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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



**MMA016AA Datasheet**  
**DC–16 GHz Power-Selectable Wideband**  
**Amplifier**




**Microsemi Corporate Headquarters**

 One Enterprise, Aliso Viejo,  
 CA 92656 USA

Within the USA: +1 (800) 713-4113

Outside the USA: +1 (949) 380-6100

Fax: +1 (949) 215-4996

 Email: [sales.support@microsemi.com](mailto:sales.support@microsemi.com)
[www.microsemi.com](http://www.microsemi.com)

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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

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The MMA016AA device is a gallium arsenide (GaAs) monolithic microwave integrated circuit (MMIC) power-selectable wideband amplifier die that operates between DC and 16 GHz. The amplifier provides a gain of 13 dB to 16 dB and 29 dBm P3dB at the highest power option, while requiring only 80 mA from a 4 V supply. Gain flatness is excellent, varying less than 1.4 dB over the –40 °C to 85 °C temperature range, making the MMA016AA device ideal for electronic warfare (EW), electronic countermeasures (ECM), radar, and test equipment applications. The MMA016AA amplifier I/Os are internally matched to 50 Ω, facilitating easy integration into multi-chip modules (MCMs). The MMA016AA device is available as a highly compact 0.5 mm<sup>2</sup> die.

### 2.1 Applications

The MMA016AA device is designed for the following applications:

- Test instrumentation
- Electronic warfare
- Microwave communications
- Radar

### 2.2 Key Features

The following are key features of the MMA016AA device:

- Power-selectable from 7 dbm to 19 dBm P1dB and from 16 dBm to 21 dBm P3dB by choosing bond option
- Gain of 13 dB–16 dB and approximately 29 dBm OIP3 at the highest power option
- Gain varies <1.4 dB from –40 °C to 85 °C
- Self-biased with single positive supply
- Input and output matched to 50 Ω
- 0.76 mm × 0.66 mm × 0.1 mm die size



## 3 Electrical Specifications

### 3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MMA016AA device. The bare die is non-hermetic. It is recommended to use the die in an environmentally sealed package.

**Table 1 Absolute Maximum Ratings**

Parameter	Value	Units
Drain voltage ( $V_{DD}$ )	4.5	V
Input power ( $P_{IN}$ )	19	dBm
Operating channel temperature	175 <sup>1</sup>	°C
Operating ambient temperature ( $T_A$ )	–55 to 85	°C
Storage temperature	–65 to 150	°C
Thermal resistance, Channel to die backside	175	°C/W

1. MTTF is approximately  $10^7$  hours at  $T_{CHANNEL} = 175$  °C. The device is intended to small-signal applications only.

### 3.2 Electrical Characteristics

The following table shows the RF specifications of the MMA016AA device at 25 °C, where  $V_{DD} = 4$  V (the device is intended for small-signal applications only).

**Table 2 RF Specifications (CW, Typical Device, RF Probe)**

Bond Option	ID	Gain	P1dB	OIP3
None	80	14.5	19	29
R1 to ground	45	12.5	15	25
R2 to ground	32	11.5	12	22
R3 to ground	24	10.5	8	18

The following table shows the specifications (CW, 100% test) of the MMA016AA device at 25 °C, where  $V_{DD} = 4$  V.

**Table 3 Specifications (CW, 100%)**

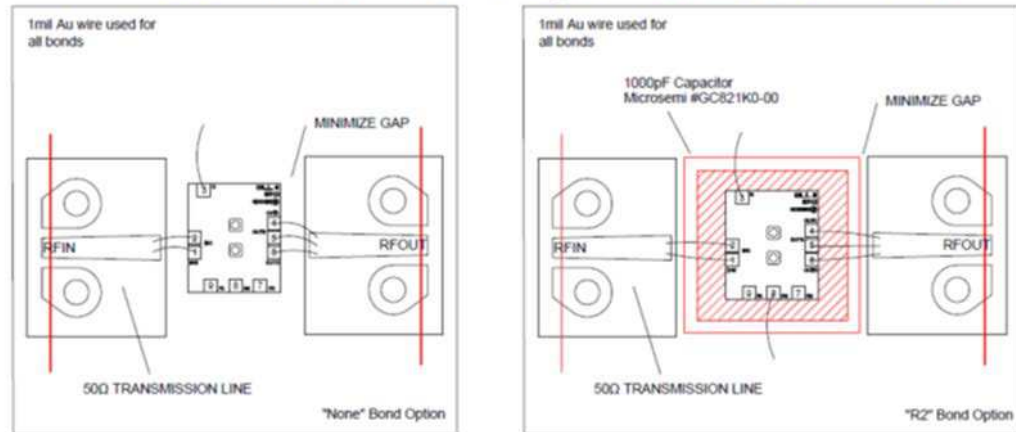
Parameter	Min	Typ	Max	Units
$I_{DD}$ , bond option = “none”	45	80	115	mA

