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# ADVAPIX TPX

Version 1.0 - Datasheet

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Model No.: APXMDE-Xxx170208



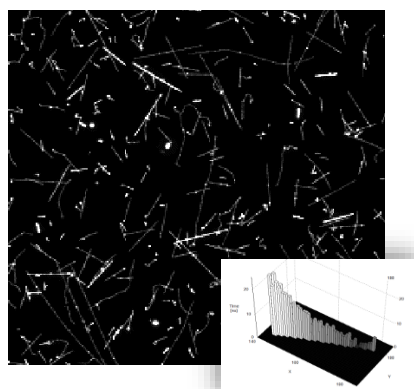


Illustration of single particle sensitivity of Timepix device. The tracks of different particles of radiation background (mostly muons and few protons) were recorded in 5 minutes on board of airplane. No noise (clean zero) is seen in dark regions. Inset shows the time profile along one muon track.

The **ADVAPIX TPX** modules were designed with special emphasis to performance and versatility which is often required in a scientific experimental work. The fast modules with Si or CdTe pixel detectors Timepix can be used in different configurations such as stack of several layers or tiling to cover larger area or combination of both. Each module contains single Timepix device with fast parallel readout up to per second independent of frame occupancy. A separate USB 3.0 communication channel for each device assures fast read-out of the whole modular system. All modules in the system can be operated synchronously or triggered independently. The sensor type and thickness is of customer's choice.

The **ADVAPIX** can be used in a variety of applications such as fast radiography (X-rays, neutrons, ions), spectroscopic imaging (each pixel records the energy spectrum), particle tracking, time-of-flight imaging, multilayer Compton camera (thin top sensor, thick bottom sensor) and many other. The sensors can be adapted for neutron imaging by deposition of converter layers<sup>1</sup>. The spatial resolution in some applications (slow neutrons) can reach units of microns or even sub-micrometric level (ions).

## Main Features:

- Readout chip type..... Timepix
- Pixel size .....55 x 55  $\mu\text{m}$
- Sensor resolution.....256 x 256 pixels
- Dynamic range in one frame.....11 810<sup>2</sup>
- Time resolution..... 20 ns
- Sensor material.....100,300,500  $\mu\text{m}$  Si or 1000  $\mu\text{m}$  CdTe
- Power..... External or via second USB 3.0
- Interface.....USB 3.0 (Super-Speed)
- Maximum readout speed..... 1700 fps
- Dimensions .....125 x 79 x 25.5 mm
- Weight ..... 503 g

<sup>1</sup> Convertors based on 6LiF or 10B4C for slow neutrons (efficiency up to 4%) or PE for fast neutrons.

<sup>2</sup> A final picture can be created as sum of individual images. The dynamic range is limited only by the measurement time.

## Device Parameters

### Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units	Comment
T <sub>A</sub>	Temperature Range	0	50	70	°C	
Φ	Humidity			60	%	Not condensing

## Electrical Specification

T<sub>A</sub> = 25°C, USB voltage V<sub>CC</sub> = 4.8V

Symbol	Parameter	Min	Typ	Max	Units	Comment
V <sub>CC</sub>	Supply Voltage	4.0	5.0	5.5	V	
I <sub>CC</sub>	Supply Current					
I <sub>CC1</sub>	Chip active		800	1500	mA	
P <sub>1</sub>	Power Dissipation			7.5	W	
I/O Conn. Input CMOS (pin 4,6,8,10)						
V <sub>INL</sub>	Voltage Low	0		1.15	V	
V <sub>INH</sub>	Voltage High	2.15		3.3	V	
I/O Conn. Input LVDS (pin 3,5,7,9)						
V <sub>IN</sub>	Voltage Range	0		2.5	V	
V <sub>INDIFF</sub>	Differential Voltage	250		600	mA	
Bias Voltage Source for Sensor Diode						
V <sub>BIAS</sub>	Bias Voltage	0		±450	V	Polarity is sensor dependent

