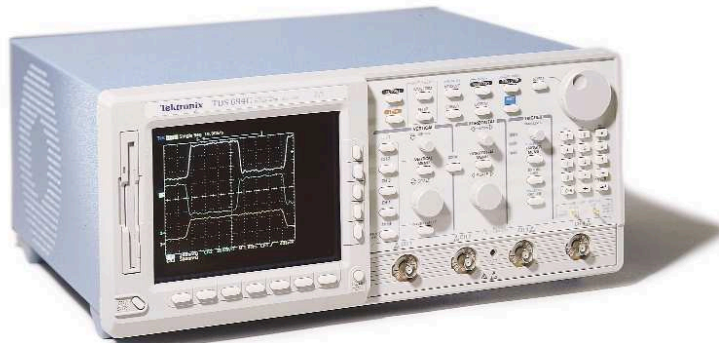


Digital Storage Oscilloscopes

► TDS694C • TDS684C



► **TDS694C.**

Whether you are working on next generation microprocessor designs, high-speed data communications equipment or in high-energy physics research, the TDS694C captures your fastest signals with the best fidelity and resolution available. Its 3 GHz bandwidth preserves your waveform's fast rising edges and accurately shows signal details. With 10 GS/s digitizing rate simultaneously on all four channels and a high-stability timebase, the TDS694C makes your critical timing measurements with the highest resolution and accuracy – even channel-to-channel measurements made in a single acquisition.

The TDS600C oscilloscopes incorporate all the advanced trigger features you expect in a high performance oscilloscope: triggering on Glitches, Slew Rate violations, Setup-and-hold Time violations, Timeouts, Logic Patterns and States on four channels. For applications where sophisticated multi-channel debugging is required, the TDS694C can be configured for cross triggering with a Tektronix TLA700 Logic Analyzer.

The TDS600C oscilloscopes give you the total solution to your digital design characterization and debugging needs. Now you have the tool you need to verify design margins, characterize setup-and-hold times and measure clock-to-data skew on the fastest digital designs. The TDS694C's companion probe, the P6249, offers small size to reliably contact your high-density boards with their fine-pitch, hard to reach components. The P6249 has short ground connection to give the maximum system bandwidth and preserve the details of your signals.

The TDS600C offers 29 automatic measurements, with measurement statistics, to make your design verification and characterization job much faster and easier. Available Java-based application packages for jitter analysis, disk drive measurements and processor specification measurements provide customized measurements and analysis capability. The TDS600C gives you the performance and features you need to get your job done faster and more thoroughly.

► **Features & Benefits**

3 GHz and 1 GHz Bandwidths to Work with the Fastest Signals in Today's Digital Designs

10 GS/s and 5 GS/s Sample Rates on all Channels Simultaneously for Full Bandwidth Single-shot Capture

Waveform Math and Advanced Waveform DSP

Waveform Pass/Fail Template Testing

Color Display

RS-232, Centronics and GPIB Interfaces Included Standard

Record Length to 120,000 Points/Channel*¹

Timebase Accuracy to 10 ppm, Time Interval Measurement Accuracy to ± 15 ps (TDS694C)

Trigger Jitter 8 ps_{RMS} (Typical)

1% Vertical Accuracy (TDS694C)

100 ps Peak Detect (TDS694C Only)

*¹TDS694C with long record length option (1 M) only. 15,000 points/channel maximum on TDS684C.

► **Applications**

Validation and Characterization of High Speed Digital Designs

- Verify Simulation Performance with Real Measurements
- Ensure that Desired Design Margins Exist
- Jitter Measurements on High-speed Data, Phase-locked Loops and Spread-spectrum Clock Circuits
- Capture Glitches, Cross-talk, Setup/Hold Violations

Telecommunications/Data Communications Design

- Characterize Rise Times, Overshoot, Channel-to-channel Timing
- Verify and Test High-speed Serial Data Streams

High-energy Physics

- Transient Event Capture

COMPUTING
COMMUNICATIONS
VIDEO

Digital Storage Oscilloscopes

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▶ Characteristics

Time Base System

Time Bases – Main and delayed.

