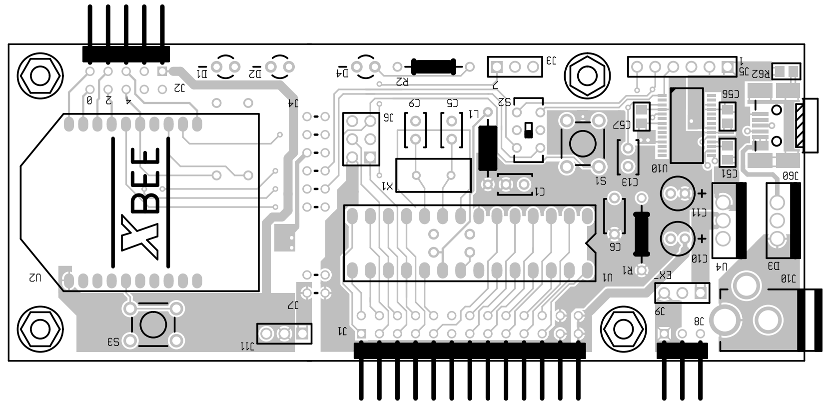
ZB1 Description

The ZB1 is a microcontroller development system that is compatible with the Arduino software environment. For system development a variety of peripheral modules are available.



Features

- Compatible with the Arduino development tools.
- ATmega168 running at 12MHz with a V_{cc} of 3.3V.
- Socket for XBee Radio.
- 4.4” x 1.75” (uC + XBee). 2.7” x 1.75” if the board is cut to remove the XBee radio. Each half of a cut board can be functional.
- I/O connections are wired to a single 26 pin header. Application boards can be mounted parallel using vertical connectors, co-planar using right-angle connectors or remotely using a flexible cable.
- The board can be built with either a USB interface FTDI FT232RL or with a six pin header for use with an FTDI TTL-232R-3V3 cable. The USB interface circuitry includes transient suppression and current limiting resistors.
- ICSP port (3.3V levels)
- A/D reference supply filtered per Atmel specification.
- Reset circuit per Atmel specification.
- Power supply is jumpered between either an LDO or an external 3.3V supply. The LDO input is diode or’ed from a wall adapter or the USB 5V supply.
- Accessories include an LCD board and 2AA power supply.

1 Assembling the ZB1

Semiconductors are electrostatic-sensitive devices. Proper ESD handling precautions need to be taken to avoid damage.

The Bill of Materials (BOM) and Component List is in section 9. For full page assembly drawings see Figure 1 (top) and Figure 2 (bottom).

Extra care needs to be taken when soldering the right-angle connectors (J8, J1, J2). The outer edge of the connector bodies should not protrude over the edge of the board. After soldering, the connector pins should be parallel to the board.

A DC source with current limiting is useful for testing each section of the ZB1 as you build it.

If you are not building the USB circuit proceed to subsection 1.2.

1.1 USB Circuit Assembly

Solder the top side components:

- U10 - FT232RL
- C57, C56, C51
- R62
- J60

Solder the bottom side components:

- U55
- R52, R53 [1]
- R59
- R58

At this point clean the flux off of the top and bottom side of the board. After the board is cleaned visually inspect the board for solder shorts, opens and cold solder joints. If possible power up U10 with a current limited +3.3V supply by attaching clip leads to the pads of the LDO (U4). +3.3V connected to U4-2 and GND connects to U1-1. The current drawn from the +3.3V supply should not exceed a few milliamperes. If it does then check for solder bridges on U10 and U55.

[1] R52 and R53 are only present on Rev 1 boards. Use 0Ω resistors for these two positions.

1.2 Bottom Side Components

- F1
- C4
- C12
- C2, C3
- R3, R5

  The tolerance of R3 and R5 is not critical. Some kits include 5% resistors others include 1% resistors. The 5% resistor has four color bands (red, red, brown, gold). The 1% resistor has five color bands (red, red, brown, black, brown).

NB: *Optional components U3 and C7 are used to provide a 3.3V supply for the XBee using the +5V from J4. See the datasheet for more information*

1.3 Power Supply Circuit Assembly

Solder the top side components:

- C10, C11

  C10 and C11 are polarized parts. The long lead is the positive. The short lead is the negative. Make sure that the **positive** *lead is inserted into positive hole in the PCB*

- U4

  Be careful to not mixup U4 and D3. U4 is marked `MC33269T-3.3G` *Make sure that the tab is aligned to the tab marking on the PCB.*

- D3

  Be careful to not mixup D3 and U4. D3 is marked `MBR1545CTG` *Make sure that the tab is aligned to the tab marking on the PCB.*

- J9
- J10
- J8

  J8 enables the usage of an external 3.3V power source with the ZB1. If you do not need this function then you can omit the installation of J9.

At this point clean the flux off of the top and bottom side of the board. After the board is cleaned visually inspect the board for solder shorts, opens and cold solder joints.

1.3.1 Testing the Power Suppy Circuit

If possible apply power through J10 with a current limited +5V supply. The current drawn from the +5V supply should not exceed a few milliamperes. If it does then verify the orientation on C10, C11, D3, U4.

1.4 Microcontroller Circuit Assembly

Solder the top side components:

- R1

  The tolerance of R1 is not critical. Some kits include a 5% resistor others include a 1% resistor. The 5% resistor has four color bands (brown, black, orange, gold). The 1% resistor has five color bands (brown, black, black, red, brown)

- C6, C13, C1

- L1

  *The value of inductor L1 is not critical. Kits will contain an inductor with a value between 10*μH *and 15*μH

- D4

  The negative lead of the LED is the short lead. Align the short lead with the negative marking on the PCB.

- R2

  The tolerance of R2 is not critical. Some kits include a 5% resistor others include a 1% resistor. The 5% resistor has four color bands (red, red, brown, gold). The 1% resistor has five color bands (red, red, brown, black, brown).

- J3

- X1, C5, C9

- U1 (socket)

- J6

- J5

- J1

  The J1 that is included with the ZB1 Kit is a right angle connector. If your application requires parallel board mounting or a cable connection then replace J3 with a vertical header. A 2x13 receptacle can also be used.

