

RMPA29200

29-31 GHz 2 Watt Power Amplifier MMIC

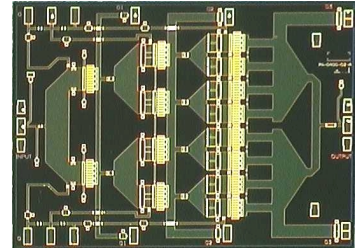
ADVANCED INFORMATION

Description

The Raytheon RMPA29200 is a high efficiency power amplifier designed for use in Sat-Com, point to point radio, point to multi-point communications, LMDS and other millimeter wave applications. The RMPA29200 is a 3-stage GaAs MMIC amplifier utilizing Raytheon's advanced 0.15µm gate length Power PHEMT process and can be used in conjunction with other driver or power amplifiers to achieve the required total power output.

Features

- ◆ 17 dB small signal gain (typ.)
- ◆ 33 dBm saturated power out (typ.)
- ◆ DC Bias connections on top or bottom side
- ◆ Circuit contains individual source vias
- ◆ Chip size 4.00 mm x 2.98 mm



Absolute Maximum Ratings

Parameter	Symbol	Typical	Units
Positive DC Voltage (+5 V Typical)	V _d	+ 6	Volts
Negative DC Voltage	V _g	- 2	Volts
Simultaneous (V _d - V _g)	V _{dg}	+ 8	Volts
Positive DC Current	I _D	2450	mA
RF Input Power (from 50 Ω source)	P _{IN}	+22	dBm
Operating Base plate Temperature	T _C	-30 to +85	°C
Storage Temperature Range	T _{Stg}	-55 to +125	°C
Thermal Resistance (Channel to Backside)	R _{Jc}	5.6	°C/W

Electrical Characteristics

(at 25 °C) 50 Ohm system, V_d=+5V, Quiescent current (I_{dq})=1500 mA

Parameter	Min	Typ	Max	Unit
Frequency Range	29		31	GHz
Gate Supply Voltage (V _g) ¹		-0.2		V
Gain Small Signal (Pin=0 dBm)	14.5	17		dB
Gain Variation vs. Frequency		+/-0.5		dB
Power Output at 1 dB Compression		32.5		dBm
Power Output Saturated: (Pin=+19 dBm)	32	33		dBm
Drain Current at Pin=0 dBm		1500		mA

Parameter	Min	Typ	Max	Unit
Drain Current at P1 dB Compression		1780		mA
Power Added Efficiency (PAE): at P1dB		20		%
OIP3 (26 dBm/Tone)		38		dBm
Input Return Loss (Pin=0 dBm)		12		dB
Output Return Loss (Pin=0 dBm)		10		dB

Note:

1. Typical range of the negative gate voltage is -1.0 to 0.0V to set typical I_{dq} of 1500 mA.

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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 for power devices 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 typically 2 mils gap between the chip and the substrate material.

