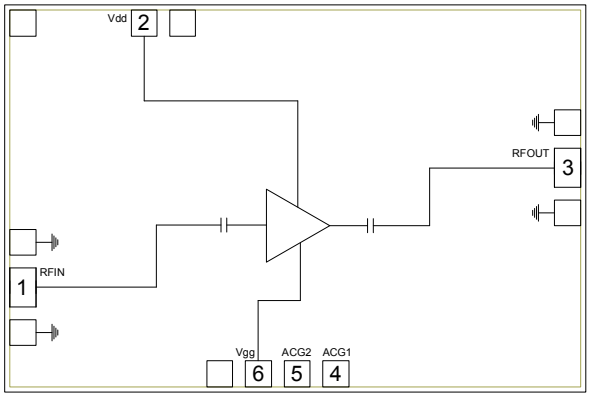
# CMD241

## 2-22 GHz Distributed Amplifier

### Features

- Ultra wideband performance
- Low noise figure
- Low current consumption
- Excellent return losses
- Small die size

### Functional Block Diagram




### Description

The CMD241 is wideband GaAs MMIC distributed low noise amplifier die which operates from 2 to 22 GHz. The amplifier delivers 14 dB of gain with a corresponding noise figure of 2.3 dB and an output 1 dB compression point of +21 dBm at 11 GHz. The CMD241 is a 50 ohm matched design which eliminates the need for external DC blocks and RF port matching. The CMD241 offers full passivation for increased reliability and moisture protection.

### *Electrical Performance* - $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V, $T_A$ = 25 °C, F=11 GHz

| Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|
| Frequency Range | | 2 - 22 | | GHz |
| Gain | | 14 | | dB |
| Noise Figure | | 2.3 | | dB |
| Input Return Loss | | 20 | | dB |
| Output Return Loss | | 17 | | dB |
| Output P1dB | | 21 | | dBm |
| Output IP3 | | 28 | | dBm |
| Supply Current | | 74 | | mA |



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## Specifications

### Absolute Maximum Ratings

| Parameter | Rating |
|---|---|
| Drain Voltage, Vdd | 10 V |
| Gate Voltage, Vgg | -2.5 to 0 V |
| RF Input Power | +20 dBm |
| Channel Temperature, Tch | 150 °C |
| Power Dissipation, Pdiss | 1.75 W |
| Thermal Resistance | 37 °C/W |
| Operating Temperature | -55 to 85 °C |
| Storage Temperature | -55 to 150 °C |

Operation of this device outside the maximum ratings may cause permanent damage.

### Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|
| Vdd | 3.0 | 5.0 | 8.0 | V |
| Idd | | 74 | | mA |
| Vgg | | -0.65 | | V |

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

### Electrical Specifications, $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V, $T_A$ = 25 °C

| Parameter | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency Range | 2 - 6 | | | 6 - 18 | | | 18 - 22 | | | GHz |
| Gain | 11 | 14 | | 10.5 | 13.5 | | 11 | 15 | | dB |
| Noise Figure | | 3.5 | | | 2.5 | | | 3.75 | | dB |
| Input Return Loss | | 13 | | | 13 | | | 15 | | dB |
| Output Return Loss | | 15 | | | 14 | | | 10 | | dB |
| Output P1dB | 16 | 20 | | 14 | 18 | | 14 | 17 | | dBm |
| Output IP3 | | 29 | | | 28 | | | 25 | | dBm |
| Supply Current | 50 | 74 | 100 | 50 | 74 | 100 | 50 | 74 | 100 | mA |
| Gain Temperature Coefficient | | 0.004 | | | 0.006 | | | 0.007 | | dB/°C |
| Noise Figure Temperature Coefficient | | 0.01 | | | 0.009 | | | 0.014 | | dB/°C |



