To our customers,

# Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation



Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

# Notice

# BB304C

## Built in Biasing Circuit MOS FET IC
## VHF RF Amplifier

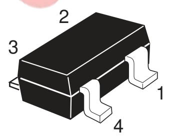
REJ03G0826-0600
(Previous ADE-208-606D)
Rev.6.00
Aug.10.2005

### Features

- Built in Biasing Circuit; To reduce using parts cost & PC board space.
- High gain;
  (PG = 29 dB typ. at f = 200 MHz)
- Low noise characteristics;
  (NF = 1.2 dB typ. at f = 200 MHz)
- Wide supply voltage range;
  Applicable with 5V to 9V supply voltage.
- Withstanding to ESD;
  Built in ESD absorbing diode. Withstand up to 200V at C=200pF, Rs=0 conditions.
- Provide mini mold packages; CMPAK-4(SOT-343mod)

### Outline

RENESAS Package code: PTSP0004ZA-A
(Package name: CMPAK-4)




1. Source
2. Gate1
3. Gate2
4. Drain

Notes: 1. Marking is “DW –”.
2. BB304C is individual type number of RENESAS BBFET.

## Absolute Maximum Ratings

(Ta = 25°C)

| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Drain to source voltage | $V_{DS}$ | 12 | V |
| Gate1 to source voltage | $V_{G1S}$ | +10<br>–0 | V |
| Gate2 to source voltage | $V_{G2S}$ | ±10 | V |
| Drain current | $I_D$ | 25 | mA |
| Channel power dissipation | Pch | 100 | mW |
| Channel temperature | Tch | 150 | °C |
| Storage temperature | Tstg | –55 to +150 | °C |

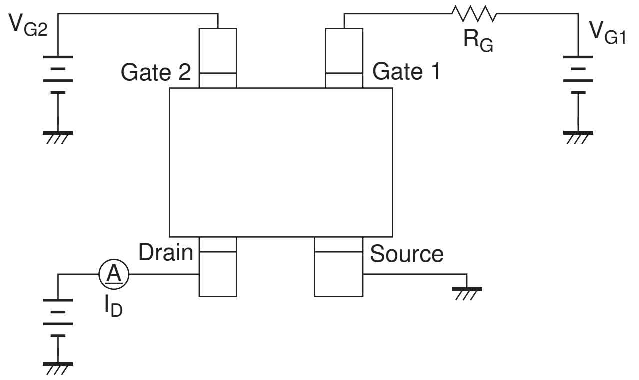
## Electrical Characteristics

(Ta = 25°C)

