M480 emWin BMP with SPIM

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	This example code utilizes API of emWin to show pictures storing in the external SPI flash on the panel.
BSP Version	M480 Series BSP CMSIS V3.03.001
Hardware	NuMaker-PFM-M487 V3.0 & M487 Advance Ver4.0

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1 Function Description

1.1 Introduction

Nuvoton has license emWin library from Segger. It is really simple to use API of emWin to develop human machine interface(HMI) on the product. This example code uses M480 MCU and utilizes API of emWin to show pictures storing in the external SPI flash on the panel. emWin can easily implement how to change pictures on the NuMaker-PFM-M487 V3.0 board.

For more information on the NuMaker-PFM-M487 board and NuMaker-M487-Advance board platform for emWin, please visit Nuvoton website to download the User Manual document UM_NuMaker-PFM_M487_User_Manual and UM_NuMaker_M487_Advance_User_Manual, more detail about emWin. Please download the UM_NuMaker-emWin-M487_User_Manual:

https://www.nuvoton.com/hq/products/microcontrollers/arm-cortex-m4-mcus/User-Manual/?__locale=en&resourcePage=Y&category=&pageIndex=3

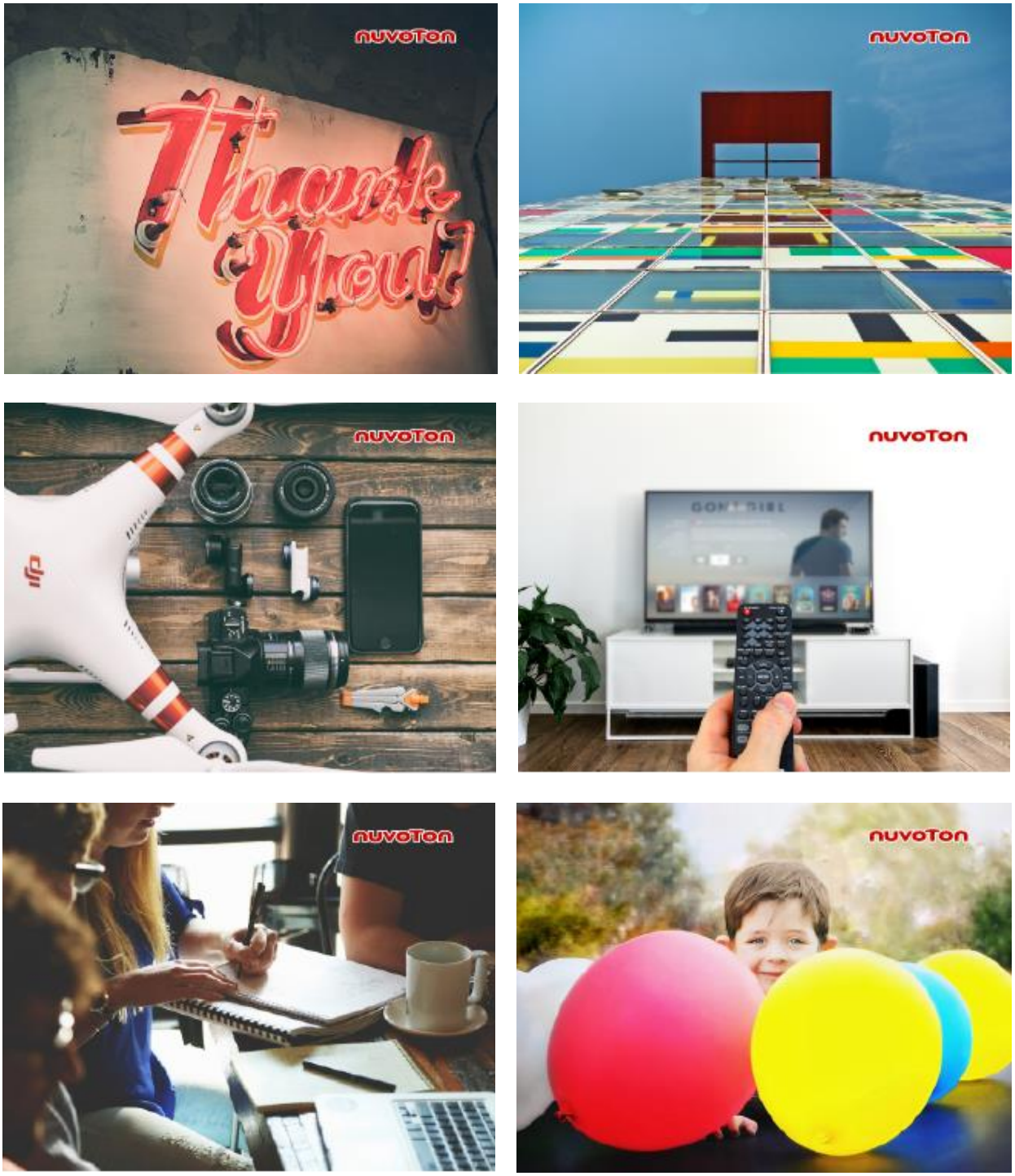
NuMaker emWin M487 Board

1.2 Principle

