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## Features

- **Hardware**
  - **ATSTK94 Onboard Features**
    - Programmable Switches, LEDs and Alphanumeric Displays
    - Two RS232 Compatible Serial Ports
    - Multiple Clocks (4 MHz, 18.432 MHz, 32.768 kHz and Manual)
    - 2-wire Serial Interface for Communication
    - Easy Access to all FPSLIC Pins via Headers
    - Push Button AVR and FPSLIC Reset
  - Supports both Drop-In and In-System Programming (ISP)
  - Runs Off Portable 9V DC Power Supply
  - Designed to Work with Atmel System Designer™ 1.0 or Above
- **Software**
  - **Atmel's System Designer**
    - Atmel's AVR Studio®
    - Atmel's Configurator Programming System (CPS)
    - Co-verification, Powered by Mentor Graphics
    - Exemplar's LeonardoSpectrum™
    - Model Technology™'s ModelSim®
    - Several C Compiler Evaluation Copies
  - Atmel's Integrated Development System (IDS) – FPGA Place & Route Tool
  - Supports Windows® 95/98/2000/Me and WindowsNT®
  - Online Help
- **Contents**
  - ATSTK94 Starter Kit Board with 1 Configurator
  - ATDH2225 Programming Dongle with 10-pin Ribbon Cable
  - 9V DC, 200 mA, 2.1 mm Center Positive Power Supply
  - Atmel System Designer CD with Evaluation License (4 Months)
  - Detailed User Guide including Complete Board Schematics
  - Software Tutorial and Sample Designs on Floppy Disk

## Description

Atmel's AT94K Starter Kit (ATSTK94) allows designers to, quickly and economically, evaluate Atmel's family of AT94K Field Programmable System Level Integrated Circuit (FPSLIC) devices and AT17 FPSLIC Configuration Memory devices. The ATSTK94, see Figure 1, board connects to any x86 PC via the parallel port through a 10-pin header cable to program the AT17 FPSLIC Configuration EEPROM, which in turn programs the AT94K FPSLIC device. A truly portable solution, which allows engineers to prototype and develop designs from their lab bench or office.



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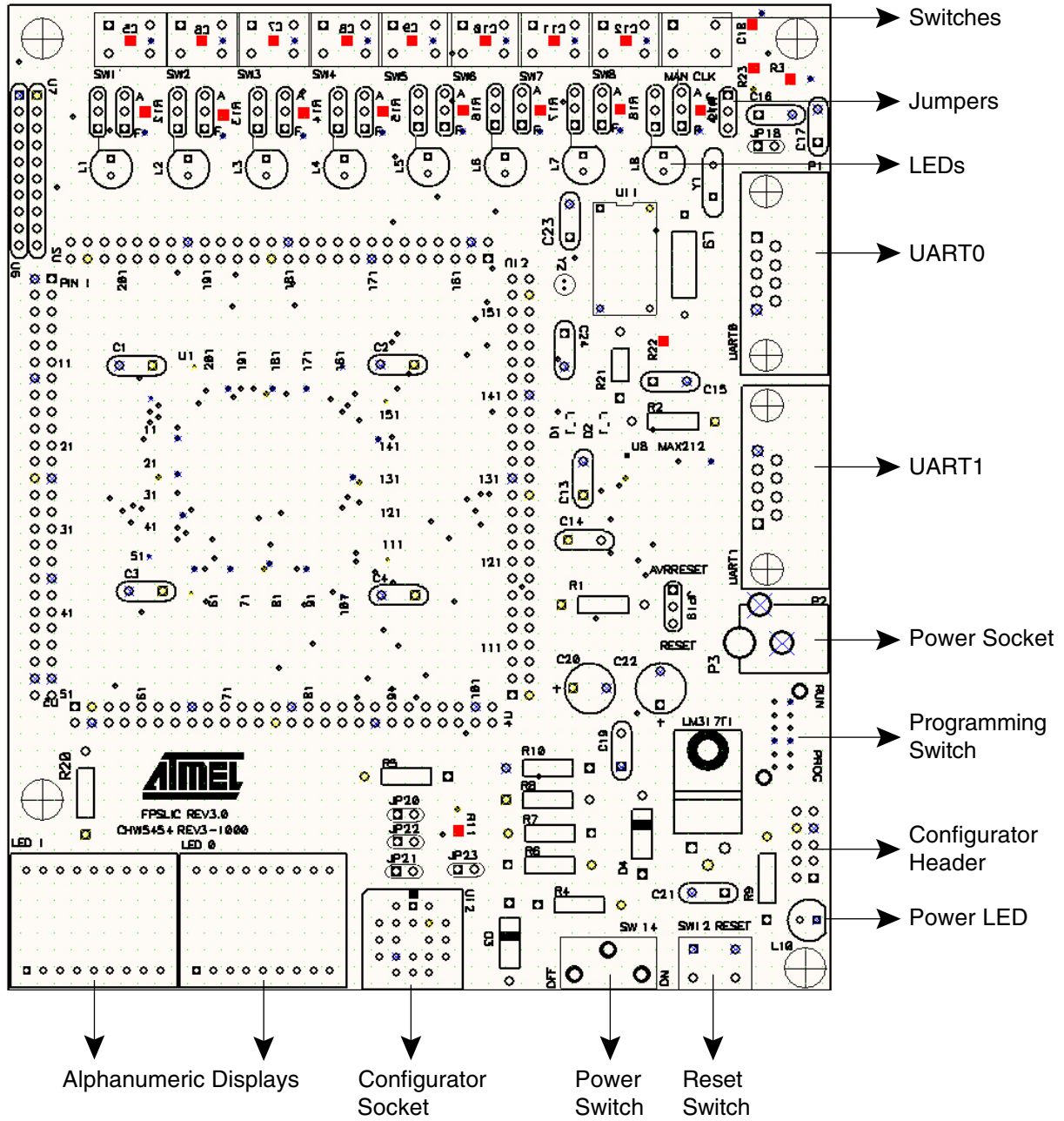
## Starter Kit



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## Programmable SLI ATSTK94

Figure 1. ATSTK94 FPSLIC Starter Kit Board



## Switches, LEDs, and Alphanumeric Displays

The user configures each Programmable Switch or LED for use, with either the FPGA or AVR portion of the FPSLIC device. Furthermore, some switches may be configured for use as AVR External Interrupts allowing simulation of external events. The board features four Alphanumeric Displays which are connected to I/O pins of the embedded AT40KAL FPGA core.

## Program and Run Switch

The Program and Run Switch controls the connection from the download cable to the Configurator and the Configurator to the FPSLIC.

In the PROG position you can use the download cable and CPS to program the configuration memory with your FPSLIC Bitstream file generated by System Designer.

In the Run position the FPSLIC device will load the Bitstream file and run your design. If the design does not start, you can use the RESET button with JP19 in the RESET position to force a reconfiguration of the device. In the Run position, the configurator will boot the FPSLIC device with the current program.

## ISP and Reset Connections

There are 2 device reset connections in the FPSLIC device.

The AVR RESET will reset the AVR and start from the reset vector in the interrupt table.

RESET will cause the whole device to reset and reboot from the Configurator.

SW12 is used to perform the reset. Jumper 19 is used to determine whether it will be an AVR reset or a full device reset, see Table 1.

