BB504M

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

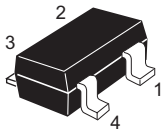
R07DS0286EJ0800
(Previous: REJ03G0837-0700)
Rev.8.00
Mar 28, 2011

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

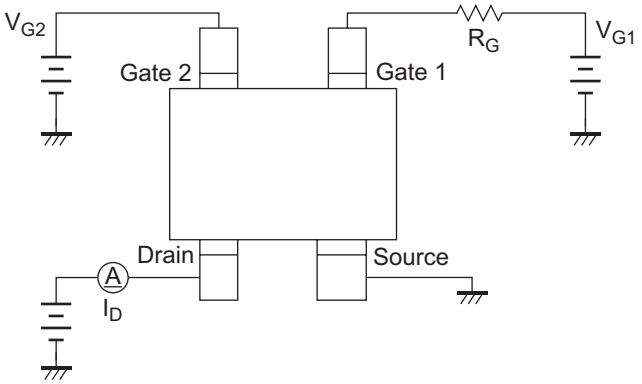
Electrical Characteristics

(Ta = 25°C)

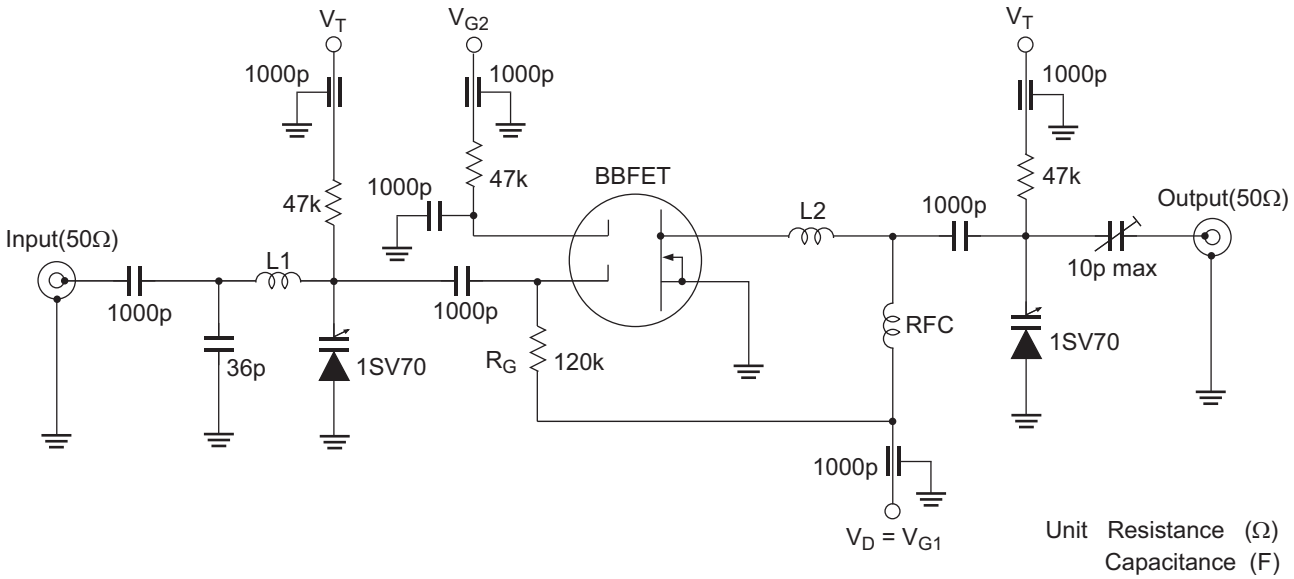
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	I_D = 200 µA, V_{G1S} = V_{G2S} = 0
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	I_{G1} = +10 µA, V_{G2S} = V_{DS} = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	+6	—	—	V	I_{G2} = +10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

Test Circuits

- **DC Biasing Circuit for Operating Characteristics Items** ($I_{D(op)}$, |yfs|, Ciss, Coss, Crss, NF, PG)

