



MMIC DIE

Wideband Amplifier

AVA-5R183-D+

50Ω 0.5 to 18 GHz

THE BIG DEAL

- Wideband, 0.5 to 18 GHz
- Excellent Gain Flatness, ± 1.6 dB Typ. up to 18 GHz
- Good Reverse Isolation, 36 dB Typ.
- +18 dBm Typ. P1dB.



+RoHS Compliant

The +Suffix identifies RoHS Compliance.
See our website for methodologies and qualifications

APPLICATIONS

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

SEE ORDERING INFORMATION ON THE LAST PAGE

PRODUCT OVERVIEW

The AVA-5R183-D+ is a GaAs PHEMT MMIC wideband amplifier operating from 0.5 to 18 GHz. The amplifier provides 13.5 dB of Gain, +18 dBm P1dB, and +23 dBm OIP3 typical performance while operating from a +5V supply with 85 mA current consumption. The amplifier has excellent input and output impedance matches which makes for easy cascading with other devices in multi-chip modules. The Gain flatness along with the other performance characteristics makes AVA-5R183-D+ ideal for use in wideband EW Defense Systems and Test and Measurement Equipment.

KEY FEATURES

| Features | Advantages |
|---|---|
| Wideband: 0.5 to 18 GHz | General purpose wideband amplifier is suitable for wide variety of applications. |
| Excellent Gain Flatness • 1.6 dB Typ. up to 18 GHz | Desirable feature for maintaining frequency response within wideband signal chains. |
| Good Reverse Isolation, 18 dB Typ. | Isolates adjacent circuitry without need for an external expensive isolator. |
| Good Input and Output Return Loss | Excellent Return Loss enables easy cascade within wideband signal chains. |
| Unpackaged die | Suitable for chip and wire hybrid assemblies. |

REV. OR
ECO-014348
AVA-5R183-D+
MCL NY
220727



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ELECTRICAL SPECIFICATIONS¹ AT 25°C, VDD = +5V, IDD = 85mA & Zo = 50Ω, UNLESS NOTED OTHERWISE

| Parameter | Condition (GHz) | VDD = +5V | | | Units |
|---|-----------------|-----------|-------|-------|-------|
| | | Min. | Typ. | Max. | |
| Frequency Range | | 0.5 | | 18 | GHz |
| Gain | 0.5 | | 14.6 | | dB |
| | 5 | | 12.9 | | |
| | 10 | | 13.3 | | |
| | 15 | | 12.5 | | |
| | 18 | | 13.1 | | |
| Input Return Loss | 0.5 | | 12 | | dB |
| | 5 | | 12 | | |
| | 10 | | 13 | | |
| | 15 | | 9 | | |
| | 18 | | 12 | | |
| Output Return Loss | 0.5 | | 36 | | dB |
| | 5 | | 25 | | |
| | 10 | | 34 | | |
| | 15 | | 16 | | |
| | 18 | | 17 | | |
| Reverse Isolation | 0.5-18 | | 36 | | dB |
| Output Power at 1 dB Compression | 0.5 | | 19.5 | | dBm |
| | 5 | | 19.7 | | |
| | 10 | | 18.6 | | |
| | 15 | | 17.7 | | |
| | 18 | | 16.3 | | |
| Output Third-Order Intercept Pout = 0 dBm/Tone | 0.5 | | 31.3 | | dBm |
| | 5 | | 27.4 | | |
| | 10 | | 23.3 | | |
| | 15 | | 21.7 | | |
| | 18 | | 20 | | |
| Noise Figure | 0.5 | | 4.8 | | dB |
| | 5 | | 3.3 | | |
| | 10 | | 2.8 | | |
| | 15 | | 3.6 | | |
| | 18 | | 4.4 | | |
| Device Operating Voltage (VDD) | | +4.75 | +5 | +5.25 | V |
| Device Operating Current (IDD) | | | 85 | | mA |
| Device Gate Voltage (VG) | | | -0.94 | | V |
| Device Gate Current (IG) | | | 0.47 | | µA |
| Device Current Variation vs. Temperature ² | | | 264.5 | | µA/°C |
| Device Current Variation vs. Voltage ³ | | | 0.007 | | mA/mV |
| Thermal Resistance, Junction-to-Ground Lead (ΘJC) | | | 22.2 | | °C/W |

1. Die is soldered and measured on a die characterization board. See characterization circuit (Fig. 1)

2. Device Current Variation vs. Temperature = (Current in mA at +100°C - Current in mA at -55°C) / +155°C

3. Device Current Variation vs. Voltage = (Current in mA at +5.25V - Current in mA at +4.75V) / ((+5.25V - +4.75V) * 1000 mA/mV)



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MAXIMUM RATINGS⁴

| Parameter | Ratings |
|-------------------------------------|---------------------|
| Operating Temperature (ground lead) | -55°C to +100°C |
| Junction Temperature | +150°C ⁵ |
| Power Dissipation | 4.4W ⁶ |
| Input Power (CW) | +22 dBm |
| DC Voltage on RF-OUT & VDD | +7V |
| DC Voltage on VG | -0.5V to -2V |
| DC Voltage on RF-IN ⁷ | +7V |
| Current IDD | 250mA |
| Current IG | 2mA |

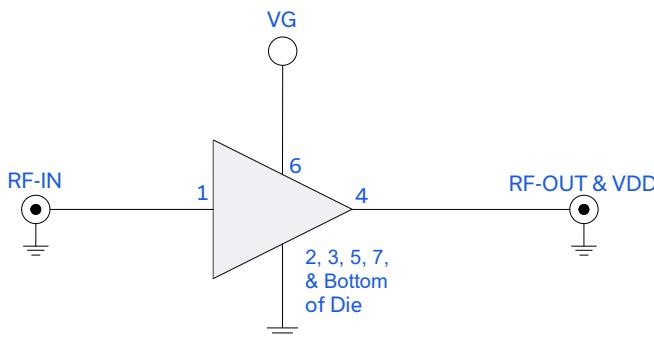
4. Permanent damage may occur if these limits are exceeding. Electrical maximum ratings are not intended for continuous normal operation.

5. $T_j = +85^\circ\text{C} + (\text{VDD})^*(\text{IDD})^*(\text{eJC}) = +94^\circ\text{C}$. Keeping T_j below +94°C will ensure MTTF > 100 Years.

