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Agilent U1068A

Acqiris High-Speed PCI Digitizers

DP211: 8-bit, 1 ch, 500 MHz, 2 GS/s
DP210: 8-bit, 1 ch, 500 MHz, 2 GS/s

Agilent Technologies

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Main Features

- 2 GS/s sampling rate
- 500 MHz bandwidth
- 256 kSample acquisition memory (16 Msamples optional)
- Single-channel or dual-input front-end, with internal calibration and input protection
- 50 Ω and 1 MΩ input impedance
- < ±2% DC accuracy for precise voltage measurement
- Complete pre- and post-triggering
- ±2 ppm clock accuracy
- Built-in 5 ps trigger time interpolator (TTI) for accurate timing measurements
- Low dead-time (< 800 ns) sequential recording with time stamps
- Device drivers for Windows®, VxWorks, LabViewRT, and Linux, with application code examples for MATLAB®, C/C++, Visual Basic, LabVIEW, and LabWindows/CVI

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Acqiris High-Speed Digitizers

The proprietary ADC chipsets in Agilent Technologies Acqiris high-speed digitizers are designed for the specific purpose of optimizing high-speed ADC performance. The analog front-end technology provides the signal conditioning, amplification, and interleaving functions essential to 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 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[1] with 8-, 10-, and 12-bit resolution, wide bandwidths, and large acquisition memory. These products, in PCI, 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.

Supreme PCI Performance

The Agilent Acqiris U1068A high-speed digitizer delivers 2 GS/s single-shot sampling rate, wide 500 MHz bandwidth, and long 256-ksample acquisition memory (optional extension to 16 Msample). The high sampling rate and wide bandwidth combine to allow the accurate capture of signals up to 500 MHz in frequency. The long acquisition memory enables the digitizer to record complex signals over long periods of time.

Long memories are essential for maintaining fast sampling rates and therefore timing resolution. For example, a U1068A with 4 Msamples of acquisition memory can record a signal over 2 ms with a sampling rate of 2 GS/s (0.5 ns per point). The fast sampling rate ensures all high-frequency signal components, up to the full bandwidth of the digitizer, are accurately recorded, complete and in the correct order.

Mezzanine Front-end

The signal input of the U1068A-001 digitizer has programmable front-end electronics that provide a complete set of input voltage ranges (from 50 mV to 5 V, full scale, in a 1, 2, 5 sequence) and variable voltage offset. The input has selectable impedance (50 Ω or 1 MΩ) and is fully protected against over-voltage signals. The amplifiers feature internal calibration (no need to disconnect input signals) and very fast recovery from out-of-range signals. The input buffer is mounted on a removable mezzanine card so replacement is fast and efficient, in the event of accidental damage or as components fatigue over time (such as relays in high-duty-cycle automated testing applications).

Flexible Trigger

The digitizer includes a precision trigger system with full pre- and post-trigger adjustment. User-selectable coupling is combined with internal or external trigger sources for maximum flexibility. The digitizer also provides a sophisticated sequential trigger mode with less than 500 ns dead time between successive triggers. This extremely low dead time enables events, that may occur at high repetition rates, to be captured and stored in their correct arrival sequence. This trigger mode is perfect for "impulse-response" type applications (radar, sonar, LIDAR, ultrasonic, medical and biomedical research, etc.).

The sequential trigger mode and low dead time greatly extend the digitizers' timing range and resolution. Each event can be individually time stamped and relative time measurements (between events) can be made with less than 1-ns resolution.

Precision Time Base

Each digitizer has its own crystal-controlled precision time base, and sample rates can be selected, in a 1, 2, 2.5, 4, 5 sequence, from 100 S/s to 2 GS/s. An internal time-to-digital converter (TDC) with high timing resolution is used to assist with timing calibration and trigger positioning. The TDC permits accurate positioning of the trigger signal with regard to the internal clock (sampling time). The sample rate can also be generated externally using the external input connector for applications where the sample rate must be synchronized with the signal to be acquired.

