MMS006AA Datasheet

DC–20 GHz GaAs MMIC SP2T Non-Reflective Switch

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1 Revision History

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

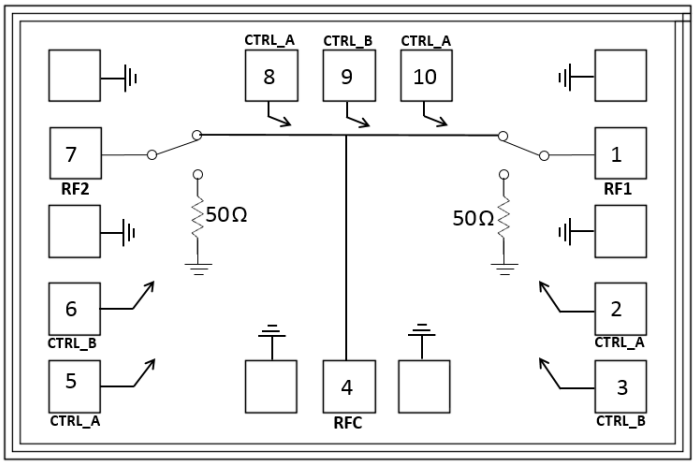
The MMS006AA device is a DC-to-20 GHz, non-reflective gallium arsenide (GaAs) pseudomorphic high-electron mobility transistor (pHEMT), high isolation single pole double throw (SPDT) monolithic microwave integrated circuit (MMIC) chip.

The switch delivers over 40 dB of isolation across the entire DC-to-20 GHz frequency range, while maintaining a low insertion loss of less than 2 dB. The MMS006AA device operates using two negative control voltage logic lines of –5 V and 0 V, respectively. It requires no V_{EE}, and consumes essentially zero current. The RF ports are internally matched to 50 Ω, 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 MMS006AA device.

Figure 1 Functional Block Diagram



2.2 Applications

The MMS006AA 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 MMS006AA device.

- Non-reflective topology
- Fast switching: <10 ns
- Low insertion loss: <2 dB
- Excellent isolation: >40 dB

- Compact die size: 0.85 mm × 1.30 mm × 0.1 mm
- High Input P1dB: 24 dBm
- High Input IP3: 42 dBm

3 Electrical Specifications

3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MMS006AA 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 –7.5 V
Hot switching power	27 dBm
Channel temperature	150 °C
ESD HBM	Class 1A

3.2 Typical Electrical Performance

The following table shows the typical electrical performance of the MMS006AA device at 25 °C, where $V_{CONTROL}$ is 0 V, –5 V, and V_{EE} is –5 V. The system is 50 Ω.

Table 2 Typical Electrical Performance

Parameter	Test Conditions	Min	Typ	Max	Units
Operational frequency range		DC		20	GHz
Control voltage	Low	–3.0		0	V
	High	–5.0		–4.2	V
Insertion loss (all states)	DC–20 GHz			2.0	dB
Isolation	DC–20 GHz	–40			dB
Return loss (all states)	DC–20 GHz		–15		dB
T_{RISE}, T_{FALL}	DC–20 GHz (10% to 90% and 90% to 10% RF)		10	10	ns
T_{ON}, T_{OFF}	DC–20 GHz (50% control to 90% RF, and 50% control to 90% RF)		10		ns
Input P1dB	DC–20 GHz		24		dBm
Input third order intercept (IIP3)	DC–20 GHz (two-tone input power, 7 dBm/tone)		42		dBm

3.3 Typical Performance Curves

The following graphs show the typical performance curves of the MMS006AA device.

