

KA-200W-M-TH-0001

Pulse Width Modulator Microprocessor Controlled Motor Drive 200 Watt



Assembly Manual

KA-200W-M-TH-0001 Assembly Manual

Revision 1.0

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How to Safely Use this Product

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 always the responsibility of the user.

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.

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:

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

Schematic

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

The link to this document is back on the startup page that popped up when you first explored the CD for this product.

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
3	D1, D2, D4	DIODE, GP, 1A, 400V, TH, DO-41
2	D3, 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, DIP8-300
1	U1	IC, REG, 5V, 0.1A, TH, TO-92
1	LED1	LED, GREEN, 2.1V, 10MA, 75MW, TH
2	LED2, LED3	LED, RED, 2.0V, 10MA, 60MW, TH
1	HS1	MECH, HEAT SINK, TO-220, BLACK ANNODIZED, 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
2	R6, R11	RES, CF, 1.0K, 5%, 150V, 1/6W, TH, RES265
3	R1, R3, R9	RES, CF, 2.2, 5%, 150V, 1/6W, TH, RES265
3	R5, R10, R12	RES, CF, 10K, 5%, 150V, 1/6W, TH, RES265
3	R2, R4, R7	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

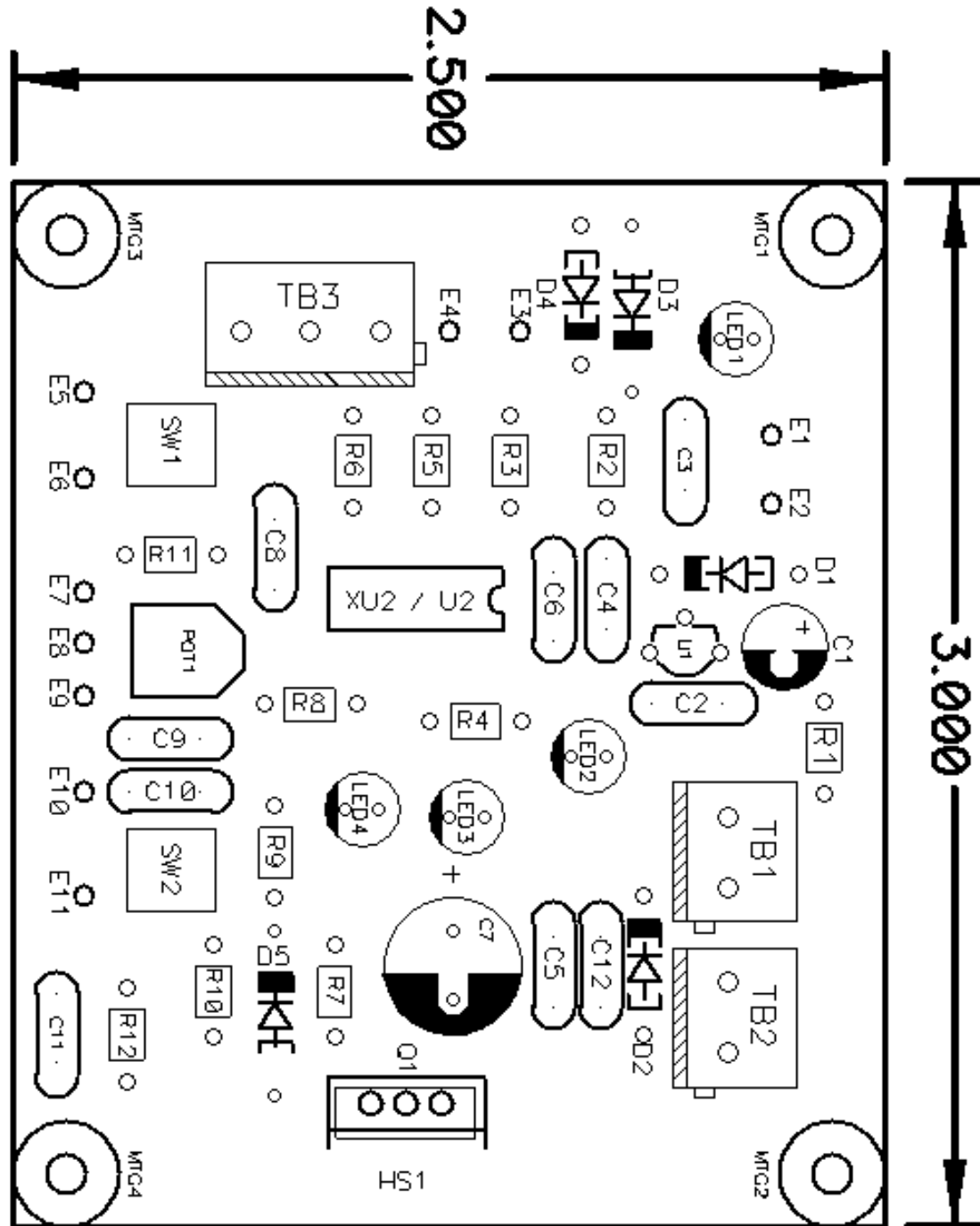


Figure 1: Component Locations and Reference Designators.

Board rotated 90 degrees for maximum image size..

