

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC4320

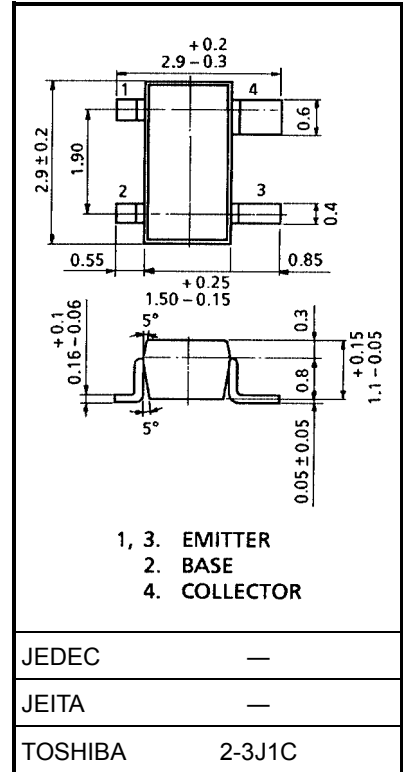
VHF~UHF Band Low Noise Amplifier Applications

Unit: mm

- Low noise figure, high gain.
- $NF = 1.1\text{dB}$, $|S_{21e}|^2 = 15\text{dB}$ ($f = 1\text{GHz}$)

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 | 20 | mA |
| Collector current | I_C | 40 | mA |
| Collector power dissipation | P_C | 150 | mW |
| Junction temperature | T_j | 125 | $^\circ\text{C}$ |
| Storage temperature range | T_{stg} | -55~125 | $^\circ\text{C}$ |



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

Weight: 0.012 g (typ.)

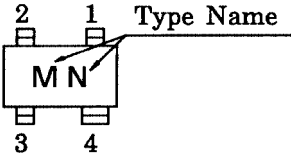
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|----------------------|-------------------|--|-----|------|-----|------|
| Transition frequency | f_T | $V_{CE} = 8\text{V}$, $I_C = 20\text{mA}$ | 7 | 10 | — | GHz |
| Insertion gain | $ S_{21e} ^2$ (1) | $V_{CE} = 8\text{V}$, $I_C = 20\text{mA}$, $f = 1\text{GHz}$ | 12 | 15 | — | dB |
| | $ S_{21e} ^2$ (2) | $V_{CE} = 8\text{V}$, $I_C = 20\text{mA}$, $f = 2\text{GHz}$ | — | 9 | — | |
| Noise figure | NF (1) | $V_{CE} = 8\text{V}$, $I_C = 5\text{mA}$, $f = 1\text{GHz}$ | — | 1.1 | 2.5 | dB |
| | NF (2) | $V_{CE} = 8\text{V}$, $I_C = 5\text{mA}$, $f = 2\text{GHz}$ | — | 1.7 | — | |

