M480 Heart Beating

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	Heart Beating example code
BSP Version	M480 Series BSP CMSIS V3.04.000
Hardware	NuMaker-ETM-M487

The information described in this document is the exclusive intellectual property of Nuvoton Technology Corporation and shall not be reproduced without permission from Nuvoton.

Nuvoton is providing this document only for reference purposes of NuMicro microcontroller based system design. Nuvoton assumes no responsibility for errors or omissions.

All data and specifications are subject to change without notice.

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

1 Function Description

1.1 Introduction

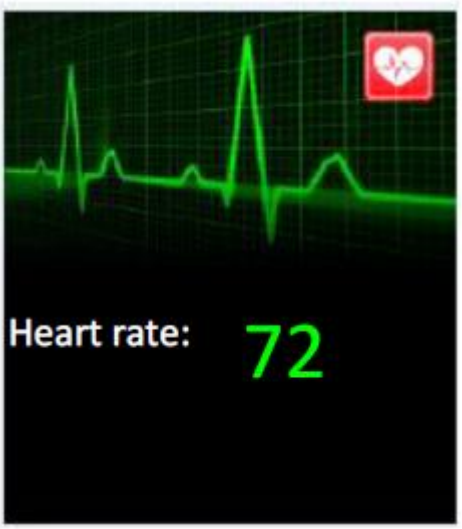
This example code shows how to get ADC voltage and send it out by DAC

1.2 Principle

NuMicro® M487 series 32-bit microcontrollers built-in three sets of OPA hardware, it can detect the weak heart beating pulse signals at the finger tops of both two hands without any extra external OPA components outside this microcontroller. After amplifying and filtering these pulse signals by these three embedded OPA, and then these pre-processed pulse signals will be passed into the heart beat processing of algorithm firmware inside the M487 embedded flash to measure the heart beat value of user.

1.3 Demo Result

After executing the program, the current heart beat value of user will show on the LCD screen.



2 Code Description

Get ADC data and send data out by PWM and DAC

```
void TMR0_IRQHandler(void)
{
    int i;

    /* Reset the EADC interrupt indicator and trigger sample module 0 to start A/D
conversion */
    EADC_START_CONV(EADC, 0x1);
    for(i = 20; i>0; i--)
    {
        ADCData[i+1] = ADCData[i];
    }
    ADCData[1] = ADCData[0];
    ADCData[0] = g_u32ADCValue_ch14;

    //report sensor
    report_sensors((int16_t)g_u32ADCValue_ch14);
    if((ADCData[7] < ADCData[6]) && (ADCData[6] < ADCData[5]))
    {
        if((ADCData[4] > ADCData[3]) && (ADCData[3] > ADCData[2]))
        {
            Time[4]=Time[3];
            Time[3]=Time[2];
            Time[2]=Time[1];
            Time[1]=Time[0];
            Time[0]=Timer_Counter;
            HeartFreq[3] = Time[3] - Time[4];
            HeartFreq[2] = Time[2] - Time[3];
            HeartFreq[1] = Time[1] - Time[2];
            HeartFreq[0] = Time[0] - Time[1];

            if(((HeartFreq[0]-3) > HeartFreq[1]) && ((HeartFreq[2]-3) > HeartFreq[1]))
            {
                HeartFreq1[0] = HeartFreq[0] + HeartFreq[1];
                HeartFreq1[1] = (float)1200/(float)(HeartFreq1[0]);
                if(HeartFreq1[1]<120 && HeartFreq1[1]>45)
                {
                    ShowCounter++;
```

