

# MGA-62563

## Current-Adjustable, Low Noise Amplifier



### Data Sheet

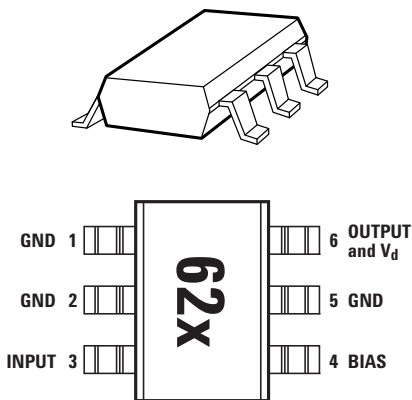
#### Description

Avago's MGA-62563 is an economical, easy-to-use GaAs MMIC amplifier that offers excellent linearity and low noise figure for applications from 0.1 to 3.5 GHz. Packaged in an miniature SOT-363 package, it requires half the board space of a SOT-143 package.

One external resistor is used to set the bias current taken by the device over a wide range. This allows the designer to use the same part in several circuit positions and tailor the linearity performance (and current consumption) to suit each position.

The output of the amplifier is matched to 50Ω (below 2:1 VSWR) across the entire bandwidth and only requires minimum input matching. The amplifier allows a wide dynamic range by offering a 0.9 dB NF coupled with a +32.9 dBm Output IP3. The circuit uses state-of-the-art E-pHEMT technology with proven reliability. On-chip bias circuitry allows operation from a single +3V power supply, while internal feedback ensures stability ( $K > 1$ ) over all frequencies.

#### Pin Connections and Package Marking



Note:

Package marking provides orientation and identification:

"62" = Device Code

"x" = Date code indicates the month of manufacture.

#### Features

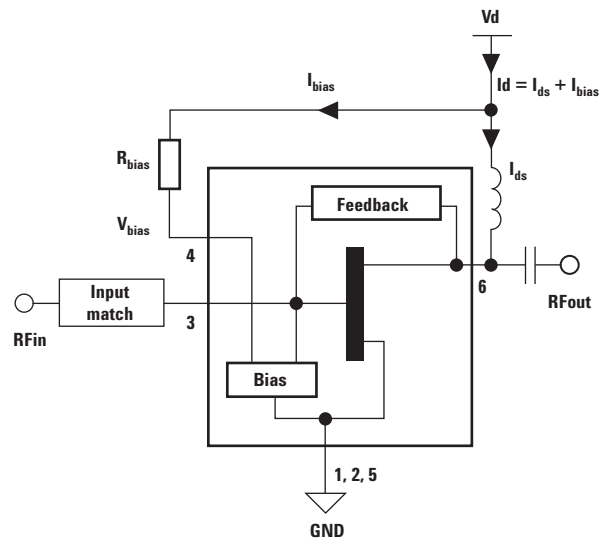
- Single +3V supply
- High linearity
- Low noise figure
- Miniature package
- Unconditionally stable

#### Specifications

at 500 MHz; 3V, 60 mA (Typ.)

- 0.9 dB noise figure
- 32.9 dBm OIP3
- 22 dB gain
- 17.8 dBm P<sub>1dB</sub>

#### Simplified Schematic

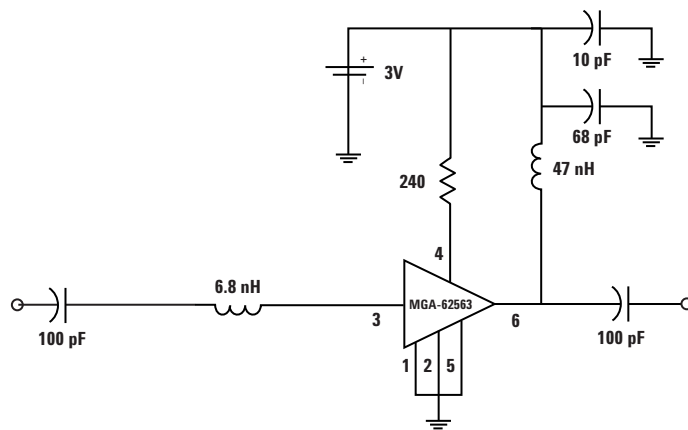


## MGA-62563 Absolute Maximum Ratings<sup>[1]</sup>

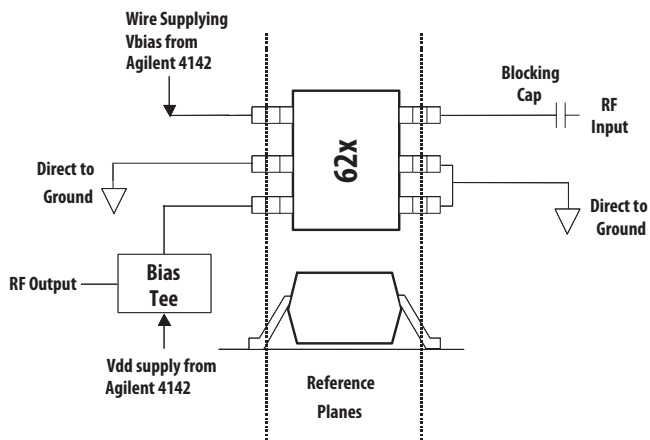
| Symbol           | Parameter                                | Units | Absolute Maximum |
|------------------|--|-------|------------------|
| $V_d$            | Device Voltage (pin 6) <sup>[2]</sup>    | V     | 6                |
| $I_d$            | Device Current (pin 6) <sup>[2]</sup>    | mA    | 100              |
| $P_{in}$         | CW RF Input Power (pin 3) <sup>[3]</sup> | dBm   | 21               |
| $I_{ref}$        | Bias Reference Current (pin 4)           | mA    | 12               |
| $P_{diss}$       | Total Power Dissipation <sup>[4]</sup>   | mW    | 600              |
| $T_{CH}$         | Channel Temperature                      | °C    | 150              |
| $T_{STG}$        | Storage Temperature                      | °C    | -65 to 150       |
| $\theta_{ch\_b}$ | Thermal Resistance <sup>[5]</sup>        | °C/W  | 97               |

Notes:

1. Operation of this device above any one of these parameters may cause permanent damage.
2. Bias is assumed at DC quiescent conditions.
3. With the DC (typical bias) and RF applied to the device at board temperature  $T_B = 25^\circ\text{C}$ .
4. Total dissipation power is referred to board (package belly) temperature  $T_B = 85^\circ\text{C}$ ,  $P_{diss}$  is required to derate at  $10\text{ mW}/^\circ\text{C}$  for  $T_B > 85^\circ\text{C}$ .
5. Thermal resistance measured using  $150^\circ\text{C}$  Liquid Crystal Measurement method.

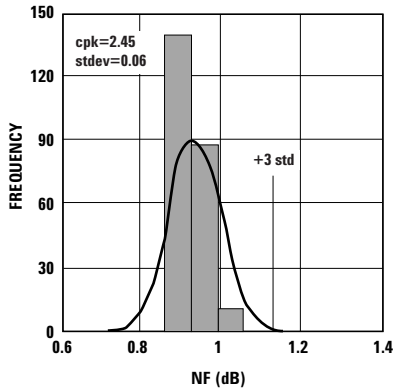


**Figure 1.** Test circuit of the 0.5 GHz production test board used for NF, Gain and OIP3 measurements. This circuit achieves a trade-off between optimal NF, Gain, OIP3 and input return loss. Circuit losses have been de-embedded from actual measurements.

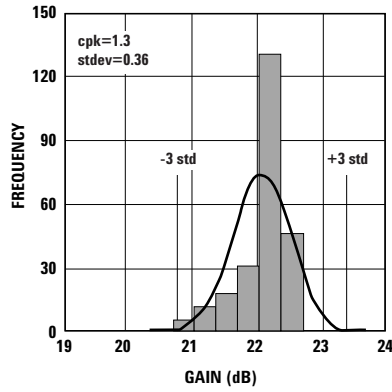


**Figure 1b.** A diagram showing the connection to the DUT during an S and Noise parameter measurement using an automated tuner system.

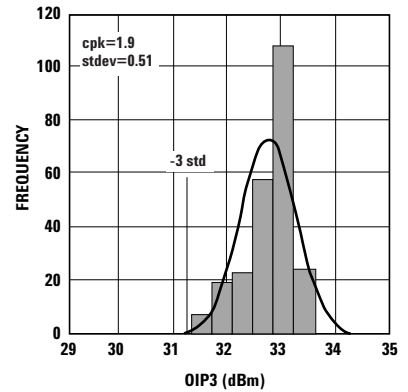
**Product Consistency Distribution Charts at 3V, 0.5 GHz,  $R_{bias} = 240\Omega$ [1]**



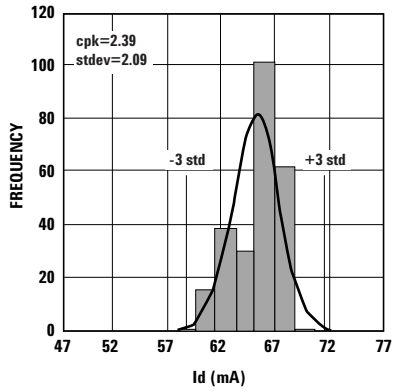
**Figure 2. NF @ 2 GHz 3V 60 mA.**  
**USL=1.4, Nominal=0.93.**



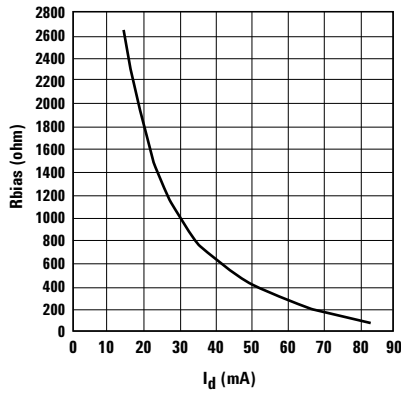
**Figure 3. Gain @ 2 GHz 3V 60 mA.**  
**LSL =20.4, Nominal = 22, USL = 23.4**



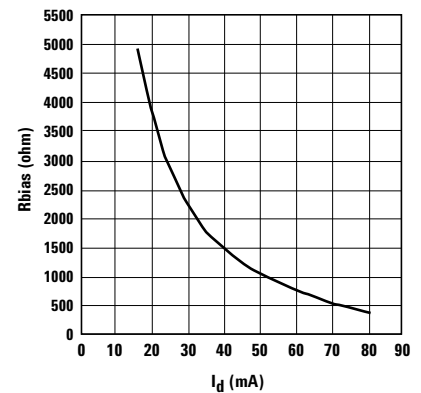
**Figure 4. OIP3 @ 2 GHz 3V 60 mA.**  
**LSL=30, Nominal=32.9.**



**Figure 5. Id @ 3V.**  
**LSL = 47, Nominal = 62, USL = 77**



**Figure 6. Rbias vs. Id (3V supply).**



**Figure 7. Rbias vs. Id (5V supply).**

Note:

