Waverunner®-2 LT584 model

LEADING FEATURES

- *1 GHz Bandwidth*
- *4 Channels*
- *2 GS/s Single shot sampling on all channels*
- *4 GS/s Single shot sampling on two channels combined*
- *50 GS/s repetitive sample rate*
- *Better than 10 ppm timebase accuracy with 5 ps resolution*
- *Up to 8 Mpt waveforms on two channels combined (with option L)*
- *8.4" TFT LCD color display*
- *SMART Triggers include slew rate and runt to ≤2.5ns (optional)*
- *Analog Persistence feature with History view*
- *QuickZoom button automatically magnifies signal views*
- *Wavepilot™ provides quick access to analysis views of measurements such as FFTs, Histograms, and TrackViews*
- *Averaging and enhanced resolution up to 11 bits*
- *Deskew and rescale*
- *GPIB, RS-232-C, VGA and Centronics Ports (Standard); Ethernet (Optional)*
- *Automatic pass/fail testing*
- *PC Card support for hard drives and memory cards*
- *Internal graphics printer option*

The LT 584 model Waverunner-2 scope provides excellent data acquisition characteristics and terrific value.

The LT584 is the new flagship of the Waverunner-2 series of digital oscilloscopes. It harnesses the power of 1 GHz bandwidth, and gives users remarkable cost savings and convenience. With today's extreme time-to-market pressures, engineers need to evaluate signals quickly and accurately. The Waverunner-2 series accomplishes these critical tasks, and does so at appealing prices. LeCroy's Waverunner-2 reputation has been built largely upon its intuitive front panel operation which saves engineers time in analysis and problem solving.

The new Waverunner LT584 scope provides 1 GHz of bandwidth at 2 GS/s into 250 kpts of acquisition memory per channel, standard. It can also be equipped with 4 Mpt memory (8 Mpts in 2-channel mode), along with 4 GS/s sample rate in 2-channel mode. This allows single-shot capture of long, complex signals at high sampling rates. There is an external trigger input which can be used to trigger on an additional signal.

Altogether, the Waverunner-2 series provides the bandwidth, sample rate, acquisition memory, and processing power needed to test signals with excellent fidelity, resolution, and precision.

Each Waverunner-2 oscilloscope is an integrated and powerful system providing the capability to CAPTURE, VIEW, and ANALYZE both simple and complex signals. The Wavepilot toolbar offers easy access to popular measurement and analysis functions. You get one-touch operation of features that automatically sets up cursors, creates context-sensitive displays of up to 26 waveform parameters, histograms, and trends. Functions like JitterTrack and TrackView help you track down timing and signal integrity problems right to the source.

Select the best configuration for your needs and budget. If you want to expand in the future, LeCroy provides reasonably priced upgrades for both hardware and software.

LeCroy

Signal Viewing

Display

The bright, clear 8.4" TFT LCD color display makes it easy to see text and signals. Select Full Screen, and the entire display is devoted to signal viewing to enhance signal details. QuickZoom automatically displays up to eight traces on multiple grids with maximum S/N ratio. With a press of the green "Analog Persist" button, choose the intensity-graded or color-graded view and quickly visualize the signal's history.

Analog Persistence with "History"

The newest function available in Analog Persistence mode is "History." You can select "History" to store and view up to 4,000 sequential acquisitions with individual display of each event and trigger time down to 1 ns resolution. Scan forward and backward to search for signal errors, then analyze when and why the error occurred.

Quick Zoom

Press QuickZoom to explore signal relationships and inspect or magnify selected regions of a waveform. Use AutoScroll to scan and view details on signals of up to 8 Mpts (with option L).

Wavepilot

Wavepilot is the easy-to-access signal analysis feature on new Waverunner-2 oscilloscopes. Wavepilot gives you the most direct way to view measurement cursors, or a group of 26 signal parameters or evaluate the signal with graphs including Histograms, TrackView, or the frequency spectrum (FFT) view.

Graph

Press Wavepilot and select "Graph" for quick and simple setup of measurements, FFT or TrackView trends. Select optional histograms or JitterTrack for accurate and precise results when evaluating critical timing parameters, crosstalk, and signal integrity problems in high-speed designs. All JitterTrack views are synchronized to the signal so you can track problems to the source.

