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AN204736

F²MC-8FX Family MB95F200 Series 8-Bit Microcontroller LED Control Reference Solution

Associated Part Family: MB95F200 Series

This application note gives a demo on how to dim the LED by turning on and off LED drive IC using the low frequency PWM signal.

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1 Overview

LED is widely used in many fields now. In order to achieve higher efficiency or better illumination, the light is usually required to have diming function. There are two ways to dim the LED: one is reducing the drive current, and another is tuning on and off LED drive IC using the low frequency PWM signal. This demo adopts the second way.

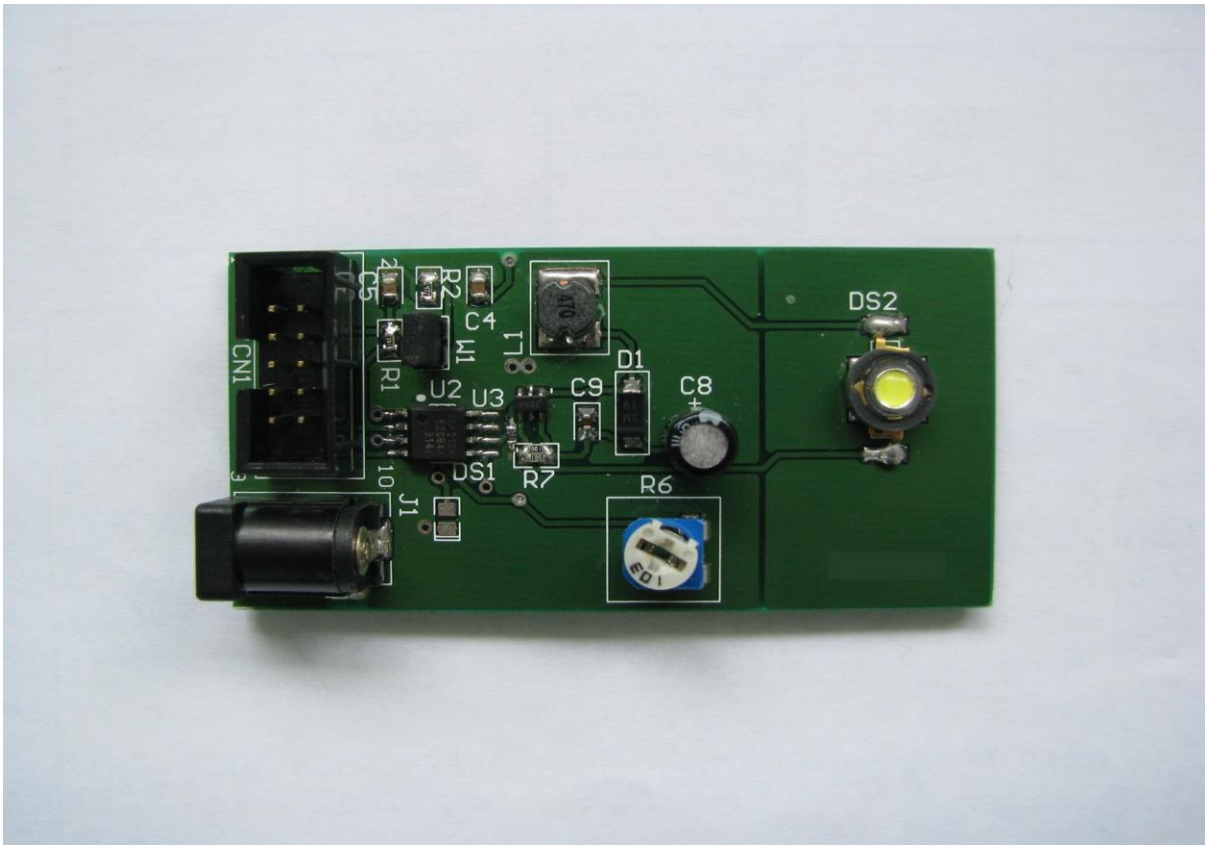
This demo supports such features:

- Dim the LED by turning on and off the LED drive IC
- Change the PWM duty by potentiometer easily

2 Demo Platform

This demo set is based on MB95F212K an 8 pins MCU. The MCU will generate a PWM signal to the LED drive IC to dim LED. The potentiometer decides the PWM duty. Figure 1 shows the demo.

