**ARM Cortex®-M**

**32-bit Microcontroller**

# NuMicro® Family
# M480 Series
# OLED Display User Manual

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NUMICRO® M480 SERIES OLED DISPLAY USER MANUAL

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# 1 OVERVIEW

This reference design is based on NuMicro M480 series which control a 2" OLED display and play GIF on it. The M480 series run up to 192 MHz with 512 kB embedded Flash memory and 160 kB embedded SRAM. This high performance microcontroller decodes GIF motion graphics smoothly. The OLED display is embedded an emWin system to display a user configure graphic. emWin system is a library used in the graphic display interface. It can quickly and conveniently design a HMI System. In addition, the library has built-in font libraries. This reference design is suitable to create a dedicated display style for OLED application.

## 1.1 Features

- ARM Cortex-M4F M480 Series:
    - CPU up to 192MHz
    - Internal 512 kB FLASH / 160 kB SRAM
    - SPI Interface up to 96MHz
- ELW2106AA OLED supports 256 x 64 pixel
- Supports GIF decode function (LZW)
- 2" OLED display customized GUI
- Internal Flash memory for storing font libraries

## 1.2 Applications

- OLED display board
- High Level PC Board
- External Hard Drive
- Home appliance

## 2 OLED DISPLAY HARDWARE

The OLED Display uses the M484SIDAE as the target microcontroller. Figure 2-1 shows board placement. The schematic is builed in a 16V regulator to provide the OLED driver power. And it also has SD card slot and SPI flash to store the graphic files. For audio application, it reserves an audio codec to implement playing music function.
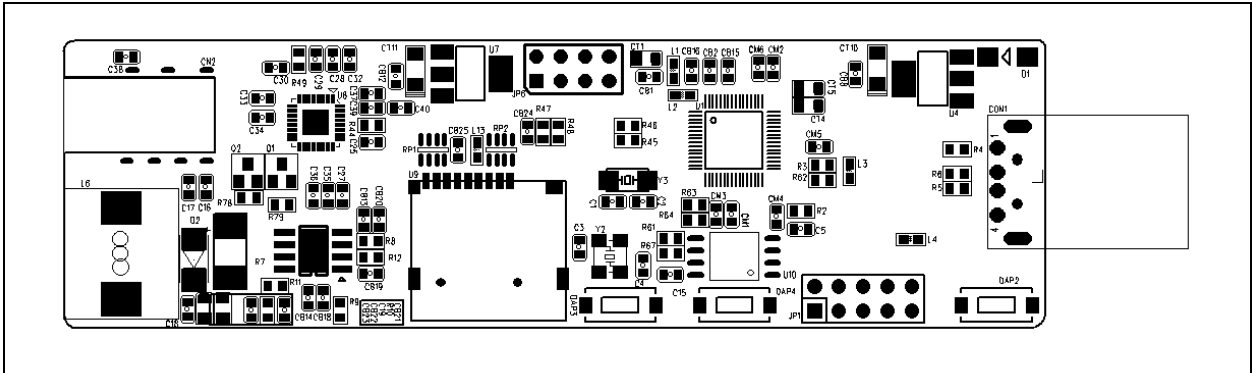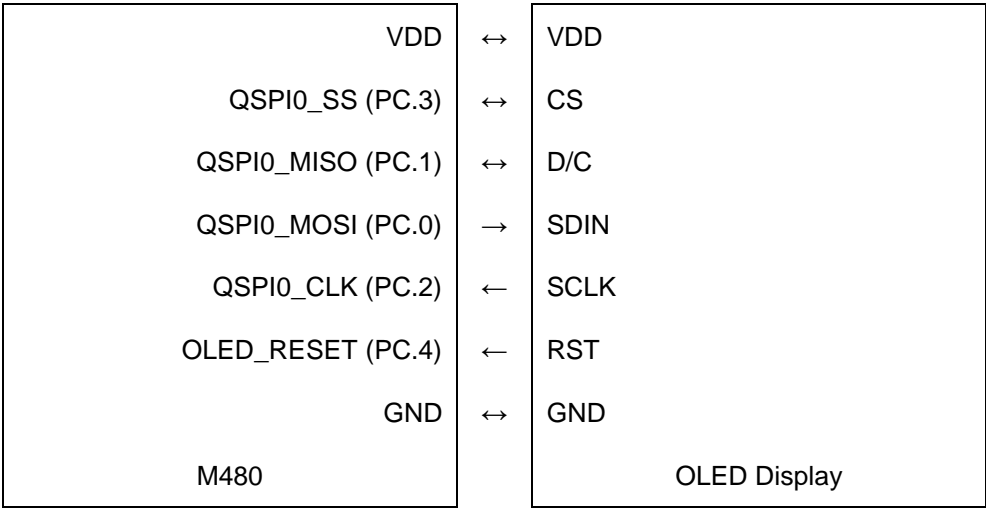