Cursors and Automatic Measurements

Press Wavepilot and select "Parameters" to view up to 26 of the 28 standard waveform parameters (over 40 are available with optional analysis packages). It's context-sensitive, so if you select FFT, histogram or TrackView, it shows the right parameters with the right units. Select the Cursors button for instant access to cursor measurements.

Signal Analysis Solutions

Optional software packages customize the Waverunner-2 scopes with powerful signal analysis solutions including power measurements, disk drive and media development, wireless and network communications, and computer design. Press Wavepilot and select Analysis Packages for direct access.

Custom DSO

Get your work done fast by automating your analysis with your own customized setups and applications. CustomDSO applications can be created offline and stored on a floppy disk, or on the optional hard drive and memory cards for quick access.

LT584 Waverunner-2 Oscilloscope Configurations

Bandwidth	1 GHz	
Input Channels	4	
Single-Shot Sample Rate/Ch	2 GS/s	4 GS/s (Max)
Random Interleaved Sampling (RIS)	50 GS/s for repetitive signals:	
Maximum Acquisition Points		
Standard	250 kpts/Ch	500 kpts (Max)
M — memory option	1 Mpt/Ch	2 Mpts (Max)
L — memory option	4 Mpts/Ch	8 Mpts (Max)

Specifications

Vertical System	LT584/M/L
Input Channel	4
Analog Bandwidth @ 50 Ω (-3 dB)	1 GHz
Hardware Bandwidth Limits	20 MHz or 200 MHz
Input Impedance	50 Ω ± 1%; 1 MΩ //12 pF typical (using PP006 probe)
Input Coupling	1 MΩ: AC, DC, GND; 50 Ω: DC, GND
Maximum Input	50 Ω: 5 Vrms; 1 MΩ: 400 Vmax (peak AC ≤ 5 kHz + DC)
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)
Sensitivity (50 Ω or 1 MΩ)	2 mV – 10 V/div fully variable
DC Gain Accuracy	± (1.5% + 0.5% of full scale)
Offset Accuracy (50 Ω or 1 MΩ)	± (1.5% + 0.5% of full scale + 1 mV)
Offset Range	2 mV – 99 mV/div: ±1 V 100 mV – 99 V/div: ±10 V 1 V – 10 V/div: ±100 V
Isolation — Channel to Channel	>250:1 at same V/div settings

Timebase System	
Timebases	Main and up to four independent zoom traces simultaneously
Ranges	500 ps/div – 1000 s/div
Clock Accuracy	≤10 ppm
Interpolator Resolution	5 ps
External Clock Frequency	500 MHz maximum, 50 Ω, or 1 MΩ impedance
Roll Mode – Operating Range	time/div 500 ms – 1000 s/div or sample rate <100 kS/s max
External Timebase Clock	500 MHz maximum external sample clock input on front panel EXT BNC

Acquisition System	
Single Shot Sample Rate	
1 Channel Max.	4 GS/s
2 Channel Max.	4 GS/s
3 - 4 Channel Max.	2 GS/s
Maximum Acquistion Points/Ch	
1 Channel Max.	500k / 2M / 8M
2 Channel Max.	500k / 2M / 8M
3 - 4 Channel Max.	250k / 1M / 4M

Acquisition Modes		
Random Interleaved Sampling (RIS)	50 GS/s for repetitive signals: 500 ps/div – 2 µs/div	
Single Shot	For transient and repetitive signals: 500 Rps/div - 100s/div	
Sequence		
	Standard	2 – 1000 segments
	Memory Option M or L	2 - 4,000 segments
	Intersegment Time	50 µsec max.

Acquisition Processing	
Averaging	Summed averaging to 10^3 sweeps; continuous averaging with weighting range from 1:1 to 1:1023 (standard).
Enhanced Resolution (ERES)	From 8.5 to 11 bits vertical resolution
Envelope (Extrema)	Envelope, floor, roof for up to 10^6 sweep

Specifications (continued)

Triggering System

Modes	Normal, Auto, Single, and Stop
Sources	Any input channel, external, Ext/10 or line; slope, level, and coupling unique to each source (except line trigger) Inactive channels usable as trigger inputs.
Slope	Positive, Negative, Window
Coupling modes	DC, AC, HF, HFREJ, LFREJ
AC Cutoff Frequency	7.5 Hz Typical
HFREJ, LFREJ	50 kHz typical
Pre-trigger delay	0 – 100% of horizontal time scale
Post-trigger delay	0 – 10 000 divisions
Hold-off by time or events	Up to 20s or from 1 to 99 999 999 events
Internal trigger range	±5 div
Max trigger frequency	500 MHz (with HF trigger coupling)
External trigger input range	±0.5 (±5 V with Ext/10 selected)
Maximum ext. input @ 50 Ω	±5 V DC or 5Vrms
Maximum ext. input @ 1 MΩ	400 Vmax (DC + peak AC < 5 kHz)

