**MOTOROLA**

## Advance Information

# NPN Silicon
# Low Noise Transistor

**MRF1027T1**

The MRF1027T1 is fabricated utilizing Motorola's latest 12 GHz $f_\tau$ discrete bipolar silicon process. It offers 1.0 dB Minimum Noise Figure at $V_{CE}$ = 1.0 V, IC = 1.0 mA and f = 1.0 GHz. The noise performance of the MRF1027T1 at low bias makes this device the ideal choice in high gain, low noise applications. This device is well suited for low–voltage, low–current, front–end applications. It is designed for use in pagers, cellular and cordless phones, and other portable wireless systems.

The MRF1027T1 has 9 emitter fingers, with self–aligned and enhanced processing; resulting in a high $f_\tau$, low operating current transistor with reduced parasitics. The MRF1027T1 is fully–ion implanted with gold metallization and nitride passivation for maximum device reliability, performance and uniformity.

- Low Noise Figure, $NF_{min}$ = 1.0 dB (Typ) @1.0 GHz, 3.0 V and 1.0 mA
- High Current Gain–Bandwidth Product, $f_\tau$ = 12 GHz @ 3.0 V and 10 mA
- Maximum Stable Gain, 17 dB @ 1.0 GHz, 3.0 V and 8.0 mA
- Output Third Order Intercept, $OIP_3$ = 23 dBm @ 1.0 GHz, 3.0 V and 10 mA
- Fully Ion–Implanted with Gold Metallization and Nitride Passivation

**RF NPN
SILICON TRANSISTOR**

$f_\tau$ = 12 GHz
$NF_{min}$ = 1.0 dB
$I_{CMAX}$ = 25 mA
$V_{CEO}$ = 5.0 V

**SEMICONDUCTOR
TECHNICAL DATA**

Pin  1. Base
     2. Emitter
     3. Collector
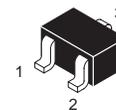


PLASTIC PACKAGE
CASE 419
(SC–70, Tape & Reel Only)

### ORDERING INFORMATION

| Device | Marking | Package |
|--------|---------|---------|
| MRF1027T1 | WA | SC–70 Tape & Reel* |

*3,000 Units per 8 mm, 7 inch reel.

## MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--------|--------|-------|------|
| Collector–Emitter Voltage | $V_{CEO}$ | 5.0 | Vdc |
| Collector–Base Voltage | $V_{CBO}$ | 12 | Vdc |
| Emitter–Base Voltage | $V_{EBO}$ | 2.5 | Vdc |
| Power Dissipation @ $T_C$=75°C<br>  Derate Linearly above $T_C$ = 75°C at | $P_{D(max)}$ | 136<br>1.82 | W<br>mW/°C |
| Collector Current–Continuous [Note 3] | $I_C$ | 25 | mA |
| Maximum Junction Temperature | $T_{J(max)}$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | –55 to 150 | °C |

**NOTES:** 1. Meets Human Body Model (HBM) ≤300 V and Machine Model (MM) ≤75 V.
　　　　　　2. ESD data available upon request.
　　　　　　3. $I_C$ Continuous for MTBF >10 years.

## THERMAL CHARACTERISTIC

| Characteristics | Symbol | Max | Unit |
|-----------------|--------|-----|------|
| Thermal Resistance, Junction–to–Case | $R_{\theta JC}$ | 550 | °C/W |

**NOTE:** To calculate the junction temperature use $T_J$ = ($P_D$ x $R_{\theta JC}$) + $T_C$. The case temperature measured on collector lead adjacent to the package body.

**LIFETIME BUY**

**LAST ORDER 17SEP00   LAST SHIP 17MAR01**

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Rev 1

# MRF1027T1

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C, unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTIC** [Note 1] | | | | | |
| Collector–Emitter Breakdown Voltage ($I_C$ = 0.1 mA, $I_B$ = 0) | $V_{(BR)CEO}$ | 5.0 | – | – | Vdc |
| Collector–Base Breakdown Voltage ($I_C$ = 0.1 mA, $I_E$ = 0) | $V_{(BR)CBO}$ | 12 | – | – | Vdc |
| Emitter–Base Breakdown Voltage ($I_E$ = 0.1 mA, $I_C$ = 0) | $V_{(BR)CBO}$ | 2.5 | – | – | Vdc |
| Emitter Cutoff Current ($V_{EB}$ = 1.0 V, $I_C$ = 0) | $I_{EBO}$ | – | – | 0.1 | μA |
| Collector Cutoff Current ($V_{CB}$ = 1.0 V, $I_E$ = 0) | $I_{CBO}$ | – | – | 0.2 | μA |
| **ON CHARACTERISTIC** [Note 1] | | | | | |
| DC Current Gain ($V_{CE}$ = 3.0 V, $I_C$ = 3.0 mA) | $h_{FE}$ | 100 | – | 200 | – |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Collector–Base Capacitance ($V_{CB}$ = 1.0 V, $I_E$ = 0, f = 1.0 MHz) | $C_{cb}$ | – | 0.35 | – | pF |
| Current Gain Bandwidth Product ($V_{CE}$ = 3.0 V, $I_C$ = 10 mA, f = 1.0 GHz) | $f_\tau$ | – | 12 | – | GHz |
| **PERFORMANCE CHARACTERISTIC** | | | | | |
| Insertion Gain<br>  $V_{CE}$ = 1.0 V, $I_C$ = 1.0 mA, f = 1.0 GHz<br>  $V_{CE}$ = 3.0 V, $I_C$ = 3.0 mA, f = 1.0 GHz | $|S_{21}|^2$ | <br>–<br>– | <br>8.0<br>13 | <br>–<br>– | dB |
| Maximum Stable Gain and/or Maximum Available Gain [Note 2]<br>  $V_{CE}$ = 1.0 V, $I_C$ = 1.0 mA, f = 1.0 GHz<br>  $V_{CE}$ = 3.0 V, $I_C$ = 3.0 mA, f = 1.0 GHz | MSG, MAG | <br>–<br>– | <br>12<br>16 | <br>–<br>– | dB |
| Minimum Noise Figure<br>  $V_{CE}$ = 1.0 V, $I_C$ = 1.0 mA, f = 1.0 GHz<br>  $V_{CE}$ = 3.0 V, $I_C$ = 3.0 mA, f = 1.0 GHz | $NF_{min}$ | <br>–<br>– | <br>1.0<br>1.1 | <br>–<br>– | dB |
| Associated Gain at Minimum NF<br>  $V_{CE}$ = 1.0 V, $I_C$ = 1.0 mA, f = 1.0 GHz<br>  $V_{CE}$ = 3.0 V, $I_C$ = 3.0 mA, f = 1.0 GHz | $G_{NF}$ | <br>–<br>– | <br>11<br>14 | <br>–<br>– | dB |
| Output Power at 1.0 dB Gain Compression [Note 3] ($V_{CE}$ = 3.0 V, $I_C$ = 3.0 mA, f = 1.0 GHz) | $P_{1dB}$ | – | –0.3 | – | dBm |
| Output Third Order Intercept [Note 3] ($V_{CE}$ = 3.0 V, $I_C$ = 3.0 mA, f = 1.0 GHz) | $OIP_3$ | – | 22 | – | dBm |

**NOTES:** 1. Pulse width ≤300 μs, duty cycle ≤2% pulsed.
2. Maximum Available Gain and Maximum Stable Gain are defined by the K factor as follows:

$$MAG = \left| \frac{S_{21}}{S_{12}} \left( K \pm \sqrt{K^2 - 1} \right) \right|, \text{ if } K > 1, \quad MSG = \left| \frac{S_{21}}{S_{12}} \right|, \text{ if } K < 1$$

3. $Z_{in}$ = 50 Ω and $Z_{out}$ matched for optimum IP3.

