

MGF1423B

SMALL SIGNAL GaAs FET

DESCRIPTION

The MGF1423B, low-noise GaAs FET with an N-channel Schottky gate, is designed for use in S to Ku band amplifiers.

FEATURES

- High linear power gain
 $G_{LP} = 11 \text{ dB (TYP.) @ } f = 12 \text{ GHz}$
- High output power at 1 dB gain compression
 $P_{1dB} = 13 \text{ dBm (TYP.) @ } f = 12 \text{ GHz}$
- High reliability and stability

APPLICATION

S to Ku band amplifiers

QUALITY GRADE

- IG, IGX, IGV

RECOMMENDED BIAS CONDITIONS

- $V_{DS} = 3V$
- $I_D = 10 \text{ mA}$ for Low Noise Amplifiers
- $I_D = 30 \text{ mA}$ for Small Signal Amplifiers
- Refer to Bias Procedure

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

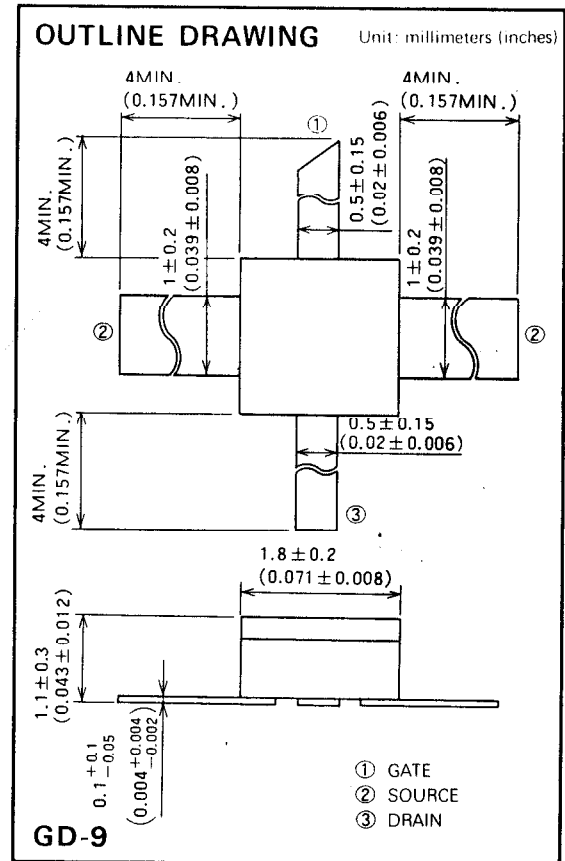
| Symbol | Parameter | Ratings | Unit |
|-----------|----------------------------|------------|------------------|
| V_{GDO} | Gate to drain voltage | -6 | V |
| V_{GSO} | Gate to source voltage | -6 | V |
| I_D | Drain current | 80 | mA |
| P_T | Total power dissipation *1 | 240 | mW |
| T_{ch} | Channel temperature | 175 | $^\circ\text{C}$ |
| T_{stg} | Storage temperature | -55 ~ +175 | $^\circ\text{C}$ |

