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TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5096

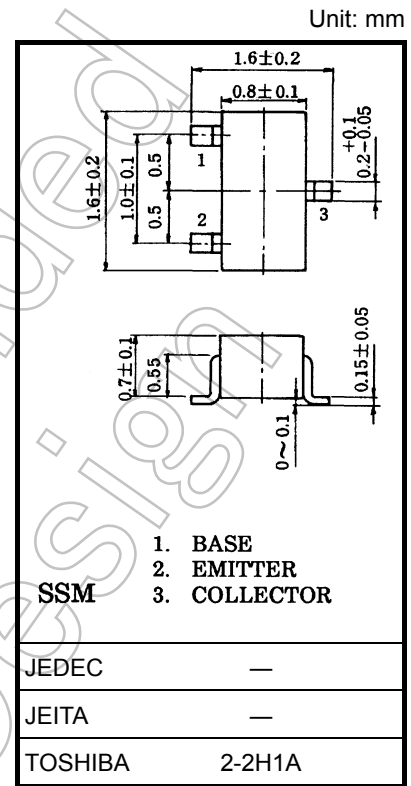
VHF~UHF Band Low Noise Amplifier Applications

- Low noise figure, high gain.
- $NF = 1.8\text{dB}$, $|S_{21e}|^2 = 7.5\text{dB}$ ($f = 2\text{GHz}$)

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} | 10 | V |
| Emitter-base voltage | V_{EBO} | 1.5 | V |
| Base current | I_B | 7 | mA |
| Collector current | I_C | 15 | mA |
| Collector power dissipation | P_C | 100 | mW |
| Junction temperature | T_j | 125 | $^\circ\text{C}$ |
| Storage temperature range | T_{stg} | -55 to 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: 2.4 mg (typ.)

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|----------------------|-------------------|---|-----|------|-----|------|
| Transition frequency | f_T | $V_{CE} = 6\text{V}$, $I_C = 7\text{mA}$ | 7 | 10 | — | GHz |
| Insertion gain | $ S_{21e} ^2$ (1) | $V_{CE} = 6\text{V}$, $I_C = 7\text{mA}$, $f = 1\text{GHz}$ | — | 13 | — | dB |
| | $ S_{21e} ^2$ (2) | $V_{CE} = 6\text{V}$, $I_C = 7\text{mA}$, $f = 2\text{GHz}$ | 4.5 | 7.5 | — | |
| Noise figure | NF (1) | $V_{CE} = 6\text{V}$, $I_C = 3\text{mA}$, $f = 1\text{GHz}$ | — | 1.4 | — | dB |
| | NF (2) | $V_{CE} = 6\text{V}$, $I_C = 3\text{mA}$, $f = 2\text{GHz}$ | — | 1.8 | 3.0 | |

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

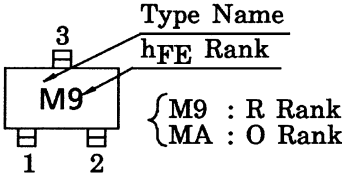
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|------------------------------|----------------------|--|-----|------|------|---------------|
| Collector cut-off current | I_{CBO} | $V_{CB} = 10\text{V}$, $I_E = 0$ | — | — | 1 | μA |
| Emitter cut-off current | I_{EBO} | $V_{EB} = 1\text{V}$, $I_C = 0$ | — | — | 1 | μA |
| DC current gain | h_{FE} (Note 1) | $V_{CE} = 6\text{V}$, $I_C = 7\text{mA}$ | 50 | — | 160 | |
| Output capacitance | C_{ob} | $V_{CB} = 10\text{V}$, $I_E = 0$, $f = 1\text{MHz}$ (Note 2) | — | 0.5 | — | pF |
| Reverse transfer capacitance | C_{re} | | — | 0.4 | 0.85 | pF |

