MMA041AA Datasheet

DC–26 GHz GaAs MMIC Distributed Amplifier

Microsemi

Power Matters.™

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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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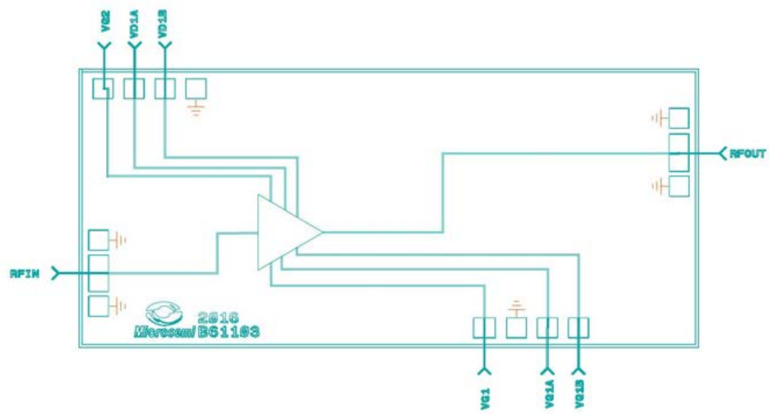
2 Product Overview

MMA041AA is a gallium arsenide (GaAs) monolithic microwave integrated circuit (MMIC) pseudomorphic high-electron mobility transistor (pHEMT) distributed amplifier die that operates between DC and 26 GHz. It is ideal for test instrumentation and communications infrastructure applications. The amplifier provides a flat gain of 18 dB, 3.2 dB noise figure, and 22 dBm of output power at 1 dBm gain compression while requiring only 150 mA from a 7 V supply. Output IP3 is typically 36 dBm. The MMA041AA amplifier features RF I/Os that are internally matched to 50 Ω, which allows for easy integration into multi-chip modules (MCMs).

The following illustration shows the primary functional blocks of the MMA041AA device.

Figure 1 Functional Block Diagram



2.1 Applications

The MMA041AA device is designed for the following applications:

- Test instrumentation
- Telecom infrastructure
- OC192 LN/MZ modulator driver
- Military and space
- Electronic warfare (EW), electronic countermeasures (ECM), and electronic counter-countermeasures (ECCM)

2.2 Key Features

The following are key features of the MMA041AA device:

- Frequency range: DC to 26 GHz
- Flat gain: 18 dB

- High output IP3: 36 dBm
- Low noise figure: 3.2 dB
- Supply voltage: 7 V at 150 mA
- 50 Ω matched I/O
- Compact die size: 3 mm × 1.30 mm × 0.1 mm

3 Electrical Specifications

3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MMA041AA device.

Table 1 Absolute Maximum Ratings

Parameter	Rating
Storage temperature	–65 °C to 150 °C
Operating temperature	–55 °C to 85 °C
Drain bias voltage (V_D)	8 V
Gate bias voltages (V_{G1} and V_{G2})	–2 V to 0.5 V
Gate bias voltage (V_{G2})	0 V to 2.5 V
V_D current (I_{DD})	300 mA
RF input power	19 dBm
DC power dissipation (T = 85 °C)	2.4 W
Channel temperature	150 °C
Thermal impedance	18 °C/W
ESD HBM	

3.2 Typical Electrical Performance

The following table shows the typical electrical performance of the MMA041AA device at 25 °C, where V_{DD} is 7 V and I_{DD} is 150 mA. Unless otherwise indicated, all measurements are derived from the RF probed die according to the assembly diagram shown in section 4.4.

