

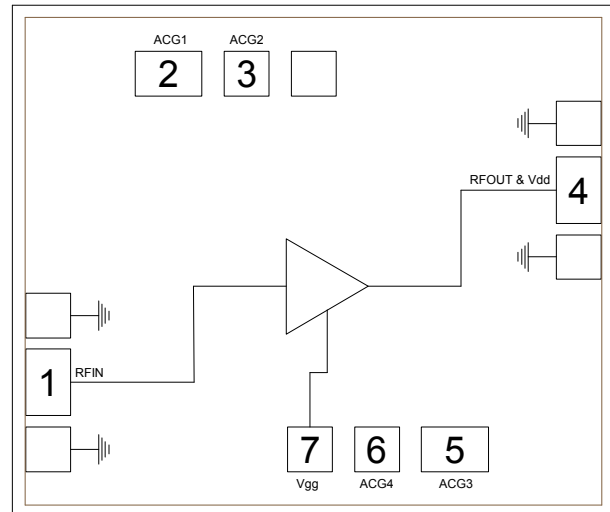
Features

- ▶ Ultra wideband performance
- ▶ Flat gain response
- ▶ Low noise figure
- ▶ Low power consumption
- ▶ Small die size

Description

The CMD304 is an ultra wideband GaAs MMIC distributed driver amplifier die which operates from DC to 67 GHz. The amplifier delivers 9.5 dB of gain with a corresponding noise figure of 3 dB and output 1 dB compression point of +11 dBm at 30 GHz. The CMD304 is a 50 ohm matched design which eliminates the need for RF port matching. The CMD304 offers full passivation for increased reliability and moisture protection.

Functional Block Diagram



Electrical Performance – $V_{dd} = 3.0\text{ V}$, $I_{dd} = 40\text{ mA}$, $T_A = 25\text{ }^\circ\text{C}$, $F = 30\text{ GHz}$

Parameter	Min	Typ	Max	Units
Frequency Range	DC – 67			GHz
Gain		9.5		dB
Noise Figure		3		dB
Input Return Loss		20		dB
Output Return Loss		18		dB
Output P1dB		11		dBm
Output Psat		14		dBm
Output IP3		21		dBm
Supply Current		40		mA

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CMD304

DC-67 GHz Distributed Driver Amplifier

Specifications

Absolute Maximum Ratings

Parameter	Rating
Drain Voltage, Vdd	7 V
Gate Voltage, Vgg	-2.5 V to 0 V
RF Input Power	+15 dBm
Channel Temperature, Tch	150 °C
Power Dissipation, P _{diss}	697 mW
Thermal Resistance, Θ_{JC}	93.25 °C/W
Operating Temperature	-55 to 85 °C
Storage Temperature	-55 to 150 °C

Exceeding any one or combination of the maximum ratings may cause permanent damage to the device.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Vdd	2.0	3.0	5.0	V
I _{dd}		40		mA
V _{gg}		-0.4		V

Electrical performance is measured at specific test conditions. Electrical specifications are not guaranteed over all recommended operating conditions.

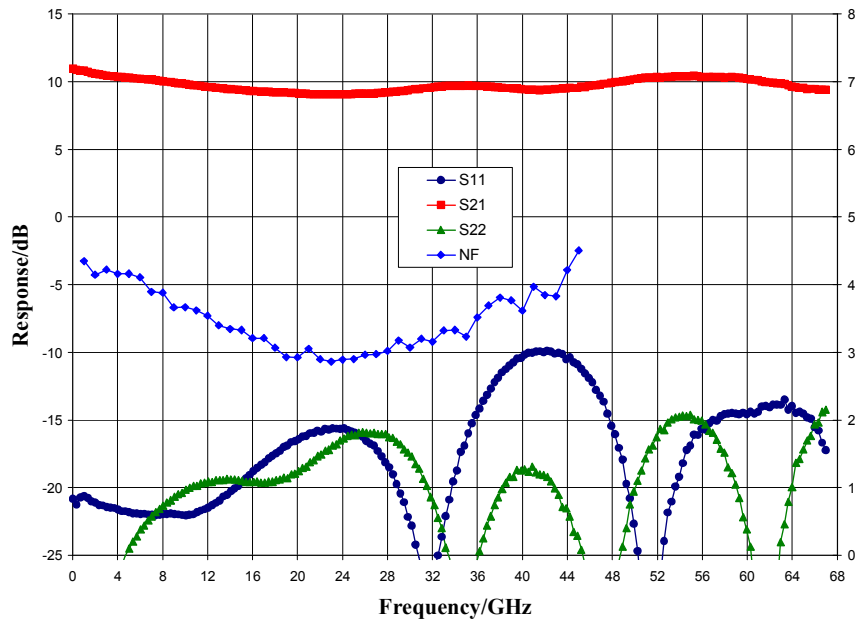
Electrical Specifications – V_{dd} = 3.0 V, I_{dd} = 40 mA T_A = 25 °C

Parameter	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Units
Frequency Range	DC - 30			30 - 50			50 - 67			GHz
Gain	7	9.5		7.5	9.5		7.5	10		dB
Noise Figure		3.5			3.5					dB
Input Return Loss		20			13			14		dB
Output Return Loss		18			18			18		dB
Output P _{1dB}	9	11.5		5	9					dBm
Output P _{sat}		14			12					dBm
Output IP ₃		22			20					dBm
Supply Current	28	40	52	28	40	52	28	40	52	mA
Gain Temp Coefficient		0.006			0.009			0.015		dB/°C
Noise Figure Temp Coefficient		0.009			0.014					dB/°C

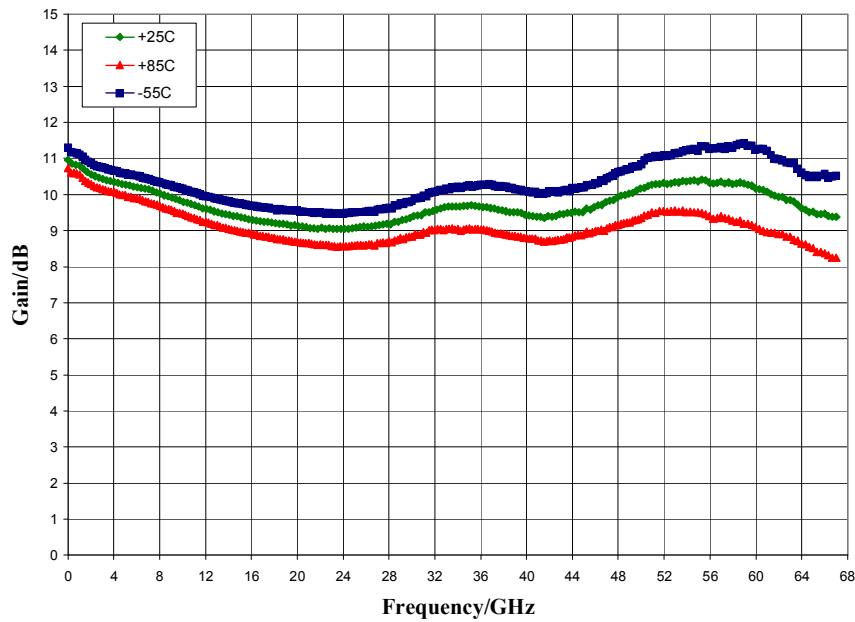
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Typical Performance

