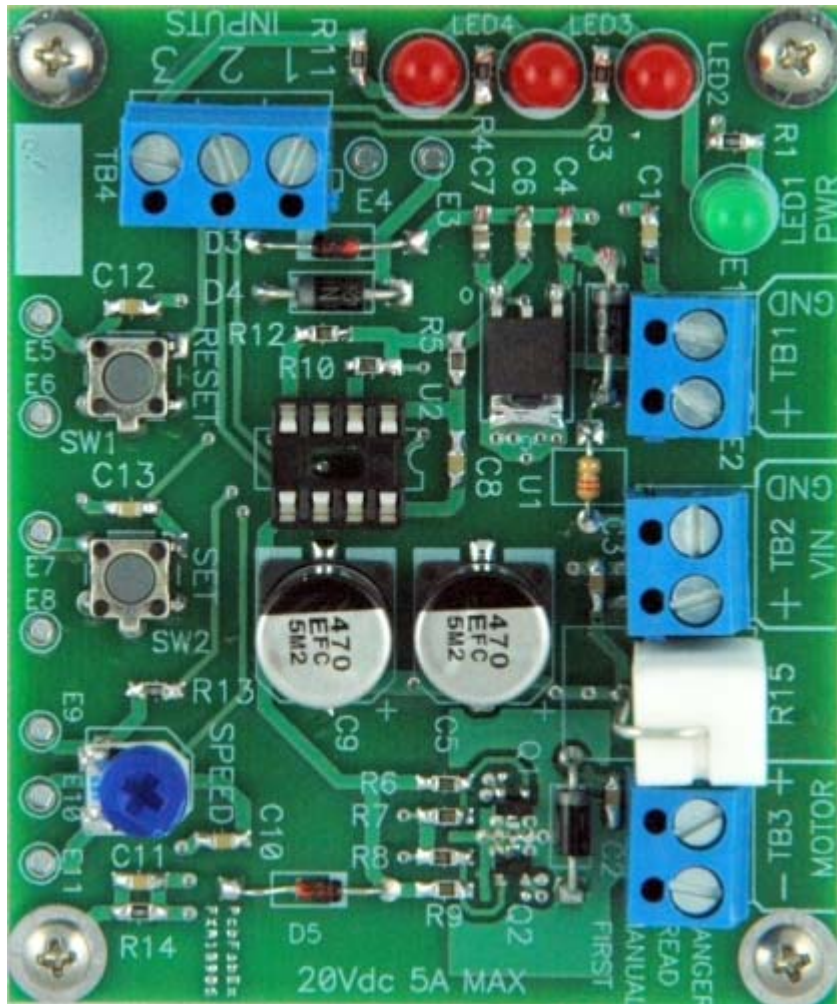# KA-100W-M-SM-0001

Pulse Width Modulator Microprocessor Controlled Motor Drive 100 Watt

Assembly Manual

Table of Contents

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 current to the unit is protected by a 5 amp fuse.

Provide an emergency power shutoff.

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

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**

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

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.

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
- Industrial
- Medical
- 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
- SMD Power MOSFET SOT-23 5.7 Amps Each
- 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: 5 Amps
- Power Control: 100 Watts
- PWM Frequency: 20KHz (Requires programming)

KA-100W-M-SM-0001 Assembly Manual   Revision 1.0

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)
- Total lifetime: N/A

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

| Count	RefDes	Description
1	PCB1	PCB, KF-PWM-100W-M-SM-X, 3X2.5, 2 LY, GRN, SMD
10	C1, C2, C3, C4, C6, C8, C10, C11, C12, C13	CAP, CER, 0.1uF, 10%, 50V, SMD, 0805
1	C7	CAP, CER, 1.0uF, 10%, 25V, SMD, 0805
2	C5, C9	CAP, ELEC, 470uF, 20%, 25V, SMD, CASE G
3	D1, D2, D4	DIODE, GP, 1A, 400V, TH, DO-41
1	LED1	DIODE, LED GREEN, 75mW, 2.1V, 10mA, TH
3	LED2, LED3, LED4	DIODE, LED RED, 60mW, 2.0V, 10mA, TH
2	Q1,Q2	FET, N-CH, 20V, 5.7A, SMD, SOT-23
1	U2	IC, MICRO, DIP8-300
1	XU2	SOCKET FOR U2
1	U1	IC, VOLT REG, 5V, SMD, TO-252
1	POT1	POT, LINEAR, 300D, 5.0K, 5%, 150V, 0.8W, PANEL, TH
1	R2	RES, CF, 2.2, 5%, 150V, 1/6W, TH, RES265
4	R1, R3, R4, R11	RES, THKFLM, 392, 1%, 150V, 1/8 W, SMD, 0805
2	R13, R14	RES, THKFLM, 1.00K, 1%, 150V, 1/8 W, SMD, 0805
4	R7, R8, R10, R12	RES, THKFLM, 10.0K, 1%, 150V, 1/8 W, SMD, 0805
3	R5, R6, R9	RES, THKFLM, 0.0, N/A, N/A, N/A, SMD, 0805
1	R15	RES, WIRE, 0.1, 5%, 350V, 5W, TH, RADIAL
2	SW1, SW2	SW, SPST, TACT, 12VDC, 50mA, TH, N/A
3	TB1, TB2, TB3	TERM, 2-PIN, VERT SCREW CLAMP, 22-14 AWG, 5.08MM
1	TB4	TERM, 3-PIN, VERT SCREW CLAMP, 22-14 AWG, 5.08MM

