T-Board Wireless

Suitable for various XBee, Bluetooth and Wi-Fi wireless modules

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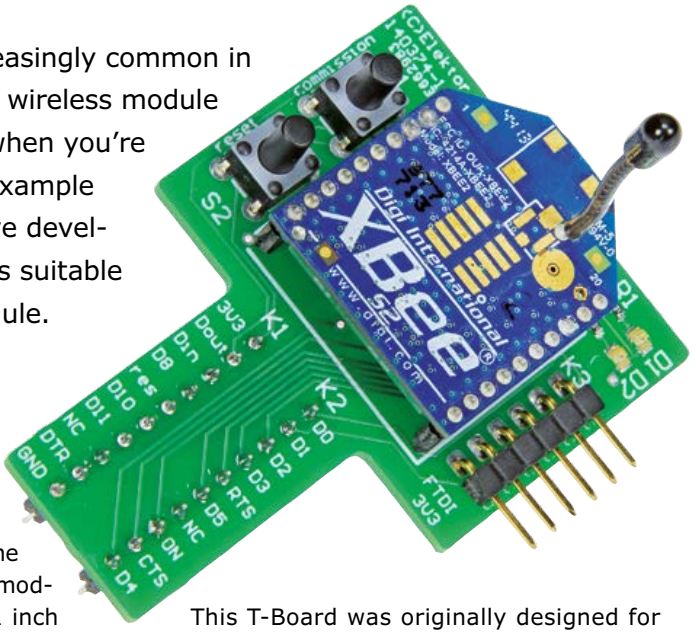
Wireless links are becoming increasingly common in microcontroller circuits. Adding a wireless module to a project can come in handy when you're working on a circuit design, for example on a breadboard. For this we have developed a convenient T-Board that is suitable for various types of wireless module.



This board, the latest member of our T-Board family, is designed to simplify the connection of several popular wireless modules to standard breadboards with 0.1 inch (2.54 mm) hole pitch or other types of breadboard. The 20 pins of the module (with the somewhat unusual spacing of 2 mm) are connected to two 10-pin headers with a standard pitch of 100 mil (2.54 mm), which are positioned 300 mil (7.62 mm) apart.
The T-Board is shaped so that the narrow part of the T, which connects to the breadboard, leaves as much room as possible for other components and wiring on the breadboard. The broad part of the T, which holds the wireless module, extends to the side and therefore does not take up any space on the breadboard.

Figure 1.
Several wireless modules from Digi, Ciseco and Microchip. All of them fit T-Board Wireless.

This T-Board was originally designed for an XBee module from Digi International, which was needed for an Elektor project. The pin designations on the schematic and the PCB relate to that module. However, the footprint of the XBee module (also known as the XBee form factor) is the same as that of several other Wi-Fi and Bluetooth modules, such as the RN-171-XV or RN41x and RN42x modules from Microchip and the XRF modules from Ciseco [1].
The pinouts of the XBee module from Digi, a Bluetooth module and a Wi-Fi module from Microchip, and the XRF module from Ciseco (ISM band) are listed side by side in **Table 1**. From this you can see that all of these modules can easily be connected to the T-Board without any modifications. All important pins, including the supply voltage, UART and reset pins, of the Microchip and Ciseco modules are exactly the same as those of the Digi modules.

If you want to use another type of module, you should first check whether the T-Board is suitable for the module you have in mind, particularly with regard to the supply voltage and ground pins, because there are quite a few different pinouts in use.

The circuit

There aren't very many components other than the wireless module on the T-Board PCB (see the schematic diagram in **Figure 2**). The MOD1, K1 and K2 connectors are necessary due to the non-standard pin pitch of the wireless modules. Other components on the board include a connector for a USB/TTL interface cable with 3.3-V signal levels (K3), a 3.3 V voltage regulator (IC1 with decoupling capacitors C1 and C2), two pushbuttons (S1 and S2) and LEDs for special functions (D1 and D2).