Broadband Performance, $V_{dd} = 3\text{ V}$, $I_{dd} = 40\text{ mA}$, $T_A = 25\text{ }^\circ\text{C}$

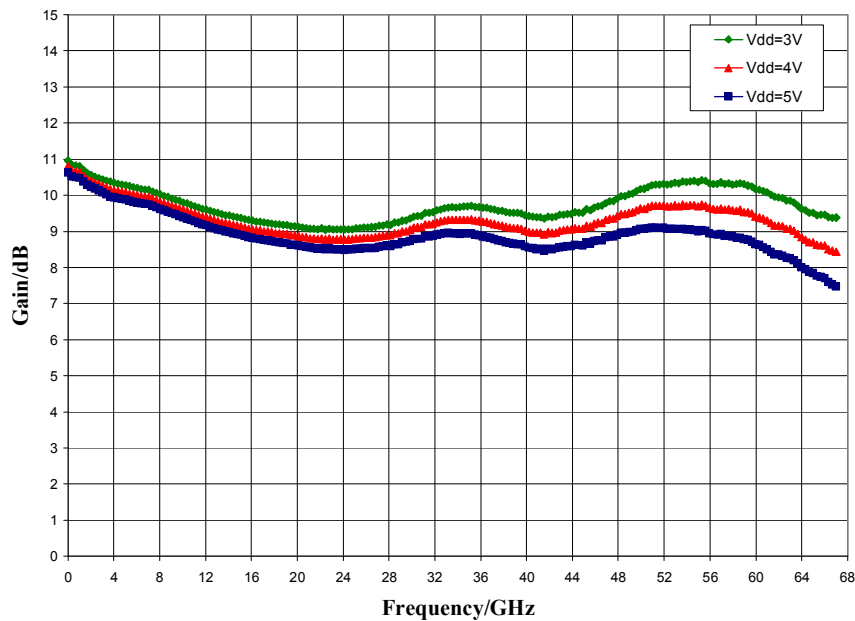


Gain vs. Temperature, $V_{dd} = 3\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$

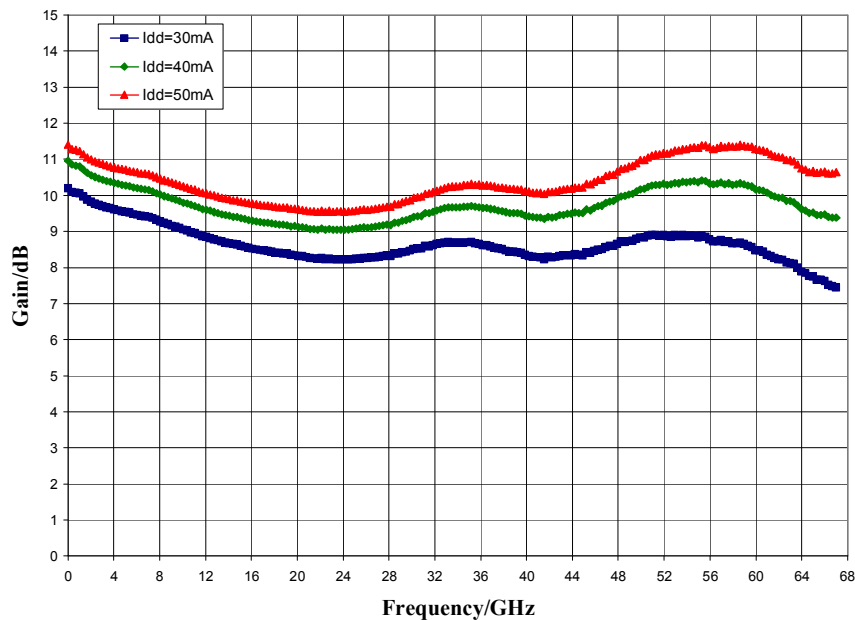


Typical Performance

Gain vs. V_{dd} , $I_{dd} = 40 \text{ mA}$, $T_A = 25 \text{ }^\circ\text{C}$

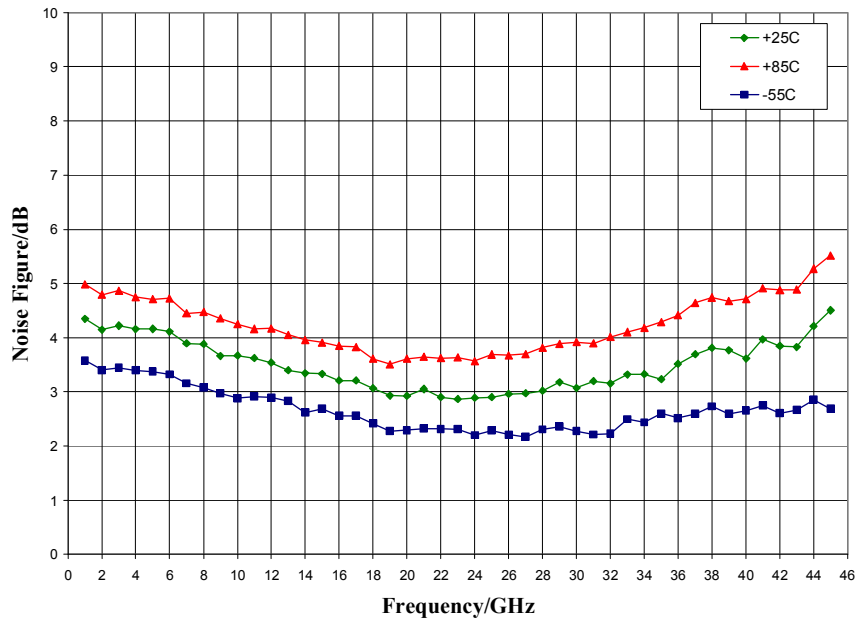


Gain vs. I_{dd} , $V_{dd} = 3 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$

