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Find the *Acqiris U1084A-001* at our website: ***Click HERE***



Agilent U1084A

Acqiris High-Speed PCIe Data Converter

Targeting Embedded OEM Applications

8-bit, 2 ch, 1.5 GHz, 2-4 GS/s

with either a Firmware for Signal Averaging or Peak Analysis

Agilent Technologies

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Main Features

- Highly flexible, high-speed data acquisition card with on-board FPGA for real-time data processing
- Dual- and single-channel acquisition modes
- Up to 4 GS/s sampling rate
- Up to 1.5 GHz bandwidth
- High-speed PCI Express x4 bus transfers data up to 520 MB/s to a host processor
- Fully featured 50 Ω front-end with programmable full-scale, offset, and internal calibration
- Complete pre- and post-triggering
- Six I/O connectors for trigger, clock, reference, and control signals
- Built-in 15 ps Trigger Time Interpolator (TTI) for accurate timing measurements
- Low total power consumption
- Device drivers for 32- and 64-bit Windows® and Linux
- Application code examples for C/C++

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Acqiris High-Speed Data Converters

The proprietary ASICS in Agilent Acqiris high-speed digitizers are designed for the specific purpose of optimizing high-speed ADC performance. The analog front-end technology provides signal conditioning, amplification, and interleaving functions essential for achieving high-speed data acquisition at GS/s rates. The digital data handling components provide vital clock and synchronization signals to capture and memorize acquired data with maximum data throughput. Together these ASICS make low-power, high-fidelity data acquisition much more accessible and provide maximum data throughput to the host PC or processor to reduce the time and cost of measurement.

The Acqiris product line provides a range of high-speed digitizer cards with 8-, 10-, and 12-bit resolution, wide bandwidth, and large acquisition memory. These products, in PCI, PCIe, PXI, cPCI, and VME formats, are used in research, and in ATE and OEM applications in industries such as biotechnology, semiconductors, aerospace, physics, and astronomy.

Embedding Extreme Data Conversion into Your System

The Agilent U1084A Acqiris high-speed data converter allows you to leverage the performance of our leading edge technology and know-how to meet your most demanding requirements.

By integrating our proprietary technology into a standard PCIe card format, we help you reduce the risk associated with new product development, providing a state-of-the-art data converter front-end that is easily integrated into more complex systems. This principle of using standardized, off-the-shelf, data conversion and signal processing platforms ensures cost-effectiveness, system longevity, and system flexibility, at low risk. Agilent high-speed data conversion products provide consistent quality and reliability you can depend upon.

As it is designed for OEM use, embedded in equipment that may well fall under RoHS compliance, the U1084A product uses only lead free components and non-toxic methods, to be fully RoHS compliant.

Using Agilent technology and know-how the component count on U1084A is kept to a minimum, increasing the operational reliability of the card, and maximizing analog and digital performance.

Analog performance of U1084A is such that maximum measurement accuracy performance is obtained over the full bandwidth of the analog front end. Lower noise and more effective bits mean less repeated measurements, reducing measurement time and lowering cost per measurement.

High-Speed Digitizers with Real-Time Analysis

The Agilent U1084A Acqiris high-speed data converter is a dual-channel, 8-bit PCIe digitizer card with an on-board, high-speed, field programmable gate array (FPGA) component that is used for real-time data processing tasks. Featuring 4 GS/s sampling rates, the digitizer provides on-board real-time signal processing firmware for on-the-fly signal averaging.

The firmware option allows the data converter card to perform specific post-processing tasks which are easily uploaded into the FPGA under program control. The firmware option redefines the way in which data acquisition can be performed. It makes the analyzer platforms extremely flexible and easy to reconfigure.

Using the PCI EXPRESS® (PCIe®) bus maximizes the data throughput. Implemented in the base product as a 4-lane PCIe card, the U1084A products provide data throughput at up to 520 MB/s.