At this point clean the flux off of the top and bottom side of the board. After the board is cleaned visually inspect the board for solder shorts, opens and cold solder joints. After inserting an ATmega168 into the U1 socket the microcontroller section of the ZB1 should be fully functional. If possibly apply power through J10 with a current limited +5V supply. The current drawn should not exceed 10mA (20mA if the J3 jumper is installed in the VCC position).

1.5 XBee Circuit Assembly

NB: Optional connector J2 is used to connect to DIO-DIO5 of the XBee.
Solder the bottom side components:

- U3, C7 (optional)

Solder the top side components:

- J4

- J7

- J11

- D2, D1

  The negative lead of the LED is the short lead. Align the short lead with the negative marking on the PCB.

- J2 (optional)

Placing headers rather than jumper wires for J4 and J7 enables the **X**Bee to be quickly disconnected from the ATmega168 and connected to a serial terminal using an FTDI TTL-232R-3V3 cable. Using the 100mil dual-row headers and jumpers, that are supplied in the kit, is recommended.

Revision one boards only The reset jumper is not used. Included in the kit is a 2x2 header for J7. Place J7 such that the reset position is open.

At this point clean the flux off of the top and bottom side of the board. After the board is cleaned visually inspect the board for solder shorts, opens and cold solder joints.

1.6 Electro-mechanical Components

The electro-mechanical components are sensitive to washing. Place all of these last and lightly wash afterwards. If water does get into these components let them dry out before applying power.
Solder the top side components:

- S2

- S1

- S3

1.7 Mounting Hardware

Space has been provided for four #2 hex standoffs and washers.

1.8 Test

Remove the ATmega168 from the antistatic foam and insert it into the U1 socket aligning the notch in the IC package with notch mark indicated on the PCB silkscreen. Be careful to align pins on both sides of the socket prior to pressing the IC into the socket.

The board is now ready to program. To test the programming using the Arduino tools (see section 4).

2 IO Connectors

J1	13x2 header	I/O connections from the ATmega168. See Table 2
J2	5x2 header	I/O connections for the **X**Bee. See Table 3
J4	6x2 jumper	**X**Bee jumpers To connect either (1) the ATmega168 to **X**Bee or (2) **X**Bee to an FTDI TTL-232R-3V3 cable.
J5	6x1 header	USB header for an FTDI TTL-232R-3V3 cable. This is only installed if the USB circuit is not populated.
J6	3x2 header	ICSP header
J7	2x2 jumper	Power and ground the **X**Bee.
J8	3x1 header	External 3.3V regulated voltage input.
J9	3x1 jumper	Jumper to switch between the external 3.3V input and the on board LDO.
J10	2.1mm Power Jack	5V to 15V unregulated DC. The power dissipation in U4 needs to be kept below one watt.
J60	USB Mini-B	

Table 1: ZB1 connectors

2.1 J1 Header

ATmega168 Pins (Arduino Pins)		J1 Pin		ATmega168 Pins (Arduino Pins)	
PB0 (**8**)	14	1	2	PB1 (**9**)	15
PD7/AIN1 (**7**)	13	3	4	PB2 (**10**)	16
PD6/AIN0 (**6**)	12	5	6	PB3/MOSI (**11**)	17
PD5 (**5**)	11	7	8	PB4/MISO (**12**)	18
PD4 (**4**)	6	9	10	PB5/SCK (**13**)	19
GND		11	12	GND	
PD3 (**3**)	5	13	14	PC0/ADC0 (**A0**)	23
PD2 (**2**)	4	15	16	PC1/ADC1 (**A1**)	24
PD1 (**1**)		17	18	PC2/ADC2 (**A2**)	25
PD0 (**0**)		19	20	PC3/ADC3 (**A3**)	26
PC5/ADC5/SCL (**A5**)	28	21	22	PC4/ADC4/SDA (**A4**)	27
+3.3V		23	24	+3.3V	
VBUS		25	26	VBUS	

Table 2: J1 Pinout

2.2 J2 Header

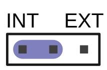
XBee Pin (U2)		J2 Pin		XBee Pin (U2)	
+3.3V		1	2	GND	
NC		3	4	NC	
DIO4	11	5	6	DIO5	15
DIO2	18	7	8	DIO3	17
DIO0	20	9	10	DIO1	19

Table 3: J2 Pinout

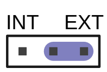
3 Electrical Hints

3.1 Power Supply

The ZB1 can be powered by a wall adapter, the USB port or an external regulated 3.3V supply. The wall adapter and the USB port are diode or'ed and are connected to the input of a LDO regulator (U4). Jumper J9 selects between the two power sources – INT is the LDO regulator (U4), EXT is the power source connected to J8.



Power jumper in the internal position



Power jumper in the external position

It is critcal to keep the power dissipation in the LDO regulator (U4), to less than one watt. The voltage drop across U4 is

$$\mathrm{V_{drop}} = \mathrm{V_{in}} - 0.5V$$

where $\mathrm{V_{in}}$ is the greater of the wall adapter voltage or +5V (USB 5V supply). The power dissipated in U4 is given by

$$\mathrm{P_{diss}} = \mathrm{V_{drop}} \cdot \mathrm{I_{system}}$$

where $\mathrm{I_{system}}$ is the load of the ZB1 plus its peripheral circuity.

3.2 Powering from the USB Port

The intial startup load of a device connected to the USB port must not exceed 10μF in parallel with 44Ω ((USB-IF, 2000a)). The ZB1 powering an **X**Bee does not exceed the specification. However, peripheral circuitry attached to the ZB1 may produce a system load that exceeds the specification.

3.3 $\mathrm{V_{bus}}$

$\mathrm{V_{bus}}$ is the unregulated voltage at the cathode of the or'ing diode (D3). Applications that require current beyond the current rating of the LDO regulator (U4) should use $\mathrm{V_{bus}}$. Since the only volage drop between the input power source and $\mathrm{V_{bus}}$ is the $\mathrm{V_f}$ of the or'ing diode (D3) it is more efficient to use $\mathrm{V_{bus}}$ rather than the +3.3V supply as an input voltage for other power conversions.

3.4 XBee/XBee Pro

RF Exposure To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

The ZB1 can use either an **X**Bee or **X**Bee Pro. Since the startup delay is not implemented for the USB power supply the power consumption of a USB powered ZB1 needs to be kept to a maximum of 100mA. **X**Bee Pro applications should only be powered by the wall adapter or an external regulated supply.