Assembly Drawing, Page 2

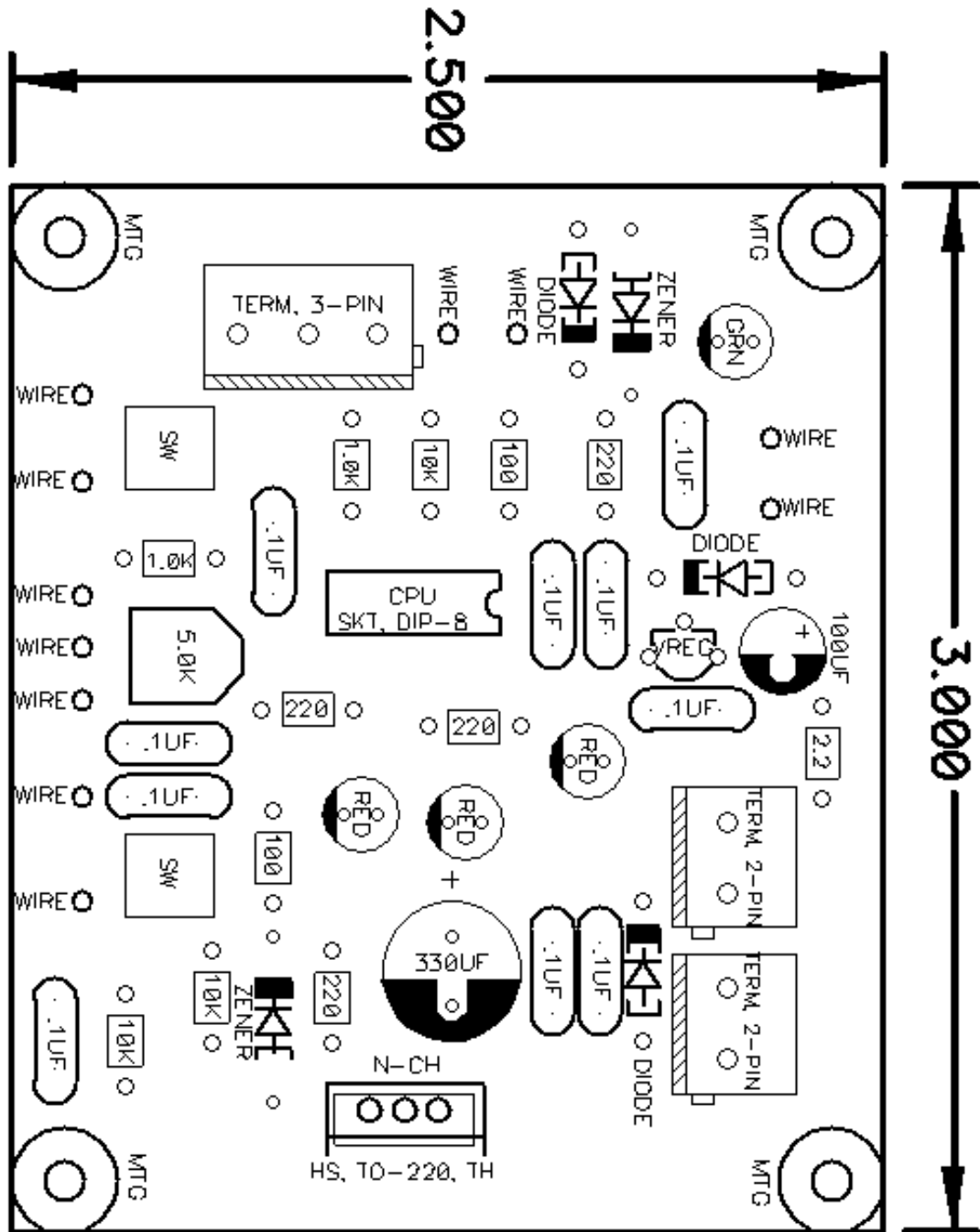


Figure 2: Component Values.

Board rotated 90 degrees for maximum image size.

Assembly Instructions

Bare Board (for reference)

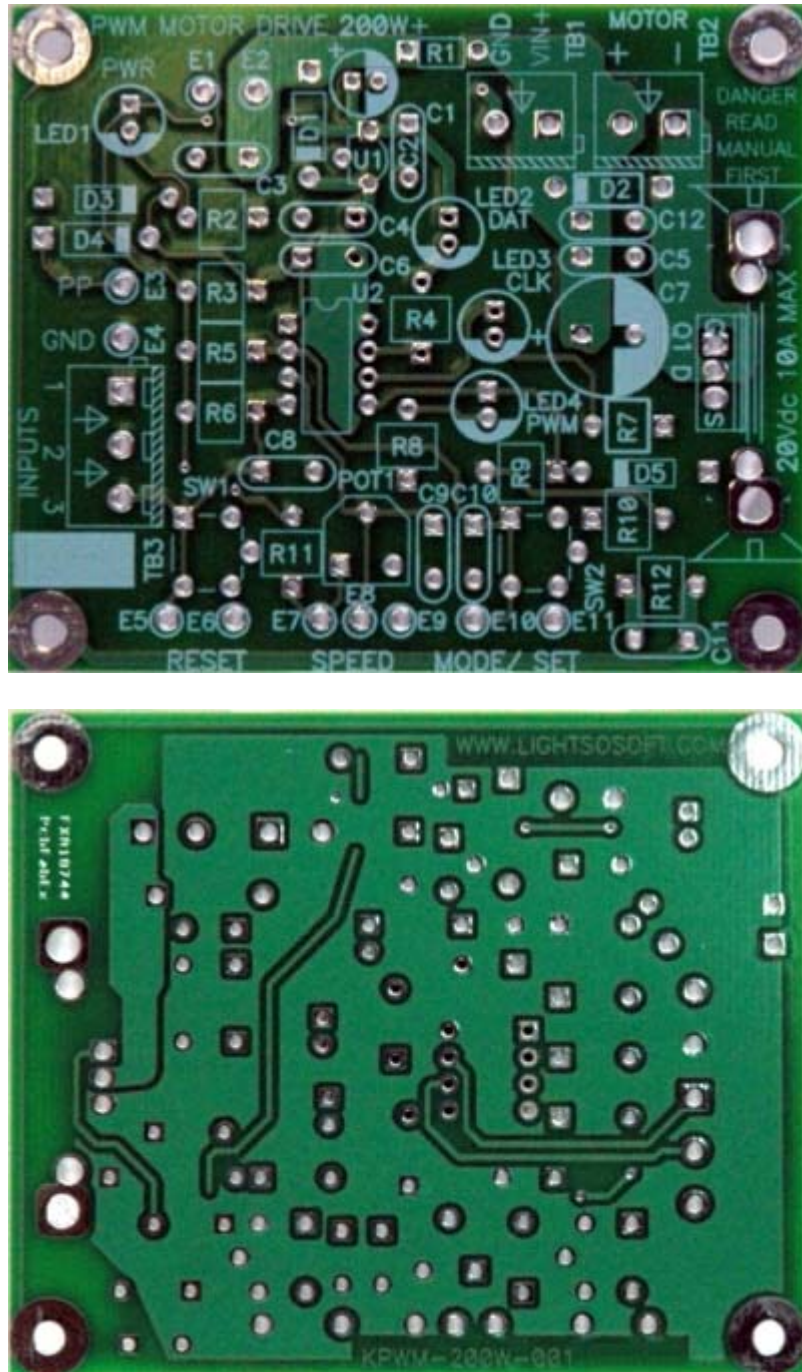


Figure 3: Board with no components installed, top and bottom sides.

