



# *SBC65EC*

Ethernet enabled Single Board Computer

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# 1 Introduction

The following documentation is for the SBC65EC Revision 201, which is marked on the PCB as SBC65EC REV2! It has a label on the 100 pin network chip with the hardware version number, and should be "HW: V2.01".

The SBC65EC is a single board computer with 10Mbps Ethernet and RS232 interface. It can be added to any 10/100Mbps Ethernet network. It is assembled with a PIC18F6621 CPU. It is supplied with the Modtronix Free TCP/IP stack (a modified version of the free Microchip TCP/IP stack) written in C, that can be compiled with the Hi Tech or Microchip PIC18 C compilers. The TCP/IP stack is available for free from our product page, see [www.modtronix.com/products/sbc65ec](http://www.modtronix.com/products/sbc65ec). Typical applications include HTTP Web servers, Mail clients, Ethernet to RS232 interface converter, Ethernet to RS485 interface converters, Remote control via Web Server, Protocol Bridge applications - Ethernet to USART, CAN, I2C, SPI etc.



Figure 1

## 2 Features

- Is part of our MicroX product range, meaning you can upgrade or expand it with any of the other MixroX products. For details see [www.modtronix.com/microx](http://www.modtronix.com/microx).
- Has 32 general purpose user programmable I/O, of which 12 can be configured as 10 bit Analog Inputs.
- Can be used as a daughter board to Ethernet enable any product.
- Diode protected 2.1mm power connector for standard DC transformer. Center is positive.
- 64KBytes FLASH, 3840 Bytes SRAM and pluggable EEPROM. Default TCP/IP stack uses less than half the available memory, which leaved heaps of code space for custom code.
- Has space for a 8 pin Ramtron SPI FRAM chip (32Kbyte FM25256 chip for example) to be assembled on the bottom of the board.
- Wide operating voltage range from 7 – 35V.
- Default operating frequency of 40MHz, software configurable low power mode that runs at 10MHz.
- Red 3mm User programmable LED.
- RJ45 connector with two built in LEDs. Green LED is for link indication, yellow LED is for activity.
- Assembled with 10BaseT Ethernet and RS232 interface with +- 15kV ESD protection.
- RS232 interface via 3 pin Molex type connector or Daughter Board connector.
- Has a 40 pin Daughter Board connector. For details see [www.modtronix.com/microx/expansion](http://www.modtronix.com/microx/expansion)
- Assembled with brand name, quality components. For example, electrolytic capacitor used is extra long life rated, which is 5 times more than standard!
- Has an ICSP (In Circuit Serial Programming) connector (ICPC1 type) - CPU can be programmed and debugged in circuit. For details see <http://www.modtronix.com/picboards/prog>.
- Is designed to run with the freely available Modtronix TCP/IP stack that features:
  - Includes MAC, IP, ARP, ICMP, TCP, UDP, HTTP, FTP, DHCP, IP Gleaning, MPFS
  - Socket support for TCP and UDP
  - Portable across PIC18 MCUs
  - Out-of-box support for Microchip C18 and Hi-Tech PICC-18 compilers
  - RTOS independent
  - Full TCP state machine
  - Modular Design

### 3 Daughter Board Connectors

The SBC65EC has two 2x10 pin, 2.54mm female connectors. They contains all free CPU port pins, power, I2C, SPI, RS232 signal,..... For the location of the Daughter Board connectors, see the *Dimensions* chapter of this document. The Daughter Boards connectors pins are mapped to the following signals:

