

Low Noise, High IP3

# Monolithic Amplifier

PMA-5454+

50Ω      0.05 to 6 GHz



3mm x 3mm MCLP Pkg

## The Big Deal

- Ultra Low Noise Figure, 0.8 dB
- High IP3/Low Current, 20mA
- Wideband, up to 6 GHz

## Product Overview

Mini-Circuits PMA-5454+ is a E-PHEMT based Ultra-Low Noise MMIC Amplifier operating from 50 MHz to 6 GHz with a unique combination of low noise and high IP3 making this amplifier ideal for sensitive receiver applications. This design operates on a single 5V supply at only 20mA and is internally matched to 50 Ohms.

## Key Features

| Feature                  | Advantages                                                                                                                                                                                                                     |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ultra Low Noise, 0.8 dB  | Outstanding Noise Figure, measured in a 50 Ohm environment without any external matching                                                                                                                                       |
| High IP3, 27 dBm         | Combining Low Noise and High IP3 makes this MMIC amplifier ideal for Low Noise Receiver Front End (RFE) because it gives the user advantages at both ends of the dynamic range: sensitivity & two-tone spur-free dynamic range |
| Low Current, 20mA        | At only 20mA, the PMA-5454+ is ideal for remote applications with limited available power or densely packed applications where thermal management is critical.                                                                 |
| Broad Band               | Operating over a broadband the PMA-5454+ covers the primary wireless communications bands: Cellular, PCS, LTE, WiMAX                                                                                                           |
| Internally Matched       | No external matching elements required to achieve the advertised noise and output power over the full band                                                                                                                     |
| MCLP Package             | Low Inductance, repeatable transitions, excellent thermal pad                                                                                                                                                                  |
| Max Input Power, +20 dBm | Ruggedized design operates up to input powers of +20 dBm without the need of an external limiter                                                                                                                               |
| High Reliability         | Low, small signal operating current of 20mA nominal maintains junction temperatures typically below 100°C at 85°C ground lead temperature                                                                                      |

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Low Noise, High IP3

# Monolithic Amplifier

0.05-6 GHz

## Product Features

- Single Positive Supply Voltage, 5V,  $I_d=20\text{mA}$
- Ultra Low Noise Figure, 0.8 dB typ. at 0.5 GHz
- High IP3, 27 dBm typ. 1GHz
- Gain, 18dB typ. at 1 GHz
- Output Power, up to +15 dBm typ.
- Micro-miniature size -3mm x 3mm
- Aqueous washable

## Typical Applications

- Cellular
- ISM
- GSM
- WCDMA
- LTE
- WiMAX
- WLAN
- UNII and HIPERLAN



Generic photo used for illustration purposes only

## PMA-5454+

CASE STYLE: DQ849

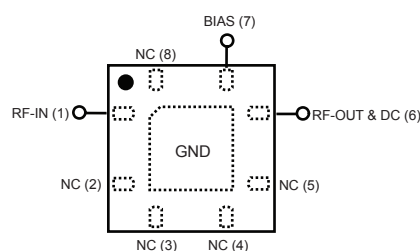
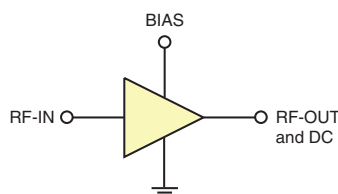
**+RoHS Compliant**

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

## General Description

PMA-5454+ is a high dynamic range, low noise, high IP3, high output power, monolithic amplifier. Manufactured using E-PHEMT\* technology enables it to work with a single positive supply voltage.

## simplified schematic and pad description



| Function    | Pad Number                 | Description (See Application Circuit, Fig. 3)                                                           |
|-------------|----------------------------|---------------------------------------------------------------------------------------------------------|
| RF-IN       | 1                          | RF input pad                                                                                            |
| RF-OUT & DC | 6                          | RF output pad (connected to RF-OUT via blocking external cap C2, and Supply voltage Vs via RF Choke L1) |
| BIAS        | 7                          | Bias pad (connected to Vs via Rbias)                                                                    |
| GND         | paddle in center of bottom | Connected to ground                                                                                     |
| NOT USED    | 2,3,4,5,8                  | No internal connection; recommended use: per PCB Layout PL-299                                          |

\*Enhancement mode Pseudomorphic High Electron Mobility Transistor.

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M151107  
PMA-5454+  
TH/RS/CP/AM  
200528  
Page 2 of 4

**Electrical Specifications<sup>(1)</sup> at 25°C, Z<sub>0</sub>=50Ω, (refer to characterization circuit, Fig. 1)**

| Parameter                                           | Condition (GHz) | Min. | Typ. | Max. | Units |
|-----------------------------------------------------|-----------------|------|------|------|-------|
| Frequency Range                                     |                 | 0.05 |      | 6.0  | GHz   |
| DC Voltage (V <sub>d</sub> )                        |                 |      | 5.0  |      | V     |
| DC Current (I <sub>d</sub> ) <sup>(6)</sup>         |                 | 12   | 20   | 40   | mA    |
| DC Current (I <sub>Rbias</sub> )                    |                 |      | 0.6  |      | mA    |
| Noise Figure                                        | 0.05            |      | 1.7  | —    | dB    |
|                                                     | 0.5             |      | 0.8  | —    |       |
|                                                     | 1.0             |      | 0.9  | —    |       |
|                                                     | 2.0             |      | 1.0  | 1.3  |       |
|                                                     | 3.0             |      | 1.4  | —    |       |
|                                                     | 4.0             |      | 1.8  | —    |       |
|                                                     | 5.0             |      | 2.0  | —    |       |
|                                                     | 6.0             |      | 2.5  | —    |       |
| Gain                                                | 0.05            | —    | 23.6 | —    | dB    |
|                                                     | 0.5             | —    | 21.7 | —    |       |
|                                                     | 1.0             | —    | 18.4 | —    |       |
|                                                     | 2.0             | 12.1 | 13.5 | 14.9 |       |
|                                                     | 3.0             | —    | 10.4 | —    |       |
|                                                     | 4.0             | —    | 8.5  | —    |       |
|                                                     | 5.0             | —    | 6.6  | —    |       |
|                                                     | 6.0             | —    | 5.2  | —    |       |
| Input Return Loss                                   | 0.05-0.5        |      | 9.0  |      | dB    |
|                                                     | 0.5-6           |      | 6.0  |      |       |
| Output Return Loss                                  | 0.05-0.5        |      | 12.0 |      | dB    |
|                                                     | 0.5-6           |      | 18.0 |      |       |
| Output IP3                                          | 0.05            |      | 24.6 |      | dBm   |
|                                                     | 0.5             |      | 25.6 |      |       |
|                                                     | 1.0             |      | 26.5 |      |       |
|                                                     | 2.0             |      | 28.1 |      |       |
|                                                     | 3.0             |      | 28.8 |      |       |
|                                                     | 4.0             |      | 28.3 |      |       |
|                                                     | 5.0             |      | 29.3 |      |       |
|                                                     | 6.0             |      | 29.8 |      |       |
| Output Power @ 1 dB compression <sup>(2)</sup>      | 0.05            |      | 12.0 |      | dBm   |
|                                                     | 0.5             |      | 15.5 |      |       |
|                                                     | 1.0             |      | 15.6 |      |       |
|                                                     | 2.0             |      | 14.6 |      |       |
|                                                     | 3.0             |      | 15.2 |      |       |
|                                                     | 4.0             |      | 13.8 |      |       |
|                                                     | 5.0             |      | 16.0 |      |       |
|                                                     | 6.0             |      | 15.8 |      |       |
| DC Current Variation vs. Temperature <sup>(3)</sup> |                 |      | -0.1 |      | mA/°C |
| Thermal Resistance                                  |                 |      | 128  |      | °C/W  |

**Absolute Maximum Ratings<sup>(4)</sup>**

| Parameter                            | Ratings        |
|--------------------------------------|----------------|
| Operating Temperature <sup>(5)</sup> | -40°C to 85°C  |
| Storage Temperature                  | -55°C to 100°C |
| Channel Temperature                  | 150°C          |
| DC Voltage (Pad 6)                   | 6V             |
| Power Dissipation                    | 500mW          |
| DC Current (Pad 6)                   | 60mA           |
| Bias Current (Pad 7)                 | 10mA           |
| Input Power <sup>(7)</sup>           | 20dBm          |

<sup>(1)</sup> Measured on Mini-Circuits Characterization test board TB-502+. See Characterization Test Circuit (Fig. 1)

<sup>(2)</sup> P1dB specified with external current limiting of 30mA; Capable of higher P1dB at higher current (see Fig.2)

<sup>(3)</sup> (Current at 85°C - Current at -45°C)/130

<sup>(4)</sup> Permanent damage may occur if any of these limits are exceeded. These maximum ratings are not intended for continuous normal operation.

<sup>(5)</sup> Defined with reference to ground pad temperature.

<sup>(6)</sup> Specified DC current consumption is under small signal conditions. Current will increase with input RF Power. To maintain maximum current consumption, external DC current limiting circuits are required on Vd line.

<sup>(7)</sup> Maximum input power is specified based upon external Vd current limiting of 40 mA. Maximum input power will degrade without external current limiting.

