

MRF300AN 13.56 MHz REFERENCE CIRCUIT

ORDERABLE PART NUMBER: **MRF300AN-13MHZ**



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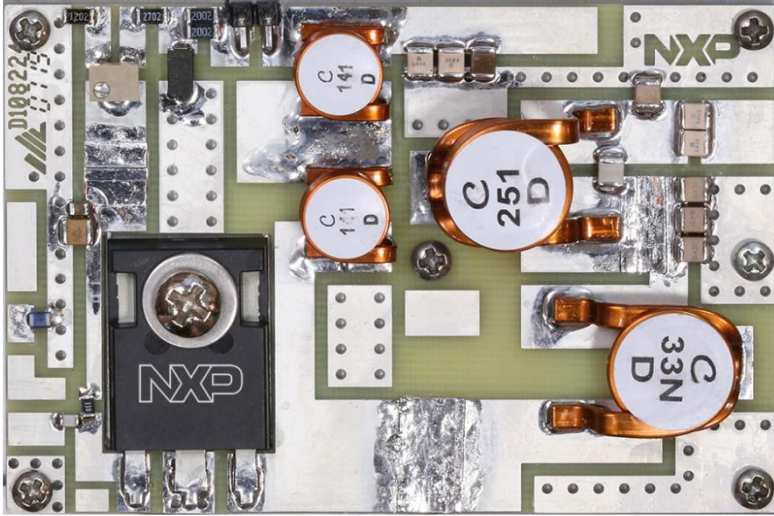
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Introduction

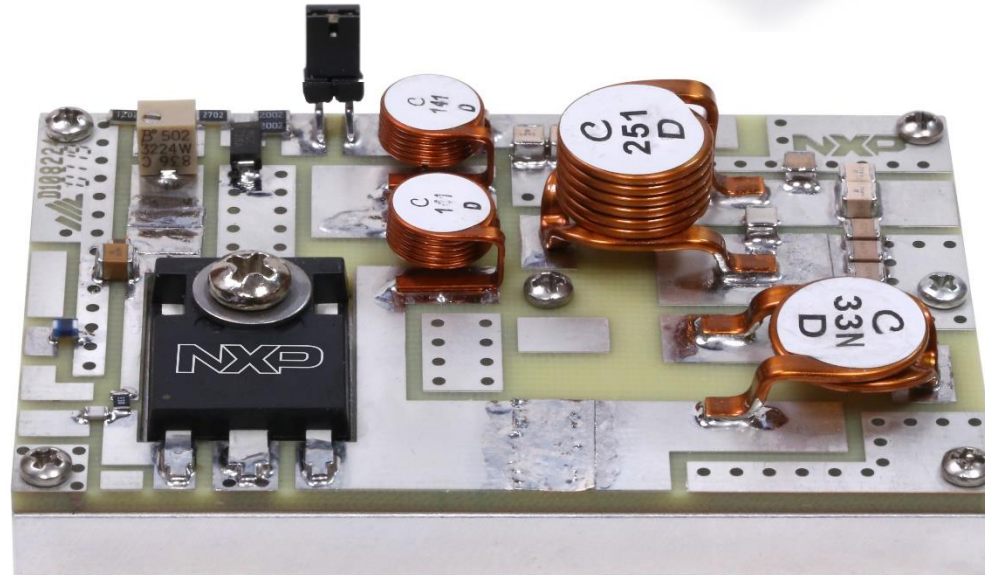
- The NXP MRF300AN is a 1.8-250 MHz, 300 W RF CW power LDMOS housed in a TO-247 over-molded plastic package. Its unmatched input and output allows wide frequency range utilization.
 - Further details about the device, including its data sheet, are available on www.nxp.com/MRF300AN.
- The following pages describe the 13.56 MHz reference circuit (evaluation board). Its typical applications are industrial, scientific, medical (ISM), RF Energy and plasma generation.
- The reference circuit can be ordered through NXP's distribution partners and etailers using part number MRF300AN-13MHZ.



