

### Product Overview

The CMD299 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 30 GHz and delivers greater than 17 dB of gain with a corresponding noise figure of 3.5 dB and output 1 dB compression point of +7 dBm. The CMD299 is a 50 ohm matched design which eliminates the need for external DC blocks and RF port matching. The CMD299 offers full passivation for increased reliability and moisture protection.

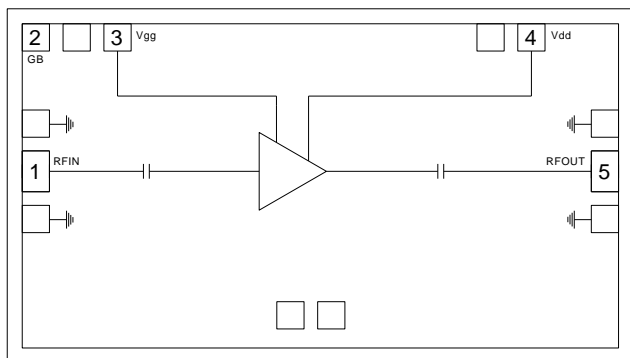
### Key Features

- Low Noise Performance
- Wide Bandwidth
- All Positive Supply Voltages
- Low Current Consumption
- Small Die Size

### Ordering Information

Part No.	Description
CMD299	100 pcs in gel pack

### Functional Block Diagram



### Electrical Performance ( $V_{dd} = 3.0\text{ V}$ , $V_{gg} = 3.0\text{ V}$ , $T_A = 25^\circ\text{ C}$ , $F = 30\text{ GHz}$ )

Parameter	Min	Typ	Max	Units
Frequency Range		18 - 40		GHz
Gain		17		dB
Noise Figure		3.5		dB
Input Return Loss		13		dB
Output Return Loss		12		dB
Output P1dB		7		dBm
Output IP3		18		dBm
Supply Current		33		mA

## Absolute Maximum Ratings

Parameter	Rating
Drain Voltage, $V_{dd}$	3.5 V
Gate Voltage, $V_{gg}$	3.5 V
RF Input Power	+20 dBm
Channel Temperature, $T_{ch}$	150° C
Power Dissipation, $P_{diss}$	408 mW
Thermal Resistance, $Q_{JC}$	159.3° 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
$V_{dd}$	1.5	3.0	3.3	V
$I_{dd}$		33		mA
$V_{gg}$		3.0		V
$I_{gg}$		2.3		mA

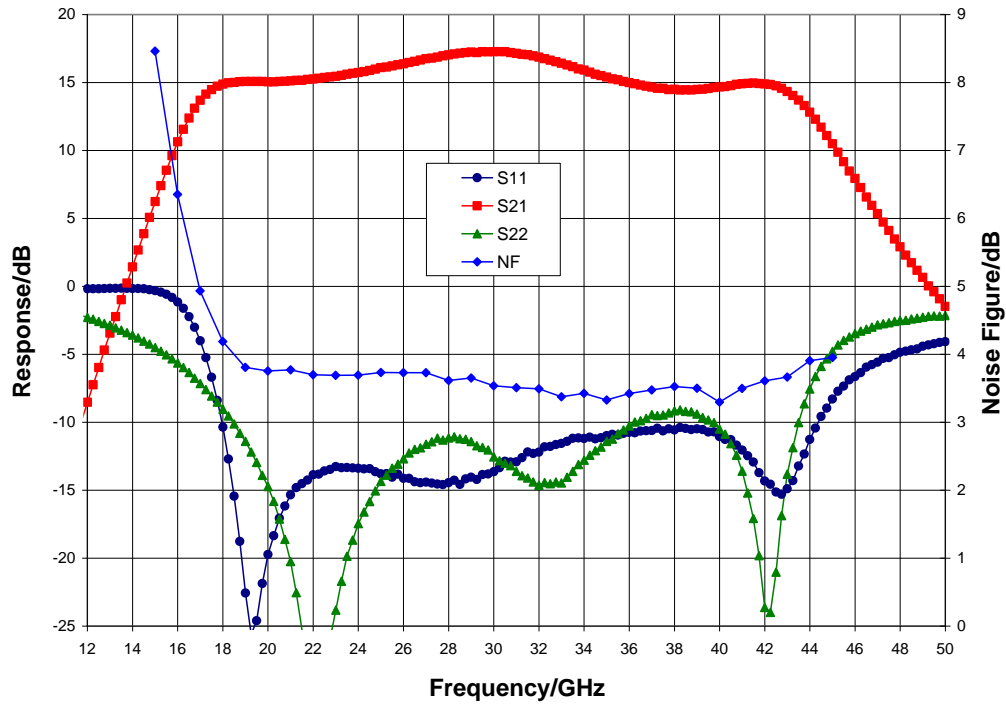
Electrical performance is measured at specific test conditions.  
 Electrical specifications are not guaranteed over all recommended operating conditions.

