ADQ3x-USB Datasheet

The ADQ3 series digitizers are available in a stand-alone USB 3.2 box. The USB 3.2 version of ADQ3 series features:

- **USB 3.2 connection to PC with up to 1.9 Gbyte/s data transfer rate**
- **Extended GPIO**
- **12 V power supply**
- **Fan-less operation for OEM assembly**
- **Fan option for desktop use**

1 ORDERING INFORMATION

1.1 Compatibility

The USB 3.2 connection is available for a selected set of digitizer model. See the datasheet of the respective digitizer model for details about the digitizer. Order USB 3.2 box by adding the USB-option to the model's name, for example ADQ32-USB.

The USB 3.2 box is available for:

- ADQ30
- ADQ32 (Sampling rates 2 and 2.5 GSPS, bandwidth 1 and 2.5 GHz)
- ADQ32-PDRX (Sampling rates 2 and 2.5 GSPS)
- ADQ33
- ADQ33-PDRX
- ADQ35
- ADQ35-PDRX
- ADQ35-WB

1.2 Fan-less for design-in

The ADQ3x-USB features a fan-less design and relies on system airflow for cooling. Its construction is resilient to dust, making it suitable for use in environments where particulate matter may be present.

Figure 1 ADQ3x-USB without fan

1.3 Cooling with attached fan

The ADQ3x is available with a fan for cooling the device. The fan option is ordered by adding the code -FAN to the product name. The ADQ3x-USB-FAN can then be used as a desk-top measurement instrument. This option is also useful in the applications development phase.

Figure 2 ADQ3x-USB-FAN with fan

1.4 Deliverables

The standard deliverables are:

- Selected digitizer model (with or without fan depending on order)
- 2 meter, 20 Gbit/s, USB-C cable
- Power supply
- SDK software development kit
- Digitizer Studio graphical interface
- FWDAQ – firmware for data acquisition

2 ADQ3X-USB INTRODUCTION

2.1 Features

- Stand-alone box version of ADQ3 series digitizers
- GPIO connector
- Up to 1.9 Gbyte/s continuous data throughput
- USB-C connector

2.2 Applications

- Swept-source optical coherence tomography (SS-OCT)
- Time-of-flight mass spectrometry
- Distributed optical fiber sensing
- LIDAR
- Scientific instruments
- ATE
- Test and measurement

2.3 Advantages

- A space-saving, compact stand-alone box with high data transfer rate to the host PC
- Digitizer can be located close to the detector for optimized analog performance
- Use a mini-PC or laptop without PCIe-slots
- Real-time processing and high data throughput of the ADQ3 series digitizers
- Fan-less option for systems integration reduces cost of ownership
- Teledyne SP Devices' design services are available for fast integration to reduce time-to-market

3 SYSTEM DESIGN OPTIMIZATION

The ADQ3x-USB solution for high-speed data acquisition system allows the user to place the digitizer close to the detector and to use PC without PCIe-slot. Important aspects of using the ADQ3x-USB are listed here:

3.1 Front-end optimization

The ADQ3x-USB is intended to be mounted inside other equipment. Thanks to the USB cable, the box can be placed close to the detector. Cables can be kept short to reduce the impact of reflections. This optimizes the analog performance.

3.2 Streaming to CPU

ADQ3x-USB supports up to 1.9 Gbyte/s sustained data streaming to a host computer. Implementing the application-specific algorithms in the CPU results in an efficient system. The data rate is about matching the data rate that can be conveniently processed in a CPU.

3.3 Application firmware

An ADQ3 series digitizer can produce up to 20 Gbyte/s of raw data. There are several firmware packages to perform the initial stage of digital signal pre-processing and data reduction in the onboard FPGA of the digitizer. These firmware packages typically extract information from the data and reduce the data rate to match the data transfer capacity of the USB 3.2 interface.

3.4 Open FPGA for real-time processing

In addition to the application firmware, the ADQ3 series digitizers offer an open FPGA for implementation of custom application-specific computations in the FPGA. The firmware development kit is ordered separately.