Table 2 Typical Electrical Performance

Parameter	Frequency Range	Min	Typ	Max	Units
Operational frequency range		DC		26	GHz
Gain	DC–6 GHz	18	20		dB
	6 GHz–12 GHz	18	18.5		dB
	12 GHz–20 GHz	17	18		dB
Gain flatness	DC–6 GHz		±0.5		dB
	6 GHz–12 GHz		±0.25		dB
	12 GHz–20 GHz		±0.25		dB
Input return loss	DC–6 GHz		17		dB
	6 GHz–12 GHz		20		dB
	12 GHz–20 GHz		20		dB
Output return loss	DC–6 GHz		12		dB
	6 GHz–12 GHz		16		dB
	12 GHz–20 GHz		16		dB

Parameter	Frequency Range	Min	Typ	Max	Units
P1dB	DC–6 GHz	22	22.5		dBm
	6 GHz–12 GHz	21	22		dBm
	12 GHz–20 GHz	18	20		dBm
OIP3	DC–6 GHz		35		dBm
	6 GHz–12 GHz		35		dBm
	12 GHz–20 GHz		34		dBm
V_{DD} (drain voltage supply)			7		V
I_{DD} (drain current)			150		mA

3.3 Typical Performance Curves

The following graphs show the typical performance curves of the MMA041AA device at 25 °C, unless otherwise indicated.

