

RFIC Power Amplifier

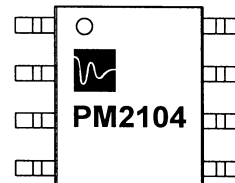
2400 to 2485 MHz Operation

Features

- 29.5 dBm Output Power
- 45% Efficiency
- 50 Ω Matched Output
- 8 Pin PCMCIA Compatible Package

Applications

- 2400 MHz ISM Band Design
- Wireless Data Communications
- Handheld and Portable Devices



Tpak
8 Pin Package

Description

The PM2104 is a low cost, high-efficiency GaAs RFIC power amplifier developed for applications in the 2400 MHz ISM band. The PM2104 contains two cascaded FET amplifiers, an on-chip interstage coupling capacitor and 50Ω output matching network. As with any RF or microwave component, external capacitors are recommended for stable and consistent performance.

Electrical Characteristics

$V_{DD} = 5.0V$, $T_A = +25^\circ C$, 50Ω System

Tested in 50 Ω system, using external circuit shown on page 3

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Frequency Range	F		2400		2485	MHz
Power Output	P_{SAT}	F=2440 MHz, Pin=6 dBm		29.5		dBm
Power Added Efficiency	PAE	F=2440 MHz, Pin=6 dBm		45		%
Small Signal Gain	G			26.0		dB
Input Return Loss	S11			10.0		dB
Drain Voltage	V_{DD}			5.0		V
Drain Current	I_{DD}			400		mA
Gate Voltage 1	V_{GG1}			-1.2		V
Gate Voltage 2	V_{GG2}			-2.3		V
Gate Current	I_{GG}			0.5	2.0	mA
Stability (spurious levels)		Load VSWR 10:1 all phase angles			-60	dBc
Thermal Resistance	θ_{JC}	T=85°C, $P_{DISS} = 1.9W$		35		°C/W



Absolute Maximum Ratings

Characteristics	Symbol	Value	Units
Drain Voltage	V _{DD}	+9.0	V
Gate Voltage	V _{GG}	-5.0	V
Bias Current	I _{DS}	600	mA
RF Input Power	P _{IN}	+20.0	dBm
Power Dissipation (P _{DC} - P _{RF})	P _{DISS}	1.9	W
Operating Baseplate Temperature	T _{OP}	-40 to +85	°C
Junction Temperature	T _J	150	°C
Storage Temperature Range	T _{STG}	-65 to +150	°C

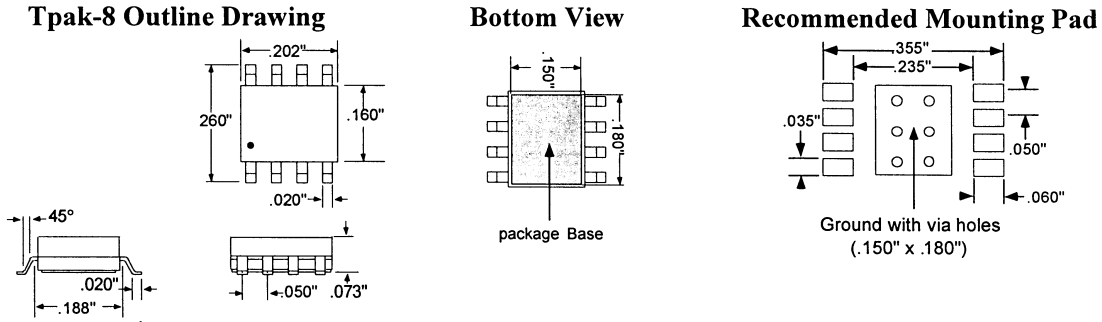
Caution: Operating beyond the specified rating for any of these parameters may cause permanent damage to device.