Assembly Drawing, Page 1
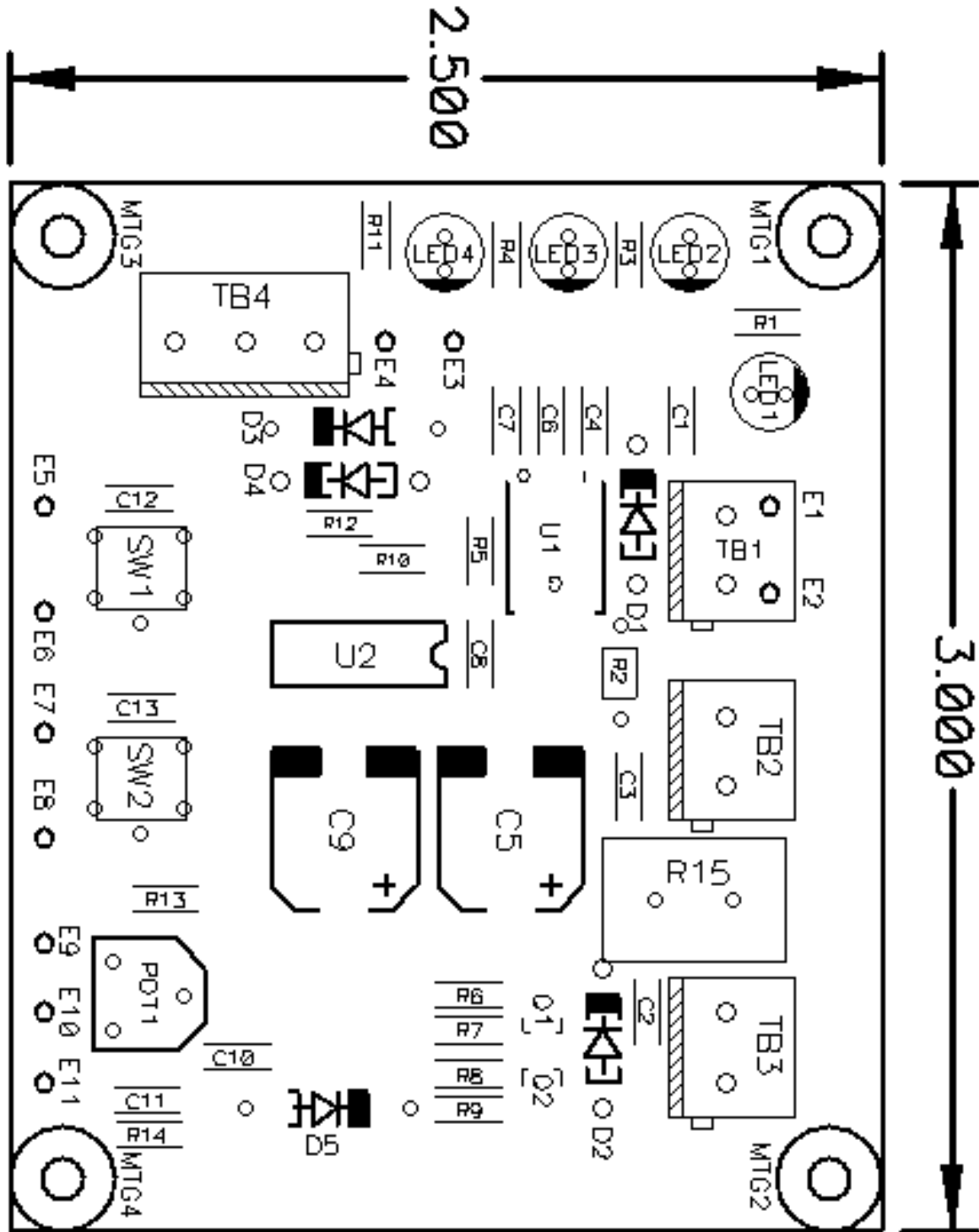
Figure 1: Component Locations and Reference Designators.

Board rotated 90 degrees for maximum image size..

Assembly Drawing, Page 2

Figure 2: Component Values.

Board rotated 90 degrees for maximum image size.

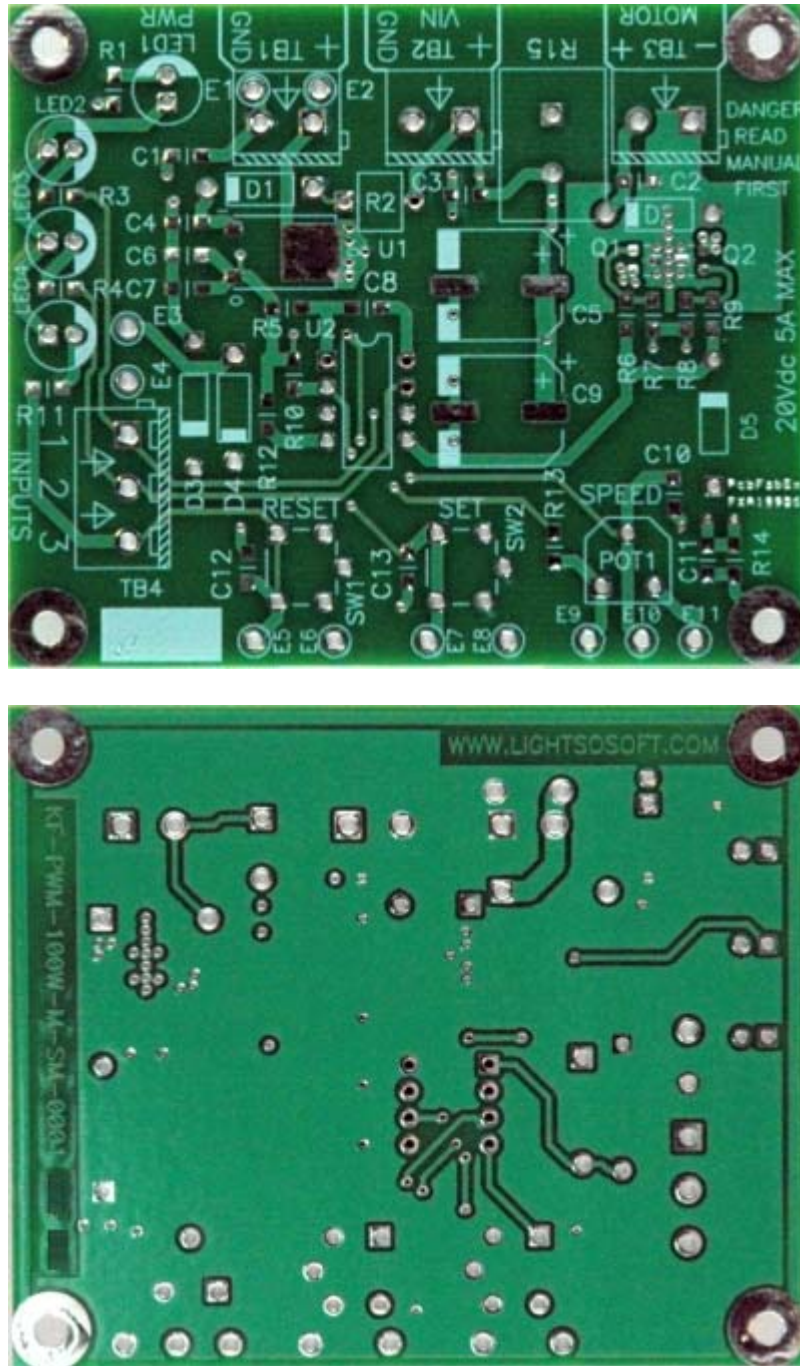# Assembly Instructions

Bare Board (for reference)

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

Step 1: 0.1uF 0805 capacitors, QTY 10
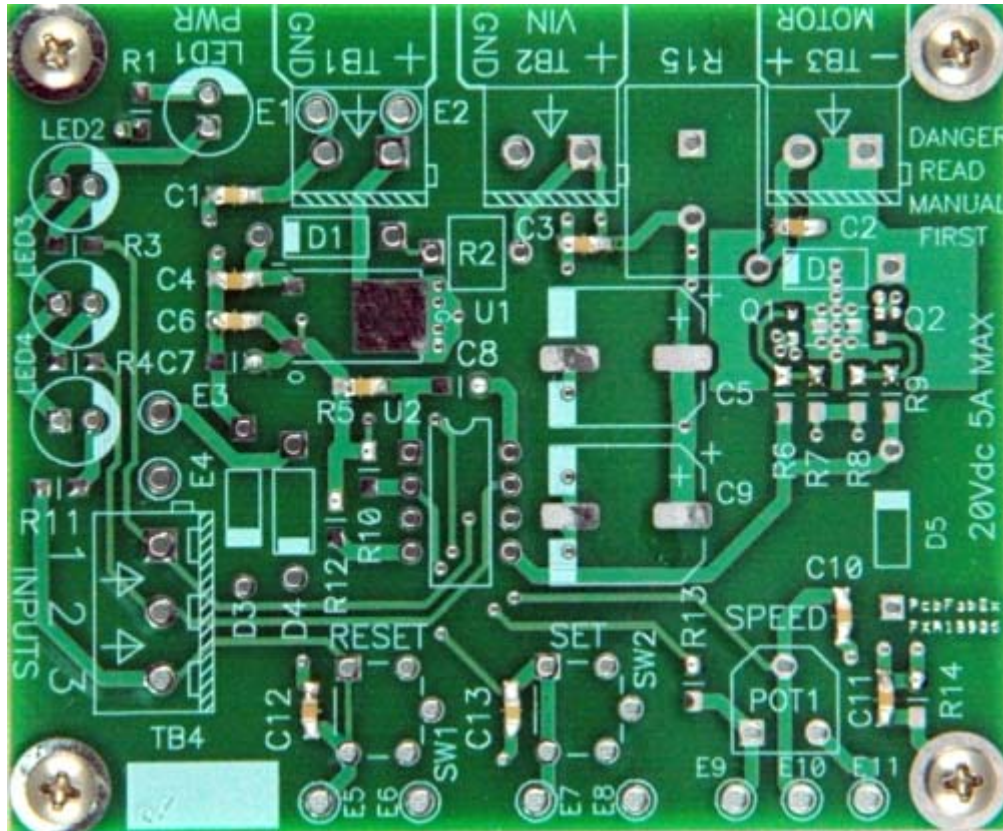## **C1, C2, C3, C4, C6, C8, C10, C11, C12, C13**

