R-51SP and R-51SD USER'S GUIDE

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1   OVERVIEW

The R-51SP and R-51SD boards are very low-cost chip carriers for 8051 family microcontrollers in the 44-pin PLCC and 40 pin dip packages. They contain a clock oscillator, a reset chip, and an RS-232 level converter. These support chips allow the microcontroller to be run in the single-chip mode. That is, running code from internal ROM, and using the on-chip RAM. The R-51SP / SD complement the line of MCS-51 single-chip mode products from Rigel Corporation. Most significantly, this line includes the programming / development board R-51PB and Reads51, Rigel's Integrated Development Environment, with a C compiler, and assembler, and a linker. Reads51 now supports code generation for the single-chip mode.

The R-51SP and R-51SD are intended to be embedded into the end product. Connections to the R-51SP and R-51SD may be through sockets, headers, or straight soldering into the ports. All integrated circuits except the reset chip are socketed. This makes the R-51SP and R-51SD disposable, as the expensive components may be removed and used over again. Moreover, the clock frequency is determined by the socketed oscillator chip. This way, the clock frequency may be changed simply be replacing this chip.

2   SOFTWARE DEVELOPMENT AND PROGRAMMING THE ROM

Code must be downloaded into the ROM of the microcontroller before it is inserted into the R-51SP or R-51SD board. You may use any software development tool and any chip programmer that supports the 8051 family. Rigel offers Reads51 for code development and a programmer / development board, the R-51PB with rP51 programming software, specifically designed to program the ROM on 8051-family microcontrollers. For more information on Reads51 and R-51PB visit our web site www.rigelcorp.com. Please see the references at the end of this document for more information.

3   BOARD CONNECTIONS

The connections to the R-51SP and R-51SD boards are made through the terminals placed along the peripheral of the boards. The port terminals are placed along the two longer sides of the board. The terminals may be populated by headers or sockets, and the application signals may be applied through mating connectors. The headers or sockets may be connected from the top or the bottom of the boards. Alternatively, these terminals may be left as open holes and the application signals may be directly soldered to the terminals. These options are intentionally left open to provide the maximum level of flexibility in the physical assembly of the final product.

The connections to the boards may be classified into three categories: power connections, serial communications signals, and port connections. These categories are presented below. There are several alternate ways to connect the R-51SP and R-51SD boards to the application. Refer to the board layout and the circuit diagrams when considering these options.

3.1   Power connections

The R-51SP and R-51SD boards require a well-regulated 5Volt DC supply. The power is connections are marked with a V (+5V) and G (ground) on the boards. The dedicated power header J6 may be used for power. In addition, the port terminals placed along the two longer sides of the board terminate have power posts. This is convenient if a single harness of power and port signals is to be used. Similarly, the serial communications signals at the dedicated terminal J1 terminate with power posts. Again, a single harness carrying power and the serial communications signals may be used.
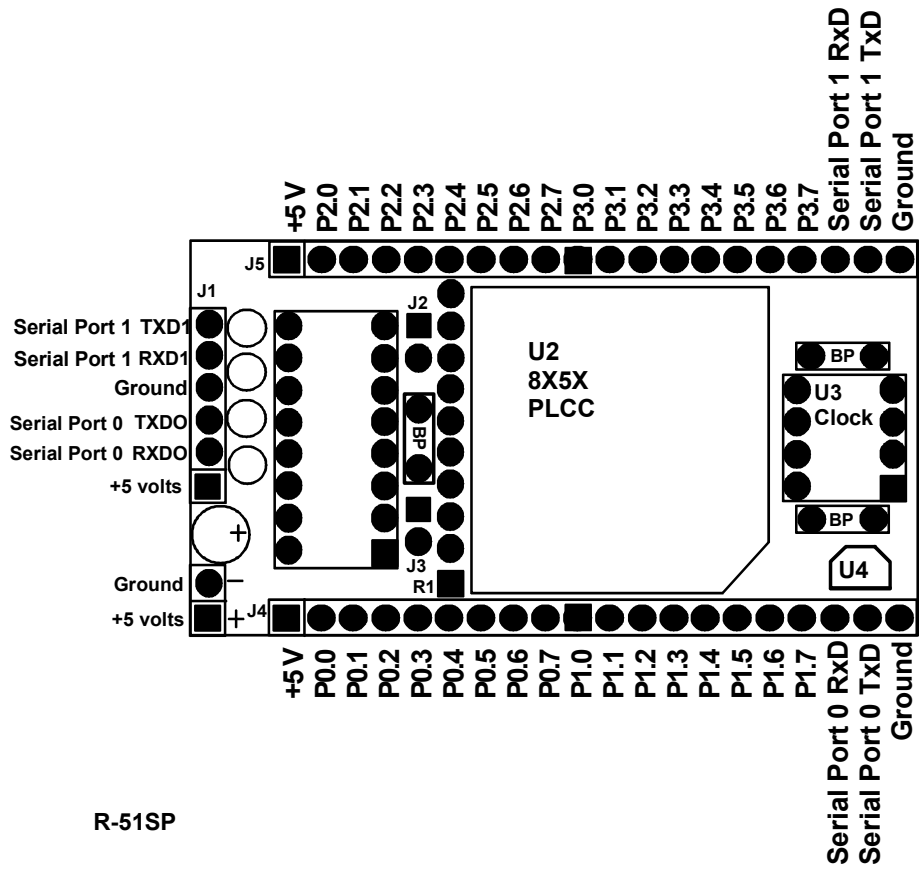
3.2   Serial communications signals