**Notes**

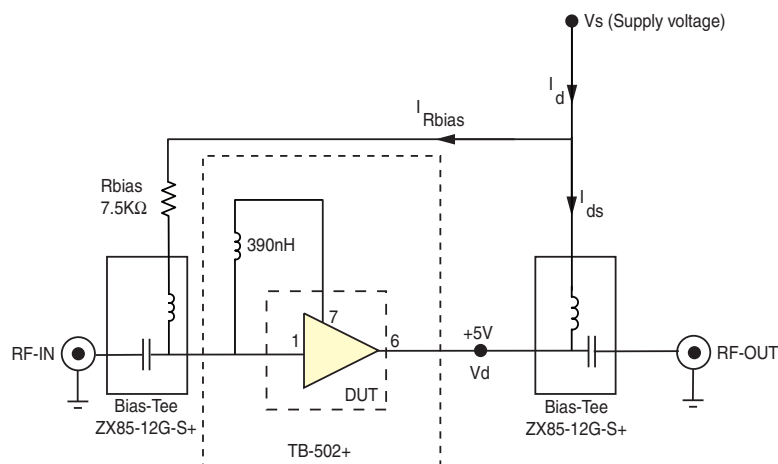
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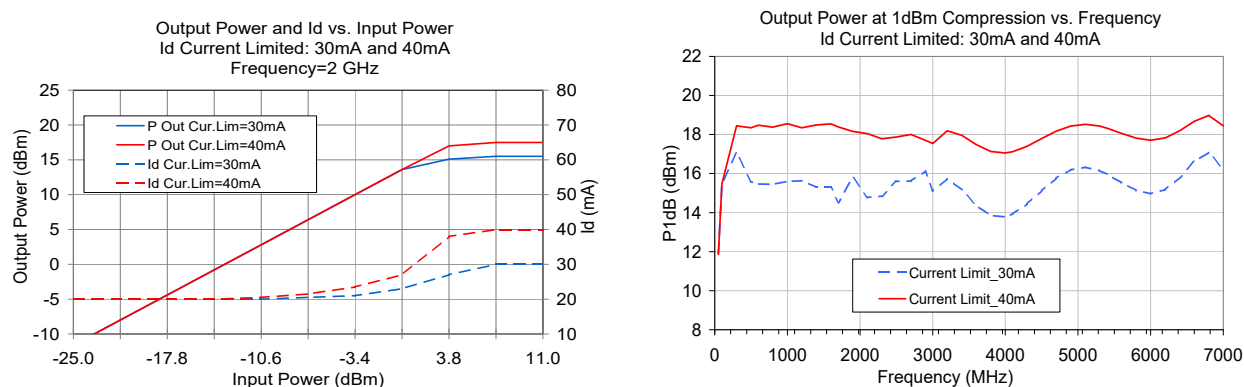
## Characterization Test Circuit



**Fig 1.** Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization Test Board TB-502+) Gain, Output power at 1dB compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X Microwave network analyzer.

Conditions:

1. Gain: Pin=-25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.
3. Vs adjusted for 5V at device (Vd), compensating loss of bias tee.



**Fig 2.** Output Power and Id vs. Input Power and Frequency. Performance measured on Mini-Circuits Characterization test board TB-502+. See Characterization Test Circuit (Fig. 1) Measurements performed with current (Id) limited as noted.

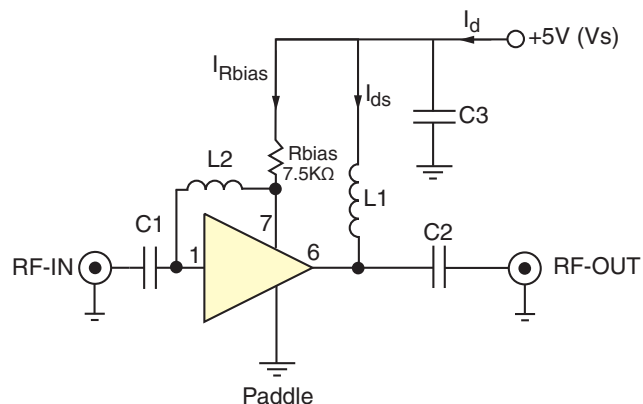
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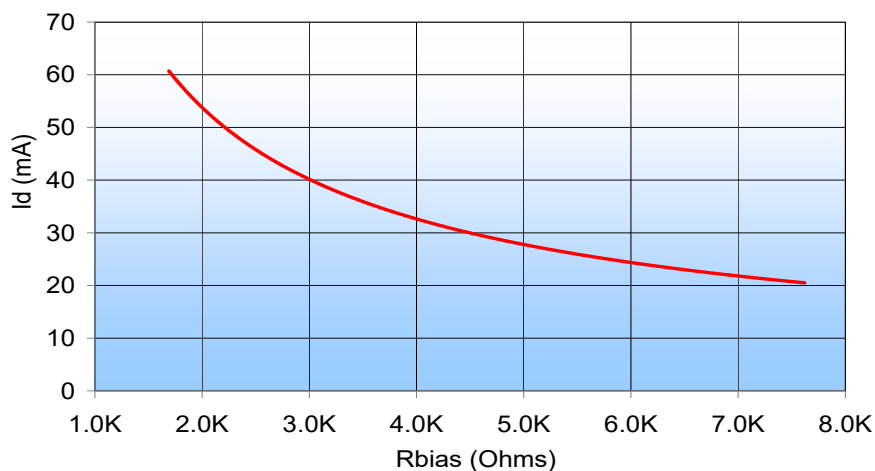
**Recommended Application Circuit**

(refer to evaluation board for PCB Layout and component values)



**Fig 3. Recommended Application Circuit**  
 Note: Resistance of L1, 0.1-0.2Ω typically

Typical Current ( $I_d$ ) as a function of  $R_{bias}$   
 ( $V_d = 5V$ )



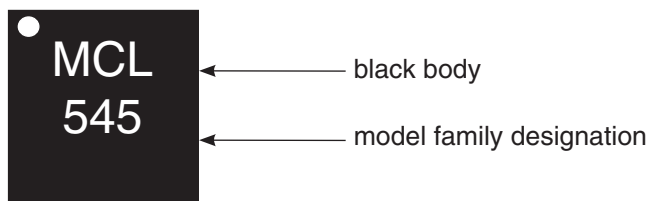
**Fig 4.**  $I_d$  varies as a function of  $R_{bias}$ . The  $I_d$  current range is defined based upon the specific  $R_{bias}$  value noted in the Application Circuit (Fig 3).  $R_{bias}$  may be adjusted to optimize  $I_d$  for a customers' application. RF performance will vary accordingly.

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## Product Marking



Marking may contain other features or characters for internal lot control

## Additional Detailed Technical Information

Additional information is available on our web site [www.minicircuits.com](http://www.minicircuits.com). To access this information enter the model number on our web site home page.

### Performance data, graphs, s-parameter data set (.zip file)

#### Case Style: DQ849

Plastic package, exposed paddle, lead finish: tin-silver over nickel

#### Tape & Reel: F104

Standard quantities available on reel: 7" reels with 20, 50, 100, 200, 500, 1K, or 2K devices.

#### Suggested Layout for PCB Design: PL-299

#### Evaluation Board: TB-501-4+ (50-5000 MHz)

#### Environmental Ratings: ENV08T1

## ESD Rating

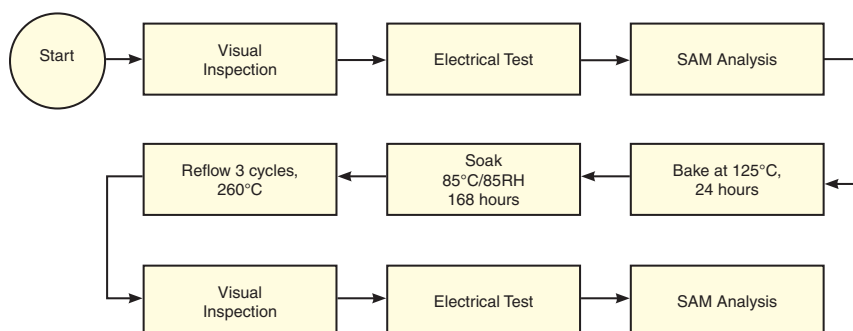
Human Body Model (HBM): Class 1A (250V to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (<100V) in accordance with ANSI/ESD STM5.2-1999; passes 40V

## MSL Rating

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

## MSL Test Flow Chart



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## 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 = 5V, Rbias=7.5K ohms, Id=21 mA @ Temperature =25degC

