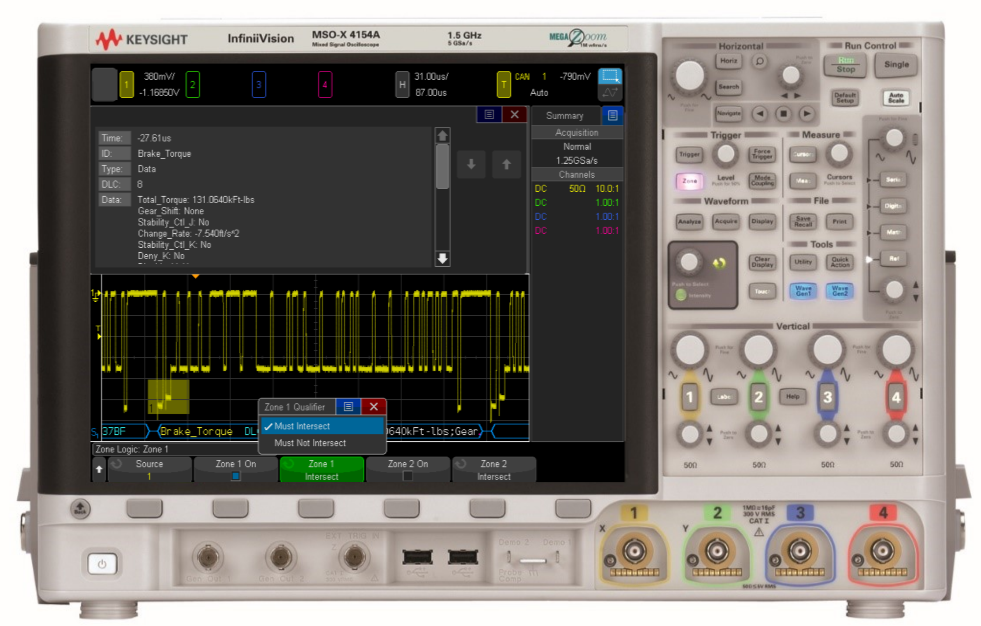
DATA SHEET

Automotive Software Package

for InfiniiVision X-Series Oscilloscopes

The Automotive Software Package for Keysight's InfiniiVision oscilloscopes enables protocol triggering and decode for a broad range of the most common automotive serial buses used today for power train and body control and monitoring. This package also enables other advanced analysis capabilities including eye-diagram mask testing and frequency response analysis to help test and debug automotive electronic systems.



KEYSIGHT TECHNOLOGIES

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Introduction

The primary reason engineers use oscilloscopes to debug and characterize automotive serial buses, such as CAN, CAN FD, LIN, SENT, PSI5, CXPI and FlexRay, is because of an oscilloscope's inherent ability to characterize the analog quality of these signals. Performing analog characterization using an oscilloscope is often referred to as "physical layer" measurements.

Many of the most popular automotive serial bus protocol decode & triggering capabilities and advanced analysis features are enabled on InfiniiVision X-Series oscilloscope if licensed with the Automotive Software Package. Table 1 lists the specific measurement capabilities that are enabled on each series with the Automotive Package.

Table 1. Automotive Software Packages InfiniiVision Oscilloscopes

InfiniiVision X-Series		2000A	3000A	3000T	4000A	6000A	P9240	M9240
Automotive Package Model Number		D2000AUTB	D3000AUTB	D3000AUTB	D4000AUTB	D6000AUTB	P9240AUTC	M9240AUTB
Serial Trigger & Decode	CAN [1]	✓	✓	✓	✓	✓	✓	✓
	CAN FD [1]			✓	✓	✓	✓	✓
	LIN [2]	✓	✓	✓	✓	✓	✓	✓
	FlexRay		✓	✓	✓	✓		
	SENT			✓	✓	✓	✓	✓
	PSI5 (User-definable Manchester)			✓	✓	✓	✓	✓
	User-definable NRZ			✓	✓	✓	✓	✓
	CXPI			✓	✓	✓	✓	✓
Advanced Analysis	Mask Limit Test [3]	✓	✓	✓	✓	✓	✓	✓
	Measurement Limit Test	✓	✓	✓	✓	✓		
	Frequency Response Analysis (Bode Plots)			✓	✓	✓	✓	✓
	Advanced Math	Std	✓	Std	Std	Std	Std	Std

Notes:
1. Symbolic decoding supported by importing a .dbc file, except on the 2000A and 3000A Series.
2. Symbolic decoding supported by importing a .ldf file, except on the 2000A and 3000A Series.
3. CAN, CAN FD, FlexRay, and SENT mask files available for download at no additional charge.

Although there are many oscilloscopes on the market today from multiple vendors that offer automotive-focused options, Keysight's InfiniiVision Series oscilloscopes offer some unique measurement capabilities for debugging and characterizing the physical layer of automotive serial buses including:

- CAN and CAN FD symbolic trigger and decode (based on .dbc file import)
- LIN symbolic trigger and decode (based on .ldf file import)
- CAN eye-diagram mask testing
- CAN FD eye-diagram mask testing
- FlexRay eye-diagram mask testing
- SENT mask pulse-shape physical layer testing
- Dual-bus time-interleaved protocol lister display
- Hardware-based decoding for responsiveness
- Decoding of all frames captured using segmented memory
- Real-time frame/error counter with bus load measurement
- Zone trigger to isolate occurrences of CAN bus arbitration
- Signal charting (CAN, CAN FD, LIN, and SENT)

To learn more about these advanced measurement capabilities, refer to the extensive list of Keysight automotive-focused application notes listed at the end of this document.

Figure 1 shows an example of symbolically decoding the CAN bus with a .dbc file while triggering on occurrences of arbitration with an InfiniiVision oscilloscope's unique zone trigger capability.

Figure 1. Capturing CAN bus arbitration while decoding CAN messages symbolically.

Also available on the InfiniiVision 3000T, 4000A, and 6000A X-Series oscilloscopes is signal charting for the CAN, CAN FD, LIN, and SENT automotive serial buses. For any signals that have been defined in an imported .dbc file (CAN data base file), .ldf file (LIN descriptive file), or SENT transfer function based on user-defined bits, these InfiniiVision oscilloscopes can chart signal values using the “Chart Serial Signal” waveform math function. Signal values can be charted either time-correlated to the captured automotive serial bus waveform or charted in a non-time-correlated roll mode for up to 1 hour. This can be very useful for tracking signal values that change very slowly over a long period of time such as temperature or pressure. Figure 2 shows an example of charting the position of a SENT-based electronic throttle blade. We can see that throttle blade changed from fully open (100%) to fully closed (0%) two times over a 2 second time span. The yellow waveform (channel-1) is the real-time capture of approximately 1500 SENT frames. The purple waveform is a plot of the S1 signal (throttle blade position) based on data in each frame. The Top and Base measurements are the throttle positions in percent. The +Width measurement shows that the throttle position was fully open (100%) for approximately 500 milliseconds.

