



# *SBC28PC*

Single board computer for 28 pin DIP PICs

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# 1 Introduction

The following documentation is for the SBC28PC Revision 2, which is marked on the PCB as SBC28PC Rev2!

The SBC28PC is a single board computer for 28 pin PIC microcontrollers. It has a RS232 serial interface that is available via a 3 pin molex connector and a 5 pin 3.81mm terminal block connector (can be configured via solder straps to be available on terminal block connector) . It has a socket for a MCP2551 CAN BUS driver chip. When the CAN BUS driver chip is inserted, the CAN signals are available on the 5 pin terminal block connector.

This board has been optimized for the following 28 pin DIP PIC chips:

- PIC18F242, PIC18F252, PIC18F248, PIC18F258
- PIC18F2320, PIC18F2410, PIC18F2680 (CAN BUS), PIC18F2550 (USB)
- PIC16F870, PIC16F873(A), PIC16F876(A)
- PIC16C63, PIC16C66, PIC16C73(A), PIC16F73, PIC16C76, PIC16F76

This is only because the above mentioned chips have internal USARTs, which are connected to the serial drivers on this board. It can however also be used with **most other 28 pin DIP PIC chips**, as long as their power, reset(MCLR) and oscillator pins are situated in the same place as the chips listed above. The only difference is that if a USART is required, it will have to be done with software on the PIC chip. Examples of other PIC chips that can be used are:

- PIC16F872
- PIC16C62(A), PIC16C72
- Many more PIC chips that match the above mentioned criteria!

When using this board with the CAN driver chip, it must be used with a PIC chip that has an onboard CAN peripheral, like the PIC18F248, PIC18F258, PIC18F2680, ..... chips.

