

BB504M

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

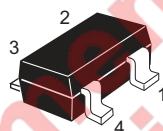
R07DS0286EJ0800
(Previous: REJ03G0837-0700)
Rev.8.00
Mar 28, 2011

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; 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 "DS-".
 2. BB504M 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	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	-55 to +150	°C

Electrical Characteristics

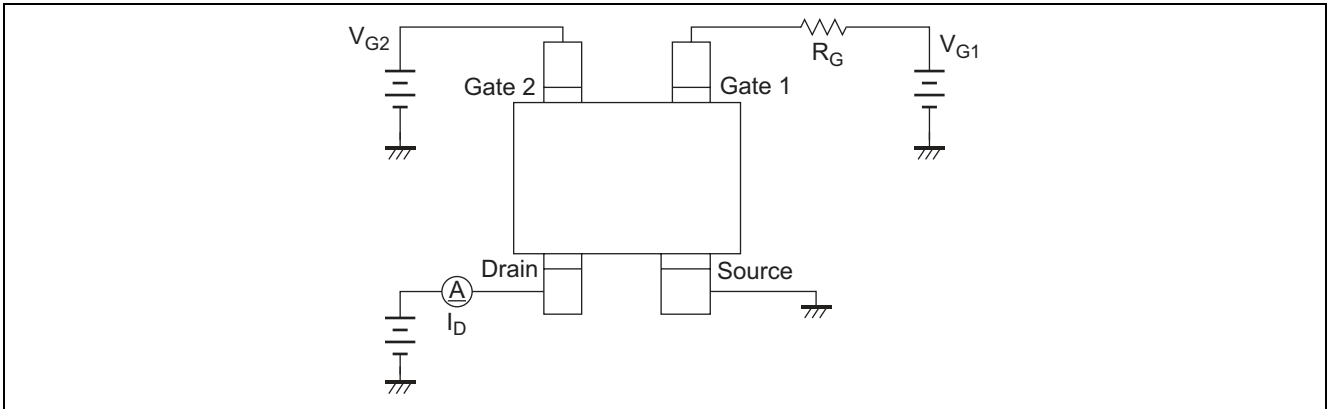
(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	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	C_{iss}	1.7	2.1	2.5	pF	$V_{DS} = 5 V, V_{G1} = 5 V$
Output capacitance	C_{oss}	1.0	1.4	1.8	pF	$V_{G2S} = 4 V, R_G = 120 k\Omega$
Reverse transfer capacitance	C_{rss}	—	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	$V_{G2S} = 4 V, R_G = 120 k\Omega$ $f = 900 MHz$

