

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5064

VHF~UHF Band Low Noise Amplifier Applications

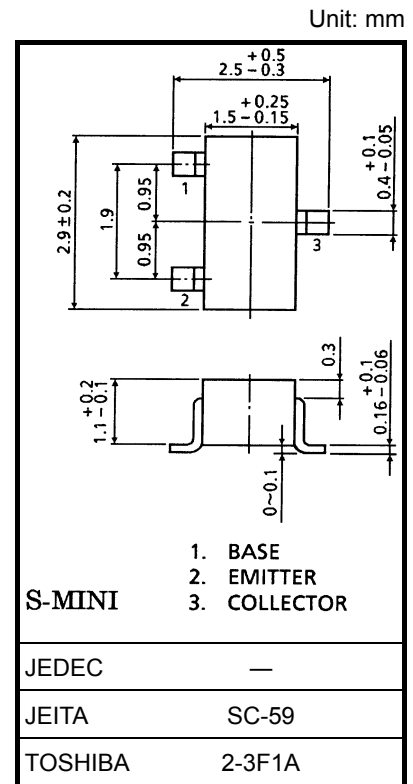
- Low noise figure, high gain.
- $NF = 1.1\text{dB}$, $|S_{21e}|^2 = 12\text{dB}$ ($f = 1\text{GHz}$)

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

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|---------|------------------|
| Collector-base voltage | V_{CBO} | 20 | V |
| Collector-emitter voltage | V_{CEO} | 12 | V |
| Emitter-base voltage | V_{EBO} | 3 | V |
| Base current | I_B | 15 | mA |
| Collector current | I_C | 30 | mA |
| Collector power dissipation | P_C | 150 | mW |
| Junction temperature | T_j | 125 | $^\circ\text{C}$ |
| Storage temperature range | T_{stg} | -55~125 | $^\circ\text{C}$ |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).



Weight: 0.012 g (typ.)

Microwave Characteristics ($T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|----------------------|-------------------|--|-----|------|-----|------|
| Transition frequency | f_T | $V_{CE} = 5\text{V}$, $I_C = 10\text{mA}$ | 5 | 7 | — | GHz |
| Insertion gain | $ S_{21e} ^2$ (1) | $V_{CE} = 5\text{V}$, $I_C = 10\text{mA}$, $f = 500\text{MHz}$ | — | 17 | — | dB |
| | $ S_{21e} ^2$ (2) | $V_{CE} = 5\text{V}$, $I_C = 10\text{mA}$, $f = 1\text{GHz}$ | 8.5 | 12 | — | |
| Noise figure | NF (1) | $V_{CE} = 5\text{V}$, $I_C = 3\text{mA}$, $f = 500\text{MHz}$ | — | 1 | — | dB |
| | NF (2) | $V_{CE} = 5\text{V}$, $I_C = 3\text{mA}$, $f = 1\text{GHz}$ | — | 1.1 | 2.0 | |

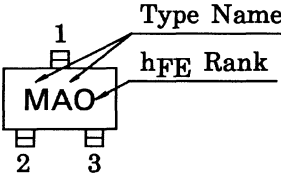
Electrical Characteristics ($T_a = 25^\circ\text{C}$)