Figure 2 Insertion Loss vs. Temperature

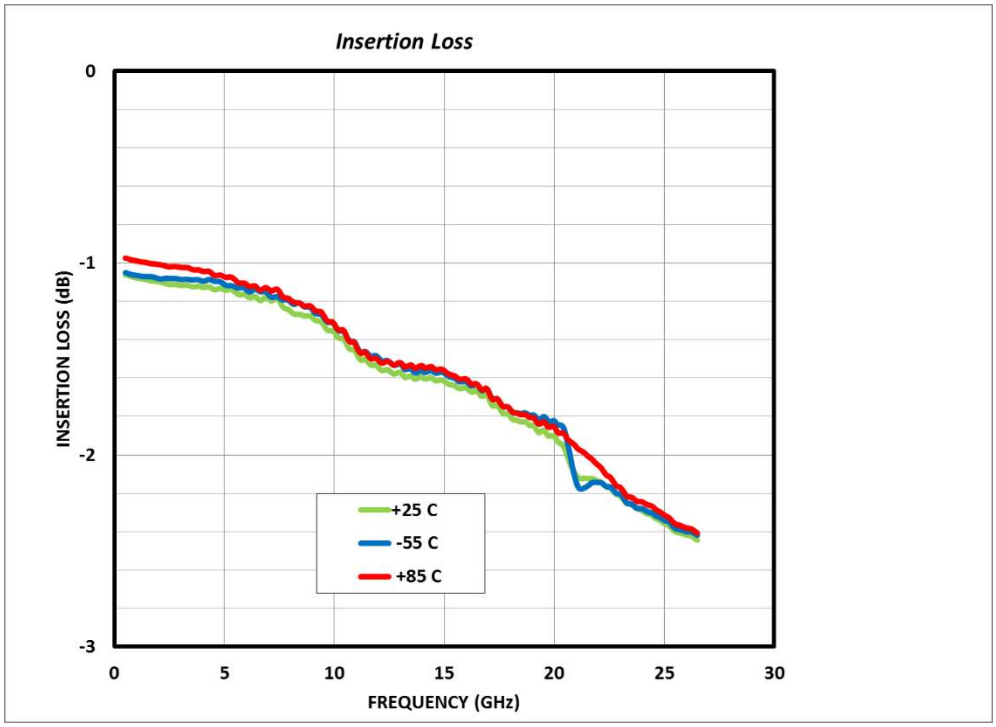


Figure 3 Isolation vs. Temperature

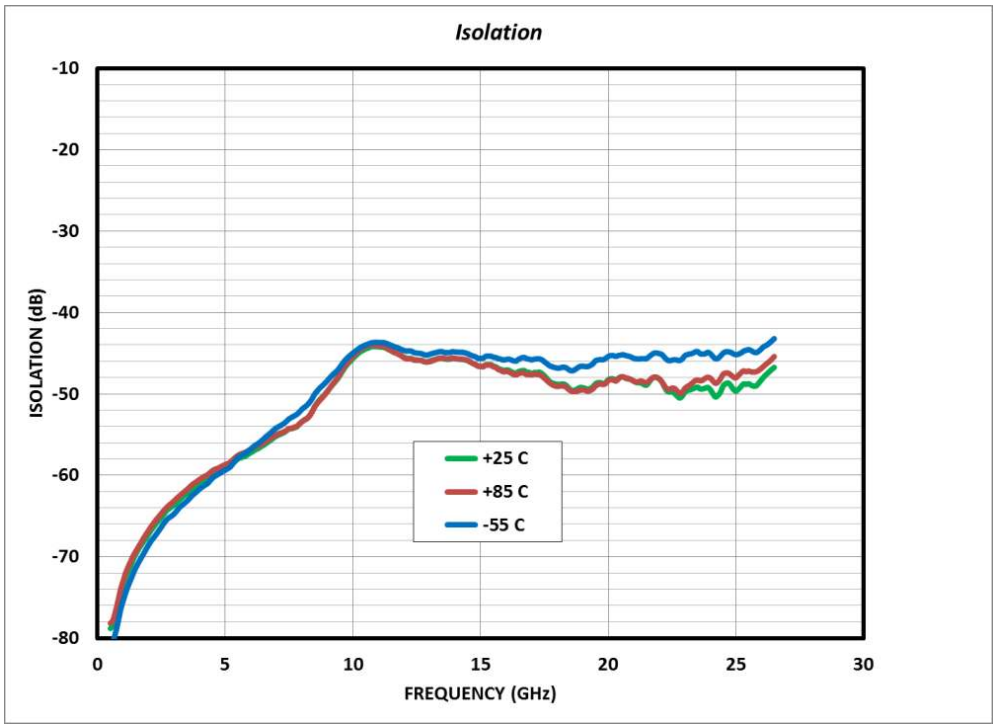


Figure 4 Return Loss vs. Temperature

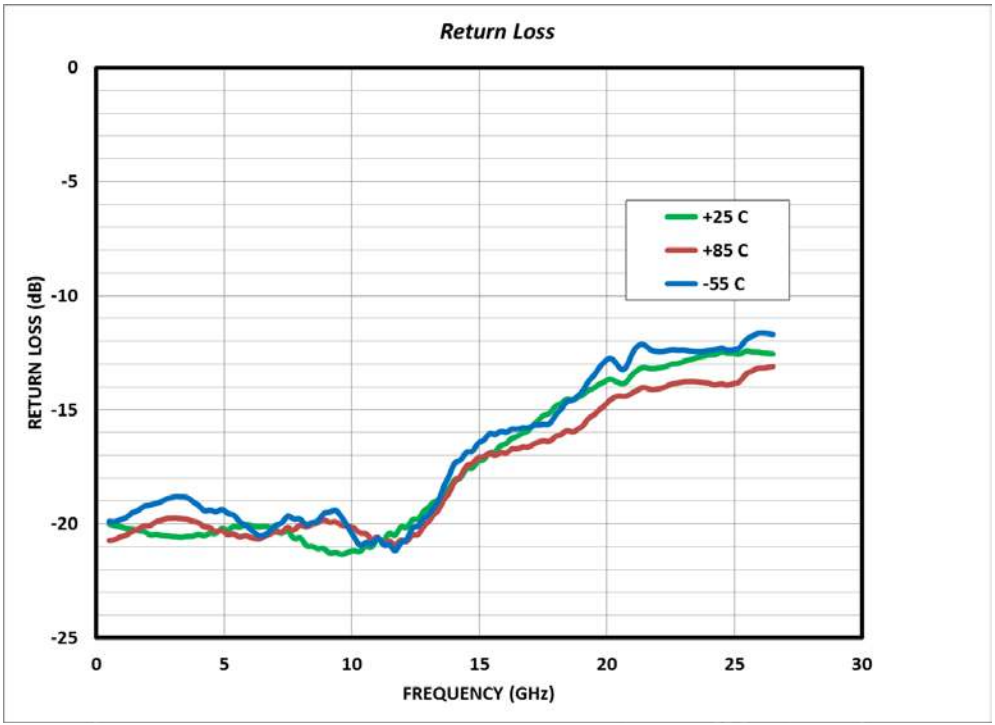


Figure 5 0.1 dB and 1 dB Input Compression Point

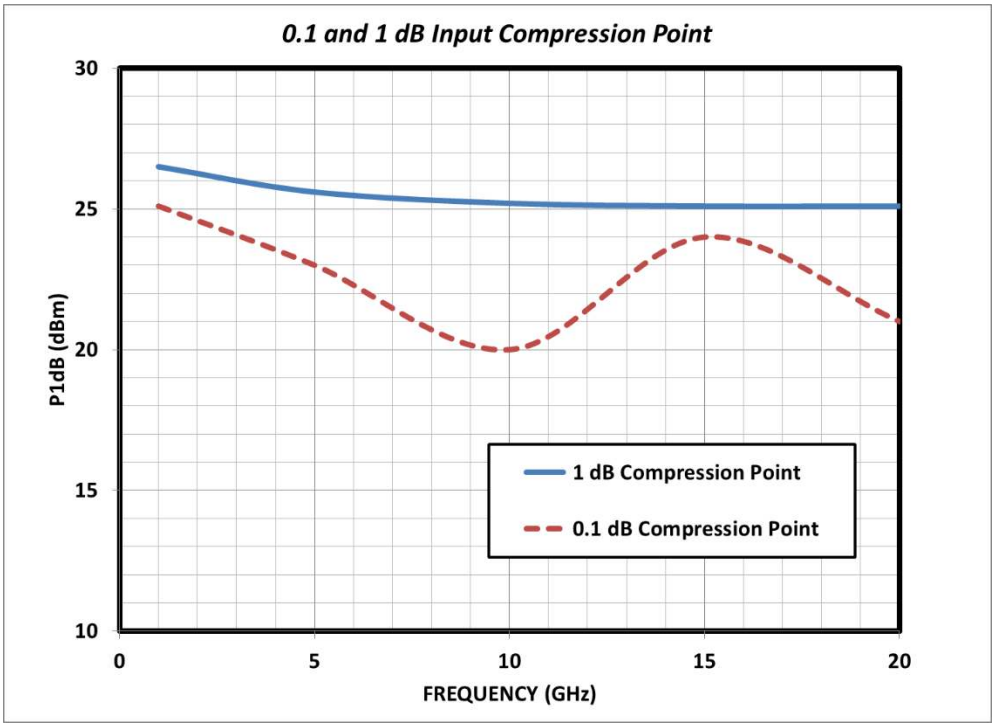


Figure 6 Input Third Order Intercept Point

3.4 Control Voltages

The following tables show the control voltages of the MMS006AA device.

Table 3 Switch Control Truth Table

Control Input		Signal Path Condition	
A	**B**	**RF Common to RF1**	**RF Common to RF2**
High	Low	On	Off
Low	High	Off	On

