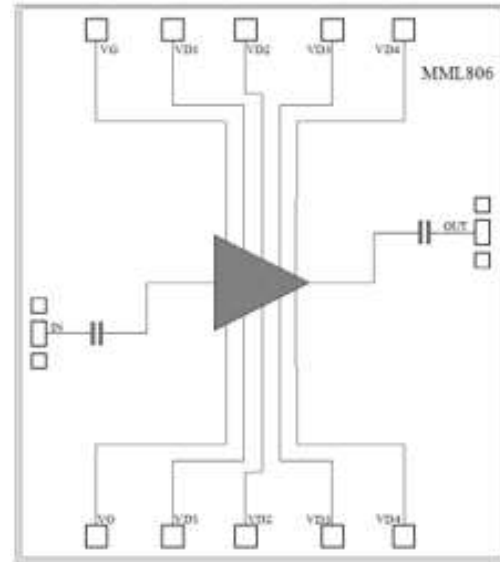


**Featrues**

- Frequency : 45-90GHz
- Small Signal Gain : 15dB Typical
- Gain Flatness :  $\pm 2.5$ dB Typical
- Noise Figure : 4.5dB Typical
- P1dB : 12dBm Typical
- Power Supply : VD=+4V@119mA ,VG=-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**

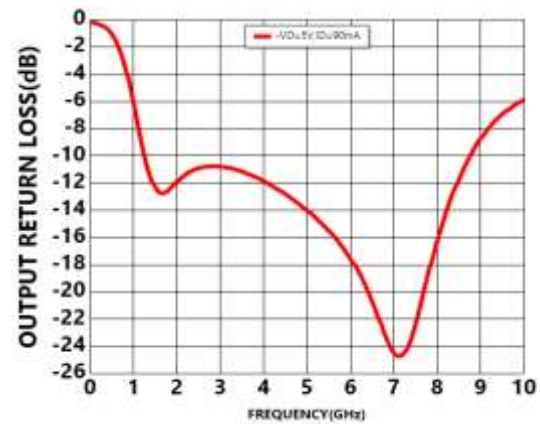
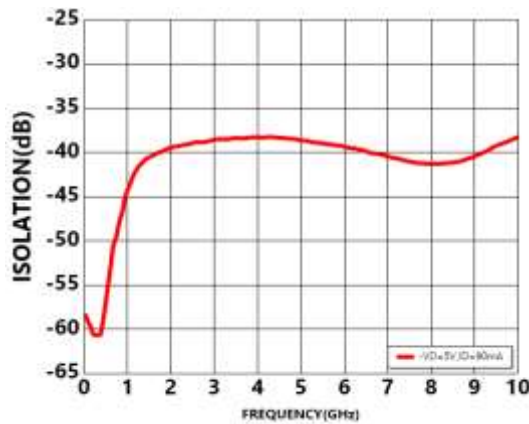
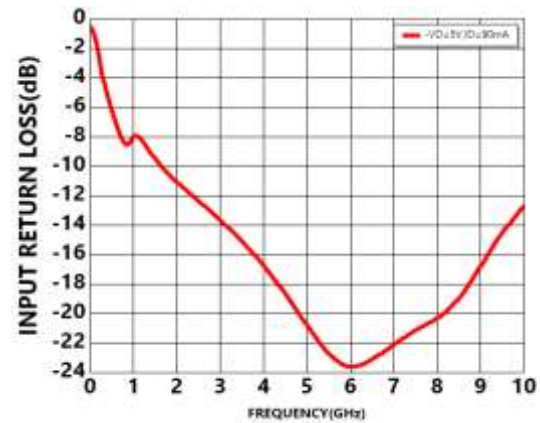
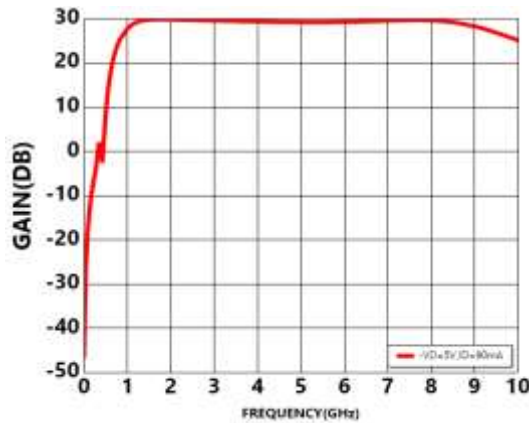
**TA = +25°C, -VD=5V,ID=90mA**

