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# ADVAPIX TPX3

Version 1.0 - Datasheet

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Model No.: APXMD3-Xxx170704



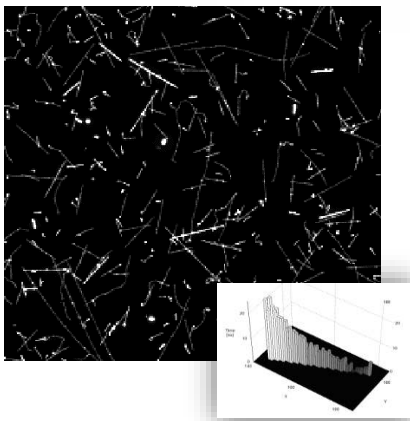


Illustration of single particle sensitivity of Timepix3 device. The tracks of different particles of radiation background (mostly muons and few protons) were recorded in 5 minutes on board of airplane. No noise (clean zero) is seen in dark regions. Inset shows the time profile along one muon track.

The **ADVAPIX TPX3** modules were designed with special emphasis to performance and versatility which is often required in a scientific experimental work. They contain latest CERN detector Timepix3 for particle tracking and imaging. The fast modules with Si or CdTe pixel detectors Timepix3 can be used in different configurations such as stack of several layers or tiling to cover larger area. Each module contains single Timepix3 device with ultra-fast sparse data readout to acquire up to 40 Mhits per second. A separate USB 3.0 channel for each device assures fast read-out of the whole modular system. The sensor type and thickness is of customer's choice.

The **ADVAPIX TPX3** can be used in a variety of applications such as energy resolved radiography (X-rays, neutrons, ions), particle tracking, time-of-flight imaging, multilayer Compton camera and many other. The sensors can be adapted for neutron imaging by deposition of converter layers<sup>1</sup>. Recording individual hits together with advanced data processing allows increasing the spatial resolution in some applications to units of microns or even sub-micrometric level (for ions).

Compared to the older Timepix chip the Timepix3 detector offers 6 times better time resolution, 2 times better energy resolution, 2 times lower minimum energy threshold, zero dead time and 10x faster data transfer.

## Main Features:

- Readout chip type..... Timepix3
- Pixel size .....55 x 55 µm
- Sensor resolution.....256 x 256 pixels
- Time resolution..... 1,6 ns
- Power..... External or via second USB 3.0
- Interface.....USB 3.0(Super-Speed)
- Maximum readout speed..... 40 million pixels / s
- 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.



## 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 disabled		800	1500	mA	
P <sub>1</sub>	Power Dissipation			2.5	W	
<b>I/O Conn. Input CMOS (pin 4,6,8,10)</b>						
V <sub>INL</sub>	Voltage Low	0		1.15	V	
V <sub>INH</sub>	Voltage High	2.15		3.3	V	
<b>I/O Conn. Input LVDS (pin 3,5,7,9)</b>						
V <sub>IN</sub>	Voltage Range	0		2.5	V	
V <sub>INDIFF</sub>	Differential Voltage	250		600	mA	
<b>Bias Voltage Source for Sensor Diode</b>						
V <sub>BIAS</sub>	Bias Voltage	0		±450	V	Polarity is sensor dependent

## Performance Characteristics for Timepix3

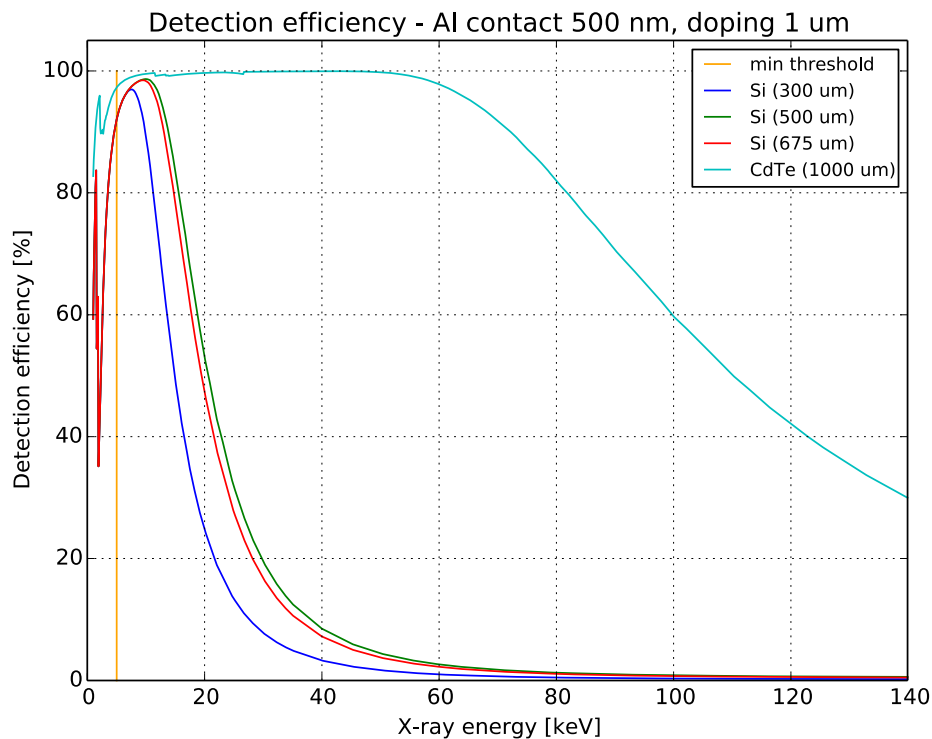
Symbol	Parameter	Min	Typ	Max	Units	Comment
f	Hit-rate			40	MPixels/s	with USB 3.0 cable
	Data rate			2.4	Gbit/s	with USB 3.0 cable
T <sub>READ</sub>	Frame Readout Time		33		ms	with USB 3.0 cable
dT	Time resolution	1.56			ns	
F <sub>READ</sub>	Read-out frequency		320		MHz	½ of maximum ROC freq