Time/div Range – 200 ps/div to 10 s/div.

Except TDS694C: 100 ps/div to 10 s/div.

Time Base Accuracy – ± 100 ppm. Except TDS694C: ± 10 ppm.

Time Interval Measurement Accuracy – TDS684C: $\pm [(0.2/\text{sample rate}) + (100 \text{ ppm} \times \text{reading})]$ single shot. (≈ 50 ps @ 5 GS/s). TDS694C: $\pm [(0.15/\text{sample rate}) + (10 \text{ ppm} \times \text{reading})]$ single shot. (≈ 15 ps @ 10 GS/s).

Record Length per Channel – 500 to 15,000 pts.

Except TDS694C: 500 to 30,000 pts.

(optional: 120,000 pts.).

Trigger Jitter – 8 ps_{RMS} (typical).

Pre-trigger Position – 0% to 100% of record.

Channel-to-channel Deskew Range – ± 25 ns.

Vertical System

Vertical Resolution – 8-Bit (> 11-Bit with averaging).

Vertical Sensitivity – 1 mV/div to 10 V/div.

Except TDS694C: 10 mV/div to 1 V/div.

Floppy Disk Drive – Store reference waveforms, setups and image files on 3.5 in. 1.44 MB or 720 K Microsoft DOS-format floppy disk.

Maximum Input Voltage – 300 V CAT II; ± 400 V peak. Derate at 20 dB/decade above 1 MHz.

Except TDS694C: 5 V_{RMS}.

DC Gain Accuracy – $\pm 1.5\%$.

Except TDS694C: $\pm 1.0\%$.

Position Range – ± 5 divs.

Offset –

± 1 V from 1 to 99.5 mV/div, ± 10 V from 100 mV to 995 mV/div, ± 100 V from 1 V to 10 V/div.

Except TDS694C: ± 0.5 V from 10 to 50 mV/div, ± 0.25 V from 50.5 to 100 mV/div, ± 5 V from 101 mV to 500 mV/div, ± 2.5 V from 505 mV to 1 V/div.

Bandwidth Selections – 20 MHz, 250 MHz and full.

Except TDS694C: Full only.

Input Impedance Selections – 1 M Ω in parallel with 10 pF, or 50 Ω (AC and DC coupling).

Except TDS694C: 50 Ω (DC coupled).

Input Coupling – AC, DC or GND. Except TDS694C: DC or GND.

AC Coupled Low Frequency Limit (except TDS694C) – < 10 Hz when AC, 1 M Ω coupled. < 200 kHz when AC, 50 Ω coupled.

Channel Isolation – > 100:1 at 100 MHz and > 30:1 at BW for any two channels having equal V/div settings.

Acquisition Modes

Peak Detect – High frequency and random glitch capture. Captures glitches of 1 ns using acquisition hardware at all real-time sampling rates. TDS694C captures glitches of 100 ps.

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions.

Average – Waveform data from 2 to 10,000 waveforms (selectable) is averaged.

Single Sequence – Use RUN/STOP button to capture a single triggered acquisition at a time, which may be automatically saved to NVRAM with AutoSave.

Triggering System

Trigger Types

EDGE (main and delayed) –

Conventional level-driven trigger. Positive or negative slope on any channel or rear panel auxiliary input.

Coupling selections: DC, AC, noise reject, HF reject, LF reject.

LOGIC (main) –

PATTERN: Specifies a logical combination (AND, OR, NAND, NOR) of the four input channels (high, low, don't care). Trigger when pattern stays true or false for a specified time.

STATE: Any logical pattern of channels 1, 2 and 3 plus a clock edge on channel 4. Triggerable on rising or falling clock edge.

SETUP/HOLD: Trigger on violations of both setup time and hold time between clock and data which are on two input channels.

PULSE (main) –

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

RUNT: Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again.

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

SLEW RATE: Trigger on pulse edge rates that are either faster or slower than a set rate. Edges can be rising, falling or either.