*1: $T_c = 25^\circ\text{C}$

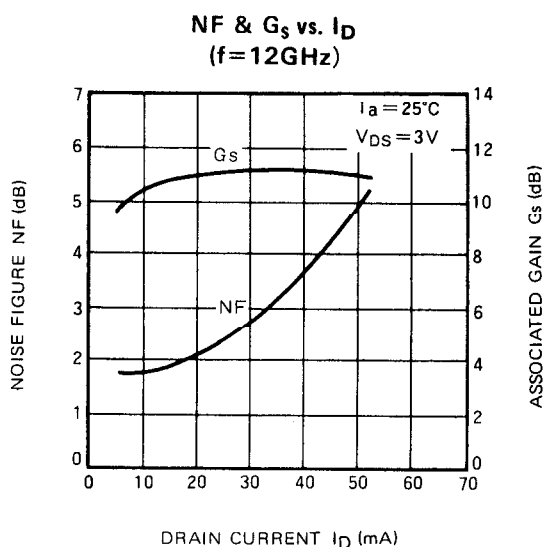
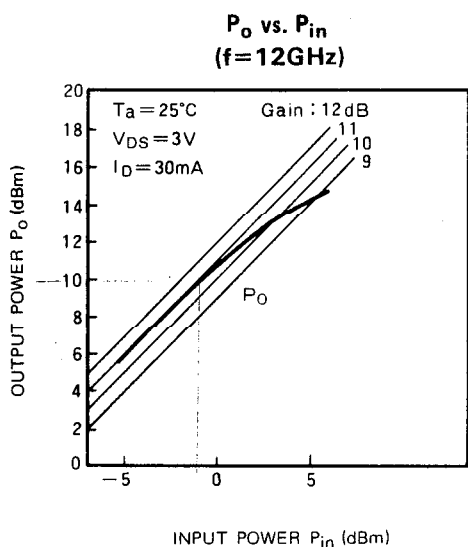
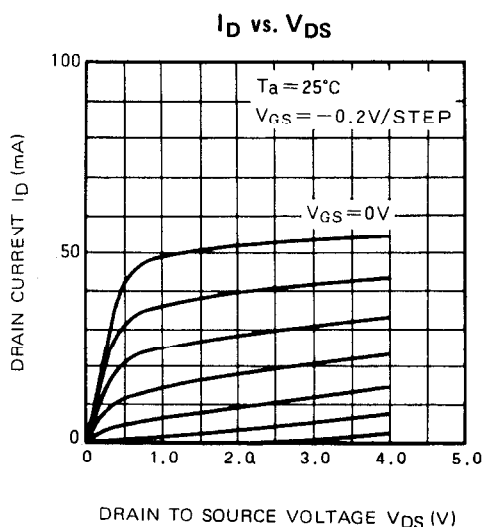
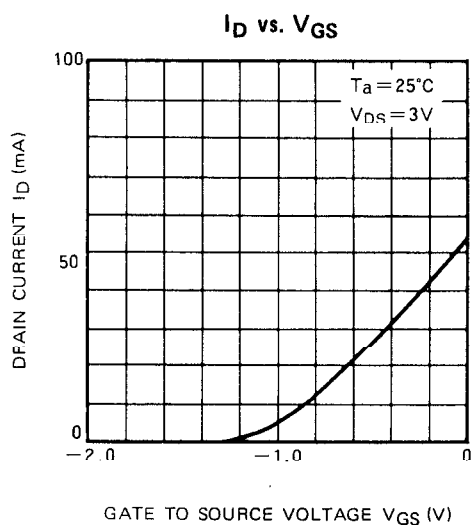
ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

| Symbol | Parameter | Test conditions | Limits | | | Unit |
|----------------|---------------------------------------|--|--------|-----|------|--------------------|
| | | | Min | Typ | Max | |
| $V_{(BR)GDO}$ | Gate to drain breakdown voltage | $I_G = -100 \mu\text{A}$ | -6 | — | — | V |
| $V_{(BR)GSO}$ | Gate to source breakdown voltage | $I_G = -100 \mu\text{A}$ | -6 | — | — | V |
| I_{GSS} | Gate to source leakage current | $V_{GS} = -3V, V_{DS} = 0V$ | — | — | 10 | μA |
| I_{DSS} | Saturated drain current | $V_{GS} = 0V, V_{DS} = 3V$ | 40 | 60 | 80 | mA |
| $V_{GS(off)}$ | Gate to source cut-off voltage | $V_{DS} = 3V, I_D = 100 \mu\text{A}$ | -0.5 | — | -3.5 | V |
| g_m | Transconductance | $V_{DS} = 3V, I_D = 10 \text{ mA}$ | 20 | 35 | — | mS |
| G_{LP} | Linear power gain | $V_{DS} = 3V, I_D = 30 \text{ mA}, f = 12 \text{ GHz}$ | 9 | 11 | — | dB |
| P_{1dB} | Output power at 1 dB gain compression | $V_{DS} = 3V, I_D = 30 \text{ mA}, f = 12 \text{ GHz}$ | 10 | 13 | — | dBm |
| G_s | Associated gain | $V_{DS} = 3V, I_D = 10 \text{ mA}, f = 12 \text{ GHz}$ | 8 | — | — | dB |
| NF_{min} | Minimum noise figure | $V_{DS} = 3V, I_D = 10 \text{ mA}, f = 12 \text{ GHz}$ | — | — | 2.3 | dB |
| $R_{th(ch-a)}$ | Thermal resistance *1 | ΔV_f method | — | — | 625 | $^\circ\text{C/W}$ |

