Completing COM/SEG LCD Project with NuTool-LCDView

Example Code Introduction for 32-bit NuMicro® Family

Document Information

Application	This example code uses NuMaker-M258KG as an example to show how to complete a COM/SEG LCD project using NuTool-LCDView.
BSP Version	M251_M252_M254_M256_M258_Series_BSP_CMSIS_V3.02.003
Hardware	NuMaker-M258KG V1.1

1. Overview

NuTool-LCDView is a powerful tool that can generate LCD configuration code and obtain real-time emulator COM/SEG status, and help engineers complete and debug LCD projects easier.

1.1 Principle

1.1.1 Functional Description

The NuTool-LCDView has two functional modes, create mode and emulator mode. Users need to set LCD panel, COM/SEG table and generate header file under the create mode. After building and loading code into MCU, users can see the effect on PC after switching to emulator mode. Furthermore, the NuTool-LCDView supports not only stand-alone version, but plug-in Keil IDE and plug-in IAR IDE. Users can execute single-step debug while seeing text on LCD in the same time in Keil or IAR IDE.

Please refer to NuTool-LCDView User Manual for more details of interface and operations.

1.1.2 Supported Chips

The NuTool-LCDView supports Arm® Cortex®-M23-based M254/M256/M258 series and M2354 series, and 8-bit-8051-based ML54 series and ML56 series.

1.2 Execution Steps

There are four steps to complete a COM/SEG LCD project with LCDView, as described in section 1.2.1 to 1.2.4.

1.2.1 Preparation of Hardware and Software

For the hardware, the NuMaker-M258KG evaluation board and COM/SEG LCD panel NuMaker-TNLCDSub_M258K are used as example.

For the software, there are three software tools that need to be prepared, including NuTool-LCDView, NuTool-PinConfigure, and Nu-Link Keil Driver. The NuTool-PinConfigure is used to configure pins, and then the pins are imported into NuTool-LCDView to show the corresponding pin number.To debug in Keil IDE, the Nu-Link Keil Driver is used to support the plug-in Keil IDE version. More description and examples can be found in section 1.2.2 and section 1.2.4 respectively.

Please refer to Chapter 3 to prepare for related hardware and software.

1.2.2 Editing LCD Contents in Create Mode

Follow the steps below to configure LCD pins in NuTool-PinConfigure, import to LCDView, and edit LCD panel and COM/SEG table in create mode.

1. Open NuTool-PinConfigure, and choose the target MCU series. Set the LCD pin according to the schematic file of NuMaker-M258KG, as shown in Figure 1-1 and Figure 1-2.

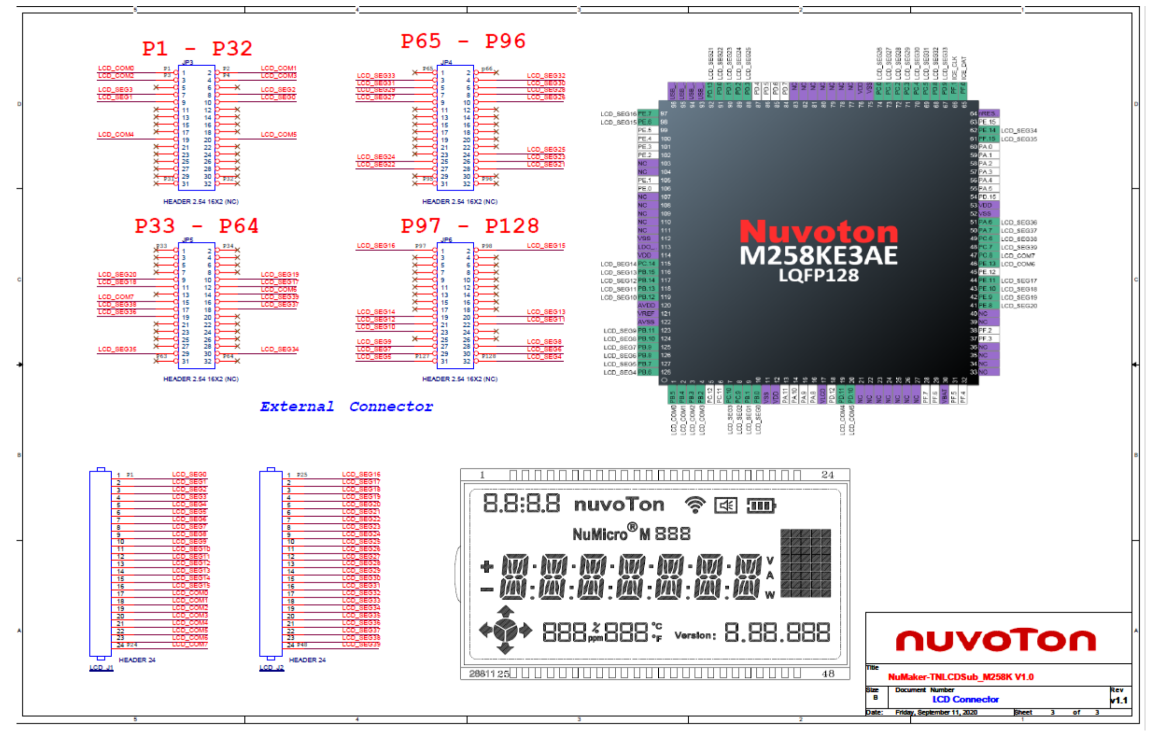
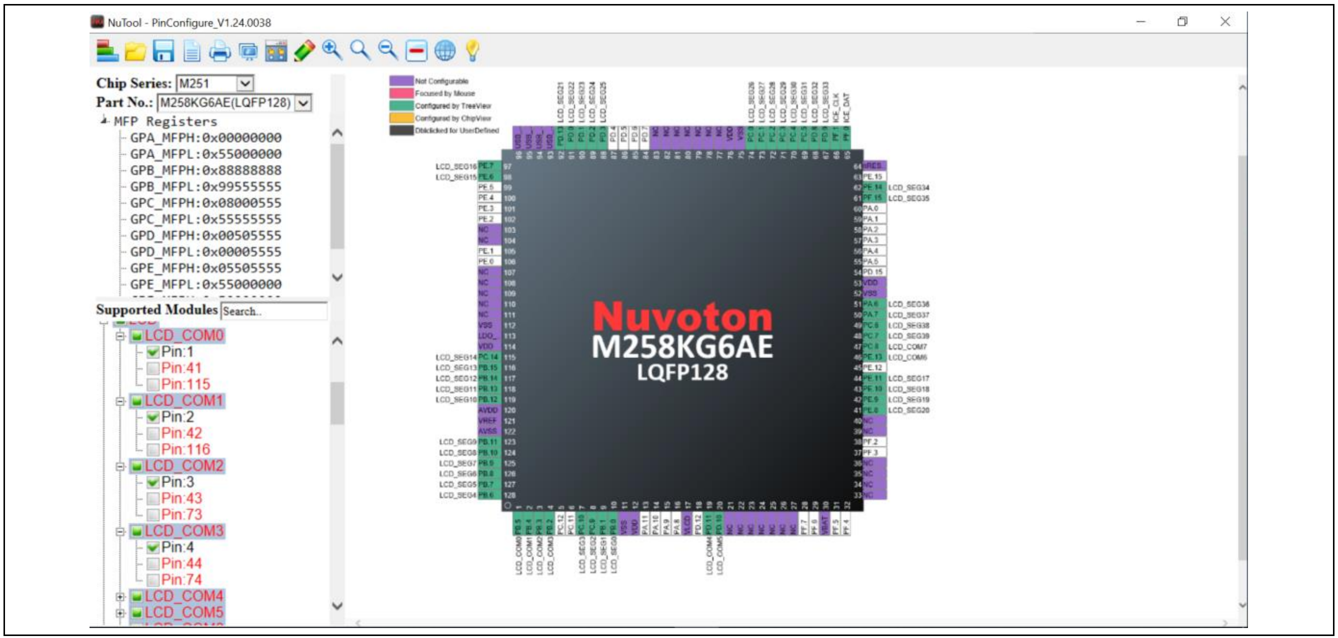


Figure 1-1 NuMaker-M258KG Schematic


NuTool - PinConfigure_V1.24.0038

Chip Series: M251

Part No.: M258KG6AE(LQFP128)

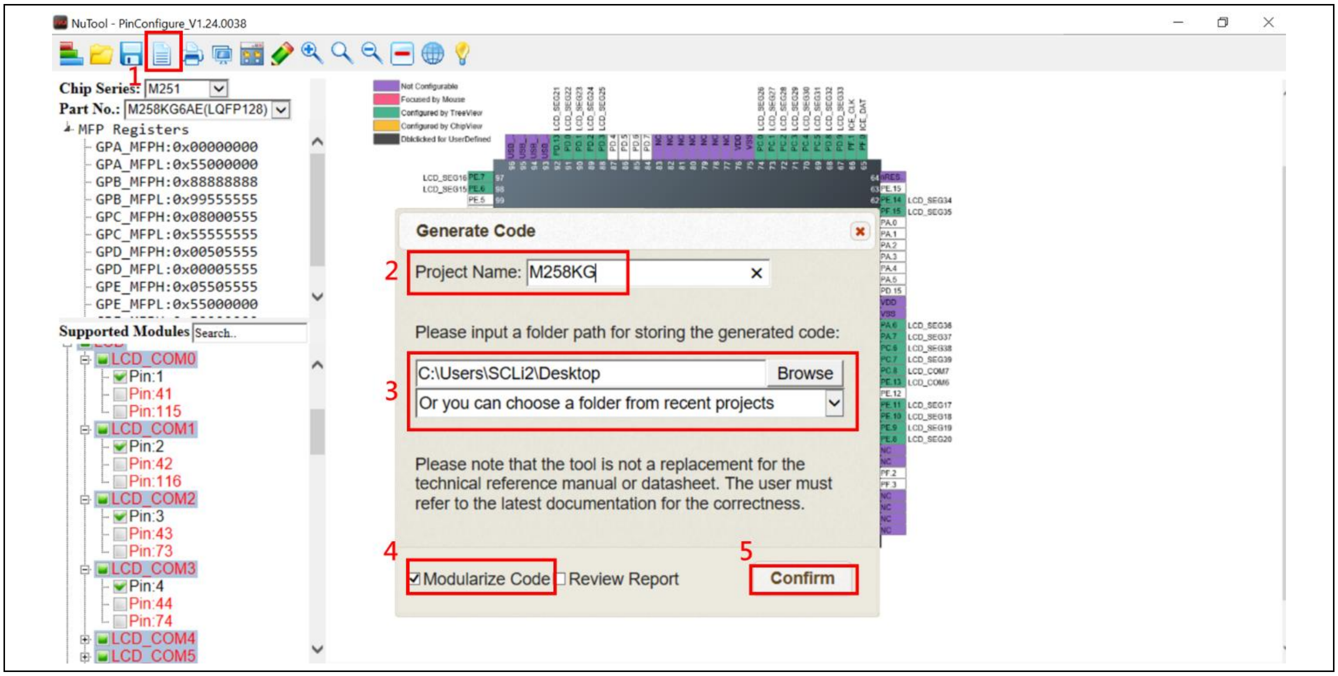
```
MFP Registers
  GPA_MFPH:0x00000000
  GPA_MFPL:0x55000000
  GPB_MFPH:0x88888888
  GPB_MFPL:0x99555555
  GPC_MFPH:0x08000555
  GPC_MFPL:0x55555555
  GPD_MFPH:0x00505555
  GPD_MFPL:0x00005555
  GPE_MFPH:0x05505555
  GPE_MFPL:0x55000000
```