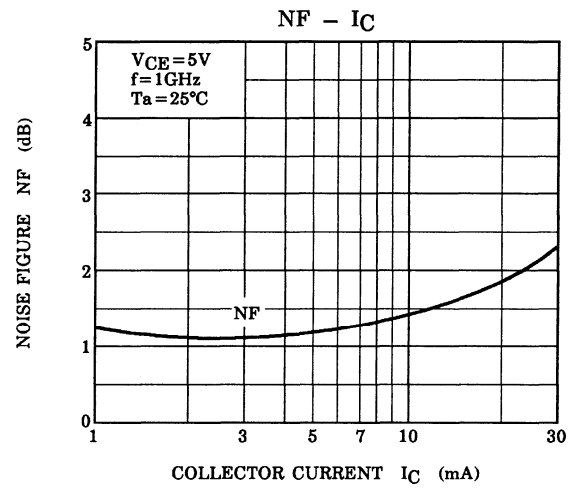
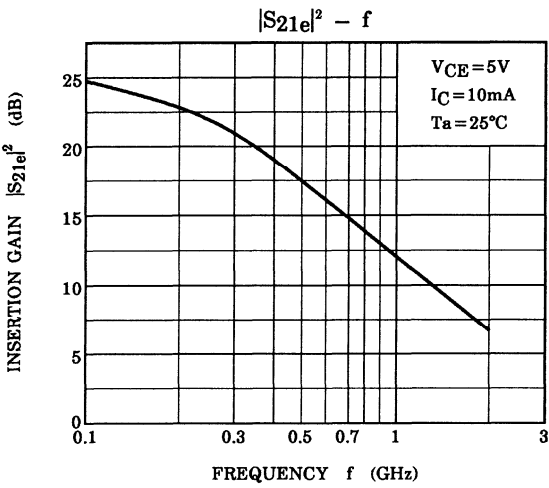
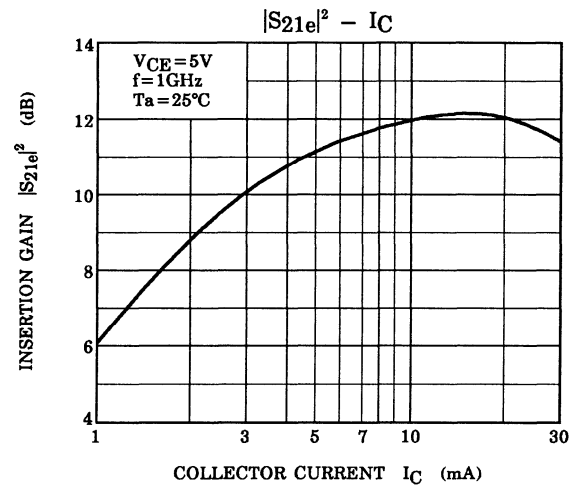
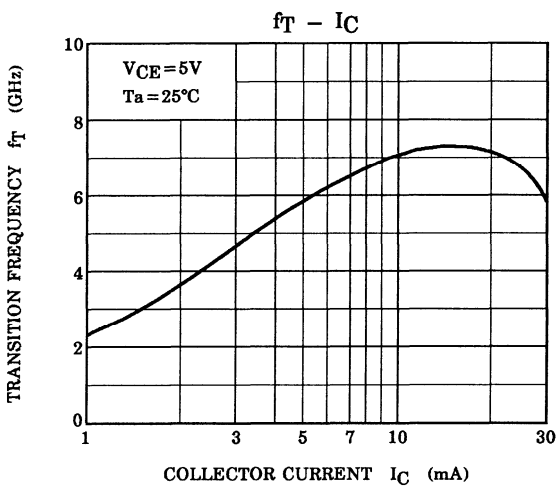
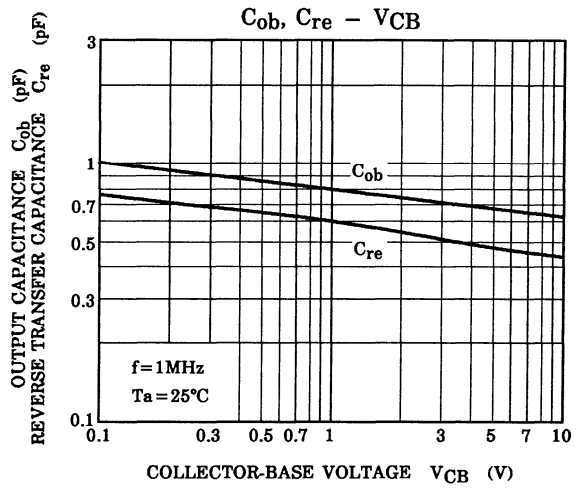
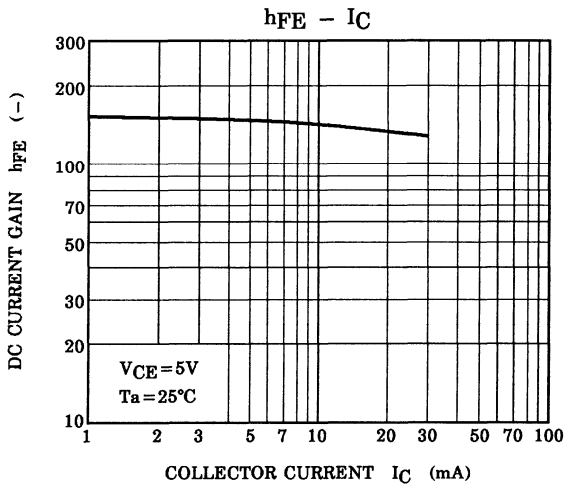
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|------------------------------|----------------------|---|-----|------|-----|---------------|
| Collector cut-off current | I_{CBO} | $V_{CB} = 10\text{V}$, $I_E = 0$ | — | — | 1 | μA |
| Emitter cut-off current | I_{EBO} | $V_{EB} = 1\text{V}$, $I_C = 0$ | — | — | 1 | μA |
| DC current gain | h_{FE} (Note 1) | $V_{CE} = 5\text{V}$, $I_C = 10\text{mA}$ | 80 | — | 240 | |
| Output capacitance | C_{ob} | $V_{CB} = 5\text{V}$, $I_E = 0$, $f = 1\text{MHz}$ (Note 2) | — | 0.7 | — | pF |
| Reverse transfer capacitance | C_{re} | | — | 0.45 | 0.9 | pF |

