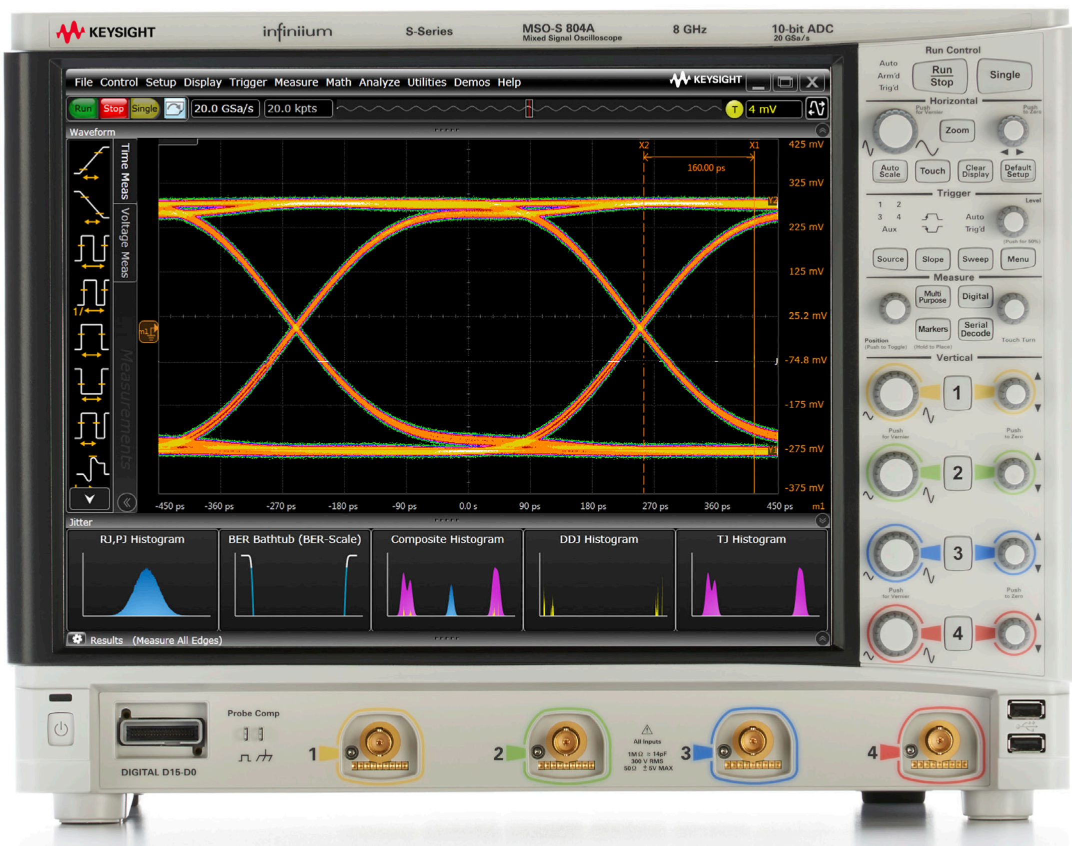
Keysight U1882B
Measurement Application for Infiniium Oscilloscopes

Data Sheet



KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Fast, Automatic and Reliable Characterization of Switching Mode Power Devices

Today's power supply designers are facing an increasing number of constraints in the development of high-efficiency, low-cost power supplies. Cost-effective solutions used to be the designer's key target. Today, rising energy costs bring power supply efficiency to the forefront. Additionally, other constraints such as design compactness, migration to digital control, tighter voltage tolerances, and regulations for power quality and EMI force the need for quick and reliable power supply testing. Increasing design constraints translate into more time dedicated to power device measurement and analysis for today's power supply designers.

In spite of the increasing analysis capability offered by many oscilloscopes over recent years, it is not uncommon to see designers perform measurements and characterization manually. These measurements typically take a considerable amount of time to capture, analyze, and report.