| FREQ   | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output (1) |                    | Noise Figure |
|--------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|----------------------|--------------------|--------------|
|        |       |           |                   |                    |           |         |             | Current Limit 30mA   | Current Limit 40mA |              |
| (MHz)  | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)                |                    | (dB)         |
| 50.0   | 23.35 | 29.51     | 9.73              | 8.89               | 1.09      | 0.67    | 24.71       | 11.90                | 11.86              | 1.40         |
| 100.0  | 23.55 | 28.98     | 8.68              | 11.74              | 1.07      | 0.72    | 24.98       | 15.48                | 15.49              | 0.90         |
| 300.0  | 22.82 | 27.85     | 7.86              | 14.60              | 1.00      | 0.81    | 25.35       | 17.08                | 18.45              | 0.66         |
| 500.0  | 21.55 | 26.85     | 7.24              | 16.15              | 0.97      | 0.90    | 24.89       | 15.60                | 18.35              | 0.63         |
| 600.0  | 20.86 | 26.40     | 6.99              | 16.98              | 0.97      | 0.94    | 25.50       | 15.46                | 18.48              | 0.73         |
| 800.0  | 19.48 | 25.50     | 6.57              | 18.45              | 0.97      | 1.00    | 26.03       | 15.45                | 18.38              | 0.73         |
| 1000.0 | 18.20 | 24.72     | 6.30              | 20.05              | 0.99      | 1.04    | 26.30       | 15.60                | 18.56              | 0.76         |
| 1200.0 | 17.03 | 24.07     | 6.05              | 21.57              | 1.02      | 1.08    | 27.25       | 15.63                | 18.35              | 0.85         |
| 1400.0 | 15.98 | 23.37     | 5.91              | 22.66              | 1.04      | 1.10    | 26.73       | 15.30                | 18.49              | 0.92         |
| 1600.0 | 15.01 | 22.71     | 5.76              | 23.81              | 1.06      | 1.12    | 27.11       | 15.29                | 18.54              | 1.06         |
| 1700.0 | 14.55 | 22.46     | 5.69              | 24.18              | 1.07      | 1.13    | 27.15       | 14.52                | 18.39              | 0.80         |
| 1900.0 | 13.76 | 21.76     | 5.68              | 24.54              | 1.08      | 1.13    | 27.63       | 15.80                | 18.16              | 0.98         |
| 2100.0 | 13.00 | 21.22     | 5.60              | 25.15              | 1.10      | 1.14    | 27.71       | 14.78                | 18.05              | 1.07         |
| 2300.0 | 12.33 | 20.70     | 5.60              | 25.29              | 1.11      | 1.14    | 27.68       | 14.84                | 17.78              | 1.17         |
| 2500.0 | 11.65 | 20.26     | 5.84              | 25.94              | 1.16      | 1.14    | 27.93       | 15.60                | 17.87              | 1.10         |
| 2700.0 | 10.95 | 19.77     | 5.51              | 23.78              | 1.14      | 1.16    | 27.89       | 15.62                | 18.00              | 1.40         |
| 2900.0 | 10.57 | 19.11     | 5.70              | 25.02              | 1.14      | 1.14    | 28.24       | 16.13                | 17.70              | 1.25         |
| 3000.0 | 10.32 | 18.86     | 5.79              | 25.08              | 1.15      | 1.14    | 28.19       | 15.10                | 17.53              | 1.16         |
| 3200.0 | 9.84  | 18.40     | 5.84              | 24.99              | 1.15      | 1.13    | 28.43       | 15.74                | 18.19              | 1.26         |
| 3400.0 | 9.41  | 17.93     | 6.05              | 24.86              | 1.16      | 1.12    | 28.27       | 15.17                | 17.96              | 1.26         |
| 3600.0 | 9.01  | 17.47     | 6.23              | 24.47              | 1.17      | 1.11    | 28.24       | 14.37                | 17.48              | 1.39         |
| 3800.0 | 8.63  | 17.02     | 6.36              | 23.85              | 1.17      | 1.10    | 28.25       | 13.85                | 17.14              | 1.49         |
| 4000.0 | 8.29  | 16.60     | 6.60              | 23.13              | 1.18      | 1.09    | 28.10       | 13.79                | 17.05              | 1.48         |
| 4100.0 | 8.08  | 16.43     | 6.65              | 22.84              | 1.19      | 1.08    | 28.28       | 13.92                | 17.12              | 1.41         |
| 4300.0 | 7.62  | 16.15     | 6.77              | 22.44              | 1.21      | 1.08    | 27.20       | 14.44                | 17.40              | 1.60         |
| 4500.0 | 7.31  | 15.69     | 6.93              | 22.77              | 1.21      | 1.06    | 27.56       | 15.13                | 17.79              | 1.67         |
| 4700.0 | 6.88  | 15.40     | 7.25              | 22.74              | 1.25      | 1.05    | 27.64       | 15.77                | 18.17              | 1.80         |
| 4900.0 | 6.64  | 15.01     | 6.79              | 23.23              | 1.21      | 1.07    | 28.93       | 16.20                | 18.44              | 1.84         |
| 5100.0 | 6.45  | 14.62     | 6.63              | 22.68              | 1.19      | 1.06    | 29.44       | 16.33                | 18.53              | 1.74         |
| 5300.0 | 6.18  | 14.30     | 6.44              | 22.35              | 1.17      | 1.07    | 29.40       | 16.15                | 18.43              | 1.91         |
| 5400.0 | 6.04  | 14.15     | 6.38              | 21.83              | 1.17      | 1.07    | 28.92       | 15.97                | 18.33              | 1.84         |
| 5600.0 | 5.77  | 13.85     | 6.26              | 20.90              | 1.17      | 1.06    | 29.19       | 15.53                | 18.06              | 2.06         |
| 5800.0 | 5.48  | 13.61     | 6.11              | 19.84              | 1.16      | 1.07    | 29.55       | 15.13                | 17.81              | 2.11         |
| 6000.0 | 5.22  | 13.35     | 5.87              | 19.28              | 1.15      | 1.07    | 29.66       | 14.96                | 17.70              | 2.17         |
| 6200.0 | 4.93  | 13.12     | 5.63              | 18.26              | 1.14      | 1.08    | 29.68       | 15.18                | 17.82              | 2.21         |
| 6400.0 | 4.66  | 12.92     | 5.42              | 17.78              | 1.13      | 1.09    | 29.53       | 15.80                | 18.19              | 2.44         |
| 6600.0 | 4.36  | 12.74     | 5.25              | 16.90              | 1.14      | 1.09    | 28.96       | 16.62                | 18.68              | 2.29         |
| 6800.0 | 4.01  | 12.62     | 5.10              | 16.33              | 1.15      | 1.10    | 29.19       | 17.09                | 18.97              | 2.42         |
| 7000.0 | 3.51  | 12.63     | 5.49              | 15.58              | 1.24      | 1.08    | 32.04       | 16.20                | 18.45              | 3.02         |

(1) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

*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 = 5V, Rbias=7.5K ohms, Id=25 mA @ Temperature = -45degC

| FREQ   | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |         | IP-3<br>Output | Noise<br>Figure |
|--------|-------|-----------|-------------------------|--------------------------|-----------|---------|----------------|-----------------|
| (MHz)  | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Measure | (dBm)          | (dB)            |
| 50.0   | 24.12 | 29.29     | 11.17                   | 10.19                    | 1.05      | 0.65    | 25.34          | 1.20            |
| 100.0  | 24.09 | 29.04     | 10.58                   | 14.62                    | 1.07      | 0.72    | 26.01          | 0.90            |
| 300.0  | 23.28 | 28.13     | 9.40                    | 20.18                    | 1.04      | 0.79    | 26.48          | 0.57            |
| 500.0  | 22.01 | 27.26     | 8.29                    | 22.35                    | 1.03      | 0.87    | 26.08          | 0.46            |
| 600.0  | 21.33 | 26.83     | 7.84                    | 23.43                    | 1.03      | 0.90    | 26.80          | 0.52            |
| 800.0  | 19.97 | 25.97     | 7.21                    | 25.17                    | 1.03      | 0.96    | 27.37          | 0.54            |
| 1000.0 | 18.69 | 25.13     | 6.77                    | 27.43                    | 1.05      | 1.00    | 27.80          | 0.53            |
| 1200.0 | 17.52 | 24.34     | 6.43                    | 28.62                    | 1.06      | 1.03    | 28.65          | 0.66            |
| 1400.0 | 16.48 | 23.58     | 6.21                    | 30.04                    | 1.07      | 1.05    | 28.11          | 0.69            |
| 1600.0 | 15.51 | 22.88     | 6.02                    | 29.60                    | 1.08      | 1.07    | 28.49          | 0.74            |
| 1700.0 | 15.06 | 22.50     | 5.93                    | 30.11                    | 1.08      | 1.08    | 28.52          | 0.72            |
| 1900.0 | 14.26 | 21.84     | 5.87                    | 29.27                    | 1.09      | 1.08    | 29.02          | 0.65            |
| 2100.0 | 13.51 | 21.15     | 5.77                    | 29.67                    | 1.09      | 1.09    | 29.09          | 0.67            |
| 2300.0 | 12.86 | 20.56     | 5.76                    | 29.09                    | 1.10      | 1.09    | 29.04          | 0.83            |
| 2500.0 | 12.15 | 20.13     | 6.00                    | 31.98                    | 1.14      | 1.09    | 29.26          | 0.82            |
| 2700.0 | 11.36 | 19.65     | 5.64                    | 25.08                    | 1.13      | 1.13    | 29.21          | 1.13            |
| 2900.0 | 11.10 | 18.84     | 5.80                    | 28.60                    | 1.10      | 1.09    | 29.62          | 0.83            |
| 3000.0 | 10.85 | 18.62     | 5.90                    | 29.24                    | 1.11      | 1.09    | 29.55          | 0.85            |
| 3200.0 | 10.38 | 18.11     | 6.00                    | 28.80                    | 1.11      | 1.08    | 29.81          | 0.82            |
| 3400.0 | 9.95  | 17.63     | 6.18                    | 29.95                    | 1.12      | 1.07    | 29.62          | 0.87            |
| 3600.0 | 9.56  | 17.15     | 6.36                    | 28.85                    | 1.12      | 1.06    | 29.58          | 0.86            |
| 3800.0 | 9.18  | 16.67     | 6.47                    | 28.78                    | 1.12      | 1.05    | 29.67          | 1.01            |
| 4000.0 | 8.85  | 16.22     | 6.75                    | 27.09                    | 1.12      | 1.03    | 29.41          | 1.00            |
| 4100.0 | 8.64  | 16.05     | 6.78                    | 26.99                    | 1.13      | 1.03    | 29.69          | 1.06            |
| 4300.0 | 8.19  | 15.75     | 6.86                    | 25.09                    | 1.15      | 1.03    | 28.32          | 1.14            |
| 4500.0 | 7.86  | 15.30     | 7.01                    | 25.44                    | 1.15      | 1.02    | 28.58          | 1.03            |
| 4700.0 | 7.46  | 15.00     | 7.21                    | 23.77                    | 1.17      | 1.01    | 28.77          | 1.28            |
| 4900.0 | 7.08  | 14.72     | 6.97                    | 24.39                    | 1.18      | 1.02    | 29.96          | 1.33            |
| 5100.0 | 6.97  | 14.26     | 6.66                    | 22.91                    | 1.13      | 1.01    | 30.66          | 1.29            |
| 5300.0 | 6.70  | 13.94     | 6.44                    | 22.62                    | 1.12      | 1.02    | 30.72          | 1.37            |
| 5400.0 | 6.55  | 13.80     | 6.34                    | 21.39                    | 1.12      | 1.02    | 30.17          | 1.29            |
| 5600.0 | 6.28  | 13.51     | 6.25                    | 20.47                    | 1.11      | 1.02    | 30.47          | 1.34            |
| 5800.0 | 5.99  | 13.25     | 6.07                    | 19.27                    | 1.11      | 1.02    | 30.73          | 1.49            |
| 6000.0 | 5.73  | 13.02     | 5.89                    | 18.76                    | 1.10      | 1.02    | 30.86          | 1.65            |
| 6200.0 | 5.44  | 12.80     | 5.59                    | 17.68                    | 1.09      | 1.03    | 30.95          | 1.46            |
| 6400.0 | 5.18  | 12.57     | 5.40                    | 17.15                    | 1.08      | 1.04    | 30.78          | 1.39            |
| 6600.0 | 4.88  | 12.38     | 5.17                    | 16.05                    | 1.08      | 1.04    | 30.67          | 1.57            |
| 6800.0 | 4.58  | 12.26     | 4.98                    | 15.70                    | 1.08      | 1.05    | 30.71          | 1.78            |
| 7000.0 | 4.14  | 12.22     | 5.10                    | 14.64                    | 1.13      | 1.04    | 30.94          | 2.18            |