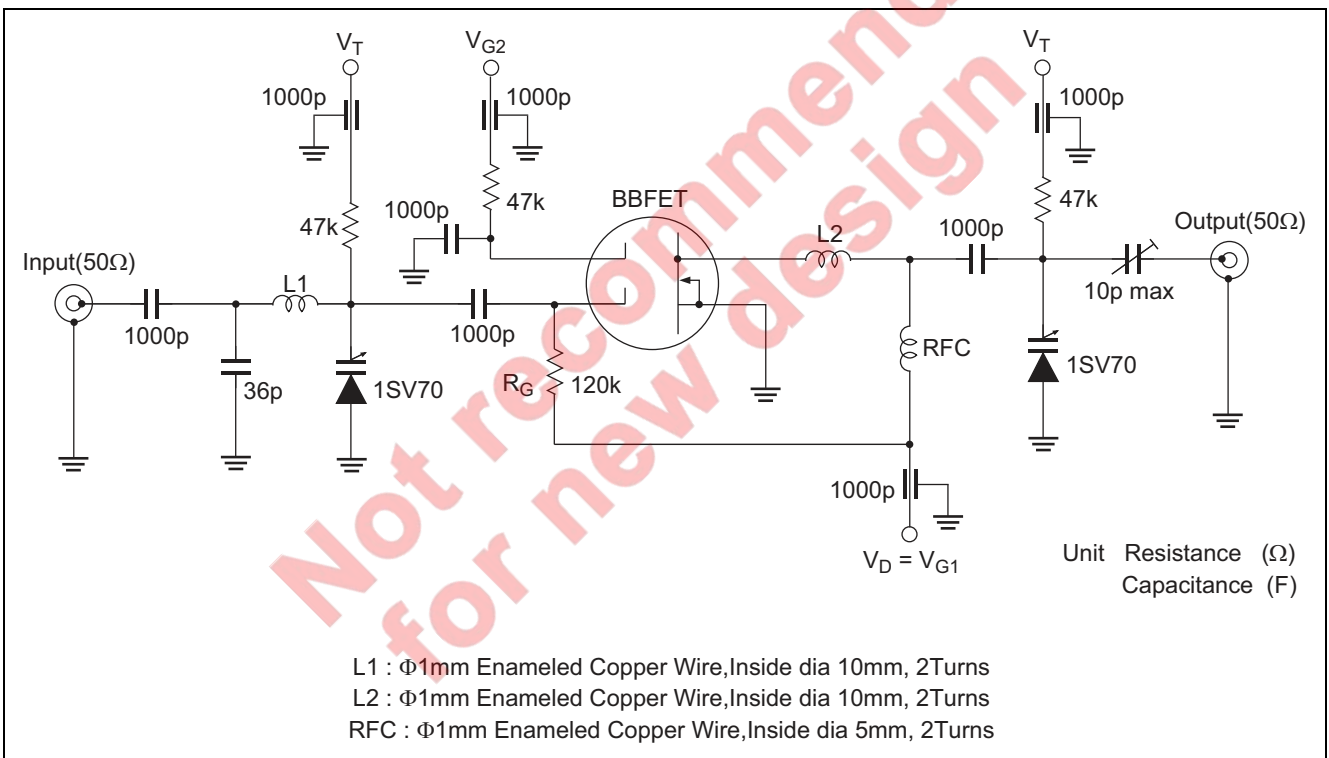
Not recommended
for new designs

Test Circuits

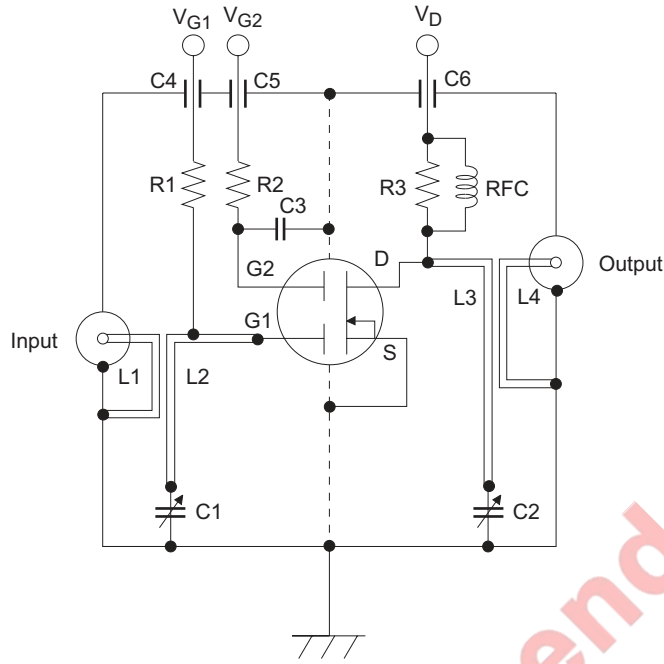
- DC Biasing Circuit for Operating Characteristics Items ($I_{D(op)}$, $|y_{fs}|$, C_{iss} , C_{oss} , C_{rss} , NF, PG)



