

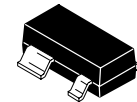
**The MRFIC Line**  
**General Purpose**  
**RF Cascode Amplifier**

The MRFIC0915 is a cost-effective, high isolation cascode silicon monolithic amplifier in the industry standard SOT-143 surface mount package designed for general purpose RF applications. The device is a lower current version of the MRFIC0916 and is appropriate for VCOs, VCO buffers and amplifiers. On-chip bias circuitry sets the bias point while matching is accomplished off chip affording the maximum in application flexibility.

- Usable Frequency Range = 100 to 2500 MHz
- Good Small Signal Gain at  $V_{CC} = 2.7$  Volts
  - 16.2 dB Typ at 850 MHz
  - 9.6 dB Typ at 1800 MHz
  - 5.8 dB Typ at 2400 MHz
- -4.6 dBm typical Output Power at 1 dB Gain Compression at 850 MHz,  $V_{CC} = 2.7$  Volts
- 38 dB Typical Reverse Isolation at 850 MHz
- 2.5 mA Max Bias Current at  $V_{CC} = 2.7$  Volts
- 2.7 to 5 Volt Supply
- Order MRFIC0915T1 for Tape and Reel.  
 T1 Suffix = 3.000 Units per 8 mm, 7 inch Reel.
- Device Marking = 22

**MRFIC0915**

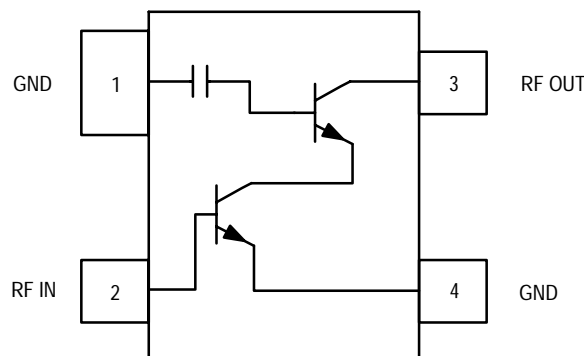
**100 to 2500 MHz**  
**SILICON GENERAL PURPOSE**  
**RF CASCODE AMPLIFIER**



**CASE 318A-05**  
**(SOT-143)**

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

| Rating                               | Symbol          | Limit        | Unit               |
|--------------------------------------|-----------------|--------------|--------------------|
| Supply Voltage                       | $V_{CC}$        | 6            | Vdc                |
| RF Input Power                       | $P_{RF}$        | 10           | dBm                |
| Power Dissipation                    | $P_{DIS}$       | 100          | mW                 |
| Supply Current                       | $I_{CC}$        | 10           | mA                 |
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 250          | $^\circ\text{C/W}$ |
| Storage Temperature Range            | $T_{stg}$       | - 65 to +150 | $^\circ\text{C}$   |
| Operating Case Temperature           | $T_C$           | - 40 to +100 | $^\circ\text{C}$   |



**Pin Connections and Functional Block Diagram**

Freescale Semiconductor, Inc.  
 DEVICE ON LIFETIME BUY

LAST SHIP 27DEC02  
 LAST ORDER 15JAN02

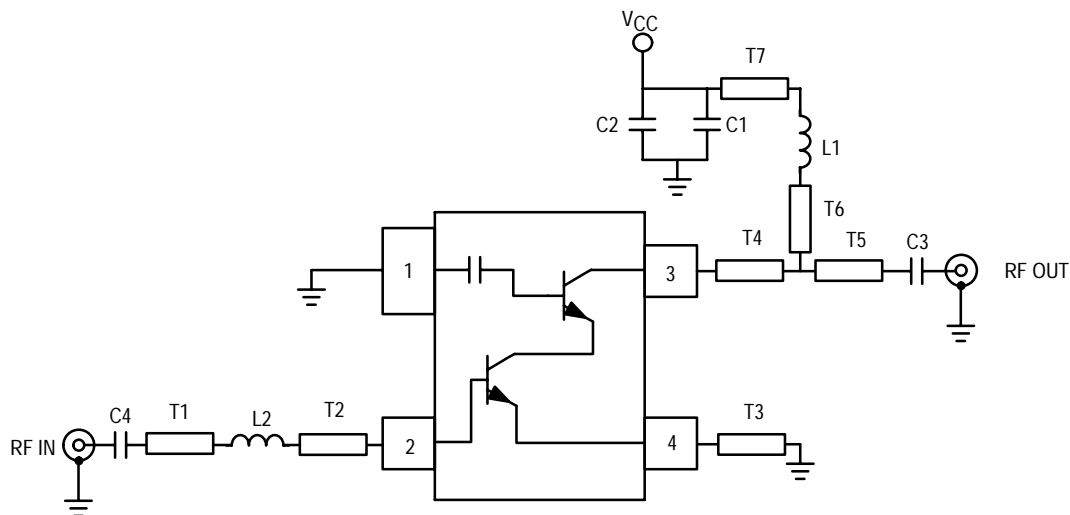
# Freescale Semiconductor, Inc.

