

# Digital Phosphor Oscilloscopes

## ► TDS7000B Series



## Superior Measurement Fidelity, Unrivaled Analysis, Uncompromised Usability

The TDS7000B Series' unique combination of superior measurement fidelity, unrivaled analysis and uncompromised usability makes it the ultimate test machine to simplify and speed the design of high-speed, complex systems. This family offers the industry's best solution to the challenging signal integrity issues faced by designers verifying, characterizing and debugging sophisticated electronic designs.

They deliver up to 7.25 GHz (typical) true analog bandwidth, down to 43 ps rise time (20% to 80%), and 20 GS/s maximum real-time sample rate to capture critical events with fine detail.

Exclusive DPX® acquisition technology enables waveform capture rates up to 400,000 wfms/s to quickly find rare glitches in seconds or minutes, instead of hours or days. Innovative software solutions deliver domain expertise for advanced analysis and compliance testing, while the OpenChoice® architecture enables users to integrate their expertise through the ability to easily write custom programs or utilize popular commercial software. The intuitive graphical user interface delivers sophisticated capability to advanced users without intimidating occasional users.

## ► Features & Benefits

Up to 7.25 GHz True Analog Bandwidth and Down to 43 ps Rise Time (20% to 80%)

>400,000 wfms/s Waveform Capture Rate, Powered by Exclusive DPX® Acquisition Technology

20 GS/s Maximum Real-time Sample Rate

Exceptional Delta-time Accuracy for High Confidence in Critical Timing Measurements

MyScope® Custom Control Windows Enhance Productivity

Right Mouse Click Menus for Exceptional Efficiency

Powerful Triggering Features for Fast Detection of Relevant Faults

Communications Mask Testing Up to 4.25 Gb/s Rates

Clock Recovery from Serial Data Streams up to 3.125 Gb/s

Up to 64 MB Record Length with MultiView Zoom™ for Quick Navigation of Long Records

TekConnect® Interface for High Fidelity Connection

Classic Direct Controls, Touch-sensitive Display or Mouse Navigation

OpenChoice® with Microsoft Windows 2000 Delivers Built-in Networking and Analysis

XGA 1024x768 Display

## ► Applications

Signal Integrity, Jitter and Timing Analysis

Verification, Debug and Characterization of Sophisticated Designs

Design, Development and Compliance Testing of Serial Data Streams Up to 4.25 Gb/s Rates

Debug of Telecom, Datacom and Storage Area Network Equipment Designs, and High-speed Backplanes

Spectral Analysis

Investigation of Transient Phenomena

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#### **MyScope® Custom Control Windows**

MyScope control windows allow you to build your own control windows with only the controls, features and capabilities that you care about and are important in your job. For the first time you can create your own personalized “toolbox” of oscilloscope features. No longer do you need to search through menus for features or re-learn how to drive the oscilloscope after a break from the lab. MyScope control windows are easily created in a matter of minutes using a simple, visual, drag-and-drop process. Once created, these customized windows are easily accessed through a dedicated MyScope button and menu selection on the oscilloscope button/menu bar, just like any other control window. You can make an unlimited number of custom control windows, enabling each person who uses the oscilloscope in a shared

environment to have their own unique control window. Since the control windows are stored as files on the hard drive, they can easily be transferred to other CSA7000B, TDS5000B or TDS6000B/C Series oscilloscopes, or they can even be e-mailed to a co-worker around the world when the need arises. MyScope control windows will benefit all oscilloscope users, from eliminating the ramp-up time that many face when returning to the lab after not using an oscilloscope for a while, to the power user who can now operate far more efficiently. Everything you need is found in one control window rather than having to constantly navigate through menu after menu to repeat similar tasks.

#### **Right Clicks**

Right mouse click menus make simple things as they should be – simple. Right click menus are context sensitive, meaning the choices presented in the menu depend on where you right clicked

the mouse. This makes right click menus extremely intuitive. Want to change the cursor type? Right click on a cursor or the cursor readouts. Want to change the reference levels of an automatic measurement? Right click on the measurement. Want to change trigger parameters? Right click on the trigger readouts. Want to change a waveform’s color? Right click on the waveform handle. Virtually all objects on the oscilloscope display have right click menus associated with them that include all the appropriate actions or features relative to those objects. There are also right click menus for regions of the display in addition to just objects. For example, right clicking in the main graticule brings up a menu with choices such as Clear Data, Default Setup, Autoset, Screen Captures, Save All Waveforms and Add Screen Text, providing single-click access to many of your most commonly performed tasks.