6. Derates linearly to 1.57 W at +100°C

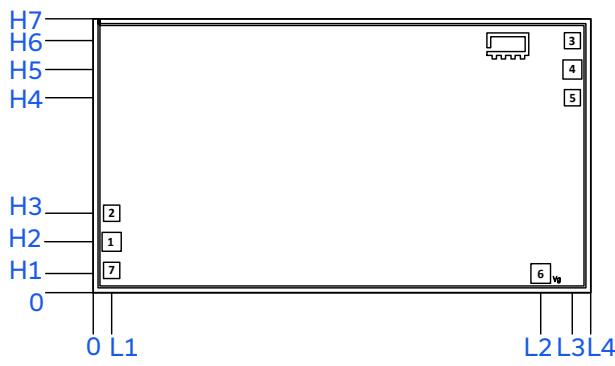
7. DC signal at RF-IN will be blocked by internal blocking capacitor. However, a DC current of 3.5µA will be present due to the input shunt resistor assuming VRF-IN = +7V.

SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION



| Function | Pad Number | Description |
|--------------|-------------------------|---|
| RF-IN | 1 | RF Input Pad |
| RF-OUT & VDD | 4 | RF Output and DC Input Pad |
| VG | 6 | Gate Bias Pad |
| GROUND | 2,3,5,7 & Bottom of Die | The bond pads are connected to back-side through vias and do not require any wire-bond connections to ground. |

BONDING PAD POSITION



DIMENSIONS IN µm, TYP.

| L1 | L2 | L3 | L4 |
|----|------|------|------|
| 96 | 2351 | 2518 | 2614 |

| H1 | H2 | H3 | H4 | H5 | H6 | H7 |
|----|-----|-----|------|------|------|------|
| 99 | 267 | 417 | 1024 | 1172 | 1324 | 1438 |

| Thickness | Die size | Pad size 1,4 & 6 | Pad size 2,3,5,7 |
|-----------|-------------|------------------|------------------|
| 100 | 2614 x 1438 | 100 x 100 | 85 x 85 |



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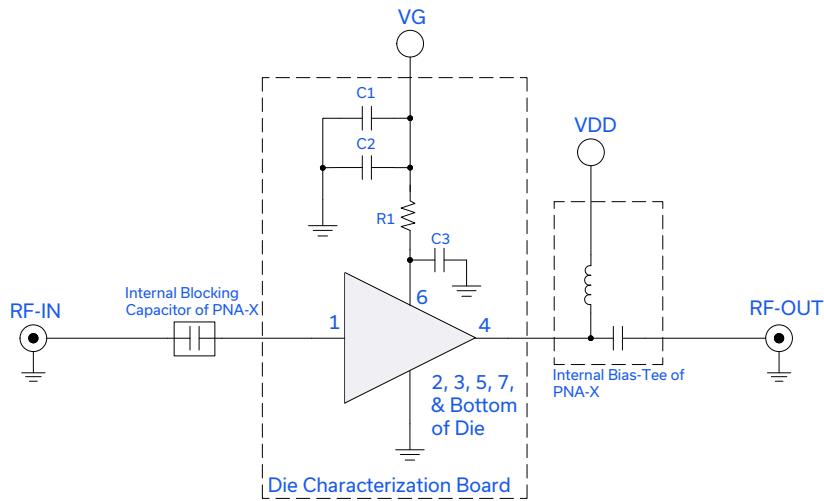
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CHARACTERIZATION & APPLICATION CIRCUIT



| Component | Size | Value | Part Number | Manufacturer |
|-----------|----------------|--------|--------------------|--------------|
| R1 | 0402 | 1K Ohm | FC0402E1001DTT5 | Vishay |
| C1 | 0402 | 100pF | GRM1555C1H101JA01J | Murata |
| C2 | 0402 | 0.1uF | GRM155R71C104KA88D | Murata |
| C3 | Chip Capacitor | 100pF | MA4M3100 | MACOM |

Fig 1. Characterization & Application Circuit

Note: This block diagram is used for characterization, (Die is attached and wire-bonded on die characterization test board). Gain, Return Loss, Output Power at 1dB Compression (P1dB), Output IP3 (OIP3) and Noise Figure are measured using Agilent's N5242A PNA-X Microwave Network Analyzer.

Conditions:

1. VDD = +5V
2. VG is set to obtain desired IDD as shown in specification table.
3. Gain and Return Loss: Pin = -25 dBm
4. Output IP3 (OIP3): Two Tones, spaced 1 MHz apart, 0 dBm/Tone at output.

Switch ON/OFF sequence:

1. To switch the amplifier ON:
 - a. Set VG = -1.1V. Apply VG.
 - b. Set VDD = +5V. Apply VDD.
 - c. Increase VG to obtain desired IDD as shown in specification table.
 - d. Apply RF signal
2. To switch the amplifier OFF:
 - a. Turn OFF RF signal
 - b. Adjust VG down to -1.1V.
 - c. Turn off VDD.
 - d. Turn off VG.

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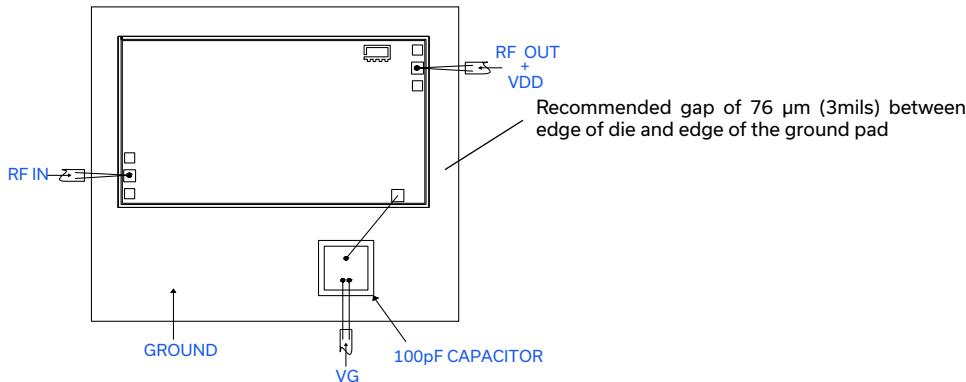
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ASSEMBLY DRAWING



Note: Tested on die characterization board with following bond lengths:

