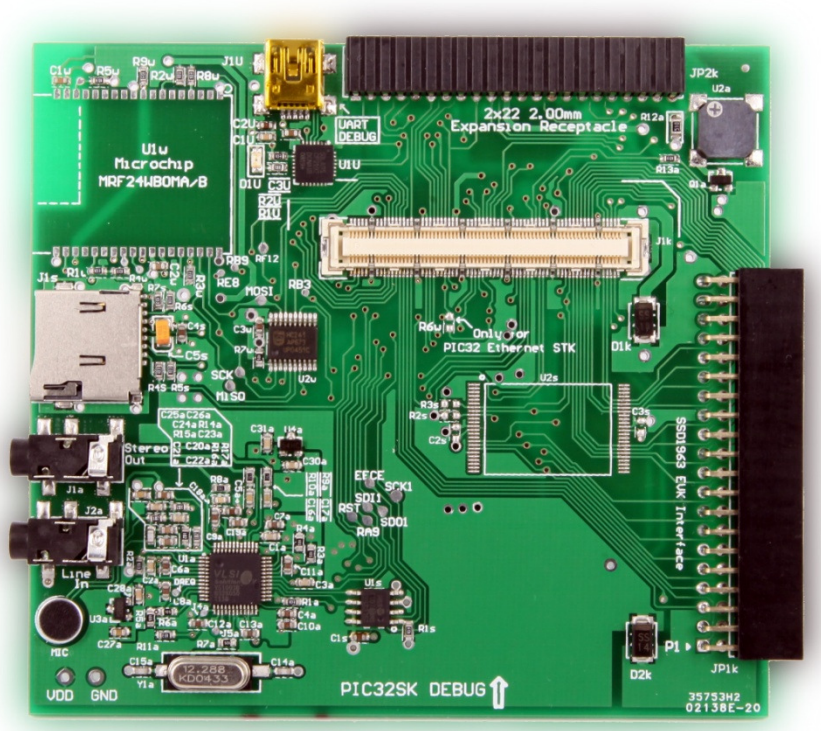
Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Expansion Board for Microchip PIC32 Starter Kits

PIC32-SSD1963 Multimedia Evaluation Kit



Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

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Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Revisions

	Date
First draft……..	26th July 2011

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Chapter 1. Introduction

1.1 Overview

The PIC32-SSD1963 Multimedia Evaluation Kit (MMEVK) is a development board designed to work with our SSD1963 Evaluation Kit (SSD1963EVK)[i] together with any of the Microchip PIC32 Starter Kits. There are three variants of PIC32 Starter Kits at time of writing, that are the General Purpose Starter Kit (DM320001)[ii], USB Starter Kit II (DM320003-2)[iii], and the Ethernet Starter Kit (DM320004)[iv].

Besides the interface for the SSD1963 Evaluation Kit, peripherals including a MP3 audio codec chip, WiFi module (footprint), and a microSD card socket are onboard for development of content-rich Graphical User Interface (GUI) applications.

Components on MMEVK are labeled in Figure 1-1.

1. Hirose FX10A-120S socket for Microchip PIC32 Starter Kits
2. VS1003B MP3 audio codec chip manufactured by VLSI Solution[v]
3. Footprint for Microchip MRF24WB0MA/B WiFi modules[vi]
4. SPI EEPROM for storage of web pages or non-volatile data such as touch screen calibration constants
5. MicroSD socket
6. USB to UART bridge CP2102 for program debug
7. 2x20 2.54mm receptacle for SSD1963 Evaluation Kit (SSD1963EVK R3B)
8. Buzzer with an amplifier circuit
9. 2x22 2.00mm expansion port (JP2k) for application modules

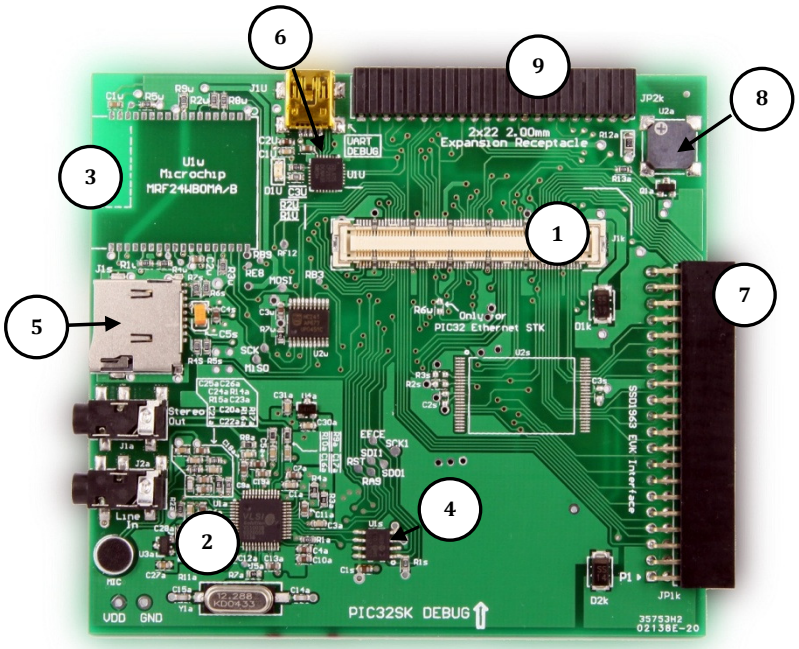


Figure 1-1. A board layout of PIC32-SSD1963 Multimedia Evaluation Kit (MMEVK)

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

1.2 Operational Requirements

The following hardware and software are required to use MMEVK.

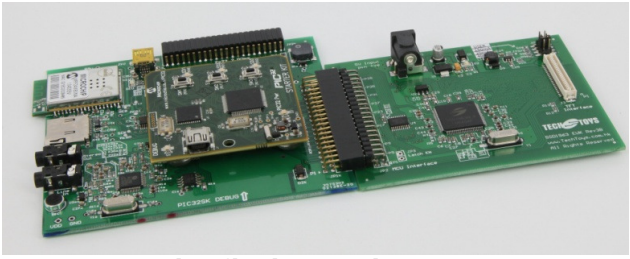
1.2.1 Hardware

- Any of the Microchip PIC32 Starter Kits. It can be the PIC32 GP Starter Kit (DM320001), PIC32 USB Starter Kit II (DM320003-2), or PIC32 Ethernet Starter Kit (DM320004).
- A PC compatible system running Microsoft Windows XP SP2 or above
- Two USB ports on the PC, one for USB-UART bridge for program debug, and the other USB port for PIC32 Starter Kit.
- Two USB cables with a mini-USB type B at one end for our EVK and a USB type A at the other for PC.
- A microSD memory card of 2GB or smaller (optional).
- Microchip MRF24WB0MA/B WiFi modules (optional, and soldering is required).
- A wireless LAN router in your workplace (optional)
- SSD1963 Evaluation Kit (SSD1963EVK R3B). This is optional, but highly recommended.

Figure 1-2 illustrates various possible hardware combinations.

