



# CMD194C3

## 6-20 GHz Low Noise Amplifier

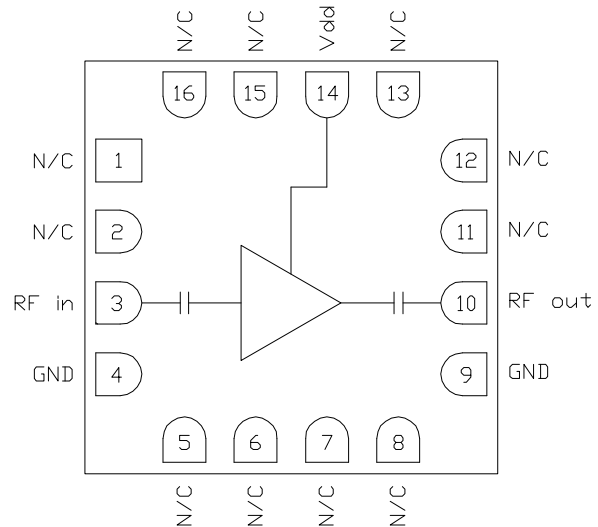
### Features

- ▶ Low noise figure
- ▶ High gain broadband performance
- ▶ Single supply voltage
- ▶ Pb-free RoHs compliant 3x3 QFN package

### Description

The CMD194C3 is a broadband MMIC low noise amplifier housed in a leadless 3x3 mm plastic surface mount package. The CMD194C3 is ideally suited for EW and communications systems where small size and low power consumption are needed. The broadband device delivers greater than 20 dB of gain with a corresponding output 1 dB compression point of +15 dBm and a noise figure of 2 dB. The CMD194C3 is a 50 ohm matched design eliminating the need for external DC blocks and RF port matching.

### Functional Block Diagram



### Electrical Performance - $V_{dd} = 4.0 \text{ V}$ , $T_A = 25 \text{ }^\circ\text{C}$ , $F = 13 \text{ GHz}$

| Parameter          | Min    | Typ  | Max | Units |
|--------------------|--------|------|-----|-------|
| Frequency Range    | 6 - 20 |      |     | GHz   |
| Gain               |        | 20   |     | dB    |
| Noise Figure       |        | 2    |     | dB    |
| Input Return Loss  |        | 11   |     | dB    |
| Output Return Loss |        | 20   |     | dB    |
| Output P1dB        |        | 15.5 |     | dBm   |
| Supply Current     |        | 120  |     | mA    |

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### Specifications

#### Absolute Maximum Ratings

| Parameter                            | Rating        |
|--------------------------------------|---------------|
| Drain Voltage, Vdd                   | 5.5 V         |
| RF Input Power                       | +20 dBm       |
| Channel Temperature, Tch             | 150 °C        |
| Power Dissipation, P <sub>diss</sub> | 866 mW        |
| Thermal Resistance                   | 75 °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 |
|-----------------|-----|-----|-----|-------|
| Vdd             | 2.0 | 4.0 | 5.0 | V     |
| I <sub>dd</sub> |     | 120 |     | mA    |

