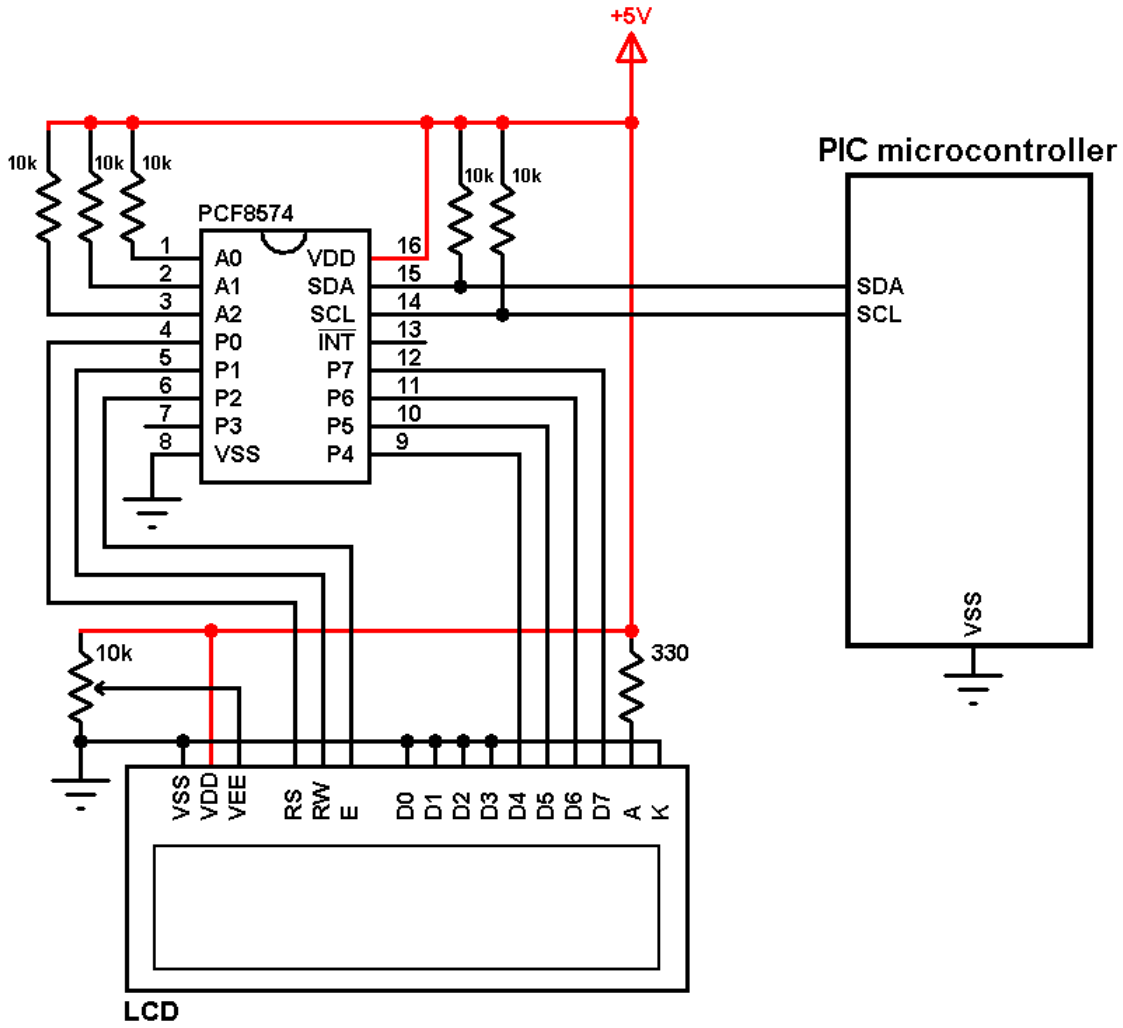
I2C LCD driver for CCS PIC C compiler

Interfacing LCD displays with a PIC microcontroller using CCS C compiler needs at least 7 data pins (using the built-in LCD driver). Number of pins needed for the LCD can be reduced to 2 by using an I2C I/O (Input/Output) expander like PCF8574 or PCF8574A. Adding the I2C I/O expander builds an I2C LCD. The I2C LCD is connected with the microcontroller via 2 lines: SDA (serial data) and SCL (serial clock). I2C = IIC = Inter-Integrated Circuit.
This post shows how to interface PIC microcontroller with I2C LCD using CCS C compiler where a driver (library) will be used to simplify the interfacing source codes for further project.
This driver works also with **DFRobot I2C LCD displays**since they've the same main circuit connections.

