

**2SC5231**

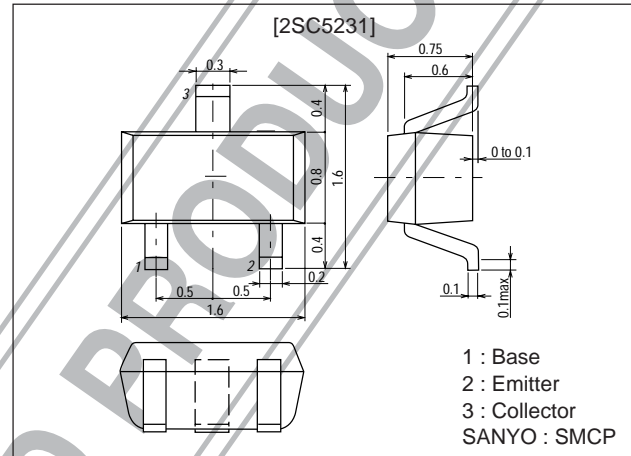
VHF to UHF Wide-Band Low-Noise Amplifier Applications

Features

- Low noise : $NF=1.0\text{dB typ (}f=1\text{GHz)}$.
- High gain : $|S_{21e}|^2=12\text{dB typ (}f=1\text{GHz)}$.
- High cutoff frequency : $f_T=7\text{GHz typ}$.
- Ultrasmall package permitting applied sets to be small and slim.

Package Dimensions

unit:mm
2106A



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} | | 2 | V |
| Collector Current | I_C | | 70 | mA |
| Collector Dissipation | P_C | | 100 | 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_{CBO} | $V_{CB}=10\text{V}, I_E=0$ | | | 1.0 | μA |
| Emitter Cutoff Current | I_{EBO} | $V_{EB}=1\text{V}, I_C=0$ | | | 10 | μA |
| DC Current Gain | h_{FE} | $V_{CE}=5\text{V}, I_C=20\text{mA}$ | 60* | | 270* | |
| Gain-Bandwidth Product | f_T | $V_{CE}=5\text{V}, I_C=20\text{mA}$ | 5 | 7 | | GHz |
| Output Capacitance | C_{ob} | $V_{CB}=10\text{V}, f=1\text{MHz}$ | | 0.7 | 1.2 | pF |
| Reverse Transfer Capacitance | C_{re} | $V_{CB}=10\text{V}, f=1\text{MHz}$ | | 0.45 | | pF |

≠ : Pulse Test Pulse Width $\leq 2\text{ms}$

* : The 2SC5231 is classified by 20mA h_{FE} as follows :

| Marking | C7 | C8 | C9 |
|----------|-----------|-----------|------------|
| h_{FE} | 60 to 120 | 90 to 180 | 135 to 270 |

