MMIC SURFACE MOUNT

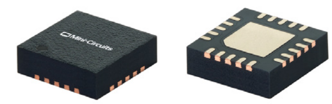
Wideband Amplifier

AVA-5R183+

50Ω 0.5 to 18 GHz High Dynamic Range

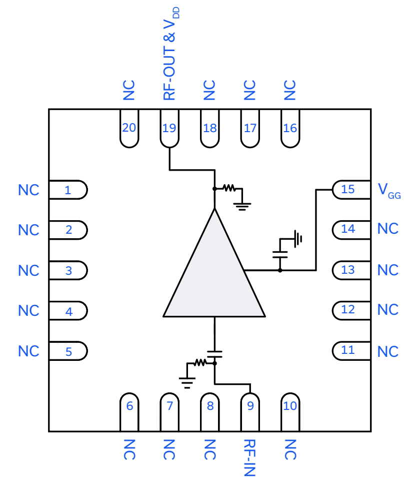
THE BIG DEAL

- Ultra wideband, 0.5-18 GHz
- High Dynamic Range
  - P1dB, Typ. +16.8 dBm
  - Gain, Typ. 14.4 dB
  - Noise Figure, Typ. 3.4 dB
- Low Power Dissipation, Typ. 0.4W
- OIP3, Typ. +27.9 dBm
- 4x4mm 20-Lead QFN-Style Package



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

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

PRODUCT OVERVIEW

AVA-5R183+ is a GaAs pHEMT MMIC wideband amplifier operating from 0.5 to 18 GHz. The amplifier provides 14.4 dB of Gain, +16.8 dBm P1dB, and +27.9 dBm OIP3 typical performance while operating from an +5V supply with 85mA current consumption. The AVA-5R183+ offers high dynamic range and lower power dissipation making it ideal as a receiver gain block in wideband applications such as Test and Measurement Equipment and Defense Systems. The amplifier is housed in an industry standard 4x4mm QFN-style package, with RF ports internally matched to 50Ω, facilitating easy integration into microwave system PC boards.

KEY FEATURES

Features	Advantages
Wideband: 0.5 to 18 GHz	Ideal for use in wideband Test and Measurement, Electronic Warfare and Electronic Countermeasure signal chains.
High Dynamic Range • P1dB, Typ. +16.8 dBm • OIP3, Typ. +27.9 dBm • NF, Typ. 3.4 dB	Suitable as a gain block for wideband signal chains.
Good Input and Output Return Loss	Eliminates need for external matching circuit enabling easy integration into signal chains.
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, V_{DD}=+5V, I_{DD}= 85 mA, UNLESS NOTED OTHERWISE

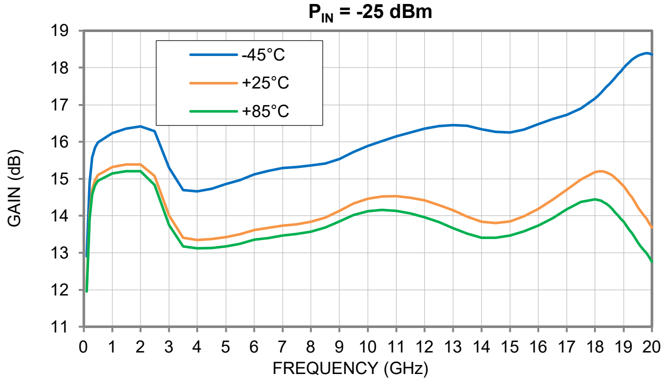
Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.5		18	GHz
Gain	0.5	14.2	15.0		dB
	5	12.8	13.4		
	10	13.9	14.4		
	15	13.1	13.9		
	18	14.6	15.3		
Input Return Loss	0.5		11.1		dB
	5		12.5		
	10		16.8		
	15		10.5		
	18		20.0		
Output Return Loss	0.5		20.0		dB
	5		20.0		
	10		18.3		
	15		17.2		
	18		19.4		
Isolation	0.5-18		40.5		dB
Output Power at 1 dB Compression (P1dB)	0.5		+18.0		dBm
	5		+18.3		
	10		+16.8		
	15		+15.0		
	18		+11.3		
Output Third-Order Intercept Point (P_{OUT} = 0dBm/Tone)	0.5		+26.2		dBm
	5		+29.4		
	10		+27.9		
	15		+27.9		
	18		+23.1		
Noise Figure	0.5		5.4		dB
	5		3.8		
	10		3.4		
	15		4.5		
	18		5.1		
Device Operating Voltage (V_{DD})		+4.75	+5	+5.25	V
Device Operating Current (I_{DD})[2]			85		mA
Gate Voltage (V_{GG})[3]			-0.9		V
Gate Current (I_{GG})			0.47		µA
Device Current Variation Vs. Temperature[4]			74.2		µA/°C
Device Current Variation Vs. Voltage[5]			0.007		mA/mV

