

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

## 2SC5084

## VHF~UHF Band Low Noise Amplifier Applications

Unit: mm

- 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 | $P_C$     | 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).

|              |        |  |  |
|--------------|--------|--|--|
|              |        |  |  |
| 1. BASE      |        |  |  |
| 2. EMITTER   |        |  |  |
| 3. COLLECTOR |        |  |  |
| JEDEC        | —      |  |  |
| JEITA        | SC-59  |  |  |
| TOSHIBA      | 2-3F1A |  |  |

Weight: 0.012 g (typ.)

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

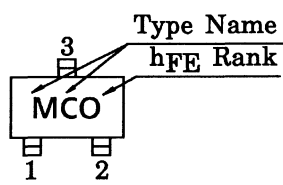
| Characteristics      | Symbol            | Test Condition                                                    | Min | Typ. | Max | Unit |
|----------------------|-------------------|-------------------------------------------------------------------|-----|------|-----|------|
| Transition frequency | $f_T$             | $V_{CE} = 10\text{V}$ , $I_C = 20\text{mA}$                       | 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   |      |

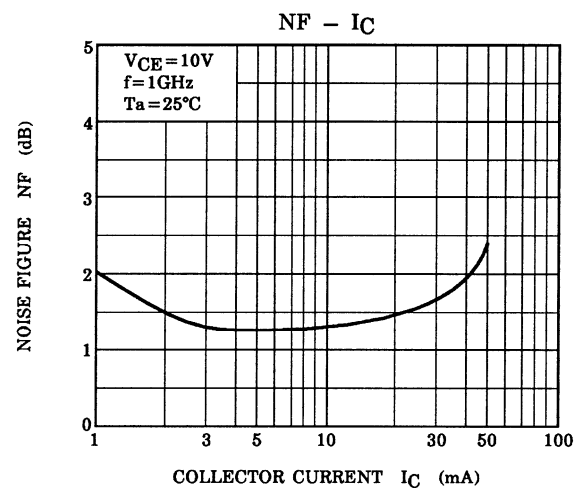
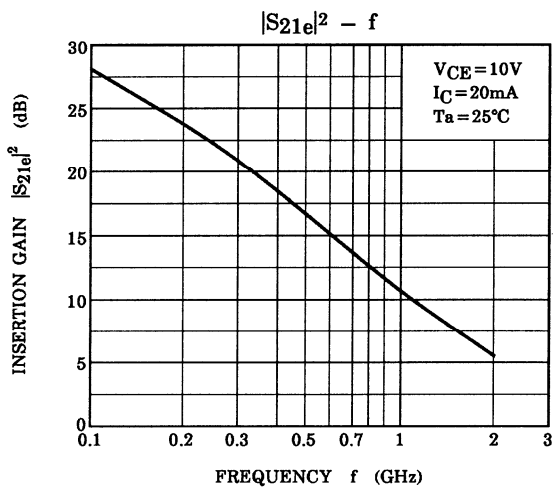
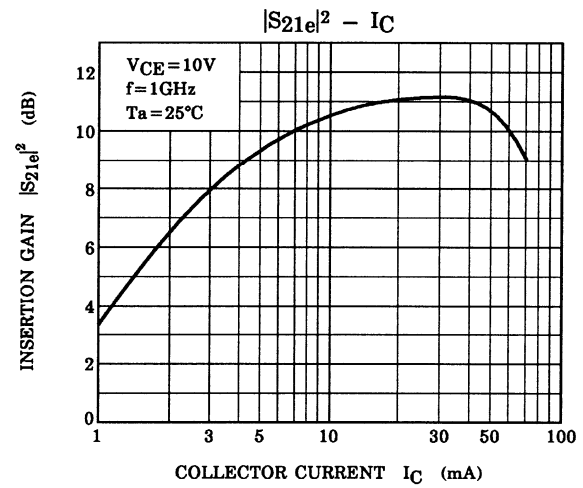
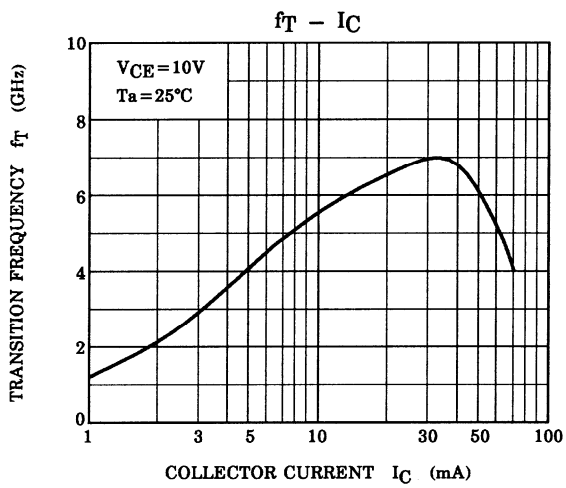
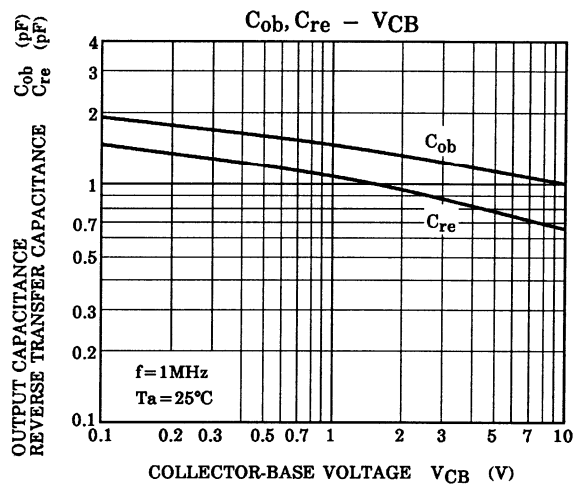
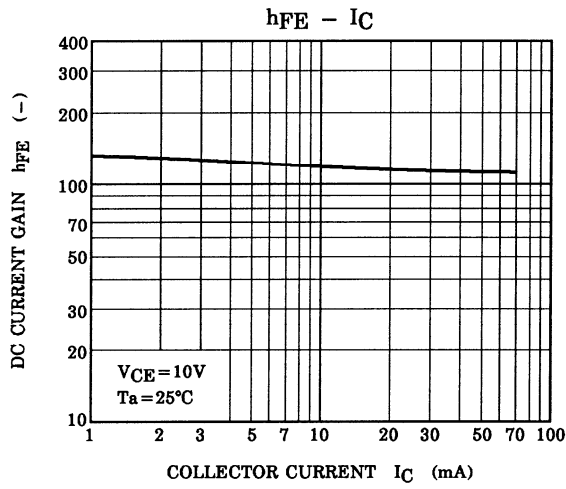
Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