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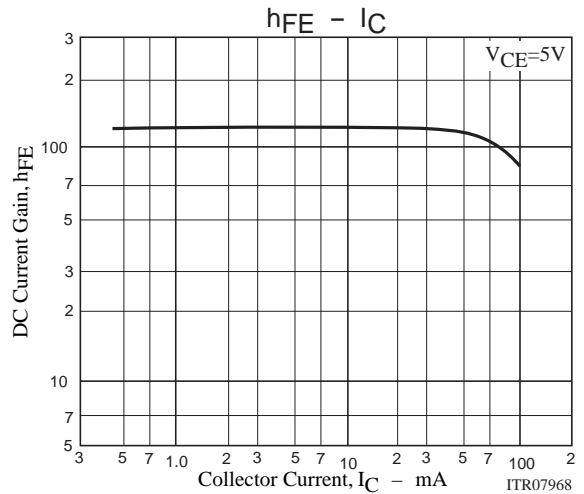
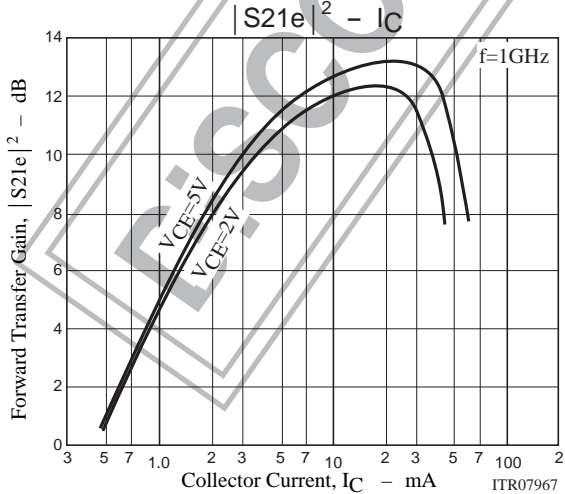
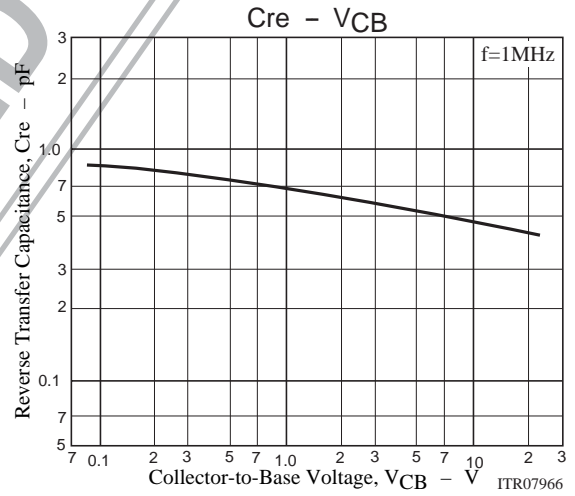
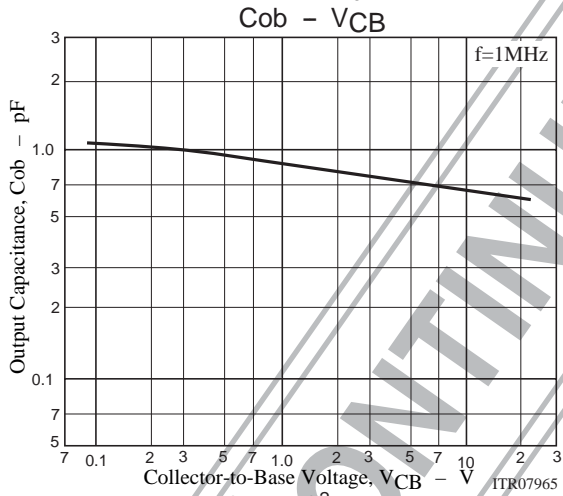
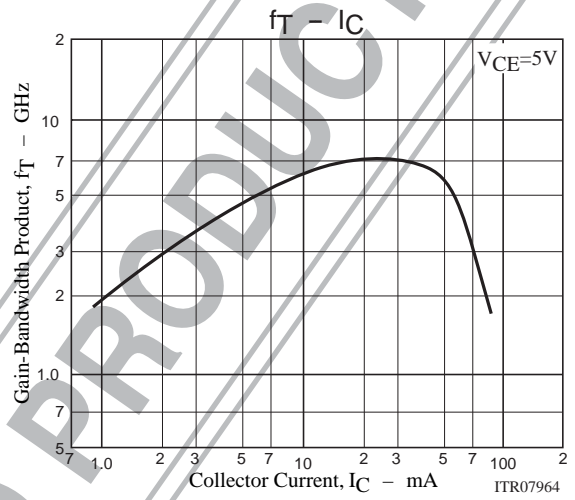
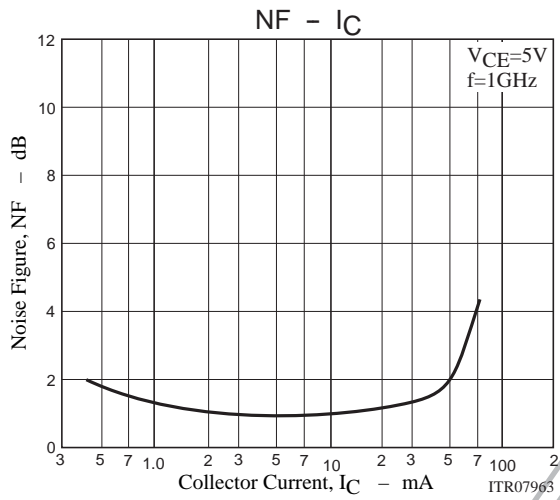
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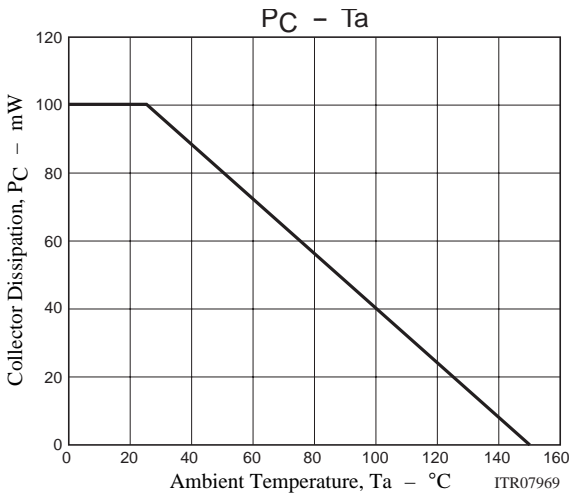
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| Parameter | Symbol | Conditions | Ratings | | | Unit |
|-----------------------|-----------------|-------------------------------|---------|-----|-----|------|
| | | | min | typ | max | |
| Forward Transfer Gain | $ S_{21e} ^2 1$ | $V_{CE}=5V, I_C=20mA, f=1GHz$ | 9 | 12 | | dB |
| | $ S_{21e} ^2 2$ | $V_{CE}=2V, I_C=3mA, f=1GHz$ | | 8.5 | | dB |
| Noise Figure | NF | $V_{CE}=5V, I_C=7mA, f=1GHz$ | | 1.0 | 1.8 | dB |