Figure 1. LED Diming Demo Board

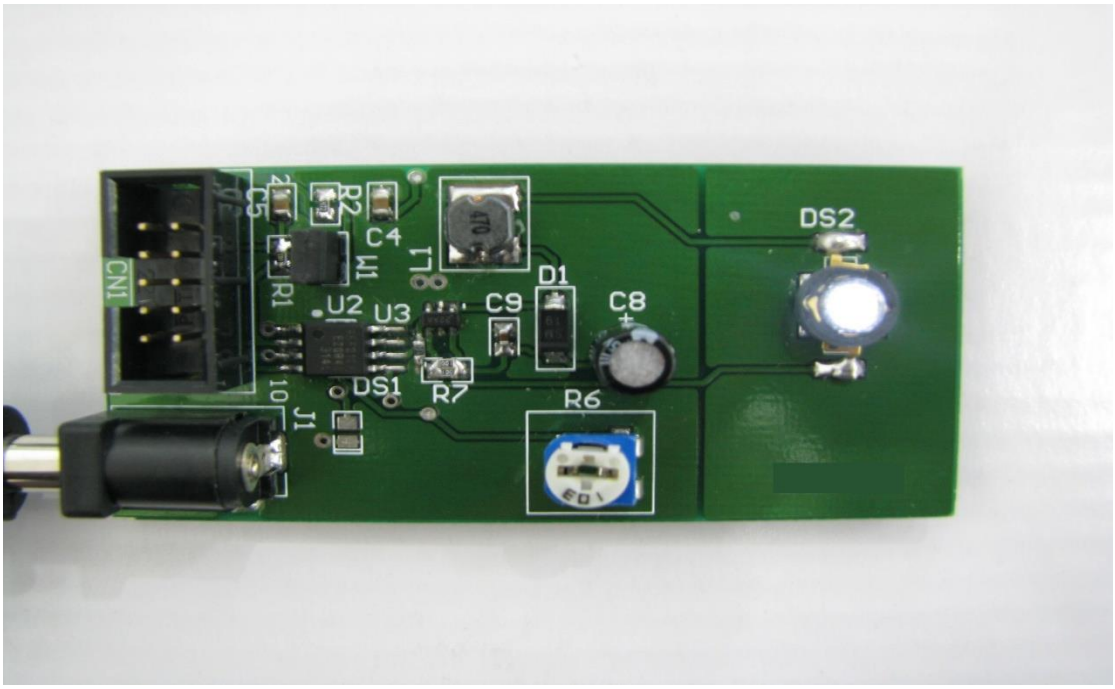


3 Functions

3.1 Tune the Light Up

User can turn the potentiometer to tune the light up.

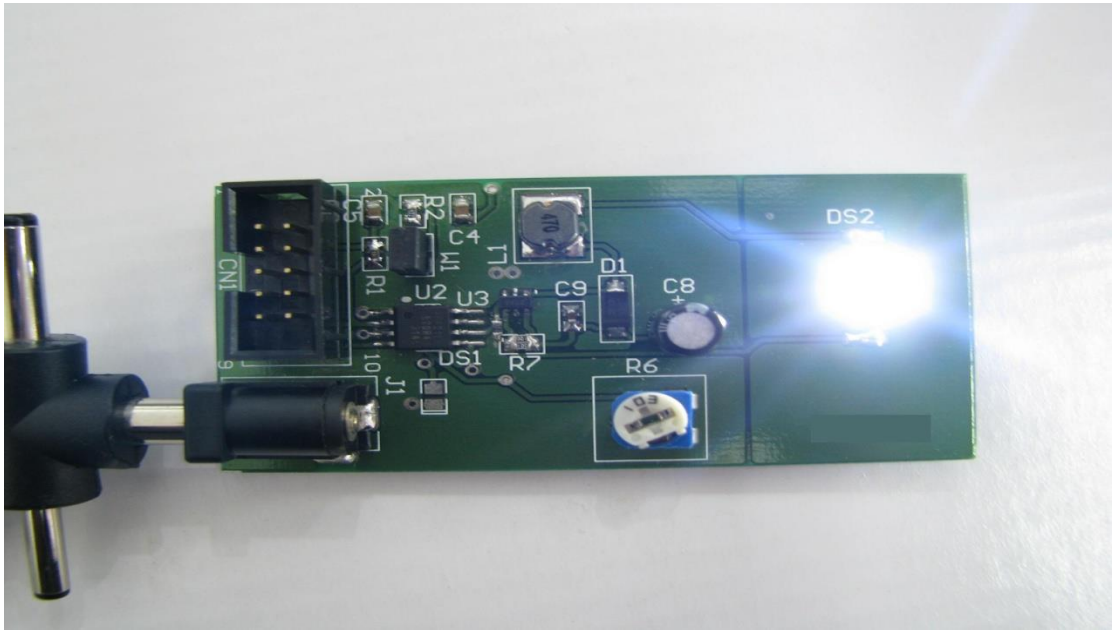
Figure 2. LED at High Luminance



3.2 Tune the Light Down

User can turn the potentiometer to tune the light down.