Figure 2 Gain Response

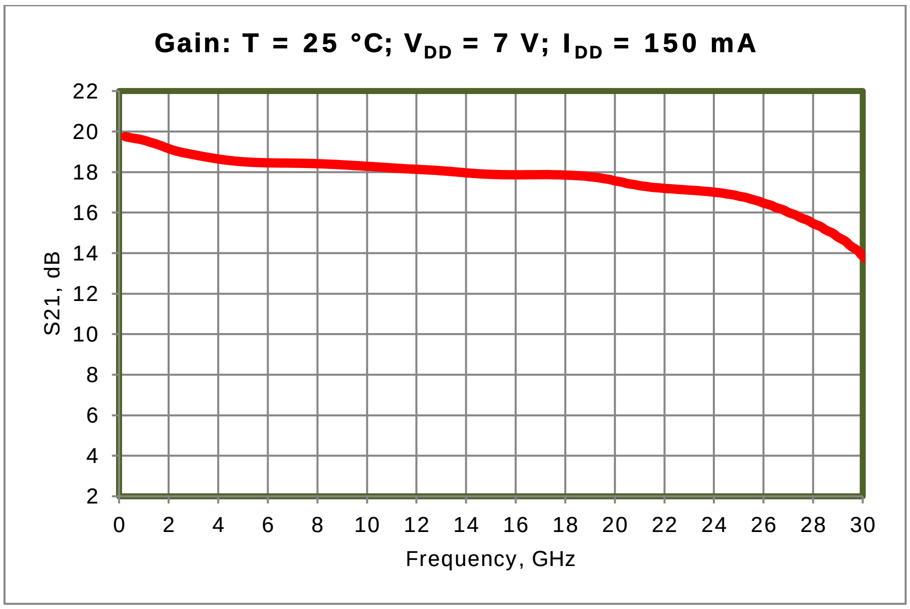


Figure 3 Gain vs. Temperature

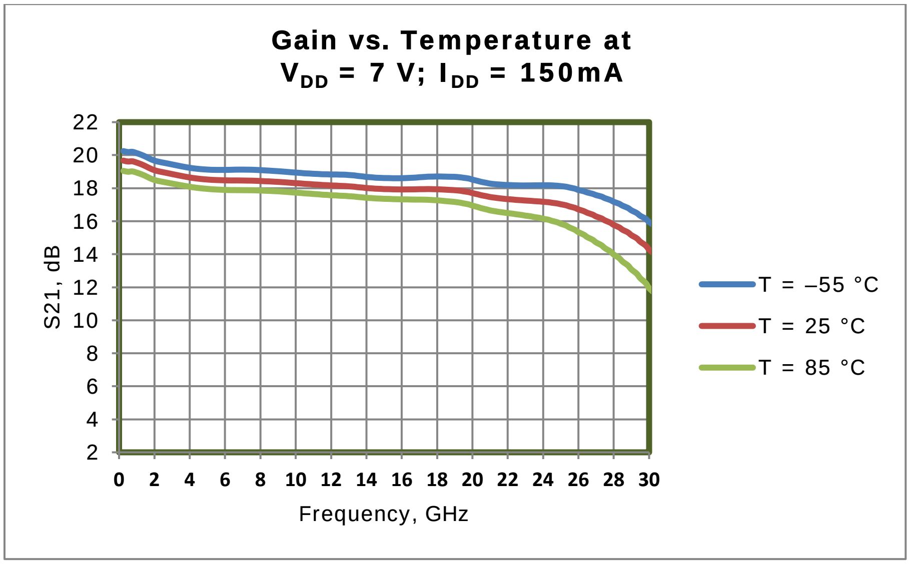


Figure 4 Gain vs. Voltage

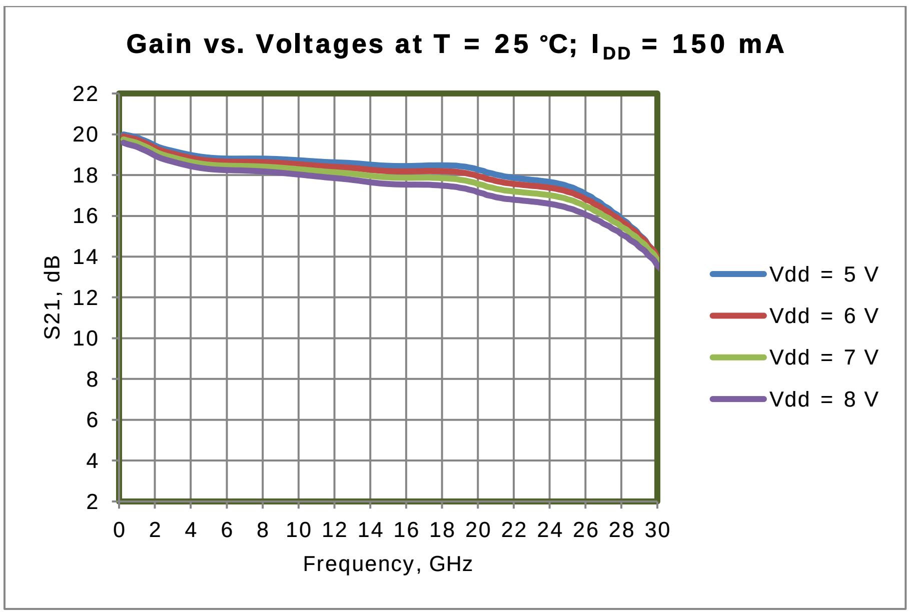


