

## BB504C

Built in Biasing Circuit MOS FET IC  
VHF&UHF RF Amplifier

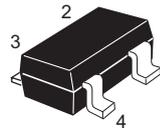
REJ03G0836-0600  
(Previous ADE-208-983D)  
Rev.6.00  
Aug.10.2005

### Features

- Built in Biasing Circuit; To reduce using parts cost & PC board space.
- Low noise; NF = 1.0 dB typ. at f = 200 MHz, NF = 1.75 dB typ. at f = 900 MHz
- High gain; PG = 30 dB typ. at f = 200 MHz, PG = 22 dB typ. at f = 900 MHz
- Withstanding to ESD;  
Built in ESD absorbing diode. Withstand up to 200 V at C = 200 pF, 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 "DS-".
  2. BB504C is individual type number of RENESAS BBFET.

## Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	$V_{DS}$	6	V
Gate1 to source voltage	$V_{G1S}$	+6 -0	V
Gate2 to source voltage	$V_{G2S}$	+6 -0	V
Drain current	$I_D$	30	mA
Channel power dissipation	Pch	100	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	-55 to +150	°C

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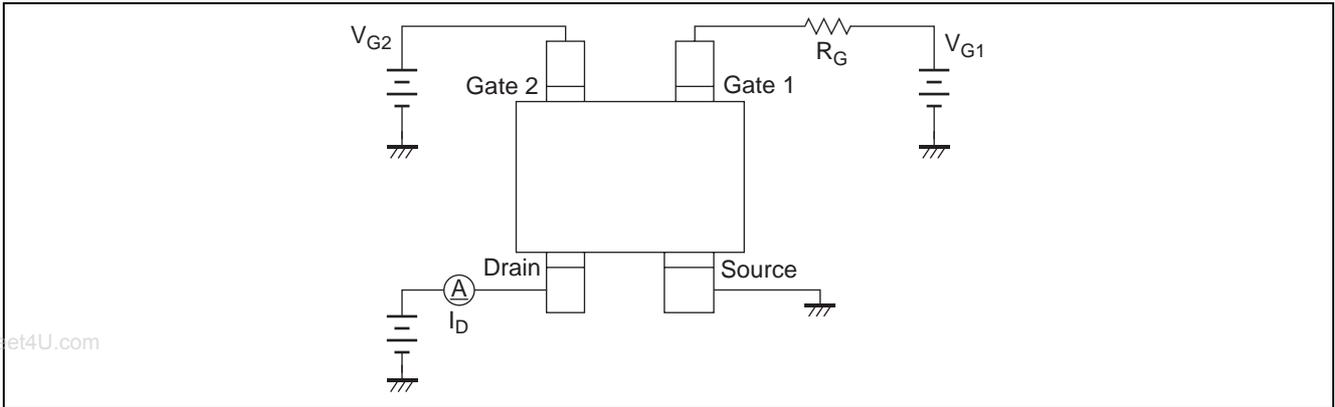
## Electrical Characteristics

(Ta = 25°C)

