



SANYO Semiconductors

DATA SHEET

15GN03NA

 — NPN Epitaxial Planar Silicon Transistor
VHF High-frequency Amplifier Applications

Applications

- VHF, RF, MIXER, OSC, IF amplifier.

Features

- High cutoff frequency : $f_T=1.5\text{GHz}$ typ.
- High gain : $|S_{21e}|^2=11.5\text{dB}$ typ ($f=0.4\text{GHz}$).

Specifications

Absolute Maximum Ratings at $T_a=25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|------------------------------|-----------|------------|-------------|------------------|
| Collector-to-Base Voltage | V_{CB0} | | 20 | V |
| Collector-to-Emitter Voltage | V_{CE0} | | 10 | V |
| Emitter-to-Base Voltage | V_{EB0} | | 3 | V |
| Collector Current | I_C | | 70 | mA |
| Collector Dissipation | P_C | | 400 | mW |
| Junction Temperature | T_j | | 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | | -55 to +150 | $^\circ\text{C}$ |

Electrical Characteristics at $T_a=25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|------------------------------|-----------|-------------------------------------|---------|-----|-----|---------------|
| | | | min | typ | max | |
| Collector Cutoff Current | I_{CB0} | $V_{CB}=10\text{V}, I_E=0\text{A}$ | | | 0.1 | μA |
| Emitter Cutoff Current | I_{EB0} | $V_{EB}=2\text{V}, I_C=0\text{A}$ | | | 1 | μA |
| DC Current Gain | h_{FE} | $V_{CE}=5\text{V}, I_C=10\text{mA}$ | 100 | | 180 | |
| Gain-Bandwidth Product | f_T | $V_{CE}=5\text{V}, I_C=20\text{mA}$ | 1.0 | 1.5 | | GHz |
| Output Capacitance | C_{ob} | $V_{CB}=10\text{V}, f=1\text{MHz}$ | | 1.1 | 1.4 | pF |
| Reverse Transfer Capacitance | C_{re} | $V_{CB}=10\text{V}, f=1\text{MHz}$ | | 0.7 | | pF |

Marking : ZC

Continued on next page.

