CMD184

0.5-20 GHz GaN Power Amplifier

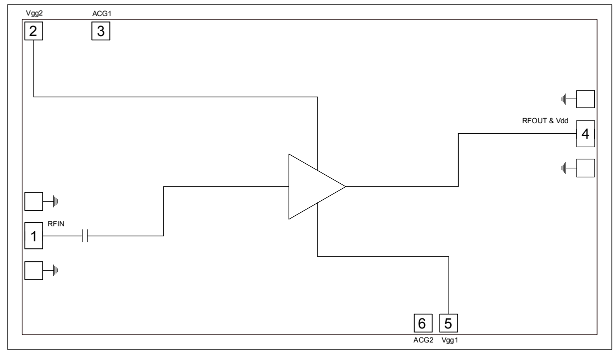
Features

- ► Ultra wideband performance
- ► High Output Power
- ► High Gain
- ► High Linearity

Description

The CMD184 is a 4.5 W wideband GaN MMIC power amplifier die which operates from 0.5 to 20 GHz. The amplifier delivers greater than 13 dB of gain with a corresponding output 1 dB compression point of +34.5 dBm and a saturated output power of +36.5 dBm. The CMD184 is a 50 ohm matched design which eliminates the need for RF port matching. The CMD184 offers full passivation for increased reliability and moisture protection.

Functional Block Diagram



Electrical Performance - V_{dd} = 28 V, $V_{gg\,1}$= -2.8 V, $V_{gg\,2}$= 10 V, T_A = 25 ^{o}C, F=10 GHz

Parameter	Min	Typ	Max	Units
Frequency Range		0.5 - 20		GHz
Gain		13		dB
Input Return Loss		19		dB
Output Return Loss		25		dB
P1dB		34.5		dBm
Psat		36.5		dBm
Supply Current		700		mA

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Specifications

Absolute Maximum Ratings

Parameter	Rating
Drain Voltage, Vdd	40 V
Gate Voltage, Vgg1	-10 V
Gate Voltage, Vgg2	1/3 Vdd to 2/3 Vdd
RF Input Power	+30 dBm
Channel Temperature, Tch	200 °C
Power Dissipation, Pdiss	72 W
Thermal Resistance, Θ_{JC}	1.25 °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		28		V
Idd		700		mA
Vgg1		-2.8		V
Vgg2		10		V

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

Electrical Specifications, V_{dd} = 28 V, V_{gg1} = -2.8 V, V_{gg2} = 10 V, T_A = 25 °C

Parameter	Min	Typ	Max	Min	Typ	Max	Units
Frequency Range		0.5 - 12			12 - 20		GHz
Gain	10	12.5		9.5	13		dB
Input Return Loss		15			15		dB
Output Return Loss		18			20		dB
Output P1dB	32	34.5		29	32.5		dBm
Output IP3		42			41		dBm
Supply Current	500	700	750	500	700	750	mA
Gain Temperature Coefficient		0.012			0.02		dB/°C

