MMIC SURFACE MOUNT

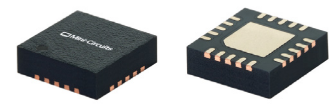
Wideband Amplifier

AVA-183MP+

50Ω   0.05 to 18 GHz   High Dynamic Range   Low Noise

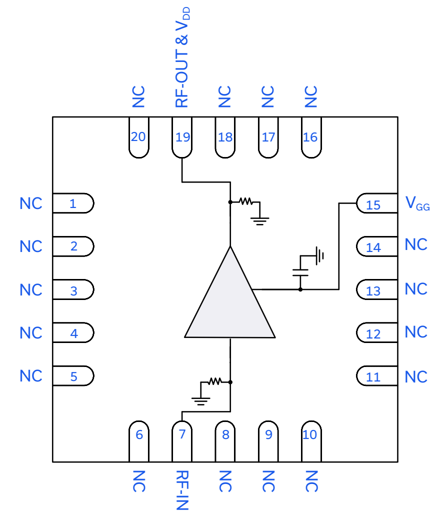
THE BIG DEAL

- Ultra wideband, 0.05-18 GHz
- High Dynamic Range
  - P1dB, Typ. +24 dBm
  - Gain, Typ. 16 dB
  - Low Noise Figure, Typ. 1.8 dB
- High OIP3, Typ. +31 dBm
- 4x4mm 20-Lead QFN-Style Package



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- 5G MIMO and Back Haul Radio Systems
- Satellite Communications
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

AVA-183MP+ is a GaAs pHEMT MMIC wideband distributed amplifier operating from 0.05 to 18 GHz. The amplifier provides 16.5 dB of Gain, +24 dBm P1dB, and +31 dBm OIP3, and 1.8 dB Noise Figure typical performance while operating from an +8V supply with 160mA current consumption. The AVA-183MP+ offers a leading combination of wide bandwidth, low noise figure, high linearity, and output power resulting in a 50Ω matched high dynamic range amplifier. The AVA-183MP+ performance characteristics are ideal for use in wideband Defense Systems and Test and Measurement Equipment. The amplifier is housed in an industry standard 4x4mm QFN-style package.

KEY FEATURES

Features	Advantages
Wideband: 0.05 to 18 GHz • Gain, Typ. 16 dB	Ideal for use in wideband Electronic Warfare and Test and Measurement transmit signal chains.
High Dynamic Range • P1dB, Typ. +24 dBm • OIP3, Typ. +31 dBm • NF, Typ. 1.8 dB	Suitable as a driver amplifier for wideband power amplifier signal chains.
Good Input and Output Return Loss	Internally matched to 50Ω, this eliminates the need for external matching components making the device easy to integrate.
4x4mm 20-Lead QFN-style package	Small footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.

REV. OR
ECO-017253
AVA-183MP+
MCL NY
230324

ELECTRICAL SPECIFICATIONS[1] AT +25°C, V_{DD}= +8V, I_{DD} = 160mA, UNLESS NOTED OTHERWISE

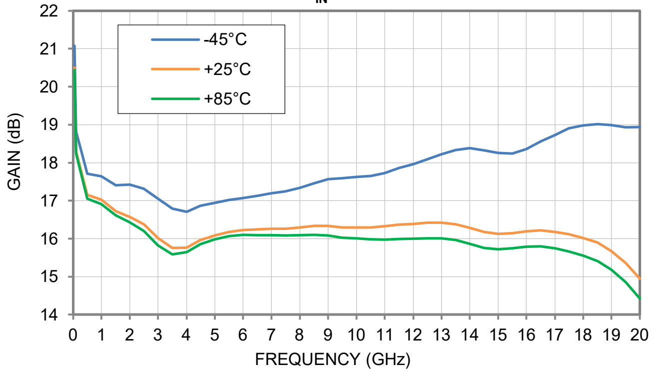
Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.05		18	GHz
Gain	0.05	20.0	20.6		dB
	5	15.7	16.2		
	10	15.9	16.5		
	15	15.5	16.3		
	18	15.2	16.3		
Input Return Loss	0.05		11.4		dB
	5		20.0		
	10		13.6		
	15		11.2		
	18		15.9		
Output Return Loss	0.05		14.3		dB
	5		20.0		
	10		20.0		
	15		20.0		
	18		19.3		
Isolation	0.05-18		43.0		dB
Output Power at 1 dB Compression (P1dB)	0.05		+25.8		dBm
	5		+24.2		
	10		+23.8		
	15		+24.4		
	18		+24.4		
Output Third-Order Intercept Point (P_{OUT} = 0dBm/Tone)	0.05		+32.7		dBm
	5		+32.2		
	10		+31.1		
	15		+29.3		
	18		+27.4		
Noise Figure	0.05		7.0		dB
	5		1.5		
	10		1.8		
	15		2.8		
	18		3.6		
Device Operating Voltage (V_{DD})		+7.75	+8	+8.25	V
Device Operating Current (I_{DD})[2]			160		mA
Gate Voltage (V_{GG})[3]			-1.3		V
Gate Current (I_{GG})			-0.5		μA
Device Current Variation Vs. Temperature[4]			5.4		μA/°C
Device Current Variation Vs. Voltage[5]			0.208		mA/mV