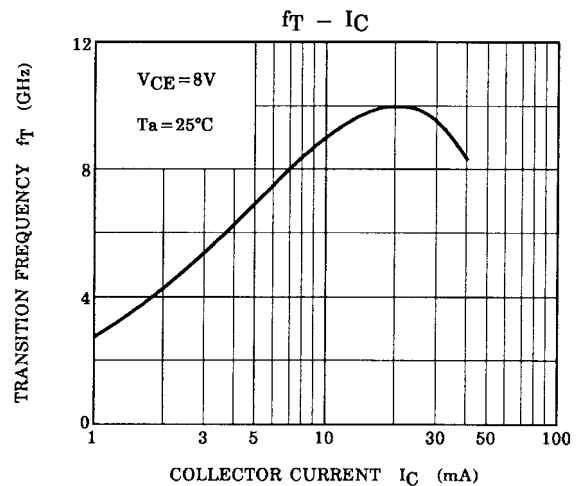
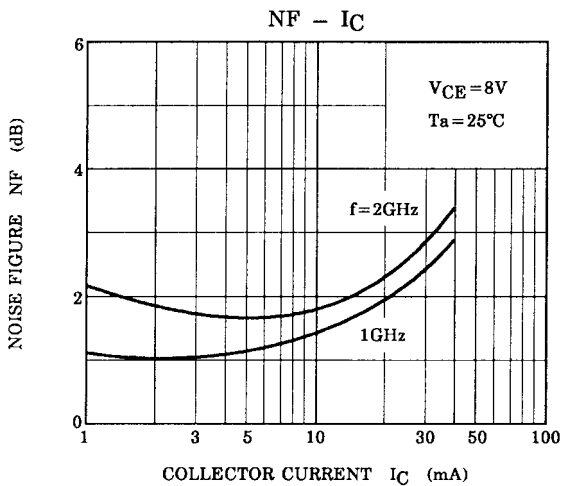
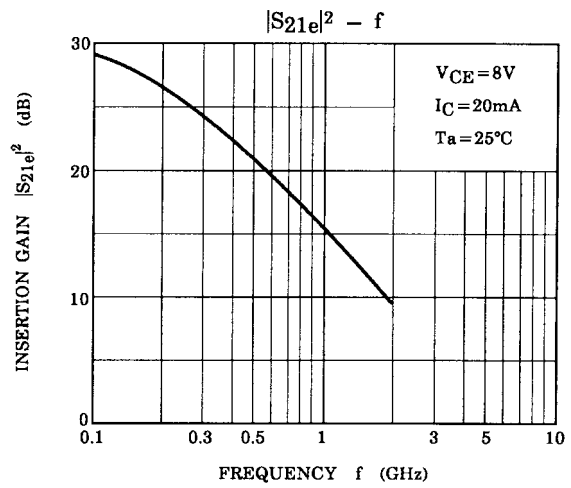
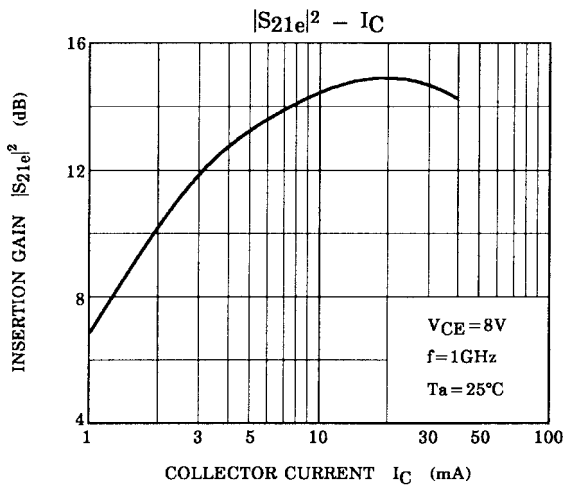
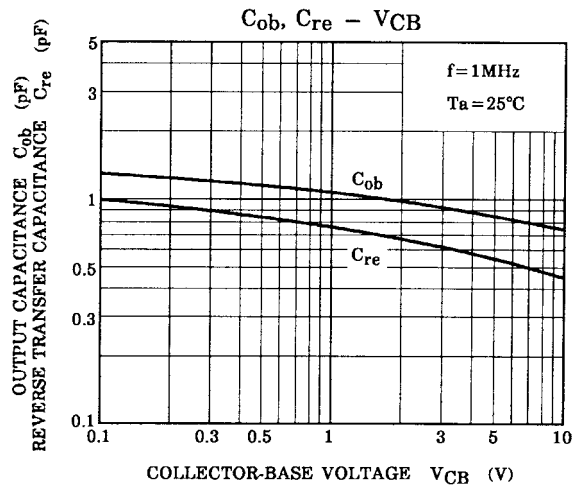
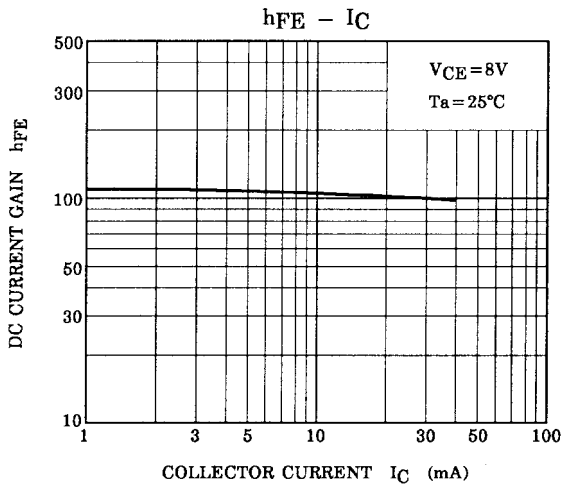
Electrical Characteristics ($T_a = 25^\circ\text{C}$)