Step 1: 0.1uF ceramic capacitors, QTY 9 C2, C3, C4, C5, C6, C9, C10, C11, C12

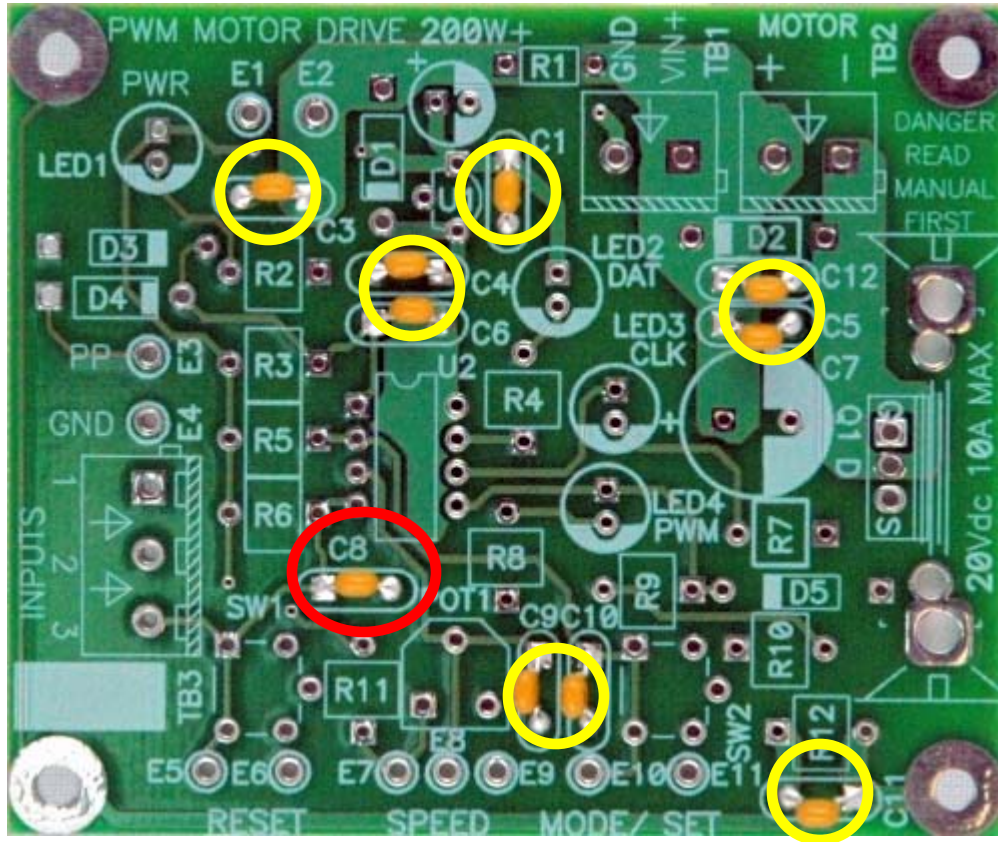


Figure 4: Board with 0.1uF ceramic capacitors installed.

From the kit, locate 10 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.

Step 2: 1.0K resistors (R6 & R11)

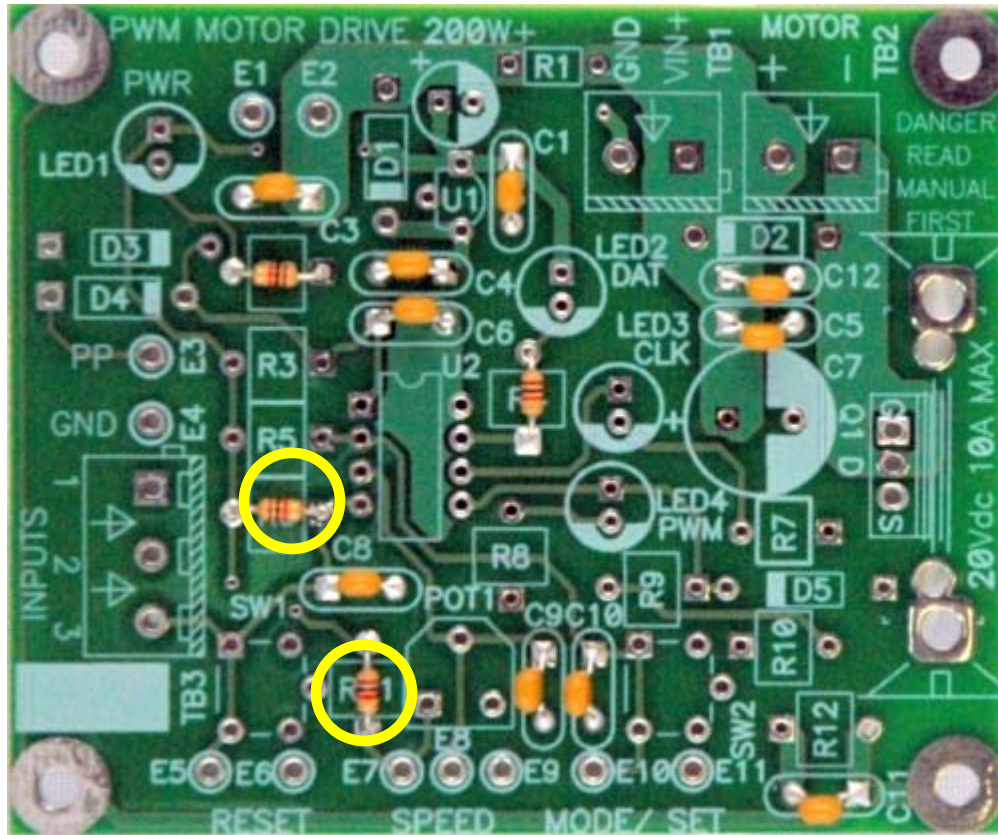


Figure 5: Board with 1.0K resistors installed.

From the kit, locate 2 pieces of the 1.0K resistor. (brown black red)

Find the locations for these parts on the board. They are marked R6, R11. 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.