*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 = 5V, Rbias=7.5K ohms, Id=18 mA @ Temperature = +85degC

| FREQ   | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |         | IP-3<br>Output | Noise<br>Figure |
|--------|-------|-----------|-------------------------|--------------------------|-----------|---------|----------------|-----------------|
| (MHz)  | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Measure | (dBm)          | (dB)            |
| 50.0   | 22.39 | 30.92     | 8.56                    | 7.45                     | 1.24      | 0.71    | 24.62          | 1.60            |
| 100.0  | 22.77 | 28.97     | 7.24                    | 9.30                     | 1.07      | 0.71    | 24.54          | 1.10            |
| 300.0  | 22.16 | 27.62     | 6.66                    | 11.26                    | 0.97      | 0.82    | 24.82          | 0.84            |
| 500.0  | 20.92 | 26.26     | 6.33                    | 12.54                    | 0.91      | 0.91    | 24.22          | 0.82            |
| 600.0  | 20.26 | 25.78     | 6.22                    | 13.28                    | 0.90      | 0.95    | 24.76          | 0.91            |
| 800.0  | 18.89 | 24.91     | 6.00                    | 14.57                    | 0.91      | 1.02    | 25.20          | 0.91            |
| 1000.0 | 17.64 | 24.19     | 5.85                    | 15.87                    | 0.93      | 1.07    | 25.31          | 0.96            |
| 1200.0 | 16.48 | 23.57     | 5.69                    | 17.11                    | 0.96      | 1.11    | 26.35          | 1.09            |
| 1400.0 | 15.45 | 22.99     | 5.60                    | 18.04                    | 1.00      | 1.13    | 25.79          | 1.15            |
| 1600.0 | 14.49 | 22.40     | 5.50                    | 19.03                    | 1.02      | 1.15    | 26.19          | 1.09            |
| 1700.0 | 14.03 | 22.22     | 5.44                    | 19.30                    | 1.04      | 1.16    | 26.24          | 1.15            |
| 1900.0 | 13.24 | 21.66     | 5.44                    | 19.83                    | 1.07      | 1.17    | 26.71          | 1.21            |
| 2100.0 | 12.49 | 21.12     | 5.38                    | 20.46                    | 1.08      | 1.18    | 26.79          | 1.27            |
| 2300.0 | 11.82 | 20.69     | 5.40                    | 20.65                    | 1.11      | 1.18    | 26.77          | 1.45            |
| 2500.0 | 11.14 | 20.34     | 5.60                    | 20.97                    | 1.16      | 1.18    | 26.98          | 1.47            |
| 2700.0 | 10.44 | 19.87     | 5.36                    | 20.29                    | 1.16      | 1.20    | 26.95          | 1.77            |
| 2900.0 | 10.05 | 19.27     | 5.53                    | 20.89                    | 1.16      | 1.18    | 27.25          | 1.66            |
| 3000.0 | 9.79  | 19.08     | 5.61                    | 20.93                    | 1.17      | 1.18    | 27.26          | 1.58            |
| 3200.0 | 9.31  | 18.62     | 5.69                    | 20.88                    | 1.18      | 1.17    | 27.45          | 1.66            |
| 3400.0 | 8.87  | 18.24     | 5.89                    | 20.97                    | 1.21      | 1.16    | 27.33          | 1.68            |
| 3600.0 | 8.47  | 17.80     | 6.06                    | 20.74                    | 1.22      | 1.15    | 27.31          | 1.79            |
| 3800.0 | 8.10  | 17.37     | 6.20                    | 20.30                    | 1.22      | 1.14    | 27.27          | 1.74            |
| 4000.0 | 7.75  | 16.97     | 6.42                    | 19.97                    | 1.23      | 1.13    | 27.20          | 1.85            |
| 4100.0 | 7.54  | 16.81     | 6.46                    | 19.82                    | 1.24      | 1.12    | 27.38          | 1.84            |
| 4300.0 | 7.08  | 16.54     | 6.58                    | 19.71                    | 1.27      | 1.12    | 26.44          | 2.05            |
| 4500.0 | 6.78  | 16.10     | 6.75                    | 20.23                    | 1.28      | 1.11    | 26.83          | 2.34            |
| 4700.0 | 6.37  | 15.79     | 7.03                    | 20.45                    | 1.32      | 1.09    | 26.84          | 2.38            |
| 4900.0 | 6.11  | 15.41     | 6.69                    | 20.90                    | 1.28      | 1.10    | 27.92          | 2.36            |
| 5100.0 | 5.92  | 15.02     | 6.47                    | 20.75                    | 1.25      | 1.11    | 28.43          | 2.41            |
| 5300.0 | 5.67  | 14.67     | 6.30                    | 20.65                    | 1.23      | 1.11    | 28.38          | 2.46            |
| 5400.0 | 5.54  | 14.53     | 6.27                    | 20.39                    | 1.23      | 1.11    | 27.93          | 2.47            |
| 5600.0 | 5.28  | 14.22     | 6.17                    | 19.96                    | 1.22      | 1.11    | 28.20          | 2.63            |
| 5800.0 | 4.99  | 13.96     | 5.96                    | 19.46                    | 1.21      | 1.12    | 28.65          | 2.72            |
| 6000.0 | 4.72  | 13.69     | 5.78                    | 18.83                    | 1.20      | 1.12    | 28.70          | 2.82            |
| 6200.0 | 4.44  | 13.49     | 5.57                    | 18.05                    | 1.19      | 1.13    | 28.73          | 2.85            |
| 6400.0 | 4.17  | 13.24     | 5.37                    | 17.90                    | 1.18      | 1.14    | 28.64          | 3.04            |
| 6600.0 | 3.87  | 13.07     | 5.21                    | 17.14                    | 1.18      | 1.14    | 28.58          | 3.05            |
| 6800.0 | 3.54  | 12.96     | 5.08                    | 16.85                    | 1.20      | 1.15    | 28.60          | 3.28            |
| 7000.0 | 3.07  | 12.92     | 5.35                    | 16.03                    | 1.28      | 1.13    | 29.51          | 3.81            |

## 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 = 5V, Id=20mA @ Temperature = +25degC (1)

| FREQ   | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output (2) |                    | FREQ   | Noise Figure |
|--------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|----------------------|--------------------|--------|--------------|
|        |       |           |                   |                    |           |         |             | Current Limit 30mA   | Current Limit 40mA |        |              |
| (MHz)  | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)                |                    | (MHz)  | (dB)         |
| 50.0   | 22.91 | 29.72     | 9.57              | 8.26               | 1.13      | 0.67    | 23.72       | 11.90                | 11.86              | 50.0   | 1.36         |
| 100.0  | 23.21 | 28.87     | 8.52              | 10.84              | 1.08      | 0.71    | 24.06       | 15.48                | 15.49              | 100.0  | 0.90         |
| 300.0  | 22.58 | 27.72     | 7.58              | 13.25              | 1.00      | 0.80    | 24.20       | 17.08                | 18.45              | 400.0  | 0.71         |
| 500.0  | 21.38 | 26.64     | 6.97              | 14.77              | 0.95      | 0.89    | 24.33       | 15.60                | 18.35              | 600.0  | 0.73         |
| 600.0  | 20.71 | 26.22     | 6.68              | 15.60              | 0.95      | 0.94    | 24.56       | 15.46                | 18.48              | 800.0  | 0.80         |
| 800.0  | 19.37 | 25.32     | 6.26              | 17.21              | 0.95      | 1.01    | 24.91       | 15.45                | 18.38              | 1100.0 | 0.87         |
| 1000.0 | 18.10 | 24.62     | 5.98              | 18.80              | 0.97      | 1.06    | 25.07       | 15.60                | 18.56              | 1300.0 | 0.90         |
| 1200.0 | 16.94 | 23.94     | 5.76              | 20.29              | 0.99      | 1.10    | 26.01       | 15.63                | 18.35              | 1600.0 | 0.99         |
| 1400.0 | 15.88 | 23.34     | 5.61              | 21.62              | 1.02      | 1.12    | 25.69       | 15.30                | 18.49              | 1800.0 | 1.14         |
| 1600.0 | 14.94 | 22.70     | 5.51              | 22.84              | 1.04      | 1.14    | 26.15       | 15.29                | 18.54              | 2000.0 | 0.95         |
| 1700.0 | 14.49 | 22.42     | 5.45              | 23.37              | 1.05      | 1.15    | 26.76       | 14.52                | 18.39              | 2300.0 | 1.10         |
| 1900.0 | 13.69 | 21.84     | 5.43              | 24.02              | 1.07      | 1.15    | 26.17       | 15.80                | 18.16              | 2500.0 | 1.13         |
| 2100.0 | 12.96 | 21.26     | 5.40              | 24.61              | 1.08      | 1.16    | 25.80       | 14.78                | 18.05              | 2700.0 | 1.69         |
| 2300.0 | 12.31 | 20.69     | 5.44              | 24.86              | 1.09      | 1.16    | 26.28       | 14.84                | 17.78              | 3000.0 | 1.25         |
| 2500.0 | 11.71 | 20.11     | 5.52              | 24.72              | 1.10      | 1.15    | 26.64       | 15.60                | 17.87              | 3200.0 | 1.30         |
| 2700.0 | 10.87 | 19.88     | 5.39              | 22.65              | 1.14      | 1.18    | 26.81       | 15.62                | 18.00              | 3400.0 | 1.34         |
| 2900.0 | 10.62 | 19.10     | 5.57              | 24.73              | 1.12      | 1.15    | 26.75       | 16.13                | 17.70              | 3700.0 | 1.40         |
| 3000.0 | 10.40 | 18.85     | 5.65              | 24.55              | 1.12      | 1.15    | 27.03       | 15.10                | 17.53              | 3900.0 | 1.49         |
| 3200.0 | 9.97  | 18.33     | 5.77              | 24.08              | 1.12      | 1.14    | 26.71       | 15.74                | 18.19              | 4100.0 | 1.53         |
| 3400.0 | 9.56  | 17.83     | 5.91              | 23.75              | 1.12      | 1.12    | 27.59       | 15.17                | 17.96              | 4400.0 | 1.69         |
| 3600.0 | 9.18  | 17.37     | 6.03              | 23.47              | 1.13      | 1.11    | 27.62       | 14.37                | 17.48              | 4600.0 | 1.78         |
| 3800.0 | 8.80  | 16.92     | 6.16              | 23.06              | 1.13      | 1.10    | 27.46       | 13.85                | 17.14              | 4900.0 | 2.11         |
| 4000.0 | 8.44  | 16.49     | 6.25              | 22.53              | 1.13      | 1.10    | 26.60       | 13.79                | 17.05              | 5100.0 | 1.93         |
| 4100.0 | 8.24  | 16.31     | 6.29              | 22.09              | 1.13      | 1.09    | 27.08       | 13.92                | 17.12              | 5300.0 | 2.10         |
| 4300.0 | 7.83  | 16.00     | 6.25              | 21.51              | 1.14      | 1.09    | 26.09       | 14.44                | 17.40              | 5600.0 | 2.32         |
| 4500.0 | 7.53  | 15.62     | 6.21              | 21.59              | 1.14      | 1.09    | 27.37       | 15.13                | 17.79              | 5800.0 | 2.27         |
| 4700.0 | 7.19  | 15.28     | 6.30              | 21.25              | 1.15      | 1.08    | 26.95       | 15.77                | 18.17              | 6000.0 | 2.49         |
| 4900.0 | 6.64  | 15.12     | 6.63              | 21.21              | 1.22      | 1.07    | 27.46       | 16.20                | 18.44              | 6400.0 | 2.66         |
| 5100.0 | 6.55  | 14.60     | 5.86              | 20.90              | 1.13      | 1.09    | 27.55       | 16.33                | 18.53              | 6600.0 | 2.78         |
| 5300.0 | 6.29  | 14.29     | 5.66              | 20.17              | 1.11      | 1.10    | 27.91       | 16.15                | 18.43              | 6800.0 | 2.94         |
| 5400.0 | 6.15  | 14.12     | 5.58              | 19.75              | 1.10      | 1.10    | 27.18       | 15.97                | 18.33              | 7000.0 | 3.06         |
| 5600.0 | 5.86  | 13.86     | 5.42              | 19.02              | 1.10      | 1.10    | 27.66       | 15.53                | 18.06              |        |              |
| 5800.0 | 5.57  | 13.62     | 5.24              | 18.33              | 1.09      | 1.11    | 28.57       | 15.13                | 17.81              |        |              |
| 6000.0 | 5.27  | 13.37     | 5.14              | 17.69              | 1.09      | 1.11    | 28.18       | 14.96                | 17.70              |        |              |
| 6200.0 | 5.00  | 13.14     | 4.92              | 17.13              | 1.08      | 1.12    | 27.61       | 15.18                | 17.82              |        |              |
| 6400.0 | 4.74  | 12.88     | 4.75              | 16.63              | 1.07      | 1.12    | 27.96       | 15.80                | 18.19              |        |              |
| 6600.0 | 4.46  | 12.70     | 4.61              | 16.18              | 1.06      | 1.13    | 28.41       | 16.62                | 18.68              |        |              |
| 6800.0 | 4.17  | 12.52     | 4.49              | 15.75              | 1.07      | 1.13    | 28.11       | 17.09                | 18.97              |        |              |
| 7000.0 | 3.82  | 12.43     | 4.47              | 15.22              | 1.09      | 1.13    | 28.05       | 16.20                | 18.45              |        |              |

