Future Technology Devices International Ltd

TTL-232R CE FC

TTL to USB Serial Converter Range of Cables

Datasheet

Document Reference No.: FT_000054

Version 2.02

Issue Date: 2010-09-02

Future Technology Devices International Limited (FTDI)

Unit 1, 2 Seaward Place, Glasgow G41 1HH, United Kingdom
Tel.: +44 (0) 141 429 2777 Fax: + 44 (0) 141 429 2758
E-Mail (Support): **support1@ftdichip.com** Web: http://www.ftdichip.com

Neither the whole nor any part of the information contained in, or the product described in this manual, may be adapted or reproduced in any material or electronic form without the prior written consent of the copyright holder. This product and its documentation are supplied on an as-is basis and no warranty as to their suitability for any particular purpose is either made or implied. Future Technology Devices International Ltd will not accept any claim for damages howsoever arising as a result of use or failure of this product. Your statutory rights are not affected. This product or any variant of it is not intended for use in any medical appliance, device or system in which the failure of the product might reasonably be expected to result in personal injury. This document provides preliminary information that may be subject to change without notice. No freedom to use patents or other intellectual property rights is implied by the publication of this document. Future Technology Devices International Ltd, Unit 1, 2 Seaward Place, Centurion Business Park, Glasgow, G41 1HH, United Kingdom. Scotland Registered Number: SC136640

Copyright © 2010 Future Technology Devices International Limited

1 Description

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

Each TTL-232R cable contains a small internal electronic circuit board, utilising the FT232R, which is encapsulated into the USB connector end of the cable. The FT232R datasheet, DS_FT232R, is available at http://www.ftdichip.com. The other end of the cable comes with a selection of different connectors supporting various applications – see Table 1.1

Cables are FCC, CE, RoHS compliant and are available at TTL levels of +5V and +3.3V.

Cables are available with either a 6-way SIL,0.1" pitch connector, a 3.5mm Audio Jack, an 8 way, keyed 2mm pitch connector (intended for use with VMUSIC2 or VDRIVE2) or bare, tinned wire ended connections (see Table 1.1)

The USB side of the cable is USB powered and USB 2.0 full speed compatible. Each cable is 1.8m long and supports a data transfer rate up to 3 Mbaud. Each cable 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 cable. Further information and examples on this feature are available at http://www.ftdichip.com under FTDIChip-ID Projects.

The TTL-232R cables require USB drivers, available free from **http://www.ftdichip.com**, which are used to make the FT232R in the cable 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 cable though a DLL. This is illustrated in the Figure 1.1