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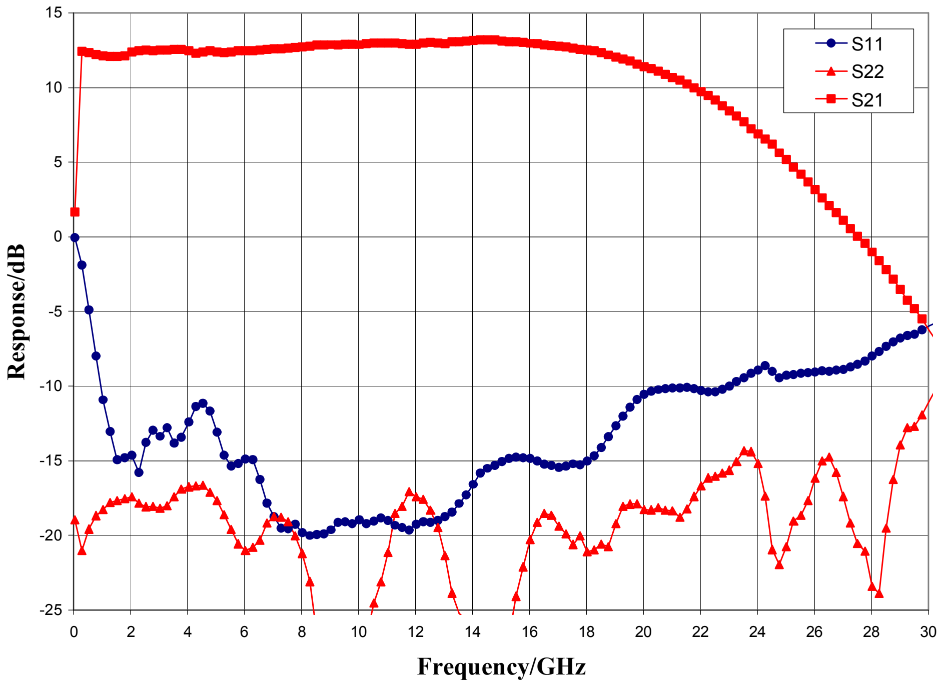
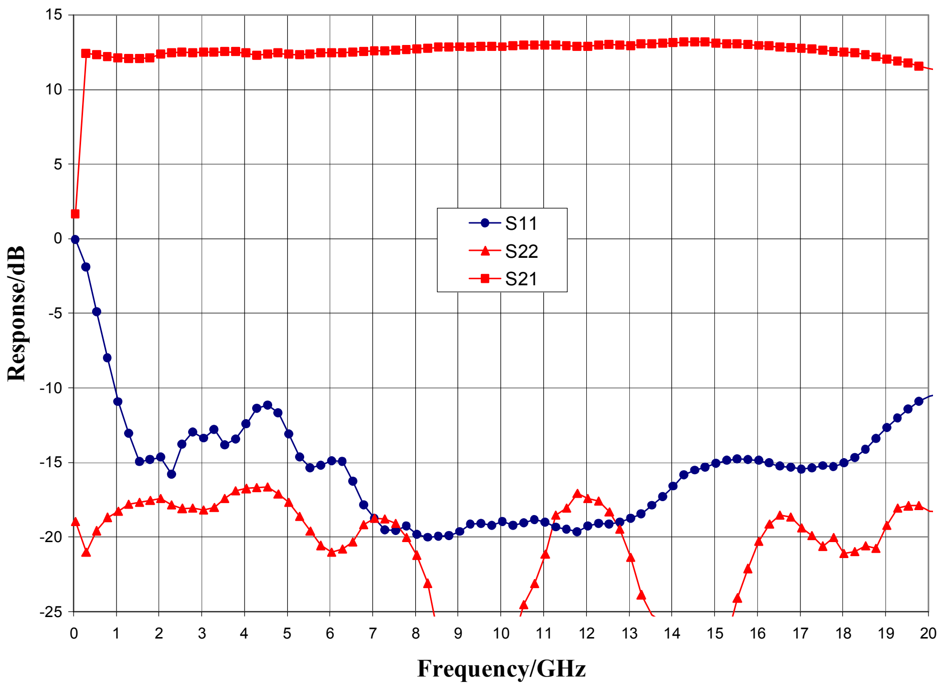
Typical Performance

Broadband Performance, V_{dd} = 28 V, V_{gg1} = -2.8 V, V_{gg2} = 10 V, I_{dd} = 700 mA, T_A = 25 °C



Narrow-band Performance, V_{dd} = 28 V, V_{gg1} = -2.8 V, V_{gg2} = 10 V, I_{dd} = 700 mA, T_A = 25 °C