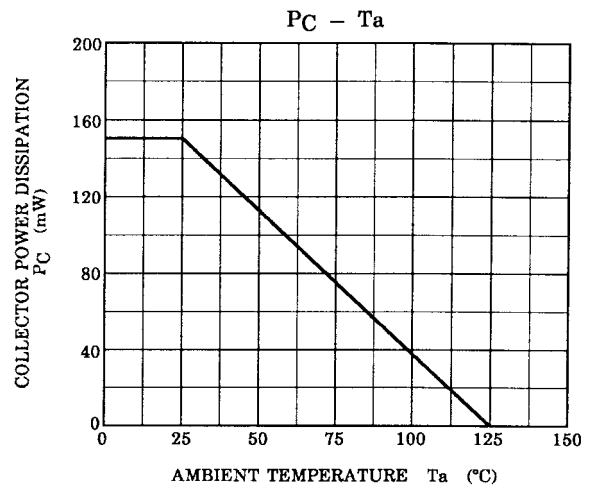
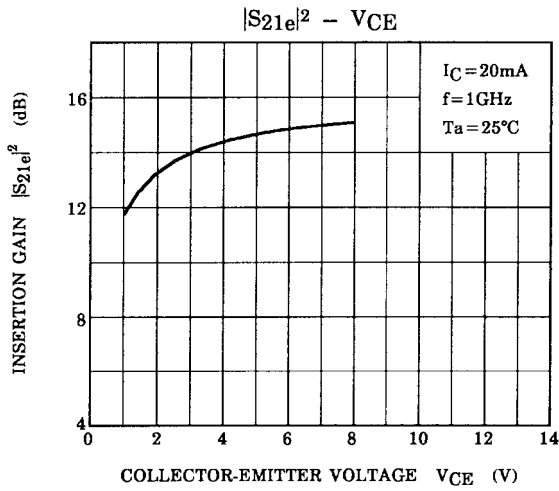
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|------------------------------|-----------|--|-----|------|-----|---------------|
| Collector cut-off current | I_{CBO} | $V_{CB} = 10\text{V}$, $I_E = 0$ | — | — | 1 | μA |
| Emitter cut-off current | I_{EBO} | $V_{EB} = 1\text{V}$, $I_C = 0$ | — | — | 1 | μA |
| DC current gain | h_{FE} | $V_{CE} = 8\text{V}$, $I_C = 20\text{mA}$ | 50 | — | 250 | |
| Output capacitance | C_{ob} | $V_{CB} = 10\text{V}$, $I_E = 0$, $f = 1\text{MHz}$ (Note) | — | 0.75 | — | pF |
| Reverse transfer capacitance | C_{re} | | — | 0.45 | 0.9 | pF |

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

Marking







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

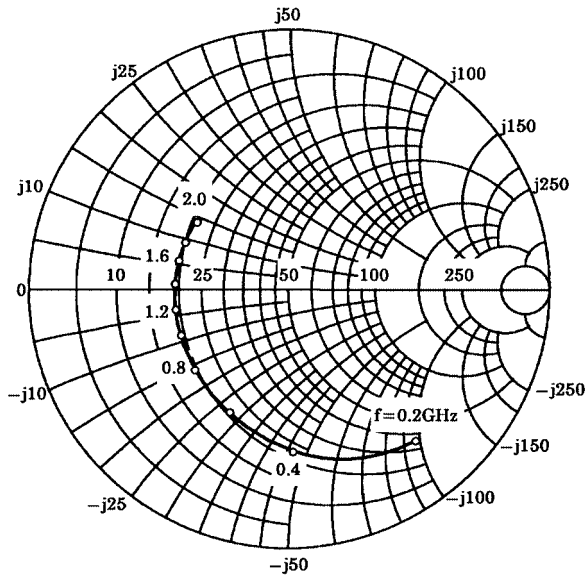
$V_{CE} = 8 \text{ V}, I_C = 5 \text{ mA}$