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

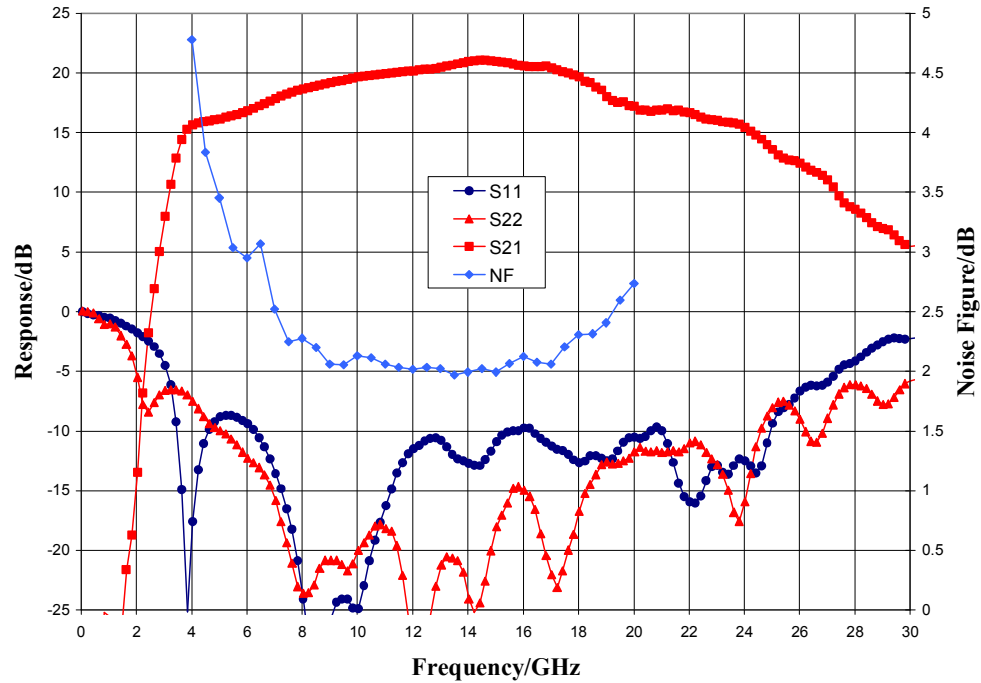
#### Electrical Specifications - V<sub>dd</sub> = 4.0 V, T<sub>A</sub> = 25 °C

| Parameter                            | Min    | Typ   | Max | Min    | Typ   | Max | Units |
|--------------------------------------|--------|-------|-----|--------|-------|-----|-------|
| Frequency Range                      | 6 - 20 |       |     | 9 - 17 |       |     | GHz   |
| Gain                                 | 14     | 20    | 24  | 16     | 20    | 24  | dB    |
| Noise Figure                         |        | 2.1   | 3.5 |        | 2.1   | 2.5 | dB    |
| Input Return Loss                    |        | 12    |     |        | 12    |     | dB    |
| Output Return Loss                   |        | 15    |     |        | 18    |     | dB    |
| Output P <sub>1dB</sub>              |        | 15    |     |        | 15    |     | dBm   |
| Output IP <sub>3</sub>               |        | 26    |     |        | 26    |     | dBm   |
| Supply Current                       | 90     | 120   | 150 | 90     | 120   | 150 | mA    |
| Gain Temperature Coefficient         |        | 0.014 |     |        | 0.014 |     | dB/°C |
| Noise Figure Temperature Coefficient |        | 0.01  |     |        | 0.01  |     | dB/°C |

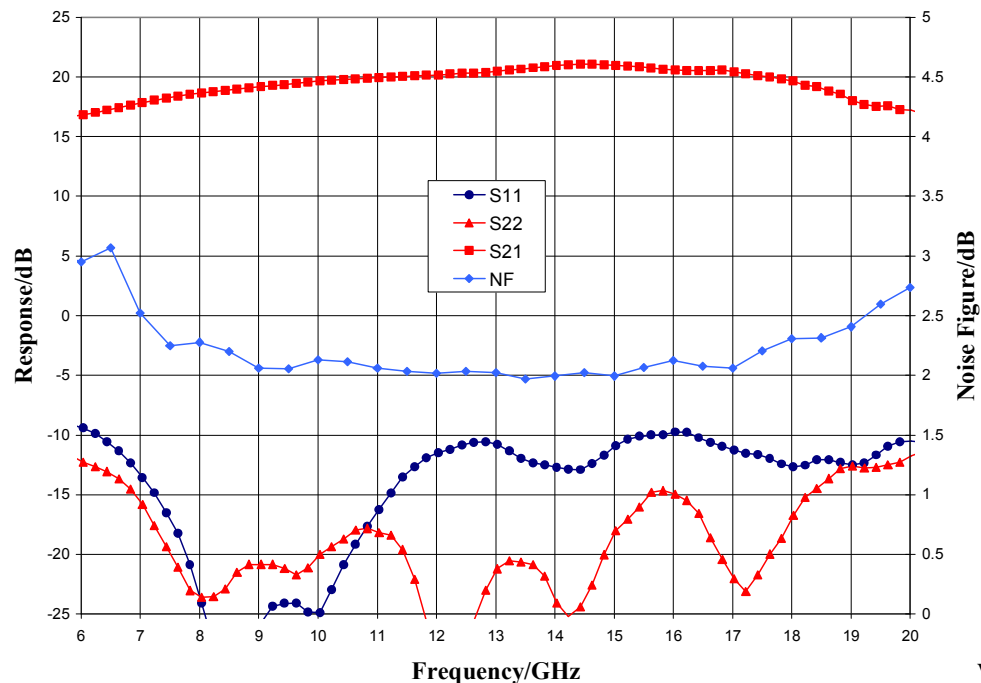
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### Typical Performance

