Thank you for requesting the MSP430F663x Sample Kit. This kit gives you an opportunity to evaluate the first device in the MSP430 F6xx family.

This *Getting Started* guide reviews the contents of your kit and provides an overview for how to quickly get started with the MSP430F6638 experimental device.

Contents

1   What is MSP430F6638?

The MSP430F6638 is an F6xx-architecture-based MSP430 device equipped with Full Speed USB2.0.

Please note that the included MSP430 samples are XMS430F6638 prototype device and have not met or completed Texas Instrument's internal reliability qualification requirements. These devices are for prototyping purposes only and not intended to be used in production systems. Therefore, the devices are sampled on an "as is" basis and Texas Instruments makes no warranty of fitness for a specific purpose.

The device is subject to errata items, as detailed in the *MSP430F66xx Errata* document that can be found in the product folder web page.

Before proceeding, please also review the *X430F66xx Experimental Device Disclaimer* document, accompanying this document.

2   Sample Kit Contents

1.   One XMSP430F6638 device sample

2.   Target board with 100-pin socket (MSP-TS430PZ100USB), with eight 1x20 pin headers (four male and four female) and an USB Cable (Type A to B).

    Please note that this board does not support other 100-pin MSP430 devices and only supports the MSP430F66xx.

3   Documentation Available Online

It is recommended to download the following documents from www.msp430.com from the F6638 product folder by selecting the 'Technical Documents' tab.

1.   Device Datasheet

2.   MSP430x5xx Family User's Guide

3.   Application Report: PMM, UCS, Port Mapping, and Flash Libraries for the MSP430x5xx and MSP430x6xx Devices

4.   MSP430F66xx Device Erratasheet

5.   Starting a USB Design Using MSP430 MCUs

6.   MSP430 USB CDC + HID API Stacks for USB development.

7.   MSP430F663x C and ASM IAR Code Examples

8.   MSP-TS430PZ100USB Target Board schematic

4   Getting Started with F66xx/F56xx Development

4.1   Setting up the IDE

Code Composer Studio v4:

Go to www.msp430.com. Select the 'Tools & Software' tab and scroll down to CCS V4 MCU Core Edition. This version of CCS will have built-in support for the F66xx device family. Install this version of CCS in a separate folder to be used for F66xx development.

IAR Workbench Kickstart:

Go to www.msp430.com. Select the 'Tools & Software' tab and scroll down to IAR Kickstart (Code limited IDE). This version of IAR will have built-in support for the F66xx

device family. Install this version of IAR in a separate folder to be used for F66xx development.

Note: Downloading the latest IDEs from the TI website will provide you with versions that include F66xx support. It is not required to install any device specific patches when using these versions.

4.2 MSP-FET430UIF Installation

1. Connect the Emulation Interface with the USB cable to a USB port of your PC.

2. The USB FET should be recognized instantly as the USB device driver should have been installed already with the IDE installation. If for any reason the Install Wizard starts, respond to the prompts and point the wizard to the driver files which are located (on a default installation) in directory:

   **CCS:** C:\Program Files\Texas Instruments\MSP430_USB_DRIVERS_v3\USB

   IAR: C:\ProgramFiles\IAR Systems\Embedded Workbench x.x\430\drivers\TIUSBFET\WinXP

   The MSP430 Hardware Tool User's Guide (Appendix F) gives detailed instructions how to install the USB drivers. A link to this document can be found in www.msp430.com under the User's Guides tab.

3. Use the 14-conductor (JTAG) cable to connect the evaluation module to a FET programmer (14-conductor cables are supplied with the FET programmers - parallel PC-FET (MSP-FET430Pxxx) and USB-FET (MSP-FET430Uxxx)). Ensure that the JTAG cable is plugged in correctly and that all jumpers (LEDs, and Vcc) are in place.