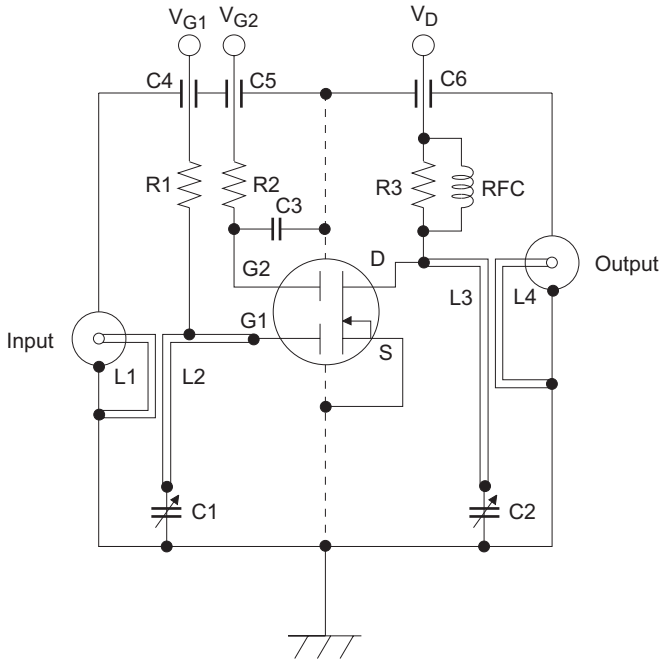


- **200 MHz Power Gain, Noise Figure Test Circuit**



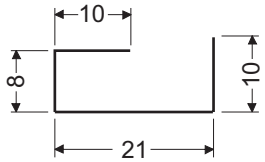
L1 : Φ1mm Enameled Copper Wire,Inside dia 10mm, 2Turns
L2 : Φ1mm Enameled Copper Wire,Inside dia 10mm, 2Turns
RFC : Φ1mm Enameled Copper Wire,Inside dia 5mm, 2Turns

- **900 MHz Power Gain, Noise Figure Test Circuit**

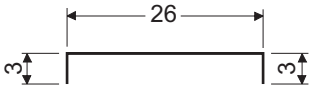


C1, C2 : Variable Capacitor (10pF MAX)
C3 : Disk Capacitor (1000pF)
C4 to C6 : Air Capacitor (1000pF)
R1 : 120 kΩ
R2 : 47 kΩ
R3 : 4.7 kΩ

L1:

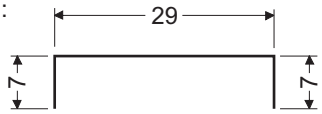


L2:

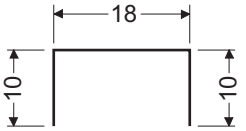


(Φ1mm Copper wire)
Unit:mm

L3:

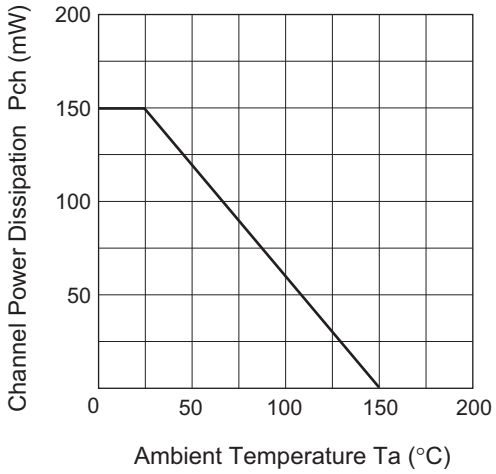


L4:

