

Drop-In

NON-CATALOG

# Monolithic Amplifier

MAR-7+

50Ω

DC to 2000 MHz



## Features

- wideband, DC to 2000 MHz
- high gain, up to 32.5 dB @ 100 MHz
- low noise
- MAR-7+ is equivalent to MSA-0785
- cascadable
- protected by US Patent, 6,943,629 (except MAR-6+)

CASE STYLE: VV105

**+ RoHS compliant in accordance with EU Directive (2002/95/EC)**

The +Suffix has been added in order to identify RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications.

## Applications

- cellular
- PCN instrumentation

## Electrical Specifications \*

| MODEL NO. | FREQ. <sup>2</sup> (MHz) |                | GAIN (dB) Typical at MHz |      |      |             | MAXIMUM POWER (dBm)       |                   | DYNAMIC RANGE |                | VSWR (:1) Typ. |     | ABSOLUTE MAXIMUM RATING <sup>5</sup> (25°C) |        | DC OPERATING POWER <sup>7</sup> at Pin 3 |                  | THERMAL RESISTANCE <sup>5</sup> |
|-----------|--------------------------|----------------|--------------------------|------|------|-------------|---------------------------|-------------------|---------------|----------------|----------------|-----|---------------------------------------------|--------|------------------------------------------|------------------|---------------------------------|
|           | f <sub>L</sub>           | f <sub>U</sub> | 100                      | 1000 | 2000 | Note 1 Min. | Output (1 dB Compr.) Typ. | Input (no damage) | NF (dB) Typ.  | IP3 (dBm) Typ. | In             | Out | I (mA)                                      | P (mW) | Current (mA)                             | Device Volt Typ. |                                 |
| MAR-7+    | DC                       | 2000           | 13.5                     | 12.5 | 11.0 | 8.5         | +7.0                      | +13               | 5.0           | +19.0          | 1.7            | 1.7 | 60                                          | 275    | 22                                       | 4.0              | 120                             |

\* Test data based on models tested with bent leads per case style WW107

### NOTES:

1. Minimum gain over the full frequency range and temperature range.
2. Low frequency cutoff determined by external coupling capacitors.
3. Thermal resistance (θ<sub>JA</sub>) is from hottest junction in device to mounting surface of leads.
4. Permanent damage may occur if any of these limits are exceeded. These ratings are not intended for continuous normal operation.
5. Supply voltage must be connected to pin 3 through a bias resistor in order to prevent damage. See "Biasing MMIC Amplifiers" in [minicircuits.com/application.html](http://minicircuits.com/application.html). Reliability predictions are applicable at specified current & normal operating conditions.

## Maximum Ratings

Operating Temperature -40°C to 85°C

Storage Temperature -55°C to 100°C

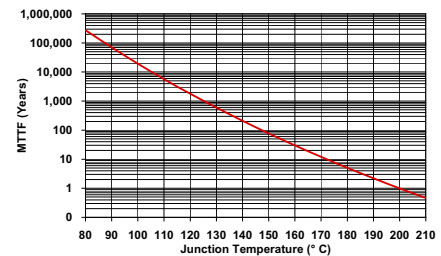
## Pin Connections

|        |     |
|--------|-----|
| RF IN  | 1   |
| RF OUT | 3   |
| DC     | 3   |
| GROUND | 2,4 |

## Model Identification

|           |         |
|-----------|---------|
| Model No. | Marking |
| MAR-7+    | 07      |

MTTF vs. Junction Temp.



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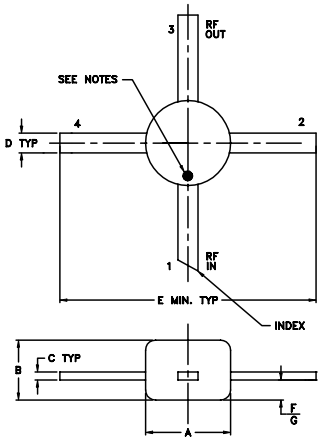
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For detailed performance specs & shopping online see web site

**Notes:** 1. Performance and quality attributes and conditions not expressly stated in this specification sheet are intended to be excluded and do not form a part of this specification sheet. 2. Electrical specifications and performance data contained herein are based on Mini-Circuit's applicable established test performance criteria and measurement instructions. 3. The parts covered by this specification sheet 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](http://www.minicircuits.com/MCLStore/terms.jsp).

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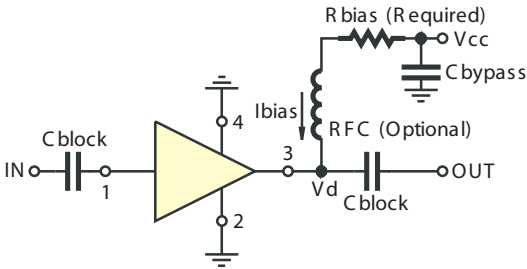
Outline Drawing



Outline Dimensions (inch mm)

| A    | B    | C    | D    | E    | F    | G    | wt    |
|------|------|------|------|------|------|------|-------|
| .085 | .060 | .008 | .020 | .250 | .012 | .025 | grams |
| 2.16 | 1.52 | 0.20 | 0.51 | 6.35 | 0.30 | 0.64 | .015  |

Typical Biasing Configuration



| Resistor Values ("1%" Res.) |        |
|-----------------------------|--------|
| Vcc                         | MAR-7+ |
| 7                           | 137    |
| 8                           | 182    |
| 9                           | 226    |
| 10                          | 274    |
| 11                          | 316    |
| 12                          | 365    |
| 13                          | 412    |
| 14                          | 456    |
| 15                          | 499    |

## Typical Performance Data

**NOTE: Use PDF Bookmarks to view DATA at required conditions  
or to view GRAPHS.**

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Icc = 22mA, Vd = 4.02V @Temperature = +25degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 13.93 | 18.71     | 36.62                   | 28.19                    | 1.15      | 0.58  | 21.65         | 8.23                   | 3.20            |
| 100   | 13.91 | 18.65     | 39.15                   | 28.50                    | 1.15      | 0.58  | 21.64         | 8.02                   | 3.29            |
| 150   | 13.85 | 18.73     | 37.15                   | 28.79                    | 1.16      | 0.57  | 21.94         | 8.22                   | 3.25            |
| 200   | 13.83 | 18.69     | 38.01                   | 28.53                    | 1.16      | 0.57  | 21.71         | 8.27                   | 3.16            |
| 250   | 13.79 | 18.67     | 35.48                   | 28.48                    | 1.16      | 0.57  | 21.01         | 8.12                   | 3.18            |
| 300   | 13.76 | 18.68     | 34.74                   | 28.41                    | 1.16      | 0.57  | 21.93         | 8.25                   | 3.34            |
| 350   | 13.72 | 18.65     | 33.81                   | 28.36                    | 1.16      | 0.57  | 21.54         | 8.08                   | 3.31            |
| 400   | 13.67 | 18.64     | 33.20                   | 28.40                    | 1.17      | 0.56  | 21.31         | 8.32                   | 3.24            |
| 450   | 13.62 | 18.61     | 32.32                   | 28.12                    | 1.17      | 0.56  | 20.96         | 8.06                   | 3.23            |
| 500   | 13.56 | 18.56     | 31.49                   | 27.90                    | 1.17      | 0.56  | 21.24         | 8.25                   | 3.31            |
| 550   | 13.51 | 18.54     | 30.65                   | 27.76                    | 1.17      | 0.56  | 21.09         | 8.06                   | 3.31            |
| 600   | 13.45 | 18.50     | 30.09                   | 27.29                    | 1.17      | 0.56  | 21.10         | 8.02                   | 3.25            |
| 650   | 13.41 | 18.47     | 29.37                   | 27.02                    | 1.17      | 0.56  | 20.89         | 8.16                   | 3.22            |
| 700   | 13.35 | 18.45     | 28.83                   | 26.58                    | 1.17      | 0.55  | 21.19         | 7.93                   | 3.32            |
| 750   | 13.27 | 18.42     | 28.25                   | 26.30                    | 1.18      | 0.55  | 21.24         | 8.15                   | 3.31            |
| 800   | 13.20 | 18.37     | 27.81                   | 25.78                    | 1.18      | 0.55  | 21.19         | 7.77                   | 3.21            |
| 850   | 13.15 | 18.33     | 27.40                   | 25.37                    | 1.18      | 0.55  | 21.06         | 8.09                   | 3.18            |
| 900   | 13.06 | 18.30     | 26.86                   | 24.95                    | 1.18      | 0.55  | 21.08         | 7.93                   | 3.27            |
| 940   | 13.01 | 18.27     | 26.29                   | 24.59                    | 1.18      | 0.54  | 21.24         | 7.69                   | 3.35            |
| 1000  | 12.92 | 18.20     | 25.81                   | 24.06                    | 1.18      | 0.54  | 21.09         | 7.78                   | 3.27            |
| 1050  | 12.84 | 18.18     | 25.43                   | 23.58                    | 1.19      | 0.54  | 21.10         | 7.80                   | 3.26            |
| 1100  | 12.76 | 18.13     | 24.93                   | 23.13                    | 1.19      | 0.54  | 20.89         | 7.99                   | 3.34            |
| 1150  | 12.68 | 18.06     | 24.51                   | 22.68                    | 1.19      | 0.54  | 20.95         | 7.74                   | 3.30            |
| 1200  | 12.60 | 18.03     | 24.11                   | 22.29                    | 1.19      | 0.53  | 20.82         | 7.93                   | 3.34            |
| 1250  | 12.51 | 17.98     | 23.75                   | 21.85                    | 1.19      | 0.53  | 20.92         | 7.75                   | 3.31            |
| 1300  | 12.43 | 17.93     | 23.40                   | 21.50                    | 1.20      | 0.53  | 20.82         | 7.79                   | 3.34            |
| 1350  | 12.34 | 17.88     | 23.00                   | 21.16                    | 1.20      | 0.53  | 20.70         | 7.72                   | 3.39            |
| 1400  | 12.26 | 17.83     | 22.59                   | 20.78                    | 1.20      | 0.53  | 20.57         | 7.78                   | 3.31            |
| 1450  | 12.18 | 17.80     | 22.24                   | 20.39                    | 1.20      | 0.52  | 20.42         | 7.80                   | 3.33            |
| 1500  | 12.07 | 17.73     | 21.90                   | 20.05                    | 1.21      | 0.52  | 20.44         | 7.82                   | 3.31            |
| 1550  | 12.00 | 17.69     | 21.51                   | 19.74                    | 1.21      | 0.52  | 20.72         | 7.81                   | 3.32            |
| 1600  | 11.88 | 17.63     | 21.29                   | 19.45                    | 1.21      | 0.52  | 20.76         | 7.99                   | 3.34            |
| 1650  | 11.79 | 17.58     | 21.03                   | 19.17                    | 1.21      | 0.52  | 20.77         | 7.73                   | 3.27            |
| 1700  | 11.70 | 17.53     | 20.65                   | 18.92                    | 1.21      | 0.51  | 20.67         | 7.92                   | 3.23            |
| 1750  | 11.61 | 17.49     | 20.36                   | 18.61                    | 1.22      | 0.51  | 20.55         | 7.69                   | 3.35            |
| 1800  | 11.50 | 17.43     | 20.09                   | 18.33                    | 1.22      | 0.51  | 20.57         | 7.94                   | 3.43            |
| 1850  | 11.40 | 17.36     | 19.84                   | 18.09                    | 1.22      | 0.51  | 20.12         | 7.54                   | 3.40            |
| 1900  | 11.31 | 17.33     | 19.56                   | 17.86                    | 1.23      | 0.50  | 19.76         | 7.76                   | 3.40            |
| 1950  | 11.21 | 17.27     | 19.29                   | 17.65                    | 1.23      | 0.50  | 19.90         | 7.67                   | 3.37            |
| 2000  | 11.12 | 17.21     | 19.02                   | 17.42                    | 1.23      | 0.50  | 19.79         | 7.62                   | 3.36            |