## ► Characteristics

## ► Vertical System

|  | TDS7054  | TDS7104 | TDS7154B              | TDS7254B  | TDS7404B            | TDS7704B  |
|--|--|---------|-----------------------|---|---------------------|---|
| Input Channels   | 4  | 4       | 4                     | 4   | 4                   | 4   |
| Hardware Analog Bandwidth (-3 dB)  | 500 MHz  | 1 GHz   | 1.5 GHz <sup>*1</sup> | 2.5 GHz <sup>*1</sup>   | 4 GHz <sup>*1</sup> | 7.25 GHz <sup>*1</sup> (typical), 7GHz <sup>*1</sup> guaranteed |
| Rise Time 10% to 90% (typical)   | 800 ps   | 400 ps  | 200 ps                | 130 ps  | 100 ps              | 62 ps   |
| Rise Time 20% to 80% (typical)   |  |         | 135 ps                | 83 ps   | 72 ps               | 43 ps   |
| DC Gain Accuracy   | 1%   |         |                       | ±(2% + (2% x offset))   |                     | ±2.5% + (2% x offset)   |
| Hardware Bandwidth Limits  | 250 MHz or 20 MHz  |         |                       | Requires TCA-1 MEG  |                     |   |
| Input Coupling   | AC, DC, GND  |         |                       | DC, GND   |                     |   |
| Input Impedance  | 1 MΩ ±0.5% or 50 Ω ±1%   |         |                       | 50 Ω ±2.5%  |                     |   |
| Input Sensitivity, 1 MΩ  | 1 mV/div to 10 V/div   |         |                       | —   |                     |   |
| Input Sensitivity, 50 Ω  | 1 mV/div to 1 V/div  |         |                       | 2 mV/div to 1 V/div   |                     |   |
| Vertical Resolution  | 8-Bit (>11-Bit with averaging)   |         |                       | 8-Bit (>11-Bit with averaging)  |                     |   |
| Max Input Voltage, 1 MΩ  | ±150 V CAT I Derate at 20 dB/decade to 9 V <sub>RMS</sub> above 200 kHz                        |         |                       | —   |                     |   |
| Max Input Voltage, 50 Ω  | 5 V <sub>RMS</sub> , with peaks less than ±30 Volts  |         |                       | <1 V <sub>RMS</sub> for <100 mV/div, <5 V <sub>RMS</sub> for ≥100 mV/div settings<br>Also determined by TekConnect® accessory |                     |   |
| Offset Range   | 1 mV/div to 100 mV/div: ±1 V<br>101 mV/div to 1 V/div: ±10 V<br>1.01 V/div to 10 V/div: ±100 V |         |                       | 2 mV to 50 mV/div: ±0.5 V<br>50.5 mV to 99.5 mV: ±0.25 V<br>100 mV to 500 mV: ±5 V<br>505 mV to 1 V/div: ±2.5 V               |                     |   |
| Channel-to-Channel Isolation Any Two Channels at Equal Vertical Scale Settings | ≥100:1 at 100 MHz and<br>≥30:1 at the rated bandwidth<br><br>≥ ≥ ≥                             |         |                       | ≥80:1 at 1.5 GHz and<br>≥15:1 at the rated bandwidth  |                     |   |

<sup>\*1</sup> At ≥10 mV/div.

Note: Typical system bandwidth of TDS7404B with P7240: 4 GHz.

Note: Typical system bandwidth of TDS7404B with P7330: 3.5 GHz.

Note: Typical system bandwidth of TDS7704B with P7260: 6 GHz.

Note: Typical system bandwidth of TDS7704B with P7350: 5 GHz.

Note: Typical system bandwidth of TDS7704B with P7380: 7 GHz.

## Digital Phosphor Oscilloscopes

### ► TDS7000B Series

#### ► Time Base System

|   | TDS7054/TDS7104   | TDS7154B/TDS7254B/<br>TDS7404B/TDS7704B   |
|---|---|---|
| Time Base Range                               | 200 ps/div to 40 s/div  | 50 ps to 10 s/div   |
| Time Base Delay Time Range                    | 16 ns to 250 s  | 5 ns to 250 s   |
| Channel-to-Channel Deskew Range               | ±25 ns  | ±75 ns  |
| Delta Time Measurement Accuracy               | $\pm((0.06/\text{sample rate}) + (15 \text{ ppm} \times \text{reading})) \text{ RMS}$ | $\pm((0.06/\text{sample rate}) + (2.5 \text{ ppm} \times \text{reading})) \text{ RMS}$  |
| Trigger Jitter (RMS)                          | 8 ps <sub>RMS</sub> (typical)   | 2 ps <sub>RMS</sub> (typical) (7254B/7154B)<br>1.5 ps <sub>RMS</sub> (typical) (7404B)<br>1.2 ps <sub>RMS</sub> (typical) (7704B) |
| Long Term Sample Rate and Delay Time Accuracy | ±15 ppm over ≥1 ms interval   | 2.5 ppm over any ≥100 ms interval   |