## Performance Characteristics for Timepix

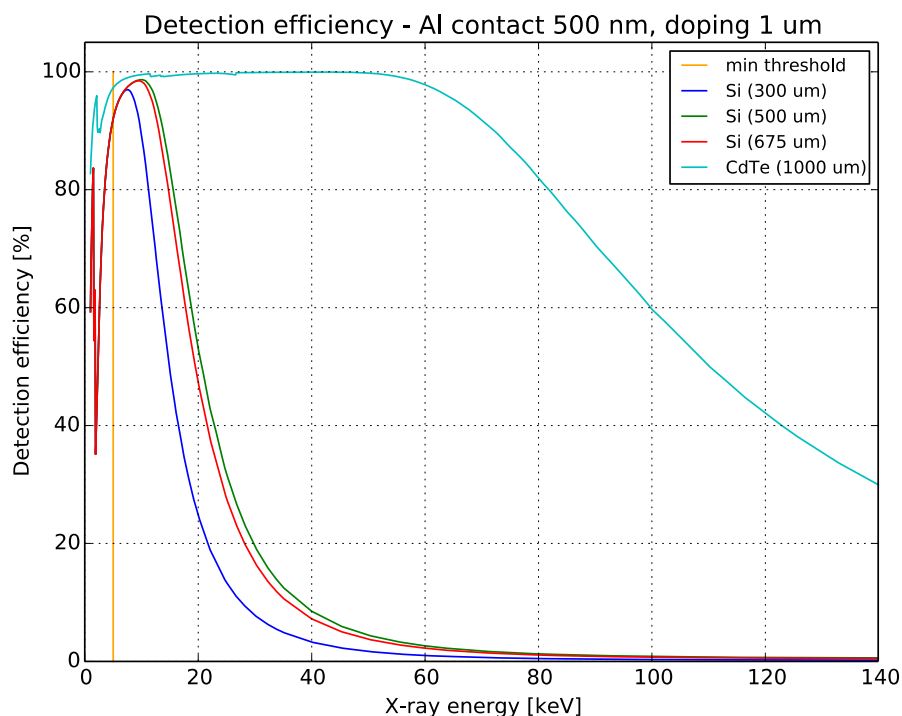
Symbol	Parameter	Min	Typ	Max	Units	Comment
f	Frame Rate			1700	fps	with USB 3.0 cable
T <sub>READ</sub>	Frame Readout Time <sup>3</sup>		588		μs	with USB 3.0 cable
dT	Time resolution	20	100		ns	

<sup>3</sup>During Readout time (or Dead time), no charge is collected from the sensor.

## Sensor parameters

T<sub>A</sub> = 25°C

Symbol	Parameter	Si				CdTe	Units	Comment
	Thickness	100	300	500	675	1000	μm	
σ	Energy resolution of energy discrimination threshold (σ @ 23 keV)	0.5				1.1	keV	
σ	Energy resolution of energy discrimination threshold (σ @ 60 keV)	0.6				1.5	keV	
σ	Energy resolution in full spectral mode (σ @ 23 keV)	0.7				3.0	keV	
σ	Energy resolution in full spectral mode (σ @ 60 keV)	1.0				3.6	keV	
	Typical detectable energy range for X-rays <sup>4</sup>	5 to 60				5 to 600	keV	See chart below
	Pixel size	55				55	μm	



<sup>4</sup> The maximum detectable energy is limited only by sensitivity of the selected sensor for the given radiation type. The maximum measured energy can reach several MeV in case of heavy charged particles



**+5VDC connector**

Main power supply (via standard 2.1 mm connector). Connect after plugging USB connector.

**USB connector**

USB type micro B, Standard USB 3.0 Super-Speed.

