

## BB304M

Built in Biasing Circuit MOS FET IC  
VHF RF Amplifier

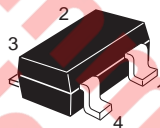
REJ03G0827-0600  
(Previous ADE-208-605D)  
Rev.6.00  
Aug.10.2005

### 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; MPAK-4(SOT-143Rmod)

### Outline

RENESAS Package code: PLSP0004ZA-A  
(Package name: MPAK-4)



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

- Notes:
1. Marking is "DW -".
  2. BB304M 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 -0	V
Gate2 to source voltage	$V_{G2S}$	±10	V
Drain current	$I_D$	25	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	-55 to +150	°C

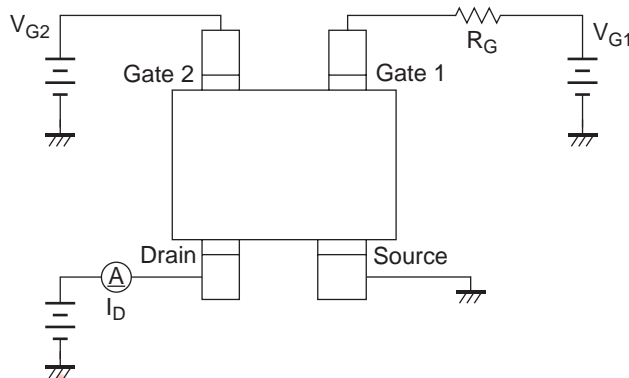
## Electrical Characteristics

(Ta = 25°C)

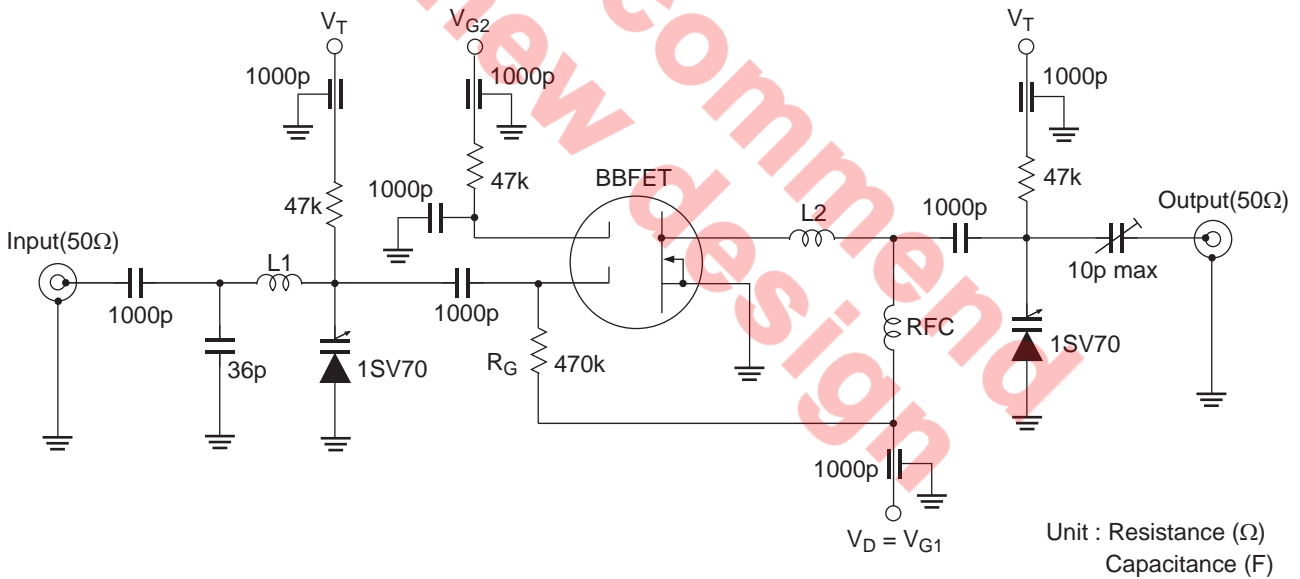
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	12	—	—	V	$I_D = 200 \mu A, V_{G1S} = V_{G2S} = 0$
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+10	—	—	V	$I_{G1} = +10 \mu A, V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±10	—	—	V	$I_{G2} = \pm 10 \mu A, V_{G1S} = V_{DS} = 0$
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	$V_{G2S} = \pm 9 V, V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	0.4	—	1.0	V	$V_{DS} = 5 V, V_{G2S} = 4 V$ $I_D = 100 \mu A$
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.5	—	1.0	V	$V_{DS} = 5 V, V_{G1S} = 5 V$ $I_D = 100 \mu A$
Input capacitance	$C_{iss}$	2.3	2.8	3.6	pF	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 180 k\Omega, f = 1 MHz$
Output capacitance	$C_{oss}$	0.9	1.3	2.0	pF	
Reverse transfer capacitance	$C_{rss}$	0.003	0.02	0.05	pF	
Drain current	$I_{D(op)1}$	9	15	19	mA	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 180 k\Omega$
	$I_{D(op)2}$	—	13	—	mA	$V_{DS} = 9 V, V_{G1} = 9 V, V_{G2S} = 6 V$ $R_G = 470 k\Omega$
Forward transfer admittance	$ y_{fs} 1$	22	27	34	mS	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 180 k\Omega, f = 1 kHz$
	$ y_{fs} 2$	—	27	—	mS	$V_{DS} = 9 V, V_{G1} = 9 V, V_{G2S} = 6 V$ $R_G = 470 k\Omega, f = 1 kHz$
Power gain	PG1	24	29	32	dB	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 180 k\Omega, f = 200 MHz$
	PG2	—	29	—	dB	$V_{DS} = 9 V, V_{G1} = 9 V, V_{G2S} = 6 V$ $R_G = 470 k\Omega, f = 200 MHz$
Noise figure	NF1	—	1.2	1.9	dB	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 180 k\Omega, f = 200 MHz$
	NF2	—	1.2	—	dB	$V_{DS} = 9 V, V_{G1} = 9 V, V_{G2S} = 6 V$ $R_G = 470 k\Omega, f = 200 MHz$

