Reference Design for Interfacing ViaUSB to Target Systems
For use with 65xxEduSDK & 65xxProSDK

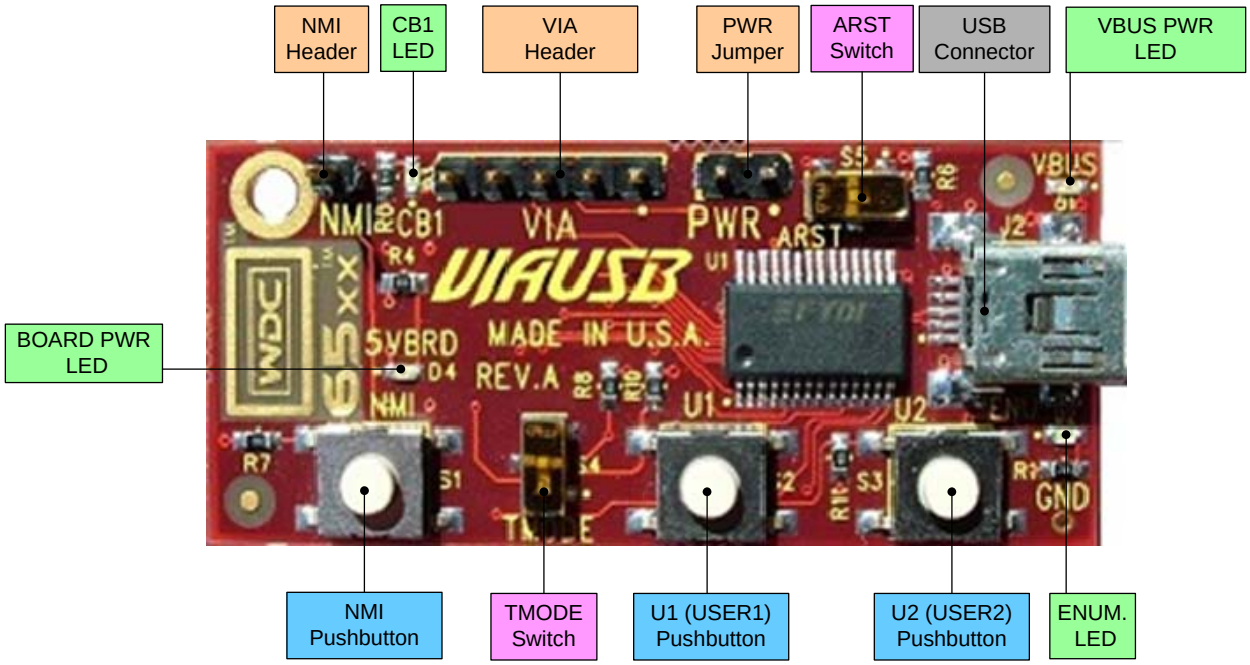
TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Version	Date	Author	Description
1.0	09-21-10	David Gray	Initial Document Release

HARDWARE SETUP AND INTERFACE

ViaUSB Board Setup



USB Power Supply Issues on ViaUSB

The USB cable connected to the ViaUSB can power 100mA during enumeration periods (startup) and 500mA during normal operation. A power transistor is gated on after enumeration so as to prevent over loading when the PWR jumper is inserted to power the target board.

