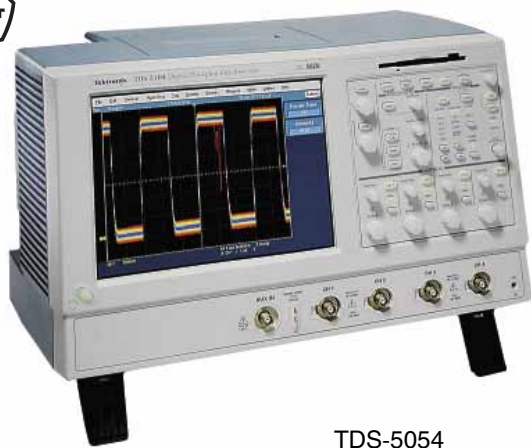


# Осциллографы запоминающие



TDS-5054

## Осциллографы цифровые запоминающие TDS5052, TDS5054, TDS5104 TEKTRONIX, Inc.

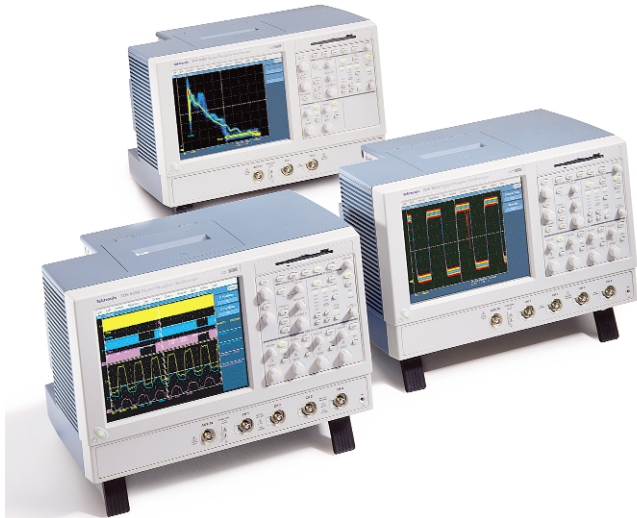
- 2 / 4 канала с полосой пропускания 500 МГц и 1 ГГц
- Макс. частота дискретизации 5 Гвыб/с; эквив. 250 Гвыб/с
- Объем памяти на канал 400 К (расширение до 8 М)
- Скорость захвата до 100.000 сигналов в секунду
- Открытая архитектура Microsoft Windows, совмещающая Hi-end осциллограф и персональный компьютер
- Передовой набор функций синхронизации
- Расширение функций математического анализа (опция)
- Расширенная ТВ синхронизация (PAL/SECAM, NTSC, HDTV)
- Вход внешней опорной частоты (9,8...10,2 МГц)
- Встроенный термопринтер (опция)
- Привод CD-ROM (опция CD-RW), дискковод 3,5"
- Интерфейсы: USB, GPIB, LAN, IEEE 1284, SVGA, VGA, COM1
- Цветной ЖКИ с технологией «цветного фосфора» (DPO)
- Полная совместимость с логич. анализаторами Tektronix