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## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Icc = 16mA, Vd = 3.94V @Temperature = +25degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 13.27 | 18.20     | 29.19                   | 21.05                    | 1.16      | 0.57  | 16.18         | 3.28                   | 3.25            |
| 100   | 13.26 | 18.23     | 28.55                   | 21.27                    | 1.16      | 0.57  | 16.16         | 2.98                   | 3.28            |
| 150   | 13.18 | 18.23     | 29.10                   | 21.34                    | 1.17      | 0.56  | 16.44         | 3.11                   | 3.29            |
| 200   | 13.16 | 18.22     | 28.59                   | 21.41                    | 1.17      | 0.56  | 16.25         | 3.15                   | 3.22            |
| 250   | 13.14 | 18.23     | 29.56                   | 21.53                    | 1.17      | 0.56  | 15.65         | 3.07                   | 3.23            |
| 300   | 13.11 | 18.22     | 28.85                   | 21.67                    | 1.17      | 0.56  | 16.44         | 3.15                   | 3.35            |
| 350   | 13.06 | 18.19     | 28.46                   | 21.92                    | 1.17      | 0.56  | 16.07         | 2.89                   | 3.33            |
| 400   | 13.03 | 18.13     | 28.83                   | 22.00                    | 1.17      | 0.56  | 15.95         | 3.24                   | 3.32            |
| 450   | 12.98 | 18.14     | 28.93                   | 22.05                    | 1.18      | 0.55  | 15.63         | 3.00                   | 3.28            |
| 500   | 12.94 | 18.12     | 28.44                   | 22.33                    | 1.18      | 0.55  | 15.94         | 3.12                   | 3.31            |
| 550   | 12.87 | 18.07     | 28.38                   | 22.48                    | 1.18      | 0.55  | 15.79         | 2.93                   | 3.31            |
| 600   | 12.82 | 18.02     | 28.30                   | 22.56                    | 1.18      | 0.55  | 15.85         | 2.92                   | 3.30            |
| 650   | 12.80 | 17.99     | 28.09                   | 22.84                    | 1.18      | 0.55  | 15.64         | 3.13                   | 3.28            |
| 700   | 12.75 | 17.98     | 27.84                   | 23.04                    | 1.18      | 0.55  | 15.94         | 2.91                   | 3.31            |
| 750   | 12.67 | 17.93     | 27.89                   | 23.11                    | 1.18      | 0.54  | 16.01         | 3.17                   | 3.30            |
| 800   | 12.62 | 17.92     | 27.53                   | 23.24                    | 1.18      | 0.54  | 15.99         | 2.71                   | 3.25            |
| 850   | 12.56 | 17.85     | 27.09                   | 23.52                    | 1.18      | 0.54  | 15.89         | 3.09                   | 3.22            |
| 900   | 12.48 | 17.80     | 26.88                   | 23.51                    | 1.19      | 0.54  | 15.92         | 2.90                   | 3.27            |
| 940   | 12.43 | 17.79     | 26.71                   | 23.51                    | 1.19      | 0.54  | 16.17         | 2.77                   | 3.31            |
| 1000  | 12.35 | 17.73     | 26.17                   | 23.54                    | 1.19      | 0.54  | 16.02         | 2.90                   | 3.30            |
| 1050  | 12.30 | 17.69     | 25.86                   | 23.58                    | 1.19      | 0.53  | 16.17         | 2.89                   | 3.31            |
| 1100  | 12.21 | 17.64     | 25.59                   | 23.44                    | 1.19      | 0.53  | 15.92         | 3.19                   | 3.35            |
| 1150  | 12.13 | 17.59     | 25.16                   | 23.26                    | 1.19      | 0.53  | 16.13         | 2.82                   | 3.27            |
| 1200  | 12.07 | 17.54     | 24.80                   | 23.17                    | 1.19      | 0.53  | 16.01         | 3.11                   | 3.35            |
| 1250  | 12.00 | 17.51     | 24.41                   | 22.97                    | 1.20      | 0.53  | 16.20         | 2.92                   | 3.35            |
| 1300  | 11.91 | 17.44     | 24.11                   | 22.84                    | 1.20      | 0.52  | 16.18         | 2.91                   | 3.33            |
| 1350  | 11.83 | 17.39     | 23.72                   | 22.64                    | 1.20      | 0.52  | 16.18         | 2.91                   | 3.36            |
| 1400  | 11.76 | 17.35     | 23.26                   | 22.34                    | 1.20      | 0.52  | 16.13         | 2.86                   | 3.35            |
| 1450  | 11.68 | 17.31     | 22.92                   | 22.12                    | 1.20      | 0.52  | 16.07         | 2.95                   | 3.34            |
| 1500  | 11.58 | 17.25     | 22.54                   | 21.84                    | 1.20      | 0.52  | 16.17         | 3.05                   | 3.30            |
| 1550  | 11.51 | 17.22     | 22.15                   | 21.54                    | 1.21      | 0.51  | 16.50         | 2.96                   | 3.29            |
| 1600  | 11.40 | 17.15     | 21.91                   | 21.34                    | 1.21      | 0.51  | 16.59         | 3.43                   | 3.34            |
| 1650  | 11.31 | 17.10     | 21.60                   | 21.06                    | 1.21      | 0.51  | 16.73         | 3.18                   | 3.31            |
| 1700  | 11.25 | 17.05     | 21.21                   | 20.80                    | 1.21      | 0.51  | 16.61         | 3.22                   | 3.25            |
| 1750  | 11.16 | 17.01     | 20.92                   | 20.48                    | 1.21      | 0.51  | 16.83         | 3.19                   | 3.33            |
| 1800  | 11.05 | 16.95     | 20.60                   | 20.19                    | 1.22      | 0.50  | 16.88         | 3.45                   | 3.42            |
| 1850  | 10.96 | 16.90     | 20.34                   | 19.96                    | 1.22      | 0.50  | 16.85         | 3.00                   | 3.43            |
| 1900  | 10.88 | 16.86     | 20.04                   | 19.70                    | 1.22      | 0.50  | 16.30         | 3.29                   | 3.40            |
| 1950  | 10.78 | 16.80     | 19.74                   | 19.47                    | 1.22      | 0.50  | 16.79         | 3.33                   | 3.35            |
| 2000  | 10.70 | 16.74     | 19.44                   | 19.14                    | 1.23      | 0.50  | 16.54         | 3.28                   | 3.31            |

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Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Icc = 28mA, Vd = 4.09V @Temperature = +25degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 14.26 | 18.98     | 28.02                   | 38.30                    | 1.15      | 0.58  | 25.44         | 10.09                  | 3.21            |
| 100   | 14.24 | 18.93     | 28.80                   | 38.54                    | 1.15      | 0.58  | 25.44         | 10.10                  | 3.34            |
| 150   | 14.18 | 18.91     | 28.41                   | 37.54                    | 1.15      | 0.58  | 25.84         | 10.20                  | 3.28            |
| 200   | 14.16 | 18.97     | 28.52                   | 35.69                    | 1.16      | 0.57  | 25.49         | 10.27                  | 3.15            |
| 250   | 14.12 | 18.92     | 27.74                   | 34.22                    | 1.15      | 0.58  | 24.66         | 10.26                  | 3.20            |
| 300   | 14.09 | 18.93     | 27.85                   | 32.99                    | 1.16      | 0.57  | 25.73         | 10.37                  | 3.41            |
| 350   | 14.04 | 18.91     | 27.68                   | 31.81                    | 1.16      | 0.57  | 25.24         | 10.30                  | 3.36            |
| 400   | 13.99 | 18.90     | 27.22                   | 30.93                    | 1.16      | 0.57  | 24.89         | 10.45                  | 3.24            |
| 450   | 13.94 | 18.85     | 27.04                   | 29.90                    | 1.16      | 0.57  | 24.55         | 10.40                  | 3.26            |
| 500   | 13.88 | 18.85     | 26.78                   | 29.03                    | 1.17      | 0.56  | 24.73         | 10.51                  | 3.35            |
| 550   | 13.83 | 18.82     | 26.34                   | 28.13                    | 1.17      | 0.56  | 24.58         | 10.42                  | 3.35            |
| 600   | 13.77 | 18.80     | 26.06                   | 27.43                    | 1.17      | 0.56  | 24.52         | 10.40                  | 3.25            |
| 650   | 13.72 | 18.73     | 25.59                   | 26.74                    | 1.17      | 0.56  | 24.27         | 10.54                  | 3.21            |
| 700   | 13.65 | 18.70     | 25.42                   | 25.92                    | 1.17      | 0.56  | 24.53         | 10.38                  | 3.34            |
| 750   | 13.58 | 18.68     | 25.02                   | 25.45                    | 1.17      | 0.56  | 24.54         | 10.54                  | 3.35            |
| 800   | 13.51 | 18.64     | 24.81                   | 24.79                    | 1.17      | 0.55  | 24.42         | 10.16                  | 3.23            |
| 850   | 13.44 | 18.60     | 24.53                   | 24.15                    | 1.18      | 0.55  | 24.26         | 10.42                  | 3.17            |
| 900   | 13.35 | 18.56     | 24.16                   | 23.67                    | 1.18      | 0.55  | 24.28         | 10.31                  | 3.32            |
| 940   | 13.31 | 18.53     | 23.81                   | 23.29                    | 1.18      | 0.55  | 24.31         | 10.10                  | 3.35            |
| 1000  | 13.21 | 18.47     | 23.57                   | 22.67                    | 1.18      | 0.55  | 24.10         | 10.20                  | 3.26            |
| 1050  | 13.12 | 18.43     | 23.26                   | 22.18                    | 1.18      | 0.54  | 23.95         | 10.24                  | 3.25            |
| 1100  | 13.03 | 18.38     | 22.85                   | 21.76                    | 1.19      | 0.54  | 23.74         | 10.38                  | 3.36            |
| 1150  | 12.96 | 18.33     | 22.64                   | 21.32                    | 1.19      | 0.54  | 23.67         | 10.08                  | 3.33            |
| 1200  | 12.87 | 18.29     | 22.41                   | 20.91                    | 1.19      | 0.54  | 23.51         | 10.23                  | 3.35            |
| 1250  | 12.78 | 18.25     | 22.08                   | 20.51                    | 1.19      | 0.54  | 23.49         | 10.10                  | 3.32            |
| 1300  | 12.70 | 18.19     | 21.80                   | 20.20                    | 1.20      | 0.53  | 23.33         | 10.08                  | 3.34            |
| 1350  | 12.60 | 18.15     | 21.53                   | 19.84                    | 1.20      | 0.53  | 23.06         | 10.04                  | 3.43            |
| 1400  | 12.52 | 18.09     | 21.22                   | 19.47                    | 1.20      | 0.53  | 22.88         | 10.06                  | 3.34            |
| 1450  | 12.42 | 18.04     | 20.94                   | 19.15                    | 1.20      | 0.53  | 22.72         | 10.04                  | 3.33            |
| 1500  | 12.32 | 18.00     | 20.69                   | 18.87                    | 1.21      | 0.53  | 22.66         | 9.98                   | 3.32            |
| 1550  | 12.23 | 17.93     | 20.40                   | 18.56                    | 1.21      | 0.52  | 22.87         | 9.98                   | 3.37            |
| 1600  | 12.13 | 17.89     | 20.24                   | 18.35                    | 1.21      | 0.52  | 22.90         | 10.06                  | 3.37            |
| 1650  | 12.03 | 17.85     | 20.02                   | 18.07                    | 1.21      | 0.52  | 22.78         | 9.81                   | 3.27            |
| 1700  | 11.94 | 17.78     | 19.72                   | 17.80                    | 1.22      | 0.52  | 22.66         | 9.81                   | 3.27            |
| 1750  | 11.84 | 17.72     | 19.49                   | 17.55                    | 1.22      | 0.52  | 22.34         | 9.67                   | 3.42            |
| 1800  | 11.74 | 17.68     | 19.27                   | 17.30                    | 1.22      | 0.51  | 22.37         | 9.71                   | 3.48            |
| 1850  | 11.64 | 17.63     | 19.04                   | 17.09                    | 1.22      | 0.51  | 21.72         | 9.34                   | 3.43            |
| 1900  | 11.54 | 17.57     | 18.81                   | 16.86                    | 1.23      | 0.51  | 21.44         | 9.49                   | 3.43            |
| 1950  | 11.44 | 17.51     | 18.60                   | 16.68                    | 1.23      | 0.51  | 21.39         | 9.31                   | 3.43            |
| 2000  | 11.34 | 17.46     | 18.37                   | 16.47                    | 1.23      | 0.51  | 21.39         | 9.22                   | 3.40            |

