MRFX1K80H 87.5-108 MHz REFERENCE CIRCUIT

ORDERABLE PART NUMBER: **MRFX1K80H-88MHZ**

PUBLIC

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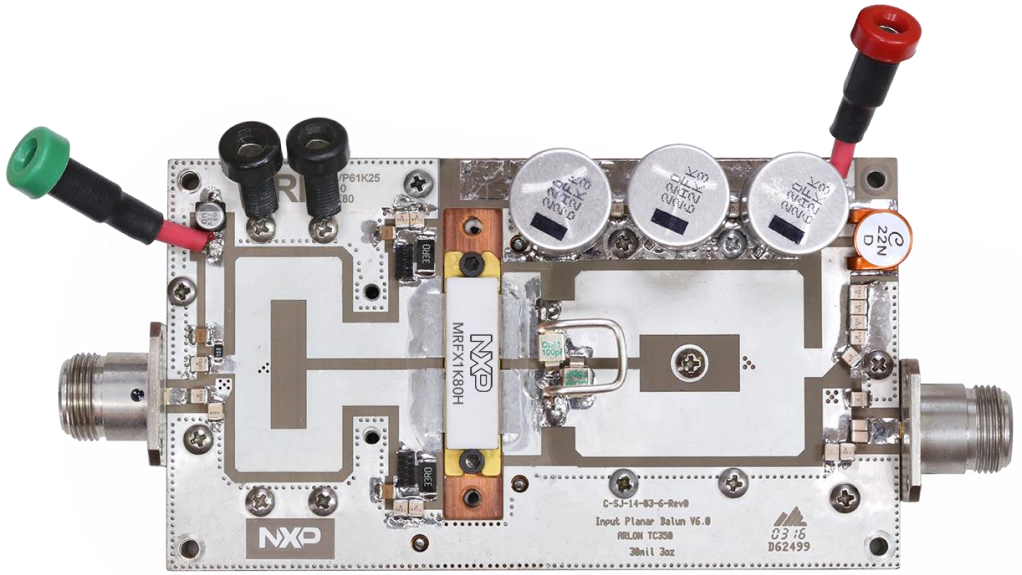
Introduction

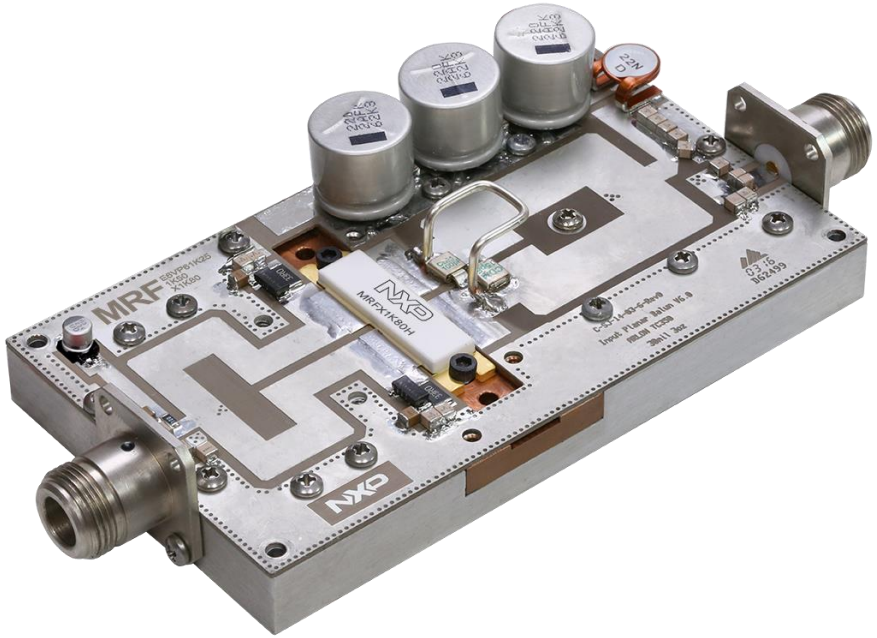
- The NXP MRF1K80H is a 1.8-400 MHz, 1800 W CW RF power LDMOS transistor housed in an NI-1230 air-cavity ceramic package. Its unmatched input and output allows wide frequency range utilization.
  - Further details about the device, including its data sheet, are available on www.nxp.com/MRFX1K80H.

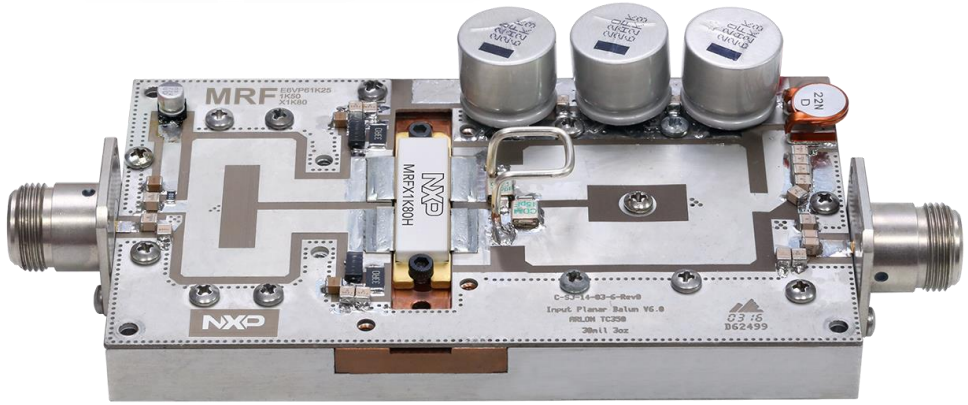
- The following pages describe the 87.5-108 MHz reference circuit (evaluation board).
  Its typical application is FM radio broadcast.