The mainly principle for user need to know how to use the tool of BmpCvtNuvoton that the purpose of function is to convert pictures to bitmap, storing in the external SPI flash. Utilize emWin API to show the bitmap on the panel. As before using the API of emWin to show picture on the panel of platform, user need to initialize emWin first then can call any emWin API to arrive regarding emWin functions.

1.3 Demo Result

After executed this example code, user will be seeing six pictures, changed regularly on the panel.



2 Code Description

This main() function is used to initialize platform for emWin include PLL clock to 192MHz, Uart clock, EBI, Timer and multi-function pins.

```
/**
 * @brief       main
 *
 * @param[in]   None
 *
 * @return      None
 *
 * @details     This function is used to initialize platform for emWin
 */

void main(void)
{
    // Init System, IP clock and multi-function I/O
    _SYS_Init();
    // Init UART to 115200-8n1 for print message
    UART_Open(UART0, 115200);
    SPIM_Init();
    // Enable Timer0 clock and select Timer0 clock source
    CLK_EnableModuleClock(TMR0_MODULE);
     CLK_SetModuleClock(TMR0_MODULE, CLK_CLKSEL1_TMR0SEL_HXT, 0);

     // Initial Timer0 to periodic mode with 1000Hz
     TIMER_Open(TIMER0, TIMER_PERIODIC_MODE, 1000);

     // Enable Timer0 interrupt
     TIMER_EnableInt(TIMER0);
     NVIC_SetPriority(TMR0_IRQn, 1);
     NVIC_EnableIRQ(TMR0_IRQn);

    // Start Timer0
     TIMER_Start(TIMER0);
    // Start application
     GUI_Main();
     while(1);
```