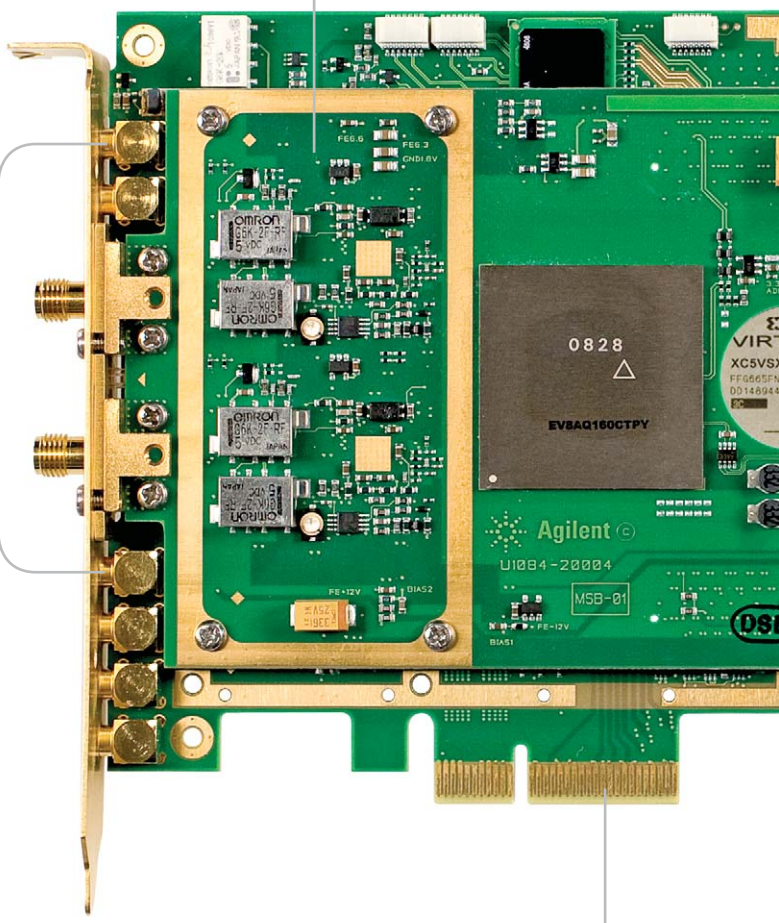
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High-Speed Digitizer with On-Board Signal Processing

Front end mezzanine with ADC

The analog mezzanine contains the analog signal conditioning (amplification, offset, and channel interleaving) as well as the analog-to-digital converter (ADC) component. Impedance on the two input channels (CH1, CH2) is fixed at 50 Ω ± 1%. Either input can be used as a trigger source.

Normally the two channel inputs are sent to their dedicated ADCs and simultaneously sampled at 2 GS/s. Alternatively, with channel interleaving, the signal from either one of the channels can be sent to both ADCs to achieve sampling rates of up to 4 GS/s.



Trigger and clock

The trigger and clock circuitry provides access to trigger input and output as well as reference clock input. The clock circuit provides calibration signals and ADC clock signals for the analog mezzanine as well as the FPGA for data processing.

I/O control

Control over the trigger, time base, and data processing is made even more flexible by the addition of front-panel input/output connections.

The six MCX-type front-panel connectors can support an external clock (up to 2 GHz) or reference signal (10 MHz), an external trigger input, a trigger output, and three additional I/O digital control lines (I/O A, B, and C). The latter can be used for monitoring or modifying the platforms' status and configuration. Trigger output can also be used as an I/O control.

PCI Express

The use of the PCIe x4 allows data rates up to 520 MB/s. This high throughput reduces measurement time and increases throughput to reduce measurement time over traditional PCI based technologies.

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Flexible data processing

The FPGA provides capacity for real-time processing of the acquired data. The firmware loaded into the processing FPGA provides either real-time peak detection or averaging functionality.