*1: Channel to ambient

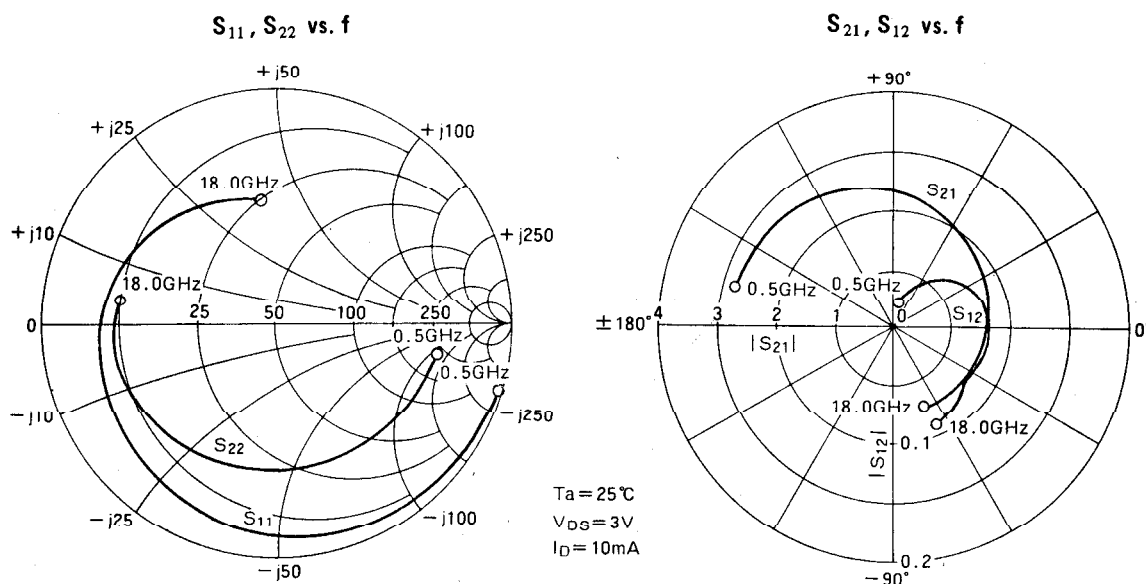


TYPICAL CHARACTERISTICS



MGF1423B

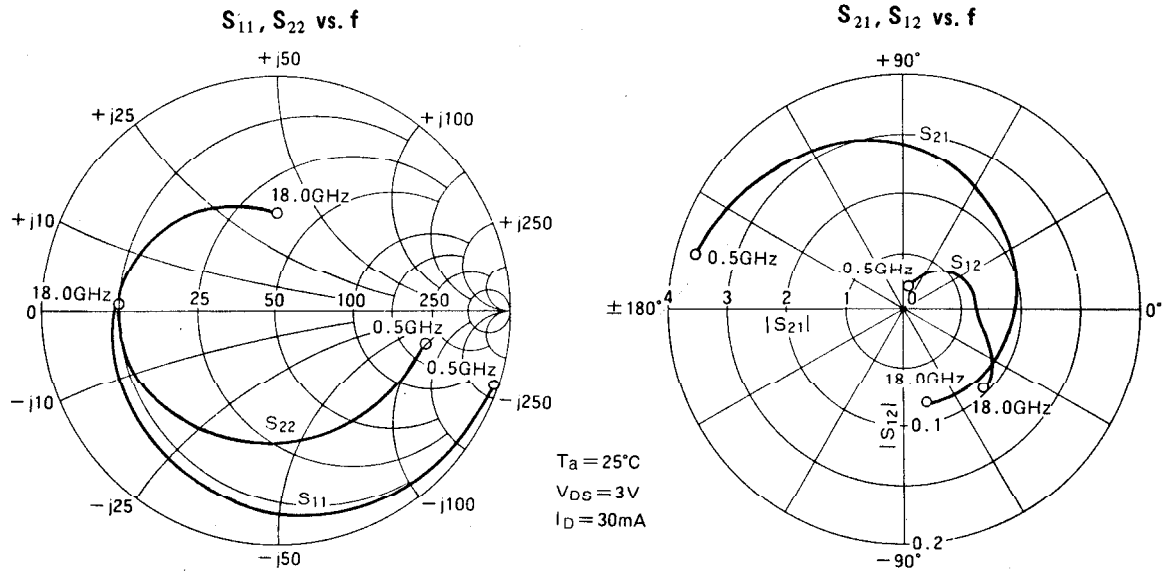
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S PARAMETERS ($T_a = 25^\circ\text{C}$, $V_{DS} = 3\text{V}$, $I_D = 10\text{mA}$)