## RECOMMENDED OPERATING RANGES

| Parameter      | Symbol   | Value       | Unit |
|----------------|----------|-------------|------|
| RF Frequency   | $f_{RF}$ | 100 to 2500 | MHz  |
| Supply Voltage | $V_{CC}$ | 2.7 to 5    | Vdc  |

## ELECTRICAL CHARACTERISTICS ( $V_{CC} = 2.7$ V, $T_A = 25^\circ\text{C}$ )

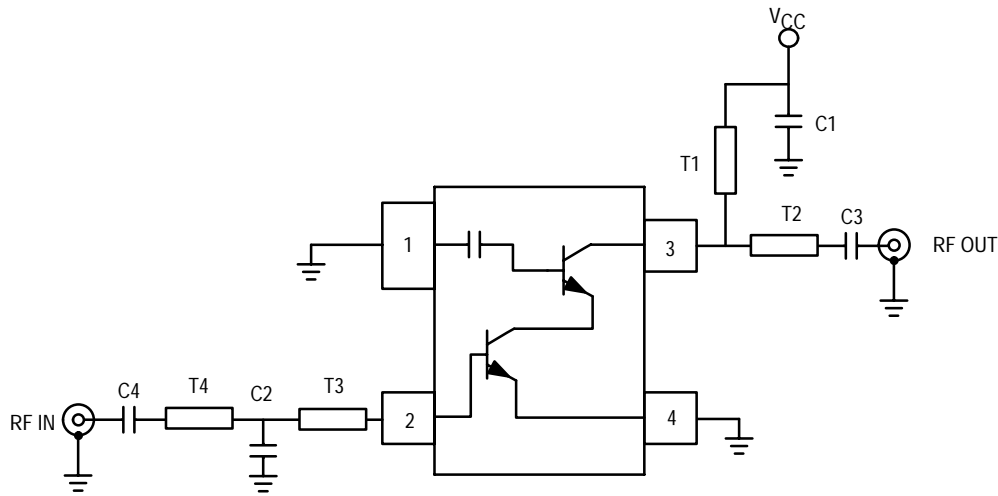
| Characteristic                       | Min  | Typ  | Max | Unit |
|--------------------------------------|------|------|-----|------|
| Small Signal Gain                    |      |      |     |      |
| 850 MHz                              | 14.2 | 16.2 | —   | dB   |
| 1800 MHz                             | 7.4  | 9.6  | —   | dB   |
| 2400 MHz                             | 5    | 5.8  | —   | dB   |
| Noise Figure                         |      |      |     |      |
| 850                                  | —    | 1.9  | —   | dB   |
| 1800 MHz                             | —    | 3.6  | —   | dB   |
| 2400 MHz                             | —    | 5.5  | —   | dB   |
| Power Output at 1dB Gain Compression |      |      |     |      |
| 850 MHz                              | —    | -4.6 | —   | dBm  |
| 1800 MHz                             | —    | -7.8 | —   | dBm  |
| 2400 MHz                             | —    | -9.8 | —   | dBm  |
| Output 3rd Order Intercept Point     |      |      |     |      |
| 850 MHz                              | —    | 4    | —   | dBm  |
| 1800 MHz                             | —    | 1    | —   | dBm  |
| 2400 MHz                             | —    | -1   | —   | dBm  |
| Reverse Isolation                    |      |      |     |      |
| 850 MHz                              | —    | 38   | —   | dB   |
| 1800 MHz                             | —    | 33   | —   | dB   |
| 2400 MHz                             | —    | 29   | —   | dB   |
| Supply Current                       | 1.5  | 2.0  | 2.5 | mA   |



