Raytheon

RMDA20420
20-42 GHz General Purpose MMIC Amplifier

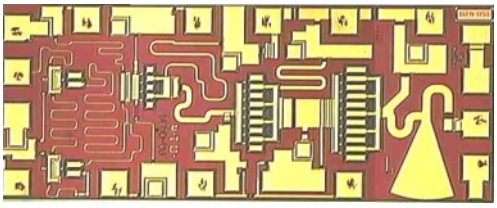
ADVANCED INFORMATION

Description

The Raytheon RMDA20420 is a broadband general purpose driver amplifier designed for use in point to point radio, point to multi-point communications, LMDS, SatCom and other millimeter wave applications. The RMDA20420 is a fully matched GaAs MMIC utilizing Raytheon's advanced 0.15μm gate length PHEMT process.

Features

- Wideband 20 - 42 GHz operation
- 22 dB small signal gain (typ.)
- 23 dBm saturated power output (typ.)
- Matched to 50 Ohms
- Optional bonding configuration for multiplier applications
- Chip Size 1.720 mm x 0.760 mm



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Positive DC Voltage (+3.5 V Typical)	Vd	+ 5	Volts
Negative DC Voltage	Vg	- 2	Volts
Simultaneous (Vd - Vg)	Vdg	+ 7	Volts
Positive DC Current	Id	600	mA
RF Input Power (from 50 Ω source)	Pin	15	dBm
Operating Base Plate Temperature	Tc	-30 to +70	°C
Storage Temperature Range	Tstg	-55 to +125	°C
Thermal Resistance (Channel to Backside)	Rjc	57	°C/W

Electrical Characteristics[1]

Parameter	Min	Typ	Max	Unit
Frequency Range	20		42	GHz
Drain Supply Voltage (Vd)	2	3.5	5	V
Gate Supply Voltage (Vg)[2]	-2	-0.2	0.5	V
Gain Small Signal Gain	20	22		dB
Gain Variation vs. Frequency		+/-2.5		dB
Power Output at 1 dB Compression		21		dBm

Parameter	Min	Typ	Max	Unit
Power Output Saturated	22	23		dBm
Drain Current at P1 dB Compression		355		mA
Drain Current at Psat		362		mA
Input Return Loss (Pin=-20 dBm)		12		dB
Output Return Loss (Pin=-20 dBm)		10		dB

Notes:
1. Operated at 25 °C, 50 Ohm system, Vd=+3.5 V, quiescent current (Idq)=350 mA.
2. Typical range of the negative gate voltage is -0.5 to 0.0V to set typical Idq of 350 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 typical 2 mil gap between the chip and the substrate material.

