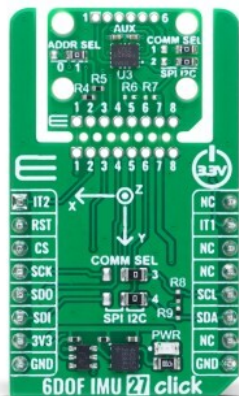


# 6DOF IMU 27 Click



PID: MIKROE-6514

**6DOF IMU 27 Click** is a compact add-on board designed for precise and reliable 6-axis motion sensing. This board features the [ICM-45686](#) sensor from [TDK InvenSense](#), which combines a 3-axis gyroscope and a 3-axis accelerometer in a single compact package. The board features ultra-low sensor noise, exceptional stability against temperature and mechanical shock, an 8KB FIFO buffer, and supports I3C, I2C, and SPI interfaces. It also includes the advanced APEX Motion Processing engine, programmable filters, and a unique Click Snap format for flexible integration. This Click board™ is ideal for head-mounted displays, AR/VR controllers, wearable technology, and various IoT applications.

For more information about **6DOF IMU 27 Click** visit the official [product page](#).

## How does it work?

6DOF IMU 27 Click is based on the ICM-45686, a MEMS MotionTracking device from TDK InvenSense that integrates a 3-axis gyroscope and a 3-axis accelerometer in a single package. This high-performance motion tracking add-on board designed to provide accurate and reliable 6-axis motion sensing for a wide range of modern applications. The sensor is made with a dual interface architecture, combining both UI and AUX communication paths, allowing for exceptional flexibility in data acquisition. The ICM-45686 supports multiple host interfaces, including I3C, I2C, and SPI, ensuring compatibility with a variety of host MCUs. Thanks to its compact form factor and advanced features, 6DOF IMU 27 Click is an ideal solution for use in head-mounted displays, augmented and virtual reality (AR/VR) controllers, wearable technology, and various IoT-based systems that demand accurate motion tracking and robust sensor performance.

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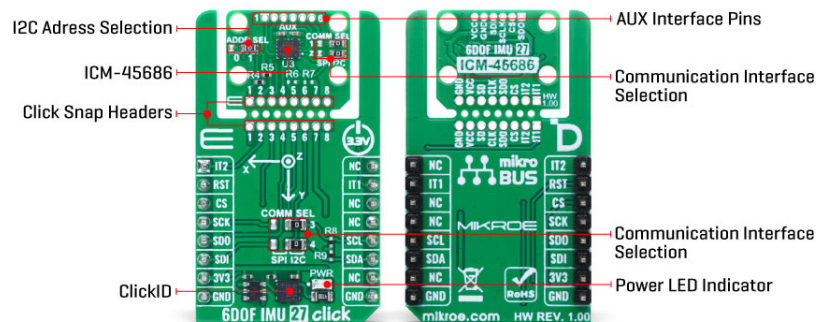
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The ICM-45686 is specifically designed to deliver superior performance in terms of precision and stability. It provides ultra-low noise levels for both gyroscope and accelerometer sensors, setting a new standard in its class. Its robust architecture ensures outstanding thermal stability, resistance to mechanical shocks up to 20,000g, and immunity to disturbances caused by PCB bending or out-of-band vibration noise. The sensor includes an 8Kbyte FIFO buffer, enabling efficient data management with a configurable Output Data Rate (ODR) and FIFO Data Rate (FDR), which makes it suitable for both high-speed and low-power applications.

One of the standout features of the ICM-45686 is the embedded APEX Motion Processing engine developed by InvenSense, which provides powerful onboard motion processing capabilities. Complemented by programmable digital filters and an integrated temperature sensor, this device ensures optimal performance even in challenging operating conditions. The gyroscope integrated into the ICM-45686 supports a total of eight full-scale range configurations, ranging from  $\pm 15.625$  degrees per second (dps) up to  $\pm 4000$ dps, independently programmable for both the UI and AUX data paths. Similarly, the accelerometer offers four full-scale range options from  $\pm 2$ g to  $\pm 32$ g, also independently configurable for both paths.

This Click board™ is designed in a unique format supporting the newly introduced MIKROE feature called "Click Snap." Unlike the standardized version of Click boards, this feature allows the main sensor area to become movable by breaking the PCB, opening up many new possibilities for implementation. Thanks to the Snap feature, the ICM-45686 can operate autonomously by accessing its signals directly on the pins marked 1-8. Additionally, the Snap part includes a specified and fixed screw hole position, enabling users to secure the Snap board in their desired location.

This board supports communication with the host MCU through either SPI (maximum clock frequency of 24MHz) or I2C (maximum clock frequency of 1MHz) interfaces, with I2C being the default option. The communication interface is selected by adjusting the COMM SEL jumper to the desired position. To enhance flexibility, particularly with the detachable Snap section of the Click Snap format, an additional COMM SEL jumpers are available. These jumpers functions the same as the COMM SEL, allowing for independent communication interface selection when the Snap section is used independently. To ensure proper functionality, all COMM jumpers must be set to the same interface. For those using the I2C interface, the board also provides an ADDR SEL jumper, enabling users to configure the I2C address as needed for their specific application.

