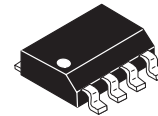
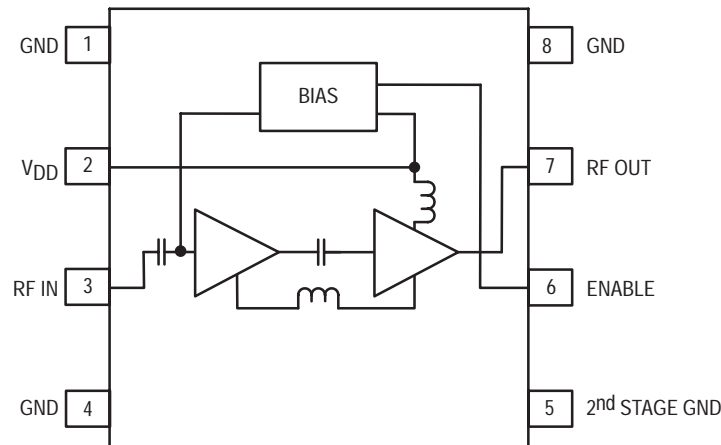


ARCHIVED BY FREESCALE SEMICONDUCTOR, INC. 2005

**The MRFIC Line**
**GPS GaAs Low Noise Amplifier**

The MRFIC1501 is a low cost yet high performance two-stage, low-noise amplifier designed primarily for use in Global Positioning Satellite System (GPS) and other L-band satellite receivers. The broadband nature of the design makes the device applicable to a variety of L-band applications where high performance at reasonable current and cost are required. Supply current is minimized through a current sharing DC cascode circuit configuration. Supply voltage can be applied to either the  $V_{DD}$  pin or the RF output pin for remote antenna applications. The integrated circuit requires minimal off-chip matching while allowing for maximum flexibility in optimizing gain and noise figure. An ENABLE pin is provided to allow for a reduced supply current standby mode. The design employs Motorola's low cost planar self-aligned MESFET process to assure repeatable characteristics at minimal cost.

- Usable Frequency Range = 1 to 2 GHz
- 18 dB Typ Gain at  $V_{DD}$  = 5 Volts
- 1.1 dB Typ Noise Figure at  $V_{DD}$  = 5 Volts
- Simple Off-chip Matching for Maximum Gain/Noise Figure Flexibility
- Single Bias Supply = 3 to 5 Volts
- Low Power Consumption = 30 mW (Typ) at 5 Volts
- Low Cost Surface Mount Plastic Package
- Order MRFIC1501R2 for Tape and Reel.  
R2 Suffix = 2,500 Units per 12 mm, 13 inch Reel.
- Device Marking = M1501

**MRFIC1501**
**1.6 GHz GaAs  
LOW NOISE  
AMPLIFIER**

**CASE 751-06  
(SO-8)**

**Pin Connections and Functional Block Diagram**

**MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

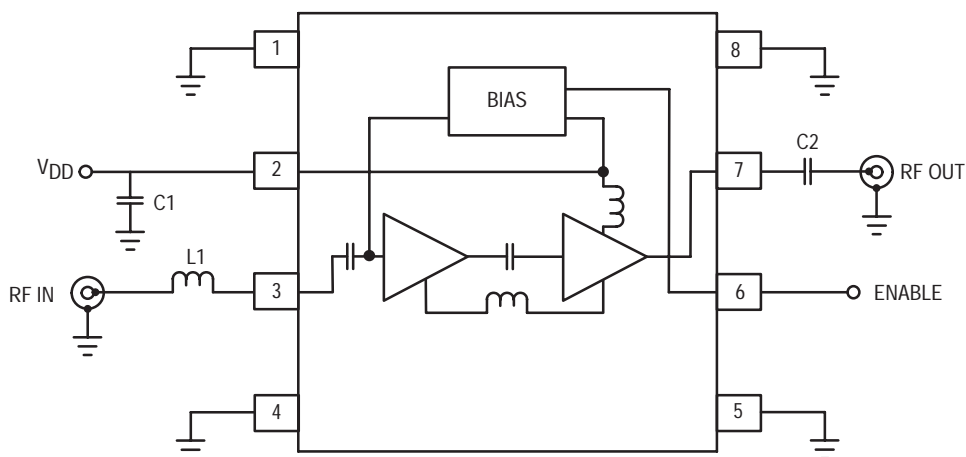
| Ratings  | Symbol     | Limit        | Unit             |
|--|------------|--------------|------------------|
| Supply Voltage   | $V_{DD}$   | 6            | Vdc              |
| RF Input Power   | $P_{RF}$   | 3            | dBm              |
| ENABLE Voltage   | ENABLE     | 6            | Vdc              |
| $V_{DD}$ Current Sourcing (With Supply Connected to Pin 7) | $I_{PIN2}$ | 20           | mA               |
| Storage Temperature Range                                  | $T_{stg}$  | - 65 to +150 | $^\circ\text{C}$ |
| Operating Ambient Temperature                              | $T_A$      | - 30 to +100 | $^\circ\text{C}$ |

