# 630m AMP using the G3R40MT12D SiC-MOSFET

01/06/2025 update. R5 can be a 3.3K or 3K. The 3.3K 5 watt works the same in the circuit.

If not going above 35vdc for the supply voltage, the High Voltage regulator is not necessary. I do recommend keeping the 2A fuse and R7, 1 ohm in the circuit. The LM78xx series regulators can only handle a maximum of 35v input. An option is to use a LM317HV adjustable regulator which is good up to 60vdc. **TIP142 Darlington** used as a regulator. The TIP142 is the voltage regulator I use with my amplifiers when the supply voltage above 35vdc. I use the TIP142 as a 21v regulator and continue to use the LM78xx regulators as they provide (short circuit protection, and output safe operating protection).

If not using the TIP120 pre-driver the 15-volt regulator can be replaced with 12v LM7812. The 15 volt is necessary for the Driver output level to reach +30dbm.

SMD resistors and caps, use size 1206 for ease of construction. Leg components will work on board too.

Do not use Silicone insulator pads under the MOSFET. Mica pads work, and 1mm Aluminum Oxide Alumina Ceramic work very well, slightly better than the Mica for heat transfer.

L2, and L3 are double stacked T106-2 Toroid's.

T.P. Test point on schematic can be connected to a three digit display panel meter to monitor the drive on the gate. I use three wire meters like the ones shown in the Amazon link. Three wire is needed to work in the circuit. You will find this meter to be a very helpful tool.

https://www.amazon.com/bayite-Digital-Voltmeter-Display-Motorcycle/dp/B00YALUXH0/ref=sr_1_34

Non Linear operation. The amplifier can be built without linear bias. Just don't add the 5-volt regulator and connect R12 270-ohm resistor to ground. I'm running my amp linear, but running nonlinear modes 99% of the time.

See additional build info on my web page.

http://wb4jwm.com/630M%20200%20WATT%20LINEAR.pdf

See MOSFET notes. This link is for the IRFP250 but the drain scope signals apply to the G3R40MT as well.

http://wb4jwm.com/200%20watt%20amplifier%20data.pdf

SSB voice operation. The SiC MOSFET does not have the true linear ramp like the IRFP250 but seem to work ok under test. The output looks like the amplifier is under compression, making the linear operation a power curve, so keep the mike gain low to reduce compression. Also when

