

# **R-51SD**

# **ASSEMBLY MANUAL**

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# 1 INTRODUCTION

The R-51SD is designed for easy assembly by the hobbyist or prototyping engineer. The components are assembled on the both sides of the board as marked. All of the integrated circuits, except the reset switch, are inserted into sockets. The recommended sequence for manual assembly is as follows:

1. Bypass Capacitors (quantity 3)
2. Resistor Network (quantity 1)
3. Dip Sockets (quantity 2)
4. TO92 IC
5. Capacitors (quantity 5)
6. Sip Sockets (quantity 2)
7. Headers (quantity 4)
8. Optional Headers (quantity 2)

The board may then be tested.

The assembly and test steps are explained in detail in the following pages. Please refer to the board layout for part placement locations. Depending on your experience, the assembly process may take about one hour. It is highly recommended that you read all instructions and become familiar with the parts before starting the assembly process.

We give DigiKey part numbers for all components used on this board. Digikey has data sheets on-line for most of their parts so you can cross reference to different manufacturers and suppliers if you wish. In addition DigiKey accepts orders for single pieces and small dollar amounts, which you may pay for by credit card. DigiKey's web site is [www.digikey.com](http://www.digikey.com).

# 2 SOLDERING

Use a low power (about 30 Watts) soldering iron. Heat the component lead and the pad with the iron, and then apply solder to the lead and pad. Solder should be shiny in appearance. Be careful not to deposit too much solder on the joints. The most common problem with board assembly is shorted pins or tracks due to excessive solder. Solder may be removed by solder-removal braid, also known as solder wick. Place the wick over the solder and heat the solder through the wick. The wick will absorb the excess solder. Use a good quality solder, such as Radio Shack's silver bearing solder. Soldering is the most important aspect of assembly. Please be patient and strive for excellence!

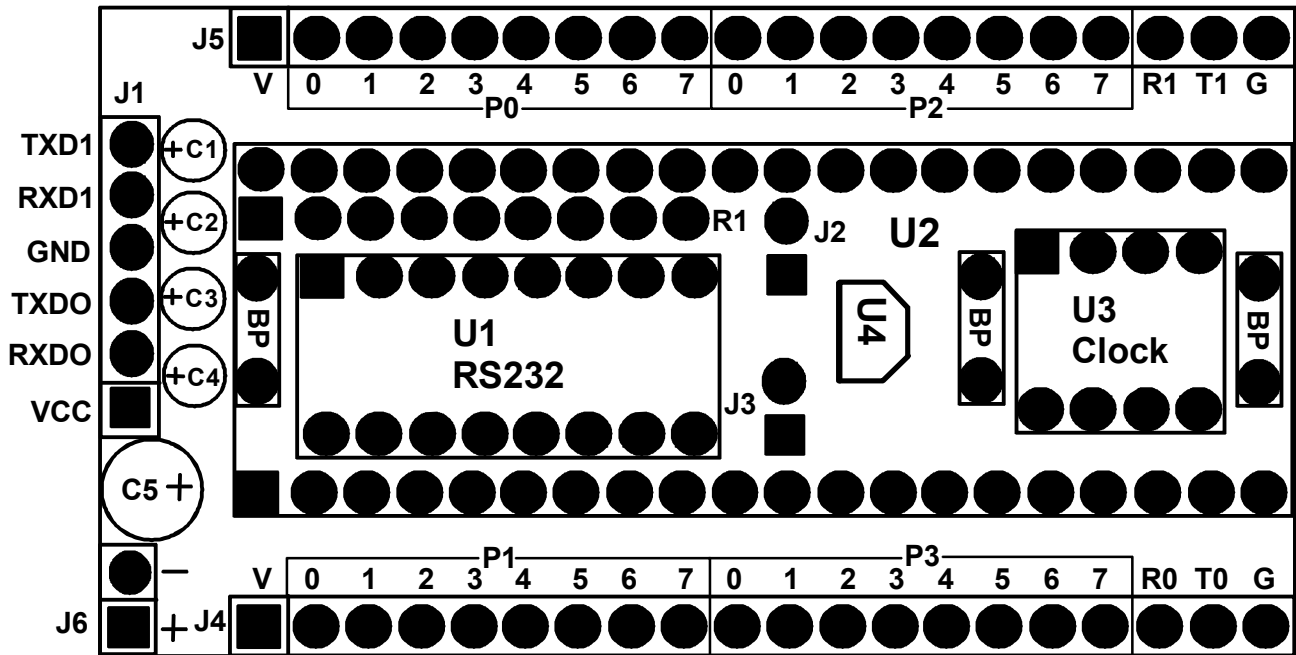
**Please note that most solder contains lead.  
Take the necessary precautions when working with solder.  
Work in a well-ventilated area.  
Do not inhale the solder vapors.  
Wash your hands after soldering.**

### 3 ASSEMBLY STEPS

Familiarize yourself with the board, the components, and the layout. Also refer to the bill of materials at the end of this assembly manual. This board has components populated on both sides. We recommend you assemble the board in the following order.

