

1 GHz – 30 GHz GaAs Single-Supply MMIC Broadband Driver Amplifier in Plastic Package

MMA142PP5



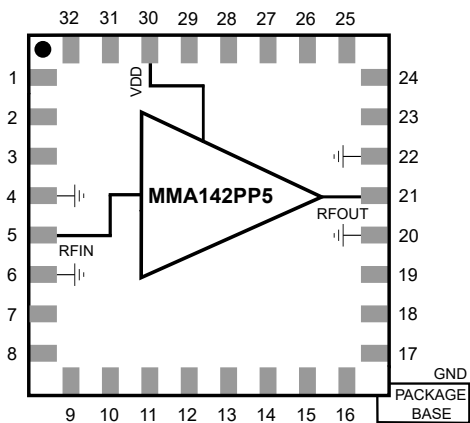
Product Overview

MMA142PP5 is a 1 GHz – 30 GHz Gallium Arsenide (GaAs) Monolithic Microwave Integrated Circuit (MMIC) pseudomorphic High-Electron Mobility Transistor (pHEMT), plastic packaged amplifier. Nominally, self-biased at 6V and 70 mA, the amplifier provides a 1 dB positive gain slope with a typical gain of 14 dB, 3 dB noise figure, 17 dBm P1dB, and 29 dBm OIP3 at 18 GHz. Bias is supplied through an on-chip bias choke and the RF I/O's are nominally matched to 50Ω, allowing for ease of integration and making it ideal for use in narrow or wide-band, test instrumentation, new aerospace, defense, and space applications.

Key Features

- Frequency range: 1 GHz to 30 GHz
- Gain: 14 dB with + 1 dB slope
- Low noise figure: 3 dB at 18 GHz
- High OIP3: +29 dBm at 18 GHz
- Single supply: self-biased at +6V at 70 mA
- 50Ω matched input/output
- Plastic QFN 5 mm × 5 mm package

Amplifier Functional Diagram



Applications

- Wide-band microwave radios
- Test and measurement instrumentation
- Electronic warfare (EW), electronic countermeasures (ECM), and electronic counter-countermeasures (ECCM)
- Aerospace, Defense, and Space
- Telecom infrastructure
- Microwave and millimeter-wave communication systems

Overall Performance

Parameter	Typ.	Units
Frequency range	1 – 30	GHz
Gain	14	dB
NF at 18 GHz	3	dB
P1dB at 18 GHz	+17	dBm
OIP3 at 18 GHz	+29	dBm
Current at +6V supply	70	mA

Export Classification: EAR99

Performance Curves

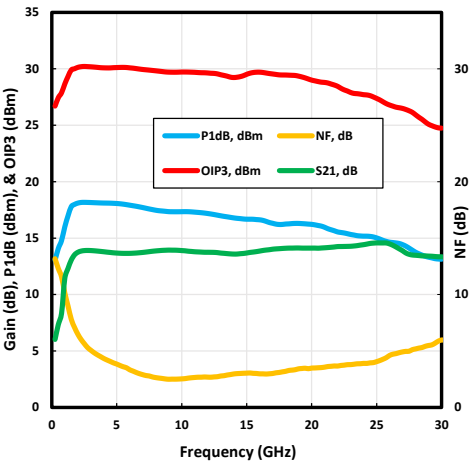


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1. Electrical Specifications

1.1. Typical Electrical Performance

Table 1-1. Typical Electrical Performance at 25 °C, $V_{DD} = +6V$, $I_{DD} = 70$ mA (unless otherwise mentioned)

Parameter	Frequency Range	Min	Typ.	Max	Units
Frequency range		1		30	GHz
Gain	1.5 GHz – 15 GHz	12.5	14		dB
	15 GHz – 25 GHz	13	15		
	25 GHz – 30 GHz	12.5	14		
Gain flatness	1 GHz – 14 GHz		± 0.5		dB
	14 GHz – 30 GHz		± 1		
Noise figure	1.5 GHz – 10 GHz		4	8.6	dB
	10 GHz – 20 GHz		3	4	
Input return loss	1.5 GHz – 15 GHz	13	15		dB
	15 GHz – 25 GHz	13	15		
	25 GHz – 30 GHz	9	12		
Output return loss	1.5 GHz – 15 GHz		12		dB
	15 GHz – 25 GHz		12		
	25 GHz – 30 GHz		12		
P1dB	1.5 GHz – 15 GHz	14	18		dBm
	15 GHz – 25 GHz	13	17		
	25 GHz – 30 GHz	11	15		
P_{sat}	1.5 GHz – 15 GHz		20		dBm
	15 GHz – 25 GHz		18		
	25 GHz – 30 GHz		16		
OIP3	1.5 GHz – 15 GHz	28	30		dBm
	15 GHz – 25 GHz	27	29		
	25 GHz – 30 GHz	24	27		
IM2 at 10 dBm	1.5 GHz – 15 GHz		-40		dBc
	15 GHz – 25 GHz		-41		
	25 GHz – 30 GHz		-42		
V_{DD} (drain voltage supply)			6		V
I_{DD} (drain current)		65	70	90	mA

1.2. Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MMA142PP5 device at 25 °C, unless otherwise specified. Exceeding any of the maximum ratings could cause damage and/or latent defects to the device.

Table 1-2. Absolute Maximum Ratings

Parameter	Rating
Drain bias voltage (V_{DD})	+8V
Drain bias current (I_{DD})	240 mA
Channel temperature	175 °C
Thermal resistance	51 °C/W
Operating temperature	-55 °C to +85 °C
Storage temperature	-65 °C to +150 °C



ESD Sensitive Device

1.3. Typical Performance Curves

1.3.1. Typical Performances vs. Temperature

The graphs shown in Figures 1-1 through 1-27 represent the Typical Performance versus Temperature curves of the MMA142PP5 device under specific bias conditions. All measurements were taken using the test circuit shown in [Figure 3-2](#)