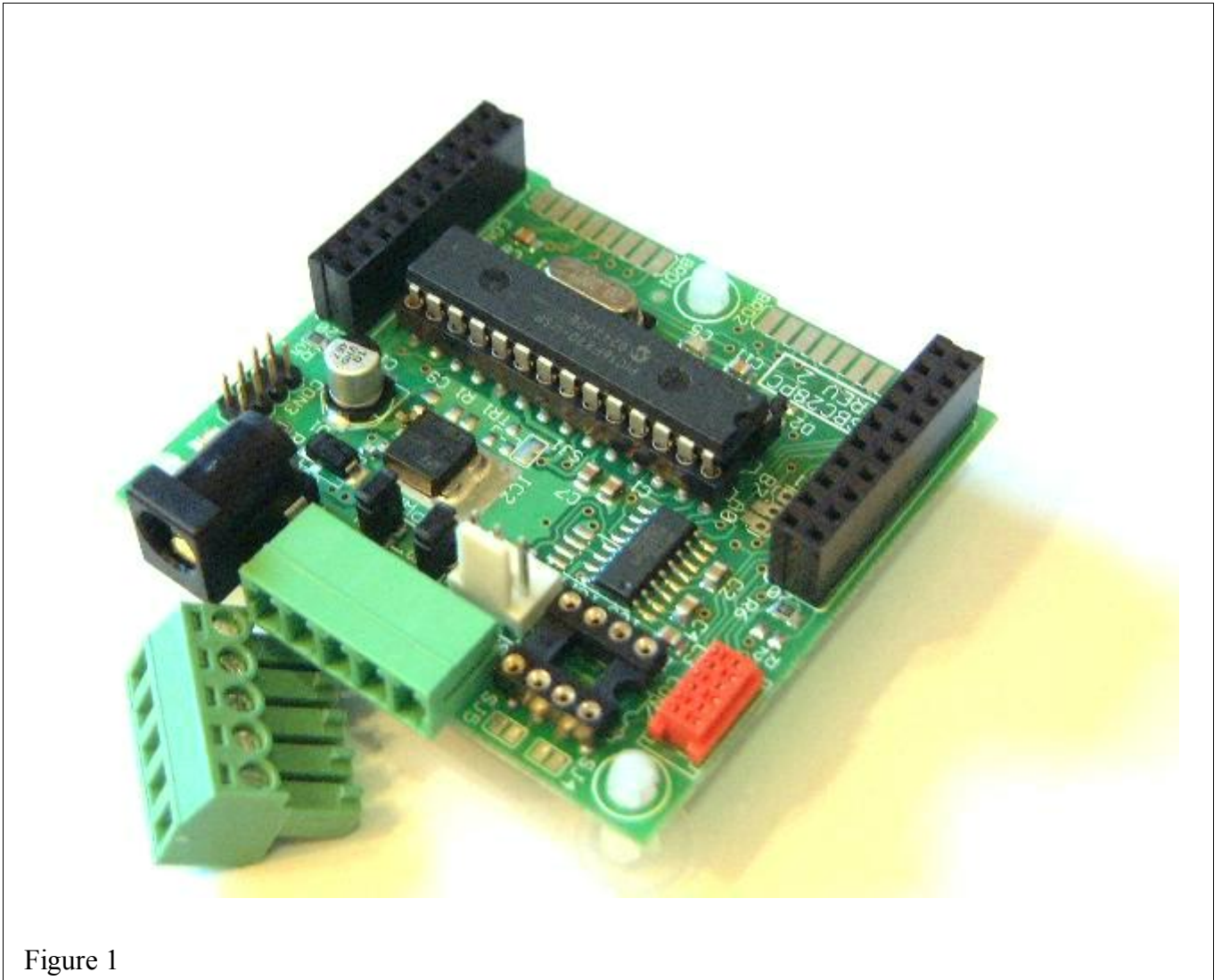


Figure 1

## 2 Features

- 22 I/O ports when using common PIC chips, for example the PIC16F876A or PIC18F252.
- Is part of our MicroX product range, and has a **Frontend connector**, **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](http://www.modtronix.com/microx).
- Compact size of 58mm x 54mm. For details see [www.modtronix.com/microx/dimensions](http://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 to 30V.
- On board 15kV ESD protected RS232 interface. Assembled with industrial temperature range interface driver chip.
- 5 pin 3.81mm terminal block connector with RS232 or CAN BUS signals (when CAN interface driver is 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 strap. 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.
- Micro Match socket with Power, I<sup>2</sup>C and SPI signals. The Micro Match connector can be used to daisy chain multiple I<sup>2</sup>C 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 Daughter Board Connectors

The SBC28PC's Daughter Board connectors can be used as an expansion port to add additional functionality. It 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 Board connectors port pins are mapped to the following signals:

<i>CON2 Daughter Board Connector</i>		<i>CON1 Daughter Board Connector</i>	
<i>Daughter Board Port Pin</i>	<i>Signal</i>	<i>Daughter Board Port Pin</i>	<i>Signal</i>
T0	Routed to T0 pin of Frontend Connector	T4	Routed to T4 pin of Frontend Connector
T1	Routed to T1 pin of Frontend Connector	T5	Routed to T5 pin of Frontend Connector
T2	Routed to T2 pin of Frontend Connector	T6	Routed to T6 pin of Frontend Connector
T3	Routed to T3 pin of Frontend Connector	T7	Routed to T7 pin of Frontend Connector
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 – also used for CAN TXD <sup>(4)</sup>	A0	PIC pin RA0
B3	PIC pin RB3 – also used for CAN RXD <sup>(4)</sup>	A1	PIC pin RA1
B4	PIC pin RB4	A2	PIC pin RA2
B5	PIC pin RB5	A3	PIC pin RA3
B6	PIC pin RB6 – also used for ICP <sup>(1)</sup>	A4	PIC pin RA4
B7	PIC pin RB7 – also used for ICP <sup>(1)</sup>	A5	PIC pin RA5
C4	PIC pin RC4 – port pin assigned for I <sup>2</sup> C <sup>(2)</sup>	C0	PIC pin RC0
C5	PIC pin RC5	C1	PIC pin RC1
C6	PIC pin RC6 – also used for RS232/RS485 RX <sup>(3)</sup>	C2	PIC pin RC2
C7	PIC pin RC7 – also used for RS232/RS485 RX <sup>(3)</sup>	C3	PIC pin RC3 – port pin assigned for I <sup>2</sup> C <sup>(2)</sup>
D6	N.C. - not connected	D0	N.C. - not connected
D7	N.C. - not connected	D1	N.C. - not connected

