

## RMWP23001

### 21–24 GHz Power Amplifier MMIC

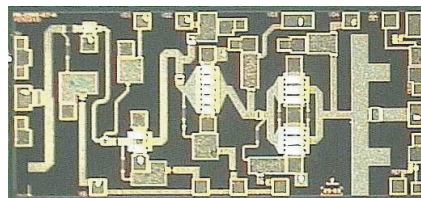
#### General Description

The RMWP23001 is a 4-stage GaAs MMIC amplifier designed as a 21 to 24 GHz Power Amplifier for use in point to point and point to multi-point radios, and various communications applications. In conjunction with other Fairchild Semiconductor amplifiers, multipliers and mixers it forms part of a complete 23 GHz transmit/receive chipset. The RMWP23001 utilizes our 0.25 $\mu$ m power PHEMT process and is sufficiently versatile to serve in a variety of power amplifier applications.

#### Features

- 4mil substrate
- Small-signal gain 22.5dB (typ.)
- 1dB compressed Pout 23.5dBm (typ.)
- Chip size 2.6mm x 1.2mm

#### Device



#### Absolute Ratings

Symbol	Parameter	Ratings	Units
Vd	Positive DC Voltage (+4V Typical)	+6	V
Vg	Negative DC Voltage	-2	V
Vdg	Simultaneous (Vd–Vg)	8	V
I <sub>D</sub>	Positive DC Current	607	mA
P <sub>IN</sub>	RF Input Power (from 50 $\Omega$ source)	+8	dBm
T <sub>C</sub>	Operating Baseplate Temperature	-30 to +85	°C
T <sub>STG</sub>	Storage Temperature Range	-55 to +125	°C
R <sub>JC</sub>	Thermal Resistance (Channel to Backside)	36.5	°C/W

**Electrical Characteristics** (At 25°C), 50Ω system, Vd = +4V, Quiescent Current Idq = 400mA

Parameter	Min	Typ	Max	Units
Frequency Range	21		24	GHz
Gate Supply Voltage (Vg) <sup>1</sup>		-0.3		V
Gain Small Signal at Pin = -8dBm	20	22.5		dB
Gain Variation vs. Frequency		1.0		dB
Gain at 1dB Compression		21.5		dB
Power Output at 1dB Compression		24		dBm
Power Output Saturated: Pin = +3dBm	22	25		dBm
Drain Current at Pin = -8dBm		400		mA
Drain Current at 1dB Compression		430		mA
Drain Current at Saturated: Pin = +3dBm		410		mA
Power Added Efficiency (PAE): at P1dB		15		%
Input Return Loss (Pin = -8dBm)		14		dB
Output Return Loss (Pin = -8dBm)		12		dB
OIP3		33		dBm
Noise Figure		8		dB

**Note:**

1. Typical range of gate voltage is -0.7 to -0.05V to set Idq of 400mA.

## Application Information

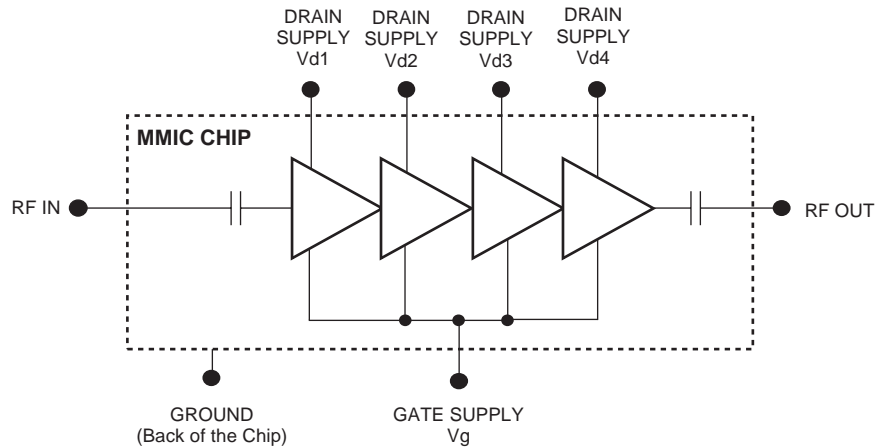
**CAUTION: THIS IS AN ESD SENSITIVE DEVICE.**

Chip carrier material should be selected to have GaAs compatible thermal coefficient of expansion and high thermal conductivity such as copper molybdenum or copper tungsten. The chip carrier should be machined, finished flat, plated with gold over nickel and should be capable of withstanding 325°C for 15 minutes.