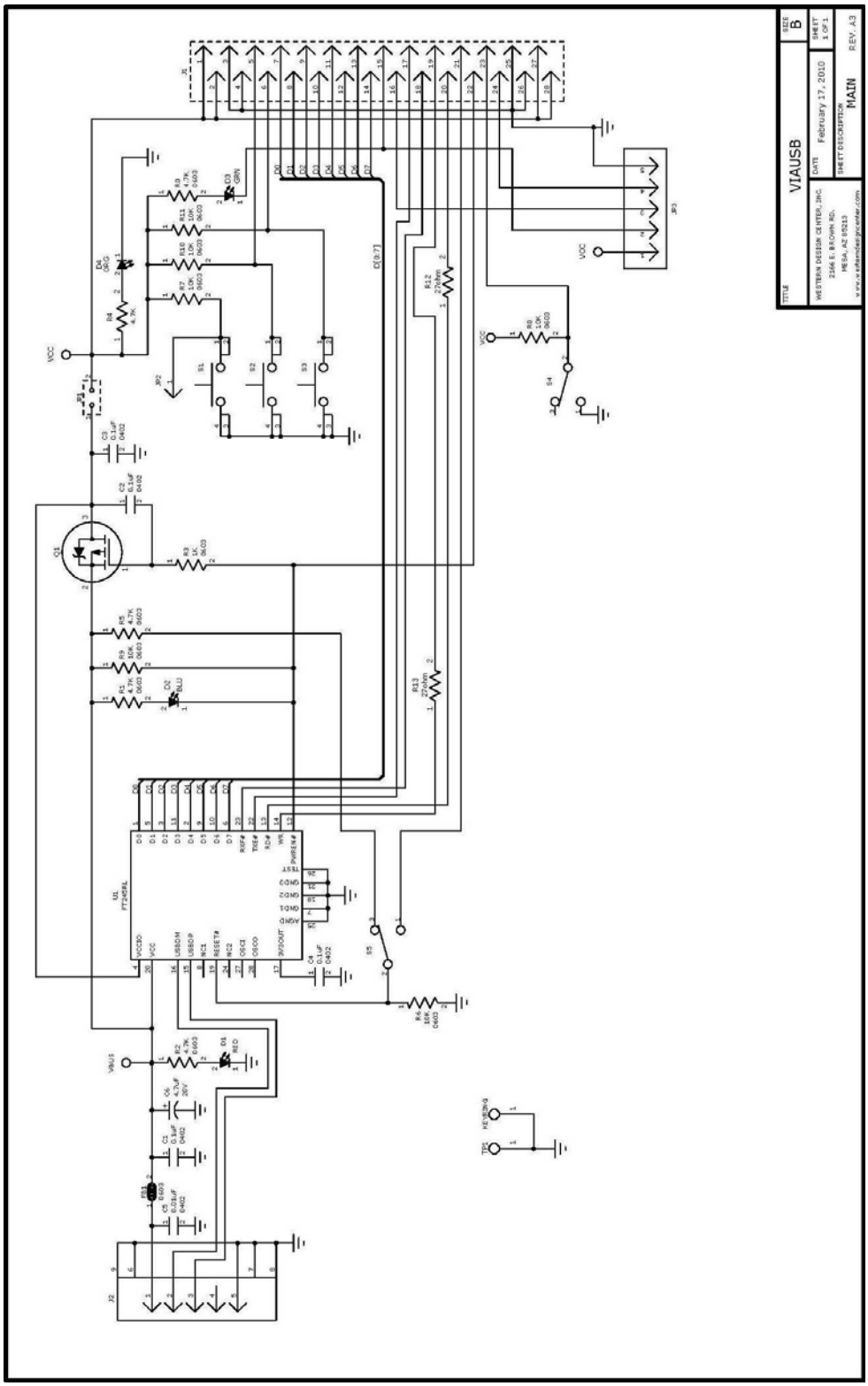
VIA Header (JP3) Pin List

VIA Header (JP3) Pin List		
Pin #	**Signal**	**Notes**
1	VCC	
2	CB1	Connected to CB1 Green LED
3	CB2	Jumper to CB1 for ViaUSB Demo on WDC DB's and EB50
4	PB7	
5	VSS	

