

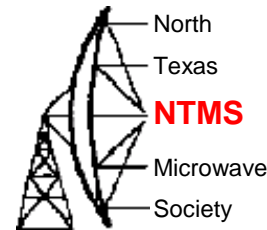
VHF/UHF/Microwave High-Power LDMOS Amplifiers

Greg McIntire, AA5C

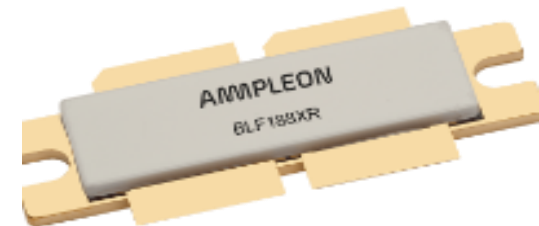
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LDMOS Devices



- Laterally Diffused Metal Oxide Semiconductor (LDMOS)
- Enhancement Mode FETS
 - Drain Voltage – now as high as 65 VDC
 - Positive Gate Bias Voltage - Typically ~3VDC
- Generally Dual Devices in One Package
 - Push-pull operation
- High Gain
 - 20 to 28 dB Typical
- Robust Output VSWR Performance
 - Survives 65:1 VSWR
 - 100 us pulse, 20% duty cycle
- Gate Very Sensitive to Overvoltage or Glitches



BLF188XR

- 1,400W
- up to 600 MHz
- obsolete but new parts being sold for <\$150

Compare Device and System Cost to Vacuum Tubes!

Typical Specifications

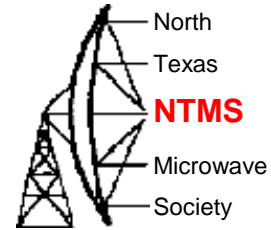


Device	Manufacturer	Drain Supply	Gain (dB)	Pout @ Frequency	Sources
MRF151G	MaCOM	50V	14	150W/FET up to 175 MHz (300W total)	Mouser, eBay
MRF1K50	NXP	50V	23	1.5 KW total@ 144 MHz	Mouser
MRFX1K80	NXP	65V	24	1.8 KW total@ 144 MHz	Mouser
BLF578XR	Ampleon (NXP)	50V	23.5	1.4 KW @ 225 MHz	Digi-Key
BLF184XP	Ampleon (NXP)	50V	23.9	700 W @ 432 MHz	Digi-Key
MRF13750	NXP	50V	17.2 @ 1.3 GHz	750W @ 1.3 GHz	Mouser
MRF19125	NXP (Freescale)	26V	13.6	125W @ 2 GHz	Obsolete (eBay)

Manufacturers Include: Ampleon, MaCOM, Qorvo, Infineon and ST Microelectronics

(Freescale and NXP Merged – Ampleon is a Spin off of NXP)
(RFMD and Triquint merged to form Qorvo)

LDMOS Amplifier Options



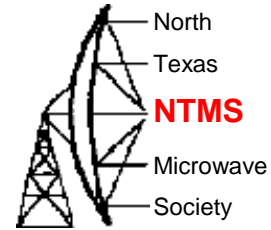
- Surplus Amps from Analog to Digital TV Transition
 - Larcan
 - Harris
- Build from available parts or subsystems
 - W6PQL
- Custom
 - W6PQL
 - N4GA
- Full Commercial
- Design and Build Your Own