1) 500 MS/s, 1 GS/s, 2 GS/s, 4 GS/s and 8 GS/s high-speed digitizer cards

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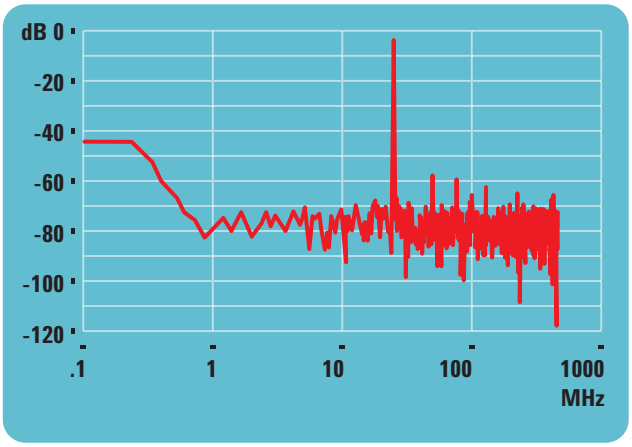

Figure1: FFT analysis of a pure 25 MHz sinewave, measured with U1068A-001 at 500 mV full scale, shows very low noise floor and little harmonic distortion.

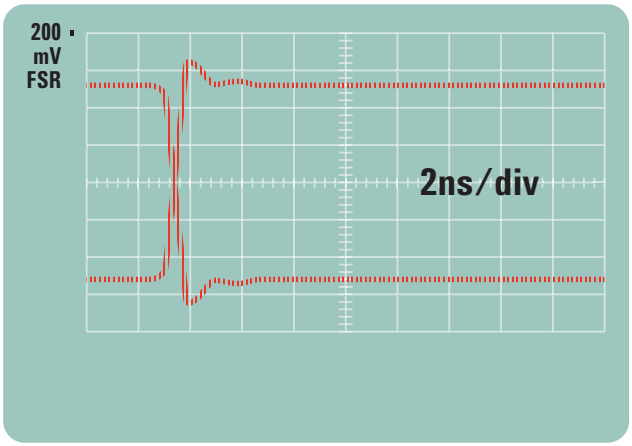

Figure 2: Positive and negative step responses of U1068A-001 show minimum overshoot and undershoot.

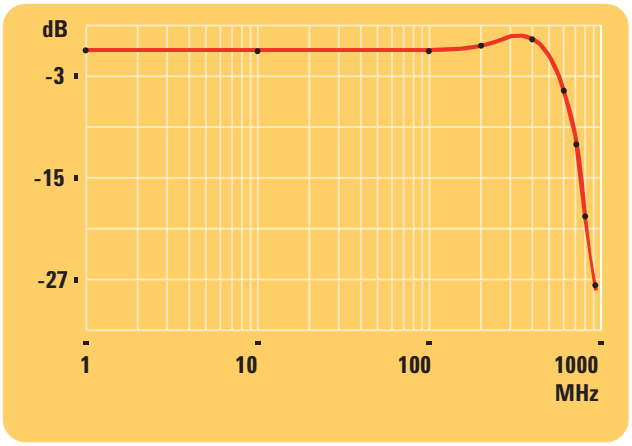

Figure 3: Frequency response of U1068A-001 is flat and system bandwidth reaches beyond the specified 500 MHz

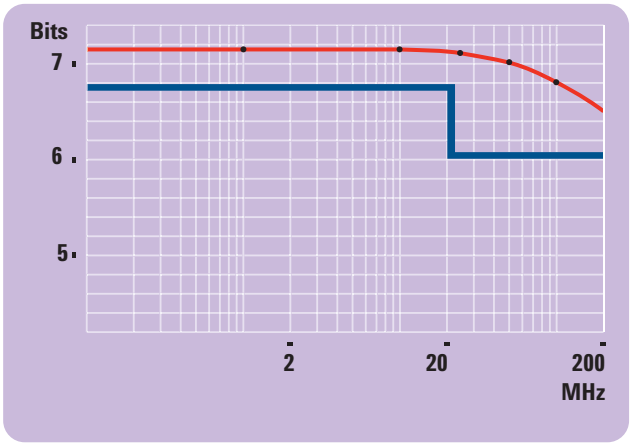

Figure 4: Effective bits (top graph) are significantly higher than the guaranteed performance (bottom graph)

Quality Acquisitions

Acqiris digitizers are designed to provide superior measurement precision and accuracy. Key acquisition specifications (such as DC accuracy, integral and differential linearity) are optimized to deliver maximum measurement fidelity. Careful circuit layout, custom IC's, and special packaging techniques are all used to reduce overall system noise. The low noise and low harmonic distortion are best demonstrated by the following Fourier transform performed on an acquired signal. Other important qualities of the digitizer include step response, frequency response, and high effective bit score. The following figures depict typical measurements.

Low Parts Count

A high level of integration is needed in order to achieve the level of performance obtained with the U1068A digitizer. By drastically reducing the number of components, the integration also has clear benefits for reliability and lowers the total power consumption. To maintain quality measurements in the severe, poorly-cooled PC environment can be very difficult. Agilent Acqiris digitizers use a proprietary-cooling scheme. This cooling method allows components to run at safe and stable operating temperatures. It helps to extend component life as well as minimize measurement errors caused by temperature variation.