4. The evaluation module is now ready to be used for programming and debugging the MSP430.

4.3   MSP-TS430PZ100 USB Target Board

This section gives a brief description of the MSP430F6638 target board; on-board connectors and jumper settings. Figure1 shows the MSP-TS430PZ100 USB target board.
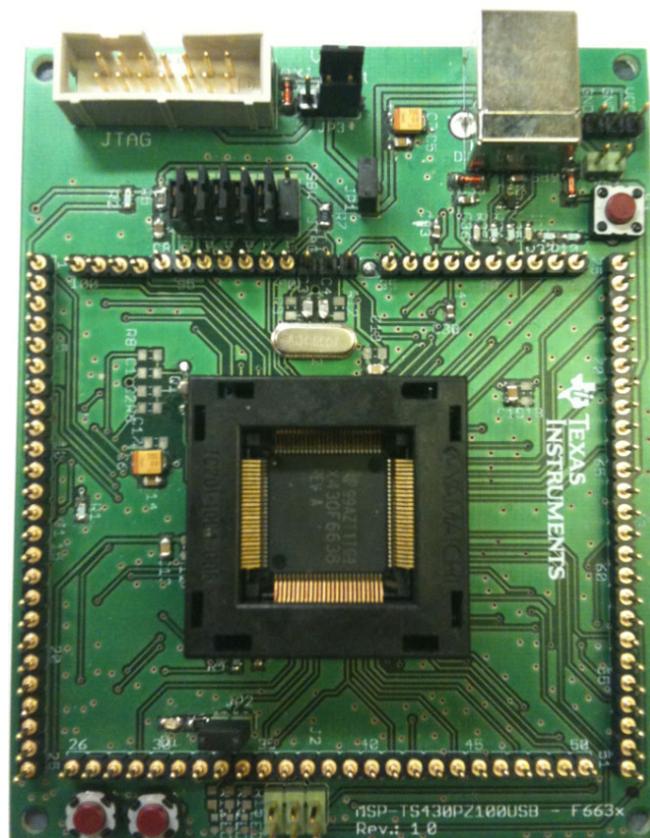
Figure 1.   MSP-TS430PZ100 USB Target Board

4.3.1 On-Board Connectors

- **JTAG Connector:** The 14-pin JTAG pin header is used to connect the USB-FET tool (MSPFET430UIF)

- **USB Connector:** The USB type B connector on the target board is used to connect the USB cable (Type A to B) between PC and the target board

4.3.2 Jumper Settings

The default jumper settings of the target board are:

1. JP3 set to internal (FET powered)

2. JP2 closed (LED)

3. JP4 open (not USB powered)

This section discusses about the two power scenarios (MSP-FET430UIF powered and USB powered) and the correct jumper settings required in both the cases.

• USB Powered Scenario (default jumper setting): Connect pin 3-2 of JP3 to indicate to the MSP-FET430UIF that external on-board power is used. Close jumper JP4 connection in order to use the USB bus power.

NOTE: The USB connection from the MSP430 target board to the PC can only be used for powering the device (if bus powered configuration is set) and for USB transmissions to and from the MSP430.

To open a debug session via the IDE, the MSP-FET430UIF is required.

• USB FET Powered Scenario: Place jumper on pins 1-2 of JP3 to use the internal USB FET power and make sure pin header JP4 is not closed. Pin Header JP1 is closed in both the power scenarios cases. This jumper can be removed to measure board current.

4.4   Setting up a USB Code Example

Detailed information on the MSP430 USB offering is available in the document *Starting a USB Design Using MSP430 MCUs*. The section below outlines getting started with development on the F6638 using a USB code example.

4.4.1   Attach the USB-FET Tool to the PC

Connect the USB-FET tool to a spare USB port on the PC using the USB cable.

If the USB-FET tool (MSP-FET430UIF) is attached to the PC for the first time, the device must be installed as described in section 4.2.

4.4.2   MSP430F6638 Target Board Connections

- Place the XMSP430F6638 unit in the device socket that is present on the MSP-TS430PZ100 USB Target board

- To ensure the jumper settings on the target board are correct (default jumper settings) refer to section 4.3.2 of this document

- Connect the 14 pin conductor cable between the JTAG connector on the target board and the MSP-FET430UIF FET tool.

- Make sure the USB cable (Type A to B) is used to connect the Type B USB connector on the target board and a spare USB port on the PC.

4.4.3   USB Firmware for the F6638

The USB Communications Device Class (CDC) API firmware can serve as the foundation of a USB application on the MSP430. The CDC is a device class supported by the USB Implementers' Forum, as well as all major OSes, which causes a "virtual" COM port to be mounted on the PC. The COM port can then be accessed by various PC applications. One such

PC application is the HyperTerminal, which is installed as part of a Windows and is therefore available on any Windows-based PC.

The USB API stacks and all the demo example codes/applications that use the USB CDC API can be downloaded from the MSP430F6638 product folder online, under the Tools & Software section. For detailed information regarding the USB stacks, refer to the documents *MSP430 USB CDC API Examples.pdf* that is located within the zip file.

4.4.4 Using CCS/IAR to Compile/Download/Run the Firmware

If the default power jumper settings are used: make sure the USB cable is connected between the Type B connector on the target board and a spare serial port on the PC.

