RMPA2451-58
2.4 to 2.5 GHz GaAs MMIC Power Amplifier

Description

Raytheon RMPA2451-58 is a partially matched monolithic power amplifier in a surface mount package for use in wireless applications in the 2.4 to 2.5 GHz ISM frequency band. The amplifier may be biased for linear, class AB or class F for high efficiency applications. External matching components are required to optimize the RF performance. The MMIC chip design utilizes Raytheon's 0.25 μm power PHEMT process.

Maximum Ratings

Parameter	Symbol	Value	Unit
Positive Drain DC Voltage	V_{d1},V_{d2}	+8	Volts
Negative Gate DC Voltage	V_{g1},V_{g2}	-5	Volts
Simultaneous Drain to Gate Voltage	V_d-V_g	+10	Volts
RF Input Power (from 50Ω source)	P_{in}	+10	dBm
Drain Current, First Stage	I_{d1}	75	mA
Drain Current, Second Stage	I_{d2}	525	mA
Gate Current	I_g	5	mA
Channel Temperature	T_{ch}	175	°C
Operating Case Temperature	T_{case}	-40 to 85	°C
Storage Temperature Range	T_{stg}	-40 to 125	°C
Thermal Resistance (Channel to Case)	R_{th}	33	°C/Watt

Electrical Characteristics (Notes 3, 4. At 25°C using Raytheon Test Boards)

Parameter	Min	Typ	Max	Unit
Frequency Range	2400	2450	2500	MHz
Gain (Note 1, 2, 3)	28.5	33		dB
Output Power, P1dB (Note 1, 3)	27	28.5		dBm
Assoc. Power Added Efficiency		33		%
3rd order Intermod. Product (Note 4)		-30	-27	dBc
Drain Current (I_{d1}), First Stage			75	mA
Drain Current (I_{d2}), Second Stage			525	mA
Gate Current (I_{g1} + I_{g2})			5	mA
Input Return Loss (50Ω), (Note 2)	7.5			dB

Notes:

1. Idq1 = 60 mA, Idq2 = 340 mA, Vd1 = Vd2 = +5.0 V.
2. Pin= -10 dBm.
3. Production Testing includes Gain, Output Power at 1-dB gain compression (P1dB) and Input Return Loss at V_{d1} = V_{d2} = +5.0V; V_{g1},V_{g2} = -0.5V (nominal), adjust V_{g1} and V_{g2} to get I_{dq1} = 60 mA, I_{dq2} = 340 mA and at F = 2.45 GHz.
4. Two tone 3rd order Output Intermodulation products (IM3) are measured with total output power level of +25 dBm.

Other Parameters are guaranteed by Design Validation Testing (DVT).

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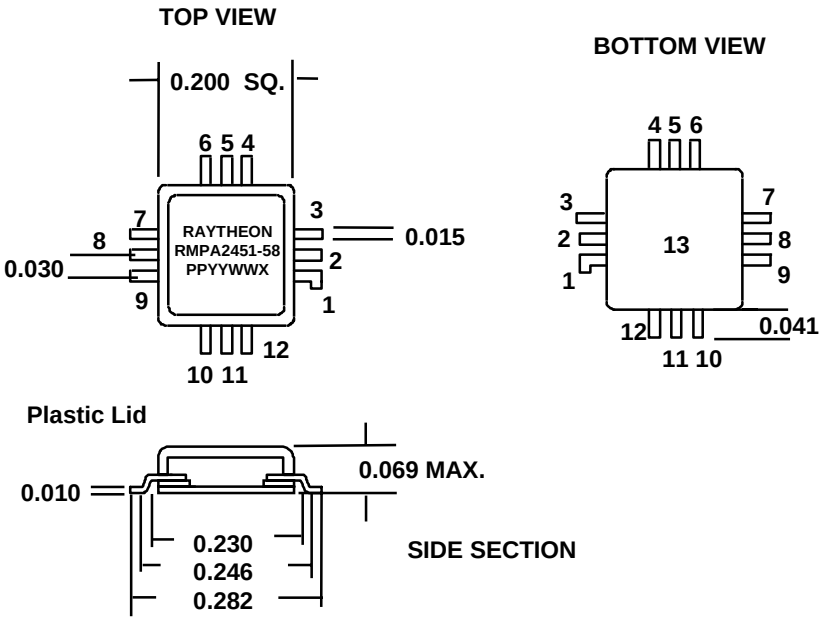
Figure 1. Outline Dimensions (RMPA2451-58)



