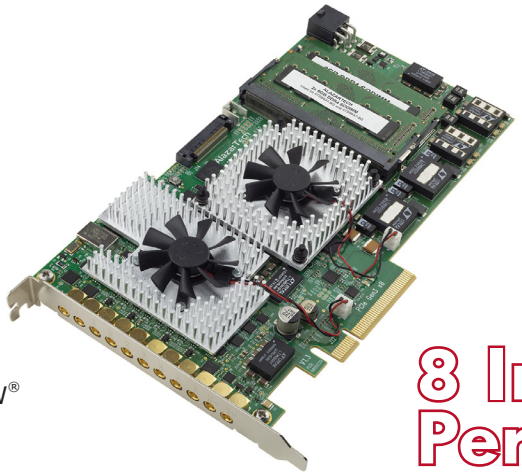
ATS9637

370 MS/s 8 channel PCIe Digitizer

- 8 analog channels per card
- Sample rate of 370 MS/s per channel
- 16-bit vertical resolution
- 6.8 GB/s PCIe Gen 3 (8-lane) interface
- Up to 4 Gigasample dual-port memory
- Continuous streaming mode
- Asynchronous DMA device driver
- AlazarDSO® oscilloscope software
- Software Development Kit supports C/C++, C#, Python, MATLAB®, LabVIEW®
- Support for Windows® & Linux®



RoHS 3 COMPLIANT
2015/863/EU

CE

8 Inputs Per Card

Product	Bus	Operating System	Channels	Max. Sample Rate	Bandwidth	Memory Per Channel	Resolution
ATS9637	PCIe x8 Gen 3	64-bit Windows & 64-bit Linux	8	370 MS/s	200 MHz	Up to 4 Gig in single channel mode	16 bits

Overview

AlazarTech ATS®9637 is an 8-lane PCI Express Gen 3, 8-channel, high-speed, 16-bit, 370 MS/s waveform digitizer card capable of streaming acquired data to PC memory at rates up to 6.8 GB/s or storing it in its deep on-board dual-port acquisition memory buffer of up to 4 Gigasamples.

Each ATS9637 board has 8 Analog-to-Digital converters (ADCs) that are clocked simultaneously using a low-jitter clock circuit to provide absolute synchronization.

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.

ATS9637 is supplied with AlazarDSO software that lets the user get started immediately without having to go through a software development process.

Users who need to integrate the ATS9637 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 low-power, two-thirds-length PCI Express card.

Applications

Fiber Sensing

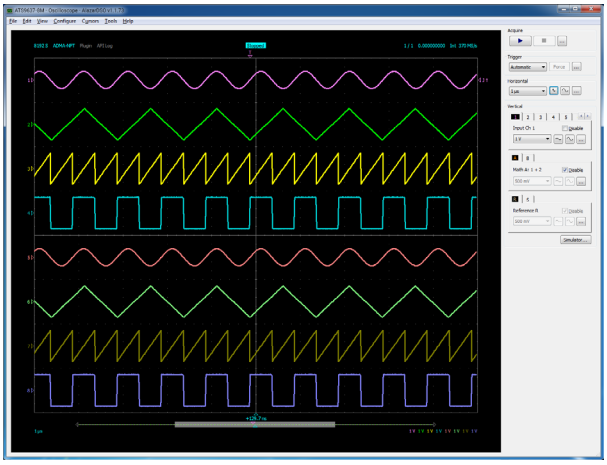
Microscopy

Multi-Channel RF Recording

Terabyte Storage Oscilloscope

High-Resolution Oscilloscope

Spectroscopy



PCI Express Gen 3 Bus Interface

ATS9637 interfaces to the host computer using an 8-lane PCI Express bus. Each lane operates at 8.0 Gbps (Gen 3).

According to PCIe specification, an 8-lane board can be plugged into any 8-lane or 16-lane slot, but not into a 4-lane or 1-lane slot. As such, ATS9637 requires at least one free 8-lane or 16-lane slot on the motherboard.

ATS9637 is fully compatible with motherboards of all generations of PCI Express (Gen 1, Gen 2 or Gen 3). At run-time, ATS9637 and the motherboard negotiate the appropriate link speed and width.

The physical and logical PCIe x8 interface is provided by an on-board FPGA, which also integrates acquisition control functions, memory management functions and acquisition datapath. This very high degree of integration maximizes product reliability.

The AlazarTech® 6.8 GB/s bus throughput benchmark was done on ASUS TRX40-Pro and ASUS X99-E WS motherboards.