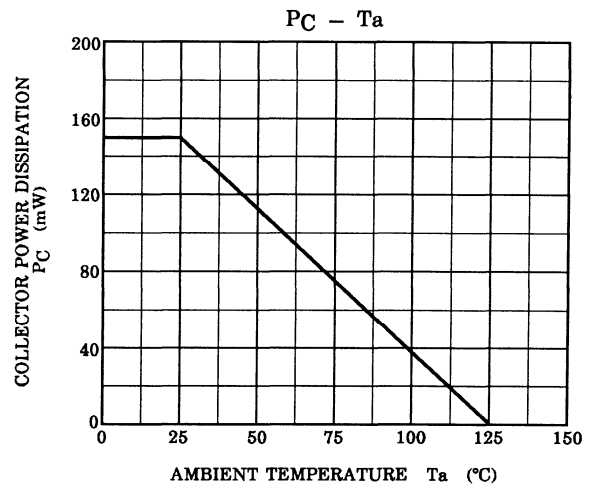
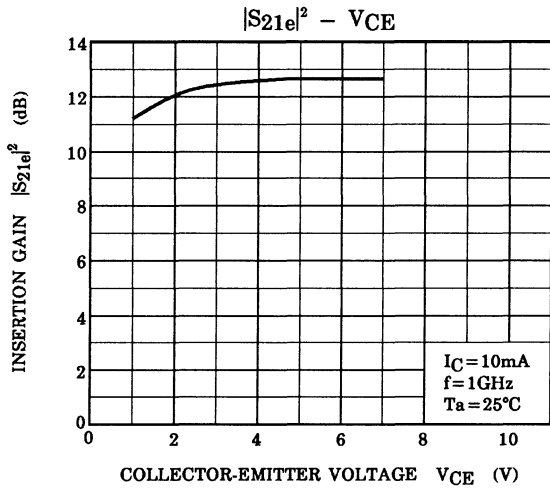
Note 1: h_{FE} classification O: 80~160, Y: 120~240

Note 2: C_{re} is measured by 3 terminal method with capacitance bridge.

Marking







S-Parameter $Z_O = 50 \Omega, T_a = 25^\circ\text{C}$

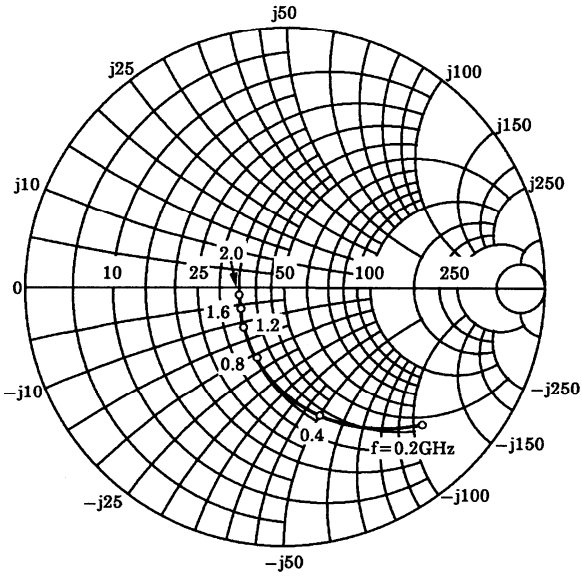
$V_{CE} = 5 \text{ V}, I_C = 5 \text{ mA}$

