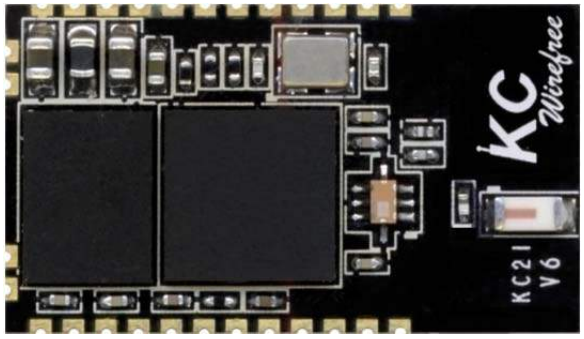
Firmware Features

- Wireless Data Communications System
- Embedded Bluetooth Serial Port Profile (SPP)
- Remote Command And Control
- Low Power Connection Modes < 500µA
- Easy To Use AT Command Interface Using UART
- OEM Programmable Configuration
- Custom Firmware Available

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
- 12 Digital Programmable I/O Pins
- 2 Analog Programmable I/O Pins
- UART, USB, SPI Interfaces
- Onboard Antenna
- 8Mbit Flash Memory



26.9mm x 15.2mm x 2.5mm

Applications

- Serial Cable Replacement
- Remote Sensors
- Medical Monitoring
- Bar Code Readers
- RFID Tag Readers
- Credit Card Readers

Description

The KC-21 series 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-21 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.

(For long range applications, KC Wirefree recommends our KC-5100 -- Class 1, Bluetooth Data Hi Power Module.)

Standard Bluetooth Data Profiles

The KC Wirefree KC-21 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-21 is capable of supporting additional Bluetooth profiles. Contact KC Wirefree for customization options.

HID - Human Interface Device Profile

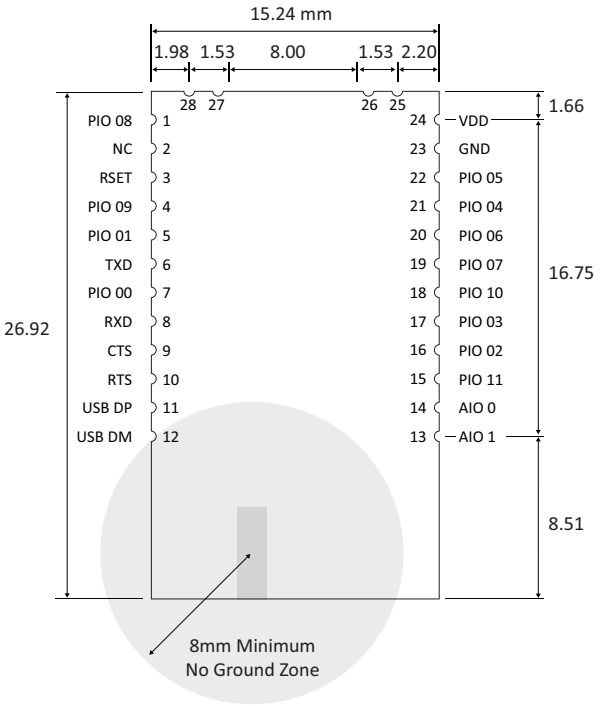
The HID profile defines the protocols, procedures and features to be used by Bluetooth HID such as keyboards, pointing devices, gaming devices and remote monitoring devices. The most common usage would be your wireless desktop, keyboard, mouse, etc.

OPP – Object Push Profile

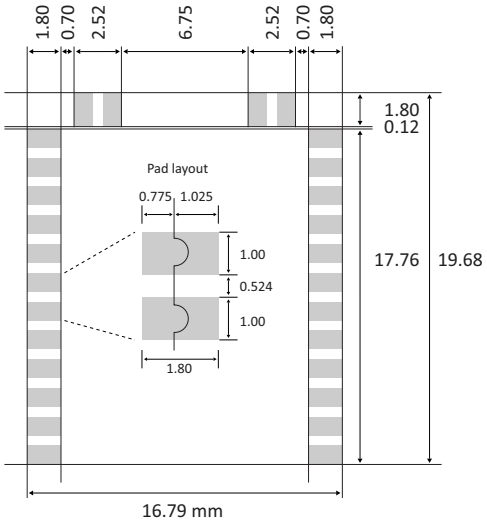
OPP defines the roles of push server and push client. These roles are analogous to and must interoperate with the server and client device roles that GOEP defines. An example scenario would be the exchange of a contact or appointment between two mobile phones, or a mobile phone and a PC.