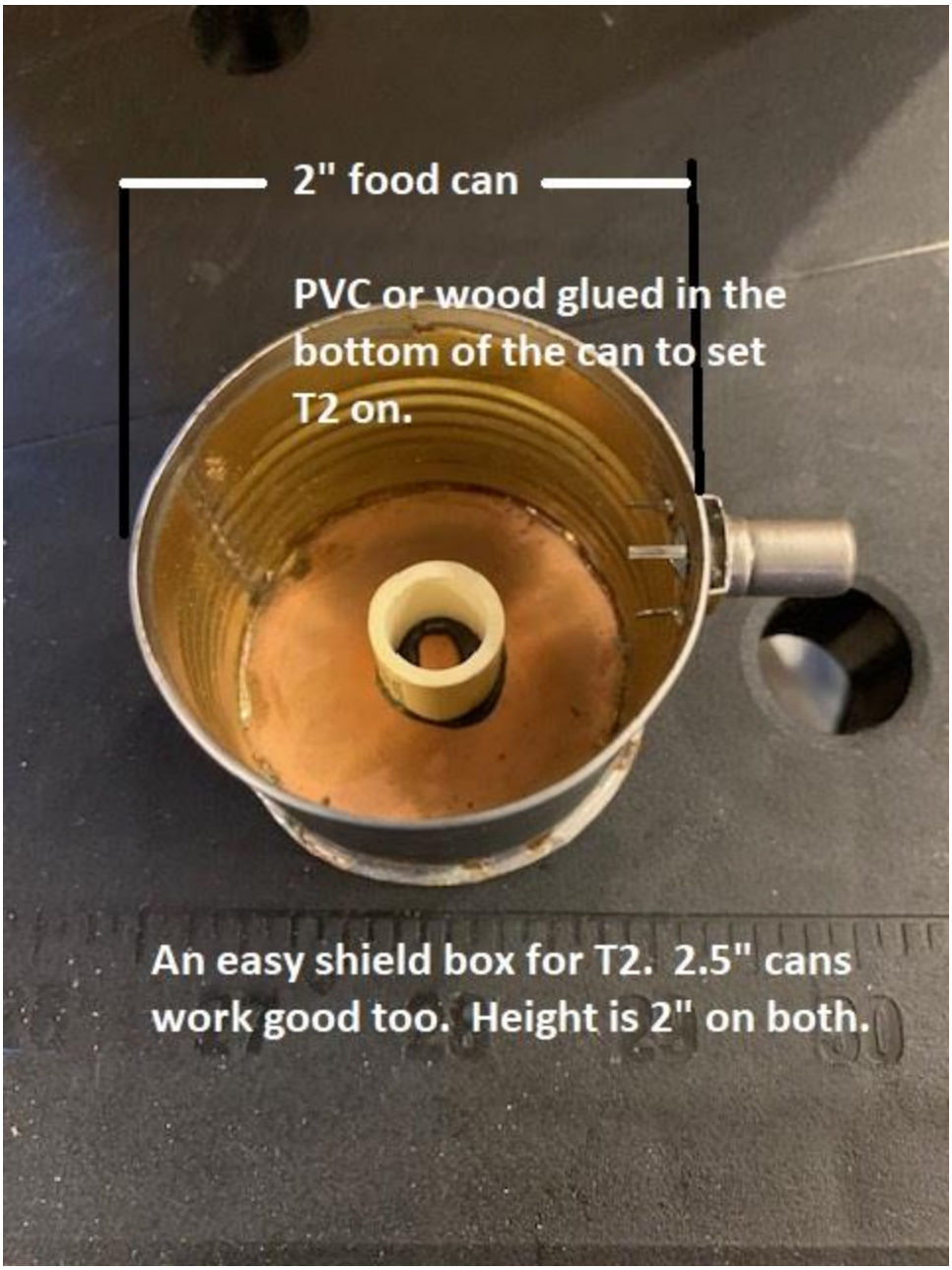
operating SSB the modulation frequency peaks up to 3khz moving the transmit frequency out of resonance with the 630m antenna system. This can cause high reflected spikes. I have found that its best to run reduced voltage when operating voice to keep the drain dissipation below the maximum rating of the G3R40 MOSFET, and the SWR spikes low. 36V or below seems to be a good level. This will give you around 200 watts' peak output. Nonlinear modes like wsjt-x, cw, with 15v gate drive you can push this device to over 600 watts and the drain dissipation will be well under the maximum. This is a problem with any switching MOSFETS, when the gate drive is reduced the Drain dissipation goes up.

Building the TIP120 Driver amp.