3.5 Cooling, fan-less for OEM design-in

The ADQ3x-USB features a fan-less design and relies on system airflow for cooling. Its construction is resilient to dust, making it suitable for use in environments where particulate matter may be present.

3.6 Cooling, fan for desk-top use

There is an optional fan for the ADQ3x-USB digitizer. The ADQ3x-USB can then be used as a desk-top measurement instrument. This option is also useful in the applications development phase.

3.7 Systems assembly

The mechanical robustness is a core parameter. Safe fastening of the box and cable attachment is therefore important. Here are some details:

- There are screw holes at the bottom plate of the digitizer for attaching it to the rack or other instrument. See Figure 5 for location of the holes.

- Analog signals are firmly attached via SMA connectors for more reliable and robust operation.

- The USB-C connection in the box is supplied with screw attachment to avoid that the cable falls out. Standard shipment includes a USB cable without screw. An USB-C cable with a screw attachment can be ordered separately.

Figure 3 Typical USB cable with screw lock

- The power supply and the GPIO connectors have snap lock cable attachment.

3.8 Software interface

The USB version operates with the same API as the PCIe version. The API automatically selects USB connection or PCIe connection, depending on which version that is used. USB and PCIe digitizers can be used simultaneously in the same installation.

3.9 Power supply

The ADQ3x-USB is powered by a 12 V supply via the included power adapter, which connects through an XLR connector. Warranty coverage and compliance testing are valid only when using the supplied adapter. For alternative power sources, please consult a Teledyne SP Devices' representative.

4 TECHNICAL DATA

Read the datasheet for each respective digitizer model for additional information.

Table 1 Environmental and mechanical parameters

Parameter	Condition	Min	Typical	Max	Unit
Power and temperature					
Power consumption [1]			60		W
Power supply		10.8	12	13.2	V
Operating temperature fan-less[2]		0		55	ºC
Operating temperature fan option[3]		0		35	ºC
Size[4]					
Width			215		mm
Length			235		mm
Height			40		mm
Weight			1930		g
Compliances					
RoHS3		Yes			
CE		Yes			
FCC	Exclusion according to CFR 47, part 15, paragraph 15.103(c).				

Table 2 GPIO expansion

Parameter	Value
Connector type	ST60-24P(50)
Number of differential input signals LVDS	2
Number of differential output signals LVDS	2
Number of single-ended 3.3-V LVCMOS I/O signals	4
Control bus	I2C, 3.3 V
Power supply	3.3 V, max 0.5 A

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[1] Power consumption depends on selected digitizer model and firmware selection. The USB interface typically adds 10 W to the specification of the specific ADQ3 digitizer.

[2] This is typical operating conditions with air flow. The digitizer has to be mounted so it cannot be touched if the fan-less mode is selected.

[3] This temperature range is valid if the board is placed so it can be touched by the operator.

[4] See Figure 4 for drawing.

Table 3 Software support

Parameter	Value
Operating system[5]	Windows / Linux
GUI	Digitizer Studio
Example code	C, Python
API	C / C++
High-level API	LabVIEW / MATLAB / C#

Table 4 Data transfer[6]

Parameter	Value	Unit
Supported versions of data transfer standard	USB 3.2	
Sustained data rate to CPU	Up to 1.9	Gbyte/s

5 ABSLOUTE MAXIMUM RATINGS

Table 5 Absolute maximum ratings

Parameter	Condition	Min	Max	Unit
Power supply to GND		-0.4	14	V
Ambient temperature[7]				°C
Storage temperature		-40	70	°C

Exposure to conditions exceeding these ratings may reduce lifetime or permanently damage the digitizer. The built-in temperature monitoring unit will protect the digitizer from overheating by temporarily shutting down parts of the device in an overheat situation. The SMA connectors have an expected lifetime of 500 operations. For frequent connecting and disconnecting of cables, connector savers are recommended.

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[5] See 15-1494 Operating system support for a detailed listing of supported distributions.

[6] This is the data rate that the USB 3.2 implementation supports. Other parts of the system may limit the performance.

