

Radiation Click



PID: MIKROE-4036

Radiation Click is a Click board™ based on [BG51](#) radiation sensor from [Teviso Sensor Technologies](#). The function of the BG51 radiation sensor is based on an array of customized PIN diodes. Performance of the Radiation Click board™ with solid state sensor, in combination with high immunity to electrostatic fields make it a good choice for new state-of-the-art designs as well as for upgrading existing designs of detecting beta and gamma radiation and X-rays.

Radiation Click board™ is supported by a mikroSDK compliant library, which includes functions that simplify software development. This Click board™ comes as a fully tested product, ready to be used on a system equipped with the mikroBUS™ socket.

How does it work?

Radiation Click board™ detects beta and gamma radiation and X-rays by using PIN diode inside BG51 as sensor. A PIN diode is a diode with a wide region of intrinsic semiconductor material (undoped) contained between a p-type semiconductor and an n-type semiconductor. The advantage of a PIN diode is that the depletion region exists almost completely within the intrinsic region, which has a constant width (or almost constant) regardless of disturbances applied to the diode.

Interaction of radiation beta, gama, and X-rays with the p-i-n diode structure generates a dark current in diode junction due to the charge carriers generation. This is detected by electronic circuit as the dark current peaks and interrupt is reported on INT pin of mikroBUS™ and indicator LED/BUZZER .

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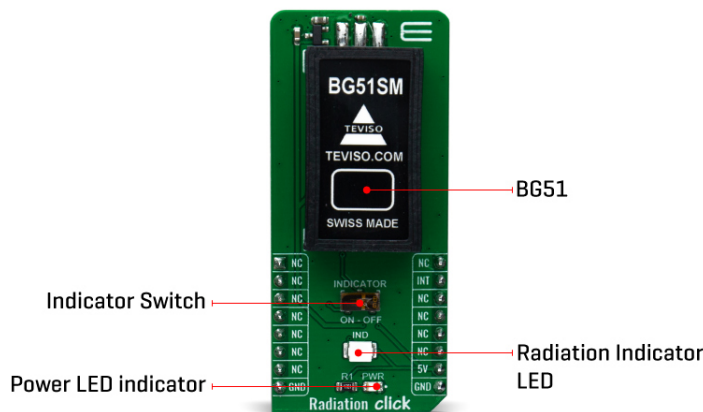
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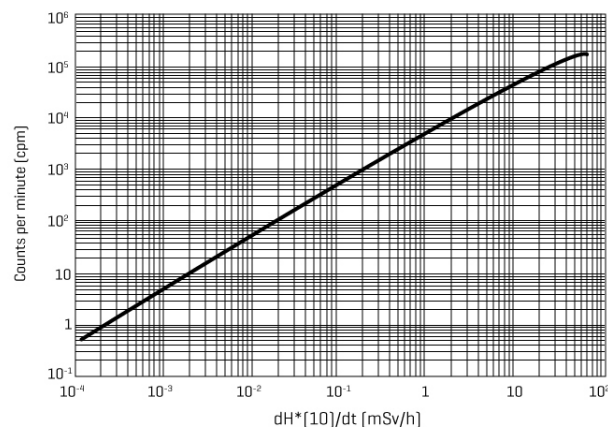


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In a heuristic sense, nuclear radiation is the effluence from a nuclear radiation source that consists of energy in the form of particles or waves. The waves are represented as photons or quanta of radiant energy. A radiation detector may be exposed to neutrons (particles), gamma rays, X-rays, or other radiation energy. The radiation can vary in energy density, wavelength, and duration.

There are two types of detected radiation readout: counts or radiation dose. The counts display is the simplest and is the number of ionizing events detected displayed either as a count rate, such as "counts per minute" or "counts per second", or as a total number of counts over a set time period (an integrated total). The counts readout is normally used when alpha or beta particles are being detected. More complex to achieve is a display of radiation dose rate, displayed in a unit such as the sievert which is normally used for measuring gamma or X-ray dose rates.



