



**Future Technology Devices International Ltd**

# **DB9-USB Family of UART Converter Modules**

## **Datasheet**

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## 1 Introduction

### 1.1 The DB9-USB Family of UART Converter Modules

The DB9-USB connector modules can be used to upgrade an RS232 port to an active USB port. In some cases, this can be done without the need to redesign the PCB. In some cases, they can reduce system costs by removing an RS232 level shifter from a design.

The DB9-USB family consist of 6 modules. Two of these operate at RS232 voltage levels – these can be used as a direct replacement in a system which uses RS232 levels, while four of them operate at digital voltage levels (a choice of 5V or 3.3V) – these can be used to interface to an application systems logic level which could result in the bill-of-materials being reduced by the removal of any RS232 level shifters which may be in the system. Each is available to replace either a male or a female DB9.

### 1.2 Functional Description

DB9-USB modules can be used to upgrade a UART port of a device to an active USB port. These active connectors contain all the USB to UART (and vice-versa) conversion electronics and are designed to fit directly into the same PCB footprint as a PC compatible UART DB9 connector.

The FTDI DB9-USB RS232 level modules are available in two types DB9-USB-M and DB9-USB-F. Using these modules does not require any changes to a PCB or enclosure.

A **DB9-USB-M** can be used to replace a male DB9 connector that is wired in a PC compatible RS232 manner. This module operates at **RS232** signal levels.

A **DB9-USB-F** can be used to replace a female DB9 connector that is wired in a PC compatible RS232 manner. This module operates at **RS232** signal levels.

The FTDI DB9-USB 3.3V digital voltage level modules are available in two types DB9-USB-D3-M and DB9-USB-D3-F. Using these modules may require a minor change to the PCB but saves in material costs by removing the need for an RS232 level shifter.

A **DB9-USB-D3-M** can be used to replace a male DB9 connector that is wired in a PC compatible RS232 manner. This module operates at **3.3V** signal levels.

A **DB9-USB-D3-F** can be used to replace a female DB9 connector that is wired in a PC compatible RS232 manner. This module operates at **3.3V** signal levels.

The FTDI DB9-USB 5V digital voltage level modules are available in two types DB9-USB-D5-M and DB9-USB-D5-F. Using these modules may require a minor change to the PCB but saves in material costs by removing the need for an RS232 level shifter.

A **DB9-USB-D5-M** can be used to replace a male DB9 connector that is wired in a PC compatible RS232 manner. This module operates at **5.0V** signal levels.

A **DB9-USB-D5-F** can be used to replace a female DB9 connector that is wired in a PC compatible RS232 manner. This module operates at **5.0V** signal levels.

The purpose of these modules are to provide a simple method of adapting legacy serial devices with UART interfaces to modern USB ports by replacing the DB9 connector with this miniaturised module which closely resembles a DB9 connector. This is accomplished by incorporating the industry standard FTDI FT232RQ USB-Serial Bridge IC. The RS232 level DB9-USB modules include an RS232 level transceiver.


**Figure 1.1 – DB9-USB Family**

DB9-USB modules use a standard USB-MINI-B connector for connection to an upstream host or hub port.

**RS232 Level:** RS232 level signals, includes modem handshake signals, and capable of transmitting data at rates up to 1 Mega Baud.

**Digital Voltage Level:** 3.3V or 5V level signals, includes modem handshake signals, and capable of transmitting data at rates up to 3 Mega Baud.

DB9-USB modules require USB device drivers, available free from [www.ftdichip.com](http://www.ftdichip.com), which are used to make DB9-USB modules appear as a Virtual COM Port (VCP). This allows existing serial communications software, such as HyperTerminal, to exchange data through the DB9-USB to a legacy UART peripheral device.