- The reference circuit can be ordered through NXP's distribution partners and etailers using part number MRFX1K80H-88MHZ.

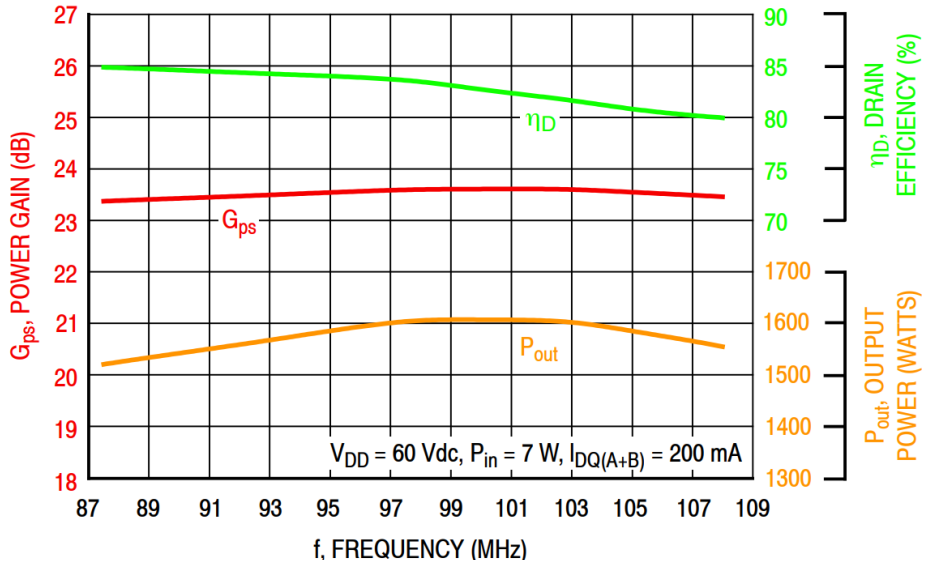
Circuit Overview – 7.3 cm × 13.0 cm (2.88″ × 5.12″)

