

Future Technology Devices International Ltd

USB to RS232 UART Serial Converter PCB

Datasheet

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1 Description

The **USB-RS232-PCB** is a USB to RS232 level serial UART converter PCB incorporating FTDI's FT232RQ USB to Serial UART interface IC device which handles all the USB signalling and protocols. The PCB provides a fast, simple way to connect devices with a RS232 level serial interface to USB.

Each USB-RS232-PCB contains a small internal electronic circuit board, utilising the FT232R plus a USB type-A connector. The FT232R datasheet, DS_FT232R, is available at http://www.ftdichip.com. The integrated electronics also include an RS232 level shifter plus Tx and Rx LEDs which give a visual indication of UART traffic. All components used, including the FT232R are Pb-free (RoHS compliant).

The PCB is USB powered and USB 2.0 full speed compatible. Each PCB supports a data transfer rate up to 1 Mbaud and supports the FTDIChip-ID™, with a unique USB serial number programmed into the FT232R. This feature can be used to create a security or password protected file transfer access using the PCB. Further information and examples on this feature are available at http://www.ftdichip.com under FTDIChip-ID Projects.

The USB-RS232-PCB requires USB drivers, available free from **http://www.ftdichip.com**, which are used to make the FT232R on the PCB appear as a virtual COM port (VCP). This then allows the user to communicate with the USB interface via a standard PC serial emulation port (for example TTY). Another FTDI USB driver, the D2XX driver, can also be used with application software to directly access the FT232R on the PCB though a DLL. This is illustrated in the Figure 1.1.

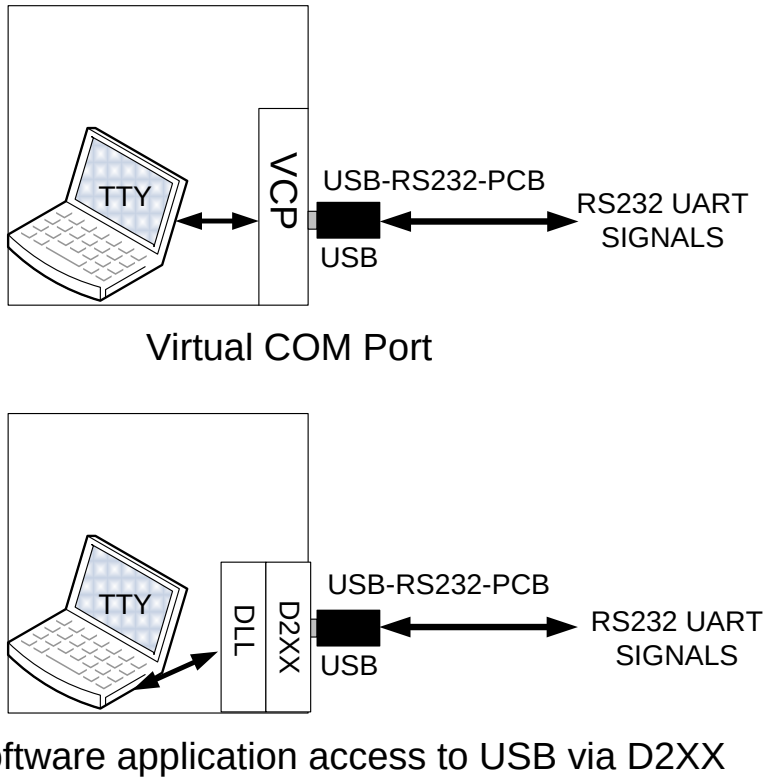


Figure 1.1 Using the USB-RS232-PCB

1.1 Part Number

The following Table 1.1 gives details of the available USB-RS232-PCB.

Part Number	Description
USB-RS232-PCB	USB to RS232 level UART PCB

Table 1.1 USB-RS232-PCB Part Number

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1.2 USB Compliant

The USB-RS232-PCB is fully compliant with the USB 2.0 specification.



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2 Typical Applications

- USB to Serial RS232 Level Converter.
- Upgrading Legacy Peripherals to USB.
- Interface Microcontroller UART or I/O to USB.
- Interface FPGA / PLD to USB.
- USB Instrumentation PC interface.
- USB Industrial Control.
- USB password protected file transfers.