### 3.3 RF Probe Measurement Set-Up with Reference Planes

The following diagram shows how to set up the RF probe measurement using reference planes. The reference planes are the same for S-parameter files, which are available for download at [www.microsemi.com/mmics](http://www.microsemi.com/mmics).

**Figure 1 RF Probe Measurement**

### RF Probe Measurement Set-Up With Reference Planes



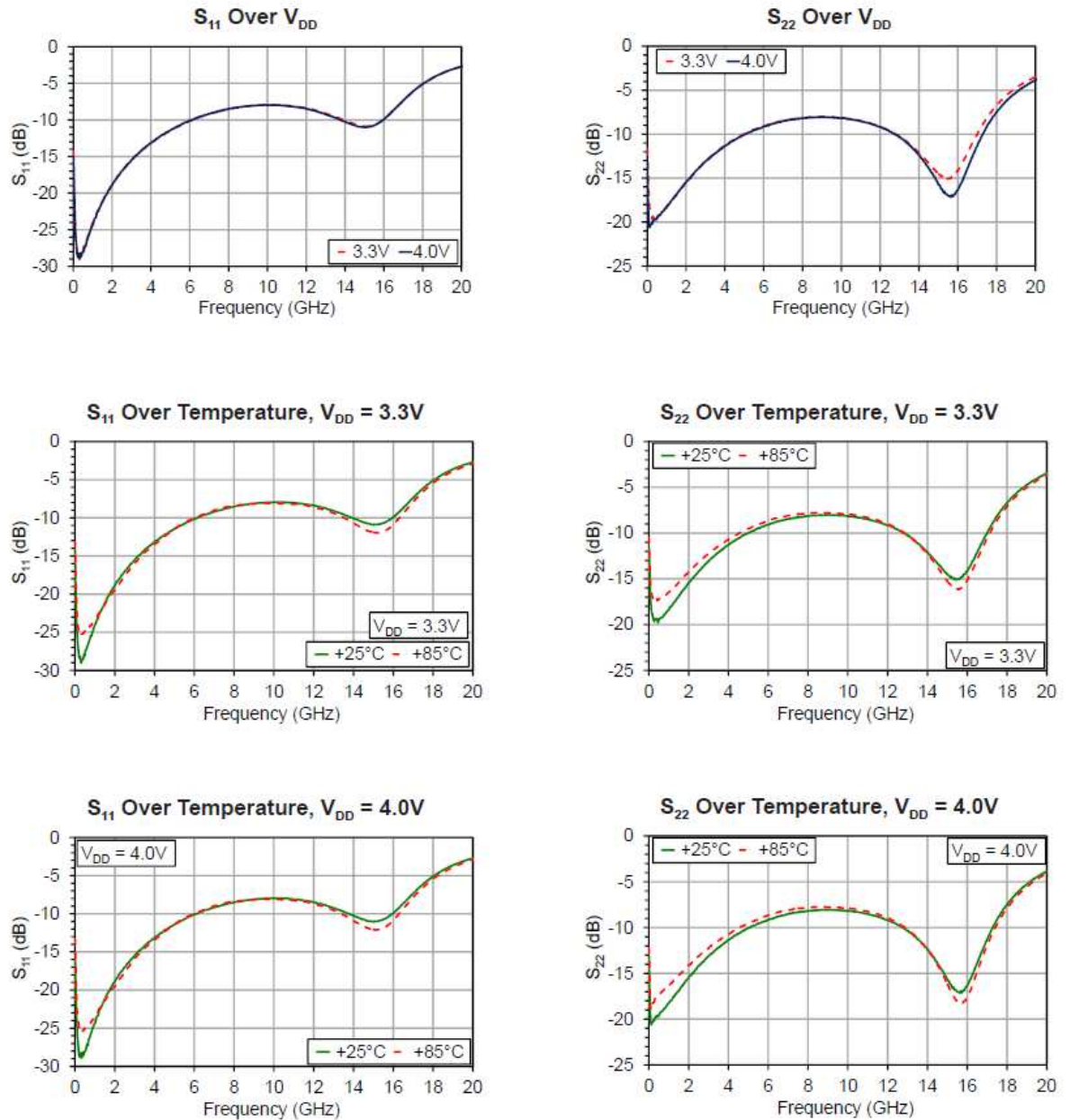
To use the "none" bonding option, attach the die directly to the baseplate.

