

Ultra High Dynamic Range

Monolithic Amplifier

PHA-101+

50Ω 0.05 to 1.5 GHz

The Big Deal

- Ultra High IP3
- Broadband High Dynamic Range without external Matching Components
- May be used as a replacement to WJ AH101^{a,b}



SOT-89 PACKAGE

Product Overview

PHA-101+ (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 PHA-101+ has good input and output return loss over a broad frequency range without the need for external matching components and has demonstrated excellent reliability. It has repeatable performance from lot to lot and is enclosed in a SOT-89 package for very good thermal performance.

Key Features

| Feature | Advantages |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Broad Band: 0.05 to 1.5 GHz | Broadband covering primary wireless communications bands: Cellular, PCS, LTE |
| Extremely High IP3 Versus DC power Consumption 45 dBm typical at 0.9 GHz | The PHA-101+ matches industry leading 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">• Driver amplifiers for complex waveform up converter paths• Drivers in linearized transmit systems• Secondary amplifiers in ultra High Dynamic range receivers |
| No External Matching Components Required | Unlike competing products, Mini-Circuits PHA-101+ provides Input and Output Return Loss of 9.9-12.5 dB up to 1.5 GHz without the need for any external matching components |

Notes:

a. Suitability for model replacement within a particular system must be determined by and is solely the responsibility of the customer based on, among other things, electrical performance criteria, stimulus conditions, application, compatibility with other components and environmental conditions and stresses.

b. The WJ AH101 part number is used for identification and comparison purposes only.



Ultra High Dynamic Range

Monolithic Amplifier

0.05-1.5 GHz

Product Features

- High IP3, 45 dBm typ. at 0.9 GHz
- Gain, 15.2 dB typ. at 0.9 GHz
- High Pout, P1dB 26 dBm typ. at 0.9 GHz
- Low noise figure, 4.0 dB at 0.9 GHz
- No external matching components required
- May be used as replacement for WJ AH101^{a,b}



Generic photo used for illustration purposes only

CASE STYLE: DF782

Typical Applications

- Base station infrastructure
- CATV
- LTE

PHA-101+

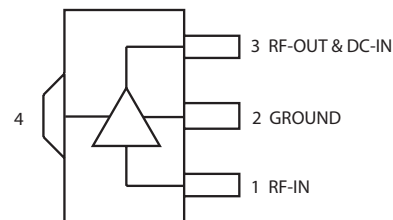
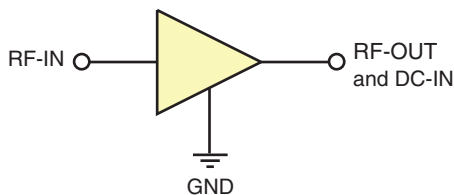
+RoHS Compliant

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

General Description

PHA-101+ (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 PHA-101+ has good input and output return loss over a broad frequency range without the need for external matching components. It has repeatable performance from lot to lot and is enclosed in a SOT-89 package for very good thermal performance.

simplified schematic and pin description



| Function | Pin Number | Description |
|------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RF IN | 1 | RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation. |
| RF-OUT and DC-IN | 3 | RF output and bias pin. DC voltage is present on this pin; 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 | 2,4 | Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance. |

Notes:

- a. Suitability for model replacement within a particular system must be determined by and is solely the responsibility of the customer based on, among other things, electrical performance criteria, stimulus conditions, application, compatibility with other components and environmental conditions and stresses.
- b. The WJ AH101 part number is used for identification and comparison purposes only.



Electrical Specifications at 25°C, 50 ohms, unless noted

| Parameter | Condition (MHz) | Vd=9V ¹ | | | Units |
|-----------------------------------------------------------------------|-----------------|--------------------|-------|------|-------|
| | | Min. | Typ. | Max. | |
| Frequency range | | 0.05 | | 1.5 | GHz |
| Gain | 50 | — | 15.3 | — | dB |
| | 450 | — | 15.5 | — | |
| | 900 | 13.8 | 15.2 | 16.9 | |
| | 1500 | — | 15.0 | — | |
| Input return loss | 50 | | 10.7 | | dB |
| | 450 | | 11.4 | | |
| | 900 | | 10.7 | | |
| | 1500 | | 9.5 | | |
| Output return loss | 50 | | 13.2 | | dB |
| | 450 | | 10.7 | | |
| | 900 | | 10.2 | | |
| | 1500 | | 8.9 | | |
| Reverse isolation | | | 20.5 | | dB |
| Output power @ 1dB compression | 50 | | 25.3 | | dBm |
| | 450 | | 26.2 | | |
| | 900 | | 25.8 | | |
| | 1500 | | 25.4 | | |
| Output IP3 ² | 50 | — | 47.0 | — | dBm |
| | 450 | — | 44.3 | — | |
| | 900 | 40.0 | 45.0 | — | |
| | 1500 | — | 43.8 | — | |
| Noise figure | 50 | | 4.1 | | dB |
| | 450 | | 3.9 | | |
| | 900 | | 4.0 | | |
| | 1500 | | 4.2 | | |
| Device operating voltage | | | 9.0 | | V |
| Device operating current | | — | 182 | 220 | mA |
| Device current variation vs. temperature ³ | | | -4 | | μA/°C |
| Device current variation vs voltage | | | 0.024 | | mA/mV |
| Thermal Resistance, junction-to-ground lead at 85°C stage temperature | | | 20 | | °C/W |

1. Measured on Mini-Circuits Characterization test board TB-869+. See Characterization Test Circuit (Fig. 1)

2. Tested at Pout=8dBm / tone.

3. (Current at 85°C — Current at -45°C)/130

Absolute Maximum Ratings⁴

| Parameter | Ratings |
|-------------------------------------|--------------------------------------------------|
| Operating Temperature (ground lead) | -40°C to 85°C |
| Storage Temperature | -65°C to 150°C |
| Operating Current at 9V | 360 mA |
| Power Dissipation | 3.25 W |
| Input Power (CW) | +24 dBm (5 minutes max.) +20 dBm (continuous) |
| DC Voltage on Pin 3 | 11 V |

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

Characterization Test Circuit

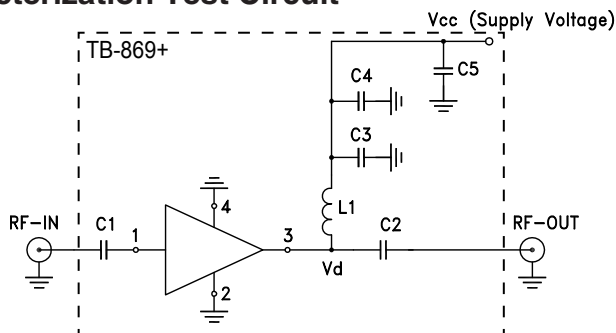
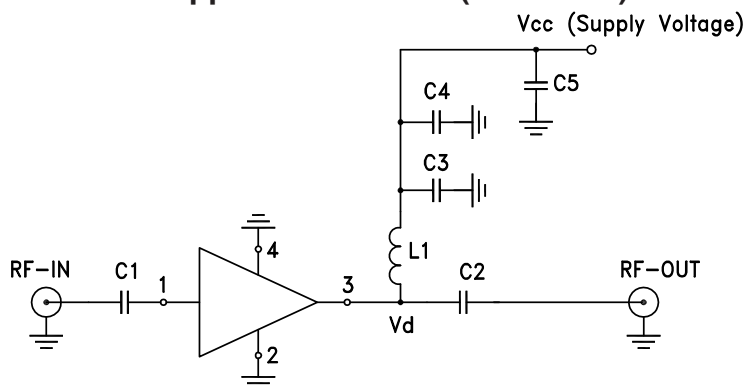


Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-869+) Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and noise figure measured using Agilent’s N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 8 dBm/tone at output.

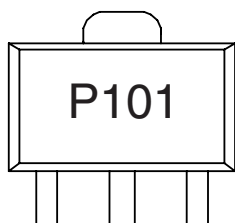
Recommended Application Circuit (TB-869A+)



| Component | Value | Size | Part Number | Manufacturer |
|------------|---------|------|--------------------|--------------|
| C1, C2, C3 | 150 pF | 0603 | GRM1885C1H151JA01D | Murata |
| C4 | 0.01 μF | 0603 | GRM188R71H103KA01D | Murata |
| C5 | 10 μF | 1206 | GRM31CR61H106KA12L | Murata |
| L1 | 390 nH | 0505 | 0805CS-391XJEC | Coilcraft |

Fig 2. Test board (TB-869A+) includes case, connectors, and components soldered to PCB

Product Marking



Marking may contain other features or characters for internal lot control

| Additional Detailed Technical Information <i>additional information is available on our dash board. To access this information click here</i> | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Performance Data | Data Table |
| | Swept Graphs |
| | S-Parameter (S2P Files) Data Set (.zip file) |
| Case Style | DF782 (SOT 89) <i>Plastic package, exposed paddle lead finish: Matte-Tin</i> |
| Tape & Reel Standard quantities available on reel | F55 <i>7" reels with 20, 50, 100, 200, 500 or 1K devices</i> |
| Suggested Layout for PCB Design | PL-486 |
| Evaluation Board | TB-869A+ |
| Environmental Ratings | ENV08T1 |

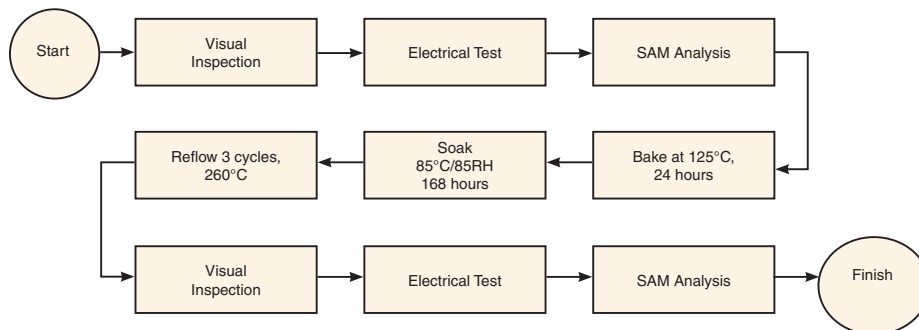
ESD Rating

Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001
Machine Model (MM): Class M1 (>25V) in accordance with ANSI/ESD STM5.2-1999

MSL Rating

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL Test Flow Chart



Additional Notes

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions

Definitions:

- Input Return Loss = -S11 (dB)
- Gain(Power Gain) = S21 (dB)
- Reverse Isolation = -S12 (dB)
- Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 9V, Id = 190.68 mA @ Temperature = +25degC

| 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 | 15.27 | 20.39 | 11.33 | 14.18 | 1.13 | 0.67 | 48.57 | 25.93 | 4.12 |
| 100 | 15.49 | 20.63 | 12.58 | 12.60 | 1.14 | 0.63 | 45.82 | 26.49 | 4.04 |
| 150 | 15.51 | 20.74 | 12.56 | 12.06 | 1.14 | 0.63 | 45.50 | 26.41 | 3.98 |
| 200 | 15.52 | 20.77 | 12.55 | 11.88 | 1.14 | 0.62 | 45.27 | 26.63 | 3.89 |
| 250 | 15.51 | 20.81 | 12.52 | 11.78 | 1.14 | 0.62 | 44.99 | 26.48 | 4.01 |
| 300 | 15.50 | 20.85 | 12.47 | 11.71 | 1.15 | 0.63 | 44.46 | 26.66 | 4.04 |
| 350 | 15.48 | 20.82 | 12.45 | 11.63 | 1.14 | 0.62 | 43.54 | 26.67 | 4.10 |
| 400 | 15.46 | 20.84 | 12.39 | 11.58 | 1.15 | 0.63 | 43.35 | 26.45 | 4.08 |
| 450 | 15.44 | 20.84 | 12.33 | 11.52 | 1.15 | 0.63 | 42.92 | 26.55 | 4.08 |
| 500 | 15.42 | 20.87 | 12.26 | 11.43 | 1.15 | 0.63 | 42.77 | 26.47 | 4.12 |
| 550 | 15.40 | 20.91 | 12.17 | 11.36 | 1.15 | 0.63 | 42.68 | 26.58 | 4.09 |
| 600 | 15.38 | 20.89 | 12.16 | 11.31 | 1.15 | 0.63 | 42.55 | 26.39 | 4.10 |
| 650 | 15.36 | 20.89 | 12.04 | 11.25 | 1.15 | 0.63 | 42.78 | 26.40 | 4.09 |
| 700 | 15.33 | 20.93 | 12.00 | 11.22 | 1.16 | 0.63 | 43.22 | 26.53 | 4.10 |
| 750 | 15.32 | 20.92 | 11.90 | 11.12 | 1.16 | 0.63 | 43.07 | 26.57 | 4.05 |
| 800 | 15.30 | 20.97 | 11.81 | 11.02 | 1.16 | 0.64 | 43.31 | 26.55 | 4.03 |
| 850 | 15.28 | 20.99 | 11.74 | 10.96 | 1.16 | 0.64 | 43.68 | 26.64 | 4.02 |
| 1000 | 15.21 | 21.07 | 11.42 | 10.63 | 1.16 | 0.64 | 44.91 | 26.60 | 4.14 |
| 1050 | 15.20 | 21.10 | 11.27 | 10.49 | 1.17 | 0.64 | 44.91 | 26.52 | 4.12 |
| 1100 | 15.18 | 21.14 | 11.20 | 10.39 | 1.17 | 0.64 | 45.25 | 26.57 | 4.12 |
| 1150 | 15.15 | 21.17 | 11.08 | 10.26 | 1.17 | 0.64 | 45.14 | 26.71 | 4.18 |
| 1200 | 15.13 | 21.23 | 10.99 | 10.12 | 1.17 | 0.64 | 46.20 | 26.48 | 4.20 |
| 1250 | 15.11 | 21.28 | 10.87 | 10.01 | 1.18 | 0.65 | 46.47 | 26.54 | 4.15 |
| 1300 | 15.08 | 21.36 | 10.74 | 9.83 | 1.18 | 0.65 | 46.16 | 26.23 | 4.20 |
| 1350 | 15.04 | 21.42 | 10.68 | 9.70 | 1.18 | 0.65 | 47.37 | 26.34 | 4.20 |
| 1400 | 15.05 | 21.45 | 10.53 | 9.64 | 1.18 | 0.65 | 46.77 | 26.14 | 4.21 |
| 1450 | 15.04 | 21.53 | 10.38 | 9.50 | 1.19 | 0.65 | 46.13 | 26.14 | 4.23 |
| 1500 | 15.02 | 21.54 | 10.28 | 9.37 | 1.19 | 0.65 | 44.94 | 26.19 | 4.20 |
| 1550 | 14.99 | 21.66 | 10.15 | 9.24 | 1.19 | 0.65 | 43.39 | 26.07 | 4.26 |
| 1600 | 14.97 | 21.71 | 10.09 | 9.10 | 1.20 | 0.65 | 43.61 | 25.97 | 4.28 |
| 1650 | 14.94 | 21.78 | 9.93 | 8.94 | 1.20 | 0.65 | 44.29 | 25.99 | 4.29 |
| 1700 | 14.90 | 21.89 | 9.83 | 8.81 | 1.21 | 0.66 | 42.39 | 25.70 | 4.23 |
| 1750 | 14.87 | 22.02 | 9.75 | 8.70 | 1.22 | 0.66 | 41.46 | 25.76 | 4.36 |
| 1800 | 14.81 | 22.13 | 9.61 | 8.57 | 1.23 | 0.67 | 41.62 | 25.63 | 4.32 |
| 1850 | 14.76 | 22.21 | 9.56 | 8.42 | 1.23 | 0.67 | 41.39 | 25.52 | 4.52 |
| 1900 | 14.70 | 22.38 | 9.39 | 8.28 | 1.25 | 0.67 | 41.32 | 25.48 | 4.44 |
| 1950 | 14.62 | 22.53 | 9.30 | 8.13 | 1.26 | 0.68 | 41.07 | 25.42 | 4.47 |
| 2000 | 14.50 | 22.71 | 9.23 | 8.00 | 1.28 | 0.69 | 40.75 | 25.27 | 4.50 |



Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 8.5V, Id = 177.90 mA @ Temperature = +25degC

| 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 | 15.25 | 20.62 | 11.33 | 14.22 | 1.15 | 0.69 | 48.81 | 25.41 | 4.02 |
| 100 | 15.47 | 20.66 | 12.53 | 12.62 | 1.14 | 0.63 | 45.09 | 25.95 | 3.98 |
| 150 | 15.49 | 20.75 | 12.53 | 12.07 | 1.14 | 0.63 | 45.04 | 25.86 | 3.89 |
| 200 | 15.50 | 20.77 | 12.50 | 11.87 | 1.14 | 0.63 | 44.50 | 26.09 | 3.84 |
| 250 | 15.49 | 20.83 | 12.47 | 11.77 | 1.15 | 0.63 | 43.32 | 25.94 | 3.95 |
| 300 | 15.47 | 20.81 | 12.41 | 11.68 | 1.14 | 0.63 | 43.46 | 26.14 | 3.96 |
| 350 | 15.46 | 20.85 | 12.40 | 11.62 | 1.15 | 0.63 | 41.84 | 26.13 | 4.03 |
| 400 | 15.43 | 20.86 | 12.32 | 11.57 | 1.15 | 0.63 | 41.74 | 25.91 | 4.04 |
| 450 | 15.42 | 20.88 | 12.29 | 11.53 | 1.15 | 0.63 | 41.61 | 26.01 | 4.04 |
| 500 | 15.40 | 20.88 | 12.22 | 11.44 | 1.15 | 0.63 | 41.10 | 25.95 | 4.04 |
| 550 | 15.38 | 20.87 | 12.12 | 11.37 | 1.15 | 0.63 | 41.94 | 26.06 | 4.03 |
| 600 | 15.36 | 20.90 | 12.11 | 11.33 | 1.15 | 0.63 | 41.82 | 25.85 | 4.03 |
| 650 | 15.33 | 20.91 | 12.01 | 11.28 | 1.16 | 0.63 | 42.24 | 25.85 | 4.02 |
| 700 | 15.31 | 20.91 | 11.97 | 11.22 | 1.16 | 0.63 | 42.61 | 26.02 | 4.03 |
| 750 | 15.30 | 20.92 | 11.87 | 11.14 | 1.16 | 0.64 | 42.80 | 26.05 | 4.00 |
| 800 | 15.27 | 20.95 | 11.76 | 11.05 | 1.16 | 0.64 | 43.31 | 26.04 | 3.94 |
| 850 | 15.26 | 20.96 | 11.71 | 10.97 | 1.16 | 0.64 | 44.23 | 26.13 | 3.97 |
| 1000 | 15.19 | 21.06 | 11.38 | 10.65 | 1.17 | 0.64 | 46.07 | 26.05 | 4.09 |
| 1050 | 15.17 | 21.10 | 11.24 | 10.51 | 1.17 | 0.64 | 46.35 | 26.00 | 4.11 |
| 1100 | 15.15 | 21.14 | 11.15 | 10.39 | 1.17 | 0.64 | 47.37 | 26.03 | 4.06 |
| 1150 | 15.13 | 21.19 | 11.05 | 10.27 | 1.17 | 0.65 | 45.95 | 26.17 | 4.10 |
| 1200 | 15.10 | 21.24 | 10.95 | 10.13 | 1.18 | 0.65 | 46.58 | 25.94 | 4.11 |
| 1250 | 15.08 | 21.31 | 10.83 | 10.01 | 1.18 | 0.65 | 45.71 | 26.03 | 4.10 |
| 1300 | 15.05 | 21.36 | 10.70 | 9.83 | 1.18 | 0.65 | 44.62 | 25.73 | 4.15 |
| 1350 | 15.01 | 21.42 | 10.64 | 9.70 | 1.19 | 0.65 | 44.92 | 25.84 | 4.17 |
| 1400 | 15.02 | 21.46 | 10.47 | 9.64 | 1.19 | 0.65 | 44.68 | 25.64 | 4.15 |
| 1450 | 15.01 | 21.50 | 10.34 | 9.50 | 1.19 | 0.65 | 44.13 | 25.66 | 4.14 |
| 1500 | 14.99 | 21.56 | 10.24 | 9.37 | 1.19 | 0.65 | 43.45 | 25.69 | 4.14 |
| 1550 | 14.95 | 21.66 | 10.11 | 9.24 | 1.20 | 0.66 | 41.94 | 25.60 | 4.21 |
| 1600 | 14.93 | 21.76 | 10.06 | 9.12 | 1.20 | 0.66 | 41.71 | 25.51 | 4.20 |
| 1650 | 14.90 | 21.83 | 9.89 | 8.95 | 1.21 | 0.66 | 42.36 | 25.52 | 4.22 |
| 1700 | 14.86 | 21.92 | 9.80 | 8.81 | 1.21 | 0.66 | 41.21 | 25.23 | 4.23 |
| 1750 | 14.83 | 22.04 | 9.72 | 8.71 | 1.22 | 0.67 | 40.45 | 25.30 | 4.31 |
| 1800 | 14.77 | 22.17 | 9.58 | 8.58 | 1.23 | 0.67 | 40.30 | 25.17 | 4.26 |
| 1850 | 14.72 | 22.27 | 9.53 | 8.44 | 1.24 | 0.67 | 40.19 | 25.06 | 4.44 |
| 1900 | 14.65 | 22.42 | 9.36 | 8.29 | 1.25 | 0.68 | 40.27 | 25.01 | 4.34 |
| 1950 | 14.57 | 22.58 | 9.28 | 8.15 | 1.27 | 0.68 | 39.87 | 24.96 | 4.40 |
| 2000 | 14.45 | 22.73 | 9.22 | 8.03 | 1.29 | 0.69 | 39.83 | 24.82 | 4.45 |



Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 9.5V, Id = 202.27 mA @ Temperature = +25degC

| 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) | | | (dBm) | (dBm) | (dB) |
| 50 | 15.19 | 20.38 | 11.36 | 14.12 | 1.14 | 0.67 | 44.16 | 26.43 | 4.37 |
| 100 | 15.41 | 20.62 | 12.60 | 12.52 | 1.14 | 0.63 | 44.18 | 26.99 | 4.30 |
| 150 | 15.43 | 20.72 | 12.59 | 11.98 | 1.14 | 0.63 | 44.34 | 26.91 | 4.22 |
| 200 | 15.43 | 20.79 | 12.55 | 11.78 | 1.15 | 0.63 | 43.98 | 27.11 | 4.15 |
| 250 | 15.43 | 20.78 | 12.53 | 11.66 | 1.15 | 0.63 | 43.44 | 26.97 | 4.25 |
| 300 | 15.41 | 20.81 | 12.49 | 11.59 | 1.15 | 0.63 | 42.89 | 27.11 | 4.30 |
| 350 | 15.40 | 20.81 | 12.46 | 11.53 | 1.15 | 0.63 | 42.50 | 27.17 | 4.33 |
| 400 | 15.37 | 20.82 | 12.39 | 11.47 | 1.15 | 0.63 | 42.34 | 26.93 | 4.33 |
| 450 | 15.36 | 20.83 | 12.34 | 11.42 | 1.15 | 0.63 | 42.12 | 27.01 | 4.33 |
| 500 | 15.34 | 20.88 | 12.29 | 11.35 | 1.16 | 0.63 | 42.17 | 26.96 | 4.39 |
| 550 | 15.31 | 20.84 | 12.19 | 11.26 | 1.15 | 0.63 | 41.90 | 27.05 | 4.36 |
| 600 | 15.30 | 20.88 | 12.18 | 11.21 | 1.16 | 0.63 | 42.00 | 26.85 | 4.33 |
| 650 | 15.27 | 20.90 | 12.07 | 11.17 | 1.16 | 0.63 | 41.93 | 26.87 | 4.35 |
| 700 | 15.25 | 20.91 | 12.04 | 11.12 | 1.16 | 0.64 | 42.07 | 27.03 | 4.33 |
| 750 | 15.24 | 20.94 | 11.94 | 11.01 | 1.16 | 0.64 | 42.08 | 27.06 | 4.28 |
| 800 | 15.21 | 20.94 | 11.83 | 10.93 | 1.16 | 0.64 | 42.01 | 27.02 | 4.26 |
| 850 | 15.20 | 20.96 | 11.78 | 10.86 | 1.16 | 0.64 | 42.24 | 27.11 | 4.29 |
| 1000 | 15.13 | 21.05 | 11.43 | 10.53 | 1.17 | 0.64 | 42.94 | 27.07 | 4.37 |
| 1050 | 15.11 | 21.10 | 11.30 | 10.39 | 1.17 | 0.64 | 42.74 | 27.00 | 4.37 |
| 1100 | 15.09 | 21.10 | 11.23 | 10.28 | 1.17 | 0.64 | 42.94 | 27.04 | 4.38 |
| 1150 | 15.06 | 21.14 | 11.10 | 10.15 | 1.17 | 0.64 | 42.71 | 27.17 | 4.44 |
| 1200 | 15.04 | 21.23 | 11.00 | 10.01 | 1.18 | 0.65 | 43.03 | 26.96 | 4.42 |
| 1250 | 15.02 | 21.25 | 10.88 | 9.89 | 1.18 | 0.64 | 43.27 | 27.00 | 4.43 |
| 1300 | 14.99 | 21.32 | 10.75 | 9.72 | 1.18 | 0.65 | 43.24 | 26.69 | 4.47 |
| 1350 | 14.95 | 21.41 | 10.68 | 9.60 | 1.19 | 0.65 | 43.95 | 26.78 | 4.47 |
| 1400 | 14.96 | 21.45 | 10.52 | 9.53 | 1.19 | 0.65 | 44.00 | 26.57 | 4.46 |
| 1450 | 14.95 | 21.49 | 10.38 | 9.39 | 1.19 | 0.65 | 43.42 | 26.58 | 4.48 |
| 1500 | 14.93 | 21.54 | 10.27 | 9.26 | 1.19 | 0.65 | 43.18 | 26.61 | 4.46 |
| 1550 | 14.90 | 21.63 | 10.14 | 9.13 | 1.20 | 0.65 | 42.48 | 26.49 | 4.51 |
| 1600 | 14.87 | 21.68 | 10.08 | 8.99 | 1.20 | 0.65 | 43.05 | 26.41 | 4.50 |
| 1650 | 14.84 | 21.78 | 9.91 | 8.82 | 1.20 | 0.65 | 43.16 | 26.41 | 4.56 |
| 1700 | 14.81 | 21.88 | 9.81 | 8.69 | 1.21 | 0.66 | 41.62 | 26.11 | 4.51 |
| 1750 | 14.77 | 21.97 | 9.73 | 8.58 | 1.22 | 0.66 | 40.99 | 26.18 | 4.63 |
| 1800 | 14.71 | 22.12 | 9.59 | 8.45 | 1.23 | 0.67 | 41.35 | 26.04 | 4.61 |
| 1850 | 14.67 | 22.24 | 9.54 | 8.31 | 1.24 | 0.67 | 41.32 | 25.94 | 4.77 |
| 1900 | 14.60 | 22.39 | 9.36 | 8.17 | 1.25 | 0.67 | 40.98 | 25.90 | 4.68 |
| 1950 | 14.52 | 22.54 | 9.28 | 8.01 | 1.26 | 0.68 | 41.01 | 25.84 | 4.74 |
| 2000 | 14.41 | 22.70 | 9.23 | 7.90 | 1.29 | 0.69 | 40.53 | 25.66 | 4.77 |

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 9V, Id = 191.59 mA @ Temperature = -45degC

| 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 | 15.47 | 20.54 | 11.34 | 14.38 | 1.13 | 0.67 | 46.32 | 25.98 | 3.43 |
| 100 | 15.66 | 20.72 | 12.35 | 12.45 | 1.13 | 0.62 | 52.25 | 26.63 | 3.36 |
| 150 | 15.68 | 20.81 | 12.15 | 11.72 | 1.13 | 0.61 | 52.56 | 26.59 | 3.29 |
| 200 | 15.69 | 20.85 | 12.18 | 11.58 | 1.13 | 0.61 | 51.72 | 26.77 | 3.18 |
| 250 | 15.70 | 20.85 | 12.35 | 11.69 | 1.13 | 0.61 | 51.26 | 26.65 | 3.31 |
| 300 | 15.71 | 20.87 | 12.49 | 11.82 | 1.13 | 0.61 | 48.85 | 26.81 | 3.34 |
| 350 | 15.71 | 20.90 | 12.66 | 11.89 | 1.14 | 0.62 | 47.50 | 26.85 | 3.39 |
| 400 | 15.69 | 20.85 | 12.63 | 11.84 | 1.14 | 0.62 | 48.10 | 26.59 | 3.36 |
| 450 | 15.68 | 20.86 | 12.62 | 11.77 | 1.14 | 0.61 | 47.03 | 26.70 | 3.35 |
| 500 | 15.67 | 20.88 | 12.51 | 11.70 | 1.14 | 0.62 | 46.14 | 26.64 | 3.41 |
| 550 | 15.65 | 20.88 | 12.38 | 11.61 | 1.14 | 0.62 | 46.70 | 26.73 | 3.35 |
| 600 | 15.63 | 20.89 | 12.30 | 11.52 | 1.14 | 0.62 | 46.48 | 26.54 | 3.36 |
| 650 | 15.60 | 20.91 | 12.13 | 11.41 | 1.14 | 0.62 | 46.26 | 26.58 | 3.36 |
| 700 | 15.58 | 20.91 | 12.05 | 11.33 | 1.14 | 0.62 | 47.41 | 26.74 | 3.34 |
| 750 | 15.57 | 20.95 | 11.96 | 11.26 | 1.14 | 0.62 | 47.33 | 26.78 | 3.30 |
| 800 | 15.55 | 20.97 | 11.86 | 11.17 | 1.14 | 0.62 | 48.25 | 26.75 | 3.25 |
| 850 | 15.54 | 20.98 | 11.84 | 11.12 | 1.14 | 0.62 | 49.09 | 26.85 | 3.27 |
| 1000 | 15.49 | 21.03 | 11.66 | 10.92 | 1.15 | 0.62 | 55.49 | 26.79 | 3.39 |
| 1050 | 15.48 | 21.07 | 11.54 | 10.83 | 1.15 | 0.63 | 57.21 | 26.76 | 3.33 |
| 1100 | 15.46 | 21.10 | 11.49 | 10.76 | 1.15 | 0.63 | 50.47 | 26.79 | 3.37 |
| 1150 | 15.44 | 21.13 | 11.36 | 10.63 | 1.15 | 0.63 | 50.39 | 26.94 | 3.41 |
| 1200 | 15.43 | 21.18 | 11.30 | 10.50 | 1.16 | 0.63 | 47.84 | 26.75 | 3.40 |
| 1250 | 15.42 | 21.22 | 11.24 | 10.44 | 1.16 | 0.63 | 46.69 | 26.78 | 3.36 |
| 1300 | 15.39 | 21.26 | 11.14 | 10.31 | 1.16 | 0.63 | 45.42 | 26.53 | 3.42 |
| 1350 | 15.37 | 21.32 | 11.07 | 10.16 | 1.16 | 0.63 | 44.65 | 26.67 | 3.40 |
| 1400 | 15.34 | 21.37 | 10.99 | 10.10 | 1.17 | 0.64 | 44.62 | 26.44 | 3.40 |
| 1450 | 15.36 | 21.42 | 10.75 | 9.94 | 1.17 | 0.64 | 44.51 | 26.48 | 3.41 |
| 1500 | 15.35 | 21.46 | 10.60 | 9.77 | 1.17 | 0.63 | 44.15 | 26.53 | 3.37 |
| 1550 | 15.31 | 21.54 | 10.40 | 9.62 | 1.17 | 0.64 | 42.97 | 26.46 | 3.45 |
| 1600 | 15.29 | 21.63 | 10.31 | 9.46 | 1.18 | 0.64 | 42.10 | 26.37 | 3.44 |
| 1650 | 15.26 | 21.68 | 10.11 | 9.26 | 1.18 | 0.64 | 42.96 | 26.40 | 3.47 |
| 1700 | 15.23 | 21.77 | 10.00 | 9.10 | 1.18 | 0.64 | 42.42 | 26.11 | 3.41 |
| 1750 | 15.20 | 21.83 | 9.92 | 9.00 | 1.18 | 0.64 | 41.53 | 26.17 | 3.53 |
| 1800 | 15.15 | 21.98 | 9.79 | 8.86 | 1.20 | 0.65 | 41.04 | 26.07 | 3.51 |
| 1850 | 15.12 | 22.09 | 9.77 | 8.75 | 1.20 | 0.65 | 41.00 | 25.95 | 3.68 |
| 1900 | 15.06 | 22.20 | 9.62 | 8.63 | 1.21 | 0.66 | 41.19 | 25.93 | 3.58 |
| 1950 | 14.99 | 22.34 | 9.54 | 8.50 | 1.23 | 0.67 | 40.80 | 25.89 | 3.60 |
| 2000 | 14.89 | 22.48 | 9.48 | 8.37 | 1.24 | 0.67 | 40.85 | 25.74 | 3.65 |



Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 8.5V, Id = 178.39 mA @ Temperature = -45degC

| 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 | 15.47 | 20.60 | 11.31 | 14.37 | 1.13 | 0.67 | 45.58 | 25.29 | 3.35 |
| 100 | 15.66 | 20.72 | 12.30 | 12.44 | 1.13 | 0.62 | 51.88 | 26.05 | 3.27 |
| 150 | 15.67 | 20.85 | 12.11 | 11.70 | 1.13 | 0.61 | 52.65 | 25.99 | 3.19 |
| 200 | 15.69 | 20.85 | 12.12 | 11.57 | 1.13 | 0.61 | 50.64 | 26.23 | 3.08 |
| 250 | 15.70 | 20.89 | 12.30 | 11.68 | 1.14 | 0.61 | 49.34 | 26.10 | 3.20 |
| 300 | 15.71 | 20.83 | 12.45 | 11.81 | 1.13 | 0.61 | 48.69 | 26.25 | 3.24 |
| 350 | 15.71 | 20.81 | 12.60 | 11.87 | 1.13 | 0.61 | 46.10 | 26.30 | 3.29 |
| 400 | 15.69 | 20.89 | 12.59 | 11.83 | 1.14 | 0.62 | 46.18 | 26.03 | 3.26 |
| 450 | 15.68 | 20.87 | 12.57 | 11.76 | 1.14 | 0.62 | 45.85 | 26.15 | 3.25 |
| 500 | 15.67 | 20.86 | 12.48 | 11.69 | 1.14 | 0.61 | 44.63 | 26.06 | 3.30 |
| 550 | 15.64 | 20.86 | 12.34 | 11.58 | 1.14 | 0.61 | 45.76 | 26.19 | 3.31 |
| 600 | 15.63 | 20.92 | 12.26 | 11.53 | 1.14 | 0.62 | 45.86 | 26.02 | 3.23 |
| 650 | 15.60 | 20.91 | 12.09 | 11.42 | 1.14 | 0.62 | 46.31 | 26.01 | 3.24 |
| 700 | 15.58 | 20.93 | 12.03 | 11.35 | 1.14 | 0.62 | 47.22 | 26.16 | 3.24 |
| 750 | 15.56 | 20.93 | 11.92 | 11.25 | 1.14 | 0.62 | 48.17 | 26.19 | 3.21 |
| 800 | 15.54 | 20.96 | 11.82 | 11.17 | 1.14 | 0.62 | 49.61 | 26.18 | 3.19 |
| 850 | 15.53 | 20.98 | 11.79 | 11.11 | 1.15 | 0.62 | 52.78 | 26.27 | 3.17 |
| 1000 | 15.48 | 21.03 | 11.62 | 10.93 | 1.15 | 0.63 | 48.05 | 26.23 | 3.25 |
| 1050 | 15.47 | 21.10 | 11.50 | 10.86 | 1.15 | 0.63 | 47.91 | 26.20 | 3.23 |
| 1100 | 15.46 | 21.10 | 11.46 | 10.77 | 1.15 | 0.63 | 46.62 | 26.25 | 3.25 |
| 1150 | 15.44 | 21.16 | 11.32 | 10.64 | 1.16 | 0.63 | 45.75 | 26.40 | 3.29 |
| 1200 | 15.42 | 21.20 | 11.26 | 10.52 | 1.16 | 0.63 | 44.20 | 26.19 | 3.28 |
| 1250 | 15.41 | 21.23 | 11.21 | 10.45 | 1.16 | 0.63 | 43.53 | 26.24 | 3.26 |
| 1300 | 15.39 | 21.31 | 11.10 | 10.32 | 1.16 | 0.64 | 42.75 | 25.98 | 3.32 |
| 1350 | 15.36 | 21.36 | 11.04 | 10.18 | 1.17 | 0.64 | 42.19 | 26.14 | 3.30 |
| 1400 | 15.33 | 21.40 | 10.96 | 10.10 | 1.17 | 0.64 | 42.29 | 25.91 | 3.31 |
| 1450 | 15.36 | 21.43 | 10.72 | 9.96 | 1.17 | 0.64 | 42.23 | 25.96 | 3.31 |
| 1500 | 15.34 | 21.48 | 10.58 | 9.80 | 1.17 | 0.64 | 41.70 | 26.00 | 3.27 |
| 1550 | 15.30 | 21.55 | 10.39 | 9.64 | 1.17 | 0.64 | 40.83 | 25.94 | 3.33 |
| 1600 | 15.29 | 21.61 | 10.30 | 9.49 | 1.17 | 0.64 | 40.31 | 25.86 | 3.31 |
| 1650 | 15.25 | 21.73 | 10.10 | 9.28 | 1.18 | 0.64 | 40.86 | 25.89 | 3.37 |
| 1700 | 15.22 | 21.80 | 9.99 | 9.12 | 1.18 | 0.64 | 40.59 | 25.61 | 3.32 |
| 1750 | 15.19 | 21.90 | 9.92 | 9.03 | 1.19 | 0.65 | 39.81 | 25.68 | 3.41 |
| 1800 | 15.14 | 21.99 | 9.79 | 8.91 | 1.20 | 0.65 | 39.44 | 25.56 | 3.39 |
| 1850 | 15.11 | 22.09 | 9.77 | 8.79 | 1.21 | 0.66 | 39.32 | 25.46 | 3.60 |
| 1900 | 15.05 | 22.19 | 9.62 | 8.69 | 1.21 | 0.66 | 39.57 | 25.43 | 3.45 |
| 1950 | 14.98 | 22.39 | 9.55 | 8.54 | 1.23 | 0.67 | 39.02 | 25.37 | 3.48 |
| 2000 | 14.87 | 22.52 | 9.48 | 8.43 | 1.25 | 0.68 | 39.26 | 25.24 | 3.53 |

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 9.5V, Id = 204.54 mA @ Temperature = -45degC