2.1 Driver Support

Royalty free VIRTUAL COM PORT (VCP) DRIVERS for…

- Windows 98, 98SE, ME, 2000, Server 2003, XP and Server 2008
- Windows XP and XP 64-bit
- Windows Vista and Vista 64-bit
- Windows XP Embedded
- Windows CE 4.2, 5.0 and 6.0
- Mac OS 8/9, OS-X
- Linux 2.4 and greater

Royalty free D2XX *Direct* Drivers (USB Drivers + DLL S/W Interface)

- Windows 98, 98SE, ME, 2000, Server 2003, XP and Server 2008
- Windows XP and XP 64-bit
- Windows Vista and Vista 64-bit
- Windows XP Embedded
- Windows CE 4.2, 5.0 and 6.0
- Linux 2.4 and greater
- Mac OS-X

The drivers listed above are all available to download for free from **www.ftdichip.com**. Various 3rd Party Drivers are also available for various other operating systems - see **www.ftdichip.com** for details.

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2.2 Features

- USB-RS232-PCB provides a USB to RS232 Serial UART interface.
- Entire USB protocol handled by the electronics on the PCB.
- EIA/TIA-232 and V.28/V.24 communication interface with low power requirements.
- UART interface support for 7 or 8 data bits, 1 or 2 stop bits and odd / even / mark / space / no parity.
- Fully assisted hardware (RTS#/CTS#) or X-On / X-Off software handshaking.
- Data transfer rates up to 1 Mbaud.
- Internal EEPROM with user writeable area.
- FTDI's royalty-free VCP allow for communication as a standard emulated COM port and D2XX 'direct' drivers provide DLL application programming interface.
- Support for FT232R FTDIChip-ID™ feature for improved security.
- PCB is USB Powered - no external supply required.
- 6 outputs provide Tx, Rx, RTS#, CTS#, POWER and GND.
- Low USB bandwidth consumption.
- UHCI / OHCI / EHCI host controller compatible.
- USB 2.0 Full Speed compatible.
- -40°C to +85°C operating temperature range.
- ESD Protection for RS-232 I/O's
  ±15kV Human Body Model (HBM)
  ±15kV EN61000-4-2 Air Gap Discharge
  ±8kV EN61000-4-2 Contact Discharge

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3 Features of FT232R applicable to USB-RS232-PCB

The USB-RS232-PCB uses FTDI's FT232RQ USB to serial IC device. This section summarises the key features of the FT232RQ which apply to the USB-RS232-PCB. For further details, and a full features and enhancements description consult the FT232R datasheet, this is available from www.ftdichip.com.

Internal EEPROM. The internal EEPROM is used to store USB Vendor ID (VID), Product ID (PID), device serial number, product description string and various other USB configuration descriptors. Each FT232RQ is supplied with the internal EEPROM pre-programmed as described in **Appendix A - PCB EEPROM Configuration**. The internal EEPROM descriptors can be programmed in circuit, over USB without any additional voltage requirement. It can be programmed using the FTDI utility software called MPROG, which can be downloaded from FTDI Utilities on the FTDI website (www.ftdichip.com). Additionally, there is a user area of the internal EEPROM available to system designers to allow storing of data (note that this is not modified by MPROG).

Lower Operating and Suspend Current. The FT232R has a low 15mA operating supply current and a very low USB suspend current of approximately 70µA.

Low USB Bandwidth Consumption. The USB interface of the FT232R, and therefore the USB-RS232-PCB has been designed to use as little as possible of the total USB bandwidth available from the USB host controller.

UART Pin Signal Inversion. The sense of each of the UART signals can be individually inverted by configuring options in the internal EEPROM. For example CTS# (active low) can be changed to CTS (active high), or TXD can be changed to TXD#.

FTDIChip-ID™. The FT232R includes the new FTDIChip-ID™ security dongle feature. This FTDIChip-ID™ feature allows a unique number to be burnt into each FT_232RQ during manufacture. This number cannot be reprogrammed. This number is only readable over USB can be used to form the basis of a security dongle which can be used to protect any customer application software being copied. This allows the possibility of using the USB-RS232-PCB as a dongle for software licensing. Further to this, a renewable license scheme can be implemented based on the FTDIChip-ID™ number when encrypted with other information. This encrypted number can be stored in the user area of the FT232R internal EEPROM, and can be decrypted, then compared with the protected FTDIChip-ID™ to verify that a license is valid. Web based applications can be used to maintain product licensing this way. An application note, AN232R-02, available from FTDI website (www.ftdichip.com) describes this feature.

Extended Operating Temperature Range - The USB-RS232-PCB is capable of operating over an extended temperature range of -40º to +85ºC thus allowing it to be used in automotive or industrial applications.

