Datasheet

ADVACAM
Imaging the Unseen

MiniPIX
SPRINTER

Model No.: MNXT2S-Xxx

General features

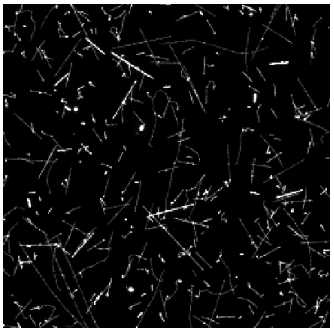


Illustration of single particle sensitivity of Timepix2 detector. The tracks of different particles of radiation background (mostly muons and few protons) were recorded in 5 minutes on board of an airplane. No noise (clean zero) is seen in the dark regions.

The **MiniPIX SPRINTER** 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 high-energetic particle tracking for space applications[1]. This energy-sensitive detector also brings a new dimension to radiographic images. **The MiniPIX SPRINTER** device utilizes a USB 2.0 interface, allowing for reading of up to 99 frames per second. The signal-to-noise ratio exceeding 1000 enables crystal-clear X-ray images with low noise[2].

The **MiniPIX SPRINTER** device controlled via a USB interface is compatible with major operating systems: MS Windows, Mac OS and Linux. The software PIXet Pro for detector operation, offering comprehensive functionality and ease of use, is supplied with the device. With its miniaturized size, low power consumption, and advanced Timepix2 detector technology, the **MiniPIX SPRINTER** is an efficient and effective solution for various radiation detection applications (imaging, XRD, XRF, particle tracking, space radiation monitoring, electron microscopy, science, education, etc.).

Main Features

- Readout chip type Timepix2
- Pixel size[3] ..... 55 x 55 µm^2
- Sensor resolution ..... 256 x 256 pixels
- Counter bit depth ..... 10-bit / 14-bit
- Sensor material ..... 300, 500 µm Si, 1000 µm CdTe
- Dark current ..... none
- Interface ..... USB 2.0 (High-Speed)
- Maximum frame rate[2] ..... up to 99 fps
- Dimensions ..... 80 x 21 x 14 mm
- Weight ..... 37 g

[1] The device is not certified dosimeter. 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 with this device.

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

[3] 55 x 110 µm^2 at the edges and 110 x 110 µm^2 at the corners

Device parameters

Operation conditions

Symbol	Parameter	Value	Units	Comment
T_a	Operating ambient temperature range[1]	0-50	°C	
Φ	Humidity	< 80	%	Not condensing
IP	IP rating with cover	IP40		
IP	IP rating without cover	IP10		

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

Vacuum operation

ADVACAM detectors can be vacuum compatible on request. Contact support@advacam.cz for more information.

- In case of vacuum operation, operate only with air pressure lower than 10^{-3} Pa.
- The device will automatically shut down after chip or CPU temperature exceeds 55 °C.
- Intended for dust free indoor use.
- Make sure to disconnect the device from power during pumping down or venting the vacuum chamber!
- A direct connection to the host device is required for maximum performance. Connecting via a USB hub may negatively affect the performance and stability of the device.

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.

Electrical specification

T_{dev} = 22 °C, USB voltage V_{CC} = 4,8 V

Symbol	Parameter	Min	Typ	Max	Units	Comment
V_{CC}	Supply Voltage	4,5	5,0	5,25	V	
I_{CC}	Chip active		550	1000*	mA	
P1	Power consumption		2,75	5	W	
V_{BIAS}Si	Bias voltage for Si sensors	5	150	200	V	Depends on sensor thickness
V_{BIAS}CdTe	Bias voltage for CdTe sensors	-200	-450	-500	V	