If you have logic RESET signal in your design, you cannot use SW12 to perform this reset; you should use one of the switches SW 1 – 8 to perform your design reset. Your design reset can be connected to any User IO on the FPGA side of FPSLIC. If you are using SW1 – 8, then you should use Pin locks to assign the correct user IO for the correct Switch.

**Table 1.** Reset Connections

RESET	Source	Pin	Hardware Settings
RESET	SW12	108	JP19 Set to RESET (Default)
AVR RESET	SW12	48	JP19 Set to AVR RESET

## Button/Switch Connections

The jumpers, located next to the buttons/switches control the button/switch connections, see Table 2.

The left side of the jumpers are connected to LEDs, the right side of the jumpers are connected to Switches.

The A and F markings indicate a connection to the AVR or the FPGA.

When you press the switch it generates a “1”.

**Table 2.** Switch Connections

Switch	Destination	Pin	Hardware Settings
SW1	FPGA User IO	202	Jumper Set to F
SW2	FPGA User IO	198	Jumper Set to F
SW3	FPGA User IO	192	Jumper Set to F
SW4	FPGA User IO	188	Jumper Set to F
SW5	FPGA User IO	180	Jumper Set to F
SW6	FPGA User IO	176	Jumper Set to F
SW7	FPGA User IO	172	Jumper Set to F
SW8	FPGA User IO	168	Jumper Set to F
SW1	AVR Interrupt INTP0	135	Jumper Set to A
SW2	AVR Interrupt INTP1	145	Jumper Set to A
SW3	AVR Interrupt INTP2	146	Jumper Set to A
SW4	AVR Interrupt INTP3	152	Jumper Set to A
SW5	AVR PortE PE0	109	Jumper Set to A
SW6	AVR PortE PE1	110	Jumper Set to A
SW7	AVR PortE PE2	113	Jumper Set to A
SW8	AVR PortE PE3	122	Jumper Set to A

## LED Connections

The jumpers, located next to the LEDs, control the LED connections.

Alternate jumpers connect to the switches, see Table 3, and to the LEDs. A white line on the silk screen indicates whether the jumper is for LED or the Switch.

With the A F text the right way up the left most Jumper is for the LED 1. The A and F markings indicate a connection to the AVR or the FPGA.

When you drive a “1” to the LED it will light.

**Table 3.** LED Connections

LED	Source	Pin	Hardware Settings
L1	FPGA User IO	200	Jumper Set to F
L2	FPGA User IO	196	Jumper Set to F
L3	FPGA User IO	190	Jumper Set to F
L4	FPGA User IO	186	Jumper Set to F
L5	FPGA User IO	178	Jumper Set to F
L6	FPGA User IO	174	Jumper Set to F
L7	FPGA User IO	170	Jumper Set to F
L8	FPGA User IO	166	Jumper Set to F
L1	AVR PortD PD0	111	Jumper Set to A
L2	AVR PortD PD1	112	Jumper Set to A
L3	AVR PortD PD2	114	Jumper Set to A

**Table 3.** LED Connections

LED	Source	Pin	Hardware Settings
L4	AVR PortD PD3	120	Jumper Set to A
L5	AVR PortD PD4	121	Jumper Set to A
L6	AVR PortD PD5	126	Jumper Set to A
L7	AVR PortD PD6	127	Jumper Set to A
L8	AVR PortD PD7	134	Jumper Set to A

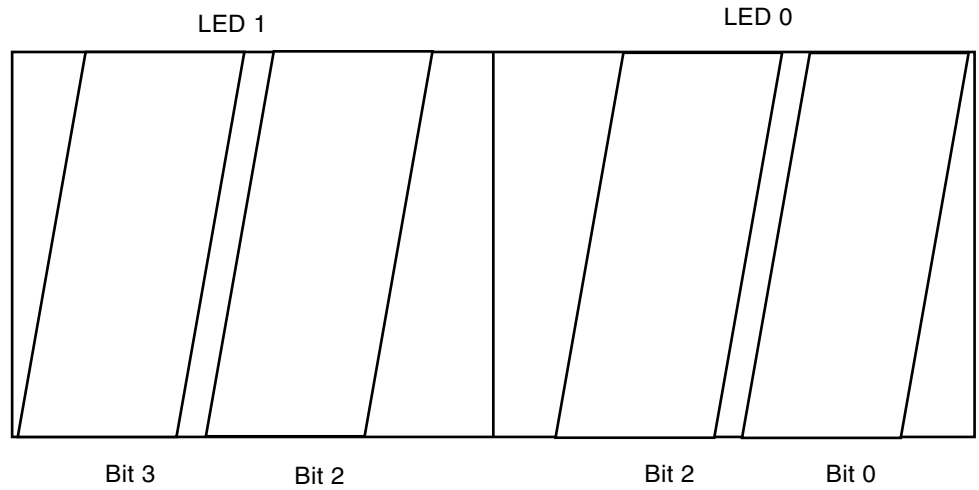
## Alphanumeric Connections

There are 4 digits of Alphanumeric on the board. The connections to the Alphanumeric are shared between both bits on the same device, see Table 4. This means that Bit 0 and Bit 1 share connections, and Bit 2 and Bit 3 share connections for all the segments, see Figure 2. The difference in connection is in the cathode connection that selects between the 2 digits. The cathodes should be driven with a 1/10 Duty Cycle and a 0.1 ms Pulse Width, see Table 5.

**Table 4.** Alphanumeric Connections

LED 0	Source	Pin	LED 1	Source	Pin
Anode A	FPGA User IO	94	Anode A	FPGA User IO	73
Anode B	FPGA User IO	98	Anode B	FPGA User IO	80
Anode C	FPGA User IO	97	Anode C	FPGA User IO	76
Anode D	FPGA User IO	93	Anode D	FPGA User IO	72
Anode E	FPGA User IO	81	Anode E	FPGA User IO	59
Anode F	FPGA User IO	82	Anode F	FPGA User IO	60
Anode G	FPGA User IO	87	Anode G	FPGA User IO	66
Anode H	FPGA User IO	89	Anode H	FPGA User IO	69
Anode J	FPGA User IO	91	Anode J	FPGA User IO	70
Anode K	FPGA User IO	88	Anode K	FPGA User IO	68
Anode L	FPGA User IO	86	Anode L	FPGA User IO	65
Anode M	FPGA User IO	83	Anode M	FPGA User IO	61
Anode N	FPGA User IO	92	Anode N	FPGA User IO	71
Anode P	FPGA User IO	84	Anode P	FPGA User IO	63
Anode D.P.	FPGA User IO	95	Anode D.P.	FPGA User IO	74
Cathode Bit 1	FPGA User IO	85	Cathode Bit 1	FPGA User IO	64
Cathode Bit 2	FPGA User IO	96	Cathode Bit 2	FPGA User IO	75

**Figure 2. LEDs**



**Table 5. ASCII Code Table**

Value	DP	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
2	0	0	1	0	0	0	1	0	0	0	1	1	0	1	1	
3	0	0	1	0	0	0	1	0	0	0	0	1	1	1	1	
4	0	0	1	0	0	0	1	0	0	1	0	0	1	1	0	
5	0	0	1	0	0	0	1	0	0	1	0	1	1	0	1	
6	0	0	1	0	0	0	1	0	0	1	1	1	1	0	1	
7	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
8	0	0	1	0	0	0	1	0	0	1	1	1	1	1	1	
9	0	0	1	0	0	0	1	0	0	1	0	1	1	1	1	
a	0	0	1	0	0	0	1	0	0	0	1	1	1	1	1	
b	0	0	1	0	0	0	1	0	0	1	1	1	1	0	0	
c	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	
d	0	0	1	0	0	0	1	0	0	0	1	1	1	1	0	
e	0	0	1	0	0	0	1	0	0	1	1	1	0	1	1	
f	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	
.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
*	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	

## RS232-compatible UARTs

The RS232-compatible UARTs allow for communication between the two on-board UARTs through the null-modem cable. It is also possible for communication between the UARTs and other devices, such as your PC, by using a simple terminal program.