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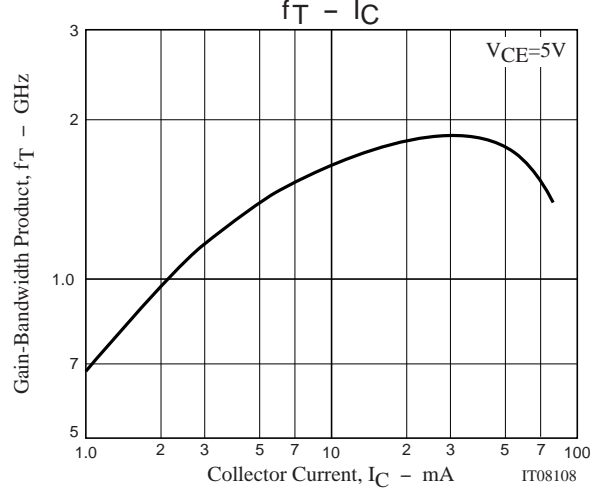
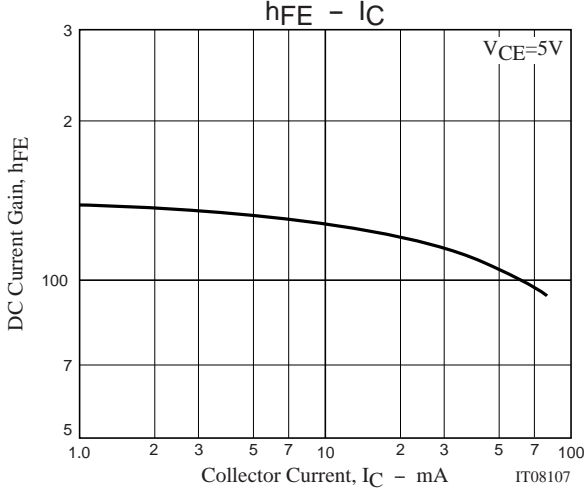
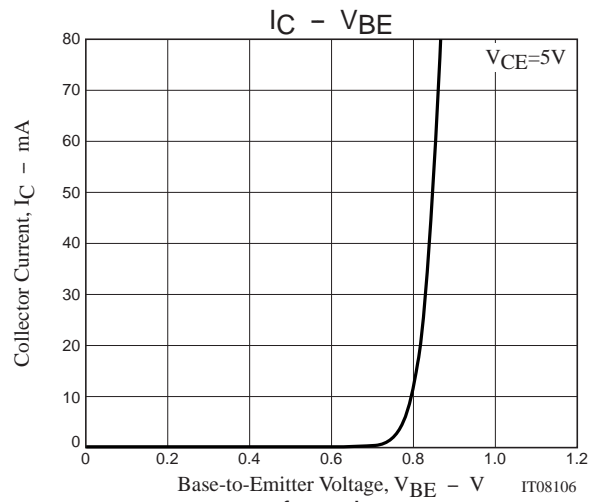
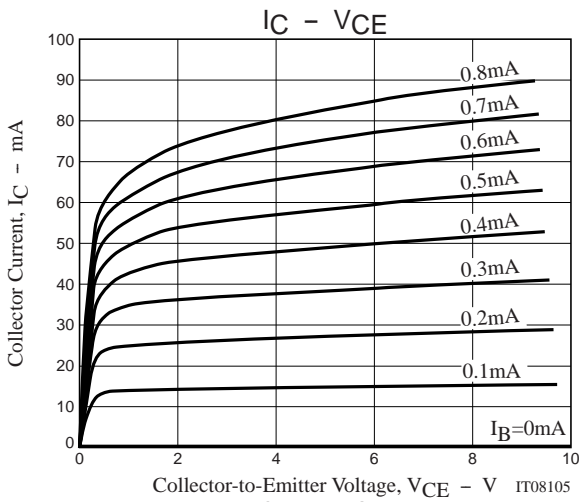
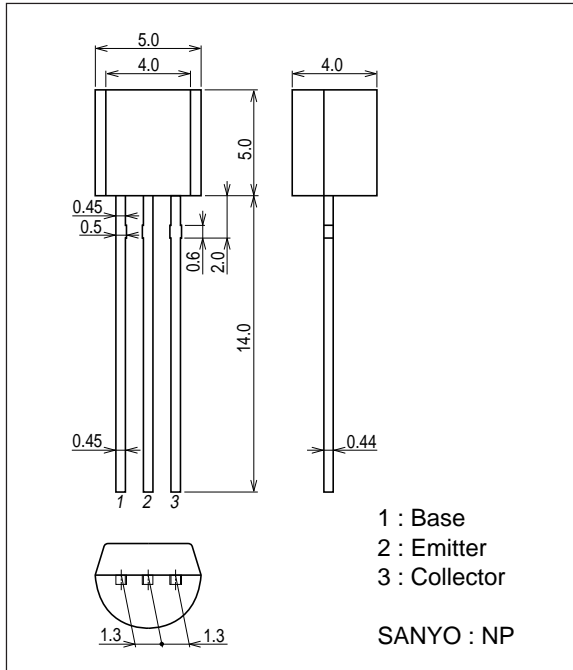
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| Parameter | Symbol | Conditions | Ratings | | | Unit |
|-----------------------|---------------|---------------------------------|---------|------|-----|------|
| | | | min | typ | max | |
| Forward Transfer Gain | $ S_{21e} ^2$ | $V_{CE}=5V, I_C=20mA, f=0.4GHz$ | 9 | 11.5 | | dB |
| Noise Figure | NF | $V_{CE}=3V, I_C=2mA, f=0.4GHz$ | | 1.6 | | dB |