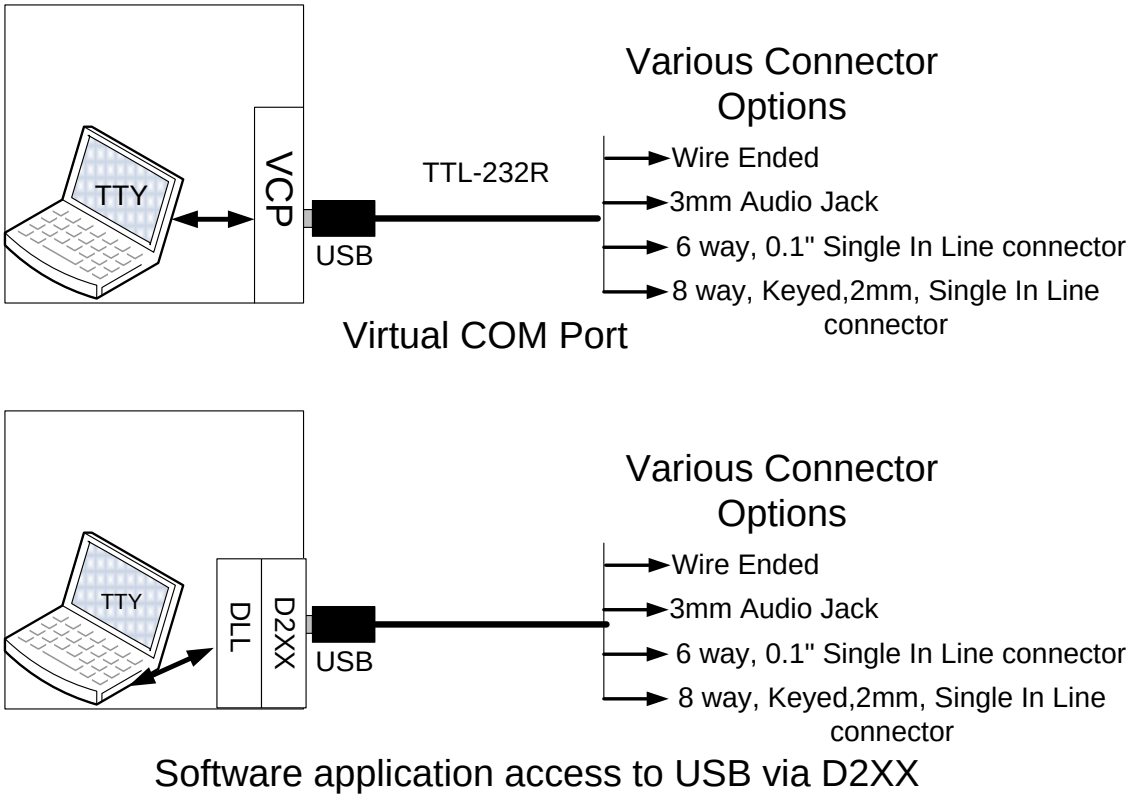


Figure 1.1 Using the TTL-232R Cable

Copyright © 2010 Future Technology Devices International Limited

1.1 Available Cables and Part Numbers

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

Part Number	Description	End Connector*	Cable details
TTL-232R-5V**	USB to UART cable with +5V TTL level UART signals.	6 pin SIL, 0.1" pitch	6 core, UL2464 24 AWG, diam=5mm
TTL-232R-3V3	USB to UART cable with +3.3V TTL level UART signals.	6 pin SIL, 0.1" pitch	6 core, UL2464 24 AWG, diam=5mm
TTL-232R-5V-WE**	USB to UART cable with +5V TTL level UART signals.	Wire Ended (no connector)	6 core, UL2464 24 AWG, diam=5mm
TTL-232R-3V3-WE	USB to UART cable with +3.3V TTL level UART signals.	Wire Ended (no connector)	6 core, UL2464 24 AWG, diam=5mm
TTL-232R-5V-AJ**	USB to UART cable with +5V TTL level UART signals.	3.5mm Audio Jack	2 core and spiral, 24 AWG diam=5mm
TTL-232R-3V3-AJ	USB to UART cable with +3.3V TTL level UART signals.	3.5mm Audio Jack	2 core and spiral, 24 AWG diam=5mm
TTL-232R-3V3-2mm	USB to UART cable with +3.3V TTL level UART signals.	8 way, keyed, 2mm connector for use with FTDI VDRIVE2 or VMUSIC2 modules	7 core, UL2464 26 AWG, diam=5mm

Table 1.1 TTL-232R Cables Descriptions and Part Numbers

* FTDI supports customised end connector designs. For more information, please contact FTDI Sales Team (sales1@ftdichip.com)

** These cables are identical to cables which do not have the "5V" in the part number. The 5V was added to the part number for clarity.

Copyright © 2010 Future Technology Devices International Limited

1.2 Certifications

FTDI TTL-232R range of cables are fully RoHs compliant as well as CE and FCC certified (with the exception of the TTL-232R-XX-WE cables which have not yet completed FCC and CE testing).

1.3 USB Compliant

The TTL-232R cables are fully compliant with the USB 2.0 specification.

Copyright © 2010 Future Technology Devices International Limited

Table of Contents

1 Description 1
1.1 Available Cables and Part Numbers 2
1.2 Certifications 3
1.3 USB Compliant 3
The TTL-232R cables are fully compliant with the USB 2.0 specification. 3
2 Typical Applications 6
2.1 Driver Support 6
2.2 Features 7
3 Features of FT232R applicable toTTL-232R Cables 8
4 TTL-232R-5V and TTL-232R-3V3 Cables 10
4.1 TTL-232R-5V, TTL-232R-3V3 Connector Pin Out and Mechanical details 10
4.2 TTL-232R-5V and TTL-232R-3V3 Cable Signal Descriptions 10
4.3 TTL-232R-5V and TTL-232R-3V3 Electrical Parameters 11
4.3.1 TTL-232R-5V Electrical Parameters 11
4.3.2 TTL-232R-3V3 Electrical Parameters 11
5 TTL-232R-5V-AJ and TTL-232R-3V3-AJ 13
5.1 TTL-232R-5V-AJ, TTL-232R-3V3-AJ Connector Pin Out and Mechanical details 13
5.2 TTL-232R-5V-AJ and TTL-232R-3V3-AJ Cable Signal Descriptions 14
5.3 TTL-232R-5V-AJ and TTL-232R-3V3-AJ Electrical Parameters 14
5.3.1 TTL-232R-5V-AJ Electrical Parameters 14
5.3.2 TTL-232R-3V3-AJ Electrical Parameters 15
6 TTL-232R-5V-WE and TTL-232R-3V3-WE Cables 16
6.1 TTL-232R-5V-WE, TTL-232R-3V3-WE Connections and Mechanical Details 16
6.2 TTL-232R-5V-WE and TTL-232R-3V3-WE Cable Signal Descriptions 16
6.3 TTL-232R-5V-WE and TTL-232R-3V3-WE Electrical Parameters 16
6.3.1 TTL-232R-5V-WE Electrical Parameters 17
6.3.2 TTL-232R-3V3-WE Electrical Parameters 17
7 TTL-232R-3V3-2mm Cables 18
7.1 TTL-232R-3V3-2mm Connector Pin Out and Mechanical details 18
7.2 TTL-232R-3V3-2mm Cable Signal Descriptions 19
7.3 TTL-232R-3V3-2mm Electrical Parameters 19
8 Cable PCB Circuit Schematic 20
9 Contact Information 21
Appendix A - Cable EEPROM Configuration 22
Appendix B - List of Figures and Tables 24

Copyright © 2010 Future Technology Devices International Limited

Appendix C - Revision History 25

Copyright © 2010 Future Technology Devices International Limited

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
- Interface to FTDI VDRIVE2 or VMUSIC2 modules.
- 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) 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

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.

Copyright © 2010 Future Technology Devices International Limited

2.2 Features

- TTL-232R Converter Cable provides a USB to TTL Serial interface with various end connectors.
- On board FT232RQ provides single chip USB to asynchronous serial data transfer interface.
- Entire USB protocol handled by the electronics in the cable USB.
- 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.
- 5V CMOS drive outputs and 5V safe TTL inputs makes the TTL-232R 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.
- +5V or +3.3V output allows external logic to be powered from the USB port.
- 6 way outputs provide Tx, Rx, RTS#, CTS#, VCC and GND (except Audio Jack which provides only TX,RX and GND).
- 8 way, keyed connector to support FTDI VDRIVE2 and VMUSIC2.
- 3 way Audio Jack connector provides Tx, Rx 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.
- Cable length is 1.80m (6 feet).
- FCC and CE compliant.
- Custom versions also available (subject to MOQ).