Physical Dimensions

KC-21 Top View
(dimensions in mm)



KC-21 Landing Pattern
(dimensions in mm)



Pio Assignments

Only for this KC-21 v6 module, our previous kcSerial v2.4 firmware edition provided a logical GPIO assignment within the AT Command language to preserve compatibility with older generations of KC-21 modules. Since our new kcSerial v3.0 firmware provides completely re-assignable Pio Input/Output features, this logical GPIO assignment is no longer necessary, and the Bluetooth chip physical PIO assignments are used.

Pin	kcSerial v3.0	kcSerial v2.4
1	PIO 08	GPIO 03
4	PIO 09	GPIO 08
5	PIO 01	GPIO 10
7	PIO 00	GPIO 09
15	PIO 11	GPIO 13
16	PIO 02	GPIO 00

Pin	kcSerial v3.0	kcSerial v2.4
17	PIO 03	GPIO 01
18	PIO 10	GPIO 04
19	PIO 07	GPIO 02
20	PIO 06	GPIO 05
21	PIO 04	GPIO 15
22	PIO 05	GPIO 06

Pin Assignment

Pin	Function	Type	Description
1	PIO_08	I/O	Programmable Input/Output
2	NC	--	Not Connected
3	RESET	Input	Hardware Reset when Low >5ms
4	PIO_09	I/O	Programmable Input/Output
5	PIO_01	I/O	Programmable Input/Output [Class 1 TX Enable]
6	UART_TXD	Output	UART Data Output
7	PIO_00	I/O	Programmable Input/Output [Class 1 RX Enable]
8	UART_RXD	Input	UART Data Input
9	UART_CTS	Input	UART Clear To Send
10	UART_RTS	Output	UART Request To Send
11	USB_DP	I/O	USB Data Positive
12	USB_DN	I/O	USB Data Negative
13	AIO_1	I/O	Programmable Input/Output [ADC, CLK]
14	AIO_0	I/O	Programmable Input/Output [ADC, CLK]
15	PIO_11	I/O	Programmable Input/Output
16	PIO_02	I/O	Programmable Input/Output
17	PIO_03	I/O	Programmable Input/Output
18	PIO_10	I/O	Programmable Input/Output
19	PIO_07	I/O	Programmable Input/Output [RXD Passthrough]
20	PIO_06	I/O	Programmable Input/Output [CTS Passthrough]
21	PIO_04	I/O	Programmable Input/Output [TXD Passthrough]
22	PIO_05	I/O	Programmable Input/Output [RTS Passthrough]
23	GND	--	Ground
24	VDD	Input	3V3 Regulated Input
25	SPI_MISO	I/O	SPI Master In Slave Out
26	SPI_MOSI	I/O	SPI Master Out Slave In
27	SPI_CS	I/O	SPI Chip Select
28	SPI_CLK	I/O	SPI Clock

[Special/optional pin features shown in brackets]

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

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-21 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-21 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.

UART Bypass Interface

A UART bypass feature is available where the UART signals are passed through to PIO [4,5,6,7]. An external processor is required to issue a command that enables the bypass mode. The module will be in Deep Sleep while in bypass mode, and requires an external reset to resume normal operation.

USB Interface

The USB interface is available for custom applications.

Firmware Command and Control

KC-21 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

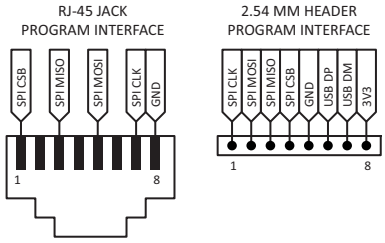
PIO pins are read and write enabled via kcSerial commands. Inputs can be configured for weak pull-up, weak pull-down, strong pull-up, strong pull-down. Voltage input tolerance and output level is equal to the VDD level.

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.

