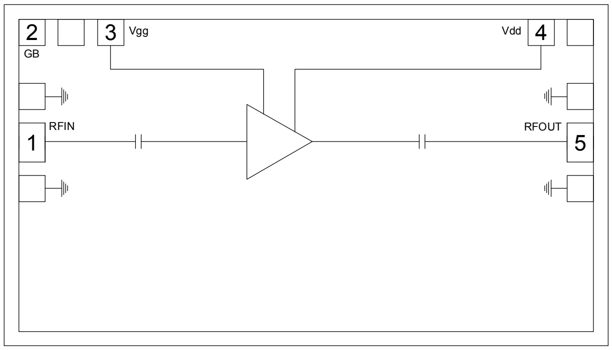
CMD298

17-25 GHz Low Noise Amplifier

Features

- ► Ultra low noise performance
- ► High gain
- ► All positive supply voltages
- ► Low current consumption
- ► Small die size

Functional Block Diagram



Description

The CMD298 is a highly efficient GaAs MMIC low noise amplifier ideally suited for EW and communications systems where small size and low power consumption are needed. The device is optimized for 21 GHz and delivers greater than 27 dB of gain with a corresponding noise figure of 1.4 dB and output 1 dB compression point of +8 dBm. The CMD298 is a 50 ohm matched design which eliminates the need for external DC blocks and RF port matching. The CMD298 offers full passivation for increased reliability and moisture protection.

Electrical Performance - V_{dd} = 3.0 V, V_{gg} = 1.5 V, T_A = 25 ^oC, F=21 GHz

Parameter	Min	Typ	Max	Units
Frequency Range		17 - 25		GHz
Gain		27		dB
Noise Figure		1.4		dB
Input Return Loss		19		dB
Output Return Loss		10		dB
Output P1dB		8		dBm
Output IP3		17		dBm
Supply Current		27		mA

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Specifications

Absolute Maximum Ratings

Parameter	Rating
Drain Voltage, Vdd	3.5 V
Gate Voltage, Vgg	3 V
RF Input Power	+20 dBm
Channel Temperature, Tch	150 °C
Power Dissipation, Pdiss	499 mW
Thermal Resistance Θ_{jc}	120.3 °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	1.5	3.0	3.3	V
Idd		27		mA
Vgg		1.5		V
Igg		1		mA

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, V_{gg} = 1.5 V, T_A = 25 °C

Parameter	Min	Typ	Max	Min	Typ	Max	Units
Frequency Range	17 - 22			22 - 25			GHz
Gain	24	27.5		22	26		dB
Noise Figure		1.4	2.1		1.4	2	dB
Input Return Loss		10			13		dB
Output Return Loss		10			13		dB
Output P1dB		8			9		dBm
Output IP3		17			18		dBm
Supply Current	19	27	35	19	27	35	mA
Gain Temperature Coefficient		0.02			0.02		dB/°C
Noise Figure Temperature Coefficient		0.007			0.007		dB/°C

