



SBC44B

Single board computer for 44 pin PLCC PICs

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1 Introduction

The following documentation is for SBC44B Revision 2, which is marked on the PCB as SBC44B Rev2!
SBC44B is a single board computer for 44 pin PLCC PIC chips(PIC16F877, PIC18F452).

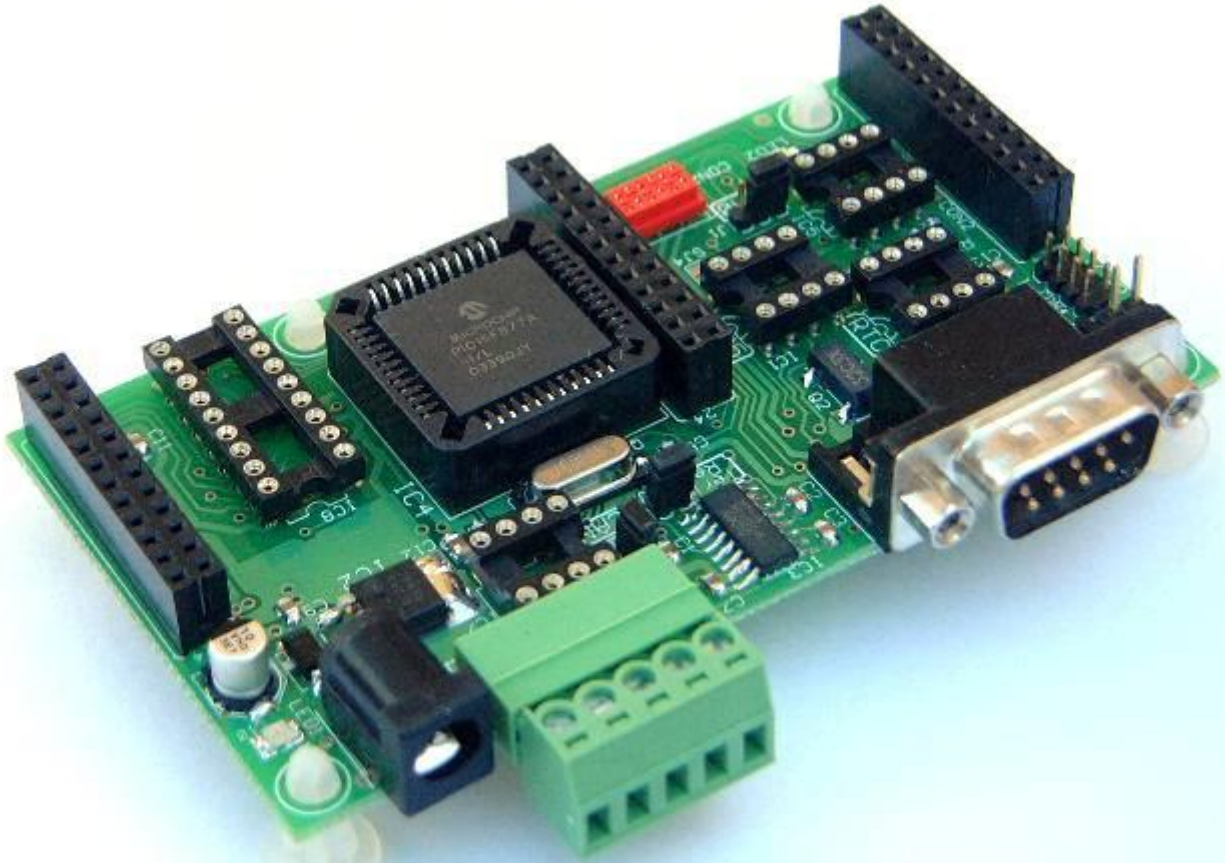


Figure 1

2 Features

- 33 I/O ports when using common PIC chips, for example the PIC16F877A or PIC18F452.
- 8 Analog inputs when using PIC chips with ADC units, for example the PIC16F877A or PIC18F452.
- 8 Additional I/Os when assembling MCP23008 I/O expander. This gives a total of **39 I/O ports**.
- Is part of our MicroX product range, and has a **Daughter board connector** and a **Compact Daughter board connector** for expansion. Any of our Daughter or Compact Daughter boards can be plugged into it. For example, a prototype Daughter board can be plugged into it for the user to do prototyping. For details on our MicroX range see www.modtronix.com/microx.
- Compact size of 97mm x 54mm. For details see www.modtronix.com/microx/dimensions.
- Assembled with High Quality, Industrial Temperature components - electrolytic capacitors used are extra long lifetime rated!
- Diode protected 2.1mm power connector for a standard DC transformer.
- Wide operating voltage range from 7 – 30V.
- On board 15kV ESD protected RS232 interface. Assembled with industrial temperature range interface driver chip.
- Sub-d 9 pin male connector (DTE configuration) with ground and RS232 transmit and receive signals.
- 5 pin 3.81mm terminal block connector with RS485 or CAN BUS signals (when interface drivers are assembled), ground and external power.
- The power pin on the 5 pin terminal block connector can be connected to the boards unregulated power supply (the input of the 2.1mm power connector) via a jumper. This can be used to:
 - Provide power for all other boards daisy chained to this one. For this to work this board must be powered via its 2.1mm power connector! It will supply power to all other boards daisy chained to it.
 - Obtain power for this board. In this case no power has to be supplied via the 2.1mm power connector. It will obtain it's power via the 5 pin terminal block connector.
- Power LED to indicate when device is powered.
- User LED connected to B6 via high impedance resistor (2k2). Can be used by user application, and does not interfere with in circuit serial programming.
- Socket for a I²C Serial EEPROM to be fitted. For example the 24LC256 (32 kbytes), 24LC512 (64 kbytes).....