Figure 1
Functional Block Diagram

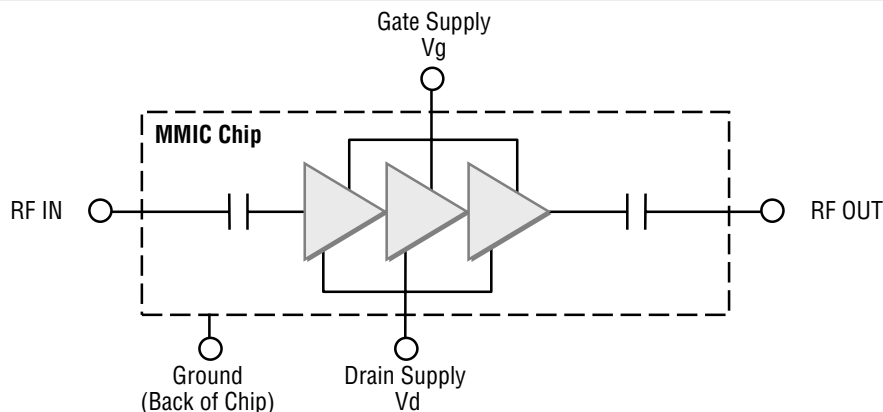
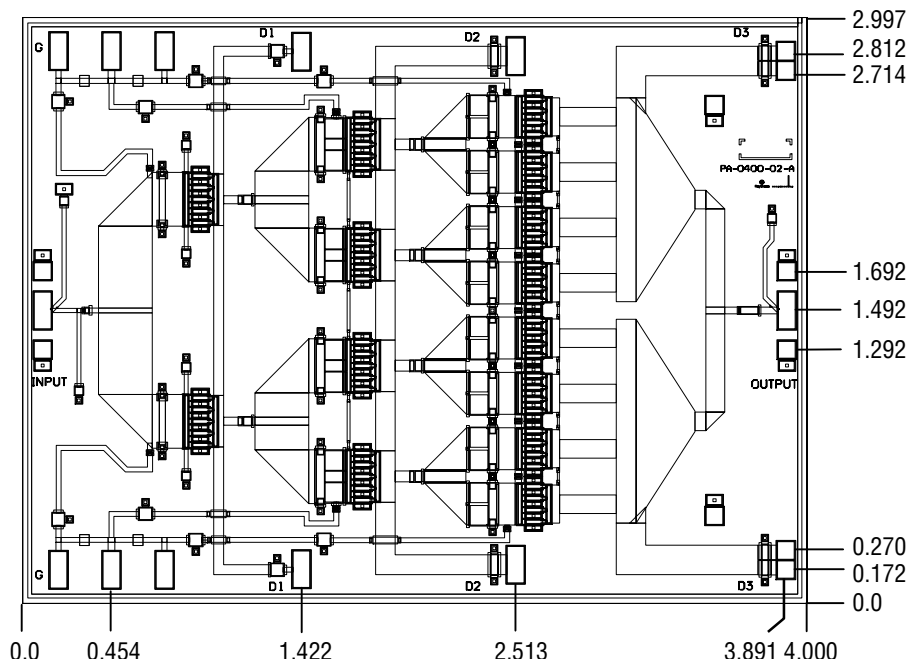


Figure 2
Chip Layout and Bond Pad Locations
(Chip Size=4.000 mm x 2.997 mm x 50 μm. Back of Chip is RF and DC Ground)

Dimensions in mm



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Figure 3
Recommended
Application Schematic and
Circuit Diagram

