

# BB505M

## Build in Biasing Circuit MOS FET IC UHF RF Amplifier

REJ03G0365-0100Z

Rev.1.00

Jun.14.2004

### Features

- Build in Biasing Circuit; To reduce using parts cost & PC board space.
- Low noise; NF = 1.5 dB typ. at f = 900 MHz
- High gain; PG = 24 dB typ. at f = 900 MHz
- Withstanding to ESD;  
Build in ESD absorbing diode. Withstand up to 190 V at C = 200 pF, Rs = 0 conditions.
- Provide mini mold packages; MPAK-4 (SOT-143mod)

### Outline

MPAK-4

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

Notes: 1. Marking is "ES-".  
2. BB505M 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	$I_D$	20	mA
Channel power dissipation	$P_{ch}^{note3}$	300	mW
Channel temperature	$T_{ch}$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

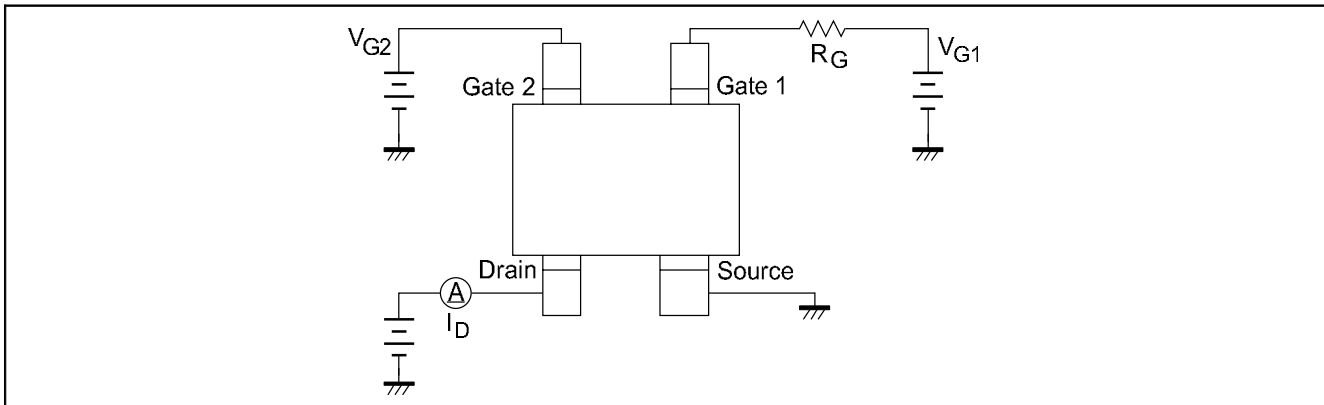
Notes: 3. Value on the glass epoxy board (50 mm × 40 mm × 1 mm ).

Electrical Characteristics

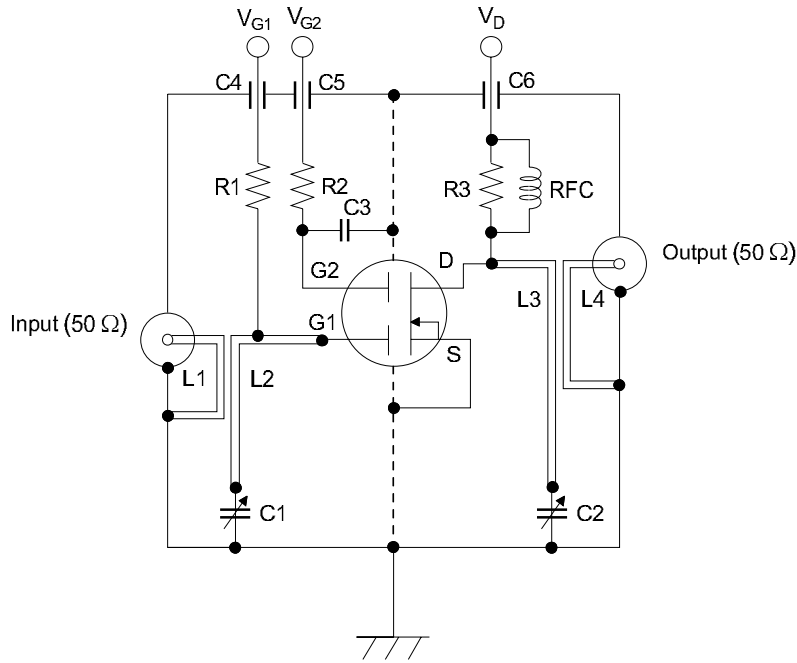
(Ta = 25°C)