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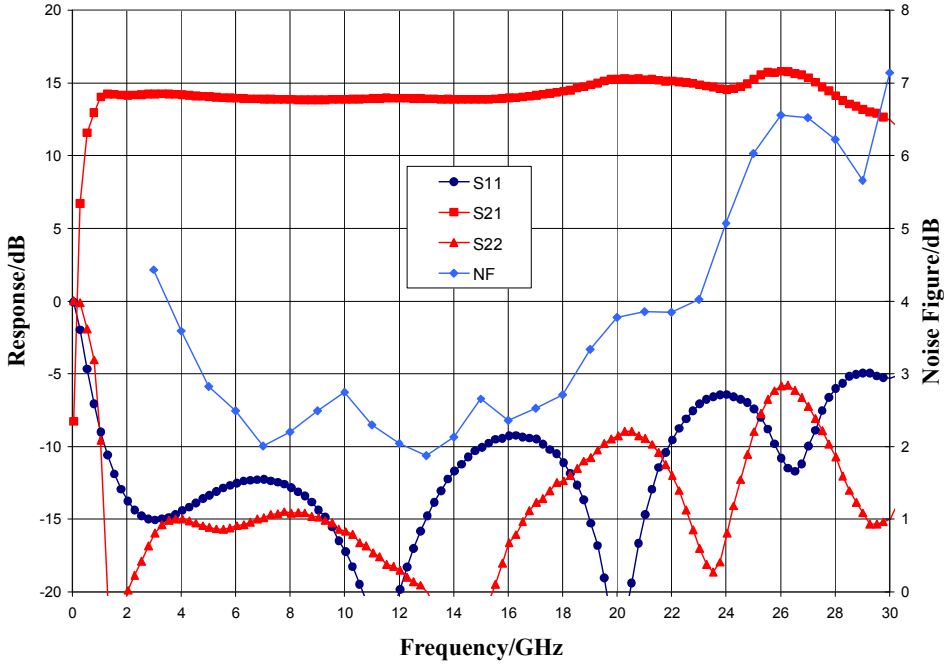
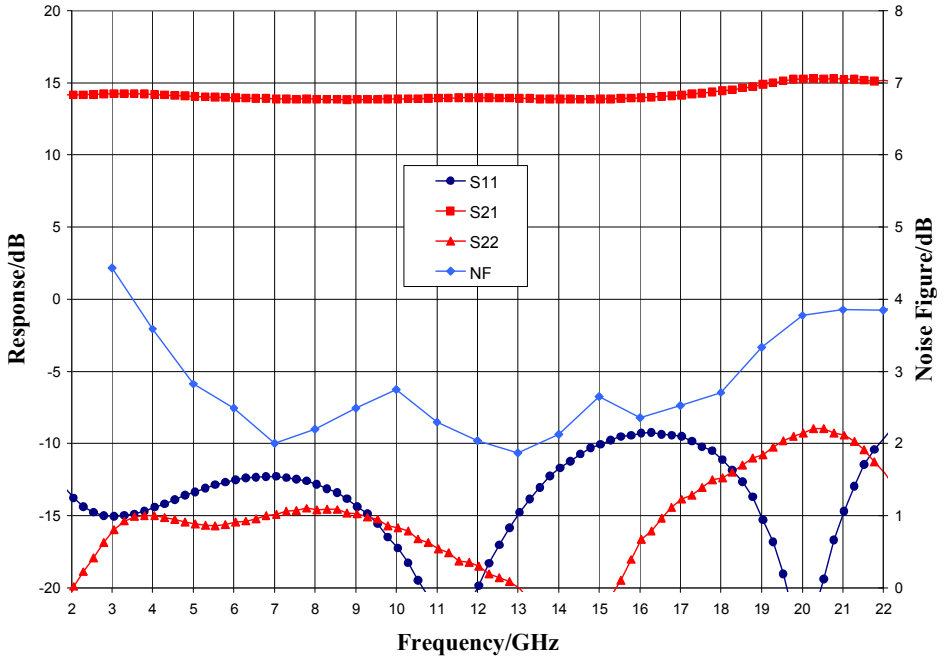
## Typical Performance