| Freq. (GHz) | S_{11} | | S_{21} | | S_{12} | | S_{22} | | K | MSG/MAG (dB) |
|----------------|----------|--------|----------|-------|----------|-------|----------|--------|-------|-----------------|
| | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | | |
| 0.5 | 0.997 | -16.6 | 2.783 | 165.5 | 0.018 | 76.4 | 0.697 | -10.3 | 0.073 | 22.0 |
| 1.0 | 0.984 | -25.2 | 2.726 | 157.2 | 0.024 | 70.5 | 0.688 | -16.9 | 0.159 | 20.5 |
| 1.5 | 0.972 | -33.8 | 2.669 | 148.8 | 0.031 | 64.5 | 0.680 | -23.4 | 0.212 | 19.3 |
| 2.0 | 0.960 | -42.4 | 2.612 | 140.5 | 0.038 | 58.6 | 0.672 | -29.9 | 0.250 | 18.4 |
| 2.5 | 0.948 | -51.0 | 2.555 | 132.2 | 0.045 | 52.7 | 0.664 | -36.4 | 0.281 | 17.6 |
| 3.0 | 0.935 | -59.6 | 2.498 | 123.9 | 0.051 | 46.8 | 0.655 | -43.0 | 0.307 | 16.9 |
| 3.5 | 0.923 | -68.2 | 2.441 | 115.5 | 0.058 | 40.8 | 0.647 | -49.5 | 0.331 | 16.2 |
| 4.0 | 0.911 | -76.8 | 2.384 | 107.2 | 0.065 | 34.9 | 0.639 | -56.0 | 0.352 | 15.6 |
| 4.5 | 0.896 | -85.3 | 2.315 | 99.3 | 0.068 | 29.0 | 0.632 | -62.6 | 0.396 | 15.3 |
| 5.0 | 0.880 | -93.8 | 2.246 | 91.3 | 0.071 | 23.2 | 0.625 | -69.2 | 0.441 | 15.0 |
| 5.5 | 0.864 | -102.2 | 2.176 | 83.4 | 0.074 | 17.3 | 0.617 | -75.7 | 0.486 | 14.7 |
| 6.0 | 0.849 | -110.7 | 2.107 | 75.4 | 0.077 | 11.4 | 0.610 | -82.3 | 0.533 | 14.4 |
| 6.5 | 0.838 | -116.9 | 2.040 | 68.9 | 0.077 | 7.4 | 0.611 | -87.8 | 0.572 | 14.2 |
| 7.0 | 0.828 | -123.1 | 1.973 | 62.3 | 0.078 | 3.4 | 0.612 | -93.3 | 0.613 | 14.1 |
| 7.5 | 0.817 | -129.3 | 1.905 | 55.8 | 0.078 | -0.6 | 0.613 | -98.8 | 0.658 | 13.9 |
| 8.0 | 0.807 | -135.5 | 1.838 | 49.2 | 0.078 | -4.6 | 0.614 | -104.3 | 0.706 | 13.7 |
| 8.5 | 0.797 | -141.1 | 1.797 | 43.0 | 0.078 | -7.7 | 0.619 | -109.2 | 0.746 | 13.7 |
