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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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BB304M

Build in Biasing Circuit MOS FET IC UHF/VHF RF Amplifier

RENESAS

ADE-208-605D (Z)

5th. Edition

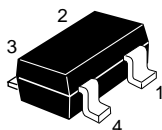
Mar. 2001

Features

- Build 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;
Build in ESD absorbing diode. Withstand up to 200V at C=200pF, Rs=0 conditions.
Provide mini mold packages; MPAK-4(SOT-143Rmod)

Outline

MPAK-4



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

- Notes:
1. Marking is "DW -".
 2. BB304M is individual type number of HITACHI 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)

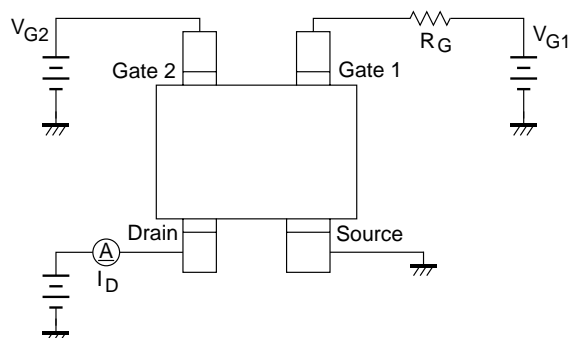
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	12	—	—	V	$I_D = 200\mu A$, $V_{G1S} = V_{G2S} = 0$
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+10	—	—	V	$I_{G1} = +10\mu A$, $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±10	—	—	V	$I_{G2} = \pm 10\mu A$, $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff current	I_{G1SS}	—	—	+100	nA	$V_{G1S} = +9V$, $V_{G2S} = V_{DS} = 0$
Gate2 to source cutoff current	I_{G2SS}	—	—	±100	nA	$V_{G2S} = \pm 9V$, $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	0.4	—	1.0	V	$V_{DS} = 5V$, $V_{G2S} = 4V$ $I_D = 100\mu A$
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.5	—	1.0	V	$V_{DS} = 5V$, $V_{G1S} = 5V$ $I_D = 100\mu A$

Electrical Characteristics (Ta = 25°C)

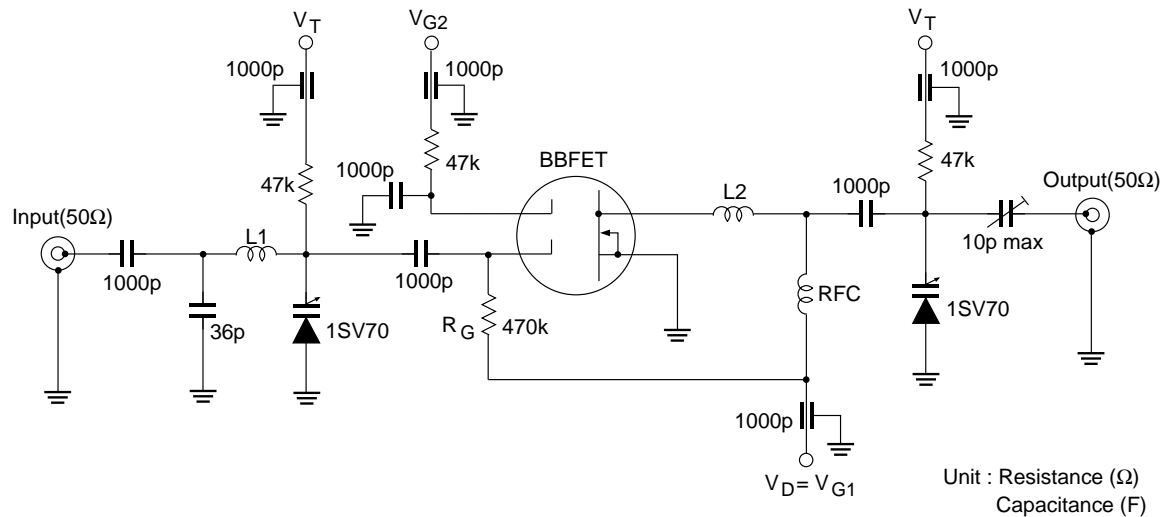
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input capacitance	C_{iss}	2.3	2.8	3.6	pF	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$
Output capacitance	C_{oss}	0.9	1.3	2.0	pF	$R_G = 180k\Omega, f = 1MHz$
Reverse transfer capacitance	C_{rss}	0.003	0.02	0.05	pF	
Drain current	$I_{D(op)1}$	9	15	19	mA	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$ $R_G = 180k\Omega$
	$I_{D(op)2}$	—	13	—	mA	$V_{DS} = 9V, V_{G1} = 9V, V_{G2S} = 6V$ $R_G = 470k\Omega$
Forward transfer admittance	$ y_{fs} 1$	22	27	34	mS	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$ $R_G = 180k\Omega, f = 1kHz$
	$ y_{fs} 2$	—	27	—	mS	$V_{DS} = 9V, V_{G1} = 9V, V_{G2S} = 6V$ $R_G = 470k\Omega, f = 1kHz$
Power gain	PG1	24	29	32	dB	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$ $R_G = 180k\Omega, f = 200MHz$
	PG2	—	29	—	dB	$V_{DS} = 9V, V_{G1} = 9V, V_{G2S} = 6V$ $R_G = 470k\Omega, f = 200MHz$
Noise figure	NF1	—	1.2	1.9	dB	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$ $R_G = 180k\Omega, f = 200MHz$
	NF2	—	1.2	—	dB	$V_{DS} = 9V, V_{G1} = 9V, V_{G2S} = 6V$ $R_G = 470k\Omega, f = 200MHz$

