Construction Manual
6m-Linear-Transverter
XV6/10

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2606

Technical data

exciter frequency:	28 ... 30 MHz
RF frequency:	50 ... 52 MHz
supply voltage:	11.5 ... 13.8 Volts
current consumption (rec./ transm.)	0.04A / 1.5A

Receiver

noise figure:	<2 dB
gain:	20 dB
image response:	-70dB
input intercept point IP_3:	0dBm

Transmitter

transmission power at 12 V:	5 Watts single tone
input power:	0.1 ... 10 Watt adjustable
spurious transmissions:	-56 dB

Circuit description

Fig 1. shows the circuit diagram. The receiving path leads from the RX/TX relays and the hi-Q input filter L6 to the pre-amplifier T2, which operates in grounded base configuration. In transmit mode the stage is shut down by a bias voltage from D3. On the bandpass filter L3, L4 follows the dual-gate-FET mixers T1. An the drain the IF signal is coupled through another band pass and the RX/TX relays to the output.

In transmit mode the input signal first reaches the load resistors R19 and R21. They are required as the maximum input power for the mixer is only 1mW. The resistors are good for up to 15 Watts in SSB and 8 Watts in FM mode. You can match the output power of your exciter to the transverter with the variable resistor R27. L14, C41 is a notch filter for 50MHz.

Between mixer T9 and driver transistor T7 there is a hi-Q bandpass filter with L12 and L15. T7 provides the PA transistor T8 with a power of 500mW. The output power leads through a 5-pole low pass filter to the RX/TX relays and then to the output connector.

T3 generates the oscillator signal. T4 works as buffer stage. Since the same PCB is used for the 10m and the 2m version there are different components to mount depending on the crystal frequency.

To switch between RX and TX mode you can either put pin 4 to ground (PTT-mode) or use the RF-VOX. RF-VOX means that an input power of at least 50mW will be rectified by D1 and D2 which renders T5 to supply the TX chain. C32 determines the hold time, which is 500ms with the current values.

Construction

Fig. 2 shows the place plan, a picture of the read-made PCB shows fig.3. All components fit on a double sided board of 71x109mm size. Nearly all traces are on the solder side, the component side mainly consists of a copper plane.

The best idea is to start with the low-profile components like resistors and diodes. Then proceed with the next bigger like capacitors and finally placing inductors and crystal. Each part which is soldered should be checked on the component list. This makes it unlikely to make errors. **The relay K1 must be mounted after the PCB sits in the housing**. Otherwise you would not reach the soldering pad beneath the BCN connectors.

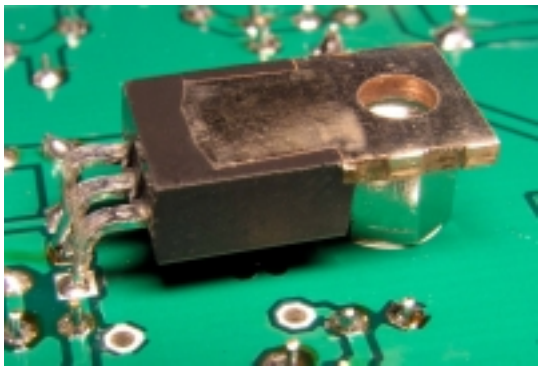
The dual-gate FETs have one long leg which is the drain. This pin is marked with a “D” on the place plan. Some capacitors have their values coded in Picofarads like the resistors in Ohms, starting with two value digits and the number of zeros. 103 e.g. means 10,000pF or 10nF or 330 is 33pF. Unfortunately the printing on the parts sometimes has low contrast so that a magnifier is highly recommended. C4, C8 and C44 are printed capacitors and will not be stuffed. The resistors R7 and R13 can become rather warm and should have an 1mm gap to the PCB. Please notice that C7 (5.6p) and the 10nF capacitors look very similar as do the 1N4148 diodes and D7. Don’t mix them up.

L8, L11

L10

Instead a short msut be placed on this position. The 1µH and 0.47µH inductors look like a resistors and are coded with color rings. L8 and L11 are made from 0.5mm enameled copper wire. The inner diameter is 6mm. Wind the wire tight on a 6mm drill. L8 has 6 turns, L11 7 turns. L10 has 8 turns of 0.5mm enameled copper wire and is wound on a torrid core (see figures above).

