



MMIC SURFACE MOUNT

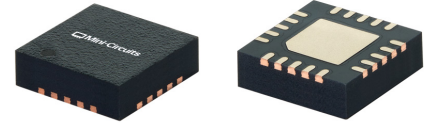
# Wideband Amplifier

## AVA-5R183+

50Ω 0.5 to 18 GHz High Dynamic Range

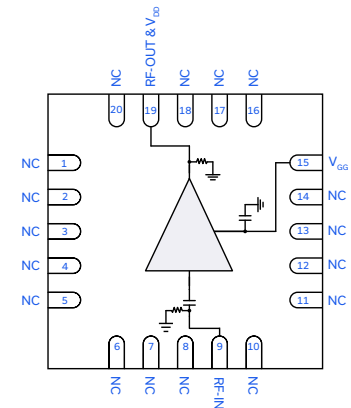
### THE BIG DEAL

- 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. 0.4 W
- OIP3, Typ. +27.9 dBm
- 4x4 mm 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 drawing 85 mA from the +5 V supply. 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 4x4 mm 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 <ul style="list-style-type: none"> <li>• P1dB, Typ. +16.8 dBm</li> <li>• OIP3, Typ. +27.9 dBm</li> <li>• NF, Typ. 3.4 dB</li> </ul>	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.
4x4 mm 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.

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ECO-024366  
AVA-5R183+  
MCL NY  
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## Wideband Amplifier

AVA-5R183+

Mini-Circuits

50Ω 0.5 to 18 GHz High Dynamic Range

ELECTRICAL SPECIFICATIONS<sup>1</sup> AT 25°C, V<sub>DD</sub>= +5 V, I<sub>DD</sub>= 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 @ 1 dB Compression (P <sub>1dB</sub> )	0.5		+19.9		dBm
	5		+20.3		
	10		+19.3		
	15		+18.4		
	18		+16.6		
Output Third-Order Intercept Point (P <sub>OUT</sub> = 0 dBm/Tone)	0.5		+31.7		dBm
	5		+33.6		
	10		+30.6		
	15		+30.7		
	18		+25.9		
Noise Figure	0.5		4.9		dB
	5		3.2		
	10		2.4		
	15		3.1		
	18		3.5		
Device Operating Voltage (V <sub>DD</sub> )		+4.75	+5	+5.25	V
Device Operating Current (I <sub>DD</sub> ) <sup>2</sup>			85		mA
Gate Voltage (V <sub>GG</sub> ) <sup>3</sup>			-0.9		V
Gate Current (I <sub>GG</sub> )			0.47		μA
Device Current Variation vs. Temperature <sup>4</sup>			74.2		μA/°C
Device Current Variation vs. Voltage <sup>5</sup>			0.007		mA/mV

1. Tested on Mini-Circuits Characterization Test/Evaluation Board TB-AVA-5R183C+. See Figure 2. De-embedded to the device reference plane.

2. Current at P<sub>IN</sub> = -25 dBm. Increases to 125 mA at P<sub>1dB</sub>.

3. Typical Gate Voltage for when I<sub>DD</sub> = 85 mA. V<sub>GG</sub> must be adjusted so that I<sub>DD</sub> = 85 mA.

4. ((Current at +Tmax°C - Current at -Tmin°C) / (+Tmax °C - -Tmin °C))