Copyright © 2010 Future Technology Devices International Limited

3 Features of FT232R applicable toTTL-232R Cables

The TTL-232R cables use FTDI's FT232RQ USB to serial IC device. This section summarises the key features of the FT232RQ which apply to the TTL-232R USB to serial TTL converter cables. 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 in each cable is used to store USB Vendor ID (VID), Product ID (PID), device serial number, product description string and various other USB configuration descriptors. Each cable is supplied with the internal EEPROM pre-programmed as described in **Contact Information**

Head Office – Glasgow, UK

Future Technology Devices International Limited
Unit 1, 2 Seaward Place,
Glasgow G41 1HH
United Kingdom
Tel: +44 (0) 141 429 2777
Fax: +44 (0) 141 429 2758

E-mail (Sales) sales1@ftdichip.com
E-mail (Support) support1@ftdichip.com
E-mail (General Enquiries) admin1@ftdichip.com
Web Site URL http://www.ftdichip.com
Web Shop URL http://www.ftdichip.com

Branch Office – Taipei, Taiwan

Future Technology Devices International Limited (Taiwan)
2F, No. 516, Sec. 1, NeiHu Road
Taipei 114
Taiwan , R.O.C.
Tel: +886 (0) 2 8797 1330
Fax: +886 (0) 2 8751 9737

E-mail (Sales) tw.sales1@ftdichip.com
E-mail (Support) tw.support1@ftdichip.com
E-mail (General Enquiries) tw.admin1@ftdichip.com
Web Site URL http://www.ftdichip.com

Branch Office – Hillsboro, Oregon, USA

Future Technology Devices International Limited (USA)
7235 NW Evergreen Parkway, Suite 600
Hillsboro, OR 97123-5803
USA
Tel: +1 (503) 547 0988
Fax: +1 (503) 547 0987

E-Mail (Sales) us.sales@ftdichip.com
E-Mail (Support) us.support@ftdichip.com
E-Mail (General Enquiries) us.admin@ftdichip.com
Web Site URL http://www.ftdichip.com

Branch Office – Shanghai, China

Future Technology Devices International Limited (China)
Room 408, 317 Xianxia Road,
ChangNing District,
ShangHai, China

Tel: +86 (21) 62351596
Fax: +86(21) 62351595

E-Mail (Sales): cn.sales@ftdichip.com

Copyright © 2010 Future Technology Devices International Limited

E-Mail (Support): cn.support@ftdichip.com
E-Mail (General Enquiries): cn.admin1@ftdichip.com
Web Site URL: http://www.ftdichip.com

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 - Cable 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 (www.ftdichip.com).

Lower Operating and Suspend Current. The FT232R has a low 15mA operating supply current and a very low USB suspend current of approximately 70µA. (Note that during suspend mode, the current drawn by application should not exceed 2.5mA to remain USB compliant)

Low USB Bandwidth Consumption. The USB interface of the FT232R, and therefore the TTL-232R cables 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 cables (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 to the cables. This option is enabled in the internal EEPROM.

UART Pin Signal Inversion. The sense of each of the eight 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 cable 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 cables 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.

Improved EMI Performance. The TTL-232R cables are FCC and CE certified.

Extended Operating Temperature Range - The TTL-232R cables are capable of operating over an extended temperature range of -40º to +85º C thus allowing them to be used in automotive or industrial applications.

Copyright © 2010 Future Technology Devices International Limited

4 TTL-232R-5V and TTL-232R-3V3 Cables

The TTL-232R-5V and TTL-232R-3V3 cables are both terminated by a 6 way, 0.1", Single-In-Line (SIL) connector. The difference between the two cables is that the TTL-232R-5V operates at +5V levels (signals and power supply) and the TTL-232R-3V3 operates at +3.3V levels (signals only, VCC= +5V).

4.1 TTL-232R-5V, TTL-232R-3V3 Connector Pin Out and Mechanical details

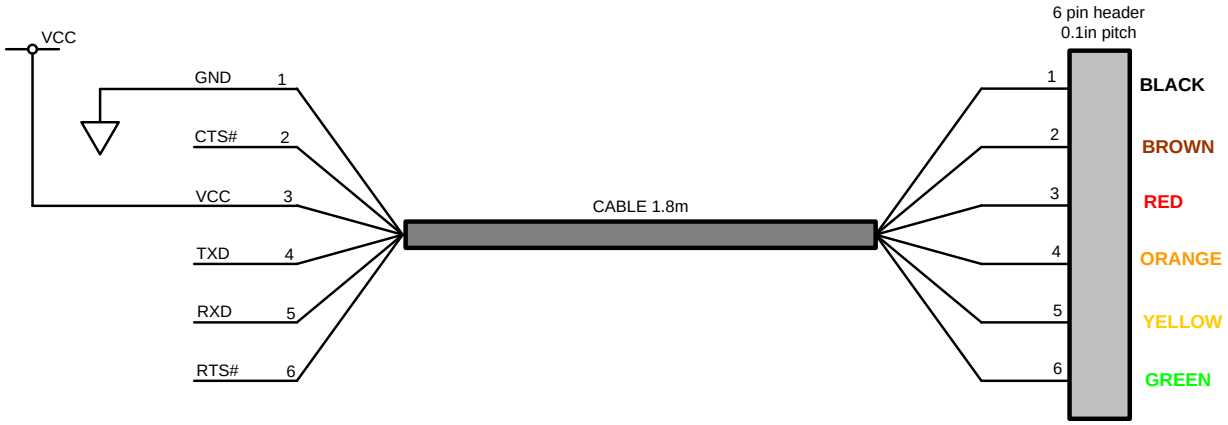
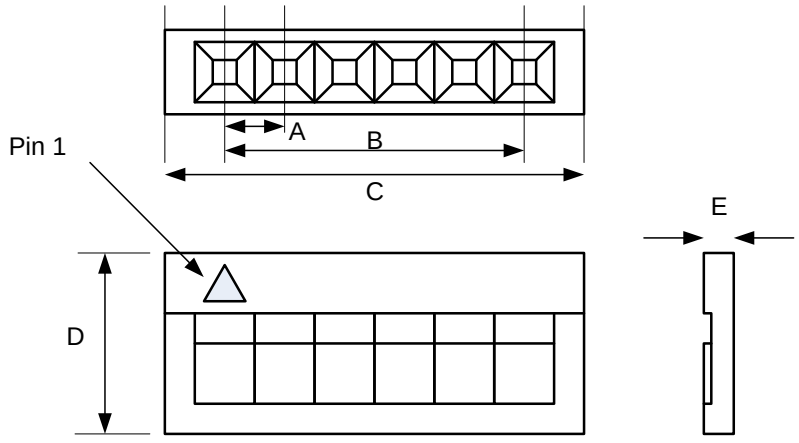