Figure 3. LED at Low Luminance

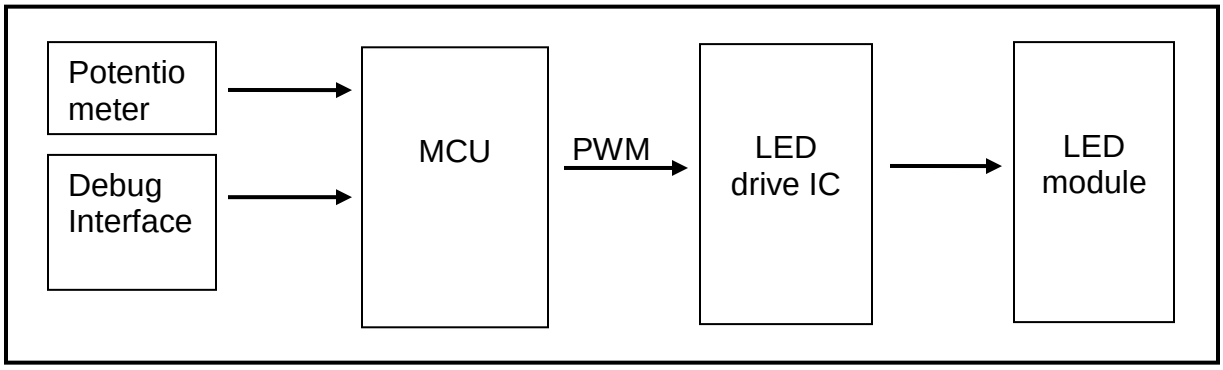


4 Hardware

4.1 System Block

Figure 4 shows the system block of the demo.

Figure 4. System Block Diagram



4.2 Schematic

Figure 5 (next page) shows the hardware of this demo. The main parts are MB95F212 and T6322A. P04 is connected to a potentiometer which is used control the PWM duty. P05 is PWM output pin and is connected to the EN pin of LED drive IC. When P05 outputs “H”, the IC will output maximum current to the LED module. When P05 outputs “L”, the IC will shut down, and the LED module is off.

4.3 Pin Assignment

Table 1 shows MB95F212 pin assignment.

