

MMA015AA Datasheet
DC–14 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

www.microsemi.com

©2016 Microsemi Corporation. All rights reserved. Microsemi and the Microsemi logo are registered trademarks of Microsemi Corporation. All other trademarks and service marks are the property of their respective owners.

Microsemi makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does Microsemi assume any liability whatsoever arising out of the application or use of any product or circuit. The products sold hereunder and any other products sold by Microsemi have been subject to limited testing and should not be used in conjunction with mission-critical equipment or applications. Any performance specifications are believed to be reliable but are not verified, and Buyer must conduct and complete all performance and other testing of the products, alone and together with, or installed in, any end-products. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the Buyer's responsibility to independently determine suitability of any products and to test and verify the same. The information provided by Microsemi hereunder is provided "as is, where is" and with all faults, and the entire risk associated with such information is entirely with the Buyer. Microsemi does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other IP rights, whether with regard to such information itself or anything described by such information. Information provided in this document is proprietary to Microsemi, and Microsemi reserves the right to make any changes to the information in this document or to any products and services at any time without notice.

About Microsemi

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions; security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, California, and has approximately 4,800 employees globally. Learn more at www.microsemi.com.

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.

Contents

1	Revision History.....	3
1.1	Revision 1.0.....	3
2	Product Overview	7
2.1	Applications	7
2.2	Key Features.....	7
3	Electrical Specifications.....	8
3.1	Absolute Maximum Ratings	8
3.2	Electrical Characteristics	8
3.3	RF Probe Measurement Set-Up with Reference Planes	8
3.4	Typical Performance, RF Probe (No Bond Option).....	10
3.5	Typical Performance, RF Probe (Bond Option)	13
4	Chip Layout and Pad Descriptions.....	14
4.1	Chip Layout and Pad Locations	14
4.2	Pad Descriptions	14
5	Handling and Die Attachment Recommendations.....	15
6	Ordering Information	16

List of Figures

Figure 1 RF Probe Measurement	9
Figure 2 S_{11} and S_{22} over V_{DD} and Temperature	10
Figure 3 S_{21} and NF over V_{DD} and Temperature	11
Figure 4 P_{1dB}/P_{3dB} and OIP3	12
Figure 5 Power Sweep and IMD3 Sweep	12
Figure 6 Bonding Option	13
Figure 7 Chip Layout and Pad Locations	14

List of Tables

Table 1	Absolute Maximum Ratings	8
Table 2	RF Specifications (CW, Typical Device, RF Probe)	8
Table 3	Specifications (CW, 100%).....	8
Table 4	Pad Descriptions.....	14
Table 5	Ordering Information	16

2 Product Overview

The MMA015AA device is a gallium arsenide (GaAs) monolithic microwave integrated circuit (MMIC) power-selectable wideband amplifier die that operates between DC and 14 GHz. The amplifier provides gain of 11 dB to 15 dB and 29 dBm OIP3 at the highest power option, while requiring only 80 mA from a 4 V supply. Gain flatness is excellent, varying less than 1 dB over the –40 °C to 85 °C temperature range, making the MMA015AA device ideal for electronic warfare (EW), electronic countermeasures (ECM), radar, and test equipment applications. The MMA015AA amplifier I/Os are internally matched to 50 Ω , facilitating easy integration into multi-chip modules (MCMs). The MMA015AA device is available as a highly compact 0.5 mm² die.

2.1 Applications

The MMA015AA 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 MMA015AA device:

- Power-selectable from 7 dBm to 19 dBm P1dB and from 15 dBm to 21 dBm P3dB by choosing bond option
- $\leq \pm 0.5$ dB P1dB flatness across the band
- Gain varies < 1 dB from –40 °C to 85 °C
- Gain of 11 dB–15 dB and approximately 29 dBm OIP3 at the highest power option
- Self-biased with single positive supply
- Input and output matched to 50 Ω
- 0.76 mm $\times$ 0.66 mm $\times$ 0.1 mm die size

3 Electrical Specifications

3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MMA015AA 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 ¹	°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 MMA015AA 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	19	29
R1 to ground	45	13	17	27
R2 to ground	24	11	11	21
R3 to ground	15	10	7	17

The following table shows the specifications (CW, 100% test) of the MMA015AA device at 25 °C, where $V_{DD} = 4$ V.

