

AFIC901N 350-520 MHz REFERENCE CIRCUIT OVERVIEW

ORDERABLE PART NUMBER: AFIC901N-350MHZ



PUBLIC



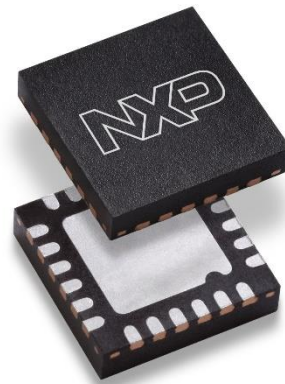
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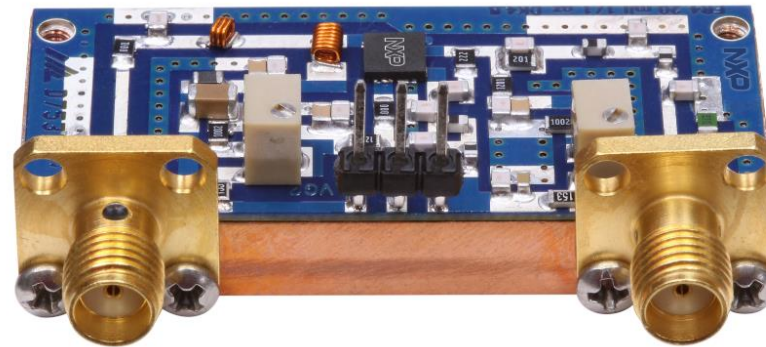
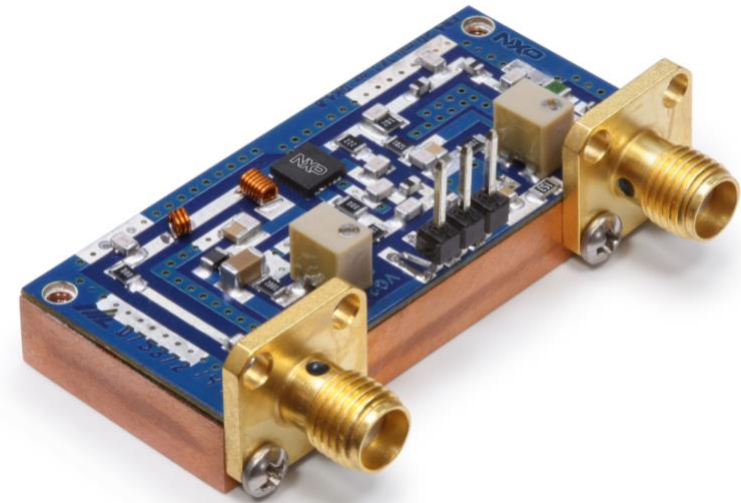
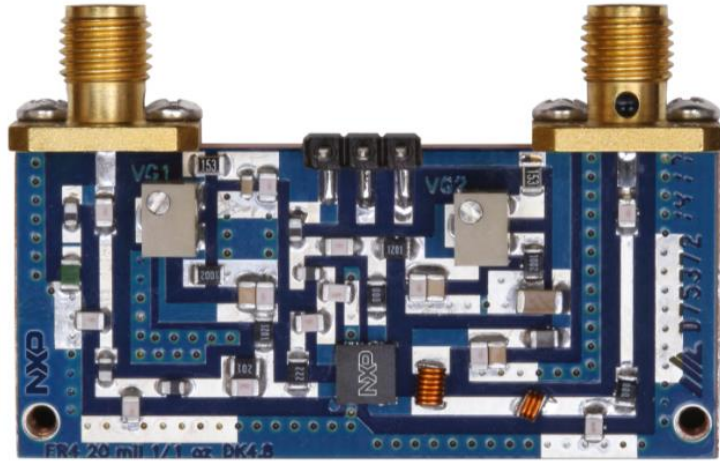
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Introduction