To use the "R1", "R2" or "R3" bonding options, mount the die on top of a capacitor to float the source and bond the appropriate pad to ground.

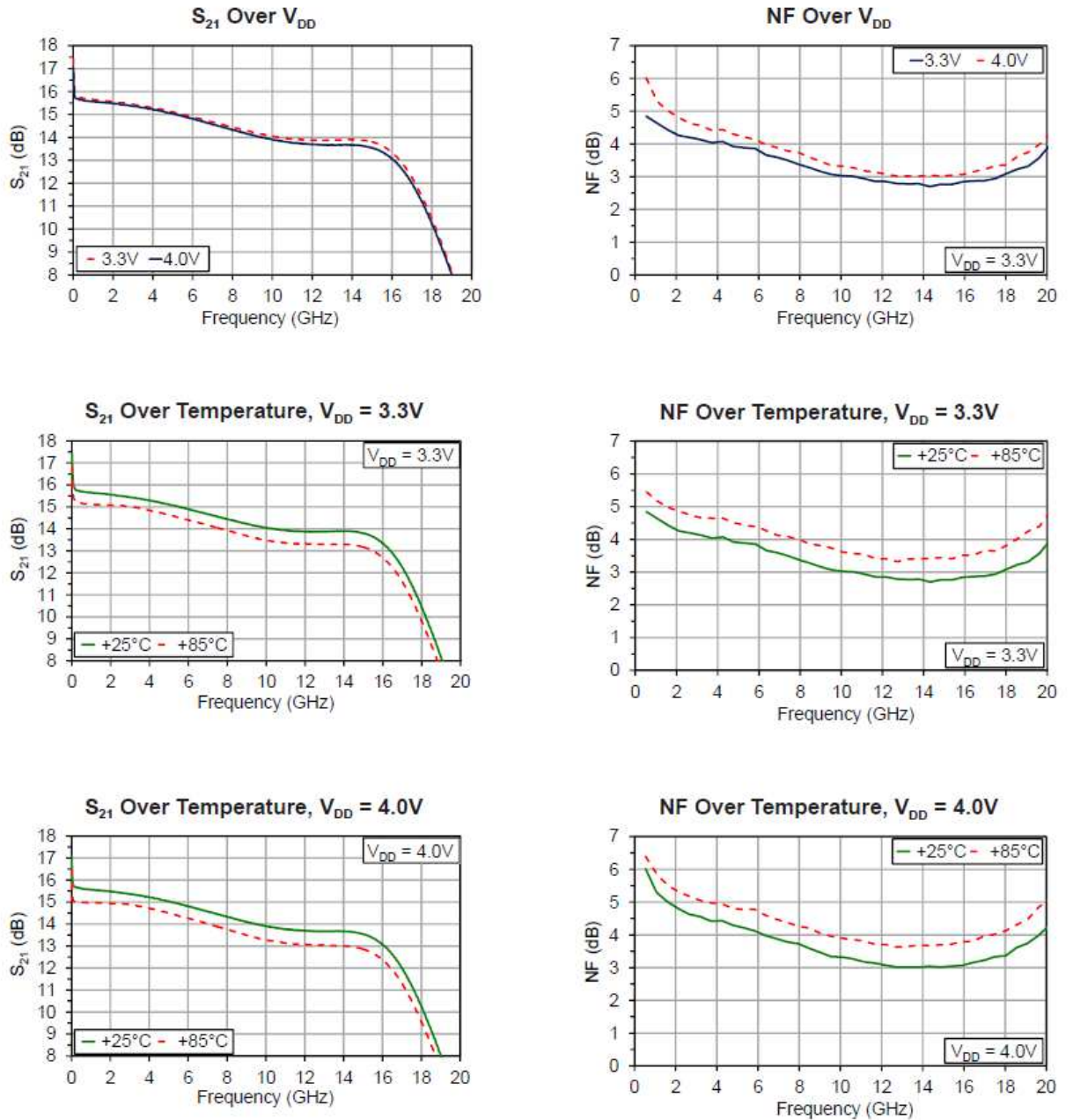
### 3.4 Typical Performance, RF Probe (No Bond Option)

The following graphs show the typical performance of the MMA016AA device at 25 °C, where  $V_{DD} = 4\text{ V}$ ,  $I_{DD} = 80\text{ mA}$ , and the bond option is “none,” unless otherwise specified.