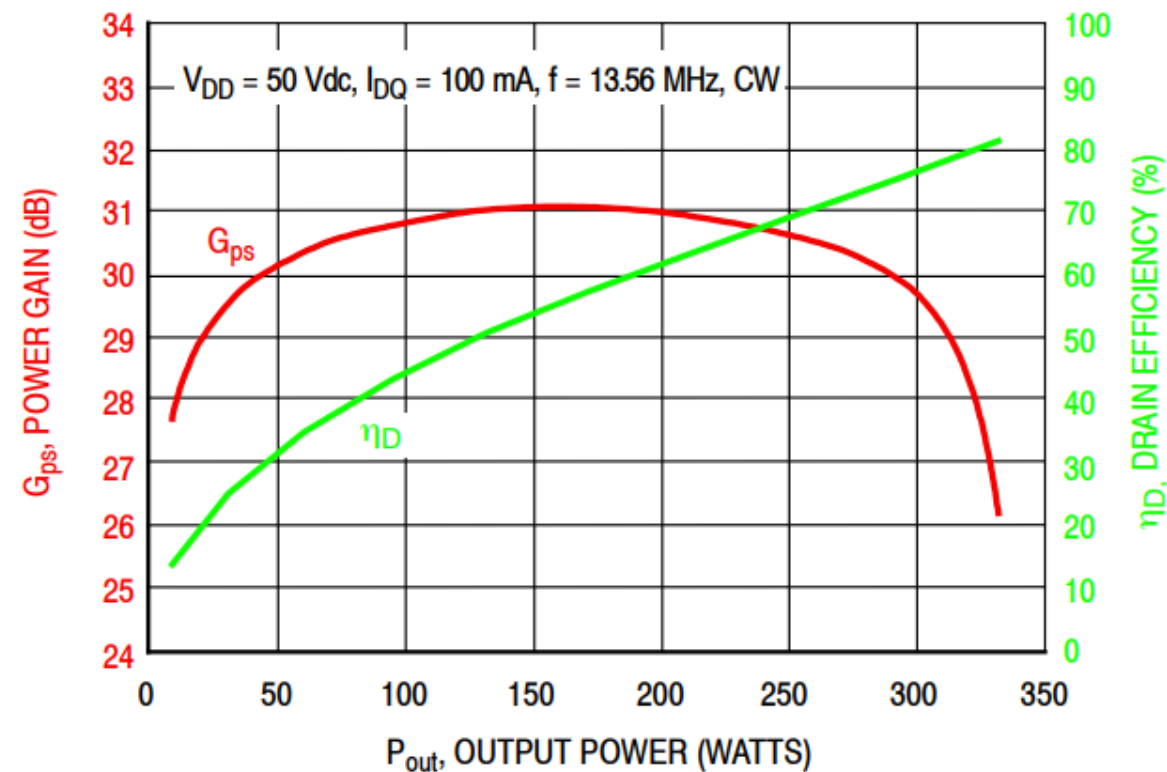
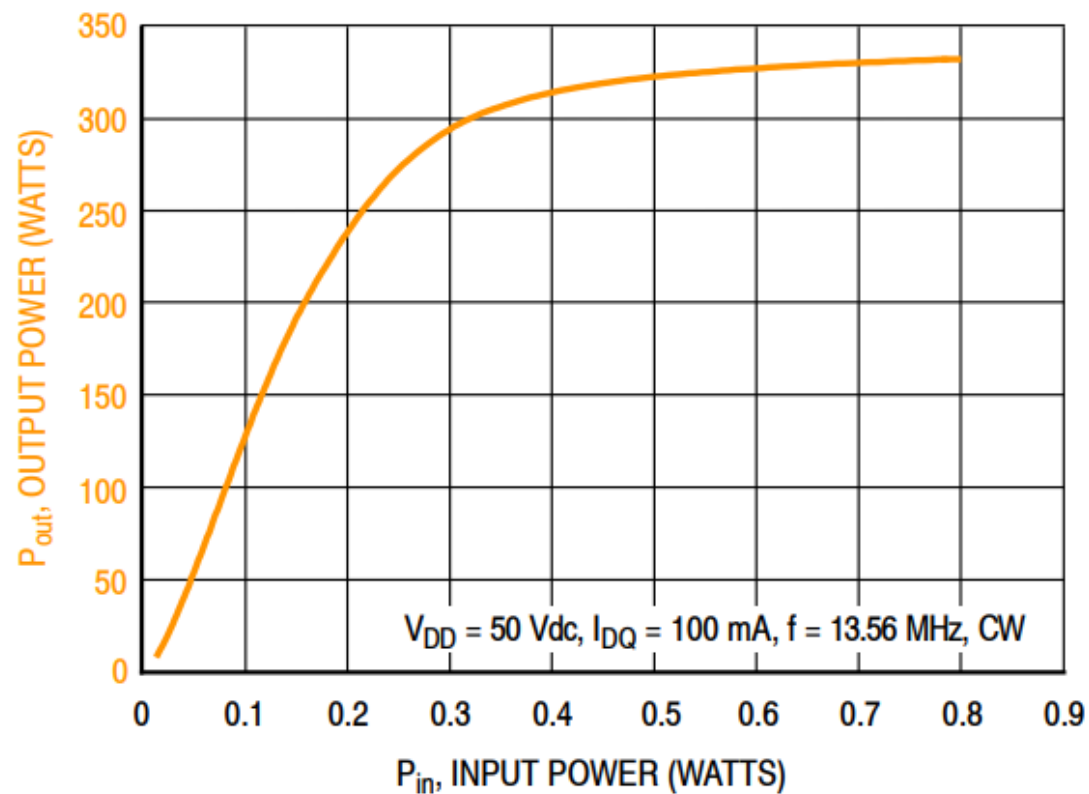
Circuit Overview – 5.08 cm × 7.62 cm (2.0" × 3.0")