## UART Connections

The 2 UART connections, see Table 6, are made to DB9 connectors. Printf commands are sent out on UART 0.

**Table 6.** UART Connections

UART	Source/Destination	Pin	Hardware Settings
UART 0	RX0	140	Connect Cable to UART0
UART 0	TX0	141	Connect Cable to UART 0
UART1	RX1	149	Connect Cable to UART 1
UART1	TX1	150	Connect Cable to UART 1

## Multiple Clocks

There are multiple clock circuits on the Starter Kit. A Manual Clock or the 4 MHz Oscillator are connected to 2 of the FPGA Global Clock pins. The 32,768 KHz (for the implementation of the Real Time Clock calculations), 4 MHz, or 18.432 MHz can be used to drive the AVR. The FPGA has 8 Global Clocks, 2 of these (GCLK5 and GCLK6) can also be driven from the AVR system Clock. GCLK6 can alternatively be driven from the Watchdog timer or one of the timer counters. For full details on the Clock circuits in the FPSLIC device please refer to the AT94K datasheet available on the Atmel web site, at <http://www.atmel.com/atmel/acrobat/doc1138.pdf>.

**Table 7.** Clock Connections

Frequency	Destination	Pin	Hardware Settings
Manual Clock	FPGA GCLK7	162	Use MAN CLK Switch (SW9) to Pulse Clock
Available Global Clocks	FPGA GCLK1 FPGA GCLK2 FPGA GCLK3 FPGA GCLK4 FPGA GCLK7 FPGA GCLK8	4 47 57 100 162 204	
32,768 KHz Crystal	AVR TOSC 1	147	None
4 MHz Oscillator	AVR System Clock	138	For Rev2 – JP17 towards side of board, JP18 is unconnected. For Rev3 and beyond – Position of JP17 is changed, it is aligned with FPGA and AVR jumpers. JP17 is connected towards the inner side of the board, JP18 is unconnected.
18.432 MHz Crystal	AVR System Clock	138	For Rev2 – JP17 towards middle of board, JP18 connected. For Rev3 and beyond – Position of JP17 is changed, it is aligned with FPGA and AVR jumpers. JP17 is connected towards the edge of the board, JP18 is connected.

