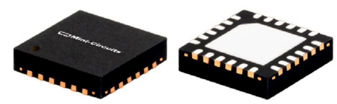
MMIC SURFACE MOUNT

Wideband Amplifier AVA-6123MP+

50Ω 5.6 to 11.7 GHz Medium Power Driver Amplifier

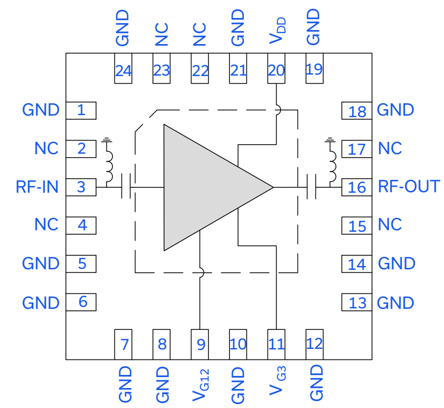
THE BIG DEAL

- High P_{SAT}, Typ. +23.2 dBm
- High Linear Gain, Typ. 22.4 dB
- Bias Condition, +5 V at 140 mA
- 4x4 mm 24-Lead QFN-Style Package



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- Back Haul Radio
- Satellite Communications
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

The AVA-6123MP+ is a GaAs MMIC multi-stage medium power driver amplifier operating from 5.6 to 11.7 GHz. The amplifier is biased at +5 V and 140 mA quiescent current providing 22.4 dB of Linear Gain and +23.2 dBm of Saturated Output Power. The device is internally DC-blocked, and a DC path to ground is present at the RF input and output ports for ESD protection. AVA-6123MP+ is matched at the input and output to 50Ω and comes in a small, low profile 4x4 mm 24-lead QFN-Style package allowing for easy integration into dense circuit board layouts.

KEY FEATURES

Features	Advantages
Medium Power, Typ. +23.2 dBm P_{SAT}	Provides high saturated output power required for Back Haul Radio and Radar Systems.
High Gain, Typ. 22.4 dB	Reduces the number of devices in the signal chain.
4x4mm 24-Lead QFN-Style Package	A small footprint saves 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

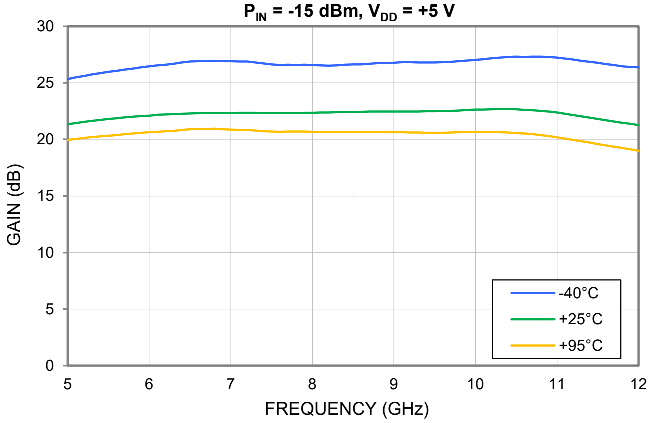
ELECTRICAL SPECIFICATIONS[1] AT +25°C, V_{DD} = +5 V, UNLESS NOTED OTHERWISE

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		5.6		11.7	GHz
Gain	5.6		21.9		dB
	7.1		22.4		
	8.5		22.4		
	10.0		22.6		
	11.7		21.6		
Output Power at 1 dB Compression (P1dB)	5.6		+20.7		dBm
	7.1		+21.6		
	8.5		+21.6		
	10.0		+21.6		
	11.7		+21.5		
Output Power at Saturation (P_{SAT})[2]	5.6		+22.9		dBm
	7.1		+23.3		
	8.5		+23.2		
	10.0		+23.5		
	11.7		+23.1		
Output Third-Order Intercept (P_{OUT} = +9 dBm/Tone)	5.6		+27.6		dBm
	7.1		+27.8		
	8.5		+28.2		
	10.0		+27.5		
	11.7		+25.5		
Input Return Loss	5.6		19		dB
	7.1		17		
	8.5		16		
	10.0		20		
	11.7		20		
Output Return Loss	5.6		11		dB
	7.1		15		
	8.5		18		
	10.0		15		
	11.7		11		
Isolation	5.6		63		dB
	7.1		66		
	8.5		70		
	10.0		61		
	11.7		55		
Noise Figure	5.6		6.7		dB
	7.1		6.1		
	8.5		5.9		
	10.0		5.7		
	11.7		5.2		
Device Operating Voltage (V_{DD})		+4	+5	+6	V
Device Operating Current (I_{DD})[3]			140		mA
Gate Voltage (V_{GG})[4]		-2	-0.72	-0.5	V
Device Gate Current (I_{GG})[5]			6		µA
DC Current Variation vs. Temperature[6]			47.57		µA/°C
DC Current Variation vs. Voltage[7]			+8		µA/mV

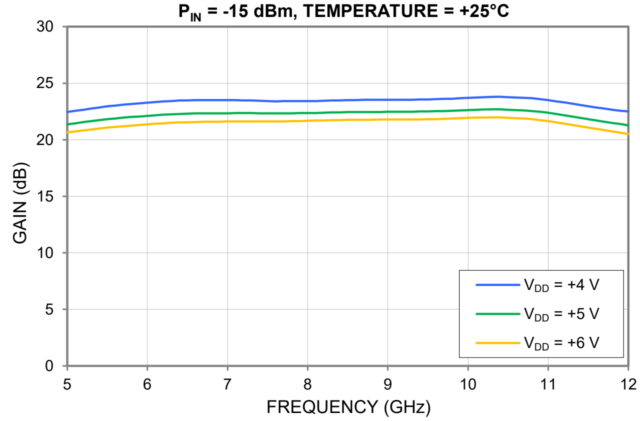
1. Tested on Mini-Circuits Characterization Test Board TB-AVA-6123MPC+. See Figure 2. Board loss de-embedded to the device.
2. P_{SAT} is defined as when the Output Power changes 0.1 dB per 1 dB change in Input Power.
3. Current at P_{IN} = -15 dBm. Increases to 152 mA at P1dB.
4. $V_{GG} = V_{G12} = V_{G3}$
5. $I_{GG} = I_{G12} = I_{G3}$
6. (Current at +95°C – Current at -40°C)/(135°C).
7. (Current at +6 V - Current at +4 V)/(+6 V - +4 V)