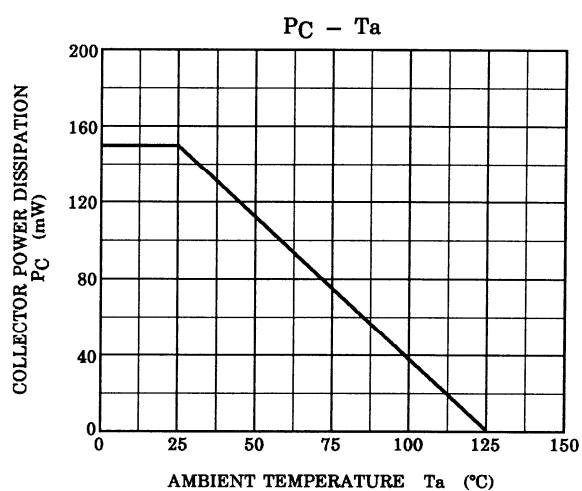
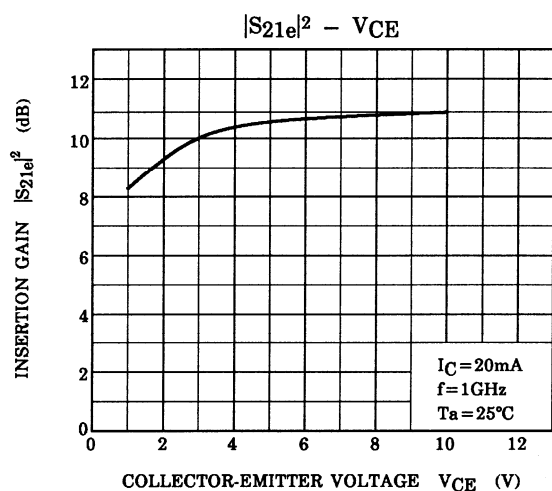
| Characteristics              | Symbol               | Test Condition                                                 | Min | Typ. | Max  | Unit          |
|------------------------------|----------------------|----------------------------------------------------------------|-----|------|------|---------------|
| 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: 80~160, Y: 120~240Note 2:  $C_{re}$  is measured by 3 terminal method with capacitance bridge.