### 1.3 Background

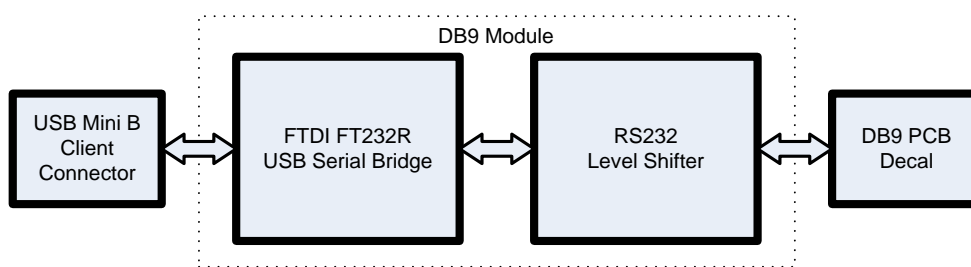
In the long distant past, there was no standard defined for the connections on a DB9 connector when it was used as an RS232 interface. That changed when IBM introduced the PC-AT. This introduced a *generally accepted* DB9 RS232 standard and PC peripherals adopted the same pin-out using a 1-to-1 cable connection between the PC and the peripheral.

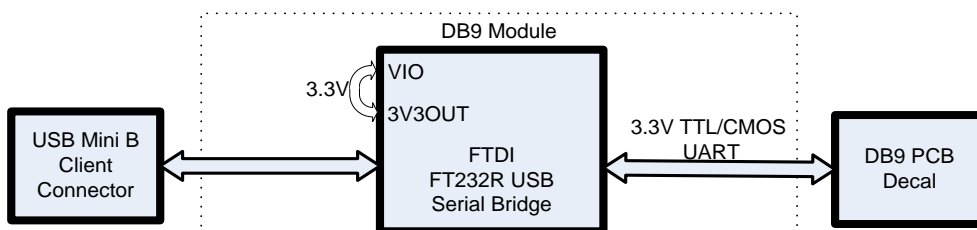
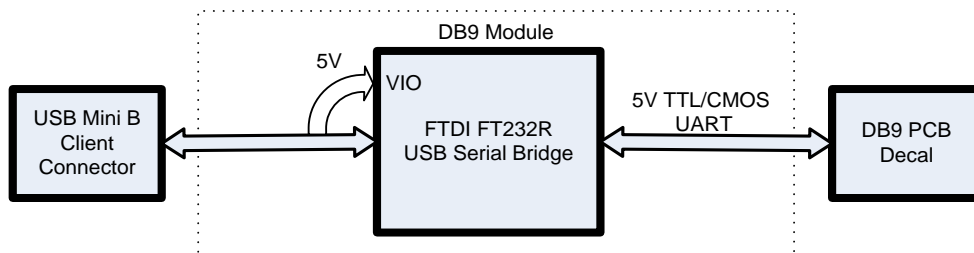
DB9-USB modules have adopted this standard. The DB9 connector wire schemes used by this module either the standard male or standard female wire configuration.

Note that **NOT ALL** peripheral adopted this standard so it is important for the user to check against the pin-out used for the male and female DB9-USB connectors.

**Note:** DB9 connectors are also known as DE9 connector since it consists of 9 pins in a size E shell. However, DE9 connectors are more commonly referred to as DB9 connector.

### 1.4 Block Diagrams


**Figure 1.2 – DB9-USB RS232 Level Block Diagram**


**Figure 1.3 – DB9-USB-D3 Digital Voltage Level Block Diagram**

**Figure 1.4 – DB9-USB-D5 Digital Voltage Level Block Diagram**

## 1.4.1 Block Description

### **USB Mini B Client Connector**

This connector provides the interface for connection to a USB Host or Hub port.

### **FTDI FT232RQ**

The FTDI FT232RQ provides the USB-to-Serial conversion. Operating system device drivers are required in order to operate with the FT232RQ to provide the Virtual COM Port serial functionality.

### **RS232 Level Shifter**

The RS232 level shifter converts the signals provided by the FT232RQ into the voltage levels required by application RS232 interface.