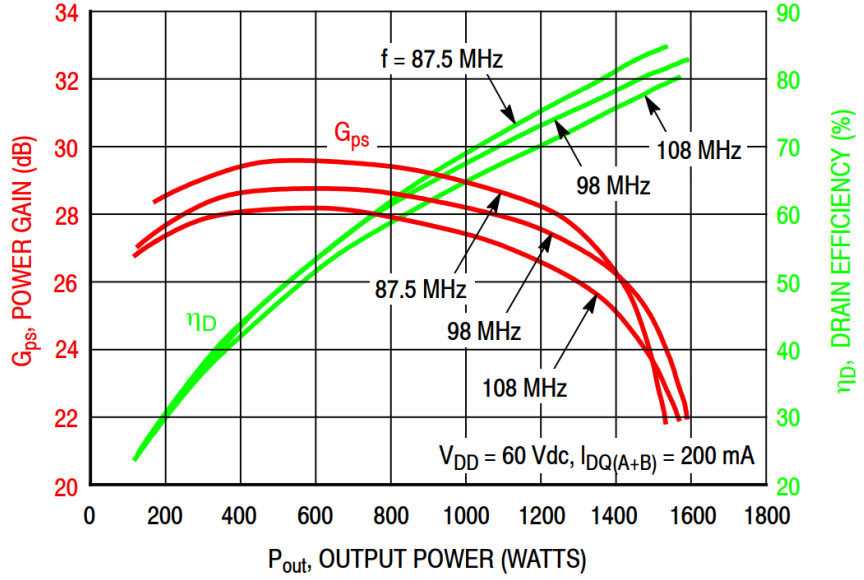






Typical Performance

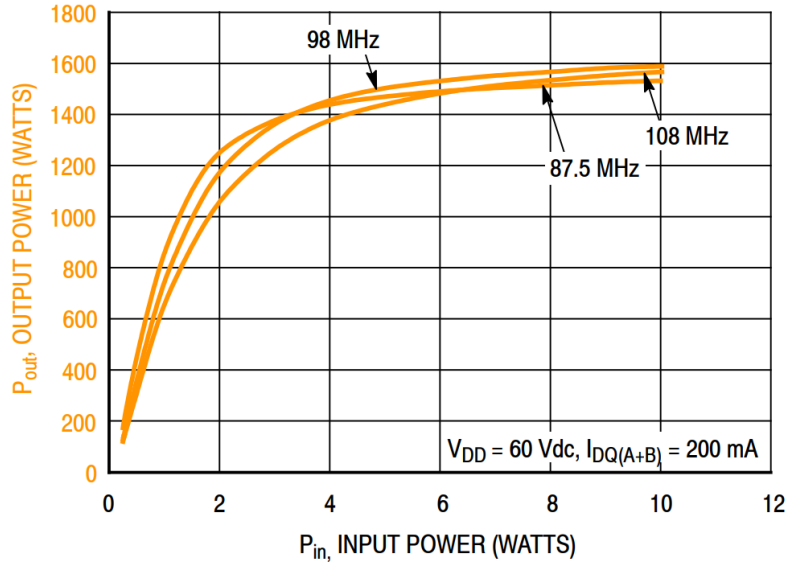




Typical Performance: $I_{DQ(A+B)}$ = 200 mA, P_{in} = 7 W (38.5 dBm), CW

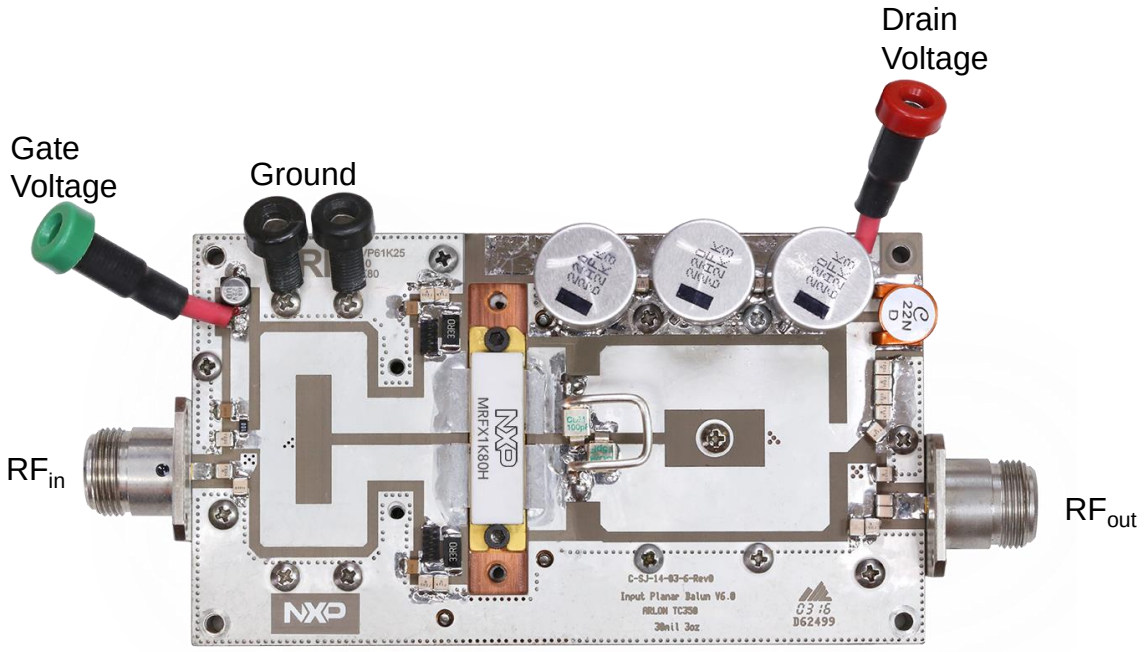
Frequency (MHz)	V_{DD} (V)	P_{out} (W)	G_{ps} (dB)	η_D (%)
87.5	60	1521	23.4	84.9
98	60	1600	23.6	82.5
108	60	1556	23.5	80.0

V_{DD} at 60 V provides the best compromise between efficiency and output power. This circuit, however, is 65 V capable.