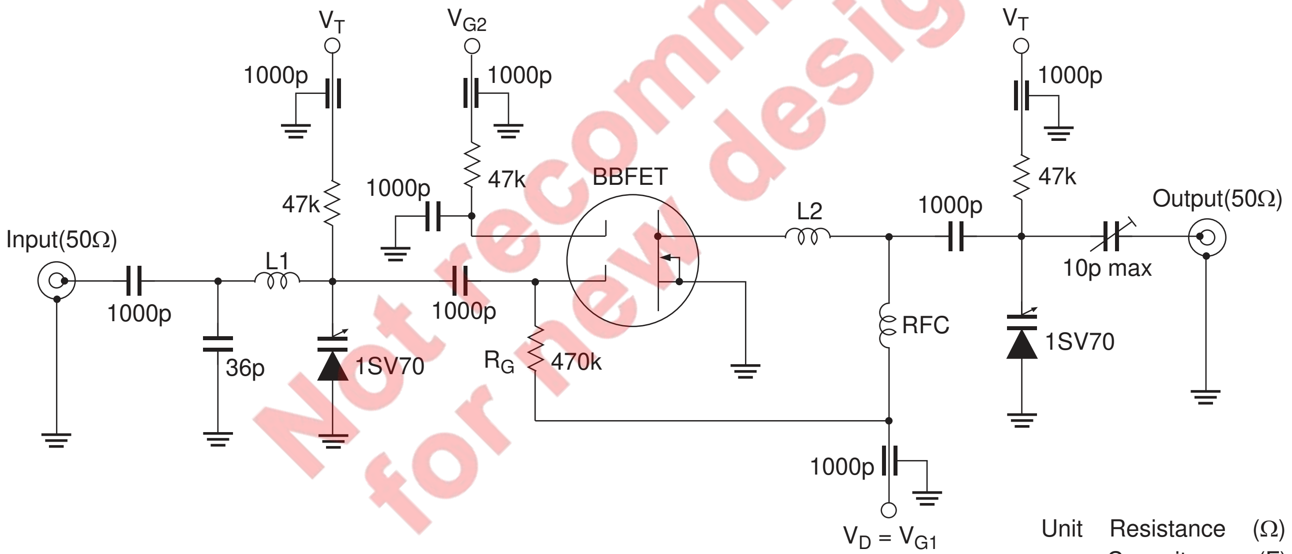
| Item | Symbol | Min | Typ | Max | Unit | Test conditions |
|---|---|---|---|---|---|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | 12 | — | — | V | $I_D$ = 200 μA, $V_{G1S}$ = $V_{G2S}$ = 0 |
| Gate1 to source breakdown voltage | $V_{(BR)G1SS}$ | +10 | — | — | V | $I_{G1}$ = +10 μA, $V_{G2S}$ = $V_{DS}$ = 0 |
| Gate2 to source breakdown voltage | $V_{(BR)G2SS}$ | ±10 | — | — | V | $I_{G2}$ = +10 μA, $V_{G1S}$ = $V_{DS}$ = 0 |
| Gate1 to source cutoff current | $I_{G1SS}$ | — | — | +100 | nA | $V_{G1S}$ = +9 V, $V_{G2S}$ = $V_{DS}$ = 0 |
| Gate2 to source cutoff current | $I_{G2SS}$ | — | — | ±100 | nA | $V_{G2S}$ = +9 V, $V_{G1S}$ = $V_{DS}$ = 0 |
| Gate1 to source cutoff voltage | $V_{G1S(off)}$ | 0.4 | — | 1.0 | V | $V_{DS}$ = 5 V, $V_{G2S}$ = 4 V<br>$I_D$ = 100 μA |
| Gate2 to source cutoff voltage | $V_{G2S(off)}$ | 0.5 | — | 1.0 | V | $V_{DS}$ = 5 V, $V_{G1S}$ = 5 V<br>$I_D$ = 100 μA |
| Input capacitance | Ciss | 2.3 | 2.8 | 3.6 | pF | $V_{DS}$ = 5 V, $V_{G1}$ = 5 V, $V_{G2S}$ = 4 V<br>$R_G$ = 180 kΩ, f = 1 MHz |
| Output capacitance | Coss | 0.9 | 1.3 | 2.0 | pF | |
| Reverse transfer capacitance | Crss | 0.003 | 0.02 | 0.05 | pF | |
| Drain current | $I_{D(op)}$ 1 | 9 | 14 | 19 | mA | $V_{DS}$ = 5 V, $V_{G1}$ = 5 V, $V_{G2S}$ = 4 V<br>$R_G$ = 180 kΩ |
| | $I_{D(op)}$ 2 | — | 13 | — | mA | $V_{DS}$ = 9 V, $V_{G1}$ = 9 V, $V_{G2S}$ =6 V<br>$R_G$ = 470 kΩ |
| Forward transfer admittance | $\|y_{fs}\|$1 | 22 | 27 | 34 | mS | $V_{DS}$ = 5 V, $V_{G1}$ = 5 V, $V_{G2S}$ =4 V<br>$R_G$ = 180 kΩ, f = 1 kHz |
| | $\|y_{fs}\|$2 | — | 27 | — | mS | $V_{DS}$ = 9 V, $V_{G1}$ = 9 V, $V_{G2S}$ =6 V<br>$R_G$ = 470 kΩ, f = 1 kHz |
| Power gain | PG1 | 24 | 29 | 32 | dB | $V_{DS}$ = 5 V, $V_{G1}$ = 5 V, $V_{G2S}$ =4 V<br>$R_G$ = 180 kΩ, f = 200 MHz |
| | PG2 | — | 29 | — | dB | $V_{DS}$ = 9 V, $V_{G1}$ = 9 V, $V_{G2S}$ =6 V<br>$R_G$ = 470 kΩ, f = 200 MHz |
| Noise figure | NF1 | — | 1.2 | 1.9 | dB | $V_{DS}$ = 5 V, $V_{G1}$ = 5 V, $V_{G2S}$ =4 V<br>$R_G$ = 180 kΩ, f = 200 MHz |
| | NF2 | — | 1.2 | — | dB | $V_{DS}$ = 9 V, $V_{G1}$ = 9 V, $V_{G2S}$ =6 V<br>$R_G$ = 470 kΩ, f = 200 MHz |

