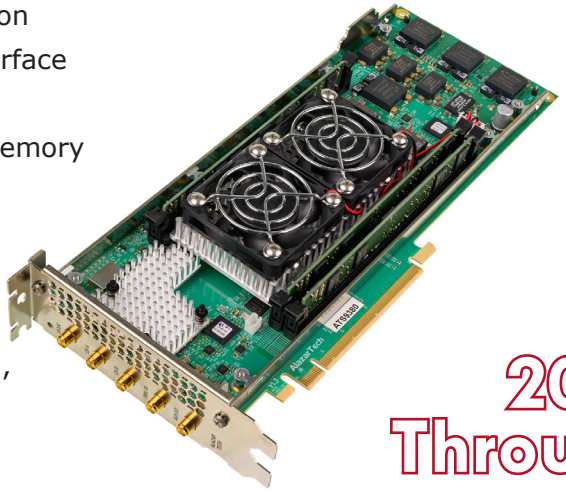
ATS9380

10 GS/s 12-Bit PCIe Gen 4 Digitizer

- Up to 10 GS/s 12-bit A/D conversion
- 22 GB/s PCIe Gen 4 (16-lane) interface
- 2 channel operation at 5 GS/s
- Up to 12 Gigasamples dual-port memory
- Continuous streaming mode
- ±400 mV fixed input range
- DC-coupled inputs
- AlazarDSO® oscilloscope software
- Optional SDK supports C/C++, C#, Python, MATLAB®, LabVIEW®
- Support for Windows® & Linux®



RoHS 3 COMPLIANT
2015/863/EU

CE

20 GB/s Throughput

Product	Bus	Operating System	Channels	Max. Sample Rate	Bandwidth	Memory Per Channel	Resolution
ATS9380	PCIe x16 Gen 4	64-bit Windows & 64-bit Linux	2	10 GS/s - 1ch 5 GS/s - 2ch	DC ~ 5 GHz	12/6 Gigasamples in single/dual channel mode	12 bits

Overview

AlazarTech ATS®9380 is a 16-lane PCI Express Gen 4 (PCIe x16), single or dual-channel, 12-bit, 10 GS/s or 5 GS/s waveform digitizer card capable of acquiring data into its on-board 24 GB memory or streaming acquired data to PC memory at rates up to 20 GB/s.

There are two A/D converters on the ATS9380 board, each running at 5 GS/s. ATS9380 uses interleaved sampling (DES mode) to achieve 10 GS/s sampling.

Users can synchronize the sampling clock to an external 10 MHz reference. It should be noted that variable frequency external clock is not supported on ATS9380.

Users can capture data from one trigger or a burst of triggers. Users can also stream very large datasets continuously to PC memory or hard disk.

ATS9380 is supplied with AlazarDSO software that lets the user start data acquisition immediately, without having to go through a software development process.

Users who need to integrate the ATS9380 in their own program can purchase a software development kit, ATS-SDK, for C/C++, C#, Python, MATLAB, and LabVIEW for both Windows and Linux operating systems.

All of this advanced functionality is packaged in a full-length dual-slot PCI Express Gen 4 card.

Applications

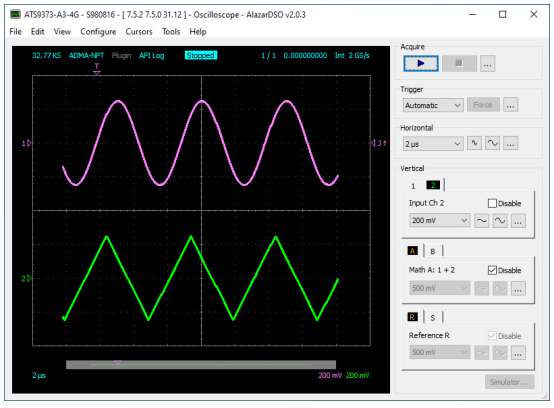
RF Signal Recording & Analysis

Terabyte Storage Oscilloscope

Multi-Channel Transient Recording

High-Resolution Oscilloscope

Quantum Computing



PCI Express Gen 4 Bus Interface

ATS9380 interfaces to the host computer using a 16-lane PCI Express bus. Each lane operates at 16.0 Gbps (Gen 4).

