

Ultra Linear Low Noise

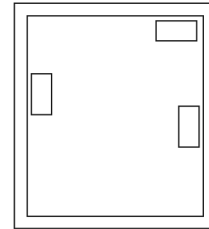
# Monolithic Amplifier Die

PGA-103-D+

50Ω 0.05 to 4 GHz

## The Big Deal

- Ultra High IP3
- Broadband High Dynamic Range



## Product Overview

PGA-103-D+ (RoHS compliant) is an advanced wideband amplifier die fabricated using E-PHEMT technology and offers extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the PGA-103-D+ has good input and output return loss over a broad frequency range without the need for external matching components and has demonstrated excellent reliability.

## Key Features

| Feature  | Advantages  |
|--|---|
| Broad Band: 0.05 to 4.0 GHz  | Broadband covering primary wireless communications bands:<br>Cellular, PCS, LTE, WiMAX  |
| Ultra High IP3<br>Versus DC power Consumption:<br>42 dBm typical at 2 GHz at +5.0V<br>Supply Voltage and only 97mA | The PGA-103-D+ provides excellent IP3 performance relative to device size and power consumption. The combination of the design and E-PHEMT Structure provides enhanced linearity over a broad frequency range as evidence in the IP3 being typically 20 dB above the P 1dB point. This feature makes this amplifier ideal for use in: <ul style="list-style-type: none"><li>• Driver amplifiers for complex waveform up converter paths</li><li>• Drivers in linearized transmit systems</li><li>• Secondary amplifiers in ultra High Dynamic range receivers</li></ul> |
| Low Noise Figure:<br>0.6 dB up to 1.0 GHz  | A unique feature of the PGA-103-D+ which separates this design from all competitors is the low noise figure performance in combination with the high dynamic range.   |



# Ultra Linear Low Noise Monolithic Amplifier Die

## PGA-103-D+

50Ω 0.05 to 4 GHz

### Product Features

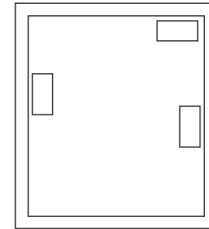
- 5V/3V operation
- High IP3, 42 dBm typ. at 2 GHz, Vd=5V
- Low Noise Figure, 0.6 at 1 GHz; 0.8 dB at 2 GHz
- Gain, 11.3 dB typ. at 2 GHz
- P1dB 22.3 dBm typ. at 2 GHz at Vd=5V
- Protected under US Patent 8,803,612

### Typical Applications

- Base station infrastructure
- Portable Wireless
- CATV & DBS
- MMDS & Wireless LAN
- LTE

### General Description

PGA-103-D+ (RoHS compliant) is an advanced wideband amplifier fabricated using E-PHEMT technology and offers extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the PGA-103-D+ has good input and output return loss over a broad frequency range without the need for external matching components.

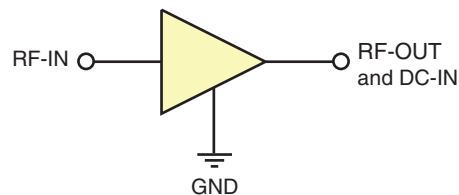


**+RoHS Compliant**

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

Ordering Information: Refer to Last Page

### Simplified Schematic and Pad description



| Pad              | Description   |
|------------------|---|
| RF IN            | RF input pad. This pad requires the use of an external DC blocking capacitor chosen for the frequency of operation.   |
| RF-OUT and DC-IN | RF output and bias pad. DC voltage is present on this pad; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit", Fig. 2 |
| GND              | Connections to ground.  |

Note: 1. Bond Pad material - Gold  
2. Bottom of Die - Gold plated

**Electrical Specifications<sup>1</sup> at 25°C, 50Ω unless noted**

| Parameter                                   | Condition (GHz) | Vd=5.0V |       |      | Vd=3V    | Units |
|---|-----------------|---------|-------|------|----------|-------|
|   |                 | Min.    | Typ.  | Max. | Typ.     |       |
| Frequency range                             |                 | 0.05    |       | 4.0  | 0.05-4.0 | GHz   |
| Gain  | 0.05            |         | 26.7  |      | 26.1     | dB    |
|   | 0.4             |         | 22.3  |      | 21.8     |       |
|   | 1.0             |         | 16.5  |      | 16.1     |       |
|   | 2.0             |         | 11.3  |      | 10.8     |       |
|   | 3.0             |         | 8.1   |      | 7.7      |       |
|   | 4.0             |         | 6.1   |      | 5.6      |       |
| Noise figure                                | 0.05            |         | 0.4   |      | 0.3      | dB    |
|   | 0.4             |         | 0.7   |      | 0.7      |       |
|   | 1.0             |         | 0.6   |      | 0.6      |       |
|   | 2.0             |         | 0.8   |      | 0.8      |       |
|   | 3.0             |         | 1.4   |      | 1.4      |       |
|   | 4.0             |         | 1.6   |      | 1.5      |       |
| Input return loss                           | 0.05            |         | 6.8   |      | 6.1      | dB    |
|   | 0.8             |         | 11.5  |      | 10.4     |       |
|   | 2.0             |         | 14.0  |      | 12.8     |       |
|   | 3.0             |         | 14.5  |      | 13.1     |       |
|   | 4.0             |         | 12.1  |      | 11.2     |       |
|   | 6.0             |         | 11.5  |      | 10.7     |       |
| Output return loss                          | 0.05            |         | 13.8  |      | 13.4     | dB    |
|   | 0.8             |         | 20.0  |      | 21.9     |       |
|   | 2.0             |         | 16.8  |      | 20.7     |       |
|   | 3.0             |         | 16.0  |      | 20.1     |       |
|   | 4.0             |         | 19.1  |      | 22.5     |       |
|   | 6.0             |         | 18.6  |      | 19.7     |       |
| Reverse isolation                           | 2.0             |         | 21.4  |      |          | dB    |
| Output power @ 1dB compression <sup>2</sup> | 0.05            |         | 19.1  |      | 14.8     | dBm   |
|   | 0.8             |         | 21.1  |      | 17.9     |       |
|   | 2.0             |         | 21.5  |      | 18.8     |       |
|   | 3.0             |         | 22.3  |      | 19.5     |       |
|   | 4.0             |         | 22.2  |      | 19.9     |       |
|   | 6.0             |         | 22.8  |      | 20.5     |       |
| Output IP3                                  | 0.05            |         | 35.8  |      | 31.1     | dBm   |
|   | 0.8             |         | 38.0  |      | 32.6     |       |
|   | 2.0             |         | 40.3  |      | 33.4     |       |
|   | 3.0             |         | 41.6  |      | 34.2     |       |
|   | 4.0             |         | 42.2  |      | 33.1     |       |
|   | 6.0             |         | 42.8  |      | 32.4     |       |
| Device operating voltage                    |                 |         | 5.0   |      | 3.0      | V     |
| Device operating current                    |                 | 72      | 97    | 120  | 60       | mA    |
| Device current variation vs voltage         |                 |         | 0.035 |      | 0.018    | mA/mV |
| Thermal resistance, junction-to-ground lead |                 |         | 32    |      | 32       | °C/W  |

1. Measured on Mini-Circuits Die Characterization test board. See Characterization Test Circuit (Fig. 1)

2. Current increases at P1dB

**Absolute Maximum Ratings<sup>3</sup>**

| Parameter                           | Ratings  |
|-------------------------------------|--|
| Operating Temperature (ground lead) | -40°C to 85°C  |
| Operating Current at 5.0V           | 200 mA   |
| Power Dissipation at 5.0V           | 1W   |
| Input Power (CW)                    | +21 dBm (50 to 2000 MHz)<br>+26 dBm (2000 to 4000 MHz) |
| DC Voltage on RF-OUT & DC-IN        | 6V   |

3. Permanent damage may occur if any of these limits are exceeded.  
Electrical maximum ratings are not intended for continuous normal operation.  
Measured in industry standard SOT-89 package.



Characterization Test Circuit

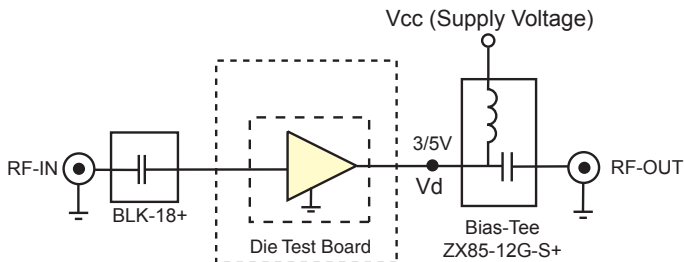


Fig 1. Block Diagram of Test Circuit used for characterization. Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and noise figure measured using Agilent’s N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain and Return loss: Pad= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.

Recommended Application Circuit

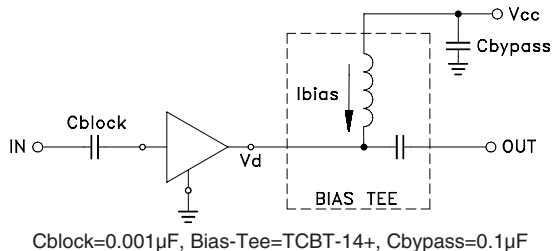


Fig 2a. Simplified

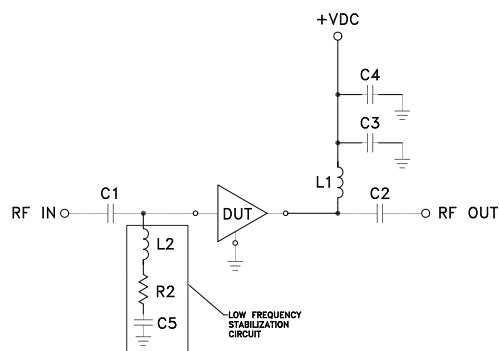


Fig 2b. Unconditionally stable (see note AN-60-064)

| SEQ    | Manufacturer P/N / Value               | Size      |
|--------|--|-----------|
| A1     | PGA-103-D+ in industry standard SOT-89 | —         |
| C1, C2 | .01 uF                                 | 0805      |
| C3     | 0.33 uF                                | 1206      |
| C4     | 10 uF                                  | 1206      |
| C5     | 330 pF                                 | 0603      |
| L1     | TCCH-80+                               | —         |
| L2     | 620 nH                                 | .115X.110 |
| R2     | 150 Ohm                                | 0603      |

Die Layout

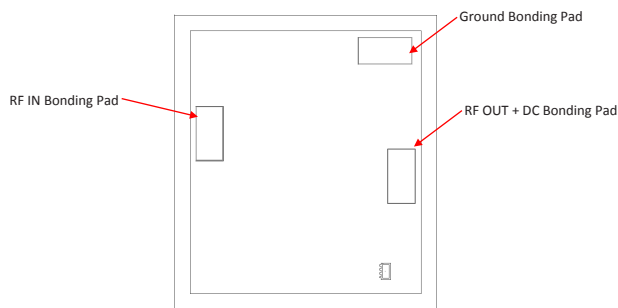


Fig 3. Die Layout

Critical Dimensions

| Parameter         | Values   |
|-------------------|----------|
| Die Thickness, µm | 100      |
| Die Width, µm     | 820      |
| Die Length, µm    | 731      |
| Bond Pad Size, µm | 150 x 75 |

Bonding Pad Position  
(Dimensions in µm, Typical)

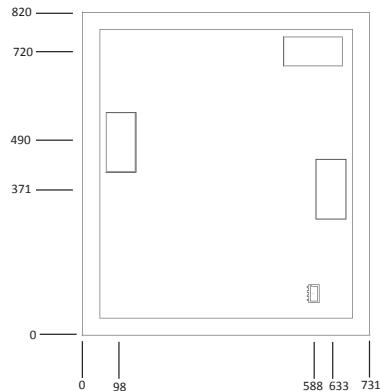


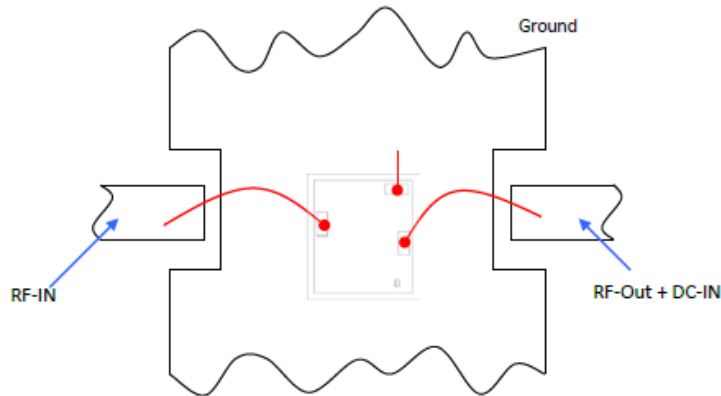
Fig 4. Bonding Pad Positions

# Monolithic E-PHEMT MMIC Amplifier Die

## Assembly and Handling Procedure

- 1. Storage**  
Dice should be stored in a dry nitrogen purged desiccators or equivalent.
- 2. ESD**  
MMIC E-PHEMPT amplifier dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.
- 3. Die Attach**  
The die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030HK-PT/H579 or Ablestik 84-1LMISR4. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total die periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. It is recommended to use antistatic die pick up tools only.
- 4. Wire Bonding**  
Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermosonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1 mil diameter. Bonds must be made from the bond pads on the die to the package or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.