Figure 2. SENT-based throttle blade position signal (S1) charted on the oscilloscope’s display.

Serial Trigger and Decode

CAN (2000A and 3000A X-Series models)

Table 2. CAN Performance Characteristics (2000A and 3000A X-Series only)

CAN input source	Analog channels 1, 2, 3 or 4
	Digital channels D0 to D15 non-differential. (except 2000 X-Series)
Signal types	Rx, Tx, CAN_L, CAN_H, Diff (L-H), Diff (H-L)
Baud rates	10 kb/s up to 5 Mb/s
Triggering	Start-of-frame (SOF)
	Remote frame ID (RMT)
	Data frame ID (~RMT)
	Remote or data frame ID
	Data frame ID and data
	Error frame
	All errors (includes protocol “form” errors that may not generate flagged error frames)
	Acknowledge errors
	Overload frames
	ID length: 11 bits or 29 bits (extended)
Hardware-based decode	Frame ID (hex digits in yellow)
	Remote frame (RMT in green)
	Data length code (DLC in blue)
	Data bytes (hex digits in white)
	CRC (hex digits in blue = valid, hex digits in red = error)
	Error frame (bi-level bus trace and ERR message in red)
	Form error (bi-level bus trace and “?” in red)
	Overload frame (“OVRLD” in blue)
	Idle bus (mid-level bus trace in dark blue)
	Active bus (bi-level bus trace in dark blue)
Multi-bus analysis	CAN plus one other serial bus, including another CAN bus. (except 2000 X-Series)
Totalize function	Total frames, total overload frames, total error frames, bus utilization (bus load)
Eye-diagram mask testing	Various downloadable mask files available based on differential probing polarity, baud rate and network length

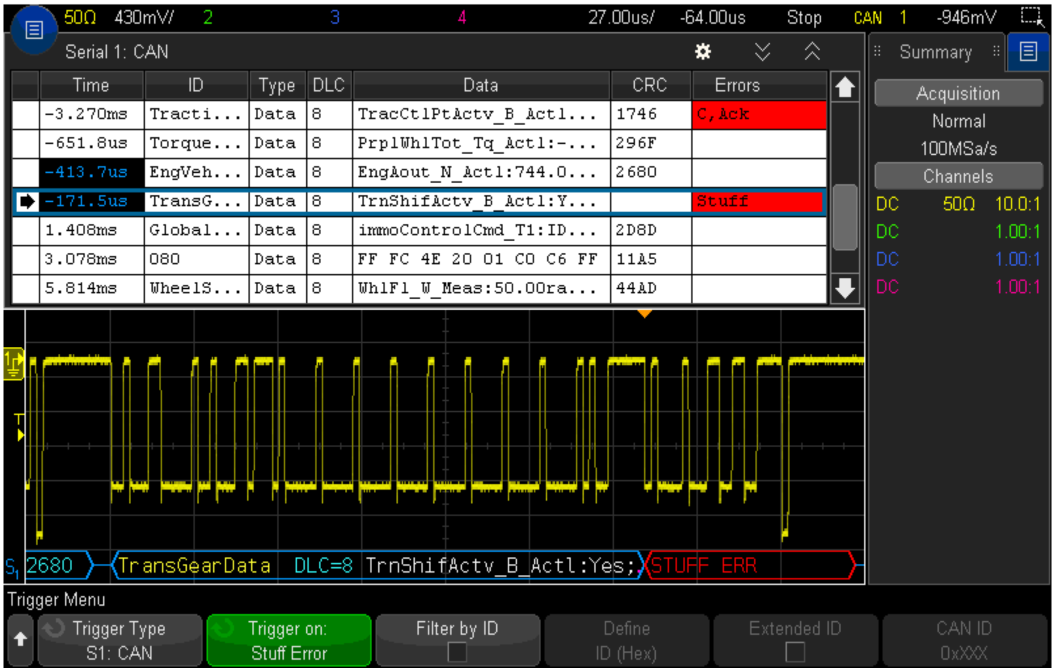

Figure 3. CAN decode on an InfiniiVision X-Series oscilloscope.

CAN/CAN FD (3000T, 4000A, 6000A, P9240, and M9240 X-Series models)

Table 3. CAN/CAN FD Performance Characteristics

Note: "Classic" CAN 2.0 specifications are a subset of the combined CAN/CAN FD ISO specifications. CAN FD trigger and decode supports ISO and non-ISO CAN FD specifications.	
CAN input source	Analog channels 1, 2, 3 or 4
	Digital channels D0 to D15 non-differential
Signal types	Rx, Tx, CAN_L, CAN_H, Diff (L-H), Diff (H-L)
Standard baud rates	10 kb/s up to 5 Mb/s
FD baud rates	10 kb/s up to 10 Mb/s
Triggering	SOF (Start-of-frame)
	EOF (End-of-frame, filtered by ID)
	Data frame ID (11 bits or 29 bits: Extended)
	Data frame ID and data – non FD
	Data frame ID and data - FD
	Remote frame ID (RTR)
	Remote or data frame ID
	Error frame (filtered by ID)
	Acknowledge error (filtered by ID)
	Form error (filtered by ID)

Triggering	Stuff error (filtered by ID)
	CRC error (filtered by ID)
	Spec error (includes Ack, Form, Stuff or CRC error; filter by ID)
	All errors (includes any Spec error or Error frame; filtered by ID)
	BRS bit (filtered by ID of FD frames only)
	CRC delimiter bit (filtered by ID of FD frames only)
	ESI bit active (filtered by ID of FD frames only)
	Overload frames
Symbolic triggering (based on .dbc file)	Message names
	Message and signal values/encoded states (first 8 bytes)
Hardware-based decode	Frame ID (hex digits in yellow)
	Remote frame (RMT in green)
	Data length code (DLC = with decimal digits in blue)
	Data bytes (hex digits in white)
	ESI bit passive (frame type column in lister shaded yellow; FD frames only)
	Error frame (bi-level red bus trace with ERR FRAME in red)
	Stuff bit error (bi-level red bus trace with STUFF ERR in red)
	Form error (bi-level red bus trace with FORM ERR in red)
	Acknowledge error (bi-level red bus trace with ACK ERR in red)
	CRC (hex digits in blue = valid, hex digits in red = error)
	Overload frame ("OVRLD" in blue)
	Idle bus (mid-level dark blue bus trace)
	Active bus (bi-level dark blue bus trace with embedded decode within)
Symbolic decode (based on .dbc file)	Message names (alpha-numeric characters in yellow)
	Signal names, value/encoded state (first 8 bytes) and units (alpha-numeric characters in white)
Multi-bus analysis	CAN/CAN FD plus one other serial bus, including another CAN/CAN FD bus
Totalize function (real time)	Total frames, total error frames with %, total spec errors, bus load in %
CAN/CAN FD Eye-diagram mask testing	Various downloadable mask files available based on differential probing polarity, baud rate and network length