1. Tested in Mini-Circuits Characterization Test/Evaluation Board TB-AVA-183MPC+. See Figure 2. De-embedded to the device reference plane.
2. Current at P_{IN} = -25 dBm. Increases to 190 mA at P1dB.
3. Typical Gate Voltage for when I_{DD} = 160 mA. V_{GG} must be adjusted so that I_{DD} = 160 mA.
4. ((Current at Tmax°C - Current at -Tmin°C))/(Tmax °C -Tmin °C)
5. (Current at Nominal V +ΔV in mA)- (Current at Nominal V -ΔV mA)/(2ΔV mV)

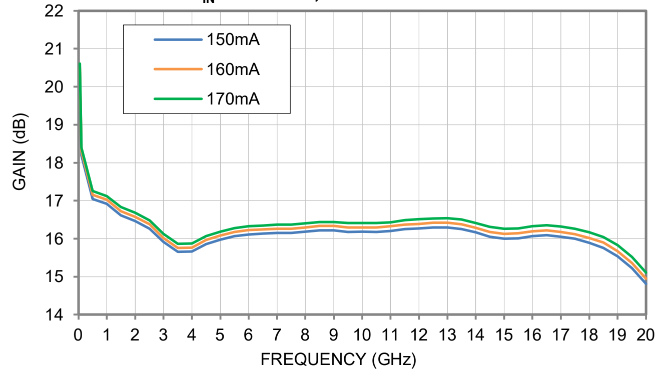
TYPICAL PERFORMANCE GRAPHS

All data taken was at nominal conditions V_{DD} = +8V and I_{DD} = 160 mA unless noted otherwise. For over temperature data, I_{DD} is adjusted to 160 mA at each temperature specified. For over current data, V_{DD} is set to +8V and V_{GG} is adjusted until each specified current level is achieved.

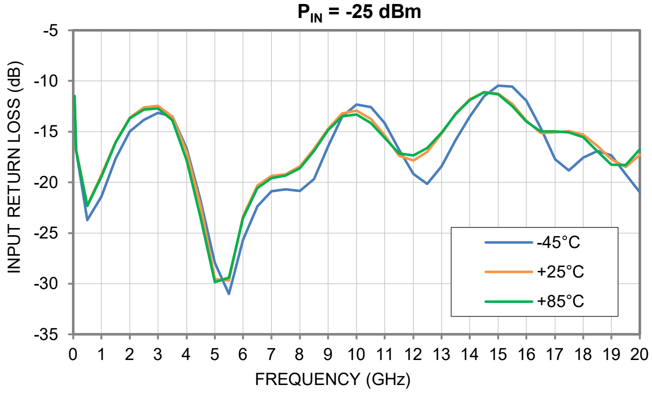
GAIN vs. TEMPERATURE, P_{IN} = -25 dBm



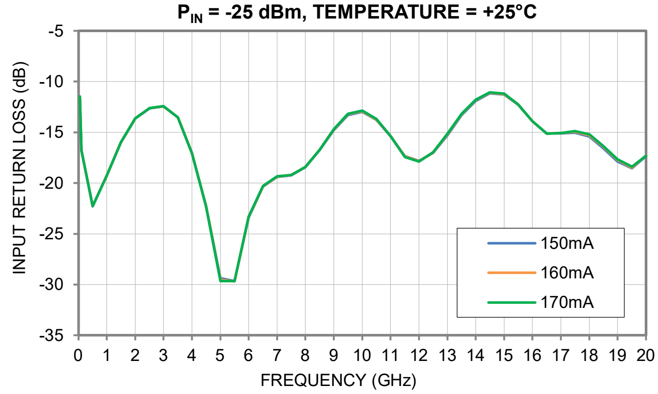
GAIN vs. DEVICE CURRENT, P_{IN} = -25 dBm, TEMPERATURE = +25°C



