MRF1K50H 87.5-108 MHz
REFERENCE CIRCUIT

ORDERABLE PART NUMBER: **MRF1K50H-TF1**

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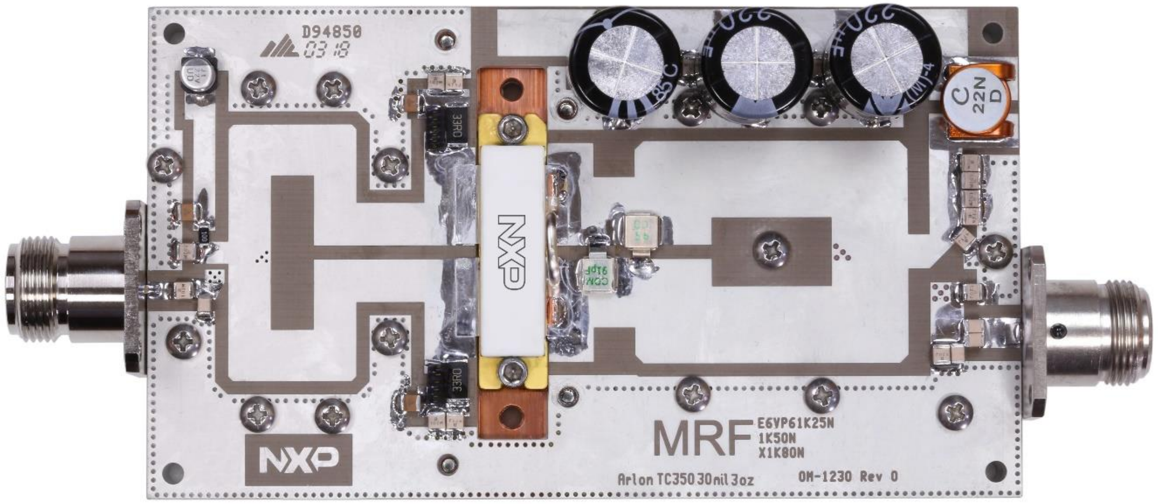
Introduction

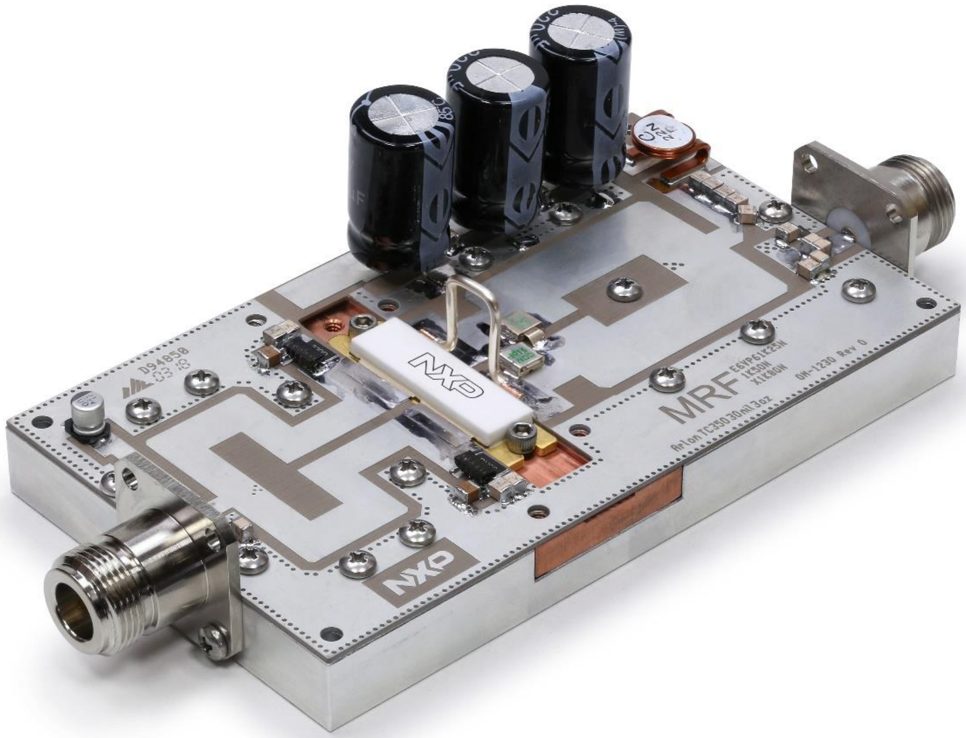
- The NXP MRF1K50H is a 1.8-500 MHz, 1500 W CW RF power LDMOS transistor housed in an NI-1230 air-cavity ceramic package. Its unmatched input and output allows wide frequency range utilization.
  - Further details about the device, including its data sheet, are available here.