The original 8051 microcontrollers have a single serial port. Connections to the serial port require three signals, transmit (TxD), receive (RxD), and the ground (reference) signal.   The serial communications signals are available on the dedicated header J1. As mentioned, J1 also carries the power signals. For applications not requiring port input/output, but simply serial communications, the connection to the board may be through a single harness connected to J1. Serial communications signals are also available at the end of the port posts. One side contains the RxD and TxD signals for port 0, marked R0 and T0. The other has the same for port 1, marked R1 and T1.

Some of the newer microcontrollers contain a second serial port. To access the second serial port on these processor insert the jumpers J2 and J3, which are not normally populated on the boards.
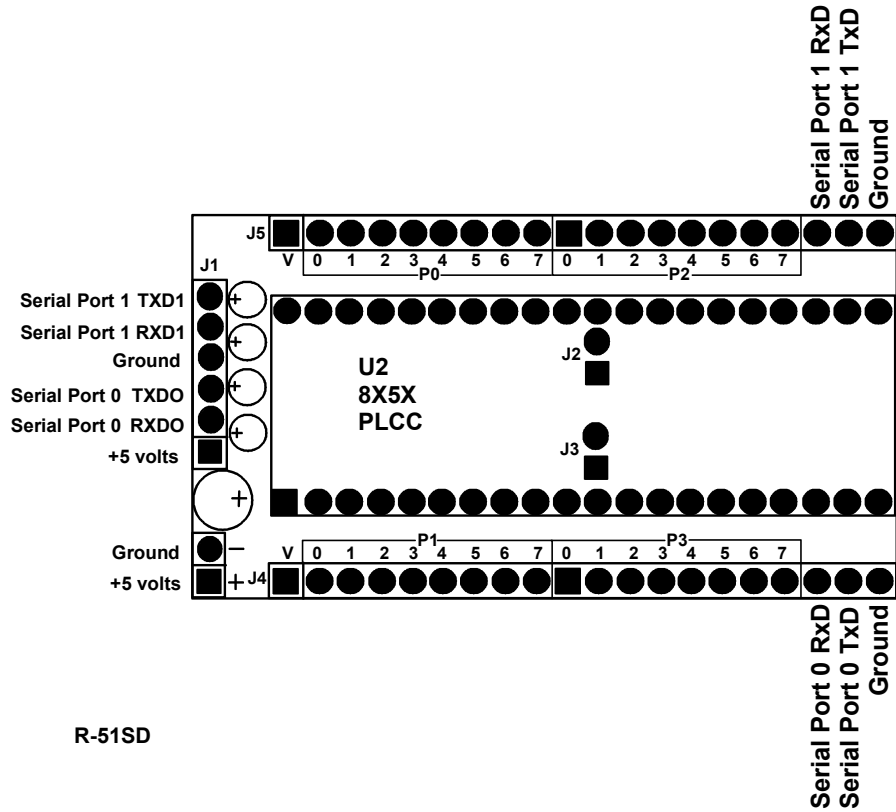
3.3   Port connections

