

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5086

## VHF~UHF Band Low Noise Amplifier Applications

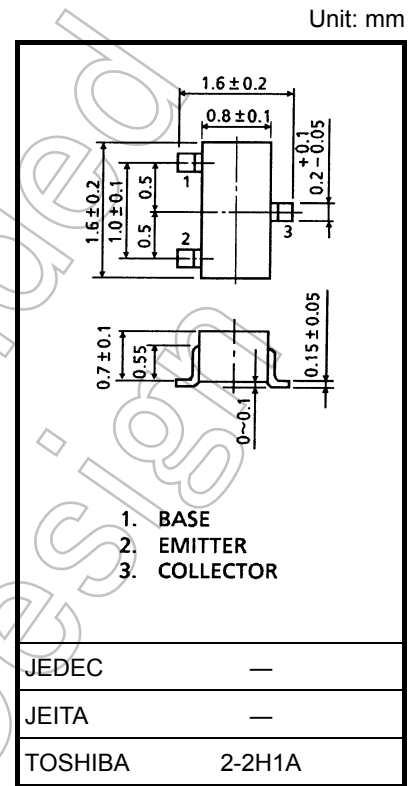
- Low noise figure, high gain.
- $NF = 1.1\text{dB}$ ,  $|S_{21e}|^2 = 11\text{dB}$  ( $f = 1\text{GHz}$ )

### 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                | $I_B$     | 40         | mA               |
| Collector current           | $I_C$     | 80         | 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 | $f_T$             | $V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$                       | 5   | 7    | —   | GHz  |
| Insertion gain       | $ S_{21e} ^2 (1)$ | $V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$ , $f = 500\text{MHz}$ | —   | 16.5 | —   | dB   |
|                      | $ S_{21e} ^2 (2)$ | $V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$ , $f = 1\text{GHz}$   | 7.5 | 11   | —   |      |
| Noise figure         | NF (1)            | $V_{CE} = 10\text{V}$ , $I_C = 5\text{mA}$ , $f = 500\text{MHz}$  | —   | 1    | —   | dB   |
|                      | NF (2)            | $V_{CE} = 10\text{V}$ , $I_C = 5\text{mA}$ , $f = 1\text{GHz}$    | —   | 1.1  | 2   |      |

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

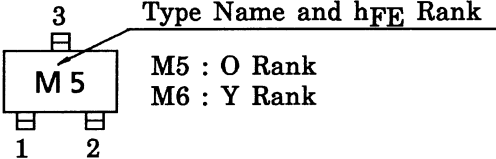
| Characteristics              | Symbol               | Test Condition   | Min | Typ. | Max  | Unit          |
|------------------------------|----------------------|--|-----|------|------|---------------|
| Collector cut-off current    | $I_{CBO}$            | $V_{CB} = 10\text{V}$ , $I_E = 0$                              | —   | —    | 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) | $V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$                    | 80  | —    | 240  |               |
| Output capacitance           | $C_{ob}$             | $V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$ (Note 2) | —   | 1.0  | —    | pF            |
| Reverse transfer capacitance | $C_{re}$             |  | —   | 0.65 | 1.15 | pF            |