**Broadband Performance, $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V, $I_{dd}$ = 74 mA, $T_A$ = 25**




**Narrow-band Performance, $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V, $I_{dd}$ = 74 mA, $T_A$ = 25**



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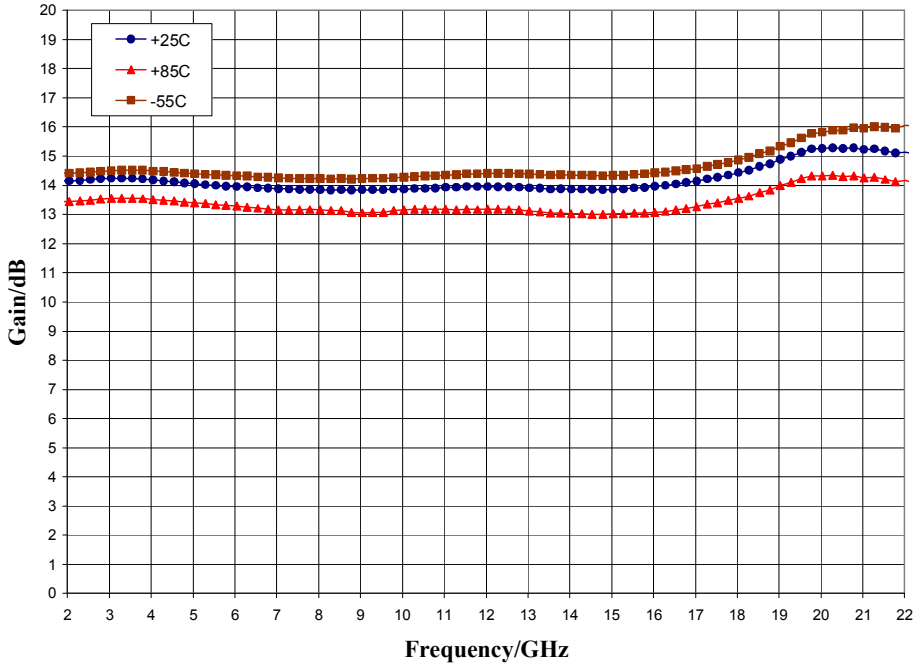
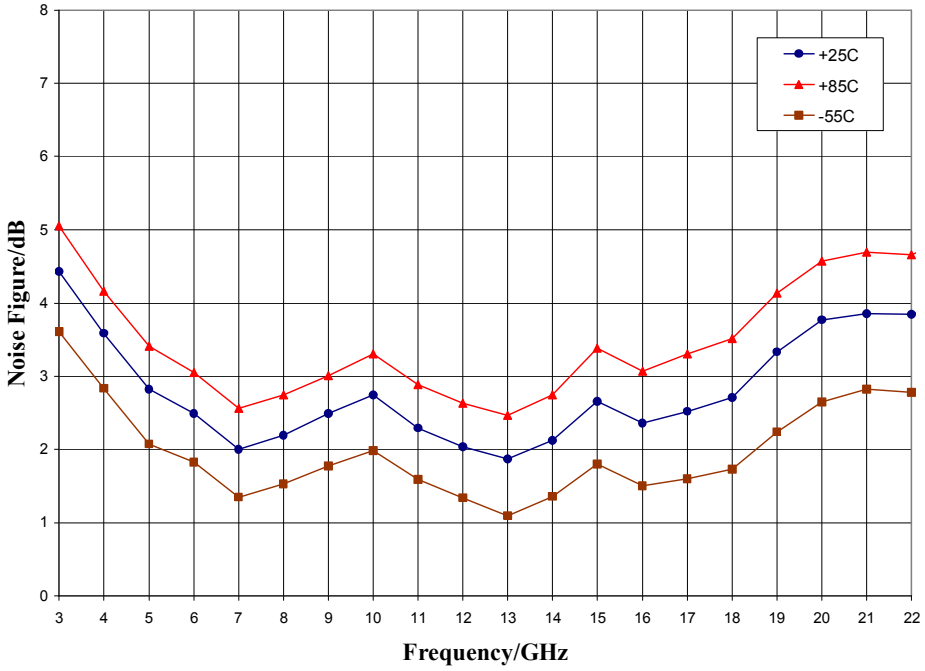
## Typical Performance