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 C1, C2, C3, C4, C6, C8, C10, C11, C12, C13.

At each location, center the capacitor on the two flat copper pads.

Solder the capacitor to these pads.

Page   13
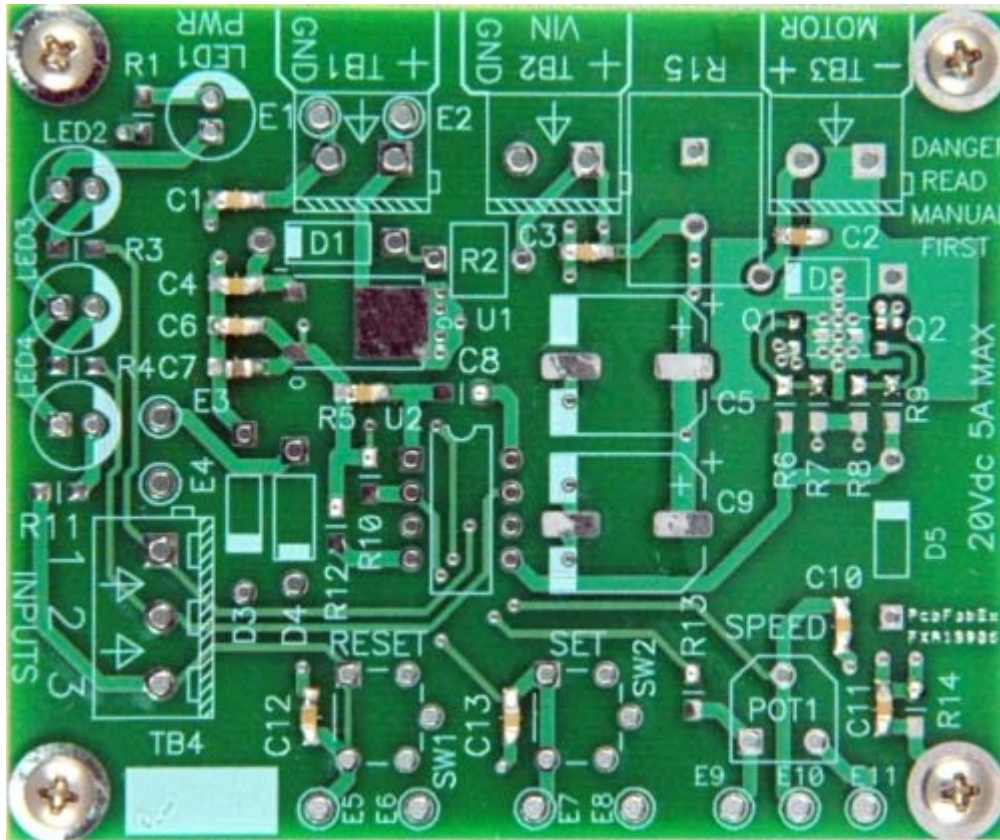
Step 2: 1.0uF 0805 capacitor (C7)

Figure 5: Board with 1.0uF capacitor installed.

From the kit, locate 1 piece of the 1.0uF ceramic capacitor.

Find the locations for this part on the board. It is marked C7

At this location, center the capacitor on the two flat copper pads.

Solder the capacitor to these pads.

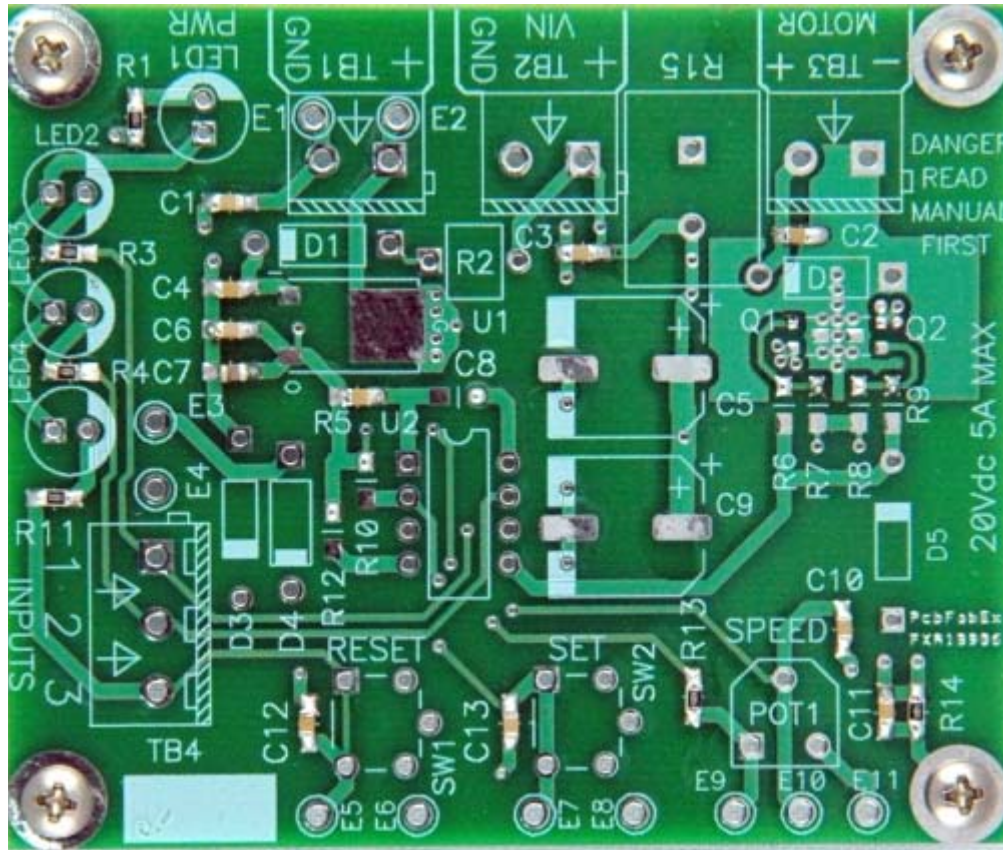# Step 3: 1.00K 0805 resistors (R13 & R14)

Figure 6: Board with 1.00K resistors installed.