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

Step 3: 10K resistors, QTY 3 R5, R10, R12

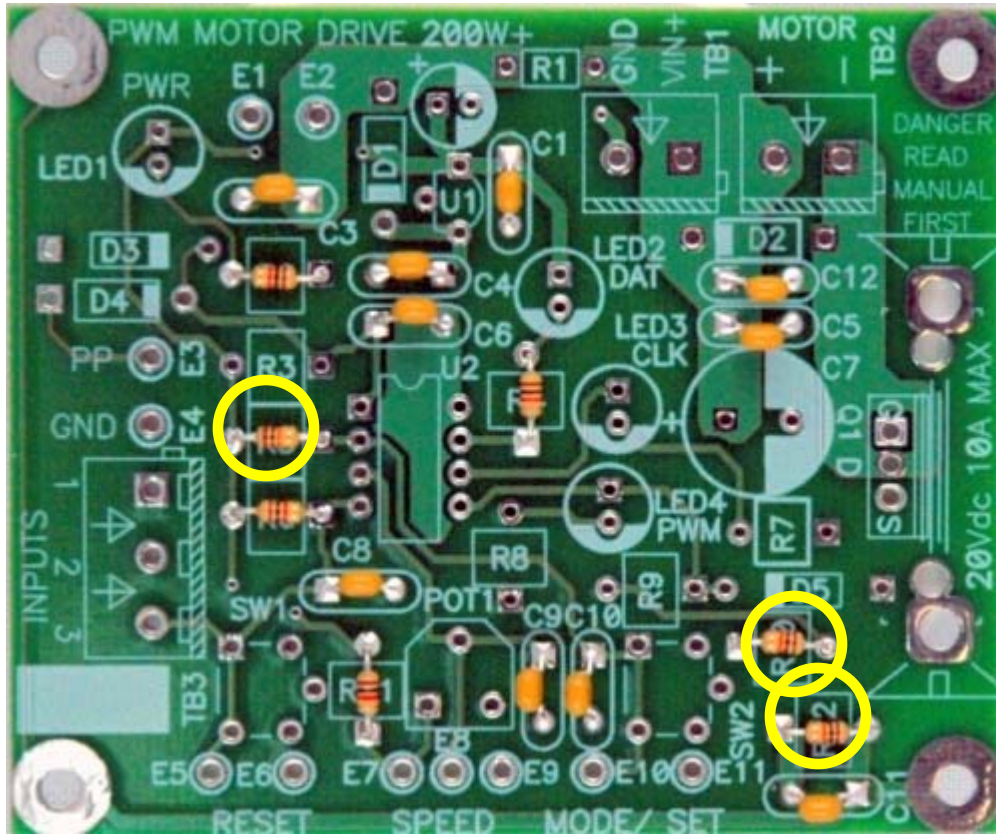


Figure 6: Board with 10K resistors installed.

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, 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 resistors, QTY 4 R2, R4, R7, R8

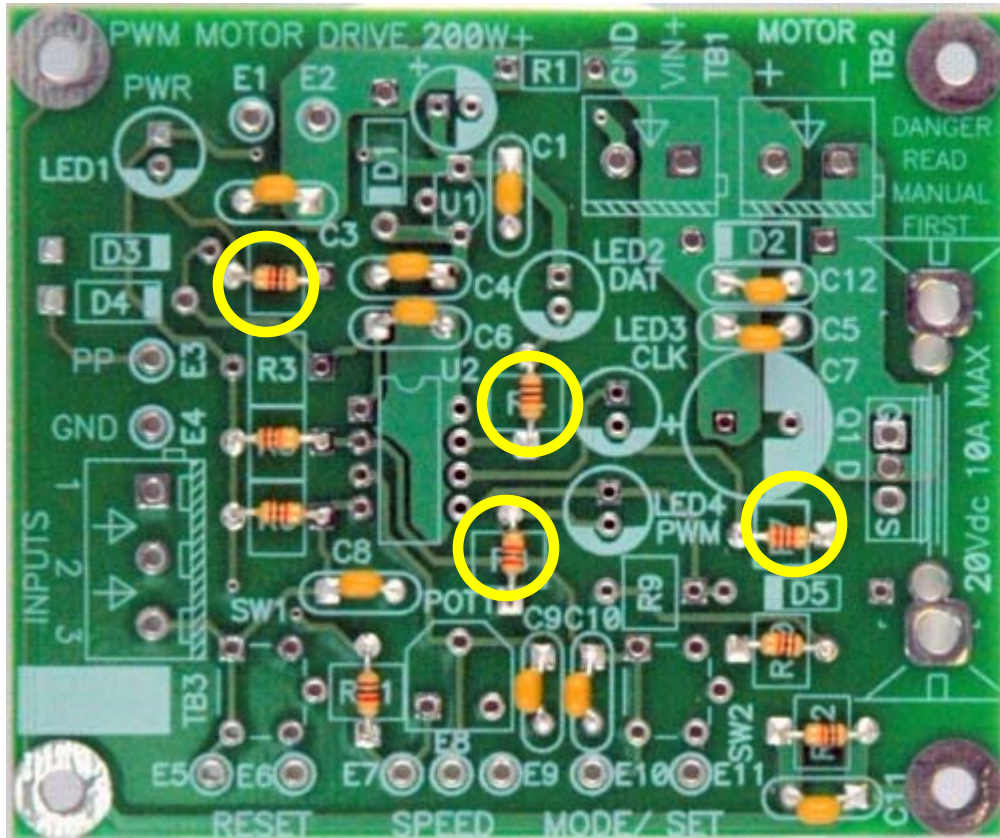


Figure 7: Board with 220 resistors installed.

From the kit, locate 2 pieces of the 220 resistor. (red red brown)

Find the locations for these parts on the board. They are marked 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: 2.2 ohm resistor, QTY 3 R1, R3, R9

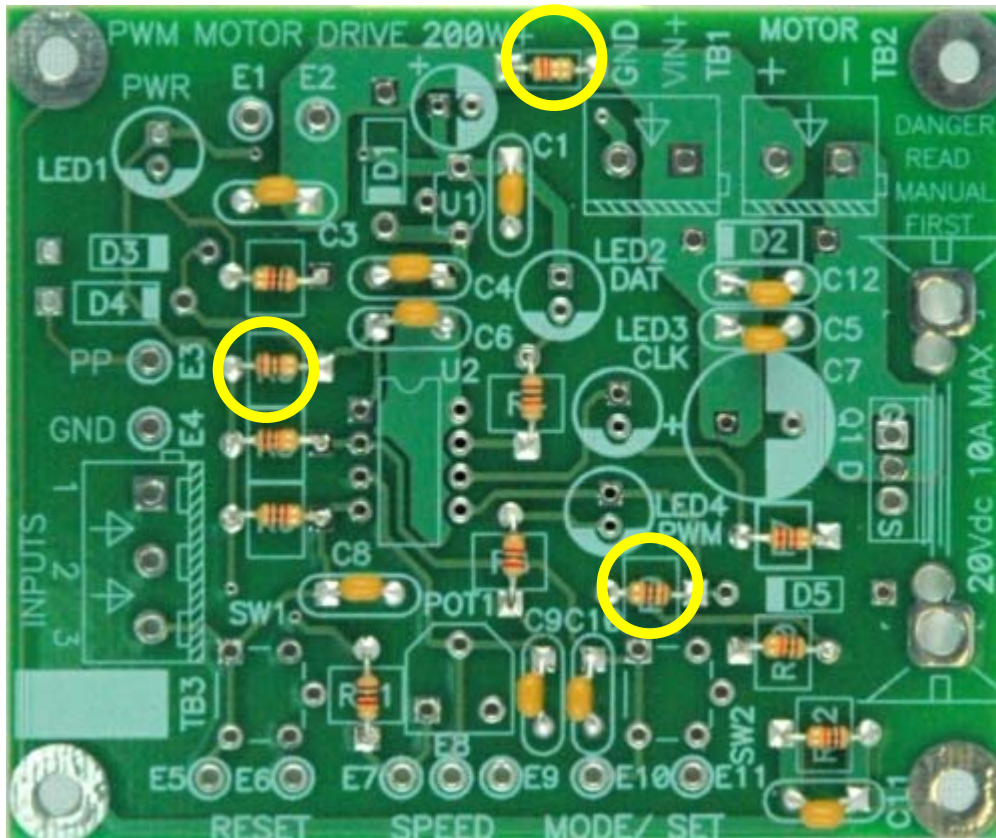


Figure 8: Board with 2.2 ohm resistors installed.