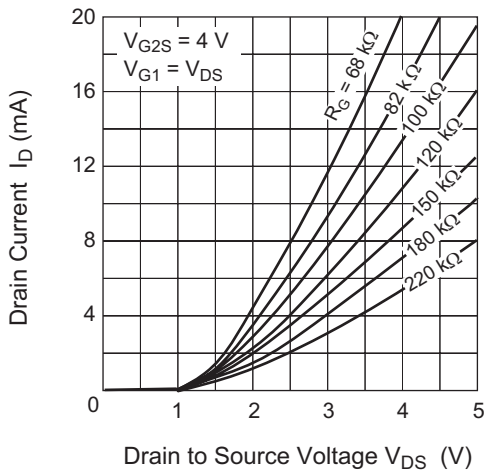


RFC : Φ1mm Copper wire with enamel 4turns inside dia 6mm

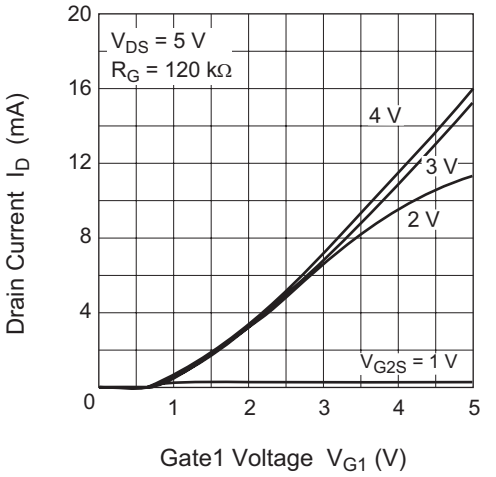
Maximum Channel Power Dissipation Curve



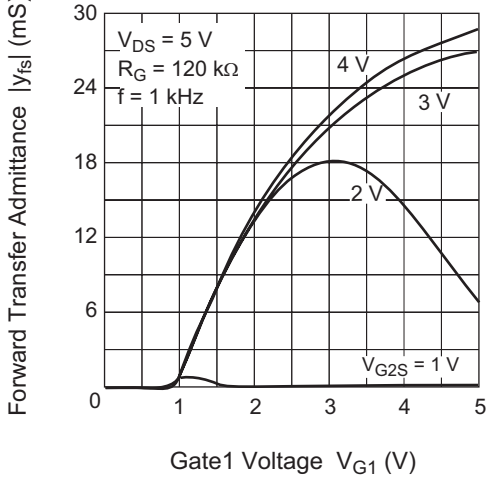
Typical Output Characteristics



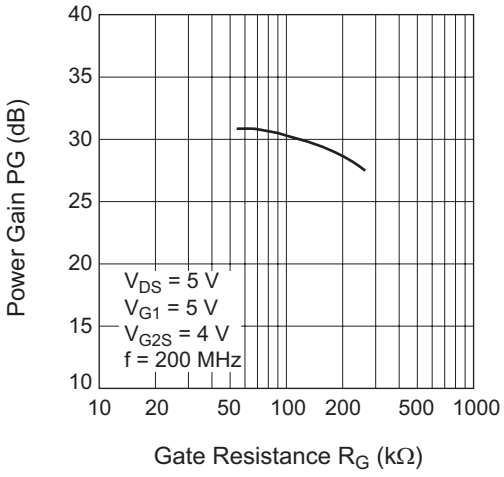
Drain Current vs. Gate1 Voltage



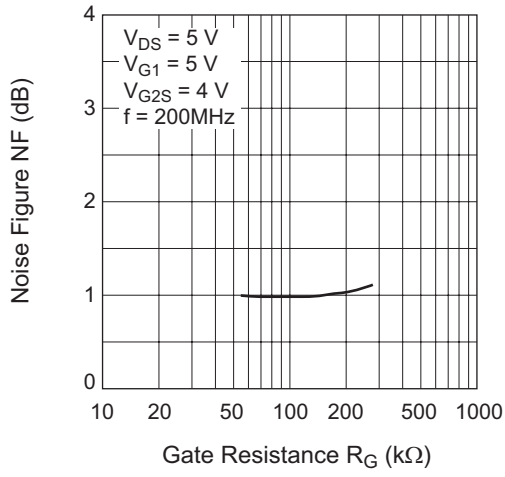
Forward Transfer Admittance vs. Gate1 Voltage