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	$V_{G1S(off)}$	0.5	0.7	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	0.7	1.0	V	$V_{DS} = 5 V, V_{G1S} = 5 V, I_D = 100 \mu A$
Drain current	$I_{D(op)}$	7	11	15	mA	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 220 k\Omega$
Forward transfer admittance	$ y_{fs} $	28	33	38	mS	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 220 k\Omega, f = 1 kHz$
Input capacitance	$C_{iss}$	1.4	1.75	2.1	pF	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$ $R_G = 220 k\Omega, f = 1 MHz$
Output capacitance	$C_{oss}$	1.0	1.4	1.8	pF	
Reverse transfer capacitance	$C_{rss}$	—	0.03	0.05	pF	
Power gain	PG	19	24	29	dB	$V_{DS} = 5 V, V_{G1} = 5 V, V_{G2S} = 4 V$
Noise figure	NF	—	1.5	2.2	dB	$R_G = 220 k\Omega, f = 900 MHz$

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

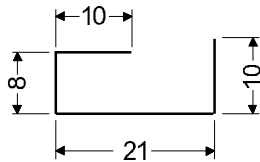


900 MHz Power Gain, Noise Figure Test Circuit

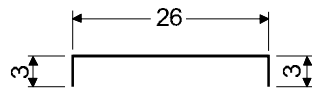


- C1, C2 : Variable Capacitor (10 pF MAX)
- C3 : Disk Capacitor (1000 pF)
- C4 to C6 : Air Capacitor (1000 pF)
- R1 : 220 kΩ
- R2 : 47 kΩ
- R3 : 4.7 kΩ

L1:

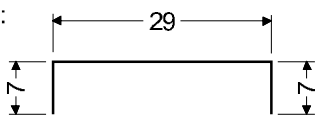


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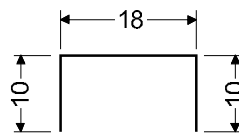


(φ1mm Copper wire)  
Unit : mm

L3:

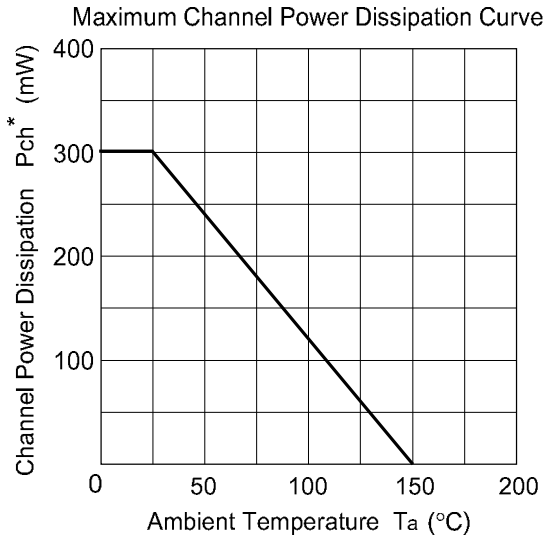


L4:

