

MiniPIXTPX2

Miniaturized and low power radiation camera



Key features	
Readout chip type	Timepix2
Pixel size	55 x 55 μm (55 x 110 μm at the edges and 110 x 110 μm at the corners)
Sensor resolution	256 x 256 pixels
Counter bit depth	10/ 14/ 18 bit
Dark current	none
Interface	USB 2.0 (Full-Speed)
Maximum frame rate	99 fps
Dimensions	88.9 x 21 x 10 mm
Weight	30 g

The MINIPIXTPX2 is a miniaturized and low-power radiation camera solution that incorporates a single Timepix2 detector with a sensor of customer preference (typically 300 μm thick silicon). The detector features 256 x 256 pixels with a pitch of 55 μm and is capable of single particle counting or particle tracking. The MINIPIXTPX2 utilizes a USB 2.0 interface, allowing for reading of up to 99 frames per second. The energy-sensitive Timepix2 detector brings a new dimension to radiographic images and now also features a new measurement modality - adaptive gain. Adaptive gain helps to improve performance in high-intensity use cases, increasing the dynamic range of the device, and making it an even more versatile and powerful tool for radiation detection.

The MINIPIXTPX2 device is controlled via a USB interface and is compatible with major operating systems such as MS Windows, Mac OS, and LINUX. The system includes free software, PIXET PRO, for detector operation, offering comprehensive functionality and ease of use. With its miniaturized size, low power consumption, and advanced Timepix2 detector technology, the MINIPIXTPX2 is an efficient and effective solution for various radiation detection applications (imaging, XRD, particle tracking etc.)



Illustration of single particle sensitivity of Timepix2 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.

¹ MINIPIXTPX2 is not certified dosimetric device. It serves as the first level indicator and monitor of radiation fields allowing identification of a radiation type. Radiation protection of people cannot be based on measurements of MINIPIXTPX2.

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

MiniPIXTPX2

Miniaturized and low power radiation camera

Device parameters

Operating conditions				
Symbol	Parameter	Value	Units	Comment
TA	Ambient Temperature Range	0-50	°C	
Φ	Humidity	<80	%	Not condensing
	Altitude	<2000	m	Above sea level
IP	IP rating	IP40		With cover

Electrical specification

$T_A = 25\text{ °C}$, USB voltage $V_{CC} = 4.8\text{ V}$

Symbol	Parameter	Min	Typ	Max	Units	Comment
V_{CC}	Supply Voltage	4.0	5.0	5.5	V	Comply with USB 2.0
I_{CC2}	Chip active		500	700	mA	Comply with USB 2.0
P1	Power Dissipation		2.5	3.5	W	
Bias Voltage Source for Sensor Diode						
V_{BIAS}	Bias Voltage	3		200	V	

Performance characteristics of Timepix2

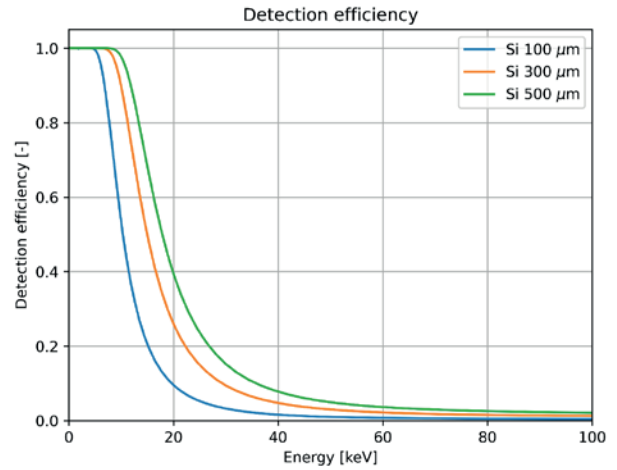
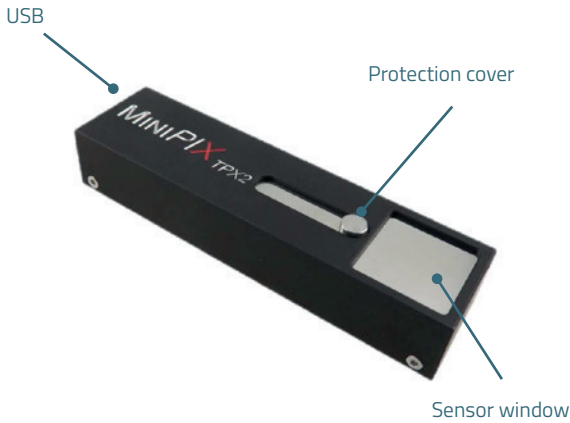
Symbol	Parameter	Min	Typ	Max	Units	Comment
f	Frame-rate			99	fps	with USB 2.0 Host
T_{READ}	Frame readout time ³		19		ms	
³ During Readout time (or Dead time), no signal is collected from the sensor.						

