

RMPA39100

37-40 GHz 1 Watt Power Amplifier MMIC

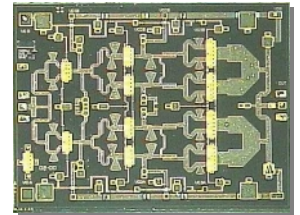
PRODUCT INFORMATION

Description

The Raytheon RMPA39100 is a high efficiency power amplifier designed for use in point to point radio, point to multi-point communications, LMDS and other millimeter wave applications. The RMPA39100 is a 3-stage GaAs MMIC amplifier utilizing Raytheon's advanced 0.15 μ m 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

- ◆ 18 dB small signal gain (typ.)
- ◆ 30 dBm saturated power output (typ.)
- ◆ Circuit contains individual source vias
- ◆ Chip Size 4.28 mm x 3.19 mm

**Absolute Maximum Ratings**

Parameter	Symbol	Value	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	1392	mA
RF Input Power (from 50 Ω source)	P _{IN}	+18	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}	9	°C/W

Electrical Characteristics

(At 25°C)
50 Ω system,
V_d=+5 V,
Quiescent current
(I_{dq})=1000 mA

Parameter	Min	Typ	Max	Unit	Parameter	Min	Typ	Max	Unit
Frequency Range	37		40	GHz	Drain Current at P _{sat} (P _{in} =+14.5 dBm)		1200		mA
Gate Supply Voltage (V _g) ¹		-0.2		V	Power Added Efficiency (PAE): at P1dB		17		%
Gain Small Signal at P _{in} =0 dBm	16	18		dB	OIP3 (17dBm/Tone) (10 MHz Tone Sep.)		35		dBm
Gain Variation vs. Frequency		+/-1.5		dB	Input Return Loss (P _{in} =0 dBm)		10		dB
Power Output at 1 dB Compression		29		dBm	Output Return Loss (P _{in} =0 dBm)		7		dB
Power Output Saturated: (P _{in} =+14.5 dBm)	28	30		dBm					
Drain Current at P _{in} =0 dBm		1000		mA					
Drain Current at P1 dB Compression		1160		mA					

Note: 1. Typical range of the negative gate voltages is -0.5 to 0.0V to set typical I_{dq} of 1000 mA.

Characteristic performance data and specifications are subject to change without notice.

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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

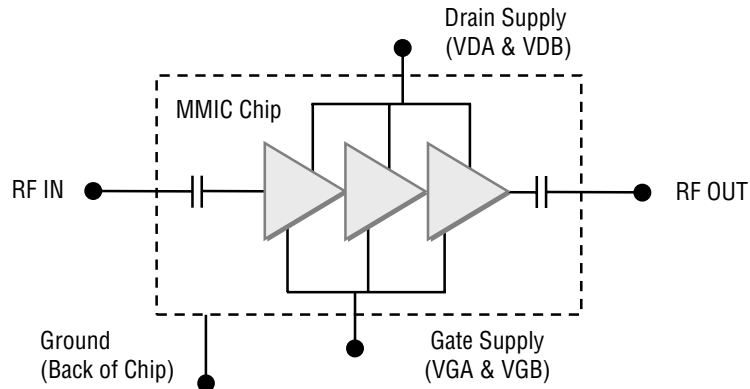
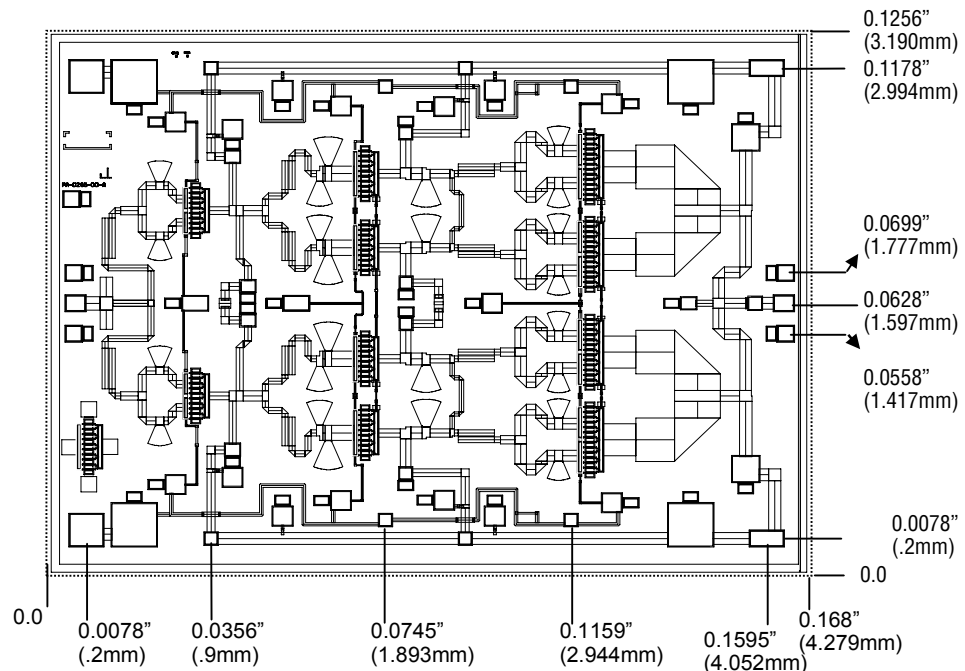


