

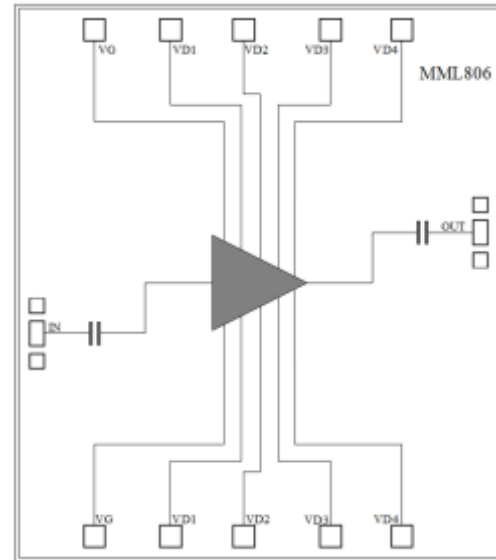
### Features

- Frequency : 0-10GHz
- Small Signal Gain : 15dB Typical
- Gain Flatness :  $\pm 2.5$ dB Typical
- Noise Figure : 4.5dB Typical
- P1dB : 12dBm Typical
- Power Supply :  $V_D = +4V @ 119mA$ ,  $V_G = -0.4V$
- Input/Output : 50 $\Omega$
- Chip Size : 1.766 x 2.0 x 0.05mm

### Typical Applications

- Test Instrumentation
- Microwave Radio & VSAT
- Military & Space
- Telecom Infrastructure
- Fiber Optics

### Functional Block Diagram

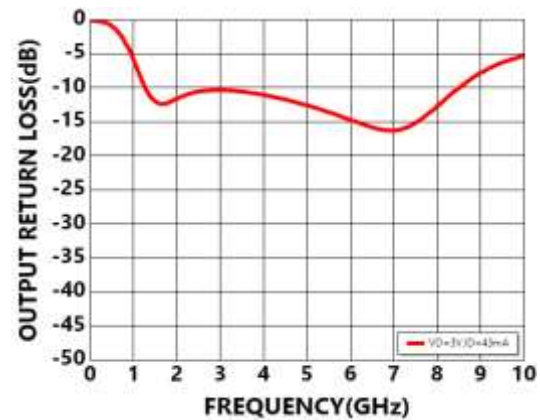
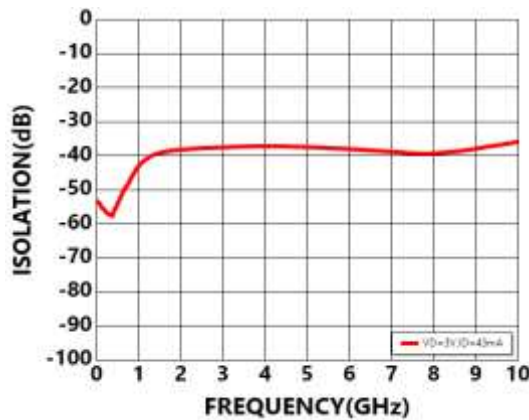
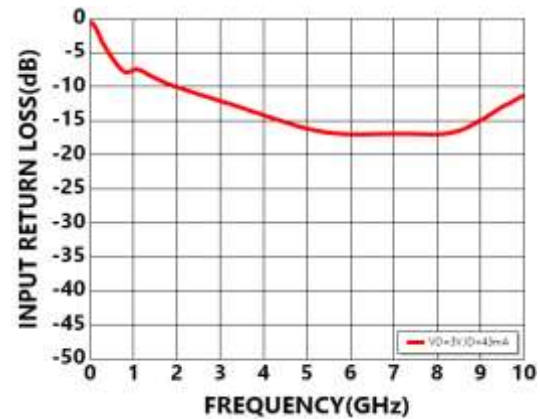
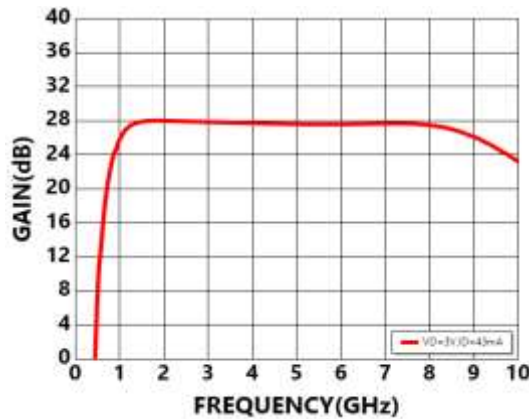