A PIC32 USB Starter Kit is stacked on MMEVK. The same socket can be used for PIC32 GP Starter Kit or PIC32 Ethernet Starter Kit. A wireless LAN module MRF24WB0MA has been soldered for internet applications.

A PIC32 GP Starter Kit is stacked on board. Wireless LAN module MRF24WB0MA soldered, with an application module for universal learning IR plugged in the 2x22 2.00mm receptacle (JP2k). The 2.00mm receptacle has been designed to bring out most of the critical I/O pins of the PIC32 MCU including SPI, I2C, PMP, UART, and ADC, to name few of those.



A PIC32 General purpose Starter Kit is stacked on board. This time, SSD1963 EVK is connected for applications requiring a graphical user interface up to 7" TFT with touch panel.

Figure 1-2. Examples of hardware combination

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

1.2.2 Software

All applications for this evaluation kit have been prepared under the following environment.

1. Microchip MPLAB Integrated Development Environment (IDE) version 8.63.

At time of writing, the latest software version is v8.73a. MPLAB can be downloaded from this hyperlink

http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en019469&part=SW007002

By following the installation procedure for default settings, MPLAB was installed under ***C:\Program Files\Microchip\MPLAB IDE***.

2. MPLAB C Complier for PIC32 MCUs version 2.00.

The MPLAB C Compiler for PIC32 (C32) is a full-featured ANSI compliant C compiler for Microchip's PIC32 family of 32-bit microcontrollers. A free evaluation is available by downloading the Evaluation Edition. It has no code size limit and provides complete functionality for 60 days. The compiler is completely usable after 60 days other than certain optimization levels are disabled.

The hyperlink for downloading C32 is
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=2615&dDocName=en532454.

By following the installation procedure for default settings, C32 was installed under ***C:\Program Files\Microchip\mplabc32\v2.00***. All example programs from us are working on the Evaluation Edition before and after 60 days.

3. The firmware package available at Doc 03. This can be downloaded from the same web page you have got this user guide. The hyperlink of this package is http://www.techtoys.com.hk/PIC_boards/PIC32STK%20SSD1963%20EVK/PIC32STK%20SSD1963%20EVK%20R1A.htm

The origin of the firmware package is the Microchip Application Libraries version v2011-07-14. The main page of the libraries is found from this web page.
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=2680&dDocName=en547784

The Microchip Application Libraries includes full source code for the following software libraries: USB, Graphics, Memory Disk Drive, TCP/IP Stack, mTouch Capacitive Touch Library, and Smart Card Library. This is a big library collection of 639MB for not only PIC32 MCUs, but also other MCU series of Microchip. Install as usual by following the default installation path. A new folder under the path C:\Microchip Solutions v2011-07-14 was installed. We have not used all of the projects but only few of those for our hardware.

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Individual versions of the Microchip Application Libraries are shown on Figure 1-3 as a reference. We will be using the USB Framework, Graphics Library, Memory Disk Drive, and the TCP/IP Stack.

Microchip Application Libraries download includes the following:

Library	Current Version	PIC16F (8-bit)	PIC18F (8-bit)	PIC24/dsPIC (16-bit)	PIC32 (32-bit)
USB Framework	2.9a		x	x	x
Graphics Library	3.01			x	x
Memory Disk Drive (MDD)	1.3.2		x	x	x
TCP/IP Stack	5.36.2		x	x	x
mTouch Capacitive Touch Library	1.31	x	x	x	x
Smart Card Library	1.02.2		x	x	x
MiWi™ Development Environment	4.2.2		x	x	x
Accessory Framework for Android™	1.0.1			x	x

Figure 1-3. Microchip Application Libraries versions

4. Virtual COM Port (VCP) driver for CP2102 USB-to-UART Bridge from Silab's web site at this hyperlink:

   http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx

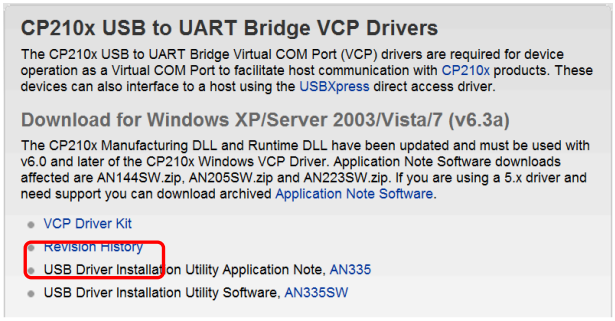


Figure 1-4. VCP Driver Kit for CP2102

After installing the VCP driver, connect a USB cable to J1U port which is the mini-USB port located close to the UART DEBUG white label on board. No external power is required because the board is drawing power from the USB cable. At this time, LED D1U will glow with a virtual com port emulated. Take a look at *Device Manager* in *Control Panel* to make sure a new COM PORT is emulated successfully under *Ports (COM & LPT).*

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Chapter 2. Running the first application

The first application is a simple demo to blink a LED at RD2 (LED3) with a key press at RD6 (SW1) that is on board of each PIC32 Starter Kit. Debug messages are displayed on two channels: Windows HyperTerminal via CP2102 and the *Output Window* of MPLAB.

The source code of this program is located in the Firmware folder under ..\MCHP_2011_07_14\Port_IO Demo.

Choose any of the PIC32 Starter Kits for this project. The project names have demystified which PIC32 Starter Kit to use with "GP" standing for general purpose, "ETH" for Ethernet, and "USB" for USB as shown on Figure 2-1.

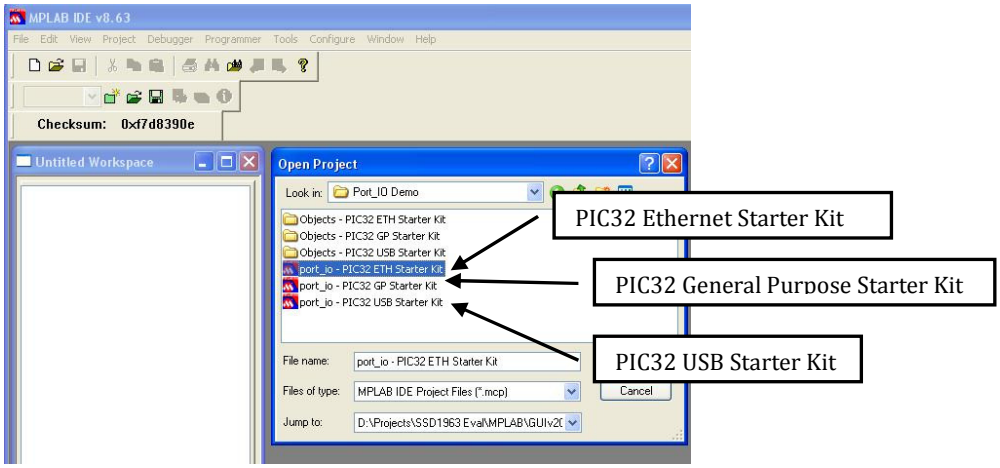


Figure 2-1. Project names of Port_IO demo

Stack the corresponding PIC32 starter kit on MMEVK to finish the hardware. No external 5V is required because the USB power for PIC32 starter kit is enough for this demo. The setup is shown on Figure 2-2 below showing a PIC32 USB SK for this example.

