

CONSTRUCTION HINTS FOR THE EB63A

These construction hints for the EB63A are only to supplement the Engineering Bulletin and are not meant to be used as a construction manual. Due to parts becoming obsolete or hard to find, some changes are recommended for the EB63. The 1N4997 bias diode is no longer available and a recommended substitute is the MJE243 transistor used as a diode. The relay has become very hard to find and if found is very expensive. An Omron replacement relay is recommended and the board has been modified to accommodate this relay. Also the original COR circuit did not perform very well as designed by Motorola. An improved COR circuit has also been implemented on the board.

HEATSINK PREPARATION

A heatsink of sufficient size to dissipate over 140 watts of power should be used. The heatsink should be marked, drilled, and tapped before construction begins on the PC board. Using the bare PC board as a pattern or template, lay the PC board on the heatsink in the desired position and mark the four mounting holes. Do not mark or drill a hole for D2. Typically, placing a metal bolt through the mounting hole of the diode D2 will short out the bias supply to the heatsink. Drill and tap the four mounting holes for 4-40 screws. After the four mounting holes are drilled and tapped, mount the bare PC board flush on the heatsink using 4 – 40 x 1/4" or 3/8 " screws. Place the RF transistors through the PC board so they rest flat on the heat sink. Mark the mounting holes for the RF transistors. Remove the RF transistors and PC board from the heatsink. Drill and tap the mounting holes for the RF transistors (4 – 40 screws). The heatsink can also be fitted with connectors, cover, etc. at this time if so desired.

BROADBAND TRANSFORMERS

Just a quick word about the broadband transformers. The low impedance winding of the input (T1) and output (T2) transformers consists of a one-turn winding. Two tubes form the low impedance winding. The tubes are electrically shorted on one end by a piece of copper-clad laminate (PC board) with holes for the tubes. The tube ends are soldered to the copper foil. A similar piece of laminate is soldered to the opposite ends of the tubes and the copper foil is divided into two sections, thus isolating the ends where the primary connections are made. The high impedance winding is formed by threading Teflon insulated wire through the tubes for the required number of turns. The transformers are loaded with ferrite material to provide sufficient low frequency response.

PC BOARD ASSEMBLY

Install the 1/4 watt metal film or carbon resistors R2, R3, and R7 in their proper locations (refer to the placement layout in the construction) and solder in place. Clip the leads close to the PC board. R1 is not used.

Install the 1N4148 diodes D3 and D4 as shown. Observe the polarity..!! The banded end is the cathode.

Install transistors Q1 and Q2 as shown in the component layout. The flat sides of the transistors face the outside of the PC board.

Install the 1N4001 diode D1 as shown. Observe the polarity..!! The banded end is the cathode.

Position the transformer T2 on the PC board as shown in the Engineering Bulletin. The transformer must be installed with the wide gap on the input end placed down on the PC board. The split-end of the transformer goes toward the center of the PC board. Solder the split-ends (two places) and the opposite solid end to the PC board with a fillet of solder (make sure the transformer is held flat against the PC board). Trim the Teflon insulated secondary windings of T2 for a proper length for mounting into their respective mounting holes on the PC board. Then trim about ¼” of the insulation off the wire leads. Install the leads into their proper mounting holes and solder to the PC board.

The input transformer T1 is mounted next. Trim the wire leads to the proper length to mount on the PC board. Strip ¼” of the insulation from the wire leads. Mount the transformer to the PC board with the split ends toward the RF transistors. Solder the transformer to the PC board similar to T2. Solder the wire leads to the PC board.

Install RFC1 as shown on the component layout. RFC1 is composed of ten beads on a piece of buss wire bent into a “U” shape. The buss wire is soldered through its respective mounting holes near the edge of the PC board.

Install the 1 uF tantalum capacitor C6 on top of the PC board as shown in the component layout.

Install the 10uF electrolytic capacitor C5 on top of the PC board as shown in the component layout.

Install the .001uF disc capacitor C7 on top of the PC board as shown in the component layout.