| Frequency MHz | S11 | | S21 | | S12 | | S22 | |
|------------------|-------|--------|--------|-------|-------|------|-------|-------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200 | 0.764 | -49.6 | 11.754 | 147.1 | 0.047 | 64.2 | 0.869 | -29.4 |
| 400 | 0.624 | -87.9 | 8.966 | 124.6 | 0.072 | 48.9 | 0.669 | -48.3 |
| 600 | 0.532 | -115.7 | 6.947 | 110.5 | 0.084 | 42.1 | 0.526 | -59.5 |
| 800 | 0.485 | -137.5 | 5.581 | 100.4 | 0.091 | 39.3 | 0.429 | -66.6 |
| 1000 | 0.446 | -155.0 | 4.636 | 92.9 | 0.097 | 38.6 | 0.370 | -71.3 |
| 1200 | 0.441 | -169.2 | 4.003 | 86.3 | 0.102 | 38.8 | 0.330 | -75.3 |
| 1400 | 0.432 | 177.1 | 3.487 | 80.1 | 0.107 | 39.6 | 0.305 | -77.6 |
| 1600 | 0.426 | 166.1 | 3.144 | 75.1 | 0.114 | 40.1 | 0.288 | -80.7 |
| 1800 | 0.431 | 154.4 | 2.900 | 70.0 | 0.119 | 41.9 | 0.276 | -83.9 |
| 2000 | 0.425 | 145.2 | 2.652 | 65.5 | 0.127 | 43.1 | 0.272 | -87.3 |

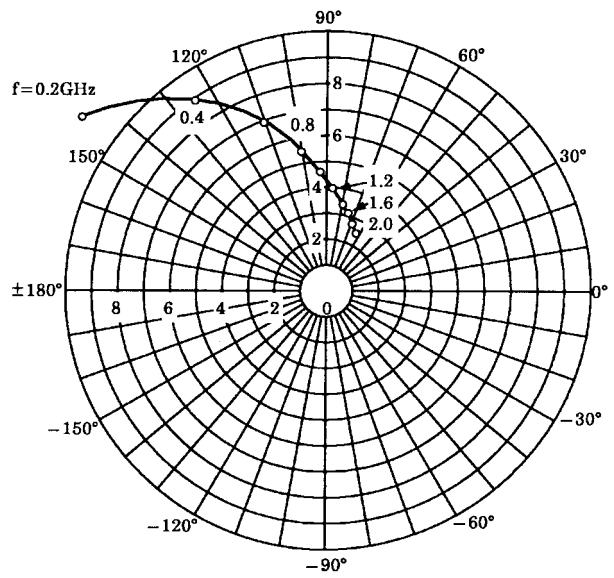
$V_{CE} = 8 \text{ V}, I_C = 20 \text{ mA}$

| Frequency MHz | S11 | | S21 | | S12 | | S22 | |
|------------------|-------|--------|--------|-------|-------|------|-------|-------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 200 | 0.540 | -90.3 | 21.037 | 129.7 | 0.033 | 55.7 | 0.670 | -46.8 |
| 400 | 0.479 | -134.8 | 13.017 | 108.7 | 0.046 | 50.0 | 0.417 | -64.5 |
| 600 | 0.461 | -159.4 | 9.230 | 98.1 | 0.054 | 51.2 | 0.297 | -71.9 |
| 800 | 0.454 | -176.0 | 7.117 | 90.5 | 0.063 | 54.1 | 0.230 | -75.4 |
| 1000 | 0.454 | 170.7 | 5.816 | 85.1 | 0.073 | 56.1 | 0.191 | -76.7 |
| 1200 | 0.452 | 160.0 | 4.944 | 79.8 | 0.084 | 57.9 | 0.168 | -77.0 |
| 1400 | 0.461 | 149.1 | 4.299 | 74.7 | 0.094 | 58.7 | 0.156 | -75.7 |
| 1600 | 0.459 | 140.7 | 3.838 | 70.6 | 0.105 | 59.0 | 0.151 | -75.8 |
| 1800 | 0.461 | 131.9 | 3.483 | 66.0 | 0.117 | 59.4 | 0.154 | -76.6 |
| 2000 | 0.450 | 124.2 | 3.171 | 61.8 | 0.130 | 59.0 | 0.161 | -79.3 |