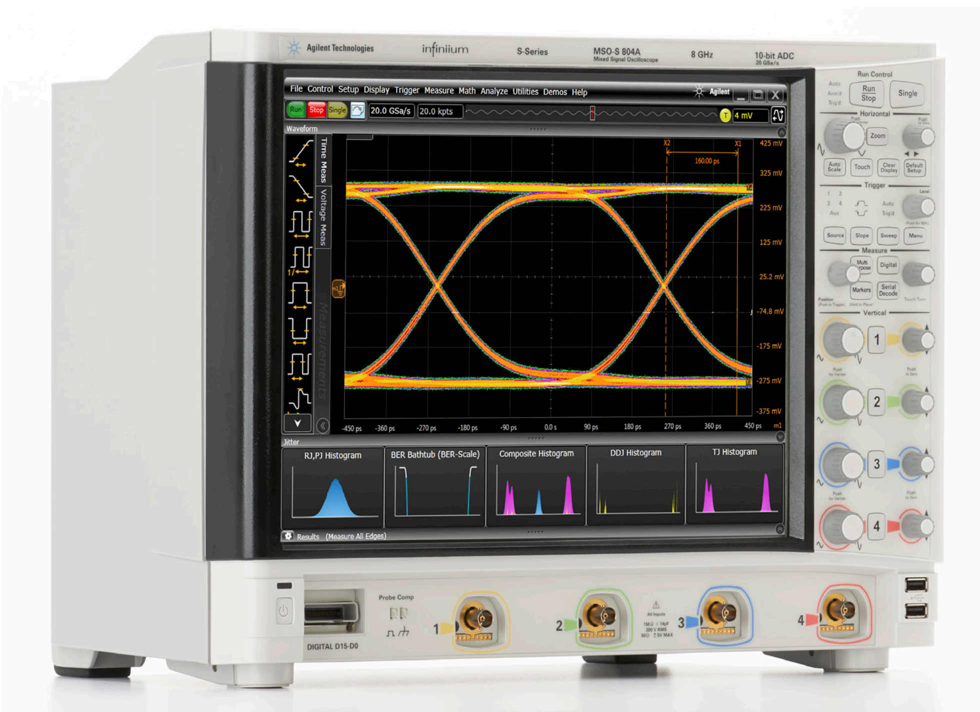


Figure 1. Power measurement application running on a Keysight Infiniium oscilloscope provides a single-box solution for testing switching mode power supply characteristics.

Full-featured Measurements and Automatic Reporting of Switching Mode Power Supply (SMPS) Characteristics

Now you can skip the time-consuming manual measurements when you are characterizing your power devices. The U1882A power measurement application for Keysight Technologies, Inc. oscilloscopes provide a full suite of power measurements that run directly on an Infiniium S-Series and 9000 Series oscilloscope. Keysight's power measurement application offers seven modules to help you characterize your devices (power device analysis, input line analysis, output analysis, turn on/off analysis, transient analysis, modulation analysis) in addition to deskew and report generation. Each module contains relevant measurement and setup selections for easy repeatability.

Modules	Measurements
Deskew	Automatic deskew for voltage and current probes
Power device analysis	Switching loss
	Safe operating area (SOA) with SOA mask editing
	Dynamic ON resistance
	dI/dt
	dV/dt
Input line analysis	Power factor (real power/apparent power)
	Real power
	Apparent power
	Reactive power
	Crest factor
	Precompliance test to IEC61000-3-2 std A, B, C, D and RTCA DO-160E
Inrush current analysis	Inrush current
Output analysis	Output voltage ripple
Turn on/off analysis	Turn on time
	Turn off time
Transient analysis	Transient load response
Modulation analysis	Pulse width versus time plot
	Duty cycle versus time plot
	Period versus time plot
	Frequency versus time plot
Report generation	Report generation

Auto Deskewing and U1880A Deskew Fixture

A power measurement is simply a point-by-point multiplication of the voltage and current waveforms measured by the voltage and current probes. To make accurate power measurement and calculation, it is extremely important to equalize the time delay between the voltage and current probes using a procedure known as deskewing. This step is critically important since a small offset in the timing of the voltage and current traces can cause a large error in the instantaneous power reading. To deskew a pair of probes, drive both voltage and current probes with the same pulse signal using the U1880A deskew fixture. With only a single click on the menu, deskewing is automatically performed and its values are saved in the power measurement software, so the next time you launch the power measurement application, you can use the saved deskew values or perform the deskewing again.