**Figure 1. Capacitance
versus Voltage**

f = 1.0 MHz

C, CAPACITANCE (pF)

$C_{ob}$

$C_{cb}$

$V_{CE}$, REVERSE VOLTAGE
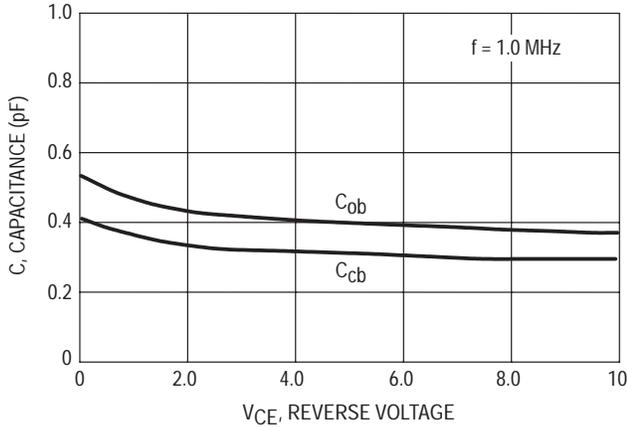
**Figure 2. Input Capacitance
versus Voltage**

f = 1.0 MHz

$C_{ib}$, INPUT CAPACITANCE

$C_{ib}$

$V_{EB}$, EMITTER–BASE VOLTAGE
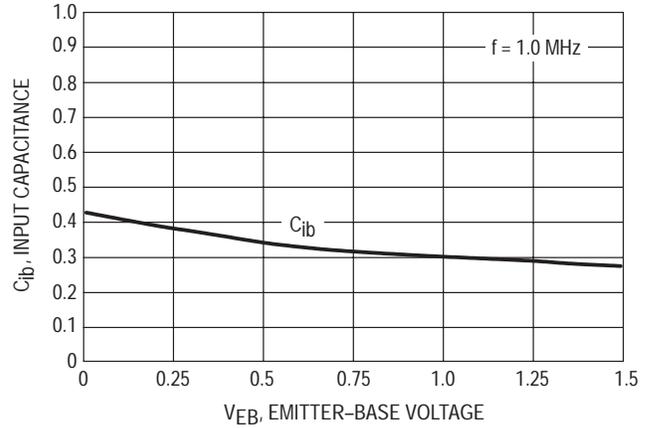
**Figure 3. DC Current Gain
versus Collector Current**

$V_{CE}$ = 1.0 V

$h_{FE}$, DC CURRENT GAIN

$I_C$, COLLECTOR CURRENT (mA)
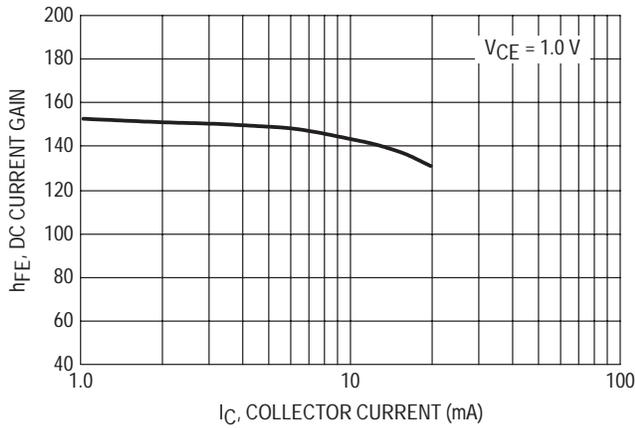
**Figure 4. Gain–Bandwidth Product
versus Collector Current**

f = 1.0 GHz

3.0 V

1.0 V

$f_\tau$, GAIN BANDWIDTH PRODUCT (GHz)

$I_C$, COLLECTOR CURRENT (mA)
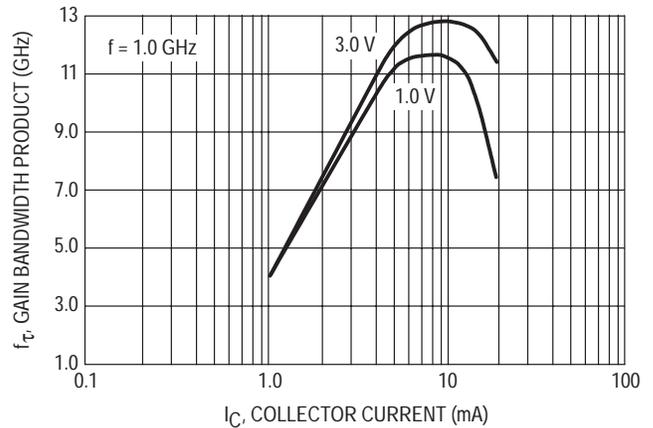
**Figure 5. Functional Circuit Schematic**

$V_{BE}$

$V_{CE}$

RF Input

Bias
Network

Slug Tuner

Slug Tuner

Bias
Network

RF Output

**Figure 6. Maximum Stable/Available Gain and Forward Insertion Gain versus Frequency**

MSG, MAXIMUM STABLE GAIN; MAG, MAXIMUM AVAILABLE GAIN; $|S_{21}|^2$, FORWARD INSERTION GAIN (dB)

f, FREQUENCY (GHz)

$V_{CE} = 1.0$ V
$I_C = 1.0$ mA

MSG

$|S_{21}|^2$

MAG
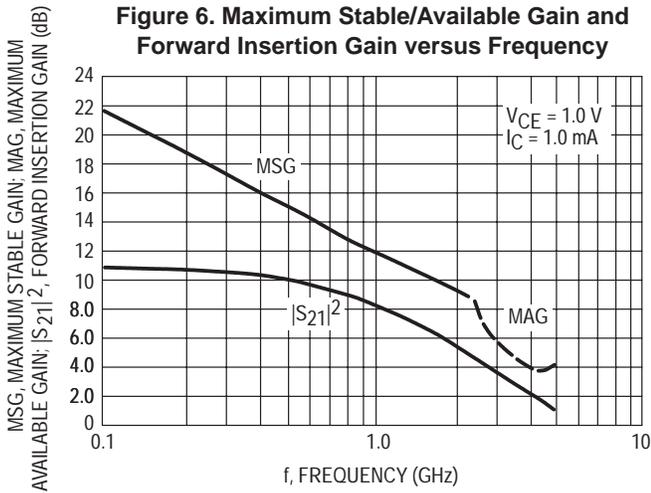
**Figure 7. Maximum Stable/Available Gain and Forward Insertion Gain versus Frequency**

