MRFX1K80H 27 MHz REFERENCE CIRCUIT

ORDERABLE PART NUMBER: **MRFX1K80H-27MHZ**

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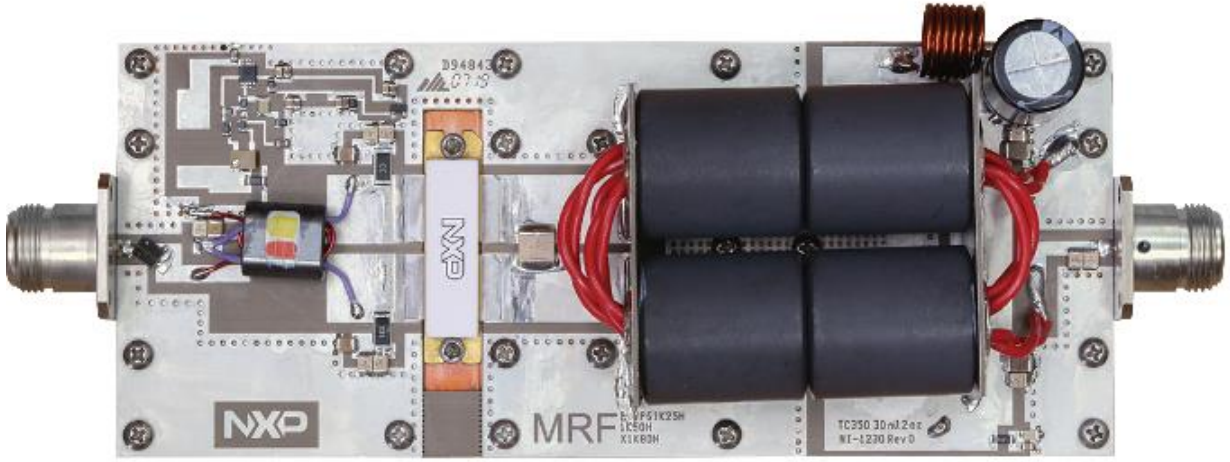
Introduction

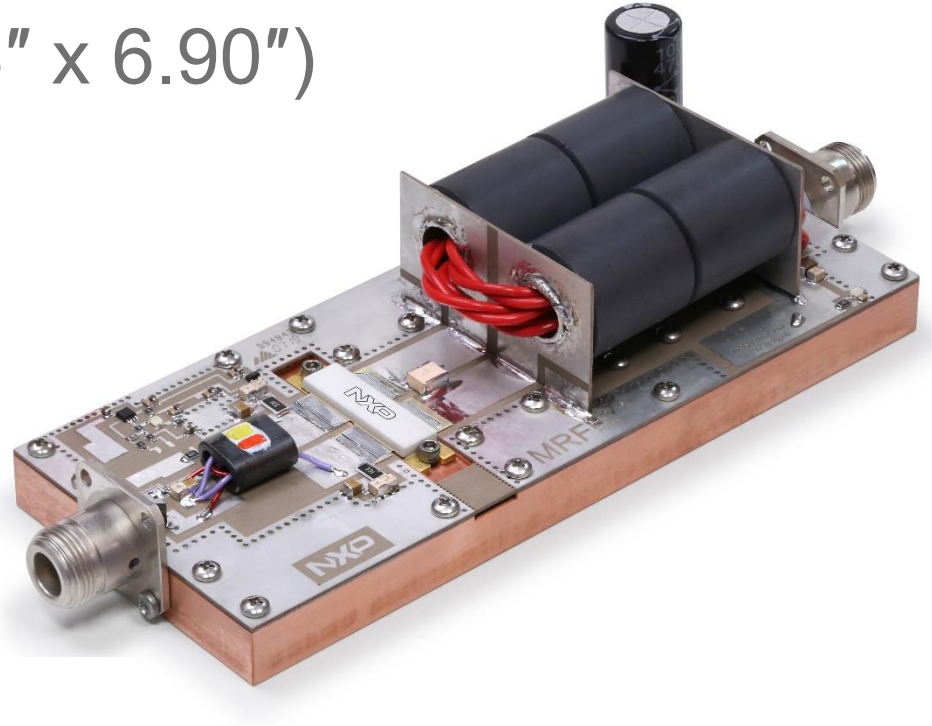
- The NXP MRFX1K80H is a 1.8-400 MHz, 1800 W CW RF power LDMOS transistor housed in an NI-1230 air-cavity ceramic package. Its unmatched input and output allows wide frequency range utilization.
  - Further details about the device, including its data sheet, are available on www.nxp.com/MRFX1K80H

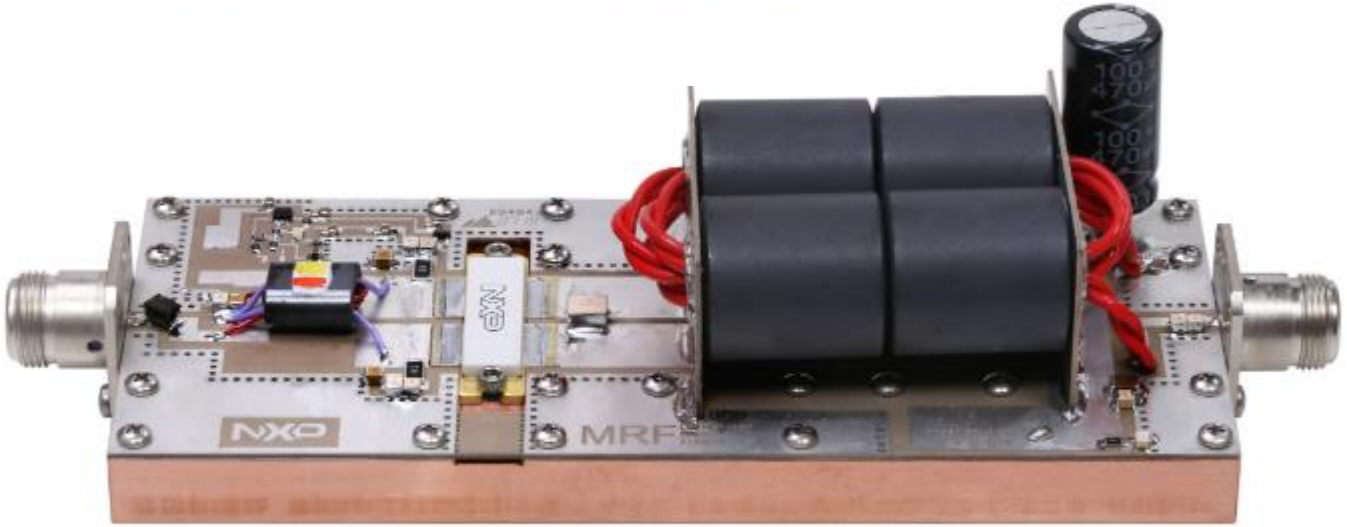
- The following pages describe the 27.12 MHz reference circuit (evaluation board).
  Its typical applications are industrial, scientific, medical (ISM), RF energy and plasma generation.

