

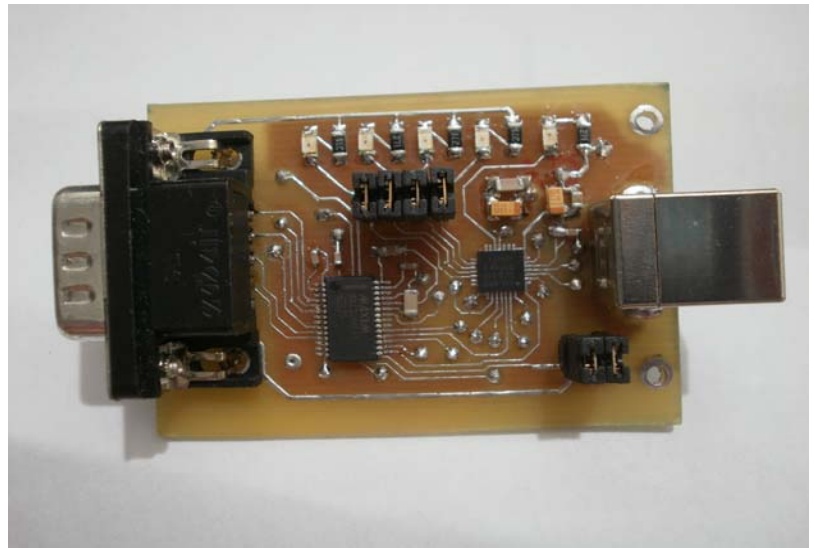
# USB-RS232 Interface Card: HT-MP213

## A compact solution for missing ports...

Thanks to a special integrated circuit from Silicon Laboratories, computer peripherals with an RS232 interface are easily connected to a USB port. This simple solution is ideal if a peripheral does not have a USB port, your notebook PC has no free RS232 port available, or none at all !

After a slow and faltering start, the USB port has become commonplace on PCs, to the extent that the latest GHz machines have just one RS232 port left, or none at all. The compact USB-RS232 interface described in this article allows your good old RS232 peripherals (printer, programmer system, etc.) to be hooked up to a USB port. The free driver programs for Win 2000/XP, Linux and Apple Macintosh make the interface virtually transparent, enabling the USB port to behave like a regular COM interface.

The driver and the conversion chip from Silicon Laboratories allow a full serial data link to be set up on a 9-way RS232 connector, including all handshaking signals.



## 1. THE SILICON LABORATORIES CP2103 SYSTEMS OVERVIEW

The CP2103 is a highly-integrated USB-to-UART Bridge Controller providing a simple solution for updating RS-232/RS-485 designs to USB using a minimum of components and PCB space. The simplified block diagram of the CP2103 is shown in **Figure 1** and the pin assignment, in **Figure 2**. Royalty-free Virtual COM Port (VCP) device drivers provided by Silicon Laboratories allow a CP2103-based product to appear as a COM port to PC applications.

The CP2103 UART interface implements all RS-232/RS-485 signals, including control and handshaking signals, so existing system firmware does not need to be modified. The device also features up to (4) GPIO signals that can be user-defined for status and control information. Support for I/O interface voltages down to 1.8 V is provided via a VIO pin. In many existing RS-232 designs, all that is required to update the design from RS-232 to USB is to replace the RS-232 level-translator with the CP2103.

Silicon Laboratories has taken care of the PC side of things by supplying royalty-free Virtual COM Port (VCP) device drivers. If you've ever used a PC RS-232-to-USB converter, you know that it looks like a standard COM port to the PC and its applications. The VCP device driver also pretends to be a standard COM port. That means that we can use our newly acquired microcontroller USB interface to communicate with a Tera Term Pro terminal window on a computer just as if we were using RS-232 hardware on the embedded side.

## 2. HT-MP213 USB-to-RS232 CONVERTER BOARD

The HT-MP213 is designed to transition a piece of hardware from an RS-232/485 interface to a USB interface. We were attracted to the CP2103 because of its skinny schematic diagram. If we believe what the CP2103 datasheet schematic is telling us, it doesn't require any external resistors or crystals to bring a fully compliant USB 2.0 interface to life. The silicon encapsulates a level 2.0 full-speed function controller, transceiver, EEPROM, oscillator, and UART in a tiny QFN-28 package. The internal EEPROM is used for storing vendor-specific information in commercial applications. If we find that we need to access the EEPROM, there is easy access and programming via its USB interface.