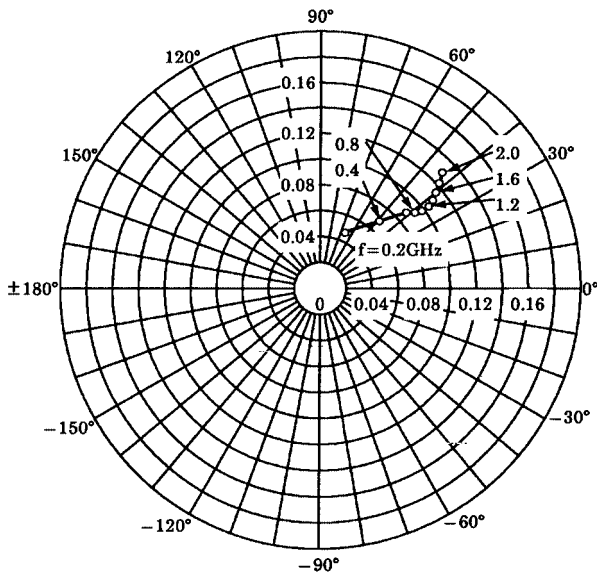
S11e
VCE=8V
IC=5mA
Ta=25°C
(UNIT : Ω)



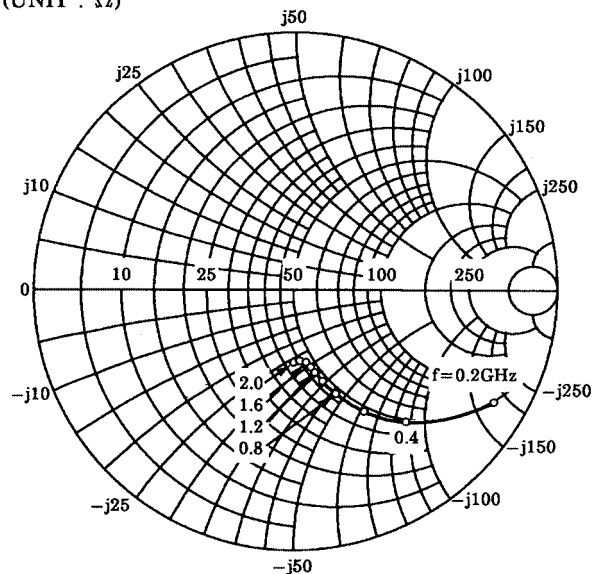
S21e
VCE=8V
IC=5mA
Ta=25°C



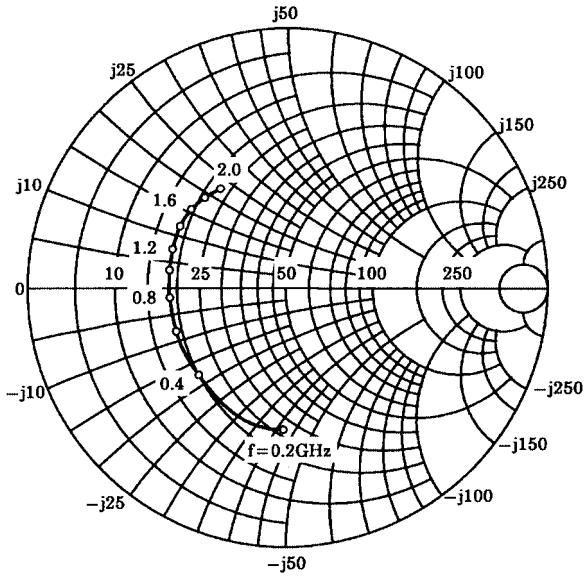
S12e
VCE=8V
IC=5mA
Ta=25°C



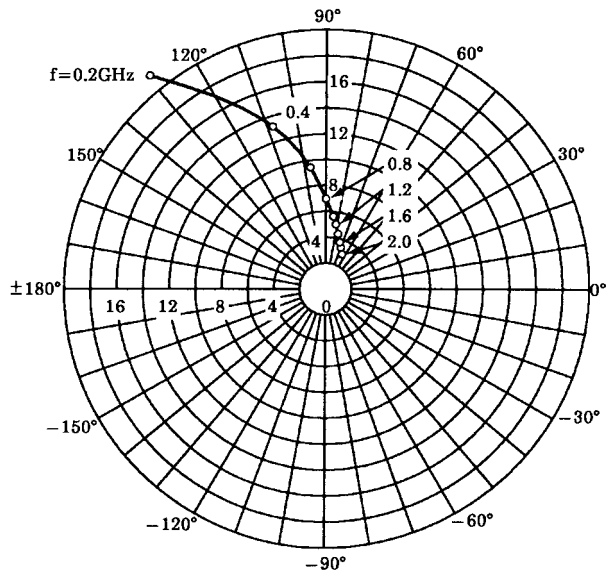
S22e
VCE=8V
IC=5mA
Ta=25°C
(UNIT : Ω)



