

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5066

## VHF~UHF Band Low Noise Amplifier Applications

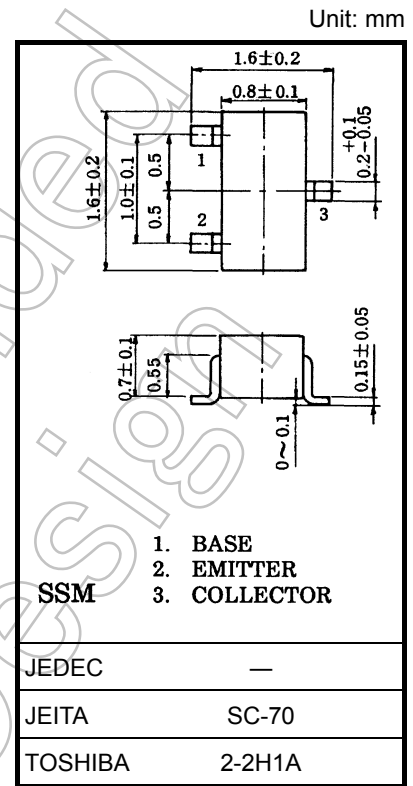
- Low noise figure, high gain.
- $NF = 1.1\text{dB}$ ,  $|S_{21e}|^2 = 12\text{dB}$  ( $f = 1\text{GHz}$ )

### 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 | $P_C$     | 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 | $f_T$             | $V_{CE} = 5\text{V}$ , $I_C = 10\text{mA}$                       | 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 ( $T_a = 25^\circ\text{C}$ )

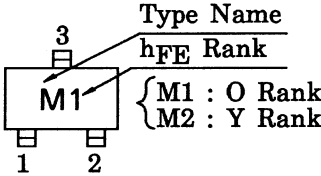
| Characteristics              | Symbol               | Test Condition  | Min | Typ. | Max | Unit          |
|------------------------------|----------------------|---|-----|------|-----|---------------|
| Collector cut-off current    | $I_{CBO}$            | $V_{CB} = 10\text{V}$ , $I_E = 0$                             | —   | —    | 1   | $\mu\text{A}$ |
| Emitter cut-off current      | $I_{EBO}$            | $V_{EB} = 1\text{V}$ , $I_C = 0$                              | —   | —    | 1   | $\mu\text{A}$ |
| DC current gain              | $h_{FE}$<br>(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 to 160, Y: 120 to 240