1. Bond length for RF-IN: 330 μm (13 mils)
2. Bond length for RF-OUT + VDD: 330 μm (13 mils)
3. Bond lengths from die, capacitor, and VG were kept as short as possible

ASSEMBLY PROCEDURE

1. Storage
Die should be stored in a dry nitrogen purged desiccators or equivalent.
2.  ESD
MMIC PHEMT amplifier die are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be open in clean room conditions at an appropriately grounded anti-static workstation.
3. Die Handling and Attachment
Devices need careful handling using correctly designed collets, it is recommended to handle the chip along the edges with a custom design collet. The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are Ablestik 84-1 LMISR4 or equivalents. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. The surface of the chip has exposed air bridges and should not be touched with vacuum collet, tweezers or fingers.
4. Wire Bonding
Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the die gold bond pads. Thermo-sonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1mil diameter. Bonds must be made from the bond pads on the die to the packaged or substrate. All bond wire length and bond wire height should be kept as short as possible unless specified by the Assembly Drawing to minimize performance degradation due to undesirable series inductance.



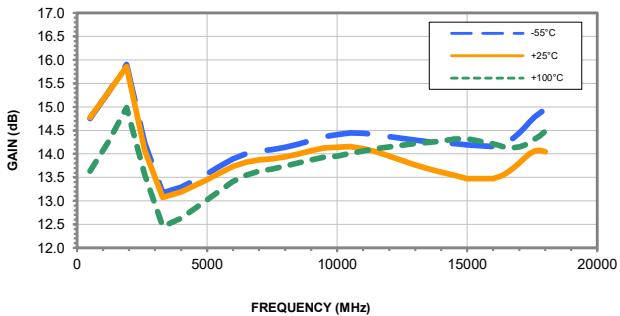
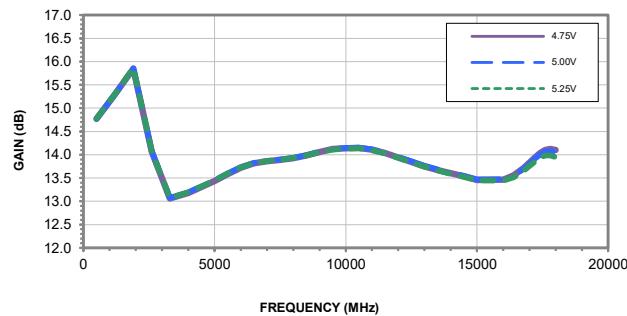
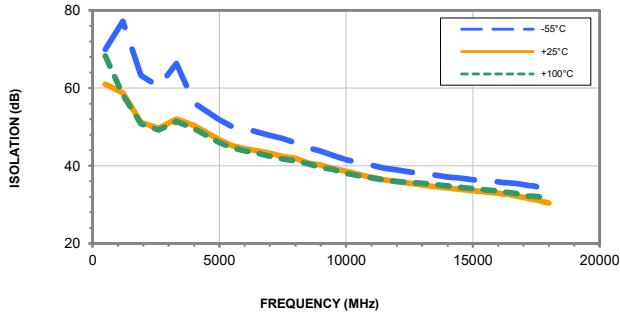
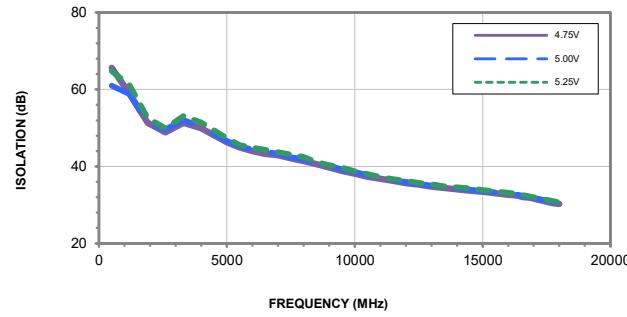
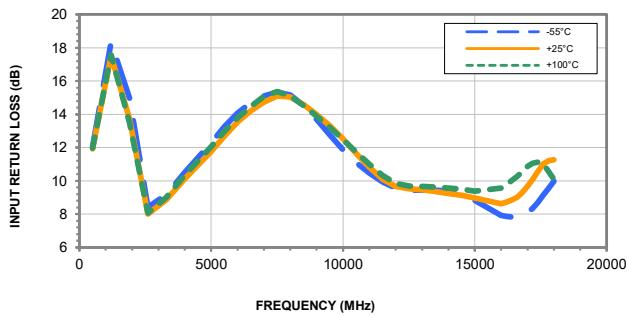
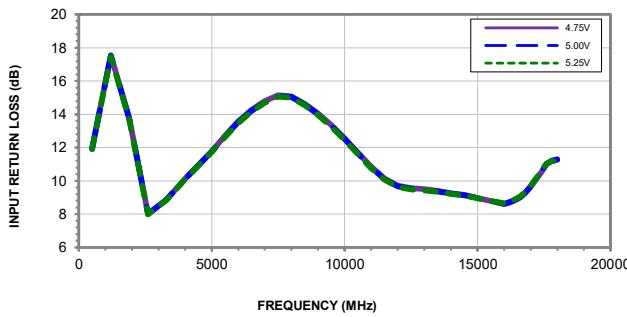
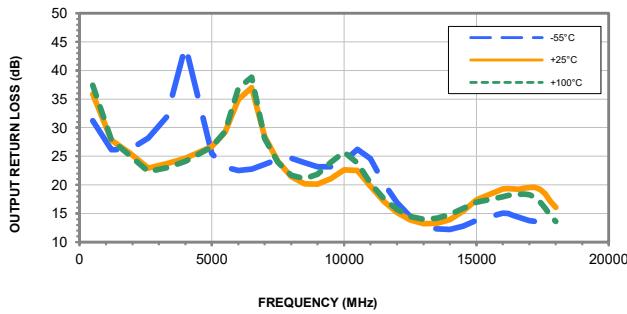
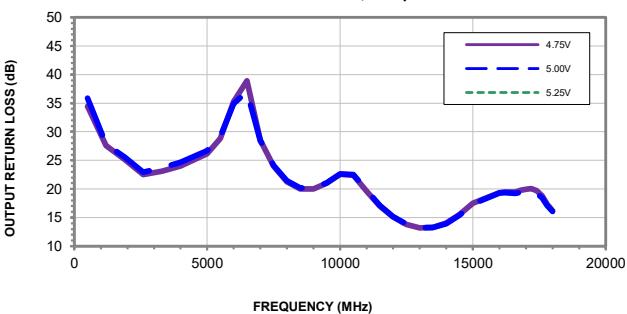
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GAIN vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25 dBm, VDD = +5VGAIN vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25 dBm, Temperature = +25°CISOLATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25 dBm, VDD = +5VISOLATION vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25 dBm, Temperature = +25°CINPUT RETURN LOSS vs. FREQ. & TEMP.
INPUT POWER = -25 dBm, VDD = +5VINPUT RETURN LOSS vs. FREQ. & DEVICE VOLTAGE
INPUT POWER = -25 dBm, Temperature = +25°COUTPUT RETURN LOSS vs. FREQ. & TEMP.
INPUT POWER = -25 dBm, VDD = +5VOUTPUT RETURN LOSS vs. FREQ. & DEVICE VOLTAGE
INPUT POWER = -25 dBm, Temperature = +25°C