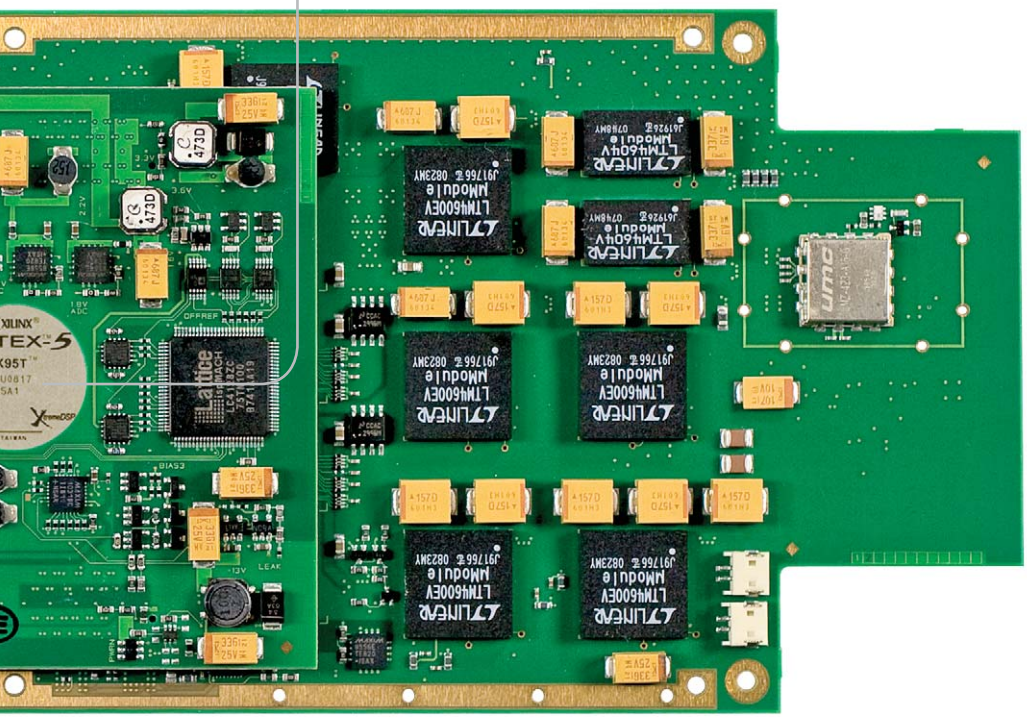


Figure 1. U1084A data converter platform

Easy integration

Agilent Acqiris high-speed digitizers are supplied with software drivers for Windows®, Linux, and application code examples for C/C++.

These code examples provide card set up and basic acquisition functionality, and are easily modified, so the card can quickly be integrated into a measurement system.

The flexibility of the driver means that, with minimum software adjustments, any Acqiris digitizer can be swapped out, replaced, and upgraded over time, with the latest high-speed Acqiris digitizer.

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Acqiris High-Speed PCIe Data Converter U1084A

Dual channel 8-bit, 1.5 GHz, 2 to 4 GS/s

Signal input

Channels
Dual at 2 GS/s,
Single at 4 GS/s

Bandwidth (-3 dB)
DC to 1.5 GHz
(1.8 GHz typ.)

Bandwidth limit filter
700 MHz, 200 MHz, and 20 MHz

Full scale (FS)
50 mV, 100 mV, 200 mV, 500 mV,
1 V, 2 V, and 5 V

Offset range
±2 V for 50 mV to 500 mV FS
±5 V for 1 V to 5 V FS

Maximum input voltage
±5 V DC

Coupling
AC, DC

Impedance
50 Ω ± 1%

Connectors
BNC or SMA, gold plated

Digital conversion

Sample rate
488.28 kS/s to 4 GS/s
binary sparsing

Resolution
8 bits

DNL
±0.9 LSB

Time base

Clock accuracy
Better than ±2 ppm

Sampling jitter
< 10 ps rms for 10 µs with internal clock and reference

Trigger (channel and external)

Channel trigger input
Threshold adjust range: FS of channel
Sensitivity: DC to 1.5 GHz, > 15% FS

Pretrigger
Adjustable to 100% of horizontal full scale

External trigger input
MCX, gold-plated
Impedance: 50 Ω and 1 MΩ +/-1%
Sensitivity:
50 Ω: DC to 1 GHz, > 0.5 V
1 MΩ: DC to 250 MHz, > 0.5 V

Modes
Edge (positive and negative)
Window[1], HF divide by 4[1], spike stretcher[1], dual-source pattern[2] (OR, AND, NOR, NAND)

Coupling
DC, AC1, HFReject[1]

Control I/O (MCX)

Connectors
MCX, gold-plated

Ctrl I/O A, B, and C signals
TTL & CMOS compatible (3.3 V)

Ctrl I/O A, B, and C output
10 MHz reference clock out with 50 Ω output impedance
Acquisition active
Trigger ready

Ctrl I/O A and B input
Trigger enable

Trigger OUT
Offset: ± 2.5 V (no load)
Amplitude: ± 0.8 V (no load), ±15 mA max
Rise/fall time: 2.5 ns into 50 Ω
Coupling: DC
Output impedance: 50 Ω

CLK IN ext. clock/ref
Amplitude: > 1 V pk-pk into 50 Ω
Threshold: variable between -2 V and +2 V
Maximum input voltage: ±5 V DC

CLK IN ext. clock input
1 GHz or 2 GHz

CLK IN ext. reference frequency
10 MHz ±0.3 %

1) Channel trigger only
2) Between either one of the input channels and the external trigger.