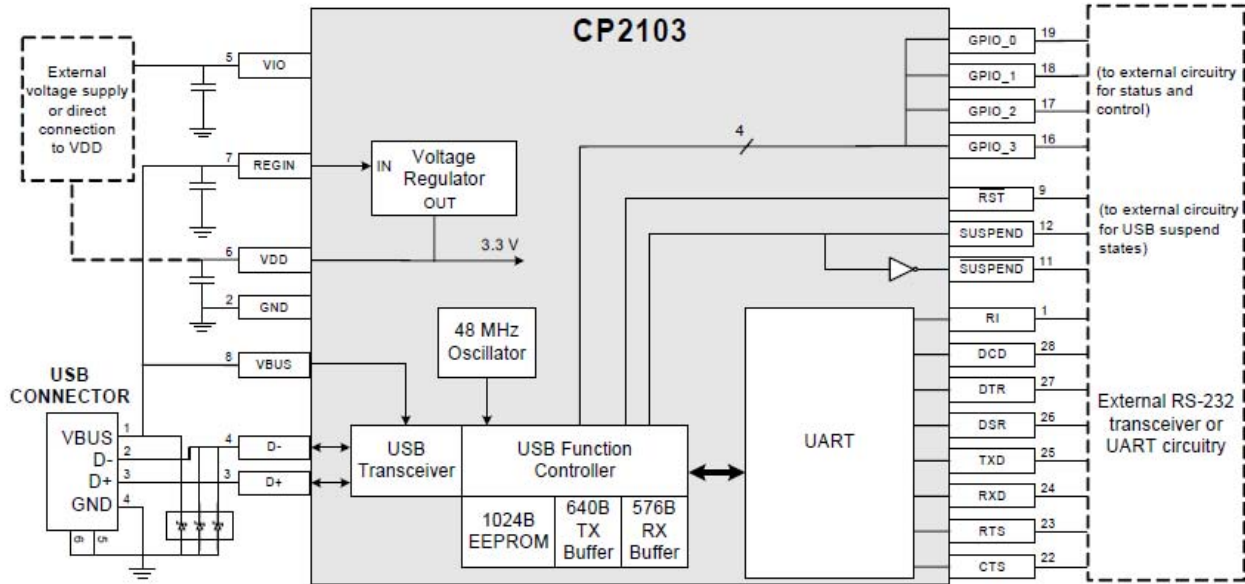


Figure 1. Simplified block diagram of the USB/RS232 converter type CP2103.

Let's talk about the functional blocks that make up the CP2103 beginning with the USB function controller and transceiver. Basically, the USB function controller manages all of the data transfers between the UART and USB interfaces. The USB function controller is also responsible for handling command requests that are generated by the USB host controller. The CP2103's internal UART is also under the command of the USB function controller. The CP2103's USB 2.0-compliant transceiver's functionality is rather obvious. The transceiver's only reason to live is to send and receive serial data on the USB bus.

There's nothing remarkable about the CP2103's UART interface. If you think about all that has been said about how the CP2103 can replace an MAX2545, it would make sense that the UART does everything exactly like any other UART would. But in fact, it is much more sophisticated than what is found on many UART-equipped microcontrollers. In addition to the standard TXD and RXD (transmit and receive) signals, the CP2103's UART interface includes all of the standard EIA modem signals.

The DTR and RTS modem signals are generated by the DTE, or Data Terminal Equipment. Your PC qualifies as a DTE device. Under normal circumstances, the modem or Data Communications Equipment (DCE) — responds to a DTR signal with a DSR signal which indicates that the modem is powered up and can communicate with the DTE. The DTE device raises the RTS signal to the modem when it wants to transmit. If the coast is clear, the modem responds to the DTE device by raising the CTS signal. When a remote modem is contacted and the carrier is sensed, the DCD line is asserted, telling the DTE that a link has been established. For switched (dial-up) links, the modem raises RI when the phone line it is attached to is ringing. The RI signal is used by the software for unsophisticated modems that cannot auto answer. Every conceivable baud rate from 300 to 921600 bps is supported by the CP2103's UART interface, which can also speak all of the parity, data bit, and stop bit combinations.