Table 1. MCU Pin Assignment

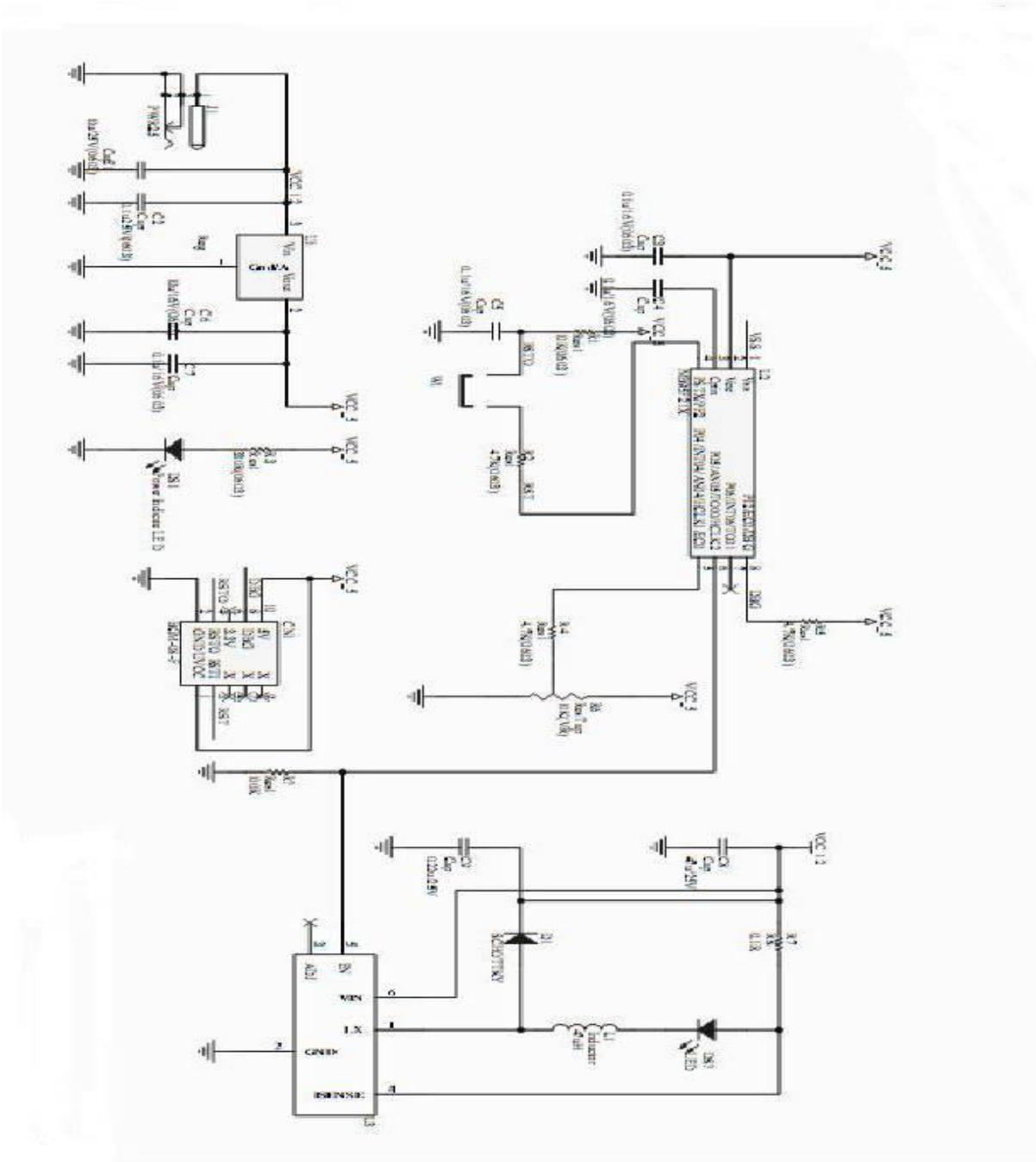
Number	Pin	Function
5	P04	Potentiometer input for PWM duty control
6	P05/TO00	Low frequency PWM
7	P06	Null
8	P12/DBG	Debugger port

Table 2 shows the T6322A pin assignment.

Table 2. LED Driver IC Pin Assignment

Number	Pin	Function
1	LX	Switch signal output
2	GND	GND
3	ADJ	Null
4		Current feedback input
5	EN	Enable signal input
6	VIN	Power input

