



# CMD160C4

## 17-25 GHz Low Noise Amplifier

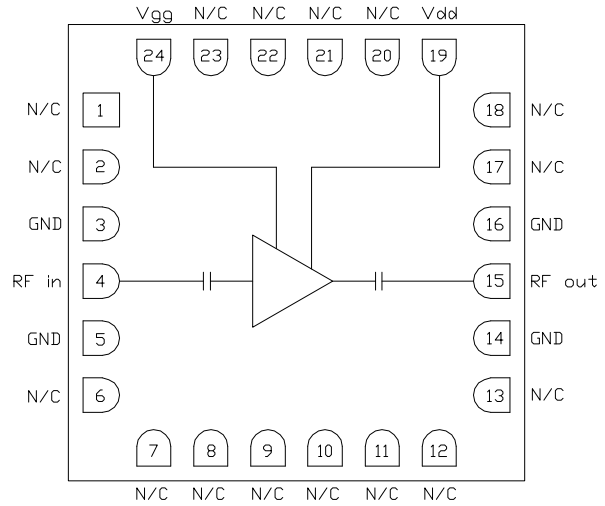
### Features

- ▶ Ultra low noise performance
- ▶ Low current consumption
- ▶ All positive supply voltages
- ▶ Pb-free RoHs compliant 4x4 QFN package

### Description

The CMD160C4 is a highly efficient GaAs MMIC low noise amplifier housed in a leadless 4x4 mm surface mount package. The CMD160C4 is ideally suited for military, space and communications systems where small size and low power consumption are needed. The device is optimized for 21 GHz and delivers 26 dB of gain with a corresponding output 1 dB compression point of +8 dBm and noise figure of 1.6 dB. The CMD160C4 is a 50 ohm matched design which eliminates the need for external DC blocks and RF port matching.

### Functional Block Diagram



### Electrical Performance - $V_{dd} = 3.0\text{ V}$ , $V_{gg} = 1.5\text{ V}$ , $T_A = 25\text{ }^\circ\text{C}$ , $F=21\text{ GHz}$

Parameter	Min	Typ	Max	Units
Frequency Range	17 - 25			GHz
Gain		26.5		dB
Noise Figure		1.6		dB
Input Return Loss		10		dB
Output Return Loss		20		dB
Output P1dB		8		dBm
Supply Current		28		mA

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### Specifications

#### Absolute Maximum Ratings

Parameter	Rating
Drain Voltage, V <sub>dd</sub>	4.0 V
Gate Voltage, V <sub>gg</sub>	3.0 V
RF Input Power	+20 dBm
Channel Temperature, T <sub>ch</sub>	150 °C
Power Dissipation, P <sub>diss</sub>	473 mW
Thermal Resistance, $\Theta_{JC}$	137 °C/W
Operating Temperature	-40 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 <sub>dd</sub>	2.0	3.0	4.0	V
I <sub>dd</sub>		28		mA
V <sub>gg</sub>	0	1.5	3.0	V
I <sub>gg</sub>		2.5		mA

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

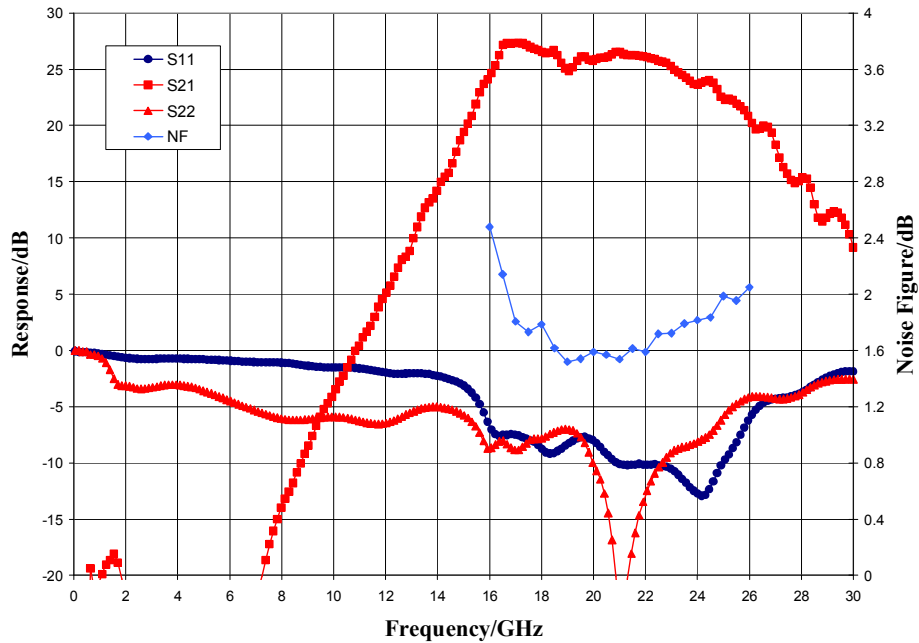
#### Electrical Specifications, V<sub>dd</sub> = 3.0 V, V<sub>gg</sub> = 1.5 V, T<sub>A</sub> = 25 °C