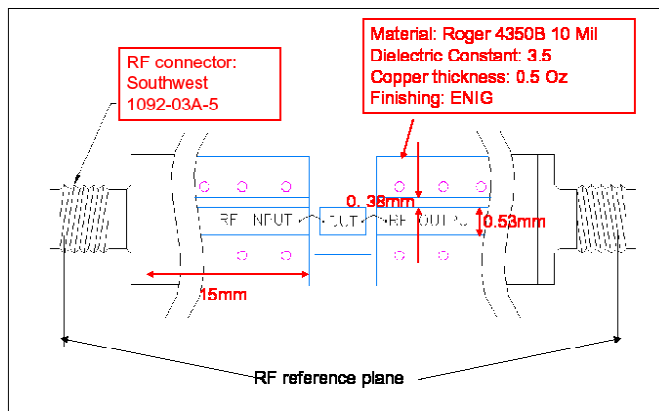
## Assembly Diagram



## Recommended Wire Length, Typical

| Wire                  | Wire Length (mm) | Wire Loop Height (mm) |
|-----------------------|------------------|-----------------------|
| RF-IN, RF-OUT + DC-IN | 0.6              | 0.15                  |
| GROUND                | 0.3              | 0.15                  |

## RF Reference Plane - No port extension



| <b>Additional Detailed Technical Information</b><br><i>additional information is available on our dash board.</i> |   |                   |           |                                  |             |                                   |             |                    |             |
|---|---|-------------------|-----------|----------------------------------|-------------|-----------------------------------|-------------|--------------------|-------------|
| <b>Performance Data</b>   | Data Table  |                   |           |                                  |             |                                   |             |                    |             |
|   | Swept Graphs  |                   |           |                                  |             |                                   |             |                    |             |
|   | S-Parameter (S2P Files) Data Set with and without port extension(.zip file)   |                   |           |                                  |             |                                   |             |                    |             |
| <b>Case Style</b>   | Die   |                   |           |                                  |             |                                   |             |                    |             |
| <b>Die Ordering and packaging information</b>   | <table> <tr> <td>Quantity, Package</td> <td>Model No.</td> </tr> <tr> <td>Small, Gel - Pak: 10,50,100 KGD*</td> <td>PGA-103-DG+</td> </tr> <tr> <td>Medium†, Partial wafer: KGD*&lt;1975</td> <td>PGA-103-DP+</td> </tr> <tr> <td>Large†, Full Wafer</td> <td>PGA-103-DF+</td> </tr> </table> <p>†Available upon request contact sales representative</p> <p>Refer to <a href="#">AN-60-067</a></p> | Quantity, Package | Model No. | Small, Gel - Pak: 10,50,100 KGD* | PGA-103-DG+ | Medium†, Partial wafer: KGD*<1975 | PGA-103-DP+ | Large†, Full Wafer | PGA-103-DF+ |
| Quantity, Package   | Model No.   |                   |           |                                  |             |                                   |             |                    |             |
| Small, Gel - Pak: 10,50,100 KGD*  | PGA-103-DG+   |                   |           |                                  |             |                                   |             |                    |             |
| Medium†, Partial wafer: KGD*<1975   | PGA-103-DP+   |                   |           |                                  |             |                                   |             |                    |             |
| Large†, Full Wafer  | PGA-103-DF+   |                   |           |                                  |             |                                   |             |                    |             |
| <b>Environmental Ratings</b>  | ENV-80  |                   |           |                                  |             |                                   |             |                    |             |

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

## ESD Rating\*\*

Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

\*\* Tested in industry standard SOT-89 package.

## Additional Notes

- 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 Die

# PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.00V, Id = 56mA @Temperature = +25°C

| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.25 | 30.61     | 6.29              | 13.66              | 0.89      | 0.83    | 31.22       | 14.88            | 0.33         |
| 100   | 25.46 | 29.55     | 7.94              | 18.00              | 0.97      | 0.76    | 31.60       | 14.91            | 0.46         |
| 200   | 24.36 | 28.43     | 9.07              | 21.23              | 1.00      | 0.74    | 31.79       | 16.77            | 0.49         |
| 400   | 21.89 | 26.16     | 10.62             | 24.05              | 1.04      | 0.72    | 32.65       | 18.08            | 0.68         |
| 500   | 20.72 | 25.06     | 11.23             | 24.71              | 1.05      | 0.72    | 32.87       | 18.19            | 0.68         |
| 600   | 19.65 | 24.08     | 11.72             | 24.87              | 1.06      | 0.72    | 33.00       | 18.46            | 0.69         |
| 700   | 18.67 | 23.14     | 12.15             | 24.91              | 1.07      | 0.71    | 33.15       | 18.50            | 0.67         |
| 800   | 17.77 | 22.28     | 12.50             | 24.80              | 1.08      | 0.71    | 33.22       | 18.57            | 0.60         |
| 900   | 16.94 | 21.50     | 12.81             | 24.56              | 1.08      | 0.71    | 33.43       | 18.69            | 0.58         |
| 1000  | 16.17 | 20.73     | 13.10             | 24.28              | 1.08      | 0.71    | 33.56       | 18.87            | 0.60         |
| 1100  | 15.47 | 20.06     | 13.33             | 24.15              | 1.09      | 0.71    | 33.57       | 18.90            | 0.61         |
| 1200  | 14.82 | 19.40     | 13.55             | 23.83              | 1.09      | 0.71    | 33.72       | 18.90            | 0.63         |
| 1300  | 14.21 | 18.80     | 13.73             | 23.60              | 1.09      | 0.70    | 33.95       | 18.97            | 0.65         |
| 1400  | 13.65 | 18.26     | 13.86             | 23.53              | 1.09      | 0.71    | 33.97       | 19.07            | 0.67         |
| 1500  | 13.12 | 17.71     | 13.95             | 23.40              | 1.09      | 0.70    | 34.12       | 19.17            | 0.69         |
| 1600  | 12.63 | 17.22     | 13.99             | 23.42              | 1.09      | 0.70    | 34.07       | 19.35            | 0.71         |
| 1700  | 12.16 | 16.74     | 14.01             | 23.54              | 1.09      | 0.70    | 34.28       | 19.41            | 0.73         |
| 1800  | 11.72 | 16.28     | 13.96             | 23.88              | 1.09      | 0.70    | 34.38       | 19.49            | 0.74         |
| 1900  | 11.30 | 15.85     | 13.90             | 24.27              | 1.09      | 0.70    | 34.36       | 19.49            | 0.75         |
| 2000  | 10.92 | 15.44     | 13.79             | 24.59              | 1.09      | 0.70    | 34.30       | 19.59            | 0.77         |
| 2100  | 10.54 | 15.06     | 13.67             | 25.10              | 1.09      | 0.70    | 34.38       | 19.70            | 0.78         |
| 2200  | 10.19 | 14.69     | 13.53             | 25.71              | 1.09      | 0.70    | 34.20       | 19.84            | 0.81         |
| 2300  | 9.85  | 14.33     | 13.36             | 26.30              | 1.09      | 0.70    | 34.24       | 19.84            | 0.85         |
| 2400  | 9.53  | 13.98     | 13.20             | 26.87              | 1.08      | 0.70    | 33.96       | 19.84            | 0.90         |
| 2500  | 9.22  | 13.65     | 13.03             | 27.39              | 1.08      | 0.70    | 33.86       | 19.85            | 0.97         |
| 2600  | 8.92  | 13.34     | 12.88             | 27.78              | 1.08      | 0.70    | 33.89       | 19.93            | 1.04         |
| 2700  | 8.64  | 13.04     | 12.71             | 27.72              | 1.08      | 0.70    | 33.86       | 19.97            | 1.13         |
| 2800  | 8.37  | 12.76     | 12.60             | 27.50              | 1.08      | 0.70    | 33.61       | 20.08            | 1.19         |
| 2900  | 8.10  | 12.47     | 12.49             | 26.90              | 1.07      | 0.70    | 33.30       | 20.07            | 1.22         |
| 3000  | 7.85  | 12.22     | 12.43             | 26.19              | 1.07      | 0.70    | 33.31       | 20.03            | 1.24         |
| 3200  | 7.38  | 11.69     | 12.36             | 24.61              | 1.07      | 0.69    | 33.35       | 20.22            | 1.21         |
| 3300  | 7.16  | 11.45     | 12.34             | 24.07              | 1.07      | 0.69    | 33.14       | 20.39            | 1.21         |
| 3400  | 6.94  | 11.21     | 12.37             | 23.36              | 1.07      | 0.69    | 33.18       | 20.37            | 1.23         |
| 3500  | 6.73  | 10.99     | 12.42             | 22.78              | 1.07      | 0.68    | 32.98       | 20.39            | 1.26         |
| 3600  | 6.53  | 10.76     | 12.51             | 22.20              | 1.06      | 0.68    | 32.92       | 20.32            | 1.30         |
| 3700  | 6.35  | 10.55     | 12.60             | 21.57              | 1.06      | 0.68    | 32.92       | 20.43            | 1.35         |
| 3800  | 6.16  | 10.33     | 12.73             | 21.05              | 1.06      | 0.67    | 32.97       | 20.52            | 1.38         |
| 4000  | 5.81  | 9.96      | 12.95             | 20.19              | 1.06      | 0.66    | 32.94       | 20.63            | 1.47         |



# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 2.70V, Id = 50mA @Temperature = +25°C

| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.04 | 30.66     | 6.09              | 13.65              | 0.89      | 0.86    | 30.18       | 14.88            | 0.36         |
| 100   | 25.25 | 29.38     | 7.68              | 17.61              | 0.96      | 0.78    | 30.29       | 14.91            | 0.49         |
| 200   | 24.16 | 28.24     | 8.78              | 20.55              | 0.99      | 0.75    | 30.53       | 16.77            | 0.51         |
| 400   | 21.70 | 25.89     | 10.29             | 23.38              | 1.02      | 0.73    | 30.98       | 18.08            | 0.69         |
| 500   | 20.53 | 24.80     | 10.88             | 24.33              | 1.04      | 0.72    | 31.22       | 18.19            | 0.69         |
| 600   | 19.47 | 23.80     | 11.34             | 24.94              | 1.05      | 0.72    | 31.43       | 18.46            | 0.72         |
| 700   | 18.49 | 22.87     | 11.76             | 25.49              | 1.06      | 0.72    | 31.58       | 18.50            | 0.68         |
| 800   | 17.59 | 22.01     | 12.09             | 25.75              | 1.07      | 0.71    | 31.68       | 18.57            | 0.62         |
| 900   | 16.76 | 21.22     | 12.41             | 25.88              | 1.07      | 0.71    | 31.81       | 18.69            | 0.59         |
| 1000  | 16.00 | 20.49     | 12.67             | 25.98              | 1.08      | 0.71    | 31.92       | 18.87            | 0.62         |
| 1100  | 15.29 | 19.80     | 12.89             | 25.98              | 1.08      | 0.71    | 32.00       | 18.90            | 0.63         |
| 1200  | 14.64 | 19.15     | 13.09             | 25.86              | 1.08      | 0.71    | 32.10       | 18.90            | 0.65         |
| 1300  | 14.04 | 18.57     | 13.26             | 25.78              | 1.09      | 0.71    | 32.18       | 18.97            | 0.67         |
| 1400  | 13.48 | 18.01     | 13.40             | 25.87              | 1.09      | 0.70    | 32.29       | 19.07            | 0.70         |
| 1500  | 12.95 | 17.46     | 13.47             | 25.81              | 1.09      | 0.70    | 32.45       | 19.17            | 0.71         |
| 1600  | 12.46 | 16.97     | 13.51             | 26.03              | 1.09      | 0.70    | 32.56       | 19.35            | 0.73         |
| 1700  | 11.99 | 16.49     | 13.51             | 26.17              | 1.09      | 0.70    | 32.67       | 19.41            | 0.74         |
| 1800  | 11.55 | 16.05     | 13.47             | 26.70              | 1.09      | 0.70    | 32.70       | 19.49            | 0.75         |
| 1900  | 11.14 | 15.61     | 13.41             | 27.17              | 1.09      | 0.70    | 32.78       | 19.49            | 0.76         |
| 2000  | 10.75 | 15.21     | 13.30             | 27.56              | 1.09      | 0.70    | 32.79       | 19.59            | 0.78         |
| 2100  | 10.38 | 14.82     | 13.19             | 28.19              | 1.08      | 0.70    | 32.81       | 19.70            | 0.79         |
| 2200  | 10.02 | 14.45     | 13.05             | 28.77              | 1.08      | 0.70    | 32.77       | 19.84            | 0.81         |
| 2300  | 9.68  | 14.10     | 12.88             | 29.08              | 1.08      | 0.70    | 32.68       | 19.84            | 0.85         |
| 2400  | 9.36  | 13.76     | 12.74             | 29.28              | 1.08      | 0.70    | 32.56       | 19.84            | 0.91         |
| 2500  | 9.05  | 13.43     | 12.57             | 29.14              | 1.08      | 0.70    | 32.56       | 19.85            | 0.98         |
| 2600  | 8.76  | 13.12     | 12.43             | 28.61              | 1.08      | 0.69    | 32.46       | 19.93            | 1.06         |
| 2700  | 8.48  | 12.83     | 12.27             | 27.84              | 1.07      | 0.69    | 32.40       | 19.97            | 1.13         |
| 2800  | 8.20  | 12.54     | 12.18             | 27.01              | 1.07      | 0.69    | 32.30       | 20.08            | 1.20         |
| 2900  | 7.94  | 12.26     | 12.06             | 26.06              | 1.07      | 0.69    | 32.22       | 20.07            | 1.23         |
| 3000  | 7.69  | 12.00     | 12.02             | 25.16              | 1.07      | 0.69    | 32.15       | 20.03            | 1.25         |
| 3200  | 7.22  | 11.49     | 11.94             | 23.61              | 1.07      | 0.69    | 31.95       | 20.22            | 1.25         |
| 3300  | 7.00  | 11.25     | 11.94             | 23.07              | 1.07      | 0.68    | 31.94       | 20.39            | 1.24         |
| 3400  | 6.78  | 11.02     | 11.97             | 22.42              | 1.06      | 0.68    | 31.86       | 20.37            | 1.28         |
| 3500  | 6.58  | 10.79     | 12.02             | 21.97              | 1.06      | 0.68    | 31.81       | 20.39            | 1.30         |
| 3600  | 6.38  | 10.57     | 12.11             | 21.46              | 1.06      | 0.67    | 31.77       | 20.32            | 1.34         |
| 3700  | 6.19  | 10.36     | 12.20             | 20.95              | 1.06      | 0.67    | 31.79       | 20.43            | 1.37         |
| 3800  | 6.01  | 10.15     | 12.34             | 20.59              | 1.06      | 0.67    | 31.75       | 20.52            | 1.41         |
| 4000  | 5.66  | 9.75      | 12.58             | 19.93              | 1.06      | 0.66    | 31.71       | 20.63            | 1.44         |





# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.30V, Id = 62mA @Temperature = +25°C

| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.43 | 30.18     | 6.42              | 13.96              | 0.88      | 0.77    | 32.38       | 15.50            | 0.35         |
| 100   | 25.63 | 29.65     | 8.16              | 18.32              | 0.97      | 0.75    | 32.63       | 16.02            | 0.48         |
| 200   | 24.52 | 28.59     | 9.33              | 21.71              | 1.01      | 0.72    | 33.19       | 17.44            | 0.51         |
| 400   | 22.04 | 26.34     | 10.93             | 24.06              | 1.05      | 0.72    | 34.20       | 18.61            | 0.69         |
| 500   | 20.87 | 25.31     | 11.54             | 24.28              | 1.06      | 0.72    | 34.64       | 18.83            | 0.69         |
| 600   | 19.80 | 24.30     | 12.05             | 23.95              | 1.07      | 0.72    | 34.96       | 18.99            | 0.71         |
| 700   | 18.82 | 23.38     | 12.49             | 23.65              | 1.08      | 0.71    | 35.26       | 19.16            | 0.67         |
| 800   | 17.91 | 22.50     | 12.84             | 23.28              | 1.08      | 0.71    | 35.42       | 19.18            | 0.60         |
| 900   | 17.08 | 21.71     | 13.17             | 22.92              | 1.09      | 0.71    | 35.68       | 19.30            | 0.59         |
| 1000  | 16.32 | 20.97     | 13.46             | 22.52              | 1.09      | 0.71    | 35.84       | 19.45            | 0.63         |
| 1100  | 15.61 | 20.29     | 13.71             | 22.27              | 1.10      | 0.71    | 36.03       | 19.50            | 0.64         |
| 1200  | 14.95 | 19.64     | 13.93             | 21.93              | 1.10      | 0.71    | 36.19       | 19.50            | 0.66         |
| 1300  | 14.35 | 19.03     | 14.12             | 21.73              | 1.10      | 0.71    | 36.37       | 19.55            | 0.68         |
| 1400  | 13.78 | 18.46     | 14.26             | 21.55              | 1.10      | 0.71    | 36.56       | 19.63            | 0.71         |
| 1500  | 13.25 | 17.93     | 14.34             | 21.41              | 1.10      | 0.71    | 36.70       | 19.69            | 0.72         |
| 1600  | 12.76 | 17.44     | 14.39             | 21.44              | 1.10      | 0.70    | 36.73       | 19.83            | 0.75         |
| 1700  | 12.29 | 16.95     | 14.42             | 21.45              | 1.10      | 0.70    | 36.77       | 19.93            | 0.76         |
| 1800  | 11.85 | 16.50     | 14.37             | 21.73              | 1.10      | 0.70    | 36.95       | 20.02            | 0.76         |
| 1900  | 11.44 | 16.06     | 14.30             | 21.98              | 1.09      | 0.70    | 37.05       | 20.04            | 0.77         |
| 2000  | 11.05 | 15.66     | 14.18             | 22.28              | 1.09      | 0.70    | 37.00       | 20.09            | 0.78         |
| 2100  | 10.67 | 15.26     | 14.07             | 22.67              | 1.09      | 0.70    | 37.02       | 20.21            | 0.79         |
| 2200  | 10.31 | 14.90     | 13.92             | 23.21              | 1.09      | 0.70    | 37.18       | 20.30            | 0.81         |
| 2300  | 9.98  | 14.53     | 13.74             | 23.74              | 1.09      | 0.70    | 37.24       | 20.24            | 0.85         |
| 2400  | 9.66  | 14.19     | 13.58             | 24.26              | 1.09      | 0.70    | 37.23       | 20.23            | 0.90         |
| 2500  | 9.35  | 13.86     | 13.38             | 24.79              | 1.08      | 0.70    | 37.30       | 20.24            | 0.97         |
| 2600  | 9.05  | 13.55     | 13.22             | 25.32              | 1.08      | 0.70    | 37.32       | 20.33            | 1.04         |
| 2700  | 8.77  | 13.24     | 13.06             | 25.63              | 1.08      | 0.70    | 37.17       | 20.37            | 1.11         |
| 2800  | 8.49  | 12.94     | 12.94             | 25.92              | 1.08      | 0.70    | 36.92       | 20.41            | 1.18         |
| 2900  | 8.23  | 12.67     | 12.82             | 25.85              | 1.08      | 0.70    | 36.84       | 20.44            | 1.21         |
| 3000  | 7.98  | 12.40     | 12.77             | 25.51              | 1.08      | 0.70    | 36.58       | 20.37            | 1.23         |
| 3200  | 7.51  | 11.89     | 12.68             | 24.48              | 1.07      | 0.70    | 36.24       | 20.52            | 1.24         |
| 3300  | 7.28  | 11.64     | 12.65             | 24.02              | 1.07      | 0.70    | 36.24       | 20.61            | 1.23         |
| 3400  | 7.07  | 11.40     | 12.69             | 23.38              | 1.07      | 0.69    | 36.16       | 20.57            | 1.27         |
| 3500  | 6.86  | 11.17     | 12.73             | 22.84              | 1.07      | 0.69    | 36.15       | 20.59            | 1.31         |
| 3600  | 6.66  | 10.94     | 12.81             | 22.25              | 1.07      | 0.69    | 36.07       | 20.58            | 1.35         |
| 3700  | 6.47  | 10.73     | 12.90             | 21.59              | 1.06      | 0.68    | 36.09       | 20.81            | 1.37         |
| 3800  | 6.28  | 10.52     | 13.05             | 21.08              | 1.06      | 0.68    | 36.05       | 20.88            | 1.41         |
| 4000  | 5.94  | 10.13     | 13.26             | 20.20              | 1.06      | 0.67    | 36.00       | 20.96            | 1.43         |



## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5V, Id = 91mA @Temperature = +25°C

| FREQ.<br>(MHz) | Gain<br>(dB) | Isolation<br>(dB) | Input<br>Return<br>Loss<br>(dB) | Output<br>Return<br>Loss<br>(dB) | Stability |         | IP-3 Output<br>(dBm) | 1dB Comp.<br>Output<br>(dBm) | Noise<br>Figure<br>(dB) |
|----------------|--------------|-------------------|---------------------------------|----------------------------------|-----------|---------|----------------------|------------------------------|-------------------------|
|                |              |                   |                                 |                                  | K         | Measure |                      |                              |                         |
| 50             | 26.90        | 30.89             | 6.94                            | 13.94                            | 0.91      | 0.77    | 35.84                | 19.28                        | 0.40                    |
| 100            | 26.07        | 29.98             | 8.81                            | 19.12                            | 0.99      | 0.71    | 36.13                | 19.53                        | 0.51                    |
| 200            | 24.94        | 29.04             | 10.05                           | 22.43                            | 1.03      | 0.70    | 36.86                | 20.45                        | 0.53                    |
| 400            | 22.41        | 26.94             | 11.72                           | 21.92                            | 1.08      | 0.71    | 38.04                | 21.16                        | 0.71                    |
| 500            | 21.22        | 25.91             | 12.36                           | 21.22                            | 1.09      | 0.71    | 38.45                | 21.22                        | 0.71                    |
| 600            | 20.14        | 24.92             | 12.87                           | 20.39                            | 1.10      | 0.71    | 39.04                | 21.48                        | 0.72                    |
| 700            | 19.14        | 24.01             | 13.34                           | 19.76                            | 1.10      | 0.72    | 39.74                | 21.54                        | 0.70                    |
| 800            | 18.23        | 23.12             | 13.70                           | 19.27                            | 1.11      | 0.72    | 39.96                | 21.57                        | 0.63                    |
| 900            | 17.39        | 22.31             | 14.06                           | 18.85                            | 1.11      | 0.72    | 40.06                | 21.74                        | 0.60                    |
| 1000           | 16.62        | 21.57             | 14.35                           | 18.47                            | 1.11      | 0.72    | 40.73                | 21.65                        | 0.63                    |
| 1100           | 15.91        | 20.89             | 14.61                           | 18.21                            | 1.11      | 0.72    | 41.23                | 21.73                        | 0.64                    |
| 1200           | 15.25        | 20.22             | 14.85                           | 17.93                            | 1.11      | 0.71    | 41.10                | 21.79                        | 0.66                    |
| 1300           | 14.64        | 19.63             | 15.05                           | 17.74                            | 1.11      | 0.71    | 41.49                | 21.84                        | 0.68                    |
| 1400           | 14.07        | 19.07             | 15.20                           | 17.58                            | 1.11      | 0.71    | 41.84                | 21.95                        | 0.70                    |
| 1500           | 13.54        | 18.53             | 15.29                           | 17.47                            | 1.11      | 0.71    | 41.33                | 22.03                        | 0.72                    |
| 1600           | 13.05        | 18.01             | 15.35                           | 17.43                            | 1.11      | 0.71    | 41.67                | 22.04                        | 0.75                    |
| 1700           | 12.57        | 17.54             | 15.37                           | 17.43                            | 1.11      | 0.71    | 42.67                | 22.09                        | 0.77                    |
| 1800           | 12.13        | 17.08             | 15.31                           | 17.58                            | 1.11      | 0.71    | 42.46                | 22.25                        | 0.78                    |
| 1900           | 11.71        | 16.65             | 15.23                           | 17.74                            | 1.11      | 0.71    | 42.08                | 22.30                        | 0.79                    |
| 2000           | 11.32        | 16.23             | 15.11                           | 17.91                            | 1.10      | 0.71    | 41.59                | 22.33                        | 0.81                    |
| 2100           | 10.95        | 15.83             | 14.97                           | 18.14                            | 1.10      | 0.71    | 42.68                | 22.41                        | 0.82                    |
| 2200           | 10.59        | 15.46             | 14.80                           | 18.44                            | 1.10      | 0.71    | 43.43                | 22.45                        | 0.84                    |
| 2300           | 10.25        | 15.09             | 14.60                           | 18.77                            | 1.10      | 0.71    | 43.07                | 22.51                        | 0.89                    |
| 2400           | 9.93         | 14.74             | 14.42                           | 19.12                            | 1.10      | 0.72    | 42.91                | 22.55                        | 0.94                    |
| 2500           | 9.62         | 14.42             | 14.22                           | 19.51                            | 1.09      | 0.72    | 42.86                | 22.67                        | 1.01                    |
| 2600           | 9.33         | 14.08             | 14.04                           | 19.90                            | 1.09      | 0.72    | 42.61                | 22.74                        | 1.09                    |
| 2700           | 9.05         | 13.78             | 13.85                           | 20.21                            | 1.09      | 0.72    | 42.82                | 22.84                        | 1.17                    |
| 2800           | 8.77         | 13.47             | 13.71                           | 20.59                            | 1.09      | 0.72    | 43.13                | 22.80                        | 1.24                    |
| 2900           | 8.51         | 13.19             | 13.56                           | 20.84                            | 1.08      | 0.72    | 43.63                | 22.53                        | 1.28                    |
| 3000           | 8.26         | 12.91             | 13.51                           | 20.97                            | 1.08      | 0.72    | 44.18                | 22.27                        | 1.30                    |
| 3200           | 7.79         | 12.39             | 13.39                           | 20.94                            | 1.08      | 0.71    | 43.58                | 22.54                        | 1.29                    |
| 3300           | 7.56         | 12.13             | 13.36                           | 20.87                            | 1.08      | 0.71    | 43.58                | 22.81                        | 1.30                    |
| 3400           | 7.35         | 11.89             | 13.38                           | 20.64                            | 1.08      | 0.71    | 43.46                | 22.93                        | 1.33                    |
| 3500           | 7.14         | 11.65             | 13.43                           | 20.34                            | 1.07      | 0.70    | 44.65                | 22.98                        | 1.36                    |
| 3600           | 6.93         | 11.41             | 13.52                           | 20.10                            | 1.07      | 0.70    | 44.62                | 22.99                        | 1.40                    |
| 3700           | 6.75         | 11.20             | 13.60                           | 19.68                            | 1.07      | 0.70    | 44.62                | 23.04                        | 1.45                    |
| 3800           | 6.55         | 10.98             | 13.75                           | 19.33                            | 1.07      | 0.69    | 43.96                | 23.01                        | 1.49                    |
| 4000           | 6.20         | 10.58             | 13.98                           | 18.65                            | 1.07      | 0.68    | 44.30                | 22.84                        | 1.57                    |

