KA-200W-M-TH-1001

Pulse Width Modulator Microprocessor Controlled Motor Drive 200 Watt

Manual

KA-200W-M-TH-1001 Manual Revision 2.0

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Product Uses

Pulse Width Modulators (PWMs) are devices which generate a square wave signal. Over a fixed interval of time they energize the signal for a certain fraction of that interval (this is called the duty cycle).

PWMs can be used to drive LEDs. The longer the duty cycle used, the brighter the LED gets, with shorter duty cycles making the LED dimmer. This is a far better method of driving an LED than simply turning its power on or off, because it gives you direct control over the intensity of the light, and it uses much less power.

PWMs can also be used to drive motors. In this case, longer duty cycles translate to more power to the motor. In addition to being more efficient, it is also much safer, and causes far less wear and tear on the motor; PWM allows you to safely accelerate the motor to the desired speed, and safely decelerate the motor to a stop.

PWMs can be also be used for varying the amount of power used to drive an electrolysis process. The duty cycle can be varied according to the requirements of the process.

No matter how universal the product, there will always be slight differences in firmware depending on the application.

This product is intended primarily as a tool for education, or for a hobby or personal experimentation. It is **not** intended to be used in **any** of the following kinds of applications:

Commercial	Medical
Industrial	Military

This product **can** be used to **develop** a design which **is** suitable for those applications.

Safety Advisories

This product should only be assembled, handled or used by adults (over 18), or children **with adult supervision.** Unsupervised children should not be permitted access to this kit or the assembled unit.

This product should only be assembled by someone who has (at minimum) some basic experience using soldering equipment, or who is being instructed by someone with such experience.

Never allow the assembled unit to run unattended or without adult supervision.

Make certain that the unit is protected by an appropriate fuse (5 amps to start), and to provide an emergency power shutoff.

This product includes devices sensitive to Electro Static Discharge (ESD) and must be handled accordingly to ensure proper operation.

Do not put the unit down on a conductive surface, like a metal table.

Caution: Before operating the unit for the first time, stop to inspect your work for:

- **Shorts between pins**
- **Unsoldered pins**
- **Devices in the wrong locations**
- **Cracks in the solder joints**
- **Install screws or standoffs to support the unit to avoid shorting to a conductive surface**

Remember: Safety is <u>always</u> the responsibility of the <u>user</u>.

How to Use this Product

First, observe **all** Safety Advisories listed in this manual. Safety is always the responsibility of the user.

With the Safety Advisories in mind, connect TB1 to your power source. The appropriate fusing for input power is listed in the safety advisories, and the appropriate voltage level for input power is listed under the Product Specifications section.

Next you need to place a load on the output, TB2. It could be as simple as a resistor and LED, or a scope probe, or a small motor. Whatever you chose to link to the output, make certain that it can tolerate the level of power you are feeding to the assembly.

Once your power source and your load are connected securely, turn on your power source.

The assembly is now running in FIXED-PULSE mode. This means that the PIC processor has pulled a stored value for the pulse width from memory, and is using that value to decide how wide the pulse width is, and will not allow it to change.

Gently tap the “MODE/SET” switch, “SW2.” It is near the heat sink, on the far end of the assembly from the three-pin terminal block.

The assembly is now running in ADJUST-PULSE mode. This means that you can turn the potentiometer labeled “POT1” clockwise to increase the width of the pulse, or counter-clockwise to decrease the width. You will see this change almost immediately as you turn the potentiometer.

Pressing SW1 again will store the width of the pulse and return you to “FIXED-PULSE” mode.

Reset Button

There is a second button on this product. It is the “RESET” button, marked “SW1.” You will find it near the 3-pin terminal block, “TB3.”

If the unit stops responding to the “MODE/SET” switch and/or the potentiometer, hit this switch. It allows you to reset the unit without removing the power or the load from the unit.

Product Specifications

Skill Level (1-5): 3

Kit Includes:

- Printed circuit board (Premium quality FR4)
- Program Microprocessor (CMOS PIC MicroChip TM based Micro)
- Manual, Schematics, Bill of Materials
- Package of appropriate components for assembly

Features:

- Microprocessor Based (Very accurate PWM)
- In circuit programming (ICSP)
- Power indicator (Green LED)
- General I/O (3 Bits)
- Diagnostic LEDs for development (RED LEDs)
- Remote Control Panel (External wire connection for SW1, SW2, POT1)
- Complete Schematics (PDF Format)
- Complete Bill of Materials (PDF Format)
- Safety and protection components included or referenced
- POWER Large Option for large MOSFETS (60V 50A)
- PWM Duty Cycle capable: 0-100%
- PWM Base Frequency Factory: 8KHz
- PWM Base Frequency Programmable by SW: 20KHz
- Hardware based PWM Timer

Absolute Maximum Ratings

- Input Voltage: 20 VDC (7.5-20VDC, **12VDC Nominal**)
- Output Voltage: 20 VDC (7.5-20VDC, **12VDC Nominal**)
- Current Sink: 10 Amps
- Power Control: 200 Watts
- PWM Frequency: 20KHz (Requires programming)

Absolute Maximum Environment Ratings

- Environment Temperature Optimal: 25 C
- Environment Temperature range: -30 to 70 C

Physical Traits

- PCB Size: 3.0" x 2.5", 0.062" thick
- Layers: Double Sided
- Weight: 2 oz (approximate)

Recommended Accessories (not included):

- **Mounting hardware:** 4-40 Screws, nuts and washers

Advanced Wiring Information

To help facilitate a more professional-looking project, we've provided wire holes to bring out various control features. This will allow you to connect control devices mounted in a bulkhead or an enclosure to this unit.

The wire hole locations where you can attach fly leads are each marked on the board as "E" followed with a number. The function to which these holes are connected are marked nearby on the board.

Schematic

The schematic for this design can be found in a separate Adobe Acrobat PDF.

Assembly Drawings

Parts List

QTY	RefDes	Description
1	C1	CAP, ALUM, 100UF, 20%, 25V, TH, RADIAL
1	C7	CAP, ALUM, 330UF, 20%, 50V, TH, RADIAL
10	C2, C3, C4, C5, C6, C9, C8, C10, C11, C12	CAP, CER DISC, 0.1UF, 10%, 50V, TH, RADIAL
2	D1, D2	DIODE, GP, 1A, 400V, TH, DO-41
1	D3	DIODE, SW DIODE, 75V, TH, DO-35
1	D5	DIODE, ZENER, 5.6V, 0.5W, TH, DO-35
1	Q1	FET, N-CH, FQP50N06, 60V, 35.4A, TH, TO-220
1	U2	IC, MICRO, PWM-HHO, TH, DIP8-300
1	U1	IC, REG, 5V, 0.1A, TH, TO-92
1	LED1	LED, GREEN, 2.1V, 10MA, 75MW, TH
3	LED2-4	LED, RED, 2.0V, 10MA, 60MW, TH
1	HS1	MECH, HEAT SINK, TO-220, BLACK, 10.4, TH
1	PCB1	PCB, KF-PWM-200W-M-TH-X, 3X2.5, 2 LY, GRN, TH
1	POT1	POT, SQ. TRIM., 5.0K, 1 TURN, 25%, 0.2W, TH, 3306F
1	R11	RES, CF, 1.0K, 5%, 150V, 1/6W, TH, RES265
1	R1	RES, CF, 2.2, 5%, 150V, 1/6W, TH, RES265
4	R5, R6, R10, R12	RES, CF, 10K, 5%, 150V, 1/6W, TH, RES265
1	R9	RES, CF, 100, 5%, 150V, 1/6W, TH, RES265
4	R2, R4, R7, R8	RES, CF, 220, 5%, 150V, 1/6W, TH, RES265
1	XU2	SOCKET, DIP-8, TH
2	SW1, SW2	SW, SPST, TACT, 12VDC, 50MA, TH, N/A
2	TB1, TB2	TERM, 2-PIN, VERT SCREW CLAMP, 22-14 AWG, 5.08MM
1	TB3	TERM, 3-PIN, VERT SCREW CLAMP, 22-14 AWG, 5.08MM

