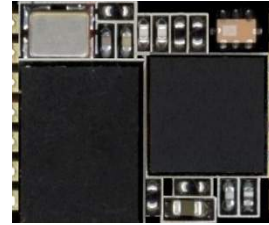## Firmware Features

- Wireless Data Communications Subsystem

- Embedded Bluetooth Serial Port Profile (SPP)

- Remote Command And Control

- Easy To Use AT Command Interface Using UART

- OEM Programmable Configuration

- Custom Firmware Available

13.4mm x 11.3mm x 2.0mm

Hardware Features

- CSR BlueCore 4 Ext Chipset

- Bluetooth v2.1 + EDR

- 2.4GHz Class 2 Radio

- Range Typically Exceeds 20m

- High Speed Data Rate Up To 3Mbps

- 4 Digital Programmable I/O Pins

- 1 Analog Programmable I/O Pins

- UART & SPI Interfaces

- External Antenna Port

- 8Mbit Flash Memory

Applications

- Bluetooth Serial Cable Replacement

- Bluetooth Data Acquisition

- Bluetooth Remote Control

- Bluetooth Bar Code Readers

- Bluetooth Medical Device Reading

- Bluetooth Credit Card Readers

Description

The KC-22 data modules are pre-engineered, pre-qualified, and highly tuned surface mount PCB modules that provide fully embedded, ready to use Bluetooth wireless technology. Multi-surface pads provide both bottom pads for high volume reflow soldering and edge pads for low volume hand soldering.

The KC-22 offers reprogrammable, embedded firmware for serial cable replacement deploying the Bluetooth Serial Port Profile (SPP). OEM specific parameters and settings can be easily loaded into these modules.

Our kcSerial embedded firmware provides an easy to use AT style command interface over UART. kcSerial is capable of storing OEM default settings, and is upgradable over UART. kcSerial also provides remote control capability, where our AT commands can be issued remotely from any other Bluetooth device using SPP. Custom firmware is available.

(Unless the micro size is absolutely necessary, KC Wirefree recommends our KC-21 for lower cost, and onboard antenna -- Class 2, Bluetooth Data Module.)

Standard Bluetooth Data Profiles

The KC Wirefree KC-22 data modules comes standard with kcSerial which includes support for (DUN) Dial-up Networking Profile, and (SPP) Serial Port Profile.

DUN - Dial-up Networking Profile

DUN provides a standard to access the Internet and other dial-up services over Bluetooth technology. The most common scenario is accessing the Internet from a laptop by using your mobile phone as a wireless dial-up modem.

SPP - Serial Port Profile

The SPP is a very popular widely used profile for transmitting data in place of a serial cable. SPP defines how to set up virtual serial ports and connect two Bluetooth enabled devices. A scenario would be using two devices, such as PCs or laptops, as virtual serial ports and then connecting the two devices via Bluetooth technology.

Available Bluetooth Data Profiles

KC-22 is capable of supporting additional Bluetooth profiles. Contact KC Wirefree for customization options.

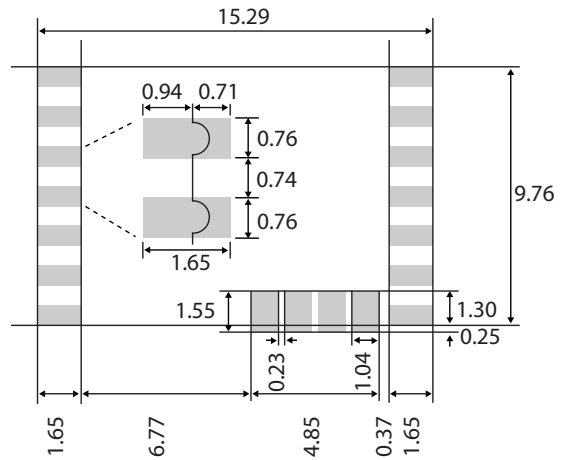**HID - Human Interface Device Profile**

We offer kcKeyboard firmware providing HID profile intended for keyboard/keypad devices. Also available is our kcHidReceiver, capable of connecting to Bluetooth keyboards and mice.

