

D9010LSSP Low Speed Serial Protocol Trigger and Decode for Infiniium Oscilloscopes

The D9010LSSP software package for Infiniium oscilloscopes gives you the ability to trigger and decode on a large and ever-expanding suite of low speed serial protocols: I²C, SPI, eSPI, Quad SPI, Quad eSPI, RS232/UART, JTAG, I²S, SVID, and Manchester. This package applies to the Keysight 9000, 90000, S, V, Z, and UXR Series Infiniium Oscilloscopes.

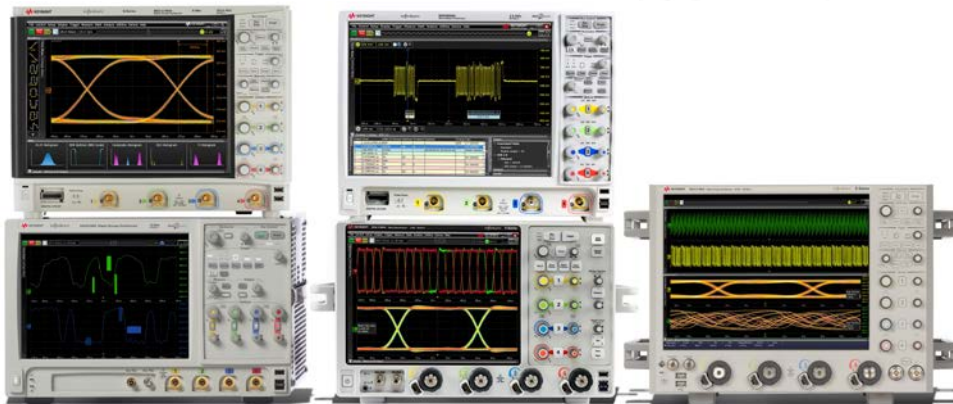


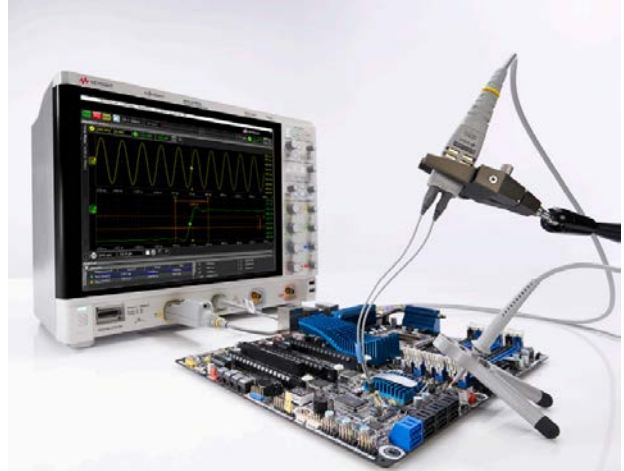
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Product Overview

This document is designed to help you understand what is available in D9010LSSP. For assistance in using the software, please reference the latest user's guide, programmer's guides, and online help for Infiniium available on Keysight.com.

Lower-speed serial bus interfaces are widely used today in electronic designs for chip-to-chip communication. In many designs these serial buses tend to provide content-rich points for debug and test. Extend your scope capability with the D9010LSSP low speed serial protocol triggering and decode application! This application makes it easy to debug and test designs that include low speed serial protocols using Infiniium oscilloscopes. Get access to a rich set of integrated protocol level triggers specific to each serial bus. When serial triggering is selected, the application enables special real-time triggering hardware inside the scope.



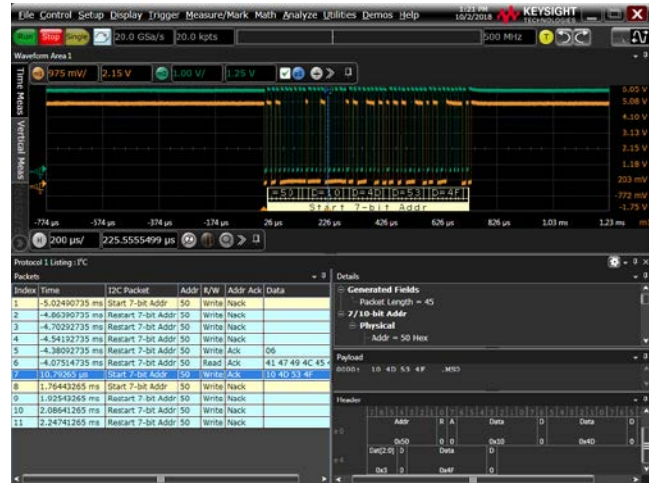
Hardware-based triggering ensures that the scope never misses a trigger event when armed. This hardware takes signals acquired using either scope or digital channels and reconstructs protocol frames. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.