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Real-time FGPA control (I/O A, B, & C)

FPGA
Virtex 5-5SX95T

Ctrl Signals
TTL & CMOS compatible (3.3 V)

Memory [1]
72 Mbit SRAM, 512 MB DRAM

1) Available data point capacity of processing memory varies depending on the firmware option chosen.

General

Host computer and operating system
PC compatible (x86) systems running 32-and 64-bit Microsoft Windows, and Linux.

Transfer speed
High-speed PCIe x4 bus transfers data at sustained rates up to 520 MB/s to host PC

Warranty

1 year
3 years (optional)

Environmental and physical

Operating temperature
5° to 40°C

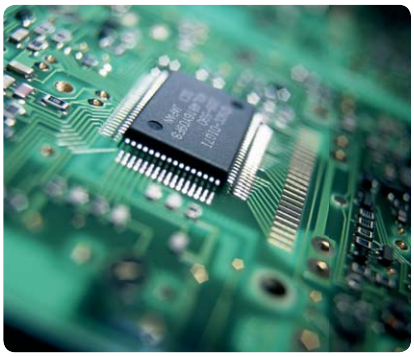
Relative humidity
0 to 80% (non-condensing)

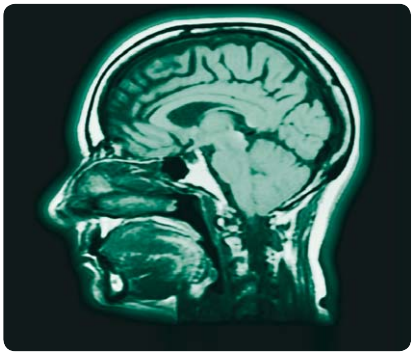
Dimensions
PCIe full-length standard

EMC
Complies with European EMC directive 2004/108/EC
· IEC/EN 61326-2-1
· CISPR Pub 11 Group 1, class A
· AS/NZS CISPR 11
· ICES/NMB-001

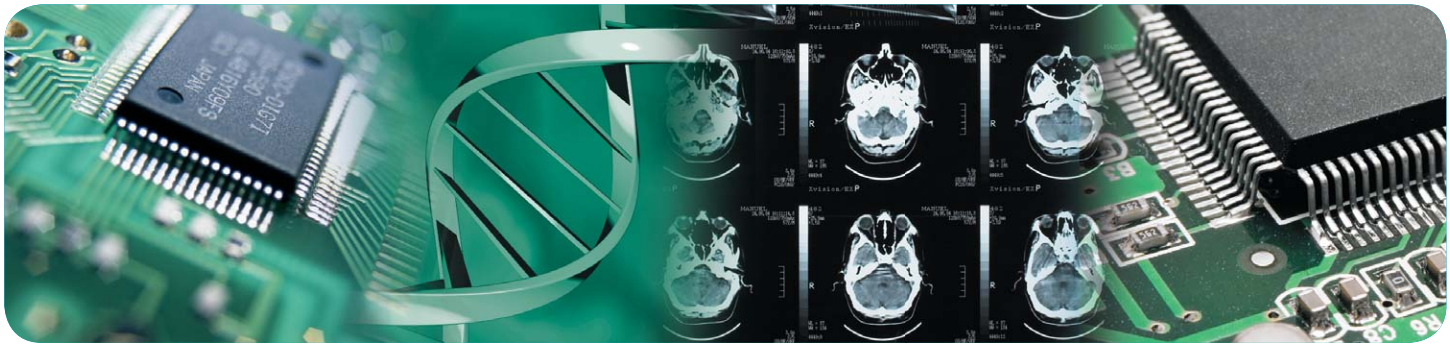
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB-001 du Canada.