PM2104 Typical Scattering-Parameters

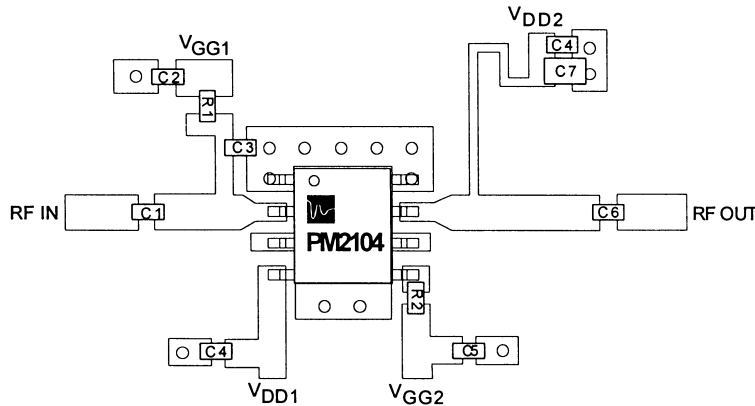
Test Conditions: V_{DD} = 5.0V, T_A = +25°C, V_{GG1} = -1.2V, V_{GG2} = -2.3V, 50Ω System

Freq. (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K Factor
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
500	0.987	-20.09	9.005	-65.24	0.000	-161.22	0.239	163.21	12.27
1000	0.948	-38.43	3.489	-15.74	0.002	70.46	0.217	-110.69	11.20
1500	0.924	-57.21	11.398	-59.64	0.002	-178.94	0.505	-136.79	2.39
1600	0.923	-61.62	12.589	-76.71	0.002	171.59	0.606	-142.46	1.30
1700	0.914	-65.90	13.450	-93.14	0.004	-173.99	0.687	-151.16	0.85
1800	0.905	-71.58	14.025	-109.33	0.003	160.15	0.734	-161.93	0.65
1900	0.889	-76.85	14.422	-125.45	0.004	145.37	0.749	-172.67	0.76
2000	0.868	-81.97	14.491	-141.01	0.006	137.66	0.730	176.34	0.88
2100	0.842	-87.51	14.568	-156.81	0.006	129.16	0.682	165.60	1.12
2200	0.812	-92.77	14.328	-172.23	0.006	118.47	0.602	154.71	1.51
2300	0.772	-98.18	13.896	171.74	0.007	112.10	0.488	143.33	1.95
2400	0.741	-102.87	13.310	155.93	0.007	99.89	0.351	133.33	2.54
2500	0.703	-107.55	12.433	139.38	0.006	82.74	0.194	127.71	3.19
2600	0.667	-111.44	11.302	123.73	0.006	80.13	0.052	170.64	4.19
2700	0.643	-114.30	10.103	108.60	0.005	59.89	0.150	-107.89	7.17
2800	0.633	-117.20	8.849	94.22	0.003	79.33	0.299	-110.11	9.33
2900	0.632	-120.52	7.644	80.58	0.003	57.85	0.434	-117.84	10.68
3000	0.629	-124.60	6.446	68.18	0.003	40.24	0.539	-125.71	10.14
3100	0.629	-128.64	5.464	56.83	0.003	58.09	0.622	-133.19	12.04
3200	0.624	-132.71	4.554	47.28	0.002	92.00	0.681	-139.70	16.27
3300	0.627	-136.15	3.826	38.02	0.002	157.04	0.729	-145.59	20.09
3400	0.629	-140.06	3.230	30.44	0.002	83.70	0.770	-150.44	19.04
3500	0.630	-143.96	2.727	22.97	0.003	88.15	0.793	-154.66	15.52
3600	0.625	-147.36	2.315	16.74	0.004	102.13	0.812	-158.70	15.36
3700	0.630	-150.64	1.976	10.60	0.002	81.51	0.827	-161.99	19.41
3800	0.626	-154.09	1.712	5.37	0.002	48.80	0.843	-165.18	34.91
3900	0.629	-156.72	1.463	0.37	0.001	20.39	0.847	-167.85	63.43
4000	0.625	-159.45	1.282	-4.22	0.001	-148.75	0.855	-169.87	65.22

