average filter to reduce waveform noise on single acquisition waveforms, where regular averaging doesn't work. The Eres function can be combined with the regular 8 bit acquisition mode, or the higher detailed 10 bit acquisition mode.

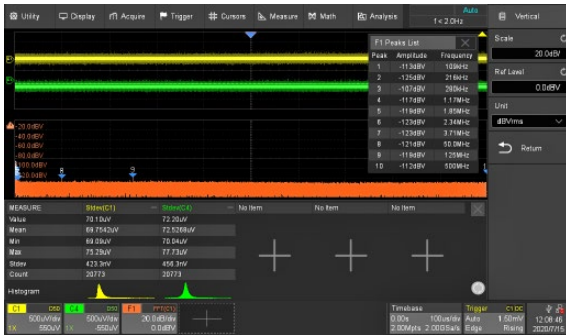
10-bit Mode



10-bit mode combined with zoom shows more detail and less noise on the waveform. The small perturbation, circled in red, can be more clearly viewed in 10 bit mode. The T3DSO2000A Oscilloscope family not only supports horizontal zoom but also the more unusual vertical voltage based zoom capability, enabling viewing of very small perturbations on a larger waveform. Eres can be combined with 8 bit or 10 bit mode to give an even clearer view of waveform detail.

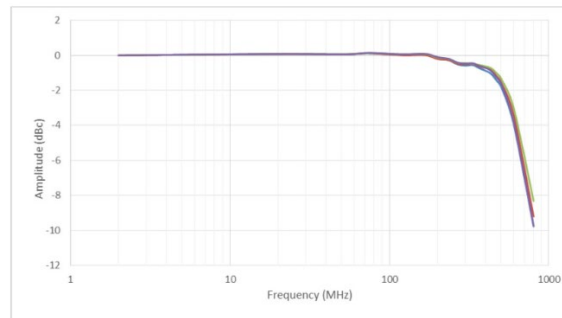
FUNCTION & CHARACTERISTICS

High Performance Front End



T3DSO2502A: At 500 MHz bandwidth the input noise floor is only 80 uVrms, and FFT Peaks are typically < -105 dBV.

Flat Frequency Response



T3DSO2502A at 2 Gsa/s shows exceptionally flat frequency response up to its maximum 500 MHz bandwidth.

Measurements of all relevant Parameters with Statistics



Parameter measurements includes 4 categories: Vertical, Horizontal, Miscellaneous and Channel Delay providing a total of 50+ different types of measurements.

Measurements can be performed on the whole waveform or within a specified gate period.

Measurements on Math, Reference and History frames are supported.

Simple measurement mode measures up to 12 waveform characteristics simultaneously, whereas advanced measurement mode offers statistics measuring the current value, maximum value, minimum value, standard deviation, mean value and count, on up to 5 parameters simultaneously.

Histogram is available to show the probability distribution of a parameter. Trend is available to show the parameter value vs. time.

In addition, horizontal measurements can process up to 1000 signal edges within one single acquisition, thus greatly improving the test efficiency.

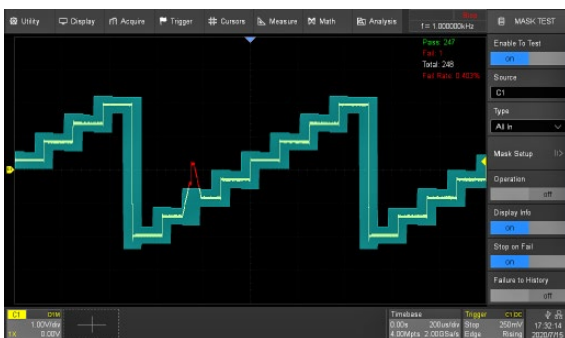
FUNCTION & CHARACTERISTICS

Serial Bus Trigger and Decode

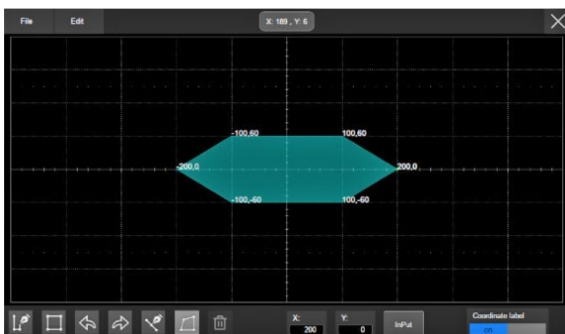


Trigger and decode up to 2 common embedded and automotive serial buses (I²C, SPI, UART, LIN and CAN) simultaneously. Options are available to add decoding of CAN FD, FlexRay, I²S and MIL-STD-1553B. Bus protocol information can be quickly and intuitively displayed time aligned with the waveform and in table format.