ViaUSB Interface Information for Developer Board and APATCO EB50

FTDI USB Signal Name	EB50 & Developer Board w/ViaUSB								Notes
	J1 Connector		W65C22 pinout		GPIO Port Usage				
	Pin	Port Name	PDIP	PLCC	Name	DB Addr	EB50 Addr	Bit	
	1	VCC	20	21	-	-	-	-	+5V DC
	2	VCC	20	21	-	-	-	-	+5V DC
	3	VSS	1	1	-	-	-	-	GND
	4	VSS	1	1	-	-	-	-	GND
	5	CA1	40	44	PCR	0x00FC	0x7F2C		User1 Pushbutton
	6	CA2	39	43	PCR	0x00FC	0x7F2C		User2 Pushbutton
D0	7	PA0	2	2	ORB	0x00F0	0x7F20	0	FTDI Data 0
D1	8	PA1	3	3	ORB	0x00F0	0x7F20	1	FTDI Data 1
D2	9	PA2	4	4	ORB	0x00F0	0x7F20	2	FTDI Data 2
D3	10	PA3	5	5	ORB	0x00F0	0x7F20	3	FTDI Data 3
D4	11	PA4	6	6	ORB	0x00F0	0x7F20	4	FTDI Data 4
D5	12	PA5	7	7	ORB	0x00F0	0x7F20	5	FTDI Data 5
D6	13	PA6	8	8	ORB	0x00F0	0x7F20	6	FTDI Data 6
D7	14	PA7	9	9	ORB	0x00F0	0x7F20	7	FTDI Data 7
	15	CB1	18	19	PCR	0x00FC	0x7F2C		CB1 Green LED, JP3 (Pin 2)
	16	CB2	19	20	PCR	0x00FC	0x7F2C		JP3 (Pin 3)
TXE#	17	PB0	10	10	ORA	0x00F1	0x7F21	0	FTDI TX Empty (active low)
RXF#	18	PB1	11	12	ORA	0x00F1	0x7F21	1	FTDI RX Full (active low)
WR	19	PB2	12	13	ORA	0x00F1	0x7F21	2	FTDI Write Strobe
RD#	20	PB3	13	14	ORA	0x00F1	0x7F21	3	FTDI Read Strobe (active low)
RESET#	21	PB4	14	15	ORA	0x00F1	0x7F21	4	FTDI Reset (usually unused)
PWREN#	22	PB5	15	16	ORA	0x00F1	0x7F21	5	FTDI Enumerated (active low)
	23	PB6	16	17	ORA	0x00F1	0x7F21	6	Test Mode select (TMODE) (active low)
	24	PB7	17	18	ORA	0x00F1	0x7F21	7	JP3 (Pin 4)
	25	VSS	1	1	-	-	-	-	GND
	26	VSS	1	1	-	-	-	-	GND
	27	VCC	20	21	-	-	-	-	+5V DC
	28	VCC	20	21	-	-	-	-	+5V DC

ViaUSB Schematic



SOFTWARE SETUP AND DEMO

Brief ViaUSB RAM/ROM Demo functional description.

1.) U1 - Pushing this button will turn the Green LED ON when a jumper is placed between the CB2 output and the CB1 input pins on the VIA 5 pin header. On the ViaUSB, U1 is wired to CA1. CA1 is configured for Negative Edge Interrupt and the IRQB interrupt handler will cause CB2 to manually make the CB2 output low turning ON the Green LED if it is OFF.

2.) U2 – Pushing and releasing this button will turn the Green LED OFF. On the ViaUSB, U2 is wired to CA2. CA2 is configured for Positive Edge Interrupt and the IRQB interrupt handler will cause CB2 to manually make CB2 output high turning the Green LED to turn OFF if it is ON.

3.) TMODE Switch= Application Mode. If TMODE is ON, this is in Application MODE. If it is OFF, it is in Monitor MODE. NMIB interrupts that occur while TMODE is ON will be handled first by the Application code which must recognize that the Monitor uses NMIB to invoke the Monitor. Interrupts that occur while TMODE is OFF will be handled by the Monitor by first interrogating the NMIB flags such as the hardware breakpoint flag that indicates that a hardware breakpoint has occurred and not the NMI push button on the ViaUSB or an application NMIB occurrence.

4.) At this time the WDC embedded Monitor does not use the IRQB pin.

5.) BRK commands are reserved for the Monitor and used for software breakpoints. BRK should not be used by the application unless absolutely necessary. If a BRK is executed, the light should not be changed.

6.) The NMIB is reserved for the monitor except for where NMI is required by the application.
   a. The Hardware Breakpoint can drive NMIB low.
   b. NMI Pushbutton on ViaUSB can drive NMIB low.
   c. The Interrupt Handler needs to look at interrupt flag to check if the interrupt was from Hardware Breakpoint or NMI Pushbutton.
   d. When in Application Mode, the NMI Handler will change the state of CB2 and therefore the CB1 light (since the jumper is on CB1 and CB2) will change. If it was previously ON, it will turn OFF (or vice-versa).

