SOLID 20 WATTS

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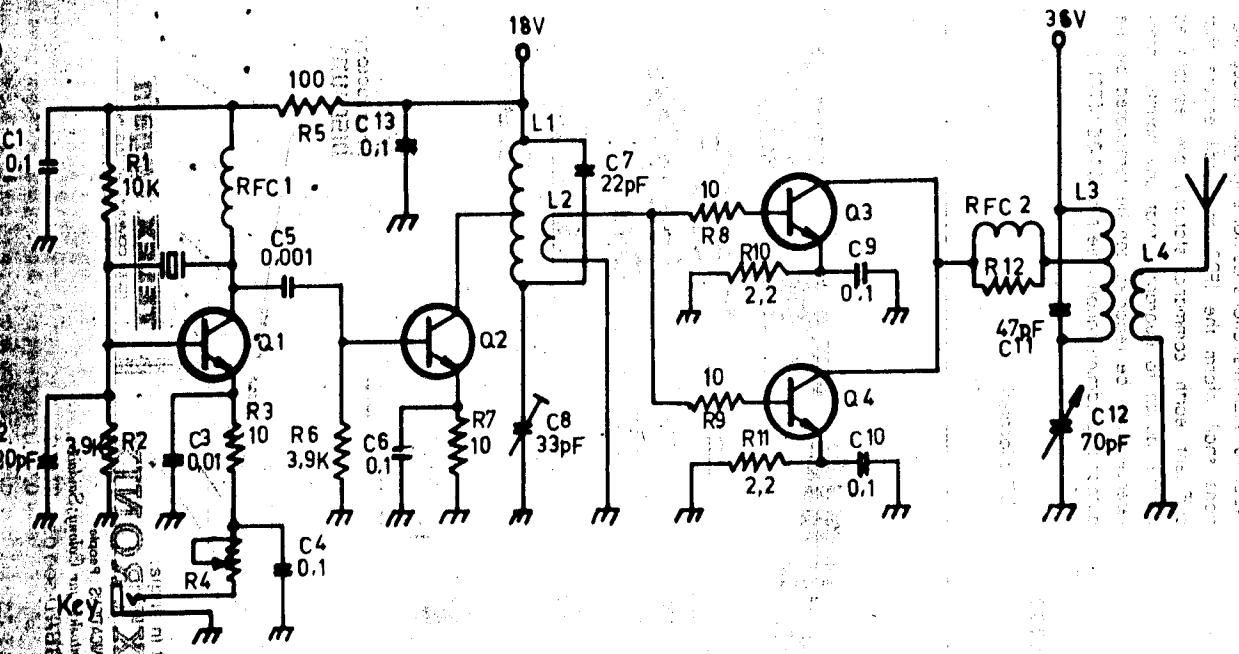
This fully solid state transmitter is capable of taking an input of 18 to 20 watts and makes use of silicon power transistors like SL 100 and 2N 3054. Though these transistors are meant for audio work, many experimenters had success with SL 100 using it as a Xtal oscillator transmitter with a DC input of upto 3 watts. The efficiency may not be comparable to that of an (RF) power transistor. Even a fifty per cent efficiency can easily give an output of about 10 watts. Here we are giving only the circuit diagram of the crystal controlled transmitter and a power supply for it. Experiments are going on for adding a stable VFO and a modulator and the results will be published very soon. The power supply will meet the power requirements of a VFO and a modulator and the transformer is designed as such. The circuit is simple and straightforward Once the components, coils and the P.C board are ready, the whole assembly and soldering will take only a couple of hours. An SL100 / CL100 silicon power transistor (Q1) is used as pierce crystal oscillator. The output from the collector of Q1 is fed to the base of a second SL100/CL100 (Q2) through the capacitor C 5 and the stage operates on class C mode. The collector of Q2 is connected to a low impedance tap on the coil L1. L1 is tuned to resonance on 7 Mhz with the help of a philips 33pF air dieelectric trimmer. There is a parallel capacitor of 22 pf connected across L1. The link coil L2 feeds the excitation to the bases of the output transistors Q3 and Q4 through equalizing series resistors of 10 ohms ½ w each These emitter resistors R8 and R9. 2 2 ohms each give protective bias to the final transistors. Q1 and Q2 are also protected likewise with emitter resistors R2 and R7. Two ferrite beads are slipped (one each) on the leads of R8 and R9 at the base ends of Q3 and Q4. These ferrite beads prevent or kill any VHF or UHF parastic appearing at the bases of Q3 and Q4. This is in addition to R8 and R9 serving as stopper resistors.