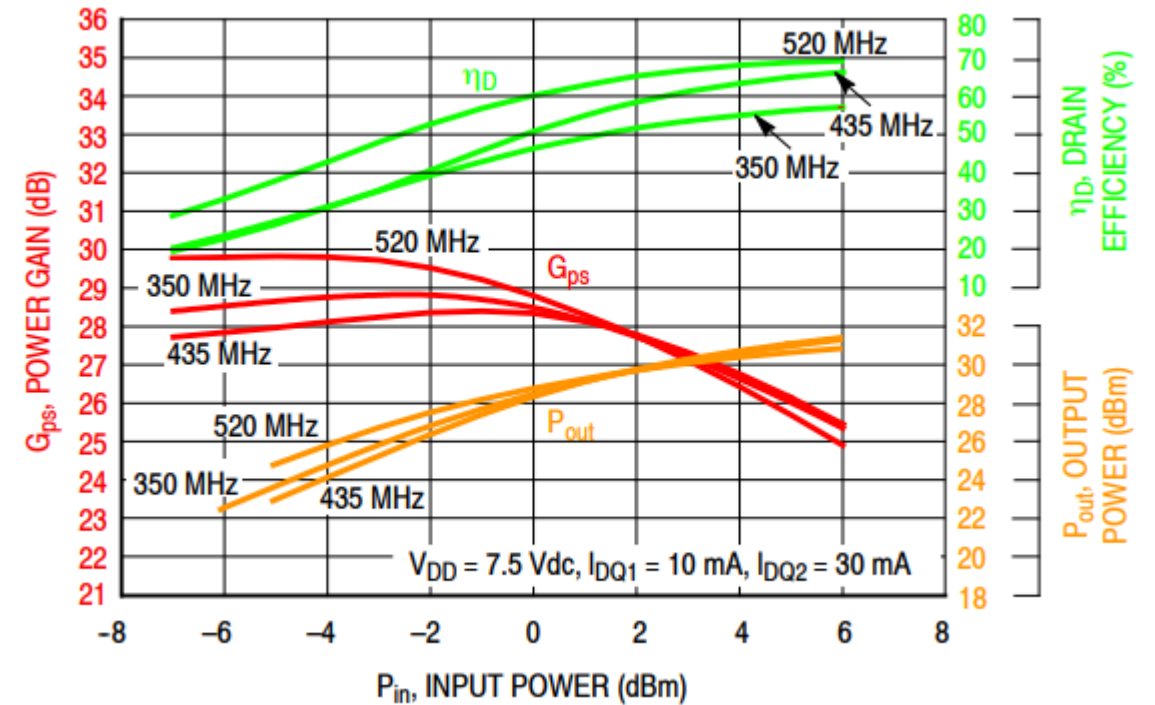
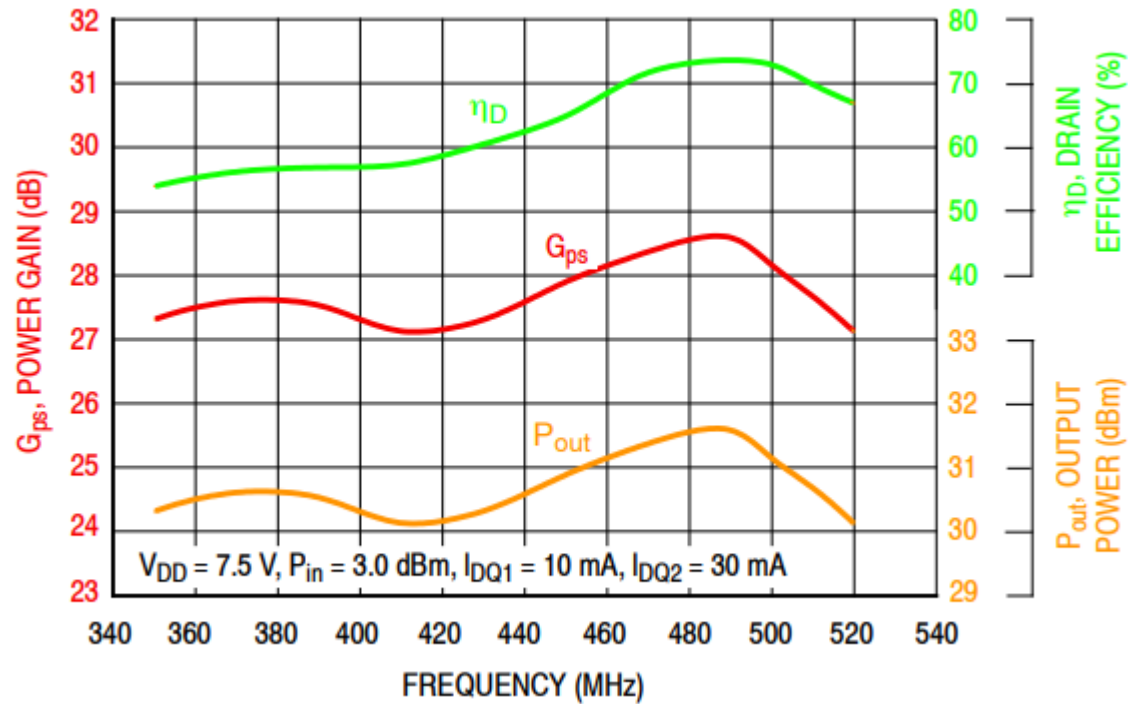
- The NXP AFIC901N is a 1.8-1000 MHz, 1 W CW RF power LDMOS transistor housed in a QFN package. It has no input, no output and no inter-stage matching, allowing off-chip matching for flexible use across frequencies.
 - Further details about the device, including its data sheet, are available [here](#).
- The following pages describe the 350-520 MHz reference circuit (evaluation board). Its typical applications are UHF land mobile radio and use as a generic driver.
- The reference circuit can be ordered through NXP's distribution partners and retailers using part number AFIC901N-350MHZ.