Figure 4.1 TTL-232R-5V and TTL-232R-3V3, 6 Way Header Pin Out

The mechanical details of the 6 way connector are shown in the following diagram



	Dimensions (mm)
A	2.54 +/- 0.05
B	12.70 +/- 0.2
C	15.24 +/- 0.2
D	14.0 +/- 0.2
E	2.54 +/- 0.05

Figure 4.2 TTL-232R-5V TTL-232R-3V3, 6 Way Header Mechanical Details

4.2 TTL-232R-5V and TTL-232R-3V3 Cable Signal Descriptions

Header Pin Number	Name	Type	Colour	Description
1	GND	GND	Black	Device ground supply pin.
2	CTS#	Input	Brown	Clear to Send Control input / Handshake signal.
3	VCC	Output	Red	+5V output,

Copyright © 2010 Future Technology Devices International Limited

Header Pin Number	Name	Type	Colour	Description
4	TXD	Output	Orange	Transmit Asynchronous Data output.
5	RXD	Input	Yellow	Receive Asynchronous Data input.
6	RTS#	Output	Green	Request To Send Control Output / Handshake signal.

Table 4.1 TTL-232R-5V and TTL-232R-3V3 Cable Signal Descriptions

4.3 TTL-232R-5V and TTL-232R-3V3 Electrical Parameters

4.3.1 TTL-232R-5V 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-5V is connected to
I_O	Output Power Current	-	-	75	mA	Must be less that 2.5mA during suspend.
T	Operating Temperature Range	-40	-	+85	°C	

Table 4.2 TTL-232R-5V I/O Operating Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
Voh	Output Voltage High	3.2	4.1	4.9	V	I source = 2mA
Vol	Output Voltage Low	0.3	0.4	0.6	V	I sink = 2mA
Vin	Input Switching Threshold	1.0	1.2	1.5	V	
VHys	Input Switching Hysteresis	20	25	30	mV	

Table 4.3 TTL-232R-5V I/O Pin Characteristics

4.3.2 TTL-232R-3V3 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-3V3 is connected to
I_O	Output Power Current	-	-	75	mA	Must be less that 2.5mA during suspend.
T	Operating Temperature Range	-40	-	+85	°C	

Table 4.4 TTL-232R-3V3 I/O Operating Parameters

Copyright © 2010 Future Technology Devices International Limited

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-3V3 I/O Pin Characteristics

Copyright © 2010 Future Technology Devices International Limited

5 TTL-232R-5V-AJ and TTL-232R-3V3-AJ

The TTL-232R-5V-AJ and TTL-232R-3V3-AJ cables are both terminated by a standard 3.5mm Audio Jack (AJ) connector. The difference between the two cables is that the TTL-232R-5V-AJ operates at +5V levels (signals and power supply) and the TTL-232R-3V3-AJ operates at +3.3V levels (signals and power supply). On these cables the VCC power is not transferred.

5.1 TTL-232R-5V-AJ, TTL-232R-3V3-AJ Connector Pin Out and Mechanical details

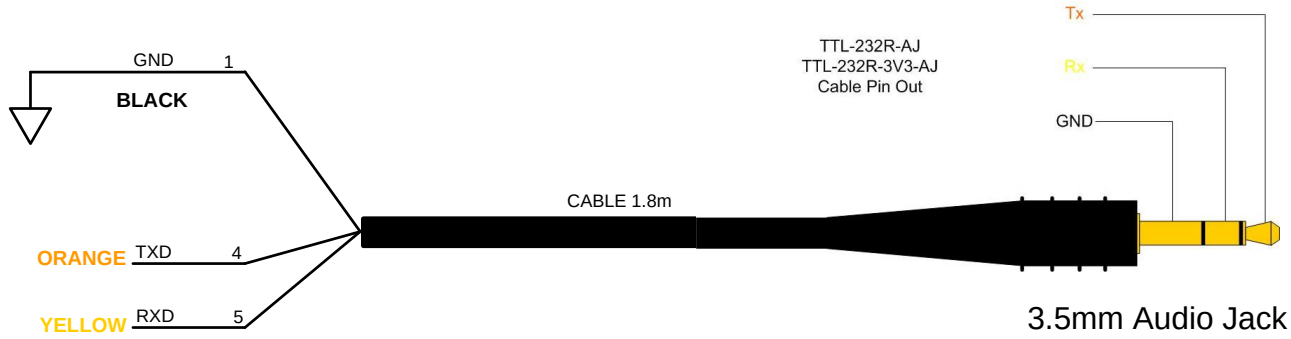


Figure 5.1 TTL-232R-5V and TTL-232R-3V3, 6 Way Header Pin Out

The mechanical details of the Audio Jack connector are shown in the following **Figure 5.2**.

