



## **RADIO FREQUENCY WARNING NOTICE**

- The PA1 is a high-frequency switch mode power supply module designed to furnish a square wave modulated high voltage alternating current at a frequency of approximately 3.1 MHz across a 50 ohm load impedance.
- If the PA1 is installed incorrectly or used improperly, it is capable of causing severe radio frequency interference. To prevent this from occurring, observed the following warnings:
- The PA1 is to be used as a research device only, or as part of a complete system to drive a plasma tube.
- The PA1 is not intended to be used for any form of radio transmission in any manner whatsoever.
- The PA1 is not intended to be connected to an antenna or to any radiating element or to be used for any form of radio communications purposes in any manner whatsoever.
- The PA1 is designed solely to be a source of power to light a plasma tube.
- All electrical connections to the output terminals of the PA1 are to be made by the use of properly shielded 50-ohm coaxial cable capable of handling at least 500 watts at 3.1 MHz.
- All connections are to be made in such a manner as to minimize any RF radiation from the connecting wires to the PA1.
- The PA1 has been specifically designed to be driven by a high-level signal that is generated by the SSQ-2F v3.10 circuit board. The PA1 cannot be driven by a sine wave signal, such as from a low powered transmitter. It is not a linear amplifier, and it will not function as such.
- The operating frequency range of the PA1 has been restricted to a 1 MHz portion of the spectrum centered at 3.1 MHz.
- Any attempt to drive the PA1 with a radio frequency source such as a CB radio transmitter, will result in either no power output from the PA1 or immediate destruction of the STW20NK50Z MOSFET in the PA1.

## GENERAL ASSEMBLY INSTRUCTIONS

Arrange for a clean work surface with adequate lighting. You will be working with small parts, and you may need to use a magnifier for close work. Working on a soft surface, such as a short nap towel, prevents parts from rolling off the work area and falling on the floor.

You will be soldering small components in place. If you are not used to soldering such items, it is suggested that you seek assistance from an experienced person before starting assembly.

The circuit board of the PA1 has been designed with ruggedness in mind. Extra-wide and thick copper traces have been used on the PA1. Because of this, the PA1 will withstand repeated soldering should repairs be necessary, such as if a component has been installed in an incorrect location. Nevertheless, it is strongly recommended that you take care in locating the position of the various components when assembling your PA1.

You will require the following tools:

- Small needle-nose pliers to install the heat sink.
- Small flush-cut or side-cutter pliers to cut off the excess wire ends of components after soldering them in place.
- A #1 Phillips head screwdriver to install the heat sink.
- A soldering iron, with a recommended wattage of between 30-70 watts, and a tip temperature of no more than 700° F. The tip should be a small conical point.
- Solder, 60/40, 63/37, or 62/36/2 grade, no larger in diameter than 0.032". rosin core flux only. Suitable types are Radio Shack 64-013 and 64-009.
- If you prefer, you may use a lead-free solder instead. The PA1 circuit board is compatible with all lead-free solders.

***WARNING! DO NOT use acid core solder!!***

**Doing so will cause damage to the circuit board and will void any and all warranties. We will NOT warranty any circuit boards that have been assembled using any type of acid core solder.**

## ***WARNING! The STW20NK50Z is Static Sensitive!!***

**The STW20NK50Z MOSFET transistor in your PA1 kit has been tested before shipment. Your STW20NK50Z has been wrapped in aluminum foil to prevent damage from static electricity during shipment.**

**Please do not unwrap the STW20NK50Z until you are ready to install it. Be sure to use antistatic precautions while installing the STW20NK50Z in your PA1 circuit board.**

Your PA1 kit includes two special parts. One is a thin, flexible electrically insulating but thermally conducting pad that is placed between the STW20NK50Z and the heat sink when the PA1 is installed in its final operating position. The other is a thicker rubber pad that is placed between the top of the STW20NK50Z and a metal clamping bar, which is used to clamp the STW20NK50Z firmly against the heat sink. Please refer to the operating instructions for the PA1 for the correct use and assembly of these parts.

The circuit layout of the PA1 is such that the leads of the 0.47 uF capacitors will pass through their respective holes on the board without the necessity of bending the leads. The leads of the 1N914 diode and the resistor will need to be bent at right angles to the body of the component before you insert them into the board. The leads of other components will need to be carefully bent according to the assembly instructions.

