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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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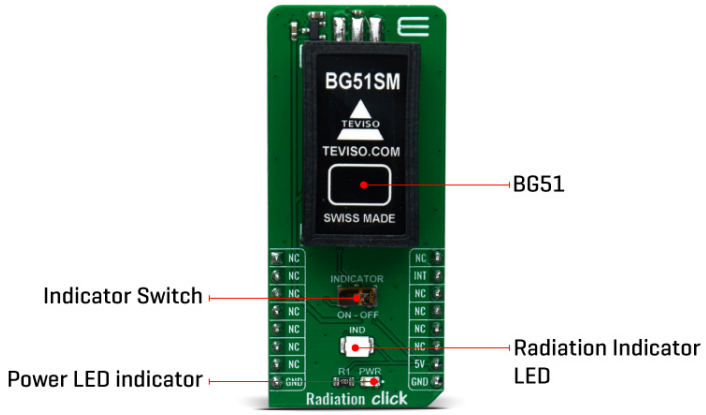
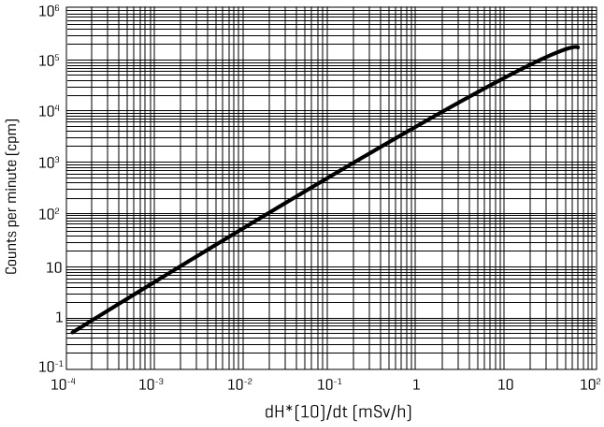


In a heuristic sense, nuclear radiation is the effluence from a nuclear radiation source that consists of energy in the form of particles or waves. The waves are represented as photons or quanta of radiant energy. A radiation detector may be exposed to neutrons (particles), gamma rays, X-rays, or other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