(1) External Rbias resistor is adjusted to obtain desired current

(2) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

## 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 = 5V, Id=24 mA @ Temperature = +25degC (1)

| FREQ   | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output (2) |                    | FREQ   | Noise Figure |
|--------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|----------------------|--------------------|--------|--------------|
|        |       |           |                   |                    |           |         |             | Current Limit 30mA   | Current Limit 40mA |        |              |
| (MHz)  | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)                |                    | (MHz)  | (dB)         |
| 50.0   | 23.57 | 30.30     | 9.89              | 8.95               | 1.15      | 0.68    | 24.96       | 11.90                | 11.86              | 50.0   | 1.33         |
| 100.0  | 23.79 | 29.21     | 9.01              | 12.05              | 1.08      | 0.72    | 25.30       | 15.48                | 15.49              | 100.0  | 0.87         |
| 300.0  | 23.06 | 28.09     | 8.02              | 14.99              | 1.01      | 0.81    | 25.43       | 17.08                | 18.45              | 400.0  | 0.67         |
| 500.0  | 21.78 | 27.09     | 7.27              | 16.72              | 0.98      | 0.90    | 25.74       | 15.60                | 18.35              | 600.0  | 0.72         |
| 600.0  | 21.09 | 26.59     | 6.94              | 17.64              | 0.97      | 0.94    | 26.00       | 15.46                | 18.48              | 800.0  | 0.76         |
| 800.0  | 19.70 | 25.72     | 6.46              | 19.48              | 0.97      | 1.00    | 26.43       | 15.45                | 18.38              | 1100.0 | 0.82         |
| 1000.0 | 18.40 | 24.94     | 6.14              | 21.31              | 0.99      | 1.05    | 26.65       | 15.60                | 18.56              | 1300.0 | 0.87         |
| 1200.0 | 17.22 | 24.26     | 5.92              | 23.04              | 1.02      | 1.08    | 27.58       | 15.63                | 18.35              | 1600.0 | 0.95         |
| 1400.0 | 16.15 | 23.52     | 5.75              | 24.75              | 1.04      | 1.10    | 27.31       | 15.30                | 18.49              | 1800.0 | 1.06         |
| 1600.0 | 15.19 | 22.87     | 5.64              | 26.19              | 1.06      | 1.12    | 27.75       | 15.29                | 18.54              | 2000.0 | 0.93         |
| 1700.0 | 14.75 | 22.53     | 5.58              | 26.87              | 1.06      | 1.13    | 28.39       | 14.52                | 18.39              | 2300.0 | 1.02         |
| 1900.0 | 13.93 | 21.90     | 5.56              | 27.44              | 1.08      | 1.13    | 27.80       | 15.80                | 18.16              | 2500.0 | 1.05         |
| 2100.0 | 13.20 | 21.26     | 5.54              | 28.08              | 1.09      | 1.14    | 27.44       | 14.78                | 18.05              | 2700.0 | 1.45         |
| 2300.0 | 12.54 | 20.68     | 5.57              | 28.35              | 1.10      | 1.14    | 27.91       | 14.84                | 17.78              | 3000.0 | 1.15         |
| 2500.0 | 11.94 | 20.09     | 5.66              | 28.04              | 1.11      | 1.13    | 28.29       | 15.60                | 17.87              | 3200.0 | 1.18         |
| 2700.0 | 11.09 | 19.82     | 5.52              | 24.53              | 1.14      | 1.16    | 28.42       | 15.62                | 18.00              | 3400.0 | 1.19         |
| 2900.0 | 10.84 | 19.01     | 5.70              | 27.42              | 1.11      | 1.13    | 28.45       | 16.13                | 17.70              | 3700.0 | 1.30         |
| 3000.0 | 10.62 | 18.76     | 5.78              | 27.19              | 1.12      | 1.12    | 28.65       | 15.10                | 17.53              | 3900.0 | 1.39         |
| 3200.0 | 10.18 | 18.23     | 5.91              | 26.57              | 1.12      | 1.11    | 28.33       | 15.74                | 18.19              | 4100.0 | 1.44         |
| 3400.0 | 9.77  | 17.71     | 6.04              | 26.07              | 1.12      | 1.10    | 29.20       | 15.17                | 17.96              | 4400.0 | 1.69         |
| 3600.0 | 9.38  | 17.24     | 6.18              | 25.58              | 1.12      | 1.09    | 29.22       | 14.37                | 17.48              | 4600.0 | 1.73         |
| 3800.0 | 9.00  | 16.77     | 6.31              | 24.99              | 1.12      | 1.08    | 29.05       | 13.85                | 17.14              | 4900.0 | 1.96         |
| 4000.0 | 8.63  | 16.35     | 6.40              | 24.22              | 1.12      | 1.07    | 28.14       | 13.79                | 17.05              | 5100.0 | 1.92         |
| 4100.0 | 8.44  | 16.17     | 6.43              | 23.61              | 1.12      | 1.07    | 28.63       | 13.92                | 17.12              | 5300.0 | 1.83         |
| 4300.0 | 8.02  | 15.84     | 6.39              | 22.63              | 1.13      | 1.07    | 27.65       | 14.44                | 17.40              | 5600.0 | 2.16         |
| 4500.0 | 7.71  | 15.46     | 6.35              | 22.34              | 1.13      | 1.06    | 28.88       | 15.13                | 17.79              | 5800.0 | 2.17         |
| 4700.0 | 7.38  | 15.14     | 6.44              | 21.79              | 1.14      | 1.05    | 28.44       | 15.77                | 18.17              | 6000.0 | 2.23         |
| 4900.0 | 6.83  | 14.96     | 6.75              | 21.41              | 1.20      | 1.04    | 28.99       | 16.20                | 18.44              | 6400.0 | 2.33         |
| 5100.0 | 6.74  | 14.45     | 5.98              | 21.03              | 1.12      | 1.06    | 29.08       | 16.33                | 18.53              | 6600.0 | 2.41         |
| 5300.0 | 6.47  | 14.12     | 5.77              | 20.23              | 1.10      | 1.07    | 29.45       | 16.15                | 18.43              | 6800.0 | 2.70         |
| 5400.0 | 6.33  | 13.98     | 5.69              | 19.78              | 1.10      | 1.07    | 28.62       | 15.97                | 18.33              | 7000.0 | 3.01         |
| 5600.0 | 6.04  | 13.71     | 5.53              | 18.99              | 1.09      | 1.07    | 29.16       | 15.53                | 18.06              |        |              |
| 5800.0 | 5.75  | 13.46     | 5.35              | 18.25              | 1.08      | 1.08    | 30.02       | 15.13                | 17.81              |        |              |
| 6000.0 | 5.45  | 13.24     | 5.24              | 17.55              | 1.08      | 1.08    | 29.65       | 14.96                | 17.70              |        |              |
| 6200.0 | 5.18  | 12.99     | 5.03              | 16.96              | 1.07      | 1.09    | 29.02       | 15.18                | 17.82              |        |              |
| 6400.0 | 4.91  | 12.75     | 4.85              | 16.44              | 1.06      | 1.09    | 28.93       | 15.80                | 18.19              |        |              |
| 6600.0 | 4.63  | 12.56     | 4.71              | 15.96              | 1.06      | 1.10    | 29.71       | 16.62                | 18.68              |        |              |
| 6800.0 | 4.35  | 12.40     | 4.58              | 15.51              | 1.06      | 1.10    | 29.36       | 17.09                | 18.97              |        |              |
| 7000.0 | 3.99  | 12.31     | 4.56              | 14.94              | 1.09      | 1.10    | 29.27       | 16.20                | 18.45              |        |              |