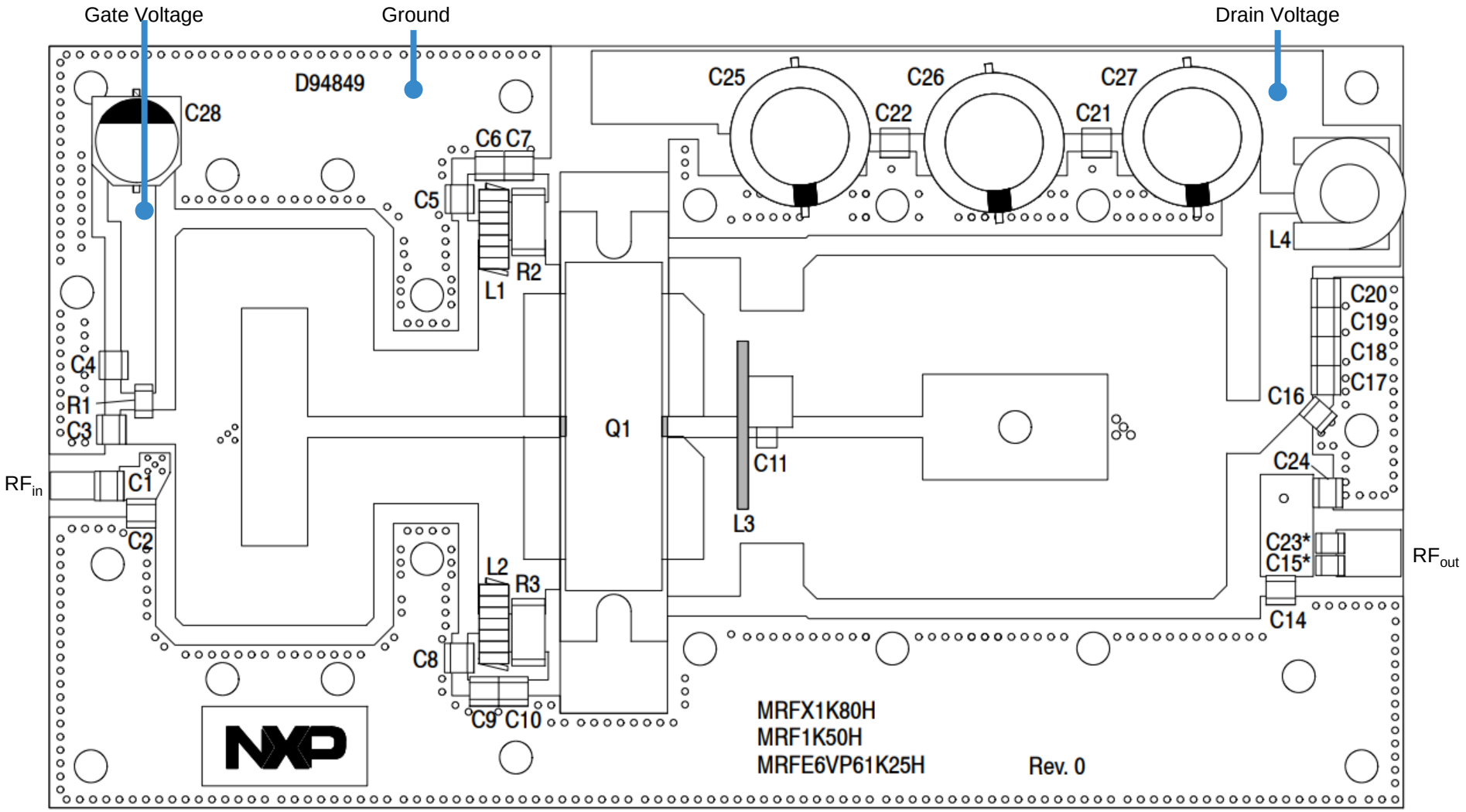
Quick Start

1. Mount the reference circuit onto a heatsink capable of dissipating more than 600 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 1600 W.
4. Connect the RF input to a 50 ohm source with the RF off.
5. Connect the gate voltage, set to 0 V.
6. Connect the drain voltage (V_{DD}) and raise slowly to 60 V. Current should be 0 A.
7. Raise the gate voltage slowly until the drain current reaches the desired level (drain quiescent current $I_{DQ(A+B)}$ = 200 mA typically). The gate voltage should be around 2.8 V.
8. Raise the RF input slowly to 7 W (38.5 dBm).
9. Check the RF output power (typically 1600 W), the drain current (around 32 A for this power level) and the temperature of the board.



