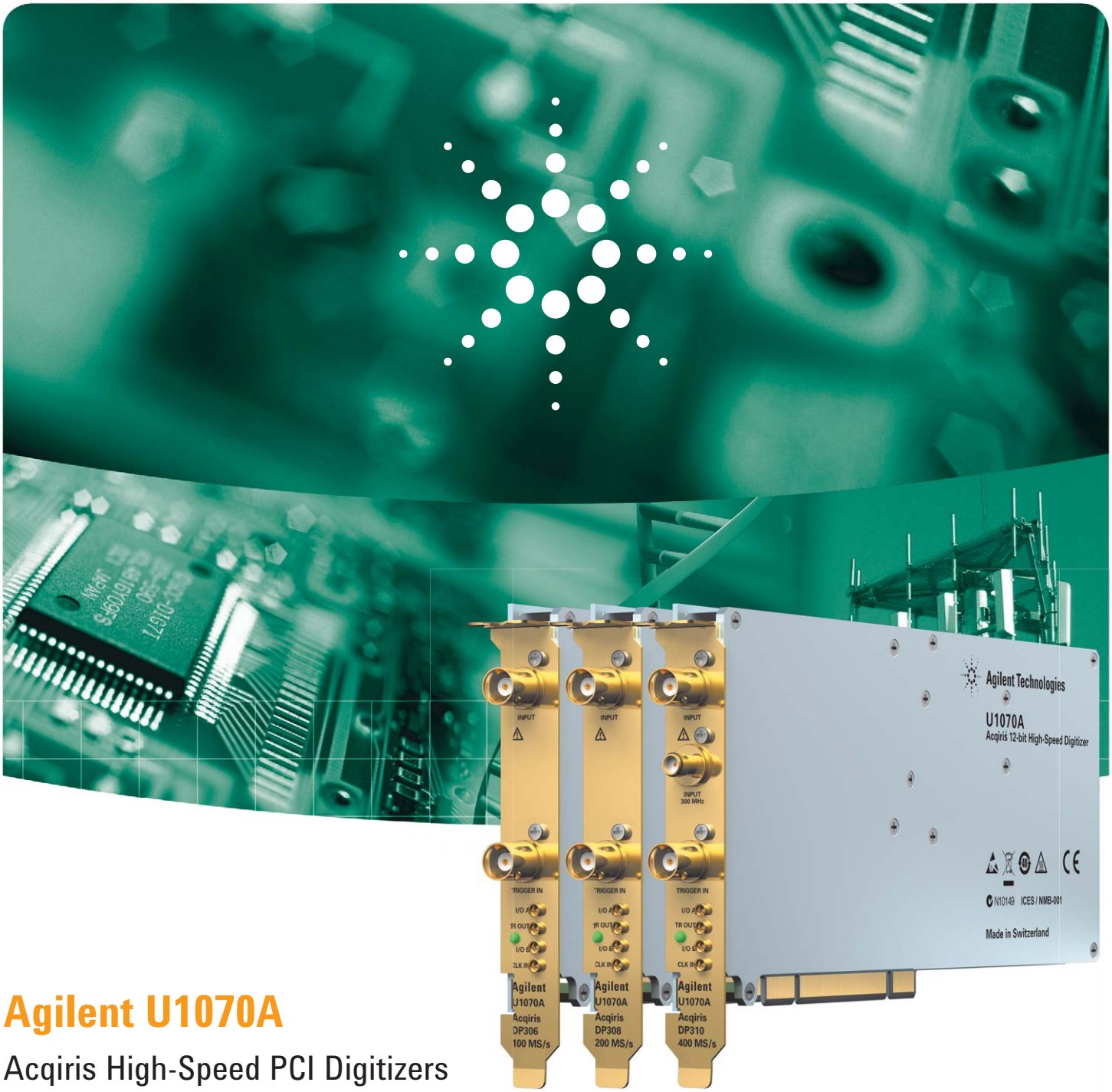