Table 3 Specifications (CW, 100%)

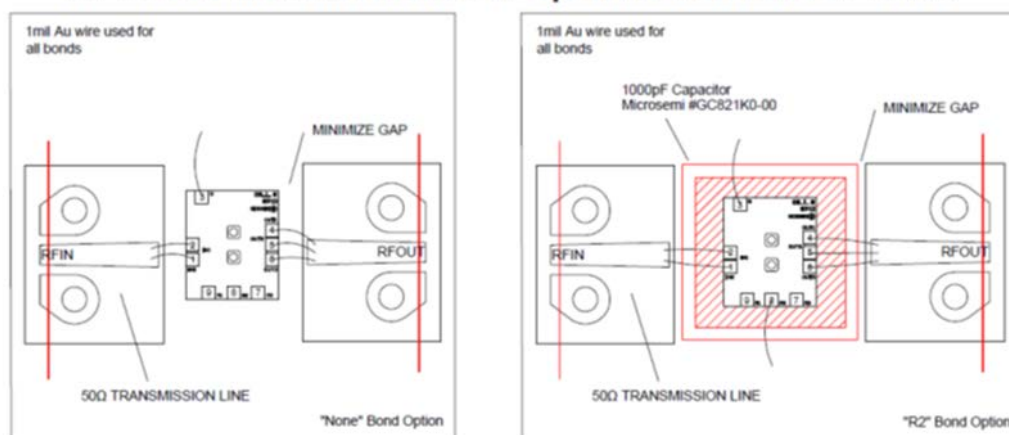
Parameter	Min	Typ	Max	Units
I_{DD} , bond option = “none”	45	80	115	mA

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.

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 MMA015AA 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