Figure 2-1 PCB Placement

| | | |
|---|---|---|
| VDD | ↔ | VDD |
| QSPI0_SS (PC.3) | ↔ | CS |
| QSPI0_MISO (PC.1) | ↔ | D/C |
| QSPI0_MOSI (PC.0) | → | SDIN |
| QSPI0_CLK (PC.2) | ← | SCLK |
| OLED_RESET (PC.4) | ← | RST |
| GND | ↔ | GND |
| M480 | | OLED Display |

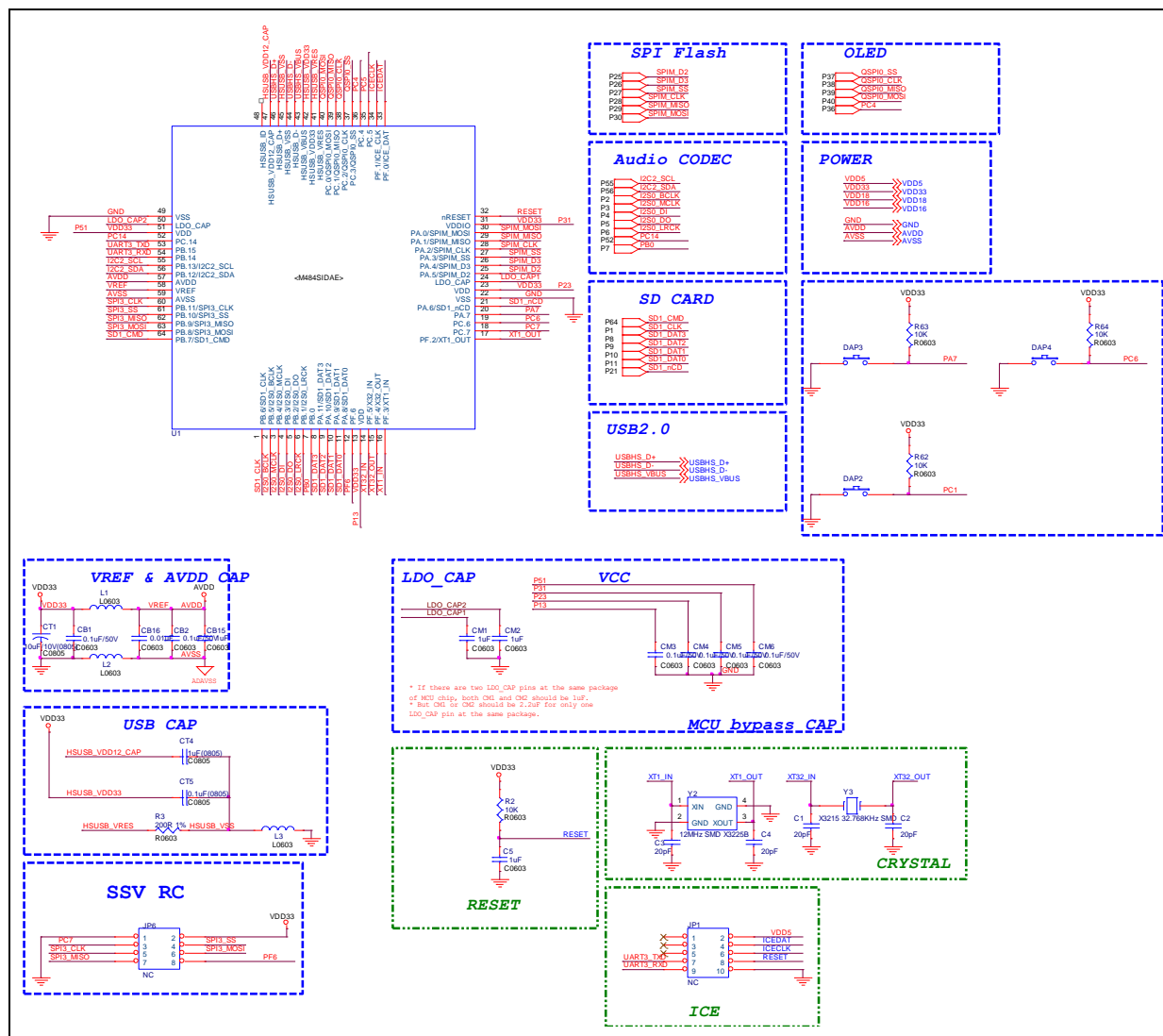Figure 2-2 Hardware Connection with OLED Display