1. Bypass capacitors, resistor network, sockets for U1 and U3 and the IC DS1812, U4 on the bottom of the board.
2. Capacitors C1-C5, headers J1, J4, J5, J6, and Sip Sockets in U2 on the top of the board.

The following is a modified overlay of the board with all of the components labeled.

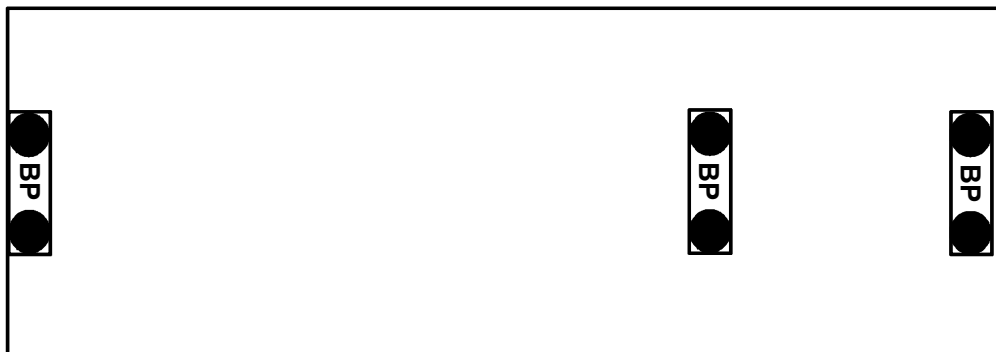


#### 3.1 Step One, Bottom of the Board

##### 3.1.1 Bypass Capacitors

Capacitors C6-C8 are axial capacitors without polarity. The value may be between 10-100 nanofarad (nF). The value is usually written on the capacitor as a number 103, 104, 105. 103 is 100nF, 104 is 10nF, 105 is 1nF. The following diagram shows where the bypass capacitors are located on the board. Populate these capacitors on the bottom of the board.

##### R-51SD



### 3.1.2 Resistor Network R1

R1 is a resistor network which contains 9 resistors with a common terminal. The common terminal is marked on the resistor networks with a line or a dot. The R-51SD board uses a square pad to mark where the common terminal is to be inserted. The orientation of this resistor must be correct for the board to work.

### 3.1.3 Sockets

Sockets use the same designation as the components they hold. Several different size sockets are used. U1 uses a 16 pin socket, and U3 uses a 8 pin socket. The 16 and 8-pin sockets are dual In-line Package (DIP) sockets with 300 mils between rows. The DIP sockets all have a notch or mark on one end. This must be matched with the socket pattern silk-screened on the board. When the notch is to the left, and viewed from the top, the lower leftmost pin is pin 1. On the R-51SD board, the pads of pin 1 of the Integrated Circuits (ICs) are square. All other IC pads are circular.