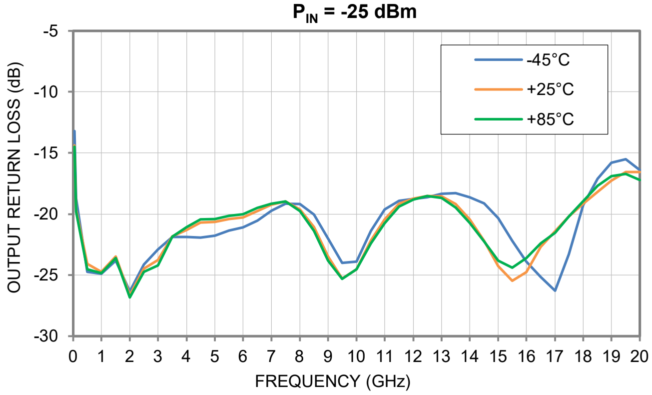
INPUT RETURN LOSS vs. TEMPERATURE, P_{IN} = -25 dBm



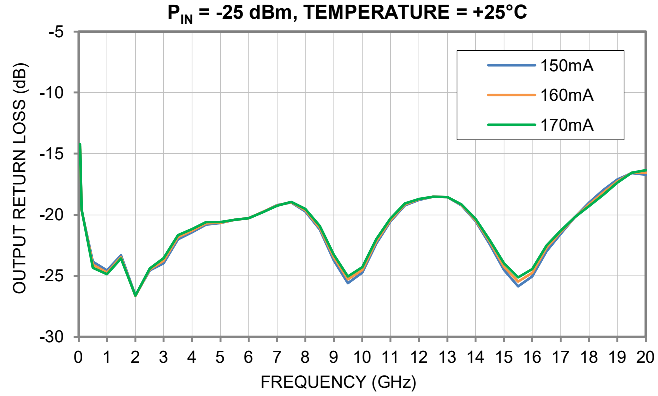
INPUT RETURN LOSS vs. DEVICE CURRENT, P_{IN} = -25 dBm, TEMPERATURE = +25°C



OUTPUT RETURN LOSS vs. TEMPERATURE, P_{IN} = -25 dBm

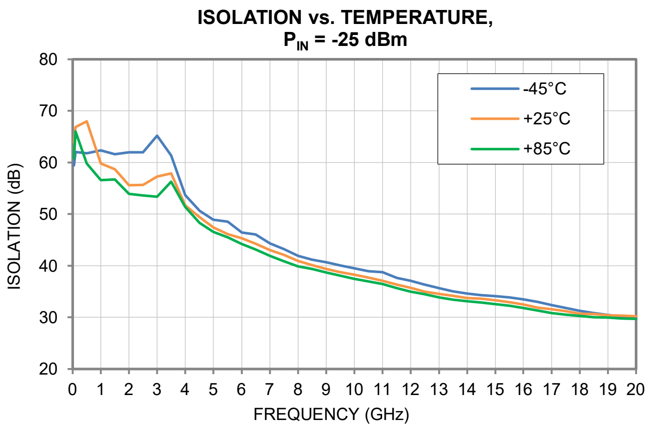


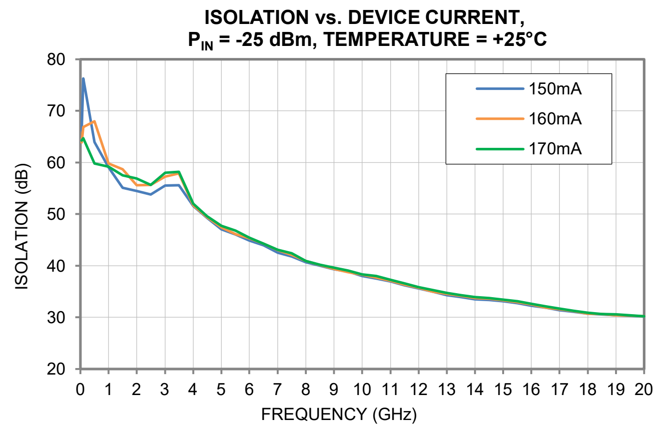
OUTPUT RETURN LOSS vs. DEVICE CURRENT, P_{IN} = -25 dBm, TEMPERATURE = +25°C

