



FELIX

TDC

Felix is a consolidated Time-to-Digital Converter (TDC) instrument with cutting-edge plug-and-play capability, multi-OS compatibility at an affordable cost. Thanks to its small size, the device is always ready for use, making it a valuable and portable tool for the user.



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USB-C

USB-C Plug-and-Play interface between Felix and PC for easy data read-out and control. Thanks to the latest generation of USB-C, the connector has a comfortable rotational symmetry.

UPDATABLE

Felix system and functionality are entirely upgradable remotely by the user. Updates can provide improvements in performance or in the addition of new firmware modules.

PROCESSING

Ultra-modern and dedicated hardware guarantees high-performance on-board processing; in this way, Felix can handle a total of 140 million samples per second of measurements in real-time.

TDC

A high-performance TDC-Core converts physical input events into timestamps characterized by an LSB of 36.6 fs; in this manner, a single-shot channel precision up to 12 ps r.m.s. is guaranteed

FRONT-END

Felix can acquire physical events from three interdependent analog sources in the range of 0-3.3 V. Each input features a programmable threshold comparator for proper event detection.



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LEDs

Four LEDs, one per input channel and an additional one for the power, let you figure the system status at a glance, e.g., measurement rate, calibration phase, on/off status, recovery.



INPUT CHs

Felix features two standard input channels that can support analog signals in the range 0 V – 3.3 V, up to 80 MHz rates.

SYNC

It is an optional input reference channel that can support up to 150 MHz periodic input events.



USB-C

Connect Felix to your PC through a common USB cable.

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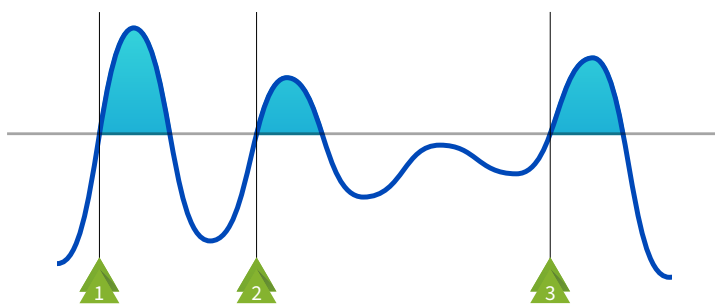
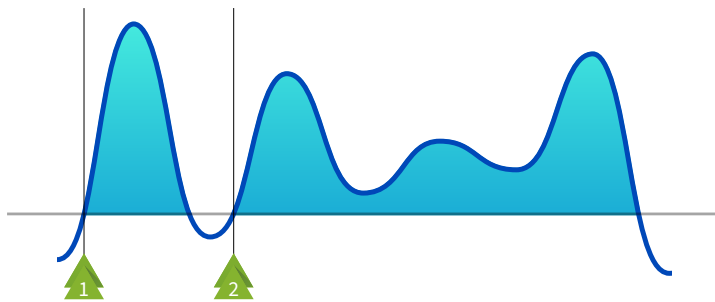


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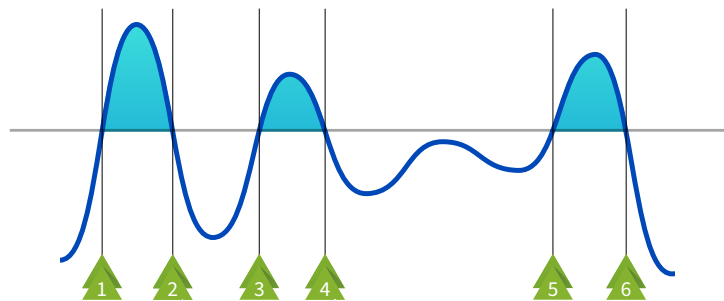
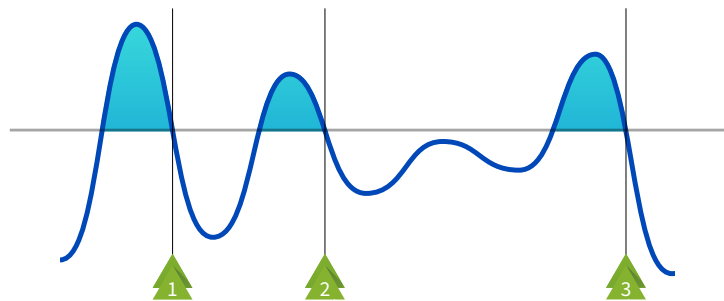
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FLEXIBLE TRIGGER

MEASURE WHAT YOU WANT

Choose which point should be measured by Felix. You can select, and freely change at runtime, which points must be measured, be them the low-to-high or the high-to-low crossing events. With the Double-Edge Sensitivity feature (optional), you can even trigger on both points in a single measurement process.