1. Measured on the production test circuit

## MGA-62563 Electrical Specifications

$T_C = 25^\circ\text{C}$ ,  $Z_O = 50\Omega$ ,  $V_d = 3\text{V}$  (unless otherwise specified)

| Symbol                         | Parameters and Test Conditions  | Freq        | Units | Min. | Typ. | Max. | Std Dev |
|--------------------------------|---|-------------|-------|------|------|------|---------|
| $I_d^{[1,2]}$                  | Device Current  |             | mA    | 47   | 62   | 77   | 2.09    |
| $NF_{\text{test}}^{[1,2]}$     | Noise Figure in test circuit <sup>[1]</sup>                           | f = 0.5 GHz | dB    |      | 0.93 | 1.4  | 0.06    |
| $G_{\text{test}}^{[1,2]}$      | Associated Gain in test circuit <sup>[1]</sup>                        | f = 0.5 GHz | dB    | 20.4 | 22   | 23.4 | 0.36    |
| $OIP3_{\text{test}}^{[1,2]}$   | Output 3 <sup>rd</sup> Order Intercept in test circuit <sup>[1]</sup> | f = 0.5 GHz | dBm   | 30   | 32.9 |      | 0.51    |
| $NF_{50\Omega}^{[3]}$          | Noise Figure in 50 $\Omega$ system                                    | f = 0.1 GHz | dB    |      | 1.1  |      | 0.06    |
|                                |   | f = 0.2 GHz |       | 1.0  |      |      |         |
|                                |   | f = 0.5 GHz |       | 0.8  |      |      |         |
|                                |   | f = 1.0 GHz |       | 0.9  |      |      |         |
|                                |   | f = 1.5 GHz |       | 1.0  |      |      |         |
|                                |   | f = 2.0 GHz |       | 1.2  |      |      |         |
|                                |   | f = 2.5 GHz |       | 1.3  |      |      |         |
| f = 3.0 GHz                    | 1.5   |             |       |      |      |      |         |
| $ S_{21} _{50\Omega}^{[3]}$    | Associated Gain in 50 $\Omega$ system                                 | f = 0.1 GHz | dB    |      | 23.5 |      | 0.36    |
|                                |   | f = 0.2 GHz |       | 23   |      |      |         |
|                                |   | f = 0.5 GHz |       | 22   |      |      |         |
|                                |   | f = 1.0 GHz |       | 20   |      |      |         |
|                                |   | f = 1.5 GHz |       | 17   |      |      |         |
|                                |   | f = 2.0 GHz |       | 15.5 |      |      |         |
|                                |   | f = 2.5 GHz |       | 14   |      |      |         |
| f = 3.0 GHz                    | 13  |             |       |      |      |      |         |
| $OIP3_{50\Omega}^{[3]}$        | Output 3 <sup>rd</sup> Order Intercept Point in 50 $\Omega$ system    | f = 0.1 GHz | dBm   |      | 34.7 |      | 0.51    |
|                                |   | f = 0.2 GHz |       | 34.7 |      |      |         |
|                                |   | f = 0.5 GHz |       | 34.8 |      |      |         |
|                                |   | f = 1.0 GHz |       | 33.5 |      |      |         |
|                                |   | f = 1.5 GHz |       | 33   |      |      |         |
|                                |   | f = 2.0 GHz |       | 32.3 |      |      |         |
|                                |   | f = 2.5 GHz |       | 32   |      |      |         |
| f = 3.0 GHz                    | 31  |             |       |      |      |      |         |
| $P1\text{dB}_{50\Omega}^{[3]}$ | Output Power at 1dB Gain Compression in 50 $\Omega$ system            | f = 0.1 GHz | dBm   |      |      |      | 18      |
|                                |   | f = 0.2 GHz |       | 18   |      |      |         |
|                                |   | f = 0.5 GHz |       | 18   |      |      |         |
|                                |   | f = 1.0 GHz |       | 17.6 |      |      |         |
|                                |   | f = 1.5 GHz |       | 17.6 |      |      |         |
|                                |   | f = 2.0 GHz |       | 17.7 |      |      |         |
|                                |   | f = 2.5 GHz |       | 17.9 |      |      |         |
| f = 3.0 GHz                    | 17.7  |             |       |      |      |      |         |

Notes:

1. Guaranteed specifications are 100% tested in the production test circuit as shown in Figure 1, the typical value is based on measurement of at least 500 parts from three non-consecutive wafer lots during initial characterization of this product.
2. Circuit achieved a trade-off between optimal NF, Gain, OIP3 and input return loss.
3. Parameter quoted at 50 $\Omega$  is based on measurement of selected typical parts tested on a 50 $\Omega$  input and output test fixture.

**MGA-62563 Typical Performance,  $V_d = 3V, I_{ds} = 60\text{ mA}$  at  $50\Omega$  Input and Output**

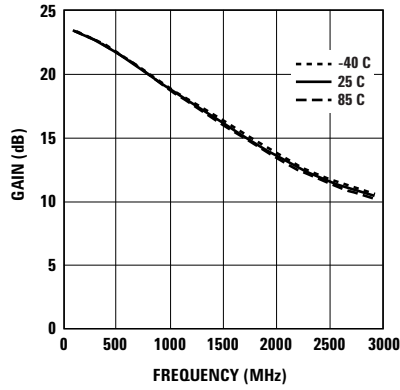


Figure 8. Gain vs. Frequency (3V 60 mA).

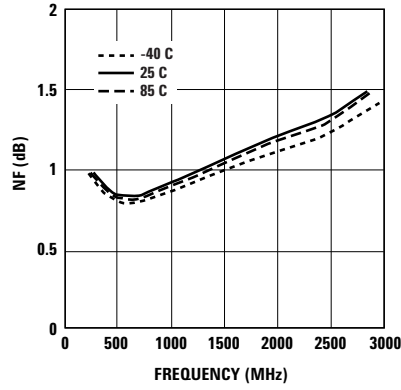


Figure 9. NF vs. Frequency (3V 60 mA).

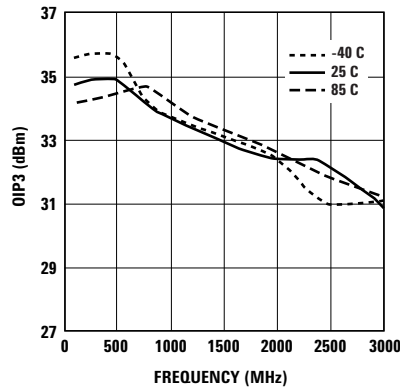


Figure 10. OIP3 vs. Frequency (3V 60 mA).

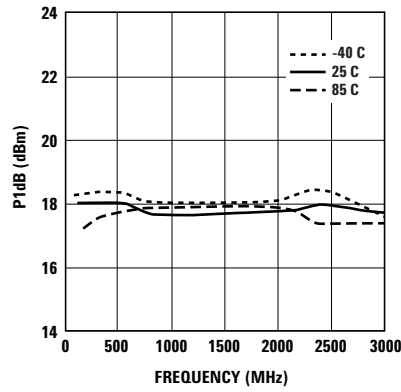


Figure 11. P1dB vs. Frequency (3V 60 mA).

**MGA-62563 Typical Performance,  $V_d = 3V$ ,  $I_{ds} = 30\text{ mA}$  at  $50\Omega$  Input and Output**

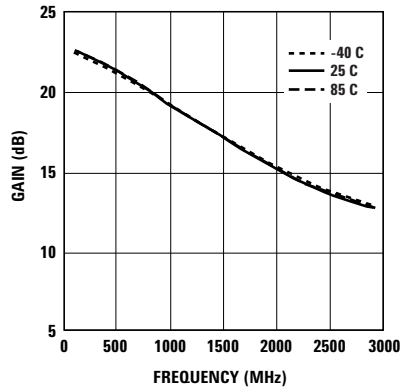


Figure 12. Gain vs. Frequency (3V 30 mA).

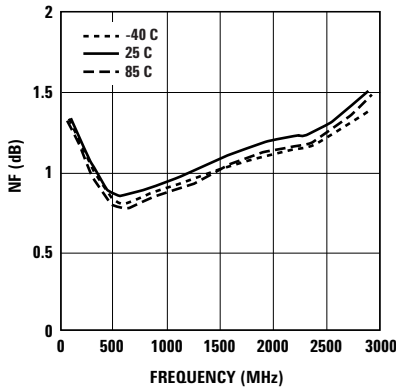


Figure 13. NF vs. Frequency (3V 30 mA).

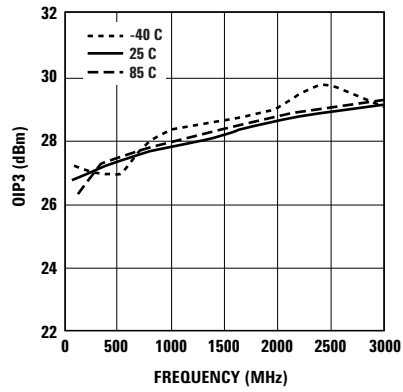


Figure 14. OIP3 vs. Frequency (3V 30 mA).

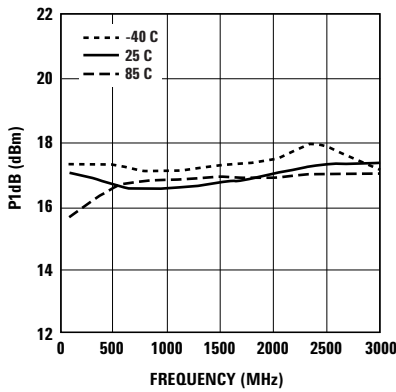


Figure 15. P1dB vs. Frequency (3V 30 mA).

**MGA-62563 Typical Performance,  $V_d = 5V$ ,  $I_{ds} = 60\text{ mA}$  at  $50\Omega$  Input and Output**

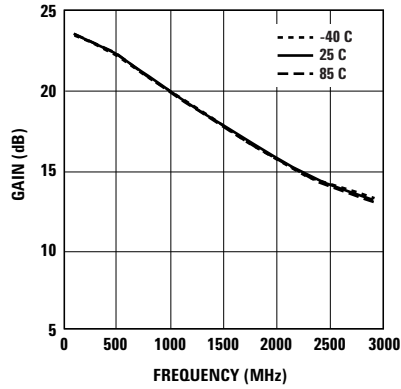


Figure 16. Gain vs. Frequency (5V 60 mA).

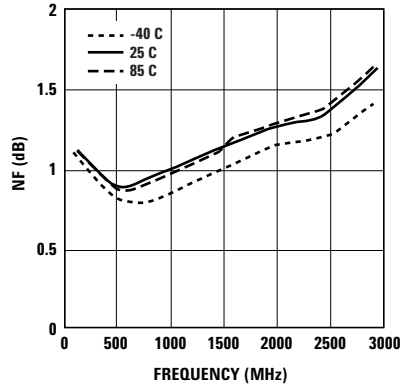


Figure 17. NF vs. Frequency (5V 60 mA).

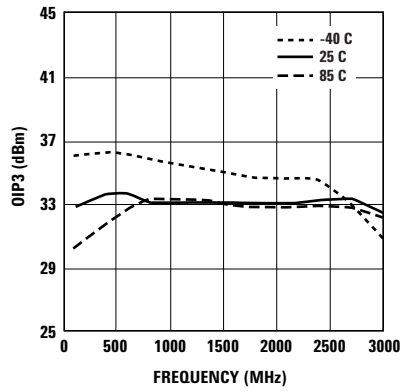


Figure 18. OIP3 vs. Frequency (5V 60 mA).

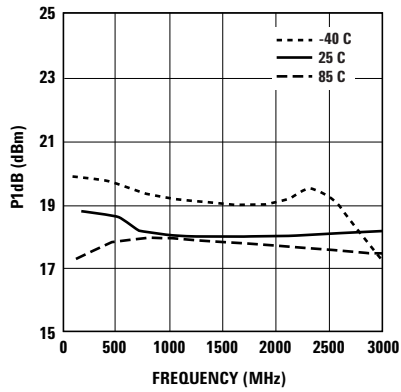


Figure 19. P1dB vs. Frequency (5V 60 mA).

**MGA-62563 Typical Performance,  $V_d = 5V$ ,  $I_{ds} = 30\text{ mA}$  at  $50\Omega$  Input and Output**

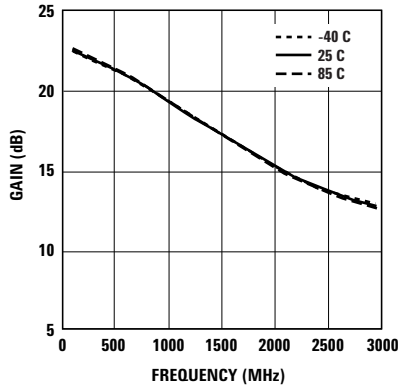


Figure 20. Gain vs. Frequency (5V 30 mA).