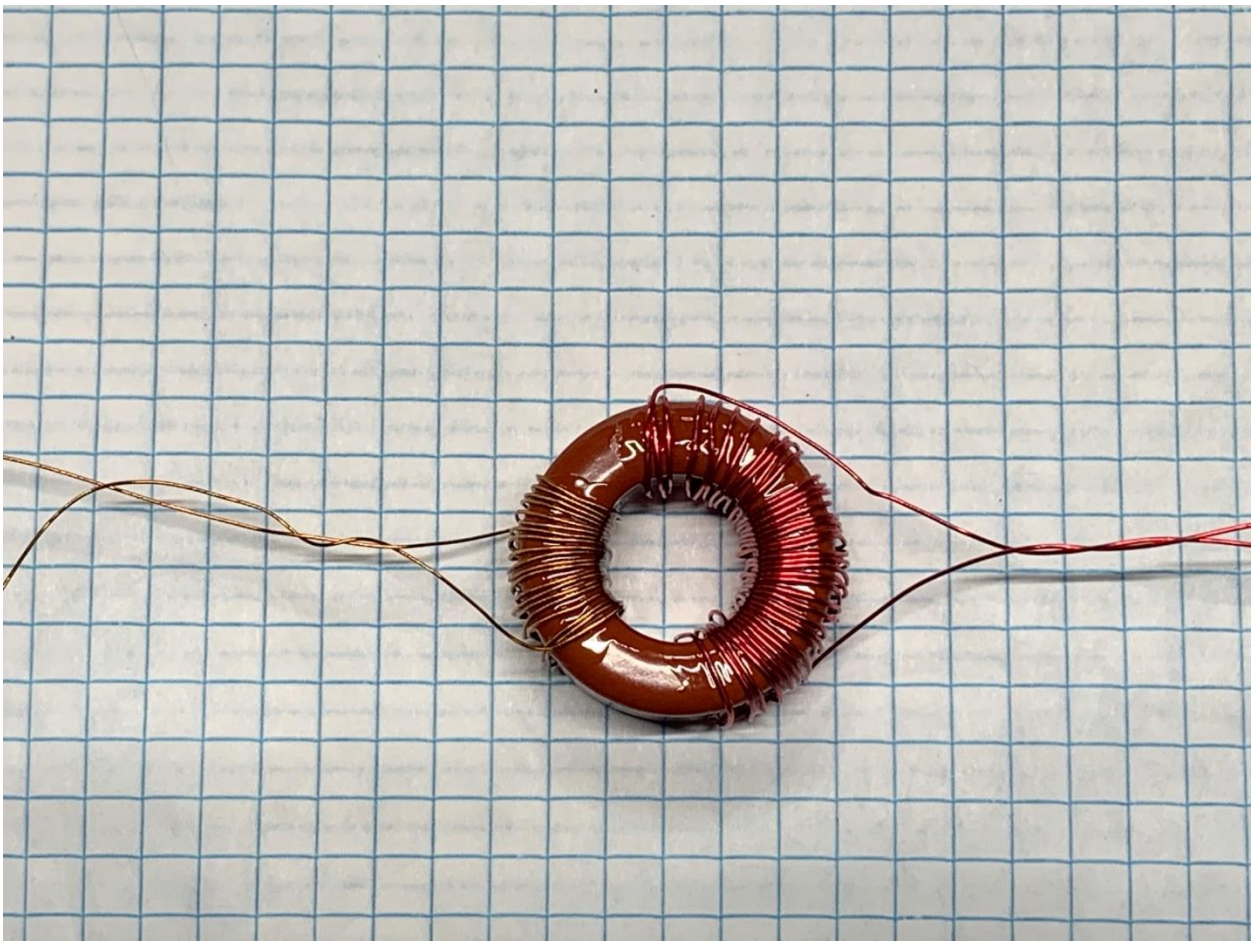
T2 needs to be in a shielded box or tin-can. I have done it both ways but the can is easiest for me. It's not necessary to cover the top of the can. *See picture*.

The link below is the project for building the TIP120 Driver. Note the TIP120 must be a STMicroelectronics don't use other brands the frequency response is not high enough for the required output of (+30dbm). Mouser **511-TIP120**, and DigiKey **497-2539-5-ND,** both ST.

http://wb4jwm.com/28DBM%20DRIVER%20AMP.pdf




It’s not very clear in the pic, but I cut the can down to 2” high and soldered a pcb board on the bottom. That way I had the rim of the canister was left on top for strength. I did found a 2.5”d 2”h can, but can’t remember what food item was in it. I used a RCA connector for the input.