Die attachment should utilize Gold/Tin (80/20) eutectic alloy solder and should avoid hydrogen environment for PHEMT devices. Note that the backside of the chip is gold plated and is used as RF and DC ground.

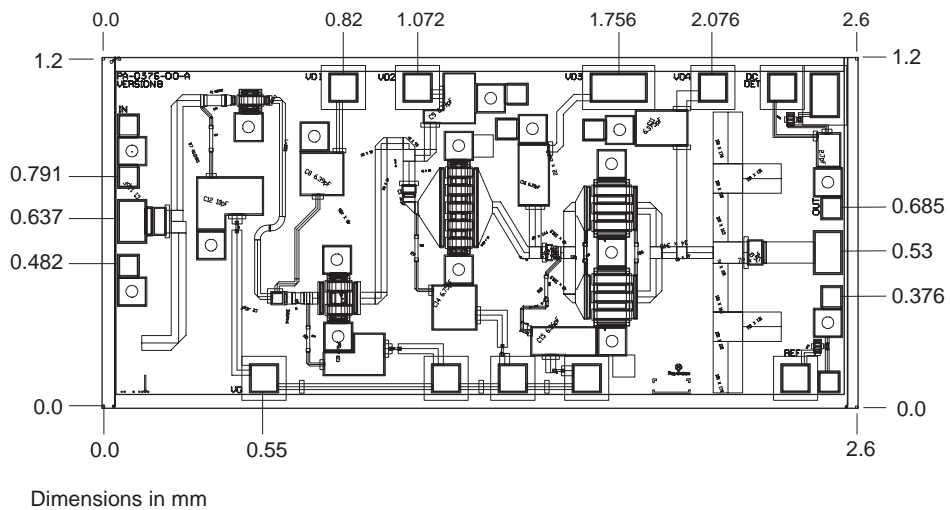
These GaAs devices should be handled with care and stored in dry nitrogen environment to prevent contamination of bonding surfaces. These are ESD sensitive devices and should be handled with appropriate precaution including the use of wrist grounding straps. All die attach and wire/ribbon bond equipment must be well grounded to prevent static discharges through the device.

Recommended wire bonding uses 3 mils wide and 0.5 mil thick gold ribbon with lengths as short as practical allowing for appropriate stress relief. The RF input and output bonds should be typically 0.012" long corresponding to a typical 2 mil gap between the chip and the substrate material.



**Note:**  
1. Typical range of gate voltage is -0.7 to -0.05V to set Idq of 400mA.

**Figure 1. Functional Block Diagram**



**Figure 2. Chip Layout and Bond Pad Locations**  
(Chip Size is 2.6mm x 1.2mm x 100µm. Back of chip is RF and DC Ground)