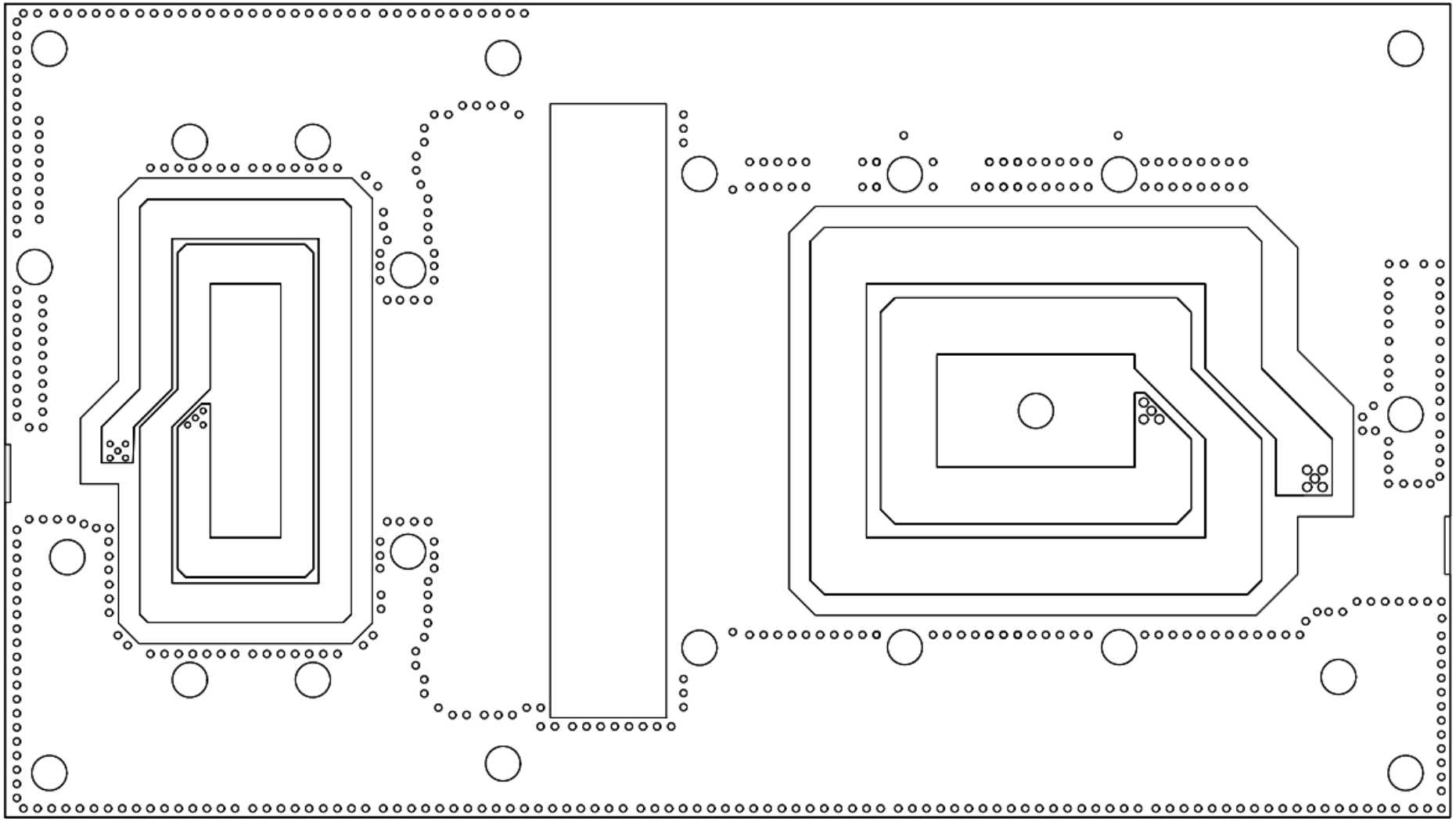
Component Placement Reference

Same as MRFE6VP61K25H and MRF1K50H 87.5-108 MHz Reference Circuits



*C15 and C23 are mounted vertically.

PCB Backside



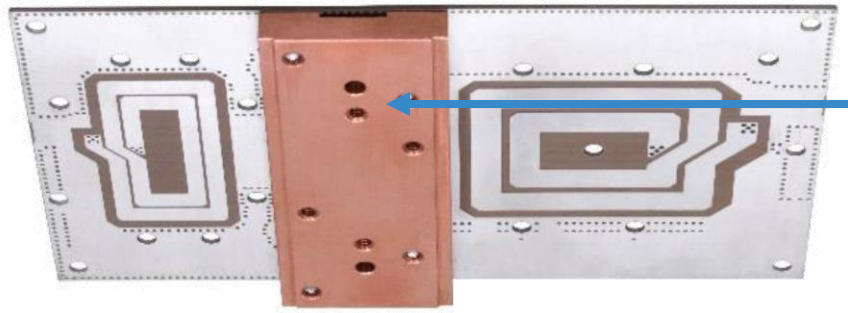
Bill of Materials

Part	Description	Part Number	Manufacturer
C1, C3, C6, C9, C18, C19, C20, C21, C22	1000 pF Chip Capacitor	ATC100B102JT50XT	ATC
C2	33 pF Chip Capacitor	ATC100B330JT500XT	ATC
C4, C5, C8	10,000 pF Chip Capacitor	ATC200B103KT50XT	ATC
C7, C10, C15, C16, C17, C23	470 pF Chip Capacitor	ATC100B471JT200XT	ATC
C11	100 pF, 300 V Mica Capacitor	MIN02-002EC101J-F	CDE
C14, C24	12 pF Chip Capacitor	ATC100B120GT500XT	ATC
C25, C26, C27	220 μF, 100 V Electrolytic Capacitor	EEV-FC2A221M	Panasonic–ECG
C28	22 μF, 35 V Electrolytic Capacitor	UUD1V220MCL1GS	Nichicon
L1, L2	17.5 nH Inductor, 6 Turns	B06TJLC	Coilcraft
L3	1.5 mm Non–Tarnish Silver Plated Copper Wire, Total Wire Length = 1.7″/43 mm	SP1500NT-001	Scientific Wire Company
L4	22 nH Inductor	1212VS-22NMEB	Coilcraft
Q1	RF Power LDMOS Transistor	MRFX1K80H	NXP
R1	10 Ω, 1/4 W Chip Resistor	CRCW120610R0JNEA	Vishay
R2, R3	33 Ω, 2 W Chip Resistor	1-2176070-3	TE Connectivity
Thermal Pad	TG Series Soft Thermal Conductive Pad	TG6050-150-150-5.0-0	t-Global Technology
PCB	Arlon TC350 0.030″, ε_r = 3.5	D94849	MTL