|    |                    |    |                                 |
|----|--------------------|----|---------------------------------|
| C1 | 10 pF, NPO/COG     | T1 | 50 $\Omega$ MICROSTRIP, 0.13"   |
| C2 | 0.01 $\mu\text{F}$ | T2 | 76 $\Omega$ MICROSTRIP, 0.072"  |
| C3 | 1.4 pF, NPO/COG    | T3 | 100 $\Omega$ MICROSTRIP, 0.035" |
| C4 | 12 pF, NPO/COG     | T4 | 50 $\Omega$ MICROSTRIP, 0.048"  |
| L1 | 8.2 nH             | T5 | 50 $\Omega$ MICROSTRIP, 0.08"   |
| L2 | 10 nH              | T6 | 76 $\Omega$ MICROSTRIP, 0.062"  |
|    |                    | T7 | 76 $\Omega$ MICROSTRIP, 0.07"   |

BOARD MATERIAL: FR4,  $\epsilon_r = 4.45$ , THICKNESS = 0.014"

Figure 1. 850 MHz Applications Circuit Configuration



1.8 GHz DESCRIPTION

|    |                         |
|----|-------------------------|
| C1 | 18 pF, NPO/COG          |
| C2 | 1.0 pF, NPO/COG         |
| C3 | 0.9 pF, NPO/COG         |
| C4 | 10 pF, NPO/COG          |
| T1 | 50 Ω MICROSTRIP, 0.41"  |
| T2 | 50 Ω MICROSTRIP, 0.076" |
| T3 | 50 Ω MICROSTRIP, 0.528" |
| T7 | N/A                     |

2.4 GHz DESCRIPTION

|    |                         |
|----|-------------------------|
| C1 | 12 pF, NPO/COG          |
| C2 | 1.2 pF, NPO/COG         |
| C3 | 0.7 pF, NPO/COG         |
| C4 | 10 pF, NPO/COG          |
| T1 | 50 Ω MICROSTRIP, 0.228" |
| T2 | 50 Ω MICROSTRIP, 0.076" |
| T3 | 50 Ω MICROSTRIP, 0.229" |
| T4 | 50 Ω MICROSTRIP, 0.345" |

BOARD MATERIAL: FR4,  $\epsilon_r = 4.45$ , THICKNESS = 0.014"