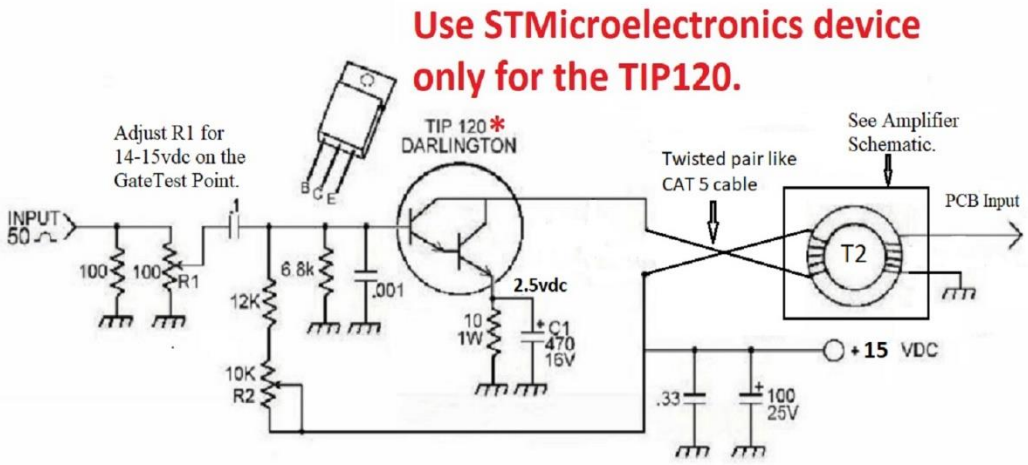


The left coil is the input 20 turns; the right is the secondary 36 turns. The secondary should be close wound on ½ the core the L should measure 26uh. The core is painted with clear fingernail polish to hold the windings in place. The T106-2 is factory coated so no insulating tape is required.

The input on this core was wound with #28-gauge wire so its looks odd, #26 will take up a little more space. Use only #26 AWG on the secondary.

# 630 METER 1 WATT AMPLIFIER

OPTIONAL INTERNAL DRIVER AMPLIFIER




-10 dBm IN +30 dBm OUT

Adjust R2 for 250 ma current at the supply voltage or adjust for 2.5 vdc on the emitter of the TIP120.

This method can be used when the driver amp is placed inside the amplifier cabinet. It eliminates the need for the FT50-43 transformer. Note, the primary winding on T2 will need to be isolated from ground. Twisted wire can be used, and I used a pair from a CAT5 cable. The length is not critical. I tested with both a 6" and 26" length, and there was no difference in the drive levels.

+15vdc is required for the 1-watt out needed to drive the G3R40MTD MOSFET.

12/24/2023

Optional method of building the Driver amp. Either one will work, but If installing the Driver in the amplifier cabinet this will eliminate the need for the FT50-43 and the two 5600p caps.

Larger print schematic on page 8.