- Socket for a RS485 (SP485, MAX485...) or CAN BUS (MCP2551) interface driver chip to be fitted.
- Socket for a I²C bus RTC (DS1307 for example) chip to be fitted, and space for 32kHz clock crystal to be assembled.
- Micro Match socket with Power, I²C and SPI signals. The Micro Match connector can be used to daisy chain multiple I²C devices together.
- Has a standard Modtronix ICSP (In Circuit Serial Programming) connector for programming the on board PIC chip - CPU can be programmed in circuit. For details see <http://www.modtronix.com/picboards/prog>

3 Expansion Connectors

3.1 Compact Daughter Board and Daughter Board Connectors

The SBC44B's Compact Daughter Board and Daughter Board connectors can be used as an expansion port to add additional functionality. It contains all free CPU port pins, MCP23008 I/O expander pins, power, I2C, SPI, RS232 signal,..... For the location of the connectors, see the *Dimensions* chapter of this document. These port pins are mapped to the following signals:

CON2 and CON3 Connector		CON1 Connector	
Daughter Board Port Pin	Signal	Daughter Board Port Pin	Signal
T0	Port 0 of the MCP23008 I/O expander (if assembled)	T4	Port 4 of the MCP23008 I/O expander (if assembled)
T1	Port 1 of the MCP23008 I/O expander (if assembled)	T5	Port 5 of the MCP23008 I/O expander (if assembled)
T2	Port 2 of the MCP23008 I/O expander (if assembled)	T6	Port 6 of the MCP23008 I/O expander (if assembled)
T3	Port 3 of the MCP23008 I/O expander (if assembled)	T7	Port 7 of the MCP23008 I/O expander (if assembled)
SIG0	RS232 receive signal – at RS232 signal levels!	GND	Ground
SIG1	RS232 transmit signal – at RS232 signal levels!	+5V	Regulated 0.5A 5V supply
B0	PIC pin RB0	VIN	Unregulated input voltage
B1	PIC pin RB1	CLR#	PIC pin /MCLR
B2	PIC pin RB2	A0	PIC pin RA0
B3	PIC pin RB3	A1	PIC pin RA1
B4	PIC pin RB4	A2	PIC pin RA2
B5	PIC pin RB5	A3	PIC pin RA3
B6	PIC pin RB6 – connected to LED2 and also used for ICP ⁽¹⁾	A4	PIC pin RA4
B7	PIC pin RB7 – also used for ICP ⁽¹⁾	A5	PIC pin RA5
C4	PIC pin RC4 – port pin assigned for I ² C ⁽²⁾	C0	PIC pin RC0
C5	PIC pin RC5	C1	PIC pin RC1
C6	PIC pin RC6 – also used for RS232/RS485 TX ⁽³⁾	C2	PIC pin RC2
C7	PIC pin RC7 – also used for RS232/RS485 RX ⁽³⁾	C3	PIC pin RC3 – port pin assigned for I ² C ⁽²⁾
D2	PIC pin RD2	D0	PIC pin RD0
D3	PIC pin RD3	D1	PIC pin RD1
D4	PIC pin RD4	E0	PIC pin RE0
D5	PIC pin RD5	E1	PIC pin RE1
D6	PIC pin RD6	E2	PIC pin RE2
D7	PIC pin RD7	GND	Ground