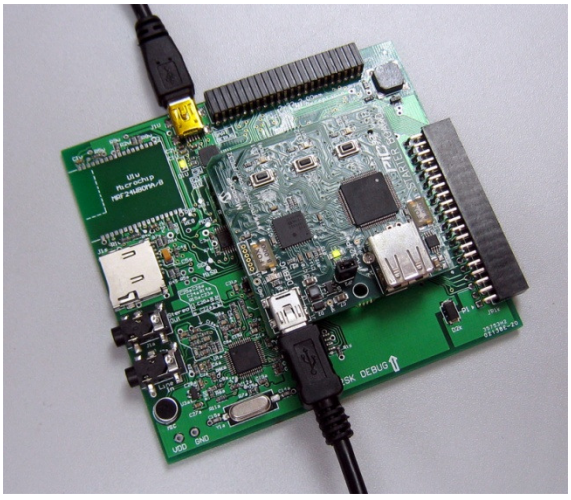


Figure 2-2. Hardware for Port_IO Demo.

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Launch Windows HyperTerminal, set the baud rate to 19200bps with no parity with no hardware handshake (8-N-1). Make sure the correct emulated COM PORT has been selected. In my case, it is COM7 emulated from the VCP driver indicated in *Windows Device Manager* as shown on Figure 2-3 below. The procedure for VPC driver installation has been described under section 1.2.2 part 4 of this guide.

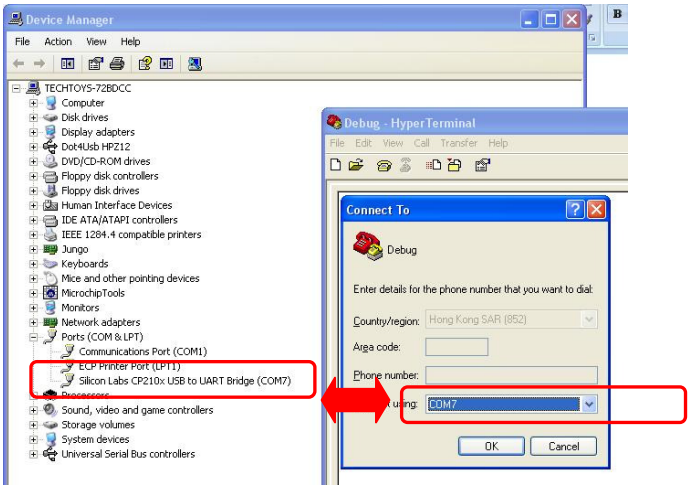


Figure 2-3. VCP emulated by CP2102 USB-UART bridge

There are two options to compile the program, that are Release and Debug versions. Let's try the Debug version first.

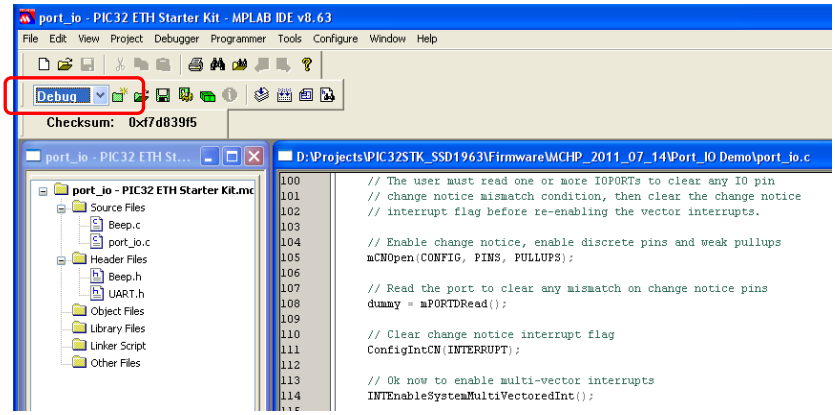


Figure 2-4. Snapshot of MPLAB debugging Port_IO Demo

Under Debugger -> Select Tool -> PIC32 Starter Kit
Under Project -> Build All

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Run the program by *F9* or click on the *Run icon* as shown on Figure 2-5.
A warning dialog box will prompt you for erase and re-program memories.
Click *Yes.*

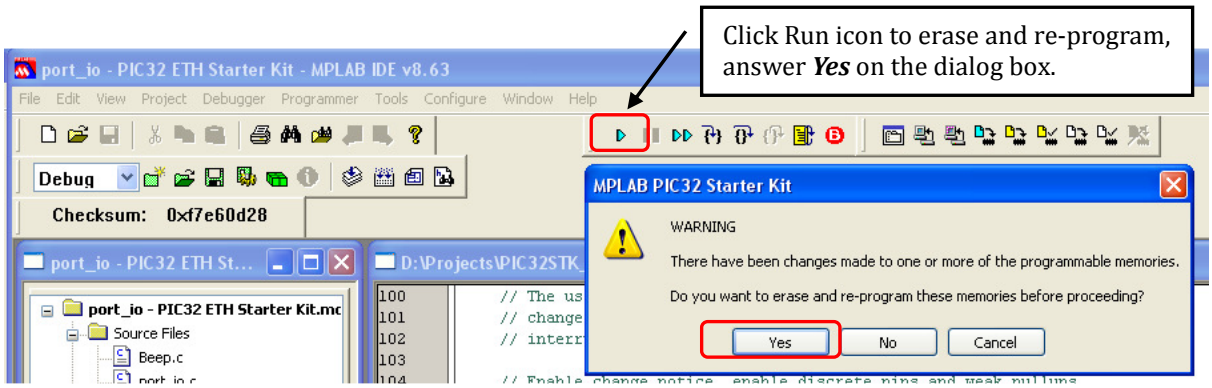


Figure 2-5. Erase and re-program to run the Port_IO Demo

Observe the *Output Window* (Figure 2-6) for a welcome message. This message is exported from the native DEBUG PORT of PIC32 Starter Kit with the functions DBINIT() and DBPRINT("Welcome to the …").

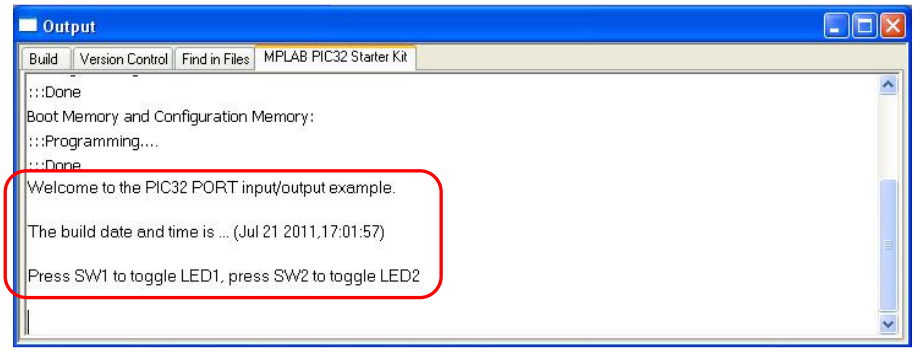


Figure 2-6. Debug message output from the native debug port of PIC32 start kit.