- 200 MHz Power Gain, Noise Figure Test Circuit

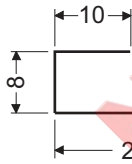


• 900 MHz Power Gain, Noise Figure Test Circuit

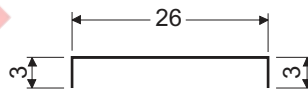


- C1, C2 : Variable Capacitor (10pF MAX)
- C3 : Disk Capacitor (1000pF)
- C4 to C6 : Air Capacitor (1000pF)
- R1 : 120 kΩ
- R2 : 47 kΩ
- R3 : 4.7 kΩ

L1:

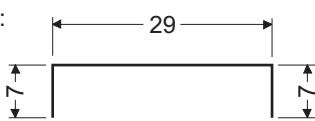


L2:

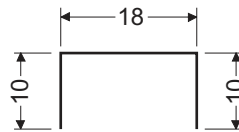


(Φ1mm Copper wire)
Unit:mm

L3:

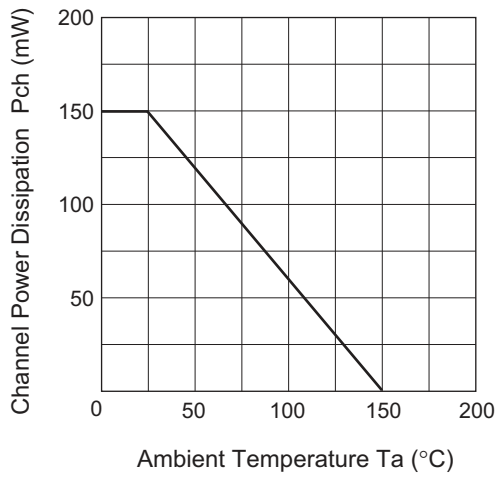


L4:

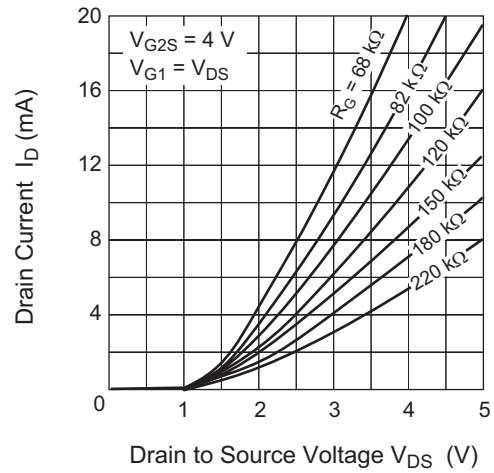


RFC : Φ1mm Copper wire with enamel 4turns inside dia 6mm

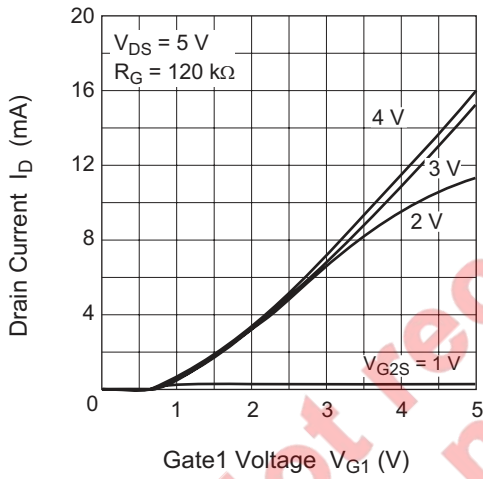
Maximum Channel Power Dissipation Curve



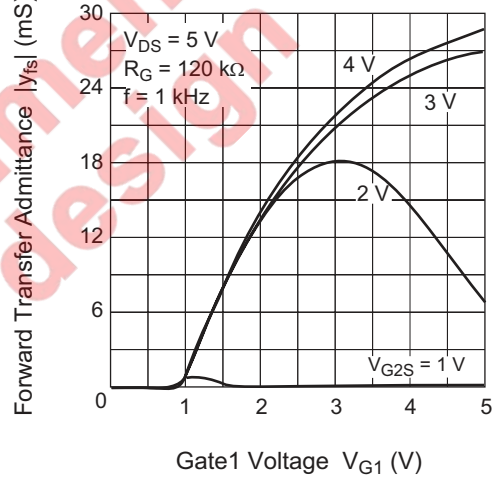
Typical Output Characteristics



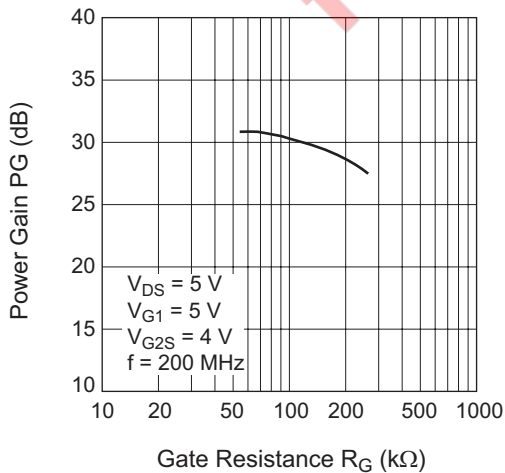
Drain Current vs. Gate1 Voltage



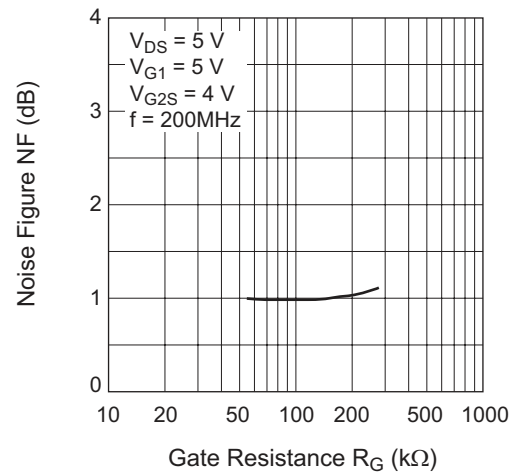
Forward Transfer Admittance vs. Gate1 Voltage