<i>CON2 Daughter Board Connector</i>			<i>CON1 Daughter Board Connector</i>		
<i>Name</i>	<i>Pin</i>	<i>Signal</i>	<i>Name</i>	<i>Pin</i>	<i>Signal</i>
TOP0	2	PIC pin RF0	TOP4	2	PIC pin RF4
TOP1	1	PIC pin RF1	TOP5	1	PIC pin RF5
TOP2	4	PIC pin RF2	TOP6	4	PIC pin RF6
TOP3	3	PIC pin RF3	TOP7	3	PIC pin RF7
SIG0	6	USART receive signal - RS232 or TTL signal level. <sup>(3)</sup>	GND	5	Ground
SIG1	5	USART transmit signal - RS232 or TTL signal levels. <sup>(3)</sup>	+5V	7	Regulated 0.5A 5V supply
B0	13	PIC pin RB0	VIN	8	Unregulated input voltage
B1	14	PIC pin RB1	CLR#	6	PIC pin /MCLR
B2	11	PIC pin RB2	A0	10	PIC pin RA0
B3	12	PIC pin RB3	A1	9	PIC pin RA1
B4	9	PIC pin RB4	A2	12	PIC pin RA2
B5	10	PIC pin RB5	A3	11	PIC pin RA3
B6	7	PIC pin RB6 – also used for ICP <sup>(1)</sup>	A4	14	PIC pin RA4
B7	8	PIC pin RB7 – also used for ICP <sup>(1)</sup>	A5	13	PIC pin RA5
C4	17	PIC pin RC4 – port pin assigned for I <sup>2</sup> C <sup>(2)</sup>	C0	16	PIC pin RC0
C5	18	PIC pin RC5	C1	15	PIC pin RC1
C6	15	PIC pin RC6	C2	18	PIC pin RC2
C7	16	PIC pin RC7	C3	17	PIC pin RC3 – port pin assigned for I <sup>2</sup> C <sup>(2)</sup>
D6	19	RG2	D0	20	RG0
D7	20	RG3	D1	19	RG1

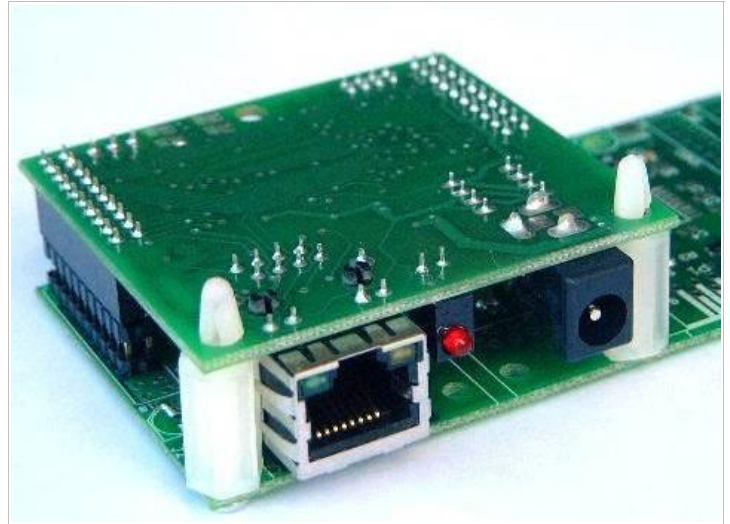
(1) Port Pins B6 and B7 are also used for in circuit programming, if the board is programmed in circuit! If they are used, and the board should still be in circuit programmable, make sure their impedance is greater then a 1000 ohms!

(2) Port Pins C3 and C4 are assigned to be used as I<sup>2</sup>C pins in Daughter and Frontend Boards.

(3) At delivery SIG0 and SIG1 pins are configured for RS232 voltage levels. See RS232 section in documentation for details

### 3.1 As a Daughter Board

The SBC65EC can be used to add Ethernet capabilities to any board by using it as a daughter board. All connectors and PCB standoffs required to do this can be purchased from our web site. The board that is to take the SBC65EC as a daughter board needs to provide two 2x10 pin, 2.54mm pin headers for the SBC65EC to plug into. Additionally, 3 PCB supports can also be provided if additional stability is required. Usually it is adequate providing the connectors on two PCB supports as shown in the picture to the right. The 2x10 pin header connectors available from Modtronix are specially made so that when mated with the connectors on the SBC65EC, the main board and SBC65EC will be 15.9mm apart. This is a standard height for PCB supports.