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Browsing the source code downward there are debug messages exported via the UART DEBUG port (via CP2102) as following.

```
putrsUART("Welcome to the PIC32 PORT input/output example. \r\n");
putrsUART( "The build date and time is ... (" __DATE__ "," __TIME__ ") \r\n" );
putrsUART("Press SW1 to toggle LED1 and Beep, press SW2 to toggle LED2\r\n");
```

The result is a message from HyperTerminal (Figure 2-7) as below.

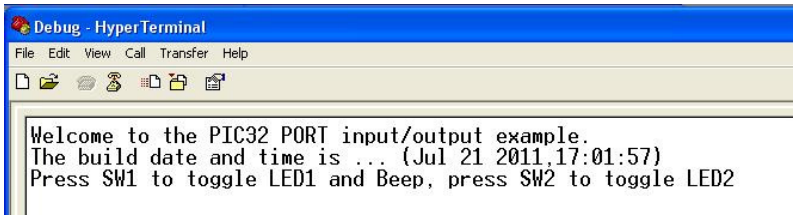


Figure 2-7. Debug message output from CP2102 UART DEBUG port (J1U)

Now, press SW1, observe the debug message "Switch SW1 has been pressed", "Switch SW1 has been released". LED3 at RD2 will blink after the "key pressed" message. At the same time, observe the HyperTerminal for the same debug message.

Finally, swap to Release mode and re-program the board for standalone application. No *MPLAB Output Window* message is available but the HyperTerminal messages remain. This is very important for our next project to know the IP address assigned by wireless LAN router from this method.

Now, you have successfully finished the first demo with debug messages on Windows HyperTerminal.

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Chapter 3. TCP/IP demo program using wireless network

A demo application to use the wireless LAN module is included under the location ..\Firmware\MCHP_2011_07_14\TCPIP\Demo App. PIC32 GP Starter Kit and PIC32 USB Starter kit are supported with project names:

C32-PIC32_GP_SK__MRF24WB_MMVEK.mcp
C32-PIC32_USB_SK__MRF24WB_MMVEK.mcp

PIC32 Ethernet Starter Kit is not supported for this demo yet.

This application has been modified from the original TCPIP demo application in Microchip Solutions v2011-07-14\TCPIP folder for hardware profile fitting our own evaluation kit. The TCPIP stack version is v5.36, with Microchip MRF24WB0MA onboard. In the project folder there is a readme.txt describing what we have done to port the original TCPIP demo to our hardware.

Procedures here describe what to do:

1. Solder a Microchip MRF24WB0MA/B on MMEVK board. Some solder flux will help this procedure. Please make sure no short circuit is made.

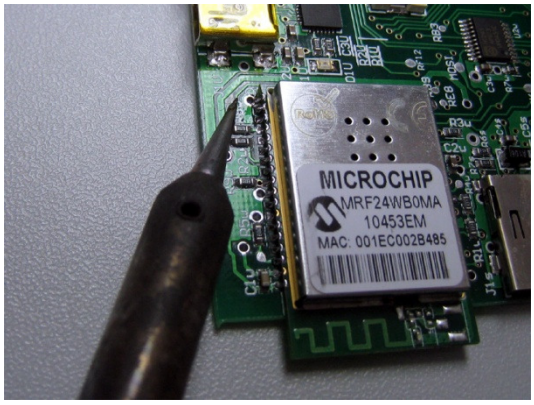


Figure 3-1. Solder MRF24WB0MA/B on MMEVK

2. Stack the PIC32 Starter kit of your choice on board. It is a PIC32 USB STK in this example. Connect the USB cable to the debug port of PIC32 USB STK.

3. Connect the second USB cable to the CP2102 UART Debug (J1U) for messages from the emulated COM PORT. No external 5V is required. Figure 3-2 illustrates the setup.

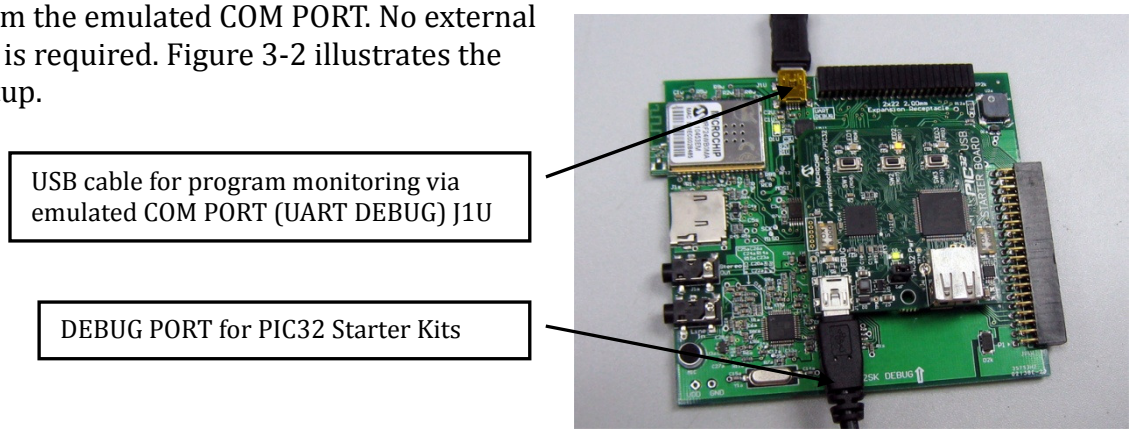


Figure 3-2. Hardware setup for wireless LAN demo

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

4. By the time a USB cable is connected to the UART DEBUG port at J1U, an emulated COM PORT will be available under Windows Control Panel → Device Manager → Ports (COM & LPT) provided that the Silabs VCP has been installed. Launch HyperTerminal, set COM PORT to the emulated PORT number of your PC. In my case, it is a COM7. Use the baud rate 19200bps, 8-N-1 with Flow control to *None*.

5. Launch MPLAB and open the project C32-PIC32_USB_SK__MRF24WB_MMVEK.mcp or C32-PIC32_GP_SK__MRF24WB_MMVEK.mcp.

   Under Debugger→Select Tool→PIC32 Starter Kit
   Under Project→Build All
   Finally click *Run* to program the starter kit.
   From HyperTerminal, there will be a message as shown on Figure 3-3.