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## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Icc = 22mA, Vd = 4.25V @Temperature = -45degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 14.22 | 18.87     | 30.84                   | 33.22                    | 1.15      | 0.58  | 21.99         | 8.28                   | 2.53            |
| 100   | 14.19 | 18.86     | 33.08                   | 32.33                    | 1.15      | 0.58  | 21.97         | 8.07                   | 2.61            |
| 150   | 14.15 | 18.87     | 32.63                   | 31.92                    | 1.15      | 0.58  | 22.26         | 8.19                   | 2.57            |
| 200   | 14.14 | 18.87     | 32.87                   | 31.79                    | 1.15      | 0.58  | 22.02         | 8.15                   | 2.47            |
| 250   | 14.10 | 18.87     | 31.22                   | 31.70                    | 1.15      | 0.58  | 21.40         | 8.16                   | 2.48            |
| 300   | 14.06 | 18.84     | 30.59                   | 31.73                    | 1.15      | 0.58  | 22.27         | 8.19                   | 2.71            |
| 350   | 14.02 | 18.84     | 29.92                   | 31.31                    | 1.16      | 0.57  | 21.92         | 8.08                   | 2.63            |
| 400   | 13.99 | 18.79     | 29.34                   | 30.85                    | 1.15      | 0.58  | 21.73         | 8.22                   | 2.54            |
| 450   | 13.94 | 18.78     | 29.15                   | 30.25                    | 1.16      | 0.57  | 21.36         | 8.04                   | 2.53            |
| 500   | 13.88 | 18.74     | 28.53                   | 29.61                    | 1.16      | 0.57  | 21.71         | 8.21                   | 2.59            |
| 550   | 13.85 | 18.71     | 27.90                   | 28.89                    | 1.16      | 0.57  | 21.57         | 8.00                   | 2.60            |
| 600   | 13.79 | 18.68     | 27.53                   | 28.25                    | 1.16      | 0.57  | 21.58         | 7.95                   | 2.56            |
| 650   | 13.74 | 18.64     | 26.83                   | 27.72                    | 1.16      | 0.57  | 21.38         | 8.19                   | 2.48            |
| 700   | 13.68 | 18.60     | 26.43                   | 26.97                    | 1.16      | 0.57  | 21.72         | 7.89                   | 2.58            |
| 750   | 13.62 | 18.57     | 26.03                   | 26.53                    | 1.16      | 0.56  | 21.76         | 8.13                   | 2.59            |
| 800   | 13.55 | 18.53     | 25.63                   | 25.80                    | 1.16      | 0.56  | 21.73         | 7.71                   | 2.48            |
| 850   | 13.50 | 18.49     | 25.21                   | 25.35                    | 1.16      | 0.56  | 21.61         | 7.98                   | 2.46            |
| 900   | 13.42 | 18.44     | 24.75                   | 24.79                    | 1.17      | 0.56  | 21.65         | 7.89                   | 2.55            |
| 940   | 13.37 | 18.42     | 24.29                   | 24.32                    | 1.17      | 0.56  | 21.85         | 7.76                   | 2.60            |
| 1000  | 13.28 | 18.36     | 23.82                   | 23.72                    | 1.17      | 0.56  | 21.72         | 7.83                   | 2.52            |
| 1050  | 13.21 | 18.31     | 23.37                   | 23.26                    | 1.17      | 0.56  | 21.78         | 7.81                   | 2.50            |
| 1100  | 13.14 | 18.26     | 22.98                   | 22.82                    | 1.17      | 0.56  | 21.56         | 7.99                   | 2.59            |
| 1150  | 13.06 | 18.22     | 22.62                   | 22.28                    | 1.17      | 0.55  | 21.71         | 7.71                   | 2.55            |
| 1200  | 12.98 | 18.18     | 22.28                   | 21.87                    | 1.17      | 0.55  | 21.58         | 7.95                   | 2.58            |
| 1250  | 12.90 | 18.13     | 21.88                   | 21.37                    | 1.18      | 0.55  | 21.71         | 7.82                   | 2.54            |
| 1300  | 12.83 | 18.08     | 21.56                   | 20.90                    | 1.18      | 0.55  | 21.66         | 7.81                   | 2.56            |
| 1350  | 12.73 | 18.02     | 21.28                   | 20.46                    | 1.18      | 0.55  | 21.58         | 7.79                   | 2.62            |
| 1400  | 12.65 | 17.97     | 20.92                   | 20.07                    | 1.18      | 0.55  | 21.48         | 7.78                   | 2.58            |
| 1450  | 12.57 | 17.92     | 20.59                   | 19.73                    | 1.18      | 0.54  | 21.35         | 7.79                   | 2.54            |
| 1500  | 12.48 | 17.87     | 20.34                   | 19.33                    | 1.18      | 0.54  | 21.44         | 7.85                   | 2.53            |
| 1550  | 12.40 | 17.82     | 19.86                   | 18.94                    | 1.18      | 0.54  | 21.72         | 7.84                   | 2.55            |
| 1600  | 12.30 | 17.77     | 19.87                   | 18.81                    | 1.19      | 0.54  | 21.78         | 8.08                   | 2.57            |
| 1650  | 12.21 | 17.71     | 19.62                   | 18.49                    | 1.19      | 0.54  | 21.78         | 7.87                   | 2.49            |
| 1700  | 12.13 | 17.66     | 19.24                   | 18.25                    | 1.19      | 0.54  | 21.73         | 8.01                   | 2.44            |
| 1750  | 12.04 | 17.60     | 18.99                   | 18.01                    | 1.19      | 0.53  | 21.74         | 7.87                   | 2.58            |
| 1800  | 11.94 | 17.55     | 18.71                   | 17.68                    | 1.19      | 0.53  | 21.76         | 8.15                   | 2.68            |
| 1850  | 11.85 | 17.50     | 18.50                   | 17.45                    | 1.20      | 0.53  | 21.37         | 7.70                   | 2.63            |
| 1900  | 11.76 | 17.44     | 18.27                   | 17.18                    | 1.20      | 0.53  | 20.96         | 8.02                   | 2.59            |
| 1950  | 11.66 | 17.38     | 18.03                   | 16.99                    | 1.20      | 0.53  | 21.19         | 7.99                   | 2.60            |
| 2000  | 11.56 | 17.35     | 17.82                   | 16.80                    | 1.21      | 0.52  | 21.08         | 7.99                   | 2.57            |