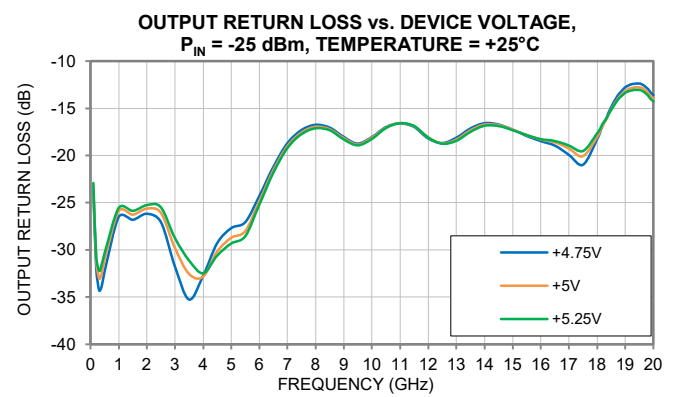
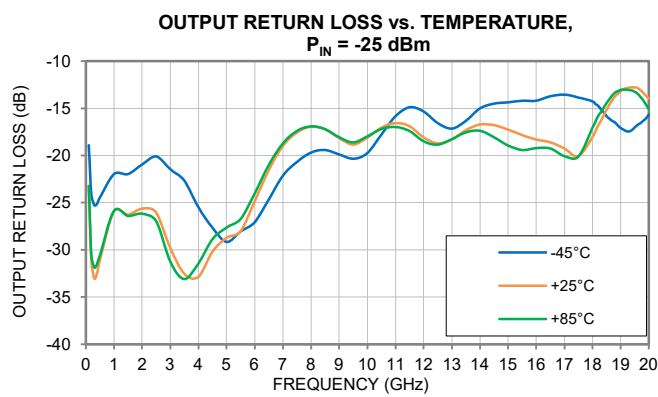
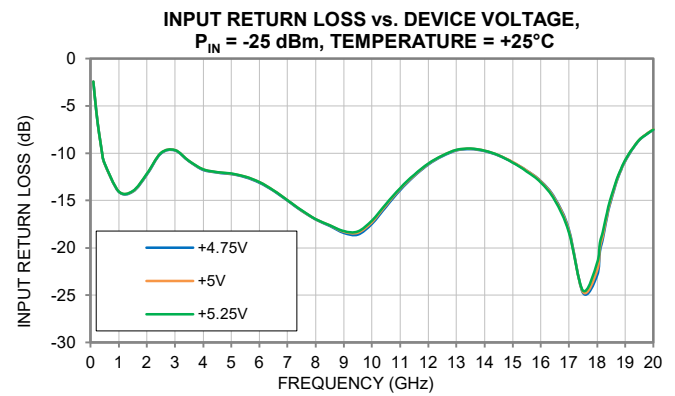
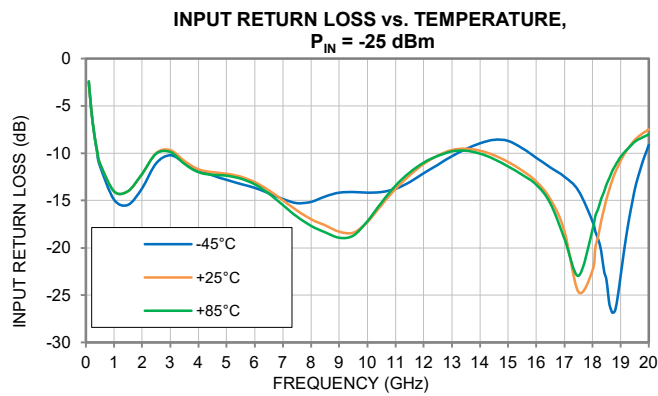
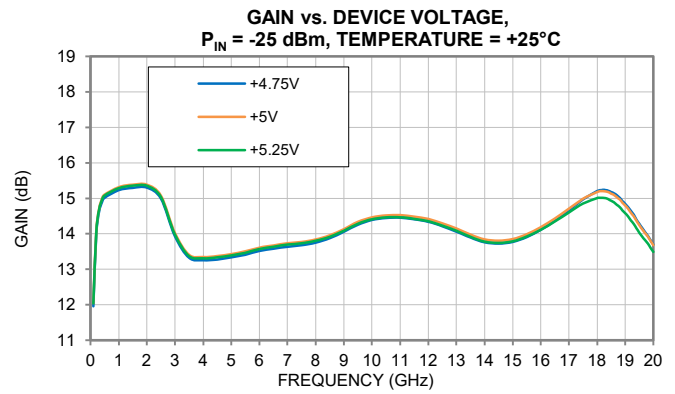
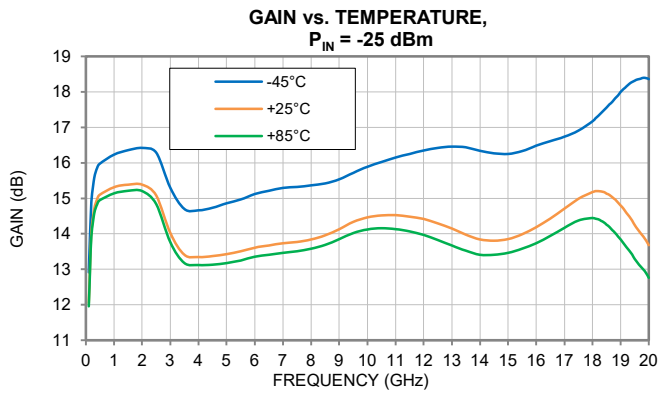
5. ((Current at +5.25 V) - (Current at +4.75 V)) / (+5.25 V - +4.75 V)