1. Tested in Mini-Circuits Characterization Test/Evaluation Board TB-AVA-5R183C+. See Figure 2. De-embedded to the device reference plane.
2. Current at P_{IN} = -25 dBm. Increases to 125 mA at P1dB.
3. Typical Gate Voltage for when I_{DD} = 85 mA. V_{GG} must be adjusted so that I_{DD} = 85 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)

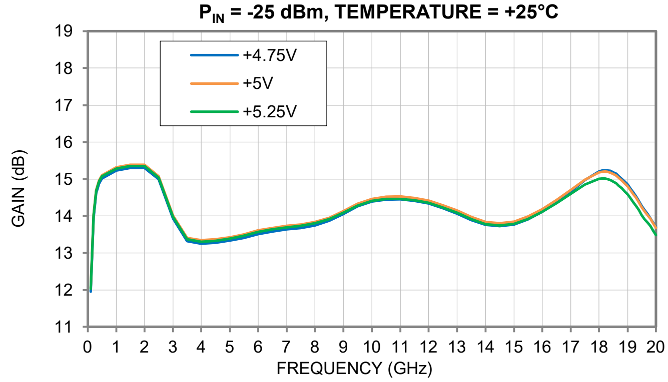
TYPICAL PERFORMANCE GRAPHS

All data taken was at nominal conditions V_{DD} = +5V and I_{DD} = 85 mA unless noted otherwise. For over temperature data, V_{GG} is adjusted to achieve I_{DD} = 85 mA at each temperature specified. For over voltage data, V_{GG} is adjusted to achieve I_{DD} = 85 mA at each voltage specified.

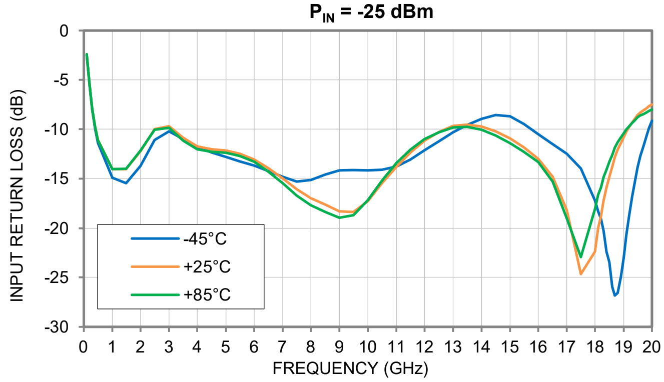
GAIN vs. TEMPERATURE, P_{IN} = -25 dBm



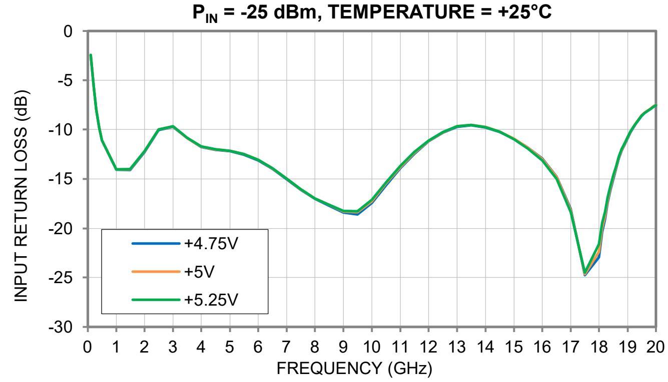
GAIN vs. DEVICE VOLTAGE, P_{IN} = -25 dBm, TEMPERATURE = +25°C