**Broadband Performance,  $V_{dd} = 4.0$  V,  $I_{dd} = 120$  mA,  $T_A = 25$  °C**



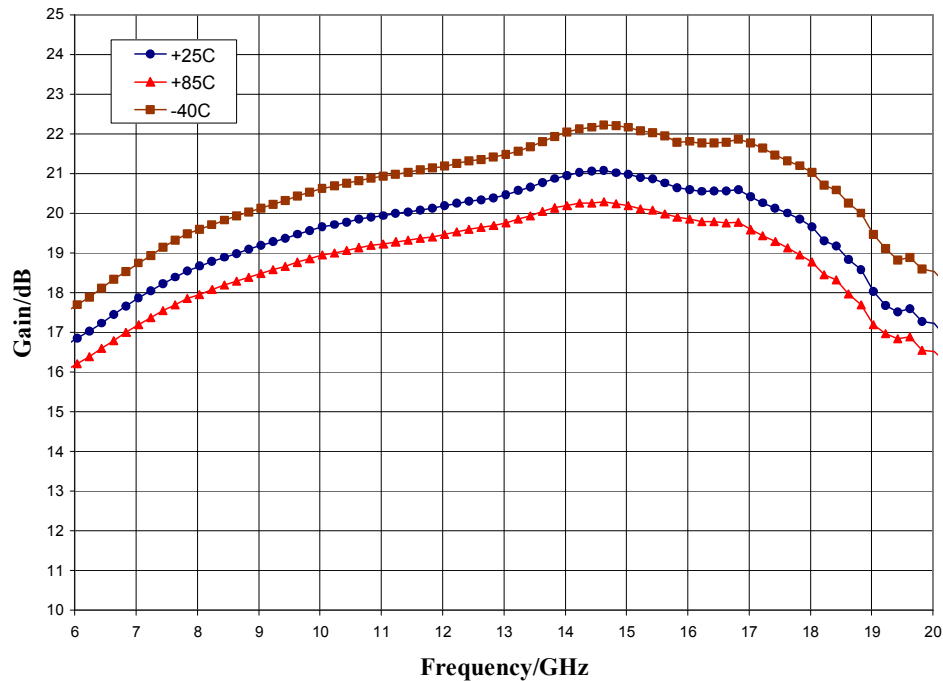
**Narrow-band Performance,  $V_{dd} = 4.0$  V,  $I_{dd} = 120$  mA,  $T_A = 25$  °C**



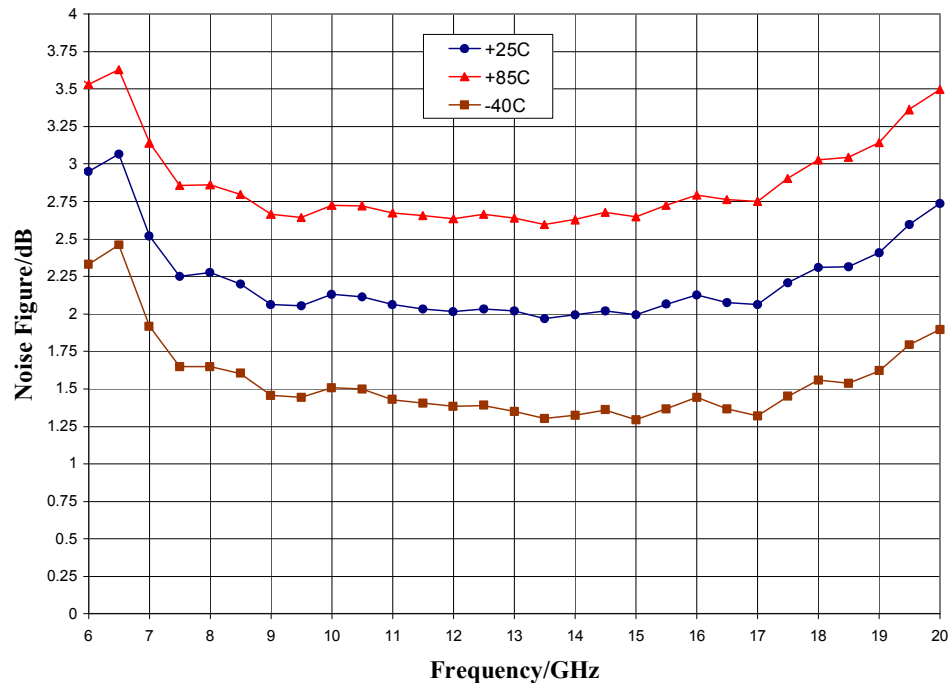
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### Typical Performance