### Electrical Specifications

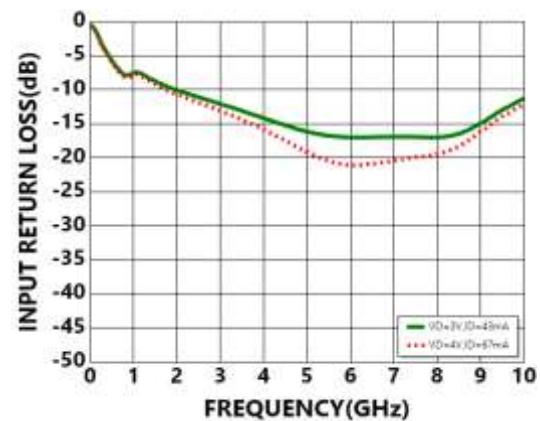
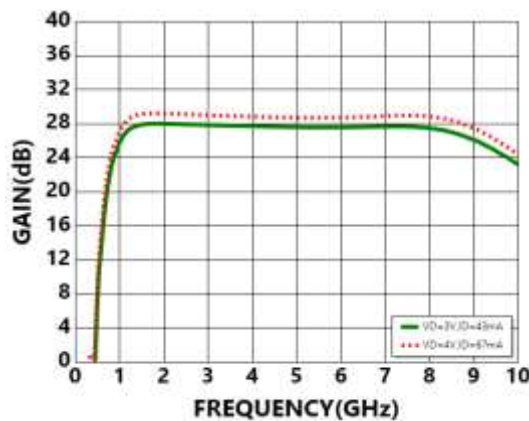
**TA = +25°C, VD=3V, ID=43mA Typical**

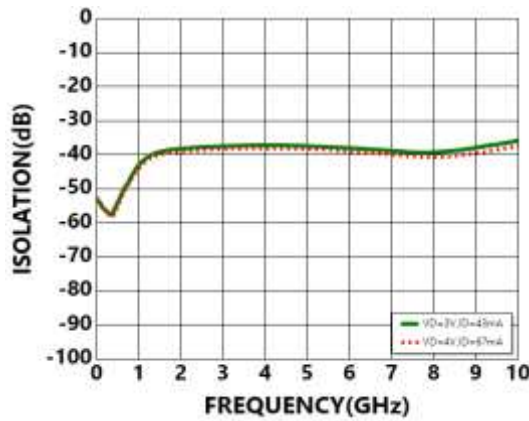
| Parameter                           | Min.  | Type.      | Max. | Min.  | Type.     | Max.  | Unit |
|-------------------------------------|-------|------------|------|-------|-----------|-------|------|
| Frequency                           |       | 0 - 5      |      |       | 5 - 10    |       | GHz  |
| Small Signal Gain                   | -47.6 | -9.8       | 28.0 | 23.3  | 25.5      | 27.7  | dB   |
| Gain Flatness                       |       | $\pm 40.1$ |      |       | $\pm 1.6$ |       | dB   |
| Noise Figure                        | 0.3   | 0.5        | 0.7  | 0.3   | 0.7       | 1.0   | dB   |
| P1dB - Output 1dB Compression       | 6.3   | 10.7       | 15.2 | 13.6  | 14.2      | 14.8  | dBm  |
| Psat - Saturated Output Power       | 14.3  | 15.0       | 15.7 | 15.6  | 16.2      | 16.7  | dBm  |
| OIP3 - Output Third Order Intercept | 18.2  | 23.2       | 28.1 | 27.4  | 28.8      | 30.3  | dBm  |
| Input Return Loss                   | -16.1 | -8.3       | -0.5 | -17.0 | -14.2     | -11.3 | dB   |
| Output Return Loss                  | -12.6 | -6.3       | -0.1 | -16.3 | -10.8     | -5.4  | dB   |