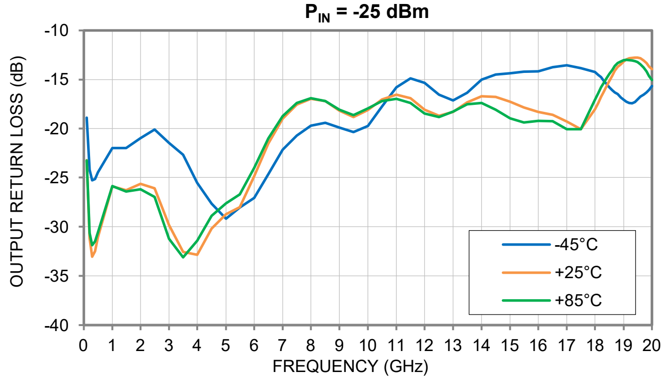
INPUT RETURN LOSS vs. TEMPERATURE, P_{IN} = -25 dBm



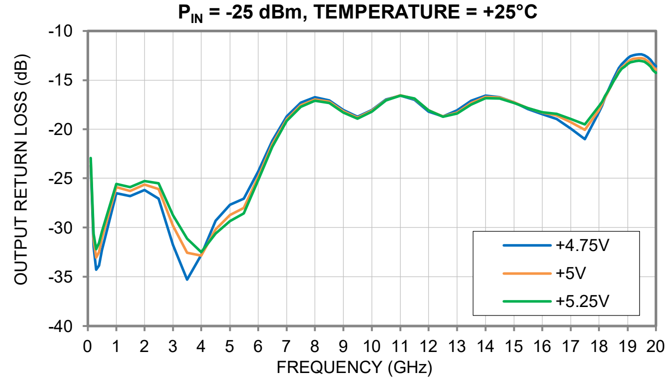
INPUT RETURN LOSS vs. DEVICE VOLTAGE, P_{IN} = -25 dBm, TEMPERATURE = +25°C



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



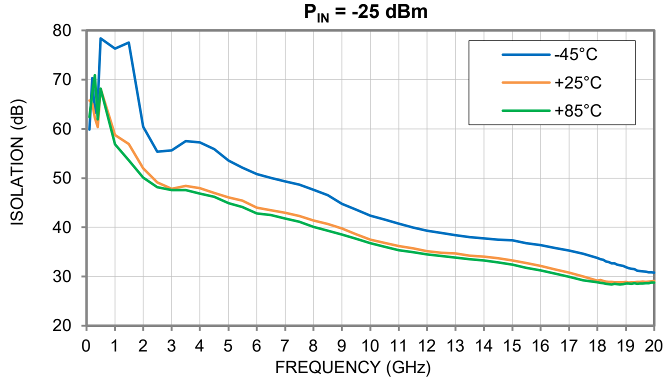
OUTPUT RETURN LOSS vs. DEVICE VOLTAGE, P_{IN} = -25 dBm, TEMPERATURE = +25°C



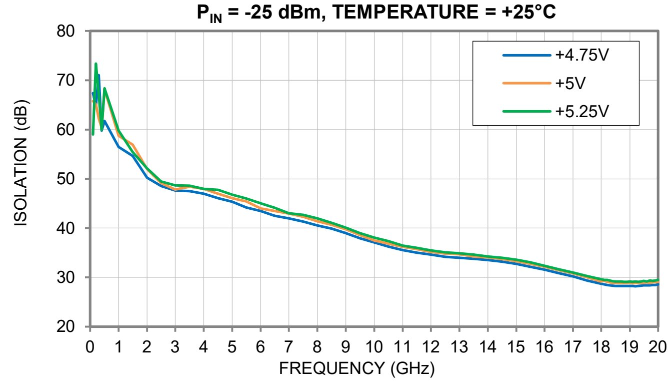
TYPICAL PERFORMANCE GRAPHS

All data taken was at nominal conditions V_{DD} = +5V and I_{DD} = 85 mA unless noted otherwise. For over temperature data, V_{GG} is adjusted to achieve I_{DD} = 85 mA at each temperature specified. For over voltage data, V_{GG} is adjusted to achieve I_{DD} = 85 mA at each voltage specified.