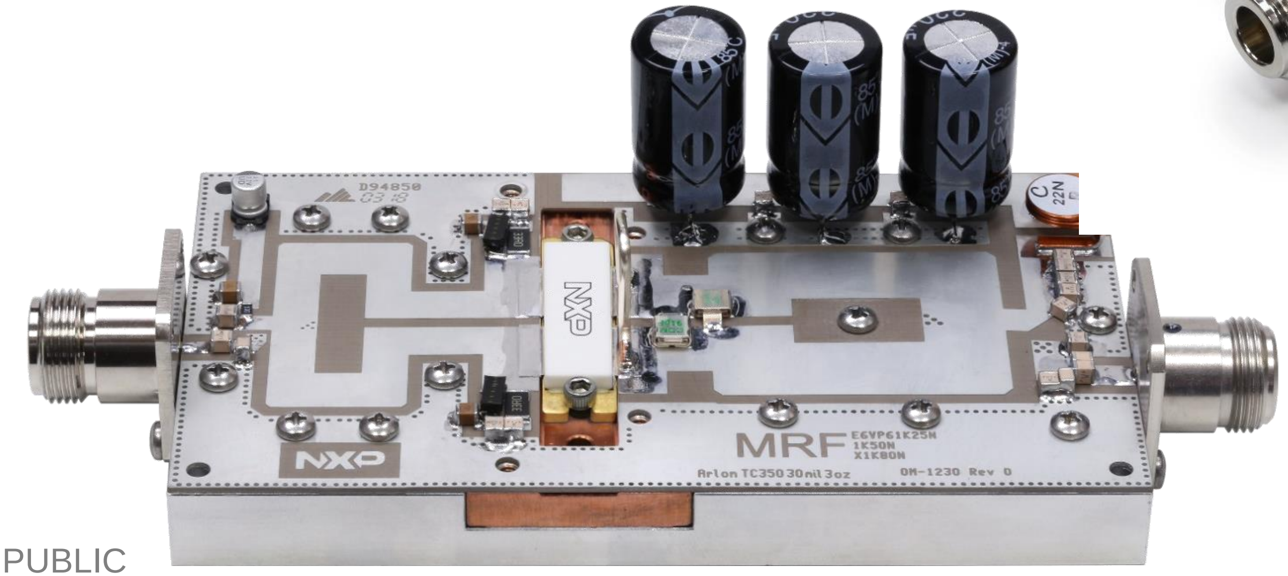
- The following pages describe the 87.5-108 MHz reference circuit (evaluation board). Its typical application is FM radio broadcast transmitters.

- The reference circuit can be ordered through NXP's distribution partners and etailers using part number MRF1K50H-TF1.

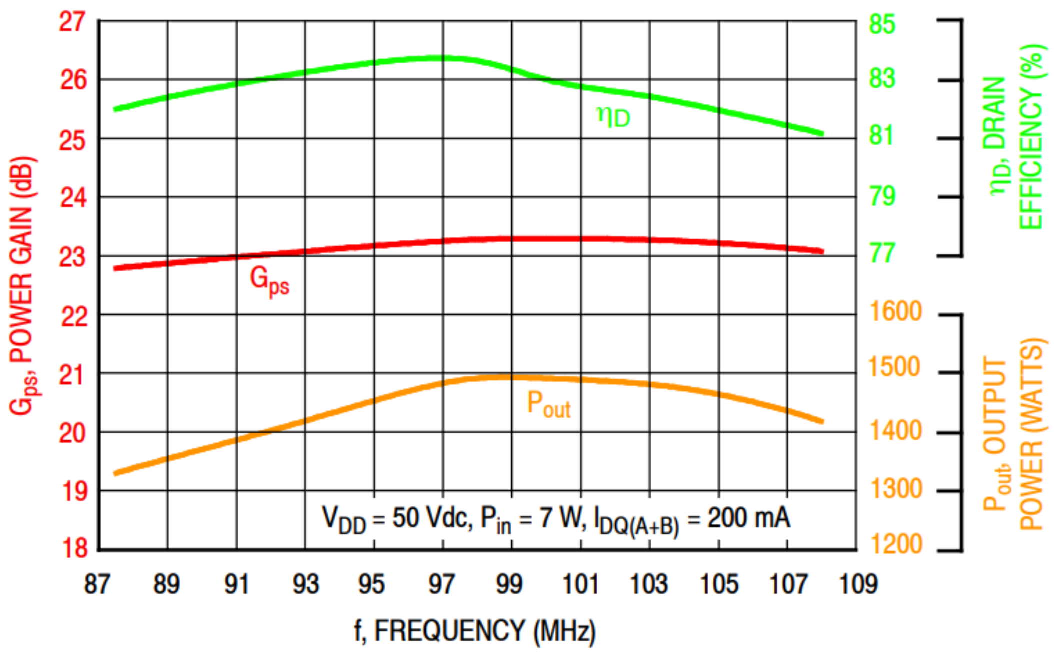
Circuit Overview – 7.3 cm × 13.0 cm (2.88″ × 5.12″)