The microcontroller has 32 ports. These are terminated along the two longer sides of the board. The port terminals also contain the power and serial communications signals.

The following diagrams show the port connections.

R-51SP

J5
+5 V P2.0 P2.1 P2.2 P2.3 P2.4 P2.5 P2.6 P2.7 P3.0 P3.1 P3.2 P3.3 P3.4 P3.5 P3.6 P3.7 Serial Port 1 RxD Serial Port 1 TxD Ground

J1
Serial Port 1 TXD1
Serial Port 1 RXD1
Ground
Serial Port 0 TXD0
Serial Port 0 RXD0
+5 volts
Ground
+5 volts

J2
J3
R1

U2
8X5X
PLCC

BP
U3
Clock
BP
U4

J4
+5 V P0.0 P0.1 P0.2 P0.3 P0.4 P0.5 P0.6 P0.7 P1.0 P1.1 P1.2 P1.3 P1.4 P1.5 P1.6 P1.7 Serial Port 0 RxD Serial Port 0 TxD Ground

R-51SD

J5
Serial Port 1 RxD Serial Port 1 TxD Ground

J1
Serial Port 1 TXD1
Serial Port 1 RXD1
Ground
Serial Port 0 TXD0
Serial Port 0 RXD0
+5 volts
Ground
+5 volts

V 0 1 2 3 4 5 6 7 P0
0 1 2 3 4 5 6 7 P2

U2
8X5X
PLCC

J2
J3

V 0 1 2 3 4 5 6 7 P1
0 1 2 3 4 5 6 7 P3

J4
Serial Port 0 RxD Serial Port 0 TxD Ground

3

4   OPERATING NOTES

4.1   Oscillator Frequency

The R-51SP and R-51SD boards use a socketed oscillator chip. The oscillator frequency may be changed simply be replacing this chip.

4.2   Reset

The R-51SP and R-51SD boards use a dedicated reset chip, the DS1812. The board is reset upon power up. Cycle the power (turn the power off and then on again) to induce a reset.

4.3   Serial Ports

4.3.1   Serial Port 0

Serial port 0 uses P3.0 and P3.1. When the serial port is used, these ports should not be used for general-purpose input/output. If no serial port is needed, ports 3.0 and 3.1 may be used for general-purpose input/output provided that the RS-232 level converter chip U1 is removed from its socket.

4.3.2   Serial Port 1

Similarly, the second serial port (serial port 1) uses P1.0 and P1.1. The port bits P1.0 and P1.1 are connected to the RS-232 level converter through two jumpers, J2 and J3. Populate these jumpers if the second serial port is to be used. Otherwise, leave these jumpers unpopulated. When the second serial port is not used, the ports P1.0 and P1.1 may be used for general-purpose input/output. Microcontrollers that do not have a second serial port may still use P1.0 and P1.1 for serial communications, provided that the communication routines are implemented in software.

4.4   Input/Output Ports

The R-51SP and R-51SD input/output ports are directly connected to the ports of the microcontroller. The MCS-51 ports are quasi-bi-directional ports. They use pull-up resistors to be at logic level high. When used as inputs, the external signal must ground the port for the microcontroller to read a logic level low. Refer to the 8051 data books for more information. Several examples are also provided in the textbooks by Rigel Press (see references).

5   PARTS LIST

The parts list for the R-51SP and R-51SD boards are the same except for the microcontroller package. The R-51SP uses a microcontroller in the 44-pin PLCC package, and the R-51SD uses one in the 40-pin DIP package.