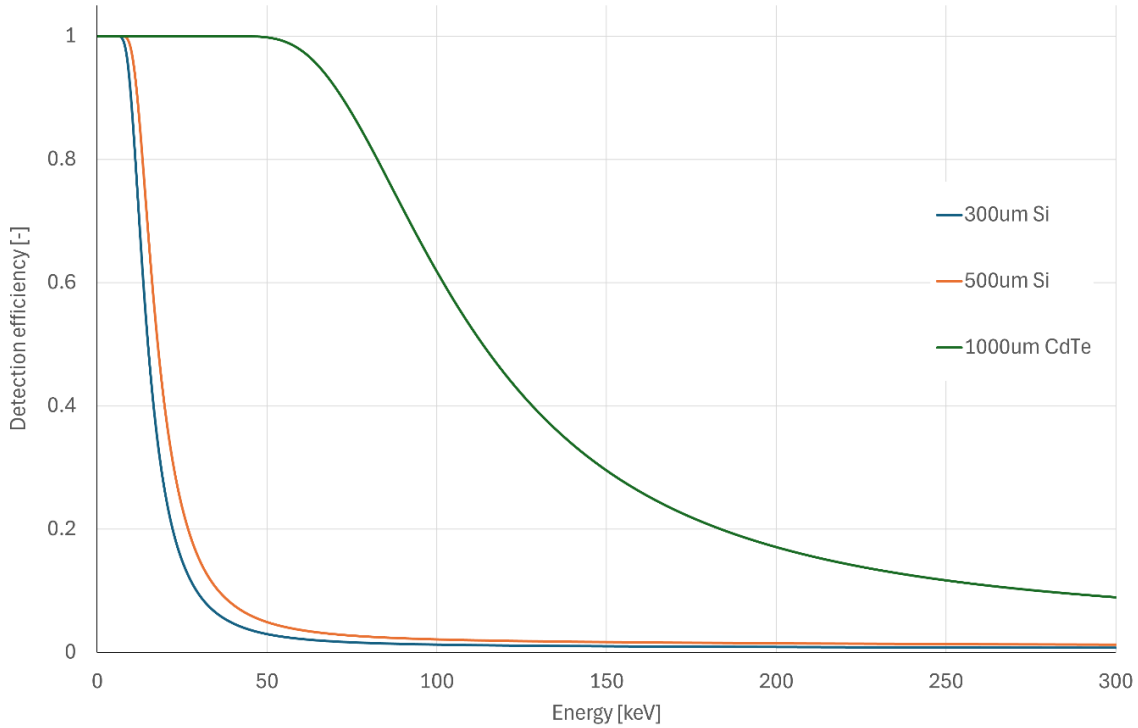
* Tentative

Sensor parameters

Symbol	Parameter	Si		CdTe	Units	Comment
	Sensor thickness	300	500	1000	µm	
σ	Energy resolution of energy discrimination threshold (σ @ 8 keV)	0,4 [1]		TBD	keV	
	Minimum energy threshold	5,0		6,0	keV	
σ	Energy resolution in full spectral mode (σ @ 8 keV)	0,9 [1]		TBD	keV	
σ	Energy resolution in full spectral mode (σ @ 23 keV)	1,3 [1]		TBD	keV	
σ	Energy resolution in full spectral mode (σ @ 60 keV)	2,0 [1]		TBD	keV	
	Typical detectable energy range for X-rays	5 to 60		8 to 400	keV	See chart below
	Pixel size[2]	55		55	µm	

[1] Typical values

[2] 55 x 110 µm at the edges and 110 x 110 µm at the corners



Modes and types of readout chip operation

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

Counter bit depth

Different counter depths can be chosen for certain measurement modes. This enables tailoring the performance for higher frame rates, or better resolution.

An overview of operation modes (default cases are highlighted) together with maximum achievable frame rates is presented in the table below. Actual frame rate might decrease due to detected particle flux, software or processing being run simultaneously with the measurement, saving the data during the measurement, performance of the computer itself.

