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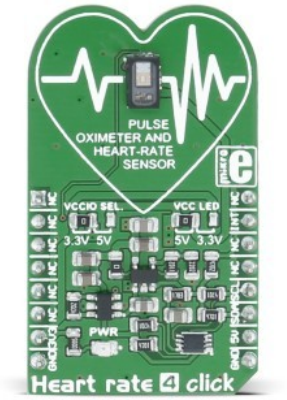
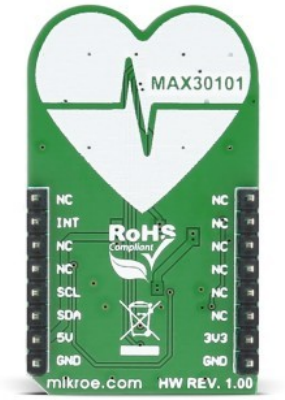
Heart rate 4 Click





PID: MIKROE-2510

Heart Rate 4 Click is a compact add-on board for heart-rate monitoring applications. This board features the MAX30101, an integrated pulse oximetry and heart-rate monitor module from Analog Devices. The module includes internal LEDs, photodetectors, optical elements, and low-noise electronics with ambient-light-rejection circuitry, establishing communication to and from the module entirely through a standard I2C compatible interface. It operates on a 1.8V supply voltage with the possibility to be shut down through software with a near-zero standby current, allowing the power rails to remain powered at all times. This Click board™ is suitable for optical pulse oximetry and heart-rate detection applications.

How does it work?

Heart Rate 4 Click is based on the MAX30101, a complete pulse oximetry and heart-rate sensor system solution module from Analog Devices. The MAX30101 includes internal LEDs (red, green, and IR (infrared) LEDs to modulate LED pulses for SpO2 and HR measurements), photodetectors, optical elements, and low-noise electronics with ambient light rejection. The MAX30101 is fully adjustable through software registers, and the digital output data can be stored in its 32-deep FIFO. The FIFO allows the MAX30101 to be connected to an MCU or processor on a shared bus, where the data is not being read continuously from the MAX30101’s registers.

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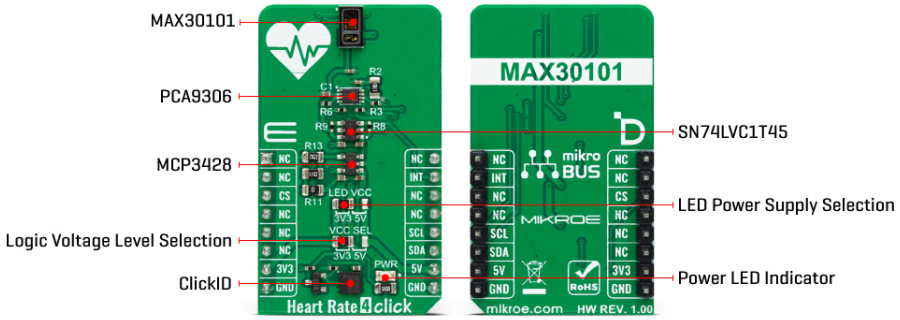

This pulse oximeter measures the oxygen saturation in one's blood, or more precisely, the percentage of hemoglobin molecules in blood that is saturated with oxygen (in a healthy adult, readings go from 94% to 100%). An internal LED current can be programmed from 0 to 50mA with the proper supply voltage selected using an onboard SMD jumper labeled LED VCC, placing it in an appropriate position marked as 3V3 or 5V. Since oxygen-saturated blood absorbs more infrared light than red light, and unsaturated blood absorbs more red light than infrared light, the SpO2 readings are calculated by comparing the amount of these two types of light. For the most accurate measurements, it is best to use your finger.

The MAX30101 also includes a proximity function to save power and reduce visible light emission when the user's finger is not on the sensor, and an on-chip temperature sensor, with an inherent resolution of 0.0625°C, for calibrating the temperature dependence of the SpO2 subsystem. This sensor does not need a specific Power-Up sequence but requires a voltage of 1.8V for its interface and logic part to work correctly. Therefore, a small regulating LDO, the SPX3819, provides a 1.8V out of mikroBUS™ power rails.

Heart Rate 4 Click communicates with MCU using the standard I2C 2-Wire interface with a maximum clock frequency of 400kHz, fully adjustable through software registers. Since the sensor for operation requires a power supply of 1.8V, this Click board™ also features the PCA9306 and SN74LVC1T45 voltage-level translators. The I2C interface bus lines are routed to the voltage-level translators allowing this Click board™ to work with 3.3V and 5V MCUs properly. In addition, it uses an interrupt pin, the INT pin of the mikroBUS™ socket, used when an interrupt occurs to alert the system when the measurement results cross upper or lower threshold settings.

This Click board™ can operate with both 3.3V and 5V logic voltage levels selected via the VCC SEL jumper. This way, it is allowed for both 3.3V and 5V capable MCUs to use the communication lines properly. However, the Click board™ comes equipped with a library containing easy-to-use functions and an example code that can be used, as a reference, for further development.

Specifications

Type	Biometrics,Heart Rate
Applications	Can be used for optical pulse oximetry and heart-rate detection applications

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On-board modules	MAX30101 - pulse oximetry and heart-rate sensor from Analog Devices
Key Features	Pulse oximetry or SpO2, high sensitivity, low power consumption, programmable sample rate and LED current, fast data output, I2C interface, interrupt, and more
Interface	I2C
Feature	ClickID Manifest,No ClickID
Compatibility	mikroBUS™
Click board size	M (42.9 x 25.4 mm)
Input Voltage	3.3V or 5V

Pinout diagram

This table shows how the pinout on Heart rate 4 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS™				Pin	Notes
	NC	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	**INT**	Interrupt
ID COMM	**CS**	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	**3.3V**	7	3.3V	5V	10	**5V**	Power Supply
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
JP1	VCC SEL	Left	Logic Level Voltage Selection 3V3/5V: Left position 3V3, Right position 5V
JP1	LED VCC	Left	LED Power Supply Selection 3V3/5V: Left position 3V3, Right position 5V

Heart rate 4 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5	V
Resolution	-	18	-	bits
Data Rate	50	-	3200	SPS

Software Support

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We provide a library for the Heart rate 4 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 4 Click driver.

Key functions

- Function is used to read desired interrupt specified by flag.
- Function is used to read the oldest RED value.
- Function is used to determine which LED is active in each time slot.

Example Description

This example demonstrates the use of Heart rate 4 click board.

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.HeartRate4

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.

Resources

mikroBUS™

Heart rate 3 click Learn Tutorial

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Heart rate 4 click example on Libstock

MAX30101 datasheet

Heart rate 4 click 2D and 3D files v100

Heart rate 4 click schematic v100ID

Heart rate 4 click 2D and 3D files v100ID