Figure 2. 1800 and 2400 MHz Applications Circuit Configuration

# Freescale Semiconductor, Inc.

## TYPICAL CHARACTERISTICS

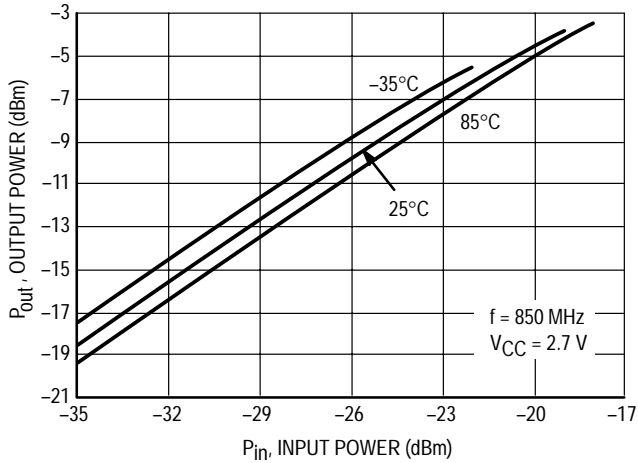


Figure 3. Output Power versus Input Power

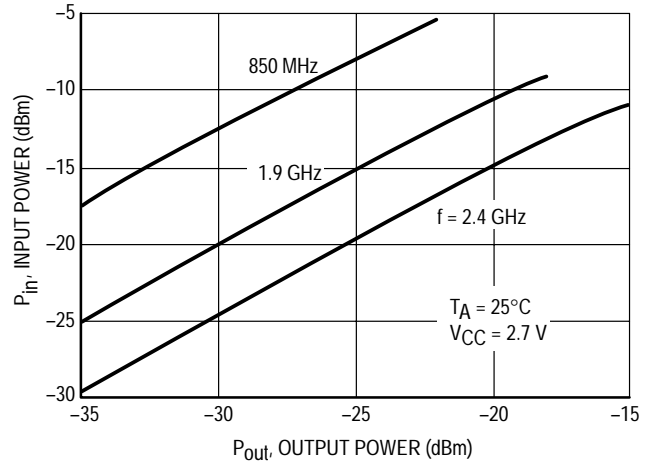


Figure 4. Output Power versus Input Power

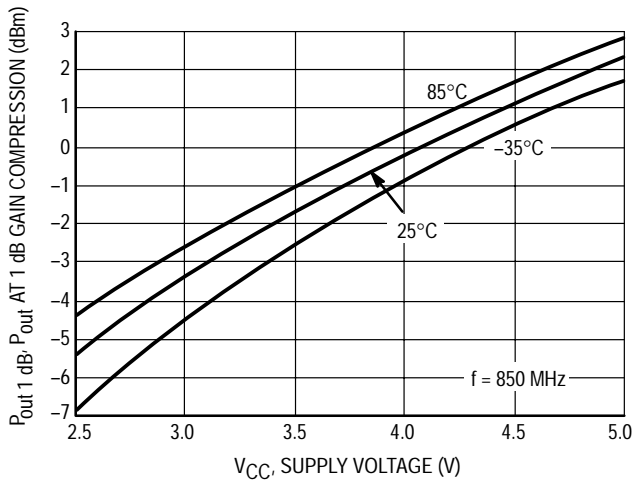


Figure 5. Output Power at 1 dB Gain Compression versus Supply Voltage

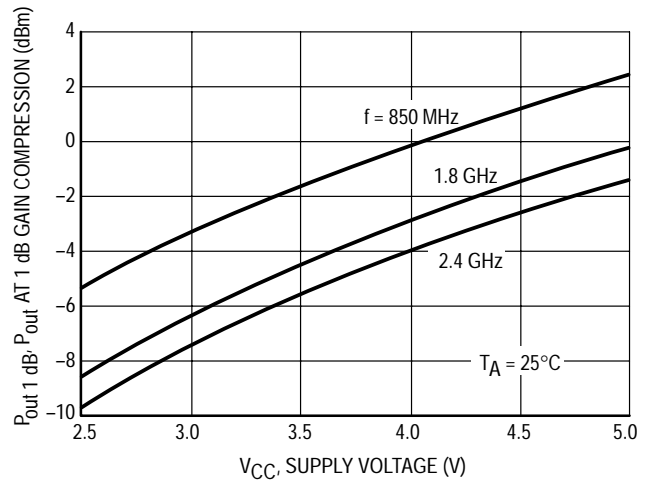


Figure 6. Output Power at 1 dB Gain Compression versus Supply Voltage

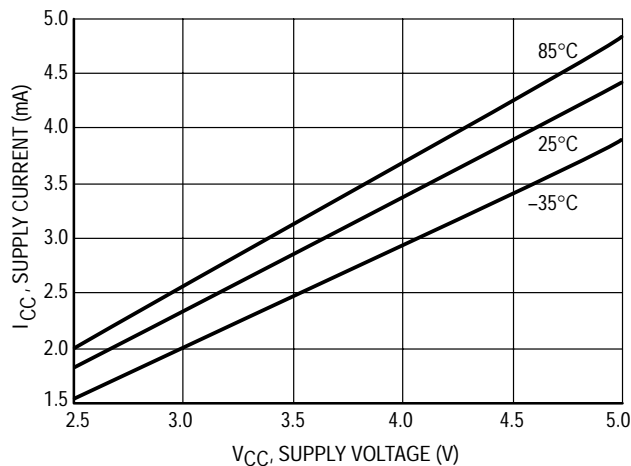


Figure 7. Supply Current versus Supply Voltage

Freescale Semiconductor, Inc. BUY DEVICE ON LIFE TIME

LAST ORDER 15JAN02 LAST SHIP 27DEC02

# Freescale Semiconductor, Inc.

| 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  |
| 100      | 0.91            | -11  | 5.72            | 168 | 0.000           | 53   | 0.97            | -3  |
| 200      | 0.90            | -22  | 5.50            | 156 | 0.001           | 85   | 0.97            | -7  |
| 300      | 0.86            | -32  | 5.32            | 145 | 0.002           | 80   | 0.96            | -10 |
| 400      | 0.82            | -42  | 5.00            | 134 | 0.002           | 74   | 0.95            | -13 |
| 500      | 0.75            | -52  | 4.72            | 122 | 0.002           | 69   | 0.94            | -16 |
| 600      | 0.70            | -60  | 4.35            | 113 | 0.002           | 67   | 0.92            | -18 |
| 700      | 0.66            | -68  | 4.05            | 105 | 0.003           | 66   | 0.91            | -21 |
| 800      | 0.63            | -75  | 3.65            | 97  | 0.003           | 67   | 0.90            | -24 |
| 900      | 0.57            | -83  | 3.52            | 89  | 0.002           | 69   | 0.89            | -26 |
| 1000     | 0.54            | -90  | 3.28            | 82  | 0.002           | 73   | 0.87            | -29 |
| 1100     | 0.50            | -96  | 3.05            | 75  | 0.002           | 78   | 0.86            | -32 |
| 1200     | 0.48            | -103 | 2.81            | 69  | 0.002           | 92   | 0.85            | -34 |