MSG, MAXIMUM STABLE GAIN; MAG, MAXIMUM AVAILABLE GAIN; $|S_{21}|^2$, FORWARD INSERTION GAIN (dB)

f, FREQUENCY (GHz)

$V_{CE} = 3.0$ V
$I_C = 3.0$ mA

MSG

$|S_{21}|^2$

MAG
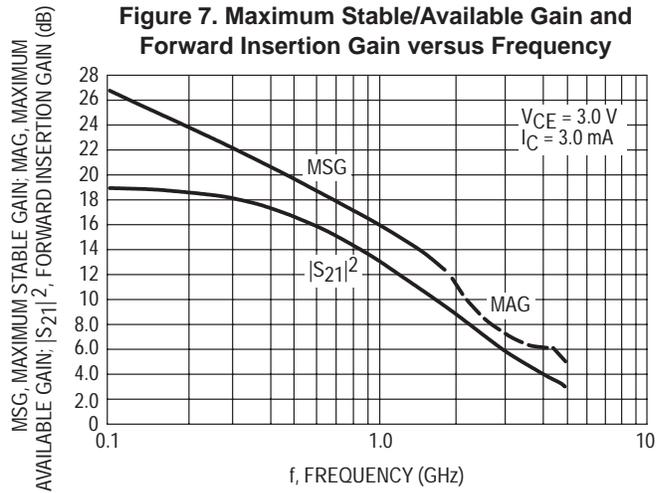
**Figure 8. Maximum Stable/Available Gain and Forward Insertion Gain versus Collector Current**

MSG, MAXIMUM STABLE GAIN; MAG, MAXIMUM AVAILABLE GAIN; $|S_{21}|^2$, FORWARD INSERTION GAIN (dB)

$I_C$, COLLECTOR CURRENT (mA)

$V_{CE} = 1.0$ V
f = 1.0 GHz

MSG

MAG

$|S_{21}|^2$
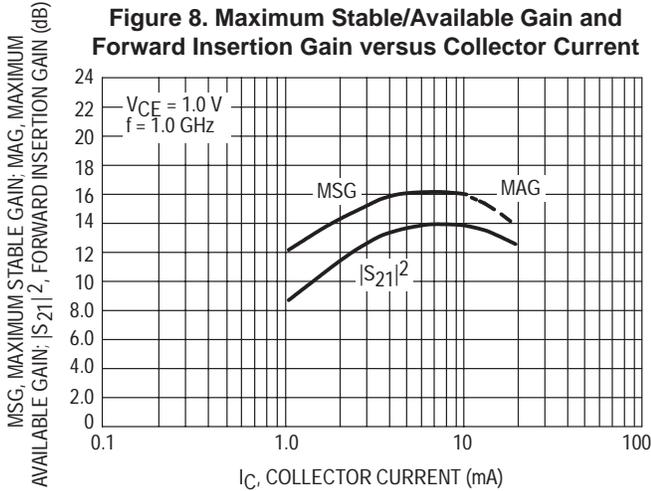
**Figure 9. Maximum Stable/Available Gain and Forward Insertion Gain versus Collector Current**

MSG, MAXIMUM STABLE GAIN; MAG, MAXIMUM AVAILABLE GAIN; $|S_{21}|^2$, FORWARD INSERTION GAIN (dB)

$I_C$, COLLECTOR CURRENT (mA)

$V_{CE} = 3.0$ V
f = 1.0 GHz

MSG

MAG

$|S_{21}|^2$
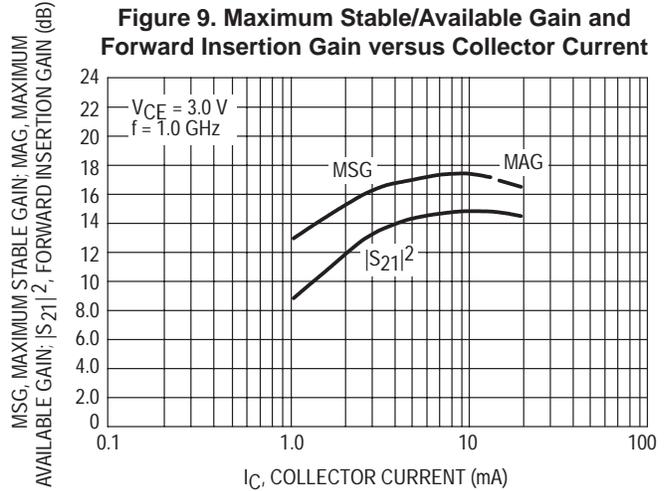
**Figure 10. Minimum Noise Figure and Associated Gain versus Frequency**

$G_{NF}$, ASSOCIATED GAIN (dB)

$NF_{min}$, MINIMUM NOISE FIGURE (dB)

f, FREQUENCY (GHz)

$V_{CE} = 1.0$ V
$I_C = 1.0$ mA

$G_{NF}$

$NF_{min}$
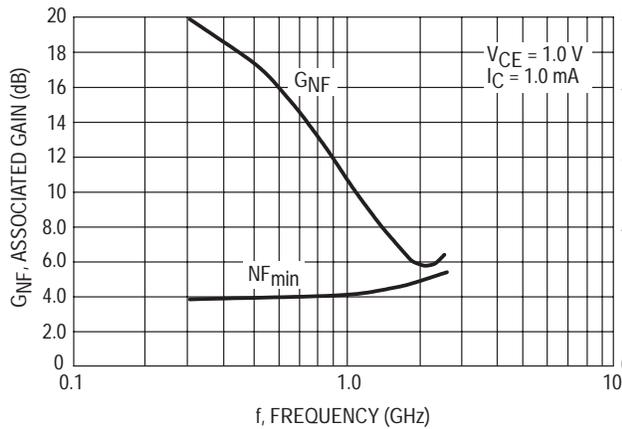
**Figure 11. Minimum Noise Figure and Associated Gain versus Frequency**

$G_{NF}$, ASSOCIATED GAIN (dB)

$NF_{min}$, MINIMUM NOISE FIGURE (dB)

f, FREQUENCY (GHz)

$V_{CE} = 3.0$ V
$I_C = 3.0$ mA

$G_{NF}$

$NF_{min}$
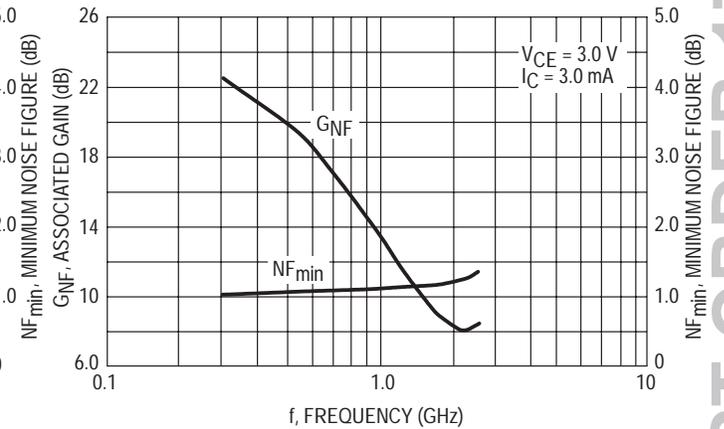
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LAST ORDER 17SEP00   LAST SHIP 17MAR01

