Ordering number:EN5186

NPN Epitaxial Planar Silicon Transistor

# 2SC5276

## UHF to S Band Low-Noise Amplifier, OSC Applications

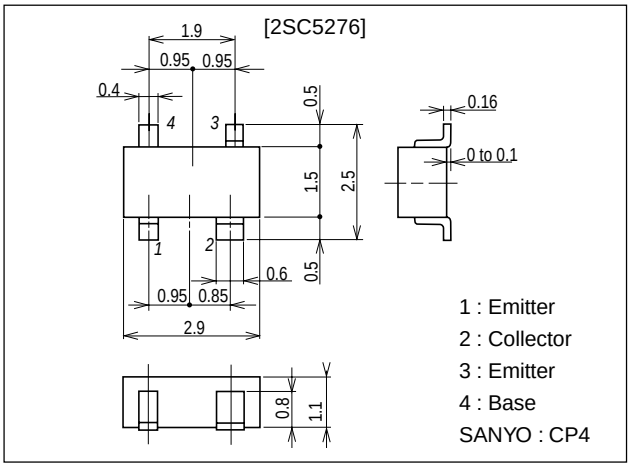
## Features

- Low noise : NF=0.9dB typ (f=1GHz).
  : NF=1.4dB typ (f=1.5GHz).
- High gain : $|S21e|^2$=11dB typ (f=1.5GHz).
- High cutoff frequency : $f_T$=11GHz typ.
- Low-voltage, low-current operation ($V_{CE}$=1V, $I_C$=1mA)
  : $f_T$=7GHz type.
  : $|S21e|^2$=6dB typ (f=1.5GHz).

## Package Dimensions

unit:mm

2110A




## 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 | $V_{EBO}$ | | 1.5 | V |
| Collector Current | $I_C$ | | 30 | mA |
| Collector Dissipation | $P_C$ | | 200 | 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, $I_C$=10mA | 60* | | 270* | |
| Gain-Bandwidth Product | $f_T1$ | $V_{CE}$=5V, $I_C$=10mA | 8 | 11 | | GHz |
| | $f_T2$ | $V_{CE}$=1V, $I_C$=1mA | | 7 | | GHz |
| Output Capacitance | Cob | $V_{CB}$=10V, f=1MHz | | 0.45 | 0.7 | pF |
| Reverse Transfer Capacitance | Cre | $V_{CB}$=10V, f=1MHz | | 0.25 | | pF |

* : The 2SC5276 is classified by 10mA $h_{FE}$ as follows :

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 | 3 | 120 | 90 | 4 | 180 | 135 | 5 | 270 |