(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 than 1000 ohms!

(2) Port Pins C3 and C4 are assigned to be used as I²C pins. When no I²C devices are used, these ports can be used as general purpose I/O pins.

(3) These pins are also used for RS232/RS485 transmit and received! If no RS232 or RS485 interface is used, these ports can be used as general purpose I/O pins.

3.2 Custom Daughter boards

The SBC44B's Daughter Board connectors can be used as an expansion port to add additional functionality. By using PCB templates that can be downloaded from the Modtronix download page (www.modtronix.com/downloads), the user can easily create custom daughter boards. All schematics and PCBs were created using Eagle schematic and PCB editor. A free version of Eagle can be downloaded from www.cadsoft.de. There are many prototyping PCB manufactures available that will create PCBs straight from Eagle files. Some examples are www.pcbpool.com and www.pcbfaxexpress.com

4 Interfaces

4.1 Micro Match connector with I²C and SPI signals

The SBC44B has a 6 pin female Micro Match type connector with I²C signals, SPI signals, Vcc and Ground. The PIC can be configured for either I²C **or** SPI mode, both can not be used at the same time. The Micro Match connector is manufactured by AMP, and is a very small, polarized and cheap connector! This connector is also supported by other manufactures of I²C equipment, which allows devices from different manufactures to be interchanged.

Male Micro Match connectors that fit into this connector are available from various distributors and also from the Modtronix online store. Particularly useful is the “male-on-wire” type connector, seeing that they can be crimped onto a standard 1.27mm ribbon cable. Multiple of these connectors can be daisy chained together to allow several I²C on a single bus. Pre made cables are also available from the Modtronix online store.

The pinouts of the Micro Match I²C connector is:

Micro Match Connector Pin	I²C Signal	SPI Signal
1	SDA - I ² C data I/O (PIC port pin RC4)	SDI - SPI data in (PIC port pin RC4)
2	+5V	+5V
3	Ground	Ground
4	SCL - I ² C clock (PIC port pin RC3)	SCK - SPI clock (PIC port pin RC3)
5	RC5 - Can be used as general purpose pin	SDO - SPI data out (PIC port pin RC5)
6	No Connection	No Connection

For further info on the pinouts have a look at the picture in the *Dimensions* section later on in this document.

For more info on the Micro Match I²C connector see www.modtronix.com/info/i2c/micromatch

4.2 RS232

The SBC44B contains an industrial quality RS232 interface via a D-Sub 9 pin male connector (DTE configuration). At delivery solder jumpers SJ2 and SJ3 are made, and SJ4 and SJ5 are open. For PIC chips with internal USARTs (PIC16F877, PIC18F452...) this will connect the USART pins to the RS232 interface driver circuitry.

If the RS485 interface driver chip is assembled, the solder jumpers will have to be changed so that the RS485 interface uses the PIC chip's internal USART and the RS232 interface uses PIC pins RB0 and RB1 (SJ2 and SJ3 are open, and SJ4 and SJ5 are made). The RS232 interface will have to be implemented in software if required. This is quite simple though, and there is lots of example software available for doing it!

4.3 Sub-D Connector

The RS232 signals are connected to the 9 pin Sub-D male connector. The pins are mapped to the following signals:

<i>Terminal Connector Pin</i>	<i>Description</i>
1	N.C.
2	RS232 receive
3	RS232 transmit
4	N.C.
5	Ground
6	N.C.
7	N.C.
8	N.C.
9	N.C.