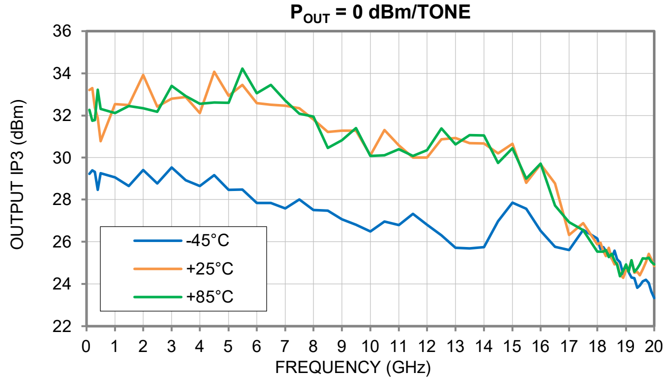
ISOLATION vs. TEMPERATURE, P_{IN} = -25 dBm



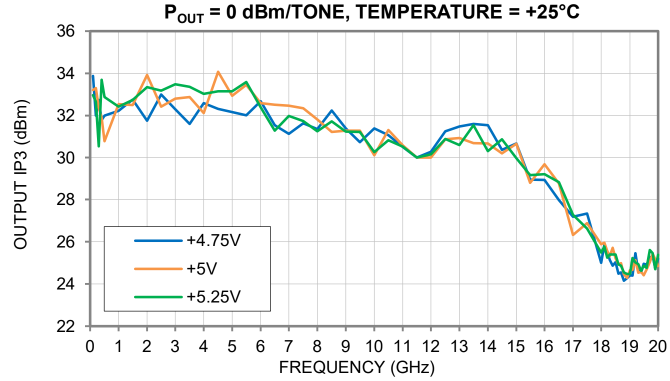
ISOLATION vs. DEVICE VOLTAGE, P_{IN} = -25 dBm, TEMPERATURE = +25°C



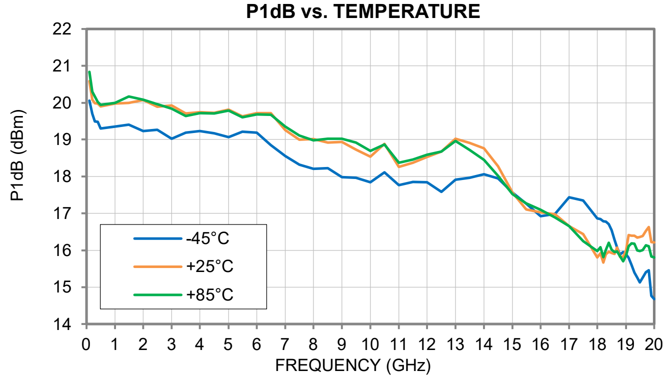
OUTPUT IP3 vs. TEMPERATURE, P_{OUT} = 0 dBm/TONE



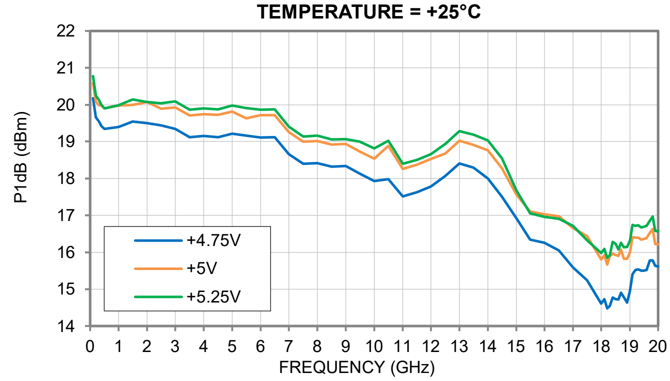
OUTPUT IP3 vs. DEVICE VOLTAGE, P_{OUT} = 0 dBm/TONE, TEMPERATURE = +25°C



