

# The KEY

The Newsletter of the Contoocook Valley Radio Club

<http://www.qsl.net/k1bke>

Volume 15, Number 1

February, 2003

## Programs

**February 11th:** DX forum with John Moore N1FOJ, and a show and tell session. John will be talking about QSL cards and DX. Bring your latest project, or a good story about ham radio in general.

**March 11th:** Cable and Connector Clinic. Dale AF1T will be talking about coaxial connectors and how to install them properly onto coax. Bring your own soldering iron, and some coax, and build your own cables! Lee AA1YN will be ordering some PL-259's, BNC's, and whatever you might need in the immediate future, so contact him on 146.520 FM simplex if you want him to order for you. Come find out how to properly build connectors.

**April 8th:** Field Trip to the Marconi Museum. For the April club meeting we will be taking a trip to tour the Marconi Museum. The club made the trip a couple of years ago and had a great time. If you couldn't make it last time, here's your second chance to join the fun. We will be meeting at the museum at 7pm. Each person is requested to contribute \$2 to cover the cost of admission. The museum is also looking for donations of old radio equipment and components. Those interested in having dinner before hand can meet at Shorty's (on Rt 101 in Bedford) between 5:30 and 6pm.

**May 12th:** Coax as a Feedline and Antenna Forum. Details to follow.

**June 9th:** Final Field Day Meeting. Come and hear all about how we will be doing Field Day this year.

**July TBD:** Club Outing. Fox hunt, food, and fun outdoors.

**August TBD:** To the Field. Details to follow. Also, Operate 10GHz.

**September 8th:** Ultra Low Band.

CVRC meetings are held on the second Tuesday of the month at the Hopkinton Town Library in Contoocook, NH. Members and nonmembers alike are welcomed. Talk-in is on the K1BKE 146.895 -600 kHz (100 Hz PL) repeater.

## Dues are Due!

It's February again, and that means your club dues are due once again. Bring your check to the meeting and renew your membership. \$20 for regular members, additional family members are \$10 each, seniors (>65 years old) are \$10. Students can have free membership, and newly licensed hams receive the first year free. Come join the club! See John Moore KB1CSI.

## Using the MAR-6SM Monolithic Amplifier Dale Clement, AF1T

At the November 12th Club meeting, I gave out sample Microwave Monolithic Integrated Circuit (MMIC) amplifiers to interested attendees. These small but useful devices were door prizes from the recent Microwave Update/Eastern VHF-UHF Conference in Enfield, CT. Don't feel too bad if you blow a few of them--I have more--but please read this first! Then you can blow them, and feel educated in the process.

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The KEY is published quarterly. The deadline for articles and submissions is the fourth Tuesday (coinciding with the usual business meeting schedule) of the preceding month.

## 2003 CVRC Hamfest

Still going on! Email/call Shawn Upton KB1CKT for table reservations (\$10/table). See elsewhere in this issue for details. The EmComm Level 1 Course is still going to be held. Email/call Kristi Upton KB1EPM for details and rsvp. See [www.qsl.net/k1bke/emcomm.html](http://www.qsl.net/k1bke/emcomm.html) for more information.



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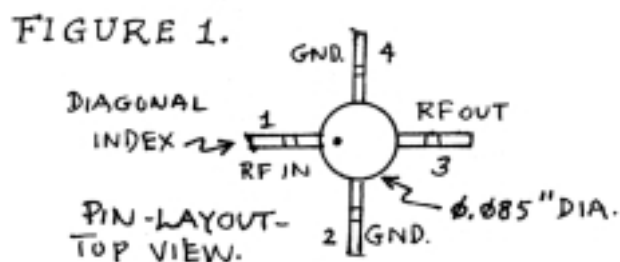
The sample devices are Minicircuits Model MAR-6SM, one of the family of broad-band MAR-devices that operate from DC to beyond 2GHz. There are several other MMIC families that offer different frequency and power ranges. For example, the ERA family are useful as amplifiers to over 10GHz, which is made possible by the Gallium Arsenide (GaAs) substrate. Most of these parts are quite inexpensive, especially when you consider what they can do. MAR-6SM's can be purchased for \$2.20 in unit quantity (yes, you have over \$20 worth of free parts).