**I/O Digital connector**

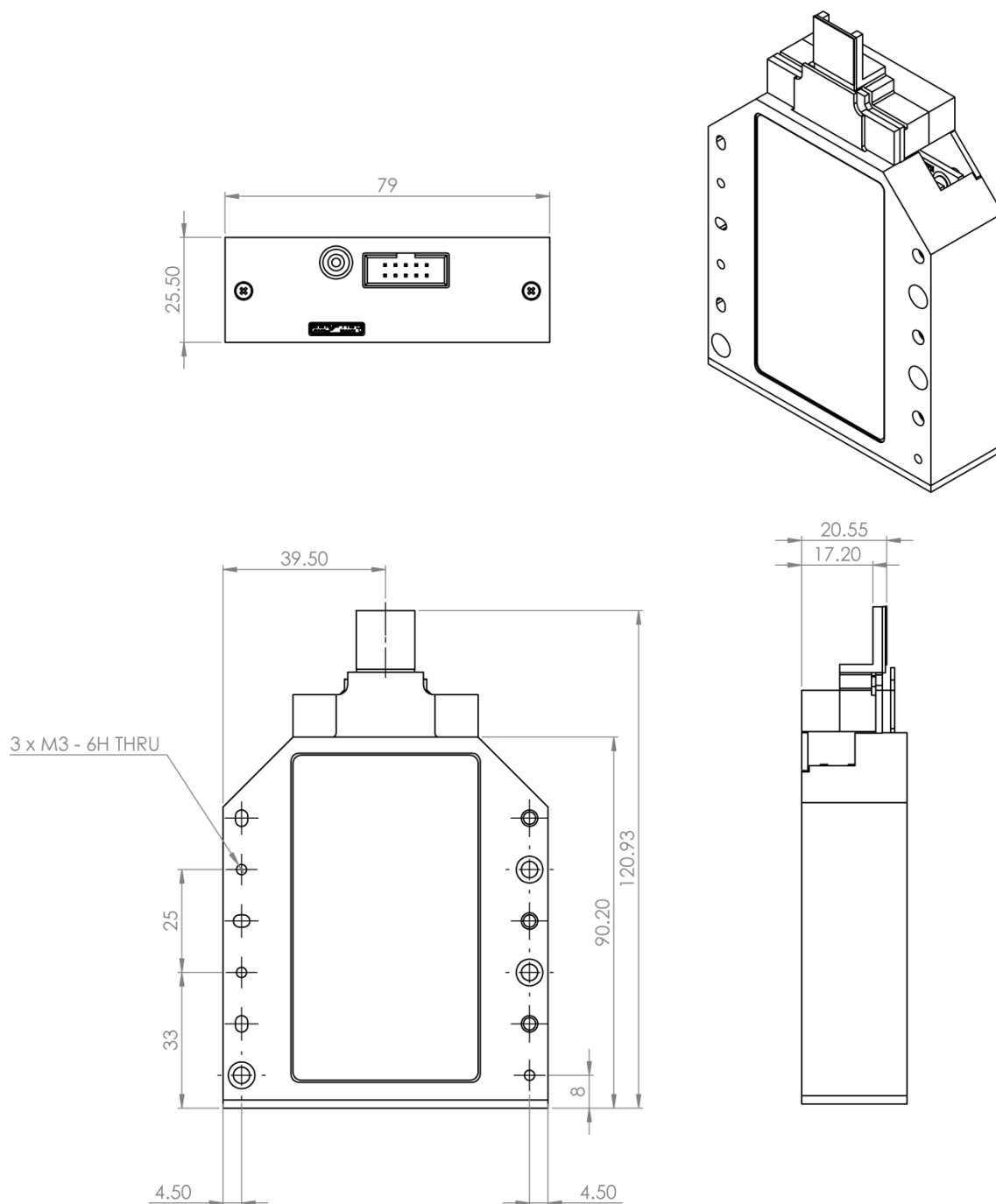
Connector is available internally on board. It can be made accessible upon request.

1	GND		2	Max	
3	Reserved	LVDS <sub>0</sub> P (2.5V)	4	Ready In	CMOS 0-5V
5	Reserved	LVDS <sub>0</sub> N (2.5V)	6	Trigger In	CMOS 0-5V
7	Reserved	LVDS <sub>1</sub> P (2.5V)	8	Ready Out	CMOS 0-5V
9	Reserved	LVDS <sub>1</sub> N (2.5V)	10	Trigger Out	CMOS 0-5V