Figure 2
Chip Layout and Bond Pad Locations

(Chip Size=0.168" x 0.1256" x 0.002". Back of Chip is RF and DC Ground)



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Figure 3
Schematic of
Application Circuit

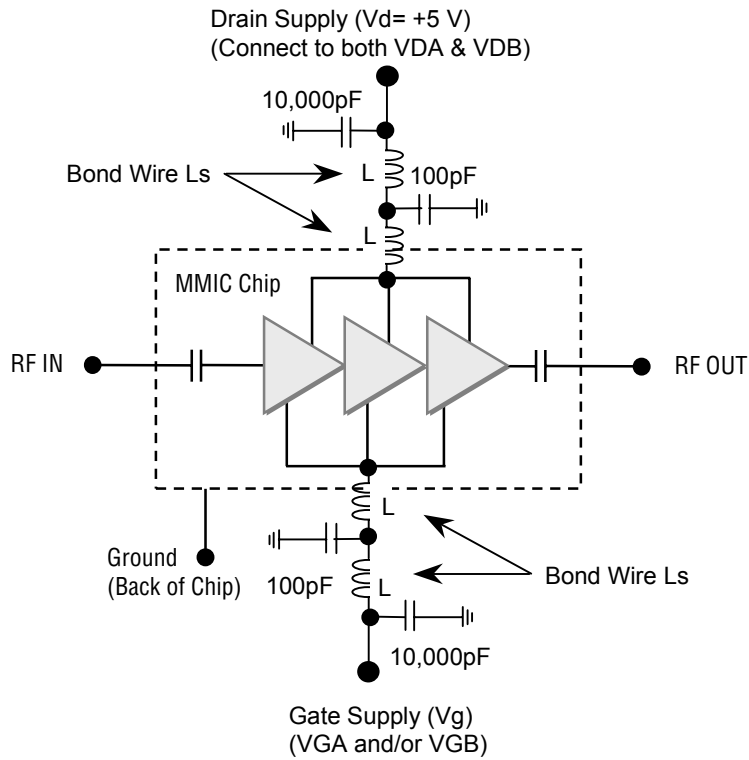
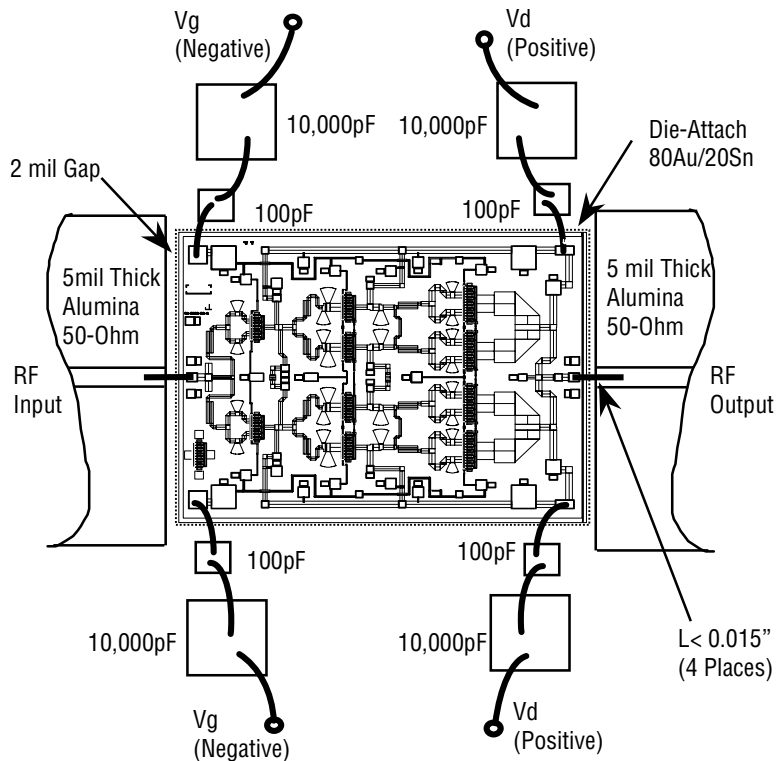