TYPICAL PERFORMANCE GRAPHS

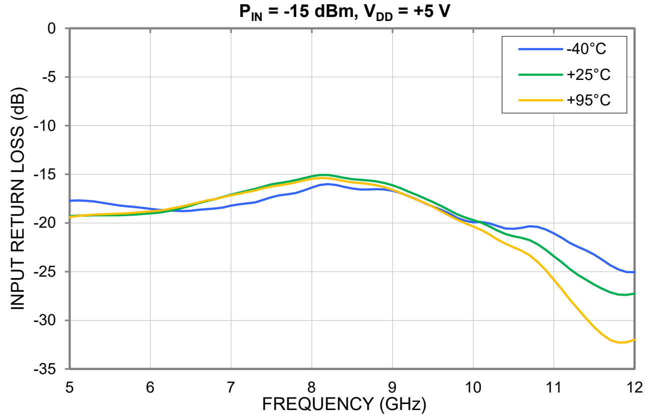
GAIN vs. TEMPERATURE
P_{IN} = -15 dBm, V_{DD} = +5 V



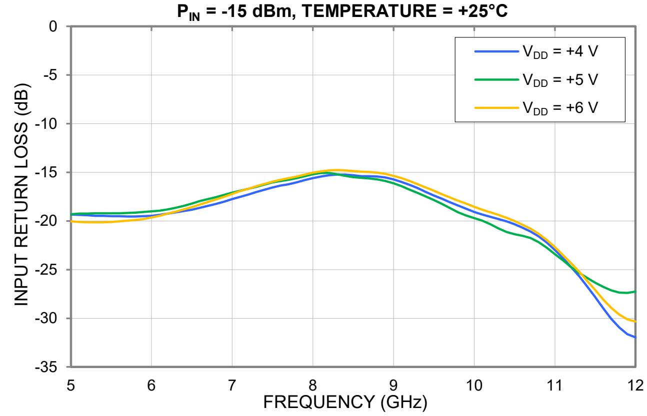
GAIN vs. DEVICE VOLTAGE
P_{IN} = -15 dBm, TEMPERATURE = +25°C



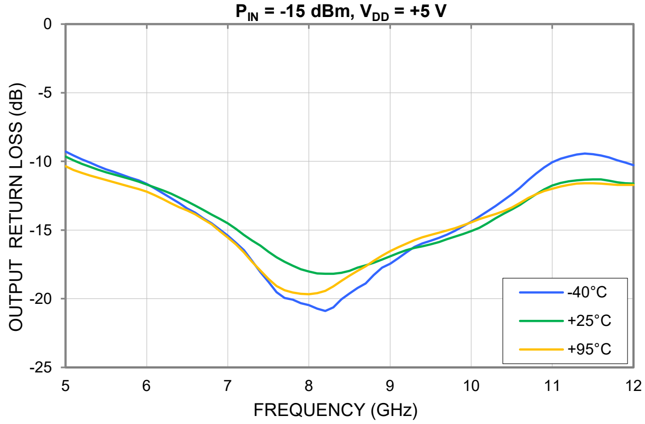
INPUT RETURN LOSS vs.TEMPERATURE
P_{IN} = -15 dBm, V_{DD} = +5 V



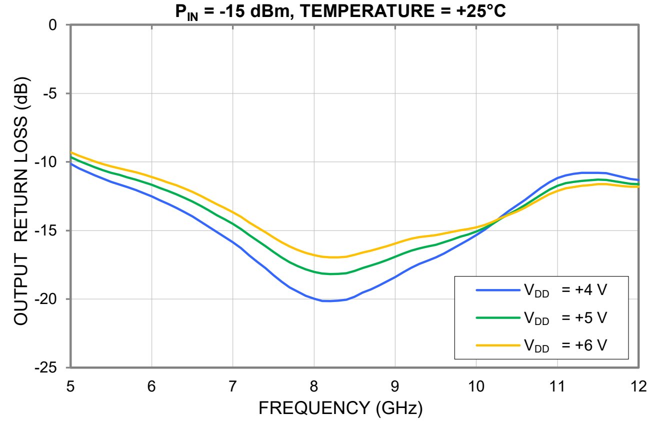
INPUT RETURN LOSS vs. DEVICE VOLTAGE
P_{IN} = -15 dBm, TEMPERATURE = +25°C



OUTPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -15 dBm, V_{DD} = +5 V

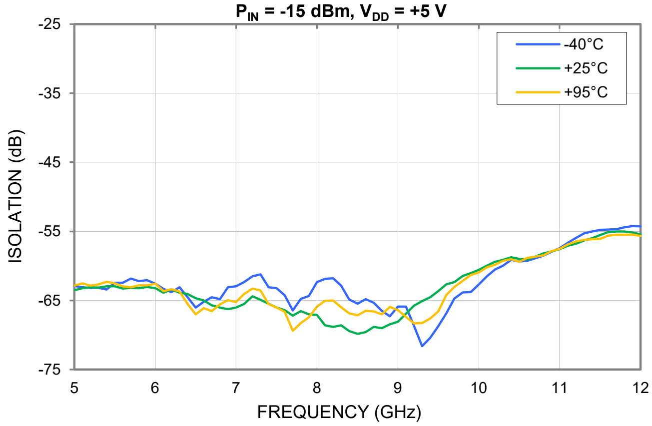


OUTPUT RETURN LOSS vs. DEVICE VOLTAGE
P_{IN} = -15 dBm, TEMPERATURE = +25°C

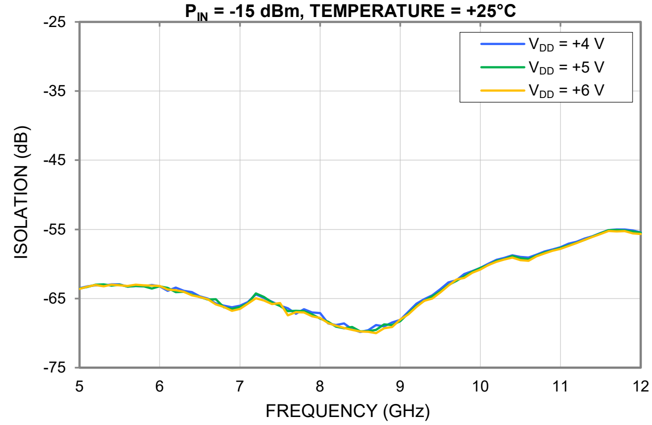


TYPICAL PERFORMANCE GRAPHS

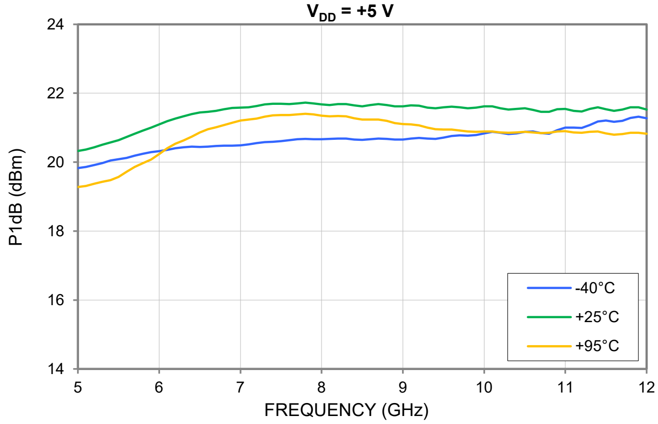
ISOLATION vs.TEMPERATURE
P_{IN} = -15 dBm, V_{DD} = +5 V



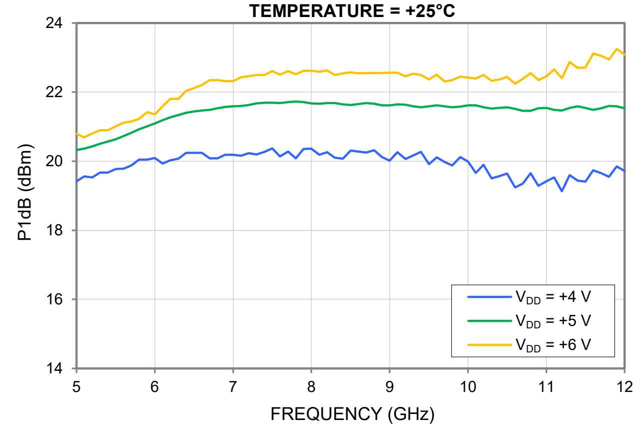
ISOLATION vs. DEVICE VOLTAGE
P_{IN} = -15 dBm, TEMPERATURE = +25°C



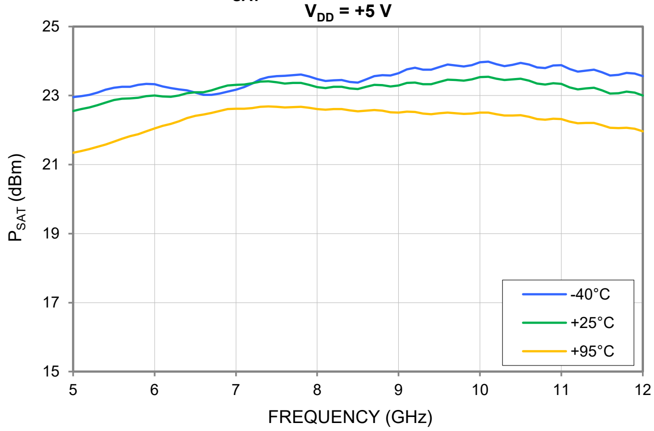
P1dB vs. TEMPERATURE
V_{DD} = +5 V



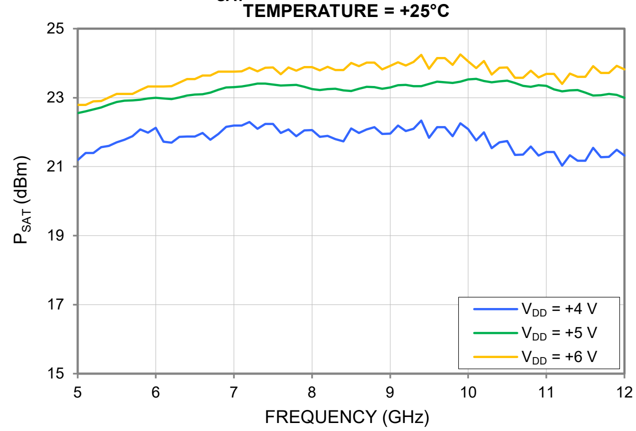
P1dB vs. DEVICE VOLTAGE
TEMPERATURE = +25°C