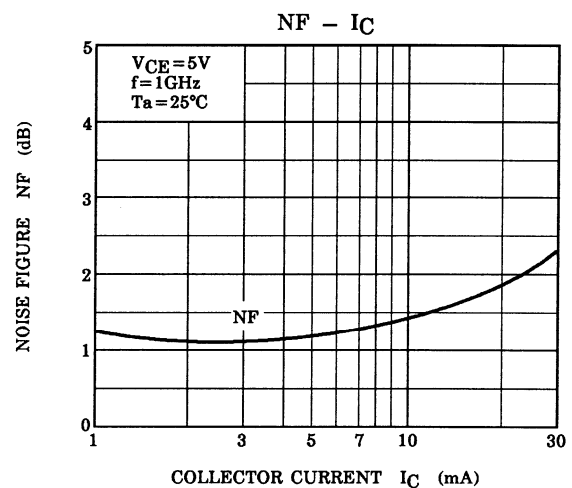
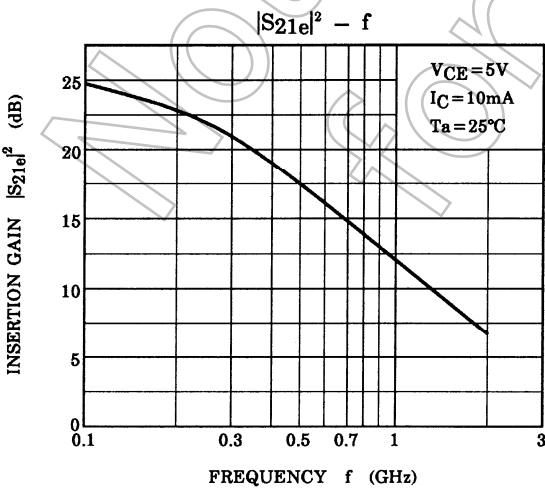
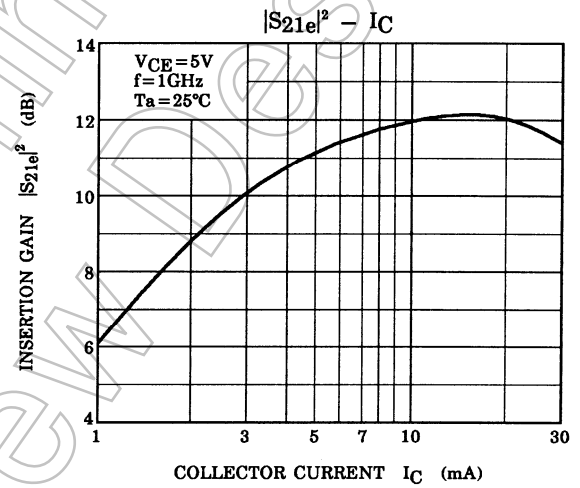
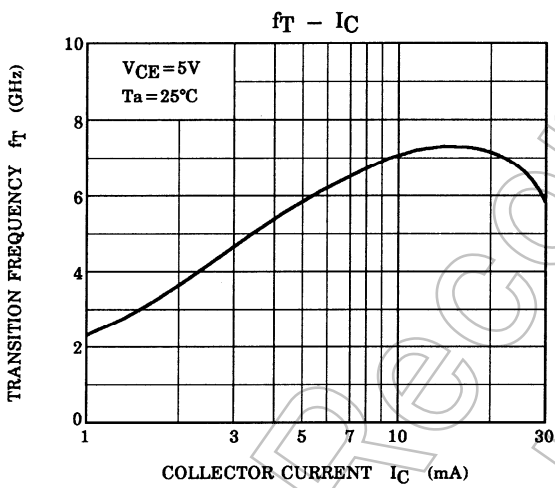
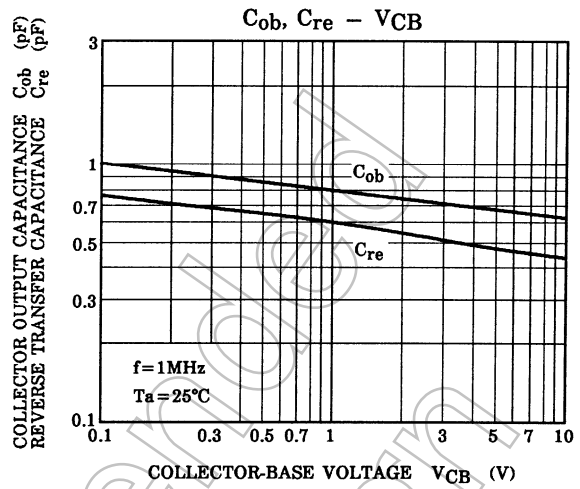
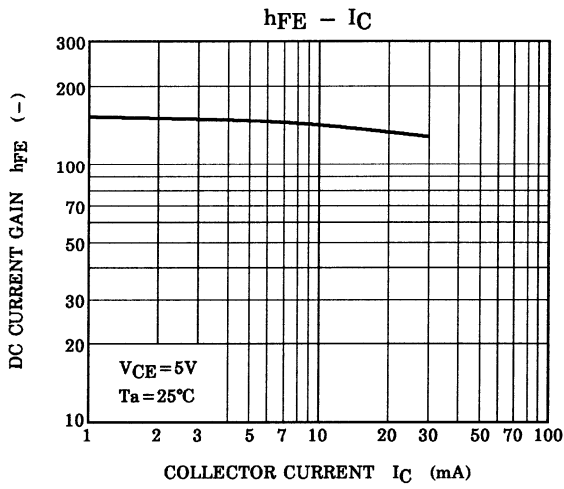
Note 2:  $C_{re}$  is measured by 3 terminal method with capacitance bridge.

