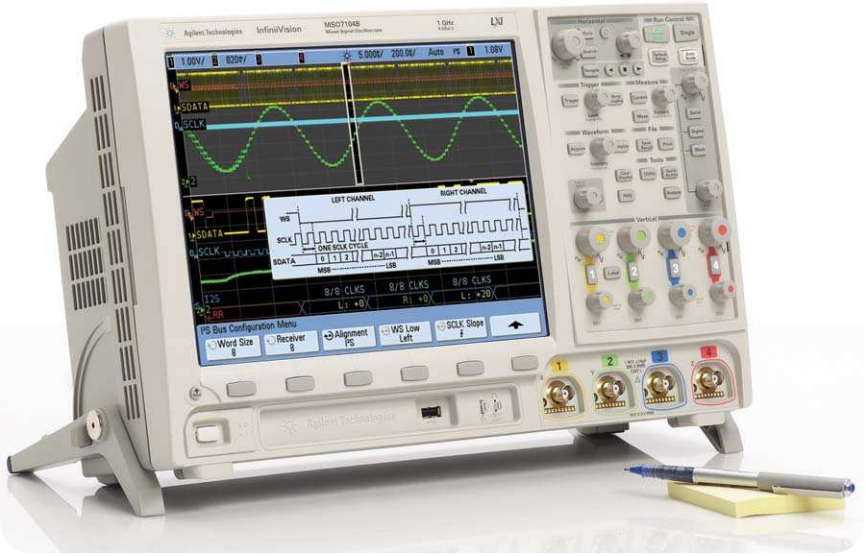
I²S Triggering and Hardware-based Decode (Option SND) for Agilent InfiniiVision Oscilloscopes

Data Sheet

Find and debug intermittent errors and signal integrity problems faster

Features:

- I²S serial bus triggering
- I²S hardware-based protocol decoding
- User-selectable signal alignment selections
- Multiple triggering selections



I²S (Inter-IC Sound, or Integrated Interchip Sound), is an electrical serial bus interface standard used for connecting digital audio devices together, such as compact disc, digital audio tape, digital sound processors, and digital TV sound. Traditional methods of debugging serial busses such as I²S includes manual bit counting. But this visual technique of counting "1's" and "0's" can be tedious and prone to errors, especially since I²S is typically formatted in a 2's complement format.

Agilent Technologies' serial bus options for the InfiniiVision oscilloscopes not only offers powerful triggering, but also provides unique hardware-accelerated decoding to help you debug audio designs with the I²S bus faster. With the industry's fastest serial decode update rates, you can more easily find and debug random and intermittent errors and signal integrity problems that you could easily miss using other serial bus decode tools.

Agilent Technologies

Other oscilloscope solutions with serial bus triggering and protocol decode typically use software post-processing techniques to decode serial packets/frames. Using these software techniques, waveform- and decode-update rates tend to be slow (sometimes seconds per update), especially when you use deep memory, which is often required to capture multiple packetized serial signals.

Figure 1 shows an example of decoding a stream of 2 channels of transmitted 8-bit audio data based on standard WS/SCLK timing alignment. The trigger condition for this example was set to synchronize on an "increasing" data value generated by the left channel of digital transmission captured on channel-1 of the oscilloscope (yellow trace).

In addition to viewing the I²S decoded strings time-correlated to the captured waveforms, you can also select to view multiple packets in a tabular format using the scope's protocol lister display mode. And with Agilent's 7000B Series oscilloscopes, you can also easily search and navigate within the lister to find and mark particular events of interest with direct time-correlation to the waveform display. In the example shown in Figure 2, an "error" search condition was setup. In this case, the scope found three words that contain errors over a 25 ms time span.