## Main Characteristics

Test Circuit for Operating Items ($I_{D(op)}$, |yfs|, Ciss, Coss, Crss, NF, PG)



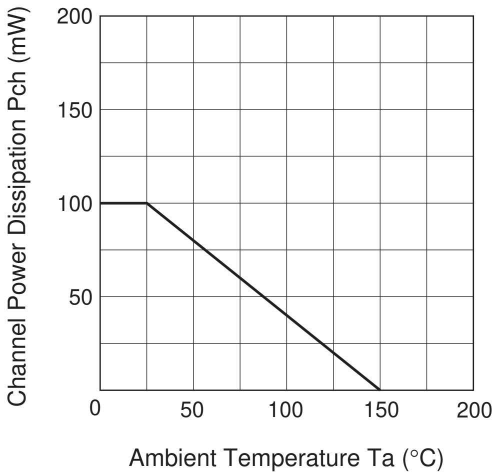

200MHz Power Gain, Noise Figure Test Circuit



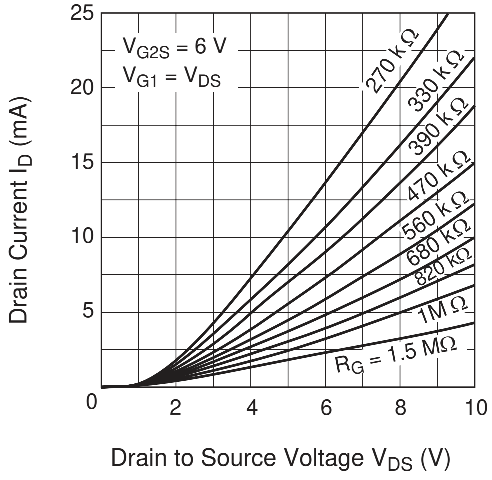

Unit Resistance (Ω)
Capacitance (F)

L1 : ϕ1mm Enameled Copper Wire,Inside dia 10mm, 2Turns
L2 : ϕ1mm Enameled Copper Wire,Inside dia 10mm, 2Turns
RFC : ϕ1mm Enameled Copper Wire,Inside dia 5mm, 2Turns

