

Gyro 3 Click



PID: MIKROE-3449

Gyro 3 click is a three-axis gyroscope Click board™ that can sense motion over three perpendicular axes. It is equipped with the I3G4250, a three-axis digital gyroscope. This IC incorporates microelectromechanical sensing elements (MEMS), produced using a proprietary CMOS micromachining technology. This technology allows for excellent stability and linearity over temperature. The angular data is available in a 16-bit format, along with 8-bit temperature data. Gyro 3 click can be used for angular speed up to 2000 degrees per second (dps), it features a FIFO buffer, two dedicated interrupt lines, and on-chip data processing for optimized firmware development.

Gyro 3 click 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.

The I3G4250 IC supports both I2C and SPI interfaces, which allows Gyro 3 click to be interfaced with a wide range of different MCUs. Although it is very sensitive (down to 0.008 dps/LSB) it is very resistant to shock and has a non-linearity of only 0.2% of the full-scale value (FS). These features make Gyro 3 click a perfect solution for the development and testing of a wide range of applications which rely on an accurate angular rate sensing. This includes gyro-stabilization for various types of robots, drones, UAVs and RC vehicles, game controllers, orientation sensing, gesture-based HMI applications, VR glasses, and similar types of applications.

How does it work?

Gyro 3 click is based on the [I3G4250](#), a three-axis digital gyroscope sensor IC, by [STMicroelectronics](#). This device is produced using a proprietary CMOS micromachining

Mikroe produces entire development toolchains for all major microcontroller architectures.

Committed to excellency, we are dedicated to helping engineers bring the project development up to speed and achieve outstanding results.

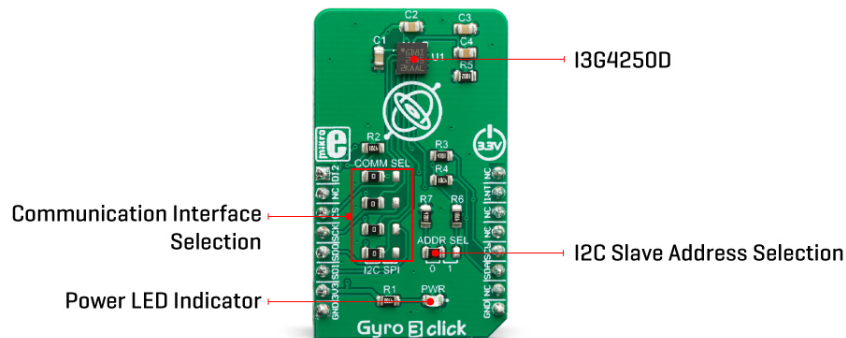


ISO 27001: 2013 certification of informational security management system.
ISO 14001: 2015 certification of environmental management system.
OHSAS 18001: 2008 certification of occupational health and safety management system.



ISO 9001: 2015 certification of quality management system (QMS).

technology, which results in a high level of integration, allowing very good linearity over temperature, and increased output stability when no motion applied (referred to as a zero-rate level in the I3G4250 datasheet). It also makes it resistant to shocks, allowing it to be used for speeds up to 2000 dps. It supports signal conditioning including low and high-pass filtering, as well as the threshold detection on each axis.



Typically, higher dps range results in lower sensitivity. Therefore, the I3G4250 allows to dynamically select the full-scale range (FSR) value in several discrete steps: ± 245 , ± 500 , and ± 2000 dps. This allows optimized performance for a given usage scenario. For example, if used in applications with faster angle rates such as sports equipment monitoring (golf club or tennis racket), a higher FSR might be required, at a cost of lower sensitivity.

The MEMS output voltage is sampled by a high-accuracy 16-bit A/D converter, allowing the output in 2's complement format. As mentioned above, different FS ranges have different sensitivity per LSB. Therefore, raw output values of the sensor will have to be multiplied with the sensitivity to obtain the values in degrees per second (dps). These values can be obtained from the I3G4250 datasheet, for every FS range, respectively.

There are two filters available on the I3G4250 sensor: an external low-pass (LP) filter, and a digital high-pass (HP) filter with user-selectable cutoff frequency. Both of these signals can be digitally selected and applied to an angular speed measurement, allowing the developer to reduce the noise or fine-tune the sensitivity within a desired bandwidth.

The I3G4250 device features a FIFO buffer, which in combination with a dedicated interrupt line, allows firmware optimizations while reducing the power consumption of the application as a result. The FIFO buffer has 32 slots, each 16-bit wide, used to store output values. The I3G4250 device can be configured to use the FIFO buffer in three different modes: Bypass mode, FIFO mode, and Stream mode. While the first mode allows the developer to read the values directly from the output registers, two other modes allow the utilization of the buffer. The FIFO mode will collect the data and stop collecting until its read (or reset), while the Streaming mode will continuously fill the buffer, discarding the oldest value.

One of the two interrupt lines is labeled as DRDY/INT2 on the schematic, and it is routed to the mikroBUS™ AN pin (labeled as DI2). This line is used to report one of the programmable FIFO events: watermark level is reached, FIFO buffer is empty, and there is an overrun event on the FIFO buffer (FIFO is full). The pin can also be used to report when there is a new data available at the output after the conversion period (data ready). To find out which event exactly has

Mikroe produces entire development toolchains for all major microcontroller architectures.

Committed to excellency, we are dedicated to helping engineers bring the project development up to speed and achieve outstanding results.



