MMRF5014H 500-2500 MHz
REFERENCE CIRCUIT

ORDERABLE PART NUMBER: MMRF5014H-500MHZ

PUBLIC

SECURE CONNECTIONS
FOR A SMARTER WORLD

License

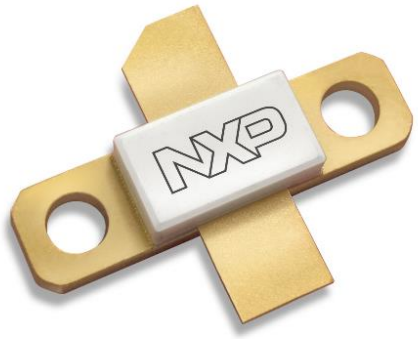
- Open and read the License.pdf included in the same zip file as the document you are currently reading. By using the documentation materials included in this zip file, you indicate that you accept the terms of the agreement.

Introduction

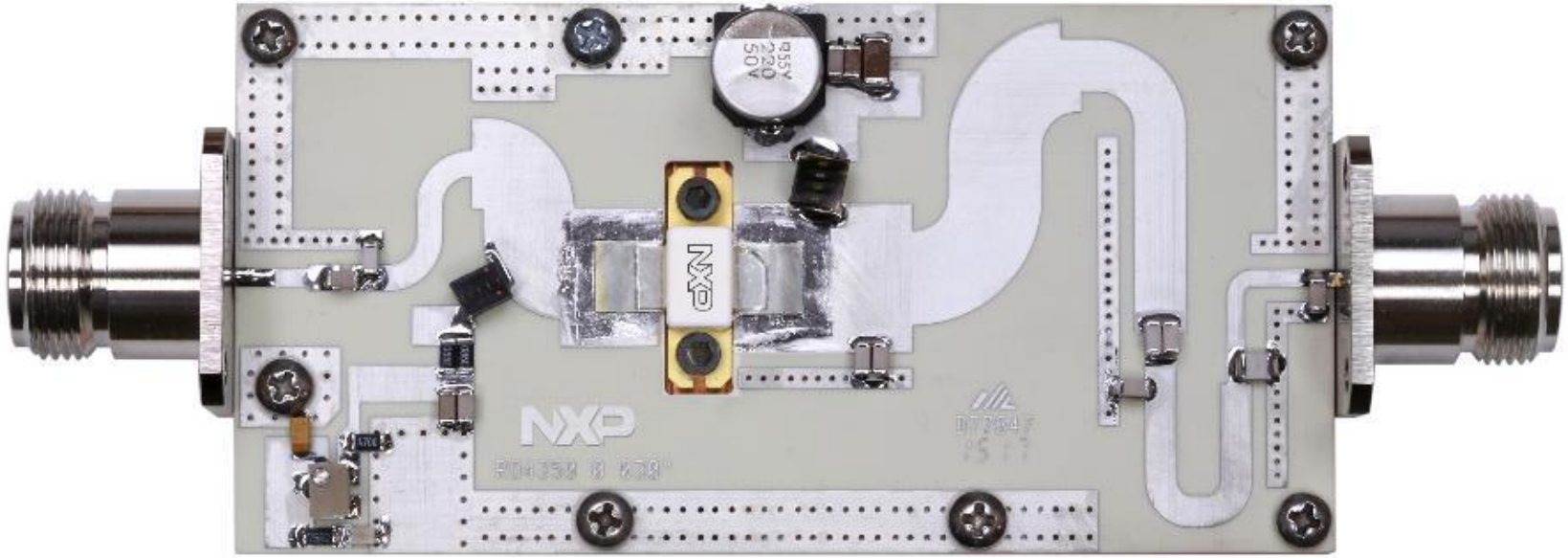
- The NXP MMRF5014H is a 1-2700 MHz, 125 W CW RF power GaN transistor housed in an NI-360 air-cavity ceramic package. Its input pre-match and no output matching enable the design of very wideband power amplifiers.
  - Further details about the device, including its data sheet, are available on www.nxp.com/MMRF5014H.