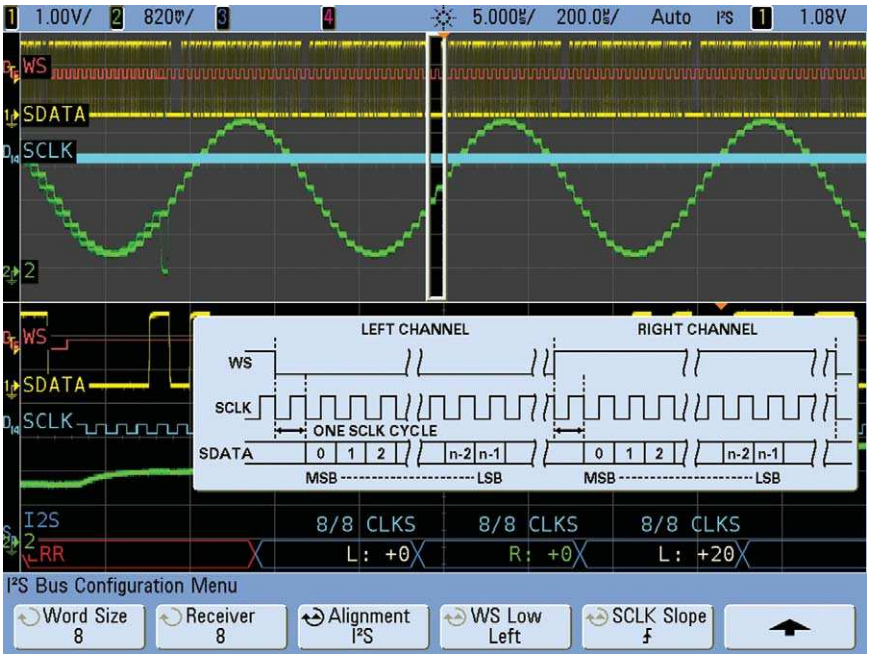


Figure 1: An InfiniiVision series oscilloscope capturing and decoding 2 channels of I²S audio data.

Figure 2. Viewing I²S decoded words in the protocol lister display along with automatic search and navigation.

Segmented Memory acquisition captures and stores serial bus data packets

The Segmented Memory acquisition option (Option LMT) for Agilent's InfiniiVision Series oscilloscopes can optimize your scope's acquisition memory, allowing you to capture more I^2S packets of data while using less memory. Segmented memory acquisition optimizes the number of serial packets that can be captured consecutively by selectively ignoring (not digitizing) unimportant idle time or unimportant packets of data. And with a minimum 250 picoseconds time-tagging resolution, you will know the precise time between each captured word.

Figure 3 shows an example of capturing consecutive occurrences of a "left" channel word with a decimal value of +39 using a specific I^2S trigger setup to capture this condition. The scope easily captures 2000 consecutive occurrences of this word for a total acquisition time of over 600 ms. After acquiring these 2000 I^2S words, we can then scroll through all words individually to look for any anomalies or errors.