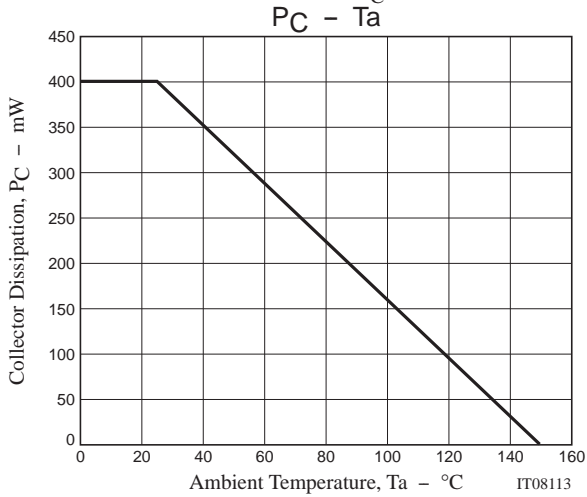
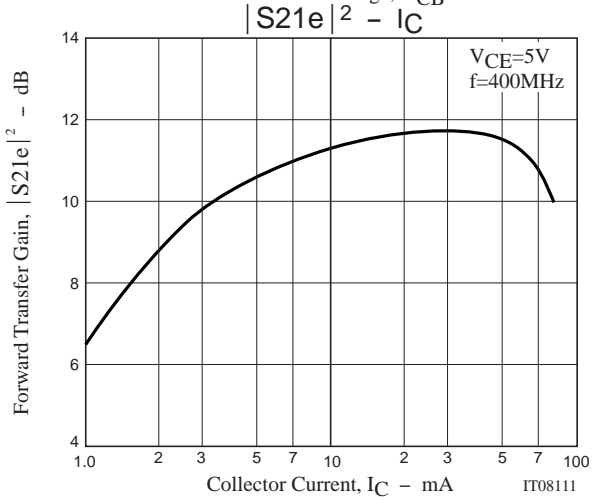
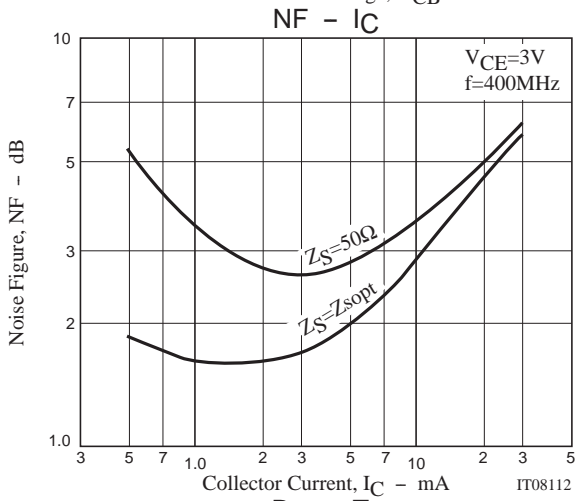
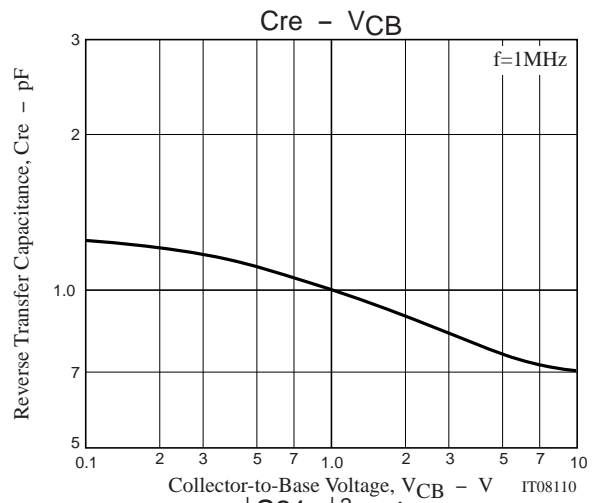
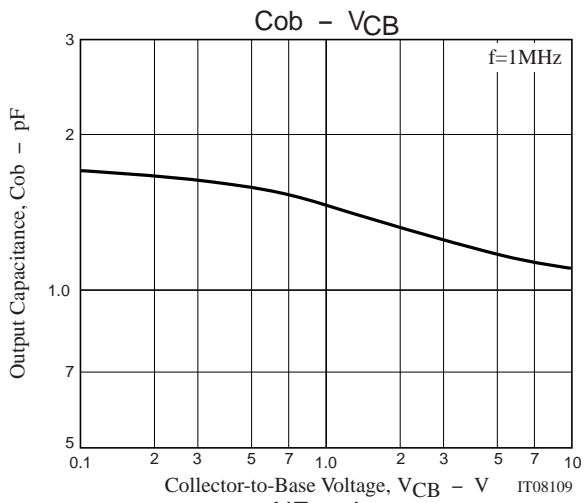
Package Dimensions

