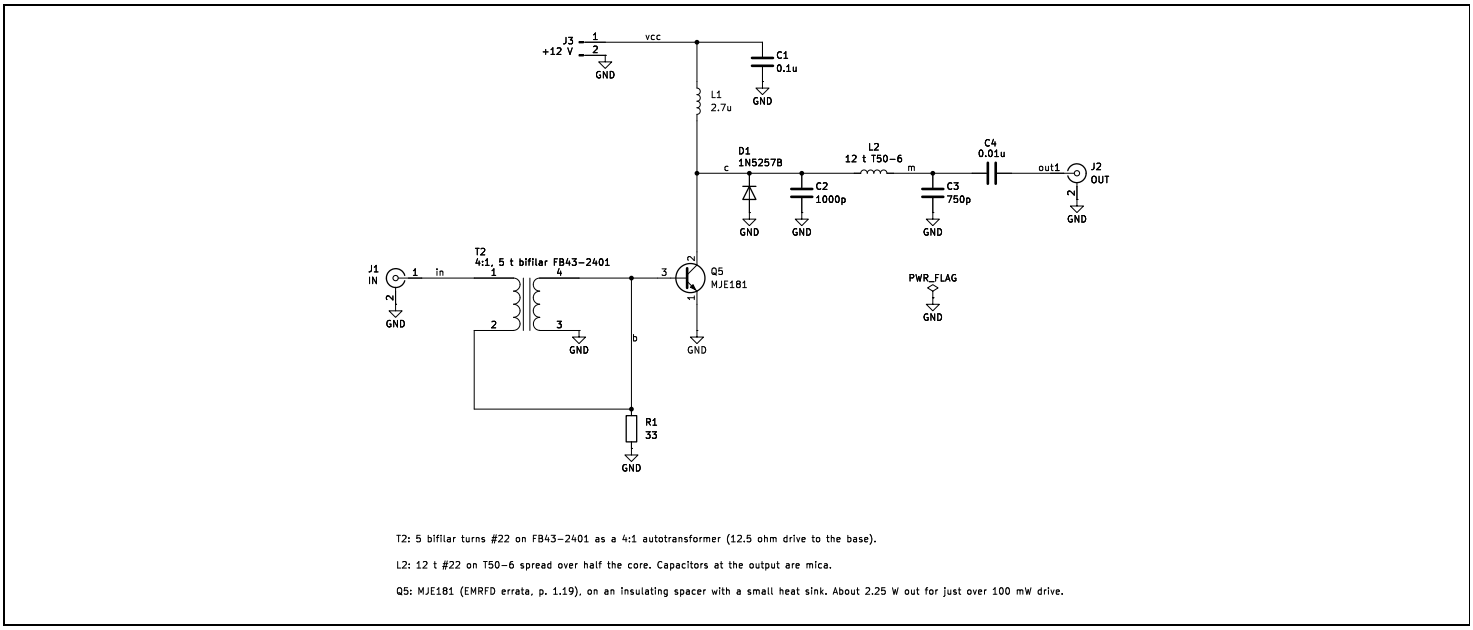
# 2 W Bipolar Power Amplifier, 7 MHz (MJE181)

40m · 50 Ω · 12 V · sim-pass
EMRFD p. 1.19

The final amplifier for a 40 m QRP CW transmitter. About 100 mW in gives about 2.25 W out into 50 Ω (EMRFD p. 1.19).




## BUILD LIST: TICK AS YOU GO

| | Ref | Value | Qty | Part / notes |
|---|---|---|---|---|
| ☐ | C1 | 0.1 µF | 1 | |
| ☐ | C2 | 1000 pF | 1 | 1000 pF and 750 pF mica |
| ☐ | C3 | 750 pF | 1 | 1000 pF and 750 pF mica |
| ☐ | C4 | 0.01 µF | 1 | |
| ☐ | D1 | 1N5257B | 1 | 1N5257B 33 V zener |
| ☐ | J1 | IN | 1 | |
| ☐ | J2 | OUT | 1 | |
| ☐ | J3 | +12 V | 1 | |
| ☐ | L1 | 2.7 µH | 1 | |
| ☐ | L2 | 12 t T50-6 | 1 | T50-6 iron-powder toroid; 12 t on T50-6 |
| ☐ | Q5 | MJE181 | 1 | MJE181 NPN |
| ☐ | R1 | 33 Ω | 1 | |
| ☐ | T2 | 4:1, 5 t bifilar FB43-2401 | 1 | FB43-2401 ferrite bead; 5 t on FB43-2401 (bifilar) |

