Agilent U1067A

Acqiris High-Speed PCI Digitizers

DP110: 8-bit, 1 ch, 250 MHz, 1 GS/s
DP105: 8-bit, 1 ch, 150 MHz, 500 MS/s

Agilent Technologies

Main Features

- **Single channel digitizer with fully-featured 50 Ω/1 MΩ mezzanine front-end design**
- **Internal calibration and input protection**
- **Analog bandwidth up to 250 MHz**
- **Up to 1 GS/s sampling rate in single channel mode with up to 8 MSamples of acquisition memory**
- **Built-in trigger time interpolator (TTI) for accurate timing measurements**
- **Low dead-time sequential recording with time stamps (U1067A-002 < 800 ns, U1067A-001 1.1 µs)**
- **Device drivers for Windows®, VxWorks, LabViewRT, and Linux, with application code examples for MATLAB®, C/C++, Visual Basic, LabVIEW, and LabWindows/CVI**

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 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[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.

Precision Waveform Acquisition

Agilent Acqiris high-speed PCI digitizers (U1067A) feature fast sampling rates, wide bandwidth, and long acquisition memories. This performance combination allows the capture of high frequency signals with precision and ease. Sampling at up to 1 GS/s improves timing resolution and accuracy while the 250 MHz bandwidth reduces signal distortion and attenuation. The deep acquisition memory, up to 8 MSamples, allows the storage of massive amounts of data over long periods of time and also helps to preserve timing resolution.

Long Acquisition Memory

The long memory of the digitizer preserves the sampling rate and ensures waveforms are captured with total confidence. With 2 MSamples of memory, the digitizer can record a signal over two milliseconds with a sampling rate of 1 GS/s (1 ns per sample). The fast sampling rate ensures that all high frequency signal components, up to the full bandwidth of the card, are accurately recorded and that all events are captured.

Fast Data Transfer

With data transfer rates up to 100 MB/s over the PCI bus, the digitizer brings high speed to applications that require rapid data throughput. The fast transfer rate enables the user to use the power of a PC to quickly perform measurements and analysis. The result is flexibility and performance that can dramatically reduce testing times, increase measurement throughput, and lower system cost.

Mezzanine Front-end

The signal input of each digitizer has a programmable amplifier that provides variable voltage offset and a complete set of ranges (from 50 mV to 5 V full scale in a 1, 2, 5 sequence). The inputs have selectable impedance (50 Ω or 1 MΩ), are fully protected against over-voltage signals, and feature internal calibration (no need to disconnect input signals). The front-end analog circuitry is mounted on a removable mezzanine card. The mezzanine card allows for fast and efficient replacement in the event of accidental damage or as components fatigue over time (e.g., relays in high-duty-cycle automated testing applications).

Flexible Trigger

The U1067A digitizer features 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 cards also provide sophisticated sequential trigger modes with less than 800 ns of dead time between successive triggers (1.1 µs with -001 version). This extremely low dead time enables events, which may occur at very 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, time-of-flight, ultrasonic, medical and biomedical research, etc.). The sequential trigger mode and very low dead time greatly extend the digitizer's 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 card also has its own crystal-controlled precision time base. Sample rates can be selected, in a 1, 2, 2.5, 4, 5 sequence, from 100 S/s to 1 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

Quality Acquisitions

Agilent Acqiris digitizers are designed to provide superior measurement precision and accuracy. Key acquisition specifications (such as DC accuracy and integral and differential linearity) are optimized to deliver maximum measurement fidelity. Careful circuit layout, custom IC's, and special packaging techniques are used to reduce system noise, often encountered in the harsh PC environment.

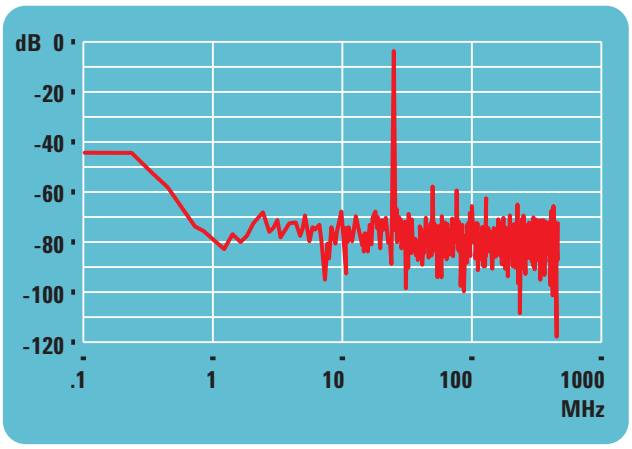


Figure 1: FFT analysis of a pure 25MHz sinewave, measured at 500 mV full scale, shows very low noise floor and little harmonic distortion.