### Gain vs. Temperature, $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V




### Noise Figure vs. Temperature, $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V



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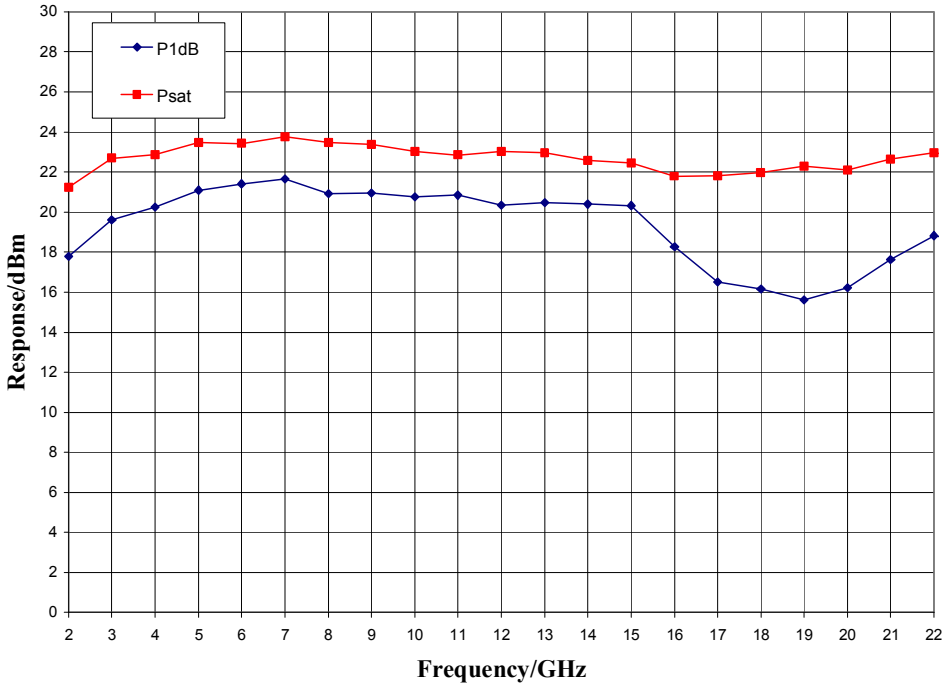
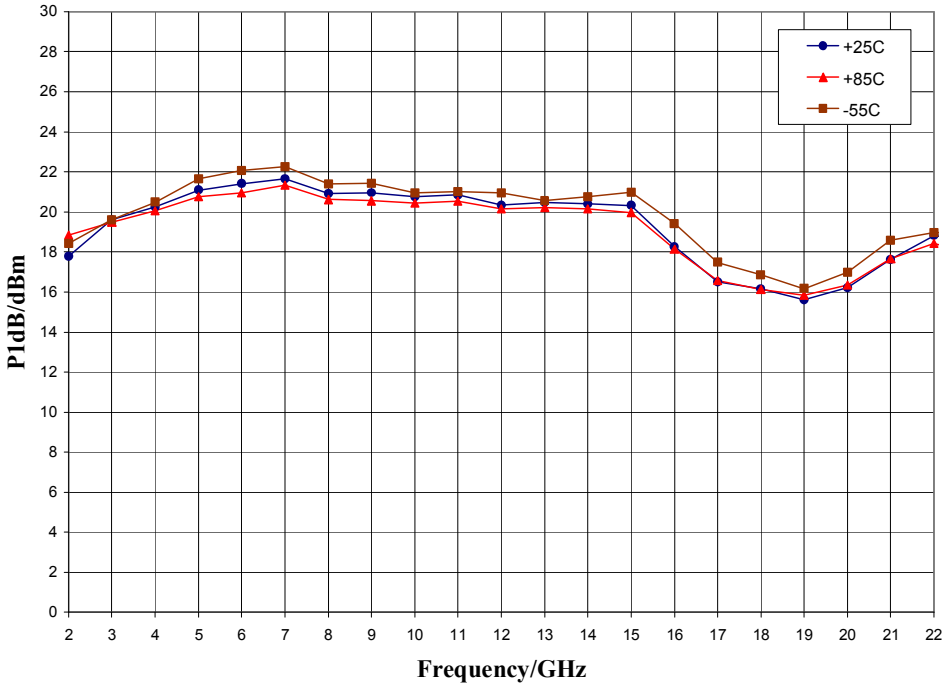
## Typical Performance

