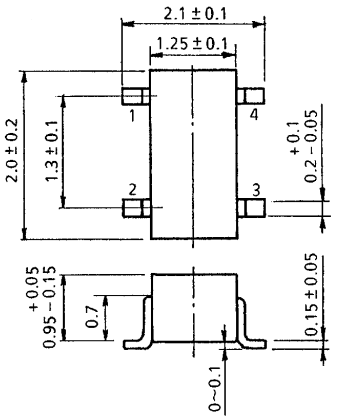
TOSHIBA TRANSISTOR SILICON NPN EPITAXIAL PLANAR TYPE

# 2SC5497

VHF~UHF BAND LOW NOISE AMPLIFIER APPLICATIONS

Unit in mm




1, 3. EMITTER
2. BASE
3. COLLECTOR

| | |
|---|---|
| USQ | |
| JEDEC | — |
| EIAJ | — |
| TOSHIBA | 2-2K1A |

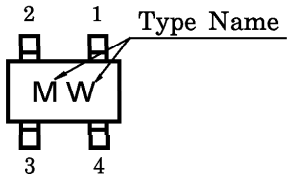
Weight : 0.006mg

- Low Noise Figure : NF = 1.4dB (f = 2GHz)
- High Gain : Ga = 14dB (f = 2GHz)

MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | 8 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | 4.5 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 1.5 | V |
| Collector Current | $I_C$ | 15 | mA |
| Base Current | $I_B$ | 7.5 | mA |
| Collector Power Dissipation | $P_C$ | 67.5 | mW |
| Junction Temperature | $T_j$ | 125 | °C |
| Storage Temperature Range | $T_{stg}$ | −55~125 | °C |

MARKING




MICROWAVE CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Transition Frequency | $f_T$ | $V_{CE}$ = 3V, $I_C$ = 10mA | 14 | 18 | 22 | GHz |
| Insertion Gain | $\|S_{21e}\|^2$ (1) | $V_{CE}$ = 3V, $I_C$ = 10mA, f = 1GHz | 16.5 | 19 | 21.5 | dB |
| | $\|S_{21e}\|^2$ (2) | $V_{CE}$ = 3V, $I_C$ = 10mA, f = 2GHz | 11.5 | 14 | 16.5 | |
| Noise Figure | NF (1) | $V_{CE}$ = 3V, $I_C$ = 3mA, f = 1GHz | — | 1.0 | 1.4 | dB |
| | NF (2) | $V_{CE}$ = 3V, $I_C$ = 3mA, f = 2GHz | — | 1.4 | 1.8 | |

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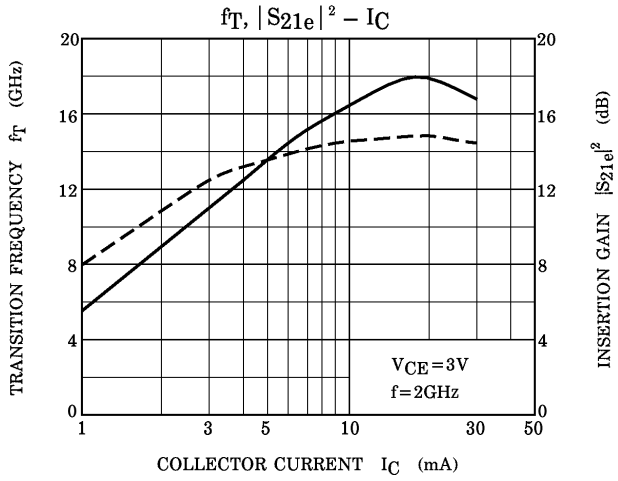
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

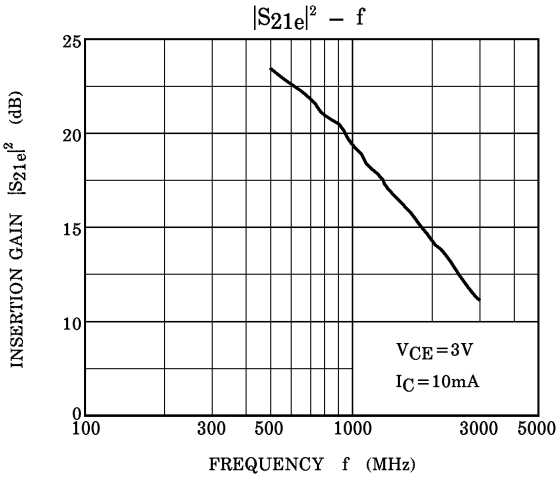
| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Collector Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 8V, $I_E$ = 0 | — | — | 1 | μA |
| Emitter Cut-off Current | $I_{EBO}$ | $V_{EB}$ = 1V, $I_C$ = 0 | — | — | 1 | μA |
| DC Current Gain | $h_{FE}$ (Note 1) | $V_{CE}$ = 3V, $I_C$ = 10mA | 50 | — | 150 | — |
| Output Capacitance | $C_{ob}$ | $V_{CB}$ = 3V, $I_E$ = 0, f = 1MHz (Note 2) | — | 0.40 | 0.65 | pF |
| Reverse Transfer Capacitance | $C_{re}$ | | — | 0.20 | 0.45 | pF |