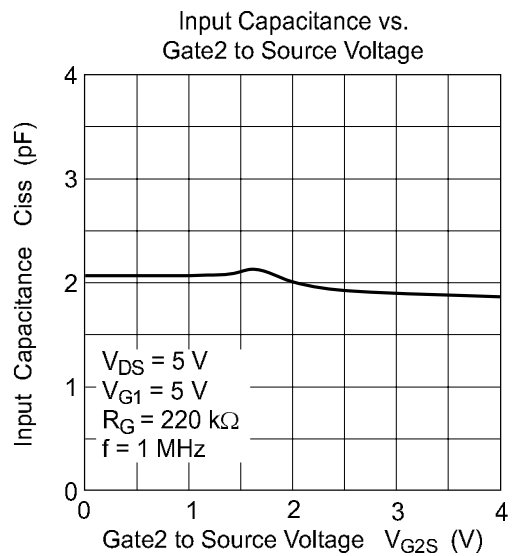
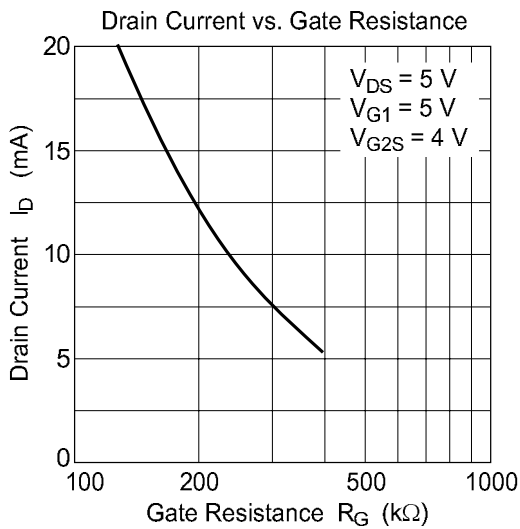
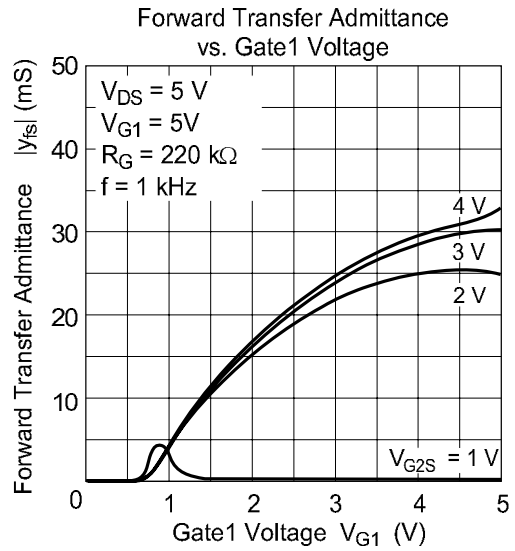
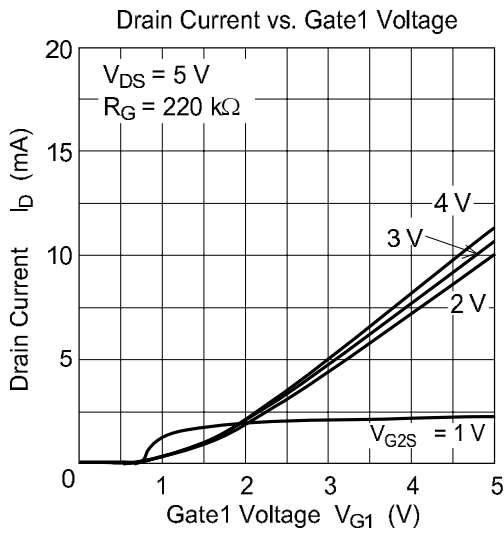
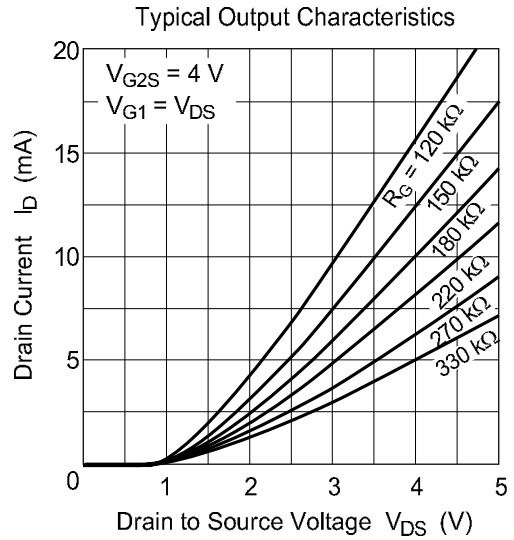