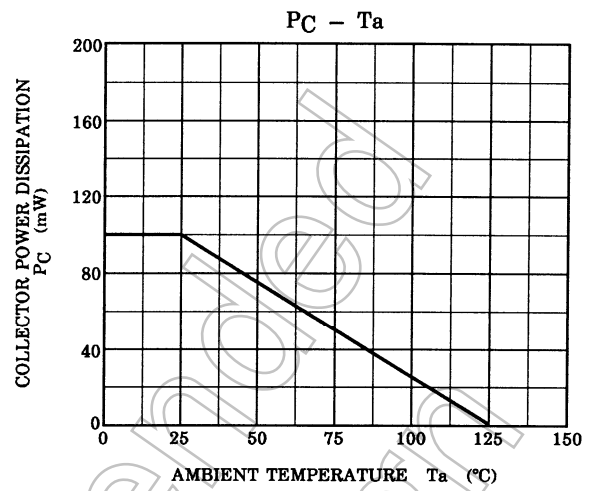
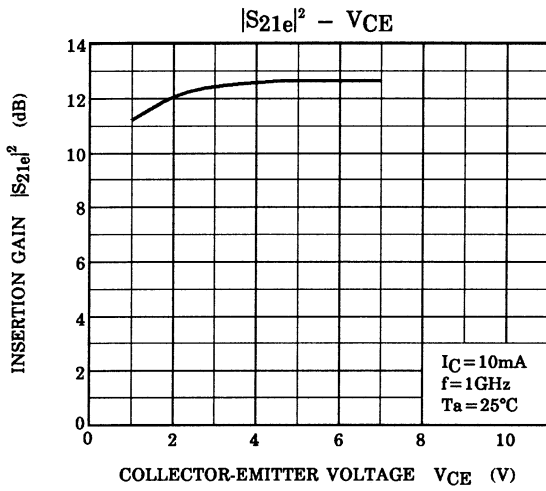
Start of commercial production  
1993-07

**Marking**



Not Recommended  
for New Design





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

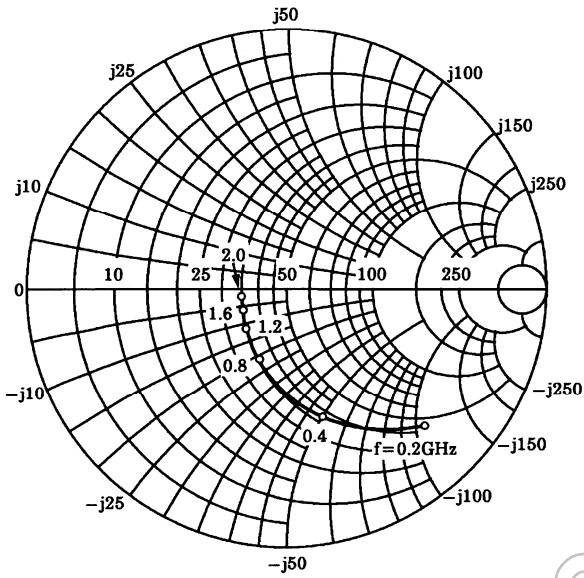
**$V_{CE} = 5 \text{ V}, I_C = 5 \text{ mA}$**

| Frequency<br>(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 |

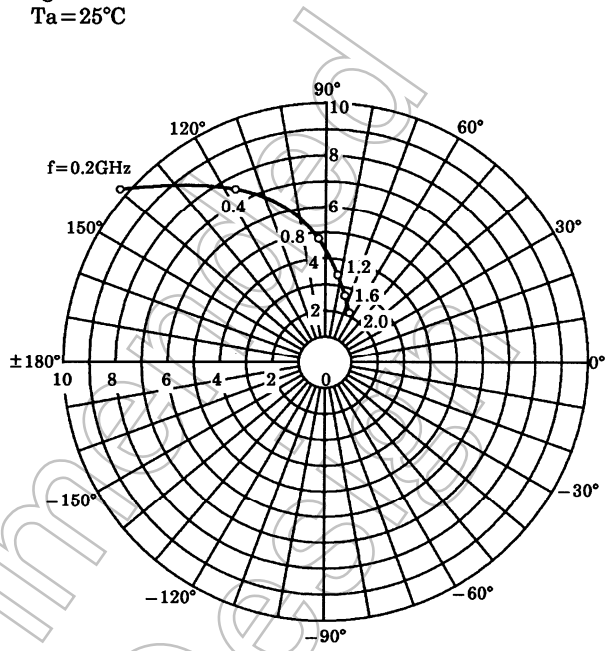
**$V_{CE} = 5 \text{ V}, I_C = 10 \text{ mA}$**