#### ► Acquisition System

|  | TDS7054                                    | TDS7104  | TDS7154B/ TDS7254B/<br>TDS7404B/ TDS7704B   |
|--|--|----------|---|
| <b>Real-time Sample Rates</b>                          |  |          |   |
| 1 channel (max)  | 5 GS/s                                     | 10 GS/s  | 20 GS/s                                     |
| 2 channels (max)                                       | 5 GS/s                                     | 5 GS/s   | 10 GS/s                                     |
| 3-4 channels (max)                                     | 2.5 GS/s                                   | 2.5 GS/s | 5 GS/s                                      |
| Equivalent Time Sample Rate (max)                      | 250 GS/s                                   | 250 GS/s | 1 TS/s                                      |
| Maximum Record Length per Channel with Standard Memory | 2 Mb (1-CH.), 1 Mb (2-CH.), 500 Kb (4-CH.) |          | 4 Mb (1-CH.), 2 Mb (2-CH.), 1 Mb (4-CH.)    |
| With Memory Opt. 2M                                    | 8 Mb (1-CH.), 4 Mb (2-CH.), 2 Mb (4-CH.)   |          |   |
| With Memory Opt. 3M                                    | 16 Mb (1-CH.), 8 Mb (2-CH.), 4 Mb (4-CH.)  |          |   |
| With Memory Opt. 4M                                    |  |          | 32 Mb (1-CH.), 16 Mb (2-CH.), 8 Mb (4-CH.)  |
| With Memory Opt. 5M                                    |  |          | 64 Mb (1-CH.), 32 Mb (2-CH.), 16 Mb (4-CH.) |

#### ► Maximum Duration at Highest Real-time Resolution (1-CH)

|                                   | TDS7054         | TDS7104          | TDS7154B/TDS7254B/<br>TDS7404B/TDS7704B |
|-----------------------------------|-----------------|------------------|---|
| Time Resolution (Single-shot)     | 200 ps (5 GS/s) | 100 ps (10 GS/s) | 50 ps (20 GS/s)                         |
| Max Duration with Standard Memory | 400 μs          | 200 μs           | 200 μs                                  |
| Max Duration with Opt. 2M         | 1.6 ms          | 800 μs           | 400 μs                                  |
| Max Duration with Opt. 3M         | 3.2 ms          | 1.6 ms           | 800 μs                                  |
| Max Duration with Opt. 4M         |                 |                  | 1.6 ms                                  |
| Max Duration with Opt. 5M         |                 |                  | 3.2 ms                                  |

► Acquisition Modes

|                                       | TDS7054/TDS7104   | TDS7154B/TDS7254B/<br>TDS7404B/TDS7704B |
|---------------------------------------|---|---|
| FastAcq Acquisition                   | Powered by exclusive DPX® acquisition technology, FastAcq optimizes the instrument for analysis of dynamic signals and capture of infrequent events |   |
| Maximum FastAcq Waveform Capture Rate | >200,000 wfms/sec   | >400,000 wfms/sec                       |
| Waveform Database                     | Accumulate Waveform Database providing three-dimensional array of amplitude, time and counts  |   |
| Sample                                | Acquire sampled values  |   |
| Peak Detect                           | Captures narrow glitches at all real-time sampling rates  |   |
| Minimum Peak Detect Pulse Width       | ≤1 ns   | 400 ps                                  |
| Averaging                             | From 2 to 10,000 waveforms included in average  |   |
| Envelope                              | From 2 to 2x10 <sup>9</sup> waveforms included in min-max envelope  |   |
| Hi-Res                                | Real-time boxcar averaging reduces random noise and increases resolution  |   |
| FastFrame™ Acquisition                | Acquisition memory divided into segments; maximum trigger rate >265,000 waveforms per second. Time of arrival recorded with each event              |   |