## Electrical Specifications ( $V_{dd} = 3.0$ V, $V_{gg} = 3.0$ V, $T_A = 25^\circ$ C)

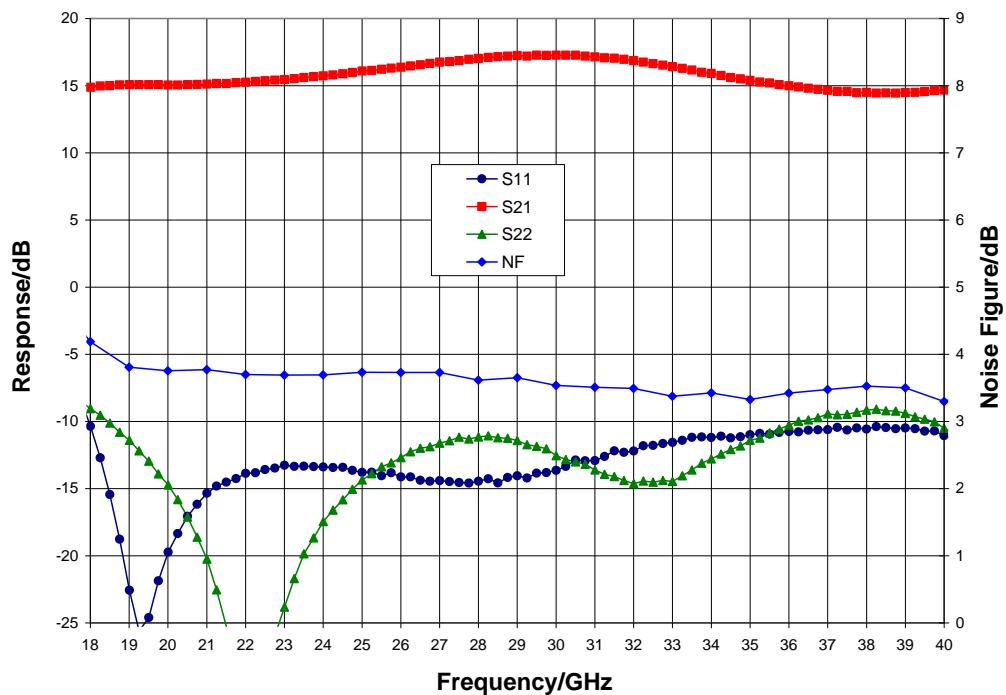
Parameter	Min	Typ	Max	Min	Typ	Max	Units
Frequency Range	18 - 30			30 - 40			GHz
Gain	12	16		11.5	15.5		dB
Noise Figure		3.7	4.6		3.5	4	dB
Input Return Loss		14			12		dB
Output Return Loss		13			10		dB
Output P1dB		6			7.5		dBm
Output IP3		16			18		dBm
Supply Current	23	33	43	23	33	43	mA
Gain Temperature Coefficient		0.016			0.016		dB/°C
Noise Figure Temperature Coefficient		0.012			0.012		dB/°C

## Typical Performance

Broadband Performance,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 3.0\text{ V}$ ,  $I_{dd} = 33\text{ mA}$ ,  $T_A = 25^\circ\text{C}$

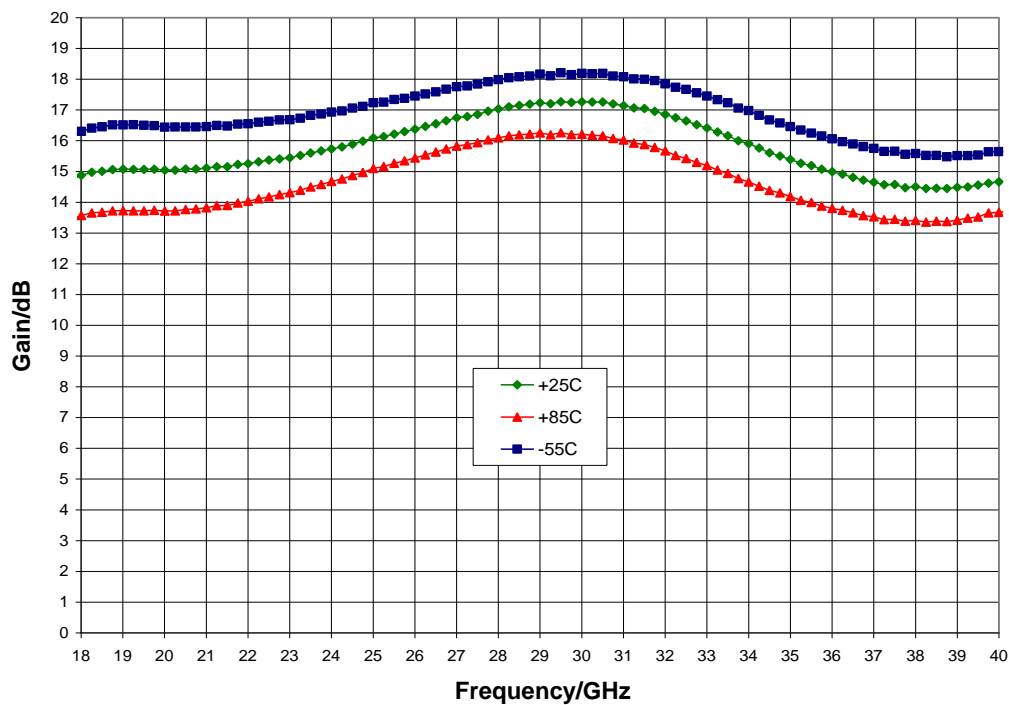


Narrow-band Performance,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 3.0\text{ V}$ ,  $I_{dd} = 33\text{ mA}$ ,  $T_A = 25^\circ\text{C}$

