

**MMS008AA Datasheet**

**DC–8 GHz GaAs MMIC SP4T Non-Reflective  
Switch**



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## **1 Revision History**

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The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

### **1.1 Revision 1.0**

Revision 1.0 was the first publication of this document.

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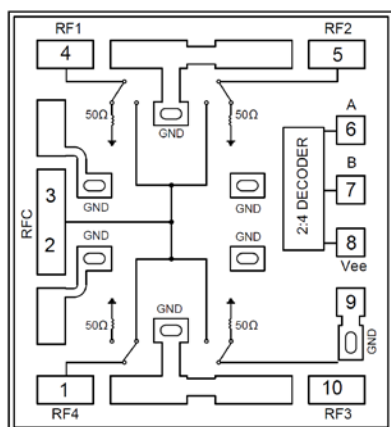
## 2 Product Overview

The MMS008AA is a DC-to-8 GHz, non-reflective gallium arsenide (GaAs) pseudomorphic high-electron mobility transistor (pHEMT) single pole 4 throw (SP4T) monolithic microwave integrated circuit (MMIC) switch chip. The switch delivers over 45 dB of isolation across the DC-to-8 GHz band while maintaining a low insertion loss of 1.6 dB. The RF ports are internally matched to 50  $\Omega$ , which allows for easy integration into multi-chip modules (MCMs).

### 2.1 Functional Block Diagram

The following illustration shows the primary functional blocks of the MMS008AA device.

**Figure 1 Functional Block Diagram**



### 2.2 Applications

The MMS008AA device is designed for the following applications:

- Test instrumentation
- Military radar, radio, EW and ECM applications
- General purpose microwave applications

### 2.3 Key Features

The following are key features of the MMS008AA device.

- Non-reflective topology
- Broadband performance: DC–8 GHz
- Fast switching: 10 ns
- Low insertion loss: <2 dB
- Excellent isolation: >45 dB
- Compact die size: 1.1 mm × 1.2 mm × 0.1 mm
- High Input P1dB: 28 dBm
- High Input IP3: 46 dBm

## 3 Electrical Specifications

### 3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MMS008AA device.

**Table 1 Absolute Maximum Ratings**

| Parameter                                | Rating           |
|------------------------------------------|------------------|
| Storage temperature                      | –65 °C to 150 °C |
| Operating temperature                    | –40 °C to 85 °C  |
| RF input power                           | 30 dBm           |
| Control voltage range (A/B)              | 0.5 V to –5 V    |
| Hot switching power                      | 27 dBm           |
| Channel temperature                      | 150 °C           |
| Thermal resistance (insertion loss path) | 130 °C/W         |
| Thermal resistance (terminated path)     | 845 °C/W         |
| ESD HBM                                  | Class 1A         |

### 3.2 Typical Electrical Performance

The following table shows the typical electrical performance of the MMS008AA device at 25 °C, where  $V_{\text{CONTROL}}$  is 0 V, –5 V, and  $V_{\text{EE}}$  is –5 V. The system is 50  $\Omega$ .