## Typical Performance Data

### Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 4.75V, Id = 85mA @Temperature = +25°C

| FREQ.<br>(MHz) | Gain<br>(dB) | Isolation<br>(dB) | Input<br>Return<br>Loss<br>(dB) | Output<br>Return<br>Loss<br>(dB) | Stability |         | IP-3 Output<br>(dBm) | 1dB Comp.<br>Output<br>(dBm) | Noise<br>Figure<br>(dB) |
|----------------|--------------|-------------------|---------------------------------|----------------------------------|-----------|---------|----------------------|------------------------------|-------------------------|
|                |              |                   |                                 |                                  | K         | Measure |                      |                              |                         |
| 50             | 26.87        | 30.54             | 6.92                            | 13.76                            | 0.90      | 0.74    | 36.67                | 18.77                        | 0.39                    |
| 100            | 26.04        | 29.93             | 8.76                            | 19.08                            | 0.99      | 0.71    | 36.84                | 19.06                        | 0.50                    |
| 200            | 24.90        | 28.98             | 10.01                           | 22.49                            | 1.03      | 0.70    | 37.21                | 20.09                        | 0.52                    |
| 400            | 22.37        | 26.91             | 11.66                           | 22.21                            | 1.08      | 0.71    | 37.70                | 20.88                        | 0.71                    |
| 500            | 21.19        | 25.84             | 12.30                           | 21.49                            | 1.09      | 0.71    | 38.31                | 20.98                        | 0.70                    |
| 600            | 20.11        | 24.87             | 12.82                           | 20.68                            | 1.10      | 0.71    | 38.92                | 21.15                        | 0.73                    |
| 700            | 19.12        | 23.95             | 13.29                           | 20.07                            | 1.10      | 0.72    | 39.36                | 21.26                        | 0.70                    |
| 800            | 18.21        | 23.10             | 13.65                           | 19.56                            | 1.11      | 0.72    | 39.79                | 21.33                        | 0.63                    |
| 900            | 17.37        | 22.29             | 14.00                           | 19.12                            | 1.11      | 0.72    | 40.27                | 21.38                        | 0.60                    |
| 1000           | 16.60        | 21.54             | 14.30                           | 18.75                            | 1.11      | 0.72    | 40.57                | 21.38                        | 0.64                    |
| 1100           | 15.89        | 20.84             | 14.56                           | 18.48                            | 1.11      | 0.72    | 40.86                | 21.43                        | 0.64                    |
| 1200           | 15.23        | 20.19             | 14.79                           | 18.19                            | 1.11      | 0.71    | 40.95                | 21.48                        | 0.66                    |
| 1300           | 14.62        | 19.59             | 15.00                           | 17.98                            | 1.11      | 0.71    | 41.21                | 21.52                        | 0.68                    |
| 1400           | 14.05        | 19.01             | 15.13                           | 17.84                            | 1.11      | 0.71    | 41.48                | 21.67                        | 0.71                    |
| 1500           | 13.52        | 18.50             | 15.23                           | 17.70                            | 1.11      | 0.71    | 41.51                | 21.73                        | 0.72                    |
| 1600           | 13.02        | 17.98             | 15.28                           | 17.67                            | 1.11      | 0.71    | 41.80                | 21.75                        | 0.75                    |
| 1700           | 12.55        | 17.49             | 15.29                           | 17.68                            | 1.11      | 0.71    | 42.03                | 21.79                        | 0.77                    |
| 1800           | 12.11        | 17.04             | 15.25                           | 17.82                            | 1.11      | 0.71    | 42.17                | 21.88                        | 0.78                    |
| 1900           | 11.69        | 16.61             | 15.17                           | 17.98                            | 1.11      | 0.71    | 42.26                | 22.02                        | 0.79                    |
| 2000           | 11.30        | 16.19             | 15.05                           | 18.15                            | 1.10      | 0.71    | 42.41                | 22.07                        | 0.81                    |
| 2100           | 10.92        | 15.80             | 14.90                           | 18.41                            | 1.10      | 0.71    | 42.61                | 22.14                        | 0.83                    |
| 2200           | 10.57        | 15.42             | 14.74                           | 18.73                            | 1.10      | 0.71    | 42.90                | 22.18                        | 0.85                    |
| 2300           | 10.23        | 15.05             | 14.54                           | 19.08                            | 1.10      | 0.71    | 43.05                | 22.26                        | 0.88                    |
| 2400           | 9.91         | 14.71             | 14.37                           | 19.42                            | 1.10      | 0.72    | 43.27                | 22.32                        | 0.94                    |
| 2500           | 9.60         | 14.37             | 14.16                           | 19.78                            | 1.09      | 0.72    | 43.24                | 22.40                        | 1.01                    |
| 2600           | 9.31         | 14.04             | 13.97                           | 20.22                            | 1.09      | 0.72    | 43.24                | 22.47                        | 1.09                    |
| 2700           | 9.03         | 13.74             | 13.79                           | 20.55                            | 1.09      | 0.72    | 43.26                | 22.50                        | 1.17                    |
| 2800           | 8.75         | 13.44             | 13.66                           | 20.94                            | 1.09      | 0.72    | 42.95                | 22.45                        | 1.23                    |
| 2900           | 8.49         | 13.15             | 13.51                           | 21.19                            | 1.08      | 0.72    | 43.24                | 22.28                        | 1.26                    |
| 3000           | 8.24         | 12.88             | 13.46                           | 21.32                            | 1.08      | 0.72    | 43.63                | 22.00                        | 1.28                    |
| 3200           | 7.76         | 12.35             | 13.35                           | 21.24                            | 1.08      | 0.71    | 44.14                | 22.27                        | 1.28                    |
| 3300           | 7.54         | 12.10             | 13.31                           | 21.12                            | 1.08      | 0.71    | 44.14                | 22.54                        | 1.28                    |
| 3400           | 7.32         | 11.85             | 13.33                           | 20.85                            | 1.07      | 0.71    | 44.37                | 22.67                        | 1.32                    |
| 3500           | 7.12         | 11.62             | 13.37                           | 20.55                            | 1.07      | 0.70    | 44.13                | 22.66                        | 1.36                    |
| 3600           | 6.91         | 11.38             | 13.47                           | 20.27                            | 1.07      | 0.70    | 44.19                | 22.70                        | 1.40                    |
| 3700           | 6.72         | 11.17             | 13.56                           | 19.85                            | 1.07      | 0.70    | 44.09                | 22.77                        | 1.43                    |
| 3800           | 6.53         | 10.95             | 13.70                           | 19.49                            | 1.07      | 0.69    | 44.02                | 22.82                        | 1.47                    |
| 4000           | 6.19         | 10.55             | 13.92                           | 18.81                            | 1.07      | 0.68    | 44.05                | 22.68                        | 1.54                    |

## Typical Performance Data

### Full 2-Port Extension

#### 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, Id = 93mA @Temperature = +25°C

| FREQ.<br>(MHz) | Gain<br>(dB) | Isolation<br>(dB) | Input<br>Return<br>Loss<br>(dB) | Output<br>Return<br>Loss<br>(dB) | Stability |         | IP-3 Output<br>(dBm) | 1dB Comp.<br>Output<br>(dBm) | Noise<br>Figure<br>(dB) |
|----------------|--------------|-------------------|---------------------------------|----------------------------------|-----------|---------|----------------------|------------------------------|-------------------------|
|                |              |                   |                                 |                                  | K         | Measure |                      |                              |                         |
| 50             | 26.92        | 30.83             | 6.98                            | 14.23                            | 0.91      | 0.77    | 35.70                | 19.56                        | 0.41                    |
| 100            | 26.09        | 29.93             | 8.83                            | 19.09                            | 0.99      | 0.71    | 35.98                | 19.76                        | 0.51                    |
| 200            | 24.95        | 29.09             | 10.06                           | 22.25                            | 1.04      | 0.70    | 36.74                | 20.62                        | 0.53                    |
| 400            | 22.42        | 27.00             | 11.73                           | 21.70                            | 1.08      | 0.71    | 37.99                | 21.20                        | 0.71                    |
| 500            | 21.23        | 25.94             | 12.38                           | 20.96                            | 1.09      | 0.71    | 38.64                | 21.32                        | 0.71                    |
| 600            | 20.15        | 24.95             | 12.90                           | 20.15                            | 1.10      | 0.71    | 39.23                | 21.48                        | 0.73                    |
| 700            | 19.15        | 24.01             | 13.37                           | 19.55                            | 1.10      | 0.72    | 39.68                | 21.58                        | 0.69                    |
| 800            | 18.24        | 23.16             | 13.74                           | 19.07                            | 1.11      | 0.72    | 40.07                | 21.60                        | 0.63                    |
| 900            | 17.40        | 22.35             | 14.09                           | 18.64                            | 1.11      | 0.72    | 40.45                | 21.76                        | 0.62                    |
| 1000           | 16.63        | 21.63             | 14.38                           | 18.28                            | 1.11      | 0.72    | 40.79                | 21.68                        | 0.65                    |
| 1100           | 15.92        | 20.92             | 14.65                           | 18.02                            | 1.11      | 0.72    | 40.92                | 21.72                        | 0.66                    |
| 1200           | 15.26        | 20.26             | 14.88                           | 17.75                            | 1.11      | 0.72    | 41.24                | 21.80                        | 0.68                    |
| 1300           | 14.65        | 19.66             | 15.08                           | 17.53                            | 1.11      | 0.72    | 41.36                | 21.85                        | 0.70                    |
| 1400           | 14.08        | 19.09             | 15.25                           | 17.39                            | 1.11      | 0.71    | 41.34                | 21.96                        | 0.73                    |
| 1500           | 13.55        | 18.55             | 15.33                           | 17.28                            | 1.11      | 0.71    | 41.48                | 22.02                        | 0.74                    |
| 1600           | 13.05        | 18.05             | 15.38                           | 17.23                            | 1.11      | 0.71    | 41.88                | 22.00                        | 0.76                    |
| 1700           | 12.58        | 17.57             | 15.40                           | 17.26                            | 1.11      | 0.71    | 42.16                | 22.02                        | 0.78                    |
| 1800           | 12.14        | 17.11             | 15.34                           | 17.39                            | 1.11      | 0.71    | 42.34                | 22.16                        | 0.79                    |
| 1900           | 11.72        | 16.69             | 15.26                           | 17.53                            | 1.11      | 0.71    | 42.46                | 22.30                        | 0.80                    |
| 2000           | 11.33        | 16.27             | 15.14                           | 17.70                            | 1.11      | 0.71    | 42.79                | 22.35                        | 0.82                    |
| 2100           | 10.95        | 15.86             | 15.00                           | 17.93                            | 1.10      | 0.71    | 42.98                | 22.45                        | 0.84                    |
| 2200           | 10.60        | 15.48             | 14.83                           | 18.25                            | 1.10      | 0.72    | 43.25                | 22.45                        | 0.85                    |
| 2300           | 10.26        | 15.12             | 14.63                           | 18.56                            | 1.10      | 0.72    | 43.12                | 22.51                        | 0.90                    |
| 2400           | 9.94         | 14.77             | 14.45                           | 18.89                            | 1.10      | 0.72    | 44.15                | 22.58                        | 0.96                    |
| 2500           | 9.63         | 14.45             | 14.25                           | 19.24                            | 1.09      | 0.72    | 43.97                | 22.70                        | 1.03                    |
| 2600           | 9.34         | 14.11             | 14.06                           | 19.66                            | 1.09      | 0.72    | 43.98                | 22.78                        | 1.11                    |
| 2700           | 9.06         | 13.81             | 13.86                           | 19.97                            | 1.09      | 0.72    | 44.17                | 22.81                        | 1.19                    |
| 2800           | 8.78         | 13.50             | 13.74                           | 20.39                            | 1.09      | 0.72    | 44.10                | 22.73                        | 1.26                    |
| 2900           | 8.52         | 13.22             | 13.58                           | 20.65                            | 1.09      | 0.72    | 44.49                | 22.48                        | 1.29                    |
| 3000           | 8.26         | 12.94             | 13.53                           | 20.77                            | 1.08      | 0.72    | 43.66                | 22.18                        | 1.31                    |
| 3200           | 7.79         | 12.41             | 13.42                           | 20.74                            | 1.08      | 0.71    | 43.95                | 22.48                        | 1.31                    |
| 3300           | 7.57         | 12.16             | 13.37                           | 20.58                            | 1.08      | 0.71    | 43.95                | 22.83                        | 1.31                    |
| 3400           | 7.35         | 11.92             | 13.40                           | 20.41                            | 1.08      | 0.71    | 44.41                | 23.02                        | 1.34                    |
| 3500           | 7.14         | 11.68             | 13.44                           | 20.11                            | 1.07      | 0.71    | 44.68                | 23.00                        | 1.38                    |
| 3600           | 6.94         | 11.44             | 13.55                           | 19.89                            | 1.07      | 0.70    | 44.91                | 23.07                        | 1.42                    |
| 3700           | 6.76         | 11.22             | 13.63                           | 19.49                            | 1.07      | 0.70    | 45.26                | 23.06                        | 1.46                    |
| 3800           | 6.56         | 11.00             | 13.76                           | 19.16                            | 1.07      | 0.69    | 45.24                | 23.03                        | 1.50                    |
| 4000           | 6.21         | 10.59             | 14.01                           | 18.53                            | 1.07      | 0.69    | 44.59                | 22.90                        | 1.59                    |

# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.00V, Id = 56mA @Temperature = +25°C

| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.33 | 29.88     | 6.29              | 13.54              | 0.87      | 0.76    | 31.22       | 14.88            | 0.33         |
| 100   | 25.52 | 29.46     | 7.94              | 17.99              | 0.96      | 0.75    | 31.60       | 14.91            | 0.46         |
| 200   | 24.40 | 28.38     | 9.07              | 21.21              | 0.99      | 0.73    | 31.79       | 16.77            | 0.49         |
| 400   | 21.90 | 26.17     | 10.62             | 24.11              | 1.04      | 0.72    | 32.65       | 18.08            | 0.68         |
| 500   | 20.71 | 25.10     | 11.23             | 24.79              | 1.05      | 0.72    | 32.87       | 18.19            | 0.68         |
| 600   | 19.63 | 24.09     | 11.72             | 24.96              | 1.06      | 0.72    | 33.00       | 18.46            | 0.69         |
| 700   | 18.63 | 23.17     | 12.15             | 24.99              | 1.07      | 0.72    | 33.15       | 18.50            | 0.67         |
| 800   | 17.72 | 22.35     | 12.50             | 24.92              | 1.08      | 0.72    | 33.22       | 18.57            | 0.60         |
| 900   | 16.88 | 21.57     | 12.81             | 24.69              | 1.09      | 0.72    | 33.43       | 18.69            | 0.58         |
| 1000  | 16.10 | 20.84     | 13.10             | 24.44              | 1.10      | 0.72    | 33.56       | 18.87            | 0.60         |
| 1100  | 15.38 | 20.15     | 13.33             | 24.22              | 1.10      | 0.72    | 33.57       | 18.90            | 0.61         |
| 1200  | 14.72 | 19.52     | 13.55             | 23.97              | 1.10      | 0.72    | 33.72       | 18.90            | 0.63         |
| 1300  | 14.11 | 18.92     | 13.73             | 23.70              | 1.11      | 0.72    | 33.95       | 18.97            | 0.65         |
| 1400  | 13.53 | 18.36     | 13.86             | 23.64              | 1.11      | 0.72    | 33.97       | 19.07            | 0.67         |
| 1500  | 12.99 | 17.85     | 13.95             | 23.54              | 1.11      | 0.72    | 34.12       | 19.17            | 0.69         |
| 1600  | 12.49 | 17.35     | 13.99             | 23.57              | 1.11      | 0.72    | 34.07       | 19.35            | 0.71         |
| 1700  | 12.01 | 16.87     | 14.01             | 23.69              | 1.11      | 0.72    | 34.28       | 19.41            | 0.73         |
| 1800  | 11.56 | 16.43     | 13.96             | 24.02              | 1.11      | 0.72    | 34.38       | 19.49            | 0.74         |
| 1900  | 11.14 | 16.02     | 13.90             | 24.38              | 1.11      | 0.72    | 34.36       | 19.49            | 0.75         |
| 2000  | 10.74 | 15.61     | 13.79             | 24.77              | 1.11      | 0.72    | 34.30       | 19.59            | 0.77         |
| 2100  | 10.36 | 15.23     | 13.67             | 25.30              | 1.11      | 0.72    | 34.38       | 19.70            | 0.78         |
| 2200  | 9.99  | 14.88     | 13.53             | 25.96              | 1.11      | 0.73    | 34.20       | 19.84            | 0.81         |
| 2300  | 9.65  | 14.54     | 13.36             | 26.50              | 1.11      | 0.73    | 34.24       | 19.84            | 0.85         |
| 2400  | 9.32  | 14.20     | 13.20             | 27.11              | 1.11      | 0.73    | 33.96       | 19.84            | 0.90         |
| 2500  | 9.00  | 13.88     | 13.03             | 27.66              | 1.11      | 0.73    | 33.86       | 19.85            | 0.97         |
| 2600  | 8.70  | 13.58     | 12.88             | 28.02              | 1.11      | 0.73    | 33.89       | 19.93            | 1.04         |
| 2700  | 8.41  | 13.29     | 12.71             | 28.02              | 1.11      | 0.73    | 33.86       | 19.97            | 1.13         |
| 2800  | 8.12  | 13.01     | 12.60             | 27.80              | 1.11      | 0.73    | 33.61       | 20.08            | 1.19         |
| 2900  | 7.85  | 12.73     | 12.49             | 27.26              | 1.11      | 0.73    | 33.30       | 20.07            | 1.22         |
| 3000  | 7.59  | 12.49     | 12.43             | 26.50              | 1.11      | 0.73    | 33.31       | 20.03            | 1.24         |
| 3200  | 7.10  | 11.98     | 12.36             | 24.94              | 1.11      | 0.73    | 33.35       | 20.22            | 1.21         |
| 3300  | 6.87  | 11.76     | 12.34             | 24.38              | 1.11      | 0.73    | 33.14       | 20.39            | 1.21         |
| 3400  | 6.65  | 11.52     | 12.37             | 23.68              | 1.10      | 0.73    | 33.18       | 20.37            | 1.23         |
| 3500  | 6.44  | 11.30     | 12.42             | 23.13              | 1.10      | 0.73    | 32.98       | 20.39            | 1.26         |
| 3600  | 6.23  | 11.08     | 12.51             | 22.60              | 1.10      | 0.73    | 32.92       | 20.32            | 1.30         |
| 3700  | 6.03  | 10.87     | 12.60             | 21.98              | 1.10      | 0.72    | 32.92       | 20.43            | 1.35         |
| 3800  | 5.84  | 10.68     | 12.73             | 21.54              | 1.10      | 0.72    | 32.97       | 20.52            | 1.38         |
| 4000  | 5.48  | 10.29     | 12.95             | 20.76              | 1.10      | 0.71    | 32.94       | 20.63            | 1.47         |



# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)


Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 2.70V, Id = 50mA @Temperature = +25°C

| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.11 | 30.26     | 6.04              | 13.78              | 0.87      | 0.83    | 30.18       | 14.88            | 0.36         |
| 100   | 25.31 | 29.37     | 7.62              | 17.56              | 0.95      | 0.77    | 30.29       | 14.91            | 0.49         |
| 200   | 24.20 | 28.19     | 8.74              | 20.50              | 0.98      | 0.74    | 30.53       | 16.77            | 0.51         |
| 400   | 21.71 | 25.85     | 10.29             | 23.42              | 1.02      | 0.72    | 30.98       | 18.08            | 0.69         |
| 500   | 20.53 | 24.78     | 10.89             | 24.35              | 1.04      | 0.72    | 31.22       | 18.19            | 0.69         |
| 600   | 19.44 | 23.82     | 11.36             | 24.94              | 1.05      | 0.72    | 31.43       | 18.46            | 0.72         |
| 700   | 18.45 | 22.91     | 11.79             | 25.45              | 1.06      | 0.72    | 31.58       | 18.50            | 0.68         |
| 800   | 17.54 | 22.08     | 12.13             | 25.82              | 1.07      | 0.72    | 31.68       | 18.57            | 0.62         |
| 900   | 16.70 | 21.29     | 12.46             | 25.97              | 1.08      | 0.72    | 31.81       | 18.69            | 0.59         |
| 1000  | 15.92 | 20.58     | 12.74             | 26.02              | 1.09      | 0.72    | 31.92       | 18.87            | 0.62         |
| 1100  | 15.21 | 19.89     | 12.98             | 26.03              | 1.09      | 0.72    | 32.00       | 18.90            | 0.63         |
| 1200  | 14.55 | 19.25     | 13.19             | 25.93              | 1.10      | 0.72    | 32.10       | 18.90            | 0.65         |
| 1300  | 13.93 | 18.68     | 13.37             | 25.82              | 1.10      | 0.72    | 32.18       | 18.97            | 0.67         |
| 1400  | 13.36 | 18.12     | 13.51             | 25.91              | 1.10      | 0.72    | 32.29       | 19.07            | 0.70         |
| 1500  | 12.82 | 17.58     | 13.59             | 25.94              | 1.10      | 0.72    | 32.45       | 19.17            | 0.71         |
| 1600  | 12.32 | 17.11     | 13.66             | 26.10              | 1.11      | 0.72    | 32.56       | 19.35            | 0.73         |
| 1700  | 11.84 | 16.65     | 13.66             | 26.30              | 1.11      | 0.72    | 32.67       | 19.41            | 0.74         |
| 1800  | 11.40 | 16.19     | 13.64             | 26.79              | 1.11      | 0.72    | 32.70       | 19.49            | 0.75         |
| 1900  | 10.98 | 15.79     | 13.57             | 27.28              | 1.11      | 0.72    | 32.78       | 19.49            | 0.76         |
| 2000  | 10.57 | 15.39     | 13.48             | 27.71              | 1.11      | 0.72    | 32.79       | 19.59            | 0.78         |
| 2100  | 10.19 | 15.02     | 13.39             | 28.28              | 1.11      | 0.72    | 32.81       | 19.70            | 0.79         |
| 2200  | 9.83  | 14.65     | 13.27             | 28.85              | 1.11      | 0.72    | 32.77       | 19.84            | 0.81         |
| 2300  | 9.48  | 14.29     | 13.12             | 29.28              | 1.11      | 0.72    | 32.68       | 19.84            | 0.85         |
| 2400  | 9.15  | 13.97     | 12.97             | 29.46              | 1.11      | 0.73    | 32.56       | 19.84            | 0.91         |
| 2500  | 8.83  | 13.66     | 12.80             | 29.38              | 1.11      | 0.73    | 32.56       | 19.85            | 0.98         |
| 2600  | 8.53  | 13.36     | 12.67             | 28.88              | 1.11      | 0.73    | 32.46       | 19.93            | 1.06         |
| 2700  | 8.24  | 13.06     | 12.52             | 28.15              | 1.10      | 0.73    | 32.40       | 19.97            | 1.13         |
| 2800  | 7.96  | 12.78     | 12.44             | 27.30              | 1.10      | 0.73    | 32.30       | 20.08            | 1.20         |
| 2900  | 7.69  | 12.53     | 12.33             | 26.29              | 1.10      | 0.73    | 32.22       | 20.07            | 1.23         |
| 3000  | 7.43  | 12.27     | 12.30             | 25.44              | 1.10      | 0.73    | 32.15       | 20.03            | 1.25         |
| 3200  | 6.94  | 11.78     | 12.24             | 23.87              | 1.10      | 0.73    | 31.95       | 20.22            | 1.25         |
| 3300  | 6.71  | 11.54     | 12.23             | 23.35              | 1.10      | 0.73    | 31.94       | 20.39            | 1.24         |
| 3400  | 6.49  | 11.32     | 12.28             | 22.74              | 1.10      | 0.73    | 31.86       | 20.37            | 1.28         |
| 3500  | 6.28  | 11.10     | 12.33             | 22.28              | 1.10      | 0.72    | 31.81       | 20.39            | 1.30         |
| 3600  | 6.07  | 10.89     | 12.44             | 21.77              | 1.10      | 0.72    | 31.77       | 20.32            | 1.34         |
| 3700  | 5.88  | 10.69     | 12.52             | 21.26              | 1.10      | 0.72    | 31.79       | 20.43            | 1.37         |
| 3800  | 5.68  | 10.48     | 12.70             | 20.93              | 1.10      | 0.72    | 31.75       | 20.52            | 1.41         |
| 4000  | 5.32  | 10.10     | 12.94             | 20.27              | 1.10      | 0.71    | 31.71       | 20.63            | 1.44         |



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REV. OR  
PGA-103-D+  
8/14/2015  
Page 8 of 12

# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 3.30V, Id = 62mA @Temperature = +25°C

| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.50 | 30.41     | 6.38              | 13.96              | 0.88      | 0.79    | 32.38       | 15.50            | 0.35         |
| 100   | 25.68 | 29.59     | 8.11              | 18.26              | 0.97      | 0.74    | 32.63       | 16.02            | 0.48         |
| 200   | 24.56 | 28.54     | 9.29              | 21.68              | 1.00      | 0.72    | 33.19       | 17.44            | 0.51         |
| 400   | 22.04 | 26.34     | 10.91             | 24.03              | 1.05      | 0.71    | 34.20       | 18.61            | 0.69         |
| 500   | 20.86 | 25.30     | 11.54             | 24.30              | 1.06      | 0.72    | 34.64       | 18.83            | 0.69         |
| 600   | 19.77 | 24.33     | 12.07             | 24.05              | 1.08      | 0.72    | 34.96       | 18.99            | 0.71         |
| 700   | 18.78 | 23.44     | 12.53             | 23.70              | 1.09      | 0.72    | 35.26       | 19.16            | 0.67         |
| 800   | 17.86 | 22.54     | 12.89             | 23.35              | 1.09      | 0.72    | 35.42       | 19.18            | 0.60         |
| 900   | 17.02 | 21.77     | 13.23             | 23.01              | 1.10      | 0.72    | 35.68       | 19.30            | 0.59         |
| 1000  | 16.24 | 21.04     | 13.52             | 22.66              | 1.10      | 0.72    | 35.84       | 19.45            | 0.63         |
| 1100  | 15.52 | 20.36     | 13.79             | 22.38              | 1.11      | 0.72    | 36.03       | 19.50            | 0.64         |
| 1200  | 14.86 | 19.74     | 14.03             | 22.05              | 1.11      | 0.72    | 36.19       | 19.50            | 0.66         |
| 1300  | 14.24 | 19.16     | 14.22             | 21.84              | 1.11      | 0.72    | 36.37       | 19.55            | 0.68         |
| 1400  | 13.66 | 18.59     | 14.36             | 21.68              | 1.11      | 0.72    | 36.56       | 19.63            | 0.71         |
| 1500  | 13.12 | 18.05     | 14.47             | 21.59              | 1.11      | 0.72    | 36.70       | 19.69            | 0.72         |
| 1600  | 12.62 | 17.57     | 14.53             | 21.59              | 1.12      | 0.72    | 36.73       | 19.83            | 0.75         |
| 1700  | 12.14 | 17.09     | 14.56             | 21.65              | 1.12      | 0.72    | 36.77       | 19.93            | 0.76         |
| 1800  | 11.69 | 16.66     | 14.53             | 21.93              | 1.12      | 0.73    | 36.95       | 20.02            | 0.76         |
| 1900  | 11.27 | 16.23     | 14.46             | 22.18              | 1.12      | 0.73    | 37.05       | 20.04            | 0.77         |
| 2000  | 10.87 | 15.83     | 14.36             | 22.51              | 1.12      | 0.73    | 37.00       | 20.09            | 0.78         |
| 2100  | 10.48 | 15.45     | 14.26             | 22.92              | 1.12      | 0.73    | 37.02       | 20.21            | 0.79         |
| 2200  | 10.12 | 15.09     | 14.11             | 23.42              | 1.12      | 0.73    | 37.18       | 20.30            | 0.81         |
| 2300  | 9.77  | 14.74     | 13.94             | 23.98              | 1.12      | 0.73    | 37.24       | 20.24            | 0.85         |
| 2400  | 9.44  | 14.39     | 13.79             | 24.52              | 1.11      | 0.73    | 37.23       | 20.23            | 0.90         |
| 2500  | 9.12  | 14.08     | 13.61             | 25.05              | 1.11      | 0.73    | 37.30       | 20.24            | 0.97         |
| 2600  | 8.82  | 13.77     | 13.46             | 25.57              | 1.11      | 0.74    | 37.32       | 20.33            | 1.04         |
| 2700  | 8.53  | 13.48     | 13.30             | 25.86              | 1.11      | 0.74    | 37.17       | 20.37            | 1.11         |
| 2800  | 8.24  | 13.19     | 13.20             | 26.20              | 1.11      | 0.74    | 36.92       | 20.41            | 1.18         |
| 2900  | 7.98  | 12.91     | 13.07             | 26.15              | 1.11      | 0.74    | 36.84       | 20.44            | 1.21         |
| 3000  | 7.72  | 12.66     | 13.03             | 25.77              | 1.11      | 0.74    | 36.58       | 20.37            | 1.23         |
| 3200  | 7.23  | 12.16     | 12.96             | 24.73              | 1.11      | 0.74    | 36.24       | 20.52            | 1.24         |
| 3300  | 6.99  | 11.92     | 12.93             | 24.29              | 1.11      | 0.74    | 36.24       | 20.61            | 1.23         |
| 3400  | 6.77  | 11.69     | 12.99             | 23.65              | 1.11      | 0.73    | 36.16       | 20.57            | 1.27         |
| 3500  | 6.55  | 11.46     | 13.04             | 23.09              | 1.11      | 0.73    | 36.15       | 20.59            | 1.31         |
| 3600  | 6.35  | 11.25     | 13.14             | 22.56              | 1.11      | 0.73    | 36.07       | 20.58            | 1.35         |
| 3700  | 6.15  | 11.04     | 13.23             | 21.91              | 1.11      | 0.73    | 36.09       | 20.81            | 1.37         |
| 3800  | 5.95  | 10.84     | 13.38             | 21.41              | 1.11      | 0.73    | 36.05       | 20.88            | 1.41         |
| 4000  | 5.59  | 10.46     | 13.61             | 20.52              | 1.11      | 0.72    | 36.00       | 20.96            | 1.43         |



# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 5V, Id = 91mA @Temperature = +25°C

| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.97 | 30.63     | 6.87              | 14.12              | 0.89      | 0.75    | 35.84       | 19.28            | 0.40         |
| 100   | 26.13 | 29.91     | 8.74              | 19.00              | 0.98      | 0.70    | 36.13       | 19.53            | 0.51         |
| 200   | 24.97 | 29.00     | 9.99              | 22.27              | 1.03      | 0.69    | 36.86       | 20.45            | 0.53         |
| 400   | 22.41 | 26.96     | 11.69             | 21.82              | 1.08      | 0.71    | 38.04       | 21.16            | 0.71         |
| 500   | 21.21 | 25.90     | 12.35             | 21.15              | 1.09      | 0.71    | 38.45       | 21.22            | 0.71         |
| 600   | 20.11 | 24.94     | 12.89             | 20.36              | 1.10      | 0.72    | 39.04       | 21.48            | 0.72         |
| 700   | 19.10 | 24.02     | 13.37             | 19.74              | 1.11      | 0.72    | 39.74       | 21.54            | 0.70         |
| 800   | 18.18 | 23.17     | 13.76             | 19.28              | 1.11      | 0.72    | 39.96       | 21.57            | 0.63         |
| 900   | 17.33 | 22.37     | 14.11             | 18.87              | 1.12      | 0.72    | 40.06       | 21.74            | 0.60         |
| 1000  | 16.55 | 21.64     | 14.42             | 18.51              | 1.12      | 0.73    | 40.73       | 21.65            | 0.63         |
| 1100  | 15.82 | 20.96     | 14.70             | 18.25              | 1.12      | 0.73    | 41.23       | 21.73            | 0.64         |
| 1200  | 15.16 | 20.33     | 14.94             | 17.98              | 1.13      | 0.73    | 41.10       | 21.79            | 0.66         |
| 1300  | 14.54 | 19.75     | 15.15             | 17.79              | 1.13      | 0.73    | 41.49       | 21.84            | 0.68         |
| 1400  | 13.96 | 19.20     | 15.31             | 17.65              | 1.13      | 0.73    | 41.84       | 21.95            | 0.70         |
| 1500  | 13.41 | 18.64     | 15.42             | 17.55              | 1.13      | 0.73    | 41.33       | 22.03            | 0.72         |
| 1600  | 12.91 | 18.16     | 15.49             | 17.51              | 1.13      | 0.73    | 41.67       | 22.04            | 0.75         |
| 1700  | 12.42 | 17.68     | 15.51             | 17.54              | 1.13      | 0.73    | 42.67       | 22.09            | 0.77         |
| 1800  | 11.97 | 17.23     | 15.47             | 17.68              | 1.13      | 0.73    | 42.46       | 22.25            | 0.78         |
| 1900  | 11.55 | 16.82     | 15.39             | 17.85              | 1.13      | 0.73    | 42.08       | 22.30            | 0.79         |
| 2000  | 11.14 | 16.41     | 15.28             | 18.02              | 1.13      | 0.74    | 41.59       | 22.33            | 0.81         |
| 2100  | 10.76 | 16.02     | 15.15             | 18.29              | 1.13      | 0.74    | 42.68       | 22.41            | 0.82         |
| 2200  | 10.39 | 15.66     | 15.00             | 18.61              | 1.13      | 0.74    | 43.43       | 22.45            | 0.84         |
| 2300  | 10.05 | 15.30     | 14.81             | 18.93              | 1.13      | 0.74    | 43.07       | 22.51            | 0.89         |
| 2400  | 9.72  | 14.96     | 14.63             | 19.28              | 1.13      | 0.74    | 42.91       | 22.55            | 0.94         |
| 2500  | 9.40  | 14.63     | 14.43             | 19.66              | 1.13      | 0.75    | 42.86       | 22.67            | 1.01         |
| 2600  | 9.10  | 14.33     | 14.27             | 20.05              | 1.13      | 0.75    | 42.61       | 22.74            | 1.09         |
| 2700  | 8.81  | 14.02     | 14.07             | 20.41              | 1.12      | 0.75    | 42.82       | 22.84            | 1.17         |
| 2800  | 8.52  | 13.72     | 13.96             | 20.79              | 1.12      | 0.75    | 43.13       | 22.80            | 1.24         |
| 2900  | 8.25  | 13.45     | 13.83             | 21.05              | 1.12      | 0.75    | 43.63       | 22.53            | 1.28         |
| 3000  | 7.99  | 13.18     | 13.78             | 21.21              | 1.12      | 0.75    | 44.18       | 22.27            | 1.30         |
| 3200  | 7.50  | 12.67     | 13.68             | 21.18              | 1.12      | 0.75    | 43.58       | 22.54            | 1.29         |
| 3300  | 7.27  | 12.43     | 13.65             | 21.06              | 1.12      | 0.75    | 43.58       | 22.81            | 1.30         |
| 3400  | 7.05  | 12.19     | 13.69             | 20.85              | 1.12      | 0.75    | 43.46       | 22.93            | 1.33         |
| 3500  | 6.83  | 11.95     | 13.73             | 20.58              | 1.11      | 0.75    | 44.65       | 22.98            | 1.36         |
| 3600  | 6.62  | 11.74     | 13.85             | 20.34              | 1.12      | 0.74    | 44.62       | 22.99            | 1.40         |
| 3700  | 6.42  | 11.52     | 13.93             | 19.94              | 1.11      | 0.74    | 44.62       | 23.04            | 1.45         |
| 3800  | 6.23  | 11.31     | 14.09             | 19.60              | 1.11      | 0.74    | 43.96       | 23.01            | 1.49         |
| 4000  | 5.86  | 10.92     | 14.34             | 18.96              | 1.11      | 0.73    | 44.30       | 22.84            | 1.57         |



# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 4.75V, Id = 86mA @Temperature = +25°C

| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.94 | 30.81     | 6.84              | 14.07              | 0.90      | 0.77    | 36.67       | 18.77            | 0.39         |
| 100   | 26.10 | 29.83     | 8.71              | 19.04              | 0.98      | 0.70    | 36.84       | 19.06            | 0.50         |
| 200   | 24.94 | 28.95     | 9.96              | 22.49              | 1.03      | 0.69    | 37.21       | 20.09            | 0.52         |
| 400   | 22.38 | 26.89     | 11.66             | 22.21              | 1.08      | 0.71    | 37.70       | 20.88            | 0.71         |
| 500   | 21.18 | 25.84     | 12.31             | 21.53              | 1.09      | 0.71    | 38.31       | 20.98            | 0.70         |
| 600   | 20.08 | 24.89     | 12.85             | 20.71              | 1.10      | 0.72    | 38.92       | 21.15            | 0.73         |
| 700   | 19.08 | 23.97     | 13.32             | 20.11              | 1.11      | 0.72    | 39.36       | 21.26            | 0.70         |
| 800   | 18.16 | 23.13     | 13.71             | 19.64              | 1.11      | 0.72    | 39.79       | 21.33            | 0.63         |
| 900   | 17.31 | 22.35     | 14.07             | 19.18              | 1.12      | 0.73    | 40.27       | 21.38            | 0.60         |
| 1000  | 16.53 | 21.62     | 14.37             | 18.84              | 1.12      | 0.73    | 40.57       | 21.38            | 0.64         |
| 1100  | 15.80 | 20.94     | 14.65             | 18.58              | 1.12      | 0.73    | 40.86       | 21.43            | 0.64         |
| 1200  | 15.14 | 20.28     | 14.89             | 18.29              | 1.12      | 0.73    | 40.95       | 21.48            | 0.66         |
| 1300  | 14.51 | 19.69     | 15.10             | 18.10              | 1.13      | 0.73    | 41.21       | 21.52            | 0.68         |
| 1400  | 13.94 | 19.13     | 15.27             | 17.96              | 1.13      | 0.73    | 41.48       | 21.67            | 0.71         |
| 1500  | 13.39 | 18.60     | 15.36             | 17.85              | 1.13      | 0.73    | 41.51       | 21.73            | 0.72         |
| 1600  | 12.89 | 18.11     | 15.43             | 17.81              | 1.13      | 0.73    | 41.80       | 21.75            | 0.75         |
| 1700  | 12.40 | 17.64     | 15.45             | 17.83              | 1.13      | 0.73    | 42.03       | 21.79            | 0.77         |
| 1800  | 11.95 | 17.19     | 15.41             | 17.98              | 1.13      | 0.73    | 42.17       | 21.88            | 0.78         |
| 1900  | 11.53 | 16.77     | 15.34             | 18.14              | 1.13      | 0.73    | 42.26       | 22.02            | 0.79         |
| 2000  | 11.13 | 16.37     | 15.22             | 18.35              | 1.13      | 0.74    | 42.41       | 22.07            | 0.81         |
| 2100  | 10.74 | 15.98     | 15.09             | 18.60              | 1.13      | 0.74    | 42.61       | 22.14            | 0.83         |
| 2200  | 10.38 | 15.63     | 14.94             | 18.92              | 1.13      | 0.74    | 42.90       | 22.18            | 0.85         |
| 2300  | 10.03 | 15.26     | 14.75             | 19.25              | 1.13      | 0.74    | 43.05       | 22.26            | 0.88         |
| 2400  | 9.70  | 14.91     | 14.58             | 19.62              | 1.13      | 0.74    | 43.27       | 22.32            | 0.94         |
| 2500  | 9.38  | 14.58     | 14.38             | 20.03              | 1.12      | 0.74    | 43.24       | 22.40            | 1.01         |
| 2600  | 9.08  | 14.28     | 14.22             | 20.44              | 1.12      | 0.75    | 43.24       | 22.47            | 1.09         |
| 2700  | 8.79  | 13.97     | 14.04             | 20.77              | 1.12      | 0.75    | 43.26       | 22.50            | 1.17         |
| 2800  | 8.50  | 13.68     | 13.91             | 21.20              | 1.12      | 0.75    | 42.95       | 22.45            | 1.23         |
| 2900  | 8.23  | 13.41     | 13.78             | 21.44              | 1.12      | 0.75    | 43.24       | 22.28            | 1.26         |
| 3000  | 7.97  | 13.14     | 13.73             | 21.58              | 1.12      | 0.75    | 43.63       | 22.00            | 1.28         |
| 3200  | 7.48  | 12.64     | 13.64             | 21.53              | 1.12      | 0.75    | 44.14       | 22.27            | 1.28         |
| 3300  | 7.25  | 12.39     | 13.61             | 21.38              | 1.12      | 0.75    | 44.14       | 22.54            | 1.28         |
| 3400  | 7.03  | 12.15     | 13.63             | 21.17              | 1.12      | 0.75    | 44.37       | 22.67            | 1.32         |
| 3500  | 6.81  | 11.92     | 13.69             | 20.86              | 1.11      | 0.75    | 44.13       | 22.66            | 1.36         |
| 3600  | 6.60  | 11.70     | 13.80             | 20.60              | 1.11      | 0.74    | 44.19       | 22.70            | 1.40         |
| 3700  | 6.40  | 11.48     | 13.88             | 20.17              | 1.11      | 0.74    | 44.09       | 22.77            | 1.43         |
| 3800  | 6.21  | 11.28     | 14.04             | 19.81              | 1.11      | 0.74    | 44.02       | 22.82            | 1.47         |
| 4000  | 5.84  | 10.89     | 14.27             | 19.17              | 1.11      | 0.73    | 44.05       | 22.68            | 1.54         |