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As mentioned, in addition to the interface pins, the board includes two configurable interrupt pins, IT1 and IT2, which triggers the host MCU whenever an interrupt event occurs, such as gesture recognition, activity classification, and pedometer because of an on-chip APEX (Advanced Pedometer and Event Detection - neXt gen) Motion Processing engine. Additionally, the board offers unsoldered AUX pins that provide access to the AUX interface, which can operate either in SPI slave mode - suitable for connecting to Optical Image Stabilization (OIS) controllers - or in I2C master mode for interfacing with external sensors.

This Click board™ can be operated only with a 3.3V logic voltage level. The board must perform appropriate logic voltage level conversion before using MCUs with different logic levels. It also comes equipped with a library containing functions and example code that can be used as a reference for further development.

## Click Snap

**Click Snap** is an innovative feature of our standardized Click add-on boards, designed to bring greater flexibility and optimize your prototypes. By simply snapping the PCB along predefined lines, you can easily detach the main sensor/IC/module area, reducing the overall size, weight, and power consumption - ideal for the final phase of prototyping. For more details about Click Snap, visit the [official page](#) dedicated to this feature.

## Specifications

Type	Motion
Applications	Ideal for head-mounted displays, AR/VR controllers, wearable technology, and various IoT applications
On-board modules	ICM-45686 - 6-axis MEMS MotionTracking device from TDK InvenSense
Key Features	Ultra-low noise 3-axis gyroscope and accelerometer, exceptional thermal and mechanical stability, embedded APEX Motion Processing engine, programmable digital filters, 8KB FIFO buffer, configurable Output and FIFO Data Rates, support for I3C, I2C, and SPI host interfaces, auxiliary interface supporting SPI slave and I2C master modes, Click Snap, and more
Interface	I2C,I3C,SPI
Feature	Click Snap,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 6DOF IMU 27 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

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Notes	Pin					Pin	Notes
Interrupt 2	<b>IT2</b>	1	AN	PWM	16	NC	
ID SEL	<b>RST</b>	2	RST	INT	15	<b>IT1</b>	Interrupt 1
SPI Select / ID COMM	<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
LD1	PWR	-	Power LED Indicator
JP2-JP5	COMM SEL	Left	Communication Interface Selection SPI/I2C: Left position SPI, Right position I2C
JP6	ADDR SEL	Left	I2C Address Selection 0/1: Left position 0, Right position 1

## 6DOF IMU 27 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	-	3.3	-	V
Gyroscope Full-Scale Range	±15.625	-	±4000	dps
Gyroscope Sensitivity	8.2	-	2097.2	LSB/dps
Accelerometer Full-Scale Range	±2	-	±32	g
Accelerometer Sensitivity	1024	-	16384	LSB/g

## Software Support

[6DOF IMU 27 Click](#) demo application is developed using the [NECTO Studio](#), ensuring compatibility with [mikroSDK](#)'s open-source libraries and tools. Designed for plug-and-play implementation and testing, the demo is fully compatible with all development, starter, and mikromedia boards featuring a [mikroBUS™](#) socket.

## Example Description

This example demonstrates the use of 6DOF IMU 27 Click board by reading and displaying the accelerometer and gyroscope data (X, Y, and Z axis) as well as a temperature measurement in degrees Celsius.

### Key Functions

- `c6dofimu27_cfg_setup` This function initializes Click configuration structure to initial values.
- `c6dofimu27_init` This function initializes all necessary pins and peripherals used for this Click board.
- `c6dofimu27_default_cfg` This function executes a default configuration of 6DOF IMU 27 Click board.

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- `c6dofimu27_get_int1_pin` This function returns the INT1 pin logic state.
- `c6dofimu27_read_data` This function reads the accelerometer, gyroscope, and temperature measurement data.

## Application Init

Initializes the driver and performs the Click default configuration.

## Application Task

Waits for a data ready indication and then reads the accelerometer, gyroscope, and temperature measurements. The results are displayed on the USB UART every 80ms as per the accel and gyro output data rate which is set to 12.5 Hz.

## Application Output

This Click board can be interfaced and monitored in two ways:

- Application Output - Use the "Application Output" window in Debug mode for real-time data monitoring. Set it up properly by following [this tutorial](#).
- UART Terminal - Monitor data via the UART Terminal using a [USB to UART converter](#). For detailed instructions, check out [this tutorial](#).

## Additional Notes and Information

The complete application code and a ready-to-use project are available through the NECTO Studio Package Manager for direct installation in the [NECTO Studio](#). The application code can also be found on the MIKROE [GitHub](#) account.

## Resources

[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

[Click boards™](#)

[ClickID](#)

## Downloads

[6DOF IMU 27 click example package](#)

[6DOF IMU 27 click 2D and 3D files v100](#)

[6DOF IMU 27 click schematic v100](#)

[ICM-45686 datasheet](#)

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