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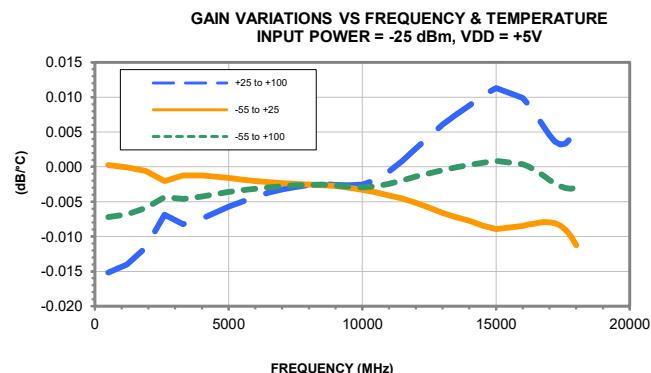
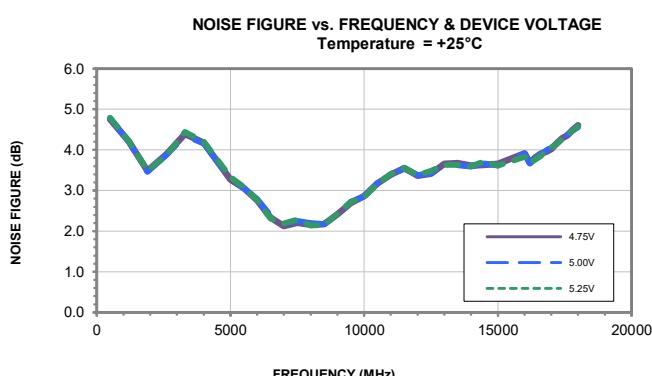
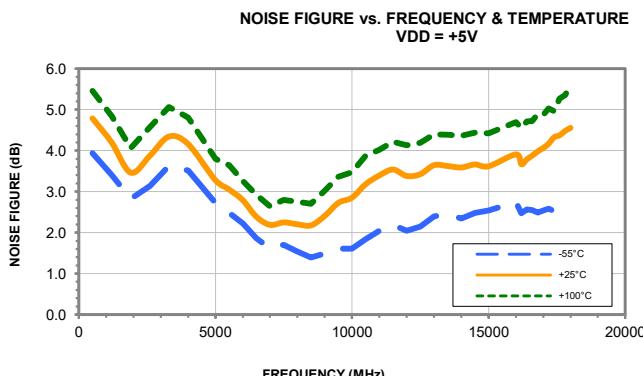
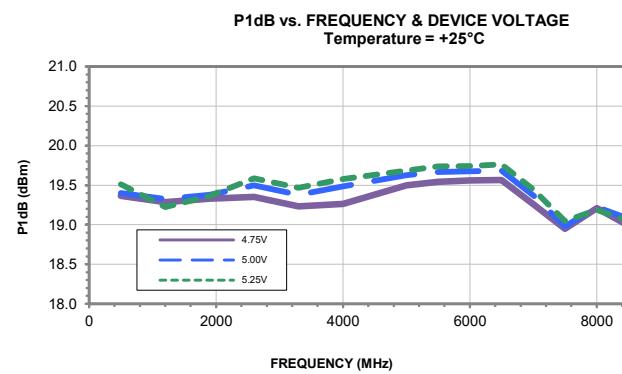
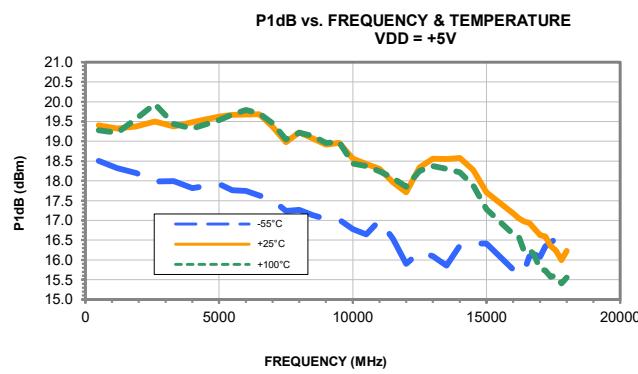
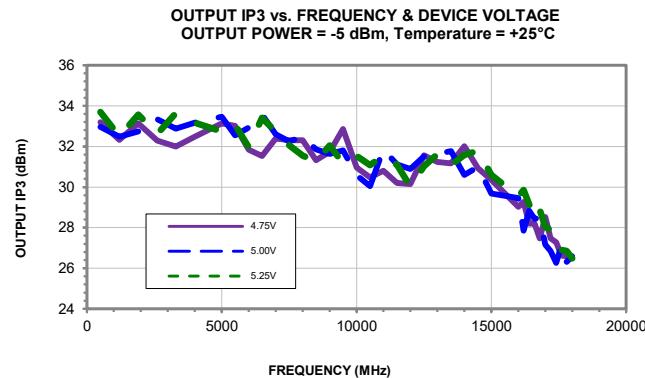
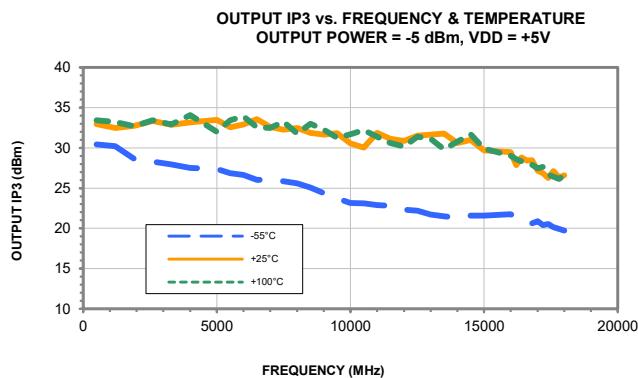
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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD.