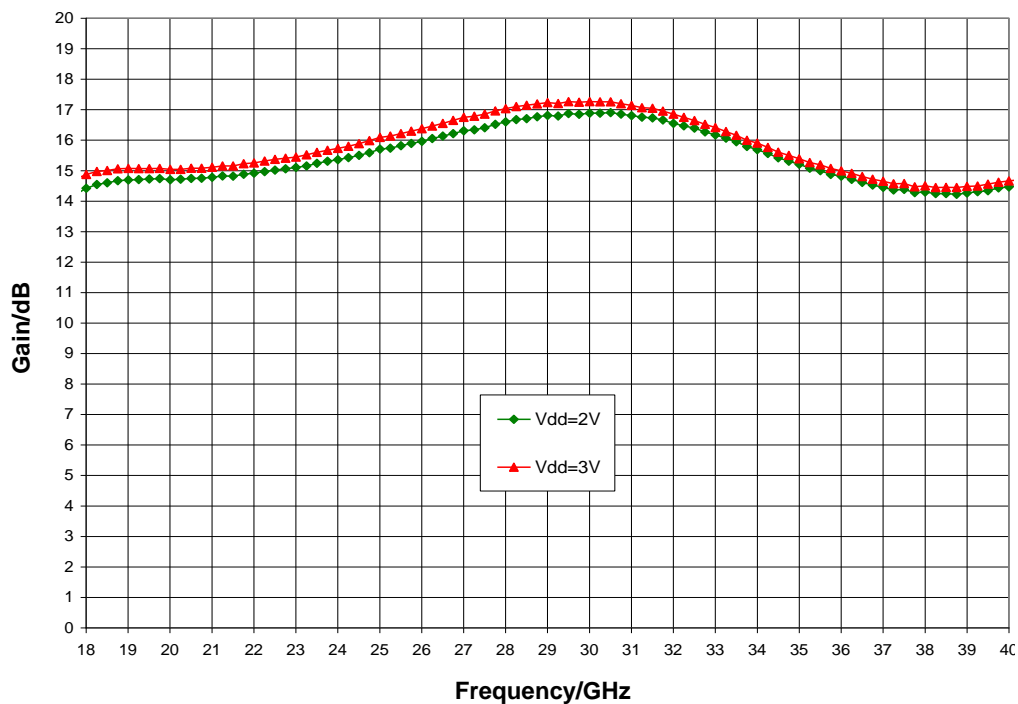


## Typical Performance

Gain vs. Temperature,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 3.0\text{ V}$

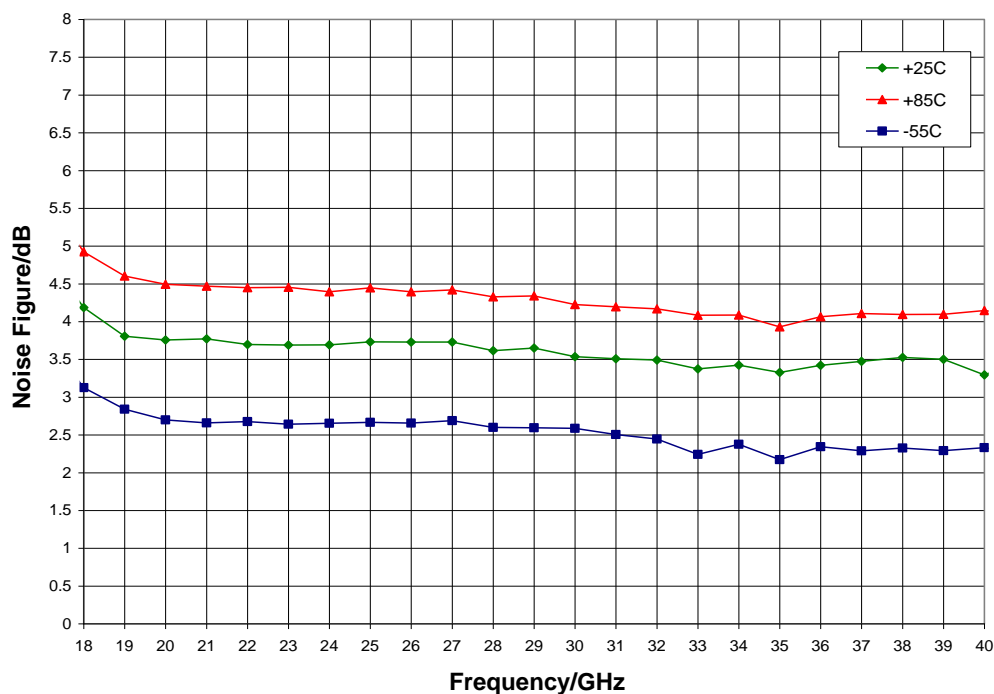


Gain vs.  $V_{dd}$ ,  $V_{gg} = 3.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$

