Ordering number:EN5036B

NPN Epitaxial Planar Silicon Transistor

# 2SC5231

## VHF to UHF Wide-Band Low-Noise Amplifier Applications

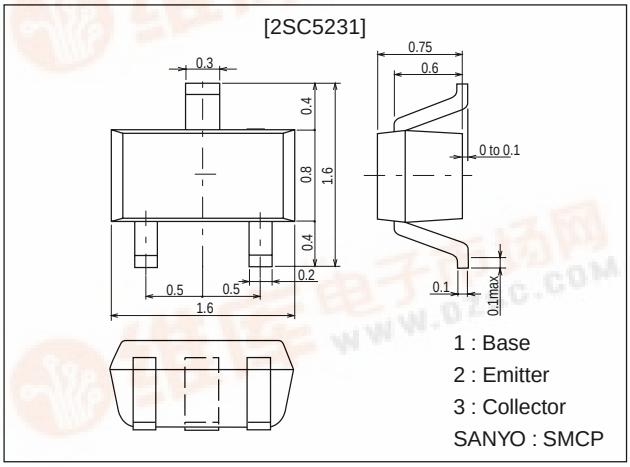
## Features

- Low noise : NF=1.0dB typ (f=1GHz).
- High gain : $|S21e|^2$=12dB typ (f=1GHz).
- High cutoff frequency : $f_T$=7GHz typ.
- Very small-sized package permiting 2SC5231-applied sets to be made small and slim.

## Package Dimensions

unit:mm

2106A




## Specifications

### Absolute Maximum Ratings at Ta = 25˚C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Collector-to-Base Voltage | $V_{CBO}$ | | 20 | V |
| Collector-to-Emitter Voltage | $V_{CEO}$ | | 10 | V |
| Emitter-to-Base Voltage | $V_{EBO}$ | | 2 | V |
| Collector Current | $I_C$ | | 70 | mA |
| Collector Dissipation | $P_C$ | | 100 | mW |
| Junction Temperature | Tj | | 150 | ˚C |
| Storage Temperature | Tstg | | –55 to +150 | ˚C |

### Electrical Characteristics at Ta = 25˚C

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$=10V, $I_E$=0 | | | 1.0 | μA |
| Emitter Cutoff Current | $I_{EBO}$ | $V_{EB}$=1V, $I_C$=0 | | | 10 | μA |
| DC Current Gain | $h_{FE}$ | $V_{CE}$=5V, $I_C$=20mA | 60* | | 270* | |
| Gain-Bandwidth Product | $f_T$ | $V_{CE}$=5V, $I_C$=20mA | 5 | 7 | | GHz |
| Output Capacitance | Cob | $V_{CB}$=10V, f=1MHz | | 0.7 | 1.2 | pF |
| Reverse Transfer Capacitance | Cre | $V_{CB}$=10V, f=1MHz | | 0.45 | | pF |

≠ : Pulse Test Pulse Width≤2ms

Continued on next page.

* : The 2SC5231 is classified by 20mA $h_{FE}$ as follows :

| Marking | C7 | C8 | C9 |
|---|---|---|---|
| $h_{FE}$ | 60 to 120 | 90 to 180 | 135 to 270 |



