
MINIPIX

SPRINTER

Preliminary Datasheet

Model No.: MNXT2S-Xxx



General features

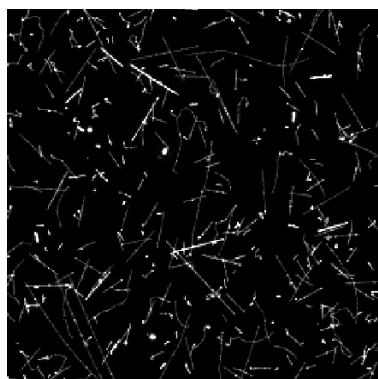


Illustration of single particle sensitivity of Timepix2 detector. The tracks of different particles of radiation background (mostly muons and few protons) were recorded in 5 minutes on board of an airplane. No noise (clean zero) is seen in the dark regions.

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 applications¹. 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 noise².

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 55 x 55 μm *
- 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 up to 99 fps
- Dimensions 80 x 21 x 14 mm
- Weight 37 g

* 55 x 110 μm at the edges and 110 x 110 μm at the corners

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.

Device parameters

Operating conditions

| Symbol | Parameter | Value | Units | Comment |
|------------------|-------------------------------|-------|-------|----------------|
| T _{dev} | Operating temperature range * | 10-55 | °C | |
| Φ | Humidity | < 80 | % | Not condensing |
| IP | IP rating | IP40 | | |

* The device shall be thermally stabilized during operation. The device will automatically shut down after exceeding 55°C.

Electrical specification

T_{dev} = 25°C, USB voltage V_{CC} = 4.8V

| Symbol | Parameter | Min | Typ | Max | Units | Comment |
|-------------------|-------------------------------|-----|------|--------|-------|-----------------------------|
| V _{CC} | Supply voltage | 4.5 | 5.0 | 5.25 | V | |
| I _{CC2} | Chip active | | 550 | 1000 * | mA | |
| P1 | Power consumption | | 2.75 | 5 | W | |
| V _{BIAS} | Bias voltage for sensor diode | 5 | 150 | 200 | V | Depends on sensor thickness |

