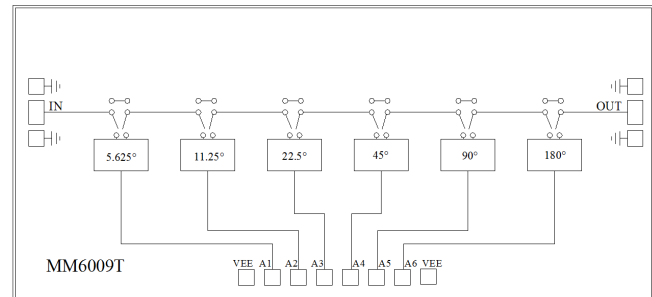


**Features**

- 6-Bit Digital Control Phase Shifter
- Phase Shift Range: 354°
- Phase Shift Accuracy RMS: 1.6°
- Insertion Loss: 5.0dB Typical
- Amplitude Variation: 0.7dB Typical
- TTL Control : Low(0 to 0.8V)  
High (2 to 5V )
- Power Supply: -5V
- Input/Output: 50Ω
- Chip Size: 3.7 x 1.7 x 0.1mm

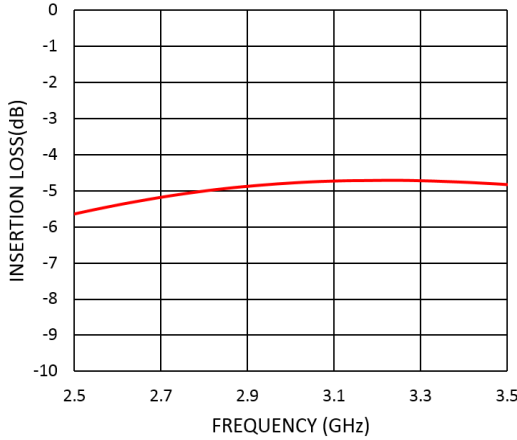
**Functional Block Diagram**

**Typical Applications**

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

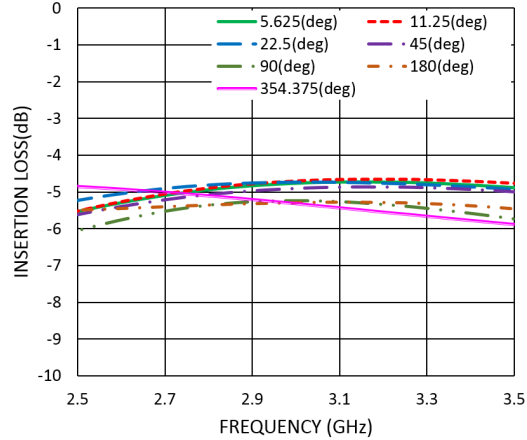
**Electrical Specifications**
**TA = +25°C, VEE = -5V, VCTL = 0/+3V~ +5V**

Parameters	Min.	Typ.	Max.	Units
Frequency	<b>2.7</b>		<b>3.5</b>	<b>GHz</b>
Insertion Loss		<b>5.0</b>	<b>6.0</b>	<b>dB</b>
Insertion Loss Variation		<b>1.0</b>		<b>dB</b>
Phase Range		<b>354</b>		<b>°</b>
Control Bits		<b>6</b>		<b>bit</b>
Control Step Size		<b>5.625</b>		<b>°</b>
Phase Shift Accuracy RMS		<b>1.6</b>		<b>°</b>
Phase-shifting Amplitude Modulation		<b>±0.5</b>		<b>dB</b>
Amplitude Variation		<b>0.7</b>		<b>dB</b>
Input Return Loss		<b>-15</b>		<b>dB</b>
Output Return Loss		<b>-14</b>		<b>dB</b>
P1dB - Input 1dB Compression		<b>25</b>		<b>dBm</b>
Switching Speed		<b>20</b>		<b>ns</b>