From the kit, locate 3 pieces of the 2.2 ohm (red red gold).

Find the locations for these parts on the board. They are marked R1, R3, 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 3
D1, D2, D4 (1N4004 or equiv)**

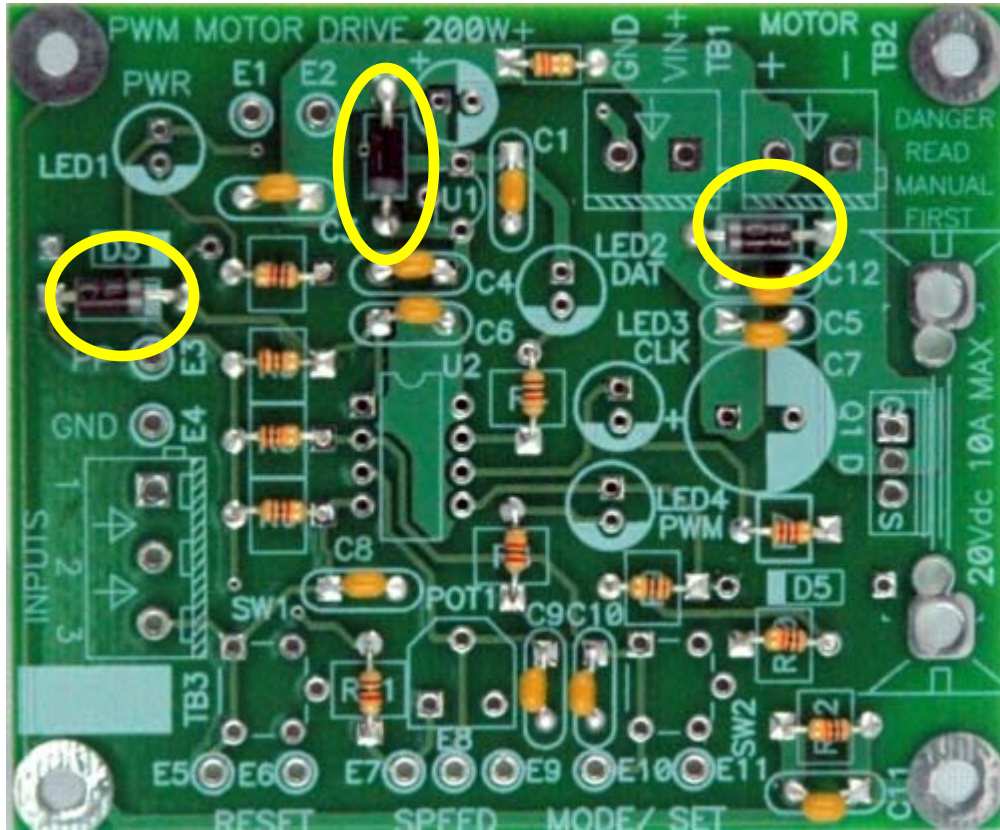


Figure 9: Board with 1A, 400V general-purpose diodes installed.

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, D4.

At each location, insert the diode'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 7: 5.6V, 0.5W zener diodes, QTY 2 D3, D5 (1N5232B or equiv)

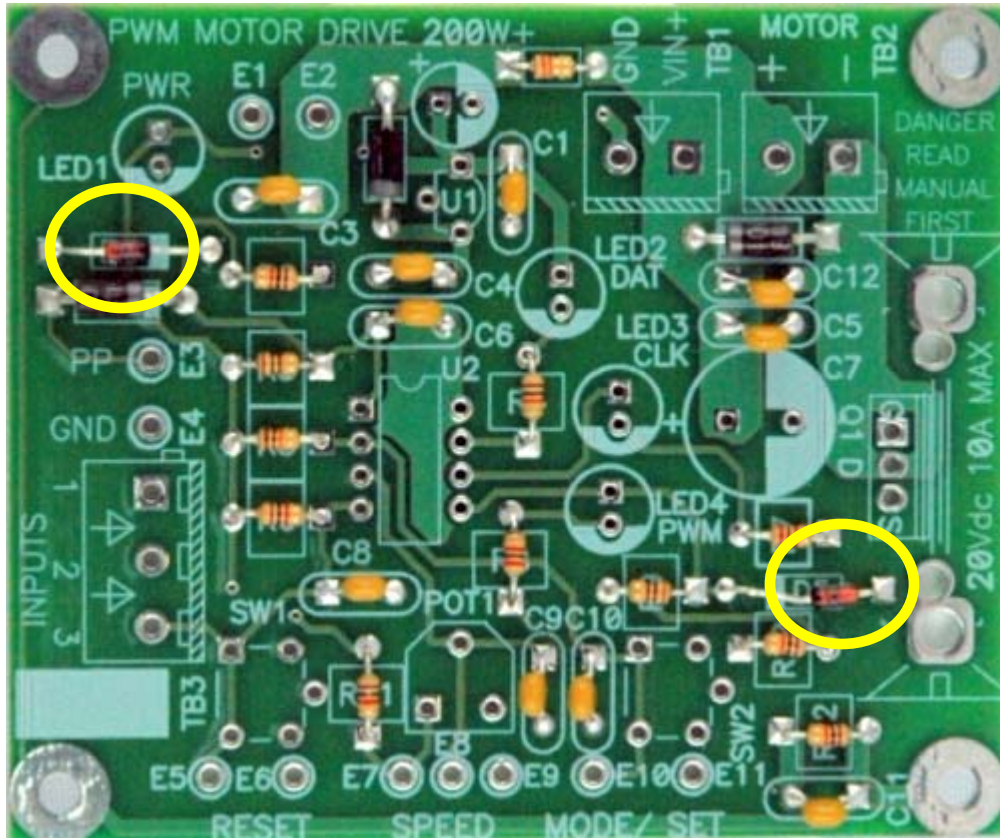


Figure 10: Board with 5.6V, 0.5W zener diodes installed.
Optional protection diodes for gate of the MOSFET

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

Find the locations for these parts on the board. They are marked D3 & D5.