Parameter	Min	Type	Max	Min	Type	Max	Unit
Frequency		0 - 5			5 - 10		GHz
Small Signal Gain	-46.7	-8.4	29.8	25.2	27.4	29.7	dB
Gain Flatness		$\pm 42.5$			$\pm 1.9$		dB
Noise Figure	0.6	0.9	1.2	0.6	0.9	1.2	dB
P1dB - Output 1dB Compression	12.0	16.2	20.3	16.1	17.9	19.6	dBm
Psat - Saturated Output Power	18.3	19.4	20.5	20.4	21.0	21.5	dBm
OIP3 - Output Third Order Intercept	26.8	29.8	32.7	27.8	29.1	30.5	dBm
Input Return Loss	-20.7	-10.6	-0.5	-23.6	-18.2	-12.7	dB
Output Return Loss	-14.0	-7.1	-0.2	-24.7	-15.3	-5.9	dB



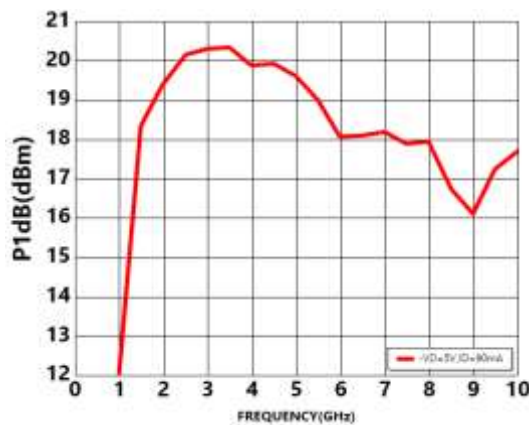
### Measurement Plots: S-parameters

$T_A = +25^{\circ}\text{C}$