**RECOMMENDED OPERATING RANGES**

| Parameter                                     | Symbol   | Value            | Unit |
|---|----------|------------------|------|
| RF Frequency                                  | $f_{RF}$ | 1 to 2           | GHz  |
| ENABLE "ON" (Device Operational) Voltage      | ENABLE   | $V_{DD} \pm 0.5$ | Vdc  |
| ENABLE "OFF" (Device in Standby Mode) Voltage | ENABLE   | 0 to 0.5         | Vdc  |
| Supply Voltage                                | $V_{DD}$ | 3 to 5           | Vdc  |

**ELECTRICAL CHARACTERISTICS** ( $V_{DD} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $R_F = 1.575\text{ GHz}$ ,  $ENABLE = 5\text{ V}$ , Circuit Configuration Shown in Figure 1)

| Characteristic                      | Min | Typ | Max | Unit |
|-------------------------------------|-----|-----|-----|------|
| RF Gain                             | 17  | 18  | —   | dB   |
| SSB Noise Figure                    | —   | 1.1 | —   | dB   |
| RF Output 3rd Order Intercept Point | —   | 10  | —   | dBm  |
| Output 1 dB Gain Compression        | —   | 0   | —   | dBm  |
| Reverse Isolation ( $s_{12}$ )      | —   | 30  | —   | dB   |
| Input Return Loss                   | —   | 10  | —   | dB   |
| Output Return Loss                  | —   | 10  | —   | dB   |
| Supply Current                      | —   | 5.9 | 7.5 | mA   |



$C1, C2 - 22\text{ pF}$   
 $L1 - 11\text{ nH}$  (Implemented in Microstrip)