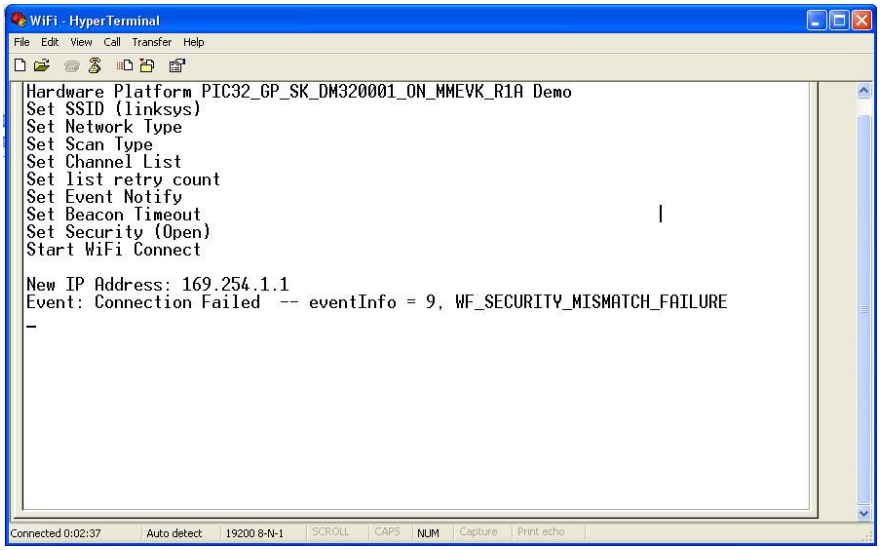


Figure 3-3. Debug message from UART DEBUG at J1U

The result above indicates a successful connection between the MCU on PIC32 starter kit with the WiFi module. It is a good sign if you can get this screen.
The last message indicates a connection failure, but why?

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

It is because the security configuration defined under WF_Config.h file has been set to *WF_SECURITY_OPEN*. See dump screen in Figure 3-4 below for details. This is the default configuration of the original Microchip example.

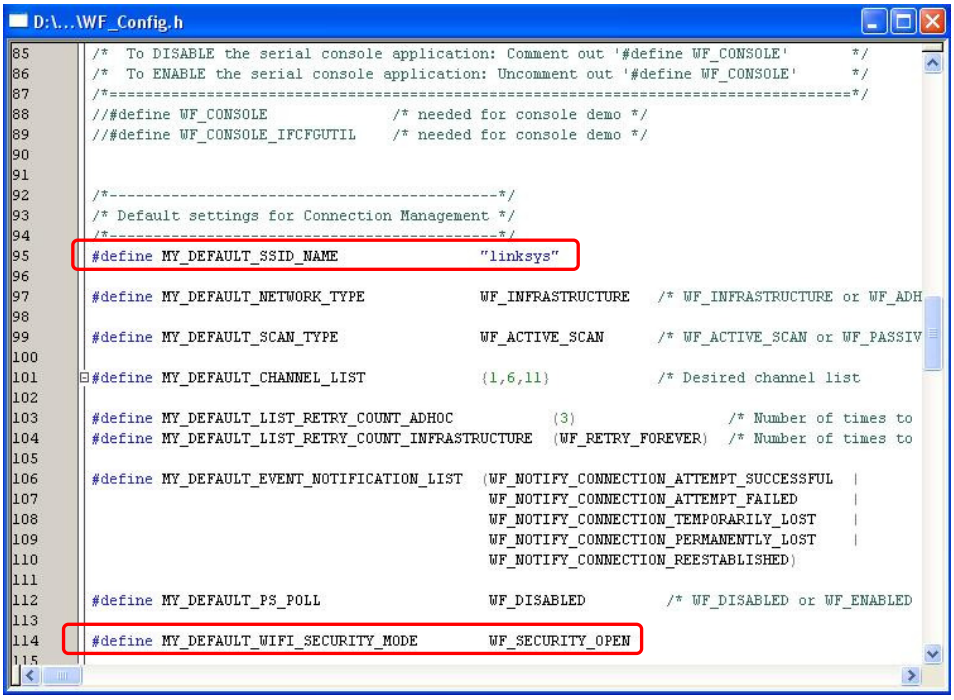


Figure 3-4. WF_Config.h header file for wireless LAN configurations

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

6. We need to set our wireless router for no security to suit the firmware. Else, we will have to change the firmware to suit the router. It is more easy to do the first in this demo. It is a Linksys WRT54GC router in our office. The Linksys, along with many other popular router brands, uses a built-in webserver on the router to administer the network for both wired and wireless configurations. Please consult the documentation that came with your router for further information on configuration and setup. To gain access to this web page, there is a default Linksys web admin URL. Input the *User name* and *Password* (Figure 3-5). By default, the user name is left blank, and the password is admin. In our case, the *User name* is *admin* with a dedicated password. Again, please remember what you or your network administrator has done for these fields.

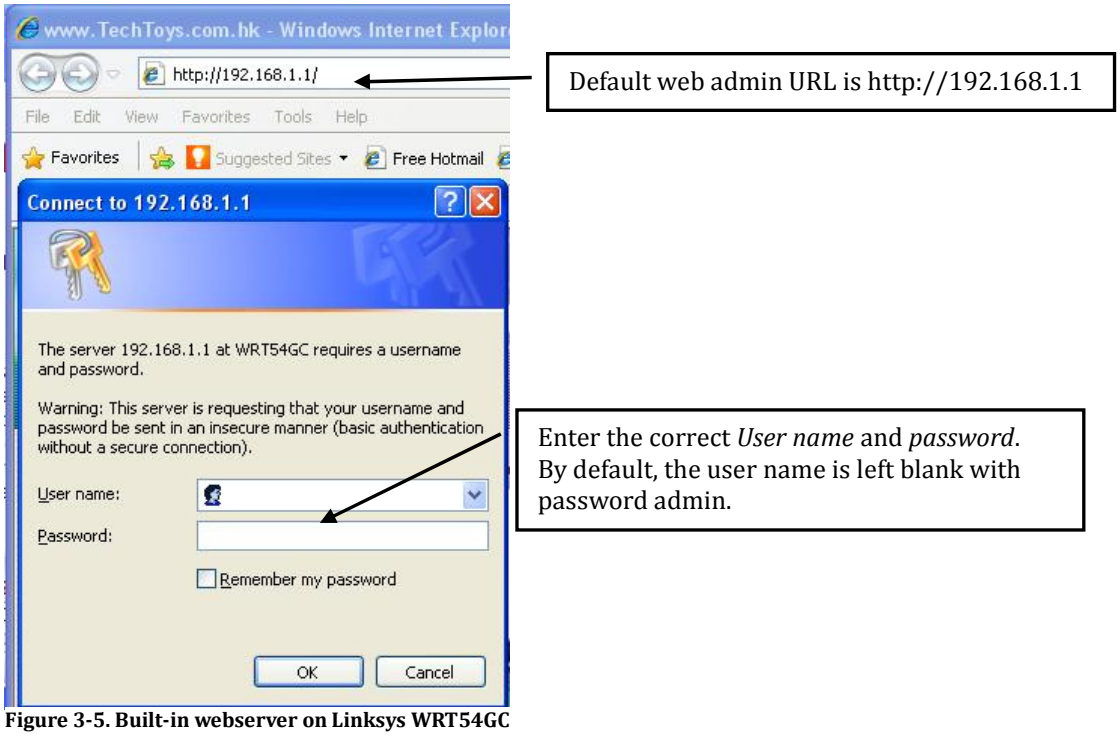


Figure 3-5. Built-in webserver on Linksys WRT54GC

Now the Setup page will be available. Go to the Basic Wireless Settings tab that shows the SSID. In our case, the Wireless Network Name (SSID) is *linksys* (case sensitive).

