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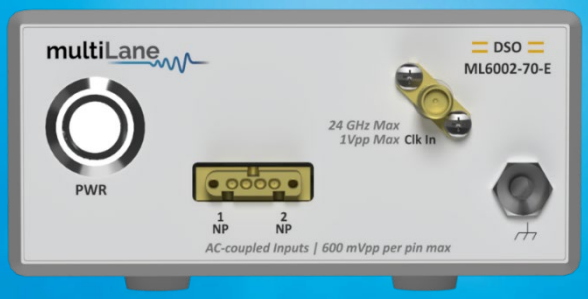
DATASHEET

Innovation for the next generation



ML6002-70-E

2 Differential Channels 67 GHz Sampling Scope

Advanced DSO for 112G and 224G applications

Summary

Rapid transition and adoption to 200G per channel electrical interfaces – key to 800G and 1.6T networks – requires cost-effective characterization tools to accelerate the deployment and enable proof of concept and validation. The precise validation of 53.125GBaud, 106.25GBaud, and 112GBaud PAM4 Electrical Signals requires prohibitively expensive instrumentation setups for production applications. MultiLane introduces the ML6002-70-E Electrical Sampling Oscilloscopes as a well-correlated solution for accelerated validation at scale.

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ML6002-70-E

Introduction

The ML6002-70-E is a fully featured, cost effective, advanced, and highly compact four channels equivalent to Digital Sampling Oscilloscope characterized by its 67 GHz bandwidth.

The oscilloscope comes equipped with comprehensive software libraries that enable eye measurements, jitter analysis, and processing of NRZ and PAM4 data. Additionally, its extensive set of APIs makes it highly suitable for automated testing and efficient go/no-go production validation.

Banner Specifications

- 2 differential inputs channels
- 2 Single Ended inputs channels
- 67 GHz input bandwidth
- Frequency-based trigger
- Full eye and mask measurements
- NRZ & PAM4

Typical Applications

- Time domain measurements of 224G high-speed digital communication signals, including SerDes, Transceivers, TIA's
- Qualification of PAM-N and NRZ drivers
- Package and Wafer test
- Characterization and Production test

Key Features

The ML6002-70-E family of DSOs is truly powerful, boasting an extensive set of features and functions that are unique in industry. These include:

- High Performance testing per Elec. Specs
- An extensive library of built-in de-embedding and component emulation API's
- Built-in standard eye window masks library
- Faster test times than benchtop methods

Electrical Specifications

Parameters	Specifications
Data Format Support	NRZ and PAM-4
Intrinsic Jitter	200 fs rms
Electrical Amplitude	< 600 mV SE and < 1200 mV Diff
Rise/Fall Time	7 ps (including conn.)
Vertical Resolution	14 bits
SFDR	46dB @ 10 GHz
ENOB	11.7 bits
Noise Floor	1.2 mV_{rms} (1. 5 mV_{rms} max)
Electrical Channel Bandwidth	67 GHz
Electrical Channel Connectors	(X1) 1X4 ML SMPX
Clock Input Bandwidth (Phase Shifter Mode)	0.1 - 4.5 Gsps
Clock Input Bandwidth (PLL Mode)	0.1 - 4.5 Gsps
Sampling Frequency	50 - 80 MHz
Data Input	AC Coupled
Supported Number of Samples per Channel	(Page 4)
Pattern Capture	SSPRQ & Up to PRBS-16
Input Return Loss Differential	< -13 dB for 10 MHz < f < 67 GHz
Normal Operating Temperature	0 - 70 °C
Instrument Automatic Shutoff	70 °C (manual reboot is needed for turn on when temperature < 65 °C)
Power Rating	31W

Supported Measurements

Coding	Measurements
PAM-4	TDECQ
	SNDR
	RLM
	Eye Height by BER
	Eye Width by BER
NRZ	Top & Base
	Min & Max
	One & Zero
	Transition Time
	Crossing %
	Mask Margin
	Peak to Peak
	Eye Amplitude
	Eye Height
	Eye Width
	Jitter
	SNR
	VEC
	Vrms
	RJ
	Noise

Recommended PC Specifications	
OS	Windows 11 64-bit
Processor	Core i7 / Ryzen 7
Memory	32 GB
GPU	4 GB (Dedicated)
Storage	10 GB (Dedicated)

Minimum PC Specifications	
OS	Windows 10 64-bit
Processor	Core i5 / Ryzen 5
Memory	16 GB
GPU	2 GB (Dedicated)
Storage	5 GB (Dedicated)

Spectrum Analysis View & THD

The DSO uses DFT to derive the spectral content of the signal present at the input. It also calculates the Total Harmonic Distortion figure.