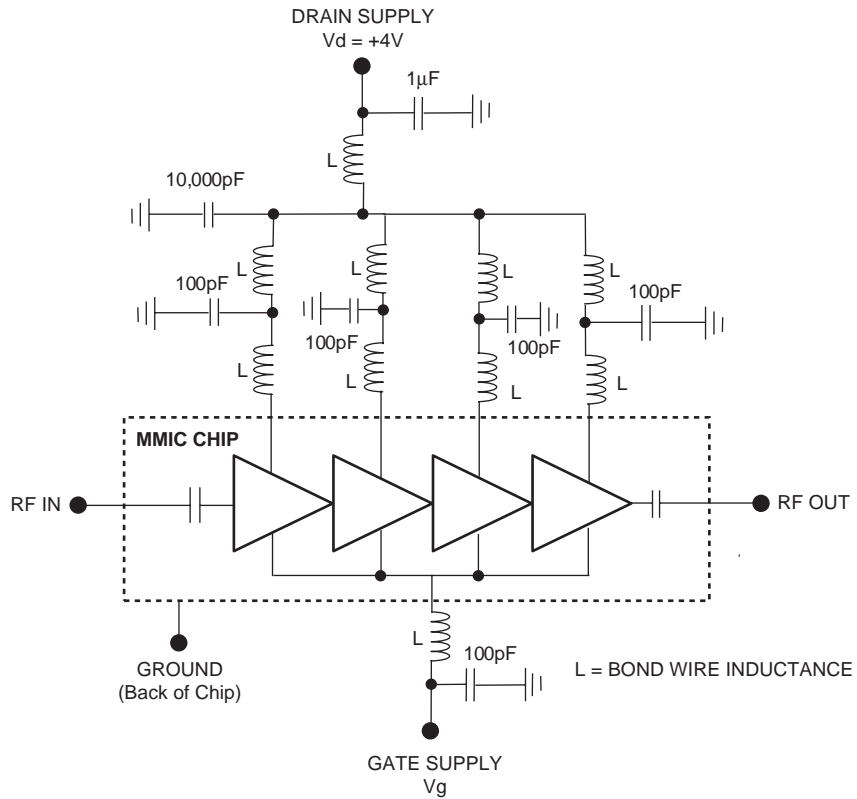
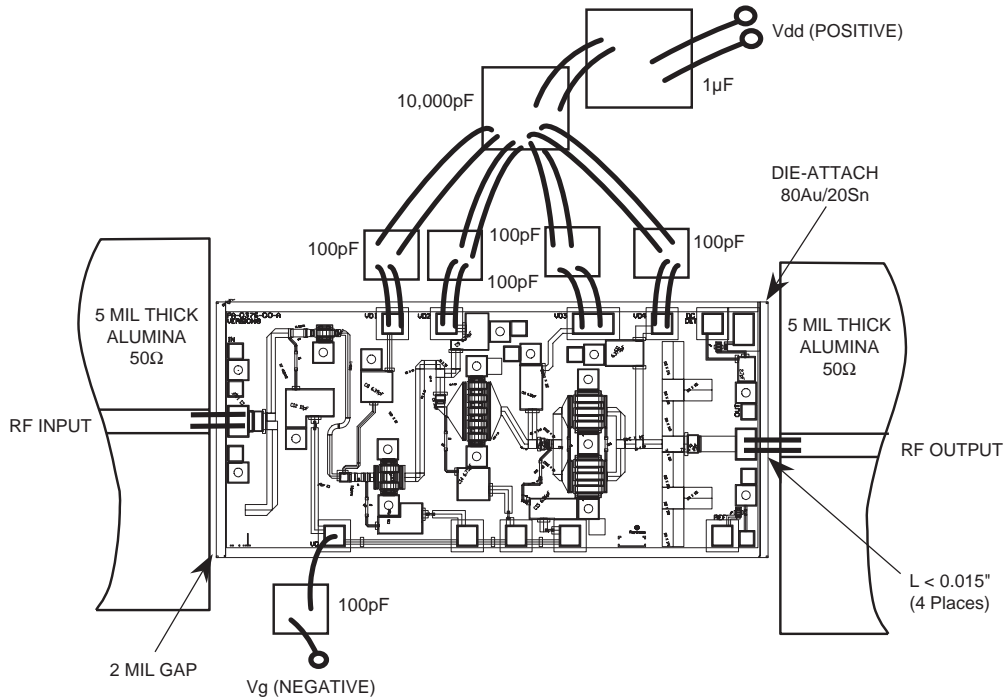


Figure 3. Recommended Application Schematic Circuit Diagram



**Note:**  
Use 0.003" by 0.0005" Gold Ribbon for bonding. RF input and output bonds should be less than 0.015" long with stress relief.