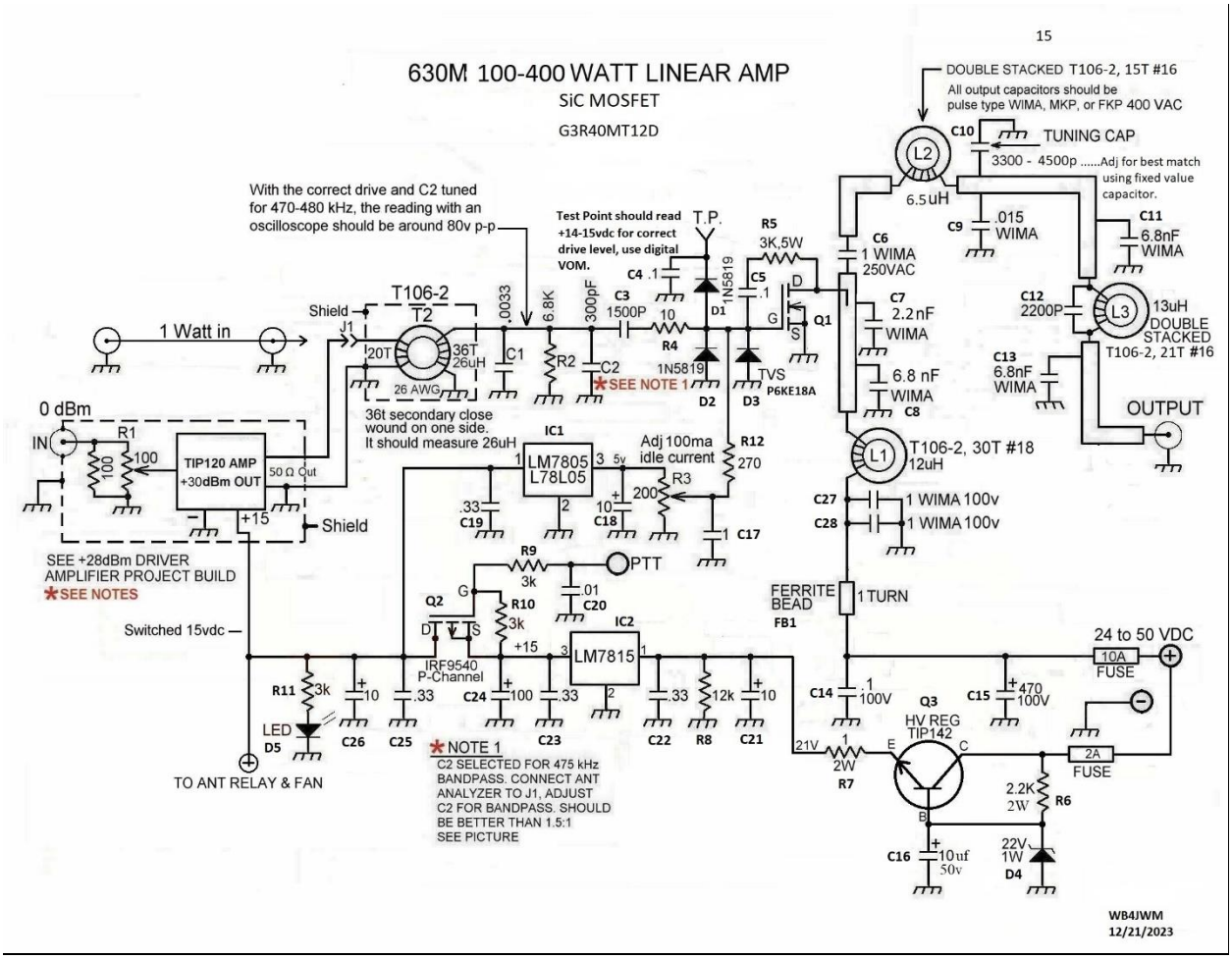
Power supply voltage/current, resulting in average power out.

