

A Broadband HF Amplifier Using Low-Cost Power MOSFETs



Part 1—With only 1 W of drive, you'll get over 40 W out—from 160 through 10 meters!

Many articles have been written encouraging experimenters to use power MOSFETs to build HF RF amplifiers. That's because power MOSFETs—popular in the design of switching power supplies—cost as little as \$1 each, whereas RF MOSFET prices start at about \$35 each!

Over the years, I tucked away several of these articles, waiting for an opportunity to experiment with them. That opportunity came when I received a call from Al, W2OHJ. Al wanted a low-cost linear amplifier to use with his 5 W QRP transmitter when band conditions got poor. Ideally, the amplifier would generate at least 25 W on all the HF bands. Al's inquiry renewed my interest in the topic and provided the motivation I needed to get my project underway.

Al provided me with an extensive list of RF-amplifier construction articles that use power MOSFETs.¹⁻⁴ These articles provided useful information about MOSFETs and general guidelines for working with them, including biasing, parasitic-oscillation suppression, broadband impedance-matching techniques and typical amplifier performance data. It was clear from the performance data that Al's desire to get 25 W output from power MOSFETs on 1.8 to 30 MHz was going to be a challenge! The RF output power of most of the amplifiers described in the articles drops off to 10 W or less as frequency increases just to 14 MHz.

An Idea Brews

After hundreds of hours of experimentation, I came up with a design that exceeds our original objective: One watt of input power produces over 40 W of output (after harmonic

filtering) from 160 through 10 meters. To the basic amplifier, I added an RF-sensed TR relay and a set of low-pass filters designed to suppress harmonic output and comply with FCC requirements. The amplifier is built on double-sided PC board and requires no tuning. Another PC board contains the low-pass filters. Power-supply requirements are 28 V dc at 5 A, although the amplifier performs well at 13.8 V dc.

Several of these amplifiers have been built and exhibit similar performance. Al has been using his amplifier on each of the HF bands, logging well over 500 contacts in 18 months. Signal reports indicate a noticeable improvement in readability (about two S units on average) over his 5 W rig. No indications of instability, CW key clicks or distortion on SSB have been reported. To make it easy for you to duplicate this project, PC boards and parts kits are available, all at a cost of about \$100!*

An Overview of MOSFETs

MOSFETs operate very differently from bipolar transistors. MOSFETs are voltage-controlled devices and exhibit a very high input impedance at dc, whereas bipolar transistors are current-controlled devices and have a relatively low input impedance. Biasing a MOSFET for linear operation only requires applying a fixed voltage to its gate via a resistor. With MOSFETs, no special bias or feedback circuitry is required to maintain the bias point over temperature as is required with bipolar transistors to prevent thermal runaway.¹⁰ With MOSFETs, the gate-threshold voltage increases with increased drain current. This works to turn off the device, especially at elevated temperatures as transconductance decreases and $R_{DS(on)}$ (static drain-to-source on resistance) increases. These built-in self-regulating actions prevent MOSFETs from being affected

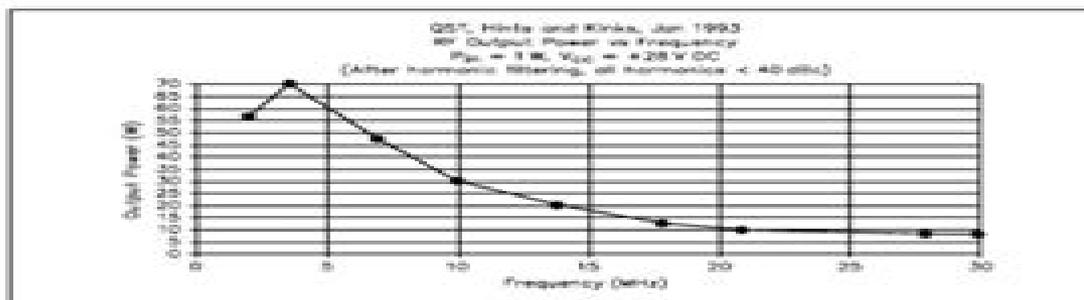


Figure 1—Jim Wyckoff, AA3X, "1 W In, 30 W Out With Power MOSFETs at 80 M," Hints and Kinks, QST, Jan 1993, pp 50-51.

*Notes appear on page 43.

A Broadband Hf Amplifier Using Low Cost

**Banlue Srisuchinwong, Wanlop
Surakamponorn, Sawasd Tantaratana**

A Broadband Hf Amplifier Using Low Cost:

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Emerging Real-World Applications of Internet of Things Anshul Verma,Pradeepika Verma,Yousef Farhaoui,Zhihan Lv,2022-11-24 The Internet of things IoT is a network of connected physical objects or things that are working along with sensors wireless transceiver modules processors and software required for connecting processing and exchanging data among the other devices over the Internet These objects or things are devices ranging from simple handheld devices to complex industrial heavy machines A thing in IoT can be any living or non living object that can be provided capabilities to sense process and exchange data over a network The IoT provides people with the ability to handle their household works to industrial tasks smartly and efficiently without the intervention of another human The IoT provides smart devices for home automation as well as business solutions for delivering insights into everything from real time monitoring of working systems to supply chain and logistics operations The IoT has become one of the most prominent technological inventions of the 21st century Due to the versatility of IoT devices there are numerous real world applications of the IoT in various domains such as smart home smart city health care agriculture industry and transportation The IoT has emerged as a paradigm shifting technology that is influencing various industries Many companies governments and civic bodies are shifting to IoT applications to improve their works and to become more efficient The world is slowly transforming toward a smart world with smart devices As a consequence it shows many new opportunities coming up in the near smart future for IoT professionals Therefore there is a need to keep track of advancements related to IoT applications and further investigate several research challenges related to the applicability of IoT in different domains to make it more adaptable for practical and industrial use With this goal this book provides the most recent and prominent applications of IoT in different domains as well as issues and challenges in developing IoT applications for various new domains *RF Power Amplifiers* Mihai Albulet,2001-06-30 The book reviews developments in the following fields RF power amplifiers modulators and power transistors *AntenTop- 01 2004* , *Ideas and Projects for QRP* Igor Grigorov,2006 *Electrical & Electronics Abstracts* ,1997 **Microwave Journal** ,2007 *Proceedings of MELECON* ,2002 *Microwave Systems News* ,1988-11 *Jane's Military Communications* ,1987 Includes index *A Collection of Technical Papers* American Institute of Aeronautics and Astronautics,1977 **Amateur Radio** ,1996-07 **CQ** ,1997 *Circuits for Wireless Communications* Banlue Srisuchinwong,Wanlop Surakamponorn,Sawasd Tantaratana,2001 Wireless communications is one of the fastest growing

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