3.4.1 XBee Range

Table 4 sumarizes the results of the MaxStream **X**Bee and **X**Bee Pro transmission performace tests (MaxStream, 2005a). Wireless Link Performance (99% Packet Throughput).

As noted in the MaxStream application note (MaxStream, 2005b):

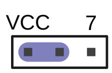
Actual performance depends on many factors in the environment. Consequently, individual results may vary. Factors include: antenna orientation; antenna height, proximity of antenna to other objects such as an enclosure, PCB, or other mounting structures; trees; rain; snow; sleet; hail; bushes; shrubbery; flocks of birds; swarms of bees; moving vans; parked cars, trucks and vans; cars, trucks and vans in motion; intentional or unintentional interferers; etc. Longer distances may be possible with reduced throughput. Obstructions in the propagation path will affect performance. Other wireless networks or systems may affect performance.

Module	**Antenna**	**Distance**		
		Outdoor Line-of-Sight	Indoor Office	Indoor Warehouse
XBee	Chip	470 ft.	80 ft.	-
	Whip	845 ft.	80 ft.	84 ft.
XBee-Pro	Chip	1690 ft.	140 ft.	-
	Whip	4382 ft.	140 ft.	355 ft.

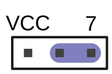
Table 4: Wireless Link Performance (99% Packet Throughput)

3.5 Debug LED

The debug LED, D4, can be connected to the +3.3V supply or to U1 pin 13 (PD7) of the ATmega168. U1 pin 13 corresponds to Arduino pin "7".



LED jumper in the VCC position

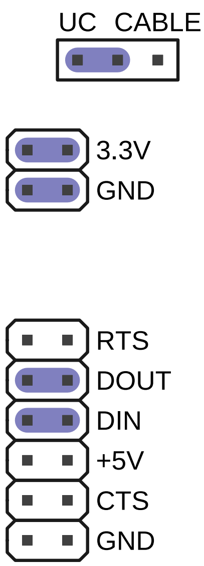


LED jumper in the Pin 7 position

4 Application Hints

4.1 Connecting the uC to the XBee

1. Disconnect the power cable and the USB cable from the ZB1.
2. Insert the J7 ground and +3.3V jumpers.
3. Insert the J4 DIN and DOUT jumpers.
4. Place S2 in the XBee position.



XBee jumpers configured for XBee operation

When powered the **X**Bee **ON** LED should be lit and the **ASSOC** LED should be blinking.

4.2 Connecting an FTDI cable to the XBee

1. Disconnect the power cable and the USB cable from the ZB1.
2. Insert the J7 ground and +3.3V jumpers.
3. Connect the header connector of the FTDI TTL-232R-3V3 cable across the **X**Bee side of jumper J4 aligning pin one of the cable to the GND pin of J4.

When powered the **X**Bee **ON** LED should be lit and the **ASSOC** LED should be blinking.

4.3 Downloading a program to the ZB1

1. Place switch S2 in the USB position.
2. The ZB1 is ready for download. It may be necessary to press the reset button prior to starting the download.

4.4 Downloading a bootloader

The ZB1 is powered from 3.3V. Any device that connects to the ZB1 needs to output 3.3V TTL levels. The Ladyada USBtiny is compatible with the ZB1.

To use the Ladyada USBtiny remove the USBtiny jumper, JP3, and plug the USBtiny cable into the ZB1 ICSP header. With JP3 removed the USBtiny output buffer (IC2) is powered by the V_{cc} from the ZB1 (3.3V). The USBtiny output buffer (IC2) is a 74AHC125 which will tolerate 5V levels when powered from a 3.3V supply.

5 XBee Setup

To enter commands you need to put the **X**Bee into command mode (see subsection 5.1). Commands are in the format

$$\langle \textit{AT command} \rangle \equiv \texttt{AT}\langle \textit{command} \rangle(\texttt{,}\langle \textit{command} \rangle)\star$$
$$\langle \textit{command} \rangle \equiv \langle \textit{name} \rangle(\langle \textit{value} \rangle)?$$

5.1 Command Mode

1. Type the string

   `+++`

   and wait at least one second before typing any additional characters. The response from the **X**Bee should be the string `OK`.[2]

   *You are now in command mode. After ten seconds of inactivity the **X**Bee will drop out of command mode and you will need to type string* `+++` *to return to command mode.*

5.2 Address and ID Setup

1. Get into command mode (see subsection 5.1).
2. Set the 16-bit address using the command

   `ATMY`⟨*address*⟩
3. Set the destination address using the commands

   `ATDL`⟨*low word*⟩

   `ATDH`⟨*high word*⟩
4. Set the Personal Area Network (PAN) ID using the command

   `ATID`⟨*id*⟩
5. Save the configuration parameters using the command

   `ATWR`

[2] If the **X**Bee fails to enter command mode check that the transmit and receive baud rates are set to the same value.

5.3 AT Command Summary

For a list of all the AT commands see the MaxStream Datasheet (MaxStream, 2007a).

Command	Values	Default	Description
MY	0 - 0xFFFF	0	Set/Get the 16 bit source address of the RF module. Setting MY address to 0xFFFF disables 16-bit addressing.
CN			Exit command mode
DL	0 - 0xFFFFFFFF	0	Set/Get the lower 32 bits of the destination address
DH	0 - 0xFFFFFFFF	0	Set/Get the upper 32 bits of the destination address
ID	0 - 0xFFFF	0	Set/Get the PAN (Personal Area Network) ID. Only modules with matching PAN IDs can communicate with each other.
WR	-	-	Write configurable parameters into memory

Table 5: XBee AT Commands

6 Programming the ZB1

Version 0011 of the Arduiono tools work with the ZB1. From the `Tools->Board` menu select

`Arduino NG or older w/ ATmega168`.

To download a program switch S2 must be in the USB position.