Assembly Details

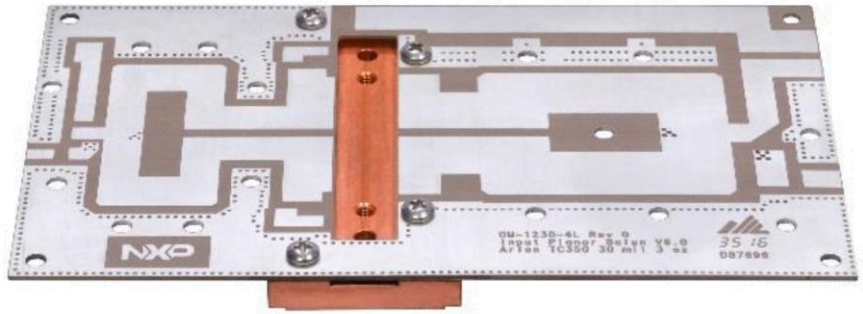
(picture from another reference circuit with different size but with similar concept)

- Back side view of the PCB:



Copper insert soldered to the PCB

- Top side view of the PCB:



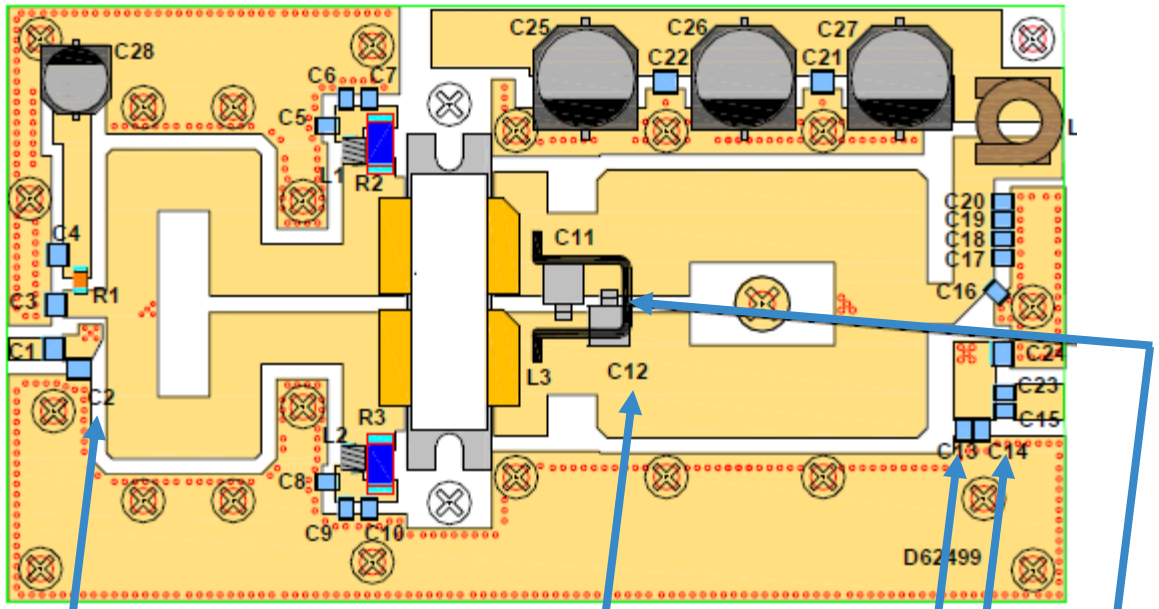
- Aluminum baseplate:

Thermal pad for heat dissipation on the drain side

Retuning Needed from the MRFE6VP61K25H 87.5-108 MHz Board

Same PCB, only 5 discrete component changes.