Assembly Drawing, Page 1

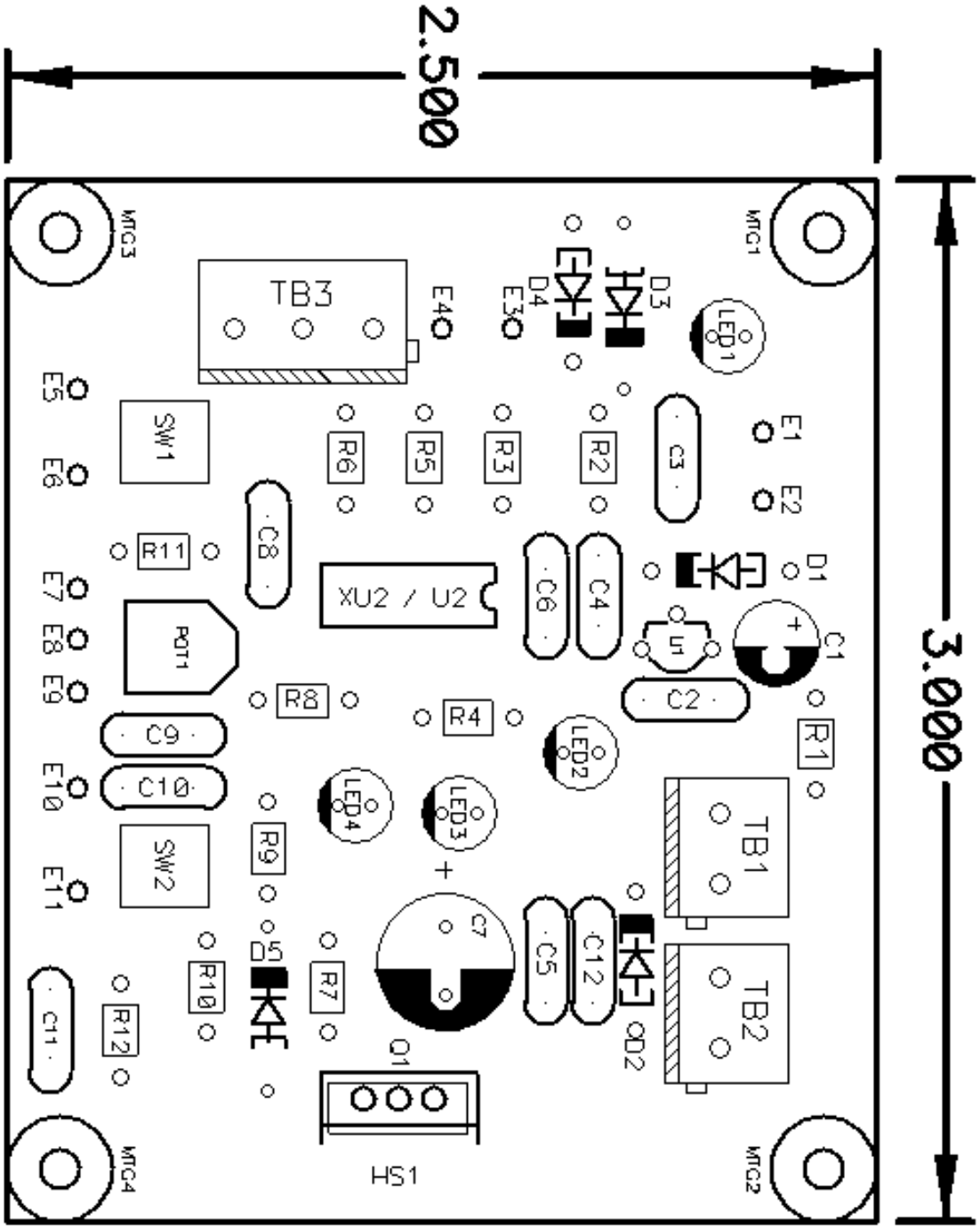

Figure 1: Component Locations and Reference Designators.

Assembly Drawing, Page 2

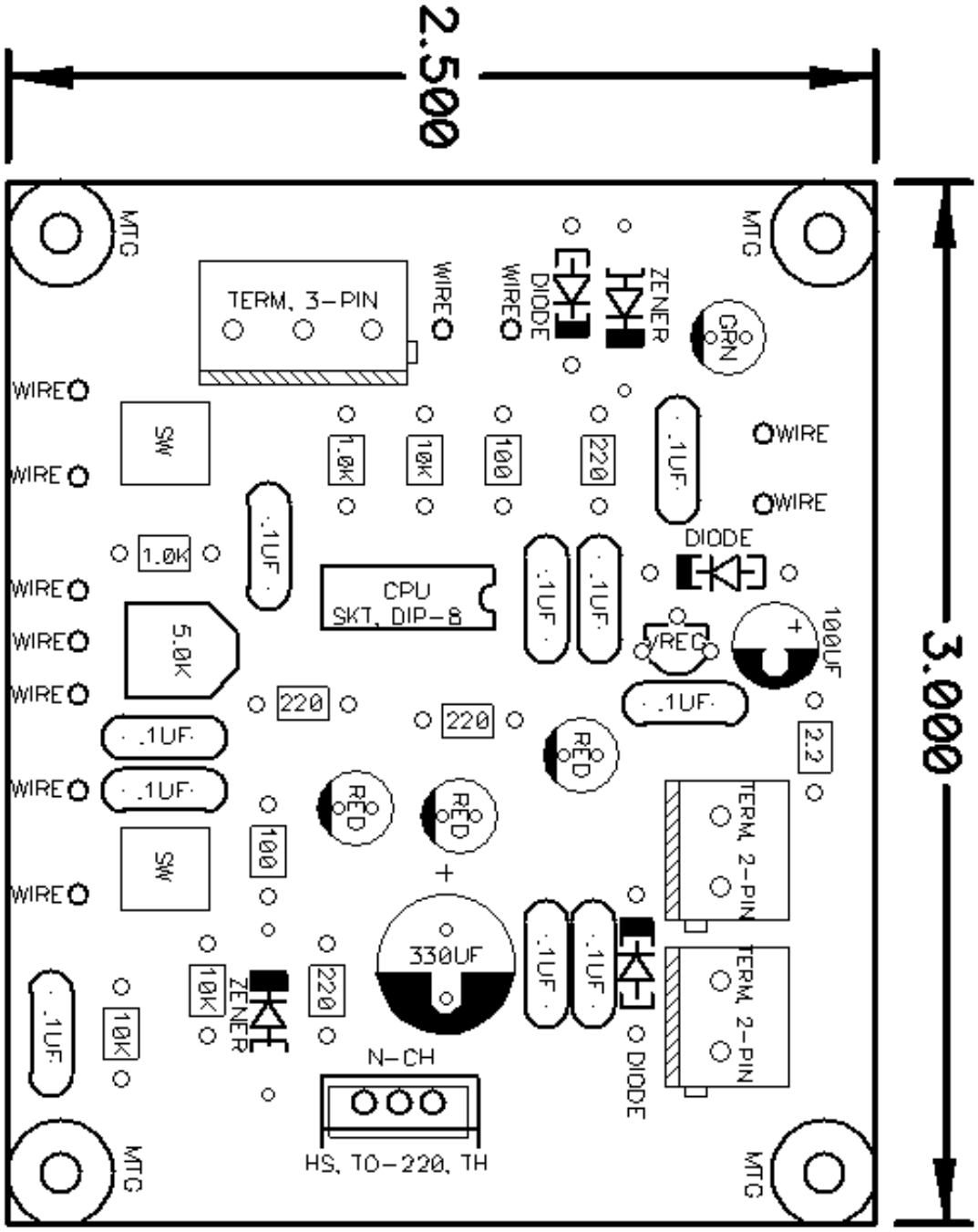

Figure 2: Component Values.

Assembly Instructions

Bare Board (for reference)