Mask Test Function

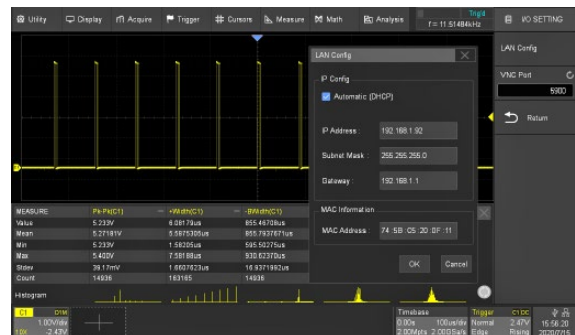


The mask test function enables users to define their own masks directly from a waveform or from the mask editor capability. The masks can then be used for Go/No Go testing with any failures stored as history waveforms or screen shots. The masks can be stored in the T3DSO2000A for future use, so are not lost when the T3DSO2000A is powered off, making it suitable for long-term signal monitoring or automated production line testing.



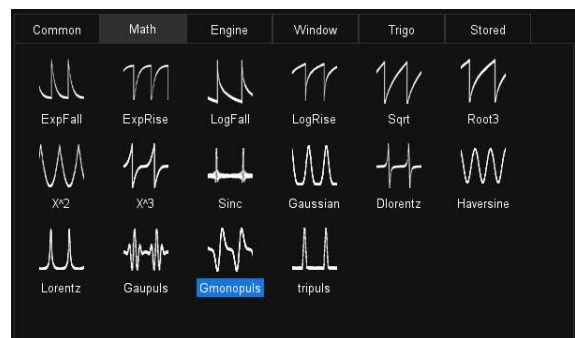
Built in mask editor

Complete Connectivity



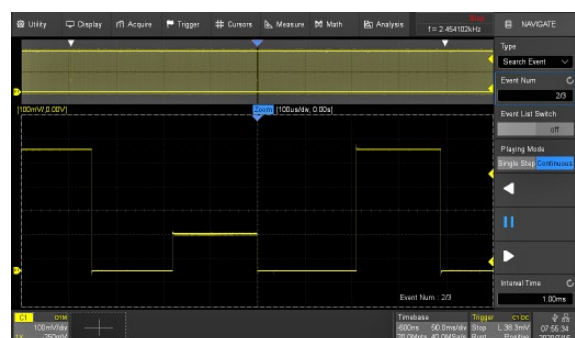
Connectivity includes External Trigger Input, Pass/Fail and Trigger Out, USB Device (USBTMC) and LAN for remote control, and a Kensington Lock security point.

Built-in 50 MHz Function/ArbitraryWaveform Generator as standard



The 50 MHz built-in function/arbitrary waveform generator comprises 6 standard waveforms and 45 arbitrary waveforms.

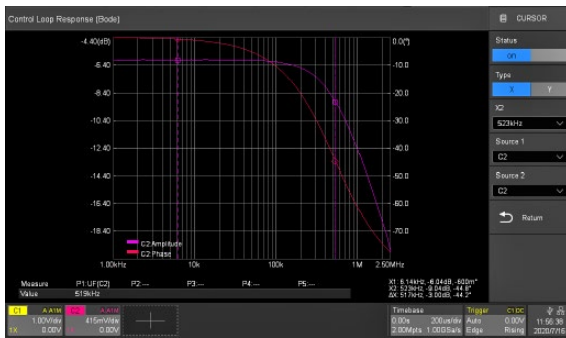
Search and Navigate



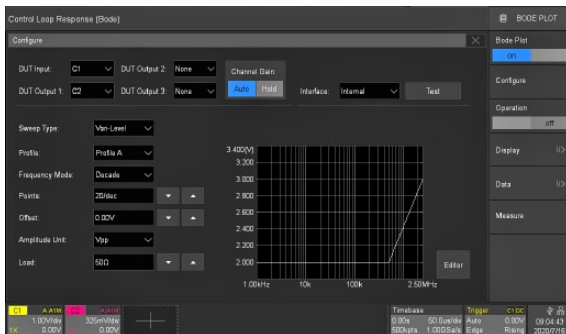
The T3DSO2000A can find events within an acquisition record or history acquisition based on user specified trigger conditions. Navigate browses through Events flagged by the Search, plays back history events or continuously moves the delay position on long records (useful in zoom view).