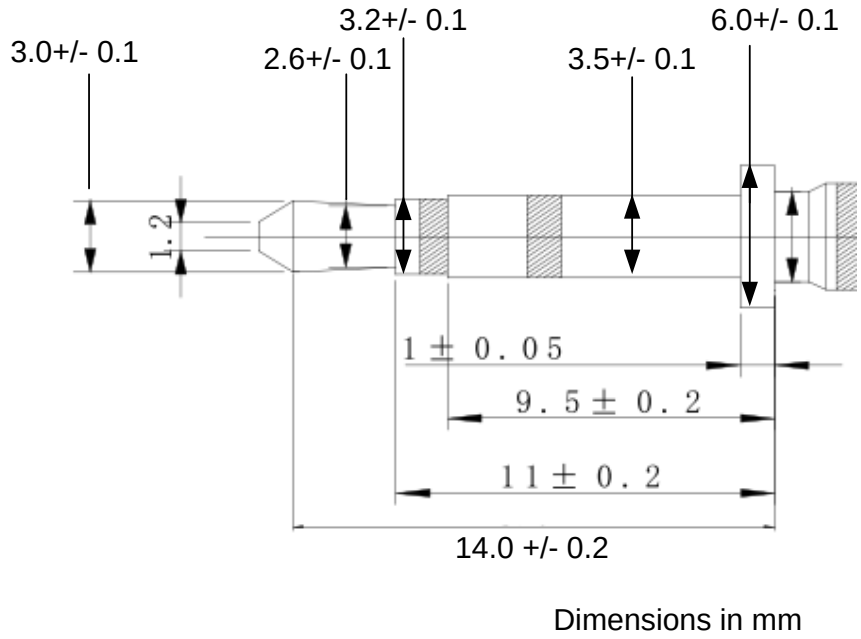


Figure 5.2 TTL-232R-5V-AJ and TTL-232R-3V3-AJ Audio Jack Mechanical Details

Copyright © 2010 Future Technology Devices International Limited

5.2 TTL-232R-5V-AJ and TTL-232R-3V3-AJ Cable Signal Descriptions

Header Pin Number	Name	Type	Colour	Description
TIP	TXD	GND	Black	Transmit Asynchronous Data output.
RING	RXD	Input	Brown	Receive Asynchronous Data input.
SLEEVE	GND	Output	Red	GND

Table 5.1 TTL-232R-5V-AJ and TTL-232R-3V3-AJ Cable Signal Descriptions

5.3 TTL-232R-5V-AJ and TTL-232R-3V3-AJ Electrical Parameters

5.3.1 TTL-232R-5V-AJ Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
I_O	Output Power Current	-		75	mA	Must be less that 2.5mA during suspend.
T	Operating Temperature Range	-40		+85	°C	

Table 5.2 TTL-232R-5V-AJ 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 5.3 TTL-232R-5V-AJ I/O Pin Characteristics

Copyright © 2010 Future Technology Devices International Limited

5.3.2 TTL-232R-3V3-AJ Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
I_O	Output Power Current	-		75	mA	Must be less that 2.5mA during suspend.
T	Operating Temperature Range	-40		+85	°C	

Table 5.4 TTL-232R-3V3-AJ I/O Operating Parameters

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 5.5 TTL-232R-3V3-AJ I/O Pin Characteristics

Copyright © 2010 Future Technology Devices International Limited

6 TTL-232R-5V-WE and TTL-232R-3V3-WE Cables

The TTL-232R-5V-WE and TTL-232R-3V3-WE cables are both un-terminated; they are bare and tinned wires. The difference between the two cables is that the TTL-232R-5V-WE operates at +5V levels (signals and power supply) and the TTL-232R-3V3-WE operates at +3.3V levels (signals only, VCC=+5V).

6.1 TTL-232R-5V-WE, TTL-232R-3V3-WE Connections and Mechanical Details

The following Figure 6.1 shows the cable signals and the wire colours for these signals on the TTL-232R-5V-WE and TTL-232R-3V3-WE cables.

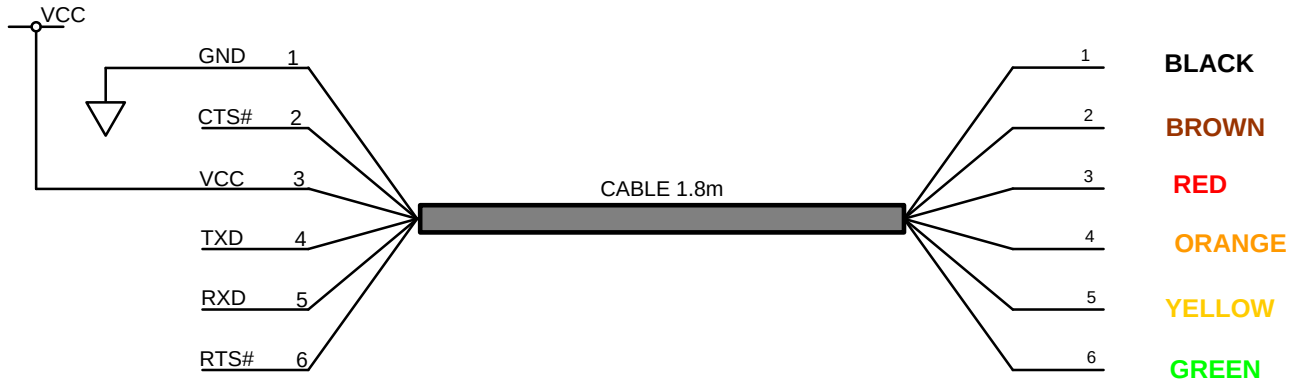


Figure 6.1 TTL-232R-5V-WE and TTL-232R-3V3-WE Connections

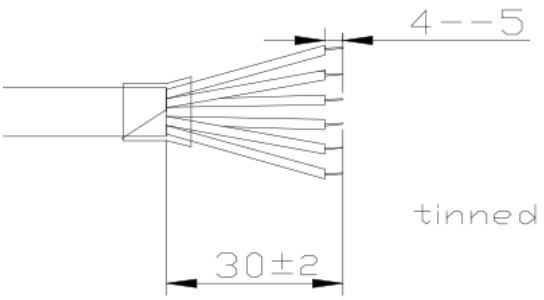


Figure 6.2 TTL-232R-5V-WE and TTL-232R-3V3-WE Mechanical Details (dimensions in mm)

6.2 TTL-232R-5V-WE and TTL-232R-3V3-WE Cable Signal Descriptions

Colour	Name	Type	Description
Black	GND	GND	Device ground supply pin.
Brown	CTS#	Input	Clear to Send Control input / Handshake signal.
Red	VCC	Output	+5V output
Orange	TXD	Output	Transmit Asynchronous Data output.
Yellow	RXD	Input	Receive Asynchronous Data input.
Green	RTS#	Output	Request To Send Control Output / Handshake signal.