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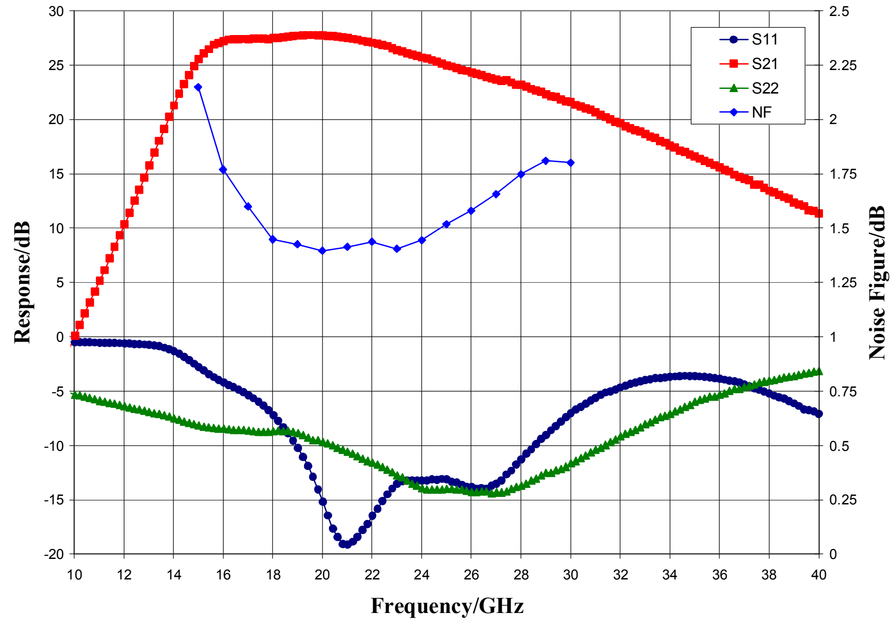
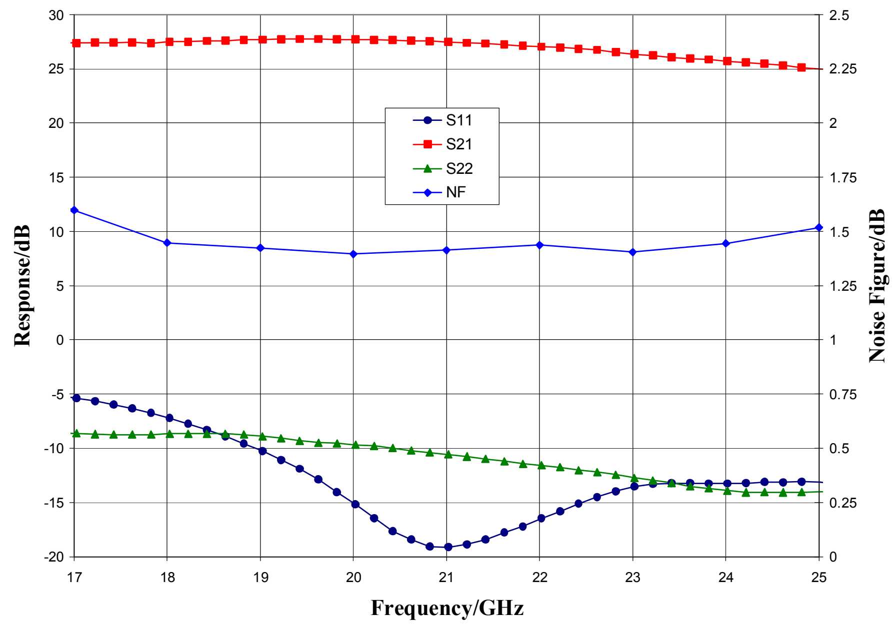
Typical Performance

Broadband Performance, V_{dd} = 3.0 V, V_{gg} = 1.5 V, I_{dd} = 27 mA, T_A = 25 °C



Narrow-band Performance, V_{dd} = 3.0 V, V_{gg} = 1.5 V, I_{dd} = 27 mA, T_A = 25 °C