www.kcwirefree.com

Physical Dimensions

KC-22 Top View
(dimensions in mm)
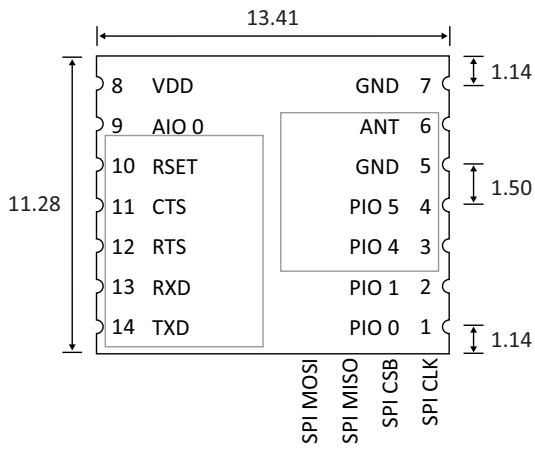
KC-22 Landing Pattern
(dimensions in mm)

Pin Assignment

Pin	Function	Type	Description
1	PIO_0	I/O	Programmable Input/Output [Class 1 Rx Enable]
2	PIO_1	I/O	Programmable Input/Output [Class 1 Tx Enable]
3	PIO_4	I/O	Programmable Input/Output
4	PIO_5	I/O	Programmable Input/Output
5	GND	--	Ground
6	ANT	Output	External Antenna Port
7	GND	--	Ground
8	VDD	Input	3.3V Regulated Voltage Input
9	AIO_0	I/O	Analog Programmable Input/Output
10	RSET	Input	Hardware Reset when Low >5ms
11	UART_CTS	Input	UART Clear To Send
12	UART_RTS	Output	UART Ready to Send
13	UART_RXD	Input	UART Data Input
14	UART_TXD	Output	UART Data Output
TP	SPI_MISO	I/O	SPI Master In
TP	SPI_MOSI	I/O	SPI Master Out
TP	SPI_CS	I/O	SPI Chip Select
TP	SPI_CLK	I/O	SPI Clock

[Special/optional pin features shown in brackets]

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Electrical Characteristics

(Conditions VDD= 3.3V and 25 °C)

Absolute Maximum Ratings	Min	Max	Unit
Storage temperature range	-40	150	°C
Supply voltage VDD	-0.4	3.7	Volts

Recommended Operating Conditions	Min	Max	Unit
Temperature Range	-40	85	°C
Supply Voltage VDD (3.3V Recommended)	2.8	3.6	Volts

Digital PIO & UART Pins Characteristics	Min	Typ	Max	Unit
Input Voltage Low Logic	-0.4	-	0.8	Volts
Input Voltage High Logic	2.3	-	3.7	Volts
Output Voltage Low Logic	-	-	0.2	Volts
Output Voltage High Logic	3.1	-	-	Volts
Input Leakage Current	-1	-	+1	µA
Input Capacitance	1.0	-	5.0	pF
Weak Internal Pull-Up	-5.0	-1.0	-0.2	µA
Weak Internal Pull-Down	+0.2	+1.0	+5.0	µA
Strong Internal Pull-Up	-100	-40	-10	µA
Strong Internal Pull-Down	+10	+40	+100	µA

Analog Programmable I/O Pins Characteristics	Min	Max	Unit
Resolution		8	Bits
Sample Rate		50	Per Sec
Voltage	0	1.8	V

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Electrical Characteristics Cont.

