

This unit provides the interface between a low power transceiver such as the IC202 or FT290, and a transverter such as the G3WDG 10 GHz system. Functions provided are:

- 1) Fully solid state transmit receive switching, with an adjustable attenuator to reduce the transmit power to a level of up to 3mW, suitable for driving the mixers of most transverter systems.
- 2) A control interface to use the DC voltage present on the antenna socket of these transceivers to provide transmit/receive switching without the need for extra control cables.
- 3) A 21 Volt inverter to provide the supply for the majority of coaxial relays on the current market together with switching for a non latching coax relay. No precise details for driving latching relays are given as the drive requirements of these vary wildly between types. Some ideas for controlling these relays are included at the end.

The complete unit is built in surface mount form on a single sided epoxy glass PCB, and fits in a standard 55 x 74 x 30 Piper tinplate box type 7764. It is intended that the PCB, together with the more 'difficult to obtain' items will be provided as a short kit by the Microwave Components Service.

Referring to figure 1; TR1 is controlled by the DC level present on the transceiver input, and switches two P-channel power Mosfets to provide alternately transmit and receive supplies. The Mosfets, although small surface mount devices, have a very low 'on' resistance and are rated at over 9A continuous. A link on the PCB allows the switching facility to be separated from the antenna line if desired. Since the polarity of the control voltage is in opposite sense for the IC202 and the FT290, cross-strap links are provided on the board to permit both transceiver types to be catered for. The 2.2W resistors on the 12V outputs are to provide a measure of protection, protecting the switching transistors from excessive current in the event of a short circuit on either of the 12V lines. The protection is only capable of short duration faults and a fuse should be provided on the input side. For most transceivers this need be no more than 1 Amp rating

Two PIN diodes, driven from the above supplies, connect the transceiver to either the receive mixer port, or via a power attenuator to the transmit mixer port. The attenuator is rated at 3 watts continuous, and will handle SSB signals of up to around 5 watts; the total attenuation provided is presetable between no output signal, and an attenuation of 30dB.

A voltage doubler is formed from a TDA2006 audio amplifier IC. This is connected as a power oscillator, operating at a frequency of 7 kHz. The squarewave output is applied to a voltage doubler and gives a nominal 21 volts output at a current of up to 100mA. A sufficiently large output capacitor has been provided such that high power latching relays and waveguide switches (these often require a brief drive exceeding the 100 mA available from this unit) may be driven. Wire links are provided at all strategic points to allow the maximum flexibility for other transceiver/transverter combinations. The unit is completed by a transistor to switch non-latching type coaxial relays from the 21V supply.

Construction

It is best to start with the control circuitry. Solder in the components, leaving TR2 and TR3 until last. These are static sensitive devices and should not be left out of their protective foam for long periods. The 2.2W protection resistors are wired off board, between the PCB and output connection points. This part of the unit may be tested by connecting the supply and checking that 12V is available from point B. Apply around 3V to the switching input and check that the 12V output swaps to point A. The transceiver antenna connection can conveniently be used for this purpose, but remember it will be transmitting into no load.

The attenuator and PIN switching components should be added next. Great care needs to be taken when bending the PIN diode wires as the glass cases are easily broken if the wire is bent too close to the body. Use a pair of tweezers to ensure that the wire is bent downwards at a distance of greater than 1mm from the diode body.

To test, first ensure that the 12V supplies toggle correctly; then connect the receive mixer port to an antenna or weak signal source and make sure the receiver can hear signals at very nearly the same strength as if the antenna were connected direct; attenuation should be no more than 0.5dB. To check the transmit path a means of measuring power levels of around 1mW is required. This level is just detectable with the 'classic' diode plus 50W resistor power meter and should give around 100 - 200mV reading using this method if a shottky diode is used. Ensure that the power varies as the output level preset is adjusted.

Finally mount the inverter components. The oscillator IC is most easily fitted by cutting off its centre leg; the ground connection then being made through the mounting tab. Connect the 12V supply and ensure that around 21V is available at the output. In use, the inverter may be operated continuously as shown, or switched only on transmit by powering it from the +12V Tx line. This latter method should only be used for lower power relays as it does not allow a high surge current to be generated.