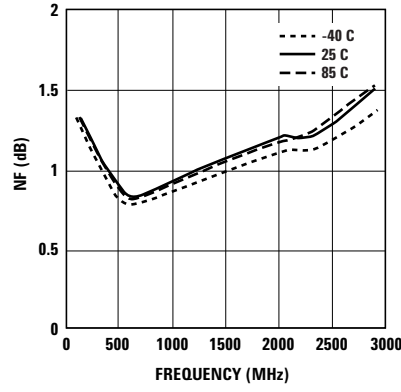


Figure 21. NF vs. Frequency (5V 30 mA).

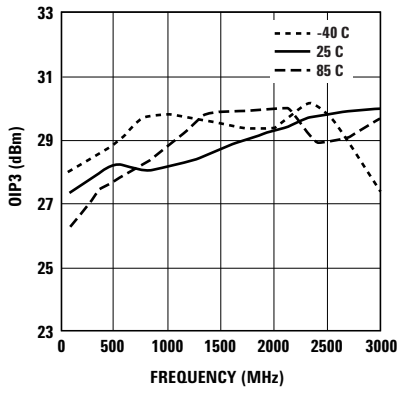


Figure 22. OIP3 vs. Frequency (5V 30 mA).

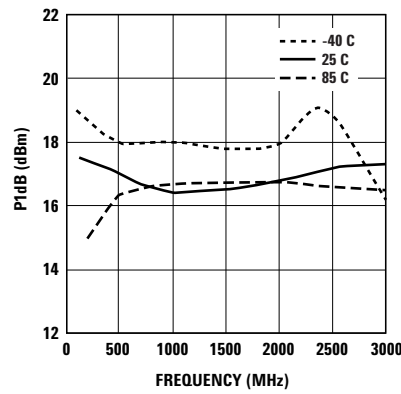
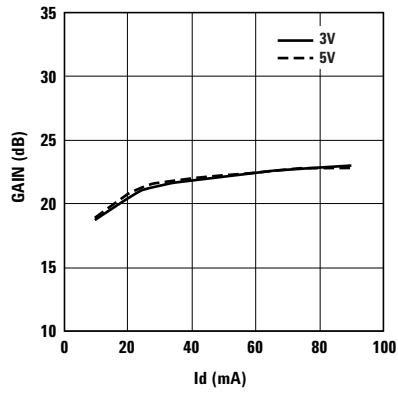


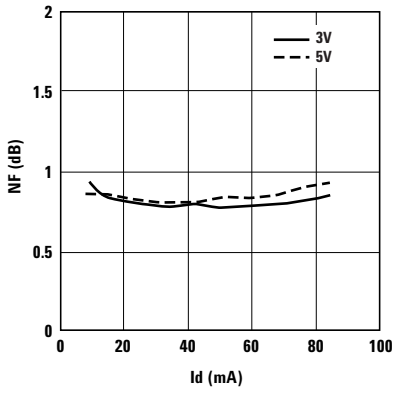
Figure 23. P1dB vs. Frequency (5V 30 mA).



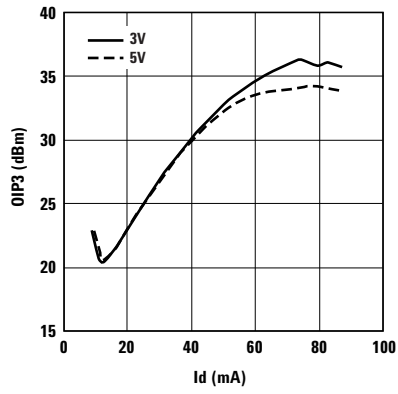
**MGA-62563 Typical Performance, Freq=0.5 GHz, T<sub>C</sub>=25°C at 50Ω Input and Output**



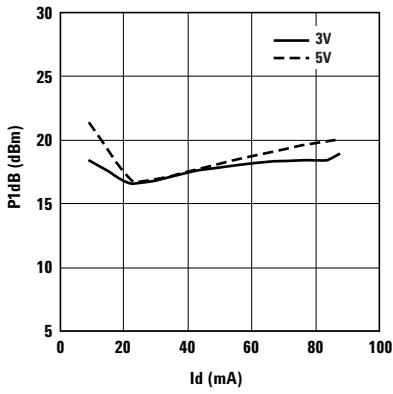
**Figure 24. Gain vs. Id (500 MHz).**



**Figure 25. NF vs. Id (500 MHz).**



**Figure 26. OIP3 vs. Id (500 MHz).**



**Figure 27. P1dB vs. Id (500 MHz).**

**MGA-62563 Typical Performance, Freq=0.1 GHz,  $T_C=25^\circ\text{C}$  at  $50\Omega$  Input and Output**

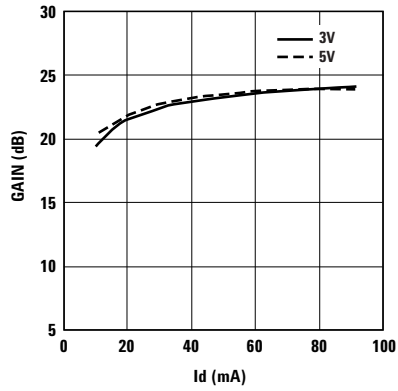


Figure 28. Gain vs. Id (100 MHz).

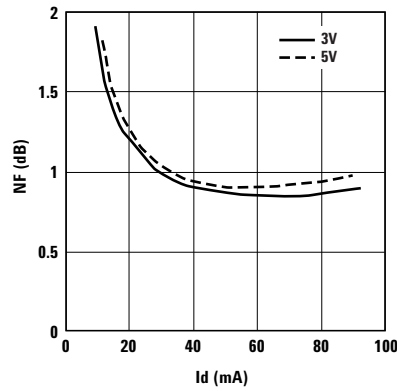


Figure 29. NF vs. Id (100 MHz).

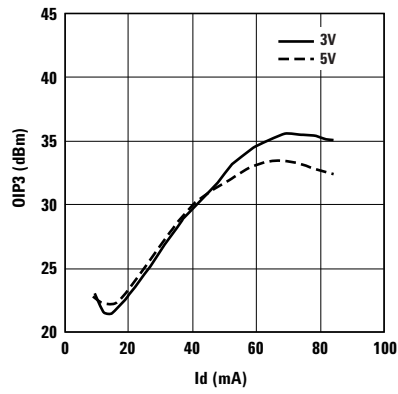


Figure 30. OIP3 vs. Id (100 MHz).

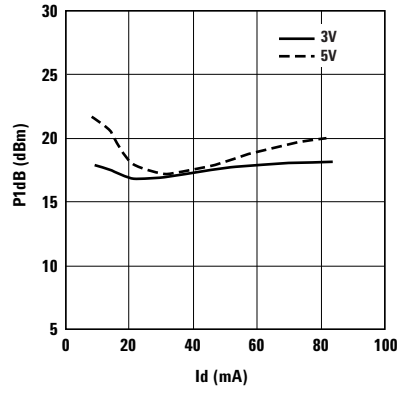


Figure 31. P1dB vs. Id (100 MHz).

**MGA-62563 Typical Scattering Parameters,  $T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 3\text{V}$ ,  $I_{ds} = 60\text{mA}$**

| Freq.<br>GHz | $S_{11}$ |          | $S_{21}$ |        |          | $S_{12}$ |         | $S_{22}$ |          | K-factor |
|--------------|----------|----------|----------|--------|----------|----------|---------|----------|----------|----------|
|              | Mag.     | Ang.     | dB       | Mag.   | Ang.     | Mag.     | Ang.    | Mag.     | Ang.     |          |
| 0.1          | 0.185    | -82.272  | 22.91    | 13.982 | 155.827  | 0.042    | 5.4     | 0.129    | -164.437 | 1.09     |
| 0.2          | 0.187    | -90.11   | 22.63    | 13.537 | 153.346  | 0.042    | 5.474   | 0.135    | -168.363 | 1.1      |
| 0.3          | 0.193    | -98.147  | 22.31    | 13.054 | 150.578  | 0.042    | 5.636   | 0.141    | -172.09  | 1.12     |
| 0.4          | 0.203    | -106.14  | 21.97    | 12.545 | 147.524  | 0.042    | 5.912   | 0.148    | -175.737 | 1.15     |
| 0.5          | 0.217    | -114.27  | 21.57    | 11.986 | 143.942  | 0.042    | 6.346   | 0.154    | -179.503 | 1.17     |
| 0.6          | 0.233    | -121.367 | 21.18    | 11.459 | 140.212  | 0.041    | 6.892   | 0.159    | 177.105  | 1.22     |
| 0.7          | 0.252    | -127.882 | 20.78    | 10.945 | 136.065  | 0.041    | 7.583   | 0.163    | 173.986  | 1.25     |
| 0.8          | 0.272    | -133.795 | 20.39    | 10.457 | 131.465  | 0.041    | 8.43    | 0.167    | 171.256  | 1.27     |
| 0.9          | 0.295    | -138.842 | 20.02    | 10.021 | 126.434  | 0.041    | 9.417   | 0.171    | 168.886  | 1.3      |
| 1            | 0.317    | -143.232 | 19.66    | 9.611  | 121.342  | 0.042    | 10.645  | 0.173    | 167.409  | 1.3      |
| 1.1          | 0.34     | -147.643 | 19.26    | 9.179  | 116.107  | 0.042    | 12.083  | 0.175    | 166.393  | 1.32     |
| 1.2          | 0.358    | -151.668 | 18.87    | 8.78   | 111.387  | 0.042    | 13.52   | 0.177    | 165.719  | 1.35     |
| 1.3          | 0.371    | -154.625 | 18.48    | 8.397  | 106.965  | 0.043    | 14.99   | 0.172    | 164.894  | 1.36     |
| 1.4          | 0.378    | -156.903 | 18.1     | 8.035  | 102.832  | 0.044    | 16.437  | 0.163    | 164.215  | 1.38     |
| 1.5          | 0.385    | -159.101 | 17.71    | 7.684  | 98.886   | 0.045    | 17.798  | 0.153    | 164.02   | 1.4      |
| 1.6          | 0.392    | -161.727 | 17.32    | 7.349  | 95.185   | 0.046    | 19.056  | 0.144    | 163.07   | 1.42     |
| 1.7          | 0.397    | -164.752 | 16.92    | 7.015  | 91.424   | 0.048    | 20.227  | 0.132    | 162.822  | 1.42     |
| 1.8          | 0.4      | -167.685 | 16.55    | 6.72   | 88.093   | 0.049    | 21.207  | 0.122    | 162.927  | 1.44     |
| 1.9          | 0.4      | -170.686 | 16.19    | 6.446  | 84.931   | 0.051    | 22.085  | 0.113    | 163.177  | 1.44     |
| 2            | 0.4      | -173.615 | 15.84    | 6.195  | 81.892   | 0.052    | 22.821  | 0.104    | 163.203  | 1.47     |
| 2.5          | 0.401    | 171.986  | 14.29    | 5.184  | 67.423   | 0.063    | 24.202  | 0.059    | 160.575  | 1.46     |
| 3            | 0.391    | 153.64   | 12.93    | 4.432  | 53.871   | 0.074    | 22.323  | 0.029    | 162.52   | 1.46     |
| 3.5          | 0.418    | 141.02   | 11.87    | 3.923  | 39.725   | 0.088    | 16.919  | 0.024    | 14.44    | 1.37     |
| 4            | 0.461    | 127.008  | 10.81    | 3.472  | 26.244   | 0.099    | 11.289  | 0.043    | 17.922   | 1.32     |
| 4.5          | 0.548    | 119.58   | 9.83     | 3.1    | 11.923   | 0.108    | 4.074   | 0.083    | 3.197    | 1.22     |
| 5            | 0.615    | 105.771  | 8.73     | 2.733  | -1.958   | 0.119    | -3.141  | 0.057    | 18.181   | 1.14     |
| 5.5          | 0.674    | 97.228   | 7.69     | 2.425  | -13.281  | 0.126    | -10.835 | 0.026    | -8.344   | 1.05     |
| 6            | 0.701    | 85.967   | 7.26     | 2.308  | -24.509  | 0.131    | -17.126 | 0.096    | 123.432  | 1.01     |
| 6.5          | 0.698    | 77.659   | 6.44     | 2.099  | -35.324  | 0.138    | -24.617 | 0.165    | 105.103  | 1.06     |
| 7            | 0.69     | 66.448   | 6.33     | 2.072  | -47.318  | 0.145    | -31.049 | 0.259    | 92.547   | 1.06     |
| 7.5          | 0.677    | 55.492   | 5.55     | 1.895  | -59.77   | 0.15     | -39.087 | 0.284    | 78.001   | 1.14     |
| 8            | 0.673    | 45.318   | 5.18     | 1.816  | -68.839  | 0.157    | -45.822 | 0.294    | 70.774   | 1.14     |
| 9            | 0.718    | 26.713   | 4.61     | 1.701  | -88.8    | 0.167    | -62.304 | 0.323    | 48.33    | 1.07     |
| 10           | 0.778    | 15.285   | 4.14     | 1.61   | -104.215 | 0.168    | -76.006 | 0.364    | 24.415   | 0.99     |