The MAR-6SM has bent leads so that it may be surface-mounted with its body flat against the circuit board. Another device, the MAR-6, has straight leads, but I believe it has been discontinued.

A most useful characteristic is the good match to 50 ohms, at both input and output, over a very broad frequency range. Internally, this is achieved through a pair of Class A Darlington-connected integrated silicon transistors, with controlled feedback. The MAR-6SM has high gain--over 20dB (power gain of over 100) in the HF to 100MHz range. The gain drops to about 16dB (power gain of 40) at 1GHz, and to 11dB (power gain of 12) at 2GHz. I've used a MAR-6 at 3456MHz, but there are better devices for this.

The MAR-6SM has the lowest noise figure of any of the MAR-series--3dB over a broad frequency range. If you want to build a super-low-noise 0.5dB amplifier for EME or satellite work, use another (GaAsFET) device, along with a more complicated matching and bias circuit.

Also, note that the MAR-6SM will saturate at about +2dBm (about 1.7milliWatts), which will occur with as little as -18dBm (17microWatts) of drive power. This is fine for a weak signal amplifier, but if you need more power, use another device, such as the MAR-4SM or MAV-11SM. Up to 13dBm (20mW) of RF drive may be applied without damaging the device, even though it will not be operating linearly. I've found that over-driven MAR-6's make simple harmonic generators, and good low-level frequency multipliers when tuned output filters are added.



Now, for the good part--how to make 'em work! See Figure 1 for the terminal layout (pinout of the device). Two opposite leads are grounded (both are needed to minimize inductance). The RF Input is the diagonally-cut lead, and the RF Output is the lead opposite. The output lead is also where the positive DC voltage is applied through a series resistor. This resistor is absolutely necessary to limit the current to a constant value, nominally 16mA. The voltage at the output terminal is approximately 3.5V, so your power source should supply considerably greater than this (I recommend at least 8V). The resistance value may

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Missed the meeting? Want to know what was discussed in your absence? The club is trying to maintain a good collection of the meeting minutes online. Goto [www.qsl.net/k1bke/minutes.html](http://www.qsl.net/k1bke/minutes.html) and see what you missed. We try to get the minutes online within two weeks of the last meeting.

be easily calculated by:

$$R = (\text{Power supply voltage} - 3.5V) / 0.016mA$$

For example, this resistance is 344 ohms for a 9V supply (use 330 or 360 ohms), or 531 ohms for a 12V supply (use 510 or 560 ohms). 1/4W resistors will do. The resistance should be much greater than 50 ohms, so that it will not load down the output and reduce the gain. If not, you may add a high-impedance RF choke or parallel resonant circuit in series with the device end of the resistor.

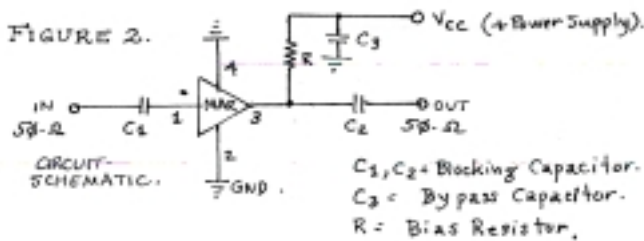
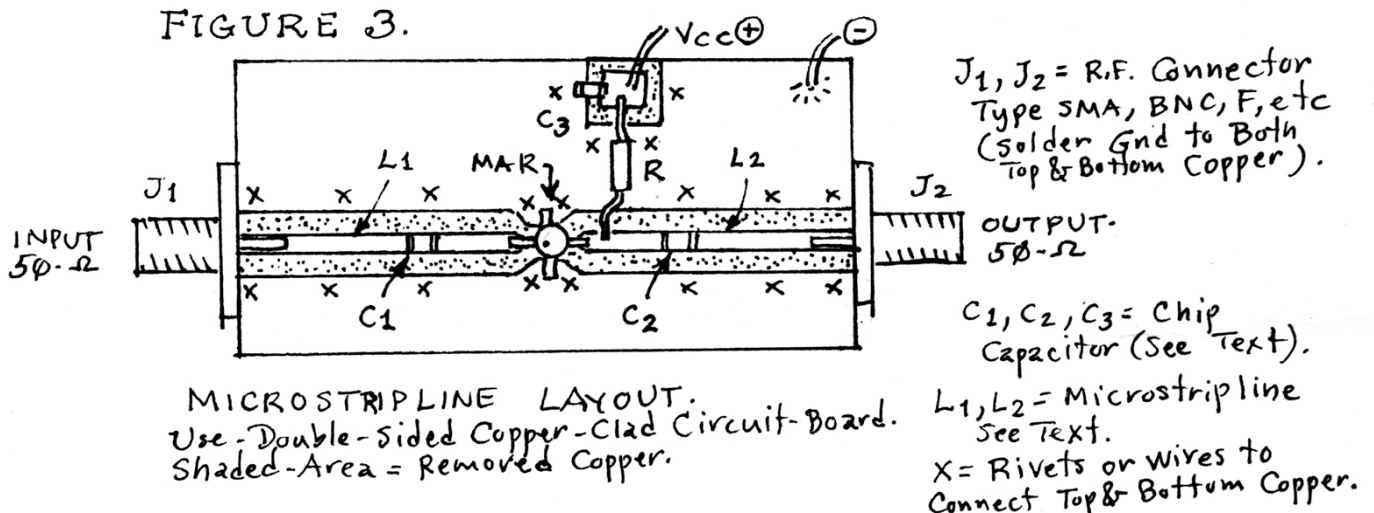


