MMIC SURFACE MOUNT

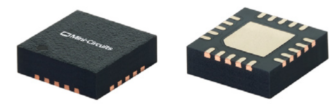
Wideband Amplifier

AVA-2183+

50Ω 2 to 20 GHz Excellent Gain Flatness

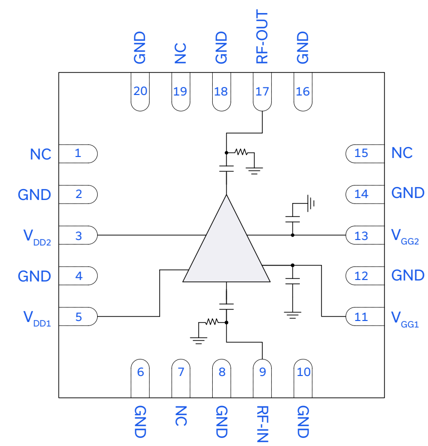
THE BIG DEAL

- Wideband 2 to 20 GHz
- Flat Gain, Typ. 16 ±1 dB
- P1dB, Typ. +19 dBm
- OIP3, Typ. +25 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

The AVA-2183+ is a GaAs pHEMT MMIC Amplifier that operates from 2 to 20 GHz. At 10 GHz the amplifier provides typical performance of 16.4 dB Gain, 5.2 dB Noise Figure, +19.3 dBm P1dB, and +24.7 dBm OIP3 from a +4V supply drawing 210 mA. The AVA-2183+ MMIC amplifier is housed in an industry standard 4x4mm 20-lead QFN-style package. With the RF ports internally matched to 50Ω this amplifier enables easy integration into microwave systems.

KEY FEATURES

Features	Advantages
Wideband: 2 to 20 GHz • Gain, Typ. 16 dB	Suitable for a variety of applications from wideband test and measurement equipment, and defense systems as well as narrowband telecommunications and satellite communications.
Good P1dB & OIP3 • P1dB, Typ. +19 dBm • OIP3, Typ. +25 dBm	Suitable as a linear gain block or as a LO driver for mixers in transmitter or receiver lineups.
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.

ELECTRICAL SPECIFICATIONS[1] AT 25°C, Zo = 50Ω, V_{DD} = +4V, I_{DD} = 210mA, UNLESS NOTED OTHERWISE

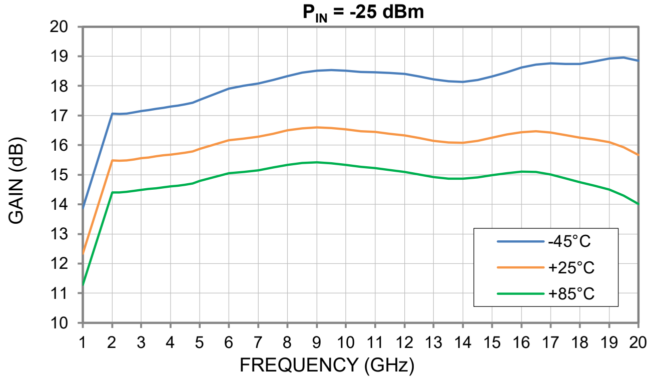
Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		2		20	GHz
Gain	2	12.9	15.0		dB
	5	14.2	15.6		
	10	15.7	16.4		
	15	15.1	16.2		
	20	13.7	15.9		
Input Return Loss	2		11.4		dB
	5		15.6		
	10		14.8		
	15		14.6		
	20		16.4		
Output Return Loss	2		18.9		dB
	5		20		
	10		20		
	15		19.8		
	20		16.3		
Isolation	2-20		60.8		dB
Output Power at 1 dB Compression (P1dB)	2		+18.4		dBm
	5		+18.9		
	10		+19.3		
	15		+18.4		
	20		+16.9		
Output Third-Order Intercept Point (P_{OUT} = 0dBm/Tone)	2		+27.9		dBm
	5		+26.3		
	10		+24.7		
	15		+22.9		
	20		+20.0		
Noise Figure	2		6.7		dB
	5		6.3		
	10		5.2		
	15		4.5		
	20		5.1		
Device Operating Voltage (V_{DD})		+3.75	+4	+4.25	V
Device Operating Current (I_{DD})[2]			210		mA
Gate Voltage (V_{GG})[3]			-0.52		V
Gate Current (I_{GG})			-0.2		μA
Device Current Variation Vs. Temperature[4]			0.48		μA/°C
Device Current Variation Vs. Voltage[5]			0.005		mA/mV