The whole PCB can be fitted in a tinplate box, with connections to the outside world being made via feedthrough capacitors or filterconns.

Suggestions for operating latching type coaxial relays

1) Where the relay can be operated by grounding alternate sides the circuit of figure 2 may be used. Here a pulse of around 100 - 200 ms is generated when the appropriate 12v line goes high and pulses the associated coil. Transco relays can be operated this way.

2) Where two 24v positive going pulses are needed, the situation gets more complicated. The circuit in figure 2 cannot be turned upside down as the drive levels would then be equivalent to -12/-24V rather than 0/-12V. The easiest solution is to reconfigure the DC/DC converter to generate -12V rather than +24V as shown in figure 3. This is easily done, keeping the same board layout, by reversing the polarity of the UF4001 diodes and the two output capacitors, then referring the capacitors to ground rather than the +12V rail. The diagram should make it all clear.

This way the switching circuit is a mirror image of that in 1), with the -12V supply taking the place of 24V.

Design notes and test results

DC Switching and control

Polarity Cross-strap	IC202	A - Rx B - Tx
	FT290	B - Tx A - Rx
Current capability of switched power rails -		1A

RF Path

Maximum power input -	4 Watts continuous / average
Attenuation through Tx path -	30dB at max setting
Attenuation to Rx mixer port while on Tx -	measured at 25dB

24V inverter

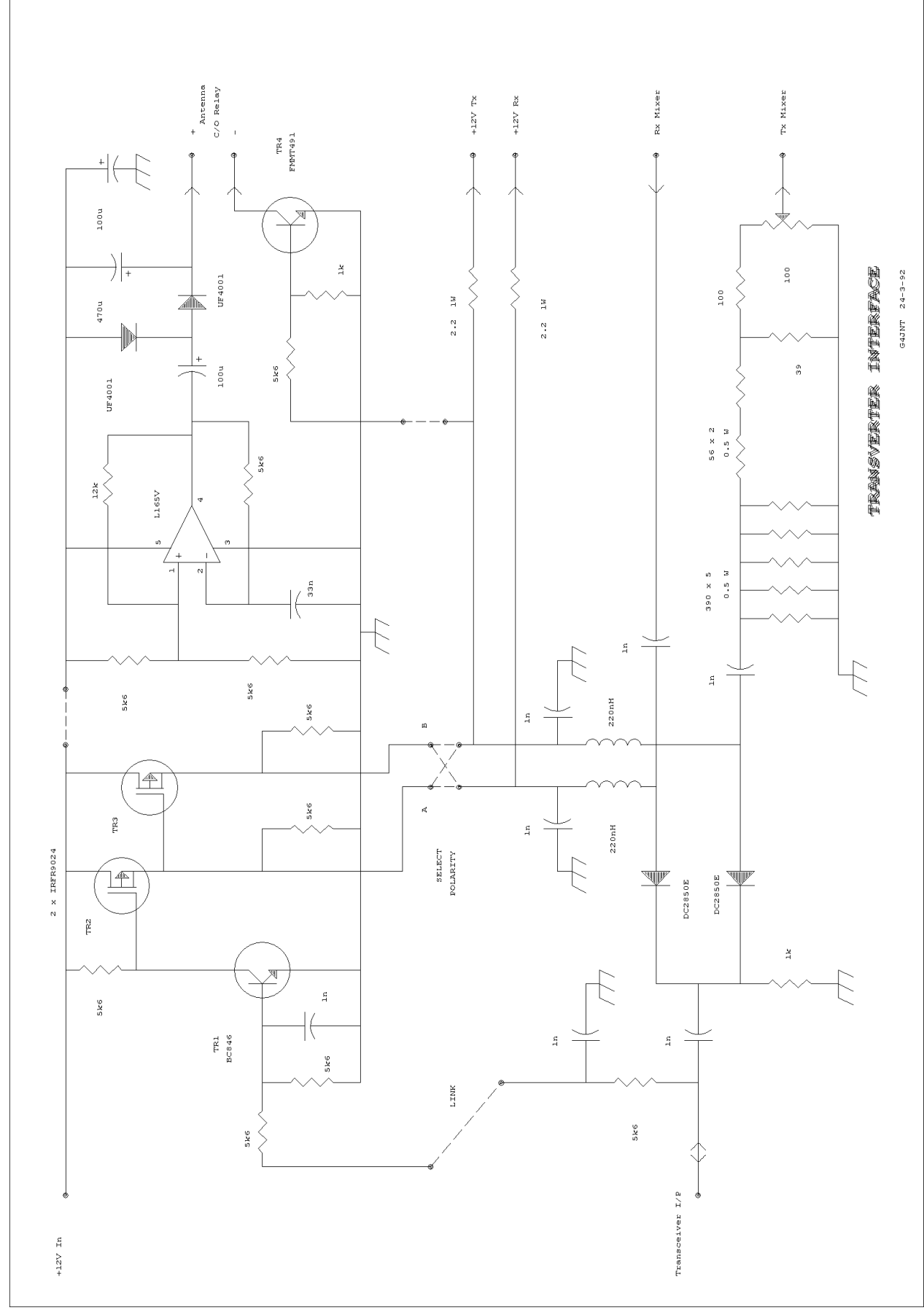
Switching frequency - 7kHz
Output current - 200 mA continuous, higher surge capability