Circuit Overview – 2.11 cm × 4.72 cm (0.83" × 1.86")



Typical CW Performance

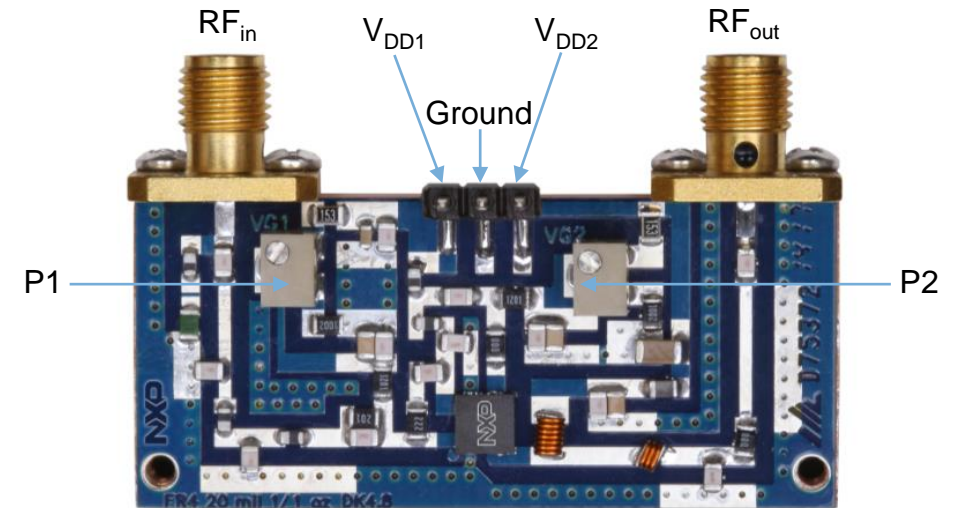


Typical Performance: $V_{DD1} = V_{DD2} = 7.5 \text{ Vdc}$, $I_{DQ1} = 10 \text{ mA}$, $I_{DQ2} = 30 \text{ mA}$, $P_{out} = 1 \text{ W}$ (30 dBm), CW