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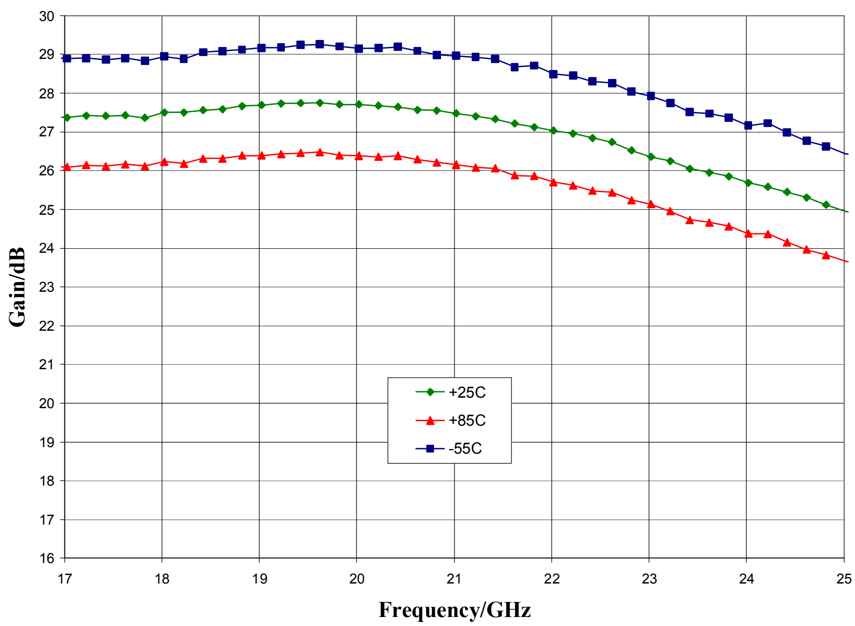
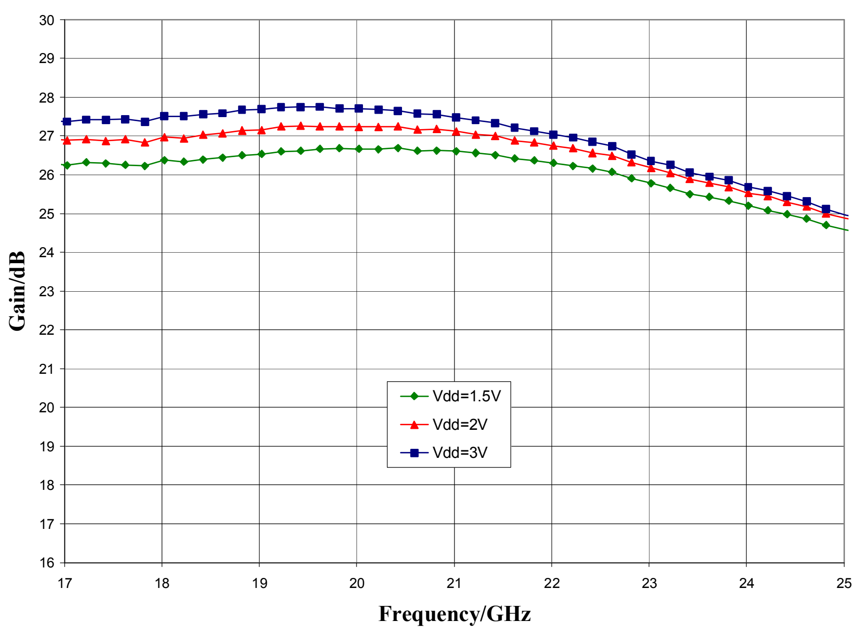
Typical Performance