**Figure 2**  $S_{11}$  and  $S_{22}$  over  $V_{DD}$  and Temperature



**Figure 3 S<sub>21</sub> and NF over V<sub>DD</sub> and Temperature**



**Figure 4**  $P_{1dB}/P_{3dB}$ , OIP3, and Power Sweep

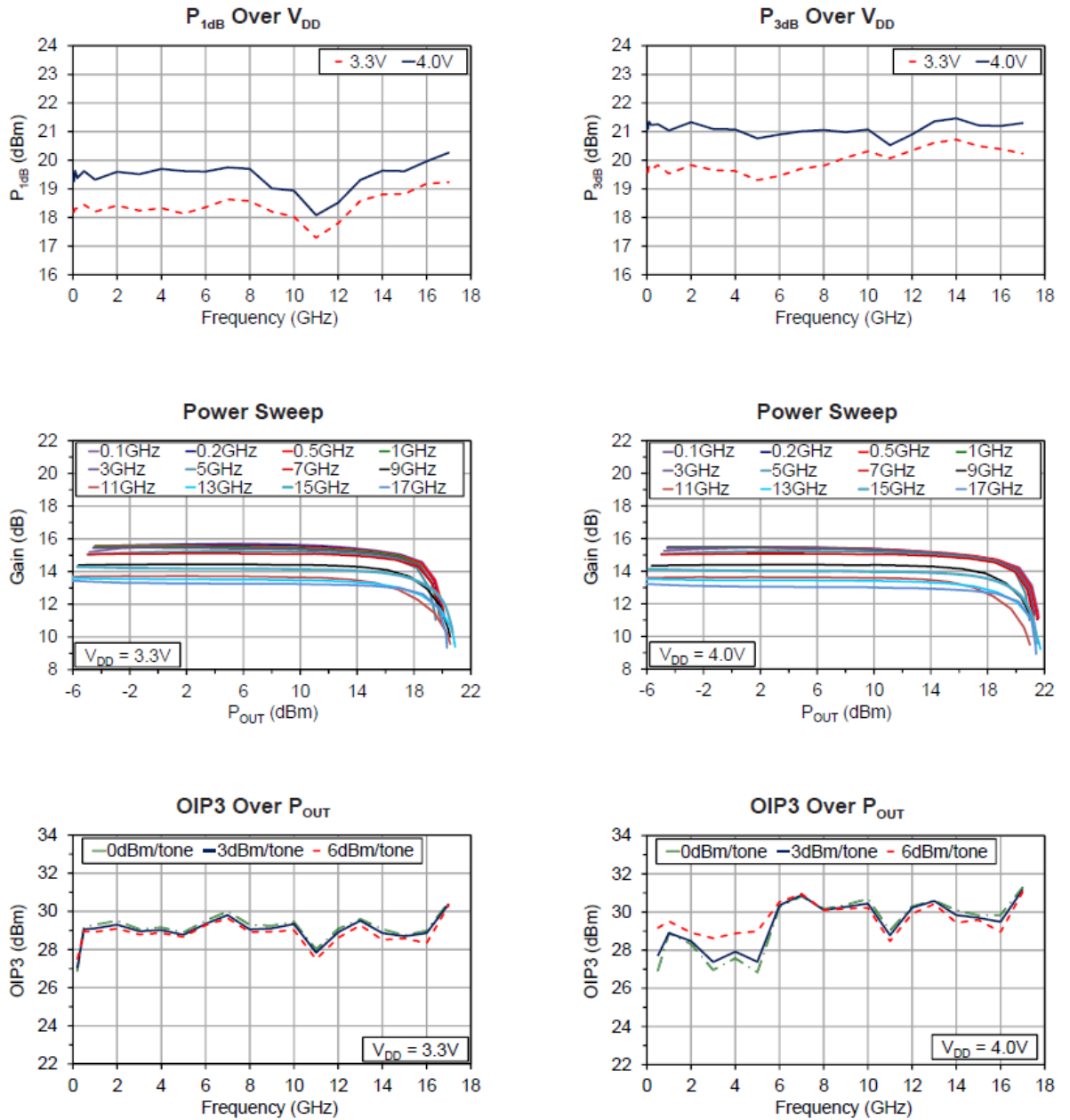
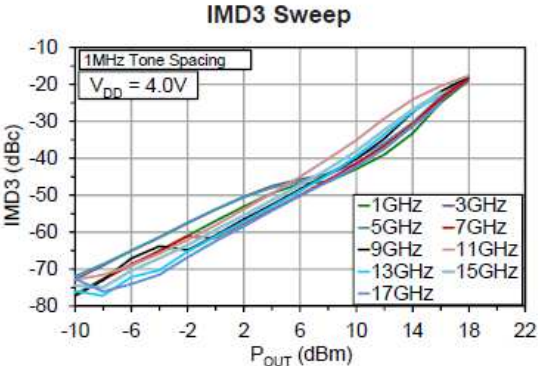
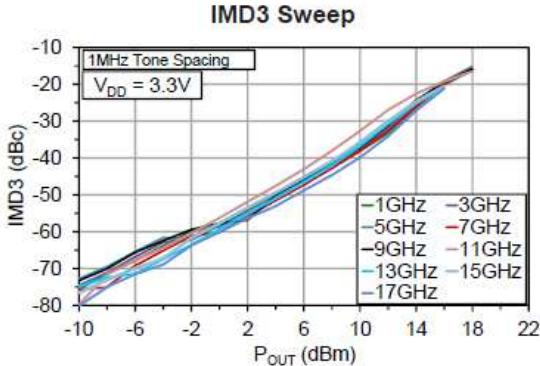