Note 1: h_{FE} classification R: 50 to 100, O: 80 to 160

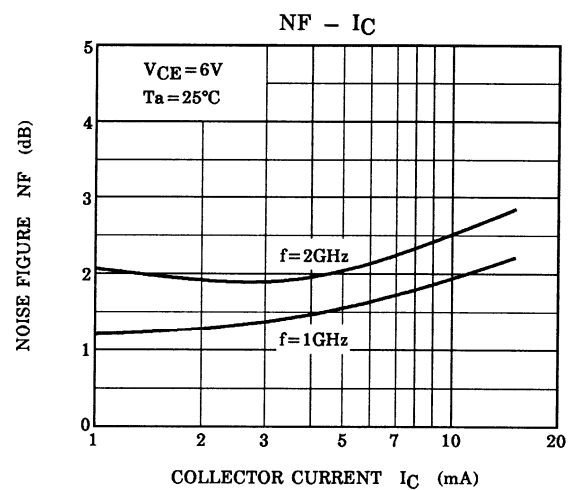
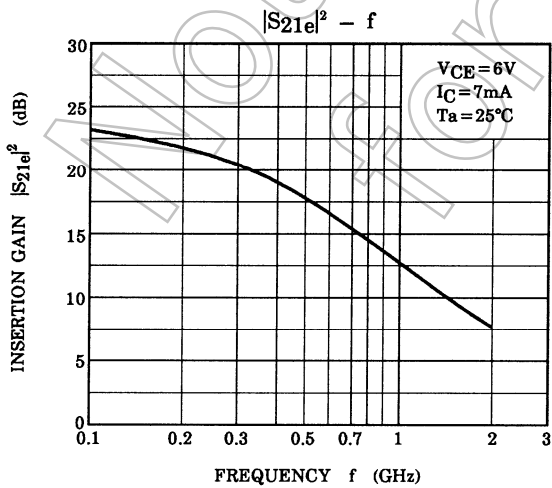
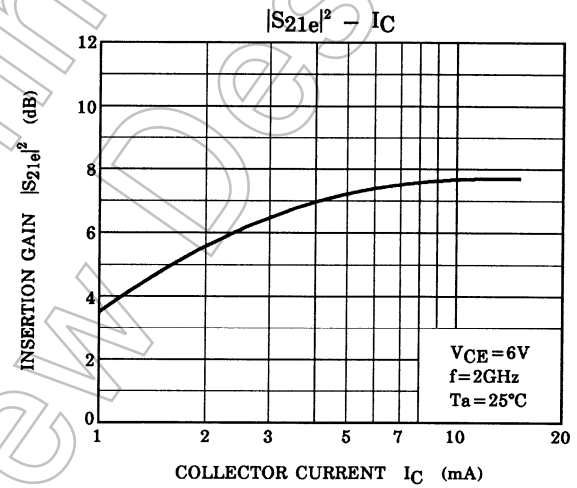
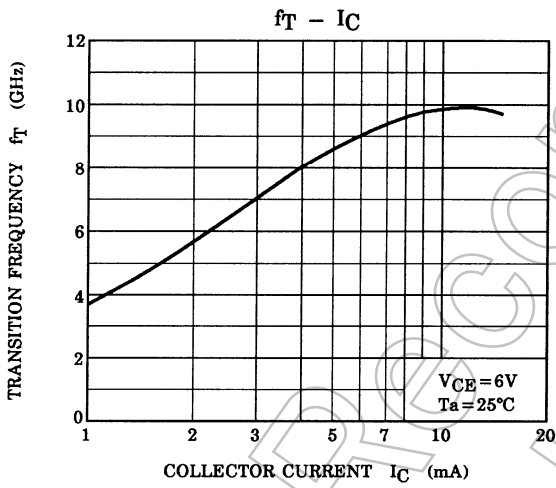
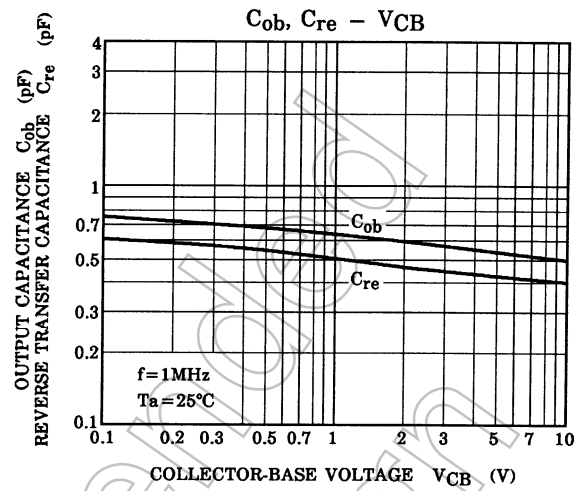
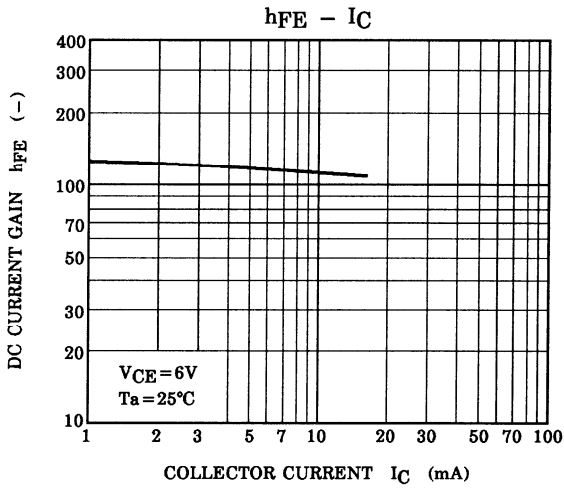
Note 2: C_{re} is measured by 3 terminal method with capacitance bridge.