- Easy access to setup with a dedicated Serial Decode front panel key.
- Setup your scope to show protocol decode in less than 30 seconds with an auto setup key for every protocol that sets threshold levels, baud rates, sample rate, memory depth and more.
- Save time and eliminate errors by viewing packets at the protocol level on the physical waveform, or in tabular or graphical format.
- Easy to use search and navigate tools allow you to search through long sets of data and find specific packets of interest on the serial bus.
- Segmented memory allows you to capture seconds to days' worth of serial protocol traffic. The scope fills memory in segments as each acquisition sees a trigger condition, using time tags to track time between segments.



I²C

D9010LSSP provides a fast and easy way to debug the Inter-Integrated Circuit (I²C) serial communication busses found in a wide variety of embedded designs. It provides protocol-level debug information for Keysight's Infiniium series oscilloscopes. With new, enhanced serial analysis capabilities, D9010LSSP provides not only decode, but also listing window view, software searching, and trigger on search. When serial triggering is selected, the application enables special real-time triggering hardware to ensure that the scope never misses a trigger when armed.

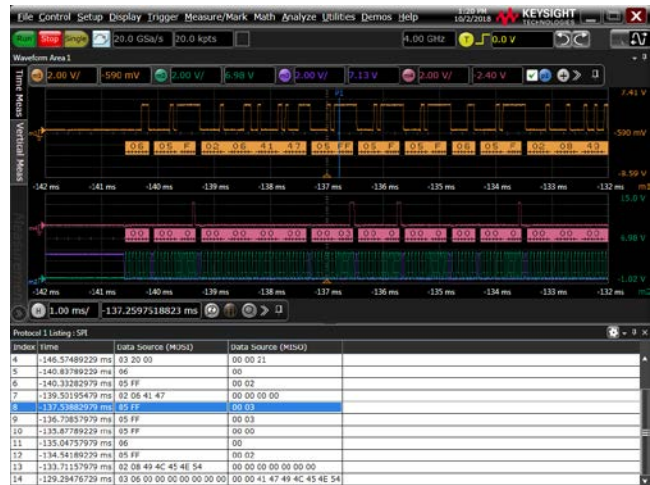


I²C specifications and characteristics

I ² C sources (clock and data)	Any analog channel Any digital channel (MSO only) Any waveform memory
Maximum rate (clock or data)	Up to 3.4 Mbps (automatically set)
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Trigger options	Start and Stop Start and Restart 7-bit Address Start and Restart 8-bit Address Start and Restart 10-bit Address Start and Restart 11-bit Address Specific values for up to three fields: Read or Write Address (Hex or Binary) Acknowledged / Not Acknowledged Data (up to 20 bytes in Hex, Binary, Decimal or ASCII)

SPI

D9010LSSP provides a fast and easy way to debug 2-wire, 3-wire or 4-wire Serial Peripheral Interface (SPI) serial communication busses found in a wide variety of embedded designs. It provides protocol-level debug information to Keysight's Infiniium series oscilloscopes. With new, enhanced serial analysis capabilities, D9010LSSP provides not only decode, but also listing window view, software searching, and trigger on search. When serial triggering is selected, the application enables special real-time triggering hardware to ensure that the scope never misses a trigger when armed.