**Measurement Plots: S-parameters**  
**VD=3V, ID=43mA**

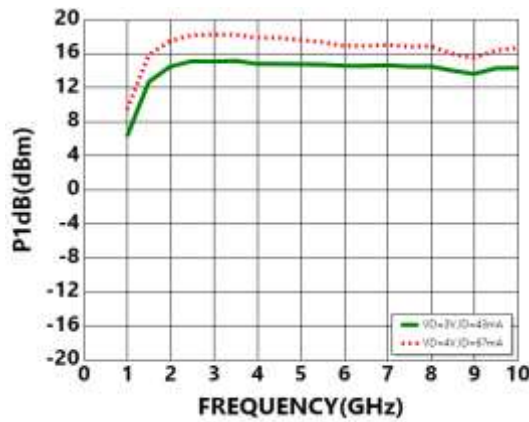


**Measurement Plots: S-parameters**  
**TA = +25°C**

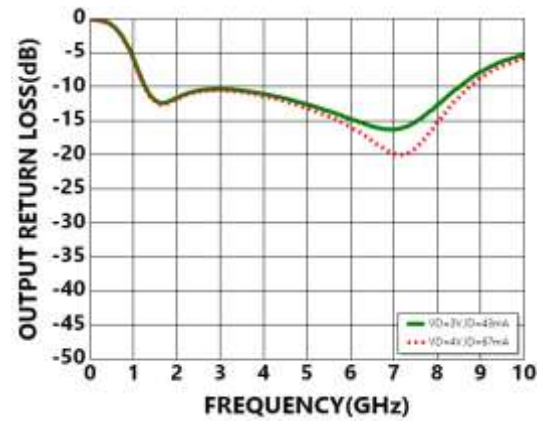
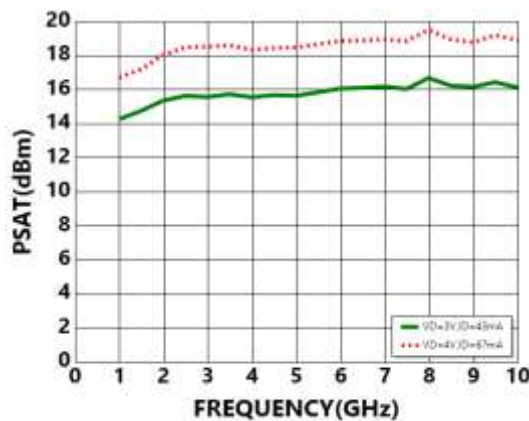




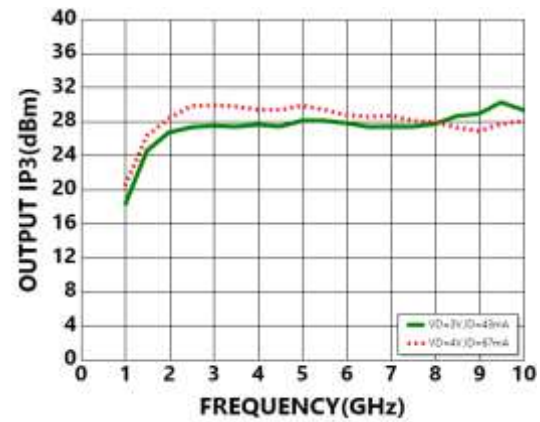
Measurement Plots: P1dB  
TA = +25°C



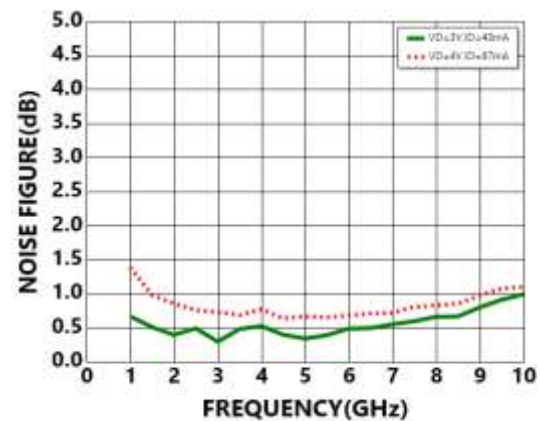
Measurement Plots: Psat  
TA = +25°C



Measurement Plots: OIP3  
TA = +25°C

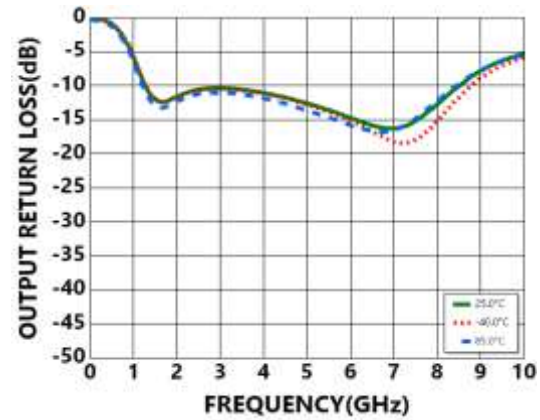
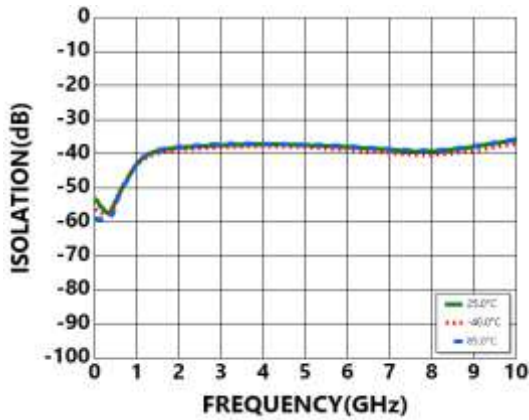
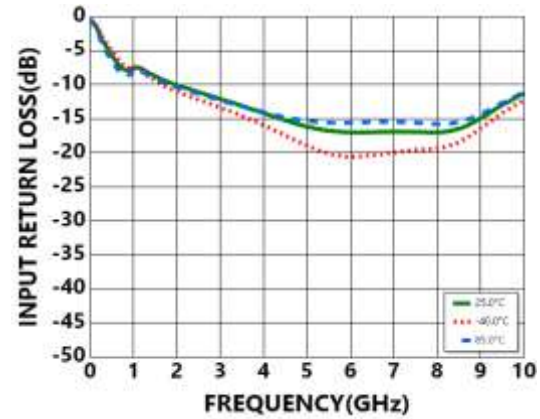
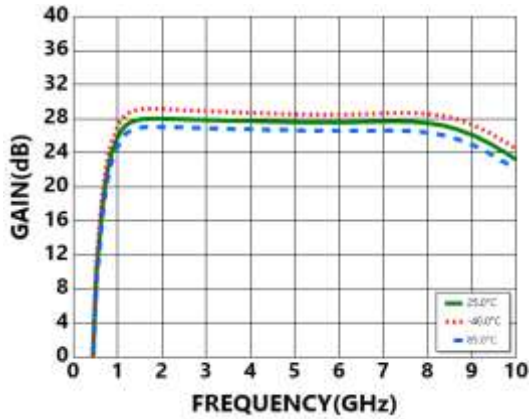