PROGRAMMABLE THRESHOLD NEVER MISS AN EVENT

Stop missing events due to an uncalibrated front-end. Felix offers the possibility to adapt to every need through a programmable variable threshold comparator. In this way, you can precisely control the voltage level which triggers the time measurement.

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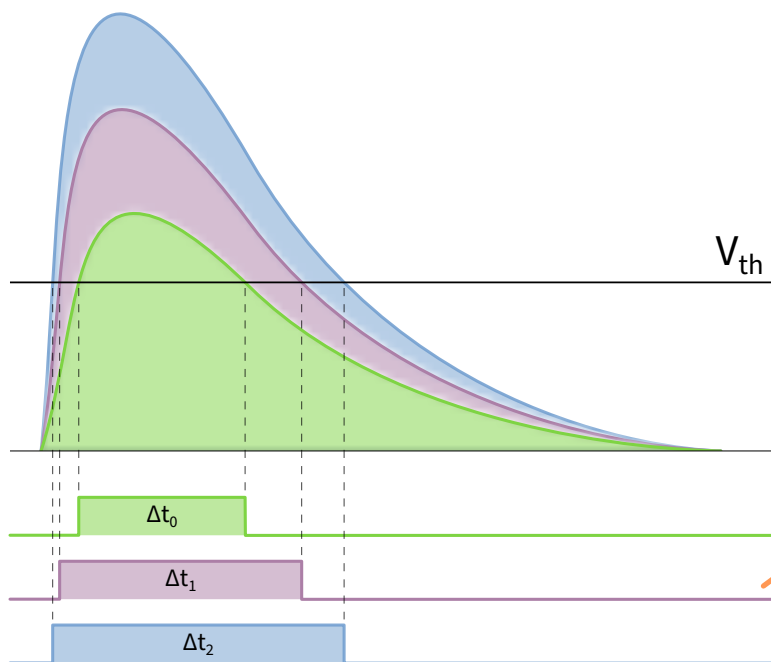


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TIME OVER THRESHOLD (ToT)



ToT

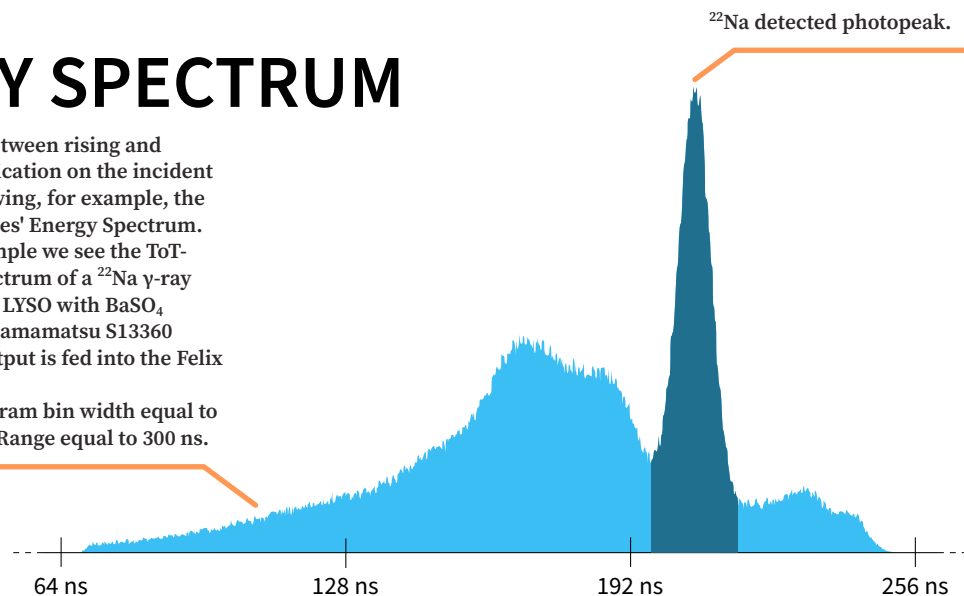
Time-over-Threshold (ToT) is a time width signal processing method applied to various areas of research such as high energy physics and medical application.