FUNCTION & CHARACTERISTICS

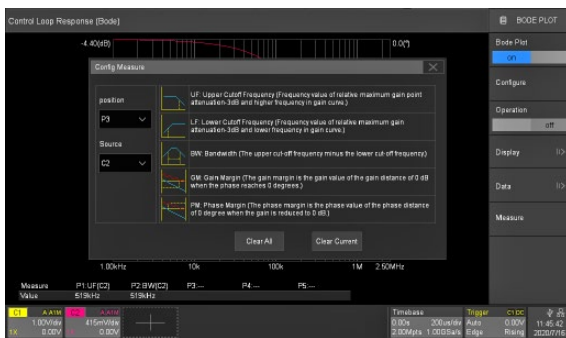
Bode Plot



The T3DSO2000A Bode Plot application can control the built-in waveform generator or any T3AFG40-80-120 function generator to make Bode Plot measurements by scanning the amplitude and phase response over frequency of passive or active components and circuits. This makes it possible to replace expensive network analyzers in less demanding applications. The built-in waveform generator allows Bode Plot measurements up to 50 MHz whereas using the T3AFG120 allows Bode Plot measurements up to 120 MHz.



The configuration screen allows configuration of the reference and measurement channels with up to three measurement channels possible. Configuration of the measurement frequency and amplitude, setting the number of measurement points, load, variable level sweeps, channel gain, decade or linear frequency mode, etc.

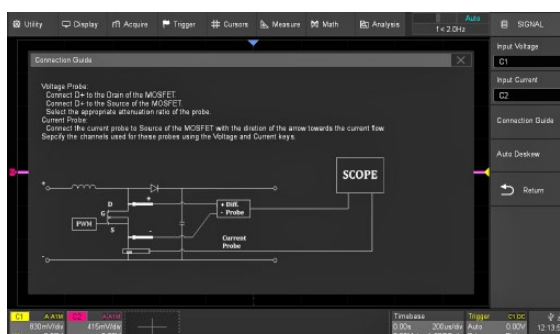
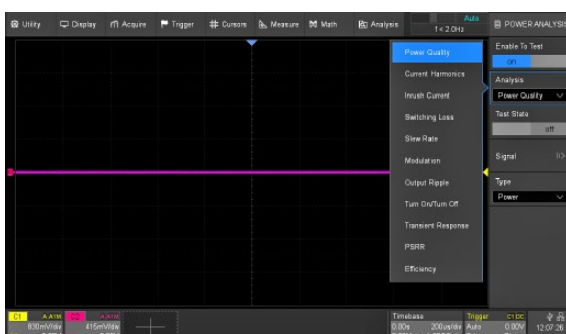


The measurement screen allows the setting of five common measurements: Upper cutoff frequency, lower cutoff frequency, bandwidth, gain margin and phase margin, as well as having user settable measurement cursors.

Power Analysis



The T3DSO2000A Power Analysis application provides a full suite of power measurements and analysis tools, thus improving the efficiency of measurement in switching power supplies and power device designs. 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.



SPECIFICATIONS

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

- The oscilloscope calibration period is valid
- The oscilloscope has been working continuously for at least 30 minutes at the specified temperature (18 – 28)

Acquire System

| | |
|---------------|---|
| Sampling Rate | 2 GSa/s (single-channel ¹⁾), 1 GSa/s (dual-channel) |
| Memory Depth | 200 Mpts (single-channel), 100 Mpts (dual-channel) |
| Peak Detect | 1 ns |
| Average | Averages: 4, 16, 32, 64, 128, 256, 512, 1024 |
| Eres | Enhance bits: 0.5, 1, 1.5, 2., 2.5, 3 selectable |
| Interpolation | Sinx/x, Linear |

Input

| | |
|--------------------|---|
| Channels | 2/4 + EXT |
| Coupling | DC, AC, GND |
| Impedance | DC: (1 M Ω \pm 2 %) (17 pF \pm 2 pF) 50 Ω : 50 Ω \pm 1 % |
| Max. Input voltage | 1 M Ω \leq 400 Vpk (DC + Peak AC), DC – 10 kHz 50 Ω \leq 5 Vrms, \pm 10 V Peak |
| CH to CH Isolation | DC – 100 MHz > 40 dB, 100 MHz – BW \geq 34 dB |
| Probe Attenuation | 1X, 10X, 100X, Custom |

Horizontal System

| | | |
|-----------------------|--|------------------------------------|
| Time Scale | 1.0 ns/div – 1000 s/div | T3DSO2502A 0.5 ns/div – 1000 s/div |
| Channel Skew | < 100 ps | |
| Waveform Capture Rate | Up to 120,000 wfm/s (normal mode), 500,000 wfm/s (sequence mode) | |
| Intensity grading | 256-level | |
| Display Format | Y-T, X-Y, Roll (\geq 50 ms/div) | |
| Time base Accuracy | \pm 1 ppm initial; \pm 1 ppm 1st year ageing; \pm 3.5 ppm 10-year ageing | |
| Roll Mode | 50 ms/div – 1000 s/div (1-2-5 Step) | |