Table 4 Digital Control Voltages

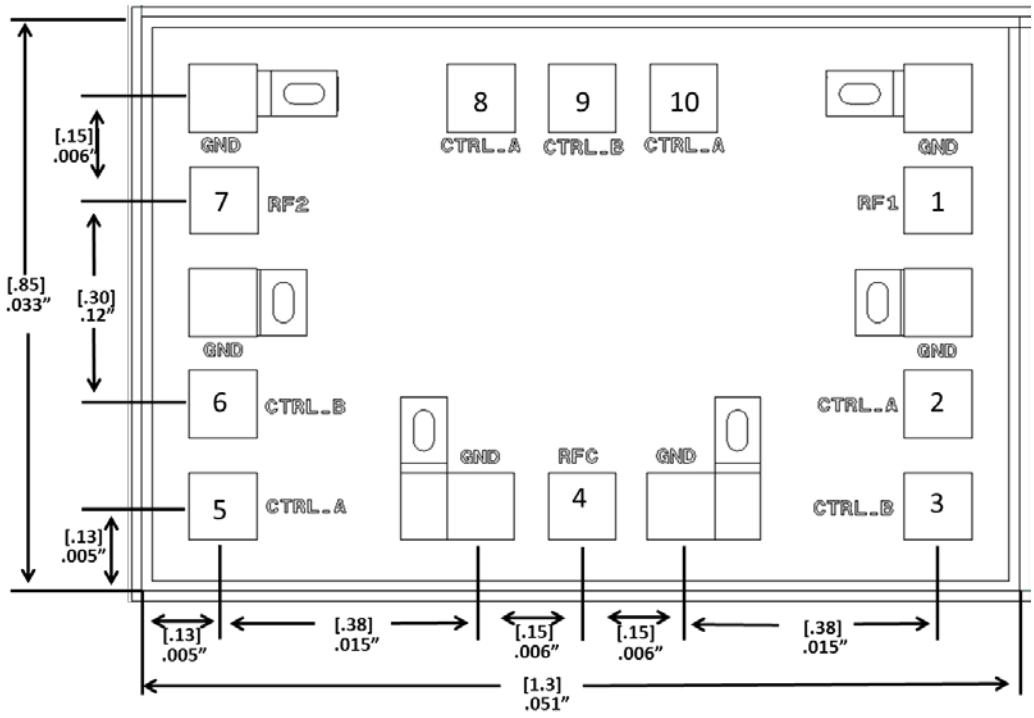
State	Bias Condition
Low	–3 V to 0 V
High	–5.0 V to –4.2 V

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 MMS006AA device. Dimensions are shown in inches and millimeters. The minimum bond pad size is 100 µm × 100 µm. Both the bond pad surface and the backside metal are 3 µm gold. The die thickness is 100 µm. 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 MMS006AA 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 MMS006AA device.

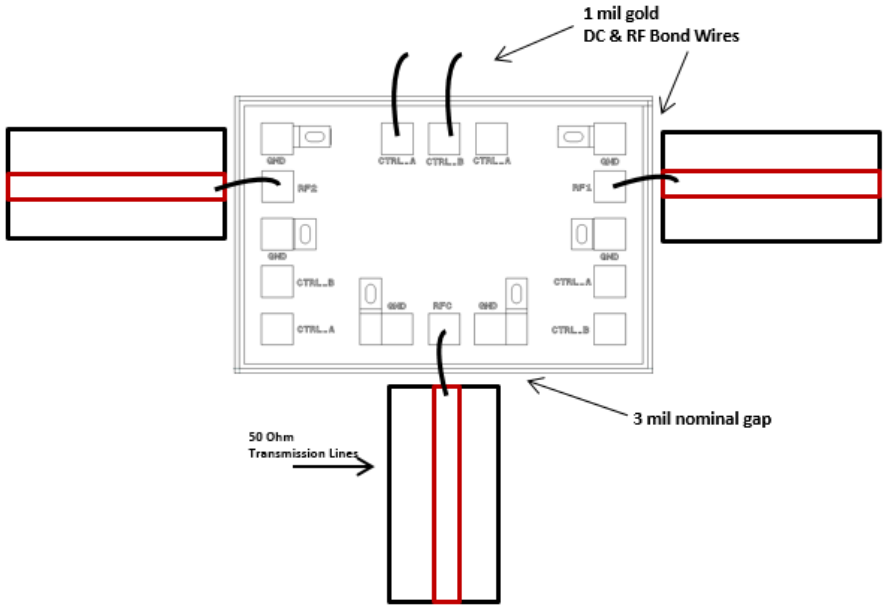
Table 6 Bond Pad Information

Bond Pad Number	Bond Pad Name	Description
1, 7	RF1, RF2	RF output 1 and RF output 2. These bond pads are DC-coupled and matched to 50 Ω. DC-blocking capacitors are required.
2, 5, 8, 10 3, 6, 9	CTRLA CTRLB	Digital control voltages. Refer to Control Voltages section.
4	RFC	RF common. DC-blocking capacitor is required.
8	V_{EE}	DC voltage supply: –5.0 VDC ±10%.
Backside Paddle	RF/DC GND	RF/DC ground.

4.4 Assembly Diagram

The following illustration shows the assembly diagram of the MMS006AA device.

Figure 8 Assembly Diagram



5 Handling and Die Attachment Recommendations

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.

6 Ordering Information

The following table shows the ordering information for the MMS006AA device.

Table 7 Ordering Information

Part Number	Package
MMS006AA	Die