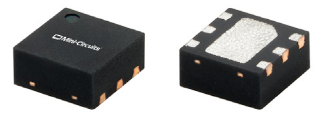
MMIC SURFACE MOUNT

Low Noise Amplifier PMA2-123LNW+

50Ω 0.01 to 12 GHz High Linearity

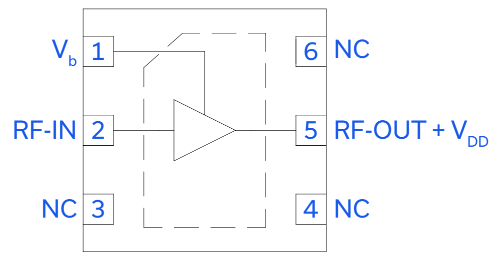


Generic photo used for illustration purposes only

THE BIG DEAL

- Low Noise Figure, Typ. 1.7 dB
- High OIP3, Typ. +30 dBm
- High P1dB, Typ. +19.1 dBm
- Single +5 V Supply Voltage
- 2x2 mm, 6-Lead QFN-Style Package

FUNCTIONAL DIAGRAM



APPLICATIONS

- Test & Measurement Equipment
- WiFi, WAN, UMTS, LTE
- Back Haul Radio Systems
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

The PMA2-123LNW+ is a GaAs pHEMT-based wideband, ultra-low noise MMIC amplifier with high OIP3 and flat gain. Operating from 0.01 to 12 GHz, this amplifier features typical 1.7 dB noise figure, 19.6 dB gain, +19.1 dBm P1dB, and +30 dBm OIP3. This combination of characteristics makes it ideal for sensitive, high dynamic range receiver applications. PMA2-123LNW+ operates on a single +5 V supply, is well matched to 50Ω, and comes in a small, low profile 2x2 mm QFN-style package for easy integration into dense circuit board layouts.

KEY FEATURES

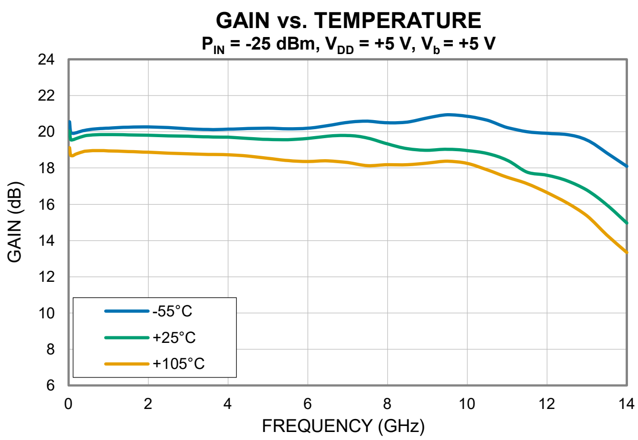
Feature	Advantages
Low Noise Figure, Typ. 1.7 dB	This ultra-low noise MMIC device enables low system noise figure performance without the need for complicated discrete-based solutions.
High OIP3 • +34 dBm at 3 GHz • +29 dBm at 9 GHz	High operating OIP3 provides very low in-band distortion products, enabling minimal signal degradation in high fidelity measurement systems and demanding communication systems.
High Input Power Handling	The combination of low noise, high input power handling and OIP3 makes this MMIC amplifier ideal for use in a low-noise receiver front end (RFE), as it provides the user with the advantages of improved sensitivity and two-tone intermodulation (IM) performance at both the lower and upper end of the input dynamic range.
2x2mm 6-Lead QFN-Style Package	Small footprints save space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB. Industry-standard packaging allows for ease of assembly in high-volume manufacturing processes.

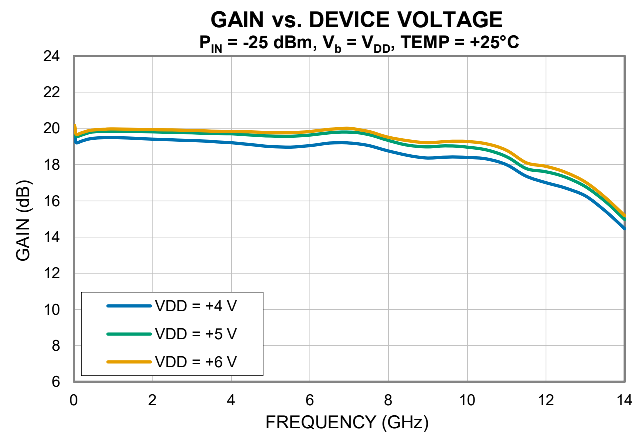
ELECTRICAL SPECIFICATIONS[1] AT +25°C, V_{DD} = +5 V, V_b = +5 V UNLESS NOTED OTHERWISE

