



## GYRO 5 CLICK

**PID: MIKROE-3669**

**Weight: 18 g**

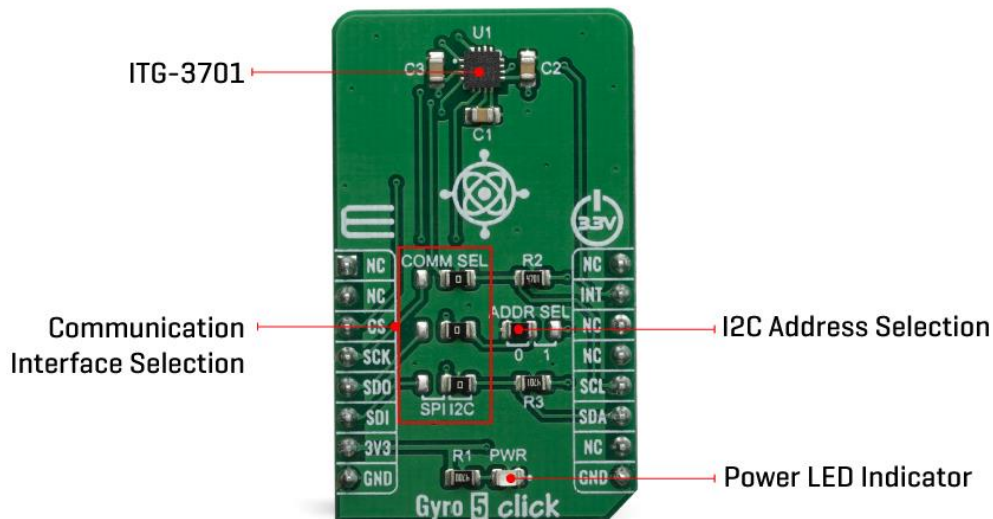
**Gyro 5 Click** is a three-axis gyroscope Click board™ that can sense motion over three perpendicular axes. It is equipped with the ITG-3701, a three-axis digital gyroscope. This IC incorporates microelectromechanical sensing elements (MEMS), produced using a proprietary CMOS micromachining technology. This technology allows for excellent stability and linearity over temperature. The angular data is available in a 16-bit format, along with device's die temperature data. Gyro 5 click can be used for angular speed up to 4000 degrees per second (dps), it features a FIFO buffer, two dedicated interrupt lines, and on-chip data processing for optimized firmware development.

Gyro 5 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 ITG-3701 IC supports both I2C and SPI interfaces, which allows Gyro 5 click to be interfaced with a wide range of different MCUs. Although it is very sensitive (down to 65.5 LSB/dps) it is very resistant to shock and has a non-linearity of only 0.3% of the full-scale value (FS). These features make Gyro 5 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 5 click is based on the ITG-3701, a three-axis digital gyroscope sensor IC, by InvenSense Inc TDK Group Company. This device features factory calibrated scale factor, High cross-axis isolation via proprietary MEMS design and a precision clock with 1% drift from -40°C to 85°C, which results in a high level of integration, allowing very good linearity over temperature, and increased output stability when no motion. It also makes it resistant to shocks up to 10,000g, allowing it to be used for speeds up to 4000 dps. It supports signal conditioning including low-pass filtering, as well as the programmable interrupt.



Typically, higher dps range results in lower sensitivity. Therefore, the ITG-3701 allows to dynamically select the full-scale range (FSR) value in several discrete steps:  $\pm 500$ ,  $\pm 1000$ ,  $\pm 2000$  and  $\pm 2000$  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 ITG-3701 datasheet, for every FS range, respectively.

The ITG-3701 sensor feature an internal programmable low-pass filter, with user-selectable cutoff frequency. The output signal 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 ITG-3701 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 FIFO can lower the traffic on the serial bus interface, and reduce power consumption by allowing the system processor to burst read sensor data and then go into a low-power mode. A FIFO counter keeps track of how many bytes of valid data are contained in the FIFO. The FIFO register supports burst reads, while the interrupt function may be used to determine when new data is available.

The interrupt pin is routed to the mikroBUS™ INT pin (labeled as INT). 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 occurred, the host MCU should read the status of the respective flag bits from the INT\_STATUS register.

Gyro 5 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 ITG-3701 slave I2C address.

The Click board™ can operate with 3.3V MCUs only, it is set to work over the I2C by default, and it is already equipped with the pull-up resistors. It is ready to be used as soon as it is inserted into a mikroBUS™ socket of the development system.