P1dB vs. TEMPERATURE

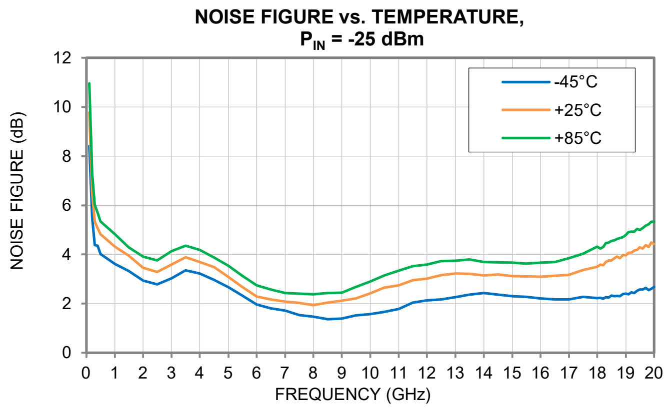


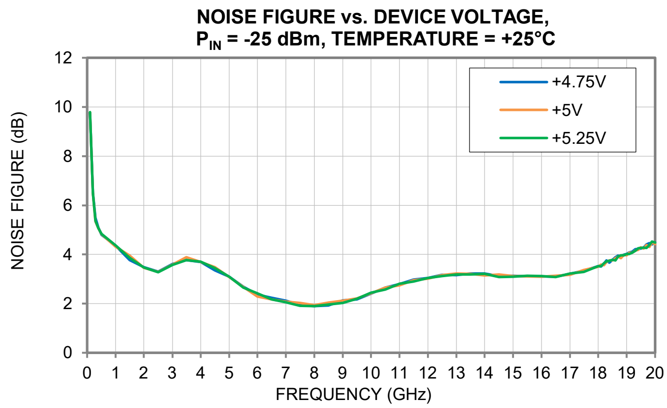
P1dB vs. DEVICE VOLTAGE, TEMPERATURE = +25°C

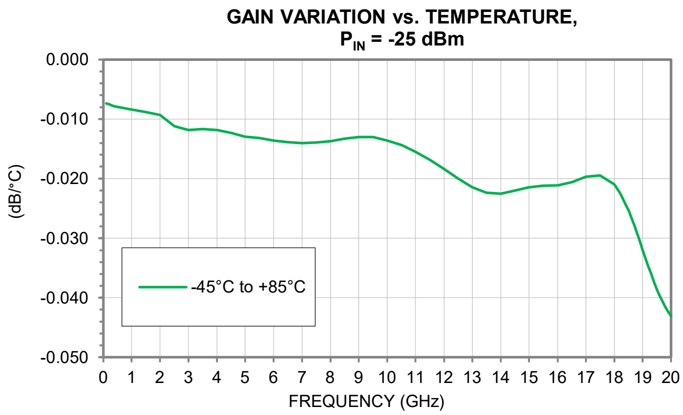


TYPICAL PERFORMANCE GRAPHS

All data taken was at nominal conditions V_{DD} = +5V and I_{DD} = 85 mA unless noted otherwise. For over temperature data, V_{GG} is adjusted to achieve I_{DD} = 85 mA at each temperature specified. For over voltage data, V_{GG} is adjusted to achieve I_{DD} = 85 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	2W
Junction Temperature[7]	+175°C
Input Power (CW), V_{DD} = +5V, I_{DD} = 85mA	+22 dBm (Continuous)
DC Voltage on RF-OUT & V_{DD}	+7V
DC Voltage on RF-IN	+7V
DC Voltage on V_{GG}	0V to -1.5V
Current I_{DD}	250mA
Current I_{GG}	0.8mA