Main Characteristics

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

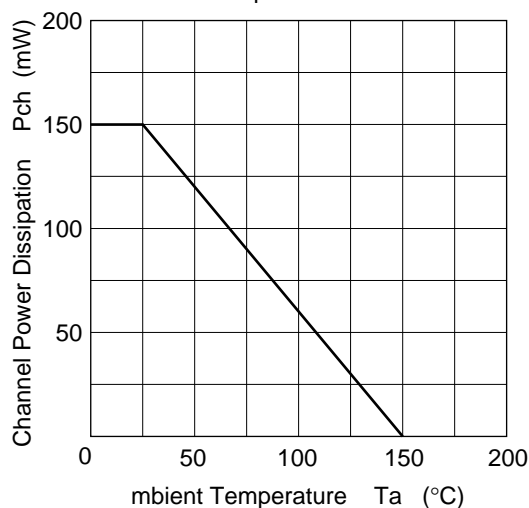


200MHz Power Gain, Noise Figure Test Circuit

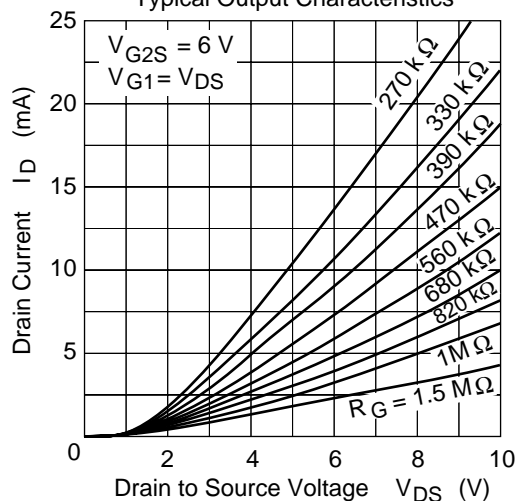


L1 : $\phi 1\text{mm}$ Enameled Copper Wire, Inside dia 10mm, 2Turns
L2 : $\phi 1\text{mm}$ Enameled Copper Wire, Inside dia 10mm, 2Turns
RFC : $\phi 1\text{mm}$ Enameled Copper Wire, Inside dia 5mm, 2Turns