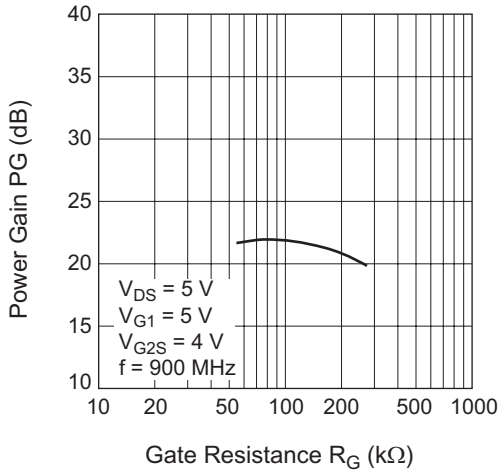
Power Gain vs. Gate Resistance



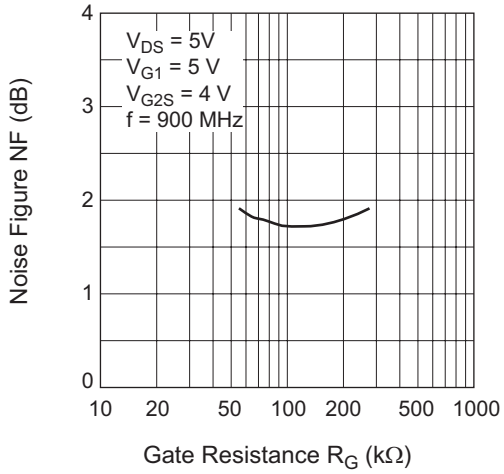
Noise Figure vs. Gate Resistance



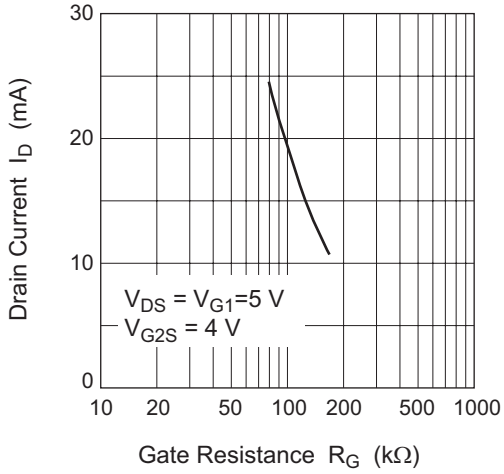
Power Gain vs. Gate Resistance



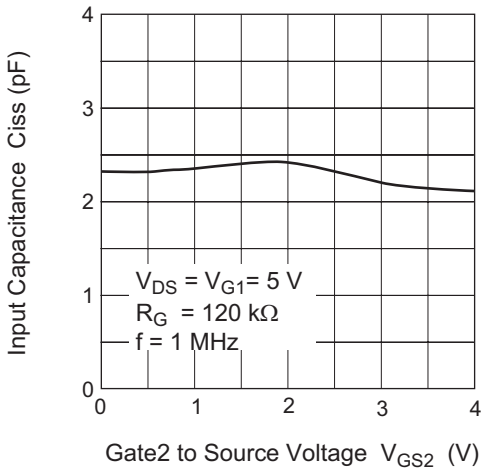
Noise Figure vs. Gate Resistance



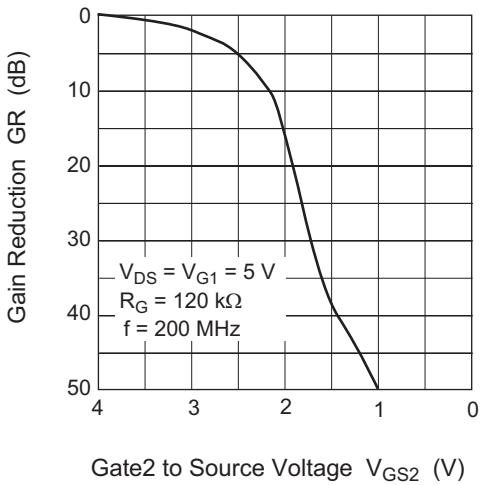
Drain Current vs. Gate Resistance



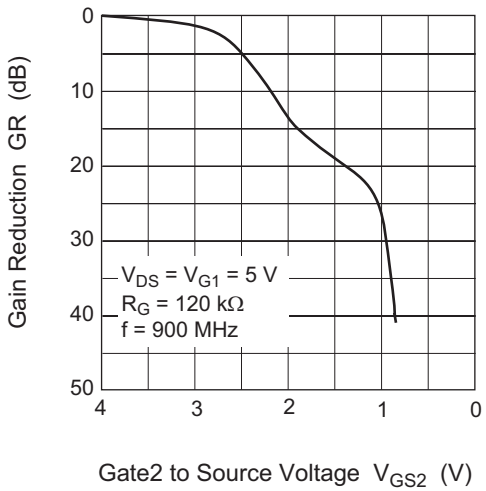
Input Capacitance vs.
Gate2 to Source Voltage