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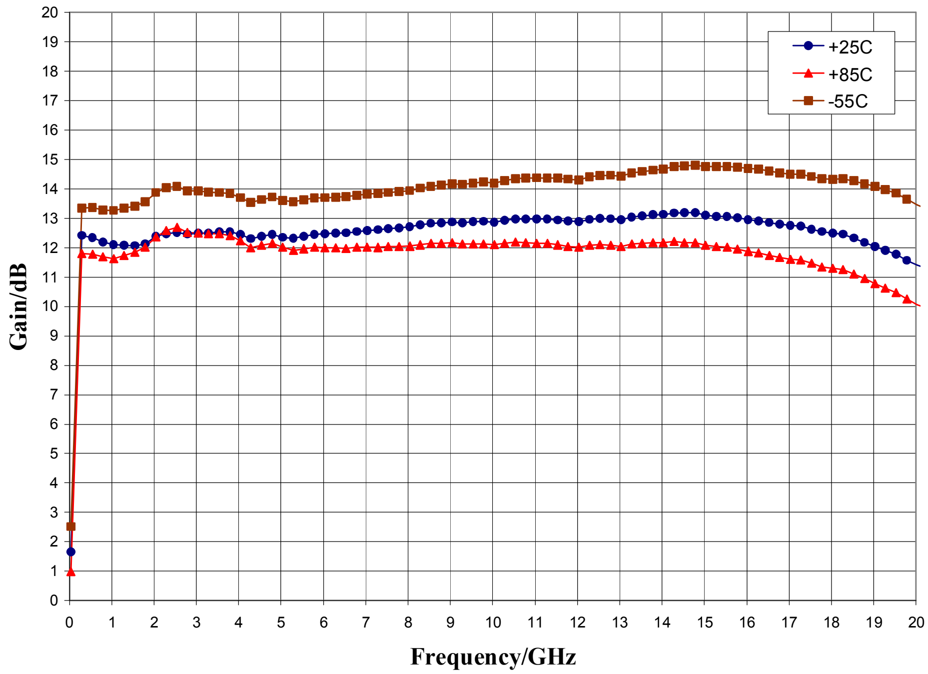
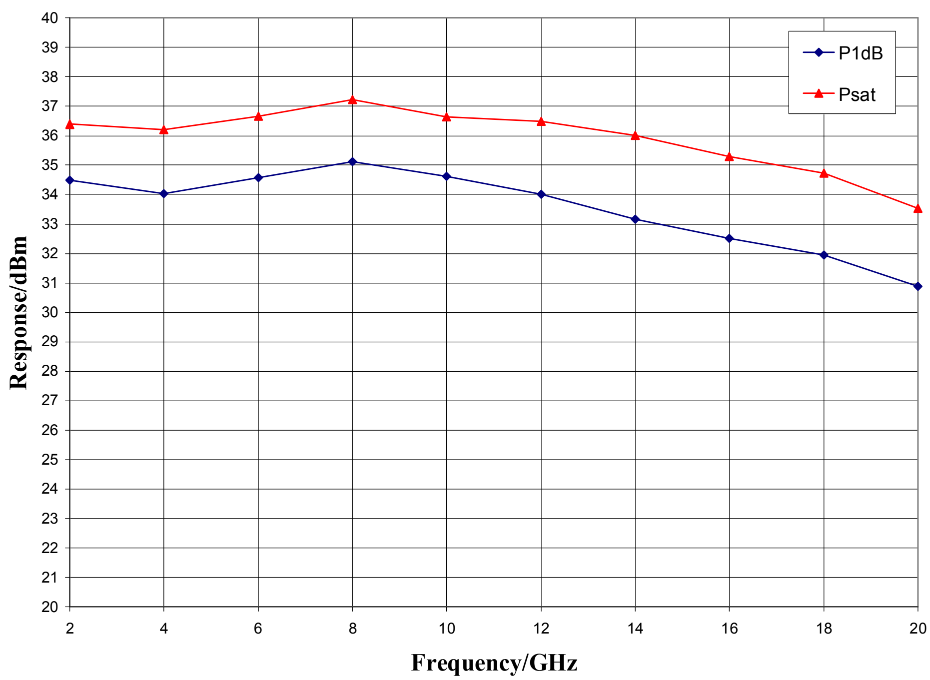
Typical Performance