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

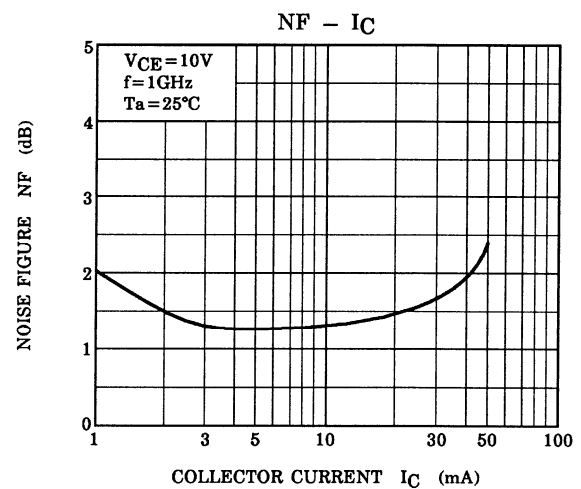
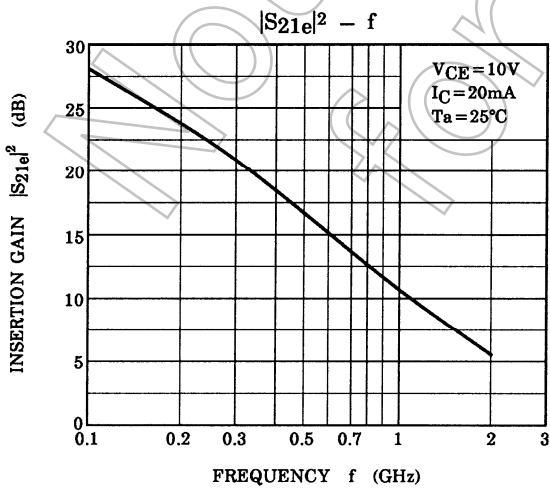
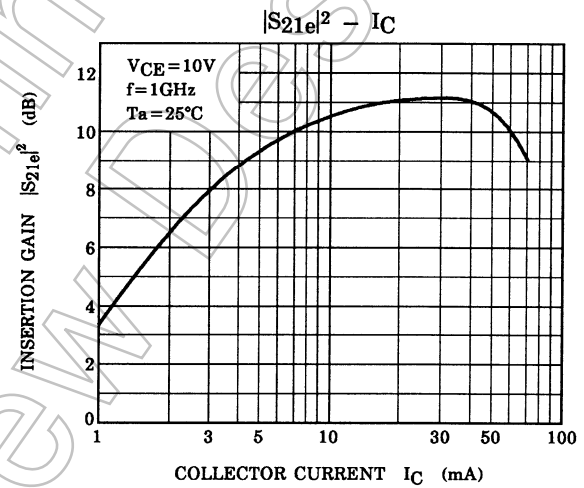
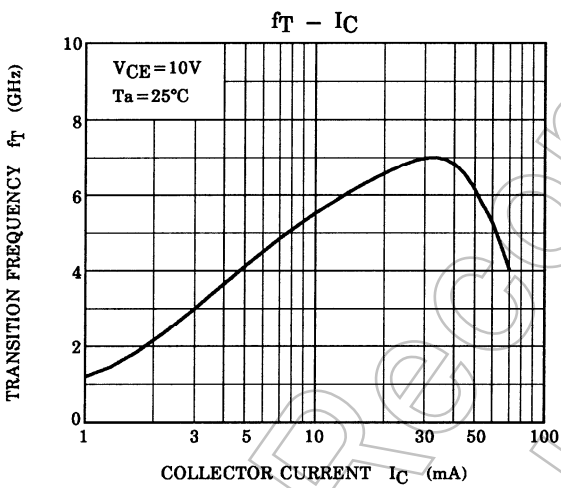
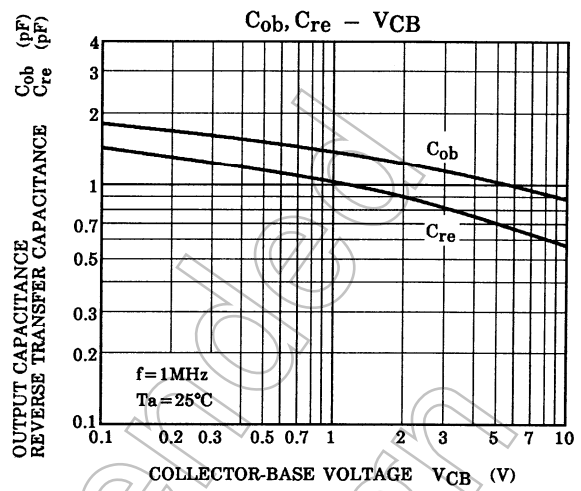
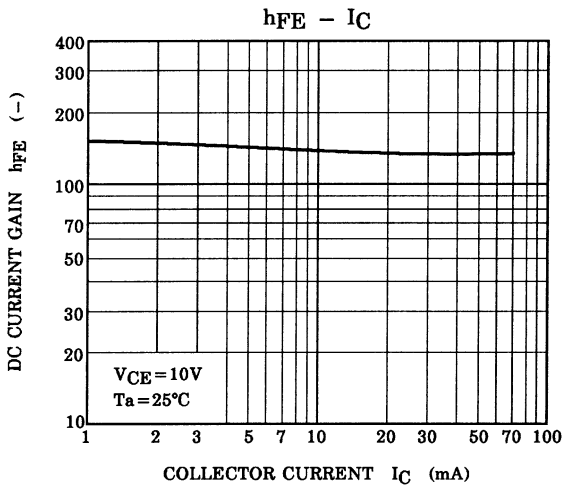
Note 2:  $C_{re}$  is measured by 3 terminal method with capacitance bridge.