Marking : MN
$h_{FE}$ rank : 3, 4, 5

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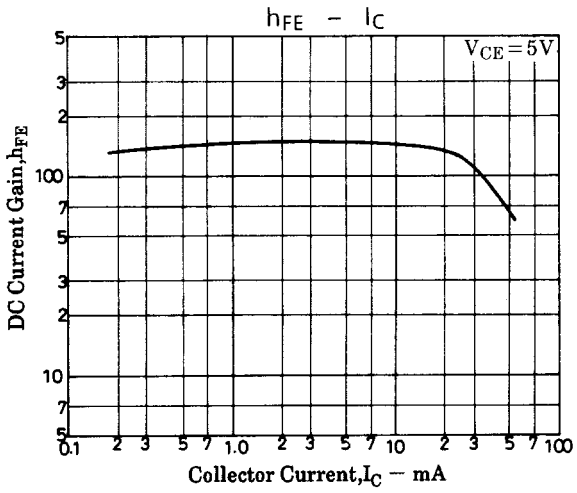
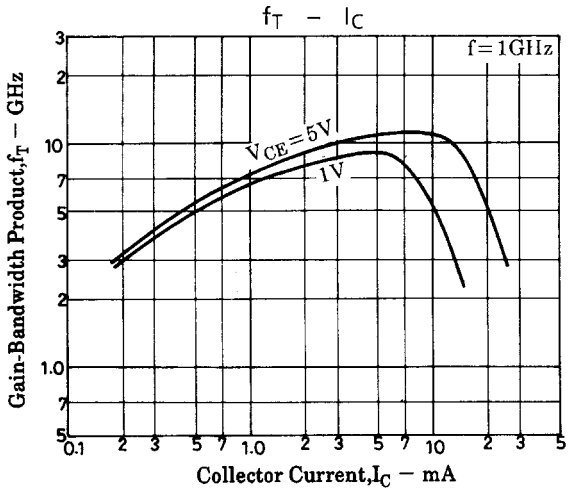
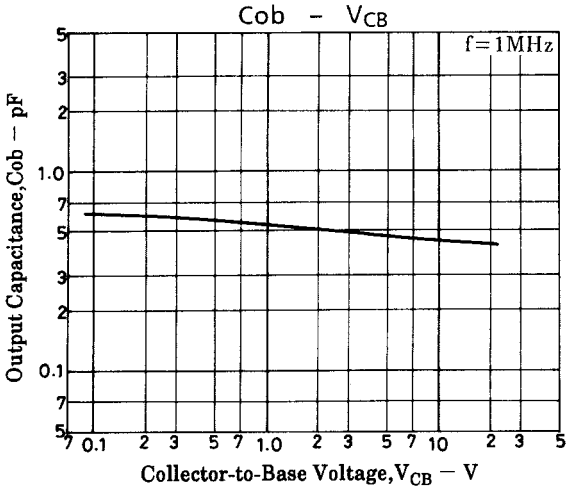
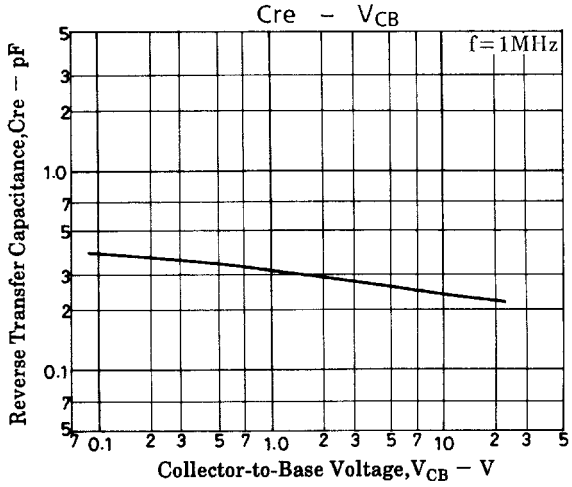
Continued from preceding page.

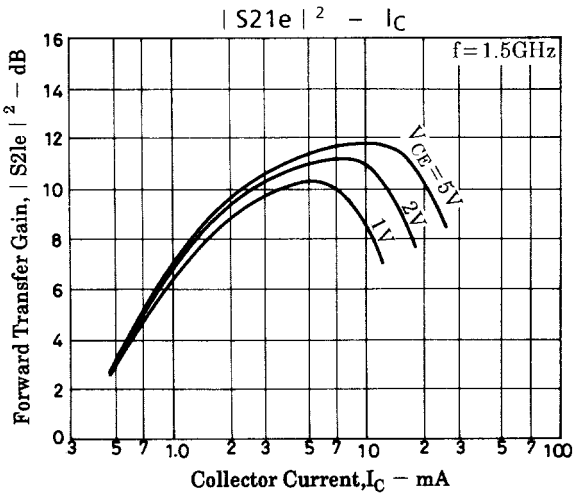
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Forward Transfer Gain | \| S21e \|$^2$ 1 | $V_{CE}$=5V, $I_C$=10mA, f=1.5GHz | 9 | 11 | | dB |
| | \| S21e \|$^2$ 2 | $V_{CE}$=1V, $I_C$=1mA, f=1.5GHz | | 6 | | dB |
| Noise Figure | NF1 | $V_{CE}$=5V, $I_C$=5mA, f=1.5GHz | | 1.4 | 3.0 | dB |
| | NF2 | $V_{CE}$=2V, $I_C$=3mA, f=1GHz | | 0.9 | | dB |