unit : mm (typ)

7522-003



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S Parameters (Common emitter)

$V_{CE}=5V, I_C=1mA, Z_O=50\Omega$

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.911 | -38.35 | 3.396 | 150.54 | 0.044 | 67.89 | 0.965 | -11.16 |
| 200 | 0.789 | -73.55 | 2.932 | 125.94 | 0.072 | 50.24 | 0.894 | -19.16 |
| 300 | 0.667 | -105.98 | 2.480 | 105.39 | 0.086 | 38.97 | 0.833 | -24.89 |
| 400 | 0.581 | -135.99 | 2.119 | 88.18 | 0.085 | 33.03 | 0.793 | -29.61 |
| 500 | 0.530 | -163.88 | 1.820 | 73.68 | 0.081 | 35.93 | 0.768 | -33.50 |
| 600 | 0.516 | 170.66 | 1.591 | 61.24 | 0.080 | 44.02 | 0.752 | -38.35 |
| 700 | 0.524 | 149.05 | 1.411 | 50.19 | 0.087 | 54.80 | 0.743 | -43.53 |
| 800 | 0.544 | 130.45 | 1.265 | 40.26 | 0.107 | 61.94 | 0.735 | -49.30 |
| 900 | 0.569 | 114.61 | 1.151 | 31.22 | 0.134 | 66.13 | 0.728 | -56.06 |
| 1000 | 0.599 | 101.73 | 1.053 | 23.11 | 0.166 | 65.91 | 0.725 | -64.11 |

$V_{CE}=5V, I_C=3mA, Z_O=50\Omega$

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.734 | -62.22 | 7.688 | 133.47 | 0.037 | 59.82 | 0.876 | -15.78 |
| 200 | 0.520 | -107.28 | 5.350 | 105.85 | 0.051 | 48.96 | 0.764 | -20.74 |
| 300 | 0.412 | -142.46 | 3.906 | 88.51 | 0.060 | 50.51 | 0.718 | -23.92 |
| 400 | 0.374 | -171.32 | 3.088 | 75.17 | 0.069 | 55.03 | 0.693 | -27.48 |
| 500 | 0.369 | 164.72 | 2.527 | 64.19 | 0.080 | 60.30 | 0.683 | -31.29 |
| 600 | 0.390 | 145.05 | 2.157 | 54.55 | 0.096 | 63.41 | 0.673 | -36.13 |
| 700 | 0.416 | 128.83 | 1.893 | 45.49 | 0.116 | 65.58 | 0.666 | -41.49 |
| 800 | 0.447 | 115.53 | 1.691 | 37.01 | 0.138 | 64.99 | 0.654 | -47.20 |
| 900 | 0.481 | 104.33 | 1.531 | 28.78 | 0.165 | 64.38 | 0.644 | -53.59 |
| 1000 | 0.513 | 94.85 | 1.405 | 20.91 | 0.196 | 61.55 | 0.633 | -61.70 |