Current Consumption	Avg	Unit
ACL Data 115Kbps Data Transfer(Master)	11	mA
ACL Data 115Kbps Data Transfer(Slave)	25	mA
Connection, No Data Traffic (Master)	4.6	mA
Connection, No Data Traffic (Slave)	17	mA
Peak current	90	mA
Sniff Mode (40ms sniff) (Master)	2.4	mA
Sniff Mode (40ms sniff) (Slave)	2.1	mA
Sniff Mode (1.3s sniff) (Master)	0.4	mA
Sniff Mode (1.3s sniff) (Slave)	0.4	mA
Deep Sleep	40	µA

Selected RF Characteristics	Test Conditions	BT Spec	Typical	Unit
Maximum RF power	50 Ω load	-6 to +4	+5	dBm
Sensitivity level	0.1% BER	≤ -70	-85	dBm
Power control range		≥ 16	35	dB
Power control resolution		-	0.5	dB
Antenna load			50	Ω

Firmware Interface

The KC-22 offers our powerful kcSerial firmware interface using the UART, which provides an easy to use AT style text command interface. The firmware interface allows persistent storage of configuration parameters such as device name, default baud rate, security PIN, and automatic connection settings. Additionally kcSerial provides operational commands such as discovery, connections, security, read/write commands for I/O pins. These commands are also available in remote command mode, so a kcSerial device will respond to these commands issued locally via UART, or wirelessly via remote command mode.

The kcSerial v3.0 firmware is compatible with kcSerial v2.4 and v2.2 firmware used on previous versions of KC-22 modules. Many new commands are available, offering greater control over features and settings.

kcSerial v3.0 AT Command List

```
AT Help
-> [CommandList]
-> AioRead          AutoConnect        BatteryMon
-> BtAddr           Build              Bypass
-> CoD              ConfigRawBaud      ConfigUart
-> ConnDiscOverride Connect            Connectable
-> ConnectDun       ConnectIOS         ConnectScan
-> DebugMode        DeepSleep          Disconnect
-> DisconnectDun    Discoverable       DiscoverSvc
-> Discovery        DiscoveryRssi      EscapeCommand
-> FactoryReset     HciMode            HwFlowControl
-> InputCmdMode     InputConnect       InputSleepBlock
-> InquiryScan      LinkTest           LinkTimeout
-> LowLatency       Messages           Name
-> OutputActivity   OutputConnect      OutputCpu
-> OutputLowBatt    Pair               Pairable
-> PairingDelete    PairingOption      Passkey
-> PinCode          PioConfig          PioRead
-> PioSettings      PioStatus          PioStrong
-> PioWrite         RemoteCommand      Reset
-> RfcService       RfPower            RoleSwitch
-> Rssi             Security           SecurityAuth
-> ShowSettings     ShowStatus         Sniff
-> SniffSettings    SniffSubrate       SppService
-> Timer            TimerAio           TimerPio
-> Version          ZvMode
->
-> EscapeMode prefix: ~~~~~1
-> EscapeCmd  prefix: ~~~~~2
-> RemoteMode prefix: ~~~~~3
-> RemoteCmd  prefix: ~~~~~4
->
-> Command help: AT <command> ?
-> [EndCommandList]
```

Please refer to our *kcSerial 3.0 User Guide* for additional information.

Hardware Interfaces

SPI Interface

The SPI pins are only available for firmware loading and test tools. SPI test points are highly recommended for emergency diagnostics access.

UART Interface

The UART is compatible with the 16450 industry standard. Four signals are provided with the UART interface. The TXD and RXD pins are used for data while the CTS and RTS pins are used for flow control. The UART pins operate at TTL voltage level and must be translated to higher RS-232 voltage levels for communicating with PC hosts. A Maxim 3225 series or similar translator is recommended. It is highly recommended that UART pins are available for external connection (DB-9 connector or test points) to allow firmware reinstallation or updates.

Firmware Command and Control

KC-22 modules can be connected to PC or MCU hosts using the UART interface. Our kcSerial firmware provides an easy to use AT style command interface using simple text commands and parameters. Please refer to our kcSerial *User Guide* for additional information.