- The reference circuit can be ordered through NXP's distribution partners and etailers using part number MRFX1K80H-27MHZ.

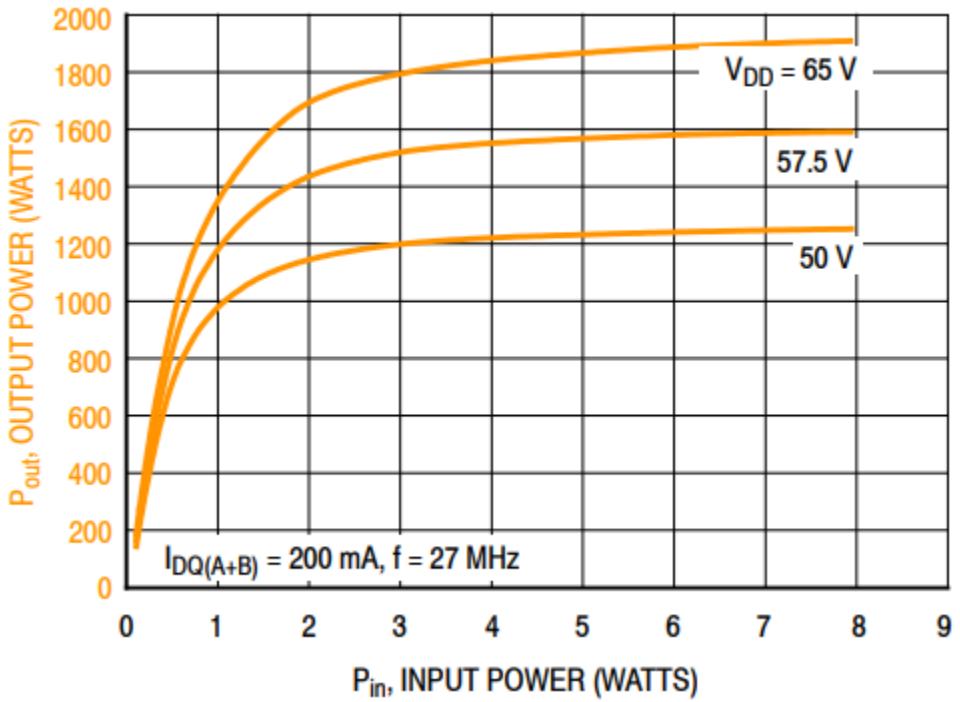
Circuit Overview – 7.3 cm x 17.5 cm (2.88″ x 6.90″)