Monitor Setup

Monitor Files

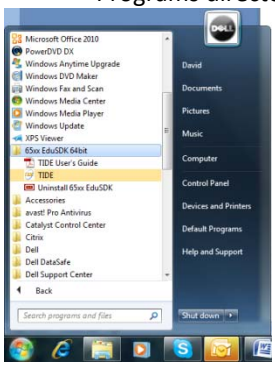
EVAL.inc – Include file for Monitor
Wdcmon.asm – Assembly Language Monitor Source

There is a BAT file for each type of board for creating the necessary output files for each board based on the original source. Contact WDC for Monitor Source and support.

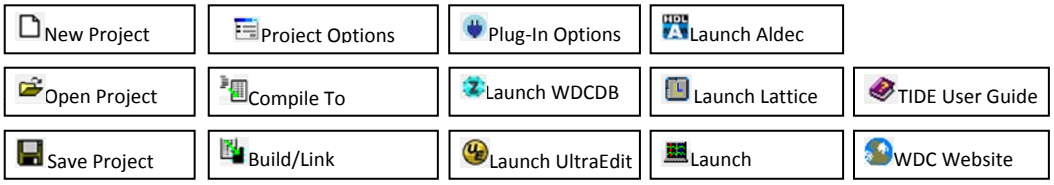
SOFTWARE EXAMPLE: C Demo Project Using TIDE and Debugger for W65C816S on EB50 board

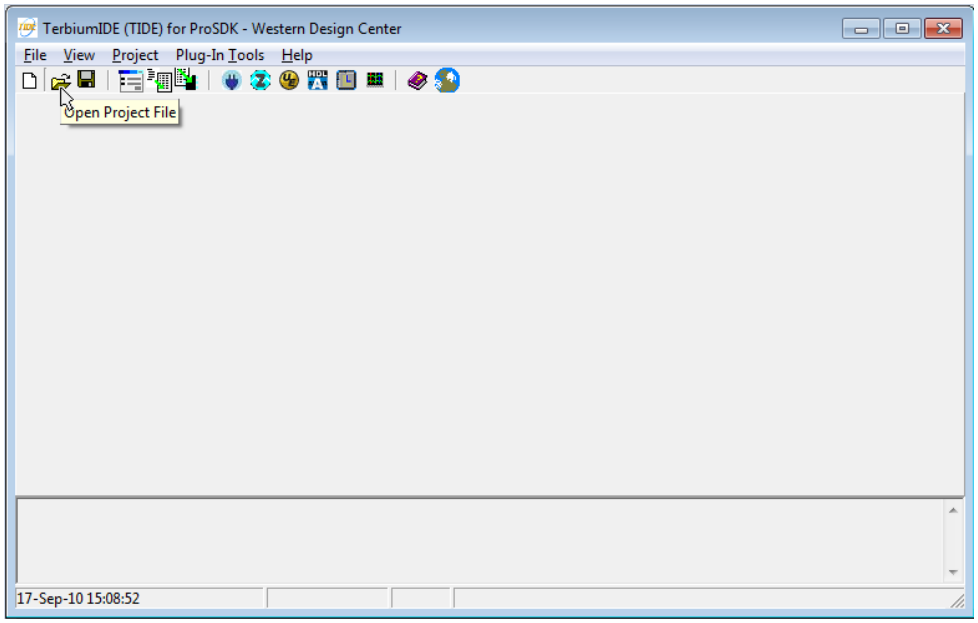
With both the ProSDK and EduSDK, there is an included project for the ViaUSBDemo in the C:\65xx_XxxSDK\Projects\ViaUSBDemo\ folder. Below is a brief walkthrough of the C code demo for the APATCO EB50 Board with W65C816S as the processor.

1.) **Start TIDE**. By default the installer can put a shortcut on the desktop. TIDE is also located in the Programs directory under the 65xx_XxxSDK folder.