PIO Interface Pins

PIO pins are read and write enabled via kcSerial commands. Inputs can be configured for weak pull-up, weak pull-down, strong pull-up, strong pull-down. Voltage input tolerance and output level is equal to the VDD level.

AIO Interface Pins

AIO 0 and AIO 1 are enabled for analog input by default, providing 8 bit samples at rates up to 50 samples/sec. Analog pins are 1.8V logic for input mode. AIO pins can be optionally configured for clock output of 8, 16, 24, or 48 MHz.

Antenna Port

The KC-22 module already contains a balun-filter onboard, so the antenna port only requires a standard 2.4 GHz RF transmission line with a 50 ohm load. Design the antenna circuit according to the antenna manufacturer guidelines. Transmission line calculation is mostly irrelevant if the antenna is placed less than 3mm from the RF pin.

The following antennas have been FCC tested and are considered pre-approved:

>Johanson 2450AT18B100E, Johanson 2450AT43A100E, Antenova Rufa A5839

For antenna transmission line design, we recommend these design calculators:

>http://chemandy.com/calculators/microstrip-transmission-line-calculator-hartley27.htm
>http://chemandy.com/calculators/coplanar-waveguide-with-ground-calculator.htm

Application Notes

- Eagle CAD footprint available at www.kcwirefree.com.

- RS232 hardware flow control is disabled in kcSerial v3.0 firmware by default, and can be enabled with AT HwFlowControl E command. It is highly recommended to enable hardware flow control, since data can be lost with poor wireless connections without flow control.

- UART interfaces are 3V3 TTL. A voltage level shifter is required when interfacing to PC standard RS232 ports.

- Power supply to module should have less than 10mVrms noise between 0-10MHz, and spikes should be minimal.

- Regulator should have a fast response time < 20μs. It is essential that the power rail recover quickly. We recommend the On Semiconductor MC78PC33NTRG.

- A voltage level monitor IC connected to RESET is recommended for fluctuating power sources (especially automotive). Flash memory can become corrupted with spiking power sources.

- 1μF or larger capacitor filter recommended for VDD input.

- All unused pins should be unconnected.

- The area around the antenna should be free of metal and grounds. Minimum clearance is 5mm, but additional clearance improves RF performance.

- Do not use ultra sonic cleaning, which may cause internal interconnect damage to IC's and crystals.

- We highly recommend test header/pads for the SPI pins, for emergency programming and diagnostic access.