Main Characteristics

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

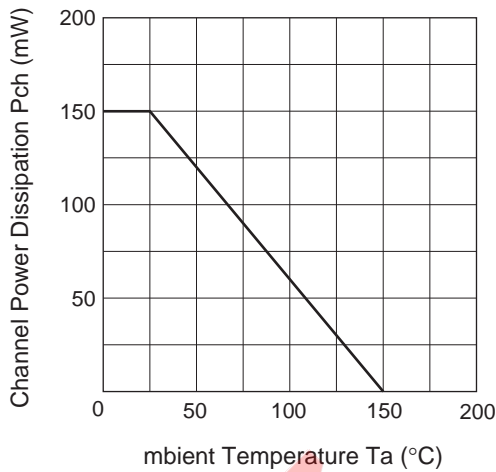


200MHz Power Gain, Noise Figure Test Circuit

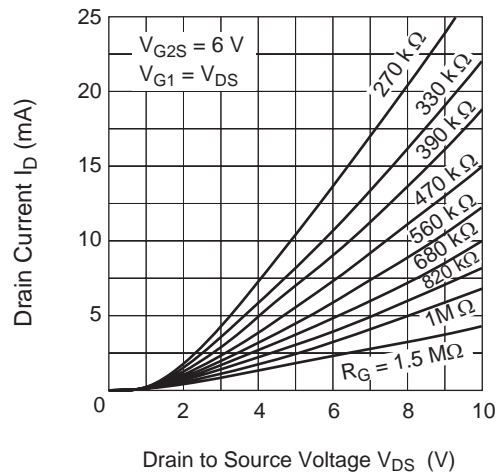


- L1 :  $\phi$ 1mm Enameled Copper Wire, Inside dia 10mm, 2Turns
- L2 :  $\phi$ 1mm Enameled Copper Wire, Inside dia 10mm, 2Turns
- RFC :  $\phi$ 1mm Enameled Copper Wire, Inside dia 5mm, 2Turns