## Sensor parameters

T<sub>A</sub> = 25°C

Symbol	Parameter	Si				CdTe	Units	Comment
		100	300	500	675			
	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>2</sup>	1.0				3 to 600	keV	See chart below
	Pixel size	55				55	µm	



<sup>2</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.

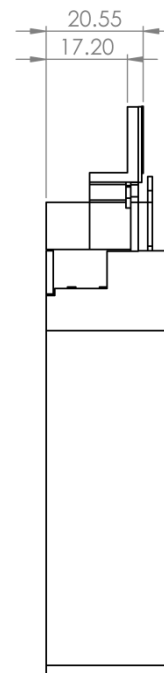
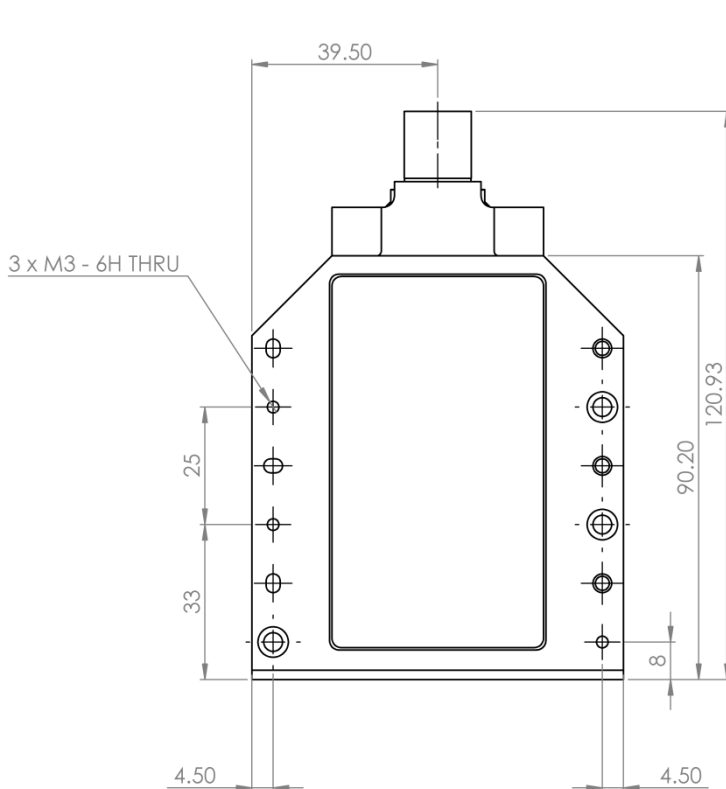
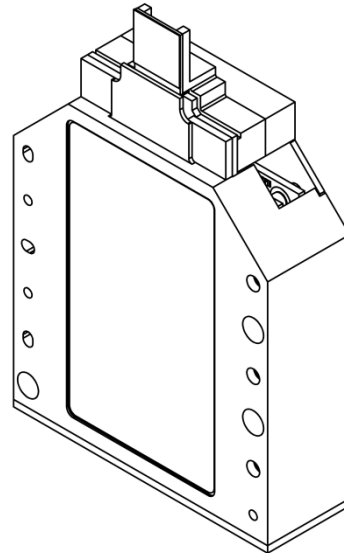
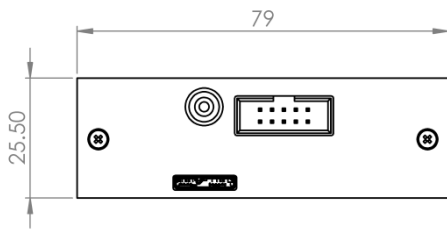
### I/O Digital connector

Connector is not used in this version of the product.