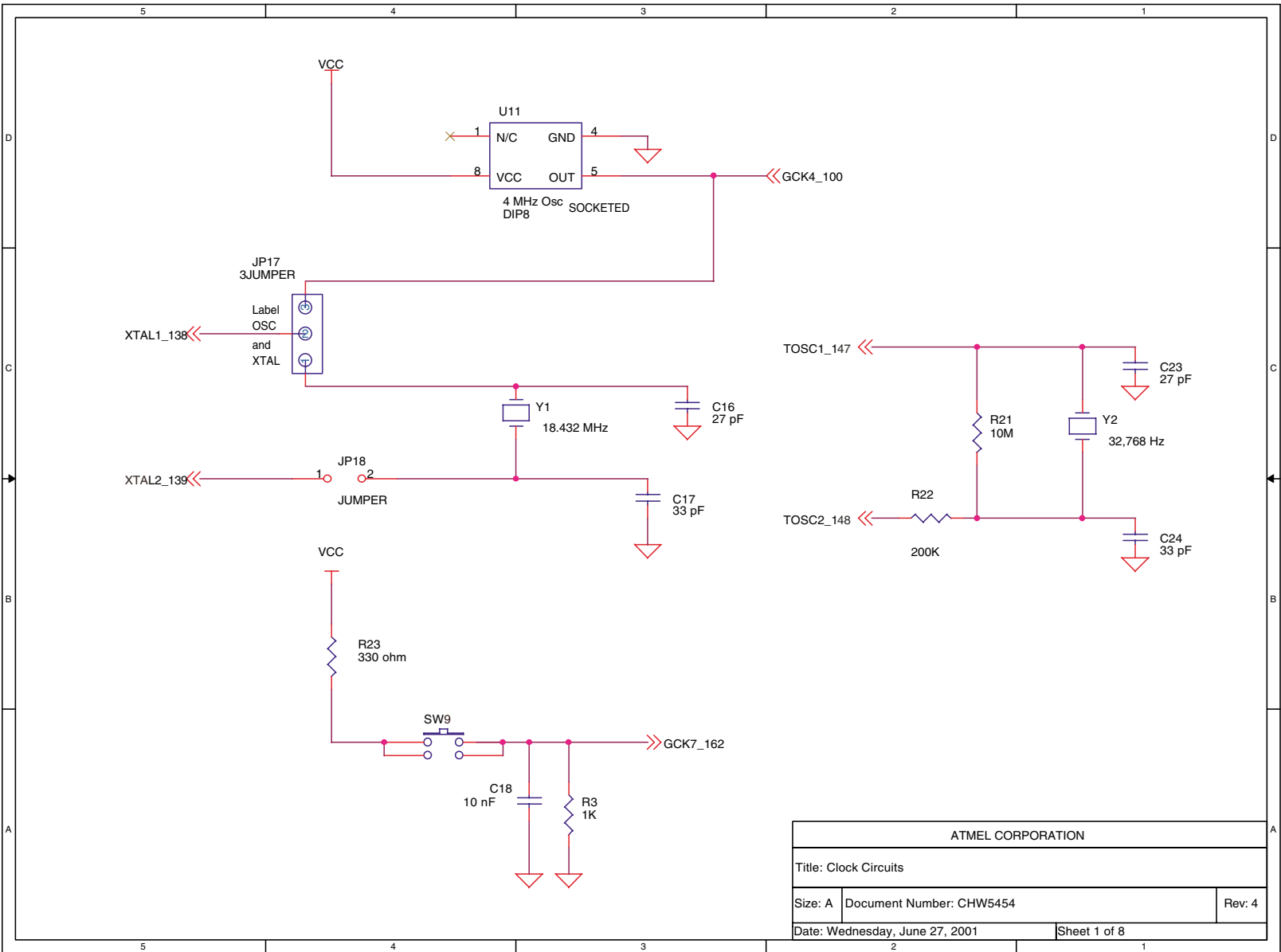


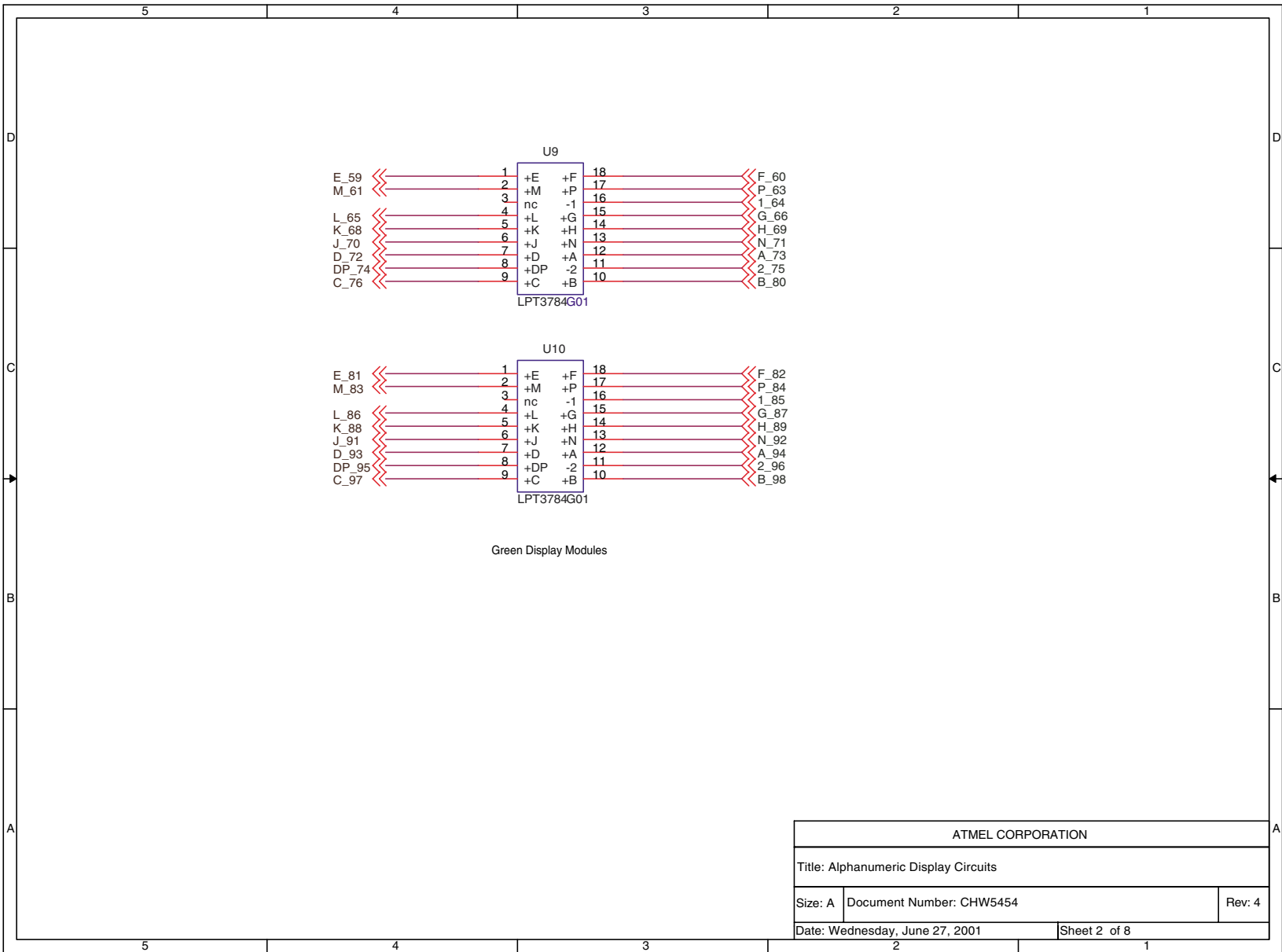
**2-wire Serial Interface** The 2-wire Serial Interface is the protocol from which the FPSLIC device receives configuration data from the AT17LV010 Configuration Memory. The maximum size of an AT94K40 design is approximately 800 kbits, thus leaving approximately 200 kbits of unused space. By using the 2-wire Serial Interface, it is possible to use the unused 200 kbits as external data storage memory.

## Related Documents

- ATSTK94 Starter Kit User Guide (Supplied with ATSTK94)
- AT94K Series datasheet, available at <http://www.atmel.com/atmel/acrobat/doc1138.pdf>.
- AT94K Series Configuration application note, available at <http://www.atmel.com/atmel/acrobat/doc2313.pdf>.
- AT17LV010 datasheet, available at <http://www.atmel.com/atmel/acrobat/doc0944.pdf>.
- Programming Specification for Atmel's Configuration EEPROMs, available at <http://www.atmel.com/atmel/acrobat/doc0437.pdf>.
- Additional application notes found on the Atmel web site, at <http://www.atmel.com/atmel/products/prod183.htm>.





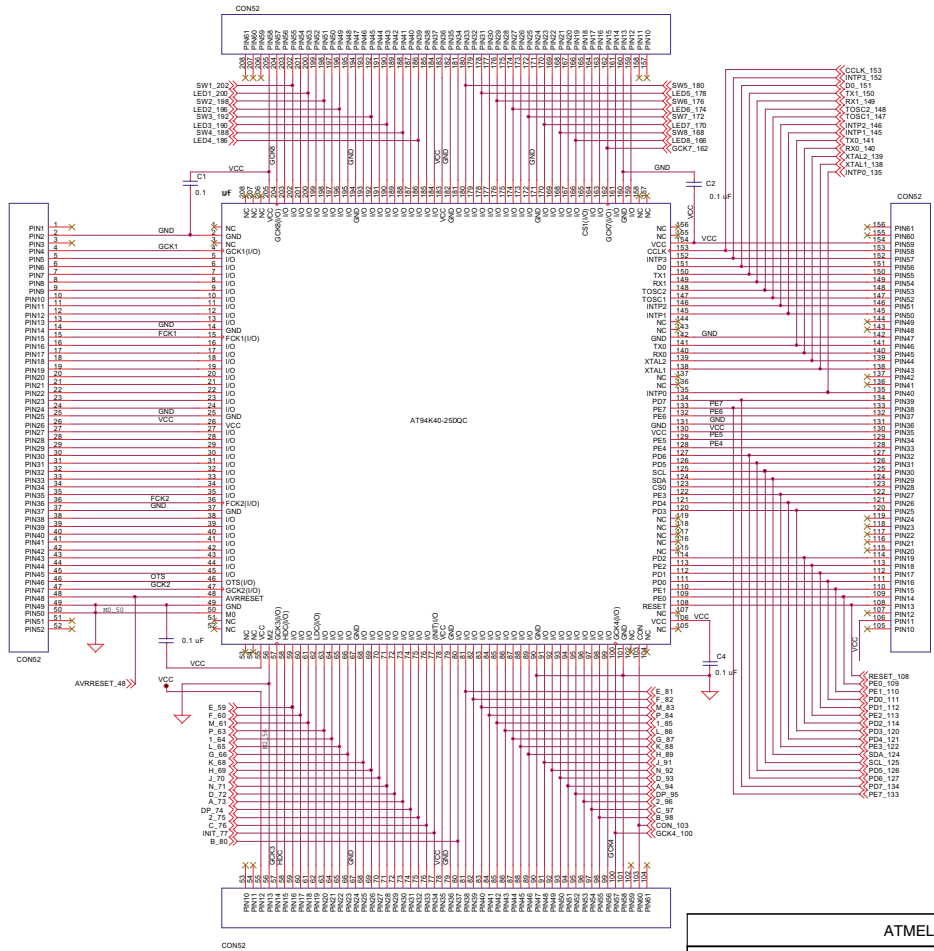


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Date: Wednesday, June 27, 2001	Sheet 2 of 8	