**Figure 1. Applications Circuit Configuration**

TYPICAL CHARACTERISTICS

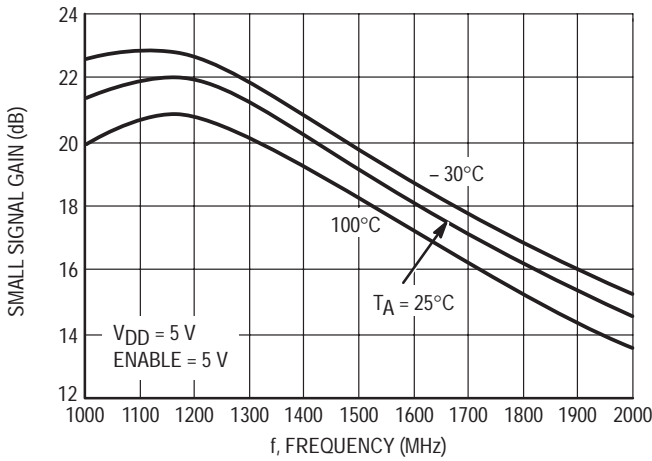


Figure 2. Small Signal Gain versus Frequency

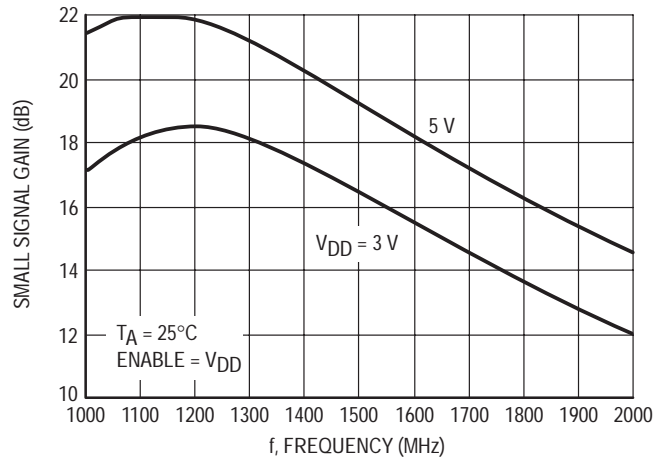


Figure 3. Small Signal Gain versus Frequency

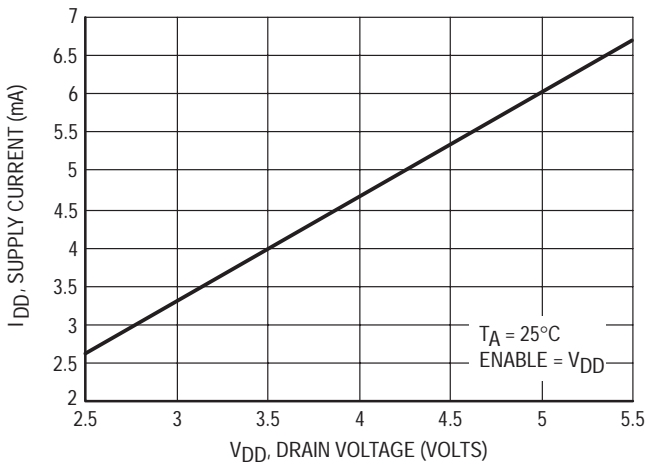


Figure 4. Drain Current versus Drain Voltage

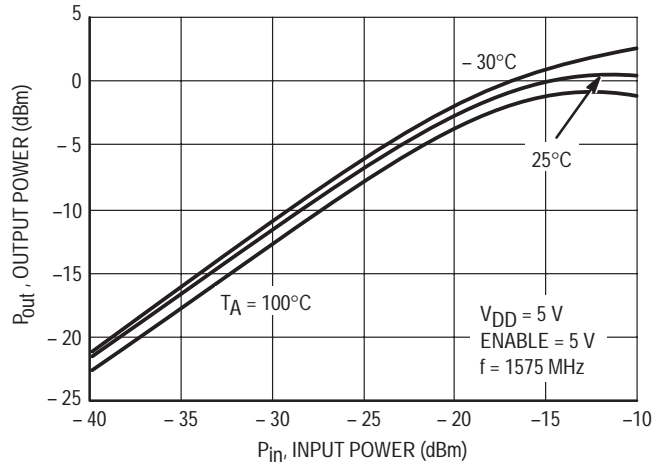


Figure 5. Output Power versus Input Power

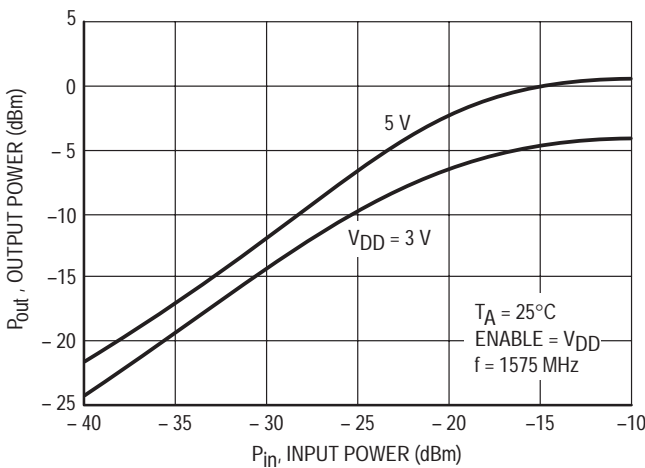


Figure 6. Output Power versus Input Power

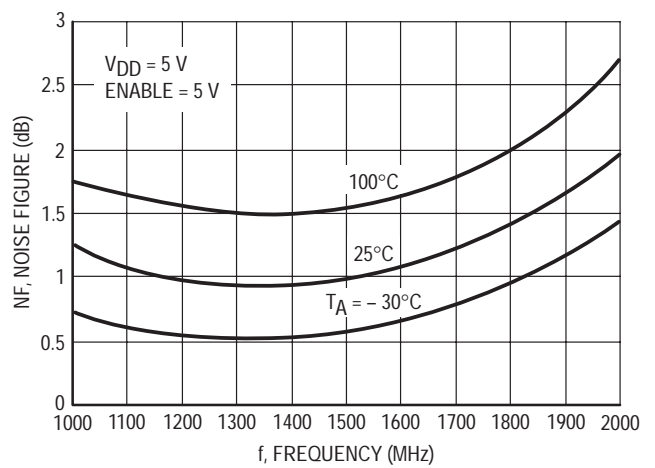


Figure 7. Noise Figure versus Frequency

## TYPICAL CHARACTERISTICS

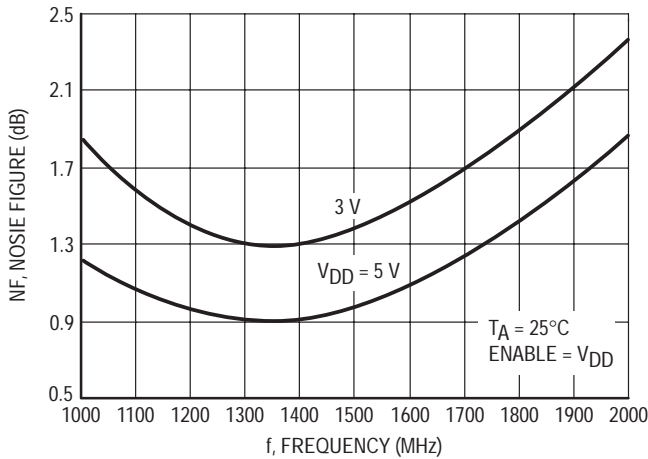


Figure 8. Noise Figure versus Frequency

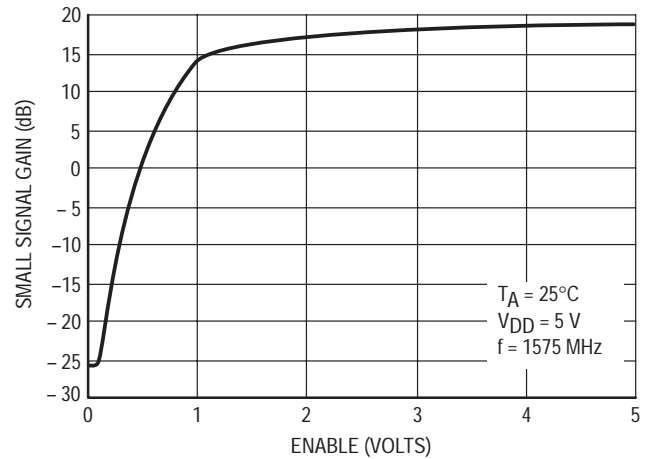


Figure 9. Gain versus ENABLE Voltage

## APPLICATIONS INFORMATION

### DESIGN CONSIDERATIONS

The circuit configuration employs a DC cascode arrangement which allows current sharing between two FETs. This gives excellent noise figure at reduced supply current. Since GPS applications often require the downconverter to be remotely mounted at the antenna, the output is DC coupled so that the drain voltage can be supplied through the coax feed. The  $V_{DD}$  pin can actually supply other components in the equipment at less than 20 mA of current. On-chip bias circuitry tracks changes in device threshold voltage and temperature and is externally controlled through the ENABLE pin. This feature allows for a low current standby mode or for gain reduction. Refer to Figure 9 for control characteristics.

### CIRCUIT CONSIDERATIONS

As shown in Figure 1, impedance matching of the MRFIC1501 is quite simple. Through use of an on-chip

source inductor in the first stage,  $\Gamma_{opt}$  and  $\Gamma_{in}^*$  are approximately equal. A single inductor at the input will give good input match and noise figure. This inductor can be implemented with a high impedance microstrip line or a chip inductor.

As with all RF active circuit designs, bypassing the supply pin is recommended. Layout and ground via location is important. Vias should be located as close as possible to ground pins and the ground side of off-chip components.

### EVALUATION BOARDS

Evaluation boards are available for RF Monolithic Integrated Circuits by adding a "TF" to the device type. For a complete list of currently available boards and ones in development for newly introduced products, please consult your local Motorola Distributor or Sales Office.