T7 is mounted on a plastic spacer. The PA transistor T8 will be mounted on the rear side of the PCB (see picture on the right). First bend the legs 90 degrees in opposite direction to the mounting flange. Mount the short 5mm nut with the 4mm M3 screw to the board. Now T8 must placed in the way that the mounting hole sits above the nut. Then solder the part. The long 6mm nut is fixed on the opposite hole of the PCB with the second 4mm screw.



Mount the BNC connectors and the feed-through capacitors before assembling the housing. The nuts of the connectors should be tightened strong. It is difficult to do it later if all is put together. The next step is to solder the walls of the housing. It can be done easily if the parts are put together by sticking it into the cover. Don’t forget to solder the pads of the PCB with the sidewalls. The last component to solder is the relay. Finally mount cover and heat sink as shown in fig. 4.

Adjustment

Necessary equipment:

- 50 MHz signal source
- 28 MHz transceiver
- Power meter (or SWR meter with dummy load)
- Frequency counter, 20mV sensitivity
- Volt- and Ampere meter

All the adjustments must be done after the PCB and enclosure are assembled. Please notice that the transmission mode must not be switched on without heat sink. Otherwise the PA transistor can become hot enough to die within a couple of seconds.

Supply

At first apply a supply voltage of 12 Volts to the transverter the current shall be 30...40mA. Connect the PTT pin (P4) to ground. A “click” from the relays shall be heard. Adjust the quiescent current with R31 to 300mA. Return to receive mode.

Oscillator

Connect the frequency counter to the emitter of T4. Adjust a frequency of 22.000MHz with the variable capacitor C26. If you have a sensitive counter you can also use a cable with a coupling loop of a few turn placed close at the oscillator.

Receiver

Connect a signal generator of 50,25MHz and 1mV output to the antenna connector. Connect a receiver tuned to 28,25MHz to the transverter output. Recursively adjust C10, C11, C13, C15 and C16 so that the signal in the receiver gets to a maximum. If you don’t have an appropriate signal source you can tune to maximum noise level. However this method does not give optimal results.

Transmitter

First you have to disable the ALC circuit by shorting R33 to ground. Connect the transmitter to the 28MHz input and a wattmeter to the output of the transverter. Turn R27 fully counter clockwise. Apply a CW signal on 28.250 MHz with a power of 1Watt. Put the PTT pin to ground. Adjust C49 and C51 to maximum output power. Watch the peaks, they are very sharp. The output power shall be around 8 Watts now. You can optimize the output by carefully spreading or squeezing L8 and L11.

Apply the maximum power which the 2m transceiver is intend to give in normal operation. Turn R22 clockwise until the output power does not exceed 6 Watts. Then remove the R33 short. The output power shall be around 5W, the current consumption approximately 1.5A.

Component list XV6/10

C1	10n	C45	10p	R3	680k
C2	10n	C46	2p2	R4	22k
C3	10n	C47	10n	R5	47
C4	1p	C48	10p	R6	100k
C5	8p2	C49	6p (weiß)	R7	330
C6	10n	C50	10p	R8	10k
C7	5p6	C51	6p (weiß)	R9	560
C8	n.b.	C52	n.b.	R10	3k9
C9	8p2	C53	10n	R11	3k9
C10	6p (weiß)	C54	10n	R12	4k7
C11	6p (weiß)	C55	10n	R13	10k
C12	10p	C56	10n	R14	1k
C13	6p (weiß)	C57	10n	R15	10k
C14	10p	C58	47µ	R16	330
C15	30p (grün)	D1	1N4148	R17	4k7
C16	30p (grün)	D2	1N4148	R18	22k
C17	68p	D3	1N4148	R19	100/4W
C18	1p	D4	1N4148	R20	47
C19	10n	D5	1N4148	R21	100/4W
C20	33p	D6	1N4148	R22	1k
C21	10n	D7	BA479	R23	1k
C22	10n	D8	n.b.	R24	1k
C23	10n	IC1	78L08	R25	1k
C24	10µ	K1	RELAIS	R26	100k
C25	47µ	L1	FCX 6-Loch	R27	1k-TRIM
C26	30p (grün)	L2	1µH	R28	100
C27	100p	L3	.47µH	R29	22
C28	10p	L4	.47µH	R30	10k
C29	100p	L5	1µH	R31	1k-TRIM
C30	10n	L6	.47µH	R32	1k
C31	100p	L7	n.b.	R33	100
C32	2µ2	L8	7Wdg. 6mmØ	T1	BF966
C33	8p2	L9	.47µH	T2	BFR91
C34	100p	L10	T37-6, 8Wdg.	T3	BF255
C35	10n	L11	6Wdg. 6mmØ	T4	BF255
C36	10n	L12	.47µH	T5	BD140
C37	10µ	L13	.47µH	T6	BC547
C38	10n	L14	.47µH	T7	2N4427
C39	10n	L15	.47µH	T8	RD06HFV1
C40	10n	L16	Brücke	T9	BF966
C41	18p	QU1	n.b.		
C42	10n	QU2	22MHz	**n.b.= do not mount**	
C43	10n	R1	47		
C44	n.b.	R2	47		