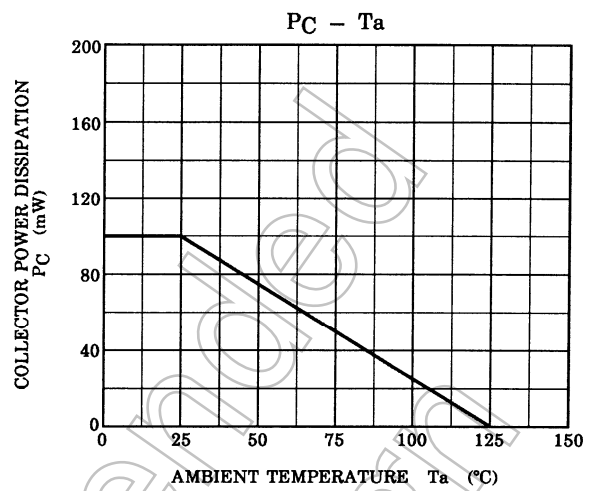
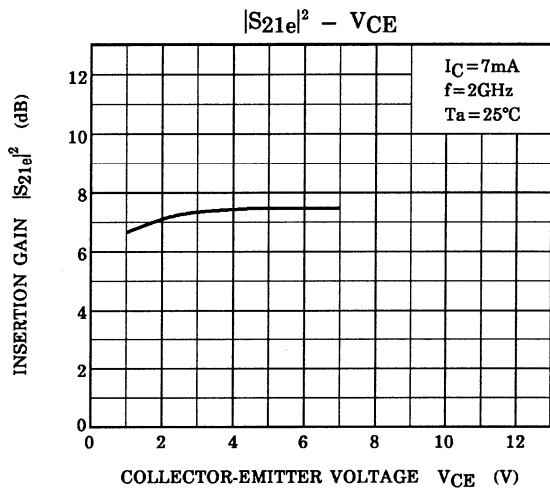
Start of commercial production
1993-10

Marking



Not Recommended
for New Design





S-Parameter $Z_0 = 50 \Omega$, $T_a = 25^\circ\text{C}$

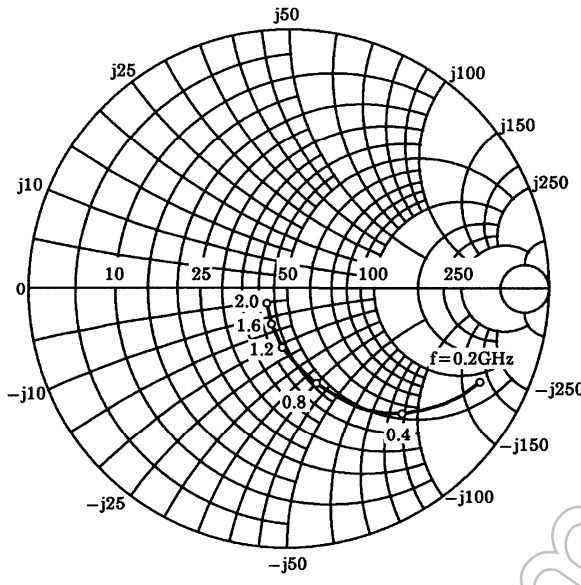
$V_{CE} = 6\text{ V}$, $I_C = 3\text{ mA}$