Supported Modules

```
LCD_COM0
  ☑ Pin:1
  ☐ Pin:41
  ☐ Pin:115
LCD_COM1
  ☑ Pin:2
  ☐ Pin:42
  ☐ Pin:116
LCD_COM2
  ☑ Pin:3
  ☐ Pin:43
  ☐ Pin:73
LCD_COM3
  ☑ Pin:4
  ☐ Pin:44
  ☐ Pin:74
LCD_COM4
LCD_COM5
```

Figure 1-2 Config LCD Pin in NuTool-PinConfigure

2. Choose Generate Code, as the steps shown in Figure 1-3, then the NuTool-PinConfigure will generate a project file “M258KG.cfg” and a pin define file “M258KG.c”, which are applied later and Chapter 2 respectively.



NuTool - PinConfigure_V1.24.0038

Chip Series: M251

Part No.: M258KG6AE(LQFP128)

MFP Registers

```
GPA_MFPH:0x00000000
GPA_MFPL:0x55000000
GPB_MFPH:0x88888888
GPB_MFPL:0x99555555
GPC_MFPH:0x08000555
GPC_MFPL:0x55555555
GPD_MFPH:0x00505555
GPD_MFPL:0x00005555
GPE_MFPH:0x05505555
GPE_MFPL:0x55000000
```

Generate Code

2 Project Name: M258KG

Please input a folder path for storing the generated code:

3 C:\Users\SCLi2\Desktop — Browse

Or you can choose a folder from recent projects

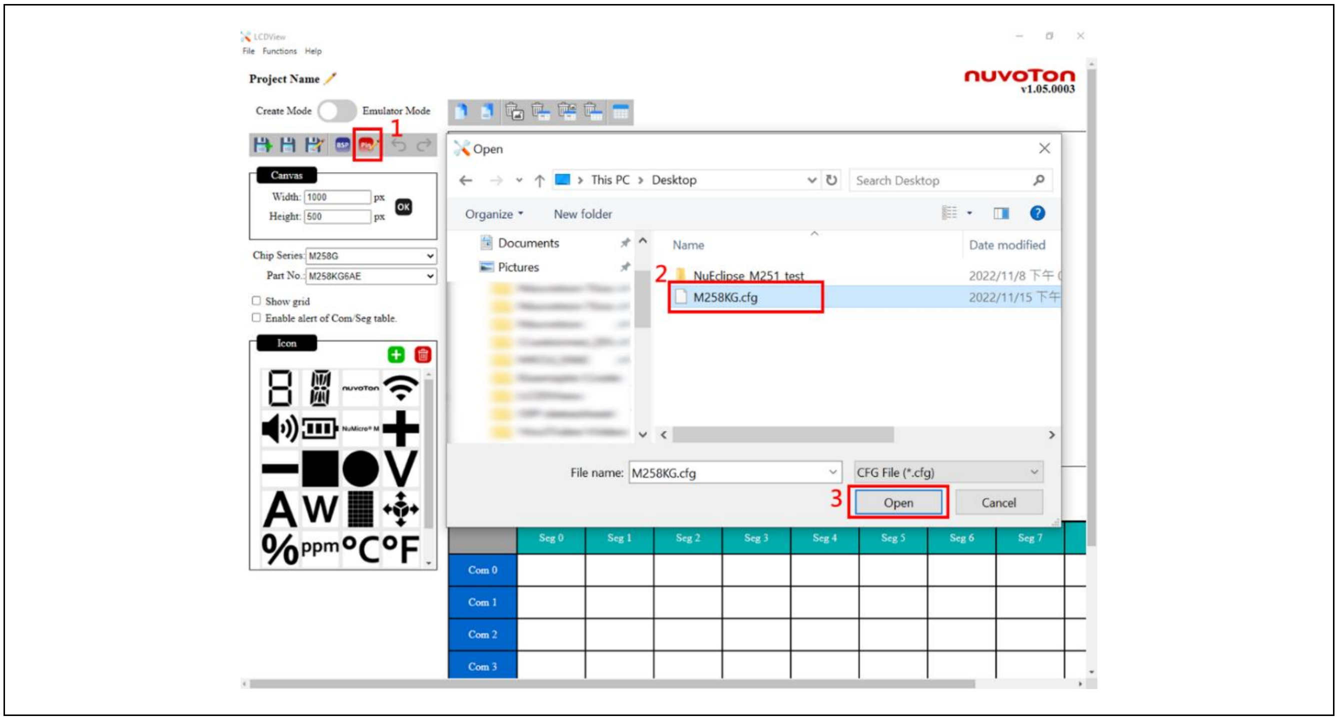
Please note that the tool is not a replacement for the technical reference manual or datasheet. The user must refer to the latest documentation for the correctness.

4 ☑ Modularize Code ☐ Review Report

5 Confirm

Figure 1-3 Save a NuTool-PinConfigure Project

3. Choose the target “Chip Series” in NuTool-LCDView and click Pin icon to import the file “M258KG.cfg” into LCDView, as shown in Figure 1-4. The MCU pin number would automatically map to the COM/SEG table, as shown in Figure 1-5.



Open

This PC › Desktop

Chip Series: M258G

Part No.: M258KG6AE

Canvas Width: 1000 px Height: 500 px

☐ Show grid

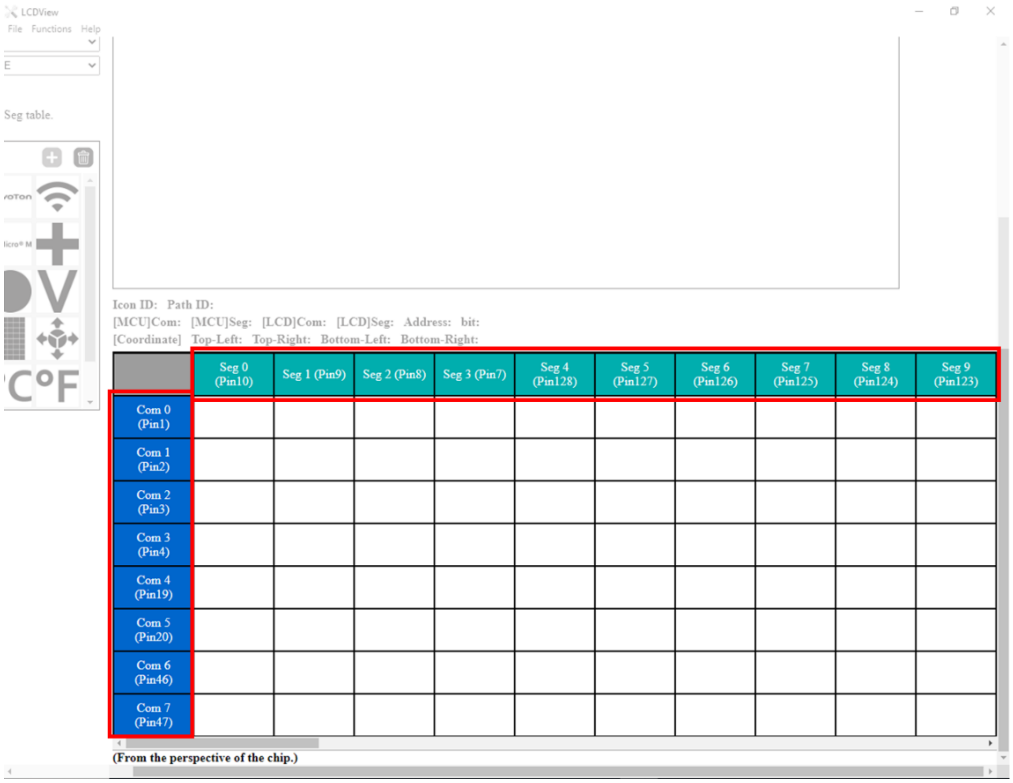
☐ Enable alert of Com/Seg table.