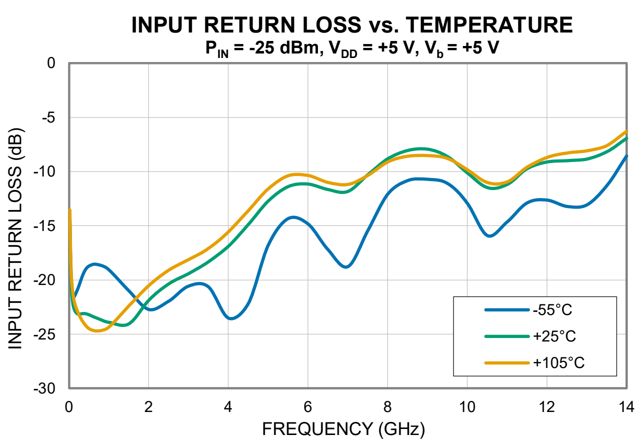
Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.01		12	GHz
Gain	0.01	20.0	20.5		dB
	3	18.5	19.7		
	6	18.4	19.6		
	9	17.4	19.0		
	12	15.4	17.6		
Input Return Loss	0.01		10		dB
	3		19		
	6		11		
	9		8		
	12		9		
Output Return Loss	0.01		14		dB
	3		22		
	6		18		
	9		13		
	12		8		
Isolation	0.01-12		26		dB
Output Power at 1 dB Compression (P1dB)	0.01		+17.7		dBm
	3		+20.8		
	6		+19.1		
	9		+17.2		
	12		+15.5		
Output Third-Order Intercept (P_{OUT} = +5 dBm/Tone)	0.01		+36		dBm
	3		+34		
	6		+30		
	9		+29		
	12		+28		
Noise Figure	0.01		8.1		dB
	3		1.4		
	6		1.7		
	9		2.5		
	12		2.4		
Device Operating Voltage (V_{DD})		+4	+5	+6	V
Device Operating Current (I_{DD})[2]			88		mA
Bias Voltage (V_b)[3]		+2	+5	+6	V
Bias Current (I_b) at V_b = +5 V			4		mA
DC Current Variation vs. Temperature[4]			-87.5		µA/°C
DC Current Variation vs. Voltage[5]			0.023		mA/mV

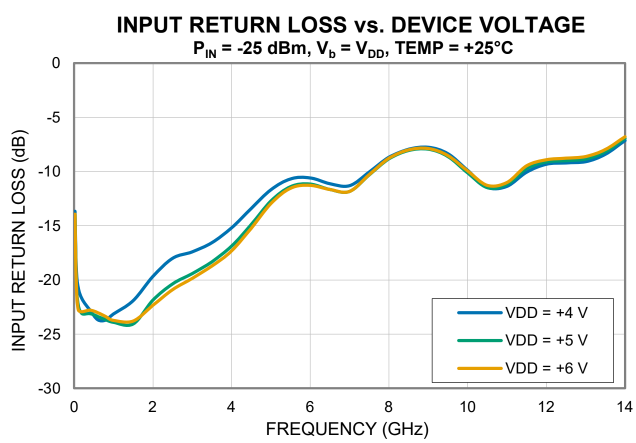
1. Tested on Mini-Circuits Characterization Test Board TB-PMA2123LNWC+. See Figure 2. Board loss de-embedded to the device.
2. Current at P_{IN} = -25 dBm. Increases to 99 mA at P1dB.
3. $V_b \le V_{DD}$ under nominal operating conditions.
4. (Current at +105°C - Current at -55°C) / (+160°C)
5. (Current at V_{DD} = V_b = +6 V - Current at V_{DD} = V_b = +4 V) / (+6 V - +4 V)