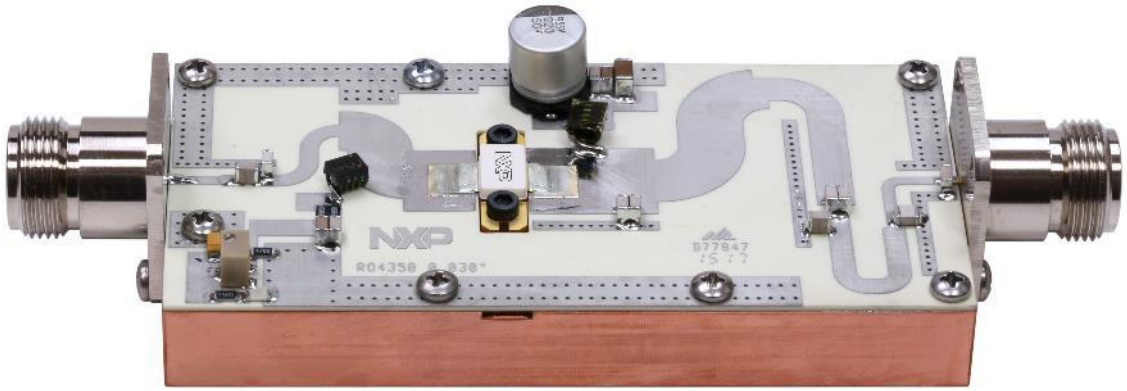
- The following pages describe the 500-2500 MHz 100 W reference circuit (evaluation board).
  Its typical applications are wideband tactical radio transmitters and EMC amplifiers.

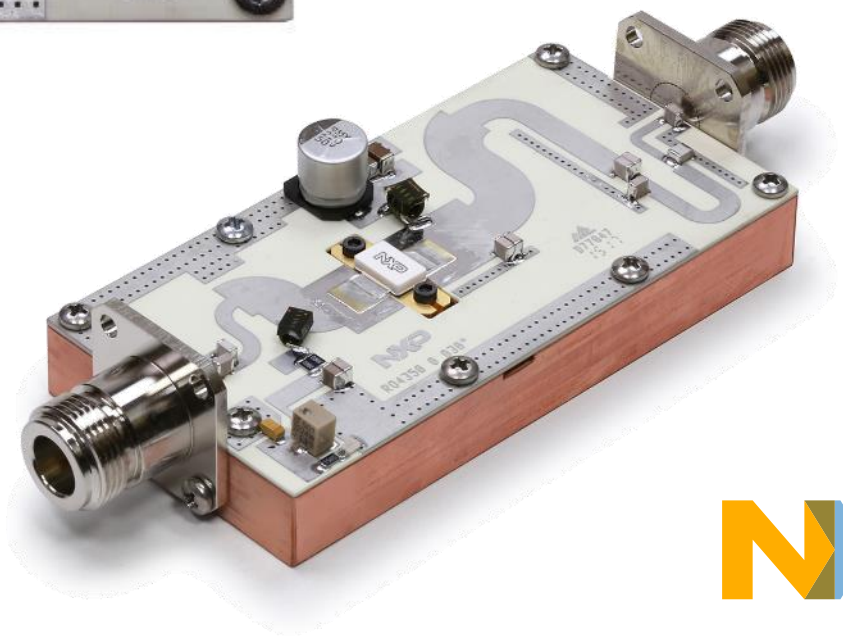
- The reference circuit can be ordered through NXP's distribution partners and etailers using part number MMRF5014H-500MHZ.