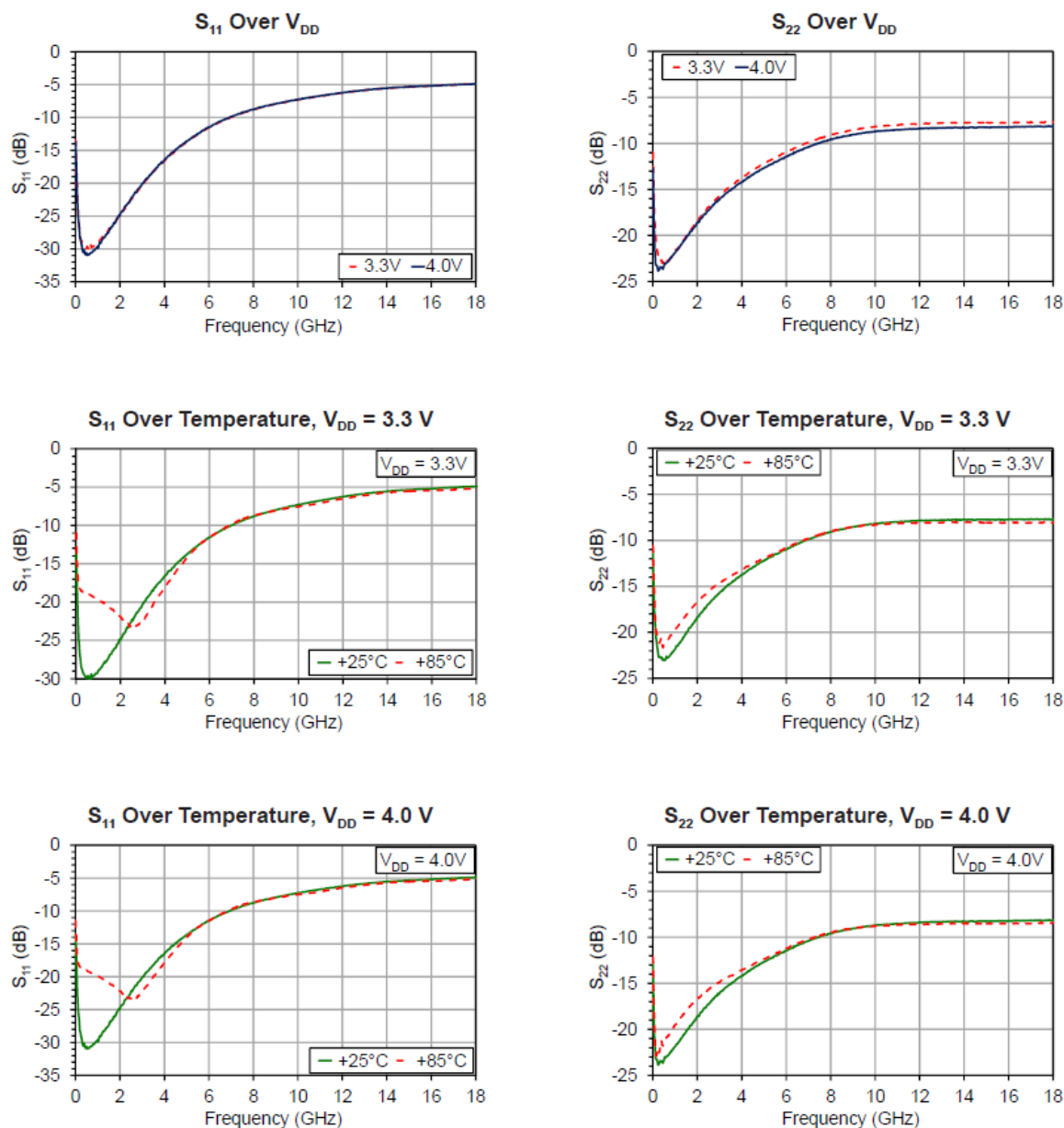


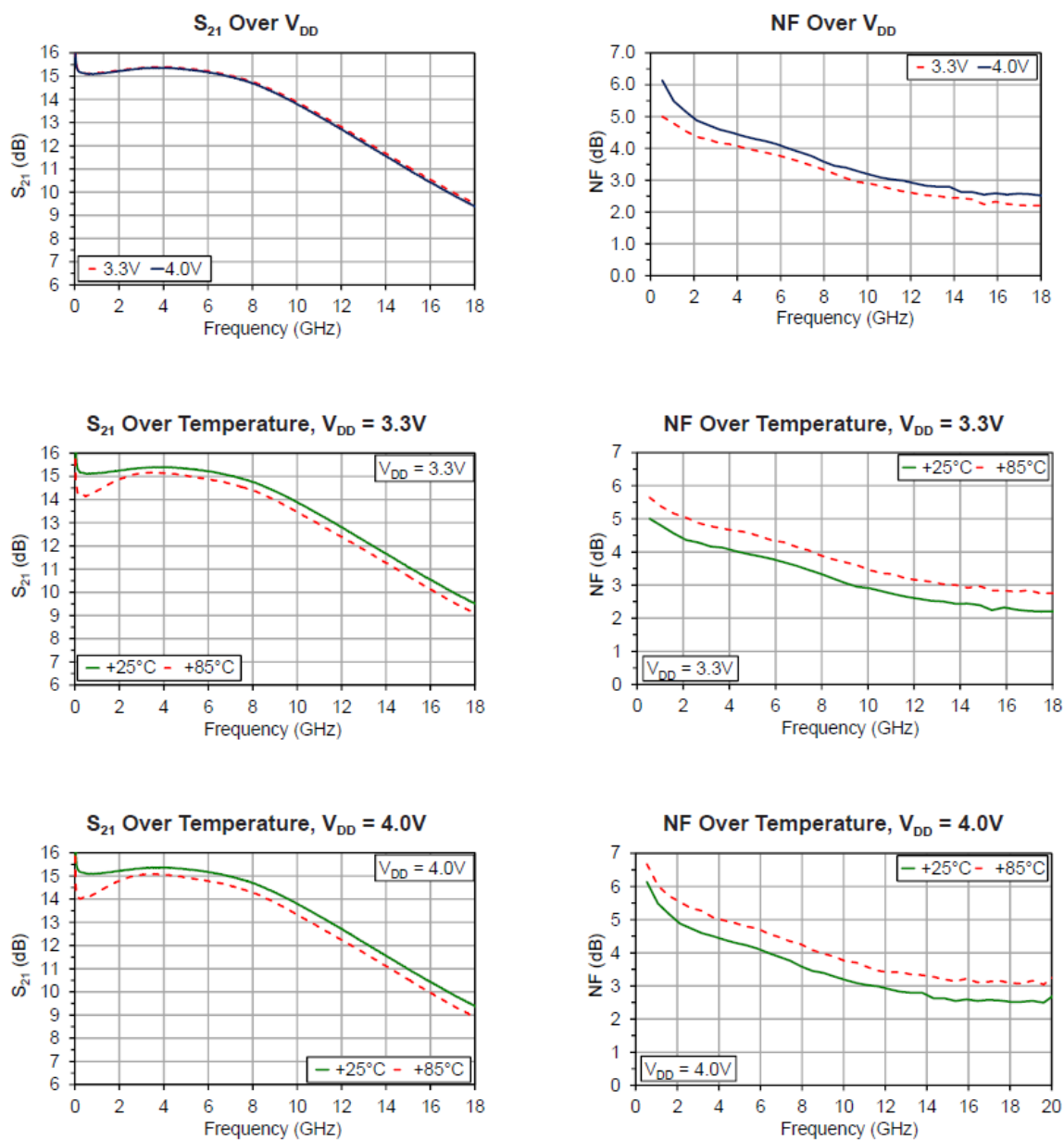