| 9.0 | 0.787 | -146.7 | 1.756 | 36.7 | 0.077 | -10.9 | 0.623 | -114.2 | 0.787 | 13.6 |
| 9.5 | 0.778 | -152.2 | 1.714 | 30.5 | 0.076 | -14.0 | 0.628 | -119.1 | 0.830 | 13.5 |
| 10.0 | 0.768 | -157.8 | 1.673 | 24.2 | 0.076 | -17.1 | 0.632 | -124.0 | 0.875 | 13.4 |
| 10.5 | 0.759 | -163.7 | 1.647 | 17.7 | 0.075 | -19.8 | 0.636 | -128.7 | 0.908 | 13.4 |
| 11.0 | 0.750 | -169.6 | 1.622 | 11.2 | 0.075 | -22.4 | 0.640 | -133.4 | 0.943 | 13.3 |
| 11.5 | 0.742 | -175.5 | 1.596 | 4.7 | 0.075 | -25.1 | 0.644 | -138.0 | 0.979 | 13.3 |
| 12.0 | 0.733 | -178.6 | 1.570 | -1.8 | 0.074 | -27.7 | 0.648 | -142.7 | 1.016 | 12.5 |
| 12.5 | 0.726 | -173.5 | 1.549 | -6.8 | 0.074 | -29.8 | 0.651 | -146.6 | 1.037 | 12.1 |
| 13.0 | 0.720 | -168.3 | 1.529 | -11.9 | 0.073 | -32.0 | 0.654 | -150.6 | 1.058 | 11.7 |
| 13.5 | 0.714 | -163.2 | 1.508 | -16.9 | 0.073 | -34.1 | 0.657 | -154.5 | 1.081 | 11.4 |
| 14.0 | 0.707 | -158.0 | 1.487 | -21.9 | 0.073 | -36.2 | 0.660 | -158.4 | 1.105 | 11.1 |
| 14.5 | 0.684 | -151.4 | 1.484 | -28.6 | 0.075 | -39.1 | 0.670 | -162.4 | 1.122 | 10.8 |
| 15.0 | 0.661 | -144.7 | 1.481 | -35.2 | 0.077 | -41.9 | 0.680 | -166.5 | 1.132 | 10.6 |
| 15.5 | 0.637 | -138.1 | 1.479 | -41.9 | 0.079 | -44.8 | 0.689 | -170.5 | 1.136 | 10.5 |
| 16.0 | 0.614 | -131.4 | 1.479 | -48.5 | 0.081 | -47.6 | 0.699 | -174.5 | 1.134 | 10.4 |
| 16.5 | 0.593 | -122.7 | 1.481 | -55.1 | 0.084 | -52.3 | 0.694 | -178.5 | 1.160 | 10.1 |
| 17.0 | 0.573 | -114.0 | 1.487 | -61.7 | 0.087 | -57.0 | 0.689 | -177.6 | 1.185 | 9.8 |
| 17.5 | 0.552 | -105.2 | 1.493 | -68.3 | 0.089 | -61.7 | 0.684 | -173.7 | 1.208 | 9.5 |
| 18.0 | 0.531 | -96.5 | 1.498 | -74.9 | 0.092 | -66.4 | 0.679 | -169.7 | 1.229 | 9.2 |