Figure 1-1. Gain vs. Temperature @5V

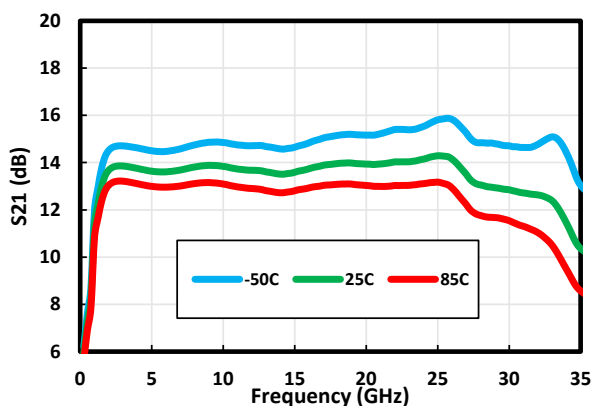


Figure 1-2. Gain vs. Temperature @6V

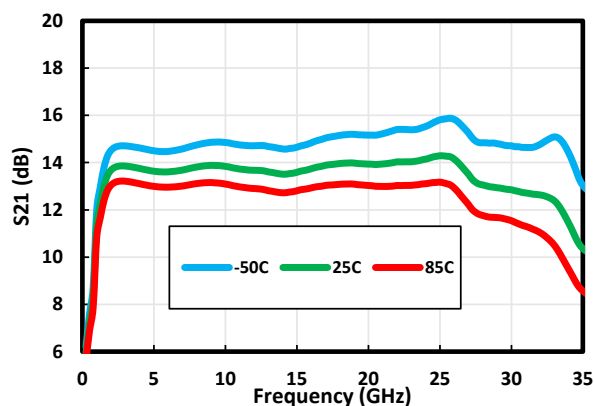


Figure 1-3. Gain vs. Temperature @7V

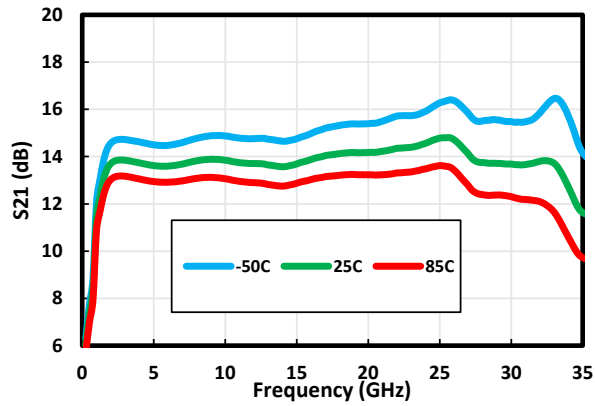


Figure 1-4. S11 vs. Temperature @5V

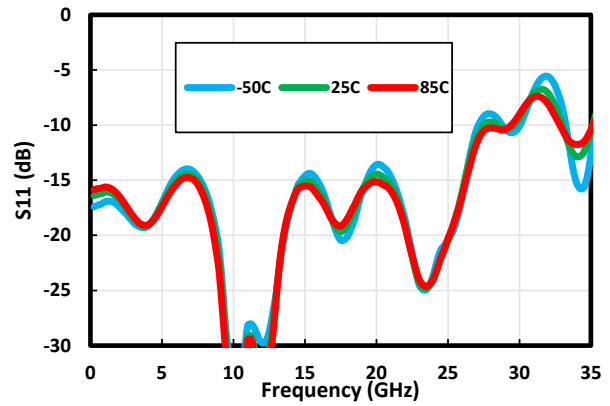


Figure 1-5. S11 vs. Temperature @6V

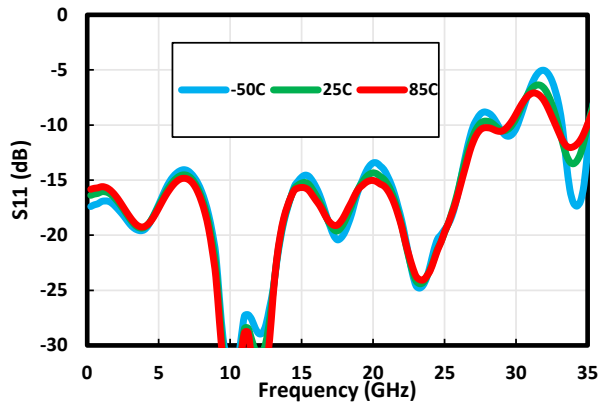


Figure 1-6. S11 vs. Temperature @7V

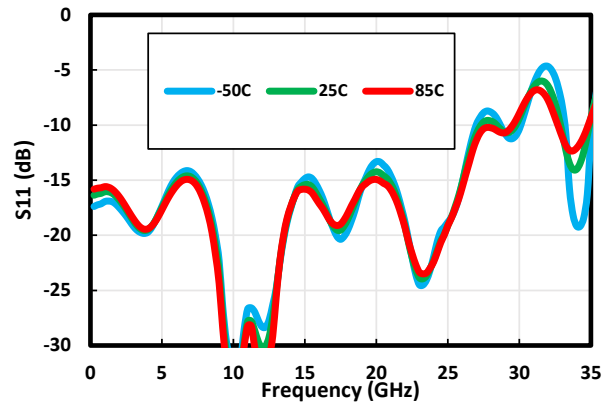


Figure 1-7. S22 vs. Temperature @5V

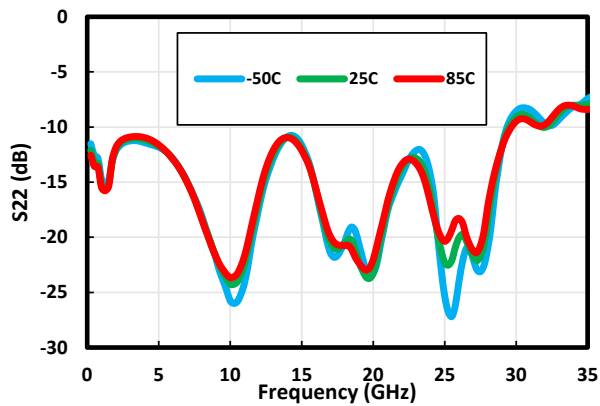


Figure 1-8. S22 vs. Temperature @6V

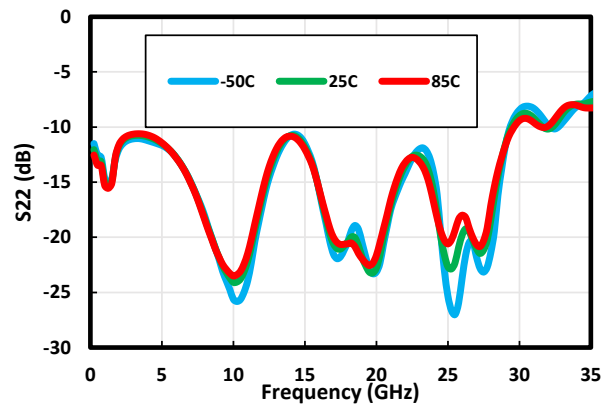


Figure 1-9. S22 vs. Temperature @7V

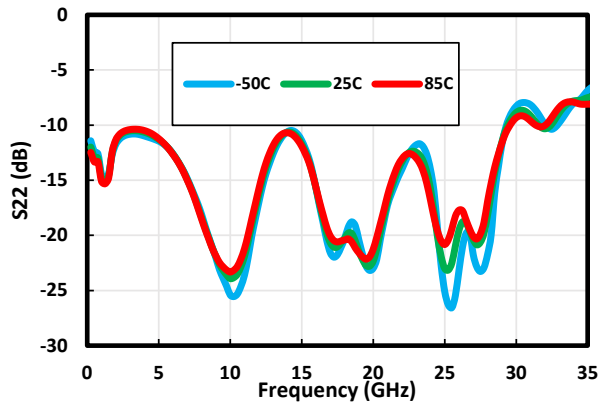


Figure 1-10. NF vs. Temperature @5V

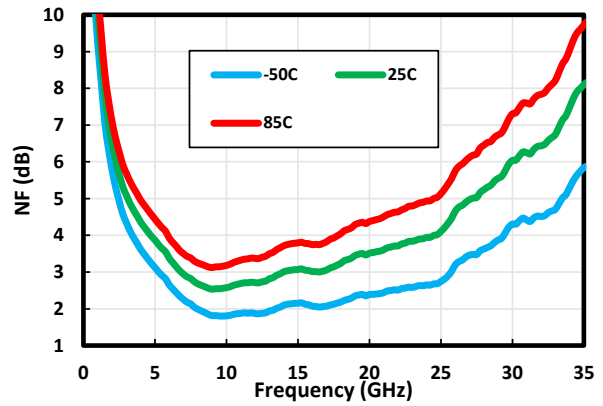


Figure 1-11. NF vs. Temperature @6V