Transistor bolted to aluminum baseplate
with thermal grease under it.
PCB bolted to aluminum baseplate with
no thermal grease.



Typical CW Performance

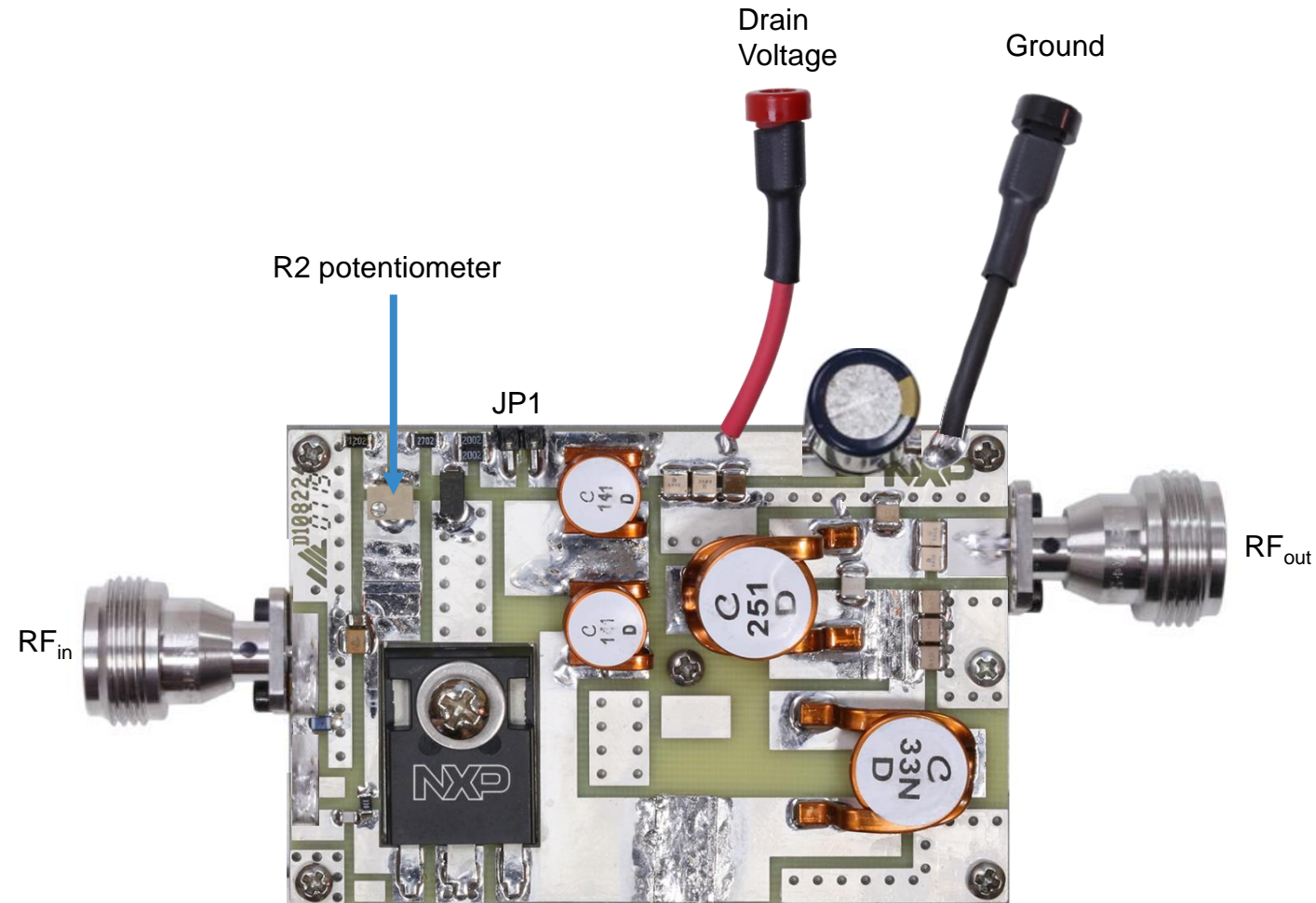


$V_{DD} = 50 \text{ Vdc}$, $I_{DQ} = 100 \text{ mA}$, $P_{in} = 0.5 \text{ W}$, CW

| Frequency (MHz) | P_{out} (W) | G_{ps} (dB) | η_D (%) |
|-----------------|---------------|---------------|--------------|
| 13.56 | 320 | 28.1 | 79.7 |