**Table 2 Typical Electrical Performance**

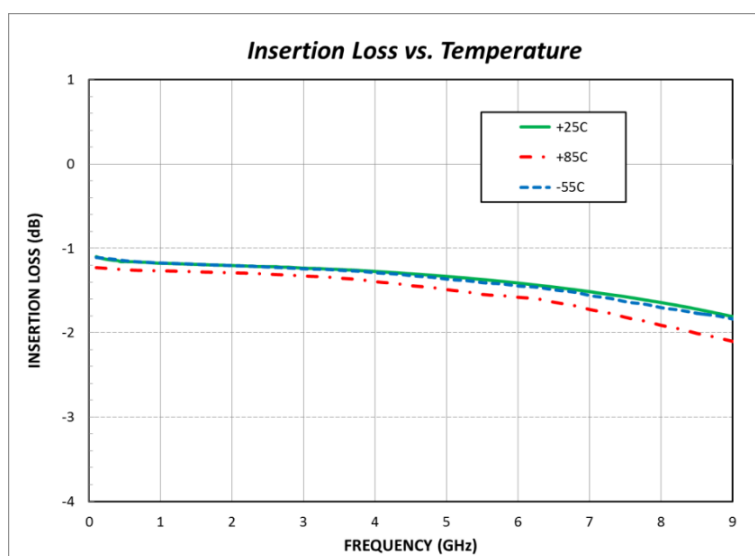
| Parameter                          | Test Conditions                                                  | Min  | Typ    | Max  | Units |
|------------------------------------|------------------------------------------------------------------|------|--------|------|-------|
| Operational frequency range        |                                                                  | DC   |        | 8.0  | GHz   |
| Control voltage                    | Low                                                              | –3.0 |        | 0    | V     |
|                                    | High                                                             | –5.0 |        | –4.2 | V     |
| Insertion loss                     | DC–6.0 GHz                                                       |      | 1.4    | 2.1  | dB    |
|                                    | DC–8.0 GHz                                                       |      | 1.6    | 2.2  | dB    |
| Isolation                          | DC–2.0 GHz                                                       | 44   | 61     |      | dB    |
|                                    | DC–4.0 GHz                                                       | 37   | 52     |      | dB    |
|                                    | DC–6.0 GHz                                                       | 34   | 47     |      | dB    |
|                                    | DC–8.0 GHz                                                       | 30   | 45     |      | dB    |
| $T_{\text{RISE}}, T_{\text{FALL}}$ | DC–8.0 GHz<br>(10% to 90% and 90% to 10% RF)                     |      | 10, 10 |      | ns    |
| $T_{\text{ON}}, T_{\text{OFF}}$    | DC–8.0 GHz<br>(50% control to 90% RF, and 50% control to 90% RF) |      | 85, 35 |      | ns    |
| Return loss (on state)             | DC–2.0 GHz                                                       | 10   | 20     |      | dB    |
|                                    | DC–8.0 GHz                                                       | 7    | 17     |      | dB    |
| Return loss (off state)            | DC–8.0 GHz                                                       | 7    | 27     |      | dB    |

| Parameter                          | Test Conditions                                       | Min | Typ | Max | Units |
|------------------------------------|-------------------------------------------------------|-----|-----|-----|-------|
| Input P1dB                         | 0.5 GHz–8.0 GHz                                       | 17  | 28  |     | dBm   |
| Input third order intercept (IIP3) | 0.5 GHz–8.0 GHz<br>(two-tone input power, 0 dBm/tone) | 43  | 46  |     | dBm   |