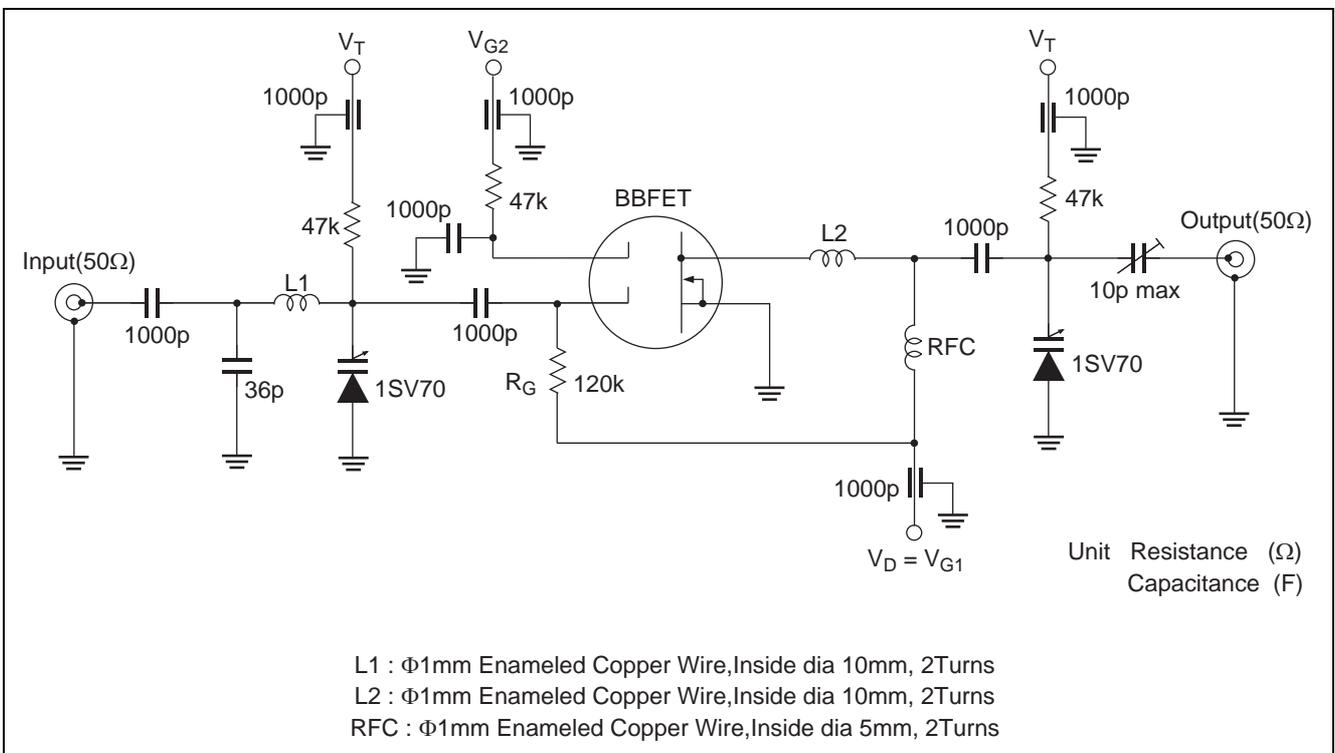
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	$I_D = 200 \mu A, V_{G1S} = V_{G2S} = 0$
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	$I_{G1} = +10 \mu A, V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	+6	—	—	V	$I_{G2} = +10 \mu A, V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff current	$I_{G1SS}$	—	—	+100	nA	$V_{G1S} = +5 V, V_{G2S} = V_{DS} = 0$
Gate2 to source cutoff current	$I_{G2SS}$	—	—	+100	nA	$V_{G2S} = +5 V, V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	0.6	0.85	1.1	V	$V_{DS} = 5 V, V_{G2S} = 4 V$ $I_D = 100 \mu A$
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.6	0.85	1.1	V	$V_{DS} = 5 V, V_{G1S} = 5 V$ $I_D = 100 \mu A$
Drain current	$I_{D(op)}$	13	16	19	mA	$V_{DS} = 5 V, V_{G1} = 5 V$ $V_{G2S} = 4 V, R_G = 120 k\Omega$
Forward transfer admittance	$ y_{fs} $	24	29	34	mS	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 120 k\Omega, f = 1 kHz$
Input capacitance	Ciss	1.7	2.1	2.5	pF	$V_{DS} = 5 V, V_{G1} = 5 V$
Output capacitance	Coss	1.0	1.4	1.8	pF	$V_{G2S} = 4 V, R_G = 120 k\Omega$
Reverse transfer capacitance	Crss	—	0.027	0.05	pF	$f = 1 MHz$
Power gain (1)	PG	25	30	—	dB	$V_{DS} = 5 V, V_{G1} = 5 V$
Noise figure (1)	NF	—	1.0	1.8	dB	$V_{G2S} = 4 V, R_G = 120 k\Omega$ $f = 200 MHz$
Power gain (2)	PG	17	22	—	dB	$V_{DS} = 5 V, V_{G1} = 5 V$
Noise figure (2)	NF	—	1.75	2.3	dB	$V_{G2S} = 4 V, R_G = 120 k\Omega$ $f = 900 MHz$