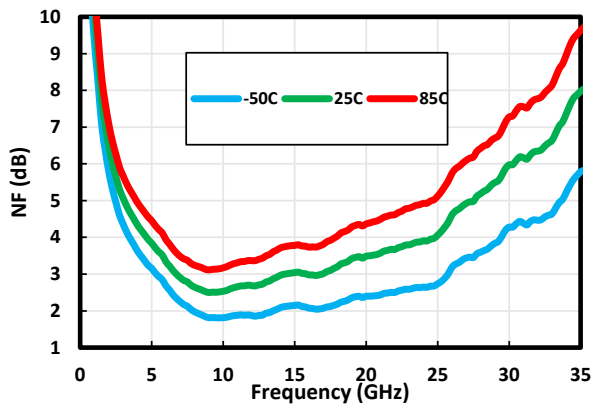


Figure 1-12. NF vs. Temperature @7V

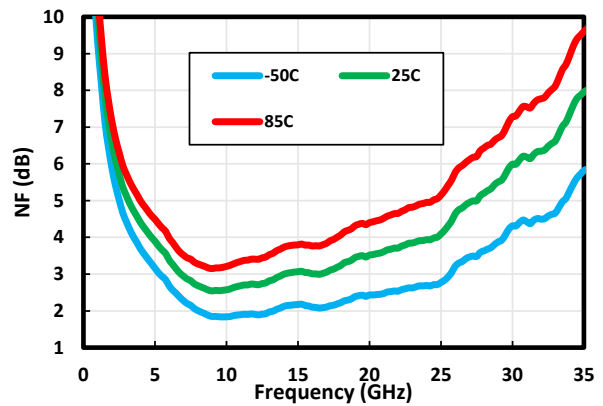


Figure 1-13. P1dB vs. Temperature @5V

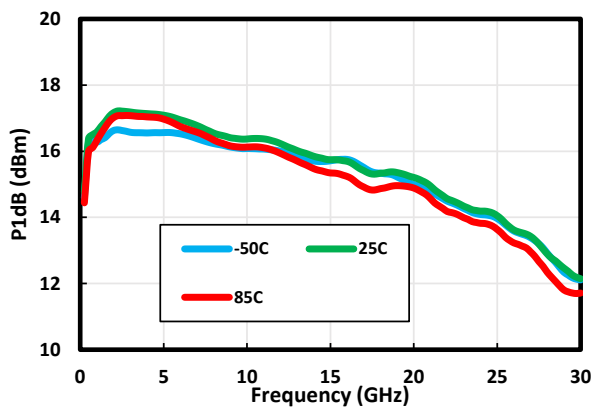


Figure 1-14. P1dB vs. Temperature @6V

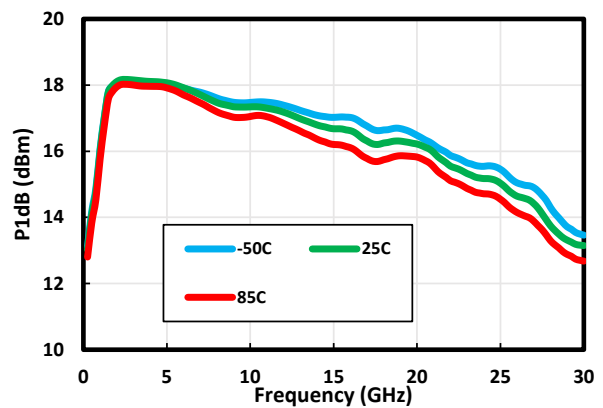


Figure 1-15. P1dB vs. Temperature @7V

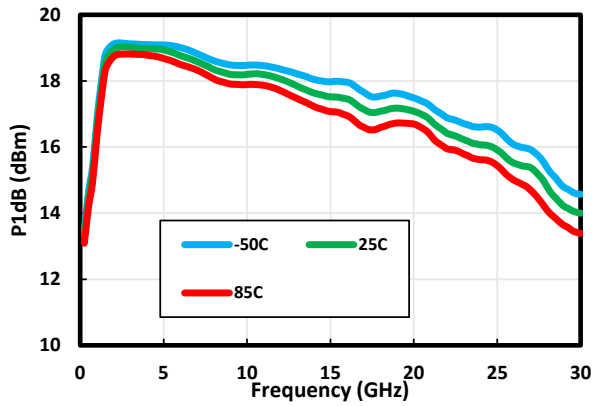


Figure 1-16. P_{sat} vs. Temperature @5V

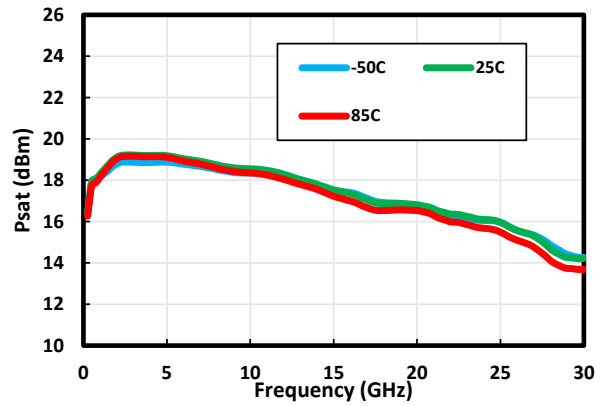


Figure 1-17. P_{sat} vs. Temperature @6V

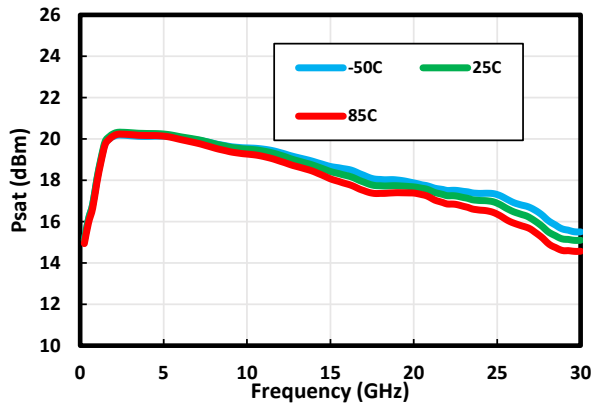


Figure 1-18. P_{sat} vs. Temperature @7V

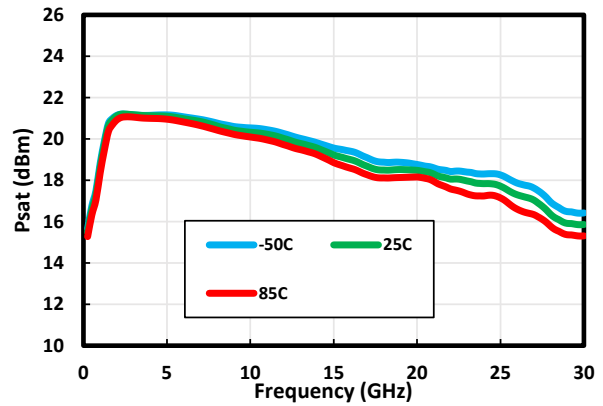


Figure 1-19. OIP2(low) vs. Temperature @5V

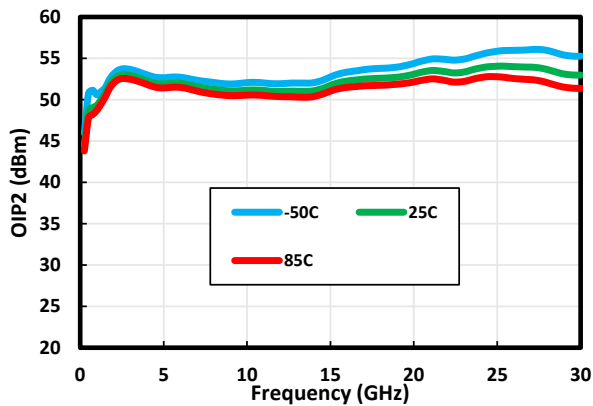


Figure 1-20. OIP2(low) vs. Temperature @6V

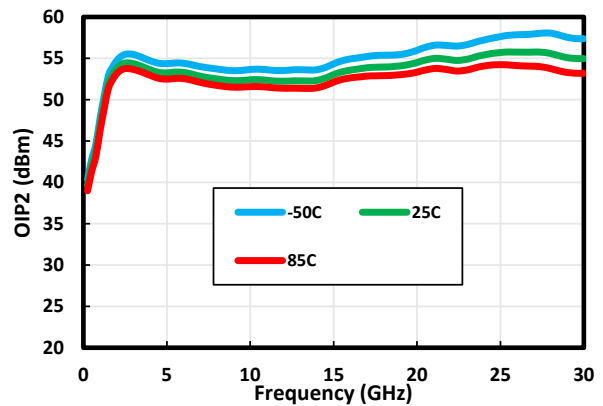