According to PCIe specification, an 16-lane board can be plugged into any 16-lane slot, but not into a 8-lane, 4-lane or 1-lane slot. Some PCIe slots use open-ended sockets to allow for longer cards. As such, ATS9380 requires at least one free 16-lane or an open-ended slot on the motherboard.

Note: The number of lanes actually connected to a PCIe slot may be fewer than the number supported by the physical slot size. In other words, a 16-lane slot may not provide a x16 electrical connection. Users must ensure that the slot is electrically x16 in order to achieve maximum sustained transfer rates.

The physical and logical PCIe Gen 4 x16 interface is provided by an on-board FPGA, which also integrates acquisition control functions, memory management functions, acquisition datapath and DSP logic. This very high degree of integration maximizes product reliability.

The AlazarTech® 22 GB/s benchmark was done on a SuperMicro X12DPG-QT6 motherboard.

Users must always be wary of throughput specifications from manufacturers of waveform digitizers. Some unscrupulous manufacturers tend to specify the raw, burst-mode throughput of the bus. AlazarTech, on the other hand, specifies the benchmarked sustained throughput. To achieve such high throughput, a great deal of proprietary memory management logic and kernel mode drivers have been designed.

Analog Input

An ATS9380 features two analog input channels. Each channel has up to 5 GHz of full power analog input bandwidth. Input voltage range is fixed at ±400 mV.

It must be noted that input impedance of both channels is fixed at 50 Ω. Input coupling is fixed to DC.

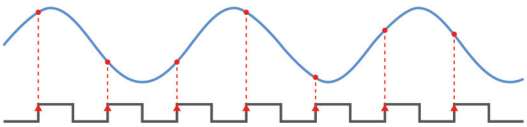
Acquisition System

ATS9380 PCI Express digitizers use state of the art dual 5 GS/s, 12-bit ADCs to digitize the input signals.

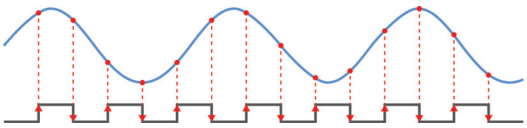
By default, both ADCs are clocked simultaneously and they sample their respective analog input using the rising edge of the ADC clock. This is called Single Edge Sampling (SES).

Alternatively, the two ADCs can be interleaved such that one ADC uses the rising edge and the other the falling edge of the ADC clock. This is called Dual Edge Sampling (DES) and it effectively doubles the sample rate.

When the two ADCs are used in DES mode, users can achieve 10 GS/s sample rate.



SES Sampling



DES Sampling

An acquisition can consist of multiple records, with each record being captured as a result of one trigger event. A record can contain both pre-trigger and post-trigger data. Up to 16384 pre-trigger points can be captured in DES mode and in 8192 SES mode.

ATS9380 can capture an infinite number of triggers. In between the multiple triggers being captured, the acquisition system is re-armed by the hardware within 256 sampling clock cycles in DES mode and 128 sampling clock cycles in SES mode.

This mode of capture, sometimes referred to as Multiple Record, is very useful for capturing data in applications with a very rapid or unpredictable trigger rate. Examples of such applications include medical imaging, ultrasonic testing, OCT and NMR spectroscopy.

On-Board Acquisition Memory

ATS9380 supports on-board memory buffers of 12 Gigasamples. Note that one sample is stored as two bytes, so 12 Gigasample uses 24 GB of memory.

This on-board memory is used as a very deep FIFO to temporarily store acquired ADC data before transferring it to motherboard memory using proprietary DMA engines. This on-board buffer allows loss-less data transfer even if the computer is temporarily interrupted by other tasks.

Maximum Sustained Bus Throughput

PCI Express support on different motherboards may vary, resulting in non-optimal data transfer rates. The reasons behind these differences are complex and varied and will not be discussed here.