Test Circuits

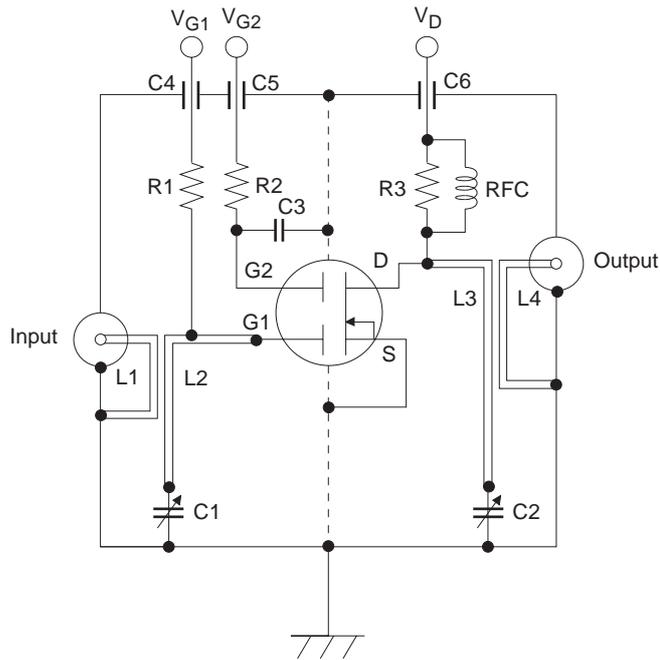
- DC Biasing Circuit for Operating Characteristics Items ( $I_{D(op)}$ ,  $|y_{fs}|$ ,  $C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$ , NF, PG)



- 200MHz Power Gain, Noise Figure Test Circuit



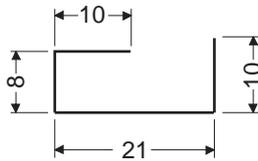
• 900 MHz Power Gain, Noise Figure Test Circuit



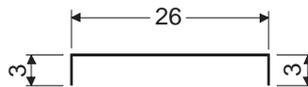
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- C1, C2 : Variable Capacitor (10pF MAX)
- C3 : Disk Capacitor (1000pF)
- C4 to C6 : Air Capacitor (1000pF)
- R1 : 120 kΩ
- R2 : 47 kΩ
- R3 : 4.7 kΩ

L1:

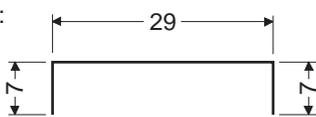


L2:

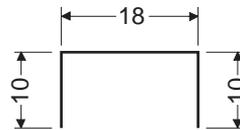


(Φ1mm Copper wire)  
Unit:mm

L3:

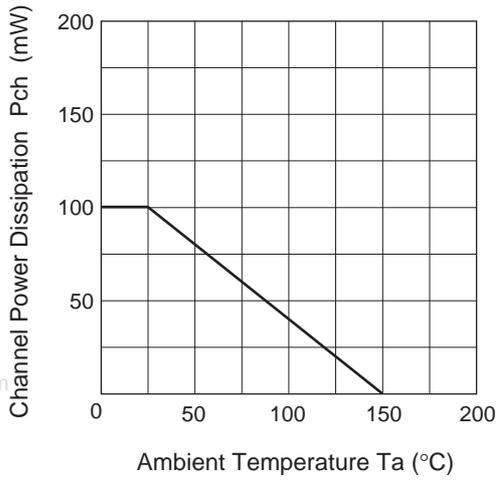


L4:

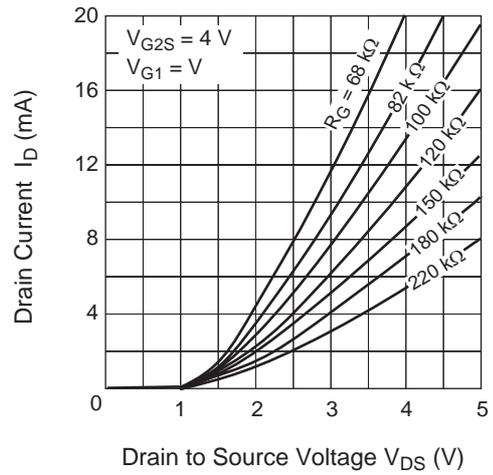


RFC : Φ1mm Copper wire with enamel 4turns inside dia 6mm

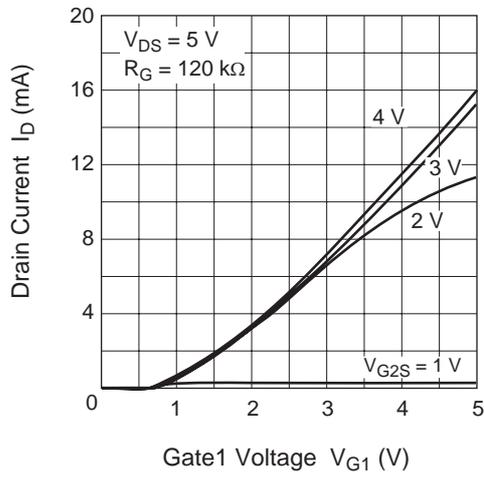
Maximum Channel Power Dissipation Curve



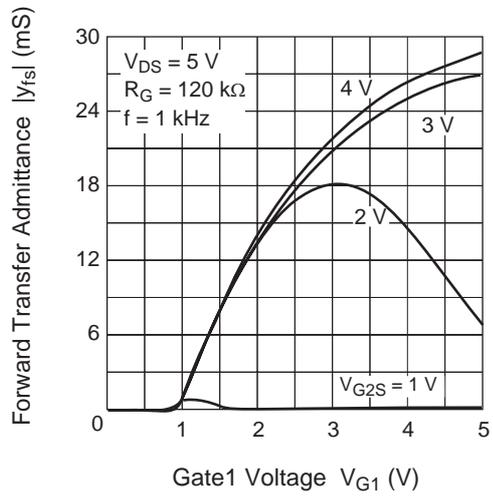
Typical Output Characteristics



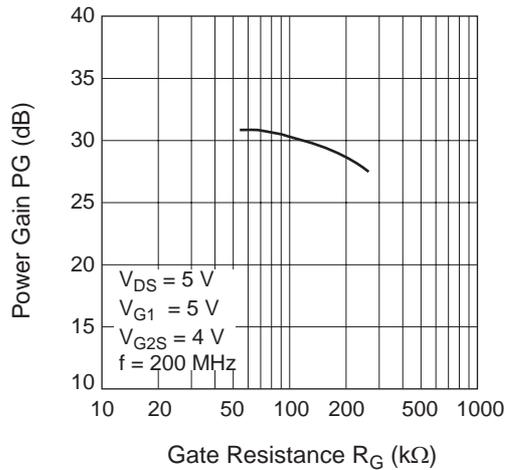
Drain Current vs. Gate1 Voltage



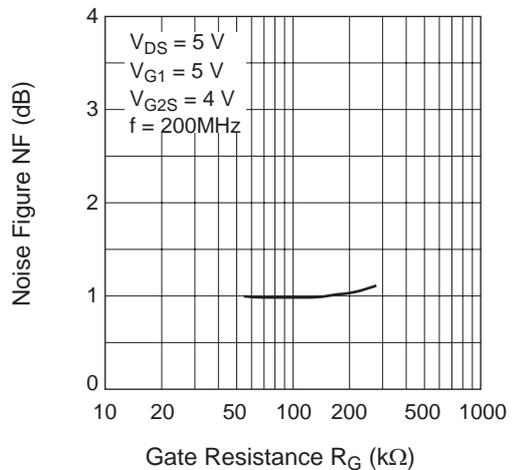
Forward Transfer Admittance vs. Gate1 Voltage

