M451 ClassD

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	M451 ClassD Sample Code.
BSP Version	M451 Series BSP CMSIS V3.01.001
Hardware	NuTiny-M451V

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

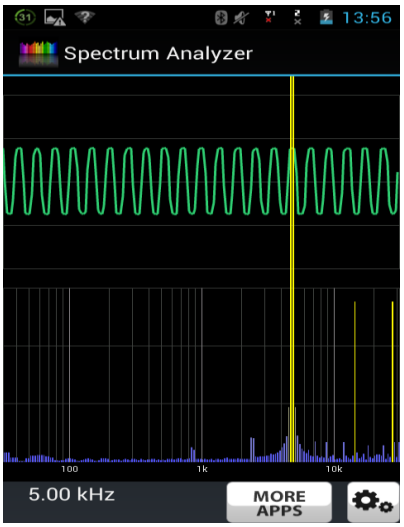
This project is to Implement ClassD amplifier.

1.2 Principle

Implement an Audio on M453 MCU chip with sound. User can input sound with ADC and output sound from PWM.

1.3 Demo Result

After execute the program, user can input 1 KHz waveform and M451 PWM will output the 1 KHz waveform.



2 Code Description

PWM initialize setting:

1. Set PC9~PC11 as PWM output
2. Select PCLK as PWM module clock source

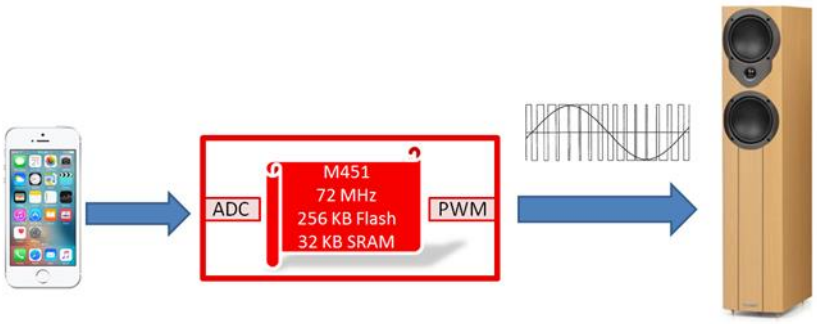
```
// ------------------------------------------------------------------------------------
//  PWM initialize setting
//   Set PC9~PC11 as PWM output
//  Select PCLK as PWM module clock source
// ------------------------------------------------------------------------------------
void Buzzer_Init()
{
    /* Enable PWM module clock */
    CLK_EnableModuleClock(PWM0_MODULE);

    /* Select PWM module clock source */
    CLK_SetModuleClock(PWM0_MODULE, CLK_CLKSEL2_PWM0SEL_PCLK0, 0);

    /* Reset PWM0 channel 0~5 */
    SYS_ResetModule(PWM0_RST);

    /* Set PC0 multi-function pins for PWM0 Channel0  */
    SYS->GPC_MFPL &= ~(SYS_GPC_MFPL_PC0MFP_Msk);
    SYS->GPC_MFPL |= SYS_GPC_MFPL_PC0MFP_PWM0_CH0;

    /* set PWMA channel 0 output configuration */
    PWM_ConfigOutputChannel(PWM0, 0, 40000, 50);

    /* Enable load mode of selected channel */
    PWM_EnableLoadMode(PWM0, 0, 0);
    /* set PWM to up-down count type */
    PWM0->CTL1 = (PWM0->CTL1 & ~(PWM_CTL1_CNTTYPE0_Msk << 0)) | (2UL << 0);
    /* SET CMR: 71884800/40000 = 898 */
    PWM_SET_CNR(PWM0, 0, 900);
    /* SET PWM0 ch0 period and zero point no action, compare up point output Low and
compare down point output High */
    PWM_SET_OUTPUT_LEVEL(PWM0, 0x1, PWM_OUTPUT_NOTHING, PWM_OUTPUT_TOGGLE,
PWM_OUTPUT_NOTHING, PWM_OUTPUT_TOGGLE);

    /* Enable PWM interrupt for PWM0 channel 0 */
```

```
    //PWM_EnablePeriodInt(PWM0, 0, 0);
    PWM_EnableZeroInt(PWM0, 0);
    /* Enable PWM0 NVIC interrupt */
    NVIC_EnableIRQ(PWM0P0_IRQn);

    /* Enable PWM Output path for PWM0 channel 0 */
    PWM_EnableOutput(PWM0, PWM_CH_0_MASK);
    // Start
    PWM_Start(PWM0, PWM_CH_0_MASK);

    /* Buzzer freq = 100Hz */
    BuzzerFreq = 100;
}
```

```
void PWM0P0_IRQHandler(void)
{
    /* Get ADC feedback */
    GetAdcData();

    // FeedBack loop
    PWMOutput = (AdcInput / 4) + 70;        //20:PWMOutput = (AdcInput / 3) + 250;
    //30:PWMOutput = (AdcInput / 4) + 110;          //PWMOutput = (AdcInput / 5) + 50;
    PWM_SET_CMR(PWM0, 0, PWMOutput);
    PWM_SET_CMR(PWM0, 2, PWMCOUNTER - PWMOutput);
    //clear INT
    PWM_ClearPeriodIntFlag(PWM0, 0);
    PWM_ClearZeroIntFlag(PWM0, 0);
}
```

3 Hardware and Software environment

- **Software Environment**
  - BSP version
    - M451 Series BSP CMSIS V3.01.001
  - IDE version
    - Keil uVersion 5.26
- **Hardware Environment**
  - Circuit components
    - NuTiny-M451V
  - Diagram



4 Directory Information

- EC_M451_ClassD_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.