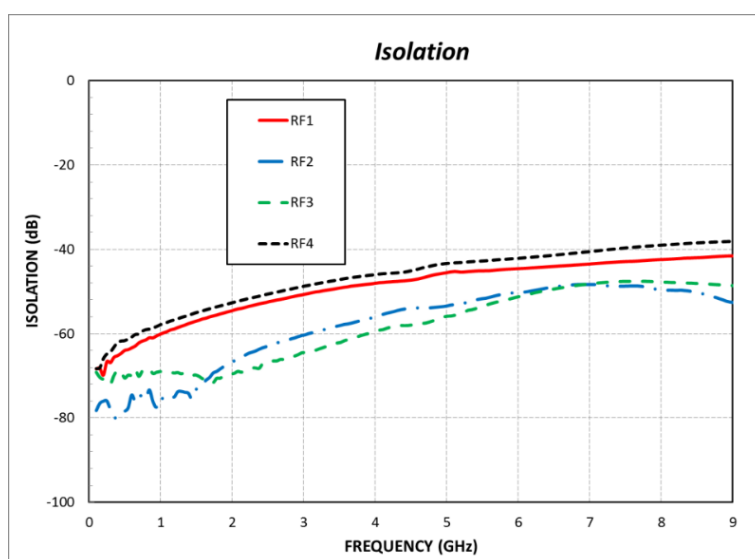
### 3.3 Typical Performance Curves

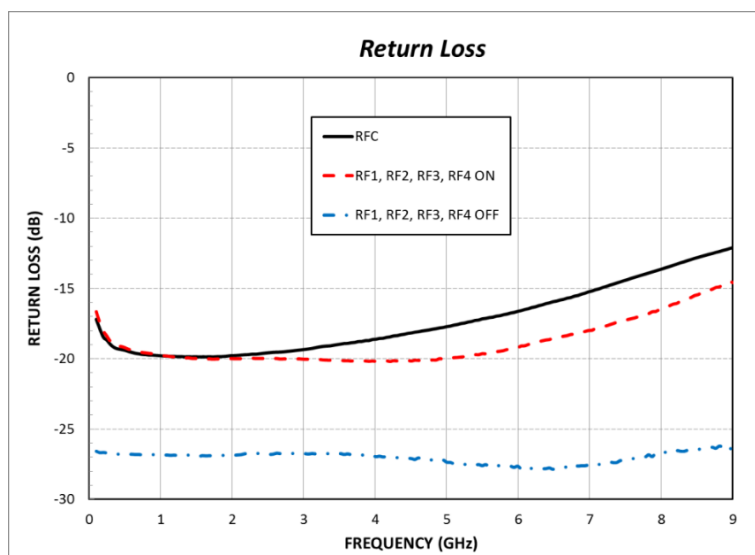
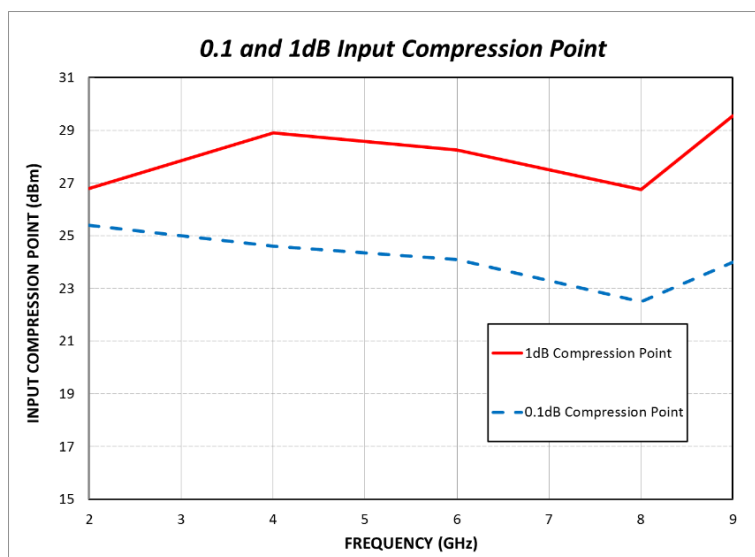
The following graphs show the typical performance curves of the MMS008AA device.

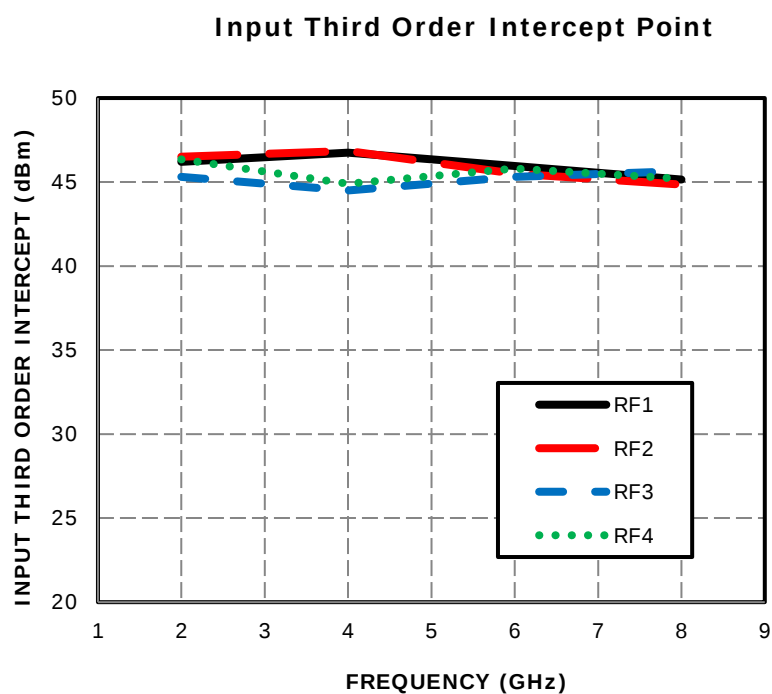
**Figure 2 Insertion Loss vs. Temperature**