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 ATS9637 features 8 analog input channels. Each channel has up to 200 MHz of full power analog input bandwidth.

Channels 1 to 8 have a common gain control, i.e. if you change the gain of, say, Channel 3, it will change the gain for Channels 1 to 8.

Full scale input range is fixed at ±1 V. Input impedance of all channels is fixed at 50 Ω. Input coupling of all channels is fixed at DC coupling.

Acquisition System

ATS9637 PCI Express digitizer board uses four state-of-the-art dual 370 MSPS, 16-bit ADCs to digitize the input signals. This means there are a total of 8 individual A/D converters, each running at 370 MS/s.

The 8 channels are guaranteed to be simultaneous, as they use a common clock.

The real-time sampling rate ranges from 370 MS/s down to 1 MS/s for internal clock.

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.

Infinite number of triggers can be captured by ATS9637, when it is operating using dual-port memory.

In between the multiple triggers being captured, the acquisition system is re-armed by the hardware within 64 sampling clock cycles.

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 spectroscopy.

On-Board Acquisition Memory

ATS9637 supports on-board memory buffer of 4 Gigasamples. Note that one sample is stored as two bytes, so 4 Gigasample means there is 8 GByte memory on-board.

Acquisition memory can be divided equally between the selected input channels.

For example, ATS9637 provides 4 Gigasamples of on-board memory when sampling in one-channel mode. In two-channel mode, it provides 2 Gigasamples per channel of on-board memory. In four-channel mode, it provides 1 Gigasamples per channel of on-board memory and so on.

When operated as dual-port memory, the on-board memory acts as a very deep FIFO between the Analog-to-Digital converters and PCI Express bus, allowing very fast sustained data transfers across the bus, even if the operating system or another motherboard resource temporarily interrupts DMA transfers.

Maximum Sustained Transfer Rate

PCI Express support on different motherboards is not always the same, resulting in significantly different sustained data transfer rates.

For example, it is possible that a motherboard may have an x8 PCI Express connector, but only one PCIe lane is connected on the motherboard. Motherboard documentation will refer to such a slot as "x8 mechanical, x1 electrical". In such a system, the maximum data throughput may be as low as 200 MB/s.

ATS9637 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.

ATS9637, which is equipped with dual-port on-board memory, will be able to achieve this maximum sustained transfer rate.

Recommended Motherboards

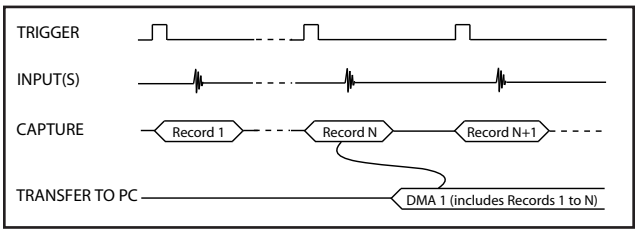
Many different types of motherboards and PCs have been benchmarked by AlazarTech. The ones that have produced the best throughput results (up to 6.8 GB/s) are listed here: www.alazartech.com/images-media/2246-AlazarTechRecommendedMotherboards.pdf.

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.

More recently, some customer applications have required a limited amount of pre-trigger data to be available even in NPT AutoDMA. This capability has been added to ATS9637 and now it is possible to acquire up to 4096 points of pre-trigger data in NPT mode.



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

NPT AutoDMA buffers support footers, so it is possible to get a 40-bit timestamp as well as other information about the record. The footer is called NPT Footer.

More importantly, a BUFFER_OVERFLOW flag is asserted only if the entire on-board memory is used up. This provides a very substantial improvement over Traditional AutoDMA.

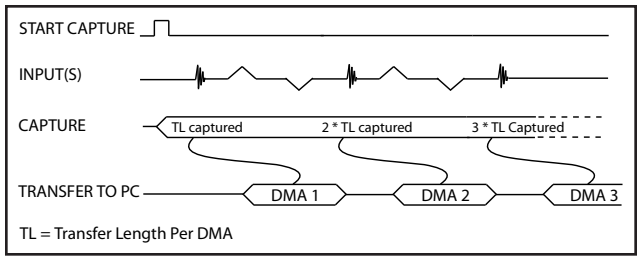
NPT AutoDMA can easily acquire data to PC host memory at the maximum sustained transfer rate of the motherboard without causing an overflow.