(1) External Rbias resistor is adjusted to obtain desired current

(2) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

## Typical Performance Data

## Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

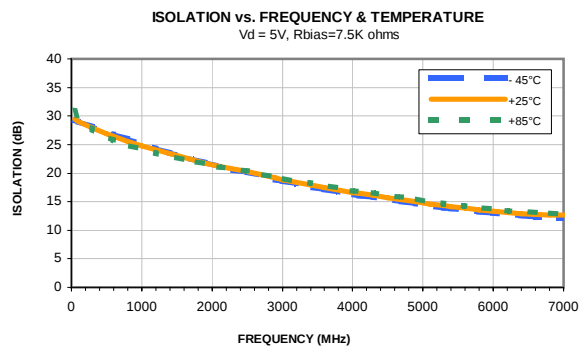
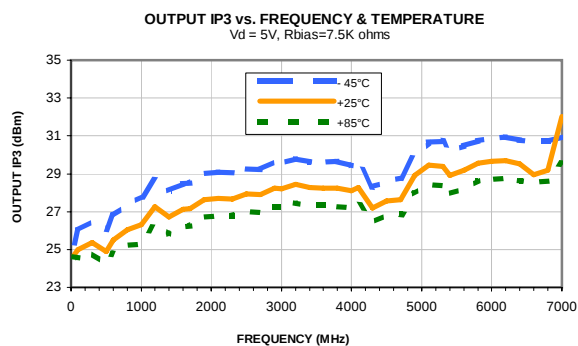
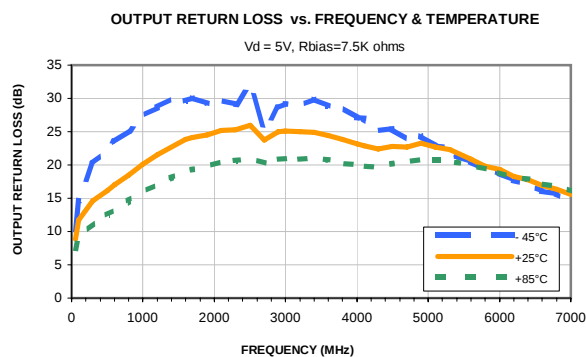
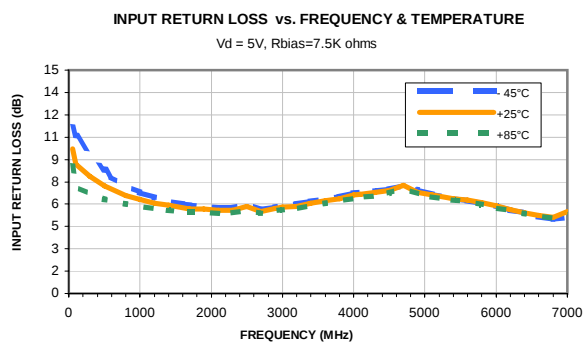
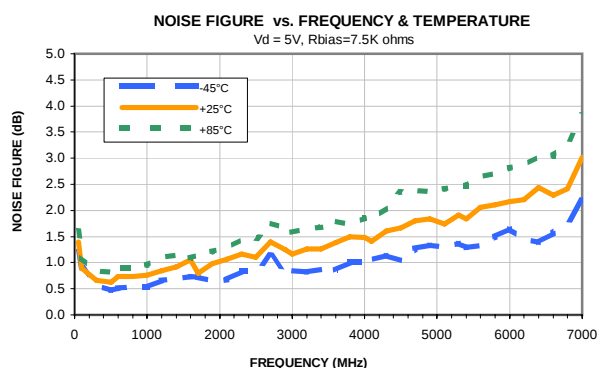
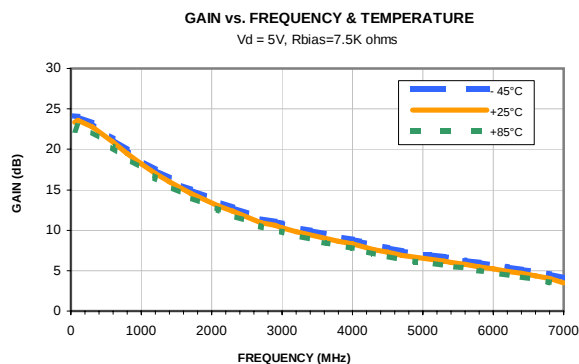
TEST CONDITIONS: Vd = 5V, Id=30 mA @ Temperature = +25degC (1)

| FREQ   | Gain  | Isolation | Input Return Loss | Output Return Loss | Stability |         | IP-3 Output | 1dB Comp. Output (2) |                    | FREQ   | Noise Figure |
|--------|-------|-----------|-------------------|--------------------|-----------|---------|-------------|----------------------|--------------------|--------|--------------|
|        |       |           |                   |                    |           |         |             | Current Limit 30mA   | Current Limit 40mA |        |              |
| (MHz)  | (dB)  | (dB)      | (dB)              | (dB)               | K         | Measure | (dBm)       | (dBm)                |                    | (MHz)  | (dB)         |
| 50.0   | 24.24 | 29.94     | 10.14             | 9.76               | 1.08      | 0.66    | 26.67       | 11.90                | 11.86              | 50.0   | 1.36         |
| 100.0  | 24.36 | 29.52     | 9.59              | 13.46              | 1.07      | 0.73    | 26.95       | 15.48                | 15.49              | 100.0  | 0.90         |
| 300.0  | 23.53 | 28.43     | 8.48              | 17.20              | 1.02      | 0.80    | 27.14       | 17.08                | 18.45              | 400.0  | 0.71         |
| 500.0  | 22.18 | 27.50     | 7.56              | 19.21              | 1.00      | 0.90    | 27.55       | 15.60                | 18.35              | 600.0  | 0.73         |
| 600.0  | 21.46 | 27.01     | 7.19              | 20.28              | 0.99      | 0.93    | 27.86       | 15.46                | 18.48              | 800.0  | 0.80         |
| 800.0  | 20.03 | 26.12     | 6.66              | 22.44              | 1.00      | 0.99    | 28.35       | 15.45                | 18.38              | 1100.0 | 0.87         |
| 1000.0 | 18.70 | 25.26     | 6.31              | 24.69              | 1.02      | 1.04    | 28.55       | 15.60                | 18.56              | 1300.0 | 0.90         |
| 1200.0 | 17.49 | 24.49     | 6.06              | 26.76              | 1.04      | 1.07    | 29.48       | 15.63                | 18.35              | 1600.0 | 0.99         |
| 1400.0 | 16.41 | 23.70     | 5.88              | 28.94              | 1.06      | 1.08    | 29.25       | 15.30                | 18.49              | 1800.0 | 1.14         |
| 1600.0 | 15.44 | 23.02     | 5.77              | 30.54              | 1.07      | 1.10    | 29.70       | 15.29                | 18.54              | 2000.0 | 0.95         |
| 1700.0 | 14.99 | 22.66     | 5.71              | 31.27              | 1.08      | 1.11    | 30.30       | 14.52                | 18.39              | 2300.0 | 1.10         |
| 1900.0 | 14.17 | 21.95     | 5.68              | 31.13              | 1.09      | 1.11    | 29.82       | 15.80                | 18.16              | 2500.0 | 1.13         |
| 2100.0 | 13.43 | 21.29     | 5.67              | 31.72              | 1.09      | 1.11    | 29.44       | 14.78                | 18.05              | 2700.0 | 1.69         |
| 2300.0 | 12.77 | 20.67     | 5.69              | 32.09              | 1.10      | 1.11    | 29.89       | 14.84                | 17.78              | 3000.0 | 1.25         |
| 2500.0 | 12.16 | 20.05     | 5.80              | 31.71              | 1.11      | 1.11    | 30.27       | 15.60                | 17.87              | 3200.0 | 1.30         |
| 2700.0 | 11.30 | 19.77     | 5.65              | 26.11              | 1.14      | 1.14    | 30.38       | 15.62                | 18.00              | 3400.0 | 1.34         |
| 2900.0 | 11.06 | 18.94     | 5.84              | 29.70              | 1.11      | 1.10    | 30.44       | 16.13                | 17.70              | 3700.0 | 1.40         |
| 3000.0 | 10.83 | 18.69     | 5.91              | 29.45              | 1.11      | 1.10    | 30.65       | 15.10                | 17.53              | 3900.0 | 1.49         |
| 3200.0 | 10.39 | 18.10     | 6.04              | 28.88              | 1.11      | 1.08    | 30.38       | 15.74                | 18.19              | 4100.0 | 1.53         |
| 3400.0 | 9.98  | 17.57     | 6.19              | 28.27              | 1.11      | 1.07    | 31.10       | 15.17                | 17.96              | 4400.0 | 1.69         |
| 3600.0 | 9.58  | 17.09     | 6.32              | 27.63              | 1.11      | 1.06    | 31.15       | 14.37                | 17.48              | 4600.0 | 1.78         |
| 3800.0 | 9.20  | 16.63     | 6.45              | 26.76              | 1.11      | 1.05    | 30.92       | 13.85                | 17.14              | 4900.0 | 2.11         |
| 4000.0 | 8.83  | 16.22     | 6.54              | 25.62              | 1.11      | 1.04    | 30.15       | 13.79                | 17.05              | 5100.0 | 1.93         |
| 4100.0 | 8.63  | 16.04     | 6.57              | 24.88              | 1.12      | 1.04    | 30.54       | 13.92                | 17.12              | 5300.0 | 2.10         |
| 4300.0 | 8.21  | 15.69     | 6.53              | 23.47              | 1.12      | 1.04    | 29.64       | 14.44                | 17.40              | 5600.0 | 2.32         |
| 4500.0 | 7.90  | 15.32     | 6.49              | 22.75              | 1.12      | 1.03    | 30.79       | 15.13                | 17.79              | 5800.0 | 2.27         |
| 4700.0 | 7.56  | 15.00     | 6.57              | 21.99              | 1.13      | 1.03    | 30.36       | 15.77                | 18.17              | 6000.0 | 2.49         |
| 4900.0 | 7.01  | 14.81     | 6.87              | 21.27              | 1.19      | 1.02    | 30.87       | 16.20                | 18.44              | 6400.0 | 2.66         |
| 5100.0 | 6.92  | 14.30     | 6.10              | 20.88              | 1.11      | 1.04    | 30.98       | 16.33                | 18.53              | 6600.0 | 2.78         |
| 5300.0 | 6.65  | 13.99     | 5.89              | 20.01              | 1.09      | 1.04    | 31.29       | 16.15                | 18.43              | 6800.0 | 2.94         |
| 5400.0 | 6.51  | 13.84     | 5.80              | 19.54              | 1.09      | 1.04    | 30.53       | 15.97                | 18.33              | 7000.0 | 3.06         |
| 5600.0 | 6.22  | 13.57     | 5.63              | 18.73              | 1.08      | 1.04    | 31.02       | 15.53                | 18.06              |        |              |
| 5800.0 | 5.93  | 13.33     | 5.45              | 17.99              | 1.08      | 1.05    | 31.74       | 15.13                | 17.81              |        |              |
| 6000.0 | 5.62  | 13.09     | 5.34              | 17.25              | 1.08      | 1.05    | 31.52       | 14.96                | 17.70              |        |              |
| 6200.0 | 5.36  | 12.86     | 5.12              | 16.70              | 1.07      | 1.06    | 30.85       | 15.18                | 17.82              |        |              |
| 6400.0 | 5.09  | 12.62     | 4.95              | 16.16              | 1.06      | 1.06    | 31.14       | 15.80                | 18.19              |        |              |
| 6600.0 | 4.80  | 12.44     | 4.80              | 15.65              | 1.06      | 1.07    | 31.73       | 16.62                | 18.68              |        |              |
| 6800.0 | 4.52  | 12.27     | 4.67              | 15.18              | 1.06      | 1.07    | 31.12       | 17.09                | 18.97              |        |              |
| 7000.0 | 4.16  | 12.18     | 4.65              | 14.60              | 1.08      | 1.07    | 30.81       | 16.20                | 18.45              |        |              |