P_{SAT} vs. TEMPERATURE
V_{DD} = +5 V

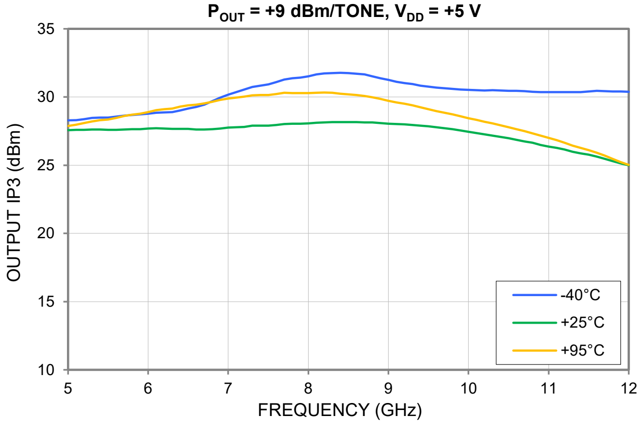


P_{SAT} vs. DEVICE VOLTAGE
TEMPERATURE = +25°C

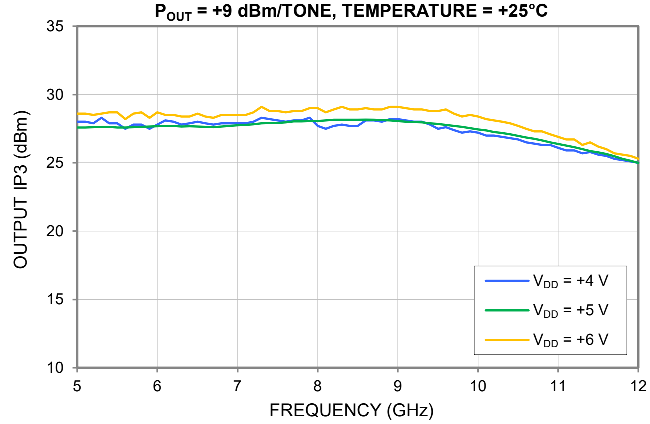


TYPICAL PERFORMANCE GRAPHS

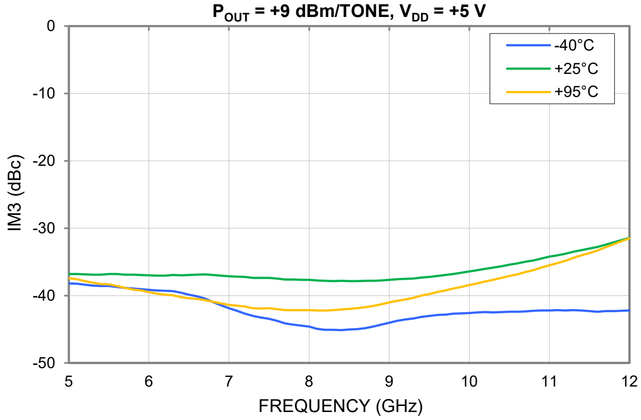
OUTPUT IP3 vs. TEMPERATURE
P_{OUT} = +9 dBm/TONE, V_{DD} = +5 V



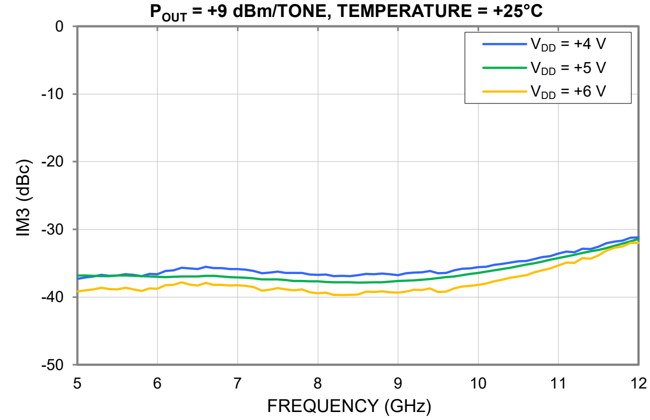
OUTPUT IP3 vs. DEVICE VOLTAGE
P_{OUT} = +9 dBm/TONE, TEMPERATURE = +25°C



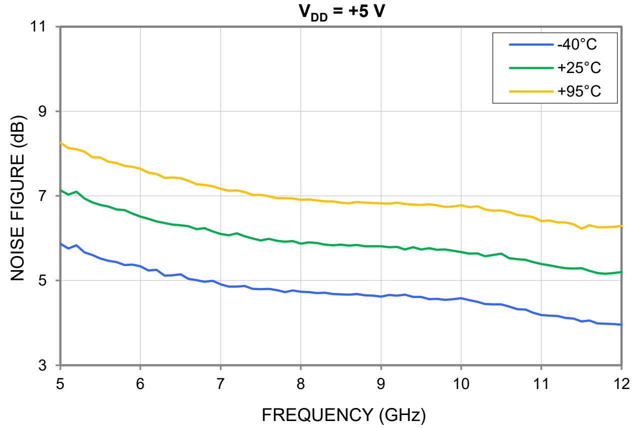
IM3 vs. TEMPERATURE
P_{OUT} = +9 dBm/TONE, V_{DD} = +5 V



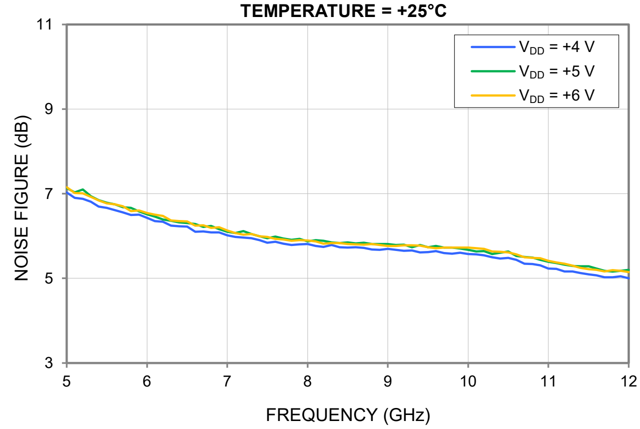
IM3 vs. DEVICE VOLTAGE
P_{OUT} = +9 dBm/TONE, TEMPERATURE = +25°C



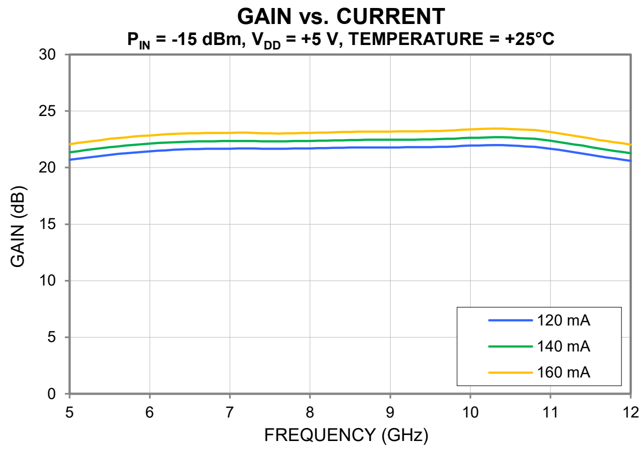
NOISE FIGURE vs. TEMPERATURE
V_{DD} = +5 V