### **DB9-USB PCB Footprint**

The DB9-USB pin-out is configured to match the industry standard DB9 footprint. See section 3.

## 1.5 Features

- Adds one USB serial port by connecting to the RS232 DB9 footprint of a device
- Easy placement for an standard Male and Female RS232 DB9 footprint of a device
- A selection of RS232, 3.3V or 5V UART signal levels.
- Works with USB 1.1 & 2.0 Host and Hub ports
- Industry Standard FTDI chip set & device drivers for maximum compatibility
- Microsoft Windows® WHQL-certified, Mac, Linux and Android drivers.
- Installs as a standard Windows COM port
- 128 bytes transmit buffer, 256 bytes receive buffer
- UART data signals: TxD, RxD, RTS, CTS, DSR, DTR, DCD, RI, GND
- Powered by USB port. No external power adapter required.
- Serial port speed up to 1Mbps (RS232 levels) or 3Mbps (3.3V/5V levels)
- Serial Communication Parameters
  - Parity: None, Even, Odd
  - Data bits: 7, 8
  - Flow control: RTS/CTS, DSR/DTR, X-ON/X-OFF, None
- Operating temperature of -40°C to +85°C

## 1.6 Technical Specification & Ordering Information

Parameter	Performance
USB Interface	12Mbps USB 2.0 Full-Speed
RS232 Interface	Standard Windows baud rates (300bps to 921.6Kbps) Custom baud rates (300bps to 1Mbps) through baud rate aliasing. See FTDI Application Note: AN_120 <a href="#">Aliasing VCP Baud Rates</a>
UART	Standard Windows baud rates (300bps to 921.6Kbps) Custom baud rates (300bps to 3Mbps) through baud rate aliasing.

**Table 1.1 – Performance Specifications**

Order Code	Description
DB9-USB-M	Full Speed USB to 1-Port RS232 level UART module that can replace an RS232 Level UART DB9 male connector
DB9-USB-F	Full Speed USB to 1-Port RS232 level UART module that can replace an RS232 level UART DB9 female connector
DB9-USB-D3-M	Full Speed USB to 1-Port 3.3V level UART module that can replace 3.3V level UART DB9 male connector
DB9-USB-D3-F	Full Speed USB to 1-Port 3.3V level UART module that can replace 3.3V level UART DB9 female connector
DB9-USB-D5-M	Full Speed USB to 1-Port 5V level UART module that can replace 5V UART DB9 male connector
DB9-USB-D5-F	Full Speed USB to 1-Port 5V level UART module that can replace 5V UART DB9 female connector

**Table 1.2 – Ordering Information**

## 1.7 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.

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## 2 USB Connections

DB9-USB modules are downstream USB 2.0 Devices. A "USB mini-B" receptacle is mounted inside the modules to facilitate connection to an upstream USB Host or Hub.