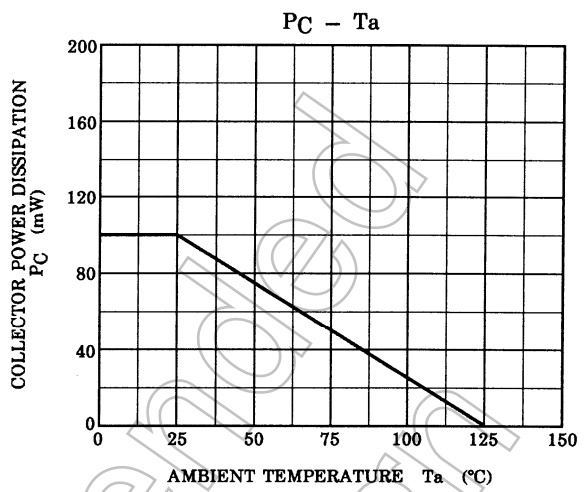
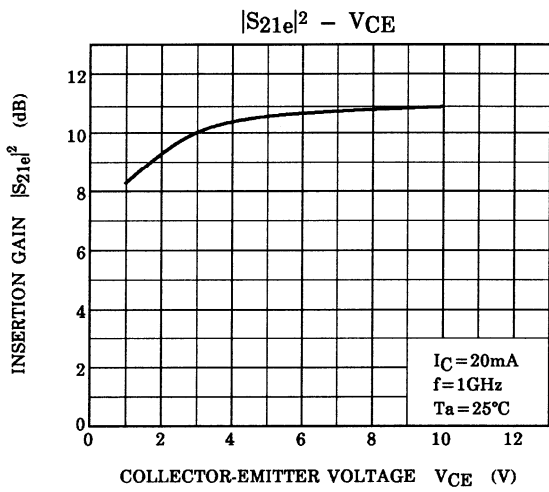
Start of commercial production  
1993-10

**Marking**



Not Recommended  
for New Design





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

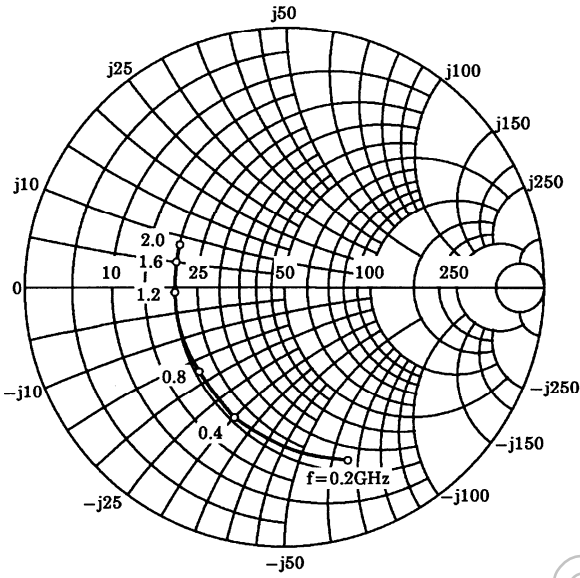
**$V_{CE} = 10 \text{ V}, I_C = 5 \text{ mA}$**