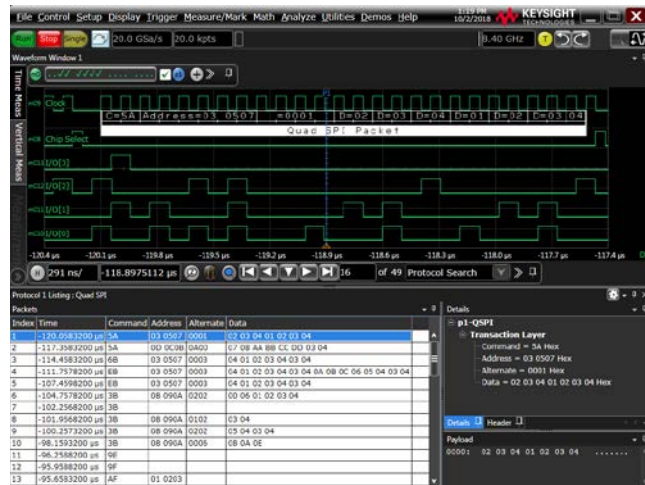
SPI specifications and characteristics

SPI protocols supported	2-wire (data, clock) 3-wire (data, clock, chip select) 4-wire (MOSI, MISO, clock, chip select)
SPI sources (all lines)	Any analog channel Any digital channel (MSO models) Any waveform memory
Maximum rate (clock or data)	Up to 50 Mbps (automatically set)
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	Word size: 4 to 32 bits Bit order: LSB or MSB
Trigger options	Up to 200 bits of data Operators include equals and OR

Quad SPI

Quad-SPI is a serial interface allowing communication on four lines between a host and external Quad-SPI memory. The Quad-SPI protocol supports traditional SPI as well as the dual-SPI mode which allows it to communicate on two lines. Quad-SPI uses up to six lines in quad mode: one line for chip select, one line for clock, and four lines for data in and data out.

Like all other low speed protocols on Infiniium, you will be able to set specific triggers, decodes, save and export data, run search queries, and view data in the lister. There is also an auto setup and symbolic decoding available.

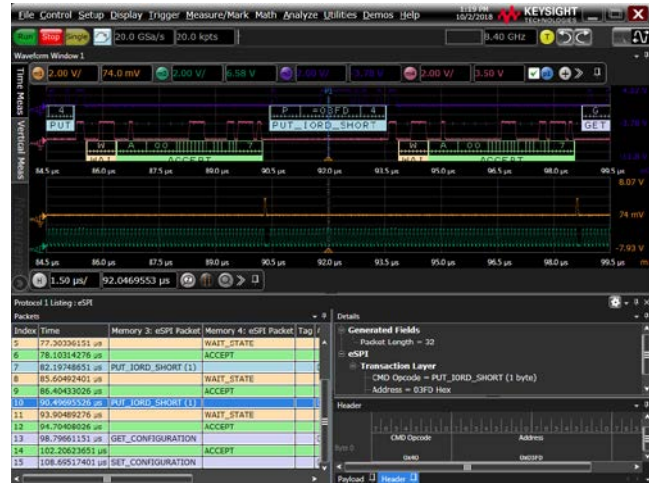


Quad SPI specifications and characteristics

Quad SPI modes supported	Single Data Rate (SDR) Double Data Rate (DDR)
Quad SPI Types	Single I/O (with or without hold) Dual I/O (with or without hold) Quad I/O
SPI sources (all lines)	Any analog channel (only when speed is ≤ 50 MHz) Any digital channel (MSO only, required for speeds > 50 MHz) Any waveform memory (only when speed is ≤ 50 MHz)
Maximum rate (clock or data)	SDR: up to 266 MHz DDR: up to 133 MHz
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	Clock sampling edge: rising or falling Chip select state: active high or active low Hold state: active high or active low Command phase: Single, dual, or quad I/O Address phase: None, single, dual, or quad I/O Address byte size: 1, 2, 3 or 4 Alternate byte phase: None, single, dual, or quad I/O Alternate byte size: 1, 2, 3 or 4 Number of dummy cycles: 0 to 31 Bit order: LSB or MSB Symbolic data decode available
Trigger options	Command: 8 bit value Address Alternate Data: up to 27 bytes

eSPI

Enhanced Serial Peripheral Interface (eSPI) is developed by Intel as a successor to its Low Pin Count (LPC) bus. So it can carry out not only legacy SPI data but also Embedded Controller (EC), Baseboard Management Controller (BMC) and Super-I/O. This standard allows designers to use 1-bit, 2-bit, or 4-bit communications at speeds from 20 to 66 MHz to further allow designers to trade off performance and cost. Extend your oscilloscope's capability with Keysight's eSPI triggering and decode application. It makes it easy to debug and test designs that include eSPI protocols using your Infiniium oscilloscope.