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.

TLA Cross Trigger (TDS694C only) – Utilize a TLA700 logic analyzer to detect a multi-channel event, then trigger the TDS694C. The trigger points on the TLA and TDS will be aligned in time.

VIDEO (optional; not available in TDS694C) –

Trigger on a particular line of individual, odd/even or all fields. Trigger on a specific pixel of a line by using the video trigger with delay by events. Choose positive or negative horizontal sync polarity.

525/NTSC: Choose monochrome or color (studio-quality NTSC) sync formats. 625/PAL: Choose color or monochrome (studio-quality PAL) sync formats. HDTV: Choose from 1125/60, 1050/60, 1250/50 and 787.5/60 HDTV formats.

Trigger Bandwidth (edge type) –

3 GHz (TDS694C).

1 GHz (TDS684C).

Main Trigger Modes – Auto, normal, single.

Delayed Trigger – Delay by time, events, or events and time.

Delay by Time Range – 16 ns to 250 s.

Delay by Events Range – 2 to 9,999,999 events.

External Trigger Input – Input impedance: ≥ 1.5 k Ω ; max. input voltage: ± 20 V (DC + peak AC).

Display Characteristics

Waveform Style – Dots, vectors, variable persistence from 32 ms to 10 s, infinite persistence and intensified samples.

Color – Standard palettes and user-definable color for waveforms, text, graticules and cursors. Measurement text and cursor colors matched to waveform.

Waveform collision areas highlighted with different color. Statistical waveform distribution shown with color grading through variable persistence.

Color Grading – With variable persistence selected, historical timing information is represented by temporal or spectral color scheme.

Graticules – Full, grid, cross-hair, frame and NTSC and PAL (with video trigger option).

Format – YT and XY.

Resolution – 640 horizontal by 480 vertical displayed pixels (VGA).

Color CRT Monitor – 7 in. diagonal NuColor™ liquid crystal full-color shutter, 256 levels.

Measurement System

Automatic Waveform Measurements –

Period, frequency, + width, –width, rise time, fall time, + duty cycle, –duty cycle, delay, phase, burst width, high, low, max, min, peak to peak, amplitude, + overshoot, –overshoot, mean, cycle mean, RMS, cycle RMS, area, cycle area, extinction ratio (ratio, dB, %) and mean optical power. Continuous update of up to four measurements on any combination of waveforms.

Measurement Statistics – Display minimum and maximum or mean and standard deviation on any displayed single-waveform measurements.

Thresholds – Settable in percentage or voltage.

Gating – Any region of the waveform may be isolated for measurement using vertical bars.

Snapshot – Performs all measurements on any one waveform showing results from one instant in time.

Cursor Measurements – Absolute, delta: Volts, time, frequency, and NTSC IRE and line number (with video trigger option).

Cursor Types – Horizontal bars (volts), vertical bars (time); operated independently or in tracking mode.

Histogram Measurements – Mean, median, standard deviation, hits, waveform count, peak hits, peak-to-peak, % mean \pm 1, 2 and 3 standard deviations.

Waveform Processing

Waveform Functions – Interpolation (sin(x)/x or linear), average, envelope, auto setup.

Advanced Waveform Functions – FFT, integration, differentiation, waveform (math or acquired) limit testing.

Arithmetic Operators – Add, subtract, multiply, divide, invert.

Autoset – Single-button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

Waveform Limit Testing – Compares incoming or math waveform to a reference waveform's upper and lower limits.

Waveform Histograms – Both vertical and horizontal histograms, with periodically updated measurements, allow statistical distributions to be analyzed over any region of the signal.

Power Requirements

Line Voltage Range – 100 to 240 V_{RMS}.

Line Frequency – 45 to 440 Hz.

Power Consumption – 300 W max. (TDS654C/684C). 450 W max. (TDS694C).

Environmental and Safety

Temperature –

Operating: +4°C to +45°C (floppy not used), +10°C to +45°C (floppy in use).