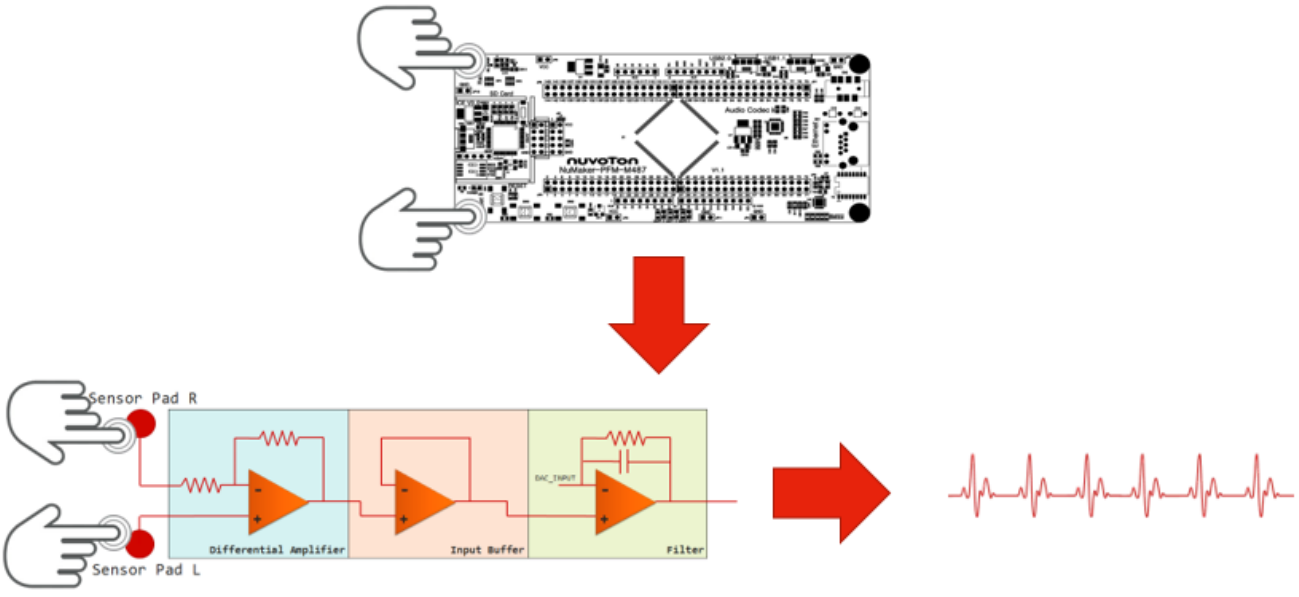
```
                    if(ShowCounter<10)
                        HeartFreq1[2] = HeartFreq1[1];
                    else
                        HeartFreq1[2] = HeartFreq1[2]*9/10 + HeartFreq1[1]/10;
                }
                Flag = 1;
            }
            else if(((HeartFreq[0]-3) < HeartFreq[1]) && ((HeartFreq[2]+3) >
HeartFreq[1]))
            {
                HeartFreq1[0] = HeartFreq[0];
                HeartFreq1[1] = (float)1200/(float)(HeartFreq1[0]);
                if(HeartFreq1[1]<120 && HeartFreq1[1]>45)
                {
                    ShowCounter++;
                    if(ShowCounter<10)
                        HeartFreq1[2] = HeartFreq1[1];
                    else
                        HeartFreq1[2] = HeartFreq1[2]*9/10 + HeartFreq1[1]/10;
                }
                Flag = 2;
            }
            else
            {
                Flag = 0;
            }
        }
    }
    Timer_Counter++;
    // enable timer interrupt trigger EADC
    TIMER0->TRGCTL |= TIMER_TRGCTL_TRGEADC_Msk;

    // clear timer interrupt flag
    TIMER_ClearIntFlag(TIMER0);

}
```

3 Hardware and Software environment

- **Software Environment**
  - BSP version
    - M480 Series BSP CMSIS V3.04.000
  - IDE version
    - Keil uVersion 5.26
- **Hardware Environment**
  - Circuit components
    - NuMaker-ETM-M487
  - Diagram



4 Directory Information

- EC_M480_Heart_Beating_V1.00
  - Library — Sample code header and source files
    - CMSIS — Cortex® Microcontroller Software Interface Standard (CMSIS) by Arm® Corp.
    - Device — CMSIS compliant device header file
    - StdDriver — All peripheral driver header and source files
  - SampleCode
    - ExampleCode — Source file of example code

5 How to execute a sample code

1. Enter Keil compile mode
    a. Build
    b. Download
    c. Start/Stop debug session
2. Enter debug mode
    a. Run

6 Revision History

Date	Revision	Description
Nov 14, 2019	1.00	1. Initially issued.

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.

Please note that all data and specifications are subject to change without notice.
All the trademarks of products and companies mentioned in this datasheet belong to their respective owners.