feel what it's like to bring a detector in an out of oscillation, to actually create the beat frequency oscillations that bring a whisper of a CW signal to life! This may be why - all technical reasons aside - the regen still survives after 85 years."

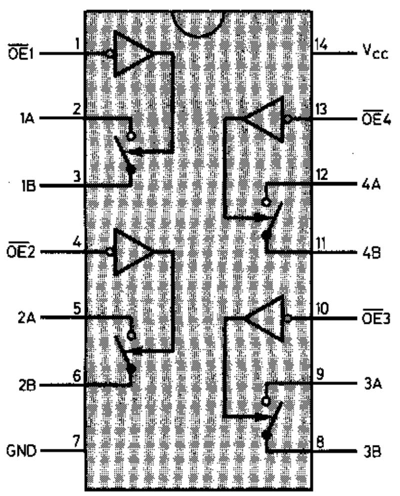
G3SBI'S H-MODE FST3125M MIXER - CONSTRUCTIONAL DETAILS

AS MENTIONED briefly at the end of the item on W7AAZ's validation of the value of the FST3125 device as a super-linear HF mixer (*TT*, August 1998, pp60-61), Colin Horrabin, G3SBI, was able later to acquire some of these low-cost surface mount chips (from Farnell Components). The FST3125M is a 14-lead moulded small outline package (SOIC JEDEC): **Fig 3**.

His results agree closely with those reported by W7AAZ, but he has now provided some further measurements, comments and constructional details which should help those taking advantage of this useful new development in high-performance switching mixers.

First, G3SBI finds that the commercial transformers made by Minicircuits - TT4-1A, style X65 (6-pin DIP) - give better results than the home-made variety using available toroid cores: **Fig 4**. This applies both to overall insertion loss and third-order intercept point (IP3) although adding significantly to cost (about £5 each). Apparently the core mix used by Minicircuits is superior to the standard mixes. The transformers are available from Minicircuits Europe (Tel: 01252 835094).

The circuit diagram, **Fig 5**, represents also the basic layout of the FST3125 used as an H-mode mixer. Note how balance and symmetry is preserved with short



Pin name	Description
OE1, OE2, OE3, OE4	Bus switch enables
1A, 2A, 3A, 4A	Bus A
1B, 2B, 3B, 4B	Bus B

Pin descriptions

Inputs	Inputs/Outputs
OE	A, B
L	A = B
H	Z

Truth table

©RSGB RC1947

Fig 3: Details of the Fairchild quad fast bus switch surface-mounted chip, device type FST3125M.

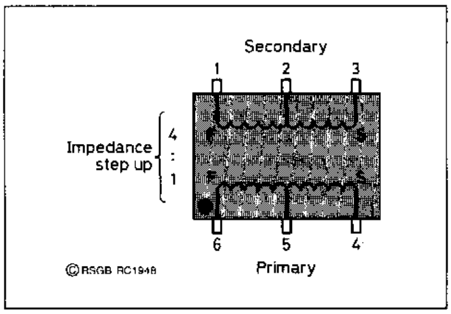


Fig 4: The commercial transformers made by Minicircuits (Type TT4-A). Although relatively costly, they give lower insertion loss and better IP3 results than are likely to be achieved with home made transformers using standard cores.