The deskew accuracy is a function of the electrical characteristics of the voltage and current probes as well as the risetime of the signal under test. In general, higher bandwidth probes will allow for better risetime fidelity and better deskew resolution. Keysight's N2790A to N2793A differential probes are recommended for most applications.

The U1880A deskew fixture is recommended for use with the following voltage and current probe combinations given various test signal risetime characteristics.

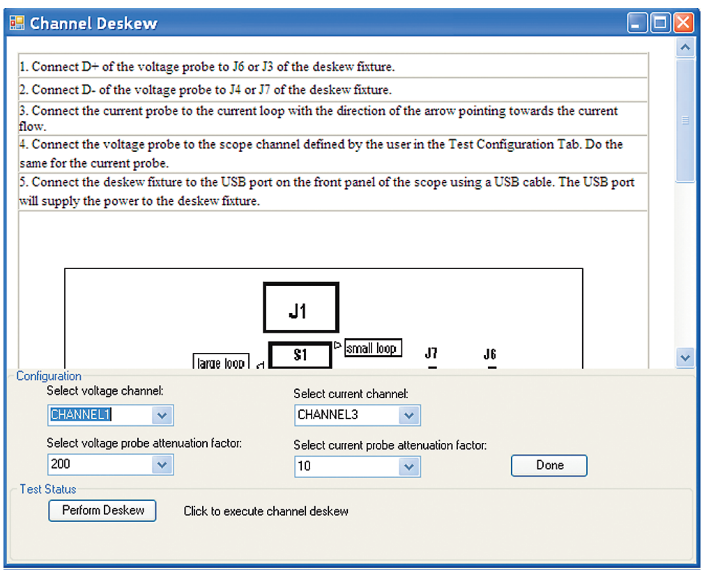


Figure 2. Deskew dialog.

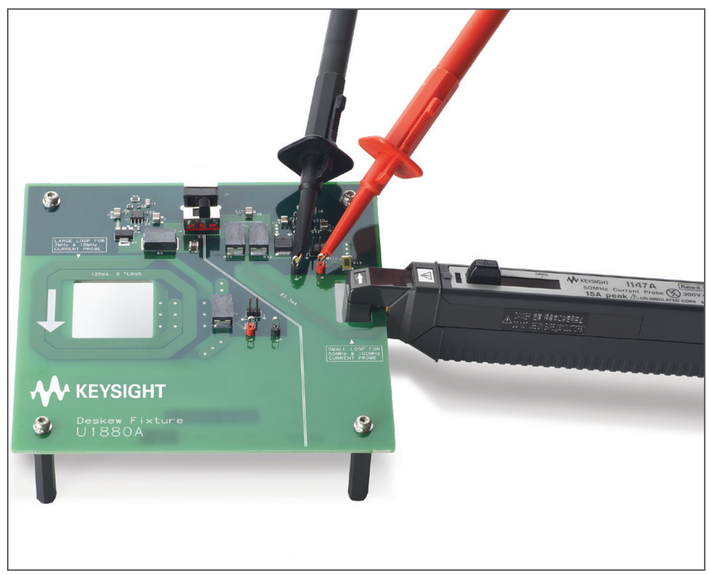


Figure 3. Deskew fixture.

Power Device Analysis

The switching loss in a power supply determines its efficiency. You can easily characterize instantaneous power loss and conduction power loss at the switching device over a designated switching cycle. The dynamic ON resistance measurement shows you power loss while the power transistor is conducting.

To determine the reliability of the power supply it is very important to measure the power loss during dynamic load changes and to observe the SOA (safe operating area) plot. Using deep acquisition memory on the scope with the SOA plot, you can easily identify improper power transistor behavior.