| Frequency (MHz) | S11 | | S21 | | S12 | | S22 | |
|--------------------|-------|--------|-------|-------|-------|------|-------|-------|
| | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. |
| 200 | 0.835 | -26.1 | 7.069 | 150.4 | 0.046 | 71.0 | 0.899 | -19.3 |
| 400 | 0.665 | -46.5 | 5.948 | 130.4 | 0.076 | 60.5 | 0.745 | -30.3 |
| 600 | 0.501 | -62.7 | 5.021 | 115.2 | 0.095 | 55.7 | 0.630 | -35.9 |
| 800 | 0.386 | -74.3 | 4.173 | 104.3 | 0.111 | 53.7 | 0.552 | -38.5 |
| 1000 | 0.297 | -83.7 | 3.592 | 95.6 | 0.124 | 53.2 | 0.500 | -39.9 |
| 1200 | 0.226 | -92.7 | 3.140 | 88.5 | 0.137 | 53.6 | 0.465 | -41.1 |
| 1400 | 0.175 | -101.9 | 2.808 | 82.3 | 0.152 | 54.1 | 0.442 | -42.2 |
| 1600 | 0.130 | -113.4 | 2.514 | 76.6 | 0.165 | 54.2 | 0.421 | -43.8 |
| 1800 | 0.103 | -128.0 | 2.293 | 71.7 | 0.179 | 53.9 | 0.405 | -45.7 |
| 2000 | 0.081 | -147.4 | 2.114 | 67.3 | 0.193 | 54.8 | 0.388 | -47.4 |

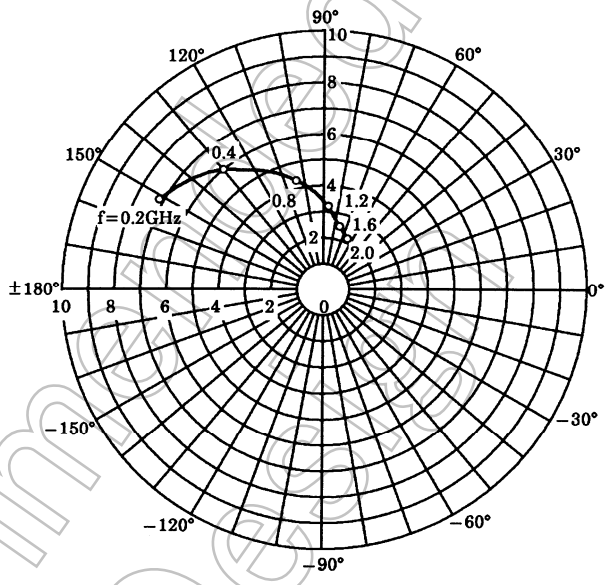
$V_{CE} = 6\text{ V}$, $I_C = 7\text{ mA}$

| Frequency (MHz) | S11 | | S21 | | S12 | | S22 | |
|--------------------|-------|--------|--------|-------|-------|------|-------|-------|
| | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. |
| 200 | 0.668 | -40.0 | 12.306 | 138.9 | 0.040 | 67.3 | 0.786 | -27.0 |
| 400 | 0.427 | -64.4 | 8.852 | 116.1 | 0.061 | 61.6 | 0.579 | -35.0 |
| 600 | 0.280 | -79.5 | 6.591 | 102.9 | 0.078 | 61.8 | 0.476 | -35.9 |
| 800 | 0.193 | -89.7 | 5.191 | 94.3 | 0.096 | 62.5 | 0.420 | -35.0 |
| 1000 | 0.134 | -99.3 | 4.288 | 87.8 | 0.112 | 63.2 | 0.390 | -34.2 |
| 1200 | 0.088 | -112.3 | 3.661 | 81.9 | 0.130 | 63.8 | 0.374 | -34.0 |
| 1400 | 0.056 | -129.8 | 3.232 | 76.9 | 0.150 | 63.4 | 0.366 | -34.8 |
| 1600 | 0.035 | -169.0 | 2.857 | 72.1 | 0.168 | 62.5 | 0.356 | -36.6 |
| 1800 | 0.040 | 157.0 | 2.574 | 68.1 | 0.185 | 61.4 | 0.347 | -39.0 |
| 2000 | 0.054 | 131.5 | 2.363 | 64.3 | 0.203 | 61.3 | 0.338 | -40.2 |