One of our concerns about moving to a USB interface involves the customization of each USB equipped device. Once again, the engineers at Silicon Laboratories have provided an out in the customization maze. As long as we stick with their USB ICs, we can use the free Product ID (PID) provided by Silicon Laboratories in conjunction with their Vendor ID (VID). Using Silicon's PID and VID with a unique serial number will assure the uniqueness of each USB device sporting a CP2103. All of the customization we just discussed is written to the CP2103's internal EEPROM. Yep, Silicon Laboratories provides the stand-alone EEPROM programming utility we will need to perform the customization.

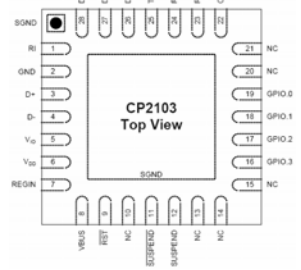


Figure 2. CP2103 QFN-28 Pin-out Diagram (Top View)

**Standard EIA Modem signals:**

- RTS - Request To Send
- CTS - Clear To Send
- DSR - Data Set Ready
- DTR - Data Terminal Ready
- DCD - Data Carrier Detect
- RI - Ring Indicate

As you can see in Schematic 1, a complete RS-232 interface is built around the MAX3545. The idea is to connect a legacy RS-232 device to the nine-pin end of the Kit which becomes a transparent bridge to a PC's USB port. With this Kit, we have all of the necessary hardware to make a USB-to-RS-232 connection.

### 3. Virtual COM Port (VCP) Driver Installation

As is well known, USB devices may be 'hot plugged' to the PC. The operating system will recognize the interface and request the associated driver. However, not one bit of data will transfer without the help of the Virtual COM Port (VCP) driver. This may be downloaded from the Drivers and Utilities page on the Silicon Lab website. The so-called Virtual COM Port (VCP) drivers arrange for the interface to behave like an ordinary serial port. There are drivers for Windows, MacOS and Linux. Having installed the driver, the simulated COM port may be addressed by applications just like any regular serial port on the system.

Download the [VCP Driver Kit](#) from Silicon Laboratories website and follow the instruction to install the VCP driver.

Since our goal is to replace an old-fashioned piece of RS-232 hardware with a new fangled piece of tiny USB hardware in an embedded environment, we decided that a good initial test of the HT-MC213's capabilities would be to interface a HT-MC02 Development Board's RS-232 port to this board.

### 4. HT- MC213 Board Detail

#### UART Signals (J1)

A RS232 transceiver circuit and DB-9 connector (J1) are provided on this board to connect the CP2103 virtual serial port to external serial devices. See Table 1 for the RS232 J1 pin descriptions.

Pin	Signal	CP2103 Direction	Description
1	DCD	Input	Data Carrier Detect
2	RXD	Input	Receive Data
3	TXD	Output	Transmit Data
4	DTR	Output	Data Terminal Ready
5	GND		Ground
6	DSR	Input	Data Set Ready
7	RTS	Output	Request to Send
8	CTS	Input	Clear to Send
9	RI	Input	Ring Indicator

Table 1. RS232 Pin Descriptions

#### Universal Serial Bus (USB) Interface (JP1)

A Universal Serial Bus (USB) connector (JP1) is provided to facilitate connections to the USB interface on the CP2103. See Table 2 for the USB pin definitions.