Larcam Lo or Lo/Hi RF Deck

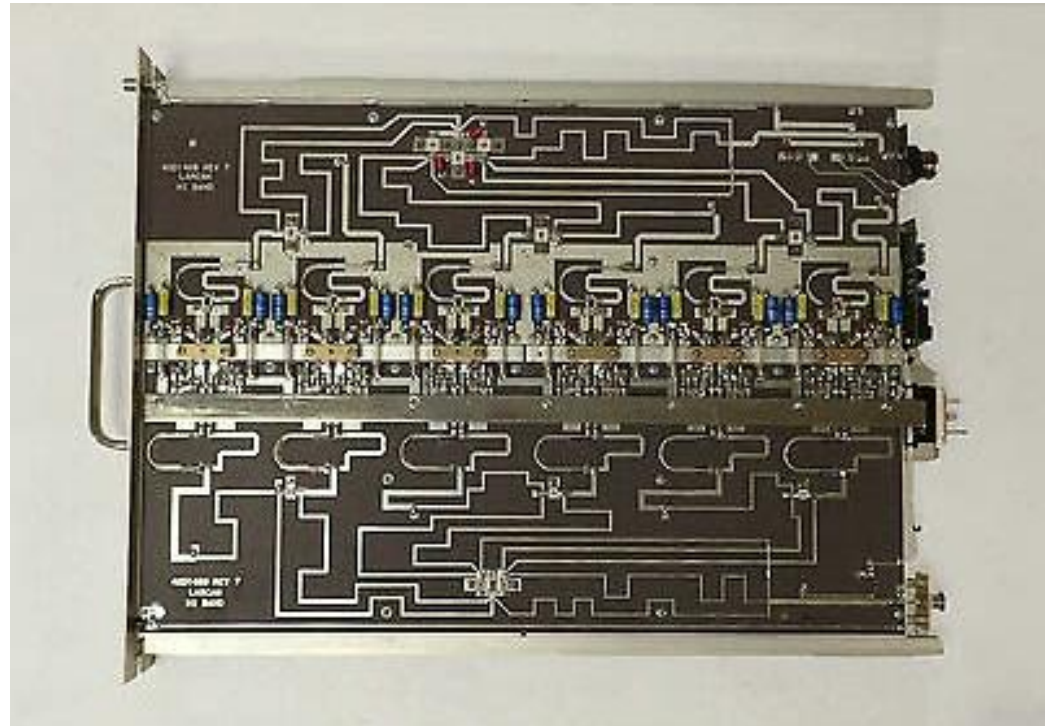
- MRF151G LDMOS FET
 - 6 Dual Devices
 - 300 Watts Each
- Frequency Range
 - 54-88 MHz
- Can be modified for
 - 50 MHz
 - 144 MHz
- Air Cooled
- Up to 1,500 W Output
- 20 dB Gain
- Bias startup and VSWR protect board on the back



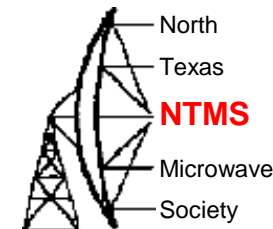
Larcen Hi Band RF Deck



- SRF 3943-2 LDMOS FET
 - 6 Dual Devices
 - 250 Watts Each
- Frequency Range
 - 174-216 MHz
- Can be used as is on 222 MHz
- Air Cooled
- Up to 1,500 W Output
- 16 dB Gain
- 32% efficient
- Bias startup and VSWR protect board on the back