ATS9380 users can quickly determine the maximum sustained transfer rate for their motherboard by inserting their card in a PCIe slot and running the bus benchmarking tool provided in AlazarDSO for Windows or AlazarFrontpanel for Linux software.

Digitizer Transfer Speed

The digitizer transfer speed is limited by the lower of:

- Bus Throughput
- Cumulative ADC Data Rate

The PCIe Gen 4 x16 bus throughput is 22 GB/s.

The Cumulative ADC Data Rate represents the maximum data the digitizer can generate and is calculated as:

Number of channels × Max. sampling rate × Bytes per sample

ATS9380: 2 channels × 5 GS/s × 2 = 20 GB/s

The Cumulative ADC Data Rate for ATS9380 is 20 GB/s and the bus throughput is 22 GB/s. Therefore, the digitizer transfer speed for ATS9380 is 20 GB/s.

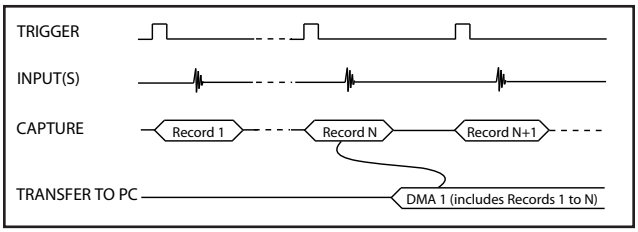
Recommended Motherboards or PCs

Many different types of motherboards and PCs have been benchmarked by AlazarTech. The ones that have produced the best throughput results (up to 22 GB/s) are listed here.

No Pre-Trigger (NPT) AutoDMA

Many ultrasonic scanning and medical imaging applications do not need any pre-trigger data: only post-trigger data is sufficient.

NPT AutoDMA is designed specifically for these applications. By only storing post-trigger data, the memory bandwidth is optimized and the entire on-board memory acts like a very deep FIFO.



Note that a DMA is not started until (RecordsPerBuffer +1) number of records (triggers) have been acquired and written to the on-board memory.

NPT AutoDMA buffers do not include headers. However, users can specify that each record should come with its own footer that contains a 40-bit trigger timestamp. The footer is called NPT Footer.

More importantly, a BUFFER_OVERFLOW flag is asserted only if the entire on-board memory is used up.

NPT AutoDMA can easily acquire data to PC host memory at the maximum sustained transfer rate of the motherboard without causing an overflow.

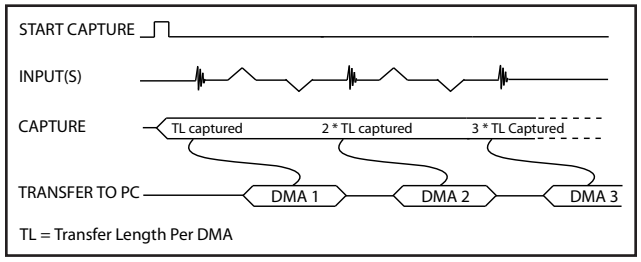
This is the recommended mode of operation for most ultrasonic scanning, OCT and medical imaging applications.

It should be noted that even though this mode is called "No Pre Trigger", it is possible to do limited pre-trigger data captures, i.e. up to 8192 points in DES mode and 4096 points in SES mode.

Continuous AutoDMA

Continuous AutoDMA is also known as the data streaming mode. In this mode, data starts streaming across the PCIe bus as soon as the ATS9380 is armed for acquisition. It is important to note that triggering is disabled in this mode.

Continuous AutoDMA buffers do not include headers, so it is not possible to get trigger time-stamps. A BUFFER_OVERFLOW flag is asserted only if the entire on-board memory is used up.