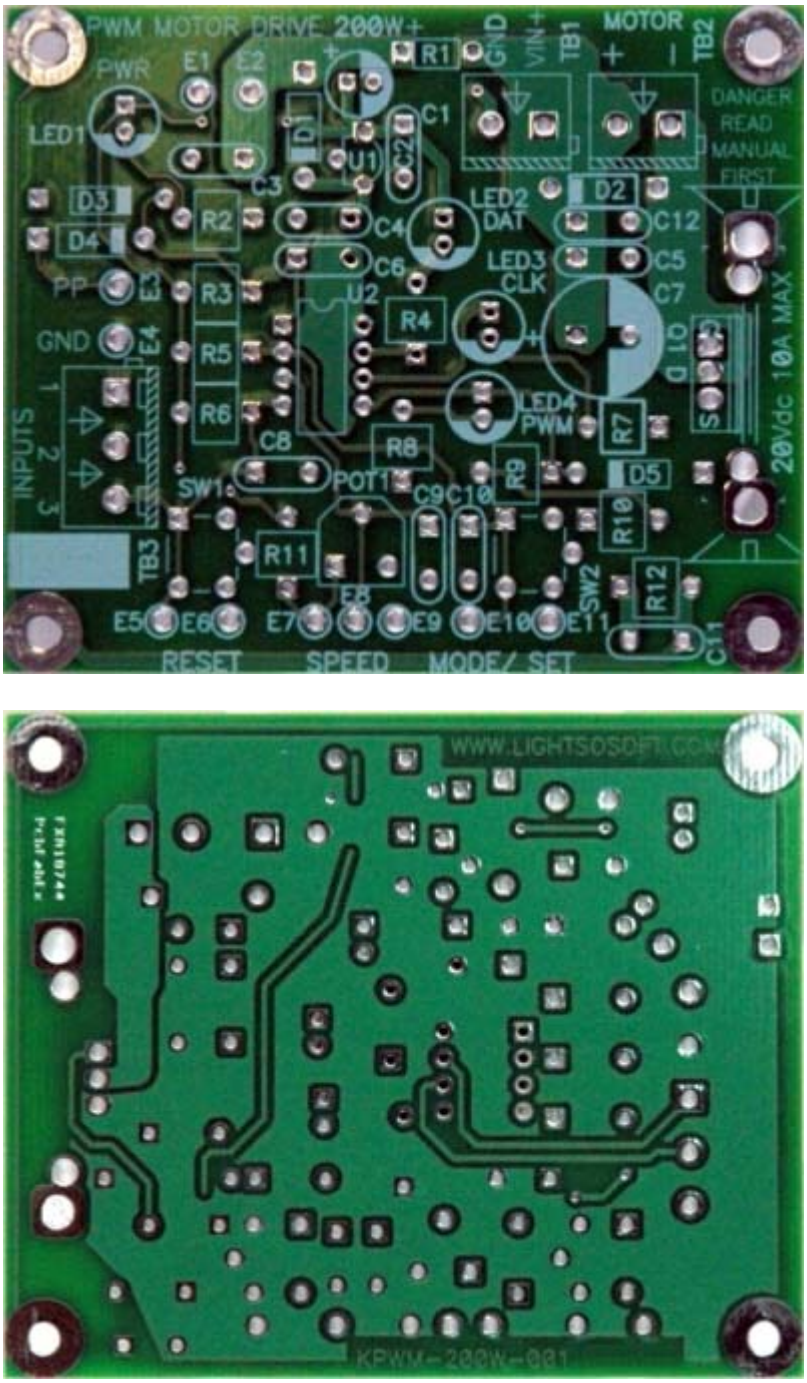

Figure 3: Board with no components installed, top and bottom sides.

Step 1: 0.1uF ceramic capacitors, QTY 9

C2, C3, C4, C5, C6, C9, C10, C11, C12

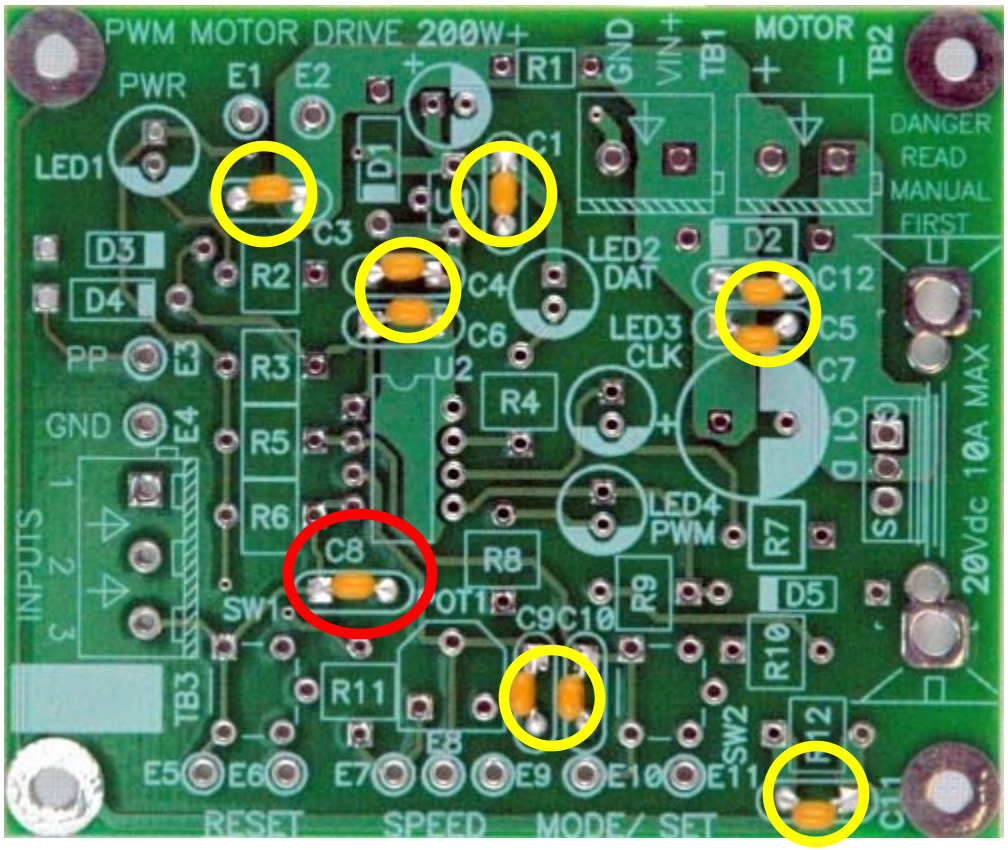

Figure 4: Board with 0.1uF ceramic capacitors installed.

From the kit, locate 9 pieces of the 0.1uF ceramic capacitor.

Find the locations for these parts on the board. They are marked C2, C3, C4, C5, C6, C9, C10, C11, C12. At each location, insert the capacitor's leads through the plated holes. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them.

Once you've soldered the leads in place, trim and discard the excess lead length.

C8 is optional – if in-circuit programming is desired, do NOT install.

Why WOULD someone want to install C8? If no good answer, remove it entirely

Step 2: 1.0K resistor, QTY 1

R11

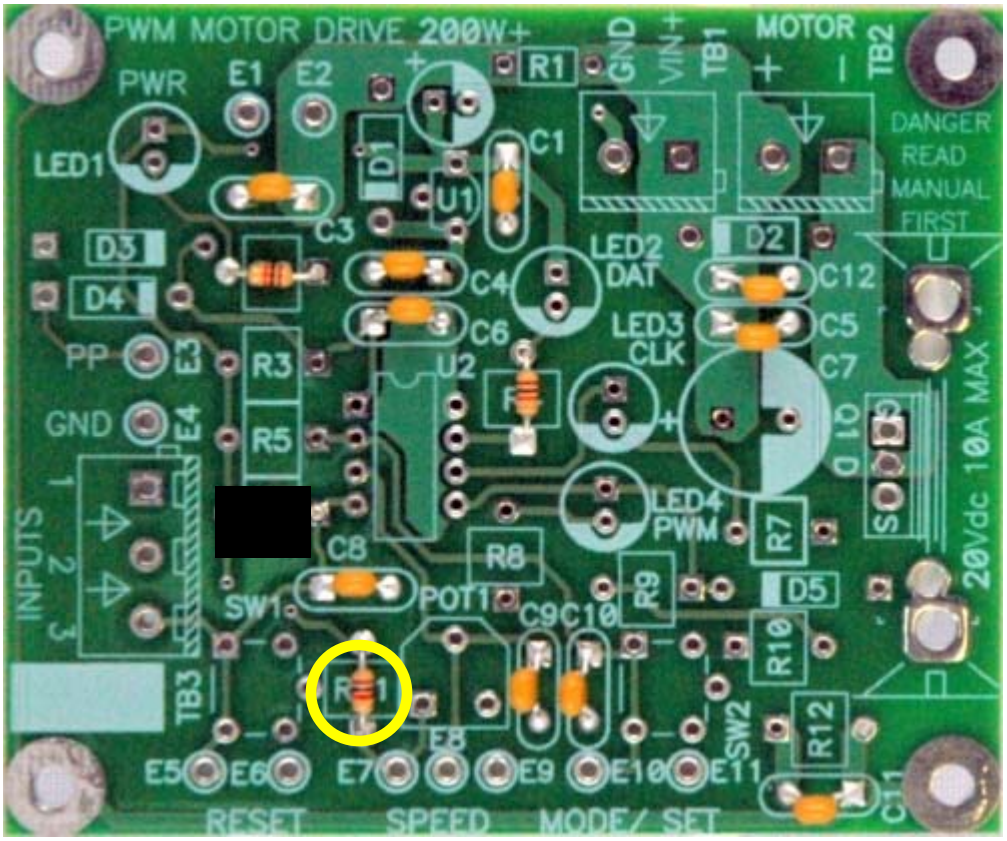

Figure 5: Board with 1.0K resistors installed.

From the kit, locate 1 piece of the 1.0K resistor. (brown black red)

Find the location for this part on the board. It is marked R11. At this location, insert the resistor's leads through the plated holes. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them. Once you've soldered the leads in place, trim and discard the excess lead length.

Locations R2 and R4 have been changed to 220 ohms to increase LED intensity.