Install the 470pF disc capacitor C11 in its proper location as shown in the component layout. Clip off the excess leads.

Install the 22uF electrolytic capacitor C12 in its proper location as shown in the component layout. Clip off the excess leads. This capacitor is used to increase the relay hold time when SSB mode is used. If a longer delay is desired, increase the size of C12 to 100 uF for approximately 1-½ seconds of delay. An external switch (not supplied) can be used to activate or ground on side of the capacitor to increase the delay time.

Install the 18pF mica capacitor C2 and the 24pF mica capacitor C10 on top of the PC board as shown in the component layout.

Install the 33pF mica capacitor C1 on top of the PC board as shown in the component layout.

Install the 910pF mica capacitor C20 on top of the transformer T2 and the 1100 mica capacitor C21 on top of the transformer T1. The leads of the capacitors are soldered to the split ends of the transformers and the capacitors lay over the top of the transformers.

Install the 0.1 ceramic mono capacitor C4 on top of the PC board as shown in the component layout.

Install the 470 uF electrolytic capacitor C22 (observe polarity). Solder and clip the excess leads close to the PC board.

Install the 82 ohm 5 watt (formerly a 33 ohm 5 watt) resistor R4 on top of the PC board. Mount the resistor approximately 1/8" to 1/4" off the PC board for cooling purposes. The resistor will run hot to the touch.

Mount the relay on the PC board as shown in the component layout.

Mount the diode D2 (MJE243 transistor) on the bottom of the PC board as shown in the component layout. The diode (transistor) mounts with the metal part of the diode toward the heatsink. Bend the leads up through the PC board. Solder and trim the leads. A 4-40 screw can temporarily be placed through the hole in the PC board and the diode to help position it in the proper position.

This completes the PC board construction except for the RF transistors, C8, C9, R5, and R6. Clean the PC board if so desired, and inspect closely for solder bridges between the PC board foil lands. Also look for any cold solder joints.

At this point, an intermediate electrical check can be performed to ensure that the bias supply is operating correctly. Too large a bias voltage will destroy the RF transistors!!! The bias supply check is performed before the RF transistors are mounted. Temporarily solder a 10 ohm resistor to one of the base pads and the ground plane. The resistor will provide a small load for the bias voltage. Apply 13.65 volts to the amplifier and monitor the bias voltage across the temporary 10 ohm resistor with a digital voltmeter. If the bias supply is working properly, the bias voltage should be around 0.66 to 0.74 volts. A higher bias voltage may cause the RF transistors to run very hot when no signal is applied. Remove the temporary 10 ohm load resistor. This completes the bias voltage check.

Install the PC board to the heatsink with 4-40 x 3/8" screws and 0.10" spacers or thin #6 nuts used as spacers (not supplied). An insulating mica washer must be placed between the diode D2 (MJE243 transistor) and the heatsink to prevent shorting out the bias supply. Use thermal compound on both sides of the mica washer.

The outmost 1/16" to 1/8" end of each RF transistor lead can be bent up at a 90-degree angle (this procedure is optional but will aid in removal of the RF transistor should it ever become necessary).

Install the RF transistors with the clipped collector lead toward the output transformer. Caution: Be sure to use thermal compound under the transistors (not supplied...available at Radio Shack). Bolt or screw the RF transistors into place using 4-40 x 1/4" screws. Solder the transistors in place.

Install the 10 ohm 1/2 watt resistors, R5 and R6, on top of the PC board as shown in the component layout. The resistors should stand approximately 1/4" above the PC board.

Install the 330pF mica capacitors, C8 and C9, on top of the PC board as shown. The capacitors should stand approximately ¼” above the PC board.

This now completes the assembly of the amplifier. The unit may now be tested.

1. Hook up a power supply of suitable current output to the amplifier. A regulated power supply capable of delivering 13.65 volts DC at 25 amps minimum is recommended for this amplifier operation.
2. Connect the output through a power meter to a suitable 50 ohm dummy load of a rating capable of handling the power output (200 watts minimum). Use 50 ohm coax cable.
3. “Slowly” bring up or increase the input power until the output equals the maximum power recommended in the Engineering Bulletin.
4. The output of the amplifier contains harmonics of the input signal. Thus if direct operation into an antenna is expected, filtering of the output is necessary to meet FCC regulations for spectral purity. The low pass filters shown in Figure 1 will provide more than sufficient harmonic attenuation with less than 1 dB of loss at the operation frequency.