The timing information is given by triggering on both the edges of the interested signal and is represented by the signal time width. The best threshold setting will give you a signal with a duration proportional to the height of the input pulse.

ENERGY SPECTRUM

The time difference between rising and falling edges gives indication on the incident radiation energy, allowing, for example, the computation of particles' Energy Spectrum. In this real-world example we see the ToT-computed Energy Spectrum of a ^{22}Na γ -ray source impinging on a LYSO with BaSO_4 crystal, readout by a Hamamatsu S13360 series SiPM, whose output is fed into the Felix TDC in DES mode.

Data taken with histogram bin width equal to 37.5 ps and Full-Scale Range equal to 300 ns.





INPUT THRESHOLD

This tab lets you correctly set the reference voltage of the programmable threshold comparators in the range 0 V - 2.5 V, with a step of 640 μ V.

COUNTER

The input channel rate is shown in real-time. In the advanced view, you can see the behavior of the channel rate as a function of the acquisition time.

TIME TAGGER

This hardware module is devoted to sending the raw timestamps generated by the TDC directly to your PC, for further offline data manipulation.

HISTOGRAM

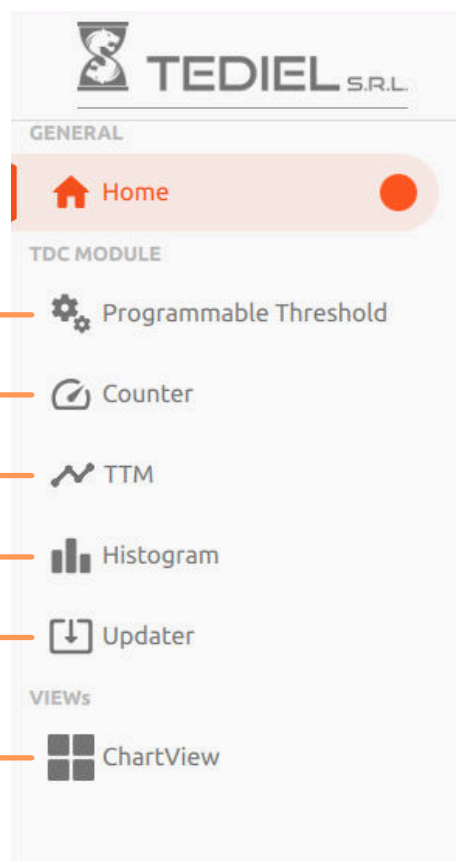
A real-time histogram engine allows you to plot the statistics of the time intervals measured between two different channels selected by the user.

UPDATE

Using this module, you can install new firmware, improve existing features, and include new innovative and exclusive real-time processing functionalities.