Supported DSP Functions

- Frequency response correction of analog front end
- Bessel Thomson 4th Order
- CTLE Adaptive/manual
- FFE Adaptive/manual
- DFE Adaptive/manual
- De-embedding S4P
- Emulating S4P
- Normalizing Filter
- Moving Average

Applying Filters

Several filters including FFE, DFE, CTLE, Bessel-Thomson are available in NRZ as well as PAM mode. Concatenation of several filters is also possible, and the effect of each filter is shown immediately on the eye or pattern.

One may also import s2p or s4p files to de- embed fixtures.

A very useful function in determining the ideal CTLE gain for a given trace or the FFE number of taps for a certain target amplitude is the adaptive equalization feature available in the DSO.

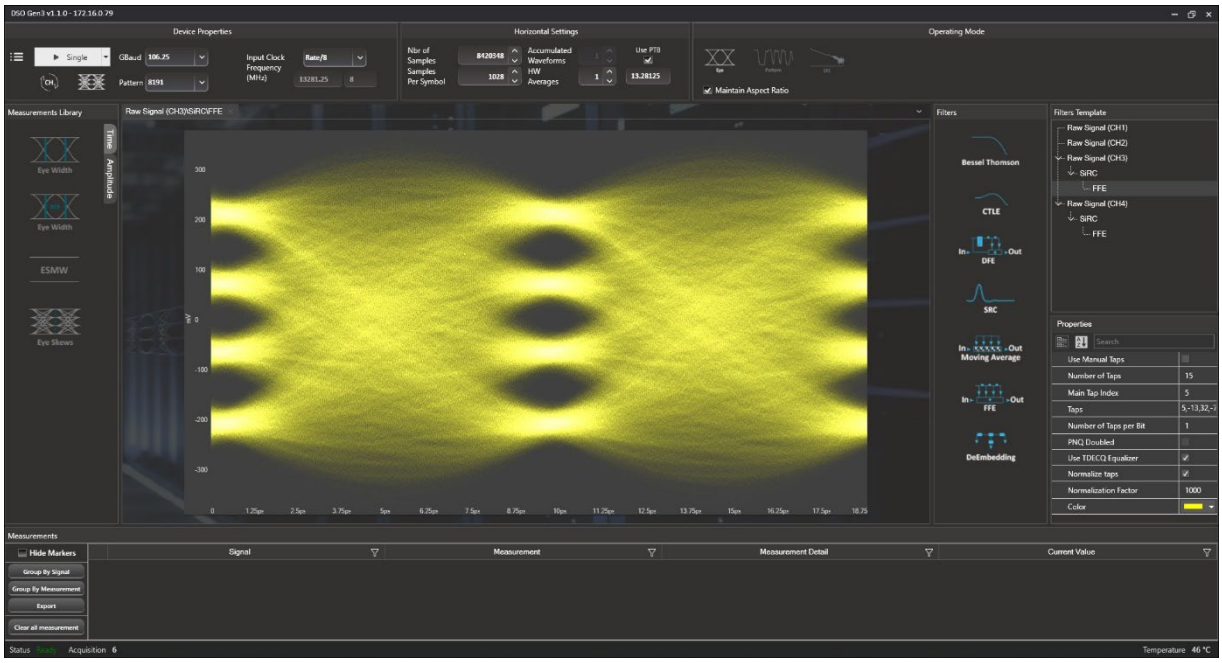

Figure 1: Eye Diagram Capture at 224G

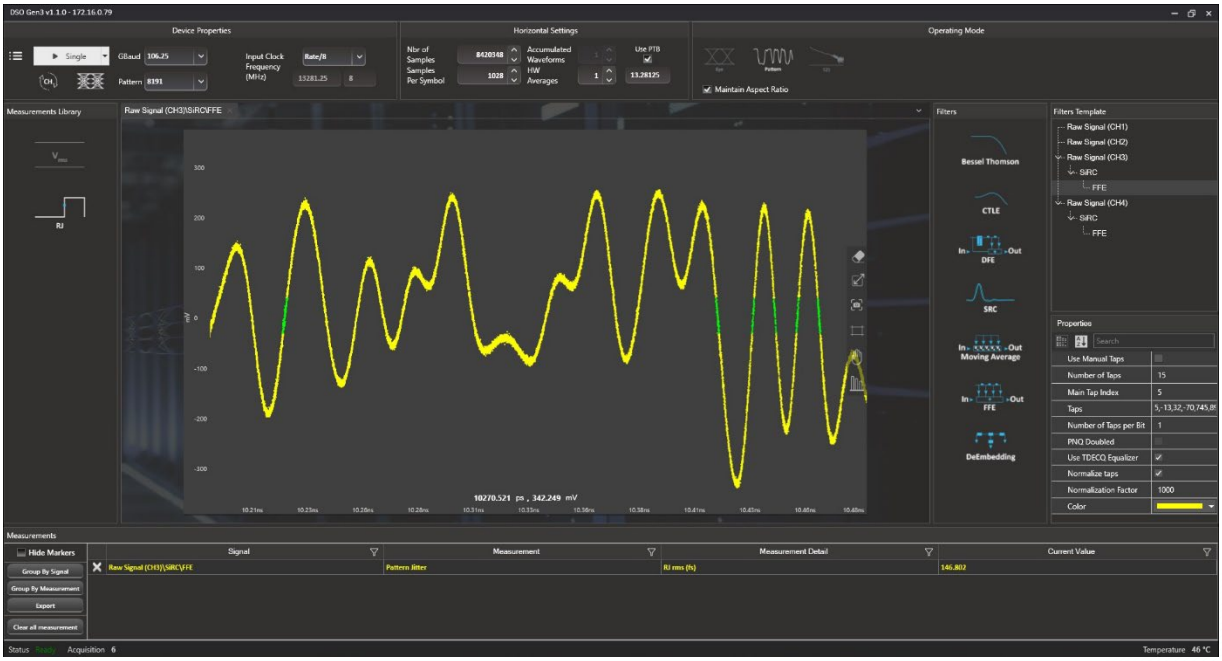

Figure 2: Pattern Capture at 224G

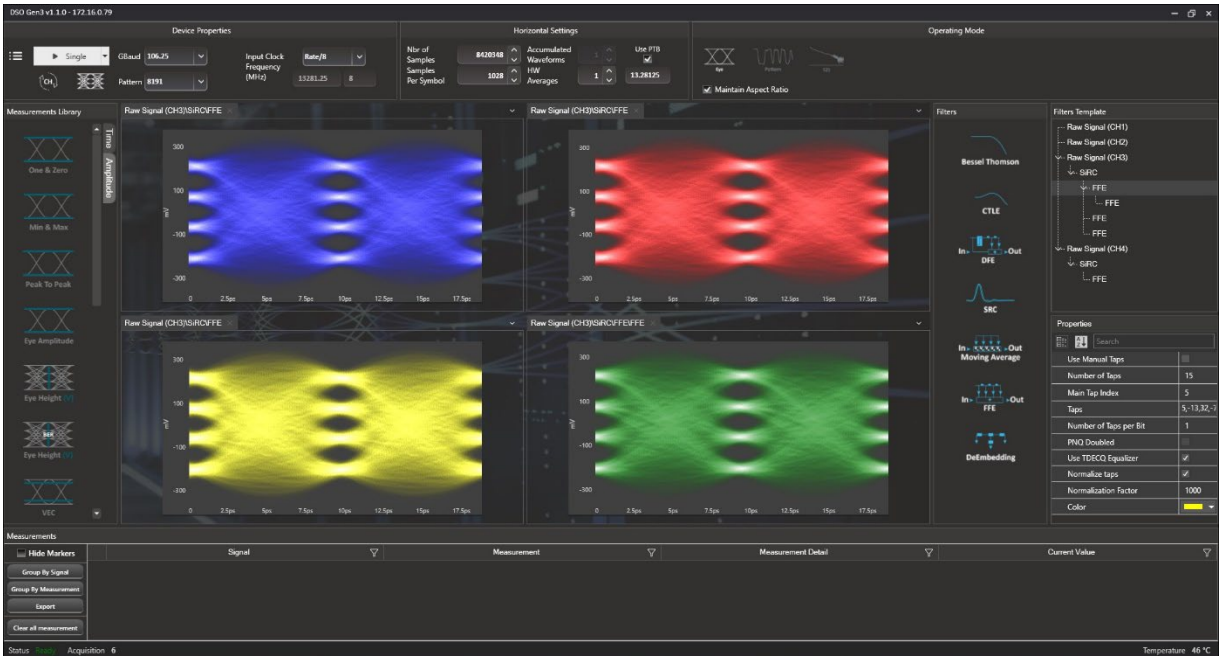

Figure 3: Multi-Signal Display Feature

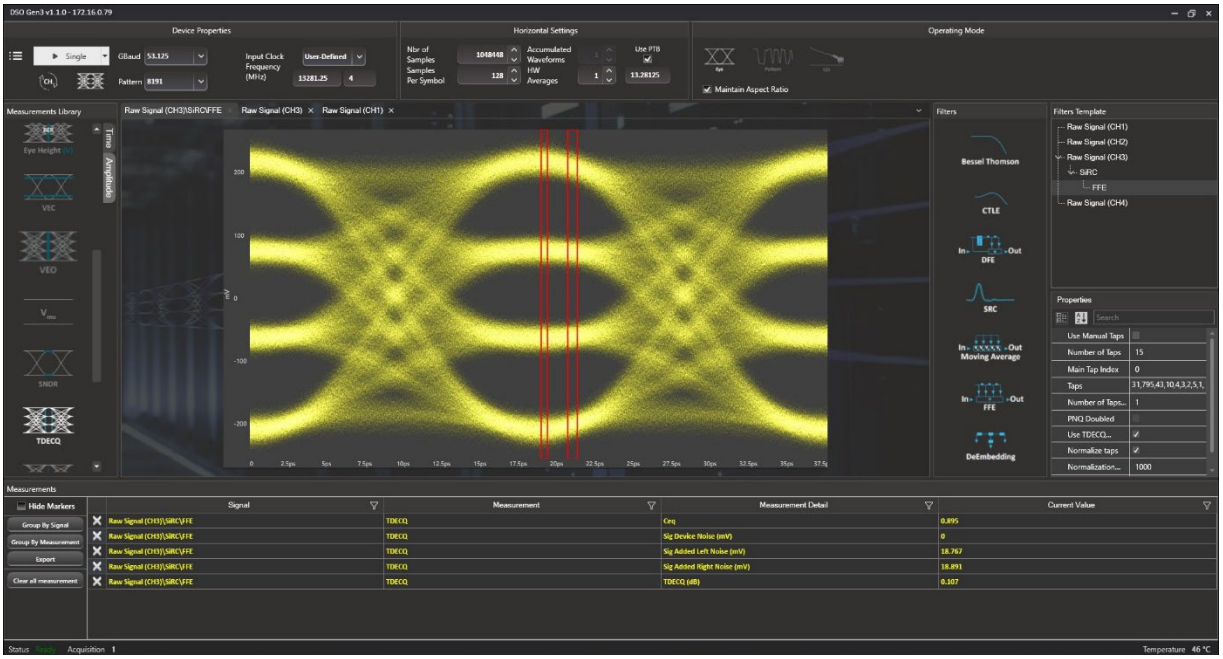

Figure 4: Eye-Diagram Capture at 53.125 GBaud with TDECQ Measurements

Supported Number of Samples per Channel

This is the maximum number of samples per symbol that can be captured by the DSO and it's calculated by:

$$Samples\ per\ Symbol = \frac{270MB}{BPS \cdot CH \cdot PRBS \cdot AVG} < 4095$$

- 270 Megabytes: Memory depth for 4 channels
- PRBS: The length of the chosen PRBS i.e., PRBS7= 127
- AVG: The number of HW averaging chosen by software
- CH: The number of channels (4)
- BPS: the number of bytes per sample (2)

Mechanical Dimensions

Figure 5: ML6002-70-E Mechanical Dimensions

Ordering Information

Option	Description
ML6002-70-E	67 GHz Standalone Electrical Scope
3YW	Total 3-year Warranty
CAL	Single Calibration
3YWC	Total 3-year Warranty with 3 Annual Calibrations

Recommended Accessories

Instruments	Recommended	Comments
ML6002-70-E	(x1) 1x4 SMPX to 1.85mm	Male or Female

Please contact us at sales@multilaneinc.com

This equipment contains ESD sensitive components and may become damaged when contacted with an electrostatic charge. To prevent equipment damage, please use proper grounding techniques.