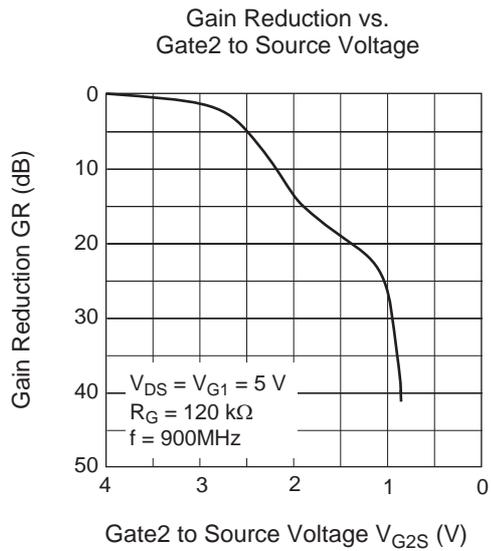
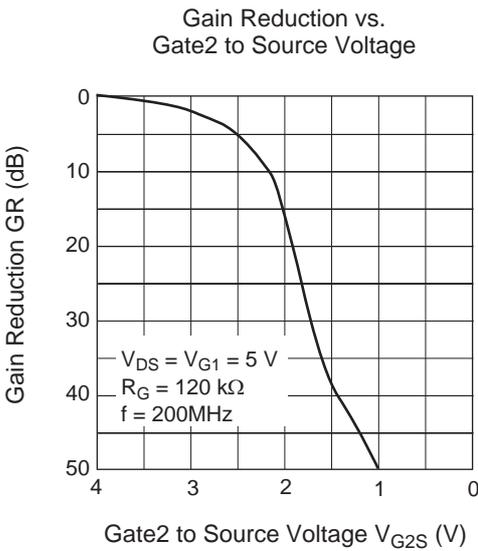
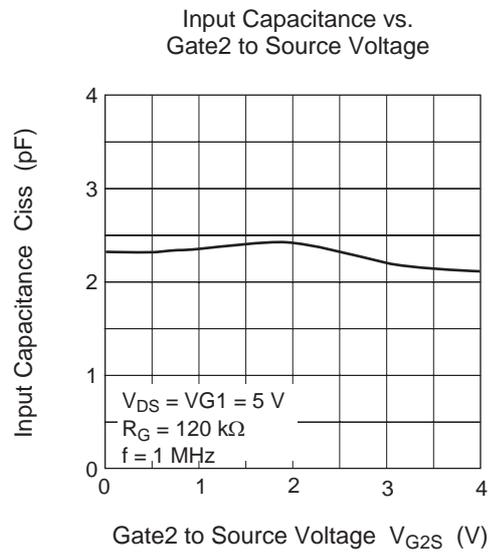
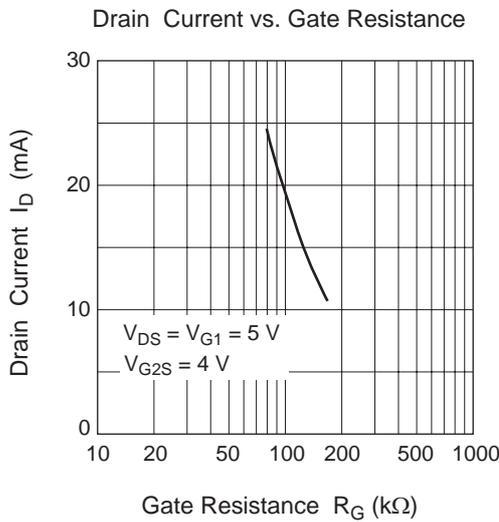
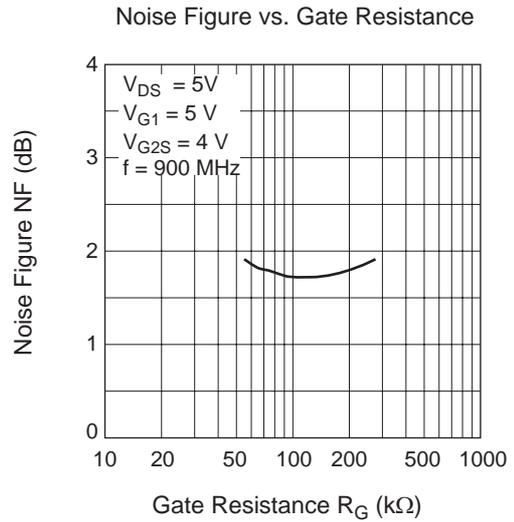
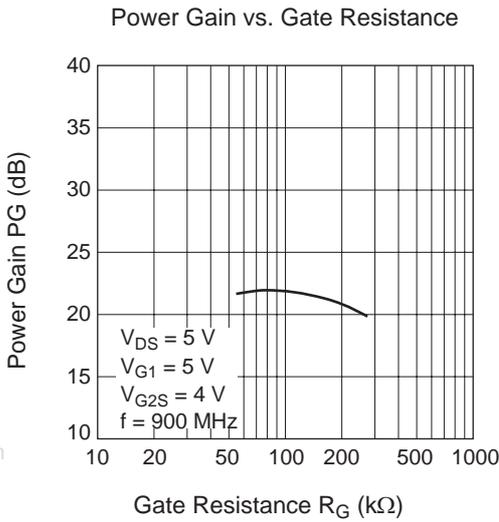