Parameter	Min	Typ	Max	Min	Typ	Max	Units
Frequency Range	17 - 20			20 - 25			GHz
Gain	22	26.5	30	20	25.5	29.5	dB
Noise Figure		1.7	2.2		1.7	2.3	dB
Input Return Loss		8			10		dB
Output Return Loss		8			10		dB
Output P1dB		5.5			9		dBm
Output IP3		13			16		dBm
Supply Current	18	28	38	18	28	38	mA
Gain Temperature Coefficient		0.02			0.02		dB/°C
Noise Figure Temperature Coefficient		0.008			0.008		dB/°C

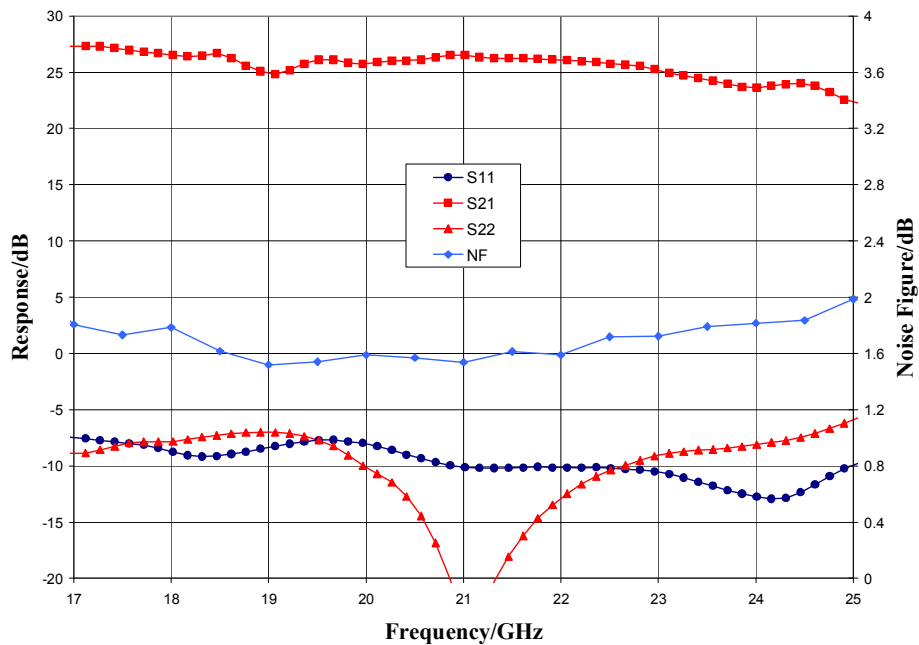
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### Typical Performance

Broadband Performance,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 1.5\text{ V}$ ,  $I_{dd} = 28\text{ mA}$ ,  $T_A = 25\text{ }^\circ\text{C}$