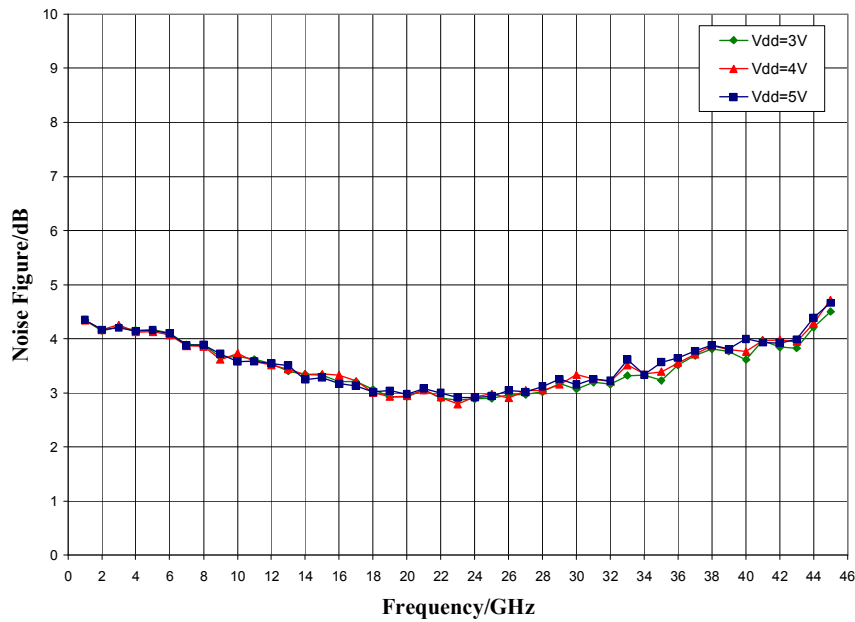


Typical Performance

Noise Figure vs. Temperature, $V_{dd} = 3\text{ V}$

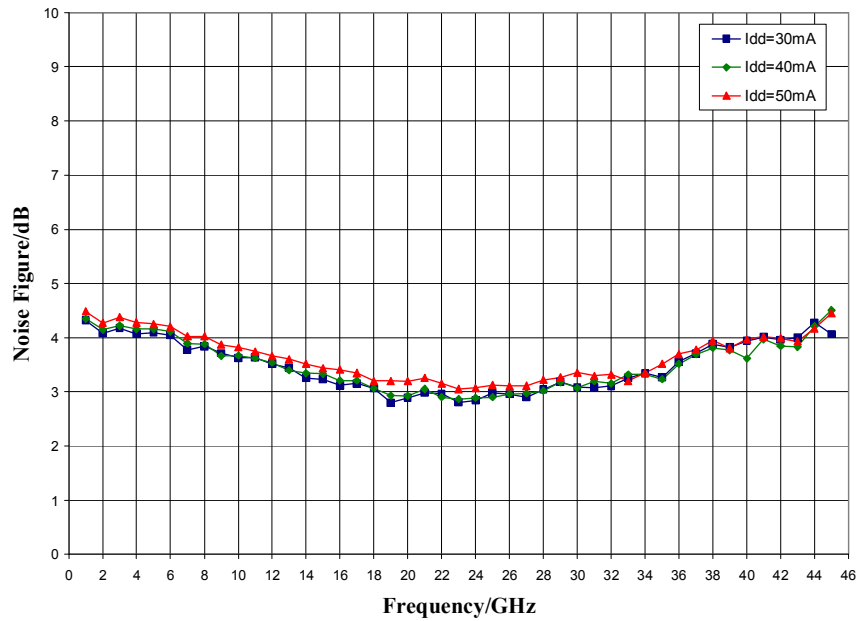


Noise Figure vs. V_{dd} , $I_{dd} = 40\text{ mA}$, $T_A = 25\text{ }^\circ\text{C}$

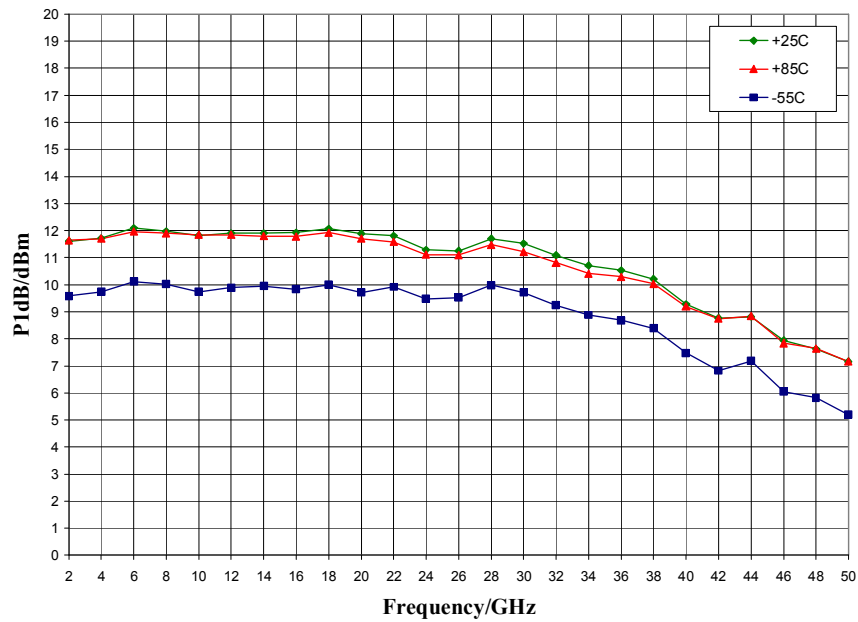


Typical Performance

Noise Figure vs. I_{dd} , $V_{dd} = 3\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$