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Easily Integrated

In production test environments, the time taken to integrate all the required test modules needs to be minimized.

In semiconductor production testing for example, the addition of high speed functionalities in on-chip design, such as Ethernet, Wi-Fi®, and Bluetooth®, have led to a growing requirement for high-speed data conversion tools. It is important that the digitizer module chosen for this task can be simply integrated into the existing component testing system, minimizing down-time.

Agilent's high-speed Acqiris digitizers are supplied with software drivers for Windows, Linux, LabVIEW RT and VxWorks, and application code examples for MATLAB, C/C++, VisualBasic, LabVIEW, and LabWindows/CVI.

These code examples provide digitizer setup and basic acquisition functionality, and are easily modified, so that the card can be quickly integrated into an existing measurement system.
The flexibility of the driver means that, with minimum software adjustments, any Acqiris digitizer can be swapped out, replaced, or upgraded with the latest high-speed version.

Figure 5: AcqirisLive Application software is supplied with the U1068A hardware

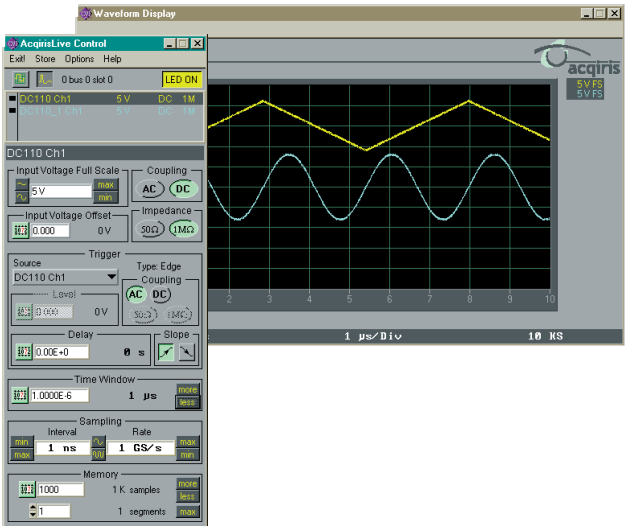
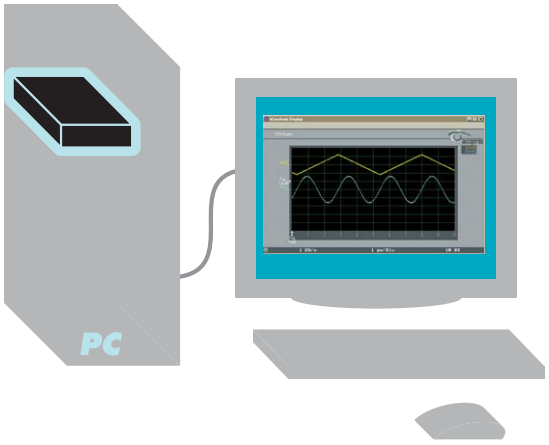


Figure 6: The standard PCI interface makes installation of the U1068A quick and easy.



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Acqiris High-Speed PCI Digitizers

Model DP211

Single-channel, dual-input, 8-bit, 2 GS/s, 500 MHz bandwidth

Model DP210

Single-channel, 8-bit, 2 GS/s, 500 MHz bandwidth

Signal input

Channels
U1068A-001: Single at 2 GS/s
U1068A-002: Single at 2 GS/s, two software selectable inputs

Bandwidth (-3 dB)
-001: DC to 500 MHz in 50 Ω, DC to 400 MHz in 1 MΩ
-002: DC to 500 MHz with FS >50 mV, DC to 200 MHz with FS at 50 mV

Bandwidth limit filter
None

Full scale (FS)
-001: 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V, and 5 V
-002: 50 mV, 100 mV, 200 mV, and 500 mV

Offset range
-001:
±2 V for 50 mV to 500 mV FS
±20 V for 1 V to 5 V FS
-002:
±2 V

Maximum input voltage
-001:
±5 V DC (2 W) or 0.5 W RMS at 50 Ω
100 V (DC + peak AC <10 kHz) at 1 MΩ
-002:
±5 V DC (2 W) or 0.5 W RMS