**Figure 3 Isolation**



**Figure 4 Return Loss****Figure 5 0.1 dB and 1 dB Input Compression Point**

**Figure 6** Input Third Order Intercept Point

### 3.4 Control Voltages

The following tables show the control voltages of the MMS008AA device.

**Table 3** Switch Control Truth Table

| Control Input |      | Signal Path Condition |                  |                  |                  |
|---------------|------|-----------------------|------------------|------------------|------------------|
| A             | B    | RF Common to RF1      | RF Common to RF2 | RF Common to RF3 | RF Common to RF4 |
| High          | High | On                    | Off              | Off              | Off              |
| Low           | High | Off                   | On               | Off              | Off              |
| High          | Low  | Off                   | Off              | On               | Off              |
| Low           | Low  | Off                   | Off              | Off              | On               |

**Table 4** Digital Control Voltages

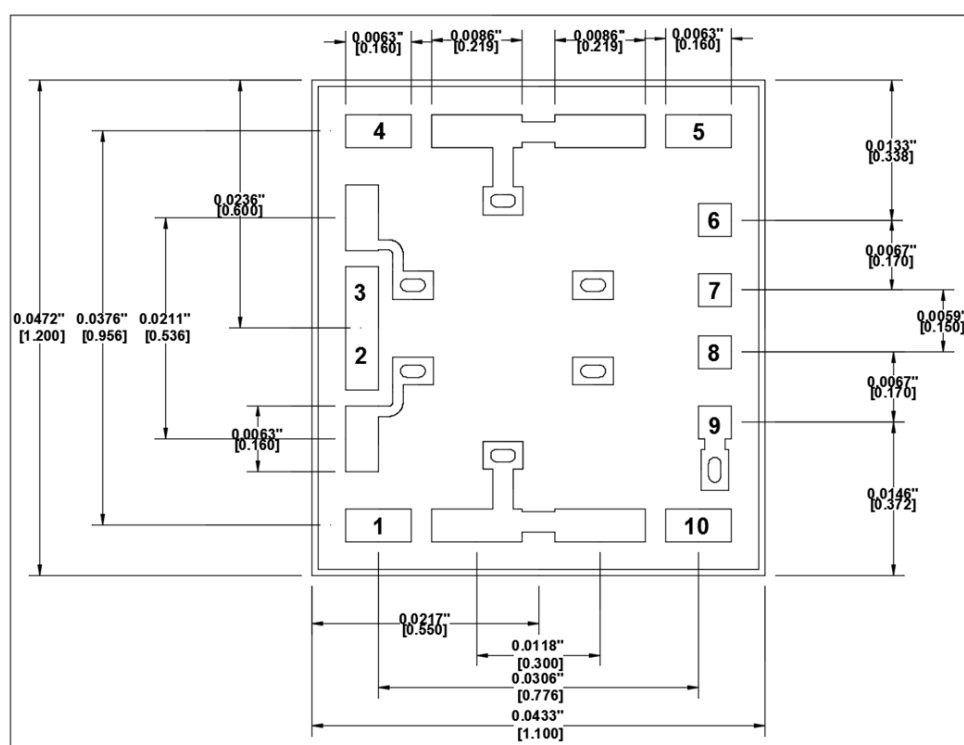
| State | Bias Condition   |
|-------|------------------|
| Low   | –3 V to 0 V      |
| High  | –5.0 V to –4.2 V |

## 4 Chip Outline Drawing, Die Packaging, Bond Pad, and Assembly Information

### 4.1 Chip Outline Drawing

The following illustration shows the chip outline of the MMS008AA device. Dimensions are shown in inches and millimeters. The minimum bond pad size is  $100\text{ }\mu\text{m} \times 100\text{ }\mu\text{m}$ . Both the bond pad surface and the backside metal are  $3\text{ }\mu\text{m}$  gold. The die thickness is  $100\text{ }\mu\text{m}$ . The backside is the DC/RF ground. The airbridge keepout region is in crosshatch, and the unlabeled pads should not be bonded.