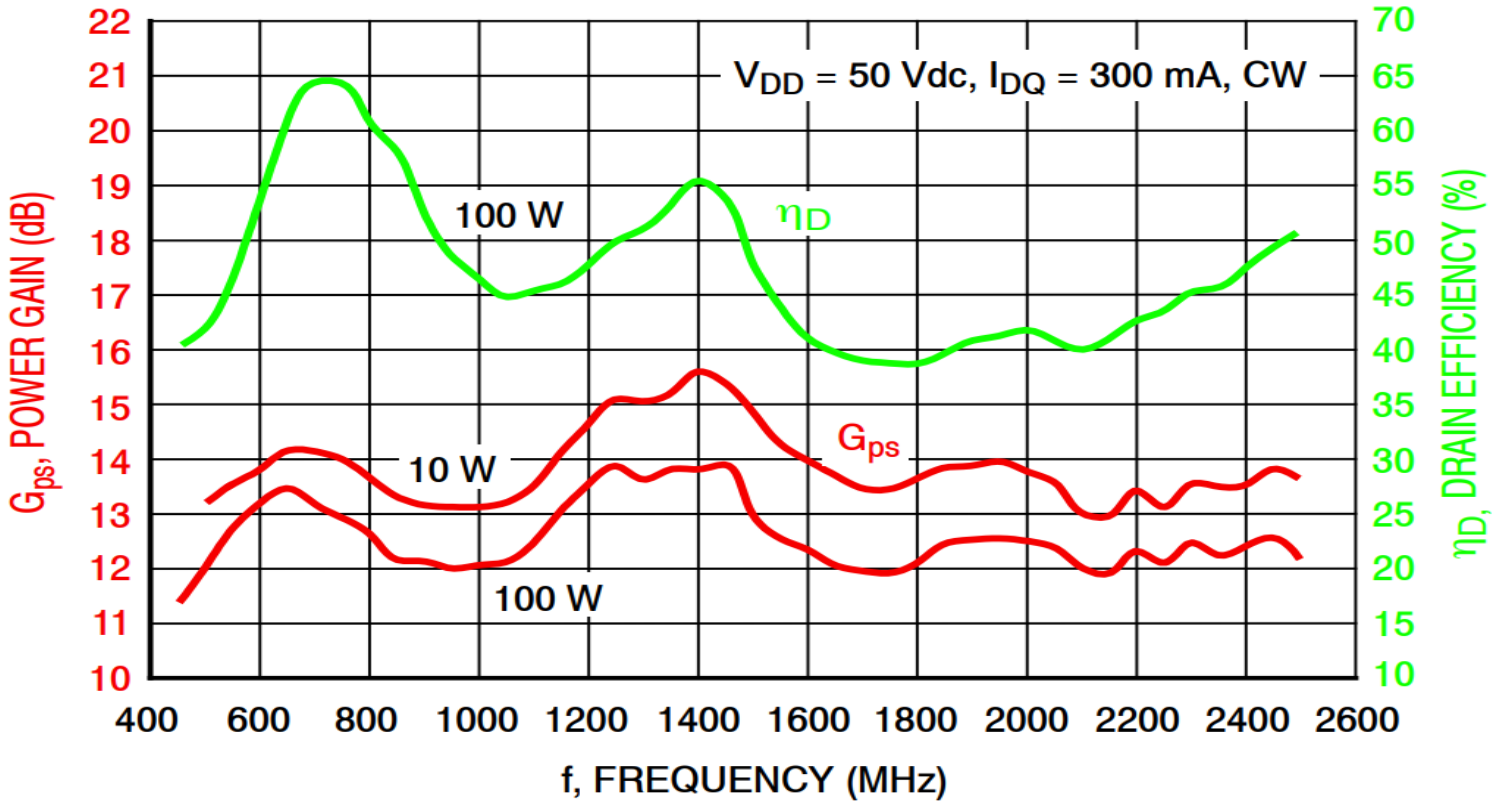
Circuit Overview – 5.08 cm x 10.16 cm (2.0″ × 4.0″)