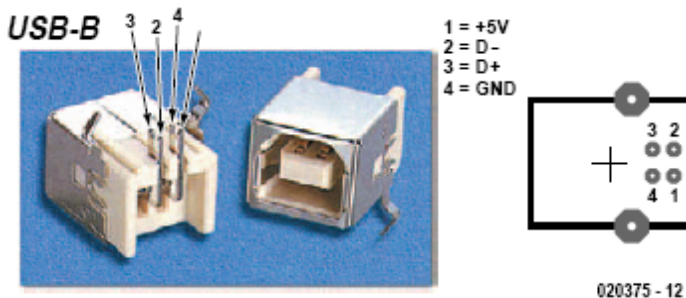


Figure 3: USB type-B connector

Pin #	Description
1	VBUS
2	D-
3	D+
4	GND (Ground)

Table 2. USB Pin Descriptions

## 5. HT-MP213 Hardware Interface to HT-MC02 8051 Development Board

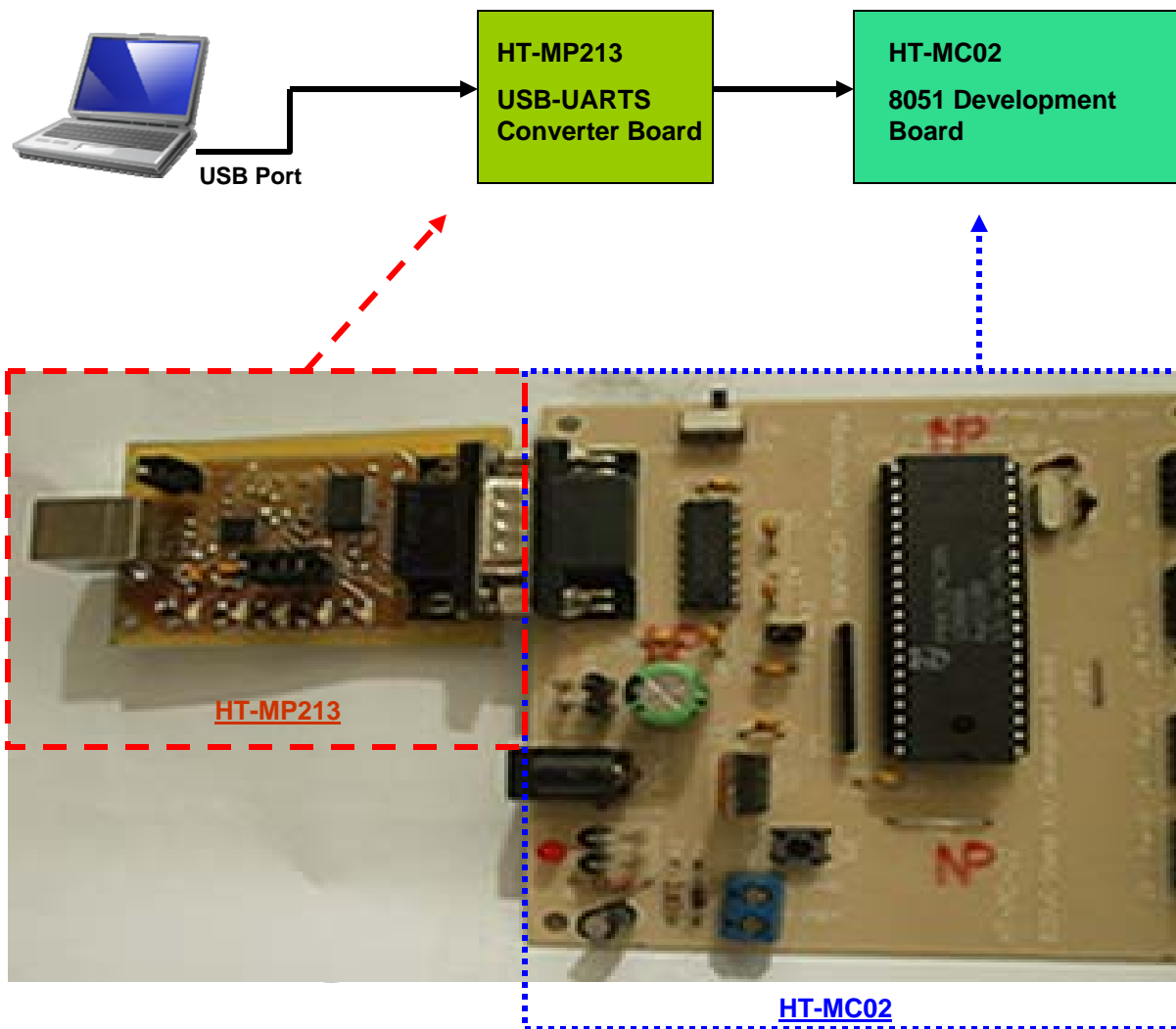
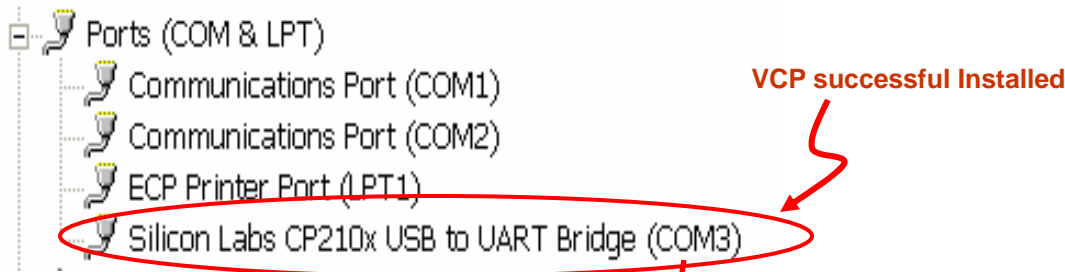