* Tentative

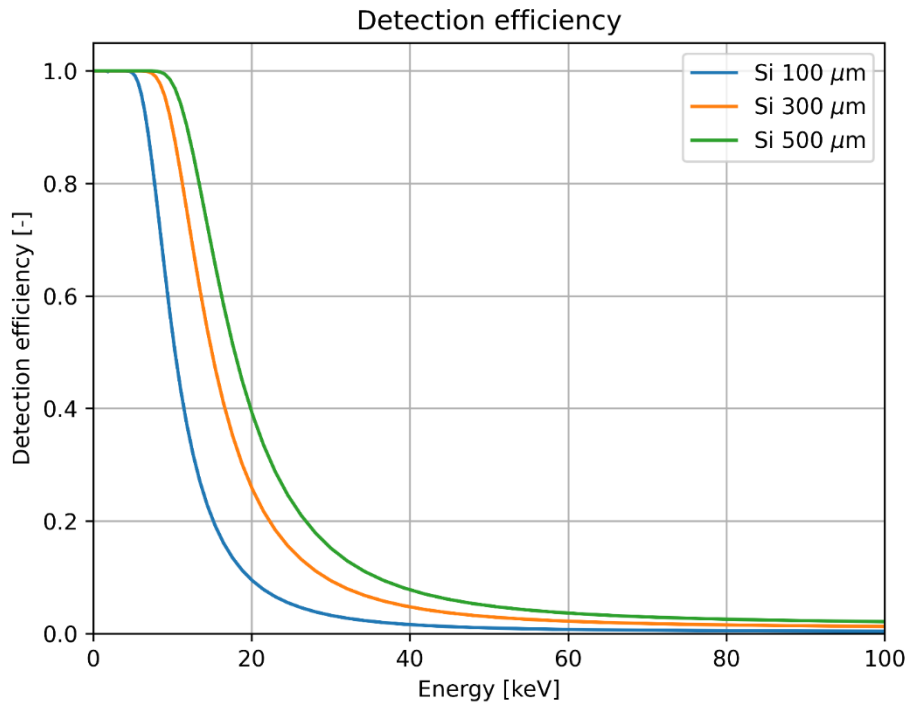
Sensor parameters

T_A = 25°C

| Symbol | Parameter | Si | | | Units | Comment |
|--------|--|---------|-----|-----|-------|-----------------|
| | | 100 | 300 | 500 | | |
| | Sensor thickness | 100 | 300 | 500 | μm | |
| σ | Energy resolution of energy discrimination threshold (σ @ 8 keV) | 0.4 * | | | keV | |
| | Minimum energy threshold | 5 | | | keV | |
| σ | Energy resolution in full spectral mode (σ @ 8 keV) | 0.9 * | | | keV | |
| σ | Energy resolution in full spectral mode (σ @ 23 keV) | 1.3 * | | | keV | |
| σ | Energy resolution in full spectral mode (σ @ 60 keV) | 2.0 * | | | keV | |
| | Typical detectable energy range for X-rays | 5 to 60 | | | keV | See chart below |
| | Pixel size | 55 | | | μm | |

* Typical values





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.

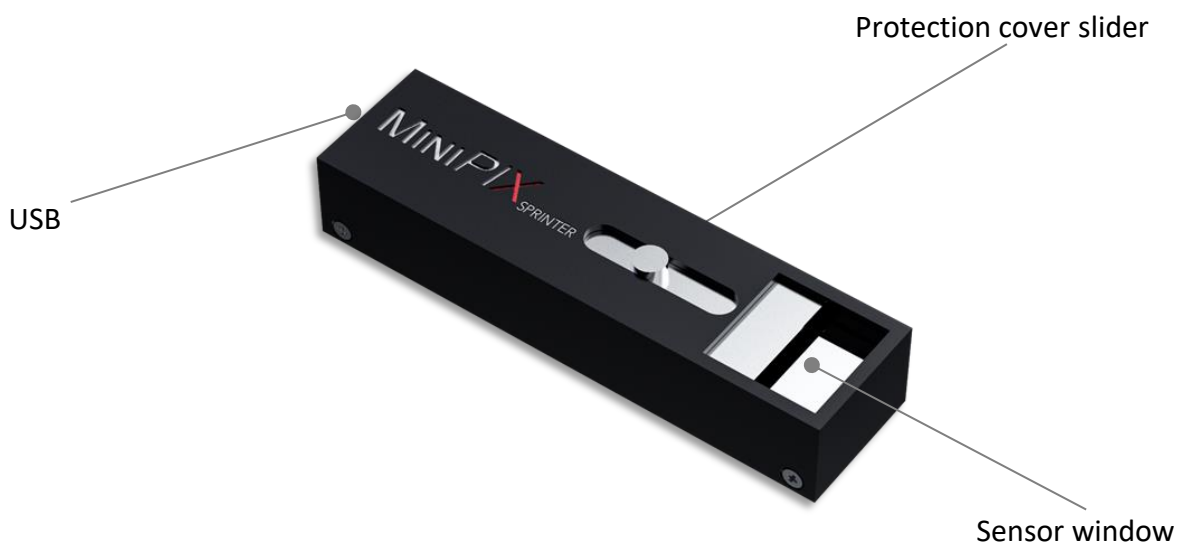
Modalities:

- **Integral measurement**
During the acquisition, the recorded data is integrated and outputted as a single frame.
- **First hit measurement**
This mode disregards other events that take place in the same pixel during the acquisition, in order to minimize pileups.
- **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 and measurement modalities (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 | Energy measurement modality | Maximum frame rate |
|-----------------|------------------------------------|-----------------------------|--------------------|
| Counts | 14 bits | N/A | 64 fps |
| | 10 bits - high frame rate | | 99 fps |
| Energy | 14 bits | Integrated energy | 65 fps |
| | | Energy of 1st hit | |
| Time | 14 bits | N/A | 65 fps |
| | 10 bits - high frame rate | | 98 fps |
| Counts + Energy | 10 bits (Energy) / 4 bits (Counts) | Integrated energy | 61 fps |
| | | Energy of 1st hit | |
| Energy + Time | 14 bits (Energy) / 14 bits (Time) | Integrated energy | 32 fps |
| | | Energy of 1st hit | |
| | 10 bits (Energy) / 18 bits (Time) | Integrated energy | 34 fps |
| | | Energy of 1st hit | |