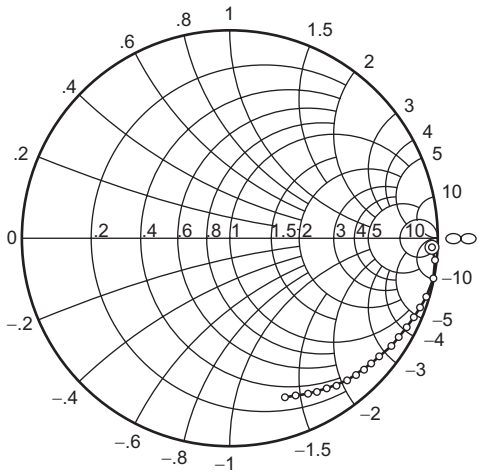
Gain Reduction vs.
Gate2 acto Source Voltage



Gain Reduction vs.
Gate2 acto Source Voltage

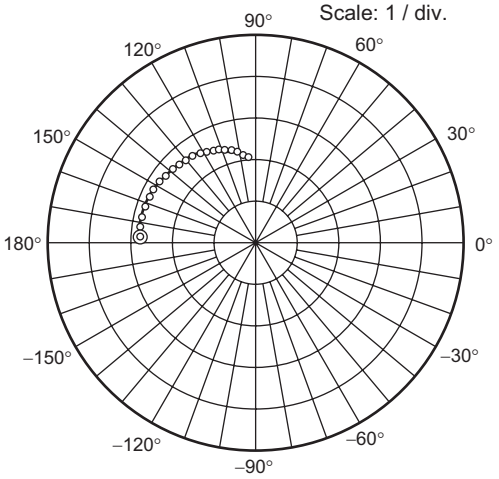


S11 Parameter vs. Frequency



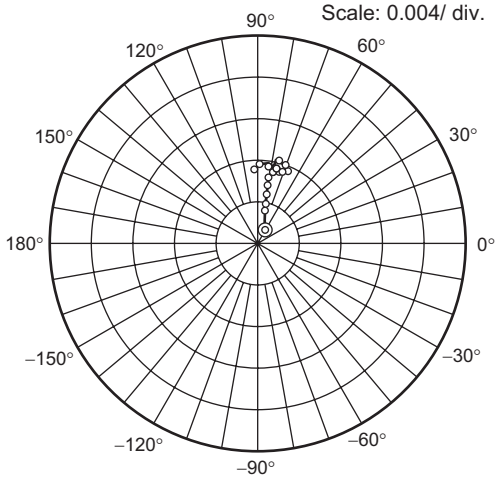
Test Condition: V_{DS} = 5 V, V_{G1} = 5 V
V_{G2S} = 4 V, R_G = 120 kΩ ,
Zo = 50Ω
50 to 1000 MHz (50 MHz step)

S21 Parameter vs. Frequency



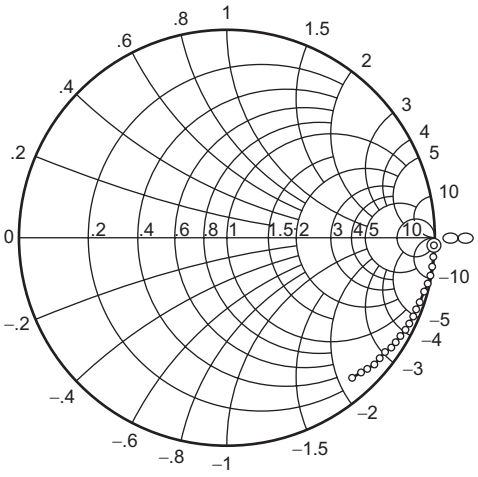
Test Condition: V_{DS} = 5 V, V_{G1} = 5 V
V_{G2S} = 4 V, R_G = 120 kΩ ,
Zo = 50Ω
50 to 1000 MHz (50 MHz step)