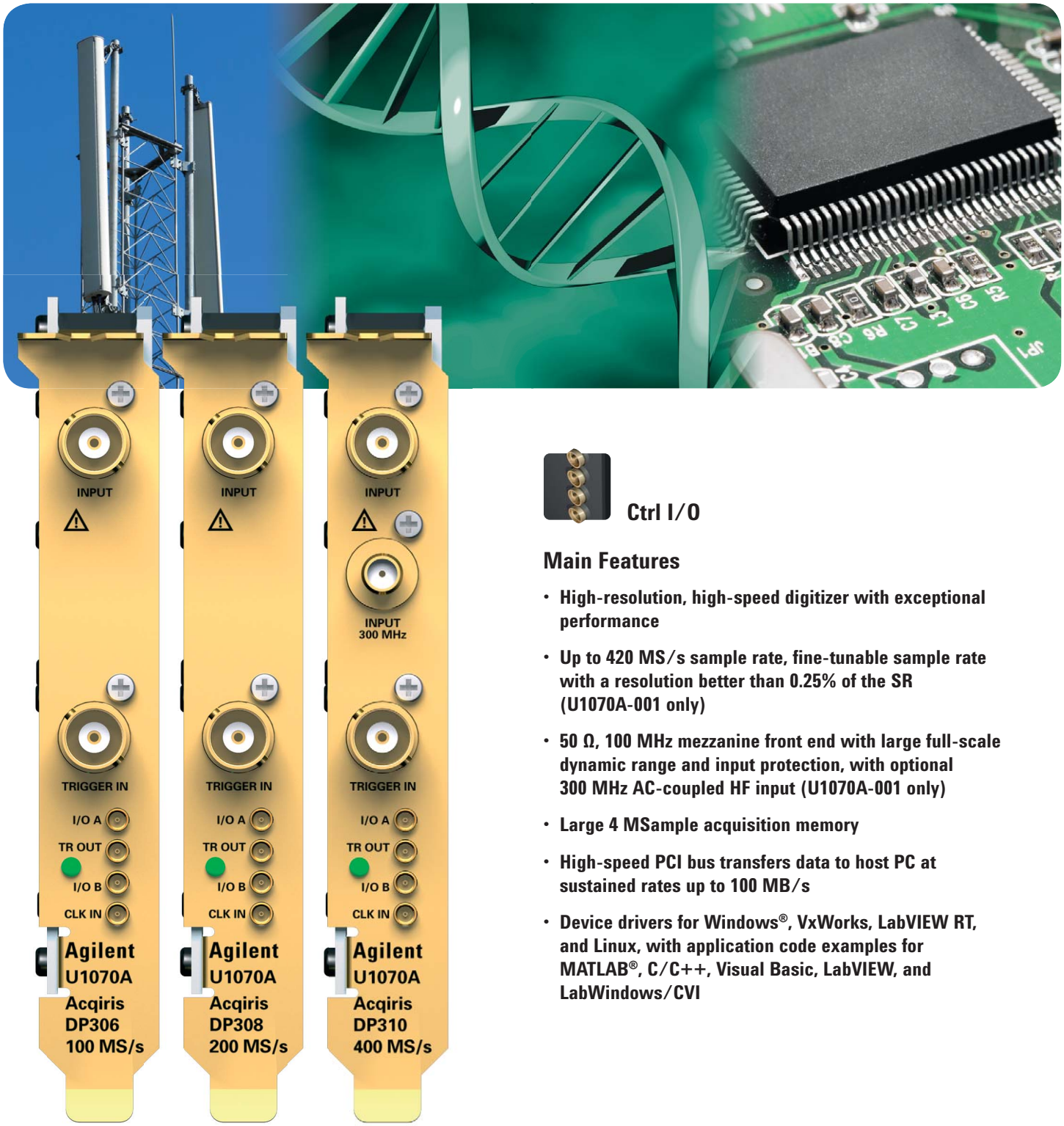