Measurement Plots: Noise Figure  
TA = +25°C

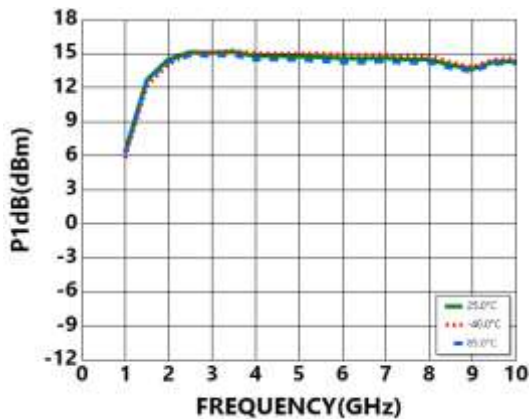




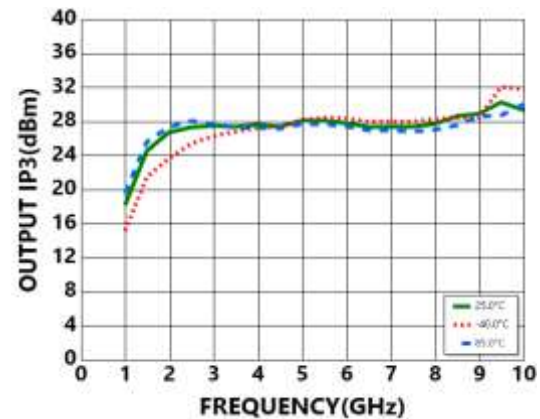
**Measurement Plots: S-parameters**  
**VD=3V, ID=43mA**



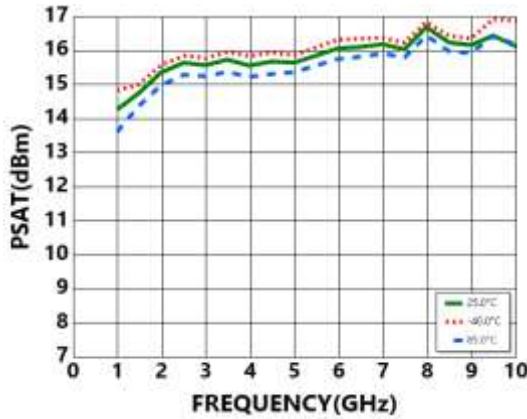
**Measurement Plots: P1dB**  
**VD=3V, ID=43mA**



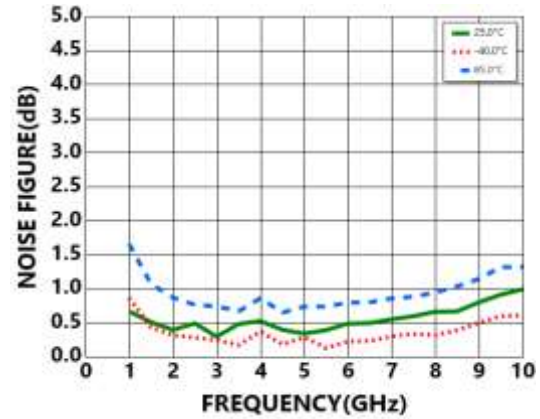
**Measurement Plots: OIP3**  
**VD=3V, ID=43mA**