Table 6.1 TTL-232R-5V-WE and TTL-232R-3V3-WE Cable Signal Descriptions

6.3 TTL-232R-5V-WE and TTL-232R-3V3-WE Electrical Parameters

Copyright © 2010 Future Technology Devices International Limited

6.3.1 TTL-232R-5V-WE 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-5V-WE is connected to
I_O	Output Power Current	-		75	mA	Must be less that 2.5mA during suspend.
T	Operating Temperature Range	-40		+85	°C	

Table 6.2 TTL-232R-5V-WE 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 6.3 TTL-232R-5V-WE I/O Pin Characteristics

6.3.2 TTL-232R-3V3-WE 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-3V3-WE is connected to
I_O	Output Power Current	-		75	mA	Must be less that 2.5mA during suspend.
T	Operating Temperature Range	-40		+85	°C	

Table 6.4 TTL-232R-3V3-WE I/O Operating Parameters

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 6.5 TTL-232R-3V3-WE I/O Pin Characteristics

Copyright © 2010 Future Technology Devices International Limited

7 TTL-232R-3V3-2mm Cables

The TTL-232R-3V3-2mm cable is terminated by a 8 way, 2mm pitch, Single-In-Line (SIL) keyed connector. The TTL-232R-3V3-2mm operates at +3.3V levels (signals and power supply). These cables are primarily intended for interfacing the FTDI VDRIVE2 and VMUSIC2 modules.

Note that when connected to VDRIVE2 or VMUSIC2 module, the TTL-232R-3V3-2mm cable 8-way connector pin 1 connects to pin 8 of the module, and pin 8 of the cable connects to pin 1 of the cable.

7.1 TTL-232R-3V3-2mm Connector Pin Out and Mechanical details

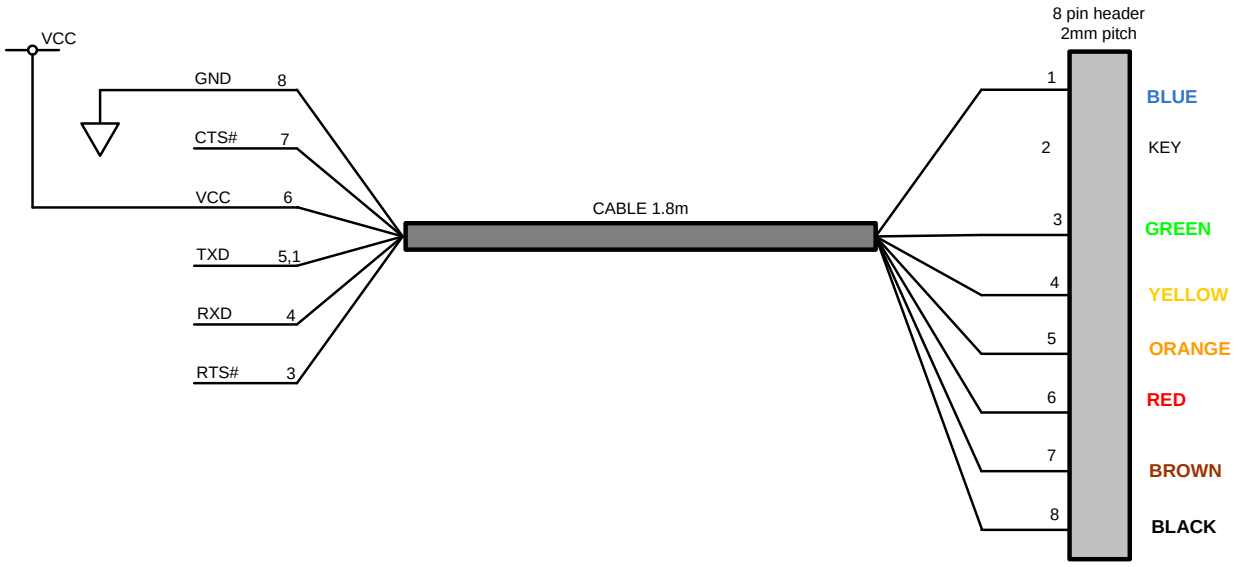
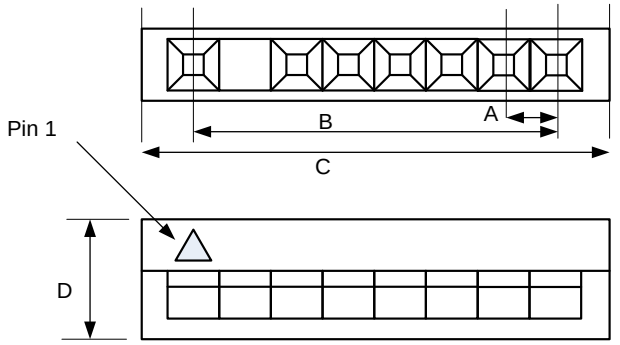


Figure 7.1 TTL-232R-3V3-2mm, 8 Way Header Pin Out

The mechanical details of the 2mm pitch 8 way, keyed, connector are shown in the following diagram



	Dimensions (mm)
A	2.00 +/- 0.005
B	14.00 +/- 0.2
C	16.40 +/- 0.2
D	7.10 +/- 0.25
E	2.00 +/- 0.005

Figure 7.2 TTL-232R-3V3-2mm, 2mm pitch, Keyed, 8 way Header Mechanical Details

Copyright © 2010 Future Technology Devices International Limited

7.2 TTL-232R-3V3-2mm Cable Signal Descriptions

Header Pin Number	Name	Type	Colour	Description
1	RI#	Output	Blue	Ring Indicator Control Input. When remote wake up is enabled taking RI# low (20ms active low pulse) can be used to resume the VMUSIC2 or VDRIVE2 host controller from suspend. Connected to TXD.
2	KEY	KEY	KEY	This connection is keyed to connect to the VRDIVE2 or the VMUSIC2 modules
3	RTS#	Output	Green	Request To Send Control Output / Handshake signal.
4	RXD	Input	Yellow	Receive Asynchronous Data input.
5	TXD	Output	Orange	Transmit Asynchronous Data output.
6	VCC	Output	Red	+5V output,
7	CTS#	Input	Brown	Clear to Send Control input / Handshake signal.
8	GND	GND	Black	Device ground supply pin.