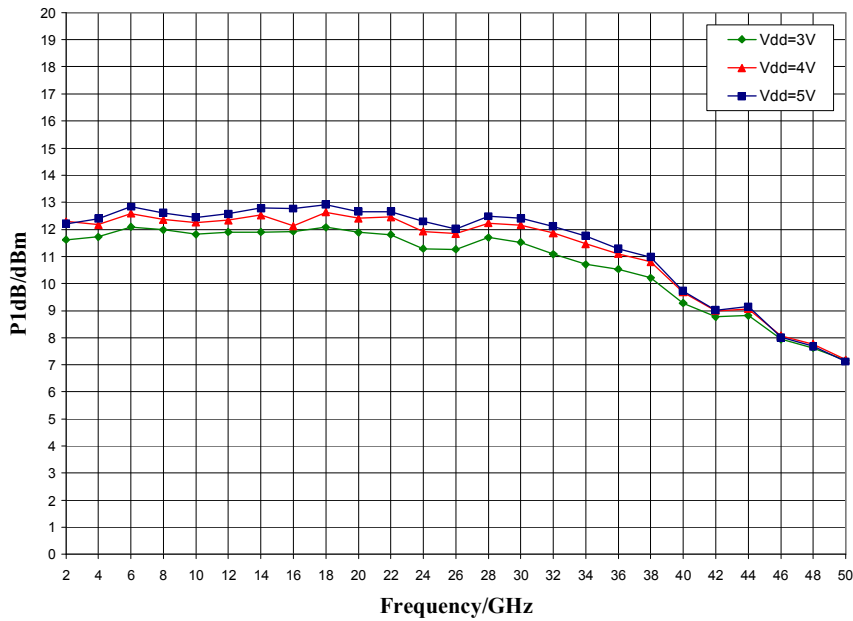


P1dB vs. Temperature, $V_{dd} = 3\text{ V}$

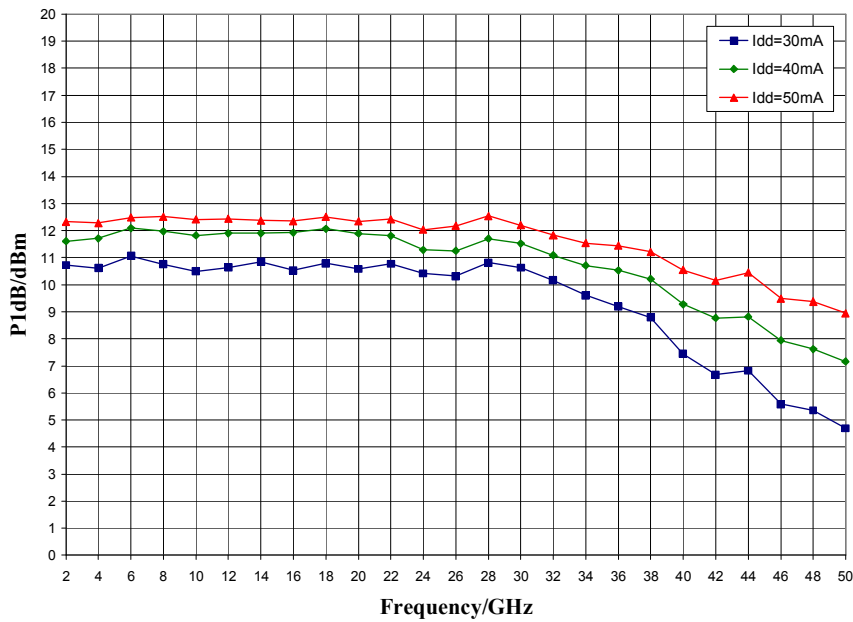


Typical Performance

P1dB vs. V_{dd} , $I_{dd} = 40\text{mA}$, $T_A = 25^\circ\text{C}$

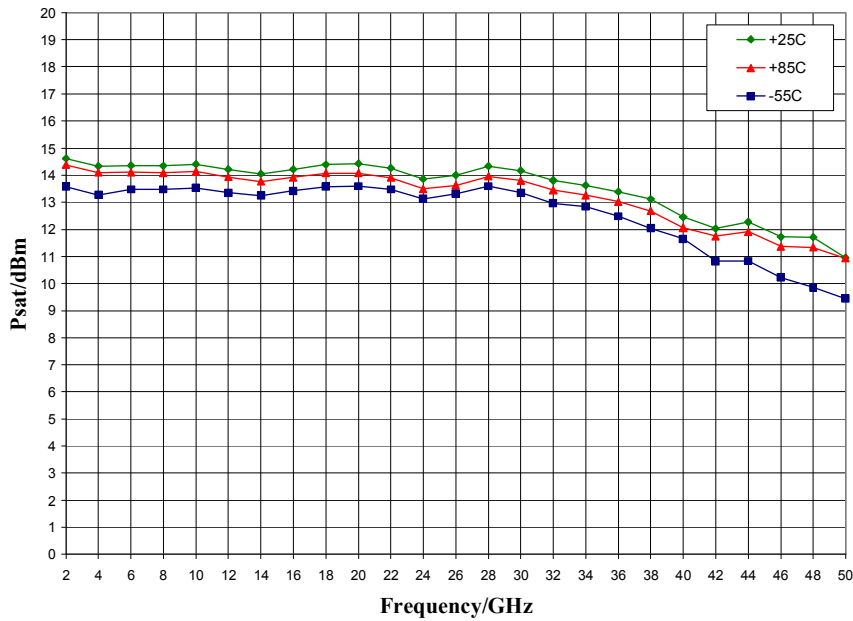


P1dB vs. I_{dd} , $V_{dd} = 3\text{V}$, $T_A = 25^\circ\text{C}$

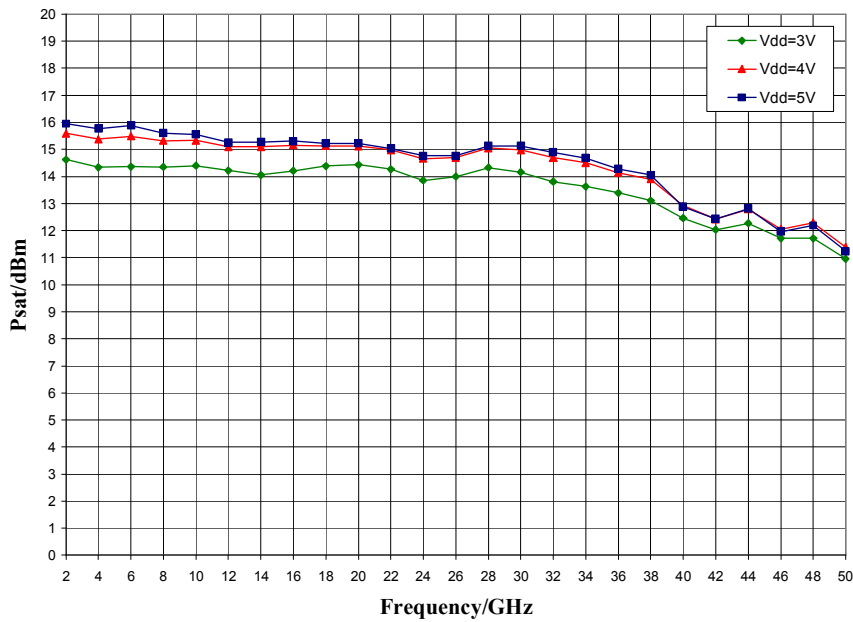