LIN

Table 4. LIN Performance Characteristics

LIN input source	Analog channels 1, 2, 3 or 4
	Digital channels D0 to D15 (except 2000A X-Series)
LIN standards	LIN 1.3 or LIN 2.X
Baud rates	2400 b/s to 625 kb/s
Triggering	Sync break
	Frame ID (0X00HEX to 0X3FHEX)
	Frame ID and data
	Parity error
	Checksum error
Hardware-based decode	Frame ID (6-bit hex digits in yellow)
	Frame ID and optional parity bits (8-bit hex digits in yellow if valid, red if parity bit error)
	Data bytes (hex digits in white)
	Check sum (hex digits in blue = valid, hex digits in red = error)
	Sync error (“SYNC” in red)
	THeader-max (“THM” in red)
	TFrame-max (“TFM” in red)
	Parity error (“PAR” in red)
	LIN 1.3 wake-up error (“WUP” in red)
	Idle bus (mid-level bus trace in dark blue)
	Active bus (bi-level bus trace in dark blue)
Symbolic triggering based on -ldf file (except 2000A and 3000A X-Series)	Message names
	Message and signal values/encoded states
Multi-bus analysis	LIN plus one other serial bus, including another LIN bus. (except 2000A X-Series)

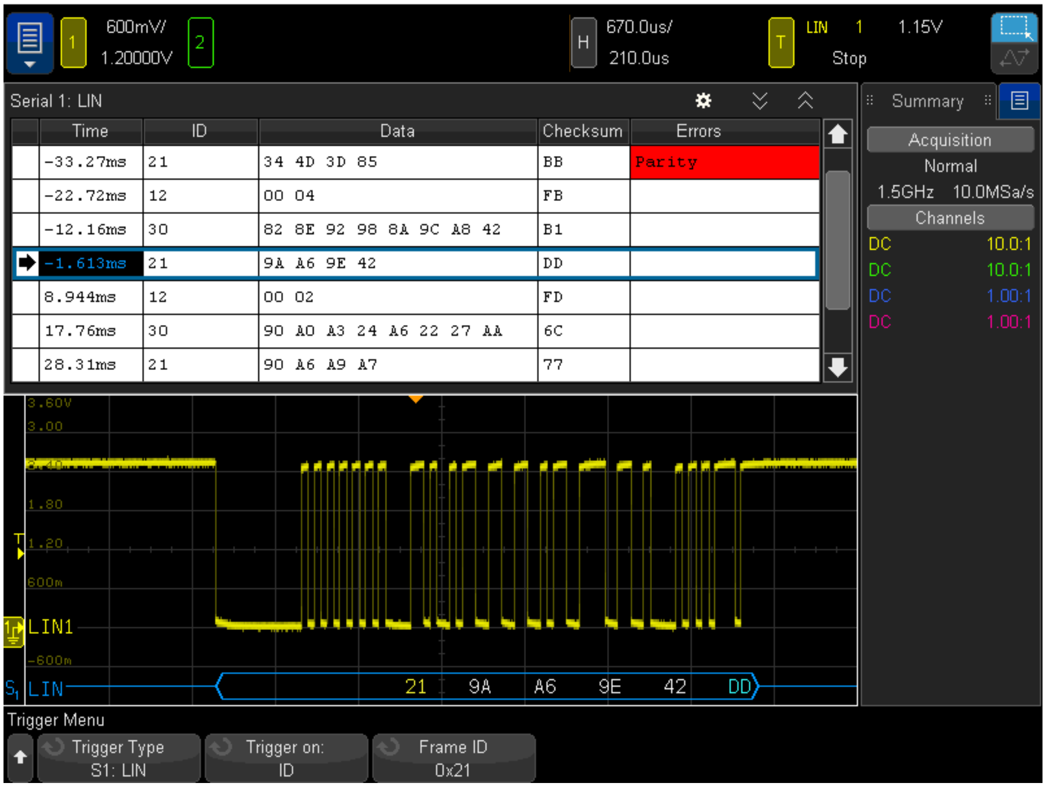

Figure 4. LIN decode on an InfiniiVision X-Series oscilloscope.

FlexRay

Table 5. FlexRay Performance Characteristics

FlexRay input source	Channel 1, 2, 3 or 4 (using differential probe)
FlexRay channels	A or B
Baud rates	2.5 Mbps, 5.0 Mbps and 10 Mbps
Frame triggering	Frame type: Startup (SUP), not startup (~SUP), sync (SYNC), not sync (~SYNC), null (NULL), not null (~NULL), normal (NORM) and All
	Frame ID: 1 to 2047 (decimal format) and All
	Cycle
	Base: 0 to 63 (decimal format) and All
	Repetition: 1, 2, 4, 8, 16, 32, 64 (decimal format) and All
Error triggering	All errors
	Header CRC error
	Frame CRC error
Event triggering	Wake-up
	TSS (transmission start sequence)
	BSS (byte start sequence)
	FES/DTS (frame end or dynamic trailing sequence)
Frame decoding	Frame type (NORM, SYNC, SUP, NULL in blue)
	Frame ID (decimal digits in yellow)
	Payload-length (decimal number of words in green)
	Header CRC (hex digits in blue if valid or red digits if invalid)
	Cycle number (decimal digits in yellow)
	Data bytes (HEX digits in white)
	Frame CRC (hex digits in blue if valid or red digits
Totalize function	Total frames
	Total synchronization frames
	Total null frames
Eye-diagram mask testing (requires mask test option plus downloadable mask files)	TP1 standard voltage (10 Mbps only)
	TP1 increased voltage (10 Mbps only)
	TP11 standard voltage (10 Mbps only)
	TP11 increased voltage (10 Mbps only)
	TP4 10 Mbps, TP4 5 Mbps and TP4 2.5 Mbps
Multi-bus analysis	FlexRay plus one other serial bus (including another FlexRay bus)