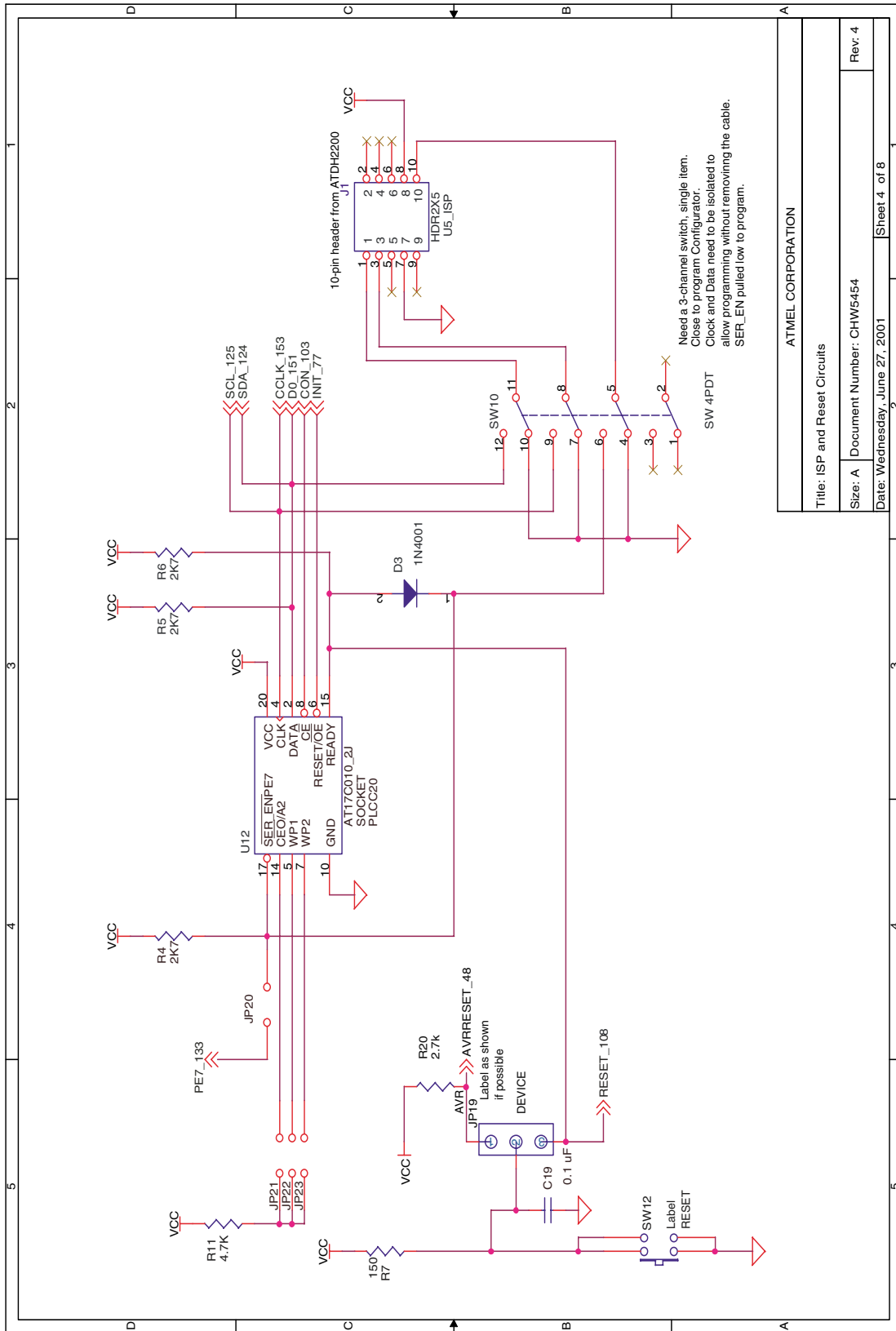
52 Pin Connectors are double rows of Probe pins, 26 x 2 on each side of the chip.

Add labels to connectors every 10 pins. Labels should match chip pin numbers up to 208.