First download the **"MSP430 USB CDC+HID API Stacks"** present in the MSP430F6638 online product folder under the Tools & Software section to a known location on the PC.

The following steps help compile and debug the API firmware in both CCS and IAR development platforms:

If using CCS:

a) Copy and extract the contents of the USB CDC API firmware *USB CDCv1.19 for CCSv4 .zip*, that is present in the *"MSP430 USB CDC+HID API Stacks"* zip file, to a known location on the PC *<...Your Working Directory \ USB CDCv1.19 for CCSv4 >*

b) Start CCSv4 Core Edition (Start → Programs → Texas Instruments → Code Composer Studio v4 → Code Composer Studio v4 Core Edition)

c) If opening the example projects for the first time:

- Upon being asked to select a workspace directory in the "Workspace Launcher" dialog, use the 'Browse' button to select the folder path, *<...Your Working Directory \ USB CDCv1.19 for CCSv4 \ Workspace>*. CCSv4 creates a new workspace in this folder path.

- Once CCS has created the workspace, import the project USBCDC_Example1 that is present at the PC location *<...Your Working Directory \ USB CDCv1.19 for CCSv4 >* into the workspace using PROJECT → Open Existing Project. An "Open Existing Project" window appears; use the 'Browse' button next to the Select Root Directory option to select the folder path *<...Your Working Directory \ USB CDCv1.19 for CCSv4 \ USBCDC_Example1>*. The project "USBCDC_Example1" gets selected in the 'Projects:' space. Then click 'Finish'.

- Multiple projects can be imported into this workspace

- Jump to Step (d)

If project is already linked to a workspace that you want to use:

- Upon being asked to select a workspace directory in the "Workspace Launcher" dialog, use the 'Browse' button to select the folder path, *<...Your Working Directory \ USB CDCv1.19 for CCSv4 \ Workspace>* where the CCS workspace was previously created for the project.

- Make sure the right project is select as the active project in the workspace.

d) Make sure that in PROJECT→ PROPERTIES → CCS BUILD → GENERAL, the Device Variant 'MSP430F6638' is selected.

e) Use PROJECT → REBUILD ALL to build and link the source code. To view the source code, double-click on the project, and then double-click on the displayed source file.

f) Use TARGET → DEBUG ACTIVE PROJECT to start the debugger. The debugger will erase the device Flash, and then download the application object file to the device Flash.

g) A firmware mismatch/update window may pop-up while trying to download the source code to device, for the first time. Click on "Update" to update the emulator firmware

h) Refer to the FET User's Guide, FAQ on Debugging #1 if the debugger is unable to communicate with the device.

i) Use RUN → RUN to start the application. If the device is connected to the PC for the first time with the firmware running, device installation/first time enumeration occurs.

If using IAR:

a) Copy and extract the contents of the USB API firmware *USB CDCv1.19 for IAR .zip,* that is present in the *"MSP430 USB CDC+HID API Stacks"* zip file, to a known location on the PC *<...Your Working Directory \ USB CDCv1.19 for IAR >*

b) Start the IAR Workbench which was installed.

Start → Programs → IAR Systems → IAR Embedded Workbench Kickstart for MSP430 → IAR Embedded Workbench

c) Open the IAR workspace provided in the USB CDC code examples. Navigate through FILE → Open → Workspace and use the 'Open' button to select the folder path *<...Your Working Directory \ USB CDCv1.19 for IAR \ Workspace*

d) Select the USBCDC_Example1 project and Make sure that under PROJECT→OPTIONS→Category: FET Debugger→ Setup tab→CONNECTION option, the Texas Instruments USB-IF or Texas Instruments LPT-IF is selected.

e) Next use PROJECT→REBUILD ALL to build and link the source code.

f) Next use PROJECT → DOWNLOAD and DEBUG to start the download and debug process. The debugger will erase the device Flash, and then download the application object file to the device Flash.

g) A firmware mismatch/update window may pop-up while trying to download the source code to device, for the first time. Refer figure below. Select "Yes" to update the emulator firmware

Emulator

⚠ The firmware on the TI USB FET does not match this software version. Do you want to update the firmware?

[Yes]   [No]

h) Refer to the FET User's Guide, FAQ on Debugging #1 if the debugger is unable to communicate with the device.

i) Use DEBUG→GO to start the application. If the device is connected to the PC for the first time with the firmware running, device installation/first time enumeration occurs. Refer Section 4.6

4.5 USB Device First-Time Enumeration

When a USB device is attached to a USB host (PC), the host *enumerates* it; that is, it queries the device as to what it is, and loads the corresponding drivers. The first time a device is attached, the OS may need help in locating the corresponding drivers so it can install the new device. Windows requests this by prompting the "Found New Hardware" wizard.