## 2.1 Schematic



Figure 2-3 M484SIDAE Microcontroller and Buttons
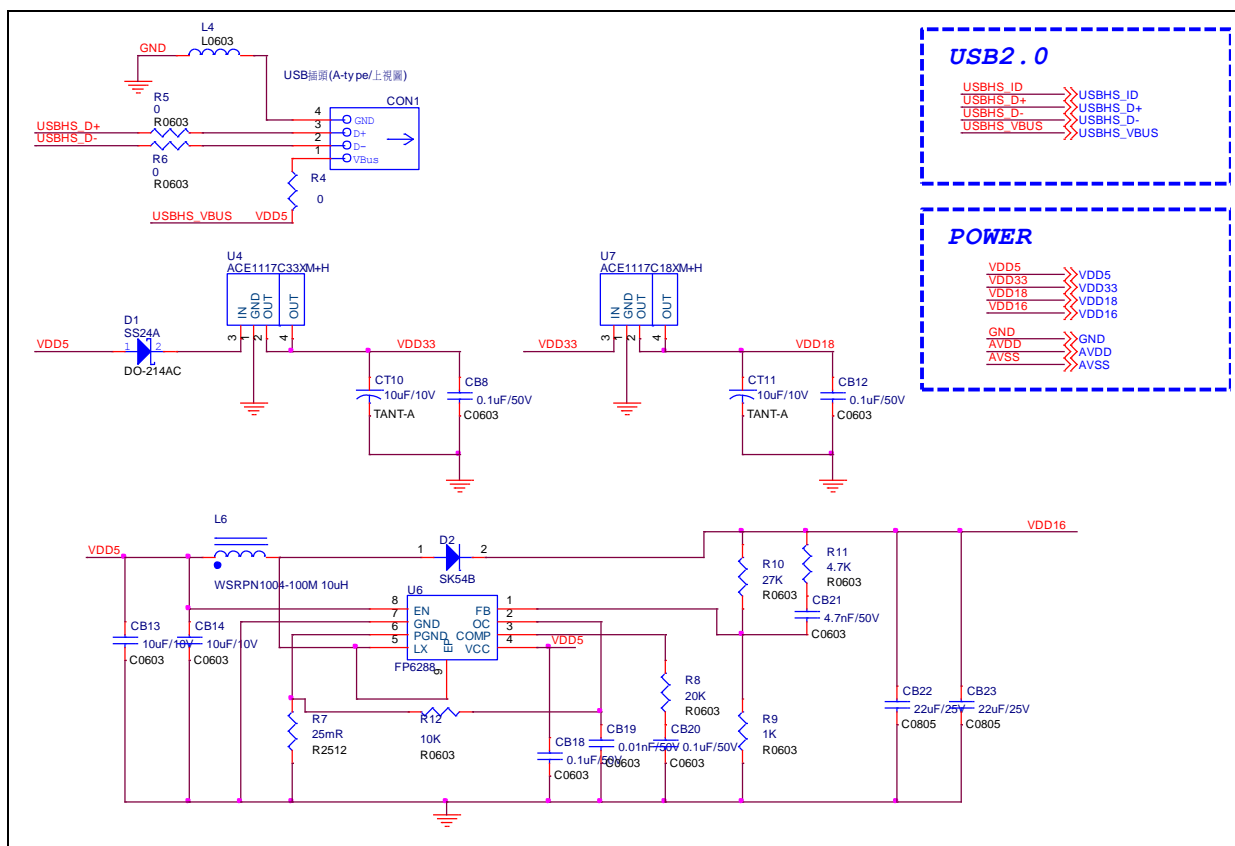