Power consumption
See firmware option specifications





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Firmware for Real-Time Sampling and Averaging U1084A-AVG

- **Synchronous, dual-channel, real-time sampling and averaging with a maximum trigger rate of up to 500 kHz**
- **Averaging from 1 to over 16 million triggers per segment**
- **Trigger and clock synchronization modes for improved accuracy**
- **Noise Suppressed Accumulation (NSA)**

As a signal averager, the U1084A takes full advantage of the high-speed data conversion performance of the module to create real-time averaged signals to reduce random noise levels in repetitive signals.

Low noise, high dynamic range

The U1084A real-time averaging firmware (U1084A-AVG option) allows real-time acquisition at up to 4 GS/s down to 488.28 kS/s with binary sparsing (4 GS/s divided by 2^n).

Averaging signals reduces random noise effects, improving the signal-to-noise ratio, as well as increasing resolution and dynamic range. The fast sampling rate is achieved with a single trigger and acquisition, and does not require the use of equivalent-time sampling techniques.

Full-speed averaging

In contrast to Averagers that use equivalent-time sampling, the U1084A maintains maximum averaging speed and does not require additional triggers that reduce the total measurement throughput.

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Noise suppressed accumulation

In some applications, such as time-of-flight spectroscopy, the signal is a rare event sitting on top of a noisy baseline and the averaging process reduces the random noise. As a consequence, to enhance the digitizers ability to detect such signals in the presence of synchronous noise, the averaging firmware allows the user to set a threshold that must be exceeded for each data value to be entered into the sum.

Furthermore, to simplify overall system design in order to avoid overflow in the summed data, the noise base can be subtracted from each data value before the summation is done. A similar capability is implemented for negative-going signals.

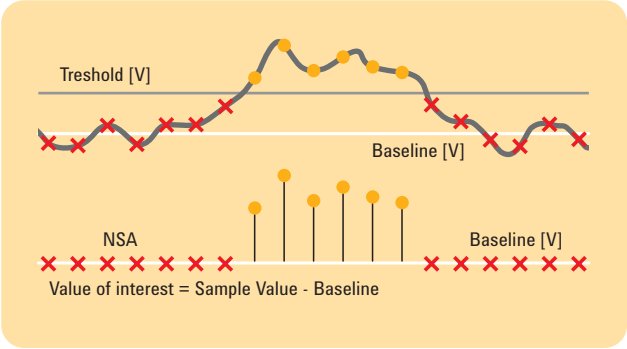


Figure 2. Signal detection using noise suppressed accumulation

Segment accumulation

In time-resolved applications where multiple averaged waveforms must be acquired with very low dead time, the averaging memory can also be segmented. This allows the user to store from 1 up to 128k separate accumulations of summed data. The segment length is user-programmable.

In standard segment accumulation mode the user selects the desired number of triggers per segment, N, up to over 16 million. The next segment accumulation will be started after the previous N triggers have been processed.

The memory in the U1084A averager is optimized to allow real-time acquisition and averaging. At the end of each average segment, a dead time exists before a new average can be stored. The dead time duration depends on the size of the segment, a 162 kS segment will incur a 1 ms dead time.

Ping-pong accumulation

To increase measurement rates the U1084A with AVG firmware will allow ping-pong accumulation and processing.

After the dead time, at the end of each segment accumulation, a new accumulation can be started before readout of the previous accumulation. Whilst accumulation continues, the previous segment can be read out through the high speed PCIe bus at up to 520 MB/s.

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Acqiris High-Speed PCIe Data Converter Firmware

U1084A-AVG

High-speed averaging firmware running on U1084A platform

Digital conversion

Sample rate
488.28 kS/s to 4 GS/s with binary sparsing

Resolution
8 bits

Time base

Clock accuracy
Better than ±2 ppm

Acquisition modes
Single shot
Sequence

Averaging memory

Acquisition length
Programmable from 1 to 524,288 Samples

Acquisition depth
Programmable from 1 to 16,777,216

Memory segmentation
Programmable from 1 to 131,072 segments

Dead time: <1.8 µs for succesive triggers in a segment

Averaging speed
Up to 4 GS/s

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System performance

Averaging resolution
32 bits

Transfer to PCI Express
130 MSamples/s

Coherent noise (typical)
< 0.02 LSB RMS (73 dB SNR)