| Frequency<br>(MHz) | S11   |        | S21   |       | S12   |      | S22   |       |
|--------------------|-------|--------|-------|-------|-------|------|-------|-------|
|                    | Mag.  | Ang.   | Mag.  | Ang.  | Mag.  | Ang. | Mag.  | Ang.  |
| 200                | 0.715 | -69.3  | 9.495 | 132.1 | 0.051 | 55.2 | 0.747 | -29.0 |
| 400                | 0.542 | -112.4 | 6.482 | 108.5 | 0.068 | 46.8 | 0.555 | -35.1 |
| 600                | 0.476 | -137.7 | 4.717 | 95.8  | 0.077 | 47.9 | 0.478 | -36.2 |
| 800                | 0.447 | -154.4 | 3.691 | 87.1  | 0.086 | 51.6 | 0.442 | -37.1 |
| 1000               | 0.435 | -166.8 | 3.049 | 79.9  | 0.096 | 55.9 | 0.424 | -38.9 |
| 1200               | 0.433 | -176.6 | 2.611 | 73.9  | 0.108 | 60.4 | 0.418 | -41.8 |
| 1400               | 0.435 | 174.8  | 2.294 | 68.3  | 0.123 | 64.2 | 0.411 | -45.0 |
| 1600               | 0.439 | 167.3  | 2.050 | 63.2  | 0.140 | 66.9 | 0.407 | -49.0 |
| 1800               | 0.444 | 160.6  | 1.860 | 58.7  | 0.159 | 68.7 | 0.406 | -53.6 |
| 2000               | 0.454 | 154.2  | 1.713 | 53.9  | 0.180 | 70.5 | 0.404 | -57.8 |

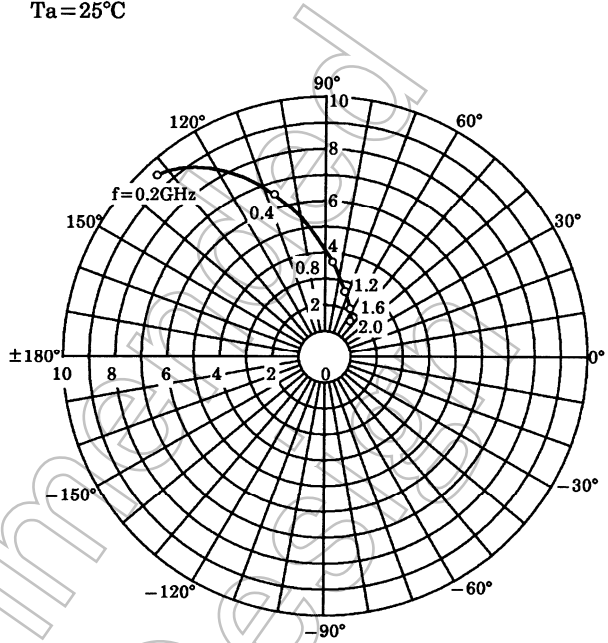
**$V_{CE} = 10 \text{ V}, I_C = 20 \text{ mA}$**

| Frequency<br>(MHz) | S11   |        | S21    |       | S12   |      | S22   |       |
|--------------------|-------|--------|--------|-------|-------|------|-------|-------|
|                    | Mag.  | Ang.   | Mag.   | Ang.  | Mag.  | Ang. | Mag.  | Ang.  |
| 200                | 0.465 | -107.8 | 16.512 | 113.2 | 0.035 | 56.7 | 0.484 | -40.9 |
| 400                | 0.375 | -145.6 | 9.090  | 96.5  | 0.052 | 62.2 | 0.331 | -37.8 |
| 600                | 0.351 | -164.4 | 6.252  | 88.1  | 0.070 | 66.5 | 0.291 | -34.1 |
| 800                | 0.343 | -176.7 | 4.762  | 81.9  | 0.089 | 68.9 | 0.277 | -33.3 |
| 1000               | 0.338 | 174.8  | 3.875  | 76.6  | 0.109 | 70.2 | 0.273 | -34.0 |
| 1200               | 0.337 | 167.9  | 3.285  | 71.8  | 0.130 | 70.8 | 0.274 | -36.2 |
| 1400               | 0.343 | 161.6  | 2.874  | 67.2  | 0.152 | 70.6 | 0.274 | -39.3 |
| 1600               | 0.343 | 156.2  | 2.553  | 62.9  | 0.173 | 69.8 | 0.274 | -43.4 |
| 1800               | 0.348 | 151.2  | 2.317  | 58.8  | 0.195 | 68.9 | 0.273 | -47.8 |
| 2000               | 0.354 | 146.2  | 2.113  | 55.0  | 0.218 | 68.2 | 0.272 | -52.1 |