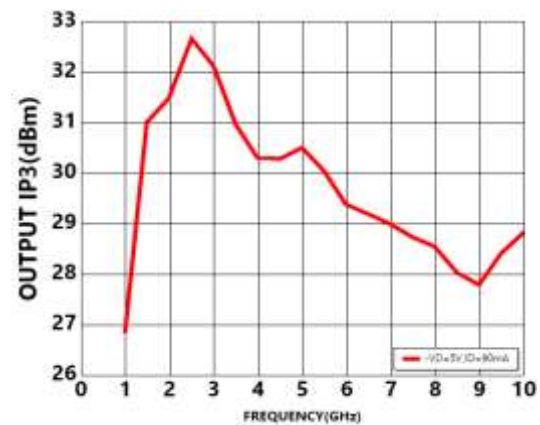
### Measurement Plots: P1dB

$T_A = +25^{\circ}\text{C}$



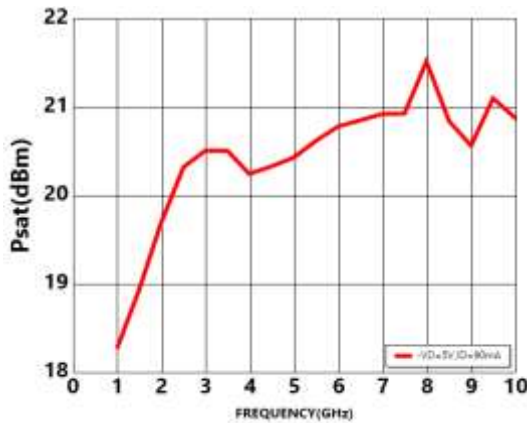
### Measurement Plots: OIP3

$T_A = +25^{\circ}\text{C}$

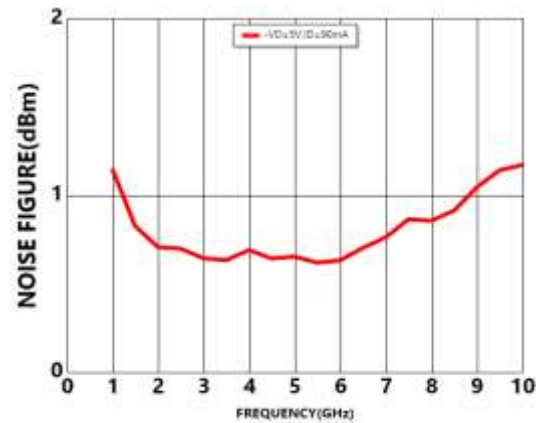




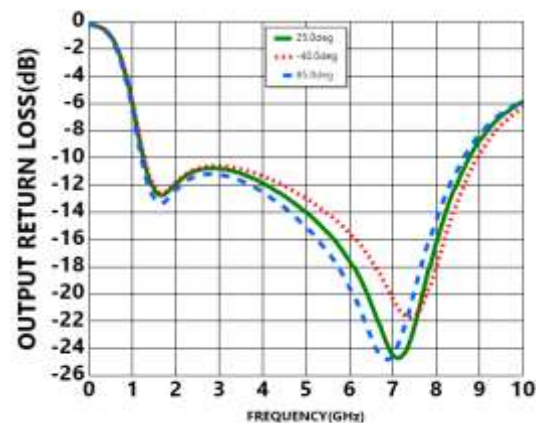
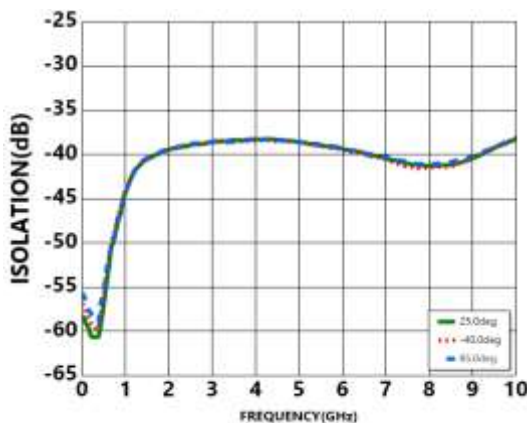
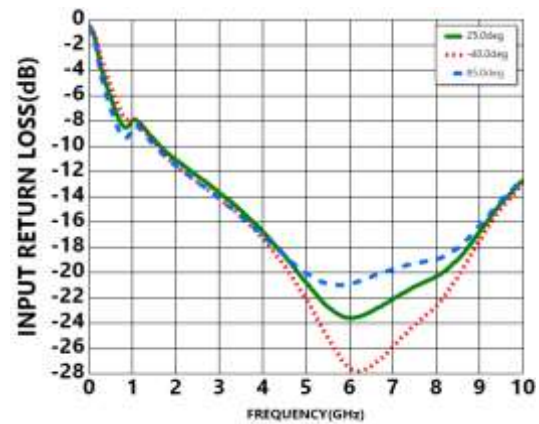
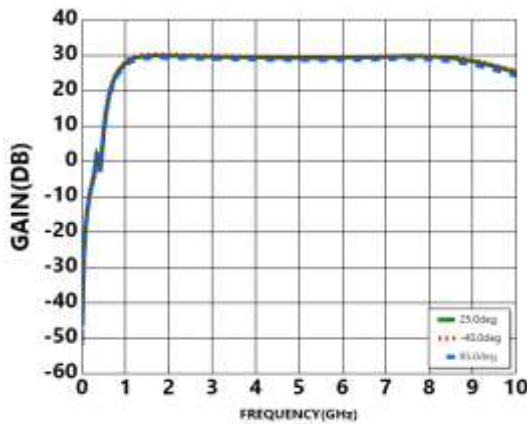
Measurement Plots: Psat  
TA = +25°C



Measurement Plots: Noise Figure  
TA = +25°C



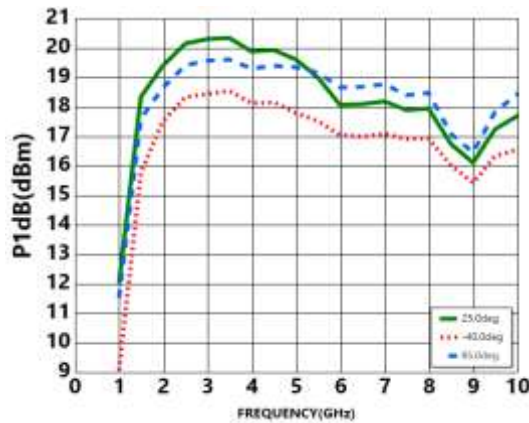
Measurement Plots: S-parameters  
-VD=5V, ID=90mA