► Trigger System

|  | TDS7054  | TDS7104   | TDS7154B/TDS7254B/<br>TDS7404B/TDS7704B  |
|--|--|---|--|
| <b>Sensitivity</b>                                   |  |   |  |
| Internal DC Coupled                                  | 0.35 div DC to 50 MHz<br>increasing to 1 div at 500 MHz  | 0.35 div DC to 50 MHz<br>increasing to 1 div at 1 GHz     | 0.5 div DC to 50 MHz<br>increasing to 1.5 div at 3 GHz<br>TDS7404B/TDS7704B:<br>2.7 div at 4 GHz (typical)   |
| External (Auxiliary Input)                           | 400 mV from DC to 50 MHz<br>increasing to 750 mV at 100 MHz  | 250mV from DC to 50 MHz<br>increasing to 500mV at 100 MHz | 150 mV from DC to 50 MHz<br>increasing to 500 mV at 2.5 GHz  |
| Main Trigger Modes                                   | Auto, Normal and Single  |   |  |
| Trigger Sequences                                    | Main, Delayed by Time, Delayed by Events. All sequences can include separate horizontal delay after the trigger event to position the acquisition window in time                         |   |  |
| <b>Trigger Characteristics</b>                       |  |   |  |
| Standard Trigger Types                               | Edge, Glitch, Runt, Width, Transition Time, Timeout, Pattern, State, Setup/Hold  |   | Edge, Glitch, Runt, Width, Transition Time, Timeout, Pattern, State, Setup/Hold, Window - all except Edge, Pattern, and State can be logic qualified |
| Communications-related Triggers (requires Option SM) | Support for AMI, HDB3, BnZS, CMI, MLT3 and NRZ encoded communications signals. Select among isolated positive or negative one, zero pulse form or eye patterns as applicable to standard |   |  |
| Serial Pattern Trigger (requires Option ST)          | 64-Bit serial word recognizer, bits specified in binary (high, low, don't care) or hex format. Trigger on NRZ-encoded data up to 1.25 GBaud  |   |  |
| <b>Trigger Level Range</b>                           |  |   |  |
| Internal   | ±12 divisions from center of screen  |   |  |
| External (Auxiliary In)                              | ±8 V   |   | ±5 V   |
| Line   | fixed at 0 V   |   |  |
| Trigger Coupling                                     | DC, AC (attenuates <60 Hz), HF Rej (attenuates >30 kHz), LF Rej (attenuates <80 kHz), Noise Reject (reduces sensitivity)   |   |  |
| Trigger Holdoff Range                                | 250 ns minimum to 12 s maximum   |   |  |

# Digital Phosphor Oscilloscopes

► TDS7000B Series

## ► Clock Recovery System (Option SM, ST)

|  | TDS7154B/TDS7254B/TDS7404B/TDS7704B   |
|--|---|
| Clock Recovery Phase Locked Loop Bandwidth | Fbaud/1600 typical  |
| Tracking/Acquisition Range                 | ±2% of requested baud   |
| Clock Recovery Jitter (Typical)            | 0.25% period +5 ps <sub>RMS</sub> for PRBS data pattern<br>or 4 ps <sub>RMS</sub> for repeating "011" data patterns |
| Input Sensitivity for Clock Recovery       | 1 division peak-to-peak displayed signal  |
| Input Data Rates                           | 1.5 Mbaud to 3.125 Gbaud  |

### Trigger Modes

**Edge** – Positive and/or negative slope on any channel or front panel auxiliary input. Coupling includes DC, AC, noise reject, HF reject and LF reject.

**Glitch** – Trigger on or reject glitches of positive, negative or either polarity. Minimum glitch width is 1.0 ns with 200 ps resolution (TDS7104/TDS7054). Minimum glitch width is 170 ps (TDS7704B) or 225 ps (all other B models) with rearm time of 250 ps (B models).

**Width** – Trigger on width of positive or negative pulse (down to 170 ps on B models) either within or out of selectable time limits – 1 ns. (TDS7104/TDS7054) or 340 ps (B models) to 1 s).

**Runt** – Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Optional time qualification.

**Timeout** – Trigger on an event which remains high, low or either, for a specified time period, selectable from 1 ns (TDS7104/TDS7054) or 340 ps (B models) to 1 s with 200 ps (TDS7104/TDS7054) or 100 ps (B models).

**Transition** – Trigger on pulse edge rates that are faster or slower than specified. Slope may be positive, negative or either.

**Setup/Hold** – Trigger on violations of both setup time and hold time between clock and data present on any two input channels.

**Pattern** – Trigger when pattern goes false or stays true for specified period of time. Pattern (AND, OR, NAND, NOR) specified for four input channels defined as HIGH, LOW or Don't Care.

**State** – Any logical pattern of channels (1, 2, 3) clocked by edge on channel 4. Trigger on rising or falling clock edge.