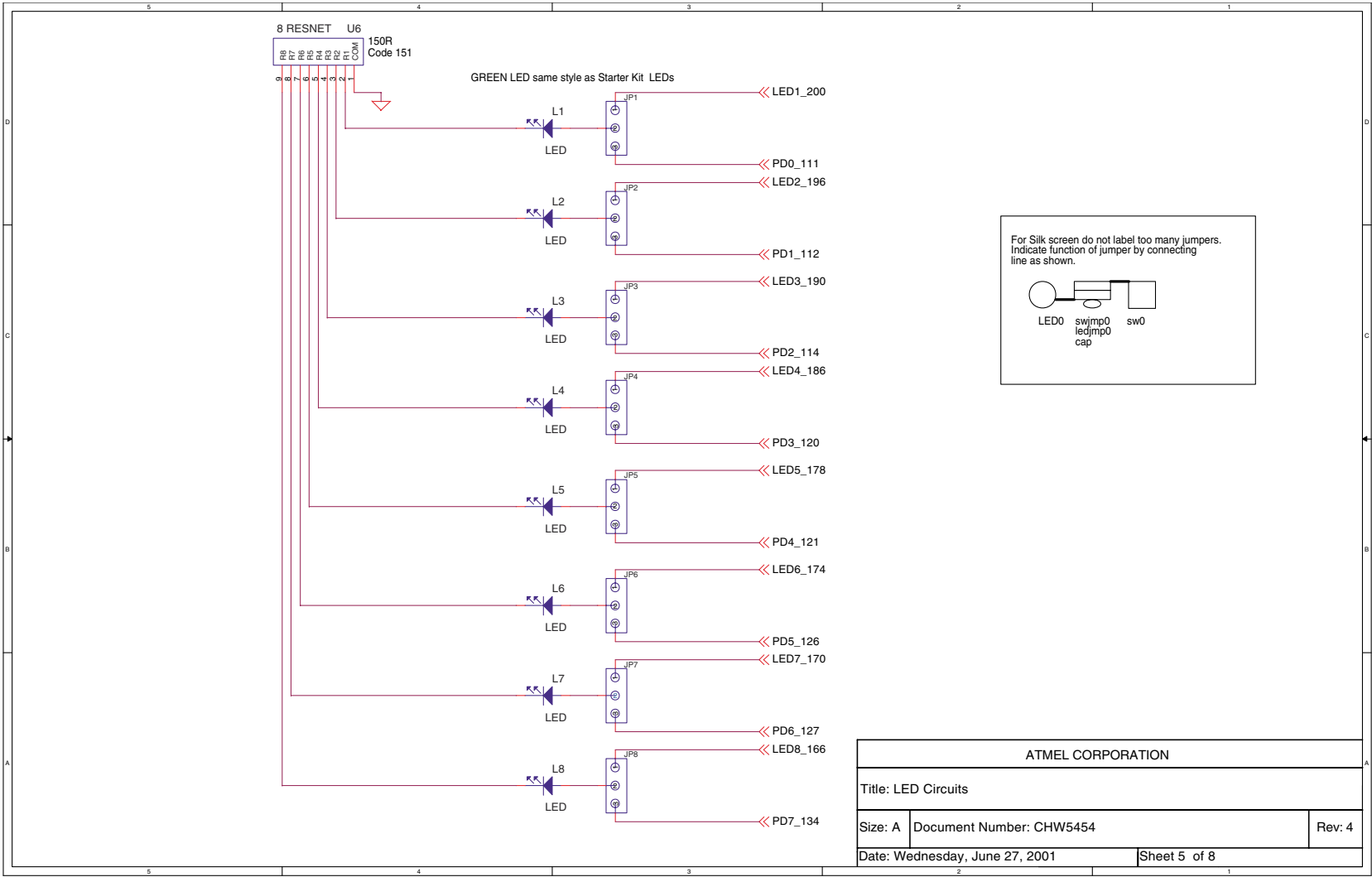


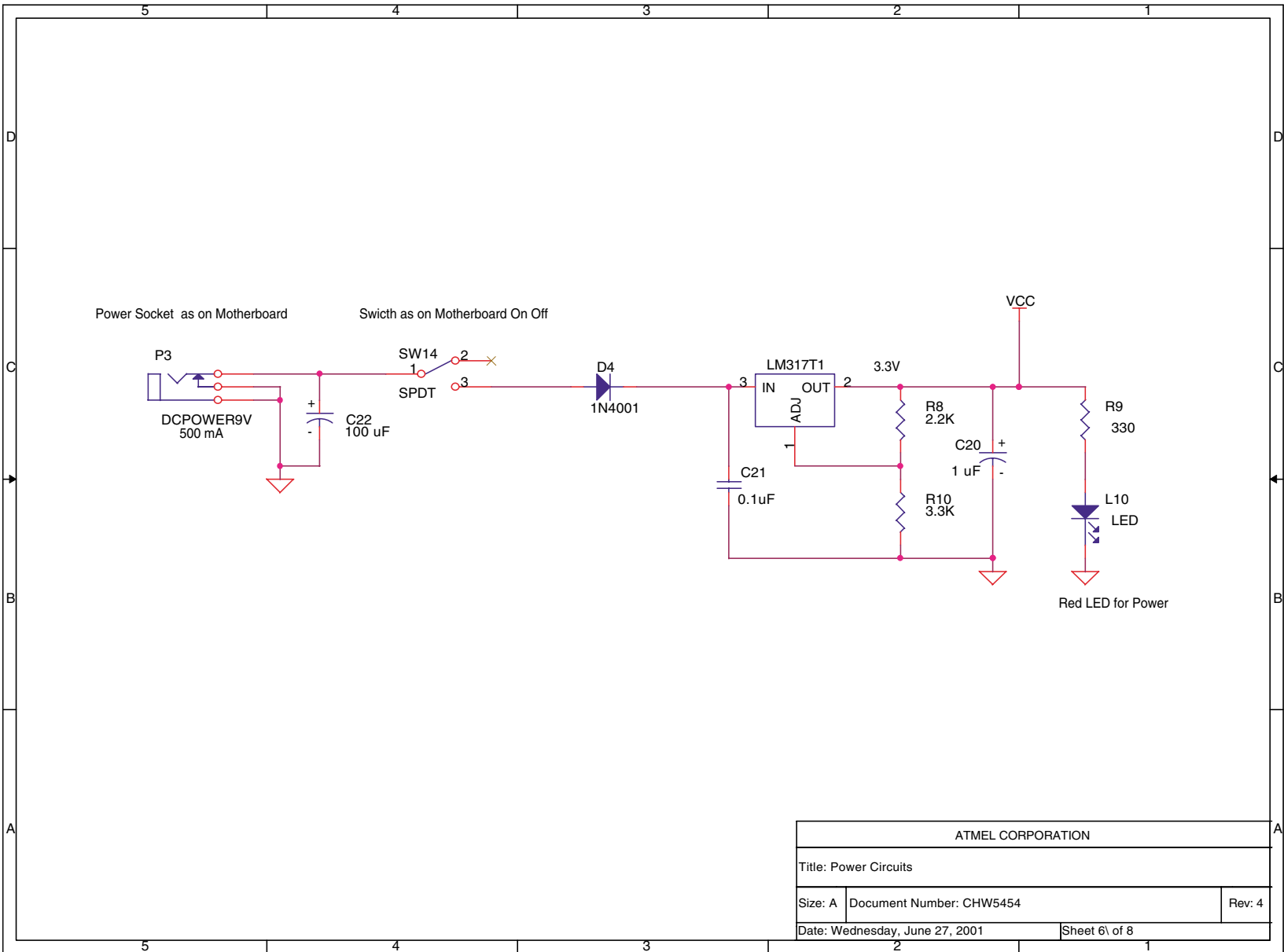
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Date: Wednesday, June 27, 2001	Sheet 3 of 8	