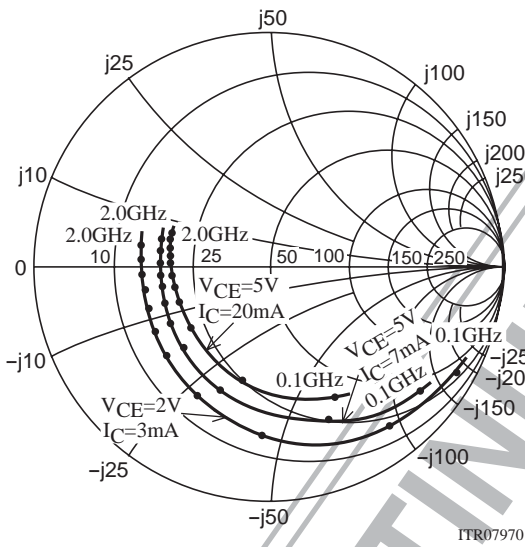
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S Parameters

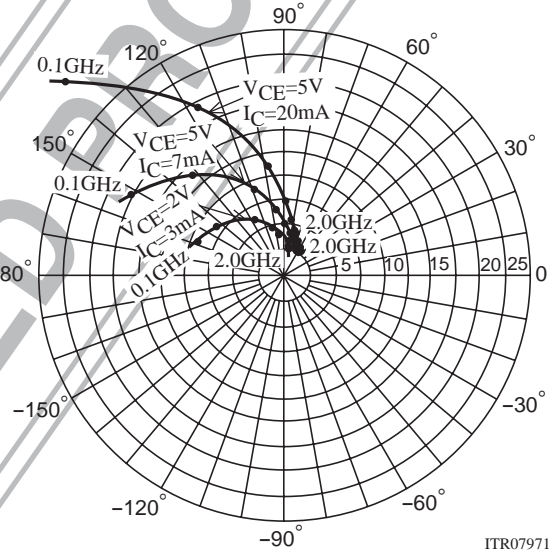
S11e

f=100MHz, 200MHz to 2000MHz(200MHz Step)