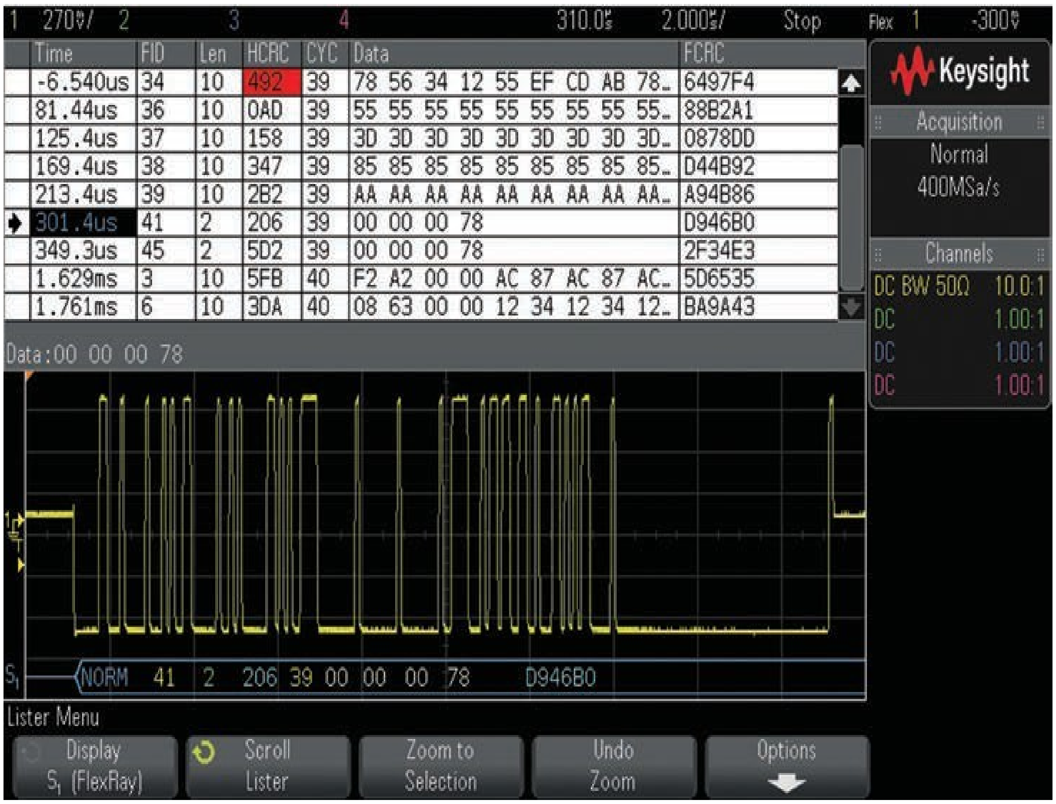

Figure 5. FlexRay decode on an InfiniiVision X-Series oscilloscope.

SENT (Single Edge Nibble Transmission)

Table 6. SENT Performance Characteristics

CAN input source	Analog channels 1, 2, 3 or 4
	Digital channels D0 to D15 non-differential
Clock period	1 µs to 300 µs with user-defined tolerance setting from 3 to 30%
Number of nibbles	1 to 6
Idle state	High or low
CRC format	2008 or 2010 standards
Pause pulse/SPC mode	Pause On, Pause Off, or SPC Mode
Message format	Fast Nibbles (All)
	Fast Signals (only)
	Fast + Short Serial
	Fast + Enhanced Serial (automatically detects bit format: 12-bit data/8-bit ID or 16-bit data/4-bit ID)
	Short Serial (only)
	Enhanced Serial (only)
Number of defined signals	1 to 6 (each specified by start bit #, number of bits and nibble order)
Numerical format of signals	Hexadecimal, unsigned decimal or transfer function with user-defined multiplier and offset for each defined signal
Triggering	Start of fast channel message
	Start of slow channel message
	Fast channel status and communication nibble + data
	Slow channel message ID
	Slow channel message ID + data
	Tolerance violation (sync pulse width exceeds user-specified tolerance)
	Fast channel CRC error
	Slow channel CRC error
	All CRC errors
	Pulse period error (if nibbles are < 12 or > 27 ticks wide)
	Successive sync pulses error (if consecutive sync pulse widths are greater than 1/64 difference)
Fast channel decode	Status and communication nibble (binary digits in green)
	Data (hex, unsigned decimal or transfer function digits in white based on user-defined signal format)
	CRC error (hex digit in blue = valid, hex digit in red = error)
	Pulse period error (< or > in red)
Slow channel decode	Message ID (hex digits in yellow)
	Data (hex digits in white)
	CRC (hex digits in blue = valid, hex digits in red = error)
Multi-bus analysis	SENT plus one other serial bus, including another SENT bus

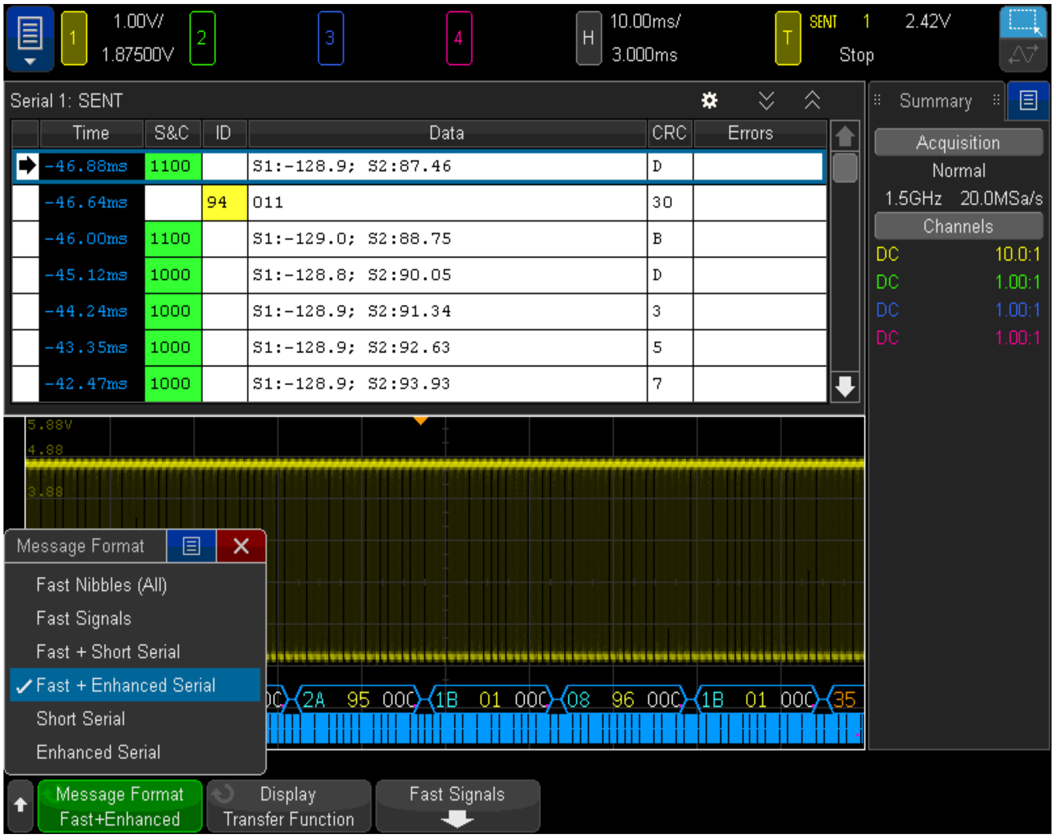

Figure 6. SENT decode on an InfiniiVision X-Series oscilloscope.