Gain vs. Temperature, V_{dd} = 3.0 V, V_{gg} = 1.5 V



Gain vs. V_{dd}, V_{gg} = 1.5 V, T_A = 25 °C



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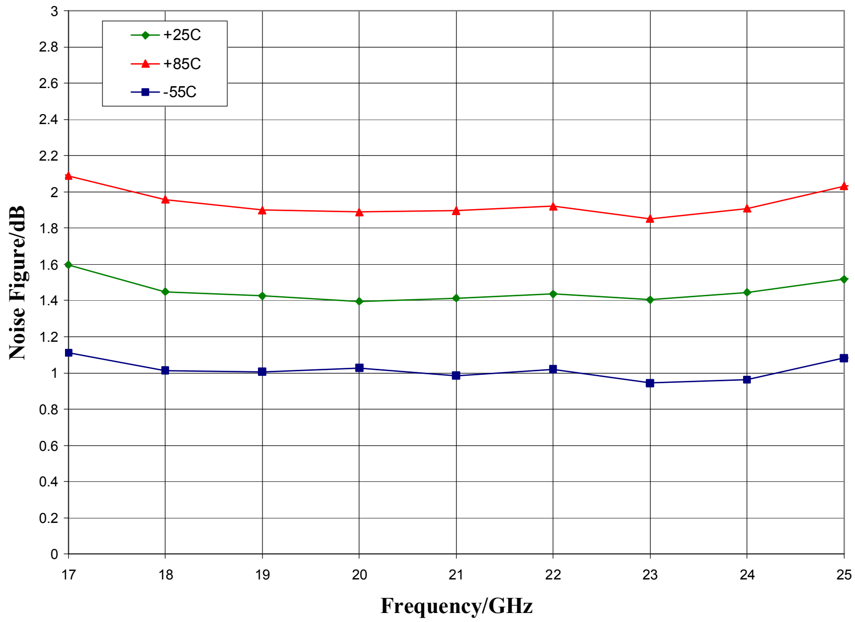
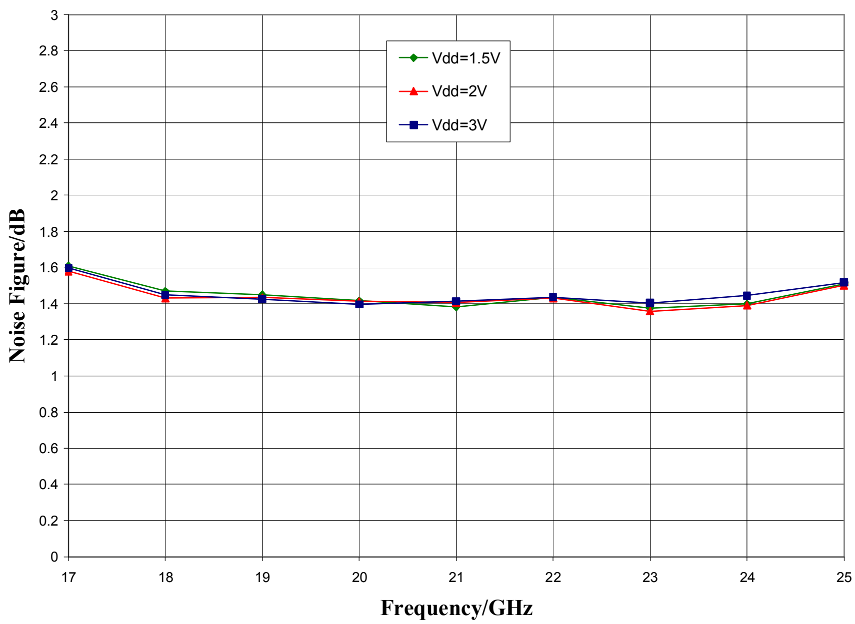
Typical Performance

Noise Figure vs. Temperature, V_{dd} = 3.0 V, V_{gg} = 1.5 V



Noise Figure vs. V_{dd}, V_{gg} = 1.5 V, T_A = 25 ^{o}C



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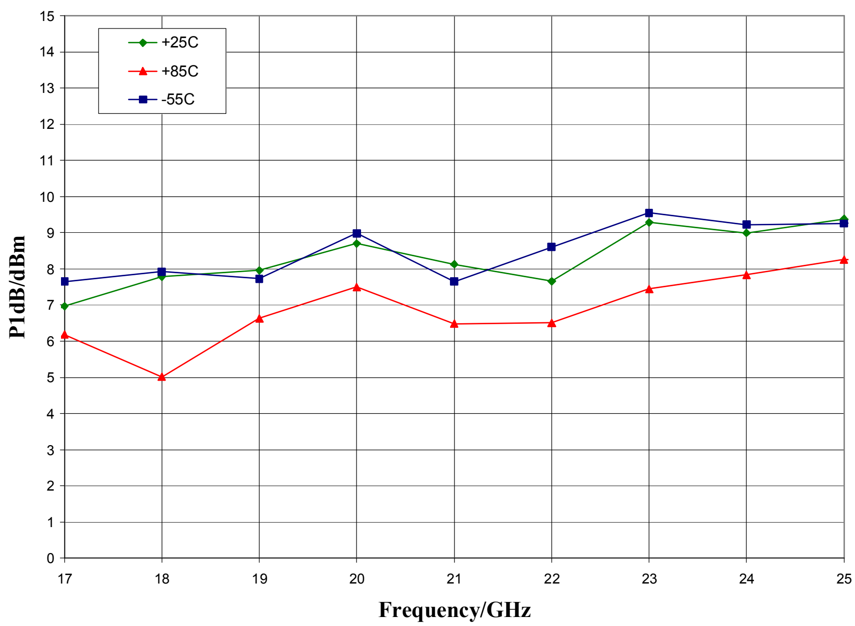
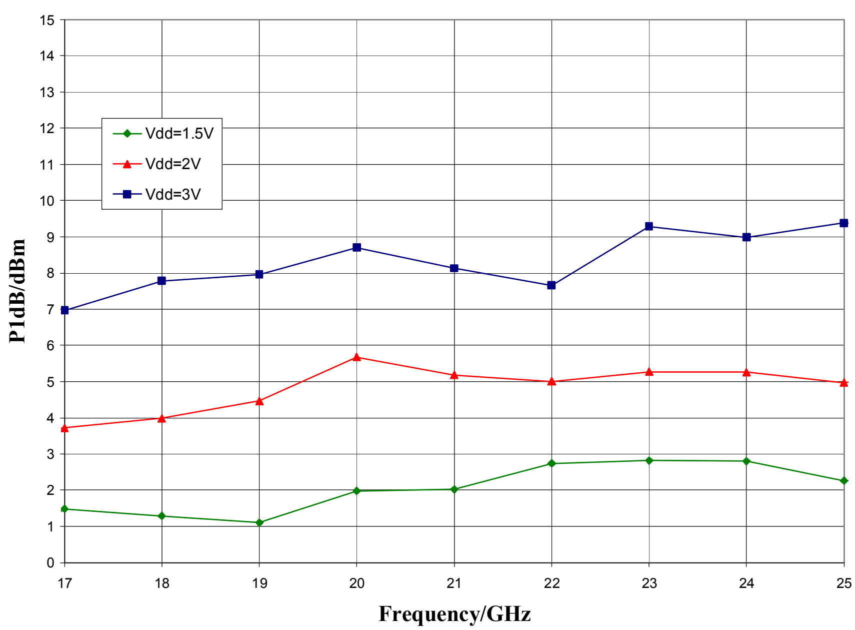
Typical Performance