Power Gain vs. Gate Resistance

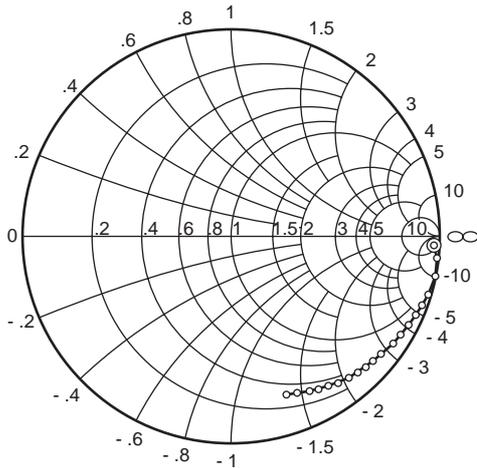


Noise Figure vs. Gate Resistance





S11 Parameter vs. Frequency

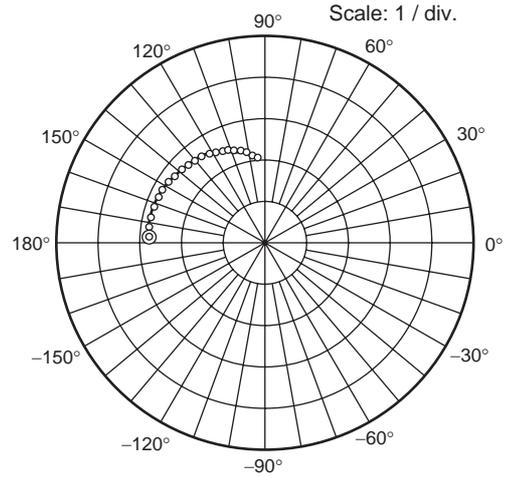


Test Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = 5\text{ V}$   
 $V_{G2S} = 4\text{ V}$ ,  $R_G = 120\text{ k}\Omega$ ,  
 $Z_0 = 50\Omega$

50 to 1000 MHz (50 MHz step)