| 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 | 15.46 | 20.47 | 11.39 | 14.34 | 1.13 | 0.66 | 48.29 | 26.41 | 3.52 |
| 100 | 15.66 | 20.69 | 12.39 | 12.45 | 1.13 | 0.62 | 50.02 | 27.13 | 3.46 |
| 150 | 15.67 | 20.83 | 12.19 | 11.71 | 1.13 | 0.61 | 51.85 | 27.07 | 3.37 |
| 200 | 15.68 | 20.86 | 12.20 | 11.58 | 1.13 | 0.61 | 51.54 | 27.30 | 3.29 |
| 250 | 15.70 | 20.84 | 12.37 | 11.68 | 1.13 | 0.61 | 50.23 | 27.19 | 3.41 |
| 300 | 15.71 | 20.87 | 12.52 | 11.83 | 1.14 | 0.62 | 49.39 | 27.32 | 3.45 |
| 350 | 15.70 | 20.80 | 12.68 | 11.87 | 1.13 | 0.61 | 47.31 | 27.37 | 3.50 |
| 400 | 15.69 | 20.85 | 12.66 | 11.84 | 1.14 | 0.62 | 46.90 | 27.08 | 3.45 |
| 450 | 15.68 | 20.85 | 12.62 | 11.77 | 1.14 | 0.61 | 46.78 | 27.23 | 3.47 |
| 500 | 15.66 | 20.88 | 12.56 | 11.68 | 1.14 | 0.62 | 45.98 | 27.14 | 3.49 |
| 550 | 15.64 | 20.89 | 12.40 | 11.59 | 1.14 | 0.62 | 45.58 | 27.24 | 3.49 |
| 600 | 15.62 | 20.87 | 12.34 | 11.51 | 1.14 | 0.61 | 45.71 | 27.06 | 3.48 |
| 650 | 15.60 | 20.91 | 12.15 | 11.40 | 1.14 | 0.62 | 45.62 | 27.11 | 3.45 |
| 700 | 15.58 | 20.90 | 12.09 | 11.32 | 1.14 | 0.62 | 46.12 | 27.24 | 3.46 |
| 750 | 15.56 | 20.94 | 11.98 | 11.23 | 1.14 | 0.62 | 46.29 | 27.29 | 3.44 |
| 800 | 15.54 | 20.94 | 11.89 | 11.14 | 1.14 | 0.62 | 46.29 | 27.33 | 3.39 |
| 850 | 15.53 | 20.97 | 11.87 | 11.08 | 1.14 | 0.62 | 46.22 | 27.38 | 3.39 |
| 1000 | 15.48 | 21.06 | 11.67 | 10.89 | 1.15 | 0.63 | 48.69 | 27.31 | 3.47 |
| 1050 | 15.48 | 21.06 | 11.56 | 10.81 | 1.15 | 0.63 | 48.34 | 27.25 | 3.47 |
| 1100 | 15.46 | 21.07 | 11.52 | 10.74 | 1.15 | 0.63 | 48.27 | 27.32 | 3.47 |
| 1150 | 15.44 | 21.11 | 11.39 | 10.61 | 1.15 | 0.63 | 50.53 | 27.45 | 3.51 |
| 1200 | 15.43 | 21.17 | 11.32 | 10.48 | 1.15 | 0.63 | 54.26 | 27.25 | 3.50 |
| 1250 | 15.41 | 21.21 | 11.26 | 10.41 | 1.16 | 0.63 | 55.06 | 27.31 | 3.48 |
| 1300 | 15.39 | 21.23 | 11.15 | 10.27 | 1.16 | 0.63 | 52.05 | 27.04 | 3.54 |
| 1350 | 15.37 | 21.32 | 11.09 | 10.13 | 1.16 | 0.63 | 49.88 | 27.18 | 3.52 |
| 1400 | 15.34 | 21.36 | 11.00 | 10.06 | 1.17 | 0.64 | 49.45 | 26.94 | 3.51 |
| 1450 | 15.36 | 21.40 | 10.76 | 9.91 | 1.16 | 0.63 | 50.59 | 26.97 | 3.52 |
| 1500 | 15.34 | 21.45 | 10.61 | 9.74 | 1.17 | 0.63 | 49.21 | 27.02 | 3.49 |
| 1550 | 15.31 | 21.53 | 10.41 | 9.57 | 1.17 | 0.64 | 46.46 | 26.93 | 3.55 |
| 1600 | 15.29 | 21.56 | 10.31 | 9.43 | 1.17 | 0.64 | 45.32 | 26.86 | 3.57 |
| 1650 | 15.26 | 21.66 | 10.11 | 9.22 | 1.17 | 0.64 | 46.89 | 26.87 | 3.61 |
| 1700 | 15.23 | 21.76 | 9.99 | 9.05 | 1.18 | 0.64 | 45.18 | 26.58 | 3.56 |
| 1750 | 15.20 | 21.85 | 9.91 | 8.95 | 1.18 | 0.64 | 43.72 | 26.65 | 3.65 |
| 1800 | 15.15 | 21.95 | 9.77 | 8.82 | 1.19 | 0.65 | 43.70 | 26.53 | 3.62 |
| 1850 | 15.12 | 22.04 | 9.76 | 8.70 | 1.20 | 0.65 | 43.55 | 26.43 | 3.77 |
| 1900 | 15.06 | 22.15 | 9.60 | 8.59 | 1.21 | 0.66 | 43.37 | 26.40 | 3.68 |
| 1950 | 14.99 | 22.35 | 9.53 | 8.43 | 1.22 | 0.66 | 43.10 | 26.33 | 3.72 |
| 2000 | 14.89 | 22.49 | 9.45 | 8.32 | 1.24 | 0.67 | 43.13 | 26.19 | 3.79 |

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 9V, Id = 186.26 mA @ Temperature = +85degC

| 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 | 14.99 | 20.36 | 11.39 | 14.01 | 1.15 | 0.68 | 42.88 | 25.45 | 4.81 |
| 100 | 15.22 | 20.62 | 12.72 | 12.47 | 1.15 | 0.65 | 43.29 | 26.23 | 4.71 |
| 150 | 15.25 | 20.68 | 12.86 | 12.11 | 1.16 | 0.64 | 42.93 | 26.16 | 4.64 |
| 200 | 15.26 | 20.74 | 12.91 | 11.99 | 1.16 | 0.64 | 42.52 | 26.36 | 4.57 |
| 250 | 15.25 | 20.75 | 12.85 | 11.83 | 1.16 | 0.64 | 42.06 | 26.29 | 4.66 |
| 300 | 15.22 | 20.77 | 12.70 | 11.64 | 1.16 | 0.64 | 41.55 | 26.36 | 4.70 |
| 350 | 15.20 | 20.78 | 12.57 | 11.47 | 1.16 | 0.64 | 41.28 | 26.43 | 4.78 |
| 400 | 15.16 | 20.81 | 12.39 | 11.33 | 1.16 | 0.64 | 41.01 | 26.18 | 4.78 |
| 450 | 15.14 | 20.84 | 12.28 | 11.23 | 1.16 | 0.64 | 40.94 | 26.29 | 4.77 |
| 500 | 15.12 | 20.84 | 12.19 | 11.15 | 1.17 | 0.64 | 40.95 | 26.20 | 4.83 |
| 550 | 15.10 | 20.84 | 12.08 | 11.07 | 1.17 | 0.64 | 40.79 | 26.26 | 4.83 |
| 600 | 15.08 | 20.85 | 12.05 | 11.02 | 1.17 | 0.64 | 40.78 | 26.11 | 4.79 |
| 650 | 15.05 | 20.87 | 11.93 | 10.95 | 1.17 | 0.64 | 40.98 | 26.10 | 4.77 |
| 700 | 15.03 | 20.90 | 11.89 | 10.88 | 1.17 | 0.65 | 41.15 | 26.24 | 4.79 |
| 750 | 15.01 | 20.96 | 11.78 | 10.75 | 1.17 | 0.65 | 41.16 | 26.31 | 4.75 |
| 800 | 14.98 | 20.98 | 11.65 | 10.64 | 1.18 | 0.65 | 41.32 | 26.22 | 4.73 |
| 850 | 14.96 | 21.03 | 11.60 | 10.57 | 1.18 | 0.65 | 41.37 | 26.35 | 4.70 |
| 1000 | 14.89 | 21.11 | 11.23 | 10.23 | 1.18 | 0.65 | 42.06 | 26.25 | 4.84 |
| 1050 | 14.87 | 21.16 | 11.09 | 10.08 | 1.19 | 0.65 | 42.02 | 26.12 | 4.84 |
| 1100 | 14.85 | 21.19 | 11.02 | 9.97 | 1.19 | 0.65 | 42.05 | 26.17 | 4.83 |
| 1150 | 14.82 | 21.22 | 10.89 | 9.84 | 1.19 | 0.65 | 41.67 | 26.29 | 4.89 |
| 1200 | 14.80 | 21.29 | 10.81 | 9.71 | 1.19 | 0.65 | 42.19 | 26.07 | 4.92 |
| 1250 | 14.77 | 21.34 | 10.72 | 9.62 | 1.20 | 0.66 | 42.29 | 26.13 | 4.86 |
| 1300 | 14.74 | 21.38 | 10.60 | 9.45 | 1.20 | 0.66 | 41.90 | 25.77 | 4.94 |
| 1350 | 14.71 | 21.49 | 10.58 | 9.37 | 1.21 | 0.66 | 42.65 | 25.87 | 4.92 |
| 1400 | 14.71 | 21.51 | 10.41 | 9.29 | 1.21 | 0.66 | 42.57 | 25.64 | 4.93 |
| 1450 | 14.70 | 21.55 | 10.30 | 9.18 | 1.21 | 0.66 | 42.35 | 25.65 | 4.95 |
| 1500 | 14.68 | 21.60 | 10.22 | 9.07 | 1.21 | 0.66 | 42.03 | 25.69 | 4.90 |
| 1550 | 14.65 | 21.69 | 10.08 | 8.95 | 1.22 | 0.66 | 40.92 | 25.53 | 4.99 |
| 1600 | 14.63 | 21.77 | 10.05 | 8.83 | 1.22 | 0.66 | 41.40 | 25.45 | 4.98 |
| 1650 | 14.59 | 21.86 | 9.90 | 8.68 | 1.23 | 0.67 | 41.69 | 25.44 | 5.02 |
| 1700 | 14.56 | 21.95 | 9.82 | 8.55 | 1.23 | 0.67 | 40.32 | 25.15 | 4.98 |
| 1750 | 14.52 | 22.06 | 9.75 | 8.46 | 1.24 | 0.67 | 39.67 | 25.21 | 5.09 |
| 1800 | 14.46 | 22.16 | 9.62 | 8.34 | 1.25 | 0.68 | 39.95 | 25.07 | 5.06 |
| 1850 | 14.42 | 22.29 | 9.60 | 8.22 | 1.26 | 0.68 | 39.82 | 24.96 | 5.22 |
| 1900 | 14.35 | 22.45 | 9.41 | 8.09 | 1.28 | 0.69 | 39.77 | 24.92 | 5.15 |
| 1950 | 14.27 | 22.64 | 9.34 | 7.95 | 1.30 | 0.69 | 39.65 | 24.85 | 5.19 |
| 2000 | 14.16 | 22.78 | 9.29 | 7.86 | 1.32 | 0.70 | 39.43 | 24.67 | 5.23 |



Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 8.5V, Id = 175.82 mA @ Temperature = +85degC