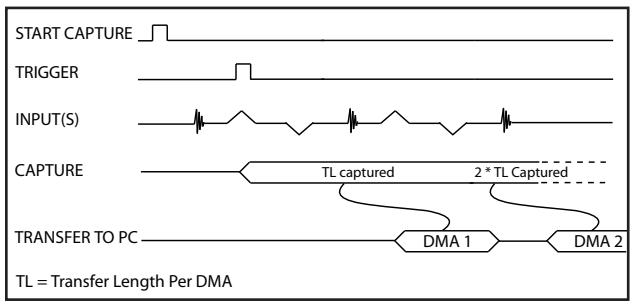
The amount of data to be captured is controlled by counting the number of buffers acquired. Acquisition is stopped by an AbortCapture command.

Continuous AutoDMA can easily acquire data to PC host memory at the maximum sustained transfer rate of the motherboard without causing an overflow. This is the recommended mode for very long signal recording.

Triggered Streaming AutoDMA

Triggered Streaming AutoDMA is virtually the same as Continuous mode, except the data transfer across the bus is held off until a trigger event has been detected. Triggered Streaming AutoDMA buffers do not include headers, so it is not possible to get trigger time-stamps.

A BUFFER_OVERFLOW flag is asserted only if the entire on-board memory is used up.



As in Continuous mode, the amount of data to be captured is controlled by counting the number of buffers acquired. Acquisition is stopped by an AbortCapture command.

Triggered Streaming AutoDMA can easily acquire data to PC host memory at the maximum sustained transfer rate of the motherboard without causing an overflow. This is the recommended mode for RF signal recording that has to be started at a specific time, e.g. based on a GPS pulse.

Dual-Channel Data Format

Users should note that when using dual-channel mode, the user buffer will contain sample-interleaved data B[n], A[n], B[n-1], A[n-1], ... B[0], A[0].

Asynchronous DMA Driver

The various AutoDMA schemes discussed above provide hardware support for optimal data transfer. However, a corresponding high-performance software mechanism is also required to make sure sustained data transfer can be achieved.

This proprietary software mechanism is called Async DMA (short for Asynchronous DMA).

A number of data buffers are posted by the application software. Once a data buffer is filled, i.e. a DMA has been completed, ATS9380 hardware generates an interrupt, causing an event message to be sent to the application so it can start consuming data. Once the data has been consumed, the application can post the data buffer back on the queue. This can go on indefinitely.

One of the great advantages of Async DMA is that almost 95% of CPU cycles are available for data processing, as all DMA arming is done on an event-driven basis.

To the best of our knowledge, no other supplier of waveform digitizers provides asynchronous software drivers. Their synchronous drivers force the CPU to manage data acquisition, thereby slowing down the overall data acquisition process.

Output Data Format

By default, ATS9380 data comes out as unsigned binary, where code 0 represents the negative full scale, code (2^n-1) represents the positive full scale with zero being 2^{n-1}.

It is possible to change the data format to signed binary using an API call. In signed binary format, zero is represented by code 0, positive full scale is represented by (2^{n-1}-1) and negative full scale is represented by (2^{n-1}).

Triggering

ATS9380 is equipped with sophisticated digital triggering options, such as programmable trigger thresholds and slope on any of the input channels or the External Trigger input.

While most oscilloscopes offer only one trigger engine, ATS9380 offers two trigger engines (called Engines J and K).

The user can specify the number of records to capture in an acquisition, the length of each record and the amount of pre-trigger data.

A programmable trigger delay can also be set by the user. This is very useful for capturing the signal of interest in a pulse-echo application, such as ultrasound, radar, lidar etc.

External Trigger Input

ATS9380 external trigger input (TRIG IN) is a 3.3 V TTL (5 V-tolerant) input.

External Trigger must an LVTTL digital signal, i.e. 0 to 3.3 V TTL signal. Minimum pulse height requirement is 2.0 Volts. Input impedance of this input is 2 kΩ.

Analog signals and smaller amplitude digital signals may not be detected as trigger events.

User can select between rising edge and falling edge of this signal as the trigger event.

Note: If full 12-bit resolution is required, users should select CH A or CH B as the trigger source. When the External Trigger Input is used as the trigger source, the least significant bit (LSB) of each 12-bit sample is replaced by the state of the external trigger signal source.

Timebase

ATS9380 timebase can be controlled either by on-board low-jitter VCO or by a 10 MHz External Clock reference.