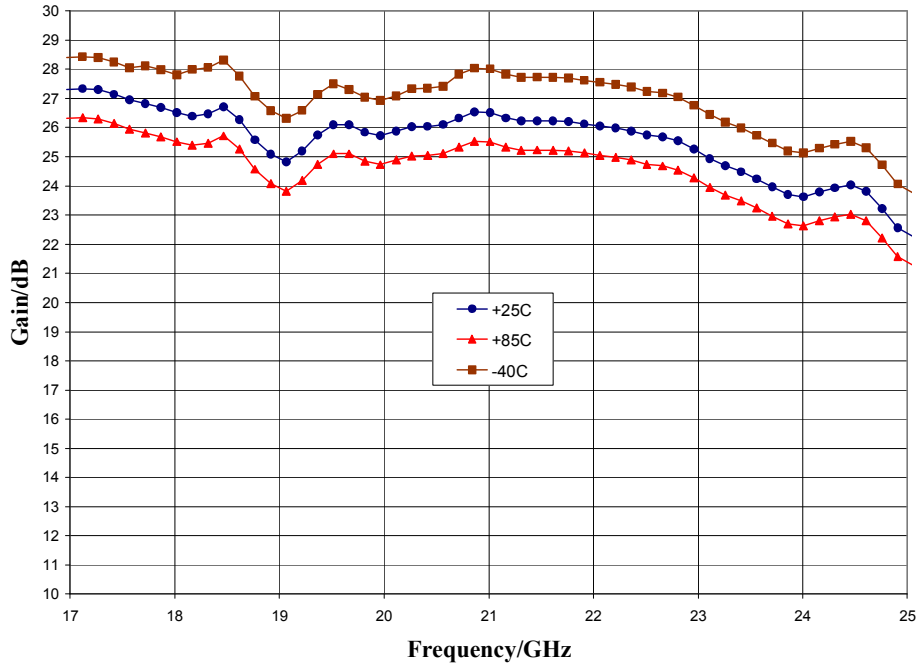
Narrow-band Performance,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 1.5\text{ V}$ ,  $I_{dd} = 28\text{ mA}$ ,  $T_A = 25\text{ }^\circ\text{C}$



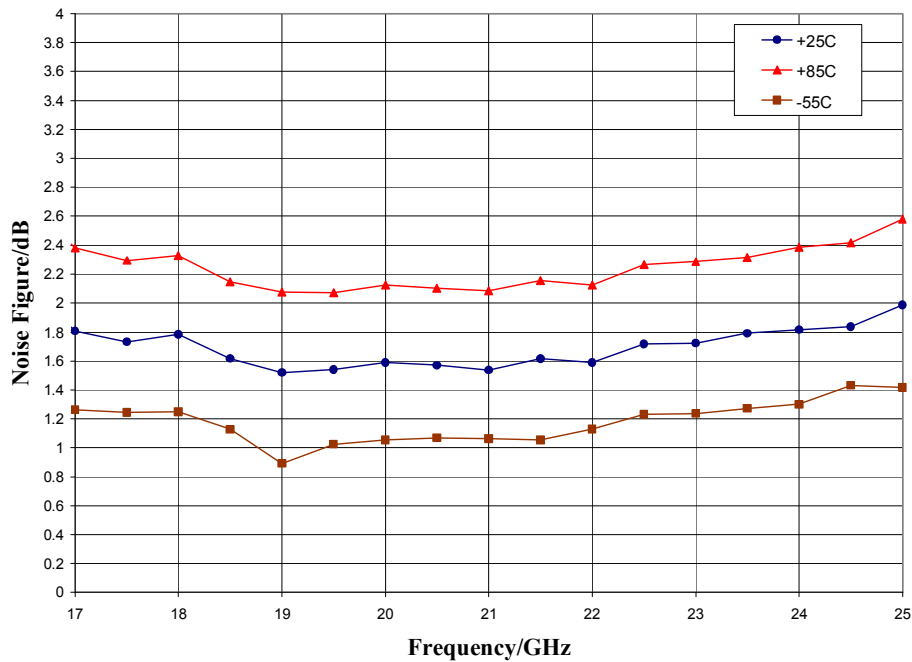
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### Typical Performance

Gain vs. Temperature,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 1.5\text{ V}$



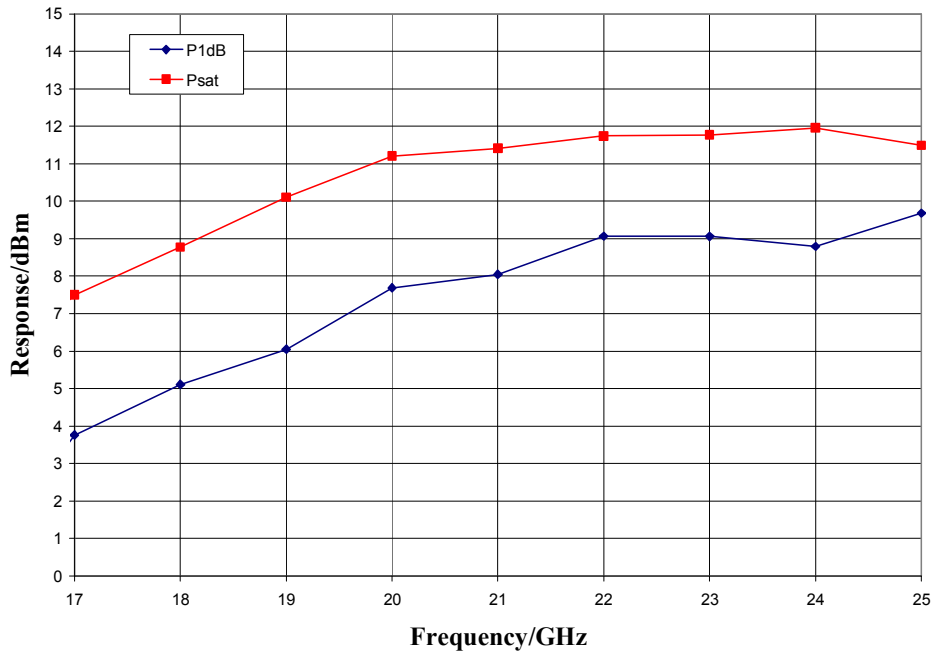
Noise Figure vs. Temperature,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 1.5\text{ V}$