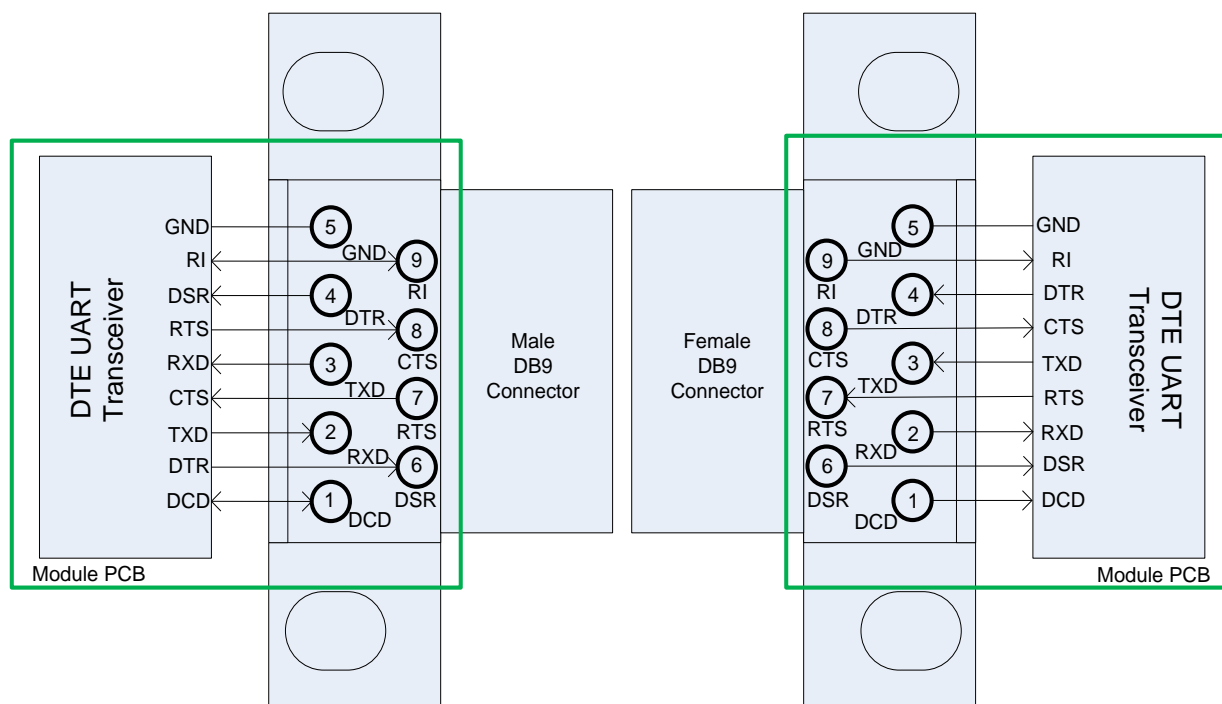
Pin Number	Pin Type	Description
1	Power	VBUS - USB Power provided from upstream USB Host or Hub
2	Bidirectional	D- = USB data signal, negative polarity
3	Bidirectional	D+ = USB data signal, positive polarity
4	ID	Not Connected
5	Ground	GND = USB signal ground
Shield	Case Ground	Drain = typically connected to the host PC case

**Table 2.1 - USB "mini-B" Receptacle Pin-Out**

### 3 UART Connections

The PC compatible accepted internal electrical connections for male and female UART DB9 connectors are illustrated in Figure 3.1 where the structure on the left is the top view of a male UART DB9 connector and the structure on the right is the top view of a female UART DB9 connector. A DTE transceiver is used in both modules, the male DB9 module has a null-modem connection between the transceiver and pins, and the female has a straight through connection between the transceiver and pins.

Assuming a design follows these connection conventions, then an FTDI male or female DB9-USB connector can be used to replace this UART DB9 connector to turn this port into an active USB interface.



**Figure 3.1 – Male & Female DB9-USB Internal Connections (Top View looking through the Module)**

The connection between a male and female DB9 module on an application board is illustrated in Figure 3.2. It can be determined that a male DB9 connector can be replaced with a male DB9 module and a female connector can be replaced with a female module.


**Figure 3.2 – DB9-USB Connection Illustrations**

### 3.1 Male DB9 UART Connector Signals

The DB9-USB-X-M can be used to replace a male DB9 connector used for transmitting UART signals.

Table 2.1 gives the pin out description of each pin/pad of a UART connector/footprint.

Pin Number	Pin Type of DB9-USB module	Pad Type at application PCB	Description
1	Input <sup>1</sup>	Input <sup>1</sup>	DCD = Data Carrier Detect
2	Output	Input	RXD = Receive Data (this is an output from the DB9-USB-X-M to the application Rx input)
3	Input	Output	TXD = Transmit Data (this is an input to the DB9-USB-X-M from the application Tx output)
4	Input	Output	DTR = Data Terminal Ready (this is an input to the DB9-USB-X-M from the application DTR output)
5	Ground	Ground	GND = RS232 signal ground
6	Output	Input	DSR = Data Set Ready (this is an output from the DB9-USB-X-M to the application DSR input)
7	Input	Output	RTS = Request To Send (this is an input to the DB9-USB-X-M from the application RTS output)
8	Output	Input	CTS = Clear To Send (this is an output from the DB9-USB-X-M to the application CTS input)
9	Input <sup>1</sup>	Input <sup>1</sup>	RI = Ring Indicator
Shield	Ground	Case Ground	Drain = typically connected to the host PC case

