ADVACAM
Imaging the Unseen

MINIPIX EDU

Datasheet

Model No.: MNXTXE-XPx210520

General features

The **MINI*PIX*** *EDU* is miniaturized and low power solution of radiation camera with single particle counting (or particle tracking) detector Timepix. The standard **MINI*PIX*** *EDU* system incorporates single Timepix detector (256 x 256 pixels with pitch of 55 µm) with 300 or 500 µm thick silicon. It uses USB 2.0 interface capable of reading up to 45 frames per second (with exposure time of 1 ms). The Timepix detector is energy sensitive which brings a new dimension to radiographic images. The device can also visualize many kinds of ionizing radiation particles (beta, alpha, cosmic radiation, etc.). The **MINI*PIX*** *EDU* device is controlled via USB interface. The major operating systems are supported (MS Windows, Mac OS and LINUX).

The **MINI*PIX*** *EDU* is an ideal device for physics classes where students can literarily "see" the radiation surrounding us.

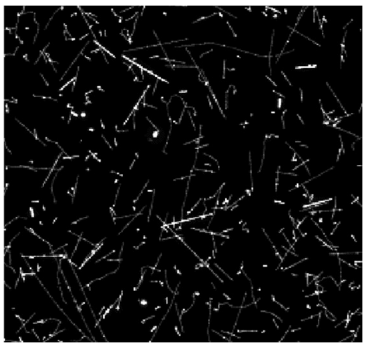


Illustration of single particle sensitivity of Timepix device. The tracks of different particles of radiation background (mostly muons and few protons) were recorded in 5 minutes on board of airplane. No noise (clean zero) is seen in dark regions.

Main features

- Readout chip type.....Timepix
- Pixel size[1] .....55 x 55 µm
- Sensor resolution.....256 x 256 pixels
- Dynamic range in one frame[2] 11 810
- Sensor material..... 300 or 500 µm Si
- Dark current.....none
- Interface.....USB 2.0 (High-Speed)
- Maximum frame rate.....45 fps
- Dimensions .....88.9 x 21 x 10 mm
- Weight.....30 g

[1] 55 x 110 µm at the edges and 110 x 110 µm at the corners

[2] Dynamic range of final picture is theoretically unlimited; the only limiting factor is exposure time.

Device parameters

Operating conditions

Symbol	Parameter	Value	Units	Comment
T_a	Operating ambient temperature range [1]	0-50	°C	
Φ	Humidity	< 85	%	Not condensing
IP	IP rating with cover	IP30		3D printed cover supplied with the device

[1] With temperature stabilization – see the paragraph below.

External temperature stabilization

Temperature stabilization of the device is strongly recommended for consistent results. Attaching a Peltier cooling or cooling plate at the back of the detector should serve the purpose. The temperature should be set to 22°C.

The device will automatically shut down after chip or CPU temperature exceeds 55°C.

Electrical specification

T_{dev} = 22°C, USB voltage V_{CC} = 4.8V

Symbol	Parameter	Min	Typ	Max	Units	Comment
V_{CC}	Supply Voltage	4.4	5.0	5.25	V	Comply with USB 2.0
I_{CC2}	Chip active			500	mA	Comply with USB 2.0
P1	Power Dissipation			2.5	W	
V_{BIAS}	Bias Voltage	3		200	V	

Performance characteristics of Timepix

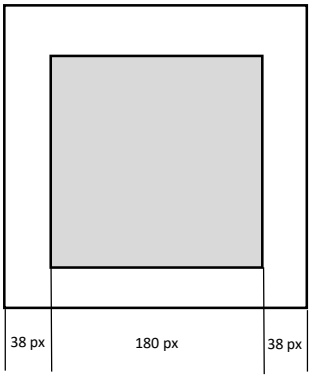
Symbol	Parameter	Min	Typ	Max	Units	Comment
f	Frame-rate			45	fps	with USB 2.0 Host
T_{READ}	Frame Readout Time[2]		22		ms	

[2] During Readout time (or Dead time), no charge is collected from the sensor.

Performance limitations

MINIPIX EDU has some minor limitations compared to the standard **MINIPIX**.

- No sensor stability or pixel response patterns are evaluated.
- Quality of the chip will be evaluated only in the central area (50% of the full sensor area).
- One column of bad pixels is allowed in the central area.
- Bad pixel clusters of up to 20 pixels are allowed (except column).
- Overall, 1 % of bad pixels in the central area (324 pixels) is allowed, including a bad column if any.
- Quality criteria for 300 µm and 500 µm thick Si sensors are the same.
- **MiniPIX EDU** comes with Pixet Basic software, which has limited functionality compared to Pixet Pro.
- In Pixet Basic in the imaging mode there is a watermark in the bottom left corner - the Advacam company logo.



Evaluated sensor area of **MINIPIX EDU**

Sensor parameters

T_{dev} = 25°C

Symbol	Parameter	Si		Units	Comment
	Thickness	300	500	µm	
σ	Energy threshold step	0.1		keV	
σ	Energy resolution in full spectral mode (σ @ 23 keV)	1.9		keV	
σ	Energy resolution in full spectral mode (σ @ 60 keV)	1.8		keV	
	Pixel size[1]	55		µm	

[1] 55 x 110 µm at the edges and 110 x 110 µm at the corners

Modes of readout chip operation

Type	Mode	Counter depth	Description
Frame (reading all pixels)	Tracking	13bit/frame	1 output image: Sum of all Energies deposited in given pixel in keV
	Imaging	13bit/frame	1 output image: Number of Events per pixel