Figure 4
Recommended
Assembly and Bonding
Diagram



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

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Recommended Procedure
for biasing and operation)

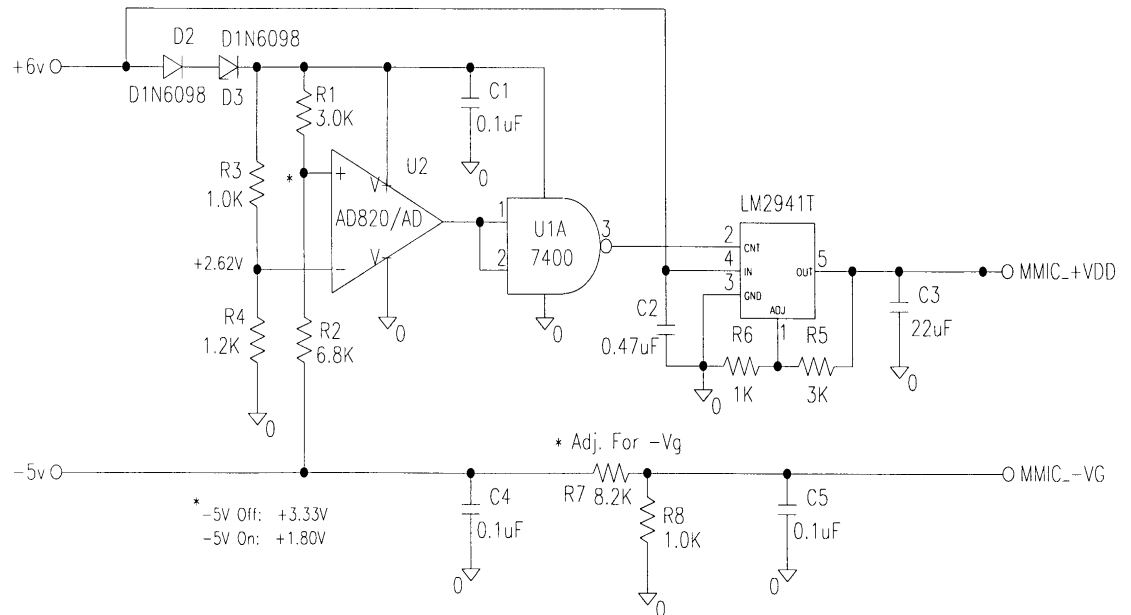
CAUTION: LOSS OF GATE VOLTAGE (VG) WHILE DRAIN VOLTAGE (VD) IS PRESENT CAN DAMAGE THE AMPLIFIER.

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 Vg.
- Step 3:** Slowly apply positive drain bias supply voltage of +5 V to Vd.
- Step 4:** Adjust gate bias voltage to set the quiescent current of Idq=1000 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 (Vd),
 - (iii) Turn down and off gate bias voltage (Vg).

Note:

An example auto bias sequencing circuit to apply negative gate voltage and positive drain voltage for the above procedure is shown below.



