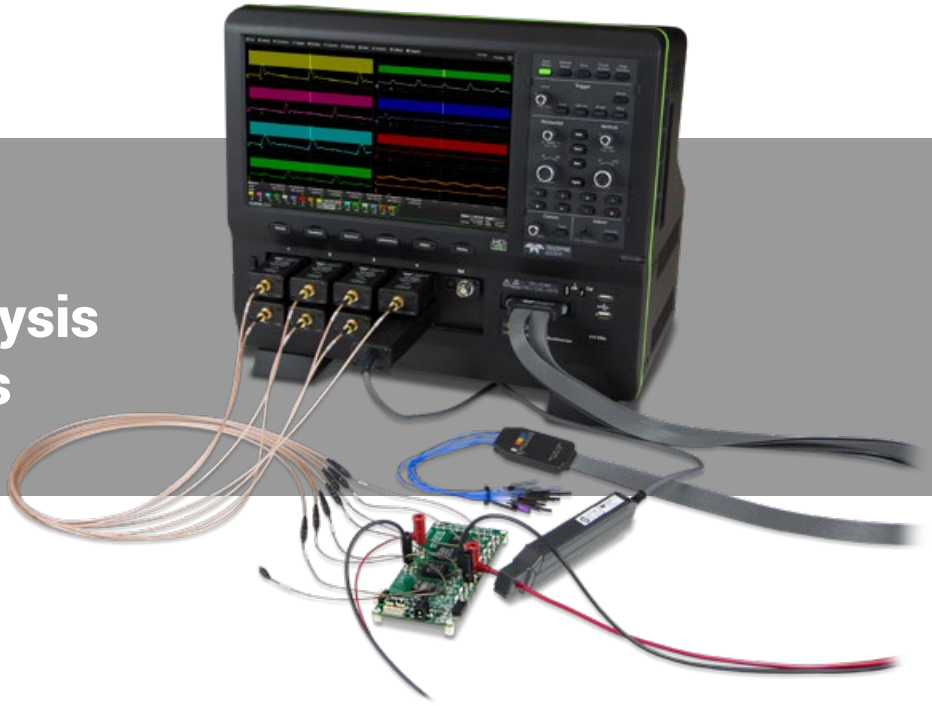
TELEDYNE LECROY
Everywhereyoulook™

Digital Power Management Analysis and Test Solutions



Key Features

Applications

- **Digital Power Management**
- **Power Integrity**
- **Power Sequencing**

High Definition Oscilloscopes:

WavePro HD:

- **12 bits up to 8 GHz**
- **5 Gpts acquisition memory**
- **Integrated mixed signal capabilities**

HDO8108A:

- **8 channels, 12 bits, 1 GHz**
- **Integrated mixed signal capabilities**

Complete Probe Selection

- **RP4030 DC Rail Probe (4 GHz)**
- **High-sensitivity Current Probes**
- **Differential Voltage Probes and Amplifiers with 10x Gain**
- **Low-cost 1 GHz Active FET probe**

20+ Serial Data Standards supported, including:

- **I²C (PMbus)**
- **SPMI**
- **USB2, USB2-HSIC**
- **UART-RS232**
- **SPI**

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, 1 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 RP4030 Rail Probe provides ±30V offset, high DC input impedance, and low noise at the highest sensitivities. The AP033 differential voltage probe provides 10x gain at high bandwidth for monitoring series/shunt resistor voltages, with rescale to current values. 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 DIGITAL POWER MANAGEMENT ANALYSIS