**Table 1. Scattering Parameters ( $V_{DD} = 3$  Volts, ENABLE = 3 Volts, 50  $\Omega$  System)**

| f<br>(MHz) | S <sub>11</sub> |               | S <sub>21</sub> |               | S <sub>12</sub> |               | S <sub>22</sub> |               |
|------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|
|            | S <sub>11</sub> | $\angle \phi$ | S <sub>21</sub> | $\angle \phi$ | S <sub>12</sub> | $\angle \phi$ | S <sub>22</sub> | $\angle \phi$ |
| 795        | 0.958           | -28.07        | 3.218           | 28.76         | 0.011           | 179.98        | 0.358           | 21.08         |
| 825        | 0.959           | -29.71        | 3.448           | 23.95         | 0.011           | 176.45        | 0.336           | 15.36         |
| 855        | 0.954           | -31.16        | 3.534           | 18.42         | 0.012           | 172.43        | 0.311           | 9.65          |
| 870        | 0.951           | -32.04        | 3.535           | 16.03         | 0.011           | 171.06        | 0.297           | 6.67          |
| 900        | 0.945           | -33.63        | 3.502           | 11.26         | 0.012           | 166.26        | 0.273           | 1.19          |
| 930        | 0.935           | -35.48        | 3.528           | 6.47          | 0.013           | 166.48        | 0.250           | -5.16         |
| 960        | 0.932           | -37.28        | 3.689           | 2.07          | 0.014           | 164.19        | 0.227           | -11.04        |
| 990        | 0.921           | -39.03        | 3.867           | -2.41         | 0.016           | 163.33        | 0.203           | -18.26        |
| 1020       | 0.912           | -40.69        | 3.954           | -7.56         | 0.018           | 160.39        | 0.181           | -25.17        |
| 1050       | 0.901           | -42.28        | 3.975           | -12.01        | 0.019           | 158.58        | 0.158           | -33.18        |
| 1080       | 0.892           | -44.16        | 4.039           | -16.73        | 0.020           | 154.26        | 0.138           | -40.98        |
| 1110       | 0.879           | -46.05        | 4.154           | -21.72        | 0.021           | 151.91        | 0.119           | -49.98        |
| 1140       | 0.865           | -47.91        | 4.296           | -27.64        | 0.022           | 147.91        | 0.101           | -58.85        |
| 1170       | 0.846           | -49.35        | 4.320           | -32.73        | 0.022           | 147.32        | 0.086           | -71.10        |
| 1200       | 0.825           | -51.34        | 4.224           | -36.64        | 0.022           | 147.46        | 0.077           | -87.14        |
| 1230       | 0.800           | -51.92        | 4.125           | -40.14        | 0.026           | 152.91        | 0.070           | -118.39       |
| 1260       | 0.798           | -52.57        | 4.224           | -42.75        | 0.029           | 141.81        | 0.053           | -155.35       |
| 1290       | 0.782           | -53.50        | 4.371           | -47.81        | 0.030           | 135.50        | 0.051           | 169.35        |
| 1320       | 0.775           | -55.70        | 4.554           | -53.11        | 0.031           | 132.76        | 0.049           | 140.94        |
| 1350       | 0.758           | -57.05        | 4.525           | -57.58        | 0.030           | 128.85        | 0.052           | 126.02        |
| 1380       | 0.742           | -58.70        | 4.501           | -61.64        | 0.031           | 125.89        | 0.061           | 114.60        |
| 1410       | 0.721           | -60.03        | 4.511           | -66.70        | 0.030           | 123.70        | 0.073           | 105.25        |
| 1440       | 0.703           | -60.76        | 4.538           | -71.38        | 0.031           | 121.40        | 0.083           | 97.32         |
| 1470       | 0.686           | -61.48        | 4.553           | -75.65        | 0.030           | 119.75        | 0.095           | 89.55         |
| 1500       | 0.668           | -62.72        | 4.497           | -79.44        | 0.031           | 116.74        | 0.107           | 82.70         |
| 1530       | 0.652           | -63.71        | 4.436           | -83.00        | 0.031           | 115.52        | 0.119           | 77.82         |
| 1560       | 0.633           | -63.91        | 4.437           | -87.36        | 0.030           | 115.29        | 0.132           | 72.37         |
| 1575       | 0.629           | -64.01        | 4.458           | -89.76        | 0.030           | 114.23        | 0.139           | 69.33         |
| 1590       | 0.621           | -63.94        | 4.474           | -91.54        | 0.030           | 112.50        | 0.147           | 66.71         |
| 1620       | 0.604           | -64.46        | 4.477           | -95.21        | 0.031           | 112.56        | 0.159           | 62.76         |
| 1650       | 0.586           | -63.98        | 4.425           | -98.51        | 0.030           | 111.63        | 0.172           | 58.00         |
| 1680       | 0.576           | -64.45        | 4.330           | -102.11       | 0.031           | 108.93        | 0.185           | 54.00         |
| 1710       | 0.559           | -64.36        | 4.264           | -105.61       | 0.030           | 106.34        | 0.198           | 50.85         |
| 1740       | 0.549           | -64.02        | 4.227           | -108.90       | 0.030           | 106.33        | 0.208           | 47.46         |
| 1770       | 0.538           | -63.89        | 4.219           | -112.08       | 0.030           | 106.56        | 0.222           | 43.54         |
| 1800       | 0.527           | -63.69        | 4.172           | -114.95       | 0.029           | 104.83        | 0.233           | 40.56         |
| 1830       | 0.523           | -63.58        | 4.046           | -118.53       | 0.030           | 104.72        | 0.244           | 37.76         |
| 1860       | 0.511           | -62.83        | 3.965           | -121.26       | 0.028           | 102.55        | 0.256           | 34.88         |
| 1890       | 0.503           | -62.92        | 3.925           | -124.29       | 0.029           | 103.12        | 0.266           | 32.47         |
| 1920       | 0.495           | -62.26        | 3.917           | -126.71       | 0.029           | 102.20        | 0.275           | 29.95         |
| 1950       | 0.485           | -60.97        | 3.843           | -129.24       | 0.029           | 102.70        | 0.283           | 27.89         |
| 1980       | 0.479           | -60.47        | 3.759           | -132.13       | 0.029           | 101.50        | 0.290           | 25.95         |
| 2010       | 0.474           | -59.93        | 3.631           | -135.13       | 0.027           | 98.87         | 0.300           | 24.27         |

Freescale Semiconductor, Inc.