Gain vs. Temperature,  $V_{dd} = 4.0$  V



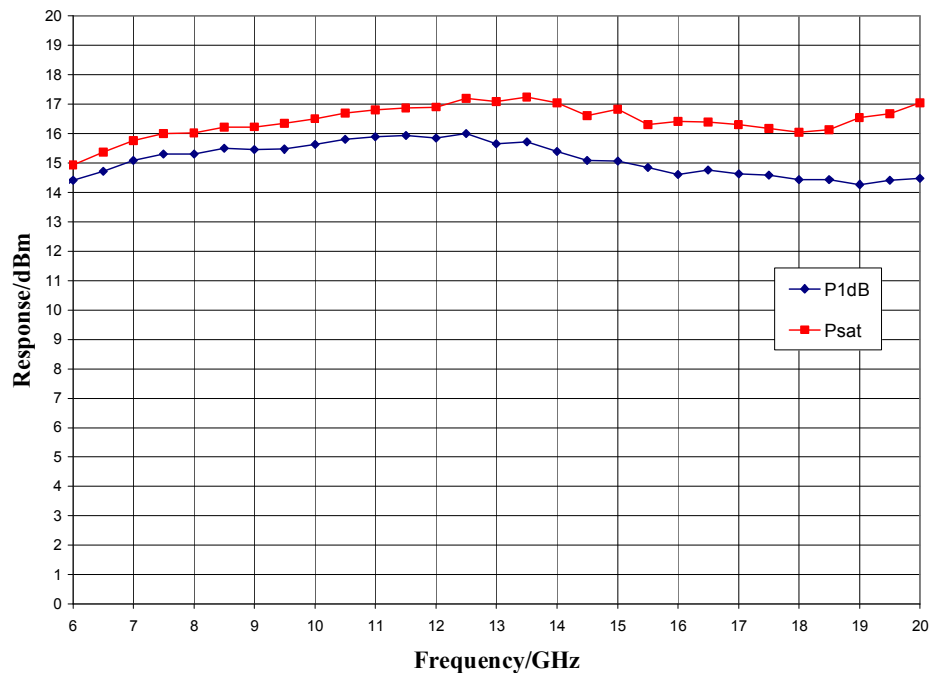
Noise Figure vs. Temperature,  $V_{dd} = 4.0$  V



