



Future Technology Devices International Ltd

TTL-232R-PCB

TTL to USB Serial Converter PCB

Datasheet

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1 Description

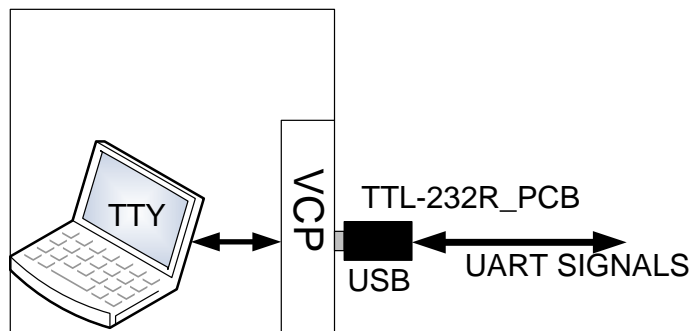
The **TTL-232R-PCB** is a USB to TTL serial UART converter PCB incorporating FTDI's FT232RQ USB to Serial UART interface IC device which handles all the USB signalling and protocols. The PCB provides a fast, simple way to connect devices with a TTL level serial interface to USB.

Each TTL-232R_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 [FTDI website](#).

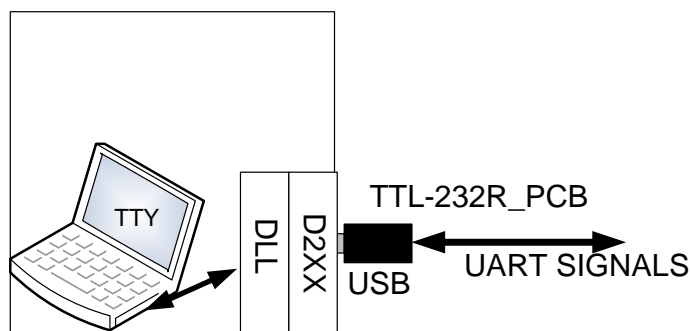
The PCB is RoHS compliant at TTL levels of + 5V or + 3.3V.

The PCB is USB powered and USB 2.0 full speed compatible. Each PCB supports a data transfer rate up to 3 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 [FTDI website](#) under FTDIChip-ID Projects.

The TTL-232R_PCB requires USB drivers, available free from [FTDI website](#), 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.



Virtual COM Port



Software application access to USB via D2XX

Figure 1.1 Using the TTL-232R-PCB

1.1 Part Number

The following Table 1.1 gives details of the available TTL-232R-PCB.

| Part Number | Description |
|------------------|---------------------------------------------------------------|
| TTL-232R-5V-PCB | USB to UART PCB with selectable +5V TTL level UART signals. |
| TTL-232R-3V3-PCB | USB to UART PCB with selectable +3.3V TTL level UART signals. |

Table 1.1 TTL-232R-PCB Part Number

1.2 USB Compliant

The TTL-232R-PCB is fully compliant with the USB 2.0 specification.



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2 Typical Applications

- USB to Serial TTL Level Converter
- Upgrading Legacy Peripherals to USB
- Interface Microcontroller UART or I/O to USB
- Interface FPGA / PLD to USB
- Replace MAX232 type level shifters allowing for direct connection of products to PC via USB
- USB Instrumentation PC interface
- USB Industrial Control
- USB Software / Hardware Encryption Dongles

2.1 Driver Support

Royalty free VIRTUAL COM PORT (VCP) and D2XX Direct Drivers are available for the following Operating Systems (OS):

- Windows
- Linux
- Mac
- Android (J2xx / D2xx only)

See the following website link for the full driver support list including OS versions and legacy OS.

<https://ftdichip.com/drivers/>

Virtual COM Port (VCP) drivers cause the USB device to appear as an additional COM port available to the PC. Application software can access the USB device in the same way as it would access a standard COM port.

D2XX Direct Drivers allow direct access to the USB device through a DLL. Application software can access the USB device through a series of DLL function calls. The functions available are listed in the [D2XX Programmer's Guide](#) document which is available from the [Documents](#) section of our website.

Please also refer to the [Installation Guides](#) webpage for details on how to install the drivers.