As you can see from the schematic diagram, the two pins of the XBee module marked 'NC' (not connected) are routed to the connectors for plugging the T-Board into a breadboard. That's because some modules from other manufacturers do have functions assigned to these pins. The two pushbuttons S1 and S2 (labeled "Reset" and "Commissioning") are not necessary in normal use. The Reset button is sometimes necessary for downloading firmware to the flash memory, and when you are developing new applications you will most likely run into situations where this button comes in handy. The Commissioning button is used with the XBee module for network diagnosis and configuration. That's also not an everyday activity, but it's always nice to have available. For more information about this, see the Digi International application notes and data sheets [2].

LED D1 (RSSI) can be used as a signal strength indicator for the most recently received data packet. This option is enabled by default in the Digi modules, and it can be switched on or off using the XCTU software. LED D2, which is called "Associate LED" in the Digi documentation, provides network status and diagnostic information in combination with the Commissioning button. With the Ciseco XRF module, D1 blinks once per second when the module is working properly and D2 lights up when a data packet is sent.

Figure 3 shows the circuit board layout of T-Board Wireless. The voltage regulator, capacitors, resistors and LEDs are all SMDs. The chosen package size is large enough to make hand soldering reasonably easy. T-Board Wireless is also available fully assembled from the Elektor Store (order number 140374-91). If all the components except the wireless module are omitted

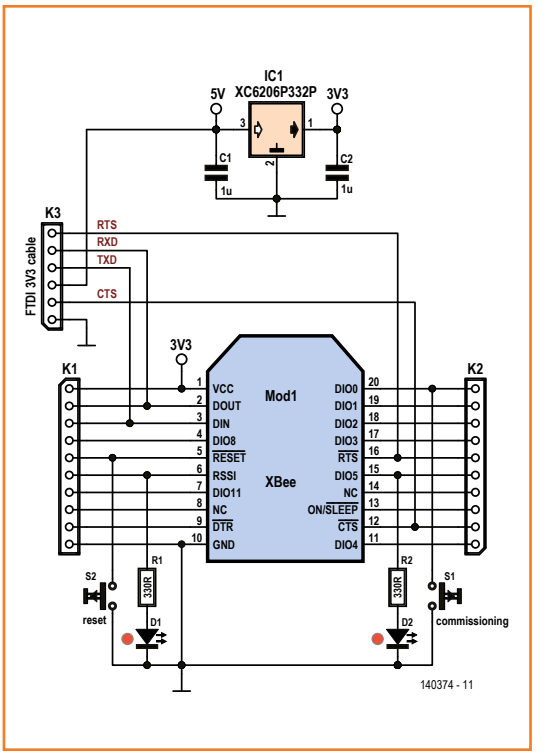


Figure 2.
The circuit consists of a wireless module, a voltage regulator and a few passive components.

Table 1. Pinouts of several wireless modules.

Pin no.	Digi XBee XBee	Ciseco XRF ISM (868 MHz)	RN171XV WiFi	RN42XV Bluetooth
1	3.3 V	3.3 V	3.3 V	3.3 V
2	Dout	Dout	Dout	Dout
3	Din	Din	Din	Din
4	DIO8	RTS	GPIO8	GPIO7
5	#reset	#reset	#reset	#reset
6	RSSI	P1_7	GPIO5	GPIO6
7	DIO11	P1_6	GPIO7	GPIO9
8	NC	P1_5	GPIO9	GPIO4
9	DTR	P1_4	GPIO1	GPIO11
10	GND	GND	GND	GND
11	DIO4	P0_1	GPIO14	GPIO8
12	CTS	CTS	RTS	RTS
13	on/#sleep	on/#sleep	GPIO4	GPIO2
14	NC	NC	NC	NC
15	DIO5	P0_7	GPIO6	GPIO5
16	RTS	P2_0	CTS	CTS
17	DIO3	P2_1	Sensor5	GPIO3
18	DIO2	P2_2	GPIO3	GPIO7
19	DIO1	P2_3	Sensor3	AIO0
20	DIO0	P0_5	Sensor2	AIO1

(pushbuttons, LEDs and voltage regulator), the board can also be used as an adapter for connection to a breadboard.