Figure 1-21. OIP2(low) vs. Temperature @7V

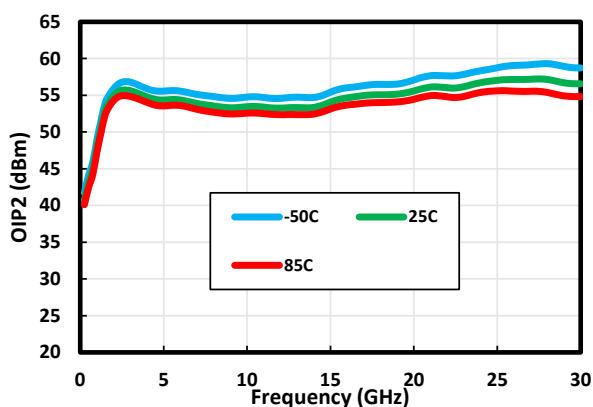


Figure 1-22. OIP3 vs. Temperature @5V

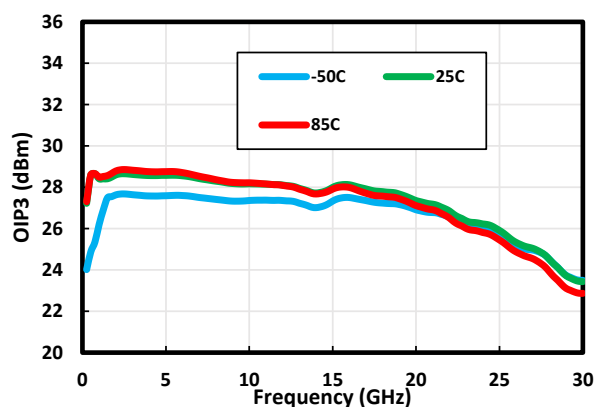


Figure 1-23. OIP3 vs. Temperature @6V

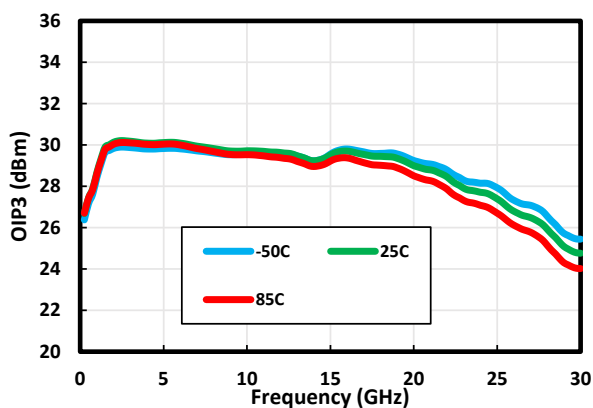


Figure 1-24. OIP3 vs. Temperature @7V

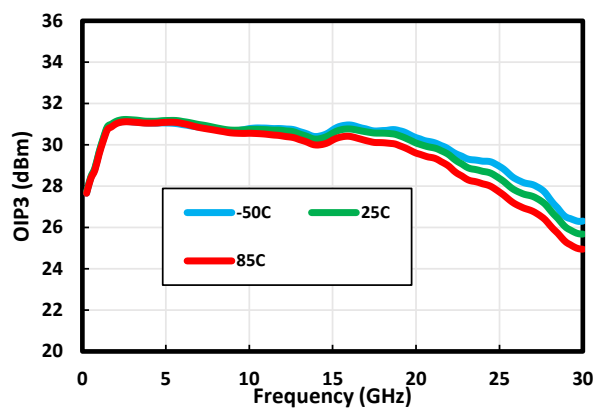


Figure 1-25. IM3 vs. Temperature @5V

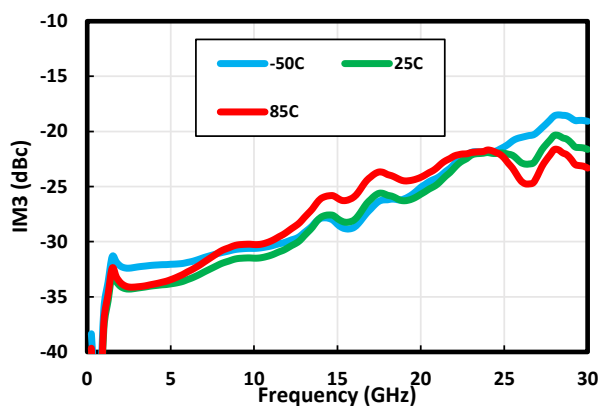


Figure 1-26. IM3 vs. Temperature @6V

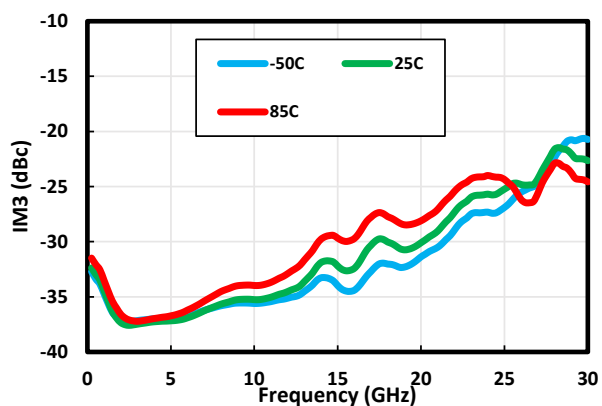
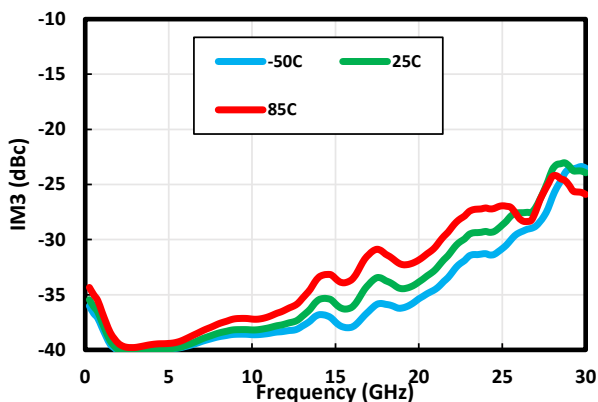


Figure 1-27. IM3 vs. Temperature @7V



1.3.2. Typical Performances vs. Bias

The graphs shown in Figures 1-28 through 1-39 represent the Typical Performance versus Bias curves of the MMA142PP5 under constant temperature of 25 °C. All measurements were taken using the test circuit shown in [Figure 3-2](#)