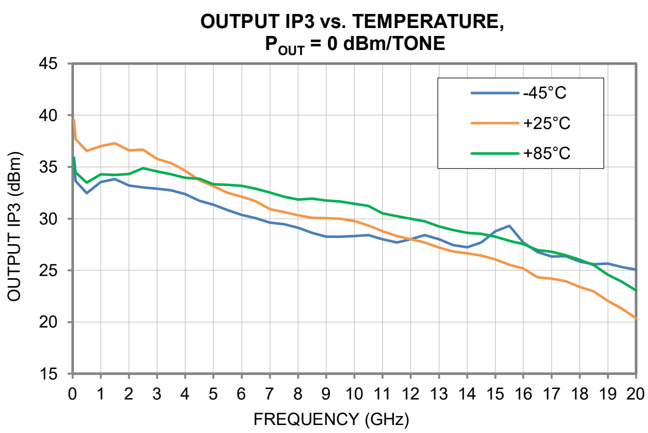


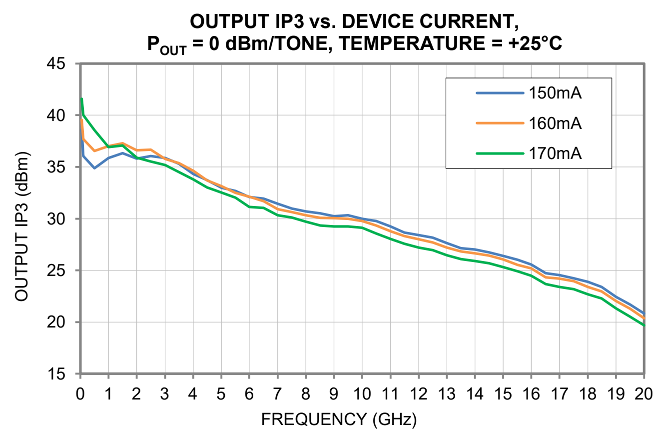
TYPICAL PERFORMANCE GRAPHS

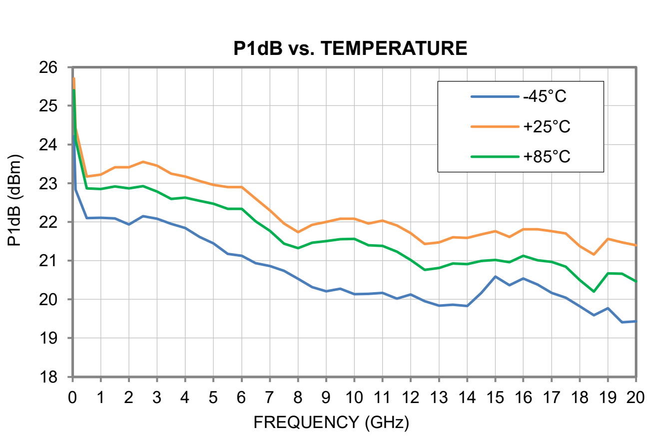
All data taken was at nominal conditions V_{DD} = +8V and I_{DD} = 160 mA unless noted otherwise. For over temperature data, I_{DD} is adjusted to 160 mA at each temperature specified. For over current data, V_{DD} is set to +8V and V_{GG} is adjusted until each specified current level is achieved.