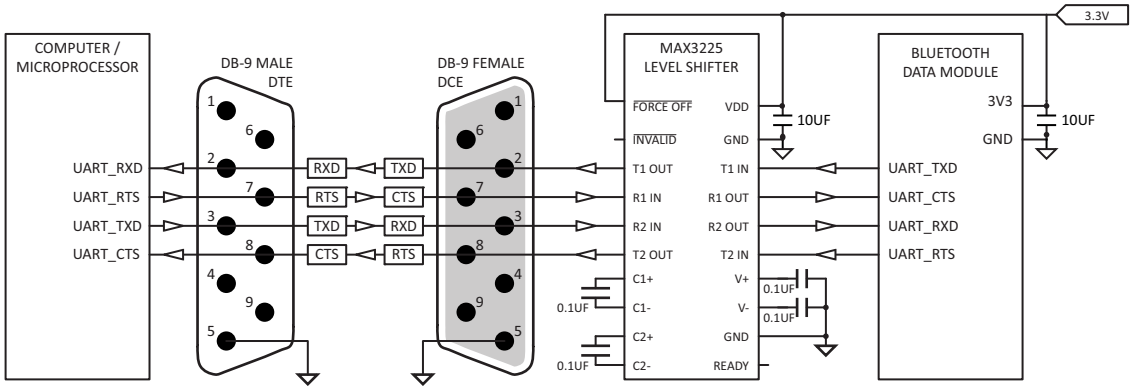
Application Notes

- Eagle CAD footprint available at www.kcwirefree.com.
- RS232 hardware flow control is disabled in kcSerial v3.0 firmware by default, and can be permanently 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 prefer 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 high or low 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 recommend providing an RJ-45 programming adapter jack, or at least a 2.54mm programming header. The component does not need to be placed unless needed for emergency diagnostics.

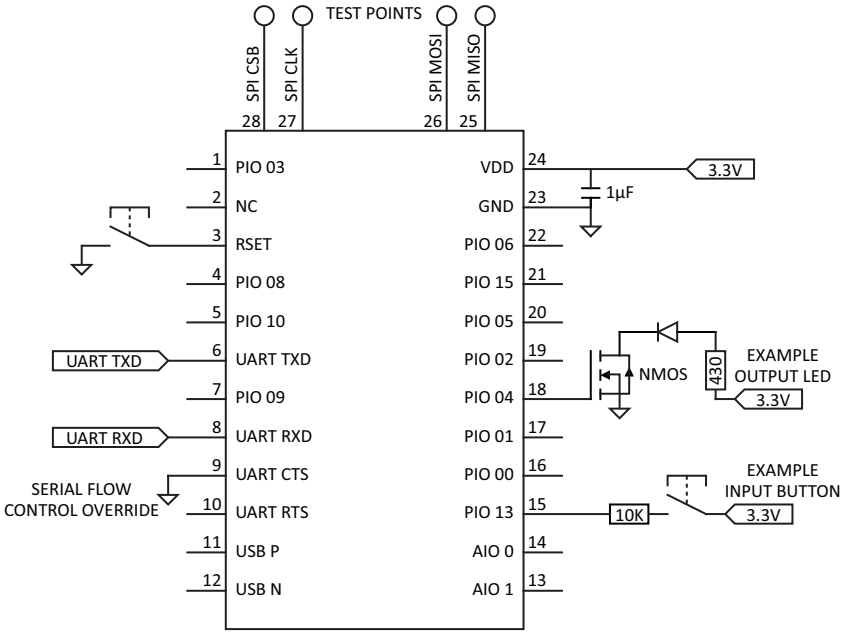


Example Hardware Interface Connections

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-21 module schematic using 3-wire serial interface option

Pre Qualifications

Bluetooth

The KC-21 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 no cost Bluetooth product listings are currently offered for products containing our pre-qualified Bluetooth modules.

FCC

The KC-21 is registered with and granted limited modular approval by the Federal Communications Commission. The KC-21 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.

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-21 complies with the following EMC Directives:

EN 300.328 V1.6.1 (2004-11)

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
February 11, 2009	KC-21 v6 datasheet release
March 3, 2009	Updated image, corrected example circuit pin numbers
March 5, 2009	Updated applications, added cross-reference for KC-5290, added block diagram
March 23, 2009	Updated kcSerial commands, example schematic, hardware interfaces
April 3, 2009	Updated example schematics, corrected MOSI, MISO pin labels
June 17, 2009	Updated example schematics, and formatting
August 3, 2009	Updated profiles
January 21, 2010	Updated dimensions, example schematics, firmware description, application notes
February 9, 2010	Update formatting
March 17, 2010	3-wire serial interface correction, rename analog IO pins, update illustrations
July 27, 2010	Updated PIO assignments, added kcSerial v3.0 information and commands
Jun 24, 2011	Updated operating voltages

Ordering Information

Product Series	KC-21
Product Version	6.3
Country of Manufacture	USA
Order Part Number	**Description**
KC-21.6	Class 2 Bluetooth Data Module w/ kcSerial v3.0 Standard Firmware
KC-21.6-FW	Class 2 Bluetooth Data Module, w/ Custom Firmware

Contact Information

KC Wirefree
2640 W Medtronic Way
Tempe, Arizona 85281

(602) 386-2640 Phone

www.kcwirefree.com Website
info@kcwirefree.com Sales Support
tech@kcwirefree.com Technical Support