Marking







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

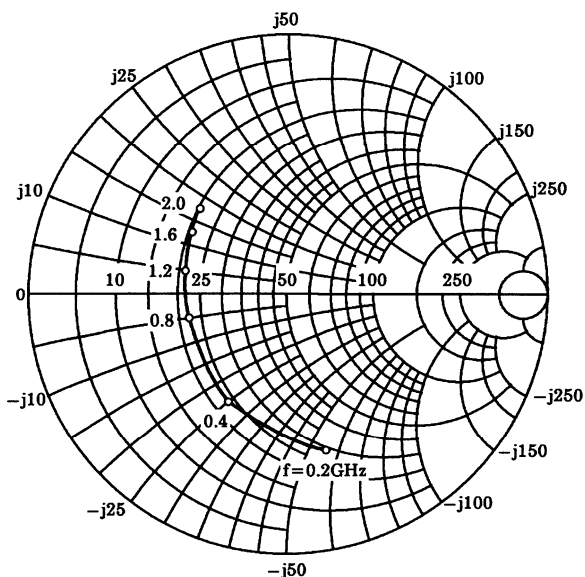
$V_{CE} = 10\ \text{V}$ ,  $I_C = 5\ \text{mA}$

| Frequency<br>(MHz) | S11   |        | S21   |       | S12   |      | S22   |       |
|--------------------|-------|--------|-------|-------|-------|------|-------|-------|
|                    | Mag.  | Ang.   | Mag.  | Ang.  | Mag.  | Ang. | Mag.  | Ang.  |
| 200                | 0.628 | -77.1  | 9.254 | 126.5 | 0.051 | 53.3 | 0.695 | -31.0 |
| 400                | 0.471 | -122.1 | 6.027 | 103.3 | 0.067 | 48.4 | 0.509 | -34.9 |
| 600                | 0.417 | -149.1 | 4.341 | 90.3  | 0.077 | 51.9 | 0.441 | -35.2 |
| 800                | 0.404 | -167.3 | 3.381 | 81.2  | 0.090 | 56.9 | 0.412 | -36.0 |
| 1000               | 0.402 | 178.1  | 2.798 | 73.3  | 0.104 | 62.0 | 0.398 | -37.7 |
| 1200               | 0.412 | 166.6  | 2.393 | 66.7  | 0.122 | 66.4 | 0.390 | -40.3 |
| 1400               | 0.427 | 156.6  | 2.108 | 60.4  | 0.145 | 69.1 | 0.385 | -44.3 |
| 1600               | 0.440 | 147.3  | 1.881 | 54.8  | 0.170 | 69.8 | 0.376 | -48.8 |
| 1800               | 0.455 | 140.0  | 1.713 | 49.4  | 0.194 | 70.2 | 0.373 | -54.3 |
| 2000               | 0.482 | 132.6  | 1.586 | 44.6  | 0.223 | 71.3 | 0.367 | -60.0 |

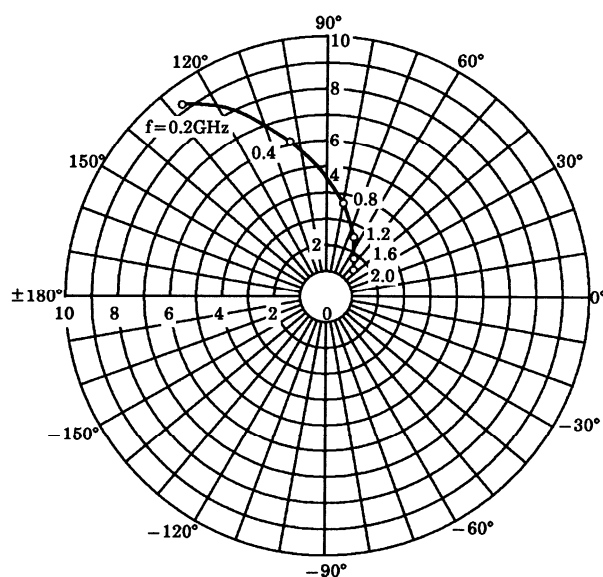
$V_{CE} = 10\ \text{V}$ ,  $I_C = 20\ \text{mA}$