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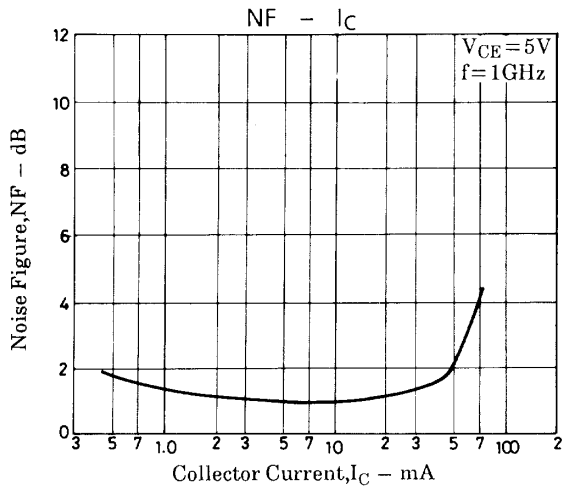
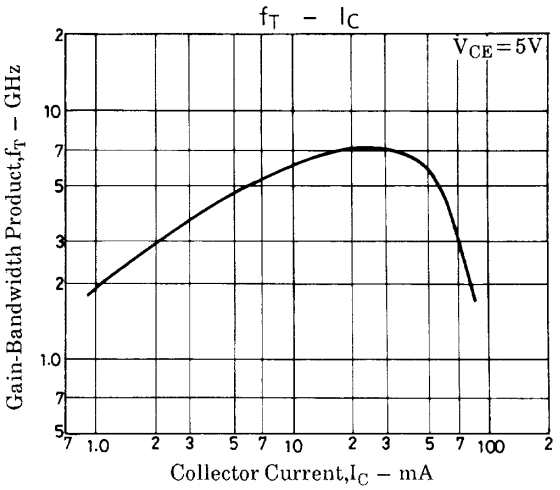
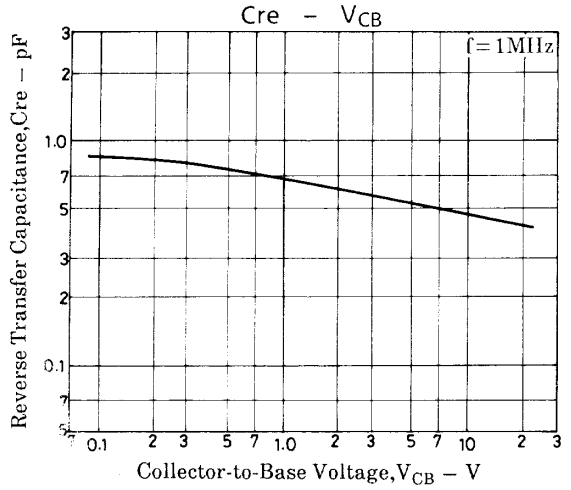
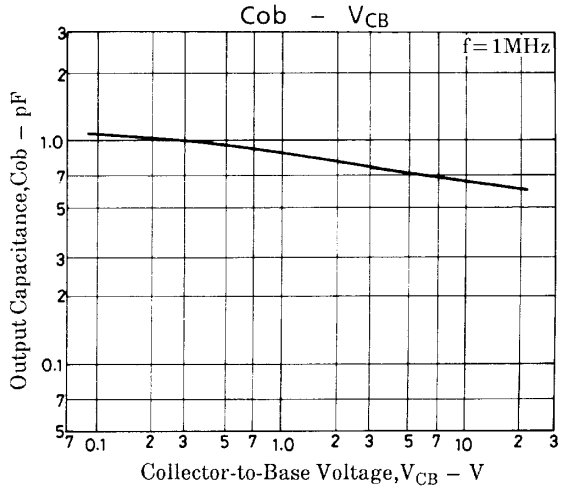
Continued from preceding page.

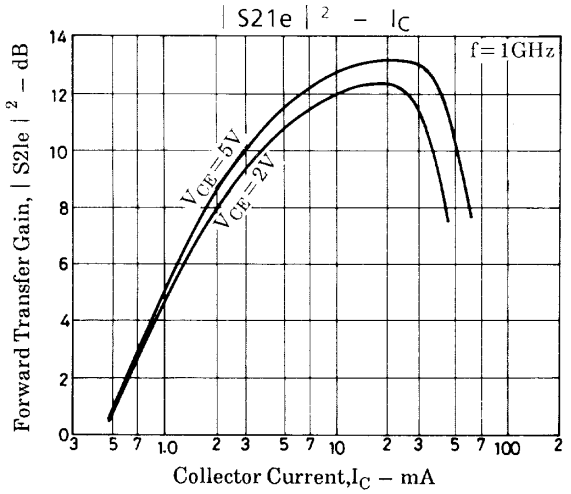
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Forward Transfer Gain | $\|S21e\|^2$ 1 | $V_{CE}$=5V, $I_C$=20mA, f=1GHz | 9 | 12 | | dB |
| | $\|S21e\|^2$ 2 | $V_{CE}$=2V, $I_C$=3mA, f=1GHz | | 8.5 | | dB |
| Noise Figure | NF | $V_{CE}$=5V, $I_C$=7mA, f=1GHz | | 1.0 | 1.8 | dB |