**Table 2.1 – Male DB9 UART Signal Description**

**Note 1:** These signals are irrelevant for DTE to DTE connections.

### 3.2 Female DB9 UART Connector Signals

The DB9-USB-X-F can be used to replace a female DB9 connector used for transmitting UART signals.

Table 2.2 gives the pin out description of each pin/pad of an UART connector/footprint.

Pin Number	Pin Type of DB9-USB module	Pad Type at application PCB	Description
1	Input	Output	DCD = Data Carrier Detect (this is an input to the DB9-USB-X-F from the application DCD output)
2	Input	Output	RXD = Receive Data (this is an input to the DB9-USB-X-F from the application Tx output, normally labelled RXD in DCE convention)
3	Output	Input	TXD = Transmit Data (this is an output to the DB9-USB-X-F from the application Rx input, normally labelled TXD in DCE convention)
4	Output	Input	DTR = Data Terminal Ready (this is an output to the DB9-USB-X-F from the application DSR input, normally labelled DTR in DCE convention)
5	Ground	Ground	GND = RS232 signal ground
6	Input	Output	DSR = Data Set Ready (this is an input to the DB9-USB-X-F from the application DTR output, normally labelled DSR in DCE convention)
7	Output	Input	RTS = Request To Send (this is an output to the DB9-USB-X-F from the application CTS input, normally labelled RTS in DCE convention)
8	Input	Output	CTS = Clear To Send (this is an input to the DB9-USB-X-F from the application RTS output, normally labelled CTS in DCE convention)
9	Input	Output	RI = Ring Indicator (this is an input to the DB9-USB-X-F from the application RI output)
Shield	Ground	Case Ground	Drain = typically connected to the host PC case

**Table 2.2 – Female DB9 UART Signal Description**

## **4 Installation**

### **4.1 Device Driver Installation**

The drivers for the DB9-USB modules are available for download from <https://ftdichip.com/>.

#### **4.1.1 Microsoft Windows Installation**

With the device drivers being Windows Hardware Quality Labs (WHQL) certified, they are also available through download directly from the Microsoft® Windows® Update service. Simply plug the device into the Windows PC and the drivers should load automatically if the PC is connected to the internet. Additional installation instructions can be found on the [Installation Guides](#) page of our website.

#### **4.1.2 MacOS, Linux and Android**

Device drivers and FTDI installation guides for Mac OS X, Linux and Android are available for download on the FTDI Chip website. Follow the respective FTDI [Installation Guides](#) for the chosen operating system.

## 5 Electrical details

### 5.1 USB

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
USB_VCC	Input Power Voltage*	4.25	5.0*	5.25	V	*Present when USB cable is attached and USB Host or Hub powered.
I <sub>cc</sub>	USB current		30	50	mA	

**Table 5.1 – USB Electrical Details**

### 5.2 RS232 Level UART

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
V <sub>trans</sub>	Transmitter output voltage swing	± 5			V	RL = 3KΩ
V <sub>rec</sub>	Receiver input voltage range	±2.4		±25	V	Input resistance = 3KΩ to 7KΩ
	ESD HBM		±15		KV	RS-232 Inputs and Outputs

**Table 5.2 – RS232 Electrical Details**

### 5.3 3.3V Level UART

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
V <sub>oh</sub>	Output Voltage High	2.2	2.7	3.2	V	I source = 1mA
V <sub>ol</sub>	Output Voltage Low	0.3	0.4	0.5	V	I sink = 2mA
V <sub>in</sub>	Input Switching Threshold	1.0	1.2	1.5	V	**