Quad I/O decode is only available on MSO models. Hardware triggering is only available on S-Series models.

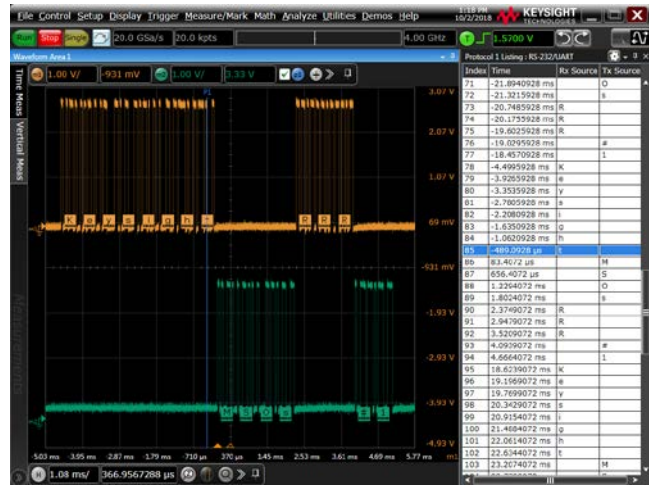
eSPI specifications and characteristics

eSPI modes supported	Single mode (clock, CS, MOSI, MISO, Alert) Dual mode (clock, CS, I/O[0], I/O[1], Alert) Quad mode (clock, CS, I/O[0], I/O[1], I/O[2], I/O[3], Alert)
eSPI sources (all lines)	Any analog channel (except Alert) Any digital channel (MSO only) Any waveform memory (except Alert)
Maximum rate (clock or data)	Up to 66 Mbps (automatic)
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	Response delay: 0 to 28 ns
Trigger options	Channel independent commands and responses Peripheral channel posted and completion commands Peripheral channel non-posted commands Peripheral channel completion responses Virtual wire channel commands and responses OOB message channel commands Flash access channel commands and responses Response status register Alert events, errors

RS232 / UART

D9010LSSP includes a suite of configurable protocol-level trigger conditions specific to RS-232 and other UART interfaces. When serial triggering is selected, the application enables special real-time triggering hardware to ensure that the scope never misses a trigger when armed.

The protocol viewer includes correlation between the waveforms and the selected packet, enabling you to quickly move between the physical and protocol layer information using the time-correlated tracking marker.

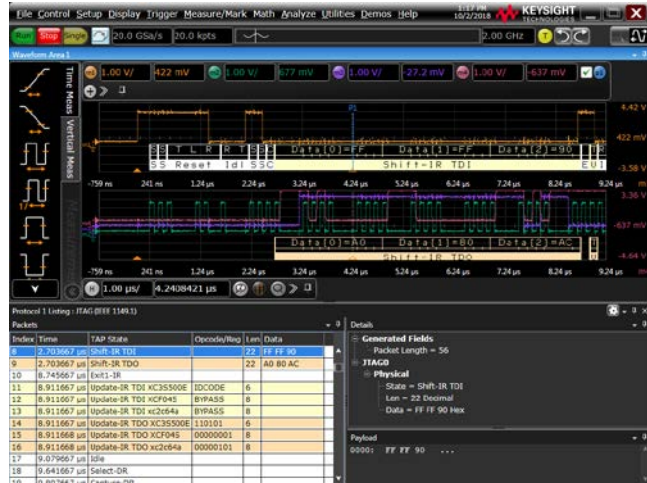


RS232 / UART specifications and characteristics

UART protocols supported	RS-232 RS-422 (up to 10 Mbps) RS-485 (up to 10 Mbps) Other UART interfaces that admit to the decode parameters in the application (see below) *90000 Series require E2697A hi-pod adapters for 1 MΩ probes
UART sources (Tx and Rx)	Any analog channel Any digital channel (MSO only) Any waveform memory
Maximum baud rate	1.2 kbps to 15 Mbps (manual)
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	Word size: 5 to 9 bits Parity: odd or even Idle polarity: low or high Bit order: MSB or LSB End of frame word: Hex, binary, decimal, or ASCII
Trigger options	Data: Rx or Tx, up to 27 bytes Parity error

JTAG

While oscilloscopes have long been used to debug JTAG (IEEE 1149.1) signal integrity issues, Keysight's Infiniium Series is the first oscilloscope family to support JTAG protocol decode. While the need to decode JTAG may be infrequent, the difficult process of manually decoding of JTAG TAP controller states, including instruction and data register values, is time consuming and error prone. D9010LSSP provides real-time, at-speed, JTAG decode from TMS, TDI, TDO and TCK signals acquired on either scope or digital (MSO) channels. This application imports device names and opcodes from industry standard BSDL files, displays JTAG protocol in real time, and flags certain types of error conditions. Signals must be probed at the periphery of the scan chain and cannot be probed in the middle of the scan chain.