Bend the component leads using **ONLY** your fingers! Using pliers to bend the leads may cause the body of the diode or resistor to break or become cracked where the lead exits the body of the component. This can result in outright failure of the PA1 to operate, or even worse, cause intermittent malfunctions during operation. Such problems can be difficult to resolve.

Although you may assemble the components in any order, the following sequence allows you to “build up” from the surface of the board, making it easier to install the rest of the components as you assemble your PA1.

**It is suggested that you take the time to inspect the blank circuit board and familiarize yourself with where the various components will be placed. Please refer to the photograph of the complete PA1 in the back of this manual for help in locating the position of the components.**

If you look at the blank circuit board, you will see that one side of the blank circuit board has a serial number engraved on it. This is the Solder Side of the circuit board. The other side of the board, the Parts Side, has the part number “STW20NK50Z” placed next to the three mounting holes for the STW20NK50Z transistor. All of the components are to be installed on the side of the board that has the STW20NK50Z identification. All of the soldering is done on the opposite (Solder Side) of the board.

The parts side of the board also has outline drawings of all the components, as well as their part number, (C1, R1,) or their value, (1500, 0.47,) thus making it easy to identify where the various components should be placed.

For each assembly step, locate the listed component, and identify where on the circuit board it will be placed. Some of the components in this kit may be furnished with the leads already pre-bent to the correct shape for insertion in the PA1 circuit board. However, some kits may include components with leads that have not been pre-bent. If you have one of these kits, it will be necessary to carefully bend the leads of some of the components to fit. When this is necessary, it will be in the assembly instructions.

After inserting the leads of the components through the proper holes in the PA1 circuit board, carefully tug on the free end of the component leads to seat the component close to the circuit board. Do not apply excessive force trying to seat the component firmly against the board. If the component is positioned slightly above the board, that is OK.

Note that several components must be installed so that they are sitting slightly above the surface of the circuit board, and not tightly in contact with it. This is done for proper heat dissipation when the PA1 is in operation. If these components are not properly spaced above the board, it is possible for the PA1 to fail during operation.

After inserting the component, bend the free ends of the component's leads at a 45° angle to prevent the component from slipping out of the circuit board when the board is turned upside down to solder the component in place.

Solder the component in place, inspect the solder joint, and then cut off the excess lead wires with the flush cutter pliers.

As you install each component, put an "X" or a check mark in the "" box to the left of each component. Assembling the components in sequence helps to prevent assembly errors.

## **INSTALLING THE COMPONENTS ON THE PA1 CIRCUIT BOARD**

### **Install ( 1 ) 1N914 Diode**

Please be sure to orient the black cathode band on the 1N4148 diode to match the marking on the circuit board.

4148

### **Install ( 1 ) 4700 Ohm Resistor**

4700 Ohm ( Yellow Violet Red )

## **TERMINAL BLOCK INSTALLATION**

When installing the two and four position terminal blocks, be sure to install them so that the wire holes are facing the outer edge of the circuit board.

Depending on manufacturing tolerances, the terminal blocks may be a tight press fit into the circuit board. Be sure to seat the terminal block completely against the circuit board before soldering. Double check to make sure the wire holes in the terminal blocks are facing the outer edge of the circuit board before soldering the terminal blocks in place.

To make soldering the terminal boards onto the circuit board an easier task, insert the terminal blocks onto the circuit board and hold them in position with your hand. Now, turn the board upside down and carefully place it down on the surface of your workbench. The PA1 circuit board should now be laying flat against the back of each of the terminal blocks. It is now an easy task to solder the terminal blocks into position.

### **Install ( 1 ) 2 Position Terminal Strip at This Location:**

RF IN

### **Install ( 1 ) 4 Position Terminal Strip at This Location:**

PWR – RF OUT

### **Install ( 1 ) 3 Position Terminal Strip at This Location:**

NOTE – You will only have this terminal block if you ordered it as an option when you purchased your PA1 kit. If you did not order this option, please proceed with the next assembly step.

- STW20NK50Z

### **Install ( 1 ) 2200 pF Mica Capacitor (Rectangular)**

The capacitor should be mounted “on edge.”