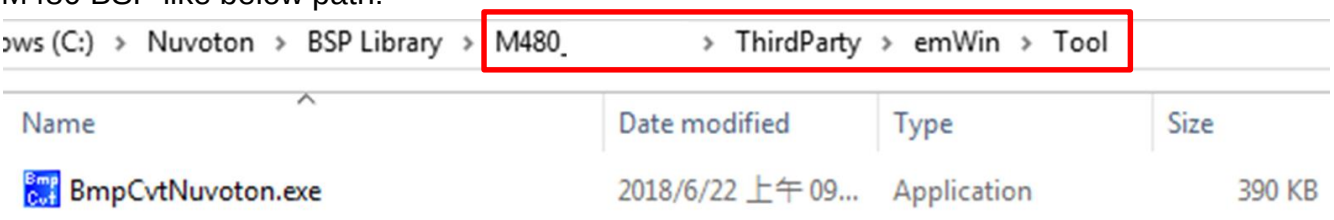
This SPIM_Init() function is to initialize some functions of SPIM. Some of the functions must be set such as SPIM clock, SPI flash detection, SPIM cache mode and SPIM DMM mode. There is a define, SPIM_CIPHER_ON to decide whether the data is encrypted or not.

```
/**
  * @brief  This function is used to initialize for SPIM
  * @param  None.
  * @retval None.
  */
#define SPIM_CIPHER_ON              1
void SPIM_Init(void)
{
    /* Set SPIM clock as HCLK divided by 2, 192MHz/2 = 96MHz */
    SPIM_SET_CLOCK_DIVIDER(1);
    /* Insert 0 delay cycle */
    SPIM_SET_RXCLKDLY_RDDLYSEL(0);
    /* Use SPI input clock rising edge to sample received data */
    SPIM_SET_RXCLKDLY_RDEDGE();
    /* Set dummy cycle number = 8 */
    SPIM_SET_DCNUM(8);
    /* Initialized SPI flash */
    if(SPIM_InitFlash(1) != 0) {
        …
    }
    /* Read SPI flash ID */
    SPIM_ReadJedecId(idBuf, sizeof (idBuf), 1);
    printf("SPIM get JEDEC ID=0x%02X, 0x%02X, 0x%02X\n", idBuf[0], idBuf[1], idBuf[2]);
    SPIM_DISABLE_CCM();
    /*SPIM_ENABLE_CACHE();*/
    SPIM_ENABLE_CACHE();
    /* Enable/Disable Cipher */
    if(SPIM_CIPHER_ON)
        SPIM_ENABLE_CIPHER();
    else
        SPIM_DISABLE_CIPHER();
    /* Set SPIM as 4 bytes mode */
    SPIM_Enable_4Bytes_Mode(0, 1);
    /* Invalidate cache */
    SPIM_INVALID_CACHE();
    /* Enter SPI DMM mode */
    SPIM_EnterDirectMapMode(0, CMD_DMA_FAST_READ, 0);
}
```

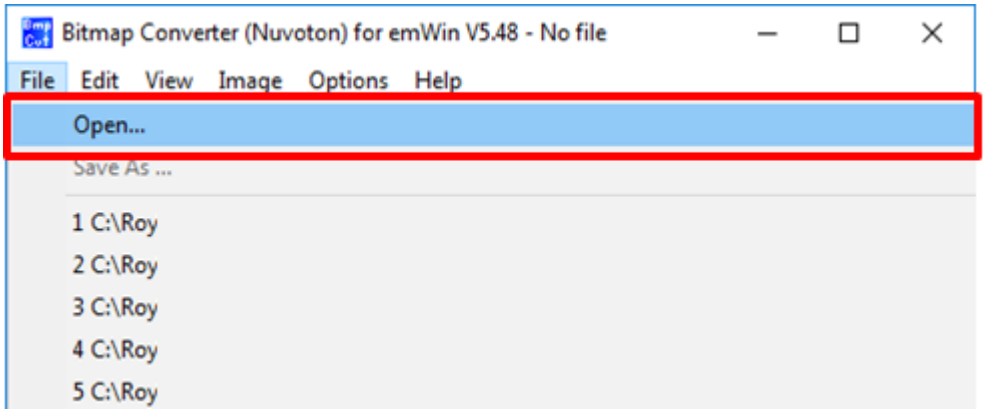
This GUI_Main () function is used to emWin API to show pictures. First, GUI_Init() function is initialized for setting regarding emWin configuration and display driver link and emWin initialization in GUI_Main () function. Second, the background color of display is used to GUI_SetBkColor function then refresh panel need to use GUI_Clear() function.

```
/**
  * @brief  SendRecData, prepare the record data for next ISO transfer.
  * @param  None.
  * @retval None.
  */
extern GUI_CONST_STORAGE GUI_BITMAP bmNuvoTon_320x240_1;
extern GUI_CONST_STORAGE GUI_BITMAP bmNuvoTon_320x240_2;
extern GUI_CONST_STORAGE GUI_BITMAP bmNuvoTon_320x240_3;
extern GUI_CONST_STORAGE GUI_BITMAP bmNuvoTon_320x240_4;
extern GUI_CONST_STORAGE GUI_BITMAP bmNuvoTon_320x240_5;
extern GUI_CONST_STORAGE GUI_BITMAP bmNuvoTon_320x240_6;
void GUI_Main(void)
{
    GUI_Init();
    GUI_SetBkColor(GUI_BLACK);
    GUI_Clear();
    while (1)
    {
        GUI_DrawBitmap(&bmNuvoTon_320x240_1,0 ,0);
        GUI_Delay(500);
        GUI_DrawBitmap(&bmNuvoTon_320x240_2,0 ,0);
        GUI_Delay(500);
        GUI_DrawBitmap(&bmNuvoTon_320x240_3,0 ,0);
        GUI_Delay(500);
        GUI_DrawBitmap(&bmNuvoTon_320x240_4,0 ,0);
        GUI_Delay(500);
        GUI_DrawBitmap(&bmNuvoTon_320x240_5,0 ,0);
        GUI_Delay(500);
        GUI_DrawBitmap(&bmNuvoTon_320x240_6,0 ,0);
        GUI_Delay(500);
    }
```