Gain vs. Temperature, V_{dd} = 28 V, V_{gg1} = -2.8 V, V_{gg2} = 10 V



Output Power, V_{dd} = 28 V, V_{gg1} = -2.8 V, V_{gg2} = 10 V, T_A = 25 °C



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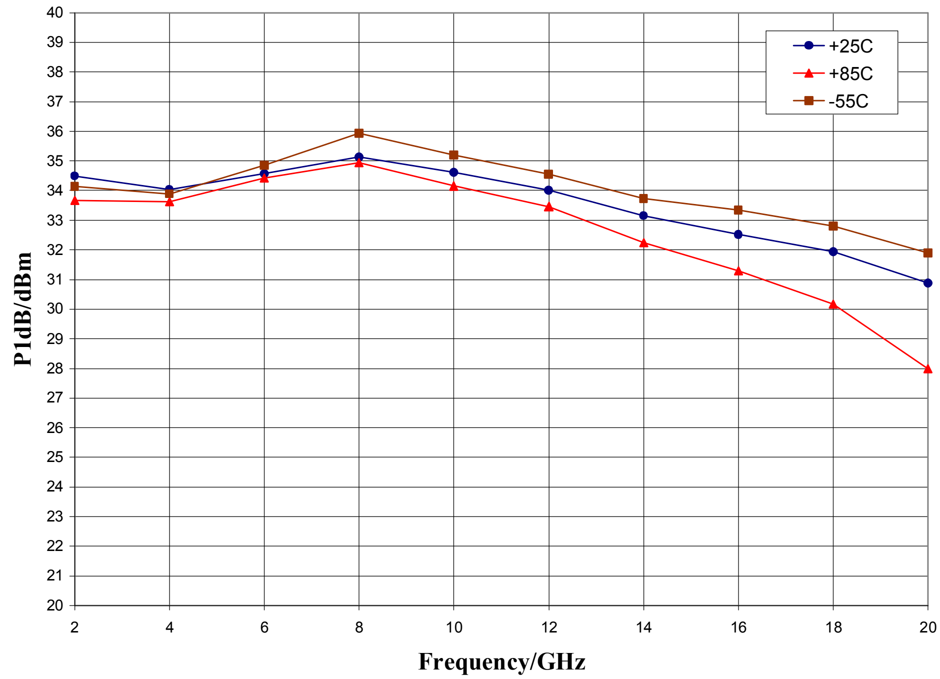
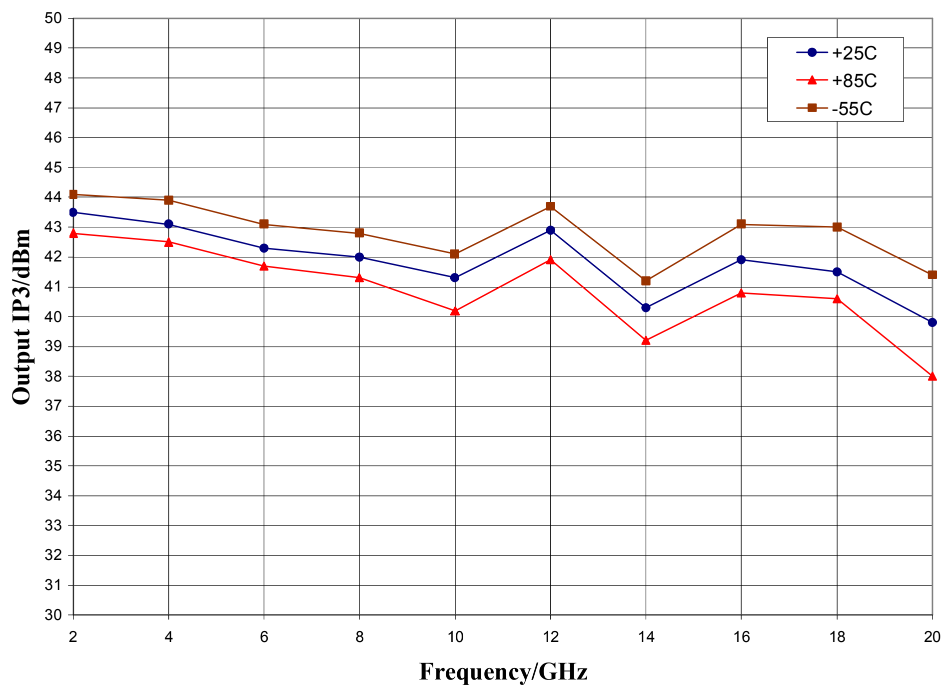
Typical Performance