| 1300     | 0.45            | -109 | 2.71            | 62  | 0.002           | 108  | 0.84            | -37 |
| 1400     | 0.43            | -114 | 2.53            | 56  | 0.002           | 129  | 0.83            | -40 |
| 1500     | 0.41            | -120 | 2.37            | 51  | 0.002           | 147  | 0.81            | -42 |
| 1600     | 0.39            | -125 | 2.28            | 45  | 0.003           | 160  | 0.80            | -45 |
| 1700     | 0.38            | -132 | 2.12            | 39  | 0.004           | 167  | 0.79            | -48 |
| 1800     | 0.37            | -137 | 2.00            | 34  | 0.005           | 113  | 0.78            | -51 |
| 1900     | 0.36            | -141 | 1.88            | 28  | 0.006           | 116  | 0.77            | -53 |
| 2000     | 0.35            | -146 | 1.78            | 23  | 0.008           | -2   | 0.76            | -56 |
| 2100     | 0.34            | -150 | 1.71            | 18  | 0.010           | -61  | 0.75            | -59 |
| 2200     | 0.33            | -155 | 1.65            | 12  | 0.012           | -120 | 0.74            | -62 |
| 2300     | 0.34            | -159 | 1.51            | 7   | 0.013           | -120 | 0.73            | -65 |
| 2400     | 0.33            | -161 | 1.51            | 2   | 0.016           | -61  | 0.72            | -69 |
| 2500     | 0.34            | -167 | 1.39            | -5  | 0.019           | 58   | 0.71            | -73 |
| 2600     | 0.34            | -171 | 1.32            | -10 | 0.022           | 176  | 0.70            | -77 |
| 2700     | 0.34            | -173 | 1.26            | -15 | 0.025           | 175  | 0.69            | -80 |
| 2800     | 0.34            | -176 | 1.20            | -20 | 0.028           | 174  | 0.68            | -83 |
| 2900     | 0.34            | -119 | 1.14            | -25 | 0.032           | 172  | 0.67            | -86 |
| 3000     | 0.34            | 118  | 1.09            | -30 | 0.036           | 170  | 0.66            | -90 |

Table 1. S-Parameters (V<sub>CC</sub> = 2.7 V, 50 Ω System)