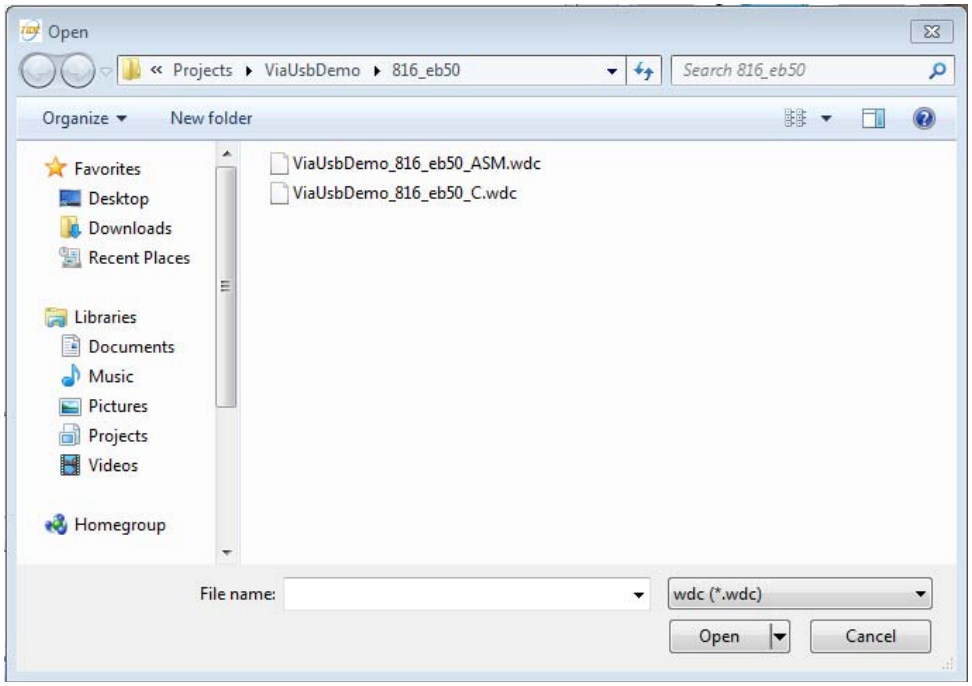


2.) **Open Project File**. Once TIDE is running it will look like the screen shot below. Immediately below are the meanings of each icon of the main tool bar. For the demo application we want to Open a Project File. To open a project, click File → Open Project from the Menu or click on the  icon from the toolbar.

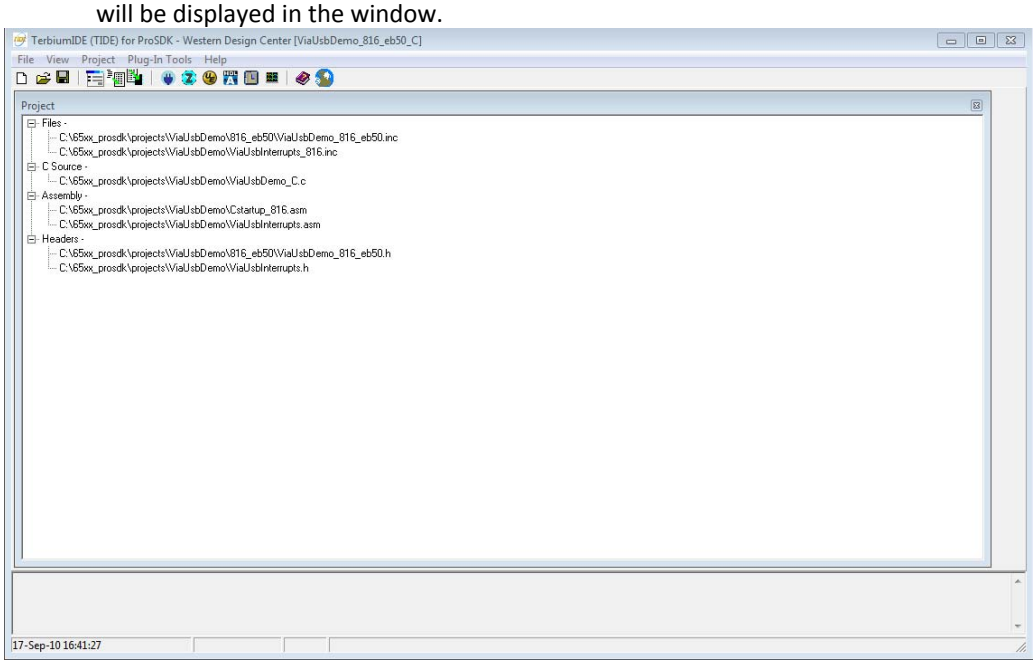




3.) **Project Open Dialog Box.** This brings up the Open dialog box. Navigate to your project to open. For this demo we will open the C demo for the EB50 board. It is in the C:\65xx_XxxSDK\Projects\ViaUSBDemo\816_eb50. Notice in the folder there is a project for Assembly and one for C.