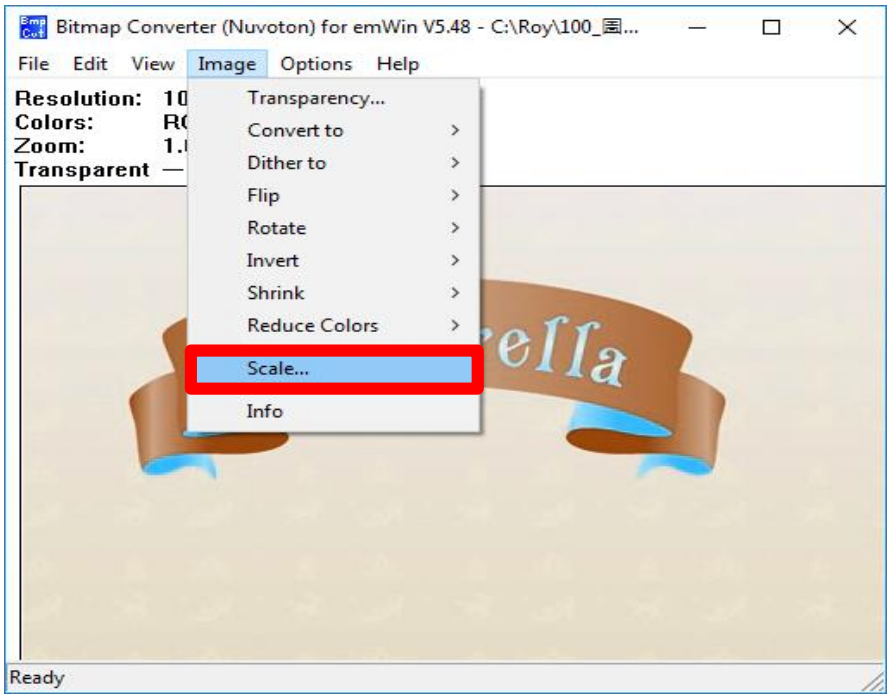
User need to open the tool of BmpCvtNuvoton to converter for emWin. The tool is at the M480 BSP like below path:



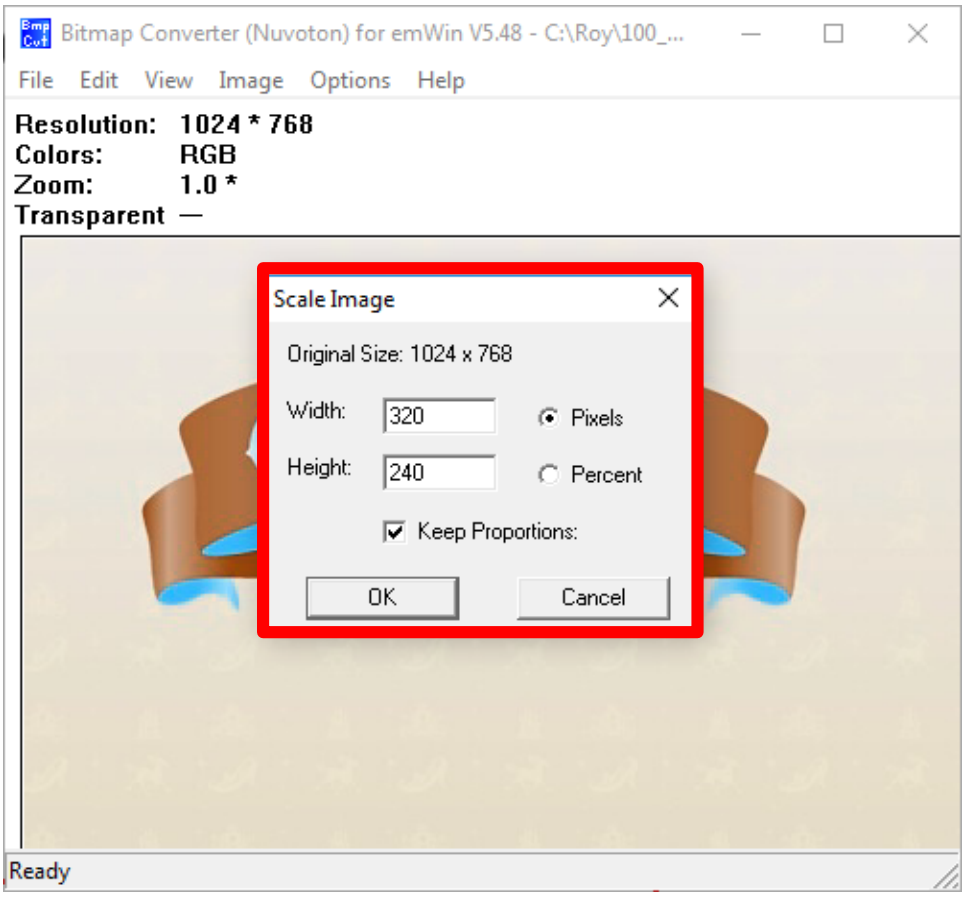
User have two ways to import pictures. You can drag the picture to the window of the tool or click file of tool bar to choose file location



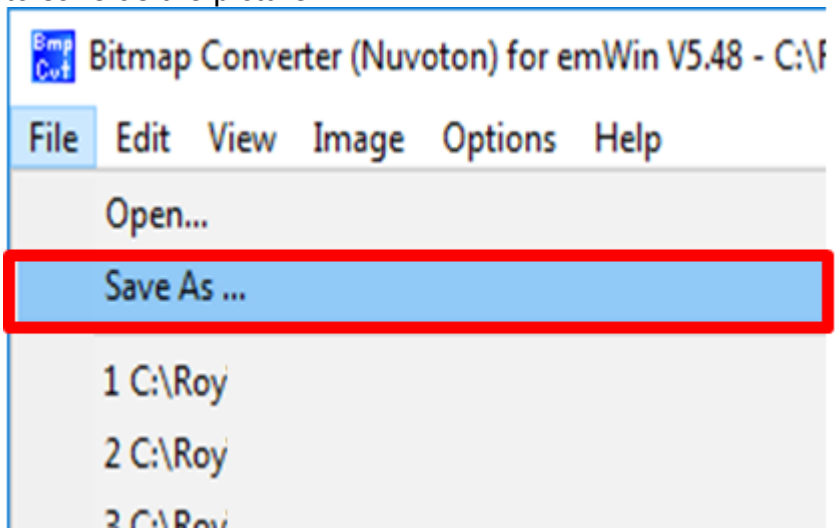
If the picture's size is too big to show whole picture in the screen, you must use scale to adjust picture's size.