24v, 4.5A, 100 watts

35v, 6.3A, 200 watts

43v, 7.8A, 300 watts

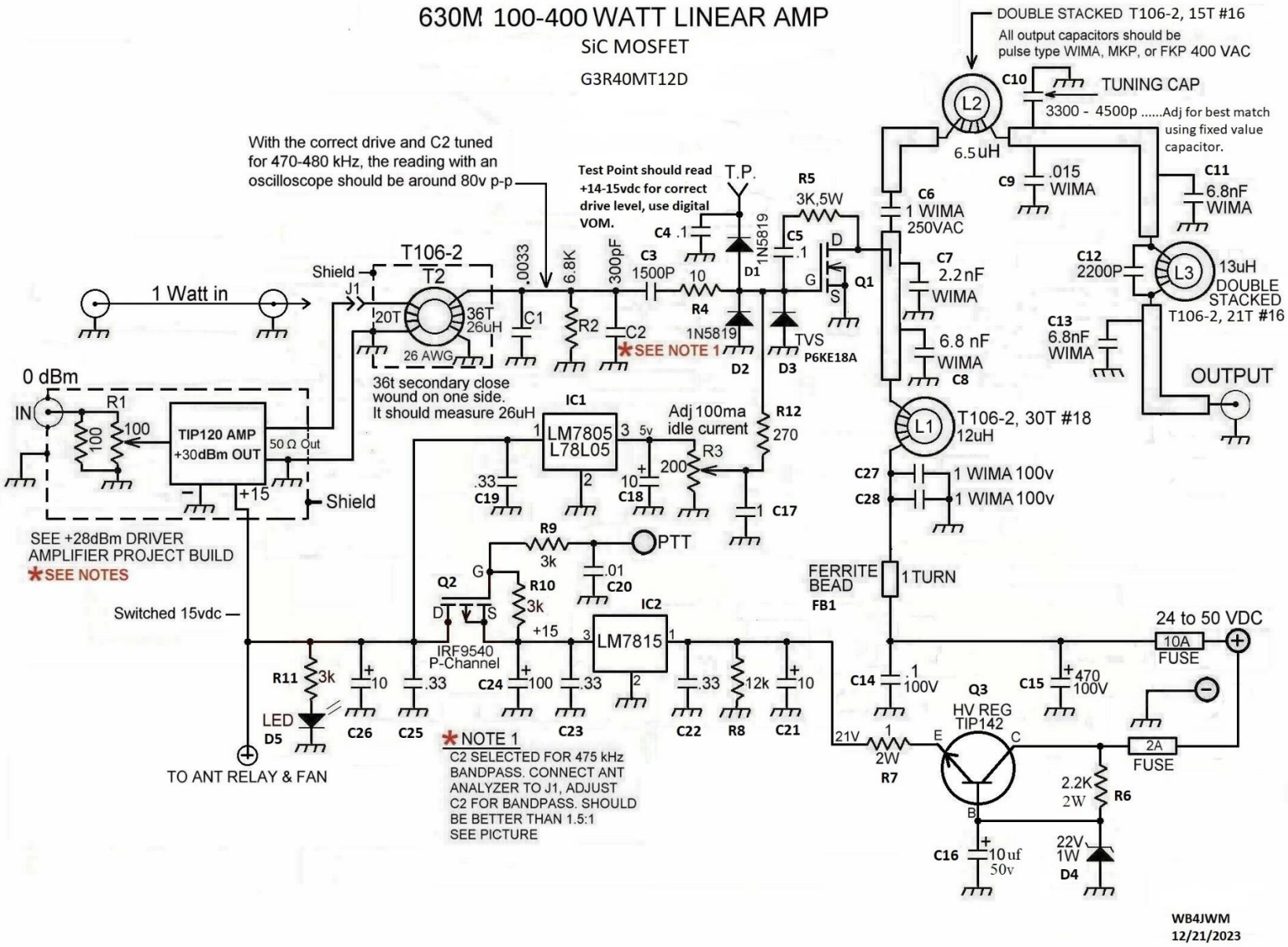
50v, 9.2A, 400 watts




Large print Schematic on page 7

Thanks to Mike N9BNN for helping create the parts BOM for this amplifier.