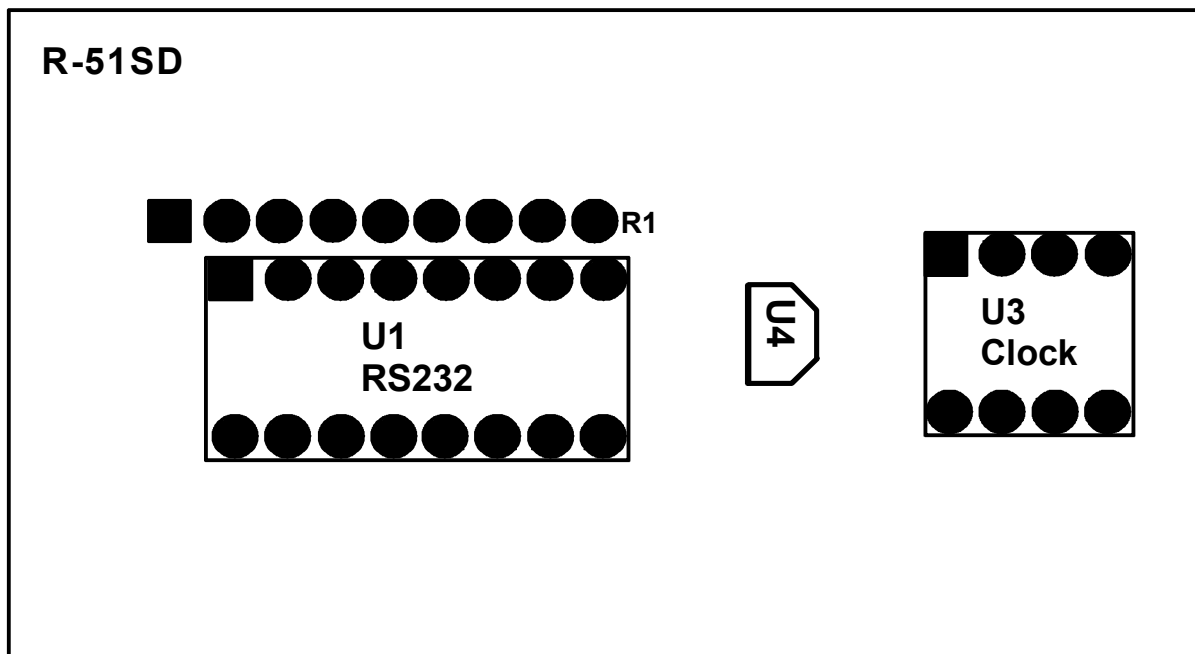
**The orientation of the sockets is critical.**

You will be placing the ICs in the sockets using the notch for pin 1 identification. The board will not work and the ICs may be damaged if they are populated backwards. If you do solder a socket in backwards the board will still work, but

**you must be extremely careful to orient the IC to the notch silk-screened on the board and not according to the notch on the socket.**

### 3.1.4 DS1812

The DS1812 is a reset chip in a TO92 package. This IC must be inserted to match the footprint on the board.





## 3.2 Step Two, Top of the Board

### 3.2.1 Electrolytic Capacitors

Capacitors C1 – C4 and C5 are electrolytic capacitors. Electrolytic capacitors are polarized components. The positive terminal of the capacitors are indicated by the (+) sign or a square pad on the R-51SD board. The capacitors have labels to indicate their polarity and value. Often, the negative terminal is indicated by a minus (-) sign.

### 3.2.2 Headers

J1 is the serial connector for the board. It is a 1x6 100mil header.

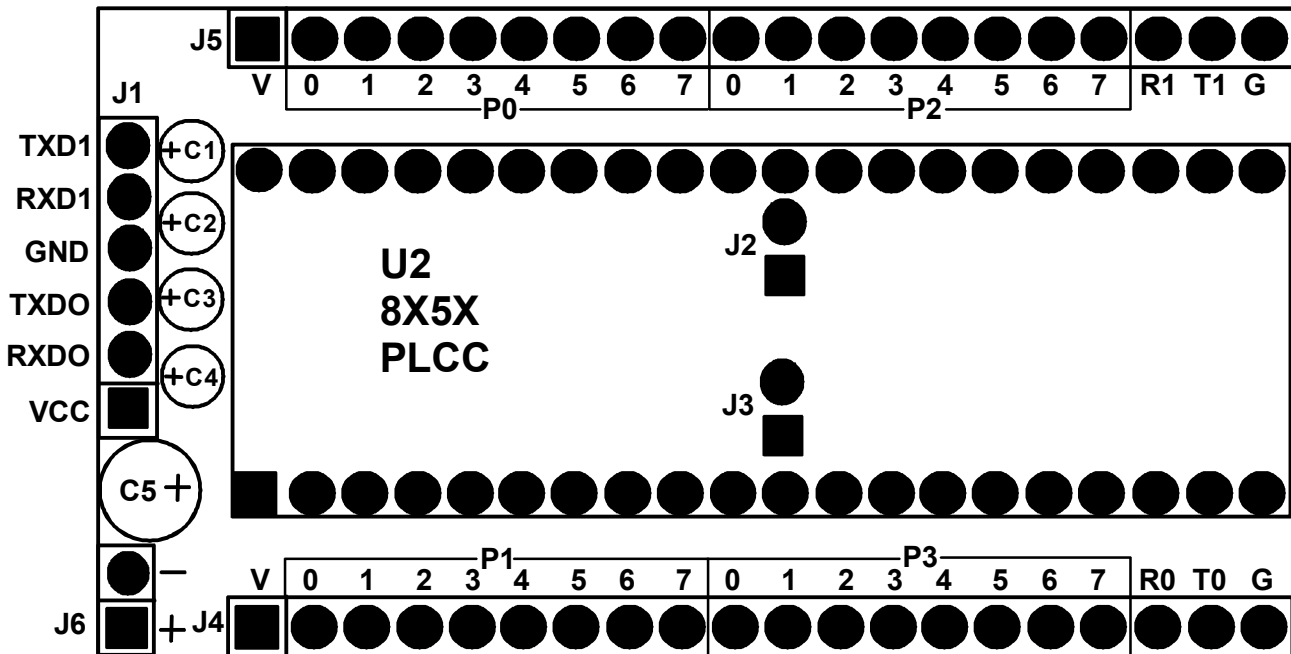
J4 and J5 are the connectors used to access the signals on the board. They are 1x20 100mil headers. The headers are labeled on the board with the corresponding signals available.