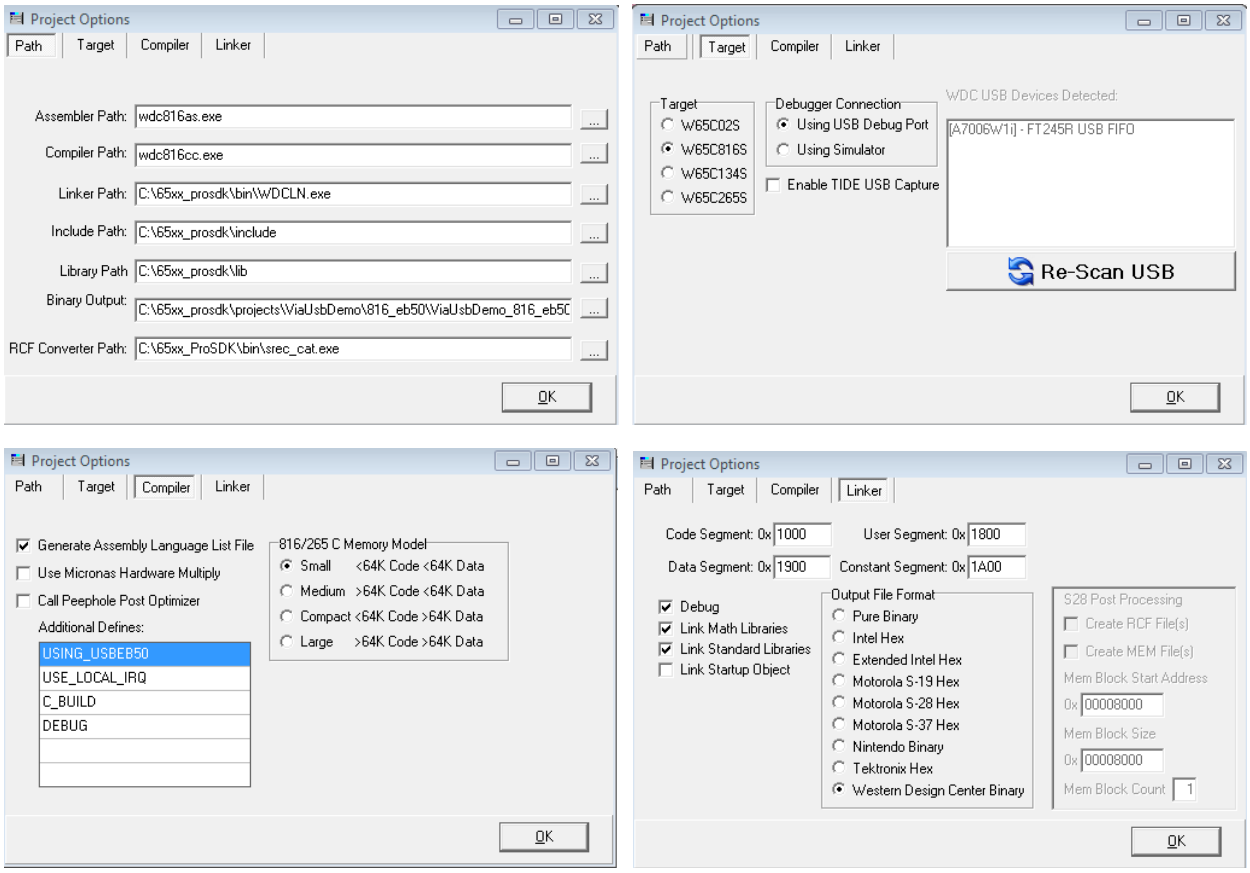


4.) **Project Window**. Once the project is open, the files used in the project are displayed in the Project Window. If a project is not configured to open the Project Window, click View → Project. All project files will be displayed in the window.



5.) **Project Options**

The figures below show the four tabs of the Project Options. These are accessed by the top menu "Project->Options…", or by clicking the icon.



Path Tab

This tab defines the directory paths for the various WDC tools called from within TIDE.