Figure 1
Functional Block Diagram

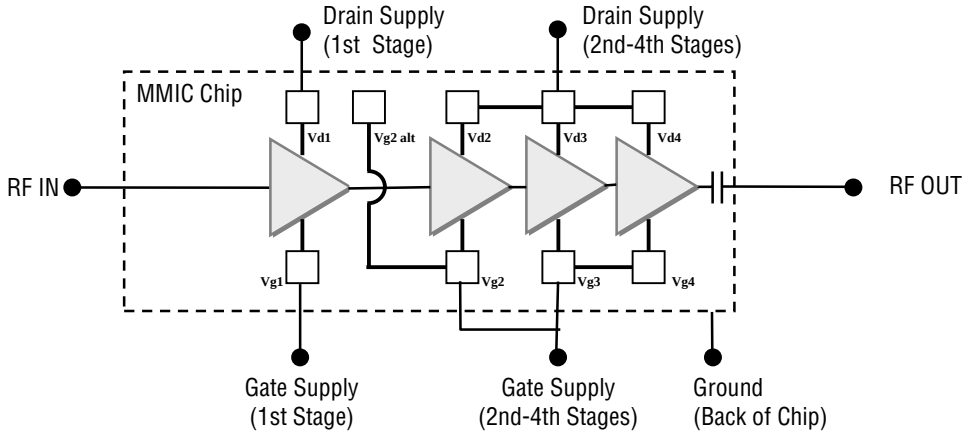
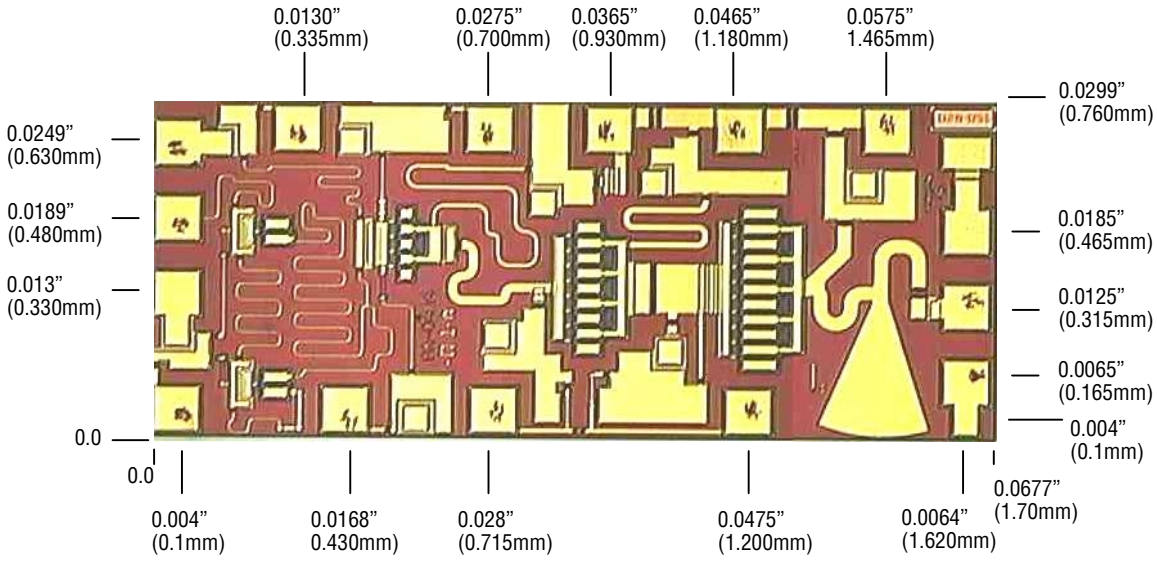


Figure 2
Chip Layout and Bond Pad Locations

Chip Size=0.0677" x 0.30" x 0.002" (1720 µm x 760 µm x 50 µm)



Back of Chip is RF and DC Ground

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Figure 3
Schematic of
Application Circuit