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

Continuous AutoDMA

Continuous AutoDMA is also known as data streaming mode.

In this mode, data starts streaming across the PCIe bus as soon as the ATS9637 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.

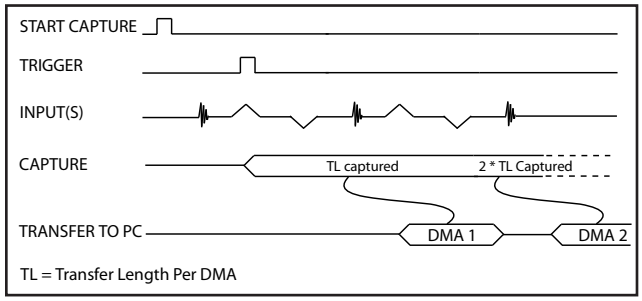
A BUFFER_OVERFLOW flag is asserted only if the entire on-board memory is used up.

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.

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, ATS9637 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, ATS9637 data comes out as unsigned binary, where code 0 represents the negative full scale, code (2^{n-1}-1) represents the positive full scale with zero being 2^{n-2}.

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-2}-1) and negative full scale is represented by (2^{n-2}).

Triggering

ATS9637 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, ATS9637 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

The external trigger input on the ATS9637 is labeled TRIG IN.

External trigger is a digital TTL input with 6.7 kΩ impedance. Note that external trigger input cannot accept an analog signal.

Timebase

ATS9637 timebase can be controlled either by on-board low-jitter clock circuit or by an external 10 MHz REF IN.

On-board low-jitter clock circuit uses an on-board 10 MHz TCXO as a reference clock.

10 MHz Reference Clock Input

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.

ATS9637 uses an on-board low-jitter clock circuit to generate the sampling clock used by the ADC. This sampling clock can be set to any value between 100 MHz and 370 MHz with a 1 MHz resolution.

Auxiliary (AUX) I/O

ATS9637 an Auxiliary (AUX) MCX connector that is configured as a Trigger Output connector by default.

When configured as a Trigger Output, AUX MCX connector outputs a 5 Volt TTL signal synchronous to the ATS9637 Trigger signal, allowing users to synchronize their test systems to the ATS9637 Trigger.

When combined with the Trigger Delay feature of the ATS9637, 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 the AUX connector in OCT applications.

Calibration

ATS9637 digitizers use RF ADCs that do not have individual gain control. This means that the ATS9637 cannot be calibrated in the same way as most other AlazarTech digitizers.

There are 2 methods of calibration for ATS9637. They are described below:

Hardware Calibration Mechanism

Every ATS9637 digitizer is factory calibrated to NIST- or CNRC-traceable standards. To hardware re-calibrate an ATS9637, the digitizer must be shipped back to the factory.

Users should note that for ATS9637, Hardware Calibration provides absolute accuracy, but results in missing codes.

With Hardware Calibration, the full scale input range is ±1 V.

This is the ideal calibration method for applications that require absolute accuracy.

Software Calibration Mechanism

Software Calibration provides raw data with no missing codes. There is, however, a gain error and the full scale input range is not exactly ±1 V.

The ATS-SDK includes functions that enable users to determine the exact gain error for each channel, so it is possible to achieve absolute gain accuracy by multiplication in software.

This is the ideal calibration method for applications that do not require absolute accuracy.

ATS9637 digitizers are set to hardware calibration by default. Users can set the desired calibration mechanism in custom programs created by using the ATS-SDK.

On-Board Monitoring

Adding to the reliability offered by ATS9637 are the on-board diagnostic circuits that constantly monitor over 20 different voltages, currents and temperatures. LED alarms are activated if any of the values surpass the limits.

AlazarDSO Software

ATS9637 is supplied with the powerful AlazarDSO software that allows the user to setup the acquisition hardware and capture, display and archive the signals.

ATS9637 users should note that AlazarDSO enables data capture in two modes:

Calibrated Mode

Calibrated Mode is best used for applications that require absolute accuracy, however, it results in missing codes.

In Calibrated Mode, the full scale input range is ±1 V.

Uncalibrated Mode

For applications that do not require absolute accuracy, Uncalibrated Mode provides raw data with no missing codes. There is, however, a gain error.

In Uncalibrated Mode, the full scale input range is not precisely ±1 V.

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 ATS9637 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 ATS9637 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 its family of PCI Express waveform digitizers to a CUDA®-enabled GPU card at sustained transfer rates as high as 6.9 GB/s.