Figure 5 Input Return Loss vs. Temperature

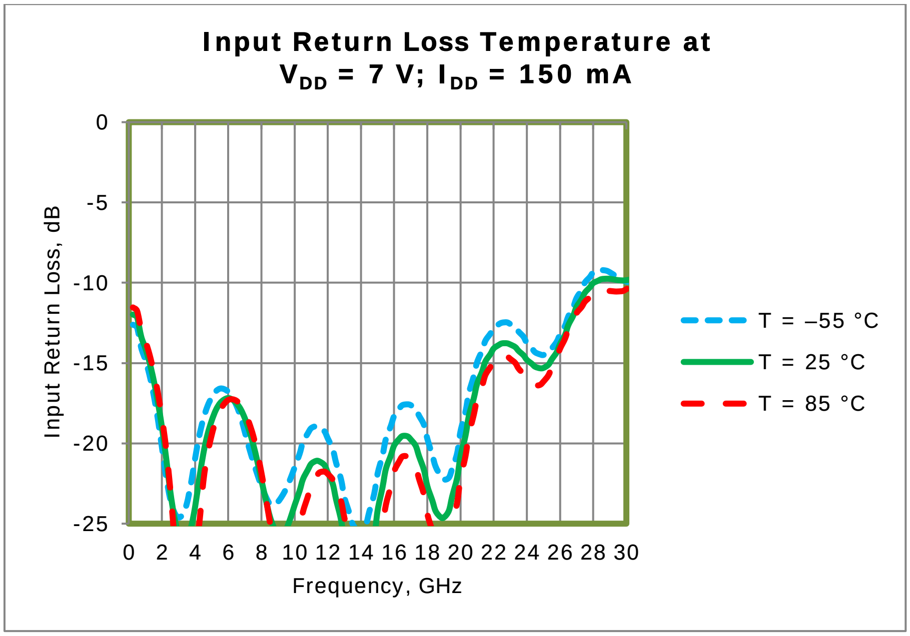


Figure 6 Output Return Loss vs. Temperature

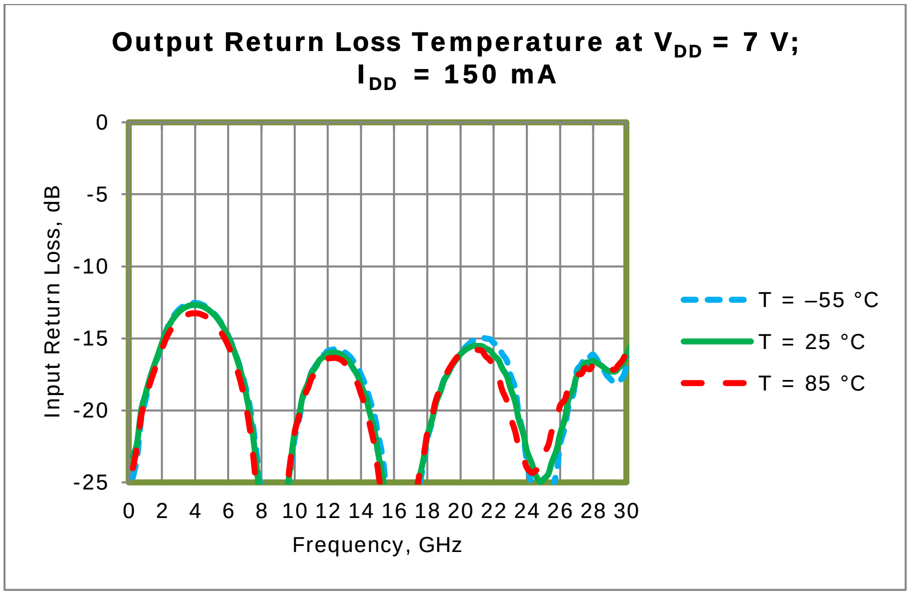


Figure 7 Noise Figure vs. Temperature