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## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Icc = 16mA, Vd = 4.17V @Temperature = -45degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 13.65 | 18.44     | 36.44                   | 24.01                    | 1.15      | 0.58  | 16.44         | 3.19                   | 2.54            |
| 100   | 13.63 | 18.50     | 33.77                   | 23.77                    | 1.16      | 0.57  | 16.41         | 2.91                   | 2.58            |
| 150   | 13.59 | 18.47     | 34.07                   | 23.51                    | 1.16      | 0.57  | 16.68         | 3.04                   | 2.58            |
| 200   | 13.59 | 18.47     | 33.41                   | 23.47                    | 1.16      | 0.57  | 16.48         | 3.14                   | 2.53            |
| 250   | 13.55 | 18.46     | 34.63                   | 23.92                    | 1.16      | 0.57  | 15.95         | 2.87                   | 2.51            |
| 300   | 13.51 | 18.42     | 33.84                   | 24.27                    | 1.16      | 0.57  | 16.69         | 3.11                   | 2.70            |
| 350   | 13.49 | 18.43     | 32.87                   | 24.39                    | 1.16      | 0.57  | 16.37         | 2.91                   | 2.63            |
| 400   | 13.47 | 18.41     | 32.46                   | 24.57                    | 1.16      | 0.57  | 16.25         | 3.17                   | 2.59            |
| 450   | 13.41 | 18.37     | 32.15                   | 24.68                    | 1.16      | 0.56  | 15.96         | 2.96                   | 2.55            |
| 500   | 13.35 | 18.32     | 31.51                   | 24.86                    | 1.16      | 0.56  | 16.27         | 3.19                   | 2.56            |
| 550   | 13.32 | 18.31     | 30.83                   | 24.90                    | 1.16      | 0.56  | 16.10         | 2.82                   | 2.61            |
| 600   | 13.28 | 18.27     | 30.38                   | 24.95                    | 1.16      | 0.56  | 16.18         | 2.94                   | 2.58            |
| 650   | 13.23 | 18.22     | 29.64                   | 25.23                    | 1.16      | 0.56  | 15.97         | 3.05                   | 2.52            |
| 700   | 13.17 | 18.18     | 29.20                   | 25.27                    | 1.17      | 0.56  | 16.29         | 2.93                   | 2.58            |
| 750   | 13.13 | 18.15     | 28.78                   | 25.29                    | 1.17      | 0.56  | 16.34         | 3.06                   | 2.57            |
| 800   | 13.05 | 18.11     | 28.33                   | 25.18                    | 1.17      | 0.56  | 16.30         | 2.73                   | 2.52            |
| 850   | 13.01 | 18.08     | 27.81                   | 25.19                    | 1.17      | 0.56  | 16.22         | 3.08                   | 2.47            |
| 900   | 12.95 | 18.03     | 27.22                   | 25.13                    | 1.17      | 0.55  | 16.23         | 2.92                   | 2.54            |
| 940   | 12.90 | 18.01     | 26.74                   | 24.98                    | 1.17      | 0.55  | 16.50         | 2.76                   | 2.58            |
| 1000  | 12.81 | 17.94     | 26.06                   | 24.79                    | 1.17      | 0.55  | 16.40         | 2.82                   | 2.54            |
| 1050  | 12.75 | 17.91     | 25.57                   | 24.57                    | 1.17      | 0.55  | 16.55         | 2.91                   | 2.55            |
| 1100  | 12.69 | 17.87     | 25.00                   | 24.36                    | 1.17      | 0.55  | 16.30         | 3.05                   | 2.56            |
| 1150  | 12.61 | 17.81     | 24.49                   | 24.00                    | 1.17      | 0.55  | 16.56         | 2.80                   | 2.53            |
| 1200  | 12.53 | 17.75     | 24.11                   | 23.72                    | 1.18      | 0.55  | 16.43         | 3.04                   | 2.61            |
| 1250  | 12.48 | 17.72     | 23.64                   | 23.25                    | 1.18      | 0.54  | 16.64         | 2.95                   | 2.58            |
| 1300  | 12.42 | 17.66     | 23.23                   | 22.90                    | 1.18      | 0.54  | 16.65         | 2.91                   | 2.56            |
| 1350  | 12.31 | 17.61     | 22.82                   | 22.51                    | 1.18      | 0.54  | 16.69         | 2.88                   | 2.60            |
| 1400  | 12.24 | 17.54     | 22.44                   | 21.98                    | 1.18      | 0.54  | 16.66         | 2.93                   | 2.56            |
| 1450  | 12.17 | 17.50     | 22.09                   | 21.62                    | 1.18      | 0.54  | 16.54         | 2.91                   | 2.58            |
| 1500  | 12.09 | 17.46     | 21.65                   | 21.22                    | 1.18      | 0.54  | 16.71         | 3.04                   | 2.54            |
| 1550  | 12.01 | 17.42     | 21.22                   | 20.76                    | 1.18      | 0.53  | 17.03         | 3.04                   | 2.53            |
| 1600  | 11.91 | 17.37     | 21.05                   | 20.68                    | 1.19      | 0.53  | 17.14         | 3.30                   | 2.59            |
| 1650  | 11.83 | 17.32     | 20.72                   | 20.34                    | 1.19      | 0.53  | 17.24         | 3.13                   | 2.50            |
| 1700  | 11.75 | 17.25     | 20.30                   | 20.00                    | 1.19      | 0.53  | 17.14         | 3.19                   | 2.44            |
| 1750  | 11.66 | 17.18     | 20.01                   | 19.70                    | 1.19      | 0.53  | 17.47         | 3.13                   | 2.56            |
| 1800  | 11.57 | 17.15     | 19.64                   | 19.42                    | 1.19      | 0.53  | 17.49         | 3.45                   | 2.65            |
| 1850  | 11.49 | 17.11     | 19.38                   | 19.18                    | 1.19      | 0.52  | 17.61         | 2.97                   | 2.61            |
| 1900  | 11.40 | 17.06     | 19.12                   | 18.80                    | 1.20      | 0.52  | 16.97         | 3.42                   | 2.59            |
| 1950  | 11.30 | 16.98     | 18.83                   | 18.55                    | 1.20      | 0.52  | 17.58         | 3.39                   | 2.52            |
| 2000  | 11.22 | 16.97     | 18.60                   | 18.34                    | 1.20      | 0.52  | 17.32         | 3.40                   | 2.54            |

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## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Icc = 28mA, Vd = 4.32V @Temperature = -45degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 14.49 | 19.09     | 26.24                   | 52.41                    | 1.14      | 0.59  | 26.06         | 10.35                  | 2.55            |
| 100   | 14.46 | 19.10     | 27.36                   | 42.29                    | 1.14      | 0.59  | 26.03         | 10.33                  | 2.65            |
| 150   | 14.41 | 19.13     | 27.04                   | 40.08                    | 1.15      | 0.58  | 26.43         | 10.44                  | 2.60            |
| 200   | 14.41 | 19.15     | 27.30                   | 37.30                    | 1.15      | 0.58  | 26.12         | 10.45                  | 2.47            |
| 250   | 14.37 | 19.10     | 26.32                   | 35.25                    | 1.15      | 0.58  | 25.32         | 10.39                  | 2.48            |
| 300   | 14.33 | 19.07     | 26.19                   | 33.55                    | 1.15      | 0.58  | 26.32         | 10.53                  | 2.73            |
| 350   | 14.29 | 19.02     | 25.92                   | 31.84                    | 1.15      | 0.58  | 25.92         | 10.45                  | 2.67            |
| 400   | 14.25 | 19.04     | 25.49                   | 30.78                    | 1.15      | 0.58  | 25.63         | 10.64                  | 2.54            |
| 450   | 14.20 | 19.00     | 25.38                   | 29.64                    | 1.15      | 0.58  | 25.25         | 10.50                  | 2.54            |
| 500   | 14.15 | 18.98     | 25.15                   | 28.68                    | 1.16      | 0.57  | 25.50         | 10.63                  | 2.64            |
| 550   | 14.09 | 18.95     | 24.74                   | 27.75                    | 1.16      | 0.57  | 25.37         | 10.46                  | 2.63            |
| 600   | 14.04 | 18.90     | 24.52                   | 27.01                    | 1.16      | 0.57  | 25.29         | 10.44                  | 2.55            |
| 650   | 14.00 | 18.87     | 24.06                   | 26.31                    | 1.16      | 0.57  | 25.11         | 10.60                  | 2.50            |
| 700   | 13.93 | 18.82     | 23.86                   | 25.50                    | 1.16      | 0.57  | 25.41         | 10.33                  | 2.64            |
| 750   | 13.87 | 18.79     | 23.54                   | 25.05                    | 1.16      | 0.57  | 25.39         | 10.52                  | 2.63            |
| 800   | 13.80 | 18.75     | 23.33                   | 24.31                    | 1.16      | 0.57  | 25.34         | 10.18                  | 2.50            |
| 850   | 13.73 | 18.72     | 23.09                   | 23.78                    | 1.16      | 0.57  | 25.16         | 10.45                  | 2.46            |
| 900   | 13.66 | 18.67     | 22.71                   | 23.25                    | 1.16      | 0.56  | 25.16         | 10.28                  | 2.58            |
| 940   | 13.61 | 18.64     | 22.30                   | 22.86                    | 1.17      | 0.56  | 25.28         | 10.13                  | 2.64            |
| 1000  | 13.52 | 18.58     | 22.05                   | 22.25                    | 1.17      | 0.56  | 25.09         | 10.18                  | 2.54            |
| 1050  | 13.44 | 18.55     | 21.74                   | 21.78                    | 1.17      | 0.56  | 25.03         | 10.14                  | 2.54            |
| 1100  | 13.36 | 18.50     | 21.38                   | 21.42                    | 1.17      | 0.56  | 24.80         | 10.40                  | 2.62            |
| 1150  | 13.29 | 18.44     | 21.08                   | 20.93                    | 1.17      | 0.56  | 24.80         | 10.11                  | 2.60            |
| 1200  | 13.20 | 18.40     | 20.89                   | 20.51                    | 1.17      | 0.55  | 24.64         | 10.27                  | 2.64            |
| 1250  | 13.12 | 18.35     | 20.58                   | 20.06                    | 1.18      | 0.55  | 24.68         | 10.17                  | 2.58            |
| 1300  | 13.04 | 18.31     | 20.28                   | 19.68                    | 1.18      | 0.55  | 24.51         | 10.18                  | 2.59            |
| 1350  | 12.95 | 18.24     | 20.07                   | 19.33                    | 1.18      | 0.55  | 24.31         | 10.08                  | 2.67            |
| 1400  | 12.87 | 18.19     | 19.81                   | 18.93                    | 1.18      | 0.55  | 24.19         | 10.14                  | 2.61            |
| 1450  | 12.78 | 18.15     | 19.55                   | 18.61                    | 1.18      | 0.55  | 23.99         | 10.17                  | 2.58            |
| 1500  | 12.68 | 18.09     | 19.31                   | 18.31                    | 1.18      | 0.55  | 23.98         | 10.12                  | 2.56            |
| 1550  | 12.60 | 18.06     | 18.94                   | 17.90                    | 1.19      | 0.54  | 24.22         | 10.14                  | 2.59            |
| 1600  | 12.49 | 18.00     | 18.94                   | 17.83                    | 1.19      | 0.54  | 24.24         | 10.28                  | 2.62            |
| 1650  | 12.41 | 17.93     | 18.73                   | 17.57                    | 1.19      | 0.54  | 24.15         | 10.11                  | 2.53            |
| 1700  | 12.32 | 17.88     | 18.42                   | 17.31                    | 1.19      | 0.54  | 24.05         | 10.15                  | 2.46            |
| 1750  | 12.22 | 17.81     | 18.23                   | 17.09                    | 1.19      | 0.54  | 23.79         | 10.04                  | 2.64            |
| 1800  | 12.12 | 17.76     | 17.99                   | 16.78                    | 1.20      | 0.53  | 23.79         | 10.20                  | 2.72            |
| 1850  | 12.03 | 17.72     | 17.80                   | 16.61                    | 1.20      | 0.53  | 23.16         | 9.83                   | 2.65            |
| 1900  | 11.94 | 17.66     | 17.61                   | 16.38                    | 1.20      | 0.53  | 22.89         | 9.99                   | 2.61            |
| 1950  | 11.84 | 17.59     | 17.42                   | 16.19                    | 1.20      | 0.53  | 22.86         | 9.87                   | 2.63            |
| 2000  | 11.74 | 17.56     | 17.23                   | 16.00                    | 1.21      | 0.53  | 22.86         | 9.88                   | 2.63            |