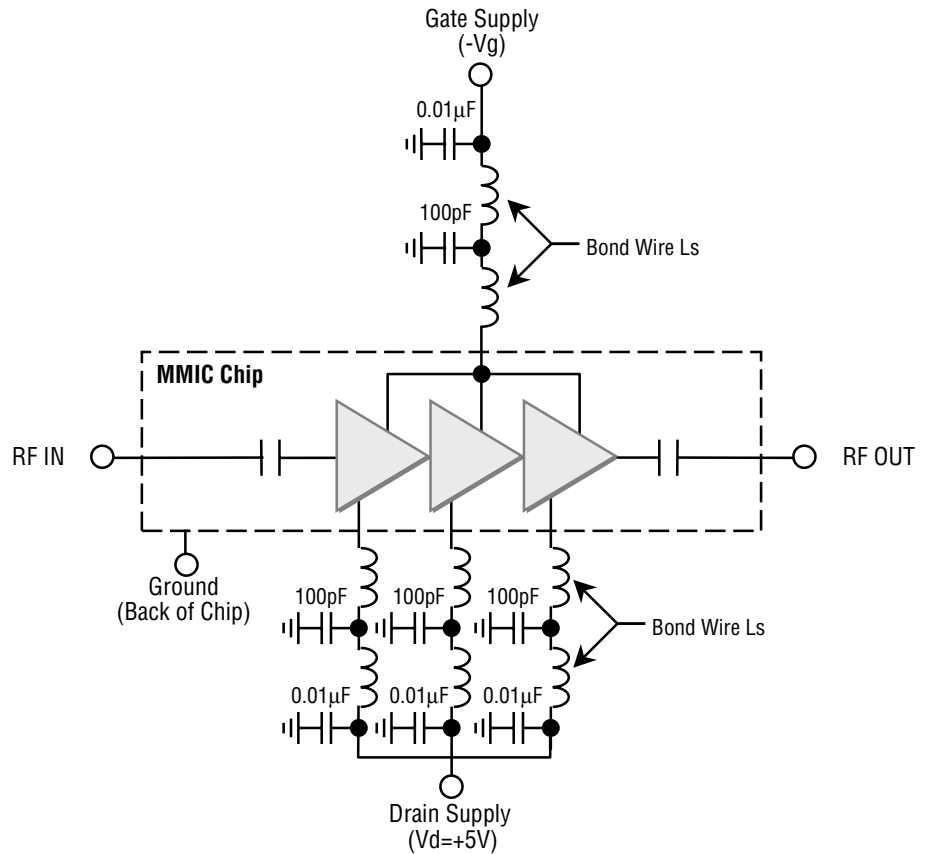
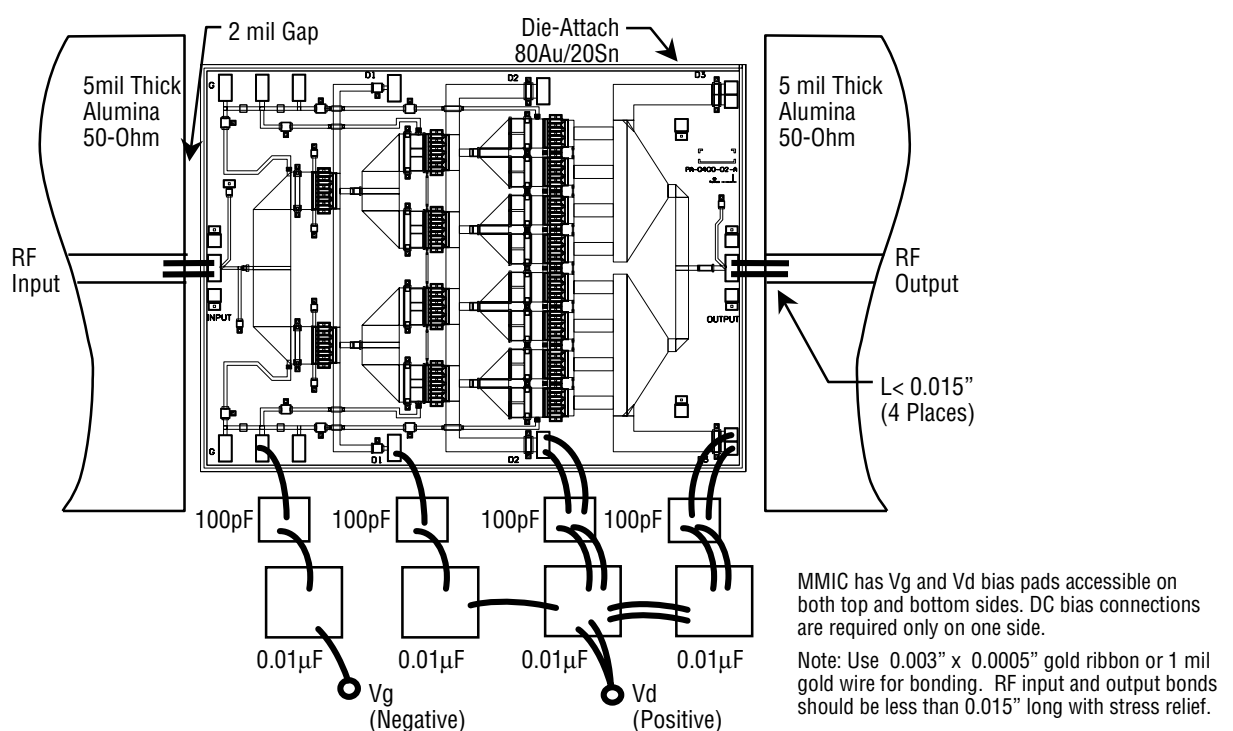