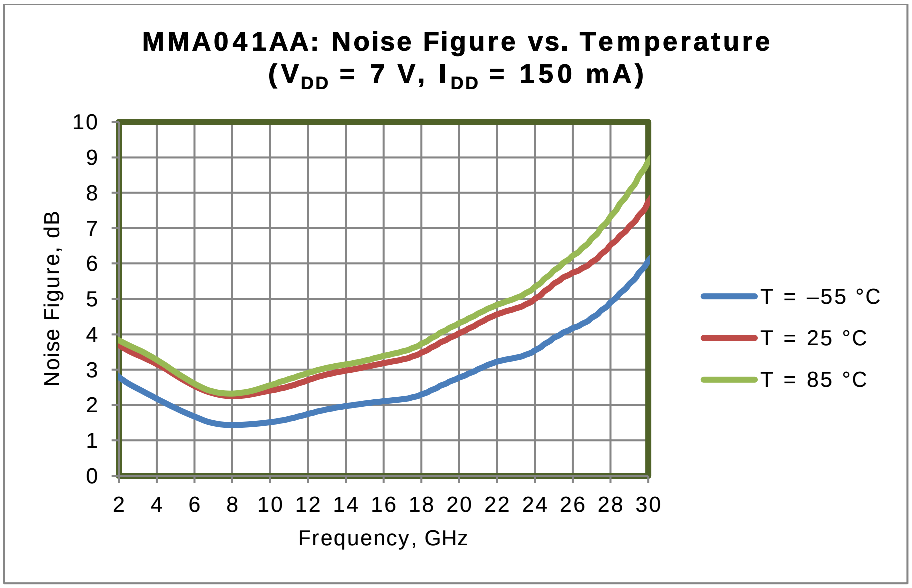


Figure 8 Noise Figure vs. Voltage

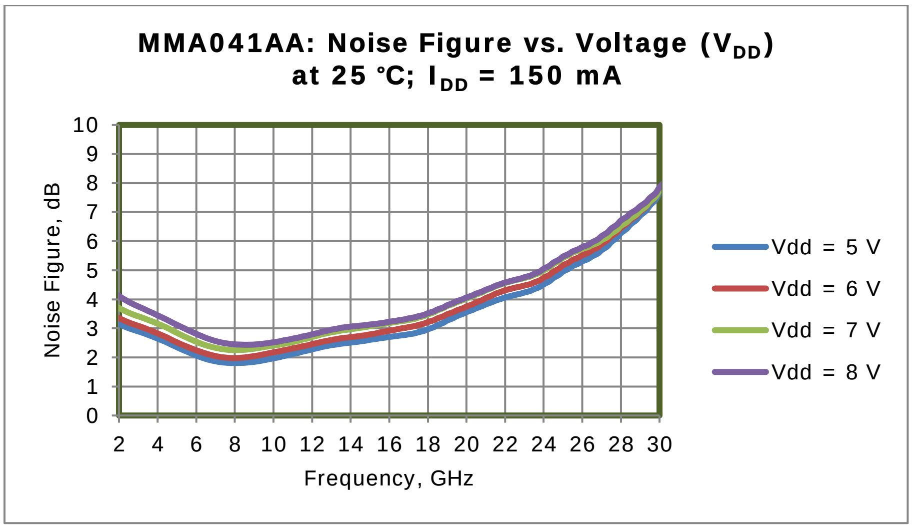


Figure 9 P1dB and P3dB Output Power vs. Temperature

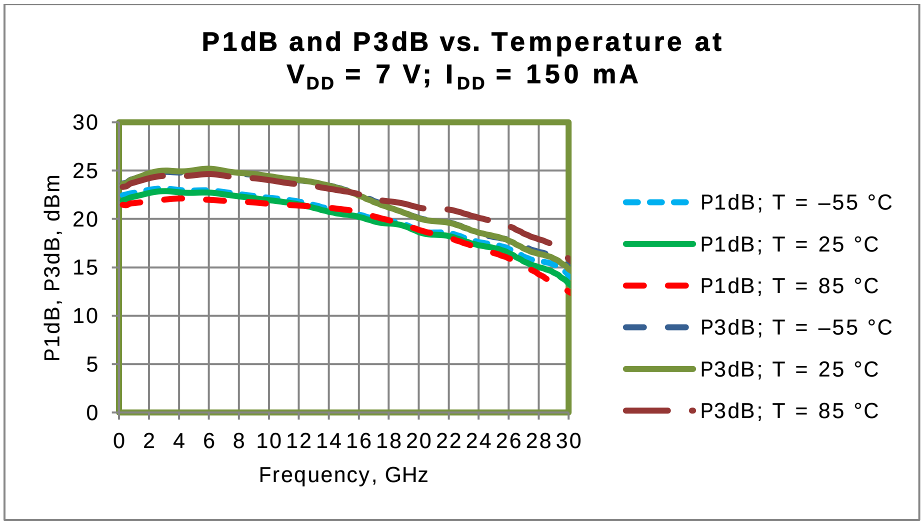