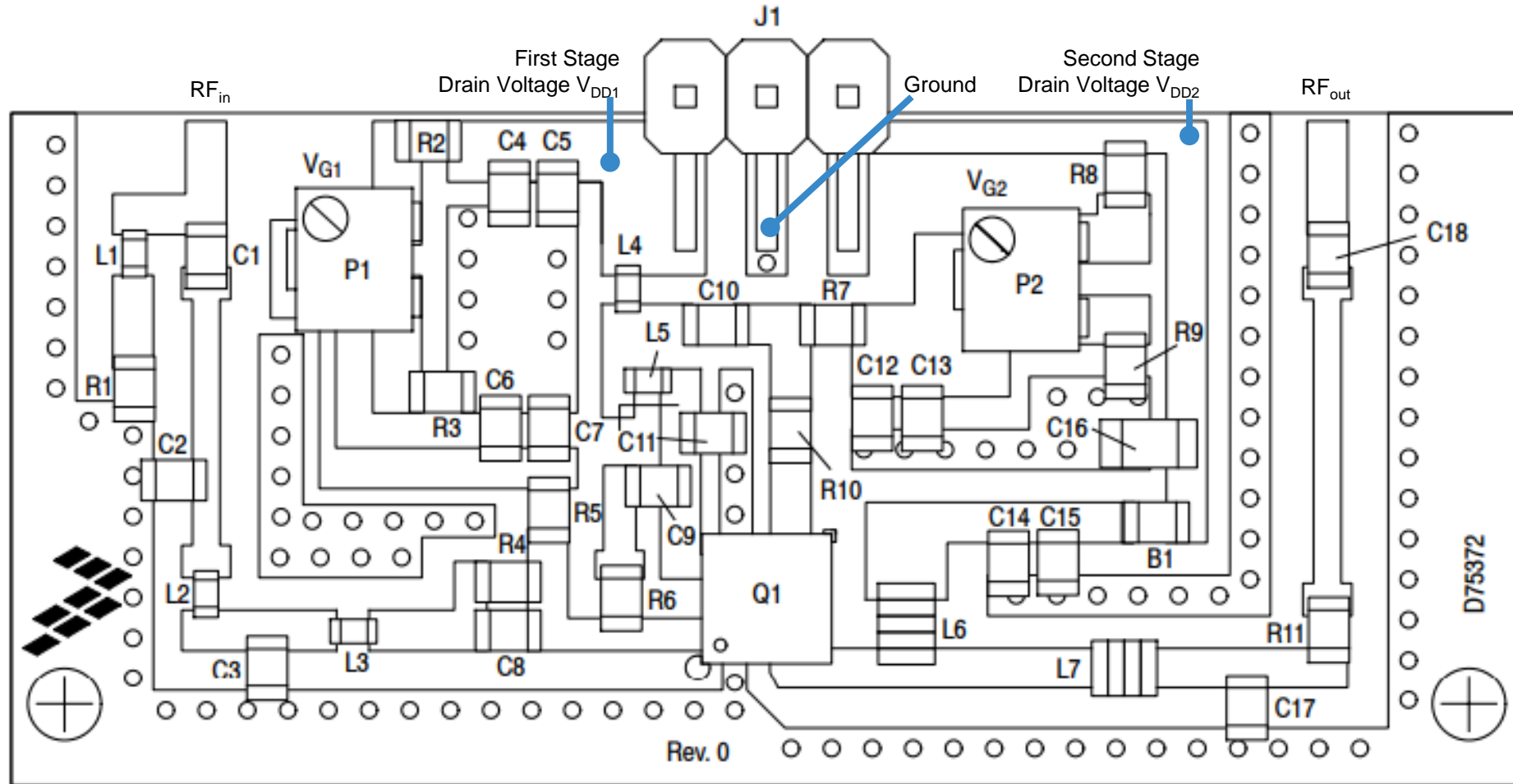
| Frequency (MHz) | P_{in} (dBm) | G_{ps} (dB) | η_D (%) | P_{out} (dBm) |
|-----------------|----------------|---------------|--------------|-----------------|
| 350 | 2.3 | 27.7 | 52.8 | 30.0 |
| 435 | 2.1 | 27.9 | 59.6 | 30.0 |
| 520 | 2.4 | 27.6 | 66.3 | 30.0 |

Quick Start

1. Connect the ground.
2. Terminate the RF output with a 50 ohm load capable of handling more than 1 W power.
3. Connect the RF input to a 50 ohm source with the RF off.
4. Connect the first stage drain voltage (V_{DD1}) and raise it slowly to 7.5 V while ensuring that the drain current remains below or equal to the typical drain quiescent current of $I_{DQ1} = 10$ mA.
5. If needed, adjust the P1 potentiometer to modify the first stage gate voltage to control the first stage drain quiescent current I_{DQ1} .
6. Disconnect the first stage drain voltage V_{DD1} . Connect the second stage drain voltage (V_{DD2}) and raise it slowly to 7.5 V while ensuring that the drain current remains below or equal to the typical quiescent current of $I_{DQ2} = 30$ mA.
7. If needed, adjust the P2 potentiometer to modify the second stage gate voltage to control the second stage drain current I_{DQ2} .
8. Keep V_{DD2} connected to 7.5 V and connect again first stage V_{DD1} to 7.5 V. The total drain current should typically be 40 mA.
9. Raise the RF input slowly to 3 dBm (2 mW).
10. Check the RF output power (typically 1 W), the drain current (around 0.3 A for this power level) and the temperature of the board. Ensure the baseplate is not overheating.