**Typical Noise Parameters at  $25^\circ\text{C}$ ,**

$T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 3\text{V}$ ,  $I_{ds} = 60\text{mA}$

| Freq<br>GHz | $F_{min}$<br>dB | $\Gamma_{opt}$<br>Mag. | $\Gamma_{opt}$<br>Ang. | $R_n/50$ | NF@50Ω<br>dB |
|-------------|-----------------|------------------------|------------------------|----------|--------------|
| 0.5         | 0.79            | 0.08                   | 57.8                   | 0.12     | 0.8          |
| 1           | 0.65            | 0.07                   | 168.2                  | 0.07     | 0.65         |
| 1.5         | 0.76            | 0.12                   | -176.7                 | 0.07     | 0.77         |
| 2           | 0.87            | 0.13                   | 149.3                  | 0.08     | 0.89         |
| 2.5         | 0.93            | 0.16                   | -179                   | 0.08     | 0.97         |
| 3           | 0.96            | 0.23                   | -164.8                 | 0.08     | 1.06         |
| 3.5         | 1.11            | 0.24                   | -150                   | 0.09     | 1.22         |
| 4           | 1.28            | 0.27                   | -142.7                 | 0.11     | 1.43         |
| 4.5         | 1.36            | 0.33                   | -133.7                 | 0.12     | 1.61         |
| 5           | 1.44            | 0.38                   | -123                   | 0.15     | 1.79         |
| 5.5         | 1.47            | 0.43                   | -114                   | 0.19     | 1.97         |
| 6           | 1.63            | 0.45                   | -103.6                 | 0.25     | 2.2          |
| 6.5         | 1.69            | 0.5                    | -94.5                  | 0.34     | 2.47         |
| 7           | 1.77            | 0.54                   | -85.3                  | 0.43     | 2.71         |
| 7.5         | 1.94            | 0.58                   | -75.1                  | 0.57     | 3.08         |
| 8           | 2.07            | 0.6                    | -64.9                  | 0.77     | 3.42         |
| 8.5         | 2.25            | 0.64                   | -54.6                  | 1        | 3.89         |
| 9           | 2.4             | 0.67                   | -45.9                  | 1.28     | 4.31         |
| 9.5         | 2.25            | 0.75                   | -39.2                  | 1.6      | 4.77         |
| 10          | 2.44            | 0.74                   | -34                    | 1.91     | 5.14         |

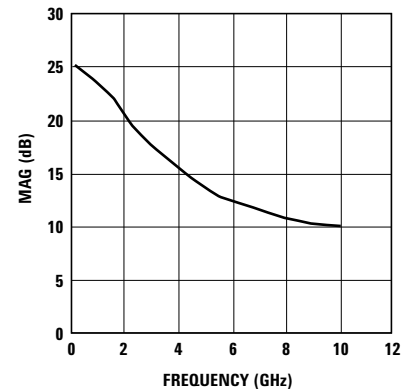


Figure 32. MAG vs. Frequency.

**MGA-62563 Typical Scattering Parameters,  $T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 3\text{V}$ ,  $I_{ds} = 30\text{ mA}$**

| Freq.<br>GHz | $S_{11}$ |          | dB    | $S_{21}$ |          | $S_{12}$ |         | $S_{22}$ |          | K-factor |
|--------------|----------|----------|-------|----------|----------|----------|---------|----------|----------|----------|
|              | Mag.     | Ang.     |       | Mag.     | Ang.     | Mag.     | Ang.    | Mag.     | Ang.     |          |
| 0.1          | 0.229    | -64.839  | 21.81 | 12.314   | 156.524  | 0.049    | 5.851   | 0.088    | -127.44  | 1.06     |
| 0.2          | 0.225    | -72.068  | 21.54 | 11.942   | 153.986  | 0.049    | 5.688   | 0.093    | -135.628 | 1.08     |
| 0.3          | 0.224    | -80.018  | 21.24 | 11.537   | 151.158  | 0.049    | 5.569   | 0.1      | -143.242 | 1.09     |
| 0.4          | 0.227    | -88.494  | 20.91 | 11.11    | 148.033  | 0.049    | 5.526   | 0.108    | -150.147 | 1.11     |
| 0.5          | 0.234    | -97.66   | 20.54 | 10.643   | 144.386  | 0.048    | 5.588   | 0.116    | -156.622 | 1.15     |
| 0.6          | 0.246    | -106.065 | 20.17 | 10.202   | 140.583  | 0.048    | 5.738   | 0.125    | -161.903 | 1.17     |
| 0.7          | 0.261    | -113.999 | 19.8  | 9.774    | 136.408  | 0.048    | 6.002   | 0.133    | -166.307 | 1.19     |
| 0.8          | 0.28     | -121.285 | 19.43 | 9.369    | 131.811  | 0.048    | 6.379   | 0.141    | -169.879 | 1.22     |
| 0.9          | 0.302    | -127.551 | 19.1  | 9.012    | 126.834  | 0.048    | 6.887   | 0.15     | -172.861 | 1.23     |
| 1            | 0.324    | -133.004 | 18.77 | 8.676    | 121.818  | 0.049    | 7.629   | 0.158    | -174.888 | 1.23     |
| 1.1          | 0.348    | -138.366 | 18.4  | 8.322    | 116.64   | 0.049    | 8.559   | 0.166    | -176.589 | 1.24     |
| 1.2          | 0.367    | -143.111 | 18.05 | 7.993    | 111.957  | 0.049    | 9.506   | 0.174    | -178.07  | 1.26     |
| 1.3          | 0.38     | -146.63  | 17.69 | 7.669    | 107.573  | 0.05     | 10.548  | 0.174    | -179.151 | 1.27     |
| 1.4          | 0.39     | -149.336 | 17.33 | 7.356    | 103.466  | 0.051    | 11.645  | 0.168    | -179.685 | 1.28     |
| 1.5          | 0.399    | -151.941 | 16.97 | 7.052    | 99.534   | 0.052    | 12.668  | 0.162    | -179.868 | 1.29     |
| 1.6          | 0.407    | -154.928 | 16.6  | 6.758    | 95.851   | 0.053    | 13.646  | 0.156    | -179.214 | 1.31     |
| 1.7          | 0.413    | -158.278 | 16.21 | 6.466    | 92.108   | 0.054    | 14.581  | 0.148    | -179.163 | 1.33     |
| 1.8          | 0.416    | -161.47  | 15.86 | 6.207    | 88.778   | 0.055    | 15.393  | 0.141    | -179.311 | 1.35     |
| 1.9          | 0.418    | -164.666 | 15.51 | 5.965    | 85.613   | 0.057    | 16.142  | 0.134    | -179.509 | 1.36     |
| 2            | 0.417    | -167.751 | 15.18 | 5.744    | 82.561   | 0.058    | 16.791  | 0.128    | -179.436 | 1.38     |
| 2.5          | 0.422    | -177.274 | 13.71 | 4.848    | 67.999   | 0.068    | 18.161  | 0.089    | -176.954 | 1.4      |
| 3            | 0.412    | 158.337  | 12.41 | 4.174    | 54.232   | 0.079    | 16.464  | 0.062    | 176.77   | 1.42     |
| 3.5          | 0.442    | 144.969  | 11.39 | 3.71     | 39.961   | 0.092    | 11.54   | 0.015    | 130.879  | 1.35     |
| 4            | 0.486    | 129.994  | 10.34 | 3.287    | 26.316   | 0.102    | 6.16    | 0.028    | 68.898   | 1.32     |
| 4.5          | 0.573    | 121.597  | 9.35  | 2.935    | 11.973   | 0.111    | -0.792  | 0.063    | 24.183   | 1.21     |
| 5            | 0.638    | 107.123  | 8.25  | 2.585    | -2.051   | 0.122    | -7.727  | 0.057    | 50.418   | 1.13     |
| 5.5          | 0.696    | 98.232   | 7.18  | 2.285    | -13.425  | 0.128    | -15.159 | 0.026    | 55.253   | 1.05     |
| 6            | 0.721    | 86.681   | 6.73  | 2.169    | -24.666  | 0.131    | -21.346 | 0.124    | 119.497  | 1        |
| 6.5          | 0.713    | 78.214   | 5.85  | 1.961    | -35.535  | 0.139    | -28.725 | 0.191    | 103.907  | 1.06     |
| 7            | 0.704    | 66.96    | 5.7   | 1.927    | -47.61   | 0.146    | -34.963 | 0.287    | 91.799   | 1.06     |
| 7.5          | 0.687    | 55.912   | 4.88  | 1.753    | -60.15   | 0.15     | -42.644 | 0.31     | 77.221   | 1.16     |
| 8            | 0.68     | 45.807   | 4.47  | 1.673    | -69.283  | 0.156    | -49.076 | 0.318    | 69.627   | 1.18     |
| 9            | 0.725    | 27.162   | 3.85  | 1.558    | -89.513  | 0.166    | -65.125 | 0.343    | 47.128   | 1.1      |
| 10           | 0.787    | 15.674   | 3.34  | 1.469    | -105.215 | 0.168    | -78.788 | 0.382    | 23.467   | 1        |