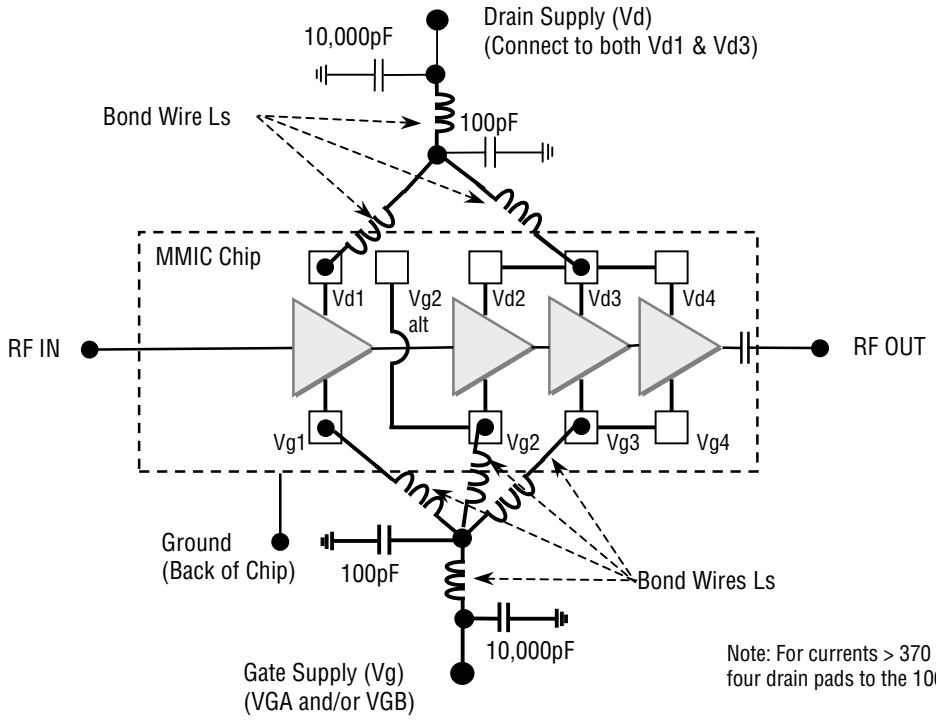
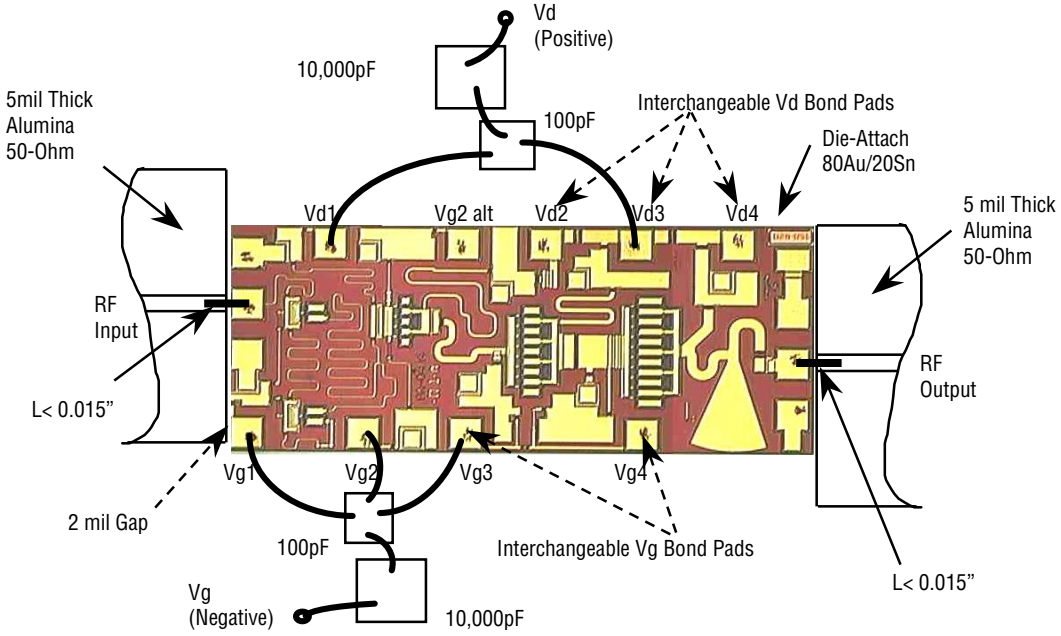


Figure 4
Recommended
Assembly and
Bonding Diagram



Notes:

1. Die-attach with 80Au/20Sn
2. Use 0.003" x 0.0005" gold ribbon for bonding.
3. RF input and output bonds should be less than 0.015" long with stress relief.
4. For currents > 370 mA connect all drain pads (Vd1, Vd2, Vd3, & Vd4) to the 100 pF capacitor.
5. Back of chip is DC and RF ground

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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 +3.5 V to Vd.