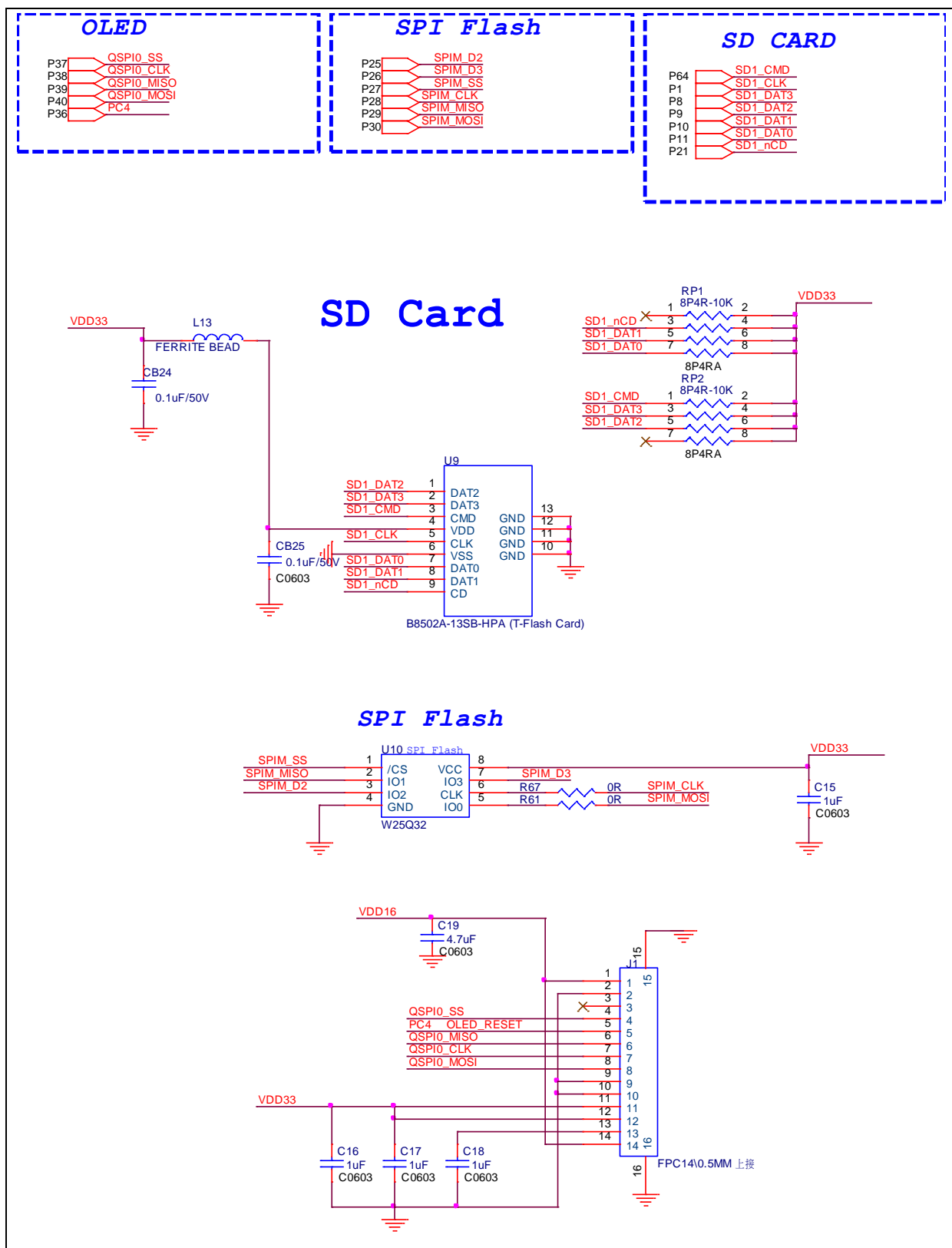Figure 2-4 USB Connector and Power Regulator