# MMIC Amplifier Die

# PGA-103-D+

## Typical Performance Data

### Without Full 2-Port Extension

#### 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, Id = 93mA @Temperature = +25°C

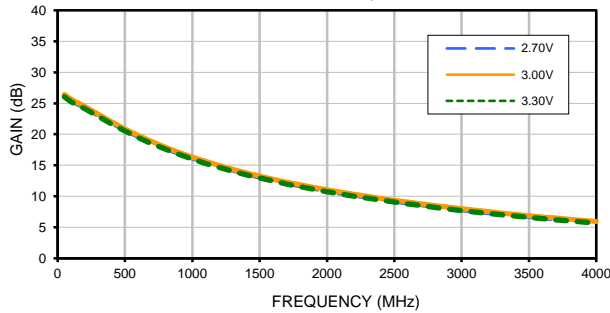
| FREQ. | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output | Noise Figure |
|-------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|------------------|--------------|
|       |       |           |                   |                    | K         | Measure |             |                  |              |
| (MHz) | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)            | (dB)         |
| 50    | 26.99 | 30.20     | 6.87              | 13.89              | 0.89      | 0.69    | 35.70       | 19.56            | 0.41         |
| 100   | 26.15 | 29.92     | 8.77              | 19.04              | 0.98      | 0.70    | 35.98       | 19.76            | 0.51         |
| 200   | 24.99 | 29.05     | 10.03             | 22.24              | 1.03      | 0.70    | 36.74       | 20.62            | 0.53         |
| 400   | 22.42 | 26.97     | 11.74             | 21.72              | 1.08      | 0.71    | 37.99       | 21.20            | 0.71         |
| 500   | 21.22 | 25.91     | 12.39             | 20.97              | 1.09      | 0.71    | 38.64       | 21.32            | 0.71         |
| 600   | 20.12 | 24.94     | 12.93             | 20.19              | 1.10      | 0.72    | 39.23       | 21.48            | 0.73         |
| 700   | 19.12 | 24.05     | 13.41             | 19.60              | 1.11      | 0.72    | 39.68       | 21.58            | 0.69         |
| 800   | 18.19 | 23.18     | 13.79             | 19.13              | 1.11      | 0.72    | 40.07       | 21.60            | 0.63         |
| 900   | 17.34 | 22.41     | 14.15             | 18.70              | 1.12      | 0.72    | 40.45       | 21.76            | 0.62         |
| 1000  | 16.56 | 21.67     | 14.45             | 18.37              | 1.12      | 0.73    | 40.79       | 21.68            | 0.65         |
| 1100  | 15.83 | 21.01     | 14.74             | 18.13              | 1.13      | 0.73    | 40.92       | 21.72            | 0.66         |
| 1200  | 15.17 | 20.37     | 14.98             | 17.84              | 1.13      | 0.73    | 41.24       | 21.80            | 0.68         |
| 1300  | 14.55 | 19.77     | 15.20             | 17.66              | 1.13      | 0.73    | 41.36       | 21.85            | 0.70         |
| 1400  | 13.97 | 19.20     | 15.35             | 17.52              | 1.13      | 0.73    | 41.34       | 21.96            | 0.73         |
| 1500  | 13.42 | 18.67     | 15.45             | 17.42              | 1.13      | 0.73    | 41.48       | 22.02            | 0.74         |
| 1600  | 12.92 | 18.18     | 15.53             | 17.38              | 1.13      | 0.73    | 41.88       | 22.00            | 0.76         |
| 1700  | 12.43 | 17.71     | 15.54             | 17.41              | 1.13      | 0.73    | 42.16       | 22.02            | 0.78         |
| 1800  | 11.98 | 17.26     | 15.49             | 17.54              | 1.13      | 0.73    | 42.34       | 22.16            | 0.79         |
| 1900  | 11.56 | 16.84     | 15.44             | 17.70              | 1.13      | 0.73    | 42.46       | 22.30            | 0.80         |
| 2000  | 11.15 | 16.43     | 15.33             | 17.89              | 1.13      | 0.74    | 42.79       | 22.35            | 0.82         |
| 2100  | 10.77 | 16.04     | 15.19             | 18.13              | 1.13      | 0.74    | 42.98       | 22.45            | 0.84         |
| 2200  | 10.40 | 15.68     | 15.02             | 18.45              | 1.13      | 0.74    | 43.25       | 22.45            | 0.85         |
| 2300  | 10.06 | 15.32     | 14.84             | 18.77              | 1.13      | 0.74    | 43.12       | 22.51            | 0.90         |
| 2400  | 9.73  | 14.99     | 14.66             | 19.12              | 1.13      | 0.74    | 44.15       | 22.58            | 0.96         |
| 2500  | 9.41  | 14.66     | 14.48             | 19.48              | 1.13      | 0.75    | 43.97       | 22.70            | 1.03         |
| 2600  | 9.11  | 14.34     | 14.29             | 19.89              | 1.13      | 0.75    | 43.98       | 22.78            | 1.11         |
| 2700  | 8.82  | 14.04     | 14.11             | 20.22              | 1.12      | 0.75    | 44.17       | 22.81            | 1.19         |
| 2800  | 8.53  | 13.75     | 13.99             | 20.60              | 1.12      | 0.75    | 44.10       | 22.73            | 1.26         |
| 2900  | 8.26  | 13.47     | 13.86             | 20.87              | 1.12      | 0.75    | 44.49       | 22.48            | 1.29         |
| 3000  | 8.00  | 13.21     | 13.79             | 21.02              | 1.12      | 0.75    | 43.66       | 22.18            | 1.31         |
| 3200  | 7.51  | 12.70     | 13.71             | 21.01              | 1.12      | 0.75    | 43.95       | 22.48            | 1.31         |
| 3300  | 7.28  | 12.45     | 13.67             | 20.92              | 1.12      | 0.75    | 43.95       | 22.83            | 1.31         |
| 3400  | 7.06  | 12.21     | 13.71             | 20.74              | 1.12      | 0.75    | 44.41       | 23.02            | 1.34         |
| 3500  | 6.84  | 11.98     | 13.75             | 20.45              | 1.12      | 0.75    | 44.68       | 23.00            | 1.38         |
| 3600  | 6.63  | 11.75     | 13.86             | 20.19              | 1.11      | 0.74    | 44.91       | 23.07            | 1.42         |
| 3700  | 6.44  | 11.54     | 13.94             | 19.81              | 1.11      | 0.74    | 45.26       | 23.06            | 1.46         |
| 3800  | 6.24  | 11.33     | 14.11             | 19.49              | 1.11      | 0.74    | 45.24       | 23.03            | 1.50         |
| 4000  | 5.87  | 10.94     | 14.36             | 18.86              | 1.11      | 0.73    | 44.59       | 22.90            | 1.59         |



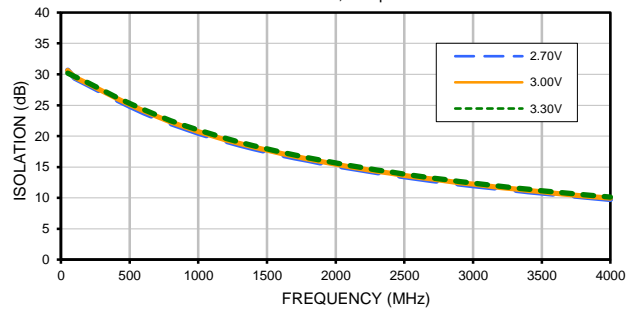
## Typical Performance Curves

### Full 2-Port Extension

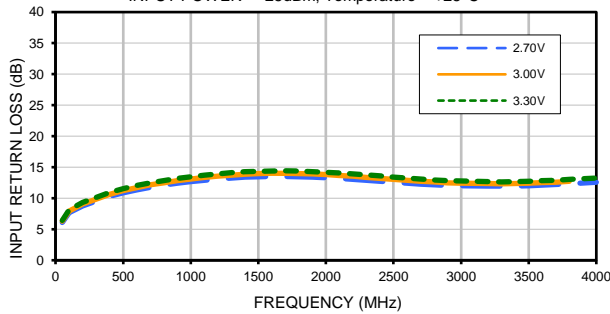
**GAIN vs. FREQUENCY & DEVICE VOLTAGE**  
INPUT POWER = -25dBm, Temperature = +25°C



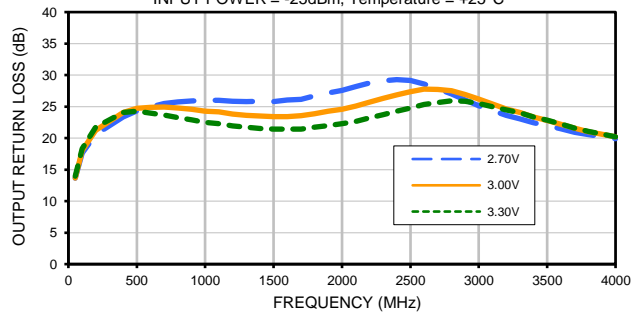
**ISOLATION vs. FREQUENCY & DEVICE VOLTAGE**  
INPUT POWER = -25dBm, Temperature = +25°C



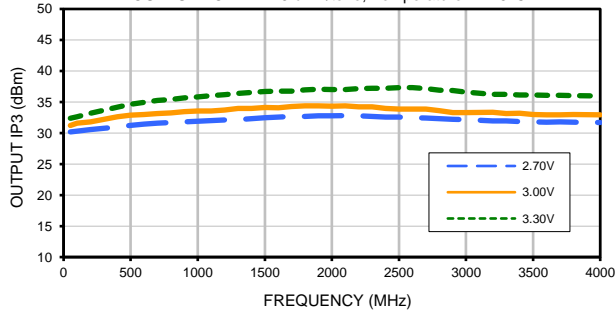
**INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE**  
INPUT POWER = -25dBm, Temperature = +25°C



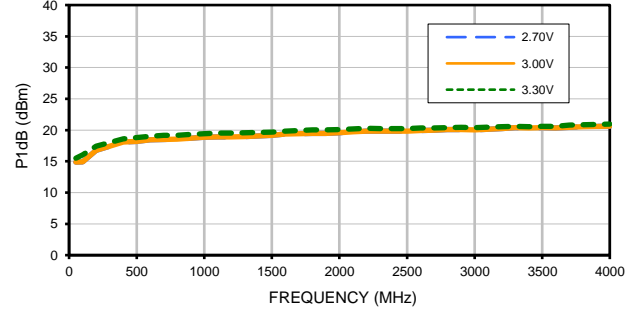
**OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE**  
INPUT POWER = -25dBm, Temperature = +25°C



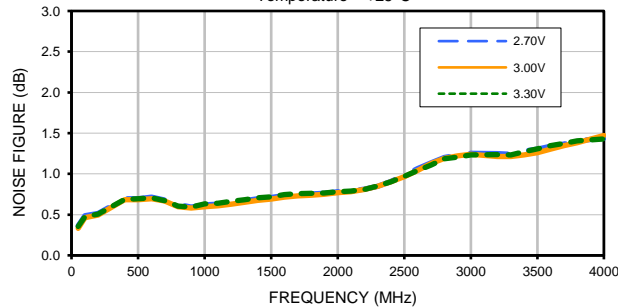
**OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE**  
OUTPUT POWER = 5 dBm/tone, Temperature = +25°C