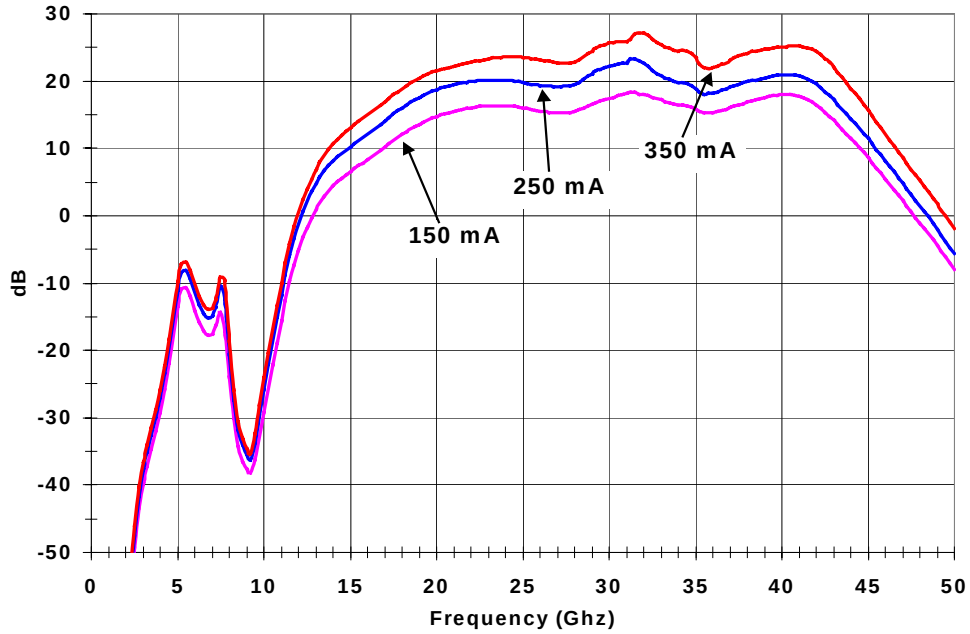
Step 4: Adjust gate bias voltage to set the quiescent current of Idq=350 mA.

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

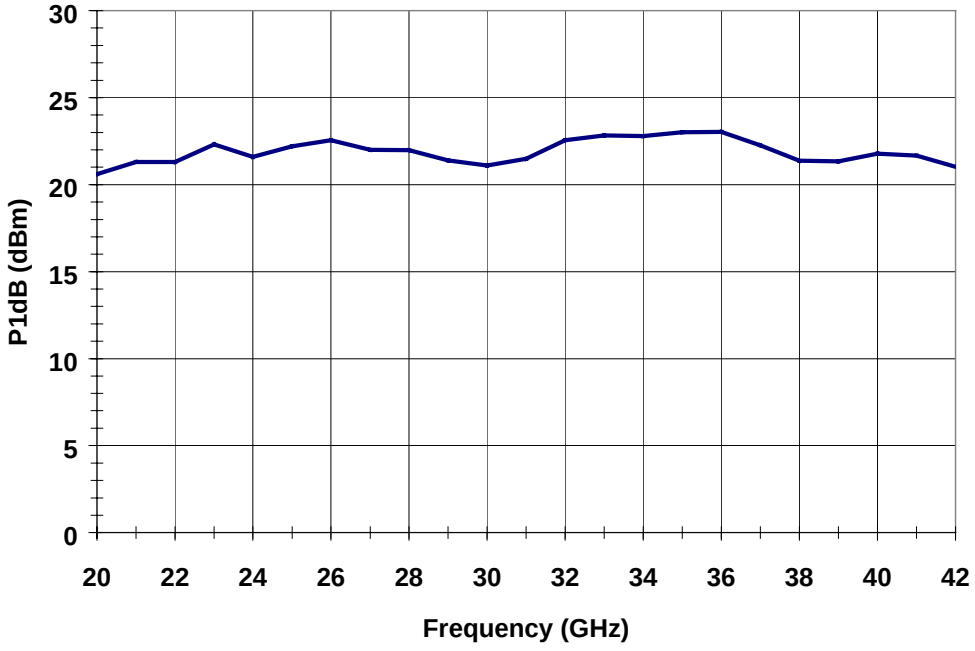
Step 6: Follow turn-off sequence of:
(i) Turn off RF input power,
(ii) Turn down and off drain voltage (Vd),
(iii) Turn down and off gate bias voltage (Vg).