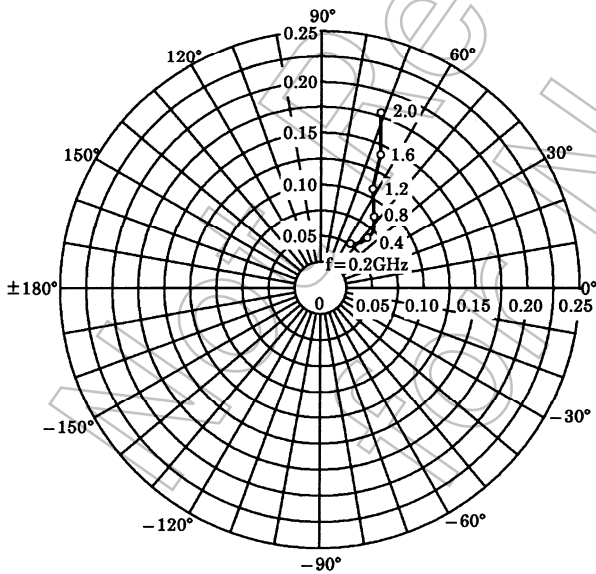
S11e  
 VCE=10V  
 IC=5mA  
 Ta=25°C  
 (UNIT : Ω)



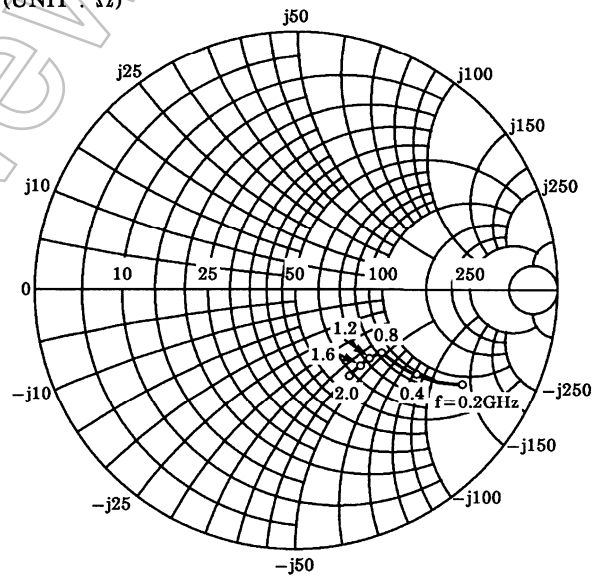
S21e  
 VCE=10V  
 IC=5mA  
 Ta=25°C



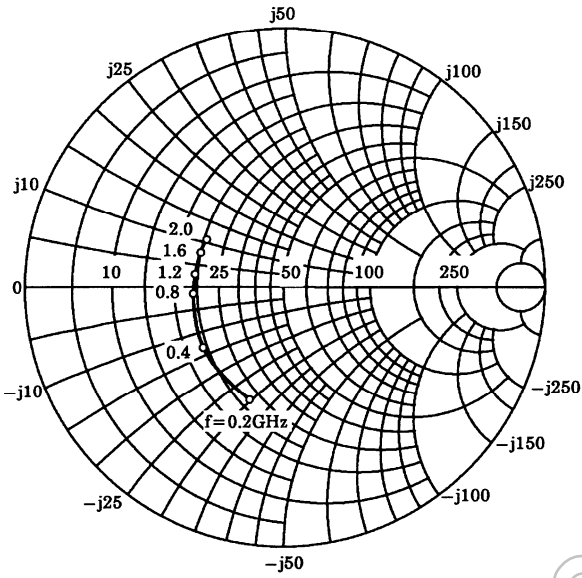
S12e  
 VCE=10V  
 IC=5mA  
 Ta=25°C



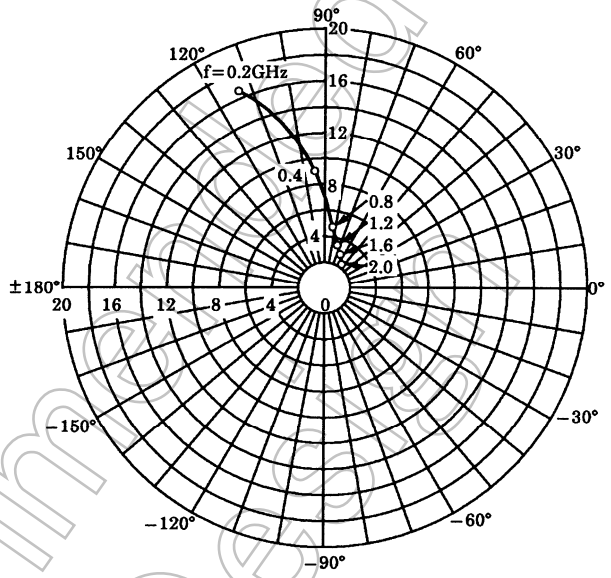
S22e  
 VCE=10V  
 IC=5mA  
 Ta=25°C  