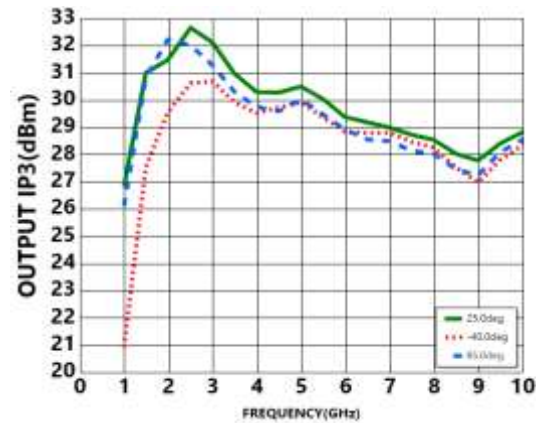
**Measurement Plots: P1dB**

**-VD=5V, ID=90mA**



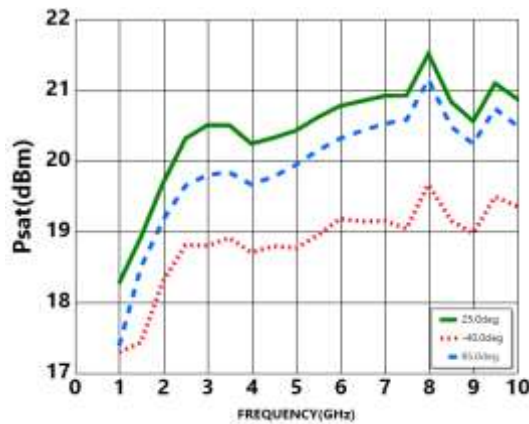
**Measurement Plots: OIP3**

**-VD=5V, ID=90mA**



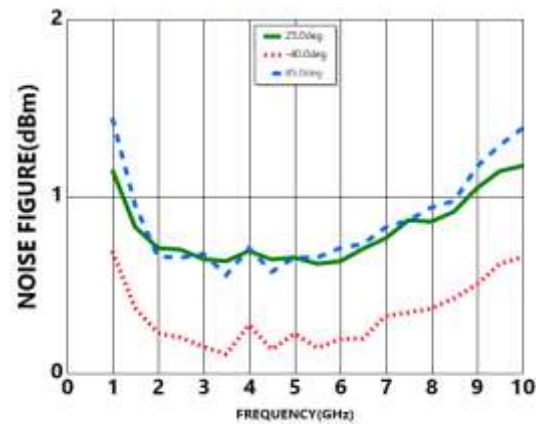
**Measurement Plots: Psat**

**-VD=5V, ID=90mA**



**Measurement Plots: Noise Figure**

**-VD=5V, ID=90mA**



### 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) (derate 6.1mW/°C above 85 °C)	175°C
Thermal Resistance (channel to die bottom)	0.55W
Operating Temperature	-55°C to +85 °C
Storage Temperature	-65°C to +150 °C