## Технические данные:

ХАРАКТЕРИСТИКИ	ПАРАМЕТРЫ	5052	5054	5104
КАНАЛ ВЕРТИКАЛЬНОГО ОТКЛОНЕНИЯ	Число каналов	2	4	4
	Полоса пропускания (-3 дБ) (5 мВ/дел...1 В/дел) Ограничение полосы пропускания	0...500 МГц	0...500 МГц	0...1 ГГц
КАНАЛ ГОРИЗОНТАЛЬНОГО ОТКЛОНЕНИЯ	Коэф. отклонения ( $K_{откл.}$ ), 1 МОм	20, 150 МГц	20, 150 МГц	20, 150 МГц
	Коэф. отклонения ( $K_{откл.}$ ), 50 Ом	1 мВ/дел...10 В/дел	1 мВ/дел...1 В/дел	1 мВ/дел...1 В/дел
СИНХРОНИЗАЦИЯ	Время нарастания (5 мВ/дел)	800 пс	800 пс	400 пс
	Входной импеданс	1 МОм ( $\pm 1\%$ ) или 50 Ом ( $\pm 1\%$ )	1 МОм ( $\pm 1\%$ ) или 50 Ом ( $\pm 1\%$ )	1 МОм ( $\pm 1\%$ ) или 50 Ом ( $\pm 1\%$ )
СБОР ДАННЫХ	Макс. вх. напряжение, 1 МОм	300 В пик-пик (уменьшение до 9 В ср. кв. при > 200 кГц)	300 В пик-пик (уменьшение до 9 В ср. кв. при > 200 кГц)	300 В пик-пик (уменьшение до 9 В ср. кв. при > 200 кГц)
	Макс. вх. напряжение, 50 Ом	5 В ср. кв.; пиковое значение не более $\pm 30$ В	5 В ср. кв.; пиковое значение не более $\pm 30$ В	5 В ср. кв.; пиковое значение не более $\pm 30$ В
АВТОМАТИЧЕСКИЕ ИЗМЕРЕНИЯ	Математика (стандарт)	Сложение, вычитание, умножение, деление, БГФ	Сложение, вычитание, умножение, деление, БГФ	Сложение, вычитание, умножение, деление, БГФ
	Коэф. развертки ( $K_{разв.}$ )	200 пс/дел...40 с/дел	200 пс/дел...40 с/дел	200 пс/дел...40 с/дел
АВТОМАТИЧЕСКИЕ ИЗМЕРЕНИЯ	Задержка запуска развертки	16 нс...250 с	16 нс...250 с	16 нс...250 с
	Режимы запуска развертки	Автоколебательный, ждущий, однократный, ТВ (NTSC, PAL / SECAM, HDTV, нестандартные), по выбросу (> 1 нс), по импульсу (1 нс...1 с), по времени (16 нс...250 с), по событию (1...9,999,999), логические условия	Автоколебательный, ждущий, однократный, ТВ (NTSC, PAL / SECAM, HDTV, нестандартные), по выбросу (> 1 нс), по импульсу (1 нс...1 с), по времени (16 нс...250 с), по событию (1...9,999,999), логические условия	Автоколебательный, ждущий, однократный, ТВ (NTSC, PAL / SECAM, HDTV, нестандартные), по выбросу (> 1 нс), по импульсу (1 нс...1 с), по времени (16 нс...250 с), по событию (1...9,999,999), логические условия
КОМПЬЮТЕР И ПЕРИФЕРИЯ	Разрешение по вертикали	8 бит (не менее 11 бит в режиме усреднения)	8 бит (не менее 11 бит в режиме усреднения)	8 бит (не менее 11 бит в режиме усреднения)
	Макс. частота дискретизации	5 ГГц (1 канала); 2,5 ГГц (2 канала); 1,25 ГГц (3/4 канала)	5 ГГц (1 канала); 2,5 ГГц (2 канала); 1,25 ГГц (3/4 канала)	5 ГГц (1 канала); 2,5 ГГц (2 канала); 1,25 ГГц (3/4 канала)
ОБЩИЕ ДАННЫЕ	Эквив. частота дискретизации	250 ГГц (периодический сигнал)	250 ГГц (периодический сигнал)	250 ГГц (периодический сигнал)
	Длина записи	400 К (1 канала); 200 К (2 канала); 100 К (4 канала)	400 К (1 канала); 200 К (2 канала); 100 К (4 канала)	400 К (1 канала); 200 К (2 канала); 100 К (4 канала)
ОБЩИЕ ДАННЫЕ	Длительность записи (5 Гвыб/с)	Опции: 8/4/2 М, 2/1/0,5 М (1/2/4 канала)	Опции: 8/4/2 М, 2/1/0,5 М (1/2/4 канала)	Опции: 8/4/2 М, 2/1/0,5 М (1/2/4 канала)
	Режимы сбора данных	80 мкс (400 К); 400 мкс (2 М); 1,6 мс (8 М) с шагом 200 пс	80 мкс (400 К); 400 мкс (2 М); 1,6 мс (8 М) с шагом 200 пс	80 мкс (400 К); 400 мкс (2 М); 1,6 мс (8 М) с шагом 200 пс
ОБЩИЕ ДАННЫЕ	Динамич. сигналы (до 100.000 в сек.); пик. детектор (> 1 нс); усреднение (2...10.000); огибающая (2...2x10 <sup>9</sup> )	Динамич. сигналы (до 100.000 в сек.); пик. детектор (> 1 нс); усреднение (2...10.000); огибающая (2...2x10 <sup>9</sup> )	Динамич. сигналы (до 100.000 в сек.); пик. детектор (> 1 нс); усреднение (2...10.000); огибающая (2...2x10 <sup>9</sup> )	Динамич. сигналы (до 100.000 в сек.); пик. детектор (> 1 нс); усреднение (2...10.000); огибающая (2...2x10 <sup>9</sup> )
	Функции по вертикали	Удвоенная амплитуда, +/- амплитуда, макс и мин, пик-пик, среднее, среднее за период, ср. кв., ср. кв. за период, +/- выброс	Удвоенная амплитуда, +/- амплитуда, макс и мин, пик-пик, среднее, среднее за период, ср. кв., ср. кв. за период, +/- выброс	Удвоенная амплитуда, +/- амплитуда, макс и мин, пик-пик, среднее, среднее за период, ср. кв., ср. кв. за период, +/- выброс
ОБЩИЕ ДАННЫЕ	Функции по горизонтали	Частота; период; время нарастания и спада; +/- ширина импульса; +/- коэф. заполнения; задержка	Частота; период; время нарастания и спада; +/- ширина импульса; +/- коэф. заполнения; задержка	Частота; период; время нарастания и спада; +/- ширина импульса; +/- коэф. заполнения; задержка
	Комбинированные по X и Y	Площадь; площадь за период; фаза; ширина пакета	Площадь; площадь за период; фаза; ширина пакета	Площадь; площадь за период; фаза; ширина пакета
ОБЩИЕ ДАННЫЕ	Процессор	Intel Celeron, 800 МГц	Intel Celeron, 800 МГц	Intel Celeron, 800 МГц
	Оперативная память	128 М	128 М	128 М
ОБЩИЕ ДАННЫЕ	Системная шина	PCI	PCI	PCI
	Накопители	HDD (> 10 Гб); FDD (3,5"; 1,44 Мб); CD-ROM (опция CD-RW)	HDD (> 10 Гб); FDD (3,5"; 1,44 Мб); CD-ROM (опция CD-RW)	HDD (> 10 Гб); FDD (3,5"; 1,44 Мб); CD-ROM (опция CD-RW)
ОБЩИЕ ДАННЫЕ	Периферия	Мышь; клавиатура (опция); термопринтер (опция)	Мышь; клавиатура (опция); термопринтер (опция)	Мышь; клавиатура (опция); термопринтер (опция)
	ЖК-дисплей	211 x 158 мм (диагональ 264 мм); разрешение 640 x 480	211 x 158 мм (диагональ 264 мм); разрешение 640 x 480	211 x 158 мм (диагональ 264 мм); разрешение 640 x 480
ОБЩИЕ ДАННЫЕ	Напряжение питания	100...240 В ( $\pm 10\%$ ), 47...63 Гц (автовывбор)	100...240 В ( $\pm 10\%$ ), 47...63 Гц (автовывбор)	100...240 В ( $\pm 10\%$ ), 47...63 Гц (автовывбор)
	Габаритные размеры	447 x 285 x 288 мм	447 x 285 x 288 мм	447 x 285 x 288 мм
ОБЩИЕ ДАННЫЕ	Масса	10,5 кг	10,5 кг	10,5 кг
	Комплект поставки	Шнур питания (1), делитель x10 (2/4, кроме 5104), мышь (1), CD-ROM с ПО (1), крышка лицевой панели (1)	Шнур питания (1), делитель x10 (2/4, кроме 5104), мышь (1), CD-ROM с ПО (1), крышка лицевой панели (1)	Шнур питания (1), делитель x10 (2/4, кроме 5104), мышь (1), CD-ROM с ПО (1), крышка лицевой панели (1)