PSI5 (based on User-definable Manchester)

Table 7. User-definable Manchester Performance Characteristics

Input source	Analog channels 1, 2, 3 or 4
	Digital channels D0 to D15 non-differential
Baud rate	500 bps to 5 Mbps
	Automatic RF demodulation at 212 kbps and 424 kbps (NFC-F)
Baud rate tolerance	5 to 30%
Display format	Word or bits
Polarity	Rising edge = 1 or falling edge = 1
Bit order	MSB or LSB (MSB only in binary display format)
Idle	1.5 to 32 bits
Sync size	0 to 255 bits
Header size (word format only)	0 to 32 bits
Number of words (word format only)	1 to 255 or auto
Data word size (word format only)	2 to 32 bits
Trailer size (word format only)	0 to 32 bits (0 if using “Auto” number of words)
Triggering	SOF (Start-of-frame)
	Value (first 4 to 128 bits entered in binary format)
	Manchester error
Decoding (word format)	Decode base (HEX, ASCII or unsigned decimal)
	Header field (all digits in yellow)
	Data field (all digits in white)
	Trailer (all digits in blue)
Decoding (bit format)	All binary digits in white
Multi-bus analysis	User-definable Manchester plus one other serial bus

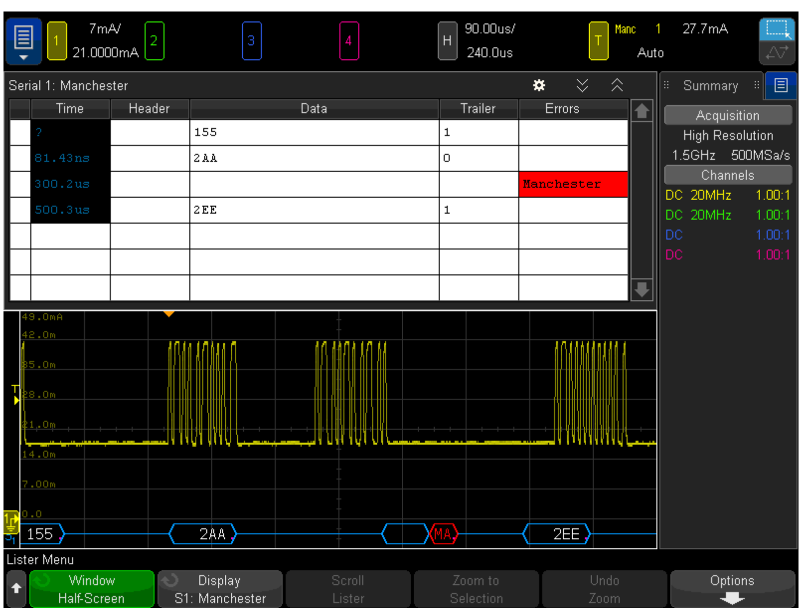

Figure 7. PSI5 decode on an InfiniiVision X-Series oscilloscope.

User-definable NRZ (non-return to zero)

Table 8. User-definable NRZ Performance Characteristics

Input source	Analog channels 1, 2, 3 or 4
	Digital channels D0 to D15 non-differential
Baud rate	5 kbps to 5 Mbps
Display format	Word or bits
Polarity	High = 1 or low = 1
Bit order	MSB or LSB (MSB only in binary display format)
Idle	1.5 to 32 bits
Idle state	High or low
Number of start bits	0 to 255 bits
Header size (word format only)	0 to 32 bits
Number of words (word format only)	1 to 255
Data word size (word format only)	2 to 32 bits
Trailer size (word format only)	0 to 32 bits
Triggering	SOF (Start-of-frame)
	Value (first 4 to 128 bits entered in binary format)
Decoding (word format)	Decode base (HEX, ASCII or unsigned decimal)
	Header field (all digits in yellow)
	Data field (all digits in white)
	Trailer (all digits in blue)
Decoding (bit format)	All binary digits in white
Multi-bus analysis	User-definable NRZ plus one other serial bus

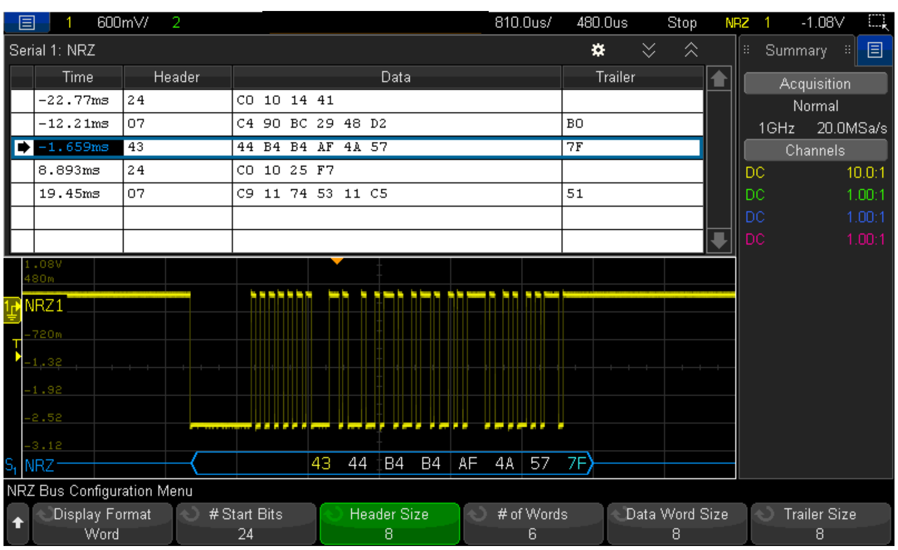

Figure 8. User-definable NRZ decode on an InfiniiVision X-Series oscilloscope.