$V_{CE}=5V, I_C=5mA, Z_O=50\Omega$

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.601 | -77.46 | 10.083 | 123.30 | 0.032 | 58.18 | 0.813 | -17.09 |
| 200 | 0.401 | -124.33 | 6.214 | 97.86 | 0.045 | 55.73 | 0.710 | -19.74 |
| 300 | 0.330 | -158.33 | 4.368 | 82.77 | 0.056 | 60.17 | 0.677 | -22.45 |
| 400 | 0.316 | 174.70 | 3.384 | 71.30 | 0.069 | 63.56 | 0.661 | -26.09 |
| 500 | 0.328 | 153.64 | 2.764 | 61.57 | 0.085 | 65.89 | 0.654 | -29.88 |
| 600 | 0.355 | 136.94 | 2.346 | 52.55 | 0.104 | 67.02 | 0.644 | -35.07 |
| 700 | 0.385 | 122.98 | 2.058 | 44.10 | 0.126 | 67.31 | 0.636 | -40.45 |
| 800 | 0.416 | 111.48 | 1.842 | 35.87 | 0.149 | 65.15 | 0.624 | -46.16 |
| 900 | 0.451 | 101.75 | 1.668 | 28.07 | 0.175 | 62.95 | 0.612 | -52.85 |
| 1000 | 0.488 | 93.45 | 1.525 | 20.21 | 0.202 | 59.91 | 0.598 | -60.59 |

$V_{CE}=5V, I_C=10mA, Z_O=50\Omega$

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.418 | -98.93 | 12.653 | 110.98 | 0.025 | 61.57 | 0.726 | -16.94 |
| 200 | 0.289 | -145.70 | 7.004 | 90.22 | 0.041 | 65.66 | 0.657 | -17.68 |
| 300 | 0.263 | -176.64 | 4.795 | 77.68 | 0.056 | 68.69 | 0.639 | -20.61 |
| 400 | 0.272 | 160.88 | 3.684 | 67.70 | 0.075 | 69.86 | 0.629 | -24.59 |
| 500 | 0.294 | 143.46 | 3.003 | 58.71 | 0.092 | 69.86 | 0.623 | -28.71 |
| 600 | 0.323 | 129.85 | 2.541 | 50.56 | 0.113 | 68.29 | 0.613 | -33.65 |
| 700 | 0.356 | 118.38 | 2.230 | 42.41 | 0.134 | 66.15 | 0.606 | -39.34 |
| 800 | 0.390 | 108.55 | 1.995 | 34.57 | 0.157 | 64.16 | 0.591 | -45.22 |
| 900 | 0.428 | 100.12 | 1.804 | 26.83 | 0.183 | 61.23 | 0.578 | -51.67 |
| 1000 | 0.465 | 92.70 | 1.655 | 19.00 | 0.210 | 58.00 | 0.561 | -59.46 |

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S Parameters (Common emitter)

$V_{CE}=5V, I_C=15mA, Z_O=50\Omega$

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.336 | -111.37 | 13.633 | 105.51 | 0.023 | 66.42 | 0.689 | -16.01 |
| 200 | 0.251 | -156.52 | 7.291 | 87.18 | 0.039 | 68.50 | 0.638 | -16.50 |
| 300 | 0.243 | 175.36 | 4.950 | 75.58 | 0.058 | 72.23 | 0.624 | -19.64 |
| 400 | 0.259 | 155.17 | 3.804 | 66.12 | 0.075 | 71.30 | 0.615 | -23.84 |
| 500 | 0.282 | 139.97 | 3.085 | 57.58 | 0.096 | 70.72 | 0.610 | -28.09 |
| 600 | 0.315 | 127.91 | 2.623 | 49.47 | 0.116 | 68.73 | 0.599 | -33.22 |
| 700 | 0.349 | 117.19 | 2.294 | 41.46 | 0.139 | 66.53 | 0.589 | -38.91 |
| 800 | 0.382 | 108.15 | 2.051 | 33.59 | 0.162 | 63.69 | 0.576 | -44.65 |
| 900 | 0.423 | 100.27 | 1.857 | 25.77 | 0.186 | 60.44 | 0.561 | -51.26 |
| 1000 | 0.461 | 93.31 | 1.699 | 18.04 | 0.213 | 56.83 | 0.543 | -58.90 |