J6 is the header that brings the 5-volt operating current to the board. A 1x2 100mil header is used for the power connector. The positive terminal of J6 is marked by a '+' on the R-51SD board.

J2 and J3 are used to activate the second serial port on the board. Normally they will not be populated.

### 3.2.3 Sip Sockets, U2

U2 uses two 20-pin sip sockets. The 20-pin sip sockets are single-in-line sockets designed to make assembly of this board easier. When populating these sip sockets please make sure that they are square to the board. If they are tipped it will make populating the sockets with the 8x5x more difficult.



## 4 VISUAL INSPECTION

Most of the problems in assembling the R-51SD are due to faulty solder joints. Inspect each solder joint, looking for missing solder, too much solder, shorts between pins or tracks due to excessive solder. Remove excessive solder with solder wick. Care taken for a thorough visual inspection often saves time in the long run.

## 5 POWER SUPPLY TESTING

Before any of the ICs are inserted, connect a 5 Volt power supply to the power header JP6 on the board. Verify the voltage on the Vcc and Ground pins of the sockets for U1, U2, and U3.

**The ICs have a notch or mark on one end.  
This must be matched with the silk-screen notch on the board.**

When the notch is to the left, and viewed from the top, the lower leftmost pin is pin 1. Pins in the lower row are enumerated, from left to right. For example, the last pin in the bottom row of U1 is pin 8. The pins on the upper row are enumerated from right to left (thus, continuing in the counterclockwise direction). The right most pin in the top row of U1 is pin 9, and the leftmost, pin 16.

IC Socket	IC	Vcc Pin	Ground Pin
U1	MAX232	16	15
U2	8x5x	40	20
U3	Clock	1, 8	4

If supply voltages are not observed, inspect all tracks, connections, and solder joints.

## 6 FUNCTIONAL TESTING

You are now ready to insert the ICs and test the functionality of the board. In order to prevent permanent damage to the ICs, do not attempt this step if discrepancies were observed during the prior tests. Please note that all of the ICs are CMOS Complementary Metal Oxide Semiconductors), which are affected by static

**Do not insert or remove the ICs while the power is connected to the R-51SD.**

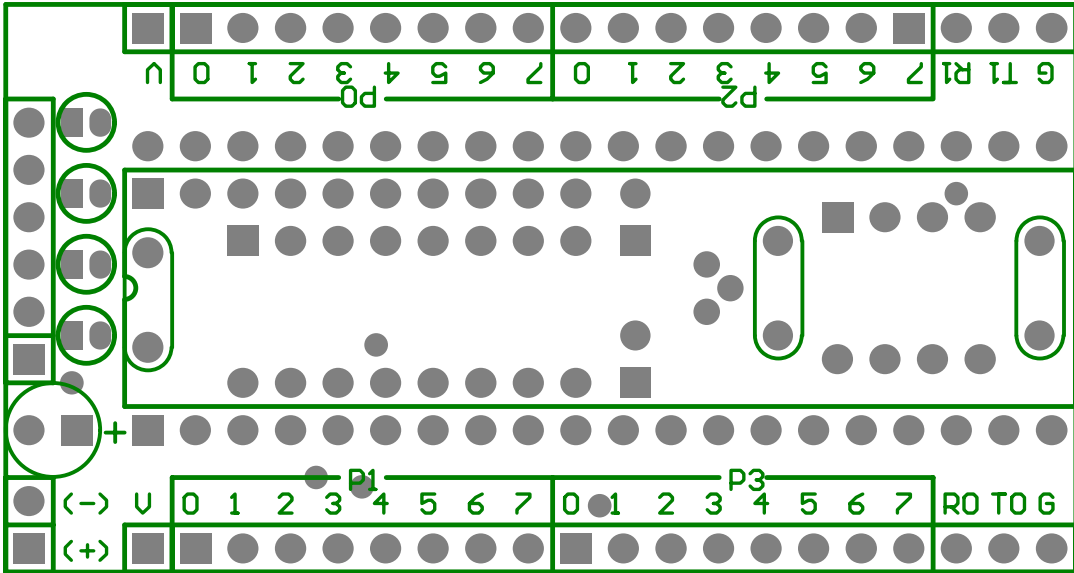
Also avoid exposure to static electricity. For example, the ICs may be zapped by static electricity collected on a sweater. Ground yourself, or touch a good conductor to ground before handling the ICs. Disconnect the power. Insert the ICs, observing their orientation. The ICs have a notch or mark on one end. This must be matched with the notch on the board overlay and should match the notch on the socket. Connect the power supply.