(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 a 1000 ohms!

(2) Port Pins C3 and C4 are assigned to be used as I<sup>2</sup>C pins. When no I<sup>2</sup>C 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 RS232 and RS485 interface is not used, these ports can be used as general purpose I/O pins.

(4) These pins are also used for CAN BUS transmit and receive signals when the CAN driver chip is assembled. It is NOT assembled by default! If CAN BUS is not used, these pins can be used as general purpose I/O pins.

### 3.2 Frontend Connectors

The SBC28PC's Frontend connectors can be used as an expansion port to add additional functionality. It contains all free CPU port pins, power, I2C, SPI, RS232 signal,..... Most important pins have been placed on BRD1 connector, so a single IDC connector can be connected to it, and it's signals will be available via a ribbon cable. For the location of the Frontend connectors, see the *Dimensions* chapter of this document. The Frontend connectors port pins are mapped to the following signals:

<i>BRD2 Frontend Connector</i>		<i>BRD1 Frontend Connector</i>	
<i>Frontend Port Pin</i>	<i>Signal</i>	<i>Frontend Port Pin</i>	<i>Signal</i>
T0	Routed to T0 pin of Daughter Board	T4	Routed to T4 pin of Daughter Board
T1	Routed to T1 pin of Daughter Board	T5	Routed to T5 pin of Daughter Board
T2	Routed to T2 pin of Daughter Board	T6	Routed to T6 pin of Daughter Board
T3	Routed to T3 pin of Daughter Board	T7	Routed to T7 pin of Daughter Board
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 – also used for CAN TXD <sup>(4)</sup>	A0	PIC pin RA0
B3	PIC pin RB3 – also used for CAN RXD <sup>(4)</sup>	A1	PIC pin RA1
B4	PIC pin RB4	A2	PIC pin RA2
B5	PIC pin RB5	A3	PIC pin RA3
B6	PIC pin RB6 – also used for ICP <sup>(1)</sup>	C2	PIC pin RC2
B7	PIC pin RB7 – also used for ICP <sup>(1)</sup>	C3	PIC pin RC3 – port pin assigned for I <sup>2</sup> C <sup>(2)</sup>
A4	PIC pin RA4	C4	PIC pin RC4 – port pin assigned for I <sup>2</sup> C <sup>(2)</sup>
A5	PIC pin RA5	C5	PIC pin RC5

- (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 a 1000 ohms!
- (2) Port Pins C3 and C4 are assigned to be used as I<sup>2</sup>C pins. When no I<sup>2</sup>C devices are used, these ports can be used as general purpose I/O pins.
- (3) These pins are also used for CAN BUS transmit and receive signals when the CAN driver chip is assembled. It is NOT assembled by default! If CAN BUS is not used, these pins can be used as general purpose I/O pins.

Figure 2 shows the location of the Frontend Connectors on the board.