**Output Power, $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V, $T_A$ = 25 °C**




**P1dB vs. Temperature, $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V**



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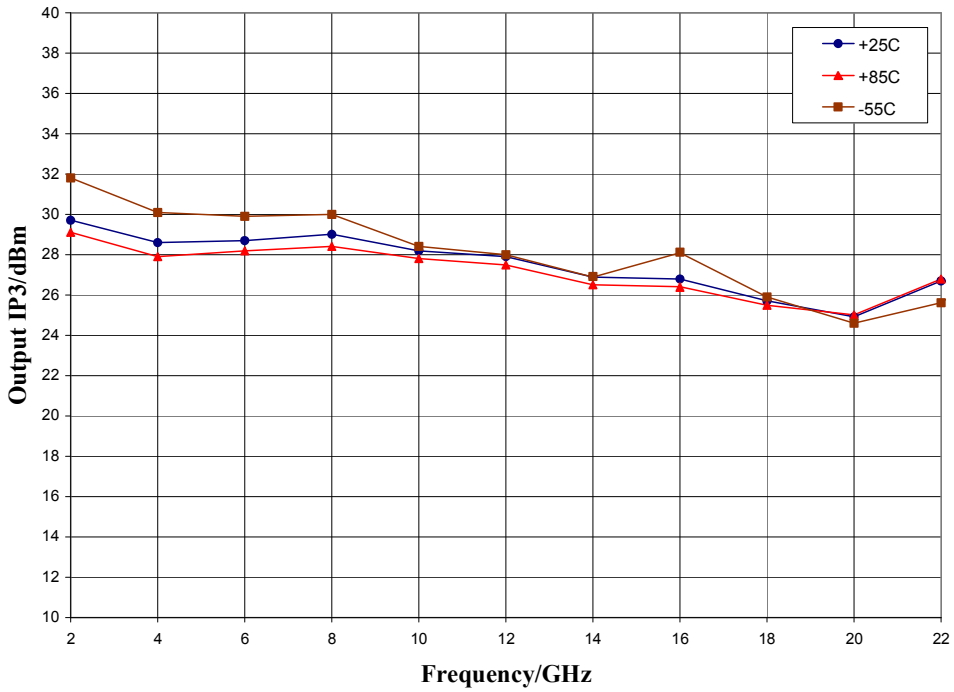
## *Typical Performance*

**Output IP3 vs. Temperature, $V_{dd}$ = 5.0 V, $V_{gg}$ = -0.65 V, $T_A$ = 25 °C**



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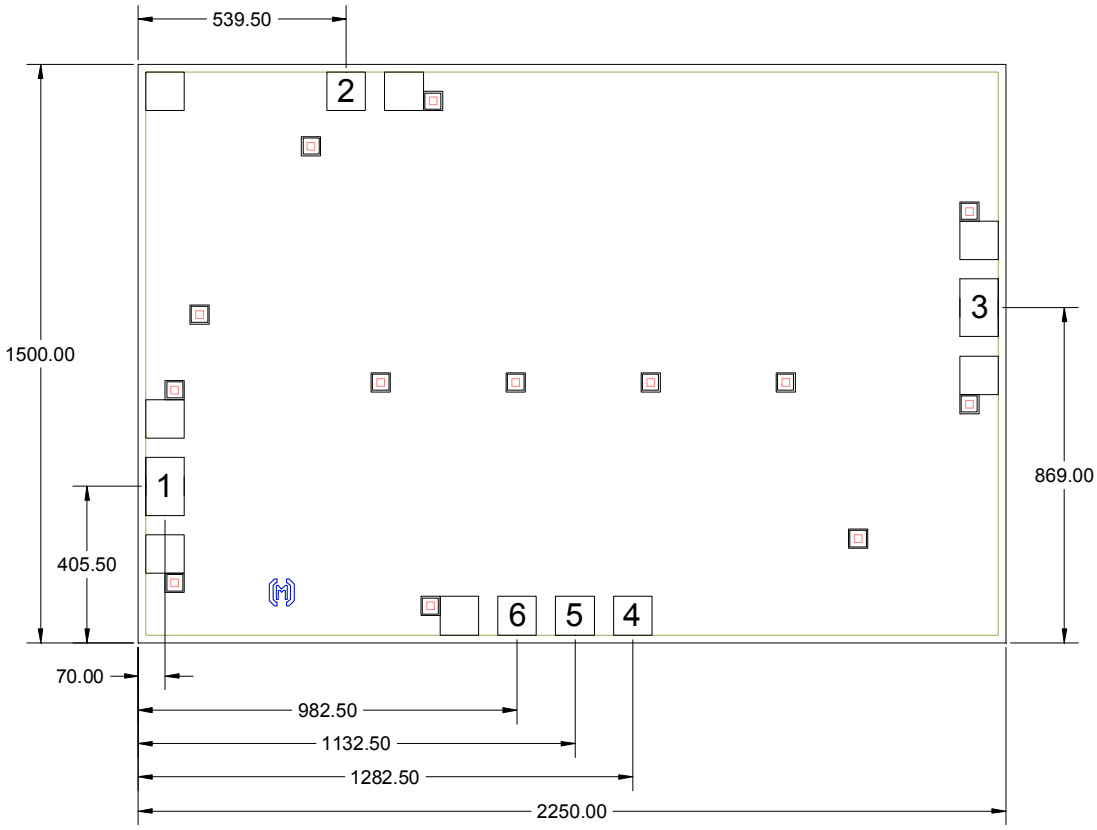
## *Mechanical Information*