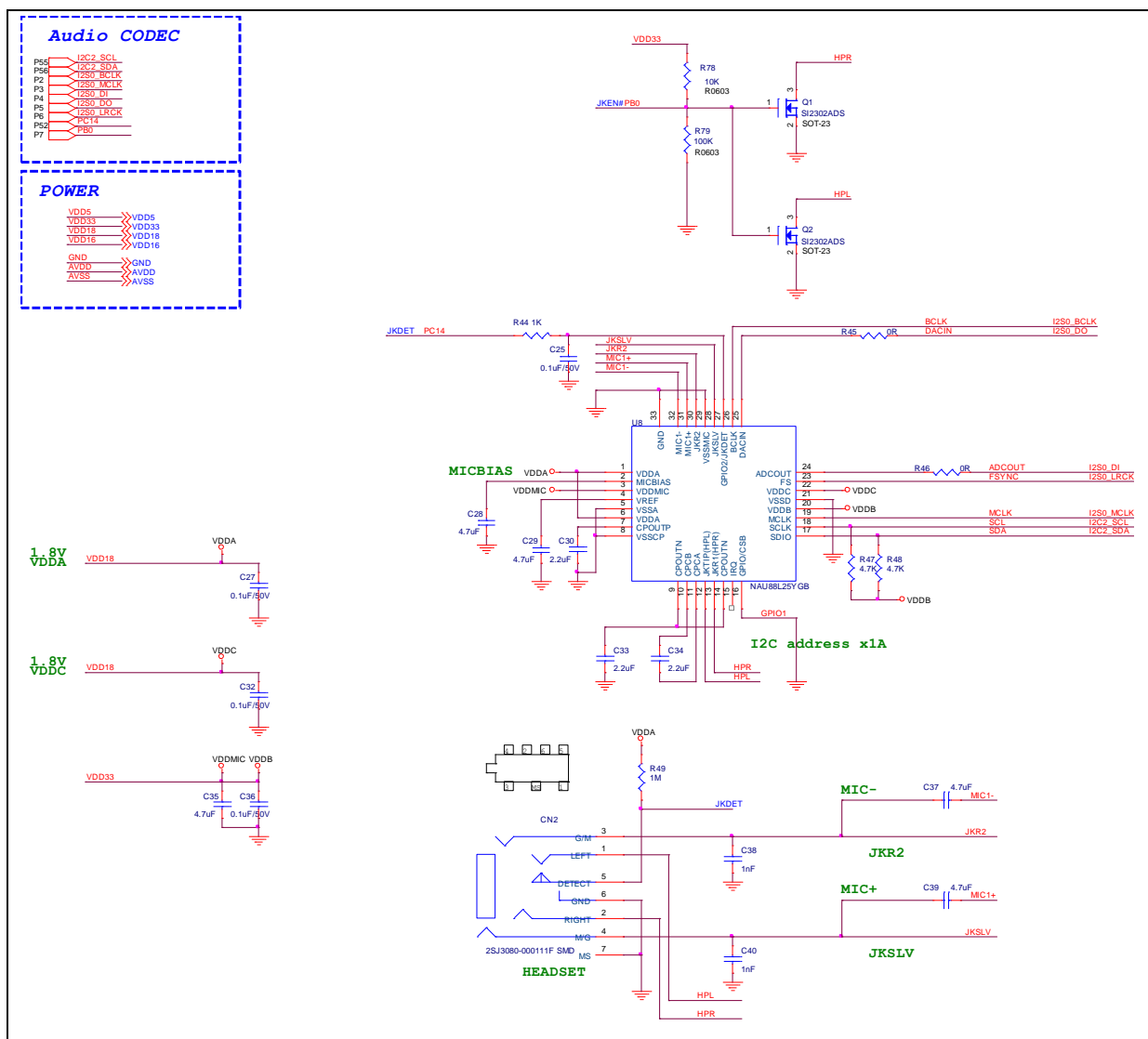
Figure 2-5 SD Card Slot, SPI Flash and OLED Connector