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.

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.

FFTs can be done on triggered data or on continuous gapless stream of data. It is also possible to do spectral averaging. Our benchmarks showed that it was possible to do 720,000 FFTs per second when capturing data in dual-channel mode and using a NVIDIA® Quadro® P5000 GPU.

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 ATS9637 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 ATS9637 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.

Users can download the DKMS driver and associated library for their specific distribution here:

www.alazartech.com/en/linux-drivers/ats9637/10/

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++.

Based on a minimum annual business commitment, the Linux driver source code license (order number ATS9637-LINUX) may be granted to qualified OEM customers for a fee. For release of driver source code, a Non-Disclosure Agreement must be executed between the customer's organization and AlazarTech.

All such source code disclosures are made on an as-is basis with limited support from the factory.

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 one (1) year parts and labor warranty. This warranty can be extended for a fee (more information can be found in the Extended Warranty section below).

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 ATS9637 includes a standard one (1) year parts and labor warranty. Customers may extend their warranty by ordering the appropriate Extended Warranty (ATS9637-061).

This must be purchased before expiration of the standard warranty (or before expiration of an Extended Warranty). Extended Warranties can only be purchased while there is a valid warranty in place.

Users can purchase up to 4 (four) additional years of warranty extensions for a maximum total of 5 years of warranty.

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, ATS9637 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 ATS9637, 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 ATS9637, 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 ATS9637, 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

ATS9637 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.

EC Conformity

ATS9637 conforms to the following standards:

Electromagnetic Emissions:
EN 55032:2015/A11:2020 (Class A):
Multimedia Equipment (MME) Radio disturbance characteristics. Limits and method of measurement:
EN 61000-3-2:2014, EN 61000-3-3:2013.

Electromagnetic Immunity:
EN 55035:2017/A11:2020:
Multimedia Equipment (MME) Immunity characteristics — Limits and methods of measurement:
EN61000-4-2:2009.

Safety:
IEC 62368-1:2018: Audio/video, information and communication technology equipment — Safety — Part 1: General requirements.

ATS9637 also follows the provisions of the following directives: 2014/35/EU (Low Voltage Equipment); 2014/30/EU (Electromagnetic Compatibility).

FCC & ICES-003 Compliance

ATS9637 has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15, subpart B of the FCC Rules, and the Canadian Interference-Causing Equipment Standard ICES-003:2016.

System Requirements

Personal computer with at least one free x8 or x16 PCI Express slot, 16 GB RAM, 100 MB of free hard disk space, SVGA display adaptor and monitor with at least a 1024 x 768 resolution.

Power Requirements

+12 V	4.2 A, typical
+3.3 V	0.2 A, typical

Physical

Size	Single slot, ⅔ length PCIe card (4.377 inches x 7.8 inches excluding the connectors protruding from the front panel)
Weight	280 g

I/O Connector

ECLK, CH A to H, TRIG IN, AUX I/O	MCX female connector

Environmental

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

Acquisition System

Resolution	16 bits
Bandwidth (-3 dB) DC-coupled, 50 Ω	DC - 200 MHz, typical for all input ranges
Number of channels	8, simultaneously sampled
Maximum Sample Rate	370 MS/s single shot
Minimum Sample Rate	1 MS/s single shot for internal clocking
Full Scale Input range 50 Ω Input impedance:	±1 V, fixed when using the "Hardware Calibration Mechanism" ("Calibrated Mode" in AlazarDSO)
DC accuracy	±2% of full scale in all ranges when using the "Hardware Calibration Mechanism" ("Calibrated Mode" in AlazarDSO)
Input coupling	DC coupling only
Input impedance	50 Ω ±5%
Absolute maximum input	±4 V (DC + peak AC)

Acquisition Memory System

Memory Size	Single Channel: 4 GS per ch. Dual Channel: 2 GS per ch. Quad Channel: 1 GS per ch. Octo Channel: 512 MS per ch.
Record Length	Software-selectable with 128-point resolution. Record length must be a minimum of 256 points. 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
Pre-trigger depth (in NPT mode)	From 0 to 8176 for single channel From 0 to 4088 for dual channel From 0 to 2044 for quad channel From 0 to 1022 for 8 channels
Post-trigger depth	Record Length – Pre-Trigger Depth

Timebase System

Timebase options	Internal Clock or 10 MHz Reference Clock
Internal Sample Rates	370 MS/s, 250 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
Internal Clock accuracy	±2 ppm

Dynamic Parameters

Typical values measured on CH A of a randomly selected ATS9637. Input signal was provided by a Rohde & Schwarz SMB100A signal generator, followed by a 9-pole, 10 MHz band-pass filter (TTE Q36T-10M-1M-50-720BMF). Input frequency was set at 9.98 MHz and output amplitude was 0.670 Vrms, which was approximately -3 dB of full scale.