The multi-tab protocol viewer includes search capabilities and correlation between the waveforms and the selected packet, enabling you to quickly move between the physical and protocol layer information using the time-correlated tracking marker.

JTAG specifications and characteristics	
JTAG sources	Any analog channel Any digital channel (MSO only) Any waveform memory
Maximum baud rate	Any (up to bandwidth of scope)
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	Load device BSDL file Custom device name and IR length
Trigger options	HW based: typically an edge trigger on TMS signal channel SW based: search on idle, reset, select, capture, shift, shift/pause, exit1, exit2, update-IR TDI/TDO device, update-DR TDI/TDO device, update, errors

I²S

I²S (Inter-IC Sound or Integrated Interchip Sound) is an electrical serial bus interface standard used for connecting digital audio devices together. From automobiles to cell phones, the I²S bus is prevalent in a breadth of different industries. Traditional methods of debugging serial buses, such as I²S, include the visual technique of manual bit counting. This method is not only tedious but is also prone to critical errors and inaccuracies compared to using professional software.



Extend your Infiniium oscilloscope's capability with Keysight's I²S protocol triggering and decode option. This protocol software has powerful triggering as well as unique software-accelerated decoding to help you precisely debug audio designs with the I²S bus. With support for several user-selectable signal alignment selections, including Time Division Multiplex (TDM), you will easily find and decode errors and signal integrity problems with confidence.

I²S specifications and characteristics

I ² S alignments supported	Standard I ² S Left and right justified TDM
UART sources (Tx and Rx)	Any analog channel Any digital channel (MSO only) Any waveform memory
Maximum baud rate	Any (automatic)
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	Transmitter / receiver word size: 4 to 64 bits Word select / frame sync edge direction: rising or falling Clock edge direction: rising or falling Bit order: MSB or LSB Display base: hex, signed decimal, binary
Trigger options	I ² S packets: equal to, not equal to, less than, greater than, within range, out of range, increasing, decreasing

SVID

This application includes a suite of configurable protocol-level trigger conditions specific to SVID. When serial triggering is selected, the application enables special real-time triggering hardware to ensure that the scope never misses a trigger when armed.

The multi-tab protocol viewer includes correlation between the waveforms and the selected packet, enabling you to quickly move between the physical and protocol layer information using the time-correlated tracking marker.

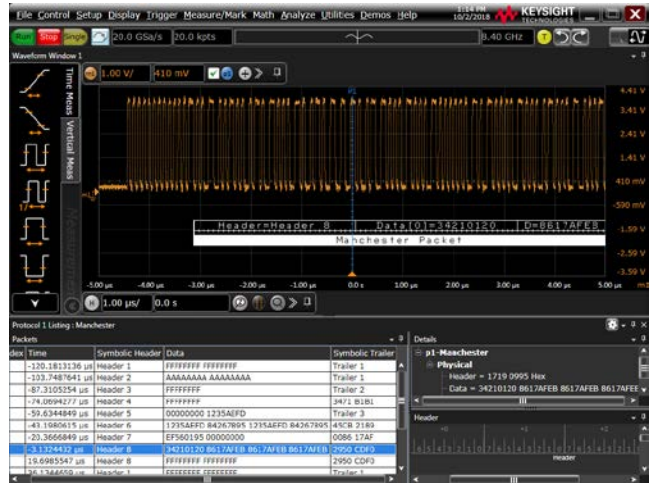


SVID specifications and characteristics

SVID modes supported	VR12.0 VR12.5
SVID sources	Any analog channel Any digital channel (MSO only) Any waveform memory
Maximum baud rate	Any (automatic)
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	All fields, including extended frame format
Trigger options	Packet types: set, get, set rejected, get rejected, errors Fields: start pattern, address, command, payload, C-parity, end pattern, acknowledge, filler, x-alert

Manchester

Manchester coding (also known as phase encoding, or PE), is one of the most prevalent physical layer encodings used in serial bus protocols. Often, Manchester encoded bus protocols are customized, uncommon, or proprietary, and are therefore not supported by protocol decode software. Keysight Technologies offers a generic Manchester decoder for troubleshooting and analyzing the physical layer of any Manchester signal. Experience flexibility like never before with Infiniium Oscilloscopes.