Step 3: 10K resistors, QTY 4

R5, R6, R10, R12

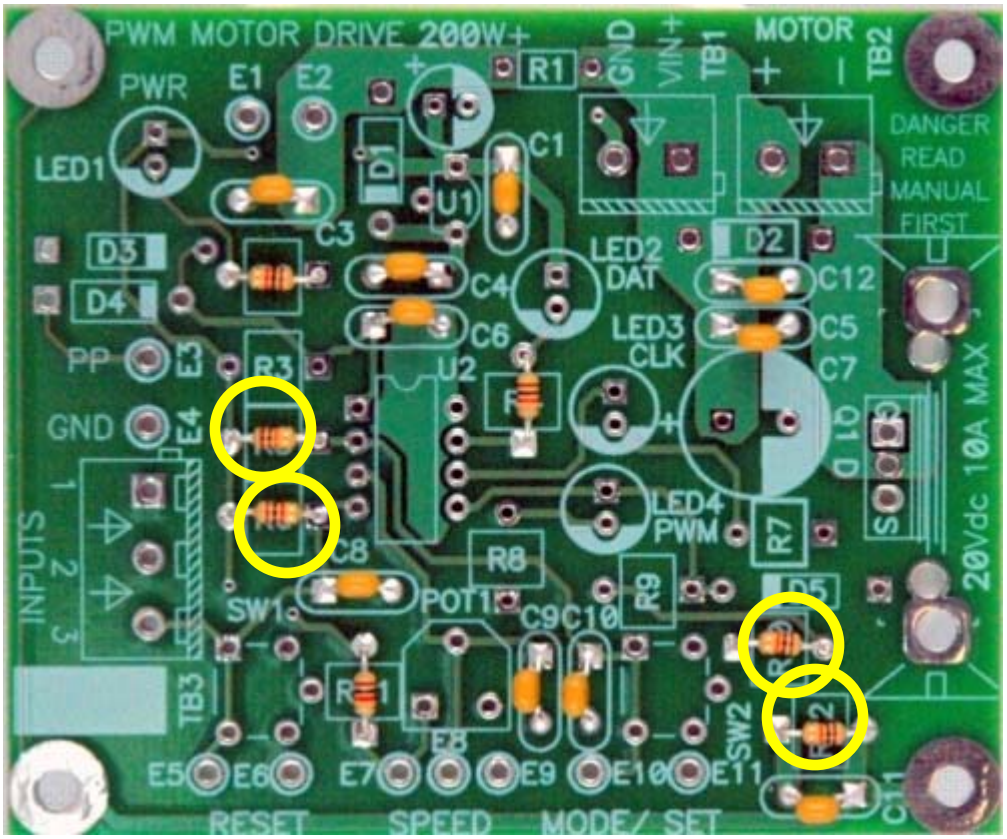

Figure 6: Board with 10K resistors installed.

From the kit, locate 3 pieces of the 10K resistor. (brown black orange)

Find the locations for these parts on the board. They are marked R5, R6, R10, R12.

At each location, insert the resistor's leads through the plated holes. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them.

Once you've soldered the leads in place, trim and discard the excess lead length.

Step 4: 220 ohm resistors, QTY 4

R2, R4, R7, R8

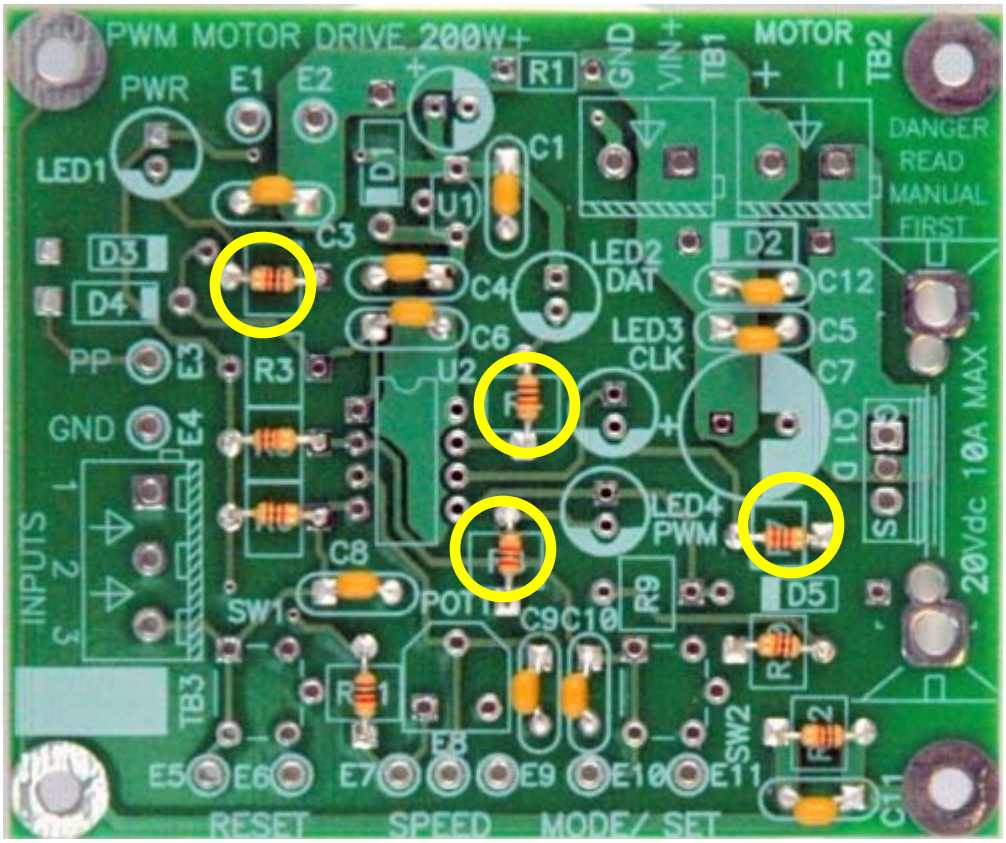

Figure 7: Board with 220 resistors installed.

From the kit, locate 4 pieces of the 220 resistor. (red red brown)

Find the locations for these parts on the board. They are marked R2, R5, R7, R8.

At each location, insert the resistor's leads through the plated holes. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them.

Once you've soldered the leads in place, trim and discard the excess lead length.

Step 5: 1 2.2 ohm resistor, 1 100 ohm resistor

R1, R9

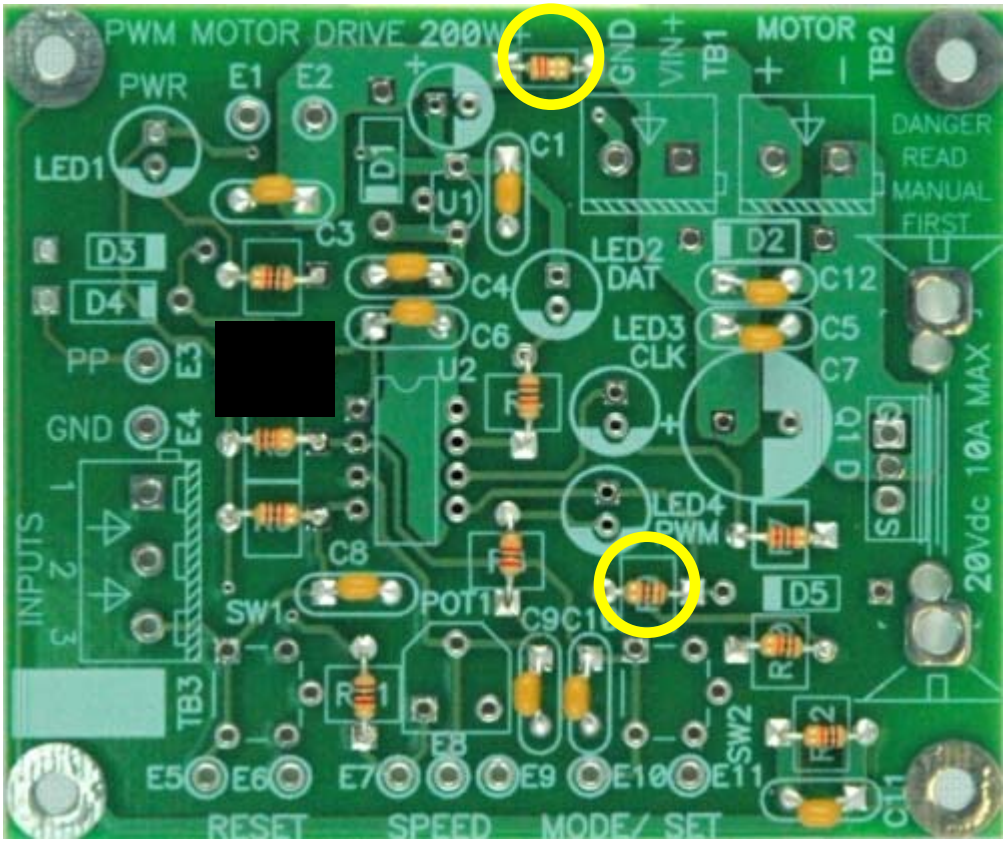

Figure 8: Board with 2.2 ohm and 100 ohm resistors installed.

From the kit, locate 1 piece of the 2.2 ohm (red red gold) resistor and 2 pieces of the 100 ohm (brown black brown) resistors.

Find the locations for these parts on the board. The 2.2 ohm resistor occupies R1, and the 100 ohm resistor occupies R9.

At each location, insert the resistor's leads through the plated holes. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them.

Once you've soldered the leads in place, trim and discard the excess.