### TYPICAL PERFORMANCE GRAPHS

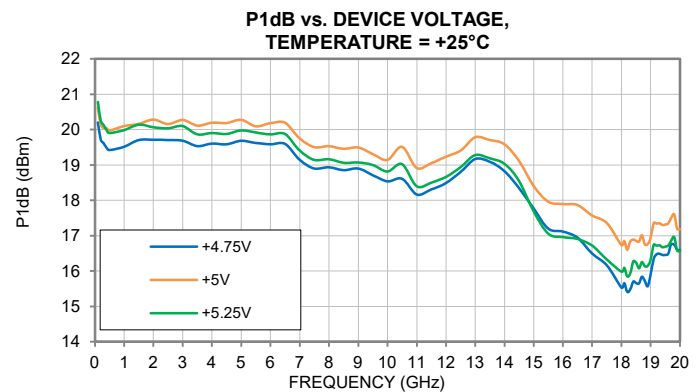
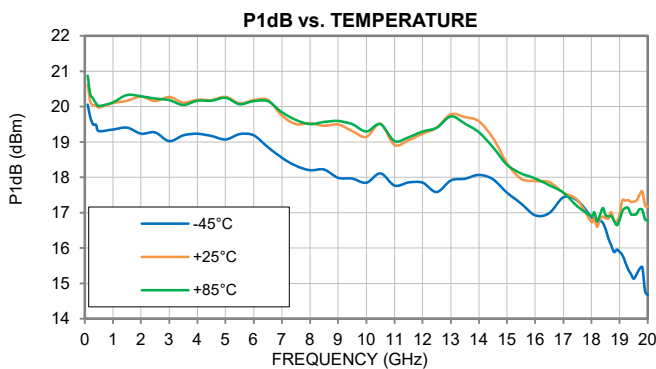
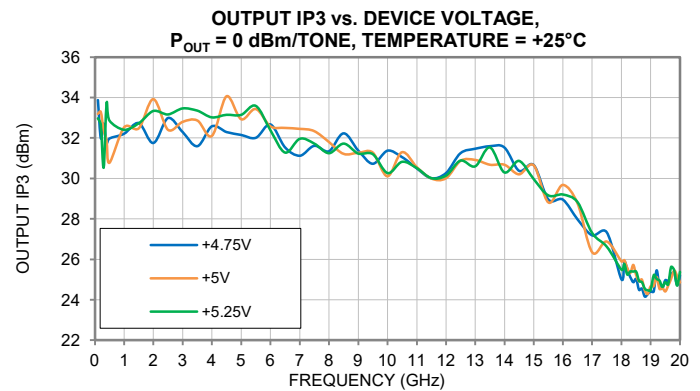
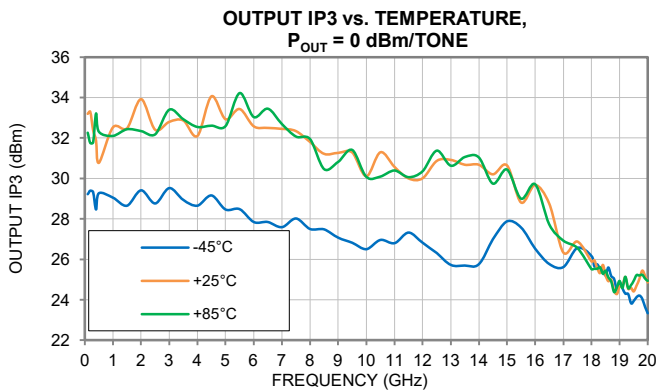
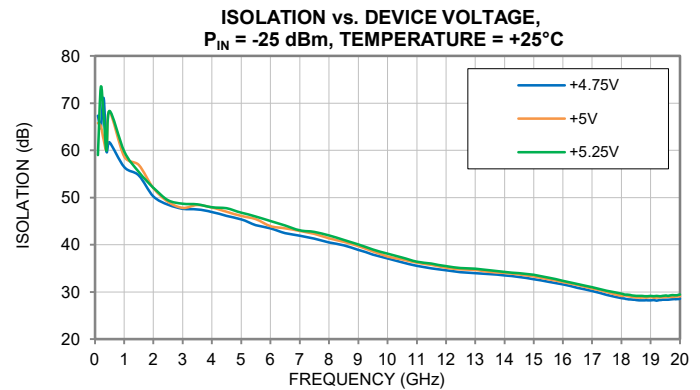
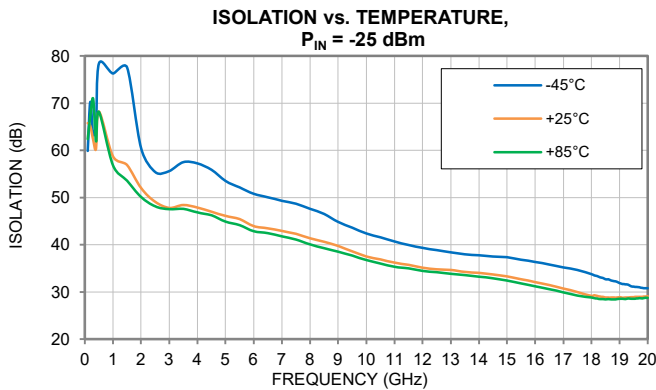
All data taken was at nominal conditions  $V_{DD} = +5\text{ V}$  and  $I_{DD} = 85\text{ mA}$  unless noted otherwise. For over temperature data,  $V_{GG}$  is adjusted to achieve  $I_{DD} = 85\text{ mA}$  at each temperature specified. For over voltage data,  $V_{GG}$  is adjusted to achieve  $I_{DD}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