# Digital Phosphor Oscilloscopes

## ► TDS5000 Series



The TDS5000 Series Digital Phosphor Oscilloscopes Deliver High-performance Features At An Unprecedented Price

The TDS5000 Series digital phosphor oscilloscopes deliver up to 1 GHz bandwidth, 5 GS/s real-time sample rate, 8 MB record length and 100,000 wfms/s maximum waveform capture rate. This performance, along with an industry-leading suite of advanced triggers, intuitive user interface, and an open Microsoft Windows platform, all in a compact bench-top package, provides exceptional value.

### Digital Phosphor Oscilloscopes

Digital phosphor oscilloscopes provide unmatched insight into signal behavior by displaying, storing and analyzing complex signals in real-time using three dimensions of signal information: amplitude, time and distribution of amplitude over time.

The TDS5000 Series digital phosphor oscilloscopes deliver fast waveform capture rates, enabled by Tektronix proprietary DPX™ acquisition technology, saving minutes, hours or even days by quickly revealing the nature of faults so sophisticated trigger modes can be applied to isolate them.

### Intuitive User Interface

The TDS5000 Series graphical user interface readily adapts to any operating style and environment, making the oscilloscope easy to learn and easy to use. Classic analog-style controls provide instant, front-panel access to the most frequently used functions while the large 10.4 in. (264 mm) display and extensive use of intuitive icons create a highly visual environment with explicit illustration of instrument features.

## ► Features & Benefits

- 1 GHz and 500 MHz Bandwidth Models
- 2 and 4 Channel Models
- 5 GS/s Maximum Real-time Sample Rate
- Up to 8 MB Record Length
- 100,000 wfms/s Maximum Waveform Capture Rate
- Intuitive User Interface for Easy Operation
- Open Microsoft® Windows Architecture Delivers Built-in Connectivity
- Small Footprint
- 10.4 in. (264 mm) Bright Display
- Industry-leading Suite of Advanced Triggers
- Built-in Printer (Optional)
- CD-RW Drive (Optional)
- Interoperability with Tektronix Logic Analyzers

## ► Applications

- Digital Design and Debug
- Investigation of Transient Phenomena
- Power Measurements
- Video Design and Debug
- DVD Analysis
- Disk Drive Analysis
- Jitter and Timing Analysis
- Spectral Analysis
- Automotive Electronics Design and Debug
- Manufacturing Test and Quality Control
- Electro-mechanical Design and Analysis
- Bio-medical Product Development
- Industrial Control

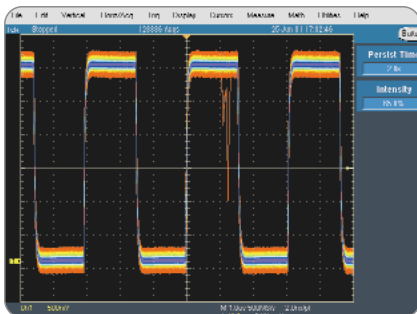
COMPUTING

COMMUNICATIONS

VIDEO

# Digital Phosphor Oscilloscopes

## ► TDS5000 Series

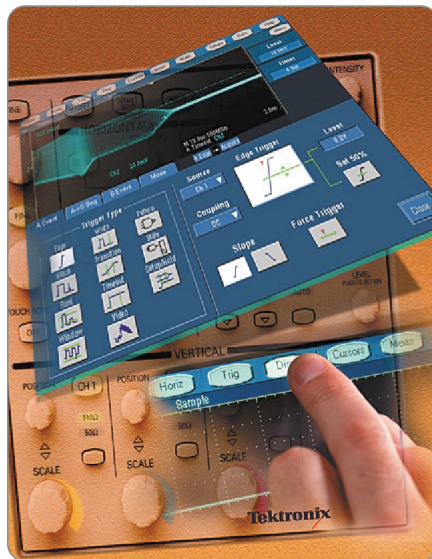


► **Elusive Glitch.** Fast waveform capture rate, enabled by Tektronix proprietary DPX™ acquisition technology, maximizes the probability of capturing elusive glitches and other infrequent events.