10 MHz Reference Clock

It is possible to generate the sampling clock based on an external 10 MHz reference input. This is useful for RF systems that use a common 10 MHz reference clock.

ATS9380 provides an SMA input for the external 10 MHz reference signal. Signal levels, specified in detail on page 7, must be respected.

ATS9380 uses an on-board low-jitter fractional PLL to generate a user-selected high-frequency clock used by the ADC.

AUX Connector

ATS9380 provides an AUX (Auxiliary) SMA connector that is configured as a Trigger Output connector by default.

When configured as a Trigger Output, AUX SMA connector outputs a 5 Volt TTL signal that signifies the occurence of a trigger event. Trigger Output is not synchronous to the Trigger Input or the ADC sampling clock, there may be significant jitter between trigger input and output.

When combined with the Trigger Delay feature of the ATS9380, this option is ideal for ultrasonic and other pulse-echo imaging applications.

AUX connector can also be used as a Trigger Enable Input for Frame Capture (B-scan) applications. In fact, this is the most popular use of AUX connector in OCT applications.

Calibration

Every ATS9380 digitizer is factory calibrated to NIST- or CNRC-traceable standards. To recalibrate an ATS9380, the digitizer must be shipped back to the factory.

Test Reports

AlazarTech thoroughly tests every digitizer that leaves the factory; each board must pass hundreds of tests before it is shipped to a customer.

In addition to an 8-hour burn-in, each digitizer undergoes a full Performance Verification Test (PVT) where functionality such as external trigger, internal & external clock are tested, and characteristics such as frequency response and bandwidth are measured to ensure that they are within specification.

Customers can obtain test reports for their AlazarTech digitizer (for a fee) by adding the following order number to their digitizer order: *TestReport*. If ordered after board shipment, use order number: *TestReport-AO*.

AlazarDSO Software

ATS9380 is supplied with the powerful AlazarDSO software that allows the user to setup the acquisition hardware and capture, display and archive the signals.

The Stream-To-Memory command in AlazarDSO allows users to stream a large dataset to motherboard memory.

AlazarDSO software also includes powerful tools for benchmarking the computer bus and disk drive.

Software Development Kits

AlazarTech provides easy-to-use software development kits for customers who want to integrate the ATS9380 into their own software.

A Windows-compatible software development kit, called ATS-SDK, includes headers, libraries and source code sample programs written in C/C++, C#, Python, MATLAB, and LabVIEW.

A Linux-compatible software development kit, called ATS-devel, includes headers, libraries and source code sample programs written in C++ and Python.

These programs can fully control the ATS9380 and acquire data in user buffers.

The purchase of an ATS-SDK license includes a subscription that allows users to download ATS-SDK updates from the AlazarTech website for period of 12 months from the date of purchase.

Customers who want to download new releases beyond this 12 month period should purchase extended maintenance (order number ATS-SDK-1YR).

ATS-GPU

ATS-GPU-BASE is a software library developed by AlazarTech that transfers data acquired by ATS9380 to a CUDA®-enabled GPU card at sustained transfer rates as high as 20 GB/s. Testing was done using a GeForce RTX 5070 WINDFORCE OC SFF 12G GPU.

Interfacing waveform digitizers to GPUs involves creating a software mechanism to move data from one to the other and back to user buffers. The standard techniques used most often can get the job done, but feature very low data throughput due to software overheads.

AlazarTech designed ATS-GPU to eliminate this software bottleneck so that data can be moved from AlazarTech digitizers to GPUs and from GPUs to user buffers at full PCIe bus speeds. Once the data is available in GPU memory, many types of digital signal processing (DSP) can be done on this data at near-hardware speeds.

ATS-GPU-BASE is supplied with an example user application in source code. The application includes GPU kernels that use ATS-GPU to receive data, do very simple signal processing (data inversion), and copy the processed (inverted) data back to a user buffer. All this is done at the highest possible data transfer rate.

Programmers can replace the data inversion code with application-specific signal processing kernels to develop custom applications.