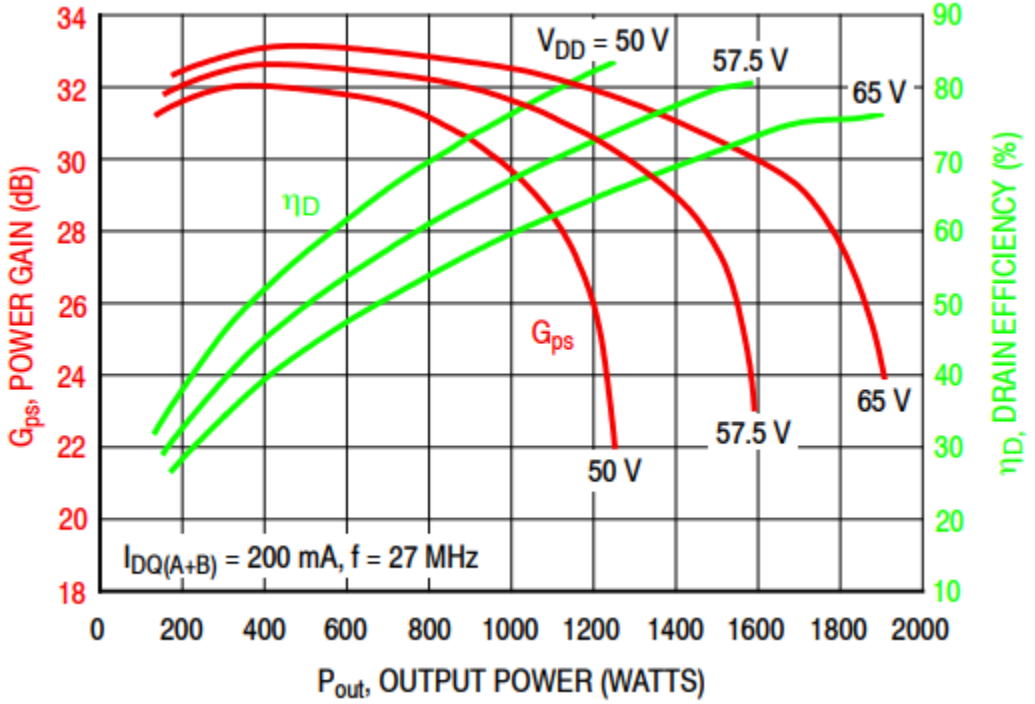






Typical CW Performance



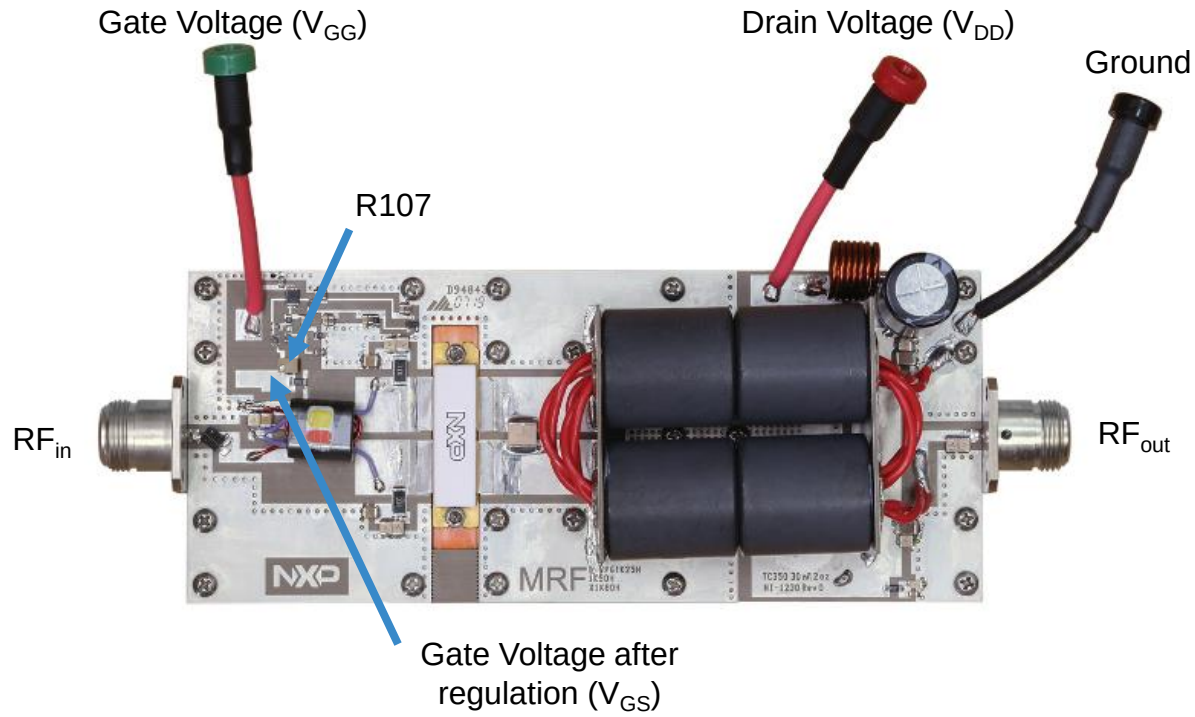


Typical Performance: $I_{DQ(A+B)}$ = 200 mA, P_{in} = 3 W (34.8 dBm), CW

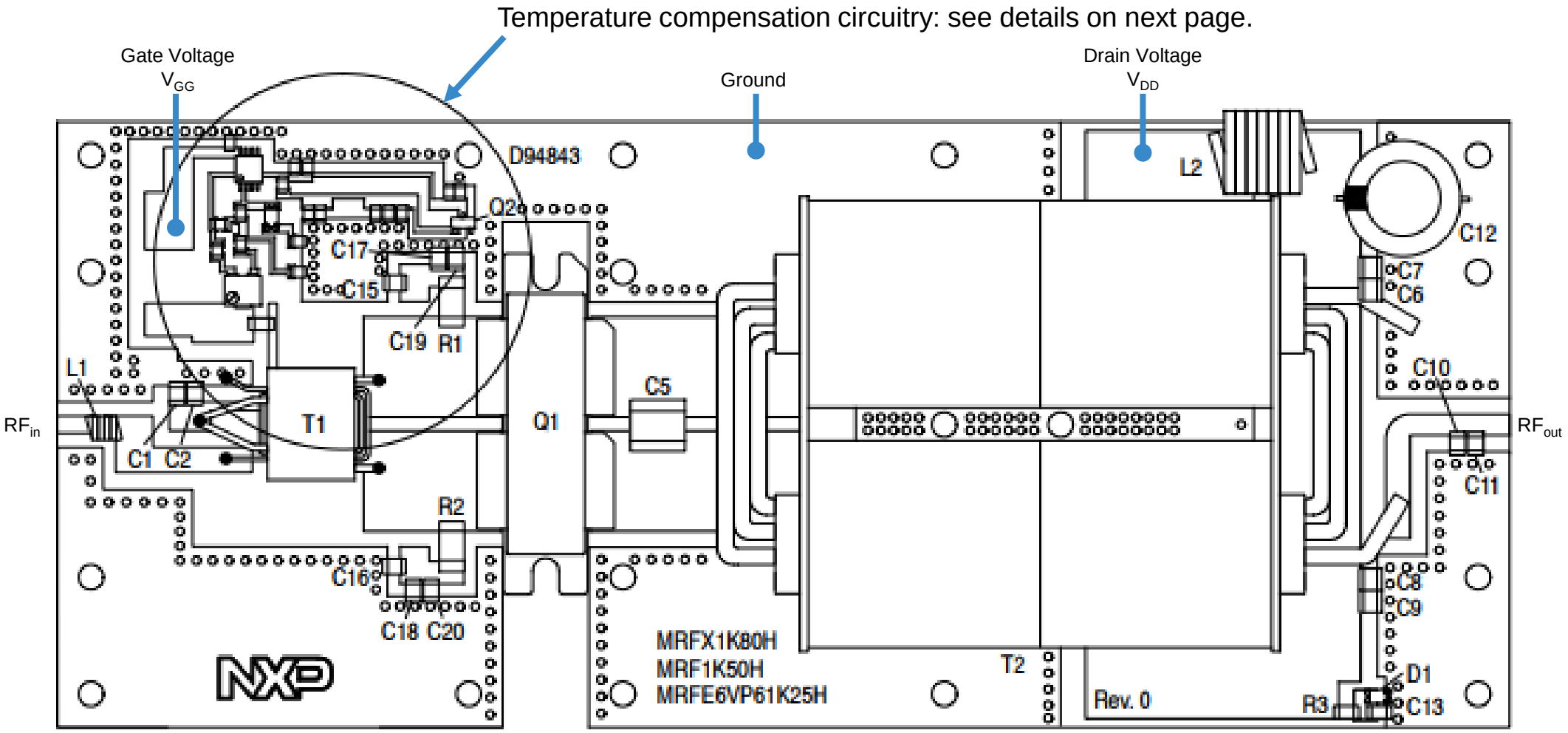
Frequency (MHz)	Drain Voltage (V_{DD})	Output Power (W)	Power Gain (dB)	Drain Efficiency (%)
27	50	1200	26.0	82.3
	57.5	1520	27.0	80.1
	65	1800	27.8	75.6