Typical CW Performance

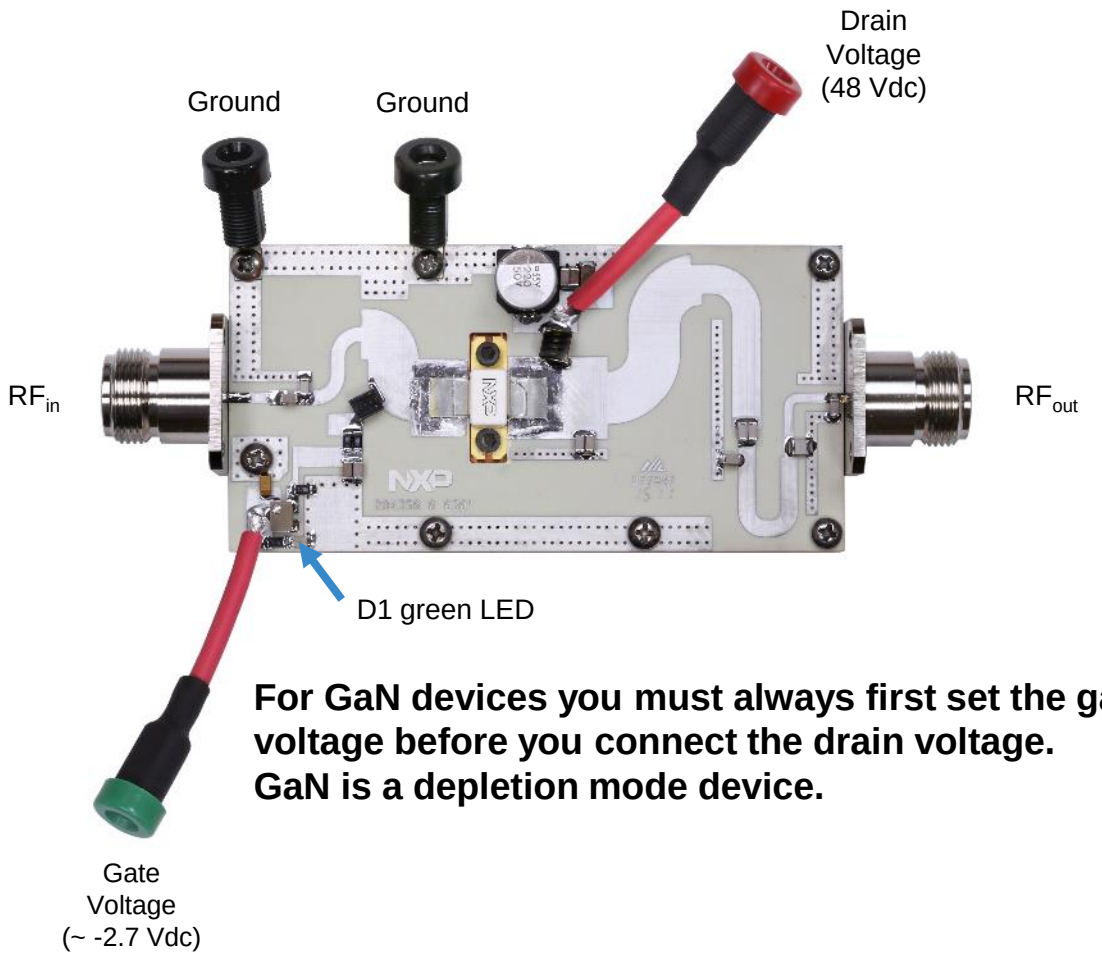


Typical Performance: V_{DD} = 50 Vdc, I_{DQ} = 300 mA, CW

Frequency (MHz)	Output Power (W)	Power Gain (dB)	Drain Efficiency (%)
500-2500 MHz	100	12.0 (minimum across the band)	38.5 (minimum across the band)