Looking at the PA1 circuit board, you will notice that there is a double component outline and four mounting holes on the circuit board provided for the installation of the 2200 pF Mica capacitor. Depending on the style of Mica capacitor supplied in your kit, you will use either the outer two holes or the inner two holes to mount the Mica capacitor.

Please see the photographs at the back of this assembly manual for correct orientation of the capacitor.

- 2200 (next to PWR terminal block)

### **Install ( 2 ) 2200 pF Disc Capacitors**

- 2200

- 2200

### **Install ( 2 ) 7.5 Ohm Resistors**

Please see the photographs at the back of this assembly manual for correct orientation of the resistors before soldering them in place.

Bend one of the leads of each resistor down flat against the body of the resistor so that both leads point in the same direction.

Mount the resistors vertically with the resistor bodies centered over the outermost holes in the mounting pads. There is a diagonal trace connecting the two solder holes where the unbent lead of each of the resistors will be soldered. The bottom end of each resistor

should be standing about 1/4 inch or 6 mm above the surface of the circuit board. Mounting the resistors in this manner allows the maximum cooling airflow between the resistors.

7.5 Ohm ( Violet Green Gold Gold )

7.5 Ohm ( Violet Green Gold Gold )

### **Install ( 2 ) 4.7 uHy Ferrite Core Inductors**

**NOTE: Your amplifier kit contains a new style inductor which replaces the black inductors that are shown in the photograph at the back of this assembly manual.** Although these new inductors look different, they are identical in function to the black inductors. The lead wires of the new inductors are pre-bent to fit into the mounting holes of the circuit board. Please see the photographs at the back of this assembly manual for correct orientation of these inductors before soldering them in place.

Mount the inductors vertically with the inductor bodies placed against the PA1 circuit board against the solder holes that do not have traces visible on the Parts Side of the circuit board. The folded over wire lead should pass through the hole in the circuit board which has a copper trace connecting to the solder pad.

4.7

4.7

### **Install ( 2 ) 0.47 uF capacitors**

0.47

0.47

### **Install ( 1 ) STW20NK50Z Transistor**

If you have ordered and installed the 3-connector terminal block for mounting the STW20NK50Z, simply insert the pins of the STW20NK50Z as far as they will go into the holes of the terminal block and gently but firmly tighten the clamping screws of the terminal block. Note that when you mount the PA1 circuit board in its final location, it



may be necessary to bend the pins of the STW20NK50Z in order to obtain the proper clearance of the PA1 circuit board from the heat sink. After you have installed the STW20NK50Z, please proceed to the next assembly step, "Install L3 Air Core Inductor."

If you will be soldering the STW20NK50Z onto the PA1 circuit board, please see the photographs at the back of this assembly manual for correct orientation of the transistor before soldering it in place.

The pins of the STW20NK50Z transistor may have to be squeezed together slightly in order for its pins to pass through the holes in the circuit board. When the STW20NK50Z is correctly positioned, the pins of the STW20NK50Z will be pointing through the three transistor mounting holes on the circuit board. When you look down at the Parts Side of the circuit board, you should be able to see the manufacturers identification marking visible on the top of the STW20NK50Z.

STW20NK50Z

### **Install ( 1 ) L3 Air Core Inductor**

L3

Please see the photographs at the back of this assembly manual for correct orientation of this inductor before soldering it in place.

The air core inductor L3 in your PA1 kit is supplied with leads that are cut to the proper length. Make sure that the enamel insulation is removed from the outermost 1/4" of each connecting wire on L3.

Carefully bend the wires on L3 so that they pass through the mounting holes in the PA1 circuit board. Be careful not to bend the leads too far so as not to split the plastic insulation that holds the coil turns together. Insert the leads of L3 through the holes in the circuit board and carefully solder them in place.

## **FINAL INSPECTION**

Using a magnifying glass and a bright light, carefully inspect the top and bottom of the finished circuit board for any unwanted solder splashes between connections, short wire clippings, or anything else that may cause problems during operation of the PA1.

Should you wish to remove the solder flux residue from the finished circuit board, you may use a commercial flux remover or 100% Isopropyl alcohol. Use only 100% Isopropyl alcohol. Rubbing alcohol is NOT suitable for removing the flux residue due to its high water content and the denaturing ingredients contained in rubbing alcohol. After cleaning the board, allow it to dry thoroughly before continuing.

