



**QS Series
USB Module
Data Guide**

Wireless made simple[®]



Warning: Some customers may want Linx radio frequency (“RF”) products to control machinery or devices remotely, including machinery or devices that can cause death, bodily injuries, and/or property damage if improperly or inadvertently triggered, particularly in industrial settings or other applications implicating life-safety concerns (“Life and Property Safety Situations”).

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Customers may use our (non-Function) Modules, Antenna and Connectors as part of other systems in Life Safety Situations, but only with necessary and industry appropriate redundancies and in compliance with applicable safety standards, including without limitation, ANSI and NFPA standards. It is solely the responsibility of any Linx customer who uses one or more of these products to incorporate appropriate redundancies and safety standards for the Life and Property Safety Situation application.

Do not use this or any Linx product to trigger an action directly from the data line or RSSI lines without a protocol or encoder/decoder to validate the data. Without validation, any signal from another unrelated transmitter in the environment received by the module could inadvertently trigger the action.

All RF products are susceptible to RF interference that can prevent communication. RF products without frequency agility or hopping implemented are more subject to interference. This module does not have a frequency hopping protocol built in.

Do not use any Linx product over the limits in this data guide. Excessive voltage or extended operation at the maximum voltage could cause product failure. Exceeding the reflow temperature profile could cause product failure which is not immediately evident.

Do not make any physical or electrical modifications to any Linx product. This will void the warranty and regulatory and UL certifications and may cause product failure which is not immediately evident.

Ordering Information

Ordering Information	
Part Number	Description
SDM-USB-QS-S	QS Series USB Module
MDEV-USB-QS	QS Series Master Development Kit

Figure 2: Ordering Information

Absolute Maximum Ratings

Absolute Maximum Ratings				
Supply Voltage V_{cc}	-0.5	to	+6.0	VDC
Any Input or Output Pin	-0.5	to	$V_{cc} + 0.5$	VDC
Max. Current Sourced by Output Pins		24		mA
Operating Temperature	0	to	+70	°C
Storage Temperature	-65	to	+150	°C

Exceeding any of the limits of this section may lead to permanent damage to the device. Furthermore, extended operation at these maximum ratings may reduce the life of this device.

Figure 3: Absolute Maximum Ratings

Pin Assignments

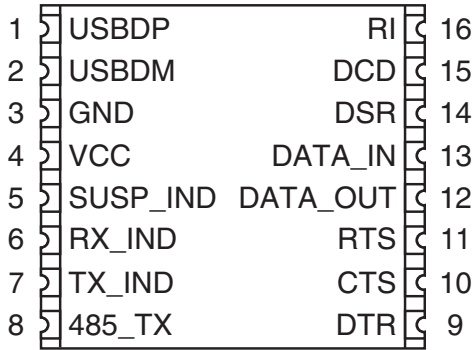


Figure 5: SDM-USB-QS-S Pinout (Top View)

Pin Descriptions

Pin Descriptions		
Pin Number	Name	Description
1	USBDP	USB data signal plus
2	USBDM	USB data signal minus
3	GND	Ground supply
4	V _{CC}	Positive power supply
5	SUSP_IND	Goes low during USB Suspend Mode. This pin can be used to power down external logic when the host puts the USB bus into suspend mode.
6	RX_IND	This line will pulse low when receiving data from the USB bus. This allows for the connection of a LED indicator.
7	TX_IND	This line will pulse low when transmitting data on the USB bus. This allows for the connection of a LED indicator.
8	485_TX	Transmit enable line for RS-485 applications.
9	DTR	Data Terminal Ready control / handshake output
10	CTS	Clear to Send control / handshake input
11	RTS	Request To Send / handshake output
12	DATA_OUT	Transmit asynchronous data output
13	DATA_IN	Receive asynchronous data input
14	DSR	Data Set Ready control / handshake input
15	DCD	Data Carrier Detect control / input
16	RI	Ring Indicator control input

Figure 6: Pin Descriptions

The USB DPLL locks onto the NRZ data and provides separate recovered clock and data signals to the Serial Interface Engine (SIE).

The SIE performs the parallel-to-serial and serial-to-parallel conversion, bitstuffing / un-stuffing, and CRC calculations on the USB data.

The USB Protocol Engine manages the data from the USB control endpoint, the USB protocol requests from the USB host controller, and the commands for controlling the functional parameters of the UART.