**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 are 100 microns square
6. RF bond pads are 100 x 150 micron



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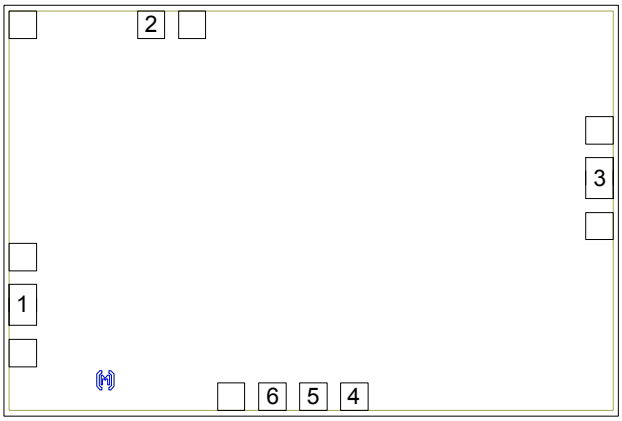
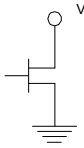
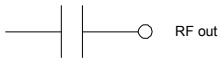
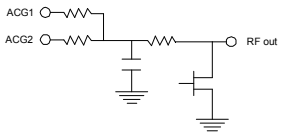
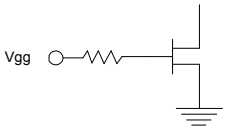
## *Pad Description*

### Pad Diagram




### Functional Description

| Pad | Function | Description | Schematic |
|---|---|---|---|
| 1 | RF in | DC blocked and 50 ohm matched |   |
| 2 | Vdd | Power supply voltage<br>Decoupling and bypass caps required |   |
| 3 | RF out | DC blocked and 50 ohm matched |   |
| 4, 5 | ACG1, 2 | Low Frequency Termination<br>Attach bypass capacitor per application circuit |   |
| 6 | Vgg | Power supply voltage<br>Decoupling and bypass caps required |   |
| Backside | Ground | Connect to RF / DC ground |   |



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## *Applications Information*