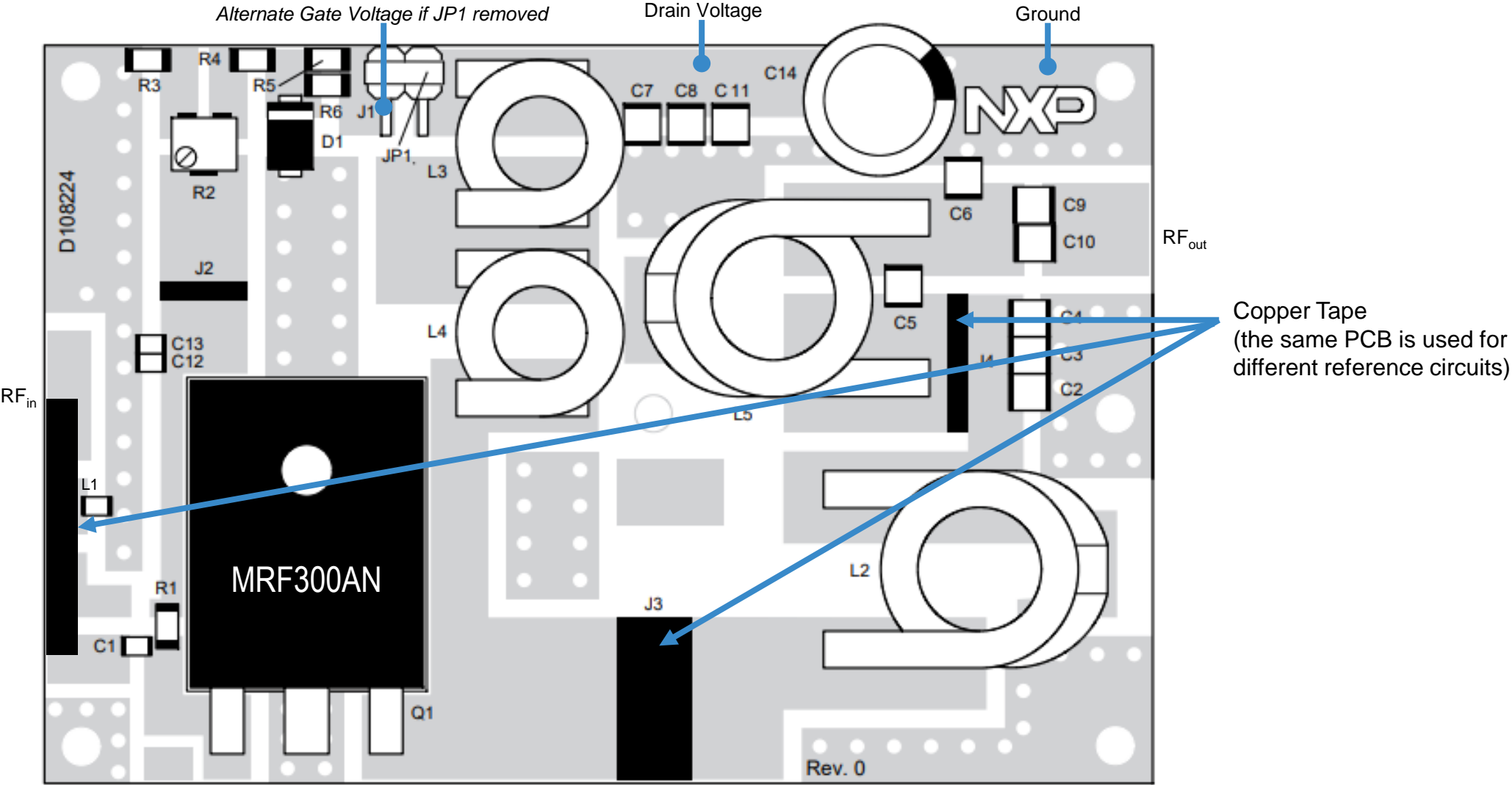
Quick Start

1. Mount the reference circuit onto a heatsink capable of dissipating more than 120 W in order to provide enough thermal dissipation (the baseplate included in this reference circuit is not sufficient to serve as a standalone heatsink).
2. Connect the ground.
3. Terminate the RF output with a 50 ohm load capable of handling more than 320 W.
4. Connect the RF input to a 50 ohm source with the RF off.
5. Connect the drain voltage (V_{DD}) and raise it slowly to 50 V while ensuring that the drain current remains below or equal to the typical drain quiescent current of $I_{DQ} = 100$ mA.
6. If needed, adjust the R2 potentiometer to modify the gate voltage to adjust the drain quiescent current.
7. Raise the RF input to 0.5 W (27 dBm).
8. Check the RF output power (typically 320 W), the drain current (around 8 A for this power level) and the temperature of the board.



Alternatively, the jumper JP1 can be removed to supply an external gate voltage on J1 connector.