P1dB vs. Temperature, V_{dd} = 3.0 V, V_{gg} = 1.5 V



P1dB vs. V_{dd}, V_{gg} = 1.5 V, T_A = 25 °C



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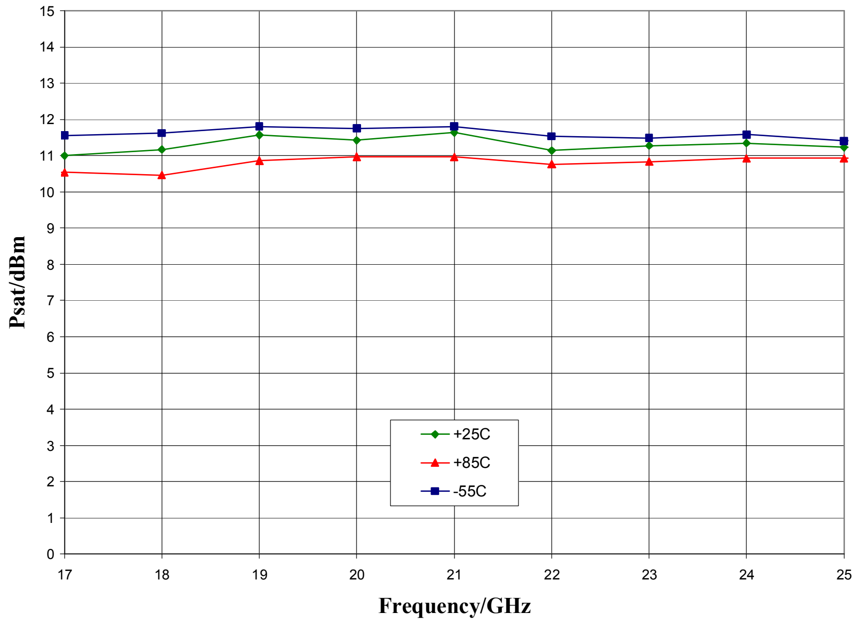
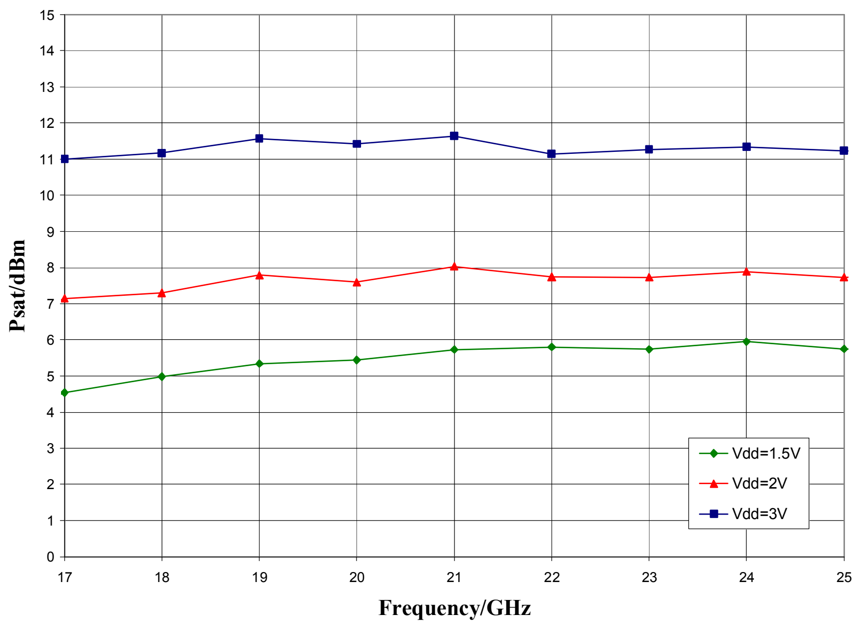
Typical Performance

