



# CMD240P4

## DC-22 GHz Distributed Amplifier

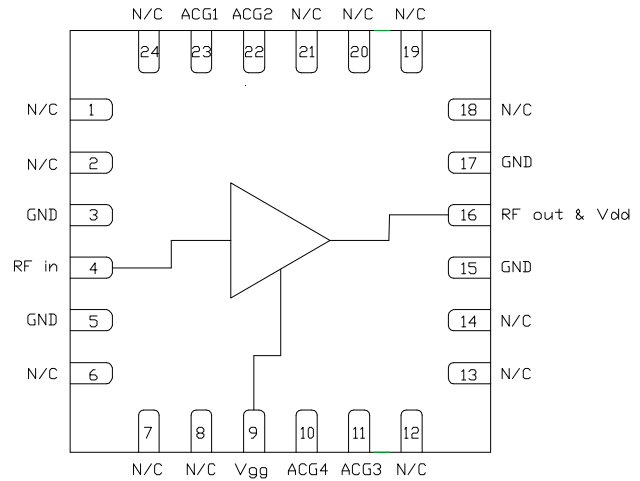
### Features

- ▶ Ultra wideband performance
- ▶ Low noise figure
- ▶ Low current consumption
- ▶ Excellent return losses
- ▶ Pb-free RoHs compliant 4x4 QFN package

### Description

The CMD240P4 is wideband GaAs MMIC distributed amplifier housed in a leadless 4x4 mm surface mount package. The amplifier operates from DC to 22 GHz and delivers greater than 15 dB of gain with a corresponding noise figure of 2.2 dB and output 1 dB compression point of +19 dBm at 10 GHz. The CMD240P4 is a 50 ohm matched design which eliminates the need for RF port matching.

### Functional Block Diagram



### Electrical Performance - $V_{dd} = 5.0\text{ V}$ , $V_{gg} = -0.6\text{ V}$ , $T_A = 25\text{ }^\circ\text{C}$ , $F = 10\text{ GHz}$

| Parameter          | Min     | Typ | Max | Units |
|--------------------|---------|-----|-----|-------|
| Frequency Range    | DC - 22 |     |     | GHz   |
| Gain               |         | 15  |     | dB    |
| Noise Figure       |         | 2.2 |     | dB    |
| Input Return Loss  |         | 19  |     | dB    |
| Output Return Loss |         | 18  |     | dB    |
| Output P1dB        |         | 19  |     | dBm   |
| Output IP3         |         | 26  |     | dBm   |
| Supply Current     |         | 80  |     | mA    |

ver 1.0 1116



# CMD240P4

## DC-22 GHz Distributed Amplifier

### Specifications

#### Absolute Maximum Ratings

| Parameter                            | Rating        |
|--------------------------------------|---------------|
| Drain Voltage, V <sub>dd</sub>       | 10 V          |
| Gate Voltage, V <sub>gg</sub>        | -2.5 to 0 V   |
| RF Input Power                       | +20 dBm       |
| Channel Temperature, T <sub>ch</sub> | 150 °C        |
| Power Dissipation, P <sub>diss</sub> | 1.7 W         |
| Thermal Resistance                   | 38 °C/W       |
| Operating Temperature                | -40 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 |
|-----------------|-----|------|-----|-------|
| V <sub>dd</sub> | 3.0 | 5.0  | 8.0 | V     |
| I <sub>dd</sub> |     | 80   |     | mA    |
| V <sub>gg</sub> |     | -0.6 |     | V     |

