ATtiny85 Development Board

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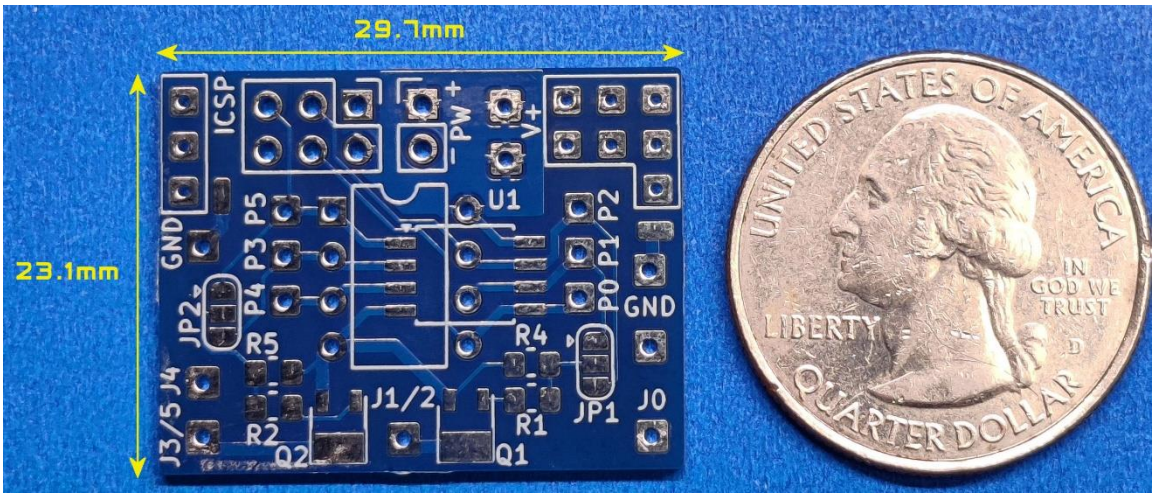

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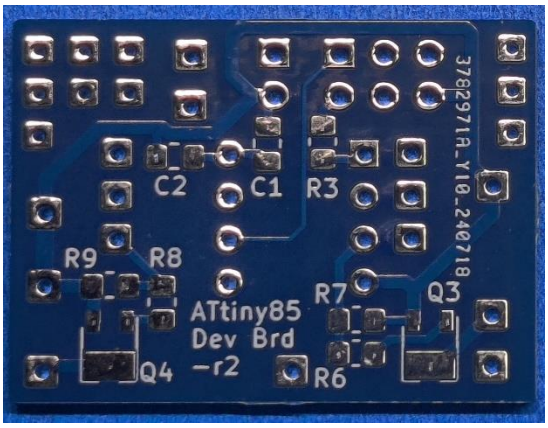


The ATtiny85 development board supports the ATtiny 25/45/85 8 pin through hole (TH) or surface mount (SMD) parts. Connections to all IO pins are provided as well as a sub set of connections through SMD resistors and MOSFET drivers. A total of 4 MOSFET transistors are available or optionally a bipolar junction transistor (BJT) can be used. Some outputs share a MOSFET and the output pin can be selected by a solder jumper (JP1-2). 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 or lower if using the low voltage parts.

Programming can be accomplished using a chip programmer for the AT part or using the In-Circuit Serial Programming (ICSP) port to program the mounted part on the board. I also have available a soft touch ICSP programming cable (No ICSP socket needed) that can be used with an Arduino UNO or NANO type of device as the programmer. You can also optionally use an 8-pin socket (If using a TH part) and then remove the part for programming. 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: 29.7 x 23.1 mm
- Parts Supported: ATtiny 25 / 45 / 85
- Up to 4 MOSFET or BJT drivers supported, see the IO Pin Connection Planning Guide at the end of this document for the 2 fixed outputs and the 2 sets of outputs (4 I/O ports) that can be configured.
- Programming using the ICSP port or directly to the removed part (Non-SMD version).

Parts List

Part Reference	**Quantity**	**Value**	**Description**	**Source Links**
U1/U2	1		ATtiny 8 pin DIP/SMD ATTINY85-20S ATTINY85-20PU	Mouser Electronics https://www.mouser.com/c/semiconductors/embedded-processors-controllers/microcontrollers-mcu/8-bit-microcontrollers-mcu/?q=attiny85&package%20%2F%20case=PDIP-8~~SOIC-8&instock=y&rp=semiconductors%2Fembedded-processors-controllers%2Fmicrocontrollers-mcu%2F8-bit-microcontrollers-mcu%7C~Package%20%2F%20Case
Socket	1		8 pin DIP TH Socket 2.54 mm pitch - Optional	Mouser Electronics https://www.mouser.com/ProductDetail/Adam-Tech/ICS-328-T?qs=FG09h9tFCuC6Ck%2FzUH9arw%3D%3D
Q1-Q4	4	A2SHB	MOSFET A2SHB/SI2302 SOT23 SMD	Mouser Electronics https://www.mouser.com/ProductDetail/Vishay-Semiconductors/SI2302CDS-T1-E3?qs=%252BPu8jn5UVnHNrjAmGCs%2Fuw%3D%3D AliExpress
R 1,2,6,8	4	470Ω	0805 SMD Resistor for transistor drivers	Mouser Electronics https://www.mouser.com/ProductDetail/Vishay-Draloric/RCG0805470RJNEA?qs=vOeJqewp7jBU33bjXc%252BrVQ%3D%3D
R3	1	10kΩ	0805 SMD - Reset pullup	