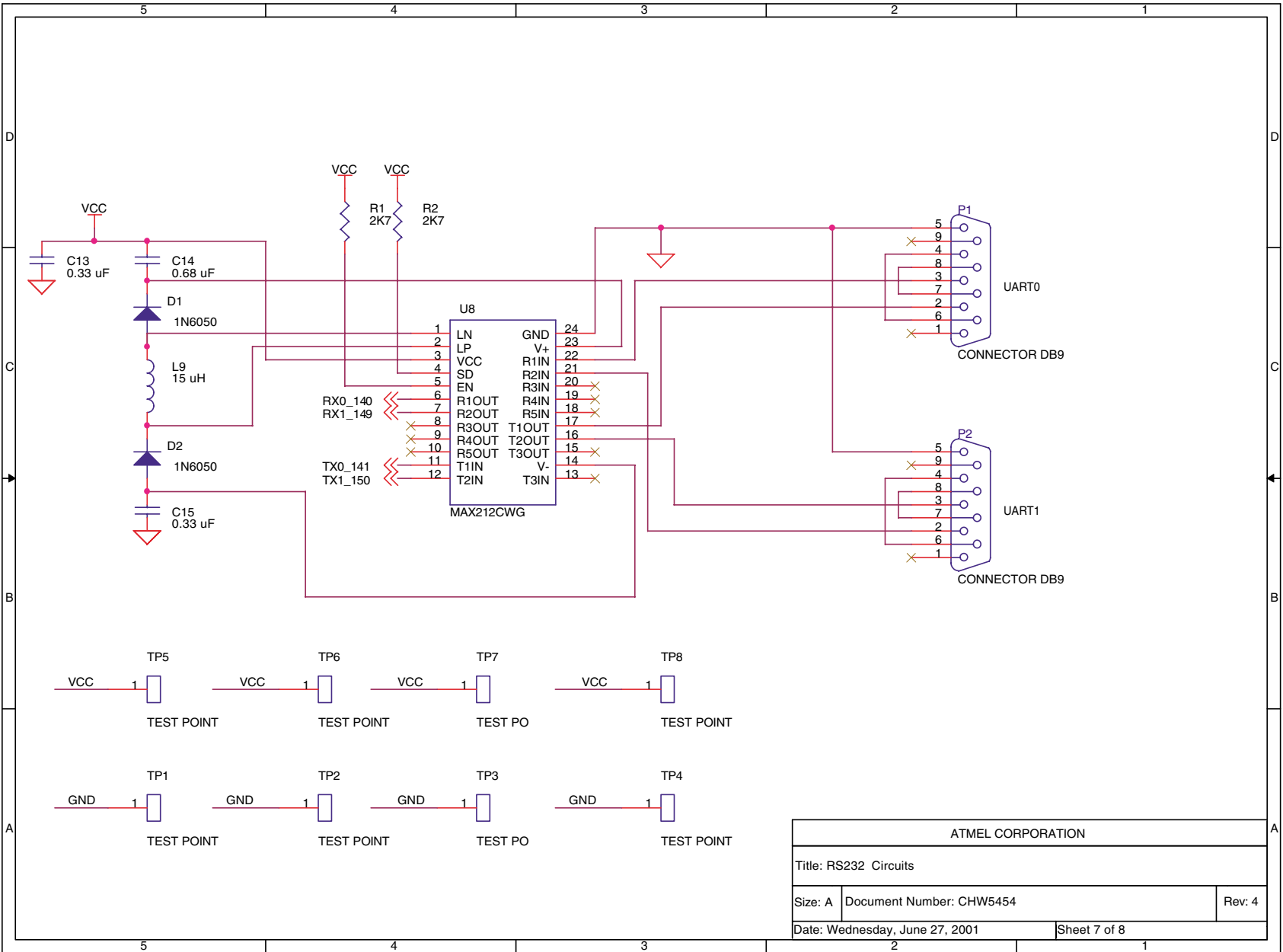
# ISP and Reset Circuits



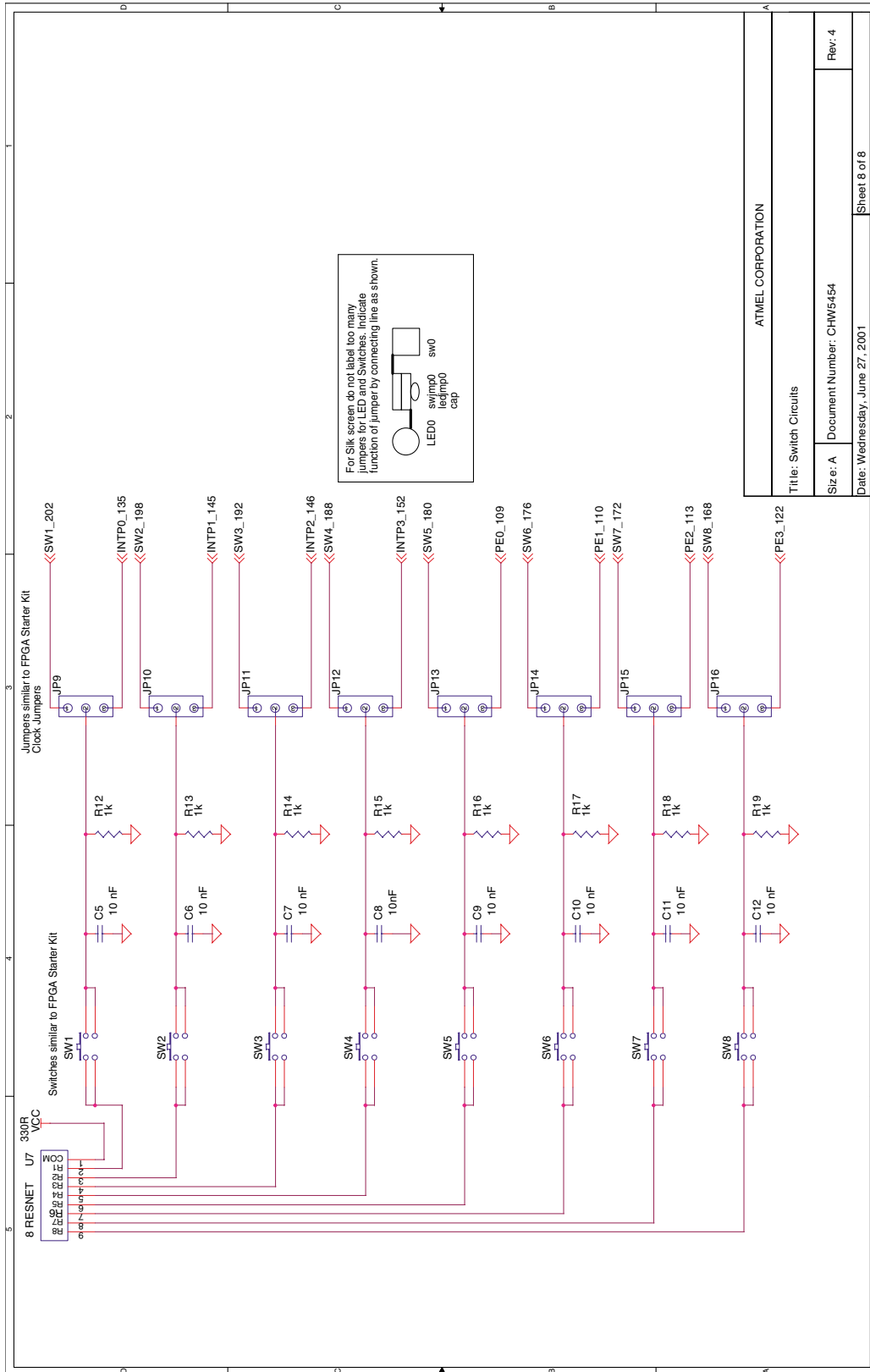
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Size: A	Document Number: CHW5454
Date: Wednesday, June 27, 2001	Sheet 4 of 8
	Rev. 4







# Switch Circuits





## Device Pinout and Board Connection Summary

Table 8 shows the pin number for the FPSLIC device, the corresponding function of the FPSLIC pin and then the function as it is laid out on the Starter Kit. Any pin that does not have a board Function assigned may be used as a wire wrap or probe connection into the FPSLIC device.

All probe pins on the board are connected to the corresponding IO of the chip.

Pins that connect to the Switches or LEDs may also be used as user-specific inputs or outputs simply by leaving the corresponding Jumper disconnected.