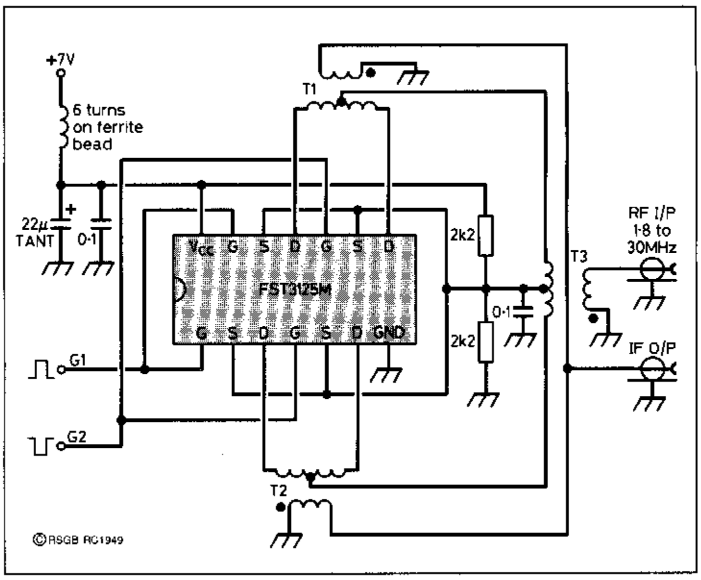


Fig 5: Circuit diagram of the basic FST3125 H-mode mixer, as implemented by G3SBI. Note that the diagram is drawn to show the symmetrical layout. T1, T2, T3 are Minicircuits TT4-1A style X65 transformers (6-pin DIP) and may be plugged into 6-pin DIP bases. G3SBI uses bases for prototypes. Note that the track joining the switch sources together goes underneath the chip and is 0.1in wide.

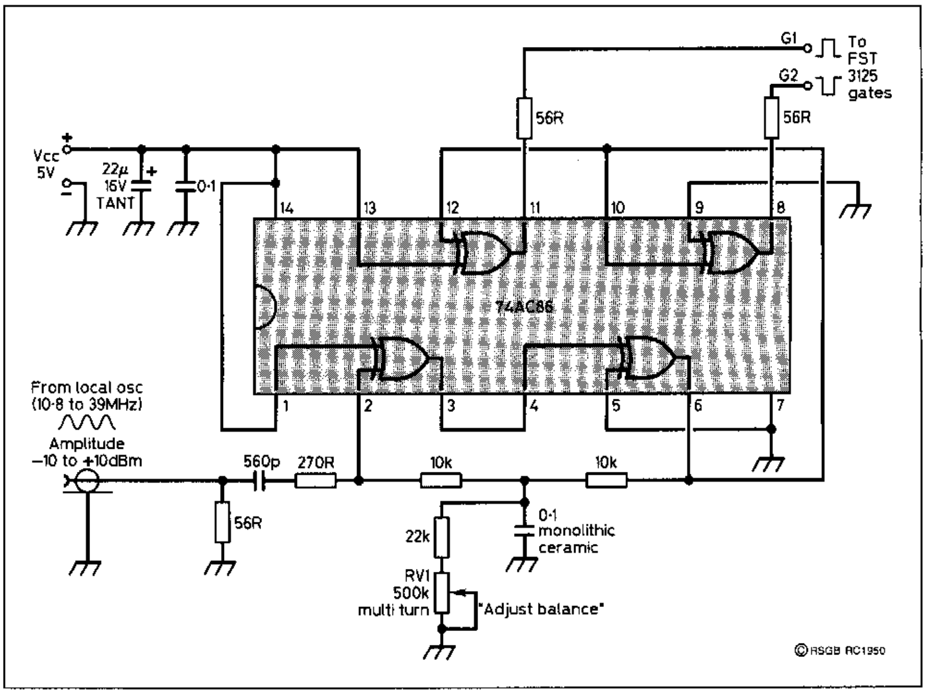


Fig 6: Fundamental frequency squarer, for use with FST3125 mixer. The unit should always have an input frequency. Use a ground plane PCB. The local oscillator input amplitude should preferably be +10dBm, as the squarer then takes less current. Balance adjustments for 9MHz IF using FST3125 mixer: (1) Set RF signal generator to 9MHz at 0dBm. (2) Set LO to 37MHz. (3) Adjust RV1 for minimum feed-through at 9MHz. The mixer should now be correctly balanced. Do not omit the 270Ω resistor, or the squarer will become unstable.

leads to the transformers from the switch; output tracks from T1 and T2 are the same length, before combined to form the IF output. Also 7 volts Vcc is used.