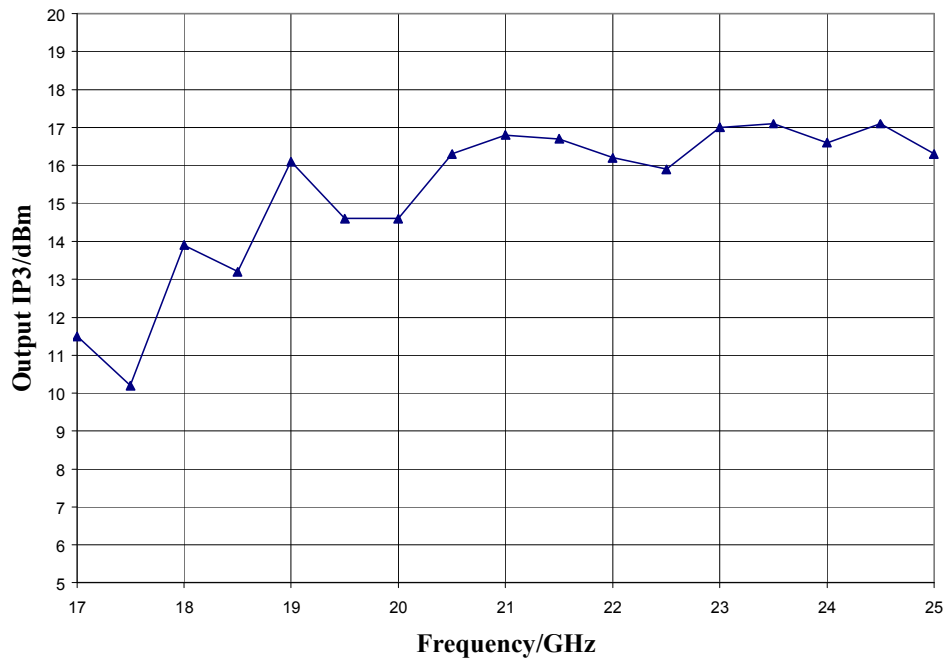
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### Typical Performance

Output Power,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 1.5\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$



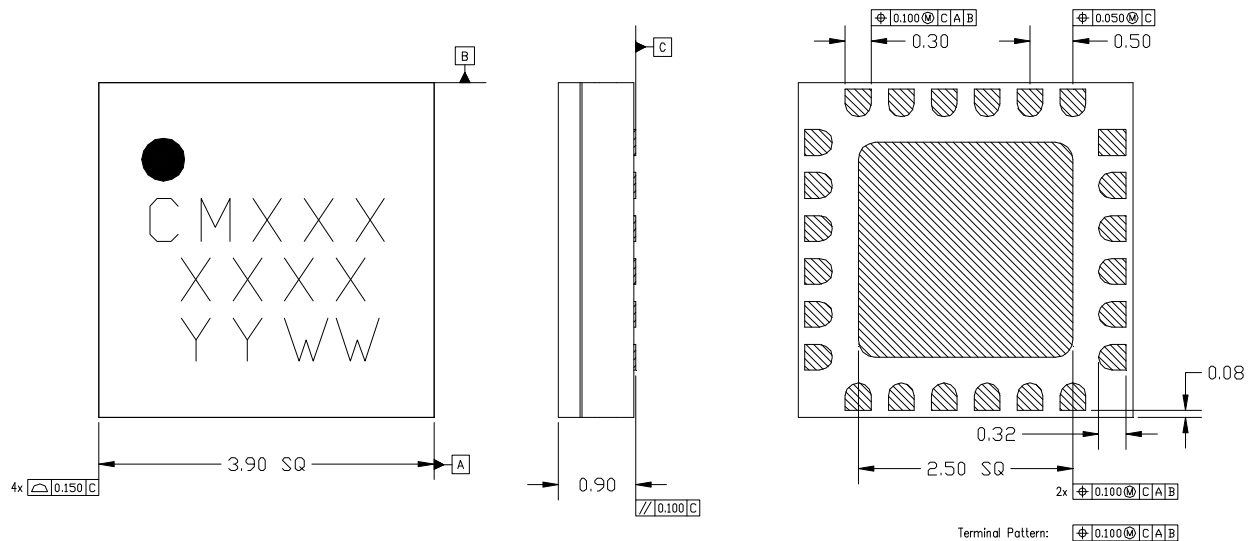
Output IP3,  $V_{dd} = 3.0\text{ V}$ ,  $V_{gg} = 1.5\text{ V}$ ,  $I_{dd} = 28\text{ mA}$ ,  $T_A = 25\text{ }^\circ\text{C}$