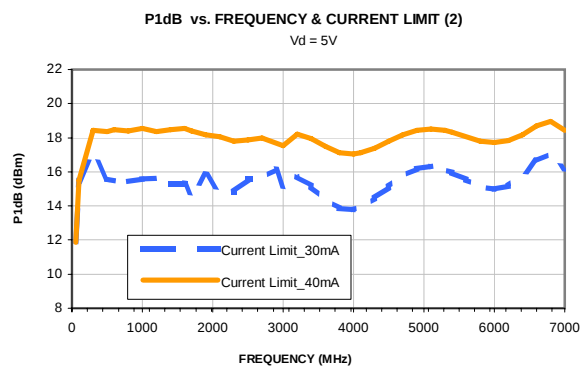
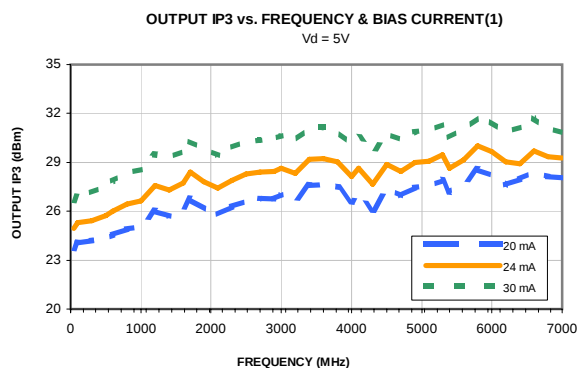
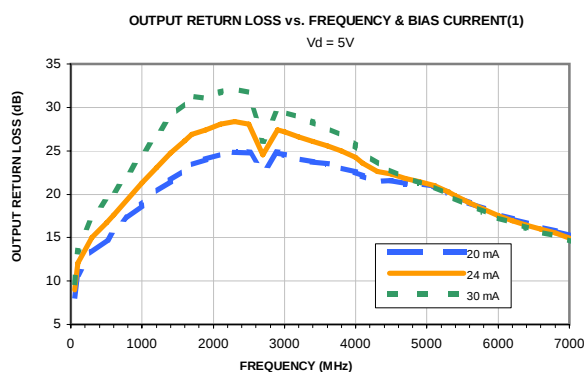
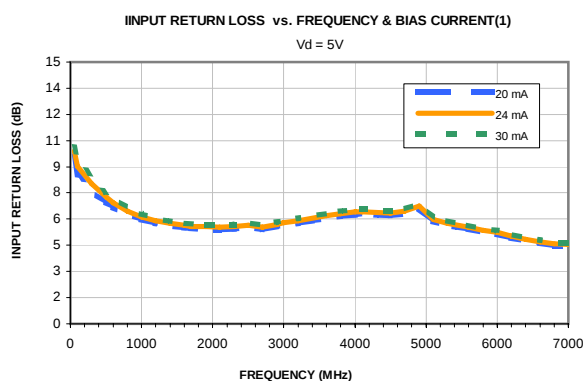
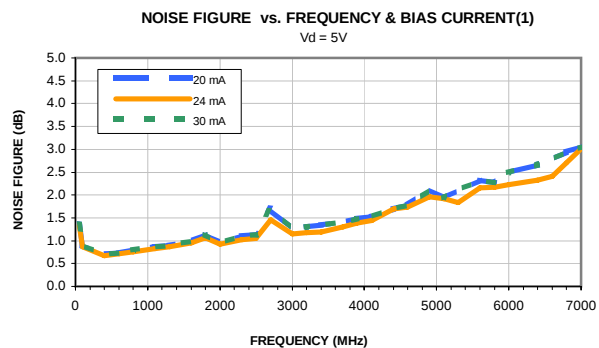
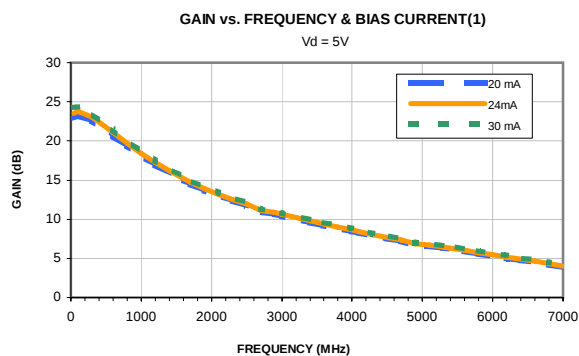
(1) External Rbias resistor is adjusted to obtain desired current

(2) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

## Typical Performance Curves



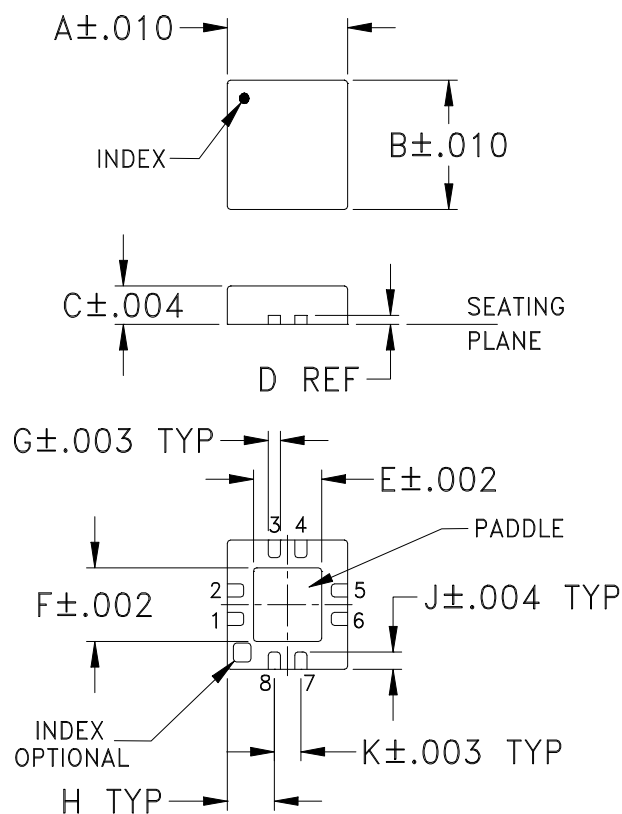
## Typical Performance Curves



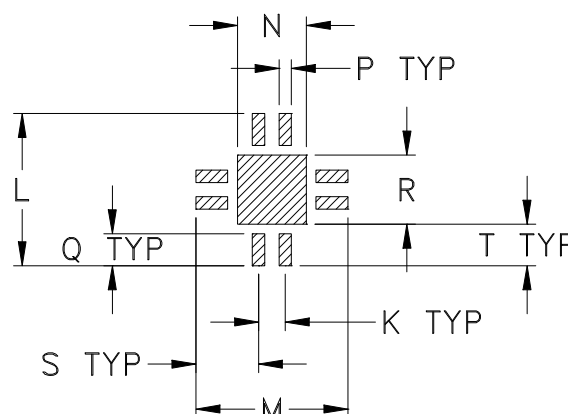
(1) External Rbias resistor is adjusted to obtain desired current

(2) Current is externally limited during P1dB measurements. Unit is capable of higher output power if current is not limited.