P1dB vs. Temperature, V_{dd} = 28 V, V_{gg1} = -2.8 V, V_{gg2} = 10 V



Output IP3, V_{dd} = 28 V, V_{gg1} = -2.8 V, V_{gg2} = 10 V, I_{dd} = 700 mA, T_A = 25 ^oC



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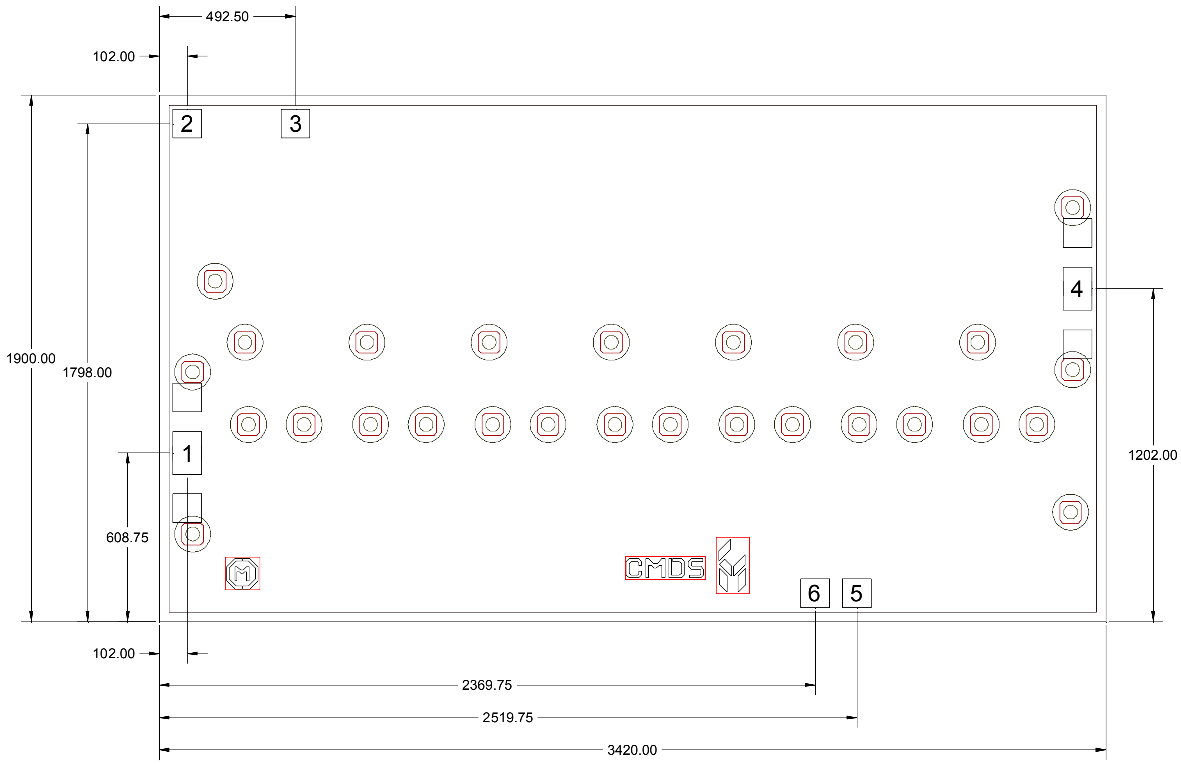
Mechanical Information