Name	Date modified
NuEclipse M251 test	2022/11/8 下午
M258KG.cfg	2022/11/15 下午

File name: M258KG.cfg — CFG File (*.cfg)

3 Open — Cancel

Figure 1-4 Import the M258KG.cfg into LCDView



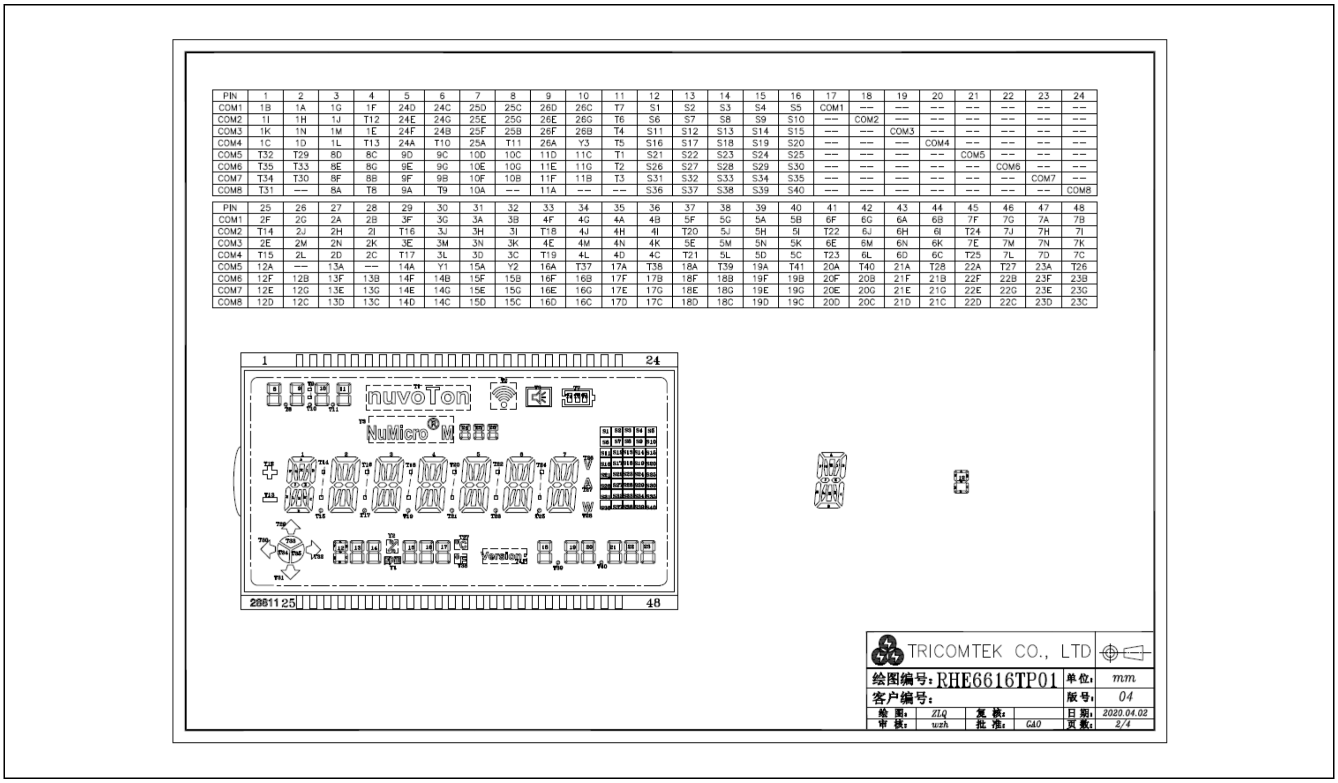
Icon ID: Path ID:
[MCU]Com: [MCU]Seg: [LCD]Com: [LCD]Seg: Address: bit:
[Coordinate] Top-Left: Top-Right: Bottom-Left: Bottom-Right:

	Seg 0 (Pin10)	Seg 1 (Pin9)	Seg 2 (Pin8)	Seg 3 (Pin7)	Seg 4 (Pin128)	Seg 5 (Pin127)	Seg 6 (Pin126)	Seg 7 (Pin125)	Seg 8 (Pin124)	Seg 9 (Pin123)
Com 0 (Pin1)										
Com 1 (Pin2)										
Com 2 (Pin3)										
Com 3 (Pin4)										
Com 4 (Pin19)										
Com 5 (Pin20)										
Com 6 (Pin46)										
Com 7 (Pin47)										

(From the perspective of the chip.)

Figure 1-5 MCU Pin Number Shown in COM/SEG Table

4. Refer to the specification of LCD panel, as shown in Figure 1-6. Drag and drop the figure from the icon database to the canvas to finish the whole placement of icons, as shown in Figure 1-7. The size and position of icons can be adjusted directly. Users can also add new icons with the “svg” file type into the icon database.

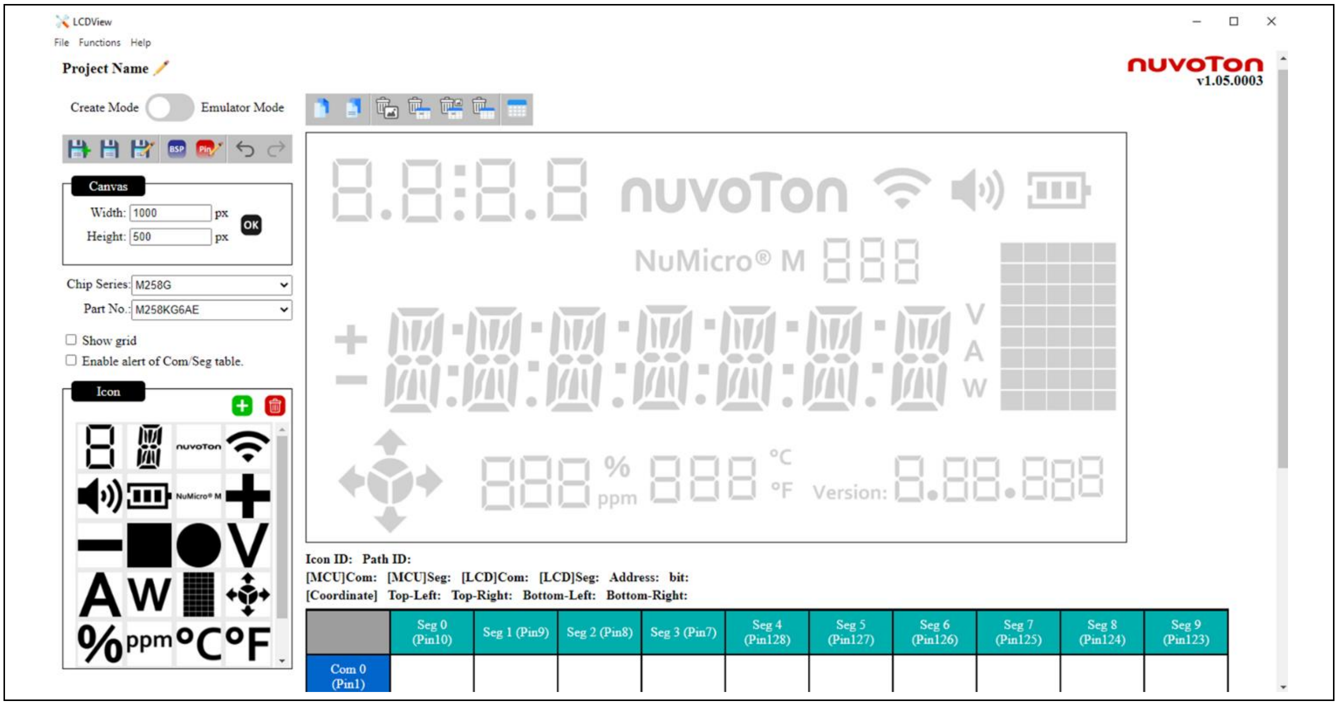


PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
COM1	1B	1A	1G	1F	24D	24C	25D	25C	26D	26C	T7	S1	S2	S3	S4	S5	COM1	--	--	--	--	--	--	--
COM2	1I	1H	1J	T12	24E	24G	25E	25G	26E	26G	T6	S6	S7	S8	S9	S10	--	COM2	--	--	--	--	--	--
COM3	1K	1N	1M	1E	24F	24B	25F	25B	26F	26B	T4	S11	S12	S13	S14	S15	--	--	COM3	--	--	--	--	--
COM4	1C	1D	1L	T13	24A	T10	25A	T11	26A	Y3	T5	S16	S17	S18	S19	S20	--	--	--	COM4	--	--	--	--
COM5	T32	T29	8D	8C	9D	9C	10D	10C	11D	11C	T1	S21	S22	S23	S24	S25	--	--	--	--	COM5	--	--	--
COM6	T35	T33	8E	8G	9E	9G	10E	10G	11E	11G	T2	S26	S27	S28	S29	S30	--	--	--	--	--	COM6	--	--
COM7	T34	T30	8F	8B	9F	9B	10F	10B	11F	11B	T3	S31	S32	S33	S34	S35	--	--	--	--	--	--	COM7	--
COM8	T31	--	8A	T8	9A	T9	10A	--	11A	--	--	S36	S37	S38	S39	S40	--	--	--	--	--	--	--	COM8

PIN	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
COM1	2F	2G	2A	2B	3F	3G	3A	3B	4F	4G	4A	4B	5F	5G	5A	5B	6F	6G	6A	6B	7F	7G	7A	7B
COM2	T14	2J	2H	2I	T16	3J	3H	3I	T18	4J	4H	4I	T20	5J	5H	5I	T22	6J	6H	6I	T24	7J	7H	7I
COM3	2E	2M	2N	2K	3E	3M	3N	3K	4E	4M	4N	4K	5E	5M	5N	5K	6E	6M	6N	6K	7E	7M	7N	7K
COM4	T15	2L	2D	2C	T17	3L	3D	3C	T19	4L	4D	4C	T21	5L	5D	5C	T23	6L	6D	6C	T25	7L	7D	7C
COM5	12A	--	13A	--	14A	Y1	15A	Y2	16A	T37	17A	T38	18A	T39	19A	T41	20A	T40	21A	T28	22A	T27	23A	T26
COM6	12F	12B	13F	13B	14F	14B	15F	15B	16F	16B	17F	17B	18F	18B	19F	19B	20F	20B	21F	21B	22F	22B	23F	23B
COM7	12E	12G	13E	13G	14E	14G	15E	15G	16E	16G	17E	17G	18E	18G	19E	19G	20E	20G	21E	21G	22E	22G	23E	23G
COM8	12D	12C	13D	13C	14D	14C	15D	15C	16D	16C	17D	17C	18D	18C	19D	19C	20D	20C	21D	21C	22D	22C	23D	23C

TRICOMTEK CO., LTD
绘图编号: RHE6616TP01 单位: mm
客户编号: 版号: 04
绘图: ZLQ 复核: 日期: 2020.04.02
审核: wzh 批准: GAO 页数: 2/4