**P1dB vs. FREQUENCY & DEVICE VOLTAGE**  
Temperature = +25°C

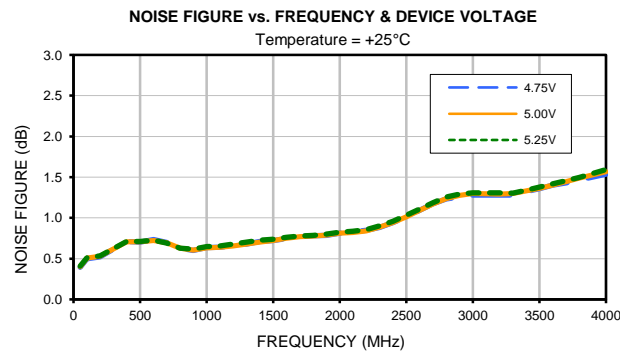
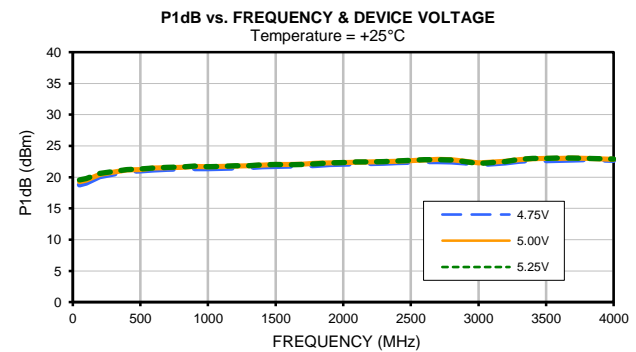
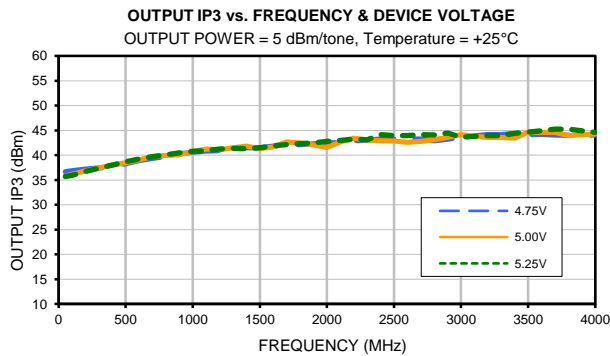
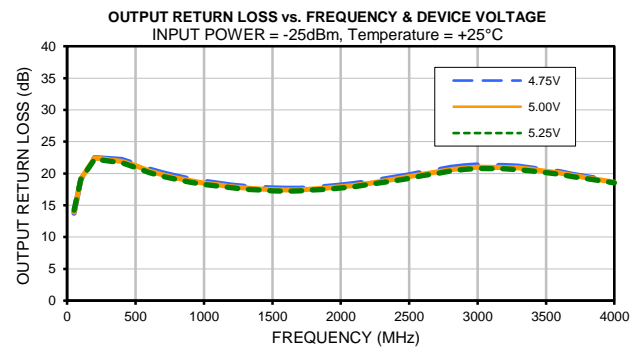
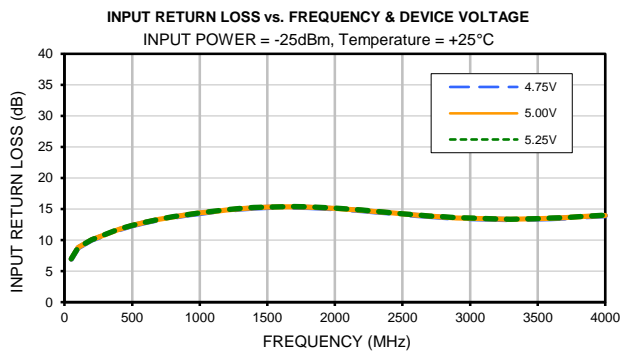
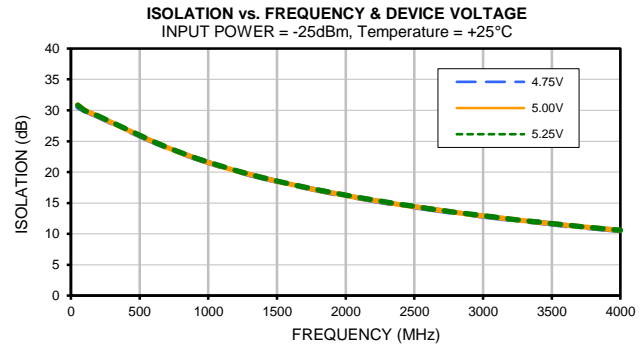
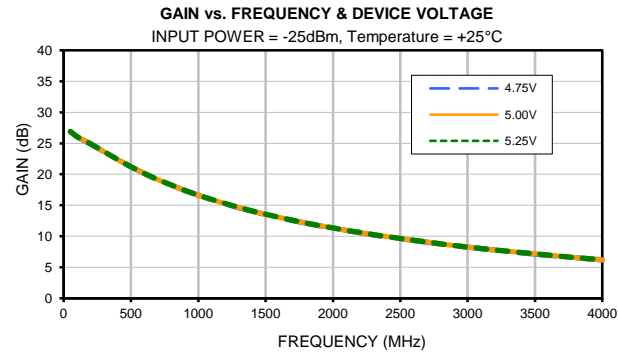


**NOISE FIGURE vs. FREQUENCY & DEVICE VOLTAGE**  
Temperature = +25°C



## Typical Performance Curves

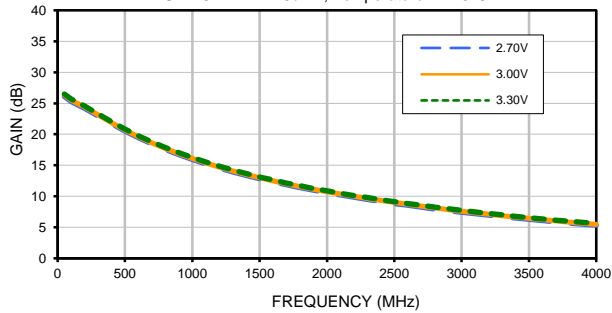
### Full 2-Port Extension



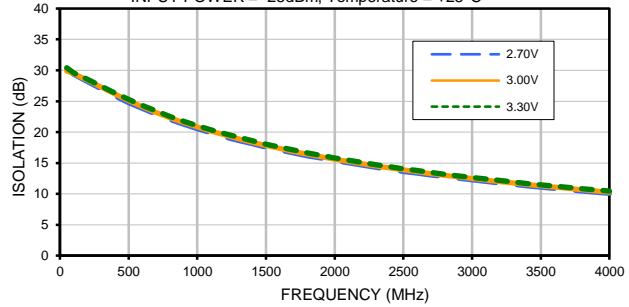
## Typical Performance Curves

### Without Full 2-Port Extension

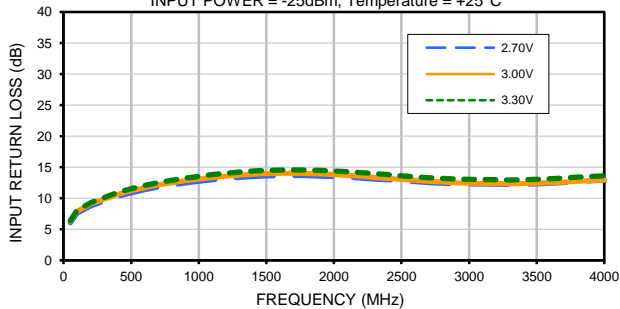
**GAIN vs. FREQUENCY & DEVICE VOLTAGE**  
INPUT POWER = -25dBm, Temperature = +25°C



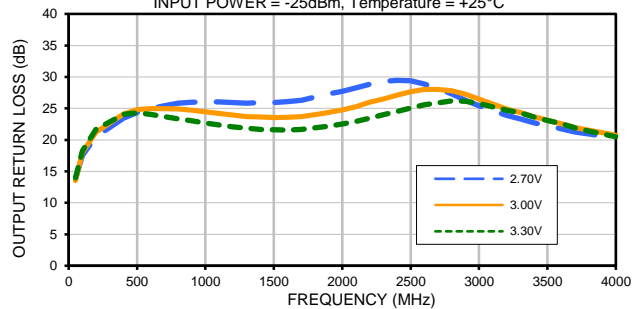
**ISOLATION vs. FREQUENCY & DEVICE VOLTAGE**  
INPUT POWER = -25dBm, Temperature = +25°C



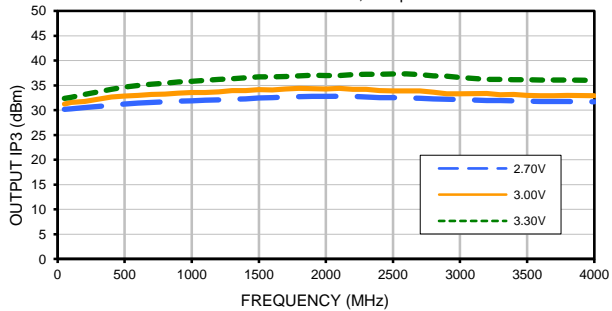
**INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE**  
INPUT POWER = -25dBm, Temperature = +25°C



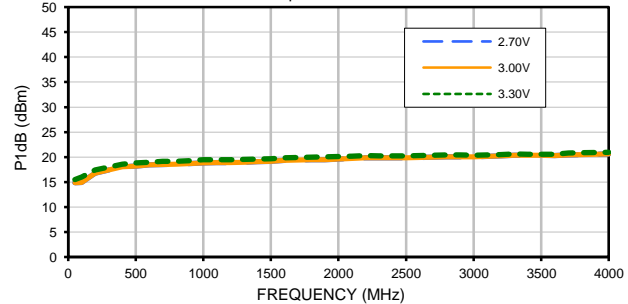
**OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE**  
INPUT POWER = -25dBm, Temperature = +25°C



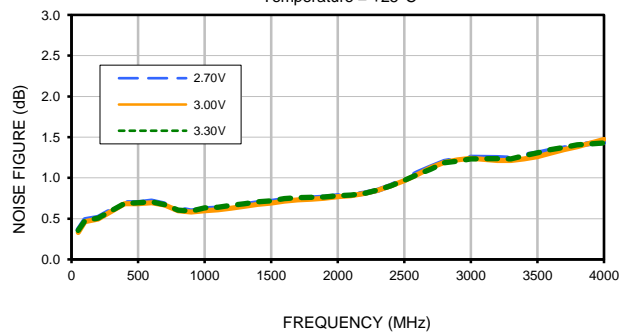
**OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE**  
OUTPUT POWER = 5 dBm/1tone, Temperature = +25°C



**P1dB vs. FREQUENCY & DEVICE VOLTAGE**  
Temperature = +25°C

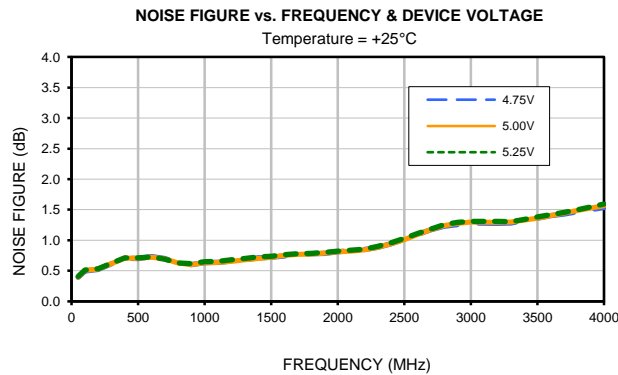
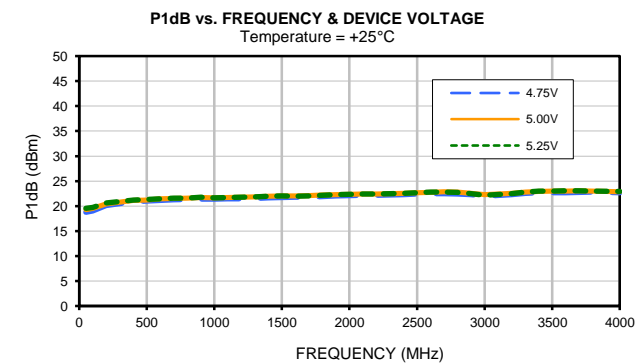
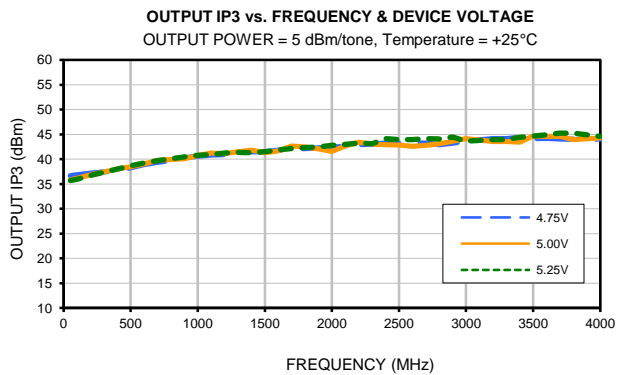
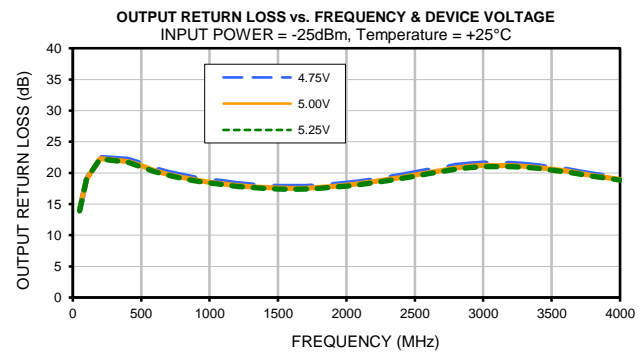
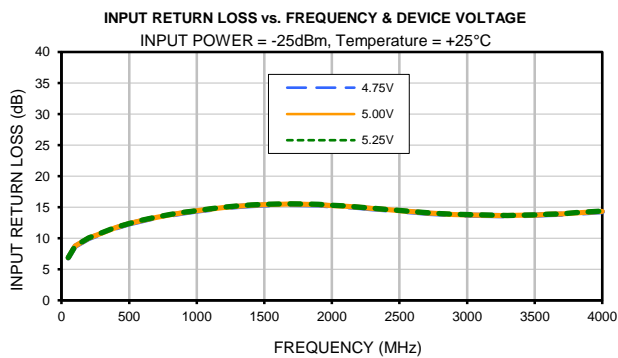
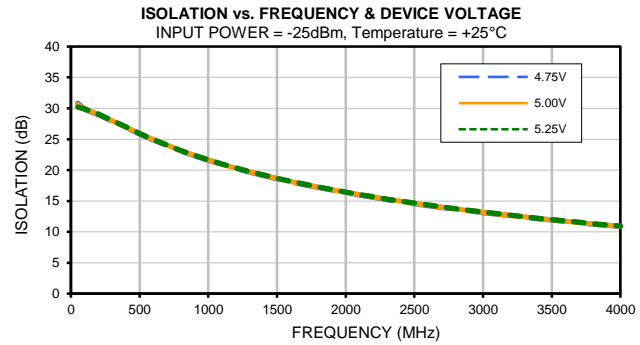
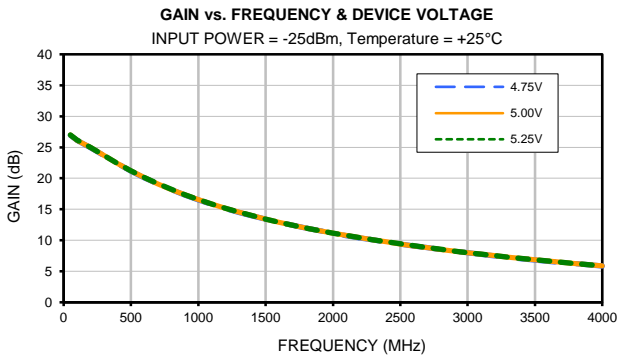


**NOISE FIGURE vs. FREQUENCY & DEVICE VOLTAGE**  
Temperature = +25°C



## Typical Performance Curves

### Without Full 2-Port Extension





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<br>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)                           |                                      |