| Frequency<br>(MHz) | S11   |        | S21    |       | S12   |      | S22   |       |
|--------------------|-------|--------|--------|-------|-------|------|-------|-------|
|                    | Mag.  | Ang.   | Mag.   | Ang.  | Mag.  | Ang. | Mag.  | Ang.  |
| 200                | 0.340 | -122.7 | 15.443 | 107.4 | 0.034 | 62.7 | 0.415 | -40.5 |
| 400                | 0.299 | -158.7 | 8.266  | 92.4  | 0.056 | 69.3 | 0.293 | -34.2 |
| 600                | 0.293 | -178.0 | 5.664  | 84.0  | 0.080 | 71.7 | 0.265 | -30.4 |
| 800                | 0.294 | 169.0  | 4.334  | 77.3  | 0.104 | 72.1 | 0.255 | -29.9 |
| 1000               | 0.299 | 157.9  | 3.528  | 71.2  | 0.129 | 72.0 | 0.252 | -30.6 |
| 1200               | 0.310 | 149.5  | 3.002  | 66.0  | 0.155 | 71.4 | 0.254 | -32.5 |
| 1400               | 0.321 | 142.0  | 2.629  | 61.0  | 0.183 | 69.7 | 0.255 | -36.1 |
| 1600               | 0.332 | 134.9  | 2.336  | 56.3  | 0.209 | 67.6 | 0.248 | -40.6 |
| 1800               | 0.341 | 129.5  | 2.121  | 51.7  | 0.234 | 65.6 | 0.242 | -45.9 |
| 2000               | 0.366 | 124.3  | 1.958  | 47.3  | 0.260 | 64.6 | 0.236 | -51.7 |

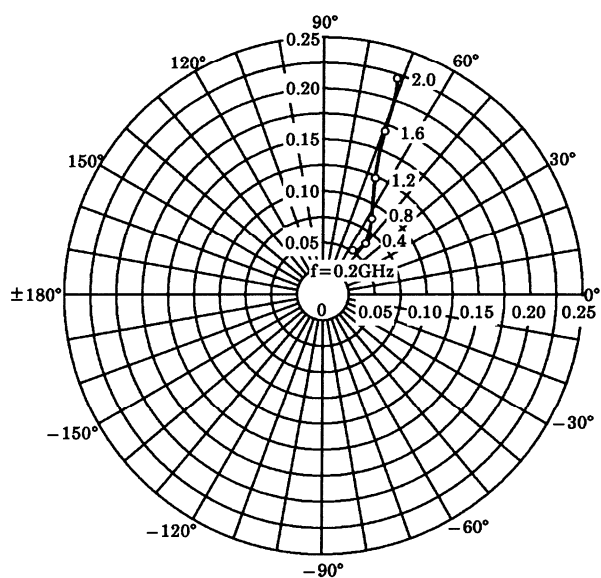
$S_{11e}$   
 $V_{CE} = 10V$   
 $I_C = 5mA$   
 $T_a = 25^\circ C$   
 (UNIT :  $\Omega$ )



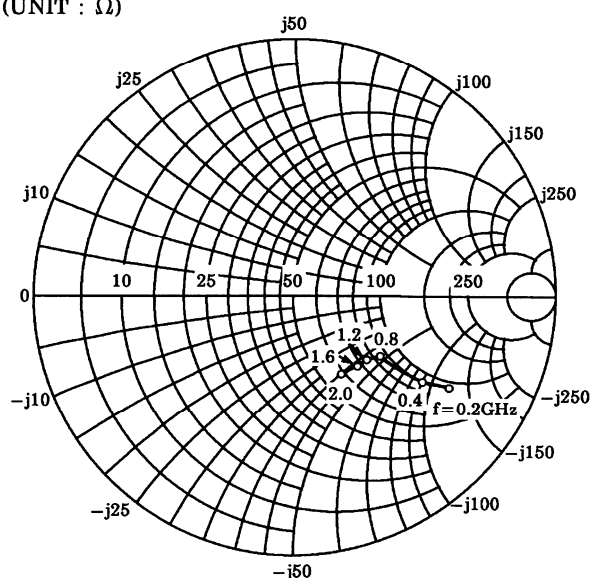
$S_{21e}$   
 $V_{CE} = 10V$   
 $I_C = 5mA$   
 $T_a = 25^\circ C$



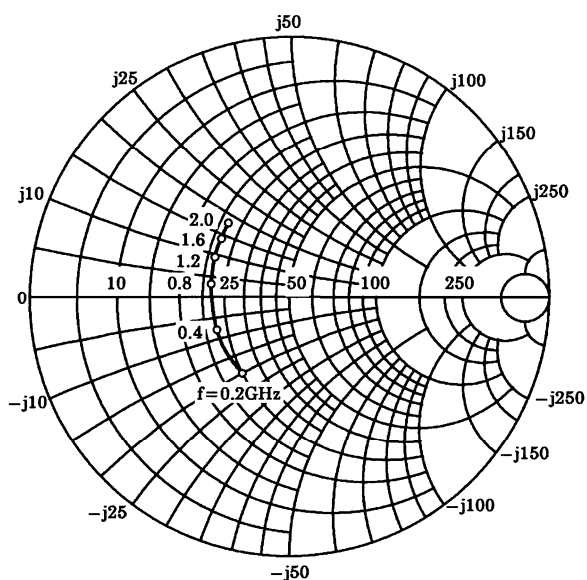
$S_{12e}$   
 $V_{CE} = 10V$   
 $I_C = 5mA$   
 $T_a = 25^\circ C$