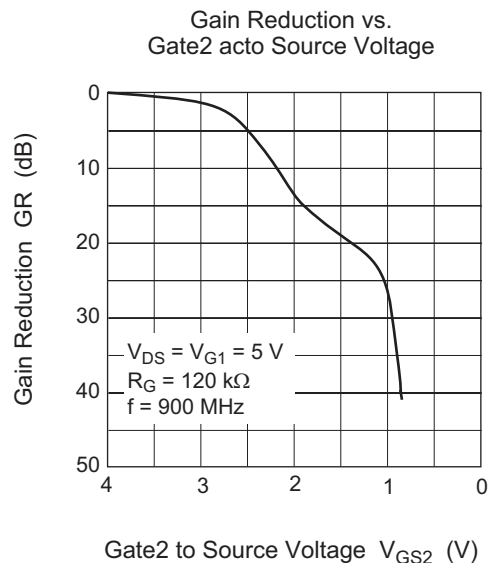
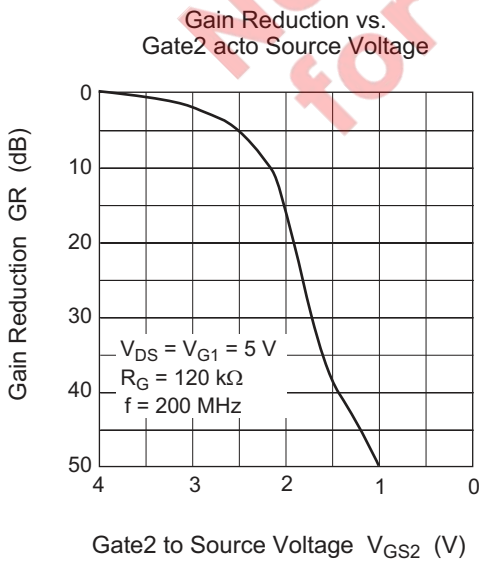
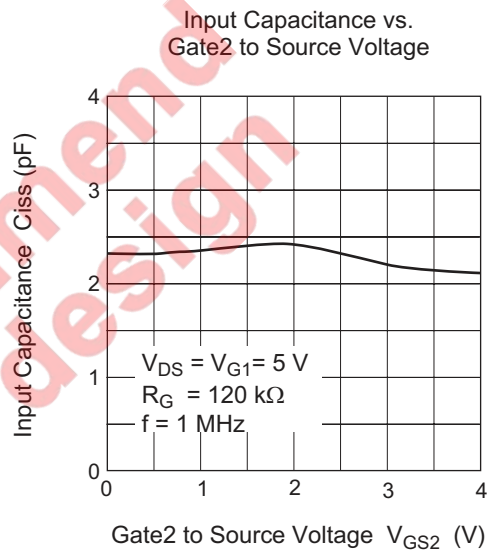
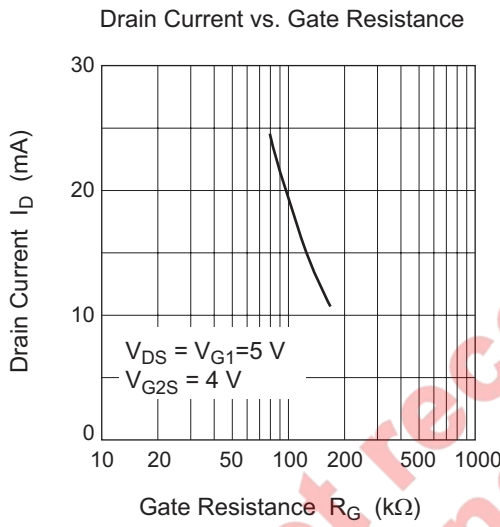
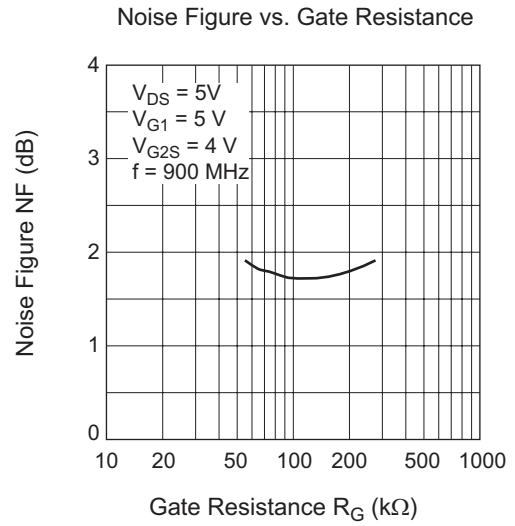
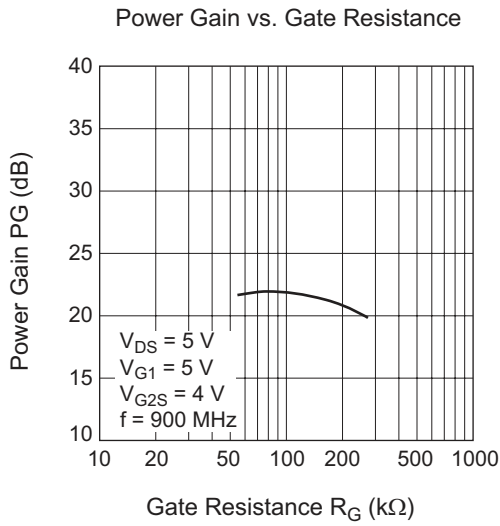