| 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 | 15.08 | 20.50 | 11.30 | 14.05 | 1.15 | 0.69 | 44.49 | 24.94 | 4.58 |
| 100 | 15.30 | 20.63 | 12.63 | 12.55 | 1.15 | 0.64 | 43.22 | 25.69 | 4.49 |
| 150 | 15.33 | 20.69 | 12.78 | 12.17 | 1.15 | 0.64 | 42.77 | 25.63 | 4.43 |
| 200 | 15.34 | 20.74 | 12.83 | 12.07 | 1.15 | 0.64 | 42.35 | 25.87 | 4.37 |
| 250 | 15.33 | 20.77 | 12.77 | 11.91 | 1.15 | 0.64 | 41.54 | 25.75 | 4.48 |
| 300 | 15.31 | 20.78 | 12.64 | 11.73 | 1.15 | 0.64 | 41.44 | 25.85 | 4.53 |
| 350 | 15.28 | 20.81 | 12.50 | 11.57 | 1.16 | 0.64 | 40.52 | 25.94 | 4.56 |
| 400 | 15.25 | 20.80 | 12.33 | 11.40 | 1.16 | 0.63 | 40.42 | 25.66 | 4.54 |
| 450 | 15.23 | 20.86 | 12.22 | 11.31 | 1.16 | 0.64 | 40.18 | 25.79 | 4.55 |
| 500 | 15.20 | 20.86 | 12.13 | 11.23 | 1.16 | 0.64 | 40.06 | 25.69 | 4.62 |
| 550 | 15.18 | 20.86 | 12.02 | 11.15 | 1.16 | 0.64 | 40.56 | 25.78 | 4.64 |
| 600 | 15.16 | 20.89 | 12.00 | 11.12 | 1.16 | 0.64 | 40.56 | 25.61 | 4.59 |
| 650 | 15.13 | 20.91 | 11.88 | 11.03 | 1.17 | 0.64 | 40.73 | 25.60 | 4.58 |
| 700 | 15.11 | 20.90 | 11.84 | 10.97 | 1.17 | 0.64 | 41.24 | 25.74 | 4.59 |
| 750 | 15.09 | 20.94 | 11.73 | 10.85 | 1.17 | 0.64 | 41.25 | 25.80 | 4.54 |
| 800 | 15.06 | 20.96 | 11.59 | 10.74 | 1.17 | 0.64 | 41.82 | 25.75 | 4.51 |
| 850 | 15.05 | 21.00 | 11.54 | 10.66 | 1.17 | 0.65 | 41.95 | 25.84 | 4.48 |
| 1000 | 14.97 | 21.09 | 11.18 | 10.32 | 1.18 | 0.65 | 42.77 | 25.76 | 4.62 |
| 1050 | 14.95 | 21.13 | 11.03 | 10.16 | 1.18 | 0.65 | 42.77 | 25.66 | 4.62 |
| 1100 | 14.93 | 21.18 | 10.97 | 10.05 | 1.18 | 0.65 | 43.24 | 25.67 | 4.62 |
| 1150 | 14.90 | 21.22 | 10.84 | 9.93 | 1.19 | 0.65 | 42.53 | 25.80 | 4.68 |
| 1200 | 14.88 | 21.28 | 10.76 | 9.80 | 1.19 | 0.65 | 43.17 | 25.62 | 4.70 |
| 1250 | 14.86 | 21.31 | 10.67 | 9.71 | 1.19 | 0.65 | 42.88 | 25.65 | 4.67 |
| 1300 | 14.83 | 21.40 | 10.55 | 9.53 | 1.20 | 0.66 | 42.31 | 25.30 | 4.74 |
| 1350 | 14.79 | 21.44 | 10.53 | 9.45 | 1.20 | 0.66 | 43.05 | 25.42 | 4.73 |
| 1400 | 14.80 | 21.49 | 10.36 | 9.37 | 1.20 | 0.66 | 42.71 | 25.20 | 4.72 |
| 1450 | 14.79 | 21.57 | 10.25 | 9.25 | 1.20 | 0.66 | 42.43 | 25.20 | 4.73 |
| 1500 | 14.77 | 21.62 | 10.17 | 9.15 | 1.21 | 0.66 | 42.02 | 25.24 | 4.70 |
| 1550 | 14.73 | 21.71 | 10.04 | 9.03 | 1.21 | 0.66 | 40.67 | 25.11 | 4.76 |
| 1600 | 14.71 | 21.76 | 10.02 | 8.91 | 1.22 | 0.66 | 40.84 | 25.02 | 4.76 |
| 1650 | 14.67 | 21.86 | 9.85 | 8.76 | 1.22 | 0.67 | 41.36 | 25.01 | 4.80 |
| 1700 | 14.64 | 21.98 | 9.79 | 8.63 | 1.23 | 0.67 | 40.08 | 24.72 | 4.78 |
| 1750 | 14.61 | 22.07 | 9.71 | 8.54 | 1.24 | 0.67 | 39.41 | 24.79 | 4.87 |
| 1800 | 14.55 | 22.21 | 9.57 | 8.43 | 1.25 | 0.68 | 39.47 | 24.64 | 4.82 |
| 1850 | 14.50 | 22.27 | 9.56 | 8.30 | 1.26 | 0.68 | 39.30 | 24.53 | 5.03 |
| 1900 | 14.43 | 22.49 | 9.37 | 8.17 | 1.27 | 0.69 | 39.27 | 24.50 | 4.92 |
| 1950 | 14.35 | 22.64 | 9.31 | 8.02 | 1.29 | 0.69 | 39.16 | 24.43 | 4.98 |
| 2000 | 14.24 | 22.81 | 9.27 | 7.94 | 1.31 | 0.70 | 39.03 | 24.26 | 5.01 |

Typical Performance Data

Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

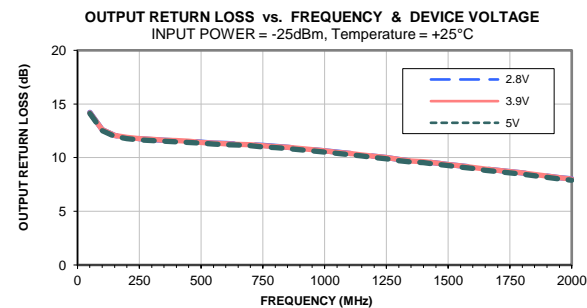
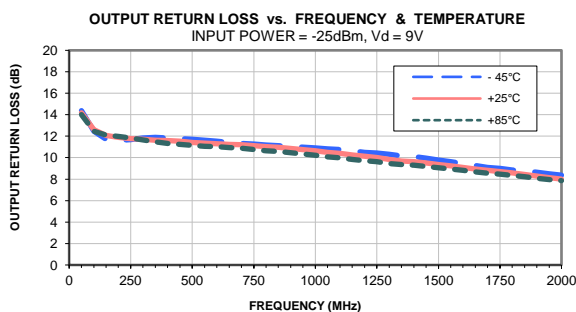
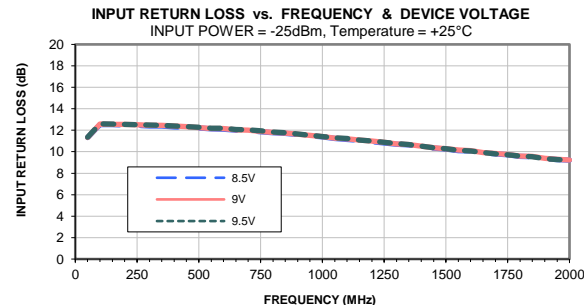
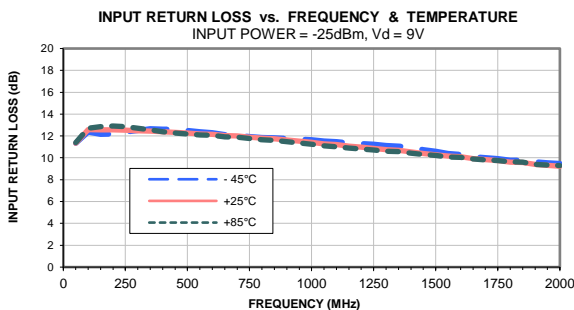
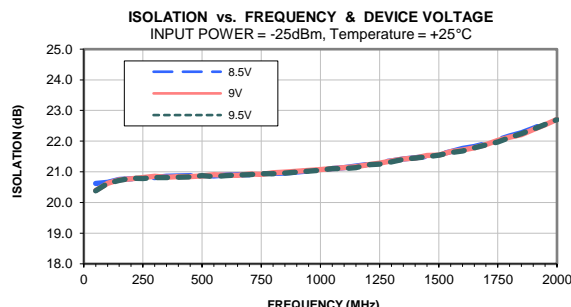
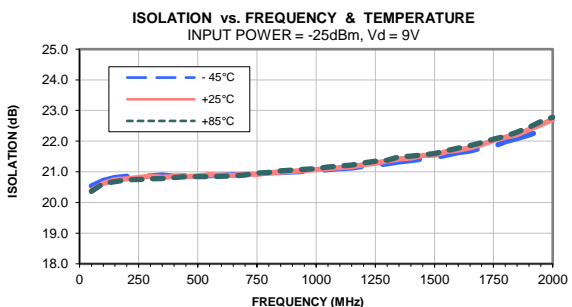
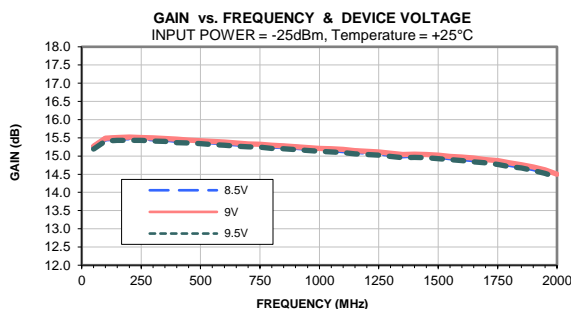
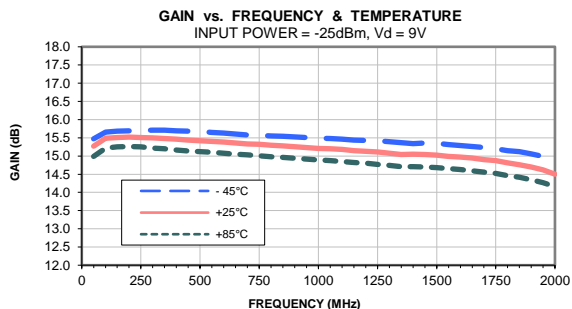
Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

