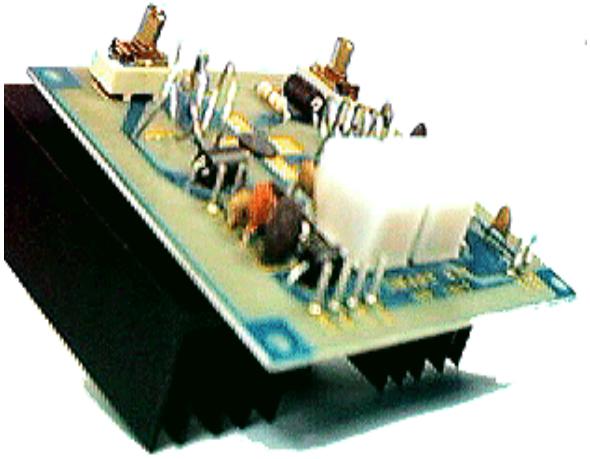
QUASAR ELECTRONICS KIT No. 1017
LINEAR CB 30 W



General Description

This is an easy to build but nevertheless very powerful and useful linear amplifier for the popular Citizen's Band (CB). It can be driven by any commercial CB transmitter and will easily deliver an output power of up to 35 W on the air (depending on the output power of your C.B.). The circuit incorporates an automatic antenna switch, that makes possible to use the same antenna for both receiver and transmitter, which is activated by the RF signal from the output of the transmitter.

Technical Specifications - Characteristics

Frequency band: ..... 27MHz (Citizen's Band)
Output power:..... 17,5 W with 5 W input
28 W with 8 W input
35 W with 10 W input
Working voltage:..... 13.6 VDC
Current requirements: 4A for max. output

How it Works

The circuit consists of two different stages, the amplifier and the electronic antenna changeover switch. The electronic switch is built around the transistor TR1 and its purpose is to switch the antenna between the receiver and the transmitter automatically by simply detecting the presence of RF power in the input of the circuit. The changeover is done by means of the relays RL1 and RL2 which are controlled by TR1. This operation is very important as it is not possible to have the receiver always connected on the antenna when there is a linear amplifier in series with the transceiver's output. (Even if it were physically possible to do it, the high output power would certainly destroy the input of the receiver). The

operation of the circuit is very simple. The network consisting of C1, R1, D1, D2, C2 which you can see between the input of the circuit and the base of TR1 is a simple voltage doubler circuit which is used to detect the presence of RF power. The output of the circuit is sufficiently high to bias the base circuit of the transistor which conducts and its collector current flows through the relays and activates them. The diode D4 is connected in parallel with the relay coils in order to short any back-emf which could appear at the moment of switch off with destructive results. There are two relays in the circuit, separate for the input and output antenna changeover in order to eliminate the possibility of RF sparks between the different sections of a single relay. The amplifier stage is built around the RF power transistor BLY89A and operates in «C» class. The diode D3 which you can see connected in series with the positive supply rail is there to protect the circuit in case it is connected the wrong way round to the power supply. The choke RFC1 together with C6, C7 and C3 forms a pi network that cuts off any RF power before it reaches the power supply. (RF power can destroy the power supply or the battery if it leaks through the power lines). The series LC network (C10, C4 & L10) in the input of the circuit together with the base-emitter capacitance of the transistor form a coupling circuit which ensures (when it is properly tuned) the highest energy transfer possible between the transceiver's output and the linear amplifier's input. At the operating frequency and when it is properly tuned the circuit appears to have a low impedance of 50 Ohms. The resistor R2 together with RFC3 is the load of the input circuit. The capacitor C8 is a coupling capacitor and at the same time it prevents any DC voltage that could be present in the output of the transceiver from damaging the power transistor. In the output, around the collector of TR2 there is RFC2 as a collector load, L2, C9 and C11 together with the antenna are a tuned circuit which has a 50 Ohm impedance and at the same time prevents the harmonics which appear on the collector of TR2 together with the amplified signal from being transmitted. The capacitor C5 couples the antenna with the output circuit and cuts any DC component, from the supply power, before it reaches the output. The LINEAR operates off a power supply voltage of 13.8 VDC and draws a maximum current of 4 A. It can be used with a stabilised power supply capable of delivering the current required by the circuit or alternatively it can be powered by a car battery for mobile use. If the circuit is going to be used with a power supply make sure that the supply can deliver the power required for the operation of the circuit and that it is not affected by RF power. The output voltage of many stabilised power supplies tends to drop dramatically when they are used with RF circuits.