TROUBLESHOOTING

Caution!!!... Never operate the amplifier, even without a RF input signal, without the RF transistors being mounted on a proper heatsink. The RF transistors can heat up and destroy themselves almost instantly if they are not heatsinked properly.

The input RF signal level should be between 1 and 5 watts. The amplifier will handle up to 6 or 8 watts safely. However, 25 watts from some of the transceivers will destroy the RF transistors very quickly. So beware of that power level switch position on those transceivers which are capable of putting out 25 watts.

As with most HF amplifiers without frequency compensation networks, it takes much less power at the low end of the frequency range (2 MHz) to drive the amplifier to full output. Typically 2 to 3 watts will drive the amplifier to 140 watts at 2 MHz. At the high end (28MHz) it takes upwards of 7 to 8 watts to obtain the full 140 watts output. Just be careful not to exceed the ratings of the transistors. Operating the amplifier at an excessive power output level will shorten the life of the RF transistors.

Be sure that an adequate size heatsink is used. The heatsink has to dissipate 140 watts of power. If heavy-duty usage of the amplifier is anticipated, it is recommended that a fan also be used to blow air over the fins of the heatsink and over the amplifier board itself.

TYPICAL PROBLEMS ENCOUNTERED

1. Relay chattering or relay will not hold in – check the power supply voltage. If a battery is used and the voltage drops to 11 volts and below when RF is applied, the

relay will drop out. Also the relay may drop in and out during SSB operation if the relay hold delay is not long enough.

2. Relay locks up – this could be caused by a variety of problems but is usually caused by the large output signal feeding back into the input. This can be caused by improper grounding of the input and output signal coax, running the coax too close together (don't tie-wrap the two together), or the routing of the coax signal lines.
3. The RF transistors get very hot with no RF signal input – too large a bias voltage on the base of the RF transistors usually causes this. Check the bias voltage with a digital voltmeter. It should be between 0.60 and 0.69 volts.