At each location, insert the diode'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 8: 1 Green, 2 Red LEDs

LED1, LED2, LED3

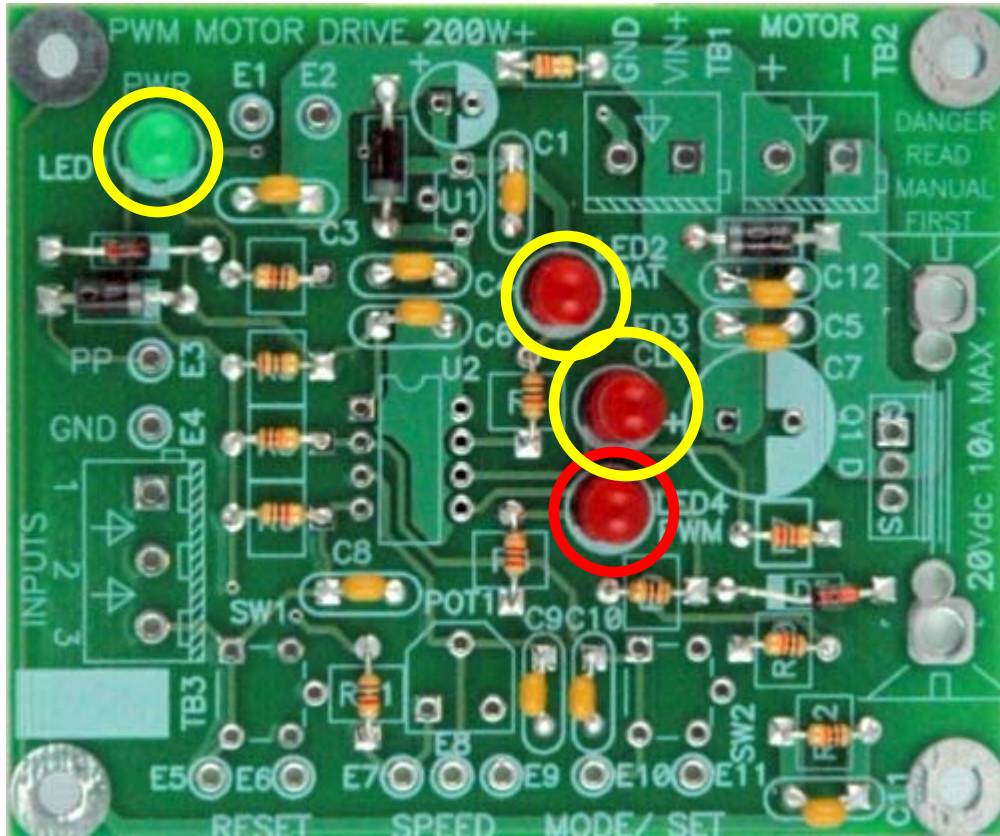


Figure 11: Board with green, red LEDs installed.

From the kit, locate 1 of the Green and 3 of the Red T13/4 LEDs.

Find the locations for these parts on the board. The Green LED occupies LED1, and the Red LEDs occupy LED2, LED3. At each location, insert the diode'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.

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

Step 9: Push-button switches, QTY 2 SW1, SW2

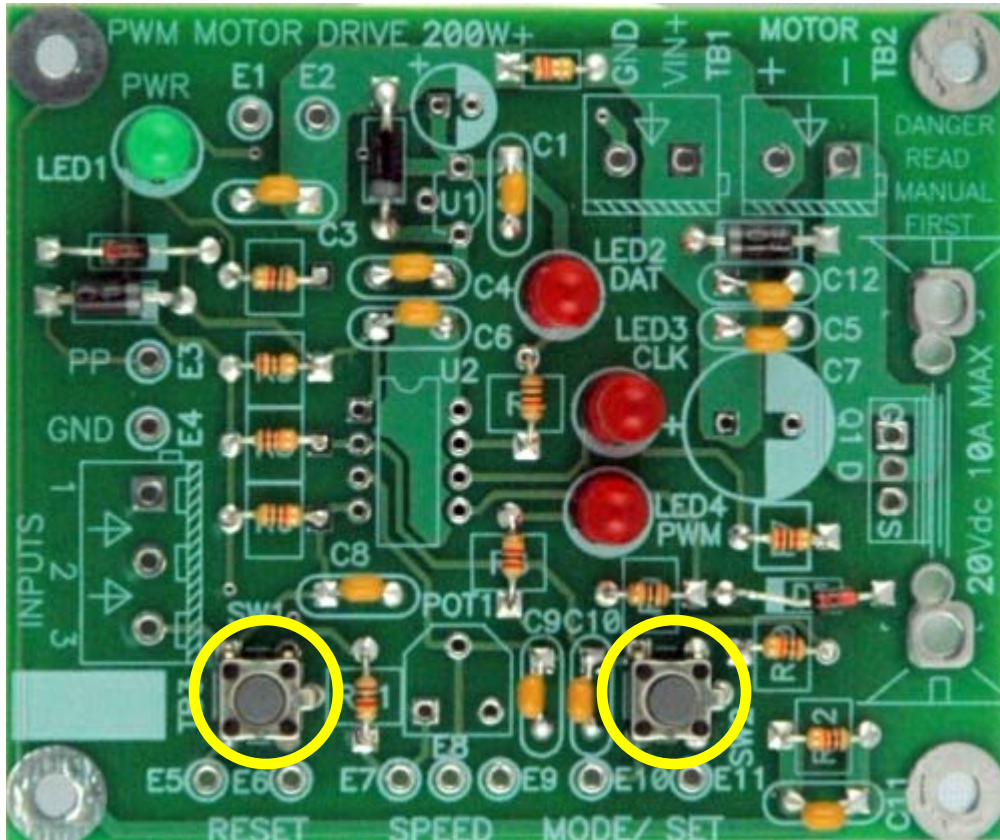


Figure 12: Board with push-button switches installed.

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 10: 5.0K potentiometer (POT1)