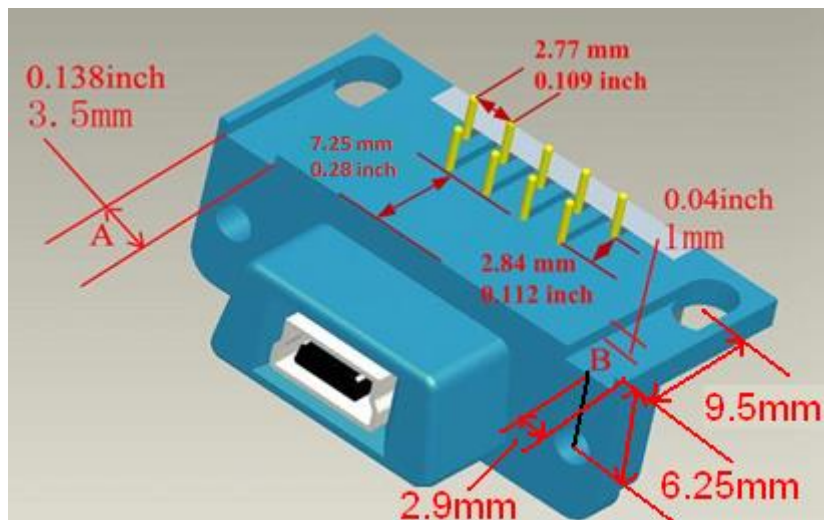
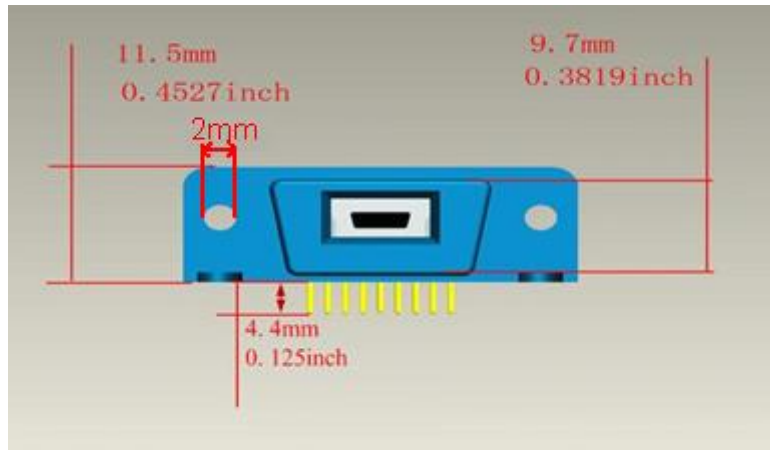
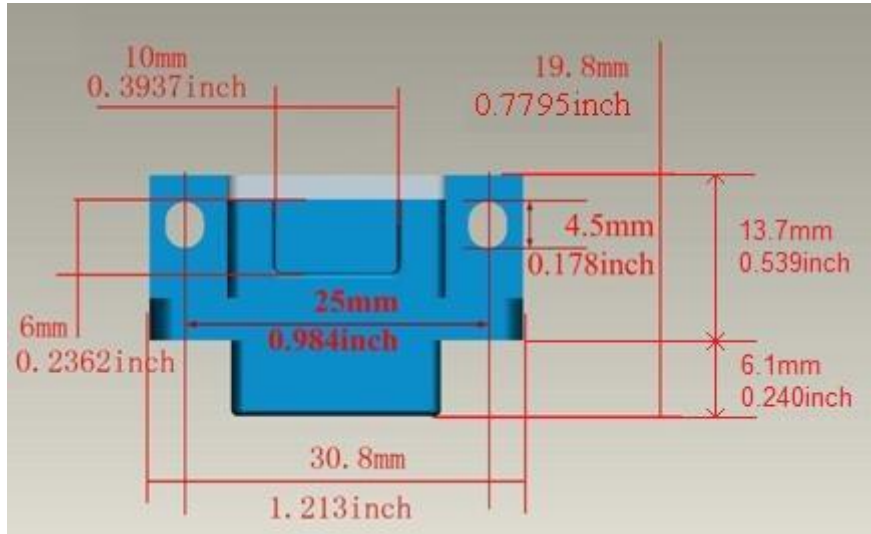
**Table 5.3 – 3.3V Level UART Electrical Details**