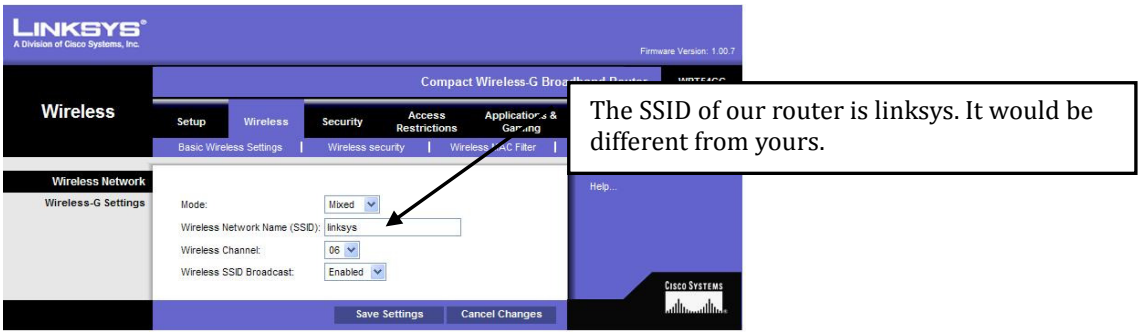


Figure 3-6. Wireless basic settings

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

This explains why it is *linksys* at the definition under the WF_Config.h header, instead of the default SSID MicrochipDemoAP in the original setting.

```
#define MY_DEFAULT_SSID_NAME        "linksys" //New setting under WF_Config.h
```

I just don't want to change the setting of our router. So, the next option is to change the firmware to suit the SSID name of WRT54GC router. This is why the original SSID 'MicrochipDemoAP" has been changed to "linksys". You will have to change this SSID as well if you don't want to change the router's SSID, because you may be using the same router for internet. In such case, because make sure the SSID defined under the file WF_Config.h is changed to suit your router.

Next, go to the *Wireless Security* tab, under the *Security Mode*, set it to *Disabled*. Finally, *Save Settings*. Make sure this setting will be restored to the original state if you don't want other devices around your workplace to share the wireless network, especially if your network provider charges by connection time.

Figure 3-7. Disable Security Mode for demo purpose

Now, everything is set.
Reboot the PIC32 start kit by removing reconnect the USB cable for PIC32 Starter Kit.
This time, a new IP address was successfully assigned to my hardware of value 192.168.1.16 as shown on Figure 3-8.

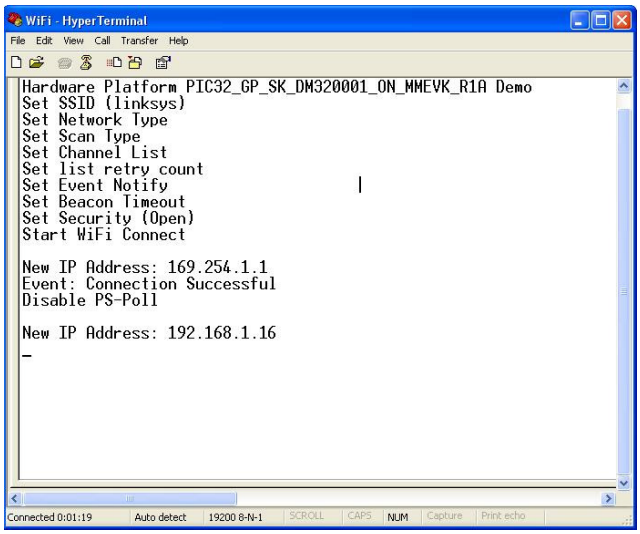


Figure 3-8. Successful wireless LAN connection with new IP address

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Verify by using command console, type in *ping 192.168.1.16*. The following dump screen indicates a successful wireless connection. The IP address 192.168.1.16 has been assigned by the Linksys router to our own wireless network device!

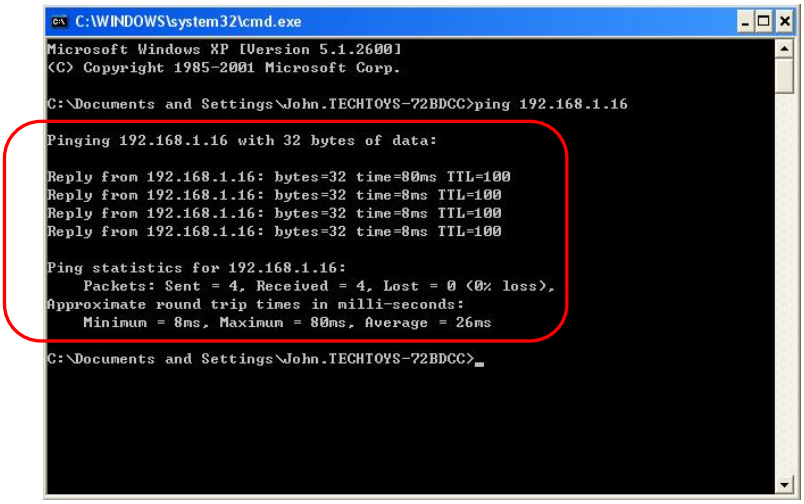


Figure 3-9. Verification of a successful WiFi connection with *"ping"*

Finally, launch the utility Microchip MPFS Generator from All Programs→Microchip→TCPIP Stack v5.36.2→MPFS2 (see Figure3-10). This utility was installed with Microchip Application Libraries.

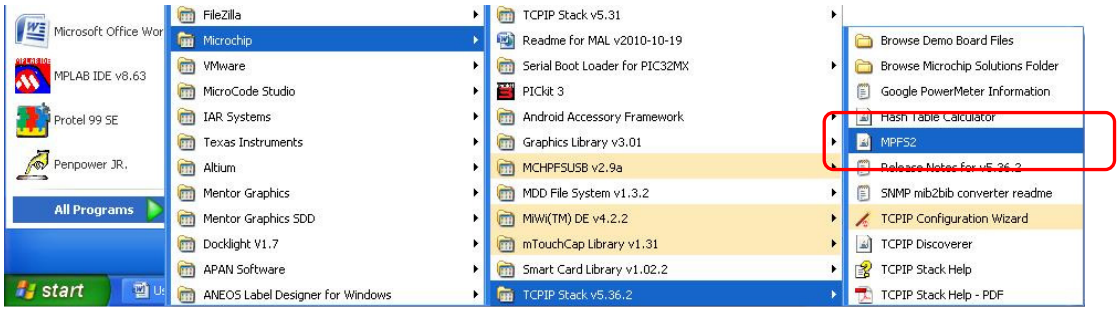


Figure 3-10. Launch Microchip MPFS Generator

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

From Source Settings, browse to the bin file at ..\Demo App\MPFSImg2.bin. Leave the Upload Settings default, and click Upload.