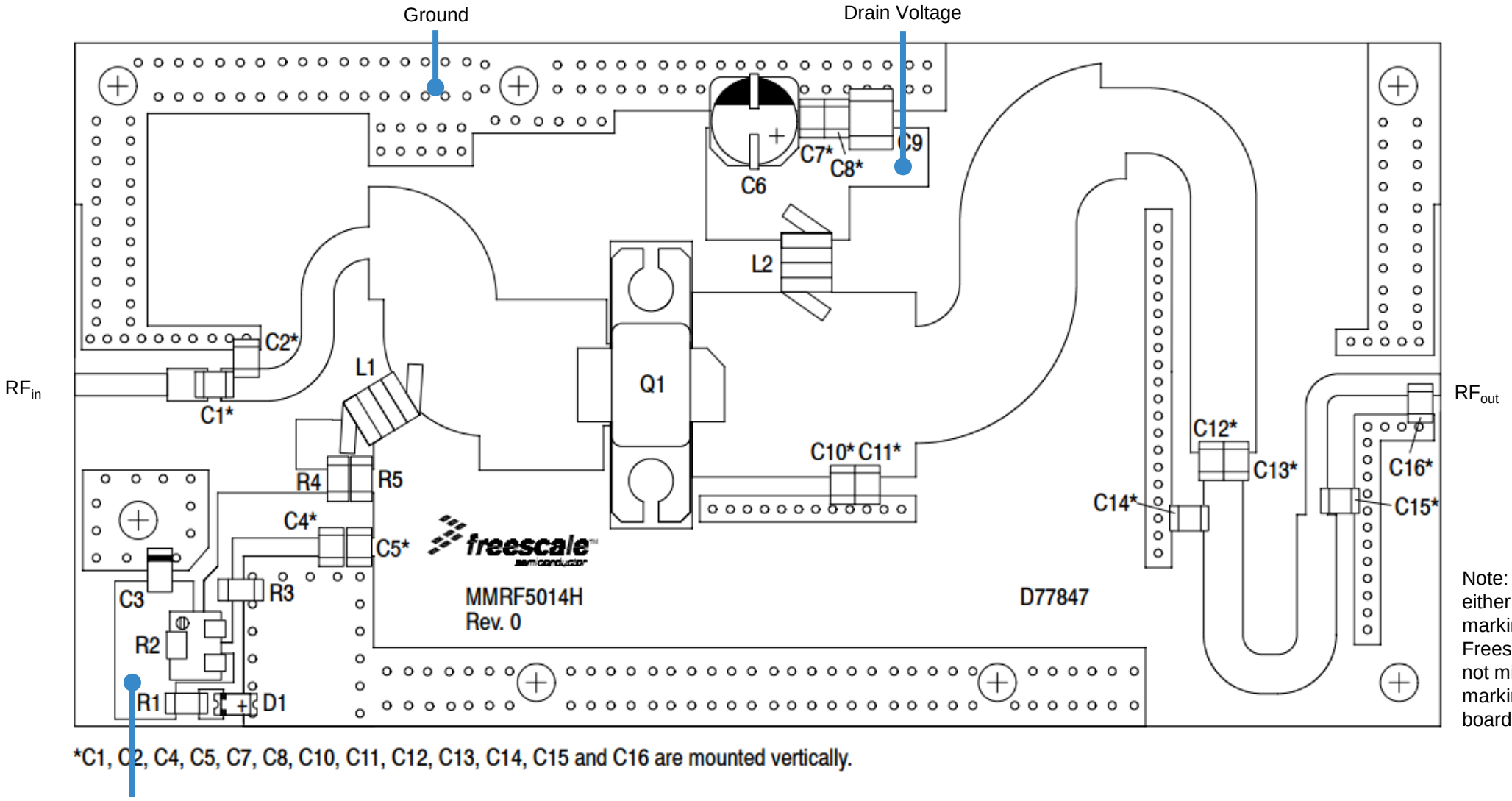
Quick Start

1. Mount the reference circuit onto a heatsink capable of dissipating more than 200 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 125 W.
4. Connect the RF input to a 50 ohm source with the RF off.
5. Connect the gate voltage and set it to -5 V.
   The green D1 LED should turn on.
6. Connect the drain voltage (V_{DD}) and raise slowly to 48 V.
7. Increase the gate voltage slowly until the drain current reaches the desired level (drain quiescent current I_{DQ} = 300 mA typically). The gate voltage should be around -2.7 V.
8. Raise the RF input slowly to 3.9 W (36 dBm). Note: the performance charts on the previous page were made with a fixed output power, variable input power.
9. Check the RF output power (typically 100-125 W), the drain current (around 4 A for this power level) and the temperature of the board.