Power Gain vs. Gate Resistance

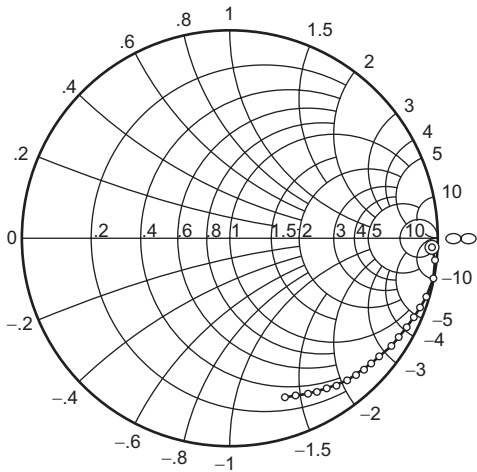


Noise Figure vs. Gate Resistance





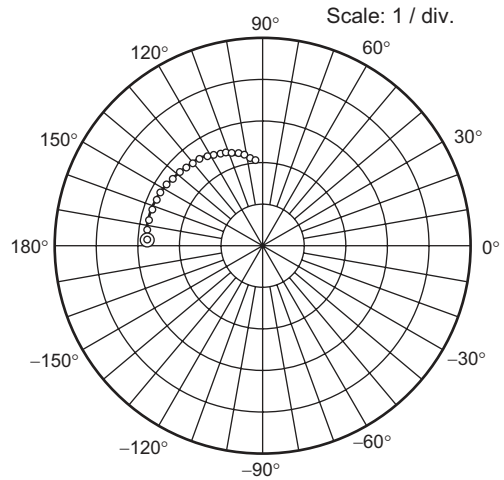
S11 Parameter vs. Frequency



Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 120\text{ k}\Omega$,
 $Z_o = 50\Omega$
 50 to 1000 MHz (50 MHz step)

⊙—○

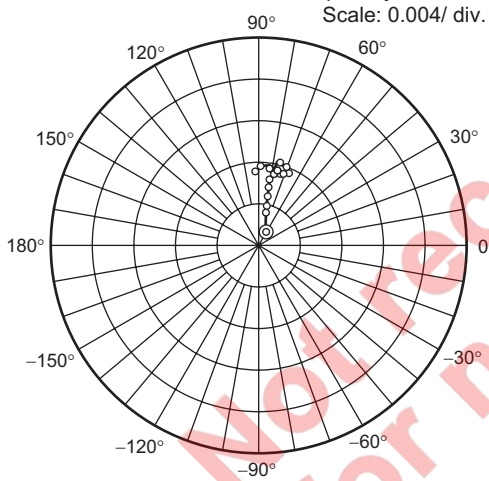
S21 Parameter vs. Frequency



Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 120\text{ k}\Omega$,
 $Z_o = 50\Omega$
 50 to 1000 MHz (50 MHz step)

⊙—○

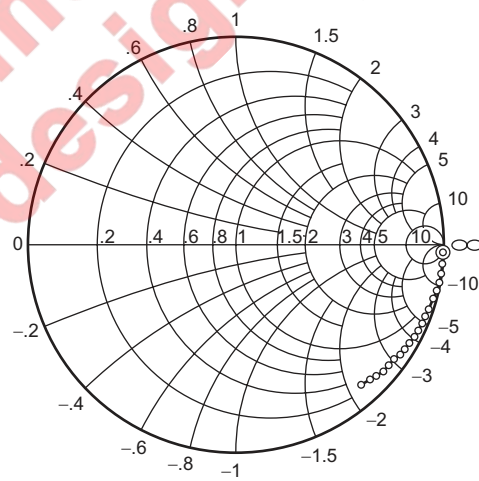
S12 Parameter vs. Frequency



Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 120\text{ k}\Omega$,
 $Z_o = 50\Omega$
 50 to 1000 MHz (50 MHz step)

⊙—○

S22 Parameter vs. Frequency



Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 120\text{ k}\Omega$,
 $Z_o = 50\Omega$
 50 to 1000 MHz (50 MHz step)