Step 6: 1A, 400V general-purpose diodes, QTY 2

D1, D2 (1N4004 or equivalent)

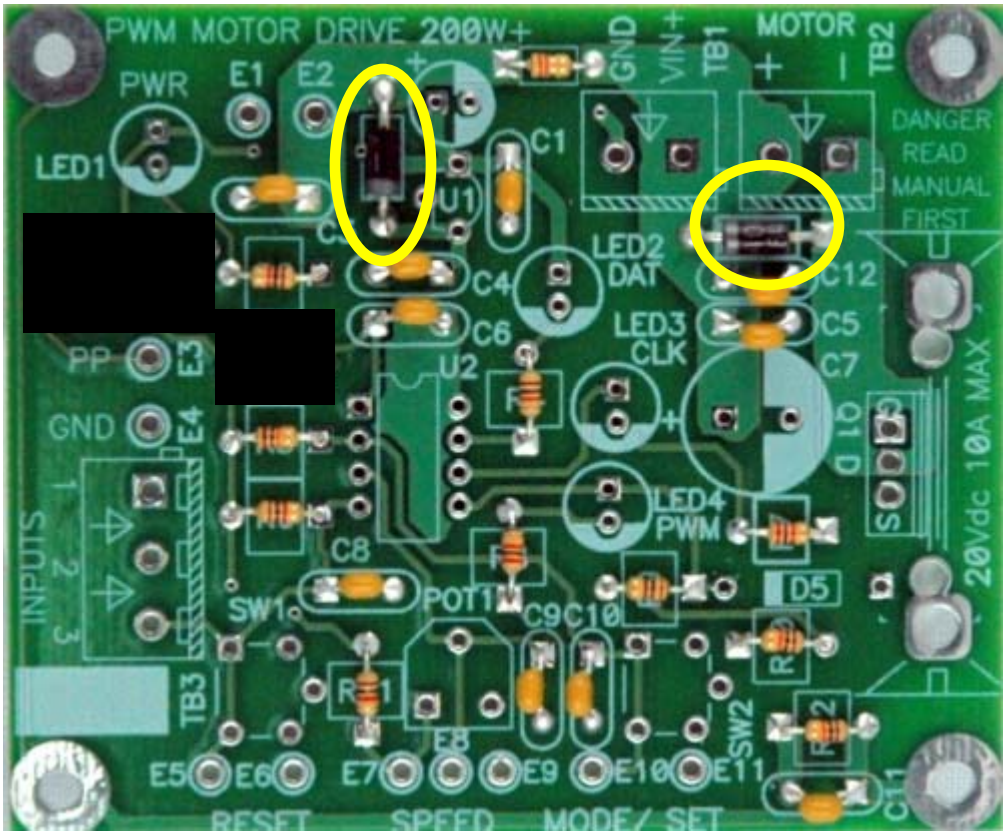

Figure 9: Board with 1A, 400V general-purpose diodes installed.

From the kit, locate 3 pieces of the 1A, 400V general-purpose diodes.

Find the locations for these parts on the board. They are marked D1, D2.

At each location, insert the leads through the plated holes. Make certain the polarity marker on the part matches the polarity marker on the board. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them.

Once you've soldered the leads in place, trim and discard the excess lead length.

Step 7: 300mA, 75V switching diode, QTY 1

D3 (1N4148 or equiv)

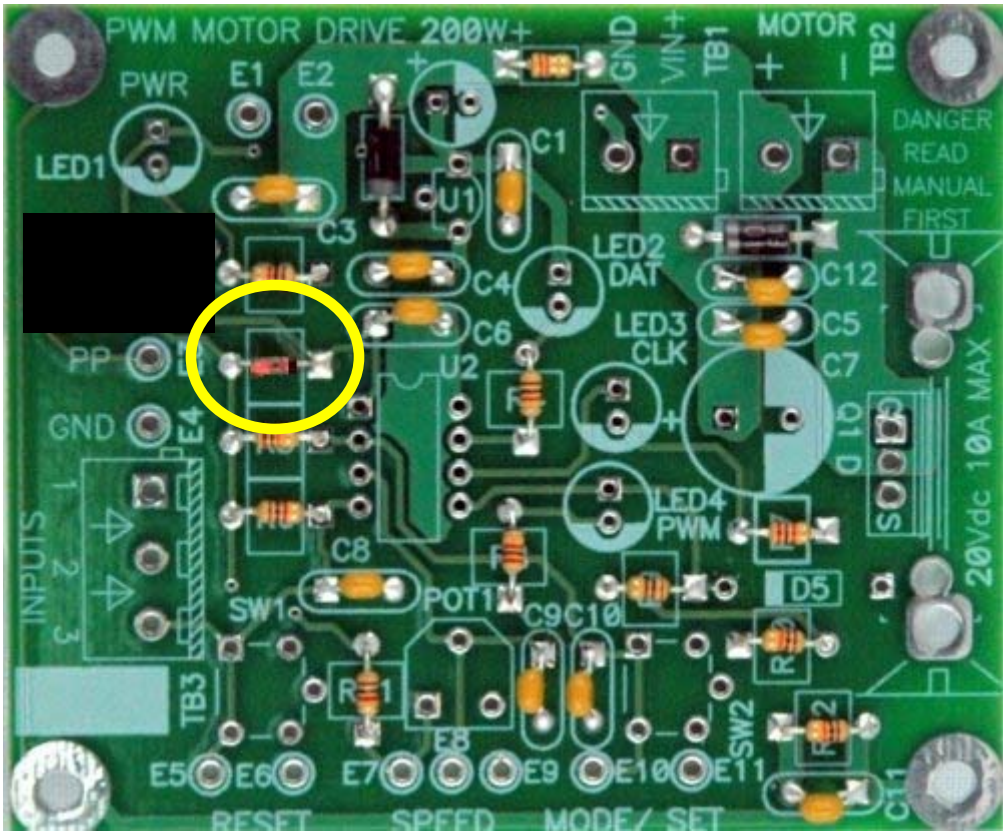

Figure 10: Board with 300mA, 75V switching diode installed.

From the kit, locate 1 piece of the 300mA, 75V switching diode.

Find the location for this part on the board. It is marked D3.

At this location, insert the diode's leads through the plated holes. Make certain the polarity marker on the part matches the polarity marker on the board. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them.

Once you've soldered the leads in place, trim and discard the excess lead length.

Step 8: 5.6V, 0.5W zener diode, QTY 1

D5

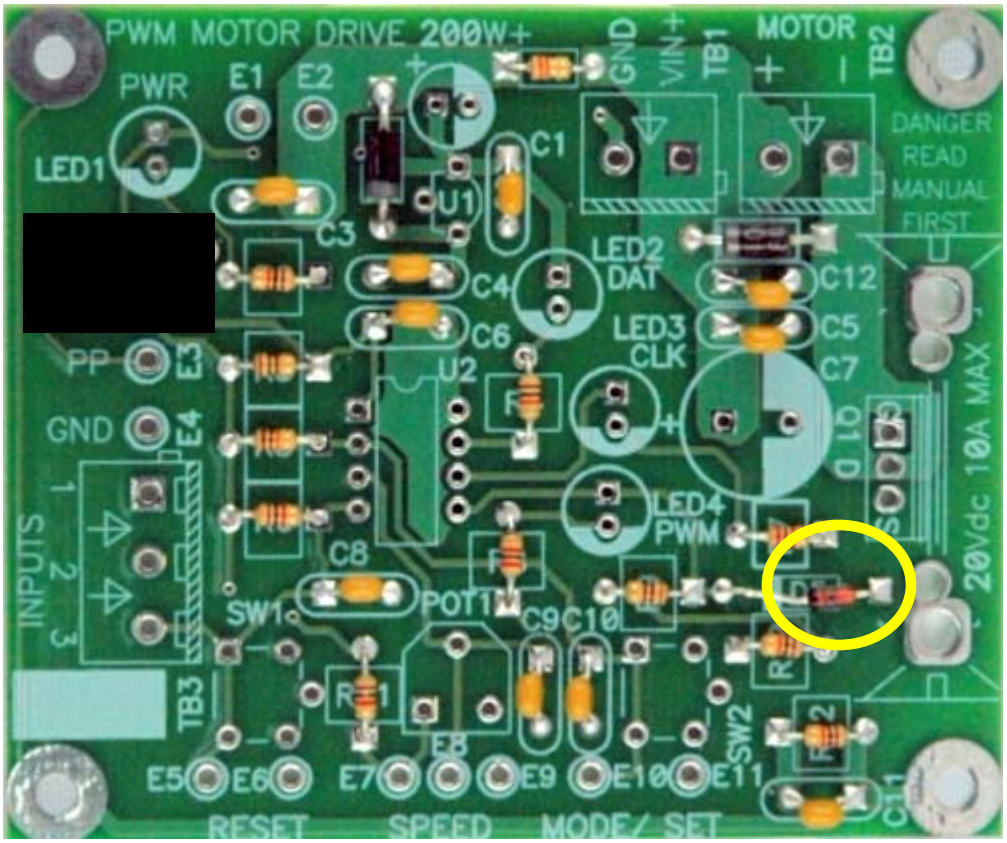

Figure 11: Board with 5.6V, 0.5W zener diode installed.
Optional protection diodes for gate of the MOSFET

From the kit, locate 2 pieces of the 5.6V, 0.5W Zener diodes.

Find the location for this part on the board. It is marked D5.