1) Compiler and Assembler Paths should be set to either: "wdc02cc.exe" and "wdc02as.exe"; or "wdc816cc.exe" and "wdc816as.exe" – setting the Target selection in the Target Tab will automatically set these to the correct values.
2) The Linker Path should be set to "C:\65xx_Xxxsdk\bin\WDCLN.exe" for the default install location.
3) The Simulator Path should be set to "C:\65xx_Xxxsdk\bin\wdcdb.exe" for the default install location.
4) The Include and Library Paths should be set to "C:\65xx_Xxxsdk\include" and "C:\65xx_Xxxsdk\lib" if the default libraries are used; otherwise set these paths to the custom user libraries desired.
5) The Source Path should be set to the source file of the main or top level ".c" or ".asm" file in the user project. Use the "…" button to the right to browse to the file.
6) The Binary Output should be set to the same as the source file above, but change the ".c" or ".asm" filename extension to ".bin".

Target Tab

This tab defines the Target and Debugger Connection options for the project.
paths for the various WDC tools called from within TIDE.

Target - Set the "Target" radio buttons to select the base processor/controller/core

a. W65C02S
b. W65C816S
c. W65C134S

d. W65C265S

Debugger Connection

a. Using USB Debug Port – Select this option if you are using a hardware board with a proper USB Interface such as ViaUSB or Terbi. Both of these use the FTDI 245 USB/FIFO chip. If this option is chosen, the "WDC USB Devices Detected" box will be active and the correct device can be chosen if more than oen USB device is plugged in.
b. Simulator – Select this option if you are not using debug hardware and you want to run in Simulator Mode.

Enable TIDE USB Capture

TIDE has a USB Capture feature and window that allows for the capturing debug output from the target. This option is not available in Simulator Mode.

Compiler Tab

Checkbox Options

a. Micronas Hardware Multiplier – Used only with Micronas microcontrollers.
b. Peephole Post Optimizer – Option used to call the WDC Optimizer for the C-Compiler
c. Generate Assembly List File - Option used to create a listing and linked listing file

816 / 265 C Memory Model – Select the appropriate Memory to use for your application. If Standard and/or Math libraries are included (see Linker tab below), set the memory model to match the target hardware to determine library size to use.

Additional Defines – These entry forms provide spaces for the user to put in additional commands to the Assembler and Compiler.

Linker Tab

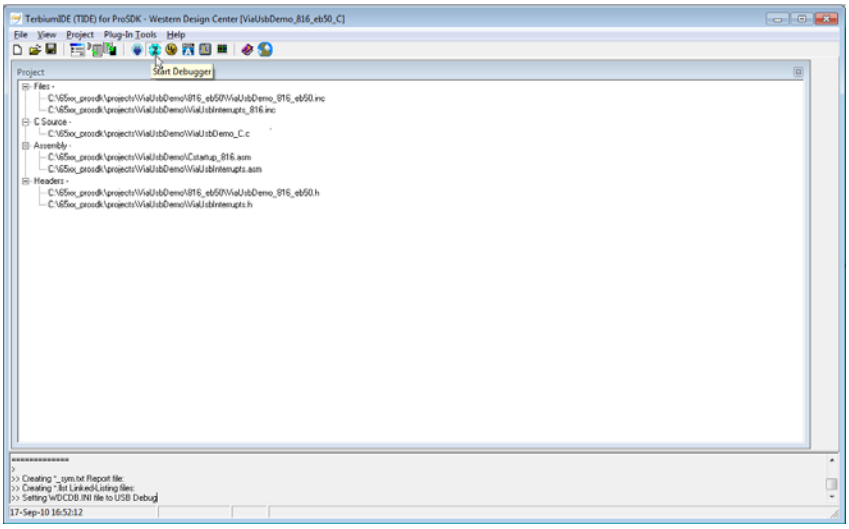
a. Set the "Code Segment" box to the address (in HEX) of the start of the code only if no ORG or SECTION statement is in the source code, if the source code specifies the code address, then leave this blank.
b. Set the "Data Segment" box to the address (in HEX) of the start of variable data. If the source code specifies this, then leave this blank.
c. Set the "User Segment" box to the address (in HEX) of the start of the user data (UDATA). If the source code specifies this, then leave this blank.
d. Set the "Constant Segment" box to the address (in HEX) of the start of constant data. If the source code specifies this, then leave this blank.
e. If debug libraries and linker debug options are desired to be included, then check the "Debug" box.
f. If the math libraries are needed, then check the "Link Math Libraries" box.
g. If the functions in the standard libraries are needed, then check the "Link Standard Libraries" box.
h. For most C applications, check the "Link Startup Object" box; and ensure that the startup.asm file is not included in the project if checked. Otherwise make sure this box is not checked. (for example for Assembly source only projects this should not be checked)
i. Set the "Output File Format" radio buttons to the format needed.
    i. Most popular are pure binary, extended Intel Hex, and Motorola S-28.
    ii. To produce binary output that is compatible with TIDE for loading into the Target hardware for running and debug, the "Western Design Center Binary" option should be selected.
    iii. The other output formats are for specialty applications and self-descriptive