Table 7.1 TTL-232R-3V3-2mm Cable Signal Descriptions

7.3 TTL-232R-3V3-2mm 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-3V3-2mm is connected to
I_O	Output Power Current	-		75	mA	Must be less that 2.5mA during suspend.
T	Operating Temperature Range	-40		+85	°C	

Table 7.2 TTL-232R-3V3-2mm I/O Operating Parameters

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 7.3 TTL-232R-3V3-2mm I/O Pin Characteristics

Copyright © 2010 Future Technology Devices International Limited

8 Cable PCB Circuit Schematic

The circuit schematic for the small internal electronic circuit board, utilising the FTDI FT232R, which is encapsulated into the USB connector end of the cable, is shown in Figure 8.1.

Customised versions of these cables are also available. Users interested in customised versions of these cables should contact FTDI sales (sales1@ftdichip.com).

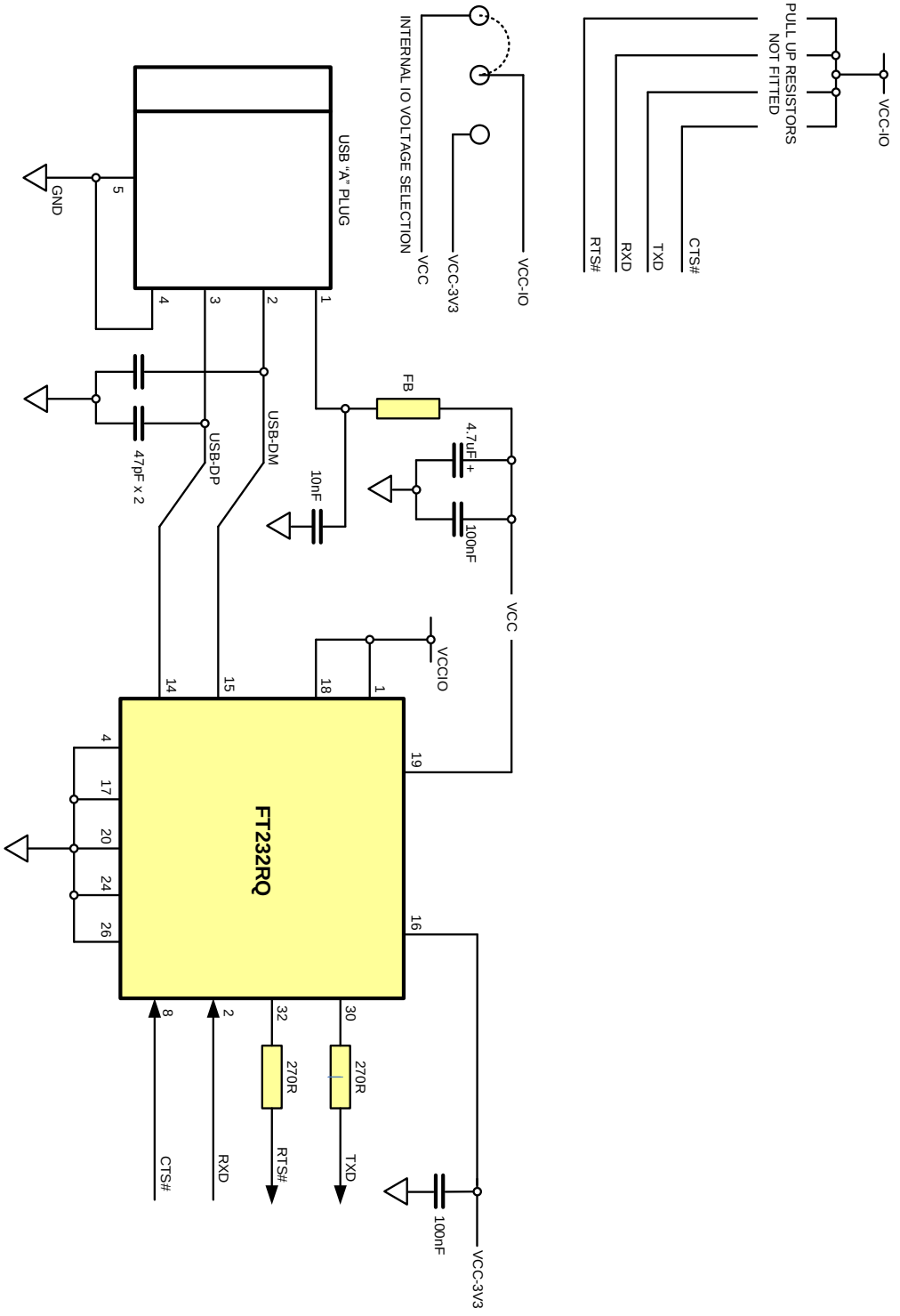


Figure 8.1 Circuit Schematic of PCB Used in the TTL to USB Serial Converter Cables

Copyright © 2010 Future Technology Devices International Limited

9 Contact Information

Head Office – Glasgow, UK

Future Technology Devices International Limited
Unit 1, 2 Seaward Place,
Glasgow G41 1HH
United Kingdom
Tel: +44 (0) 141 429 2777
Fax: +44 (0) 141 429 2758

E-mail (Sales) sales1@ftdichip.com
E-mail (Support) support1@ftdichip.com
E-mail (General Enquiries) admin1@ftdichip.com
Web Site URL http://www.ftdichip.com
Web Shop URL http://www.ftdichip.com