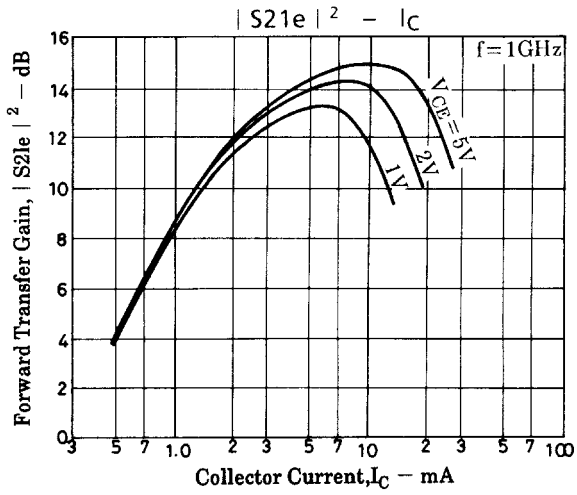


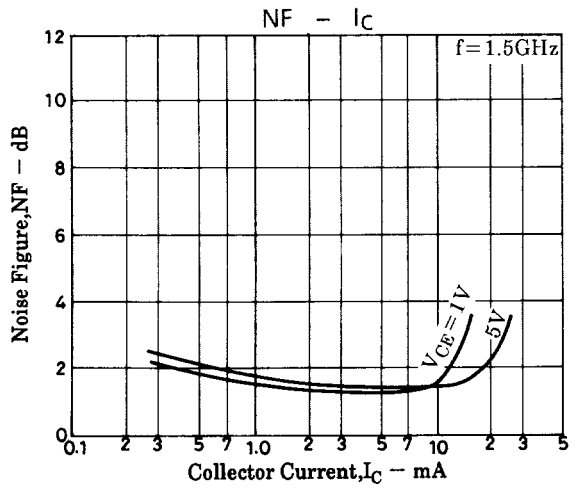



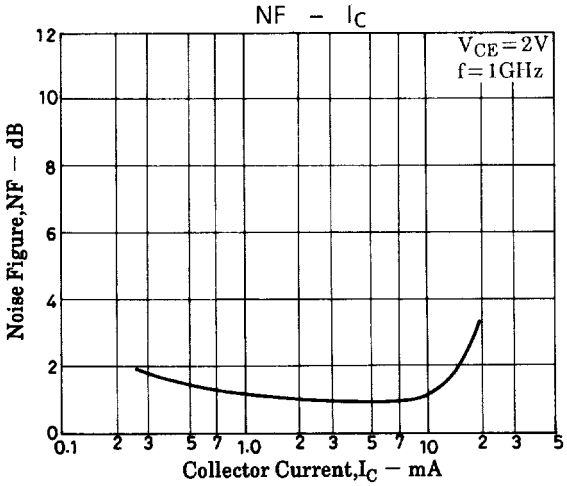



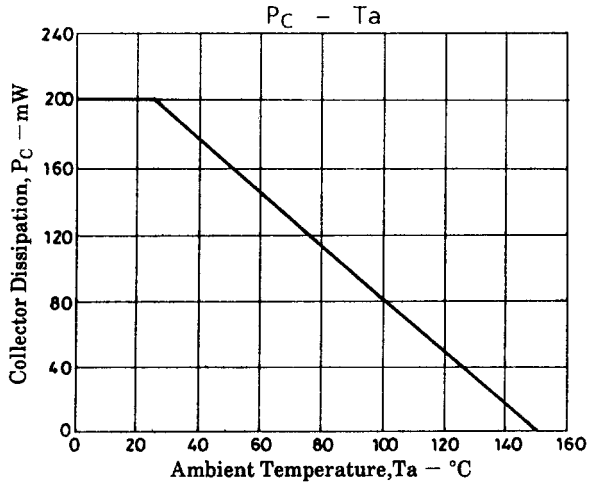



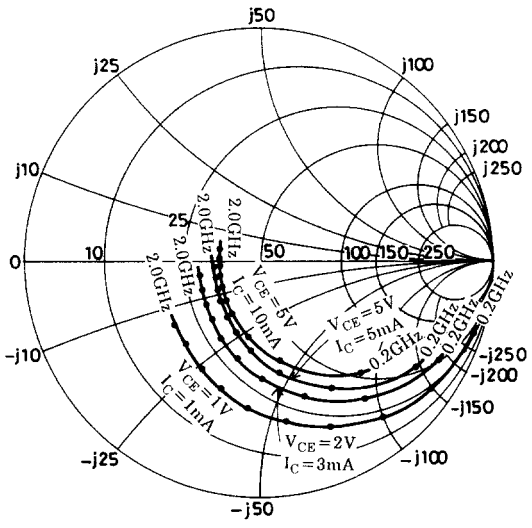