Vertical System

| | | |
|--|---|--|
| Bandwidth (-3dB) | 500 MHz T3DSO2502A (2 Channels), 350 MHz (4 Channels) 350 MHz (T3DSO2354A) 200 MHz (T3DSO2204A) 100 MHz (T3DSO2104A) | |
| Vertical Resolution | 8 bit 10 bit mode \leq 100 MHz | |
| Vertical Range | 8 divisions | |
| Vertical Scale (Probe 1X) | 1 M Ω 500 μ V/div – 10 V/div 50 Ω : 500 μ V/div – 1 V/div | |
| Offset Range (Probe 1X) | 500 μ V/div – 100 mV/div: \pm 2 V 102 mV/div – 1 V/div: \pm 20 V 1.02 V/div – 10 V/div: \pm 200 V | |
| Bandwidth Limit | 20 MHz -0 % – +20 %, 200 MHz -0 % – +20 % | |
| Bandwidth Flatness 50 Ω | DC – 10 % (BW): \pm 0.5 dB 10 % – 33 % (BW): \pm 0.8 dB 33 % – 66 % (BW): + 1 dB, - 1.2 dB 66 % – BW: + 2 dB, - 2.5 dB | |
| Low Frequency Response (AC Coupling –3 dB) | \leq 5 Hz (typical, at input BNC) | |
| Noise | 80 μ V at 500 MHz bandwidth | |
| DC Gain Accuracy | \leq 3.0 % | |
| Offset Accuracy | \pm (1 % * offset + 1.5 % * 8 * div + 1 mV) | |
| Rise Time ¹⁾ 50 Ω | (Typ.) \leq 800 ps (T3DSO2502A 2 Channel 500 MHz mode) \leq 1 ns (T3DSO2502A 4 Channel mode) (Typ.) \leq 1 ns (T3DSO2354A) (Typ.) \leq 1.7 ns (T3DSO2204A) (Typ.) \leq 3.5 ns (T3DSO2104A) (Typ.) \leq 3.3 ns (T3DSO2104A, T3DSO2204A, T3DSO2354A, T3DSO2502A in 10 bit mode) | |
| Overshoot (150 ps Fast Edge, 50 Ω input) | < 12 % | |

SPECIFICATIONS

Trigger System

| | |
|---|--|
| Mode | Auto, Normal, Single |
| Level | Internal: ± 4.1 div from the center of the screen EXT: ± 0.61 V EXT/5: ± 3.05 V |
| Holdoff Range | By Time: 8 ns – 30 s (8 ns Step) By Event: 1 – 10^8 |
| Coupling | AC, DC, LFRJ, HFRJ, Noise RJ (CH1 – CH4) AC, DC, LFRJ, HFRJ, (EXT) |
| Coupling Frequency Response (CH1 – CH4) ²⁾ | DC: Passes all components of the signal AC: Blocks DC components and attenuates signals below 20 Hz LFRJ: Attenuates the frequency components below 1.2 MHz HFRJ: Attenuates the frequency components above 600 kHz |
| Coupling Frequency Response (EXT) ²⁾ | DC: Passes all components of the signal AC: Blocks DC components and attenuates signals below 8 Hz LFRJ: Attenuates the frequency components below 33 kHz HFRJ: Attenuates the frequency components above 967 kHz |
| Accuracy ²⁾ | CH1 – CH4: ± 0.2 div EXT: ± 0.3 div |
| Sensitivity | CH1 – CH4: ≤ 2 mV / div ± 0.5 div, > 2 mV / div ± 0.33 div EXT: 200 mVpp (DC – 10 MHz), 300 mVpp (10 MHz – 300 MHz) EXT/5: 1 Vpp (DC – 10 MHz), 1.5 Vpp (10 MHz – 300 MHz) |
| Jitter | CH1 – CH4 < 10 ps rms, 6 divisions pk-pk, 2 ns edge, EXT < 200 ps rms |
| Displacement | Pre-Trigger: 0 – 100 % memory Delay-Trigger: 0 – 5,000 div |
| Zone | Up to 2 zones, Source: CH1 – CH4, Property: Intersect / Not Intersect |

Edge Trigger

| | |
|--------|--|
| Slope | Rising, Falling, Rising & Falling |
| Source | CH1 – CH4/EXT/(EXT/5)/AC Line/D0 – D15 |

Slope Trigger

| | |
|-------------|------------------------|
| Slope | Rising, Falling |
| Limit Range | $\leq, \geq, < >, > <$ |
| Source | CH1 – CH4 |
| Time Range | 2 ns – 20 s |
| Resolution | 1 ns |