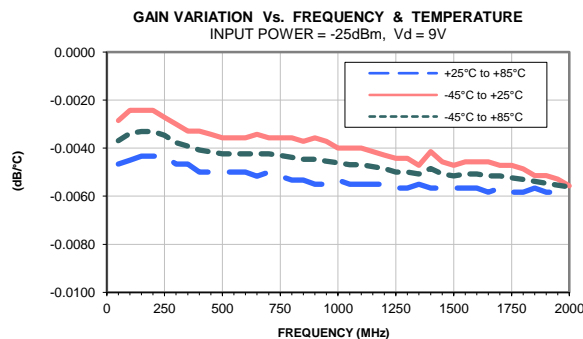
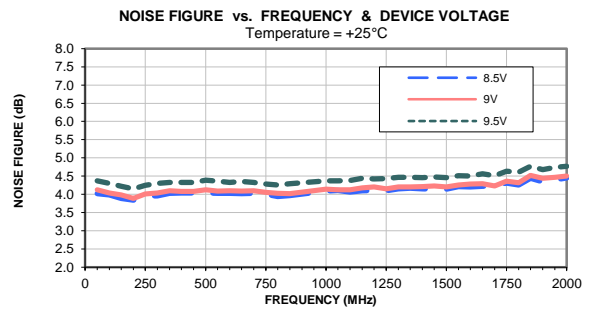
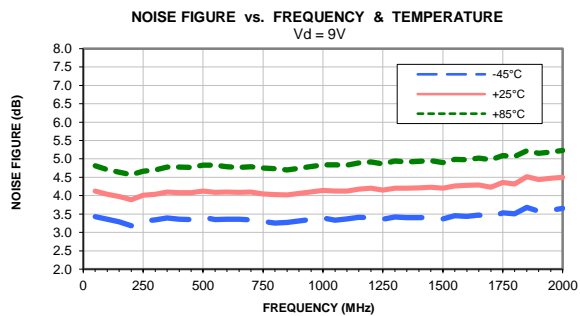
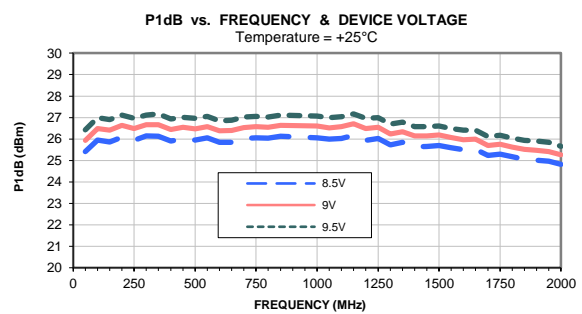
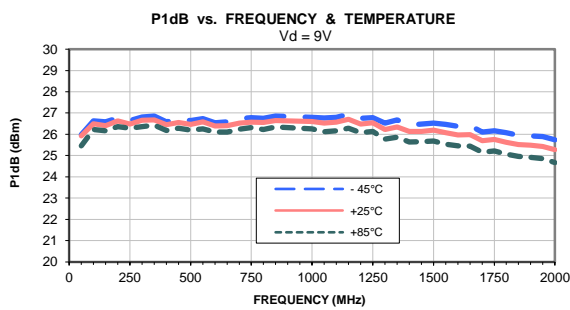
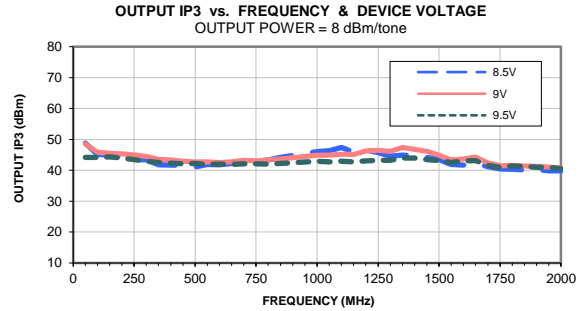
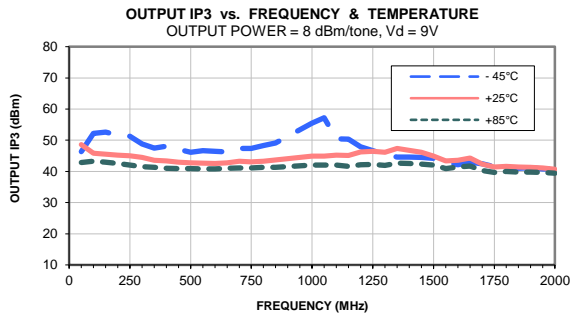
TEST CONDITIONS: Vd = 9.5V, Id = 196.61 mA @ Temperature = +85degC

| 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 | 14.89 | 20.49 | 11.40 | 14.04 | 1.16 | 0.70 | 42.40 | 25.91 | 5.11 |
| 100 | 15.11 | 20.62 | 12.76 | 12.40 | 1.16 | 0.65 | 43.80 | 26.68 | 4.99 |
| 150 | 15.15 | 20.69 | 12.91 | 12.03 | 1.16 | 0.65 | 43.16 | 26.61 | 4.96 |
| 200 | 15.15 | 20.72 | 12.96 | 11.89 | 1.16 | 0.64 | 42.57 | 26.81 | 4.82 |
| 250 | 15.14 | 20.78 | 12.89 | 11.72 | 1.17 | 0.65 | 42.11 | 26.74 | 4.93 |
| 300 | 15.12 | 20.75 | 12.73 | 11.54 | 1.16 | 0.64 | 41.41 | 26.79 | 4.99 |
| 350 | 15.09 | 20.81 | 12.61 | 11.38 | 1.17 | 0.65 | 41.52 | 26.90 | 5.04 |
| 400 | 15.06 | 20.83 | 12.44 | 11.24 | 1.17 | 0.65 | 40.93 | 26.65 | 5.02 |
| 450 | 15.04 | 20.83 | 12.34 | 11.14 | 1.17 | 0.64 | 40.86 | 26.75 | 5.03 |
| 500 | 15.02 | 20.85 | 12.24 | 11.05 | 1.17 | 0.65 | 41.06 | 26.65 | 5.07 |
| 550 | 14.99 | 20.86 | 12.13 | 10.97 | 1.17 | 0.65 | 40.64 | 26.71 | 5.07 |
| 600 | 14.97 | 20.85 | 12.12 | 10.93 | 1.17 | 0.65 | 40.64 | 26.55 | 5.03 |
| 650 | 14.95 | 20.90 | 11.98 | 10.86 | 1.18 | 0.65 | 40.74 | 26.53 | 5.04 |
| 700 | 14.92 | 20.93 | 11.94 | 10.78 | 1.18 | 0.65 | 40.74 | 26.69 | 5.04 |
| 750 | 14.90 | 20.92 | 11.83 | 10.66 | 1.18 | 0.65 | 40.68 | 26.72 | 5.00 |
| 800 | 14.87 | 20.98 | 11.69 | 10.55 | 1.18 | 0.65 | 40.84 | 26.67 | 4.97 |
| 850 | 14.86 | 20.98 | 11.64 | 10.47 | 1.18 | 0.65 | 40.68 | 26.77 | 4.98 |
| 1000 | 14.78 | 21.11 | 11.28 | 10.13 | 1.19 | 0.66 | 41.37 | 26.69 | 5.09 |
| 1050 | 14.76 | 21.14 | 11.12 | 9.98 | 1.19 | 0.66 | 41.24 | 26.55 | 5.08 |
| 1100 | 14.74 | 21.16 | 11.07 | 9.88 | 1.19 | 0.65 | 41.14 | 26.60 | 5.09 |
| 1150 | 14.71 | 21.22 | 10.93 | 9.75 | 1.20 | 0.66 | 40.90 | 26.70 | 5.14 |
| 1200 | 14.69 | 21.28 | 10.85 | 9.62 | 1.20 | 0.66 | 41.20 | 26.50 | 5.13 |
| 1250 | 14.67 | 21.31 | 10.77 | 9.52 | 1.20 | 0.66 | 41.35 | 26.54 | 5.12 |
| 1300 | 14.63 | 21.40 | 10.64 | 9.36 | 1.21 | 0.66 | 41.19 | 26.17 | 5.16 |
| 1350 | 14.60 | 21.48 | 10.61 | 9.27 | 1.21 | 0.66 | 41.85 | 26.27 | 5.19 |
| 1400 | 14.61 | 21.47 | 10.44 | 9.20 | 1.21 | 0.66 | 41.82 | 26.02 | 5.18 |
| 1450 | 14.60 | 21.57 | 10.34 | 9.09 | 1.22 | 0.66 | 41.72 | 26.04 | 5.19 |
| 1500 | 14.58 | 21.61 | 10.26 | 8.98 | 1.22 | 0.66 | 41.56 | 26.06 | 5.17 |
| 1550 | 14.54 | 21.67 | 10.13 | 8.87 | 1.22 | 0.67 | 40.75 | 25.90 | 5.23 |
| 1600 | 14.52 | 21.80 | 10.10 | 8.74 | 1.23 | 0.67 | 41.41 | 25.83 | 5.24 |
| 1650 | 14.48 | 21.87 | 9.94 | 8.59 | 1.23 | 0.67 | 41.51 | 25.81 | 5.29 |
| 1700 | 14.45 | 21.97 | 9.86 | 8.46 | 1.24 | 0.67 | 40.31 | 25.52 | 5.26 |
| 1750 | 14.41 | 22.03 | 9.80 | 8.38 | 1.25 | 0.67 | 39.80 | 25.58 | 5.34 |
| 1800 | 14.35 | 22.16 | 9.65 | 8.25 | 1.26 | 0.68 | 40.14 | 25.44 | 5.32 |
| 1850 | 14.31 | 22.31 | 9.64 | 8.14 | 1.27 | 0.68 | 40.02 | 25.33 | 5.46 |
| 1900 | 14.24 | 22.44 | 9.45 | 8.01 | 1.28 | 0.69 | 39.86 | 25.28 | 5.40 |
| 1950 | 14.17 | 22.63 | 9.37 | 7.87 | 1.30 | 0.69 | 39.98 | 25.22 | 5.45 |
| 2000 | 14.05 | 22.78 | 9.34 | 7.78 | 1.32 | 0.70 | 39.60 | 25.03 | 5.51 |

Typical Performance Curves



Typical Performance Curves



Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within $\pm .002$

| CASE # | A | B | C | D | E | F | G | H | J | K | L | M |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| DF782 | .102 (2.59) | .090 (2.29) | .181 (4.60) | .173 (4.39) | .063 (1.60) | .167 (4.24) | .155 (3.94) | .059 (1.50) | .118 (3.00) | .015 (0.38) | .041 (1.04) | .016 (0.41) |

| CASE # | N | P | Q | WT. GRAM |
|--------|----------------|----------------|----------------|----------|
| DF782 | .019 (0.48) | .065 (1.65) | .062 (1.57) | .2 |

Dimensions are in inches (mm). Tolerances: 2 Pl. $\pm .01$; 3Pl. $\pm .005$

Notes:

- Case material: Plastic.
- Termination finish:
For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin.
All models, (+) suffix. See model Data sheet.
For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.