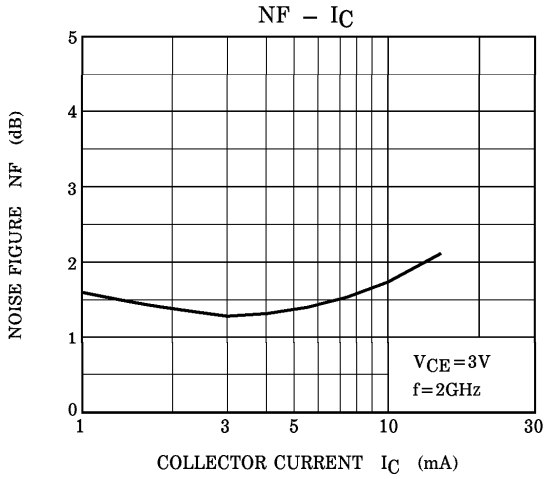
(Note) : $C_{re}$ is measured by 3 terminal method with Capacitance Bridge.

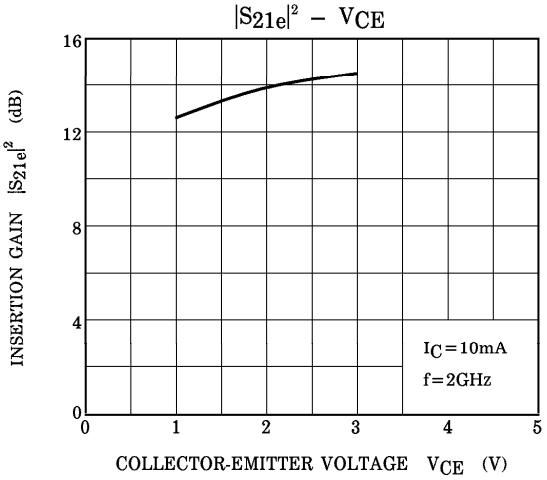
CAUTION

This device electrostatic sensitivity. Please handle with caution.


$f_T$, $|S_{21e}|^2$ – $I_C$
TRANSITION FREQUENCY $f_T$ (GHz)
INSERTION GAIN $|S_{21e}|^2$ (dB)
$V_{CE}$ = 3V
f = 2GHz
COLLECTOR CURRENT $I_C$ (mA)


$|S_{21e}|^2$ – f
INSERTION GAIN $|S_{21e}|^2$ (dB)
$V_{CE}$ = 3V
$I_C$ = 10mA
FREQUENCY f (MHz)


NF – $I_C$
NOISE FIGURE NF (dB)
$V_{CE}$ = 3V
f = 2GHz
COLLECTOR CURRENT $I_C$ (mA)


$|S_{21e}|^2$ – $V_{CE}$
INSERTION GAIN $|S_{21e}|^2$ (dB)
$I_C$ = 10mA
f = 2GHz
COLLECTOR-EMITTER VOLTAGE $V_{CE}$ (V)