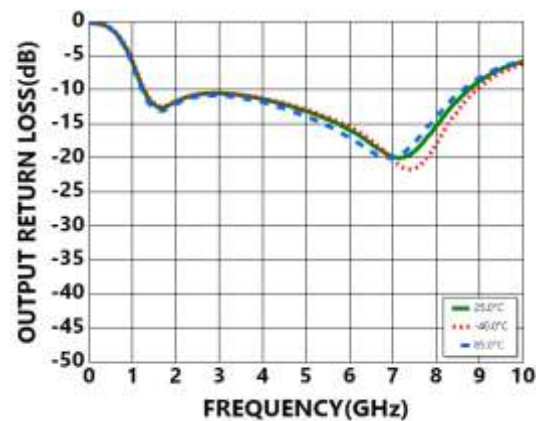
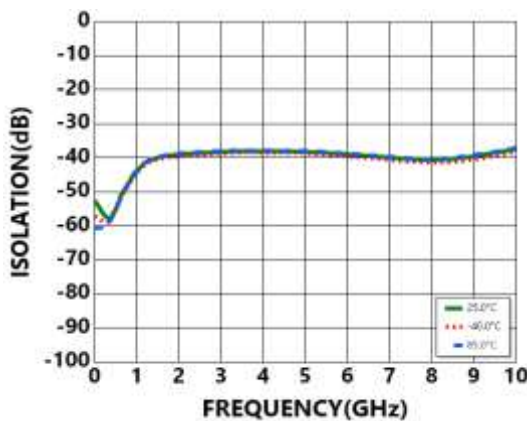
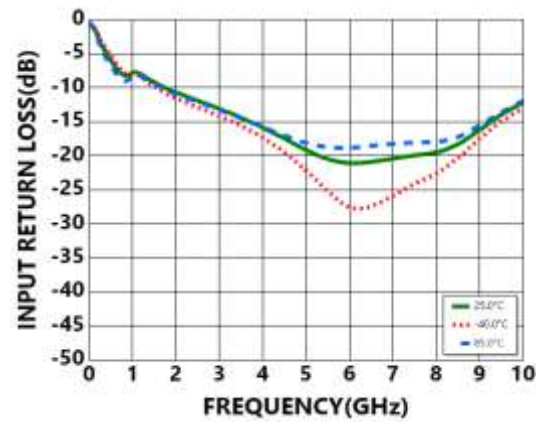
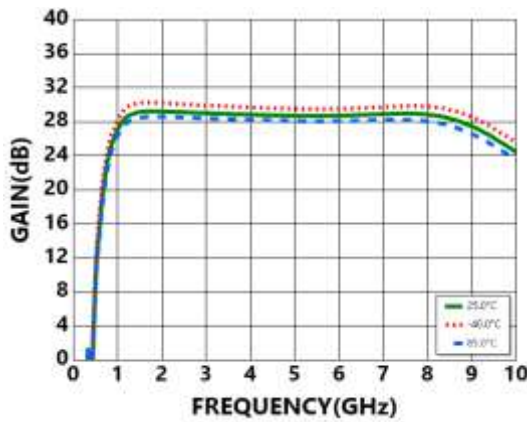
**Measurement Plots: Psat**  
**VD=3V,ID=43mA**



**Measurement Plots: Noise Figure**  
**VD=3V,ID=43mA**

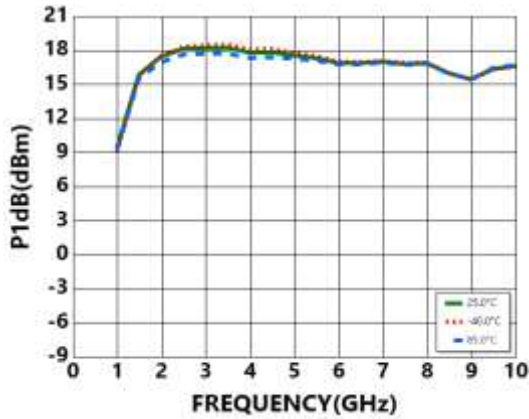


**Measurement Plots: S-parameters**  
**VD=4V,ID=67mA**

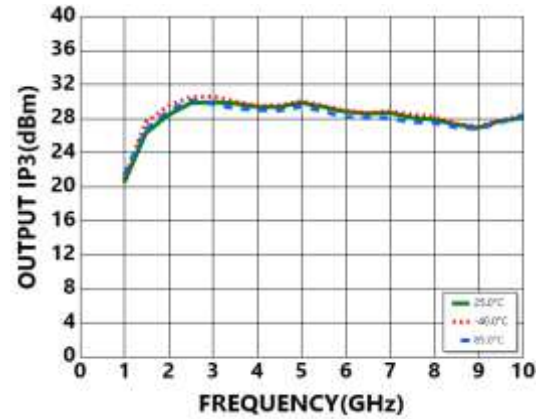




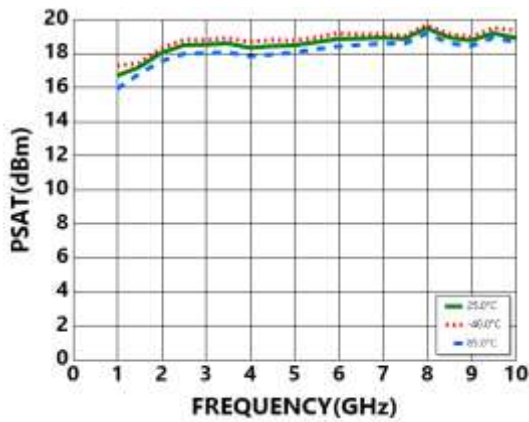
**Measurement Plots: P1dB**  
**VD=4V, ID=67mA**