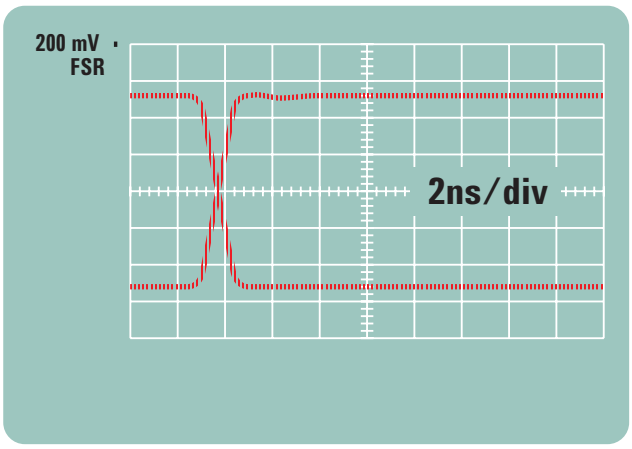


Figure 2: Positive and negative step responses show little or no overshoot or undershoot.

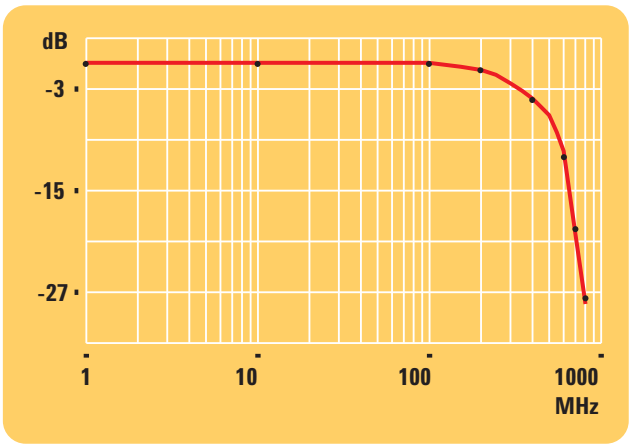


Figure 3: Frequency response is very flat and system bandwidth reaches well beyond the specified 250 MHz.

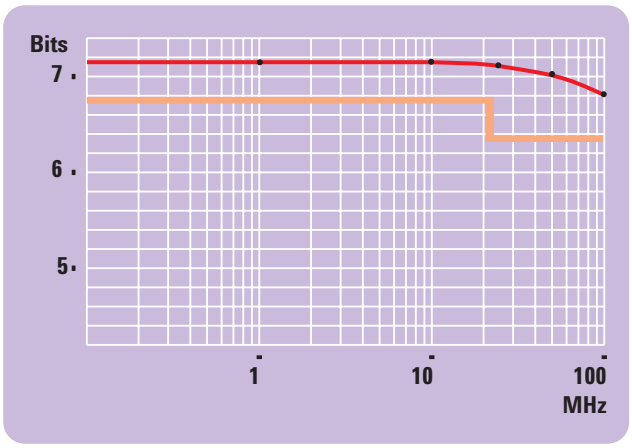


Figure 4: Effective bits (top graph) are significantly higher than the minimum guaranteed performance (bottom graph).

Low Parts Count

A high level of integration is needed in order to achieve the level of performance obtained with the U1067A digitizer card. By drastically reducing the number of components the integration also has clear benefits on reliability and lowers the total power consumption. To maintain quality measurements in the severe, poorly-cooled PC environment can be 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 minimizing measurement errors caused by temperature variation.

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 and easily 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 a 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 Acqiris digitizer.