### TYPICAL PERFORMANCE GRAPHS

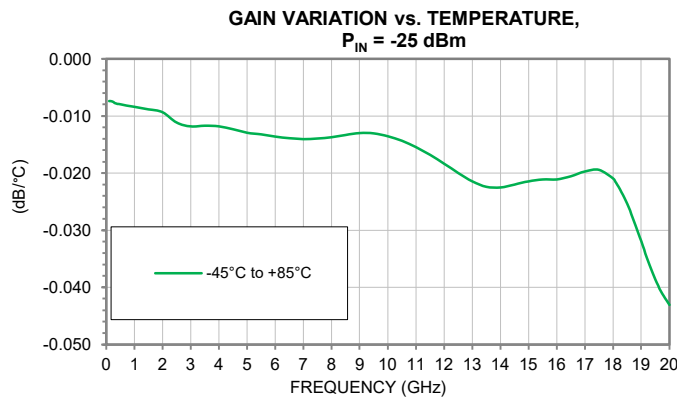
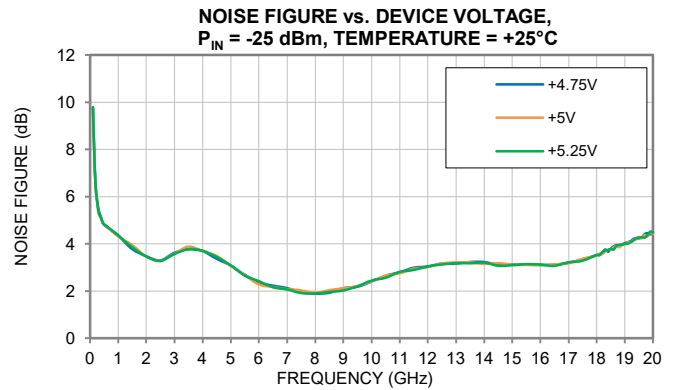
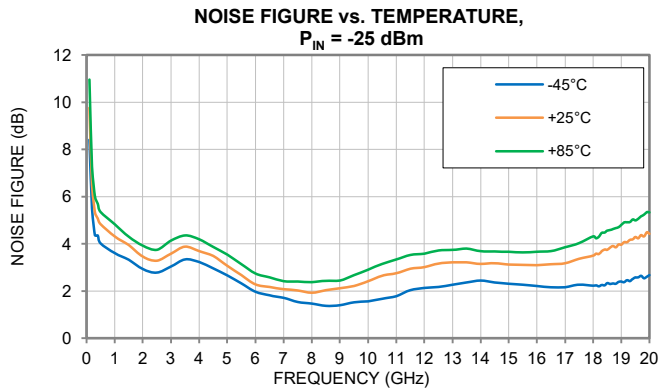
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50Ω 0.5 to 18 GHz High Dynamic Range