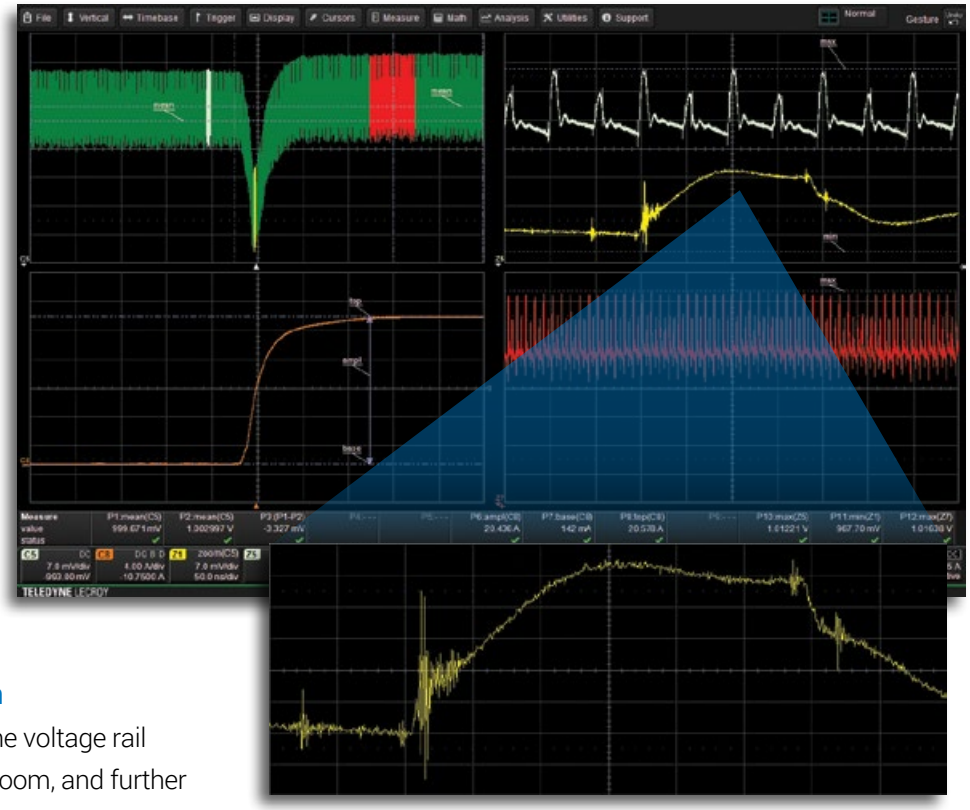
Only one company – Teledyne LeCroy – can provide you with the most specifically tailored solutions for digital power management, power sequencing and power integrity test, validation and debug. Whether you are testing multi-phase digital power management IC (PMIC) DC-DC converter operation under dynamic conditions, or complete embedded systems that contain PMICs, voltage regulator modules (VRMs), point-of-load (POL) switching regulators, or low-dropout (LDO) regulators, Teledyne LeCroy has the solution for you.

Rail Voltage Power Integrity

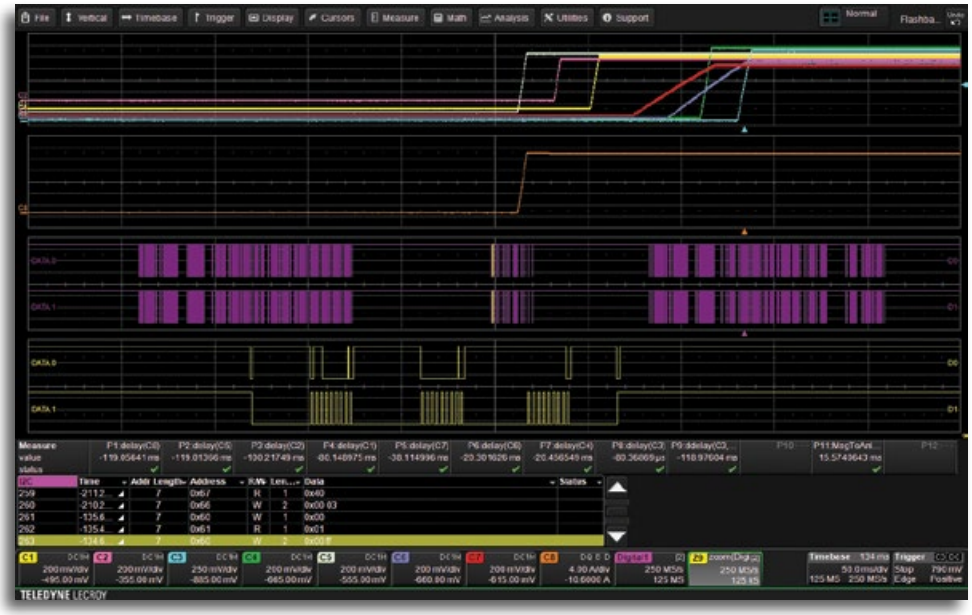
1 GHz with 8 channels and 12-bit resolution (HDO8108A) is the perfect mix of capabilities for many users. Others probing nearer to the CPU may desire more bandwidth (8 GHz in the WavePro 804HD). Use the high resolution to capture wide dynamic range signals during transient disturbing events and measure noise, ripple, droop, transients, and frequency harmonics. The RP4030 rail probe provides a convenient method to probe the power/voltage rail with high fidelity and bandwidth (up to 4 GHz).