### 5.4 5V Level UART

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
V <sub>oh</sub>	Output Voltage High	3.2	4.1	4.9	V	I source = 2mA
V <sub>ol</sub>	Output Voltage Low	0.3	0.4	0.6	V	I sink = 2mA
V <sub>in</sub>	Input Switching Threshold	1.0	1.2	1.5	V	**

**Table 5.4 – 5V Level UART Electrical Details**

## 6 Mechanical Details



**Figure 5.1 – DB9-USB dimensions**



## 7 Physical Environment Details

### 7.1 Storage Temperature

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
T	Storage Temperature Range	-65		+85	°C	

**Table 7.1 – Storage Temperature**

### 7.2 Operating Temperature

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
T	Operating Temperature Range	-40		+85	°C	5% to 95% RH, non condensing

**Table 7.2 – Operating Temperature**

## 8 Environmental Approvals & Declarations

### 8.1 EMI Compatibility

#### FCC, CE and UKCA

DB9-USB modules are certified for both FCC Part 15 Subpart B, European EMC Directive and UKCA.



**Note:** This is a Class B product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.



**Note:** This equipment is currently undergoing testing to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### 8.2 Safety

The DB9-USB modules are defined as Limited Power Supply (LPS) device, with operating voltages under 60VDC.

### 8.3 Environmental

The DB9-USB modules are lead-free devices that comply with the following environmental directives: RoHS, WEEE, REACH, PFOS and DecaBDE.

### 8.4 Reliability

The DB9-USB modules are designed to be a robust USB-Serial module for use in many environments. There are no user-serviceable parts. Any failure will require a replacement of the unit.

## 8.5 Import / Export Information

Import / Export Information	
Country of Origin	China
Harmonized Code	1.1.1.1 8471.80.4000
Product Description	USB to Connector Adapter, Single Port
USA ECCN	EAR99 – No License Required

**Table 8.1 – Import / Export Information**

## 9 Troubleshooting

Ensure the latest device driver is in use. See <https://ftdichip.com/>.

If USB devices other than FTDI chips are installed in the system, then check with all manufacturers of these devices for the latest device drivers.

Section 4 details driver installation. If the user continues to have driver installation issues, then please refer to the FTDI [Installation Guides](#) for additional details.

Common Windows Device Driver Troubles:

- **DEVICE TIMES OUT**: The default settings of the device driver assume typical data transfers of hundreds to thousands or more bytes at a given time. Some applications, such as a GPS device, only send data in short packets, often only a few bytes. If this is the case, it may be necessary to adjust the driver buffer size and/or latency timer to smaller values. These values can be adjusted through the advanced driver options. The buffer size can be reduced to 64 bytes. The latency timer can be set as low as 2ms. A setting of 1ms will cause unnecessary USB traffic and could adversely affect data transmission. Advanced driver options are described in AN\_107 [Advanced Driver Options](#).
- **ERRATIC MOUSE POINTER**: The device driver defaults to query an attached device to find out whether it is a mouse or modem, consistent with native COM port operation. Some RS232 peripherals constantly send short packets of data, causing the host system to “think” a mouse or modem has been attached. These short packets will interfere with normal mouse operation causing the pointer to jump around the screen. If this happens, disconnect the RS232 device and *uncheck the Serial Enumerator* option, also found on the advanced driver options.
- **COM PORT IN USE**: Windows keeps track of all COM port assignments. If multiple FTDIChip products have been connected to a single system, the COM port number will increase, even if the other devices are not attached. If the higher COM port assignments are not acceptable for the application, known unused COM port numbers should be uninstalled.