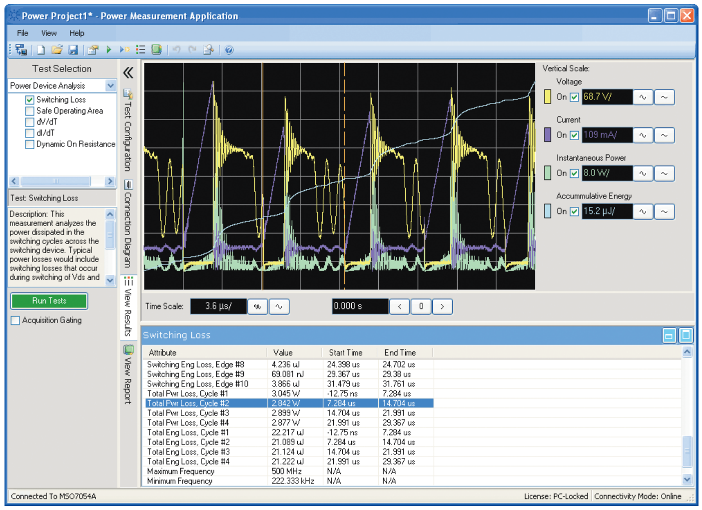


Figure 4. Power device analysis results are displayed both graphically and in a tabular, "lister" format.

Input Line Analysis

Power supply designers need to characterize the line power for power quality, harmonics and conducted emissions under different operating conditions of the power supply. Some of the implicit measurements are real power, apparent power, reactive power, power and crest factor, and graphical display of harmonics with respect to standards such as IEC 61000-3-2 (Class A, B, C, D) and RTCA DO 160E. By using a current probe and the power measurement software (equipped with an FFT math function), you can measure conducted power line harmonics.

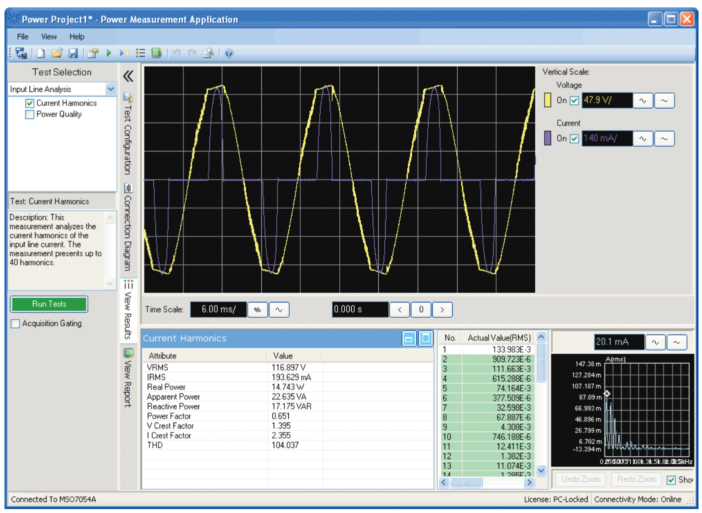


Figure 5. Input line analysis results.

Modulation Analysis

Modulation analysis allows you to quickly see the on-time and off-time information of the PWM signal, which is difficult to visualize because the information bandwidth is much lower than the pulse switching frequency. Plotting the embedded variation of on time or off time in the PWM signal over a long period of time can reveal the control loop response of the feedback loop system. This measurement performs data trending on the switching variation of the acquired waveform in the following formats:

– Frequency versus time
– Period versus time
– Duty cycle versus time
– Positive pulse width versus time