S12 Parameter vs. Frequency



Test Condition: V_{DS} = 5 V, V_{G1} = 5 V
V_{G2S} = 4 V, R_G = 120 kΩ ,
Zo = 50Ω
50 to 1000 MHz (50 MHz step)

S22 Parameter vs. Frequency



Test Condition: V_{DS} = 5 V, V_{G1} = 5 V
V_{G2S} = 4 V, R_G = 120 kΩ ,
Zo = 50Ω
50 to 1000 MHz (50 MHz step)

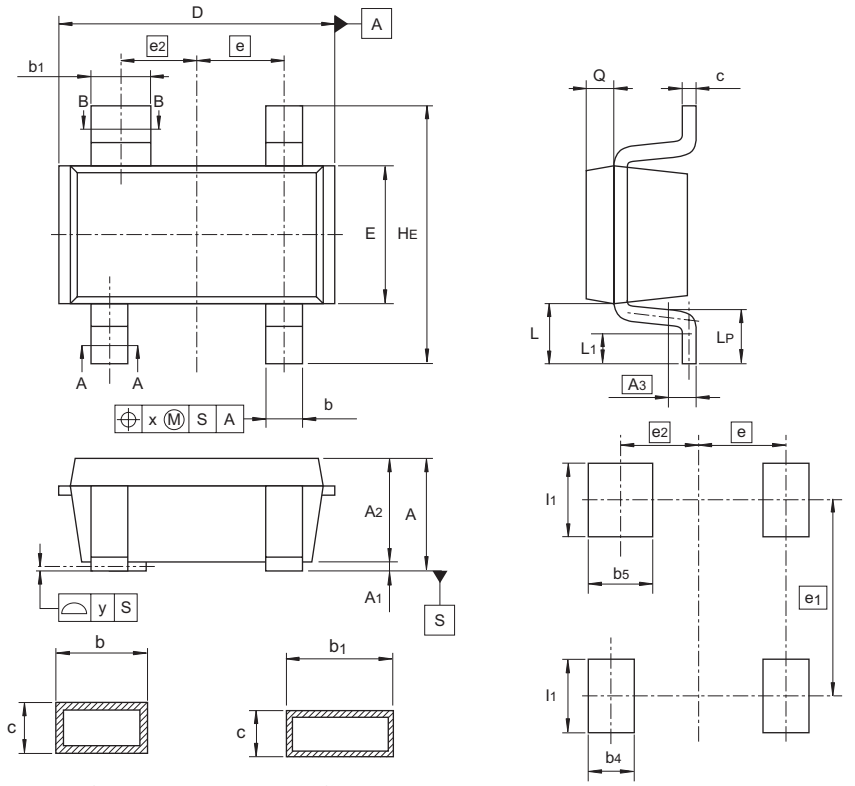
S Parameter

(V_{DS} = V_{G1} = 5V, V_{G2S} = 4 V, R_G = 120 kΩ, Zo = 50 Ω)

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

Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
MPAK-4	SC-61AA	PLSP0004ZA-A	MPAK-4 / MPAK-4V	0.013g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	1.0	–	1.3
A_1	0	–	0.1
A_2	1.0	1.1	1.2
A_3	–	0.25	–
b	0.35	0.4	0.5
b_1	0.55	0.6	0.7
c	0.1	0.16	0.26
D	2.7	–	3.1
E	1.35	1.5	1.65
e	–	0.95	–
e_2	–	0.85	–
H_E	2.2	2.8	3.0
L	0.35	–	0.75
L_1	0.15	–	0.55
L_P	0.25	–	0.65
x	–	–	0.05
y	–	–	0.05
b_4	–	–	0.55
b_5	–	–	0.75
e_1	–	1.95	–
l_1	–	–	1.05
Q	–	0.3	–

Ordering Information

Orderable Part Number	Quantity	Shipping Container
BB504MDS-TL-E BB504MDS-TL-H	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

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