CXPI (Clock Extension Peripheral Interface)

Table 9. CXPI Performance Characteristics

CXPI input source	Analog channels 1, 2, 3 or 4
Baud rates	9.6 kb/s to 40 kb/s (20 kb/s typical) with tolerance setting
Triggering	SOF (Start-of-frame)
	EOF (End-of-frame)
	PTYPE
	Frame ID (PTPYE present or not present)
	Frame ID + info + data
	Frame ID + info + data (long frame)
	CRC field error (filtered by ID)
	Parity error
	Inter-byte space error (filtered by ID)
	Inter-frame space error (filtered by ID)
	Framing error (filtered by ID)
	Data length error (filtered by ID)
	Sample error
	All errors
	Sleep frame
	Wakeup pulse
Hardware-based decode	Frame ID (hex digits in yellow if valid or red if parity error)
	Data length code (DLC = with decimal digits in blue)
	Network management (NM) bits (binary digits in green)
	Counter (CT) bits (binary digits in yellow)
	Data (hex digits in white)
	CRC (hex digits in blue = valid, hex digits in red = error)
	Idle bus (mid-level dark blue bus trace)
	Active bus (bi-level dark blue bus trace with embedded decode within)
	Inter-byte space error (IBS ERR in red)
	Data length error (LEN ERR in red)
	Sleep mode (SLEEP MODE in orange within bi-level orange bus trace)
	Wakeup pulse (WAKEUP PULSE in blue with bi-level blue bus trace)
Multi-bus analysis	CXPI plus one other serial bus

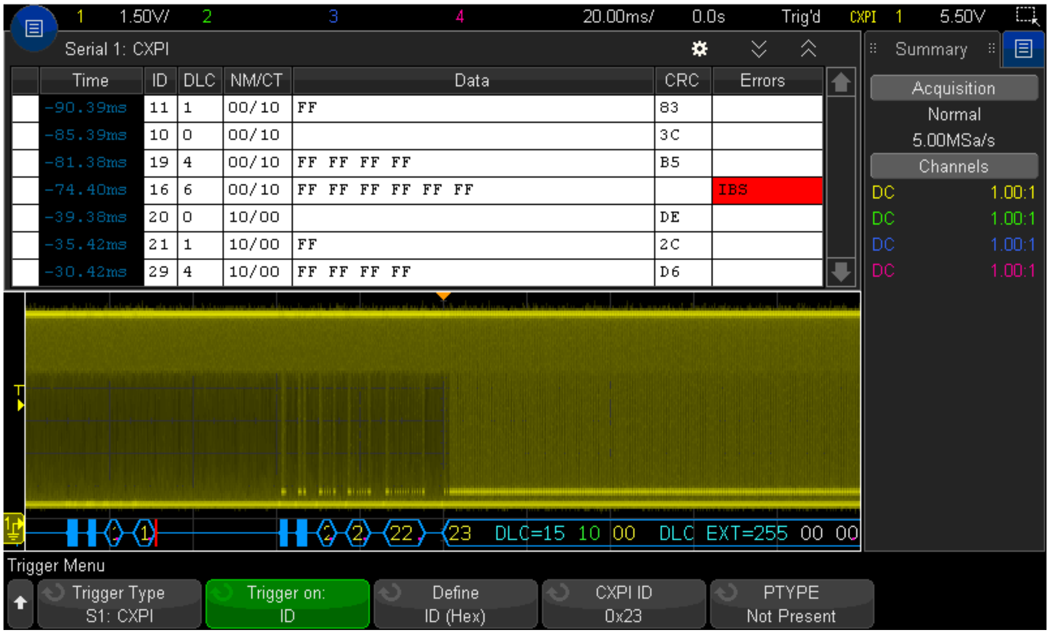

Figure 9. CXPI decode on an InfiniiVision X-Series oscilloscope.

Advanced Analysis

Mask Test (Pass/fail waveform limit testing)

If you need to validate the quality and stability of your electronic components and systems, the InfiniiVision oscilloscope's mask/waveform limit testing capability, which is enabled with the Automotive Software Package, can save you time and provide pass/fail statistics almost instantly. Mask testing offers a fast and easy way to test your signals to specified standards, as well as the ability to uncover unexpected signal anomalies, such as glitches. Mask testing on other oscilloscopes is usually based on software-intensive processing technology, which tends to be slow.

The InfiniiVision scope's mask testing is based on hardware-based technology, meaning that they can perform up to 270,000 real-time waveform pass/fail tests per second. This makes your testing throughput orders of magnitude faster than you can achieve on other oscilloscope mask test solutions.

- Test up to 270,000 waveforms per second with the industry's fastest hardware-accelerated mask testing technology
- Automatic mask creation using input standard
- Easily download multi-region masks and setups based on industry standards (CAN, CAN FD, and SENT eye-diagram and pulse-shape mask files available for download at no charge)
- Detailed pass/fail statistics
- Test to high-quality standards based on sigma
- Multiple user-selectable test criteria

Figure 10. CAN FD eye-diagram mask testing.

Table 10. Mask Test Performance Characteristics

Mask test source	Analog channels 1, 2, 3, or 4
Maximum test rate	2000 X-Series: Up to 50,000 waveforms tested per second
	3000 and 4000 X-Series: Up to 270,000 waveforms tested per second
	6000 X-Series: Up to 130,000 waveforms tested per second
Acquisition modes	Real-time sampling–non-averaged, Real-time sampling–averaged
Mask creation	
• Automask-divisions	± X divisions, ± Y divisions
• Automask-absolute	± X seconds, ± Y volts
• Mask file import	Up to 8 failure regions (created in text editor)
Mask scaling	Source lock on (mask automatically re-scales with scope settings)
	Source lock off (mask scaling fixed relative to display when loaded or created)
Test criteria	Run until forever, Minimum number of tests, Minimum time, Minimum sigma
Action on error	Stop acquisitions, save image, print, perform measurements
Trigger output	On failure
Statistics display	Number of tests, Number of failures (for each channel tested), Failure rate (for each channel tested), Test time (hours – minutes – seconds), Sigma (actual versus maximum without failures)
Display formats	Mask – translucent gray, Failing waveform segments – red, Passing waveform segments – channel color
Save/recall	4 non-volatile internal registers (.msk format), USB memory stick (.msk format)

Frequency Response Analysis (Bode gain & phase plots)

Frequency Response Analysis (FRA) is often a critical measurement used to characterize the frequency response (gain and phase versus frequency) of a variety of today's electronic designs, including passive filters, amplifier circuits, and negative feedback networks of switch mode power supplies (loop response). FRA capability is included in the Automotive Software Package. This frequency-domain measurement capability is achieved with a swept gain and phase measurement versus frequency (Bode plot). The InfiniiVision oscilloscope uses the scope's built-in waveform generator (WaveGen) to stimulate the circuit under test at various frequency settings and then captures the input and output signals using two channels of the oscilloscope. At each test frequency, the scope measures, computes, plots gain ($20LogV_{OUT}/V_{IN}$) logarithmically and phase linearly.