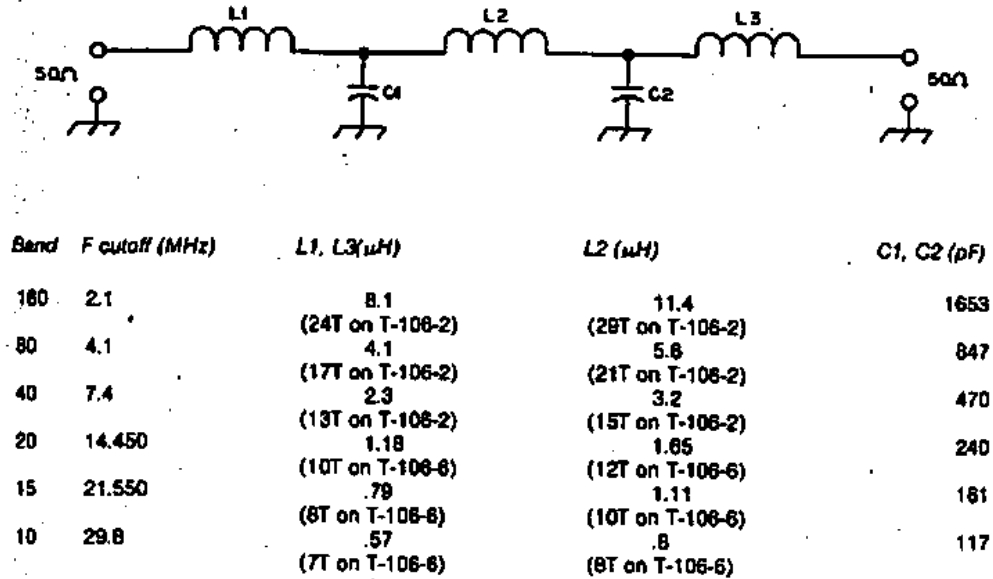


Figure 1 – Low Pass Filter Design