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-bit resolution with excellent amplitude accuracy is necessary for understanding small power/voltage rail changes under dynamic load conditions, and characterizing the AC behavior of the DC rail.



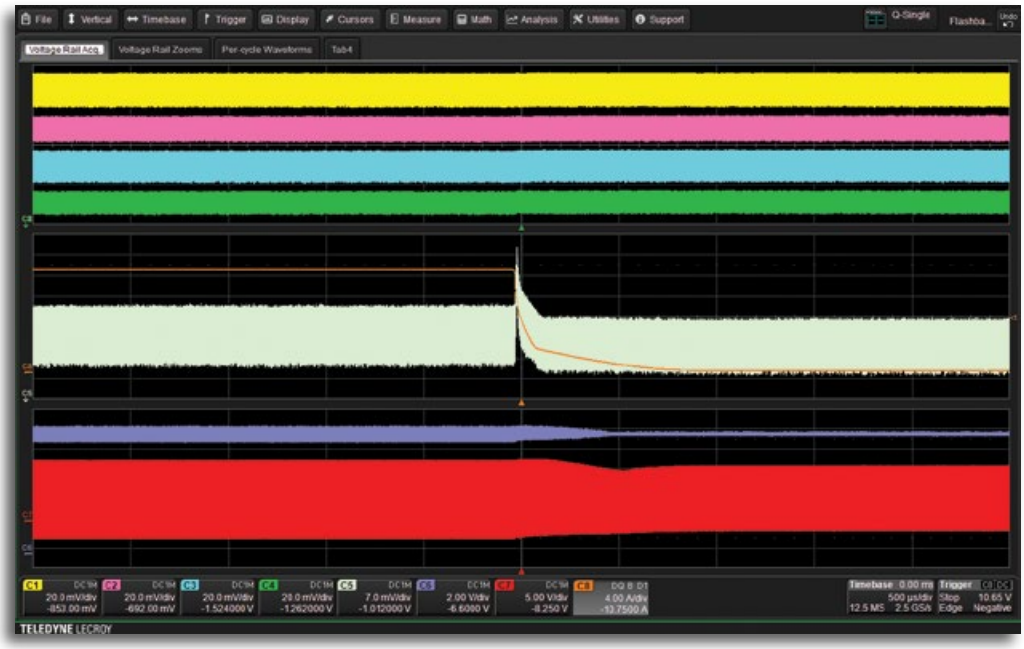
Voltage Rail Startup/Sequencing Timing Measurements

Monitor up to 8 power/voltage rails at one time along with associated serial data signals (using the MSO digital input option) to validate startup/sequencing timing budgets. Use long memory to capture startup/sequencing events while maintaining high sample rate to correlate misbehaviors with higher frequency disturbances.

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.

PMIC Transient Power/Voltage Rail Response

As the CPU and embedded system is dynamically loaded/unloaded, the power management system must react to keep the power rail stable and within its tolerance band while appropriately sharing current over multiple PMIC phases. The HDO8108A is ideal for monitoring up to 8 analog voltage or current signals at one time. Use the very large native oscilloscope offset adjustment when directly connecting, or the ±30V offset provided in the RP4030 rail probe, to center the power/voltage rail and view it with high sensitivity (e.g., 5 mV/div). 12-bit resolution provides 0.5% accuracy and precision over wide dynamic ranges. Easily zoom horizontally or vertically for more details.



8 analog channels greatly improves productivity by permitting more DC power/voltage rails to be displayed at one time to better understand causal effects.

PMIC Current Sharing/Tracking

8 channels provide an easy way to view all PMIC phases at one time, and have additional channels to monitor other transient events. The AP033 differential voltage probe and the DA1855A differential amplifier both provide 10x gain for very low voltage differential measurements on current sense resistors, and the DA1855A has exceptional common-mode rejection ratio (CMRR).