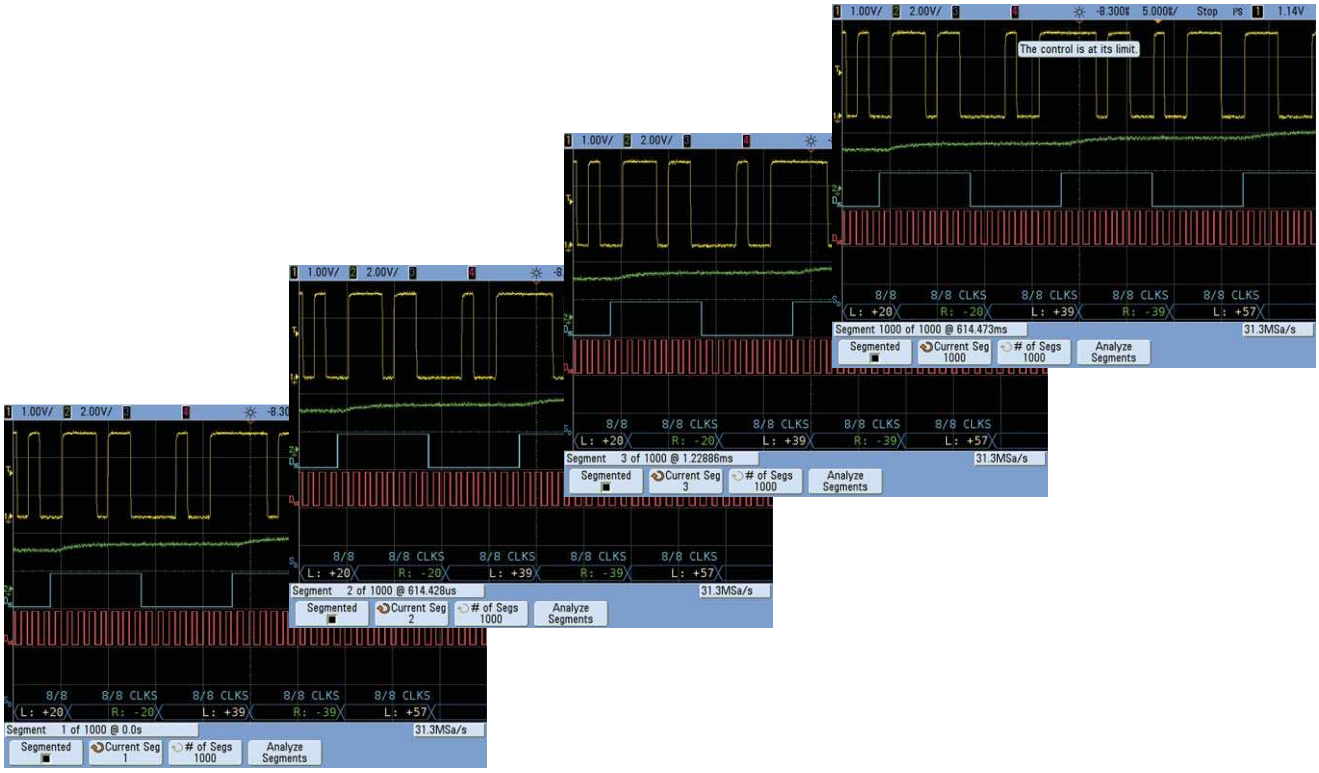


Figure 3. Segmented Memory acquisition captures up to 2000 consecutive packets of data with precise time-tagging.

Agilent InfiniiVision Portfolio

Agilent's InfiniiVision lineup includes 5000, 6000 and 7000 Series oscilloscopes. These share a number of advanced hardware and software technology blocks. Use the following selection guide to determine which best matches your specific needs.

Largest display, shallow depth

Optional battery, 100 MHz MSO

Ideal for ATE rackmount applications

Smallest form factor, lowest price

Bandwidth	7000 Series	6000A Series	6000L Series	5000 Series
100 MHz Bandwidth	●	●	●	●
300/350 MHz Bandwidth	●	●	●	●
500 MHz Bandwidth	●	●	●	●
1 GHz Bandwidth	●	●	●	
MSO Models	●	●	●	
GPIB Connectivity		●	●	●
Rackmount height	7U	5U	1U	5U
Battery option		●		
Display size	12.1″	6.3″		6.3″
Footprint (WxHxD)	17.9″x 10.9″x 6.8″	15.7″x 7.4″x 11.1″	17.1″x 1.7″x 10.6″	15.2″x 7.4″x 6.9″

Agilent's InfiniiVision oscilloscope portfolio offers:

- A variety of form factors to fit your environment
- Insightful application software
- Responsive controls and best signal visibility
- Responsive deep memory with Mega*Zoom* III

Performance characteristics

Performance characteristics	
SCLK, WS, and SDATA source	Analog channels 1, 2, 3, or 4 Digital channels D0 – D15 (on MSO models)
Bus Configuration:	
Transmitted Word Size	4 to 32 (user selectable)
Decoded/Receiver Word Size	4 to 32 (user selectable)
Alignment	Standard, Left-justified, or Right-justified
Word Select - Low	Left-channel or Right-channel
SCLK Slope	Rising edge or Falling edge
Decoded Base	Hex (2's complement) or Signed Decimal
Triggering:	
Audio Channel	Audio Left, Audio Right, or Either
Trigger Modes	= (Equal to entered data value) ≠ (Not equal to entered data value) < (Less than entered data value) > (Greater than entered data value) >< (Within range of entered data values) <> (Out of range of entered data values) Increasing value that crosses armed (<=) and trigger (>=) entered data values Decreasing value that crosses armed (>=) and trigger (<=) entered data values
Color-coded decode:	
Left Channel	R: "decoded value" in green
Right Channel	L: "decoded value" in white
Error	ERR in red (mismatch between transmitted and received word size, or invalid input signaling)
Word Size Indicator	"# of TX / # of RX" CLKS in blue displayed above each decoded word

Ordering Information

The I^2S trigger and decode option is compatible with all 4-channel and 4+16 channel Agilent InfiniiVision Series oscilloscopes (5000, 6000, and 7000 series scopes). This option is available as a factory-installed option if ordered as Option-SND along with a specific oscilloscope model, or existing InfiniiVision Series oscilloscope users can order this option as an after-purchase product upgrade (N5468A).

Model number user installed	Option number factory installed	Description
N5468A	SND	I^2S triggering and decode (4 and 4+16 channel models only)
N5457A	232	RS232/UART triggering and decode (4 and 4+16 channel models only)
N5423A	LSS	I^2C/SPI serial decode option (4 and 4+16 channel models only)
N5424A	AMS	CAN/LIN automotive triggering and decode (4 and 4+16 channel models only)
N5454A	SGM	Segmented Memory

Note that additional options and accessories are available for Agilent InfiniiVision Series oscilloscopes. Refer to the appropriate 5000, 6000, or 7000 Series data sheet for ordering information about these additional options and accessories, as well as ordering information for specific oscilloscope models.