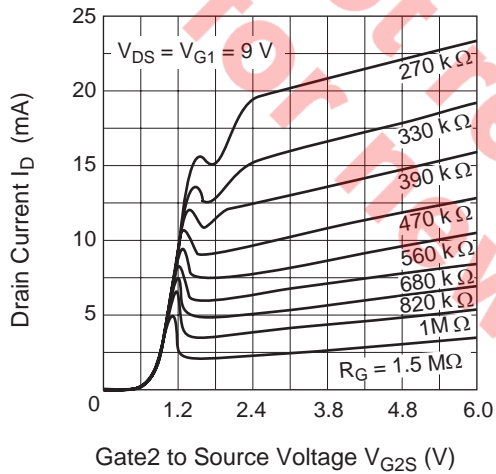
Maximum Channel Power Dissipation Curve



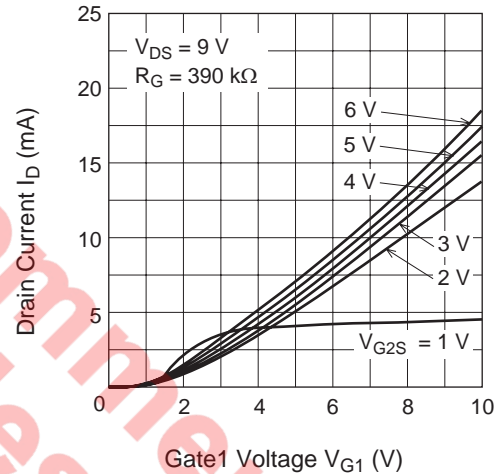
Typical Output Characteristics



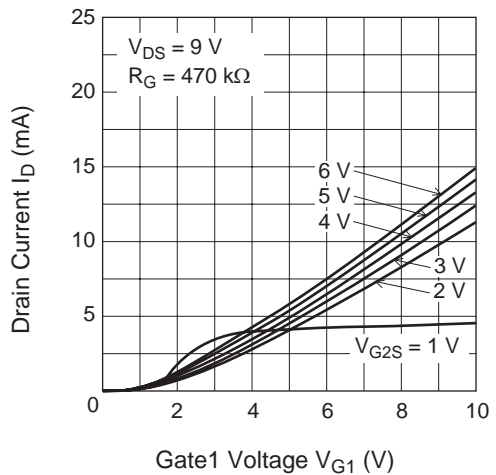
Drain Current vs. Gate2 to Source Voltage