**Table 8.** Pinout and Board Connection

Pin	FPSLIC IO Type	Board Function	Hardware
1	No Connect		
2	GND	GND	
3	No Connect		
4	GCK1(IO)		
5	IO		
6	IO		
7	IO		
8	IO		
9	IO		
10	IO		
11	IO		
12	IO		
13	IO		
14	GND	GND	
15	FCK1(IO)		
16	IO		
17	IO		
18	IO		
19	IO		
20	IO		
21	IO		
22	IO		
23	IO		
24	IO		
25	GND	GND	
26	V <sub>CC</sub>	V <sub>CC</sub>	
27	IO		
28	IO		
29	IO		

**Table 8.** Pinout and Board Connection

Pin	FPSLIC IO Type	Board Function	Hardware
30	IO		
31	IO		
32	IO		
33	IO		
34	IO		
35	IO		
36	FCK2(IO)		
37	GND	GND	
38	IO		
39	IO		
40	IO		
41	IO		
42	IO		
43	IO		
44	IO		
45	IO		
46	OTS(IO)		
47	GCK2(IO)		
48	AVRRESET	AVR RESET	JP19, SW12
49	GND	GND	
50	M0	GND	
51	No Connect		
52	No Connect		
53	No Connect		
54	No Connect		
55	V <sub>CC</sub>		
56	M2	GND	
57	GCK3(IO)		
58	HDC(IO)		
59	IO	ALPHANUMERIC 1 E	LED1 E
60	IO	ALPHANUMERIC 1 F	LED1 F
61	IO	ALPHANUMERIC 1 M	LED1 M
62	LDC(IO)		
63	IO	ALPHANUMERIC 1 P	LED1 P
64	IO	ALPHANUMERIC 1 Cathode 1	LED1 Cathode 1

**Table 8.** Pinout and Board Connection

Pin	FPSLIC IO Type	Board Function	Hardware
65	IO	ALPHANUMERIC 1 L	LED1 L
66	IO	ALPHANUMERIC 1 G	LED1 G
67	GND	GND	
68	IO	ALPHANUMERIC 1 K	LED1 K
69	IO	ALPHANUMERIC 1 H	LED1 H
70	IO	ALPHANUMERIC 1 J	LED1 J
71	IO	ALPHANUMERIC 1 N	LED1 N
72	IO	ALPHANUMERIC 1 D	LED1 D
73	IO	ALPHANUMERIC 1 A	LED1 A
74	IO	ALPHANUMERIC 1 DP	LED1 DP
75	IO	ALPHANUMERIC 1 Cathode 2	LED1 Cathode 2
76	IO	ALPHANUMERIC 1 C	LED1 C
77	INIT(IO)	INIT	AT17 RESET/OE
78	V <sub>CC</sub>	V <sub>CC</sub>	
79	GND	GND	
80	IO	ALPHANUMERIC 1 B	LED1 B
81	IO	ALPHANUMERIC 0 E	LED0 E
82	IO	ALPHANUMERIC 0 F	LED0 F
83	IO	ALPHANUMERIC 0 M	LED0 M
84	IO	ALPHANUMERIC 0 P	LED0 P
85	IO	ALPHANUMERIC 0 Cathode 1	LED0 Cathode 1
86	IO	ALPHANUMERIC 0 L	LED0 L
87	IO	ALPHANUMERIC 0 G	LED0 G
88	IO	ALPHANUMERIC 0 K	LED0 K
89	IO	ALPHANUMERIC 0 H	LED0 H
90	GND	GND	
91	IO	ALPHANUMERIC 0 J	LED0 J
92	IO	ALPHANUMERIC 0 N	LED0 N
93	IO	ALPHANUMERIC 0 D	LED0 D
94	IO	ALPHANUMERIC 0 A	LED0 A
95	IO	ALPHANUMERIC 0 DP	LED0 DP
96	IO	ALPHANUMERIC 0 Cathode 2	LED0 Cathode 2
97	IO	ALPHANUMERIC 0 C	LED0 C
98	IO	ALPHANUMERIC 0 B	LED0 B



**Table 8.** Pinout and Board Connection

Pin	FPSLIC IO Type	Board Function	Hardware
99	IO		
100	GCK4 (IO)	GCK4 – 4 MHz Clock	4 MHz Oscillator
101	GND	GND	
102	No Connect		
103	CON	Configuration Control	AT17 /CE
104	No Connect		
105	No Connect		
106	V <sub>CC</sub>	V <sub>CC</sub>	
107	No Connect		
108	RESET	FPSLIC Device RESET	JP19, SW12
109	PE0	PortE 0	JP13 A
110	PE1	PortE 1	JP14 A
111	PD0	PortD 0	JP1 A
112	PD1	PortD 1	JP2 A
113	PE2	PortE 2	JP15 A
114	PD2	PortD 2	JP3 A
115	No Connect		
116	No Connect		
117	No Connect		
118	No Connect		
119	No Connect		
120	PD3	PortD 3	JP4 A
121	PD4	PortD 4	JP5 A
122	PE3	PortE 3	JP16 A
123	CS0		
124	SDA	2 Wire Serial Data	AT17 Data
125	SCL	2 Wire Serial Clock	AT17 Clock
126	PD5	PortD 5	JP6 A
127	PD6	PortD 6	JP7 A
128	PE4	PortE 4	
129	PE5	PortE 5	
130	V <sub>CC</sub>	V <sub>CC</sub>	
131	GND	GND	
132	PE6	PortE 6	
133	PE7	PortE 7	
134	PD7	PortD 7	JP8 A

**Table 8.** Pinout and Board Connection

Pin	FPSLIC IO Type	Board Function	Hardware
135	INTP0	External Interrupt 0	JP9 A
136	No Connect		
137	No Connect		
138	XTAL1	AVR System Clock Input	JP17, Y1
139	XTAL2	AVR System Clock Pair	JP18, Y1
140	RX0	UART 0 Receive	UART 0 pin3
141	TX0	UART 0 Transmit	UART 0 pin 2
142	GND	GND	
143	No Connect		
144	No Connect		
145	INTP1	External Interrupt 1	JP10 A
146	INTP2	External Interrupt 2	JP11 A
147	TOSC1	Oscillator Input	Y2
148	TOSC2	Oscillator Pair	Y2
149	RX1	UART 1 Receive	UART 1 pin 2
150	TX1	UART 1 Transmit	UART 1 pin 3
151	D0	Configuration Data Input	AT17 Data
152	INTP3	External Interrupt 3	JP12 A
153	CCLK	Configuration Clock	AT17 Clock
154	V <sub>CC</sub>		
155	No Connect		
156	No Connect		
157	No Connect		
158	No Connect		
159	IO		
160	GND		
161	IO0		
162	GCK7(IO)	GCK7 Manual Clock	MAN CLK (SW)
163	IO		
164	IO		
165	IO		
166	IO	LED 8	JP8 F
167	IO		
168	IO	Switch 8	JP16 F
169	IO		

**Table 8.** Pinout and Board Connection

Pin	FPSLIC IO Type	Board Function	Hardware
170	IO	LED 7	JP7 F
171	GND		
172	IO	Switch 7	JP15 F
173	IO		
174	IO	LED 6	JP6 F
175	IO		
176	IO	Switch 6	JP14 F
177	IO		
178	IO	LED 5	JP5 F
179	IO		
180	IO	Switch 5	JP13 F
181	IO		
182	GND		
183	V <sub>CC</sub>		
184	IO		
185	IO		
186	IO	LED 4	JP4 F
187	IO		
188	IO	Switch 4	JP12 F
189	IO		
190	IO	LED 3	JP3 F
191	IO		
192	IO	Switch 3	JP11 F
193	IO		
194	GND		
195	IO		
196	IO	LED 2	JP2 F
197	IO		
198	IO	Switch 2	JP10 F
199	IO		
200	IO	LED 1	JP1 F
201	IO		
202	IO	Switch 1	JP9 F
203	IO		
204	GCK8(IO)		
205	V <sub>CC</sub>		

**Table 8.** Pinout and Board Connection

<b>Pin</b>	<b>FPSLIC IO Type</b>	<b>Board Function</b>	<b>Hardware</b>
206	No Connect		
207	No Connect		
208	No Connect		



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