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

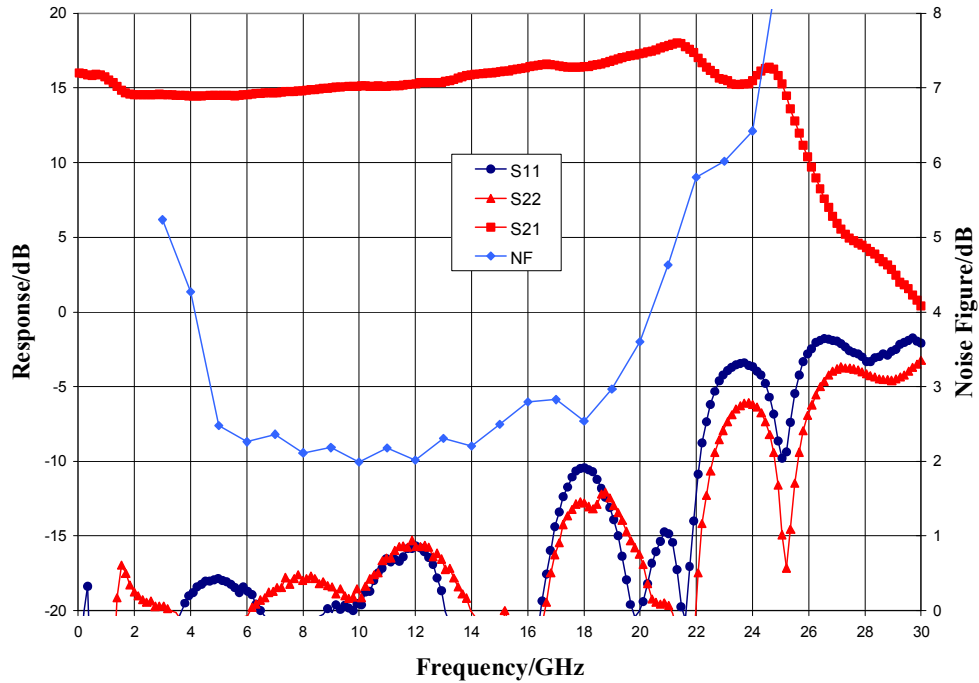
#### Electrical Specifications, V<sub>dd</sub> = 5.0 V, V<sub>gg</sub> = -0.6 V, T<sub>A</sub> = 25 °C

| Parameter                            | Min     | Typ   | Max | Min    | Typ   | Max | Units |
|--------------------------------------|---------|-------|-----|--------|-------|-----|-------|
| Frequency Range                      | DC - 22 |       |     | 6 - 18 |       |     | GHz   |
| Gain                                 | 12      | 15    |     | 12     | 15    |     | dB    |
| Noise Figure                         |         | 2.5   |     |        | 2.2   |     | dB    |
| Input Return Loss                    |         | 15    |     |        | 15    |     | dB    |
| Output Return Loss                   |         | 13    |     |        | 15    |     | dB    |
| Output P1dB                          | 13      | 18    |     | 15     | 19    |     | dBm   |
| Output IP3                           |         | 26    |     |        | 26    |     | dBm   |
| Supply Current                       | 55      | 80    | 105 | 55     | 80    | 105 | mA    |
| Gain Temperature Coefficient         |         | 0.008 |     |        | 0.008 |     | dB/°C |
| Noise Figure Temperature Coefficient |         | 0.009 |     |        | 0.009 |     | dB/°C |