Pulse Width Trigger

| | |
|-------------------|------------------------|
| Polarity | +wid, -wid |
| Limit Range | $\leq, \geq, < >, > <$ |
| Source | CH1 – CH4 / D0 – D15 |
| Pulse Width 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 | CH1 – CH4 |
| Sync | Any, Select |
| Trigger condition | Line, Field |

Window Trigger

| | |
|-------------|--------------------|
| Window Type | Absolute, Relative |
| Source | CH1 – CH4 |

¹⁾ Single-channel: one channel in CH1/CH2 (or CH3/CH4) is ON and another is OFF
Dual-channel: both channels in CH1/CH2 (or CH3/CH4) are ON

²⁾ Typical Value refers to the tested value under specific conditions. It might vary with the ambient temperature or other conditions

SPECIFICATIONS

Interval Trigger

| | |
|-------------|------------------------------------|
| Slope | Rising, Falling |
| Limit Range | \leq , \geq , $<$, $>$, $><$ |
| Source | CH1 – CH4 / D0 – D15 |
| Time Range | 2 ns – 20 s |
| Resolution | 1 ns |

Dropout Trigger

| | |
|--------------|----------------------|
| Timeout Type | Edge, State |
| Source | CH1 – CH4 / D0 – D15 |
| Slope | Rising, Falling |
| Time Range | 2 ns – 20 s |
| Resolution | 1 ns |

Runt Trigger

| | |
|-------------|------------------------------------|
| Polarity | +wid , -wid |
| Limit Range | \leq , \geq , $<$, $>$, $><$ |
| Source | CH1 – CH4 |
| Time Range | 2 ns – 20 s |
| Resolution | 1 ns |

Pattern Trigger

| | |
|-----------------|------------------------------------|
| Pattern Setting | Low, High, Don't Care |
| Logic | AND, OR, NAND, NOR |
| Source | CH1 – CH4 / D0 – D15 |
| Limit Range | \leq , \geq , $<$, $>$, $><$ |
| Time Range | 2 ns – 20 s |
| Resolution | 1 ns |

Serial Trigger

IIC Trigger

| | |
|------------------|--|
| Condition | Start, Stop, Restart, No Ack, EEPROM, Address&Data, Data Length |
| Source (SDA/SCL) | CH1 – CH4 / D0 – D15 |
| Data format | Hex |
| Limit Range | EEPROM: =, >, < |
| Data Length | EEPROM: 1 byte Address & Data: 1 – 2 byte Data Length: 1 – 12 byte |
| R/W bit | Address & Data: Read, Write, Don't Care |

SPI Trigger

| | |
|---------------------|----------------------|
| Condition | Data |
| Source (CS/CL/Data) | CH1 – CH4 / D0 – D15 |
| Data format | Binary |
| Data Length | 4 – 96 bit |
| Bit Value | 0, 1, X |
| Bit Order | LSB, MSB |

SPECIFICATIONS

| UART Trigger | |
|------------------------|--|
| Condition | Start, Stop, Data, Parity Error |
| Source (RX/TX) | CH1 – CH4 / D0 – D15 |
| 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 Rate (Selectable) | 600/1200/2400/4800/9600/19200/38400/57600/115200 bit/s |
| Baud Rate (Custom) | 300 bit/s – 334000 bit/s |
| CAN Trigger | |
| Type | All, Remote, ID, ID + Data, Error |
| Source | CH1 – CH4 / D0 – D15 |
| 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 |
| LIN Trigger | |
| Type | Break, Frame ID, ID+Data, Error |
| Source | CH1 – CH4 / D0 – D15 |
| 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 | |
| No. of Decoder | 2 |
| Decode Type | Full Duplex |
| Threshold | -4.1 – +4.1 Div |
| List | 1 – 7 lines |
| IIC Decoder | |
| Signal | SCL, SDA |
| Address | 7 bit, 10 bit |
| Decoded Frames (Max.) | 2,000 |
| SPI Decoder | |
| Signal | CLK, MISO, MOSI, CS |
| Edge Select | Rising, Falling |
| Chip Select | Active Low, Active High, Clock Timeout |
| Bit Order | MSB, LSB |
| Decoded Frames (Max.) | 15,000 |
| UART Decoder | |
| 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 |
| Decoded Frames (Max.) | 15,000 |

SPECIFICATIONS

| CAN Decoder | |
|------------------------------------|--|
| Signal | CAN_H, CAN_L |
| Source | CH1 – CH4 / D0 – D15 |
| Decoded Frames (Max.) | 2,000 |
| LIN Decoder | |
| LIN Specification Package Revision | Ver1.3, Ver2.0 |
| Baud Rate (Selectable) | 600 bps, 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, custom |
| Decoded Frames (Max.) | 3,000 |