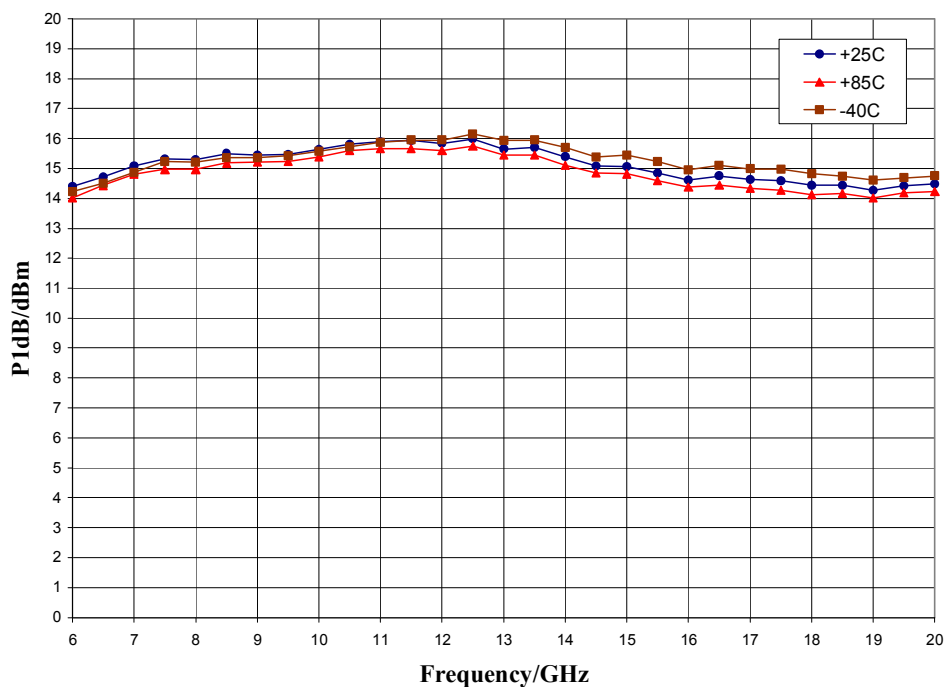
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### Typical Performance

Output Power,  $V_{dd} = 4.0$  V,  $I_{dd} = 120$  mA,  $T_A = 25$  °C



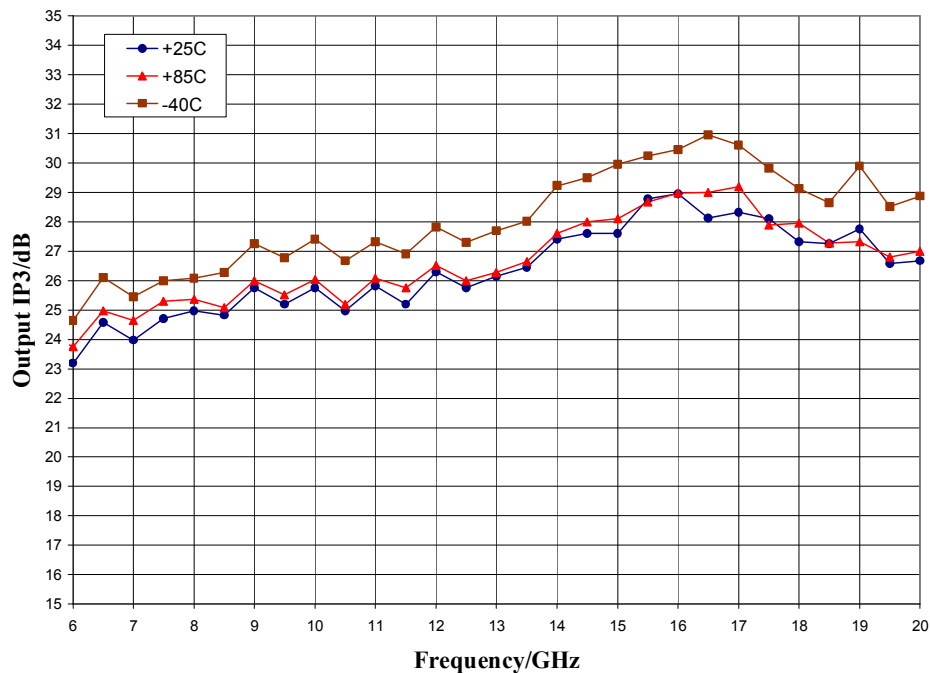
P1dB vs. Temperature,  $V_{dd} = 4.0$  V



