AT SOIC14 Development Board

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Description

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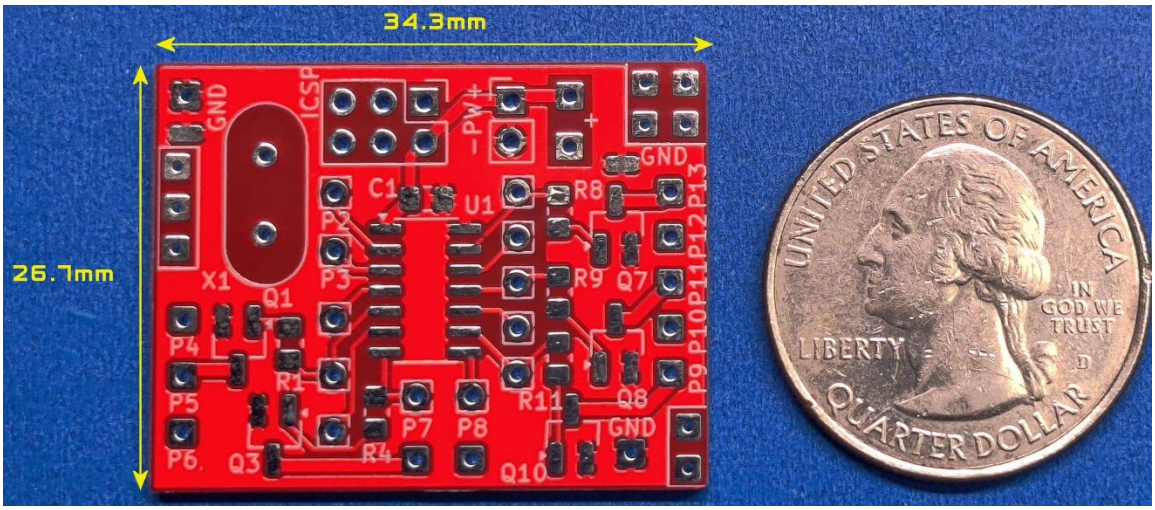
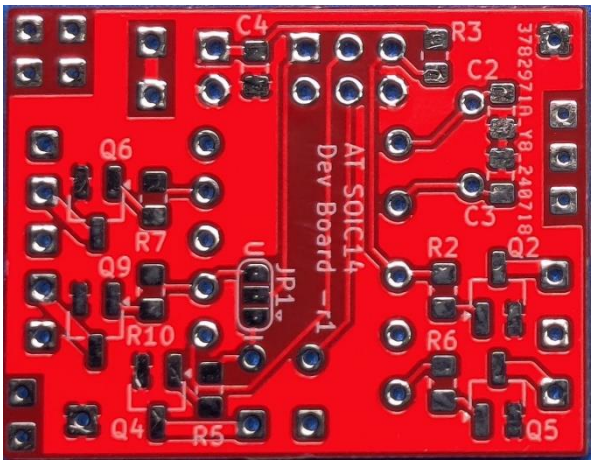


Back



The AT SOIC14 development board supports a variety of 14 pin SMD parts with ICSP or UPDI programming options (See the Board Details for a list of devices). Generally, those parts in a SOIC14 narrow package with VDD at pin 1, GND at Pin 14, and UPDI on pin 10 or ICSP should work.

Connections to all IO pins are provided (Referenced P2-P13) as well as a sub set of connections through SMD resistors and MOSFET drivers. A total of 10 MOSFET transistors are available or optionally a bipolar junction transistor (BJT) can be used. The only outputs that do not have a transistor option are Pins 2 & 3. See the *IO Pin Connection Planning Guide* at the end of this document for details.

A dedicated power connection is provided (PW) and other connection areas are marked as power (V+) and ground (GND) for sourcing other components. The power supply range is determined by the selection of U1, typically 2.7-5.5 volts.

Programming can be accomplished using the In-Circuit Serial Programming (ICSP) port to program the mounted part on the board. There is a jumper option to select either ICSP or UPDI mode. I also have available soft touch programming cables for either mode (No ICSP socket needed). There are many YouTube videos on Arduino programming options.

This board was designed to be as small as possible while providing numerous connection options and a set of MOSFET drivers for LED lighting in scale model builds. Typically used in scale model builds, dioramas or other areas where a small compact SoC (System on a chip) is needed.