Drivers for CDC (Communications Device Class) are already installed within Windows, but Windows needs to be guided to an *.inf file (MSP430_CDC.inf) included with this kit. Using this *.inf file, Windows can finish loading the appropriate drivers.

NOTE: The enumeration procedure discussed here, takes place only the first time a specific USB device is connected to the USB host (PC). Successive enumerations for the same USB device happen without any need for user intervention.

The following steps give a detailed description of the device installation/first-time enumeration procedure for MSP430F6638 (under Windows XP). The procedures are also somewhat similar for other Windows operating systems.

1. On connecting the MSP430F6638 target board to PC, Windows detects the new device attached to PC and initiates the "Found New Hardware Wizard" prompting the user to install the software for the detected USB Device.

2. Select "No, not this time" from the options available and then click "Next" to proceed with the installation.

3. Select "Install from a list or specific location (Advanced)" as shown below and then click "Next".
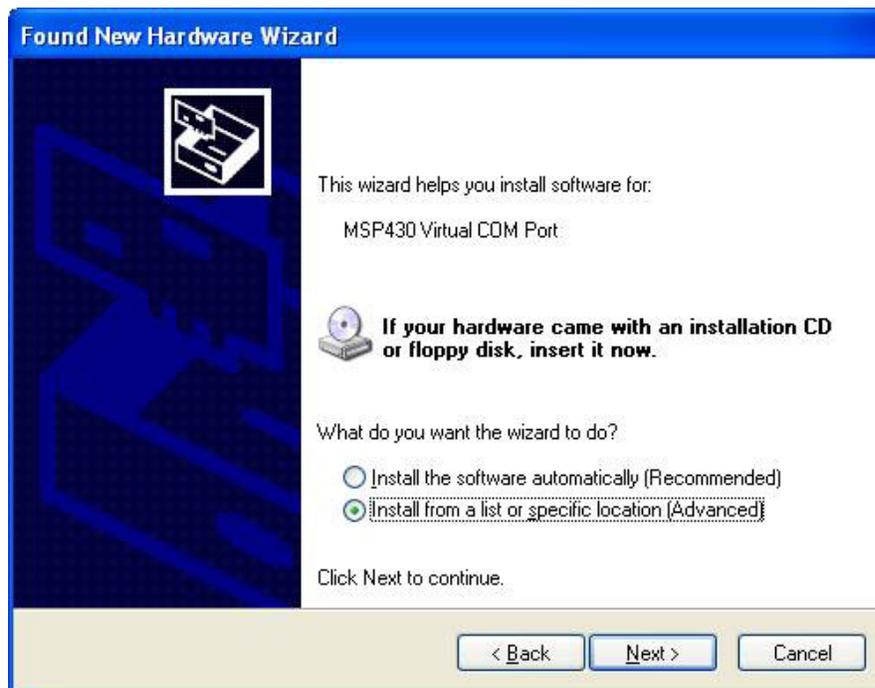
4. In the "Choose your search and installation options" window, select "Search for best driver in these locations" options and use the browse button to enter the file path that contains the USB API firmware in the combo-box. The *.inf file (MSP430_CDC.inf) is stored in the following folder location:

<...Your Working Directory \ USB CDCv1.19 for CCSv4 (or IAR) \ USBCDC_Example1 >

Once the file path has been entered in the box, click "Next" to proceed
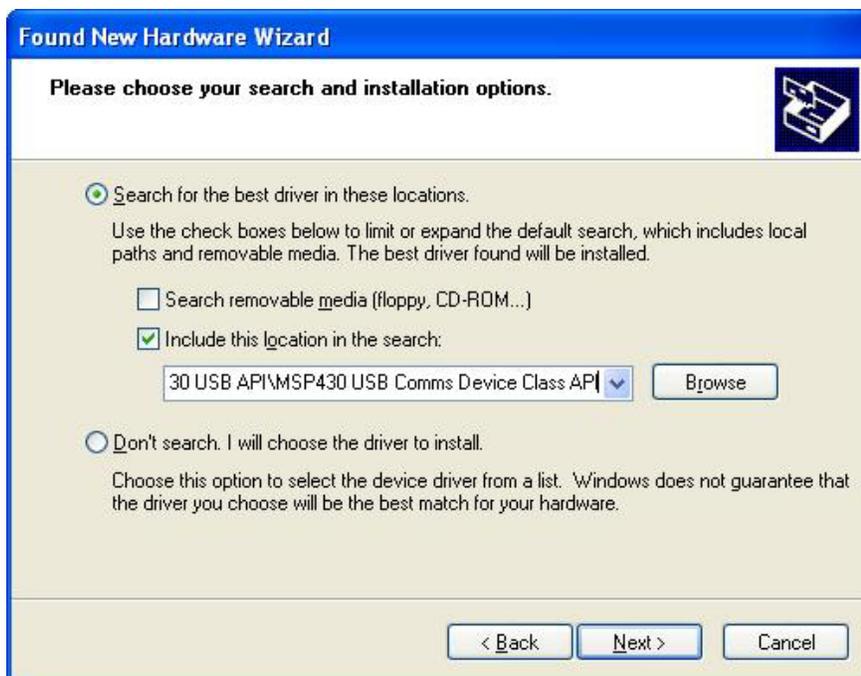
5. Wait while the wizard searches the driver files associated
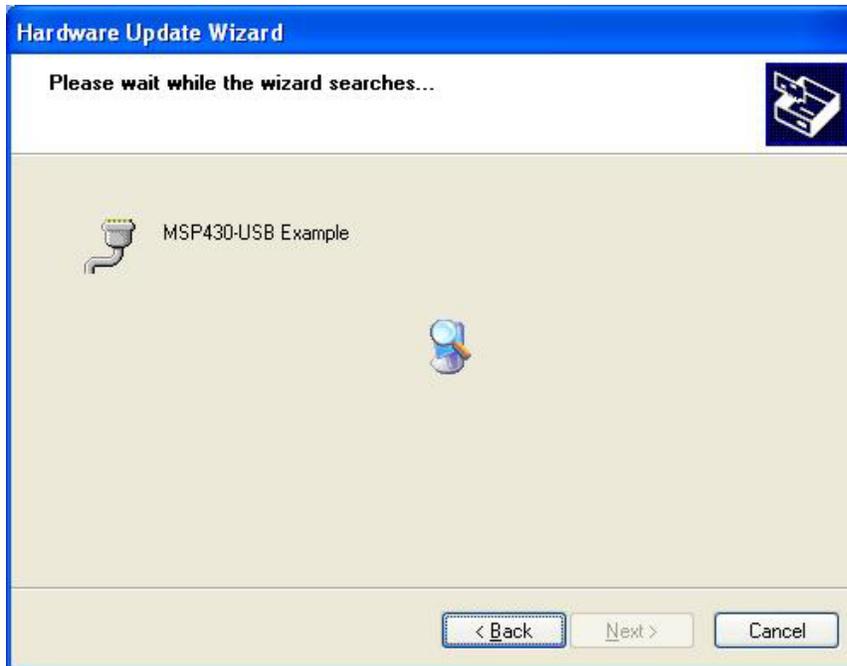
6. If Windows XP is configured to warn when unsigned (non-WHQL certified) drivers are about to be installed, the following screen will be displayed unless installing a Microsoft WHQL certified driver. Click on "Continue Anyway" to continue with the installation. If Windows XP is configured to ignore file signature warnings, no message will appear.

7. The following screen will be displayed as Windows XP copies the required driver files.

8. Windows should then display a message indicating that the installation was successful. Click "Finish" to complete the installation for the first port of the device.

4.6 Verifying USB Device Installation and Determining COM Port Assignment

To verify if the device is properly installed and to determine the COM port assignment of the device, use Device Manager, which is Windows' means of viewing all peripheral devices available in the system.

- In Windows, the Device Manager can be opened by browsing through Start → Control Panel\System, and then selecting the 'Hardware' tab and clicking 'Device Manager'.