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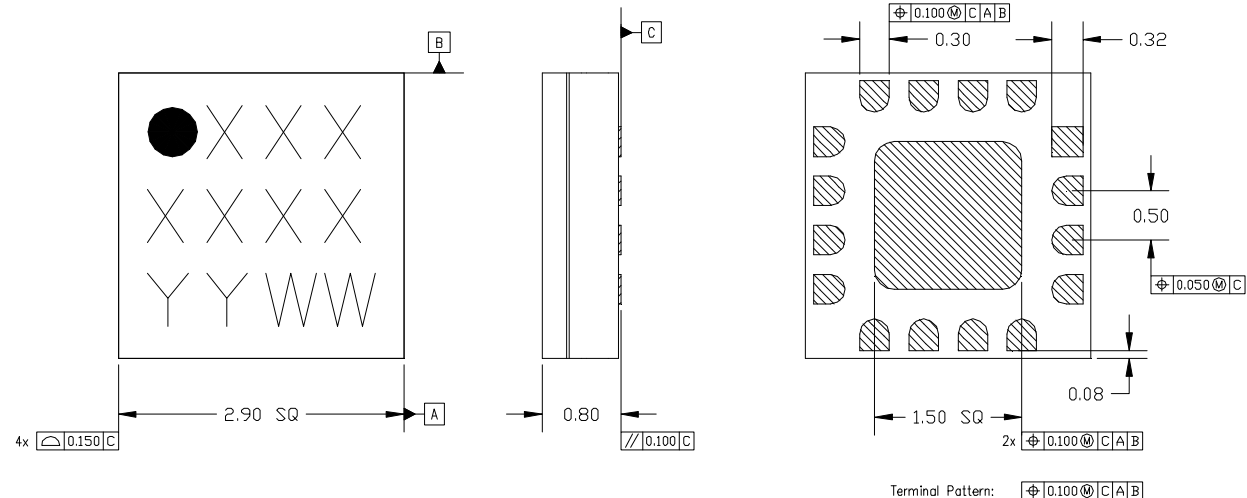
### Typical Performance

#### Output IP3 vs. Temperature, Vdd=4.0V



### Mechanical Information

#### Package Information and Dimensions



#### NOTES:

- ALL DIMENSIONS SHOWN IN mm.
- MATERIAL: BLACK ALUMINA
- LEAD FINISH:
  - Ni: 8.89um MAX, 1.27um MIN
  - Pd: 0.17um MAX, 0.07um MIN
  - Au: 0.254um MAX, 0.03um MIN
- MARKING
  - LINE 1: PART NUMBER  
4.1.1. EXAMPLE: CMD196C3 SHALL BE MARKED AS 196
  - LINE 2: LOT NUMBER
  - LINE 3: DATE CODE - LAST 2 DIGITS OF THE YEAR OF MANUFACTURE  
FOLLOWED BY A 2 DIGIT WEEK CODE
- ALTERNATE PIN #1 IDENTIFIER IS A SINGLE SQUARE PAD
- ALTERNATE DIE PADDLE MAY HAVE CHAMFERED CORNERS

#### Recommended PCB Land Pattern

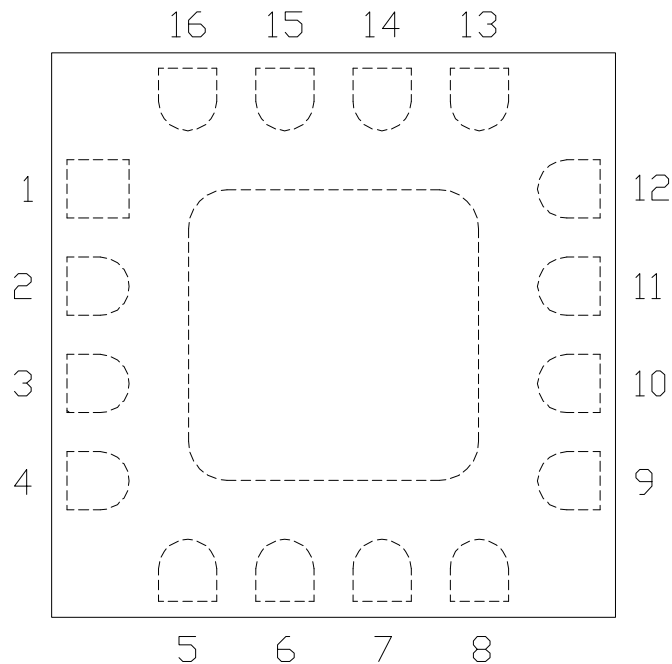
Custom MMIC Design Services recommends that the user develop the land pattern that will provide the best design for proper solder reflow and device attach for their specific application. Please review Custom MMIC Application Note AN 105 for a recommended land pattern approach.