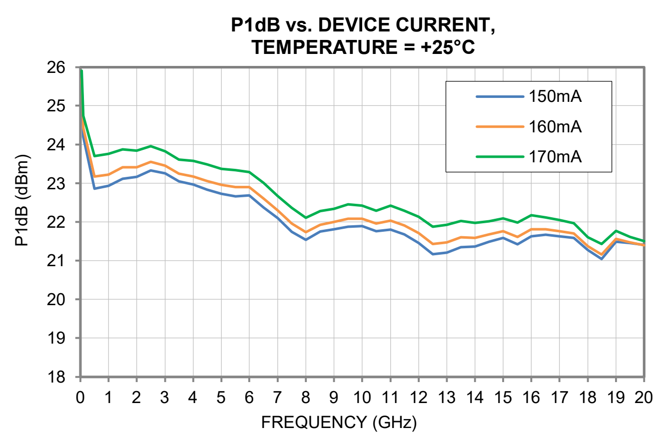












TYPICAL PERFORMANCE GRAPHS

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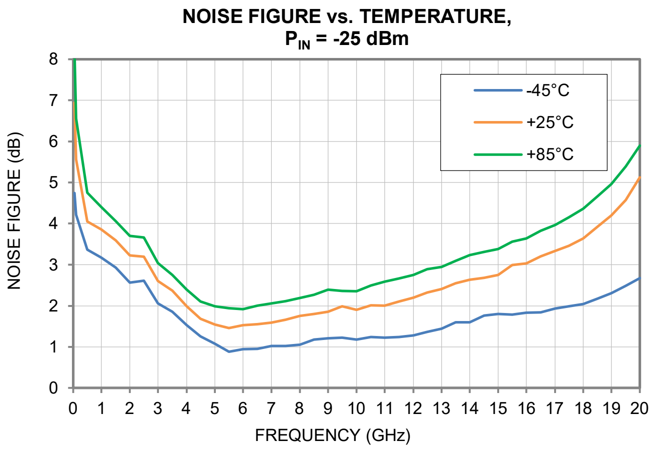
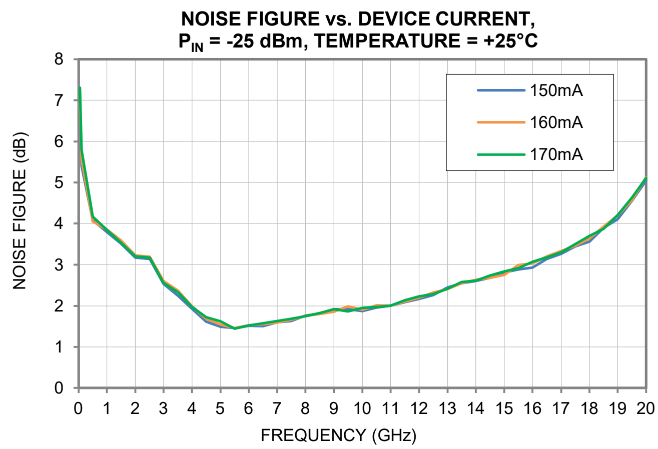
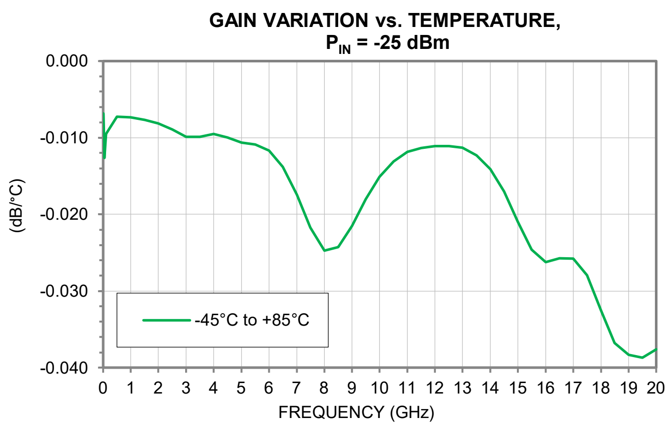






ABSOLUTE MAXIMUM RATINGS[6]

Parameter	Ratings
Operating Temperature	-45°C to +85°C
Storage Temperature	-65°C to +150°C
Total Power Dissipation	2.8W
Junction Temperature[7]	+175°C
Input Power (CW), V_{DD} = +8V, I_{DD} = 160mA	+21 dBm (Continuous)
DC Voltage on RF-OUT & V_{DD}	+10V
DC Voltage on RF-IN	+10V
DC Voltage on V_{GG}	-0.5V to -2V
Current I_{DD}	350mA
Current I_{GG}	-1.5mA to 0mA

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]	17.3 °C/W

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

ESD RATING

	Class	Voltage Range	Reference Standard
Human Body Model (HBM)	1B	500V to <1000V	ANSI/ESDA/JEDEC JS-001-2017
Charged Device Model (CDM)	C3	1000V	JESD22-C101F