From the kit, locate 6 pieces of the 1.00K resistor.

Find the locations for these parts on the board. They are marked R13 & R14.

At each location, center the resistor on the two flat copper pads.

Solder the resistor to these pads.

Step 4: 392 0805 resistors, QTY 4
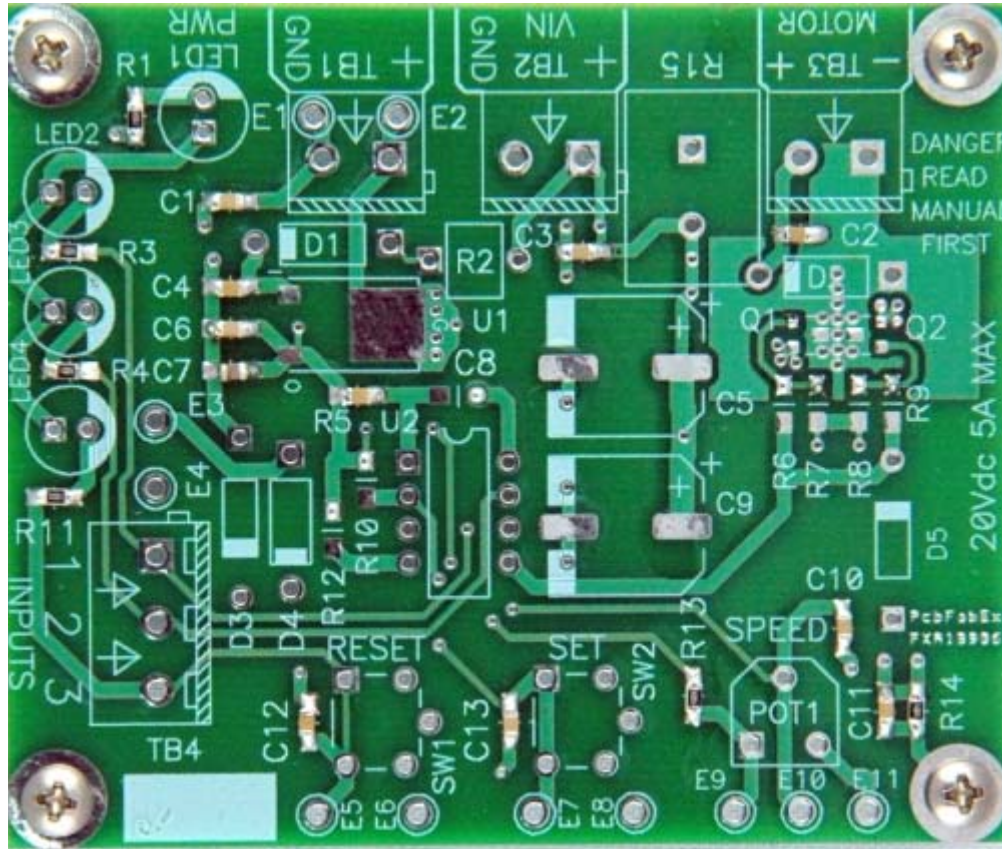## R1, R3, R4, R11

Figure 7: Board with 1.00K resistors installed.

From the kit, locate 6 pieces of the 1.00K resistor.

Find the locations for these parts on the board. They are marked R1, R3, R4, R11.

At each location, center the resistor on the two flat copper pads.

Solder the resistor to these pads.

Step 5: 10.0K 0805 resistors, QTY 4
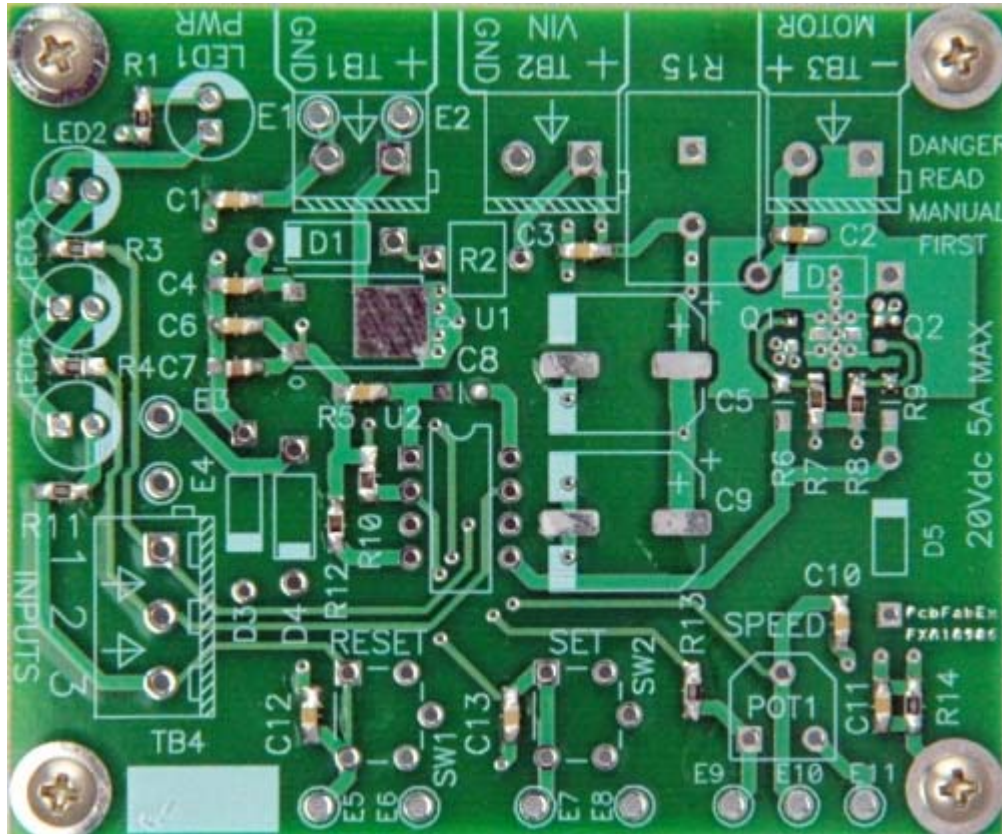## **R7, R8, R10, R12**

Figure 8: Board with 10.0K resistors installed.

From the kit, locate 4 pieces of the 2.0K resistor.

Find the locations for these parts on the board. They are marked R7, R8, R10, R12.

At each location, center the resistor on the two flat copper pads.

Solder the resistor to these pads.