Figure 1-6 Specification of LCD



Width: 1000 px
Height: 500 px

Chip Series: M258G
Part No.: M258KG6AE

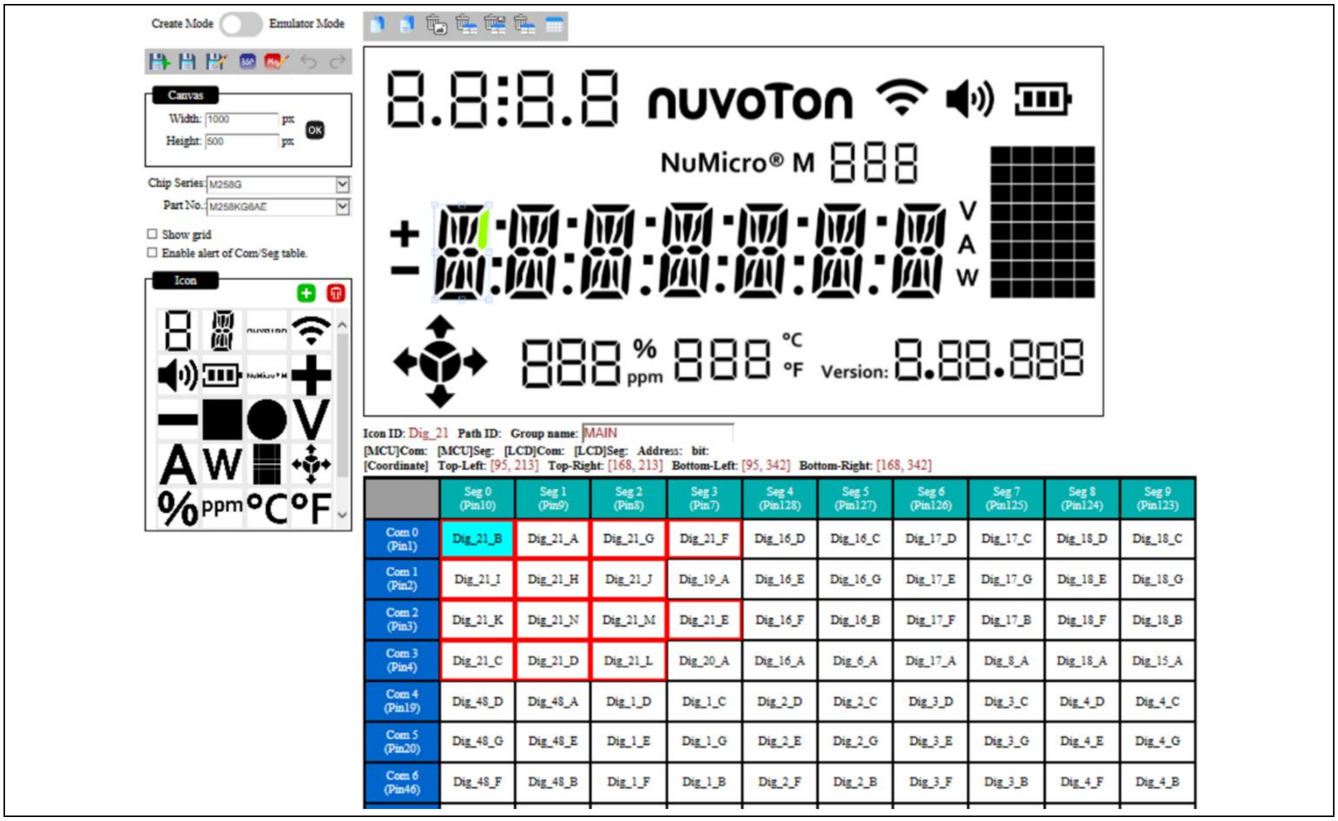
☐ Show grid
☐ Enable alert of Com/Seg table.

Icon ID: Path ID:
[MCU]Com: [MCU]Seg: [LCD]Com: [LCD]Seg: Address: bit:
[Coordinate] Top-Left: Top-Right: Bottom-Left: Bottom-Right:

	Seg 0 (Pin10)	Seg 1 (Pin9)	Seg 2 (Pin8)	Seg 3 (Pin7)	Seg 4 (Pin128)	Seg 5 (Pin127)	Seg 6 (Pin126)	Seg 7 (Pin125)	Seg 8 (Pin124)	Seg 9 (Pin123)
Com 0 (Pin1)										

Figure 1-7 Edit LCD Canvas according to the LCD Spec.

5. Click the icon and its relative COM/SEG to complete all the settings. As for the 7-segment and 14-segment display, user can set each seg in succession, as shown in Figure 1-8.



Width: 1000 px
Height: 600 px
Chip Series: M258G
Part No.: M258KG6AE
☐ Show grid
☐ Enable alert of Com/Seg table.

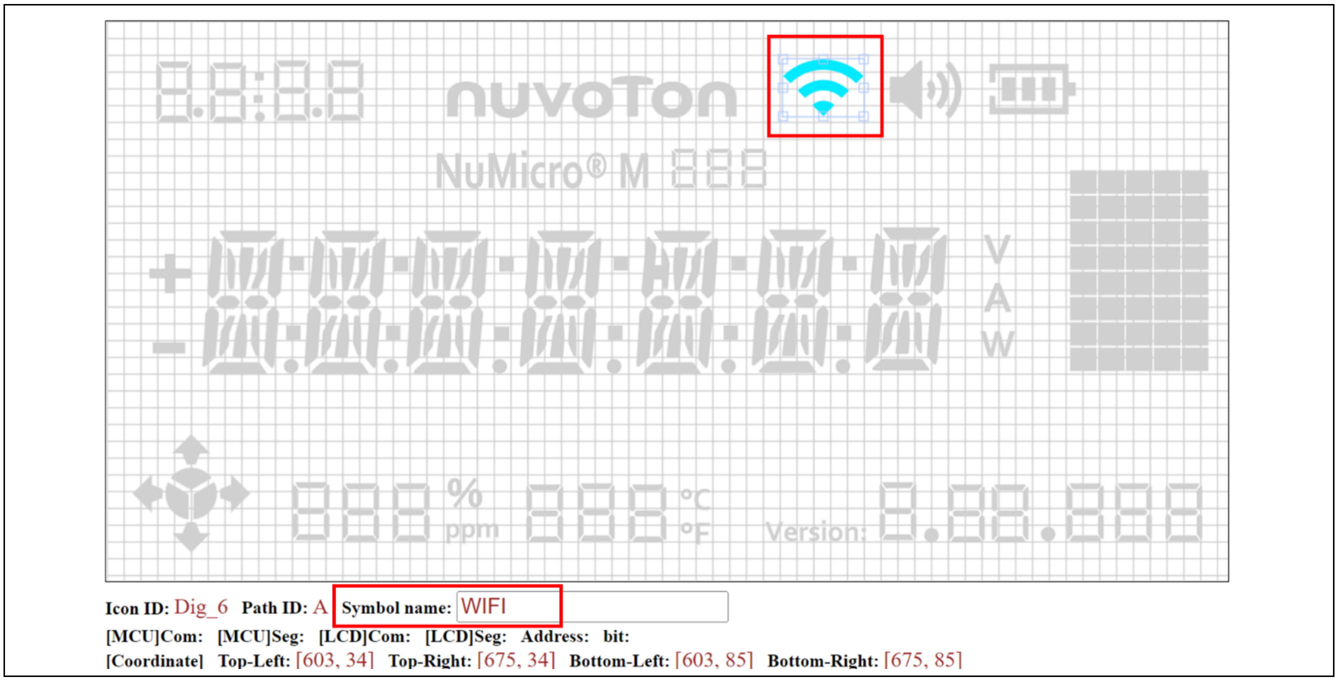
Icon ID: Dig_21 Path ID: Group name: MAIN
[MCU]Com: [MCU]Seg: [LCD]Com: [LCD]Seg: Address: bit:
[Coordinate] Top-Left: [95, 213] Top-Right: [168, 213] Bottom-Left: [95, 342] Bottom-Right: [168, 342]

	Seg 0 (Pin10)	Seg 1 (Pin9)	Seg 2 (Pin8)	Seg 3 (Pin7)	Seg 4 (Pin128)	Seg 5 (Pin127)	Seg 6 (Pin126)	Seg 7 (Pin125)	Seg 8 (Pin124)	Seg 9 (Pin123)
Com 0 (Pin1)	Dig_21_B	Dig_21_A	Dig_21_G	Dig_21_F	Dig_16_D	Dig_16_C	Dig_17_D	Dig_17_C	Dig_18_D	Dig_18_C
Com 1 (Pin2)	Dig_21_I	Dig_21_H	Dig_21_J	Dig_19_A	Dig_16_E	Dig_16_G	Dig_17_E	Dig_17_G	Dig_18_E	Dig_18_G
Com 2 (Pin3)	Dig_21_K	Dig_21_N	Dig_21_M	Dig_21_E	Dig_16_F	Dig_16_B	Dig_17_F	Dig_17_B	Dig_18_F	Dig_18_B
Com 3 (Pin4)	Dig_21_C	Dig_21_D	Dig_21_L	Dig_20_A	Dig_16_A	Dig_6_A	Dig_17_A	Dig_8_A	Dig_18_A	Dig_15_A
Com 4 (Pin19)	Dig_48_D	Dig_48_A	Dig_1_D	Dig_1_C	Dig_2_D	Dig_2_C	Dig_3_D	Dig_3_C	Dig_4_D	Dig_4_C
Com 5 (Pin20)	Dig_48_G	Dig_48_E	Dig_1_E	Dig_1_G	Dig_2_E	Dig_2_G	Dig_3_E	Dig_3_G	Dig_4_E	Dig_4_G
Com 6 (Pin46)	Dig_48_F	Dig_48_B	Dig_1_F	Dig_1_B	Dig_2_F	Dig_2_B	Dig_3_F	Dig_3_B	Dig_4_F	Dig_4_B

Figure 1-8 Assign Icons to Correct COM/SEG according to the LCD Specification

6. Define the icon name. The name would decide the icons' definition in the LCD header file, which is generated by LCDView.

   As shown in Figure 1-9, set the "wifi" icon as "WIFI", and the same as 7-segment and 14-segment, which can be set as a group. In Figure 1-10, "MAIN" is used as an example. The LCD API is provided by Nuvoton for users to use a function to print specific text on 14-segment display. The API function is discussed in section 1.2.3.