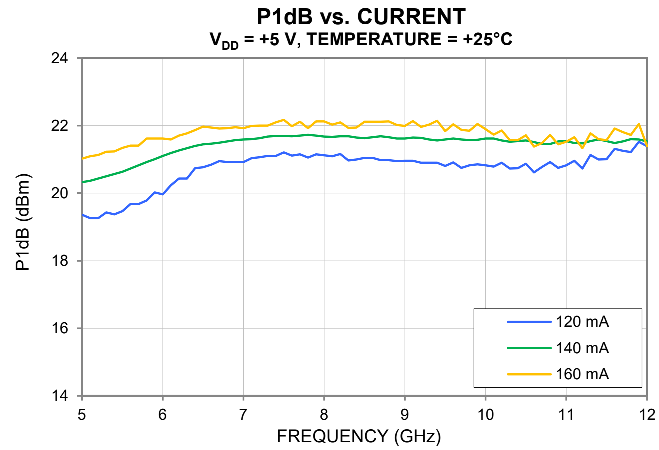


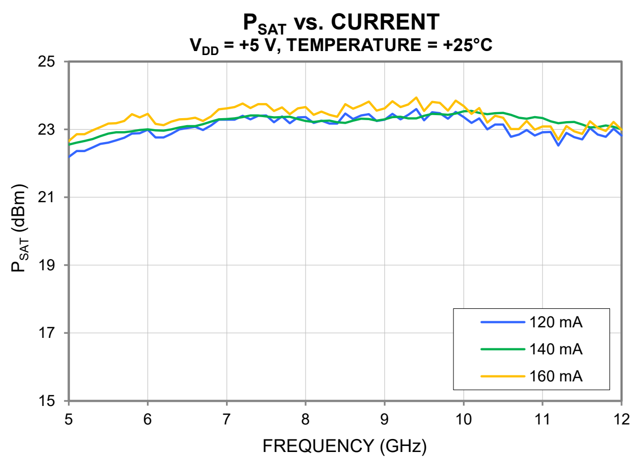
NOISE FIGURE vs. DEVICE VOLTAGE
TEMPERATURE = +25°C