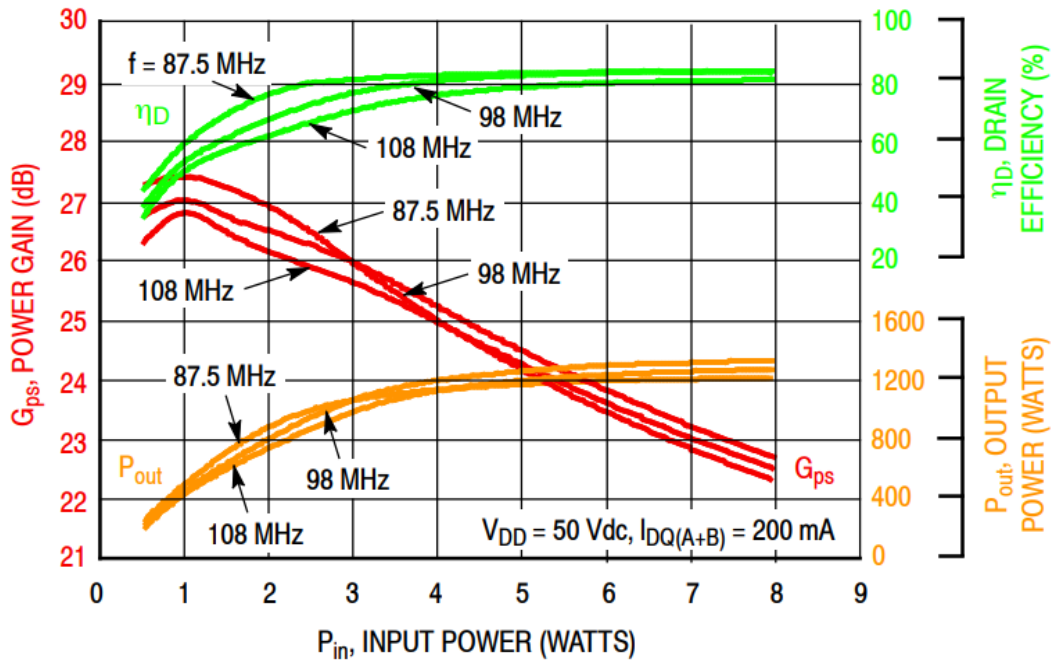






Typical CW Performance



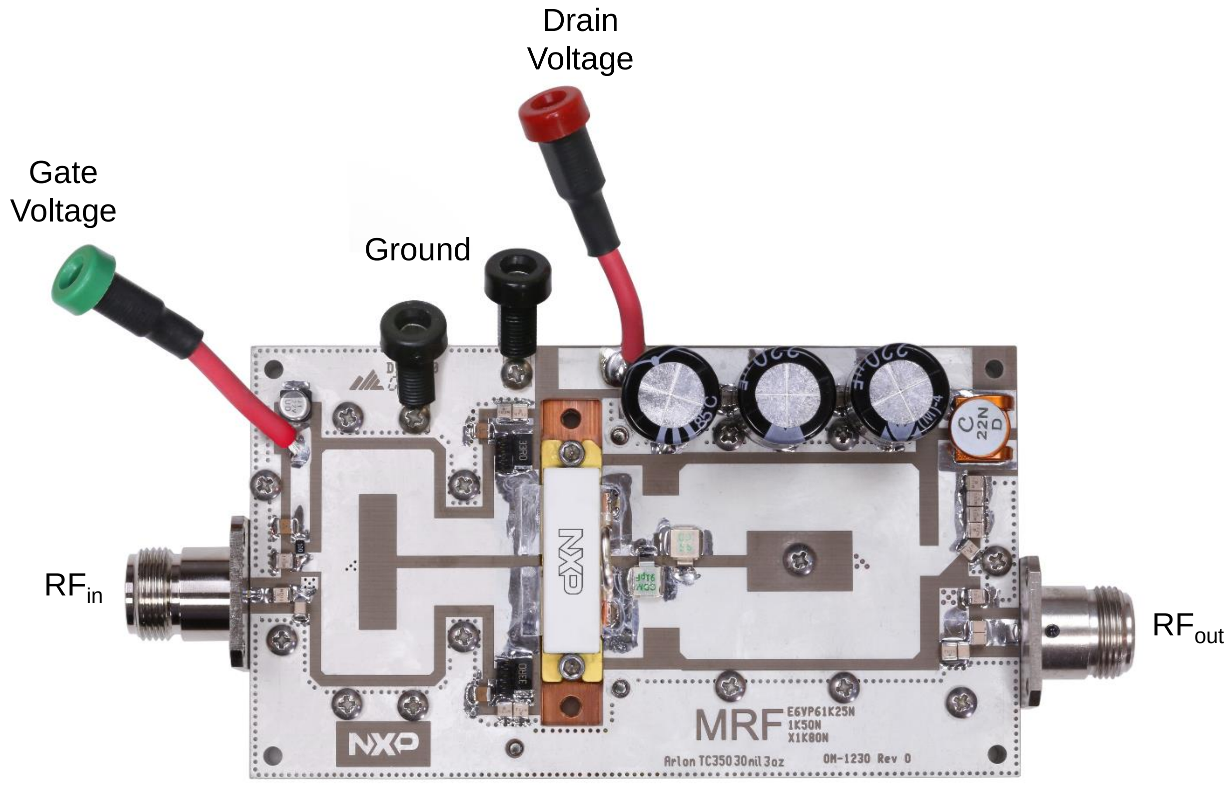


V_{DD} = 50 Vdc, $I_{DQ(A+B)}$ = 200 mA, P_{in} = 7 W, CW