⊙—○

S21 Parameter vs. Frequency

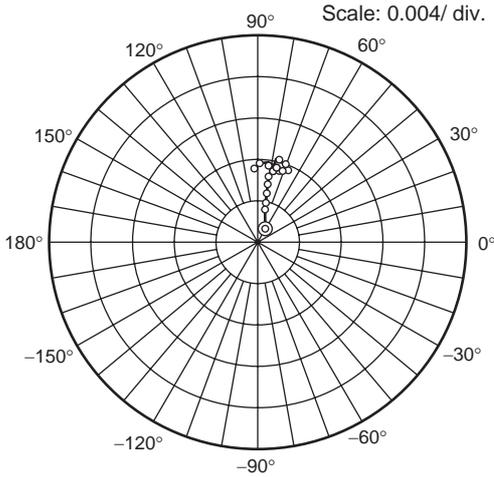


Test Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = 5\text{ V}$   
 $V_{G2S} = 4\text{ V}$ ,  $R_G = 120\text{ k}\Omega$ ,  
 $Z_0 = 50\Omega$

50 to 1000 MHz (50 MHz step)

⊙—○

S12 Parameter vs. Frequency

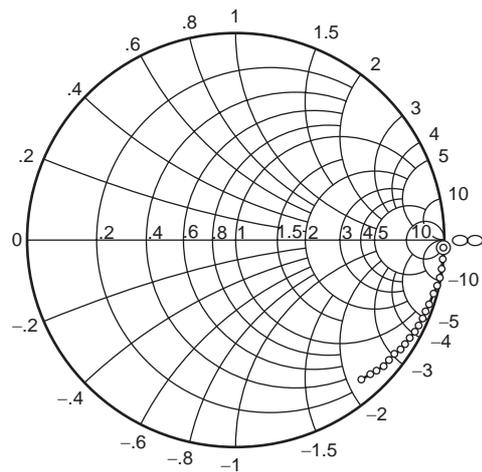


Test Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = 5\text{ V}$   
 $V_{G2S} = 4\text{ V}$ ,  $R_G = 120\text{ k}\Omega$ ,  
 $Z_0 = 50\Omega$

50 to 1000 MHz (50 MHz step)

⊙—○

S22 Parameter vs. Frequency



Test Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = 5\text{ V}$   
 $V_{G2S} = 4\text{ V}$ ,  $R_G = 120\text{ k}\Omega$ ,  
 $Z_0 = 50\Omega$

50 to 1000 MHz (50 MHz step)