Component Placement Reference



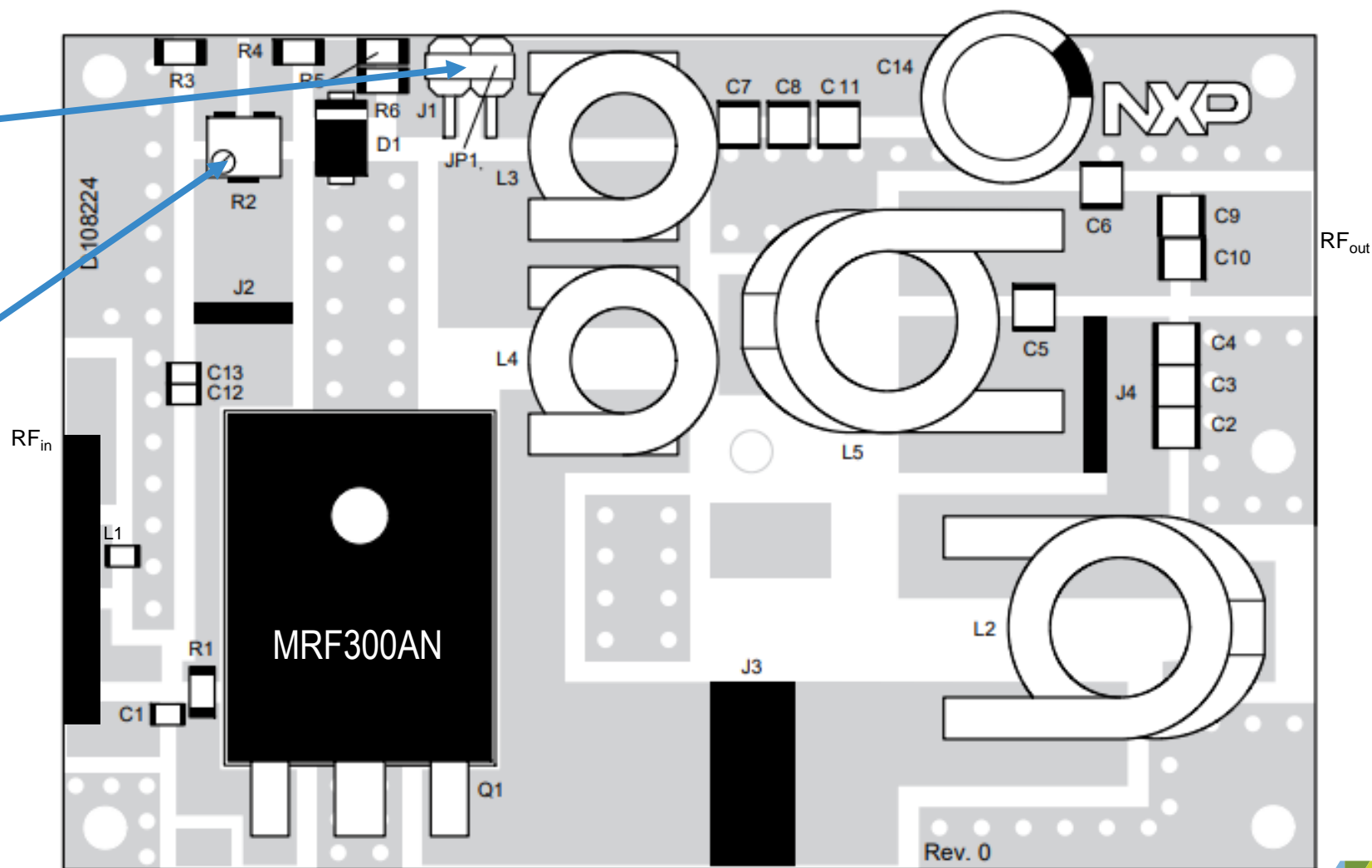
Bill of Materials

| Part | Description | Part Number | Manufacturer |
|-----------------|---|--------------------|-----------------------------|
| C1 | 1 nF Chip Capacitor | GRM2165C2A102JA01D | Murata |
| C2, C3, C4 | 430 pF Chip Capacitor | 800B431JT200XT | ATC |
| C5 | 75 pF Chip Capacitor | 800B750JT500XT | ATC |
| C6 | 330 pF Chip Capacitor | 800B331JT200XT | ATC |
| C7, C8, C9, C10 | 6.8 nF Chip Capacitor | GRM32QR73A682KW01L | Murata |
| C11 | 10 μ F Chip Capacitor | GRM32EC72A106KE05L | Murata |
| C12 | 10 nF Chip Capacitor | GRM21BR72A103KA01B | Murata |
| C13 | 1 μ F Chip Capacitor | GJ821BR71H105KA12L | Murata |
| C14 | 220 μ F, 100 V Electrolytic Capacitor | MCGPR100V227M16X26 | Multicomp |
| D1 | 8.2 V Zener Diode | SMAJ4738A-TP | Micro Commercial Components |
| J1 | Right Angle Breakaway Headers (2 Pins) | 9-146305-0 | TE Connectivity |
| J2, J3, J4 | Jumper | Copper Foil | |
| JP1 | Shunt (J1) | 382811-8 | TE Connectivity |
| L1 | 390 nH Chip Inductor | 0805CS-391XJLC | ATC |
| L2 | 33 nF Air Core Inductor | 2014VS-33NMEB | Coilcraft |
| L3, L4 | 140 nH Air Core Inductor | 1010VS-141ME | Coilcraft |