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4 USB-RS232-PCB Connector Pin Out and Mechanical details

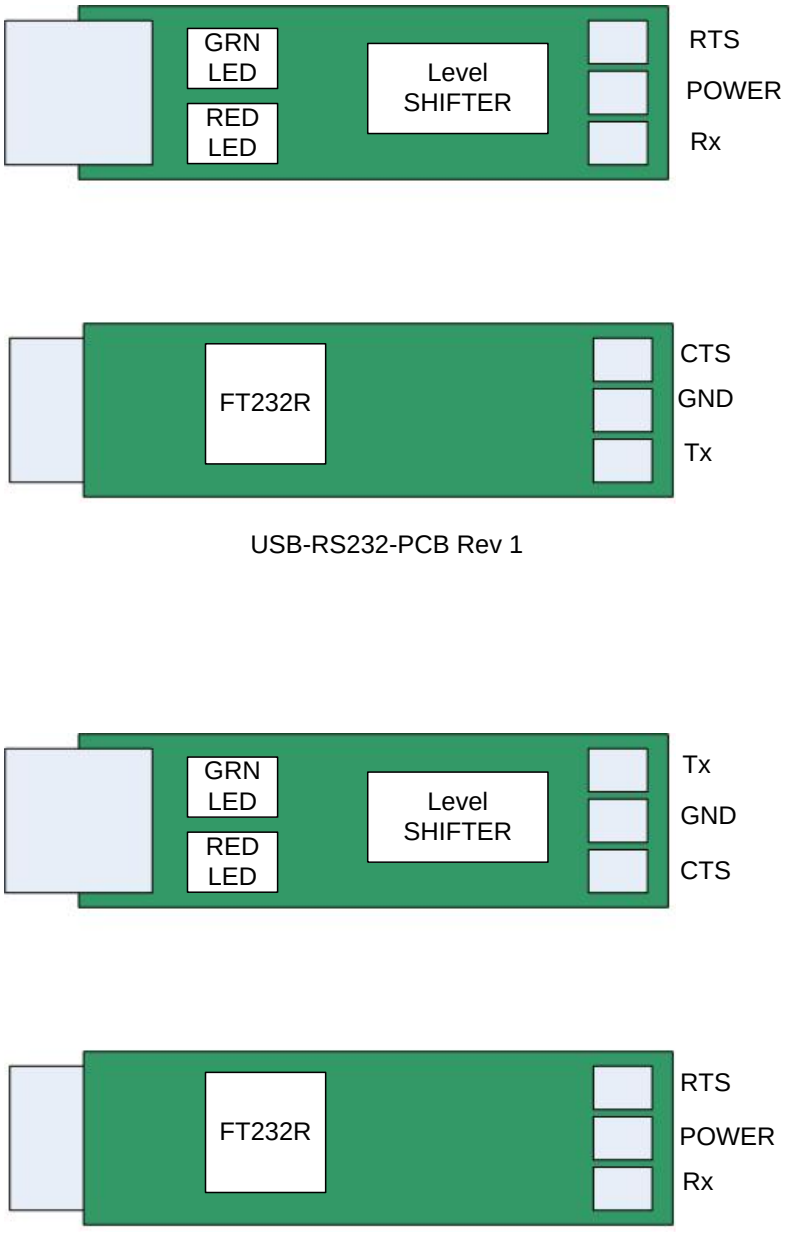


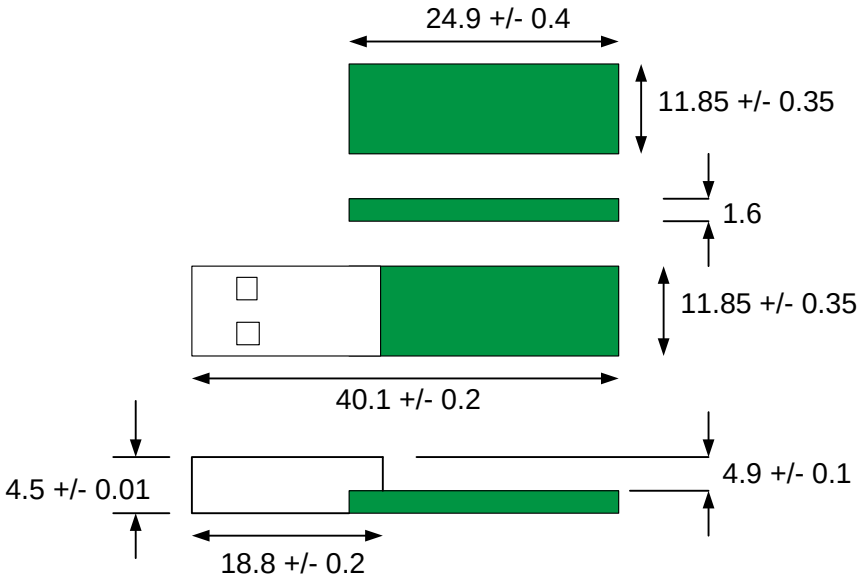
Figure 4.1 USB-RS232-PCB Pin Out (Top is TOP View, Bottom is BOTTOM View)