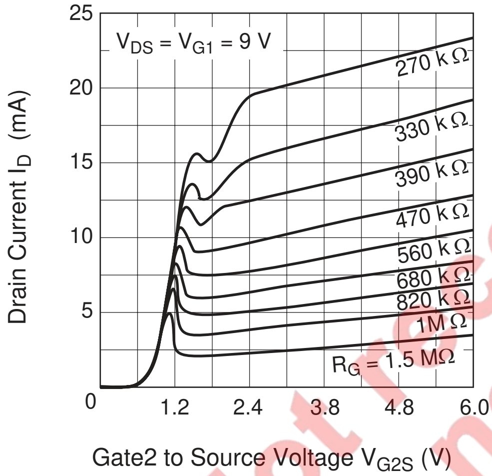
Maximum Channel Power Dissipation Curve



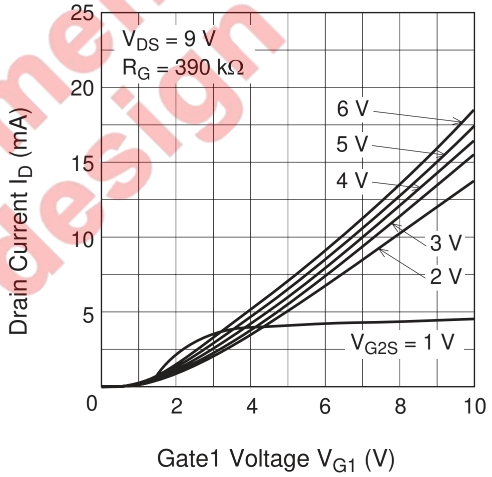

Typical Output Characteristics




Drain Current vs. Gate2 to Source Voltage

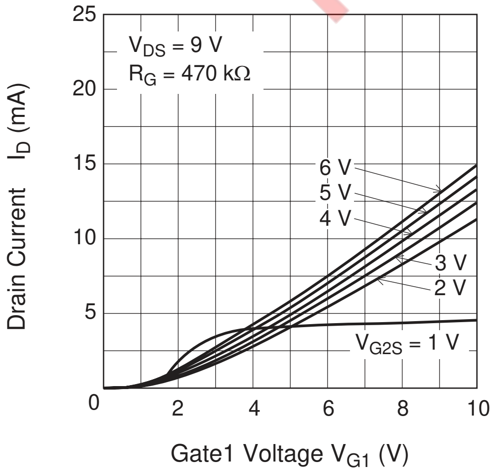



Drain Current vs. Gate1 Voltage

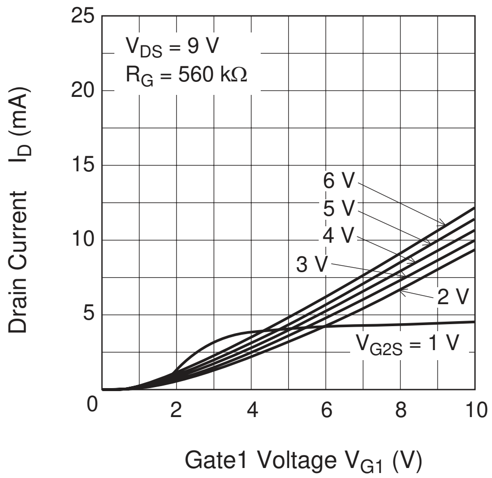




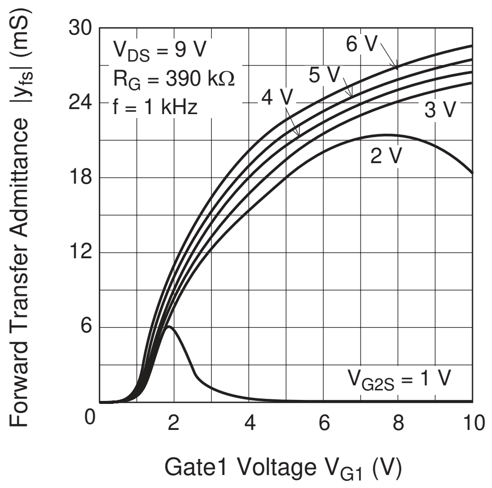

Drain Current vs. Gate1 Voltege



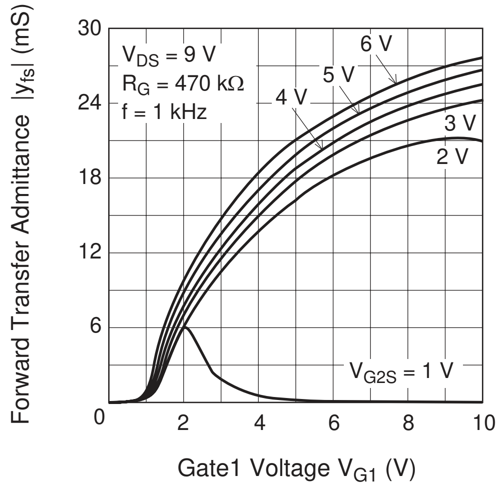

Drain Current vs. Gate1 Voltege



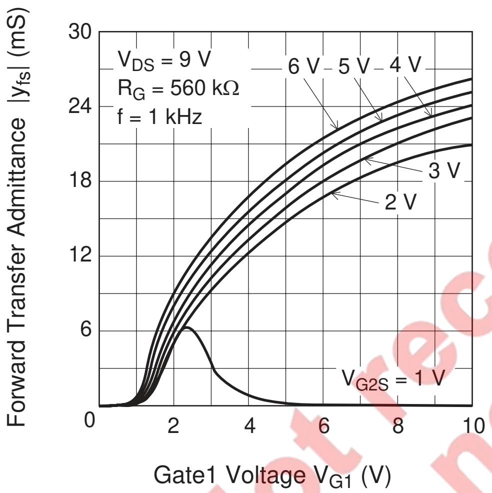
Forward Transfer Admittance vs. Gate1 Voltage