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

## Mechanical Dimensions

Without protecting cover

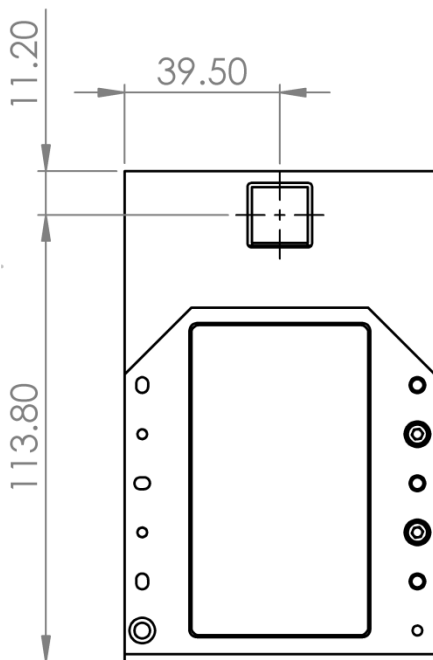
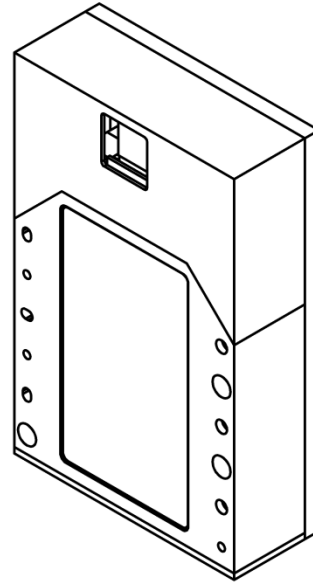
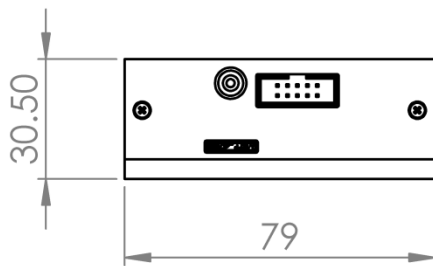


All dimensions are in mm.

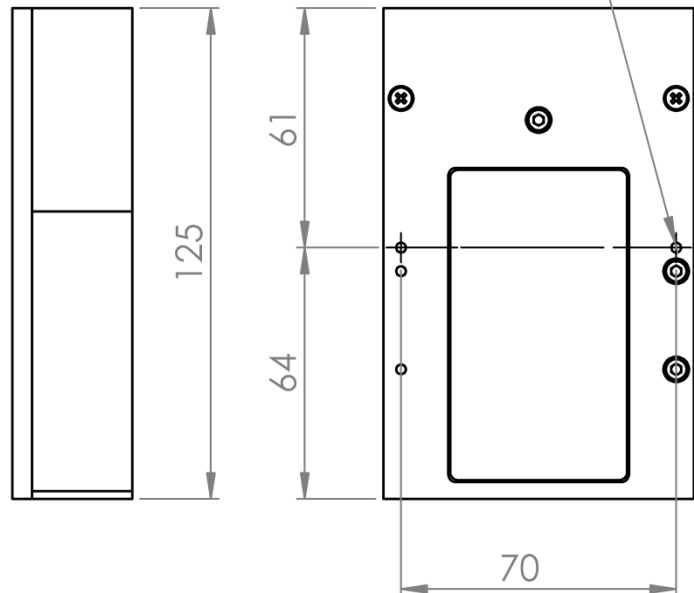
Extreme care must be taken when removing protecting cover and handling the **AdvAPIX TPX3** without the protecting cover. Warranty does not apply to mechanical damage of the sensor and wirebonds.



With protecting cover



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



All dimensions are in mm.





## Model number codes

Example: APX MD3 - X P 3 170704

Device name:  
APX – AdvaPIX

Device modification:  
MD3 – Timepix3 module

Sensor type:  
P – Planar silicon  
E – Edgless silicon  
C – CdTe

Sensor thickness:  
1 – 100 µm  
3 – 300 µm  
5 – 500 µm

## Release history

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





# Warning

Do not touch sensor surface!

Instructions for safe use.

To avoid malfunction or damage to your **ADVAPIX** TPX<sub>3</sub> 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.

## Copyright

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