**Typical Noise Parameters at  $25^\circ\text{C}$ ,**

$T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 3\text{V}$ ,  $I_{ds} = 30\text{ mA}$

| Freq<br>GHz | $F_{min}$<br>dB | $\Gamma_{opt}$<br>Mag. | $\Gamma_{opt}$<br>Ang. | $R_n/50$ | NF@50Ω<br>dB |
|-------------|-----------------|------------------------|------------------------|----------|--------------|
| 0.5         | 0.76            | 0.07                   | 92.8                   | 0.1      | 0.77         |
| 1           | 0.66            | 0.06                   | 149.8                  | 0.08     | 0.67         |
| 1.5         | 0.79            | 0.09                   | 167.2                  | 0.07     | 0.8          |
| 2           | 0.86            | 0.14                   | 142.8                  | 0.08     | 0.88         |
| 2.5         | 0.91            | 0.15                   | 167.5                  | 0.08     | 0.95         |
| 3           | 0.94            | 0.23                   | -174.7                 | 0.07     | 1.03         |
| 3.5         | 1.07            | 0.24                   | -159.3                 | 0.08     | 1.17         |
| 4           | 1.21            | 0.27                   | -148.9                 | 0.09     | 1.35         |
| 4.5         | 1.28            | 0.32                   | -140.7                 | 0.11     | 1.51         |
| 5           | 1.39            | 0.36                   | -129.5                 | 0.13     | 1.69         |
| 5.5         | 1.43            | 0.4                    | -119.9                 | 0.17     | 1.85         |
| 6           | 1.58            | 0.42                   | -109.1                 | 0.21     | 2.05         |
| 6.5         | 1.63            | 0.48                   | -100.3                 | 0.28     | 2.31         |
| 7           | 1.68            | 0.53                   | -91                    | 0.35     | 2.51         |
| 7.5         | 1.86            | 0.56                   | -80.2                  | 0.48     | 2.87         |
| 8           | 1.96            | 0.59                   | -69.4                  | 0.65     | 3.18         |
| 8.5         | 2.15            | 0.63                   | -58.6                  | 0.85     | 3.61         |
| 9           | 2.26            | 0.64                   | -51.5                  | 1.12     | 4.02         |
| 9.5         | 2.15            | 0.75                   | -42.4                  | 1.4      | 4.49         |
| 10          | 2.32            | 0.74                   | -37.5                  | 1.69     | 4.87         |

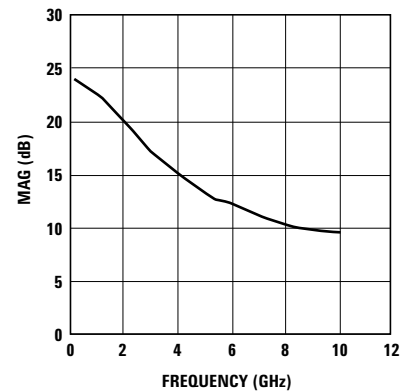


Figure 33. MAG vs. Frequency.

**MGA-62563 Typical Scattering Parameters,  $T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 3\text{V}$ ,  $I_{d5} = 20\text{mA}$**

| Freq.<br>GHz | $S_{11}$ |          | dB    | $S_{21}$ |          | $S_{12}$ |         | $S_{22}$ |          | K-factor |
|--------------|----------|----------|-------|----------|----------|----------|---------|----------|----------|----------|
|              | Mag.     | Ang.     |       | Mag.     | Ang.     | Mag.     | Ang.    | Mag.     | Ang.     |          |
| 0.1          | 0.274    | -53.949  | 20.92 | 11.121   | 157.035  | 0.054    | 5.715   | 0.094    | -80.83   | 1.05     |
| 0.2          | 0.265    | -60.28   | 20.67 | 10.806   | 154.512  | 0.054    | 5.383   | 0.09     | -91.02   | 1.07     |
| 0.3          | 0.259    | -67.514  | 20.39 | 10.459   | 151.71   | 0.054    | 5.086   | 0.089    | -102.192 | 1.08     |
| 0.4          | 0.257    | -75.557  | 20.08 | 10.093   | 148.613  | 0.054    | 4.833   | 0.091    | -113.483 | 1.1      |
| 0.5          | 0.258    | -84.672  | 19.72 | 9.687    | 144.952  | 0.054    | 4.637   | 0.095    | -124.7   | 1.12     |
| 0.6          | 0.264    | -93.431  | 19.37 | 9.304    | 141.158  | 0.054    | 4.525   | 0.101    | -133.965 | 1.14     |
| 0.7          | 0.275    | -102.057 | 19.02 | 8.932    | 137.004  | 0.054    | 4.504   | 0.109    | -141.605 | 1.16     |
| 0.8          | 0.29     | -110.18  | 18.67 | 8.581    | 132.446  | 0.054    | 4.576   | 0.118    | -147.841 | 1.18     |
| 0.9          | 0.31     | -117.309 | 18.35 | 8.271    | 127.543  | 0.054    | 4.783   | 0.129    | -152.991 | 1.19     |
| 1            | 0.331    | -123.571 | 18.04 | 7.983    | 122.588  | 0.054    | 5.195   | 0.139    | -156.749 | 1.2      |
| 1.1          | 0.354    | -129.682 | 17.71 | 7.679    | 117.464  | 0.054    | 5.763   | 0.15     | -160.026 | 1.21     |
| 1.2          | 0.372    | -134.998 | 17.38 | 7.396    | 112.827  | 0.054    | 6.374   | 0.16     | -162.849 | 1.22     |
| 1.3          | 0.387    | -138.974 | 17.04 | 7.11     | 108.473  | 0.055    | 7.105   | 0.163    | -164.481 | 1.22     |
| 1.4          | 0.397    | -142.056 | 16.69 | 6.828    | 104.388  | 0.055    | 7.939   | 0.16     | -165.092 | 1.25     |
| 1.5          | 0.407    | -145.03  | 16.33 | 6.555    | 100.473  | 0.056    | 8.736   | 0.157    | -165.37  | 1.26     |
| 1.6          | 0.416    | -148.334 | 15.97 | 6.289    | 96.786   | 0.057    | 9.514   | 0.152    | -166.308 | 1.28     |
| 1.7          | 0.423    | -151.951 | 15.6  | 6.025    | 93.017   | 0.058    | 10.294  | 0.146    | -166.218 | 1.3      |
| 1.8          | 0.427    | -155.37  | 15.25 | 5.789    | 89.657   | 0.059    | 10.984  | 0.141    | -166.034 | 1.32     |
| 1.9          | 0.428    | -158.764 | 14.91 | 5.568    | 86.471   | 0.06     | 11.651  | 0.137    | -165.814 | 1.34     |
| 2            | 0.428    | -161.995 | 14.59 | 5.365    | 83.402   | 0.062    | 12.246  | 0.132    | -165.841 | 1.35     |
| 2.5          | 0.432    | -177.573 | 13.16 | 4.549    | 68.702   | 0.07     | 13.701  | 0.098    | -166.888 | 1.41     |
| 3            | 0.422    | 162.92   | 11.89 | 3.933    | 54.632   | 0.08     | 12.332  | 0.073    | -164.868 | 1.45     |
| 3.5          | 0.453    | 148.816  | 10.89 | 3.503    | 40.096   | 0.092    | 7.985   | 0.024    | -165.023 | 1.39     |
| 4            | 0.497    | 133.003  | 9.85  | 3.108    | 26.107   | 0.102    | 3.027   | 0.013    | 108.515  | 1.35     |
| 4.5          | 0.584    | 123.794  | 8.87  | 2.777    | 11.49    | 0.111    | -3.486  | 0.044    | 23.417   | 1.24     |
| 5            | 0.648    | 108.792  | 7.8   | 2.455    | -2.939   | 0.121    | -9.998  | 0.044    | 61.186   | 1.15     |
| 5.5          | 0.705    | 99.614   | 6.75  | 2.174    | -14.677  | 0.128    | -17.142 | 0.019    | 83.666   | 1.05     |
| 6            | 0.729    | 87.836   | 6.32  | 2.07     | -26.088  | 0.131    | -23.178 | 0.129    | 125.118  | 1        |
| 6.5          | 0.719    | 79.179   | 5.46  | 1.875    | -37.227  | 0.138    | -30.431 | 0.194    | 108.15   | 1.06     |
| 7            | 0.709    | 67.879   | 5.33  | 1.847    | -49.36   | 0.144    | -36.508 | 0.289    | 94.828   | 1.06     |
| 7.5          | 0.69     | 56.687   | 4.54  | 1.686    | -62.033  | 0.148    | -43.977 | 0.312    | 79.896   | 1.17     |
| 8            | 0.682    | 46.564   | 4.15  | 1.613    | -71.166  | 0.155    | -50.351 | 0.321    | 72.003   | 1.19     |
| 9            | 0.725    | 27.786   | 3.57  | 1.508    | -91.211  | 0.164    | -66.308 | 0.344    | 49.405   | 1.11     |
| 10           | 0.791    | 15.826   | 3.07  | 1.424    | -106.691 | 0.166    | -79.9   | 0.382    | 25.395   | 1        |

**Typical Noise Parameters at  $25^\circ\text{C}$ ,**

$T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 3\text{V}$ ,  $I_{d5} = 20\text{mA}$

| Freq<br>GHz | $F_{\min}$<br>dB | $\Gamma_{\text{opt}}$<br>Mag. | $\Gamma_{\text{opt}}$<br>Ang. | $R_n/50$ | NF@50Ω<br>dB |
|-------------|------------------|-------------------------------|-------------------------------|----------|--------------|
| 0.5         | 0.83             | 0.1                           | 83.2                          | 0.11     | 0.85         |
| 1           | 0.71             | 0.06                          | 133.5                         | 0.08     | 0.71         |
| 1.5         | 0.81             | 0.09                          | 151.9                         | 0.07     | 0.82         |
| 2           | 0.88             | 0.15                          | 133.2                         | 0.08     | 0.91         |
| 2.5         | 0.93             | 0.16                          | 160.2                         | 0.08     | 0.97         |
| 3           | 0.98             | 0.23                          | 179.7                         | 0.07     | 1.07         |
| 3.5         | 1.1              | 0.24                          | -164.5                        | 0.08     | 1.2          |
| 4           | 1.2              | 0.28                          | -154                          | 0.09     | 1.36         |
| 4.5         | 1.29             | 0.33                          | -143.9                        | 0.1      | 1.52         |
| 5           | 1.4              | 0.36                          | -132.8                        | 0.12     | 1.71         |
| 5.5         | 1.46             | 0.4                           | -122.9                        | 0.16     | 1.88         |
| 6           | 1.62             | 0.42                          | -112                          | 0.21     | 2.1          |
| 6.5         | 1.68             | 0.47                          | -102.3                        | 0.28     | 2.34         |
| 7           | 1.74             | 0.52                          | -92.9                         | 0.35     | 2.56         |
| 7.5         | 1.92             | 0.55                          | -82.2                         | 0.47     | 2.91         |
| 8           | 2.04             | 0.57                          | -71.5                         | 0.65     | 3.23         |
| 8.5         | 2.22             | 0.61                          | -60                           | 0.85     | 3.65         |
| 9           | 2.32             | 0.65                          | -52.5                         | 1.13     | 4.09         |
| 9.5         | 2.2              | 0.75                          | -43.5                         | 1.41     | 4.55         |
| 10          | 2.39             | 0.74                          | -38.6                         | 1.71     | 4.94         |

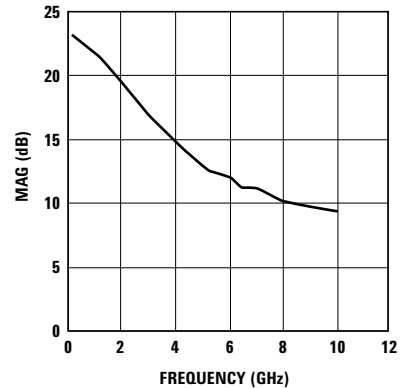


Figure 34. MAG vs. Frequency.