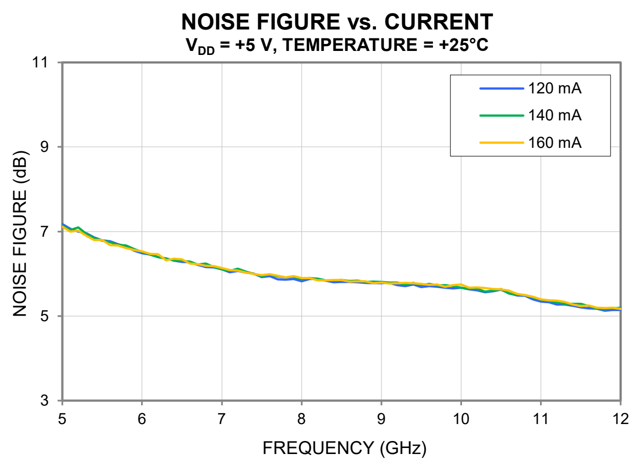


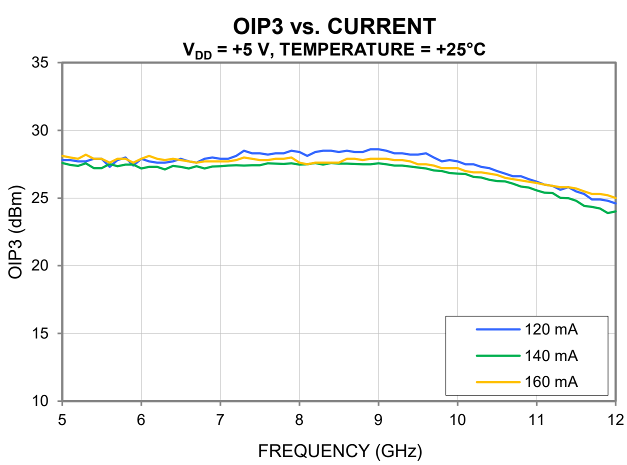
TYPICAL PERFORMANCE GRAPHS

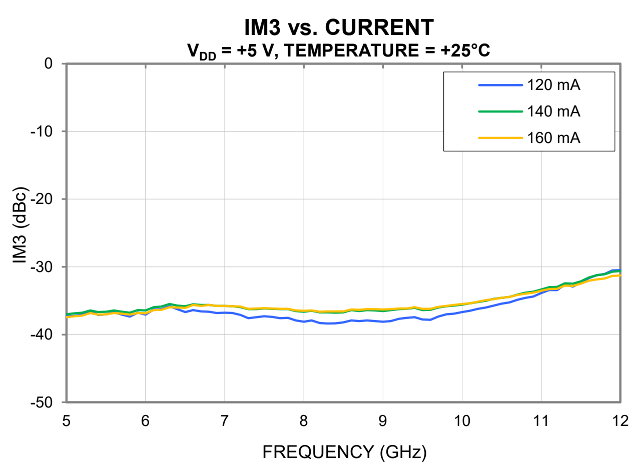






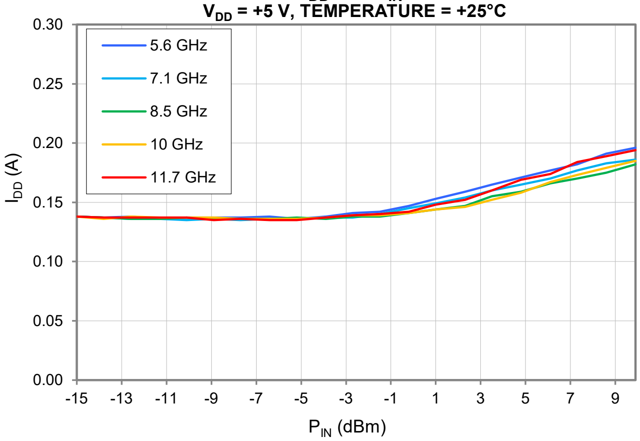




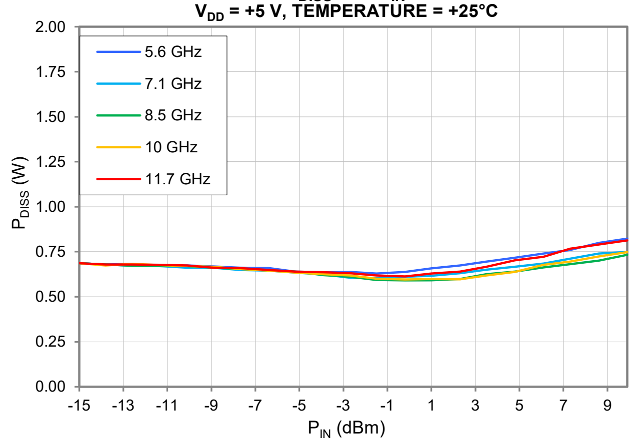


TYPICAL PERFORMANCE GRAPHS

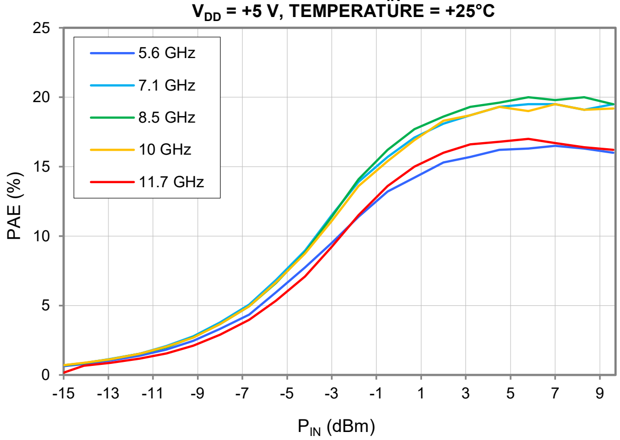
I_{DD} vs. P_{IN}
V_{DD} = +5 V, TEMPERATURE = +25°C



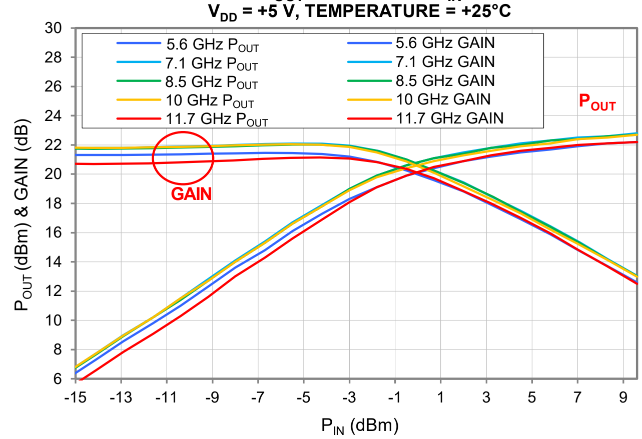
P_{DISS} vs. P_{IN}
V_{DD} = +5 V, TEMPERATURE = +25°C



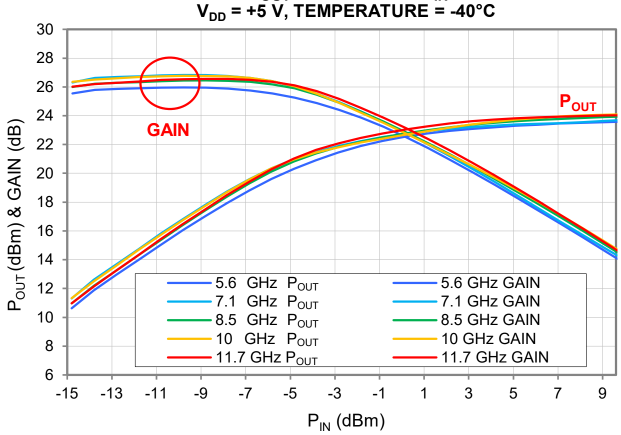
PAE vs. P_{IN}
V_{DD} = +5 V, TEMPERATURE = +25°C



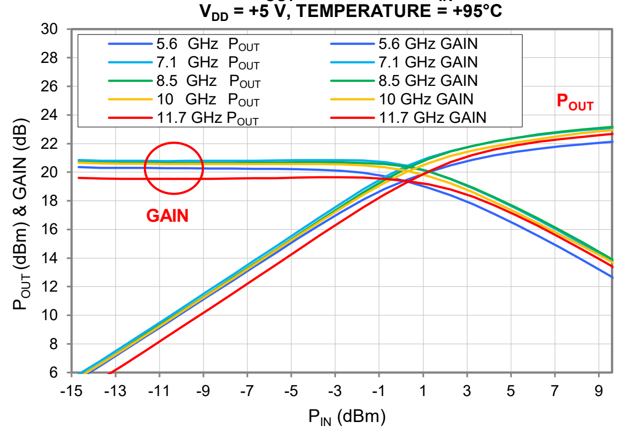
P_{OUT} & GAIN vs. P_{IN}
V_{DD} = +5 V, TEMPERATURE = +25°C