Version 23.1.0 and higher of ATS-GPU-BASE includes a Boxcar Averaging example kernel that provides the ability to perform real-time boxcar averaging on signals acquired by AlazarTech waveform digitizers. It uses optimized GPU routines that allow raw data acquisition rates up to 20 GB/s. This signal processing module can lead to a major improvement of signal-to-noise ratio without using CPU resources and without doing FPGA programming.

ATS-GPU-OCT is the optional OCT Signal Processing library for ATS-GPU. It contains floating-point FFT routines that have also been optimized to provide the maximum number of FFTs per second. Kernel code running on the GPU can do zero-padding, apply a windowing function, do a floating-point FFT, calculate the amplitude and convert the result to a log scale. It is also possible to output phase information.

ATS-GPU-NUFFT is an extension of ATS-GPU-OCT that allows non-uniform FFTs to be performed on data acquired uniformly in time domain using a fixed sampling rate. For SS-OCTs where the wavelength does not vary linearly in time, a fixed sampling rate results in data that is non-uniformly distributed in frequency domain. ATS-GPU-NUFFT allows linearized FFTs to be performed on such data.

ATS-GPU supports 64-bit Windows and 64-bit Linux for CUDA®-based development.

Support for Windows

Windows support for ATS9380 includes Windows 11, Windows 10, Windows Server® 2019, and Windows Server 2016. As Windows Server 2019 and 2016 are seldom used by our customers, they are expected to work but are not regularly tested with each software release. If there are issues related to Windows Server 2016 or 2019, tech support may not be as rapid as for other operating systems.

Only 64-bit Windows operating systems are supported.

Microsoft mainstream support ended in 2018 for Windows 8.1 and Windows Server 2012 R2. As such, AlazarTech has ceased development on these operating systems. Current software and driver releases may work with these operating systems but they are not officially supported.

Due to lack of demand and due to the fact that Microsoft no longer supports these operating systems, AlazarTech no longer supports Windows 8, Windows 7, Windows XP, Windows Vista, Windows Server 2012, Windows Server 2008 R2, and Windows Server 2008.

Linux Support

AlazarTech offers Dynamic Kernel Module Support (DKMS) drivers for the following Linux distributions: Ubuntu, Debian, and RHEL®.

AlazarTech DKMS drivers may work for other Linux distributions but they have not been tested and technical support may be limited.

Only 64-bit Linux operating systems are supported.

A GUI application called AlazarFrontPanel that allows simple data acquisition and display is also provided.

ATS-SDK includes source code example programs for Linux, which demonstrate how to acquire data programmatically using a C compiler. Note that example programs are only provided for Python and C++.

Technical Support

AlazarTech is known for its world-class technical support. Customers receive free technical support on hardware products that are under warranty.

AlazarTech digitizers come with a standard two (2) year parts and labor warranty. This warranty can be extended for a fee (more information can be found in the next section: *Extended Warranty*).

If your waveform digitizer is out of warranty, you will not be eligible for free technical support on AlazarTech hardware or software products and you will need to purchase technical support hours (order number SUPPORT-HR5) to obtain assistance.

In addition, any necessary repairs to your out-of-warranty hardware products will carry a minimum bench charge.

Extended Warranty

The purchase of an ATS9380 includes a standard two (2) year parts and labor warranty. AlazarTech hardware parts and labor warranty should be maintained to ensure uninterrupted access to technical support and warranty repair services.

Customers may extend their warranty by ordering the appropriate Extended Warranty (ATS9380-061). This should be purchased before expiration of the standard warranty (or before expiration of an Extended Warranty).

If the warranty lapses, renewal at a later date will be subject to a reinstatement fee, to cover the administrative costs of warranty reinstatement, and a 6-month waiting period for repair claims. Furthermore, warranty must be extended at least 6 months past the current date.

Get your warranty end date by registering your product at: www.alazartech.com/en/my-account/my-products/.

Export Control Classification

According to the latest *Export and brokering controls handbook*, amended August 2019, ATS9380 is classified by Export Controls Division of Government of Canada as a controlled product under ECL 1-3.A.2.h, which is equivalent to ECCN 3A002.h.