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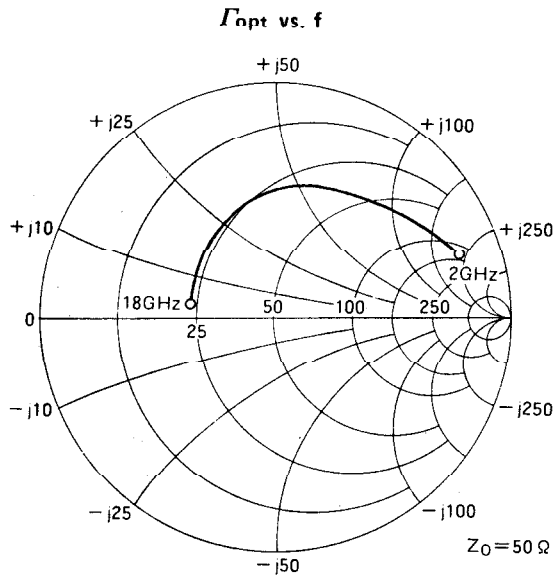


S PARAMETERS (Ta=25°C, VDS=3V, ID=30mA)

| Freq. (GHz) | S11 | | S21 | | S12 | | S22 | | K | MSG/MAG (dB) |
|----------------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-----------------|
| | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | | |
| 0.5 | 0.991 | -18.5 | 3.710 | 164.2 | 0.017 | 79.1 | 0.649 | -12.6 | 0.060 | 23.3 |
| 1.0 | 0.976 | -27.5 | 3.620 | 155.9 | 0.022 | 72.9 | 0.639 | -18.7 | 0.159 | 22.1 |
| 1.5 | 0.960 | -36.6 | 3.531 | 147.5 | 0.028 | 66.8 | 0.630 | -24.7 | 0.230 | 21.0 |
| 2.0 | 0.945 | -45.6 | 3.441 | 139.1 | 0.033 | 60.6 | 0.621 | -30.7 | 0.285 | 20.2 |
| 2.5 | 0.929 | -54.7 | 3.351 | 130.7 | 0.038 | 54.5 | 0.612 | -36.7 | 0.331 | 19.4 |
| 3.0 | 0.914 | -63.7 | 3.262 | 122.4 | 0.044 | 48.3 | 0.602 | -42.8 | 0.372 | 18.7 |
| 3.5 | 0.899 | -72.8 | 3.172 | 114.0 | 0.049 | 42.2 | 0.593 | -48.8 | 0.410 | 18.1 |
| 4.0 | 0.883 | -81.8 | 3.082 | 105.6 | 0.054 | 36.0 | 0.584 | -54.8 | 0.446 | 17.6 |
| 4.5 | 0.865 | -90.5 | 2.973 | 97.7 | 0.056 | 31.7 | 0.578 | -61.2 | 0.490 | 17.3 |
| 5.0 | 0.847 | -99.1 | 2.865 | 89.7 | 0.058 | 27.4 | 0.572 | -67.7 | 0.537 | 16.9 |
| 5.5 | 0.830 | -107.8 | 2.756 | 81.8 | 0.060 | 23.0 | 0.567 | -74.1 | 0.588 | 16.6 |
| 6.0 | 0.812 | -116.4 | 2.647 | 73.8 | 0.062 | 18.7 | 0.561 | -80.5 | 0.642 | 16.3 |
| 6.5 | 0.800 | -122.7 | 2.554 | 67.4 | 0.062 | 15.8 | 0.563 | -85.7 | 0.689 | 16.1 |
| 7.0 | 0.787 | -129.0 | 2.461 | 61.0 | 0.063 | 12.8 | 0.565 | -90.9 | 0.740 | 16.0 |
| 7.5 | 0.775 | -135.2 | 2.367 | 54.5 | 0.063 | 9.9 | 0.567 | -96.1 | 0.795 | 15.8 |
| 8.0 | 0.763 | -141.5 | 2.274 | 48.1 | 0.063 | 6.9 | 0.569 | -101.3 | 0.855 | 15.6 |
| 8.5 | 0.752 | -147.5 | 2.217 | 41.9 | 0.063 | 4.9 | 0.574 | -106.0 | 0.897 | 15.5 |
| 9.0 | 0.740 | -153.4 | 2.160 | 35.8 | 0.063 | 2.8 | 0.579 | -110.6 | 0.941 | 15.4 |
| 9.5 | 0.729 | -159.4 | 2.103 | 29.6 | 0.063 | 0.8 | 0.585 | -115.3 | 0.988 | 15.2 |
| 10.0 | 0.717 | -165.3 | 2.046 | 23.4 | 0.063 | -1.3 | 0.590 | -119.9 | 1.037 | 13.9 |
| 10.5 | 0.706 | -171.0 | 2.007 | 17.3 | 0.064 | -2.9 | 0.596 | -124.5 | 1.056 | 13.5 |