 (UNIT : Ω)



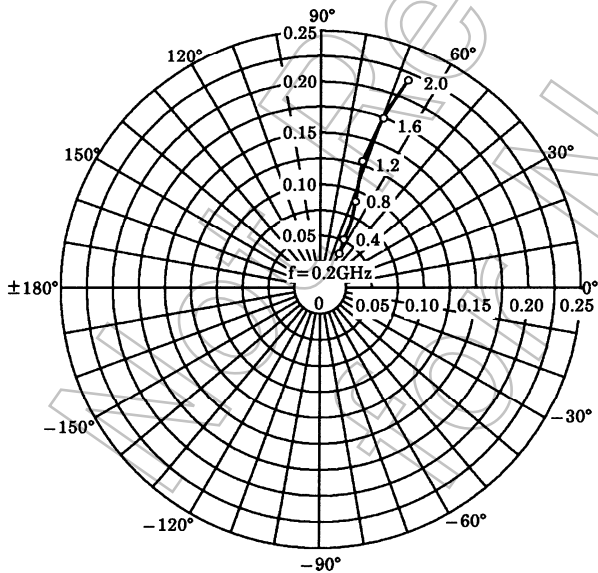
S11e  
 VCE=10V  
 IC=20mA  
 Ta=25°C  
 (UNIT : Ω)



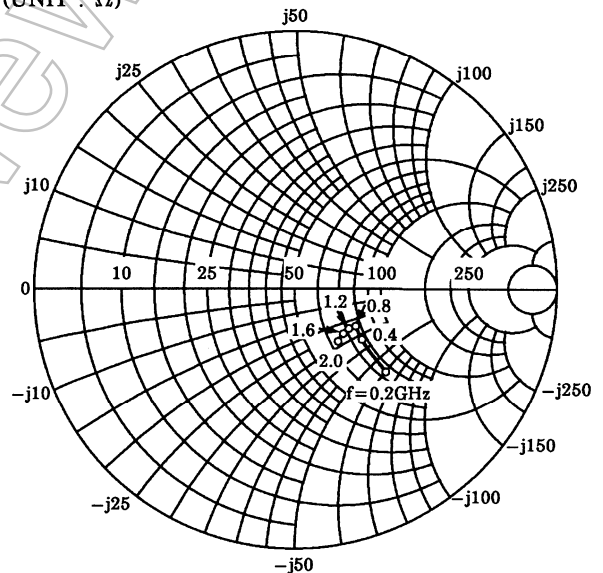
S21e  
 VCE=10V  
 IC=20mA  
 Ta=25°C



S12e  
 VCE=10V  
 IC=20mA  
 Ta=25°C



S22e  
 VCE=10V  
 IC=20mA  
 Ta=25°C  
 (UNIT : Ω)



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