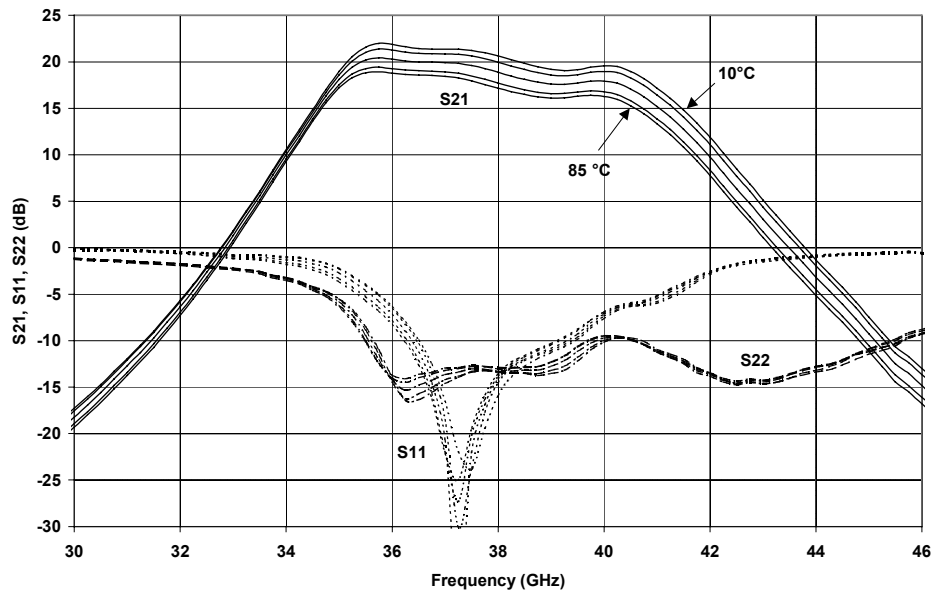
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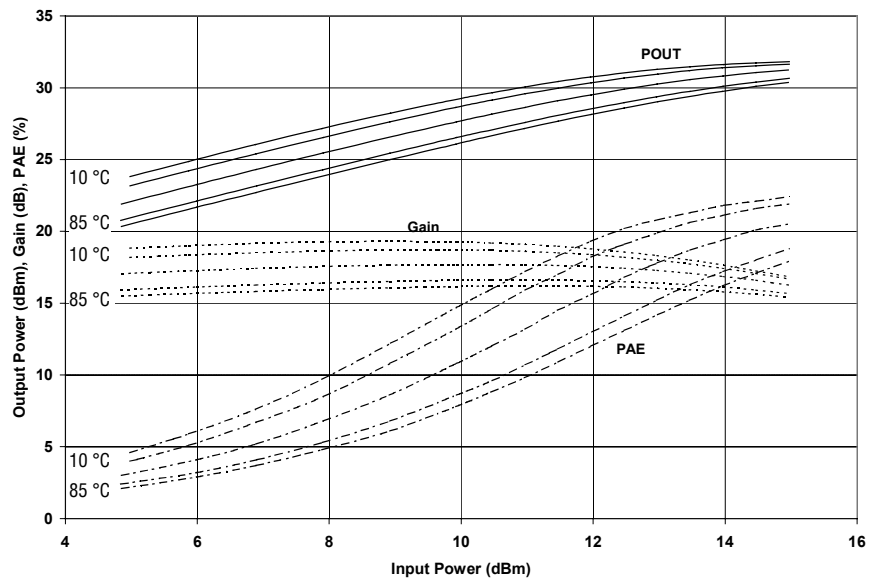
37-40 GHz 1 Watt Power Amplifier MMIC

Performance Data

RMPA39100 S-Parameters Vs. Frequency Vs. Temperature
 Bias Vd=5 V, Id=1000 mA
 Base Plate Temp 10, 25, 50, 75, and 85 °C