Quick Start

1. Mount the reference circuit onto a heatsink capable of dissipating more than 800 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 1800 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 65 V. Current should be 0 A.
7. Raise the gate voltage V_{GG} slowly to 12 V ensuring the drain current remains below or equal to typical quiescent current $I_{DQ(A+B)}$ = 200 mA. The gate voltage at the transistor level (V_{GS}) should be around 2.8 V.
8. If needed, adjust the R107 potentiometer to modify the gate voltage of the transistor V_{GS} to adjust the drain quiescent current $I_{DQ(A+B)}$.
9. Raise the RF input slowly to 3 W (34.8 dBm).
10. Check the RF output power (typically 1500 W), the drain current (around 33 A for this power level) and the temperature of the board.

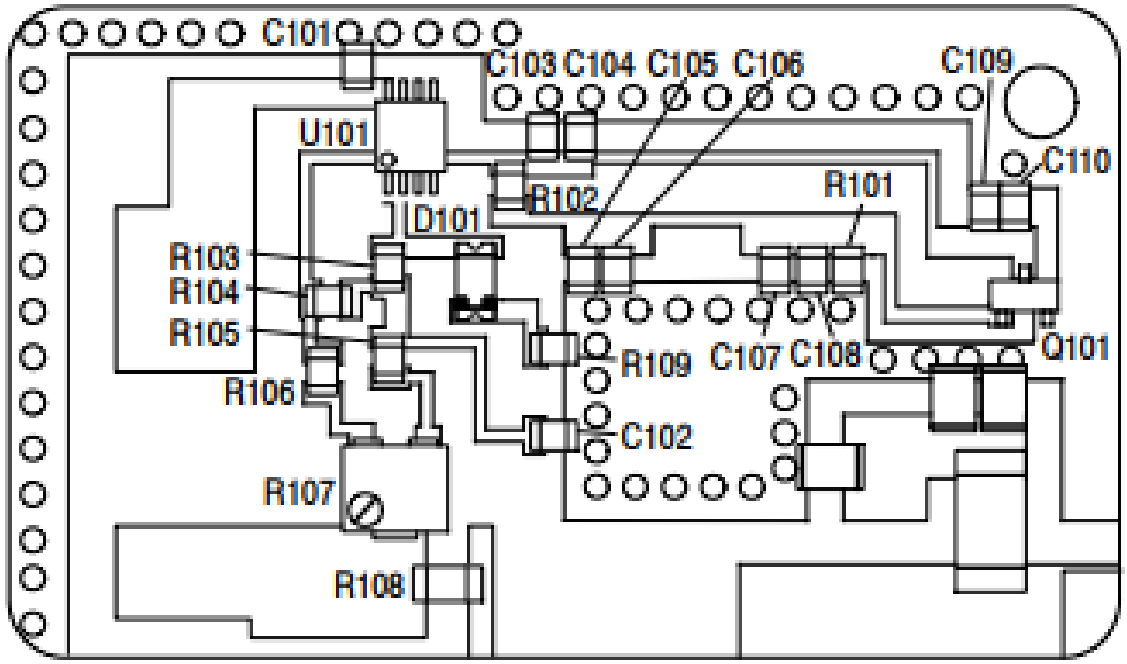


Component Placement Reference 1/2

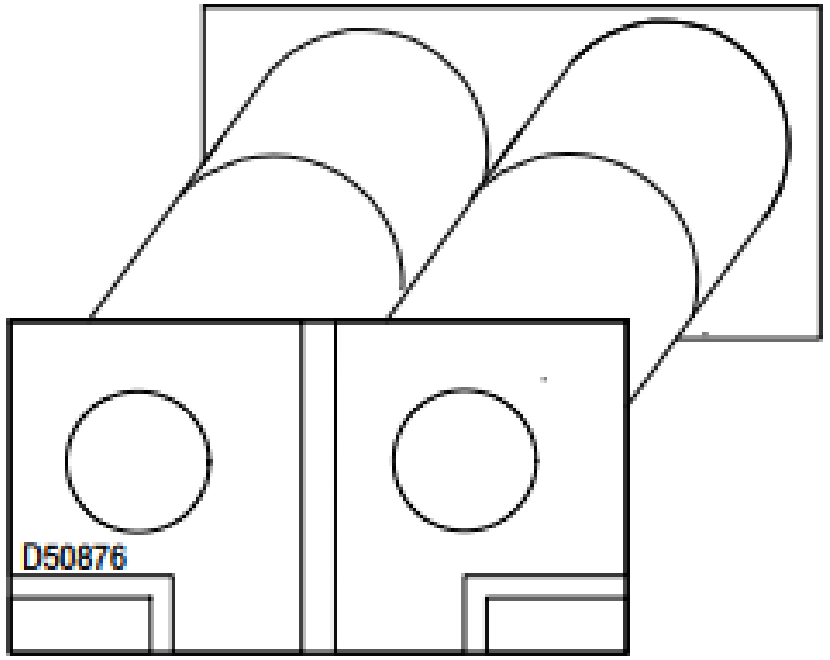


Note: Component numbers C3, C4 and C14 are not used.