Figure 10 P1dB and P3dB Output Power vs. VDD

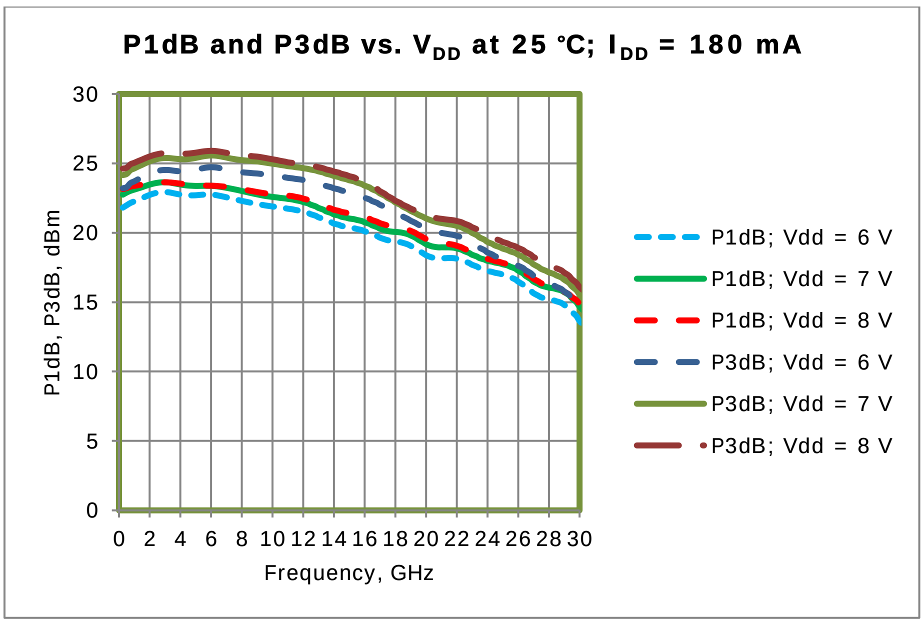


Figure 11 OIP3 vs. Temperature

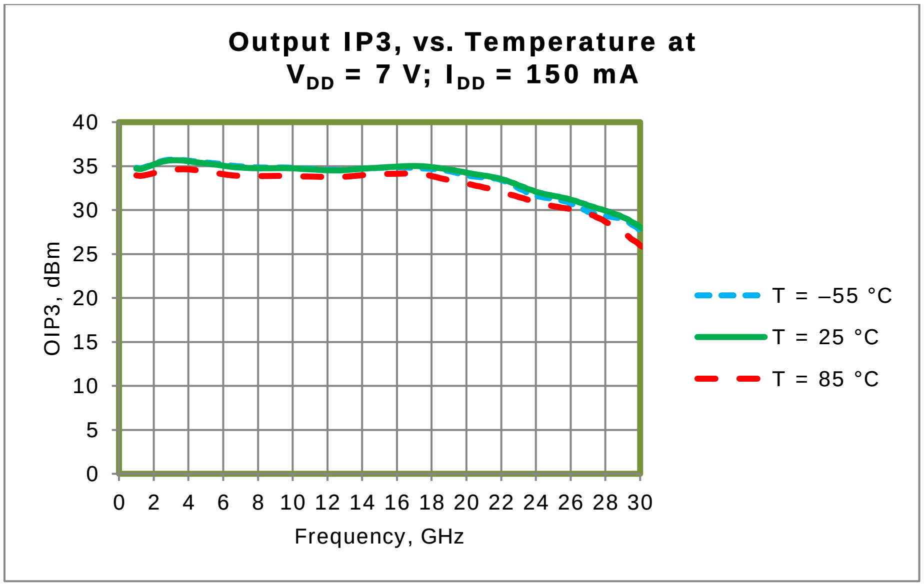
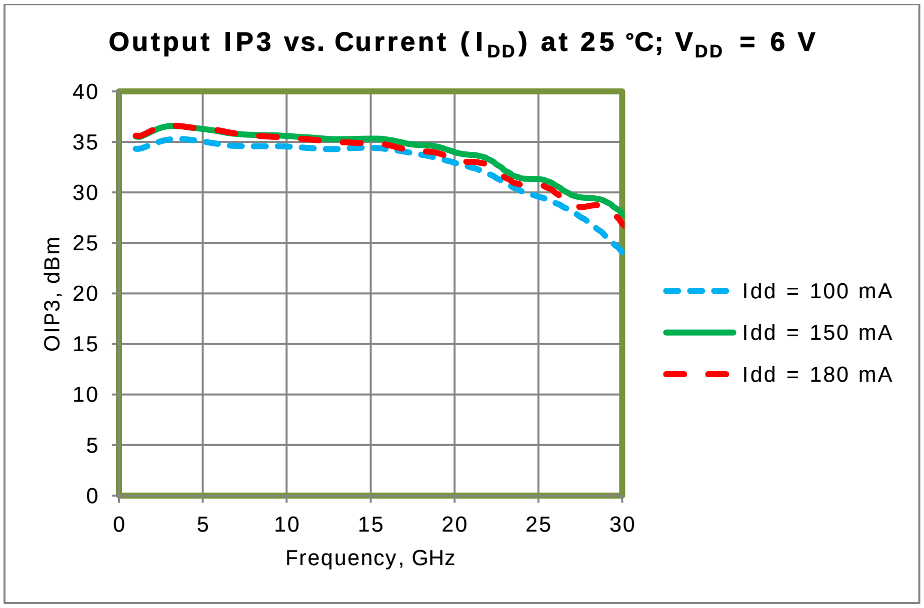