| L5 | 250 nH Air Core Inductor | 2014VS-251NMEB | Coilcraft |
| Q1 | RF Power LDMOS Transistor | MRF300AN | NXP |
| R1 | 33 Ω , 1/8 W Chip Resistor | CRCW080533R0FKEA | KOA Speer |
| R2 | 5.0 k Ω Multi-turn Cermet Trimming Potentiometer | 3224W-1-502E | Bourns |
| R3 | 12 k Ω , 1/4 W Chip Resistor | CRCW120612K0FNEA | Vishay |
| R4 | 27 k Ω , 1/4 W Chip Resistor | CRCW120627K0FKEA | Vishay |
| R5, R6 | 20 k Ω , 1/4 W Chip Resistor | CRCW120620K0FKEA | Vishay |
| PCB | FR4 0.087", $\epsilon_r = 4.8$, 2 oz. Copper | D108224 | MTL |

Tuning Tips

Remove JP1 to disable gate bias

Turn R2 to adjust I_{DQ} , clockwise to decrease

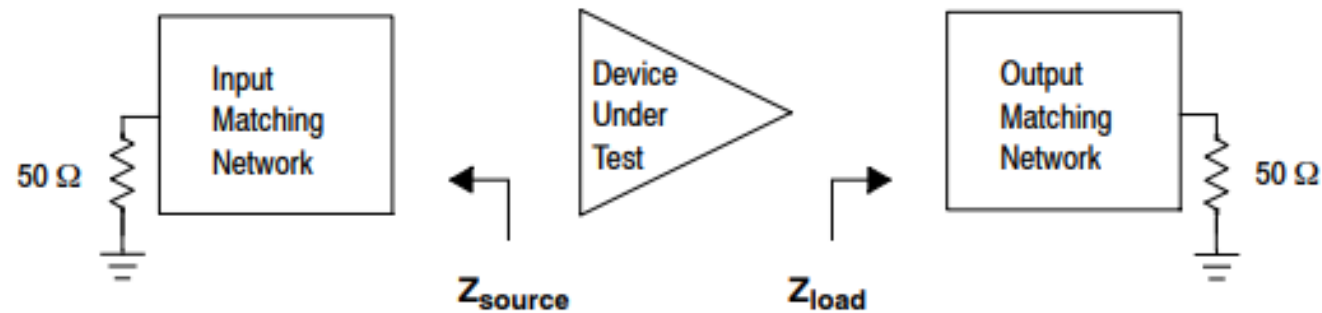


Impedances

| f (MHz) | Z_{source} (Ω) | Z_{load} (Ω) |
|--------------------|---|---|
| 13.56 | $12.0 + j5.2$ | $5.1 - j1.0$ |

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.



Revision History

- The following table summarizes revisions to the content of the MRF300AN 13.56 MHz Reference Circuit zip file.

| Revision | Date | Description |
|----------|----------------|-------------------|
| 0 | September 2019 | • Initial Release |



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