Changes made from Rev1 to Rev 2 design:

- Pad designation changed between Rev1 and Rev2 (see Figure 4.1)
- R1 doesn't exist in Rev2 design, the selection of power signal is done using either R2 (+3.3V) or R3 (+5V), (see Table 4.2)
- The LEDTX, LEDRX, PWREN and SLEEP are connected to the FT232R differently (see schematic)

The mechanical details of the PCB are shown in the following diagram Figure 4.2

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Dimensions in mm

Figure 4.2 USB-RS232-PCB, Mechanical Details

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4.1 USB-RS232-PCB Signal Descriptions

Name	Type	Description
GND	GND	Device ground supply pin.
CTS#	Input	Clear to Send Control input / Handshake signal.
POWER	Output	Power output. Default is GND, but can be customised to output +3.3V or +5V. If required, contact FTDI Sales Team (sales1@ftdichip.com)
TXD	Output	Transmit Asynchronous Data output.
RXD	Input	Receive Asynchronous Data input.
RTS#	Output	Request To Send Control Output / Handshake signal.

Table 4.1 USB-RS232-PCB Signal Descriptions

4.2 USB-RS232-PCB +5V/+3.3V Selection

Selection of whether the POWER signal is GND, +3.3V or +5V is done using resistors. The following table gives details of what resistors are required for the different voltage levels.

Resistor R2	Resistor R3	Description
Not Fitted	Not Fitted	VCC floats
Fitted	Not Fitted	POWER Signal is +3.3V
Not Fitted	**Fitted**	POWER Signal is +5.0V

Table 4.2 UART Signal Level Selection

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4.3 USB-RS232-PCB Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
VCC_5V	Output Power Voltage*	4.25	5.0*	5.25	V	*Default is GND. This figure only applies when cable has been customised to output +5V. The range is dependent on the USB port that the USB-RS232-WE is connected to
VCC_3.3V	Output Power Voltage**	3.2	3.3**	3.4	V	**Default is GND. This figure only applies when cable has been customised to output +3.3V.
I_O	Output Power Current***	-		75	mA	***Only applies when POWER output is customised to +5V or+3.3V Must be less that 2.5mA during suspend.
T	Operating Temperature Range	-40		+85	°C	

Table 4.3 USB-RS232-PCB

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
Vtrans	RS232 Transmitter output voltage swing	+/- 5	+/- 6.5	+/- 15	V	
Vrec	RS232 Receiver input voltage range	-25		+25	V	

Table 4.4 USB-RS232-PCB I/O Pin Characteristics

Description	Conditions	Minimum	Typical	Maximum
ESD HBM	RS-232 Inputs and Outputs		±15 kV	
EN61000-4-2ContactDischarge	RS-232 Inputs and Outputs		±8 kV	
EN61000-4-2AirGapDischarge	RS-232 Inputs and Outputs		±15 kV	

Table 4.5 USB-RS232-WE ESD Tolerance

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5 USB-RS232-PCB Circuit Schematic

The circuit schematic of the USB-RS232-PCB, utilising the FTDI FT232R, is shown in Figure 5.1