Component Placement Reference 2/2



Temperature Compensation Detail



T2 Transformer Detail

Bill of Materials 1/2

Part	Description	Part Number	Manufacturer
C1, C17, C18	1000 pF Chip Capacitor	ATC100B102JT50XT	ATC
C2, C15, C16	39 K pF Chip Capacitor	ATC200B393KT50XT	ATC
C5	470 pF Chip Capacitor	ATC100C471JT2500XT	ATC
C6, C8	2.2 μF Chip Capacitor	HMK432B7225KM-T	Taiyo Yuden
C7, C9, C19, C20	470 pF Chip Capacitor	ATC100B471JT200XT	ATC
C10, C11	22 pF Chip Capacitor	ATC100B220JT500XT	ATC
C12	470 μF, 100 V Electrolytic Capacitor	MCGPR100V477M16X32-RH	Multicomp
C13	1000 pF Chip Capacitor	C2012X7R2E102M	TDK
D1	Green LED, 1206	LG N971-KN-1	OSRAM
L1	82 nH Inductor	1812SMS-82NJLC	Coilcraft
L2	7 Turns, #16 AWG, ID = 10 mm Inductor, Hand Wound	8074	Belden
Q1	RF Power LDMOS Transistor	MRFX1K80H	NXP
R1, R2	33 Ω, 3 W Chip Resistor	1-2176070-3	TE Connectivity
R3	9.1 kΩ, 1/4 W Chip Resistor	CRCW12069K10FKEA	Vishay
PCB	Arlon TC350 0.030″ ε_r = 3.5	D94843	MTL

(continued)

Bill of Materials 2/2

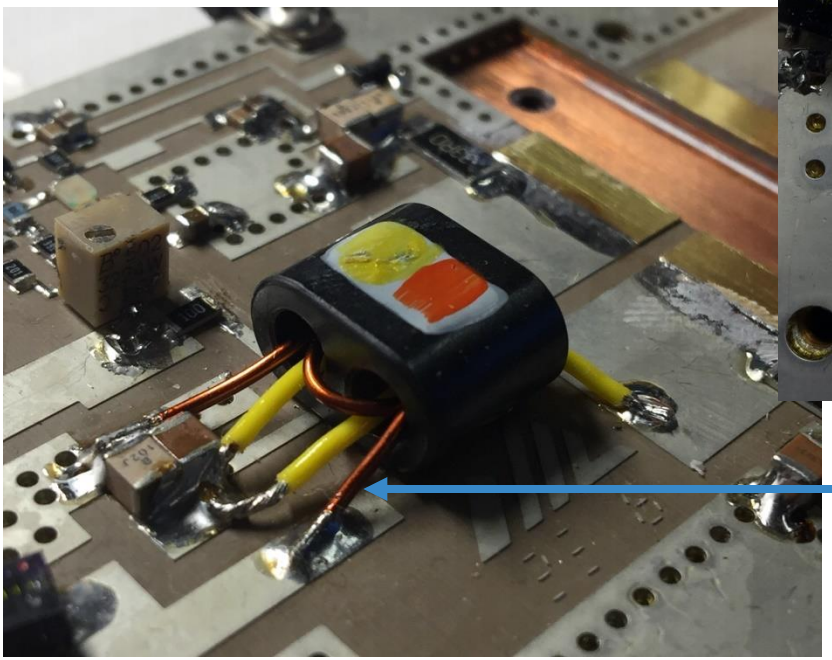
Transformer

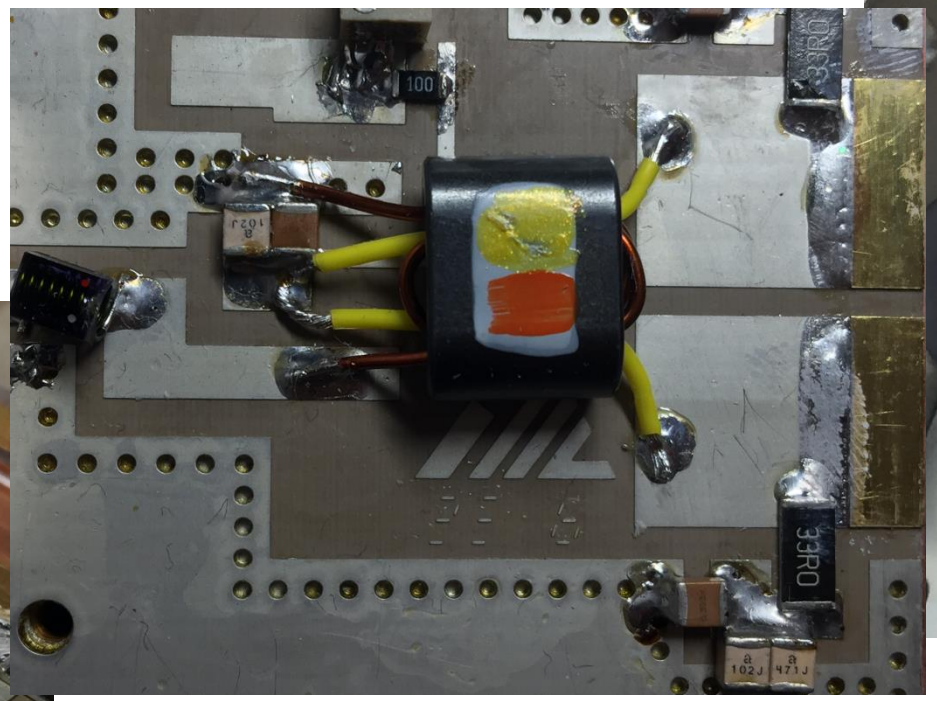
T1 Core	Multi-Aperture Core, 43 Material	2843000302	Fair-Rite
T1 Primary	2 Turns, #20 AWG Magnetic Wire	8076	Belden
T1 Secondary	1 Turn, #24 AWG Teflon Wire	5854/7 BL005	Alpha Wire
T2 Core	61 Round Cable Core, x4	2661102002	Fair-Rite
T2 Primary	Copper Pipe, Type L, ID = 3/8″, OD = 1/2″, cut to 2.4″	LH03010	Mueller
T2 Secondary	3 Turns, #16 AWG PTFE Covered Wire, Twisted	TEF16	RF Parts Company
T2 PCB	Arlon TC350 0.030″ ε_r = 3.5, x2	D50876	MTL