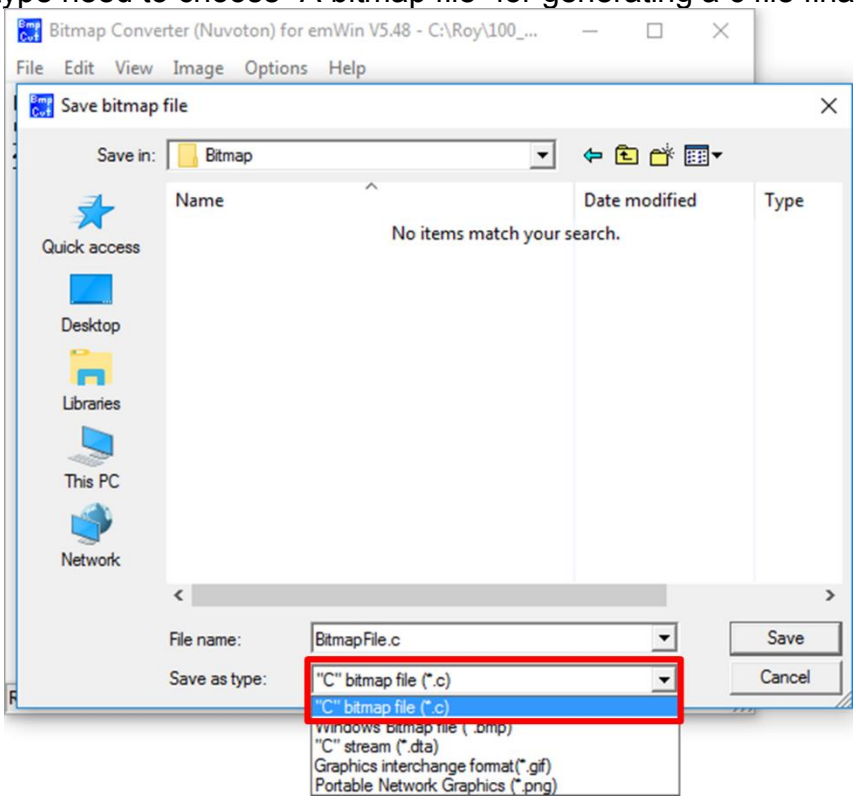
If the picture's size need to proportionate to adjust, you must tick the option of keep proportion.



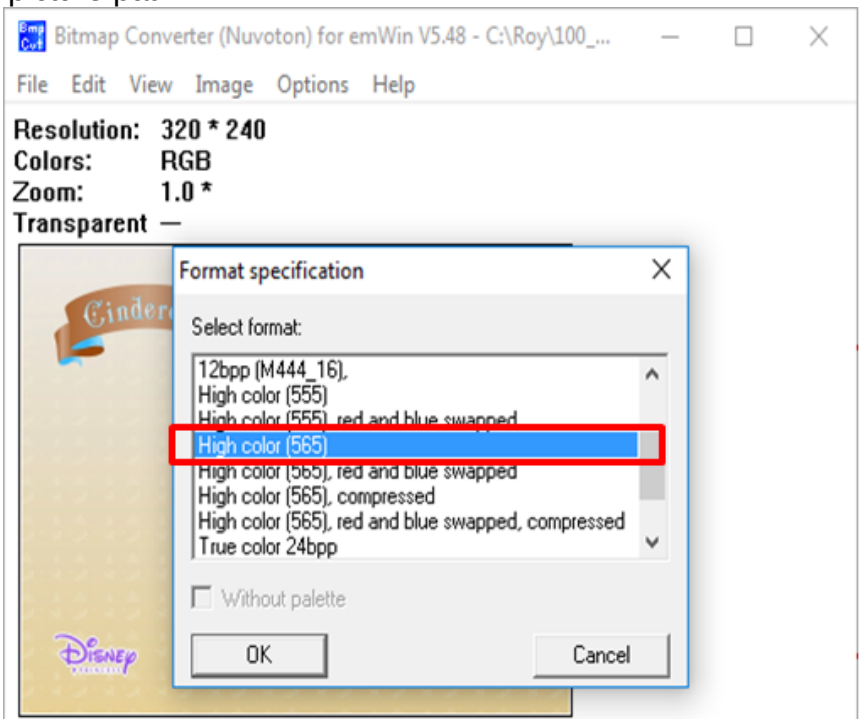
If user make sure the picture's size is right, then need to save as the picture, converting bitmap.
First, click "File" to save as the picture.