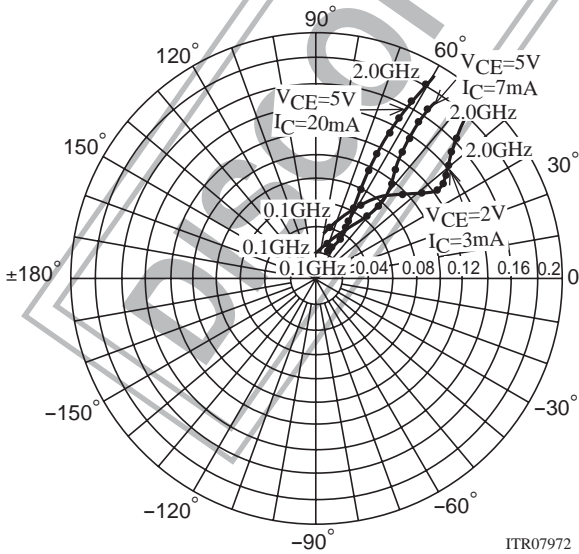
S21e

f=100MHz, 200MHz to 2000MHz(200MHz Step)



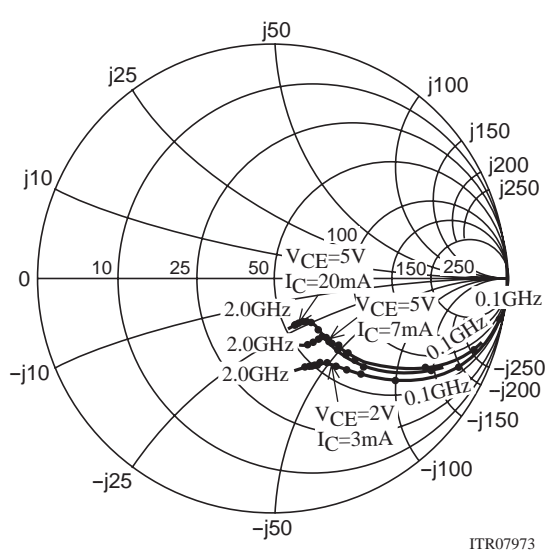
S12e

f=100MHz, 200MHz to 2000MHz(200MHz Step)



S22e

f=100MHz, 200MHz to 2000MHz(200MHz Step)



2SC5231

S parameters (Common emitter)