This completes the assembly of the PA1 circuit board.

## **PA1 CIRCUIT BOARD CHECKOUT PROCEDURE**

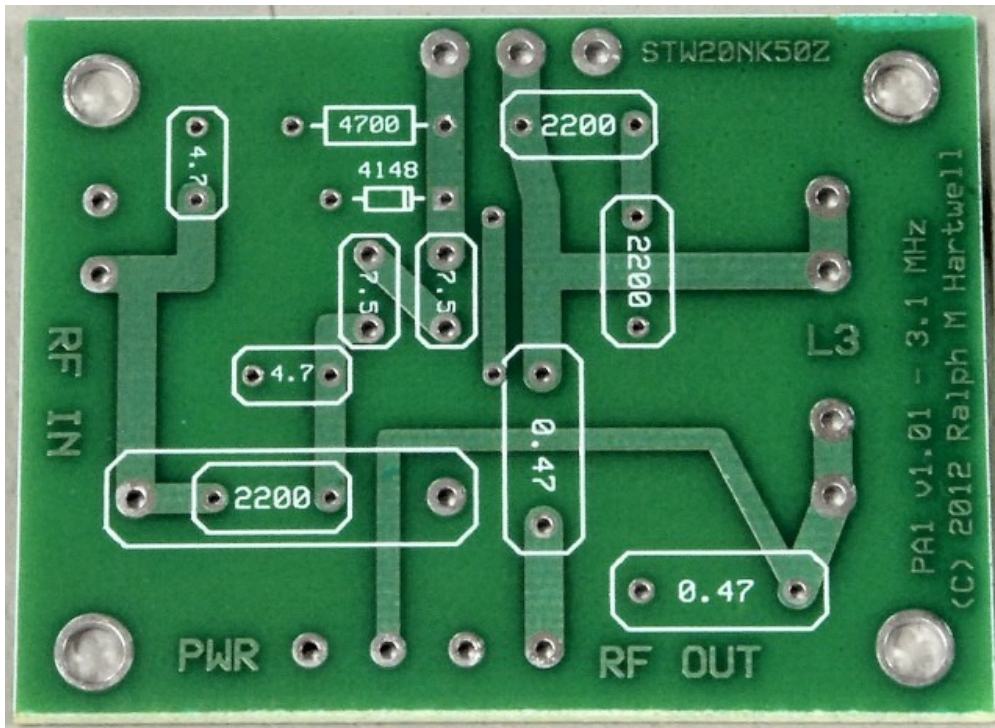
### **RESISTANCE CHECK**

The following resistance checks are to be taken with no external connections to the circuit board.

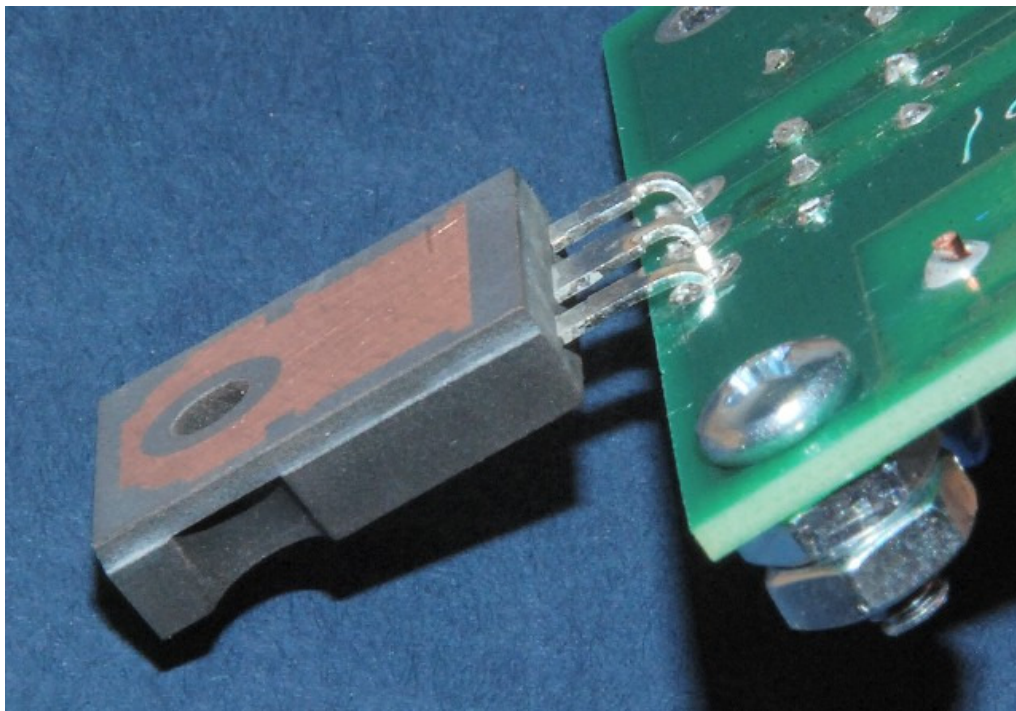
Using an Ohmmeter, measure the resistance between the **+** and **-** terminals of the PWR terminal block. The resistance reading should be greater than one Megohm. The resistance reading will be low at first when the Ohmmeter leads are connected, but the resistance reading will increase as the filter capacitors charge up from the Ohmmeter voltage,.