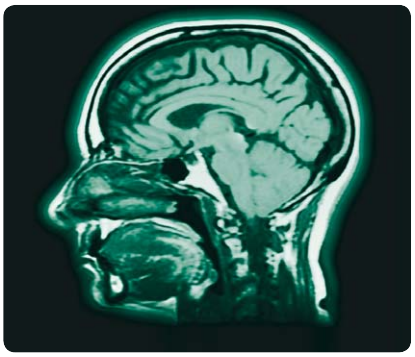
Conditions: 10,000 accumulated triggers, 10k samples, no input signal, ext. TRG, 100 mV FS, zero offset

General

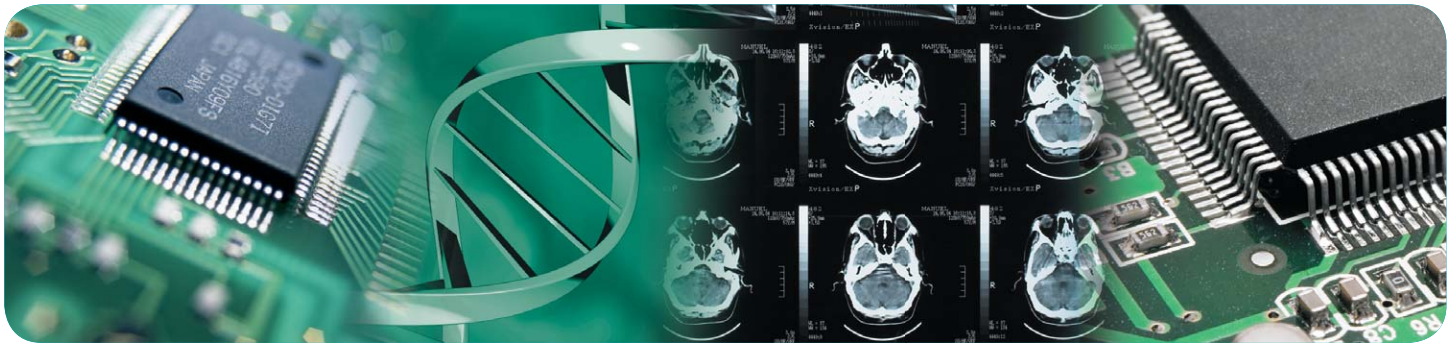
Power consumption
< 50 W

Current requirements (typ.)
Sampling at 4 GS/s
+12 V 2.5 A
+3.3 V 4 A





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Firmware for Real-Time Signal Peak Detection and Analysis

U1084A-TDC

- **Interleaved single-channel sampling and processing at up to 4 GS/s, on either input**
- **Effective acquisition length of 580 kSamples per channel**
- **Peak interpolation with time resolution down to 1/16th of the sampling period**
- **Programmable on-board TDC histogram creation with up to 4 billion counts per bin, peak count or summed amplitude**

The U1084A peak detection and analysis firmware (U1084A-TDC option) allows real-time acquisition and peak detection at up to 4 GS/s (down to 488.28 kS/s with binary sparsing). The firmware enables the creation of a histogram of peak position versus time for successive acquisitions, the histogram bins containing peak counts or summed peak amplitudes.

A large FIFO is used to provide a peak overflow protection: In the event that a burst of peaks causes congestion in the data flow, none of the previously acquired data is lost.

Large memory, high throughput

With 580 ksamples of peak analysis memory the acquired peak data can be transferred to the host PC at up to 130 Mbins/s, with each time bin as 32 bits.

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Powerful peak detection algorithm

Due to the incredible sampling speeds of the U1084A, the peak analysis firmware uses a very simple yet powerful algorithm to detect signal peaks at the full 4 GS/s sampling rate.

Nine samples are used to validate if a sample corresponds to a peak; the sample itself, along with the four samples before and after that sample are considered.

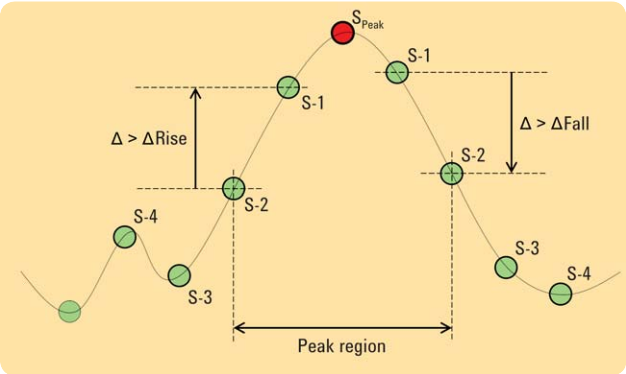


Figure 3. Peak detection algorithm in action

The sample will be considered as a peak, if within the 9 samples analyzed: a rising edge is found before the sample that exceeds the programmable delta ΔRise, a falling edge is found after the sample that exceeds the programmable delta ΔFall, and the sample is the maximum of all points between the two defined rising and falling edges. There is additional verification to make sure that only one peak is found within the rising and falling edge region.