Figure 1-28. Gain vs. V_{DD}

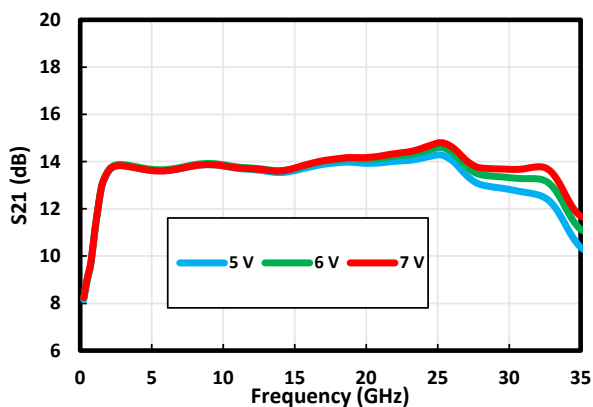


Figure 1-29. Low Frequency Gain vs. V_{DD}

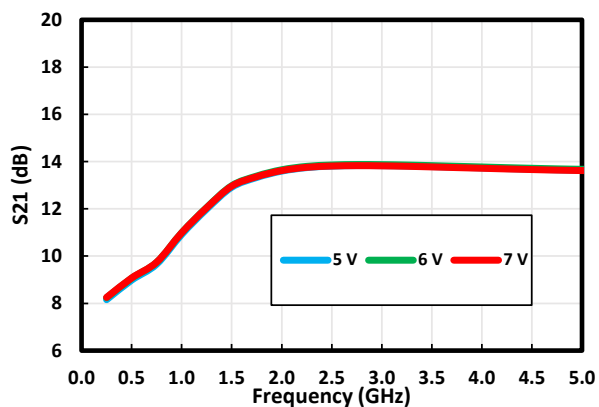


Figure 1-30. S11 vs. V_{DD}

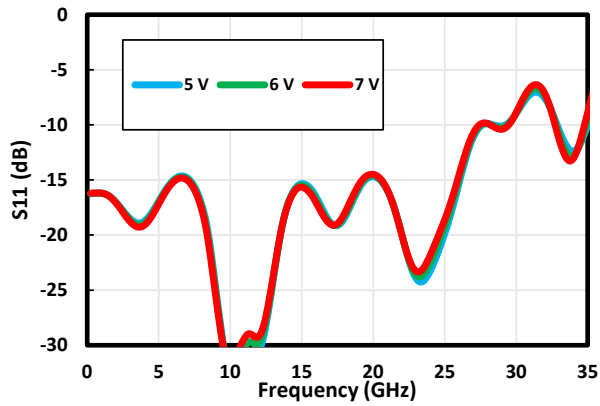


Figure 1-31. S22 vs. V_{DD}

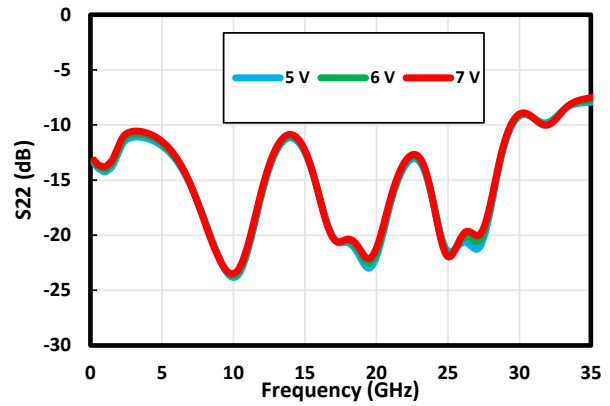


Figure 1-32. S12 vs. V_{DD}

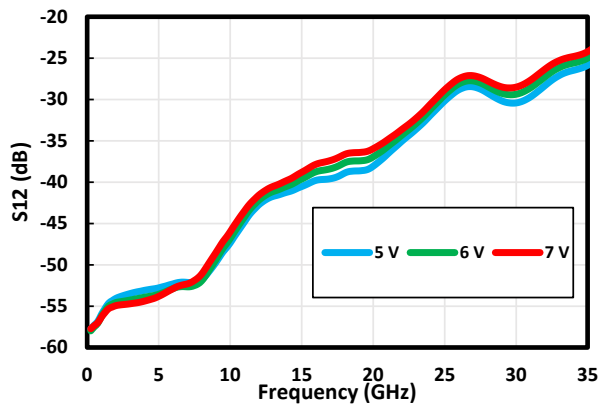


Figure 1-33. NF vs. V_{DD}

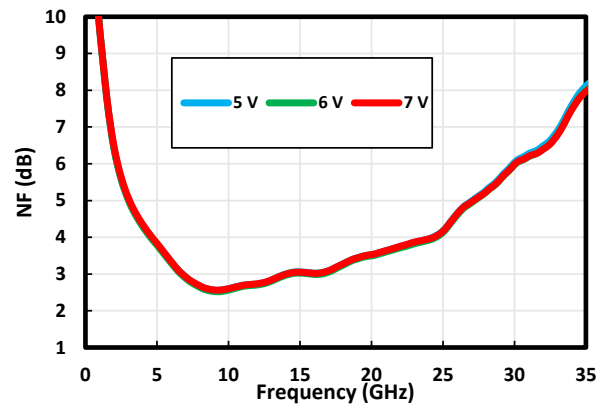


Figure 1-34. P1dB vs. V_{DD}

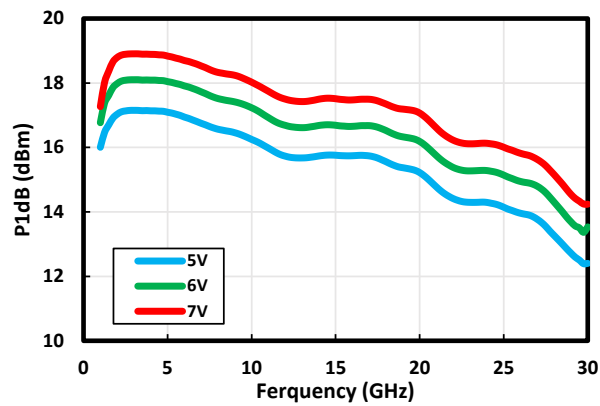


Figure 1-35. P_{sat} vs. V_{DD}

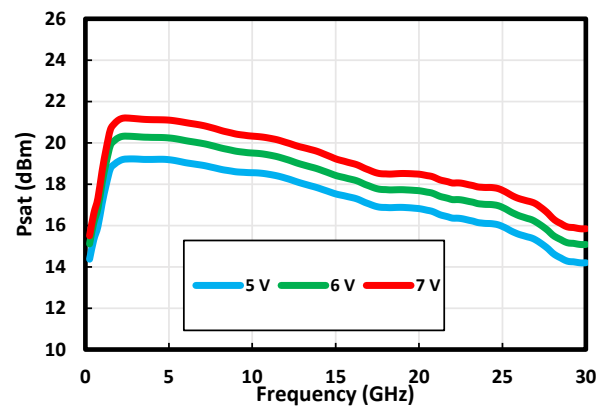


Figure 1-36. OIP3 vs. V_{DD}

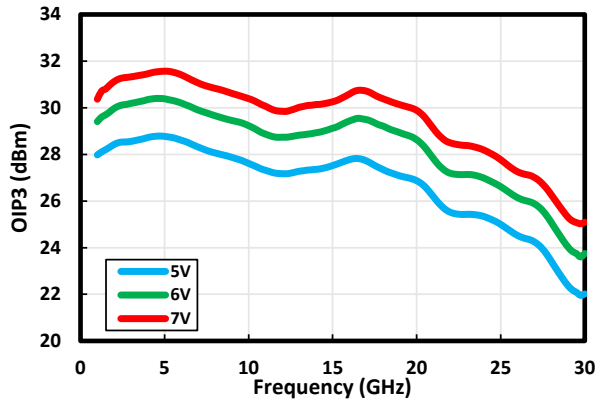


Figure 1-37. OIP2_{LOW} vs. V_{DD}

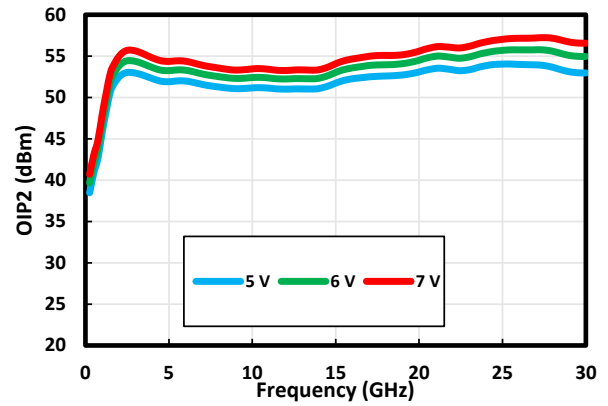


Figure 1-38. IM3 vs. V_{DD} at 10 dBm per tone

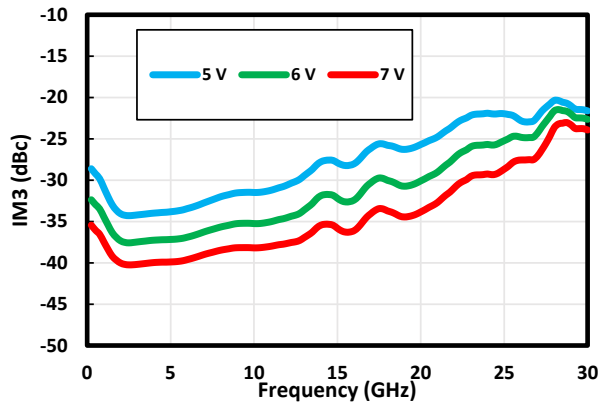
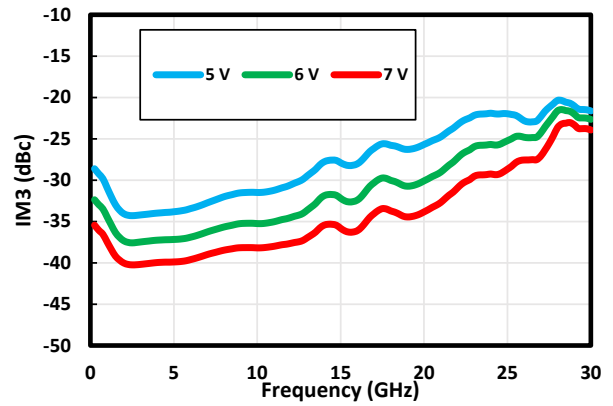