5.1   R-51SP

Quan	Part	Designator	DigiKey Part Numbers	Description
4	1uF	C1, C2, C3, C4	P993-ND	
1	22uF-100uF	C5	P5135-ND (22uF)	capacitors
3	10nF-100nF	C6, C7, C8	1206PHTR-ND (10nF)	
1	10K	R1	770-101-R10K-ND	Gang resistor (9 resistors, SIP 10
1	1x6 header	J1	WM2726-ND	serial comm. signals header
2	1x2 jumper	J2, J3	(Optional)	second serial port jumpers
2	1x20 header	J4, J5	WM6920-ND	port connections
1	1x2 header	J6	WM2722-ND	power connection
1	16 Pin Dip	U1	ED3116	Socket
2	44 PLCC	U2	ED80024	Socket
1	8 Pin Dip	U3	ED3108	Socket
1	MAX232	U1	296-1402-5-ND	RS-232 level converter
1	8052	U2	AT89C52-24JC	44-pin PLCC with ROM
1	24MHz	U3	SE1213	clock oscillator
1	DS1812	U4	DS1812-5-ND	positive reset

5.2   R-51SD

| Quan	Part	Designator	DigiKey Part Numbers	Description
4	1uF	C1, C2, C3, C4	P993-ND	
1	22uF-100uF	C5	P5135-ND (22uF)	capacitors
3	10nF-100nF	C6, C7, C8	1206PHTR-ND (10nF)	
1	10K	R1	770-101-R10K-ND	Gang resistor (9 resistors, SIP 10)
1	1x6 header	J1	WM2726-ND	serial comm. signals header
2	1x2 jumper	J2, J3	(Optional)	second serial port jumpers
2	1x20 header	J4, J5	WM6920-ND	port connections
1	1x2 header	J6	WM2722-ND	power connection
1	16 Pin Dip	U1	ED3116	Sockets
2	20 Pin Sip	U2	A208-ND	Sockets
1	8 Pin Dip	U3	ED3108	Sockets
1	MAX232	U1	296-1402-5-ND	RS-232 level converter
1	8052	U2	AT89C52-24PC	40-pin DIP with ROM
1	24MHz	U3	SE1213	clock oscillator
1	DS1812	U4	DS1812-5-ND	positive reset