Figure 4: Connecting HT-MP213 to HT-MC02 8051 Development Board

You can verify whether the VCP had successful installed in you PC in Window environments by checking the hardware configuration:

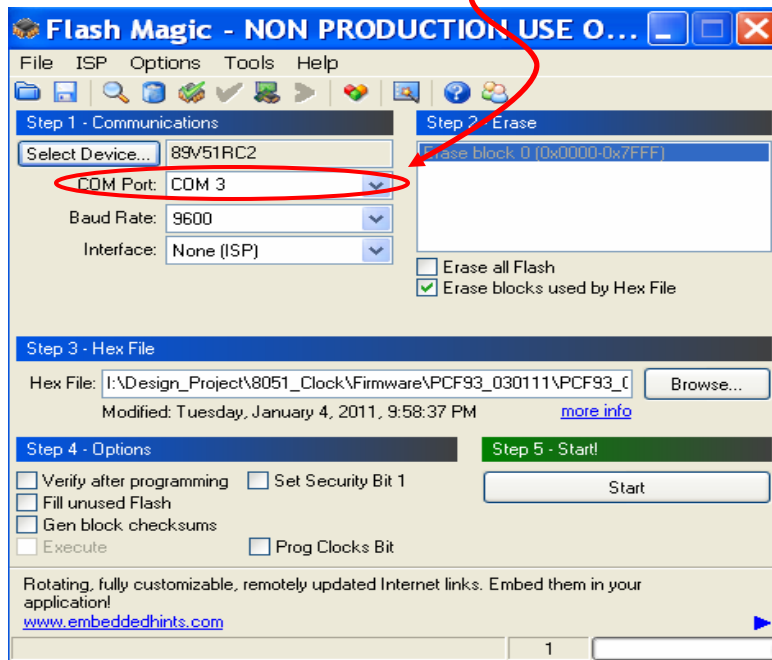
1. Click "System" icon from Window "Start" -> "Control Panel".
2. Click "Device Manager" from Hardware tab.
3. Expand the "Ports ( Com & LPT) menu by clicking the + sign.
4. If VCP is successful installed and HT-MP213 is plug into any free USB port, you should see "**Silicon Labs CP210x USB to UART Bridge ( COM3)**" displayed as shown in Figure 6.