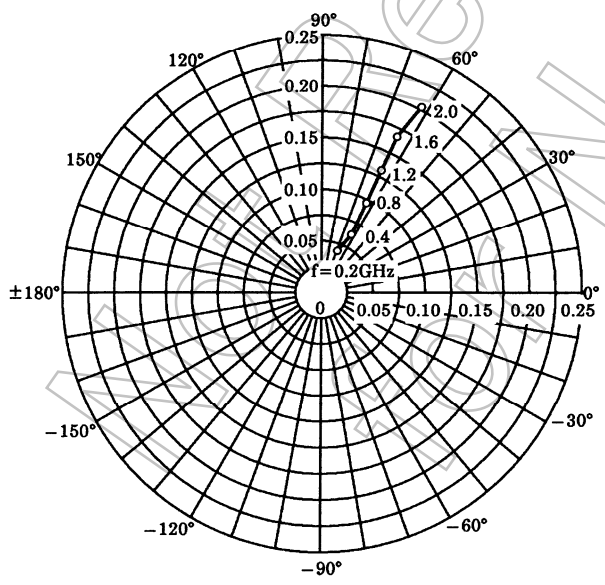
S11e
 $V_{CE} = 6V$
 $I_C = 3mA$
 $T_a = 25^\circ C$
 (UNIT : Ω)



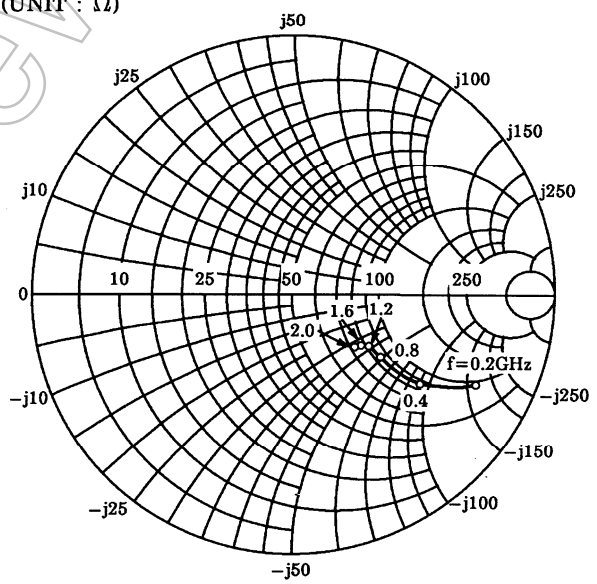
S21e
 $V_{CE} = 6V$
 $I_C = 3mA$
 $T_a = 25^\circ C$



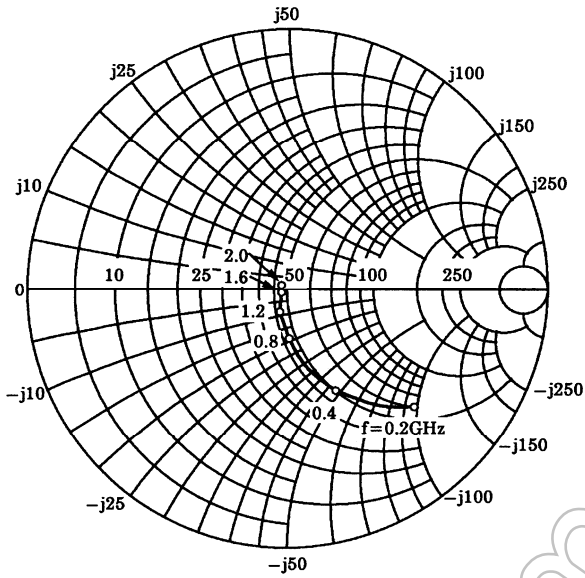
S12e
 $V_{CE} = 6V$
 $I_C = 7mA$
 $T_a = 25^\circ C$