| Frequency<br>(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 |

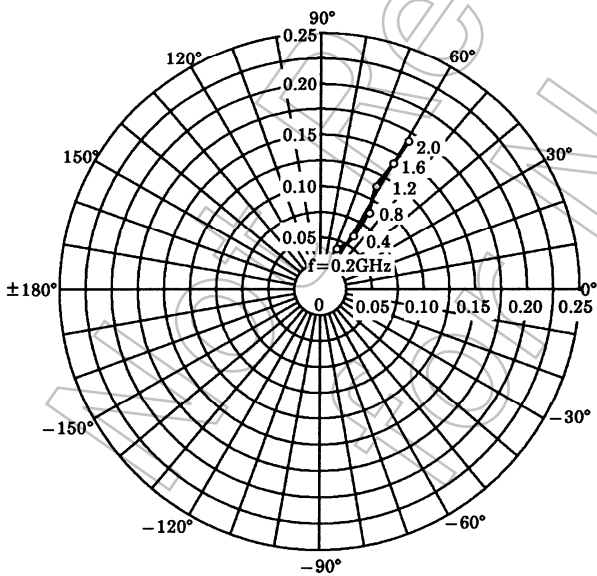
S11e  
 VCE=5V  
 IC=5mA  
 Ta=25°C  
 (UNIT : Ω)