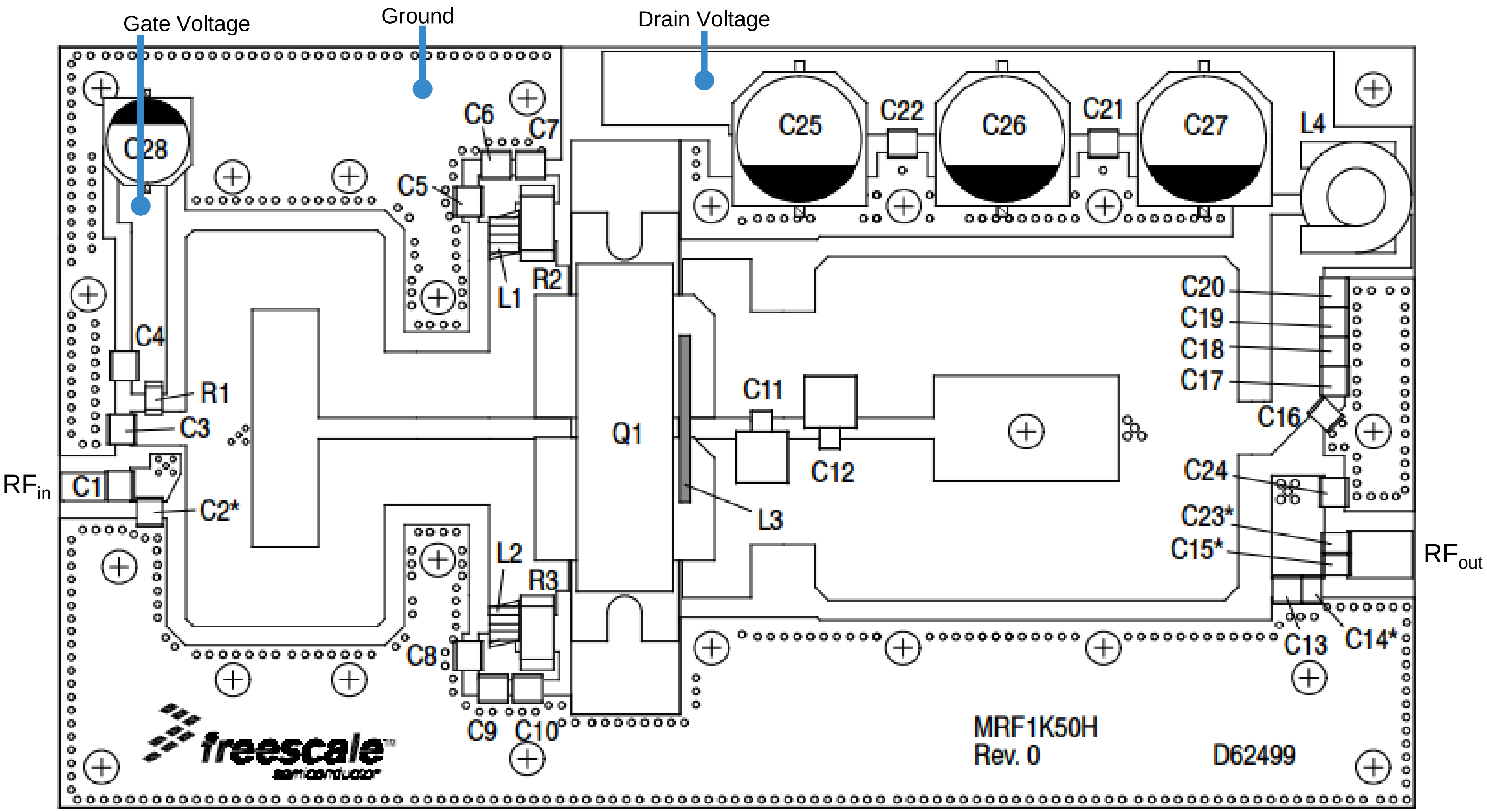
Frequency (MHz)	**G_{ps} (dB)**	**η_D (%)**	**P_{out} (W)**
87.5	22.8	81.8	1325
98	23.3	83.4	1475
108	23.0	81.2	1410