Board Details

- Dimensions: 34.3 x 26.7 mm
- Parts Supported: VDD pin 1, GND pin 14. Designed for the ATtiny 24/84 series but supports others.
    - ICSP/SPI Programming (External crystal option):
        - ATtiny 24, 44, 84, 441, 841
    - UPDI pin 10 Programming (No external crystal support):
        - ATtiny (tinyAVR Series-2) 424, 824, 1624, 3224
        - ATtiny (tinyAVR Series-0) 1604, 804, 404, 204
        - ATtiny (tinyAVR Series-1) 1614, 814, 414, 214
- Up to 10 MOSFET or BJT drivers supported, see the *IO Pin Connection Planning Guide* at the end of this document for the 10 fixed outputs.
- Programming using the ICSP/UPDI port.

Parts List

Part Reference	**Quantity**	**Value**	**Description**	**Source Links**
U1	1		SOIC14 - Narrow ATtiny/tinyAVR	Mouser Electronics https://www.mouser.com/c/semiconductors/embedded-processors-controllers/microcontrollers-mcu/8-bit-microcontrollers-mcu/?q=ATtiny&package%20%2F%20case=SOIC-14%7C~SOIC-Narrow-14&instock=y
X1	1		16Mhz Crystal (TH) -Optional -Only supported for devices that use pin 2/3 for XTAL (84, 841 series)	Mouser Electronics https://www.mouser.com/ProductDetail/ABRACON/ABL-16.000MHz-B4Y?qs=sGAEpiMZZMsBj6bBr9Q9acsm1aZFaUGXsH5khlLoENx8BbEll4UD1w%3D%3D
Q1- Q10	10	A2SHB	MOSFET A2SHB/SI2302 SOT23 SMD	Mouser Electronics https://www.mouser.com/ProductDetail/Vishay-Semiconductors/SI2302CDS-T1-E3?qs=%252BPu8jn5UVnHNrjAmGCs%2Fuw%3D%3D AliExpress
R1,2,4-11	10	470Ω	0805 SMD/TH Resistor for transistor drivers	Mouser Electronics https://www.mouser.com/ProductDetail/Vishay-Draloric/RCG0805470RJNEA?qs=vOeJgewp7jBU33bjXc%252BrVQ%3D%3D

Part Reference	Quantity	Value	Description	Source Links
R3	1	10kΩ	0805 SMD -Optional - Reset pullup (84, 841 series only)	Mouser Electronics
C4	1	1uf	0805 SMD Decoupling cap	Mouser Electronics https://www.mouser.com/c/passive-components/capacitors/ceramic-capacitors/mlccs-multilayer-ceramic-capacitors/multilayer-ceramic-capacitors-mlcc-smd-smt/?q=0805%20capacitor&capacitance=22%20pF%7C~0.1%20uF%7C~1%20uF&instock=y
C1	1	0.1uf	0805 SMD Decoupling cap	Mouser Electronics
C2,C3	2	22pf	0805 SMD - Optional - Used with X1	Mouser Electronics
ICSP	1	2x3	2x3 pin socket 2.54 mm pitch - Optional for programming	Male/Female socket header based on programming needs.
PCB	1		AT SOCI14 Dev Board	

Pre-Assembled Boards

If you purchased an assembled PCB your board will be assembled based on the option you selected:

- **Option 1/2**: Board assembly with
  - ATtiny841 or ATtiny3224
  - All decoupling capacitors
  - This option will include all 10 MOSFETS loaded with their corresponding 470Ω resistors.
  - Parts listed as OPTIONAL will NOT be loaded (ICSP/PW Header, Crystal, C2, C3, R3).

- To test the board a test program will be loaded to U1 and used to check all output pins. It is a simple high/low test pattern applied to each pin about every ¼ second or so.
- You should be able to power up your board and see that same test pattern if your selection included U1. I'd recommend doing this before you reprogram the part in case something happened in transit.
- See the Board Options/Configuration section for configuring MOSFET outputs.

Assembly Guide

Caution: Electrostatic discharge (ESD) is a sudden and momentary flow of electric current between two differently-charged objects when brought close together or when the dielectric between them breaks down, often creating a visible spark associated with the static electricity between the objects. [1]

This type of shock can cause damage to ESD sensitive parts such as those used in this build especially U1. Proper ESD protection and soldering equipment should be used to prevent damage to parts during assembly and implementation into your project.