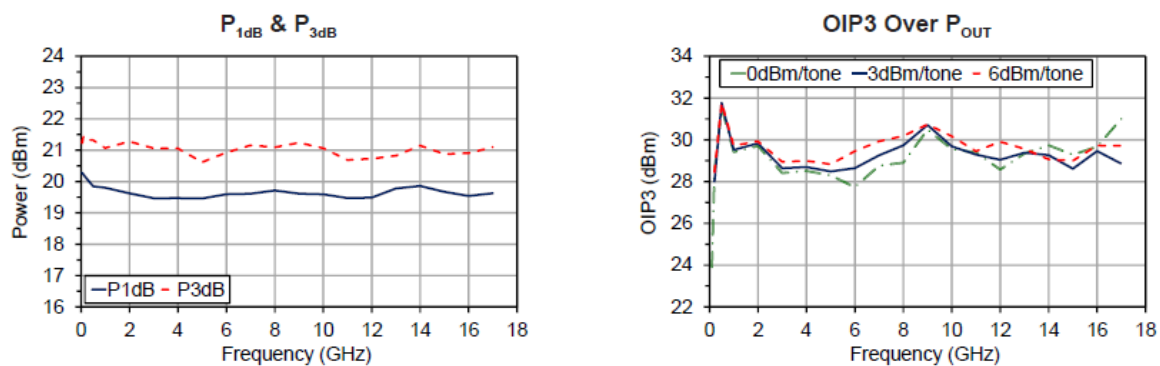
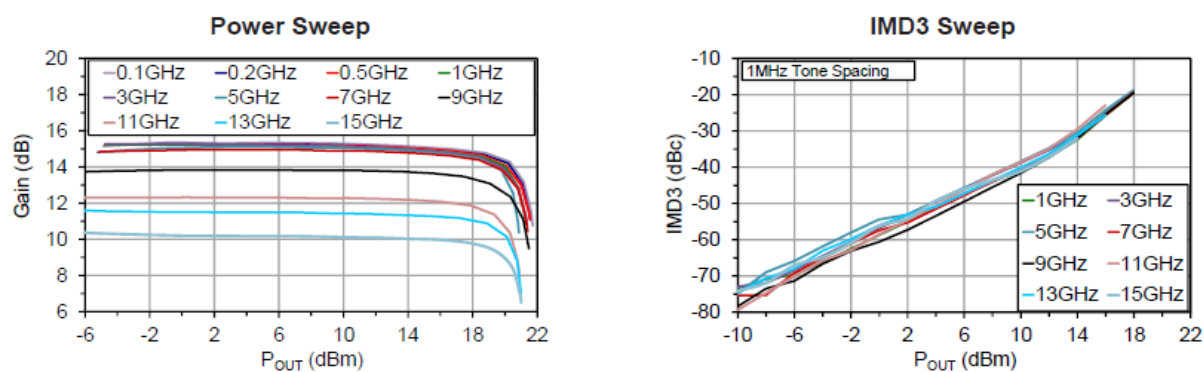