Quick Start

1. Mount the reference circuit onto a heatsink capable of dissipating more than 400 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 1500 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 it slowly to 50 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 2.4 V.
8. Raise the RF input slowly to 7.0 W (38.5 dBm).
9. Check the RF output power (typically 1475 W), the drain current (around 35 A for this power level) and the temperature of the board.

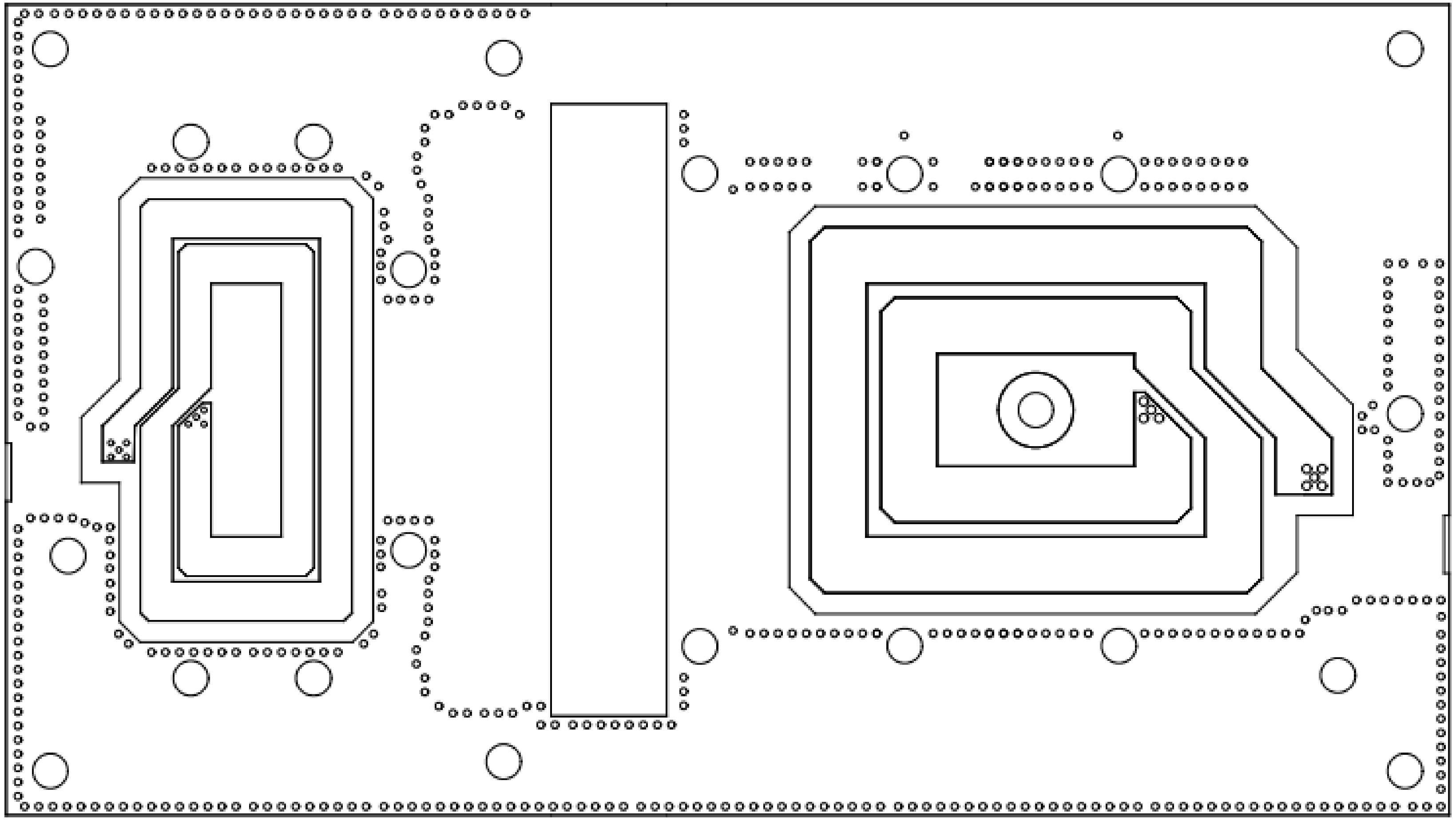


Component Placement Reference



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

PCB Backside



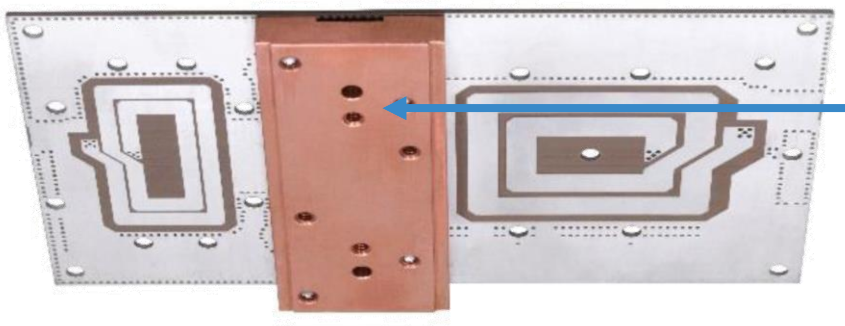
Bill of Materials

Part	Description	Part Number	Manufacturer
C1, C3, C6, C9, C18, C19, C20, C21, C22	1000 pF Chip Capacitors	ATC100B102JT50XT	ATC
C2	33 pF Chip Capacitors	ATC100B330JT500XT	ATC
C4, C5, C8	10,000 pF Chip Capacitors	ATC200B103KT50XT	ATC
