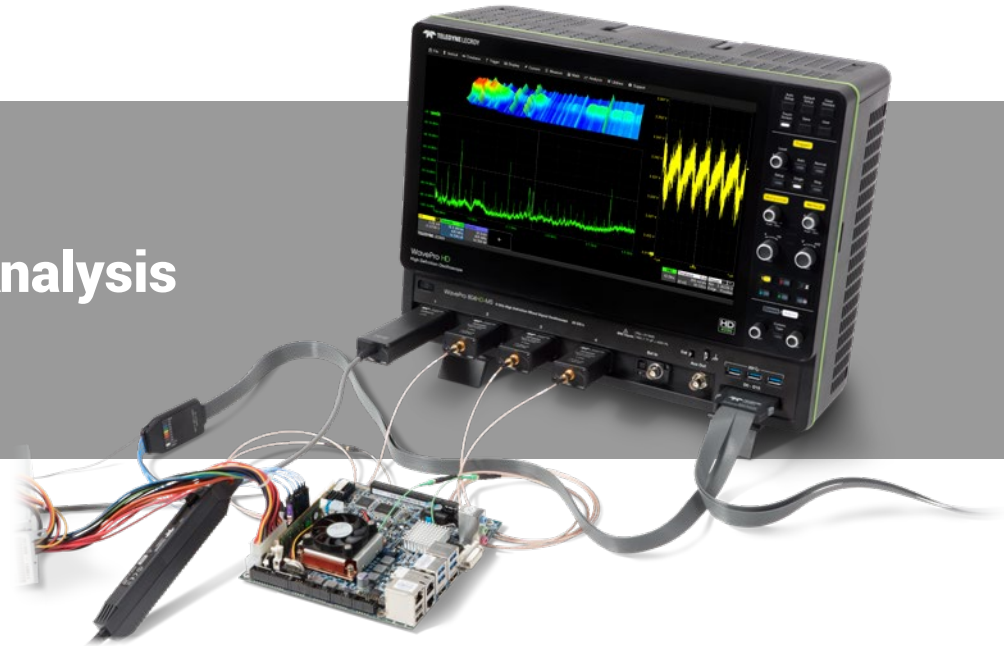


Power Integrity Analysis



Key Features

Applications

- Digital Power Management
- Power Integrity
- Power Sequencing

High Definition Oscilloscopes

- WavePro HD
- WaveRunner 8000HD
- WaveSurfer 4000HD
- HDO6000B
 - 12 bits all the time from 200 MHz to 8 GHz
 - Low noise, 0.5% gain accuracy
 - High native offset
 - Power rail probes and specialized software

Complete Probe Selection

- RP2060/RP4060 DC Rail Probes
- High-sensitivity Current Probes
- Differential Voltage Probes and Amplifiers with 10x Gain
- Low-cost 1 GHz Active FET probe

20+ Serial Data Standards supported

Application Software Package (DIG-PWR-MGMT)

Teledyne LeCroy High Definition oscilloscopes, probes, serial data options, and the Digital Power Management application software package provide the capabilities you need for digital power management IC (PMIC), power integrity, and power sequencing testing.

8 channels, 12 bits, 2 GHz

Monitor multiple phases of a PMIC, or multiple DC power/voltage rails and other signals. Capture and view many correlated and causal events. Very large native oscilloscope offset adjustment provides means for direct connection of voltage rails with high gain/sensitivity settings. MSO option provides added flexibility.

8 GHz with High Definition

For hunting high-frequency power rail noise sources and characterizing fast phenomena like ground bounce, WavePro HD with 12 bit HD4096 technology up to 8 GHz bandwidth is the ideal tool.

Extensive Serial Data Support

Support for commonly used power management standards such as I²C (PMbus) and SPMI, and many others (UART-RS232, SPI, USB2, HSIC, etc.).

Complete Probe Selection

The RP4060 and RP2060 Rail Probes provide $\pm 60V$ offset, high DC input impedance, and low noise at the highest sensitivities. Other single-ended or differential voltage or high-sensitivity current probes provide additional critical probing capabilities.

Application Software Package (DIG-PWR-MGMT)

Capture power/voltage rails over thousands of CPU or device switching periods and display numeric mean value measurements and variations in measurements over time, correlated to the power/voltage rail acquisitions.