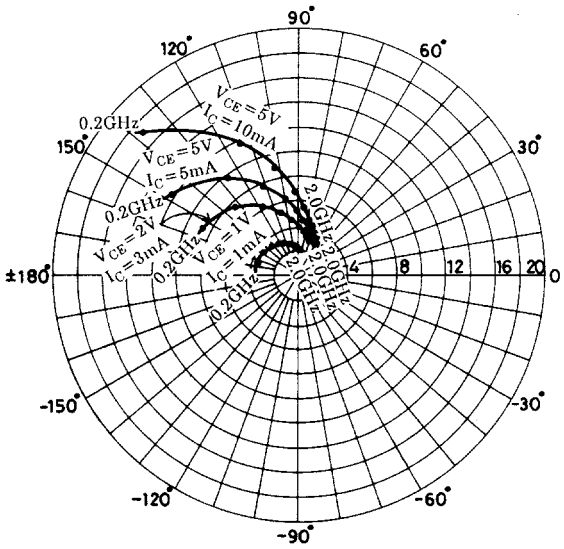




## S Parameters

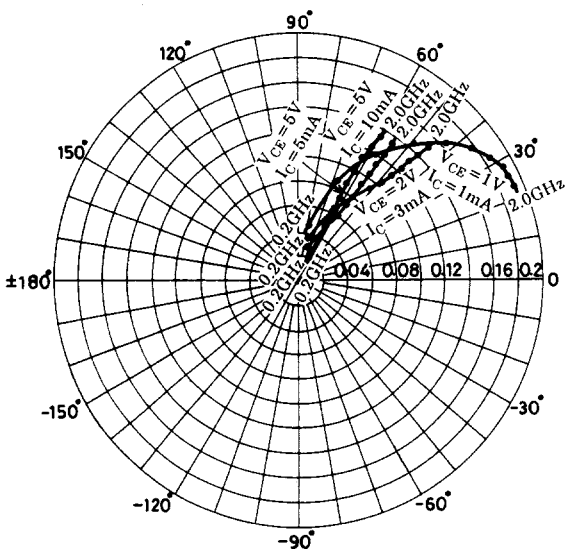
S11e : f=200 to 2000MHz (200MHz step)



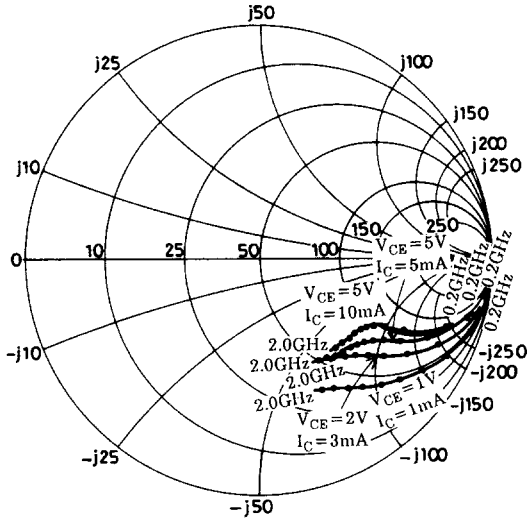

S21e : f=200 to 2000MHz (200MHz step)