| | | |
|---|---|--|
| Performance Data | Data Table Swept Graphs S-Parameter (S2P Files) Data Set with and without port extension(.zip file) | |
| Case Style | Die | |
| Die Ordering and packaging information | Quantity, Package Gel - Pak: 5, 10, 50, 100, 200 Medium [†] , Partial wafer: KGD* < 2565 Full Wafer | Model No. AVA-5R183-DG+ AVA-5R183-DP+ AVA-5R183-DF+ |
| | [†] Available upon request contact sales representative Refer to AN-60-067 | |
| Die Marking | EL-AMP-5-2 | |
| Environmental Ratings | ENV80 | |

*Known Good Die ('KGD') means that the die in question have been subjected to Mini-Circuits DC test performance criteria and measurement instructions and that the parametric data of such die fall within predefined range. While DC testing is not definitive, it does provide a higher degree of confidence that die are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

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.
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MMIC Amplifier

AVA-5R183-D+

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5.00V, Icc = 94mA @ Temperature = +100°C

| FREQ | Gain | Isolation | Input Return Loss | Output Return Loss | Stability | | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|---------|----------------|------------------------|-----------------|
| (MHz) | (dB) | (dB) | (dB) | (dB) | K | Measure | (dBm) | (dBm) | (dB) |
| 500 | 13.63 | 68.29 | 11.95 | 37.42 | 226.09 | 1.06 | 33.45 | 19.28 | 5.46 |
| 1200 | 14.25 | 58.25 | 17.57 | 27.84 | 70.88 | 1.02 | 33.22 | 19.22 | 4.84 |
| 1900 | 14.99 | 50.80 | 13.49 | 25.14 | 27.67 | 1.04 | 32.70 | 19.57 | 4.07 |
| 2600 | 13.56 | 49.25 | 8.07 | 22.33 | 25.28 | 1.15 | 33.45 | 19.94 | 4.58 |
| 3300 | 12.46 | 51.41 | 9.00 | 22.98 | 38.06 | 1.12 | 32.93 | 19.44 | 5.07 |
| 4000 | 12.63 | 49.54 | 10.34 | 24.13 | 31.76 | 1.09 | 34.07 | 19.33 | 4.80 |
| 5000 | 13.02 | 45.95 | 12.06 | 26.64 | 21.36 | 1.06 | 32.01 | 19.54 | 3.80 |
| 5500 | 13.22 | 44.62 | 12.96 | 29.31 | 18.42 | 1.05 | 33.44 | 19.68 | 3.64 |
| 6000 | 13.41 | 43.82 | 13.80 | 36.90 | 16.85 | 1.04 | 33.90 | 19.79 | 3.26 |
| 6500 | 13.55 | 43.24 | 14.47 | 38.83 | 15.81 | 1.03 | 32.55 | 19.70 | 2.93 |
| 7000 | 13.63 | 42.45 | 15.08 | 28.11 | 14.48 | 1.03 | 32.48 | 19.46 | 2.64 |
| 7500 | 13.68 | 41.77 | 15.36 | 23.95 | 13.40 | 1.02 | 33.24 | 19.05 | 2.80 |
| 8000 | 13.74 | 41.21 | 15.10 | 21.68 | 12.53 | 1.02 | 31.77 | 19.21 | 2.75 |
| 8500 | 13.81 | 40.48 | 14.53 | 21.06 | 11.46 | 1.02 | 33.02 | 19.14 | 2.70 |
| 9000 | 13.88 | 39.56 | 13.90 | 21.83 | 10.25 | 1.03 | 32.25 | 18.96 | 3.02 |
| 9500 | 13.93 | 39.04 | 13.22 | 23.92 | 9.60 | 1.04 | 31.28 | 18.98 | 3.36 |
| 10000 | 13.95 | 38.07 | 12.48 | 25.72 | 8.55 | 1.05 | 31.71 | 18.44 | 3.47 |
| 10500 | 14.01 | 37.46 | 11.74 | 23.85 | 7.90 | 1.06 | 32.22 | 18.38 | 3.88 |
| 11000 | 14.06 | 36.93 | 10.99 | 20.30 | 7.38 | 1.06 | 31.39 | 18.25 | 4.02 |
| 11500 | 14.11 | 36.34 | 10.32 | 17.63 | 6.84 | 1.07 | 30.60 | 18.07 | 4.22 |
| 12000 | 14.15 | 35.98 | 9.86 | 15.70 | 6.53 | 1.07 | 30.19 | 17.85 | 4.13 |
| 12500 | 14.19 | 35.72 | 9.69 | 14.48 | 6.34 | 1.06 | 31.40 | 18.25 | 4.19 |
| 13000 | 14.22 | 35.50 | 9.66 | 14.00 | 6.23 | 1.06 | 31.13 | 18.37 | 4.39 |
| 13500 | 14.24 | 35.12 | 9.64 | 14.17 | 6.04 | 1.06 | 29.83 | 18.31 | 4.39 |
| 14000 | 14.27 | 34.81 | 9.57 | 14.85 | 5.92 | 1.07 | 30.78 | 18.21 | 4.36 |
| 14500 | 14.32 | 34.42 | 9.50 | 15.91 | 5.76 | 1.08 | 31.71 | 17.89 | 4.44 |
| 15000 | 14.32 | 34.14 | 9.39 | 16.98 | 5.66 | 1.09 | 29.90 | 17.28 | 4.43 |
| 16000 | 14.21 | 33.45 | 9.56 | 17.95 | 5.33 | 1.09 | 29.05 | 16.65 | 4.70 |
| 16200 | 14.18 | 33.22 | 9.76 | 18.13 | 5.22 | 1.09 | 28.59 | 16.59 | 4.55 |
| 16400 | 14.15 | 33.10 | 10.01 | 18.27 | 5.16 | 1.08 | 28.36 | 16.23 | 4.71 |
| 16600 | 14.14 | 32.93 | 10.26 | 18.33 | 5.06 | 1.08 | 28.07 | 16.27 | 4.72 |
| 16800 | 14.13 | 32.67 | 10.56 | 18.43 | 4.90 | 1.07 | 27.88 | 16.11 | 4.89 |
| 17000 | 14.15 | 32.43 | 10.87 | 18.25 | 4.76 | 1.06 | 27.48 | 15.77 | 4.87 |
| 17200 | 14.18 | 32.21 | 11.06 | 17.87 | 4.62 | 1.06 | 27.65 | 15.73 | 5.02 |
| 17400 | 14.24 | 32.15 | 11.13 | 17.00 | 4.55 | 1.05 | 26.69 | 15.58 | 4.96 |
| 17600 | 14.31 | 31.98 | 11.02 | 15.93 | 4.42 | 1.04 | 26.43 | 15.61 | 5.27 |
| 17800 | 14.39 | 31.87 | 10.58 | 14.58 | 4.31 | 1.03 | 26.14 | 15.41 | 5.35 |
| 18000 | 14.48 | 31.93 | 10.11 | 13.61 | 4.30 | 1.03 | 26.57 | 15.55 | 5.59 |