### 3.2 Expansion boards

The SBC65EC can be used as a full functional Single Board Computer. Its Daughter Board connector can be used as an expansion port to add additional functionality. It contains all free CPU port pins, power, I2C, SPI, RS232 signal,..... For a list of available daughter boards from our site see [www.modtronix.com/products/sbc65ec/#expansion](http://www.modtronix.com/products/sbc65ec/#expansion). The Picture to the right shows the SBC65EC with a PT01TC prototype daughter board plugged onto it.

Additionally, users can download PCB templates for creating their own Daughter Board from our Download page – see [www.modtronix.com/downloads](http://www.modtronix.com/downloads). The *daughter\_compact.brd* PCB fits onto the SBC65EC.



## 4 Interfaces

### 4.1 Ethernet

The SBC65EC has a 10Mbps Ethernet port. The RJ45 connector meets IEEE 802.3 standards and FCC mechanical requirements. The RJ45 connector has two built in LEDs, a green LED for link indication, and a yellow LED for activity.

### 4.2 RS232

The SBC65EC has a USART interface with +- 15kV ESD protection. The USART signals are available via a 3 pin Molex type connector or the Daughter Board connector. Four solder jumpers (SJ1 to SJ4) on the back

of the board are used to configure if the USART signals are RS232 or TTL voltage levels – see circuit diagram at end of document for details.

At delivery solder jumpers SJ3 and SJ4 are made, which configures the USART signals for RS232 voltage levels. By making solder jumpers SJ1 and SJ2, and opening SJ3 and SJ4, the USART pins can be configured for TTL signal levels.

### 4.3 ICSP connector

The SBC65EC has an ICSP (In Circuit Serial Programming) connector (ICPC1 type). This enables the PIC to be programmed and debugged in circuit. For details on programming and debugging in circuit see <http://www.modtronix.com/picboards/prog>.

### 4.4 Analog and Digital I/O pins

The SBC65EC has 32 I/O pins available for general purpose user I/O. Each of these pins can be configured separately to be inputs or outputs. Digital inputs and outputs are 0 to 5V. Inputs are 3V tolerant, and outputs can be made 3V tolerant by adding a series resistor (assuming 3V input will have clamping diodes).

The SBC65EC can be configured to have between 1 to 12 analog inputs. Each channel has a 10 bit resolution. Consult the PIC18F6621 data sheet (available from [www.microchip.com](http://www.microchip.com)) for further details.

## 5 Configuration

The SBC65EC board can be configured via solder jumpers SJ1 to SJ5.

SJ1 to SJ4 are used to select RS232 or TTL signals for the USART – see section on RS232 above for details.

SJ5 is currently not used.

## 6 External Memory

### 6.1 EEPROM

The SBC65EC board has a 8 pin IC socket for mounting a serial EEPROM, like the 24LC256 (32Kbytes) or 24LC512 (64 Kbytes) chips.

Depending on the SBC65EC variant, a EEPROM might be fitted. The standard SBC65EC board is fitted with a 24LC256 EEPROM and the PIC programmed with the Modtronix TCP/IP stack (modified Microchip TCP/IP stack) that uses the external EEPROM for storing configuration data and web pages. The 24LC256 has 32Kbytes of non volatile memory, which is large enough for several web pages, including some small pictures. If this is not large enough, a larger 24LC512 chip can be fitted that can hold twice as much data.

### 6.2 FRAM

There is space on the bottom of the board for mounting a RAMTRON FRAM chip. FRAM offers features consistent with a RAM technology, but is nonvolatile like a ROM technology. FRAM bridges the gap between the two categories and creates something completely new -- a nonvolatile RAM. For further details see [www.ramtron.com](http://www.ramtron.com). Currently the following chips can be used:

- **FM25256** – SPI Interface, 4.0V to 5.5V, 32KBytes, 15MHz, 7mA, Unlimited Read/Write Cycles, 10 Year data retention, SPI Mode 0 & 3
- **FM25640** – SPI Interface, 4.0V to 5.5V, 8KBytes, 5MHz, 3mA, 1 Trillion Read/Writes Cycles, 45 Year data retention, SPI Mode 0 & 3

- Older, smaller memory version of the the SPI FRAM chip can also be used.