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Figure 2-6 Audio Codec

## 3    OLED DISPLAY FIRMWARE

The firmware can be divided into two parts that are system initializing and main task.

### 3.1    System Initializing

The system initializing includes setting system clock source, enabled peripheral clock source and the system timer.

```c
int main(void)
{

    _SYS_Init();
    // Initiate UART to 115200-8n1 for print message
    UART_Open(UART0, 115200);


    // Enable Timer0 for emWin time base
    CLK_EnableModuleClock(TMR0_MODULE);
    CLK_SetModuleClock(TMR0_MODULE, CLK_CLKSEL1_TMR0SEL_HXT, 0);
    TIMER_Open(TIMER0, TIMER_PERIODIC_MODE, 1000);
    TIMER_EnableInt(TIMER0);
    NVIC_SetPriority(TMR0_IRQn, 1);
    NVIC_EnableIRQ(TMR0_IRQn);
    TIMER_Start(TIMER0);


    printf("\n\nCPU @ %d Hz\n", SystemCoreClock);


    // Start application
    MainTask();
    while(1);
}
```

### 3.2    Main Task

There are three stages to show the different behaviors on OLED by emWin library. User could set the strings they want to show in the first stage. The second stage draws a BMP file. The last stage shows a GIF motion graphic smoothly. The emWin library also implements many functions for display. There is more information in the manual: \SW_M480_OLED_Display_V1.00\Source code\ThirdParty\emWin\Doc\

```c
void MainTask(void)
{
    // Init emWin
    GUI_Init();
    WM_SetCreateFlags(WM_CF_MEMDEV);


    GUI_SetTextMode(GUI_TM_TRANS);  // Set the text to be displayed transparent
```

```
    GUI_SetTextAlign(GUI_TA_LEFT);  // Align X-position left
    GUI_SetBkColor(GUI_BLACK);      // Set the background color
    GUI_Clear();                    // Fill the background color on OLED
    GUI_SetColor(GUI_WHITE);        // Set the foreground color


    // Display String on OLED
    GUI_SetFont(&GUI_Font8x8_ASCII);
    GUI_DispString("emWin suppot the driver, SSD1362");
    GUI_Delay(500);


    // Draw BMP file on OLED
    GUI_DrawBitmap(&bmpic006,0,0);
    GUI_Delay(500);
    GUI_Delay(500);
    GUI_Delay(500);
    while (1)
    {
        _ShowGIF();                 // Show GIF file on OLED
        GUI_Exec();                 // Exec emWin functions, updating window
    }
}
```
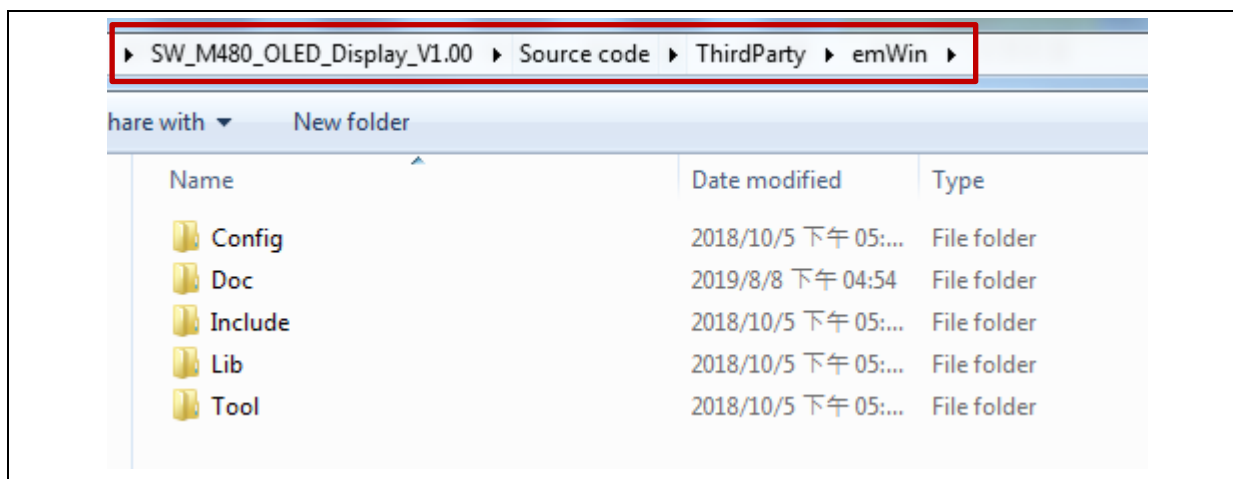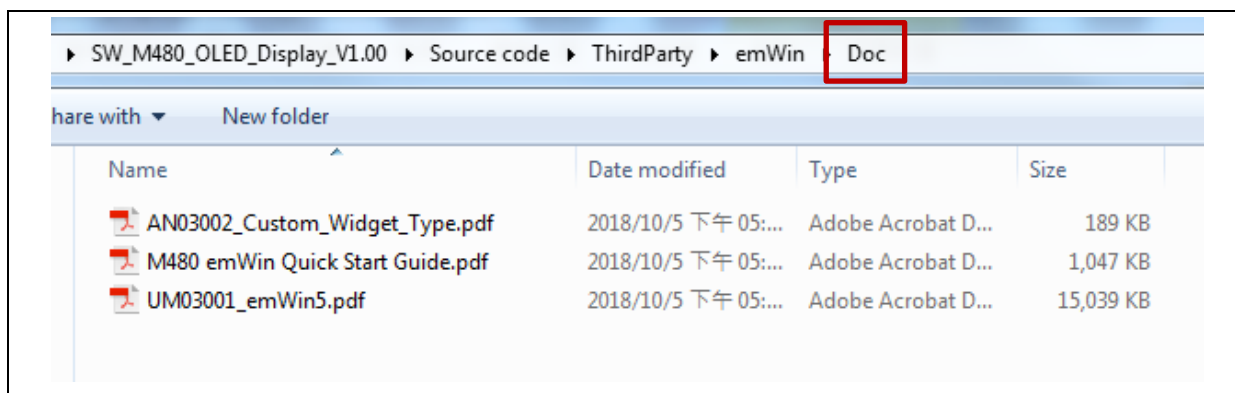
### 3.3   emWin Resource