Component Placement Reference

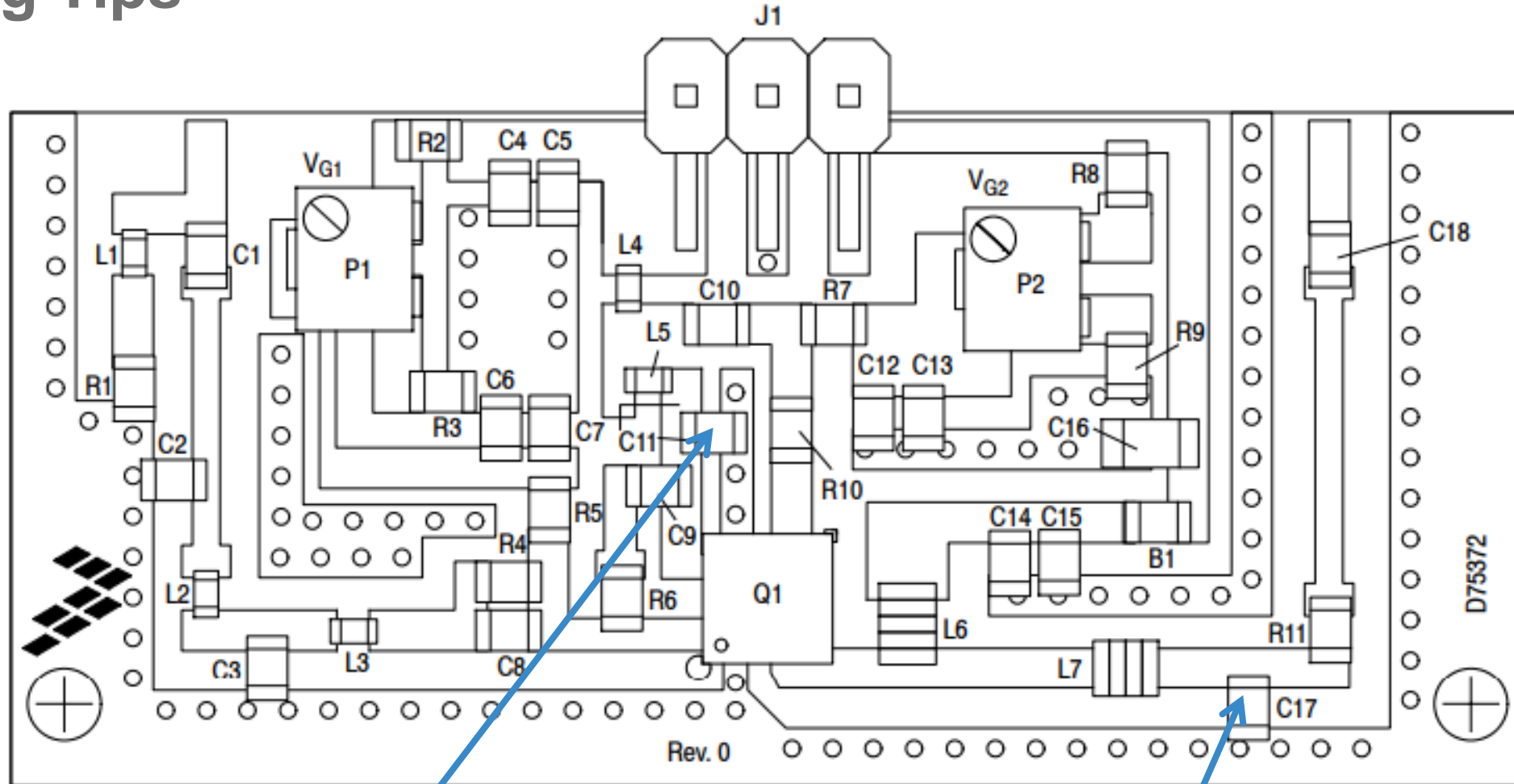


Note: PCBs may have either NXP or Freescale markings. Existing Freescale boards will not migrate to NXP markings unless a board is revised.