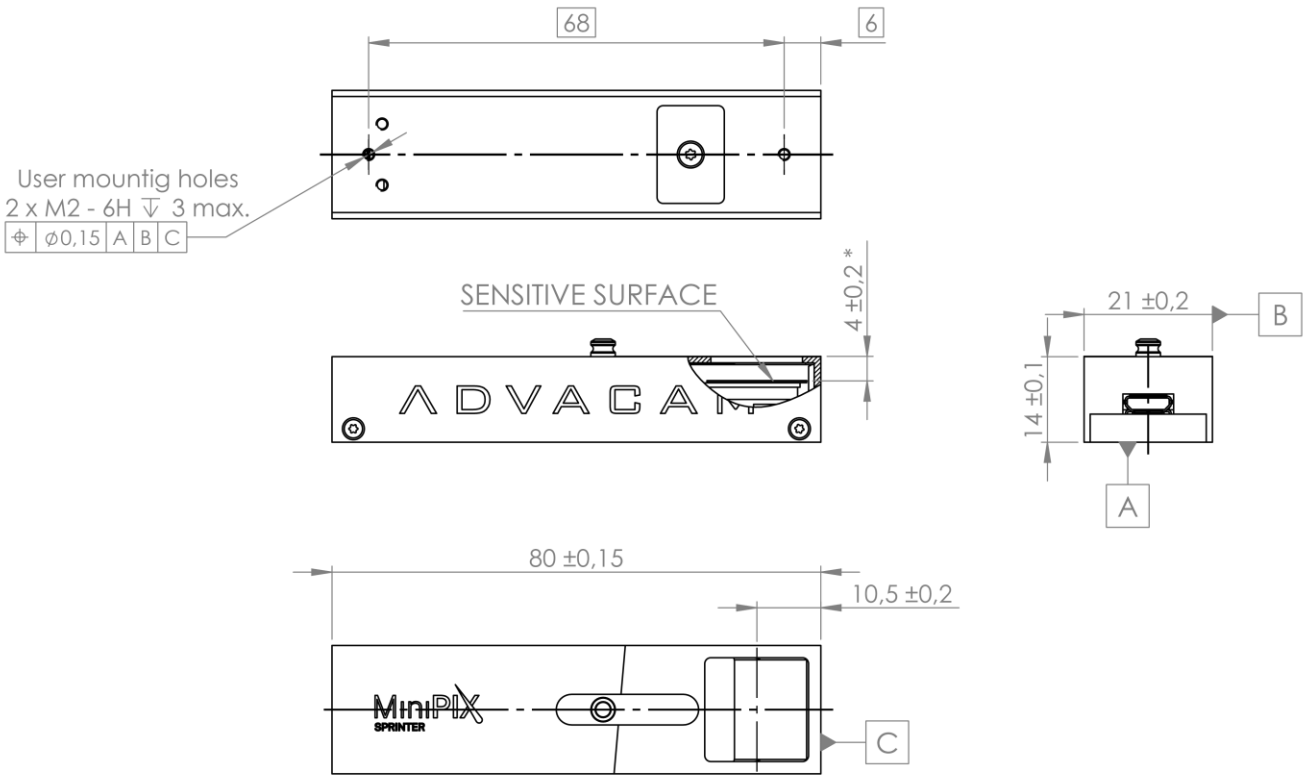
Mode	Counter depth	Maximum frame rate
Counts	**14 bits**	64 fps
	10 bits - high frame rate	99 fps
Energy	**14 bits**	65 fps
Energy + Time	**10 + 18 bit**	30 fps

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.

Mechanical dimensions



All dimensions are in mm.

* Sensitive surface distance from top of the box may vary depending on actual sensor thickness.

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

Model number codes

Example: **MNX T2S - X P 3 XXXXXXXX**

Device name:

MNX – MiniPIX

Device modification:

T2S – Timepix2 Standard

Sensor type:

P – Planar silicon

C – CdTe

Sensor thickness:

3 – 300 µm

5 – 500 µm

A – 1000 µm

Device build version:

Instructions for safe use

Do not touch sensor surface!

To avoid malfunction or damage to your **MiniPIX SPRINTER** please obey 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.
- Thermal stabilization of the device is necessary. Recommended temperature is 22 °C.
- A direct connection to the host device is required for maximum performance. Connecting via a USB hub may negatively affect the performance and stability of the device.
- 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 environmental impact.

Release history

Date (YY/MM/DD)	Changes	Changed by
19/07/28	Preliminary version	
21/06/26	ETH version	
23/03/14	New drawings and corrected versions	
08/08/23	Supply Voltage changed from 24V to 12V	
05/09/23	Default gain mode added	
24/02/15	Datasheet revision	J. Baborák
24/06/28	Water cooling details added	J. Baborák
24/07/02	New graphic style of the document	P. Bloudek
24/07/23	Minor format changes	J. Baborák
24/10/23	IP reset pointer added	J. Baborák
25/12/16	New graphic style of the document, rebranding	P. Bloudek

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