Figure 4
Recommended
Assembly Diagram



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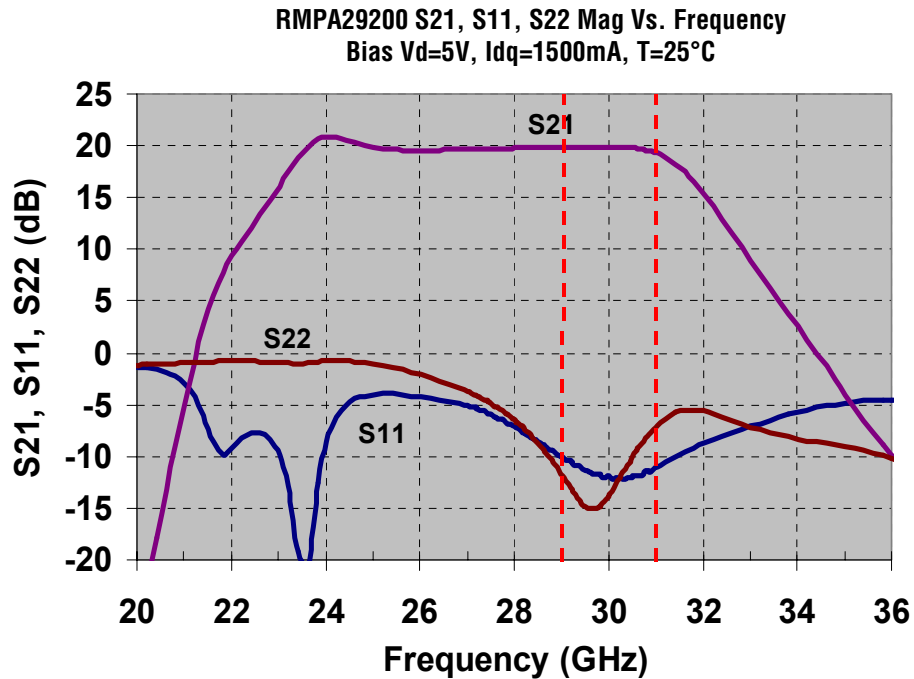
Recommended Procedure
for Biasing and Operation

CAUTION: LOSS OF GATE VOLTAGE (V_g) WHILE CORRESPONDING DRAIN VOLTAGE (V_d) IS PRESENT CAN DAMAGE THE AMPLIFIER.

The following sequence 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 -1.5 V to V_g .
- Step 3:** Slowly apply positive drain bias supply voltage of +5 V to V_d .
- Step 4:** Adjust gate bias voltage to set the quiescent current of $I_{dq}=1500$ mA.
- 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).