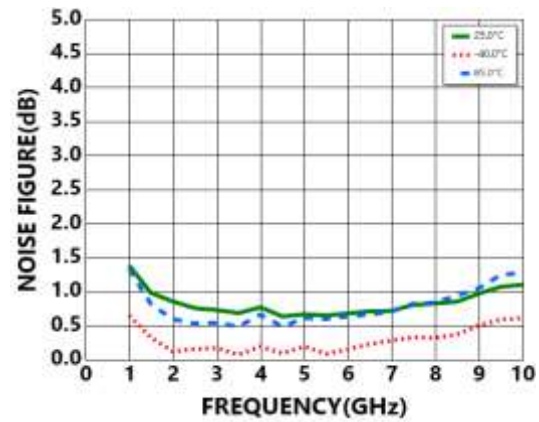
**Measurement Plots: OIP3**  
**VD=4V, ID=67mA**



**Measurement Plots: Psat**  
**VD=4V, ID=67mA**



**Measurement Plots: Noise Figure**  
**VD=4V, ID=67mA**



### Absolute Maximum Ratings

|   |                  |
|---|------------------|
| Drain Bias Voltage (VD)   | +4.5V            |
| Gate Bias Voltage (VG)  | -2V to 0V        |
| RF Input Power (RFIN)   | +15dBm           |
| Continuous P <sub>diss</sub> (T = 85 °C)<br>(derate 6.1mW/°C above 85 °C) | 175°C            |
| Thermal Resistance<br>(channel to die bottom)                             | 0.55W            |
| Operating Temperature   | -55°C to +85 °C  |
| Storage Temperature   | -65°C to +150 °C |

### Typical Supply Current

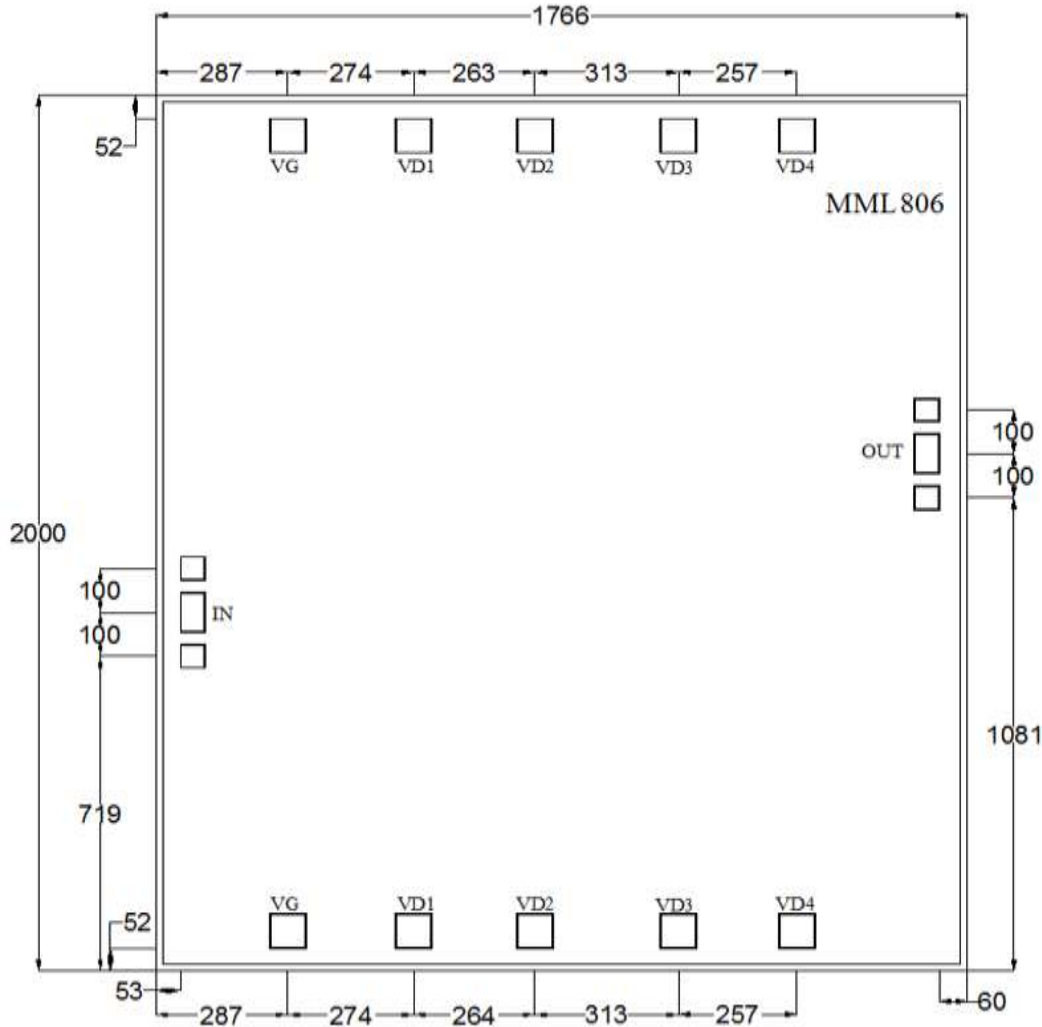
| VD(V) | VG(V) | IDQ(mA) |
|-------|-------|---------|
| +3.5  | -0.38 | 118     |
| 4.0   | -0.40 | 119     |
| 4.0   | -0.50 | 71      |