Performance Data

Typical SS Gain vs Frequency vs Supply Current
Bias Vd=3.5



Typical Output Power @ 1dB Compression
Bias Vd=3.5 V, Id=350 mA



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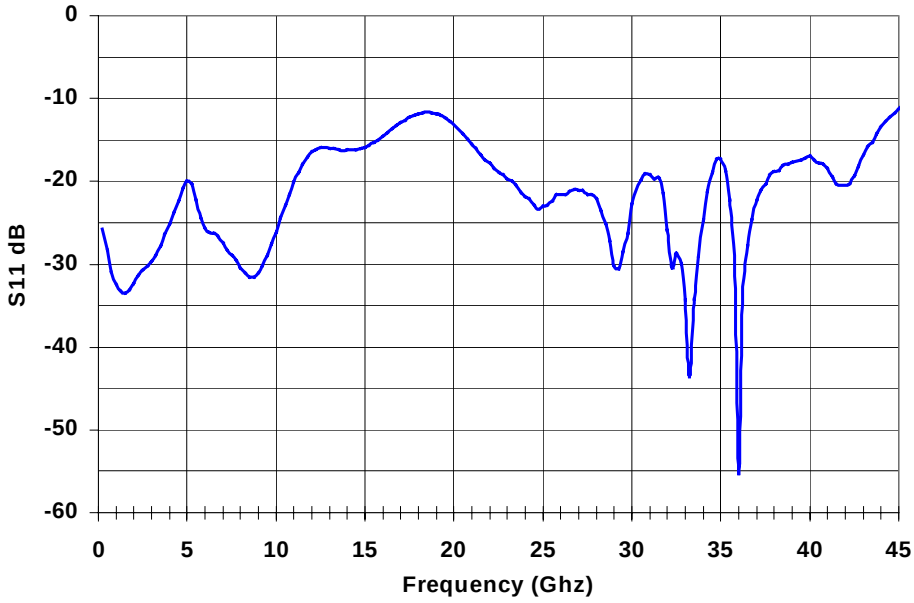
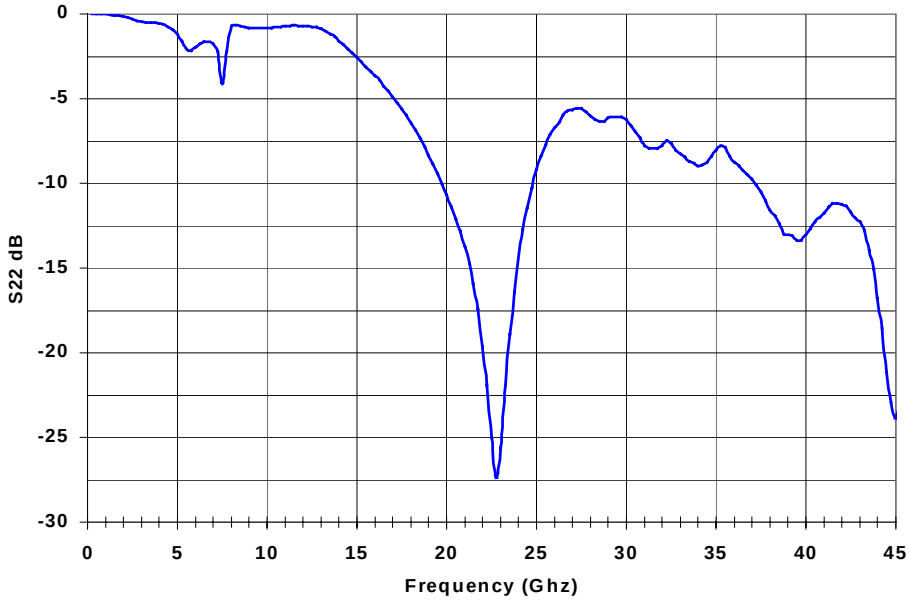
Performance Data