Automatic Setup

Auto Setup	Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals
Vertical Find	Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range

Probes

Model PP006	10:1, 10 MΩ with auto-detect (one per channel)
Probe System: ProBus	Automatically detects and supports a wide variety of differential amplifiers; active, high-voltage, current, and differential probes
Scale Factors	Up to 12 automatically or manually selected

Color Waveform Display

Type	VGA color 8.4" flat-panel TFT-LCD
Resolution	VGA 640 x 480 pixels
Screen Saver	Display blanks after 10 minutes (when screen saver is "on")
Real Time Clock	Date, hours, minutes, and seconds displayed with waveform
Number of Traces	Display a maximum of eight traces. Simultaneously display channel, zoom, memory, and math traces
Grid Styles	Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY; Full Screen gives enlarged view of each style
Intensity Controls	Separate intensity control for grids and waveforms
Waveform Styles	Sample dots joined or dots only — regular or bold sample point highlighting
Trace Overlap Display	Select opaque or transparent mode with automatic waveform overlap management

Analog Persistence Display

Analog & Color-Graded Persistence	Variable saturation levels; stores each trace's persistence data in memory
Trace Selection	Activate Analog Persistence on a selected trace, top 2 traces, or all traces
Persistence Aging Time	Select from 500 ms to infinite
Trace Display	Opaque or transparent overlap
Sweeps Displayed	All accumulated or all accumulated with last trace highlighted

Zoom Expansion Traces

Display up to Four Zoom Traces	
Vertical zoom	Up to 5X expansion, 50X with averaging
Horizontal zoom	Expand to 2 pts/div, magnify to 50,000X
Auto Scroll	Automatically scan and display any zoom or math trace

Rapid Signal Processing

Processor	Power PC
Processing Memory	Up to 128 Mbytes
Realtime Clock	Dates, hours, minutes, seconds, and time stamp trigger time to 1 ns resolution

Specifications (continued)

Internal Waveform Memory

Waveform	M1, M2, M3, M4 (Store full-length waveforms with 16 bits/data point)
Zoom and Math	Four traces A, B, C, D with chained trace capability

Setup Storage

Front Panel and Instrument Status	Four non-volatile memories and floppy drive are standard. Hard drive and memory card are optional.

Interface

Remote Control	Full control of all front panel controls and internal functions via RS232C, GPIB, or Ethernet (optional)
RS-232-C	Asynchronous transfer rate of up to 115.2 kbaud
GPIB Port	Full control via IEEE – 488.2; configurable as talker/listener for computer control and data transfer
Ethernet (optional)	10 Base-T Ethernet interface
Floppy Drive	Internal, DOS-format, 3.5" high-density
PC Card Slot (optional)	Supports memory and hard drive cards
External Monitor Port Standard	15-pin D-Type VGA-compatible
Centronics Port	Parallel printer interface
Internal Graphics Printer (optional)	Provides hard copy output in <10 seconds

Outputs

Calibrator Signal	500 Hz – 1 MHz square wave or DC level; Select from -1.0 to +1.0 into 1 M Ω, output on front panel test point and ground lug.
Control Signals	Rear Panel, TTL level, BNC output; Choice of trigger ready, trigger out, pass/fail status. (output resistance 300Ω ± 10%)

Environmental and Safety

Operating Conditions	
Temperature	5 – 40 °C rated accuracy
	0 – 50 °C operating (electronics)
	-20 – 60 °C non-operating
	5 – 50 °C 3.5" floppy drive (operating)
	5 – 40 °C internal printer (operating)
Humidity	80% max RH, non-condensing up to 35 °C; Derates to 50% max RH, non-condensing at 45 °C
Altitude	4 500 m (15 000 ft) max. up to 25 °C; Derates to 2 000 m (6 600 ft) at 45 °C
CE Approved	
EMC	EMC Directive 89/336/EEC; EN 61326-1 Emissions and Immunity
Safety	Low Voltage Directive 73/23/EEC; EN 61010-1 Product Safety (Installation Category II, Pollution Degree 2)
UL and cUL approved	UL Standard UL 3111-1 cUL Standard CSA C22.2 No. 1010-1