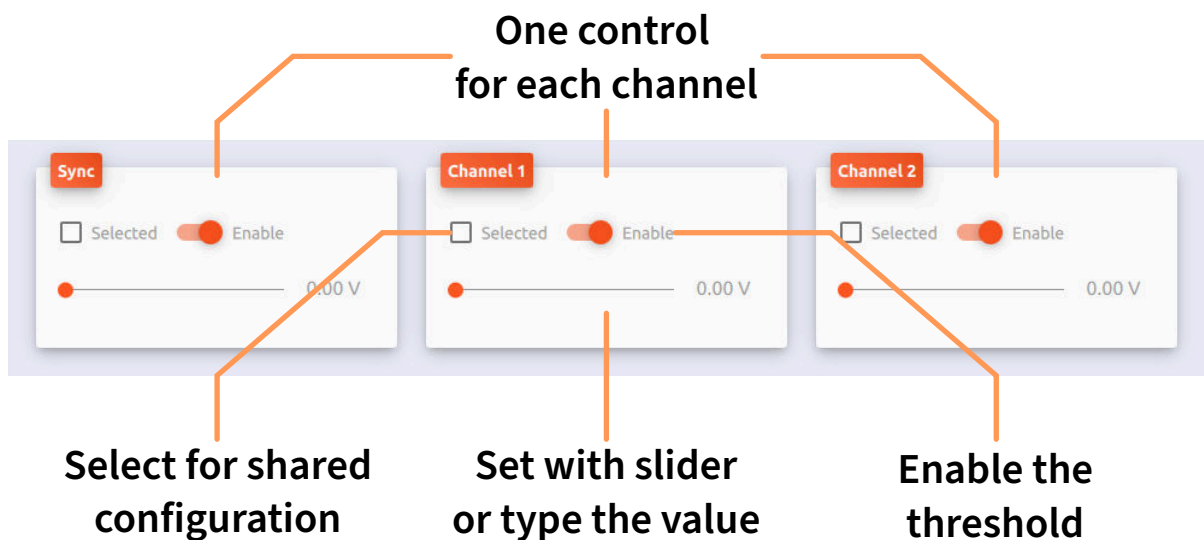
CHART VIEW

A software real-time view designed for the visualization of the generated histograms, lets you scroll through the data and zoom in and out to see exactly what's going on.

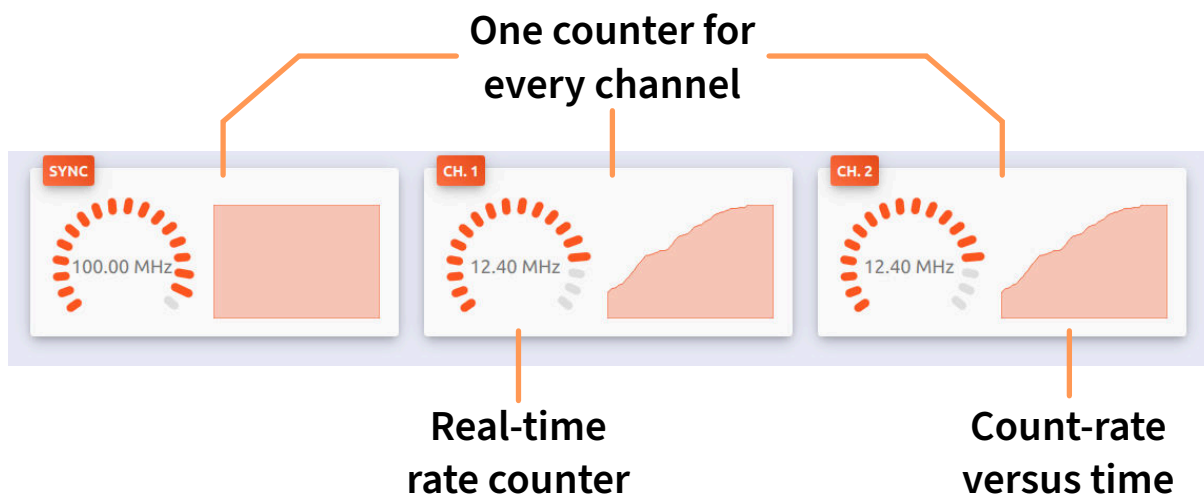




PROGRAMMABLE INPUT THRESHOLD



EVENTS COUNTER





TIME TAGGER

FORMAT

You can choose between Comma-Separated Values (CSV) and space-optimized binary format for TTM data in order to integrate it with your elaboration tools.