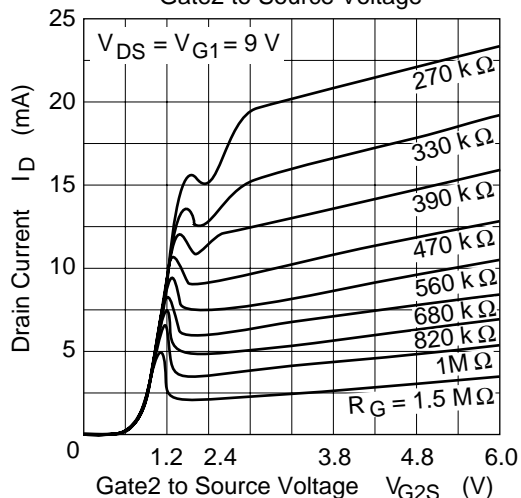
Maximum Channel Power
Dissipation Curve



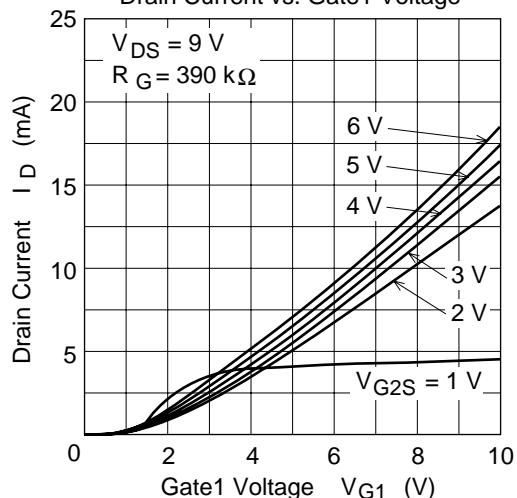
Typical Output Characteristics

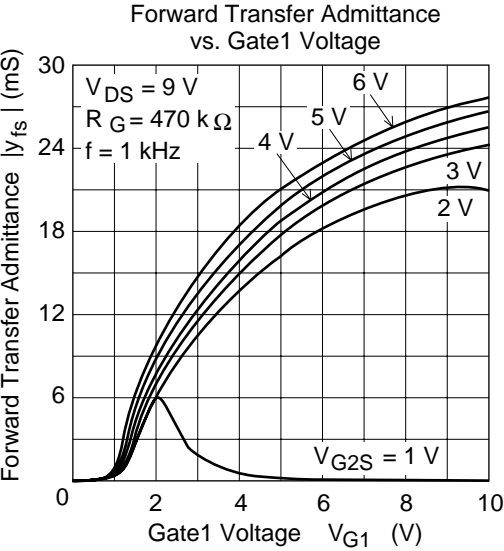
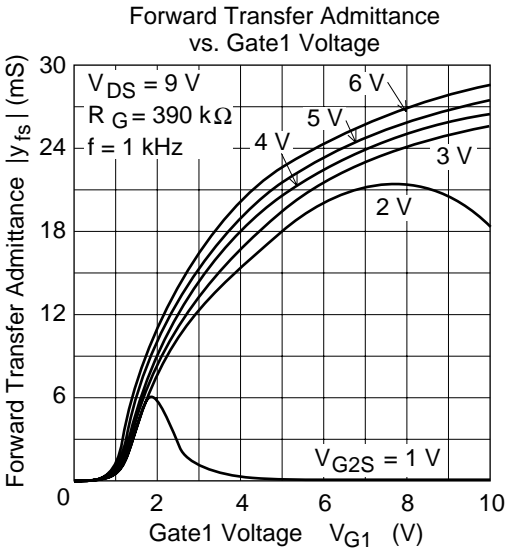
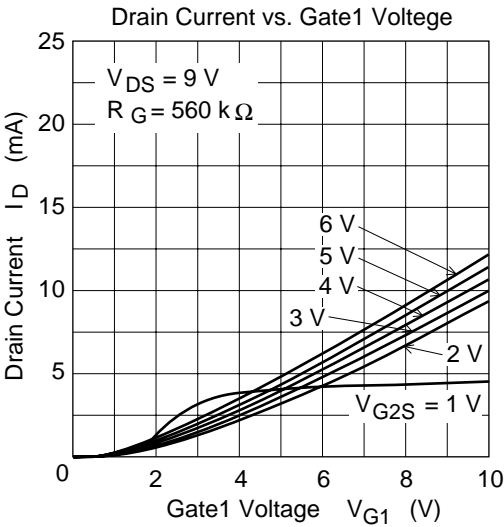
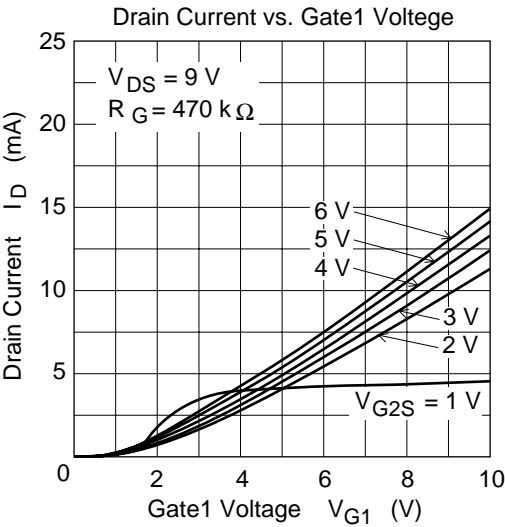