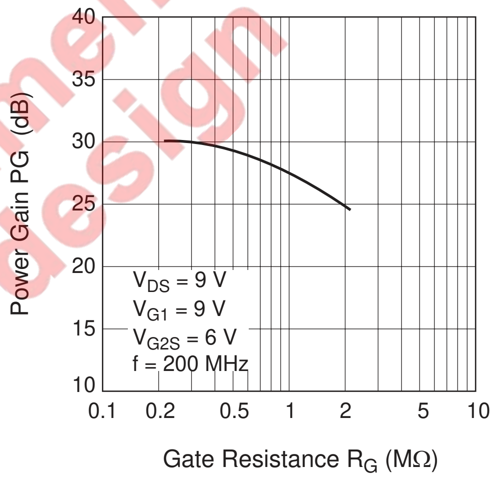

Forward Transfer Admittance vs. Gate1 Voltage




Forward Transfer Admittance vs. Gate1 Voltage

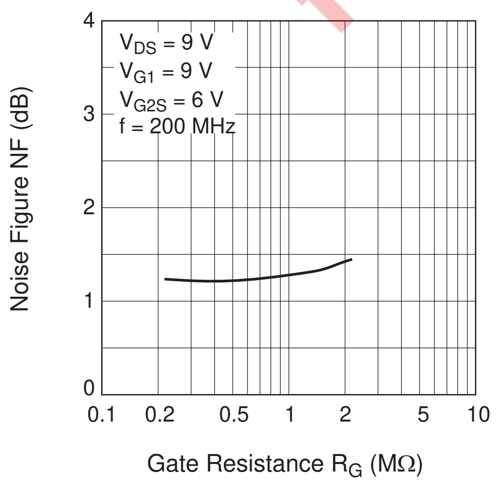



Power Gain vs. Gate Resistance

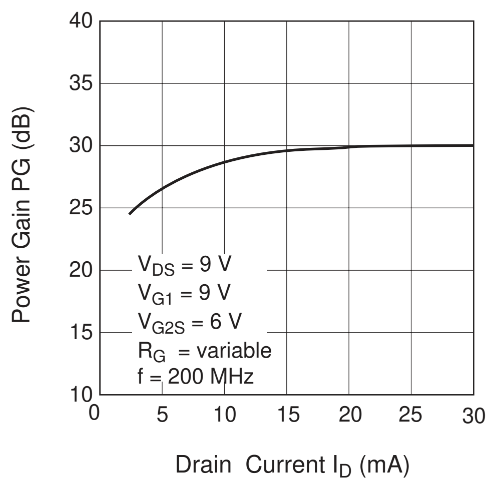




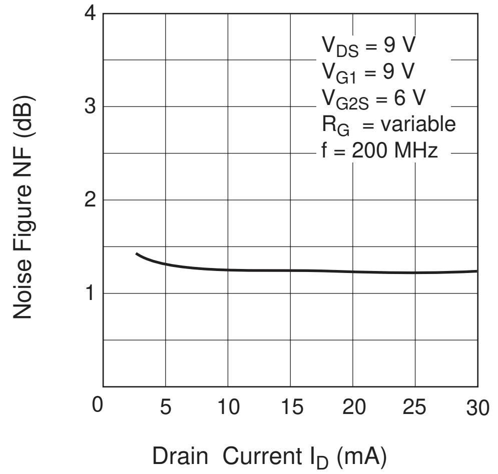

Noise Figure vs. Gate Resistance



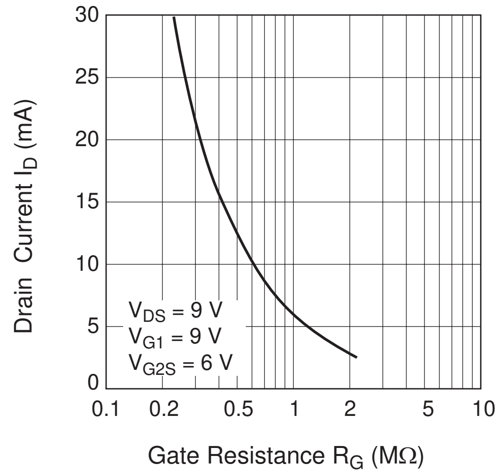

Power Gain vs. Drain Current



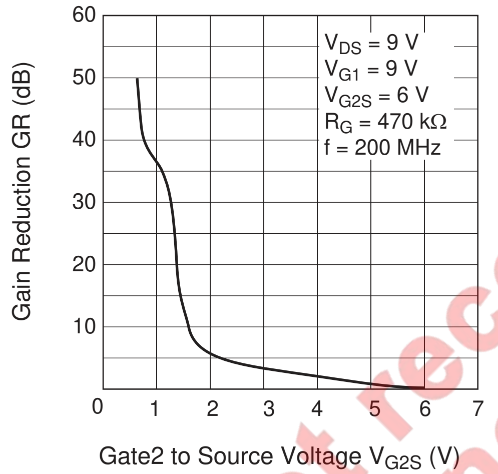