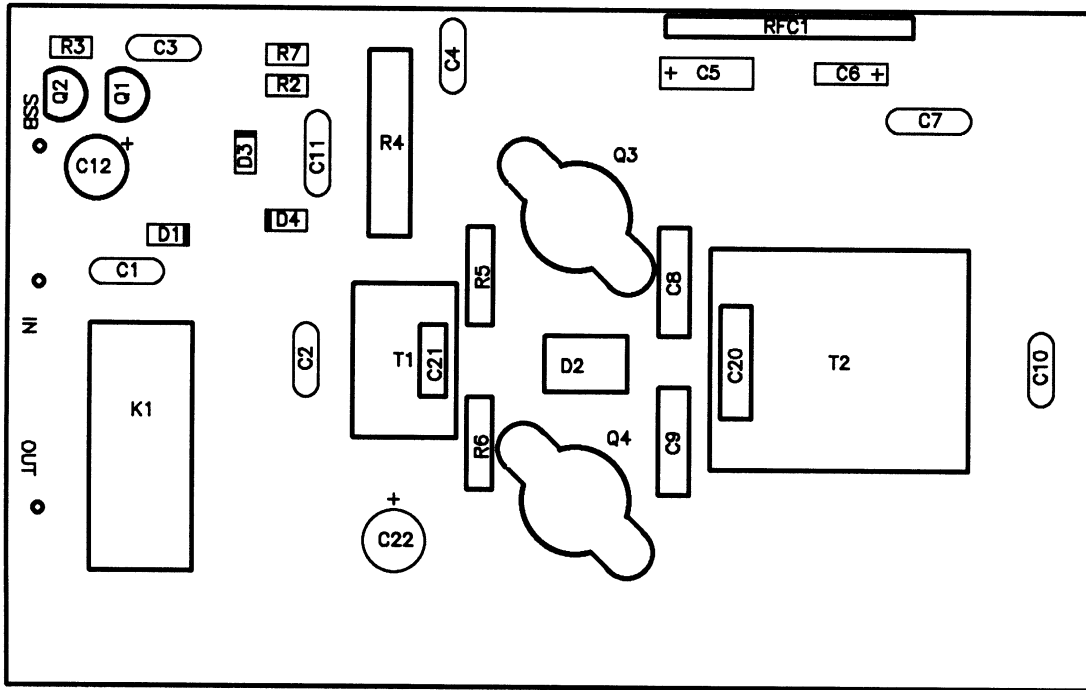
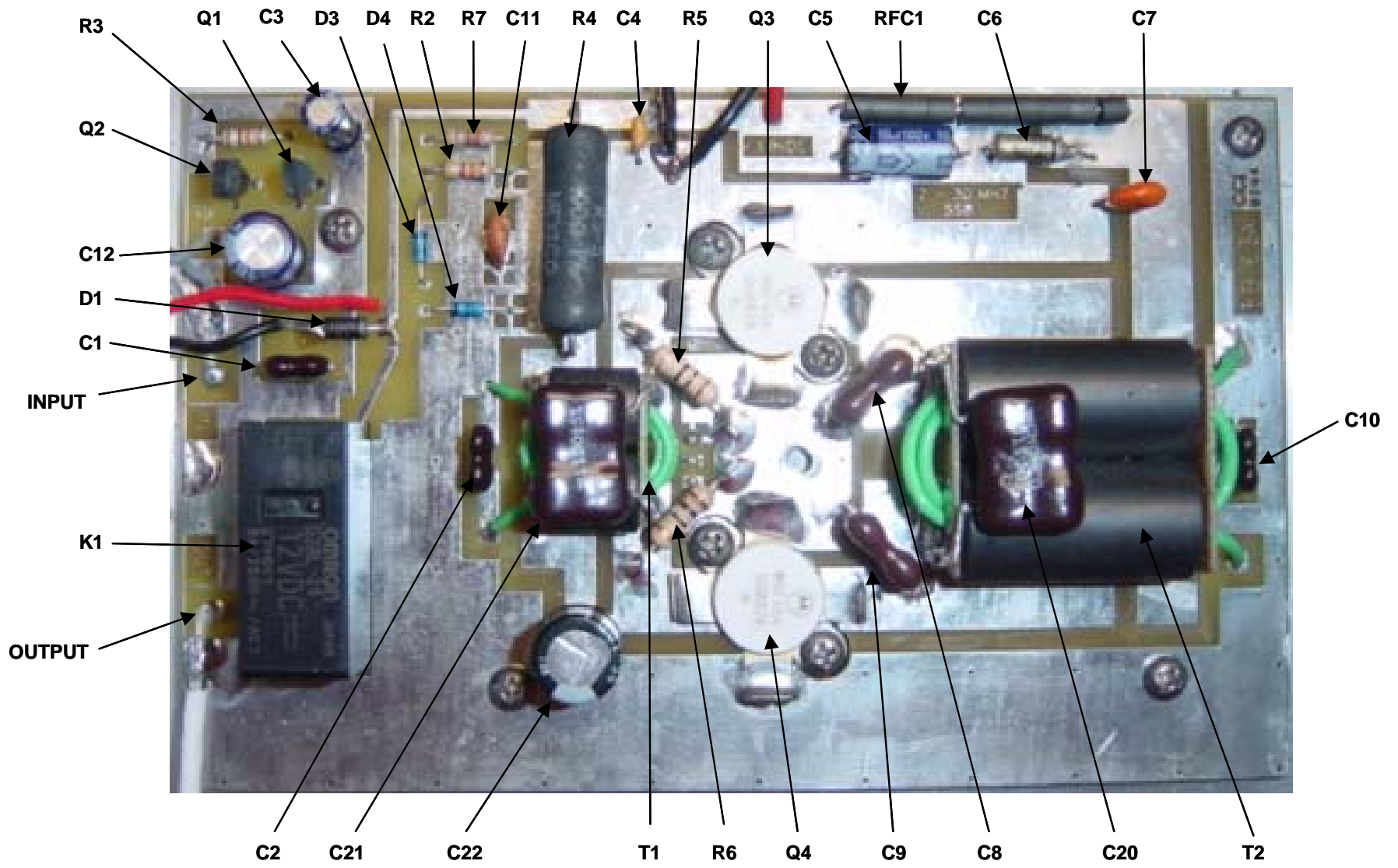