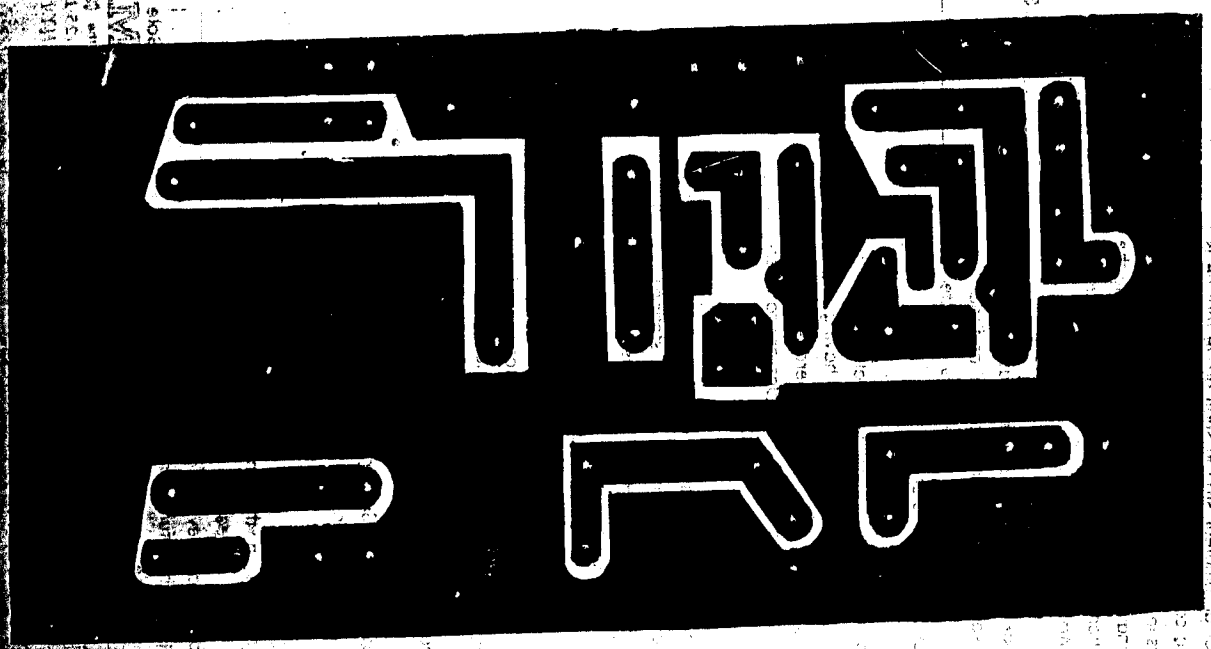
Transistor Q2 is mounted on a heat sink of not less than 4 sq. inches The heat sink is made out of 18 SWG alluminium sheet. The final transistors are mounted on a heat sink which in turn could be mounted on the rear of the proposed metal cabinet. The effective area of the heat sink should be more than 40 sq. inches. The heat sink is isolated from the metal casing of the transistors by mica separators. The P.A. works under class C condition. A full-size layout of the printed board is given elsewhere and it should serve as a guide to those who would like to duplicate the project. A screen made of 18 SWG Alluminium sheet about 2" across and running to the entire width of the printed board (layout) serves as a shield between the driver and PA stages. This prevents self oscillation between these stages and is a must The collectors of the output transistors are connected to a tap on the tank coil L2 through a parasitic suppressor RFC2. L2 is tuned to resonance with a Philips 70pf concentric air trimmer and a 47pF tubular ceramic capacitor across it. The RF output to the antenna is taken through a 4 turn link wound over the middle of L2 with hook up wire The connections to the key, Xtal, antenna etc. are all brought to the front panel. As the transmitter is meant only for the 7 Mhz band, very little adjustment of the driver and final tank coils is needed. However suitable variable capacitors could be used instead of the trimmers and they could be controlled from the front panel.

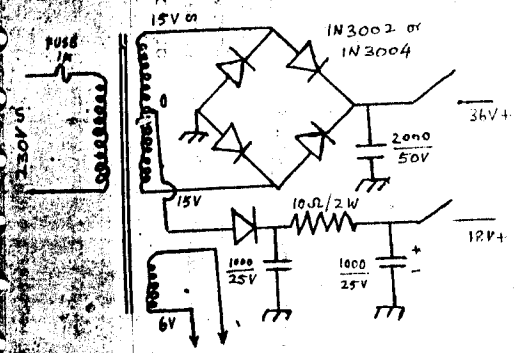
The transmitter requires a dual supply of 18 and 36 volts DC This could be easily provided by having a centre-tapped secondary of 15-0-15 volts RMS @ 1 ampere. A full-wave bridge rectifier is used across the entire winding and four IN4007 (EC4007) silicon rectifiers are used in the bridge. The power supply includes the D.C. requirements of VFO and modulator also.