ISO 9001 ISO 14001 AS 9100 CERTIFIED

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The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

IF/RF MICROWAVE COMPONENTS



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Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

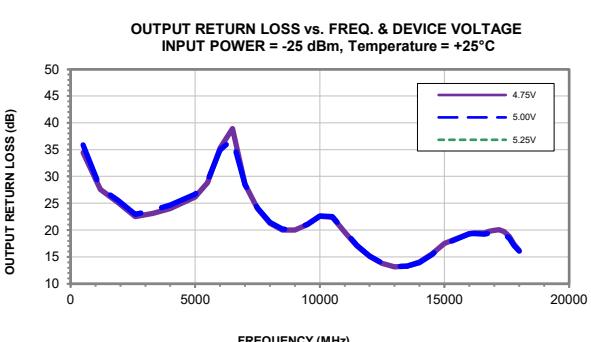
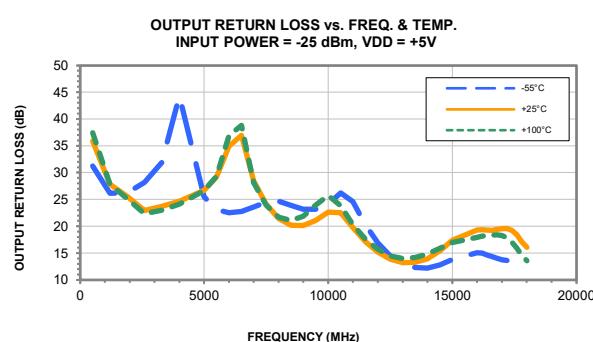
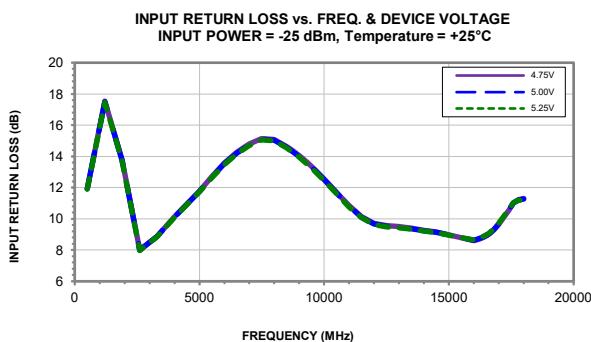
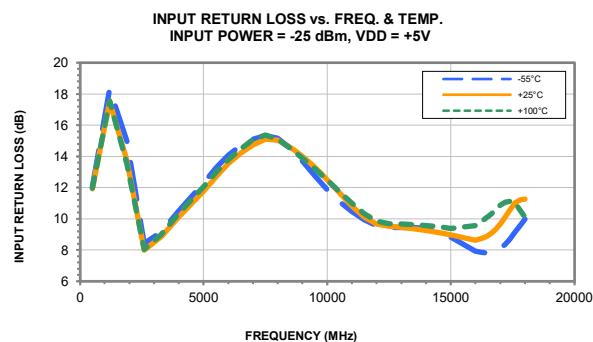
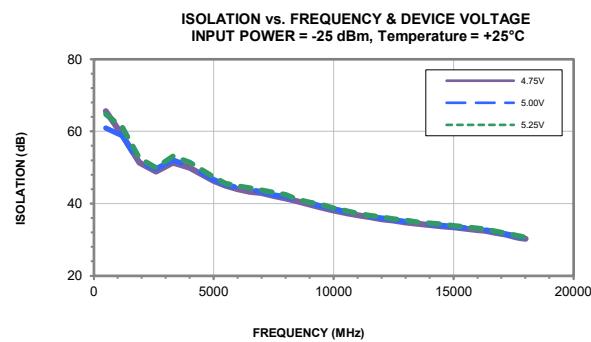
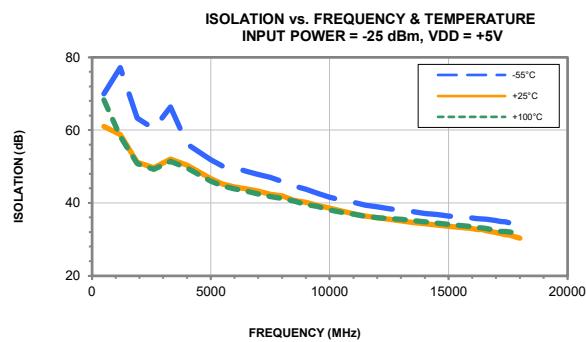
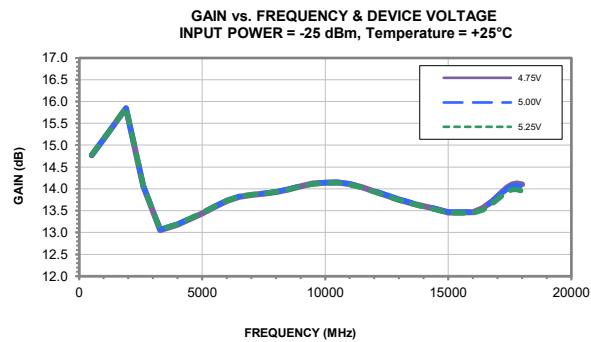
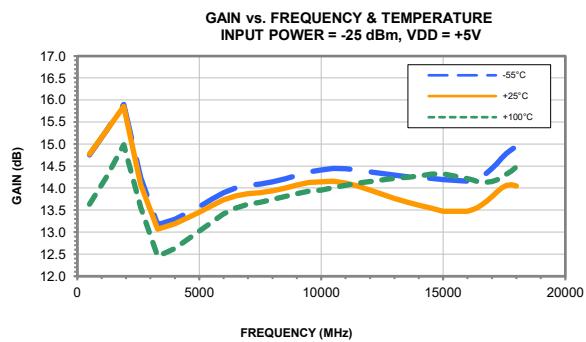
Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