Users can select traditional instrument-style buttons for navigation or switch to a Microsoft Windows menu bar. Waveform positions, cursor locations and trigger level can be directly changed using a mouse or optional touch screen. A graphical drag-box can be used to select a waveform area for zooming, histogram analysis or measurement gating. The USB interface allows a mouse, keyboard and other peripherals to be added without powering off the instrument. A context-sensitive help program supplements graphic control windows and encourages users to apply advanced capabilities to solve their problems. And an innovative software package provides voice-controlled, multi-lingual operation of the instrument.

### Open Microsoft Windows Architecture

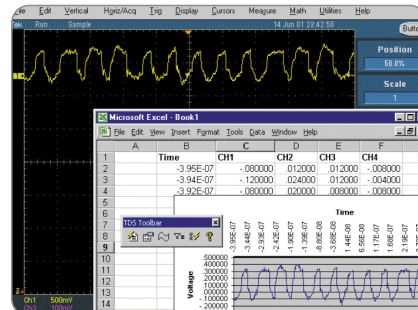
The TDS5000 Series combines a high performance oscilloscope and a PC in a self-contained unit. With DPX™ acquisition technology, an open Windows desktop and application programming interfaces (API) for Windows and UNIX, this series provides exceptionally fast data acquisition, analysis and network accessibility.



► **Intuitive User Interface.** Whatever your personal preferences, needs or application environment, the TDS5000 Series offers multiple ways to operate the instrument – classic, analog-style knobs, familiar pull-down menus, mouse, optional touch screen and voice commands.

By using the embedded PCI bus, waveform data can be moved directly from acquisition to analysis applications on the Windows desktop at much faster speeds than conventional GPIB transfers.

The analysis and connectivity software of the Tektronix TDS5000 Series oscilloscopes provide a comprehensive software infrastructure for faster, more versatile operations. Tektronix' implementation of industry-standard protocols, such as TekVISA and ActiveX Controls, are included for using and enhancing Windows applications such as Excel for data analysis and documentation. Or, create custom software to automate multi-step processes in waveform collection and analysis with Visual BASIC, C, C++, MATLAB® and other common Application Development Environments (ADE).

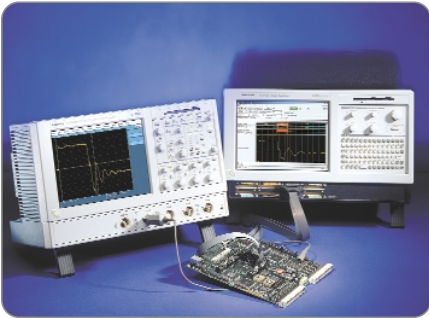


► **Open Windows Platform.** TDS5000 Series waveform display with Excel window and ActiveX toolbar.

Integration of the oscilloscope with external PCs and non-Windows hosts is also supported by the TDS5000 Series software solutions. Plug-and-play drivers are included to enable easy communication with the oscilloscope using GPIB, Serial, and LAN connections from LabVIEW and Lab Windows programs running on external PCs. UNIX applications, and other LAN resources, can connect directly using the VXI 11.2 server included on the TDS5000 Series.

### Additional Benefits

The TDS5000 Series includes virtually all modern standard interfaces for control and peripheral expansion. An optional built-in printer provides snapshot and long banner print-outs of waveform and measurement results. An optional CD-RW drive provides convenient and portable mass storage, making data transfer much easier for the user who does not connect the oscilloscope to the network via the standard LAN connection. Interoperability of the TDS5000 Series with Tektronix logic analyzers enables a time-correlated view of analog and digital signals to quickly track down elusive signal integrity problems in designs.



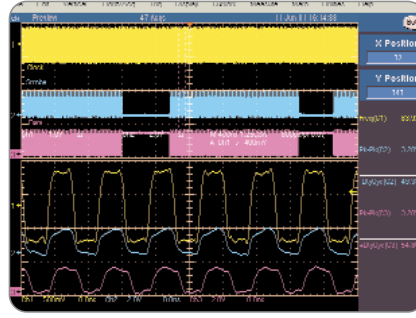
▶ **Digital Design and Debug.** Tektronix Integrated View (iView) fully integrates the performance and measurement accuracy of a Tektronix oscilloscope with the multi-channel and powerful triggering capabilities of a Tektronix logic analyzer in one display, allowing designers to quickly verify and debug their designs.

## Applications

The TDS5000 Series' high performance features make it ideal for a multitude of applications, such as digital design and debug, power measurements and video design.