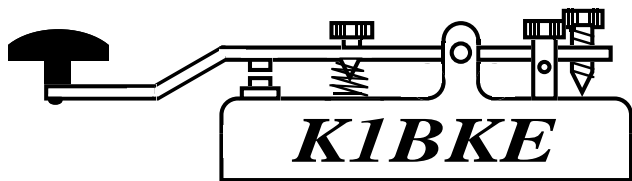
Figure 2 shows the connection schematic. Note that blocking capacitors are required because DC voltages are present on both RF terminals. These capacitors should have low reactance compared to 50 ohms, at all frequencies of interest. Typical values are 0.01uF to 0.001uF for HF and low VHF, 100pF for high VHF and UHF, and as low as 10pF for 1 to 2GHz. Any lead inductance

will become more detrimental as frequency increases, so chip capacitors are recommended for best UHF or microwave performance. The MAR-6SM should make a great antenna-mounted UHF TV amplifier, or an IF amplifier stage for a transverter.

Most importantly, don't turn your MMIC into an inadvertent microwave oscillator! Long leads and ground loops are almost certain to cause unwanted feedback. The power supply bypass capacitor should be similar to the aforementioned blocking capacitors, but it may need to be paralled with other values to squelch oscillations at other frequencies. Feedback may be overcome by so-called "dead bug" construction, or by a microstripline layout as shown in Figure 3. Microstriplines require a ground plane (use double sided circuit board), and line-width depends upon dielectric type and thickness. For common G-10 1/16th inch thick boards, 50 ohm lines will be about 0.1 inch wide. A single board need not be etched--you can cut the lines with a steel rule and utility knife (after cleaning the copper--it will solder much better if it is lightly sanded and bright shiny copper in appearance). Remove the unwanted copper by heating it with a soldering iron, then lift and peel the heated area. I have used this technique successfully at 10GHz, where Teflon dielectric is used. Fiberglass will have acceptable loss below 2GHz.

Have fun experimenting MMIC's!





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**CVRC CLUB CALL: K1BKE**

CVRC operates:

K1BKE/Rptr 146.295/146.895  
 K1BKE:CENTNH 145.57 Packet Node

**CVRC OFFICERS**

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Don Curtis, N1ZIH	Secretary	224-1697
Jack Sheehy, W1JS	Trustee of club call	529-5635
	K1BKE Repeater trustee	
Lindsay Collins, K1JY	Packet node trustee	495-3983

**ACTIVITIES & COMMITTEES**

Flea Market	Jock Irvine, N1JI	225-4248
Programs	Dale Clement, AF1T	428-3840
V.E. Sessions	Dexter Howe, KY1M	938-2955
License Classes	Bob Hadley, K1DWI	783-9294
Field Day	Jerry Blanchard, K1BBQ	
ARES	Rob Farley, K1CFI	
Outgoing QSLs	John Moore, N1FOJ	746-4817
Public Service	Steve Ingham, N1HXO	746-6412
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