Psat vs. Temperature, V_{dd} = 3.0 V, V_{gg} = 1.5 V



Psat vs. V_{dd}, V_{gg} = 1.5 V, T_A = 25 °C



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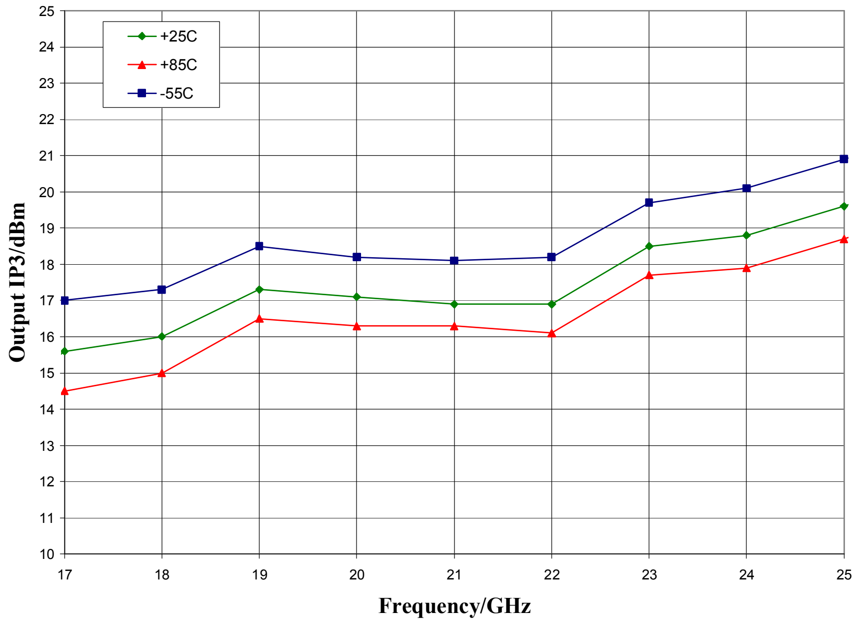
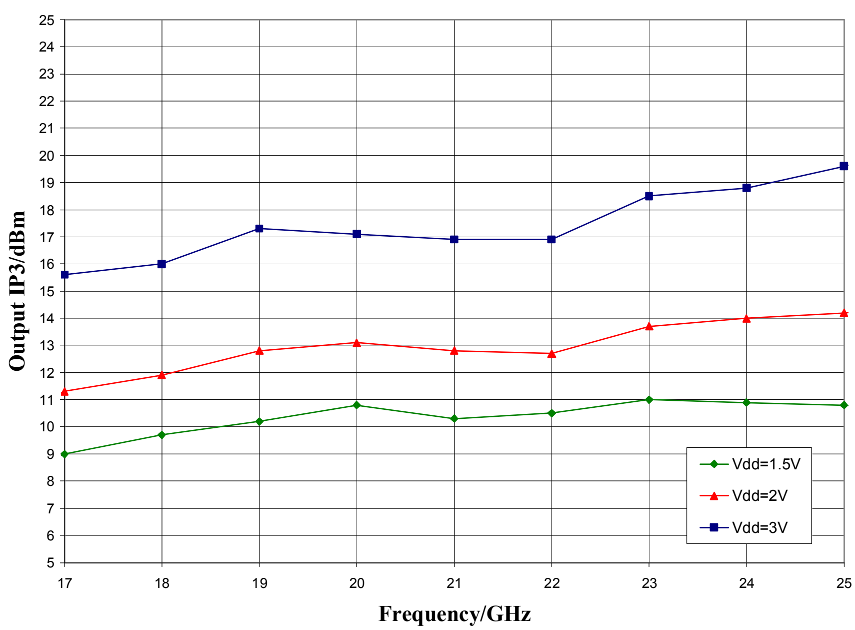
Typical Performance