**Window** – Trigger on an event that enters or exits a window defined by two user-adjustable thresholds. Event can be time or logic qualified (B models only) Logic Qualified Trigger applicable to Glitch, Width, Runt, Timeout, Transition, Setup/Hold, Window triggers – trigger on the specified event only if the logic state defined with the remaining unused channels occurs (B models only).

**Trigger Delay by Time** – 16 ns (5 ns for B models) to 250 s.

**Trigger Delay by Events** – 1 to 10,000,000 Events.

**Waveform Measurements**

**Amplitude** – Amplitude, High, Low, Maximum, Minimum, Peak-to-Peak, Mean, Cycle Mean, RMS, Cycle RMS, Positive Overshoot, Negative Overshoot.

**Time** – Rise Time, Fall Time, Positive Width, Negative Width, Positive Duty Cycle, Negative Duty Cycle, Period, Frequency, Delay.

**Combination** – Area, Cycle Area, Phase, Burst Width.

**Histogram-related** – Waveform Count, Hits in box, Peak hits, Median, Maximum, Minimum, Peak-to-Peak, Mean ( $\mu$ ), Standard Deviation ( $\sigma$ ),  $\mu+1\sigma$ ,  $\mu+2\sigma$ ,  $\mu+3\sigma$ .

**Eye Pattern-related (B models only)** – Extinction Ratio (absolute, % and dB), Eye Height, Eye Top, Eye Base, Eye Width, Crossing %, Jitter (Peak-to-Peak, RMS and  $6\sigma$ ), Noise (Peak-to-Peak and RMS), S/N ratio, Cycle Distortion, Q-factor.

**Waveform Processing/Math**

**Algebraic Expressions** – Define extensive algebraic expressions including waveforms, scalars and results of parametric measurements e.g., (Integral (CH.1-Mean(CH.1)) x 1.414).

**Arithmetic** – Add, subtract, multiply, divide waveforms and scalars.

**Relational** – Boolean result of comparison  $>$ ,  $<$ ,  $\geq$ ,  $\leq$ ,  $==$ ,  $!=$ .

**Calculus** – Integrate, differentiate.

**Frequency Domain Functions** – Spectral magnitude and phase, real and imaginary spectra.

**Vertical Units** – Magnitude: Linear, dB, dBm; Phase: Degrees, radians.

**Window Functions** – Rectangular, Hamming, Hanning, Kaiser-Bessel, Blackman-Harris, Gaussian, Flattop2, Tek Exponential.

**Waveform Definition** – As arbitrary math expression.

**Display Characteristics**

**Display Type** – Liquid crystal active-matrix color display.

**Display Size** – Diagonal: 264 mm (10.4 in.).

**Display Resolution** – TDS7104/TDS7054: 640 horizontal x 480 vertical pixels.

TDS7154B/TDS7254B/TDS7404B/TDS7704B: 1024 horizontal x 768 vertical pixels.

**Waveform Styles** – Vectors, Dots, Variable Persistence, Infinite Persistence.

# Digital Phosphor Oscilloscopes

## ► TDS7000B Series

### Computer System and Peripherals

**CPU** – TDS7104/TDS7054: Intel Celeron processor, 850 MHz.

TDS7154B/TDS7254B/TDS7404B/TDS7704B: Intel Pentium IV processor, 2.8 GHz<sup>2</sup>.

**PC System Memory** – 1 GB<sup>2</sup>.

**Hard Disk Drive** – 40 GB removable hard disk drive: rear-panel or (B models only) front-panel, (Option FHD).

**Floppy Disk Drive** – 1.44 MB 3.5 in. floppy disk drive: front-panel, or (B models only) rear-panel (Option FHD).

**CD-R/W Drive** – Rear-panel CD-R/W drive with CD creation software application.

**Mouse** – Thumb wheel model included, USB interface.

**Keyboard** – Mini keyboard included (fits in pouch); PS-2 interface. Order 119-6633-00 for full-size keyboard; USB interface and hub.

<sup>2</sup> Available September 2004.

### Input/Output Ports

**Probe Compensator Output** – Front panel BNC connector, requires Probe Cal-Deskew Fixture (included) for probe attachment. Amplitude 200 mV (TDS7104/TDS7054) or 500mV (B models)  $\pm 20\%$  into a 50  $\Omega$  load, frequency 1 kHz  $\pm 5\%$ .

**Analog Signal Output Amplitude** – Front-panel BNC connector, provides a buffered version of the signal that is attached to the Ch 3 input when Ch 3 is selected as trigger source. 20 mV/div  $\pm 20\%$  into a 1.8 M $\Omega$  load, 10 mV/div  $\pm 20\%$  into a 50  $\Omega$  load.