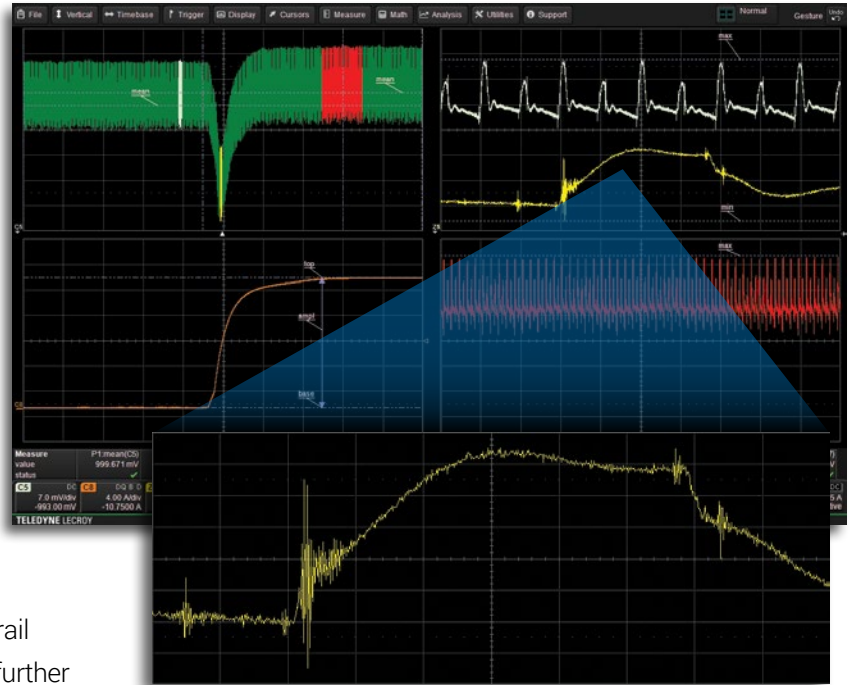
COMPLETE POWER INTEGRITY ANALYSIS

Teledyne LeCroy's High Definition Oscilloscopes (HDO®) provide more resolution, accuracy, and capability than any other oscilloscope for high confidence power integrity validation and debug.

- 12 bits all the time from 200 MHz to 8 GHz
- Low noise, 0.5% gain accuracy
- High native offset
- Power rail probes and specialized test software

Rail Voltage Power Integrity

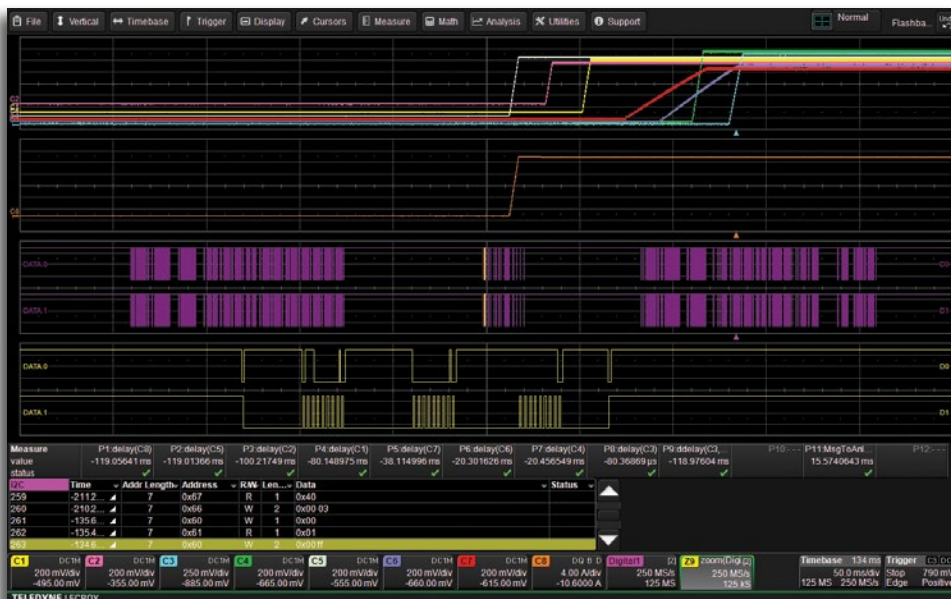
1 or 2 GHz bandwidth oscilloscopes with 12-bit resolution at rated bandwidth and sample rate is ideal for many users. Probing nearer to the CPU may require more bandwidth. 12 bits all the time with 0.5% gain accuracy provides best capability for accurately measuring transients, noise, ripple, droop, and frequency harmonics.



Crosstalk and Harmonics Evaluation

Disturbances or switching transients on the voltage rail may be closely scrutinized using vertical zoom, and further analyzed with the spectrum analysis and FFT toolsets provided standard with the oscilloscope.

12 bits all the time with high gain accuracy improves understanding of AC characteristics and dynamic load performance of power rails.