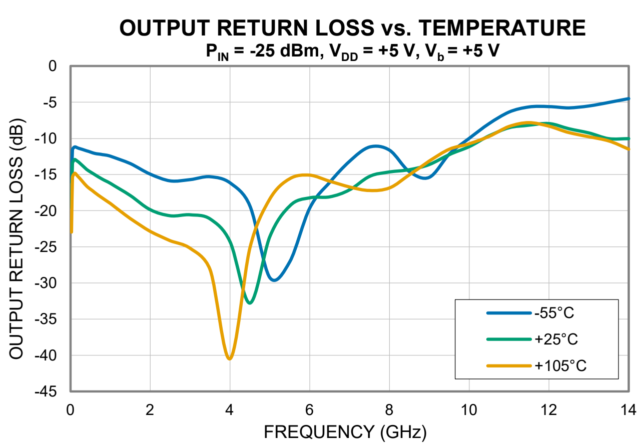
TYPICAL PERFORMANCE GRAPHS

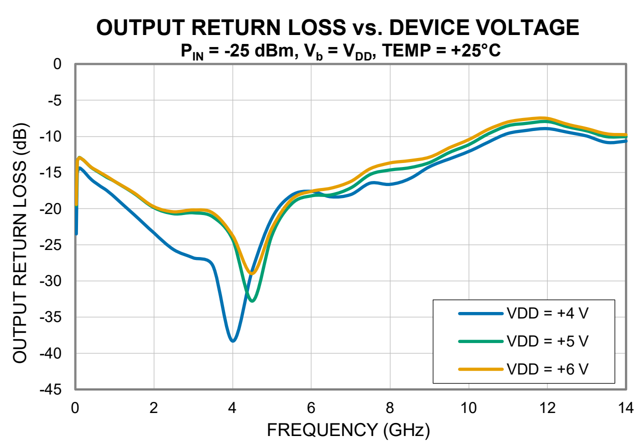












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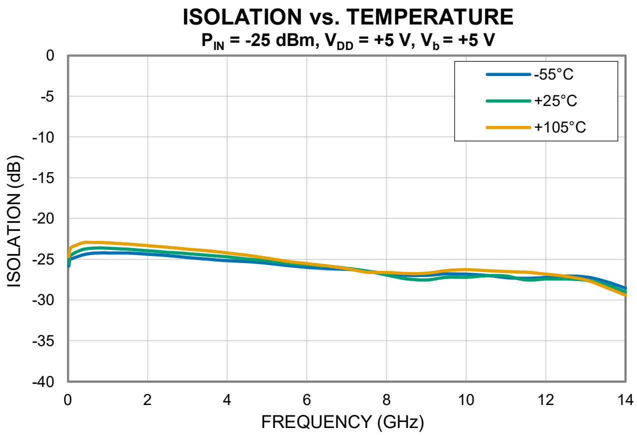
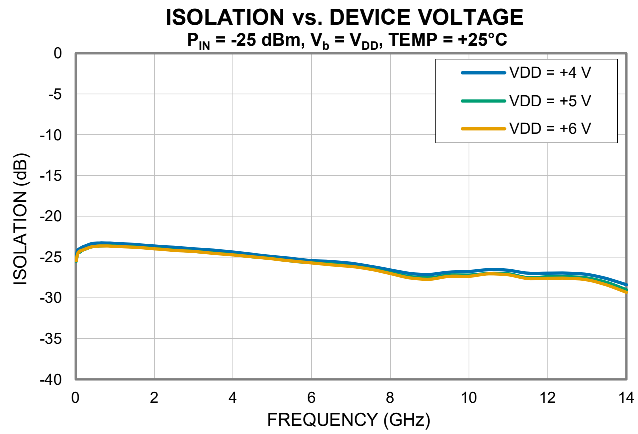
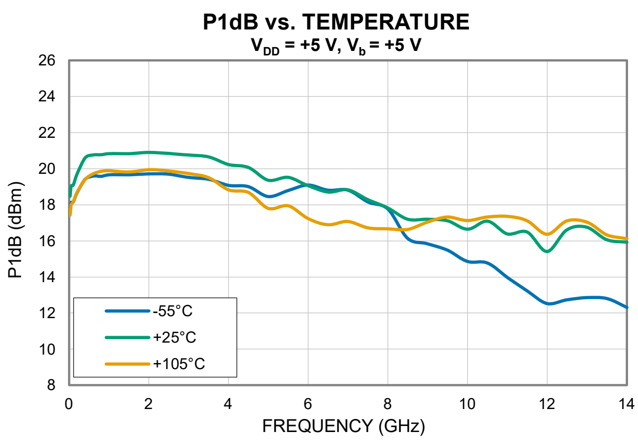
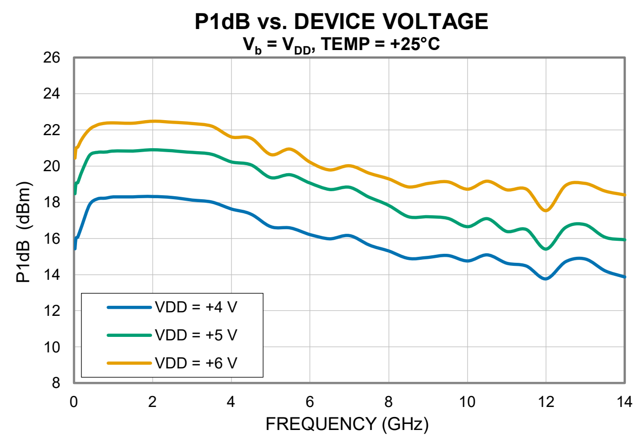
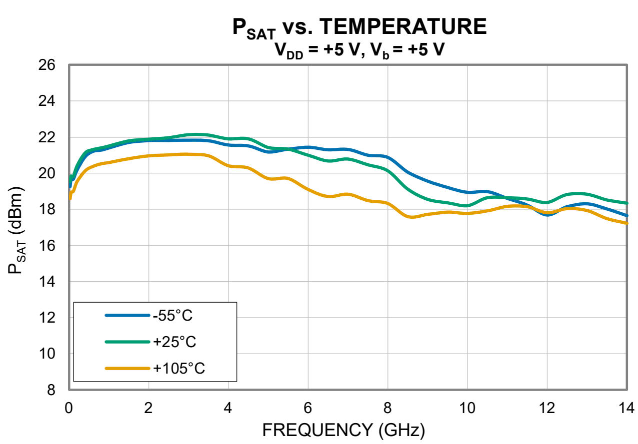
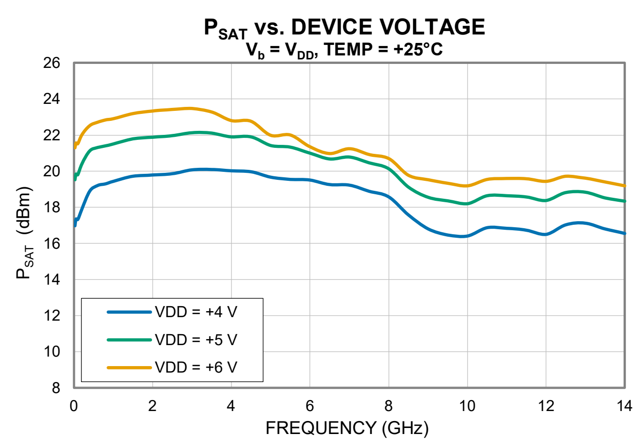