6.) **Build Project**. After the Options are all configured (for the Demo all options are already set), the project is ready to build. This can be done by Build / Link or with the icon. Below is the output that appears in the output window after the build.

```
wdc816as.exe -g -DUSING_816 -DM_SMALL -DUSING_USBEB50 -DUSE_LOCAL_IRQ -DC_BUILD -DDEBUG -l C:\65xx_prosdk\projects\ViaUsbDemo\Cstartup_816.asm

WDC 65C816 Assembler Version 3.49.1 Feb  6 2006 17:24:51
     Copyright (C) 1992-2006 by The Western Design Center, Inc.
wdc816cc.exe -bs -DUSING_816 -MS -DUSING_USBEB50 -DUSE_LOCAL_IRQ -DC_BUILD -DDEBUG -lt -o C:\65xx_prosdk\projects\ViaUsbDemo\ViaUsbDemo_C.obj
C:\65xx_prosdk\projects\ViaUsbDemo\ViaUsbDemo_C.c
WDC 65816 C   Version 3.49 Jan 19 2006 14:38:08
    Copyright (C) 1992-2006 by The Western Design Center, Inc.
wdc816as.exe -g -DUSING_816 -DM_SMALL -DUSING_USBEB50 -DUSE_LOCAL_IRQ -DC_BUILD -DDEBUG -l C:\65xx_prosdk\projects\ViaUsbDemo\ViaUsbInterrupts.asm
WDC 65C816 Assembler Version 3.49.1 Feb  6 2006 17:24:51
     Copyright (C) 1992-2006 by The Western Design Center, Inc.
Compile Complete
================
>
C:\65xx_prosdk\bin\WDCLN.exe  -C1000 -D1900 -K1A00 -U1800 -g -t -sz -HZ -oC:\65xx_prosdk\projects\ViaUsbDemo\816_eb50\ViaUsbDemo_816_eb50_C.bin
C:\65xx_prosdk\projects\ViaUsbDemo\Cstartup_816.obj C:\65xx_prosdk\projects\ViaUsbDemo\ViaUsbDemo_C.obj C:\65xx_prosdk\projects\ViaUsbDemo\ViaUsbInterrupts.obj  -lcs -lms
WDC 65C816 Linker Version 3.49.1 Apr 24 2006 15:40:38
  Copyright (C) 1992-2006 The Western Design Center, Inc.
Section: ORG:   ROM ORG:  SIZE:
CODE    001000  001000     1D0H (  464)
DATA    001900  001900      AH (   10)
UDATA   001800  ------      2H (    2)
startup  002D00  002D00     4FH (   79)
vectors  00FFE0  00FFE0     20H (   32)
Total                 24BH (  587)
Link Complete
==============
>> Creating *_sym.txt Report file:
>> Creating *.llst Linked-Listing files:
```

7.) **Start Debugger**. After the Build completes, the debugger can be used to download the output file into the board The WDCDB Debugger uses a .BIN file for download. For this example the APATCO EB50-816 board is used to download and debug. To start the debugger, click on Plug-In Tools → Debugger or click on the icon.



8.) **Using WDCDB Debugger**. Once the Debugger opens the .BIN file that is defined in the WDCDB.ini file (configured by TIDE and its options) is downloaded into the target. There are many options and functions in the WDCDB. There is a separate document with details of the features. See the C:\65xx_XxxSDK\Documentation folder for additional documentation.