**Figure 7 Chip Outline**



### 4.2 Die Packaging Information

The following table shows the chip outline of the MMS008AA device. For additional packaging information, contact your Microsemi sales representative.

**Table 5 Die Packaging Information**

| Standard Format        | Optional Format    |
|------------------------|--------------------|
| Waffle pack            | Gel pack           |
| 50–100 pieces per pack | 50 pieces per pack |

### 4.3 Bond Pad Information

The following table shows the bond pad information for the MMS008AA device.

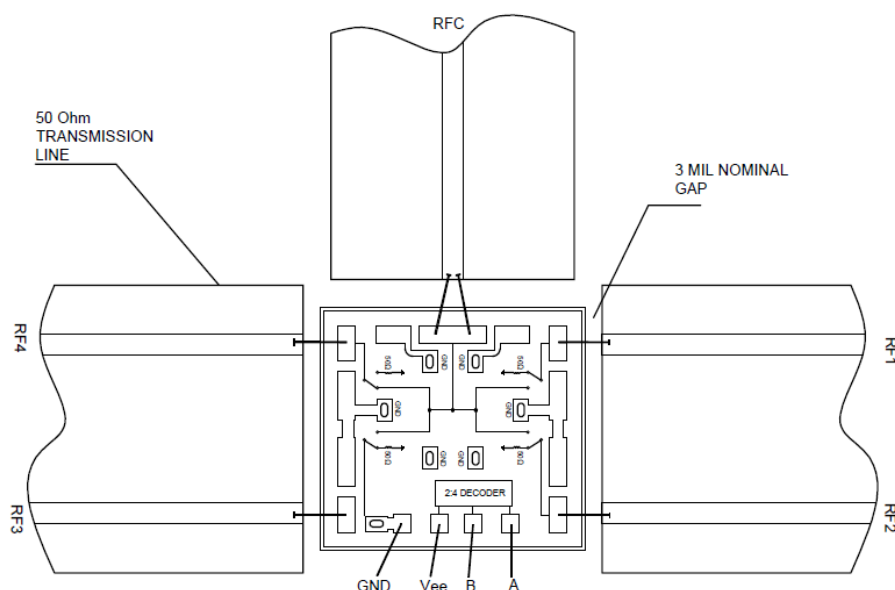
**Table 6 Bond Pad Information**

| Bond Pad Number    | Bond Pad Name      | Description                                                                                                                                             |
|--------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1, 4, 5, 10        | RF4, RF1, RF2, RF3 | RF output 4, RF output 1, RF output 2 and RF output 3. These bond pads are DC-coupled and matched to 50 $\Omega$ . DC-blocking capacitors are required. |
| 2, 3               | RFC                | RF Common. DC-blocking capacitor is required.                                                                                                           |
| 6, 7               | A, B               | Digital control voltage. Refer to Control Voltages section.                                                                                             |
| 8                  | V <sub>EE</sub>    | DC voltage supply: –5.0 VDC $\pm$ 10%.                                                                                                                  |
| 9, backside paddle | RF/DC GND          | RF/DC ground.                                                                                                                                           |

### 4.4 Assembly Diagram

The following figure shows the assembly diagram of the MMS008AA device.

**Figure 8 Assembly Diagram**



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## 5 Handling and Die Attachment Recommendations

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Gallium arsenide integrated circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. It is recommended to follow all procedures and guidelines outlined in the Microsemi application note [AN01 GaAs MMIC Handling and Die Attach Recommendations](#).

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## 6 Ordering Information

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The following table shows the ordering information for the MMS008AA device.

**Table 7 Ordering Information**

| Part Number | Package |
|-------------|---------|
| MMS008AA    | Die     |

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