Noise Figure vs. Drain Current



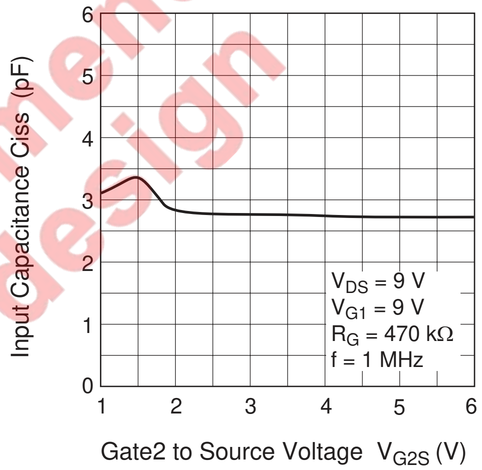

Drain Current vs. Gate Resistance



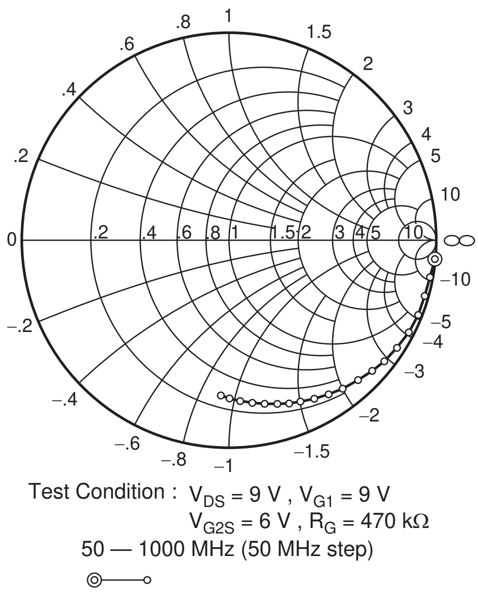

Gain Reduction vs.
Gate2 to Source Voltage




Input Capacitance vs.
Gate2 to Source Voltage

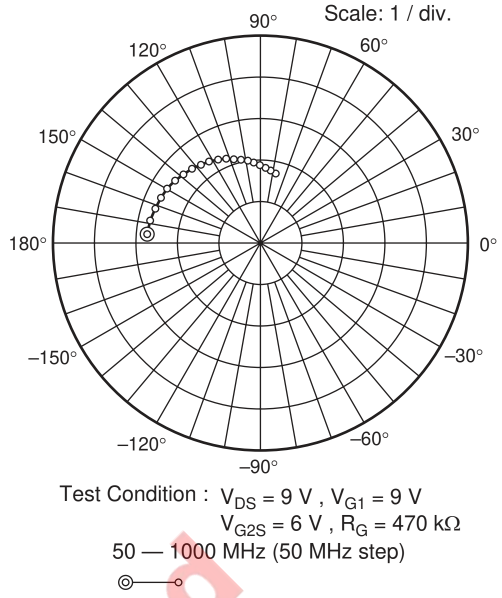


S11 Parameter vs. Frequency



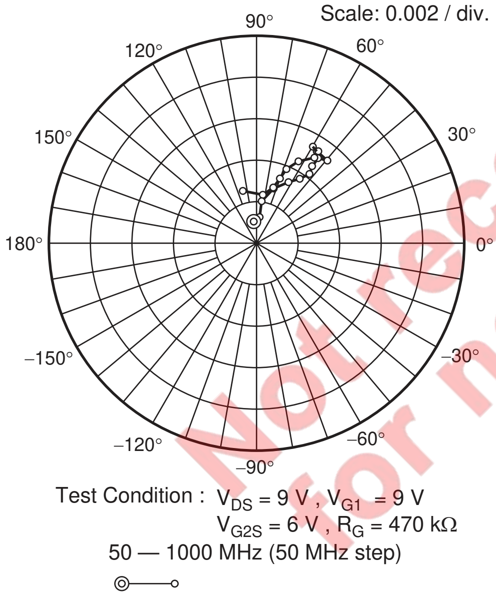

Test Condition : $V_{DS}$ = 9 V , $V_{G1}$ = 9 V
$V_{G2S}$ = 6 V , $R_G$ = 470 kΩ
50 — 1000 MHz (50 MHz step)