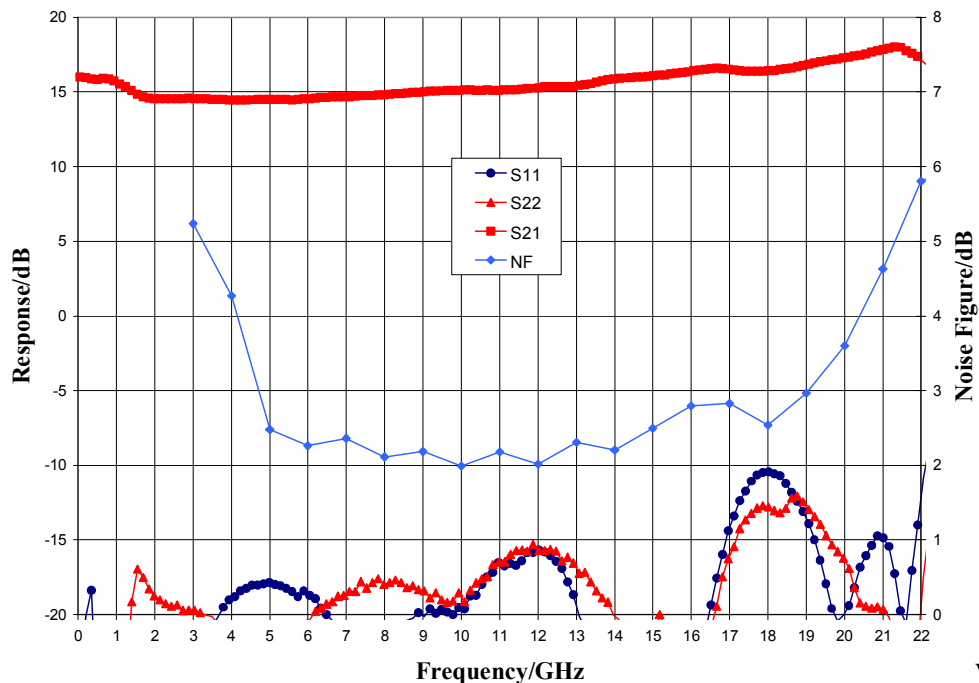
ver 1.0 1116

### Typical Performance

Broadband Performance,  $V_{dd} = 5\text{ V}$ ,  $V_{gg} = -0.6\text{ V}$ ,  $I_{dd} = 80\text{ mA}$ ,  $T_A = 25\text{ }^\circ\text{C}$



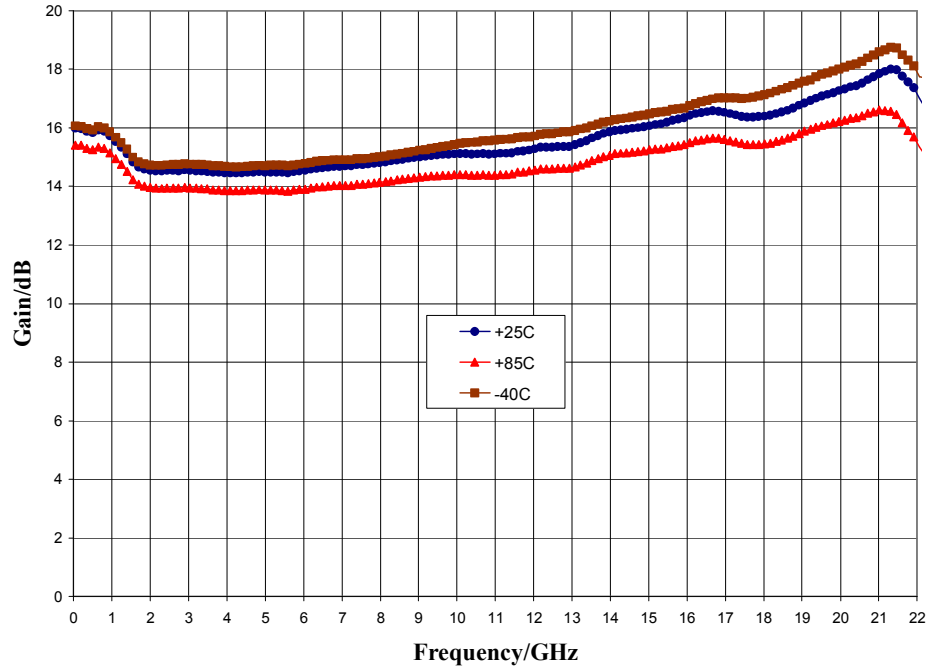
Narrow-band Performance,  $V_{dd} = 5\text{ V}$ ,  $V_{gg} = -0.6\text{ V}$ ,  $I_{dd} = 80\text{ mA}$ ,  $T_A = 25\text{ }^\circ\text{C}$