Interfacing PIC microcontroller with I2C LCD circuit:



(All grounded terminals are connected together)

The main component of the I2C LCD display is the PCF8574 I/O expander, with only two pins SDA and SCL we get a maximum of 8 pins from P0 to P7. PCF8574A also can be used but it has a different address.

All LCD data pins are connected to the PCF8574 where: RS, RW, E, D4, D5, D6 and D7 are connected to P0, P1, P2, P4, P5, P6 and P7 respectively.

PCF8574 I/O expander SDA and SCL pins are connected to the PIC microcontroller SDA and SCL pins respectively.

PCF8574 I/O expander A0, A1 and A2 pins are the address pins which decide the I2C address of the chip. In this example each pin is connected to +5V through a 10k ohm resistor (the 10k resistor is optional, each pin can be connected directly to +5V).

The I2C address of the PCF8574 is: 0 1 0 0 A2 A1 A0 0
In the circuit shown above A2, A1 and A0 are connected to +5V (through 10k resistors) which means the I2C address is equal to 0x4E.

If the PCF8574A is used instead of the PCF8574 the I2C address is: 0 1 1 1 A2 A1 A0 0 = 0x7E.

The LCD and the PCF8574 are supplied with 5V.
Note that PCF8574T is the same as PCF8574 and PCF8574AT is the same as PCF8574A.

I2C LCD driver for CCS PIC C compiler:

Driver source code is below which can be downloaded from the link below.
I2C LCD driver download

User functions:

```
LCD_Begin(unsigned int8 _i2c_addr);  // Must be called before any other function, _i2c_addr is the I2C I/O expander address, for example 0x27.
LCD_Goto(unsigned int8 col, unsigned int8 row);  // Set write position on LCD (upper left is 1,1 and second row first position is 1,2)
LCD_Out(unsigned int8 LCD_Char);    // Display Char on the LCD
LCD_Cmd(unsigned int8 Command);  // Send a command to the LCD
```

The following commands can be used with LCD_Com function (example: LCD_Com(LCD_CLEAR);):

Command	Description
LCD_FIRST_ROW	Move cursor to the 1st row
LCD_SECOND_ROW	Move cursor to the 2nd row
LCD_THIRD_ROW	Move cursor to the 3rd row

LCD_FOURTH_ROW	Move cursor to the 4th row
LCD_CLEAR	Clear display
LCD_RETURN_HOME	Return cursor to home position, returns a shifted display to its original position. Display data RAM is unaffected
LCD_CURSOR_OFF	Turn off cursor
LCD_UNDERLINE_ON	Underline cursor on
LCD_BLINK_CURSOR_ON	Blink cursor on
LCD_MOVE_CURSOR_LEFT	Move cursor left without changing display data RAM
LCD_MOVE_CURSOR_RIGHT	Move cursor right without changing display data RAM
LCD_TURN_ON	Turn Lcd display on
LCD_TURN_OFF	Turn Lcd display off
LCD_SHIFT_LEFT	Shift display left without changing display data RAM
LCD_SHIFT_RIGHT	Shift display right without changing display data RAM

Driver source code:

```c
// CCS C driver code for I2C LCDs (HD44780
// https://simple-circuit.com/


#define LCD_BACKLIGHT          0x08
#define LCD_NOBACKLIGHT        0x00
#define LCD_FIRST_ROW          0x80
#define LCD_SECOND_ROW         0xC0
#define LCD_THIRD_ROW          0x94
#define LCD_FOURTH_ROW         0xD4
#define LCD_CLEAR              0x01
#define LCD_RETURN_HOME        0x02
#define LCD_ENTRY_MODE_SET     0x04
#define LCD_CURSOR_OFF         0x0C
#define LCD_UNDERLINE_ON       0x0E
#define LCD_BLINK_CURSOR_ON    0x0F
#define LCD_MOVE_CURSOR_LEFT   0x10
#define LCD_MOVE_CURSOR_RIGHT  0x14
#define LCD_TURN_ON            0x0C
#define LCD_TURN_OFF           0x08

#define LCD_SHIFT_LEFT         0x18
```

```
23  #define LCD_SHIFT_RIGHT         0x1E
24
25  #ifndef LCD_TYPE
26     #define LCD_TYPE 2                 // 0=5x7, 1
```

Examples:

Interfacing PIC12F1822 microcontroller with I2C LCD