After the resistance reading stabilizes, reverse the Ohmmeter leads and make sure the resistance in the reverse direction also reads greater than one Megohm.

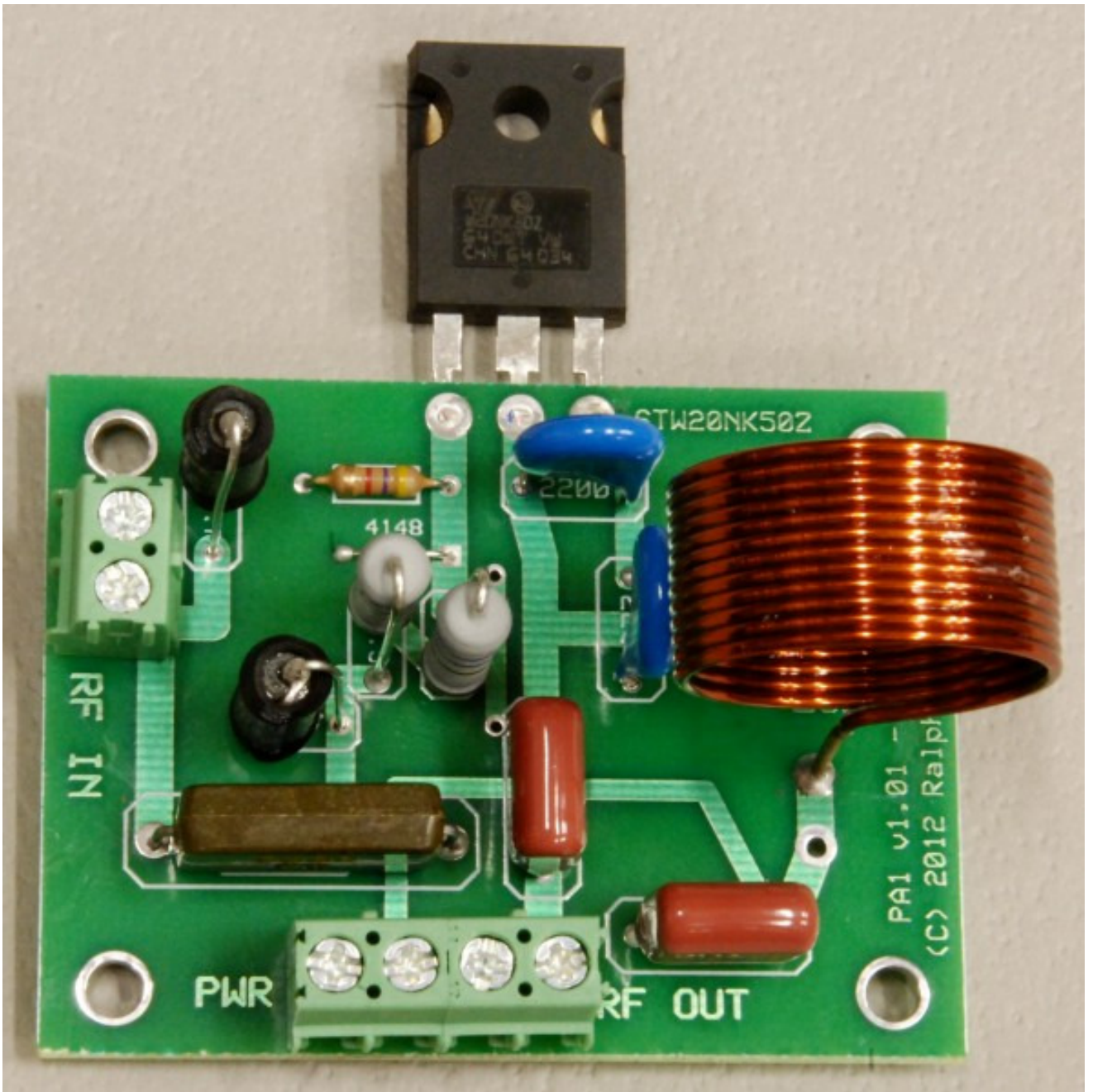
Your PA1 module is now ready for use. Please consult the PA1 Instruction Manual for final setup and operating instructions.