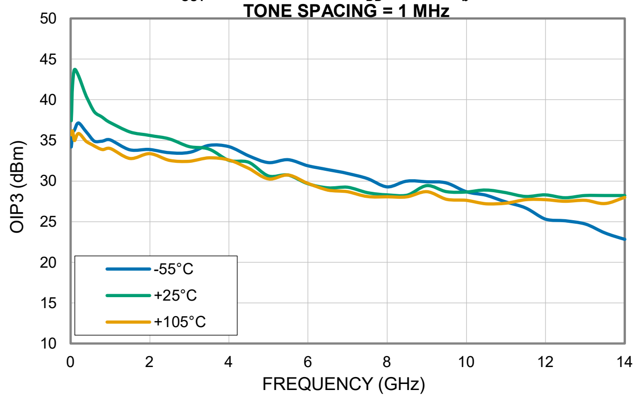




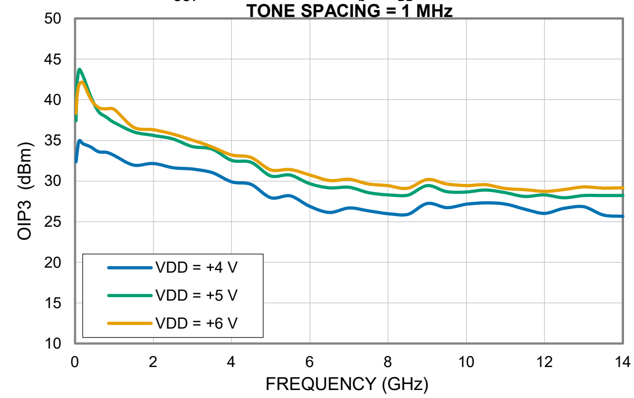


TYPICAL PERFORMANCE GRAPHS

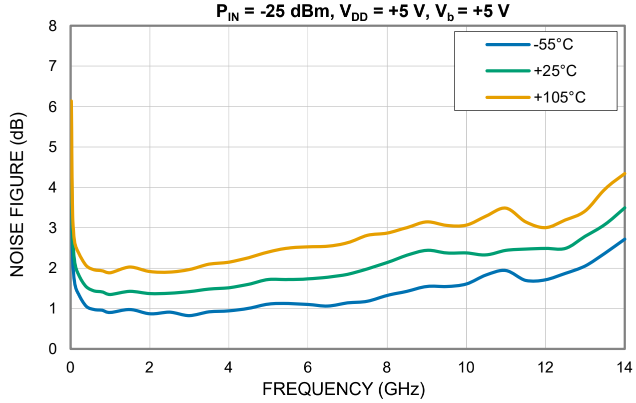
OIP3 vs. TEMPERATURE
P_{OUT} = +5 dBm/TONE, V_{DD} = +5 V, V_b = +5 V
TONE SPACING = 1 MHz