$V_{CE}=5V, I_C=7mA, Z_O=50\Omega$

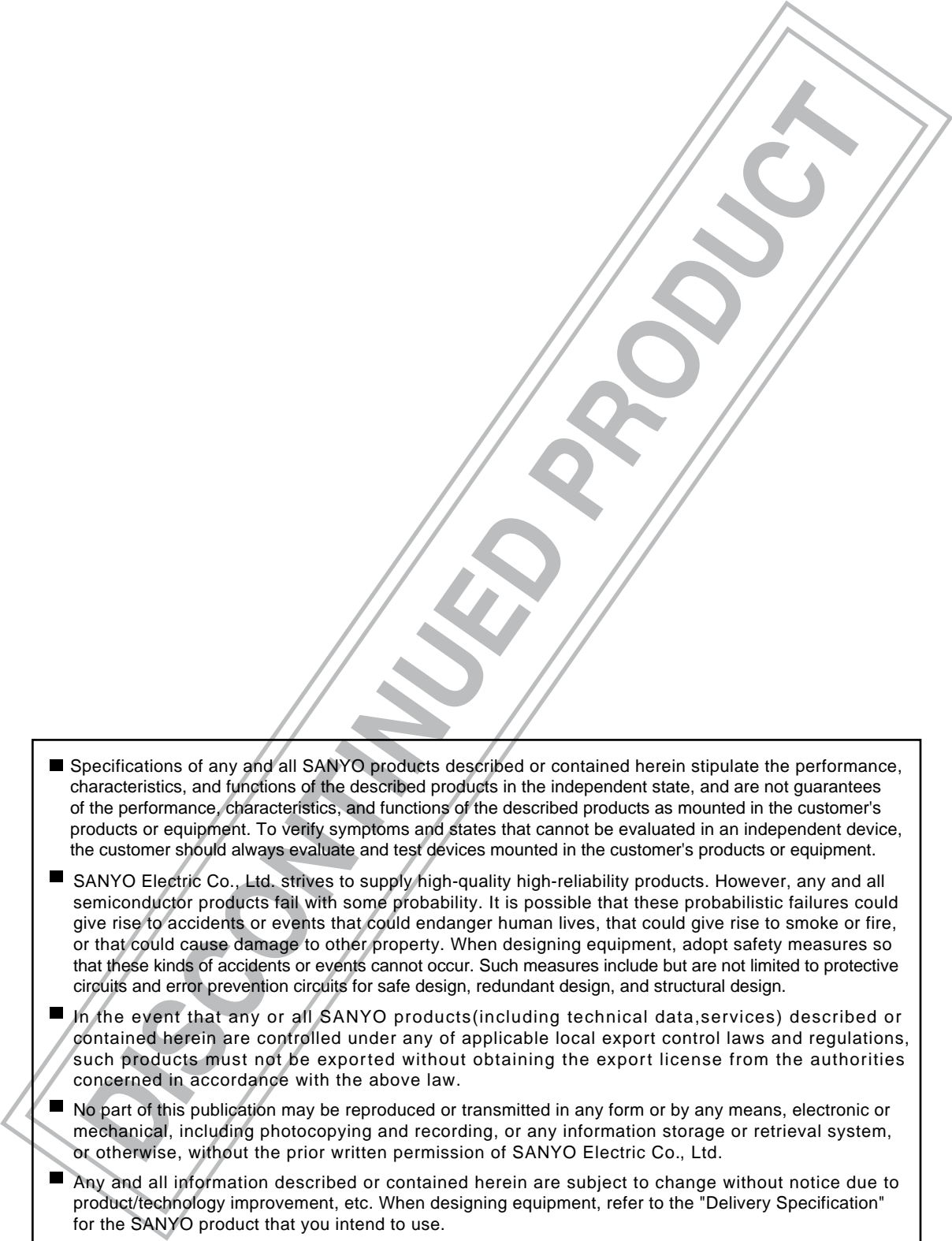
| Freq (MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.786 | -40.7 | 17.507 | 151.3 | 0.028 | 70.1 | 0.898 | -20.4 |
| 200 | 0.677 | -72.4 | 13.998 | 131.4 | 0.046 | 58.0 | 0.739 | -33.4 |
| 400 | 0.546 | -112.7 | 9.061 | 108.6 | 0.064 | 49.6 | 0.525 | -43.7 |
| 600 | 0.492 | -135.2 | 6.442 | 96.1 | 0.076 | 49.3 | 0.432 | -46.7 |
| 800 | 0.473 | -150.0 | 5.005 | 87.3 | 0.087 | 50.8 | 0.374 | -44.4 |
| 1000 | 0.465 | -160.0 | 4.073 | 80.4 | 0.099 | 52.6 | 0.346 | -49.7 |
| 1200 | 0.457 | -169.5 | 3.449 | 74.0 | 0.111 | 54.0 | 0.332 | -51.6 |
| 1400 | 0.451 | -176.2 | 2.989 | 68.6 | 0.124 | 55.2 | 0.321 | -54.1 |
| 1600 | 0.449 | 177.8 | 2.658 | 63.8 | 0.138 | 56.6 | 0.319 | -56.2 |
| 1800 | 0.454 | 172.5 | 2.378 | 58.4 | 0.151 | 56.7 | 0.313 | -60.0 |
| 2000 | 0.460 | 167.1 | 2.154 | 54.0 | 0.166 | 56.7 | 0.311 | -63.2 |