Voltage Rail Startup/Sequencing Timing Measurements

Monitor up to 16 power/voltage rails at one time along with associated serial data signals (using digital input capabilities) to validate startup/sequencing timing budgets. Use long memory to capture startup/sequencing events while maintaining high sample rate.

Seven voltage rails and one rail current are monitored during startup. Bus activity is captured and decoded, and power sequencing timing budgets are quickly validated.

Multi-rail Power Distribution Network Response

The power management system reacts to changing loads to keep the power rails stable and within their tolerance bands. Easily probe power rails with coaxial cables using the Teledyne LeCroy HDOs very large native oscilloscope offset. Or use a rail probe with $\pm 60\text{V}$ offset. Both approaches make it easy to vertically center the power rail and view it with high sensitivity (e.g., 5 mV/div) at 12 bits resolution with 0.5% accuracy.



8 analog channels greatly improves productivity by permitting more power rails to be displayed at one time for better correlation to causal events.

More Channels for More Information

8 channels (expandable to 16) provide an easy way to view many power rails at one time and also have additional channels to monitor other transient events.



The same transient rail response viewed in the top image can be augmented with per-clock cycle calculated Waveforms (right side) of the mean power rail voltages, time-correlated to the original acquisitions.

Advanced Rail Analysis Tools

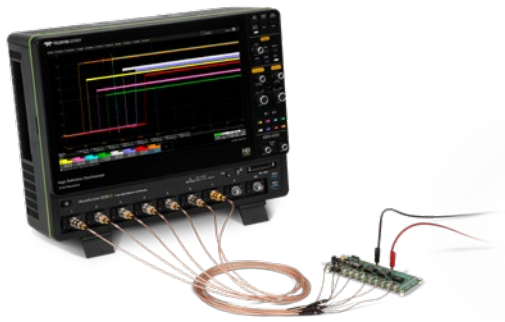
Use the Digital Power Management application package to perform a cycle-by-cycle analysis on the rail voltages and display plot the changes in rails over time as per-cycle Waveforms. This vividly displays the behaviors of the power rails in a highly intuitive and useful manner.

UNMATCHED OSCILLOSCOPE CAPABILITIES



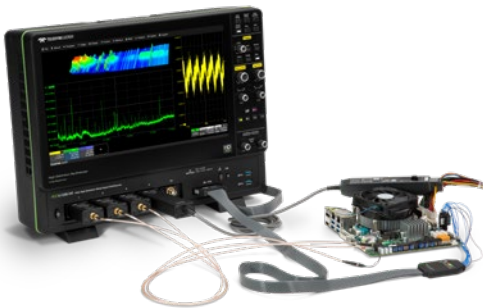
WavePro HD: Power integrity Powerhouse

- 12-bit resolution all the time plus 0.5% gain accuracy
- Long memory up to 5 Gpts/ch
- Up to 8 GHz bandwidth at 20 GS/s
- Spectral analysis on 250 Mpt waveforms provides the highest resolution bandwidth possible



WaveRunner 8000HD: Multi-rail Analysis

- High dynamic range and 0.5% gain accuracy
- 8 analog channels with 12-bit resolution
- Up to 5 Gpts/ch of acquisition memory
- 16 analog channels on one display with OscilloSYNC™



HDO6KB: Capture Every Detail

- HD4096 technology enables 12 bits of vertical resolution with 1 GHz bandwidth
- Up to 250 Mpts of acquisition memory
- Bigger display with 15.6" and Full HD resolution



WaveSurfer 4000HD: Power Integrity on a Budget

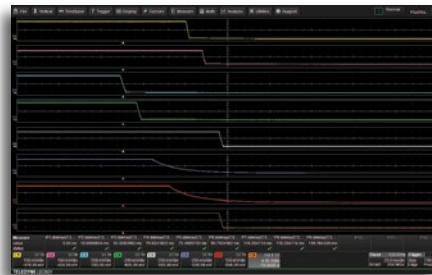
- 12-bit resolution and low noise, 0.5% gain accuracy
- Built-in FFT function or (optional) Spectrum Analyzer
- High offset capability of 1.6 V at 1 mV/div

OPTIONS AND ACCESSORIES



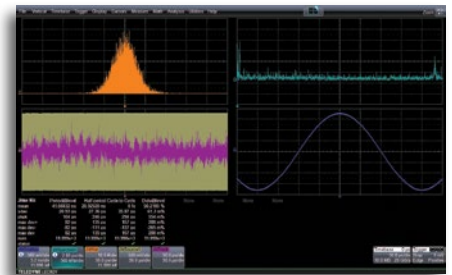
Mixed Signal Capability

Add 16 digital logic input channels capable of capturing 250 MHz digital clock rate signals. Utilize these inputs for correlating command digital or low-speed serial data activities with captured analog signals.



