Heart rate 3 click
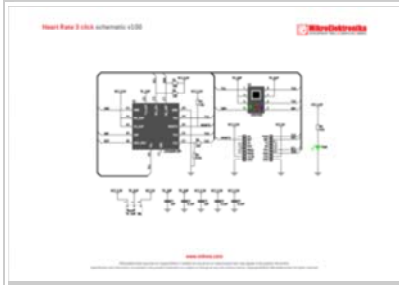
From MikroElektonika Documentation

Heart Rate 3 click is a mikroBUS™ add-on board whose functionality is determined by two components: an OSRAM's SFH7050 pulse oximetry and heart rate monitoring module, and a TI AFE4404 (analong-front-end) IC specialized for bio-sensing.

Features and usage notes

Schematic also available in PDF (http://cdn-docs.mikroe.com/images/d/d1/Heart_Rate_3_click_s

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The SFH7050 multichip package contains 3 LEDs and one photodiode separated with a light barrier to prevent optical crosstalk. When the three LEDs shine through a subject's finger, some of the light is absorbed by the pulsating blood.

The analog reading from the SFH7050 is forwarded to the AFE chip that is able to derive pulse readings from the intensity of the reflected light.

AFE4404 is highly-configurable and adaptable for different usage scenarios (different lighting conditions or skin tones) making Heart Rate 3 click a robust heart rate monitoring solution.

The board communicates with the target MCU through the mikroBUS™ I2C interface, with additional functionality provided by RST, CLK and RDY pins.

Heart Rate 3 click works on a 3.3V power supply, but an onboard jumper allows you to set the voltage for driving the SFH7050 LEDs at either 3.3V or 5V.

Heart rate 3 click

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IC/Module	AFE4404 (http://www.ti.com/lit/ds/symlink/afe4404.pdf)
	SFH7050 (http://www.osram-os.com/media/resource/HIRES/541656/246267/light-is-wearable---flysheet-biomon-sensor-sfh-7050-gb.pdf)
Interface	I2C
Power supply	3.3V
Website	www.mikroe.com/click/heart-rate-3 (http://www.mikroe.com/click/heart-rate-3)

Programming

Setting up of Heartrate 3 click and external interrupt to read values at 100hz and using an algorithm to find a heartrate.

```
1  #include <stdint.h>
2  #include "heartrate_3.h"
3  #include "resources.h"
4
5
6  // HeartRate 3 GPIO
7  sbit RST at GPIOC_ODR.B2;
8
9  void system_setup( void );
10 void setup_interrupt();
11
12 char  uart_text[20] = {0};
13 uint64_t int_count = 0;     //Used by timer to calibrate sampling freq.
14
15 void main()
16 {
17     //Local Declarations
18     uint16_t rate    = 0;
19     char txt[15]     = {0};
20
21     system_setup();    // GPIO / HeartRate 3 / UART / I2C Setups
22     Delay_ms(200);
23     initStatHRM();     // Initializes values to 0
24     setup_interrupt(); // Setup interrupt handler
25
26     while(1)
27     {
28         rate = hr3_get_heartrate();
29
30         IntToStr( rate, uart_text );
31         UART1_Write_Text( uart_text );
32         UART1_Write_Text( "\r\n" );
33     }
34
35 }
36
37 void system_setup( void )
38 {
39     //Local Declarations
40     char            text[40] = { 0 };
```

```
41      dynamic_modes_t dynamic_modes;
42      uint8_t          address = 0x58;
43
44         //Set up dynamic modes for Heart Rate 3 Initialization
45      dynamic_modes.transmit = trans_dis;                    //Transmitter disabled
46      dynamic_modes.curr_range = led_double;                 //LED range 0 - 100
47      dynamic_modes.adc_power = adc_on;                      //ADC on
48      dynamic_modes.clk_mode = osc_mode;                     //Use internal Oscillator
49      dynamic_modes.tia_power = tia_off;                     //TIA off
50      dynamic_modes.rest_of_adc = rest_of_adc_off;           //Rest of ADC off
51      dynamic_modes.afe_rx_mode = afe_rx_normal;             //Normal Receiving on AFE
52      dynamic_modes.afe_mode = afe_normal;                   //Normal AFE functionality
53
54         //GPIO setup
55      GPIO_Digital_Output( &GPIOC_BASE, _GPIO_PINMASK_2 );
56      GPIO_Digital_Input( &GPIOA_BASE, _GPIO_PINMASK_0 );
57      GPIO_Digital_Input( &GPIOD_BASE, _GPIO_PINMASK_10 );
58
59         //UART Initialize
60      UART1_Init( 9600 );
61      UART1_Write_Text( "UART is Initialized\r\n" );
62
63         //Toggle Reset pin
64      RST = 0;
65      Delay_us(50);
66      RST = 1;
67
68         //I2C Initialize
69      I2C1_Init_Advanced( 400000, &_GPIO_MODULE_I2C1_PB67 );
70      UART1_Write_Text( "I2C Initialized\r\n" );
71
72         //Heart Rate 3 Initialize
73      hr3_init( address, &dynamic_modes );
74
75
76 }
77
78 void setup_interrupt()
79 {
80   GPIO_Digital_Output(&GPIOE_BASE, _GPIO_PINMASK_HIGH);  // Enable digital output on PORTD
81   GPIOE_ODR = 0xAAAA;
82   GPIO_Digital_Input(&GPIOD_BASE, _GPIO_PINMASK_10);
83
84   RCC_APB2ENR.AFIOEN = 1;            // Enable clock for alternate pin functions
85   AFIO_EXTICR3 = 0x0300;             // PD10 as External interrupt
86   EXTI_RTSR = 0x00000400;            // Set interrupt on Rising edge
87   EXTI_IMR |= 0x00000400;            // Set mask
88   NVIC_IntEnable(IVT_INT_EXTI15_10); // Enable External interrupt
89   EnableInterrupts();                // Enables the processor interrupt.
90 }
91
92 void ExtInt() iv IVT_INT_EXTI15_10 ics ICS_AUTO {
93    EXTI_PR.B10 = 1;                               // clear flag
94    int_count++;
95    statHRMAlgo( hr3_get_led1_amb1_val() );        // Give led1 ambient value to heartrate function. ( 100 times a second )
96
97 }
```

Code examples that demonstrate the usage of Heart rate 3 click with MikroElektronika hardware, written for mikroC for ARM, AVR, dsPIC, FT90x, PIC and PIC32 are available on Libstock (http://libstock.mikroe.com/projects/view/1908/heart-rate-3-click).

Resources

- Learn article explaining Heart rate 3 click library (http://learn.mikroe.com/microcontrollers-have-a-heart-too/)

- Libstock Heart rate 3 click example (http://libstock.mikroe.com/projects/view/1908/heart-rate-3-click)

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