Basic performance on all bands (1.8 to 28MHz) is IP3 +45dBm, insertion loss 4.6dB, maximum input 7dBm (each tone) using 9MHz as the IF and high-side local oscillator. An IP3 of up to +50dBm is possible using over-voltages which are within the design maximum (Vcc) of the device, but in this case the long-term reliability may be degraded.

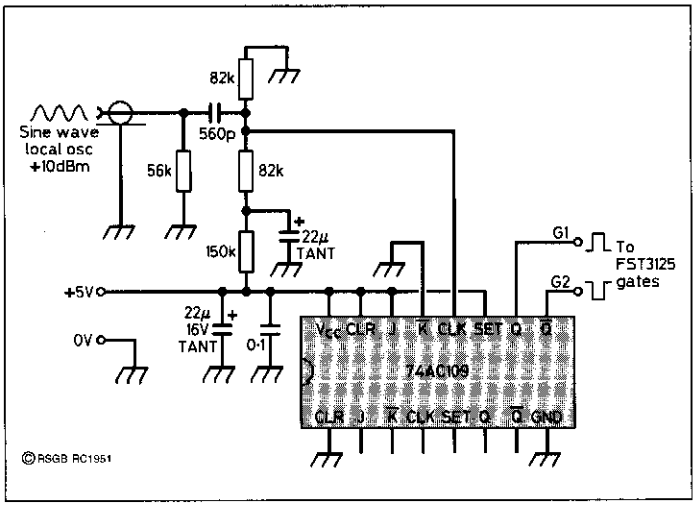


Fig 7: The ÷2 squarer, as used in the original H-mode mixer.

A squarer operating on the fundamental frequency is shown in **Fig 6**. This accepts a wide input amplitude (-10 to +10dBm), for square wave switching output. The original squarer circuit design operating on a local oscillator output at twice the required mixer switching frequency is shown in **Fig 7**. The track side of the PCB for the complete mixer is shown in **Fig 8**. Note the symmetry.

A significant feature of this design is that the mixer is almost as good with a fundamental-frequency local oscillator rather than one based on divide-by-two using a JK flip flop. The fundamental squarer is very easy to adjust for balance, using the IF amplifier to detect minimum feed through.

As G3SBI puts it: "What we need to see now is an army of constructors putting this exceptionally high-performance mixer to use." I would add that we should all be grateful to G3SBI and W7AAZ for investigating these new chips, whilst not forgetting the role of I7SWX in spotting their potential.

Finally, on the general topic of high-level mixers, I would like to correct the text statement in the July *TT* (p58) that the AD831 is capable of an IP3 of +44dBm. The correct figure is +24dBm, as shown in Table 1, with the +44dBm IP3 napplying to SD5000/SD8901 mixers.

HERE AND THERE

D A BUNDEY, G3JQQ, entirely agrees with John Truppen, VK6XJ, that the classic 'boat-anchor' Racal RA17 series of receivers when operated correctly is very good at receiving and resolving SSB signals (*TT*, July 1998, pp56-57). However, on one of his Racal receivers (Model RA17W) he has converted the noise limiter double-diode (V21) into a product detector: **Fig 9**. The BFO feed is taken to the strapped cathodes and the front panel limiter switch used to provide an SSB/AM changeover function. This simple modification has been in use for several years. Comparison with his unmodified RA17L receiver shows an improved performance on weak SSB signals, estimated at some 6dB.

Colin Horrabin, G3SBI, draws attention to a new complete DDS synthesiser chip which is expected to go into production in 1999 by Analog Devices and which will represent state-of-the-art for direct digital synthesis tuners. The AD9852 with specified applications including "agile local oscillator frequency synthesis in amateur radio tuners", features an on-chip 12-bit DAC and high speed comparator, a 300MHz internal clock rate and capable of generating a highly stable frequency/phase programmable output sinewave at up to 130MHz. It will be available in a 48-pin TQFP surface mount package. An AD9835, due later this year, is less advanced (10-bit DAC, 50MHz clock rate) but is small for a 16-pin package with serial control, and supports 12-bit phase modulation as well as two frequency registers.