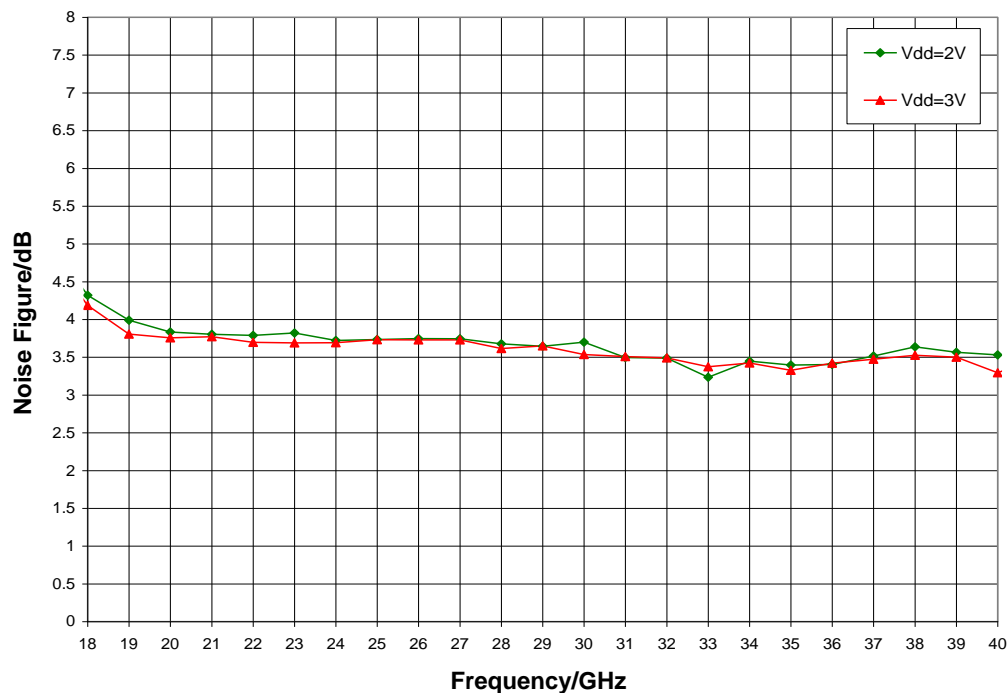


## Typical Performance

Noise Figure vs. Temperature,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 3.0\text{ V}$

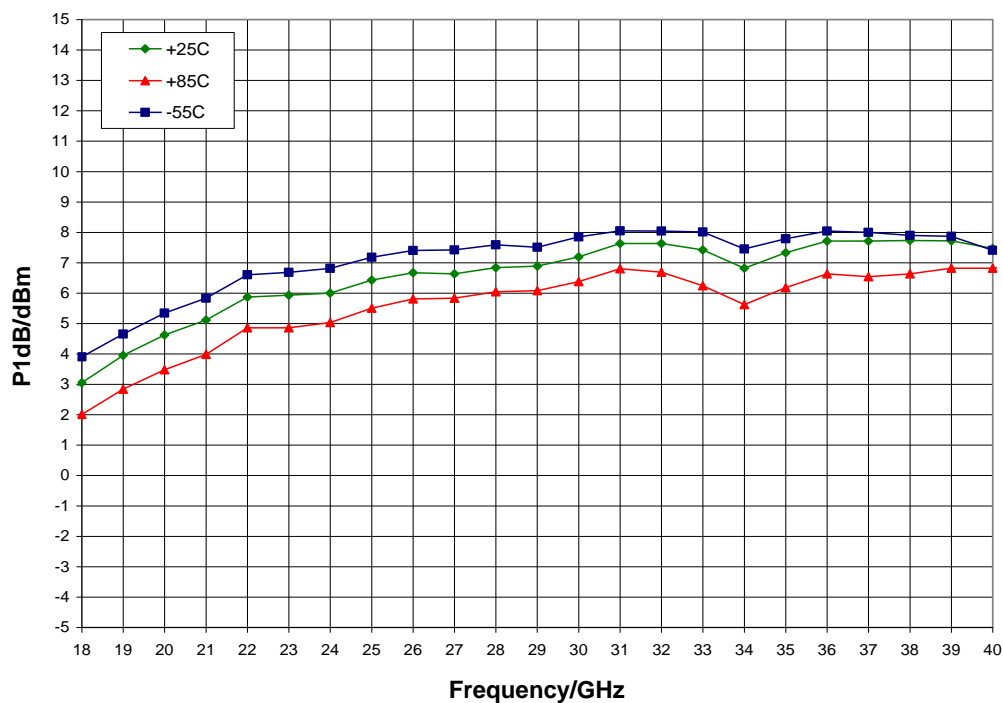


Noise Figure vs.  $V_{dd}$ ,  $V_{gg} = 3.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$