1. Tested in Mini-Circuits Characterization Test/Evaluation Board TB-AVA-2183C+. See Figure 2. De-embedded to the device reference plane.
2. Current at P_{IN} = -25 dBm. Increases to 230 mA at P1dB.
3. Typical Gate Voltage for when I_{DD} = 210 mA. V_{GG} must be adjusted so that I_{DD} = 210 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)

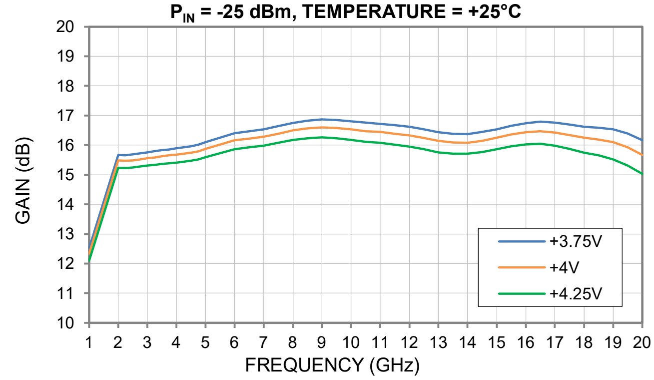
TYPICAL PERFORMANCE GRAPHS

All data taken was at nominal conditions V_{DD} = +4V and I_{DD} = 210 mA unless noted otherwise. For over temperature data, V_{GG} is adjusted to achieve I_{DD} = 210 mA at each temperature specified. For over voltage data, V_{GG} is adjusted to achieve I_{DD} = 210 mA at each voltage specified.

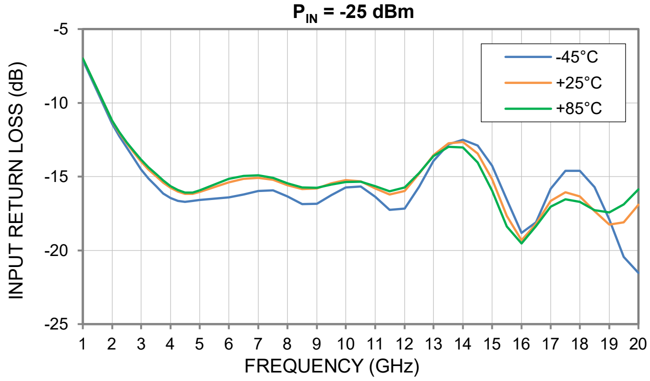
GAIN vs. TEMPERATURE, P_{IN} = -25 dBm



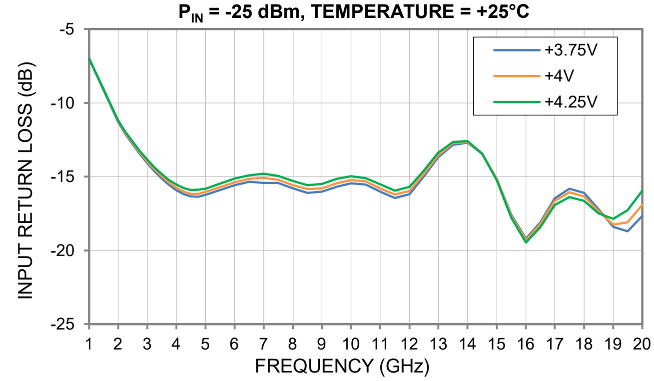
GAIN vs. DEVICE VOLTAGE, P_{IN} = -25 dBm, TEMPERATURE = +25°C