| Frequency (MHz) | S11 | | S21 | | S12 | | S22 | |
|--------------------|-------|--------|--------|-------|-------|------|-------|-------|
| | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. |
| 200 | 0.753 | -43.7 | 10.247 | 140.6 | 0.040 | 65.6 | 0.827 | -22.6 |
| 400 | 0.531 | -75.1 | 7.684 | 117.1 | 0.060 | 57.1 | 0.648 | -30.3 |
| 600 | 0.384 | -96.4 | 5.815 | 103.0 | 0.074 | 56.1 | 0.551 | -32.0 |
| 800 | 0.305 | -112.6 | 4.523 | 93.6 | 0.086 | 57.0 | 0.500 | -32.3 |
| 1000 | 0.255 | -126.5 | 3.788 | 86.3 | 0.099 | 58.9 | 0.472 | -32.4 |
| 1200 | 0.224 | -138.4 | 3.244 | 80.7 | 0.112 | 60.2 | 0.455 | -32.2 |
| 1400 | 0.203 | -150.1 | 2.833 | 75.4 | 0.127 | 60.3 | 0.442 | -32.6 |
| 1600 | 0.187 | -159.4 | 2.529 | 70.6 | 0.139 | 60.0 | 0.434 | -33.0 |
| 1800 | 0.174 | -166.5 | 2.283 | 66.7 | 0.150 | 60.3 | 0.429 | -32.6 |
| 2000 | 0.176 | -171.2 | 2.107 | 63.0 | 0.164 | 59.2 | 0.428 | -32.2 |

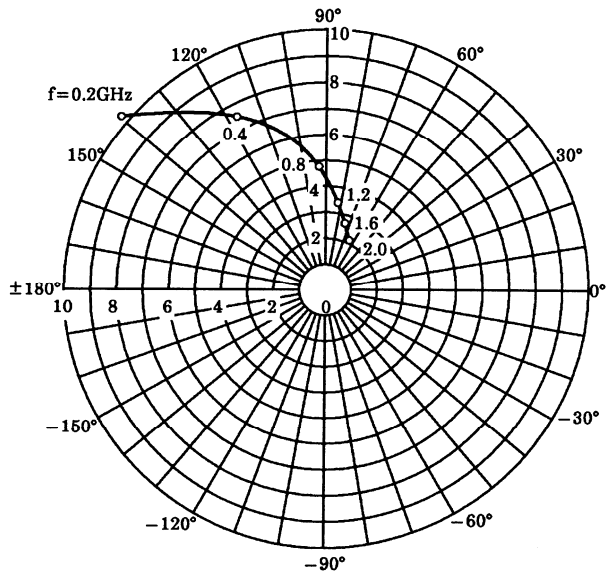
$V_{CE} = 5 \text{ V}, I_C = 10 \text{ mA}$

| Frequency (MHz) | S11 | | S21 | | S12 | | S22 | |
|--------------------|-------|--------|--------|-------|-------|------|-------|-------|
| | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. |
| 200 | 0.591 | -58.0 | 14.955 | 129.6 | 0.034 | 64.3 | 0.714 | -27.5 |
| 400 | 0.367 | -90.3 | 9.581 | 107.5 | 0.052 | 61.9 | 0.534 | -30.8 |
| 600 | 0.260 | -110.7 | 6.781 | 96.1 | 0.067 | 63.9 | 0.462 | -30.1 |
| 800 | 0.209 | -126.9 | 5.207 | 88.6 | 0.083 | 65.2 | 0.428 | -29.2 |
| 1000 | 0.178 | -141.8 | 4.269 | 82.5 | 0.100 | 66.4 | 0.412 | -28.6 |
| 1200 | 0.160 | -153.7 | 3.618 | 77.7 | 0.117 | 66.7 | 0.403 | -28.3 |
| 1400 | 0.150 | -166.3 | 3.152 | 72.7 | 0.135 | 65.4 | 0.398 | -28.8 |
| 1600 | 0.141 | -175.2 | 2.801 | 68.7 | 0.149 | 64.0 | 0.393 | -29.4 |
| 1800 | 0.130 | -178.2 | 2.521 | 65.0 | 0.163 | 63.4 | 0.392 | -29.0 |
| 2000 | 0.133 | -174.0 | 2.314 | 61.7 | 0.179 | 61.3 | 0.395 | -28.6 |