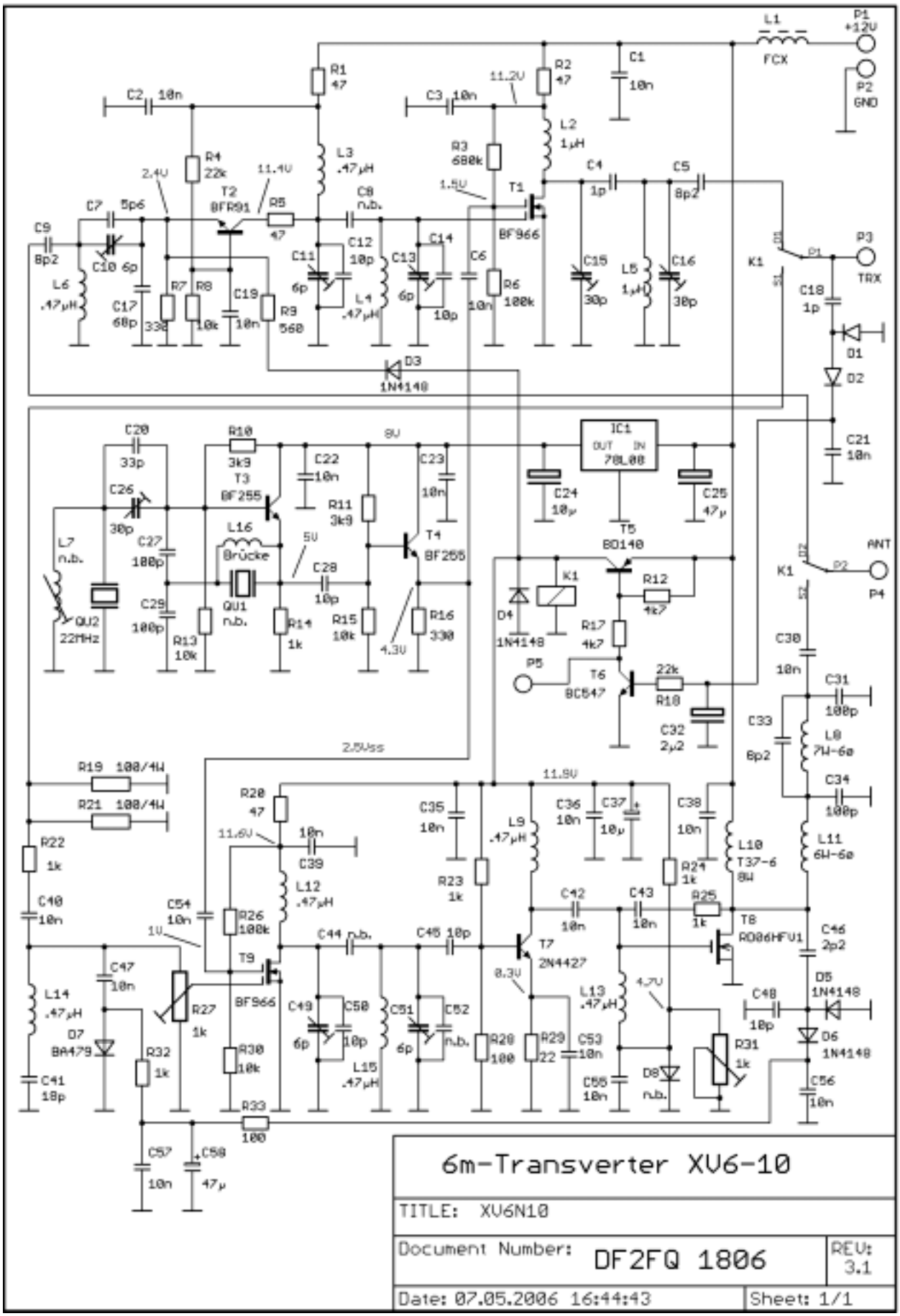


Figure 1, circuit diagram

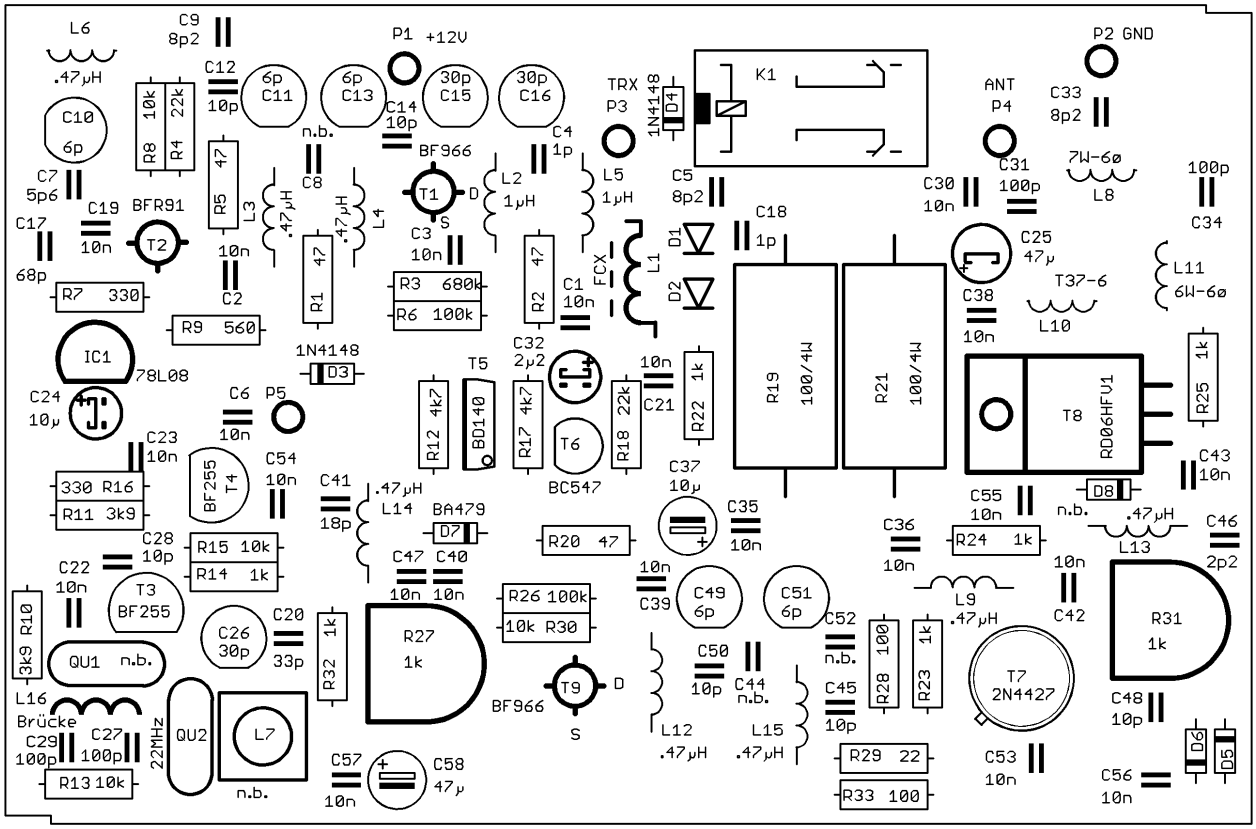


Figure 2, Place plan

Figure 3, picture of the ready made transverter

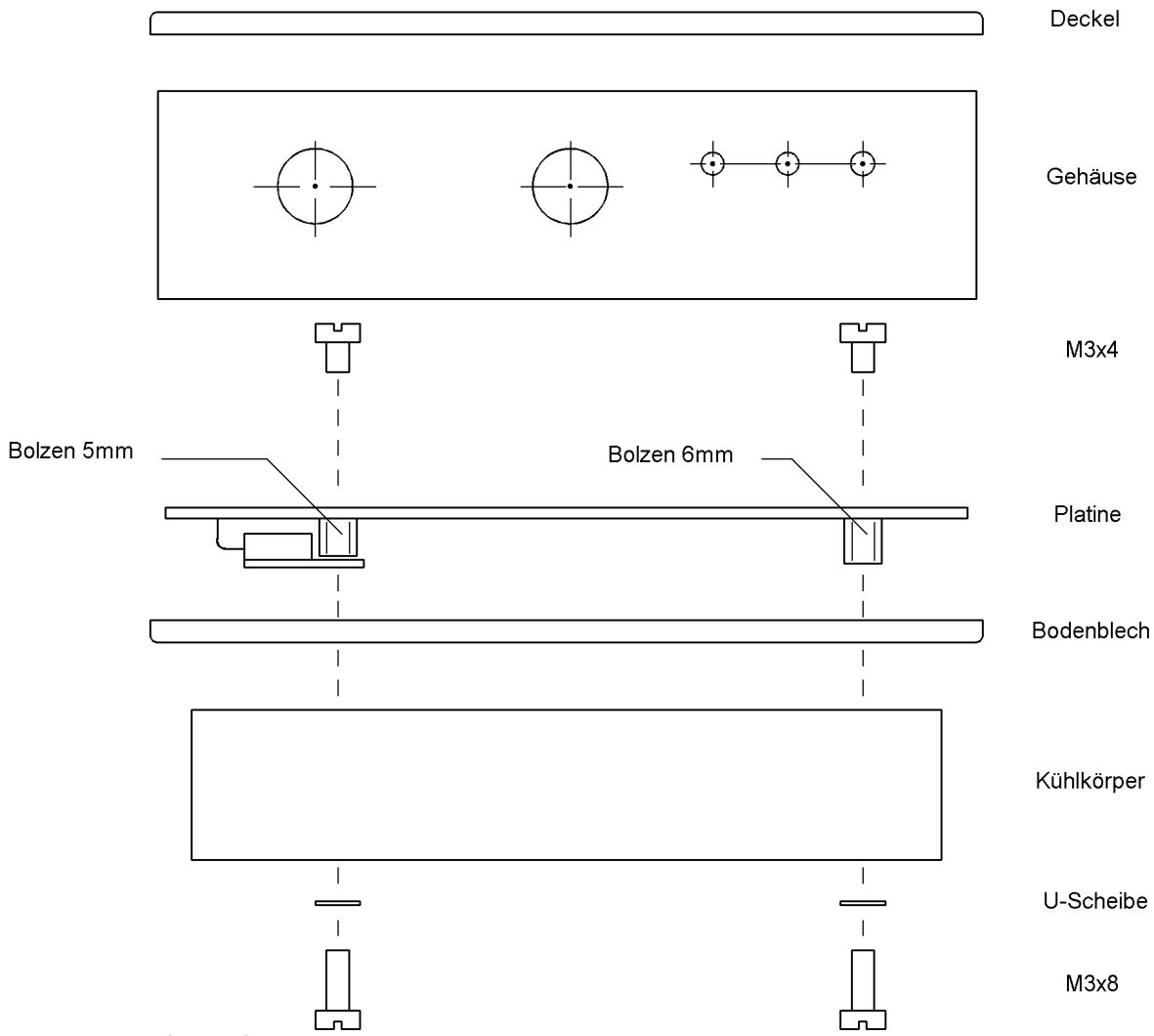


Figure 4, mounting scheme

Final remarks

This circuit design may be used by everybody for private purposes. Each commercial usage, also from parts of the design requires a permission from the author. The author rejects any liabilities for damages which result from construction or use of the device.

Appropriate construction considered the design is compliant to all requirements of the new European standard for amateur radio equipment ETS 300-684 as well as to the EMC standard EN 55022.

For questions and further information the author is available in packet radio or by e-mail under df2fq@amsat.org.