Long Memory

Up to 5 Gpts of acquisition memory permits very long capture times of combined high-speed and low-speed events while maintaining high sample rates



JITKIT Software Option

Understand the basic system jitter performance of clock signals and clock-data activities. Four views of jitter speeds debug and analysis, and correlates clock and data jitter activities to power rail behaviors.



Teledyne LeCroy's Trigger (T), Decode (D), Measure/Graph (M or G) and Eye Diagram and Physical Layer (E or P) options are the best in the industry.

Low-Speed Serial Trigger, Decode, Measure/Graph, and Eye Diagram Tools

The widest range and most complete low-speed serial data debug and validation solutions, including comprehensive triggers, color-coded decoders, automated timing measurements, serial data digital-to-analog converted (DAC) waveforms, eye diagram and physical layer analysis toolsets.

- SPMI
- PMbus
- SMBus
- I²C
- SPI
- UART-RS232
- USB2, USB2-HSIC

RP2060/RP4060 VOLTAGE RAIL PROBES

The RP4060 and RP2060 probes are designed specifically to probe low-impedance DC power/voltage rails. Low attenuation means a low-noise view of small signal variations at high frequency, while the probe's built-in offset of up to $\pm 60\text{V}$ enables compensation for the rail's DC voltage. The probe's high DC input impedance eliminates loading of the low-impedance DC rail.

Key Features

Up to 4 GHz Bandwidth

$\pm 60\text{ V}$ Offset Capability

$\pm 800\text{ mV}$ Dynamic Range

50 k Ω DC Input Impedance

1.2x Attenuation for low additive noise

MCX terminated cable with wide variety of connections:

- Solder-in (4 GHz)
- Coaxial Cable to U.FL receptacle (3 GHz)
- MCX PCB Mount (4 GHz)
- Browser (500 MHz)

ProBus Interface



Large Offset Range

Permits the DC signal to be displayed in the vertical center of the oscilloscope grid with a high-sensitivity gain setting.

Low Attenuation and Noise

The probe attenuation is a nominal 1.2x coupled to the oscilloscope at DC 50 Ω . This keeps additive noise to a minimum, and makes it exceptionally useful with Teledyne LeCroy's 12-bit High Definition oscilloscopes for lowest noise at highest sensitivity gain settings.

High DC Input Impedance

50 k Ω input impedance at DC effectively eliminates probe loading on the DC power/voltage rail and provides for more accurate measurements and signal fidelity.

High Bandwidth

The RP4060 provides 4 GHz of bandwidth, for power integrity characterization of the highest performance computing and embedded systems. The RP2060 provides the same excellent noise and loading performance in a lower-cost 2 GHz probe.

Wide Assortment of Tips and Leads

The RP4060 and RP2060 are supplied standard with solder-in and coaxial cables with MCX and U.FL PCB receptacle mounts. A browser tip is optionally available.

OTHER VOLTAGE AND CURRENT PROBES



AP033 Differential Voltage

Wide dynamic range, low loading and excellent noise performance, the AP033 provides 10x gain and high CMRR.



ZD Series Differential Voltage

The ZD200 has 200 MHz of bandwidth with 60V common mode and ± 20 V differential range. 3.5 pF differential tip capacitance, and 50 dB CMRR at 10 MHz, but with a minimum sensitivity of 10 mV/div on High Definition oscilloscopes. ZD500, ZD1000 and ZD1500 provide more bandwidth (up to 1.5 GHz) but with lower common mode (10V) and higher minimum sensitivities.



ZS Series Single-Ended Voltage

1 to 4 GHz models, high signal fidelity, and low circuit loading. ± 8 V dynamic range, ± 12 V offset.



DL-HCM

The ideal probes for lower voltage GaN power conversion measurement with the highest accuracy, best CMRR, and lowest noise. Up to 1 GHz in bandwidth.



High-sensitivity Current Probes

The CP030A (50 MHz) and CP031A (100 MHz) current probes provide high sensitivity (1 mA/div) with excellent noise performance, high bandwidth, and 50A_{pk} (30Arms) current measurement capabilities.