Bill of Materials

| Part | Description | Part Number | Manufacturer |
|------------------------------------|--|---------------------|--------------|
| B1 | RF Bead | 2508051107Y0 | Fair-Rite |
| C1, C5, C7, C9, C10, C12, C14, C18 | 100 pF Chip Capacitors | GQM2195C2E101GB12D | Murata |
| C2 | 10 pF Chip Capacitor | GQM2195C2E100FB12D | Murata |
| C3 | 12 pF Chip Capacitor | GQM2195C2E120FB12D | Murata |
| C4 | 1 μ F Chip Capacitor | GRM21BR71H105KA12L | Murata |
| C6, C13, C15 | 1000 pF Chip Capacitors | C2012X7R2E102M085AA | TDK |
| C8 | 39 pF Chip Capacitor | GQM2195C2E390GB12D | Murata |
| C11 | 4.7 pF Chip Capacitor | GQM2195C2E4R7BB12D | Murata |
| C16 | 10 μ F Chip Capacitor | GRM31CR61H106KA12L | Murata |
| C17 | 6.8 pF Chip Capacitor | GQM2195C2E6R8BB12D | Murata |
| J1 | Right-Angle Breakaway Headers (3 Pins) | 22-28-8360 | Molex |
| L1, L4 | 120 nH Inductors | LL1608-FSLR12J | TOKO |
| L2 | 12 nH Inductor | LL1608-FSL12NJ | TOKO |
| L3 | 39 nH Inductor | LL1608-FSL39NJ | TOKO |
| L5 | 15 nH Inductor | LL1608-FSL15NJ | TOKO |
| L6 | 25 nH Inductor | 0908SQ25N | Coilcraft |
| L7 | 8.1 nH Inductor | 0908SQ8N1 | Coilcraft |
| P1, P2 | 5.0 k Ω Multi-turn Cermet Trimmer Potentiometer | 3224W-1-502E | Bourns |
| Q1 | RF Power LDMOS Amplifier | AFIC901NT1 | Freescale |
| R1 | 51 Ω , 1/4 W Chip Resistor | SG73P2ATTD51R0F | KOA Speer |
| R2, R8 | 15 k Ω , 1/10 W Chip Resistors | RR1220P-153-B-T5 | Susumu |
| R3, R9 | 10 k Ω , 1/8 W Chip Resistors | CRCW080510K0FKEA | Vishay |
| R4 | 200 Ω , 1/8 W Chip Resistor | CRCW0805200RJNEA | Vishay |
| R5, R7 | 1.2 k Ω , 1/8 W Chip Resistors | CRCW08051K20FKEA | Vishay |
| R6 | 2.2 k Ω , 1/8 W Chip Resistor | CRCW08052K20JNEA | Vishay |
| R10, R11 | 0 Ω , 2.5 A Chip Resistors | CWCR08050000Z0EA | Vishay |
| PCB | FR4 (S-1000), 0.020", $\epsilon_r = 4.8$ | D75372 | MTL |