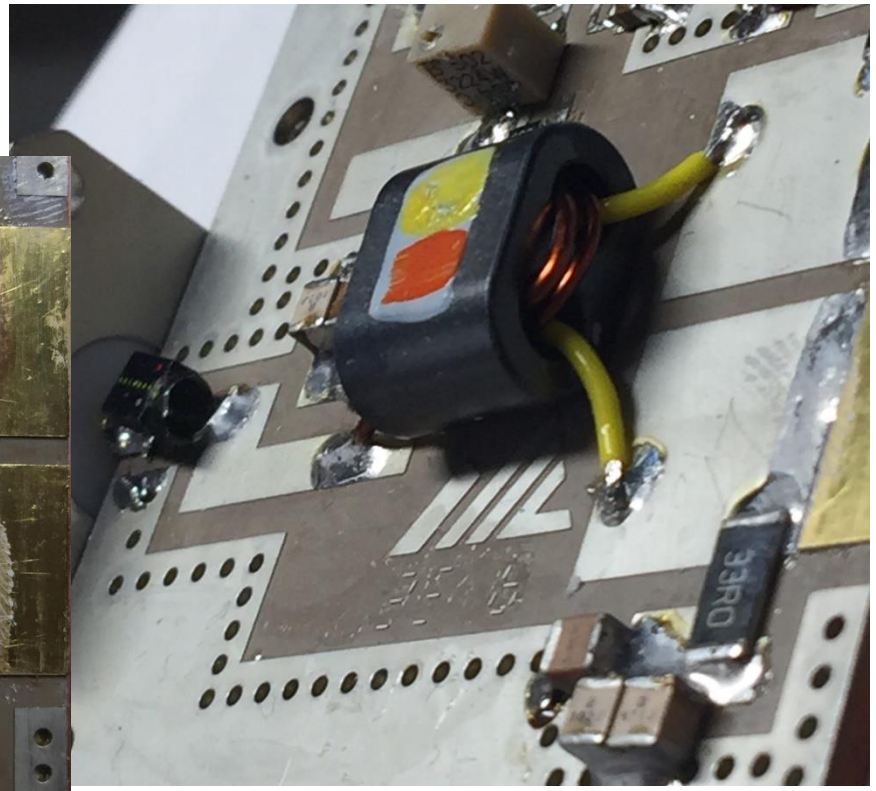
Temperature Compensation

C101, C102, C104, C106, C108, C110	1 μF Chip Capacitor	GRM21BR71H105KA12L	Murata
C103, C105, C107, C109	1 nF Chip Capacitor	C2012X7R2E102M	TDK
D101	Red LED, 1206	LH N974-KN-1	OSRAM
Q101	NPN Bipolar Transistor	BC847ALT1G	ON Semiconductor
R101	2.2 kΩ, 1/8 W Chip Resistor	CRCW08052K20JNEA	Vishay
R102, R109	1.2 kΩ, 1/8 W Chip Resistor	CRCW08051K20FKEA	Vishay
R103	10 Ω, 1/8 W Chip Resistor	RK73H2ATTD10R0F	KOA Speer
R104	1 kΩ, 1/8 W Chip Resistor	RR1220P-102-D	Susumu
R105	3.9 kΩ, 1/8 W Chip Resistor	CRCW08053K90JNEA	Vishay
R106	200 Ω, 1/8 W Chip Resistor	CRCW0805200RJNEA	Vishay
R107	5 kΩ Multi-turn Cermet Trimming Potentiometer, 11 Turns	3224W-1-502E	Bourns
R108	10 Ω, 1/4 W Chip Resistor	CRCW120610R0JNEA	Vishay
U101	Voltage Regulator 5 V, Micro8	LP2951ACDMR2G	ON Semiconductor