The ZB1 uses a 12MHz XTAL. The Arduino tools are setup for boards with a 16MHz XTAL. If you do not change the software to use a 12MHz XTAL value you will need to modify the serial port setup. To get a baudrate of 9600 (default of the **X**Bee) it is necessary to run the command:

```
Serial.begin(12800)
```

This baudrate setting value comes from the following equation:

$$\text{baud rate setting} = \frac{16\text{MHz}}{12\text{MHz}} \cdot 9600$$

7 XBee Examples

7.1 Configuring Two Radios

The two sessions listed below will configure a pair of radios with distinct addresses but the same personal area network ID.

For radio one –

```
+++
ATMY1234\r
ATMY\r
ATDL5678\r
ATDH0\r
ATID1111\r
ATWR\r
```

For radio two —

```
+++
ATMY5678\r
ATMY\r
ATDL1234\r
ATDH0\r
ATID1111\r
ATWR\r
```

8 Minicom

An easy way to setup the **X**Bee is to use an FTDI TTL-232R-3V3 cable and the Minicom terminal emulation program. Minicom is available at http://alioth.debian.org/projects/minicom.

8.1 Creating Default Configurations

Configuration files can be used to save and recall port settings. By default the files are saved in the `/etc` directory with filenames in the format `minirc.`⟨*configuration name*⟩. To create a configuration file to be used to communicate between an **X**Bee and a USB port start Minicom in configuration mode with the command:

```
su -c 'minicom -s'
```

Choose `serial port setup` from the menu and do the following:

1. Change the serial device to `/dev/ttyUSB`⟨*n*⟩ where ⟨*n*⟩ is the USB port number.

2. Change the baud rate to `9600`.

3. Choose `Save setup as ..` and type in the name `usb`⟨*n*⟩ where ⟨*n*⟩ matches the USB port number.

4. Choose `Exit from Minicom`

8.2 Finding the USB Port Number

On linux typing the command `dmesg` will output a list of devices that are connected to the USB serial ports. Both the `ZB1` and the FTDI TTL-232R-3V3 cable show up as `FT232BM` devices in the list. Typing `dmesg` should show lines similar to these:

```
FTDI USB Serial Device converter detected
Detected FT232BM
FTDI USB Serial Device ... attached to ttyUSB⟨n⟩
```

where ⟨*n*⟩ is the number of the USB port.

8.3 Running Minicom

To run Minicom with the configuration file that was just created type `minicom usb`⟨*n*⟩ where ⟨*n*⟩ matches the USB port number chosen in subsection 8.1.

A couple of useful Minicom commands –

C-A Z Help screen

C-A A linefeed on/off

C-A E Local Echo on/off

C-A P COM port parameter setup

C-A Q Quit

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9 Assembly Documentation and Schematics

Table 6: Bill of Materials

Schematic:	zb1_r2__top.sch	Sat Nov 22 20:59:45 2008
BOM:	zb1_r2__top.bom	Mon Dec 8 20:14:00 2008

Qty	Reference	Value	Footprint	Mfg PN	Notes
4	C1, C2, C3, C13	0.1u	CAPR..	Kemet C320C104K5R5TA	
4	C4, C51, C56, C57	0.1u	0805	Kemet C0805C104K5RACTU	
2	C5, C9	20p	CAPR..	Xicon 140-100N2-200J-RC	
1	C6	0.47uF	CAPR..	TDK FK24X7R1E474K	
2	C7, C12	4.7u	1210	Murata GRM32RR71C475KC01L	
2	C10, C11	10uF	CAPPR..	Nichicon UPW1E100MDD	
3	D1, D2, D4		LED..	Kingbright WP7104LGD	
1	D3		TO220-3N	On-Semi MBR1545CTG	
1	F1		1812	Littelfuse 1812L050PR	
1	J1		CON_HDR_RA..	Amp 1-103149-3	
1	J2		CON_HDR_RA..	Amp 103149-5	
3	J3, J9, J11		CON_HDR..	Harwin M20-9990345	
1	J4		JMP..	FCI 77313-101-12LF	
1	J5		CON_HDR..	Harwin M20-9990645	
1	J6		CON_HDR..	FCI 69192-406HLF	
1	J7		JMP..	FCI 67997-404	
1	J8		CON_HDR_RA..	Tyco 5-103765-3	
1	J10		CON..	CUI PJ-202AH	
1	J60		CON_USB_MIN..	Molex 67503-1020	
1	L1	10uH	IND..	Bourns 78F100J-RC	
1	R1	10K	RES..	Yageo MFR-25FBF-10K0	
3	R2, R3, R5	220	RES..	Yageo MFR-25FBF-221R	
1	R58	10K	0805	Yageo 9C08052A1002FKHFT	
1	R59	4.7K	0805	Rohm MCR10EZHF4701	
1	R62	33K	0805	Yageo 9C08052A3302FKHFT	
2	S1, S3		SW..	Panasonic EVQ-PAE04M	
1	S2		SW..	CK JS202011CQN	
1	U1		DIP-28-300	Atmel ATmega168-20PU	
1	U2		MOD..	MaxStream XB24-AxI-001	
1	U3		DPAK..	On-Semi MC33275DT-3.3	
1	U4		TO220-3N	On-Semi MC33269T-3.3G	
1	U10		SSOP..	FTDI FT232RL	
1	U55		SOT23..	TI SN65220DBV	
1	X1	12MHz	XTAL_HC-49US	ECS ECS-120-20-4X	

Table 7: Component List

Schematic:	zb1_r2__top.sch	Sat Nov 22 20:59:45 2008
BOM:	zb1_r2__top.bom	Mon Dec 8 20:14:00 2008