### Digital Design and Debug

The interoperability of the TDS5000 Series oscilloscope with the Tektronix TLA600 logic analyzer made possible by Tektronix Integrated View (iView) enables digital designers to solve signal integrity challenges and effectively debug and verify their systems more quickly and easily. iView fully integrates the industry-leading performance and measurement accuracy of a Tektronix oscilloscope with the multi-channel and powerful triggering capabilities of a Tektronix logic analyzer. This integration allows designers to view time-correlated digital and analog data in the same display window and isolate the analog characteristics of the digital signals that are causing failures in their systems. The iView Wizard simplifies this integration of the oscilloscope and logic analyzer by guiding the user through set up and connection.



▶ **Embedded Design.** A source synchronous, double-pumped bus. Channel 1 (yellow) is the clock signal, Channel 2 (blue) is the strobe signal and Channel 3 (pink) is a data line. The upper half of the graticule shows a long acquisition of a write-cycle, enabling designers to gauge the throughput efficiency of their systems by comparing live writing time with dead time. The bottom half of the graticule shows a zoomed-in view of a small slice of time in the upper graticule, enabling designers to make critical timing measurements to ensure that the data on the bus meets the setup-and-hold timing requirements of the receiver.

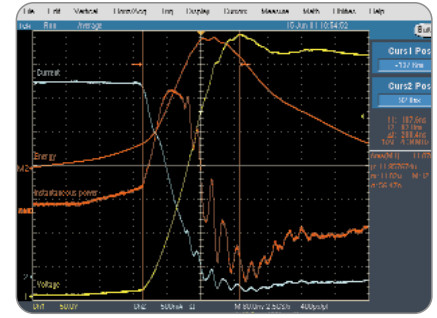
No user calibration is required. And, once set up, iView is completely automated. The result – an integrated tool set for digital design and troubleshooting.

### Embedded Design

With its long record length, high sample rate and intuitive zoom model, the TDS5000 Series simplifies the characterization of today's high-speed digital buses, making it an ideal tool for critical timing measurements in embedded design applications.

### Power Measurements

The TDS5000 Series' powerful and flexible measurements, math, and math-on-math capabilities make it an ideal solution for making power measurements, such as voltage, current, instantaneous power, and energy for power device designers.



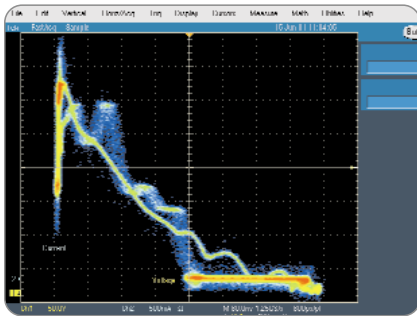
▶ **Power Measurements.** Channel 1 (yellow, labeled Voltage) shows the turn-off voltage on the FET of a switching power supply, with current on Channel 2 (blue, labeled Current). The Math 1 waveform, M1 (red, labeled Power), is the instantaneous power resulting from the multiplication of the voltage and current waveforms (Ch. 1 \* Ch. 2). The Math 2 waveform, M2 (red, labeled Energy), is the result of a calculation of the integral of M1, a math-on-math operation of the TDS5000 Series. An energy measurement, located to the right of the display, is a gated measurement made on M1 and includes statistics. The TDS5000 Series' powerful and flexible measurements, math, and math-on-math capabilities make it an ideal solution for engineers designing today's high-efficiency power devices.

### Video Design

Tektronix exclusive DPX™ acquisition technology sets the TDS5000 Series apart from other digital oscilloscopes, enabling the capture of up to 100,000 waveforms per seconds for a live, analog-like display. The TDS5000 Series also supports a wide variety of video standards with dedicated triggers including NTSC, PAL, SECAM and analog HDTV. In addition, IRE and mV graticules can be selected for easier measurements and visual inspection. All of this together makes the TDS5000 Series an ideal tool for video design and development.

# Digital Phosphor Oscilloscopes

## ► TDS5000 Series



► *Display of a current vs. voltage trajectory XY plot of the DUT. This highly dynamic waveform display provides continuous coverage of device performance – the waveform data is continuously streamed to the display. Color-grading reveals the distribution of signal activity for comparison against device Safe Operating Area (SOA) characteristics.*

### Trigger Modes

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

**Video** – Trigger on NTSC, PAL, SECAM, analog HDTV and non-standard video formats.

**Glitch** – Trigger on or reject glitches of positive, negative or either polarity. Minimum glitch width is 1.0 ns with 200 ps resolution.

**Width** – Trigger on width of positive or negative pulse either within or out of selectable time limits (1 ns to 1 s).

**Runt** – Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Event can be time or logic qualified (logic on 4 channel models only).

**Window** – Trigger on an event that enters or exits a window defined by two user-adjustable thresholds. Event can be time or logic qualified (logic on 4 channel models only).

**Timeout** – Trigger on an event which remains high, low or either, for a specified time period, selectable from 1 ns to 1 s with 200 ps resolution.