Data from the USB data out endpoint is stored in the TX buffer and removed from the buffer to the UART transmit register under control of the UART FIFO controller.

Data from the UART receive register is stored in the RX buffer prior to being removed by the SIE on a USB request for data from the device data in endpoint.

The UART FIFO controller handles the transfer of data between the RX and TX buffers and the UART transmit and receive registers.

The UART performs asynchronous 7 / 8 bit parallel-to-serial and serial-to-parallel conversion of the data on the RS-232 interface. Control signals supported by the UART include RTS, CTS, DSR, DTR, DCD, and RI. The UART provides a transmitter-enable control signal (485_TX) to assist with interfacing to RS-485 transceivers. The UART supports RTS / CTS, DSR / DTR and X-On / X-Off handshaking options. Handshaking, where required, is handled in hardware to ensure fast response times. The UART also supports the RS-232 BREAK setting and detection conditions.

Changing the Device Descriptions

The QS can be customized to display the product's name, manufacturer name, and to use different Product Identifiers (PID) and Vendor Identifiers (VID). This allows an end user to see the final product's name in their Windows Device Manager and when the hardware is first loaded. The PID and VID are set by the USB Implementers Forum and should not be changed unless the final product has gone through the certification process and received its own unique IDs.

The Manufacturer, Description, and Serial Number strings can all be modified using the QS EEPROM Programmer software, which can be downloaded from the Linx web site. This easy-to-use software reprograms the module via the USB bus and can be done during production testing.

Once the module is reprogrammed, some modifications to the driver files may be necessary. If a VID and PID other than the default Linx numbers are used, these numbers need to be added to the files. This requires modifying several lines in the .inf files and is described in detail in the QS Series Programmer's Guide. Modifying the name displayed by the Windows Device Manager requires changing only one line, also described in the Programmer's Guide.

Software Considerations

The PC needs a set of drivers that tell it how to communicate with the QS module. The CDM drivers for the QS Series module install two different drivers at the same time. The first driver makes the QS appear as a COM port on the host PC. This allows the application to use standard writes and reads to a serial port, and the drivers redirect data to the USB module.

The second driver supports a series of functions that allow direct control of the QS module. These functions are described in Application Note AN-00200: SDM-USB-QS Programmer's Guide, where examples are given in both Visual Basic and C. The Programmer's Guide can be downloaded from the Application Notes page in the Support section of the Linx website. Sample software is available on the Software page in the Support section.

In addition to the Programmer's Guide, the QS Series Master Development System (MDEV-USB-QS) includes example software and sample system source code. This source code provides the driver function declarations, examples of how to use the functions in a program, and other code that may be of use.

Power Supply Guidelines

The USB module can be powered in two ways: from the USB bus or from an external source. If necessary, a voltage regulator can be used to supply a clean 5V as the external source, or the V_{CC} pin can be connected to the bus power pin of the USB connector. Using the bus to power the module is an advantage because the module then uses power from the host rather than from the peripheral. This is especially helpful if the peripheral is battery-powered. Figure 9 shows the schematic powering from the bus.

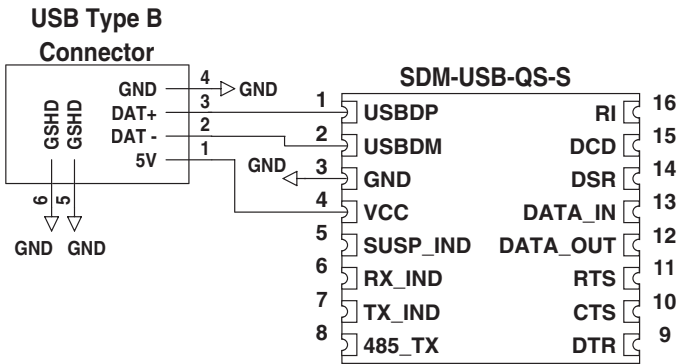


Figure 9: USB Bus-Powered Schematic

The USB specification has strict allowances for using power from the bus. A device is allowed to use 100mA before enumeration, 500mA during normal operation, and 500mA in suspend mode. A descriptor stored in the EEPROM tells the host how much current the device will pull from the bus so that the host can allocate the appropriate power. The modules come programmed for 100mA, but if the final product draws more than this, then the device descriptors need to be changed.