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### Mechanical Information

#### Package Information and Dimensions



- NOTES:
1. ALL DIMENSIONS SHOWN IN mm.
  2. MATERIAL: BLACK ALUMINA
  3. LEAD FINISH:
    - 3.1. Ni: 8.89 $\mu$ m MAX, 1.27 $\mu$ m MIN
    - 3.2. Pd: 0.17 $\mu$ m MAX, 0.07 $\mu$ m MIN
    - 3.3. Au: 0.254 $\mu$ m MAX, 0.03 $\mu$ m MIN
  4. MARKING
    - 4.1. LINE 1: PART NUMBER
      - 4.1.1. EXAMPLE: CMD191C4 SHALL BE MARKED AS CM191
    - 4.2. LINE 2: LOT NUMBER
    - 4.3. LINE 3: DATE CODE - LAST 2 DIGITS OF THE YEAR OF MANUFACTURE FOLLOWED BY A 2 DIGIT WEEK CODE
  5. ALTERNATE PIN #1 IDENTIFIER IS A SINGLE SQUARE PAD
  6. ALTERNATE DIE PADDLE MAY HAVE CHAMFERED CORNERS

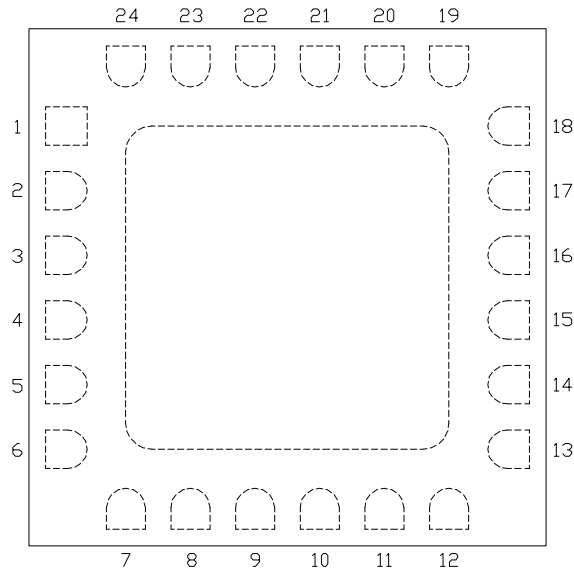
#### Recommended PCB Land Pattern

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.



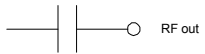
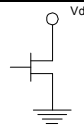
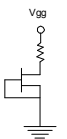
#### Recommended Solder Reflow Profile

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

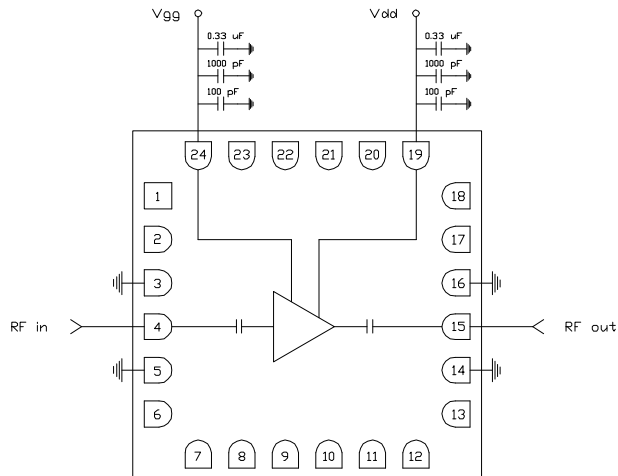


### Functional Description

Pin	Function	Description	Schematic
1, 2, 6-13, 17, 18, 20-23	N/C	No connection required. These pins may be connected to RF/DC ground	
3, 5, 14, 16 and die paddle	Ground	Connect to RF/DC ground	
4	RF in	DC blocked and 50 ohm matched	
15	RF out	DC blocked and 50 ohm matched	
19	Vdd	Power supply voltage Decoupling and bypass caps required	
24	Vgg	Power supply voltage Decoupling and bypass caps required	