Figure 4. Recommended Assembly Diagram

## Recommended Procedure for Biasing and Operation

**CAUTION: LOSS OF GATE VOLTAGE ( $V_g$ ) WHILE DRAIN VOLTAGE ( $V_d$ ) IS PRESENT MAY DAMAGE THE AMPLIFIER CHIP.**

The following sequence of steps must be followed to properly test the amplifier:

**Step 1:** Turn off RF input power.

**Step 2:** Connect the DC supply grounds to the ground of the chip carrier. Slowly apply negative gate bias supply voltage of  $-1.5V$  to  $V_g$ .

**Step 3:** Slowly apply positive drain bias supply voltage of  $+4V$  to  $V_d$ .

**Step 4:** Adjust gate bias voltage to set the quiescent current of  $I_{dq} = 400mA$ .

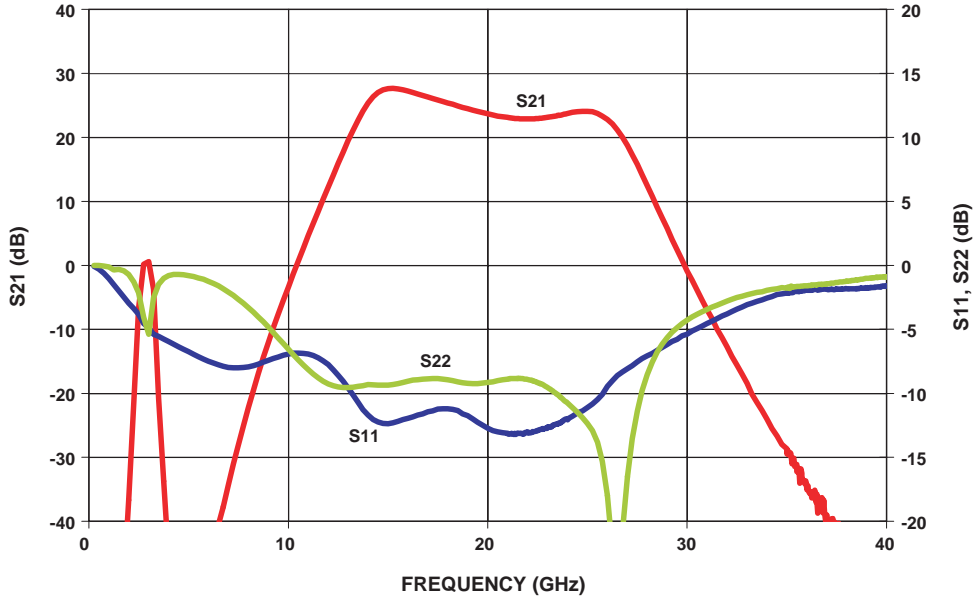
**Step 5:** After the bias condition is established, the RF input signal may now be applied at the appropriate frequency band.