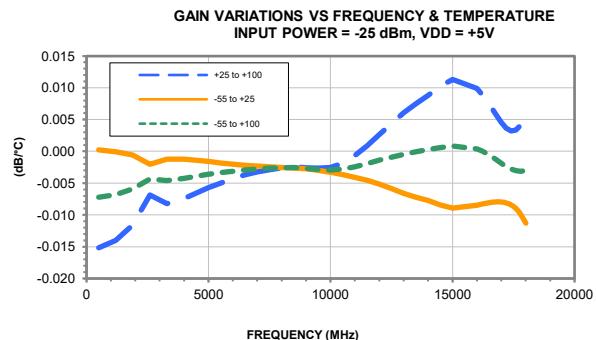
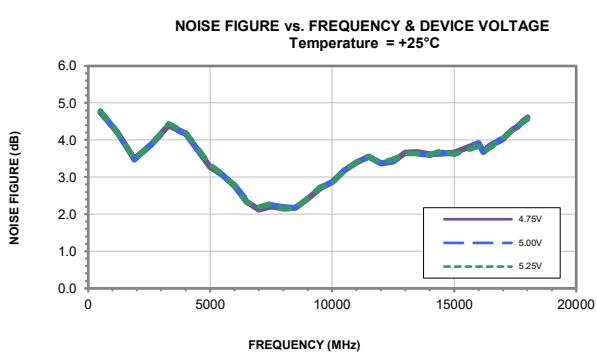
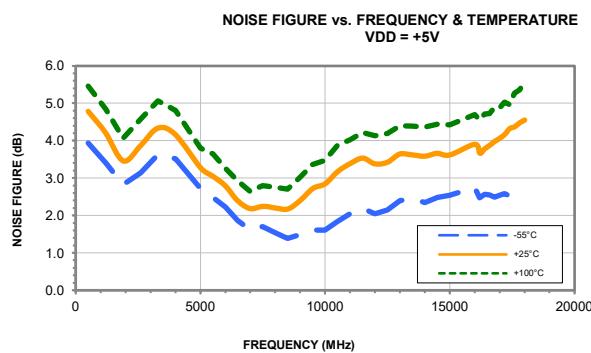
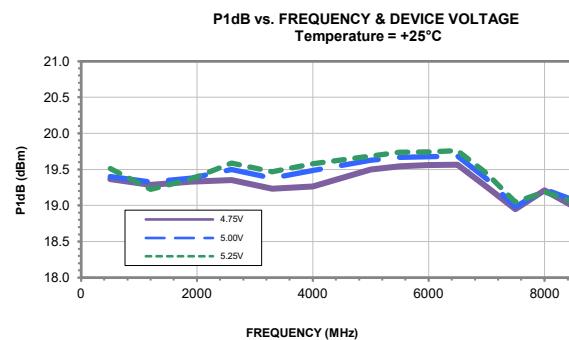
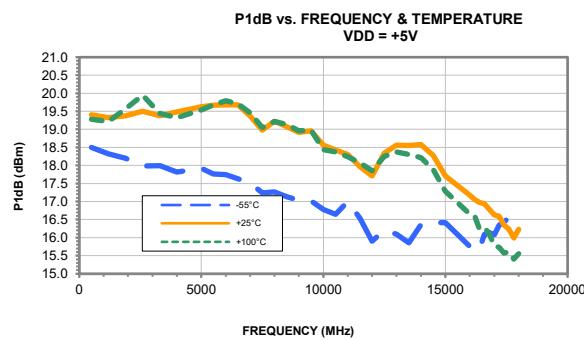
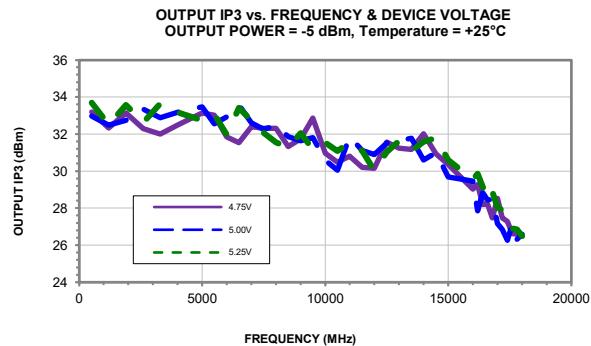
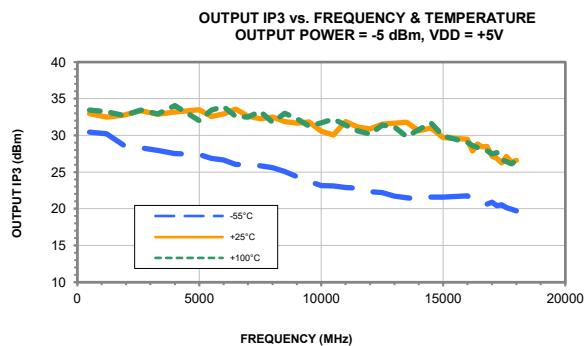
TEST CONDITIONS: Vd = 5.25V, Icc = 96mA @ Temperature = +100°C