### Typical Supply Current

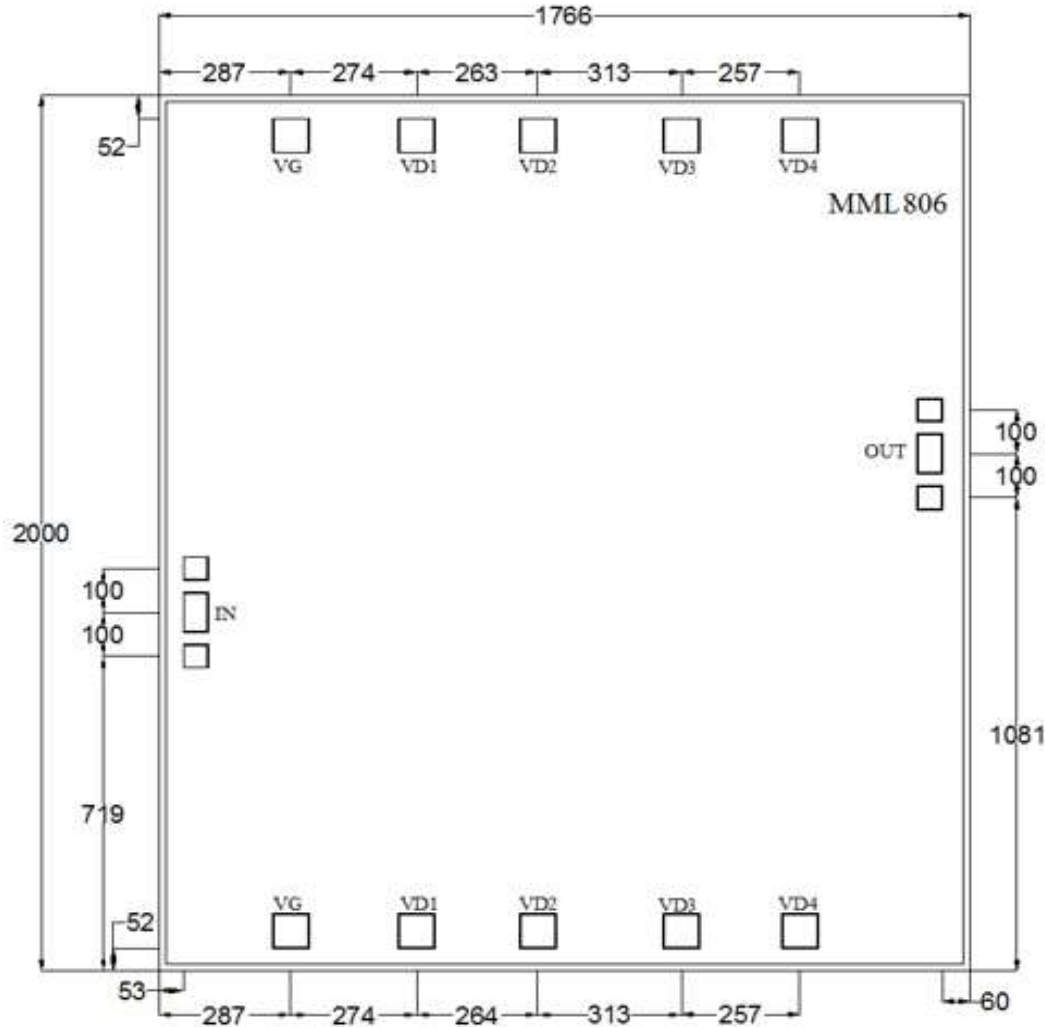
VD(V)	VG(V)	IDQ(mA)
+3.5	-0.38	118
4.0	-0.40	119
4.0	-0.50	71