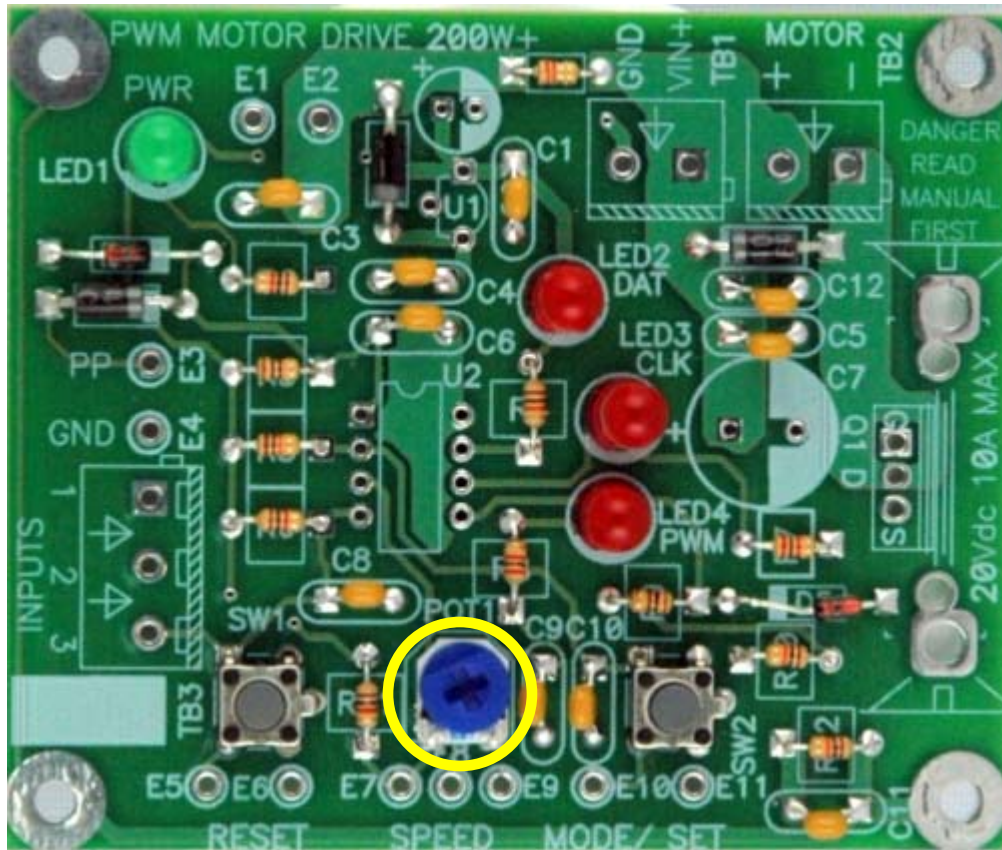


Figure 13: Board with potentiometer installed.

From the kit, locate 1 of the 5.0K potentiometers.

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 11: 5V regulator (U1)

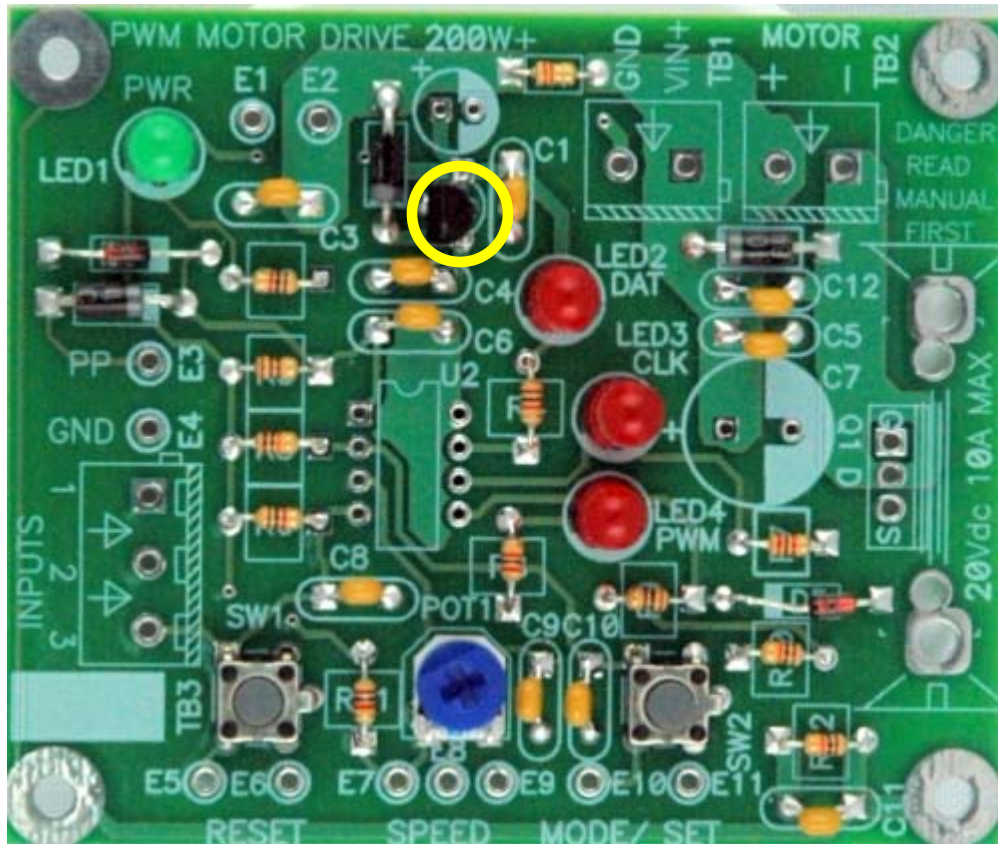


Figure 14: Board with 5V regulator installed.

From the kit, locate 1 of the 5V regulators. (LM78L05 or equiv)

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.

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

Step 12: aluminum electrolytic capacitors, QTY 2 C1, C7

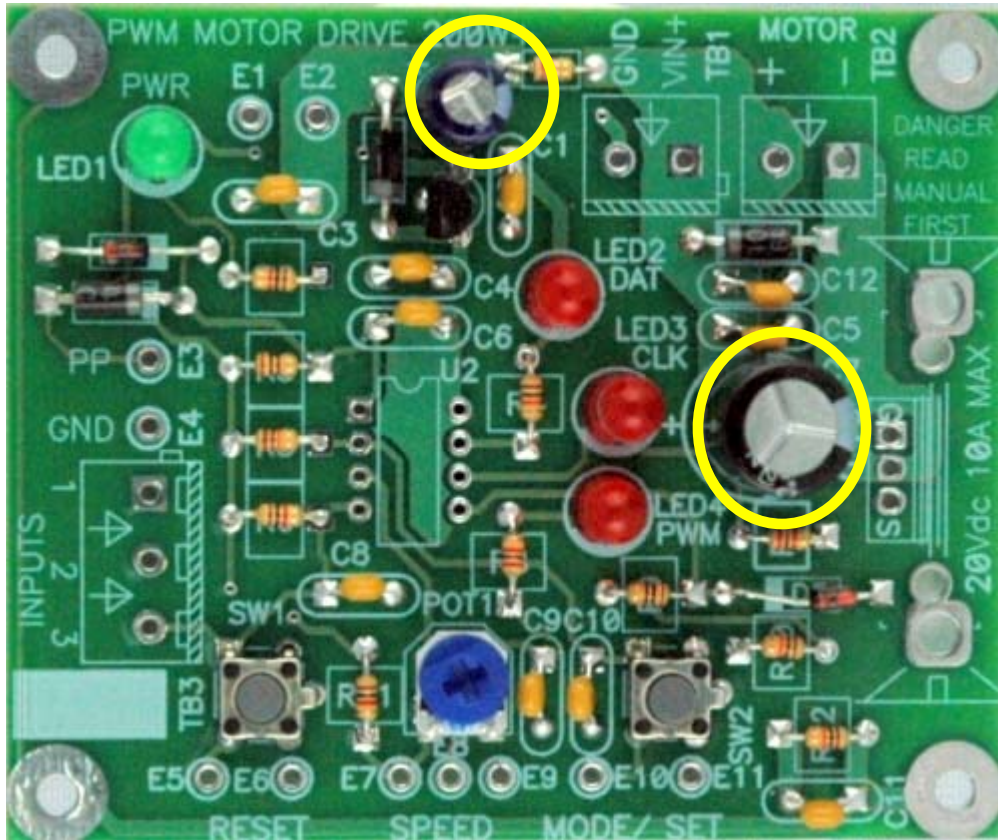


Figure 15: Board with 100uF and 330uF capacitors installed.