Dimensions in inches

Pin #	Description
1	Vd_2 + RF Out
2	Vd_2 + RF Out
3	Vd_2 + RF Out
4	GND
5	Vd1
6	GND
7	GND
8	RF In
9	GND
10	Vg1
11	Vg2
12	GND
BASE	GND

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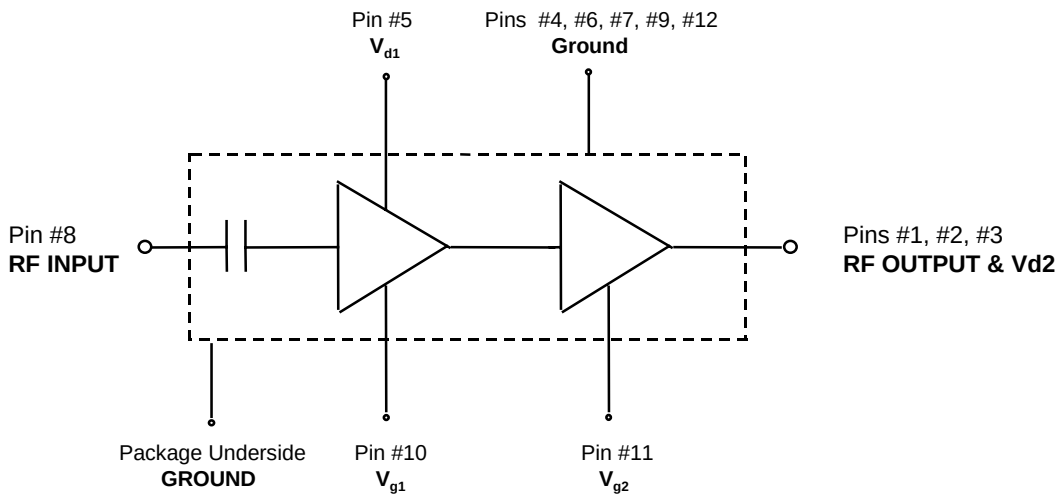
Application Information

CAUTION: THIS IS AN ESD SENSITIVE DEVICE

The following describes the procedure for evaluating the RMPA2451-58, a partially-matched Pseudomorphic High Electron Mobility (PHEMT) monolithic power amplifier which has been designed for wireless applications in the 2.4 - 2.5 GHz ISM band, in a surface mount package. Figure 1 illustrates the package outline, along with the pin designations, while Figure 2 provides a functional block diagram of the packaged product.

It should be noted that the RMPA2451-58 requires the use of external passive components to form the DC bias and RF output matching circuits. The schematic for a recommended circuits is shown in Figure 3, along with a list of the appropriate components. Figure 4 illustrates the layout of an evaluation board based on this schematic (RMPA2451-58-TB).

Figure 2: Functional Block Diagram (RMPA2451)



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Test Procedure for Evaluation Board RMPA2451-58-TB

(1) Turn the RF power OFF.

(2) Use the GND terminals of the evaluation board for the ground of the DC supplies.

(3) Apply a nominal voltage of approximately -0.5V to both V_{gg1} and V_{gg2} terminals.

(4) Apply a nominal voltage of +5.0V to the V_{dd} terminals. Adjust V_{gg1} to give a first stage quiescent Drain current, I_{d1} of 60mA. Adjust V_{gg2} to provide a second stage quiescent Drain current, I_{dd2}, of 340 mA.

(5) Apply an RF signal within the ISM frequency range (2.4 - 2.5 GHz) at an initial input power level of -10 dBm.

(6) To perform intermodulation product measurements, a second RF signal generator with a frequency difference of 1 MHz is required, along with an appropriate power combiner. The test configuration should allow this additional generator to provide the same input power level as the first generator into the device. Intermodulation readings may then be made at the required total output power levels.

(7) To operate at lower quiescent Drain currents, increase the magnitudes of V_{gg1} and V_{gg2} as required, alternatively to operate at higher quiescent Drain currents, the magnitudes of V_{gg1} and V_{gg2} should be decreased accordingly.

(8) When turning the amplifier OFF, the power-up sequence should be reversed.

Figures 5 to 7 illustrate typical device performance. This data for various operating parameters was obtained across the design bandwidth over a range of temperatures.

Figure 5 shows the variation in Gain and P1dB with temperature and operating frequency.

Figure 6 shows the 3rd-order intermodulation product measured at different total output power levels.

