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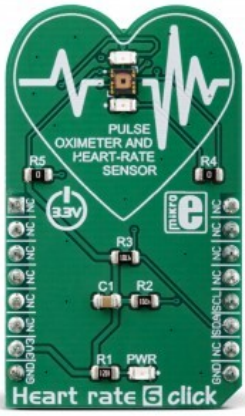
# Heart Rate 6 Click




PID: MIKROE-3215

**Heart rate 6 Click** is an optical biosensor Click board™ designed for heart-rate monitoring (HRM). This Click board™ employs a specialized sensor that incorporates two LED drivers and photo-sensing elements which are the most sensitive to green light. The green light is most commonly used to measure the dilatation of the blood vessels, therefore Heart rate 6 is equipped with two green LEDs, which are driven by the BH1790GLC, a monolithic integrated sensor for heart rate monitoring. Heart rate 6 click is a perfect solution for the development of various wearable health-related devices, smartphones, tablets, and similar space-constrained applications.

It comes in the package which also includes the mikroSDK™ software and a library with all the functions. The Click board™ comes as a fully tested and approved prototype, making it a reliable device ready to use on the development board.

The photo elements inside the BH1790GLC sensor are located behind the IRCUT filter, which reduces the influence of the IR spectrum of the light. There is a green filter also, narrowing down the green light responsiveness even further, which helps to achieve accurate readings, even by using common green LEDs.

Two LEDs are driven by the BH1790GLC sensor, which provides a constant, programmable current. The choice of LEDs is not critical at all since the integrated light filters on the sensor allow only a narrow band of green light in the range from 520nm to 560nm with 0.8X reduction in respect to the center frequency (about 540nm). The complete monolithic solution IC with the two constant current LED drivers, narrow pass-band for the green light spectrum, low power consumption, and a high integration ratio that allows a very low number of external

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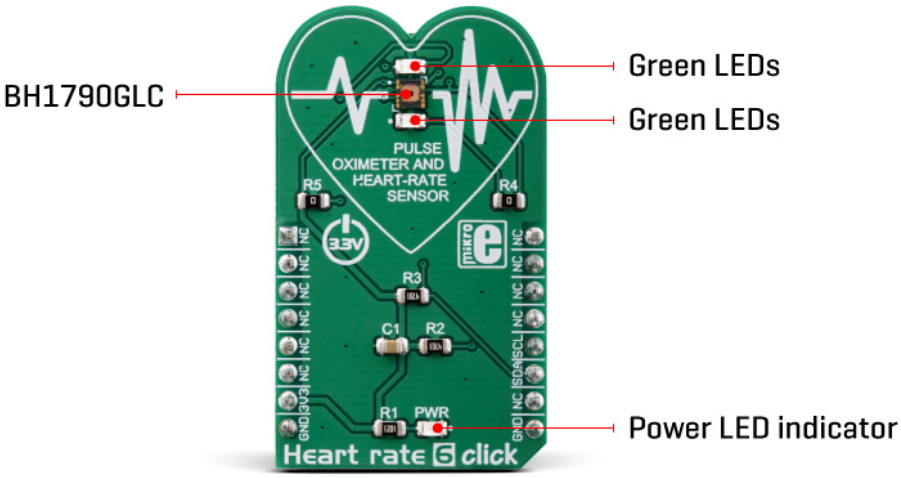
components, make the Heart rate 6 click a perfect solution for development of various wearable health-related devices, smartphones, tablets, and similar space-constrained applications.

## Heart Rate Monitoring or HRM

While the blood passes through the capillary blood vessels, they expand and dilate. Their light reflectance index changes accordingly. This is the basis of the photo-plethysmogram (PPM), a method used for the volumetric measurement of an organ, or in this case - blood vessels. The heart rate signal is calculated according to the changes of the reflected green light, sensed by the PD element. The Heart Rate 6 click can provide the HRM readings by simply placing the index finger over the optical sensor.

## How does it work?

Heart rate 6 click is equipped with the BH1790GLC, a monolithic integrated sensor for heart rate monitoring, from ROHM Semiconductor company. This IC is a highly integrated optical sensor, very well suited for performing PPM measurements. Due to the large integration scale of this sensor, as well as its low power consumption, it is perfectly suited to be used on a wearable IoT device. However, being a Click board™, Heart rate 6 click allows easy evaluation and rapid application and firmware development.