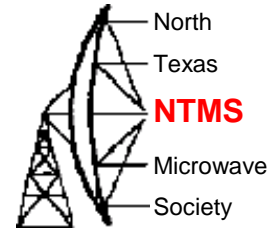


Building a Working Amplifier from a Surplus RF Deck

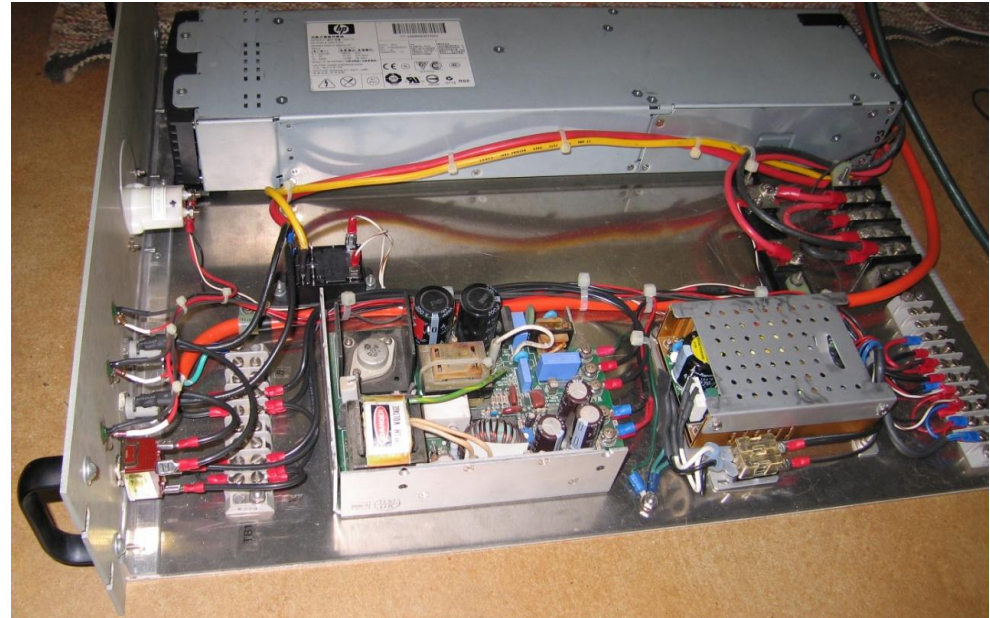


- Sequencer
 - RX to TX: 1st T/R relays, 2nd bias/start up, 3rd full drain voltage
 - TX to RX: Reverse order
- Cooling
 - 120 mm fans work well
- Connectors
- Biasing - check/reset all stages
- Input/Output RF Switching
- Input Protection
 - Attenuation to control maximum input level
 - Level dependent on rig output

Power Supplies

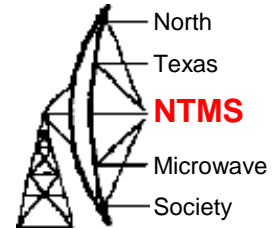


- 50V Supplies
 - 50V, 60A output
 - 220VAC, 20A input
 - Affordable (<\$90)
 - HP ESP120
 - Eltek 48V/3000 HE Flatpak
- Input filtering and ferrites on the output lines are good insurance
- Multi-Speed Fans
 - Can get loud
- Auxiliary Voltages - either
 - Regulate from 50V down, or
 - Use separate supplies
- Many 12VDC and 24VDC supplies operate from 115VAC or 220 VAC