T1 Input Balun Details

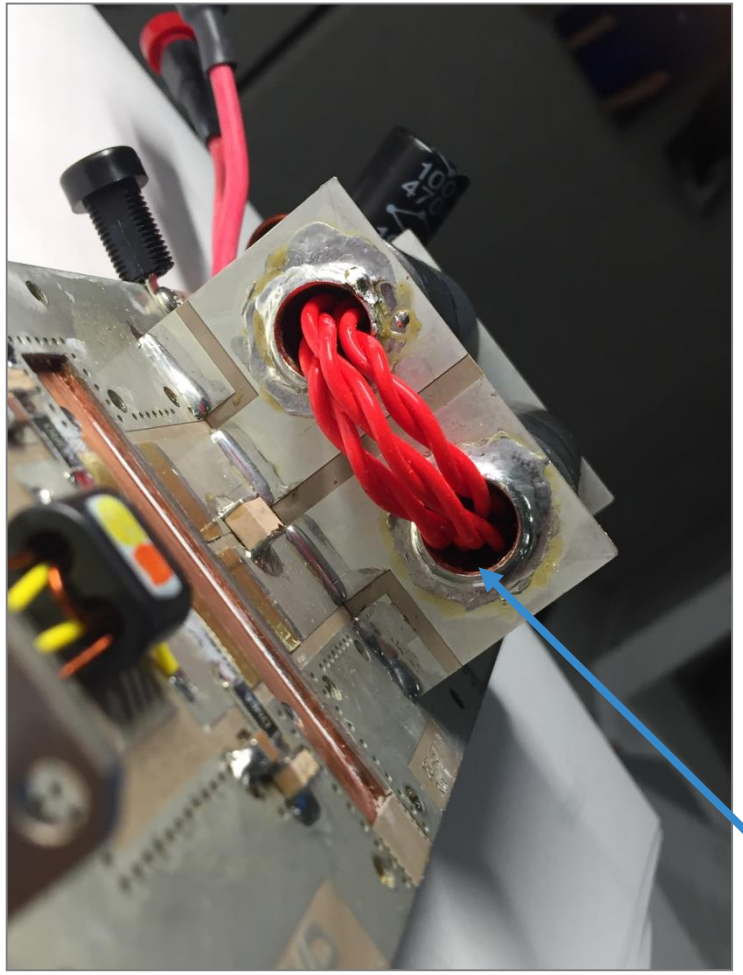


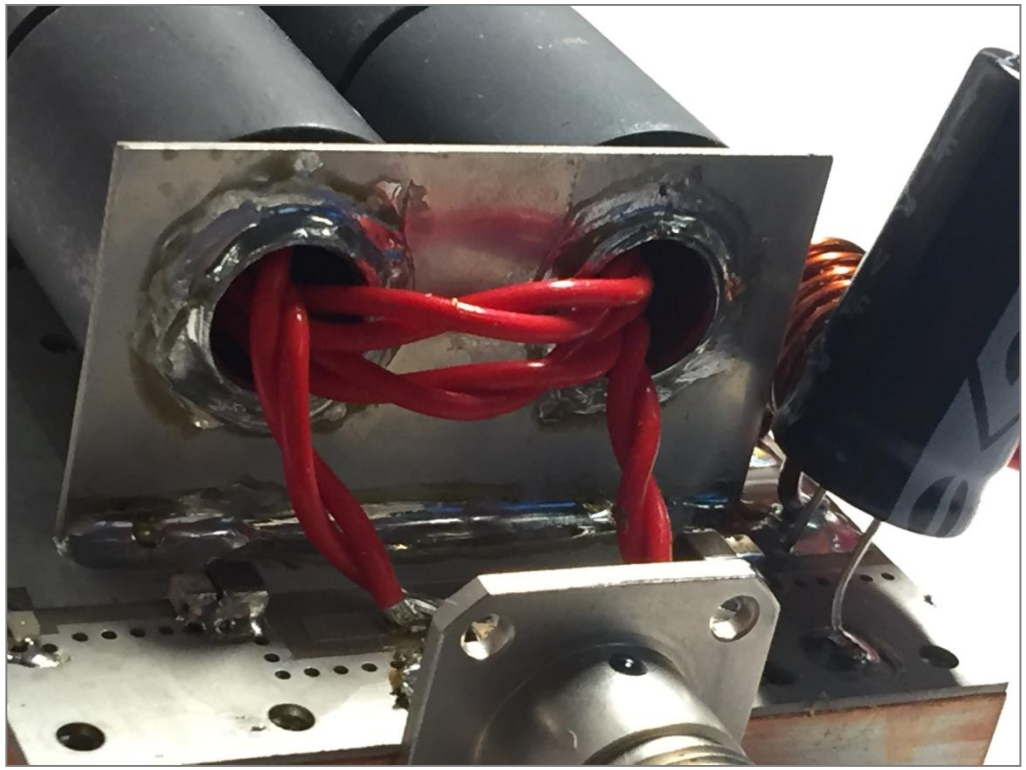


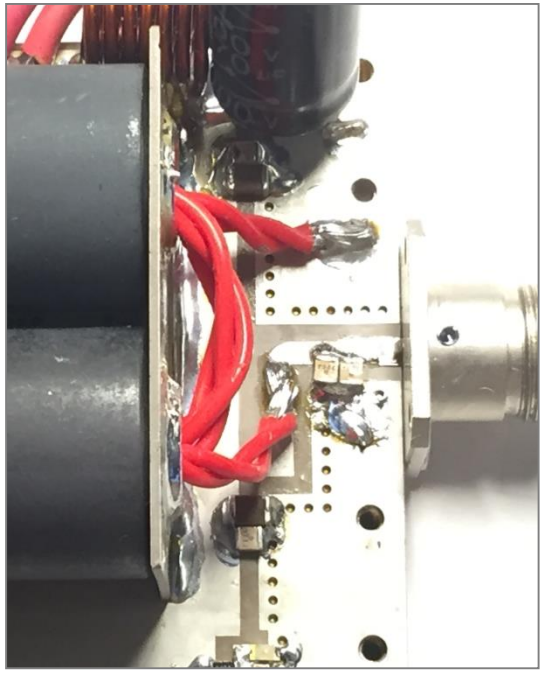


The primary cable (brown) makes 2 turns within the transformer.
The secondary cable (yellow) makes 1 turn within the transformer.
At half its length, the secondary cable has a connection to the decoupling capacitors.