Figure 1-39. 2nd Harmonic vs. V_{DD} at 10 dBm per tone



1.3.3. Typical Performances vs. Output Power

The graphs shown in Figures 1-40 through 1-48 represent the Typical Performance versus Output power curves of the MMA142PP5 under constant temperature of 25 °C. All measurements were taken using the test circuit shown in [Figure 3-2](#)

Figure 1-40. IM2 vs. Power @5V

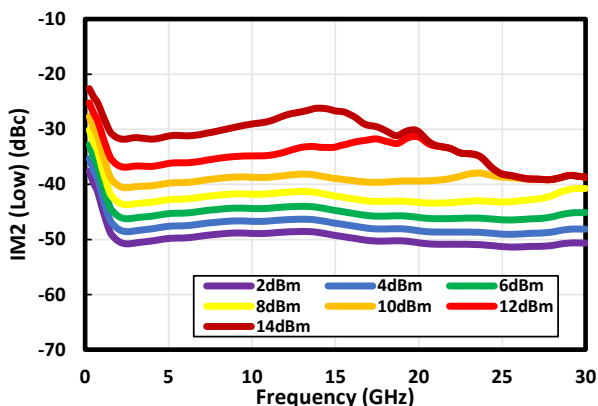


Figure 1-41. IM2 vs. Power @6V

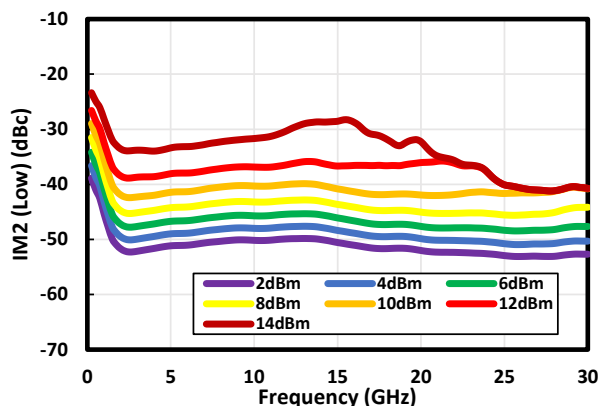


Figure 1-42. IM2 vs. Power @7V

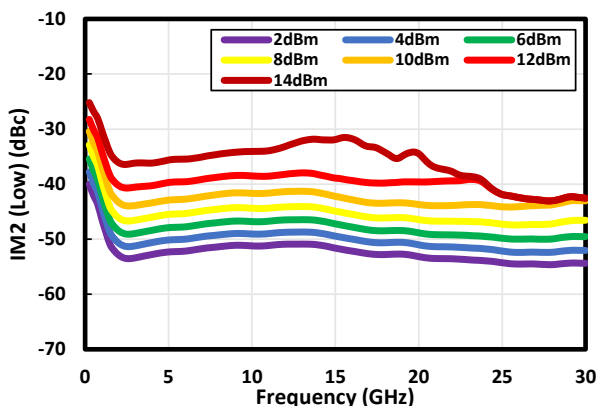


Figure 1-43. IM3 vs. Power @5V

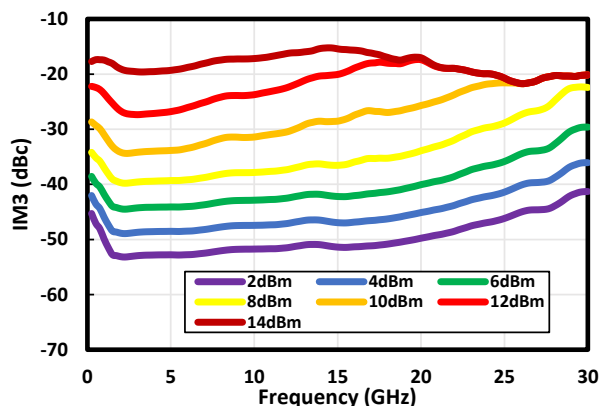


Figure 1-44. IM3 vs. Power @6V

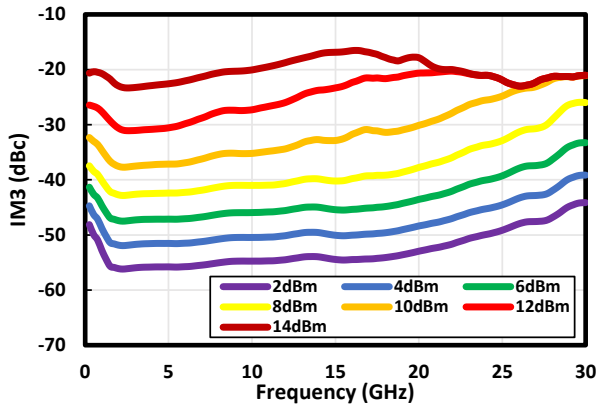


Figure 1-45. IM3 vs. Power @7V

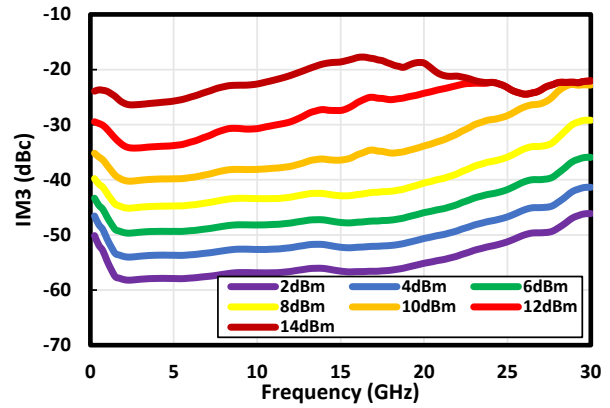


Figure 1-46. 2nd Harmonic vs. Power @ 5V

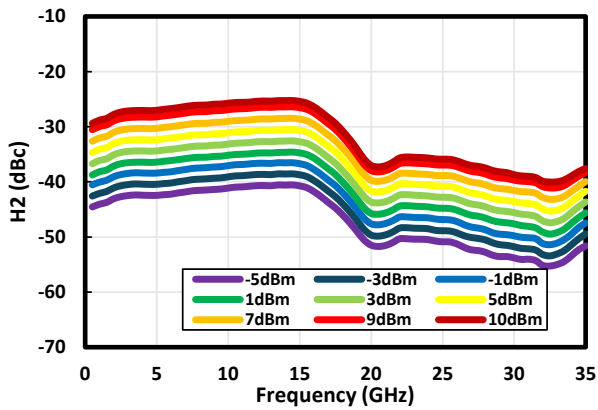


Figure 1-47. 2nd Harmonic vs. Power @ 6V

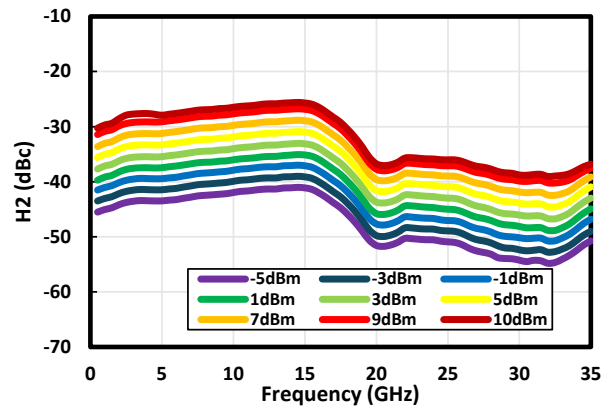
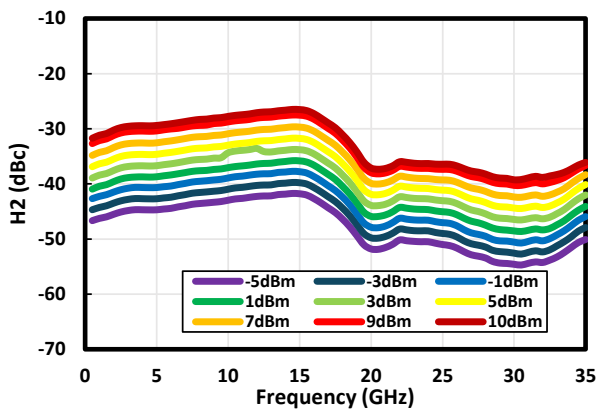


Figure 1-48. 2nd Harmonic vs. Power @ 7V



2. Package Specifications

For additional packaging information, contact your Microchip sales representative.