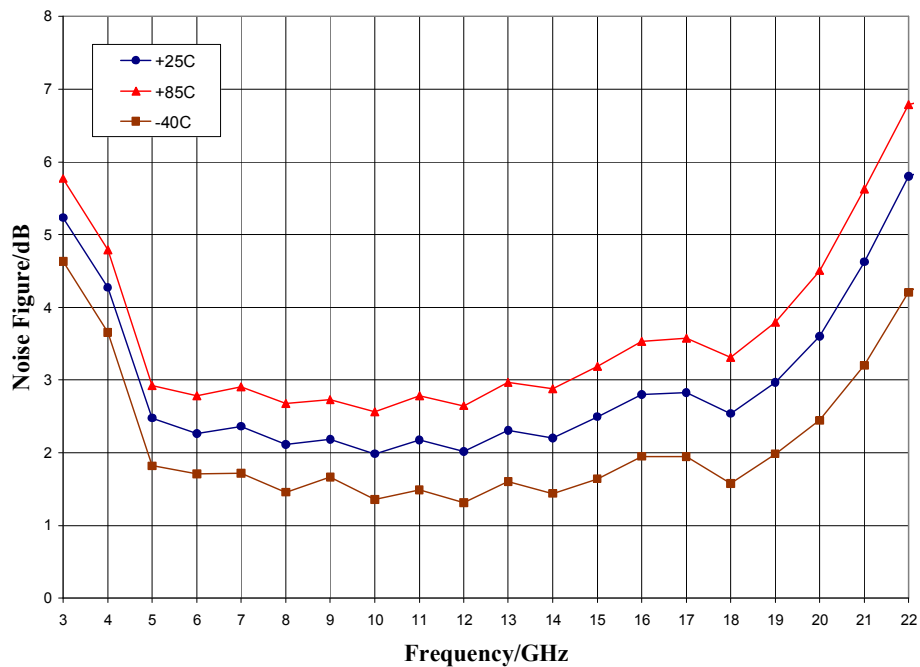
ver 1.0 1116

### Typical Performance

Gain vs. Temperature,  $V_{dd} = 5\text{ V}$ ,  $V_{gg} = -0.6\text{ V}$



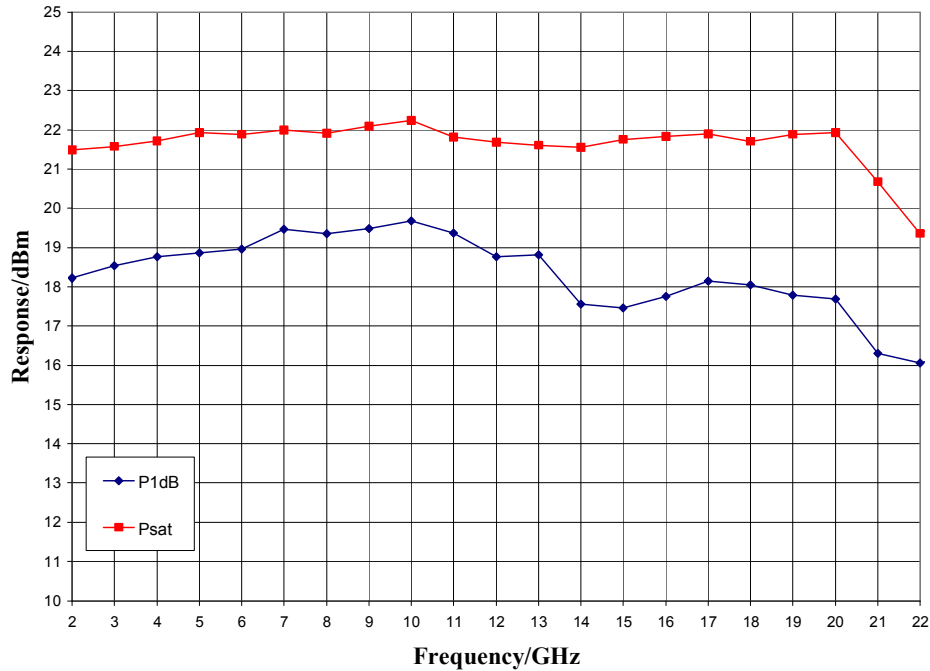
Noise Figure vs. Temperature,  $V_{dd} = 5\text{ V}$ ,  $V_{gg} = -0.6\text{ V}$