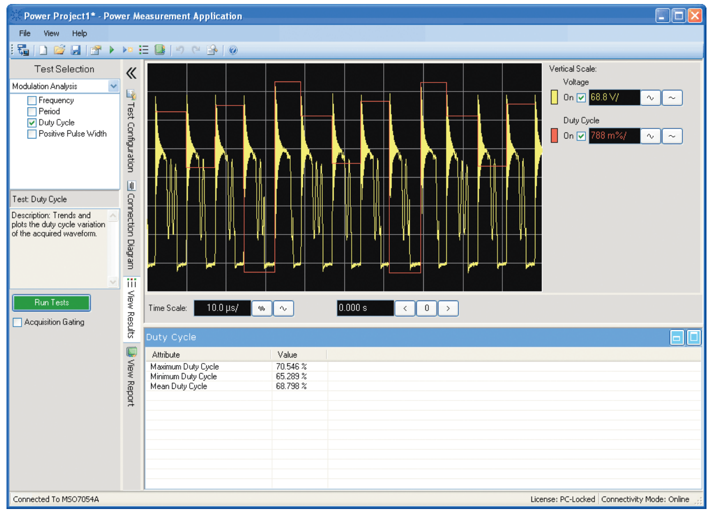


Figure 6. Modulation analysis results.

Output Analysis

This module includes characterizing the ripple (either AC or switching) component in the output DC voltage. Ripple is the residual AC component that is superimposed on the DC output of a power supply. Line frequency and switching frequency can contribute to the ripple. This measurement presents the peak-to-peak ripple value as well as the frequency response of the captured signal.

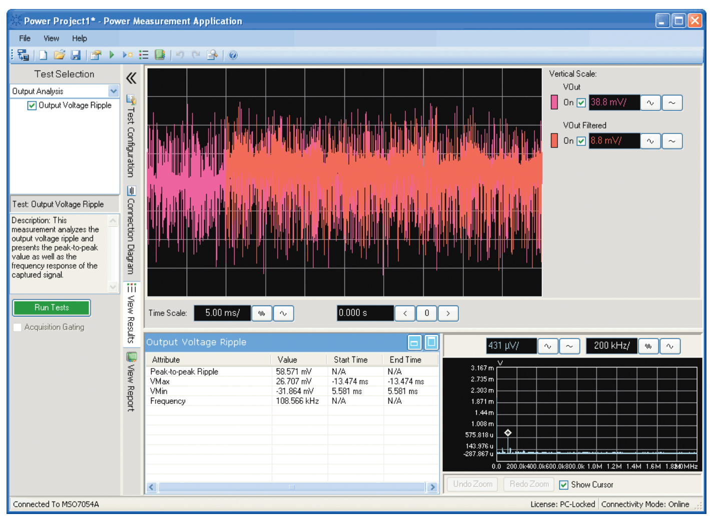


Figure 7. Output analysis results.

Turn On/Off Time Analysis

This module measures the time taken to get to the steady output voltage of the power supply after the input voltage is applied (turn on time) and for the output voltage of the power supply to turn off after the input voltage is removed (turn off time).

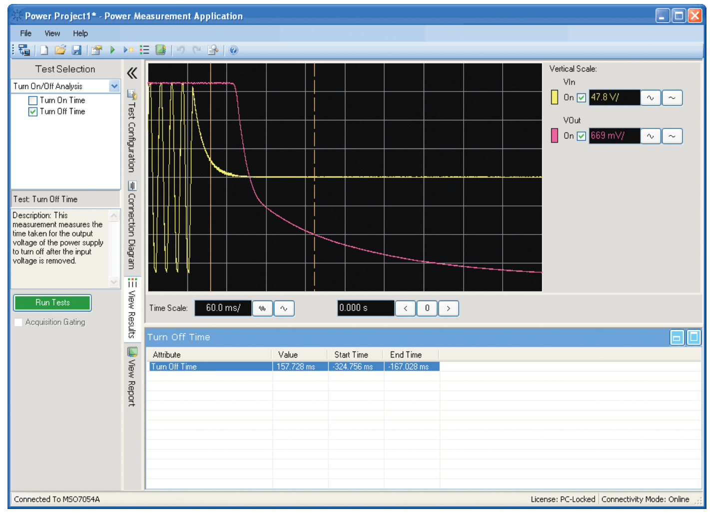


Figure 8. Turn on/off analysis results.

Transient Response Analysis

Power supplies are subject to transient conditions, such as turn-on and turn-off transients, as well as sudden changes in output load and line input voltage. These conditions lead to one of the key specifications of the power supplies: load transient response. This module measures the load transient response of the DC output; namely, the time taken for the DC output to stabilize during a load change.