Performance Data



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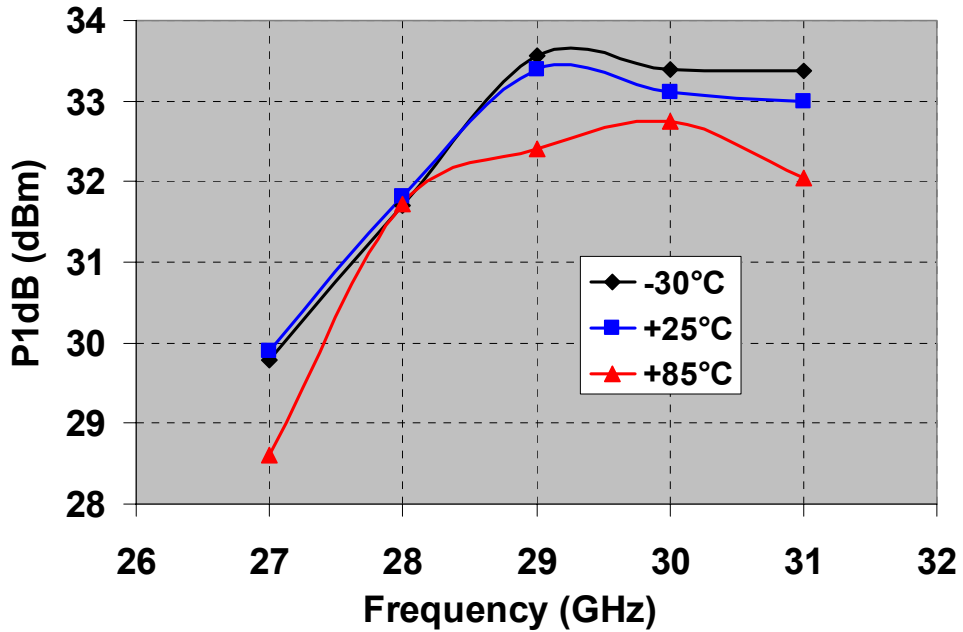
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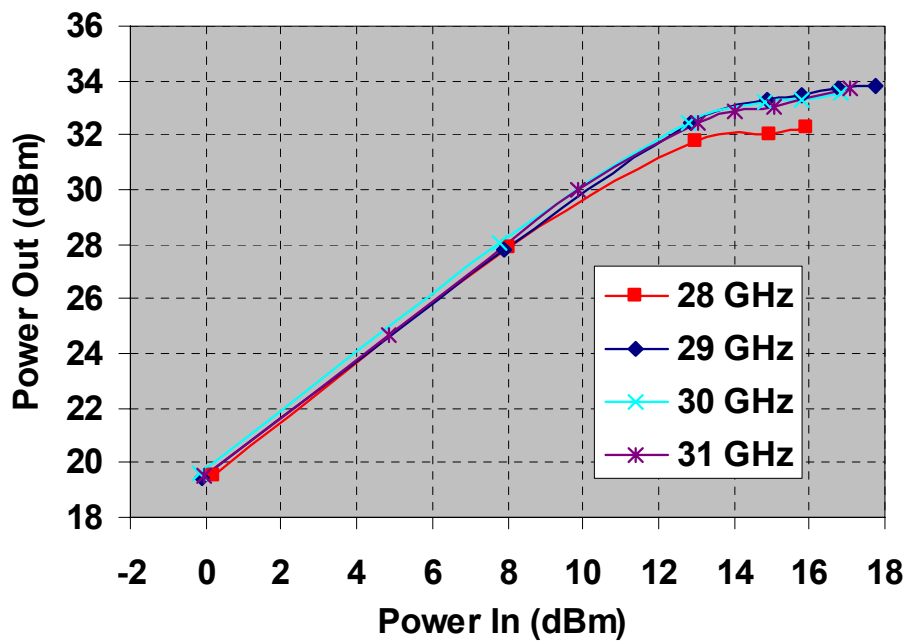
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Performance Data