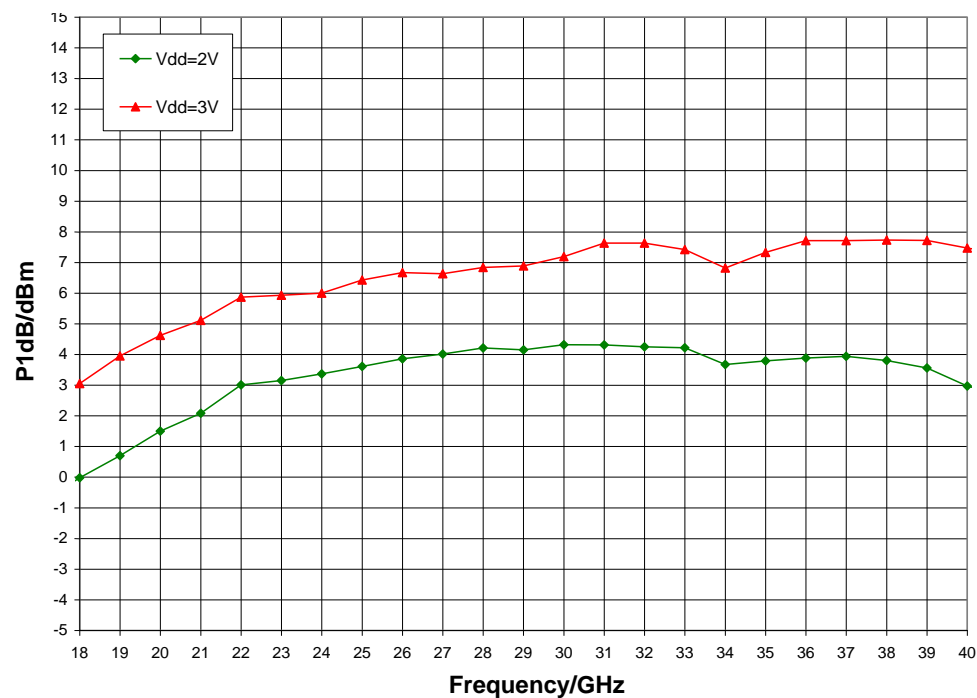


## Typical Performance

P1dB vs. Temperature,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 3.0\text{ V}$

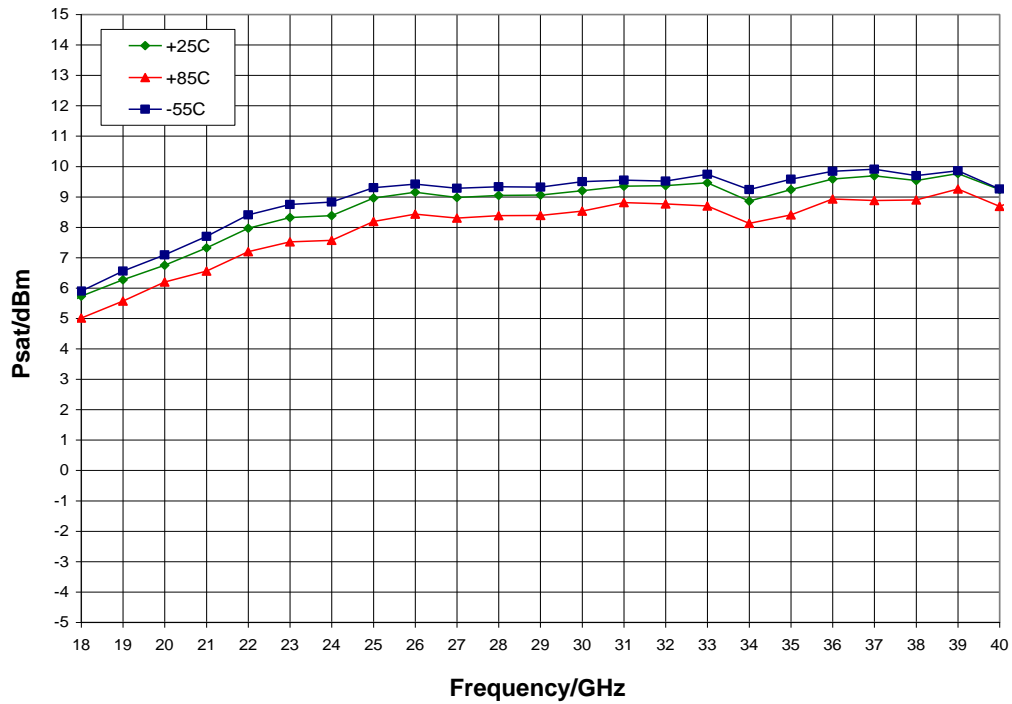


P1dB vs.  $V_{dd}$ ,  $V_{gg} = 3.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$