Components list

Quantity	Component
	Resistors
10	5k6 1208 SMT
1	12k "
1	100 "
2	1k "
1	39 "
2	56 0.5 Watt
5	390 0.5 Watt
2	2.2 1 Watt
1	100R preset
	Inductors
2	220nH
	Capacitors
1	33n 0812 SMT
7	1n 0805 SMT.
2	100u Radial
1	470u Axial
	Semiconductors
2	DC2850E
2	UF4001
2	IRF9024
1	FMMT491
1	BC846

All components except DC2850E PIN diodes are available from Farnell.

FMMT491 is nearest available SMD equivalent to BFY50 etc.



TRANSVERTER INTERFACE

Fig 2

Drive circuit for latching relays
where drive coil positive side
can be commoned. eg Transco

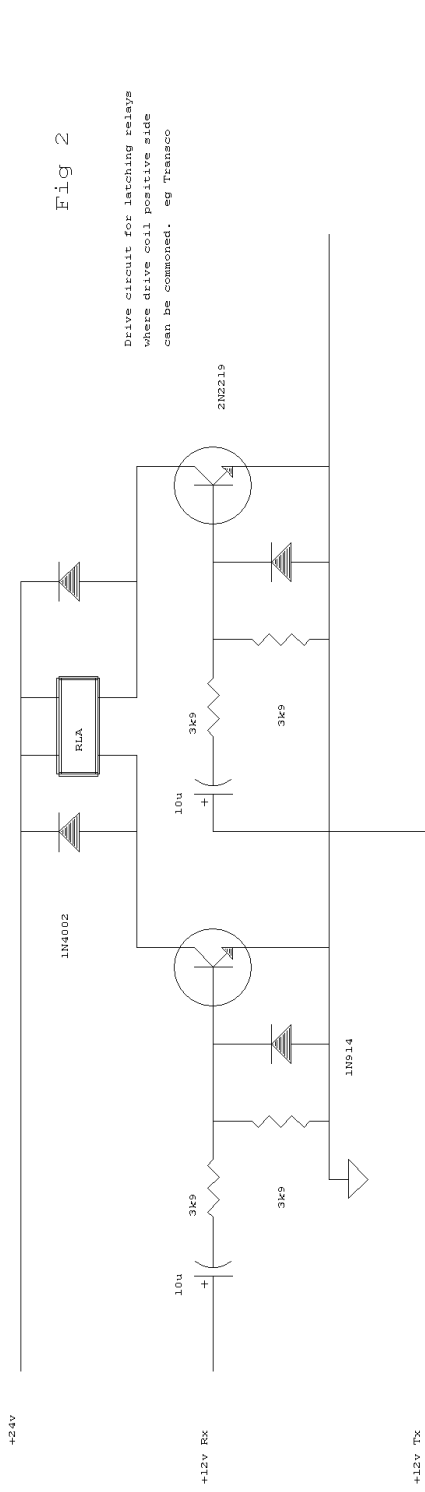


Fig 3

Drive circuit and controller
modifications where relay drive coil
negative side only can be commoned