Good Ventilation Is Needed

AA5C VHF/UHF Amplifiers



222 MHz 1.5 KW Amp →

Power Supply Tray →

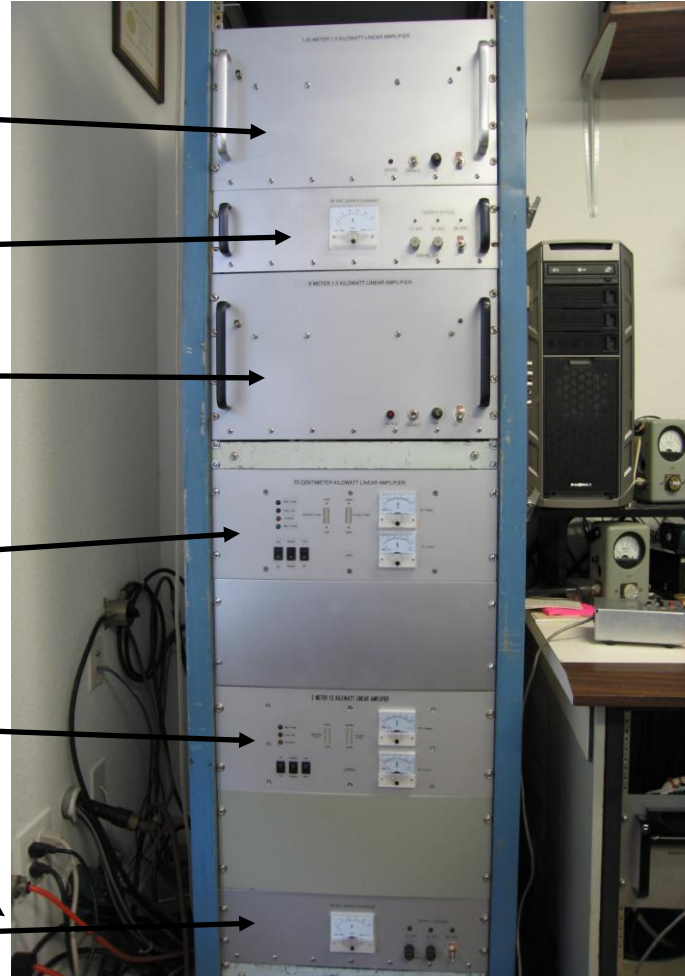
50 MHz 1.5 KW Amp →

432 MHz 1 KW Amp →

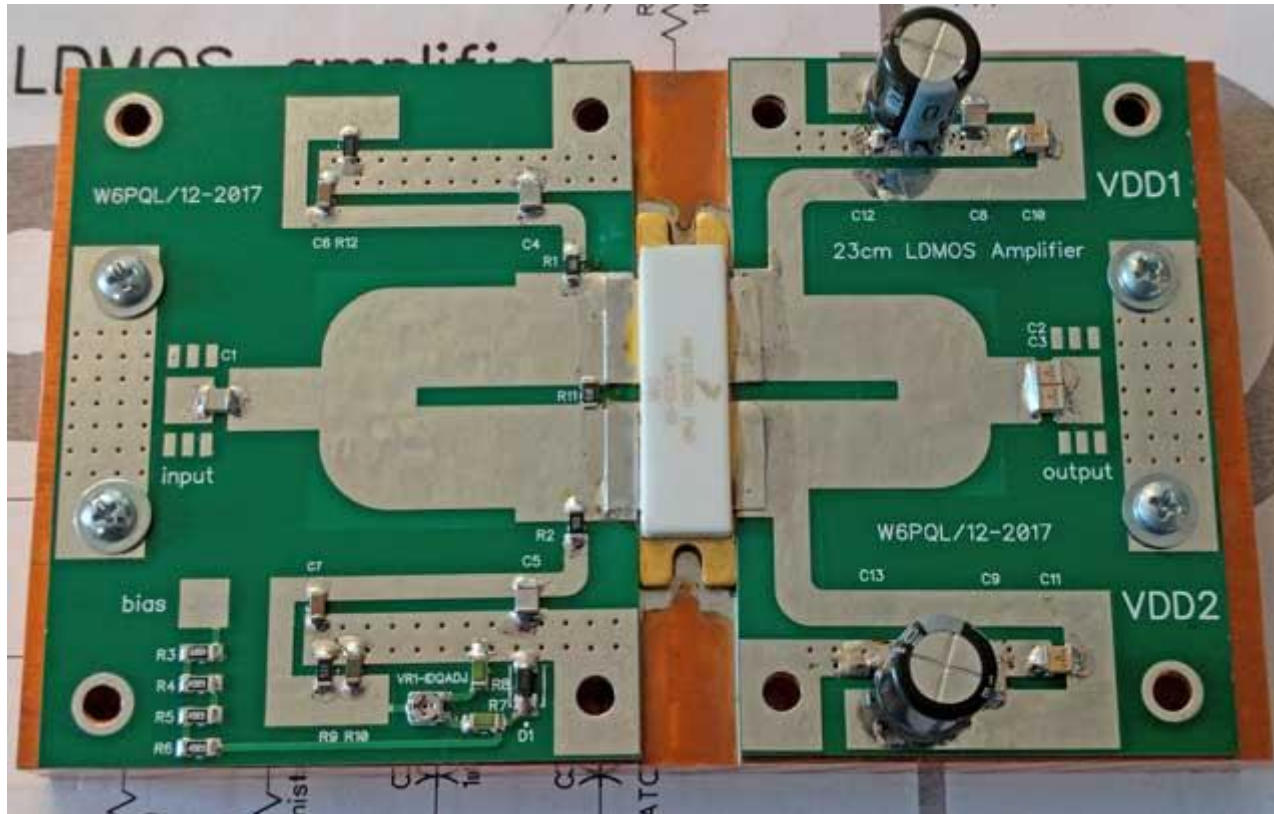
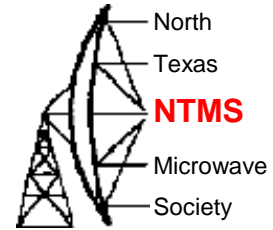
144 MHz 1.5 KW Amp →

220 VAC Outlets ↘

Power Supply Tray →

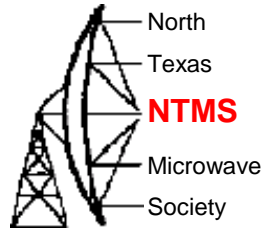


W6PQL 600 W 1296 MHz Amp



10 W Drive for 600 W Out

Summary



- LDMOS devices are overtaking vacuum tubes as the mainstay technology for amateur high power amplifiers
- Lots of approaches for LDMOS amplifiers
 - Design from scratch
 - Surplus RF decks
 - Build from parts or subassemblies
 - Full turn key/commercial
- Protect that gate!
 - Check your driver carefully and use caution
- Look for the technology to continue to advance
 - Higher power
 - Higher frequency