- Select "View > Devices by Type" and the device appears as a "MSP430 Virtual COM port" under Ports (COM & LPT), as shown in figure below.
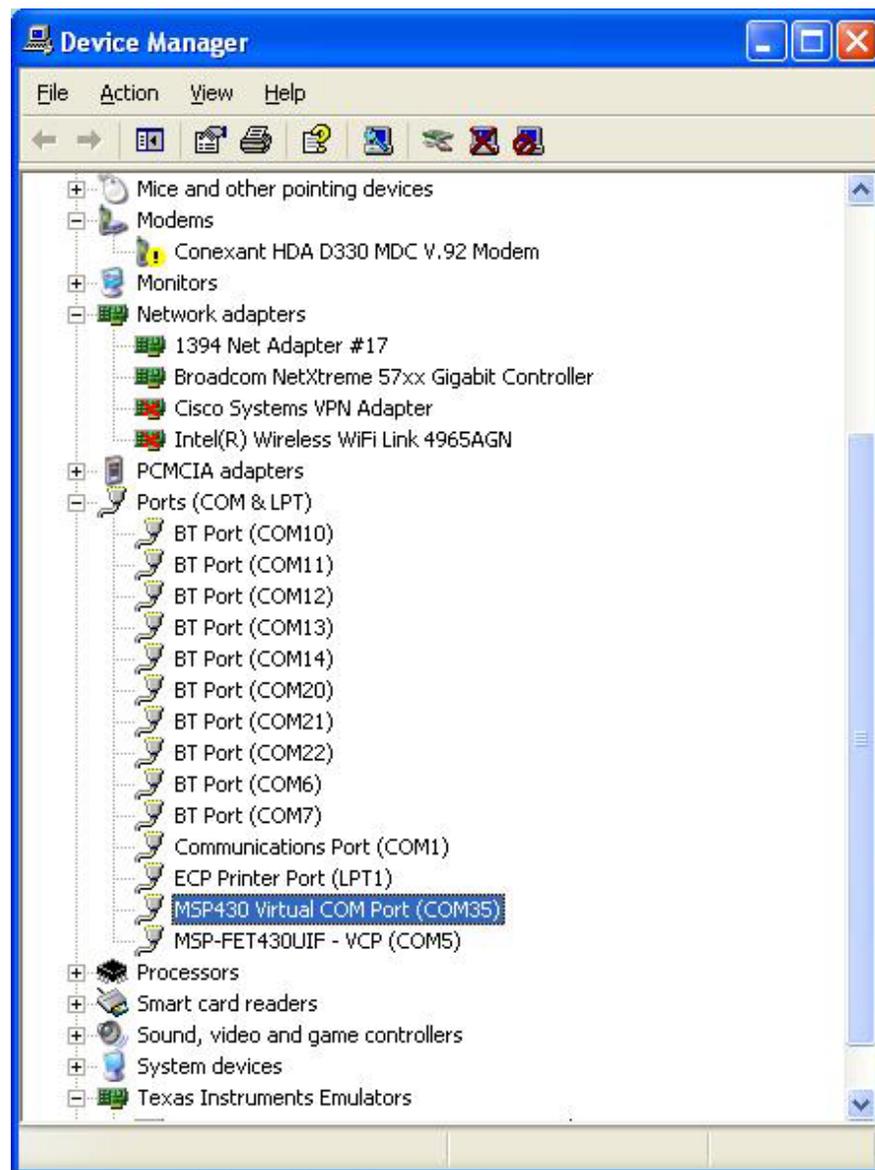
NOTE: The number assigned to the COM port (shown here as COM35) varies depending on the computer hardware configuration. Windows will check what COM ports are unused or free in the target PC and assigns that port number to the device.

If the installation was successful, then unplugging and re-plugging the target board should alternatively cause the device to disappear and re-appear in the Device Manager (assuming the "Scan for new hardware" feature is selected).

4.7   Running a USBCDC Demo Application using HyperTerminal

All the USBCDC examples that are provided with the USB API firmware interface with HyperTerminal application on the PC. The USBCDC_Example1 demo application is used to control the LED on the target board. Typing different phrases in the Hyper Terminal window is used to control the LED operation on the target board.

Here are steps to run the demo application:

- Open HyperTerminal. (For Windows XP, browse through Start → All Programs → Accessories → Communications → HyperTerminal)