For sales where the ultimate country destination is Canada or U.S., no export permit is required unless the end-use of ATS9380, in part or in its entirety, is related to the development or deployment of weapons of mass destruction.

For shipments to eligible destinations, AlazarTech is allowed to export under a general export permit, unless the end-use of ATS9380, in part or in its entirety, is related to the development or deployment of weapons of mass destruction. For general export permit shipments, users must provide a signed export compliance statement (ECS) that includes a detailed description of the end-use. Shipments cannot be made without a signed ECS on file.

For all other countries, and for all cases where the end-use of ATS9380, in part or in its entirety, is related to the development or deployment of weapons of mass destruction, an export permit is required, which will require extensive details on the end-use and end-users. This process may cause significant delays.

RoHS Compliance

ATS9380 is fully RoHS compliant, as defined by Directive 2015/863/EU (RoHS 3) of the European Parliament and of the Council of 31 March 2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

All manufacturing is done using RoHS-compliant components and lead-free soldering.

REACH Compliance

AlazarTech verifies its supply chain against the latest REACH requirements. A compliance statement is usually available within 6 months of release of the European Chemicals Agency (ECHA) updated substance of very high concern (SVHC), Authorizations, and Restrictions lists.

System Requirements

Personal computer with at least one free x16 or open-ended PCI Express slot (must be Gen 4 [or higher] x16 slot to achieve full data throughput) and 16 GB RAM; if using AlazarDSO, 16 GB of free hard disk space is also required.

Power Requirements

+12 V	5.4 A, typical

Physical

Size	Dual slot, PCI Express card (4.377 inches x 10.8 inches excluding the connectors protruding from the front panel)
Weight	645 g

I/O Connectors

ECLK, CH A, CH B, TRIG IN, AUX I/O	SMA female connector

Environmental

Operating temperature	0 to 55 degrees Celsius, ambient
Storage temperature	-20 to 70 degrees Celsius
Relative humidity	5 to 95%, non-condensing

Acquisition System

Resolution	12 bits
Bandwidth (-3 dB)	
DC-coupled, 50 Ω	Standard DC - 5.0 GHz
Number of channels	2, simultaneously sampled
Maximum sample rate	
DES mode	10 GS/s single shot
SES mode	5 GS/s single shot
Minimum sample rate	
DES mode	10 GS/s single shot
SES mode	1 MS/s single shot
Full scale input range 50 Ω input impedance:	±400 mV
Input coupling	DC only
Input impedance	50 Ω ±1%
Absolute maximum input 50 Ω	4 V_{P-P} (DC + peak AC for CH A, CH B, and TRIG IN only without external attenuation)

Acquisition Memory System

Memory size	24 GB (12 Gigasamples)
Record length	Software-selectable with 128-point resolution. Record length must be a minimum of 256 points in SES mode (512 in DES mode). There is no upper limit on the maximum record length.
Number of records	Software-selectable from a minimum of 1 to a maximum of infinite number of records. The record length and number of records must satisfy the following requirement: (Number of Channels * Record Length * RecordsPerBuffer) = (N * 8192) bytes
Pre-trigger depth	From 0 to 16384 for DES mode From 0 to 8192 for SES mode
Post-trigger depth	Record Length – Pre-Trigger Depth

Timebase System

Timebase options	Internal Clock or External 10 MHz Reference Clock
Internal clock accuracy	< 3 ppm
Internal sample rates	
DES mode:	10 GS/s
SES mode:	5 GS/s, 2.5 GS/s, 2 GS/s, 1 GS/s, 500 MS/s, 200 MS/s, 100 MS/s, 50 MS/s, 20 MS/s, 10 MS/s, 5 MS/s, 2 MS/s, 1 MS/s