Keysight Technologies' serial bus applications for Infiniium oscilloscopes not only offer powerful triggering, but also provide unique software-accelerated decoding to help you accurately debug Manchester encoded signals. View the signal with ease through triggering on Start of Frame, Header and Data Value, Data Value, or Manchester Error. Customize the results through a variety of parameter input options. Set up a decode in under a minute and easily view the results in a convenient lister format.

Manchester specifications and characteristics

Manchester sources	Any analog channel Any digital channel (MSO only) Any waveform memory
Maximum baud rate	2 kbps to 10 Gbps
Auto setup	Automatically configures trigger levels, decode thresholds, sample rate, memory depth, holdoff, and trigger
Decode options	Tolerance: 5-30% (minimum depends on data rate) Polarity: rising = 1 or falling = 1 Word size: 1 to 32 bits Bit order: MSB or LSB Idle bits: 1.25 to 32 bits Start edge: 1 to 256 Sync size: 0 to 255 Header size: 0 to 32 bits Trailer size: 0 to 32 bits Symbolic data decode available
Trigger options	Manchester packet: header and data Manchester error

Ordering information and related literature

This option is offered as perpetual or time-based (subscription) license, as described in the tables and examples below. A valid support contract is included in the pricing for the term of any time-based licenses. For perpetual license holders, a separate support contract is required to access Keysight technical support and receive software updates.

Types	Description	Pricing formula
Node-locked	Allows you to use the license on one specified instrument/computer	
Transportable	Allows you to use the license on one instrument or computer at a time. This license may be transferred to another instrument or computer using Keysight's online tool.	130% of node-locked
USB Portable	Allows you to move the license from one instrument/computer to another by end-user only with a certified USB dongle, which is purchased separately.	130% of node-locked
Floating	Allows you to access the license on networked instruments / computers from a server, one at a time. For concurrent access, multiple licenses may be purchased.	140% of node-locked
Perpetual	Software license can be used in perpetuity.	
Time-Based	Software license is time limited to a defined period, such as 12 months	38% of a perpetual for a 12-month license
Support contract (for perpetual licenses)	Allows license holder access to Keysight technical support and all software upgrades.	15% of perpetual for 12 months of support

Software license and support subscription contract model number format:

R-B	Term / Service	P -	License type	License / Support contract term
	4 = Time Based License 5 = Perpetual 6 = Subscription		001 = Node-locked 002 = Floating 004 = Transportable 005 = USB Portable	A = Fixed B = Floating (Single Site) D = Floating (Transportable Perpetual) E = USB F = 6 month term L = 12 month term X = 24 month term Y = 36 month term Z = 60 month term

Examples

Software license and support configuration examples	Model number	Perpetual license	Support contract
Node-locked perpetual license and 12-month renewable support contract (most common)	D9010LSSP	R-B5P-001-A	R-B6P-001-L
Floating 24-month license subscription	D9010LSSP	N/A	R-6BP-002-X

Benefits of flexible license types (transportable, floating, USB portable)

- Maximize the flexibility of your test assets by sharing measurement applications between your Infiniium oscilloscopes
- Save money and increase your return on test asset investments as project needs change by purchasing fewer applications per instrument
- Save time by transporting the licenses to the test bench nearest you, instead of physically moving the test equipment or DUT
- Use the same application in different time zones, departments, and/or test benches
- Keep up with your changing project needs by transporting measurement application licenses; use a simple Keysight server connection with an instrument or a PC to check-in/out licenses

Related literature

Type	Description / URL
Brochure	S-Series Product Fact Sheet
Brochure	V-Series Product Fact Sheet
Brochure	30 Things Only Infiniium Oscilloscopes Can Do

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