4.4 RS485 and CAN

In addition the SBC44B has sockets for assembling driver chips for RS485 or CAN BUS. Only one of the two can be assembled, not both RS485 and CAN BUS at the same time! The signals are routed to the 5 pin 3.81mm terminal block connector – see next section for pin details.

4.5 Terminal Block Connector

The RS485 or CAN BUS data signals, Vin supply and ground are connected to the 5 pin terminal block connector. Pin 1 is the leftmost pin of the connector, next to the 2.1mm power connector. See dimensions diagram for details. The pins are mapped to the following signals:

<i>Terminal Connector Pin</i>	<i>Description</i>
1	Ground
2	RS485 signal A -- OR -- CAN BUS CANL signal
3	RS485 signal B -- OR -- CAN BUS CANH signal
4	No connection
5	Vin supply signal.

A 5 pin screw type female 3.81mm connector is fitted to the 5 pin terminal block connector on the SBC44B at delivery. Additional connectors can be bought from the Modtronix web site, see www.modtronix.com/product_info.php?&products_id=106.

5 External Memory

The SBC44B board has a 8 pin IC socket for mounting an I²C bus serial EEPROM, like the 24LC256 (32Kbytes) or 24LC512 (64 Kbytes) chips. This is very useful for applications that need to store non volatile memory, like data loggers for example.

6 Real Time Clock

The SBC44B board has a 8 pin IC socket for mounting an I²C bus RTC chip, like the DS1307 for example. A high accuracy, 20ppm, 32.768 kHz crystal is already assembled on all SBC44B boards, so all that needs to be done to add a Real Time Clock to the SBC44B is to insert the RTC chip. A 2 pin, 2.54mm header (JP1) is provided for an external battery to be connected. The battery voltage must be between 2.0V to 3.5V for proper operation.

When no external battery is used, the DS1307 requires that a jumper be inserted onto header JP1! This will set the Vbat input pin of the DS1307 to ground potential. At delivery this jumper will already be inserted.

7 8 Bit I/O Expander

The SBC44B board has a 18 pin IC socket for mounting an MCP23008 I²C bus I/O expander chip. The MCP23008 provides 8 additional I/O ports rated at 25mA each. It has internal power-on reset circuitry to assure defined pin values on power up. The MCP23008 has an interrupt output pin that indicates certain events. At delivery this pin is connected to PIC port pin RB0. If this is not required, solder jumper SJ7 can be cut.

8 Configuration

The SBC44B board can be configured via solder jumpers SJ1 to SJ6 and headers J1, J2 and J4. Refer to the PCB layout later on in this document for the location of these jumpers and headers.

8.1 RS485 Transmit/Receive control

The J1 header on the SBC44B is used to configure what CPU pin is used for RS485 transmit/receive selection. When the jumper is inserted into the B7 position, PIC port pin B7 is used. When the jumper is inserted into the A0 position, PIC port pin A0 is used. A logical 1 will set the driver for transmission, and a 0 for reception. At delivery it is configured for signal B7. If no RS485 driver chip is inserted, this jumper has no affect.

8.2 Power via terminal block connector

Pin 5 of the 5 pin terminal block connector can be configured via jumper J2 to be connected to the unregulated supply voltage. This can be used to:

- Provide power to all other boards daisy chained to this one. For this to work this board must be powered via its 2.1mm power connector! It will supply power to all other boards daisy chained to it.
- Obtain power for this board. In this case no power has to be supplied via the 2.1mm power connector. It will obtain it's power via the 5 pin terminal block connector.

8.3 CAN BUS or RS485 Terminating Resistor

The J4 header on the SBC44B is used to connect a 120 ohm terminating resistor to the data signals of the CAN BUS or RS485 bus. A terminating resistor is required on the nodes on either end of the CAN BUS or RS485 bus. This jumper is made by default. If there are for example only two nodes on the bus (this board and another board), both nodes should have terminating resistors.