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

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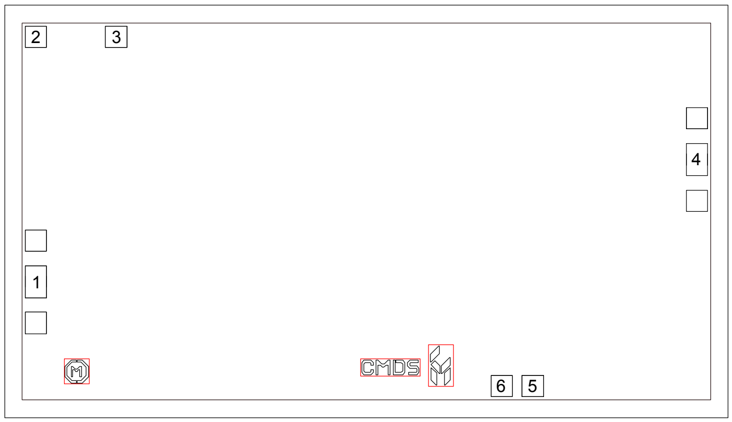
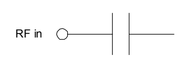
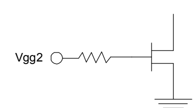
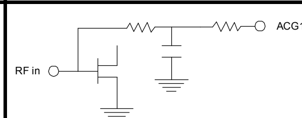
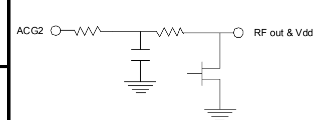
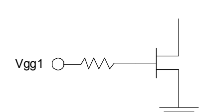
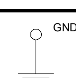
Pad Description

Pad Diagram



Functional Description

Pad	Function	Description	Schematic
1	RF in	50 ohm matched input	
2	Vgg2	Power Supply Voltage Decoupling and bypass caps required	
3	ACG1	Low frequency termination. Attach bypass capacitor per application circuit	
4	RF out & Vdd	Power supply voltage and 50 ohm matched output	
6	ACG2	Low frequency termination. Attach bypass capacitor per application circuit	
5	Vgg1	Power supply voltage Decoupling and bypass caps required	
Backside	Ground	Connect to RF/DC ground	