S-PARAMETER $Z_O = 50\Omega$, Ta = 25°C
$V_{CE}$ = 3V, $I_C$ = 3mA

| f | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| (MHz) | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. |
| 100 | 0.918 | −9.5 | 9.134 | 171.9 | 0.015 | 74.7 | 0.978 | −6.5 |
| 200 | 0.910 | −18.7 | 8.939 | 164.5 | 0.027 | 82.9 | 0.960 | −12.1 |
| 300 | 0.886 | −27.6 | 8.725 | 157.3 | 0.039 | 74.8 | 0.931 | −18.7 |
| 400 | 0.855 | −36.4 | 8.430 | 150.5 | 0.050 | 68.5 | 0.905 | −24.3 |
| 500 | 0.824 | −44.6 | 8.090 | 144.5 | 0.059 | 66.8 | 0.868 | −29.3 |
| 600 | 0.802 | −52.1 | 7.716 | 138.1 | 0.072 | 61.8 | 0.841 | −34.1 |
| 700 | 0.762 | −59.9 | 7.341 | 133.0 | 0.073 | 56.3 | 0.796 | −39.1 |
| 800 | 0.728 | −67.3 | 7.078 | 127.5 | 0.091 | 52.0 | 0.765 | −43.6 |
| 900 | 0.698 | −75.0 | 6.691 | 123.5 | 0.091 | 50.5 | 0.721 | −47.0 |
| 1000 | 0.667 | −80.4 | 6.411 | 118.2 | 0.103 | 44.4 | 0.694 | −50.2 |
| 1100 | 0.653 | −86.7 | 6.080 | 114.3 | 0.097 | 45.9 | 0.654 | −53.9 |
| 1200 | 0.620 | −92.8 | 5.862 | 110.1 | 0.111 | 38.0 | 0.629 | −57.1 |
| 1300 | 0.607 | −98.8 | 5.551 | 106.6 | 0.113 | 39.7 | 0.593 | −61.1 |
| 1400 | 0.576 | −104.5 | 5.363 | 102.6 | 0.110 | 35.9 | 0.574 | −62.9 |
| 1500 | 0.569 | −109.8 | 5.088 | 99.6 | 0.114 | 35.9 | 0.558 | −65.6 |
| 1600 | 0.550 | −115.0 | 4.901 | 96.0 | 0.114 | 32.1 | 0.527 | −68.8 |
| 1700 | 0.536 | −119.8 | 4.717 | 93.2 | 0.119 | 28.3 | 0.501 | −70.7 |
| 1800 | 0.530 | −124.5 | 4.492 | 89.7 | 0.124 | 32.5 | 0.482 | −72.4 |
| 1900 | 0.508 | −130.2 | 4.331 | 87.2 | 0.121 | 30.4 | 0.458 | −74.9 |
| 2000 | 0.498 | −133.2 | 4.169 | 83.7 | 0.123 | 30.4 | 0.438 | −76.3 |
| 2100 | 0.502 | −138.9 | 4.032 | 81.9 | 0.120 | 28.5 | 0.432 | −78.1 |
| 2200 | 0.490 | −140.9 | 3.893 | 78.5 | 0.124 | 27.3 | 0.412 | −80.7 |
| 2300 | 0.484 | −145.9 | 3.747 | 77.3 | 0.137 | 28.1 | 0.401 | −79.2 |
| 2400 | 0.487 | −149.3 | 3.646 | 73.3 | 0.135 | 23.2 | 0.387 | −82.3 |
| 2500 | 0.477 | −153.3 | 3.525 | 72.0 | 0.132 | 25.0 | 0.364 | −83.1 |
| 2600 | 0.462 | −156.5 | 3.452 | 69.0 | 0.136 | 32.0 | 0.358 | −84.5 |

$V_{CE}$ = 3V, $I_C$ = 5mA

| f | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| (MHz) | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. |
| 100 | 0.873 | −12.1 | 13.426 | 169.8 | 0.011 | 91.9 | 0.961 | −7.6 |
| 200 | 0.853 | −24.4 | 12.949 | 160.4 | 0.025 | 82.7 | 0.933 | −15.9 |
| 300 | 0.819 | −35.7 | 12.471 | 152.0 | 0.038 | 69.0 | 0.893 | −23.7 |
| 400 | 0.784 | −45.7 | 11.751 | 144.3 | 0.053 | 61.6 | 0.852 | −30.0 |
| 500 | 0.738 | −55.7 | 11.046 | 136.9 | 0.055 | 66.2 | 0.797 | −35.8 |
| 600 | 0.699 | −64.8 | 10.327 | 130.4 | 0.059 | 56.2 | 0.757 | −40.9 |
| 700 | 0.655 | −73.5 | 9.581 | 124.9 | 0.064 | 51.4 | 0.711 | −46.4 |
| 800 | 0.621 | −81.3 | 9.097 | 119.8 | 0.066 | 46.1 | 0.661 | −50.1 |
| 900 | 0.595 | −88.3 | 8.423 | 114.8 | 0.077 | 45.9 | 0.620 | −53.9 |
| 1000 | 0.564 | −95.6 | 7.925 | 110.6 | 0.081 | 40.6 | 0.582 | −57.1 |
| 1100 | 0.548 | −102.2 | 7.436 | 106.7 | 0.084 | 40.8 | 0.547 | −60.4 |
| 1200 | 0.519 | −107.2 | 7.068 | 102.7 | 0.097 | 41.7 | 0.518 | −62.9 |
| 1300 | 0.508 | −114.1 | 6.638 | 99.4 | 0.091 | 42.0 | 0.491 | −66.6 |
| 1400 | 0.488 | −119.7 | 6.333 | 95.9 | 0.083 | 39.9 | 0.476 | −67.8 |
| 1500 | 0.477 | −125.6 | 5.970 | 92.9 | 0.098 | 41.3 | 0.445 | −70.2 |
| 1600 | 0.467 | −129.3 | 5.720 | 89.6 | 0.100 | 40.2 | 0.437 | −73.7 |
| 1700 | 0.456 | −134.9 | 5.457 | 87.3 | 0.098 | 36.1 | 0.404 | −74.1 |
| 1800 | 0.459 | −139.7 | 5.159 | 83.9 | 0.111 | 41.0 | 0.390 | −75.8 |
| 1900 | 0.454 | −143.1 | 4.945 | 81.8 | 0.105 | 36.1 | 0.373 | −78.8 |
| 2000 | 0.453 | −147.1 | 4.749 | 78.8 | 0.109 | 38.3 | 0.352 | −79.2 |
| 2100 | 0.441 | −152.1 | 4.587 | 76.7 | 0.116 | 35.7 | 0.330 | −80.1 |
| 2200 | 0.430 | −155.2 | 4.420 | 74.1 | 0.117 | 35.2 | 0.315 | −81.7 |
| 2300 | 0.433 | −159.0 | 4.254 | 72.6 | 0.116 | 34.2 | 0.313 | −84.6 |
| 2400 | 0.414 | −162.4 | 4.100 | 69.1 | 0.122 | 34.6 | 0.308 | −85.6 |
| 2500 | 0.438 | −167.1 | 3.963 | 67.9 | 0.117 | 33.4 | 0.286 | −86.2 |
| 2600 | 0.424 | −169.2 | 3.870 | 65.4 | 0.114 | 32.4 | 0.282 | −90.4 |