9 Programming

9.1 Programming Connector

10 Specifications

10.1 Absolute Maximum Ratings

<i>Item</i>	<i>Symbol</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Operating Temperature:	Top	-40		85	°C

10.2 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 with PIC16F877A at 20MHz	Idd	Vdd = 12V		16		mA
32.768 kHz crystal Frequency tolerance (at 25 °C)		T=25°C		20		ppm

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

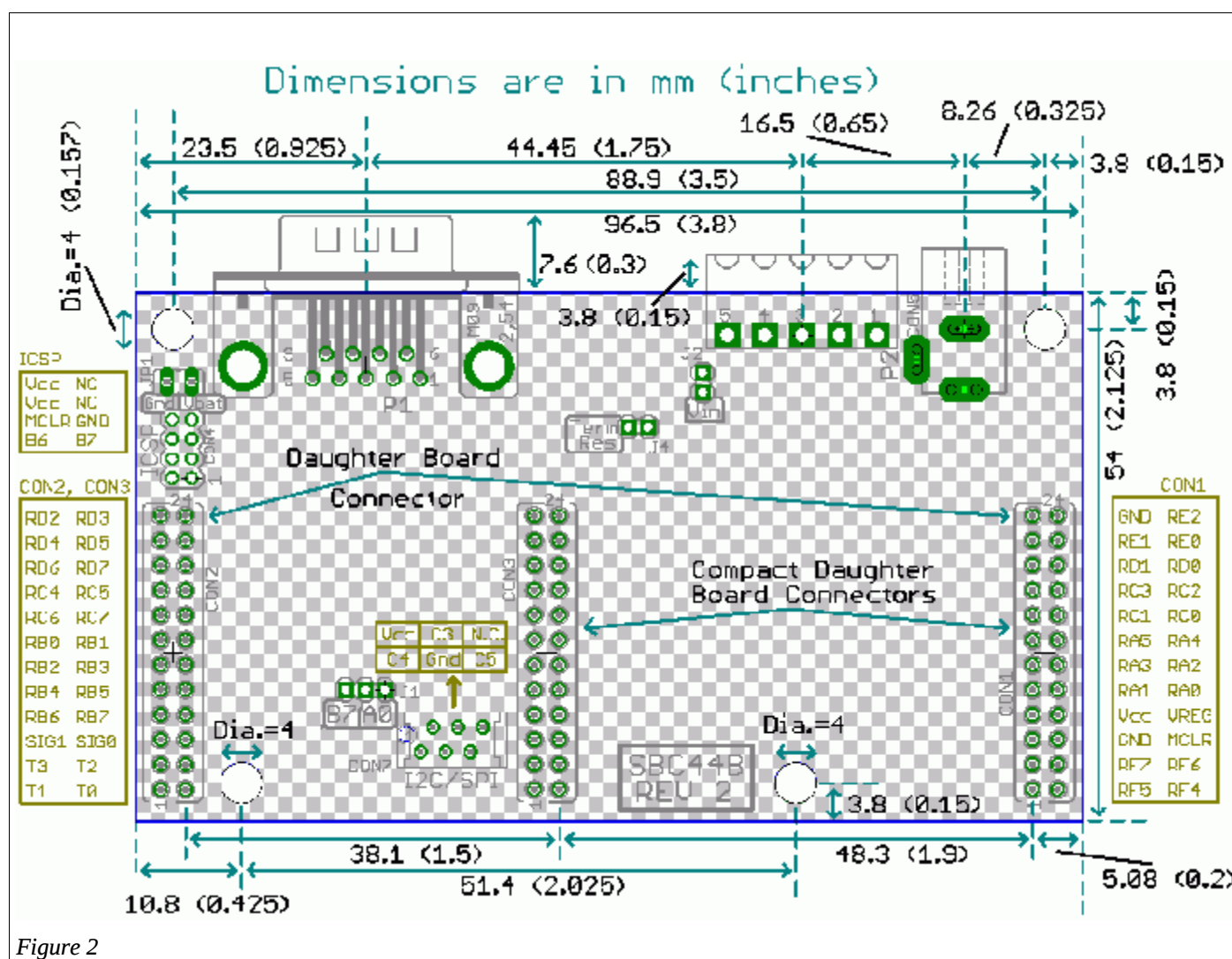
The following values are for common PIC chips like the PIC16F877A or the PIC18F452.