Agilent U1070A

Acqiris High-Speed PCI Digitizers

DP310: 12-bit, 1 ch, 100 MHz/300 MHz, 420 MS/s
DP308: 12-bit, 1 ch, 100 MHz, 200 MS/s
DP306: 12-bit, 1 ch, 50 MHz, 100 MS/s

Agilent Technologies



Ctrl I/O

Main Features

- High-resolution, high-speed digitizer with exceptional performance
- Up to 420 MS/s sample rate, fine-tunable sample rate with a resolution better than 0.25% of the SR (U1070A-001 only)
- 50 Ω, 100 MHz mezzanine front end with large full-scale dynamic range and input protection, with optional 300 MHz AC-coupled HF input (U1070A-001 only)
- Large 4 MSample acquisition memory
- High-speed PCI bus transfers data to host PC at sustained rates up to 100 MB/s
- Device drivers for Windows®, VxWorks, LabVIEW RT, and Linux, with application code examples for MATLAB®, C/C++, Visual Basic, LabVIEW, and LabWindows/CVI

Windows is a U.S. registered trademark of Microsoft Corporation.
MATLAB is a U.S. registered trademark of The Math Works, Inc.

Acqiris High-Speed Digitizers

The proprietary ADC chipsets in the 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 rates at GS/s. 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 100 MS/s, 200 MS/s, 400 MS/s, 500 MS/s, 1 GS/s, 2 GS/s, 4 GS/s and 8 GS/s high-speed digitizer cards with 8-, 10- and 12-bit resolution, wide bandwidth and large acquisition memory. These products, in PCI, PXI, cPCI, and VME formats, are used in research, ATE, and OEM applications in industries as wide spread as biotechnology, semiconductors, aerospace, physics, and astronomy.

Unique Tools for Complex Frequency Analysis

Agilent Acqiris high-speed PCI digitizers (U1070A) set the standard in high-resolution data acquisition. Using the latest technology, the digitizers provide fast sample rates of up to 420 MS/s and wide bandwidths of up to 300 MHz. The digitizers feature long 4 MSample acquisition memory. Waveforms are transferred directly into the digitizers' large acquisition memory so that complex signals can be stored over long time periods. Large memory is essential for maintaining fast sampling rates and timing resolution.

The 12-bit digitizers have their own crystal-controlled precision time base (better than ±2 ppm). Sampling rates for the DP308 and DP306 configurations can be chosen among a discrete number of values that cover the full range between 100 S/s and 200 MS/s respective 100 MS/s. Sampling rates for the U1070A-001 configuration, however, can be precisely tuned with a resolution better than 0.25% (500 kS/s in the 200 to 400 MS/s range) of the sampling frequency, in the full range up to 420 MS/s. This unusual time base flexibility is ideal for wideband frequency-related measurements. It allows for easy demodulation processing of I/Q modulated carriers, like the ones used in QAM or RF/IF digital receivers. The high-resolution sample rate (HRes SR) applications range from IF sampling and wireless communications (and derivative applications) to radar identification. The HRes SR can also be exploited to deliver a fine-grained adjustable distance/sample-period ratio in ranging applications.

The sample rate selection and bandwidth combine to allow the high-resolution capture of signals with a high spurious-free dynamic range (typ. 80 dB into the HF input and 75 dB otherwise) and a high signal-to-noise ratio (typ. 65 dB into the HF input, 62 dB otherwise).

Additional outstanding specifications include typ. total harmonic distortion (THD) of -78 dB, very low noise floor spectrum at -90 dB and effective bits (ENOB) of more than 10. Such specifications make the U1070A digitizers a perfect match for test and measurement applications in automotive, ultrasound, medical imaging, lidar, NDT, and high-accuracy analytical instruments. The HF input of the DP310 is ideal for wireless communication equipment testing, general QAM or RF/IF digital receivers, and radar wideband communication and analysis (SIGINT) applications.

Advanced Features for Broadband Signal Capturing

Mezzanine front end

The standard signal input of the U1070A digitizer has programmable front-end electronics that provide an input voltage range from 250 mV to 10 V full scale in a 1, 2, 5 sequence, and variable voltage offsets. The HF input bypasses the input stage and gives direct access to the ADCs. Both the standard and HF inputs have 50Ω impedance and are protected against over-voltage signals by clamp diodes. The amplifier in the standard input has internal calibration. Many applications can save time by only performing calibration for the configurations that will actually be used. Calibration can usually be performed with signals present at the channel, external, and clock inputs. However, if the calibration is found to be unreliable, as shown by a calibration failure status, it may be necessary to remove such signals. The input buffer amplifier and ADCs are mounted on a removable mezzanine card guaranteeing fast replacement, in the event of accidental damage or component fatigue.

Flexible trigger

The U1070A digitizer include 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 1 µs dead-time between successive triggers. This 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 such as radar, lidar, ultrasound, medical and biomedical research. The sequential trigger mode and very low dead time greatly extend the digitizer timing range and resolution. Each event can be individually time-stamped and relative time measurements (between events) can be made with better than 100 ps accuracy.
Furthermore, a TV trigger capability has been added. This opens the way to wideband video signal applications such as the ones based on fast CCD cameras for imaging readout. The TV trigger mode is for positive video modulation and allows line and frame selection (odd and even) for common video standards:

- B/G: 625 lines/50 frames, PAL
- L: 625 lines/50 frames, SECAM
- M: 525 lines/60 frames, NTSC

Front-panel multiple I/O ports

The control over the trigger and time base is made even more flexible by the addition of high-density, high-frequency front-panel connectors. The four MMCX-type front-panel connectors enable the use of an external clock (up to 400 MHz) or reference signal (10 MHz), a trigger output, and two additional I/O digital control lines.