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

Advanced Rail Analysis Tools

Go beyond use of cursors or simple measurements – use the Digital Power Management application package to perform a cycle-by-cycle analysis on the rail voltages and display mean parametric values in a Numerics table, and then plot the changes in these values over time as per-cycle Waveforms. This vividly displays the behaviors of the DC rails in a highly intuitive and useful manner. Zoom+Gate to view details on specific portions of large acquisitions.

UNMATCHED OSCILLOSCOPE CAPABILITIES

HDO8108A

The only 8 channel, 12-bit resolution, 1 GHz bandwidth oscilloscope available, and the "workhorse" for digital power management, power sequencing, and power integrity testing, validation and debug .

- 8 channels
- 12-bit resolution (HD4096 technology)
- 1 GHz
- Up to 250 Mpts/ch memory
- Exceptional signal fidelity and DC gain accuracy
- Optional MSO capabilities
- 20+ low-speed serial data options
- Powerful, deep toolbox

WavePro HD

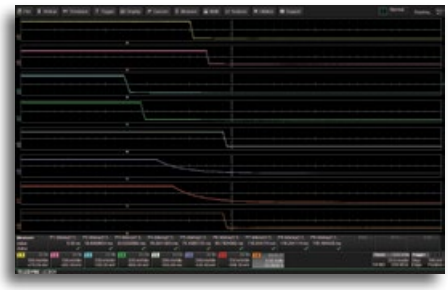
A higher bandwidth choice for power integrity testing of faster phenomena - power rail pollution from high-speed signals, on-die effects like ground bounce, and rail-noise-related jitter.

- 4 channels
- 12 bit resolution (HD4096 technology)
- Up to 5 Gpts memory
- Exceptional signal fidelity
- Optional MSO capabilities
- Low-speed and high-speed serial analysis options
- Powerful, deep toolbox

OTHER OPTIONS AND ACCESSORIES FOR FASTER TESTING

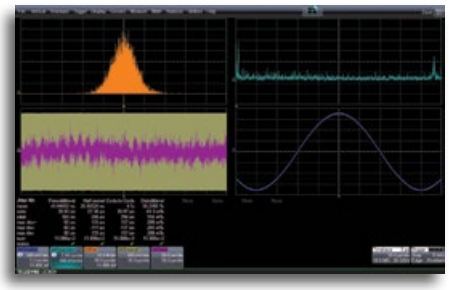
Mixed Signal Capability

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. Digital logic inputs can be part of a combined analog+digital pattern or used as inputs for the low-speed serial data triggers or decoders.



Long Memory

The 5 Gpts of acquisition memory available in the WavePro HD permits very long capture times of combined high-speed and low-speed events. Quickly and easily correlate rail load changes to causal commands or find system misbehaviors many milliseconds after load is applied or released from the power rail.



JITKIT Software Option

JITKIT makes it simple and easy to understand the basic system jitter performance of clock signals and clock-data activities. Four views of jitter speeds debug and analysis. Use the JITKIT toolbox to correlate clock and data jitter activities to power rail behaviors or transient events, or vice-a-versa.

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 converter (DAC) parameters and waveforms from the DAC output, and eye diagram and physical layer analysis toolsets.

SPMI Decoder

MIPI System Power Management Interface (SPMI) bus is quickly becoming the industry-standard for managing power distribution in mobile/handheld embedded systems. Teledyne LeCroy's SPMI Decoder provides full frame and bit level decoding of SPMI low-level protocol, arbitration, and command sequences with search and filtering of decoded numeric or text data.

RP4030 DC POWER/VOLTAGE RAIL PROBE

The RP4030 is a practical and superior alternative to conventional techniques to probe a 50 Ω DC power/voltage rail. The probe has large built-in offset, low attenuation (noise), and high DC input impedance. This permits a voltage rail to be offset in the oscilloscope by its mean DC voltage with user adjustment of oscilloscope gain to achieve a noise-free view of small signal variations in the DC power/voltage rail without inadvertently loading the DC rail.

Key Features

4 GHz Bandwidth

±30V Offset Capability

±800mV Dynamic Range

50 kΩ DC Input Impedance

1.2x Attenuation
(Low Additive Noise, ~5%)

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 (350 MHz)

ProBus Interface

High 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 50Ω. This keeps additive noise to a minimum, and makes it exceptionally useful with High Definition oscilloscopes for lowest noise at highest sensitivity gain settings.