**Table 2. Scattering Parameters ( $V_{DD} = 4$  Volts, ENABLE = 4 Volts, 50  $\Omega$  System)**

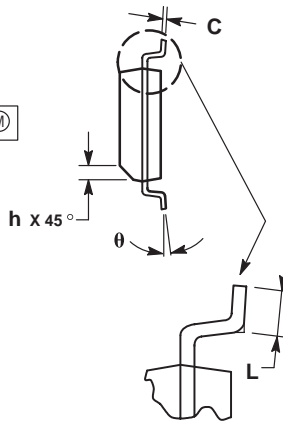
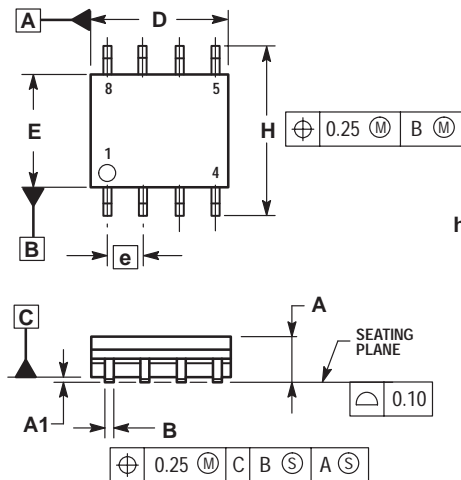
| f<br>(MHz) | S <sub>11</sub> |               | S <sub>21</sub> |               | S <sub>12</sub> |               | S <sub>22</sub> |               |
|------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|
|            | S <sub>11</sub> | $\angle \phi$ | S <sub>21</sub> | $\angle \phi$ | S <sub>12</sub> | $\angle \phi$ | S <sub>22</sub> | $\angle \phi$ |
| 900        | 0.927           | -34.45        | 4.901           | 4.43          | 0.011           | 167.24        | 0.210           | -4.75         |
| 930        | 0.915           | -36.30        | 4.962           | -0.21         | 0.012           | 166.66        | 0.185           | -12.35        |
| 960        | 0.908           | -38.22        | 5.164           | -4.86         | 0.013           | 165.06        | 0.160           | -20.80        |
| 990        | 0.895           | -39.78        | 5.383           | -9.68         | 0.015           | 161.65        | 0.135           | -30.56        |
| 1020       | 0.883           | -41.42        | 5.485           | -14.72        | 0.016           | 158.86        | 0.112           | -42.22        |
| 1050       | 0.869           | -43.05        | 5.514           | -19.31        | 0.017           | 158.43        | 0.092           | -55.71        |
| 1080       | 0.858           | -44.69        | 5.573           | -24.34        | 0.018           | 155.12        | 0.078           | -73.31        |
| 1110       | 0.840           | -46.48        | 5.695           | -29.10        | 0.019           | 151.63        | 0.068           | -94.03        |
| 1140       | 0.822           | -48.23        | 5.813           | -35.10        | 0.020           | 149.83        | 0.063           | -115.86       |
| 1170       | 0.804           | -49.58        | 5.817           | -40.03        | 0.020           | 149.25        | 0.066           | -136.79       |
| 1200       | 0.783           | -51.19        | 5.741           | -43.83        | 0.020           | 149.99        | 0.077           | -153.70       |
| 1230       | 0.750           | -51.37        | 5.625           | -47.36        | 0.023           | 155.59        | 0.102           | -172.32       |
| 1260       | 0.753           | -51.39        | 5.762           | -49.92        | 0.026           | 144.73        | 0.114           | 165.51        |
| 1290       | 0.747           | -52.29        | 5.894           | -55.24        | 0.028           | 137.19        | 0.122           | 150.89        |
| 1320       | 0.741           | -54.09        | 6.078           | -60.53        | 0.028           | 134.63        | 0.123           | 139.00        |
| 1350       | 0.727           | -55.80        | 5.998           | -65.01        | 0.028           | 131.72        | 0.129           | 131.12        |
| 1380       | 0.709           | -57.17        | 5.957           | -68.70        | 0.028           | 128.11        | 0.137           | 124.50        |
| 1410       | 0.692           | -58.13        | 5.921           | -73.18        | 0.027           | 126.13        | 0.144           | 117.65        |
| 1440       | 0.676           | -59.05        | 5.928           | -77.75        | 0.027           | 126.40        | 0.153           | 111.32        |
| 1470       | 0.661           | -59.68        | 5.909           | -81.80        | 0.028           | 122.94        | 0.162           | 105.05        |
| 1500       | 0.641           | -60.62        | 5.821           | -85.30        | 0.027           | 122.00        | 0.169           | 98.79         |
| 1530       | 0.628           | -61.62        | 5.715           | -88.81        | 0.028           | 119.28        | 0.179           | 93.52         |
| 1560       | 0.613           | -61.52        | 5.686           | -93.11        | 0.028           | 119.11        | 0.190           | 87.97         |
| 1575       | 0.606           | -61.90        | 5.667           | -95.29        | 0.028           | 119.48        | 0.196           | 85.31         |
| 1590       | 0.599           | -61.76        | 5.667           | -97.03        | 0.029           | 117.97        | 0.201           | 82.57         |
| 1620       | 0.587           | -62.04        | 5.635           | -100.45       | 0.028           | 117.17        | 0.209           | 78.01         |
| 1650       | 0.570           | -61.74        | 5.550           | -103.32       | 0.027           | 117.04        | 0.222           | 73.51         |
| 1680       | 0.560           | -62.07        | 5.423           | -106.67       | 0.028           | 114.76        | 0.233           | 69.07         |
| 1710       | 0.543           | -62.20        | 5.318           | -110.16       | 0.028           | 112.28        | 0.243           | 65.48         |
| 1740       | 0.534           | -61.92        | 5.250           | -113.26       | 0.028           | 113.29        | 0.253           | 61.42         |
| 1770       | 0.527           | -61.70        | 5.212           | -116.15       | 0.028           | 112.91        | 0.264           | 58.10         |
| 1800       | 0.516           | -61.84        | 5.146           | -118.66       | 0.029           | 113.11        | 0.274           | 54.22         |
| 1830       | 0.511           | -61.24        | 4.991           | -121.89       | 0.027           | 112.07        | 0.285           | 50.97         |
| 1860       | 0.501           | -60.19        | 4.848           | -124.80       | 0.027           | 111.64        | 0.295           | 47.95         |
| 1890       | 0.491           | -60.35        | 4.783           | -127.80       | 0.027           | 110.45        | 0.304           | 45.16         |
| 1920       | 0.484           | -59.86        | 4.747           | -130.12       | 0.028           | 109.45        | 0.315           | 42.60         |
| 1950       | 0.474           | -58.58        | 4.697           | -132.44       | 0.028           | 109.35        | 0.323           | 40.11         |
| 1980       | 0.471           | -58.40        | 4.605           | -134.97       | 0.028           | 111.10        | 0.329           | 38.15         |
| 2010       | 0.462           | -57.51        | 4.407           | -138.30       | 0.026           | 108.25        | 0.339           | 35.69         |