Reference	Value	Footprint	Mfg PN	Notes
C1	0.1u	CAPR..	Kemet C320C104K5R5TA	
C2	0.1u	CAPR..	Kemet C320C104K5R5TA	
C3	0.1u	CAPR..	Kemet C320C104K5R5TA	
C4	0.1u	0805	Kemet C0805C104K5RACTU	
C5	20p	CAPR..	Xicon 140-100N2-200J-RC	
C6	0.47uF	CAPR..	TDK FK24X7R1E474K	
C7	4.7u	1210	Murata GRM32RR71C475KC01L	
C9	20p	CAPR..	Xicon 140-100N2-200J-RC	
C10	10uF	CAPPR..	Nichicon UPW1E100MDD	
C11	10uF	CAPPR..	Nichicon UPW1E100MDD	
C12	4.7u	1210	Murata GRM32RR71C475KC01L	
C13	0.1u	CAPR..	Kemet C320C104K5R5TA	
C51	0.1u	0805	Kemet C0805C104K5RACTU	
C56	0.1u	0805	Kemet C0805C104K5RACTU	
C57	0.1u	0805	Kemet C0805C104K5RACTU	
D1		LED..	Kingbright WP7104LGD	
D2		LED..	Kingbright WP7104LGD	
D3		TO220-3N	On-Semi MBR1545CTG	
D4		LED..	Kingbright WP7104LGD	
F1		1812	Littelfuse 1812L050PR	
J1		CON_HDR_RA..	Amp 1-103149-3	
J2		CON_HDR_RA..	Amp 103149-5	
J3		CON_HDR..	Harwin M20-9990345	
J4		JMP..	FCI 77313-101-12LF	
J5		CON_HDR..	Harwin M20-9990645	
J6		CON_HDR..	FCI 69192-406HLF	
J7		JMP..	FCI 67997-404	
J8		CON_HDR_RA..	Tyco 5-103765-3	
J9		CON_HDR..	Harwin M20-9990345	
J10		CON..	CUI PJ-202AH	
J11		CON_HDR..	Harwin M20-9990345	
J60		CON_USB_MIN..	Molex 67503-1020	
L1	10uH	IND..	Bourns 78F100J-RC	
R1	10K	RES..	Yageo MFR-25FBF-10K0	
R2	220	RES..	Yageo MFR-25FBF-221R	
R3	220	RES..	Yageo MFR-25FBF-221R	
R5	220	RES..	Yageo MFR-25FBF-221R	
R58	10K	0805	Yageo 9C08052A1002FKHFT	
R59	4.7K	0805	Rohm MCR10EZHF4701	
R62	33K	0805	Yageo 9C08052A3302FKHFT	
S1		SW..	Panasonic EVQ-PAE04M	
S2		SW..	CK JS202011CQN	
S3		SW..	Panasonic EVQ-PAE04M	
U1		DIP-28-300	Atmel ATmega168-20PU	

Reference	Value	Footprint	Mfg PN	Notes
U2		MOD..	MaxStream XB24-AxI-001	
U3		DPAK..	On-Semi MC33275DT-3.3	
U4		TO220-3N	On-Semi MC33269T-3.3G	
U10		SSOP..	FTDI FT232RL	
U55		SOT23..	TI SN65220DBV	
X1	12MHz	XTAL_HC-49US	ECS ECS-120-20-4X	