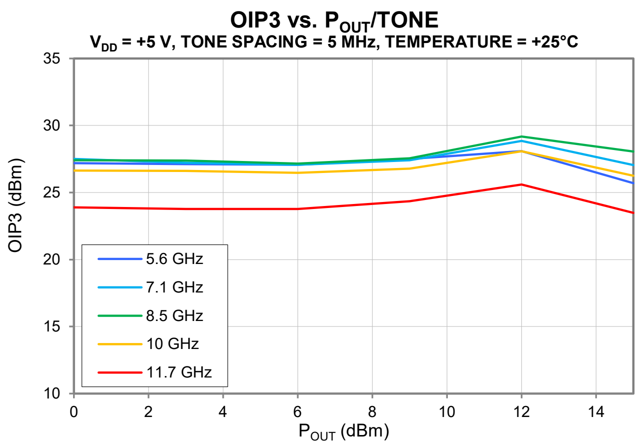
P_{OUT} & GAIN vs. P_{IN}
V_{DD} = +5 V, TEMPERATURE = -40°C

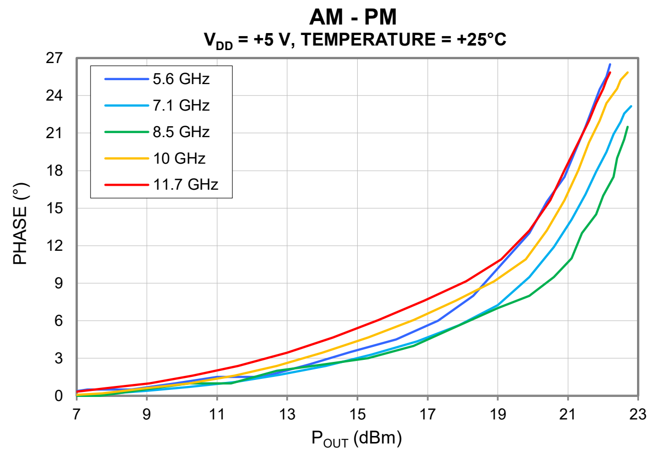


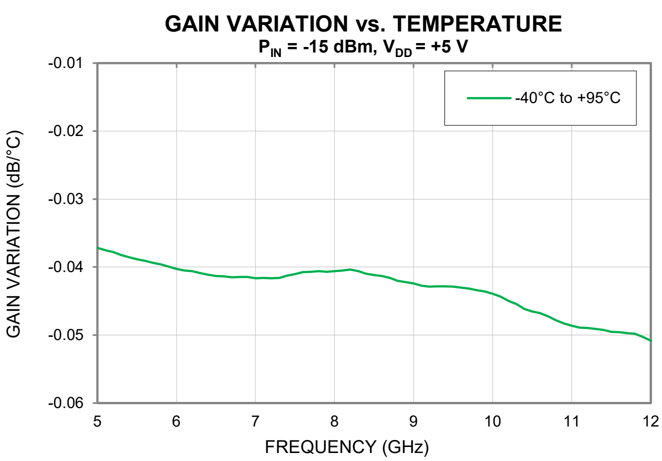
P_{OUT} & GAIN vs. P_{IN}
V_{DD} = +5 V, TEMPERATURE = +95°C



TYPICAL PERFORMANCE GRAPHS







ABSOLUTE MAXIMUM RATINGS[8]

Parameter	Ratings
Operating Temperature	-40°C to +95°C
Storage Temperature	-65°C to +150°C
Junction Temperature[9]	+175°C
Total Power Dissipation	2.4 W
Input Power (CW), V_{DD} = +5 V	+22 dBm
DC Drain Voltage at V_{DD}	+8 V
DC Gate Voltage at $V_{GG} = V_{G12} = V_{G3}$	-3 V < V_{GG} < -0.2 V
DC Drain Current I_{DD}	300 mA
DC Gate Current I_{GG}	0.6 mA

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

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{JC})[10]	35.7°C/W

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

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	1C	1000 to < 2000	ANSI/ESDA/JEDEC JS-001-2023
CDM	C3	≥ 1000	ANSI/ESDA/JEDEC JS-002-2022

ESD HANDLING PRECAUTION: This device is designed to be Class 1C 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

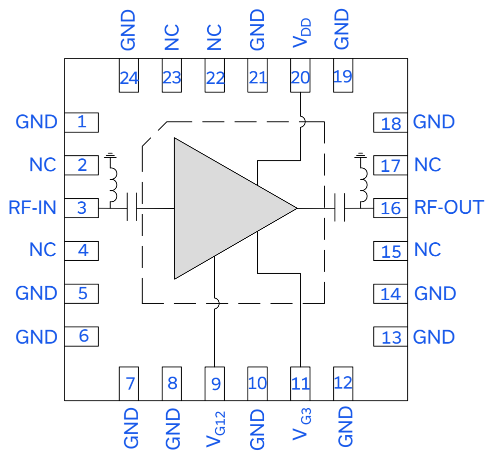


Figure 1. AVA-6123MP+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Fig 2)
RF-IN	3	RF-IN pad connects to RF Input port.
RF-OUT	16	RF-OUT pad connects to RF Output port.
V_{DD}	20	DC Input pad connects to Drain Voltage port.
V_{G12}	9	DC Input pad connects to First and Second Stage Gate Voltage port.
V_{G3}	11	DC Input pad connects to Third Stage Gate Voltage port.
NC	2, 4, 15, 17, 22, 23	Not used internally. Connected to ground on test board.
GND	1, 5-8, 10, 12-14, 18, 19, 21, 24, Paddle	Connects to ground.