Package Specifications



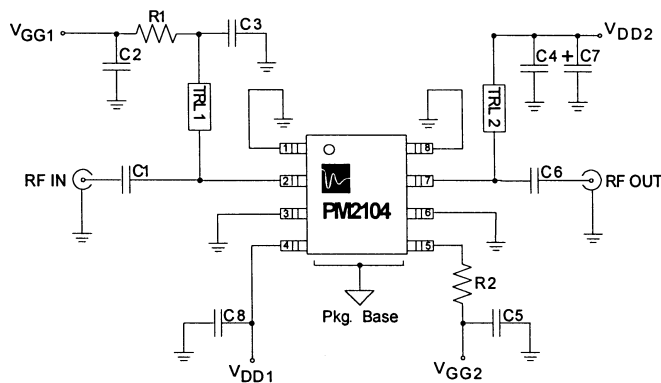
PC Board Layout



Pin Connections

Pin #	Function
1	GND
2	RF _{IN} /V _{GG1}
3	GND
4	V _{DD1}
5	V _{GG2}
6	GND
7	RF _{OUT} /V _{DD2}
8	GND
Base	GND

Schematic



List of Components

Part	Value	Size
C1, C3, C6	33 pF	0603
C2, C4, C5	1000 pF	0603
C7	6.8 μF	1208
C8	0.1 μF	0603
R1, R2	51 Ω	0603

Notes:

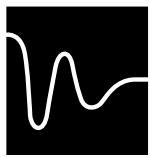
PCB Material: 0.028", FR4, $\epsilon_r = 4.2$

TRL1: W=.025, L=.085 $z=72\Omega$, $\theta=10^\circ$ @ 2440 MHz
 TRL2: W=.010, L=.450 $z=100\Omega$, $\theta=56^\circ$ @ 2440 MHz

V_{DD1}, V_{DD2}: 3 to 6V Typical

V_{GG1}: -1.2V Typical

V_{GG2}: -1.9V Typical



Basic Operation

This amplifier requires a positive and negative bias supply. The negative gate bias supply should always be applied before or coincident with the application of the drain supply voltage. *If the drain supply is applied without gate bias, possible damage may occur with the failure being of thermal nature.* No damage will occur for periods of up to 100 mSec in the absence of negative bias under most operating conditions.

Linear Power Output

The PM2104 can be used as a linear amplifier by adjusting the gate bias levels and decreasing the RF input drive for the desired output power. The limitation is power dissipation. Under linear conditions, efficiency will drop as the drive level is reduced causing a corresponding increase in package dissipation. The maximum safe dissipation of the PM2104 package is highly dependent upon the heat sinking provided by the user. In a PC board environment, 1.5 W maximum is a recommended guideline. At 5V V_{DD1} the V_{GG2} supply should be made more negative to give a maximum current of about 400 mA. At this bias level the PM2104 will give a typical performance of 27 dB linear gain and a 3rd order intercept point of 38 dBm.

Mounting Requirements

The area beneath the amplifier and the associated matching networks must have a continuous ground plane. Failing to do this may compromise the performance of the PM2104. It is also important to provide a good thermal path for the PM2104 since the device can dissipate up to 1.9 Watts of power.

The amplifier ground pins 1, 3, 8 and package base must be soldered to a common ground pad on the circuit board. This ground pad under the amplifier should be designed such that the bottom side of the PM2104 device is soldered directly to a heat sink or PC board with via holes. As a minimum, one plated via hole must be placed close to each ground pin location for good RF grounding and heat sinking.

The line width and length dimensions of the recommended circuit board (FR-4, Getek .028" thick) layout must be maintained, however, the lines can be wrapped and bent into different configurations. Different circuit materials can be used but the RF impedance of the matching networks must not be changed.

The recommended solder reflow profile is 45-90 seconds over 183°C and a peak temperature of 215-225°C maximum.

The PM2104 is an electrostatic sensitive device and reasonable caution must be exercised when inspecting and handling it outside of its shipping container.