Typical Input Return Loss vs Frequency
Bias Vd=3.5 V, Id=350 mA

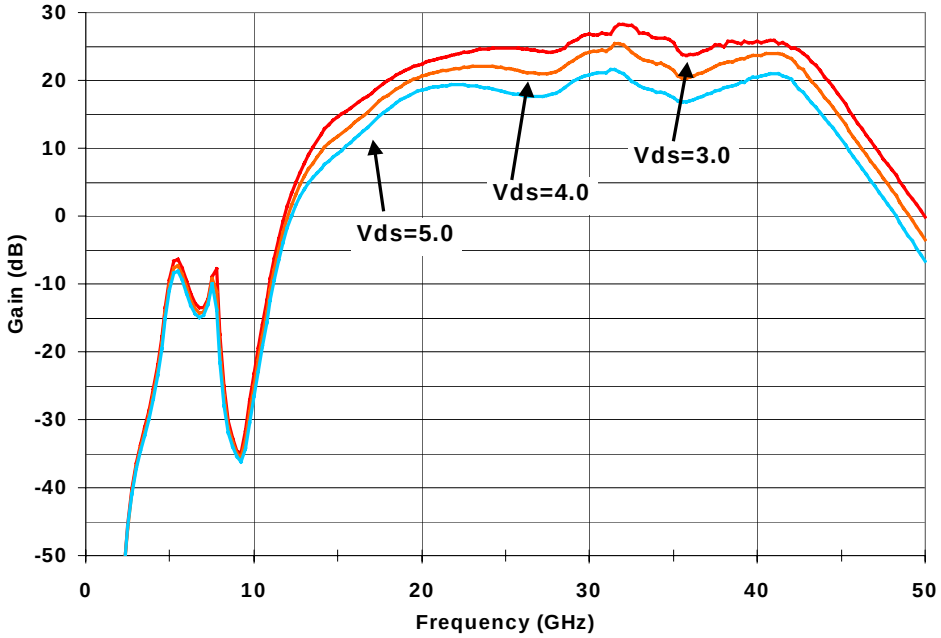


Typical Output Return Loss vs Frequency
Bias Vd=3.5 V, Id=350 mA

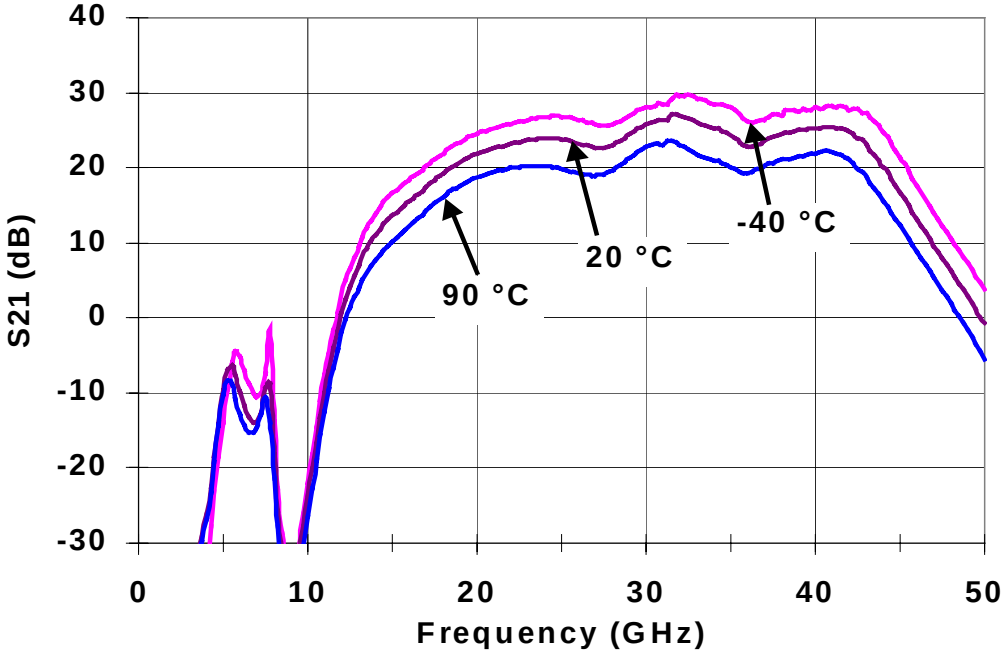


Performance Data

Typical SS Gain vs Frequency vs Supply Voltage