- Enter a name for the new connection and press OK
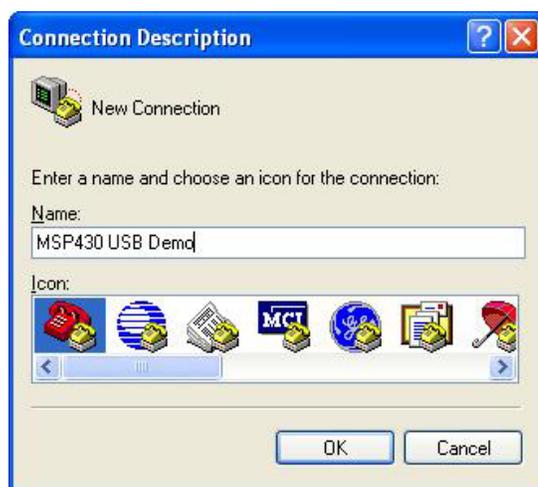
- Next select the drop down box for "CONNECT USING" to select the COM port that is assigned for the MSP430F6638 device (in this example, its COM35) and press OK
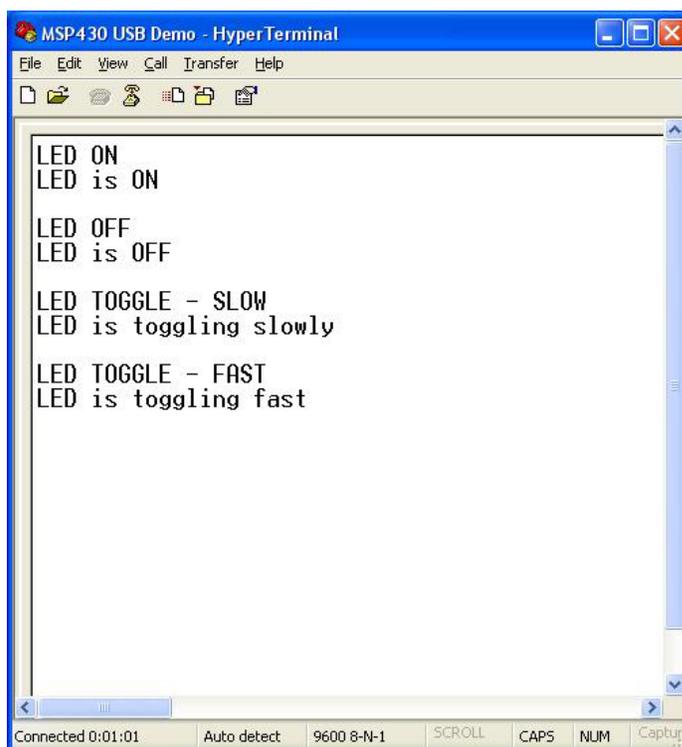
- Set appropriate PORT SETTINGS as shown below and press OK.
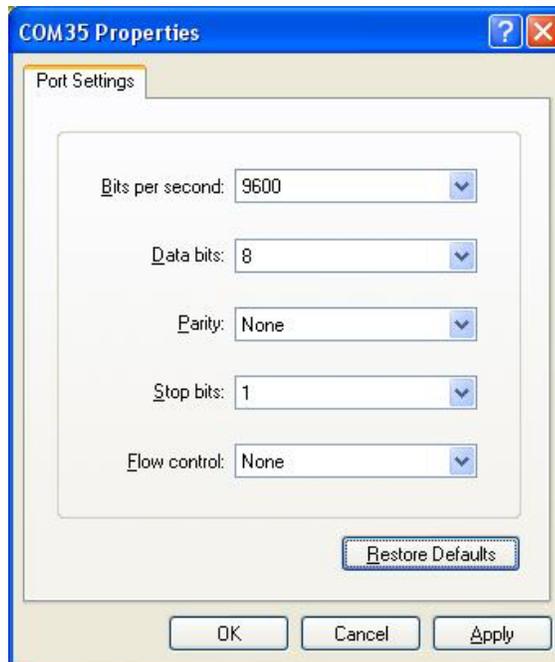
- Find below the ASCII set-up configurations for this demo. This window can be opened by navigating through File → Properties → Settings (tab) → ASCII setup
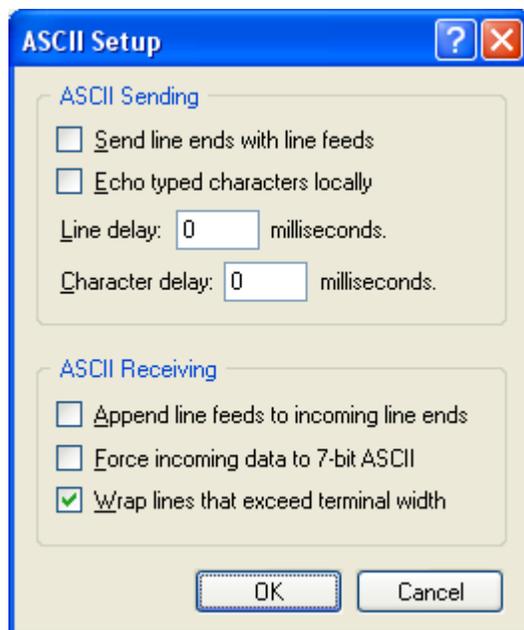
- Appropriate phrases entered in the HyperTerminal window help control the LED on the MSP430F6638 target board