## ► Characteristics

Vertical System	TDS5052	TDS5054	TDS5104
Input Channels	2	4	4
Analog Bandwidth (–3 dB) 5 mV/div to 1 V/div	500 MHz	500 MHz	1 GHz
Calculated Rise Time 5 mV/div (typical)	800 ps	800 ps	400 ps
Hardware Bandwidth Limits	150 MHz or 20 MHz		
Input Coupling	AC, DC, GND		
Input Impedance	1 M $\Omega$ $\pm$ 1% or 50 $\Omega$ $\pm$ 1%		
Input Sensitivity, 1 M $\Omega$	1 mV/div to 10 V/div		
Input Sensitivity, 50 $\Omega$	1 mV/div to 1 V/div		
Vertical Resolution	8-bits (>11-bits w/ averaging)		
Max Input Voltage, 1 M $\Omega$	$\pm$ 150 V CAT I derate at 20 dB/decade to 9 V <sub>RMS</sub> above 200 kHz		
Max Input Voltage, 50 $\Omega$	5 V <sub>RMS</sub> with peaks < $\pm$ 30 V		
DC Gain Accuracy	1.5% with offset set to 0 V		
Offset Range, 1 M $\Omega$	1 mV/div to 99.5 mV/div $\pm$ 1 V 100 mV/div to 1 V/div $\pm$ 10 V 1.01 V/div to 10 V/div $\pm$ 100 V		
Offset Range, 50 $\Omega$	1 mV/div to 99.5 mV/div $\pm$ 1 V 100 mV/div to 1 V/div $\pm$ 10 V	1 mV to 50 mV/div $\pm$ 0.5 V 50.5 mV to 99.5 mV $\pm$ 0.25 V 100 mV to 500 mV $\pm$ 5 V 505 mV to 1 V/div $\pm$ 2.5 V	
Channel-to-channel Isolation Any Two Channels at Equal Vertical Scale	$\geq$ 100:1 at $\leq$ 100 MHz and $\geq$ 30:1 at >100 MHz up to the rated bandwidth		
<b>Timebase System</b>			
Timebase Range	200 ps/div to 40 s/div		
Timebase Delay Time Range	16 ns to 250 s		
Channel-to-channel Deskew Range	$\pm$ 25 ns		
Delta Time Measurement Accuracy	$\pm$ (0.30 sample interval) + (15 ppm * reading)		
Trigger Jitter (RMS)	8 ps <sub>RMS</sub> (typical)		
Long Term Sample Rate and Delay Time Accuracy	$\pm$ 15 ppm over $\geq$ 1 ms interval		

## ► Characteristics, cont.

Acquisition System	TDS5052	TDS5054	TDS5104
Real-time Sample Rates:			
1 Channel (max)	5 GS/s	5 GS/s	5 GS/s
2 Channels (max)	2.5 GS/s	2.5 GS/s	2.5 GS/s
3-4 Channels (max)	–	1.25 GS/s	1.25 GS/s
Equivalent Time Sample Rate (max)	250 GS/s	250 GS/s	250 GS/s
Maximum Record Length per Channel:			
With Standard Memory	400 k (1 ch) 200 k (2 ch)	400 k (1 ch) 200 k (2 ch) 100 k (4 ch)	400 k (1 ch) 200 k (2 ch) 100 k (4 ch)
With Opt. 1M	2 M (1 ch) 1 M (2 ch)	2 M (1 ch) 1 M (2 ch) 500 k (4 ch)	2 M (1 ch) 1 M (2 ch) 500 k (4 ch)
With Opt. 2M	8 M (1 ch) 4 M (2 ch)	8 M (1 ch) 4 M (2 ch) 2 M (4 ch)	8 M (1 ch) 4 M (2 ch) 2 M (4 ch)

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

Time Resolution (single shot)	200 ps (5 GS/s)		
Max Duration with Standard Memory	80 $\mu$ s	80 $\mu$ s	80 $\mu$ s
Max Duration with Opt. 1M	400 $\mu$ s	400 $\mu$ s	400 $\mu$ s
Max Duration with Opt. 2M	1.6 ms	1.6 ms	1.6 ms

### Acquisition Modes

FastAcq Acquisition	FastAcq optimizes the instrument for analysis of dynamic signals and capture of infrequent events
Maximum FastAcq Waveform Capture Rate	100,000 wfms/s
Sample	Acquire sampled values
Peak Detect	Captures narrow glitches at all real-time sampling rates
Minimum Peak Detect Pulse Width	< 1 ns
Averaging	From 2 to 10,000 waveforms included in average
Envelope	From 2 to $2 \times 10^9$ waveforms included in min-max envelope
Hi-Res	Real-time boxcar averaging reduces random noise and increases resolution



► **Video Design.** Illustration of triggering on an analog HDTV tri-level sync signal and examining horizontal blanking interval.

**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 (channel 2 on TDS5052). Trigger on rising or falling clock edge.

**Trigger Delay by Time** – 16 ns to 250 seconds.

**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 (optional)** – Waveform count, Hits in box, Peak hits, Median, Maximum, Minimum, Peak to Peak, Mean ( $\mu$ s), Standard Deviation (sigma),  $\mu+1$  ( $\sigma$ ),  $\mu+2$  ( $\sigma$ ),  $\mu+3$  ( $\sigma$ ).