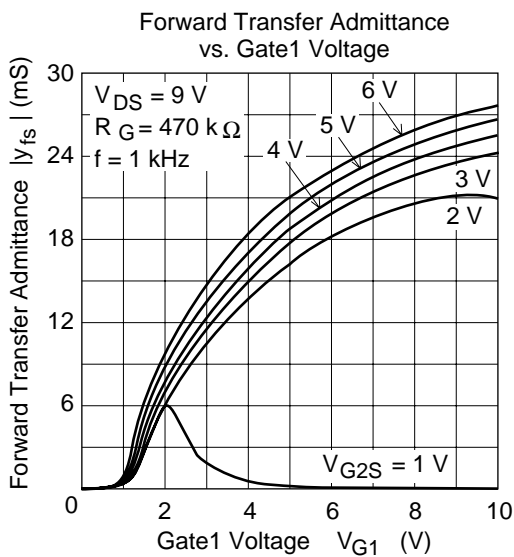
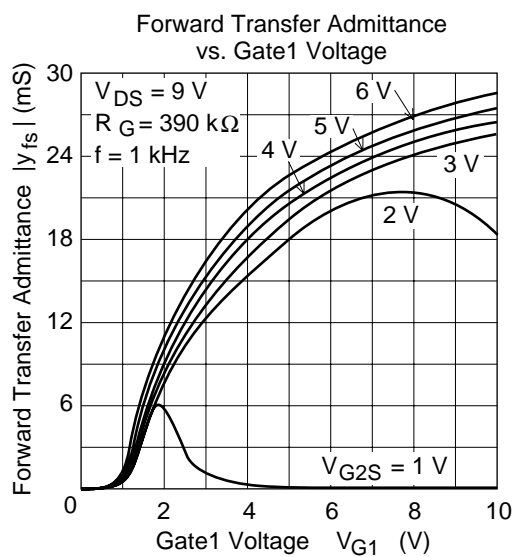
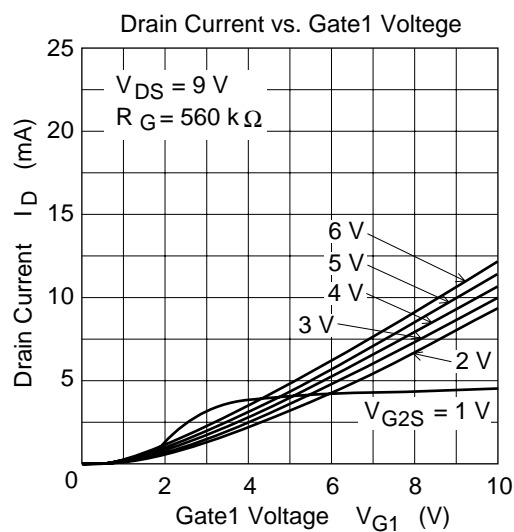
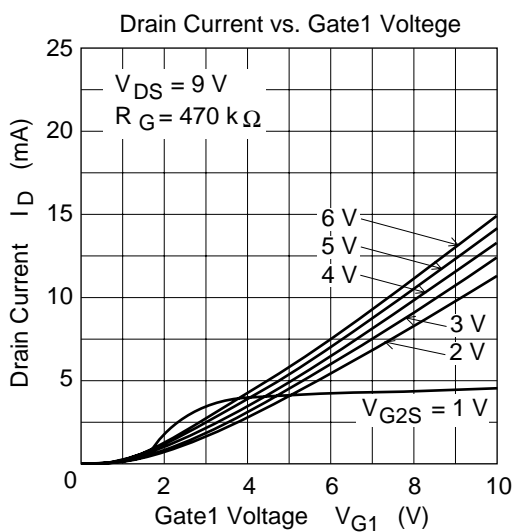
Drain Current vs.
Gate2 to Source Voltage