INTERNET <http://www.minicircuits.com>

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Mini-Circuits ISO 9001 & ISO 14001 Certified

Tape & Reel Packaging TR-F55

DEVICE ORIENTATION IN T&R



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel | |
|----------------|-------------------------|-------------------|------------------------------------|------|
| 12 | 8 | 7 | Small quantity standard (see note) | 20 |
| | | | | 50 |
| | | | | 100 |
| | | | | 200 |
| | | | Standard | 500 |
| | | | | 1000 |

Note: Please consult individual model data sheet to determine device per reel availability.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf



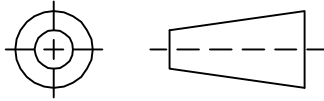
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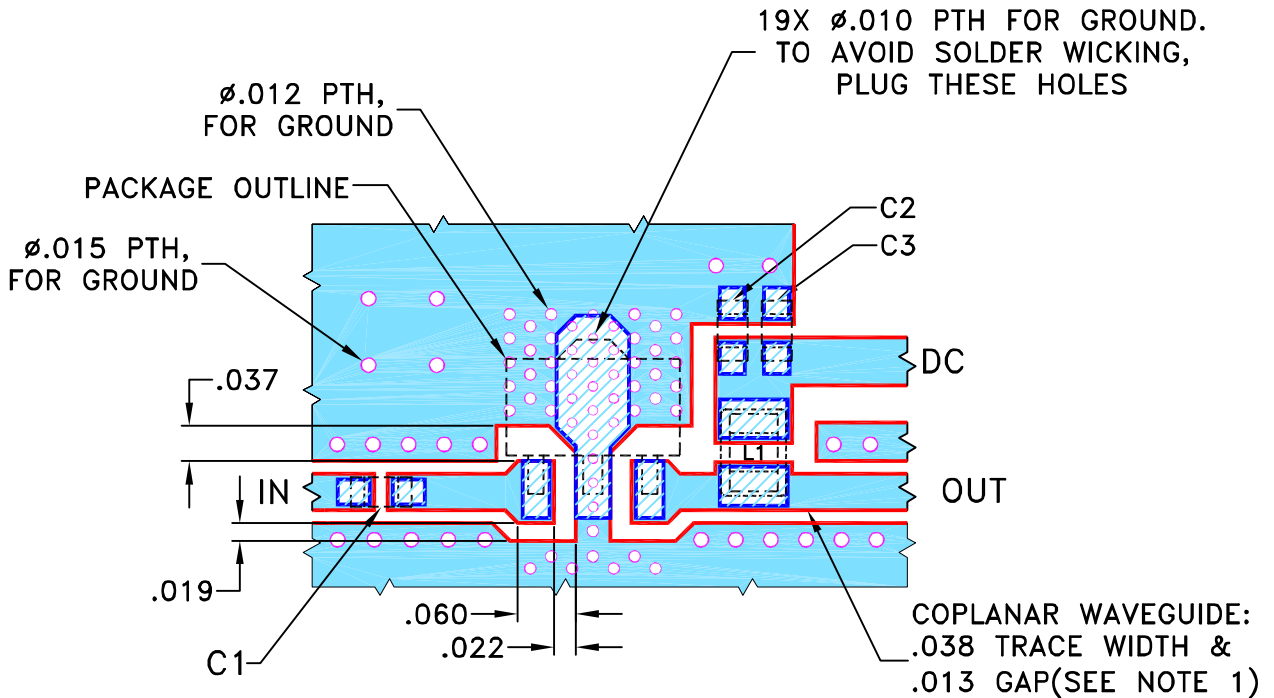
THIRD ANGLE PROJECTION



REVISIONS

| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
|-----|---------|-------------|----------|----|------|
| OR | M156313 | NEW RELEASE | 05/09/16 | GF | RS |
| | | | | | |
| | | | | | |

**SUGGESTED MOUNTING CONFIGURATION FOR
DF782 CASE STYLE, "04AM03" PIN CODE**



| COMPONENT | SIZE |
|-----------|------|
| C1-C3 | 0603 |
| L1 | 0805 |

NOTES:

- TRACE WIDTH PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $.020 \pm .0015$ ". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
- BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

 DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

| UNLESS OTHERWISE SPECIFIED | INITIALS | DATE |
|----------------------------|----------|----------|
| DRAWN | GF | 05/09/16 |
| CHECKED | IL | 05/09/16 |
| APPROVED | RS | 05/09/16 |

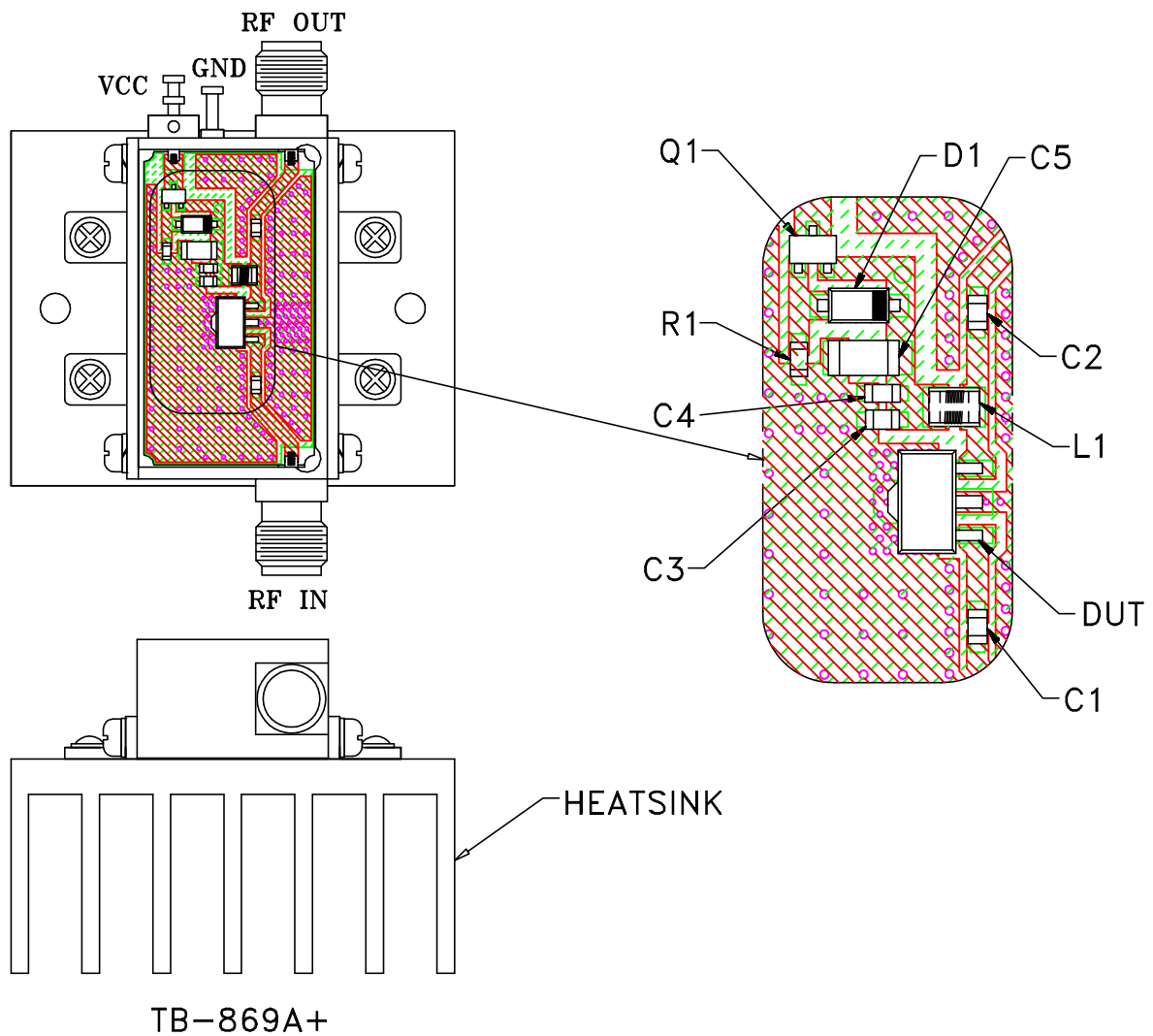
 **Mini-Circuits®** 13 Neptune Avenue
Brooklyn NY 11235

PL, 04AM03, DF782, TB-869A+

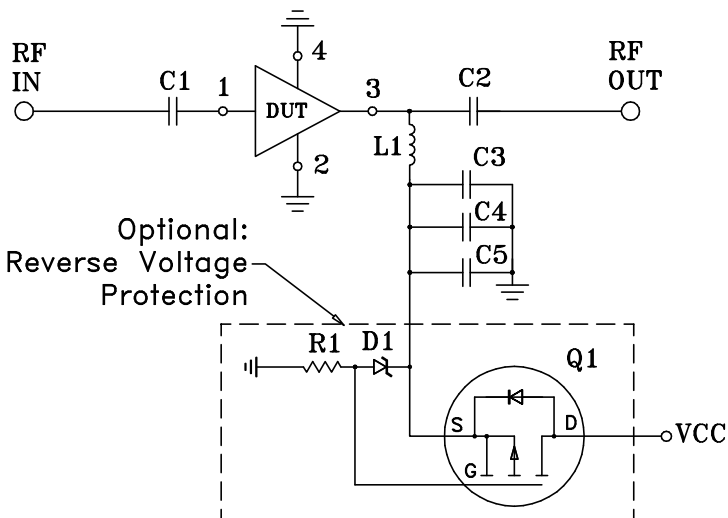
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| | | | |
|------------------|---------------------|--------------------------|------------|
| SIZE A | CODE IDENT 15542 | DRAWING NO: 98-PL-486 | REV: OR |
| FILE: 98PL486 | SCALE: 5:1 | SHEET: 1 OF 1 | |

Evaluation Board and Circuit



TB-869A+




Schematic Diagram

| COMPONENT | VALUE | SIZE |
|-----------|----------------------------------------|--------|
| DUT | PHA-101+ | - |
| C1,C2,C3 | 150 pF, 50V | 0603 |
| C4 | 0.01 μ F,25V | |
| C5 | 10 μ F,35V | 1206 |
| L1 | 390 nH | 0805 |
| D1 | Zener Diode 5.6V ONSEMI MMSZ4690T1G | SOD123 |
| R1 | 1.5 kOhm | 0603 |
| Q1 | Transistor ONSEMI FET NTS4101P | SOT323 |

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: RO4350 or equivalent.
Dielectric Constant=3.5, Thickness=.020 inch.

 **Mini-Circuits®**

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 Ambient Environment | Individual Model Data Sheet |
| Storage Temperature | -55° to 100° C or -65° to 150° Ambient Environment | Individual Model Data Sheet |
| Thermal Shock | -55° to 100°C, 100 cycles | MIL-STD-202, Method 107, Condition A-3, except +100°C |
| Mechanical Shock | 1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only | MIL-STD-883, Method 2002, Condition B, except Y1 direction only |
| Vibration (Variable Frequency) | 50g peak | MIL-STD-883, Method 2007, Condition B |
| Autoclave | 15 psig, 100% RH, 121°C, 96 hours | JESD22-A102, Condition C |
| HAST | 130°C, 85% RH, 96 hours | JESD22-A110 |
| Solderability | 10X Magnification | J-STD-002, Para 4.2.5, Test S, 95% Coverage |
| Solder Reflow Heat | Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak | J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1 |
| Moisture Sensitivity: Level 1 | Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak | J-STD-020 |
| Marking Resistance to Solvents | Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + | MIL-STD-202, Method 215 |



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

monoethanolamine at 63°C to 70°C