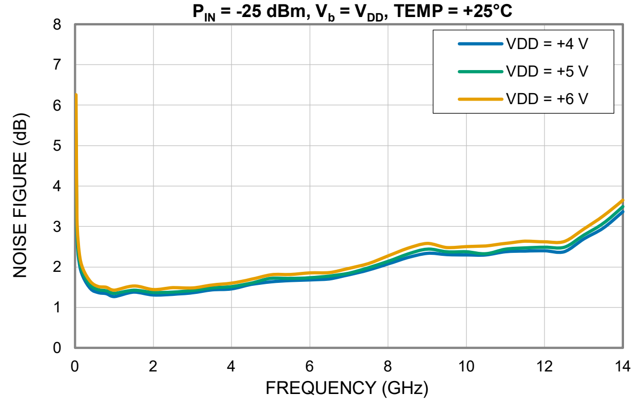
OIP3 vs. DEVICE VOLTAGE
P_{OUT} = +5 dBm/TONE, V_b = V_{DD}, TEMP = +25°C
TONE SPACING = 1 MHz



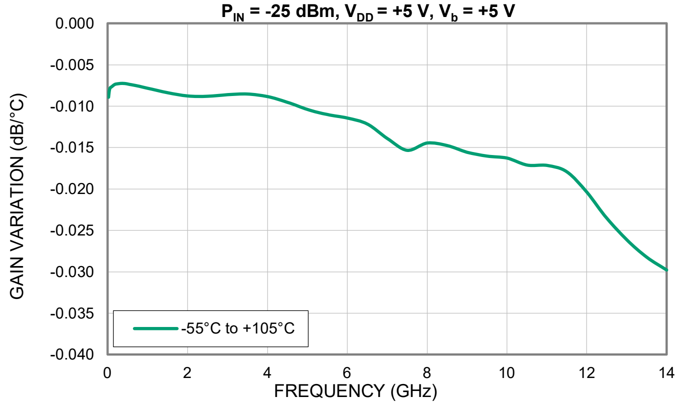
NOISE FIGURE vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +5 V, V_b = +5 V



NOISE FIGURE vs. DEVICE VOLTAGE
P_{IN} = -25 dBm, V_b = V_{DD}, TEMP = +25°C



GAIN VARIATION vs. TEMPERATURE
P_{IN} = -25 dBm, V_{DD} = +5 V, V_b = +5 V



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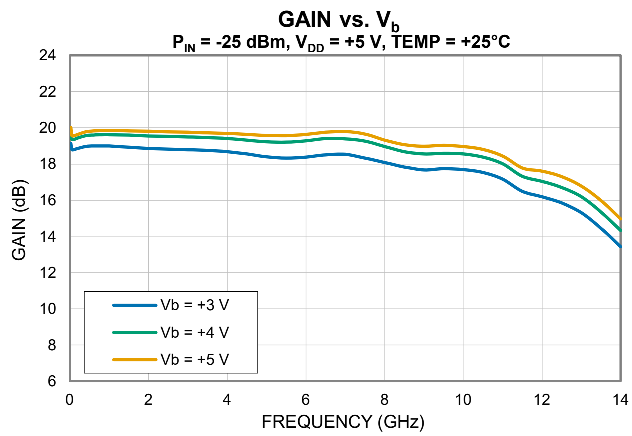