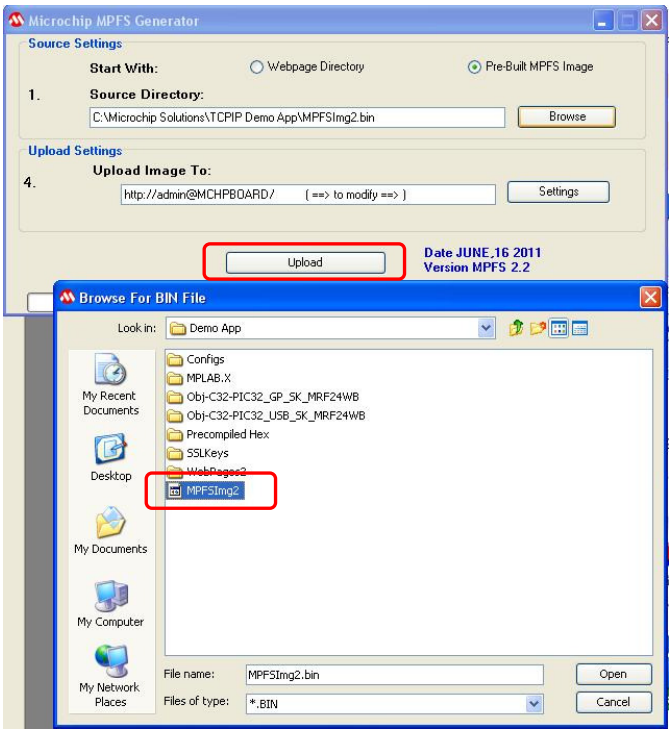


Figure 3-11. Make use of Microchip MPFS Generator utility to program the EEPROM 25LC256 to store a web page

The message box on Figure 3-12 shows the pre-built MPFS image has been uploaded to the EEPROM (25LC256) onboard. From now on, the board is accessible at the mchpboard host name or at the board's IP address. When accessed in a web browser, a real-time update of the board's controls is displayed.

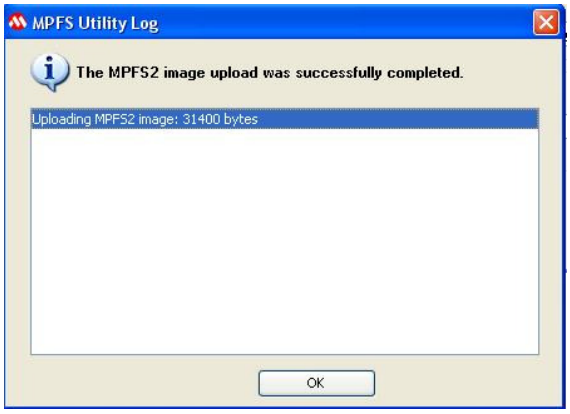


Figure 3-12. MPFS2 bin file uploaded successfully

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

As a final test, try clicking on the LEDs on the web page, and press buttons on PIC32 Starter Kit to observe the real-time changes.

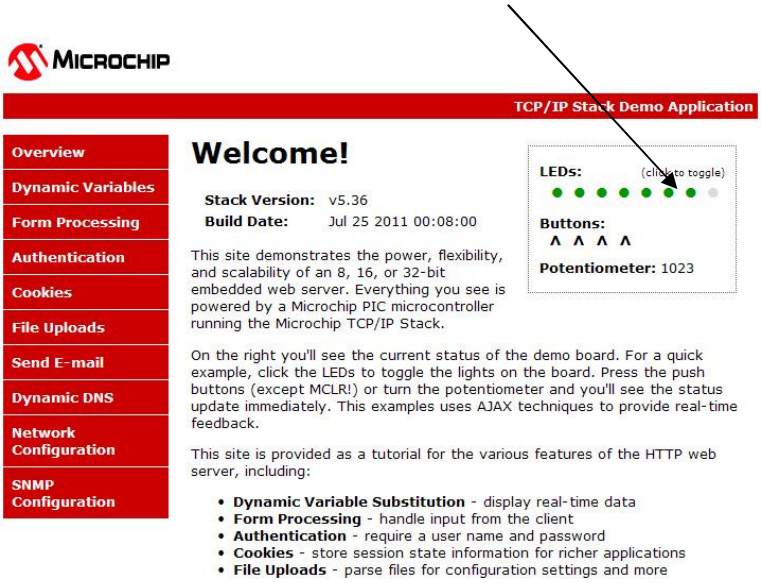


Figure 3-13. Real-time update of the board's controls is displayed

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

Chapter 4. Interfacing Solomon SSD1963 display controller

SSD1963 is a display controller of 1215k bytes frame buffer to support up to 864x480x24bit graphics content. We have a demo kit SSD1963 EVK R3B with all necessary circuits to facilitate testing the chip for online purchase.
A demonstration program is described in this chapter to access SSD1963 in 16-bit 8080 addressing mode. No complex functions, no GUI, no touch panel, but the basic IO command for addressing SSD1963 is provided here. The PIC32 MCU is to generate the required control signal (CS#, DC, RD#, WR#, and D[15:0]) to display a single pixel on one of the 4.3" to 7" display panels. The low level driver developed in this section lays the foundation for more complex applications such as displaying jpeg pictures from a microSD card, Windows-style GUI with icons, animation, etc.

The hardware configuration is illustrated in Figure 4-1below.

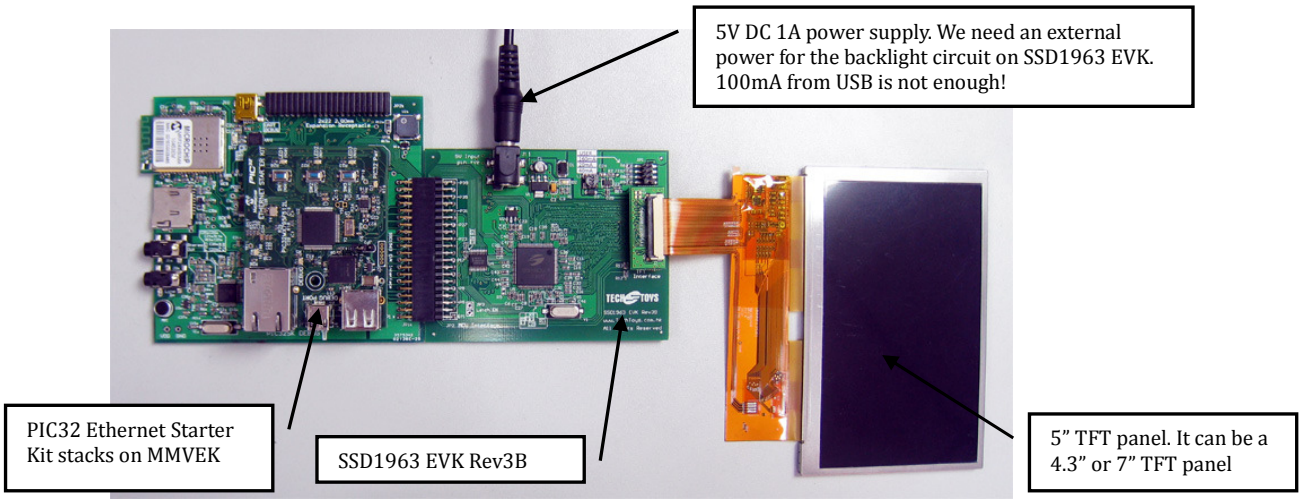


Figure 4-1. Hardware setup for interfacing the SSD1963 Evaluation Kit

The source code of this project is located under the folder Firmware\MCHP_2011_07_14\Graphics\Primitives LLD.