At each location, insert the diode's leads through the plated holes. Make certain the polarity marker on the part matches the polarity marker on the board. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them.

Once you've soldered the leads in place, trim and discard the excess lead length.

Step 9: 1 Green, 2 Red LEDs

LED1, LED2, LED3

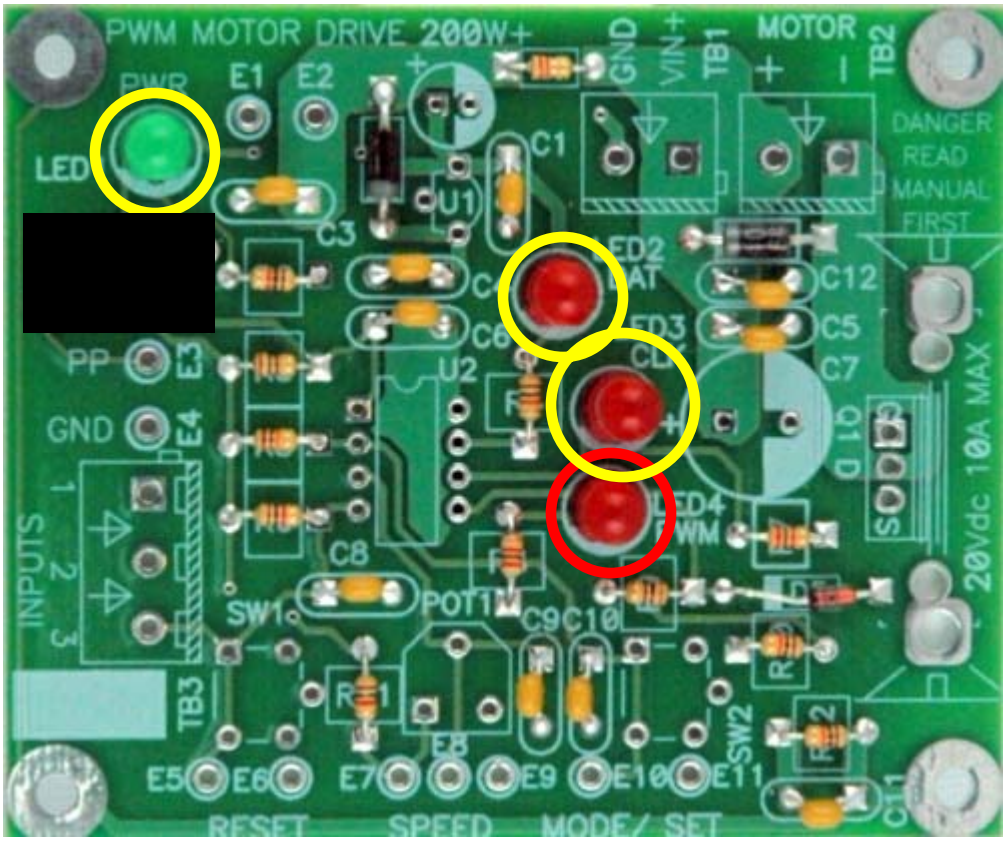

Figure 12: Board with green, red LEDs installed.

From the kit, locate 1 of the Green and 2 of the Red T13/4 LEDs.

Find the locations for these parts on the board. The Green LED occupies LED1, the Red LEDs occupy LED2, LED3. At each location, insert the diode's leads through the plated holes. Make certain the polarity marker on the part matches the polarity marker on the board. On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them. Once you've soldered the leads in place, trim and discard the excess lead length.

LED4 is used for debug purposes of custom code development only. For this product to function properly with the software installed, it must NOT be installed.

Step 10: Push-button switches, QTY 2

SW1, SW2

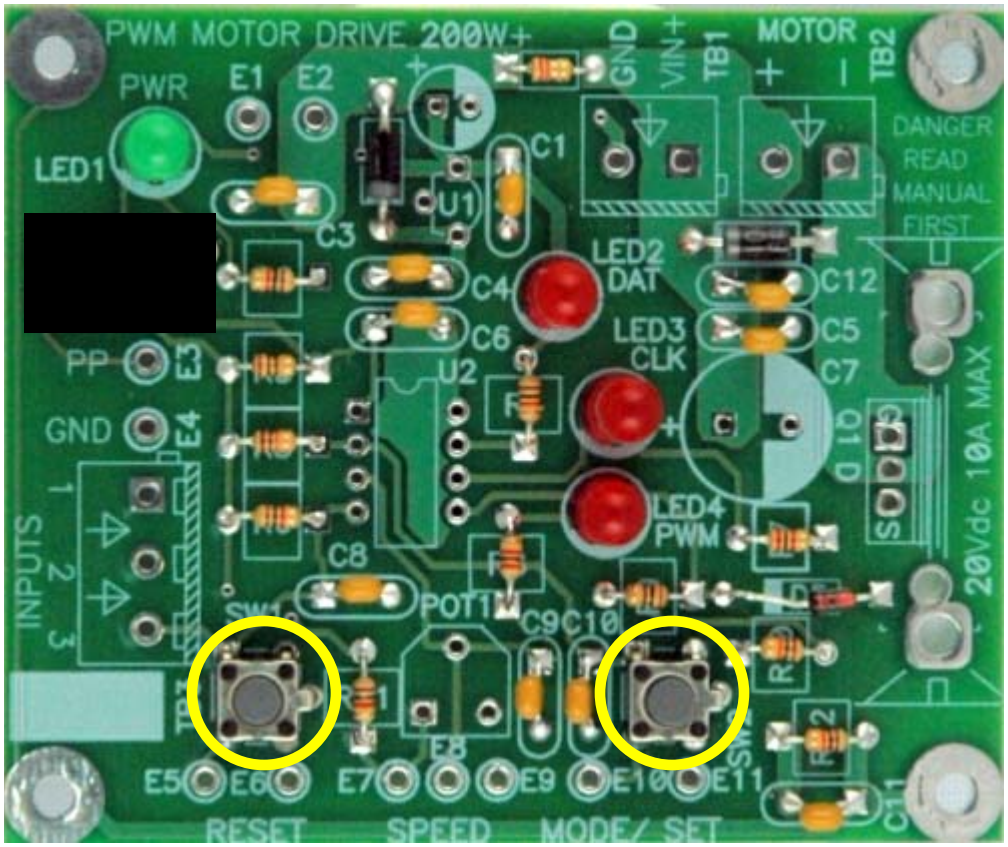

Figure 13: Board with push-button switches installed.

From the kit, locate 2 of the push button switches. (SPST NO PB)

Find the locations for these parts on the board. They are marked SW1 & SW2.

At each location, insert the switch's leads through the plated holes and solder them in place.

PLEASE NOTE: SW1 has corresponding wire holes (E5 and E6) for mounting a remote switch if desired. SW2 has E10 and E11 for mounting a remote switch as well.

Step 11: 5.0K potentiometer, QTY 1

POT1

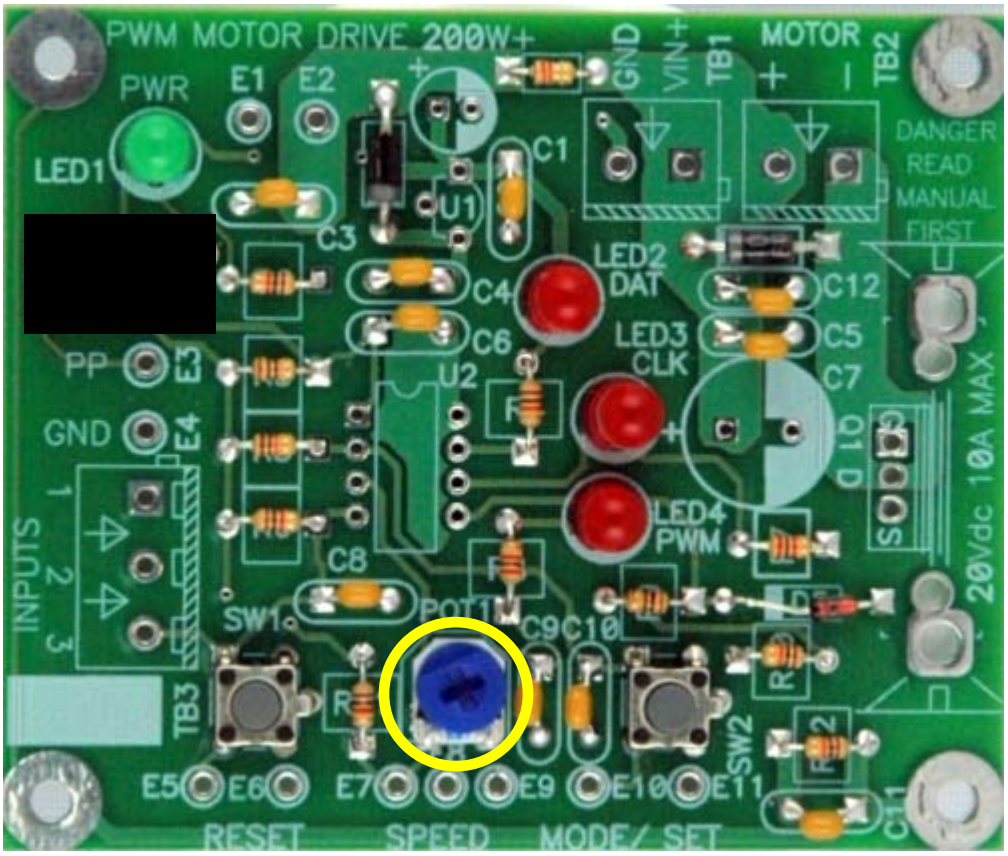

Figure 14: Board with potentiometer installed.