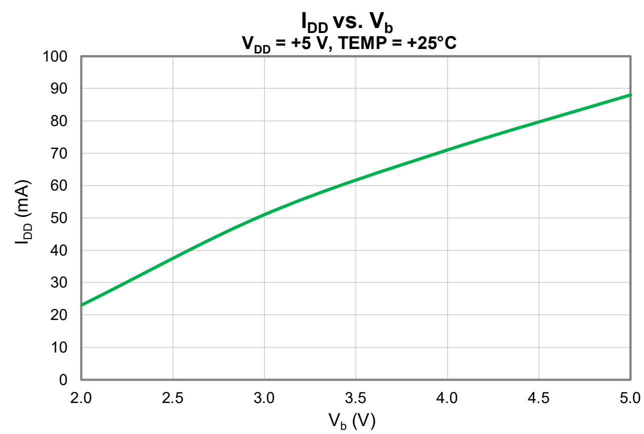

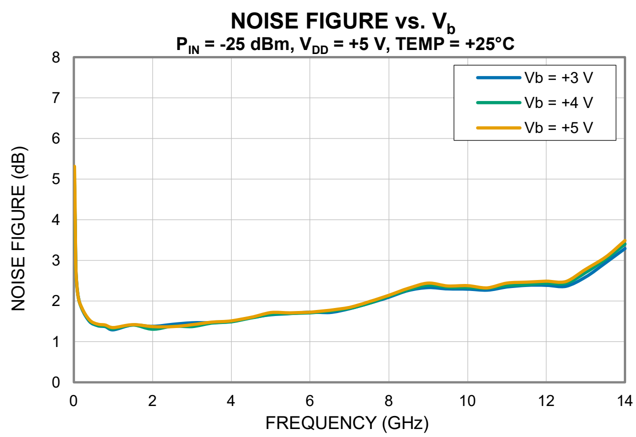

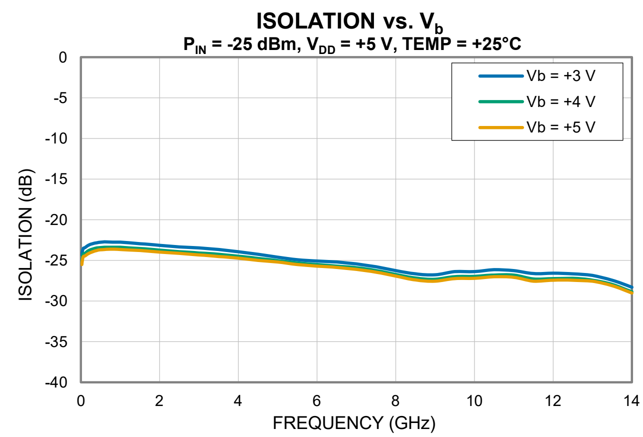

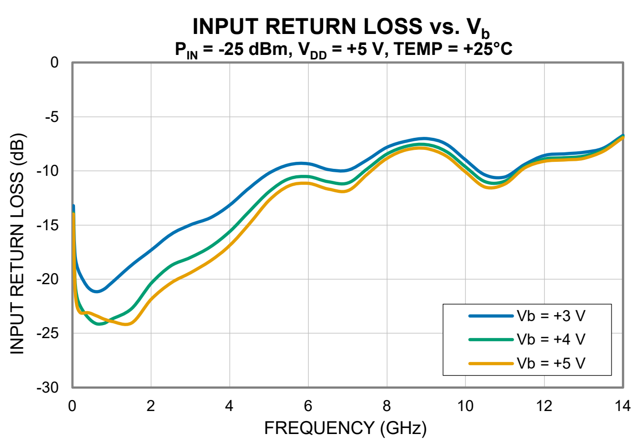

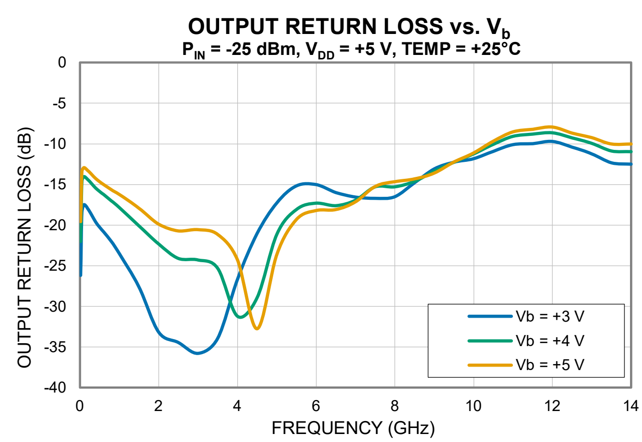

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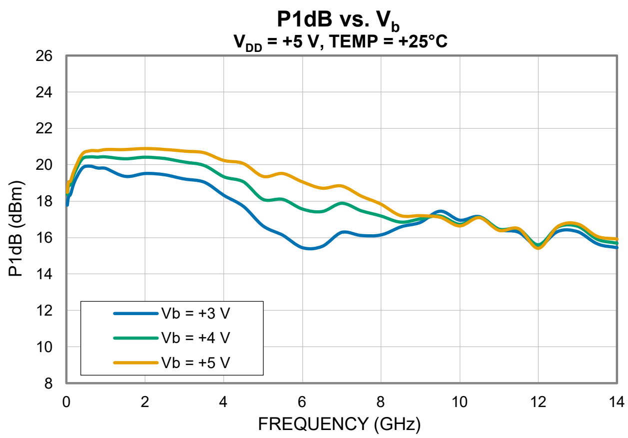
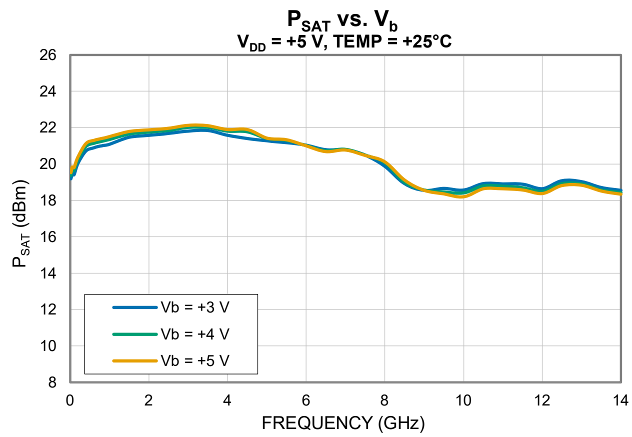
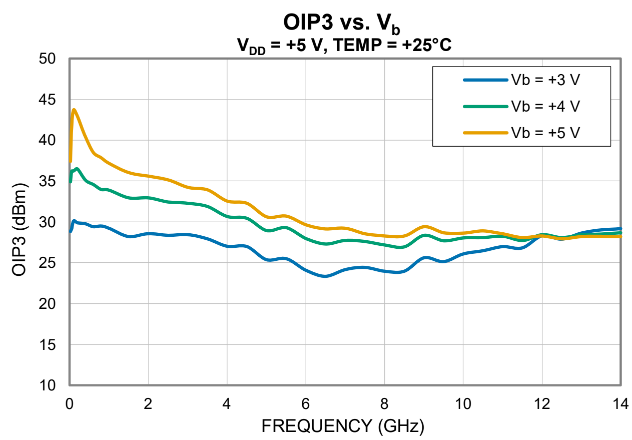