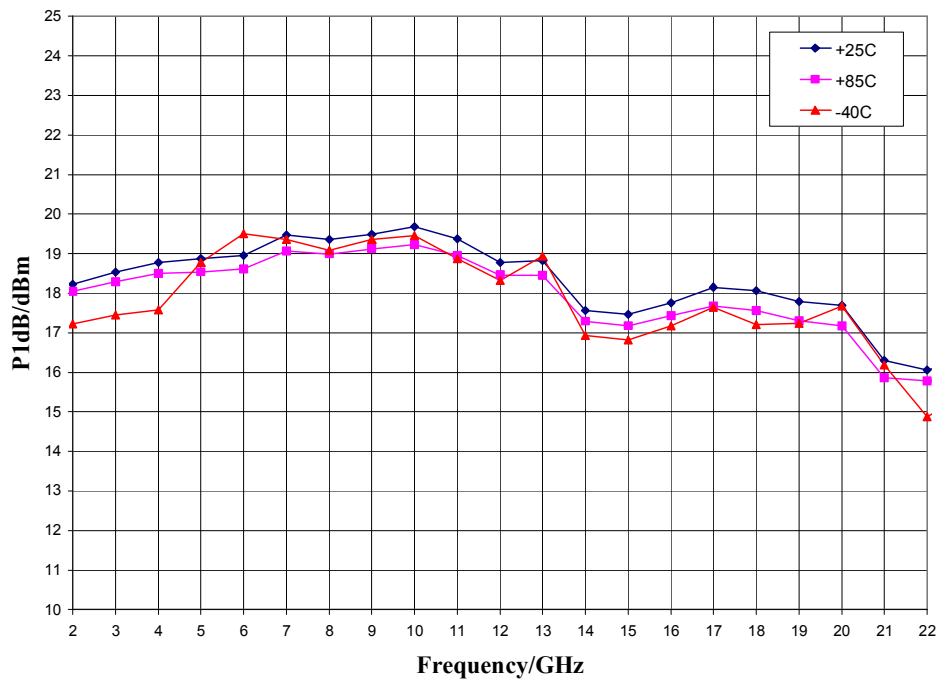
ver 1.0 1116

### Typical Performance

Output Power,  $V_{dd} = 5\text{ V}$ ,  $V_{gg} = -0.6\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$



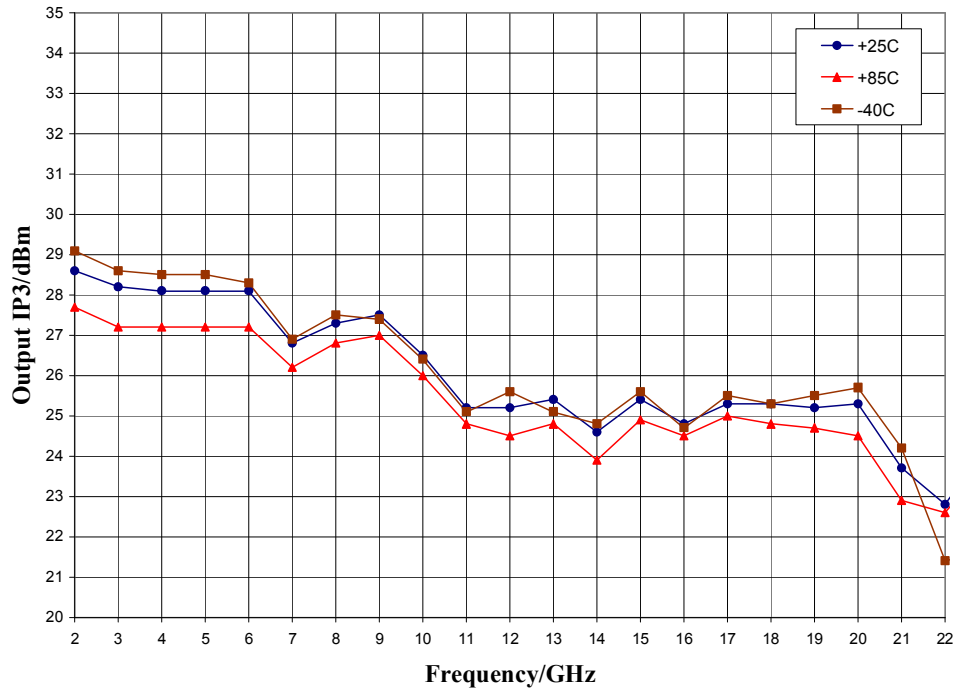
P1dB vs. Temperature,  $V_{dd} = 5\text{ V}$ ,  $V_{gg} = -0.6\text{ V}$