| 11.0 | 0.696 | -176.7 | 1.968 | 11.1 | 0.065 | -4.6 | 0.603 | -129.0 | 1.076 | 13.2 |
| 11.5 | 0.685 | -177.7 | 1.929 | 5.0 | 0.065 | -6.2 | 0.609 | -133.6 | 1.096 | 12.8 |
| 12.0 | 0.674 | -172.0 | 1.890 | -1.2 | 0.066 | -7.8 | 0.616 | -138.1 | 1.116 | 12.5 |
| 12.5 | 0.659 | -166.7 | 1.860 | -6.8 | 0.067 | -9.7 | 0.622 | -141.9 | 1.138 | 12.1 |
| 13.0 | 0.644 | -161.4 | 1.831 | -12.4 | 0.069 | -11.5 | 0.627 | -145.7 | 1.159 | 11.8 |
| 13.5 | 0.628 | -156.0 | 1.801 | -17.9 | 0.070 | -13.4 | 0.633 | -149.5 | 1.179 | 11.5 |
| 14.0 | 0.613 | -150.7 | 1.772 | -23.5 | 0.072 | -15.2 | 0.638 | -153.3 | 1.198 | 11.2 |
| 14.5 | 0.592 | -143.9 | 1.772 | -29.7 | 0.075 | -18.2 | 0.646 | -157.1 | 1.176 | 11.2 |
| 15.0 | 0.570 | -137.0 | 1.771 | -36.0 | 0.078 | -21.2 | 0.655 | -160.9 | 1.152 | 11.2 |
| 15.5 | 0.549 | -130.2 | 1.771 | -42.2 | 0.081 | -24.2 | 0.663 | -164.7 | 1.127 | 11.2 |
| 16.0 | 0.528 | -123.3 | 1.771 | -48.4 | 0.084 | -27.2 | 0.671 | -168.5 | 1.101 | 11.3 |
| 16.5 | 0.498 | -114.4 | 1.758 | -55.7 | 0.087 | -32.4 | 0.674 | -172.4 | 1.120 | 10.9 |
| 17.0 | 0.469 | -105.5 | 1.746 | -63.1 | 0.091 | -37.6 | 0.677 | -176.3 | 1.135 | 10.6 |
| 17.5 | 0.439 | -96.6 | 1.733 | -70.4 | 0.094 | -42.7 | 0.680 | -179.8 | 1.148 | 10.3 |
| 18.0 | 0.409 | -87.7 | 1.720 | -77.7 | 0.098 | -47.9 | 0.683 | -175.9 | 1.158 | 10.0 |

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NOISE PARAMETERS ($V_{DS}=3.0V, I_D=10mA$)



| Frequency (GHz) | Γ_{OPT} | | R_n (Ω) | NF min (dB) |
|--------------------|----------------|-------|-----------------------|----------------|
| | MAG | ANG | | |
| 2 | 0.820 | 18.5 | 23.5 | 0.68 |
| 4 | 0.695 | 36.0 | 21 | 0.75 |
| 8 | 0.573 | 81.2 | 19 | 1.30 |
| 12 | 0.489 | 115.8 | 17 | 1.80 |
| 18 | 0.362 | 173.0 | 21 | 2.55 |

G_{lp} and P_{1dB} ($T_a=25^\circ C, V_D=3V$)

| | f = 4GHz | | f = 12GHz | |
|------------------------|------------|------------|------------|------------|
| | $I_D=10mA$ | $I_D=30mA$ | $I_D=10mA$ | $I_D=30mA$ |
| G _{lp} (dB) | 15.9 | 16.9 | 11.7 | 12.0 |
| P _{1dB} (dBm) | 12.4 | 14.2 | 10.9 | 12.8 |