Figure 2-1. Package Outline Drawing (mm[Inches])

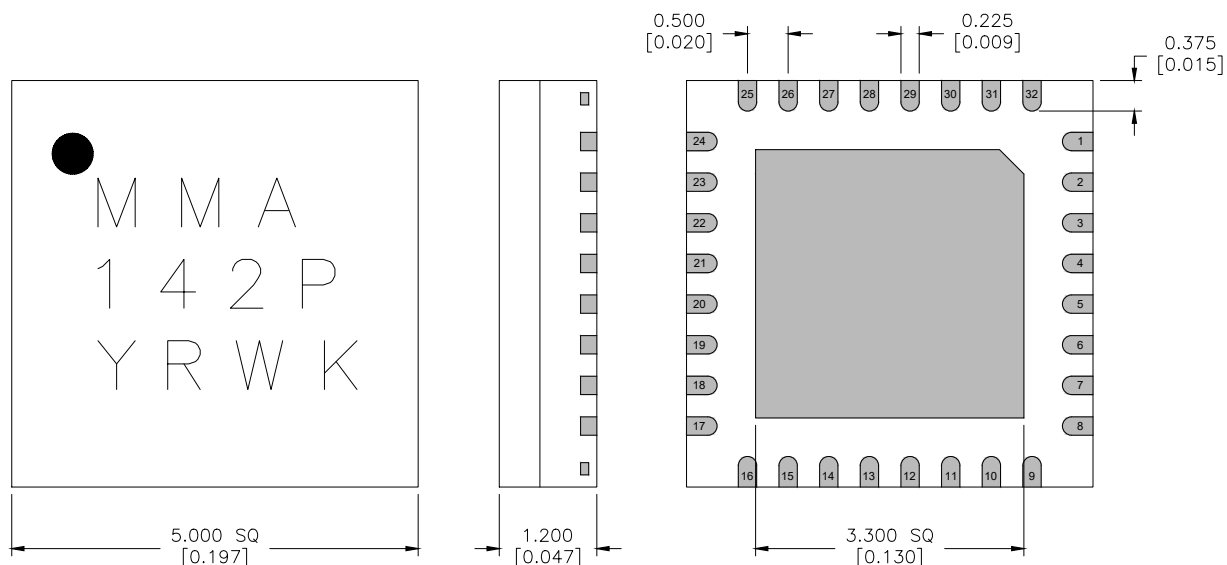


Table 2-1. Package Information

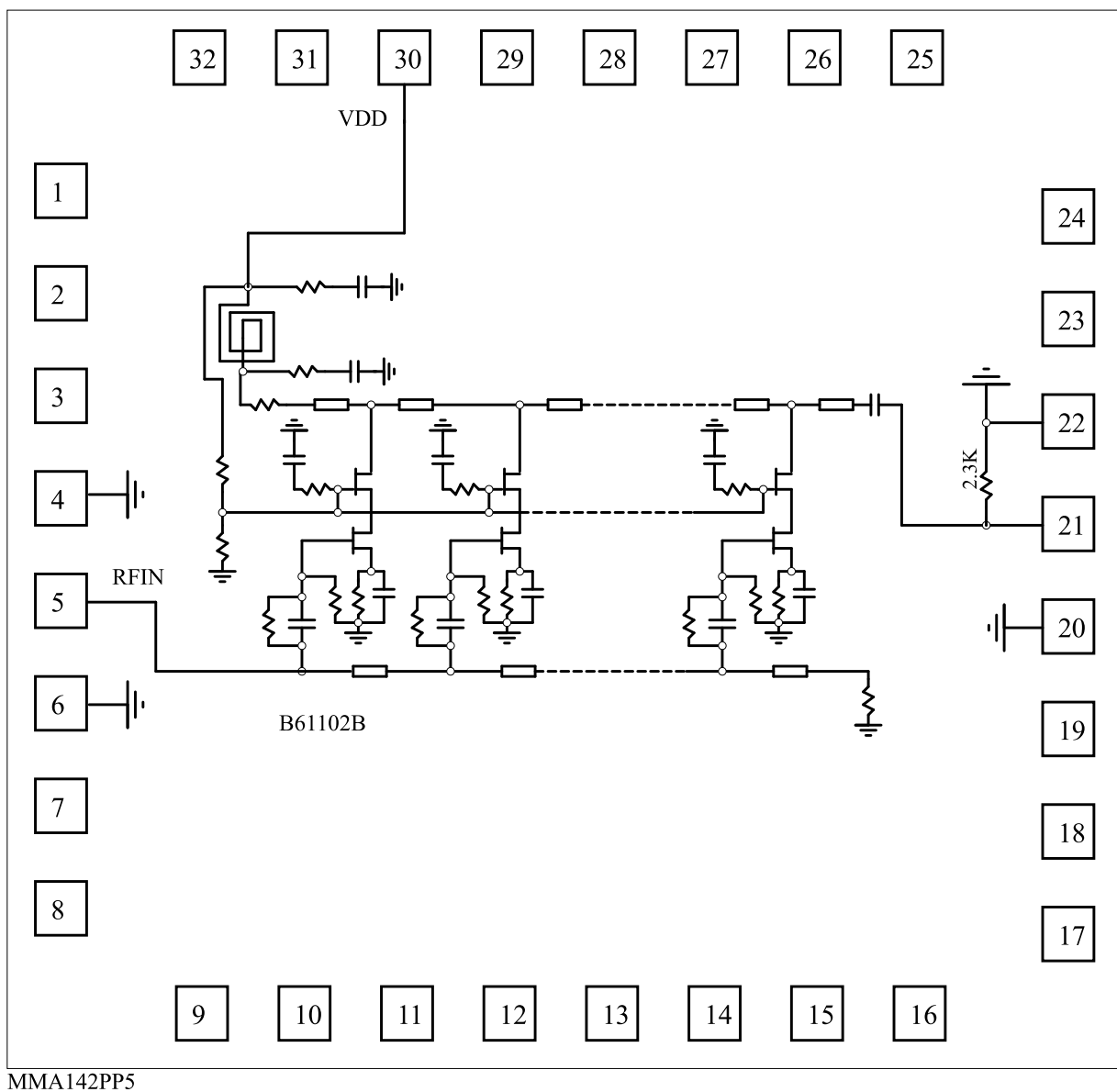
Material	Lead Frame
Plating	Ni: 0.50 μm min Pd: 0.08 μm min Au: 0.05 μm max

Table 2-2. PIN Description

PIN Number	Pad Name	Pad Description
5	RFIN	RF Input Pad -DC coupled to 50Ohm .
21	RFOUT	RF output pad - DC decoupled to FET Drains and nominally matched to 50 Ω , having 2.3 k Ω resistor connected to ground.
30	VDD	This pad is used to supply +VDD voltage bias to the MMIC
4,6,20,22	GND	Those Ground connections to be merged with Circuit ground and Backside Pad
1-3,7-19,23-29 and 31-32	N/C	Un-Connected Pads, Recommended to be grounded
Backside Paddle	RF/DC GND	Must be connected to RF/DC Ground