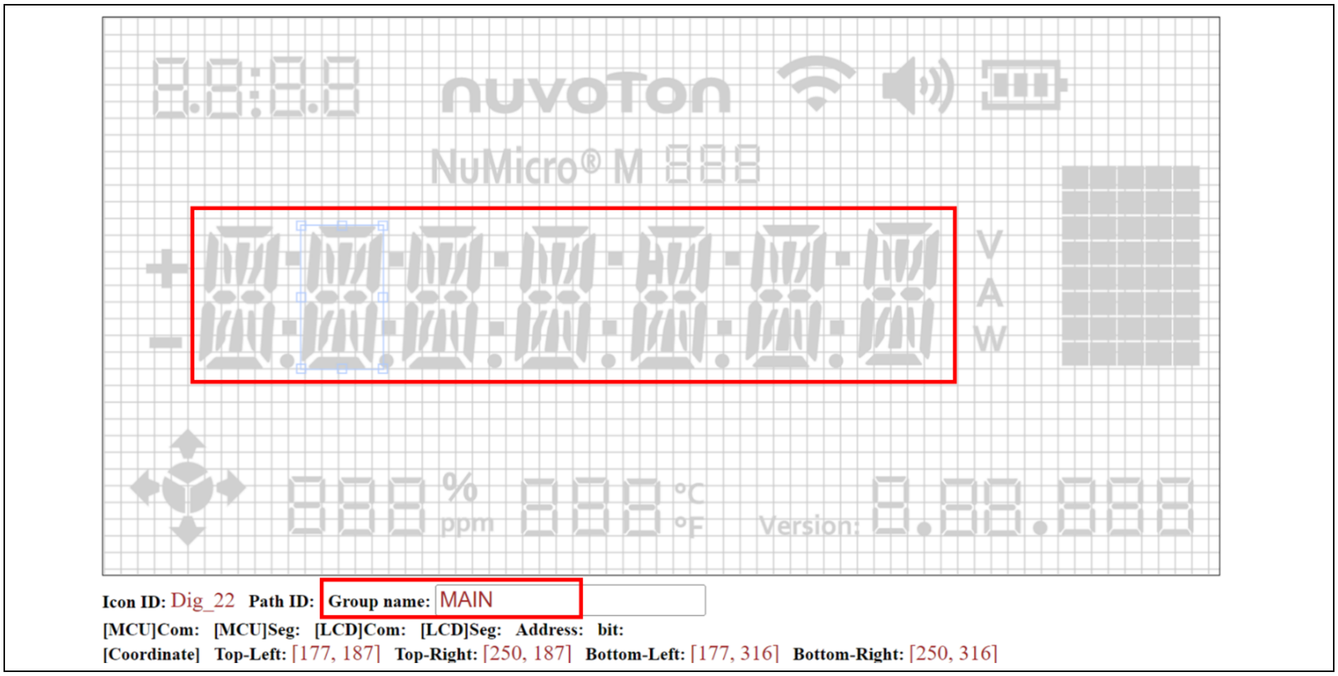


Icon ID: Dig_6 **Path ID:** A **Symbol name:** WIFI

[MCU]Com: **[MCU]Seg:** **[LCD]Com:** **[LCD]Seg:** **Address:** **bit:**

[Coordinate] **Top-Left:** [603, 34] **Top-Right:** [675, 34] **Bottom-Left:** [603, 85] **Bottom-Right:** [675, 85]

Figure 1-9 Example of the Definition for Icon Name



Icon ID: Dig_22 **Path ID:** **Group name:** MAIN

[MCU]Com: **[MCU]Seg:** **[LCD]Com:** **[LCD]Seg:** **Address:** **bit:**

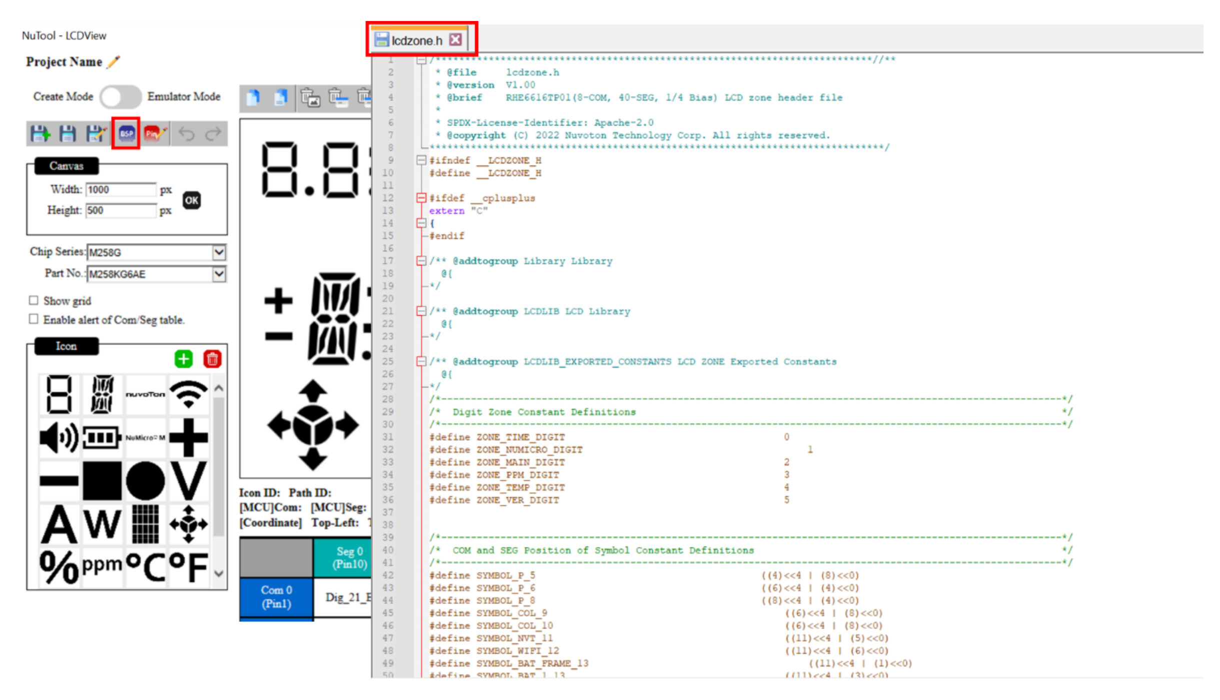
[Coordinate] **Top-Left:** [177, 187] **Top-Right:** [250, 187] **Bottom-Left:** [177, 316] **Bottom-Right:** [250, 316]

Figure 1-10 Example of the Definition for 7/14-segment Display

1.2.3 Coding

Follow the steps below to generate LCD header file by LCDView and import into LCD library.

1. Click the BSP icon BSP to generate the LCD header file, which is called lcdzone.h by default, as shown in Figure 1-11.



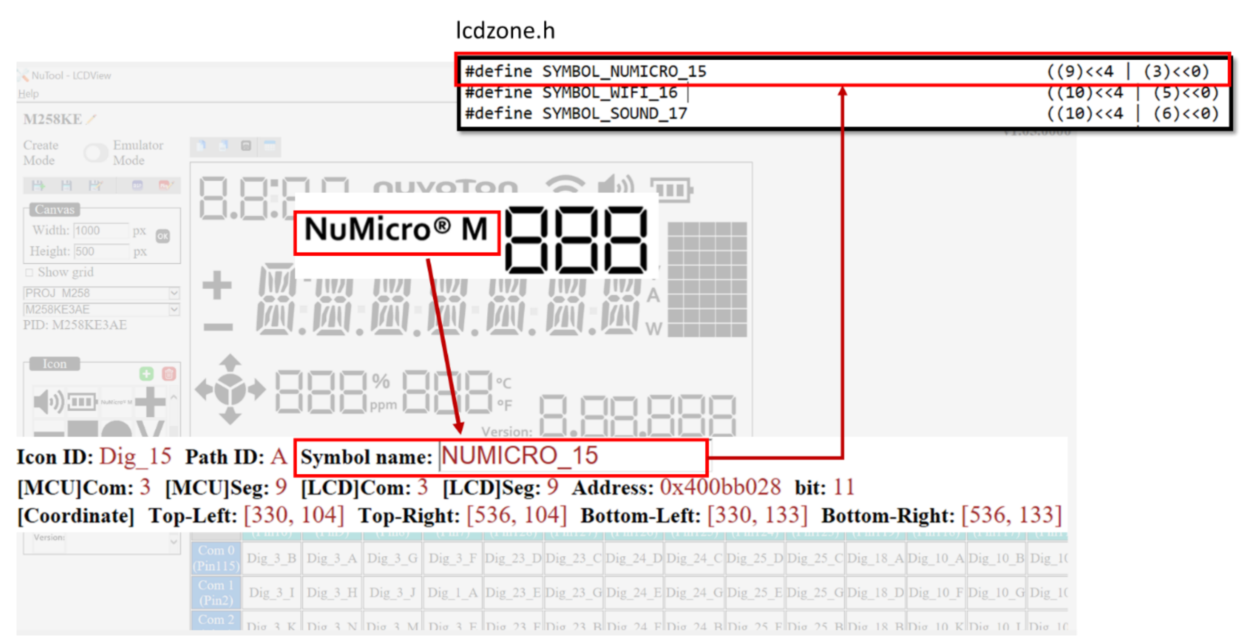
Width: 1000 px
Height: 500 px
Chip Series: M258G
Part No.: M258KG6AE
☐ Show grid
☐ Enable alert of Com/Seg table.

Icon ID: Path ID:
[MCU]Com: [MCU]Seg:
[Coordinate] Top-Left:

```
/*************************************************************************//**
 * @file     lcdzone.h
 * @version  V1.00
 * @brief    RHE6616TP01(8-COM, 40-SEG, 1/4 Bias) LCD zone header file
 *
 * SPDX-License-Identifier: Apache-2.0
 * @copyright (C) 2022 Nuvoton Technology Corp. All rights reserved.
*****************************************************************************/
#ifndef __LCDZONE_H
#define __LCDZONE_H

#ifdef __cplusplus
extern "C"
{
#endif

/** @addtogroup Library Library
  @{
*/

/** @addtogroup LCDLIB LCD Library
  @{
*/

/** @addtogroup LCDLIB_EXPORTED_CONSTANTS LCD ZONE Exported Constants
  @{
*/
/*---------------------------------------------------------------------------------------------------------*/
/*  Digit Zone Constant Definitions                                                                         */
/*---------------------------------------------------------------------------------------------------------*/
#define ZONE_TIME_DIGIT                                 0
#define ZONE_NUMICRO_DIGIT                                  1
#define ZONE_MAIN_DIGIT                                 2
#define ZONE_PPM_DIGIT                                  3
#define ZONE_TEMP_DIGIT                                 4
#define ZONE_VER_DIGIT                                  5


/*---------------------------------------------------------------------------------------------------------*/
/*  COM and SEG Position of Symbol Constant Definitions                                                     */
/*---------------------------------------------------------------------------------------------------------*/
#define SYMBOL_P_5                                  ((4)<<4 | (8)<<0)
#define SYMBOL_P_6                                  ((6)<<4 | (4)<<0)
#define SYMBOL_P_8                                  ((8)<<4 | (4)<<0)
#define SYMBOL_COL_9                                    ((6)<<4 | (8)<<0)
#define SYMBOL_COL_10                                   ((6)<<4 | (8)<<0)
#define SYMBOL_NVT_11                                   ((11)<<4 | (5)<<0)
#define SYMBOL_WIFI_12                                  ((11)<<4 | (6)<<0)
#define SYMBOL_BAT_FRAME_13                                 ((11)<<4 | (1)<<0)
#define SYMBOL_BAT_1_13                                 ((11)<<4 | (3)<<0)
```

Figure 1-11 Generate lcdzone.h by Clicking BSP Icon

2. Confirm the name of icons defined in LCDView to find the corresponding definition in lcdzone.h, as shown in Figure 1-12.