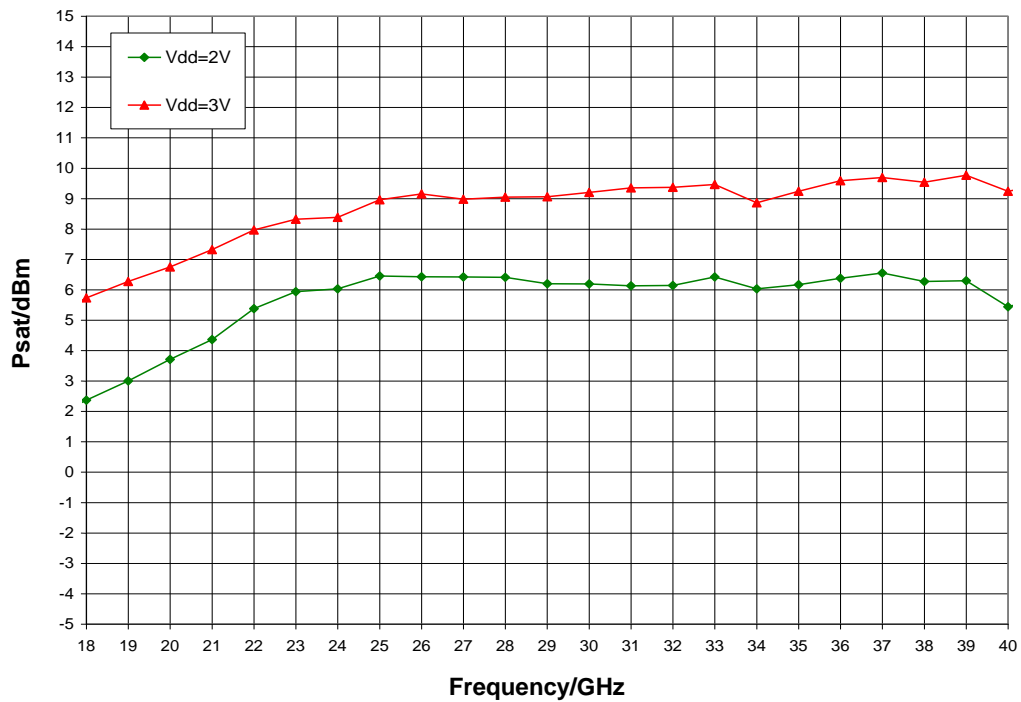


## Typical Performance

Psat vs. Temperature,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 3.0\text{ V}$

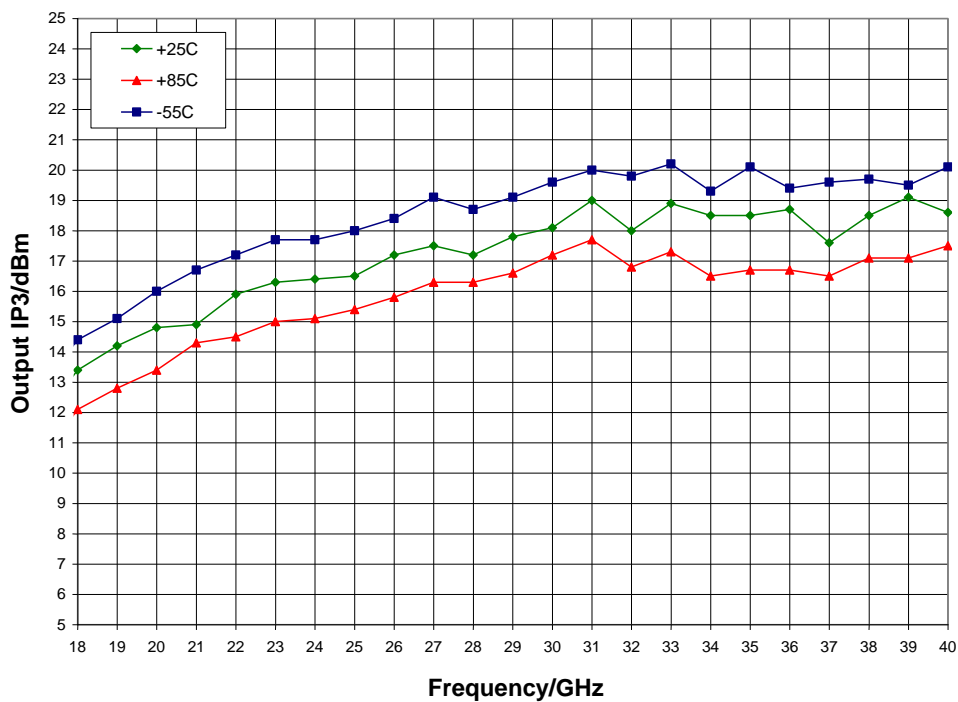


Psat vs.  $V_{dd}$ ,  $V_{gg} = 3.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$