Step 6: 0-ohm 0805 resistors, QTY 3
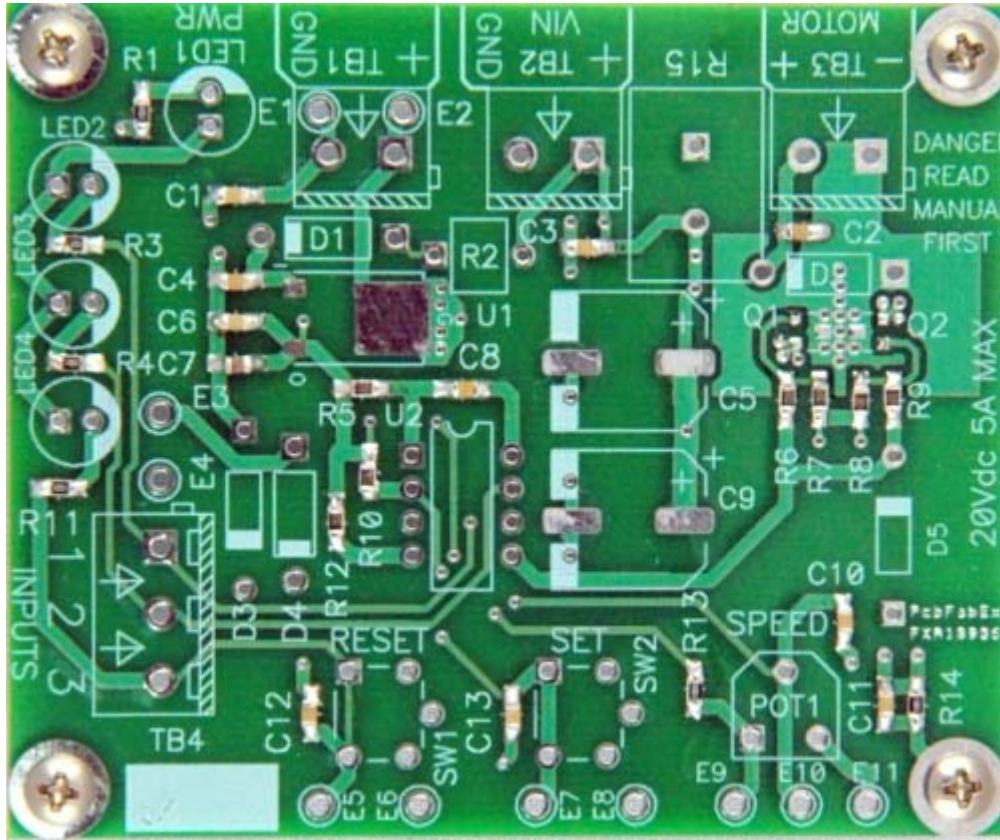## R5, R6, R9

Figure 9: Board with 100 ohm resistors installed.

From the kit, locate 3 pieces of the 100 ohm resistor.

Find the locations for these parts on the board. They are marked R5, R6, R9.

At each location, center the resistor on the two flat copper pads.

Solder the resistor to these pads.
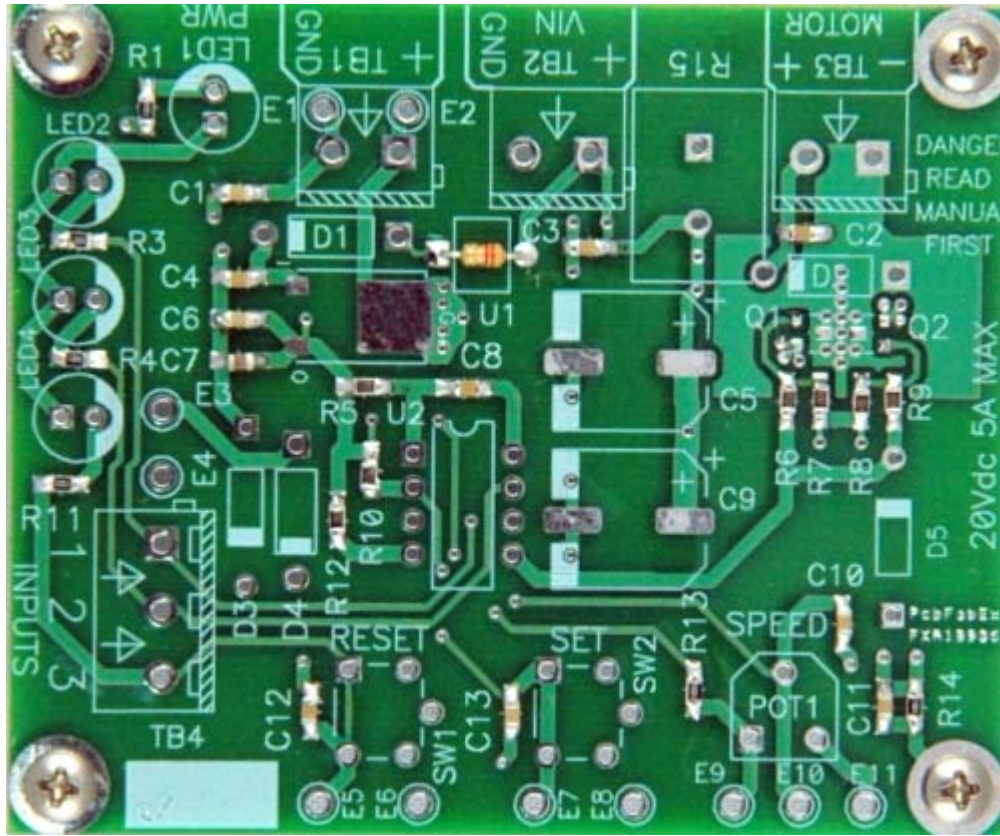
Step 7: 2.2 ohm TH resistor (R2)

Figure 10: Board with 2.2 ohm resistor installed.

From the kit, locate 1 piece of the 2.2 ohm resistor.

Find the location for this part on the board. It is marked R2.

At this location, center the resistor on the two flat copper pads.

Solder the resistor to these pads.

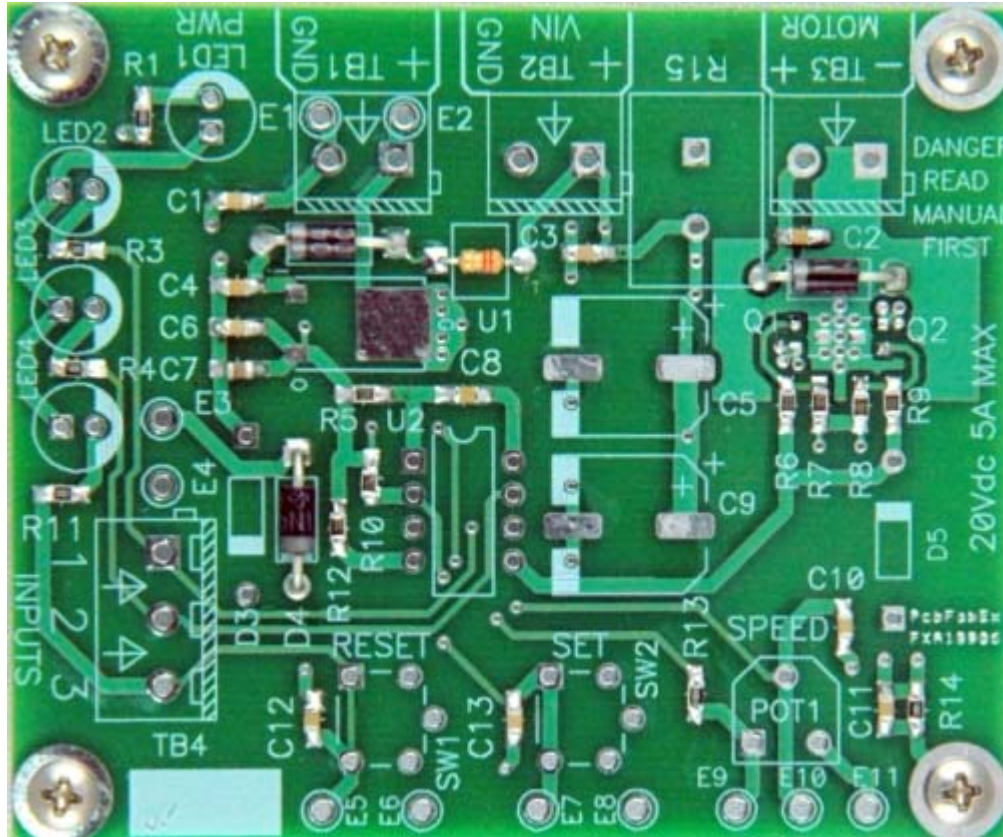# Step 8: 1N4004 1A, 400V TH general-purpose diodes, QTY 3
D1, D2, D4

Figure 11: Board with 1N4004 diodes installed.