**Figure 12. Minimum Noise Figure and
Associated Gain versus Collector Current**



$V_{CE}$ = 1.0 V
f = 1.0 GHz

$G_{NF}$

$NF_{min}$

$G_{NF}$, ASSOCIATED GAIN (dB)

$NF_{min}$, MINIMUM NOISE FIGURE (dB)

$I_C$, COLLECTOR CURRENT (mA)
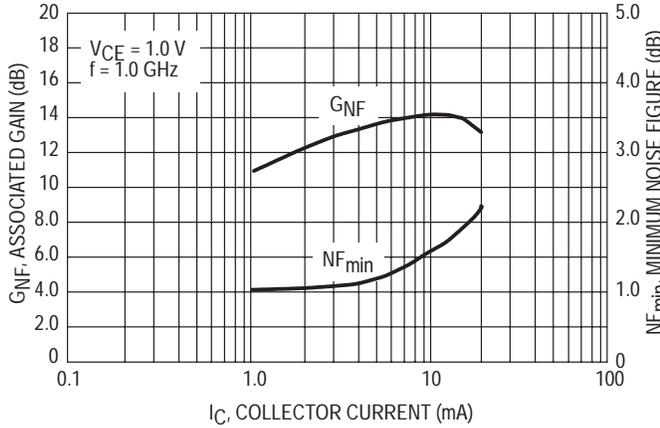
**Figure 13. Minimum Noise Figure and
Associated Gain versus Collector Current**



$V_{CE}$ = 3.0 V
f = 1.0 GHz

$G_{NF}$

$NF_{min}$

$G_{NF}$, ASSOCIATED GAIN (dB)

$NF_{min}$, MINIMUM NOISE FIGURE (dB)

$I_C$, COLLECTOR CURRENT (mA)
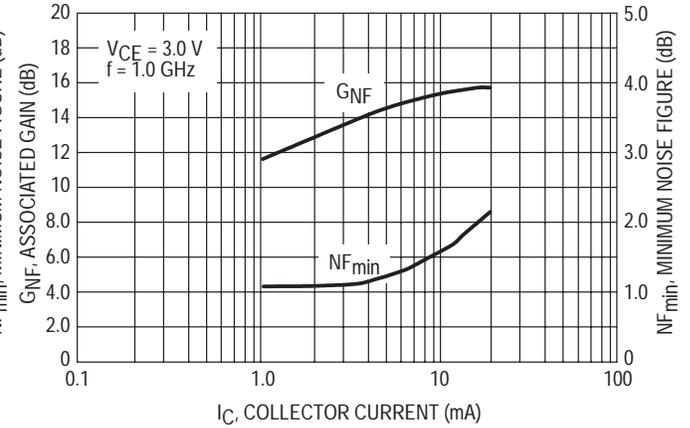
**Figure 14. Output Third Order Intercept and Output Power
at 1.0 dB Gain Compression versus Collector Current**



VCE = 3.0 V
f = 1.0 GHz
$Z_{in}$ = 50 Ω
$Z_{out}$ matched for
optimum IP3

$OIP_3$

$P_{-1.0\ dB}$

THIRD ORDER INTERCEPT and
1.0 dB COMPRESSION POINT (dBm)

$I_C$, COLLECTOR CURRENT (mA)