**MGA-62563 Typical Scattering Parameters,  $T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 5\text{V}$ ,  $I_{ds} = 40\text{mA}$**

| Freq.<br>GHz | $S_{11}$ |          | dB    | $S_{21}$ |          | $S_{12}$ |         | $S_{22}$ |          | K-factor |
|--------------|----------|----------|-------|----------|----------|----------|---------|----------|----------|----------|
|              | Mag.     | Ang.     |       | Mag.     | Ang.     | Mag.     | Ang.    | Mag.     | Ang.     |          |
| 0.1          | 0.22     | -62.539  | 22.22 | 12.911   | 155.715  | 0.046    | 2.6     | 0.041    | -117.254 | 1.09     |
| 0.2          | 0.214    | -69.644  | 21.94 | 12.502   | 153.158  | 0.045    | 2.081   | 0.038    | -129.6   | 1.12     |
| 0.3          | 0.212    | -77.541  | 21.62 | 12.057   | 150.317  | 0.045    | 1.608   | 0.038    | -142.653 | 1.14     |
| 0.4          | 0.214    | -86.029  | 21.28 | 11.588   | 147.183  | 0.044    | 1.201   | 0.039    | -155.322 | 1.18     |
| 0.5          | 0.22     | -95.298  | 20.89 | 11.075   | 143.514  | 0.043    | 0.89    | 0.041    | -167.419 | 1.23     |
| 0.6          | 0.229    | -103.863 | 20.5  | 10.59    | 139.683  | 0.043    | 0.698   | 0.043    | -177.186 | 1.26     |
| 0.7          | 0.243    | -112.001 | 20.1  | 10.12    | 135.429  | 0.042    | 0.643   | 0.045    | 174.82   | 1.31     |
| 0.8          | 0.259    | -119.5   | 19.71 | 9.675    | 130.731  | 0.041    | 0.734   | 0.047    | 168.782  | 1.37     |
| 0.9          | 0.279    | -125.972 | 19.35 | 9.281    | 125.639  | 0.041    | 1.042   | 0.048    | 164.393  | 1.4      |
| 1            | 0.299    | -131.628 | 19    | 8.911    | 120.513  | 0.04     | 1.762   | 0.049    | 163.524  | 1.45     |
| 1.1          | 0.32     | -137.177 | 18.61 | 8.521    | 115.245  | 0.039    | 2.85    | 0.048    | 164.901  | 1.51     |
| 1.2          | 0.336    | -142.073 | 18.23 | 8.159    | 110.507  | 0.039    | 4.1     | 0.049    | 167.544  | 1.55     |
| 1.3          | 0.348    | -145.665 | 17.84 | 7.801    | 106.06   | 0.039    | 5.603   | 0.043    | 170.928  | 1.59     |
| 1.4          | 0.356    | -148.38  | 17.45 | 7.455    | 101.898  | 0.039    | 7.304   | 0.032    | 178.48   | 1.64     |
| 1.5          | 0.363    | -150.989 | 17.05 | 7.121    | 97.936   | 0.039    | 9.091   | 0.024    | -165.089 | 1.7      |
| 1.6          | 0.37     | -154.012 | 16.65 | 6.8      | 94.219   | 0.039    | 10.88   | 0.019    | -143.445 | 1.75     |
| 1.7          | 0.374    | -157.396 | 16.23 | 6.481    | 90.464   | 0.04     | 12.735  | 0.02     | -106.9   | 1.78     |
| 1.8          | 0.376    | -160.639 | 15.85 | 6.2      | 87.131   | 0.04     | 14.442  | 0.027    | -86.207  | 1.84     |
| 1.9          | 0.376    | -163.914 | 15.47 | 5.939    | 83.969   | 0.041    | 16.084  | 0.035    | -75.973  | 1.87     |
| 2            | 0.375    | -167.082 | 15.12 | 5.699    | 80.94    | 0.042    | 17.612  | 0.043    | -70.287  | 1.9      |
| 2.5          | 0.372    | -177.387 | 13.51 | 4.736    | 66.672   | 0.05     | 22.955  | 0.081    | -58.59   | 1.9      |
| 3            | 0.356    | 158.01   | 12.14 | 4.047    | 53.37    | 0.059    | 24.196  | 0.112    | -56.813  | 1.89     |
| 3.5          | 0.381    | 144.376  | 11.06 | 3.573    | 39.369   | 0.07     | 21.054  | 0.14     | -52.546  | 1.75     |
| 4            | 0.423    | 129.789  | 10.03 | 3.175    | 25.905   | 0.08     | 17.196  | 0.146    | -53.692  | 1.66     |
| 4.5          | 0.508    | 121.918  | 9.07  | 2.842    | 11.472   | 0.09     | 11.517  | 0.155    | -54.803  | 1.49     |
| 5            | 0.576    | 107.907  | 8.06  | 2.528    | -2.535   | 0.102    | 5.225   | 0.123    | -67.978  | 1.35     |
| 5.5          | 0.639    | 99.362   | 7.06  | 2.255    | -14.4    | 0.11     | -2.316  | 0.122    | -90.136  | 1.23     |
| 6            | 0.672    | 88.277   | 6.69  | 2.16     | -25.888  | 0.122    | -8.464  | 0.105    | -150.094 | 1.1      |
| 6.5          | 0.672    | 79.728   | 5.92  | 1.976    | -37.199  | 0.125    | -15.947 | 0.121    | 162.804  | 1.18     |
| 7            | 0.668    | 68.454   | 5.81  | 1.953    | -49.487  | 0.135    | -22.415 | 0.187    | 127.855  | 1.15     |
| 7.5          | 0.657    | 57.275   | 5.12  | 1.803    | -62.284  | 0.142    | -30.896 | 0.213    | 108.129  | 1.22     |
| 8            | 0.655    | 47.003   | 4.75  | 1.728    | -71.76   | 0.151    | -38.436 | 0.231    | 98.412   | 1.2      |
| 9            | 0.704    | 28.227   | 4.24  | 1.629    | -91.789  | 0.161    | -55.934 | 0.261    | 73.264   | 1.09     |
| 10           | 0.772    | 16.7     | 3.85  | 1.558    | -107.404 | 0.162    | -68.84  | 0.298    | 44.421   | 0.98     |

**Typical Noise Parameters at  $25^\circ\text{C}$ ,**

$T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 5\text{V}$ ,  $I_{ds} = 40\text{mA}$

| Freq<br>GHz | $F_{min}$<br>dB | $\Gamma_{opt}$<br>Mag. | $\Gamma_{opt}$<br>Ang. | $R_n/50$ | NF@50Ω<br>dB |
|-------------|-----------------|------------------------|------------------------|----------|--------------|
| 0.5         | 0.75            | 0.05                   | 89.7                   | 0.1      | 0.75         |
| 1           | 0.67            | 0.06                   | 157.9                  | 0.08     | 0.67         |
| 1.5         | 0.78            | 0.1                    | 174                    | 0.07     | 0.79         |
| 2           | 0.87            | 0.13                   | 147.1                  | 0.08     | 0.9          |
| 2.5         | 0.95            | 0.15                   | 174.2                  | 0.08     | 0.98         |
| 3           | 0.98            | 0.22                   | -169.9                 | 0.08     | 1.07         |
| 3.5         | 1.1             | 0.23                   | -153.6                 | 0.09     | 1.2          |
| 4           | 1.25            | 0.26                   | -146.3                 | 0.1      | 1.4          |
| 4.5         | 1.33            | 0.31                   | -138.5                 | 0.12     | 1.54         |
| 5           | 1.42            | 0.36                   | -127.2                 | 0.14     | 1.73         |
| 5.5         | 1.44            | 0.4                    | -117.8                 | 0.18     | 1.88         |
| 6           | 1.61            | 0.43                   | -107.4                 | 0.22     | 2.1          |
| 6.5         | 1.66            | 0.48                   | -97.8                  | 0.3      | 2.36         |
| 7           | 1.7             | 0.53                   | -89.1                  | 0.38     | 2.57         |
| 7.5         | 1.92            | 0.56                   | -78.4                  | 0.51     | 2.94         |
| 8           | 2.03            | 0.58                   | -68.2                  | 0.69     | 3.27         |
| 8.5         | 2.21            | 0.62                   | -57.2                  | 0.91     | 3.7          |
| 9           | 2.34            | 0.65                   | -50.2                  | 1.18     | 4.15         |
| 9.5         | 2.23            | 0.75                   | -41.6                  | 1.48     | 4.64         |
| 10          | 2.43            | 0.75                   | -36.6                  | 1.8      | 5.06         |

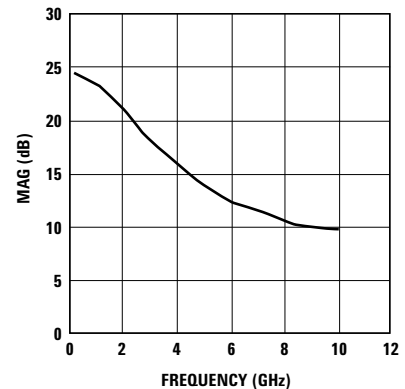


Figure 35. MAG vs. Frequency.

**MGA-62563 Typical Scattering Parameters,  $T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 5\text{V}$ ,  $I_{ds} = 30\text{mA}$**

| Freq.<br>GHz | $S_{11}$ |          | $S_{21}$ |        |          | $S_{12}$ |         | $S_{22}$ |          | K-factor |
|--------------|----------|----------|----------|--------|----------|----------|---------|----------|----------|----------|
|              | Mag.     | Ang.     | dB       | Mag.   | Ang.     | Mag.     | Ang.    | Mag.     | Ang.     |          |
| 0.1          | 0.237    | -58.467  | 21.8     | 12.306 | 156.126  | 0.048    | 2.335   | 0.051    | -78.66   | 1.09     |
| 0.2          | 0.23     | -65.183  | 21.53    | 11.928 | 153.564  | 0.048    | 1.765   | 0.045    | -87.521  | 1.11     |
| 0.3          | 0.227    | -72.749  | 21.23    | 11.518 | 150.716  | 0.047    | 1.228   | 0.039    | -99.059  | 1.14     |
| 0.4          | 0.226    | -81.026  | 20.89    | 11.082 | 147.575  | 0.047    | 0.749   | 0.036    | -112.979 | 1.16     |
| 0.5          | 0.23     | -90.235  | 20.51    | 10.603 | 143.898  | 0.046    | 0.336   | 0.033    | -129.188 | 1.21     |
| 0.6          | 0.238    | -98.902  | 20.13    | 10.153 | 140.036  | 0.046    | 0.043   | 0.033    | -143.928 | 1.24     |
| 0.7          | 0.25     | -107.258 | 19.75    | 9.716  | 135.78   | 0.045    | -0.127  | 0.034    | -156.168 | 1.28     |
| 0.8          | 0.265    | -115.042 | 19.37    | 9.304  | 131.095  | 0.044    | -0.173  | 0.036    | -165.43  | 1.33     |
| 0.9          | 0.284    | -121.835 | 19.03    | 8.94   | 126.04   | 0.043    | -0.043  | 0.039    | -171.896 | 1.38     |
| 1            | 0.304    | -127.797 | 18.69    | 8.602  | 120.95   | 0.043    | 0.462   | 0.041    | -173.502 | 1.4      |
| 1.1          | 0.325    | -133.627 | 18.32    | 8.246  | 115.706  | 0.042    | 1.306   | 0.044    | -172.856 | 1.46     |
| 1.2          | 0.342    | -138.742 | 17.97    | 7.914  | 110.976  | 0.042    | 2.313   | 0.047    | -171.524 | 1.48     |
| 1.3          | 0.354    | -142.508 | 17.6     | 7.583  | 106.528  | 0.042    | 3.581   | 0.044    | -166.973 | 1.52     |
| 1.4          | 0.363    | -145.389 | 17.22    | 7.259  | 102.357  | 0.041    | 5.063   | 0.038    | -156.713 | 1.6      |
| 1.5          | 0.371    | -148.151 | 16.83    | 6.946  | 98.374   | 0.041    | 6.652   | 0.034    | -141.923 | 1.64     |
| 1.6          | 0.378    | -151.305 | 16.45    | 6.644  | 94.631   | 0.042    | 8.268   | 0.032    | -127.89  | 1.66     |
| 1.7          | 0.383    | -154.816 | 16.04    | 6.342  | 90.832   | 0.042    | 9.963   | 0.034    | -108.748 | 1.72     |
| 1.8          | 0.386    | -158.161 | 15.67    | 6.075  | 87.455   | 0.043    | 11.558  | 0.039    | -95.871  | 1.74     |
| 1.9          | 0.386    | -161.511 | 15.31    | 5.827  | 84.258   | 0.043    | 13.115  | 0.045    | -87.243  | 1.8      |
| 2            | 0.385    | -164.738 | 14.96    | 5.6    | 81.188   | 0.044    | 14.587  | 0.052    | -81.336  | 1.83     |
| 2.5          | 0.383    | 179.495  | 13.41    | 4.684  | 66.72    | 0.051    | 19.968  | 0.083    | -65.882  | 1.86     |
| 3            | 0.368    | 159.885  | 12.09    | 4.023  | 53.234   | 0.06     | 21.459  | 0.111    | -61.634  | 1.85     |
| 3.5          | 0.393    | 145.917  | 11.05    | 3.568  | 39.154   | 0.071    | 18.676  | 0.136    | -55.813  | 1.72     |
| 4            | 0.435    | 130.892  | 10.05    | 3.179  | 25.626   | 0.081    | 15.046  | 0.14     | -56.384  | 1.62     |
| 4.5          | 0.52     | 122.592  | 9.11     | 2.854  | 11.264   | 0.09     | 9.563   | 0.148    | -56.648  | 1.46     |
| 5            | 0.588    | 108.322  | 8.1      | 2.541  | -2.66    | 0.102    | 3.467   | 0.117    | -69.997  | 1.32     |
| 5.5          | 0.65     | 99.592   | 7.11     | 2.266  | -14.387  | 0.11     | -3.953  | 0.117    | -92.334  | 1.2      |
| 6            | 0.682    | 88.363   | 6.72     | 2.167  | -25.768  | 0.122    | -10.031 | 0.106    | -153.954 | 1.07     |
| 6.5          | 0.68     | 79.738   | 5.93     | 1.979  | -36.871  | 0.125    | -17.411 | 0.125    | 160.43   | 1.16     |
| 7            | 0.675    | 68.426   | 5.8      | 1.949  | -49      | 0.134    | -23.769 | 0.193    | 126.821  | 1.14     |
| 7.5          | 0.663    | 57.213   | 5.06     | 1.791  | -61.602  | 0.141    | -32.118 | 0.218    | 107.343  | 1.21     |
| 8            | 0.659    | 46.972   | 4.67     | 1.711  | -70.948  | 0.15     | -39.536 | 0.236    | 97.607   | 1.21     |
| 9            | 0.707    | 28.23    | 4.07     | 1.597  | -90.845  | 0.16     | -56.781 | 0.265    | 72.633   | 1.11     |
| 10           | 0.774    | 16.694   | 3.6      | 1.513  | -106.409 | 0.161    | -69.865 | 0.303    | 44.117   | 1        |