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

| Freq (MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.601 | -65.8 | 28.967 | 137.1 | 0.023 | 64.1 | 0.757 | -32.9 |
| 200 | 0.497 | -103.7 | 19.309 | 116.6 | 0.035 | 57.0 | 0.534 | -50.3 |
| 400 | 0.435 | -139.6 | 10.891 | 98.6 | 0.050 | 58.7 | 0.345 | -50.3 |
| 600 | 0.419 | -156.6 | 7.461 | 89.3 | 0.065 | 61.3 | 0.280 | -50.7 |
| 800 | 0.414 | -166.6 | 5.695 | 82.5 | 0.081 | 63.1 | 0.251 | -51.3 |
| 1000 | 0.413 | -174.0 | 4.613 | 77.0 | 0.098 | 63.8 | 0.235 | -52.9 |
| 1200 | 0.413 | 178.6 | 3.870 | 71.8 | 0.114 | 63.9 | 0.226 | -55.1 |
| 1400 | 0.411 | 173.8 | 3.345 | 66.9 | 0.131 | 63.6 | 0.221 | -57.7 |
| 1600 | 0.413 | 169.6 | 2.960 | 62.7 | 0.148 | 63.2 | 0.220 | -60.2 |
| 1800 | 0.416 | 165.1 | 2.655 | 58.0 | 0.165 | 61.8 | 0.219 | -64.8 |
| 2000 | 0.422 | 160.3 | 2.406 | 54.0 | 0.182 | 60.6 | 0.218 | -68.3 |

$V_{CE}=2V, I_C=3mA, Z_O=50\Omega$

| Freq (MHz) | $ S_{11} $ | $\angle S_{11}$ | $ S_{21} $ | $\angle S_{21}$ | $ S_{12} $ | $\angle S_{12}$ | $ S_{22} $ | $\angle S_{22}$ |
|------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|
| 100 | 0.888 | -30.2 | 9.280 | 158.6 | 0.038 | 73.6 | 0.949 | -15.1 |
| 200 | 0.815 | -56.4 | 8.218 | 141.3 | 0.067 | 60.5 | 0.849 | -26.9 |
| 400 | 0.690 | -96.0 | 6.074 | 116.7 | 0.098 | 45.1 | 0.657 | -41.1 |
| 600 | 0.616 | -120.7 | 4.517 | 101.4 | 0.112 | 38.4 | 0.539 | -47.6 |
| 800 | 0.584 | -138.0 | 3.610 | 90.4 | 0.120 | 35.8 | 0.475 | -51.2 |
| 1000 | 0.566 | -150.7 | 2.995 | 81.9 | 0.125 | 35.7 | 0.434 | -54.5 |
| 1200 | 0.555 | -161.2 | 2.540 | 74.2 | 0.131 | 36.5 | 0.410 | -57.5 |
| 1400 | 0.546 | -169.3 | 2.213 | 67.5 | 0.137 | 38.4 | 0.393 | -60.7 |
| 1600 | 0.541 | -176.4 | 1.982 | 62.0 | 0.143 | 40.7 | 0.391 | -64.0 |
| 1800 | 0.545 | 177.1 | 1.774 | 55.9 | 0.152 | 42.5 | 0.382 | -67.8 |
| 2000 | 0.547 | 170.9 | 1.614 | 50.9 | 0.163 | 44.7 | 0.381 | -72.1 |

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