Sensor parameters						
$T_A = 25\text{ °C}$						
Symbol	Parameter	Si			Units	Comment
	Thickness	100	300	500	μm	
σ	Energy resolution of energy discrimination threshold (σ @ 8 keV)	0.36			keV	
σ	Energy resolution in full spectral mode (σ @ 8 keV)	0.6			keV	
σ	Energy resolution in full spectral mode (σ @ 23 keV)	0.9			keV	
σ	Energy resolution in full spectral mode (σ @ 60 keV)	1.4			keV	
	Typical detectable energy range for X-rays	5.0 - 60			keV	See chart below
	Pixel size	55			μm	

MiniPIXTPX2

Miniaturized and low power radiation camera

Device description



USB connector

USB type Micro-B, Standard USB 2.0 High-Speed. The USB cable length should be less than 2m! For longer connections, a repeater or active cable is suggested.

Modes and types of readout chip operation

The detector is frame-based: The data from all the pixels are read out after the acquisition time is over.

Modalities:

- **Integral measurement:**
During the acquisition, recorded data is integrated and output as a single frame.
- **First hit measurement:**
This mode disregards events that take place in the same pixel during the acquisition time, in order to minimize pile-ups.
- **Counter bit Depth:**
Different counter-bit depths can be chosen for certain measurement modes. This enables tailoring the performance for higher frame rates, or better resolution.

Vacuum Operation

Advacam detectors are vacuum compatible out of the box. Operate only with air pressure lower than 10^{-3} Pa. Intended for dust-free indoor use.

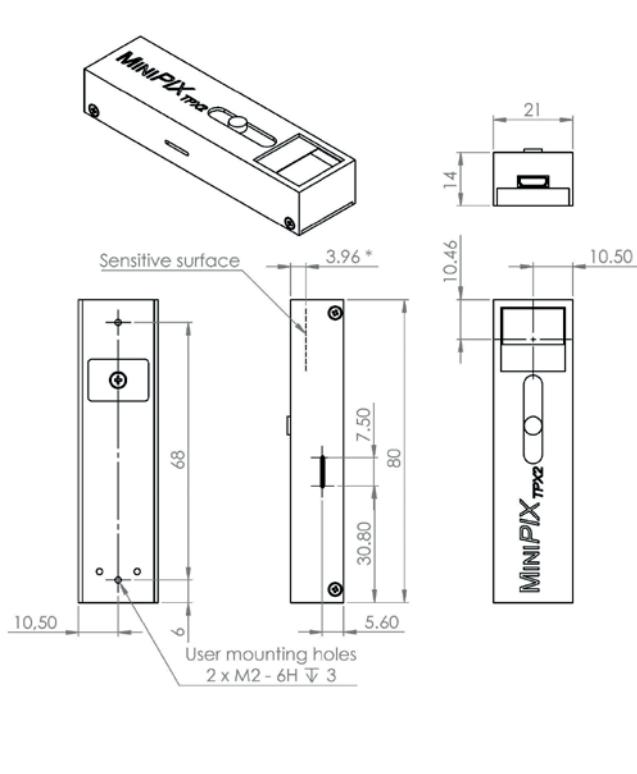
Make sure to disconnect the device from power during pumping down or venting the vacuum chamber!

Combinations of operation modes and measurement modalities (default cases are highlighted):			
Mode	Counter depth	Energy measurement	Frame Rate
Counts	14 bits	N/A	64 fps
	10 bits - high frame rate		99 fps
Energy	14 bits	Integrated energy	65 fps
		1 st hit measurement	
Time	14 bits	N/A	65 fps
	14 bits		98 fps
Counts + Energy	10 bits (Energy) / 4 bits (Counts)	Integrated energy	61 fps
		1 st hit measurement	
Energy + Time	14 bits (Energy) / 14 bits (Time)	Integrated energy	32 fps
		10 bits (Energy) / 18 bits (Time)	1 st hit measurement

MiniPIXTPX2

Miniaturized and low power radiation camera

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 without the protecting cover. Warranty does not apply to mechanical damage of the sensor and wirebonds.

Model number codes (example)

MXN	T2S	X	P	3	210520
Device name MNX – MiniPIX	Device modification T2S – Timepix Standard		Sensor type P-Planar silicon	Sensor thickness 1 – 100 μm 3 – 300 μm 5 – 500 μm	YY MM DD

Do not touch sensor surface!



Instructions for safe use

To avoid malfunction or damage to your MiniPIXTPX2 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.
- 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

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