2.2 Features

- TTL-232R_PCB provides a USB to TTL Serial UART interface.
- On board FT232RQ provides single chip USB to asynchronous serial data transfer interface.
- Entire USB protocol handled by the electronics on the PCB.
- Connect directly to a microcontroller UART or I/O pins.
- 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 from 300 baud to 3 Mbaud at TTL levels.
- Internal EEPROM with user writeable area.
- Selectable +3.3V or +5V CMOS drive outputs and 5V safe TTL inputs makes the TTL-232R_PCB easy to interface to 5V MCU's.
- 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.
- +5V or +3.3V output allows external logic to be powered from the USB port.
- 6 outputs provide Tx, Rx, RTS#, CTS#, VCC 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.

3 Features of FT232R applicable to TTL-232R PCB

The TTL-232R_PCB uses FTDI's FT232RQ USB to serial IC device. This section summarises the key features of the FT232RQ which apply to the TTL-232R_PCB USB to serial TTL converter. 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. A user area of the internal EEPROM is available to system designers to allow storing additional data. 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 [FT_PROG](#), which can be downloaded from FTDI Utilities on the [FTDI website](#).

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 TTL-232R_PCB has been designed to use as little as possible of the total USB bandwidth available from the USB host controller.

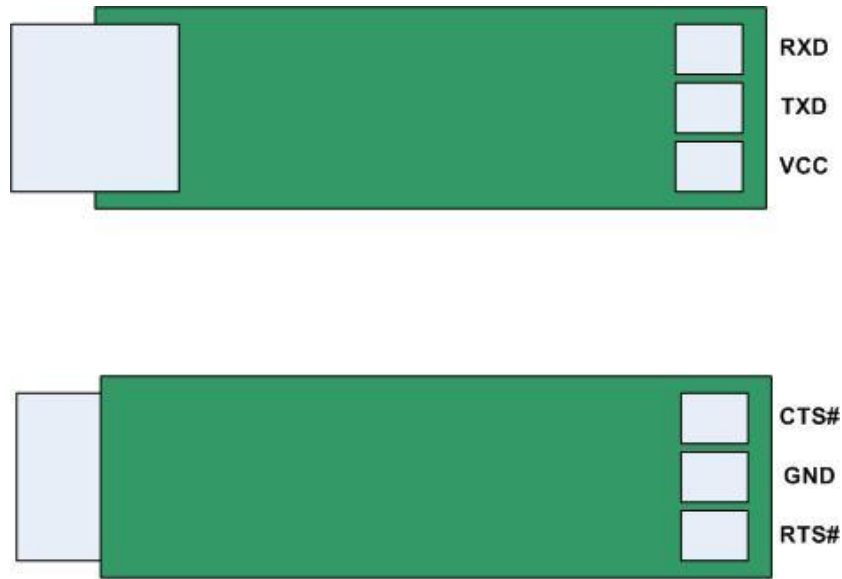
High Output Drive Option. The UART interface I/O pins on the TTL-232R_PCB (RXD, TXD, RTS#, and CTS#) can be configured to use the FT232R's high output drive option. This option allows the FT232R I/O pins to drive up to three times the standard signal drive level. This allows multiple devices to be driven, or devices that require a greater signal drive strength to be interfaced on the PCB. This option is enabled in the internal EEPROM.

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 TTL-232R_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](#) describes this feature.

Extended Operating Temperature Range - The TTL-232R_PCB is capable of operating over an extended temperature range of -40° to +85°C thus allowing it to be used in automotive or industrial applications.

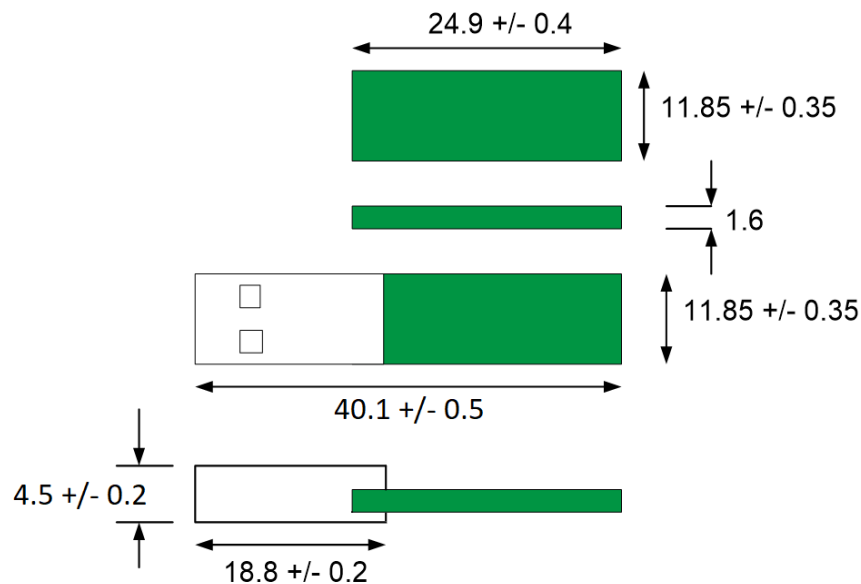
4 TTL-232R-PCB Connector Pin Out and Mechanical details