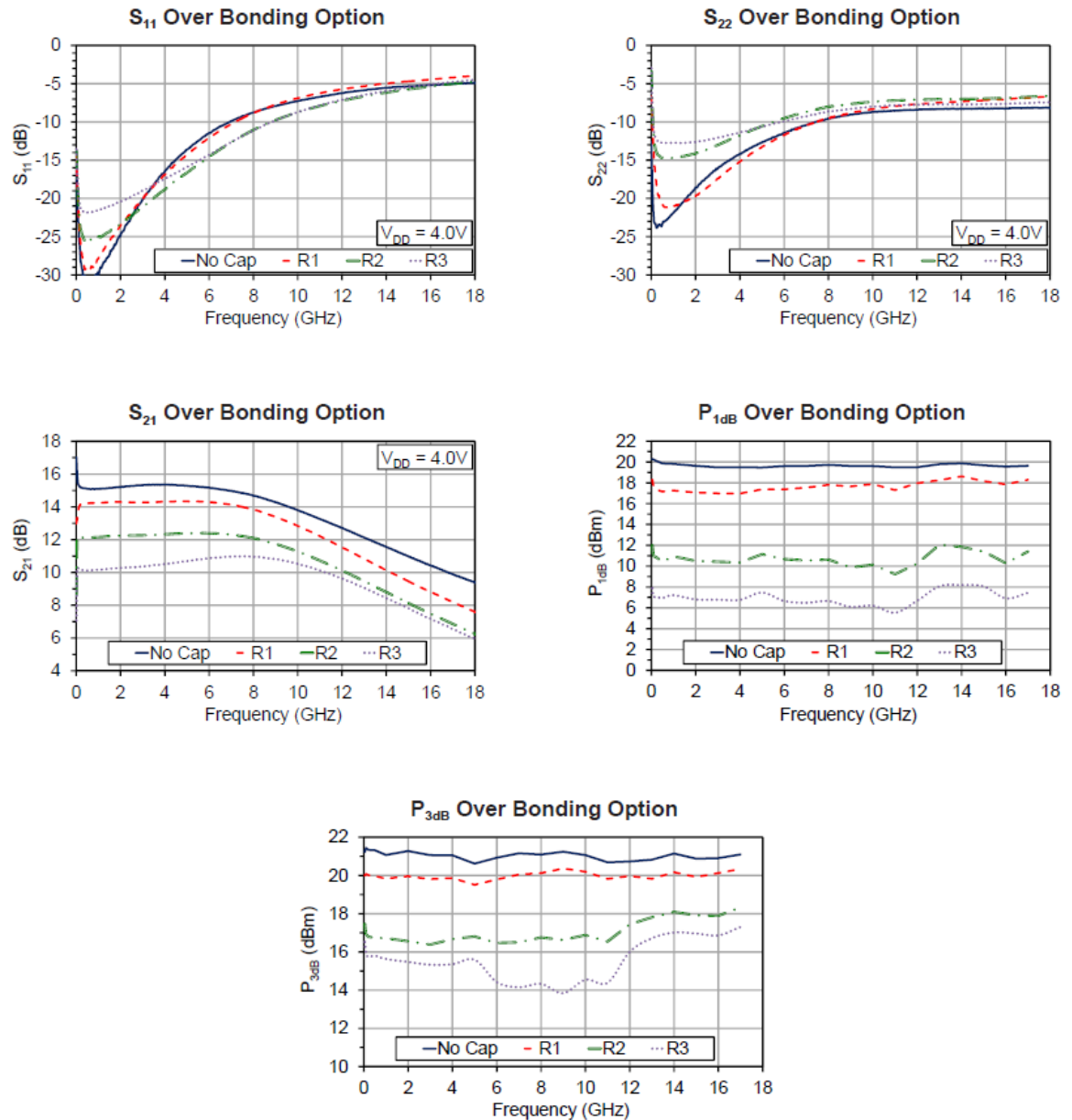
Figure 3 S_{21} and NF over V_{DD} and Temperature