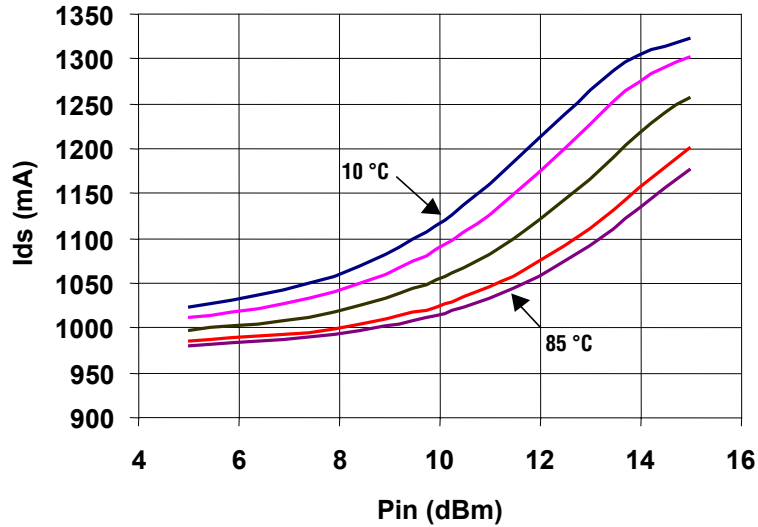
RMPA39100 Power, Gain, PAE Vs. Frequency Vs. Temperature
 Frequency =39 GHz, Bias Vd=5 V, Id=1000 mA
 Base Plate Temp 10, 25, 50, 75, and 85 °C



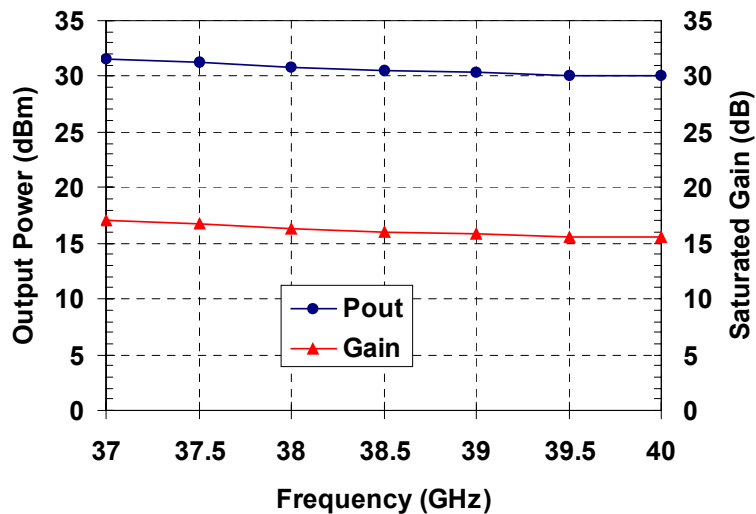
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Performance Data

RMPA39100 Ids Vs. Pin Vs. Temperature
 Frequency =39 GHz, Bias Vd=5 V, Id=1000 mA
 Base Plate Temp 10, 25, 50, 75, and 85 °C



RMPA39100 Saturated Power and Gain Vs. Frequency
 Pin = 14.5 dBm, Bias Vd=5 V, Id=1000 mA T=25 °C