Again, projects for all three MCU variants are available. Because it is a PIC32 Ethernet Starter kit in this example, we will select PIC32 ETH SK Primitives SSD1963 LLD.mcp

Name	Size	Type
Objects - PIC32 ETH SK Primitive SSD1963 LLD		File Folder
Objects - PIC32 GP SK Primitive SSD1963 LLD		File Folder
Objects - PIC32 USB SK Primitive SSD1963 LLD		File Folder
MainDemo	4 KB	C File
MainDemo.d	1 KB	D File
MainDemo.o	13 KB	O File
PIC32 ETH SK Primitives SSD1963 LLD	2 KB	Microchip MPLAB.Pr...
PIC32 ETH SK Primitives SSD1963 LLD	45 KB	Microchip MPLAB.W...
PIC32 ETH SK Primitives SSD1963 LLD.mcs	4 KB	MCS File
PIC32 GP SK Primitives SSD1963 LLD	2 KB	Microchip MPLAB.Pr...
PIC32 GP SK Primitives SSD1963 LLD	45 KB	Microchip MPLAB.W...
PIC32 GP SK Primitives SSD1963 LLD.mcs	4 KB	MCS File
PIC32 USB SK Primitives SSD1963 LLD	2 KB	Microchip MPLAB.Pr...
PIC32 USB SK Primitives SSD1963 LLD	45 KB	Microchip MPLAB.W...
PIC32 USB SK Primitives SSD1963 LLD.mcs	4 KB	MCS File

Figure 4-2. Primitives SSD1963 LLD projects

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

There are only three steps to use this demo as follows:

(1) Define the hardware platform under *system.h* file and comment out
```
//#define PIC32MX_EVK_RD4
#define PIC32_STARTER_KIT
```

(2) Define the TFT panel under *TFT.h*, select only one of the TFT panels available from us. In this example, the 5" TFT panel was connected.

```
//#define DISPLAY_PANEL TY430TFT480272
#define DISPLAY_PANEL TY500TFT800480
//#define DISPLAY_PANEL TY700TFT800480
//#define DISPLAY_PANEL YOUR_PANEL
```

(3) Finally, rebuild and program.

Online debug can be performed with this example. A breakpoint set at the delay function after running PutPixel(x,y) in a for-loop with color set to BRIGHTBLUE. Result of running the program is illustrated in this Figure 4-3.

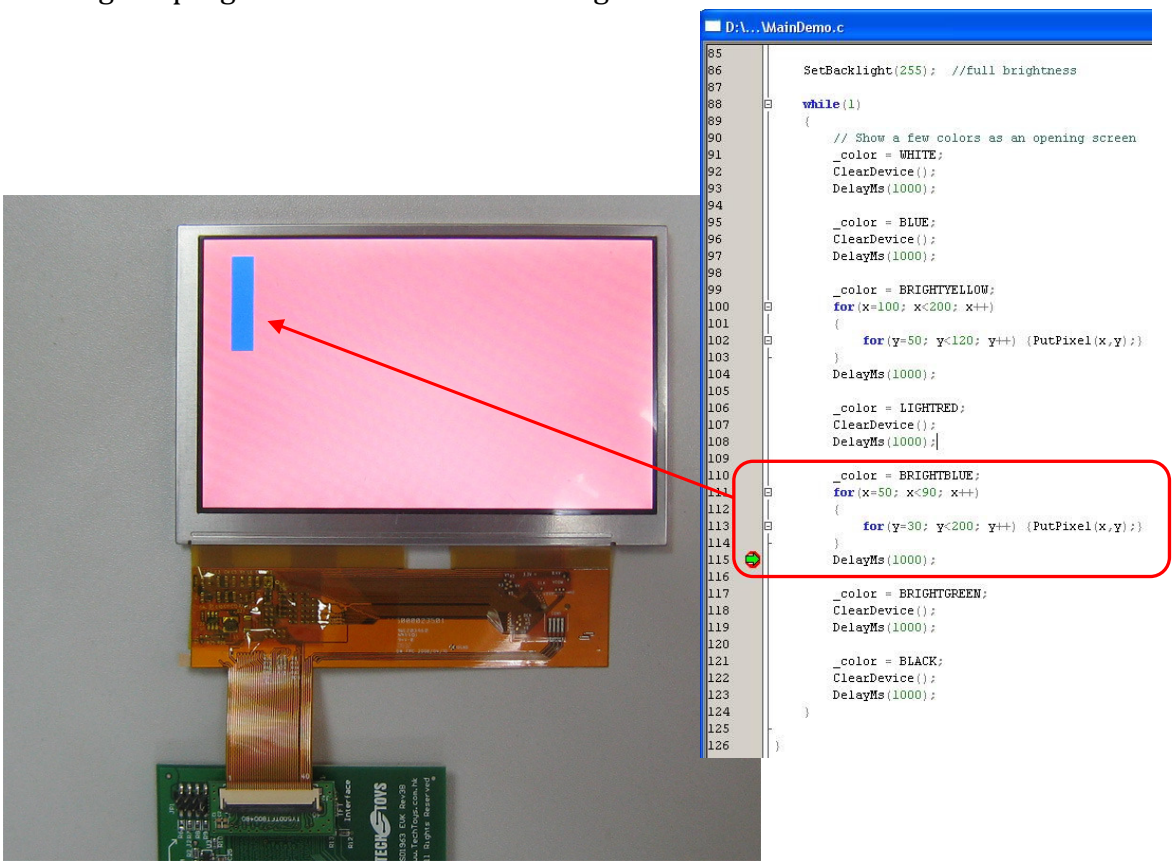


Figure 4-3. A breakpoint at PutPixel(x,y) with blue color

Keywords: SSD1963, Microchip PIC32, PIC32 Starter Kits, VS1003B audio codec, Microchip PIC32 Plays MP3, WiFi, 4.3" TFT GUI, 5" TFT GUI, 7" TFT GUI

End Notes

[i] Evaluation kit for Solomon SSD1963 Display Controller, hyperlink:
http://www.techtoys.com.hk/Displays/SSD1963EvalRev3B/SSD1963%20Eval%20Board%20Rev3B.htm

[ii] Microchip PIC32 Starter Kit, hyperlink:
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=2615&dDocName=en532453

[iii] Microchip PIC32 USB Starter Kit, hyperlink:
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=2615&dDocName=en535536

[iv] Microchip PIC32 Ethernet Starter Kit, hyperlink
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=2615&dDocName=en545713

[v] VLSI Solution
http://www.vlsi.fi/

[vi] Microchip MRF24WB0MA/B WiFi modules
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=2885&param=en547232