Typical Performance

Psat vs. Temperature, $V_{dd} = 3\text{ V}$

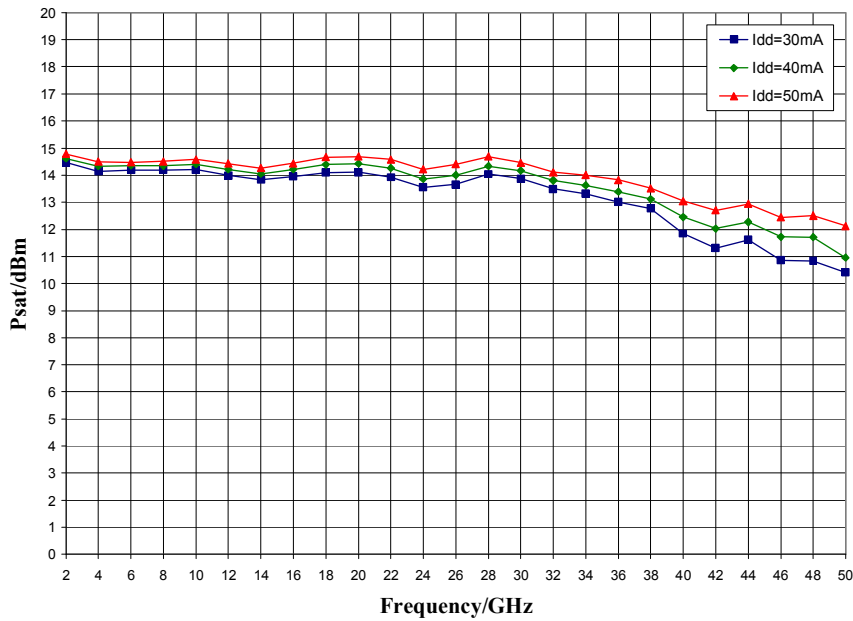


Psat vs. V_{dd} , $I_{dd} = 40\text{ mA}$, $T_A = 25\text{ }^\circ\text{C}$

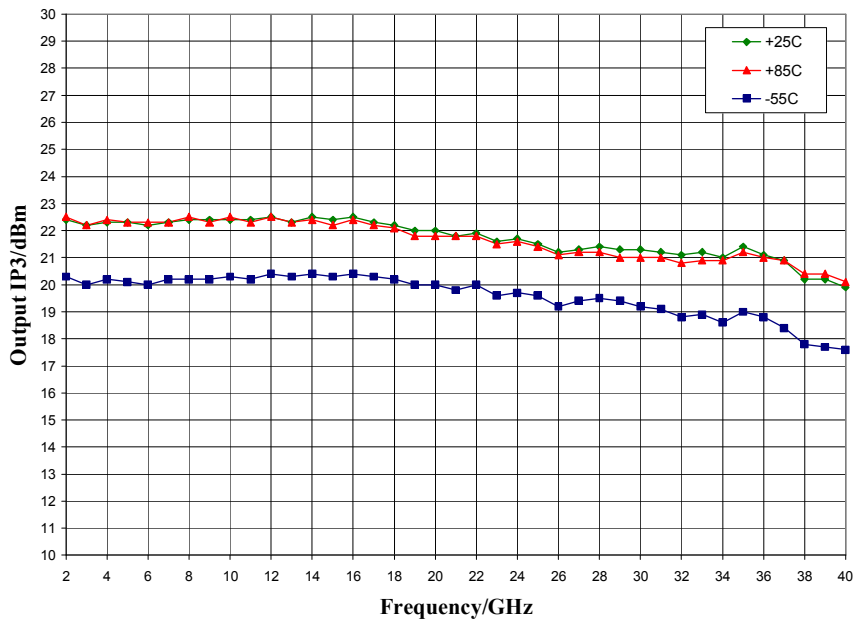


Typical Performance

Psat vs. I_{dd} , $V_{dd} = 3\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$