Serial Decoder (Optional)

| CAN FD | |
|-----------------------|---|
| Source | CH1 – CH4 / D0 – D15 |
| Nominal Baud Rate | 10 kbps, 25 kbps, 50 kbps, 100 kbps, 250 kbps, 1 Mbps, custom |
| Data Baud Rate | 500 kbps, 1 Mbps, 2 Mbps, 5 Mbps, 8 Mbps, 10 Mbps, custom |
| Decoded Frames (Max.) | 1,000 |
| FlexRay | |
| Source | CH1 – CH4 |
| Data Baud Rate | 2.5 Mbps, 5 Mbps, 10 Mbps, custom |
| Decoded Frames (Max.) | 1,000 |
| I²S | |
| Signal | BCLK, WS, DATA |
| Audio Variant | Audio-I ² S, Audio-LJ, Audio-RJ |
| Start Bits | 0 – 31 |
| Baud Rate | 1 – 32 |
| Decoded Frames (Max.) | 10,000 |
| MIL-STD-1553B | |
| Source | CH1 – CH4 |
| Decoded Frames (Max.) | 10,000 |

Measurement

| | |
|--------|--|
| Source | CH1 – CH4 / D0 – D15, F1 – F2, Ref, History, Z1 – Z4 |
| Mode | Simple, Advanced |
| Range | Screen, Gate |

Measurement Parameters

| Vertical (Voltage) | | |
|---------------------------|--|---|
| Max | | Highest value in input waveform |
| Min | | Lowest value in input waveform |
| Pk-Pk | | Difference between maximum and minimum data values |
| Amplitude | | 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 |
| Cycle Mean | | Average of data values in the first cycle |
| stdev | | Standard deviation of all data values |
| Cycle stdev | | Standard deviation of data values in the first cycle |
| RMS | | Root mean square of all data values |
| Cycle RMS | | Root mean square of all data values in the first cycle |
| Median | | Middle data value of all data values |
| Cycle Median | | Middle data value 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@Trigger | | The voltage value of the trigger point |

SPECIFICATIONS

| | | | |
|--------------------------|--|---|---|
| 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 | |
| | Time@max | Time of maximum value | |
| | Time@min | Time of minimum value | |
| | +Width | Width measured at 50 % level and positive slope | |
| | -Width | Width measured at 50 % level and negative slope | |
| | 10 – 90 % Rise | Time Duration of rising edge from 10 – 90 % | |
| | 90 – 10 % Fall | Time Duration of falling edge from 90 – 10 % | |
| | 20 – 80 % Rise | Time Duration of rising edge from 20 – 80 % | |
| | 80 – 20 % Fall | Time Duration of falling edge from 80 – 20 % | |
| | +Bwidth | Time from the first rising edge to the last falling edge at the 50 % crossing | |
| | -Bwidth | Time from the first falling edge to the last rising edge at the 50 % crossing | |
| | +Duty | Ratio of positive width to period | |
| | -Duty | Ratio of negative width to period | |
| | Delay | Time from the trigger to the first transition at the 50 % crossing | |
| | T@M | Time from the trigger to each rising edge at the 50 % crossing | |
| | CCJ | The difference between two consecutive period | |
| | Delay | Phase | Calculate the phase difference between two edges |
| | | FRFR | Time between the first rising edge of source A and the following first rising edge of source B at the 50 % crossing |
| FRFF | | Time between the first rising edge of source A and the following first falling edge of source B at the 50 % crossing | |
| FFFR | | Time between the first falling edge of source A and the following first rising edge of source B at the 50 % crossing | |
| FFFF | | Time between the first falling edge of source A and the following first falling edge of source B at the 50 % crossing | |
| FRLR | | Time between the first rising edge of source A and the last rising edge of source B at the 50 % crossing | |
| FRLF | | Time between the first rising edge of source A and the last falling edge of source B at the 50 % crossing | |
| FFLR | | Time between the first rising edge of source A and the last falling edge of source B at the 50 % crossing | |
| FFLF | | Time between the first falling edge of source A and the last falling edge of source B at the 50 % crossing | |
| Skew | | Time of source A edge minus time of nearest source B edge | |
| Miscellaneous | | +Area | Area of the waveform above zero |
| | | -Area | Area of the waveform below zero |
| | Area | Area of the waveform | |
| | AbsArea | Absolute area of the waveform | |
| | Cycles | Number of cycles in a periodic waveform | |
| | Rising Edges | Number of rising edges in a waveform | |
| | Falling Edges | Number of falling edges in a waveform | |
| | Edges | Number of edges in a waveform | |
| | Ppulses | Number of positive pulses in a waveform | |
| | Npulses | Number of negative pulses in a waveform | |
| | Cursors | Manual: Time X1, X2, (X1–X2), (1/ΔT) Voltage Y1, Y2, (Y1–Y2) Track: Time X1, X2, (X1–X2) Source: CH1 – CH4 / D0 – D15, Math, Ref | |
| Statistics | Current, Mean, Min, Max, Sdev, Count, Histogram, Trend | | |
| Counter | Source: CH1 – CH4 Frequency Resolution: 7 Digits | | |

