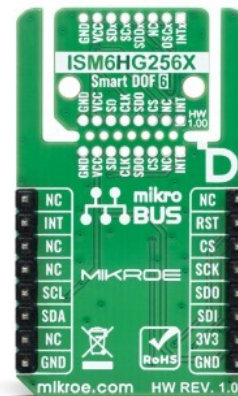
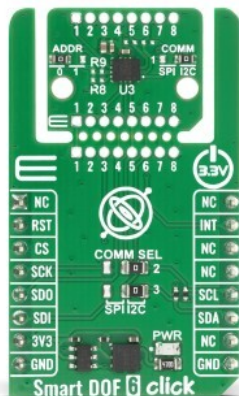


Smart DOF 6 Click



PID: MIKROE-6853

Smart DOF 6 Click is a compact add-on board for intelligent motion tracking, orientation sensing, and high-dynamic inertial measurement in industrial and embedded applications. It is based on the [ISM6HG256X](#), a low-power 6-axis intelligent IMU from [STMicroelectronics](#) that integrates a 3-axis accelerometer and a 3-axis gyroscope with advanced embedded processing capabilities and a 10-year longevity commitment. This device features dual accelerometer channels for simultaneous low-g ($\pm 2/\pm 4/\pm 8/\pm 16g$) and high-g ($\pm 32/\pm 64/\pm 128/\pm 256g$) measurements, a configurable gyroscope with ranges up to $\pm 4000dps$, a programmable finite state machine for real-time sensor data processing up to 960Hz, an integrated machine learning core for edge AI feature extraction, adaptive self-configuration, a low-power sensor fusion algorithm, and a Smart FIFO buffer up to 4.5KB for efficient data batching. The board also supports flexible SPI or I2C communication and includes the Click Snap format for detachable sensor placement and autonomous operation. This Click board™ is ideal for applications such as condition monitoring, asset tracking, robotics, factory automation, safety helmets, and black box motion and impact data logging systems.

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

How does it work?

Smart DOF 6 Click is based on the ISM6HG256X, a low-power 6-axis intelligent inertial measurement unit from STMicroelectronics that integrates a 3-axis accelerometer and a 3-axis gyroscope with advanced embedded processing capabilities. As an industrial-grade device, the ISM6HG256X offers a minimum 10-year longevity commitment for demanding professional applications. The accelerometer subsystem features two independent 3-axis channels, allowing simultaneous monitoring of both low-g and high-g events. The low-g accelerometer supports

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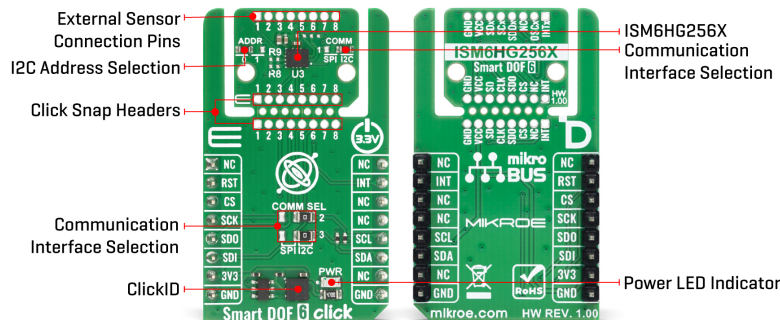


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selectable full-scale ranges of $\pm 2g$, $\pm 4g$, $\pm 8g$, and $\pm 16g$ for precise motion and tilt measurements, while the dedicated high-g channel provides extended measurement ranges of $\pm 32g$, $\pm 64g$, $\pm 128g$, and $\pm 256g$ for capturing high-impact or vibration-intensive events. The integrated 3-axis gyroscope offers flexible full-scale configuration options of ± 250 , ± 500 , ± 1000 , ± 2000 , and up to ± 4000 degrees per second, enabling accurate rotational motion detection across a wide variety of dynamic conditions.



To support intelligent edge processing, the ISM6HG256X incorporates a programmable finite state machine capable of processing accelerometer, gyroscope, and external sensor data at rates up to 960Hz, reducing the processing load on the host microcontroller. In addition, the device integrates a machine learning core that enables AI-oriented feature extraction and filtering directly within the sensor, allowing developers to implement advanced classification and anomaly detection algorithms while minimizing system power consumption and latency. The sensor also includes embedded adaptive self-configuration technology that optimizes performance and power usage depending on motion conditions, as well as a built-in low-power sensor fusion algorithm that combines accelerometer and gyroscope data to provide enhanced motion awareness with minimal energy consumption.