www.kcwirefree.com

Example Hardware Interface Connections

KC Wirefree modules provide UART, SPI, and PIO hardware interfaces. This section illustrates a typical implementation, and does not consider all cases. Our engineers are available to review designs and answer any other design questions. Contact our engineering department directly by email: support@kcwirefree.com
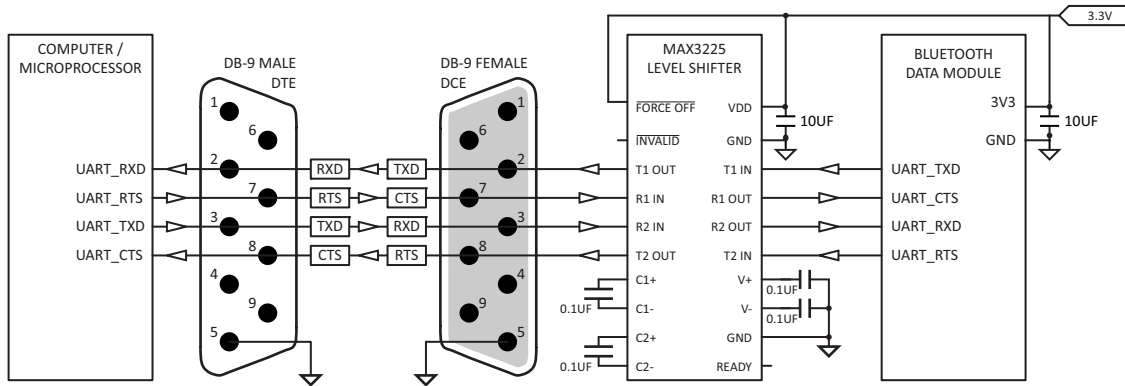
UART connection with level shifting
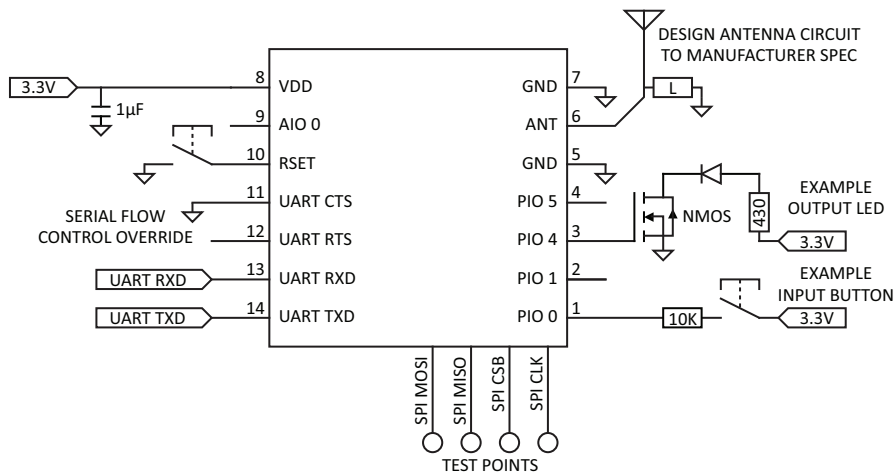
Example KC-22 module schematic using 3-wire serial interface option

Pre Qualifications

Bluetooth

The KC-22 is registered with and licensed by Bluetooth SIG as a qualified design.

> Qualification Design ID: B015017

> Bluetooth Version: 2.1 + EDR

> Qualified Profiles: BB, DUN, GAP, HCI, L2CAP, LM, RFCOMM, SDP, SPP

Usage of Bluetooth registered trademarks must be licensed directly from Bluetooth SIG. A no cost membership is currently offered for trademark usage, and a no cost Bluetooth product listings are currently offered for products containing our pre-qualified Bluetooth modules.

FCC

The KC-22 is registered with and granted limited modular approval by the Federal Communications Commission. The KC-22 meets the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Bluetooth spread spectrum transmitters.

The following external antenna solutions are suggested, and will comply with our FCC equipment grant: Johanson 2450AT18B100E, Johanson 2450AT43A100E, Antenova Rufa 3030A5839-01, ¼ wave monopole wire.

With a written agreement, Original Equipment Manufacturers may use our FCC ID transmitter license. The following FCC ID must be visible on the exterior of final the product.

> FCC ID: S2242

CE

The KC-22 complies with the following EMC Directives:

> EN 300.328 V1.6.1 (2004-11) [Approval pending]

Industry Canada

IC Warning Statement: The device's user manual does not contain the following or equivalent statement as per RSS-GEN section 7.1.5: Operation of this device is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

> IC ID: 8193A-BTMODULECL2

SAR

SAR compliant.

Datasheet Versions

Revisions	Changes
January 21, 2010	Initial release
March 20, 2010	Updated 3-wire application note, illustration
June 24, 2011	Updated operating voltages
February 28, 2012	Updated minor text

Ordering Information

Product Series	KC-22
Product Version	6.0
Country of Manufacture	USA
Order Part Number	**Description**
KC-22.6	Class 2 Bluetooth Data Micro Module w/ kcSerial Standard Firmware
KC-22.6-FW	Class 2 Bluetooth Data Micro Module, w/ Custom Firmware

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