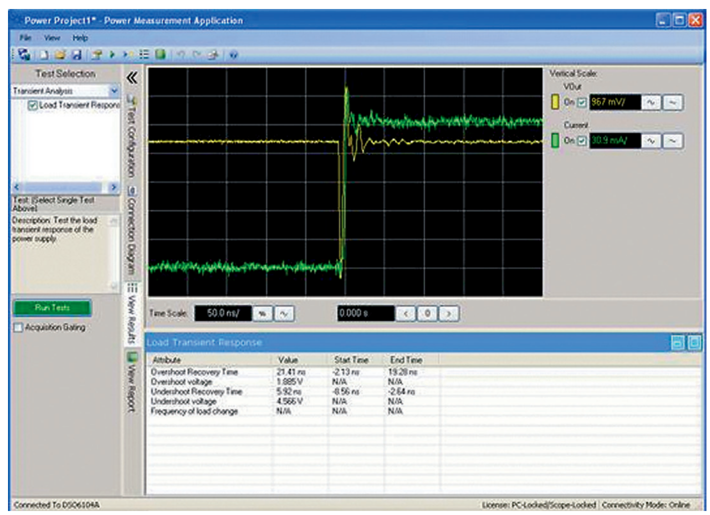


Figure 9. Transient response results.

Report Generation

After a single test or a test module has been run, the View Report tab populates with measurement data and graphs for your archival and date sharing purposes. Reports are saved in a .htm format. Each report contains an up-front summary of pertinent test information.

Reports are automatically saved to a test folder on the directory of your choice.

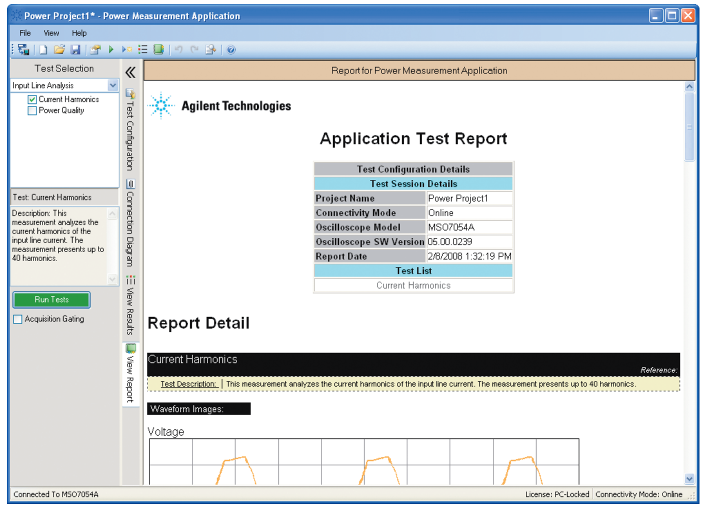


Figure 10. Automatic report generation makes test result archival easy.

Ordering Information

Product number	Description
U1882B [1, 2]	Power measurement application for Infiniium S-Series and 9000 Series oscilloscopes
– Option 1FP	Oscilloscope-locked, fixed perpetual license
– Option 1TP	Transportable, fixed perpetual license
U1880A	Deskew fixture

1. Requires software 5.00 and above.
2. Software 4.30 or above requires Windows 7. N2753A Infiniium Windows XP to 7 OS upgrade kit (oscilloscope already has M890 motherboard). N2754A Infiniium Windows XP to 7 OS and M890 motherboard upgrade kit (oscilloscope without M890 motherboard). Verify the M890 motherboard using the procedure found in the Windows 7 upgrade kit data sheet with the publication number 5990-8569EN.