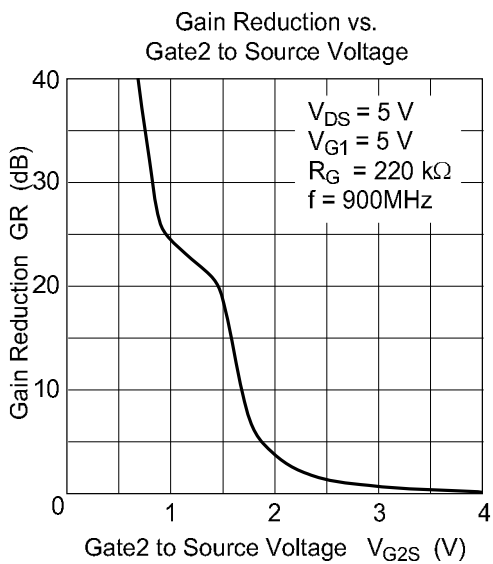
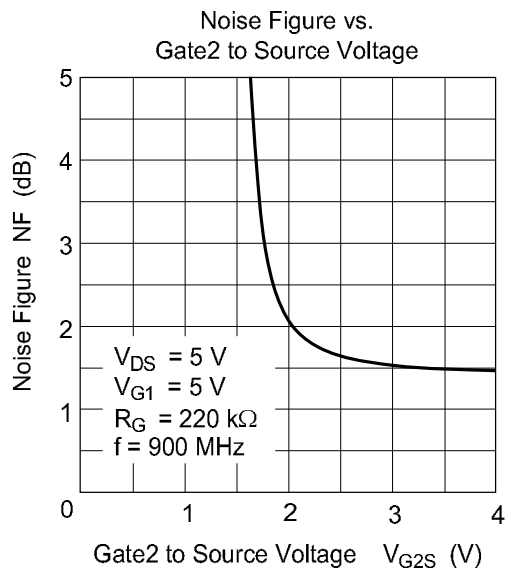
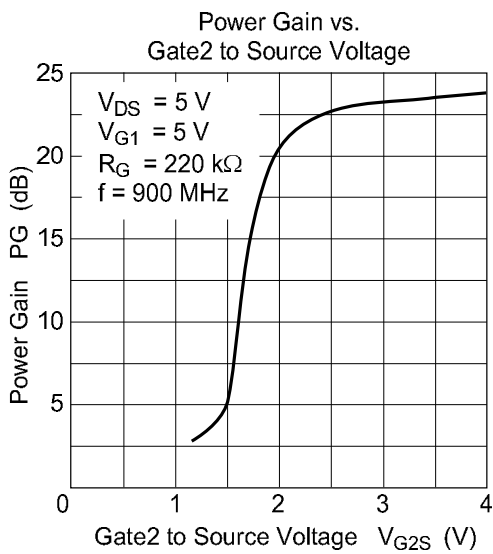
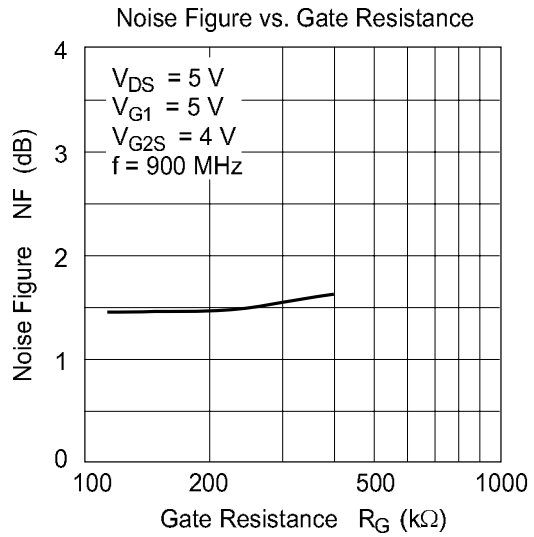
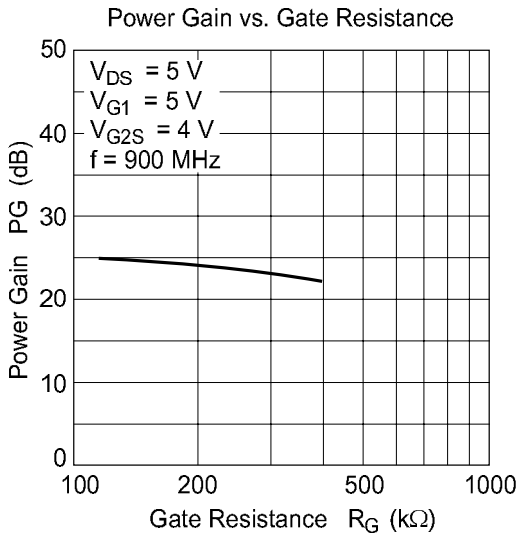
RFC : φ1mm Copper wire with enamel 4 turns inside dia 6 mm