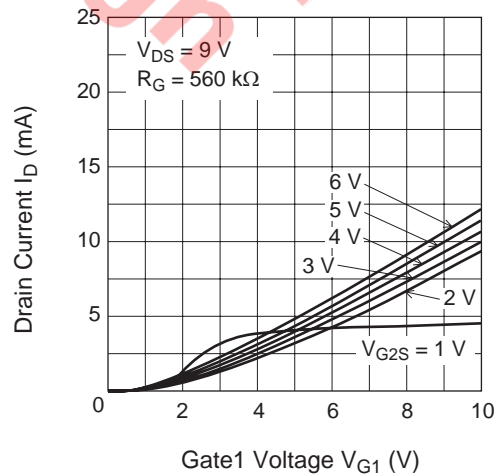
Drain Current vs. Gate1 Voltage

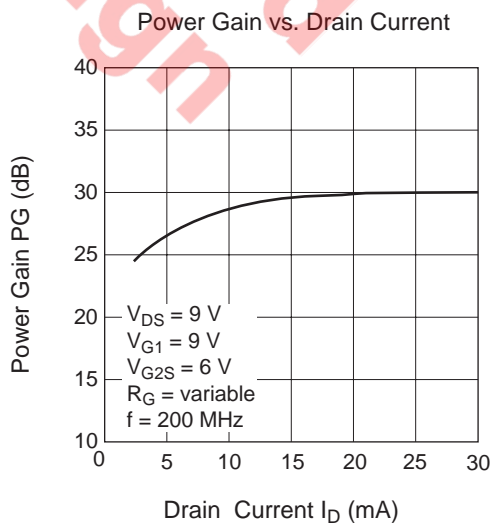
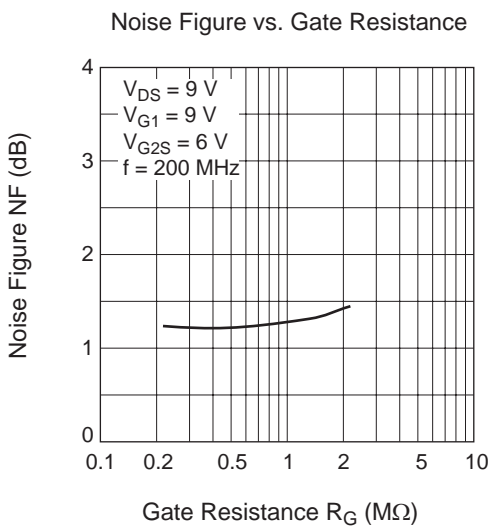
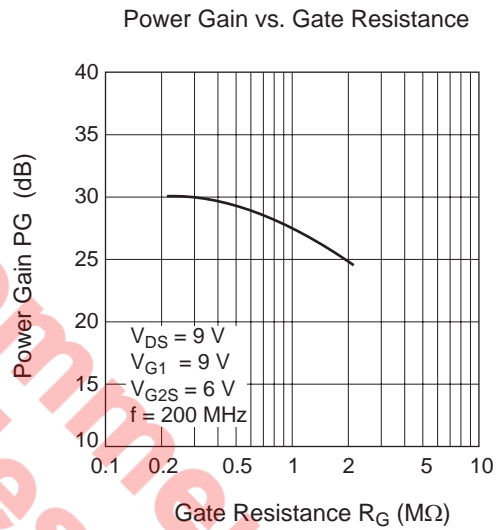
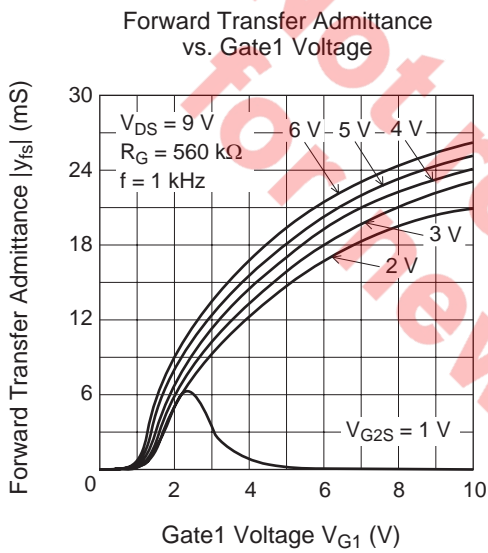
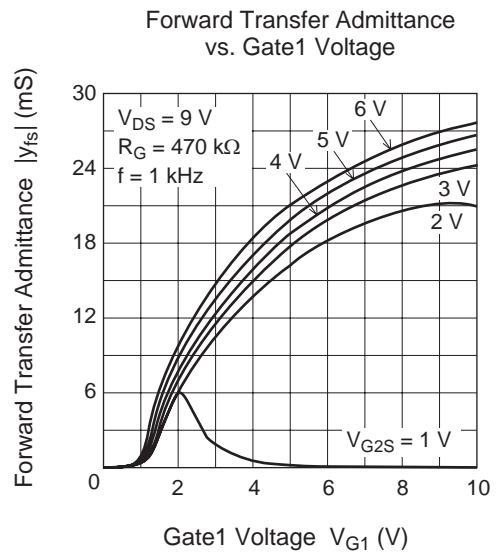
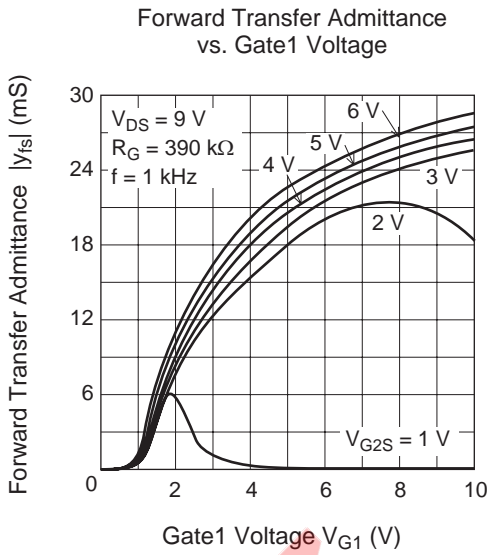