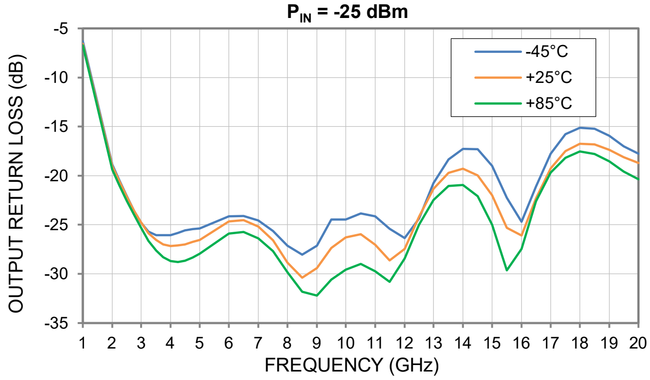
INPUT RETURN LOSS vs. TEMPERATURE, P_{IN} = -25 dBm



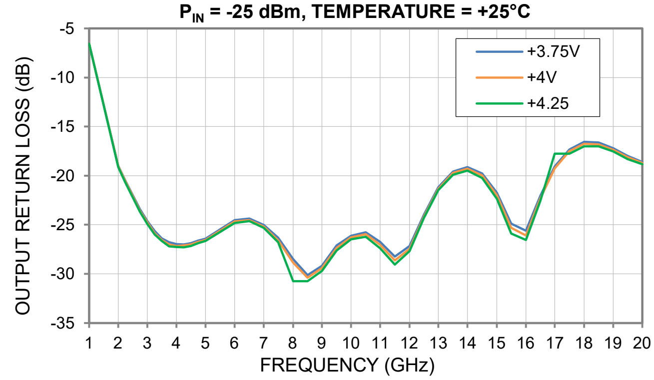
INPUT RETURN LOSS vs. DEVICE VOLTAGE, P_{IN} = -25 dBm, TEMPERATURE = +25°C



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



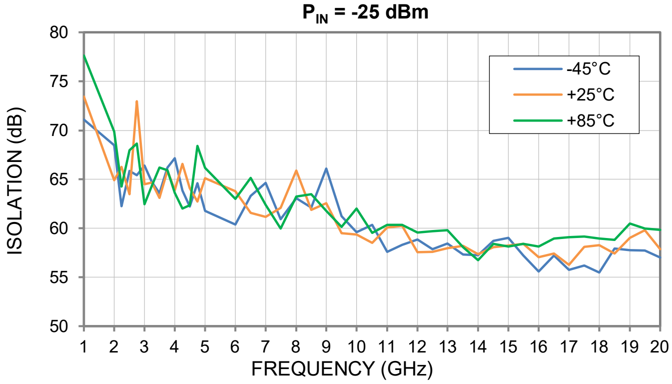
OUTPUT RETURN LOSS vs. DEVICE VOLTAGE, P_{IN} = -25 dBm, TEMPERATURE = +25°C



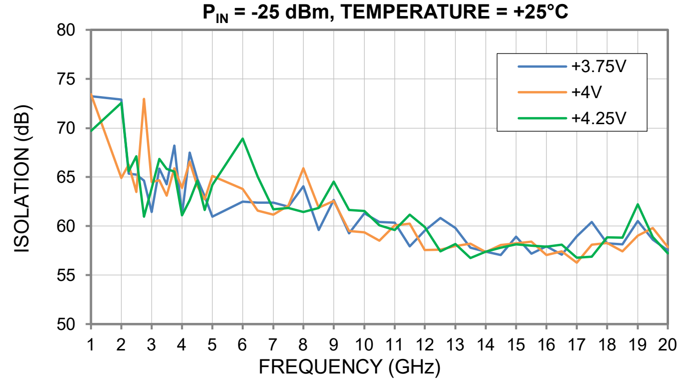
TYPICAL PERFORMANCE GRAPHS

All data taken was at nominal conditions V_{DD} = +4V and I_{DD} = 210 mA unless noted otherwise. For over temperature data, V_{GG} is adjusted to achieve I_{DD} = 210 mA at each temperature specified. For over voltage data, V_{GG} is adjusted to achieve I_{DD} = 210 mA at each voltage specified.