ver 1.0 1116

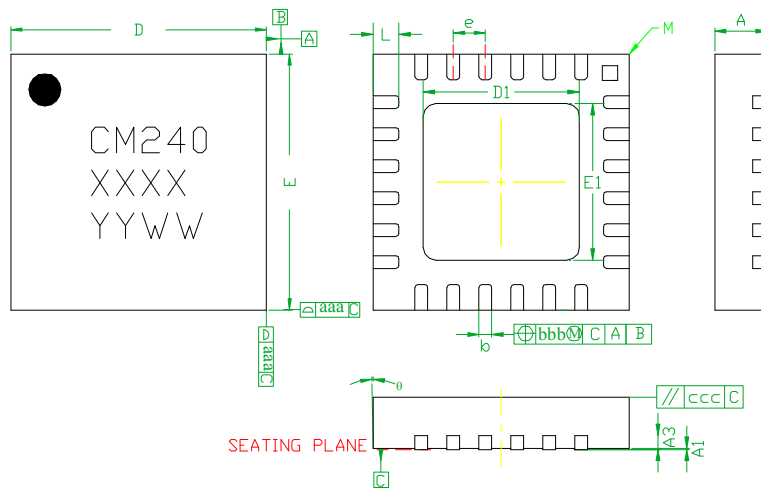
### Typical Performance

Output IP3 vs. Temperature,  $V_{dd} = 5\text{ V}$ ,  $V_{gg} = -0.6\text{ V}$



### Mechanical Information

#### Package Information and Dimensions

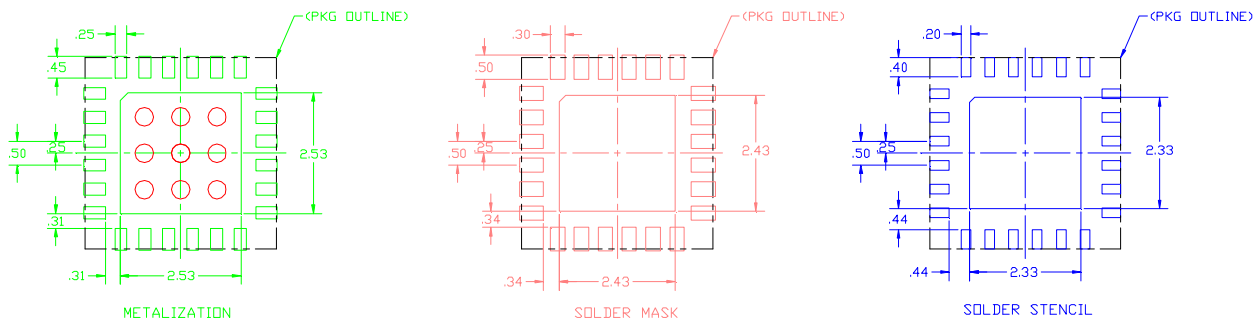


| SYMBOLS | DIMENSIONS IN MILLIMETERS |          |      |
|---------|---------------------------|----------|------|
|         | MIN                       | NOM      | MAX  |
| A       | 0.80                      | 0.90     | 1.00 |
| A1      | 0                         | 0.02     | 0.05 |
| A3      | —                         | 0.25REF. | —    |
| b       | 0.18                      | 0.23     | 0.30 |
| D       | 3.85                      | 4.00     | 4.15 |
| D1      | 2.40                      | 2.50     | 2.60 |
| E       | 3.85                      | 4.00     | 4.15 |
| E1      | 2.40                      | 2.50     | 2.60 |
| e       | —                         | 0.50BSC  | —    |
| L       | 0.30                      | 0.40     | 0.50 |
| ø       | 0                         | —        | 12   |
| aaa     | —                         | 0.25     | —    |
| bbb     | —                         | 0.10     | —    |
| ccc     | —                         | 0.10     | —    |
| M       | —                         | —        | 0.05 |

#### NOTES:

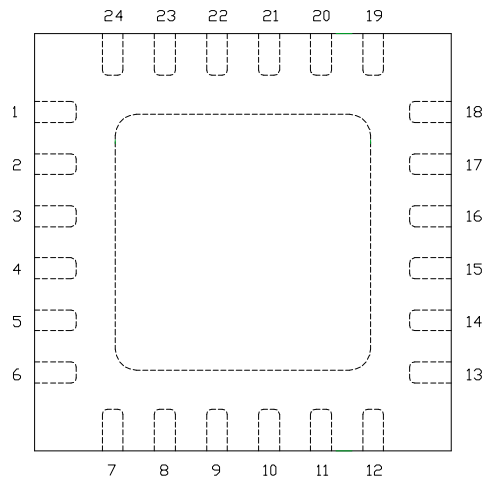
1. DIMENSIONS ARE IN MILLIMETERS