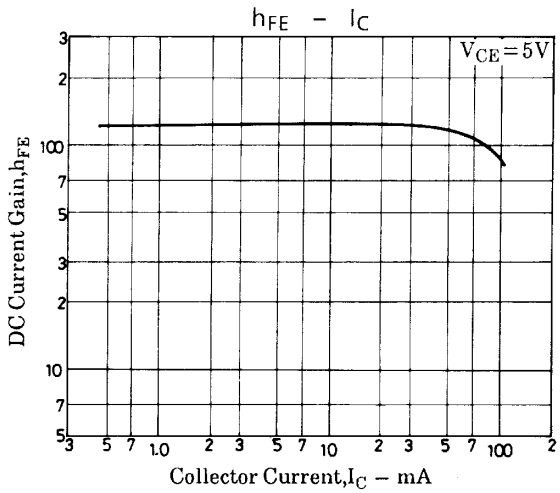


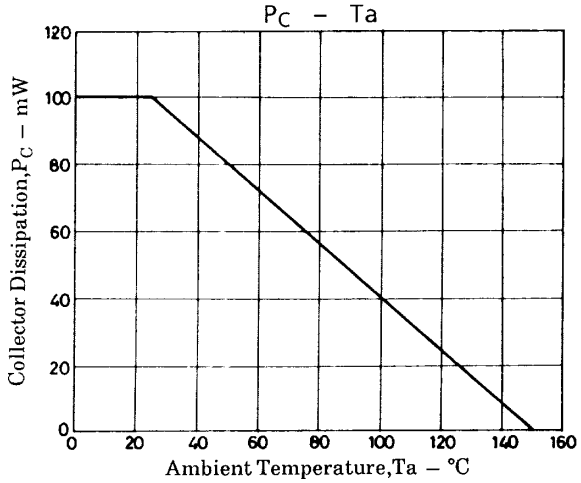



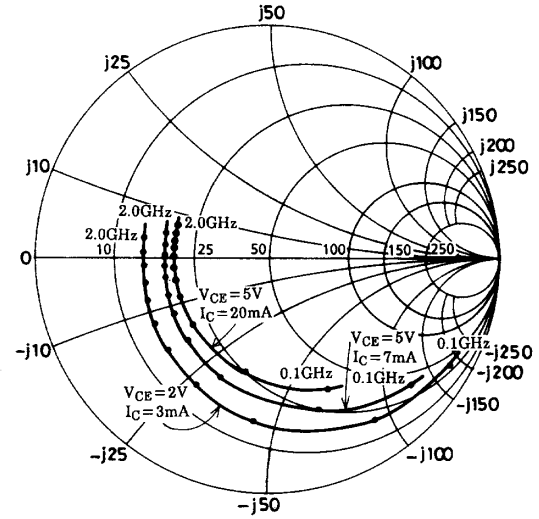



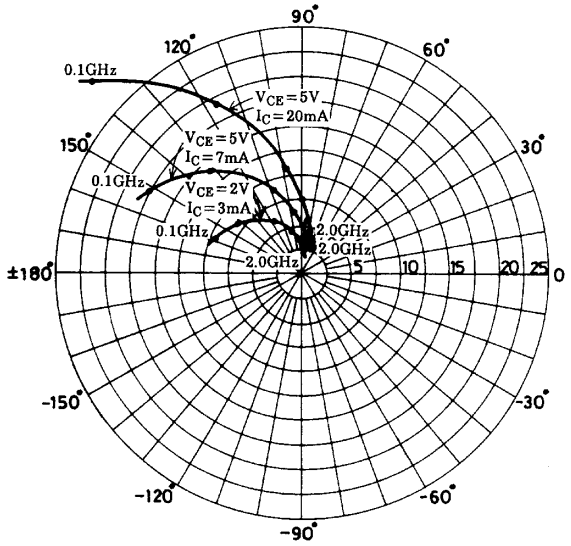



## S Parameters

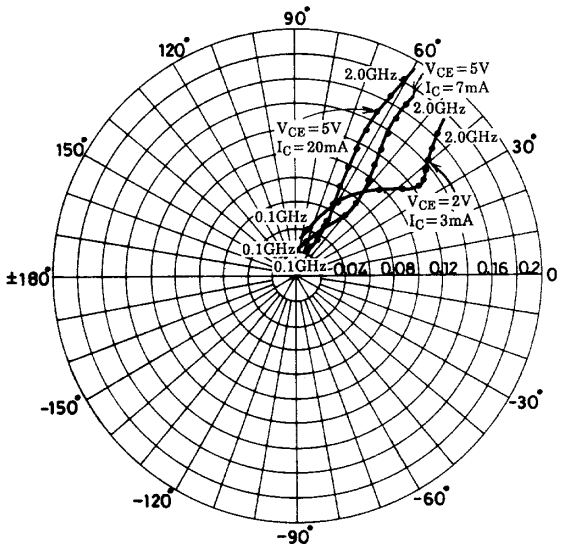
S11e : f=100MHz, 200~2000MHz (200MHz step)



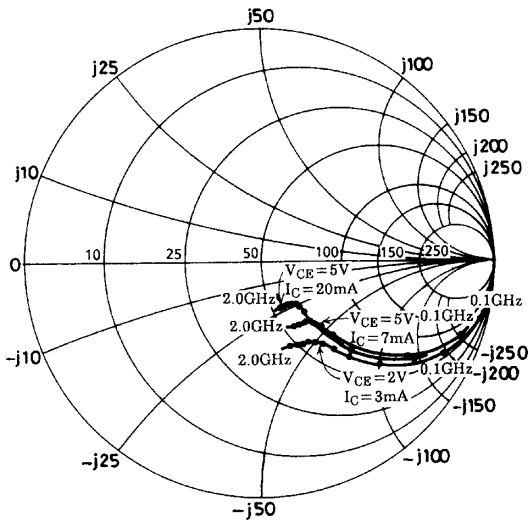

S21e : f=100MHz, 200~2000MHz (200MHz step)




S12e : f=100MHz, 200~2000MHz (200MHz step)




S22e : f=100MHz, 200~2000MHz (200MHz step)



## **S parameters** (Common emitter)

$V_{CE}$=5V, $I_C$=7mA, $Z_O$=50Ω

| Freq (MHz) | $\|S_{11}\|$ | $\angle S_{11}$ | $\|S_{21}\|$ | $\angle S_{21}$ | $\|S_{12}\|$ | $\angle S_{12}$ | $\|S_{22}\|$ | $\angle S_{22}$ |
|---|---|---|---|---|---|---|---|---|