TTL232R PCB PADS

Figure 4.1 TTL-232R-PCB Pin Out (Top is TOP View, Bottom is BOTTOM View)

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



Dimensions in mm

Figure 4.2 TTL-232R TTL-232R-PCB, Mechanical Details

4.1 TTL-232R-PCB Signal Descriptions

| Name | Type | Description |
|------|--------|----------------------------------------------------|
| GND | GND | Device ground supply pin. |
| CTS# | Input | Clear to Send Control input / Handshake signal. |
| VCC | Output | +5V output, |
| TXD | Output | Transmit Asynchronous Data output. |
| RXD | Input | Receive Asynchronous Data input. |
| RTS# | Output | Request To Send Control Output / Handshake signal. |

Table 4.1 TTL-232R-PCB Signal Descriptions

4.2 TTL-232R-PCB +5V/+3.3V Selection

Selection of whether the UART signal are +3.3V levels or +5V levels is done using resistors. The following table gives details of what resistors are required for the two different voltage levels. Note that the VCC output signal will always drive at +5V.

| Resistor R1 | Resistor R2 | Description |
|-------------|-------------|--------------------------------------|
| Fitted | Not Fitted | UART signals are +5V level signals |
| Not Fitted | Fitted | UART signals are +3.3V level signals |

Table 4.2 UART Signal Level Selection

4.3 TTL-232R-PCB Electrical Parameters

| Parameter | Description | Minimum | Typical | Maximum | Units | Conditions |
|----------------|-----------------------------|---------|---------|---------|-------|------------------------------------------------------------------|
| VCC | Output Power Voltage | 4.25 | 5.0 | 5.25 | V | Dependant on the USB port that the TTL-232R-PCB is connected to. |
| I _o | Output Power Current | - | | 75 | mA | |
| T | Operating Temperature Range | -40 | | +85 | °C | |

Table 4.3 TTL-232R-PCB I/O Operating Parameters

| Parameter | Description | Minimum | Typical | Maximum | Units | Conditions |
|-----------|----------------------------|---------|---------|---------|-------|----------------|
| Voh | Output Voltage High | 3.2 | 4.1 | 4.9 | V | I source = 6mA |
| Vol | Output Voltage Low | 0.3 | 0.4 | 0.6 | V | I sink = 6mA |
| Vin | Input Switching Threshold | 1.0 | 1.2 | 1.5 | V | |
| VHys | Input Switching Hysteresis | 20 | 25 | 30 | mV | |

Table 4.4 TTL-232R-PCB I/O Pin Characteristics (+5V level signals)

| Parameter | Description | Minimum | Typical | Maximum | Units | Conditions |
|-----------|----------------------------|---------|---------|---------|-------|----------------|
| Voh | Output Voltage High | 2.2 | 2.8 | 3.2 | V | I source = 3mA |
| Vol | Output Voltage Low | 0.3 | 0.4 | 0.6 | V | I sink = 8mA |
| Vin | Input Switching Threshold | 1.0 | 1.2 | 1.5 | V | |
| VHys | Input Switching Hysteresis | 20 | 25 | 30 | mV | |

Table 4.5 TTL-232R-PCB I/O Pin Characteristics (+3.3V level signals)

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.

Appendix A - PCB EEPROM Configuration

Each TTL-232R-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 the table below.

| Parameter | Value | Notes |
|-----------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| USB Vendor ID (VID) | 0403h | FTDI default VID (hex) |
| USB Product ID (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 | TTL-232R-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 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 [FT_PROG](#). [FT_PROG](#) 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

Document Title : TTL-232R-PCB Datasheet
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Product Page : <https://ftdichip.com/product-category/products/>
Document Feedback : [Send Feedback](#)

| Revision | Changes | Date |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1.00 | First Release | 08-08-2008 |
| 1.01 | Added RoHS compliant statement in section 1. Added section 1.2 USB Compliant Logo. Updated contact details. Replaced reference MProg with FT_PROG. | 02-09-2010 |
| 1.02 | Updated Figure 4.2 TTL-232R TTL-232R-PCB, Mechanical Details. | 25-10-2023 |