ABSOLUTE MAXIMUM RATINGS[6]

Parameter	Ratings
Operating Temperature	-55°C to +105°C
Storage Temperature	-65°C to +150°C
Junction Temperature[7]	+175°C
Total Power Dissipation	1.14 W
Input Power (CW), V_{DD} = +5 V, V_b = +5 V	+28 dBm
DC Voltage at V_{DD}	+8 V
Current I_{DD}	150 mA
DC Voltage at V_b	+8 V
Current I_b	6 mA

6. Permanent damage may occur if any of these limits are exceeded. Maximum ratings are not intended for continuous normal operation.
7. Peak temperature on top of Die.

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{JC})[8]	97.7°C/W

8. Θ_{JC}= (Hot Spot Temperature on Die - Temperature at Ground Lead) / Dissipated Power

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	1B	500 V to <1000 V	ANSI/ESDA/JEDEC JS-001-2023
CDM	C3	≥1000 V	ANSI/ESDA/JEDEC JS-001-2022

ESD HANDLING PRECAUTION: This device is designed to be Class 1B for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage.

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E/JEDEC J-STD-033C

FUNCTIONAL DIAGRAM

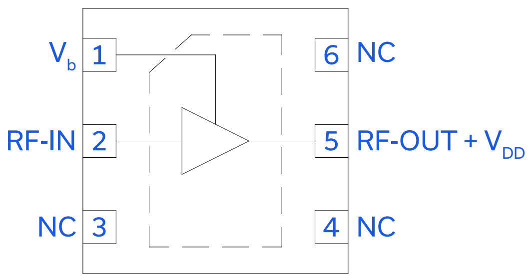


Figure 1. PMA2-123LNW+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-IN	2	RF-IN Pad connects to RF-Input port.
RF-OUT + V_{DD}	5	RF-OUT Pad connects to RF-Output port.
V_b	1	DC Input Pad connects to bias voltage input port V_b.
GND	Paddle	Connects to ground.
NC	3-4, 6	Not used internally. Connected to ground on test board.

CHARACTERIZATION TEST BOARD

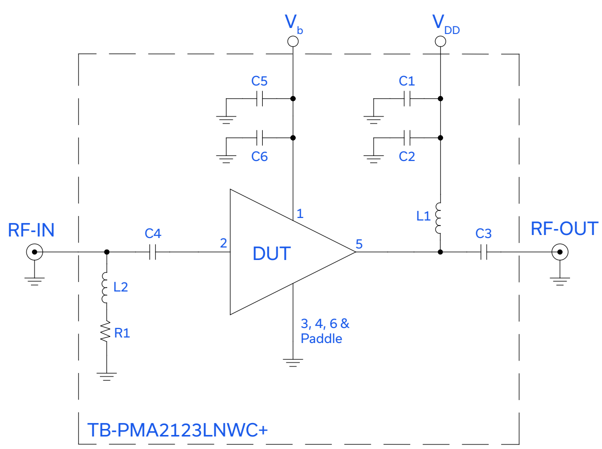


Figure 2. PMA2-123LNW+ Characterization and Application Circuit.