| 100 | 0.786 | –40.7 | 17.507 | 151.3 | 0.028 | 70.1 | 0.898 | –20.4 |
| 200 | 0.677 | –72.4 | 13.998 | 131.4 | 0.046 | 58.0 | 0.739 | –33.4 |
| 400 | 0.546 | –112.7 | 9.061 | 108.6 | 0.064 | 49.6 | 0.525 | –43.7 |
| 600 | 0.492 | –135.2 | 6.442 | 96.1 | 0.076 | 49.3 | 0.432 | –46.7 |
| 800 | 0.473 | –150.0 | 5.005 | 87.3 | 0.087 | 50.8 | 0.374 | –44.4 |
| 1000 | 0.465 | –160.0 | 4.073 | 80.4 | 0.099 | 52.6 | 0.346 | –49.7 |
| 1200 | 0.457 | –169.5 | 3.449 | 74.0 | 0.111 | 54.0 | 0.332 | –51.6 |
| 1400 | 0.451 | –176.2 | 2.989 | 68.6 | 0124 | 55.2 | 0.321 | –54.1 |
| 1600 | 0.449 | 177.8 | 2.658 | 63.8 | 0.138 | 56.6 | 0.319 | –56.2 |
| 1800 | 0.454 | 172.5 | 2.378 | 58.4 | 0.151 | 56.7 | 0.313 | –60.0 |
| 2000 | 0.460 | 167.1 | 2.154 | 54.0 | 0.166 | 56.7 | 0.311 | –63.2 |