SPECIFICATIONS

Math

| | |
|--------------------------|---|
| Number of Math Operators | 2 |
| Source | CH1 – CH4, Z1 – Z4, F1, F2 |
| Operation | +, -, *, /, FFT, d/dt, jdt, square root, Formula Editor |
| FFT | Length: 2 Mpts, 1 Mpts, 512 kpts, 256 kpts, 128 kpts, 64 kpts, 32 kpts, 16 kpts, 8 kpts, 4 kpts, 2 kpts Window: Rectangular, Blackman, Hanning, Hamming, Flattop Display: Full Screen, Split, Exclusive Mode: Normal, Max hold, Average Tools: Peaks, Markers |

Analysis

Search

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

Navigate

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

Mask Test

| | |
|---------------------|--|
| Source | CH1 – CH4, Z1 – Z4 |
| Mask creating | Auto (Create mask), Custom (Mask Editor, optional) |
| Mask test speed | Up to 80,000 frames/s |
| Store failed frames | To history, To screenshot |

Bode Plot

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

Power Analysis

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

Built-in Function/Arbitrary Waveform Generator

| | |
|-----------------------|---|
| Channel | 1 |
| Max. Output Frequency | 50 MHz |
| Sampling Rate | 125 MSa/s |
| Frequency Resolution | 1 μ Hz |
| Frequency Accuracy | ± 50 ppm |
| Vertical Resolution | 14 bits |
| Amplitude Range | -1.5 V – +1.5 V (into 50 Ω) -3 V – +3 V (into HiZ) |
| Waveforms | Sine, Square, Ramp, Pulse, DC, Noise, 45 Arbitrary |
| Output Impedance | 50 $\Omega \pm 2\%$ |
| Protection | Over voltage protection, Current limit |

SPECIFICATIONS

Sine

| | |
|---|--|
| Frequency | 1 μ Hz – 50 MHz |
| Offset Accuracy (10 kHz) | \pm (1 % * offset setting value + 3 mVpp) |
| Amplitude Flatness (Compared to 10 kHz, 5 Vpp) | \pm 0.3 dB \leq 25 MHz \pm 0.5 dB $>$ 25 MHz |
| SFDR | DC – 1 MHz -60 dBc 1 MHz – 5 MHz -55 dBc 5 MHz – 25 MHz -50 dBc 25 MHz – 50 MHz -40 dBc |
| Harmonic Distorsion | DC – 5 MHz -50 dBc 5 MHz – 25 MHz -45 dBc 25 MHz – 50 MHz -40 dBc |

Square/Pulse

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

Ramp

| | |
|---------------------|---|
| Frequency | 1 μ Hz – 300 kHz |
| Linearity (Typical) | $<$ 0.1 % of Pk-Pk (Typical, 1 kHz, 1 Vpp, 50 % Symmetry) |
| Symmetry | 0 % – 100 % |

DC

| | |
|--------------|---|
| Offset range | \pm 1.5 V (into 50 Ω) \pm 3 V (into HiZ) |
| Accuracy | \pm (Setting Value * 1 % + 3 mV) |

Noise

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

Arb

| | |
|-----------------|--|
| Frequency | 1 μ Hz – 5 MHz |
| Wave Length | 16 Kpts |
| Sampling Rate | 125 MSa/s |
| Waveform Import | EasyWave, U-Disk, directly from waveform data of analog channels |

Digital Channels

| | |
|-----------------------------|---|
| No. of Channels | 16 |
| Max. Sampling Rate | 500 MSa/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 ²⁾ | D0 – D15: \pm 1 sampling interval Digital to Analog: \pm (1 sampling interval +1 ns) |

²⁾ Typical Value refers to the tested value under specific conditions. It might vary with the ambient temperature or other conditions

SPECIFICATIONS

I/O

| | |
|----------|---|
| Standard | USB 2.0 Host x2, USB 2.0 Device, LAN 100 M, Pass/Fail Out 3.3 V TTL, Trigger Out 3.3 V LVCMOS, EXT Trigger ≤ 1.5 Vrms, EXT/5 Trigger ≤ 7.5 Vrms |
|----------|---|