C7, C10, C15, C16, C17, C23	470 pF Chip Capacitors	ATC100B471JT200XT	ATC
C11	91 pF 300 V Mica Capacitor	MIN02-002EC910J-F	CDE
C12	56 pF 300 V Mica Capacitor	MIN02-002DC560J-F	CDE
C13	2.2 pF Chip Capacitor	ATC100B2R2JT500XT	ATC
C14, C24	12 pF Chip Capacitors	ATC100B120GT500XT	ATC
C25, C26, C27	220 μF, 63 V Electrolytic Capacitors	EEV-FK2A221M	Panasonic
C28	22 μF, 35 V Electrolytic Capacitor	UUD1V220MCL1GS	Nichicon
L1, L2	17.5 nH Inductors, 6 Turns	B06TJLC	Coilcraft
L3	1.5 mm Non-Tarnish Silver Plated Copper Wire	SP1500NT-001	Scientific Wire Company
L4	22 nH Inductor	1212VS-22NMEB	Coilcraft
Q1	RF Power LDMOS Transistor	MRF1K50H	NXP
R1	10 Ω, 1/4 W Chip Resistor	CRCW120610R0JNEA	Vishay
R2, R3	33 Ω, 2 W Chip Resistors	1-2176070-3	TE Connectivity
PCB	Arlon TC350 0.030", ε_r = 3.5	D62499	MTL

Assembly Details

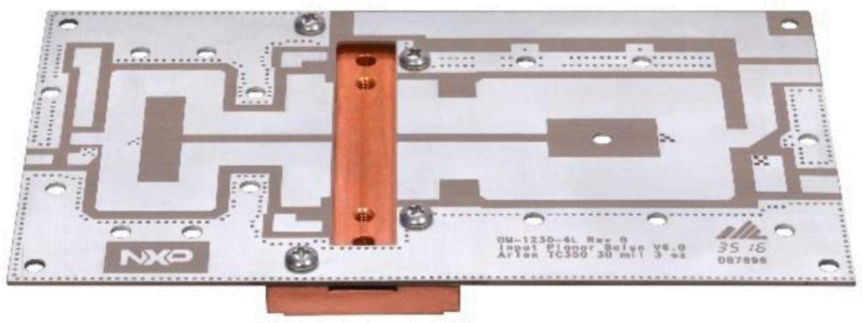
(Picture from another reference circuit with different size but with a similar concept)

