## 2SC5812

## Silicon NPN Epitaxial

VHF/UHF wide band amplifier
REJ03G0757-0100
(Previous ADE-208-1468)
Rev.1.00
Aug.10.2005

## Application

- High power gain, Low noise figure at low power operation:
$\left|\mathrm{S}_{21}\right|^{2}=17 \mathrm{~dB}$ typ, $\mathrm{NF}=1.0 \mathrm{~dB} \operatorname{typ}\left(\mathrm{~V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{I}_{\mathrm{C}}=5 \mathrm{~mA}, \mathrm{f}=900 \mathrm{MHz}\right)$


## Outline

RENESAS Package code: PUSF0003ZA-A
(Package name: MFPAK ${ }^{\circledR}$ )


Note: Marking is "WG-".
*MFPAK is a trademark of Renesas Technology Corp.

## Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit |  |
| :--- | :---: | :---: | :---: | :---: |
| $\mathrm{C})$ |  |  |  |  |
| Collector to base voltage | $\mathrm{V}_{\text {CBO }}$ | 15 | V |  |
| Collector to emitter voltage | $\mathrm{V}_{\text {CEO }}$ | 4 | V |  |
| Emitter to base voltage | $\mathrm{V}_{\text {EBO }}$ | 1.5 | V |  |
| Collector current | $\mathrm{I}_{\mathrm{C}}$ | 50 | mA |  |
| Collector power dissipation | $\mathrm{P}_{\mathrm{C}}$ | 80 | mW |  |
| Junction temperature | Tj | 150 | ${ }^{\circ} \mathrm{C}$ |  |
| Storage temperature | Tstg | -55 to +150 | ${ }^{\circ} \mathrm{C}$ |  |

## Electrical Characteristics

$\left(\mathrm{Ta}=25^{\circ} \mathrm{C}\right)$

| Item | Symbol | Min | Typ | Max | Unit | Test conditions |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Collector to base breakdown voltage | $\mathrm{V}_{\text {(BR) }}$ CbO | 15 | - | - | V | $\mathrm{I}_{\mathrm{C}}=10 \mu \mathrm{~A}, \mathrm{I}_{\mathrm{E}}=0$ |
| Collector cutoff current | $\mathrm{I}_{\text {cbo }}$ | - | - | 0.1 | $\mu \mathrm{A}$ | $\mathrm{V}_{\mathrm{CB}}=15 \mathrm{~V}, \mathrm{I}_{\mathrm{E}}=0$ |
| Collector cutoff current | $\mathrm{I}_{\text {ceo }}$ | - | - | 1 | $\mu \mathrm{A}$ | $\mathrm{V}_{\text {CE }}=4 \mathrm{~V}, \mathrm{R}_{\text {BE }}=\infty$ |
| Emitter cutoff current | $\mathrm{I}_{\text {Ebo }}$ | - | - | 0.1 | $\mu \mathrm{A}$ | $\mathrm{V}_{\mathrm{EB}}=0.8 \mathrm{~V}, \mathrm{I}_{\mathrm{C}}=0$ |
| DC current transfer ratio | $\mathrm{h}_{\text {FE }}$ | 100 | 120 | 150 |  | $\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{I}_{\mathrm{C}}=5 \mathrm{~mA}$ |
| Reverse transfer capacitance | $\mathrm{Cr}_{\text {re }}$ | - | 0.2 | - | pF | $\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}$, Emitter ground, $\mathrm{f}=1 \mathrm{MHz}$ |
| Collector output capacitance | $\mathrm{C}_{\text {ob }}$ | - | 0.4 | 0.7 | pF | $\begin{aligned} & \mathrm{V}_{\mathrm{CB}}=1 \mathrm{~V}, \mathrm{I}_{\mathrm{E}}=0, \\ & \mathrm{f}=1 \mathrm{MHz} \end{aligned}$ |
| Gain bandwidth product | $\mathrm{f}_{\mathrm{T}}(1)$ | 8 | 11 | - | GHz | $\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{I}_{\mathrm{C}}=5 \mathrm{~mA}$ |
| Gain bandwidth product | $\mathrm{f}_{\mathrm{T}}(2)$ | - | 15 | - | GHz | $\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{I}_{\mathrm{C}}=20 \mathrm{~mA}$ |
| Forward transmission coefficient | $\left\|S_{21}\right\|^{2}$ | 14 | 17 | - | dB | $\begin{aligned} & \mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{IC}_{\mathrm{C}}=5 \mathrm{~mA}, \\ & \mathrm{f}=900 \mathrm{MHz} \end{aligned}$ |
| Noise figure | NF | - | 1.0 | 1.7 | $\mathrm{dB}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{I}_{\mathrm{C}}=5 \mathrm{~mA}, \\ & \mathrm{f}=900 \mathrm{MHz}, \\ & \mathrm{Z}_{\mathrm{S}}=\mathrm{Z}_{\mathrm{L}}=50 \Omega \end{aligned}$ |