| FREQ (MHz) | Gain (dB) | Isolation (dB) | Input Return Loss (dB) | Output Return Loss (dB) | Stability | | IP-3 Output (dBm) | 1dB Comp. Output (dBm) | Noise Figure (dB) |
|---------------|--------------|-------------------|---------------------------------|----------------------------------|-----------|------|-------------------------|---------------------------------|-------------------------|
| 500 | 13.78 | 62.75 | 11.95 | 39.37 | 119.32 | 1.06 | 32.18 | 19.64 | 5.56 |
| 1200 | 14.48 | 58.39 | 17.54 | 28.13 | 72.02 | 1.02 | 32.84 | 19.59 | 4.87 |
| 1900 | 15.36 | 50.63 | 13.46 | 25.54 | 27.11 | 1.04 | 33.46 | 19.87 | 4.12 |
| 2600 | 13.39 | 49.49 | 8.05 | 22.78 | 26.00 | 1.15 | 33.74 | 20.33 | 4.50 |
| 3300 | 12.65 | 51.85 | 8.99 | 23.54 | 40.03 | 1.12 | 32.95 | 19.90 | 5.07 |
| 4000 | 12.90 | 50.03 | 10.33 | 24.87 | 33.59 | 1.09 | 33.93 | 19.71 | 4.79 |
| 5000 | 13.28 | 46.30 | 12.04 | 27.28 | 22.25 | 1.06 | 33.41 | 19.82 | 3.85 |
| 5500 | 13.47 | 44.80 | 12.94 | 29.97 | 18.79 | 1.05 | 34.58 | 20.05 | 3.54 |
| 6000 | 13.66 | 44.25 | 13.75 | 37.59 | 17.70 | 1.04 | 33.29 | 20.08 | 3.30 |
| 6500 | 13.81 | 43.48 | 14.45 | 38.65 | 16.27 | 1.03 | 32.68 | 20.07 | 2.98 |
| 7000 | 13.90 | 42.78 | 15.04 | 28.43 | 15.05 | 1.03 | 33.26 | 19.74 | 2.73 |
| 7500 | 13.98 | 42.01 | 15.32 | 24.22 | 13.79 | 1.02 | 31.85 | 19.32 | 2.77 |
| 8000 | 14.07 | 41.65 | 15.06 | 21.90 | 13.19 | 1.02 | 31.45 | 19.65 | 2.73 |
| 8500 | 14.15 | 40.64 | 14.48 | 21.26 | 11.68 | 1.02 | 31.55 | 19.33 | 2.75 |
| 9000 | 14.24 | 39.87 | 13.84 | 21.98 | 10.63 | 1.03 | 32.12 | 19.23 | 3.00 |
| 9500 | 14.31 | 39.02 | 13.16 | 24.01 | 9.60 | 1.04 | 31.75 | 19.33 | 3.42 |
| 10000 | 14.36 | 38.22 | 12.44 | 25.81 | 8.71 | 1.05 | 31.14 | 18.71 | 3.50 |
| 10500 | 14.44 | 37.64 | 11.71 | 24.05 | 8.08 | 1.06 | 30.81 | 18.65 | 3.86 |
| 11000 | 14.50 | 37.17 | 10.97 | 20.50 | 7.60 | 1.06 | 31.25 | 18.60 | 4.06 |
| 11500 | 14.55 | 36.67 | 10.29 | 17.79 | 7.12 | 1.07 | 30.40 | 18.42 | 4.24 |
| 12000 | 14.58 | 36.30 | 9.83 | 15.84 | 6.79 | 1.07 | 30.93 | 18.12 | 4.13 |
| 12500 | 14.63 | 35.96 | 9.66 | 14.56 | 6.53 | 1.06 | 30.83 | 18.43 | 4.15 |
| 13000 | 14.71 | 35.70 | 9.65 | 14.05 | 6.40 | 1.06 | 31.51 | 18.64 | 4.39 |
| 13500 | 14.76 | 35.43 | 9.63 | 14.19 | 6.28 | 1.06 | 31.43 | 18.58 | 4.43 |
| 14000 | 14.79 | 35.13 | 9.58 | 14.83 | 6.15 | 1.07 | 30.99 | 18.58 | 4.34 |
| 14500 | 14.80 | 34.65 | 9.50 | 15.89 | 5.93 | 1.08 | 30.90 | 18.08 | 4.39 |
| 15000 | 14.76 | 34.41 | 9.39 | 16.91 | 5.86 | 1.09 | 30.68 | 17.55 | 4.39 |
| 16000 | 14.63 | 33.59 | 9.59 | 17.84 | 5.44 | 1.09 | 29.94 | 16.89 | 4.77 |
| 16200 | 14.62 | 33.48 | 9.80 | 18.01 | 5.39 | 1.09 | 29.42 | 16.64 | 4.56 |
| 16400 | 14.59 | 33.26 | 10.06 | 18.10 | 5.28 | 1.08 | 28.49 | 16.36 | 4.64 |
| 16600 | 14.59 | 33.05 | 10.30 | 18.12 | 5.15 | 1.08 | 27.88 | 16.40 | 4.70 |
| 16800 | 14.60 | 32.90 | 10.62 | 18.15 | 5.06 | 1.07 | 28.19 | 16.25 | 4.76 |
| 17000 | 14.62 | 32.68 | 10.90 | 17.92 | 4.92 | 1.06 | 27.72 | 16.08 | 4.94 |
| 17200 | 14.66 | 32.55 | 11.10 | 17.55 | 4.83 | 1.05 | 27.64 | 15.95 | 5.10 |
| 17400 | 14.73 | 32.36 | 11.13 | 16.72 | 4.69 | 1.05 | 27.20 | 15.78 | 5.09 |
| 17600 | 14.81 | 32.32 | 11.00 | 15.75 | 4.63 | 1.04 | 27.05 | 15.72 | 5.37 |
| 17800 | 14.92 | 32.27 | 10.54 | 14.47 | 4.54 | 1.03 | 26.15 | 15.61 | 5.41 |
| 18000 | 15.05 | 32.10 | 10.06 | 13.57 | 4.42 | 1.03 | 26.57 | 15.74 | 5.55 |

Typical Performance Curves



Typical Performance Curves



**Environmental Specifications****ENV80**

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification | Test/Inspection Condition | Reference/Spec |
|--------------------------------|--|--------------------------------------|
| Operating Temperature | -40° to 85° C or -40° to 105° C or -55° to 105° C or -45° to 105° C Ambient Environment | Refer to Individual Model Data Sheet |
| Storage Environment (Die) | -65° to 150°C | Individual Model Data Sheet |
| Storage Environment(Packaging) | -40° to 70°C and 40 to 60% humidity (In Factory Shipped Package) | |