### ABSOLUTE MAXIMUM RATINGS<sup>6</sup>

Parameter	Ratings
Operating Temperature	-45°C to +85°C
Storage Temperature	-65°C to +150°C
Total Power Dissipation	2 W
Junction Temperature <sup>7</sup>	+175°C
Input Power (CW), $V_{DD} = +5 V$ , $I_{DD} = 85 mA$	+22 dBm (Continuous)
DC Voltage on RF-OUT & $V_{DD}$	+7 V
DC Voltage on RF-IN	+7 V
DC Voltage on $V_{GG}$	0 V to -1.5 V
Current $I_{DD}$	250 mA
Current $I_{GG}$	0.8 mA

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 ( $\Theta_{jc}$ ) <sup>8</sup>	22.2 °C/W

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

### ESD RATING

	Class	Voltage Range	Reference Standard
Human Body Model (HBM)	1C	1000 V to <2000 V	ANSI/ESDA/JEDEC JS-001-2017
Charged Device Model (CDM)	C3	1000 V	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

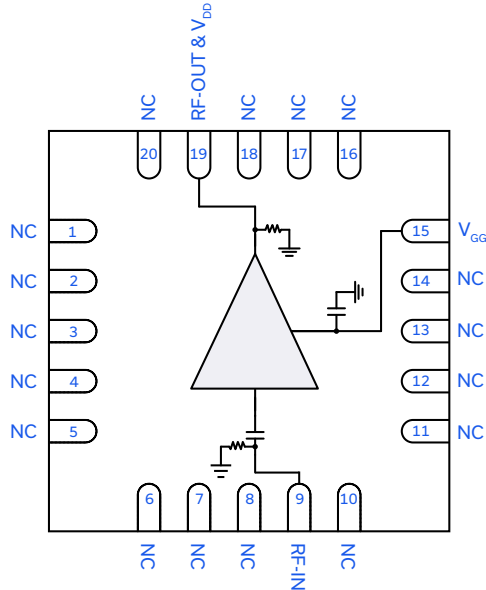


Figure 1. AVA-5R183+ Functional Diagram

### PAD DESCRIPTION

Function	Pad Number	Application 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 <sub>DD</sub>	19	RF-OUT & V <sub>DD</sub> Pad connects to the RF-Output and the voltage input, V <sub>DD</sub> , port. DUT includes an integrated shunt resistor for ESD protection.
V <sub>GG</sub>	15	DC Input Pad connects to the gate voltage input port, V <sub>GG</sub> .
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

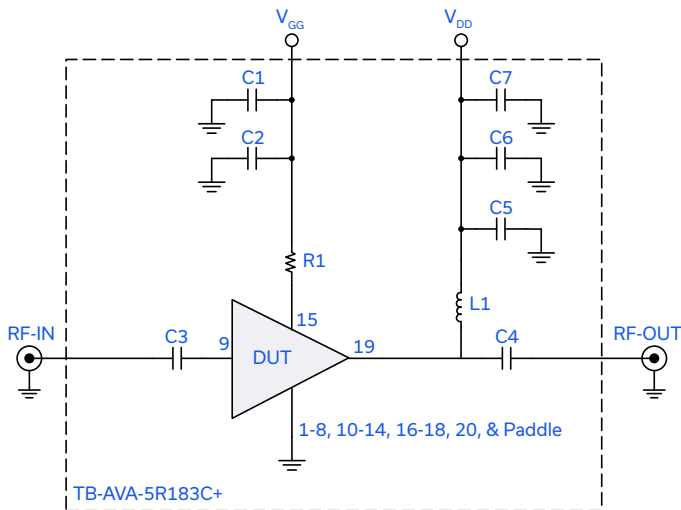


Figure 2. DUT soldered on Mini-Circuits Evaluation Board: TB-AVA-5R183C+

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<sub>IN</sub> = -25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.
3. V<sub>DD</sub> = +5 V, V<sub>GG</sub> = -0.9 V, I<sub>DD</sub> = 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<sub>GG</sub> = -1.5 V. Apply V<sub>GG</sub>.
- 2) Set V<sub>DD</sub> = +5 V. Apply V<sub>DD</sub>.
- 3) Increase V<sub>GG</sub> to obtain desired I<sub>DD</sub> as shown in specification table.
- 4) Apply RF Signal

#### Power OFF Sequence:

- 1) Turn off RF Signal.
- 2) Adjust V<sub>GG</sub> down to -1.5 V.
- 3) Turn off V<sub>DD</sub>.
- 4) Turn off V<sub>GG</sub>.