From the kit, locate 1 5.0K potentiometer.

Find the location for this part on the board. It is marked POT1.

At this location, snap the potentiometer's leads through the plated holes and solder them in place.

PLEASE NOTE: The potentiometer has corresponding wire holes (E7, E8, and E9) for mounting a remote switch if desired.

Step 12: 5V regulator, QTY 1

U1

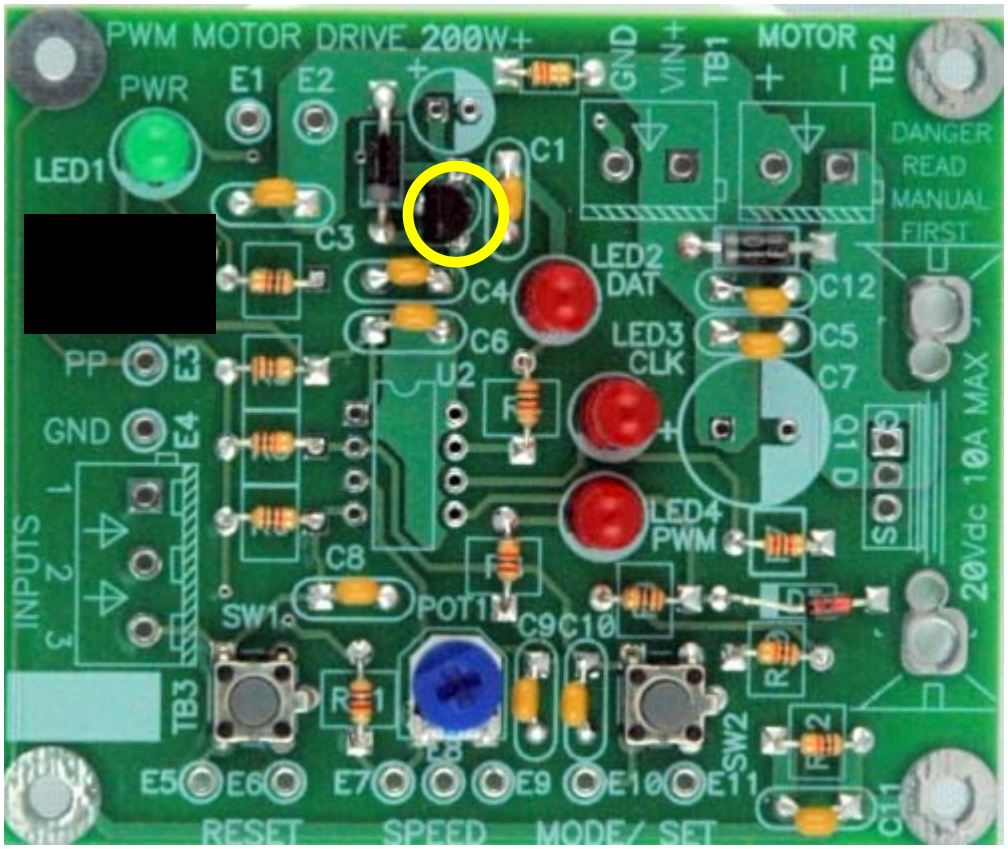

Figure 15: Board with 5V regulator installed.

From the kit, locate the 5V regulator. (LM78L05 or equivalent)

Find the location for this part on the board. It is marked U1.

At this location, insert the regulator's leads through the plated holes and solder them in place. Make certain the polarity marker on the part matches the polarity marker on the board.

PLEASE NOTE: Be sure to form the legs for U1 properly. One pin must be bent slightly to fit into the board.

Step 13: aluminum electrolytic capacitors, QTY 2

C1, C7

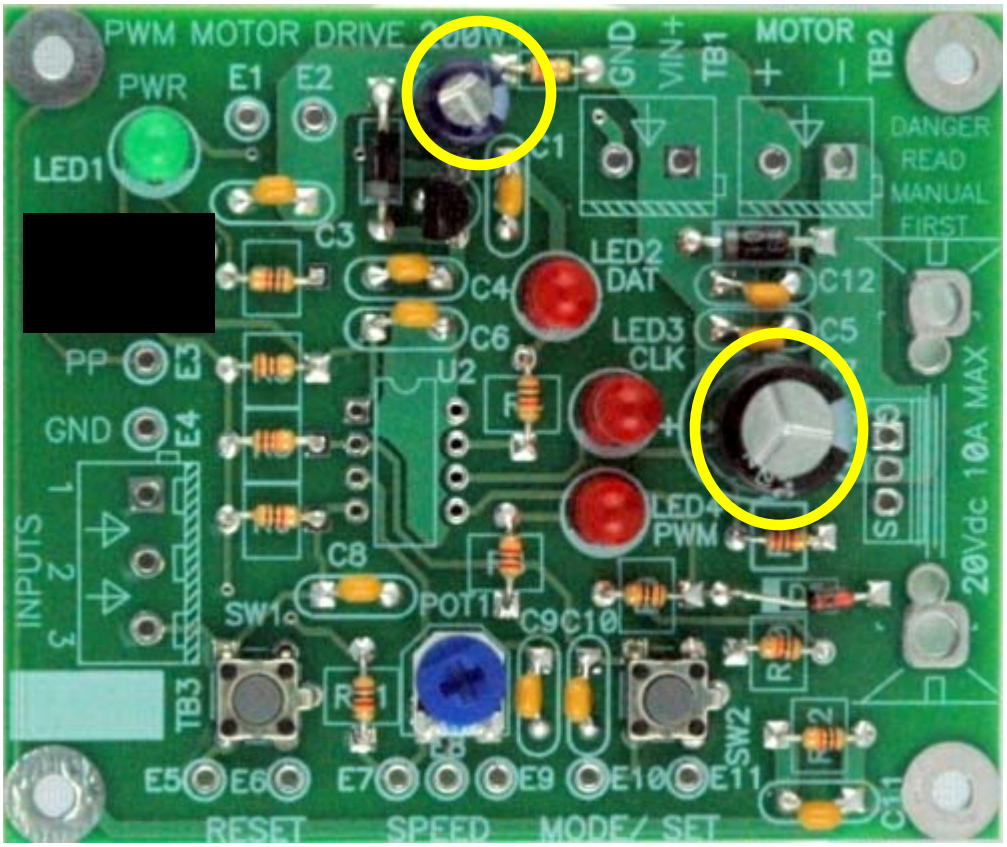

Figure 16: Board with 100uF and 330uF capacitors installed.

From the kit, locate 1 piece of the 100 uF capacitor and 1 piece of the 330 uF capacitor.

Find the locations for these parts on the board. The 100 uF occupies C1, and the 330 uF occupies C7.

At each location, insert the capacitor's leads through the plated holes, making sure to line up the polarity indicators on the board with the polarity indicators on the capacitor with the negative polarity indicator on the board. The bar on the capacitor should line up with the negative polarity indicator on the board.

On the back side of the board, bend the leads at 90-degree angles so that the parts are held in place when you solder them.

Once you've soldered the leads in place, trim and discard the excess lead length.