**Analog Signal Output Bandwidth, Typical** – TDS7054, TDS7104: 100 MHz into a 50  $\Omega$  load. TDS7154B/TDS7254B/TDS7404B/TDS7704B: 1 GHz into a 50  $\Omega$  load.

**External Time Base Reference In** – Rear-panel BNC connector, time base system can phase-lock to external 10 MHz reference.

**Time Base Reference Out** – Rear-panel BNC connector, accepts TTL-compatible output of internal 10 MHz reference oscillator.

**Auxiliary Output Levels** – Front-panel BNC connector, provides a TTL-compatible, polarity switchable pulse when the oscilloscope triggers.

**Parallel Port** – IEEE 1284, DB-25 connector.

**Audio Ports** – Miniature phone jacks for stereo microphone input and stereo line output.

**USB Port** – Allows connection or disconnection of USB keyboard and/or mouse while oscilloscope power is on. B models have 2 USB ports.

**Keyboard Port** – PS-2 compatible.

**Mouse Port** – PS-2 compatible.

**LAN Port** – RJ-45 connector, supports 10Base-T and 100Base-T.

**Serial Port** – DB-9 COM1 port.

**Windows Video Port** – 15 pin D-Sub connector on the rear panel; connect a second monitor to use dual-monitor display mode. Video is DDC2B compliant.

**GPIB Port** – IEEE 488.2 standard.

**Scope Video Port** – 15 pin D-Sub connector on the rear panel, video is IBM XGA compatible on B models. Connect to show the oscilloscope display, including live waveforms on an external monitor or projector. The primary Windows desktop can also be displayed on an external monitor using this port.

### Power Source

**Power** – 100 to 240 V<sub>RMS</sub>,  $\pm 10\%$ , 50/60 Hz; 115 V<sub>RMS</sub>  $\pm 10\%$ , 400 Hz; CAT II, <300 W (450 VA).



**Physical Characteristics  
 Benchtop Configuration**

| <b>Dimensions</b> | <b>mm</b> | <b>in.</b>  |
|-------------------|-----------|-------------|
| Height            | 277       | 10.9        |
| Width             | 455       | 17.9        |
| Depth             | 425       | 16.75       |
| <b>Weight</b>     | <b>kg</b> | <b>lbs.</b> |
| Net               | 19.1      | 42.0        |
| Shipping          | 37        | 85          |

**Physical Characteristics  
 Rackmount Configuration**

| <b>Dimensions</b> | <b>mm</b> | <b>in.</b>  |
|-------------------|-----------|-------------|
| Height            | 277       | 10.5        |
| Width             | 502       | 19.75       |
| Depth             | 486       | 19.125      |
| <b>Weight</b>     | <b>kg</b> | <b>lbs.</b> |
| Net               | 18.6      | 41          |
| Kit               | 5.6       | 12.25       |

**Mechanical**

**Cooling - Required Clearance**

|            | <b>mm</b> | <b>in.</b> |
|------------|-----------|------------|
| Top        | 0 or >76  | 0 or >3    |
| Bottom     | 0         | 0          |
| Left side  | 76        | 3          |
| Right side | 76        | 3          |
| Front      | 0         | 0          |
| Rear       | 0         | 0          |

**Environmental**

**Temperature –**

Operating: 0 °C (TDS7104/TDS7054) or +5 °C (B models) to +50 °C, excluding floppy disk and CD-R/W drives; +10 °C to +45 °C, including floppy disk and CD-ROM drives.

Nonoperating: –22 °C to +60 °C.

**Humidity –**

Operating: 20% to 90% relative humidity with a maximum wet bulb temperature of +29 °C at or below +50 °C, noncondensing. Upper limit derated to 25% relative humidity at +50 °C.

Nonoperating: With no diskette in floppy disk drive. 20% to 90% relative humidity with a maximum wet bulb temperature of +29 °C at or below +60 °C, noncondensing. Upper limit derated to 20% relative humidity at +60 °C.

**Altitude –**

Operating: 10,000 ft. (3,048 m).

Nonoperating: 40,000 ft. (12,190 m).

**Random Vibration –**

Operating: 0.000125 G<sup>2</sup>/Hz from 5 to 350 Hz, –3 dB/octave from 350 to 500 Hz, 0.0000876 G<sup>2</sup>/Hz at 500 Hz. Overall level of 0.24 G<sub>RMS</sub>.

Nonoperating: 0.0175 G<sup>2</sup>/Hz from 5 to 100 Hz, –3 dB/octave from 100 to 200 Hz, 0.00875 G<sup>2</sup>/Hz from 200 to 350 Hz, –3 dB/octave from 350 to 500 Hz, 0.006132 G<sup>2</sup>/Hz at 500 Hz. Overall level of 2.28 G<sub>RMS</sub>.