**Typical Noise Parameters at  $25^\circ\text{C}$ ,**

$T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 5\text{V}$ ,  $I_{ds} = 30\text{mA}$

| Freq<br>GHz | $F_{min}$<br>dB | $\Gamma_{opt}$<br>Mag. | $\Gamma_{opt}$<br>Ang. | $R_n/50$ | NF@50Ω<br>dB |
|-------------|-----------------|------------------------|------------------------|----------|--------------|
| 0.5         | 0.77            | 0.08                   | 83.8                   | 0.11     | 0.78         |
| 1           | 0.67            | 0.05                   | 149.4                  | 0.08     | 0.68         |
| 1.5         | 0.79            | 0.09                   | 168.8                  | 0.07     | 0.8          |
| 2           | 0.87            | 0.13                   | 142.3                  | 0.08     | 0.9          |
| 2.5         | 0.95            | 0.14                   | 169.1                  | 0.08     | 0.98         |
| 3           | 0.98            | 0.22                   | -173.6                 | 0.08     | 1.06         |
| 3.5         | 1.09            | 0.23                   | -159.3                 | 0.08     | 1.19         |
| 4           | 1.21            | 0.26                   | -148.7                 | 0.1      | 1.35         |
| 4.5         | 1.29            | 0.31                   | -140.3                 | 0.11     | 1.51         |
| 5           | 1.39            | 0.35                   | -129.6                 | 0.13     | 1.68         |
| 5.5         | 1.42            | 0.39                   | -120.3                 | 0.17     | 1.82         |
| 6           | 1.58            | 0.41                   | -109.2                 | 0.21     | 2.03         |
| 6.5         | 1.62            | 0.47                   | -100                   | 0.28     | 2.28         |
| 7           | 1.68            | 0.52                   | -90.7                  | 0.35     | 2.49         |
| 7.5         | 1.88            | 0.55                   | -79.9                  | 0.48     | 2.85         |
| 8           | 2               | 0.57                   | -69.8                  | 0.65     | 3.17         |
| 8.5         | 2.17            | 0.62                   | -58.8                  | 0.85     | 3.59         |
| 9           | 2.3             | 0.64                   | -51.3                  | 1.12     | 4.03         |
| 9.5         | 2.25            | 0.72                   | -42.6                  | 1.41     | 4.48         |
| 10          | 2.37            | 0.74                   | -37.8                  | 1.7      | 4.91         |

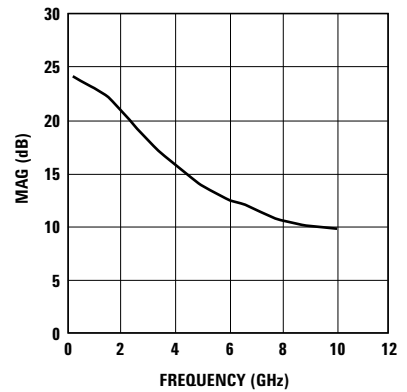


Figure 36. MAG vs. Frequency.

**MGA-62563 Typical Scattering Parameters,  $T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 5\text{V}$ ,  $I_{ds} = 20\text{mA}$**

| Freq.<br>GHz | $S_{11}$ |          | dB    | $S_{21}$ |          | dB    | $S_{12}$ |       | $S_{22}$ |      | K-factor |
|--------------|----------|----------|-------|----------|----------|-------|----------|-------|----------|------|----------|
|              | Mag.     | Ang.     |       | Mag.     | Ang.     |       | Mag.     | Ang.  | Mag.     | Ang. |          |
| 0.1          | 0.276    | -50.781  | 20.99 | 11.213   | 156.884  | 0.053 | 3.086    | 0.093 | -52.766  | 1.07 |          |
| 0.2          | 0.266    | -56.676  | 20.74 | 10.894   | 154.329  | 0.053 | 2.41     | 0.083 | -58.024  | 1.09 |          |
| 0.3          | 0.259    | -63.497  | 20.46 | 10.544   | 151.483  | 0.052 | 1.753    | 0.074 | -64.698  | 1.12 |          |
| 0.4          | 0.255    | -71.17   | 20.15 | 10.174   | 148.356  | 0.052 | 1.131    | 0.065 | -72.808  | 1.14 |          |
| 0.5          | 0.254    | -80.022  | 19.79 | 9.763    | 144.671  | 0.051 | 0.542    | 0.058 | -83.072  | 1.18 |          |
| 0.6          | 0.257    | -88.677  | 19.44 | 9.375    | 140.845  | 0.051 | 0.052    | 0.052 | -94.078  | 1.2  |          |
| 0.7          | 0.265    | -97.315  | 19.08 | 8.997    | 136.657  | 0.05  | -0.34    | 0.05  | -105.431 | 1.24 |          |
| 0.8          | 0.277    | -105.608 | 18.73 | 8.641    | 132.057  | 0.05  | -0.641   | 0.05  | -116.715 | 1.27 |          |
| 0.9          | 0.294    | -113.01  | 18.41 | 8.327    | 127.118  | 0.049 | -0.769   | 0.052 | -126.861 | 1.31 |          |
| 1            | 0.313    | -119.584 | 18.1  | 8.038    | 122.134  | 0.049 | -0.568   | 0.056 | -133.663 | 1.32 |          |
| 1.1          | 0.332    | -125.983 | 17.77 | 7.732    | 117      | 0.048 | -0.093   | 0.062 | -138.752 | 1.36 |          |
| 1.2          | 0.349    | -131.536 | 17.44 | 7.446    | 112.349  | 0.048 | 0.54     | 0.067 | -142.695 | 1.38 |          |
| 1.3          | 0.362    | -135.667 | 17.09 | 7.154    | 107.971  | 0.047 | 1.412    | 0.068 | -141.888 | 1.43 |          |
| 1.4          | 0.371    | -138.843 | 16.73 | 6.864    | 103.851  | 0.047 | 2.497    | 0.066 | -137.128 | 1.47 |          |
| 1.5          | 0.38     | -141.9   | 16.37 | 6.583    | 99.905   | 0.047 | 3.676    | 0.065 | -131.552 | 1.51 |          |
| 1.6          | 0.389    | -145.323 | 16    | 6.311    | 96.172   | 0.047 | 4.908    | 0.063 | -126.926 | 1.55 |          |
| 1.7          | 0.394    | -149.051 | 15.62 | 6.037    | 92.39    | 0.047 | 6.242    | 0.063 | -119.49  | 1.6  |          |
| 1.8          | 0.397    | -152.57  | 15.26 | 5.794    | 89.022   | 0.048 | 7.499    | 0.065 | -113.329 | 1.62 |          |
| 1.9          | 0.397    | -156.063 | 14.91 | 5.566    | 85.817   | 0.048 | 8.774    | 0.067 | -107.935 | 1.68 |          |
| 2            | 0.396    | -159.406 | 14.58 | 5.357    | 82.739   | 0.049 | 10.021   | 0.07  | -103.352 | 1.7  |          |
| 2.5          | 0.395    | -175.583 | 13.08 | 4.508    | 68.14    | 0.055 | 14.801   | 0.083 | -84.66   | 1.78 |          |
| 3            | 0.38     | 164.391  | 11.79 | 3.888    | 54.386   | 0.063 | 16.272   | 0.102 | -74.77   | 1.81 |          |
| 3.5          | 0.407    | 149.754  | 10.77 | 3.454    | 40.091   | 0.074 | 13.807   | 0.118 | -63.62   | 1.7  |          |
| 4            | 0.449    | 133.82   | 9.76  | 3.075    | 26.308   | 0.083 | 10.436   | 0.118 | -61.976  | 1.63 |          |
| 4.5          | 0.534    | 124.633  | 8.8   | 2.753    | 11.752   | 0.092 | 5.262    | 0.123 | -58.73   | 1.47 |          |
| 5            | 0.6      | 109.771  | 7.78  | 2.448    | -2.529   | 0.104 | -0.451   | 0.093 | -72.766  | 1.33 |          |
| 5.5          | 0.661    | 100.709  | 6.77  | 2.179    | -14.499  | 0.111 | -7.532   | 0.097 | -96.992  | 1.22 |          |
| 6            | 0.692    | 89.216   | 6.37  | 2.083    | -26.054  | 0.122 | -13.423  | 0.102 | -166.868 | 1.09 |          |
| 6.5          | 0.688    | 80.407   | 5.56  | 1.897    | -37.379  | 0.125 | -20.653  | 0.134 | 151.132  | 1.18 |          |
| 7            | 0.681    | 69.043   | 5.43  | 1.868    | -49.653  | 0.134 | -26.784  | 0.209 | 121.656  | 1.16 |          |
| 7.5          | 0.666    | 57.717   | 4.69  | 1.716    | -62.476  | 0.141 | -34.82   | 0.234 | 103.118  | 1.24 |          |
| 8            | 0.661    | 47.473   | 4.3   | 1.641    | -71.899  | 0.149 | -41.982  | 0.25  | 93.688   | 1.24 |          |
| 9            | 0.708    | 28.579   | 3.73  | 1.537    | -92      | 0.159 | -58.934  | 0.278 | 69.322   | 1.13 |          |
| 10           | 0.774    | 16.789   | 3.28  | 1.459    | -107.719 | 0.161 | -72.037  | 0.315 | 41.449   | 1.02 |          |