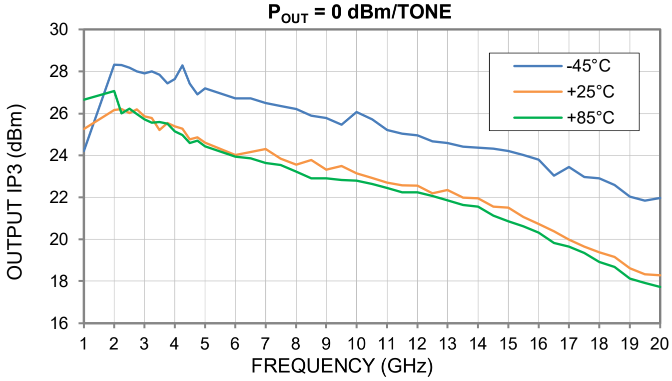
ISOLATION vs. TEMPERATURE, P_{IN} = -25 dBm



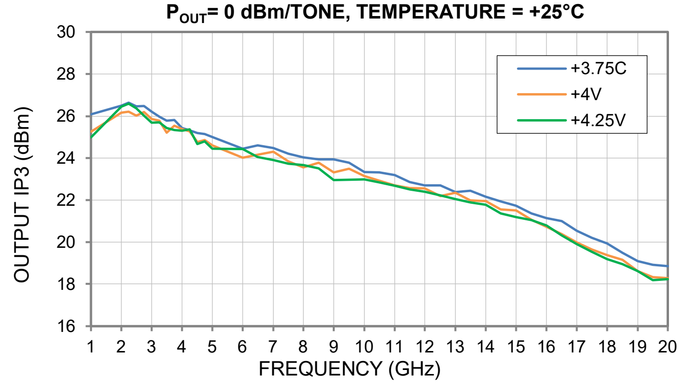
ISOLATION vs. DEVICE VOLTAGE, P_{IN} = -25 dBm, TEMPERATURE = +25°C



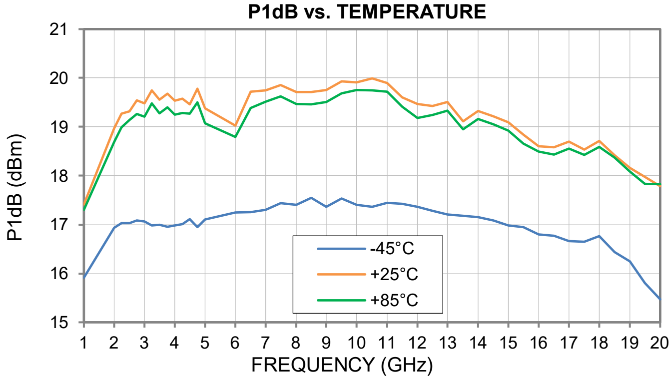
OUTPUT IP3 vs. TEMPERATURE, P_{OUT} = 0 dBm/TONE



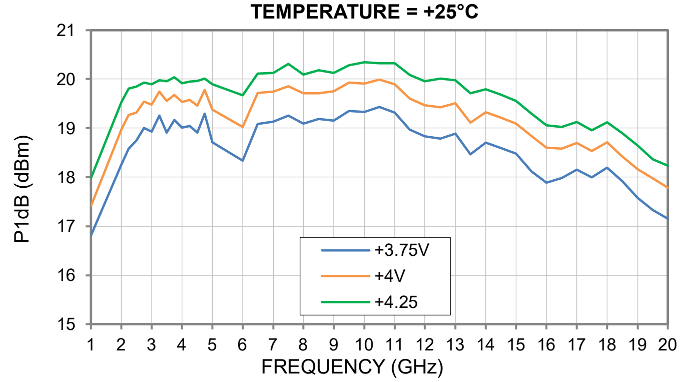
OUTPUT IP3 vs. DEVICE VOLTAGE, P_{OUT}= 0 dBm/TONE, TEMPERATURE = +25°C