There is an option to produce audible clicks representing the number of ionization events detected. This is the distinctive sound normally associated with handheld or portable Geiger counters. The purpose of this is to allow the user to concentrate on manipulation of the instrument whilst retaining auditory feedback on the radiation rate.

Specifications

| Type | Environmental |
|---|---------------|
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| | |
|------------------|---|
| Applications | Equipment for detecting radioactivity in medical environment, Radiation monitors for nuclear safeguards and security, Gamma detector to detect illicit nuclear material, Natural sciences courses and practical lab experiments |
| On-board modules | BG51 radiation sensor is based on an array of customized PIN diodes |
| Key Features | Detects beta and gamma radiation and X-rays, Detector sensitivity: 5 cpm/μSv/h, High immunity to RF and electrostatic fields, Linear response over wide temperature range (-30°C to 60°C) |
| Interface | GPIO |
| Feature | No ClickID |
| Compatibility | mikroBUS™ |
| Click board size | L (57.15 x 25.4 mm) |
| Input Voltage | 5V |

Pinout diagram

This table shows how the pinout on Radiation click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

| Notes | Pin |  | | | | Pin | Notes |
|--------|------------|---|------|-----|----|------------|--------------|
| | NC | 1 | AN | PWM | 16 | NC | |
| | NC | 2 | RST | INT | 15 | INT | Interrupt |
| | NC | 3 | CS | RX | 14 | NC | |
| | NC | 4 | SCK | TX | 13 | NC | |
| | NC | 5 | MISO | SCL | 12 | NC | |
| | NC | 6 | MOSI | SDA | 11 | NC | |
| | NC | 7 | 3.3V | 5V | 10 | 5V | Power Supply |
| Ground | GND | 8 | GND | GND | 9 | GND | Ground |

Onboard settings and indicators

| Label | Name | Default | Description |
|-------|-----------|---------|-------------------------------------|
| PWR | LED GREEN | - | Power LED Indicator |
| LD2 | IND | - | Radiation Indicator LED |
| PZ1 | BUZZER | - | Radiation Indicator BUZZER |
| SW1 | INDICATOR | OFF | Enable/Disable Indicator LED/BUZZER |

Software Support

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We provide a library for the Radiation Click on our [LibStock](#) page, as well as a demo application (example), developed using MikroElektronika [compilers](#). The demo can run on all the main MikroElektronika [development boards](#).

Library Description

The library contains a reading of the state on the interrupt pin. Calculates the number of interruptions in one minute (cpm).

Key functions:

- `uint32_t radiation_get_cpm_counter(uint8_t cpm_time)` - Gets CPM (Counts per minute).
- `void radiation_tick()` - Tick functions.
- `uint8_t radiation_get_int_state()` - Gets interrupt pin state.

Examples description

The application is composed of three sections :

- System Initialization - Initializes the INT pin required to measure.
- Application Initialization - Initializes the driver
- Application Task - Checks whether command S has been entered
- if so starts radiation measurement. After 60sec it prints the measured radiation in [CPM] and [uSv/h] units.

We used a PB40 sensor with <0.05uCi for the test.

- Radiation units note - The standard unit of radiation dosing in an area is the micro-Sievert/hour (uSv/hr). For this tube, multiply its CPM by 0.0057 to get the equivalent uSv/hr radiation level.

The full application code, and ready to use projects can be found on our [LibStock](#) page.

Other mikroE Libraries used in the example:

- Conversions library

Additional notes and informations

Depending on the development board you are using, you may need [USB UART click](#), [USB UART 2 click](#) or [RS232 click](#) to connect to your PC, for development systems with no UART to USB interface available on the board. The terminal available in all MikroElektronika [compilers](#), or any other terminal application of your choice, can be used to read the message.

mikroSDK

This Click board™ is supported with [mikroSDK](#) - MikroElektronika Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the [LibStock](#) and installed for the compiler you are using.

For more information about mikroSDK, visit the [official page](#).

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Resources

[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

[Click Boards™](#)

Downloads

[Radiation click example on Libstock](#)

[Radiation click 2D and 3D files](#)

[BG51 datasheet](#)

[Radiation click schematic](#)

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