See the circuit diagram for details on what PIC port pins are connected to the FRAM chip. Notice that the PIC data lines used are used for the SPI2 bus on new PIC chips like the PIC18F6627 for example. Future versions of the SBC65EC will use this chip!

## 7 Specifications

### 7.1 Absolute Maximum Ratings

<i>Item</i>	<i>Symbol</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Operating Temperature:	Top	0		70	°C
Storage Temperature:	Tst	-65		140	°C

### 7.2 Electrical Characteristics

<i>Item</i>	<i>Symbol</i>	<i>Condition</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
DC Supply Voltage:	Vdd	-	7		35	V
Typical Operating Current at 40MHz	Idd	Vdd = 12V	55	58	65	mA
Typical Operating Current at 10MHz	Idd	Vdd = 12V	32	35	39	mA
RJ45 Ethernet connector DCR RX/TX		T=25°C		0.35		Ω
RJ45 Ethernet connector inductance		T=25°C		0.3		uH
RJ45 Ethernet connector capacitance		T=25°C		12		pF
RJ45 Ethernet connector Hi-Pot test		T=25°C		1500		Vrms

The RJ45 connector (Ethernet connector) meets IEEE 802.3 standards and FCC mechanical requirements.

### 7.3 D.C. Characteristics of user I/O pins on Daughter Board connector.

<i>Item</i>	<i>Symbol</i>	<i>Condition</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Input Low Voltage - configured as TTL input:	V <sub>IL</sub>		0		0.75	V
Input Low Voltage - configured as Schmitt Trigger input:	V <sub>IL</sub>		0		1	V
Input High Voltage - configured as TTL input:	V <sub>IH</sub>		2.05		5	V
Input High Voltage - configured as Schmitt Trigger input:	V <sub>IH</sub>		4		5	V
Output High Voltage:	V <sub>OL</sub>	I <sub>OL</sub> = 8.5mA			0.6	V
Output Low Voltage:	V <sub>OH</sub>	I <sub>OH</sub> = 3mA	4.3			V
Capacitive loading:	C <sub>IO</sub>			50		pF

Many inputs on the PIC18F6621 are Schmitt Trigger inputs, consult the data sheet for details.

## 8 Dimensions

The SBC65EC conforms to the MicroX Compact Main Board Dimensions, as shown in Figure 2.