P1dB vs. TEMPERATURE

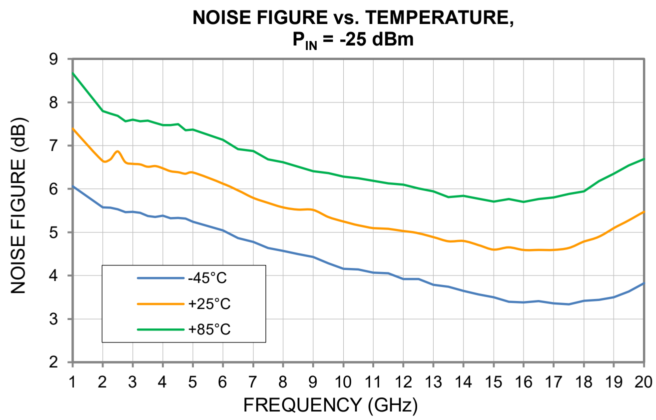


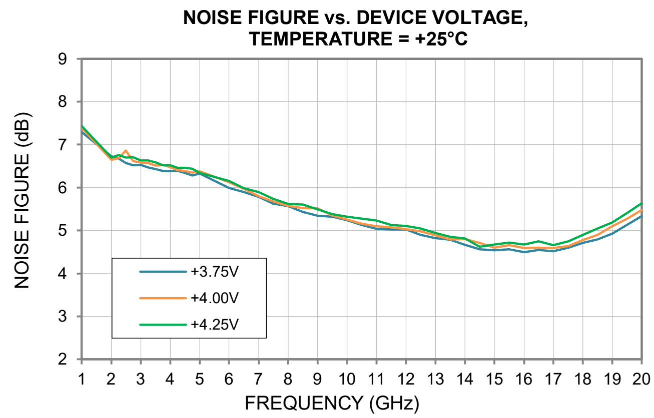
P1dB vs. DEVICE VOLTAGE, TEMPERATURE = +25°C

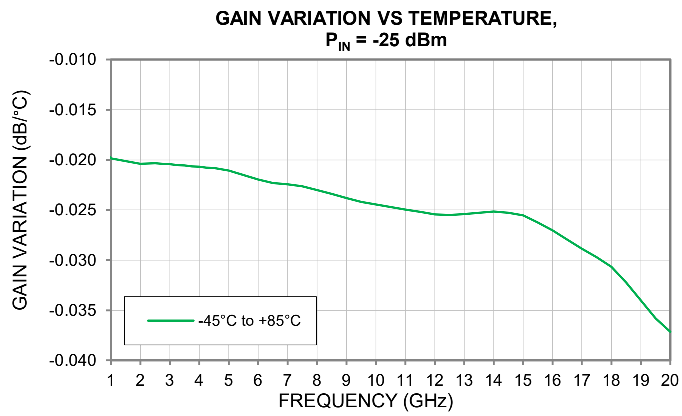


TYPICAL PERFORMANCE GRAPHS

All data taken was at nominal conditions V_{DD} = +4V and I_{DD} = 210 mA unless noted otherwise. For over temperature data, V_{GG} is adjusted to achieve I_{DD} = 210 mA at each temperature specified. For over voltage data, V_{GG} is adjusted to achieve I_{DD} = 210 mA at each voltage specified.







ABSOLUTE MAXIMUM RATINGS[6]

Parameter	Ratings
Operating Temperature	-45°C to +85°C
Storage Temperature	-65°C to +150°C
Total Power Dissipation	1.7 W
Junction Temperature[7]	+175°C
RF Input Power (CW)	+23 dBm (5 minute max) +14 dBm (continuous)
DC Voltage on RF-OUT & V_{DD}	+7V
DC Voltage on V_{GG}	-1.5 V to -0.2 V
Current I_{GG}	-5mA to 0mA
Current I_{DD}	320mA

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

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{jc})[8]	38.8 °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	500 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