<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 _{IL}		0		0.75	V
Input Low Voltage - configured as Schmitt Trigger input:	V _{IL}		0		1	V
Input High Voltage - configured as TTL input:	V _{IH}		2.05		5	V
Input High Voltage - configured as Schmitt Trigger input:	V _{IH}		4		5	V
Output High Voltage:	V _{OL}	I _{OL} = 8.5mA			0.6	V
Output Low Voltage:	V _{OH}	I _{OH} = 3mA	4.3			V
Capacitive loading:	C _{IO}			50		pF

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

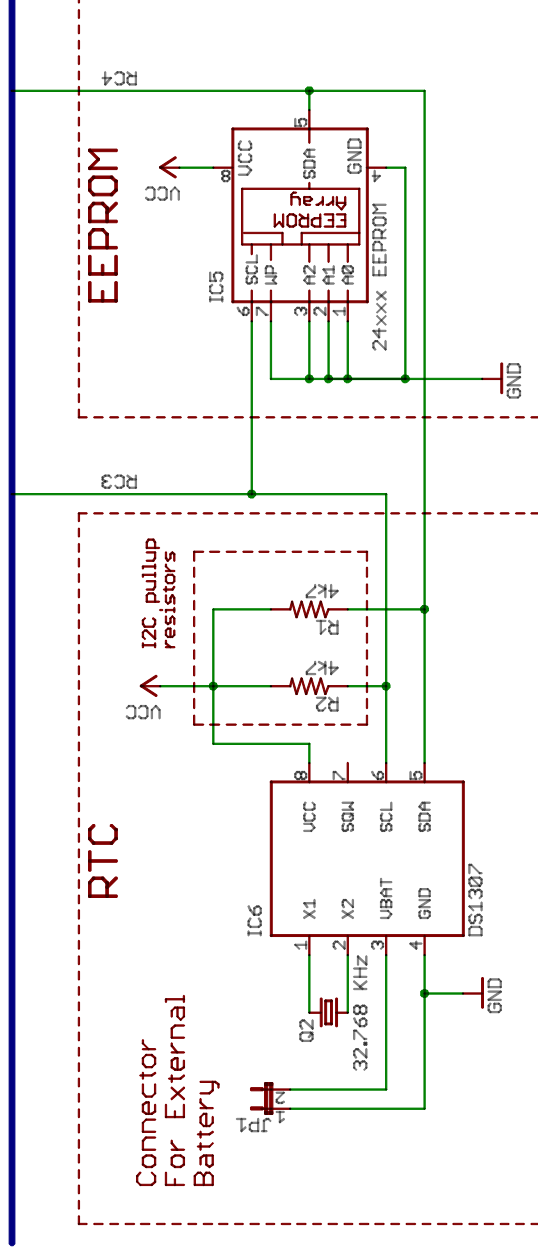
11 Dimensions

The SBC44B conforms to the MicroX Main Board Dimensions, as shown in Figure 2.



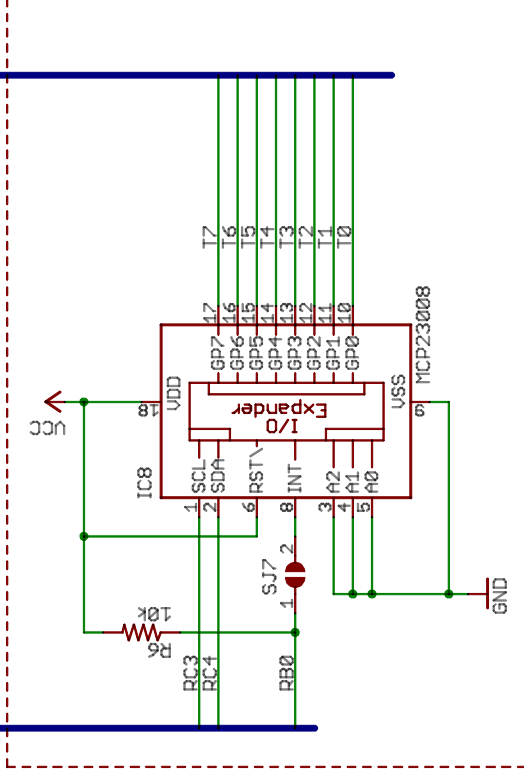


RA[0..5],RB[0..7],RC[0..7],RD[0..7],RE[0..2],TE[0..7]



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