The latter can be used for monitoring or modifying the digitizer's status and configuration; an example of the control available is trigger gating. Also, they can be used as a 10 MHz, built-in source for autonomous board test purposes.

High Reliability

Low parts count

The low number of components increases reliability and lowers total power consumption. To maintain quality measurements the digitizer also uses 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.

High-Fidelity Frequency-Related Measurements

Quality acquisitions

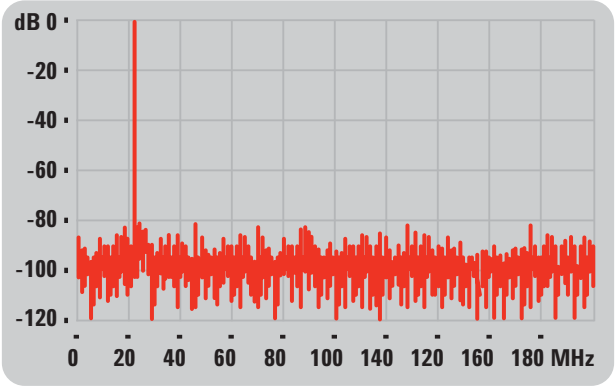
Agilent Acqiris digitizers provide superior measurement precision and accuracy. Key acquisition specifications such as DC accuracy, integral and differential linearity and phase noise are optimized to deliver maximum measurement fidelity. Careful circuit layout, custom ICs, and special packaging techniques are all used to reduce overall system noise.

Easy Software Integration

Agilent Technologies' 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 set up 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.

FFT analysis: standard input



FFT analysis: HF input

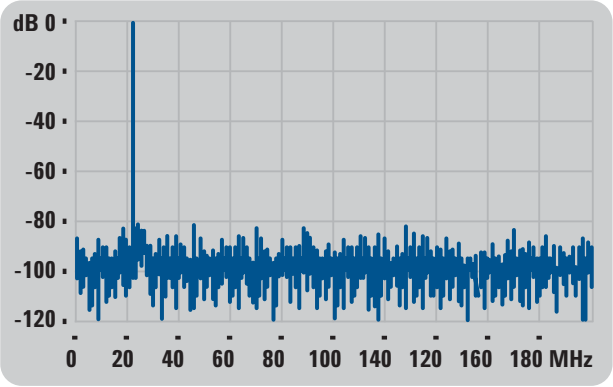


Figure 1 and 2: FFT analysis of a pure 25 MHz sinewave at 400 MS/s shows amazingly low noise floor, extremely high SFDR and little harmonic distortion for both the standard and high-frequency inputs.

Frequency response: standard input

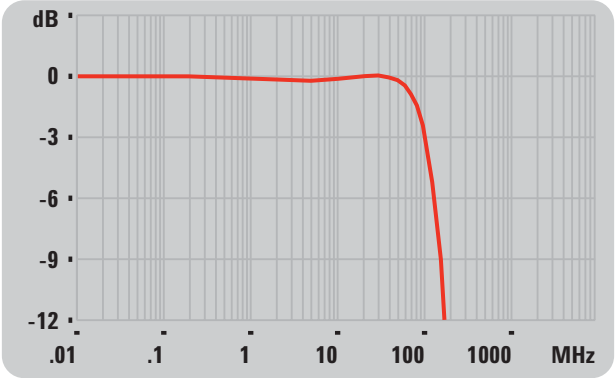


Figure 3: Frequency response for standard input is flat and system bandwidth for 1 V FS exceeds the specified 100 MHz.

Frequency response: HF input

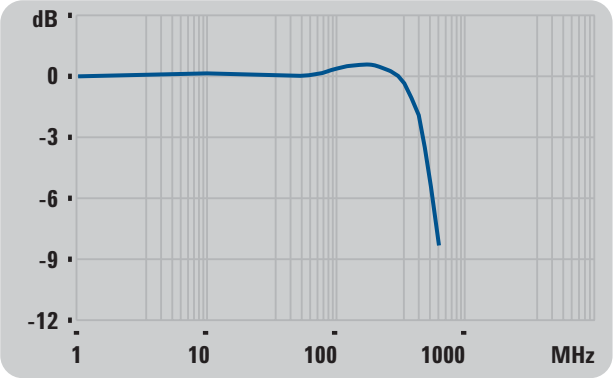


Figure 4: Frequency response of HF input shows system bandwith above the specified 300 MHz.