A Smart FIFO buffer with up to 4.5KB capacity allows efficient data batching and reduces host processor wake-ups, which is particularly beneficial in battery-powered systems. The device further incorporates a rich set of digital motion processing functions such as an advanced pedometer, step detector, step counter, significant motion detection, and tilt detection, enabling quick implementation of activity monitoring and motion-triggered applications. The Smart DOF 6 Click is well suited for a wide range of applications including condition monitoring in industrial machinery, asset tracking systems, robotics platforms, factory automation equipment, safety helmets and hard hats for worker monitoring, and black box systems for motion and impact data logging.

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/IC/module area to become movable by breaking the PCB, opening many new possibilities for implementation. Thanks to the Snap feature, the ISM6HG256X 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

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frequency of 10MHz) 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 jumper is available. This jumper 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 jumper, allowing users to configure the I2C address as needed for their specific application.

This Click board™ also provides hardware flexibility through its J1 header, allowing the ISM6HG256X to connect to external sensors and expand its functionality. In this configuration, the board supports the use of either auxiliary I3C or auxiliary SPI (3- or 4-wire) for transferring measured acceleration and angular rate data. The OSCx pin (pin 2) on the J1 header serves as the auxiliary interface selector: when driven HIGH, the pin places the auxiliary SPI in idle mode and enables the I3C interface, while when driven LOW, it activates auxiliary SPI communication and disables the I3C interface.

In addition, the ISM6HG256X enhances intelligent motion sensing with its event-detection interrupt pins (one available on INT pin of mikroBUS socket and other on pin 1 of unsoldered header), enabling recognition of a wide range of movement and context-awareness events such as free-fall detection, 6D orientation, single and double-click actions, activity or inactivity status, stationary or motion detection, and wake-up triggers.

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 applications such as condition monitoring, asset tracking, robotics, factory automation, safety helmets, and black box motion and impact data logging systems
On-board modules	ISM6HG256X - low-power 6-axis intelligent IMU from STMicroelectronics
Key Features	Low-power 6-axis intelligent IMU, dual 3-axis accelerometer channels with low-g ranges, 3-axis gyroscope with selectable full-scale, programmable finite state machine for real-time sensor data processing, integrated machine learning core for on-sensor AI feature

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	extraction and filtering, embedded adaptive self-configuration (ASC) and low-power sensor fusion algorithm (SFLP), Smart FIFO buffer up to 4.5KB, advanced embedded motion functions, Click Snap, and more
Interface	I2C,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 Smart DOF 6 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	
ID SEL	RST	2	RST	INT	15	INT	Interrupt
SPI Select / ID COMM	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
LD1	PWR	-	Power LED Indicator
JP1-JP2	COMM SEL	Right	mikroBUS-Side Communication Interface Selection SPI/I2C: Left position SPI, Right position I2C
JP3	COMM	Right	Snap-Side Communication Interface Selection SPI/I2C: Left position SPI, Right position I2C
JP4	ADDR SEL	Left	I2C Address Selection 0/1: Left position 0, Right position 1

Smart DOF 6 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	-	3.3	-	V
Acceleration Measurement Range (low-g)	±2	-	±16	g

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Acceleration Measurement Range (high-g)	±32	-	±256	g
Angular Rate Measurement Range	±250	-	±4000	dps
Acceleration Sensitivity	0.061	-	0.488	mg/LSB
Angular Rate Sensitivity	± 250	-	± 4000	mdps/LSB

Software Support

[Smart DOF 6 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 Smart DOF 6 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

- `smartdof6_cfg_setup` This function initializes Click configuration structure to initial values.
- `smartdof6_init` This function initializes all necessary pins and peripherals used for this Click board.
- `smartdof6_default_cfg` This function executes a default configuration of Smart DOF 6 Click board.
- `smartdof6_get_int_pin` This function returns the interrupt 1 pin logic state.
- `smartdof6_get_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 at 7.5 Hz output data rate.

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

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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

[Smart DOF 6 click example package](#)

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

[Smart DOF 6 click schematic v100](#)

[ISM6HG256X datasheet](#)

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