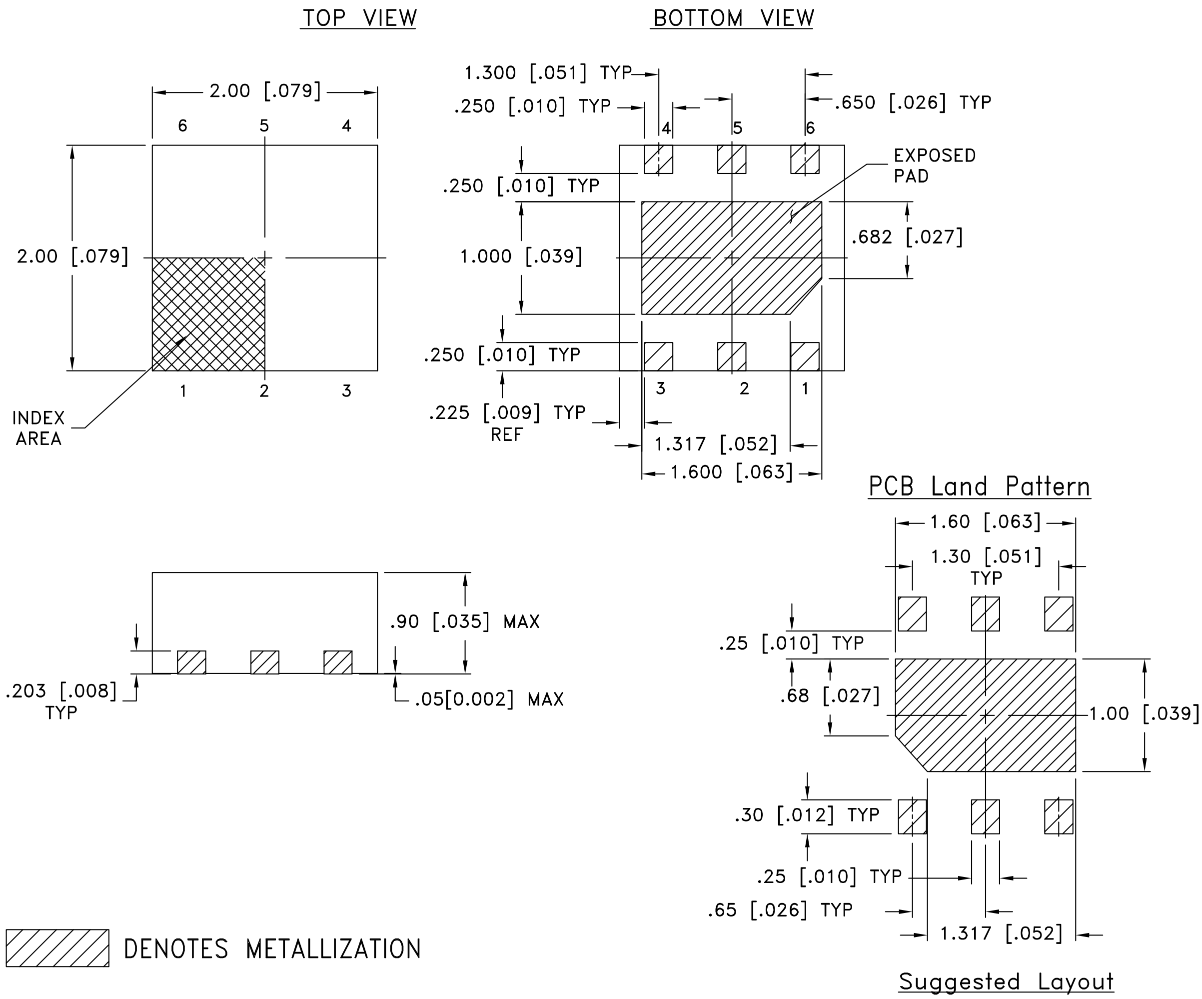
Electrical Parameters and Conditions
Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3), and Noise Figure measured using N5242A PNA-X Microwave Network Analyzer.

Conditions:
a. Gain and Return Loss: P_{IN} = -25 dBm
b. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, +5 dBm/Tone at output.
c. V_{DD} = +5 V, V_b = +5 V

Component	Vendor	Vendor P/N	Value	Size
C1, C5	Murata	GRM155R71H104KE14J	0.1 µF	0402
C2, C6	Murata	GRM1555C1H101JA01D	100 pF	0402
C3	Murata	GRM155R71E103KA01D	0.01 µF	0402
C4	Murata	GRM155C81E105KE11D	1 µF	0402
L1, L2	Coilcraft	0402DF-901XJRU	900 nH	0402
R1	KOA Speer	RK73B1ETTP820J	82 Ω	0402

Power ON/Power OFF Sequence:
Parts are not sensitive to power ON/OFF sequence. V_{DD} and V_b can be applied in any order, but it is recommended to turn on V_b first.

CASE STYLE DRAWING



Weight: 0.0108 grams
Dimensions are in mm [Inches]. Tolerances: 2 Pl.±0.25 [0.01]; 3 Pl.±0.127 [0.005] mm [Inches]

PRODUCT MARKING

Index Over Pin 1

Black Body

Model Family Designation

Marking may contain other features or characters for internal lot control.

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD

CLICK HERE

Performance Data & Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	MC1630-2. Plastic package, exposed paddle, Lead Finish: Matte-Tin
RoHS Status	Compliant
Tape & Reel **Standard Quantities Available on Reel**	F66 7" Reels with 20, 50, 100, 200, 500, 1000, 2000, or 3000 devices
Suggested Layout for PCB Design	PL-828
Evaluation Board	TB-PMA2123LNWC+ Gerber File
Environmental Ratings	ENV08T1