#### Recommended Solder Reflow Profile

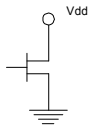
Custom MMIC Design Services recommends screen printing with belt furnace reflow to ensure proper solder reflow and device attach. Please review Custom MMIC Application Note AN 102 for a recommended solder reflow profile.

### Pin Description

#### Pin Diagram



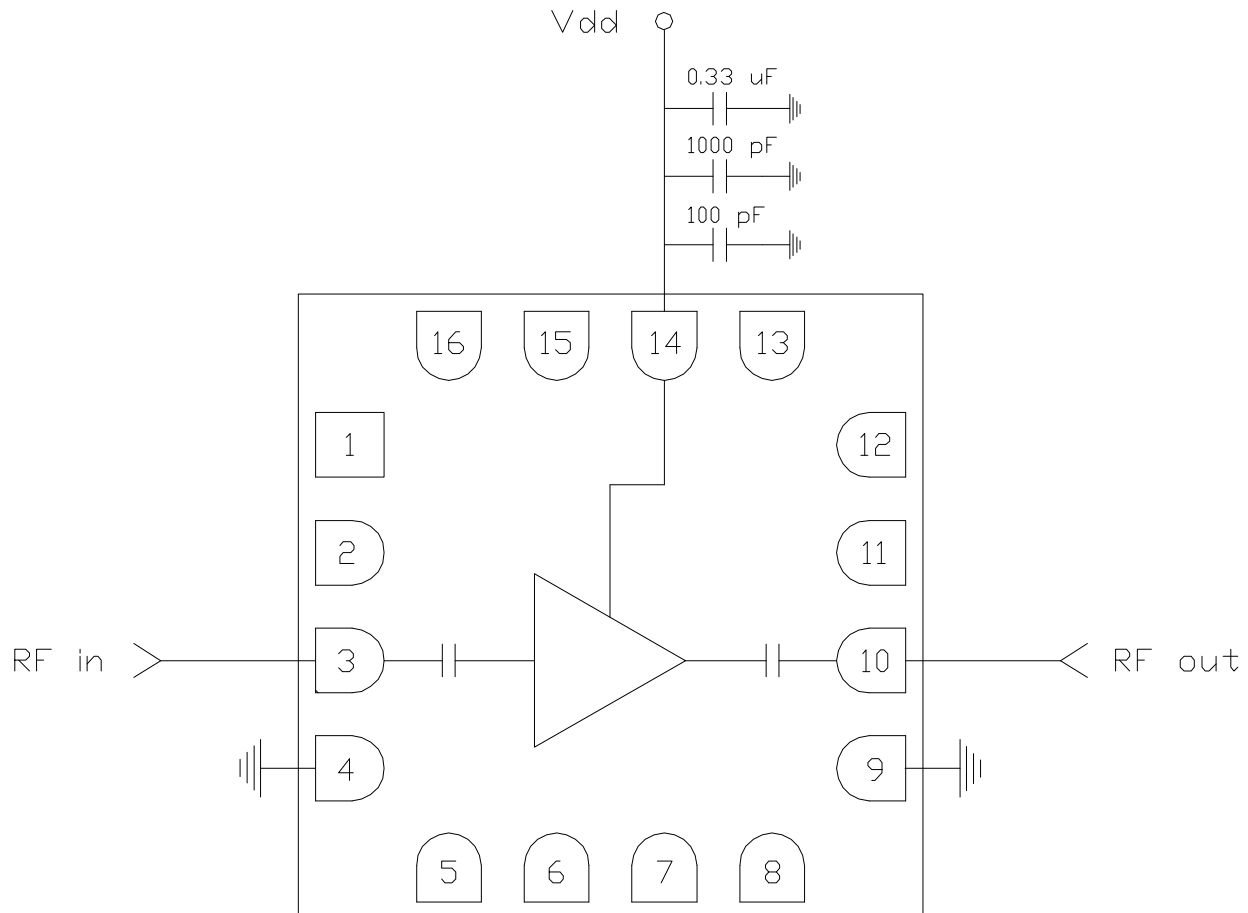
#### Functional Description

| Pin                      | Function | Description                                                          | Schematic                                                                             |
|--------------------------|----------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1, 2, 5-8, 11-13, 15, 16 | N/C      | No connection required. These pins may be connected to RF/DC ground. |                                                                                       |
| 3                        | RF in    | DC blocked and 50 ohm matched                                        |  |
| 10                       | RF out   | DC blocked and 50 ohm matched                                        |  |
| 14                       | Vdd      | Power supply voltage<br>Decoupling and bypass caps required          |  |
| 4, 9 and die paddle      | Ground   | Connect to RF / DC ground                                            |  |

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### Applications Information

#### Application Circuit



#### Biasing and Operation

The CMD194C3 is biased with a single 4.0 V positive drain supply.