S21 Parameter vs. Frequency



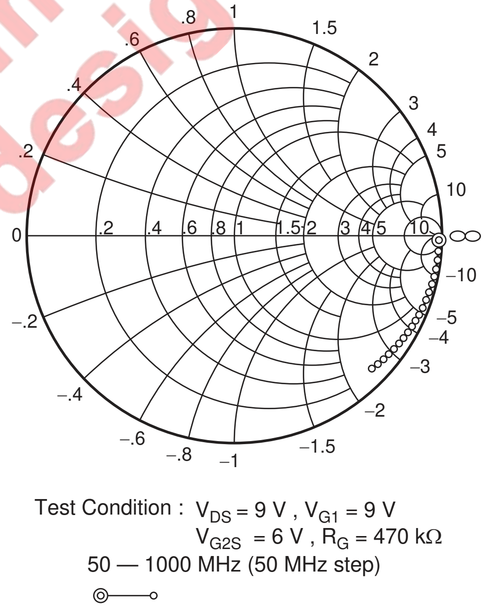

Test Condition : $V_{DS}$ = 9 V , $V_{G1}$ = 9 V
$V_{G2S}$ = 6 V , $R_G$ = 470 kΩ
50 — 1000 MHz (50 MHz step)

S12 Parameter vs. Frequency




Test Condition : $V_{DS}$ = 9 V , $V_{G1}$ = 9 V
$V_{G2S}$ = 6 V , $R_G$ = 470 kΩ
50 — 1000 MHz (50 MHz step)

S22 Parameter vs. Frequency




Test Condition : $V_{DS}$ = 9 V , $V_{G1}$ = 9 V
$V_{G2S}$ = 6 V , $R_G$ = 470 kΩ
50 — 1000 MHz (50 MHz step)

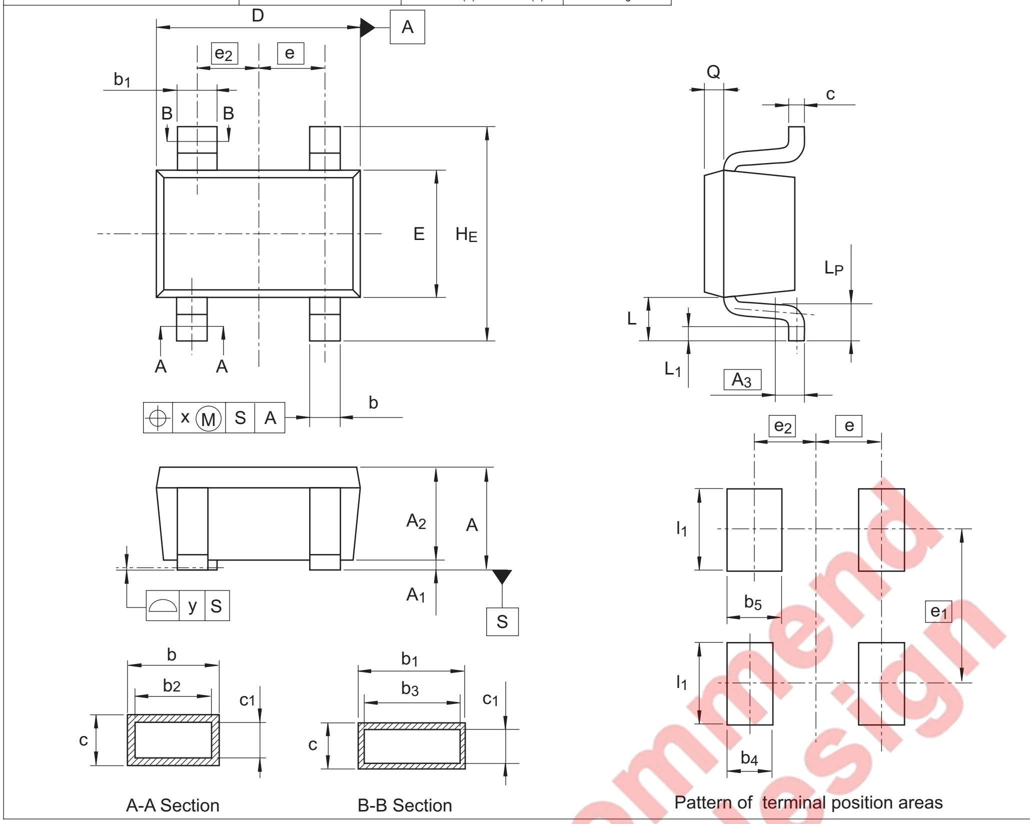
## S Parameter

($V_{DS}$ = $V_{G1}$ = 9V, $V_{G2S}$ = 6V, $R_G$ = 470kΩ, Zo = 50Ω)