Figure 4 P_{1dB}/P_{3dB} and OIP3**Figure 5** Power Sweep and IMD3 Sweep

3.5 Typical Performance, RF Probe (Bond Option)

The following graphs show the typical performance of the MMA015AA 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

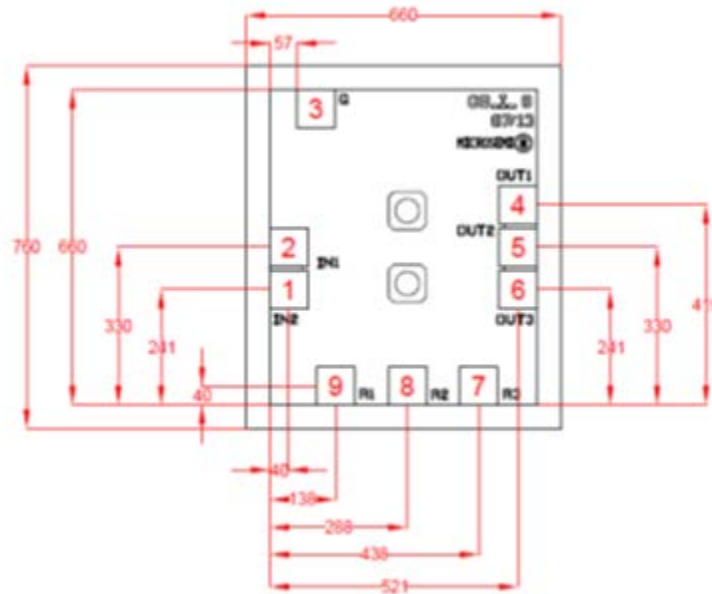


4 Chip Layout and Pad Descriptions

4.1 Chip Layout and Pad Locations

The following illustration shows the chip layout and pad locations of the MMA015AA device. All dimensions are in μm . The die thickness is 100 μm . 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 MMA015AA device. The MMA015AA is a self-biased device with a single positive supply. Apply V_{DD} to RF_{OUT} .

Table 4 Pad Descriptions

Pad	Description	Pad Dimensions (μm)
1, 2	RF_{IN} , DC coupled	75×75
3, 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 RF Probe Measurement Set-Up with Reference Planes	

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 MMA015AA device.

Table 5 Ordering Information

Part Number	Package
MMA015AA	Die