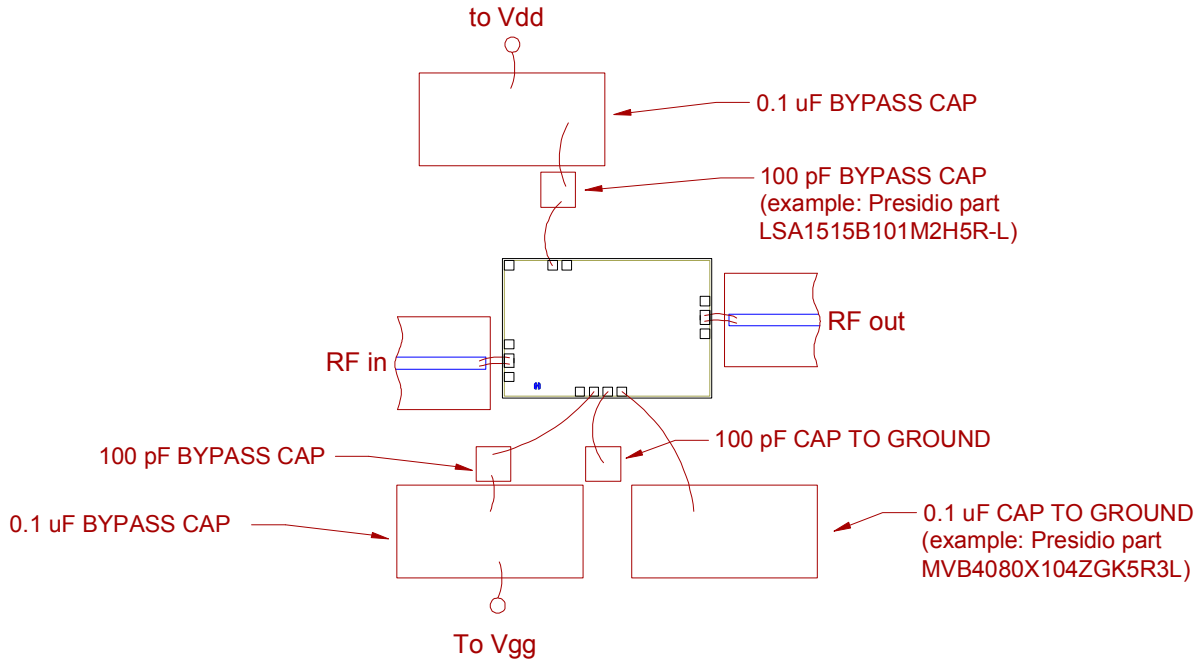
### Assembly Guidelines

The backside of the CMD241 is RF ground. Die attach should be accomplished with electrically and thermally conductive epoxy or eutectic attach. 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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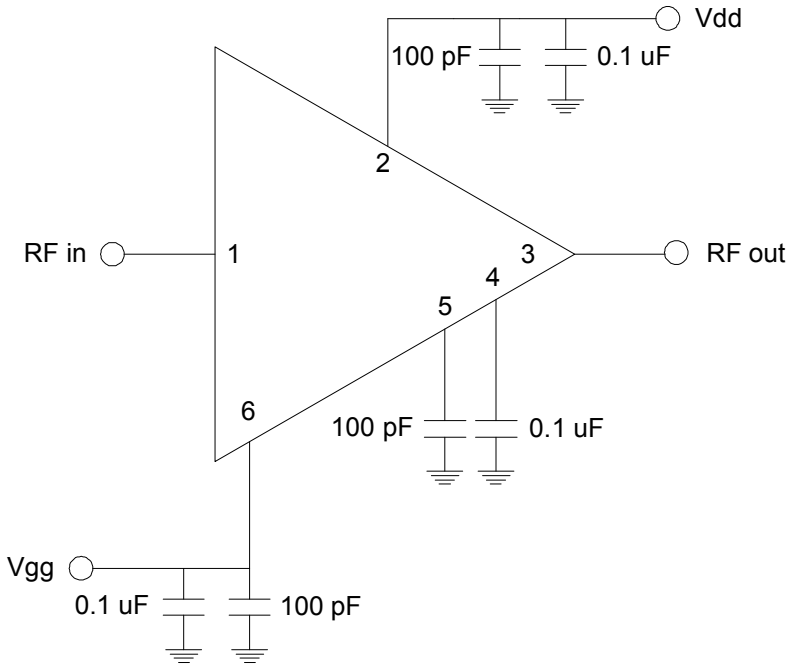
## *Applications Information*

### Application Circuit




### Biasing and Operation

The CMD241 is biased with a positive drain supply and a negative gate supply. Performance is optimized when the drain voltage is set to +5.0 V. The nominal gate voltage is -0.65 V.

Turn ON procedure:

1.Apply gate voltage $V_{gg}$ and set to -2 V
2.Apply drain voltage $V_{dd}$ and set to +5 V
3.Increase $V_{gg}$ (less negative) to achieve a drain current of 74 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.



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