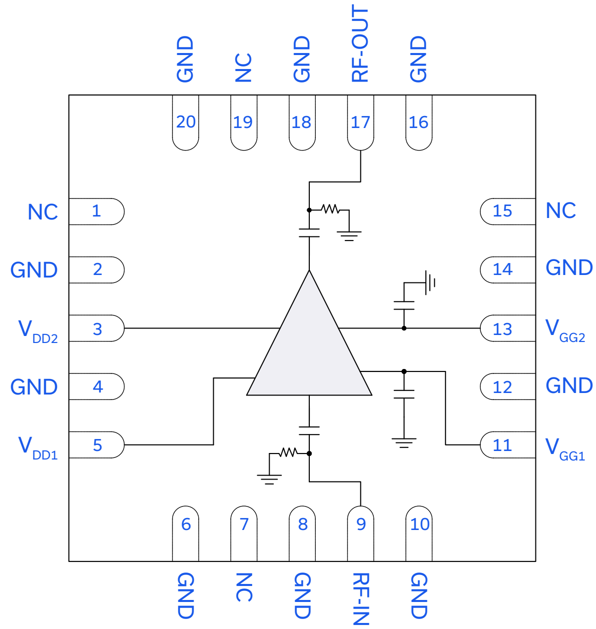


Figure 1. AVA-2183+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-IN	9	RF-IN Pad connects to RF-Input port. DUT includes an integrated shunt resistor for ESD protection and a DC blocking capacitor.
RF-OUT	17	RF-OUT Pad connects to RF-Output port. DUT includes an integrated shunt resistor for ESD protection and a DC blocking capacitor.
V_{DD1}	5	DC Input Pad connects to voltage input port V_{DD1}.
V_{DD2}	3	DC Input Pad connects to voltage input port V_{DD2}.
V_{GG1}	11	DC Input Pad connects to voltage input port V_{GG1}. DUT includes an integrated shunt capacitor.
V_{GG2}	13	DC Input Pad connects to voltage input port V_{GG2}. DUT includes an integrated shunt capacitor.
GND	2,4,6,8,10, 12,14,16,18, 20, & Paddle	Connects to ground.
NC	1,7,15, &19	Not used internally. Connected to ground on test board.

CHARACTERIZATION TEST BOARD

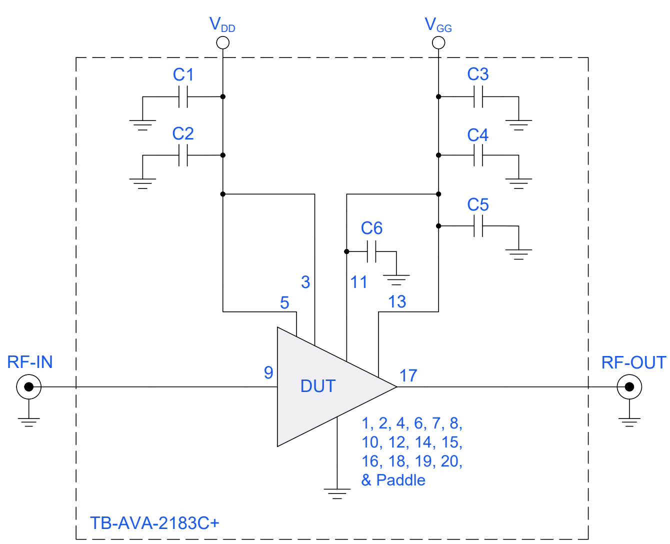


Figure 2. DUT soldered on Mini-Circuits Characterization Test Board: TB-AVA-2183C+