### Applications Information

#### Application Circuit



#### Biasing and Operation

The CMD160C4 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 +2.0 V and a maximum of +4.0 V. The recommended gate voltage is +1.5 V.

Turn ON procedure:

1. Apply drain voltage  $V_{dd}$  and set to +3 V
2. Apply gate voltage  $V_{gg}$  and set to +1.5 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 CMD160C4 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.

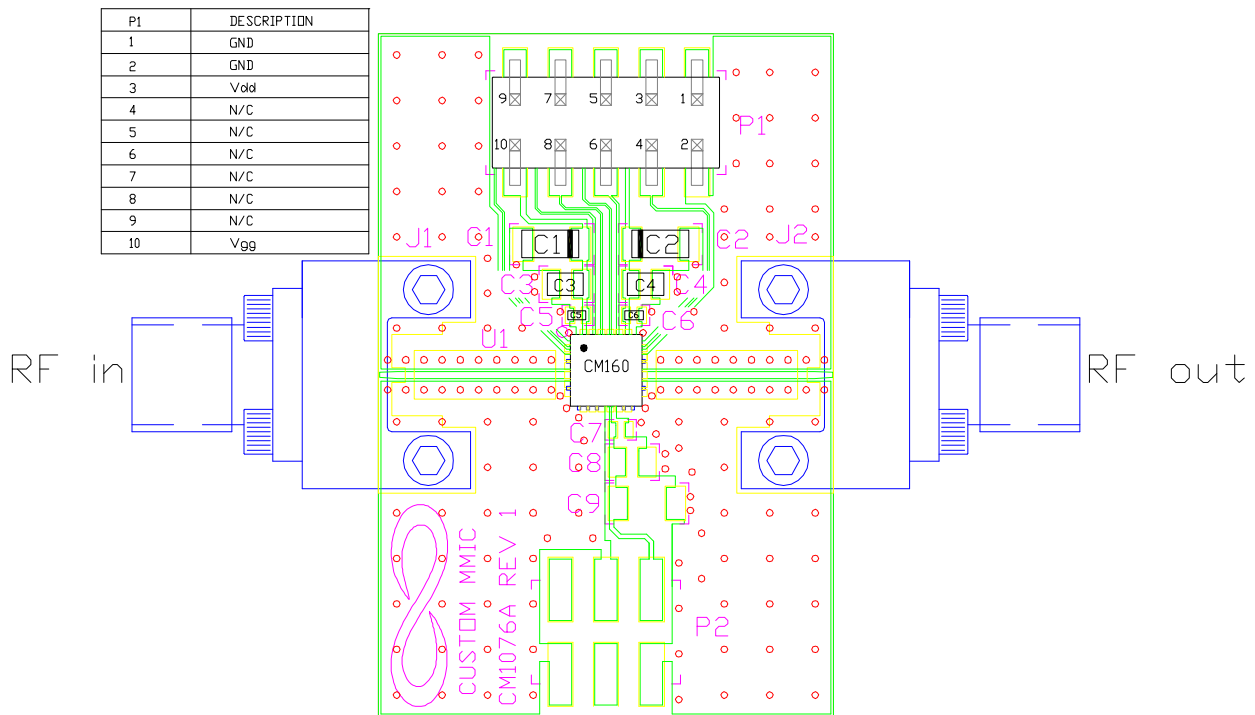
**GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.**



### Applications Information

#### Evaluation Board

The circuit board shown has been developed for optimized assembly at Custom MMIC. 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.



Designator	Value	Description
J1, J2		SMA End Launch Connector
P1		10 Pin Header
C1, C2	0.33 $\mu$ F	Capacitor, Tantalum
C3, C4	1000 pF	Capacitor, 0603
C5, C6	100 pF	Capacitor, 0402
U1		CMD160C4 Low Noise Amplifier
PCB		CM1076A Evaluation PCB

Please note, all information contained in this data sheet is subject to change without notice.

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