SNR	64.31 dB
SINAD	63.57 dB
SFDR	TBD

Note that these dynamic parameters may vary from one unit to another, with input frequency and with the full scale input range selected.

10 MHz Reference PLL Input

Signal Level	750 mVp-p to 2 Vp-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 Freq.	100 MHz

Triggering System

Mode	Edge triggering with hysteresis
Comparator Type	Digital comparators for internal (CH A ~ CH H) triggering and TTL receiver 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	Any one of CH A ~ CH H, TRIG IN, Software or None, independently software-selectable for each of the two Trigger Engines.
Hysteresis	±5% of full scale input, typical. Only applies to internal trigger.
Trigger sensitivity	±10% of full scale input range (only applies to internal trigger). 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. Only applies to internal trigger.
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 range	3.3 V TTL
Input impedance	6.7 kΩ ±10% for TTL input
Coupling	DC only
Min. pulse width	100 ns
Min. pulse amplitude	2 Volts
Absolute maximum input	0 Volts to 4 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 a clock derived from the ADC sampling clock. Divide-by-8 clock (dual channel mode) or divide-by-16 clock (single channel mode)
Input	
Amplitude:	3.3 Volt TTL (5 Volt compliant)

Materials Supplied

ATS9637 PCI Express Card

ATS9637 Installation Disk (on USB Flash Drive)

Certification and Compliances

RoHS 3 (Directive 2015/863/EU) Compliance

REACH Compliance

CE Marking — EC Conformity

FCC Part 15 Class A / ICES-003 Class A Compliance

All specifications are subject to change without notice

ORDERING INFORMATION

ATS9637	ATS9637-001
ATS9637: One Year Extended Warranty	ATS9637-061
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.

6600 TRANS-CANADA HIGHWAY, SUITE 310
POINTE-CLAIRE, QC, CANADA H9R 4S2

TOLL FREE: 1-877-7-ALAZAR OR 1-877-725-2927
TEL: (514) 426-4899 FAX: (514) 426-2723

E-MAIL: sales@alazartech.com

DATASHEET REVISION HISTORY

Changes from version 1.4B (Dec 2022) to version 1.4C	Section, Page
Added section for REACH Compliance	REACH Compliance, pg. 7
Added download link for the Linux driver and associated library	Linux Support, pg. 6
Added REACH Compliance to list of Certification and Compliances	Certification and Compliances, pg. 9

Changes from version 1.4A (Aug 2022) to version 1.4B	Section, Page
Removed 32-bit Windows	Feature Table, pg. 1
Corrected minimum sample rate	Acquisition System, pg. 2
Added new section to specify default output data format is unsigned binary and that it can be changed to signed binary via an API call.	Output Data Format, pg. 4
Separate description for Linux SDK to detail supported programming languages	Software Development Kits, pg. 5
Noted that only 64-bit Windows is supported	Support for Windows, pg. 6
Added note: ATS-SDK example programs are only provided for Python and C++	Linux Support, pg. 6
Corrected minimum sample rate	Acquisition System, pg. 8
Removed internal sample rates below 1 MS/s	Timebase System, pg. 8
Removed products ATS9637-SMA, ATS9637-BNC, ATS9637-040, ATS9637-041 AlazarTech no longer offers cables or ATS9637 models that come with cables	Ordering Information, pg. 9

Changes from version 1.4 (March 2022) to version 1.4A	Section, Page
Changes to maintenance subscription inclusions: removed technical support	Software Development Kits, pg. 5
Added Windows 11	Support for Windows, pg. 6
Added new section to specify how AlazarTech handles technical support: Customers receive free technical support on hardware products that are under warranty. Out-of-warranty support requires the purchase of support hours.	Technical Support, pg. 6
Updated standards (product was retested)	EC Conformity, pg. 7
Updated name for product *Software Development Kit* Now called: *ATS-SDK purchased with a digitizer board or ATS-GPU*	Ordering Information, pg. 9
Added products ATS-SDK-WOD and SUPPORT-HR5	Ordering Information, pg. 9