Figure 7 demonstrates the device performance under a Wideband Code Division Multiple Access (W-CDMA) modulation scheme, the conditions of which are specified.

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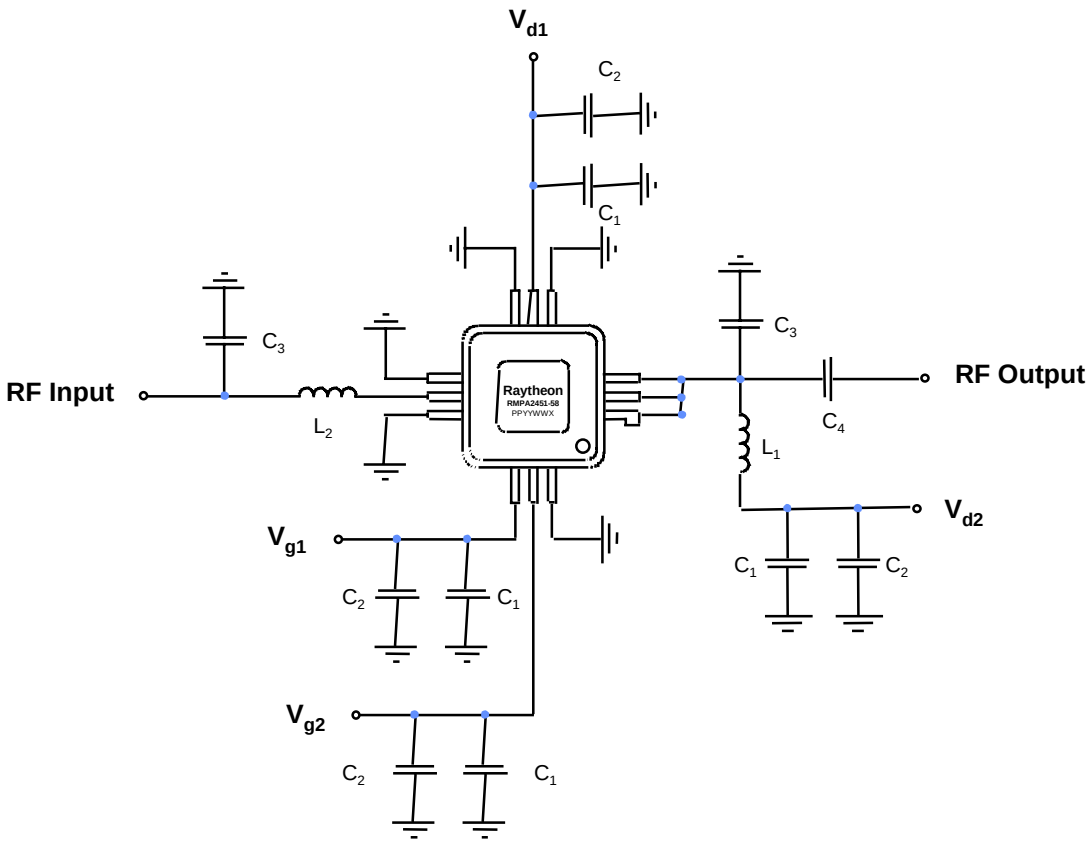
Figure 3: Schematic of a recommended DC bias / RF matching circuit



Parts List for Test Evaluation Board (RMPA2451-58-TB)

Part	Value	Quantity	Supplier	Part No.
C_1	1000 pF	4	MURATA	GRM36X7R102K050
C_2	2.2 µF	4	SPRAGUE	595D225X0016T2T
C_3	1.0 pF	2	MURATA	GRM36COG1R0B050
C_4	2.0 pF	1	MURATA	GRM36COG2R0B050
L_1	10.0 nH	1	COILCRAFT	0805HT10NTKBC
L_2	1.8 nH	1	COILCRAFT	0805HT1N8TKBC