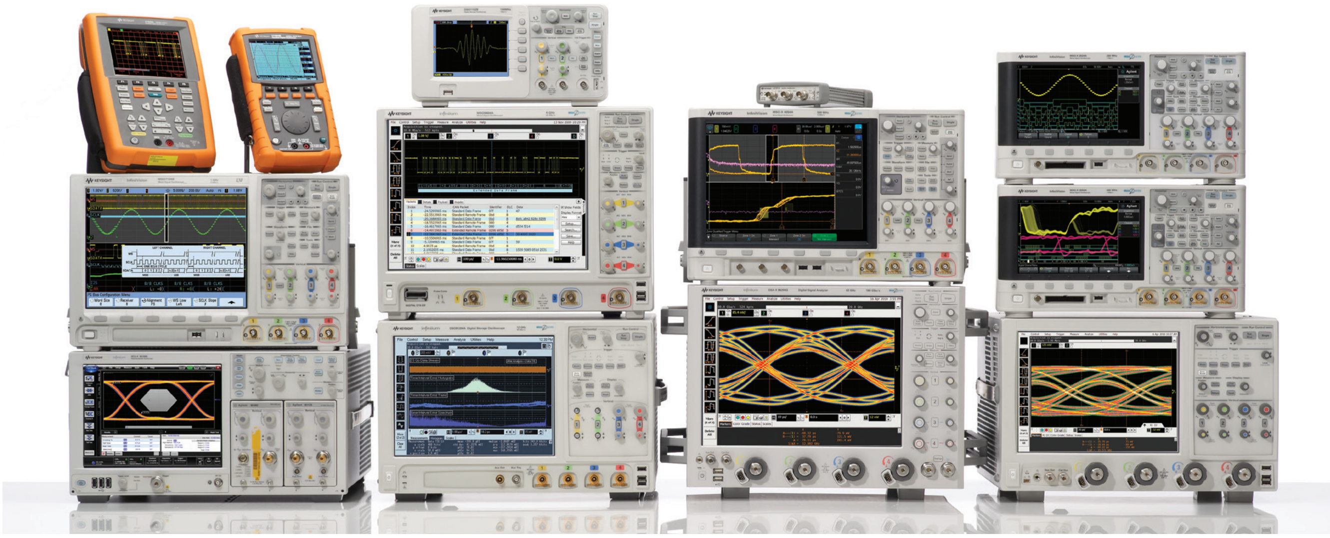
Recommended probes and accessories	
U1880A	Deskew fixture for voltage and current probe deskewing
AC/DC current probes (one or more of these Keysight current probes)	1147B 50-MHz, 15-A current probe with AutoProbe interface
	N2893A 100-MHz, 15-A current probe with AutoProbe interface
	N2780A 2-MHz, 500-A current probe (requires N2779A power supply)
	N2781A 10-MHz, 150-A current probe (requires N2779A power supply)
	N2782A 50-MHz, 30-A current probe (requires N2779A power supply)
	N2783A 100-MHz, 30-A current probe (requires N2779A power supply)
Differential probes (one or more of these Keysight differential probes)	N2790A 100-MHz differential probe with AutoProbe interface (± 1.4 kV differential)
	N2791A 25-MHz differential probe (± 700 V differential)
	N2792A 200-MHz differential probe (± 20 V differential)
	N2793A 800-MHz differential probe (± 15 V differential)
	N2804A 300-MHz differential probe (± 300 V differential)
	N2805A 200-MHz differential probe (± 100 V differential)
	N2891A 70-MHz differential probe (± 7 kV differential)
Passive probe (for measuring output noise)	1162A 1:1, 25-MHz passive probe
	N2870A 1:1, 35-MHz passive probe

Related Literature

Publication title	Publication number
Infiniium S-Series High-Definition Oscilloscopes - Data Sheet	5991-3904EN
Oscilloscope Probes and Accessories - Selection Guide	5989-6162EN

Product Web site

For the most up-to-date and complete application and product information, please visit our product Web site at:
www.keysight.com/find/scopes



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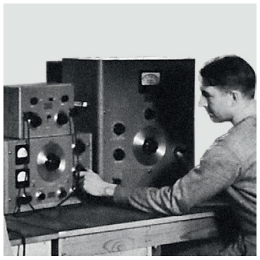

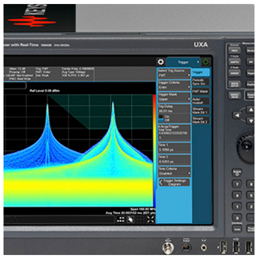

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