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: MSL3 in accordance with IPC/JEDEC J-STD-020E/JEDEC J-STD-033C

FUNCTIONAL DIAGRAM

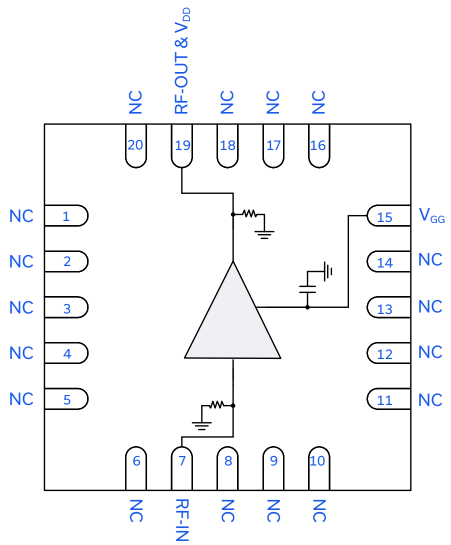


Figure 1. AVA-183MP+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF-IN	7	RF-IN Pad connects to RF-Input port. DUT includes an integrated shunt resistor for ESD protection.
RF-OUT & V_{DD}	19	RF-OUT & V_{DD} Pad connecs to RF-Output and the voltage input, V_{DD}, port. DUT includes an integrated shunt resistor for ESD protection.
V_{GG}	15	Gate DC Input Pad connects to the voltage input port V_{GG}.
GND	Paddle	Connects to ground.
NC	1-6, 8-14, 16-18, & 20	Not used internally. Connected to ground on test board.

CHARACTERIZATION TEST BOARD

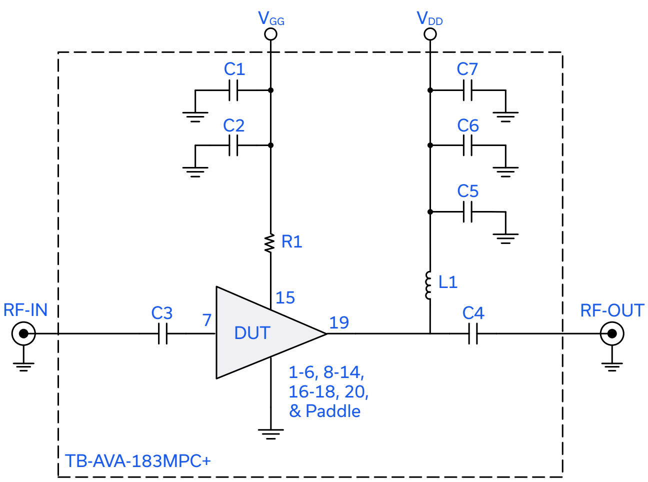


Figure 2. DUT soldered on Mini-Circuits Characterization Test Board: TB-AVA-183MPC+

Gain, Return Loss, Output Power at 1dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using PNA-X N5247B Microwave Network Analyzer:

Conditions
1. Gain and Return Loss: P_{IN}= -25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.
3. V_{DD} = +8V, I_{DD} = 160 mA