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## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Icc = 22mA, Vd = 3.83V @Temperature = +85degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 13.71 | 18.43     | 47.82                   | 26.02                    | 1.15      | 0.58  | 21.56         | 8.24                   | 3.80            |
| 100   | 13.69 | 18.52     | 51.52                   | 26.57                    | 1.16      | 0.57  | 21.57         | 8.09                   | 3.88            |
| 150   | 13.64 | 18.53     | 43.26                   | 26.88                    | 1.16      | 0.57  | 21.90         | 8.27                   | 3.83            |
| 200   | 13.61 | 18.54     | 41.63                   | 26.97                    | 1.16      | 0.57  | 21.67         | 8.28                   | 3.72            |
| 250   | 13.56 | 18.52     | 38.23                   | 27.13                    | 1.17      | 0.56  | 20.93         | 8.15                   | 3.77            |
| 300   | 13.52 | 18.53     | 37.69                   | 26.95                    | 1.17      | 0.56  | 21.85         | 8.27                   | 3.96            |
| 350   | 13.49 | 18.49     | 36.57                   | 26.66                    | 1.17      | 0.56  | 21.45         | 8.12                   | 3.91            |
| 400   | 13.43 | 18.49     | 35.56                   | 26.52                    | 1.17      | 0.56  | 21.20         | 8.34                   | 3.82            |
| 450   | 13.37 | 18.47     | 34.79                   | 26.47                    | 1.17      | 0.56  | 20.83         | 8.11                   | 3.82            |
| 500   | 13.32 | 18.43     | 34.08                   | 26.42                    | 1.17      | 0.55  | 21.09         | 8.31                   | 3.88            |
| 550   | 13.26 | 18.41     | 32.87                   | 26.23                    | 1.18      | 0.55  | 20.93         | 8.07                   | 3.89            |
| 600   | 13.20 | 18.38     | 32.17                   | 26.10                    | 1.18      | 0.55  | 20.88         | 8.11                   | 3.83            |
| 650   | 13.15 | 18.34     | 31.16                   | 26.08                    | 1.18      | 0.55  | 20.68         | 8.22                   | 3.81            |
| 700   | 13.08 | 18.31     | 30.66                   | 25.80                    | 1.18      | 0.55  | 20.97         | 8.03                   | 3.90            |
| 750   | 13.00 | 18.27     | 29.94                   | 25.67                    | 1.19      | 0.54  | 20.99         | 8.17                   | 3.88            |
| 800   | 12.94 | 18.26     | 29.44                   | 25.28                    | 1.19      | 0.54  | 20.92         | 7.78                   | 3.80            |
| 850   | 12.87 | 18.20     | 29.02                   | 25.02                    | 1.19      | 0.54  | 20.79         | 8.13                   | 3.79            |
| 900   | 12.78 | 18.16     | 28.52                   | 24.71                    | 1.19      | 0.54  | 20.80         | 7.99                   | 3.87            |
| 940   | 12.73 | 18.13     | 28.00                   | 24.41                    | 1.19      | 0.53  | 20.94         | 7.71                   | 3.94            |
| 1000  | 12.63 | 18.09     | 27.52                   | 23.97                    | 1.20      | 0.53  | 20.76         | 7.85                   | 3.85            |
| 1050  | 12.55 | 18.04     | 27.01                   | 23.56                    | 1.20      | 0.53  | 20.71         | 7.86                   | 3.85            |
| 1100  | 12.46 | 17.99     | 26.45                   | 23.24                    | 1.20      | 0.53  | 20.47         | 8.00                   | 3.95            |
| 1150  | 12.38 | 17.95     | 25.97                   | 22.80                    | 1.20      | 0.52  | 20.50         | 7.72                   | 3.91            |
| 1200  | 12.30 | 17.90     | 25.63                   | 22.47                    | 1.21      | 0.52  | 20.36         | 7.90                   | 3.96            |
| 1250  | 12.21 | 17.87     | 25.15                   | 22.07                    | 1.21      | 0.52  | 20.40         | 7.70                   | 3.94            |
| 1300  | 12.12 | 17.81     | 24.75                   | 21.84                    | 1.21      | 0.52  | 20.27         | 7.75                   | 3.94            |
| 1350  | 12.02 | 17.74     | 24.28                   | 21.58                    | 1.21      | 0.52  | 20.11         | 7.70                   | 4.01            |
| 1400  | 11.94 | 17.70     | 23.75                   | 21.24                    | 1.22      | 0.51  | 19.97         | 7.69                   | 3.95            |
| 1450  | 11.84 | 17.67     | 23.39                   | 20.93                    | 1.22      | 0.51  | 19.81         | 7.69                   | 3.93            |
| 1500  | 11.74 | 17.61     | 23.00                   | 20.64                    | 1.22      | 0.51  | 19.80         | 7.69                   | 3.95            |
| 1550  | 11.65 | 17.59     | 22.63                   | 20.24                    | 1.23      | 0.50  | 20.06         | 7.71                   | 3.94            |
| 1600  | 11.54 | 17.51     | 22.52                   | 20.16                    | 1.23      | 0.50  | 20.07         | 7.88                   | 3.98            |
| 1650  | 11.45 | 17.45     | 22.24                   | 19.81                    | 1.23      | 0.50  | 20.08         | 7.52                   | 3.92            |
| 1700  | 11.35 | 17.40     | 21.84                   | 19.47                    | 1.23      | 0.50  | 19.95         | 7.56                   | 3.89            |
| 1750  | 11.25 | 17.35     | 21.54                   | 19.17                    | 1.24      | 0.50  | 19.76         | 7.43                   | 4.00            |
| 1800  | 11.15 | 17.31     | 21.18                   | 18.84                    | 1.24      | 0.49  | 19.77         | 7.59                   | 4.08            |
| 1850  | 11.04 | 17.25     | 20.86                   | 18.61                    | 1.24      | 0.49  | 19.31         | 7.15                   | 4.07            |
| 1900  | 10.94 | 17.20     | 20.56                   | 18.28                    | 1.25      | 0.49  | 18.92         | 7.44                   | 4.05            |
| 1950  | 10.84 | 17.14     | 20.21                   | 18.07                    | 1.25      | 0.49  | 19.01         | 7.26                   | 4.02            |
| 2000  | 10.74 | 17.12     | 19.99                   | 17.94                    | 1.26      | 0.48  | 18.92         | 7.18                   | 3.99            |

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## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: Icc = 16mA, Vd = 3.75V @Temperature = +85degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 13.00 | 18.03     | 26.74                   | 19.90                    | 1.17      | 0.57  | 16.62         | 3.25                   | 3.86            |
| 100   | 12.99 | 18.06     | 26.44                   | 20.15                    | 1.17      | 0.56  | 16.65         | 3.02                   | 3.87            |
| 150   | 12.95 | 18.07     | 27.33                   | 20.47                    | 1.17      | 0.56  | 16.93         | 3.46                   | 3.89            |
| 200   | 12.91 | 18.06     | 27.38                   | 20.45                    | 1.17      | 0.56  | 16.74         | 3.35                   | 3.81            |
| 250   | 12.87 | 18.04     | 27.60                   | 20.53                    | 1.18      | 0.55  | 16.11         | 3.10                   | 3.83            |
| 300   | 12.85 | 18.04     | 27.27                   | 20.69                    | 1.18      | 0.55  | 16.93         | 3.34                   | 3.97            |
| 350   | 12.82 | 18.03     | 27.02                   | 20.76                    | 1.18      | 0.55  | 16.57         | 3.16                   | 3.91            |
| 400   | 12.75 | 18.00     | 27.10                   | 20.81                    | 1.18      | 0.55  | 16.38         | 3.33                   | 3.89            |
| 450   | 12.70 | 17.95     | 26.69                   | 20.89                    | 1.18      | 0.55  | 16.04         | 3.13                   | 3.85            |
| 500   | 12.65 | 17.95     | 26.54                   | 21.01                    | 1.19      | 0.55  | 16.32         | 3.39                   | 3.87            |
| 550   | 12.61 | 17.91     | 26.72                   | 21.29                    | 1.18      | 0.54  | 16.20         | 2.96                   | 3.91            |
| 600   | 12.54 | 17.87     | 26.78                   | 21.32                    | 1.19      | 0.54  | 16.22         | 3.11                   | 3.91            |
| 650   | 12.49 | 17.83     | 26.59                   | 21.51                    | 1.19      | 0.54  | 16.00         | 3.40                   | 3.87            |
| 700   | 12.44 | 17.82     | 26.37                   | 21.81                    | 1.19      | 0.54  | 16.32         | 3.16                   | 3.92            |
| 750   | 12.36 | 17.77     | 26.36                   | 21.96                    | 1.19      | 0.54  | 16.36         | 3.26                   | 3.90            |
| 800   | 12.31 | 17.75     | 26.09                   | 22.06                    | 1.19      | 0.53  | 16.32         | 2.99                   | 3.87            |
| 850   | 12.25 | 17.71     | 26.05                   | 22.27                    | 1.19      | 0.53  | 16.25         | 3.39                   | 3.85            |
| 900   | 12.17 | 17.67     | 25.91                   | 22.43                    | 1.20      | 0.53  | 16.25         | 3.26                   | 3.90            |
| 940   | 12.13 | 17.63     | 25.76                   | 22.42                    | 1.20      | 0.53  | 16.50         | 3.03                   | 3.94            |
| 1000  | 12.03 | 17.57     | 25.40                   | 22.46                    | 1.20      | 0.53  | 16.36         | 3.11                   | 3.91            |
| 1050  | 11.96 | 17.55     | 25.26                   | 22.55                    | 1.20      | 0.52  | 16.49         | 3.17                   | 3.94            |
| 1100  | 11.89 | 17.50     | 25.09                   | 22.63                    | 1.20      | 0.52  | 16.26         | 3.27                   | 3.96            |
| 1150  | 11.81 | 17.45     | 24.76                   | 22.52                    | 1.21      | 0.52  | 16.39         | 2.97                   | 3.90            |
| 1200  | 11.71 | 17.41     | 24.46                   | 22.48                    | 1.21      | 0.51  | 16.28         | 3.24                   | 3.99            |
| 1250  | 11.65 | 17.36     | 24.17                   | 22.42                    | 1.21      | 0.51  | 16.41         | 3.17                   | 3.99            |
| 1300  | 11.58 | 17.31     | 23.94                   | 22.43                    | 1.21      | 0.51  | 16.37         | 3.11                   | 3.97            |
| 1350  | 11.48 | 17.26     | 23.57                   | 22.37                    | 1.21      | 0.51  | 16.34         | 3.01                   | 3.99            |
| 1400  | 11.39 | 17.21     | 23.09                   | 22.25                    | 1.22      | 0.51  | 16.26         | 3.21                   | 3.98            |
| 1450  | 11.32 | 17.18     | 22.77                   | 22.15                    | 1.22      | 0.50  | 16.19         | 3.18                   | 4.01            |
| 1500  | 11.23 | 17.10     | 22.42                   | 21.97                    | 1.22      | 0.50  | 16.25         | 3.19                   | 3.96            |
| 1550  | 11.14 | 17.10     | 22.20                   | 21.80                    | 1.23      | 0.50  | 16.58         | 3.24                   | 3.93            |
| 1600  | 11.04 | 17.00     | 22.01                   | 21.69                    | 1.23      | 0.50  | 16.65         | 3.42                   | 3.99            |
| 1650  | 10.95 | 16.95     | 21.82                   | 21.46                    | 1.23      | 0.49  | 16.78         | 3.25                   | 3.96            |
| 1700  | 10.85 | 16.91     | 21.48                   | 21.22                    | 1.23      | 0.49  | 16.69         | 3.47                   | 3.93            |
| 1750  | 10.77 | 16.86     | 21.23                   | 20.93                    | 1.23      | 0.49  | 16.77         | 3.26                   | 3.99            |
| 1800  | 10.68 | 16.81     | 20.98                   | 20.61                    | 1.24      | 0.49  | 16.79         | 3.52                   | 4.08            |
| 1850  | 10.57 | 16.76     | 20.74                   | 20.38                    | 1.24      | 0.48  | 16.65         | 3.12                   | 4.06            |
| 1900  | 10.47 | 16.70     | 20.45                   | 20.13                    | 1.24      | 0.48  | 16.16         | 3.47                   | 4.07            |
| 1950  | 10.37 | 16.66     | 20.09                   | 19.91                    | 1.25      | 0.48  | 16.53         | 3.50                   | 4.01            |
| 2000  | 10.28 | 16.63     | 19.93                   | 19.75                    | 1.25      | 0.48  | 16.31         | 3.32                   | 3.95            |