Figure 5. LED Diming Board

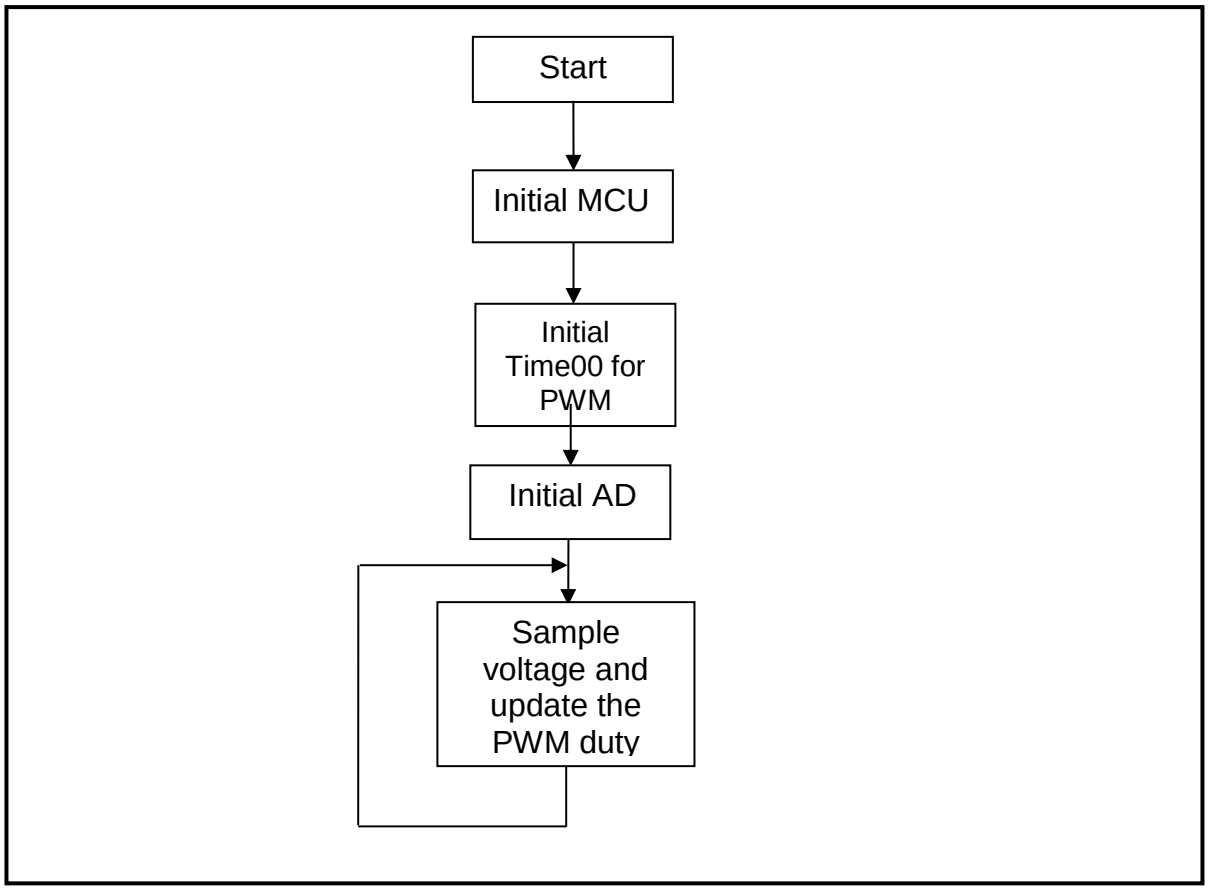


5 Firmware

5.1 Flow Chart

The main function of this firmware is sampling voltage and generating PWM signal. The flow chart is shown as Figure 6.

Figure 6. Main Function Flow Chart



5.2 Files Description

Table 3. File Description

Functions	Description
MCU_ initialization()	Initialize MCU
PWM_init()	Initialize timer00 for PWM
io_ad_init()	Initialize AD module
ad_sample()	Sample voltage and update the PWM duty

5.3 Source Code

```
#include "mb95200.h“
/*----------------------------- SUB ROUTINES -------------------------------*/
void MCU_initialization()
{
        __DI();
        /*system clock*/
        SYCC=0x01;
        while( !STBC_MCRDY );
        /*IO port*/
        PDR0_P05=0;    //pin state="L",default L = LED off
        DDR0_P05=1;            //Enable output level
        InitIrqLevels();
            __EI();
}

/*----------------------------- SUB ROUTINES -------------------------------*/
void PWM_init()
{
   T00CR0=0xC3;
   T00CR1=0x20;                  //timer01 output disable
   TMCR0=0x20;                          //8-BIT-OPERATION
   T00CR1_STA=1;                 //start timer01
   T00CR1_OE=0;                  //output disable
}

/*----------------------------- SUB ROUTINES -------------------------------*/
#define AD_CNT        8
unsigned char ad_data;
void io_ad_init()
{
        DDR0_P00=0;
        AIDRL_P00=1;
        ADC1=0x40;            //AN00 pin
        ADC2=0x80;            //8bit AD
}
```

```
/*----------------------------- SUB ROUTINES ---------------------------------*/
void ad_sample()
{
        unsigned char a=0,b=0;
        unsigned int c=0;
        for(a=0;a<AD_CNT;a++)
        {
                ADC1=0x41;    //Start AD
                while(!ADC1_ADI&&b<250)
                {
                        b++;    //prevent AD halting in dead loop
                }
                c=c+ADDL;
        }
        ad_data=c/AD_CNT;    //c/8
        T00DR=ad_data;
}

/*----------------------------- MAIN ROUTINE ---------------------------------*/
void main()
{
  MCU_initialization();
  io_ad_init();
  ad_sample();
  PWM_init();
  T00CR1_OE=1;            //output enable
       while(1)
       {
         ad_sample();
       }
}
```

Document History

Document Title: AN204736 – F²MC-8FX Family MB95F200 Series 8-Bit Microcontroller LED Control Reference Solution

Document Number: 002-04736

Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	-	RLIU	11/04/2009	Original version
*A	5235002	RLIU	04/26/2016	Migrated Spansion Application Note MCU-AN- 500055-E-10 to Cypress format.
*B	5844607	MALI	08/04/2017	Updated logo and copyright

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