EVALUATION BOARD

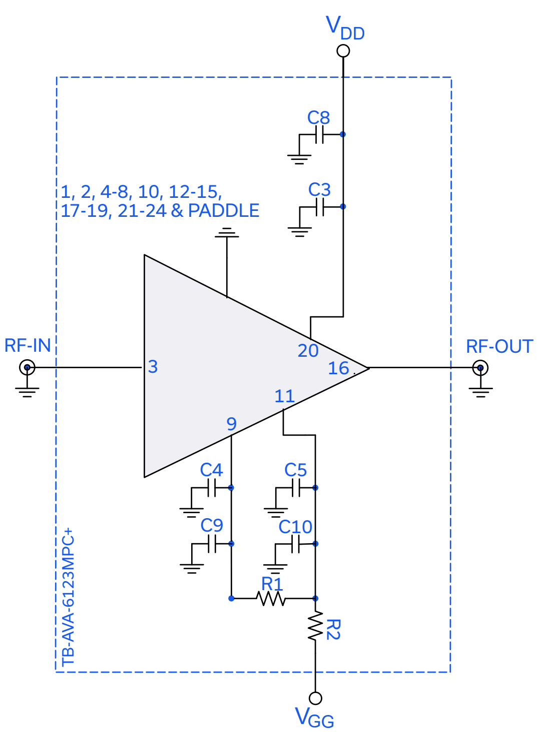


Figure 2. AVA-6123MP+ Evaluation and Characterization Circuit

Electrical Parameters and Conditions
Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3), Saturated Output Power (P_{SAT}) and Noise Figure measured using N5247B PNA-X Microwave Network Analyzer.

Conditions:
a. Gain and Return Loss: P_{IN} = -15 dBm
b. Output IP3 (OIP3): Two tones, spaced 5 MHz apart, +9 dBm/Tone at output

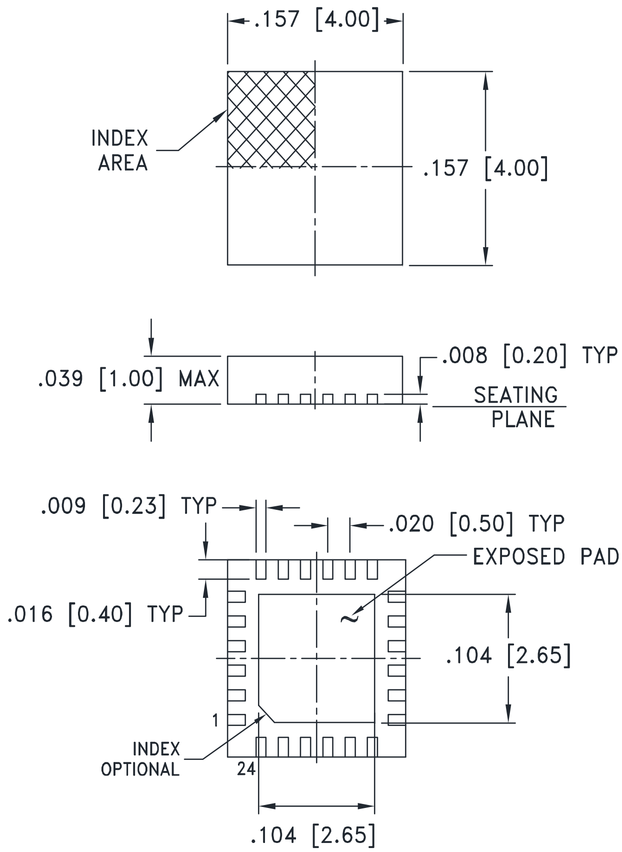
Power ON/Power OFF Sequence
Caution: Permanent damage to the device will occur if the Power ON and Power OFF sequences are not followed

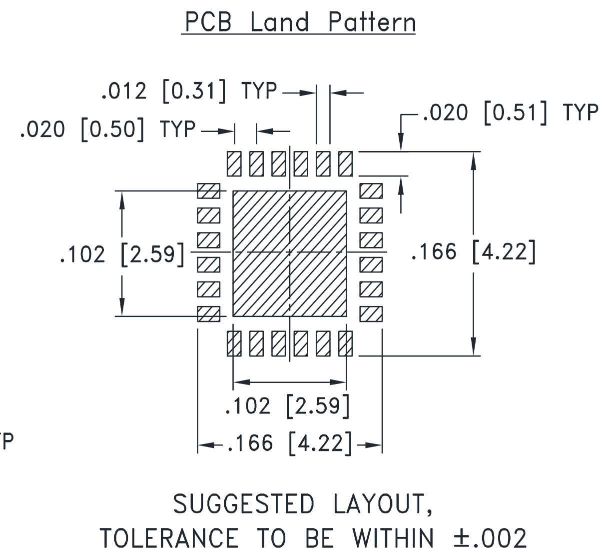
POWER ON:
1) Set V_{GG} = -2 V. Apply V_{GG}.
2) Set V_{DD} = +5 V. Apply V_{DD}.
3) Increase V_{GG} to obtain desired I_{DD} as shown in spec table.
4) Apply RF Signal.

POWER OFF:
1) Turn off RF Signal.
2) Adjust V_{GG} down to -2 V.
3) Turn off V_{DD}.
4) Turn off V_{GG}

Component	Value	Size	Part Number	Manufacturer
C3 – C5	0.001 µF	0402	GRM1555C1H102JA01D	MURATA
C8 – C10	0.1 µF	0402	GRM155R71E104KE14D	MURATA
R1, R2	100Ω	0402	RK73H1ETTP1000F	KOA SPEER

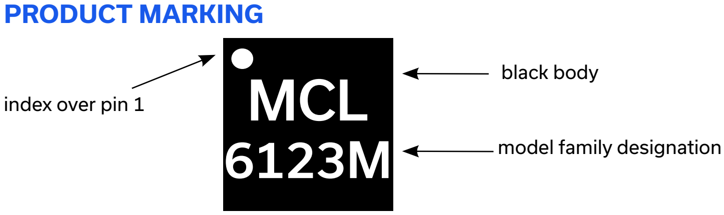
CASE STYLE DRAWING





Weight: .04 Grams
Dimensions are in inches [mm]. Tolerances in inches: 2 Pl. ± .01; 3 Pl. ± .005 inches

PRODUCT MARKING



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	DG1847 Plastic package, exposed paddle, Lead Finish: Matte-Tin
RoHS Status	Compliant
Tape & Reel **Standard quantities available on reel**	F68 7" reels with 20, 50, 100, 200, 500, 1K devices
Suggested Layout for PCB Design	PL-796
Evaluation Board	TB-AVA-6123MPC+ Gerber File
Environmental Ratings	ENV08T1

NOTES

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.

C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/terms/viewterm.html