$V_{CE}$=5V, $I_C$=20mA, $Z_O$=50Ω

| Freq (MHz) | $\|S_{11}\|$ | $\angle S_{11}$ | $\|S_{21}\|$ | $\angle S_{21}$ | $\|S_{12}\|$ | $\angle S_{12}$ | $\|S_{22}\|$ | $\angle S_{22}$ |
|---|---|---|---|---|---|---|---|---|
| 100 | 0.601 | –65.8 | 28.967 | 137.1 | 0.023 | 64.1 | 0.757 | –32.9 |
| 200 | 0.497 | –103.7 | 19.309 | 116.6 | 0.035 | 57.0 | 0.534 | –50.3 |
| 400 | 0.435 | –139.6 | 10.891 | 98.6 | 0.050 | 58.7 | 0.345 | –50.3 |
| 600 | 0.419 | –156.6 | 7.461 | 89.3 | 0.065 | 61.3 | 0.280 | –50.7 |
| 800 | 0.414 | –166.6 | 5.695 | 82.5 | 0.081 | 63.1 | 0.251 | –51.3 |
| 1000 | 0.413 | –174.0 | 4.613 | 77.0 | 0.098 | 63.8 | 0.235 | –52.9 |
| 1200 | 0.413 | 178.6 | 3.870 | 71.8 | 0.114 | 63.9 | 0.226 | –55.1 |
| 1400 | 0.411 | 173.8 | 3.345 | 66.9 | 0.131 | 63.6 | 0.221 | –57.7 |
| 1600 | 0.413 | 169.6 | 2.960 | 62.7 | 0.148 | 63.2 | 0.220 | –60.2 |
| 1800 | 0.416 | 165.1 | 2.655 | 58.0 | 0.165 | 61.8 | 0.219 | –64.8 |
| 2000 | 0.422 | 160.3 | 2.406 | 54.0 | 0.182 | 60.6 | 0.218 | –68.3 |

$V_{CE}$=2V, $I_C$=3mA, $Z_O$=50Ω

| Freq (MHz) | $\|S_{11}\|$ | $\angle S_{11}$ | $\|S_{21}\|$ | $\angle S_{21}$ | $\|S_{12}\|$ | $\angle S_{12}$ | $\|S_{22}\|$ | $\angle S_{22}$ |
|---|---|---|---|---|---|---|---|---|
| 100 | 0.888 | –30.2 | 9.280 | 158.6 | 0.038 | 73.6 | 0.949 | –15.1 |
| 200 | 0.815 | –56.4 | 8.218 | 141.3 | 0.067 | 60.5 | 0.849 | –26.9 |
| 400 | 0.690 | –96.0 | 6.074 | 116.7 | 0.098 | 45.1 | 0.657 | –41.1 |
| 600 | 0.616 | –120.7 | 4.517 | 101.4 | 0.112 | 38.4 | 0.539 | –47.6 |
| 800 | 0.584 | –138.0 | 3.610 | 90.4 | 0.120 | 35.8 | 0.475 | –51.2 |
| 1000 | 0.566 | –150.7 | 2.995 | 81.9 | 0.125 | 35.7 | 0.434 | –54.5 |
| 1200 | 0.555 | –161.2 | 2.540 | 74.2 | 0.131 | 36.5 | 0.410 | –57.5 |
| 1400 | 0.546 | –169.3 | 2.213 | 67.5 | 0.137 | 38.4 | 0.393 | –60.7 |
| 1600 | 0.541 | –176.4 | 1.982 | 62.0 | 0.143 | 40.7 | 0.391 | –64.0 |
| 1800 | 0.545 | 177.1 | 1.774 | 55.9 | 0.152 | 42.5 | 0.382 | –67.8 |
| 2000 | 0.547 | 170.9 | 1.614 | 50.9 | 0.163 | 44.7 | 0.381 | –72.1 |