Assembly Planning

The smallest components are 0805 and while small can still be hand soldered with care and patience. A fine tip soldering iron is useful along with 0.015" (0.38mm) flux core solder and extra flux if needed. See the references section for a YouTube video link on assembling this and other boards.

A note on connector sockets: The ICSP and PW locations support 2.54mm pitch sockets. However, I have found that these can cause a height issue with scale models as space can be very limited. For flexibility I usually wire directly to the board or use in-line connectors to keep the board height to a minimum. An angled 2x3 header for the ICSP can be better than a vertical one or the use of a soft touch programmer cable eliminates the need altogether.

PCB Assembly

- PCB assembly can be completed in any order.
- If using a hot plate or reflow heater I usually start with the side with the most SMD or hardest parts to hand solder and then hand solder the other side.
- If you are completely hand soldering my recommendation is to complete the back of the board first by mounting the capacitors C2,3,4.
- Next determine if you will use the reset pull up resistor R3. The reset pin has a weak internal pull up but a stronger one may be desired.
- If using the external crystal install capacitors C4,5.
- Next install any transistor output drivers for LED's or other needs. Depending on your design of input and output signals you may not want to mount all of the MOSFET or BJT parts and the associated resistors. *I've included a design planning table at the end of this document that can be used to help lay out your design and connection options.*
- Continue to mount the 470Ω SMD (or a value of your choice in SMD or TH) resistors for each transistor installed.
- Moving to the top of the board install U1 and C1.
- Repeat the mounting of any other resistor/transistor pairs for the top layer.
- A note about MOSFET transistors. To keep the board size as small as possible I did not include any gate pull down resistors. These are usually used to prevent signal instability when U1 initializes the output pins on power up. If you feel these are needed for your design an appropriate value resistor can be added across the gate/source pins of the MOSFET. They are generally not needed when using BJT transistors.
- If using X1 install the crystal.

  It can be useful to bend the crystal pins to hold the part in place for soldering. Once one pin is soldered check that the part is flush with the board. If not just reheat the connection while pressing the part flush with the board. You can then solder the remaining pin.
- Determine how you will program the part and if needed install a 2x3 (2.54mm pitch) header for ICSP.
- If you will be using a connector for power then install a 1x2 (2.54mm pitch) header at PW.

[1] Definition provided by From Wikipedia, the free encyclopedia. For more information on ESD see https://en.wikipedia.org/wiki/Electrostatic_discharge

Board Options/Configuration

This section should be reviewed for those that are assembling the board themselves or purchased a pre-assembled version.

Using the table below determine which programming method will be used. Selecting **I**CSP (JP1, 1 & 2) will connect the MISO line to ICSP pin 1. Selecting **U**PDI (JP1, 2 & 3) will connect the UPDI pin 10 to ICSP pin 1. When using UPDI only pins 1, 2, and 6 will be used on the ICSP header.

Jumper Options

JP1	1-2 – ICSP 2-3 – UPDI

Making a solder bridge

You can make your connection by selecting which half of the bridge to connect but make sure you do not connect both parts. The center pad will connect to either the upper or lower pad, ie pad 1-2 or 2-3. Once you determine the pads to connect add some solder to each pad then continue to heat both pads adding more solder if needed until the two pads are connected. The images below show some examples:

Step 1
Example bridging pad 1 & 2

Step 2
Completed Bridge

Bad Solder Bridge
All pads connected

IO Connections

Power	**PW +/-** Connect an appropriate power source to the PW connector. There are also extra power and ground connections for other needs. (V+ / GND)
Reset	**P4** The reset can be used as an input and depending on your design you may want to remove or change the R3 pull up resistor. *Use care if setting this port as an output as this is one of the programming pins and cannot easily be reverted back to be a Reset.* (ATtiny84, 841 series only)
ICSP	Programming connection for a serial programmer to program U1 on the board. Supports ICSP/UPDI modes
IO Ports	**Round Pads** **P2/3** These connections are IO only and do not have transistors to drive a load. **P4-13** These remaining connection points are to the device IO lines and bypass the transistor and resistors. See IO Pad Sections below for examples.
Transistor Outputs	**Square Pads** **P4-13** These connections align with the devices port outputs and have a resistor/transistor to drive a load. The transistors (MOSFET/BJT) sink to ground. P4 or P10 will align to a reset pin depending on the device selected. See IO Pad Sections below for examples.
Development Areas	This board used some available free space as a development area for adding other components (Resistors, transistors, diodes, sensors, connectors, etc…). 