SFDR & THD: standard input, HF input

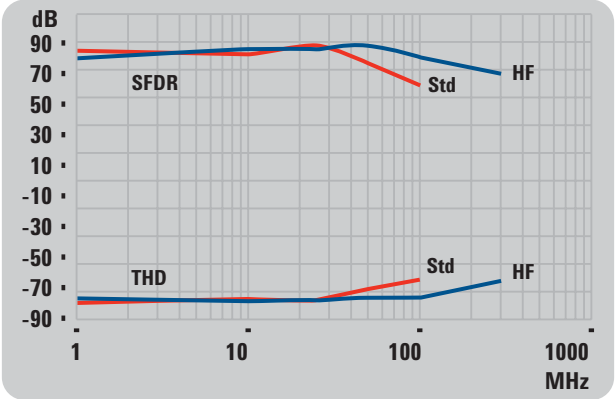


Figure 5: SFDR & THD values at 170 MS/s SR and 80% of 1 V FS are remarkably high for both the standard and HF inputs.

Effective bits: standard input, HF input

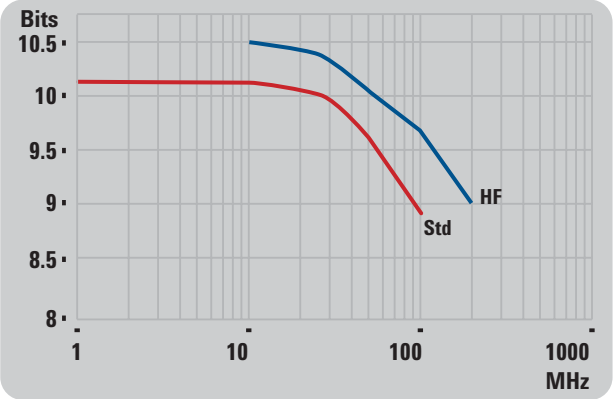


Figure 6: Effective bits at 170 MS/s SR and 80% of 1 V FS are well above 10 for both the standard and HF inputs.

Acqiris High-Speed PCI Digitizers

Model DP310

Single-channel, 12-bit, 420 MS/s, 4 MSample memory

Model DP308

Single-channel, 12-bit, 200 MS/s, 4 MSample memory

Model DP306

Single-channel, 12-bit, 100 MS/s, 4 MSample memory

Signal input – 50 Ω BNC

Channels
U1070A-001: Single at 420 MS/s
U1070A-002: Single at 200 MS/s
U1070A-003: Single at 100 MS/s

Bandwidth (-3 dB)
-001, -002: DC to 100 MHz
-003: DC to 50 MHz

Bandwidth limit filter
-001, -002: 35 MHz 2-pole Bessel filter
-003: None

Full scale (FS)
250 mV, 500 mV, 1 V, 2 V, 5 V, 10 V

Offset range
±1 V for 250, 500 mV, 1 V FS
±2 V for 2 V FS
±5 V for 5 V FS
±10 V for 10 V FS

Maximum input voltage
±10 V DC (2 W) or 10 V RMS at 50 Ω

Coupling
DC into 50 Ω

Impedance
50 Ω ± 1% at DC

Connectors
BNC, gold plated

Signal input – 50 Ω SMA (-001 only)

Channels
Single at 420 MS/s

Bandwidth (-3 dB)
1 to 300 MHz

Full scale (FS)
+8.9 dBm (1.75 V FS) typical

Maximum input voltage
± 15 V DC + 2 V RMS (AC component) at 50 Ω
(Diode clamping at 6 V pk-pk)

Coupling
AC

Impedance
50 Ω ± 5%, AC coupled

Connectors
SMA, gold plated

Digital conversion

Sample rate
-001: 100 S/s to 420 MS/s
-002: 100 S/s to 200 MS/s
-003: 100 S/s to 100 MS/s

Signal rate adjustment granularity
-001: < 0.25% of SR;
500 kS/s in 200–420 MS/s range
-002: < 10% of SR
-003: < 50% of SR

Resolution
-001: 12 bits ar SR > 200 MS/s, 13 bits at SR ≤ 200 MS/s
-002: 12 bits at SR > 110 MS/s, 13 bits at SR ≤ 110 MS/s
-003: 12 bits