# MRF1027T1

## Table 1. Common Emitter S–Parameters

| V_CE (Vdc) | I_C (mA) | f (GHz) | S₁₁ \|S11\| | S₁₁ ∠ φ | S₂₁ \|S21\| | S₂₁ ∠ φ | S₁₂ \|S12\| | S₁₂ ∠ φ | S₂₂ \|S22\| | S₂₂ ∠ φ | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 1.0 | 0.1 | 0.971 | −7 | 3.44 | 173 | 0.023 | 85 | 0.989 | −5 | 0.04 |
| | | 0.3 | 0.945 | −22 | 3.35 | 159 | 0.067 | 76 | 0.965 | −14 | 0.12 |
| | | 0.5 | 0.906 | −35 | 3.10 | 143 | 0.104 | 66 | 0.908 | −22 | 0.27 |
| | | 0.7 | 0.803 | −47 | 2.88 | 131 | 0.134 | 59 | 0.856 | −29 | 0.36 |
| | | 0.9 | 0.721 | −58 | 2.71 | 120 | 0.157 | 53 | 0.797 | −35 | 0.45 |
| | | 1.0 | 0.684 | −63 | 2.62 | 116 | 0.166 | 51 | 0.770 | −38 | 0.49 |
| | | 1.3 | 0.576 | −78 | 2.34 | 101 | 0.188 | 45 | 0.692 | −45 | 0.62 |
| | | 1.5 | 0.518 | −87 | 2.19 | 93 | 0.200 | 42 | 0.649 | −50 | 0.69 |
| | | 1.8 | 0.429 | −101 | 1.98 | 82 | 0.212 | 38 | 0.592 | −56 | 0.81 |
| | | 2.0 | 0.386 | −112 | 1.86 | 75 | 0.219 | 37 | 0.563 | −59 | 0.87 |
| | | 2.5 | 0.309 | −140 | 1.63 | 59 | 0.232 | 35 | 0.491 | −69 | 1.01 |
| | | 3.0 | 0.258 | −163 | 1.47 | 47 | 0.251 | 36 | 0.459 | −77 | 1.09 |
| | | 3.5 | 0.238 | 167 | 1.33 | 36 | 0.276 | 37 | 0.445 | −85 | 1.11 |
| | | 4.0 | 0.256 | 142 | 1.22 | 26 | 0.312 | 38 | 0.431 | −95 | 1.08 |
| | | 4.5 | 0.269 | 121 | 1.17 | 17 | 0.365 | 37 | 0.410 | −106 | 1.03 |
| | | 5.0 | 0.305 | 106 | 1.09 | 9 | 0.417 | 34 | 0.411 | −118 | 0.99 |
| | 3.0 | 0.1 | 0.912 | −13 | 8.89 | 167 | 0.022 | 82 | 0.964 | −9.0 | 0.11 |
| | | 0.3 | 0.809 | −36 | 7.88 | 145 | 0.061 | 70 | 0.871 | −24 | 0.27 |
| | | 0.5 | 0.665 | −53 | 6.52 | 126 | 0.086 | 62 | 0.737 | −33 | 0.48 |
| | | 0.7 | 0.532 | −66 | 5.40 | 113 | 0.106 | 58 | 0.643 | −38 | 0.62 |
| | | 0.9 | 0.432 | −77 | 4.58 | 103 | 0.122 | 56 | 0.569 | −42 | 0.74 |
| | | 1.0 | 0.392 | −82 | 4.25 | 98 | 0.130 | 55 | 0.543 | −44 | 0.78 |
| | | 1.3 | 0.296 | −95 | 3.49 | 87 | 0.151 | 54 | 0.476 | −47 | 0.90 |
| | | 1.5 | 0.247 | −103 | 3.12 | 81 | 0.167 | 53 | 0.447 | −50 | 0.95 |
| | | 1.8 | 0.188 | −119 | 2.70 | 72 | 0.189 | 52 | 0.410 | −54 | 1.01 |
| | | 2.0 | 0.162 | −132 | 2.48 | 66 | 0.205 | 51 | 0.391 | −57 | 1.03 |
| | | 2.5 | 0.145 | −170 | 2.09 | 54 | 0.244 | 49 | 0.338 | −66 | 1.06 |
| | | 3.0 | 0.131 | 163 | 1.83 | 44 | 0.286 | 46 | 0.323 | −73 | 1.06 |
| | | 3.5 | 0.150 | 132 | 1.64 | 34 | 0.327 | 43 | 0.314 | −82 | 1.05 |
| | | 4.0 | 0.184 | 115 | 1.50 | 26 | 0.370 | 39 | 0.300 | −92 | 1.03 |
| | | 4.5 | 0.208 | 101 | 1.40 | 17 | 0.416 | 35 | 0.289 | −102 | 1.01 |
| | | 5.0 | 0.245 | 91 | 1.322 | 10 | 0.461 | 30 | 0.286 | −115 | 0.98 |
| | 5.0 | 0.1 | 0.852 | −17 | 13.06 | 163 | 0.022 | 81 | 0.938 | −12 | 0.17 |
| | | 0.3 | 0.687 | −46 | 10.50 | 135 | 0.055 | 68 | 0.783 | −29 | 0.39 |
| | | 0.5 | 0.510 | −62 | 7.97 | 117 | 0.076 | 62 | 0.626 | −36 | 0.64 |
| | | 0.7 | 0.385 | −75 | 6.27 | 104 | 0.093 | 61 | 0.535 | −39 | 0.78 |
| | | 0.9 | 0.301 | −85 | 5.13 | 95 | 0.111 | 60 | 0.475 | −41 | 0.87 |
| | | 1.0 | 0.269 | −89 | 4.71 | 92 | 0.119 | 60 | 0.454 | −42 | 0.91 |
| | | 1.3 | 0.193 | −102 | 3.78 | 81 | 0.145 | 59 | 0.406 | −44 | 0.98 |
| | | 1.5 | 0.155 | −111 | 3.35 | 76 | 0.163 | 59 | 0.385 | −47 | 1.01 |
| | | 1.8 | 0.114 | −132 | 2.88 | 68 | 0.190 | 57 | 0.359 | −51 | 1.03 |
| | | 2.0 | 0.100 | −149 | 2.63 | 63 | 0.207 | 56 | 0.343 | −54 | 1.05 |
| | | 2.5 | 0.114 | 168 | 2.20 | 52 | 0.253 | 52 | 0.297 | −63 | 1.05 |
| | | 3.0 | 0.115 | 143 | 1.92 | 43 | 0.298 | 49 | 0.287 | −70 | 1.05 |
| | | 3.5 | 0.147 | 117 | 1.71 | 34 | 0.342 | 44 | 0.280 | −80 | 1.03 |
| | | 4.0 | 0.182 | 105 | 1.57 | 25 | 0.386 | 40 | 0.265 | −91 | 1.01 |
| | | 4.5 | 0.205 | 94 | 1.46 | 17 | 0.431 | 35 | 0.256 | −102 | 1.00 |
| | | 5.0 | 0.242 | 86 | 1.38 | 10 | 0.474 | 30 | 0.251 | −115 | 0.98 |
| 3.0 | 3.0 | 0.1 | 0.927 | −11 | 8.88 | 168 | 0.018 | 83 | 0.968 | −7 | 0.11 |
| | | 0.3 | 0.836 | −32 | 8.00 | 147 | 0.051 | 73 | 0.892 | −20 | 0.26 |
| | | 0.5 | 0.704 | −47 | 6.74 | 129 | 0.073 | 64 | 0.776 | −27 | 0.48 |
| | | 0.7 | 0.573 | −58 | 5.65 | 116 | 0.091 | 60 | 0.694 | −32 | 0.62 |
| | | 0.9 | 0.473 | −67 | 4.83 | 106 | 0.106 | 58 | 0.627 | −36 | 0.73 |
| | | 1.0 | 0.432 | −71 | 4.50 | 102 | 0.113 | 58 | 0.603 | −37 | 0.77 |
| | | 1.3 | 0.332 | −82 | 3.72 | 90 | 0.133 | 57 | 0.542 | −40 | 0.89 |
| | | 1.5 | 0.281 | −87 | 3.33 | 84 | 0.147 | 56 | 0.514 | −43 | 0.94 |
| | | 1.8 | 0.213 | −98 | 2.89 | 75 | 0.167 | 55 | 0.480 | −46 | 0.99 |
| | | 2.0 | 0.179 | −107 | 2.66 | 70 | 0.181 | 55 | 0.462 | −49 | 1.02 |
| | | 2.5 | 0.131 | −139 | 2.25 | 57 | 0.218 | 52 | 0.412 | −56 | 1.05 |