**Step 6:** Follow turn-off sequence of:

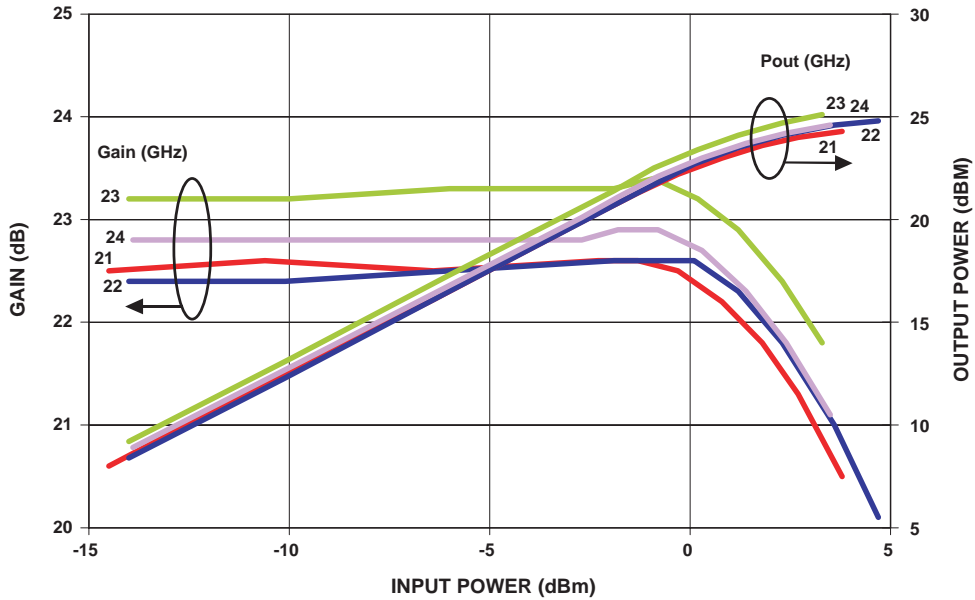
- (i) Turn off RF input power,
- (ii) Turn down and off drain voltage ( $V_d$ ),
- (iii) Turn down and off gate bias voltage ( $V_g$ ).

Typical Characteristics

RMWP23001, 23 GHz Power Amplifier, Typical Performance,  
 Vd = 4V, Idq = 370mA, Chip Bonded into 50Ω Test Fixture

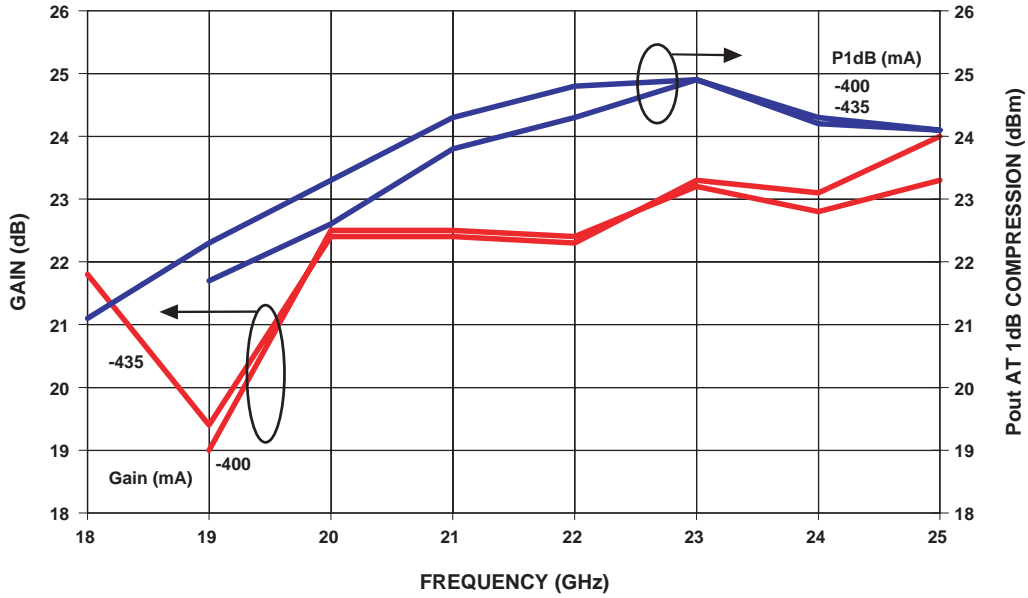


RMWP23001, 23 GHz Power Amplifier, Typical Performance,  
 On-Wafer Measurements, Vd = 4V, Idq = 400mA