**Typical Noise Parameters at  $25^\circ\text{C}$ ,**

$T_C = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_d = 5\text{V}$ ,  $I_{ds} = 20\text{mA}$

| Freq<br>GHz | $F_{min}$<br>dB | $\Gamma_{opt}$<br>Mag. | $\Gamma_{opt}$<br>Ang. | $R_n/50$ | NF@50Ω<br>dB |
|-------------|-----------------|------------------------|------------------------|----------|--------------|
| 0.5         | 0.81            | 0.1                    | 90                     | 0.11     | 0.83         |
| 1           | 0.7             | 0.05                   | 129.3                  | 0.08     | 0.71         |
| 1.5         | 0.82            | 0.08                   | 150.1                  | 0.08     | 0.83         |
| 2           | 0.9             | 0.13                   | 132.1                  | 0.08     | 0.92         |
| 2.5         | 0.94            | 0.15                   | 158.4                  | 0.08     | 0.98         |
| 3           | 0.98            | 0.22                   | 180                    | 0.07     | 1.06         |
| 3.5         | 1.1             | 0.23                   | -165                   | 0.08     | 1.19         |
| 4           | 1.19            | 0.27                   | -153.6                 | 0.09     | 1.34         |
| 4.5         | 1.28            | 0.31                   | -144.2                 | 0.1      | 1.49         |
| 5           | 1.39            | 0.35                   | -132.9                 | 0.12     | 1.66         |
| 5.5         | 1.42            | 0.39                   | -122.5                 | 0.16     | 1.81         |
| 6           | 1.58            | 0.4                    | -112                   | 0.2      | 2.01         |
| 6.5         | 1.64            | 0.46                   | -102.7                 | 0.27     | 2.26         |
| 7           | 1.7             | 0.51                   | -93.5                  | 0.33     | 2.47         |
| 7.5         | 1.9             | 0.54                   | -82.5                  | 0.45     | 2.82         |
| 8           | 1.99            | 0.57                   | -71.3                  | 0.62     | 3.15         |
| 8.5         | 2.17            | 0.6                    | -60.2                  | 0.82     | 3.54         |
| 9           | 2.3             | 0.63                   | -52.6                  | 1.09     | 3.98         |
| 9.5         | 2.11            | 0.75                   | -44                    | 1.36     | 4.45         |
| 10          | 2.41            | 0.73                   | -38.5                  | 1.67     | 4.85         |

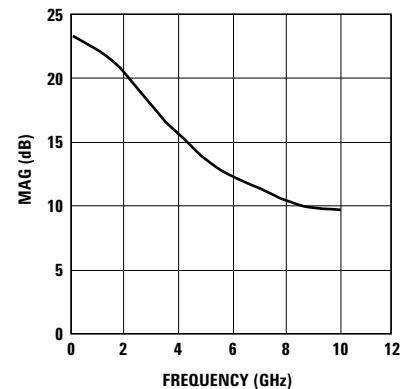


Figure 37. MAG vs. Frequency.



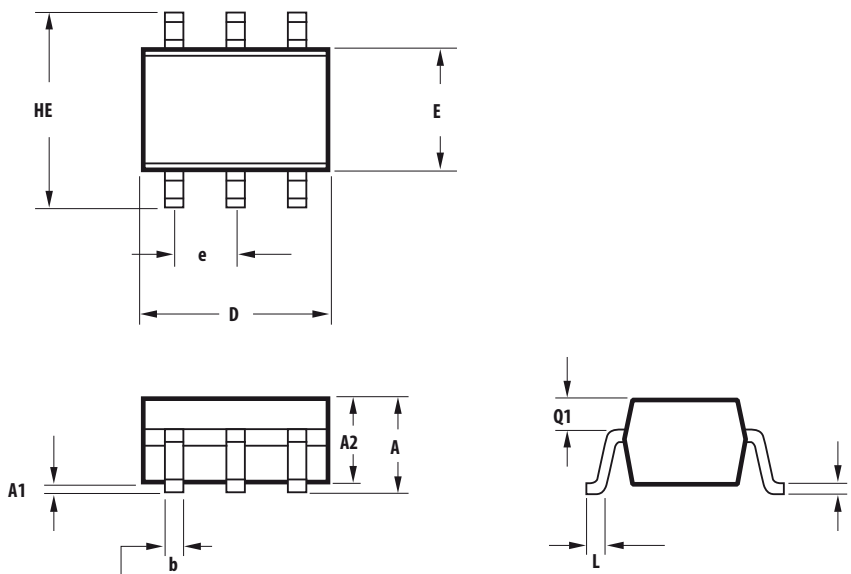
Refer to Avago Technologies Web Site for S-parameters at different biases. [www.avagotech.com/view/rf](http://www.avagotech.com/view/rf)

**Device Models**, Refer to Avago Technologies Web Site [www.avagotech.com/view/rf](http://www.avagotech.com/view/rf)

### Ordering Information

| Part Number    | No. of Devices | Container      |
|----------------|----------------|----------------|
| MGA-62563-TR1G | 3000           | 7" Reel        |
| MGA-62563-TR2G | 10000          | 13" Reel       |
| MGA-62563-BLKG | 100            | antistatic bag |

### SOT-363/SC-70 (JEDEC DFP-N) Package Dimensions

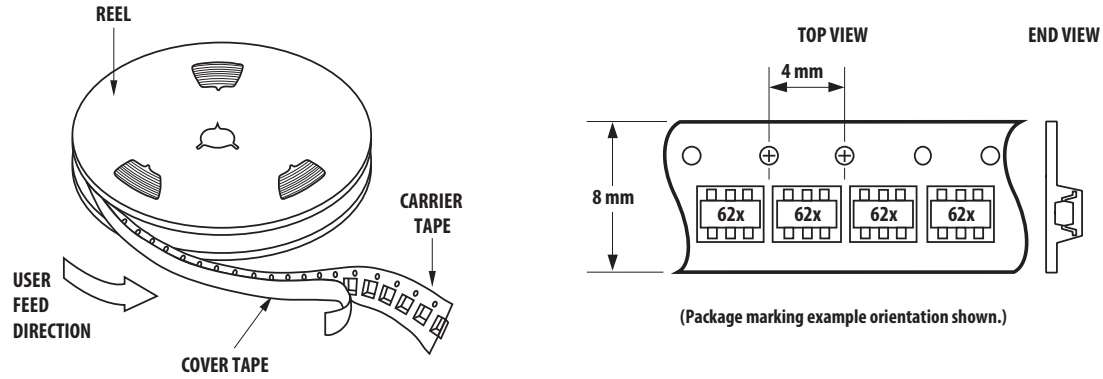


| SYMBOL | DIMENSIONS (mm) |      |
|--------|-----------------|------|
|        | MIN.            | MAX. |
| E      | 1.15            | 1.35 |
| D      | 1.80            | 2.25 |
| HE     | 1.80            | 2.40 |
| A      | 0.80            | 1.10 |
| A2     | 0.80            | 1.00 |
| A1     | 0.00            | 0.10 |
| Q1     | 0.10            | 0.40 |
| e      | 0.650 BCS       |      |
| b      | 0.15            | 0.30 |
| c      | 0.10            | 0.20 |
| L      | 0.10            | 0.30 |

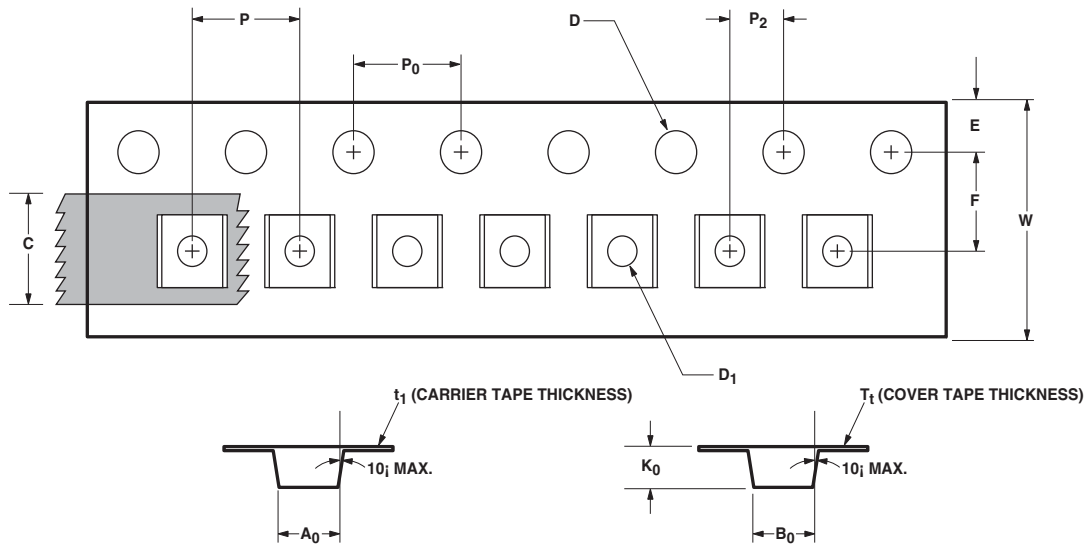
**NOTES:**

1. All dimensions are in mm.
2. Dimensions are inclusive of plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. All specifications comply to EIAJ SC70.
5. Die is facing up for mold and facing down for trim/form, ie: reverse trim/form.
6. Package surface to be mirror finish.

## Device Orientation



## Tape Dimensions



| DESCRIPTION  |  | SYMBOL         | SIZE (mm)          | SIZE (INCHES)    |
|--------------|--|----------------|--------------------|------------------|
| CAVITY       | LENGTH                                   | A <sub>0</sub> | 2.40 ± 0.10        | 0.094 ± 0.004    |
|              | WIDTH                                    | B <sub>0</sub> | 2.40 ± 0.10        | 0.094 ± 0.004    |
|              | DEPTH                                    | K <sub>0</sub> | 1.20 ± 0.10        | 0.047 ± 0.004    |
|              | PITCH                                    | P              | 4.00 ± 0.10        | 0.157 ± 0.004    |
|              | BOTTOM HOLE DIAMETER                     | D <sub>1</sub> | 1.00 + 0.25        | 0.039 + 0.010    |
| PERFORATION  | DIAMETER                                 | D              | 1.50 ± 0.10        | 0.061 ± 0.002    |
|              | PITCH                                    | P <sub>0</sub> | 4.00 ± 0.10        | 0.157 ± 0.004    |
|              | POSITION                                 | E              | 1.75 ± 0.10        | 0.069 ± 0.004    |
| CARRIER TAPE | WIDTH                                    | W              | 8.00 ± 0.30 - 0.10 | 0.315 ± 0.012    |
|              | THICKNESS                                | t <sub>1</sub> | 0.254 ± 0.02       | 0.010 ± 0.0005   |
| COVER TAPE   | WIDTH                                    | C              | 5.40 ± 0.10        | 0.205 ± 0.004    |
|              | TAPE THICKNESS                           | T <sub>t</sub> | 0.062 ± 0.001      | 0.0025 ± 0.00004 |
| DISTANCE     | CAVITY TO PERFORATION (WIDTH DIRECTION)  | F              | 3.50 ± 0.05        | 0.138 ± 0.002    |
|              | CAVITY TO PERFORATION (LENGTH DIRECTION) | P <sub>2</sub> | 2.00 ± 0.05        | 0.079 ± 0.002    |

For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

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