Three Keys in One

J. Worthington GW3COI, a diehard c.w. user, wanted a circuit that retained the individuality of the operator's hand when using bug keys.

I was discussing the relative merits of the mechanical bug key and the iambic or plain electronic model with a friend. Like myself, he is a diehard c.w. user. We agreed that the former, although more difficult to use because of its need for hand-made dashes and possibly more tiring too, was unique in allowing its operator to emphasise certain letters and words when the occasion arose. For instance, when you wish to penetrate heavy QRN it is known that longer dashes are more easily read. Then again, if you wish to get a certain number or name across first time it is always politic to slow down and "emphasise" the letters in a way that only can be done on "up and downers" or mechanical bugs. I appreciate an electronic key can be slowed down, but it is awkward to do so just for one word and the result is somehow never as satisfactory.

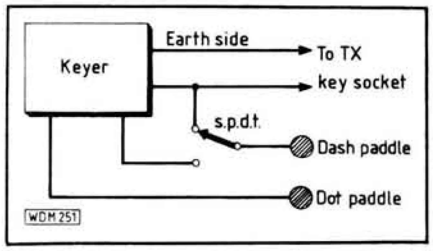


Fig. 1: The wiring in of the single-pole two-way switch that transforms your Morse key

My friend then went on to say that he was thinking of swapping his el-key for a bug as, "it would allow him better to express his individuality". At this I was slightly disturbed as I knew he tended to favour "Baghdad" Morse which, after giving the recipient a good laugh, goes on to make him reach for the off switch as it so distorts the proper code. Reactions to receiving this kind of Morse can be strong and various.

Perhaps it was the spur of this which produced a simple idea—it had to be simple because my friend is largely an "operator" type amateur who thinks a test meter is what umpires use at Lord's. It will be seen from the diagram that the wiring in of a single-pole two-way switch is all that is required to transform an el-key into an instrument that will perform as a mechanical bug by enabling the operator to make dashes; to act as a sideswiping hand key on the dash paddle and, of course, in its original role of an electronic Morse maker.

As a final bonus, in the "mechanical" position, it allows the operator to send a long dash for tuning purposes—a system which has finer control in obviating over running of p.a. stages! **PW**

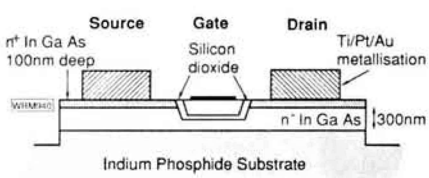
The MISFET–

A Challenge to the Power MESFET?

The gallium arsenide m.e.s.f.e.t. (metal-semiconductor f.e.t. or metal Schottky f.e.t.) is one of the best microwave amplifier devices which has yet become commercially available for both small-signal and power amplification. In this article, Brian Dance looks at a new device which takes power amplification a step further.

The performance of m.e.s.f.e.t.s at higher frequencies has improved as devices with smaller gate lengths have been produced. However, recent work has shown that the m.i.s.f.et. (metal-insulator-semiconductor f.e.t.) fabricated in gallium indium arsenide has some potential advantages over the gallium arsenide m.e.s.f.e.t. for power amplification. This has stimulated efforts to produce practical m.i.s.f.e.t. devices suitable for microwave applications.

The m.i.s.f.e.t. has the structure shown in Fig. 1, with an oxide gate insulation. As the gate breakdown is controlled by the insulator thickness and the dielectric strength and not by the semiconductor material, the channel doping can be optimised independently of the gate breakdown. The linearity of the m.i.s.f.e.t. is better than that of the m.e.s.f.e.t., since the input capacitance of the m.i.s. gate is less



case of a Schottky gate. Linearity is also improved because the m.i.s.f.e.t. can operate with zero bias on the gate.

The gallium indium arsenide, actually $Ga_{0.47}In_{0.53}As$, has the highest electron mobility of any room temperature semiconductor material. It cannot be used for making satisfactory Schottky contacts for m.e.s.f.e.t.s, as the barrier height to metals is too low, resulting in low breakdown voltages and high leakage currents.

The gallium indium arsenide used to make m.i.s.f.e.t.s is lattice matched to the indium phosphide substrate. Silicon ... temperature (75°C) for gate insulation using a self-aligned gate approach to minimise the gate overlap capacitances which can impair r.f. performance. The gate length used has been 1μm (micrometre).

Outputs of 857mW at 4GHz (power gain 12.7dB), 424mW at 12GHz (gain 7.2dB), 415mW at 20GHz (gain 3.0dB and 114mW at 32.5GHz (gain 3.1dB) have been produced by m.i.s.f.e.t.s of this type. Extrapolation of the performance at about 10–20GHz to higher frequencies indicates a cut-off frequency of about 45GHz (maximum frequency of oscillation).

It is expected that considerable improvements in performance will be obtained by fabricating gates of sub-micrometre dimensions. The m.i.s.f.e.t.'s high resistance to ionising radiation will be of considerable importance for military applications, where the devices may be used in a