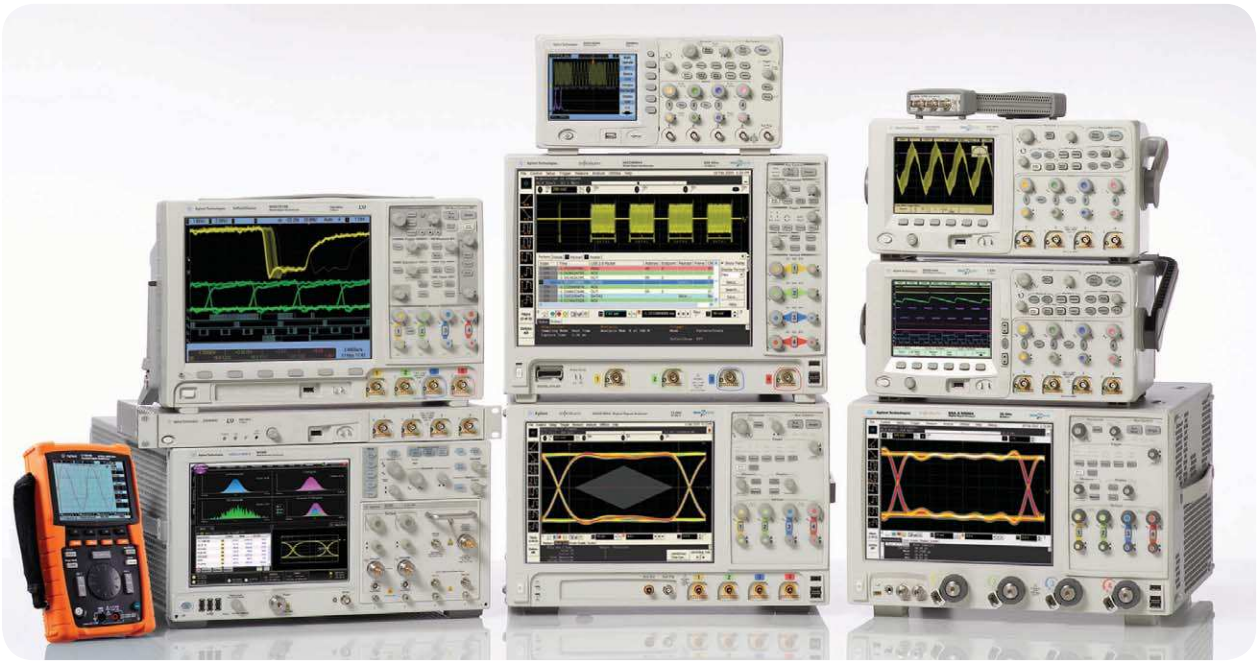
Related Agilent literature

Publication title	Publication type	Publication number
Agilent 7000 Series InfiniiVision Oscilloscopes	Data sheet	5990-4769EN
Agilent 6000 Series InfiniiVision Oscilloscopes	Data sheet	5989-2000EN
Agilent 5000 Series InfiniiVision Oscilloscopes	Data sheet	5989-6110EN
Agilent InfiniiVision Series Oscilloscope Probes and Accessories	Data sheet	5968-8153EN
Segmented Memory Acquisition (5454A) for Agilent InfiniiVision Series Oscilloscopes	Data sheet	5989-7833EN
RS-232/UART Triggering and hardware-based decode (N5457A for Agilent InfiniiVision Series Oscilloscopes	Data sheet	5989-7832EN
I2C and SPI triggering and hardware-based decode (N5423A) for Agilent InfiniiVision Series Oscilloscopes	Data sheet	5989-5126EN
CAN/LIN (N5424A) decode and triggering option for Agilent InfiniiVision Series Oscilloscopes	Data sheet	5989-6220EN
Evaluating Oscilloscopes for Best Waveform Update Rates	Application note	5989-7885EN
Evaluating Oscilloscopes to Debug Mixed-Signal Designs	Application note	5989-3702EN
Using an Agilent InfiniiVision MSO to Debug an Automotive CAN Bus	Application note	5989-5049EN
Evaluating Oscilloscope Bandwidths for your Applications	Application note	5989-5733EN
Evaluating Oscilloscope Sample Rates vs. Sampling Fidelity	Application note	5989-5732EN
Evaluating Oscilloscope Vertical Noise Characteristics	Application note	5989-3020EN
Evaluating Oscilloscope Segmented Memory for Serial Bus Applications	Application note	5990-5817EN

To download these documents, insert the publication number in the URL:
http://cp.literature.agilent.com/litweb/pdf/xxxx-xxxxEN.pdf

Product Web site

For the most up-to-date and complete application and product information, please visit our product Web site at: **www.agilent.com/find/7000**



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