Output IP3 vs. Temperature, V_{dd} = 3.0 V, V_{gg} = 1.5 V



Output IP3 vs. V_{dd}, V_{gg} = 1.5 V, T_A = 25 ^oC



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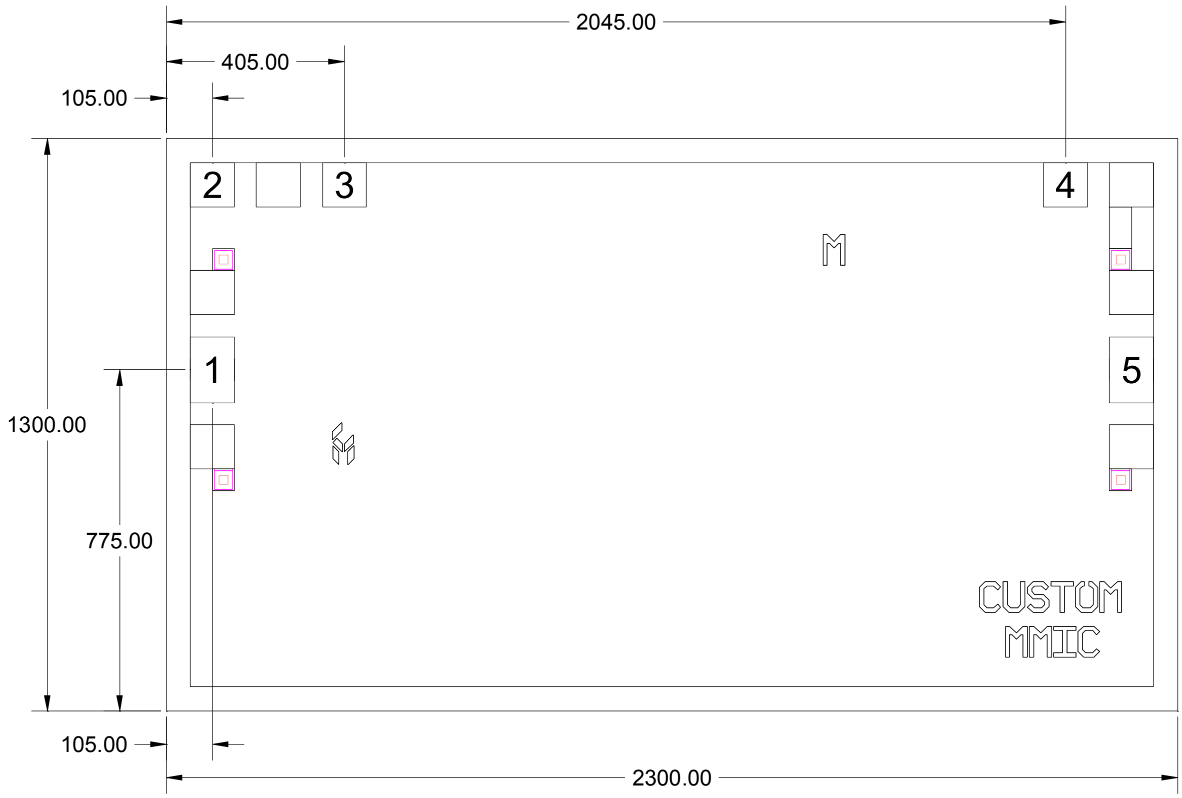
Mechanical Information