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## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

TEST CONDITIONS: INPUT POWER = -20dBm, Icc = 28mA, Vd = 3.90V @Temperature = +85degC

| FREQ  | Gain  | Isolation | Input<br>Return<br>Loss | Output<br>Return<br>Loss | Stability |       | IP3<br>Output | 1dB<br>Comp.<br>Output | Noise<br>Figure |
|-------|-------|-----------|-------------------------|--------------------------|-----------|-------|---------------|------------------------|-----------------|
| (MHz) | (dB)  | (dB)      | (dB)                    | (dB)                     | K         | Delta | (dBm)         | (dBm)                  | (dB)            |
| 50    | 14.07 | 18.92     | 30.00                   | 33.20                    | 1.16      | 0.57  | 25.13         | 9.75                   | 3.81            |
| 100   | 14.05 | 18.86     | 30.26                   | 33.73                    | 1.16      | 0.57  | 25.14         | 9.90                   | 3.91            |
| 150   | 13.99 | 18.81     | 29.29                   | 34.48                    | 1.16      | 0.57  | 25.56         | 9.98                   | 3.86            |
| 200   | 13.97 | 18.80     | 29.57                   | 34.35                    | 1.16      | 0.57  | 25.24         | 10.02                  | 3.73            |
| 250   | 13.92 | 18.81     | 28.57                   | 32.92                    | 1.16      | 0.57  | 24.36         | 10.07                  | 3.76            |
| 300   | 13.88 | 18.80     | 28.85                   | 31.59                    | 1.16      | 0.57  | 25.42         | 10.19                  | 4.00            |
| 350   | 13.83 | 18.75     | 28.86                   | 30.69                    | 1.16      | 0.57  | 24.95         | 10.18                  | 3.91            |
| 400   | 13.78 | 18.77     | 28.77                   | 30.00                    | 1.17      | 0.56  | 24.62         | 10.34                  | 3.81            |
| 450   | 13.72 | 18.76     | 28.62                   | 29.27                    | 1.17      | 0.56  | 24.19         | 10.26                  | 3.81            |
| 500   | 13.66 | 18.70     | 28.24                   | 28.62                    | 1.17      | 0.56  | 24.36         | 10.41                  | 3.92            |
| 550   | 13.60 | 18.69     | 27.86                   | 27.90                    | 1.17      | 0.56  | 24.18         | 10.33                  | 3.92            |
| 600   | 13.55 | 18.68     | 27.56                   | 27.28                    | 1.18      | 0.55  | 24.07         | 10.32                  | 3.83            |
| 650   | 13.48 | 18.62     | 27.05                   | 26.71                    | 1.18      | 0.55  | 23.84         | 10.49                  | 3.80            |
| 700   | 13.41 | 18.59     | 26.78                   | 26.00                    | 1.18      | 0.55  | 24.04         | 10.35                  | 3.94            |
| 750   | 13.34 | 18.56     | 26.42                   | 25.56                    | 1.18      | 0.55  | 24.02         | 10.46                  | 3.93            |
| 800   | 13.27 | 18.53     | 26.14                   | 24.91                    | 1.18      | 0.55  | 23.90         | 10.19                  | 3.81            |
| 850   | 13.20 | 18.49     | 26.03                   | 24.44                    | 1.19      | 0.54  | 23.72         | 10.42                  | 3.78            |
| 900   | 13.10 | 18.46     | 25.79                   | 23.93                    | 1.19      | 0.54  | 23.71         | 10.33                  | 3.90            |
| 940   | 13.05 | 18.42     | 25.34                   | 23.55                    | 1.19      | 0.54  | 23.69         | 10.15                  | 3.96            |
| 1000  | 12.95 | 18.35     | 25.07                   | 22.98                    | 1.19      | 0.54  | 23.46         | 10.18                  | 3.86            |
| 1050  | 12.86 | 18.32     | 24.76                   | 22.47                    | 1.20      | 0.53  | 23.26         | 10.19                  | 3.84            |
| 1100  | 12.77 | 18.28     | 24.36                   | 22.07                    | 1.20      | 0.53  | 23.04         | 10.31                  | 3.97            |
| 1150  | 12.68 | 18.24     | 24.05                   | 21.63                    | 1.20      | 0.53  | 22.92         | 10.04                  | 3.96            |
| 1200  | 12.59 | 18.19     | 23.82                   | 21.28                    | 1.20      | 0.53  | 22.76         | 10.15                  | 3.96            |
| 1250  | 12.50 | 18.14     | 23.51                   | 20.90                    | 1.21      | 0.52  | 22.68         | 10.02                  | 3.92            |
| 1300  | 12.41 | 18.10     | 23.22                   | 20.59                    | 1.21      | 0.52  | 22.48         | 9.93                   | 3.96            |
| 1350  | 12.31 | 18.04     | 22.88                   | 20.31                    | 1.21      | 0.52  | 22.20         | 9.85                   | 4.05            |
| 1400  | 12.22 | 17.99     | 22.52                   | 19.99                    | 1.22      | 0.52  | 22.03         | 9.85                   | 3.98            |
| 1450  | 12.12 | 17.93     | 22.24                   | 19.71                    | 1.22      | 0.51  | 21.85         | 9.81                   | 3.95            |
| 1500  | 12.02 | 17.88     | 21.97                   | 19.41                    | 1.22      | 0.51  | 21.76         | 9.67                   | 3.95            |
| 1550  | 11.93 | 17.87     | 21.60                   | 19.04                    | 1.23      | 0.51  | 21.98         | 9.68                   | 3.98            |
| 1600  | 11.82 | 17.79     | 21.60                   | 18.93                    | 1.23      | 0.51  | 21.95         | 9.73                   | 4.01            |
| 1650  | 11.72 | 17.74     | 21.36                   | 18.58                    | 1.23      | 0.50  | 21.85         | 9.42                   | 3.91            |
| 1700  | 11.62 | 17.68     | 21.00                   | 18.32                    | 1.23      | 0.50  | 21.70         | 9.39                   | 3.90            |
| 1750  | 11.52 | 17.62     | 20.72                   | 18.06                    | 1.24      | 0.50  | 21.39         | 9.25                   | 4.04            |
| 1800  | 11.41 | 17.58     | 20.41                   | 17.72                    | 1.24      | 0.50  | 21.36         | 9.21                   | 4.11            |
| 1850  | 11.30 | 17.52     | 20.17                   | 17.49                    | 1.24      | 0.49  | 20.76         | 8.82                   | 4.06            |
| 1900  | 11.20 | 17.47     | 19.90                   | 17.25                    | 1.25      | 0.49  | 20.45         | 8.95                   | 4.08            |
| 1950  | 11.09 | 17.41     | 19.56                   | 17.07                    | 1.25      | 0.49  | 20.39         | 8.69                   | 4.05            |
| 2000  | 10.99 | 17.37     | 19.38                   | 16.91                    | 1.26      | 0.49  | 20.38         | 8.66                   | 4.04            |

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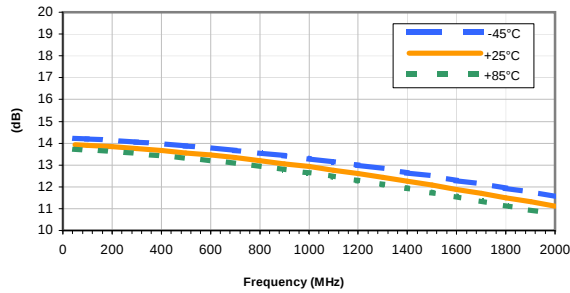
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## Typical Performance Curves