RMPA29200 P1dB Vs. Frequency Vs. Temperature
Vd=5V Idq=1500mA



RMPA29200 Power Out Vs. Power In
Vd=5V Idq=1500mA T=25°C



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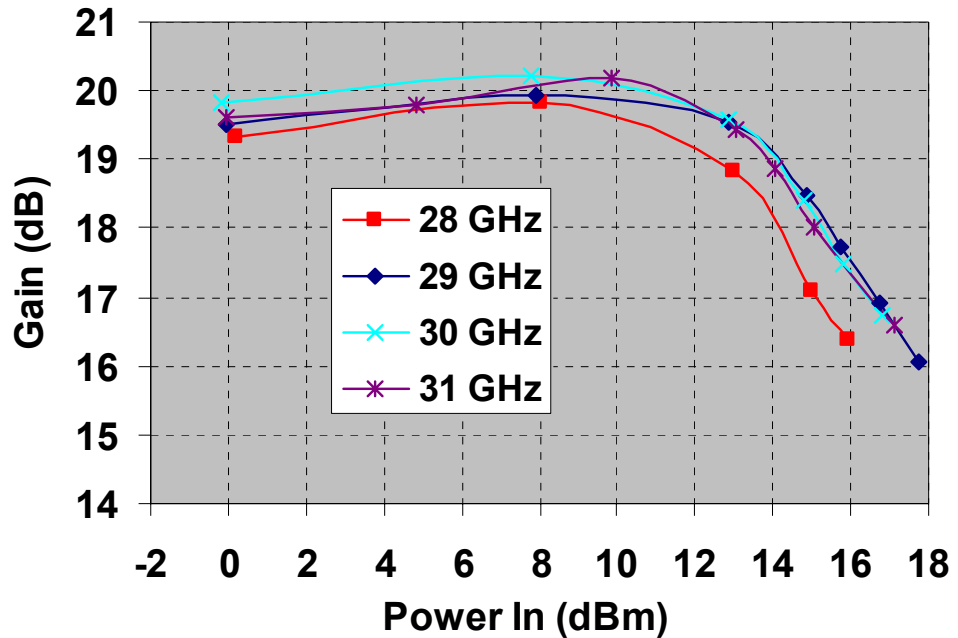
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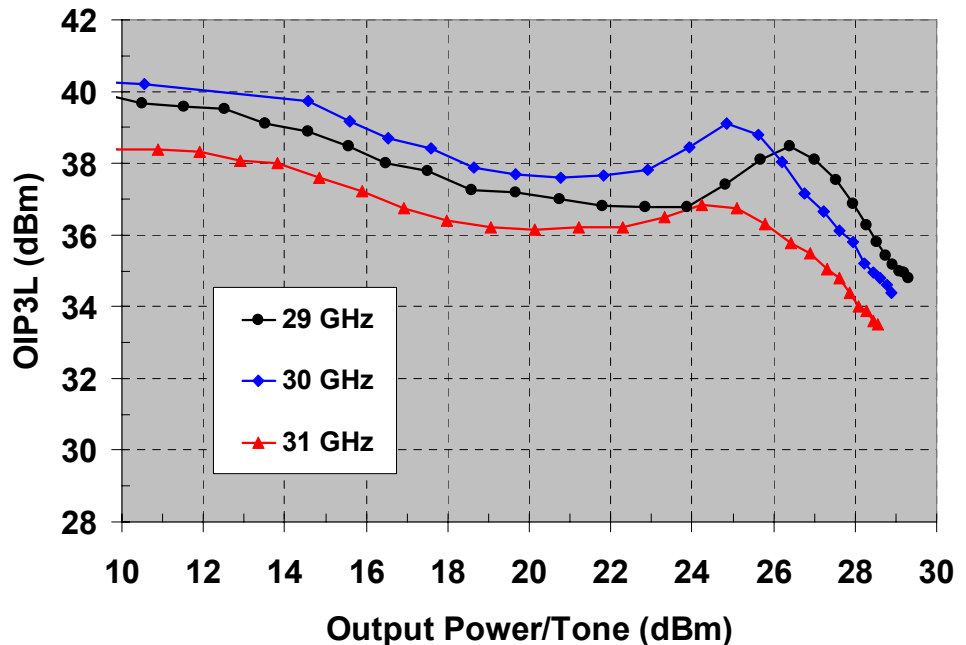
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Performance
Data