Figure 5: AcqirisLive Application

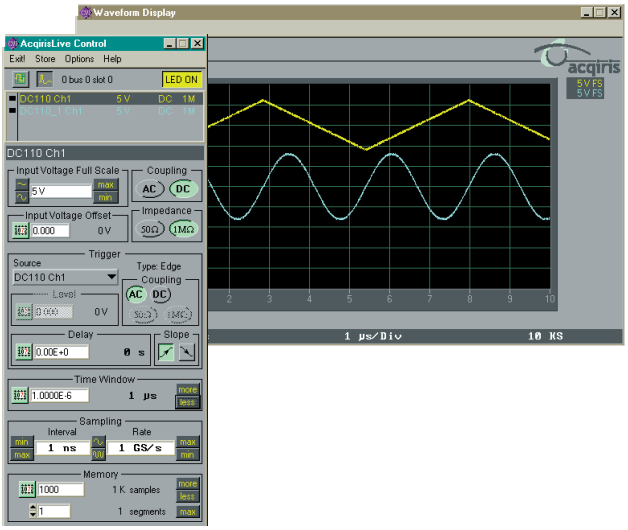
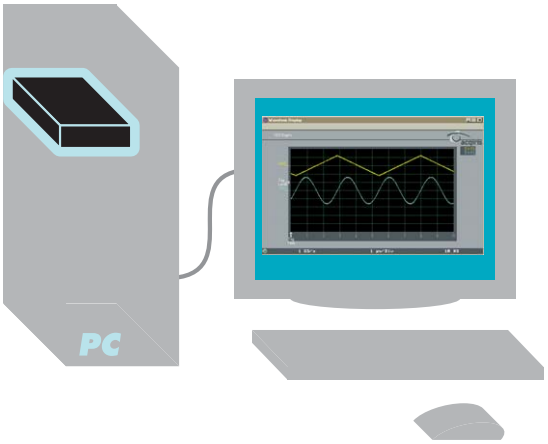


Figure 6: PC Solution



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Acqiris High-Speed PCI Digitizers

Model DP110

Single-channel, 8-bit, 1 GS/s, 250 MHz bandwidth

Model DP105

Single-channel, 8-bit, 500 MS/s, 150 MHz bandwidth

Signal input

Channels
U1067A-001: Single at 500 MS/s
U1067A-002: Single at 1 GS/s

Bandwidth (-3 dB)
-001: DC to 150 MHz
-002: DC to 250 MHz

Bandwidth limit filter
None

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
±20 V for 1 V to 5 V FS

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

Coupling
AC, DC

Impedance
1 MΩ ± 1% // 8-16 pF
50 Ω ± 1%

Connectors
BNC or SMA, gold plated

Digital conversion

Sample rate
-001: 100 S/s to 500 MS/s
-002: 100 S/s to 1 GS/s

Resolution
8 bits

DNL
±0.7 LSB

Acquisition memory
-001: 128 kSamples
-002: 128 kSamples

Optional memory
-001: 2 MSamples
-002: 2 MSamples or 8 MSamples

Time base

Clock accuracy
Better than ±50 ppm

Sampling jitter
< 10 ps rms for 20 µs with internal clock and reference

Acquisition modes
Single shot
Sequence: 1 to 200 segments (4000 segments with 2 MSamples, 8000 segments with 8 MSamples)
Dead time:
-001: < 800 ns
-002: < 1.1 µs

Trigger time interpolator
80 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 -2 V and +2 V

External clock/ref amplitude
>2 V pkpk

System performance

DC accuracy
±2% of FS for ≥ 100 mV FS
±2.5% 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
<16 W

Current requirements

12 V	0.55 A
5 V	1.9 A
-12 V	0.02 A

Warranty
1 year

Environmental and physical

Operating temperature
0° to 50°C

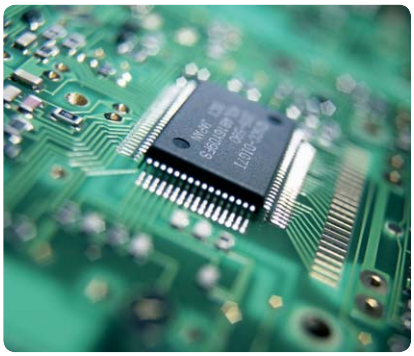
Relative humidity
5 to 95% (non-condensing)

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



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Ordering Information

Model	Description
U1067A	Acqiris DP110 and DP105 8-bit high speed PCI digitizer
U1067A-001	Single-channel, 150 MHz, 500 MS/s, 128 kSample, DP105
U1067A-002	Single-channel, 250 MHz, 1 GS/s, 128 kSample, DP110
U1067A-M2M	2 MSample acquisition memory
U1067A-M8M	8 MSample acquisition memory for U1067A-002

Accessories

U1067A-XP1	Fan unit for U1067A digitizers
U1067A-UK6	Calibration Certificate and Cal Data

www.agilent.com

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

Product specifications and descriptions in this document subject to change without notice.

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