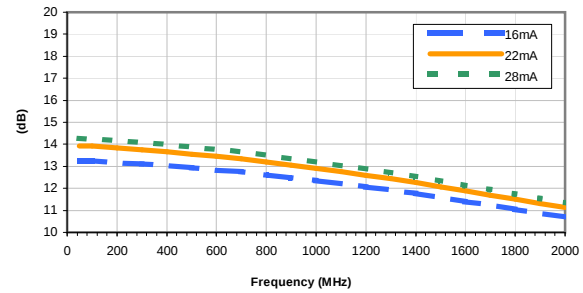
**GAIN vs. TEMPERATURE**

INPUT POWER = -20dBm, CURRENT = 22mA



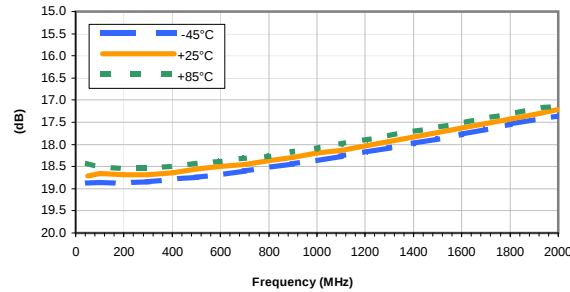
**GAIN vs. CURRENT**

INPUT POWER = -20dBm, Temperature = +25°C



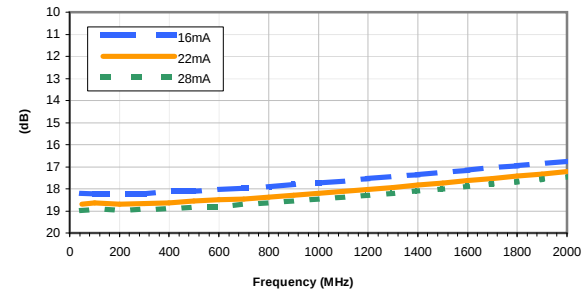
**ISOLATION vs. TEMPERATURE**

INPUT POWER = -20dBm, CURRENT = 22mA



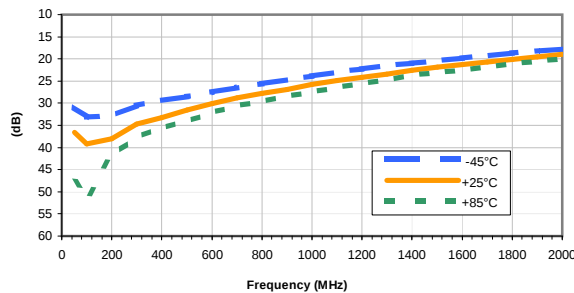
**ISOLATION vs. CURRENT**

INPUT POWER = -20dBm, Temperature = +25°C



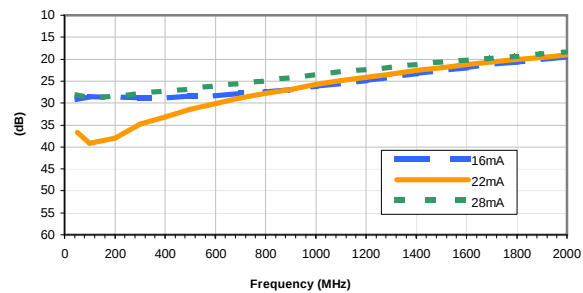
**INPUT RETURN LOSS vs. TEMPERATURE**

INPUT POWER = -20dBm, CURRENT = 22mA



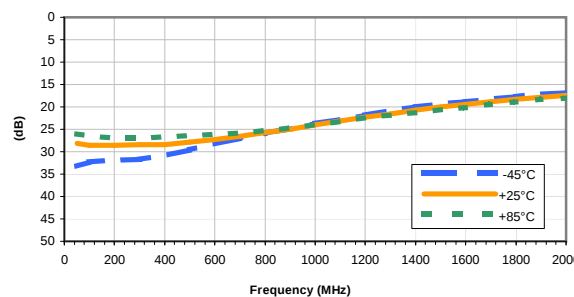
**INPUT RETURN LOSS vs. CURRENT**

INPUT POWER = -20dBm, Temperature = +25°C



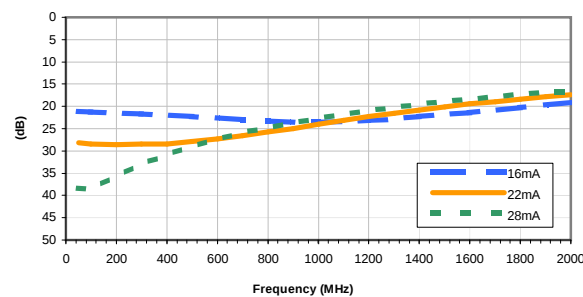
**OUTPUT RETURN LOSS vs. TEMPERATURE**

INPUT POWER = -20dBm, CURRENT = 22mA



**OUTPUT RETURN LOSS vs. CURRENT**

INPUT POWER = -20dBm, Temperature = +25°C



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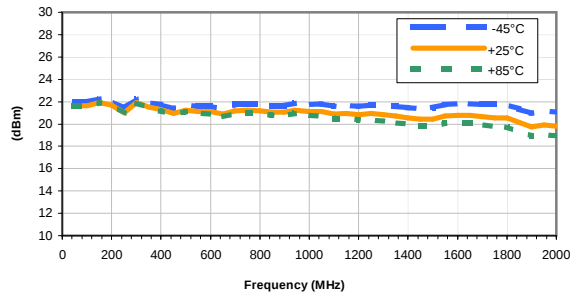
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## Typical Performance Curves

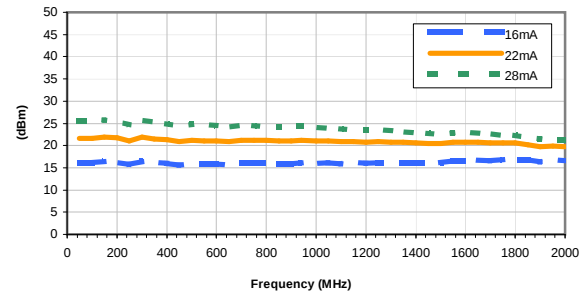
OUTPUT IP3 vs. TEMPERATURE

INPUT POWER = -20dBm, CURRENT = 22mA



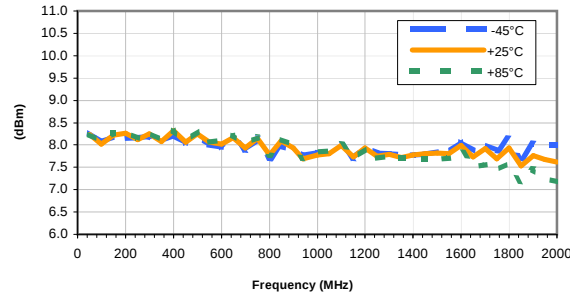
OUTPUT IP-3 vs. CURRENT

INPUT POWER = -20dBm, Temperature = +25°C



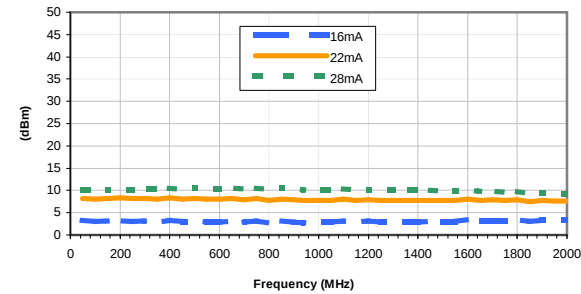
OUTPUT POWER at 1dB Compression vs. TEMPERATURE

CURRENT = 22mA



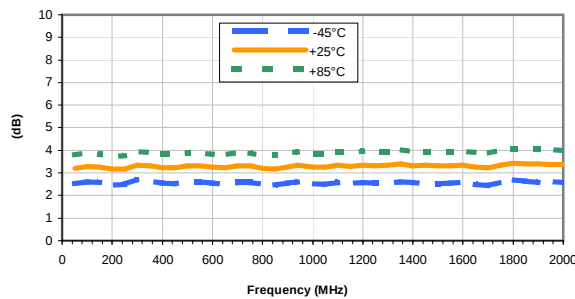
OUTPUT POWER at 1dB Compression vs. CURRENT