Second, the file type need to choose “A bitmap file” for generating a c file finally.



The converter type should be choosing High color 565, then click OK. A C file will be generated at the picture path.



3 Software and Hardware Environment

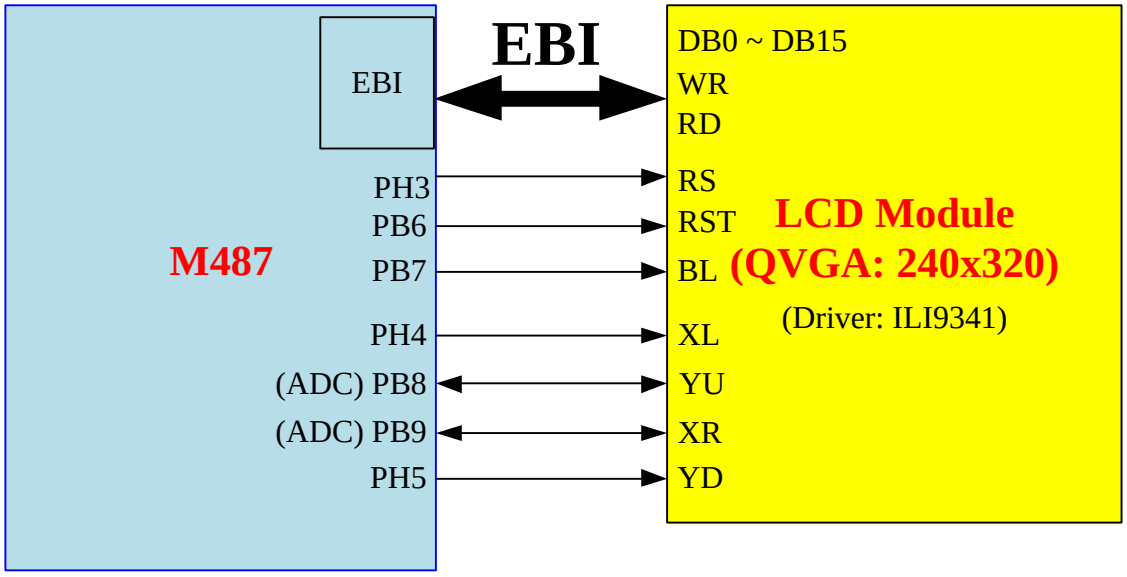
Software Environment

- BSP version
  - M480 Series BSP CMSIS V3.03.001
- IDE version
  - Keil uVersion 5.26

Hardware Environment

- Circuit components
  - NuMaker-PFM-M487 V3.0 board
  - M487 Advance Ver4.0
- Diagram

The below diagram is to show how to connect LCD module with M487 including EBI interface for communication, determination data or command by RS pin, module reset by RST pin, backlight control by BL pin and two ADC pin for measuring x and y coordinate。



4 Directory Information

- EC_M480_emWin_SimpleDemo_BMP_SPIM_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
  - ThirdParty
    - emWin — emWin is designed to provide an efficient, processor- and display controller-independent graphical user interface for any application that operates with a graphical display.

5 How to Execute Example Code?

1. Browsing into sample code folder by Directory Information (section 4) and double click emWin_SimpleDemo.uvproj.
2. Enter Keil compile mode
   a. Build
   b. Download
   c. Start/Stop debug session
3. Enter debug mode
   a. Run

6 Revision History

Date	Revision	Description
Aug. 08, 2019	1.00	1. Initially issued.

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