all the time that they are forward biased with a vairly substantial DC current. From the RF point of view the signal coming out of F1 connects directly with the input of F2 ensuring the normal state signal path. If Q2 turns off during an interference pulse, R11 will reverse bias D2 and D3 cutting off the signal flow to the filter. R6 establishes the reverse bias at 4V.

Although filter F1 is shown as a ceramic resonator of the cheapo type associated with domestic FM tuners, its function in this circuit is as a delay line. A signal input on F1 takes roughly 1½ microseconds to reach the output terminal. That offers quite enough time to turn off D2 and D3 thus blocking the signal path before the arrival of the interference pulse.

You may ask where good RF design comes in. The answer is simple. Sticking diodes in the signal path is generally a recipe for intermodulation distortion unless you are very careful. As far as the signal is concerned, the diodes operate in push pull reducing the residual distortion to a very low level. There is also another reason for using a pair of diodes in this manner. Q2 switches off fairly fast. With circuits of this type, you have to be careful that the induced switching transients aren't actually worse than the pulse interference that you are trying to suppress. Since both diodes switch simultaneously — they are DC balanced by the series resistors R9 and R10 — switching transients cancel out, in theory at least. The transformer construction and circuitry layout require considerable care to achieve this in practice.

Filter

Filter F2 is a standard monlithic crystal filter of whatever bandwidth the user wants. Generally 500Hz bandwidth is adequate for CW although there are no special techniques required for using filters of other bandwidths. The important note about the filter is the termination resistance. The input to F2 would already have a resistive element reflected all the way back to the drain circuit of Q1 via the noise blanker switch circuitry. However some trimming by R12 will almost certainly be necessary. F2 would typically have an input/output impedance of around 500 ohms.

On its own, the input impedance of Q4, the first narrow band IF amp would be in the order of 100's of kilohms when resonated at 10.7MHz. The reflected impedance through to the filter from the IF transformer will probably need adjustment. R13 provides this and would have a value possibly in the region of 50K ohms. This would of course appear as several 100 ohms across the filter.

The output from Q4 goes to the notch filter circuit via IFT4. This notch circuit has an insertion loss of less than 1dB but is capable of providing a 50dB null. Interfering signals in the passband of the CW filter can be effectively removed with this type of circuit. The question has been asked: "Why not use a varicap diode for the notch tuning capacitor (C17)?" Well, you could do but the bandwidth and depth of the notch would be seriously impaired because varicap diodes of all types are very lossy devices. At series resonance, the crystal X1 represents pure resistance in the region of 10 ohms. This is balanced by a real resistance on the opposite end of the centre tapped transformer. At resonance, both cancel out the signal path very sharply, eliminating an interfering signal almost completely. R71 allows fine adjustment for maximum notch depth.

AGC circuitry

Things are fairly straightforward up to the product detector, Q6, A small amount of RF from the transmit oscillator circuitry (Q10, Q11) is injected into the product detector to provide sidetone on transmit. Q7 is a bipolar transistor driven from the noise blanker line. If there is enough high level interference present, the drain voltage of Q2 will spend more time up than down and charge up C13 through Q3. Q7 will then go into conduction and short circuit the audio signal to the power amplifier. This gives protection against static crashes of the type which otherwise take out the eardrums.

Why am I pointing this out? Well...it's a case of good design which is what this article is supposed to be about. High level interference signals are unable to find their way to the AGC amplifier IC2, (as well as the ears) allowing the AGC to respond only to the signal and not to the interference. Another point. The circuitry as shown enables the AGC line to swing negative of the earth rail offering a control range of about 80dB when applied to the gate 2 structures of Q4 and Q5. Hopefully, the complete transreceiver will boast a dynamic range of better than 100 dB which means that the AGC line would fall short by some 20dB of control range. The difference is made up by applying AGC to the IF pre-amp transistor Q1. This stage operates with delayed AGC. Signal levels need to be in the medium to high range before the AGC rail will be sent negative of ground. The AGC diode D1 ensures that AGC will affect Q1 only for high level signals. This is done to maintain strong signal performance in the presence of weak signals and maintain Q1 in the state for optimum signal to noise ratios while permitting gain controls.

Other considerations

There are a couple of critical signal paths which require careful layout of the PCB if the overall board performance is not to be jeopardised.

The first of these concerns the BFO circuitry, Q12. The beat frequency oscillator provides a carrier which is a few 100's of Hertz away from 10.7MHz to provide an audible tone when mixed with the incoming signal in the product detector, Q6. The BFO signal, with an amplitude of around a volt, is almost at the same frequency as the incoming signal, typical level in the microvolt region. Careless layout can cause the BFO signal to find its way into the front end of the IF strip causing blocking with subsequent degradation of the system noise figure.

Like all RF circuitry, this type of unwanted coupling can be minimised by using double sided circuit board material even though groundplane design rules need not be applied for impedance matching purposes.

The same comments about unwanted coupling apply to the crystal filter. A good quality component may exhibit upwards of 90dB out of band rejection. However, unless very careful screening procedures are used to separate the input/output circuitry, all those dB's will be wasted. **G4JST**