## 10 Contact Information

### Head Office – Glasgow, UK

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

E-mail (Sales) [sales1@ftdichip.com](mailto:sales1@ftdichip.com)  
E-mail (Support) [support1@ftdichip.com](mailto:support1@ftdichip.com)  
E-mail (General Enquiries) [admin1@ftdichip.com](mailto:admin1@ftdichip.com)

### Branch Office – Tigard, Oregon, USA

Future Technology Devices International Limited (USA)  
7130 SW Fir Loop  
Tigard, OR 97223-8160  
USA  
Tel: +1 (503) 547 0988  
Fax: +1 (503) 547 0987

E-mail (Sales) [us.sales@ftdichip.com](mailto:us.sales@ftdichip.com)  
E-mail (Support) [us.support@ftdichip.com](mailto:us.support@ftdichip.com)  
E-mail (General Enquiries) [us.admin@ftdichip.com](mailto:us.admin@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](mailto:tw.sales1@ftdichip.com)  
E-mail (Support) [tw.support1@ftdichip.com](mailto:tw.support1@ftdichip.com)  
E-mail (General Enquiries) [tw.admin1@ftdichip.com](mailto:tw.admin1@ftdichip.com)

### Branch Office – Shanghai, China

Future Technology Devices International Limited (China)  
Room 1103, No. 666 West Huaihai Road,  
Shanghai, 200052  
China  
Tel: +86 21 62351596  
Fax: +86 21 62351595

E-mail (Sales) [cn.sales@ftdichip.com](mailto:cn.sales@ftdichip.com)  
E-mail (Support) [cn.support@ftdichip.com](mailto:cn.support@ftdichip.com)  
E-mail (General Enquiries) [cn.admin@ftdichip.com](mailto:cn.admin@ftdichip.com)

### Web Site

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## Appendix A – References

### Document References

AN\_149 [Upgrading a passive DB9 RS232 Interface to an active USB Interface using an FTDI DB9-USB-RS232 Module](#)

AN\_107 [Advanced Driver Options](#)

AN\_120 [Aliasing VCP Baud Rates](#)

[Installation Guides](#)

### Acronyms and Abbreviations

<b>Terms</b>	<b>Description</b>
OS	Operating System
PC	Personal Computer
RoHS	Restriction of Hazardous Substances
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver-Transmitter
VCP	Virtual COM Port
WEEE	Waste Electrical and Electronic Equipment
WHQL	Windows Hardware Quality Labs

## Appendix B – List of Figures and Tables

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## Appendix C – Revision History

Document Title: DB9-USB Family of UART Converter Modules Datasheet  
 Document Reference No.: FT\_000204  
 Clearance No.: FTDI# 130  
 Product Page: [Modules](#)  
 Document Feedback: [Send Feedback](#)

Revision	Changes	Date
Version 1.0	Initial Release	2009-11-18
Version 1.1	Updated Part Numbers	2010-02-19
Version 1.2	Added Figure 2.2 & 2.4; Updated Tables 2.2 & 2.3; Added Note 1 to Table 2.2	2010-06-01
Version 1.3	Simplified the datasheet contents	2010-11-05
Version 2.0	Added details on Digital 3.3V and Digital 5V Modules; Edited descriptions	2011-08-31
Version 2.1	Changed DB9-USB-RS232-M/F name to match the part number: DB9-USB-M/F	2011-10-04
Version 2.2	Updated Figure 3.1 & 3.2; Added more details to the text reference for Figure 3.1; Corrected the front to back inch measurements and pin to front measurement	2012-06-06
Version 2.3	Updated Figure 5.1 and contact information	2017-11-07
Version 2.4	Added UKCA and updated part number to FT232RQ. Added driver support section and updated links.	18-07-2023