**ELECTROSTATIC SENSITIVE DEVICE**  
**OBSERVE HANDLING PRECAUTIONS**



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

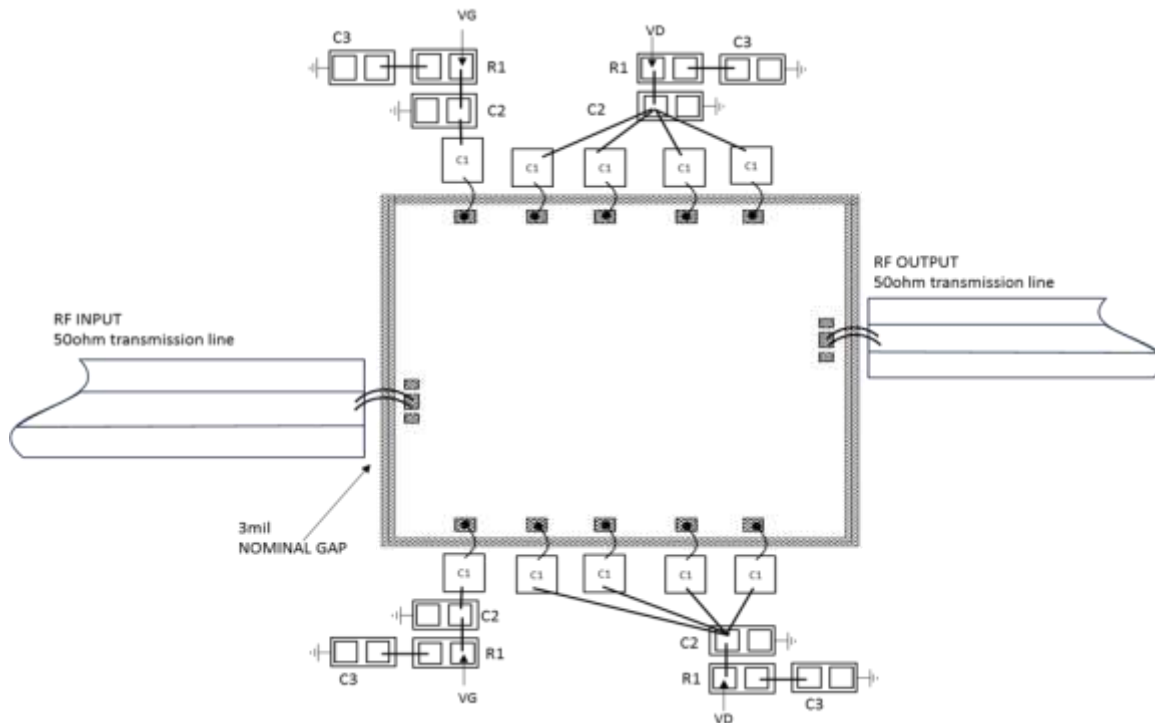


**Notes:**

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



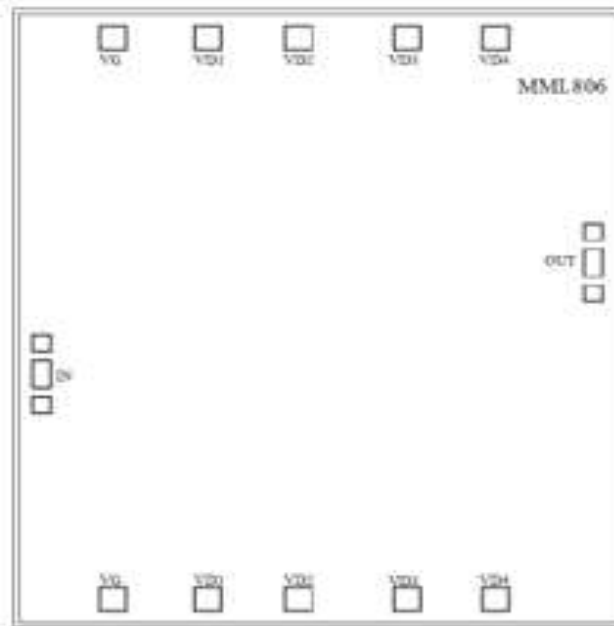
### Assembly Drawing



Item	Description
C1	100pF Example: Skyworks Part: SC10002430
C2	0.01μF Example: TDK Part:C1005X7R1H103K050BB (0402)
C3	0.1μF Example: TDK Part:C1005X7R1H104K050BB (0402)
R1	100Ω Example: Yageo 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,  $V_G$  to -2V.
3. Set the drain bias voltages  $V_D$  to +4V.
4. Increase the gate bias voltages to achieve a quiescent supply current of 82 mA.
5. Apply RF signal.

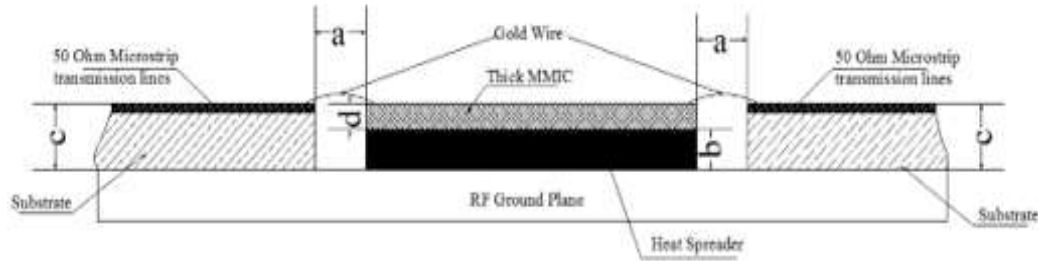
Turn OFF procedure:

1. Turn off the RF signal.
2. Decrease the gate bias voltages,  $V_G$  to -2V to achieve a  $IDQ = 0$  mA (approximately).
3. Decrease the drain bias voltages to 0 V.
4. Increase the gate bias voltages to achieve a quiescent supply current of 82 mA.
5. 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 50Ω 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 50Ω transmission line is usually made using 25 μm 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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