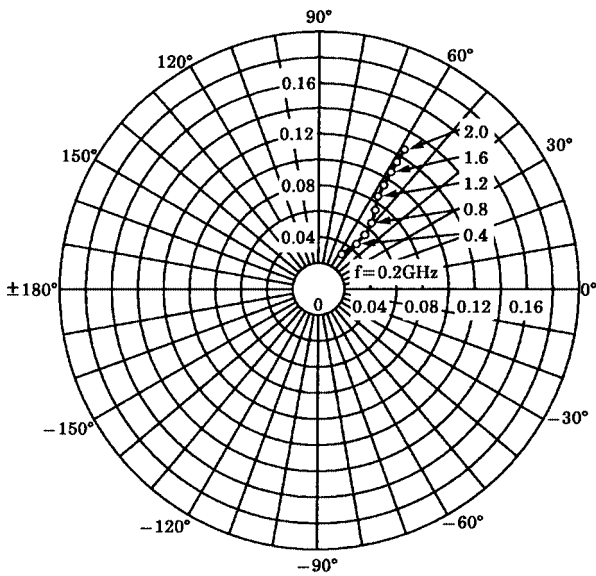
S11e
 VCE=8V
 IC=20mA
 Ta=25°C
 (UNIT : Ω)



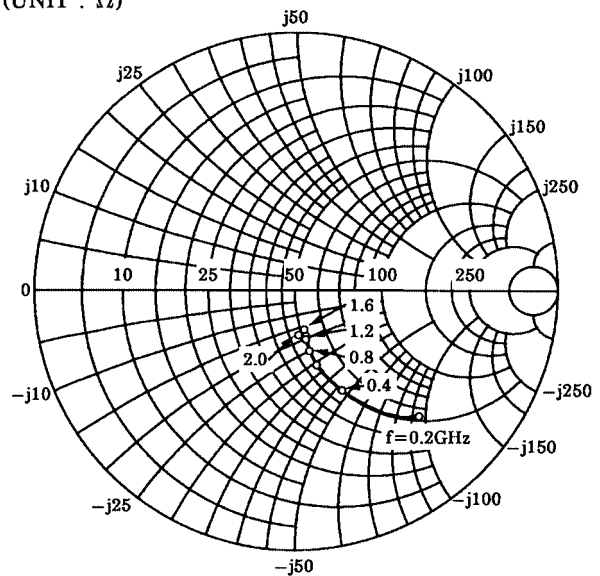
S21e
 VCE=8V
 IC=20mA
 Ta=25°C



S12e
 VCE=8V
 IC=20mA
 Ta=25°C



S22e
 VCE=8V
 IC=20mA
 Ta=25°C
 (UNIT : Ω)



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