**Figure 6: Window Device Manager Hardware Configuration**

5. Connect up the systems as shown in Figure 4. Launch the Flash Magic for 8051 Programming Software.



**Figure 7: Flash Magic: 8051 Programming Software**

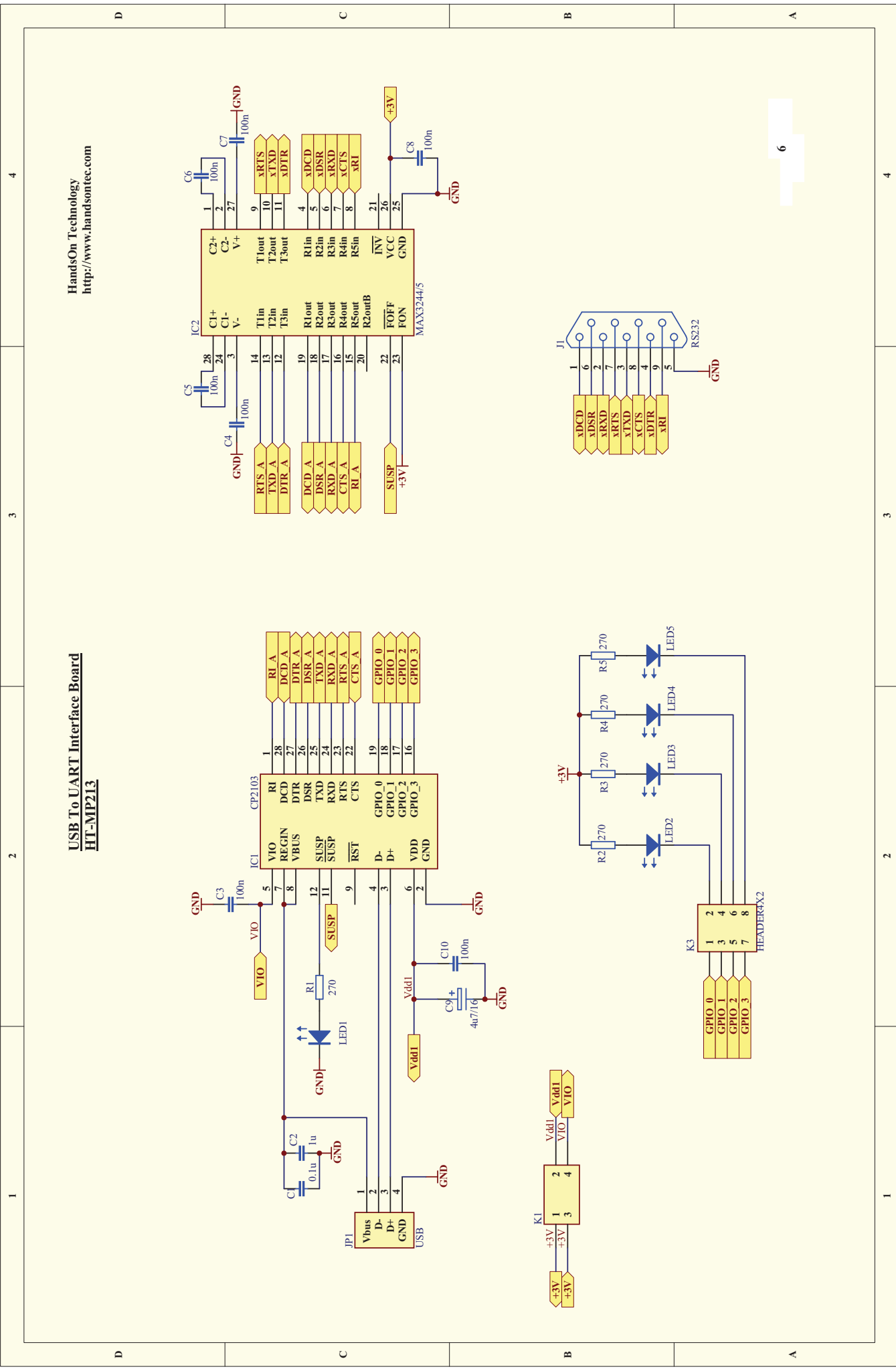
6. Select the correct "COM Port" drop-down menu according to as shown in the "Window Device Manager. In this case the COM 3 have been selected. Refer to User Guide for [HT-MC02](#) 8051 Development Board for more operating detail operation of this flash programming software for 8051 u-Controller.