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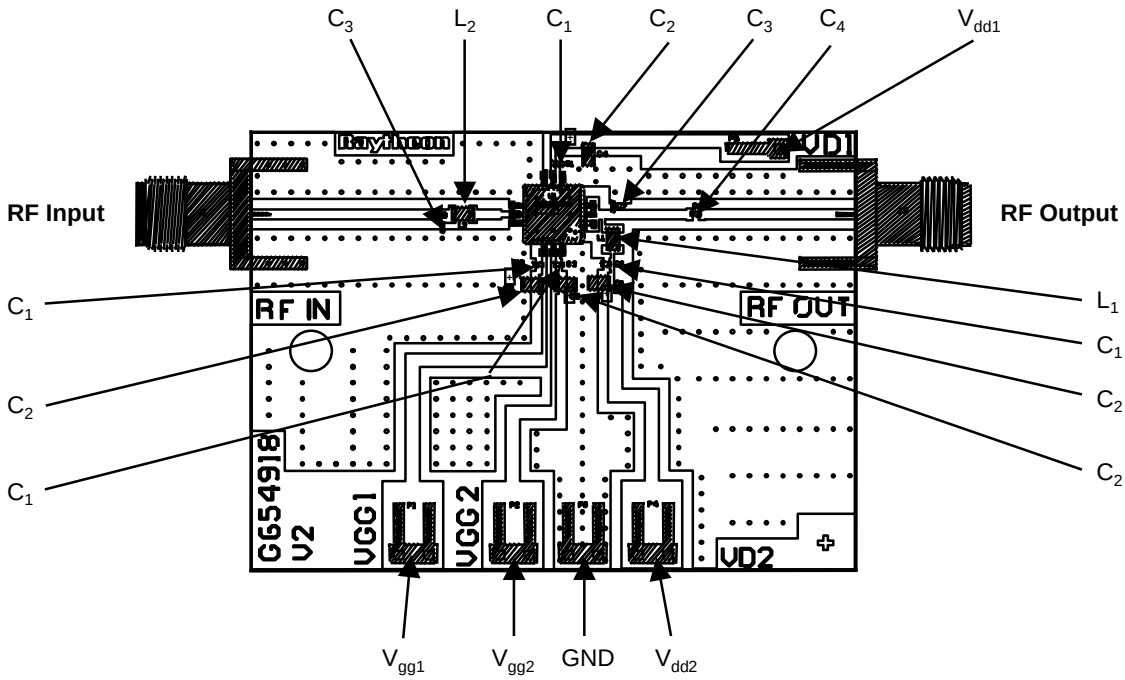
Figure 4: Layout of Evaluation Board (RMPA2451-58-TB)



It is important that the following points be noted prior to testing;

- Pin designations are as shown in Figure 1.
- V_{gg1} and V_{gg2} are the negative Gate bias voltages applied at the pins of the evaluation test board.
- V_{dd1} and V_{dd2} are the positive Drain bias voltages applied at the pins of the evaluation test board.
- V_{g1} and V_{g2} are the negative Gate bias voltages applied at the pins of the package.
- V_{d1} and V_{d2} are the positive Drain bias voltages applied at the pins of the package.

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Figure 5: Typical Gain and P1dB performance across bandwidth over temperature

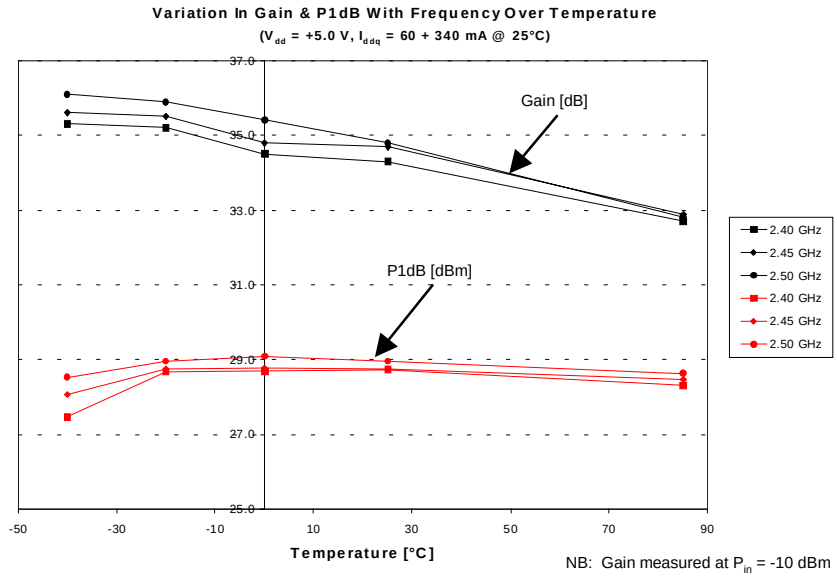
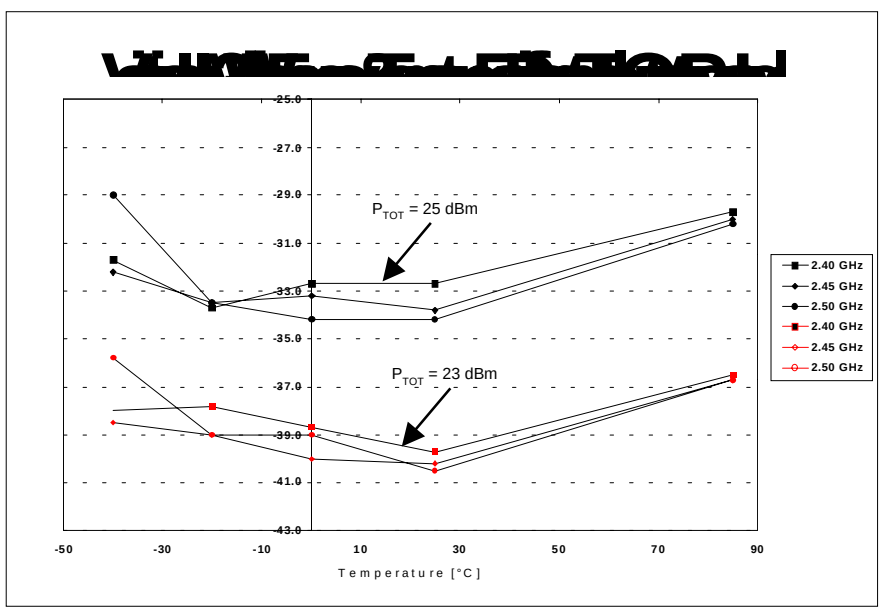