**Table 3. Scattering Parameters (V<sub>DD</sub> = 5 Volts, ENABLE = 5 Volts, 50 Ω System)**

| f<br>(MHz) | S <sub>11</sub> |        | S <sub>21</sub> |         | S <sub>12</sub> |        | S <sub>22</sub> |         |
|------------|-----------------|--------|-----------------|---------|-----------------|--------|-----------------|---------|
|            | S <sub>11</sub> | ∠ φ    | S <sub>21</sub> | ∠ φ     | S <sub>12</sub> | ∠ φ    | S <sub>22</sub> | ∠ φ     |
| 900        | 0.909           | -35.17 | 6.271           | -1.16   | 0.011           | 168.82 | 0.163           | -11.03  |
| 930        | 0.892           | -37.01 | 6.337           | -6.08   | 0.011           | 165.10 | 0.137           | -21.39  |
| 960        | 0.882           | -38.73 | 6.583           | -10.74  | 0.012           | 163.68 | 0.109           | -33.61  |
| 990        | 0.869           | -40.38 | 6.808           | -15.88  | 0.014           | 161.24 | 0.088           | -49.68  |
| 1020       | 0.855           | -41.71 | 6.927           | -21.01  | 0.015           | 160.19 | 0.072           | -71.47  |
| 1050       | 0.840           | -43.22 | 6.925           | -25.76  | 0.016           | 157.93 | 0.065           | -98.66  |
| 1080       | 0.828           | -44.84 | 6.996           | -30.74  | 0.017           | 156.01 | 0.067           | -124.50 |
| 1110       | 0.807           | -46.50 | 7.081           | -35.59  | 0.018           | 152.69 | 0.076           | -144.89 |
| 1140       | 0.791           | -47.98 | 7.172           | -41.40  | 0.019           | 151.04 | 0.088           | -161.86 |
| 1170       | 0.769           | -49.03 | 7.150           | -45.93  | 0.019           | 150.32 | 0.103           | -174.42 |
| 1200       | 0.745           | -50.40 | 7.082           | -49.82  | 0.018           | 149.54 | 0.120           | 178.54  |
| 1230       | 0.716           | -49.79 | 6.940           | -53.44  | 0.021           | 156.21 | 0.149           | 168.88  |
| 1260       | 0.726           | -49.58 | 7.070           | -56.18  | 0.024           | 146.99 | 0.165           | 154.85  |
| 1290       | 0.724           | -50.16 | 7.183           | -61.43  | 0.025           | 140.13 | 0.175           | 144.80  |
| 1320       | 0.721           | -52.48 | 7.285           | -66.39  | 0.027           | 136.54 | 0.177           | 136.23  |
| 1350       | 0.707           | -54.20 | 7.176           | -70.78  | 0.025           | 133.27 | 0.183           | 130.59  |
| 1380       | 0.690           | -55.55 | 7.102           | -74.39  | 0.026           | 131.27 | 0.191           | 124.77  |
| 1410       | 0.675           | -56.53 | 7.006           | -78.73  | 0.026           | 129.73 | 0.198           | 119.51  |
| 1440       | 0.660           | -57.13 | 6.962           | -82.74  | 0.026           | 127.44 | 0.204           | 113.76  |
| 1470       | 0.646           | -57.73 | 6.936           | -86.50  | 0.026           | 126.66 | 0.212           | 108.23  |
| 1500       | 0.629           | -58.40 | 6.822           | -89.92  | 0.026           | 124.54 | 0.219           | 102.92  |
| 1530       | 0.618           | -59.69 | 6.687           | -93.31  | 0.026           | 122.48 | 0.227           | 98.15   |
| 1560       | 0.601           | -59.69 | 6.606           | -97.38  | 0.026           | 121.63 | 0.235           | 93.28   |
| 1575       | 0.594           | -59.80 | 6.573           | -99.55  | 0.027           | 122.68 | 0.243           | 90.64   |
| 1590       | 0.592           | -59.78 | 6.548           | -101.29 | 0.027           | 122.13 | 0.246           | 88.16   |
| 1620       | 0.577           | -60.13 | 6.477           | -104.22 | 0.027           | 120.48 | 0.254           | 84.10   |
| 1650       | 0.562           | -59.69 | 6.366           | -106.82 | 0.027           | 119.01 | 0.263           | 79.24   |
| 1680       | 0.552           | -60.13 | 6.218           | -110.11 | 0.027           | 118.15 | 0.272           | 75.16   |
| 1710       | 0.543           | -60.34 | 6.094           | -113.45 | 0.026           | 117.67 | 0.282           | 71.64   |
| 1740       | 0.529           | -59.65 | 6.000           | -116.40 | 0.027           | 118.05 | 0.291           | 67.99   |
| 1770       | 0.523           | -59.54 | 5.945           | -119.10 | 0.026           | 116.25 | 0.301           | 64.28   |
| 1800       | 0.515           | -59.87 | 5.845           | -121.60 | 0.027           | 117.55 | 0.311           | 60.73   |
| 1830       | 0.507           | -59.61 | 5.676           | -124.69 | 0.027           | 116.91 | 0.320           | 57.22   |
| 1860       | 0.497           | -58.77 | 5.488           | -127.65 | 0.027           | 115.88 | 0.330           | 54.18   |
| 1890       | 0.491           | -58.79 | 5.414           | -130.43 | 0.027           | 114.66 | 0.339           | 51.39   |
| 1920       | 0.478           | -58.39 | 5.376           | -132.53 | 0.028           | 117.05 | 0.348           | 48.34   |
| 1950       | 0.472           | -57.29 | 5.324           | -134.66 | 0.029           | 114.84 | 0.356           | 45.85   |
| 1980       | 0.466           | -56.94 | 5.193           | -137.20 | 0.028           | 114.82 | 0.363           | 43.87   |
| 2010       | 0.461           | -56.18 | 4.972           | -140.40 | 0.027           | 114.81 | 0.372           | 41.56   |