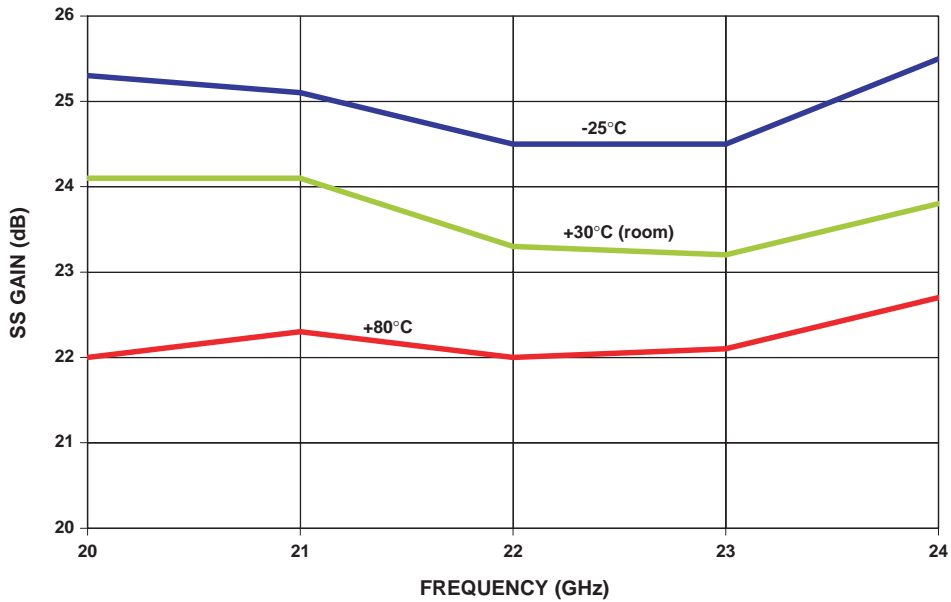


Typical Characteristics (Continued)

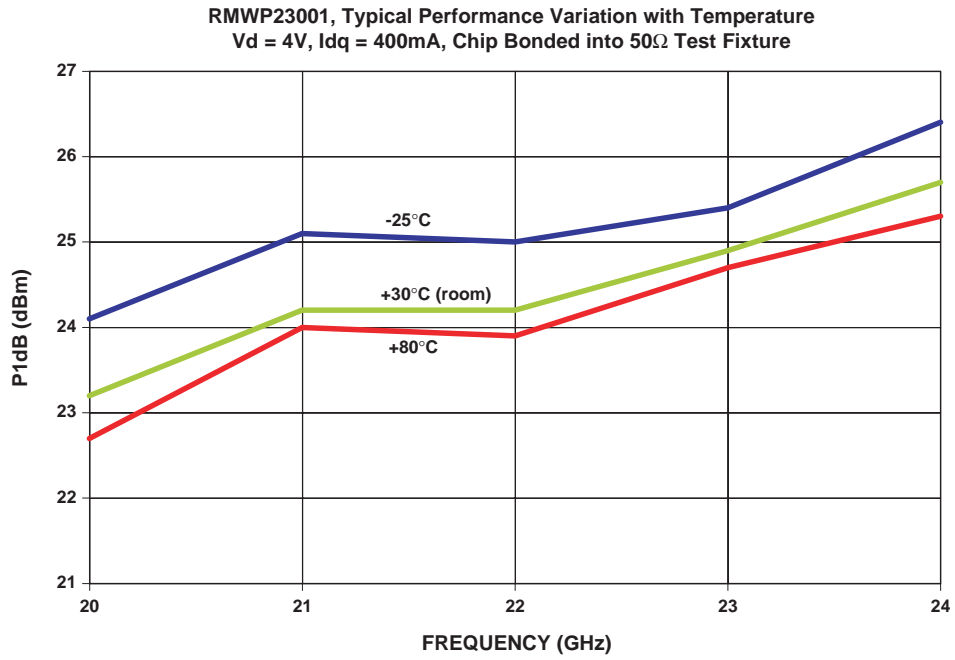
RMWP23001, 23 GHz Power Amplifier, Typical Performance, On-Wafer Measurements,  $V_d = 4V$ ,  $I_{dq} = 400mA$  and  $435mA$



RMWP23001, Typical Performance Variation with Temperature  $V_d = 4V$ ,  $I_{dq} = 400mA$ , Chip Bonded into  $50\Omega$  Test Fixture



Typical Characteristics (Continued)





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