⊙—○

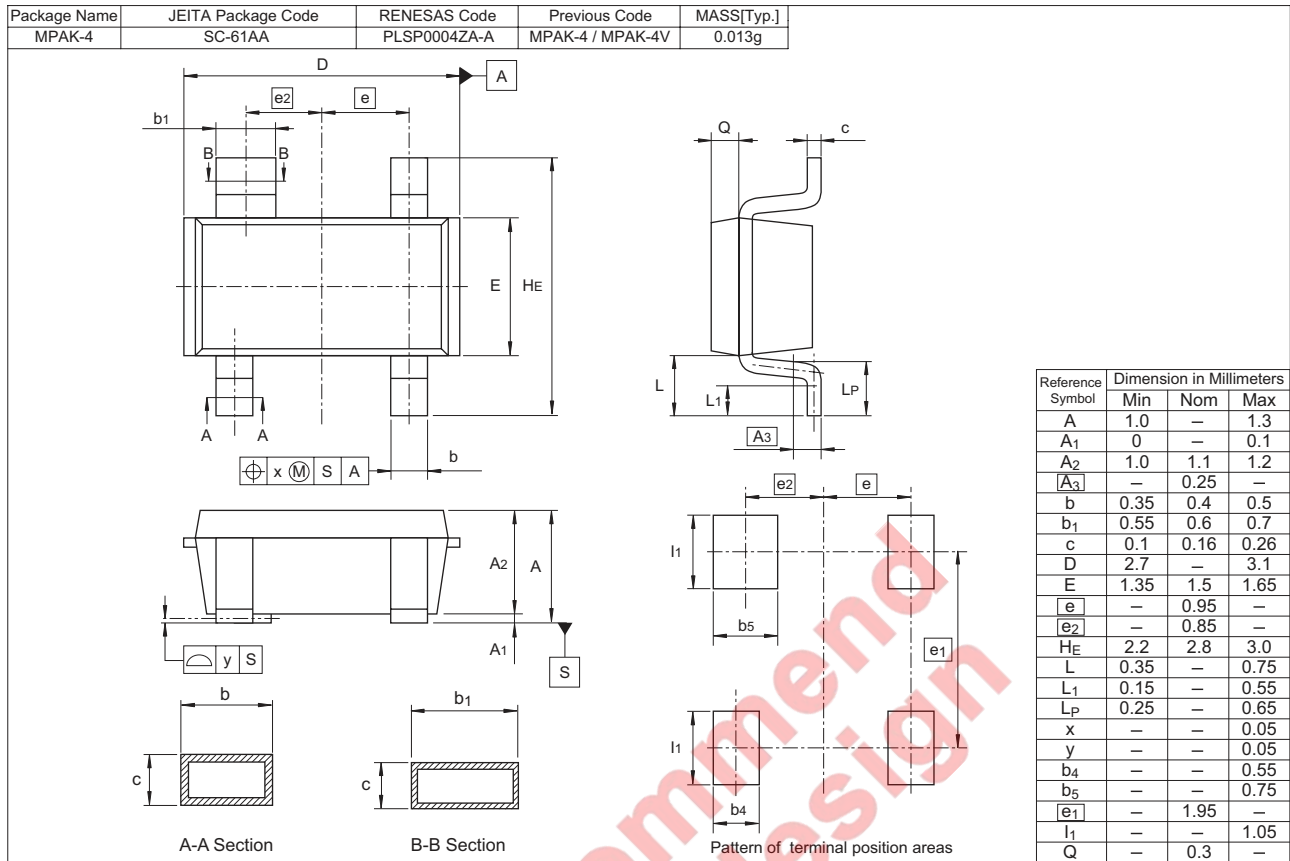
S Parameter

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

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

Not recommended for new design

Package Dimensions



Ordering Information

Orderable Part Number	Quantity	Shipping Container
BB504MDS-TL-E	3000	φ 178 mm Reel, 8 mm Emboss Taping
BB504MDS-TL-H		

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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