Main Characteristics

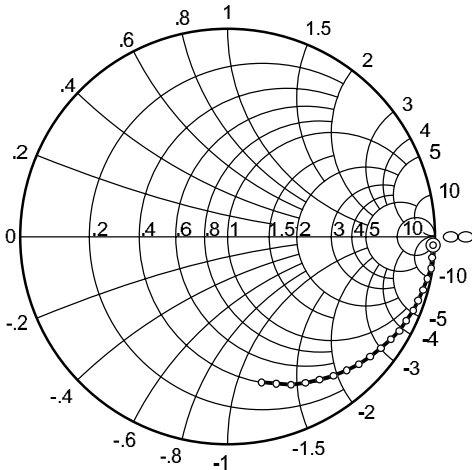


\* Value on the glass epoxy board (50mm × 40mm × 1mm)



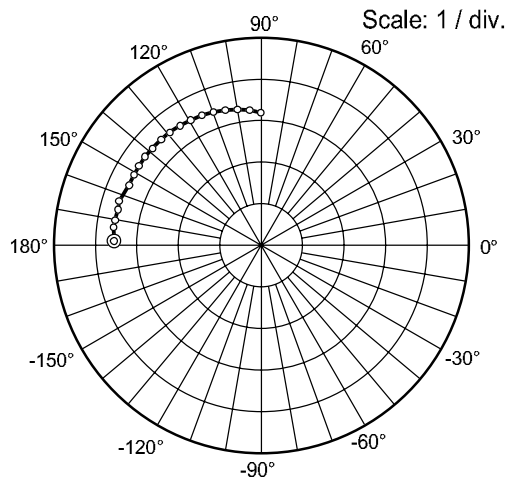


S<sub>11</sub> Parameter vs. Frequency



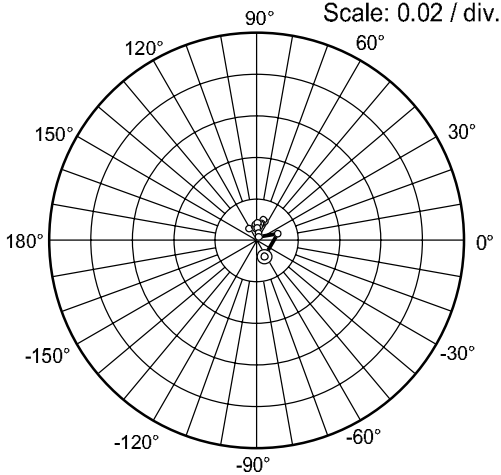
Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = 5\text{ V}$ ,  $V_{G2S} = 4\text{ V}$   
 $R_G = 220\text{ k}\Omega$ ,  $Z_o = 50\ \Omega$   
 50 to 1000 MHz (50 MHz Step)

S<sub>21</sub> Parameter vs. Frequency



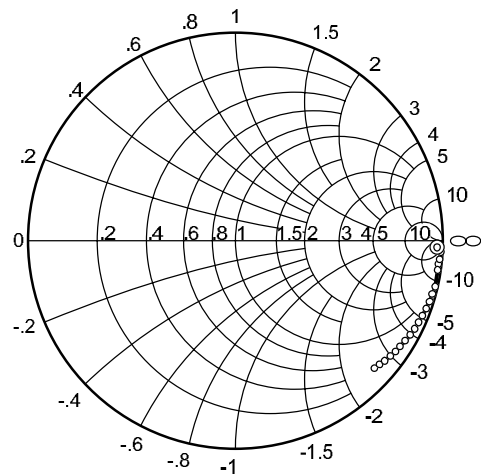
Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = 5\text{ V}$ ,  $V_{G2S} = 4\text{ V}$   
 $R_G = 220\text{ k}\Omega$ ,  $Z_o = 50\ \Omega$   
 50 to 1000 MHz (50 MHz Step)

S<sub>12</sub> Parameter vs. Frequency



Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = 5\text{ V}$ ,  $V_{G2S} = 4\text{ V}$   
 $R_G = 220\text{ k}\Omega$ ,  $Z_o = 50\ \Omega$   
 50 to 1000 MHz (50 MHz Step)