## 7 R-51SD BOARD PARTS LIST

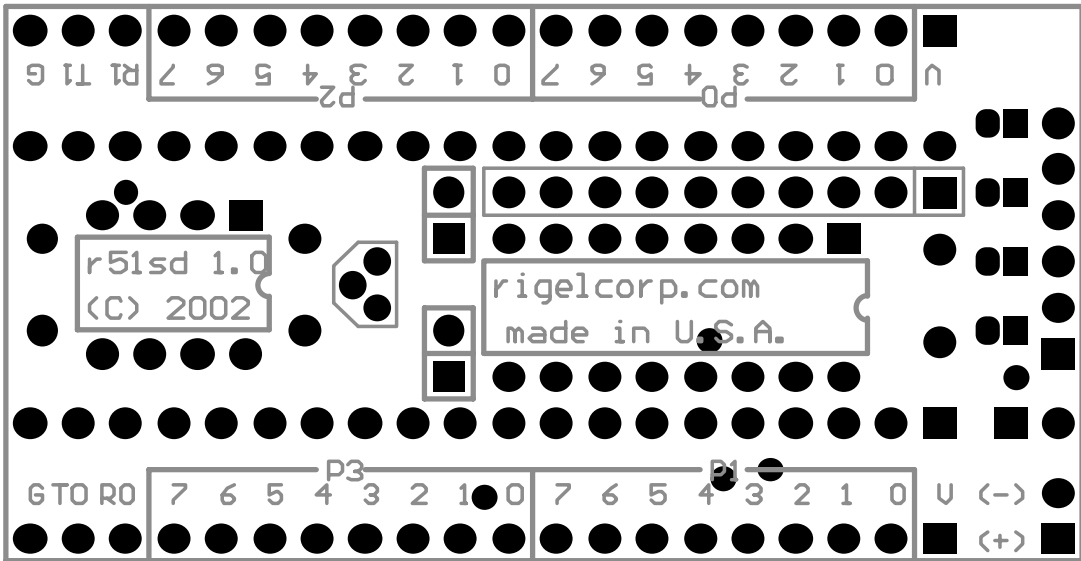
We give DigiKey part numbers for all components used on this board. Digikey has data sheets on-line for most of their parts so you can cross reference to different manufacturers and suppliers if you wish. In addition DigiKey accepts orders for single pieces and small dollar amounts, which you may pay for by credit card. DigiKey's web site is [www.digikey.com](http://www.digikey.com).

Quantity	Part	DigiKey Part Numbers	Designator
3	BP, 10-100nF	1206PHTR-ND (10nF)	C6, C7, C8
4	1uF, 50v	P992-ND	C1-C4
1	22uF-100uF, 16v	P5135-ND (22uF)	C5
1	10K, 10 Position Gang	770-101-R10K-ND	R1
1	1x6 Header	WM2726-ND	J1
1	1x2 Header	WM2722-ND	J6
2	1x20 Header	WM6920-ND	J4, J5
2	Wire Jumper	Optional	J2, J3
1	16 Pin Dip	ED3116-ND	U1
2	20 Pin Sip Sockets	A208-ND	U2
1	8 Pin Dip	ED3108-ND	U3
1	MAX232	296-1402-5-ND	U1
1	AT89C52-24PC (Any standard 40 pin dip chip with internal ROM may be used)	AT89C52-24PC	U2
1	24MHz Clock (This can be changed to match the speed of processor you are using)	SE1213-ND	U3
1	DS1812	DS1812-5-ND	U4

# 8 TOP OVERLAY



# Bottom Overlay



## **9 R-51SD SCHEMATICS**