6   TOP OVERLAY

6.1   R-51SP
Top Overlay
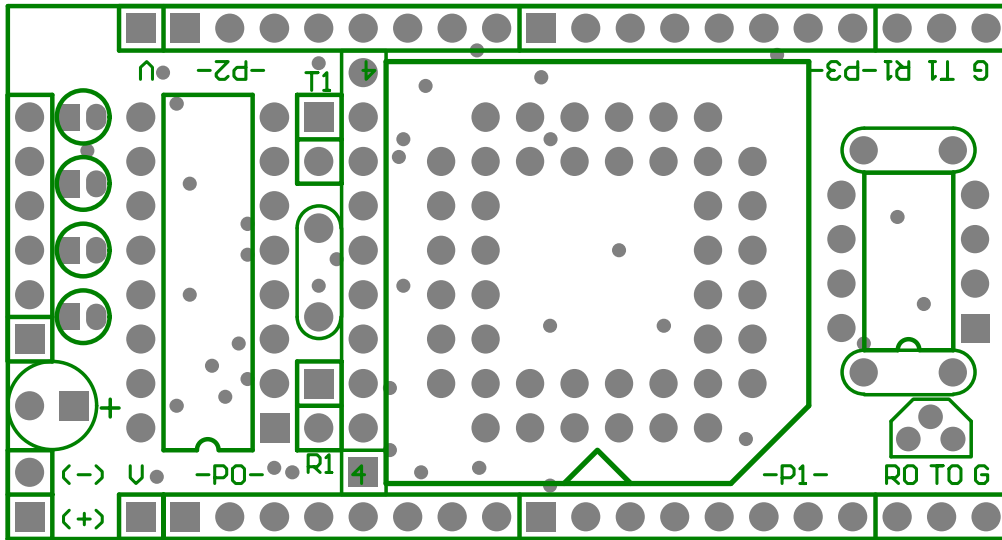
6.2   R-51SD

Top Overlay
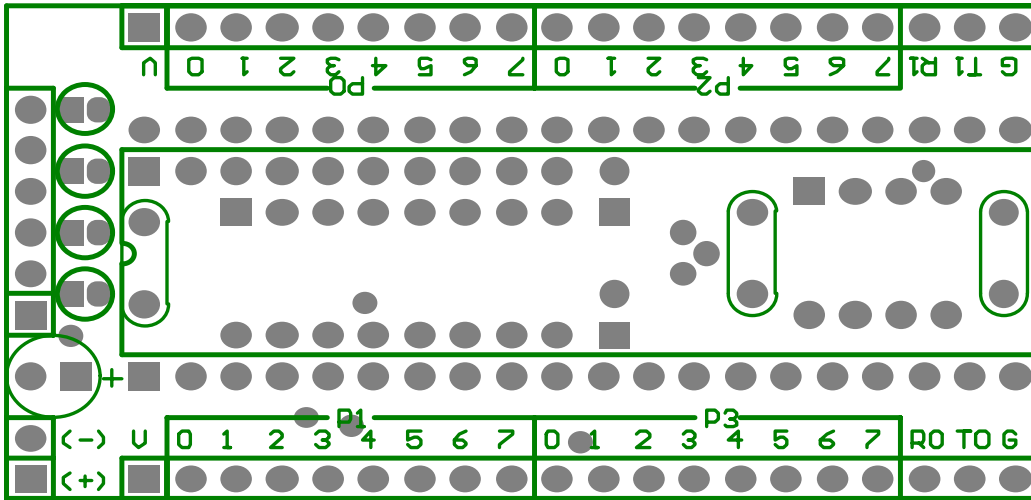
Bottom Overlay
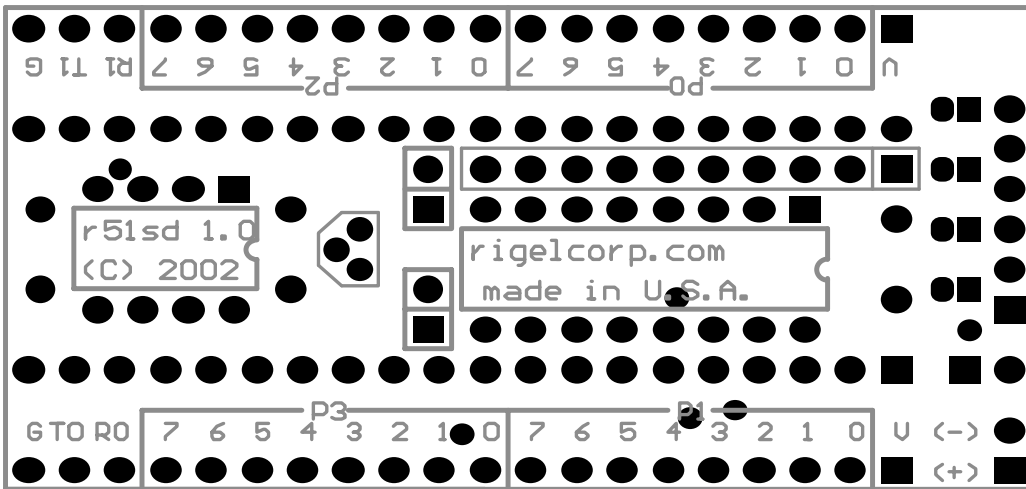
7   SCHEMATICS

Schematics not given on-line

8   REFERENCES

Books

"Programming and Interfacing the 8051 in C and Assembly" published by Rigel Press

"The 8051 Cookbook for Assembly and C" published by Rigel Press

User's Manuals

Reads51 User's Guide,   download from www.rigelcorp.com

R-51PB User's Manual,   download from www.rigelcorp.com

Data Sheets

Atmel, Philips, Dallas Semiconductor, … Data sheets and User's Guides, download from chip manufacturer's web sites