- Dynamic range: > 80 dB (typical)
- Frequency range: 10 Hz to 20 MHz
- Sweep or single frequency test modes
- Fixed test amplitude or custom Amplitude Profile
- 60 to 1000 points across Start/Stop sweep range
- Two pair of tracking gain and phase markers
- Plots gain and phase and tabular view of test results
- Easily export and/or save measurement results in .csv format for offline analysis

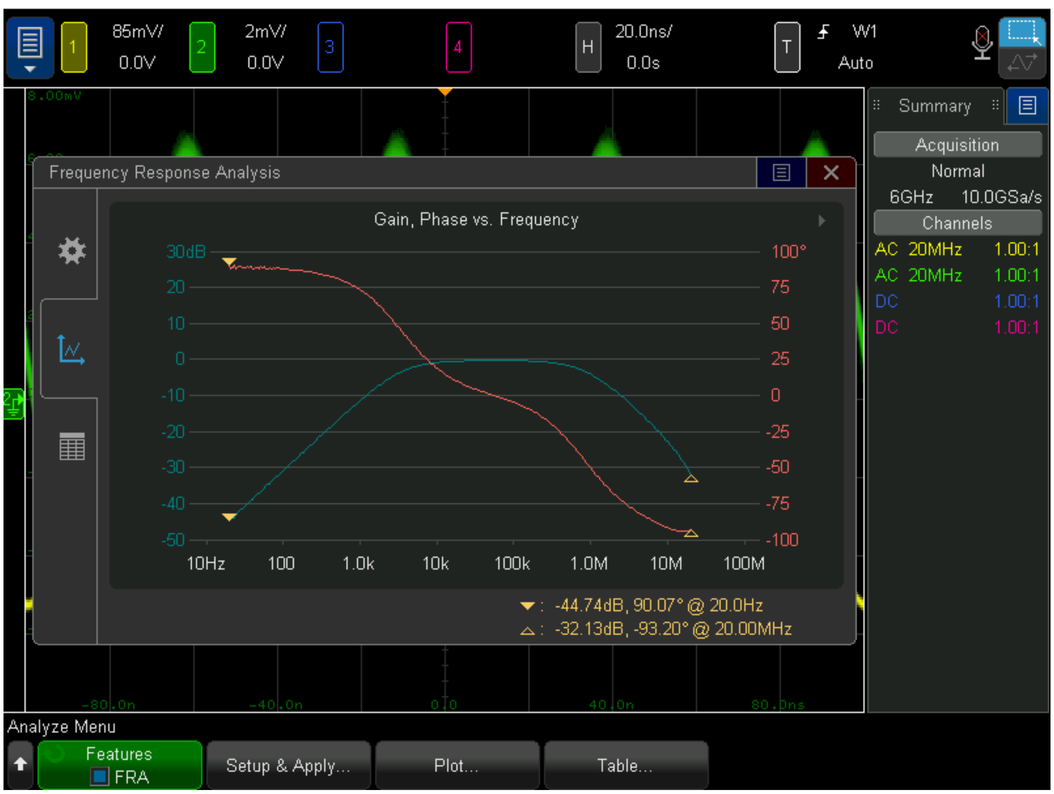

Figure 11. Frequency response analysis (gain & phase) on a bandpass filter.

Table 11. Frequency Response Analysis Performance Characteristics

	Frequency Response Analysis	
Frequency mode	Sweep or single	
Frequency range	10 Hz to 20 MHz	
Test amplitude modes	Fixed or amplitude profile	
Test amplitude range	3000T	10 mVpp to 2.5 Vpp into 50-Ω load
		20 mVpp to 5.0 Vpp into high impedance load
	4000A/6000A	10 mVpp to 5.0 Vpp in 50-Ω load
		20 mVpp to 10.0 Vpp into high impedance load
Input and output sources	Channel 1, 2, 3, and 4	
Number of test points	60 to 1000 points across Start/Stop sweep range	
Test results	Overlaid gain and phase plot and tabular view	
Dynamic range	> 80 dB (typical) based on 0 dBm (630 mVpp) input into 50-Ω load	
Measurements	Dual pair of tracking gain and phase markers	
Plot scaling	Auto-scaled during test and manual setting after test	

Advanced Waveform Math (3000A X-Series only)

Advanced waveform math functions come standard on all models of the InfiniiVision X-Series oscilloscopes except for the 3000A Series. Refer to the appropriate InfiniiVision X-Series oscilloscope data sheet to see a complete list of standard waveform math functions on each model. When licensed with Automotive Software Package, advanced waveform math functions are also enabled on the InfiniiVision 3000A Series oscilloscope.

The Keysight 3000A X-Series oscilloscopes come standard with the following waveform math functions:

- Add
- Subtract
- Multiply
- Divide
- Integrate
- Differentiate
- Square Root
- FFT

The Automotive Software Package adds the following waveform math functions on the Keysight 3000A X-Series:

- Ax + B
- Square
- Absolute
- Common Logarithm
- Natural Logarithm
- Exponential
- Base 10 Exponential
- Low-pass Filter
- High-pass Filter
- Measurement Trend
- Magnify
- Chart Logic Bus Timing
- Chart Logic Bus State