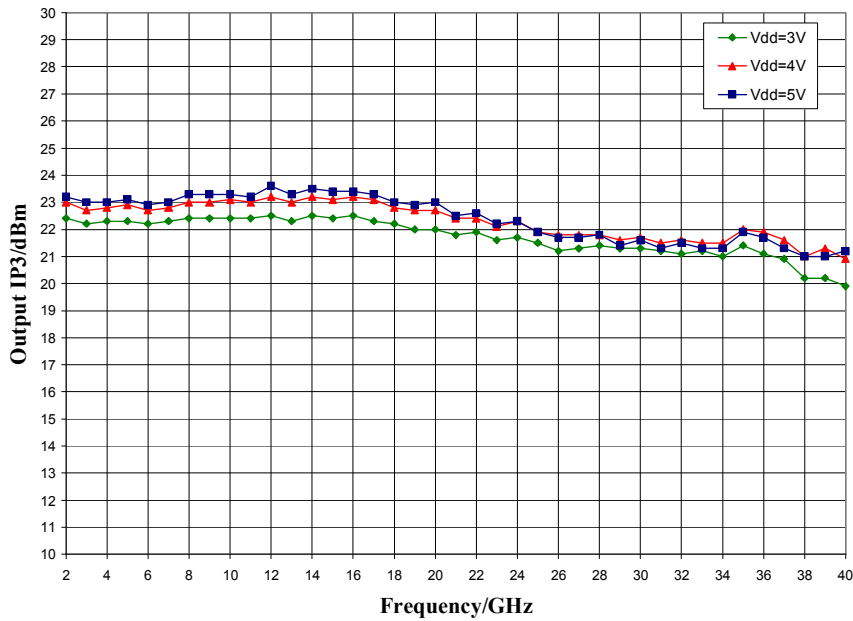


Output IP3 vs. Temperature, $V_{dd} = 3\text{ V}$

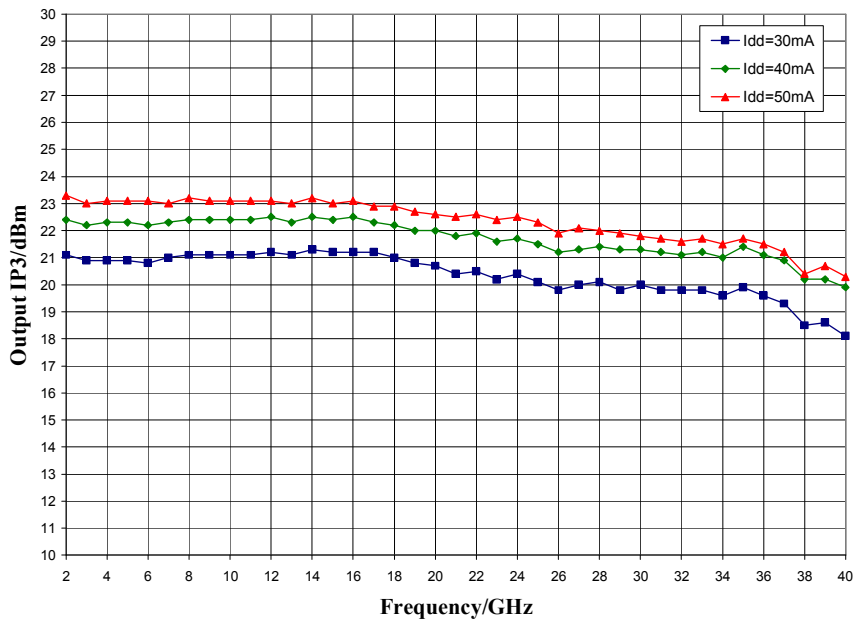


Typical Performance

Output IP3 vs. V_{dd} , $I_{dd} = 40\text{mA}$, $T_A = 25^\circ\text{C}$

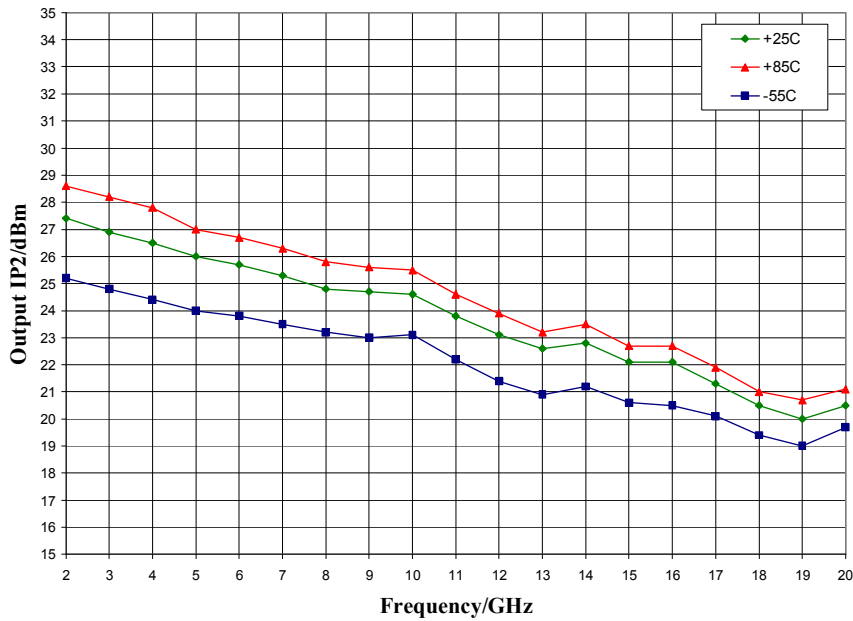


Output IP3 vs. I_{dd} , $V_{dd} = 3\text{V}$, $T_A = 25^\circ\text{C}$

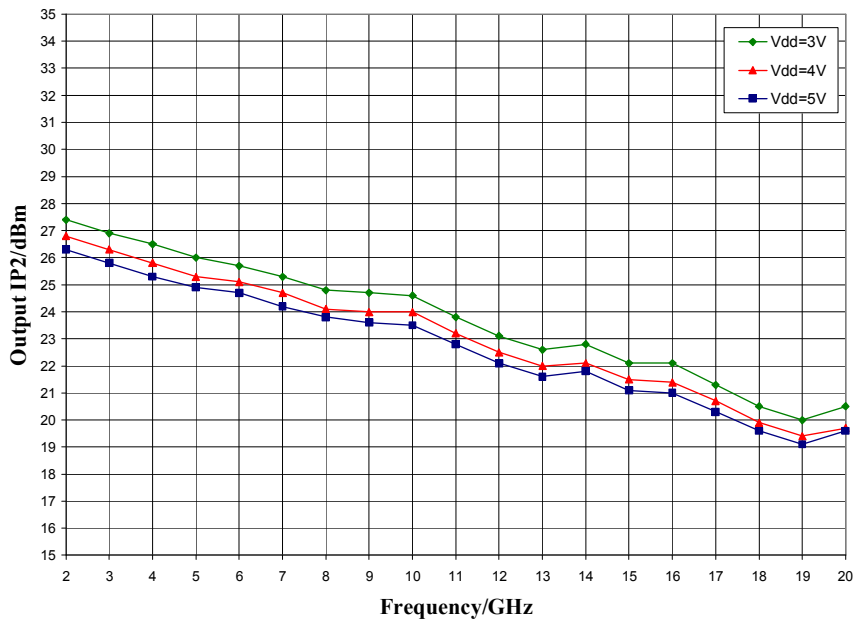


Typical Performance

Output IP2 vs. Temperature, $V_{dd} = 3\text{ V}$

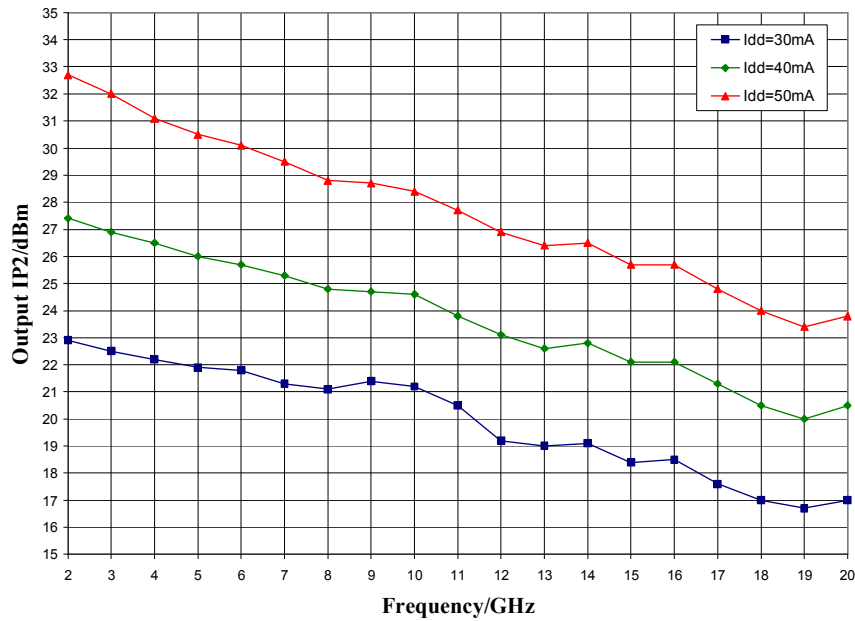


Output IP2 vs. V_{dd} , $I_{dd} = 40\text{mA}$, $T_A = 25\text{ }^\circ\text{C}$



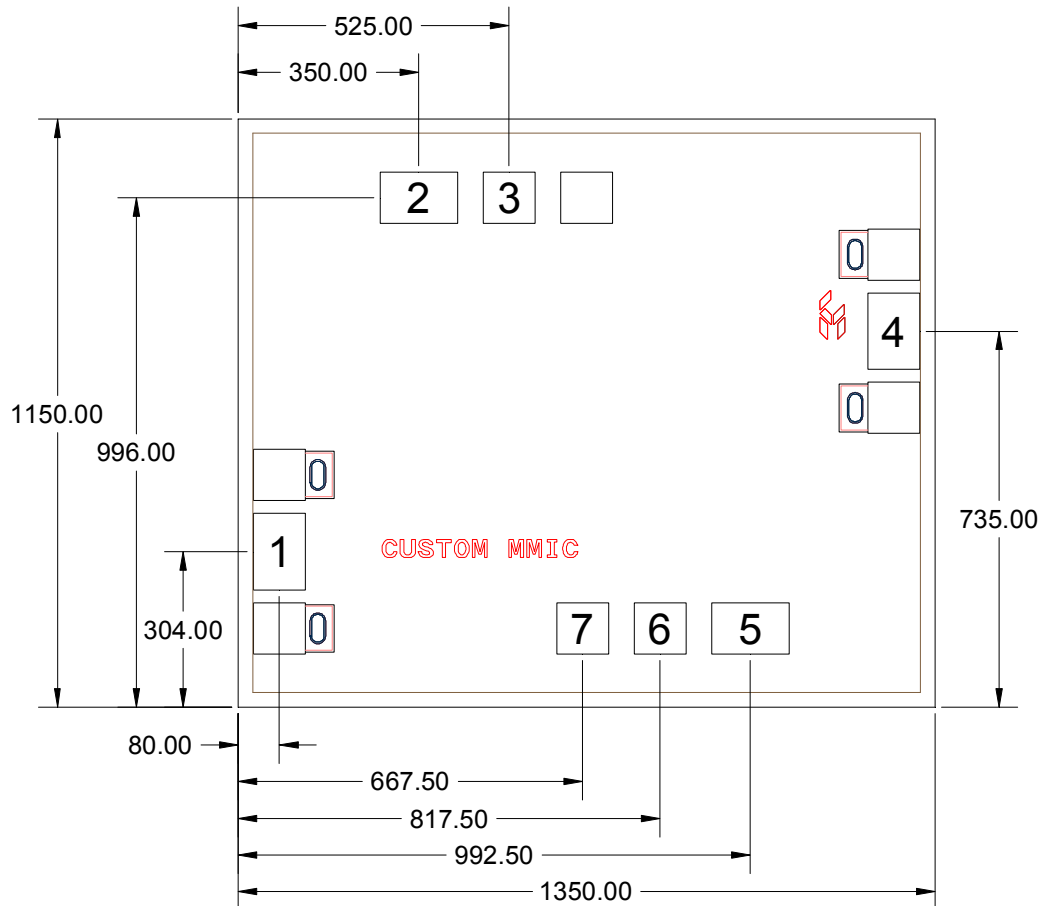
Typical Performance

Output IP2 vs. I_{dd} , $V_{dd} = 3\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$



Mechanical Information

Die Outline (all dimensions in microns)

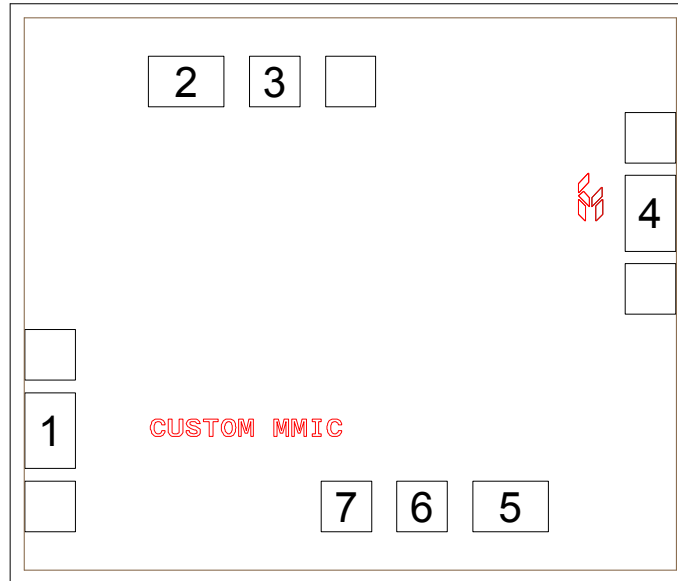


Notes:

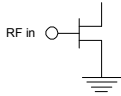
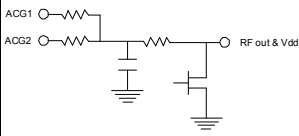
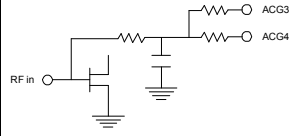
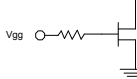

1. No connection required for unlabeled pads
2. Backside is RF and DC ground
3. Backside and bond pad metal: Gold
4. Die is 100 microns thick
5. Bond pads 1, 2, 4 and 5 are 100 x 150 microns
6. Bond pads 3, 6 and 7 are 100 x 100 microns

Pad Description

Pad Diagram



Functional Description

Pad	Function	Description	Schematic
1	RF in	50 ohm matched input	
2, 3	ACG1, 2	Low frequency termination. Attach bypass capacitor per application circuit	
4	RF out & Vdd	Power supply voltage and 50 ohm matched output	
5, 6	ACG3, 4	Low frequency termination. Attach bypass capacitor per application circuit	
7	Vgg	Power supply voltage Decoupling and bypass caps required	
Backside	Ground	Connect to RF / DC ground	