ORDERING INFORMATION

Product Description

Product Code

Recommended High Definition Oscilloscopes and Options

2.5 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Oscilloscope with 15.6" Full HD capacitive touch screen	WavePro 254HD
4 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Oscilloscope with 15.6" Full HD capacitive touch screen	WavePro 404HD
6 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Oscilloscope with 15.6" Full HD capacitive touch screen	WavePro 604HD
8 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Oscilloscope with 15.6" Full HD capacitive touch screen	WavePro 804HD
2.5 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Mixed Signal Oscilloscope with 15.6" Full HD capacitive touch screen	WavePro 254HD-MS
4 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Mixed Signal Oscilloscope with 15.6" Full HD capacitive touch screen	WavePro 404HD-MS
6 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Mixed Signal Oscilloscope with 15.6" Full HD capacitive touch screen	WavePro 604HD-MS
8 GHz, 20 GS/s, 4 Ch, 100 Mpts/Ch High Definition Mixed Signal Oscilloscope with 15.6" Full HD capacitive touch screen	WavePro 804HD-MS
Digital Power Management Analysis Software Option for WavePro HD	WPHD-DIG-PWR-MGMT
1 GHz, 10GS/s, 8 Ch, 50 Mpts/ch, High Definition Oscilloscope with 15.6" Full HD capacitive touch screen	WaveRunner8108HD
2 GHz, 10GS/s, 8 Ch, 50 Mpts/ch, High Definition Oscilloscope with 15.6" Full HD capacitive touch screen	WaveRunner8208HD
1 Gpt/2Ch (500 Mpt/4Ch, 250 Mpt/8Ch) Memory Option for WaveRunner/MDA 8000HD (includes 32GB RAM)	WR8KHD-1000MPT
5 Gpt/2Ch (2.5 Gpt/4Ch, 1.25 Gpt/8Ch) Memory Option for WaveRunner/MDA 8000HD (includes 32GB RAM)	WR8KHD-5000MPT
Digital Power Management Analysis Option for WaveRunner/MDA 8000HD	WR8kHD DIG-PWR-MGMT
1 GHz, 4 Ch, 12-bit, 10 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 15.6" Full HD capacitive touch screen	HDO6104B
1 GHz, 4+16 Ch, 12-bit, 10 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 15.6" Full HD capacitive touch screen	HDO6104B-MS
1 GHz, 4 Ch, 12-bit, 5 GS/s, 12.5 Mpts/Ch High Definition Oscilloscope with 12.1" widescreen capacitive touch screen	WaveSurfer 4104HD

Recommended Power Rail Probes and Accessories

Power/Voltage Rail Probe, 2 GHz bandwidth, 1.2x, attenuation, $\pm 60V$ offset, ± 800 mV dynamic range	RP2060
Power/Voltage Rail Probe, 4 GHz bandwidth, 1.2x, attenuation, $\pm 60V$ offset, ± 800 mV dynamic range	RP4060
RP2060/RP4060 500 MHz Browser Tip Accessory	RP4000-BROWSER
Qty. 3 additional MCX solder-in leads	RP4000-MCX-LEAD-SI

Recommended Other Probes

500 MHz Differential Voltage Probe with x1 and x10 gain and /10 and /100 attenuation, 42V common-mode	AP033
200 MHz Differential Voltage Probe, $\pm 20V$	ZD200
1 GHz Differential Voltage Probe, $\pm 8V$	ZD1000
1 GHz, 0.9 pF, 1 M Ω Single-ended Active Voltage Probe	ZS1000
4 GHz, 0.6 pF, 1 M Ω Single-ended Active Voltage Probe	ZS4000
30Arms (50Apk), 50 MHz High-sensitivity AC/DC Current Probe	CP030A
30Arms (50Apk), 100 MHz High-sensitivity AC/DC Current Probe	CP031A
150Arms (500Apk), 10 MHz AC/DC Current Probe	CP150

Serial Trigger, Decode, Measure/Graph, and Eye Diagram Options

PMbus serial trigger, decode, measure/graph, and eye diagram	PMbus TDME
SMbus serial trigger, decode, measure/graph, and eye diagram	SMbus TDME
I ² C serial trigger, decode, measure/graph, and eye diagram	I2Cbus TDME
SPMI serial decode	SPMIbus D
SPI serial trigger, decode, measure/graph, and eye diagram	SPIbus TDME
UART-RS232 serial trigger, decode, measure/graph, and eye diagram	UART-RS232bus TDME
USB2 serial trigger, decode, measure/graph, and eye diagram	USB2bus TDME
USB2 HSIC serial decode	USB2-HSICbus D

More than 20 standards are supported. For a complete list of supported standards and capabilities, visit our website at teledynelecroy.com/t dime

Customer Service

Teledyne LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years and our probes are warranted for one year. This warranty includes:

- No charge for return shipping
- Long-term 7-year support
- Upgrade to latest software at no charge



1-800-5-LeCroy
teledynelecroy.com

Local sales offices are located throughout the world.
Visit our website to find the most convenient location.