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**



**Outline Drawing:**  
All Dimensions in  $\mu\text{m}$



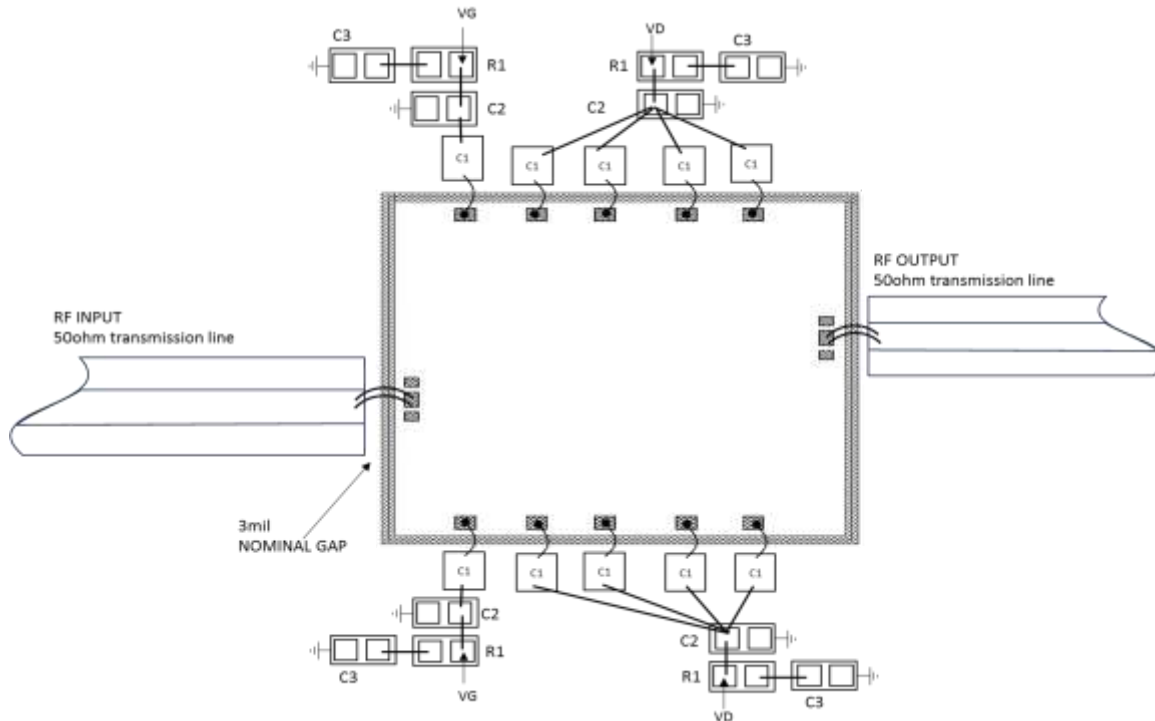
**Notes:**

1. Die thickness:  $50\mu\text{m}$
2. VD bond pad is  $75*75\mu\text{m}^2$
3. VG bond pad is  $75*75\mu\text{m}^2$
4. RF IN/OUT bond pad is  $50*86\mu\text{m}^2$
5. Bond pad metalization: Gold
6. Backside metalization: Gold