General

Auto Calibration	Ensures specified DC and timing accuracy is maintained for 1 year minimum
Auto Calibration time	< 500 ms
Power Requirements	90 – 132 VAC at 45 - 440 Hz 180 - 250 VAC at 45 - 66 Hz Automatic AC voltage selection Power Consumption: 160 VA max; 210 VA max with internal printer
Battery Backup	Front panel settings retained for two years minimum
Warranty and Calibration	Three years; calibration recommended yearly

Physical Dimensions

Dimensions (HWD)	210 mm x 350 mm x 300 mm; 8.3" x 13.8" x 11.8" (height excludes feet)
Weight	19 lbs (8.5 kg)
Shipping Weight	31 lbs (14 kg)

Math Tools

Simultaneously perform up to four math (signal) processing functions; traces can be chained together to perform math on math.

Specifications (continued)

Standard Math Tools

average (sum to 4 000 sweeps)	product
average (continuous weighted)	ratio
difference	reciprocal (invert)
enhanced resolution (to 11 bits)	resample (deskew)
envelope	rescale (with units)
FFT of 50 kpoint waveforms	roof
floor	sine x/x
identity	sum
negate	

Measure Tools

Automated Measurements: Display any five parameters together with their average, high, low, and standard deviations.

Standard Measure Tools

amplitude	fall 90-10%	period
area	fall 80-20%	phase
base	frequency	rise 10-90%
cycle mean	maximum	rise 20-80%
cycle rms	mean	rms
cycles	minimum	sdev
delay	+overshoot	top
Δ delay	–overshoot	width
duty cycle	peak-to-peak	xamn
		xamx

Pass/Fail

Test any five parameters against selectable thresholds. Limit testing is performed using masks created on the scope or PC. Set up a pass or fail condition to initiate actions such as hard copy output, saving waveform to memory, GPIB SRQ, or pulse out.

Cursor Measurements

Type	Symbol	From	To
Relative time		First point on waveform	Any other point on waveform
Relative voltage		Select voltage level	Any other voltage level
Absolute time		Time and voltage relative to	Ground and trigger
Absolute voltage		Voltage	Ground

Extended Math and Measurement Option (EMM)

Adds math and advanced measurements for all general purpose applications. Includes all standard math and measurement tools, plus:

Extended Math Tools

absolute value	integrate
differentiate	square
exp (base e)	square root
exp (base 10)	trend (datalog)
log (base e)	histogram (200 events)
log (base(10)	

Extended Measure Tools

cycle median	first point
cycle std. deviation	last point
Δ time @ level; % and volts	number of points
Δ time @ level from trigger	median
Δ time from clock to data + (setup time)	rise @ level; % and volts
Δ time from clock to data - (hold time)	std. deviation
fall @ level; % and volts	duration

WaveAnalyzer (WAVA)

Includes the Extended Math and Measure Tools as well as expanded capabilities for performing FFTs, averaging, histograms, and histogram parameters.

WaveAnalyzer Tools

Histogram up to 2 billion events. Analyze with 18 histogram parameters
Summed averaging to 1 million sweeps
WaveAnalyzer FFT capability expands the basic FFT to include:
- FFT power averaging
- FFT power density, real, and imaginary
- FFT on all acquisition points

With WaveAnalyzer FFT you get maximum resolution at wide frequency spans.

Other Application Solutions

Jitter and Timing Analysis (JTA)
Digital Filter Package (DFP)
PowerMeasure Analysis (PMA1)
Communications Mask Testing (MT01/MT02)
Polymask Mask Testing (PMSK)
Disk Drive Measurements (DDM)
PRML Analysis (PRML)
Surface Map Analysis (SMAP)

Free Software Utilities

ScopeExplorer:	Easy to use utility that provides a simple but powerful way to control your scope remotely over RS232C, GPIB, or Ethernet.
DSOPrintGateway:	Print screen images to network printers and save BMP images to files on a networked computer.
ActiveDSO:	Active X controls for flexible windows applications programming with remote control.
MaskMaker:	Create a tolerance test mask offline with this graphic tool.
DSO Filter:	Specify a set of filter coefficients and load them into the scope.