## Main Characteristics




Noise Figure vs. Collector Current


Collector Current $I_{C}(m A)$


Test conditions: $\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{Z}_{\mathrm{O}}=50 \Omega$ 100 to 2000 MHz ( 100 MHz step)
$\bigcirc$ - ( $\left.\mathrm{I}_{\mathrm{C}}=5 \mathrm{~mA}\right)$
$\square$ ( $\left.I_{C}=20 \mathrm{~mA}\right)$
$\mathrm{S}_{12}$ Parameter vs. Frequency


Test conditions: $\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{Z}_{\mathrm{O}}=50 \Omega$ 100 to 2000 MHz ( 100 MHz step)
๑— $\left(\mathrm{I}_{\mathrm{C}}=5 \mathrm{~mA}\right)$
$\square-\left(I_{C}=20 \mathrm{~mA}\right)$
$\mathrm{S}_{21}$ Parameter vs. Frequency


Test conditions: $\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{Z}_{\mathrm{O}}=50 \Omega$ 100 to 2000 MHz ( 100 MHz step)
$\bigcirc$ - ( $\mathrm{I}=5 \mathrm{~mA})$
$\square-\left(I_{C}=20 \mathrm{~mA}\right)$
$\mathrm{S}_{22}$ Parameter vs. Frequency


Test conditions: $\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{Z}_{\mathrm{O}}=50 \Omega$ 100 to 2000 MHz ( 100 MHz step)
๑— $\left(I_{C}=5 \mathrm{~mA}\right)$
回— $\left(I_{C}=20 \mathrm{~mA}\right)$

## S Parameter

$\left(\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{I}_{\mathrm{C}}=5 \mathrm{~mA}, \mathrm{Z}_{\mathrm{O}}=50 \Omega\right)$

| $\mathbf{f}(\mathbf{M H z})$ | S11 |  | S21 |  | S12 |  | S22 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 100 | 0.842 | -16.3 | 15.23 | 164.9 | 0.015 | 80.2 | 0.963 | -10.1 |
| 200 | 0.783 | -31.7 | 14.17 | 152.2 | 0.027 | 72.9 | 0.904 | -18.4 |
| 300 | 0.719 | -44.6 | 12.84 | 141.4 | 0.037 | 66.8 | 0.826 | -24.9 |
| 400 | 0.637 | -55.4 | 11.41 | 131.8 | 0.045 | 62.9 | 0.754 | -29.4 |
| 500 | 0.582 | -65.9 | 10.25 | 124.8 | 0.051 | 60.8 | 0.691 | -32.9 |
| 600 | 0.531 | -73.2 | 9.16 | 118.6 | 0.056 | 60.1 | 0.638 | -35.0 |
| 700 | 0.472 | -80.9 | 8.22 | 113.1 | 0.061 | 59.7 | 0.595 | -36.7 |
| 800 | 0.443 | -87.0 | 7.49 | 108.9 | 0.065 | 60.0 | 0.561 | -37.7 |
| 900 | 0.404 | -92.3 | 6.80 | 104.6 | 0.069 | 60.7 | 0.530 | -38.5 |
| 1000 | 0.377 | -99.2 | 6.26 | 101.0 | 0.073 | 61.5 | 0.508 | -39.1 |
| 1100 | 0.355 | -103.4 | 5.80 | 98.1 | 0.077 | 62.8 | 0.490 | -39.7 |
| 1200 | 0.337 | -108.0 | 5.38 | 94.8 | 0.081 | 64.1 | 0.474 | -40.4 |
| 1300 | 0.327 | -112.6 | 5.04 | 92.4 | 0.085 | 65.0 | 0.461 | -40.8 |
| 1400 | 0.305 | -116.3 | 4.71 | 90.1 | 0.090 | 66.4 | 0.452 | -41.7 |
| 1500 | 0.299 | -120.3 | 4.45 | 87.7 | 0.094 | 67.5 | 0.440 | -42.0 |
| 1600 | 0.297 | -123.8 | 4.20 | 86.0 | 0.099 | 68.5 | 0.437 | -42.8 |
| 1700 | 0.284 | -127.7 | 3.98 | 83.6 | 0.104 | 70.0 | 0.428 | -43.4 |
| 1800 | 0.282 | -132.2 | 3.80 | 81.7 | 0.109 | 71.1 | 0.423 | -44.3 |
| 1900 | 0.272 | -134.3 | 3.62 | 79.8 | 0.114 | 72.0 | 0.418 | -45.3 |
| 2000 | 0.268 | -138.4 | 3.47 | 77.9 | 0.120 | 73.0 | 0.414 | -46.0 |