Wiring and testing is straight forward. It is advisable to check each and every component for its value before it is soldered into circuit. First wind all the coils and attach the leads to the taps and solder them in position. Then wind the secondary links over them. After completing the wiring the p c. board is checked for any short circuit or any mistake in the placement of components. After making sure the wiring is right in all respects, the 18 volts supply is connected to the P.C.B The two SL100s should be able to withstand the supply without breaking down. The crystal oscillator should go into oscillation instantaneously when the Xtal is plugged in and the key is pressed. The oscillation could be easily monitored on the station receiver. The preset R4 is adjusted to a point where the oscillation starts with the key up and reversed slightly to a point where the oscillation stops. The tuned circuit L1C5 is peaked by monitoring the strength of the output signal on the receiver. When C5 is adjusted the strength of the signal will have a definite peak. After peaking L1C5 the key is lifted.

A 7 Mhz antenna is connected to the transmitter output terminal. The 36 volts DC supply is switched on in the key up position and the two output transistors should be able to withstand the voltage on their collectors. Spurious and faulty devices will pack off, the moment the supply is switched on. This in turn will lead to a short circuit and the supply should be switched off immediately. In order to know that, it is safer to have a current meter in the supply lead having a







All capacitors in decimal values are disc ceramic. All capacitors in whole numbers are tubular ceramic, 10% tolerance. All resistors are 1/8W high stability carbon, 10% tolerance unless otherwise stated.

C8 and C12 are Philips concentric tubular trimmers.

RFC1 : 1 to 2.5mm RF choke

RFC2 : 6 turns enamelled wire 20SWG wound over R12 as former

R12 : 100 ohms ½ resistor

L1 : 25 turns close wound with 26 SWG enamelled copper wire over ½" former, tapped at 5 turns from the cold end.

L2 : Link 5 turns wound with thin hook-up wire over cold end of L1

L3 : 20 turns close wound with 20 SWG enamelled copper wire over 1" former tapped at 4 turns from cold end.

L4 : Link 4 turns wound with hook-up wire over the middle of L3

T1 : Power transformer - 230V a.c. primary; 15-0-15 1 amp. secondary 6.3V 1 amp for dial lamp and other 6V a.c. outlets

FSD of atleast 1 ampere. A fuse (1 ampere capacity) is also necessary. While testing the prototype we did lose a couple of transistors, the reason - bad manufacture. This happens, even if such devices are used in audio circuits. When we start tuning up the final, the signal picked up by the receiver will be strong enough to overload it. So earth the antenna terminal of the receiver at this time. The final tank circuit should be quickly tuned to resonance when the key is pressed. Keeping the final off resonance for a considerable time increases the collector dissipation to a great extent and it may result in permanent damage to them. Keep the key pressed for a few seconds only, each time the final tank coil is tuned. If an output meter or an SWR bridge is available it will be of great assistance in tuning the P. A.

If none is available a neon line tester will be helpful. L3 C12 is peaked for maximum output. Whenever the tank circuit is at resonance, the neon tester will burn bright. It may need a little touch up once the neon tester is removed. At this time tuned circuit L1 C5 is touched up for maximum drive as indicated by an increase in the output. The link L4 is moved over the centre of L3 to get maximum output. In the prototype the link had to be placed almost at the centre of L3. While adjusting the tuning condenser C 12 care should be taken to avoid direct contact with the hot end of L3. There is enough Rf voltage there to give a burn.

The voltages are about the maximum for this operation and for the transistors used. Exceeding these values may lead to thermal runaway. For that matter, the final transistors should never be tried even for a few seconds without a proper load or a heatsink. The heatsink for the prototype is home made but commercial heat sinks are readily available which may even do a better job. The total area of dissipation should be not less than 40 sq. inches. The heat sink may be fixed to the rear of the metal cabinet. The side panels help in further dissipation of heat. The metal cabinet may be made large enough to include the VFO and modulator.

Different methods of keying were tried viz. keying final only, keying the final and the driver stages, keying the driver stage only. In all these cases there was severe backwave. Therefore it was decided to key the oscillator itself. Then again, keying the supply voltage to Q, led to key clicks and sluggish oscillation. The present method of keying the emitter of Q1 with a preset adjustment solved all these problems. The correct setting of the preset R4 is very important.

All the coils are close wound. Any former with the requisite diameter could be used. Even if the diameter is different the number of turns could be altered suitably, maintaining, at the same time, the ratio for the collector taps and links.

A word of caution before we close up. Don't tinker with a naked screwdriver. Any accidental short between two terminals may ruin the transistors. If there is any need for such probing viz. searching for a lr contact etc. use a P.V.C or wooden stick. While testing the transmitter for the first time feel the power transistor heat sinks with your thumb for any over heating. If so, the power should be switched off immediately and the reason for such over heating should be found out and rectified. It is better to wire stage by stage and check every stage for correct operation.

There are many possibilities of modification with this set up-such as using RF power transistors in the P. A - making it as a multiband VFO controlled transmitter - by giving 12V to the P.A. and slightly altering the link L4, it can be made as a portable mobile transmitter etc. etc.

PC boards may be available with Madras Amateur Radio Society very shortly at a nomial price.