2. RoHS COMPLIANT MOLD COMPOUND
3. LEADFRAME MATERIAL: COPPER ALLOY
4. LEAD FINISH: 100% MATTE Sn
5. INDICATED DIMENSION/TOLERANCE APPLIES TO LEADS AND EXPOSED PAD

#### Recommended PCB Land Pattern

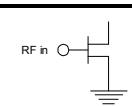
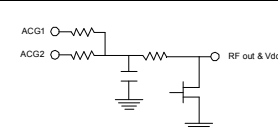
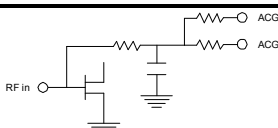
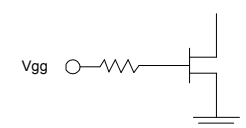



### Pin Description

#### Pin Diagram



#### Functional Description

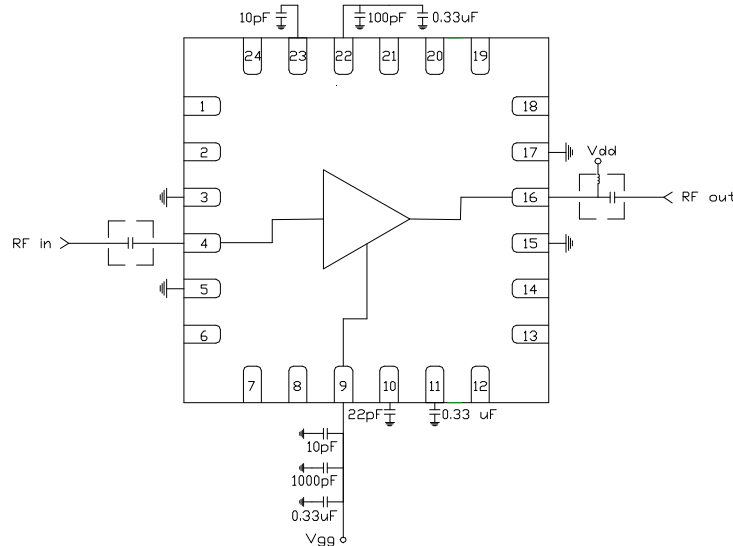
| Pin                         | Function     | Description   | Schematic   |
|-----------------------------|--------------|---|---|
| 1, 2, 6-8, 12-14, 18-21, 24 | N/C          | No connection required. These pins may be connected to RF/DC ground         |   |
| 4                           | RF in        | 50 ohm matched input  |  |
| 22, 23                      | ACG2, 1      | Low frequency termination. Attach bypass capacitors per application circuit |  |
| 16                          | RF out & Vdd | Power supply voltage and 50 ohm matched output                              |   |
| 10, 11                      | ACG4, 3      | Low frequency termination. Attach bypass capacitors per application circuit |  |
| 9                           | Vgg          | Power supply voltage<br>Decoupling and bypass caps required                 |  |
| 3, 5, 15, 17 and die paddle | Ground       | Connect to RF / DC ground   |  |