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 70 microns thick
5. DC bond pads (2,3,4) are 100 x 100 microns
6. RF bond pads (1,5) are 100 x 150 microns

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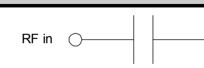
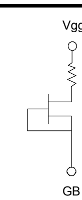
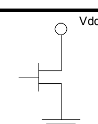
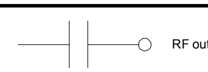
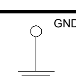
Pad Description

Pad Diagram

Functional Description

Pad	Function	Description	Schematic
1	RF in	DC blocked and 50 ohm matched	
2	GB	Connect to DC ground	
3	Vgg	Power supply voltage Decoupling and bypass caps required	
4	Vdd	Power supply voltage Decoupling and bypass caps required	
5	RF out	DC blocked and 50 ohm matched	
Backside	Ground	Connect to RF / DC ground	

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Applications Information

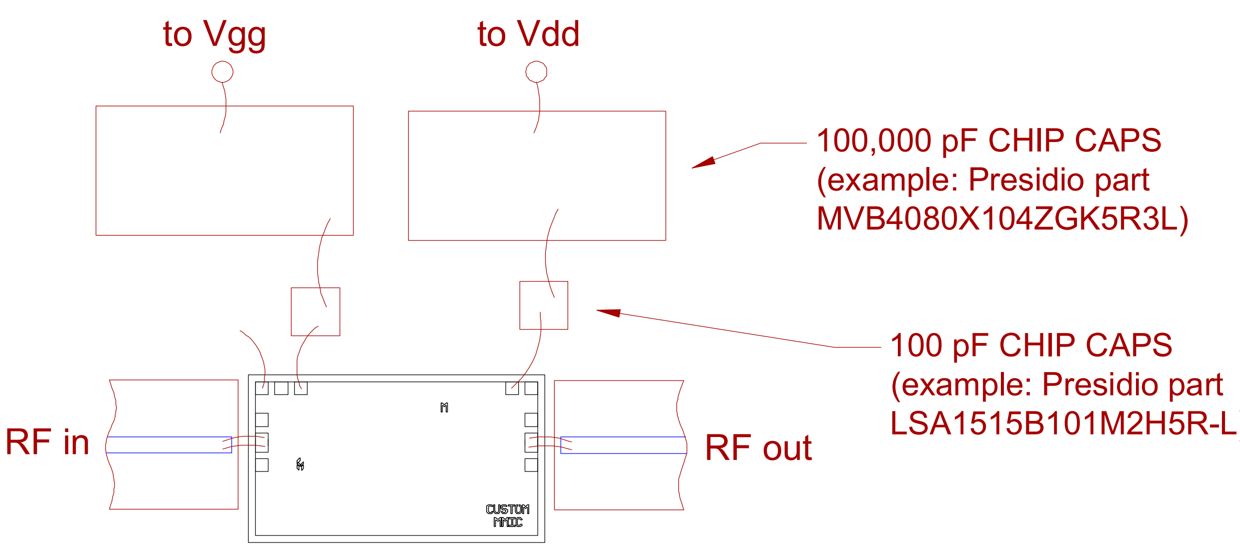
Assembly Guidelines

The backside of the CMD298 is RF ground. Die attach may be accomplished with electrically and thermally conductive epoxy or eutectic bonding. 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 70 um thick and should be handled by the sides of the die or with a custom collet. 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.

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Applications Information

Biasing and Operation

The CMD298 is biased with a positive drain supply and positive gate supply. Performance is optimized when the drain voltage is set to +3.0 V, though it may be set to a minimum of +1.5 V and a maximum of +4.0 V. The recommended gate voltage is +1.5 V.

Turn ON procedure:

1.Apply drain voltage V_{dd} and set to +3 V
2.Apply gate voltage V_{gg} and set to +1.5 V

Turn OFF procedure:

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

The preferred biasing procedure has been proven to be robust and should be used whenever possible. However, the CMD298 does allow for simultaneous biasing (applying Vdd and Vgg at the same time).

Refer to Application Note 103: Amplifier Biasing Techniques for instructions.

For either approach, RF power can be applied at any time.

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