Figure 12 OIP3 vs. Current (IDD)

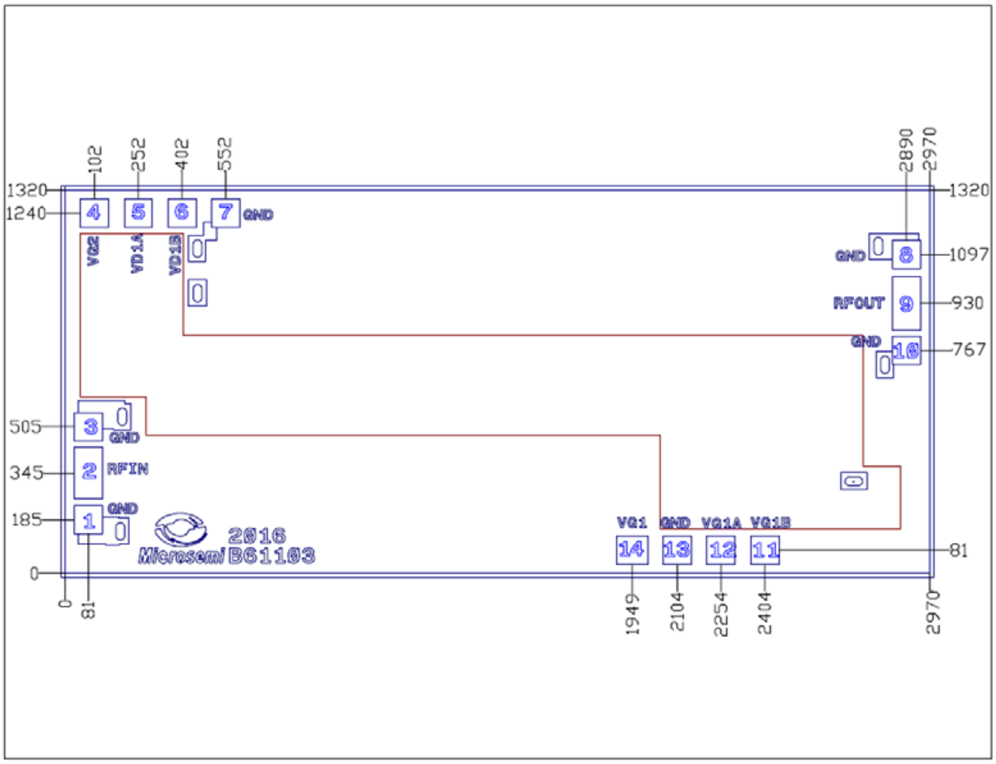


4 Chip Outline Drawing, Die Packaging, Bond Pad, and Assembly Information

4.1 Chip Outline Drawing

The following illustration shows the chip outline of the MMA041AA device. Dimensions are in µm and are relative to the zero datum locations shown in the drawing. 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 13 Chip Outline