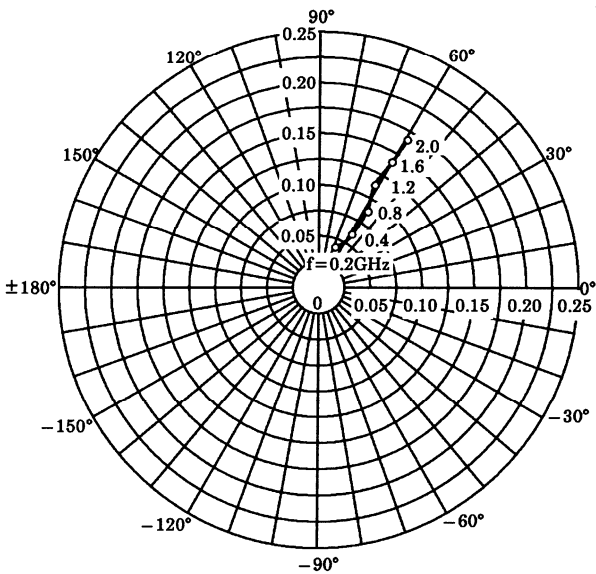
S11e
 VCE=5V
 IC=5mA
 Ta=25°C
 (UNIT : Ω)



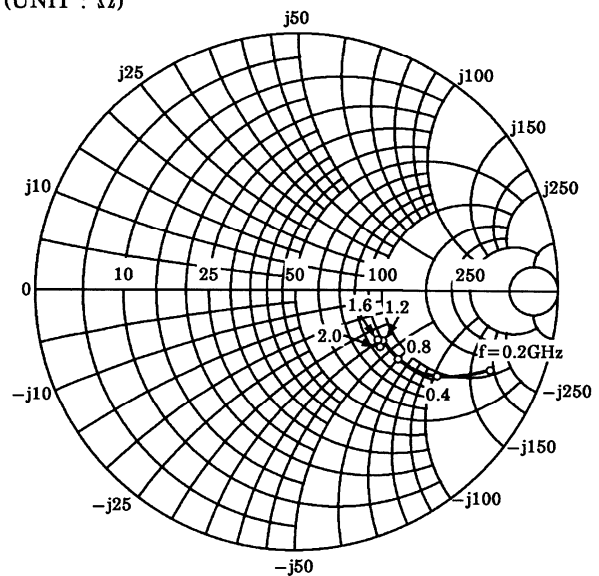
S21e
 VCE=5V
 IC=5mA
 Ta=25°C



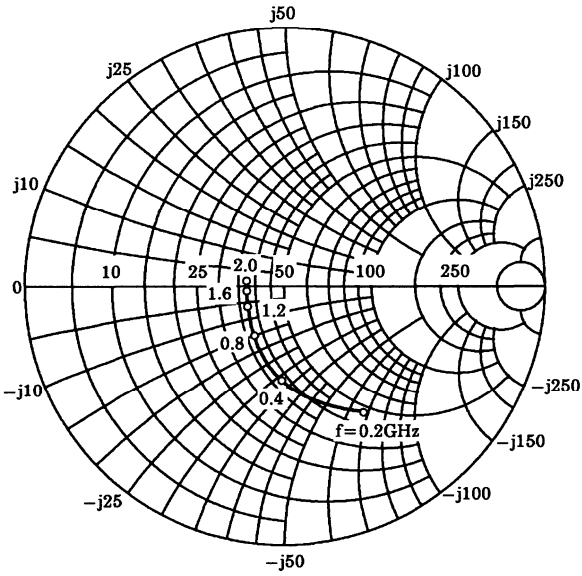
S12e
 VCE=5V
 IC=5mA
 Ta=25°C



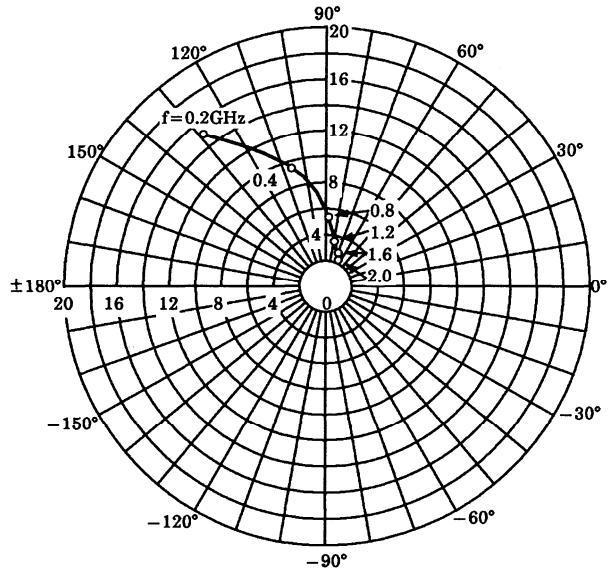
S22e
 VCE=5V
 IC=5mA
 Ta=25°C