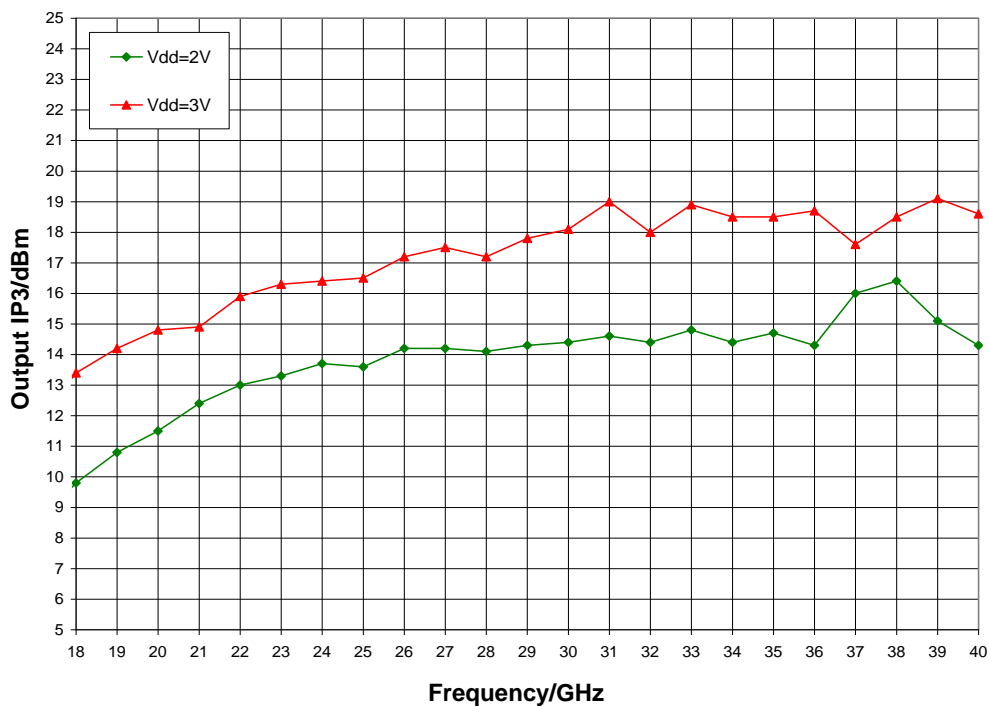


## Typical Performance

Output IP3 vs. Temperature,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 3.0\text{ V}$



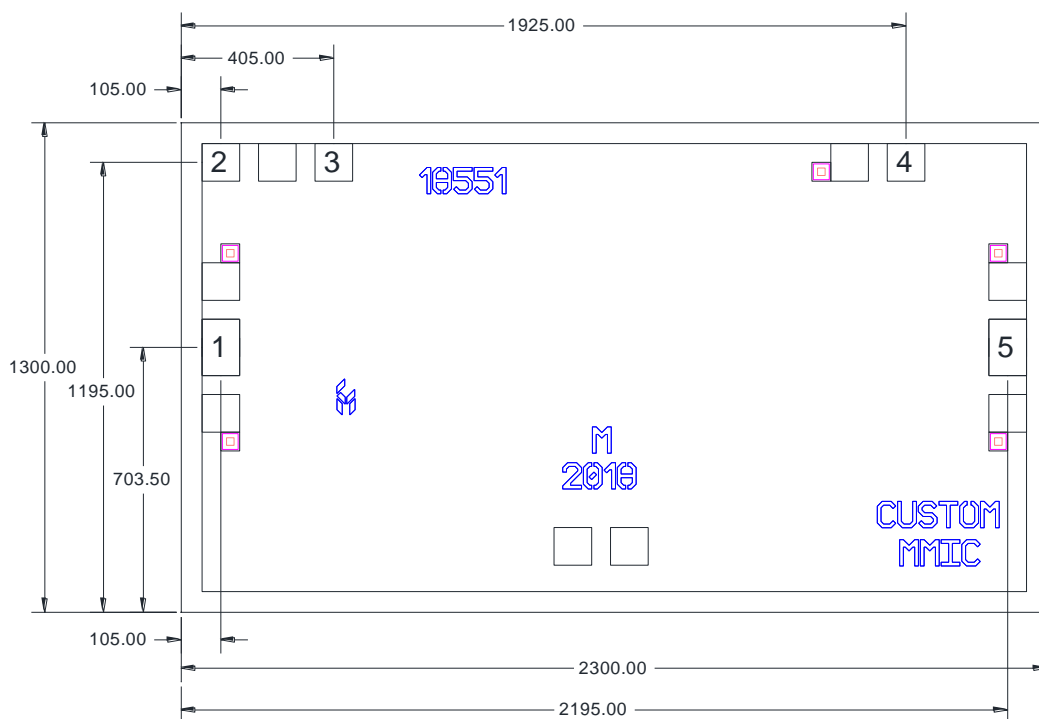
Output IP3 vs.  $V_{dd}$ ,  $V_{gg} = 3.0\text{ V}$ ,  $T_A = 25^\circ\text{C}$