RMPA29200 Gain Vs. Power In
Vd=5V Idq=1500mA T=25°C



RMPA29200 Two-Tone OIP3 Vs. Output Power/Tone
Vd=5V Idq=1500mA T=25°C



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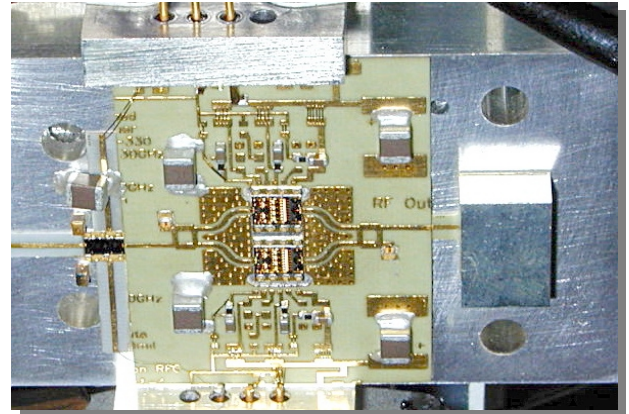
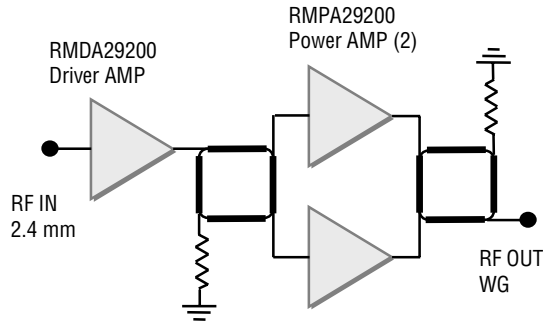
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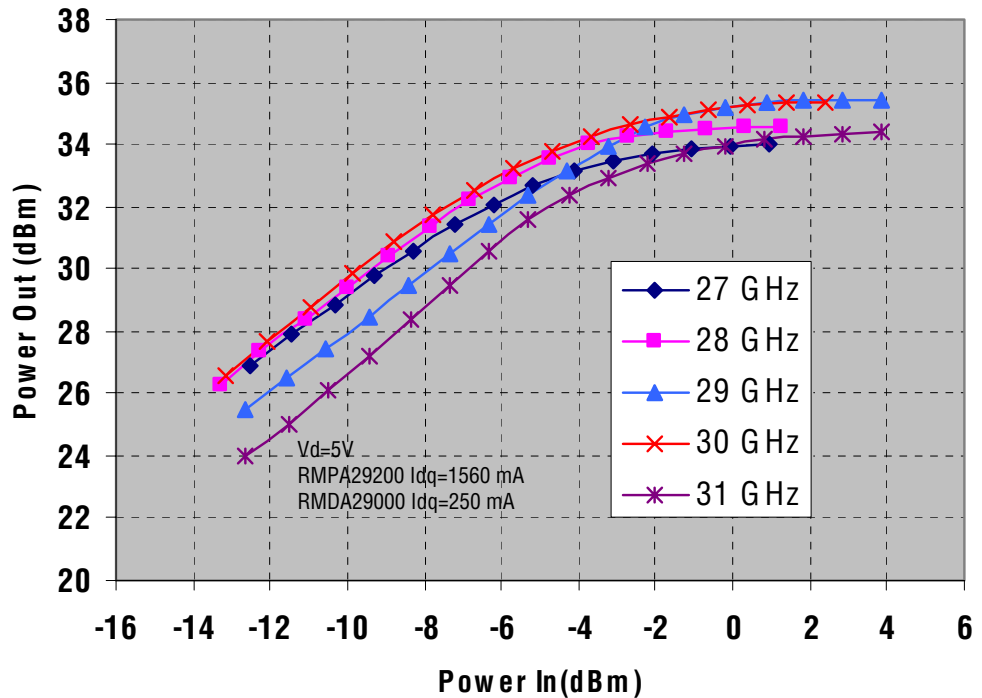
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Performance
Data