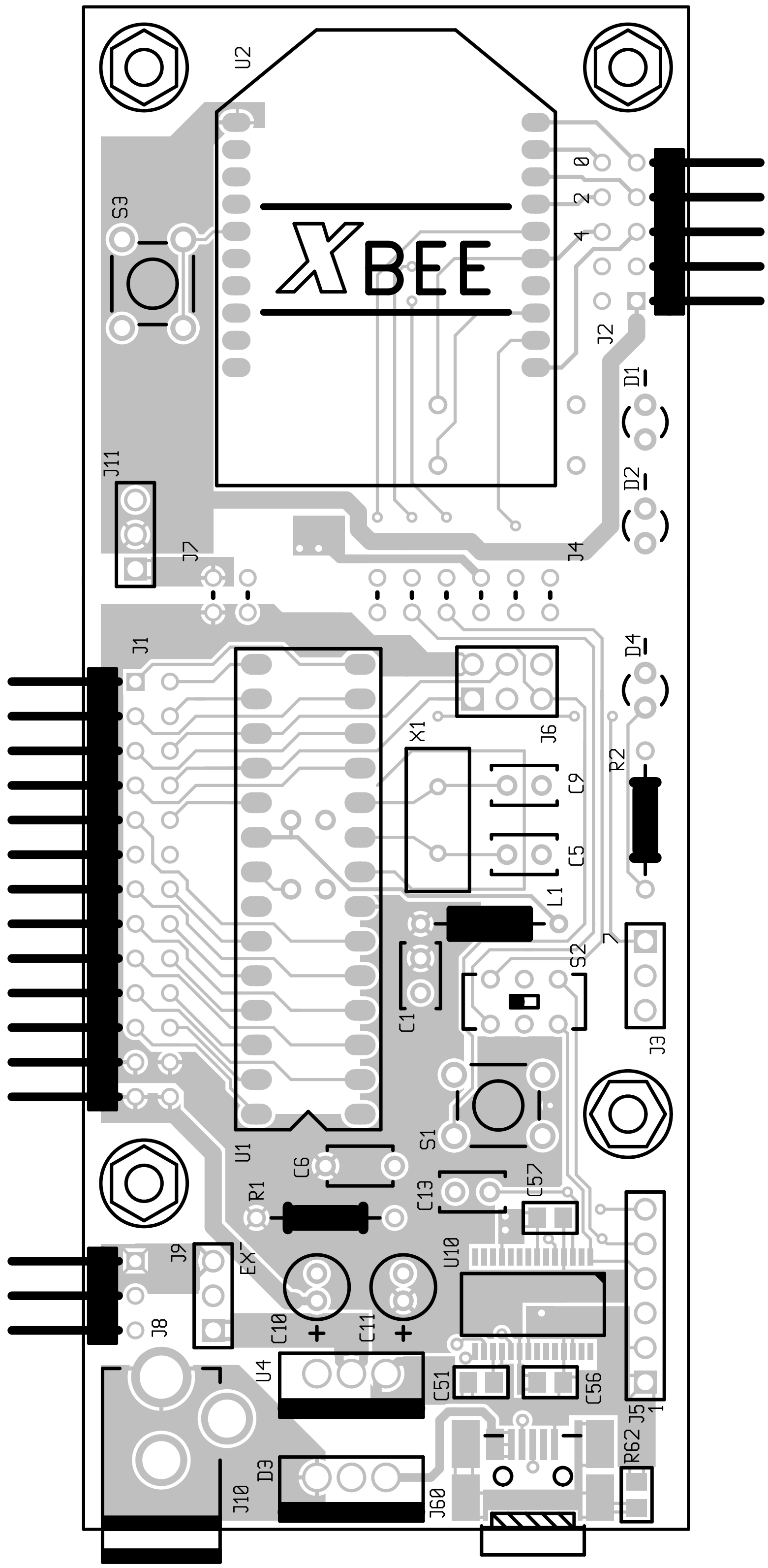

Figure 1: ZB1 Top Assembly Drawing

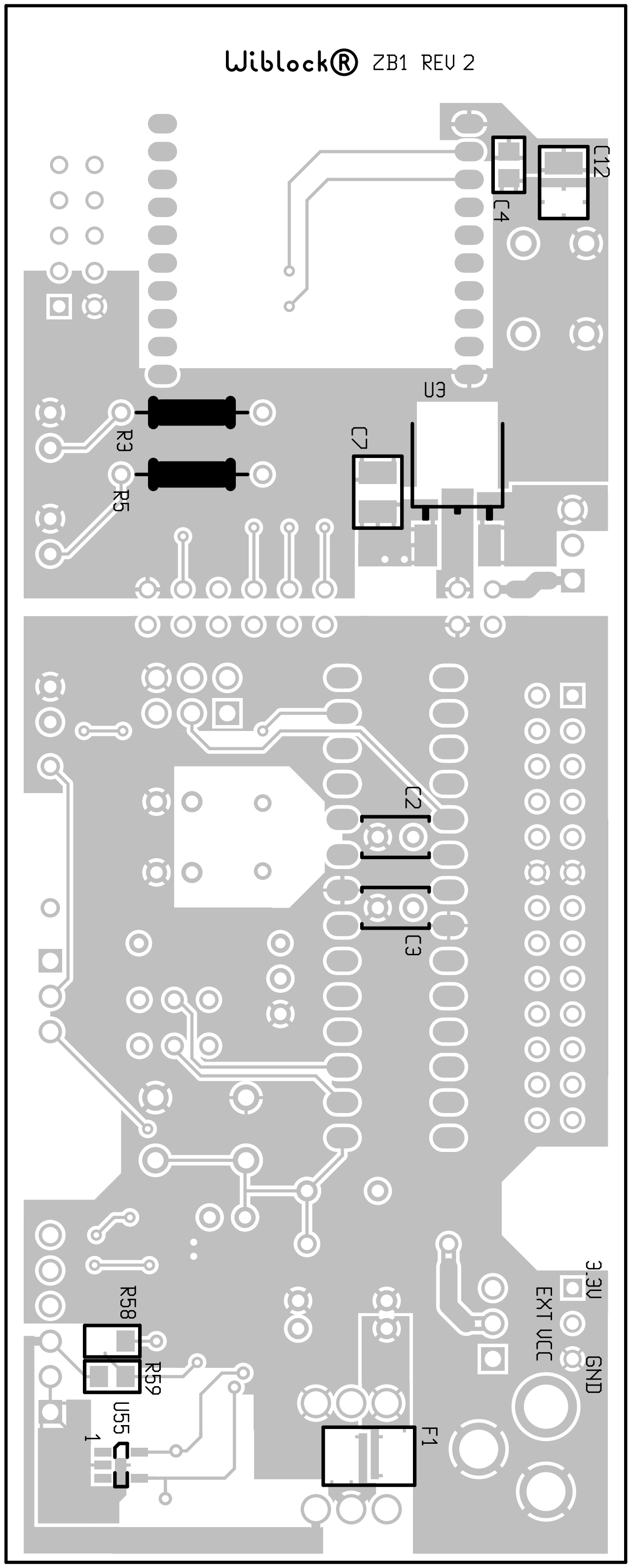

Figure 2: ZB1 Bottom Assembly Drawing