Mentioned below are the valid LED control phrases that can be typed in the HyperTerminal Window:

- LED ON

- LED OFF

- LED TOGGLE – SLOW

- LED TOGGLE – FAST

Carriage Return/an Enter command followed by any of the above instructions results in the following:

- LED ON: Turns on the LED and returns the phrase "LED is ON" back to HyperTerminal

- LED OFF: Turns off the LED and returns the phrase "LED is OFF" back to HyperTerminal

- LED TOGGLE – SLOW: Turns on the timer used to toggle LED with a large period and returns the phrase "LED is toggling slowly" back to HyperTerminal

- LED TOGGLE – FAST: Turns on the timer used to toggle LED with a smaller period and returns the phrase "LED is toggling fast" back to HyperTerminal

NOTE: In case any other phrase (other than the ones discussed above) is typed in the HyperTerminal followed by the enter command, "No such command!" is returned back to the HyperTerminal.

The CDC and HID stacks provide a number of useful code examples that can serve as a good starting point for USB development.

5   Special Considerations for the MSP430F66xx Device

The document *MSP430x5xx Overview Comparison to MSP430x2xx and MSP430x4xx* provides a high level overview of migration concerns when moving from an MSP430F2xx/4xx family device to an MSP430F5xx/6xx device. In addition the section below outlines some specifics about enhancements in select modules in the F66xx device family.

5.1   Memory Map

The MSP430F66xx family has a 1-MB unified memory map with expanded peripheral space over previous families (see Table 1).

- Peripheral space is eight times the size available in the MSP430x2xx/MSP430x4xx families.

- Info A is two times the size available in the MSP430x2xx/MSP430x4xx families.

- Interrupt vector space is two times the size available in the MSP430x2xx/MSP430x4xx families.

- Extra 2KB USB RAM which can be used by the application code if the USB module is not in use.

Table 1.   Example Memory Map (MSP430F6638)

Segment	Address

Flash Memory Size	256KB
Main: Interrupt vector	00FFFFh to 00FF80h
Main: Code memory	047FFFh to 008000h
RAM Size	16KB + 2KB
Application RAM	02400h-063FFh
USB RAM	0023FFh-001C00h
Flash Boot Strap Loader	2KB
Peripherals	4KB
Information Memory	512 Byte
Info A	01980h – 019FFh
Info B	018FFh – 0197Fh
Info C	01880h – 018FFh
Info D	01800h – 0187Fh

5.2 Backup Battery Subsystem

The F6638 device is equipped with the ability to run RTC off a backup battery or capacitor and provide automatic switching to the secondary source in case the primary power fails.

The oscillator circuitry, select RTC registers and four words of backup memory are by default powered by the backup source. If there is no backup source connected Jumper JP11 on the MSP-TS430PZ100 USB target board connects the backup battery pin V_{BAT} to the device power DV_{CC}. This connection is required to power the oscillator.

It is also possible to power the oscillator directly from DVcc by disabling the backup system in software. This is done by setting the BAKDIS and BAKSW bits in the BAKCTL register.

5.3 XT1 Oscillator

The XT1 oscillator on the F6638 device is powered by the backup or secondary battery source. On exit from a BOR it is required to clear the LOCKIO bits in the BACKCTL register to unlock XT1 pins for operation. This requirement is unique to the F66xx family and can be done by the following code.

```
  while(BAKCTL & LOCKIO)              // Unlock XT1 pins for operation

    BAKCTL &= ~(LOCKIO);
```

The X430F6638 device is affected by erratum USB7 [refer the device errata sheet]. Due to this erratum it is required to have a 32.768 KHz crystal populated on XT1 when the USB module is in use. Note that this erratum will be fixed in the released MSP430F6638 device.

5.4 RTC_B Module

The RTC_B module in the F66xx device family is unique in that it is capable of operation (1) when the device is in LPM5 (Core is powered down) and (2) When the primary supply Vcc fails.

However it is important to know that only select RTC registers and four words of backup RAM are maintained during the above mentioned conditions.

On wakeup from LPM5 or when primary supply is made available once again it is necessary to reconfigure the RTC registers to their previous state. It is important to note that this reconfiguration needs to be performed before the LOCKIO bit is cleared.

 More details on the state of each RTC register at reset can be found in the F6xx Family User's Guide.

6 Support and Updates

For additional support contact the TI technical support team at the following link: http://www.ti.com/home_d_contact

For the latest tools/documentation updates please visit: www.ti.com/msp430tools.

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