# Digital Phosphor Oscilloscopes

## ► TDS5000 Series

### ► Characteristics, cont.

Trigger System	TDS5052	TDS5054	TDS5104
<b>Sensitivity</b>			
Internal DC Coupled	0.35 div DC to 50 MHz increasing to 1 div at 500 MHz		0.35 div DC to 50 MHz increasing to 1 div at 1 GHz
External (auxiliary input)	400 mV from DC to 50 MHz increasing to 750 mV at 100 MHz		
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 Level Range</b>			
Internal	±10 divisions from center of screen		
External (auxiliary in)	±8 V		
Line	Fixed at 0 V		
Trigger Coupling	DC, AC (attenuate <60 Hz), HF reject (attenuate >30 kHz), LF reject (attenuates <80 kHz), noise reject (reduce sensitivity)		
Trigger Holdoff Range	250 ns minimum to 12 s maximum		

### Waveform Processing/Math

#### Standard Math

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

**FFT** – Magnitude.

**Vertical Units** – Magnitude: Linear, dB, dBm.

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

#### Optional Math

**Algebraic Expressions** – Define extensive algebraic expressions including waveforms, scalars and results of parametric measurements e.g. (Integral (Ch1-Mean(Ch1))\*1.414).

**Calculus** – Integrate, differentiate.

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

**Additional Vertical Units** – Phase: degrees, radians.

### Display Characteristics

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

**Display Size** – 211.2 mm (W) x 158.4 mm (H), 264 mm (10.4 in) diagonal.

**Display Resolution** – 640 horizontal x 480 vertical pixels.

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

### Computer System and Peripherals

**CPU** – Intel Celeron Processor, 800 MHz.

**PC System Memory** – 128 MB.

**Hard Disk Drive** – >10 GB capacity.

**Floppy Disk Drive** – Front panel 3.5 in floppy disk drive, 1.44 MB capacity.

**CD-ROM Drive** – Side panel CD-ROM drive.

**CD-RW Drive (Optional)** – Side panel CD-RW drive.

**Printer (Optional)** – Built-in thermal printer.

**Mouse** – Logitech thumb wheel model included, USB interface.

**Keyboard** – Order 119-6297-00 (USB interface).

### Analysis and Connectivity Software

**TekVISA** – Application Programmers Interface (API) for Windows developers. Documentation includes descriptions and samples of programming test and measurement applications on the unit in Visual BASIC, C and C++.

**Plug-and-play Drivers** – Provides support to run National Instrument's LabVIEW and LabWindows on an external PC connected to a TDS5000 Series oscilloscope.

**TekVISA Control (TVC)** – ActiveX controls to make access to TekVISA easy for integration into Microsoft Windows applications.

**Excel Toolbar** – Provides direct access to waveforms and measurements on the oscilloscope from a toolbar in Excel.

**VXI-11 server** – An Application Programmers Interface (API) for LAN connectivity from non-Windows environments.

*Note: For information regarding TDS5000 Series compatibility with National Instruments hardware and software products, contact your local Tektronix account manager.*

*Note: For information about using a TDS5000 Series oscilloscope as a GPIB controller, contact your local Tektronix account manager.*

### Input/Output Ports

**Auxiliary Input** – Front panel BNC connector. Trigger level range is adjustable from +8 V to -8 V. The maximum input voltage is ±20 V.

**Probe Compensator Output** – Front panel pins. Amplitude 1 V ± 1% into a ≥10 kΩ load, frequency 1 kHz ±5%.

**Analog Signal Output Amplitude** – Rear-panel BNC connector, provides a buffered version of the signal that is attached to the Channel 3 input. 20 mV/div ±20% into a 1 MΩ load, 10 mV/div ±20% into a 50 Ω load (4 channel models only).

**Analog Signal Output Bandwidth, Typical** – 100 MHz into a 50 Ω load (4 channel models only).

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

**External Reference In** – Rear-panel BNC connector. 9.8 MHz to 10.2 MHz.

**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.

**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.

**SVGA Video Port** – DB-15 female connector; connect a second monitor to use dual-monitor display mode. Supports basic requirements of PC99 specifications.

**GPIB Port** – IEEE 488.2 standard.

**Scope VGA Video Port** – DB-15 female connector, 31.6 kHz sync, EIA RS-343A compliant, connect to show the oscilloscope display, including live waveforms on an external monitor or projector.

#### Power Source

**Power** – 100 to 240 V<sub>RMS</sub> ± 10%, 47 to 63 Hz; CAT II, < 220 W.

### Physical Characteristics

#### Benchtop Configuration

Dimensions	mm	in.
Height	285	11.2
Width	447	17.6
Depth	288	11.35
<b>Weight</b>	<b>kg</b>	<b>lbs.</b>
Net	10.55	23.25
Shipping	25	55

#### Rackmount Configuration

Dimensions	mm	in.
Height	267	10.5
Width	483	19
Depth	288	11.35
<b>Weight</b>	<b>kg</b>	<b>lbs.</b>
Net	11.8	26
Kit	5	11

#### Mechanical

Cooling – Required Clearance for Benchtop Configuration

Dimensions	mm	in.
Top	0	0
Bottom	0	0
Left Side	76	3
Right Side	0	0
Front	0	0
Rear	0	0

### Environmental

#### Temperature

**Operating** – +5°C to +45°C.

**Nonoperating** – –20°C to +60°C without diskette in floppy drive.

#### Humidity

**Operating** – 20% to 80% 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. 5% 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** – 0.1 GRMS from 5 to 500 Hz, 10 minutes each axis, 3-axes, 30 minutes total.