**Table 1. Common Emitter S–Parameters (continued)**

| $V_{CE}$ (Vdc) | $I_C$ (mA) | f (GHz) | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $|S_{11}|$ | $\angle \phi$ | $|S_{21}|$ | $\angle \phi$ | $|S_{12}|$ | $\angle \phi$ | $|S_{22}|$ | $\angle \phi$ | |
| 3.0 | 3.0 | 3.0 | 0.096 | −163 | 1.97 | 47 | 0.255 | 51 | 0.400 | −62 | 1.05 |
| | | 3.5 | 0.092 | 152 | 1.76 | 38 | 0.294 | 48 | 0.394 | −70 | 1.03 |
| | | 4.0 | 0.121 | 126 | 1.61 | 29 | 0.335 | 44 | 0.381 | −79 | 1.01 |
| | | 4.5 | 0.143 | 109 | 1.50 | 21 | 0.379 | 41 | 0.373 | −87 | 0.98 |
| | | 5.0 | 0.180 | 97 | 1.42 | 13 | 0.424 | 37 | 0.370 | −98 | 0.95 |
| | 5.0 | 0.1 | 0.874 | −15 | 12.93 | 164 | 0.018 | 81 | 0.952 | −10 | 0.16 |
| | | 0.3 | 0.726 | −39 | 10.70 | 138 | 0.047 | 71 | 0.824 | −24 | 0.38 |
| | | 0.5 | 0.557 | −54 | 8.31 | 120 | 0.066 | 65 | 0.684 | −30 | 0.62 |
| | | 0.7 | 0.431 | −64 | 6.62 | 108 | 0.083 | 63 | 0.602 | −33 | 0.76 |
| | | 0.9 | 0.342 | −71 | 5.46 | 99 | 0.098 | 63 | 0.545 | −35 | 0.86 |
| | | 1.0 | 0.308 | −74 | 5.02 | 95 | 0.106 | 63 | 0.526 | −35 | 0.89 |
| | | 1.3 | 0.227 | −81 | 4.05 | 85 | 0.129 | 62 | 0.482 | −37 | 0.97 |
| | | 1.5 | 0.185 | −86 | 3.59 | 79 | 0.145 | 61 | 0.461 | −40 | 1.00 |
| | | 1.8 | 0.132 | −94 | 3.09 | 71 | 0.169 | 60 | 0.437 | −43 | 1.02 |
| | | 2.0 | 0.103 | −104 | 2.83 | 67 | 0.185 | 59 | 0.423 | −45 | 1.03 |
| | | 2.5 | 0.070 | −150 | 2.37 | 56 | 0.228 | 56 | 0.378 | −53 | 1.04 |
| | | 3.0 | 0.050 | 175 | 2.06 | 46 | 0.270 | 53 | 0.371 | −60 | 1.03 |
| | | 3.5 | 0.070 | 120 | 1.84 | 37 | 0.312 | 49 | 0.365 | −68 | 1.02 |
| | | 4.0 | 0.108 | 106 | 1.68 | 29 | 0.355 | 45 | 0.350 | −77 | 1.00 |
| | | 4.5 | 0.131 | 94 | 1.57 | 21 | 0.399 | 40 | 0.343 | −86 | 0.98 |
| | | 5.0 | 0.167 | 86 | 1.48 | 14 | 0.443 | 35 | 0.338 | −97 | 0.96 |
| | 10 | 0.1 | 0.760 | −21 | 19.82 | 157 | 0.017 | 79 | 0.910 | −13 | 0.26 |
| | | 0.3 | 0.539 | −50 | 13.88 | 126 | 0.041 | 70 | 0.707 | −28 | 0.57 |
| | | 0.5 | 0.367 | −61 | 9.71 | 109 | 0.058 | 68 | 0.573 | −30 | 0.81 |
| | | 0.7 | 0.269 | −69 | 7.37 | 99 | 0.074 | 68 | 0.512 | −30 | 0.91 |
| | | 0.9 | 0.206 | −73 | 5.92 | 91 | 0.091 | 68 | 0.475 | −30 | 0.97 |
| | | 1.0 | 0.183 | −75 | 5.39 | 88 | 0.100 | 68 | 0.465 | −31 | 0.98 |
| | | 1.3 | 0.128 | −79 | 4.28 | 79 | 0.126 | 67 | 0.439 | −33 | 1.02 |
| | | 1.5 | 0.097 | −81 | 3.77 | 75 | 0.144 | 66 | 0.426 | −35 | 1.03 |
| | | 1.8 | 0.059 | −90 | 3.22 | 68 | 0.170 | 64 | 0.409 | −39 | 1.04 |
| | | 2.0 | 0.037 | −104 | 2.94 | 63 | 0.188 | 63 | 0.398 | −41 | 1.04 |
| | | 2.5 | 0.043 | 164 | 2.46 | 53 | 0.234 | 59 | 0.359 | −49 | 1.03 |
| | | 3.0 | 0.048 | 126 | 2.13 | 45 | 0.278 | 55 | 0.355 | −56 | 1.02 |
| | | 3.5 | 0.088 | 99 | 1.90 | 36 | 0.321 | 50 | 0.350 | −65 | 1.00 |
| | | 4.0 | 0.123 | 94 | 1.73 | 28 | 0.365 | 45 | 0.334 | −75 | 0.98 |
| | | 4.5 | 0.145 | 86 | 1.61 | 21 | 0.409 | 41 | 0.328 | −84 | 0.97 |
| | | 5.0 | 0.178 | 80 | 1.51 | 13 | 0.453 | 35 | 0.322 | −95 | 0.95 |