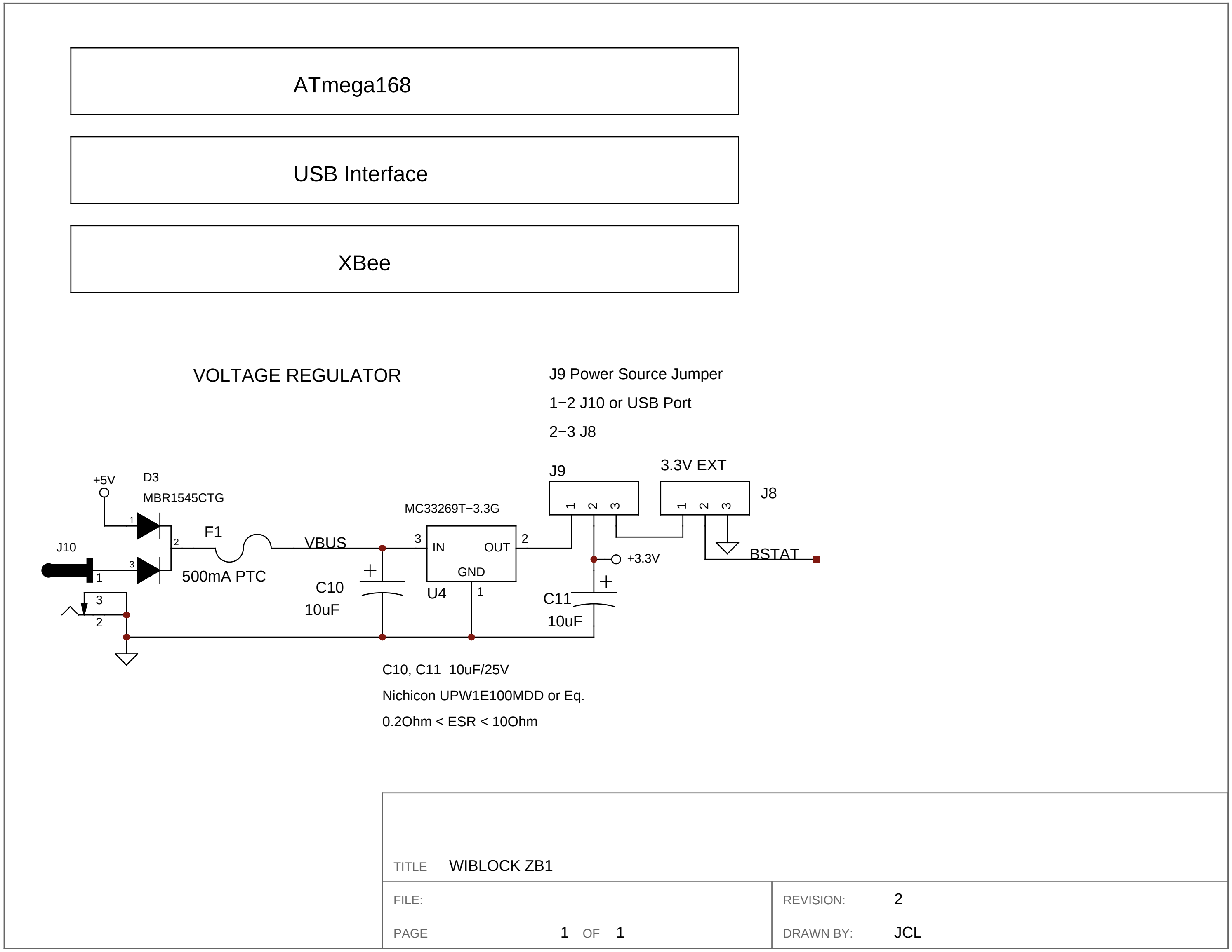

Figure 3: ZB1 Top Level Schematic

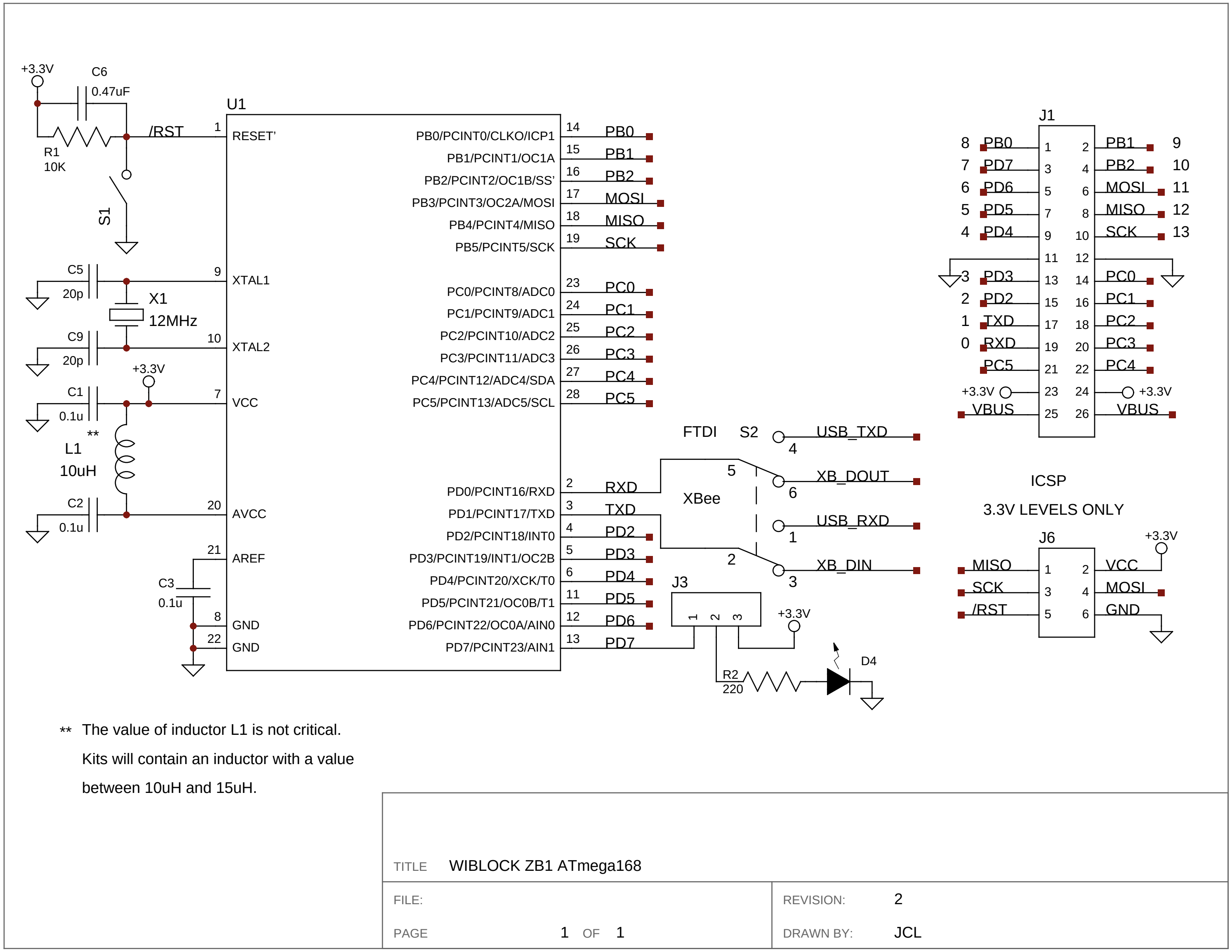

Figure 4: ZB1 ATmega168 Circuit