**Reference:**

1. CP2103 data sheet & CP2103 Evaluation Kit User's Guide
2. USB Complete 3<sup>rd</sup> Edition by Jan Axelson
3. PC Serial Peripheral Design

**Source:**

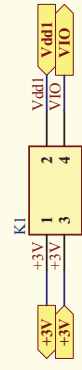
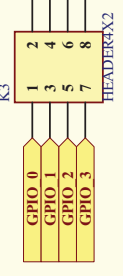
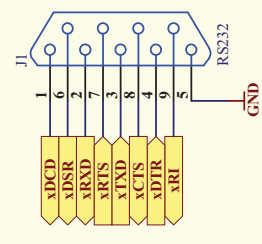
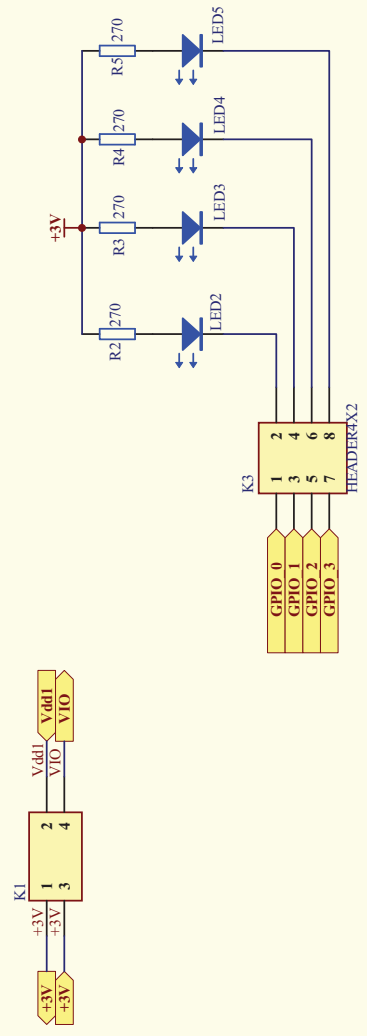
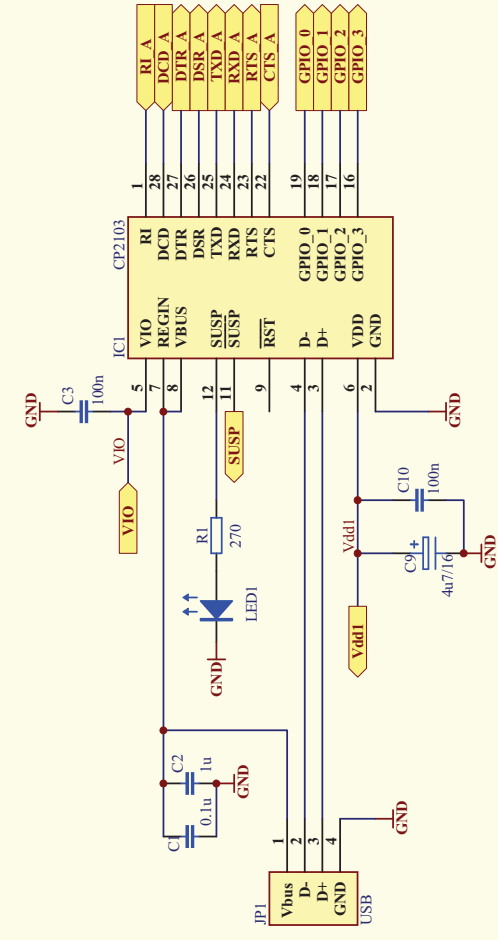
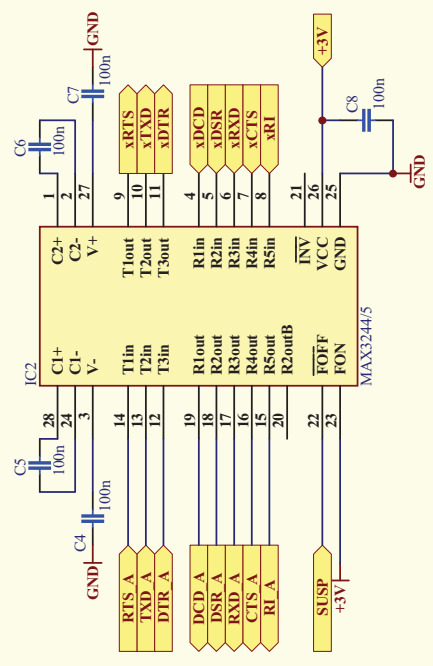
1. <http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx>
2. <http://www.handsontec.com/emag.php>



**USB To UART Interface Board  
HT-MP213**

HandsOn Technology  
http://www.handsontec.com

6



D

C

B

B

A

A

4

3

2

1

4

3

2

1