Drain Current vs. Gate1 Voltage

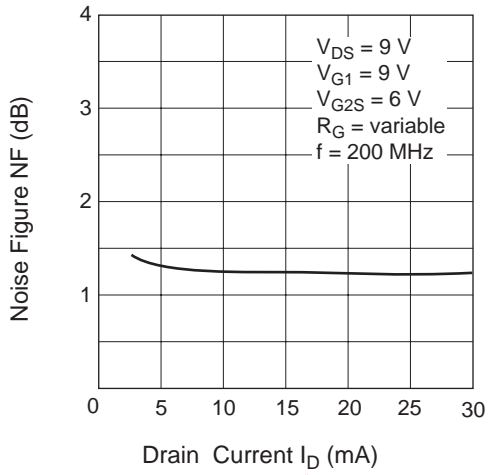


Drain Current vs. Gate1 Voltage

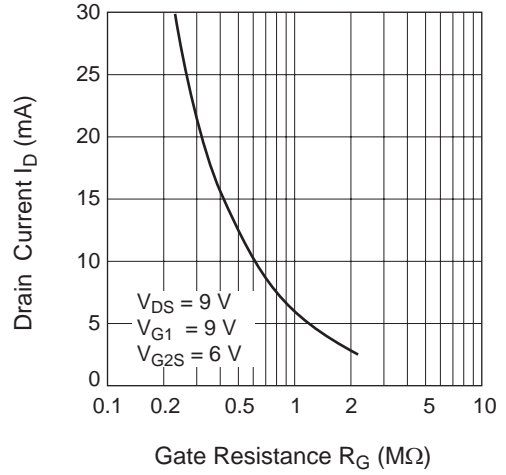




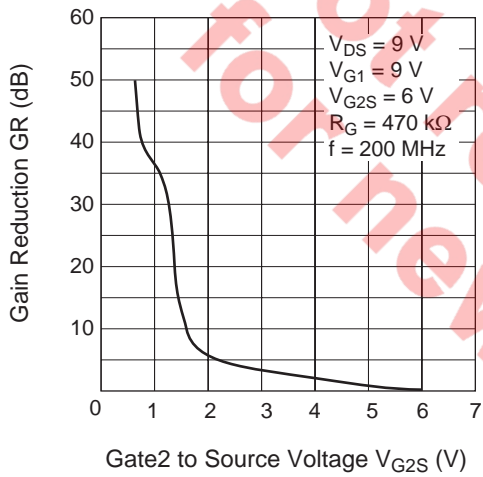
Noise Figure vs. Drain Current



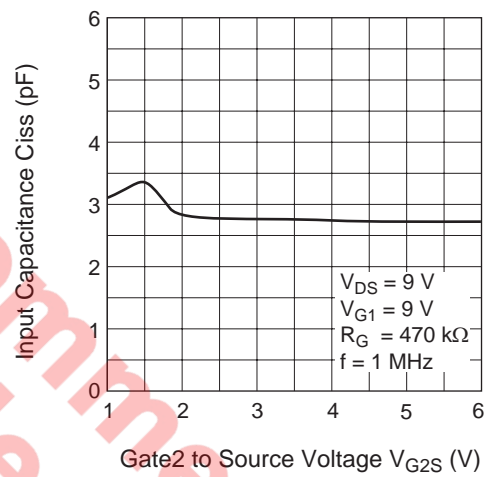
Drain Current vs. Gate Resistance



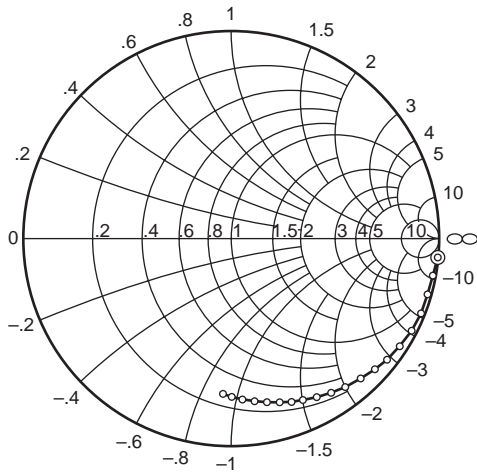
Gain Reduction vs. Gate2 to Source Voltage