Two green LEDs are driven by the integrated LED driving section of the BH1790GLC sensor, with the programmable pulsating frequency of 64Hz or 128Hz. The current through the LEDs can also be programmed in the range from 0 to 60 mA. Finally, there are two settings for the pulse duration: 0.3ms and 0.6ms. These two values affect the duty cycle of the LED pulses. Optimal readings can be achieved by balancing these three parameters: the current amount through the LED (brightness), the speed of the light pulses (LED frequency), and the pulse width (0.3ms or 0.6ms)

The reflected light burst is detected by a sensing element in a form of a photo-diode, sampled by a low noise 16-bit A/D converter. The photo-diode is located behind two light filters which pass only a narrow band of green light in the range from 520nm to 560nm, with 0.8X reduction in respect to the center frequency. The top filter is an IRCUT filter, that prevents the influence

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of the IR light, while the second filtering layer only passes the green light. This allows even broader color range LEDs to be used, reducing the overall cost of the design. However, Heart rate 6 click uses the KingBright super bright clear green LEDs, with the spectral response that is closely matched to the passband properties of the optical filter. This allows most of the LED energy to be used, further improving the power consumption profile.

Two output registers contain the 16-bit measurement in a form of two 8-bit words. The upper and the lower 8-bit registers contain the measurement data, which can be retrieved over the standard I2C interface. The host MCU can read these registers in cycles of 1/32 sec, or 1/64 sec, depending on the BH1790GLC settings. The datasheet of the BH1790GLC contains the correct algorithms, which describe the measurement process with more details. However, the Click board™ comes with the library which contains functions that allow measurements to be performed with minimum efforts.

The I2C pins of the BH1790GLC sensor are routed to the respective mikroBUS™ I2C pins. The I2C bus lines are already equipped with two pull-up resistors, which together with the two external LEDs are the only components required by the BH1790GLC sensor. Pullup resistors are connected to the 3.3V power rail so that the Click board™ can be used only with MCUs that use logic levels up to 3.3V for the communication.

## Specifications

| | |
|---|---|
| Type | Biometrics,Heart Rate |
| Applications | This sensor is an ideal solution for development of various wearable health-related devices, smart phones, tablets, and similar space-constrained applications. |
| On-board modules | BH1790GLC, a monolithic integrated sensor with I2C interface for heart rate monitoring, from ROHM Semiconductor company |
| Key Features | A complete monolithic heart rate measurement solution with two constant current LED drivers, narrow pass-band for the green light spectrum, low power consumption, and a high integration ratio that allows very low number of external components, and more |
| Interface | I2C |
| 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 **Heart rate 6 Click** corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

| Notes | Pin | | Pin | Notes |
|---|---|---|---|---|

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| | | mikro™ BUS | | | | | |
|---|---|---|---|---|---|---|---|
| | NC | 1 | AN | PWM | 16 | NC | |
| | NC | 2 | RST | INT | 15 | NC | |
| | NC | 3 | CS | RX | 14 | NC | |
| | NC | 4 | SCK | TX | 13 | NC | |
| | NC | 5 | MISO | SCL | 12 | **SCL** | I2C Clock |
| | NC | 6 | MOSI | SDA | 11 | **SDA** | I2C Data |
| Power supply | **3V3** | 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 |

## Software Support

We provide a library for the Heart rate 6 Click as well as a demo application (example), developed using MIKROE compilers. The demo can run on all the main MIKROE development boards.

Package can be downloaded/installed directly from NECTO Studio Package Manager (recommended), downloaded from our LibStock™ or found on MIKROE github account.

### Library Description

This library contains API for Heart rate 6 Click driver.

Key functions

- Function reads the LED Data as 16bit unsigned value.
- Function sets the data reading frequency and the LED pulse frequency.
- Function starts measurement cycle.

### Example Description

The example demonstrates the use of Heart rate 6 Click.

The full application code, and ready to use projects can be installed directly from NECTO Studio Package Manager (recommended), downloaded from our LibStock™ or found on MIKROE github account.

Other MIKROE Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.HeartRate6

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### 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. UART terminal is available in all MIKROE compilers.

## mikroSDK

This Click board™ is supported with mikroSDK - MIKROE 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

Heart rate 6 click example on Libstock

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[BH1790GLC datasheet]

[Heart rate 6 click schematic]

[Heart rate 6 click 2D and 3D files]