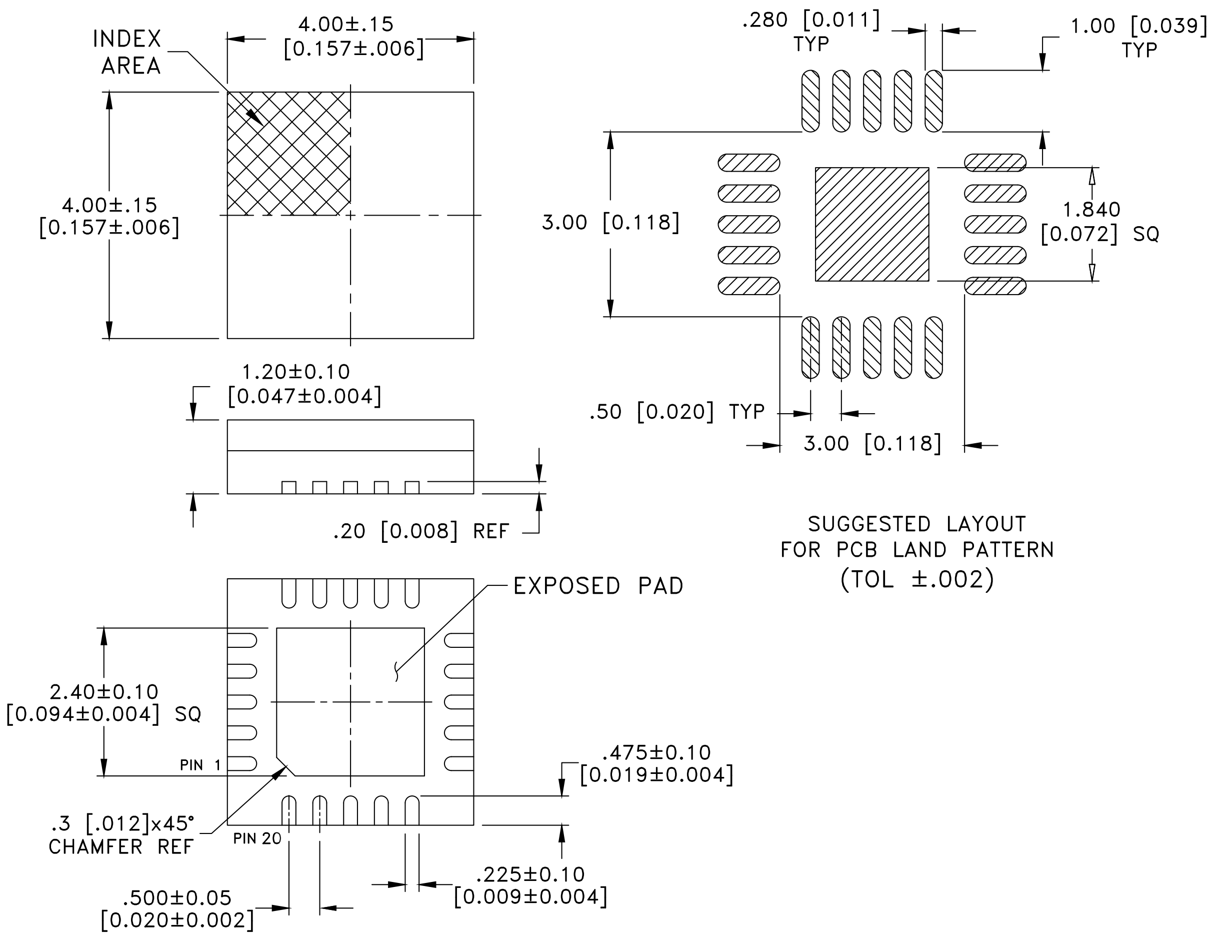
Caution: Permanent damage to the device will occur if the Power ON and Power OFF Sequences are not followed.

Power ON Sequence:
1) Set V_{GG} = -2V. Apply V_{GG}.
2) Set V_{DD} = +8V. Apply V_{DD}.
3) Increase V_{GG} to obtain desired I_{DD} as shown in specification table.
4) Apply RF Signal.

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

Component	Vendor	Vendor P/N	Value	Size
C1, C7	Samsung	CL31B106KBHNNNE	10µF	1206
C2, C6	AVX	06035C104KAT2A	0.1µF	0603
C5	Murata	GRM1885C1H101GA01D	100pF	0603
C3, C4	AVX	550L104KTT	0.1µF	0402
R1	KOA	RK73H1ETTP1001F	1kΩ	0402
L1	PICONICS	CC36T44K240G5-C	0.6µH	2.5mmx3.8mm

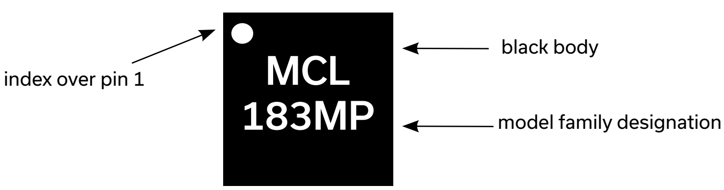
CASE STYLE DRAWING



Weight: 0.1 grams
Dimensions are in inches [mm].

Figure 3. DG1847-1 Case Style Drawing

PRODUCT MARKING



Marking may contain other features or characters for internal lot control

Figure 4. AVA-183MP+ Product Marking