### 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              | N              |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| DQ849  | .118<br>(3.00) | .118<br>(3.00) | .035<br>(0.89) | .008<br>(0.20) | .067<br>(1.70) | .067<br>(1.70) | .012<br>(0.30) | .046<br>(1.17) | .016<br>(0.41) | .026<br>(0.66) | .148<br>(3.76) | .148<br>(3.76) | .067<br>(1.70) |

| CASE # | P              | Q              | R              | S              | T              | WT. GRAM |
|--------|----------------|----------------|----------------|----------------|----------------|----------|
| DQ849  | .012<br>(0.30) | .031<br>(0.79) | .067<br>(1.70) | .061<br>(1.55) | .041<br>(1.04) | .02      |

Dimensions are in inches (mm). Tolerances: 2Pl.  $\pm.01$ ; 3 Pl.  $\pm.004$

### Notes:

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



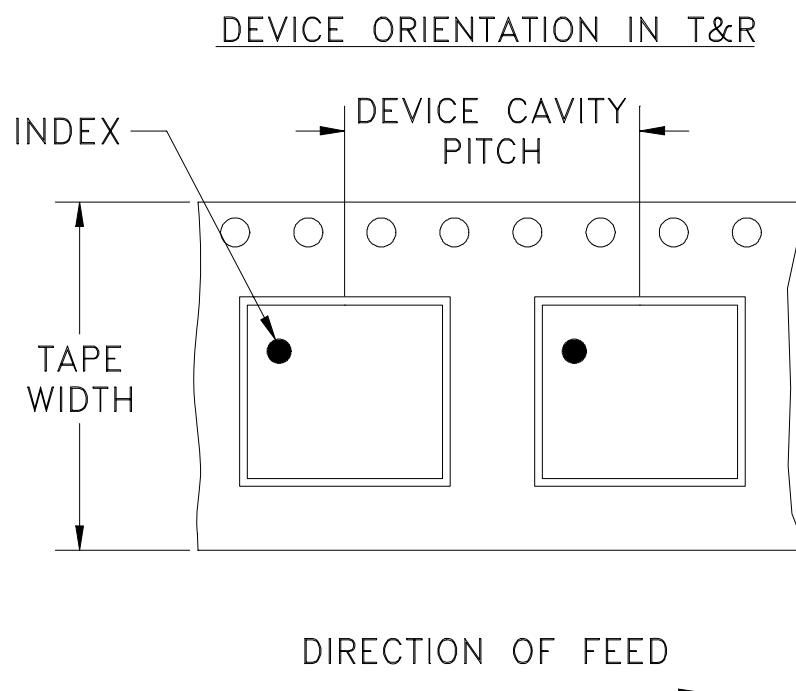
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

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Mini-Circuits ISO 9001 & ISO 14001 Certified

# Tape & Reel Packaging TR-F104



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel                    |      |
|----------------|-------------------------|-------------------|-------------------------------------|------|
| 8              | 4                       | 7                 | Small quantity standards (see note) | 20   |
|                |                         |                   |                                     | 50   |
|                |                         |                   |                                     | 100  |
|                |                         |                   |                                     | 200  |
|                |                         |                   |                                     | 500  |
|                |                         |                   |                                     | 1000 |
|                |                         | 7                 | Standard                            | 2000 |

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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



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

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Mini-Circuits ISO 9001 & ISO 14001 Certified

| REV | ECN No. | DESCRIPTION              | DATE     | DR  | AUTH |
|-----|---------|--------------------------|----------|-----|------|
| OR  | M121752 | NEW RELEASE              | 03/05/09 | PW  | TH   |
| A   | M129864 | ADDED DIMENSIONS         | 12/14/10 | MMG | MM   |
| B   | M137913 | REMOVED COMPONENT VALUES | 07/10/12 | GF  | DJ   |
|     |         |                          |          |     |      |

[illegible]

RESISTOR R1: 0402 SIZE  
INDUCTOR L1: 0603 SIZE  
CAPACITOR C1: 0805 SIZE

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020"  $\pm$  .0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. R1, L1 AND C1 FOOTPRINTS SHOWN FOR REFERENCE ONLY.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

**DIMENSIONS ARE IN INCHES**  
**TOLERANCES ON:**  
**2 PL DECIMALS ±**  
**3 PL DECIMALS ± .005**  
**ANGLES ± 1°**  
**FRACTIONS ±**

|                 |           |                 |
|-----------------|-----------|-----------------|
| <b>DRAWN</b>    | <b>PW</b> | <b>02/26/09</b> |
| <b>CHECKED</b>  | <b>IL</b> | <b>03/04/09</b> |
| <b>APPROVED</b> | <b>TH</b> | <b>03/05/09</b> |
|                 |           |                 |

11

Mini-Circuits® 13 Neptune Avenue  
Brooklyn NY 11235

PL, 08AM01, DQ849, TB-501(-X)+

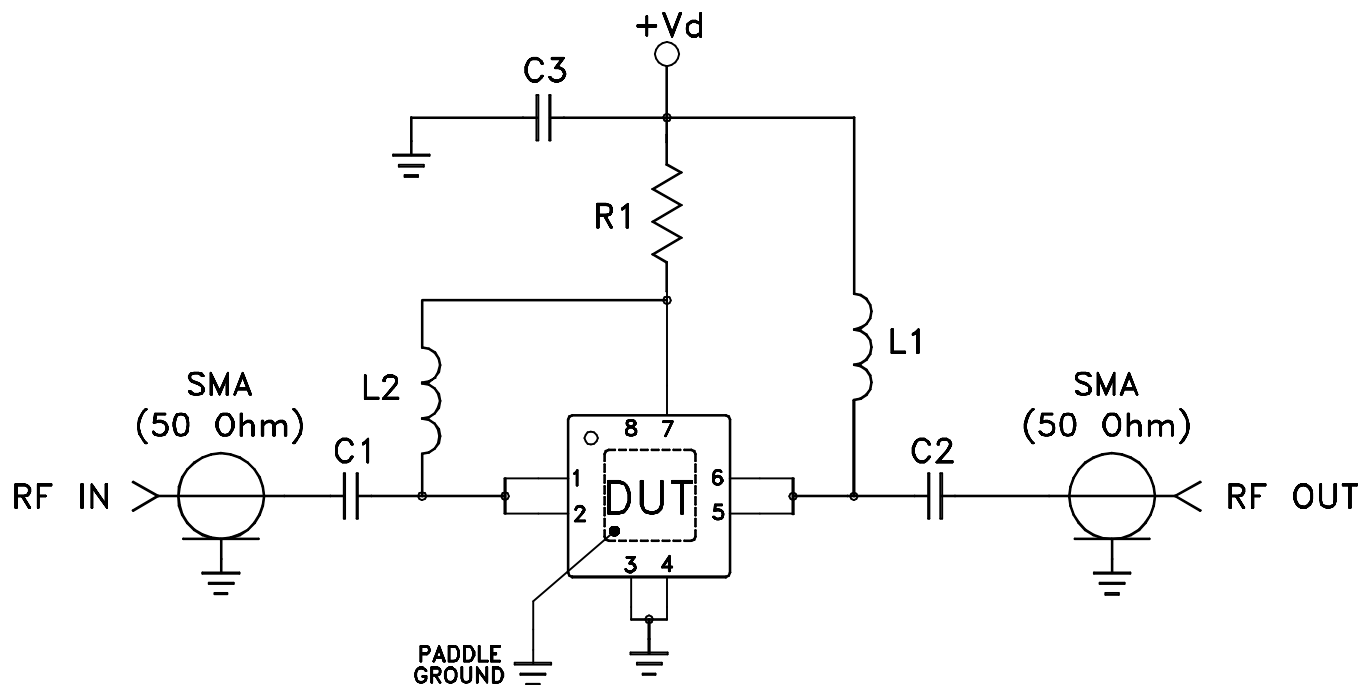
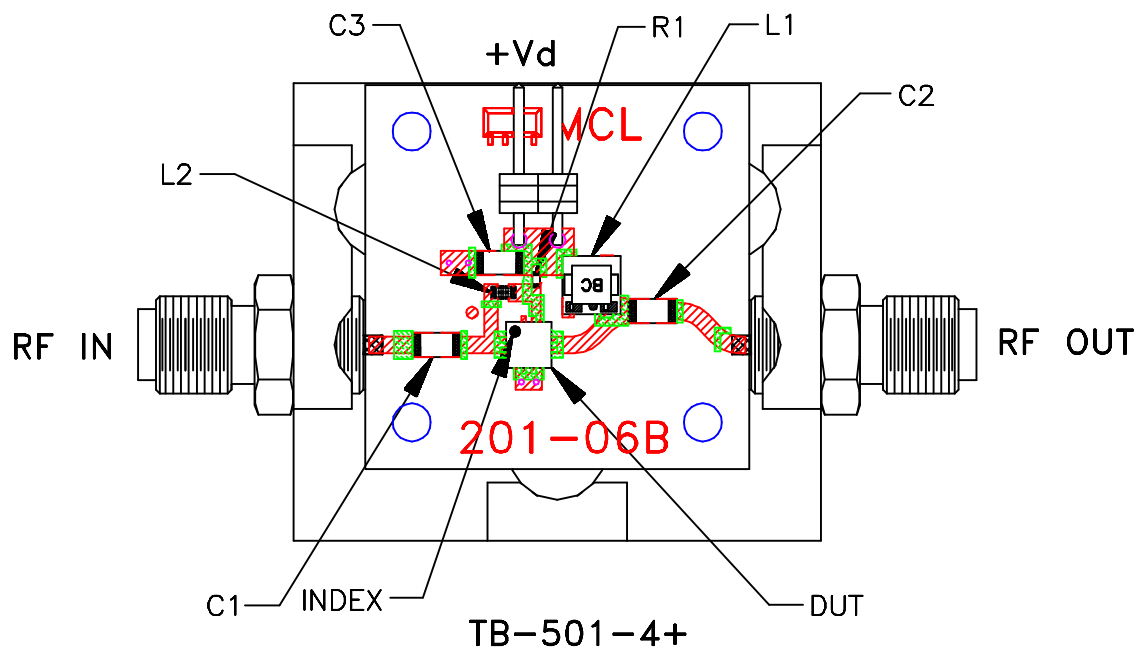
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|-----------|---------------------|--------------------------|-----------|
| SIZE<br>A | CODE IDENT<br>15542 | DRAWING NO:<br>98-PL-299 | REV:<br>B |
|-----------|---------------------|--------------------------|-----------|

|               |            |               |
|---------------|------------|---------------|
| FILE: 98PL299 | SCALE: 8:1 | SHEET: 1 OF 1 |
|---------------|------------|---------------|

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ASHEETA1.DWG REV:A DATE:01/12/95

# Evaluation Board and Circuit



| COMPONENT  | VALUE/PART NUMBER       |
|------------|-------------------------|
| DUT        | Mini-Circuits PMA-5454+ |
| C1, C2, C3 | 0.1 uF                  |
| L1         | Mini-Circuits TCCH-80+  |
| L2         | 390 nH                  |
| R1         | 7.5k Ohm                |

## Notes:

- 50 Ohm SMA Female connectors.
- PCB Material: R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.020 inch.

## Schematic Diagram

 **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<br>Ambient Environment                                                                                            | Individual Model Data Sheet                                     |
| Storage Temperature            | -55° to 100° C or -65° to 150°<br>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<br>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<br>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;<br>distilled water + proylene glycol monomethyl ether + | MIL-STD-202, Method 215                                         |



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| Specification | Test/Inspection Condition        | Reference/Spec |
|---------------|----------------------------------|----------------|
|               | monoethanolamine at 63°C to 70°C |                |