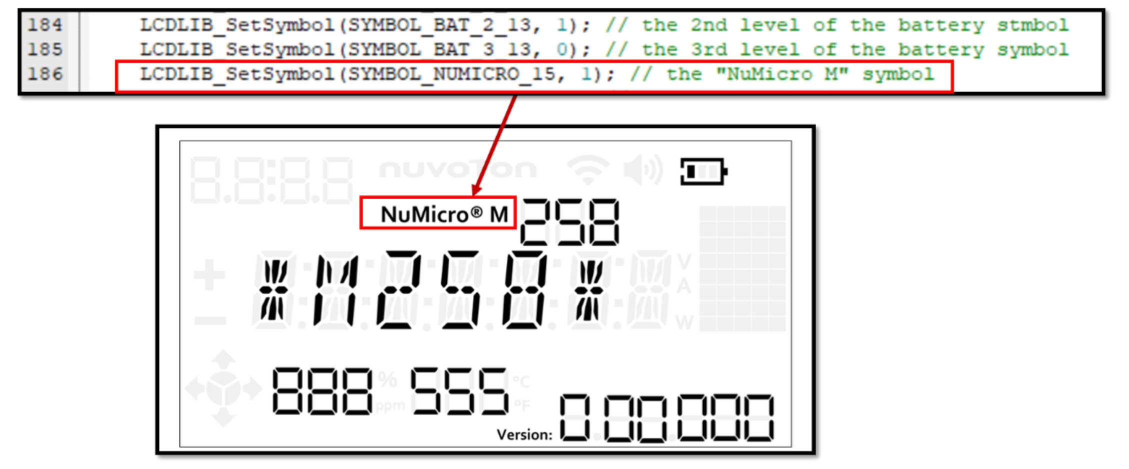


```
#define SYMBOL_NUMICRO_15                             ((9)<<4 | (3)<<0)
#define SYMBOL_WIFI_16                                ((10)<<4 | (5)<<0)
#define SYMBOL_SOUND_17                               ((10)<<4 | (6)<<0)
```

Icon ID: Dig_15 **Path ID:** A **Symbol name:** NUMICRO_15
[MCU]Com: 3 **[MCU]Seg:** 9 **[LCD]Com:** 3 **[LCD]Seg:** 9 **Address:** 0x400bb028 **bit:** 11
[Coordinate] **Top-Left:** [330, 104] **Top-Right:** [536, 104] **Bottom-Left:** [330, 133] **Bottom-Right:** [536, 133]

Figure 1-12 Definition in lcdzone.h Corresponding with the Name Specified in LCDView

3. Use Nuvoton’s API to bring up the specific icon. The effect is shown as Figure 1-13.



```
    LCDLIB_SetSymbol(SYMBOL_BAT_2_13, 1); // the 2nd level of the battery stmbol
    LCDLIB_SetSymbol(SYMBOL_BAT_3_13, 0); // the 3rd level of the battery symbol
    LCDLIB_SetSymbol(SYMBOL_NUMICRO_15, 1); // the "NuMicro M" symbol
```

Figure 1-13 Use API to Bring up the Specific Icon

4. Replace lcdzone.h under library directory with the one generated from LCDView. The file path is shown in Figure 1-14.

- EC_M258_LCD_View_V1.00
    - Library
        - LCDLib
            - Include
                - lcdzone.h

Figure 1-14 File Path of lcdzone.h

5. Edit main code. Please refer to Chapter 2 to have more information for main code.

1.2.4 Debugging and Emulating in Emulator Mode

The LCDView supports plug-in Keil IDE version. Make sure the Nu-Link Keil driver is the latest before using plug-in version.

Follow the steps below to execute single-step debug in Keil IDE.

1. Compile and build as shown in Chapter 5.
2. Click the debug session icon to enter debug mode in Keil IDE, and then open LCDView according the steps are shown in Figure 1-15 Steps for Opening LCDView in Debug Mode.

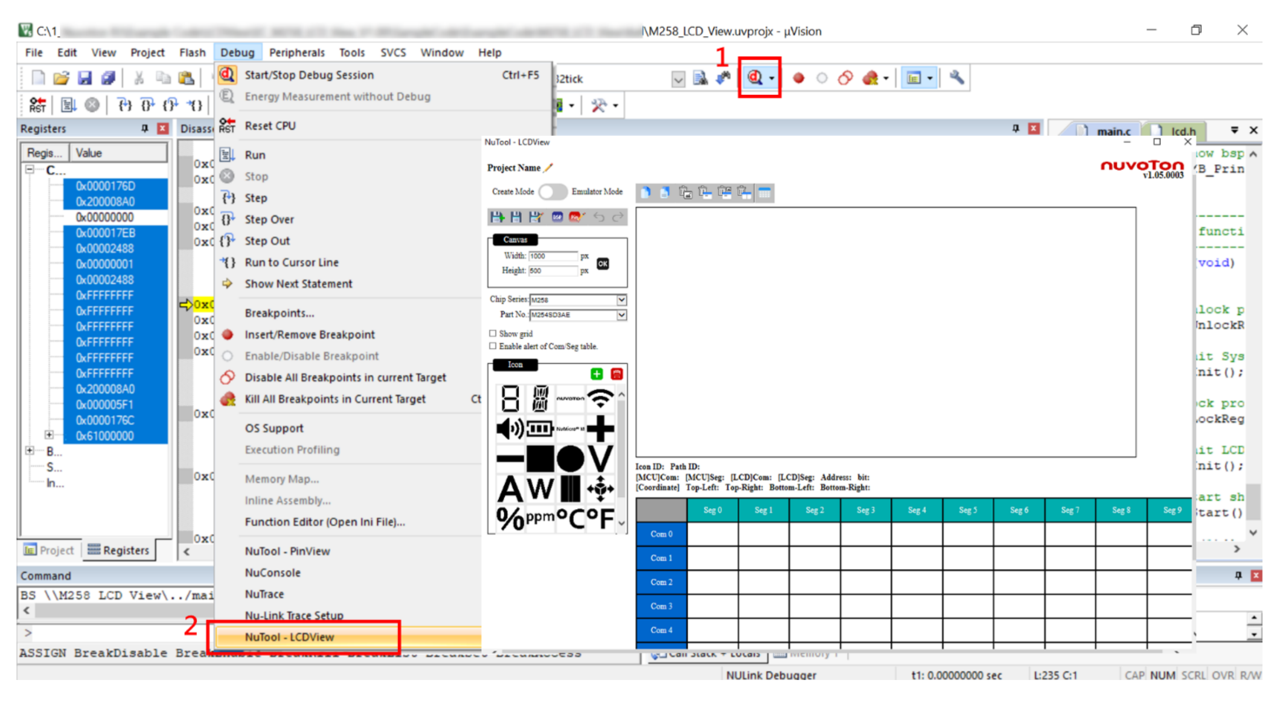


Figure 1-15 Steps for Opening LCDView in Debug Mode

3. Please refer to the step that Figure 1-16 and Figure1-17 show. Load the LCDView project file “NK-M258KG_EC_LCD.nvt” and switch to emulator mode.

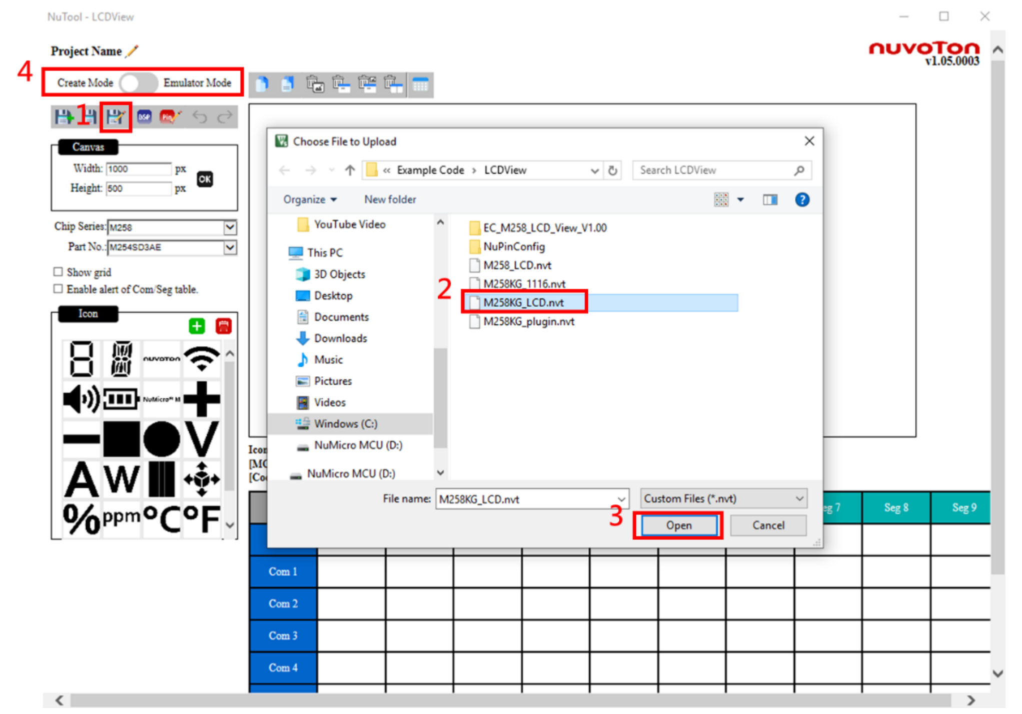
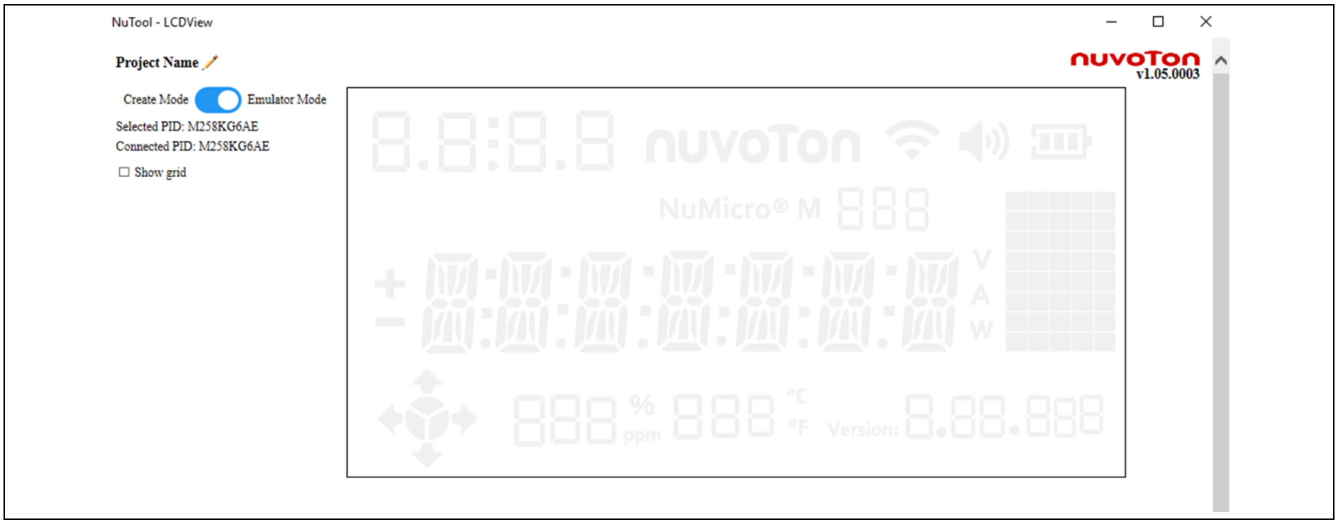