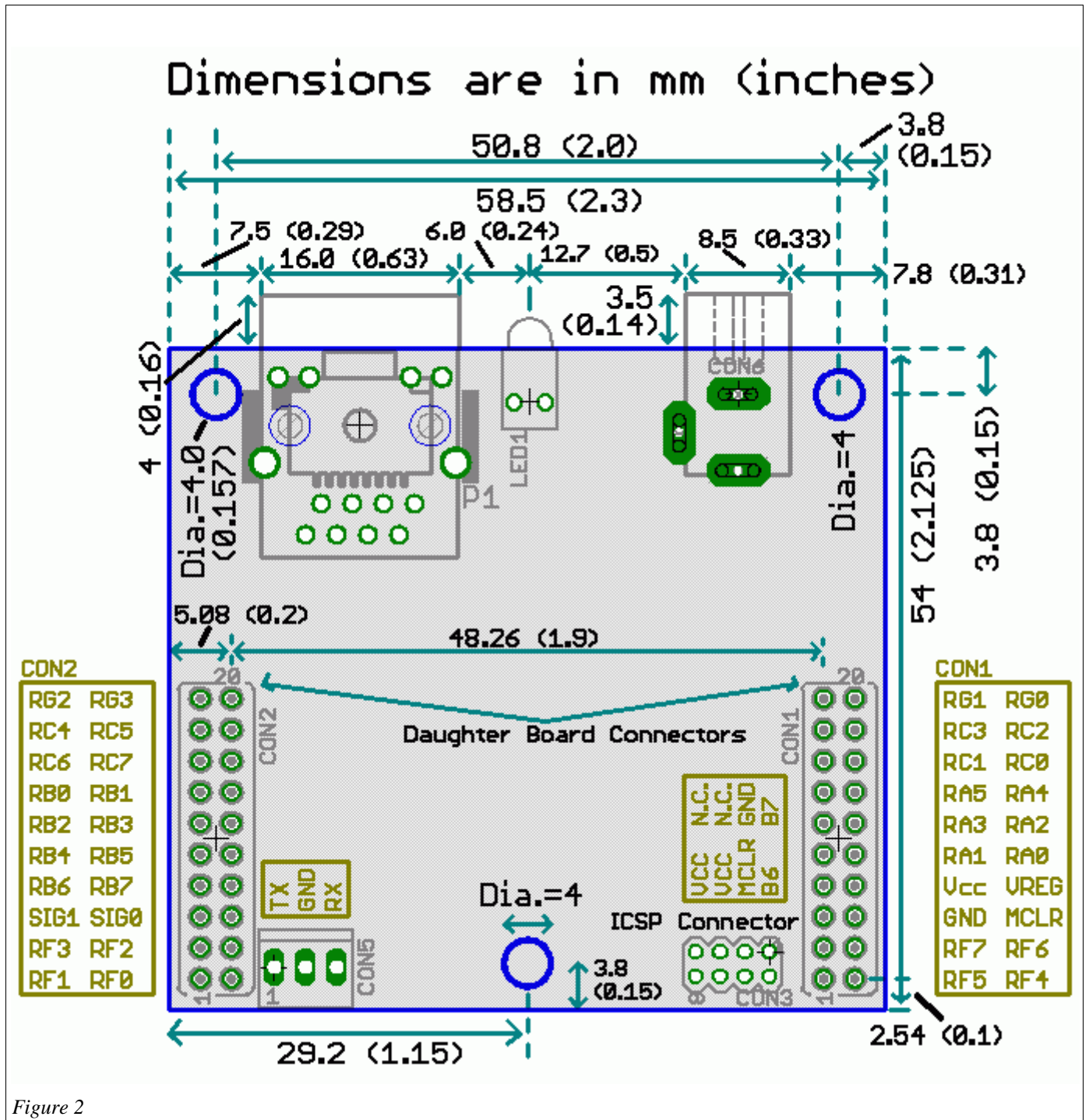


Figure 2



The SBC65EC's PCB layout is shown in Figure 3.

