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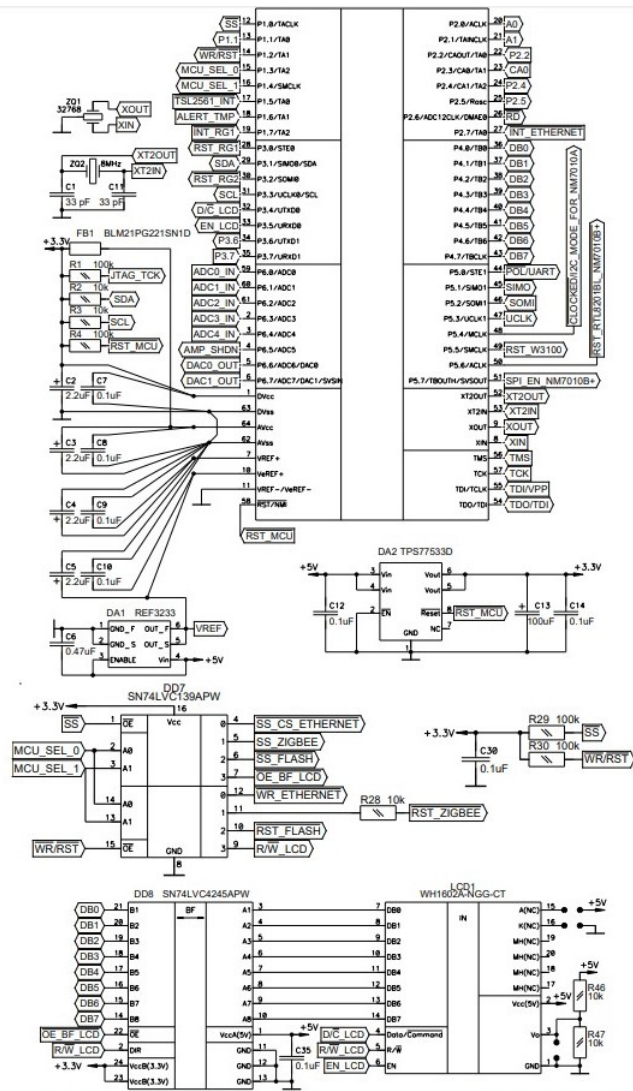
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:   Code Composer   MSP430,
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- Code Composer IDE.
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lcd.c

```c
#include "function_prototype.h"
#include "sysfunc.h"
#include "lcd.h"

char LCD_table[64]={
                    0x41,0xA0,0x42,0xA1,    //0xC0...0xC3 <=>
                    0xE0,0x45,0xA3,0x33,    //0xC4...0xC7 <=>
                    0xA5,0xA6,0x4B,0xA7,    //0xC8...0xCB <=>
                    0x4D,0x48,0x4F,0xA8,    //0xCC...0xCF <=>

                    0x50,0x43,0x54,0xA9,    //0xD0...0xD4 <=>
                    0xAA,0x58,0xE1,0xAB,    //0xD5...0xD7 <=>
                    0xAC,0xE2,0xAC,0xAE,    //0xD8...0xDB <=>
                    0x62,0xAF,0xB0,0xB1,    //0xDC...0xDF <=>

                    0x61,0xB2,0xB3,0xB4,    //0xE0...0xE4 <=>
                    0xE3,0x65,0xB6,0xB7,    //0xE5...0xE7 <=>
                    0xB8,0xA6,0xBA,0xBB,    //0xE8...0xEB <=>
                    0xBC,0xBD,0x6F,0xBE,    //0xEC...0xEF <=>

                    0x70,0x63,0xBF,0x79,    //0xF0...0xE4 <=>
                    0xE4,0xD5,0xE5,0xC0,    //0xF5...0xE7 <=>
                    0xC1,0xE6,0xC2,0xC3,    //0xF8...0xEB <=>
                    0XC4,0xC5,0xC6,0xC7     //0xFC...0xEF <=>
};

byte LCD_row, LCD_col, n;

void LCD_init()
{
  wait_1ms(20);
  P3DIR |= (D_nC_LCD + EN_LCD);
  Reset_EN_LCD();

  LCD_WriteCommand(0x3C);
   wait_1ms(1);

  LCD_WriteCommand(0x3C);
  wait_1ms(1);

  LCD_WriteCommand(0x0C);
  LCD_clear();

  LCD_WriteCommand(0x06);
}

void LCD_message(const char * buf){
  n = 0;
  while (buf[n]){
    if ( (LCD_row < LCD_MAXROWS-1) && (LCD_col >= LCD_MAXCOLS) )
      LCD_set_pos(++LCD_row, 0);
    if (LCD_col >= LCD_MAXCOLS )
      LCD_set_pos(0,0);
    LCD_WriteData( LCD_recode(buf[n]) );
    LCD_col++;
    n++;
```

```c
  }
}

void LCD_clear(){
  LCD_WriteCommand(0x01);
  LCD_row=0;
  LCD_col=0;
}

void LCD_set_pos(byte row, byte col){
  if (row > LCD_MAXROWS-1)
    row = LCD_MAXROWS-1;
  if (col > LCD_MAXCOLS-1)
    col = LCD_MAXCOLS-1;
  LCD_row = row;
  LCD_col = col;
  LCD_WriteCommand( BIT7 | ((0x40 * LCD_row) + LCD_col) );
}


byte LCD_get_row(){
  return LCD_row;
}


byte LCD_get_col(){
  return LCD_col;
}

void LCD_set_cursor(byte cursor){
  if (cursor > 3)
    cursor = 2;
  LCD_WriteCommand(cursor | BIT2 | BIT3);
}


void LCD_WriteCommand(char byte){
    LCD_WriteByte(byte, 0);
}


void LCD_WriteData(char byte){
    LCD_WriteByte(byte, 1);
}

void LCD_WriteByte(char byte, char D_nC){
  //
  DB_DIR = 0x00;
  //
  Set_MCU_SEL_0();
  Set_MCU_SEL_1();
  Reset_D_nC_LCD();
  Set_nWR_nRST();
  Reset_nSS();
  //
  Set_EN_LCD();
  Set_EN_LCD();
  Set_EN_LCD();
  //      busy flag
  while (DB_IN & BIT7);
```

```c
    Reset_EN_LCD();
    Set_nSS();
    if (D_nC) Set_D_nC_LCD();
    else Reset_D_nC_LCD();
    Reset_nWR_nRST();
    Reset_nSS();
    //
    DB_DIR = 0xFF;
    DB_OUT = byte;
    //
    Set_EN_LCD();
    Set_EN_LCD();
    Set_EN_LCD();
    Reset_EN_LCD();
    Set_nSS();
    DB_DIR = 0x00;
    Set_nWR_nRST();
}

char LCD_recode(char b){
    if (b<192) return b;
        else return LCD_table[b-192];
}
```