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]	22.2 °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)	1C	1000V to <2000V	ANSI/ESDA/JEDEC JS-001-2017
Charged Device Model (CDM)	C3	1000V	JESD22-C101F

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

FUNCTIONAL DIAGRAM

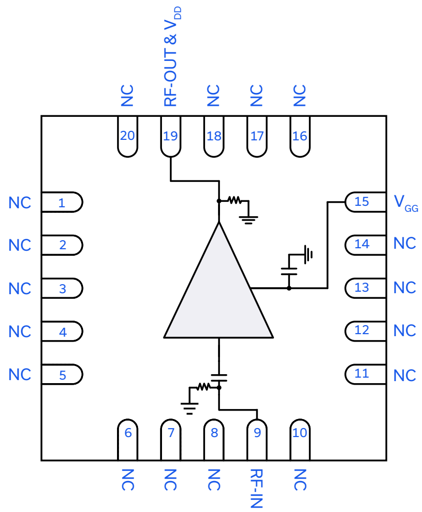


Figure 1. AVA-5R183+ Functional Diagram

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 and blocking capacitor for ESD protection.
RF-OUT & V_{DD}	19	RF-OUT & V_{DD} Pad connects to the RF-Output and the voltage input, V_{DD} , port. DUT includes an integrated shunt resistor for ESD protection.
V_{GG}	15	DC Input Pad connects to the gate voltage input port, V_{GG}.
GND	Paddle	Connects to ground.
NC	1-8, 10-14, 16-18, & 20	Not used internally. Connected to ground on test board.

CHARACTERIZATION TEST BOARD

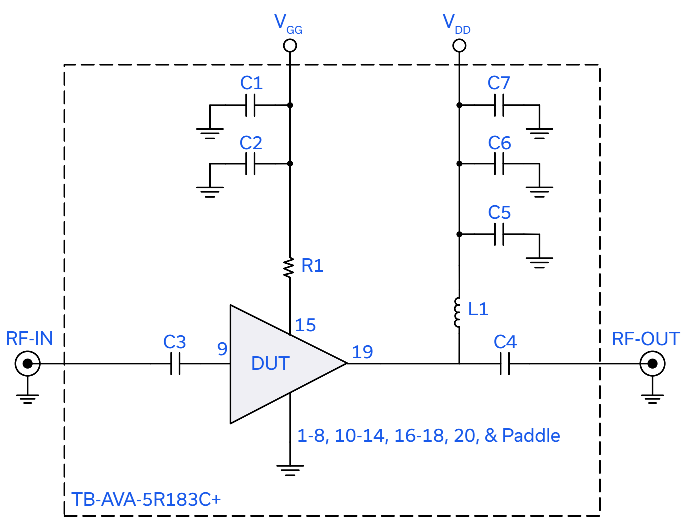


Figure 2. DUT soldered on Mini-Circuits Characterization Test Board: TB-AVA-5R183C+

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} = +5V, V_{GG} = -0.9V, I_{DD} = 85 mA