Pad Layout

The following pad layout diagram is designed to facilitate both hand and automated assembly.

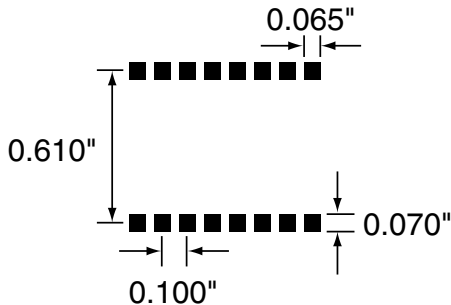


Figure 10: Recommended PCB Layout

Typical Applications

There are many potential uses for the QS Series modules, three of which will be described here. Figure 12 shows the QS and a MAX213 RS-232 level converter IC from Maxim. This creates a USB-to-RS-232 converter that supports all of the standard handshaking lines. Similarly, RS-485 or RS-422 level converter chips could be used for designs requiring those standards.

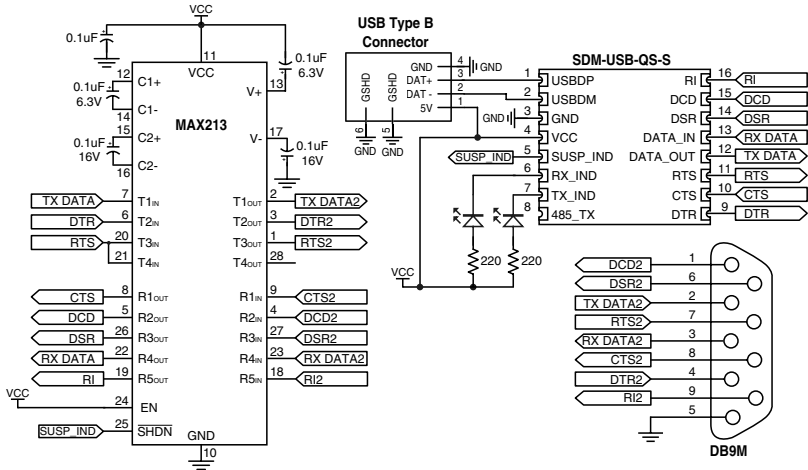


Figure 12: RS-232 to USB Converter

The QS Series modules can be used with Linx RF modules to create a wireless link between two PCs. Figure 13 shows a design using the ES Series RF modules. An option not shown in the schematic below is that one of the output lines of the QS module (RTS or DTR) could be connected to the PDN lines of the RF modules, enabling the host to turn the RF modules on and off.

Production Guidelines

The module is housed in a hybrid SMD package that supports hand and automated assembly techniques. Since the modules contain discrete components internally, the assembly procedures are critical to ensuring the reliable function of the modules. The following procedures should be reviewed with and practiced by all assembly personnel.

Hand Assembly

Pads located on the bottom of the module are the primary mounting surface (Figure 15). Since these pads are inaccessible during mounting, castellations that run up the side of the module have been provided to facilitate solder wicking to the module's underside. This allows for very

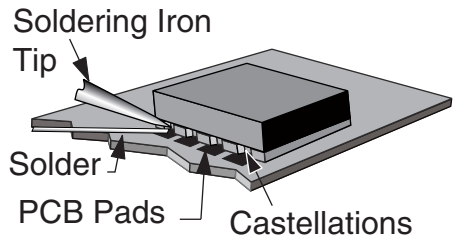


Figure 15: Soldering Technique

quick hand soldering for prototyping and small volume production. If the recommended pad guidelines have been followed, the pads will protrude slightly past the edge of the module. Use a fine soldering tip to heat the board pad and the castellation, then introduce solder to the pad at the module's edge. The solder will wick underneath the module, providing reliable attachment. Tack one module corner first and then work around the device, taking care not to exceed the times in Figure 16.

Warning: Pay attention to the absolute maximum solder times.

Absolute Maximum Solder Times

Hand Solder Temperature: +427°C for 10 seconds for lead-free alloys

Reflow Oven: +255°C max (see Figure 40)

Figure 16: Absolute Maximum Solder Times

Automated Assembly

For high-volume assembly, the modules are generally auto-placed. The modules have been designed to maintain compatibility with reflow processing techniques; however, due to their hybrid nature, certain aspects of the assembly process are far more critical than for other component types. Following are brief discussions of the three primary areas where caution must be observed.



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