Device description

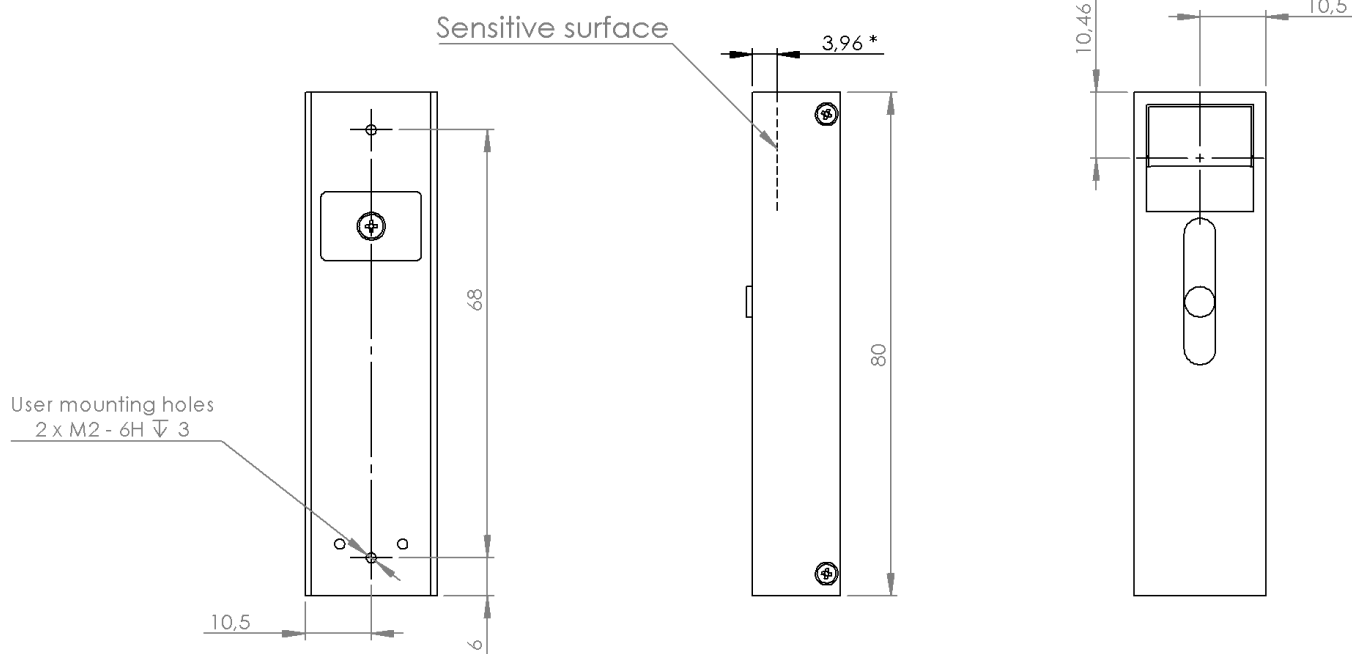
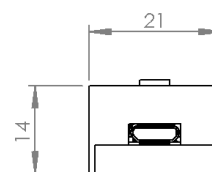
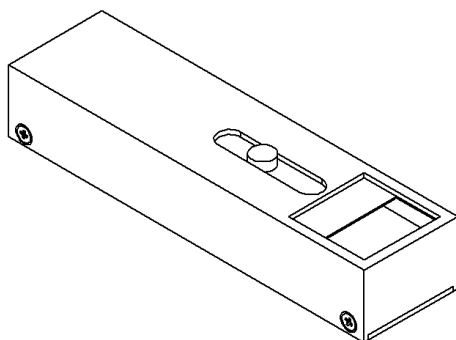


USB connector

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 is for 300 μ m sensor thickness.

Extreme care must be taken when removing protecting cover and handling the **MINIPIX**_{SPRINTER} without the protecting cover. The warranty does not apply to mechanical damage of the sensor and wirebonds.



Model number codes

Example:

MNX

T2S

-

X

P

3

23110016

Device name:

MNX – MiniPIX

Device modification:

T2S – Timepix2 Standard

Sensor type:

P – Planar silicon

Sensor thickness:

1 – 100 μm

3 – 300 μm

5 – 500 μm

Device build version:

XXXXXXXX



Instructions for safe use

Warning

Do not touch sensor surface!

To avoid malfunction or damage to your **MINIPIX**_{SPRINTER} please observe the following:

- Do not expose the device 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 2m.
- 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.

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

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Release history

| Date | Changes | Changed by |
|------------|------------------------------------|---------------|
| 25/04/2023 | First draft (MNXT2S-Xxx211214) | |
| 28/11/2023 | Preliminary datasheet (MNXT2S-Xxx) | D. Doubravová |
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