S<sub>22</sub> Parameter vs. Frequency



Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = 5\text{ V}$ ,  $V_{G2S} = 4\text{ V}$   
 $R_G = 220\text{ k}\Omega$ ,  $Z_o = 50\ \Omega$   
 50 to 1000 MHz (50 MHz Step)

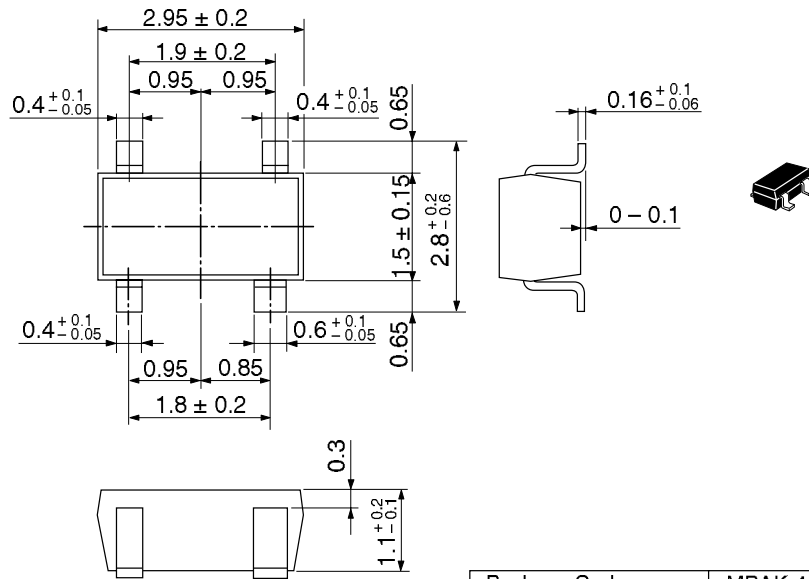
## S parameter

 $(V_{DS} = 5 \text{ V}, V_{G1} = 5 \text{ V}, V_{G2S} = 4 \text{ V}, R_G = 200 \text{ k}\Omega, Z_O = 50 \Omega)$ 

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
50	0.991	-2.4	3.55	178.2	0.009	-64.5	0.976	-1.8
100	0.991	-5.9	3.58	172.9	0.011	18.0	0.995	-3.1
150	0.993	-8.9	3.58	170.2	0.002	61.4	0.990	-5.2
200	0.983	-11.9	3.56	165.9	0.004	77.7	0.986	-6.5
250	0.977	-15.3	3.59	162.6	0.006	87.6	0.986	-8.2
300	0.969	-18.5	3.50	155.5	0.008	87.8	0.990	-12.9
350	0.962	-21.6	3.51	151.0	0.006	94.6	0.984	-15.1
400	0.952	-25.2	3.52	146.9	0.007	80.9	0.982	-17.3
450	0.944	-28.7	3.52	142.6	0.008	87.1	0.977	-19.5
500	0.929	-32.2	3.51	138.2	0.008	78.1	0.973	-21.8
550	0.914	-36.0	3.51	133.4	0.008	74.7	0.968	-24.0
600	0.897	-40.0	3.50	129.0	0.008	84.8	0.963	-26.1
650	0.881	-44.2	3.49	124.2	0.010	72.6	0.957	-28.2
700	0.863	-48.3	3.47	119.4	0.010	67.5	0.950	-30.4
750	0.842	-52.7	3.45	114.5	0.008	78.7	0.943	-32.6
800	0.819	-57.3	3.41	109.7	0.008	82.1	0.939	-34.6
850	0.797	-62.0	3.37	104.9	0.008	85.3	0.931	-36.6
900	0.775	-66.8	3.33	99.9	0.008	95.6	0.924	-38.7
950	0.746	-71.8	3.27	94.9	0.007	97.4	0.916	-40.6
1000	0.721	-76.9	3.20	90.2	0.007	122.8	0.909	-42.4

Package Dimensions

As of January, 2003  
Unit: mm



Package Code	MPAK-4
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.013 g

Ordering Information

Part Name	Quantity	Shipping Container
BB505MES-	3000	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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