## Mechanical Dimensions

Without protecting cover

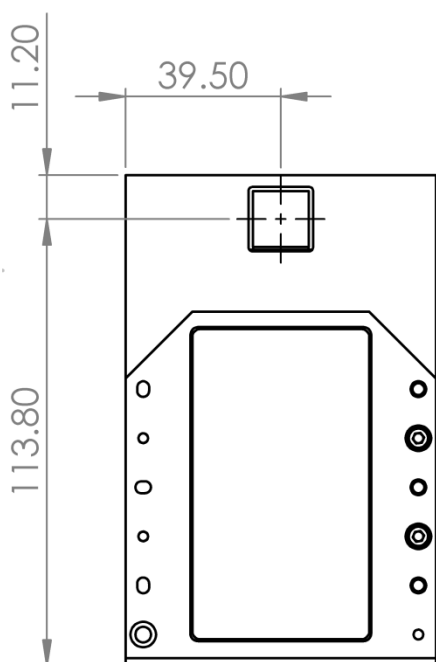
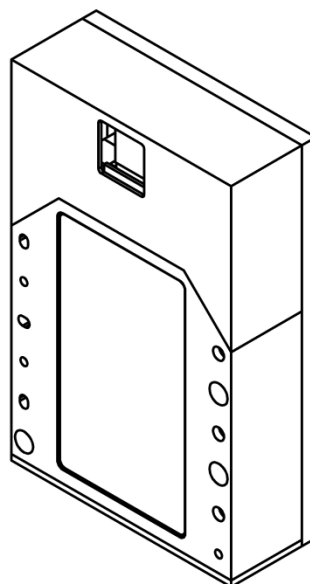
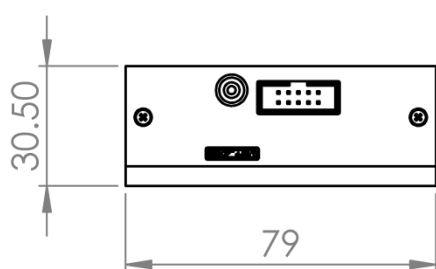


All dimensions are in mm.

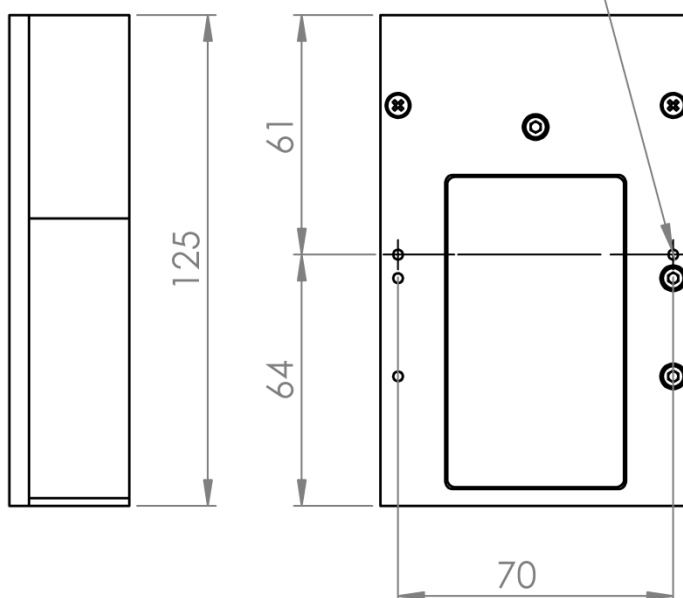
Extreme care must be taken when removing protecting cover and handling the **ADVAPIX** without the protecting cover. Warranty does not apply to mechanical damage of the sensor and wirebonds.



With protecting cover



User mounting holes  
2 x M3 - 6H  $\nabla$  5



All dimensions are in mm.





## Model number codes

Example: APX MDE - X P 3 170208

Device name:

APX – AdvaPIX

Device modification:

MDE – Timepix module

Sensor type:

P – Planar silicon

E – Edgless silicon

C – CdTe

Sensor thickness:

1 – 100  $\mu\text{m}$

3 – 300  $\mu\text{m}$

5 – 500  $\mu\text{m}$

A – 1000  $\mu\text{m}$

## Release history

Date	Changes
17/11/02	Model number codes added, datasheet version







## Configuration Examples

### Single detector

(Single layer of 256 x 256 pixels,  
speed of 1700 frames per second)



### Quad detector or

### Quad detector with central hole

(Single layer of 512 x 512 pixels, speed of 1700  
frames per second with optional hole in the  
middle. up to 2mm square)



# Warning

Do not touch sensor surface!

Instructions for safe use.

To avoid malfunction or damage to your **ADVAPIX** please observe the following:

- Do not expose to water, moisture.
- Do not disassemble. Wire-bonding connection may be irreversibly damaged.
- Do not insert any object into the sensor window.



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