ver 1.0 1116



### 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 CMD240P4 is biased with a positive drain supply and negative gate supply. Performance is optimized when the drain voltage is set to +5.0 V. The nominal gate voltage is -0.6 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 80 mA

Turn OFF procedure:

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

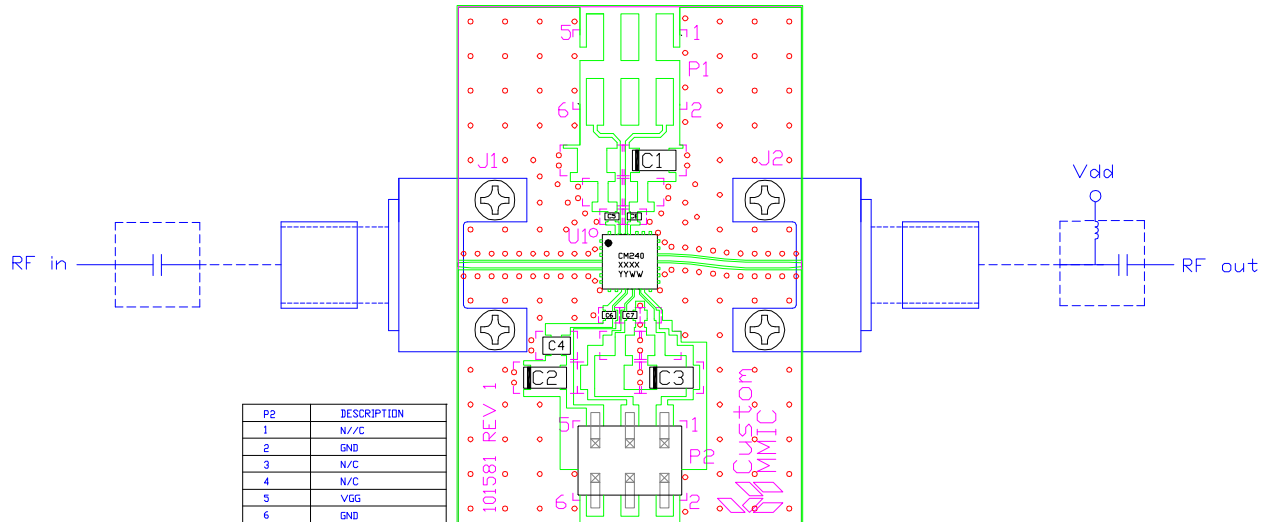
RF power can be applied at any time.

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

ver 1.0 1116

### Applications Information

#### Evaluation Board



#### Bill of Material

| Designator | Value        | Description               |
|------------|--------------|---------------------------|
| J1, J2     |              | SMA End Launch Connector  |
| P2         |              | 6 Pin DC Header           |
| C1-C3      | 0.33 $\mu$ F | Capacitor, Tantalum       |
| C4         | 1000 pF      | Capacitor, 0603           |
| C5, C6     | 10 pF        | Capacitor, 0402           |
| C7         | 22 pF        | Capacitor, 0402           |
| C8         | 100 pF       | Capacitor, 0402           |
| U1         |              | CMD240P4 Driver Amplifier |
| PCB        |              | 101581 Evaluation PCB     |

ver 1.0 1116