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} = +4V, I_{DD} = 210 mA

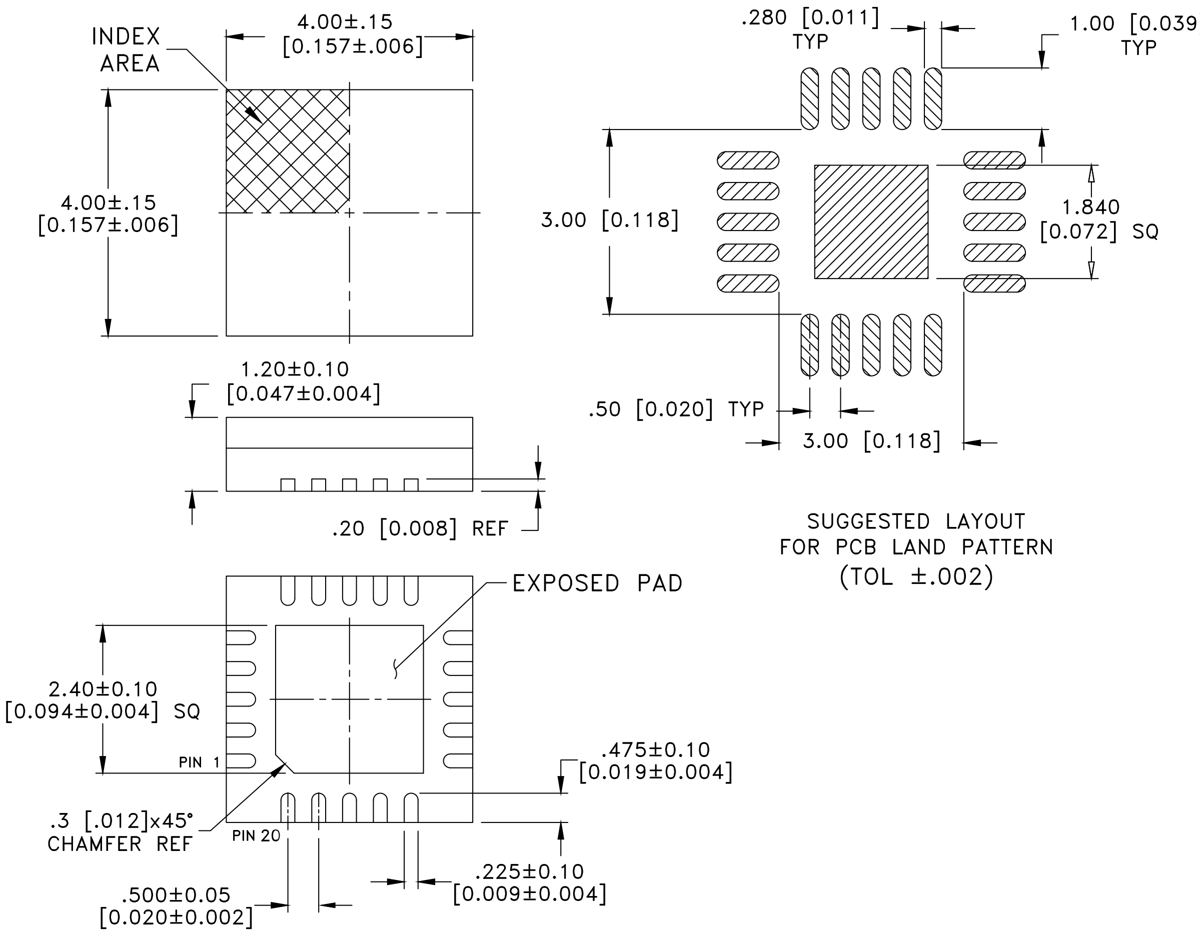
Caution: Permanent damage to the device will occur if the Power ON and Power OFF Sequences are not followed.

Power ON Sequence:
1) Set V_{GG} = -1.3V. Apply V_{GG}.
2) Set V_{DD} = +4V. 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 -1.3V.
3) Turn off V_{DD}.
4) Turn off V_{GG}.

Component	Vendor	Vendor P/N	Value	Size
C1, C3	Samsung	CL31B106KBHNNNE	10µF	1206
C2, C4	AVX	06035C104KAT2A	0.1µF	0603
C5, C6	Murata	GRM1885C1H101GA01D	100pF	0603

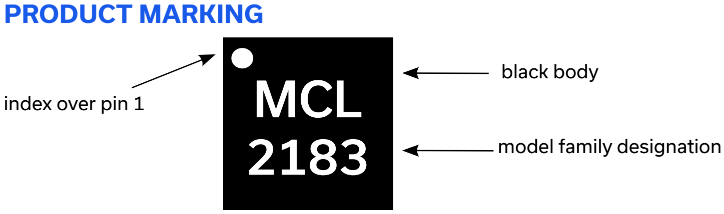
CASE STYLE DRAWING



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-2183+ Product Marking