Coupling
AC, DC

Impedance
-001:
1 MΩ ± 0.5% // 8-14 pF
50 Ω ± 1%
-002:
50 Ω ± 1%

Connectors
BNC or SMA, gold plated

Digital conversion

Sample rate
100 S/s to 2 GS/s

Resolution
8 bits

DNL
±0.7 LSB

Acquisition memory
256 kSamples

Optional memory
16 MSamples

Time base

Clock accuracy
Better than ±2 ppm

Acquisition modes
Single shot
Sequence: 1 to 200 segments (8000 segments with 16 MSamples)
Dead time:
< 800 ns

Trigger time interpolator
5 ps resolution

Internal and external trigger

External trigger input
Threshold adjust range: -3/+3 V
Impedance: 50 Ω/1 MΩ
Maximum input voltage: ±5 V DC
Amplitude range: > 10% FS

Coupling
DC, AC (50 kHz LF reject)

Modes
Edge, positive and negative

Pre-trigger
Adjustable to 100% of horizontal full scale

Post-trigger
Adjustable up to 200 MSamples

External clock and reference

External clock/ref input
Impedance: 50 Ω/1 MΩ
Maximum input voltage: ±5 V DC

External clock frequency
10 MHz to 500 MHz

External ref frequency
9 MHz to 10.2 MHz

External clock/ref threshold
Variable between -3 V and +3 V

External clock/ref amplitude
>500 mV pkpk

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System performance

DC accuracy
±2% of FS for ≥ 100 mV FS
±1% of FS for 50 mV FS

Effective bits (max. SR)
>6.5 at 10.7 MHz
>6.0 at 99.5 MHz

INL
< ±1% FS

General

Host computer and operating system:
PC compatible (x86) systems running Microsoft Windows Vista, Windows XP, Windows 2003 Server, Windows 2000, Wind River VxWorks, National Instruments LabVIEW RT, or Linux.
PowerPC systems running Wind River VxWorks.
For more information on which specific processors and operating system versions are supported, please contact us.

Transfer speed:
High-speed PCI bus transfers data at sustained rates to host computer: Up to 100 Mbytes/s for 32-bit/33 MHz operation

Power consumption
Without memory option
<22 W
With memory option
<25 W

Current requirements
Without memory option

12 V	0.7 A
5 V	2.7 A
-12 V	0.02 A

With memory option

12 V	0.7 A
5 V	3.1 A
-12 V	0.02 A

Warranty
1 year

Front-Panel LEDs indicate digitizer status
Green: ready for trigger
Yellow: module identification
Red: trigger

Environmental and physical

Operating temperature
0° to 50°C

Relative humidity
5 to 95% (non-condensing)

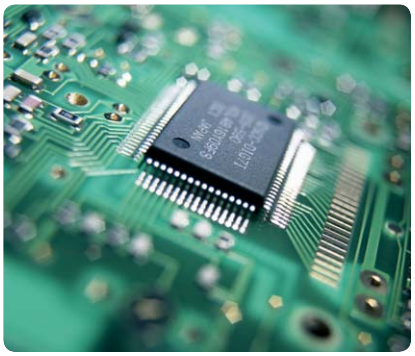
Dimensions
PCI short-length standard

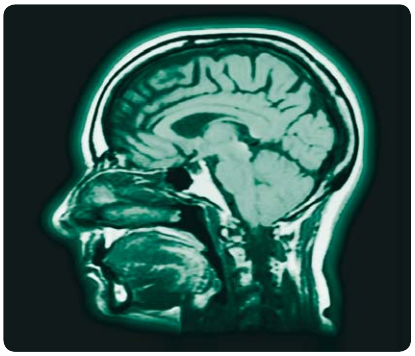
Safety
Complies with EN61010-1

EMC immunity
Complies with EN61326-1
Industrial Environment

EMC emissions
Complies with EN61326-1 Class A for radiated emissions

CE Certification and Compliance





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Contacts

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Switzerland	0800 80 53 53
United Kingdom	44 (0) 118 9276201
Other European Countries:	41 (22) 884 32 90

Revised: March 27, 2008

Ordering Information

Model	Description
U1068A	Acqiris DP211 and DP210 high-speed 8-bit digitizers
U1068A-001	Single-channel, 500 MHz, 2 GS/s, 256 kSample, DP210
U1068A-002	Single-channel dual-input, 500 MHz, 2 GS/s, 256 kSample, DP211
U1068A-M16	16 MSample acquisition memory
U1068A-M4M	4 MSample acquisition memory
Accessories	
U1068A-UK6	Calibration Certificate and Cal Data

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For more information on Acqiris product line, sales or services, see our website at:
www.agilent.com/find/acqiris

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