Using this algorithm, peaks can be found on-the-fly in signals with frequencies up to half the sample rate.

Peak interpolation

To improve the measurement, peak time and amplitude are determined using an interpolation routine. Fitting a 12-bit quadratic spline to the 3 points around the extrema found by the peak detection algorithm, the position of a peak maximum is found and defined by its time (Tmax) and amplitude (Vmax).

This interpolation method provides measurement with improved time and vertical resolution. The resulting histogram that is created, can contain up to 2 Mbins of data, with each bin width down to 1/16th of the sampling period, peak amplitudes encoded with the bins, to 1/16th of the ADC resolution.

Adjustable through software commands, the user can balance the increased timing and vertical resolution against increased memory usage and reduced measurement throughput, to best fit requirements.

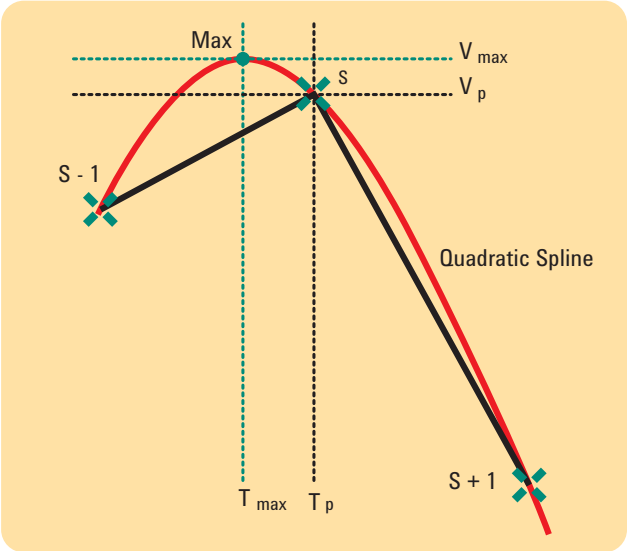


Figure 4. Peak interpolation with quadratic spline

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Acqiris High-Speed PCIe Data Converter Firmware U1084A-TDC

High-speed peak detection and analysis firmware running on U1084A platform

Digital conversion

Sample rate
488.28 kS/s to 4 GS/s with binary sparsing

Resolution
8 bits

Time base

Clock accuracy
Better than ±2 ppm

Sampling jitter
< 1 ps RMS
(for 10 µs record length)

Acquisition modes
Single segment
Single input (Input 1 or 2)

Peak histogram

Acquisition length
Programmable from 1 to 589,824 Samples

Acquisition depth
Programmable from 1 to 16,777,216

Double-pulse resolution
0.5 ns at 4 GS/s

Maximum sustained analysis rate
60 Mpeak/s

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System performance

Histogram
Count by peak value or event
Vertical count 32 bits/bin
Horizontal resolution down to 1/16th of sample rate
Readout 130 Mbins/s

General

Power consumption
<40W

Current requirements (typ.)
Sampling at 4 GS/s
+12 V 2.3 A
+3.3 V 1.2 A





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	*0.125 €/minute
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Switzerland	0800 80 53 53
United Kingdom	44 (0) 118 9276201
Other European Countries:	**www.agilent.com/find/contactus**

Revised: July 2, 2009

Ordering Information

Model	Description
U1084A	8-bit PCIe high-speed data converter
U1084A-001	2 GHz, 2-4 GS/s digitizer with on-board signal processing
U1084A-STD	Standard 512 MB processing memory
U1084A-BNC	BNC connectors
U1084A-SMA	SMA connectors

Choice of standard firmware option

U1084A-AVG	Real-time sampling and averaging
U1084A-TDC	Time-to-digital conversion and peak analysis

Accessories

U1084A-UK6	Calibration certificate and data

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Printed in USA, September 28, 2009
5990-4316EN

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