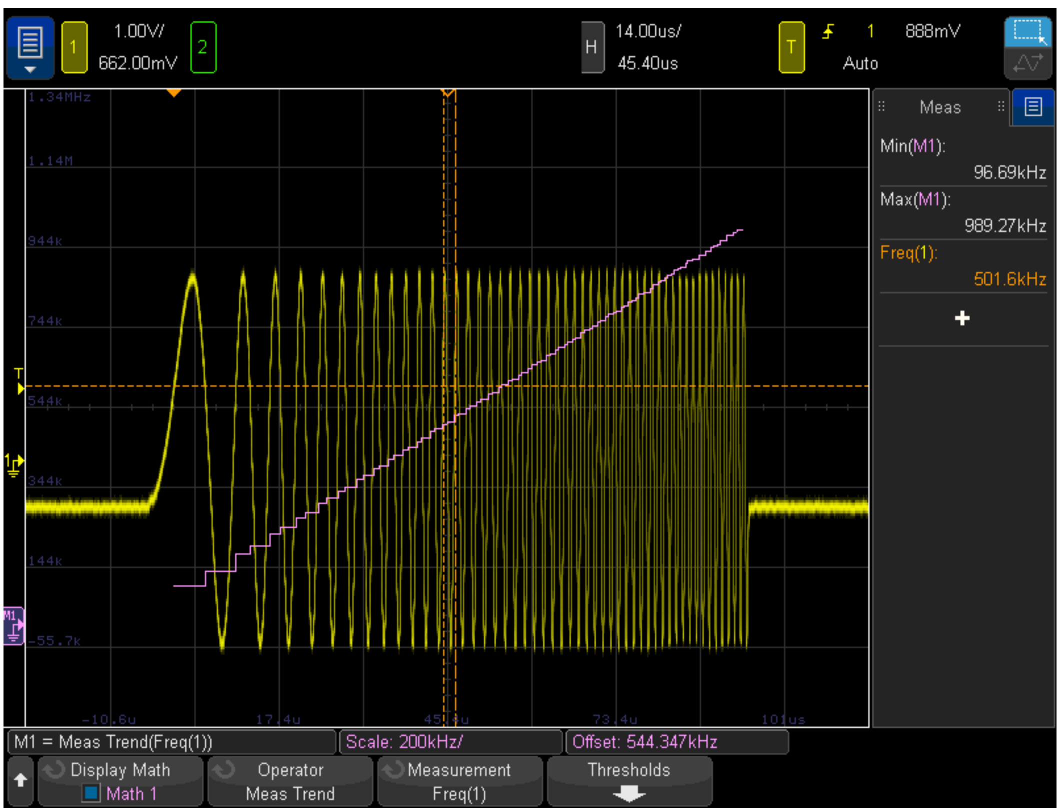

Figure 12. Measurement trend math function used to plot frequency versus time of a FM burst.

Probing Differential Serial Buses

Many of today's serial buses are based on differential signaling including MIL-STD 1553 and ARINC 429. Keysight offers a wide range of differential active probes compatible with the InfiniiVision X-Series oscilloscopes for various bandwidth and dynamic range applications. Table 12 shows the differential probes that Keysight recommends for each of the listed differential serial buses.

Figure 13. Keysight's N2818A 200-MHz differential active probe.

Table 12. Recommended probes for automotive differential buses

Differential bus (max bit rate)	N2791A (25-MHz bandwidth)	N2818A [1] (200-MHz bandwidth)
CAN (1 Mbps)	X	X
CAN FD (10 Mbps data phase)		X
FlexRay (10 Mbps)		X

1. The N2818A differential probe is not compatible with Keysight's InfiniiVision 2000 X-Series oscilloscopes.

If you need to connect to DB9-SubD connectors on your differential CAN, CAN FD and/or FlexRay bus, Keysight also offers the CAN/FlexRay DB9 probe head (part number 0960-2926) shown in Figure 14. This probe head makes it quick and easy to connect to your serial buses during the prototype phase of development and is compatible with Keysight's various differential probing solutions.

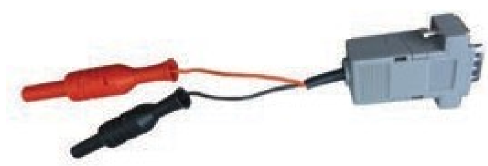

Figure 14. DB9-SubD probe head adapter.

Extreme Temperature Probing

When probing differential signals inside environmental chambers at extreme temperatures, Keysight offers the N7013A extreme temperature extension kit shown in Figure 15. The N7013A is compatible with the N2791A and N2818A differential probes and can operate in temperatures ranging from –40 to +85 °C. To learn more about Keysight's extreme temperature probing solutions, refer to the Extreme Temperature Probing Solutions selection guide (publication number 5991-3504EN) listed at the end of this document.

Figure 15. Extreme temperature probing kit.

Related Literature

Table 13. Related literature

Publication title	Publication number
Debug Automotive Serial Buses Faster – Application Note	5991-0512EN
CAN-dbc Symbolic Trigger and Decode - Application Note	5991-2847EN
CAN Eye-Diagram Mask Testing - Application Note	5991-0484EN
CAN FD Eye-Diagram Mask Testing - Application Note	5992-0437EN
Characterizing CAN Bus Arbitration - Application Note	5991-4166EN
FlexRay Physical Layer Eye-diagram Mask Testing - Application Note	5990-4923EN
SENT Automotive Sensor Physical Layer Testing – Application Note	5992-3167EN
PSI5 Sensor Serial Bus Testing - Application Note	5992-2269EN
Decoding Automotive Key Fob Communication based on ASK Modulation - Application Note	5992-2260EN
Segmented Memory for Serial Bus Applications - Application Note	5990-5817EN
InfiniiVision 2000 X-Series Oscilloscopes - Data Sheet	5990-6618EN
InfiniiVision 3000T X-Series Oscilloscopes - Data Sheet	5992-0140EN
InfiniiVision 4000 X-Series Oscilloscopes - Data Sheet	5991-1103EN
InfiniiVision 6000 X-Series Oscilloscopes - Data Sheet	5991-4087EN
M924XA InfiniiVision PXIe Modular Oscilloscopes - Data Sheet	5992-2003EN
P924XA InfiniiVision USB Oscilloscopes - Data Sheet	5992-2897EN
InfiniiVision Oscilloscope Probes and Accessories - Selection Guide	5968-8153EN
Extreme Temperature Probing Solutions - Data Sheet	5990-3504EN
N2792A/N2818A 200 MHz and N2793A/N2819A 800 MHz Differential Probes – Data Sheet	5990-4753EN

Ordering Information

Table 14. Automotive Software Package model numbers

InfiniiVision Series	Automotive Software Package
2000 X-Series	D2000AUTB
3000 X-Series	D3000AUTB
4000 X-Series	D4000AUTB
6000 X-Series	D6000AUTB
P9240 Series	P9240AUTC
M9240 Series	M9240AUTB

Table 15. Recommended probing solutions

Recommended probes and accessories	Model number
25 MHz differential active probe	N2791A
200 MHz differential active probe (recommended for differential CAN, CAN FD, and FlexRay buses)	N2818A
400 MHz extreme temperature 10:1 passive probe	N7007A
Extreme temperature probing kit for differential probes	N7013A
DB9 probe head adapter (for CAN, CAN FD and FlexRay buses)	0960-2926
150 MHz, 1 mA/div high-sensitivity current probe (for PSI5 measurements)	N7026A

To configure your product and request a quote:
www.keysight.com/find/software

Contact your Keysight representative or authorized partner for more information or to place an order:
www.keysight.com/find/contactus