| f(MHz) | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 50 | 0.996 | –5.3 | 2.74 | 174.0 | 0.00096 | 98.6 | 0.985 | –1.9 |
| 100 | 0.993 | –10.9 | 2.73 | 168.0 | 0.00130 | 84.4 | 0.991 | –4.5 |
| 150 | 0.987 | –16.6 | 2.68 | 162.3 | 0.00203 | 83.6 | 0.990 | –6.5 |
| 200 | 0.978 | –21.9 | 2.66 | 156.3 | 0.00285 | 72.3 | 0.988 | –9.4 |
| 250 | 0.972 | –27.4 | 2.63 | 150.4 | 0.00335 | 69.7 | 0.985 | –11.6 |
| 300 | 0.954 | –33.2 | 2.57 | 144.3 | 0.00385 | 68.3 | 0.982 | –14.0 |
| 350 | 0.943 | –38.2 | 2.50 | 138.7 | 0.00455 | 63.2 | 0.979 | –16.2 |
| 400 | 0.925 | –43.2 | 2.43 | 133.3 | 0.00488 | 55.4 | 0.975 | –18.4 |
| 450 | 0.910 | –48.0 | 2.37 | 128.0 | 0.00526 | 59.8 | 0.971 | –21.0 |
| 500 | 0.893 | –52.5 | 2.30 | 122.6 | 0.00522 | 56.1 | 0.967 | –23.0 |
| 550 | 0.880 | –57.4 | 2.24 | 117.5 | 0.00498 | 53.2 | 0.962 | –25.2 |
| 600 | 0.861 | –62.1 | 2.17 | 112.7 | 0.00512 | 49.1 | 0.957 | –27.3 |
| 650 | 0.847 | –66.1 | 2.10 | 108.1 | 0.00497 | 53.4 | 0.952 | –29.4 |
| 700 | 0.829 | –69.9 | 2.02 | 103.6 | 0.00455 | 53.6 | 0.947 | –31.6 |
| 750 | 0.816 | –74.1 | 1.96 | 99.1 | 0.00418 | 51.6 | 0.943 | –33.7 |
| 800 | 0.804 | –78.2 | 1.91 | 94.8 | 0.00372 | 55.7 | 0.937 | –35.8 |
| 850 | 0.791 | –82.4 | 1.85 | 80.4 | 0.00329 | 62.4 | 0.933 | –38.0 |
| 900 | 0.779 | –86.1 | 1.79 | 86.3 | 0.00275 | 73.0 | 0.928 | –40.0 |
| 950 | 0.764 | –89.5 | 1.73 | 82.2 | 0.00233 | 82.4 | 0.921 | –42.1 |
| 1000 | 0.753 | –92.4 | 1.68 | 78.3 | 0.00258 | 105.1 | 0.918 | –44.2 |

## Package Dimensions

| JEITA Package Code | RENESAS Code | Package Name | MASS[Typ.] |
|---|---|---|---|
| SC-82A | PTSP0004ZA-A | CMPAK-4(T) / CMPAK-4(T)V | 0.006g |




| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| A | 0.8 | — | 1.1 |
| $A_1$ | 0 | — | 0.1 |
| $A_2$ | 0.8 | 0.9 | 1.0 |
| $A_3$ | — | 0.25 | — |
| b | 0.25 | 0.32 | 0.4 |
| $b_1$ | 0.35 | 0.42 | 0.5 |
| $b_2$ | — | 0.3 | — |
| $b_3$ | — | 0.4 | — |
| c | 0.1 | 0.13 | 0.15 |
| $c_1$ | — | 0.11 | — |
| D | 1.8 | 2.0 | 2.2 |
| E | 1.15 | 1.25 | 1.35 |
| e | — | 0.65 | — |
| $e_2$ | — | 0.6 | — |
| $H_E$ | 1.8 | 2.1 | 2.4 |
| L | 0.3 | — | 0.7 |
| $L_1$ | 0.1 | — | 0.5 |
| $L_P$ | 0.2 | — | 0.6 |
| x | — | — | 0.05 |
| y | — | — | 0.05 |
| $b_4$ | — | — | 0.45 |
| $b_5$ | — | — | 0.55 |
| $e_1$ | — | 1.5 | — |
| $l_1$ | — | — | 0.9 |
| Q | — | 0.2 | — |

## Ordering Information

| Part Name | Quantity | Shipping Container |
|---|---|---|
| BB304CDW-TL-E | 3000 | ϕ 178 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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## RENESAS SALES OFFICES

http://www.renesas.com

Refer to "**http://www.renesas.com/en/network**" for the latest and detailed information.


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Colophon .3.0