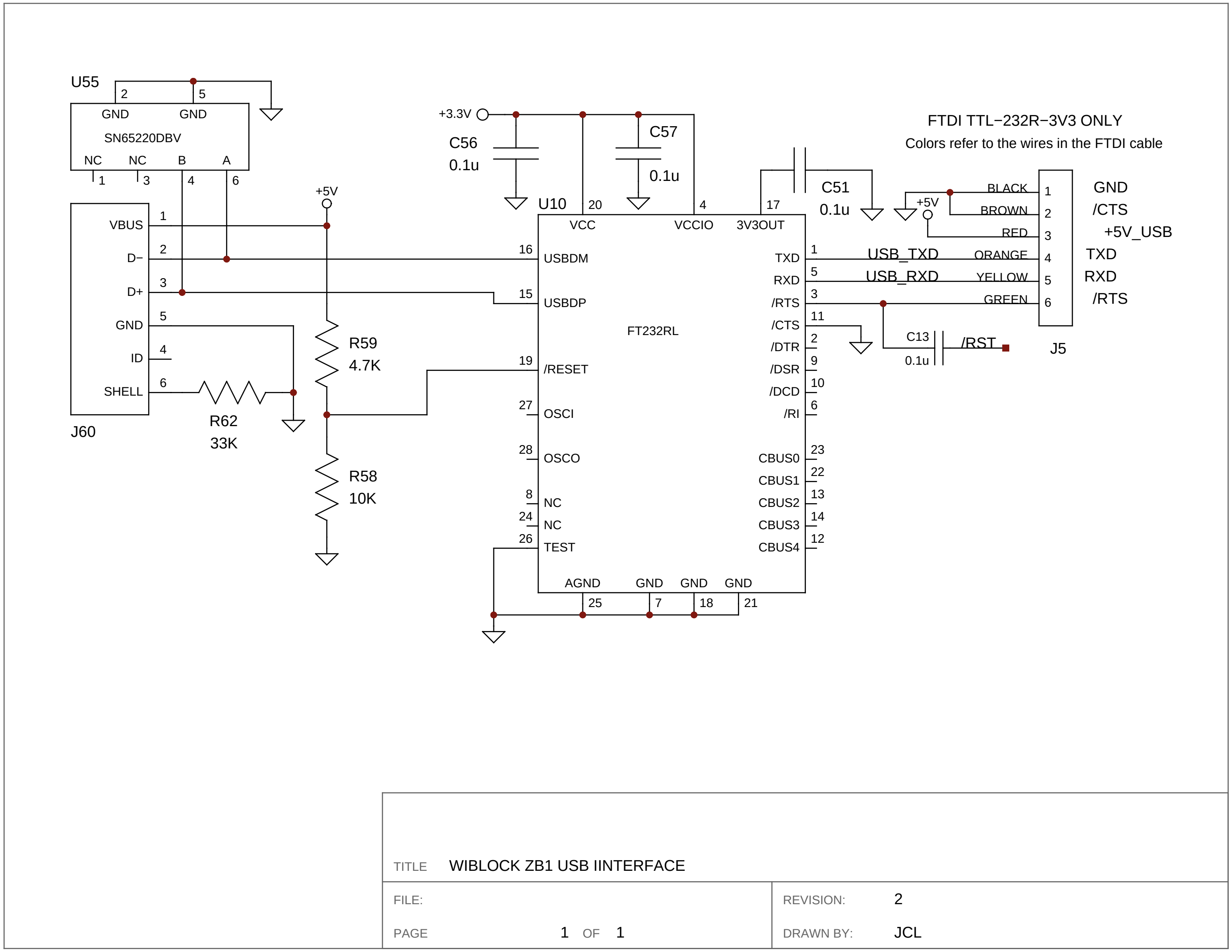

Figure 5: ZB1 USB Interface

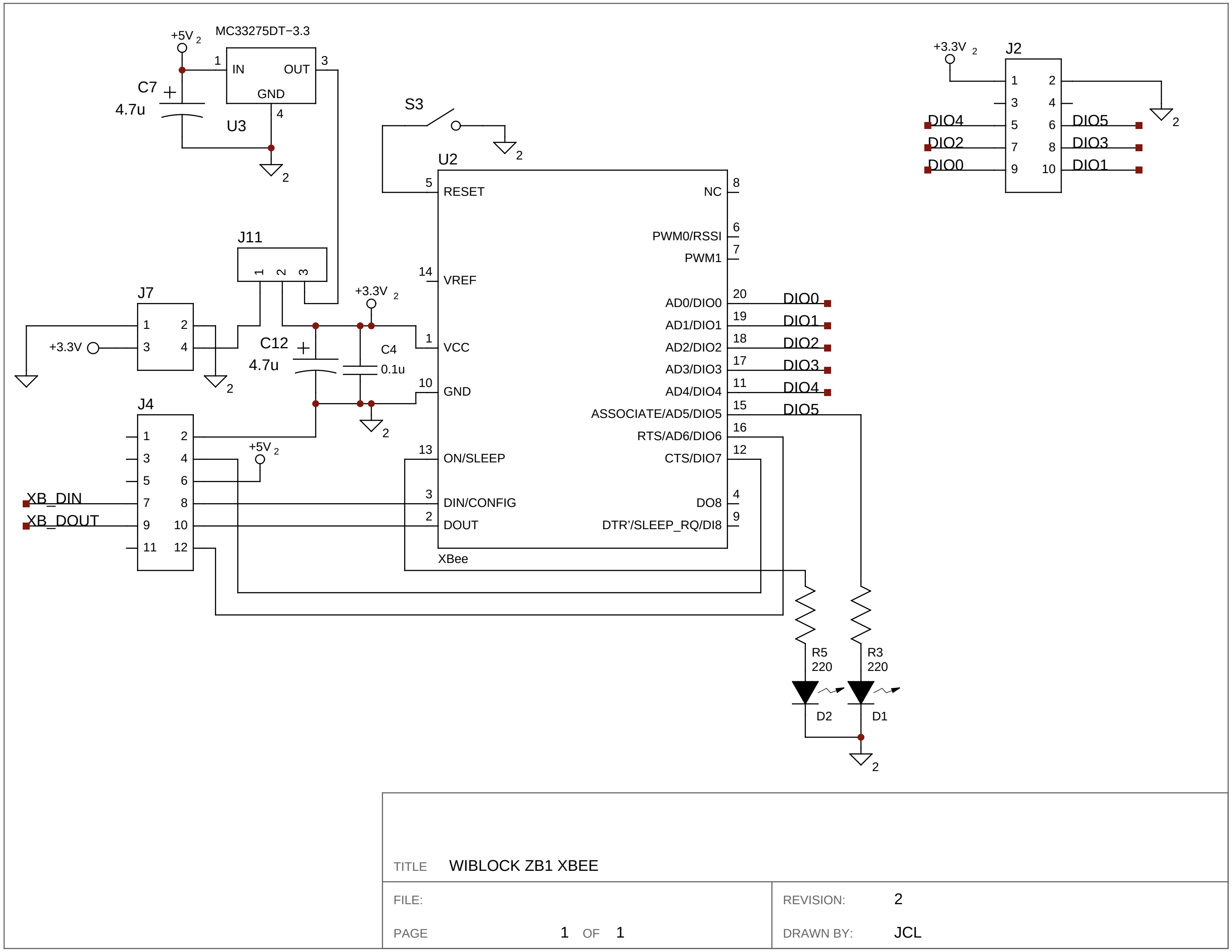

Figure 6: ZB1 XBee Interface