MRFE6VP61K25H



C2: Replace 22 pF with 33 pF

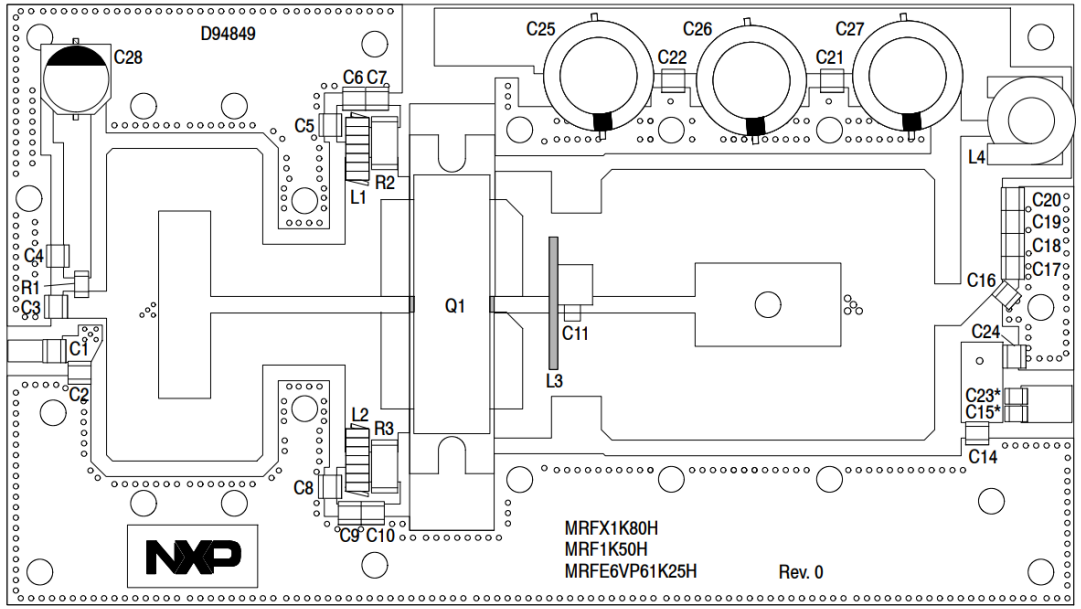
C12: Remove

C13: Remove

C14: Replace 15 pF with 12 pF

L3: Replace with proper size, detailed in the MRFX1K80H datasheet

MRFX1K80H

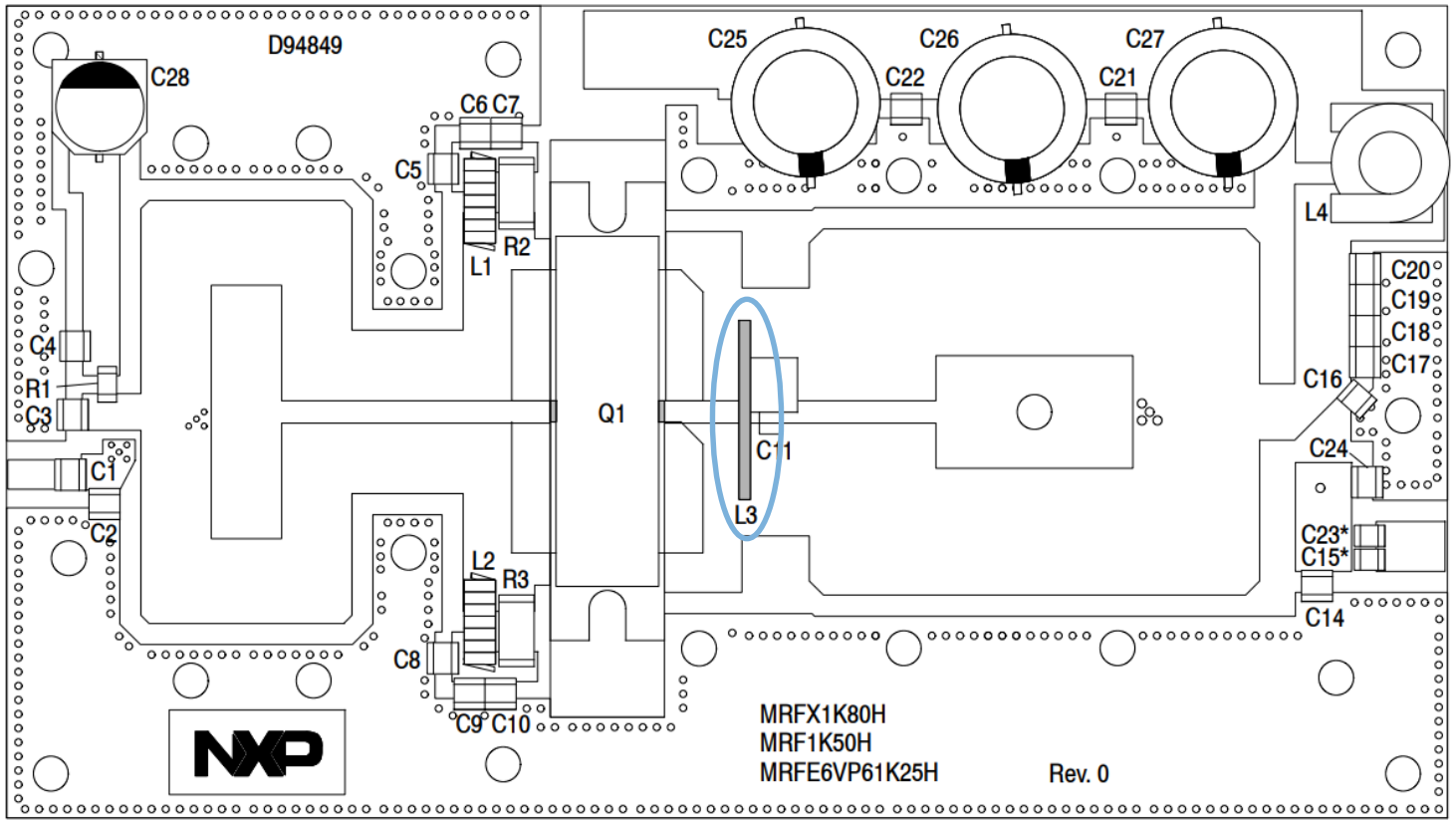


*C15 and C23 are mounted vertically.

See it live: https://www.youtube.com/watch?v=CmnjEI9Pzxs#t=3m54s

Tuning Tips

- To increase efficiency at 108 MHz bend the L3 hairpin slightly away from the device and/or move C11. (Increasing efficiency at 108 MHz will decrease output power at 87.5 MHz.)
- Note: the placement of the L3 Hairpin and C11 100 pF is sensitive.