$V_{CE}=5V, I_C=20mA, Z_O=50\Omega$

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.295 | -119.70 | 14.064 | 102.72 | 0.023 | 68.43 | 0.670 | -15.25 |
| 200 | 0.236 | -163.17 | 7.419 | 85.53 | 0.040 | 72.56 | 0.627 | -15.71 |
| 300 | 0.236 | 171.09 | 5.038 | 74.53 | 0.057 | 73.42 | 0.613 | -19.17 |
| 400 | 0.252 | 153.03 | 3.857 | 65.19 | 0.077 | 71.74 | 0.606 | -23.55 |
| 500 | 0.279 | 138.70 | 3.134 | 56.66 | 0.097 | 70.80 | 0.600 | -27.92 |
| 600 | 0.311 | 127.43 | 2.662 | 48.69 | 0.118 | 69.12 | 0.590 | -32.97 |
| 700 | 0.348 | 117.20 | 2.322 | 40.64 | 0.139 | 66.53 | 0.582 | -38.63 |
| 800 | 0.382 | 108.37 | 2.076 | 32.72 | 0.163 | 63.36 | 0.567 | -44.57 |
| 900 | 0.422 | 100.51 | 1.875 | 24.96 | 0.187 | 59.97 | 0.553 | -50.89 |
| 1000 | 0.463 | 93.56 | 1.717 | 17.22 | 0.214 | 56.66 | 0.534 | -58.57 |

$V_{CE}=5V, I_C=30mA, Z_O=50\Omega$

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.255 | -132.18 | 14.413 | 99.45 | 0.022 | 72.81 | 0.646 | -14.31 |
| 200 | 0.228 | -171.53 | 7.502 | 83.61 | 0.040 | 75.43 | 0.614 | -14.88 |
| 300 | 0.235 | 166.38 | 5.066 | 72.97 | 0.059 | 74.03 | 0.604 | -18.31 |
| 400 | 0.257 | 150.61 | 3.881 | 63.80 | 0.079 | 73.36 | 0.597 | -23.02 |
| 500 | 0.284 | 137.65 | 3.149 | 55.32 | 0.099 | 71.09 | 0.592 | -27.40 |
| 600 | 0.319 | 127.33 | 2.670 | 47.24 | 0.119 | 68.99 | 0.582 | -32.58 |
| 700 | 0.355 | 117.59 | 2.329 | 39.18 | 0.142 | 66.19 | 0.574 | -38.29 |
| 800 | 0.391 | 108.78 | 2.078 | 31.33 | 0.165 | 62.94 | 0.559 | -44.08 |
| 900 | 0.432 | 100.94 | 1.873 | 23.50 | 0.188 | 59.89 | 0.544 | -50.63 |
| 1000 | 0.476 | 93.96 | 1.712 | 15.58 | 0.214 | 56.33 | 0.527 | -58.36 |

$V_{CE}=5V, I_C=50mA, Z_O=50\Omega$

| Freq(MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|-----------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.245 | -148.53 | 14.210 | 96.44 | 0.023 | 73.67 | 0.625 | -13.18 |
| 200 | 0.244 | -179.65 | 7.331 | 81.36 | 0.041 | 76.18 | 0.600 | -14.33 |
| 300 | 0.258 | 162.46 | 4.937 | 70.79 | 0.060 | 75.61 | 0.592 | -18.11 |
| 400 | 0.284 | 149.02 | 3.773 | 61.59 | 0.081 | 73.24 | 0.585 | -22.99 |
| 500 | 0.314 | 137.48 | 3.057 | 52.94 | 0.101 | 71.86 | 0.583 | -27.31 |
| 600 | 0.349 | 127.61 | 2.577 | 44.66 | 0.122 | 68.97 | 0.573 | -32.63 |
| 700 | 0.390 | 117.90 | 2.248 | 36.55 | 0.144 | 65.54 | 0.565 | -38.50 |
| 800 | 0.427 | 109.32 | 1.996 | 28.38 | 0.169 | 63.25 | 0.549 | -44.65 |
| 900 | 0.472 | 101.47 | 1.796 | 20.36 | 0.193 | 60.00 | 0.536 | -51.23 |
| 1000 | 0.513 | 94.18 | 1.633 | 12.42 | 0.219 | 56.02 | 0.516 | -59.35 |

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