Nuvoton is ready to provide all of the related emWin resources for users. User can find the emWin folder in following folder path.



Below figure shows the content of Doc (Document) folder in emWin folder. These documents provide user the guides that how to start or use the emWin API and tool in the project.

The emWin tools are in the Tool folder. This Tool folder provides some related execution files to support user. User can create a GUI and display on the screen for the emWin project by these tools.

## 4 OLED DISPLAY DEMO



GIF Demo
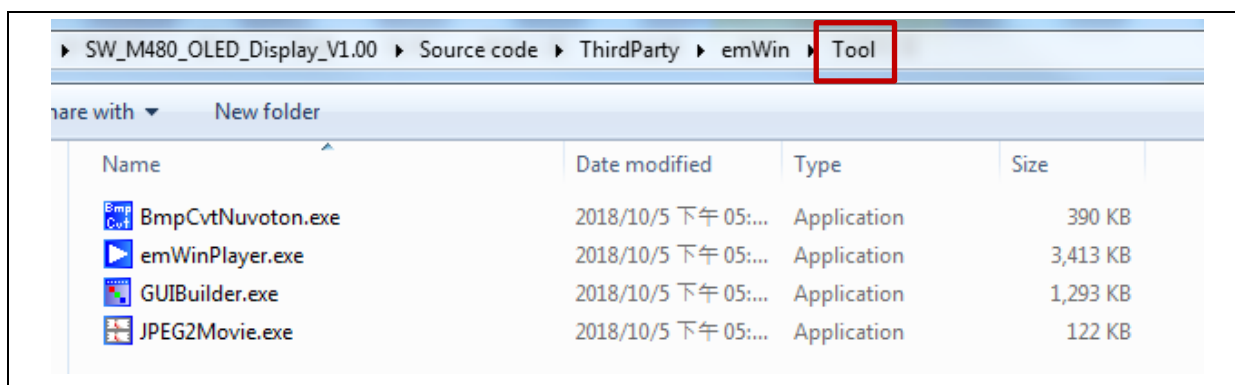


Text display Demo

## 5   REVISION HISTORY

| Revision | Date | Description |
|----------|------|-------------|
| 1.00 | Aug. 8, 2019 | Initially issued. |

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