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 13: Processor Socket (XU2)

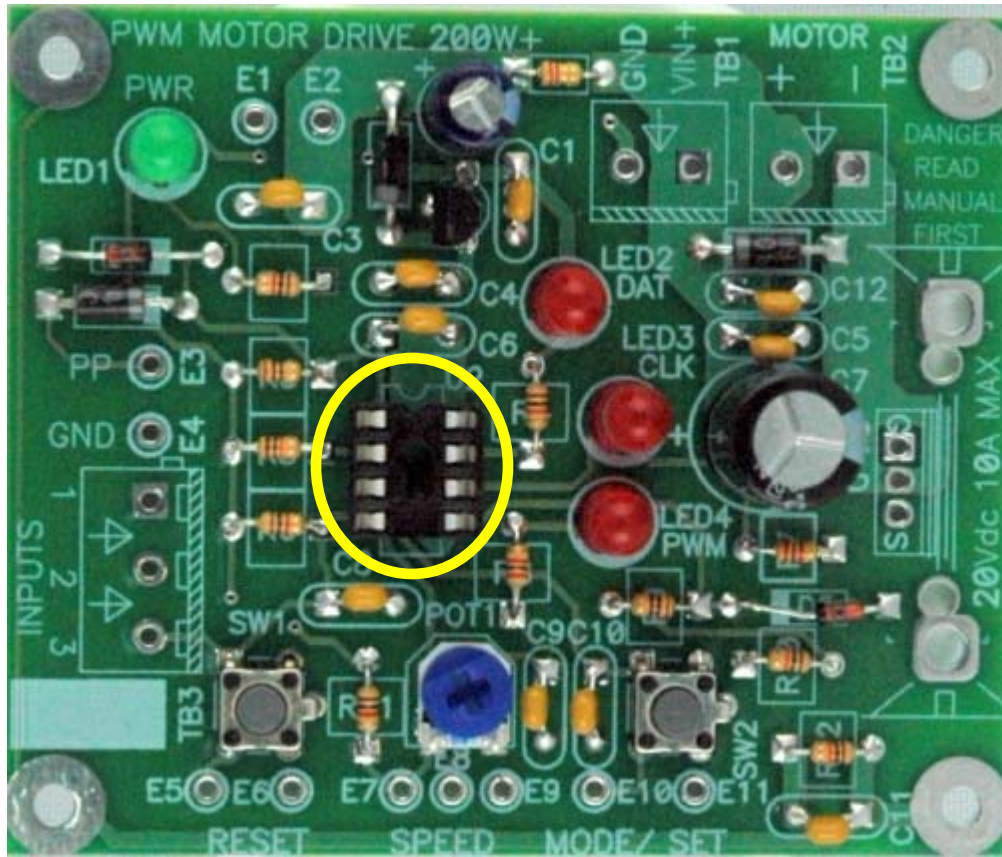


Figure 16: Board with socket installed.

From the kit, locate 1 of the 8-pin sockets.

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.

Step 14: MOSFET (Q1)



Figure 17: Board with MOSFET installed.

From the kit, locate 1 of the MOSFETs.

Find the location for this part on the board. It is marked Q1.

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

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

Step 15: 2- and 3-pin terminal blocks, QTY 3 TB1, TB2, TB3

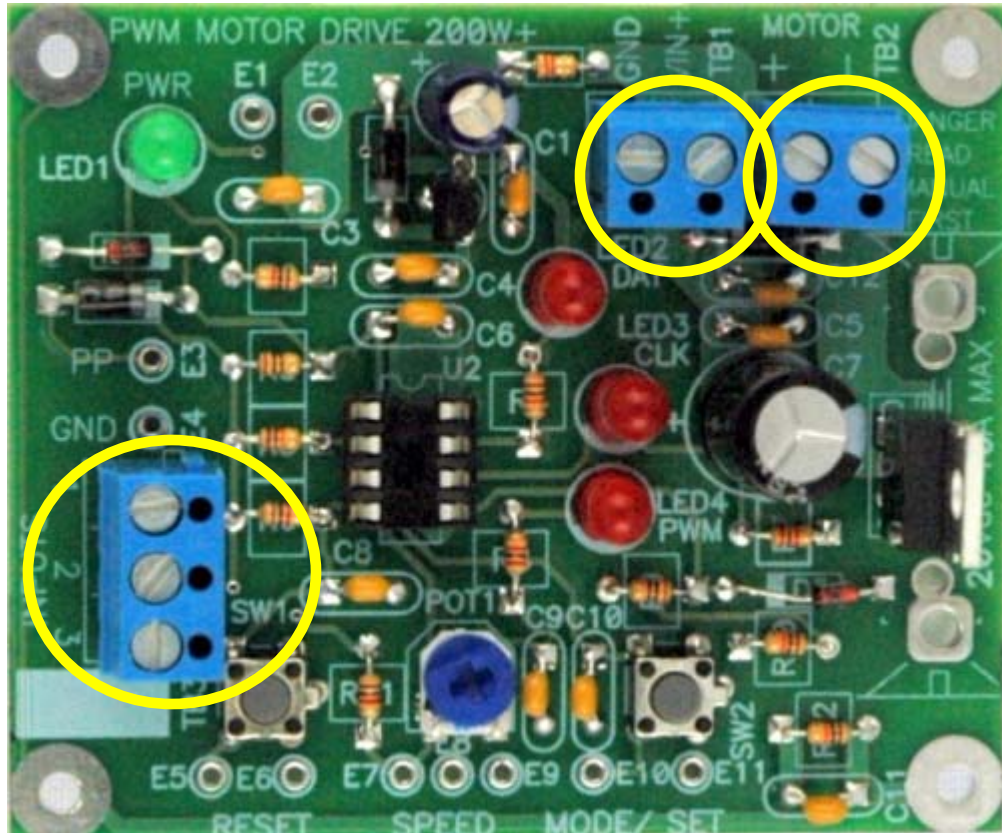


Figure 18: Board with terminal blocks installed.
Optional terminal blocks in some kits

From the kit, locate 1 of the 3-pin terminal blocks and 2 of 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 16: Heat Sink (HS1)



Figure 18: Board with heat sink installed.
Optional heat sink in some kits

From the kit, locate the heat sink.

Find the location for these parts on the board. It is marked HS1, directly behind Q1.

Make certain that you slip the “cool clip” (shaped like an “M” or a “W” if you look at it from overhead) over Q1’s body.

Solder the heat sink’s tabs into place.

Step 17: Processor (U2)



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 latest return policies.

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

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