DNL
In the range of [-0.9, 0.5] LSB

Acquisition memory
4 MSamples/channel

Time base

Clock accuracy
Better than ±2 ppm

Sampling jitter
< 1 ps rms for 1 ms with internal clock and reference

Acquisition modes
Single shot
Sequence: 1 to 8000 segments
Dead time:
-001, -002: < 1 µs
-003: < 2 µs

Residual phase modulation
-001: 0.3° RMS (typ.) at 400 MS/s
-001, -002: 0.2° RMS (typ.) at 200 MS/s
from 10 Hz to 10 MHz

Trigger time interpolator
5 ps resolution

AS bus
Synchronized clock and trigger distribution for up to 7 adjacent modules of the same type in a crate

AS bus sampling skew
± 100 ps

Internal and external trigger

Internal trigger input (Standard input only)
Threshold adjust range: ± 0.6 FS about mid-point voltage
Sensitivity:
Frequency range:
DC to 100 MHz
Amplitude range: > 10% FS

External trigger input (BNC)
Threshold adjust range: -3/+3 V
Impedance: 50 Ω/1 MΩ
Maximum input voltage: ±5 V DC
Sensitivity:
Frequency range: DC to 300 MHz
Amplitude range: > 15% FS

TV trigger
Trigger for positive modulation
Line & frame selection (odd and even)
Standards:
- B/G (625 lines/50 frames, PAL)
- L (625 lines/50 frames, SECAM)
- M (525 lines/60 frames, NTSC)

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 100 MSamples

Control I/O (MMCX)

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

Ctrl I/O A and B output
10 MHz reference clock out with 50 Ω impedance
Acquisition active
Acquisition skipping to next segment
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: ±2 V DC

CLK IN ext. clock input
-001: 10 MHz to 400 MHz
-002: 50 MHz to 200 MHz
-003: 50 MHz to 100 MHz
SR may be refined with sparsing

CLK IN ext. reference frequency
10 MHz ± 10%

System performance

DC accuracy
± 0.5% of FS at ≥ 1 V FS
± 1.0% of FS at < 1 V FS

Effective bits (max. SR)
> 9.0 at DC-25 MHz (typ. 10 for HF input)

INL
< ± 0.04% FS at 25 °C

SFDR typ. (< 25 MHz signal)
Standard input: > 78 dB at FS ≥ 1 V
Standard input: > 73 dB at FS < 1 V
HF input: > 80 dB

RMS noise (max. SR)
Standard input: > 57 dB (typ. 60 dB) at 250 mV, 500 mV FS
Standard input: > 61 dB (typ. 63 dB) at 1 V, 2 V, 5 V, 10 V FS
HF input: > 64 dB

THD typ. (< 25 MHz signal, max. SR)
Standard input: < -77 dB at 1 V FS
HF input: < -78 dB

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
U1070A-001, -002: <17 W
U1070A-003: <15 W

Current requirements
U1070A-001, -002:

12 V	0.5 A
5 V	0.8 A
3.3 V	1.5 A
-12 V	0.1 A

U1070A-003:

12 V	0.5 A
5 V	0.4 A
3.3 V	1.5 A
-12 V	0.1 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 40°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

Required airflow
> 2 m/s in situ

Front panel complies with IEEE1101.10

CE Certification and Compliance

Contacts

Acqiris Product Information

USA	**(800) 828-4444**
Asia-Pacific	**61 3 9210 2890**
Europe	**41 (22) 884 32 90**

Agilent Americas

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Hong Kong	800 938 693
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Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Thailand	1 800 226 008

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Belgium	32 (0) 2 404 93 40
Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700*
	*0.125 €/minute
Germany	01805 24 6333
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
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Sweden	0200-88 22 55
Switzerland	0800 80 53 53
United Kingdom	44 (0) 118 9276201
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Revised: March 27, 2008

Ordering Information

Model	Description
U1070A	Acqiris DP310, DP308 and DP306 12-bit high-speed PCI digitizer
U1070A-001	Single-channel 100 MHz/300MHz, 420 MS/s, 4 MSample PCI digitizer, DP310
U1070A-002	Single-channel 100 MHz, 200 MS/s, 4 MSample PCI digitizer, DP308
U1070A-003	Single-channel 50 MHz, 100 MS/s, 4 MSample PCI digitizer, DP306

Accessories

U1070A-UK6	Calibration certificate
U1070A-XP1	Standard fan unit

www.agilent.com

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

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