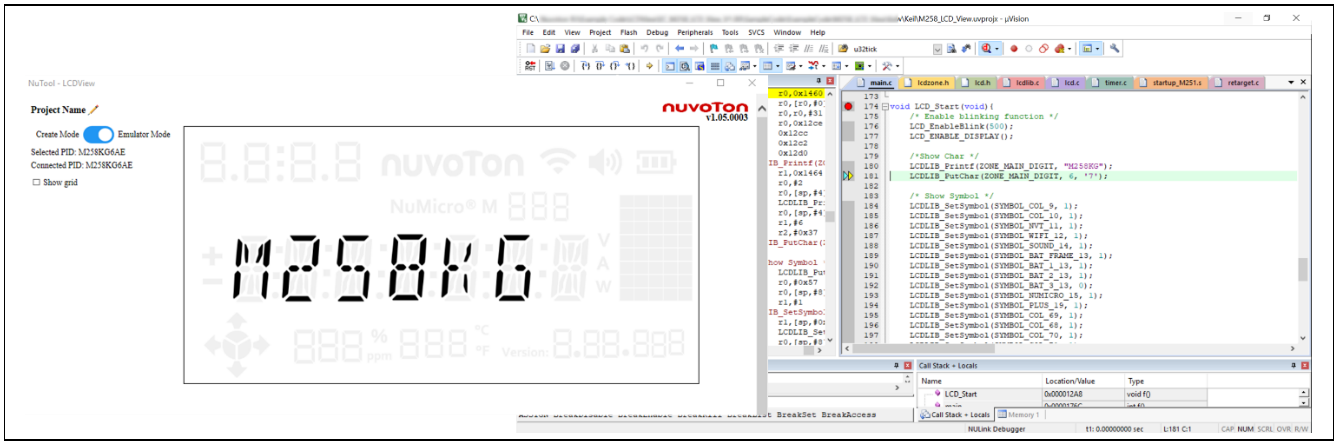
Figure 1-16 Load LCDView Project File and Switch to Emulator Mode



Selected PID: M258KG6AE
Connected PID: M258KG6AE
☐ Show grid

Figure1-17 Emulator Mode

4. LCDView will show the effect along with the single-step debug code, which greatly helps engineers to check the code before getting an actual LCD device, as shown in Figure 1-18.



Selected PID: M258KG6AE
Connected PID: M258KG6AE
☐ Show grid

```
void LCD_Start(void){
    /* Enable blinking function */
    LCD_EnableBlink(500);
    LCD_ENABLE_DISPLAY();

    /*Show Char */
    LCDLIB_Printf(ZONE_MAIN_DIGIT, "M258KG");
    LCDLIB_PutChar(ZONE_MAIN_DIGIT, 6, '7');

    /* Show Symbol */
    LCDLIB_SetSymbol(SYMBOL_COL_9, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_10, 1);
    LCDLIB_SetSymbol(SYMBOL_NVT_11, 1);
    LCDLIB_SetSymbol(SYMBOL_WIFI_12, 1);
    LCDLIB_SetSymbol(SYMBOL_SOUND_14, 1);
    LCDLIB_SetSymbol(SYMBOL_BAT_FRAME_13, 1);
    LCDLIB_SetSymbol(SYMBOL_BAT_1_13, 1);
    LCDLIB_SetSymbol(SYMBOL_BAT_2_13, 1);
    LCDLIB_SetSymbol(SYMBOL_BAT_3_13, 0);
    LCDLIB_SetSymbol(SYMBOL_NUMICRO_15, 1);
    LCDLIB_SetSymbol(SYMBOL_PLUS_19, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_69, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_68, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_70, 1);
```

Name	Location/Value	Type
LCD_Start	0x000012A8	void f()

Figure 1-18 Single-step Debug and Emulator Mode

1.3 Demo Result

The compilation and programming results of this example code are shown in Figure 1-19.

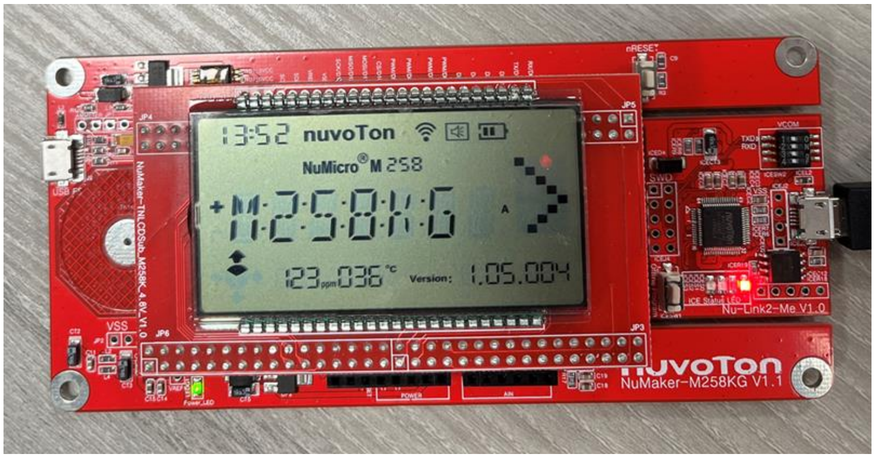


Figure 1-19 Demo Result

2. Code Description

The code located in *main.c* includes three parts:

- System initialization - SYS_Init(): To initialize system and peripheral clock.
- LCD initialization - LCD_Init(): To initialize LCD pin configuration, and LCD parameters.
- Bring up LCD - LCD_Start(): To show text on LCD with API in *lcdlib.c*.

```
int main(void)
{

    /* Unlock protected registers */
    SYS_UnlockReg();

    /* Init System, peripheral clock and multi-function I/O */
    SYS_Init();

    /* Lock protected registers */
    SYS_LockReg();

    /* Init LCD multi-function pins and settings */
    LCD_Init();

    /* Start showing the specific text */
    LCD_Start();

    while (1) {}

}
```

The function of SYS initialization includes enabling system clock, GPIO module clock and LCD module clock.

```
void SYS_Init(void)
{
    /* Enable all GPIO clock */
    CLK->AHBCLK |= (CLK_AHBCLK_GPACKEN_Msk | CLK_AHBCLK_GPBCKEN_Msk |
CLK_AHBCLK_GPCCKEN_Msk | CLK_AHBCLK_GPDCKEN_Msk |
                    CLK_AHBCLK_GPECKEN_Msk | CLK_AHBCLK_GPFCKEN_Msk);
    /* Init System Clock */
    /* Enable HIRC clock */
    CLK_EnableXtalRC(CLK_PWRCTL_HIRCEN_Msk);

    /* Waiting for HIRC clock ready */
    CLK_WaitClockReady(CLK_STATUS_HIRCSTB_Msk);

    /* Enable LIRC clock */
    CLK_EnableXtalRC(CLK_PWRCTL_LIRCEN_Msk);

    /* Waiting for LIRC clock ready */
    CLK_WaitClockReady(CLK_STATUS_LIRCSTB_Msk);

    /* Switch HCLK clock source to HIRC */
    CLK_SetHCLK(CLK_CLKSEL0_HCLKSEL_HIRC, CLK_CLKDIV0_HCLK(1));

    /* Set SysTick source to HCLK/2*/
    CLK_SetSysTickClockSrc(CLK_CLKSEL0_STCLKSEL_HCLK_DIV2);

    /* Configure LCD module clock */
    CLK_EnableModuleClock(LCD_MODULE);
    CLK_SetModuleClock(LCD_MODULE, CLK_CLKSEL2_LCDSEL_LIRC, 0);

}
```

The function of LCD initialization includes configuration of COM/SEG multi-function pin according to LCD specification. Users can copy the pin define function in M258KG.c, which is generated from NuTool-PinConfigure in steps of section 1.2.2.