Freescale Semiconductor, Inc.  
DEVICE ON LIFETIME BUY

LAST ORDER 15JAN02 LAST SHIP 27DEC02

# Freescale Semiconductor, Inc.

| 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  |
| 100      | 0.88            | -12  | 8.65            | 167 | 0.001           | 48   | 0.97            | -3  |
| 200      | 0.85            | -23  | 8.23            | 154 | 0.001           | 93   | 0.97            | -6  |
| 300      | 0.80            | -34  | 7.73            | 142 | 0.002           | 82   | 0.96            | -10 |
| 400      | 0.75            | -44  | 7.15            | 131 | 0.002           | 73   | 0.95            | -12 |
| 500      | 0.67            | -53  | 6.56            | 119 | 0.002           | 68   | 0.93            | -15 |
| 600      | 0.62            | -60  | 5.99            | 111 | 0.002           | 66   | 0.92            | -18 |
| 700      | 0.57            | -67  | 5.47            | 102 | 0.002           | 63   | 0.91            | -21 |
| 800      | 0.53            | -74  | 5.02            | 95  | 0.002           | 65   | 0.90            | -23 |
| 900      | 0.48            | -80  | 4.67            | 88  | 0.002           | 66   | 0.88            | -26 |
| 1000     | 0.44            | -86  | 4.31            | 81  | 0.002           | 69   | 0.87            | -29 |
| 1100     | 0.41            | -92  | 3.98            | 75  | 0.001           | 79   | 0.86            | -31 |
| 1200     | 0.38            | -97  | 3.71            | 69  | 0.001           | 101  | 0.85            | -34 |
| 1300     | 0.36            | -102 | 3.49            | 63  | 0.001           | 139  | 0.84            | -36 |
| 1400     | 0.34            | -107 | 3.26            | 58  | 0.002           | 102  | 0.82            | -39 |
| 1500     | 0.32            | -111 | 3.07            | 53  | 0.003           | -4   | 0.81            | -42 |
| 1600     | 0.30            | -116 | 2.89            | 49  | 0.004           | -119 | 0.80            | -44 |
| 1700     | 0.29            | -122 | 2.72            | 43  | 0.005           | -115 | 0.79            | -47 |
| 1800     | 0.28            | -126 | 2.56            | 38  | 0.007           | -113 | 0.78            | -50 |
| 1900     | 0.28            | -130 | 2.42            | 33  | 0.008           | -113 | 0.77            | -53 |
| 2000     | 0.27            | -134 | 2.30            | 29  | 0.010           | -112 | 0.76            | -55 |
| 2100     | 0.26            | -137 | 2.20            | 24  | 0.012           | -113 | 0.75            | -58 |
| 2200     | 0.25            | -141 | 2.08            | 19  | 0.014           | -114 | 0.74            | -61 |
| 2300     | 0.26            | -146 | 1.98            | 14  | 0.017           | -115 | 0.73            | -64 |
| 2400     | 0.25            | -147 | 1.90            | 10  | 0.019           | -117 | 0.72            | -68 |
| 2500     | 0.26            | -153 | 1.79            | 5   | 0.022           | -119 | 0.71            | -72 |
| 2600     | 0.26            | -157 | 1.71            | 0   | 0.025           | 59   | 0.70            | -75 |
| 2700     | 0.27            | -159 | 1.63            | -5  | 0.028           | 177  | 0.69            | -78 |
| 2800     | 0.27            | -162 | 1.55            | -9  | 0.032           | 175  | 0.68            | -81 |
| 2900     | 0.27            | -164 | 1.48            | -14 | 0.036           | 173  | 0.67            | -85 |
| 3000     | 0.27            | -167 | 1.41            | -18 | 0.040           | 171  | 0.66            | -88 |

Table 2. S-Parameters (V<sub>CC</sub> = 4.0 V, 50 Ω System)