 (UNIT : Ω)



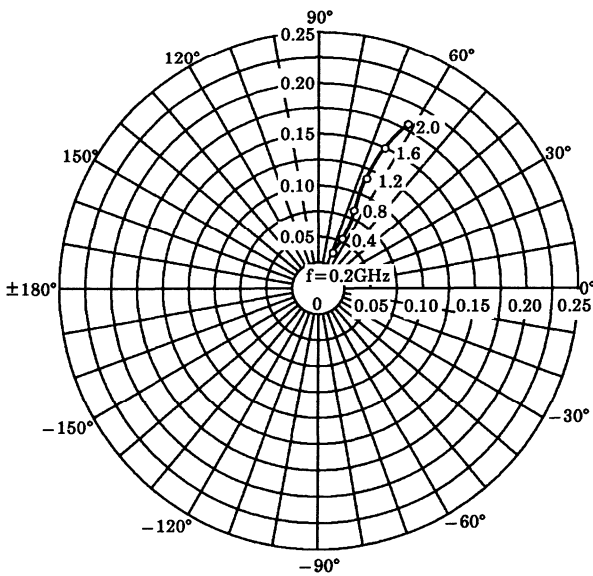
S11e
 VCE=5V
 IC=10mA
 Ta=25°C
 (UNIT : Ω)



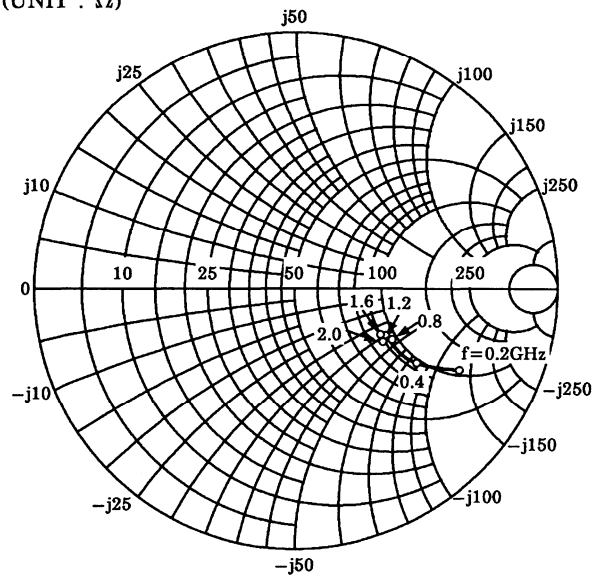
S21e
 VCE=5V
 IC=10mA
 Ta=25°C



S12e
 VCE=5V
 IC=10mA
 Ta=25°C



S22e
 VCE=5V
 IC=10mA
 Ta=25°C
 (UNIT : Ω)



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