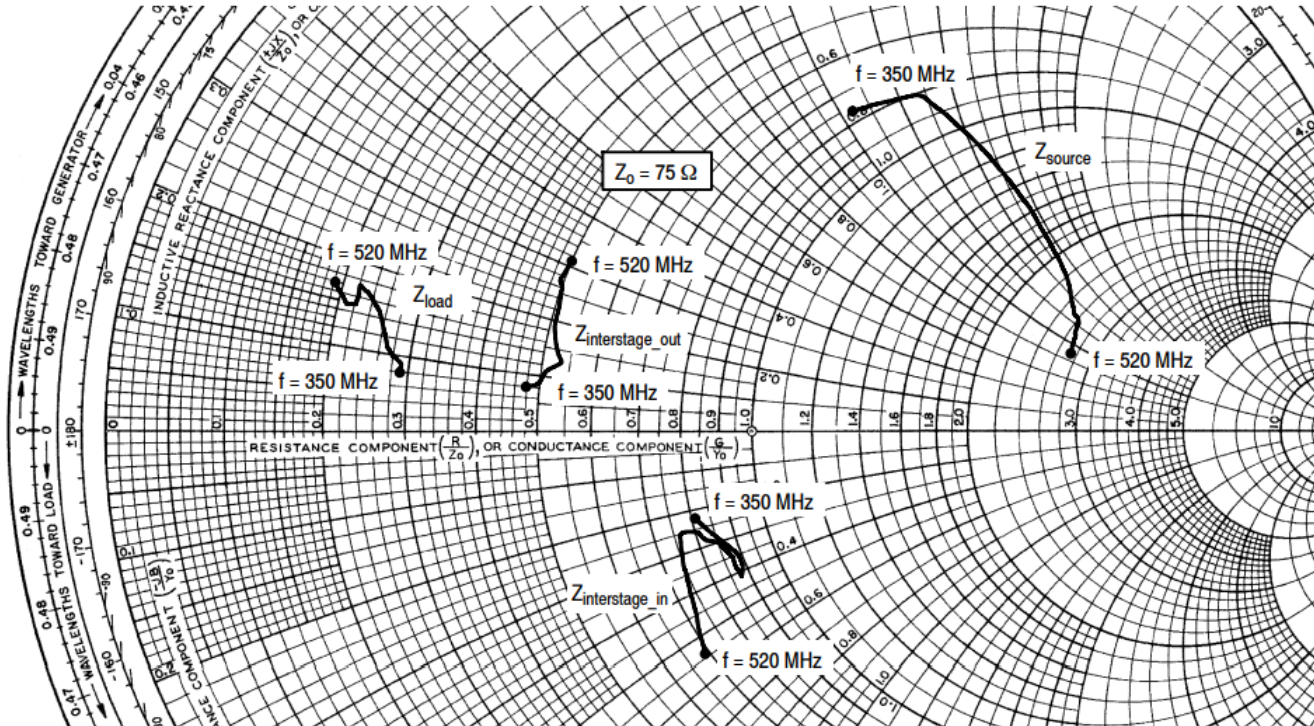
Tuning Tips



Change C11 to a larger value to
increase gain and efficiency
at 350 MHz

Change C17 to a smaller value to
increase power and efficiency
at 520 MHz

Impedances



| f MHz | $Z_{source1}$ Ω | Z_{load1} Ω | $Z_{source2}$ Ω | Z_{load2} Ω |
|----------|---------------------------|-------------------------|---------------------------|-------------------------|
| 350 | 57.4 + j77.2 | 60.5 – j16.5 | 36.3 + j5.69 | 22.0 + j6.12 |
| 360 | 60.6 + j94.9 | 62.7 – j20.6 | 37.2 + j6.57 | 21.7 + j6.35 |
| 370 | 69.0 + j100.2 | 65.1 – j24.8 | 38.3 + j8.07 | 21.5 + j6.92 |
| 380 | 79.2 + j105.3 | 66.5 – j29.4 | 39.4 + j9.66 | 21.2 + j7.57 |
| 390 | 91.5 + j109.9 | 65.1 – j30.7 | 39.2 + j11.6 | 20.3 + j8.45 |
| 400 | 106.3 + j113.5 | 65.3 – j28.6 | 38.6 + j14.6 | 19.4 + j9.81 |
| 410 | 124.0 + j115.1 | 65.3 – j26.2 | 38.0 + j17.3 | 18.6 + j11.0 |
| 420 | 144.6 + j113.6 | 64.3 – j23.4 | 37.3 + j19.2 | 17.8 + j11.9 |
| 430 | 167.9 + j107.3 | 62.6 – j21.0 | 36.7 + j20.1 | 17.2 + j12.5 |
| 440 | 192.4 + j94.1 | 60.6 – j19.3 | 36.7 + j20.3 | 16.9 + j12.7 |
| 450 | 196.1 + j89.7 | 58.9 – j18.6 | 36.8 + j20.4 | 16.7 + j12.6 |
| 460 | 197.5 + j86.7 | 57.6 – j19.1 | 36.8 + j20.5 | 16.6 + j12.2 |
| 470 | 198.8 + j83.7 | 56.8 – j20.8 | 36.8 + j20.6 | 16.5 + j11.7 |
| 480 | 199.9 + j80.6 | 56.3 – j23.7 | 36.8 + j20.7 | 16.3 + j11.3 |
| 490 | 201.0 + j77.5 | 55.8 – j27.6 | 36.9 + j20.8 | 15.9 + j11.1 |
| 500 | 202.0 + j74.3 | 54.9 – j32.3 | 36.9 + j20.9 | 15.5 + j11.2 |
| 510 | 202.8 + j71.2 | 53.4 – j36.9 | 36.9 + j21.0 | 15.0 + j11.7 |
| 520 | 206.6 + j70.1 | 51.5 – j40.8 | 37.7 + j23.5 | 14.6 + j12.5 |

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

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

Revision History

- The following table summarizes revisions to the content of the AFIC901N 350-520 MHz Reference Circuit zip file.

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



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