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Applications Information

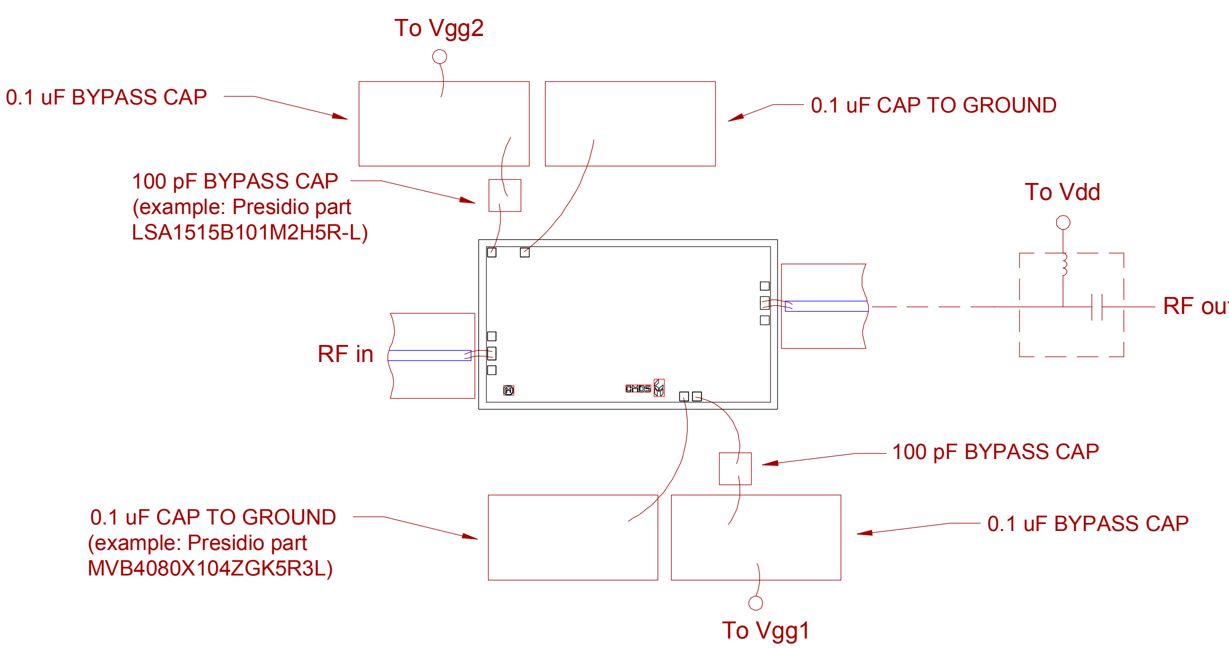
Assembly Guidelines

The backside of the CMD184 is RF ground. Eutectic die attach is 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 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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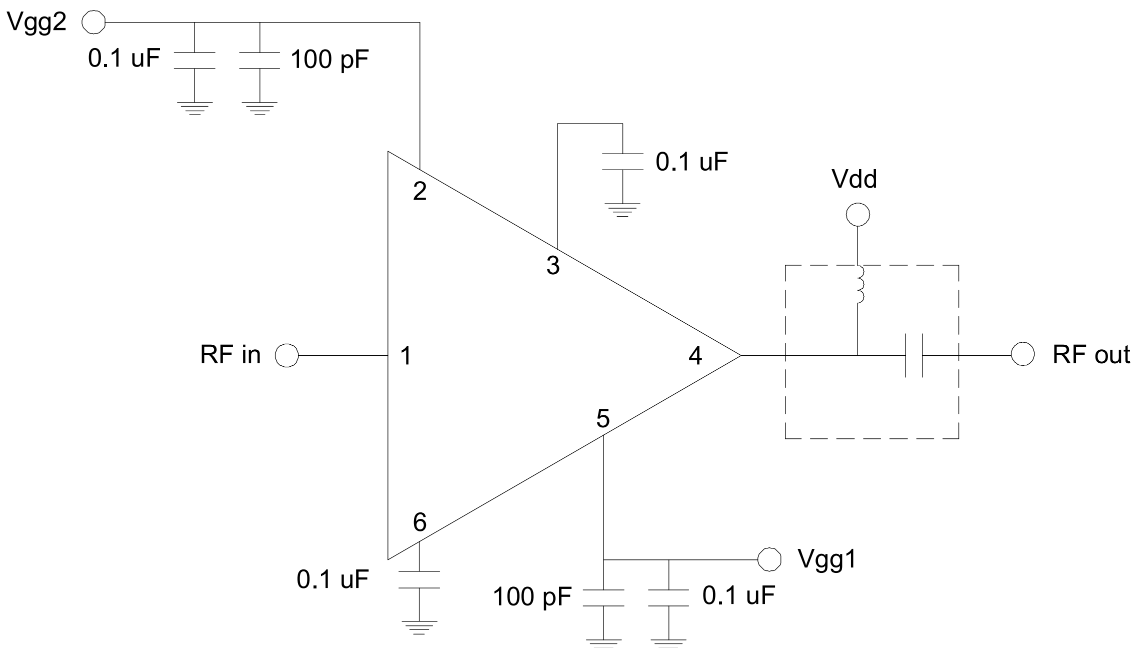
Applications Information

Application Circuit



Note: Drain voltage (Vdd) must be applied through a broadband bias tee or external bias network.

Biasing and Operation

The CMD184 is biased with a positive drain supply, positive gate supply and negative gate supply.
Turn ON procedure:

1.Apply gate voltage V_{gg1} and set to a voltage sufficient to pinch off drain current (~ -8 V)
2.Apply drain voltage V_{dd} and set to +28 V
3.Apply gate voltage V_{gg2} and set to +10 V
4.Increase V_{gg1} (less negative) to achieve a drain current of 700 mA

Turn OFF procedure:

1.Turn off gate voltage V_{gg2}
2.Turn off drain voltage V_{dd}
3.Turn off gate voltage V_{gg1}

RF power can be applied at any time.