Device description

USB connector

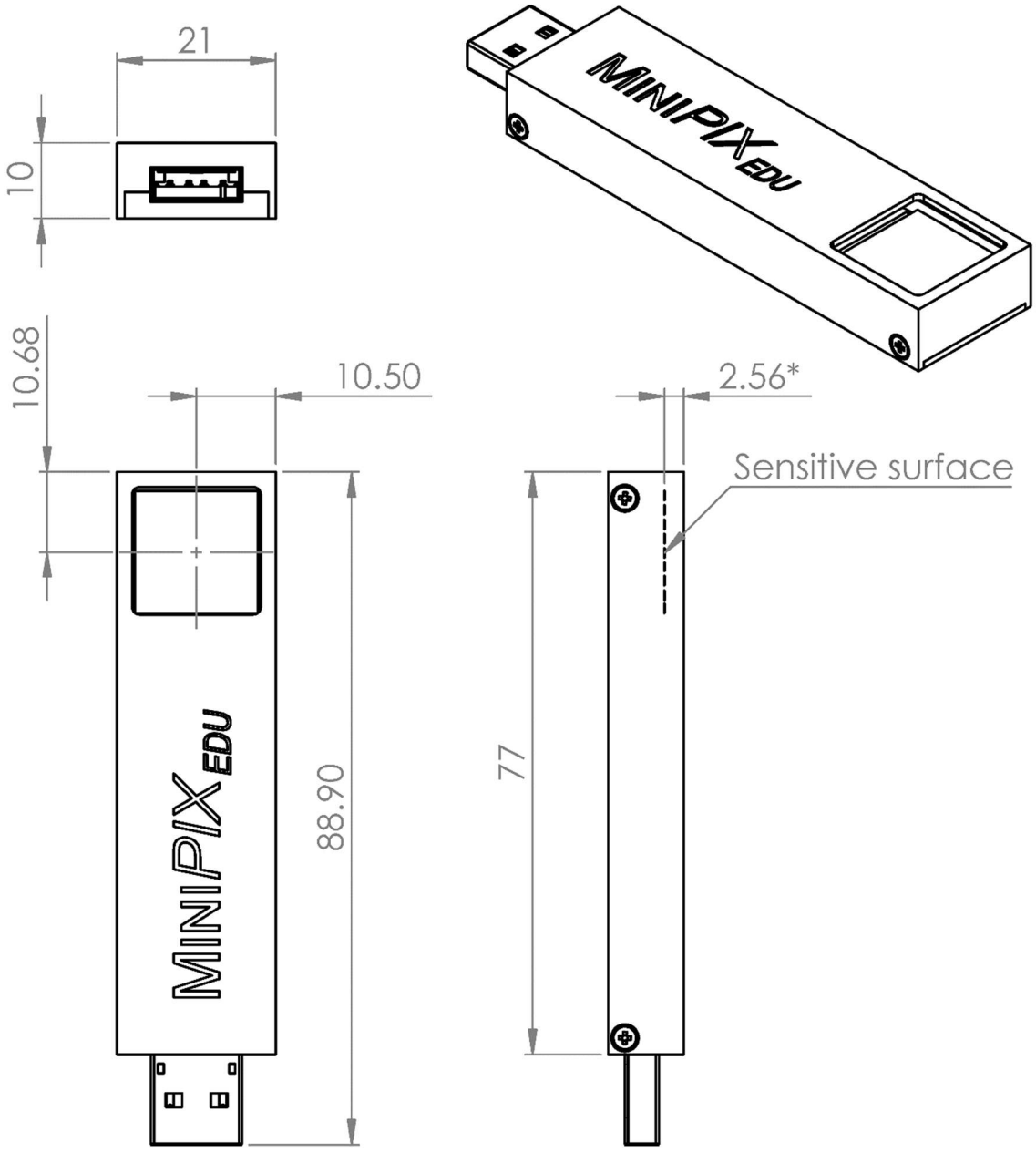
USB type A, Standard USB 2.0 High-Speed.

Certificates

MINI*PIX* ***EDU*** has been tested by certification authority (Electrotechnical testing institute EZÚ) according to following standards:

Standard number	Name
EN 61000-6-2:05	Electromagnetic compatibility (EMC) - Immunity standard for industrial environments
EN 61000-6-4:07+A1:11	Electromagnetic compatibility (EMC) - Emission standard for industrial environments

Mechanical dimensions



All dimensions are in mm.
* Sensitive surface distance from top of the box is for 300 µm sensor thickness.

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

Model number codes

Example: **MNX TXE - X P 3 00210520**

Device name:

MNX – MiniPIX

Device modification:

TXE – Timepix Edu

Sensor type:

P – Planar silicon
E – Edgeless silicon

Sensor thickness:

3 – 300 µm
5 – 500 µm

Device build version:

XXXXXXXX

Instructions for safe use

Do not touch the sensor surface!

To avoid malfunction or damage to your **MINI*PIX*** $_{EDU}$ please observe the following:

- Do not expose to water or moisture.
- Do not disassemble. Wire-bonding connection may be irreversibly damaged.
- Do not insert any object into the sensor window.
- The maximum USB cable length is 2 m.
- The protection provided by this product may be impaired if it is used in a manner not described in this document.
- Thermal stabilization of the device is necessary. Recommended temperature is 22 °C.

Disposal

Do not dispose these instruments as unsorted municipal waste. Please use separate collection facility to contact the supplier from which the instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environment impact.

Release history

Date	Changes	Changed by
20/06/10	Mechanical dimensions	
20/08/20	Added Edgeless Sensor	
21/07/09	New version	
22/01/04	EDU parameters update	
24/01/10	EDU – Pixet Basic update	J. Baborák
24/04/16	Datasheet revision, modes updated, added watermark info	J. Baborák
24/05/24	New graphic style of the document	J. Baborák, P. Bloudek
24/06/12	Warning sign change	J. Baborák

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