$\left(\mathrm{V}_{\mathrm{CE}}=1 \mathrm{~V}, \mathrm{I}_{\mathrm{C}}=20 \mathrm{~mA}, \mathrm{Z}_{\mathrm{O}}=50 \Omega\right)$

| $\mathbf{f} \mathbf{( M H z )}$ | S11 |  | S21 |  | S12 |  | S22 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 100 | 0.502 | -40.3 | 36.64 | 147.5 | 0.013 | 76.3 | 0.824 | -21.8 |
| 200 | 0.388 | -66.7 | 27.85 | 127.8 | 0.021 | 70.3 | 0.653 | -32.0 |
| 300 | 0.317 | -84.6 | 21.13 | 116.2 | 0.027 | 69.3 | 0.531 | -35.4 |
| 400 | 0.257 | -99.2 | 16.75 | 108.5 | 0.034 | 72.2 | 0.460 | -35.8 |
| 500 | 0.237 | -109.6 | 13.87 | 103.5 | 0.040 | 73.6 | 0.416 | -35.2 |
| 600 | 0.216 | -115.5 | 11.77 | 99.5 | 0.047 | 75.0 | 0.387 | -34.8 |
| 700 | 0.195 | -125.0 | 10.19 | 96.1 | 0.054 | 75.6 | 0.367 | -34.1 |
| 800 | 0.193 | -129.2 | 9.00 | 93.5 | 0.060 | 76.3 | 0.352 | -33.7 |
| 900 | 0.181 | -135.9 | 8.03 | 90.8 | 0.068 | 77.1 | 0.340 | -33.2 |
| 1000 | 0.179 | -141.0 | 7.26 | 88.8 | 0.074 | 77.7 | 0.333 | -33.3 |
| 1100 | 0.178 | -142.4 | 6.66 | 86.8 | 0.081 | 78.1 | 0.326 | -33.7 |
| 1200 | 0.176 | -147.8 | 6.12 | 84.7 | 0.088 | 78.2 | 0.321 | -34.0 |
| 1300 | 0.176 | -150.0 | 5.68 | 83.2 | 0.094 | 78.4 | 0.317 | -34.5 |
| 1400 | 0.166 | -154.2 | 5.32 | 81.7 | 0.102 | 78.5 | 0.314 | -35.1 |
| 1500 | 0.175 | -158.0 | 4.97 | 80.0 | 0.109 | 78.6 | 0.311 | -36.0 |
| 1600 | 0.172 | -159.7 | 4.70 | 78.7 | 0.116 | 79.0 | 0.309 | -36.8 |
| 1700 | 0.172 | -162.4 | 4.43 | 77.0 | 0.123 | 78.9 | 0.307 | -37.6 |
| 1800 | 0.179 | -164.9 | 4.21 | 75.7 | 0.131 | 78.8 | 0.305 | -38.6 |
| 1900 | 0.177 | -166.8 | 4.01 | 74.3 | 0.138 | 78.7 | 0.304 | -39.7 |
| 2000 | 0.183 | -169.9 | 3.83 | 72.8 | 0.145 | 78.5 | 0.303 | -40.8 |

## Package Dimensions



## Ordering Information

| Part Name | Quantity | Shipping Container |
| :---: | :---: | :---: |
| 2SC5812WG-TR-E | 9000 | $\phi 178 \mathrm{~mm}$ Reel, 8 mm Emboss Taping |

Note: For some grades, production may be terminated. Please contact the Renesas sales office to check the state of production before ordering the product.

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