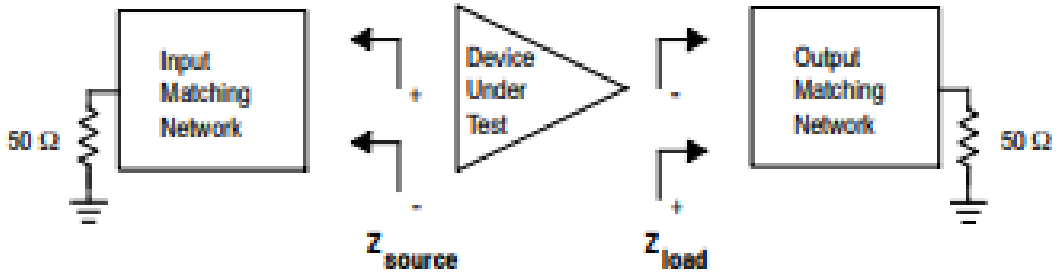
*C15 and C23 are mounted vertically.

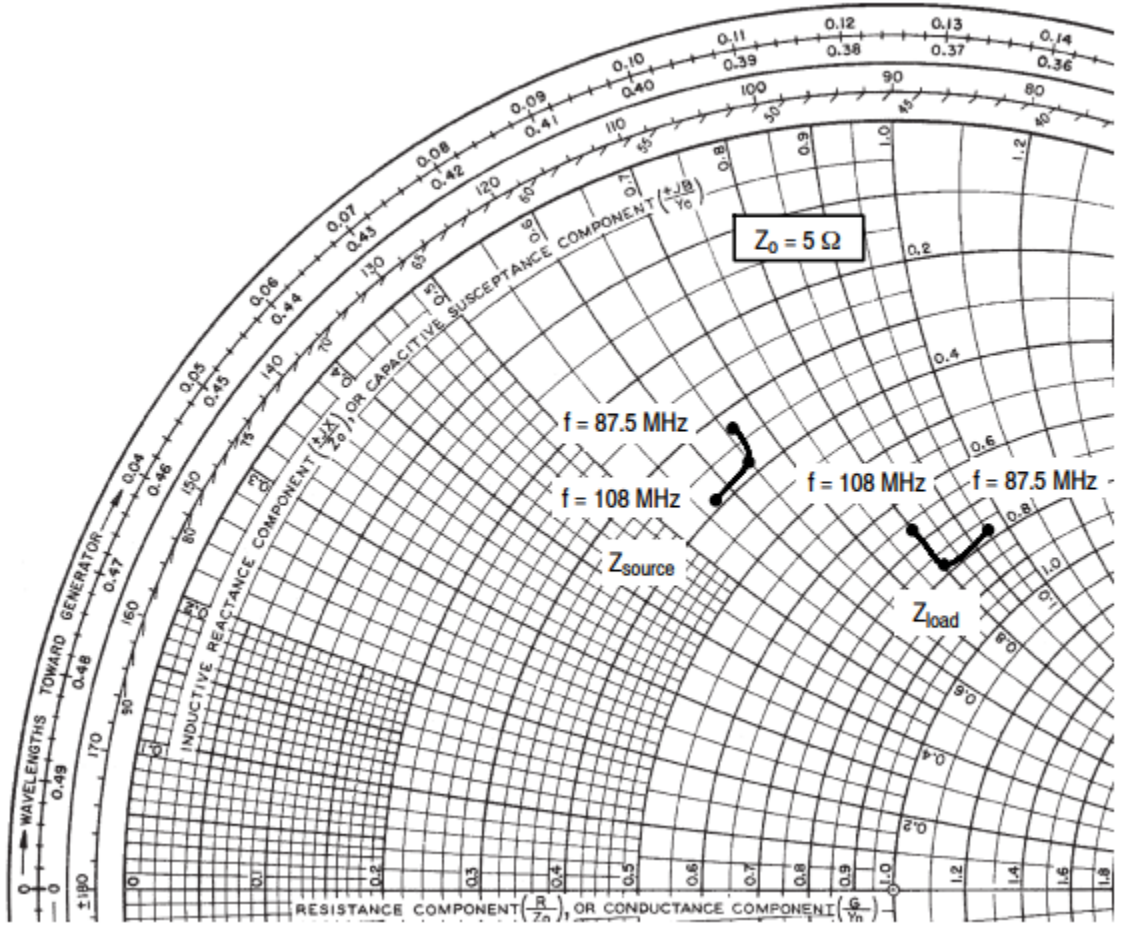
Impedances

f MHz	Z_{source} Ω	Z_{load} Ω
87.5	1.65 + j3.30	3.90 + j4.73
98	1.91 + j3.25	3.88 + j3.99
108	1.94 + j2.87	3.35 + j3.95

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

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





Revision History

- The following table summarizes revisions to the content of the MRFX1K80H 87.5-108 MHz Reference Circuit zip file:

Revision	Date	Description
0	September 2019	• Initial Release

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