High DC Input Impedance

50 kΩ input impedance at DC mitigates current loading of the DC power/voltage rail and provides for more accurate measurements and signal fidelity.

4 GHz Bandwidth

Provides maximum bandwidth for when probing is performed near the CPU, and makes it the perfect match for the 4 GHz, 10 bit HDO9404.

Wide Assortment of Tips and Leads

Supplied with solder-in and coaxial cables with MCX and U.FL PCB receptacle mounts. A browser tip is optionally available. Additional receptacles or leads may be purchased as accessories and left connected in circuit for easy connection of different signals during different test or validation stages.

OTHER VOLTAGE AND CURRENT PROBES

AP033 Differential Voltage

500 MHz of bandwidth with a range of sensitivities from x10 gain (200 µV/div) to 100x attenuation. x10 gain is perfect for measuring low voltages across current sense resistors (4nV/√Hz noise, 5V common mode, and ±400mV offset). Up to 42V common mode and ±4V offset is available at higher attenuations. CMRR is as good as 80 dB. Tip capacitance is very low (1 pF differential).

ZD Series Differential Voltage

The ZD200 has 200 MHz of bandwidth with 60V common mode and ±20V 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

Available from 1 to 4 GHz bandwidth, these probes have 1 MΩ input resistance and low tip capacitance (as low as 0.6pF) with up to 12V offset range and ±8V dynamic range. Many of these probes are available in packs of 4 (QuadPaks) for economical volume purchases.

DA1855A Differential Amplifier

With 100 dB CMRR, x10 gain, fine offset adjustment the DA1855A is the premium solution for measuring low voltages across current sense resistors. Either the DXC100A (switchable 10x/100x attenuation) provides higher common mode voltage (155V) with 500mV dynamic range, while DXC200A (1x attenuation) provides 15.5V common mode voltage with 500mV dynamic and better noise performance for lower voltage signals.

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 50Apk (30Arms) current measurement capabilities.

ORDERING INFORMATION

Product Description	Product Code
Recommended High Definition Oscilloscopes and Options	
1 GHz, 8 Ch, 12-bit, 2.5 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 12.1" WXGA Color Touch-screen Display, Ultra HD (UHD) Extended Desktop	HDO8108A
16 Digital Channel Mixed Signal Option	HDO8k-MSO
250 Mpts/Ch Memory Option	HDO8k-XL
Digital Power Management Analysis Software Option	HDO8k-DIG-PWR-MGMT
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	WPHD-DIG-PWR-MGMT
1 GHz, 4 Ch, 12-bit, 2.5 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 12.1" WXGA Color Touch-screen Display	HDO6104A
1 GHz, 4 Ch, 12-bit, 2.5 GS/s, 50 Mpts/Ch High Definition Mixed Signal Oscilloscope with 12.1" WXGA Color Touch-screen Display	HDO6104A-MS
250 Mpts/Ch Memory Option	HDO6k-XL
Digital Power Management Analysis Software Option	HDO6k-DIG-PWR-MGMT
Recommended Power Rail Probes and Accessories	
Power/Voltage Rail Probe, 4 GHz bandwidth, 1.2x, attenuation, ±30V offset, ±800mV dynamic range	RP4030
RP4030 350 MHz Browser Tip Accessory	RP4000-BROWSER
Qty. 3 additional MCX solder-in leads	RP4000-MCX-LEAD-SI
Qty. 10 additional MCX PCB mount receptacles	RP4000-MCX-PCBMOUNT
Qty. 3 additional MCX to U.FL coaxial cables	RP4000-MCX-CABLE-UFL
Qty. 10 additional U.FL PCB mount receptacles	RP4000-UFL-PCBMOUNT
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, ±20V	ZD200
1 GHz Differential Voltage Probe, ±8V	ZD1000
1 GHz, 0.9 pF, 1 MΩ Single-ended Active Voltage Probe	ZS1000
Set of 4 ZS1000	ZS1000-QUADPAK
4 GHz, 0.6 pF, 1 MΩ 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
1ch, 100 MHz Differential Amplifier with 100dB CMRR	DA1855A
100:1 High Impedance differential probe pair for DA1855A	DXC200A
Serial Trigger, Decode, Measure/Graph, and Eye Diagram Options	
I^2C 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/tdme

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

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