IO Pad Sections

Each grouping of IO ports has two connection options.

- IO Port Output - Connect to the port IO output directly (Round Pad - No resistor or transistor driver)
- Transistor Output - Connect to the transistor output driven by this port (Square Pad)

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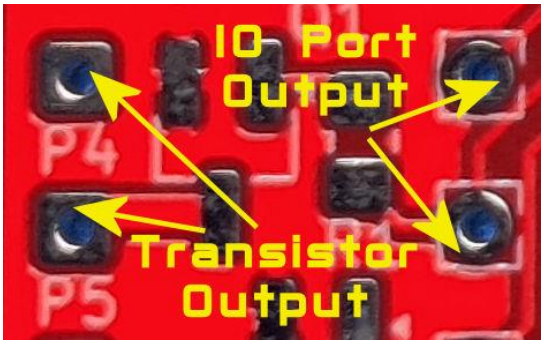
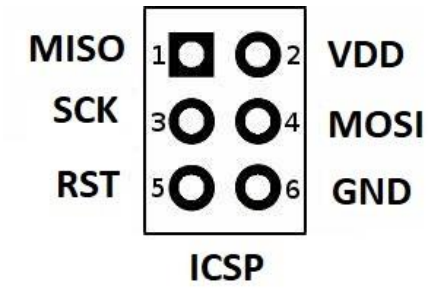


Figure 1 Example for P4 & P5

ICSP/UPDI Header



The ICSP connector follows this layout which is the same used for Arduino boards. There are a number of YouTube videos showing various methods for programming including using UNO or Nano boards as an AVR In System Programmer using the ArduinoISP sketch.

Note in UPDI mode the MISO pin connects to the UPDI (pin 10) of the device.

I also offer a soft touch programming cable to eliminate the ICSP header and connect directly to the board. Cable versions are available for ICSP or UPDI.

Mounting Options

Hot glue is my go-to option for PCB mounting in models. It has great hold and sets up quickly. It can easily be removed and reapplied. Double sided tape or possibly Velcro could also be used.

References

- **Github: Development board documentation and schematics.**
  - **https://github.com/JohnnyElectronic/Dev_Boards/**
- **YouTube: Board assembly and project videos that are related to this board.**
  - **https://www.youtube.com/@Johnny_Electronic**
- **SerialUPDI**
  - **https://github.com/SpenceKonde/AVR-Guidance/blob/master/UPDI/jtag2updi.md**
- **Arduino IDE board files**
  - **megaTinyCore - https://github.com/SpenceKonde/megaTinyCore**
  - **It can be installed manually or through the Boards Manager**

Revisions

R1	First release

Disclaimer

This information is provided “as-is” with no representation or warranty of any kind whether express or implied. However, I’ve tried to make this document (as well as the supporting videos) as useful and accurate as possible. If you find something that is incorrect or confusing, please let me know as I would like to make the correction so others will not have the same issue.

Feel free to email me for issues you may have with this board or if you need extra help with coding, programming, or just design ideas for your latest project please check out my Patreon page.

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Legal note

IO Pin Connection Planning Guide

Use this guide to help plan out your inputs/outputs/LED driver connections. It has helped me during planning and final assembly.

ATtiny SOIC14

- Actual IO lines will depend on the device selected.
- RED Sections: Pin 2,3, No transistor option.
- When directly driving an output (No MOSFET/BJT) there is a 20ma max per pin and a 100ma total for all pins or per device.
- MOSFET's can handle a few 100 mA without issue, the ones selected are rated to over 2 Amps but watch for excessive heat.

CONNECTED TO WHAT?	INPUT/OUTPUT PINS/PORTS		CONNECTED TO WHAT?
N/A - VDD	1	14	N/A - GND
	2 (P2)	**13** (P13) Q7	
	3 (P3)	**12** (P12) Q6	
	4 (P4) Q2	**11** (P11) Q8	
	5 (P5) Q1	**10** (P10) Q9	
	6 (P6) Q5	**9** (P9) Q10	
	7 (P7) Q3	**8** (P8) Q4	