- Back side view of the PCB:

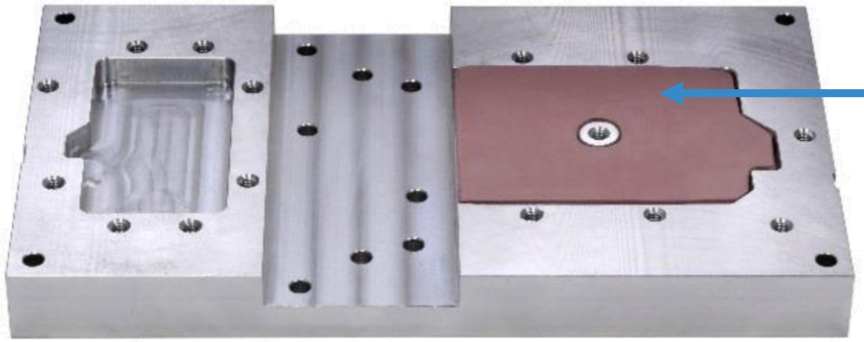


Copper insert soldered to the PCB

- Top side view of the PCB:



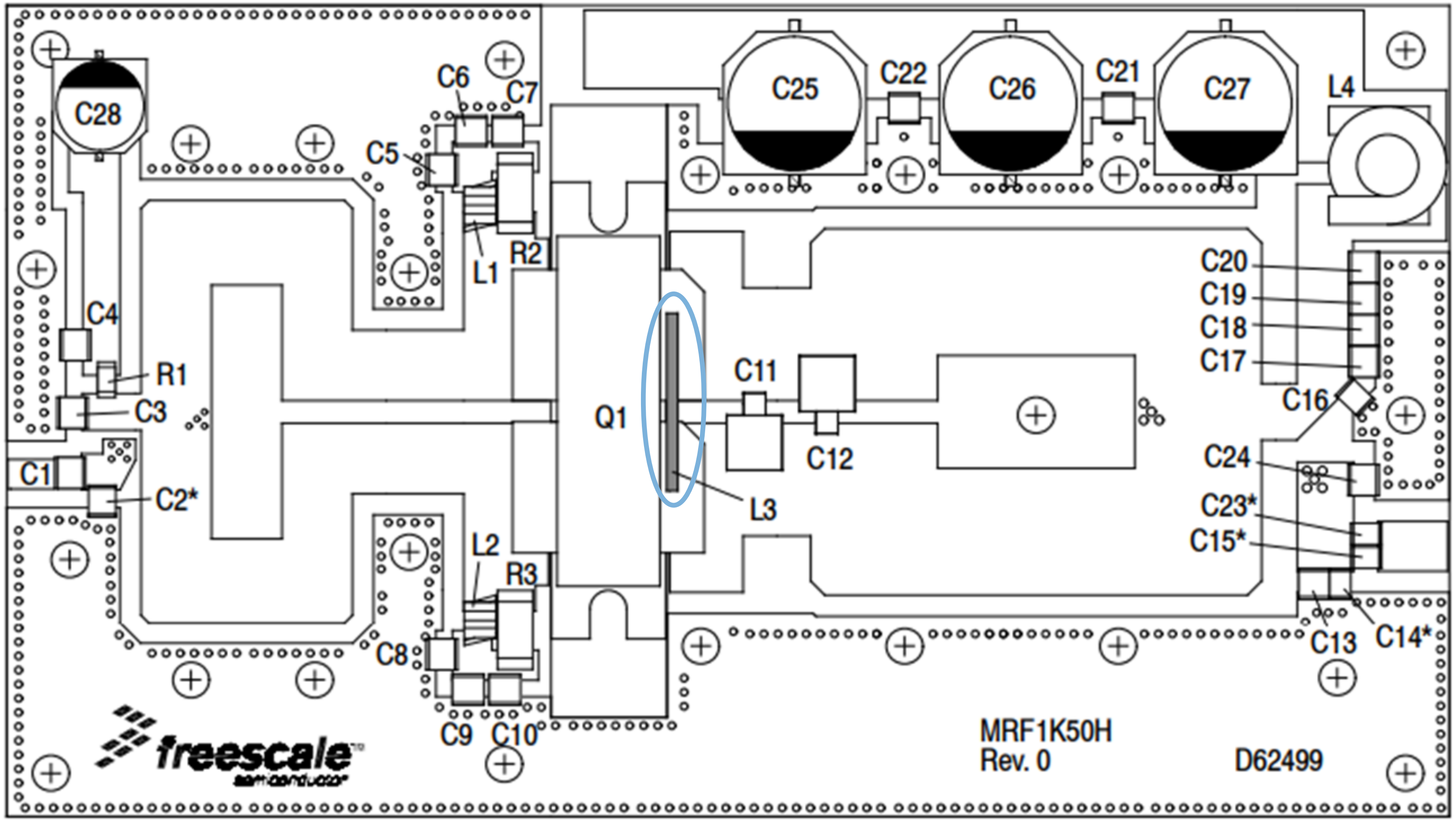
- Aluminum baseplate:



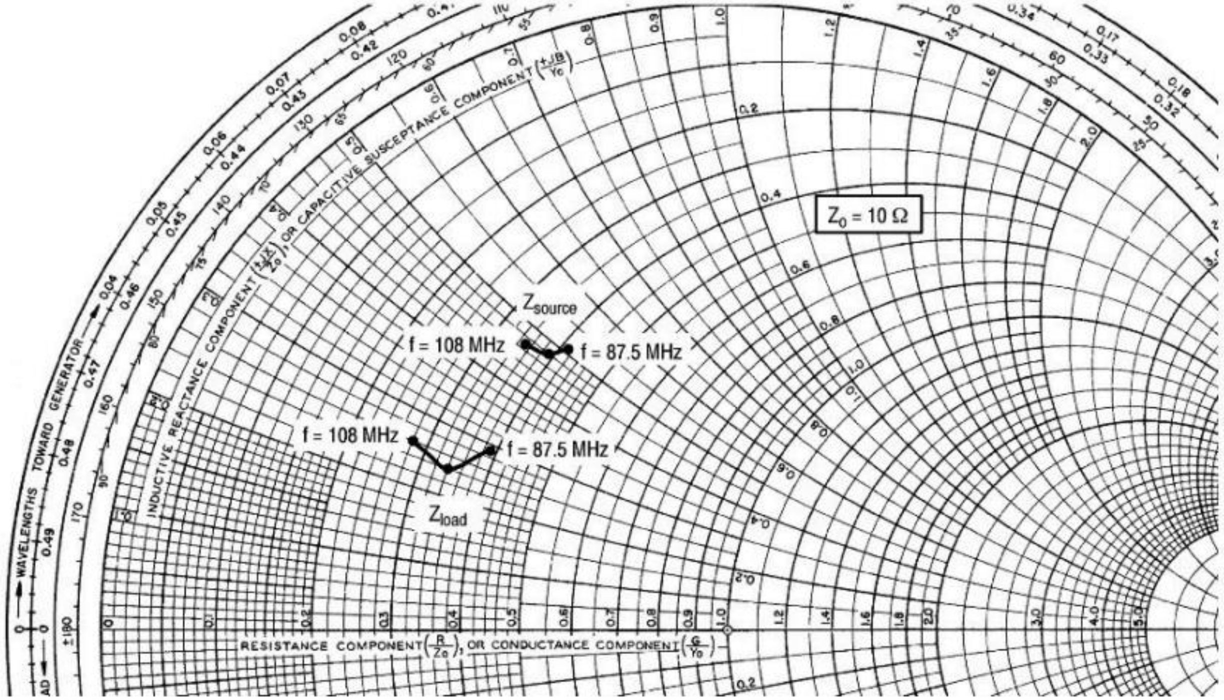
Thermal pad for heat dissipation on the drain side

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 is critical.



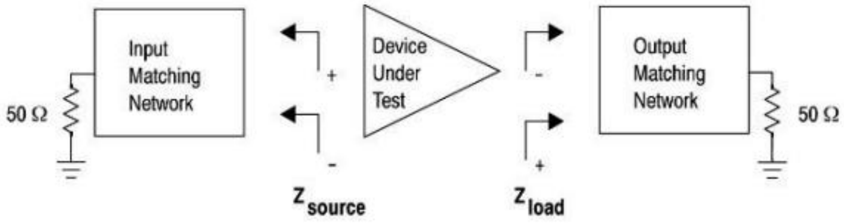
Impedances



f MHz	Z_{source} Ω	Z_{load} Ω
87.5	4.07 + j5.13	3.92 + j2.89
98	3.93 + j4.84	3.39 + j2.35
108	3.50 + j4.72	2.83 + j2.56

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 MRF1K50H 87.5-108 MHz Reference Circuit zip file.

Revision	Date	Description
0	September 2019	• Initial Release

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