Freescale Semiconductor, Inc. BUY

LAST ORDER 15JAN02 LAST SHIP 27DEC02

# Freescale Semiconductor, Inc.

| 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  |
| 100      | 0.85            | -12  | 11.04           | 166 | 0.00            | 39   | 0.97            | -3  |
| 200      | 0.82            | -24  | 10.44           | 152 | 0.00            | 94   | 0.97            | -6  |
| 300      | 0.77            | -35  | 9.79            | 140 | 0.00            | 82   | 0.96            | -9  |
| 400      | 0.70            | -44  | 8.95            | 128 | 0.00            | 74   | 0.96            | -12 |
| 500      | 0.62            | -53  | 8.16            | 117 | 0.00            | 69   | 0.94            | -15 |
| 600      | 0.57            | -59  | 7.34            | 109 | 0.00            | 64   | 0.93            | -18 |
| 700      | 0.52            | -66  | 6.70            | 100 | 0.00            | 63   | 0.92            | -20 |
| 800      | 0.48            | -72  | 6.02            | 93  | 0.00            | 65   | 0.90            | -23 |
| 900      | 0.43            | -77  | 5.58            | 86  | 0.00            | 68   | 0.89            | -26 |
| 1000     | 0.39            | -82  | 5.11            | 80  | 0.00            | 71   | 0.88            | -28 |
| 1100     | 0.36            | -87  | 4.71            | 75  | 0.00            | 81   | 0.87            | -31 |
| 1200     | 0.34            | -92  | 4.33            | 69  | 0.00            | 114  | 0.86            | -33 |
| 1300     | 0.32            | -95  | 4.08            | 63  | 0.00            | 152  | 0.84            | -36 |
| 1400     | 0.30            | -99  | 3.80            | 59  | 0.00            | 114  | 0.83            | -38 |
| 1500     | 0.28            | -104 | 3.54            | 54  | 0.00            | -118 | 0.82            | -41 |
| 1600     | 0.26            | -108 | 3.35            | 49  | 0.00            | -114 | 0.81            | -44 |
| 1700     | 0.25            | -113 | 3.13            | 44  | 0.01            | -111 | 0.80            | -47 |
| 1800     | 0.25            | -117 | 2.96            | 40  | 0.01            | -110 | 0.79            | -49 |
| 1900     | 0.24            | -120 | 2.79            | 35  | 0.01            | -111 | 0.78            | -52 |
| 2000     | 0.23            | -123 | 2.64            | 31  | 0.01            | -111 | 0.77            | -55 |
| 2100     | 0.22            | -126 | 2.52            | 26  | 0.01            | -112 | 0.76            | -58 |
| 2200     | 0.22            | -130 | 2.40            | 22  | 0.01            | -114 | 0.75            | -61 |
| 2300     | 0.23            | -135 | 2.25            | 18  | 0.02            | -115 | 0.74            | -64 |
| 2400     | 0.23            | -136 | 2.19            | 13  | 0.02            | -117 | 0.73            | -67 |
| 2500     | 0.23            | -142 | 2.05            | 8   | 0.02            | -119 | 0.72            | -71 |
| 2600     | 0.23            | -146 | 1.96            | 4   | 0.02            | -1   | 0.71            | -74 |
| 2700     | 0.24            | -149 | 1.87            | 0   | 0.03            | 177  | 0.70            | -77 |
| 2800     | 0.24            | -151 | 1.78            | -4  | 0.03            | 175  | 0.69            | -80 |
| 2900     | 0.25            | -153 | 1.70            | -9  | 0.03            | 173  | 0.68            | -84 |
| 3000     | 0.25            | -156 | 1.62            | -13 | 0.04            | 171  | 0.68            | -87 |

Table 3. S-Parameters (V<sub>CC</sub> = 5.0 V, 50 Ω System)