Step 14: Processor socket, QTY 1

XU2

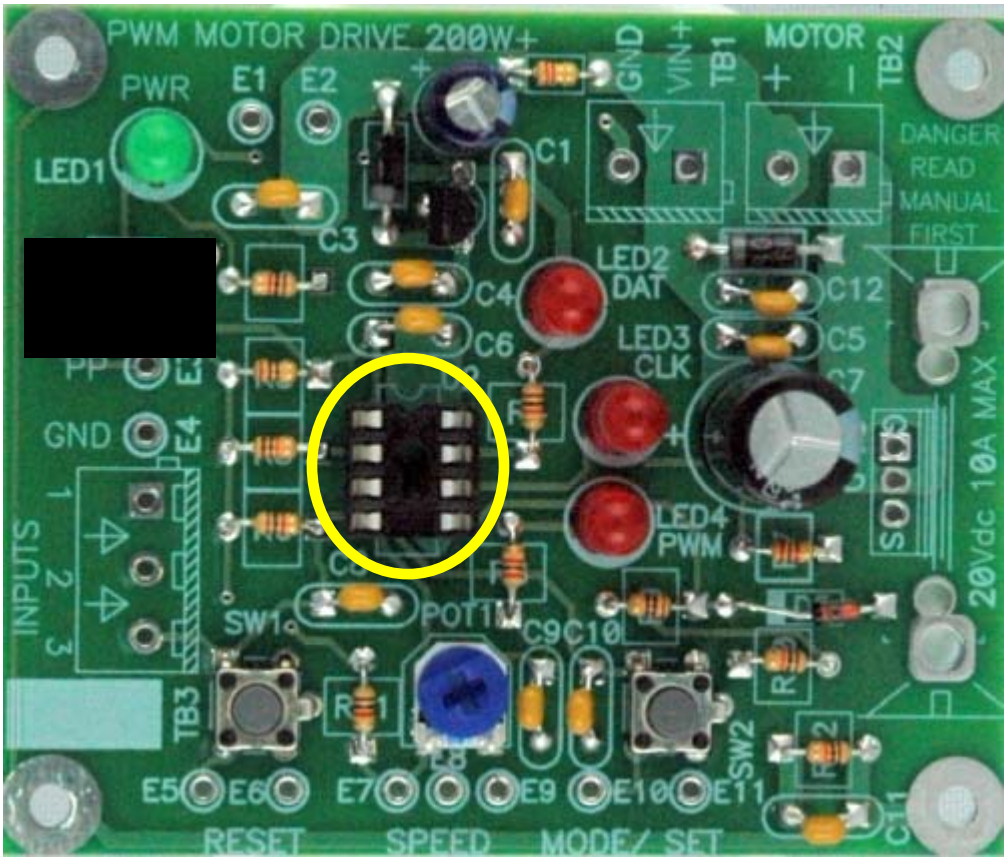

Figure 17: Board with socket installed.

From the kit, locate the 8-pin socket.

Find the location for this part on the board. It is marked XU2.

At XU2, insert the socket's leads through the plated holes and solder them in place. Make certain the polarity marker on the part matches the polarity marker on the board.

Step 15: MOSFET & Heat Sink, QTY 1

Q1, HS1

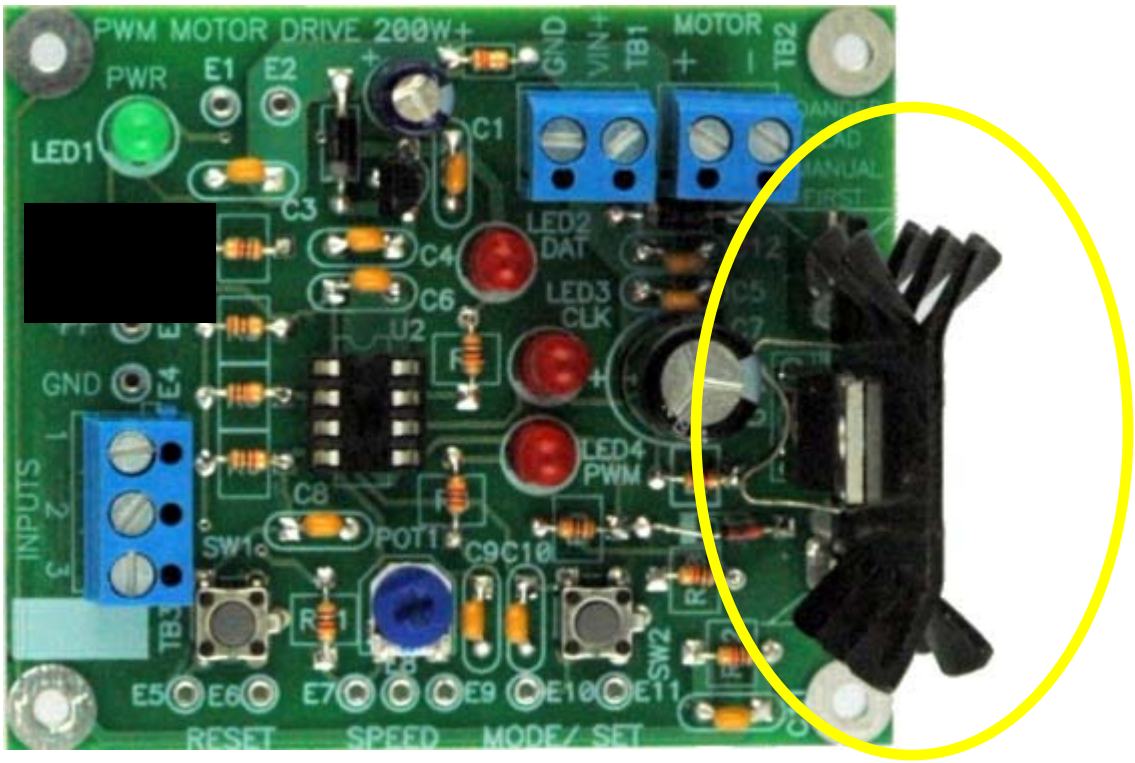

Figure 18: Board with MOSFET and heat sink installed.

From the kit, locate the MOSFET and the heat sink.

Slip the “cool clip” (shaped like an “M” or a “W” if you look at it from overhead) over the body of the MOSFET.

Find the location for these parts on the board. It is marked Q1.

At this location, insert the leads of the MOSFET and the mounting tabs of the heat sink the plated holes and solder them in place.

Once you’ve soldered the leads of the MOSFET in place, trim and discard the excess lead length from the MOSFET.

Step 16: 2- and 3-pin terminal blocks, QTY 3

TB1, TB2, TB3

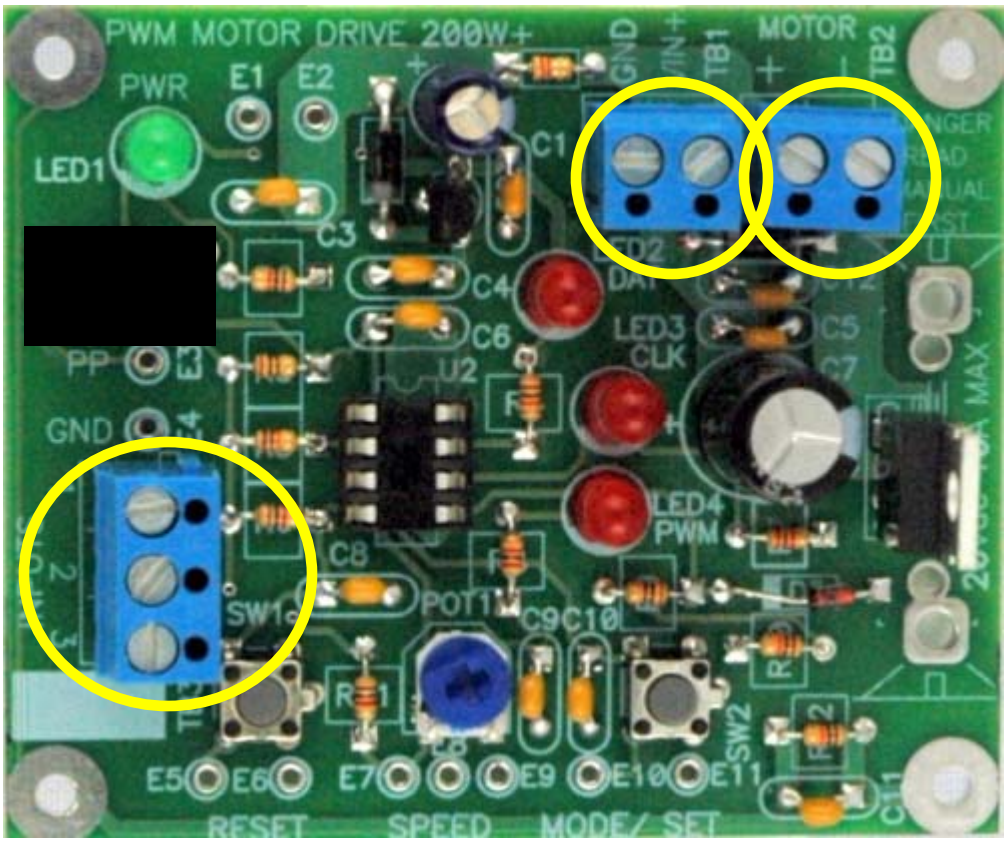

Figure 19: Board with terminal blocks installed.
Optional terminal blocks in some kits

From the kit, locate the 3-pin terminal block and the 2-pin terminal blocks.

Find the location for these parts on the board. The 3-pin terminal block is located at TB3, and the 2-pin terminal blocks are located at TB1 & TB2.

At each location, insert the block's leads through the plated holes and solder them in place.

Step 17: Processor, QTY 1

U1

Figure 20: Board with socket and processor installed.

From the kit, locate the processor chip.

Carefully insert the processor into the socket, making sure to line up the pin 1 indicator on the socket with the half-moon-shaped pin one indicator on the body of the processor.

Customer Service & Support

We have done our very best to provide you with a product that was designed and manufactured by experienced professionals.

Our assembled units are visually inspected and functionally tested.

Whether you're buying assembled units or unassembled kits from us, our goal is to ensure 100% customer satisfaction on every product, every sale, every time.

If for any reason you are unsatisfied with this product and wish to return it, please visit our web site and go to our Customer Service page to view our return policy.

We thank you for your trust and your business, and hope to hear from you in the future!

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