Dynamic Parameters

SNR	TBD
SFDR	TBD

10 MHz Reference PLL Input

Signal level	400 mV_{P-P} to 1 V_{P-P}
Input impedance	50 Ω
Input coupling	AC
Input frequency	10 MHz ± 0.1 MHz
Maximum frequency	10.1 MHz
Minimum frequency	9.9 MHz
Sampling clock frequency	
DES mode:	10 GS/s
SES mode:	5 GS/s, 2.5 GS/s, 2 GS/s, 1 GS/s, 500 MS/s, 200 MS/s, 100 MS/s, 50 MS/s, 20 MS/s, 10 MS/s, 5 MS/s, 2 MS/s, 1 MS/s

Triggering System

Mode	Edge triggering with hysteresis
Comparator type	Digital comparators for internal (CH A, CH B) triggering and analog comparators for TRIG IN (External) triggering
Number of trigger engines	2
Trigger engine combination	Engine J, engine K, J OR K, software-selectable
Trigger engine source	CH A, CH B, TRIG IN, Software or None, independently software-selectable for each of the two Trigger Engines
Hysteresis	±5% of full scale input, typical
Trigger sensitivity	±10% of full scale input range. This implies that the trigger system may not trigger reliably if the input has an amplitude less than ±10% of full scale input range selected.
Trigger level accuracy	±5%, typical, of full scale input range of the selected trigger source
Bandwidth	1 MHz (record length dependent)
Trigger Delay	Software-selectable from 0 to 9,999,999 sampling clock cycles

Trigger Timeout	Software-selectable with a 10 µs resolution. Maximum settable value is 3,600 seconds. Can also be disabled to wait indefinitely for a trigger event

TRIG IN (External Trigger) Input

Input type	3.3 V TTL (5 V-tolerant)
Input coupling	DC only
Input impedance	2 kΩ ±10%
Min. pulse width	100 ns
Min. pulse amplitude	2 Volts
Absolute maximum input	5 Volts

Auxiliary I/O (AUX I/O)

Signal direction	Input or Output, software-selectable. Trigger Output by default
Output types:	Trigger Output, Pacer (programmable clock) Output, Software-controlled Digital Output
Input types:	Trigger Enable Software-readable Digital Input
Output	
Amplitude:	5 Volt TTL
Synchronization:	Synchronized to an internal free-running clock. Trigger Output is not synchronous to the Trigger Input or the ADC sampling clock.
Input	
Amplitude:	3.3 Volt TTL
Coupling:	DC

Certification and Compliances

RoHS 3 (Directive 2015/863/EU) Compliance

REACH Compliance

Materials Supplied

ATS9380 PCI Express Card

All specifications are subject to change without notice

ORDERING INFORMATION

ATS9380	ATS9380-001
ATS9380: One Year Extended Warranty	ATS9380-061
Test reports ordered with board	TestReport
Test reports ordered after board shipment	TestReport-AO
ATS-SDK purchased with a digitizer board or ATS-GPU: License + 1 Year Subscription (Supports C/C++, Python, MATLAB, and LabVIEW)	ATS-SDK
ATS-SDK purchased separately: License + 1 Year Subscription + 5 hours of technical support (Supports C/C++, Python, MATLAB, and LabVIEW)	ATS-SDK-WOD
ATS-GPU-BASE: GPU Streaming Library License + 1 Year Subscription	ATSGPU-001
ATS-GPU-OCT: Signal Processing Library License + 1 Year Subscription (requires ATSGPU-001)	ATSGPU-101
ATS-GPU-NUFFT: ATS-GPU-OCT Extension for fixed-frequency sampled data License + 1 Year Subscription (requires ATSGPU-001 & ATSGPU-101)	ATSGPU-201
5 Hours of technical support	SUPPORT-HR5

Manufactured By:

Alazar Technologies, Inc.

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DATASHEET REVISION HISTORY

Changes from version 1.0 (April 2026) to version 1.0a	Section, Page
Corrected DES sample rate	Global change
Corrected SES sample rates	Global change
Corrected *Throughput* rate	Introduction, pg. 1
Corrected *Cumulative ADC Data Rate* and *digitizer transfer speed*	Digitizer Transfer Speed, pg. 2
Corrected *Minimum sample rate* for DES mode	Acquisition System, pg. 7