S12e : f=200 to 2000MHz (200MHz step)




S22e : f=200 to 2000MHz (200MHz step)




## S parameters (Common emitter)

$V_{CE}$=5V, $I_C$=5mA, $Z_O$=50Ω

| Freq (MHz) | $\|S_{11}\|$ | $\angle S_{11}$ | $\|S_{21}\|$ | $\angle S_{21}$ | $\|S_{12}\|$ | $\angle S_{12}$ | $\|S_{22}\|$ | $\angle S_{22}$ |
|---|---|---|---|---|---|---|---|---|
| 200 | 0.789 | –34.0 | 12.209 | 148.5 | 0.029 | 72.3 | 0.914 | –16.3 |
| 400 | 0.610 | –60.1 | 9.707 | 125.8 | 0.048 | 62.4 | 0.785 | –25.6 |
| 600 | 0.474 | –79.5 | 7.653 | 110.7 | 0.061 | 58.2 | 0.692 | –25.6 |
| 800 | 0.372 | –95.6 | 6.212 | 99.2 | 0.072 | 56.6 | 0.632 | –33.6 |
| 1000 | 0.311 | –108.2 | 5.172 | 90.8 | 0.082 | 56.1 | 0.594 | –36.1 |
| 1200 | 0.264 | –122.2 | 4.459 | 83.0 | 0.093 | 55.9 | 0.570 | –38.6 |
| 1400 | 0.225 | –135.5 | 3.905 | 76.3 | 0.103 | 55.5 | 0.553 | –41.5 |
| 1600 | 0.204 | –147.9 | 3.464 | 70.7 | 0.113 | 55.5 | 0.539 | –44.5 |
| 1800 | 0.188 | –161.6 | 3.121 | 64.9 | 0.124 | 54.7 | 0.528 | –48.2 |
| 2000 | 0.184 | –175.1 | 2.855 | 59.7 | 0.135 | 54.2 | 0.527 | –51.6 |

$V_{CE}$=5V, $I_C$=10mA, $Z_O$=50Ω

| Freq (MHz) | $\|S_{11}\|$ | $\angle S_{11}$ | $\|S_{21}\|$ | $\angle S_{21}$ | $\|S_{12}\|$ | $\angle S_{12}$ | $\|S_{22}\|$ | $\angle S_{22}$ |
|---|---|---|---|---|---|---|---|---|
| 200 | 0.629 | –47.8 | 17.118 | 137.6 | 0.025 | 69.4 | 0.839 | –20.3 |
| 400 | 0.421 | –77.9 | 11.829 | 114.0 | 0.040 | 63.6 | 0.681 | –26.7 |
| 600 | 0.316 | –98.0 | 8.649 | 101.1 | 0.052 | 62.7 | 0.605 | –28.9 |
| 800 | 0.245 | –117.5 | 6.785 | 91.2 | 0.064 | 62.8 | 0.562 | –30.7 |
| 1000 | 0.209 | –130.0 | 5.536 | 84.4 | 0.075 | 63.0 | 0.540 | –32.9 |
| 1200 | 0.183 | –147.2 | 4.719 | 77.6 | 0.088 | 62.9 | 0.528 | –35.2 |
| 1400 | 0.168 | –161.6 | 4.103 | 72.0 | 0.100 | 62.5 | 0.517 | –37.9 |
| 1600 | 0.162 | –174.0 | 3.626 | 66.7 | 0.112 | 61.9 | 0.510 | –41.4 |
| 1800 | 0.164 | 173.1 | 3.255 | 61.7 | 0.124 | 60.5 | 0.503 | –45.4 |
| 2000 | 0.170 | 160.6 | 2.962 | 56.8 | 0.135 | 59.3 | 0.502 | –49.1 |