RMPA29200 in Balance Pair Configuration with MMIC Driver



RMPA29200 Balanced Pair with
RMDA29000 Driver Power Out Vs. Pin T=25°C



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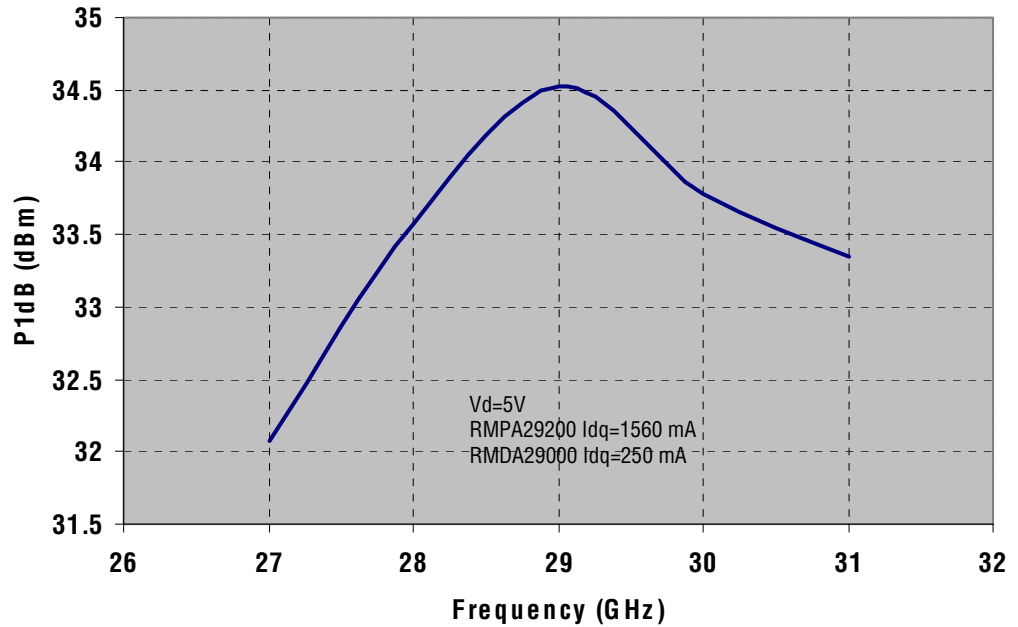
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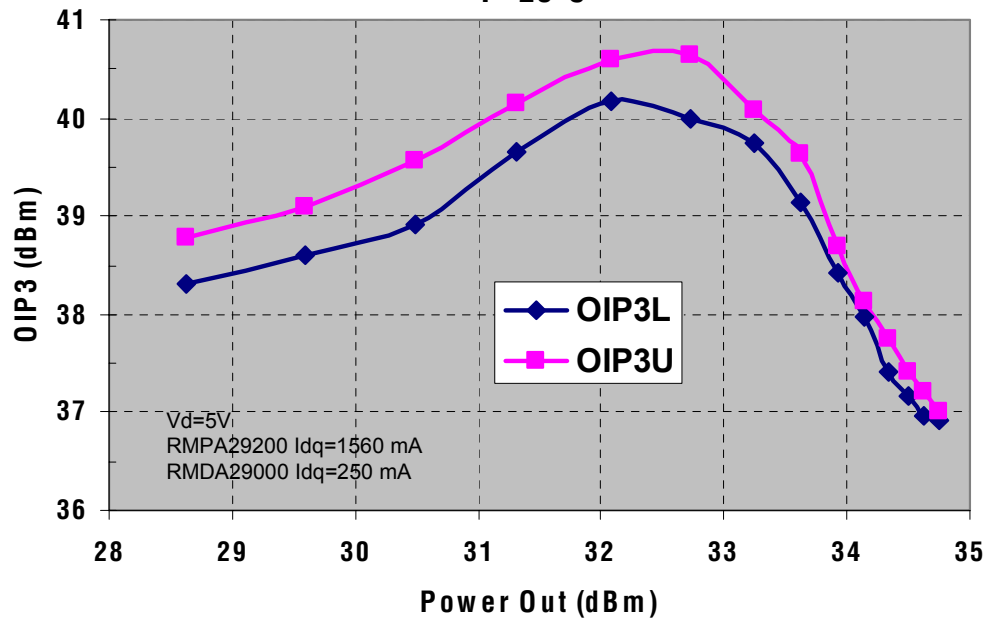
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Performance Data

RMPA29200 Balanced Pair With RMDA29000 Driver Amp P1dB Vs. Frequency T=25°C



RMPA29200 Balanced Pair With RMDA29000 Driver Amp OIP3 Vs. Pout F=29 GHz T=25°C



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