3. Application Circuit

Figure 3-1. MMA142PP5: Functional Diagram



MMA142PP5

Figure 3-2. Eval PCB Schematic

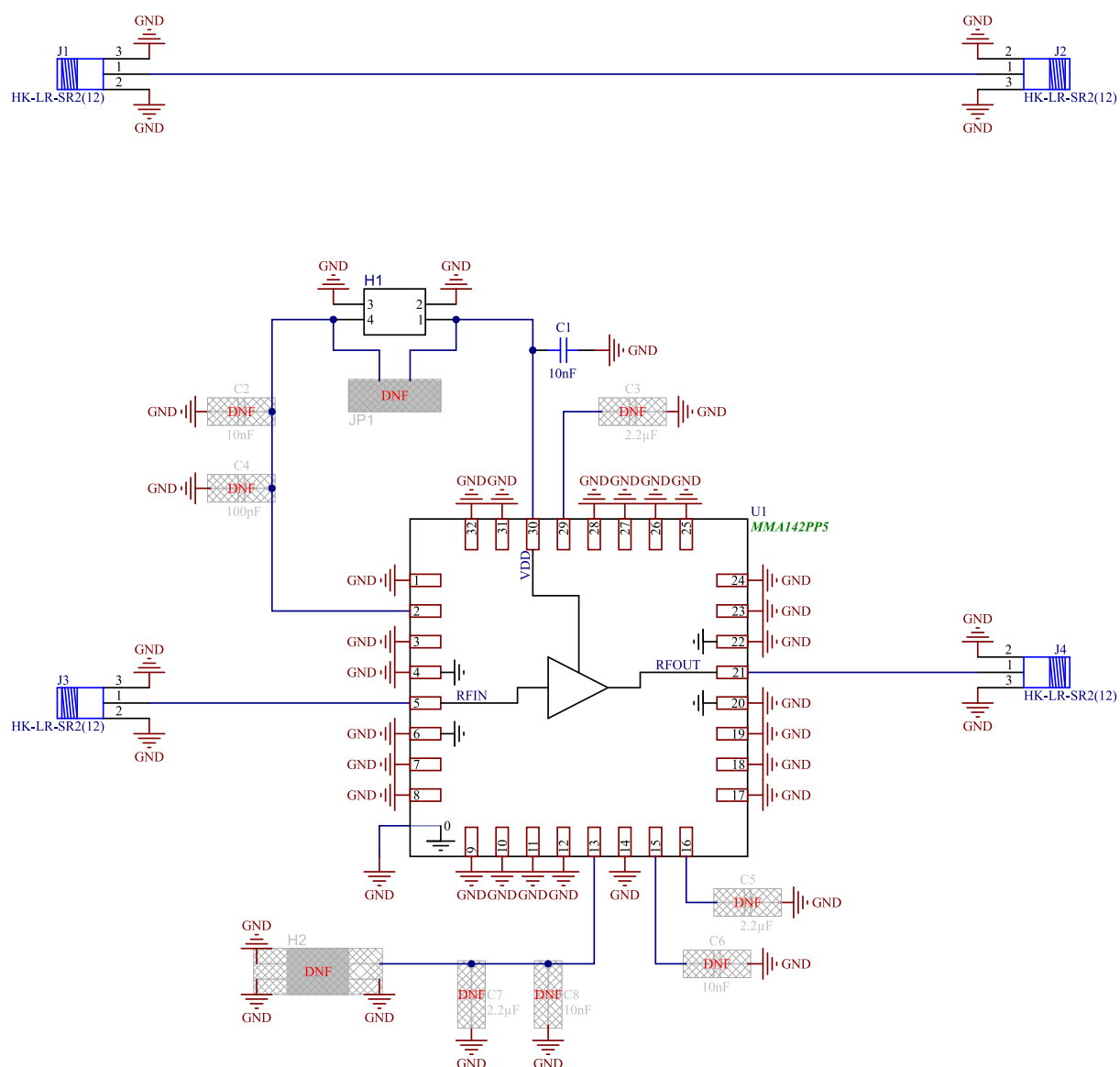


Figure 3-3. Eval PCB

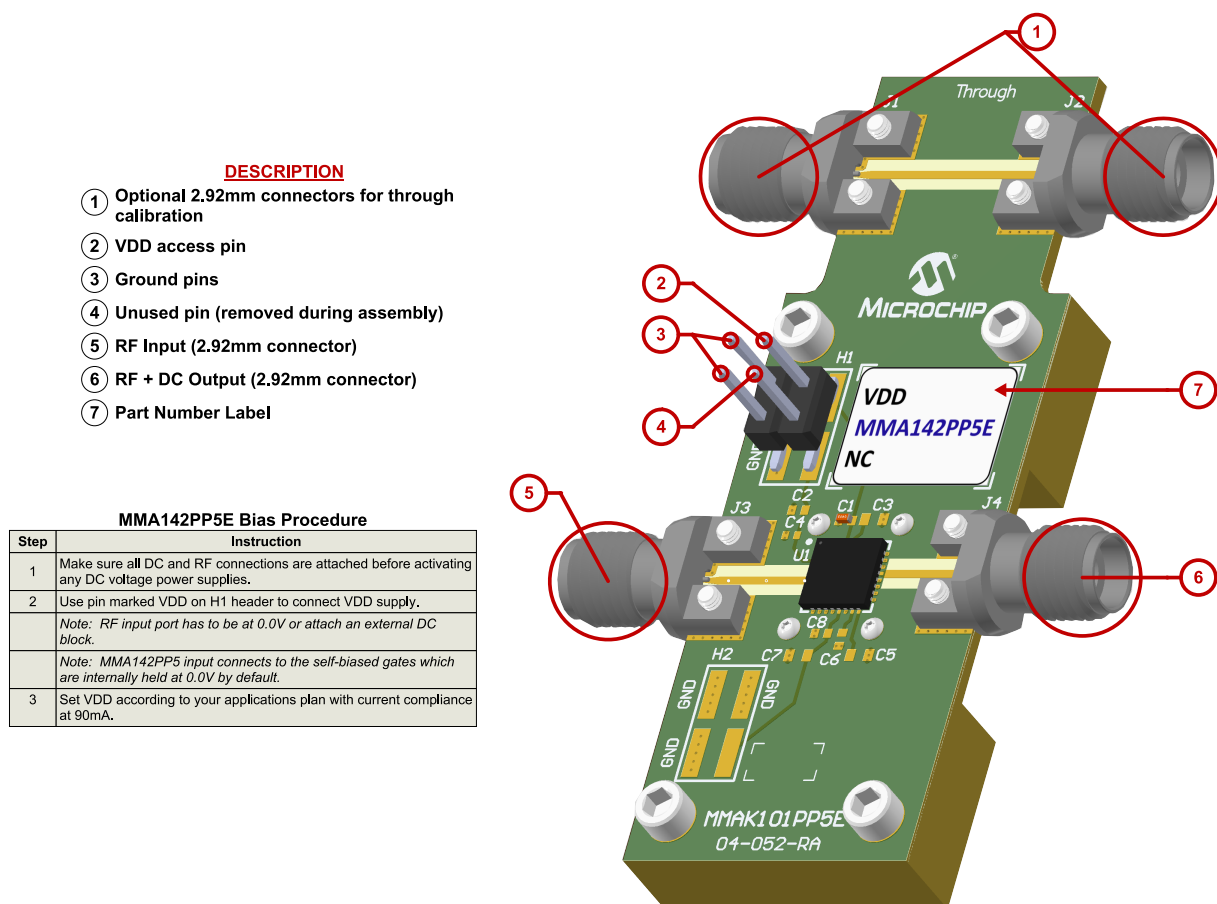


Table 3-1. Bill of Material

Designation	Description	Manufacturer Part Number	Quantity
U1	MMA142PP5 5X5 QFN	MMA142PP5	1
J1, J2, J3, J4	CONN 2.9MM FEMALE PCB EDGE MOUNT .012 PIN	25-146-1000-90	4
C1	CAP CER 10000PF 50V X7R 0402	GRM155R71H103KA88D	1
p1	PCB Backplate		1
J1	CONN HEADER SMD 4POS 2.54MM	15-91-2040	1

4. Ordering, Shipping, and Handling

4.1. Handling 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 Microchip application note AN01: GaAs MMIC Handling and Die Attach Recommendations.

4.2. Ordering Information

For additional ordering information, contact your Microchip sales representative.

Part Number	Package
MMA142AA	Die (Refer to MMA142AA Datasheet)
MMA142PP5	5 mm × 5 mm, 32L Plastic QFN
MMA142PP5E	MMA142PP5 Eval PCB

4.3. Packing Information

Standard Format
Tape and Reel

Note: Contact your Microchip sales representative for the minimum quantity order

5. Revision History

Table 5-1. Revision History

Revision	Date	Description
B	01/2026	Updated electrical specifications, drawings, and performance curves.
A	12/2021	Document created.

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