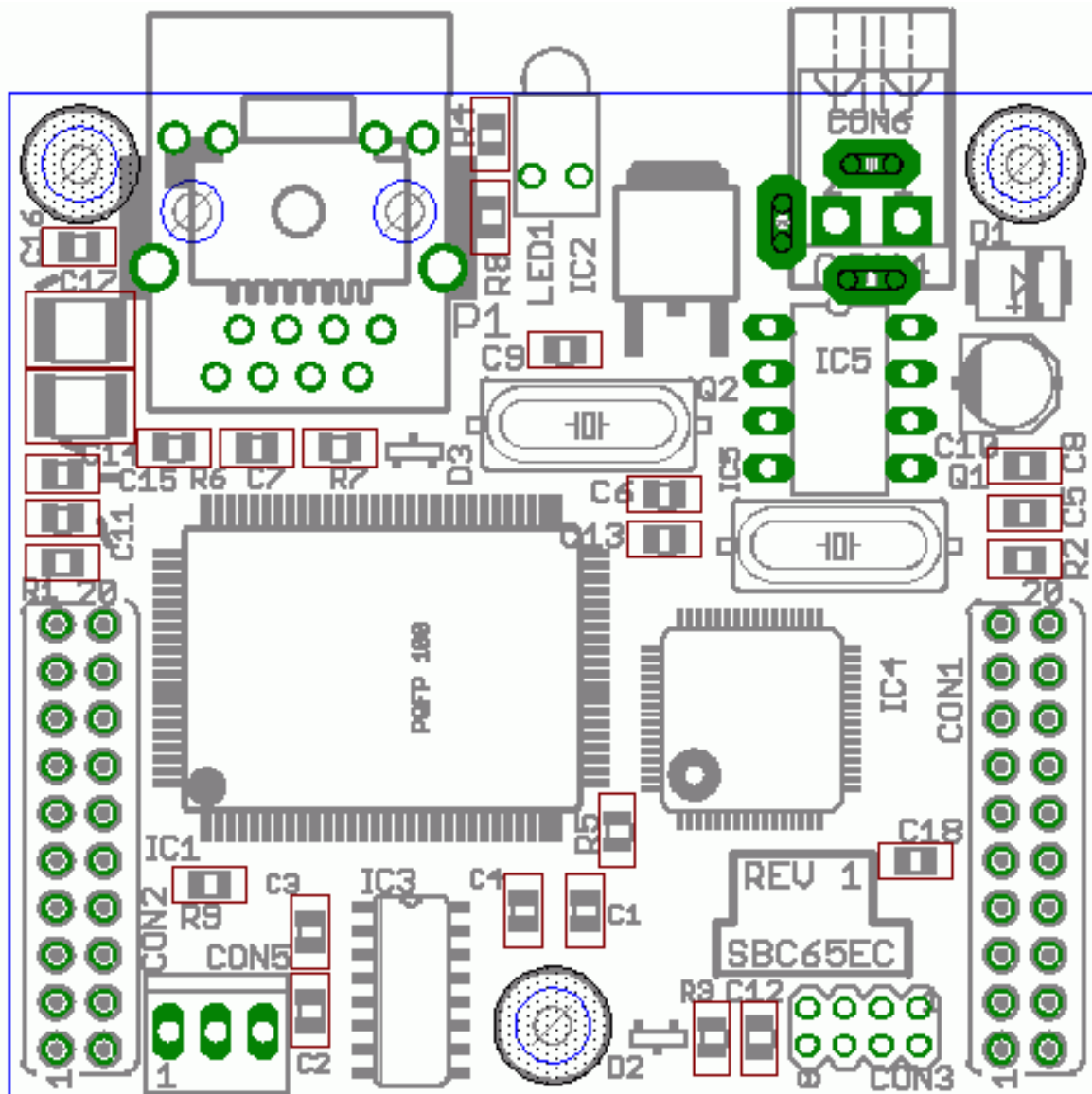
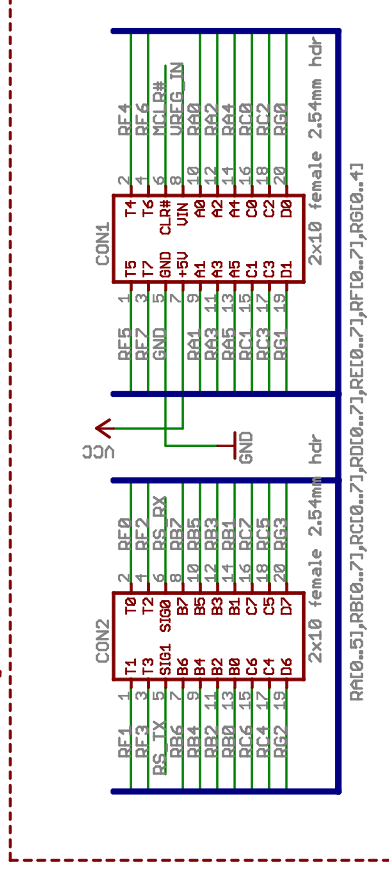


Figure 3



# Daughter Board Connector



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