T2 Output Balun Details



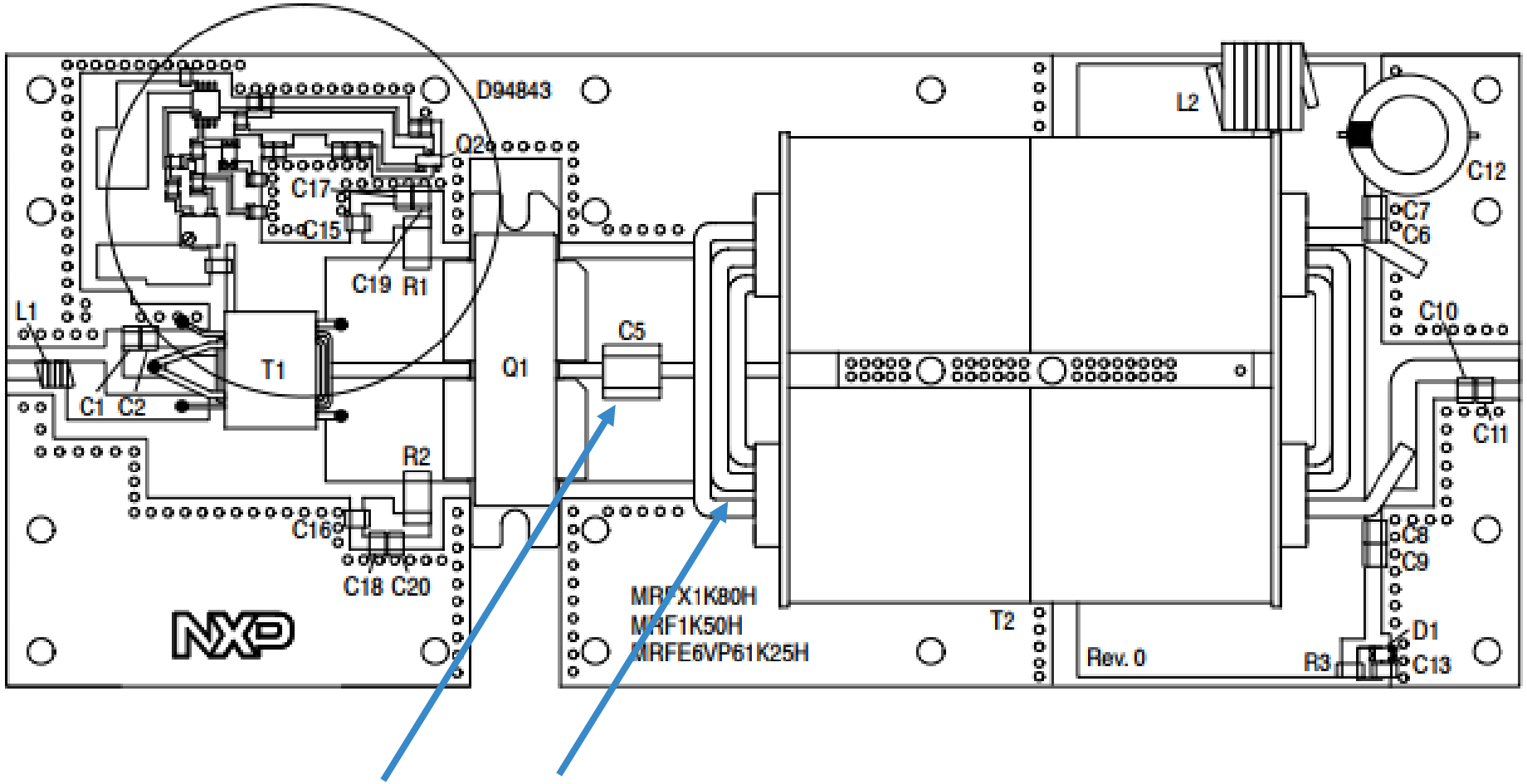




The twisted wire makes 3 turns
within the transformer.

The vertical PCBs for the T2 output transformer is cut from the D50876 board (MRFX1K80H 27 MHz Output Balun PCB.dxf).

Tuning Tips



Move C5 to adjust efficiency and output power.

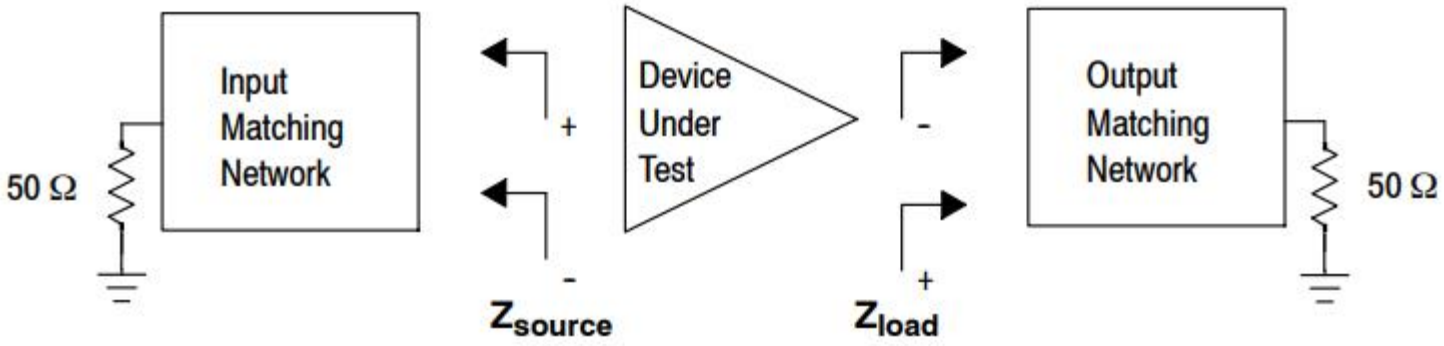
To further adjust efficiency and output power, modify the length of each twist of the twisted cable within the T2 output transformer, starting from 1.5″ (38 mm) per twist.

Impedances

f MHz	Z_{source} Ω	Z_{load} Ω
27	8.70 + j6.28	6.21 + j2.68

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 27 MHz Reference Circuit zip file:

Revision	Date	Description
0	September 2019	• Initial Release

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