Display

| | |
|--------------|---|
| Display Type | 10.1 inch TFT LCD Capacitive Touch Screen |
| Resolution | 1024 x 600 |
| Contrast | 500:1 |
| Backlight | 500 nit typical |
| Range | 8 x 10 grid |

Waveform Display

| | |
|------------------|---|
| Type | Dot, Vector |
| Persistence Time | OFF, 1 s, 5 s, 10 s, 30 s, infinite |
| Color Display | Normal, Color |
| Screen Saver | 1 min, 5 min, 10 min, 30 min, 1 hour, OFF |

Language

| | |
|----------|---|
| Language | Simplified Chinese, Traditional Chinese, English, French, Japanese, German, Russian, Italian, Portuguese, Spanish |
|----------|---|

Environments

| | |
|-------------------------------|--|
| Temperature | Operating: 10 – 40 Non-operating: -20 – 60 |
| Humidity | Operating: 85 % RH, 40 Deg C, 24 hours Non-operating: 85 % RH, 65 Deg C, 24 hours |
| Altitude | Operating: ≤ 3000 m Non-operating: $\leq 15,266$ m |
| Electromagnetic Compatibility | 2014/30/EU Execution Standard EN 61326-1:2013 |
| Safety | 2014/35/EU Execution Standard EN 61010-1:2010 |

All T3DS02000 Series Oscilloscopes come with a 3 year return to Teledyne LeCroy warranty.

Power Supply






| | |
|---------------------------|---|
| Input Voltage & Frequency | 100 – 240 Vrms 50/60 Hz 100 – 120 Vrms 400 Hz |
| Power | 80 W Max, 50 W typical, 4 W typical in standby mode |

Mechanical

| | |
|------------|--|
| Dimensions | Length * Width * Height = 352 mm * 111 mm * 224 mm |
| Weight | N.W 3.9 Kg G.W 5.4 Kg |

ORDERING INFORMATION

T3DSO2000 Probes

| Probe type | Model | Picture | Description |
|--------------|------------------------------|---|---|
| Passive | T3PP300 |  | 300 MHz bandwidth, 10 MΩ 10X Probe 1 supplied per channel. Replacement probe for the T3DSO2104A and T3DSO2204A Oscilloscopes. |
| | T3PP350A |  | 350 MHz bandwidth, 10 MΩ 10X Probe 1 supplied per channel. Replacement probe for the T3DSO2354A Oscilloscope. |
| | PP020-1 |  | 500 MHz bandwidth, 10 MΩ 10X Probe 1 supplied per channel. Replacement probe for the T3DSO2502A Oscilloscope. |
| Logic Probe | T3DSO2000-LS |  | 16 Channel Logic Probe. This probe REQUIRES that the Oscilloscope has option T3DSO2000A-MSO |
| MSO Software | T3DSO2000A-MSO ¹⁾ |  | Software License for the MSO capability. Enables one T3DSO2000-LS 16 channel logic probe lead set to be shared amongst several licensed T3DSO2000A oscilloscopes. This software option does not come with a logic probe lead set. |

¹⁾ This option REQUIRES that the scope has probe T3DSO2000-LS.

Ordering information

| | | |
|----------------------|--|---------------------|
| Description | 500 MHz, 2 Ch, 2 GSa/s (Max.), 200 Mpts/Ch, 350 MHz, 4 Ch, 2 GSa/s (Max.), 100 Mpts/Ch, 200 Mpts Interleaved | T3DSO2502A |
| | 350 MHz, 4 Ch, 2 GSa/s (Max.), 100 Mpts/Ch, 200 Mpts Interleaved | T3DSO2354A |
| | 200 MHz, 4 Ch, 2 GSa/s (Max.), 100 Mpts/Ch, 200 Mpts Interleaved | T3DSO2204A |
| | 100 MHz, 4 Ch, 2 GSa/s (Max.), 100 Mpts/Ch, 200 Mpts Interleaved | T3DSO2104A |
| Standard Accessories | USB Cable -1 | |
| | Passive Probe -4 | |
| | Power Cord -1 | |
| | Quick Start -1 | |
| | Certificate of Calibration -1 | |
| Optional Accessories | FlexRay trigger & decode (software) | T3DSO2000A-FLEXRAY |
| | MIL-STD-1553B trigger & decode (software) | T3DSO2000A-MIL-1553 |
| | CAN FD trigger & decode (software) | T3DSO2000A-CANFD |
| | I ² S trigger & decode (software) | T3DSO2000A-I2S |
| | 16 Digital Channels (Software, requires T3DSO2000-LS) | T3DSO2000A-MSO |
| | 16 Channel Logic Probe, requires T3DSO2000A-MSO | T3DSO2000-LS |

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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