## Frontend Connector on MicroX Main Board (SBC)

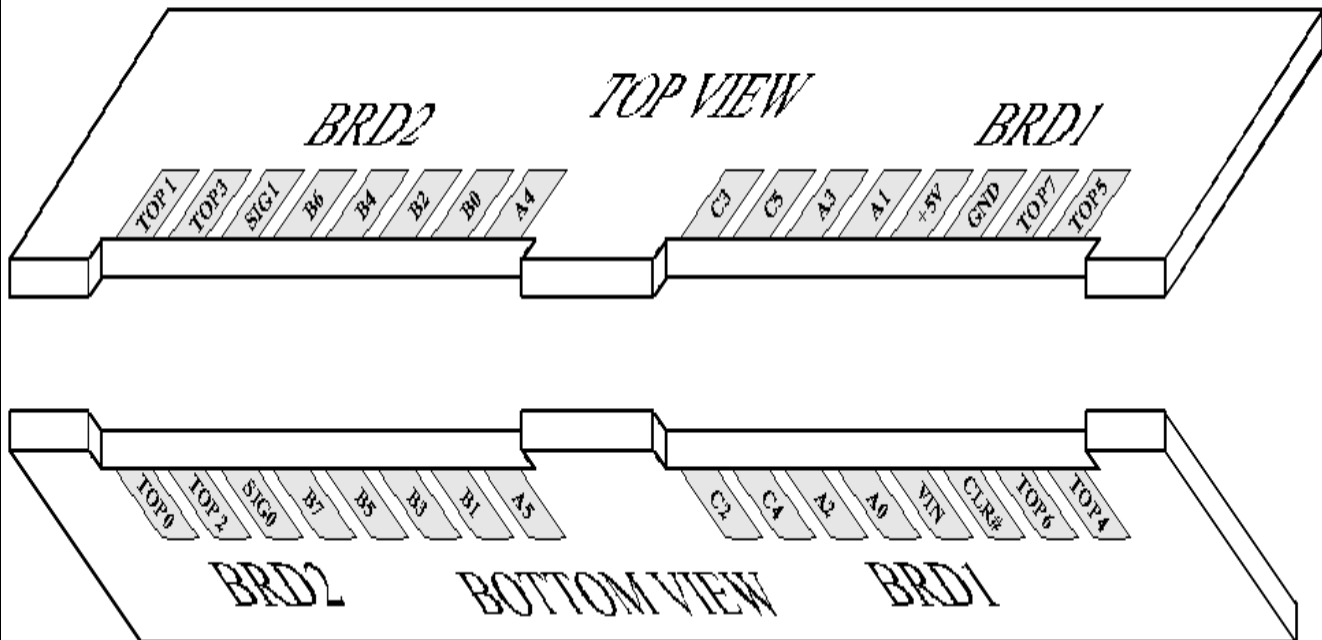
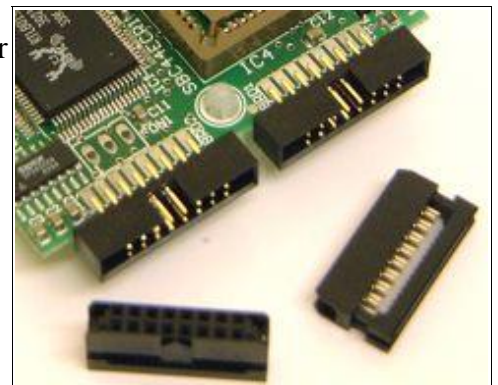


Figure 2

### 3.3 Connecting IDC connectors to the Frontend Connector

For an easy way of accessing the BRD1 and BRD2 Frontend Connectors signals, 2mm IDC connectors can be soldered onto one or both of the frontend connectors. By doing this, the frontend signals will be available via a standard 2mm ribbon cable. Note that the IDC connectors shown in the image are not soldered onto the Frontend Connector!



### 3.4 Expansion boards

The SBC28PC's Frontend connectors can be used as an expansion port to add additional functionality. It contains all free CPU port pins, power, I2C, SPI, RS232 signal,..... The image to the right shows the SBC28PC with a Sub-D 9 pin expansion board. For a list of Frontend Boards currently available from Modtronix Engineering, see [www.modtronix.com/products/sbc28pc](http://www.modtronix.com/products/sbc28pc).