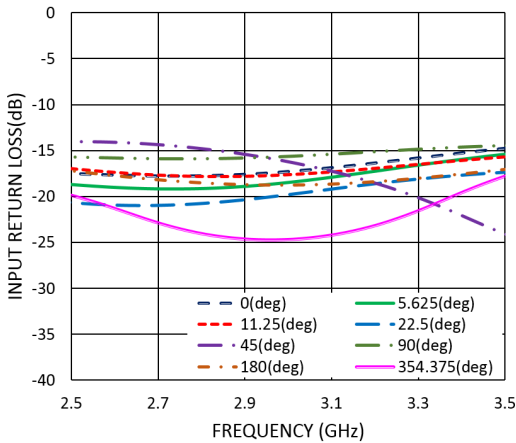
**Insertion Loss vs. Frequency**



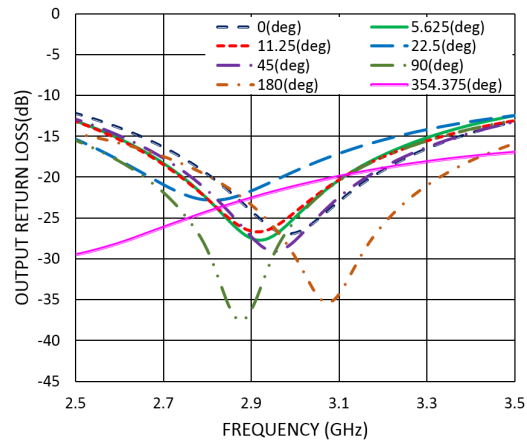
**Insertion Loss vs. Frequency**



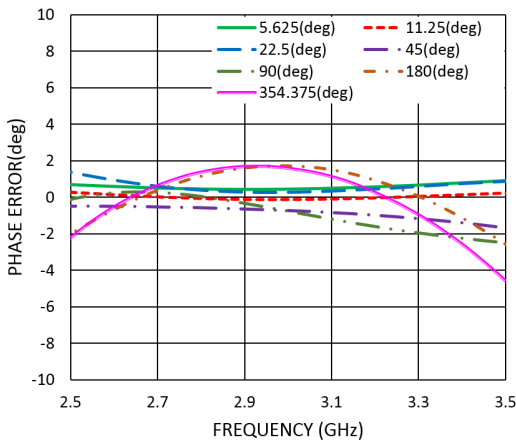
**Input Return Loss vs. Frequency**



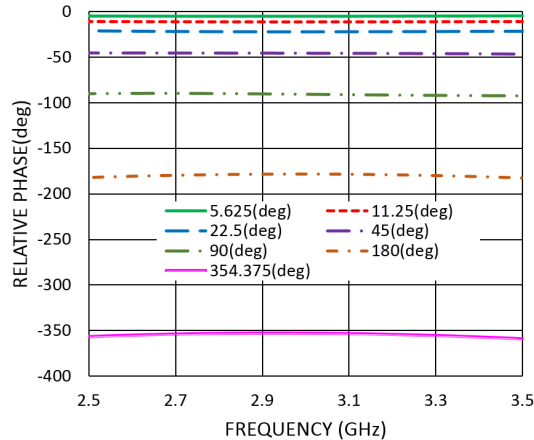
**Output Return Loss vs. Frequency**



**Phase Error vs. Frequency**

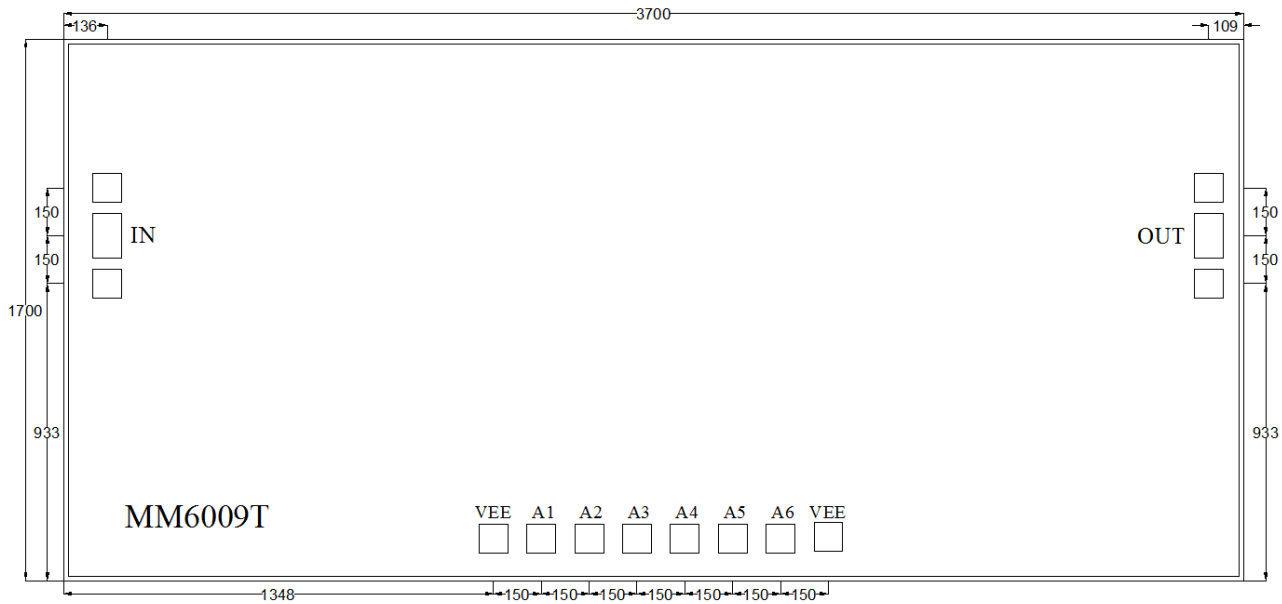


**Relative Phase Shift vs. Frequency**





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



**Truth Table**

Control Voltage Input						Phase Shift (Degrees)
A1	A2	A3	A4	A5	A6	
0	0	0	0	0	0	0(Reference)
1	0	0	0	0	0	5.625
0	1	0	0	0	0	11.25
0	0	1	0	0	0	22.5
0	0	0	1	0	0	45
0	0	0	0	1	0	90
0	0	0	0	0	1	180
1	1	1	1	1	1	354.375

**Notes:**

1. Die thickness: 100 $\mu\text{m}$
2. VEE/A1~A6 bond pad is 90\*90 $\mu\text{m}^2$
3. RF bond pad is 90\*140 $\mu\text{m}^2$
4. Bond pad metalization: Gold
5. Backside metalization: Gold

**Bias Voltages**

VEE	-6V