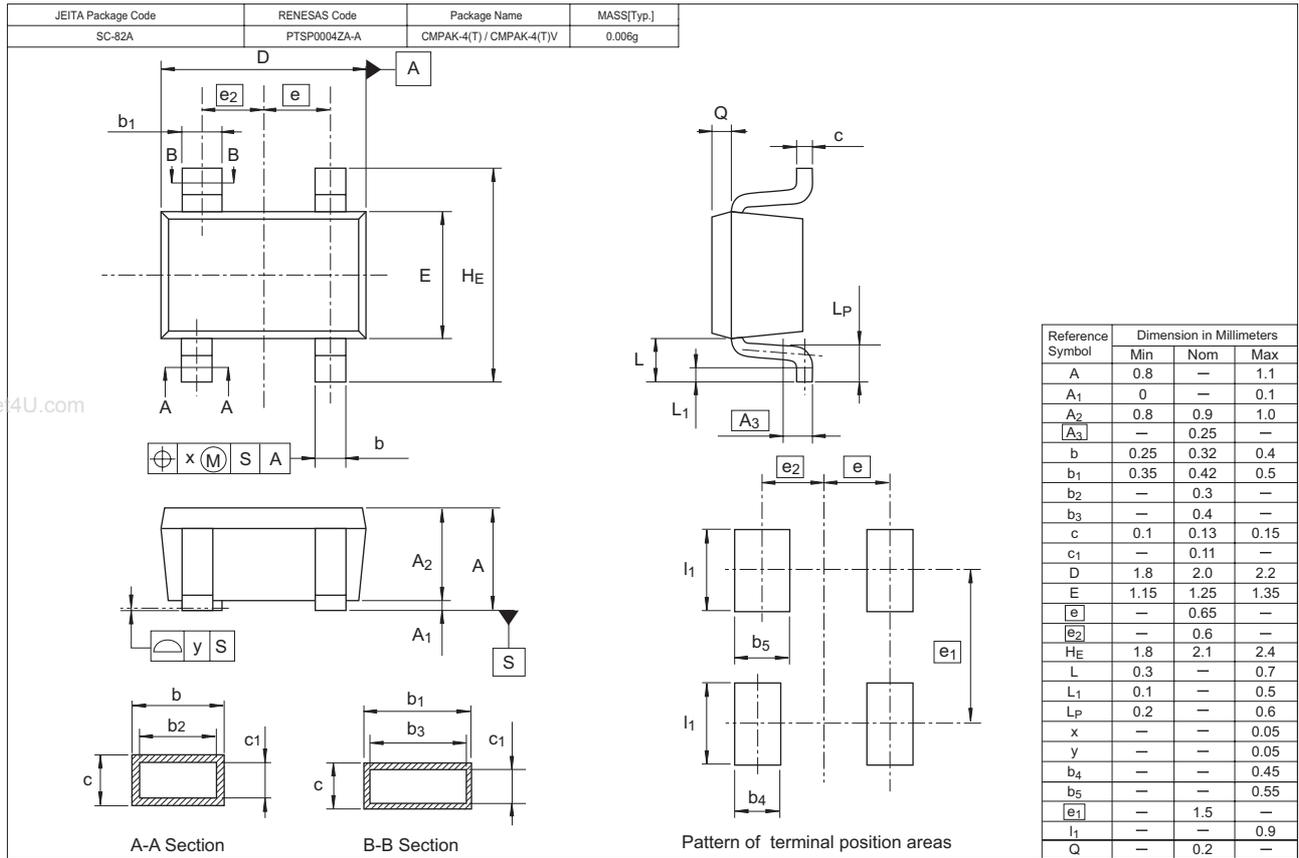
⊙—○

## S Parameter

(V<sub>DS</sub> = V<sub>G1</sub> = 5V, V<sub>G2S</sub> = 4V, R<sub>G</sub> = 120kΩ, Z<sub>0</sub> = 50Ω)

f(MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
50	1.000	-3.3	2.80	175.9	0.00106	58.8	0.990	-2.4
100	0.993	-7.2	2.78	170.9	0.00171	75.7	0.992	-4.7
150	0.991	-10.9	2.77	166.1	0.00253	75.1	0.991	-7.2
200	0.984	-15.0	2.74	161.2	0.00356	77.4	0.987	-9.6
250	0.978	-19.0	2.72	156.5	0.00442	78.2	0.985	-12.2
300	0.970	-22.8	2.68	151.8	0.00485	80.0	0.982	-14.7
350	0.958	-26.7	2.64	147.2	0.00576	74.7	0.978	-17.1
400	0.954	-30.3	2.60	142.7	0.00642	71.7	0.973	-19.6
450	0.945	-33.8	2.56	138.6	0.00689	73.3	0.968	-22.0
500	0.932	-37.5	2.50	134.1	0.00712	71.8	0.963	-24.2
550	0.920	-40.6	2.46	129.8	0.00765	70.7	0.958	-26.7
600	0.910	-44.3	2.41	125.7	0.00804	69.9	0.952	-28.9
650	0.900	-47.5	2.37	121.6	0.00798	69.1	0.947	-31.3
700	0.887	-50.9	2.31	117.8	0.00787	67.8	0.942	-33.4
750	0.870	-54.4	2.27	113.6	0.00785	70.8	0.936	-35.8
800	0.863	-57.6	2.22	110.0	0.00758	73.3	0.929	-37.9
850	0.853	-60.9	2.18	105.8	0.00721	75.2	0.924	-40.3
900	0.839	-63.6	2.12	102.2	0.00694	75.8	0.917	-42.5
950	0.827	-66.5	2.07	98.6	0.00716	88.1	0.912	-44.5
1000	0.819	-70.1	2.04	94.9	0.00667	92.7	0.906	-46.7

### Package Dimensions



### Ordering Information

Part Name	Quantity	Shipping Container
BB504CDS-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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