Supply Current=350 mA



Typical SS Gain vs Frequency vs Base Plate Temperature
Bias Vd=3.5 V, Id=350 mA



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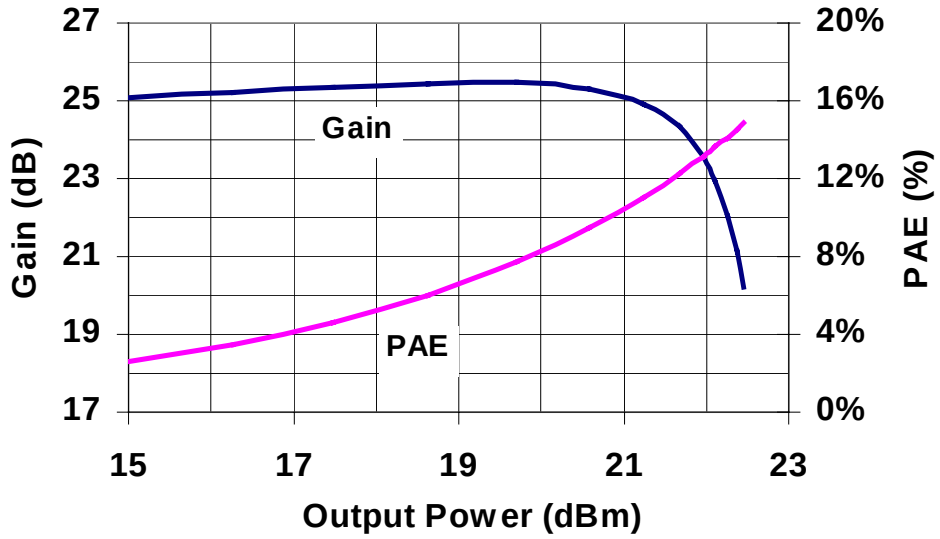
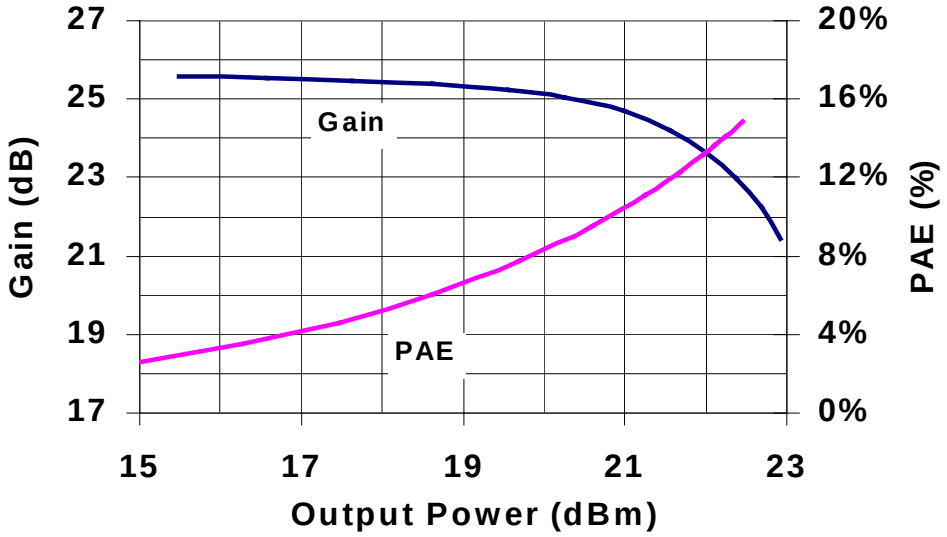
Performance Data