From the kit, locate 3 pieces of the 1N4004 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.

Step 9: 1 green, 3 red TH LEDs
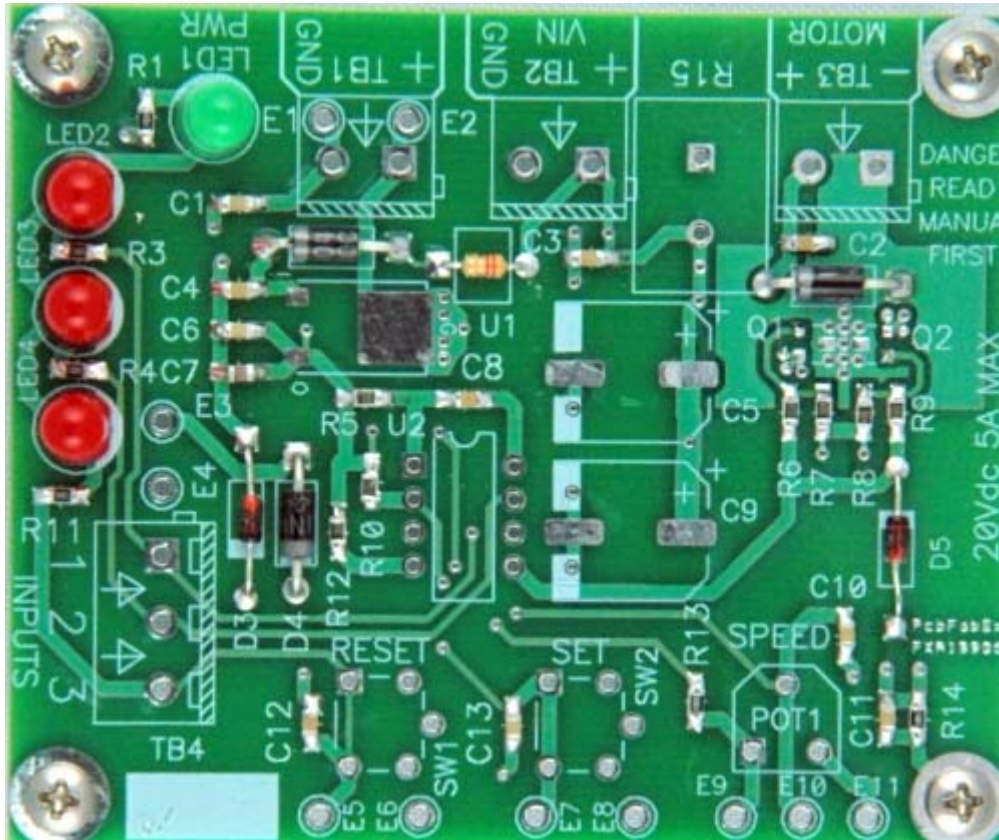## LED1, LED2, LED3, LED4

Figure 12: Board with green, red LEDs installed.

From the kit, locate 1 of the green and 3 of the red LEDs.

Find the locations for these parts on the board. The green LED occupies LED1, and the red LEDs occupy LED2, LED3, LED4.

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.

Step 10: Push-button TH switches, QTY 2
SW1, SW2

Figure 13: Board with push-button switches installed.

From the kit, locate 2 of the push button switches.

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.
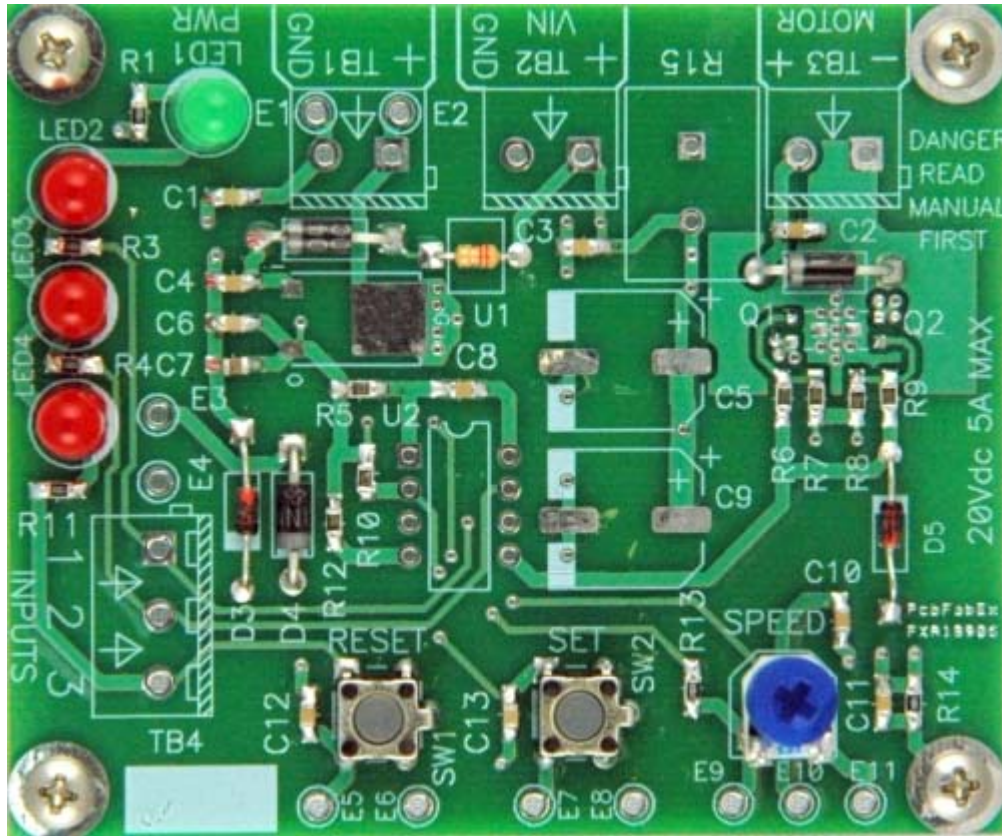
Step 11: 5.0K TH potentiometer (POT1)