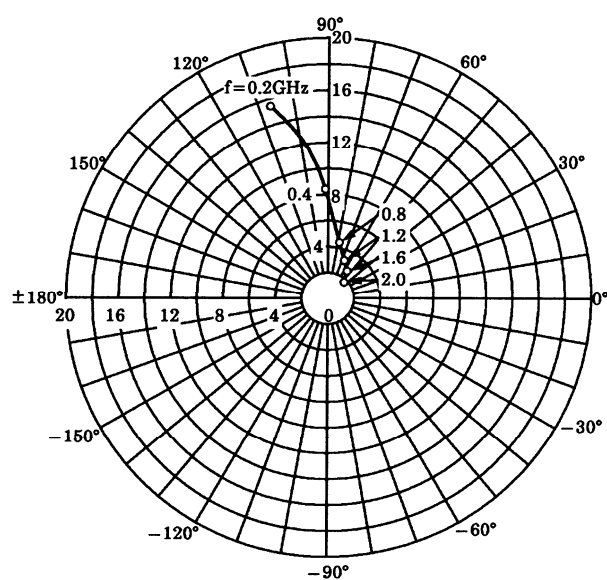
$S_{22e}$   
 $V_{CE} = 10V$   
 $I_C = 5mA$   
 $T_a = 25^\circ C$   
 (UNIT :  $\Omega$ )



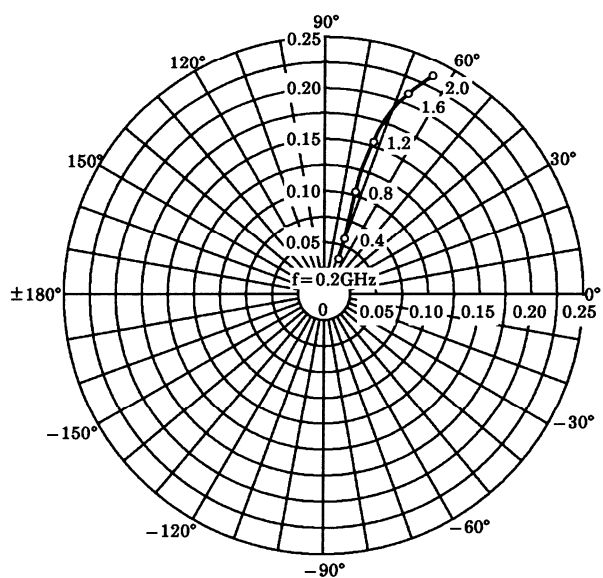
$S_{11e}$   
 $V_{CE} = 10V$   
 $I_C = 20mA$   
 $T_a = 25^\circ C$   
 (UNIT :  $\Omega$ )



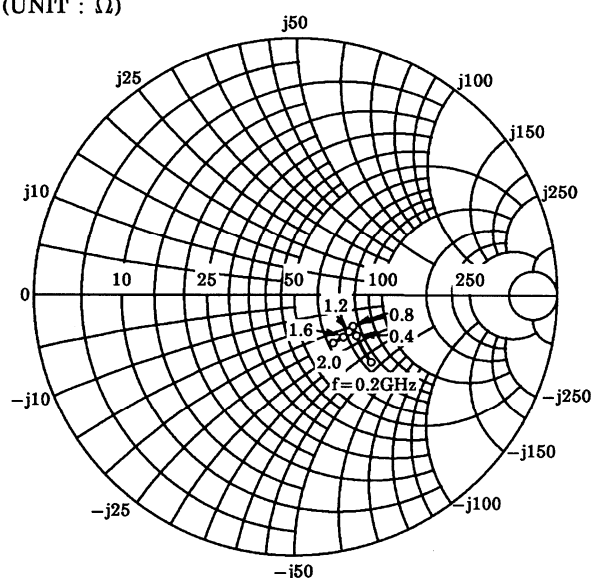
$S_{21e}$   
 $V_{CE} = 10V$   
 $I_C = 20mA$   
 $T_a = 25^\circ C$



$S_{12e}$   
 $V_{CE} = 10V$   
 $I_C = 20mA$   
 $T_a = 25^\circ C$



$S_{22e}$   
 $V_{CE} = 10V$   
 $I_C = 20mA$   
 $T_a = 25^\circ C$   
 (UNIT :  $\Omega$ )



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