Temperature = +25°C



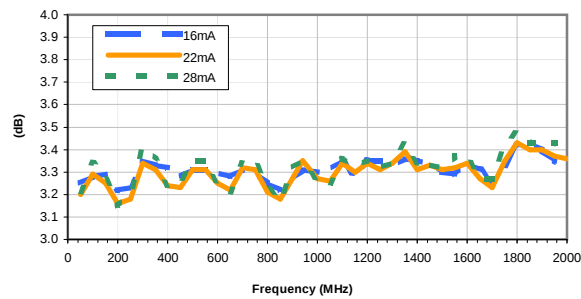
Noise Figure vs. TEMPERATURE

CURRENT = 22mA



Noise Figure vs. CURRENT

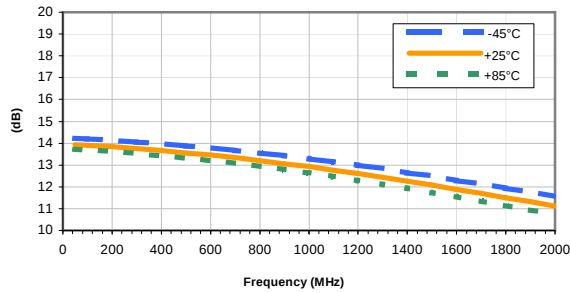
Temperature = +25°C



## Typical Performance Curves

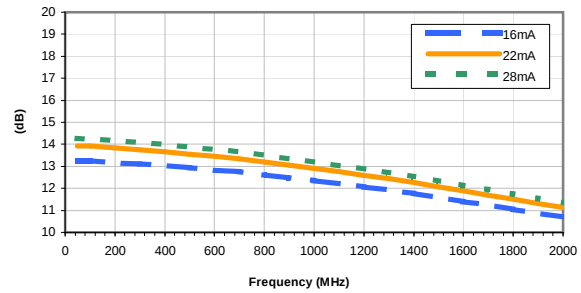
**GAIN vs. TEMPERATURE**

INPUT POWER = -20dBm, CURRENT = 22mA



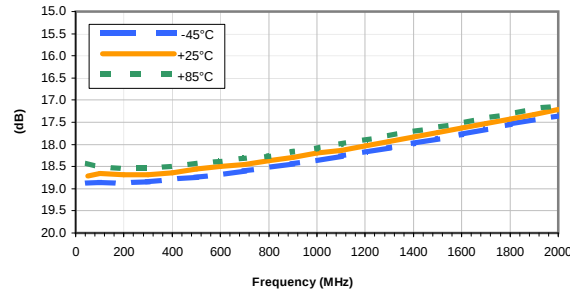
**GAIN vs. CURRENT**

INPUT POWER = -20dBm, Temperature = +25°C



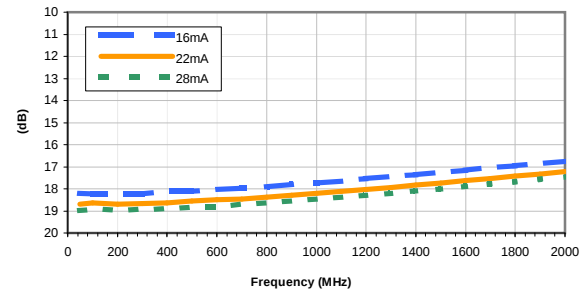
**ISOLATION vs. TEMPERATURE**

INPUT POWER = -20dBm, CURRENT = 22mA



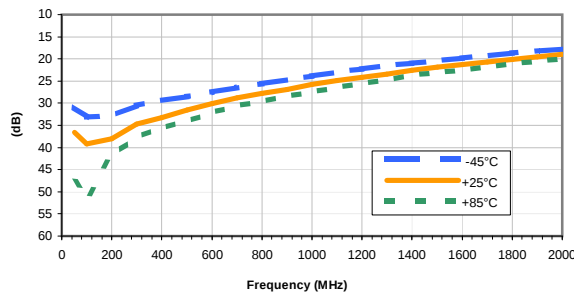
**ISOLATION vs. CURRENT**

INPUT POWER = -20dBm, Temperature = +25°C



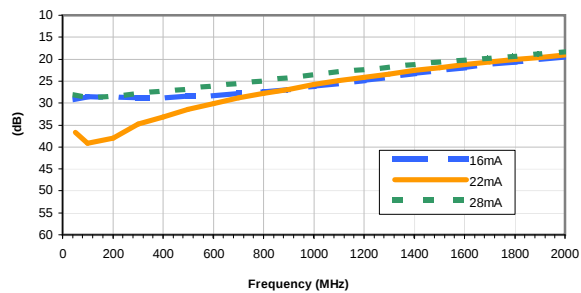
**INPUT RETURN LOSS vs. TEMPERATURE**

INPUT POWER = -20dBm, CURRENT = 22mA



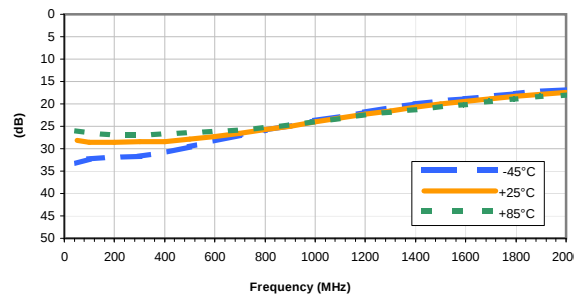
**INPUT RETURN LOSS vs. CURRENT**

INPUT POWER = -20dBm, Temperature = +25°C



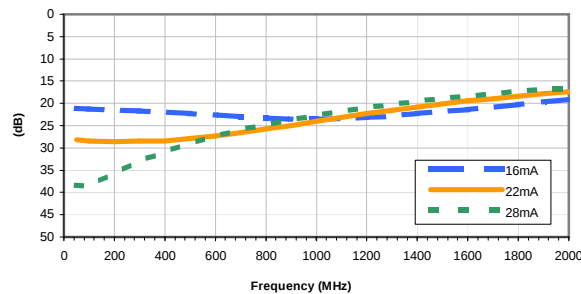
**OUTPUT RETURN LOSS vs. TEMPERATURE**

INPUT POWER = -20dBm, CURRENT = 22mA



**OUTPUT RETURN LOSS vs. CURRENT**

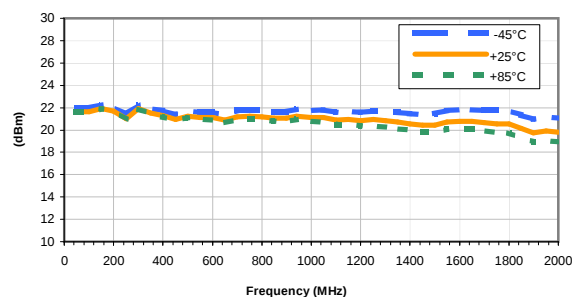
INPUT POWER = -20dBm, Temperature = +25°C



## Typical Performance Curves

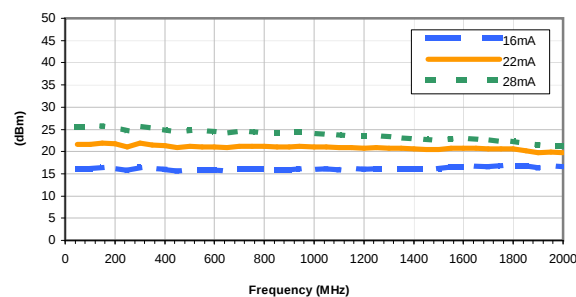
OUTPUT IP3 vs. TEMPERATURE

INPUT POWER = -20dBm, CURRENT = 22mA



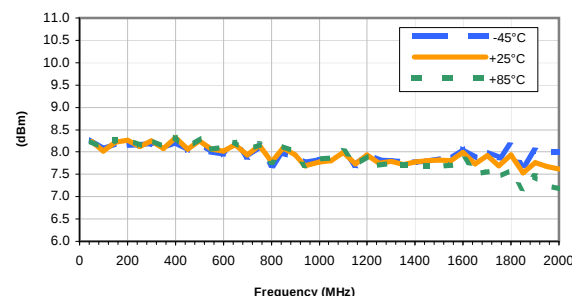
OUTPUT IP-3 vs. CURRENT

INPUT POWER = -20dBm, Temperature = +25°C



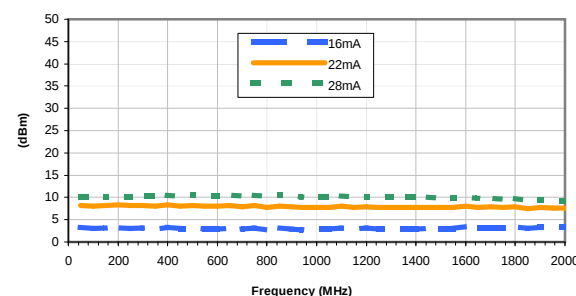
OUTPUT POWER at 1dB Compression vs. TEMPERATURE

CURRENT = 22mA



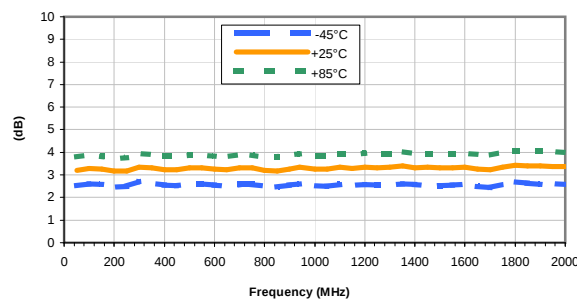
OUTPUT POWER at 1dB Compression vs. CURRENT

Temperature = +25°C



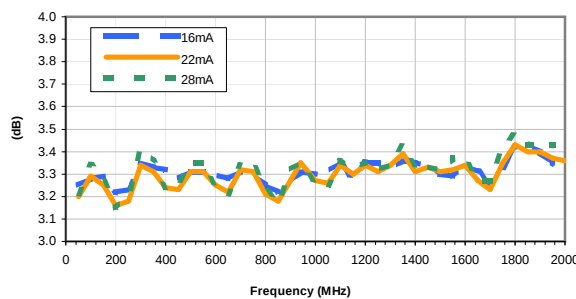
Noise Figure vs. TEMPERATURE

CURRENT = 22mA

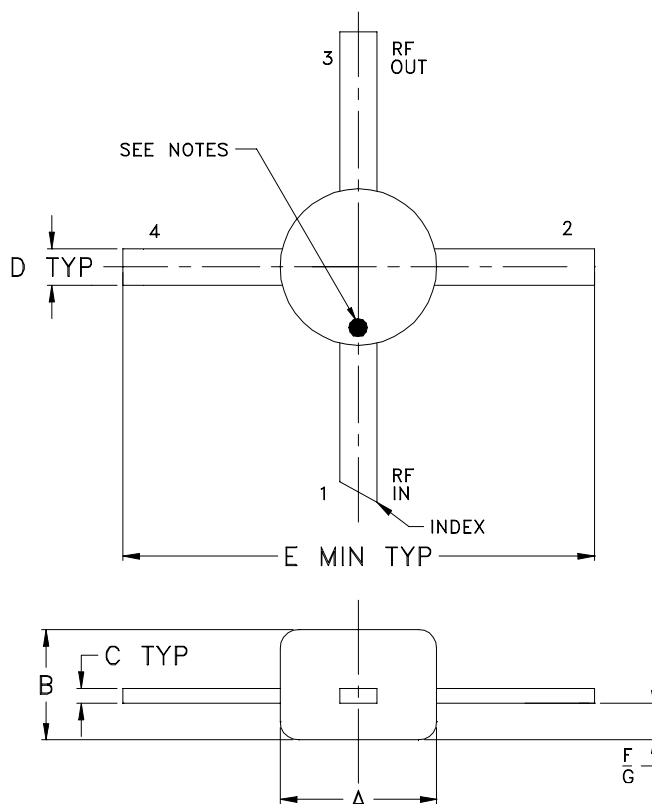


Noise Figure vs. CURRENT

Temperature = +25°C



### Outline Dimensions



| CASE# | A              | B              | C              | D              | E              | F              | G              | WT.GRAMS |
|-------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------|
| VV105 | .085<br>(2.16) | .060<br>(1.52) | .008<br>(0.20) | .020<br>(0.51) | .250<br>(6.35) | .012<br>(0.30) | .025<br>(0.64) | .015     |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .03$ ; 3 Pl.  $\pm .015$

#### Notes:

- Case material: Plastic.
- Termination finish:  
For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier.  
For RoHS-5 Case Styles: Tin-Lead plate.
- RF input termination (1) identified by one or both of the following at factory option:
  - diagonally cut termination, which be  $45^\circ$  (ref) in either direction;
  - orientation mark on the case. Model dash number is identified by color dot or alphanumeric code on case. See specification data sheet.
- Special Tolerances: Termination width  $\pm .005$  inch, termination thickness  $\pm .003$  inch.



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

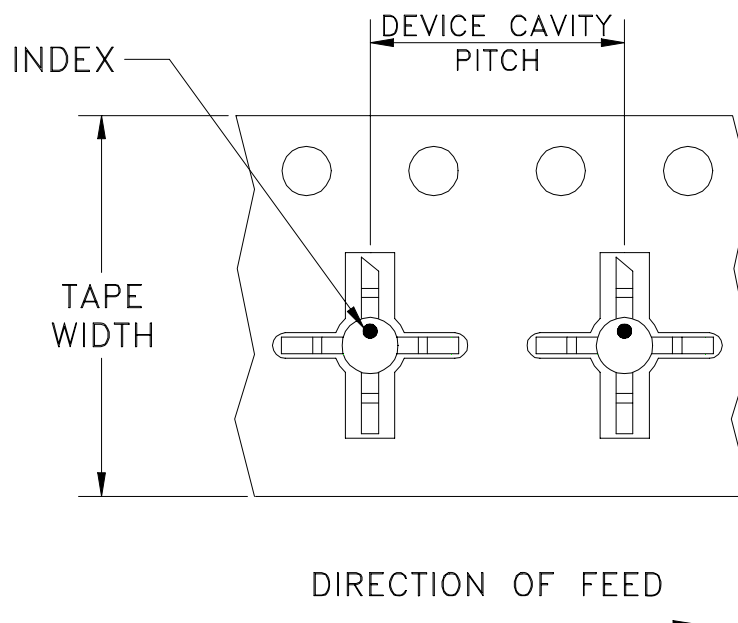
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

# Tape & Reel Packaging TR-F4

## DEVICE ORIENTATION IN T&R



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel                    |      |
|----------------|-------------------------|-------------------|-------------------------------------|------|
| 12             | 8                       | 7                 | Small quantity standards (see note) | 20   |
|                |                         |                   |                                     | 50   |
|                |                         |                   |                                     | 100  |
|                |                         |                   |                                     | 200  |
|                |                         |                   |                                     | 500  |
|                |                         | 7                 | Standard                            | 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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



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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          | -20° to 85°C<br>Ambient Environment                                                                                            | Individual Model Data Sheet                                     |
| Storage Temperature            | -55° to 100° C<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 |                |