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**Control Voltage**

State	Bias Condition
Low(0)	0 to 0.8V
High(1)	2 to 5V

**Absolute Maximum Ratings**

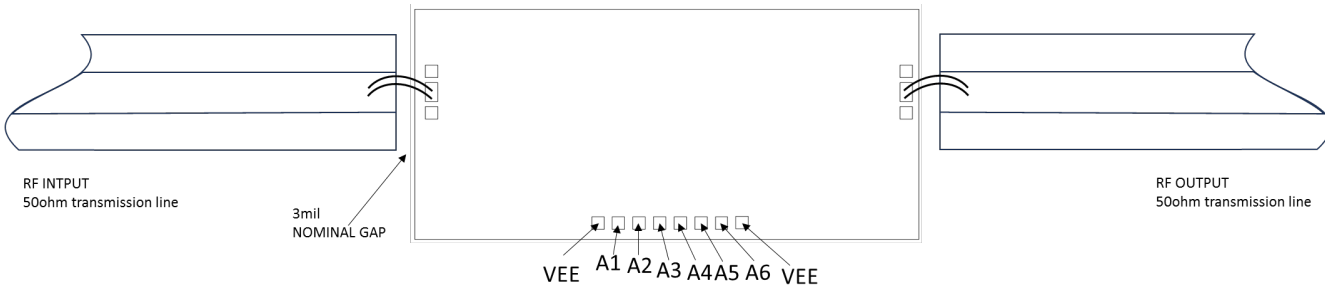
RF Input Power (RFIN)	+30dBm
Control Voltage	-0.5V to 8V
Channel Temperature	175°C
Operating Temperature	-55°C to +85 °C
Storage Temperature	-65°C to +175 °C
ESD Sensitivity (HBM)	Class 1A



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS



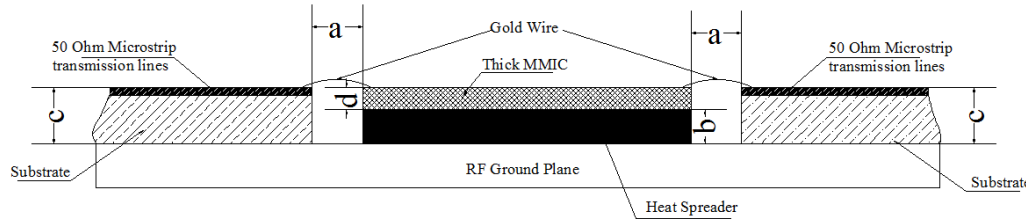
### Assembly Drawing



No	Function	Description
1	RF IN	RF signal input terminal
2	RF OUT	RF signal output terminal
3	VEE	Digital circuit power port, connect to -5V power supply voltage
4	A1,A2,A3,A4,A5,A6	Control pad, see truth table and control voltage table.
5	Die Bottom	Die bottom must be connected to RF and dc ground.



### 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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