Freescale Semiconductor, Inc.  
DEVICE ON LIFETIME BUY

LAST ORDER 15JAN02 LAST SHIP 27DEC02

# Freescale Semiconductor, Inc.

| VCC<br>(Volts) | f<br>(GHz) | NFmin<br>(dB) | $\Gamma_0$ |               | RN<br>( $\Omega$ ) |
|----------------|------------|---------------|------------|---------------|--------------------|
|                |            |               | MAG        | $\angle \phi$ |                    |
| 2.7            | 0.30       | 1.26          | 0.47       | 18            | 0.47               |
|                | 0.50       | 1.48          | 0.42       | 29            | 0.44               |
|                | 0.70       | 1.71          | 0.38       | 41            | 0.42               |
|                | 0.90       | 1.96          | 0.34       | 53            | 0.41               |
|                | 1.00       | 2.09          | 0.33       | 60            | 0.40               |
|                | 1.50       | 2.82          | 0.27       | 94            | 0.38               |
|                | 2.00       | 3.67          | 0.25       | 132           | 0.36               |
|                | 2.40       | 4.43          | 0.25       | 165           | 0.36               |
| 4.0            | 0.30       | 1.27          | 0.37       | 18            | 0.37               |
|                | 0.50       | 1.41          | 0.33       | 29            | 0.35               |
|                | 0.70       | 1.56          | 0.30       | 40            | 0.33               |
|                | 0.90       | 1.73          | 0.27       | 52            | 0.32               |
|                | 1.00       | 1.82          | 0.25       | 59            | 0.31               |
|                | 1.50       | 2.32          | 0.21       | 93            | 0.30               |
|                | 2.00       | 2.91          | 0.20       | 133           | 0.29               |
|                | 2.40       | 3.44          | 0.21       | 168           | 0.29               |
| 4.5            | 0.30       | 1.41          | 0.38       | 18            | 0.40               |
|                | 0.50       | 1.53          | 0.34       | 26            | 0.38               |
|                | 0.70       | 1.67          | 0.31       | 36            | 0.37               |
|                | 0.90       | 1.83          | 0.27       | 46            | 0.36               |
|                | 1.00       | 1.92          | 0.26       | 52            | 0.35               |
|                | 1.50       | 2.42          | 0.20       | 85            | 0.33               |
|                | 2.00       | 3.03          | 0.17       | 126           | 0.32               |
|                | 2.40       | 3.61          | 0.16       | 165           | 0.34               |
| 5.0            | 0.30       | 1.36          | 0.33       | 18            | 0.35               |
|                | 0.50       | 1.47          | 0.29       | 28            | 0.33               |
|                | 0.70       | 1.60          | 0.26       | 40            | 0.32               |
|                | 0.90       | 1.74          | 0.24       | 52            | 0.31               |
|                | 1.00       | 1.82          | 0.22       | 58            | 0.30               |
|                | 1.50       | 2.25          | 0.18       | 93            | 0.29               |
|                | 2.00       | 2.78          | 0.17       | 133           | 0.28               |
|                | 2.40       | 3.27          | 0.18       | 170           | 0.29               |

Table 4. Typical Noise Parameters (50  $\Omega$  System)

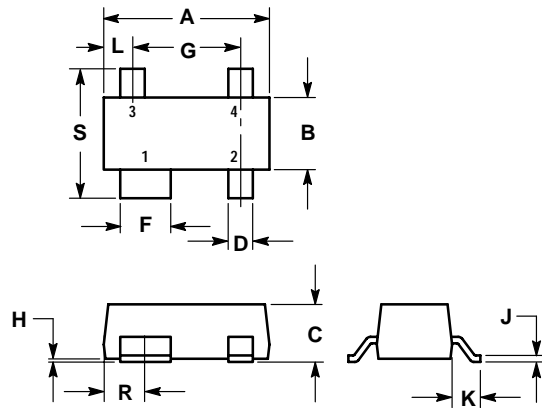
Freescale Semiconductor, Inc. BUY

LAST ORDER 15JAN02 LAST SHIP 27DEC02



# Freescale Semiconductor, Inc.

## PACKAGE DIMENSIONS



### NOTES:


1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS |      | INCHES |       |
|-----|-------------|------|--------|-------|
|     | MIN         | MAX  | MIN    | MAX   |
| A   | 2.80        | 3.04 | 0.110  | 0.120 |
| B   | 1.20        | 1.39 | 0.047  | 0.055 |
| C   | 0.84        | 1.14 | 0.033  | 0.045 |
| D   | 0.39        | 0.50 | 0.015  | 0.020 |
| F   | 0.79        | 0.93 | 0.031  | 0.037 |
| G   | 1.78        | 2.03 | 0.070  | 0.080 |
| H   | 0.013       | 0.10 | 0.0005 | 0.004 |
| J   | 0.08        | 0.15 | 0.003  | 0.006 |
| K   | 0.46        | 0.60 | 0.018  | 0.024 |
| L   | 0.445       | 0.60 | 0.0175 | 0.024 |
| R   | 0.72        | 0.83 | 0.028  | 0.033 |
| S   | 2.11        | 2.48 | 0.083  | 0.098 |

CASE 318A-05  
ISSUE R

**Freescale Semiconductor, Inc.**  
**DEVICE ON LIFE TIME BUY**

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