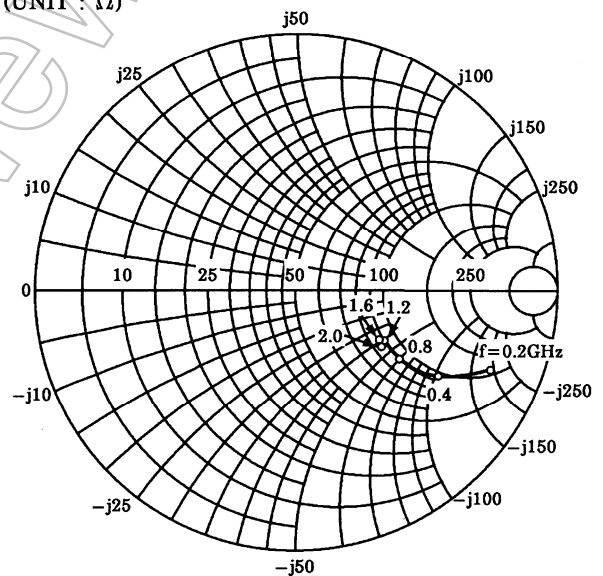
S21e  
 VCE=5V  
 IC=5mA  
 Ta=25°C



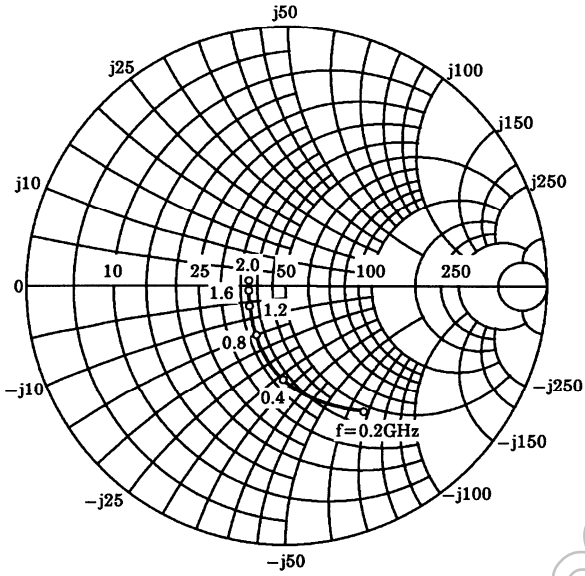
S12e  
 VCE=5V  
 IC=5mA  
 Ta=25°C



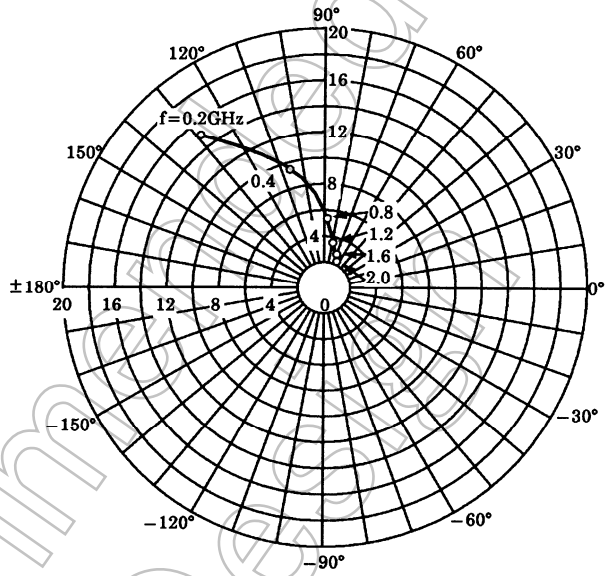
S22e  
 VCE=5V  
 IC=5mA  
 Ta=25°C  
 (UNIT : Ω)



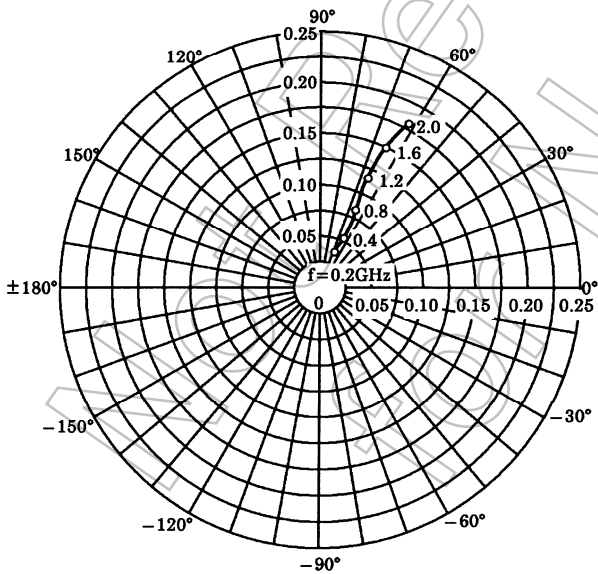
S11e  
 VCE=5V  
 IC=10mA  
 Ta=25°C  
 (UNIT : Ω)



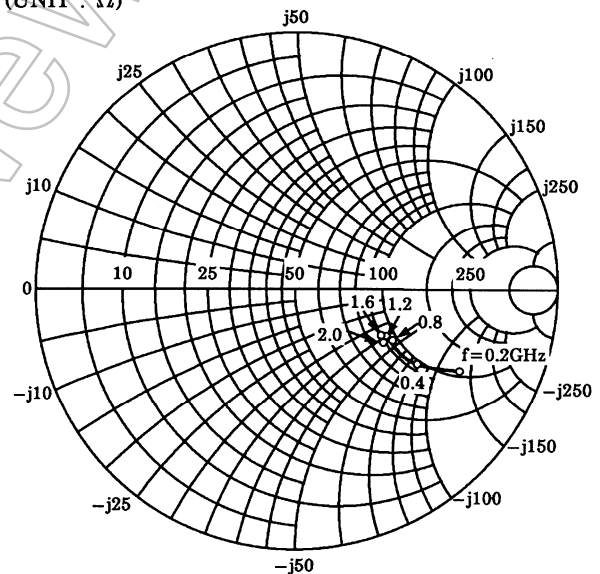
S21e  
 VCE=5V  
 IC=10mA  
 Ta=25°C



S12e  
 VCE=5V  
 IC=10mA  
 Ta=25°C



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



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