**Electromagnetic Compatibility –** 89/336/EEC.

**Safety –** UL 3111-1, CSA 1010.1, EN61010-1.2 IEC 61010-1.

# Digital Phosphor Oscilloscopes

## ► TDS7000B Series

### ► Ordering Information

#### **TDS7054**

500 MHz Digital Phosphor Oscilloscope.

#### **TDS7104**

1 GHz Digital Phosphor Oscilloscope.

**TDS7104 and TDS7054 include:** (4) P6139A 500 MHz, 10x Passive Probes, accessory pouch, front cover, USB mouse, USB mini-keyboard, probe calibration and deskew fixture (067-0405-xx), quick reference kit (020-2404-xx), user manual (071-1035-xx), TDS7000 Series product software CD-ROM, TDS7000 Series operating system restoration CD-ROM, TDS7000 Series optional applications software CD-ROM, performance verification procedure PDF file, GPIB programmer's reference (on product software CD-ROM), calibration certificate documenting NIST traceability, 2 540-1 compliance and ISO9000, power cord, one year warranty.

#### **TDS7154B**

1.5 GHz Digital Phosphor Oscilloscope.

#### **TDS7254B**

2.5 GHz Digital Phosphor Oscilloscope.

#### **TDS7404B**

4 GHz Digital Phosphor Oscilloscope.

#### **TDS7704B**

7 GHz Digital Phosphor Oscilloscope.

#### **TDS7154B, TDS7254B, TDS7404B and TDS7704B Include:**

Accessory pouch, front cover, mouse, user manual (071-1226-xx), quick reference kit (020-2519-xx), TDS7000B Series product software CD-ROM 063-3632-00 (TDS7154/7254/7404B) 063-3633-00 (TDS7704B), TDS7000B Series operating system restoration CD-ROM, TDS7000B Series optional applications software CD-ROM, performance verification procedure PDF file, GPIB programmer's reference (on product software CD-ROM), calibration certificate documenting NIST traceability, 2 540-1 compliance and ISO9000, power cord, one year warranty.

#### **For TDS7154B and TDS7254B Only, Also**

**Includes:** (4) TekConnect® to BNC adapters (TCA-BNC), (2) TekConnect high-impedance buffer amplifiers (TCA-1MEG), and deskew fixture (067-0405-xx).

#### **For TDS7404B and TDS7704B Only, Also**

**Includes:** (4) TekConnect to SMA adapters (TCA-SMA).

**For TDS7404B Only, Also Includes:** Deskew fixture (067-0405-xx).

**TDS7704B Only, Also Includes:** Deskew fixture (067-0484-xx).

Please specify disk drive and power cord option when ordering.

### Instrument Options

#### Power Plug Options

- Opt. A0 – North America power.
- Opt. A1 – Universal EURO power.
- Opt. A2 – United Kingdom power.
- Opt. A3 – Australia power.
- Opt. A5 – Switzerland power.
- Opt. A6 – Japan power.
- Opt. A99 – No power cord or AC adapter.
- Opt. A10 – China power.

#### Mounting Options

- 1K – K4000 Oscilloscope Cart.
- 1R – Rackmount Kit.

#### Disk Drive Options (for TDS7154B, TDS7254B, TDS7404B and TDS7704B only)

Opt. FHD – Front-panel 40 GB removable hard disk drive, replaces floppy disk drive that goes on the rear-panel.

#### Service Options

- Opt. C3 – Calibration Service 3 Years.
- Opt. C5 – Calibration Service 5 Years.
- Opt. D1 – Calibration Data Report.
- Opt. D3 – Calibration Data Report 3 Years (with Option C3).
- Opt. D5 – Calibration Data Report 5 Years (with Option C5).
- Opt. R3 – Repair Service 3 Years.
- Opt. R5 – Repair Service 5 Years.

### Recommended Accessories

#### Probes

- P7380 – >8 GHz Z-Active™ Differential Probe.
- P7380SMA – >8 GHz Differential Signal Acquisition System.
- P7350 – 5 GHz differential probe recommended for TDS7404B/TDS7704B.
- P7350SMA – 5 GHz SMA Input differential Probe.
- P7260 – 6 GHz active probe recommended for TDS7404B/TDS7704B.
- P6158 – 3 GHz, 20x Low C Probe.
- P6247 – 1.0 GHz Differential Probe.
- P6139A – 500 MHz, 10x Passive Probe.
- P6245 – 1.5 GHz Active Probe.
- P6248 – 1.7 GHz Differential Probe.
- P7240 – 4 GHz Active Probe.
- P7330 – 3.5 GHz Differential Probe.