Figure 2 - EB63A COMPONENT LAYOUT

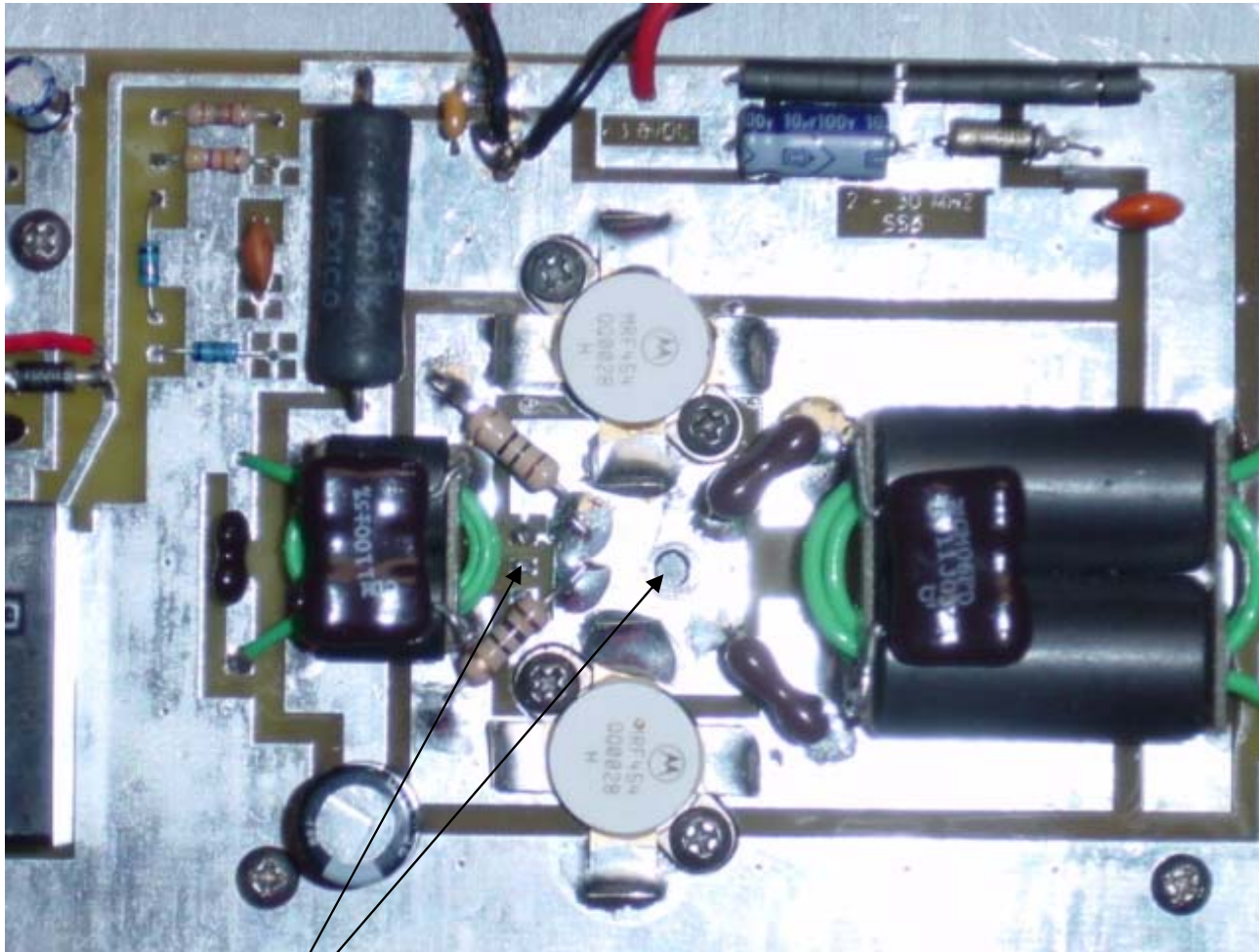
EB63A PARTS LIST

C1	33 pF Dipped Mica	R1	Not Used
C2	18 pF Dipped Mica	R2	47K ohm ¼ W Resistor
C3	0.1 uF Ceramic Mono	R3	10K ohm ¼ W Resistor
C4	0.1 uF Ceramic Mono	R4	82 ohm 5 W Resistor
C5	10 uF 35 Vdc Electrolytic	R5, 6	10 ohm ½ W Resistor
C6	1 uF 35 Vdc Tantalum	R7	1.5K ¼ W Resistor
C7	0.001 uF Erie Disc Ceramic	RFC1	10 Ferroxcube Beads on #18 AWG Wire
C8, 9	330 pF Dipped Mica	D1	1N4001
C10	24 pF Dipped Mica	D2	MFJ243 Transistor
C11	470 pF Ceramic Disc	D3, 4	1N4148
C12	22 uF 25 Vdc Electrolytic	Q1, 2	2N4401
C20	910 pF Dipped Mica	Q3, 4	MRF454
C21	1100 pF dipped Mica	T1	16:1 RF400 Transformer
C22	470 uF 10 Vdc Electrolytic	T2	16:1 RF1000 Transformer
		K1	Omron G2RL-24-DC12 8 Amp