[7] The maximum ambient temperature depends on the air flow and the load on the FPGA, that is, for example trigger rate, and firmware functions. The digitizer has an overheat protection that shuts down the board to protect it from overheating.
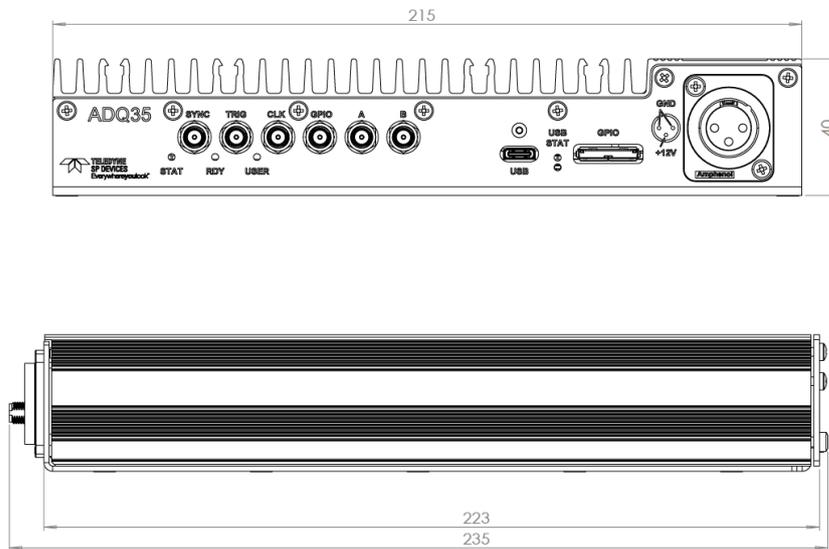
6   MECHANICAL DRAWINGS

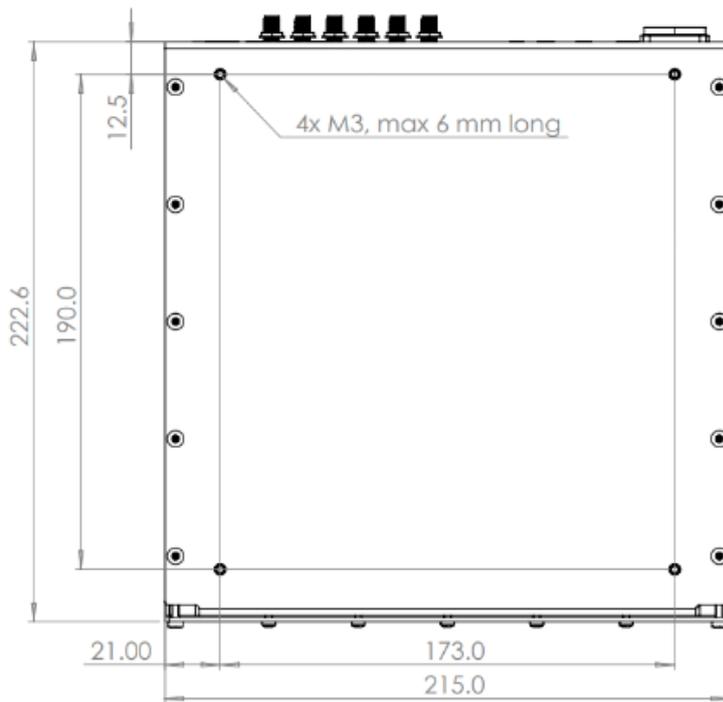**Figure 4 ADQ3x-USB outer dimensions**

Figure 5 Location of holes for screw attachment of ADQ3x-USB

7   REFERENCES

Refer to Teledyne SP Devices' website, www.spdevices.com, for the latest version of supplementary documents.

15-1494 Supported operating systems

18-2059 ADQUpdater user guide

20-2378 ADQ32 Datasheet

20-2451 ADQ33 Datasheet

20-2507 ADQ3 series development kit user guide

20-2521 ADQAssist user guide

21-2539 ADQ3 series user guide

22-2797 ADQ32-PDRX Datasheet

22-2918 ADQ35 Datasheet

22-2919 ADQ35-PDRX Datasheet

22-2869 ADQ30 Datasheet

23-3042 ADQ33-PDRX Datasheet

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