The right voltage

This T-Board has a 6-pin header for connecting a 3.3 V USB/TTL interface cable (note the voltage level), available from the Elektor Shop under order number 080213-72. This cable allows the UART lines to be connected to a PC for communication with and/or configuration of the XBee module or another wireless module. In that case the T-Board is powered directly from the interface cable. As you probably know, the supply voltage on the V_{DD} pin of the 3.3 V version of the interface cable is 5 V, which makes a voltage regulator necessary for powering the wireless module.

There are very many types and versions of XBee and other wireless modules available, and the Internet is rife with discussions about whether or not the inputs and outputs of a particular type can handle 5 V signal levels. Although there are or have been versions available that can tolerate 5 V, the best advice is simply that 3.3 V is always safe and okay, but if you want to connect 5 V logic to the inputs and/or outputs despite what the specs may say, you do so at your own risk. This means that you should **never** connect a 5 V USB/TTL interface cable to K3, and for the other pins you should provide suitable 3.3 V / 5 V level shifters whenever you use a module together with 5-V logic.

Other possibilities

T-Board Wireless can also be used to configure XBee modules or update their firmware. In that case you will need the 3.3 V interface cable for the link to the PC where you use the XTCU configuration and programming software from Digi to configure the module settings for the intended application. Incidentally, many settings can also be adjusted using AT commands from a terminal emulator program, but XCTU is easier to use for XBee modules.

Many applications with these wireless modules only use the UART function to send and receive serial data over the wireless link. In that case you can simply connect the module to a PC or microcontroller via connector K3 and leave the remaining digital I/O pins and A/D pins unused. If you need to keep the board as small as possible, you can also cut or saw off the part of the board where K1 and K2 are mounted.

(140374-I)

Web Links

[1] www.elektor.com/xrf-wireless-module-140403-91

[2] www.digi.com/products/wireless-wired-embedded-solutions/zigbee-rf-modules/

[3] www.elektor-magazine.com/140374

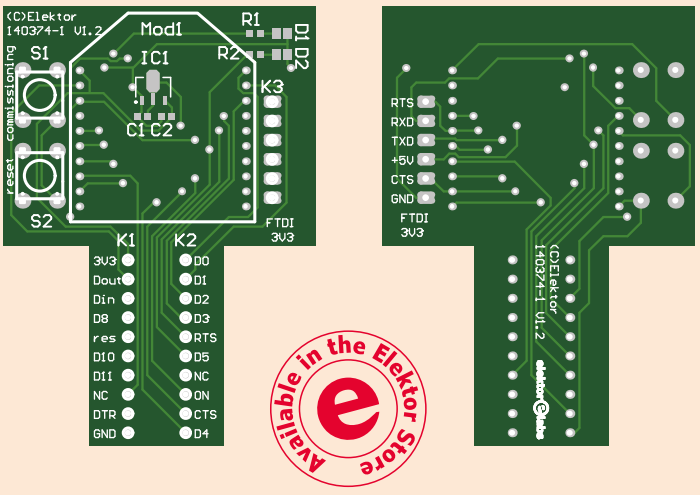


Figure 3.
PCB layout of T-Board Wireless. Fully assembled boards are also available from the Elektor Store.

Component List

Resistors
R1,R2 = 330Ω 5% 0.1W, SMD 0603

Capacitors
C1,C2 = 1µF 10V 10%, SMD 0603

Semiconductors
D1,D2 = LED, red, 20 mA, SMD 0805
IC1 = XC6206P332PR, 3.3V voltage regulator, SMD SOT-89-3

Miscellaneous
K1,K2 = 10-pin pinheader, 0.1” pitch
K3 = 6-pin pinheader, 0.1” pitch
Mod1 = 2 pcs 10-pin pinheader socket, 2mm pitch
S1,S2 = pushbutton, PCB mount, 6 x 6 mm
Wireless module, e.g. Ciseco XRF [1] or Dig XBee ZB-module
PCB # 140374-1 or
Ready assembled board excluding wireless module: Elektor Store no. 140374-91