Figure 14: 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.
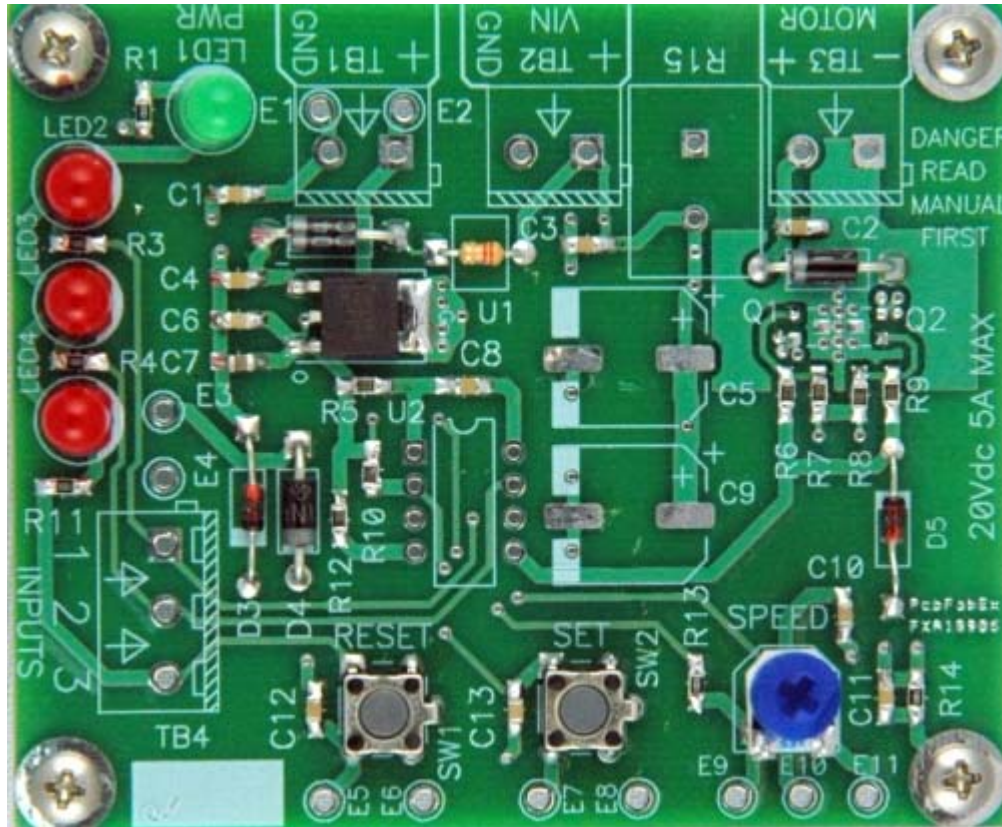
Step 12: 5V TH regulator (U1)

Figure 15: Board with 5V regulator installed.

From the kit, locate 1 of the 5V regulators.

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

At this location, center the regulator on the one large and 2 small flat copper pads.

Solder the regulator to these pads.

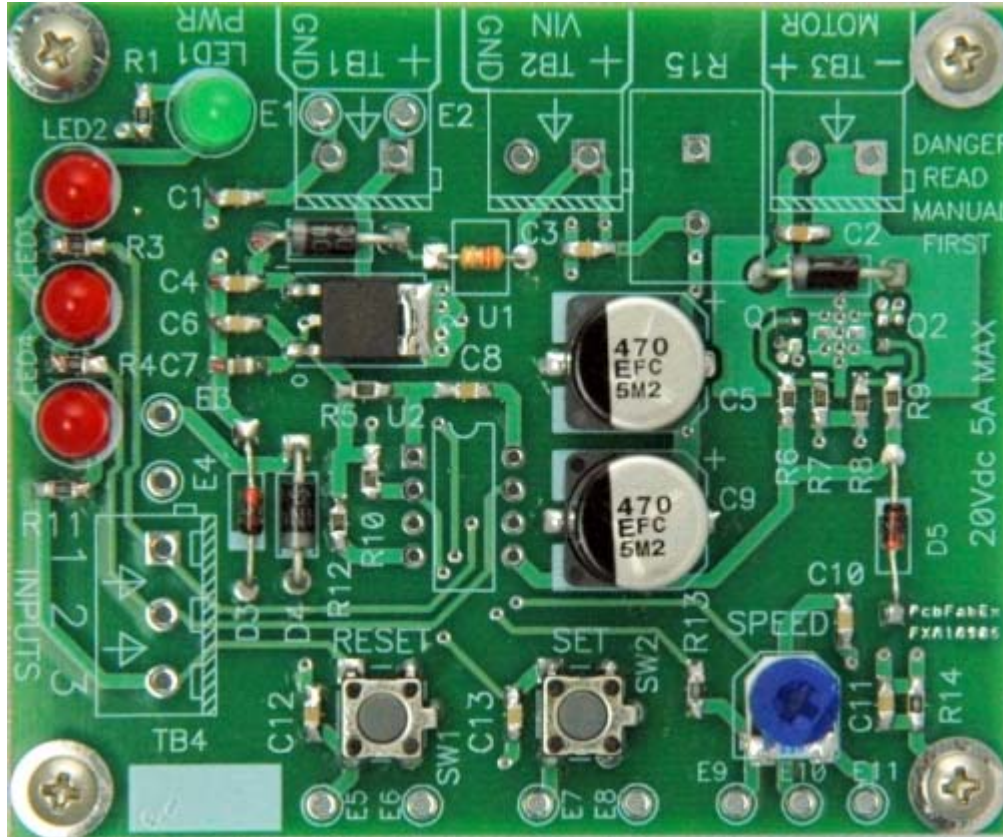# Step 13: 470 aluminum electrolytic TH capacitors, QTY 2
C5, C9

Figure 16: Board with aluminum electrolytic capacitors installed.

From the kit, locate 2 pieces of the 470 uF capacitors.

Find the locations for these parts on the board. They are marked C5 & C9.

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.

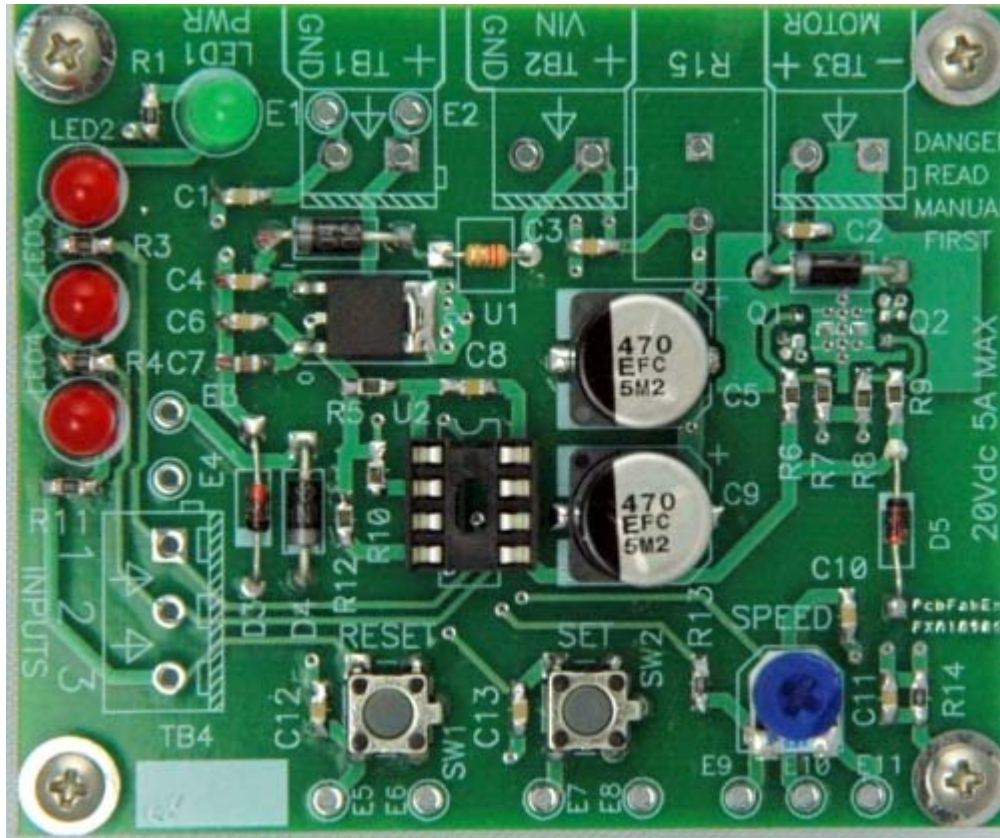# Step 14: TH Processor and TH Processor Socket

Figure 17: Board with socket and processor installed.