SAVING MODE

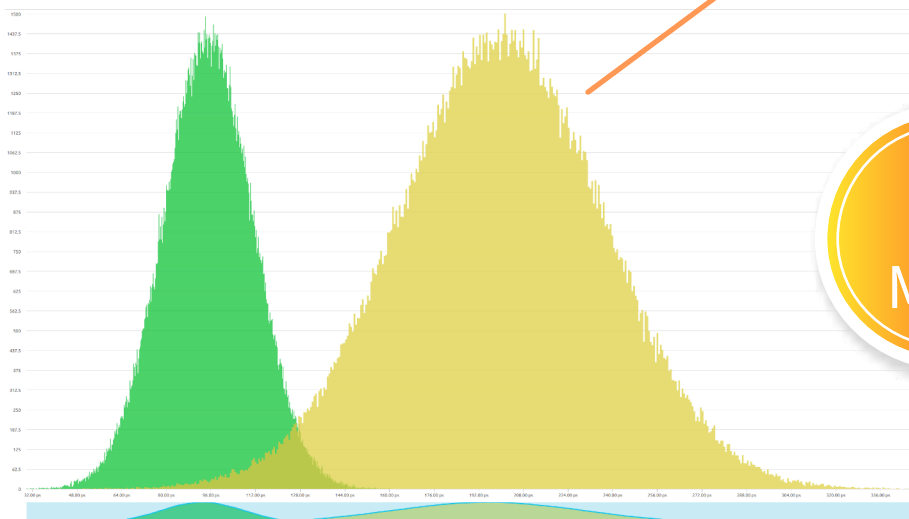
You can choose whether to manually start and stop the acquisition or just start it with a set duration and come back later with your data ready to go.

FILE SPLIT

Felix can generate large files in short time: these options lets you cleverly split the data for best management, through a dimension or a temporal rule.

DATA PREVIEW

TTM is not a graphical tool but, to give a rough idea of the undergoing acquisition, a real-time estimate of the incoming events in a histogram view is shown.





HISTOGRAM

(optional)

EASY CONFIG

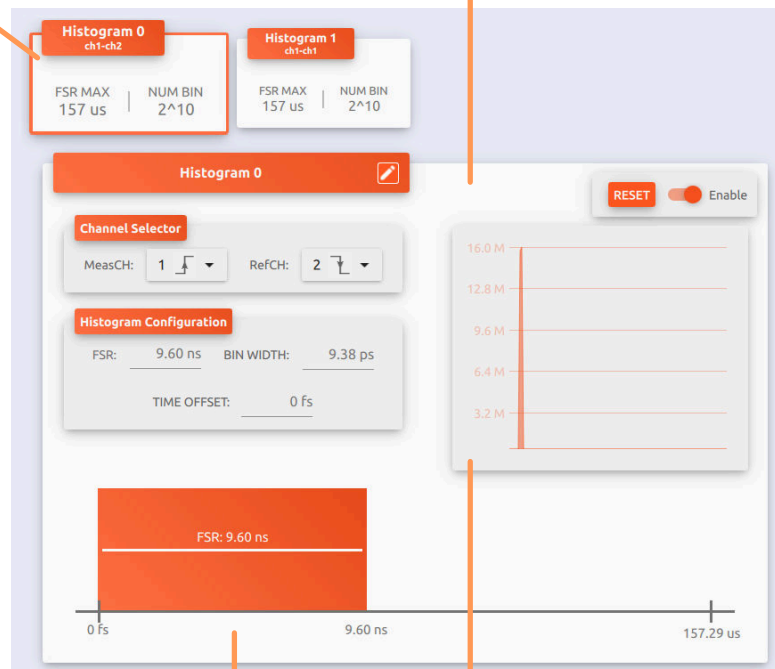
For each histogram, you can select the channels to be used to perform the time difference, Bin Width, Full-Scale Range (FSR), and Time Offset.

MULTI-HIST

Every real-time histogram engine is listed. For each module are reported the maximum Full-Scale Range (FSR MAX) and the number of bins.



The hardware histogrammer can exploit the full bandwidth of the TDC channels, without any loss of events.



WINDOWING

A graphical representation of FSR, BIN WIDTH, and TIME OFFSET is depicted with respect to the time difference computed by Felix.

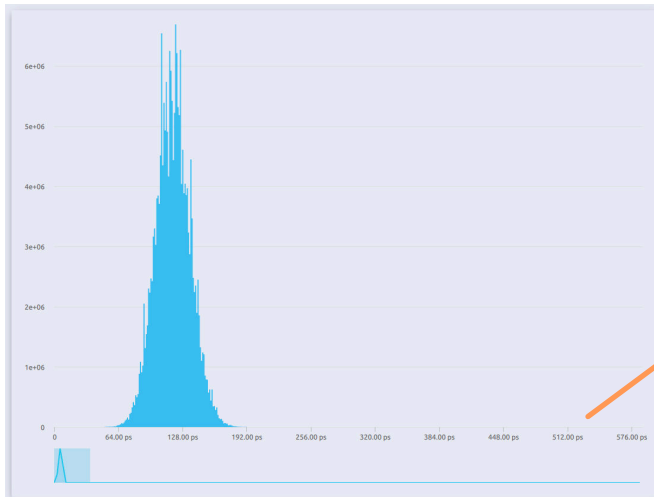
PREVIEW

The histograms are computed with time differences up to 157.29 us and 36.6 fs LSB. Still, only those falling in the selected time window are plotted.