lcd.h

```c
#ifndef __LCD_H__
#define __LCD_H__

#define LCD_MAXCOLS 16
#define LCD_MAXROWS 2

#endif
```

main.c

```c
#include <msp430.h>
#include "stdio.h"
#include "system_define.h"
#include "system_variable.h"
#include "function_prototype.h"
#include "main.h"

/*
 * main.c
 */
void main(void) {
    //
    WDTCTL = WDTPW + WDTHOLD;
    //
    Init_System_Clock();
    Init_System();

    char i = 0;
    char send_str0[] = "      -31";
    char send_str1[] = "    ,     ";
    for(i=0;i<sizeof(send_str0);i++){
        send_str0[i] = LCD_recode(send_str0[i]);
    };
    for(i=0;i<sizeof(send_str1);i++){
```

```
        send_str1[i] = LCD_recode(send_str1[i]);
    };

    LCD_init();
    LCD_set_pos(0,0);
    LCD_message(send_str0);
    LCD_set_pos(1,0);
    LCD_message(send_str1);

    /*LCD_init();
    byte character[8] =
↪ {0b00011111,0b00011011,0b00011011,0b00011011,0b00010111,0b00011101,0b00010111,0b00011101};
    char i;
    for (i = 0;i<8;i++){
        LCD_WriteCommand(0x40 + i);
        LCD_WriteData(character[i]);
    }
    LCD_set_pos(0,0);
    LCD_WriteData(0);

    byte character1[8] =
↪ {0b00011111,0b00010001,0b00010001,0b00011111,0b0001001,0b00010001,0b00010001,0b00010001};
    for (i = 0;i<8;i++){
        LCD_WriteCommand(0x48 + i);
        LCD_WriteData(character1[i]);
    }
    LCD_set_cursor(2);
    LCD_set_pos(1,0);
    LCD_WriteData(1);*/
    while(1){};
}
```

sysfunc.c

```c
#include <msp430.h>
#include "sysfunc.h"

void Init_System(){
        P1DIR |= (nSS + nWR_nRST + MCU_SEL_0 + MCU_SEL_1);
        DB_DIR = 0x00;
}

void Init_System_Clock(){
        volatile byte i;
        BCSCTL1 &= ~XT2OFF;
        do{
                IFG1 &= ~OFIFG;
                for (i = 0xFF; i > 0; i--);
        }
        while ((IFG1 & OFIFG));
        BCSCTL2 |= SELM_2 | SELS;
}

void wait_1ms(word cnt){
  for (wait_i = 0; wait_i < cnt; wait_i++)
    for (wait_j = 0; wait_j < 1000; wait_j++);
}

void wait_1mks(word cnt){
  for (wait_i = 0; wait_i < cnt; wait_i++);
}
```

sysfunc.h

```c
#ifndef __SYSFUNC_H__
#define __SYSFUNC_H__
#include "system_define.h"

extern word wait_i, wait_j;

#endif
```