Input Capacitance vs. Gate2 to Source Voltage



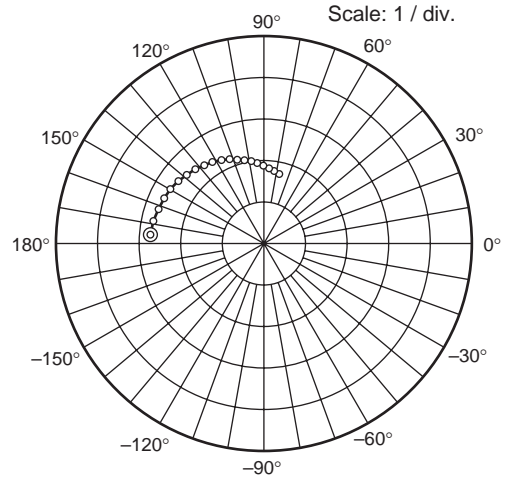
S11 Parameter vs. Frequency



Test Condition :  $V_{DS} = 9\text{ V}$ ,  $V_{G1} = 9\text{ V}$   
 $V_{G2S} = 6\text{ V}$ ,  $R_G = 470\text{ k}\Omega$   
 50 to 1000 MHz (50 MHz step)



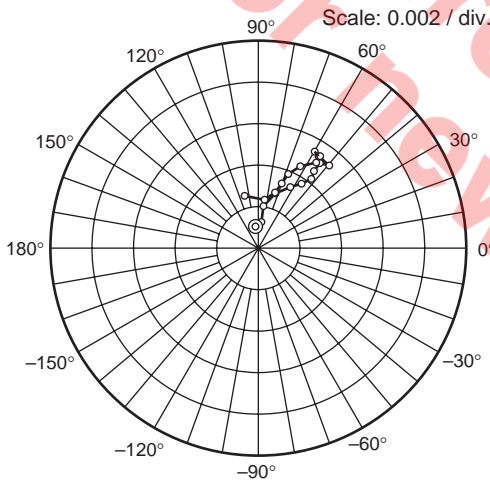
S21 Parameter vs. Frequency



Test Condition :  $V_{DS} = 9\text{ V}$ ,  $V_{G1} = 9\text{ V}$   
 $V_{G2S} = 6\text{ V}$ ,  $R_G = 470\text{ k}\Omega$   
 50 to 1000 MHz (50 MHz step)



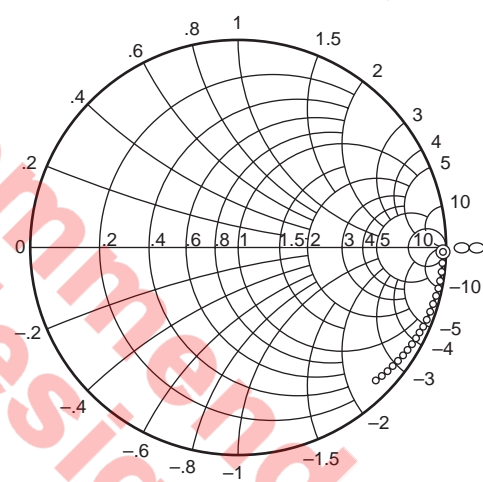
S12 Parameter vs. Frequency



Test Condition :  $V_{DS} = 9\text{ V}$ ,  $V_{G1} = 9\text{ V}$   
 $V_{G2S} = 6\text{ V}$ ,  $R_G = 470\text{ k}\Omega$   
 50 to 1000 MHz (50 MHz step)