For GaN devices you must always first set the gate voltage before you connect the drain voltage. GaN is a depletion mode device.

Component Placement Reference



*C1, C2, C4, C5, C7, C8, C10, C11, C12, C13, C14, C15 and C16 are mounted vertically.

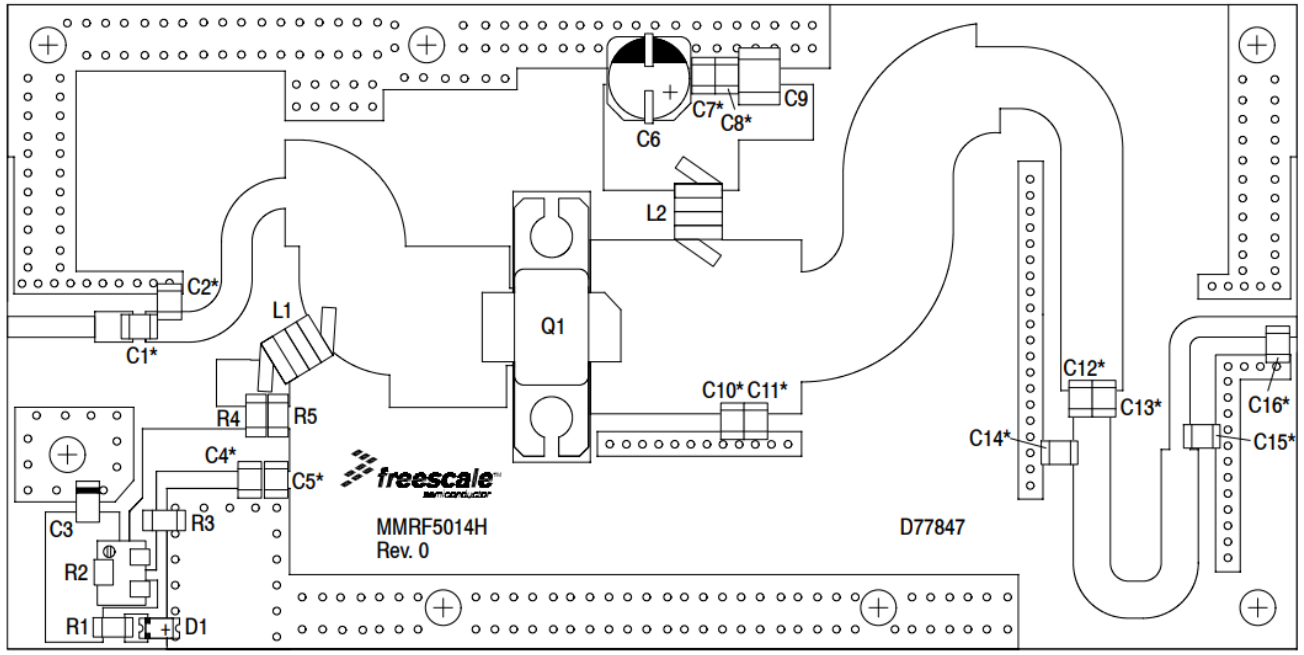
Note: PCBs may have either NXP or Freescale markings. Existing Freescale boards will not migrate to NXP markings unless a board is revised.