Additionally, users can download PCB templates for creating their own Frontend expansion boards from our Downloads page – see [www.modtronix.com/downloads](http://www.modtronix.com/downloads).

## 4 Interfaces

### 4.1 Micro Match connector with I<sup>2</sup>C and SPI signals

The SBC28PC has a 6 pin female Micro Match type connector with I<sup>2</sup>C signals, SPI signals, Vcc and Ground. The PIC can be configured for either I<sup>2</sup>C 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 I<sup>2</sup>C equipment, which allows devices from different manufactures to be interchanged.

Male Micro Match connectors that fits 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 I<sup>2</sup>C on a single bus. Pre made cables are also available from the Modtronix online store.

The pinouts of the Micro Match I<sup>2</sup>C connector is:

<i>Micro Match Connector Pin</i>	<i>I<sup>2</sup>C Signal</i>	<i>SPI Signal</i>
1	SDA - I <sup>2</sup> 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 <sup>2</sup> 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 I<sup>2</sup>C connector see [www.modtronix.com/info/i2c/micromatch](http://www.modtronix.com/info/i2c/micromatch)

### 4.2 RS232

The SBC28PC contains an industrial quality RS232 interface. The signals are available on a 3 pin Molex connector and a 5 pin 3.81mm terminal block connector. To get the signals on the 5 pin terminal block connector, solder jumpers SJ4 and SJ5 have to be made. At delivery they are NOT made, and the RS232 interface is only available on the 3 pin Molex connector. The reason for this is that the 5 pin terminal block connector is reserved for the CAN BUS signals if a CAN bus driver chip is inserted into IC socket IC5. If the CAN bus is not required (no CAN driver chip is inserted), the user can make solder jumpers SJ4 and SJ5 to get the RS232 signals on the terminal block connector.

#### 4.2.1 3 Pin Molex Connector

The RS232 signals are connected to the following pins of the 3 pin Molex connector.



<i>Terminal Connector Pin</i>	<i>Description</i>
1	RS232 transmit
2	Signal Ground
3	RS232 receive

#### 4.2.2 5 Pin Terminal Block Connector

When solder jumpers SJ4 and SJ5 are made, the 5 pin terminal block connector is assigned the following signals:

<i>Terminal Connector Pin</i>	<i>Description</i>
1	Ground
2	RS232 transmit
3	RS232 receive
4	No connection
5	Vin supply signal

Pin 1 is the leftmost pin of the connector, next to the 2.1mm power connector. See dimensions diagram for details.

In this mode (SJ4 and SJ5 made) it is **very important** not to insert the CAN driver chip, seeing that it will use the same pins as the RS232 interface. When inserting the CAN driver chip, SJ4 and SJ5 must be open.

### 4.3 CAN BUS

To use the CAN BUS a CAN driver chip (MCP2551 for example) must be inserted into IC socket IC5, and the PIC chip used must have a CAN peripheral. Examples are the PIC18F248 and PIC18F258 chips. Solder jumpers SJ4 and SJ5 must also be open. The CAN BUS signals will be available on the 5 pin 3.81mm terminal block connect.

#### 4.3.1 5 Pin Terminal Block Connector

The CAN BUS data signals, Vin supply and ground are connected to the 5 pin terminal block. 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	CAN BUS CANL signal
3	CAN BUS CANH signal
4	No connection
5	Vin supply signal

A 5 pin screw type female 3.81mm connector can be purchased from Modtronix Engineering that fits into this boards 5 pin terminal block connector. See [www.modtronix.com/product\\_info.php?&products\\_id=106](http://www.modtronix.com/product_info.php?&products_id=106).

## 5 Configuration

The SBC28PC board can be configured via solder jumpers SJ1, SJ4, SJ5, SJ6 and header J2. Refer to the PCB layout later on in this document for the location of these jumpers and headers.

### 5.1 RS232 signals via terminal block connector

When solder jumpers SJ4 and SJ5 are made, the RS232 signals are routed to pins on the 5 pin terminal block connector. At delivery, these jumpers are open. See the *Interfaces* chapter for details.