$V_{CE}$=2V, $I_C$=3mA, $Z_O$=50Ω

| Freq (MHz) | $\|S_{11}\|$ | $\angle S_{11}$ | $\|S_{21}\|$ | $\angle S_{21}$ | $\|S_{12}\|$ | $\angle S_{12}$ | $\|S_{22}\|$ | $\angle S_{22}$ |
|---|---|---|---|---|---|---|---|---|
| 200 | 0.860 | –28.3 | 8.645 | 154.3 | 0.036 | 73.8 | 0.943 | –15.2 |
| 400 | 0.725 | –52.2 | 7.452 | 133.4 | 0.063 | 62.5 | 0.839 | –26.1 |
| 600 | 0.598 | –71.6 | 6.200 | 117.7 | 0.081 | 55.4 | 0.744 | –33.3 |
| 800 | 0.490 | –88.6 | 5.210 | 105.1 | 0.094 | 51.1 | 0.667 | –38.4 |
| 1000 | 0.417 | –102.6 | 4.458 | 95.5 | 0.104 | 48.9 | 0.615 | –42.3 |
| 1200 | 0.358 | –116.9 | 3.901 | 86.7 | 0.114 | 47.5 | 0.579 | –45.5 |
| 1400 | 0.311 | –129.4 | 3.452 | 79.3 | 0.124 | 46.4 | 0.552 | –48.6 |
| 1600 | 0.285 | –141.5 | 3.072 | 72.8 | 0.132 | 46.3 | 0.531 | –51.9 |
| 1800 | 0.262 | –154.3 | 2.783 | 66.4 | 0.141 | 45.6 | 0.513 | –55.7 |
| 2000 | 0.252 | –167.3 | 2.551 | 60.9 | 0.150 | 44.5 | 0.505 | –59.0 |

$V_{CE}$=1V, $I_C$=1mA, $Z_O$=50Ω

| Freq (MHz) | $\|S_{11}\|$ | $\angle S_{11}$ | $\|S_{21}\|$ | $\angle S_{21}$ | $\|S_{12}\|$ | $\angle S_{12}$ | $\|S_{22}\|$ | $\angle S_{22}$ |
|---|---|---|---|---|---|---|---|---|
| 200 | 0.952 | –18.3 | 3.431 | 163.0 | 0.045 | 78.1 | 0.983 | –10.2 |
| 400 | 0.896 | –36.0 | 3.331 | 145.5 | 0.086 | 67.4 | 0.945 | –19.6 |
| 600 | 0.830 | –51.8 | 3.020 | 132.9 | 0.119 | 57.6 | 0.892 | –27.7 |
| 800 | 0.753 | –67.1 | 2.756 | 119.8 | 0.145 | 49.5 | 0.837 | –34.9 |
| 1000 | 0.681 | –80.9 | 2.543 | 108.6 | 0.163 | 42.6 | 0.782 | –41.5 |
| 1200 | 0.617 | –92.9 | 2.373 | 97.8 | 0.177 | 37.0 | 0.743 | –46.4 |
| 1400 | 0.557 | –107.1 | 2.184 | 88.4 | 0.185 | 32.1 | 0.699 | –51.5 |
| 1600 | 0.509 | –118.6 | 2.011 | 79.8 | 0.191 | 28.1 | 0.666 | –55.9 |
| 1800 | 0.461 | –132.1 | 1.888 | 71.6 | 0.191 | 25.5 | 0.640 | –60.6 |
| 2000 | 0.440 | –144.0 | 1.737 | 64.5 | 0.191 | 23.0 | 0.618 | –64.5 |