**Table 2. Common–Emitter Noise Parameters**

| $V_{CE}$ (Vdc) | $I_C$ (mA) | f (GHz) | $NF_{min}$ (dB) | $\Gamma_o$ Magnitude | Angle | $R_N$ $\Omega$ | $r_n$ | $G_{NF}$ (dB) | K |
|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 1.0 | 0.3 | 0.95 | 0.68 | 10 | 35 | 0.69 | 19.8 | 0.12 |
| | | 0.5 | 0.96 | 0.68 | 15 | 34 | 0.67 | 16.8 | 0.27 |
| | | 0.7 | 0.99 | 0.67 | 21 | 33 | 0.65 | 14.1 | 0.36 |
| | | 0.9 | 1.01 | 0.67 | 28 | 31 | 0.62 | 11.8 | 0.45 |
| | | 1.0 | 1.03 | 0.66 | 32 | 30 | 0.61 | 10.8 | 0.49 |
| | | 1.5 | 1.12 | 0.62 | 51 | 25 | 0.49 | 7.1 | 0.69 |
| | | 2.0 | 1.21 | 0.55 | 74 | 18 | 0.35 | 6.5 | 0.87 |
| | | 2.4 | 1.31 | 0.47 | 95 | 12 | 0.25 | 6.7 | 1.00 |
| | 3.0 | 0.3 | 1.06 | 0.58 | 10 | 24 | 0.47 | 21.8 | 0.27 |
| | | 0.5 | 1.06 | 0.57 | 15 | 23 | 0.46 | 18.9 | 0.48 |
| | | 0.7 | 1.06 | 0.55 | 20 | 22 | 0.44 | 16.2 | 0.62 |
| | | 0.9 | 1.07 | 0.53 | 26 | 21 | 0.42 | 13.9 | 0.74 |
| | | 1.0 | 1.08 | 0.52 | 30 | 20 | 0.41 | 12.9 | 0.78 |
| | | 1.5 | 1.14 | 0.47 | 50 | 17 | 0.35 | 9.1 | 0.95 |
| | | 2.0 | 1.24 | 0.40 | 75 | 13 | 0.26 | 7.4 | 1.03 |
| | | 2.4 | 1.35 | 0.33 | 98 | 10 | 0.20 | 7.6 | 1.06 |
| | 5.0 | 0.3 | 1.15 | 0.50 | 10 | 21 | 0.41 | 22.5 | 0.39 |
| | | 0.5 | 1.16 | 0.48 | 14 | 20 | 0.40 | 19.5 | 0.64 |
| | | 0.7 | 1.17 | 0.46 | 19 | 19 | 0.39 | 16.9 | 0.78 |
| | | 0.9 | 1.17 | 0.44 | 25 | 19 | 0.37 | 14.6 | 0.87 |
| | | 1.0 | 1.18 | 0.42 | 28 | 18 | 0.36 | 13.6 | 0.91 |
| | | 1.5 | 1.27 | 0.36 | 50 | 16 | 0.31 | 9.8 | 1.01 |
| | | 2.0 | 1.41 | 0.29 | 79 | 12 | 0.24 | 8.0 | 1.05 |
| | | 2.4 | 1.57 | 0.23 | 108 | 10 | 0.19 | 8.1 | 1.05 |
| 3.0 | 1.0 | 0.3 | 1.01 | 0.71 | 10 | 40 | 0.80 | 20.6 | 0.11 |
| | | 0.5 | 1.03 | 0.71 | 15 | 39 | 0.79 | 17.5 | 0.26 |
| | | 0.7 | 1.05 | 0.71 | 20 | 38 | 0.76 | 14.7 | 0.35 |
| | | 0.9 | 1.06 | 0.70 | 26 | 36 | 0.72 | 12.4 | 0.43 |
| | | 1.0 | 1.07 | 0.70 | 29 | 35 | 0.71 | 11.3 | 0.47 |
| | | 1.5 | 1.02 | 0.66 | 47 | 29 | 0.58 | 7.6 | 0.67 |
| | | 2.0 | 1.06 | 0.59 | 68 | 21 | 0.43 | 6.2 | 0.85 |
| | | 2.4 | 1.15 | 0.52 | 87 | 15 | 0.30 | 6.9 | 0.98 |
| | 3.0 | 0.3 | 1.03 | 0.64 | 9 | 29 | 0.59 | 22.5 | 0.26 |
| | | 0.5 | 1.05 | 0.63 | 14 | 29 | 0.58 | 19.5 | 0.48 |
| | | 0.7 | 1.06 | 0.61 | 19 | 28 | 0.56 | 16.9 | 0.62 |
| | | 0.9 | 1.08 | 0.60 | 25 | 27 | 0.54 | 14.6 | 0.73 |
| | | 1.0 | 1.10 | 0.59 | 28 | 26 | 0.52 | 13.6 | 0.77 |
| | | 1.5 | 1.14 | 0.54 | 46 | 22 | 0.44 | 9.7 | 0.94 |
| | | 2.0 | 1.24 | 0.49 | 69 | 17 | 0.34 | 8.1 | 1.02 |
| | | 2.4 | 1.36 | 0.43 | 89 | 13 | 0.25 | 8.3 | 1.04 |
| | 5.0 | 0.3 | 1.16 | 0.55 | 9 | 24 | 0.48 | 23.3 | 0.38 |
| | | 0.5 | 1.16 | 0.53 | 13 | 23 | 0.47 | 20.4 | 0.62 |
| | | 0.7 | 1.17 | 0.52 | 18 | 23 | 0.45 | 17.7 | 0.76 |
| | | 0.9 | 1.19 | 0.50 | 24 | 22 | 0.43 | 15.4 | 0.86 |
| | | 1.0 | 1.20 | 0.49 | 27 | 21 | 0.42 | 14.4 | 0.89 |
| | | 1.5 | 1.28 | 0.43 | 46 | 18 | 0.36 | 10.5 | 1.00 |
| | | 2.0 | 1.41 | 0.35 | 71 | 14 | 0.28 | 8.7 | 1.03 |
| | | 2.4 | 1.56 | 0.29 | 94 | 11 | 0.22 | 8.8 | 1.04 |
| | 10 | 0.3 | 1.49 | 0.41 | 14 | 20 | 0.41 | 24.3 | 0.57 |
| | | 0.5 | 1.49 | 0.38 | 15 | 20 | 0.40 | 21.2 | 0.81 |
| | | 0.7 | 1.51 | 0.36 | 18 | 19 | 0.39 | 18.5 | 0.91 |
| | | 0.9 | 1.53 | 0.34 | 23 | 19 | 0.37 | 16.2 | 0.97 |
| | | 1.0 | 1.54 | 0.33 | 27 | 18 | 0.37 | 15.2 | 0.98 |
| | | 1.5 | 1.65 | 0.26 | 52 | 16 | 0.32 | 11.2 | 1.03 |
| | | 2.0 | 1.83 | 0.19 | 88 | 13 | 0.25 | 9.3 | 1.04 |
| | | 2.4 | 2.02 | 0.13 | 123 | 11 | 0.22 | 9.3 | 1.03 |

**Figure 15. Constant Gain and Noise Figure Contours**
**(f = 1.0 GHz)**

j1.0

j0.5  j2.0

INPUT   OUTPUT

j0.2

NF Opt = 1.05 dB

11 dB
10
2.0 dB
9.0
3.0
8.0
4.0
5.0

−j0.2

−j0.5   −j2.0

−j1.0

0.2   0.5   1.0   2.0
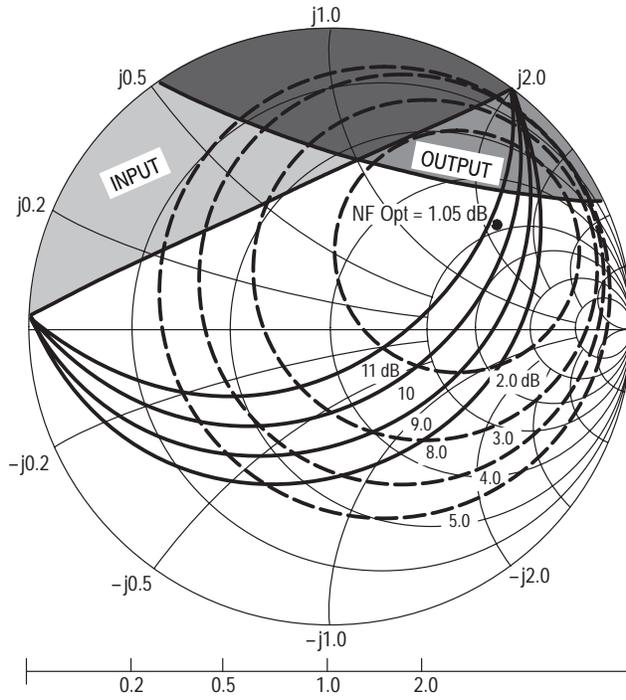
$V_{CE}$ = 1.0 V
$I_C$ = 1.0 mA
☐ — Potentially Unstable

| f (GHz) | NF Opt (dB) | $\Gamma_O$ | Rn | K |
|---------|-------------|------------|------|------|
| 1.0 | 1.05 | 0.66 ∠ 31.5° | 30.4 | 0.49 |