**Table 4. Noise Parameters (V<sub>DD</sub> = 5 Volts, ENABLE = 5 Volts, 50 Ω System)**

| f<br>(MHz) | NF <sub>min</sub><br>(dB) | Γ <sub>0</sub> |       | R <sub>N</sub> |
|------------|---------------------------|----------------|-------|----------------|
|            |                           | MAG            | ∠ φ   |                |
| 1.000      | 0.8                       | 0.859          | 26.36 | 0.98           |
| 1.575      | 1.0                       | 0.793          | 43.87 | 0.70           |
| 2.000      | 1.3                       | 0.713          | 55.80 | 0.56           |



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. DIMENSIONS ARE IN MILLIMETER.
  3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
  5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A           | 1.35     | 1.75 |
| A1          | 0.10     | 0.25 |
| B           | 0.35     | 0.49 |
| C           | 0.19     | 0.25 |
| D           | 4.80     | 5.00 |
| E           | 3.80     | 4.00 |
| e           | 1.27 BSC |      |
| H           | 5.80     | 6.20 |
| h           | 0.25     | 0.50 |
| L           | 0.40     | 1.25 |
| θ           | 0°       | 7°   |

**CASE 751-06  
ISSUE T**

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

Mfax is a trademark of Motorola, Inc.

**How to reach us:**

**USA/EUROPE/Locations Not Listed:** Motorola Literature Distribution;  
 P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.: SPD, Strategic Planning Office, 141,  
 4-32-1 Nishi-Gotanda, Shagawa-ku, Tokyo, Japan. 03-5487-8488

**Customer Focus Center: 1-800-521-6274**

**Mfax™:** RMFAX0@email.sps.mot.com – TOUCHTONE 1-602-244-6609  
 Motorola Fax Back System – US & Canada ONLY 1-800-774-1848  
 – http://sps.motorola.com/mfax/

**ASIA/PACIFIC:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
 51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

**HOME PAGE:** <http://motorola.com/sps/>



◇ **For More Information On This Product,  
Go to: [www.freescale.com](http://www.freescale.com)**

MRFIC1501/D