$V_{CE}$ = 3V, $I_C$ = 10mA

| f | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| (MHz) | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. |
| 100 | 0.772 | −17.7 | 21.134 | 166.1 | 0.014 | 69.7 | 0.942 | −11.3 |
| 200 | 0.735 | −33.8 | 19.870 | 153.8 | 0.026 | 72.6 | 0.894 | −21.9 |
| 300 | 0.678 | −49.2 | 18.317 | 142.9 | 0.029 | 73.4 | 0.818 | −31.5 |
| 400 | 0.623 | −63.2 | 16.563 | 133.9 | 0.044 | 64.8 | 0.738 | −38.2 |
| 500 | 0.576 | −74.3 | 14.956 | 126.2 | 0.045 | 56.9 | 0.674 | −45.2 |
| 600 | 0.547 | −85.3 | 13.473 | 119.5 | 0.048 | 58.7 | 0.607 | −50.1 |
| 700 | 0.506 | −94.0 | 12.201 | 114.2 | 0.053 | 53.4 | 0.559 | −54.4 |
| 800 | 0.475 | −103.4 | 11.213 | 109.2 | 0.056 | 50.0 | 0.516 | −57.8 |
| 900 | 0.461 | −111.2 | 10.178 | 105.2 | 0.065 | 58.3 | 0.475 | −61.2 |
| 1000 | 0.439 | −117.5 | 9.440 | 101.3 | 0.070 | 45.9 | 0.444 | −64.0 |
| 1100 | 0.423 | −123.0 | 8.705 | 97.8 | 0.062 | 52.5 | 0.407 | −64.9 |
| 1200 | 0.417 | −130.9 | 8.205 | 94.4 | 0.068 | 49.0 | 0.389 | −68.2 |
| 1300 | 0.415 | −135.7 | 7.597 | 91.4 | 0.072 | 48.8 | 0.351 | −71.0 |
| 1400 | 0.409 | −141.8 | 7.191 | 88.5 | 0.075 | 43.8 | 0.347 | −71.7 |
| 1500 | 0.395 | −144.5 | 6.760 | 85.9 | 0.084 | 46.0 | 0.324 | −75.4 |
| 1600 | 0.400 | −149.6 | 6.429 | 83.3 | 0.080 | 43.6 | 0.319 | −76.4 |
| 1700 | 0.393 | −154.1 | 6.096 | 81.2 | 0.086 | 47.5 | 0.288 | −78.2 |
| 1800 | 0.387 | −158.5 | 5.753 | 78.1 | 0.091 | 40.3 | 0.287 | −78.5 |
| 1900 | 0.391 | −161.2 | 5.503 | 76.5 | 0.086 | 41.3 | 0.271 | −78.2 |
| 2000 | 0.395 | −164.9 | 5.246 | 73.6 | 0.100 | 44.5 | 0.254 | −80.1 |
| 2100 | 0.402 | −168.9 | 5.037 | 71.9 | 0.098 | 44.0 | 0.254 | −85.8 |
| 2200 | 0.395 | −171.3 | 4.841 | 69.5 | 0.104 | 41.1 | 0.244 | −85.2 |
| 2300 | 0.397 | −172.4 | 4.641 | 68.3 | 0.110 | 43.1 | 0.242 | −83.4 |
| 2400 | 0.387 | −179.3 | 4.503 | 64.9 | 0.115 | 50.8 | 0.244 | −87.0 |
| 2500 | 0.397 | 179.8 | 4.306 | 63.7 | 0.109 | 42.8 | 0.228 | −87.5 |
| 2600 | 0.390 | 176.3 | 4.197 | 61.5 | 0.118 | 41.6 | 0.216 | −87.6 |