Gain Compression and PAE vs Output Power
Frequency=40 GHz, Bias Vd=3.5 V, Id=350 mA

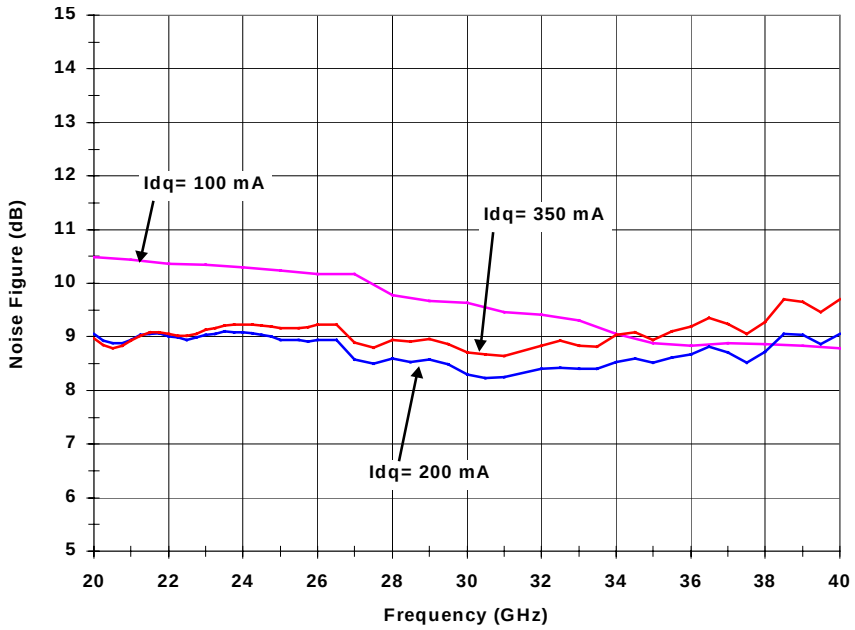


Gain Compression and PAE vs Output Power
Frequency=30 GHz, Bias Vd=3.5 V, Id=350 mA

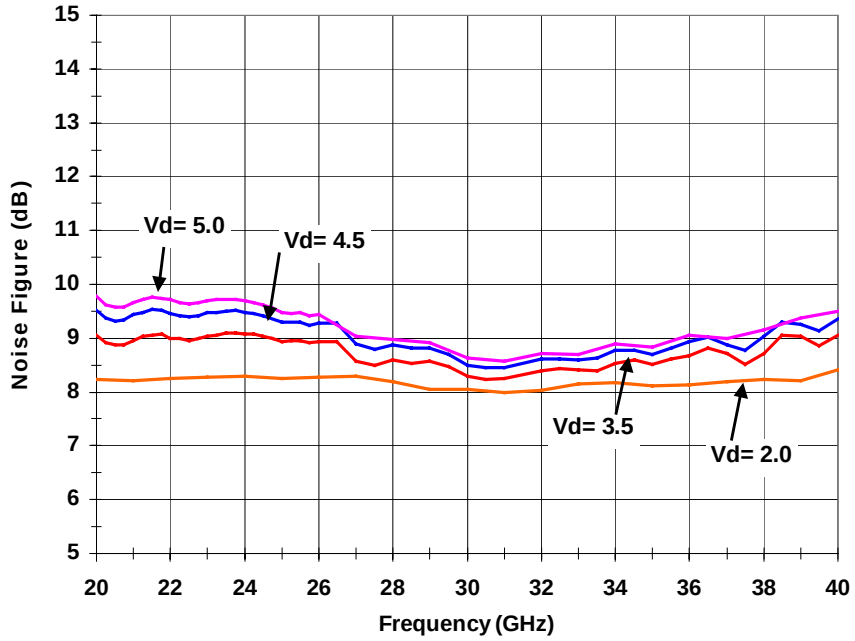


Performance Data

Noise Figure vs Frequency vs Supply Current
Bias Vd=3.5 Volts



Noise Figure vs Frequency vs Supply Voltage
Supply Current=200mA



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