Construction

First of all let us consider a few basics in building electronic circuits on a printed circuit board. The board is made of a thin insulating material clad with a thin layer of conductive copper that is shaped in such a way as to form the necessary conductors between the various components of the circuit. The use of a properly designed printed circuit board is very desirable as it speeds construction up considerably and reduces the possibility of making errors. Quasar Electronics Kit boards also come pre-drilled and with the outline of the components and their identification printed on the component side to make construction easier. To protect the board during storage from oxidation and assure it gets to you in perfect condition the copper is tinned during manufacturing and covered with a special varnish that protects it from getting oxidised and also makes soldering easier. Soldering the components to the board is the only way to build your circuit and from the way you do it depends greatly your success or failure. This work is not very difficult and if you stick to a few rules you should

have no problems. The soldering iron that you use must be light and its power should not exceed the 25 Watts. The tip should be fine and must be kept clean at all times. For this purpose come very handy specially made sponges that are kept wet and from time to time you can wipe the hot tip on them to remove all the residues that tend to accumulate on it. DO NOT file or sandpaper a dirty or worn out tip. If the tip can not be cleaned, replace it. There are many different types of solder in the market and you should choose a good quality one that contains the necessary flux in its core, to assure a perfect joint every time. DO NOT use soldering flux apart from that which is already included in your solder. Too much flux can cause many problems and is one of the main causes of circuit malfunction. If nevertheless you have to use extra flux, as it is the case when you have to tin copper wires, clean it very thoroughly after you finish your work. In order to solder a component correctly you should do the following:

Clean the component leads with a small piece of emery paper.

Bend them at the correct distance from the component's body and insert the component in its place on the board.

You may, sometimes, find a component with heavier gauge leads than usual, that are too thick to enter in the holes of the p.c. board. In this case use a mini drill to enlarge the holes slightly.

Do not make the holes too large as this is going to make soldering difficult afterwards.

Take the hot iron and place its tip on the component lead while holding the end of the solder wire at the point where the lead emerges from the board. The iron tip must touch the lead slightly above the p.c. board.

When the solder starts to melt and flow wait till it covers evenly the area around the hole and the flux boils and gets out from underneath the solder. The whole operation should not take more than 5 seconds. Remove the iron and let the solder cool naturally without blowing on it or moving the component. If every thing was done properly the surface of the joint must have a bright metallic finish and its edges should be smoothly ended on the component lead and the board track. If the solder looks dull, cracked, or has the shape of a blob then you have made a dry joint and you should remove the solder (with a pump, or a solder wick) and redo it.

Take care not to overheat the tracks as it is very easy to lift them from the board and break them.

When you are soldering a sensitive component it is good practice to hold the lead from the component side of the board with a pair of long-nose pliers to divert any heat that could possibly damage the component.

Make sure that you do not use more solder than it is necessary as you are running the risk of short-circuiting adjacent tracks on the board, especially if they are very close together.

After you finish your work cut off the excess of the component leads and clean the board thoroughly with a suitable solvent to remove all flux residues that may still remain on it.