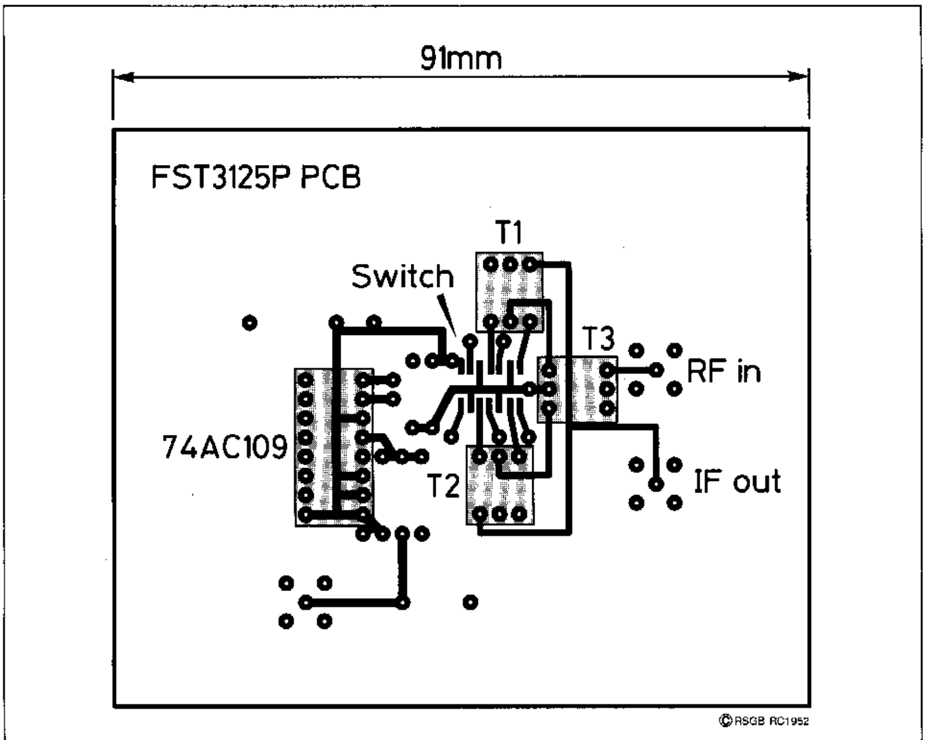


Fig 80: Track side of the PCB for the FST3125 H-mode mixer.

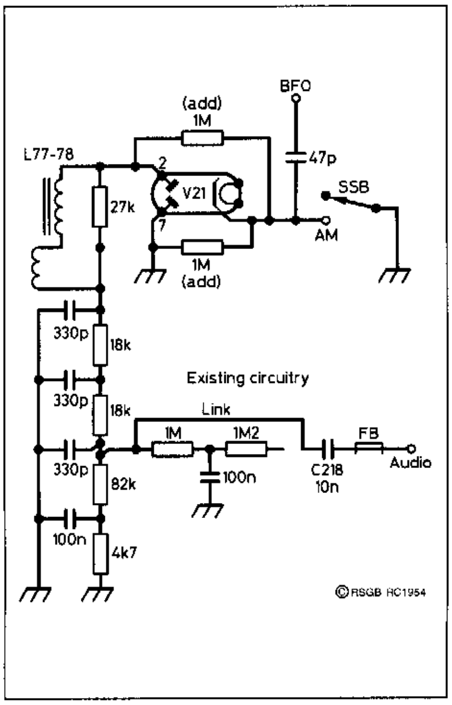


Fig 9: Simple modification to the Racal RA17W receiver converts the noise limiter into a product detector to improve performance on weak SSB signals.