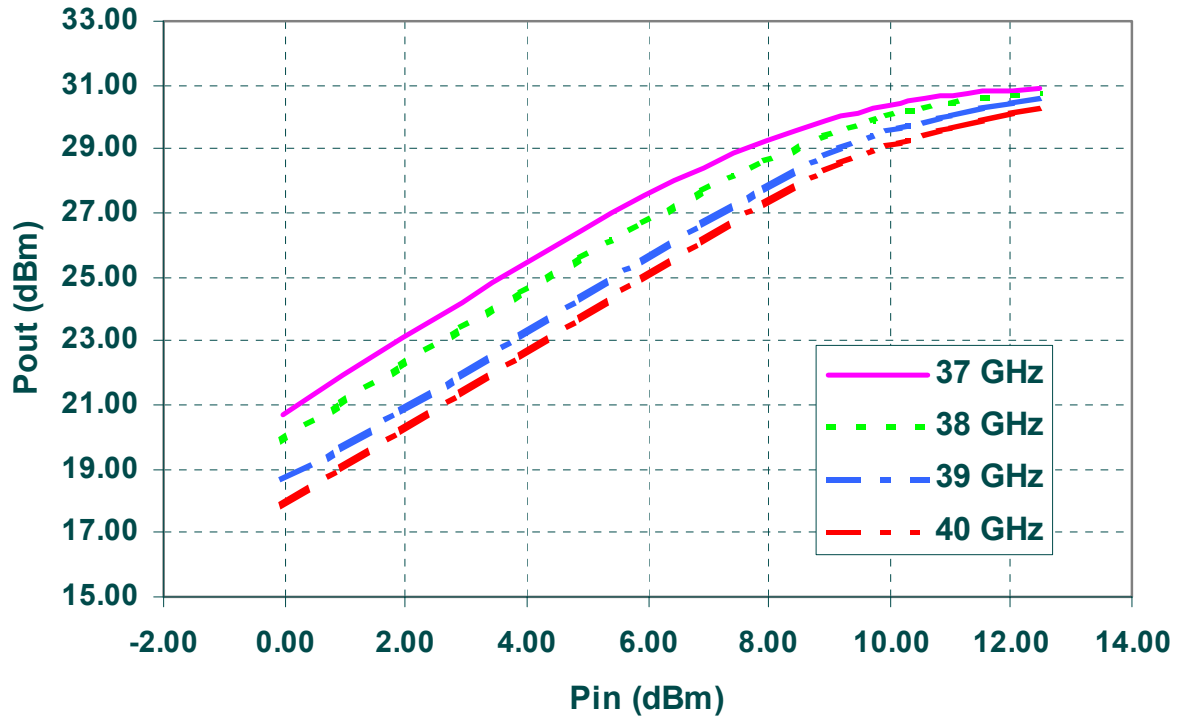
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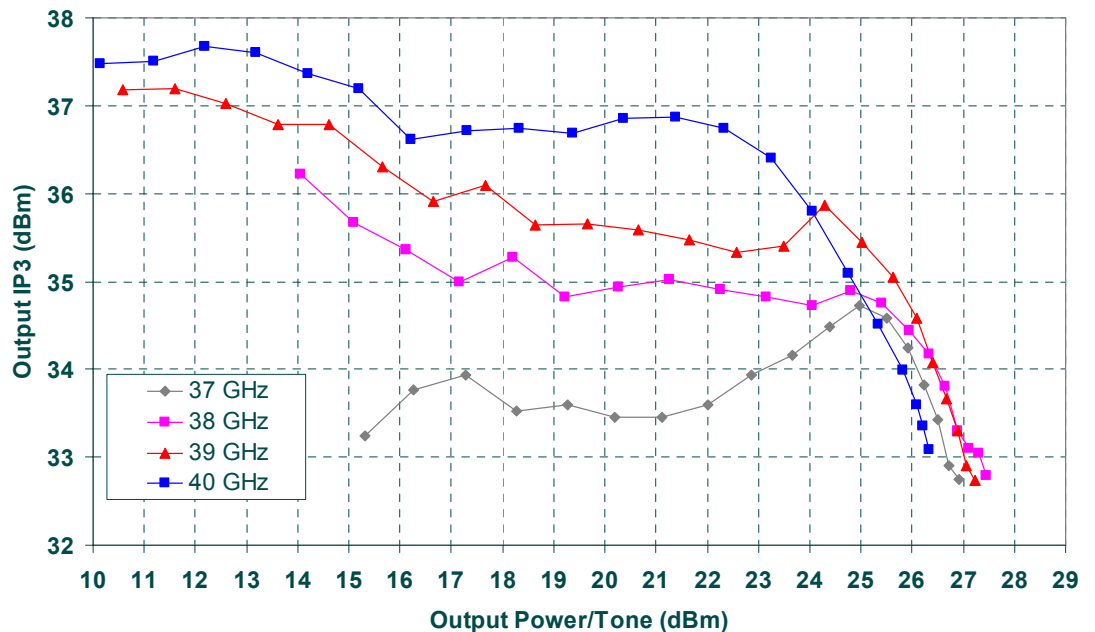
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Performance Data

RMPA39100 Power Out Vs. Power In
Bias $V_d=5\text{ V}$, $I_d=1000\text{ mA}$ $T=25\text{ }^\circ\text{C}$



RMPA39100 OIP3 vs Output Power/Tone
 $V_d=5.0\text{ V}$ $I_dq=1000\text{ mA}$ (10 MHz Tone Sep.)



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