ISO 27001: 2013 certification of informational security management system.
 ISO 14001: 2015 certification of environmental management system.
 OHSAS 18001: 2008 certification of occupational health and safety management system.



ISO 9001: 2015 certification of quality management system (QMS).

occurred, the host MCU should read the status of the respective flag bits from the STATUS register.

The second interrupt line is used to report when the programmed threshold is reached. It is possible to detect events which are above or below a programmable threshold, and trigger an interrupt on the INT1 pin, routed to the mikroBUS™ INT pin. By directing the I3G4250 device to wait for a built-in timer to expire, a false triggering can be prevented. To detect an interrupt source, the MCU can should read the status of the respective flag bits from the INT1_SRC register.

Gyro 3 click offers two communication interfaces. It can be used with either I2C or SPI. The onboard SMD jumpers labeled as COMM SEL allow switching between the two interfaces. Note that all the jumpers have to be positioned either I2C or to SPI position. When I2C interface is selected, an additional SMD jumper labeled as ADDR SEL becomes available, determining the least significant bit of the I3G4250 slave I2C address. The Click board™ should be interfaced only with MCUs that use logic levels of 3.3V.

Specifications

Type	Gyroscope,Motion
Applications	It can be used to develop applications for gyro-stabilization of different types of robots, drones, UAVs and RC vehicles, game controllers, orientation sensing, gesture-based HMI applications, VR glasses, and similar types of applications.
On-board modules	I3G4250, a three-axis digital gyroscope sensor IC, by STMicroelectronics.
Key Features	Advanced interrupt engine allows simplified firmware development and better system-wide power consumption, very good reliability, precision, and zero-level stability, signal conditioning in a form of low and high-pass filtering, both SPI and I2C interface...
Interface	I2C,SPI
Feature	No ClickID
Compatibility	mikroBUS™
Click board size	M (42.9 x 25.4 mm)
Input Voltage	3.3V

Pinout diagram

This table shows how the pinout on **Gyro 3 click** corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin		Pin	Notes
-------	-----	---	-----	-------

Mikroe produces entire development toolchains for all major microcontroller architectures.

Committed to excellency, we are dedicated to helping engineers bring the project development up to speed and achieve outstanding results.



ISO 27001: 2013 certification of informational security management system.
ISO 14001: 2015 certification of environmental management system.
OHSAS 18001: 2008 certification of occupational health and safety management system.



ISO 9001: 2015 certification of quality management system (QMS).

INT / Data Ready	DI2	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	INT	Interrupt
SPI Chip Select	CS	3	CS	RX	14	NC	
SPI Clock	SCK	4	SCK	TX	13	NC	
SPI Data OUT	SDO	5	MISO	SCL	12	SCL	I2C Clock
SPI Data IN	SDI	6	MOSI	SDA	11	SDA	I2C Data
Power Supply	3.3V	7	3.3V	5V	10	NC	
Ground	GND	8	GND	GND	9	GND	Ground

Onboard settings and indicators

Label	Name	Default	Description
PWR	PWR	-	Power LED indicator
JP1-JP4	SEL COMM	Right	Communication interface selection: left position SPI, right position I2C
JP5	I2C ADD	Right	I2C address LSB selection: left position 0, right position 1

Software support

We provide a library for the **Gyro 3 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

Library contains:

- functions for getting INT and AN pin states.
- function for setting CS pin states.
- functions for getting and setting register values.
- function for getting temperature register value.
- function for getting XYZ-Axes values.
- function for setting basic device parameters.
- function for getting status register value.
- function for getting FIFO data level.
- function for interrupt threshold values and interrupt wait time.

Key functions:

- void gyro3_config(void) - sets basic settings to device.
- void gyro3_getStatus(uint8_t * status_register) - gets value of status register (27h).
- void gyro3_getAxes(float * x_axis, float * y_axis, float * z_axis, uint8_t measurement_range) - reads values from XYZ-Axes registers and converts them to degrees per second value based on measurement range setting.

Examples description

The application is composed of the three sections :

Mikroe produces entire development toolchains for all major microcontroller architectures.

Committed to excellency, we are dedicated to helping engineers bring the project development up to speed and achieve outstanding results.



ISO 27001: 2013 certification of informational security management system.
ISO 14001: 2015 certification of environmental management system.
OHSAS 18001: 2008 certification of occupational health and safety management system.



ISO 9001: 2015 certification of quality management system (QMS).

- System Initialization - systemInit() - Initializes I2C interface, LOG interface and GPIO pins.
- Application Initialization - applicationInit() - Initializes I2C driver and basic device configuratoin.
- Application Task - applicationTask() - Checks if new data is available on all three axes, If yes then reads and logs their values.

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

Other mikroE Libraries used in the example:

- I2C
- UART
- SPI

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](#).

Resources

[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

[Click Boards™](#)

Downloads

[Gyro 3 click example on Libstock](#)

[I3G4250D datasheet](#)

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

[Gyro 3 click schematic](#)

Mikroe produces entire development toolchains for all major microcontroller architectures.

Committed to excellency, we are dedicated to helping engineers bring the project development up to speed and achieve outstanding results.



ISO 27001: 2013 certification of informational security management system.
ISO 14001: 2015 certification of environmental management system.
OHSAS 18001: 2008 certification of occupational health and safety management system.



ISO 9001: 2015 certification of quality management system (QMS).