Adjustments

This is an RF circuit and very good soldering and a very clean board are the two basic requirements for success. All the components are marked on the P.C. board and you should have no difficulty in identifying and placing them. Start building your circuit by soldering the coils and the resistors first, continue with the capacitors and the trimmers and finally place the RFC's, the relays, TR1 and the diodes. The output transistor must be mounted from the copper side of the board. One of the four leads of the transistor is notched and this is the

collector. Similarly there is a drawing representing the leads on the component side of the board and the notched lead is drawn there also. Align the transistor carefully and solder it in place. The plastic part of the transistor's body must pass through the hole provided and the heatsink screw should come out from the copper side of the board. After you have finished with the construction and the usual inspection and cleaning of the circuit you must bolt the transistor on the heatsink provided, in order to protect it from the heat that will build-up during operation. When you mount the heatsink make sure that it is not touching any parts of the circuit and that the nut is tightened as much as possible. (See the related diagram about the power transistor's mounting method). Connect the output of your C.B. transceiver across points 3 (earth) and 4 (signal) of the board and connect the output of the circuit 2 (signal) 1 (earth) with a suitable antenna (52 Ohms). At points 5 (-) and 6 (+) connect a suitable DC supply of 13.8 Volts and capable of delivering up to 4 Amperes.

1. Between the output of the linear amplifier and the antenna, place a SWR meter and set it to measure power. Select a free channel and turn the transmitter on. The relays should click and the power meter should give you an indication. Adjust C9 and C10 in this order for the maximum output power possible.
2. Transfer the SWR meter between the transceiver and the input of the linear amplifier and set it for SWR measurement. Turn the power on and carefully adjust C10 for a minimum SWR indication
3. Transfer the meter back on the output circuit, set it to measure output power and adjust C9 for maximum output.
4. Repeat the above procedure until you are quite satisfied that you have a consistent performance across the CB band.

It is very important to repeat the above procedure every time the circuit is connected on a different rig, as its performance will be affected by the other components of the set.

Warning

Quasar Electronics kits are sold as stand alone training kits.
If they are used as part of a larger assembly and any damage is caused, our company bears no responsibility.

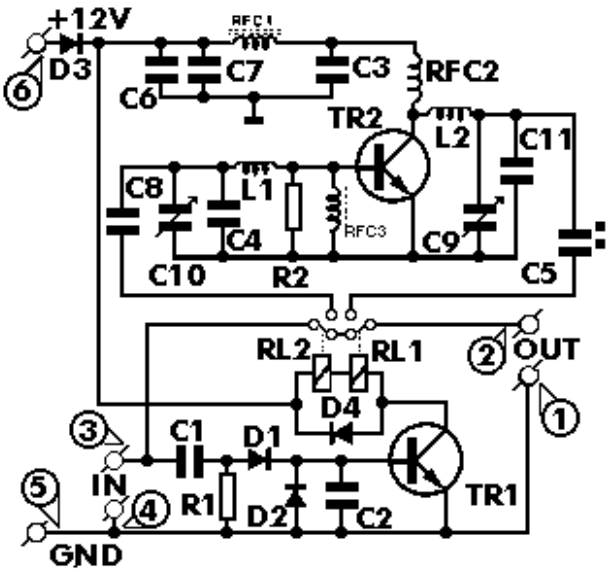
While using electrical parts, handle power supply and equipment with great care, following safety standards as described by international specs and regulations.

If it does not work

Check your work for possible dry joints, bridges across adjacent tracks or soldering flux residues that usually cause problems.
Check again all the external connections to and from the circuit to see if there is a mistake there.
See that there are no components missing or inserted in the wrong places.
Make sure that all the polarised components have been soldered the right way round.
Make sure that the supply has the correct voltage and is connected the right way round to your circuit.
Check your project for faulty or damaged components.

If your project still fails to work, please contact us for information about our Get-You-Going service.

Electronic Diagram



Parts List

All components including printed circuit board, assembly instructions including schematics and detailed parts list are supplied when you purchase the kit.

Ordering

For pricing info and online ordering please visit:

http://www.quasarelectronics.com/1017.htm

For further info please contact us by e-mail:

mailto: sales@QuasarElectronics.com