CHART VIEW (HISTOGRAM)



VIEWER

It is the graphical and interactive visualization of the histogram you have previously configured from the advanced view.

FILE FORMAT

Lets you save a screenshot (PNG, JPEG) or directly the data (CSV) of the current histogram in any location, one or several times and/or based on a time rule.

INSTANCES

Every instance of a histogram created here can be enabled on the view and its color can be optionally changed.

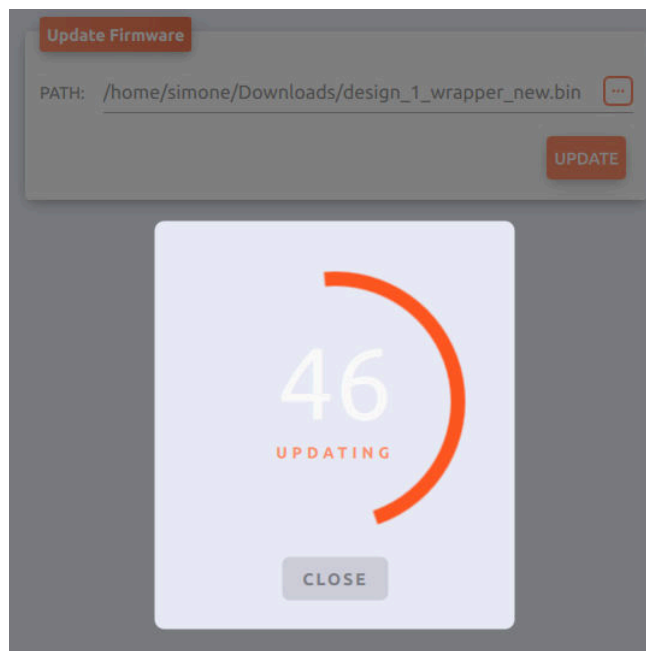




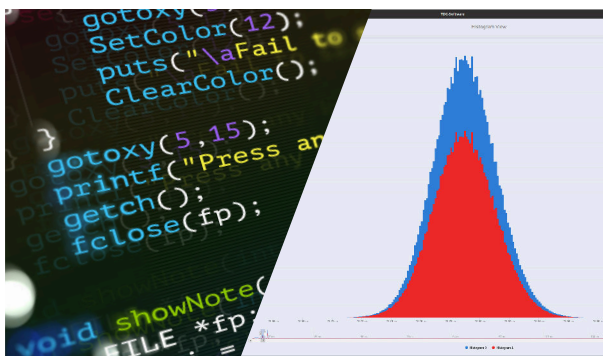
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UPDATER

The instrument's firmware is completely and remotely reconfigurable, meaning that, as soon as a new hardware feature is available, it can be included on your Felix with just a quick and simple update from this tab



CHOOSE YOUR WAY



- ✓ Easy to Install
- ✓ Intuitive GUI
- ✓ Native C++ library
- ✓ Python-scriptable



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EDU VERSION

Single-Shot Channel Precision	12 ps r.m.s.	< 1 ns r.m.s.	Input Channels	2 + SYNC
Resolution (LSB)	36.6 fs	600 ps	Input Impedance	50 Ω
Dead-Time	12 ns	100 ns	Input Voltage Level	0 V - 3.3 V
Global Measurement Rate	140 Msps	20 Msps	Programmable Threshold Level	0 V - 2.5 V
Channel Measurement Rate	80 Msps	10 Msps	Minimum Pulse Width	1.4 ns
Maximum Sync Frequency	150 MHz		Power Supply	5 V
Absolute INL	< 19 ps		Connector Type	USB-C
Absolute DNL	< 0.8 ps		Size (L x W x H) [mm]	188 X 102 X 37

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