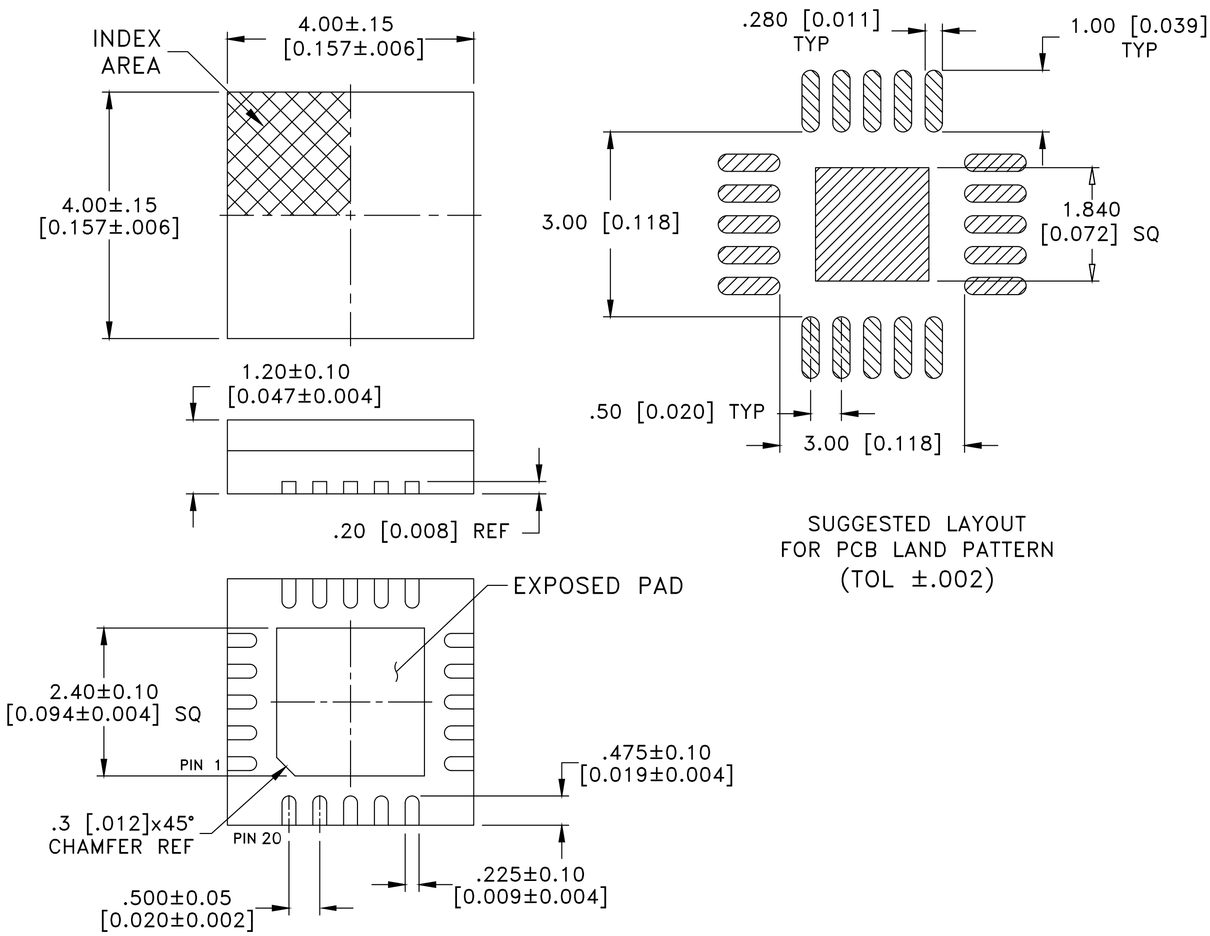
Caution: Permanent damage to the device will occur if the Power ON and Power OFF Sequences are not followed.

Power ON Sequence:
1) Set V_{GG} = -1.5V. Apply V_{GG}.
2) Set V_{DD} = +5V. 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 -1.5V.
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

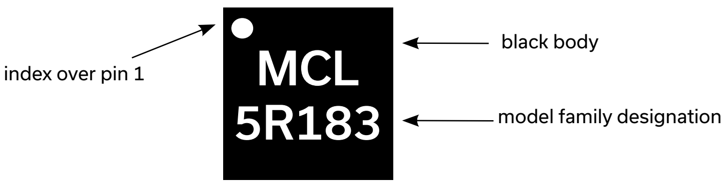
CASE STYLE DRAWING



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-5R183+ Product Marking

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD

CLICK HERE

Performance Data	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DG1847-1. QFN-style package, exposed paddle, Lead Finish: PPF
RoHs Status	Compliant
Tape & Reel **Standard quantities available on reel**	F66 7" reels with 20, 50 , 100, 200, 500, or 1000 devices
Suggested Layout for PCB Design	PL-751
Evaluation Board	TB-AVA-5R183C+ Gerber File
Environmental Ratings	ENV08T10
Product Handling	The use of no-clean solder is recommended. This package cannot be subjected to aqueous wash.