Bill of Materials

Part	Description	Part Number	Manufacturer
C1, C5, C7	33 pF Chip Capacitors	ATC800B330JT500XT	ATC
C2	0.4 pF Chip Capacitor	ATC800B0R4BT500XT	ATC
C3	2.2 μF, 16 V Tantalum Capacitor	T491A225K016AT	Kemet
C4, C8	1000 pF Chip Capacitors	ATC800B102JT50XT	ATC
C6	220 μF, 50 V Electrolytic Capacitor	EEV-HA1H221P	Panasonic-ECG
C9	2.2 μF Chip Capacitor	HMK432B7225KM-T	Taiyo Yuden
C10, C11	0.8 pF Chip Capacitors	ATC800B0R8BT500XT	ATC
C12, C13	9.1 pF Chip Capacitors	ATC800B9R1BT500XT	ATC
C14, C16	0.5 pF Chip Capacitors	ATC800B0R5BT500XT	ATC
C15	0.2 pF Chip Capacitor	ATC800B0R2BT500XT	ATC
D1	LED Green Diffused 1206, SMD	LGN971-KN-1	OSRAM
L1	33 nH Inductor	1812SMS-33NJLC	Coilcraft
L2	17.5 nH Inductor, 5 Turns	GA3095-ALC	Coilcraft
Q1	RF Power GaN Transistor	MMRF5014H	NXP
R1	75 Ω, 1/4 W Chip Resistor	CRCW120675R0FKEA	Vishay
R2	500 Ω Trimming Potentiometer, 11 Turns	3224W-1-501E	Bourns
R3	470 Ω, 1/4 W Chip Resistor	CRCW1206470RFKEA	Vishay
R4, R5	39 Ω, 1/4 W Chip Resistors	CRCW120639R0FKEA	Vishay
PCB	Rogers RO4350B 0.030″, ε_r = 3.66	D77847	MTL

Tuning Tips

- Move C10 and C11 toward the transistor to increase gain on the 1200-2500 MHz band.
- Move C14 away from the transistor to increase efficiency on the 1500-2500 MHz band.
- Move C15 toward the transistor to improve upper-band gain flatness on the 1600-2500 MHz band.
- Increase C2 or move toward the transistor to improve gain on the 500-1100 MHz band.

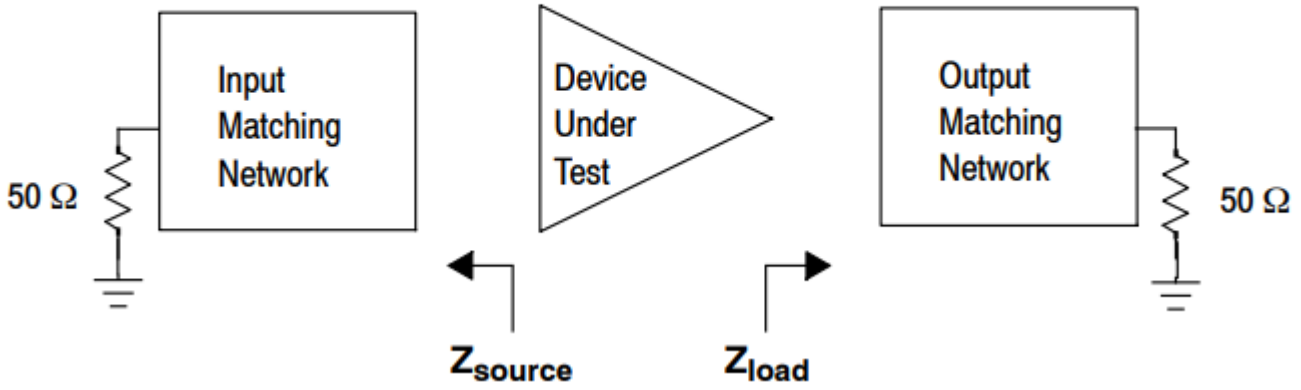


Impedances

f MHz	Z_{source} Ω	Z_{load} Ω
500	1.3 + j3.9	5.9 + j3.5
1000	1.0 + j0.3	5.5 + j2.9
1500	0.8 – j0.5	3.4 + j2.0
2000	1.2 – j2.0	4.7 + j0.3
2500	2.7 – j3.8	3.7 + j1.4

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 MMRF5014H 500-2500 MHz Reference Circuit zip file.

Revision	Date	Description
0	September 2019	• Initial Release

SECURE CONNECTIONS
FOR A SMARTER WORLD