## Mechanical Information

**Die Outline (all dimensions in microns)**

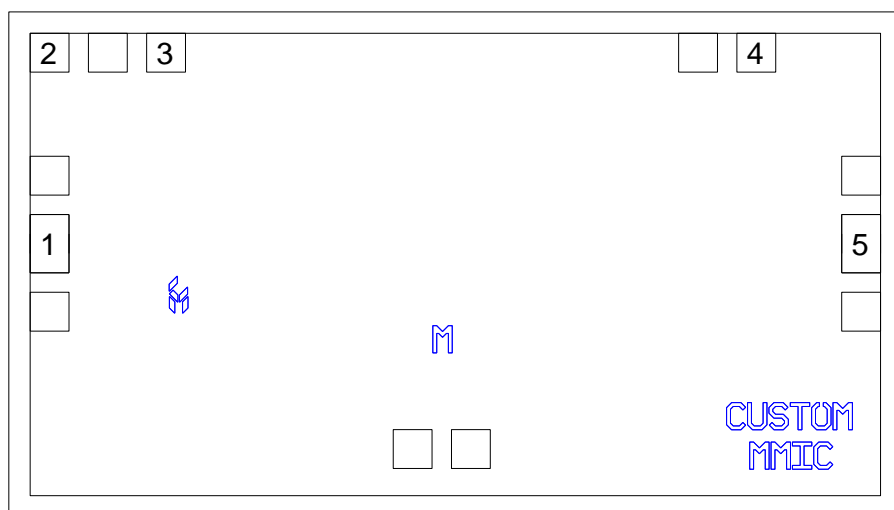


**Notes:**

1. No connection required for unlabeled pads
2. Backside is RF and DC ground
3. Backside and bond pad metal: Gold
4. Die is 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

## Pad Description

### Pad Diagram



### Functional Description

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

## Applications Information

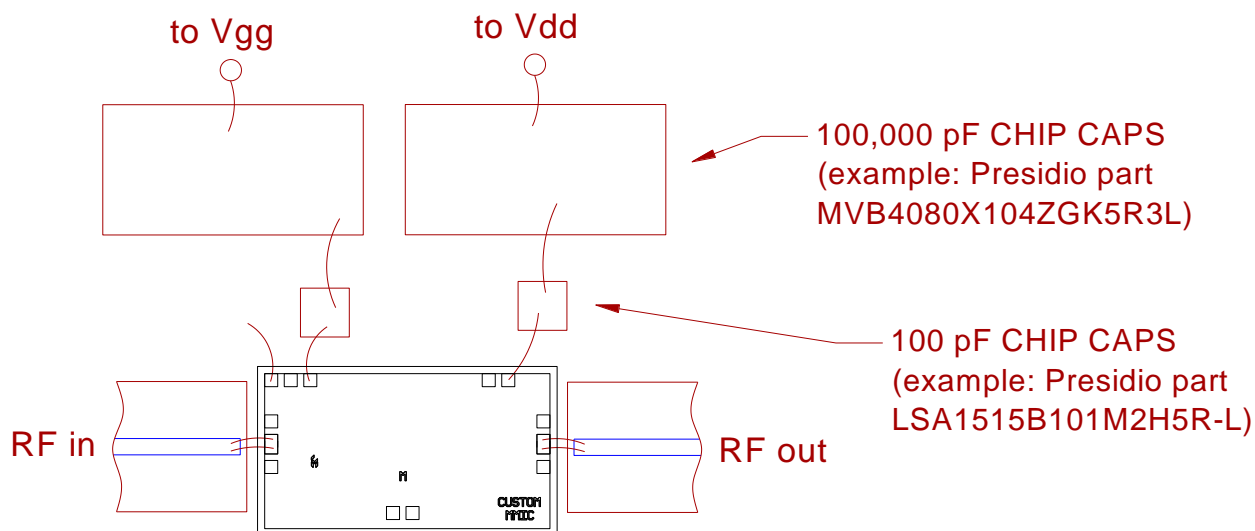
### Assembly Guidelines

The backside of the CMD299 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  $\mu\text{m}$  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.**

## Applications Information

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### Biasing and Operation

The CMD299 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 +3.5 V. The recommended gate voltage is +3.0 V.

Turn ON procedure:

1. Apply drain voltage  $V_{dd}$  and set to +3 V
2. Apply gate voltage  $V_{gg}$  and set to +3 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 CMD299 does allow for simultaneous biasing (applying  $V_{dd}$  and  $V_{gg}$  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.

## Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1A	ESDA / JEDEC JS-001-2012



Caution!  
ESD-Sensitive Device

## RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- SVHC Free
- PFOS Free
- Halogen Free



## Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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