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

Find the location for these parts on the board. It is marked U2.

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

Carefully insert the processor into the socket, making sure to line up the pin 1 indicator on the socket with the pin one indicator on the body of the processor.
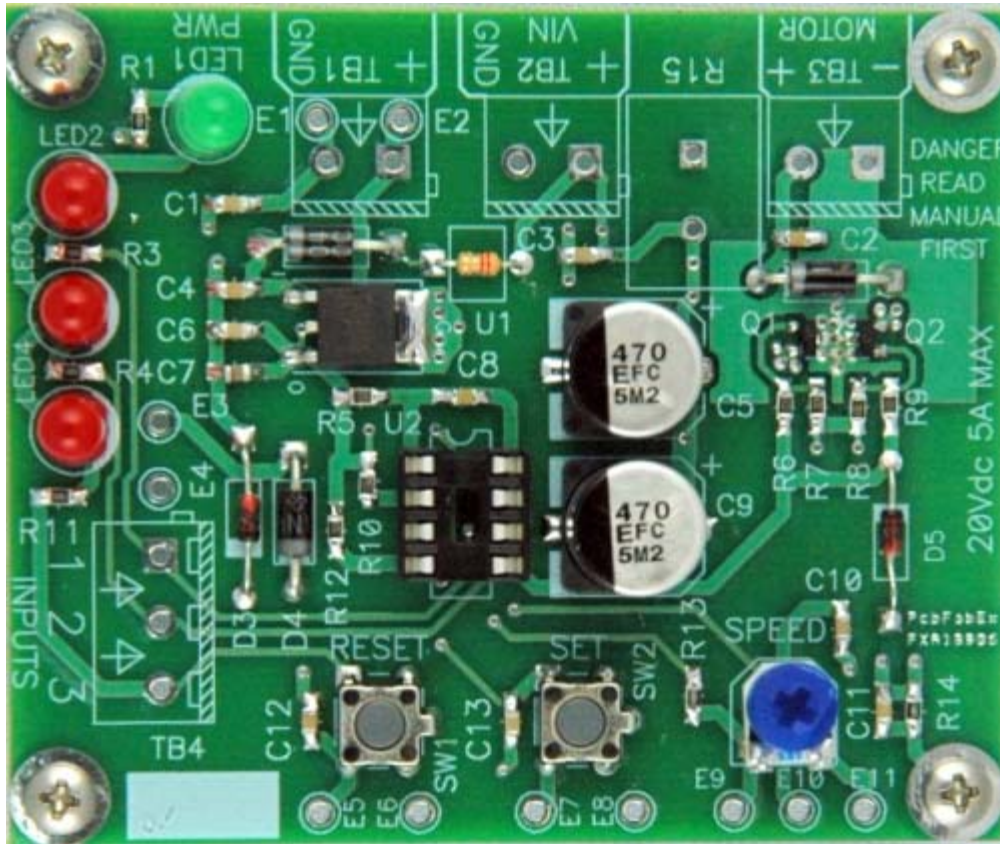
Step 15: MOSFET, QTY 2
Q1, Q2

Figure 18: Board with MOSFET installed.

From the kit, locate 2 of the MOSFETs.

Find the locations for these parts on the board. They are marked Q1 & Q2.

At each location, center the MOSFET on the three flat copper pads.

Solder the MOSFET to these pads.

Step 16: 2- and 3-pin TH terminal blocks, QTY 4
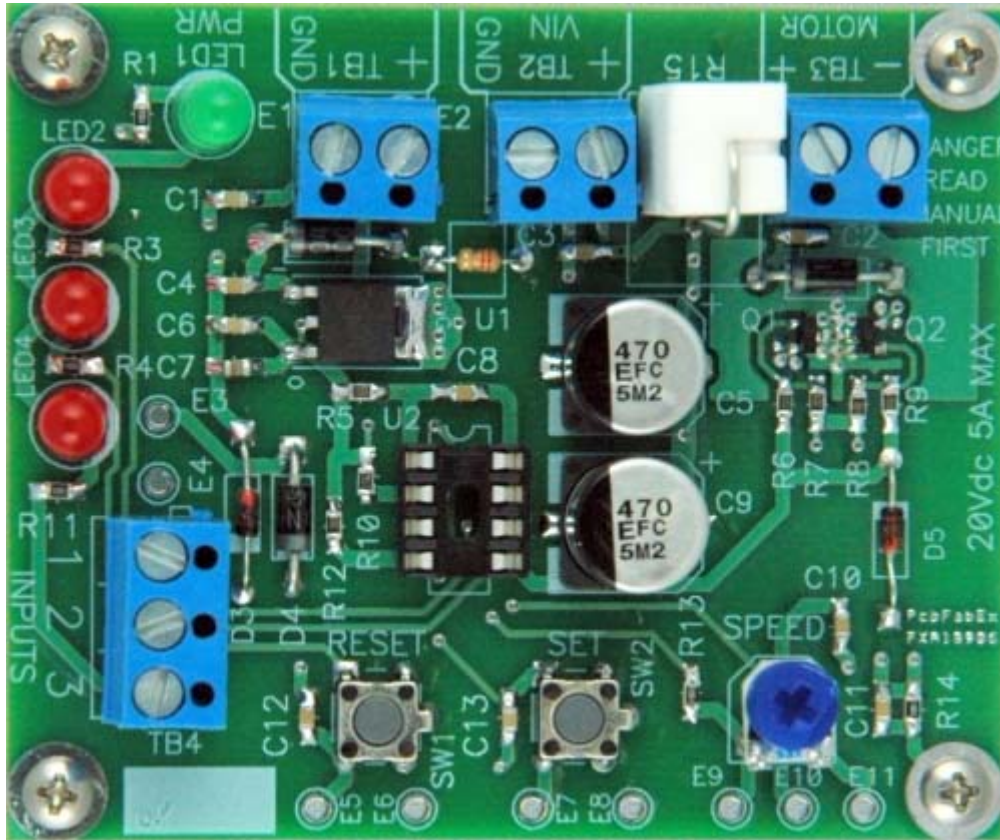## TB1-TB4

Figure 19: Board with terminal blocks installed.

From the kit, locate 1 of the 3-pin terminal blocks and 3 of the 2-pin terminal blocks.

Find the location for these parts on the board. The 3-pin terminal block is located at TB4, and the 2-pin terminal blocks are located at TB1, TB2, TB3.

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

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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.

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