Branch Office – Taipei, Taiwan

Future Technology Devices International Limited (Taiwan)
2F, No. 516, Sec. 1, NeiHu Road
Taipei 114
Taiwan , R.O.C.
Tel: +886 (0) 2 8797 1330
Fax: +886 (0) 2 8751 9737

E-mail (Sales) tw.sales1@ftdichip.com
E-mail (Support) tw.support1@ftdichip.com
E-mail (General Enquiries) tw.admin1@ftdichip.com
Web Site URL http://www.ftdichip.com

Branch Office – Hillsboro, Oregon, USA

Future Technology Devices International Limited (USA)
7235 NW Evergreen Parkway, Suite 600
Hillsboro, OR 97123-5803
USA
Tel: +1 (503) 547 0988
Fax: +1 (503) 547 0987

E-Mail (Sales) us.sales@ftdichip.com
E-Mail (Support) us.support@ftdichip.com
E-Mail (General Enquiries) us.admin@ftdichip.com
Web Site URL http://www.ftdichip.com

Branch Office – Shanghai, China

Future Technology Devices International Limited (China)
Room 408, 317 Xianxia Road,
ChangNing District,
ShangHai, China

Tel: +86 (21) 62351596
Fax: +86(21) 62351595

E-Mail (Sales): cn.sales@ftdichip.com
E-Mail (Support): cn.support@ftdichip.com
E-Mail (General Enquiries): cn.admin1@ftdichip.com
Web Site URL: http://www.ftdichip.com

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.

Copyright © 2010 Future Technology Devices International Limited

Appendix A - Cable EEPROM Configuration

Each TTL-232R cable is controlled by the FTDI FT232R IC. This FT232R device contains an EEPROM which contains the USB configuration descriptors for that device. When the cable 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

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	Product description depends on the cable. The following lists the Product description for each different cable. TTL-232R-5V TTL-232R-3V3 TTL-232R-5V-AJ TTL-232R-AJ-3V3 TTL-232R-5V-WE TTL-232R-3V3-WE TTL-232R-3V3-2mm = USB <-> Serial Cable
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

Copyright © 2010 Future Technology Devices International Limited

The internal EEPROM in the cable 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.

Copyright © 2010 Future Technology Devices International Limited

Appendix B - List of Figures and Tables

List of Figures

Figure 1.1 Using the TTL-232R Cable 1
Figure 4.1 TTL-232R-5V and TTL-232R-3V3, 6 Way Header Pin Out 10
Figure 4.2 TTL-232R-5V TTL-232R-3V3, 6 Way Header Mechanical Details 10
Figure 5.1 TTL-232R-5V and TTL-232R-3V3, 6 Way Header Pin Out 13
Figure 5.2 TTL-232R-5V-AJ and TTL-232R-3V3-AJ Audio Jack Mechanical Details 13
Figure 6.1 TTL-232R-5V-WE and TTL-232R-3V3-WE Connections 16
Figure 6.2 TTL-232R-5V-WE and TTL-232R-3V3-WE Mechanical Details (dimensions in mm) 16
Figure 7.1 TTL-232R-3V3-2mm, 8 Way Header Pin Out 18
Figure 7.2 TTL-232R-3V3-2mm, 2mm pitch, Keyed, 8 way Header Mechanical Details 18
Figure 8.1 Circuit Schematic of PCB Used in the TTL to USB Serial Converter Cables 20

List of Tables

Table 1.1 TTL-232R Cables Descriptions and Part Numbers 2
Table 4.1 TTL-232R-5V and TTL-232R-3V3 Cable Signal Descriptions 11
Table 4.2 TTL-232R-5V I/O Operating Parameters 11
Table 4.3 TTL-232R-5V I/O Pin Characteristics 11
Table 4.4 TTL-232R-3V3 I/O Operating Parameters 11
Table 4.5 TTL-232R-3V3 I/O Pin Characteristics 12
Table 5.1 TTL-232R-5V-AJ and TTL-232R-3V3-AJ Cable Signal Descriptions 14
Table 5.2 TTL-232R-5V-AJ I/O Operating Parameters 14
Table 5.3 TTL-232R-5V-AJ I/O Pin Characteristics 14
Table 5.4 TTL-232R-3V3-AJ I/O Operating Parameters 15
Table 5.5 TTL-232R-3V3-AJ I/O Pin Characteristics 15
Table 6.1 TTL-232R-5V-WE and TTL-232R-3V3-WE Cable Signal Descriptions 16
Table 6.2 TTL-232R-5V-WE I/O Operating Parameters 17
Table 6.3 TTL-232R-5V-WE I/O Pin Characteristics 17
Table 6.4 TTL-232R-3V3-WE I/O Operating Parameters 17
Table 6.5 TTL-232R-3V3-WE I/O Pin Characteristics 17
Table 7.1 TTL-232R-3V3-2mm Cable Signal Descriptions 19
Table 7.2 TTL-232R-3V3-2mm I/O Operating Parameters 19
Table 7.3 TTL-232R-3V3-2mm I/O Pin Characteristics 19
Table 0.1 Default Internal EEPROM Configuration 22

Copyright © 2010 Future Technology Devices International Limited

Appendix C - Revision History

Version 1.00	Full datasheet released	May 2006
Version 2.00	Consolidated all TTL-232R variants into one datasheet.	
	Changed part numbers for +5V cables.	July 2008
Version 2.01	Corrected Table 6.1, RED wire VCC description	September 2008
Version 2.02	Corrected Table 4.3, I source and I sink values	2nd September 2010
	Added section 1.3 USB Compliant Logo Updated contact details	
	Replaced reference MProg with FT_Prog	

Copyright © 2010 Future Technology Devices International Limited

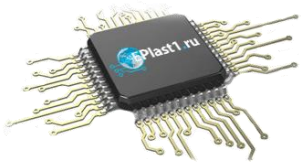
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.