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



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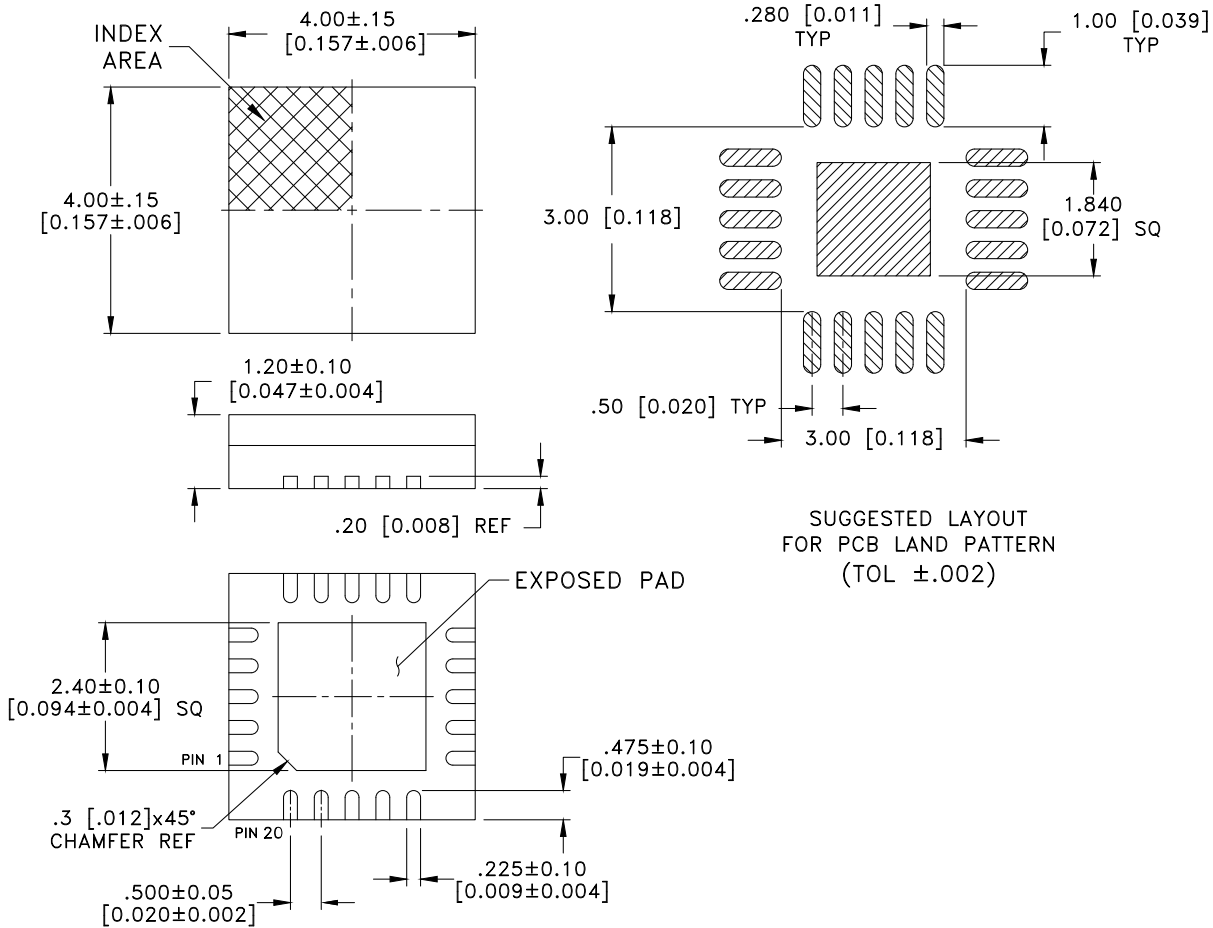
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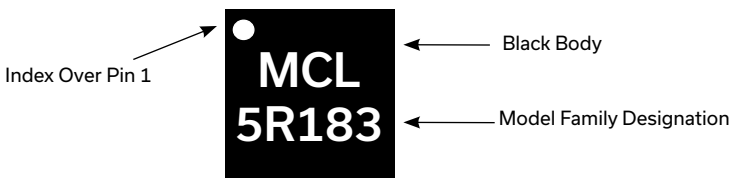
50Ω 0.5 to 18 GHz High Dynamic Range

### CASE STYLE DRAWING



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

### PRODUCT MARKING



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





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## AVA-5R183+

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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD

[CLICK HERE](#)

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

#### 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.
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