## SPECIFICATIONS

<b>Type</b>	Motion
<b>Applications</b>	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.
<b>On-board modules</b>	ITG-3701, a three-axis digital gyroscope sensor IC, by InvenSense Inc.
<b>Key Features</b>	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...
<b>Interface</b>	I2C,SPI
<b>Input Voltage</b>	3.3V
<b>Click board size</b>	M (42.9 x 25.4 mm)

## PINOUT DIAGRAM

This table shows how the pinout on Gyro 5 click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
		1	AN	PWM	16		
	NC	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	<b>INT</b>	Interrupt
SPI Chip Select	<b>CS</b>	3	CS	RX	14	NC	
SPI Clock	<b>SCK</b>	4	SCK	TX	13	NC	
SPI Data OUT	<b>SDO</b>	5	MISO	SCL	12	<b>SCL</b>	I2C Clock

SPI Data IN	<b>SDI</b>	6	MOSI	SDA	11	<b>SDA</b>	I2C Data
Power Supply	<b>3.3V</b>	7	3.3V	5V	10	NC	
Ground	<b>GND</b>	8	GND	GND	9	<b>GND</b>	Ground

## ONBOARD SETTINGS AND INDICATORS

Label	Name	Default	Description
PWR	PWR	-	Power LED Indicator
JP1- JP3	SEL COMM	Right	Communication interface selection: left position SPI, right position I2C
JP4	I2C ADD	Left	I2C address LSB selection: left position 0, right position 1

## SOFTWARE SUPPORT

We provide a library for the Gyro 5 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 function for getting INT pin state  
 Library contains function for setting CS pin state  
 Library contains function for getting register values  
 Library contains function for setting register values  
 Library contains function for device initialization  
 Library contains function for getting temperature value  
 Library contains function for getting axes values  
 Library contains function for software reset  
 Library contains functions for setting power mode and full scale range

Key functions:

- `uint8_t gyro5_initialize( void )` - initializes the device.
- `uint8_t gyro5_get_temperature( float * temperature )` - reads temperature measurement registers and converts raw temperature data to get die temperature in [deg C].

- `uint8_t gyro5_get_axes( float * x_axis, float * y_axis, float * z_axis )` - reads axes measurement registers and converts raw axes measurement data to get gyroscope data in [deg/s].

### Examples description

The application is composed of three sections :

- System Initialization - Initializes GPIO pins, I2C and LOG modules.
- Application Initialization - Initializes I2C driver and the device.
- Application Task - Checks data ready INT, gets temperature and axes data and LOGs those values.

```
void applicationTask( )
{
    data_ready_flag = gyro5_interrupt_status( _GYR05_INT_DATA_RDY );

    if (data_ready_flag == 1)
    {
        gyro5_get_temperature( &temperature_value );
        gyro5_get_axes( &x_axis_value, &y_axis_value, &z_axis_value );

        mikrobus_logWrite( " ", _LOG_LINE );

        FloatToStr( x_axis_value, text );
        gyro5_floatCut( );
        mikrobus_logWrite( "> X axis = ", _LOG_TEXT );
        mikrobus_logWrite( text, _LOG_TEXT );
        mikrobus_logWrite( degrees_per_second, _LOG_LINE );

        FloatToStr( y_axis_value, text );
        gyro5_floatCut( );
        mikrobus_logWrite( "> Y axis = ", _LOG_TEXT );
        mikrobus_logWrite( text, _LOG_TEXT );
        mikrobus_logWrite( degrees_per_second, _LOG_LINE );

        FloatToStr( z_axis_value, text );
        gyro5_floatCut( );
        mikrobus_logWrite( "> Z axis = ", _LOG_TEXT );
        mikrobus_logWrite( text, _LOG_TEXT );
        mikrobus_logWrite( degrees_per_second, _LOG_LINE );
    }
}
```

```
FloatToStr( temperature_value, text );
gyro5_floatCut( );
mikrobus_logWrite( "> Temperature = ", _LOG_TEXT );
mikrobus_logWrite( text, _LOG_TEXT );
mikrobus_logWrite( degrees_celsius, _LOG_LINE );
}
Delay_ms(300);
}
```

#### Additional Functions :

- gyro5\_floatCut() - Rounds float number converted to string to 2 decimals.

The full application code, and ready to use projects can be found on our LibStock page. Other mikroE Libraries used in the example:

- SPI
- I2C
- UART
- Conversions

#### **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.

## DOWNLOADS

mikroBUS™ Standard specification

LibStock: mikroSDK

Click board catalog

Gyro 5 click example on Libstock

Gyro 5 click 2D and 3D files

ITG-3701 datasheet

Gyro 5 click schematic



<https://www.mikroe.com/gyro-5-click/7-16-19>