LCD initialization also includes setting LCD parameters, such as duty, bias, frame rate, voltage, etc. Use LCD_Open and LCD_SET_CP_VOLTAGE to set the LCD parameters. In this example code, the LCD panel is NuMaker-TNLCDSub_M258K; according to its specification, set 1/8 duty, 1/4 bias, 64 MHz frame rate here. Please refer to the following code.

```
static S_LCD_CFG_T g_LCDCfg =
{
    /*!< LCD clock source frequency */
    __LIRC,
    /*!< COM duty */
    LCD_COM_DUTY_1_8,
    /*!< Bias level */
    LCD_BIAS_LV_1_4,
    /*!< Operation frame rate */
    64,
    /*!< Waveform type */
    LCD_WAVEFORM_TYPE_A_NORMAL,
    /*!< Interrupt source */
    LCD_DISABLE_ALL_INT,
    /*!< Driving mode */
    LCD_HIGH_DRIVING_OFF_AND_BUF_ON,
    /*!< Voltage source */
    LCD_VOLTAGE_SOURCE_CP,
};

void LCD_Init(void)
{
    uint32_t u32ActiveFPS;
    /* The definition of multifunction pin is generated from NuTool-PinConfigure.*/
    M258KG_init_lcd();

    /* Reset LCD module */
    SYS_ResetModule(LCD_RST);

    /* Output Setting Select */
    LCD_OUTPUT_SET(LCD_OUTPUT_SEL8_TO_COM4 | LCD_OUTPUT_SEL9_TO_COM5 |
                   LCD_OUTPUT_SEL10_TO_SEG20 | LCD_OUTPUT_SEL11_TO_SEG19 |
                   LCD_OUTPUT_SEL12_TO_SEG18 | LCD_OUTPUT_SEL13_TO_SEG17 |
                   LCD_OUTPUT_SEL14_TO_COM6 | LCD_OUTPUT_SEL15_TO_COM7 |
                   LCD_OUTPUT_SEL24_TO_SEG31 | LCD_OUTPUT_SEL25_TO_SEG30 |
                   LCD_OUTPUT_SEL26_TO_SEG29 | LCD_OUTPUT_SEL27_TO_SEG28 |
                 LCD_OUTPUT_SEL28_TO_SEG27 | LCD_OUTPUT_SEL29_TO_SEG26 |
                 LCD_OUTPUT_SEL41_TO_SEG14 | LCD_OUTPUT_SEL42_TO_SEG13 |
                 LCD_OUTPUT_SEL47_TO_SEG8 | LCD_OUTPUT_SEL48_TO_SEG7 |
                 LCD_OUTPUT_SEL49_TO_SEG6);

    /* LCD Initialize and calculate real frame rate */
    u32ActiveFPS = LCD_Open(&g_LCDCfg);

    /* Select output voltage level 9 for 4.8V */
    LCD_SET_CP_VOLTAGE(LCD_CP_VOLTAGE_LV_9);
}
```

After initializing the system and LCD, LCD_Start function shows how to bring up LCD and show text with the following APIs. Please find the bring up effect in section 1.3 Demo Result.

- LCDLIB_Printf(uint32_t u32Zone, char *InputStr)
  - Functional description:Show text on the area of 7-segment or 14-segment display, which set as the same group name in LCDView.
  - Parameters:
    - u32Zone:The group name that is assigned to display the text. The corresponding group name can be found in lcdzone.h, which is generated by LCDView.
    - InputStr:The text string to show on display.
- LCDLIB_PrintNumber(uint32_t u32Zone, uint32_t InputNum)
  - Functional description:Show number on the area of 7-segment or 14-segment display, which set as the same group name in LCDView.
  - Parameters:
    - u32Zone:The group name that is assigned to display the number. The corresponding group name can be found in lcdzone.h, which is generated by LCDView.
    - InputStr:The number to show on display.
- LCDLIB_PutChar(uint32_t u32Zone, uint32_t u32Index, uint8_t u8Ch)
  - Functional description:Show text on the specific position of 7-segment or 14-segment display, which set as the same group name in LCDView.
  - Parameters:
    - u32Zone:The group name that is assigned to display the text. The corresponding group name can be found in lcdzone.h, which is generated by LCDView.
    - u32Index:The specific position of the group.
    - u8Ch:The text string to show on display.
- LCDLIB_SetSymbol(uint32_t u32Symbol, uint32_t u32OnOff)

- Functional description:To set on/off on the specific symbol.
- Parameters:
  - u32Symbol:The name of the symbol. The corresponding symbol name can be found in lcdzone.h, which is generated by LCDView.
  - u32OnOff:Set 1 to display the symbol. Set 0 to not display it.

```
void LCD_Start(void)
{
    /* Enable LCD display */
    LCD_ENABLE_DISPLAY();

    /* Set the text to show on LCD. Please refer to the NK-M258KG_EC_LCD.nvt to check the
definition of the name. */
    /*Show text on the specific group with using LCDLIB_Printf */
    LCDLIB_Printf(ZONE_MAIN_DIGIT, "M258");

    /*Show char on the specific position of the group with using LCDLIB_PutChar() */
    LCDLIB_PutChar(ZONE_MAIN_DIGIT, 4, 'K');
    LCDLIB_PutChar(ZONE_MAIN_DIGIT, 5, 'G');

    /* Show number on the specific group with using LCDLIB_PrintNumber() */
    LCDLIB_PrintNumber(ZONE_TIME_DIGIT, 1352);
    LCDLIB_PrintNumber(ZONE_NUMICRO_DIGIT, 258);
    LCDLIB_PrintNumber(ZONE_PPM_DIGIT, 123);
    LCDLIB_PrintNumber(ZONE_TEMP_DIGIT, 36);
    LCDLIB_PrintNumber(ZONE_VER_DIGIT, 105004);

    /* Show the specific Symbol with using LCDLIB_SetSymbol() */
    LCDLIB_SetSymbol(SYMBOL_COL_9, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_10, 1);
    LCDLIB_SetSymbol(SYMBOL_NVT_11, 1);
    LCDLIB_SetSymbol(SYMBOL_WIFI_12, 1);
    LCDLIB_SetSymbol(SYMBOL_SOUND_14, 1);
    LCDLIB_SetSymbol(SYMBOL_BAT_FRAME_13, 1);
    LCDLIB_SetSymbol(SYMBOL_BAT_1_13, 1);
    LCDLIB_SetSymbol(SYMBOL_BAT_2_13, 1);
    LCDLIB_SetSymbol(SYMBOL_BAT_3_13, 0);
    LCDLIB_SetSymbol(SYMBOL_NUMICRO_15, 1);
    LCDLIB_SetSymbol(SYMBOL_PLUS_19, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_69, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_68, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_70, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_71, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_72, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_73, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_74, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_75, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_76, 1);
    LCDLIB_SetSymbol(SYMBOL_COL_77, 1);
    LCDLIB_SetSymbol(SYMBOL_A_29, 1);
    LCDLIB_SetSymbol(SYMBOL_S01_47, 1);
    LCDLIB_SetSymbol(SYMBOL_S07_47, 1);
    LCDLIB_SetSymbol(SYMBOL_S13_47, 1);
    LCDLIB_SetSymbol(SYMBOL_S19_47, 1);
    LCDLIB_SetSymbol(SYMBOL_S25_47, 1);
    LCDLIB_SetSymbol(SYMBOL_S29_47, 1);
    LCDLIB_SetSymbol(SYMBOL_S33_47, 1);
    LCDLIB_SetSymbol(SYMBOL_S37_47, 1);
    LCDLIB_SetSymbol(SYMBOL_CIRCLE_UP_48, 1);
    LCDLIB_SetSymbol(SYMBOL_ARROW_UP_48, 1);
    LCDLIB_SetSymbol(SYMBOL_TEMP_C_57, 1);
    LCDLIB_SetSymbol(SYMBOL_PPM_53, 1);
    LCDLIB_SetSymbol(SYMBOL_VERSION_59, 1);
    LCDLIB_SetSymbol(SYMBOL_P_66, 1);
    LCDLIB_SetSymbol(SYMBOL_P_67, 1);
}
```

3. Software and Hardware Requirements

3.1 Software Requirements

- BSP version
  - M251_M252_M254_M256_M258_Series_BSP_CMSIS_V3.02.003
- IDE version
  - Keil uVersion 5.37.0.0
- LCDView version V1.05.0004
- Nu-Link Keil Driver version V3.09.7443r

3.2 Hardware Requirements

- Circuit components
  - NuMaker-M258KG V1.1
  - NuMaker-TNLCDSub_M258K V1.0
- Nu-Link2-Me
  - Firmware Version V3.10.74xx
- LCD panel connected to NuMaker-M258KG
  - Connect the NuMaker-TNLCDSub_M258K to NuMaker-M258KG V1.1, as shown in Figure 3-1. Then, use a USB cable to connect Nu-Link2-Me USB connector to the PC USB porta as shown in Figure 3-2.

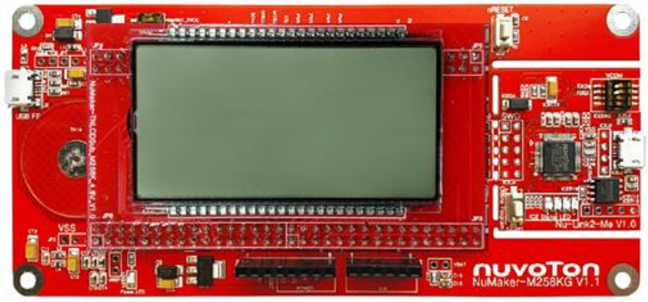


Figure 3-1 Connect NuMaker-TNLCDSub_M258K and NuMaker-M258KG V1.1

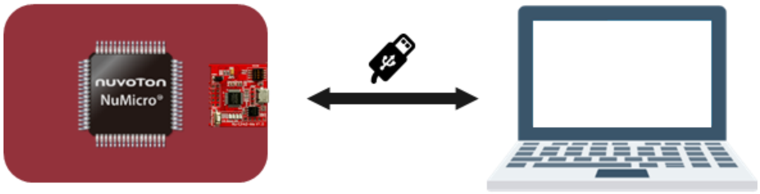


Figure 3-2 Use a USB cable to connect Nu-Link2-Me and PC USB port

4. Directory Information

The directory structure is shown below.

🗁 EC_M258_LCDView_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
🗁 LCDLib	Library for controlling LCD module
🗁 StdDriver	All peripheral driver header and source files
🗁 SampleCode	
🗁 ExampleCode	Source file of example code
🗁 NK-M258KG_EC_LCD.nvt	Sample file of LCDView for NuMaker-M258KG

Figure 4-1 Directory Structure

5. Example Code Execution

1. Browse the sample code folder as described in the Directory Information section and double-click *M258_LCD_View.uvprojx*.
2. Enter Keil compile mode.
   - Build
   - Download
   - Start/Stop debug session
3. Enter debug mode.
   - Run

6. Revision History

Date	Revision	Description
2022.11.30	1.00	Initial version.

Important Notice