### Adapters

TCA-1MEG – TekConnect high-impedance buffer amplifier.

TCA-SMA – TekConnect-to-SMA Adapter.

TCA-N – TekConnect-to-N Adapter.

TCA-BNC – TekConnect-to-BNC Adapter.

TCA75 – 4 GHz precision TekConnect 75  $\Omega$  to 50  $\Omega$  adapter with 75  $\Omega$  BNC input connector.

AFTDS – Telecom differential electrical interface adapter (for line rates <8 MB/s; requires TCA-BNC adapter for TDS7404B).

### Cables

GPIB Cable (1 m) – Order 012-0991-01.

GPIB Cable (2 m) – Order 012-0991-00.

RS-232 Cable – Order 012-1298-00.

Centronics Cable – Order 012-1214-00.

### Test Fixtures

TDSUSBF – TDSUSB test fixture for use with Opt. USB.

### Software

WSTRO – WaveStar™ waveform capture and documentation software.

### Miscellaneous

Keyboard (USB Interface) – Order 119-6633-00.

Service Manual – TDS7054/TDS7104: Order 071-0711-xx.

TDS7154B/TDS7254B/TDS7404B/TDS7704B: Order 071-0898-xx.

Transit Case – Order 016-1522-00.

## ► Options (available on models indicated by “x”)

|                                   |  | TDS7054 | TDS7104 | TDS7154B | TDS7254B | TDS7404B | TDS7704B |
|-----------------------------------|--|---------|---------|----------|----------|----------|----------|
| <b>Acquisition Memory Options</b> |  |         |         |          |          |          |          |
| 2M                                | 8 Msamples max,<br>2 Msamples/ch                                 | x       | x       | x        | x        | x        | x        |
| 3M                                | 16 Msamples max,<br>4 Msamples/ch                                | x       | x       | x        | x        | x        | x        |
| 4M                                | 32 Msamples max,<br>8 Msamples/ch                                |         |         | x        | x        | x        | x        |
| 5M                                | 64 Msamples max,<br>16 Msamples/ch                               |         |         | x        | x        | x        | x        |
| <b>Software Options</b>           |  |         |         |          |          |          |          |
| DVI                               | TDS DVI Compliance<br>Test Solution                              |         |         |          | x        | x        | x        |
| DVD                               | TDS DVD Optical<br>Storage Analysis                              | x       | x       | x        | x        | x        | x        |
| ET3                               | TDS ET3 Ethernet Compliance<br>Test Software                     | x       | x       | x        | x        | x        | x        |
| JA3                               | TDS JA3 Advanced Jitter<br>Analysis Software                     | x       | x       | x        | x        | x        | x        |
| JE3                               | TDS JE3 Essentials   | x       | x       | x        | x        | x        | x        |
| J2                                | TDS J2 Disk Drive<br>Analysis Software                           | x       | x       | x        | x        | x        | x        |
| CP2 <sup>*1</sup>                 | TDS CP2 ANSI/ITU Telecom<br>Pulse Compliance<br>Testing Software | x       | x       | x        | x        | x        | x        |
| USB <sup>*2</sup>                 | TDS USB2.0<br>Compliance Test S/W Only                           | x       | x       | x        | x        | x        | x        |
| SM                                | Serial Communications<br>Mask Testing                            | x       | x       | x        | x        | x        | x        |
| ST                                | Serial Pattern Trigger   |         |         | x        | x        | x        | x        |
| PW3                               | TDS PW3 Power Measurement<br>and Analysis Software               | x       | x       | x        | x        | x        | x        |
| RTE                               | Serial Data Compliance and<br>Analysis Software                  |         |         | x        | x        | x        | x        |
| PCE <sup>*3</sup>                 | PCI Express™ Compliance<br>Module for Option RTE                 |         |         |          |          | x        | x        |
| IBA <sup>*3</sup>                 | InfiniBand Compliance<br>Module for Option RTE                   |         |         |          |          | x        | x        |

\*<sup>1</sup> Requires Option SM.\*<sup>2</sup> Requires Option TDSUSBF (USB Test Fixture).\*<sup>3</sup> Requires Option RTE.To view instrument upgrades for the TDS7000 and TDS7000B Series, please go to [www.tektronix.com/tds7000b\\_upgrades](http://www.tektronix.com/tds7000b_upgrades).

## Digital Phosphor Oscilloscopes

► TDS7000B Series

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