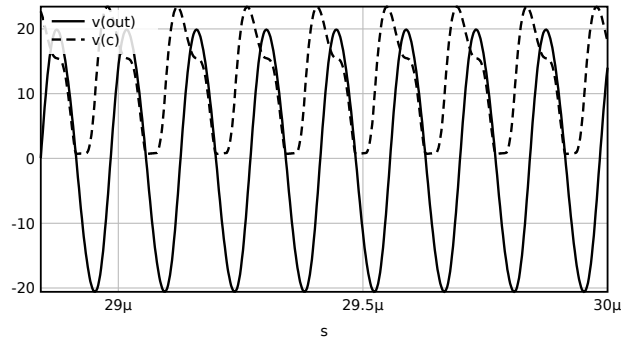
## BUILD NOTES

- Q5: MJE181, per the EMRFD errata. The figure's 2N5321 is discontinued. Mount it with an insulating spacer; a small heat sink helps.
- T2: 5 bifilar turns of #22 on an FB43-2401, connected as a 4:1 step-down.
- L2: 12 turns of #22 on a T50-6, spread over half the core.
- Use mica for the 1000 pF and 750 pF output capacitors.
- Always follow it with a low-pass filter such as the 40 m 7th-order Chebyshev LPF.

**Test:** Use a 50 Ω dummy load and a power meter. Raise the drive slowly to about 100 mW and watch the collector current and the heat sink temperature. Squeeze or spread L2 for the best output.

## CHECK AGAINST

| Check | Expect | Basis |
|---|---|---|
| Output power at 7 MHz | 2.25 W · sim 4.1 W ± 0.41 | book |
| DC input power at 7 MHz | 6.54 W ± 0.65 | simulated |




ngspice sim/tran.cir from the schematic netlist (not a measurement)

**Full page:**
https://qrpedia.com/circuits/amplifiers/bipolar-pa-2w-7mhz/
Interactive sim, KiCad project, netlist and errata.

## SPECIFICATIONS (FULL)

| Spec | Value | Basis | Reference |
|---|---|---|---|
| Output power at 7 MHz | 2.25 W | book | EMRFD p. 1.19, just over 100 mW drive |
| Output power at 7 MHz | 4.1 W ± 0.41 | simulated | sim/tran.cir, 100 mW available drive, ideal passives |
| DC input power at 7 MHz | 6.54 W ± 0.65 | simulated | sim/tran.cir |

Simulated values are this build's ngspice results (± the build's check tolerance); book and measured values are as published.

## HOW IT WORKS

Q5 runs class C with its base returned to ground through 33 Ω. T2, 5 bifilar turns on an FB43-2401 wired as a 4:1 autotransformer, steps the 50 Ω drive down to about 12.5 Ω at the base. The collector is fed through a 2.7 µH RFC. A pi network (1000 pF, L2, 750 pF) transforms the 50 Ω load to the collector load line and filters harmonics. D1, a 33 V zener, clamps collector peaks.

The simulation gives 4.1 W out for 100 mW available drive. That's well above the book's 2.25 W, because the MJE181 model and the ideal parts are optimistic. Treat it as **simulated** only.

## WHERE IT COMES FROM

The power amplifier of the beginner's experimental transmitter in Experimental Methods in RF Design, Chapter 1.

## SOURCES

- EMRFD Fig 1.35, p. 1.19 (errata: affects-circuit: Fig 1.35: change Q5 from the discontinued 2N5321 to an MJE181, mounted with an insulated spacer; a small heat sink helps and efficiency is lower than with the 2N5321. Two text-only fixes on the same page (about 10 dB; heat sink).)