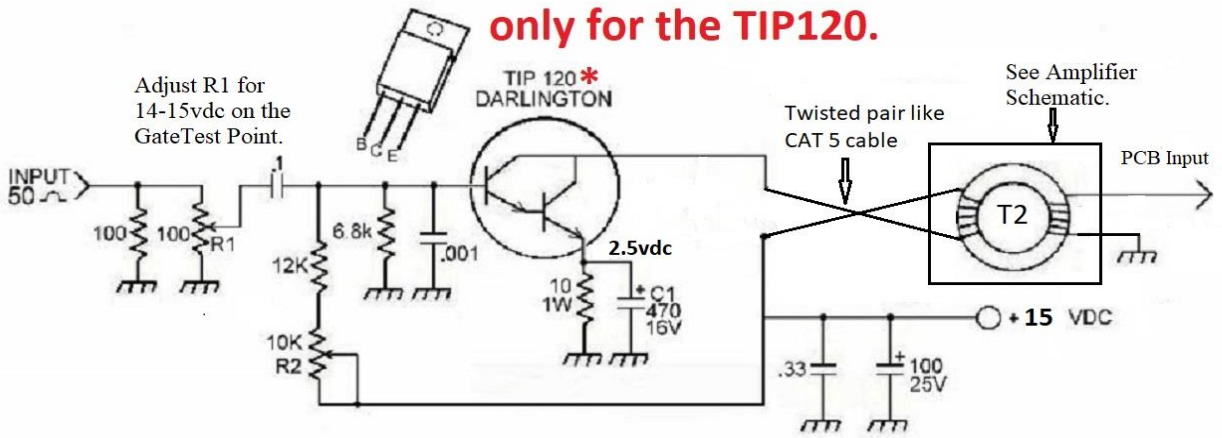
| | | 630M 100-400 Watt Linear Amp BOM | | by Tom Mills WB4JWM | | | 3/12/2024 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| QTY | Board# | Part Type | Description | Rating | Tayda# | Mouser# | Kits & Parts# |
| 1 | R2 | Resistor | 6.8k | 1/2 watt | | | |
| 1 | R3 | Resistor | 200 25 turn bias pot | | A-590 | | |
| 1 | R4 | Resistor | 10 | 1/2 watt | | | |
| 1 | R5 | Resistor | 3k | 5 watt | | 279-ROX5SSJ3K0 | |
| 1 | R6 | Resistor | 2.2k | 2 watt | | | |
| 1 | R7 | Resistor | 1 | 2 watt | | | |
| 1 | R8 | Resistor | 12k | 1/4 watt | | | |
| 3 | R9, R10, R11 | Resistor | 3k | 1/4 watt | | | |
| 1 | R12 | Resistor | 270 | 1/2 watt | | | |
| | | | | | | | |
| | | | | | | | |
| 1 | C1 | Capacitor | .0033uf WIMA | 100vac | A-1546 | | |
| 1 | C2 | Capacitor | 300pf Ceramic SMD | 100vac | | 581-12101U301JAT2A | |
| 1 | C3 | Capacitor | 1500pf | 100vac | A-699 | | |
| 1 | C4, C14 | Capacitor | .1uf Ceramic SMD | 100vdc | | 77-VJ1210Y100V104J | |
| 2 | C5 | Capacitor | .1uf | 250vac | A-7037 | | |
| 1 | C6 | Capacitor | 1uf WIMA | 250vac | | 505-M101/400/20 | |
| 1 | C7 | Capacitor | 2.2nf WIMA Pulse | 400vac | | 505-FKP42200/1000/5 | |
| 3 | C8, C11, C13 | Capacitor | 6.8nf WIMA Pulse | 400vac | | 505-FKP16800/1000/5 | |
| 1 | C9 | Capacitor | .015uf WIMA Pulse | 400vac | | 505-FKP4.015/1000/5 | |
| 1 | C10 | Capacitor | 3600pf Mica | 400vac | | 598-CD19FD362JO3F | |
| 1 | C10 | Capacitor | 3300pf WIMA | 400vac | | 505-FKP43300/1000/5 | |
| 1 | C12 | Capacitor | 2200pf WIMA | 400vac | | 505-FKP42200/1000/5 | |
| 1 | C12 | Capacitor | 2200pf Mica | 1kvdc | | 598-CDV19FF222JO3F | |
| 1 | C15 | Capacitor | 470uf Electrolytic | 100vdc | A-4545 | | |
| 4 | C16, C18, C21, C26 | Capacitor | 10uf Electrolytic | 50vdc | A-4150 | | |
| 1 | C17 | Capacitor | 1uf | 50vdc | | 581-KGM21AR71H105KU | |
| 4 | C19, C22, C23, C25 | Capacitor | .33uf Ceramic SMD | 50vdc | | 77-VJ1210Y334KXAAT | |
| 1 | C20 | Capacitor | .01uf Ceramic SMD | 50vdc | | 80-C1210C103J5GAC | |
| 1 | C24 | Capacitor | 100uf Electrolytic | 50vdc | A-2588 | | |
| 2 | C27, C28 | Capacitor | 1uf WIMA | 100vac | A-4168 | | |
| | | | | | | | |
| 1 | L1 | Inductor | 12uh T106-2 30T #18 | | | | T106-2 Toroid |
| 1 | L2 | Inductor | 6.5uh (2)T106-2 15T #16 | | | | T106-2 Toroid |
| 1 | L3 | Inductor | 13uh (2)T106-2 21T #16 | | | | T106-2 Toroid |
| 1 | T2 | Transformer | 26uh 36T #26, 20T #26 | | | | T106-2 Toroid |
| | | | | | | | |
| 2 | D1, D2 | Diode | 1N5819 Schottky | | A-484 | | |
| 1 | D3 | Diode | P6KE18A TVS 18v | | | 821-P6KE18A | |
| 1 | D4 | Diode | Zener 22v 1 watt | | A-4080 | | |
| 1 | D5 | LED | Red | | | | |
| | | | | | | | |
| 1 | Q1 | MOSFET | G3R40MT12D | | | 905-G3R40MT12D | |
| 1 | Q2 | MOSFET | IRF9540 P-Channel | | A-083 | | |
| 1 | Q3 | Transistor | TIP142 | | | 511-TIP142 | |
| | | | | | | | |
| 1 | IC1 | IC | L78L05 | | A-176 | | |
| 1 | IC2 | IC | LM7815 | | | 926-LM7815CT/NOPB | |
| | | | | | | | |
| 1 | FB1 | Ferrite Bead | 1 Turn | | | 623-2643003201 | |
| 1 | Ant relay | DPDT | RTE24012 | | | | |
| | | | | | | | |
| | | | | | | BOM by N9BNN | |