**PA1 Blank Circuit Board, Parts Side**

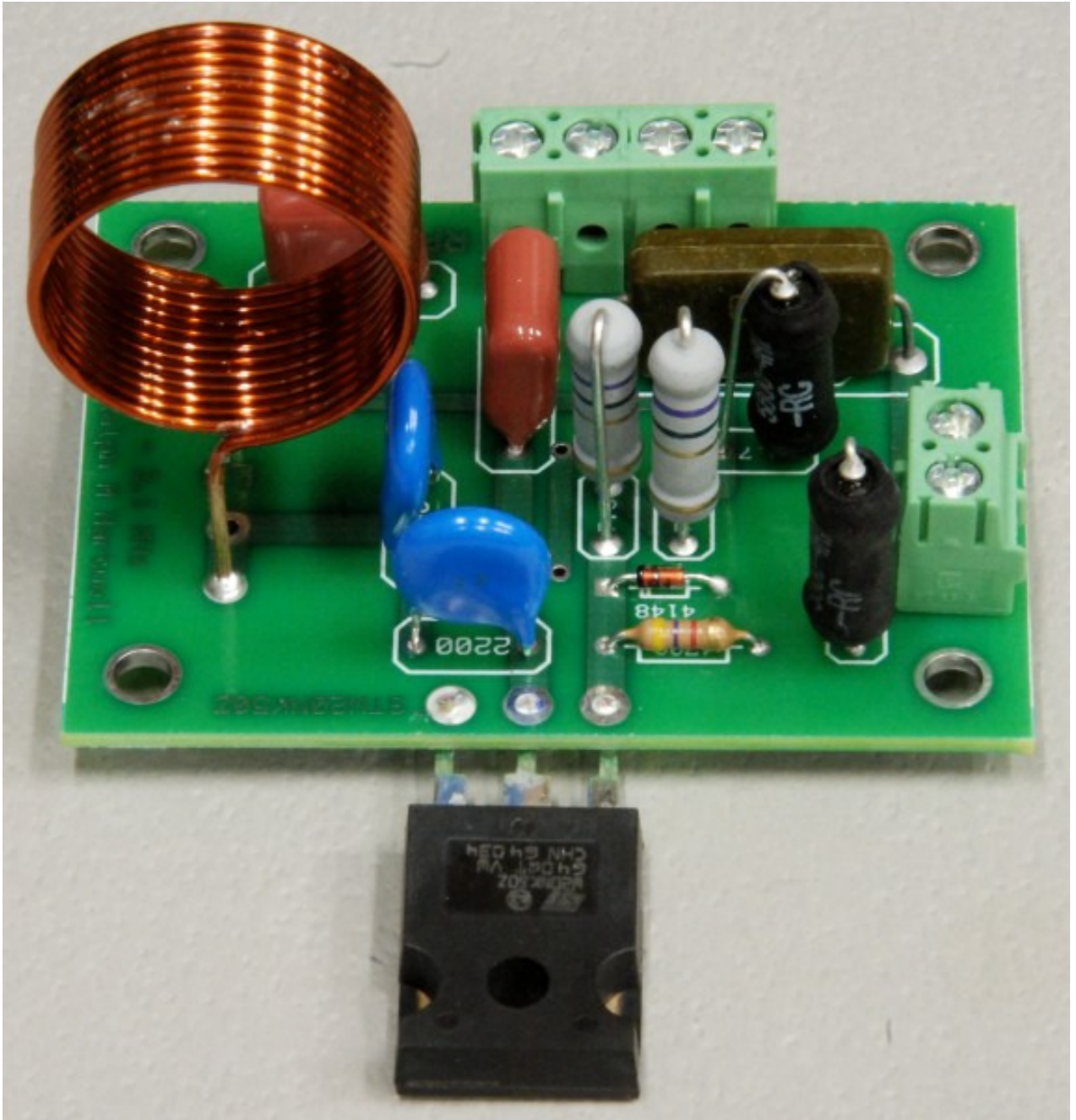


**Correct Placement of the STW20NK50Z on the PA1 Circuit Board Before Soldering**



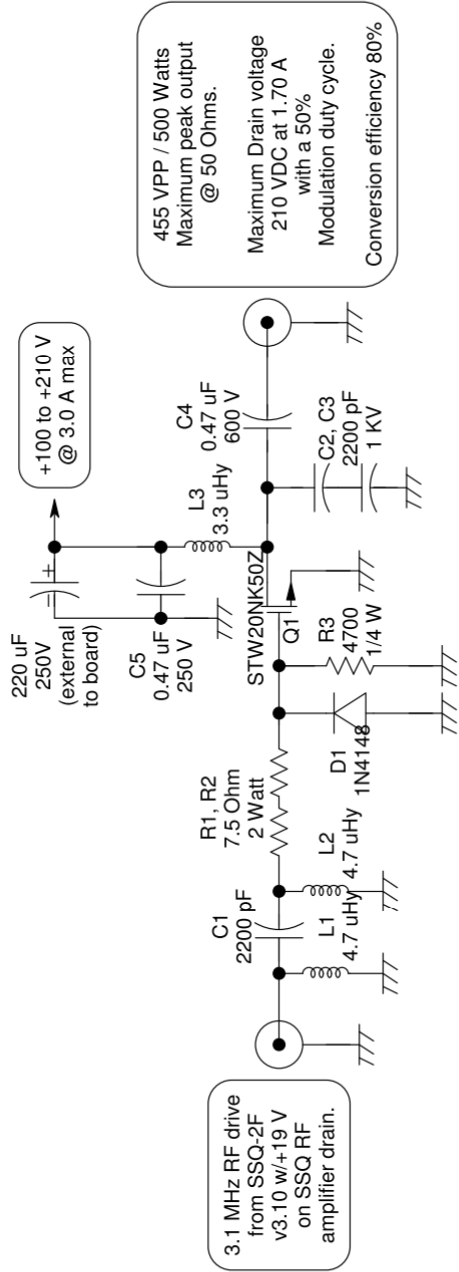
**Assembled PA1 – Front View, Showing Correct Orientation of Components**





**Assembled PA1 – Rear View, Showing Correct Orientation of Components**

**3.1 MHz RF Power Amplifier / Switch Mode Power Supply**  
 For Rife Beam Ray with 3.1 MHz Carrier  
 & Audio Sweep Modulation  
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 V1.01 03 June 2012



- NOTES:**
- C1, C2, C3, C4 and C5 are low RF loss Poly film or mica capacitors.
  - Q1 must be mounted on suitable heat sink to dissipate 125 watts at full power.
  - Q1 MUST have mounting surface machined perfectly flat to fit solidly against heat sink.
  - As received from the manufacturer, the mounting surface of Q1 is slightly convex.
  - Q1 is insulated from the heat sink with Wakefield Thermal Solutions 175-6-280P Thermal Pad.
  - L1 and L2 are Bourns Inc. 5800-4R7-RC 4.7 uHy Ferrite Core RF Chokes.
  - L3 is a 3.4 uHy air core coil. Do not use a ferrite core as it will slow the rise time of the waveform.

**Schematic Diagram of the PA1**