RF power can be applied at any time.

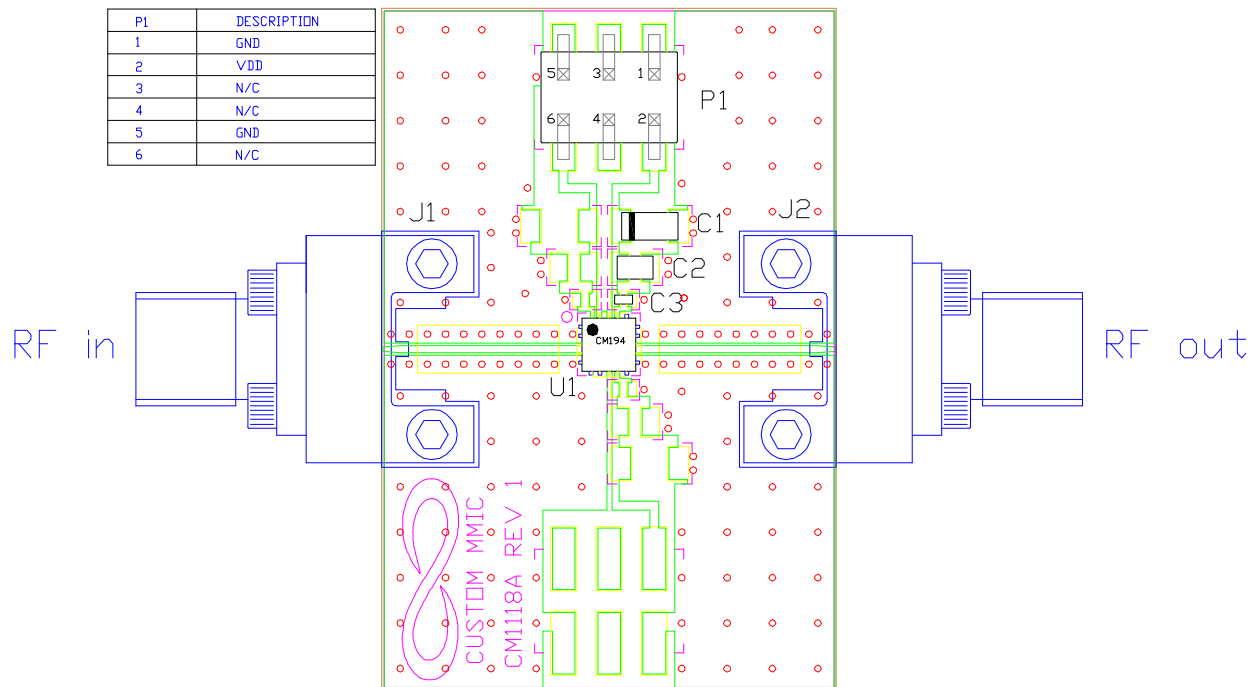
**GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.**

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### Applications Information

#### Evaluation Board

The circuit board shown has been developed for optimized assembly at CMDS. A sufficient number of via holes should be used to connect the top and bottom ground planes. As surface mount processes vary, careful process development is recommended.



#### Bill of Material

| Designator | Value        | Description                  |
|------------|--------------|------------------------------|
| J1, J2     |              | SMA End Launch Connector     |
| P1         |              | 6 Pin Header                 |
| C1         | 0.33 $\mu$ F | Capacitor, Tantalum          |
| C2         | 1000 pF      | Capacitor, 0603              |
| C3         | 100 pF       | Capacitor, 0402              |
| U1         |              | CMD194C3 Low Noise Amplifier |
| PCB        |              | CM1118A Evaluation PCB       |

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