Part Reference	Quantity	Value	Description	Source Links
R 4,5,7,9	4	10kΩ	0805 SMD - Optional - MOSFET gate pull down	
C2	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
ICSP	1	2x3	2x3 pin socket 2.54 mm pitch - Optional for programming	Male/Female socket header based on programming needs.
PCB	1		ATtiny85 Dev Board	

Pre-Assembled Boards

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

- **Option 1**: Board assembly with ATtiny85 DIP (TH) part
  - ATTINY85-20PU
  - 8 pin DIP Socket
  - All decoupling capacitors
  - All 10kΩ resistors
  - This option will include all 4 MOSFETS loaded with their corresponding 470Ω resistors
  - These OPTIONAL parts will NOT be loaded (ICSP/PW Header)
  - No bootloader installed
- **Option 2/3**: Board assembly with ATtiny85 SMD part
  - ATTINY85-20SU or SF low voltage part
  - All decoupling capacitors
  - All 10kΩ resistors
  - This option will include all 4 MOSFETS loaded with their corresponding 470Ω resistors
  - These OPTIONAL parts will NOT be loaded (ICSP/PW Header)
  - No bootloader installed

- To test the board a test program will be loaded to U1 or U2 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. 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 R3 for the reset pullup (The reset pin has a weak internal pull up but a stronger one may be desired) and then the capacitors (C1,2).
- Next install any transistor output drivers for LED's or other needs (Q3/4). 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.*
- A note about R 4,5,7,9. These are gate pull downs for the MOSFET transistors to prevent signal instability when U1 or U2 initialize the output pins on power up. You may feel these are not needed for your design and they generally are not needed when using BJT transistors.
- Moving to the top of the board. If you are using an SMD device I'd install it next allowing plenty of space to work. If using a DIP (TH) part save it for last.
- Determine if Q1 and 2 will be needed. Install them along with the associated resistors.
- If using a DIP part (TH) you can now install the 8 pin socket.
  It can be useful to bend a few of the socket 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 pins.

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

- 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.

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 shared drivers will be used, if any, and solder the appropriate side of the jumper to make the connection.

Jumper Options

JP1	1-2 – PB1 2-3 – PB2	Q1
JP2	1-2 – PB5 2-3 – PB3	Q2

Making a solder bridge

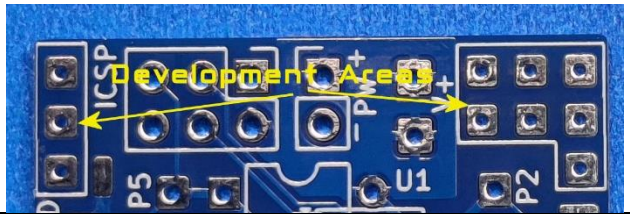
You can make your connection by selecting which half of the bridge to connect but make sure you do not connect both parts. The center pad will connect to either the upper or lower pad, ie pad 1-2 or 2-3. Once you determine the pads to connect add some solder to each pad then continue to heat both pads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

Step 1
Example bridging pad 1 & 2

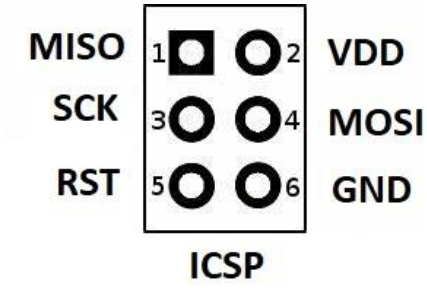
Step 2
Completed Bridge

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	**P5** 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.*
ICSP	Programming connection for a serial programmer to program U1 on the board.
IO Ports	**P0 – P5** These connection points are to the device IO lines and bypass the transistor and resistors.
Transistor Outputs	**J0, J4, J1/2, J3/5** These connections align with the devices P0-P5 outputs and have a transistor to drive a load. The transistors (MOSFET/BJT) sink to ground. If you only wanted to use the resistor in-line with the output pin you can remove the transistor and add a jumper across it. This could allow using the output line to drive a single LED or other lower current parts.
Development Areas	This board used some available free space as a development area for adding other components (Resistors, transistors, diodes, sensors, connectors, etc…). 

ICSP 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.

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**

Revisions

R1	First release
R2	Improved board layout. Added two more transistor groups. Fixed U1 SMD symbol

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.

ATtiny85 (8 pin)

- ~ Marks PWM pins
- Colored sections share the transistor (Q#) listed on the ATtiny Dev Board
- 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?
10k Reset Pull Up Reset, can be used for other purposes.	**1** (PB5) RST Q2 -JP2 (1/2)	8	N/A - VCC
	2 (PB3) -JP2 (2/3)	**7** (PB2) D18/A4 Q1 -JP1 (2/3)	
	3 (~PB4) Q3	**6** (~PB1) D17/A3 -JP1 (1/2)	
N/A - GND	4	**5** (~PB0) Q4	