630M 100-400 WATT LINEAR AMP
SiC MOSFET
G3R40MT12D
DOUBLE STACKED T106-2, 15T #16
All output capacitors should be pulse type WIMA, MKP, or FKP 400 VAC
C10 TUNING CAP
3300 - 4500p .....Adj for best match using fixed value capacitor.
L2
6.5uH
C9 .015 WIMA
C11 6.8nF WIMA
C6 1 WIMA 250VAC
C7 2.2nF WIMA
C8 6.8 nF WIMA
C12 2200P
L3 13uH DOUBLE STACKED T106-2, 21T #16
C13 6.8nF WIMA
OUTPUT
L1 T106-2, 30T #18 12uH
C27 1 WIMA 100v
C28 1 WIMA 100v
FERRITE BEAD
1 TURN
FB1
24 to 50 VDC
10A FUSE
2A FUSE
Q3 HV REG TIP142
21V
1 2W R7
2.2K 2W R6
C16 10uf 50v
22V 1W D4
C14 .1 100V
C15 470 100V
With the correct drive and C2 tuned for 470-480 kHz, the reading with an oscilloscope should be around 80v p-p
Test Point should read +14-15vdc for correct drive level, use digital VOM.
T.P.
R5 3K,5W
C4 .1
C5 .1
D1 1N5819
Q1
T106-2 T2
Shield
J1
1 Watt in
20T
36T 26uH
26 AWG
C1 .0033
R2 6.8K
C2 300pF
C3 1500P
R4 10
1N5819 D2
TVS P6KE18A D3
SEE NOTE 1
36t secondary close wound on one side. It should measure 26uH
0 dBm
IN
R1 100
100
TIP120 AMP +30dBm OUT
50 Ω Out
+15
Shield
SEE +28dBm DRIVER AMPLIFIER PROJECT BUILD
SEE NOTES
IC1
LM7805 L78L05
Adj 100ma idle current
R3 200
R12 270
.33 C19
10 C18
1 C17
R9 3k
PTT
.01 C20
Q2
R10 3k
IRF9540 P-Channel
IC2
LM7815
Switched 15vdc
R11 3k
LED D5
C26 10
C25 .33
C24 100
C23 .33
C22 .33
R8 12k
C21 10
TO ANT RELAY & FAN
NOTE 1
C2 SELECTED FOR 475 kHz BANDPASS. CONNECT ANT ANALYZER TO J1, ADJUST C2 FOR BANDPASS. SHOULD BE BETTER THAN 1.5:1 SEE PICTURE
WB4JWM
12/21/2023

# 630 METER 1 WATT AMPLIFIER

OPTIONAL INTERNAL DRIVER AMPLIFIER

**Use STMicroelectronics device only for the TIP120.**

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