S22 Parameter vs. Frequency



Test Condition :  $V_{DS} = 9\text{ V}$ ,  $V_{G1} = 9\text{ V}$   
 $V_{G2S} = 6\text{ V}$ ,  $R_G = 470\text{ k}\Omega$   
 50 to 1000 MHz (50 MHz step)



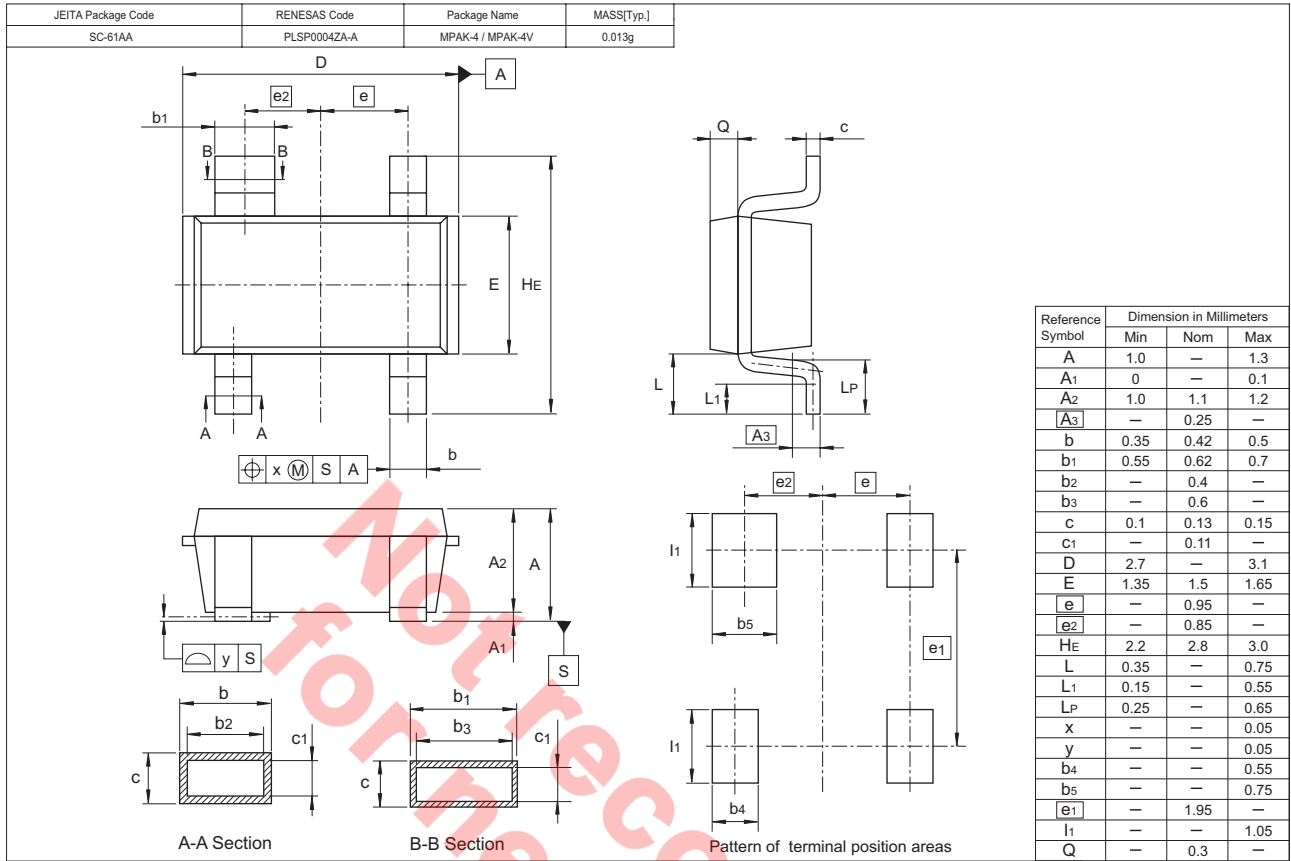
## S Parameter

 $(V_{DS} = V_{G1} = 9V, V_{G2S} = 6V, R_G = 470k\Omega, Z_0 = 50\Omega)$ 

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



### Ordering Information

Part Name	Quantity	Shipping Container
BB304MDW-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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