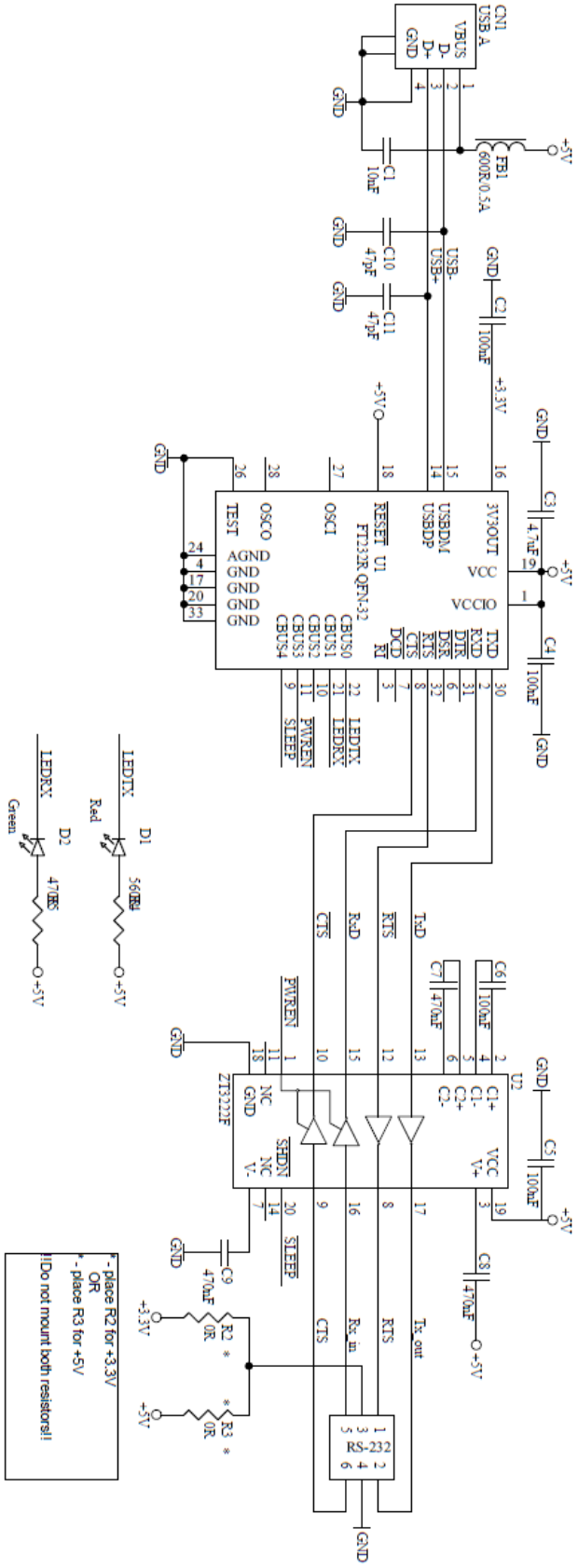


Figure 5.1 Circuit Schematic of USB-RS232-PCB.

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6 Contact Information

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Distributor and Sales Representatives

Please visit the Sales Network page of the FTDI Web site for the contact details of our distributor(s) and sales representative(s) in your country.

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Appendix A - PCB EEPROM Configuration

Each USB-RS232-PCB is controlled by the FTDI FT232R IC. This FT232R device contains an EEPROM which contains the USB configuration descriptors for that device. When the PCB is plugged into a PC or a USB reset is performed, the PC will read these descriptors. The default values stored into the internal EEPROM are defined in Table 0.1 Default Internal EEPROM Configuration

Parameter	Value	Notes
USB Vendor ID (VID)	0403h	FTDI default VID (hex)
USB Product UD (PID)	6001h	FTDI default PID (hex)
Serial Number Enabled?	Yes	
Serial Number	See Note	A unique serial number is generated and programmed into the EEPROM during device final test.
Pull down I/O Pins in USB Suspend	Disabled	Enabling this option will make the device pull down on the UART interface lines when the power is shut off (PWREN# is high).
Manufacturer Name	FTDI	
Product Description	See note	USB-RS232-PCB
Max Bus Power Current	90mA	
Power Source	Bus Powered	
Device Type	FT232R	
USB Version	0200	Returns USB 2.0 device description to the host. Note: The device is be a USB 2.0 Full Speed device (12Mb/s) as opposed to a USB 2.0 High Speed device (480Mb/s).
Remote Wake Up	Disabled	
High Current I/Os	Enabled	Enables the high drive level on the UART and CBUS I/O pins.
Load VCP Driver	Enabled	Makes the device load the VCP driver interface for the device.
Invert TXD	Disabled	Signal on this pin becomes TXD# if enable.
Invert RXD	Disabled	Signal on this pin becomes RXD# if enable.
Invert RTS#	Disabled	Signal on this pin becomes RTS if enable.
Invert CTS#	Disabled	Signal on this pin becomes CTS if enable.

Table 0.1 Default Internal EEPROM Configuration

The internal EEPROM on the PCB can be re-programmed over USB using the utility program MPROG. MPROG can be downloaded from the www.ftdichip.com. Version 2.8a or later is required for the FT232R chip. Users who do not have their own USB Vendor ID but who would like to use a unique Product ID in their design can apply to FTDI for a free block of unique PIDs. Contact FTDI support for this service.

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Appendix C - Revision History

Version Draft	First Draft	August 2008
Version 1.0	First Release	September 12th 2008
Version 1.1	Update to Taiwan address	October 1st 2008
Version 1.2	Update to UK and CH address	February 11th 2009
Version 1.3	Update to PCB drawings to show REV1 and REV2	April 13th 2009
Version 1.4	Update figure 5.1 – Schematic Updated section 4 (changes made from Rev1 to rev2) Updated contact information	May 28th 2010
Version 1.41	Added the RoHs compliant statement in section 1 Added section 1.2 USB compliant Logo	January 26th 2011

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