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Applications Information

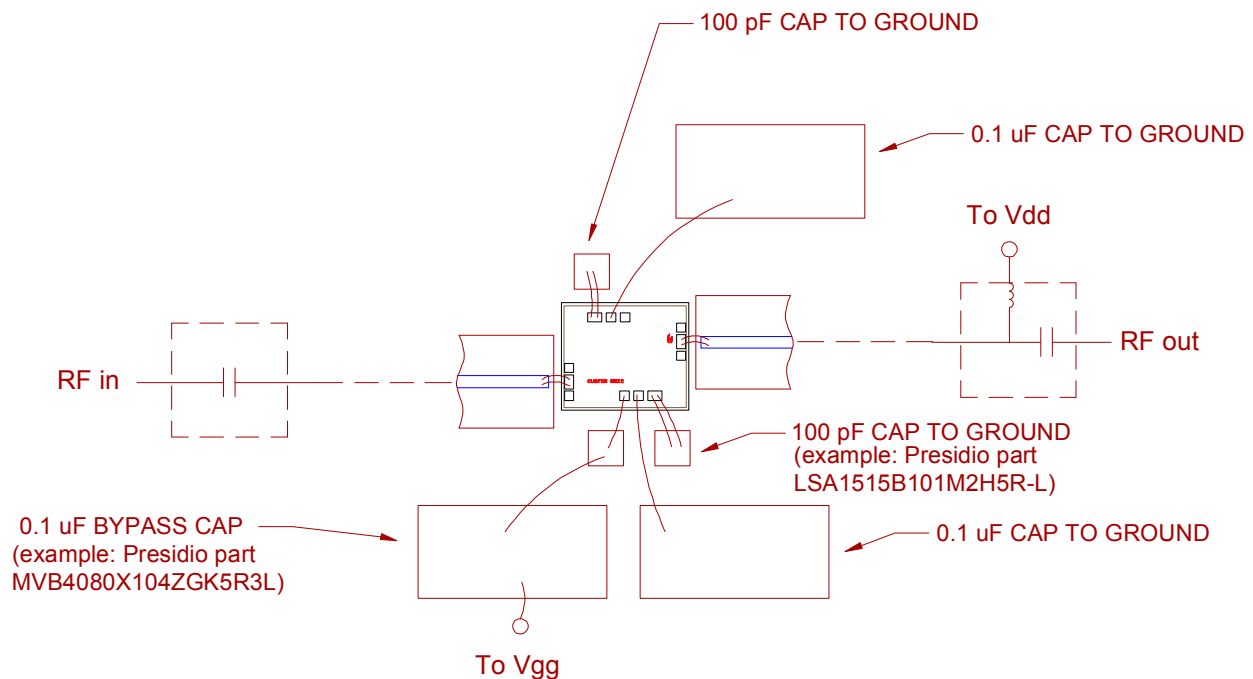
Assembly Guidelines

The backside of the CMD304 is RF ground. Die attach should be accomplished with electrically and thermally conductive epoxy only. Eutectic attach is not recommended. Standard assembly procedures should be followed for high frequency devices. The top surface of the semiconductor should be made planar to the adjacent RF transmission lines, and the RF decoupling capacitors placed in close proximity to the DC connections on chip.

RF connections should be made as short as possible to reduce the inductive effect of the bond wire. Use of a 0.8 mil thermosonic wedge bonding is highly recommended as the loop height will be minimized. The RF input and output require a double bond wire as shown.

The semiconductor is 100 um thick and should be handled by the sides of the die or with a custom collect. Do not make contact directly with the die surface as this will damage the monolithic circuitry. Handle with care.

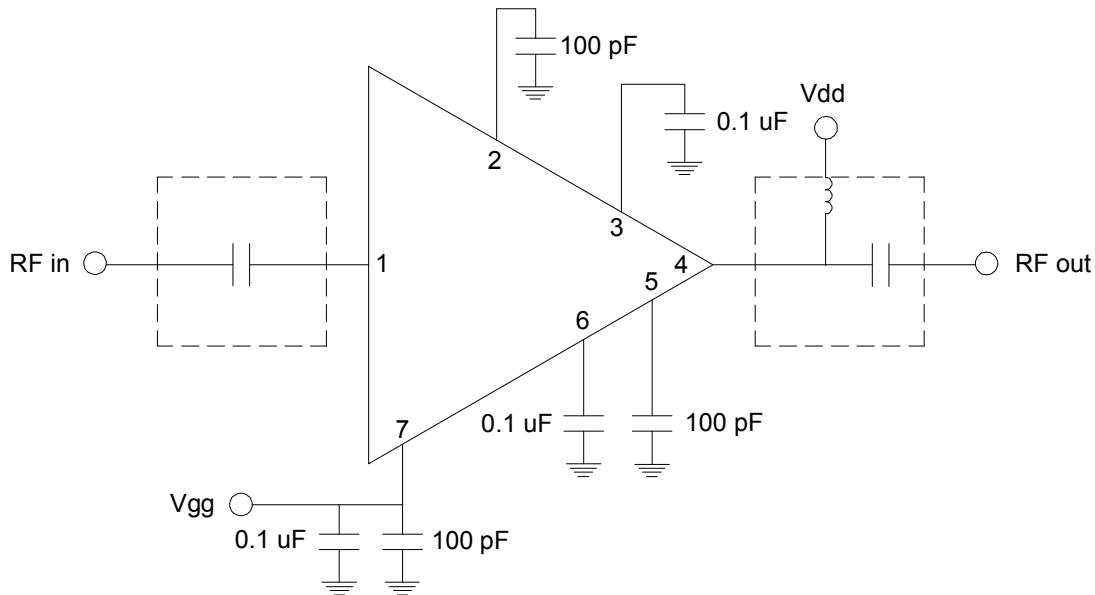
Assembly Diagram



GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

Applications Information

Application Circuit



Note: Drain voltage (V_{dd}) must be applied through a broadband bias tee or external bias network. External DC block is required on RF input.

Biasing and Operation

The CMD304 is biased with a positive drain supply and a negative gate supply. Performance is optimized when the drain voltage (V_{dd}) is set to +3 V. The nominal gate voltage (V_{gg}) is -0.4 V.

Turn ON procedure:

1. Apply gate voltage V_{gg} and set to -2 V
2. Apply drain voltage V_{dd} and set to +3 V
3. Increase V_{gg} (less negative) to achieve a drain current of 40 mA

Turn OFF procedure:

1. Turn off drain voltage V_{dd}
2. Turn off gate voltage V_{gg}

RF power can be applied at any time.