4.2 Die Packaging Information

The following table shows the chip outline of the MMA041AA device. For additional packaging information, contact your Microsemi sales representative.

Table 3 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 of the MMA041AA device.

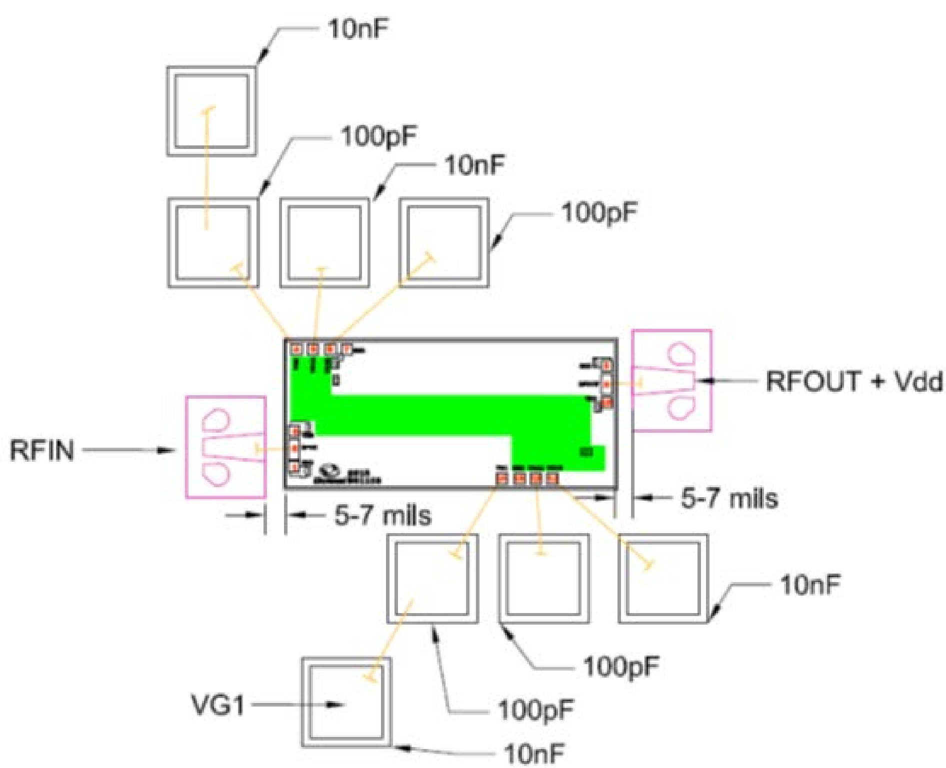
Table 4 Bond Pad Information

Bond Pad Number	Bond Pad Name	Description
1, 3, 7, 8, 10, 13	GND	Die bottom must be connected to RF/DC ground.
2	RFIN	This pad is DC-coupled and matched to 50 Ω.
4, 5, 6	VD1, VD1A, VD1B	Power supply voltage for the amplifier. External bypass capacitors are required.
9	RFOUT	This pad is DC-coupled and matched to 50 Ω.
14, 12, 11	VG1, VG1A, VG1B	Gate control for amplifier. Adjust to achieve I_{DD} = 60 mA.
Backside paddle	RF/DC GND	RF/DC ground.

4.4 Assembly Diagram

The following illustration shows the assembly diagram of the MMA041AA device.

Figure 14 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 MMA044AA device.

Table 5 Ordering Information

Part Number	Package
MMA041AA	Die