Nonoperating: –22°C to +60°C.

TDS694C: Operating: +5°C to +40°C (floppy not used), +10°C to +40°C (floppy in use).

Nonoperating: –22°C to +60°C.

Humidity – Operating: 20% to 80% RH at or below +32°C.

Altitude – Operating: 15,000 ft. (hard disk not used), 10,000 ft. (hard disk in use). Nonoperating: 40,000 ft.

Electromagnetic Compatibility – 89/336/EEC.

Safety – UL 3111-1, CSA1010.1, EN61010-1, IEC61010-1.

Physical Characteristics

Dimensions	mm	in.
Height with feet	193	7.6
Height without feet	178	7
Width with handle	445	17.5
Depth with front cover installed	434	17.1
Weight	kg	lbs.
Net approximately	14.1	31
Shipping weight approximately	24.0	53

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▶ Ordering Information

TDS694C

Four-channel Color 3 GHz, 10 GS/s Per Channel, Digital Storage Oscilloscope.

Includes: User manual (071-0473-00), quick reference guide (071-2313-00), programmer's manual in MS Help format on floppy disk (063-3060-00), technical reference (performance verification) manual (071-0496-00), probe deskew fixture (679-4809-00), footswitch and adapter (260-1189-02 and 013-0312-00), front cover (200-3696-00), North American power cord (161-0230-01), accessory pouch (016-1268-00).

TDS684C

Four-channel Color 1 GHz, 5 GS/s Per Channel Digital Storage Oscilloscope.

Includes: User manual (070-0130-00), user supplement (071-0273-00), quick reference guide (020-2235-00), programmer's manual in MS Help format on floppy disk (063-3120-00), technical reference manual (071-0272-00).

Options

Opt. 05 – Video Trigger, NTSC, PAL, HDTV, FlexFormat™ (Except TDS694C).

Opt. 1K – Model K420 Instrument Cart.

Opt. 1M – 120 K Record Length (TDS694C only).

Opt. 1R – Rackmount Kit.

Opt. 31 – Add 1 ea. P6339A Buffered Passive Probe (TDS694C only).

Opt. 33 – Add 1 ea. P6158 Low Capacitance Probe.

Opt. 34 – Add 1 ea. P6247 Differential Probe (Except TDS694C).

Opt. 36 – Add 1 ea. P6139A Passive Probe (Except TDS694C).

Opt. 37 – Add 1 ea. P6245 Active Probe.

Opt. 38 – Add 1 ea. P6249 4 GHz Active Probe (TDS694C only).

Opt. 39 – Add 1 ea. P6248 1.7 GHz Differential Probe (TDS694C only).

Opt. HD – Internal hard disk drive.

International Power Plugs

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – UK 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American; product set to operate at 60 Hz, 15A.

Opt. A5 – Switzerland 220 V, 50 Hz.

Opt. AC – China 240 V, 50 Hz.^{*1}

Measurement Service Options

Opt. C3 – Three years of Calibration Services.

Opt. D1 – Calibration data report.

Opt. D3 – Test data (requires Opt. C3).

Software

TDS Java Applications

USB and TDSUSBF – USB2.0 compliance test package (includes software and test fixture).

TDSJIT1V2 – Jitter and timing analysis application.

TDSDDM1 – Hard disk drive measurement application.

TDSPRT1 – Enhanced waveform printing application.

TDSRBS1 – Rambus timing measurements – ME.

WSTRO – WaveStar™ software for oscilloscopes, Windows 95/NT application for waveform capture, analysis, documentation and control from your PC.

WSTROU – Upgrade from WSTR31 to WSTRO.

LWCVI95 – LabWindows/CVI for Windows 95.

Recommended Accessories

P6249 – 4 GHz Active Probe.

P6248 – 1.7 GHz Differential Probe.

P6330 – 3.5 GHz Differential Probe.

SureFoot® – Surface mount device interconnects.

^{*1}Not in TDS694C.

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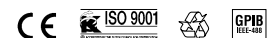
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