Specifications (continued)

Basic Triggers	
Edge/Slope/Window/Line	Triggers when signal meets slope and level condition
SMART Triggers	
State or Edge Qualified	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is selectable by time or events.
Dropout	Trigger if signal drops out for longer than selected time between 25 ns and 20 s.
Pattern	Logic combination of 5 inputs (3 on 2 channel models); Each source can be high, low, or don't care. Trigger entering or exiting the pattern
TV-Video	Triggers selectable fields (1, 2, 4, or 8) for NTSC, PAL SECAM, or nonstandard video (up to 1500 lines)
SMART Triggers with Exclusion Technology	
Signal or Pattern Width	Triggers on glitches or on pulse widths selectable from <2.5 ns to 20 s or on intermittent faults.
Signal or Pattern Interval	Triggers on intervals selectable between 10 ns and 20 s.
Slew Rate*	Trigger on edge rates; select limits for dV, dt, and slope. Select edge limits between 2..5 ns and 20 s.
Runt*	Positive or negative runts defined by two voltage limits and two time limits. Select between 2.5ns and 20 ns.
Hard Copy	
	Print Screen is activated by a front-panel button or remote control. Store screen image files or print to external printers including network printers and directories. Network printing and file access requires the LAN10BT Ethernet option.
Supported Printers	
B/W	LaserJet, DeskJet, Epson An optional, internal high-resolution graphics printer is also available for screen dumps; stripchart output formats capable of up to 200 cm/div.
Color	DeskJet 550C, Epson Stylus, Canon 200/600/800 series, HP7470 and HP7550
Hard copy Formats	TIFF b/w, TIFF color, BMP color, BMP compressed, and HPGL
Waveform Output	
	Store waveforms to floppy disk or optional PC-Card hard drives and memory cards Save any trace you choose and select Auto-Store to automatically store the waveform after each trigger
Output Formats	The ASCII waveform output is compatible with spreadsheets, MATLAB, Mathcad, etc. Binary output is also available for reduced file size.
Documentation	
Included with Waverunner-2 Oscilloscopes:	Operators Manual — hard copy Remote Programming Manual — hard copy CD-ROM — PDF formatted manuals plus software utilities including ScopeExplorer, ActiveDSO, MaskMaker, DSO-Filter, and DSOPrint Gateway.
* optional Advanced Trigger Package	

Ordering Information

Waverunner-2 Digital Oscilloscopes	Product Code
1 GHz, 2 GS/s, 250 kpts/ch, 4 Channel Color DSO	LT584
Included with Standard Configuration	
10:1 10 MΩ Passive Probe (1 per channel)	PP006
Operator's Manual, Quick Reference Guide, CD-ROM with OM/RCM PDF manuals, and utility software	WR2-OMCD-E
Operator's Manual	WR2-OM-E
Remote Control Manual	WR-RCM-E
Floppy Disk Drive	
GPIB, RS-232-C, Centronics Parallel Port, VGA Video Output Port	
Protective Front Cover	
Performance Certificate	
Three-Year Warranty	
Memory Options	
1 Mpt/ch	Option-M
4 Mpts/ch	Option-L
Hardware Options	
Internal Graphics Printer	GP02
10 Base-T Ethernet LAN option	LAN10BT
PC Card Slot	PCSLOT
PC Card Slot including 1 hard drive card and 1 memory card	PCMEDIA
Software Options	
Wave Analyzer Analysis Package	WAVA
Jitter Analysis and Wave Analyzer	JTWA
Extended Math and Measurement Package	EMM
ITU G.703 Fully Automated Mask Tester	MT01
ANSI T1.102 Fully Automated Mask Tester	MT02
Jitter and Timing Analysis Package	JTA
Digital Filter Package	DFP
Disk Drive Measurements	DDM
Supplementary Disk Drive Measurements	PRML
Power Measure Analysis Software	PMA1
Advanced Trigger Package	ATP
Surface Map Analysis Software package	SMAP
Selected Accessories	
1 GHz Active probe	HFP 1000
1.5 GHz Active probe	HFP 1500
Differential Probe	ADP300 series
Current Probe	CP and AP series
Differential Amplifiers	DA1800 series
50Ω to 75Ω adapter	PP090
Oscilloscope Cart	OC1021
Graphic Printer Paper/10 Rolls	GPR10
Service and Extended Warranties	
US NIST Standard Calibration	CCNIST
US Military Standard Calibration	CCMIL
Swiss OFMET Standard Calibration	CCOFMET
Five-Year Warranty at time of scope purchase	W5
Five-Year Warranty and NIST Calibration at time of scope purchase	T5

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