Figure 6: Typical third-order intermodulation product variation over temperature



Raytheon reserves the right to update or change specifications without notice.

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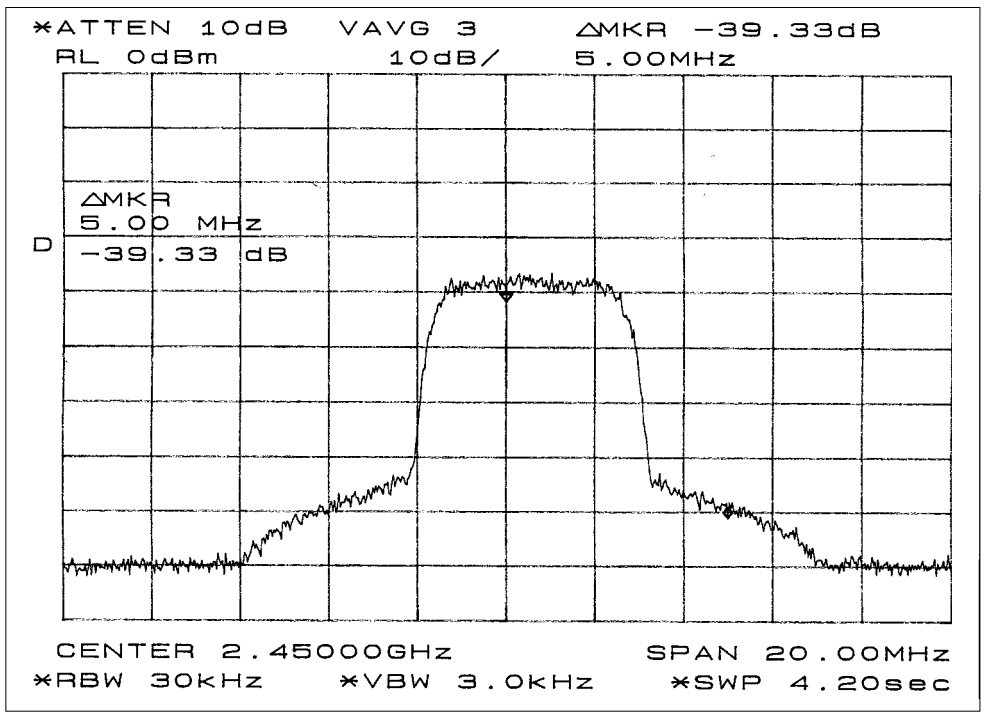
Figure 7: Typical ACPR performance under W-CDMA conditions



Note: (1) Vdd = +5.0V, Idq1 = 60 mA, Idq2 = 340 mA
(2) Pout = 25 dBm
(3) CDMA waveform at 4.096 Mcps with Root Nyquist filter (α = 0.22) at 5 MHz offset
(4) CDMA performance achieved by replacing the C_2 bypass capacitors with 4.7 µF components.