### 5.2 Power via terminal block connector

Pin 5 of the 5 pin terminal block connector can be configured via solder jumper SJ6 or 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.

### 5.3 CAN BUS Terminating Resistor

The J3 header on the SBC28PC is used to connect a 120 ohm terminating resistor onto the data signals of the CAN BUS. A terminating resistor is required on the nodes on either end of the CAN BUS 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.

## 6 Specifications

### 6.1 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

### 6.2 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 PIC16F876A at 20MHz	Idd	Vdd = 12V		16		mA

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

The following values are for common PIC chips like the PIC16F876A or the PIC18F252.

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

## 7 Dimensions

The SBC28PC conforms to the MicroX Compact Main Board Dimensions, as shown in Figure 3.

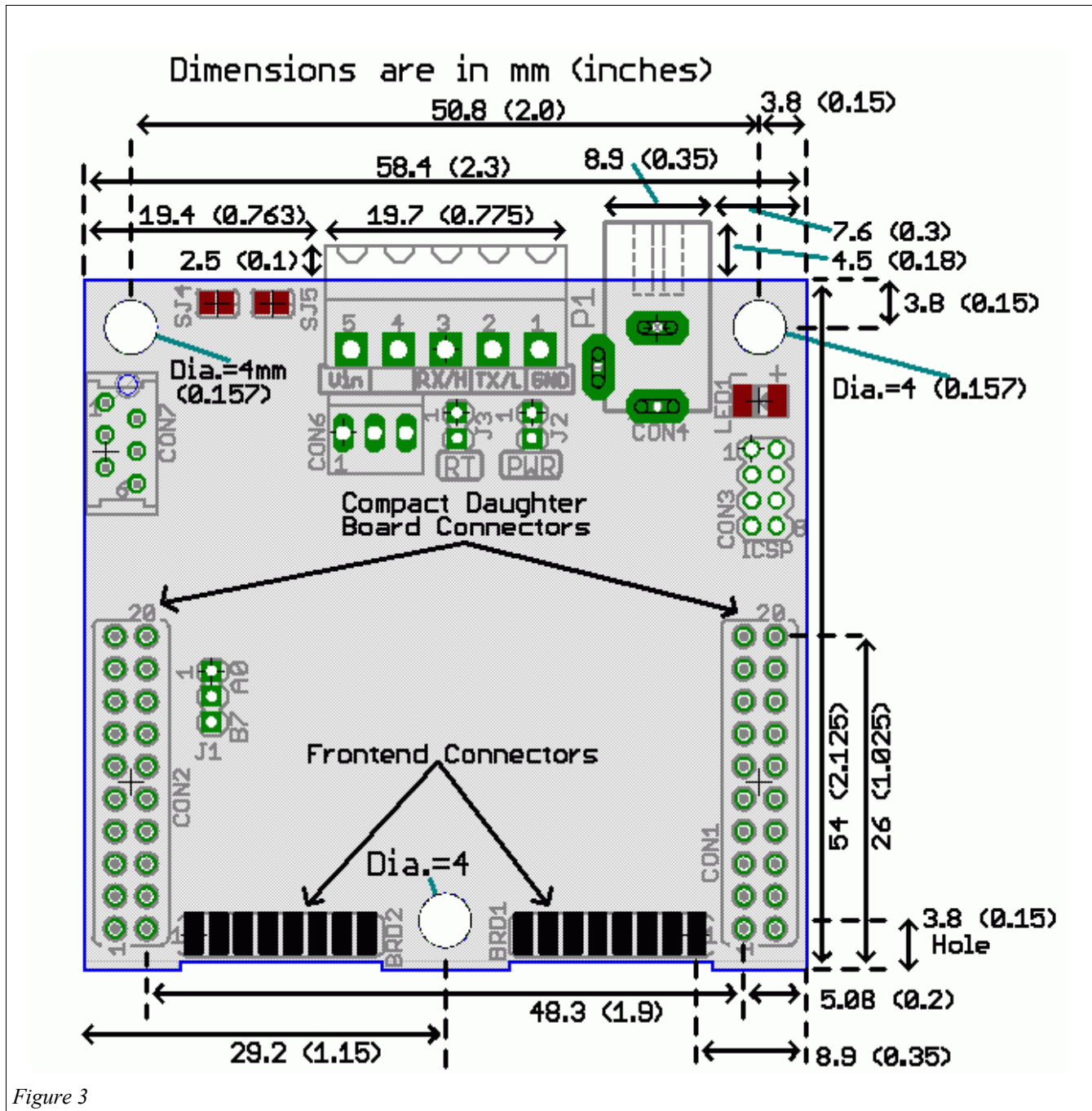
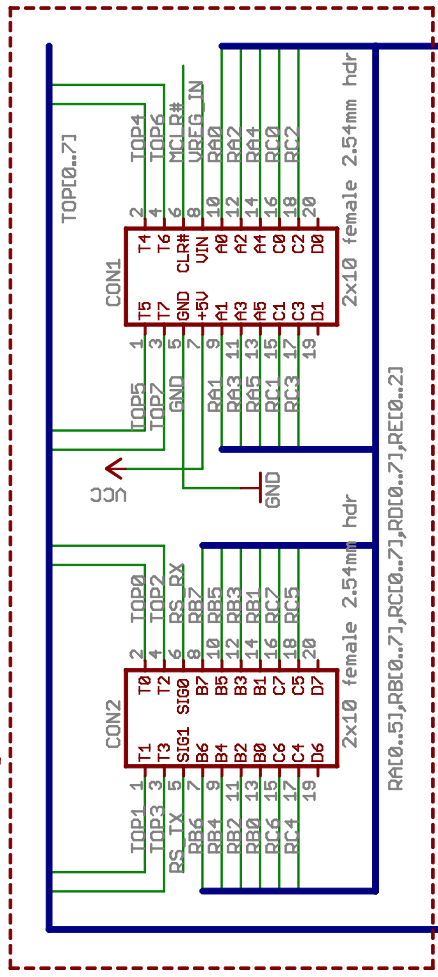