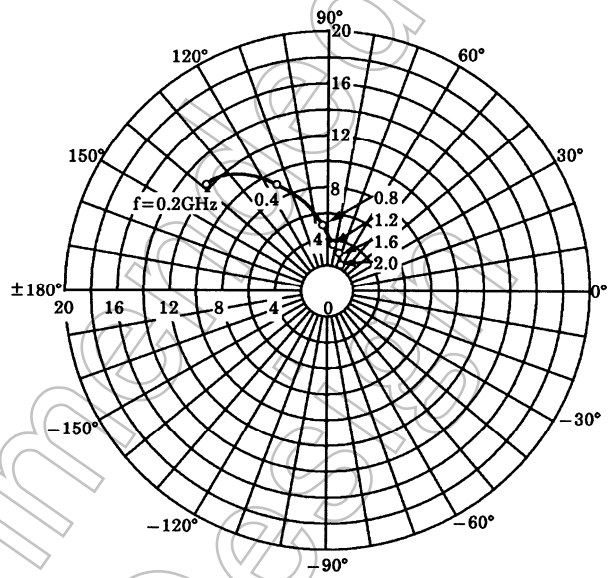
S22e
 $V_{CE} = 6V$
 $I_C = 7mA$
 $T_a = 25^\circ C$
 (UNIT : Ω)



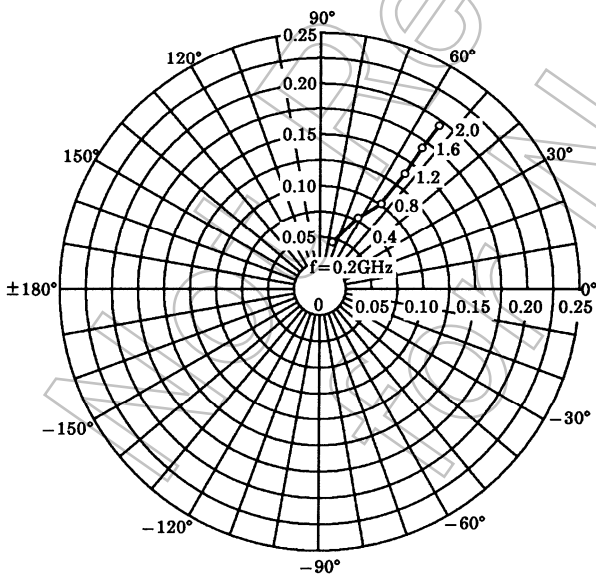
S11e
 $V_{CE} = 6V$
 $I_C = 7mA$
 $T_a = 25^\circ C$
 (UNIT : Ω)



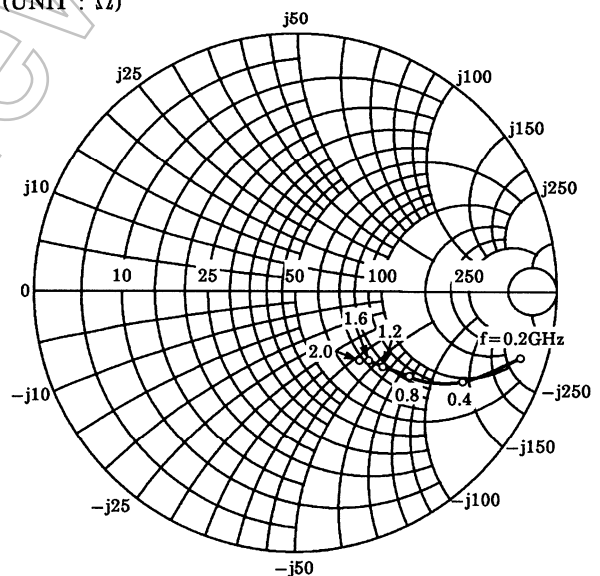
S21e
 $V_{CE} = 6V$
 $I_C = 7mA$
 $T_a = 25^\circ C$



S12e
 $V_{CE} = 6V$
 $I_C = 3mA$
 $T_a = 25^\circ C$



S22e
 $V_{CE} = 6V$
 $I_C = 3mA$
 $T_a = 25^\circ C$
 (UNIT : Ω)



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