**Nonoperating** – 2.0 GRMS from 5 to 500 Hz, 10 minutes each axis, 3-axes, 30 minutes total.

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

**Safety** – UL 3111-1, CSA-22.2 No. 1010.1, EN61010-1, IEC61010-1/A2.

### ▶ Ordering Information

**TDS5052** – 500 MHz, 2 channel digital phosphor oscilloscope.

**TDS5054** – 500 MHz, 4 channel digital phosphor oscilloscope.

**TDS5104** – 1 GHz, 4 channel digital phosphor oscilloscope.

**All models include:** Front Cover (200-4651-00), Mouse (119-6298-00), Quick Reference (020-2398-00), User Reference (071-0876-00), GPIB Programmer's Reference, TDS5000 Series Product Software CD-ROM, TDS5000 Series Operating System Restoration CD-ROM, Oscilloscope Analysis and Connectivity Made Easy (071-1046-00), Performance Verification Procedure PDF file, NIST, MIL-STD-45662A and ISO9000 Calibration Certificate, Power Cord.

**TDS5052 Also Includes** – (2) P5050 500 MHz, 10x passive probes.

**TDS5054 Also Includes** – (4) P5050 500 MHz, 10x passive probes.

**TDS5104** – No probes included.

### Power Cord Options

**Opt. A1** – Universal European power cord (220 V, 50 Hz).

**Opt. A2** – UK power cord (240 V, 50 Hz).

**Opt. A3** – Australia power cord (240 V, 50 Hz).

**Opt. A5** – Switzerland power cord (220 V, 50 Hz).

**Opt. AC** – China power cord (240 V, 50 Hz).

**Opt. A99** – No power cord.

### Recommended Accessories

**Keyboard (USB interface)** – Order 119-6633-00.

**Service Manual** – Order 071-1004-00.

**Transit Case** – Order 016-1522-00.

**Scope Cart** – Order K420 and 436-0317-00 (mouse accessory tray).

**Video Display Clamp** – Order 013-0278-00.

**Thermal Printer Paper** – Order 016-1897-00.

### Software

**TDSJIT2** – Jitter and timing analysis software.

**TDSDDM2** – Disk drive measurements software.

**WSTRO** – WaveStar™ waveform capture and documentation software.

**VCKLNK** – VocalLink™ voice control software.

### 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 012-1250-00.

### Instrument Upgrades

Acquisition memory upgrades equivalent to options 1M and 2M and software upgrades equivalent to options 2A, J1, and J2 can be ordered to extend instrument performance after initial purchase. Users can install upgrades without opening the instrument case or requiring on-site service. Order a TDS5UP and the appropriate option(s) listed below.



# Digital Phosphor Oscilloscopes

## ► TDS5000 Series

### ► Instrument Options

(Available where indicated by 'x')

		TDS5052	TDS5054	TDS5104
<b>Hardware Options</b>				
16	CD-RW drive	x	x	x
17	Additional 128 MB of RAM	x	x	x
18	Touch-screen interface	x	x	x
1P	Built-in thermal printer	x	x	x
<b>Acquisition Memory Options</b>				
1M	2 Msamples max (1 ch)	x	x	x
2M	8 Msamples max (1 ch)	x	x	x
<b>Mounting Options</b>				
1K	K420 oscilloscope cart	x	x	x
1R	Rackmount kit	x	x	x
<b>Software Options</b>				
2A	Advanced analysis – equation editor, spectral FFT and histograms	x	x	x
J1	TDSJIT2 – Jitter and timing analysis software	x	x	x
J2	TDSDDM2 – Disk drive measurements software	x	x	x
USB	TDSUSBS – USB2.0 Compliance Test software only		x	x
<b>Probe Options</b>				
33	Add (1) P6158 3.0 GHz, 20x low C probe			x
34	Add (1) P6247 1.0 GHz differential probe	x	x	
35	Add (1) P6243 1.0 GHz active probe	x	x	
37	Add (1) P6245 1.5 GHz active probe			x
39	Add (1) P6248 1.7 GHz differential probe			x
53	Add (1) P5050 500 MHz, 10x passive probe	x	x	x
<b>Service Options</b>				
D1	Calibration data report	x	x	x
C3	Additional 2 years of calibration	x	x	x
D3	Calibration data report for Option C3	x	x	x
R3	Additional 2 years of repair	x	x	x

TDS5UP Upgrade Kit (Kit requires at least one option)

**Opt. M01** – Upgrade memory depth from standard to Opt. 1M.

**Opt. M02** – Upgrade memory depth from standard to Opt. 2M.

**Opt. M12** – Upgrade memory depth from Opt. 1M to Opt. 2M.

**Opt. 2A** – Advanced analysis – equation editor, spectral FFT and histograms.

**Opt. J1** – TDSJIT2 – Jitter and timing analysis software.

**Opt. J2** – TDSDDM2 – Disk drive measurements software.

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