Figure 5 Power Sweep and IMD3 Sweep

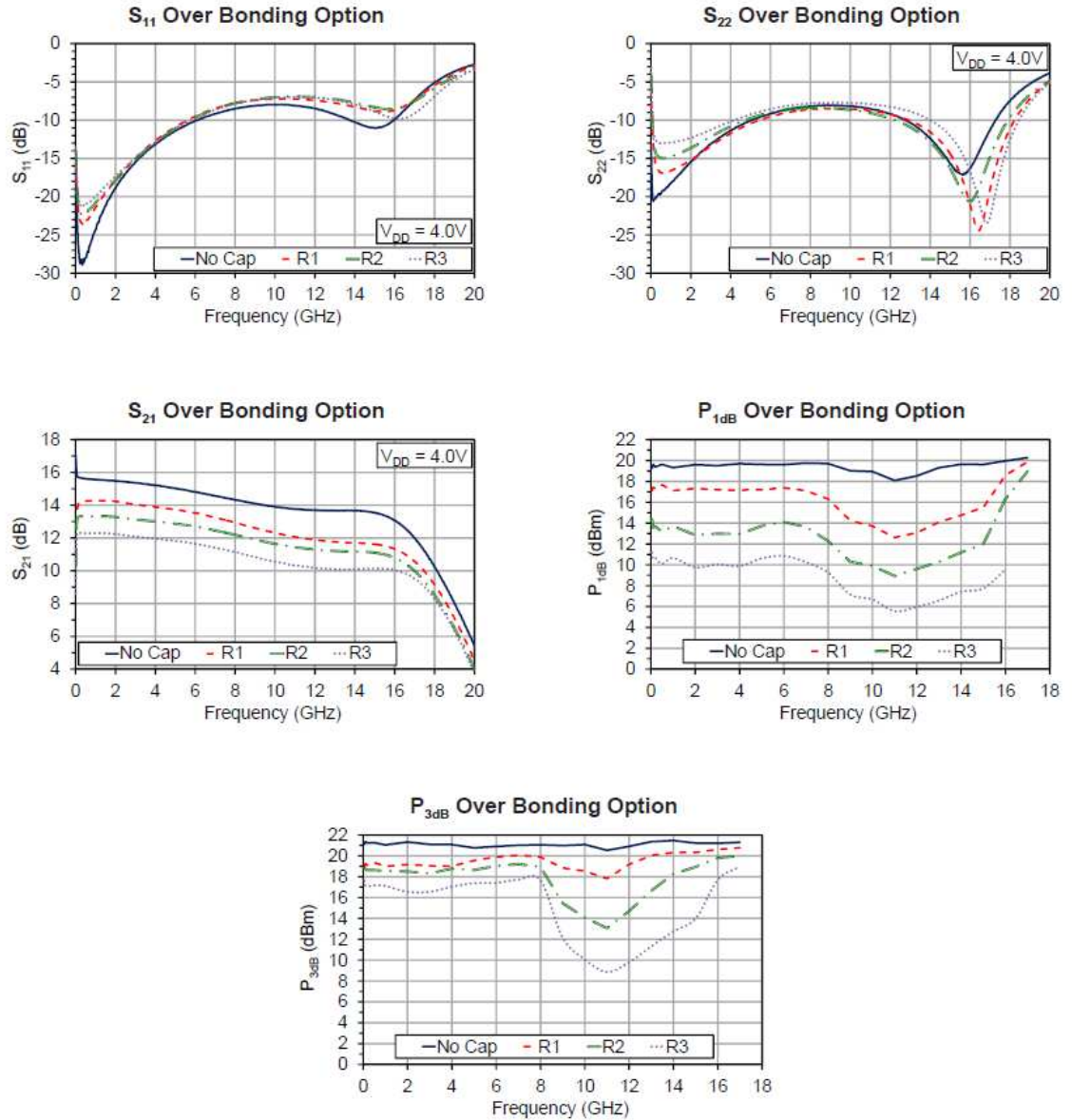




### 3.5 Typical Performance, RF Probe (Bond Option)

The following graphs show the typical performance of the MMA016AA device at 25 °C, where  $V_{DD} = 4\text{ V}$ ,  $I_{DD} = 80\text{ mA}$ , and performance is over the bond option.

Figure 6 Bonding Option



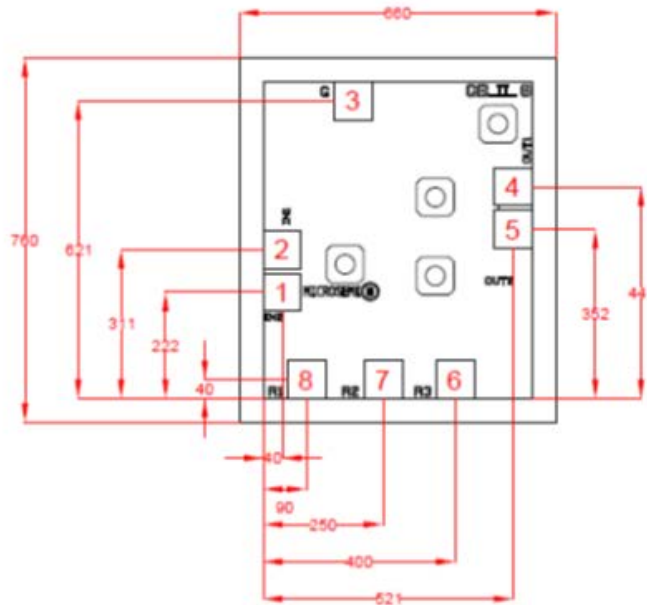


## 4 Chip Layout and Pad Descriptions

### 4.1 Chip Layout and Pad Locations

The following illustration shows the chip layout and pad locations of the MMA016AA device. All dimensions are in  $\mu\text{m}$ . The die thickness is 100  $\mu\text{m}$ . The backside metal and the bond pad metal are gold. Refer to [AN01 GaAs MMIC Handling and Die Attach Recommendations](#) for more information.

**Figure 7** Chip Layout and Pad Locations



### 4.2 Pad Descriptions

The following table shows the pad descriptions for the MMA016AA device. The MMA016AA is a self-biased device with a single positive supply. Apply  $V_{DD}$  to  $RF_{OUT}$ .

**Table 4** Pad Descriptions

Pad	Description	Pad Dimensions ( $\mu\text{m}$ )
1, 2	$RF_{IN}$ , DC coupled	75 × 75
3	Grounded	75 × 75
4, 5	$RF_{OUT}$ , DC coupled	75 × 75
6	R3 bond option	75 × 75
7	R2 bond option	75 × 75
8	R1 bond option	75 × 75
Die backside	See <a href="#">RF Probe Measurement Set-Up with Reference Planes</a>	

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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 MMA016AA device.

**Table 5 Ordering Information**

Part Number	Package
MMA016AA	Die