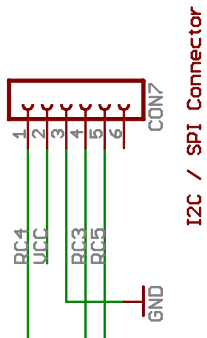
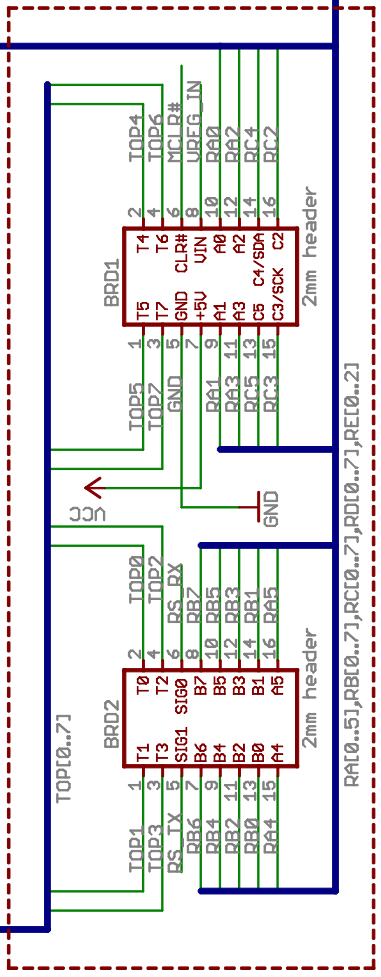
Figure 3



# Daughter Board Connector



# Frontend Board Connector



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