**Figure 16. Constant Gain and Noise Figure Contours**
**(f = 2.0 GHz)**

j1.0   OUTPUT

j0.5   j2.0

INPUT

j0.2

NF Opt = 1.21 dB

9.0 dB
8.0
2.0 dB
7.0
6.0   3.0
4.0
5.0

−j0.2

−j0.5   −j2.0

−j1.0

0.2   0.5   1.0   2.0
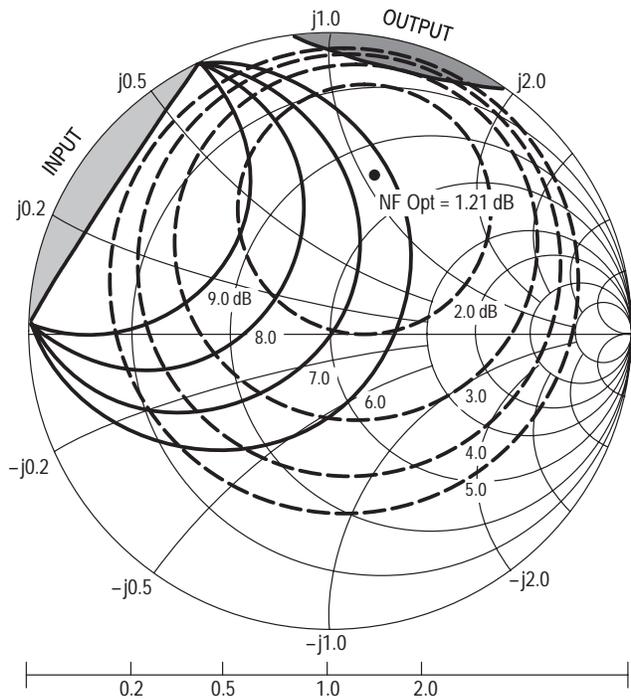
$V_{CE}$ = 1.0 V
$I_C$ = 1.0 mA
☐ — Potentially Unstable

| f (GHz) | NF Opt (dB) | $\Gamma_O$ | Rn | K |
|---------|-------------|------------|------|------|
| 2.0 | 1.21 | 0.55 ∠ 74.1° | 17.6 | 0.87 |

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**Figure 17. Constant Gain and Noise Figure Contours**
**(f = 1.0 GHz)**
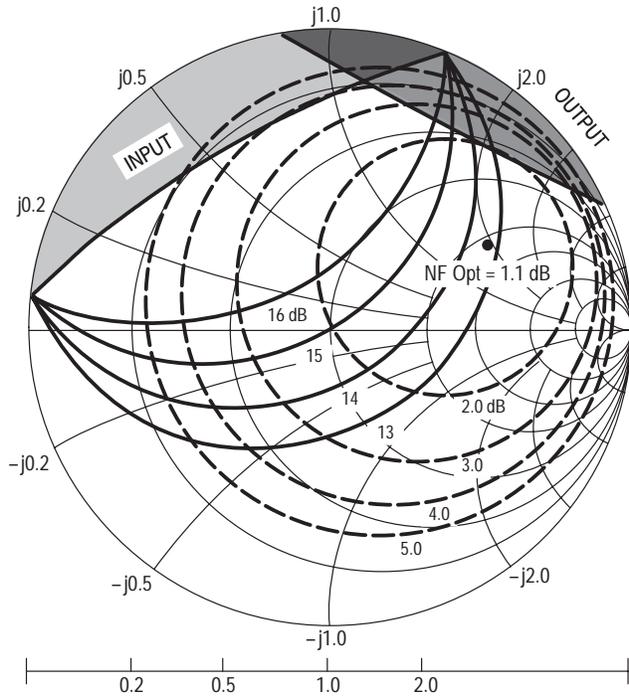


$V_{CE}$ = 3.0 V
$I_C$ = 3.0 mA
▨ — Potentially Unstable

| f (GHz) | NF Opt (dB) | $\Gamma_O$ | Rn | K |
|---------|-------------|------------------------|------|------|
| 1.0 | 1.10 | 0.59 ∠ 27.9° | 26 | 0.77 |

**Figure 18. Constant Gain and Noise Figure Contours**
**(f = 2.0 GHz)**
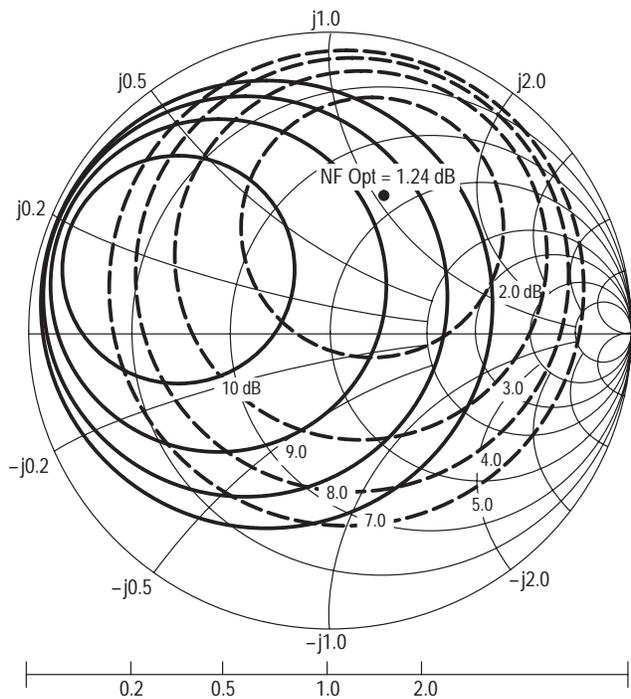


$V_{CE}$ = 3.0 V
$I_C$ = 3.0 mA
▨ — Potentially Unstable

| f (GHz) | NF Opt (dB) | $\Gamma_O$ | Rn | K |
|---------|-------------|------------------------|------|------|
| 2.0 | 1.24 | 0.49 ∠ 68.6° | 16.8 | 1.02 |

# MRF1027T1

## OUTLINE DIMENSIONS

PLASTIC PACKAGE
CASE 419–02
(SC–70)
ISSUE J
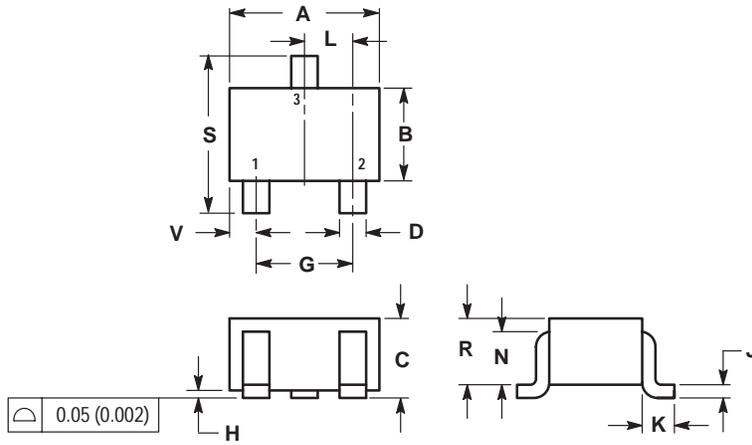
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.035 | 0.049 | 0.90 | 1.25 |
| D | 0.012 | 0.016 | 0.30 | 0.40 |
| G | 0.047 | 0.055 | 1.20 | 1.40 |
| H | 0.000 | 0.004 | 0.00 | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.017 REF | | 0.425 REF | |
| L | 0.026 BSC | | 0.650 BSC | |
| N | 0.028 REF | | 0.700 REF | |
| R | 0.031 | 0.039 | 0.80 | 1.00 |
| S | 0.079 | 0.087 | 2.00 | 2.20 |
| V | 0.012 | 0.016 | 0.30 | 0.40 |

0.05 (0.002)

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