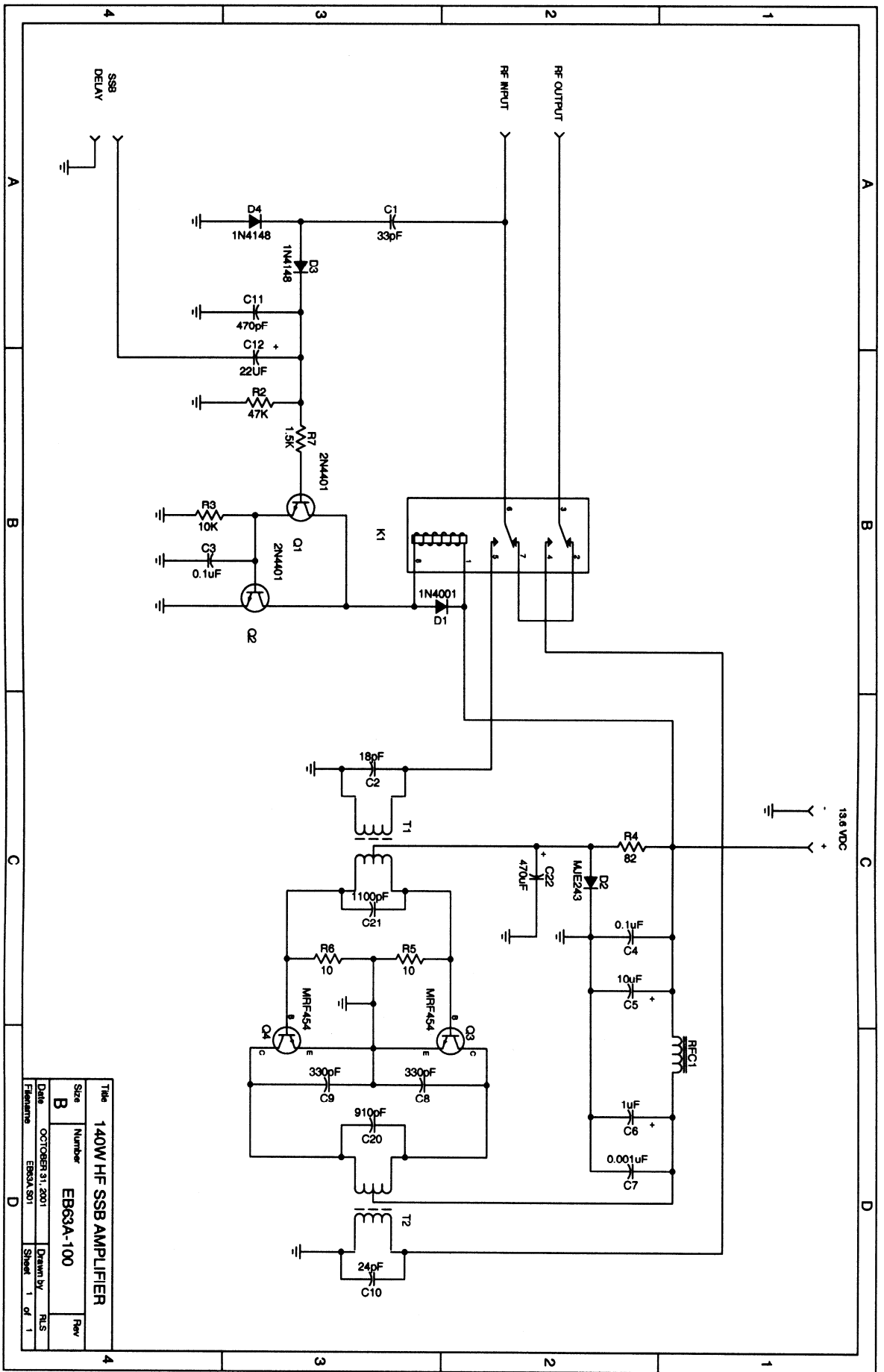
EB-63 COMPONENT LAYOUT

Capacitors C13 thru C19 not used



D2

D2 is mounted flush on the bottom of the pcb with the metal portion of the transistor/diode against the heatsink



Title		140W HF SSB AMPLIFIER	
Size	Number	Rev	
B	EB63A-100		
Date	OCTOBER 31, 2001	Drawn by	RLS
Filename	EB63A.S01	Sheet	1 of 1