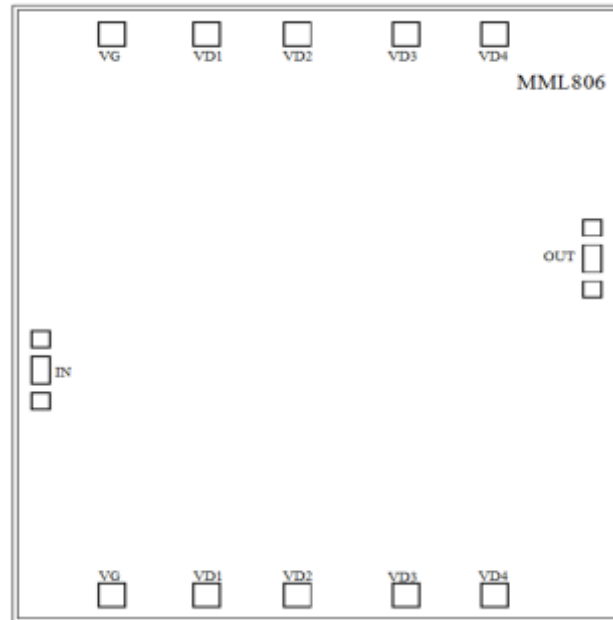


### Assembly Drawing



| Item | Description  |
|------|--|
| C1   | 100pF Example: Skyworks<br>Part: SC10002430            |
| C2   | 0.01μF Example: TDK<br>Part:C1005X7R1H103K050BB (0402) |
| C3   | 0.1μF Example: TDK<br>Part:C1005X7R1H104K050BB (0402)  |
| R1   | 100Ω Example: Yageo<br>Part:SR0402FR-7T10RL            |

| Item | Funciton   | Description   |
|------|------------|---|
| 1    | RF IN      | RF signal input terminal; no blocking capacitor required.                 |
| 2    | RF OUT     | RF signal output terminal; no blocking capacitor required.                |
| 3    | VD         | Drain Biases for the Amplifier ; An external biasing circuit is required. |
| 4    | VG         | Gate Biases for the Amplifier ; An external biasing circuit is required.  |
| 5    | Die Bottom | Die bottom must be connected to RF and dc ground.                         |



### Biasing and Operation

Turn ON procedure:

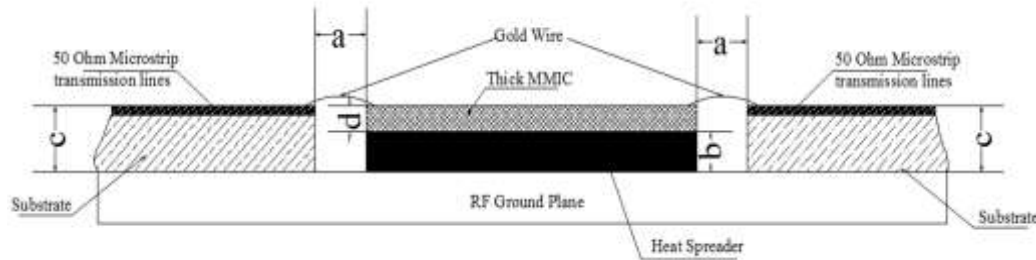
1. Connect GND to RF and dc ground.
2. Set the gate bias voltages VG to -2V.
3. Set the drain bias voltages VD to +4V.
4. Increase the gate bias voltages to achieve a quiescent supply current of 82 mA.
5. Apply RF signal.

Turn OFF procedure:

1. Turn off the RF signal.
2. Decrease the gate bias voltages, VG to -2V to achieve a IDQ = 0 mA (approximately).
3. Decrease the drain bias voltages to 0 V.
4. Increase the all gate bias voltages to 0 V.



### Mounting & Bonding Techniques for MMICs



#### Direct Mounting

1. Typically, the die is mounted directly on the ground plane.
2. If the thickness difference between the substrate (thickness  $c$ ) and the die (thickness  $d$ ) exceeds 0.05 mm (i.e.,  $c - d > 0.05$  mm), it is recommended to first mount the die on a heat spreader, then attach the heat spreader to the ground plane.
3. Heat Spreader Material: Molybdenum-copper (MoCu) alloy is commonly used.
4. Heat Sink Thickness ( $b$ ): Should be within the range of  $(c - d - 0.05$  mm) to  $(c - d + 0.05$  mm).
5. Spacing ( $a$ ): The gap between the bare die and the 50 $\Omega$  transmission line should typically be 0.05 mm to 0.1 mm. If the application frequency is higher than 40GHz, then this gap is recommended to be 0.05mm

#### Wire Bonding Interconnection

The connection between the die and the 50 $\Omega$  transmission line is usually made using 25  $\mu$ m diameter gold (Au) wires, bonded via wedge bonding or ball bonding processes.

#### Die Attachment Methods

##### 1. Conductive Epoxy:

After adhesive application, cure according to the manufacturer's recommended temperature profile.

##### 2. Au-Sn80/20 Eutectic Bonding:

Use preformed Au-Sn80/20 solder preforms.

Perform bonding in an inert atmosphere ( $N_2$  or forming gas: 90%  $N_2$  + 10%  $H_2$ ).

Keep the time above 320°C to less than 20 seconds to prevent excessive intermetallic formation.

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