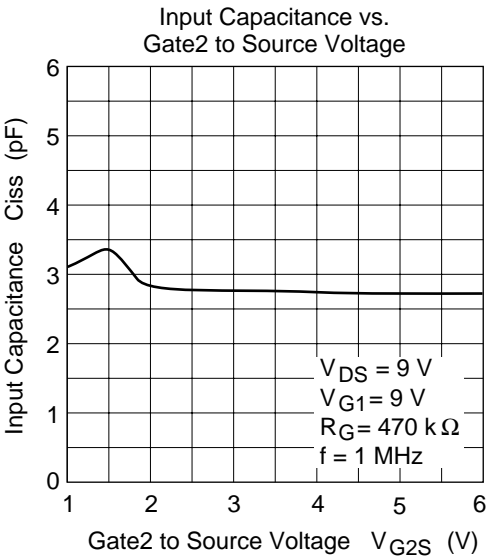
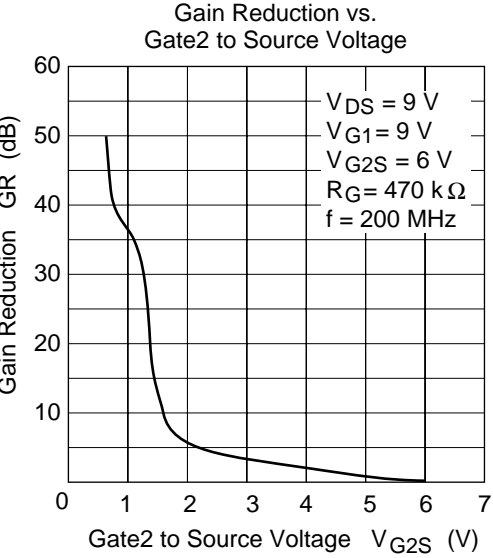
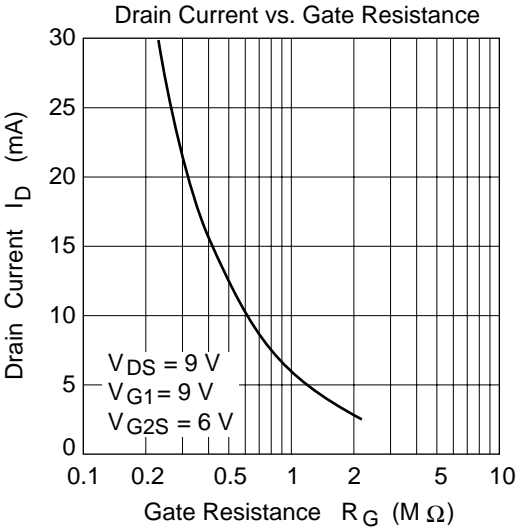
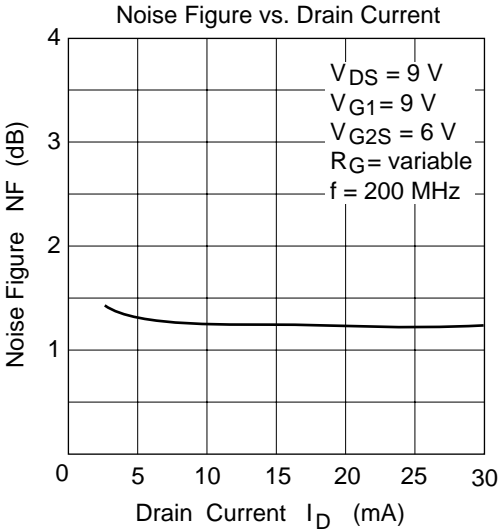


Drain Current vs. Gate1 Voltage

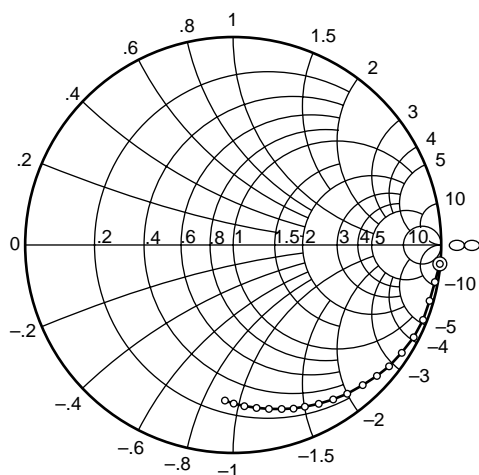








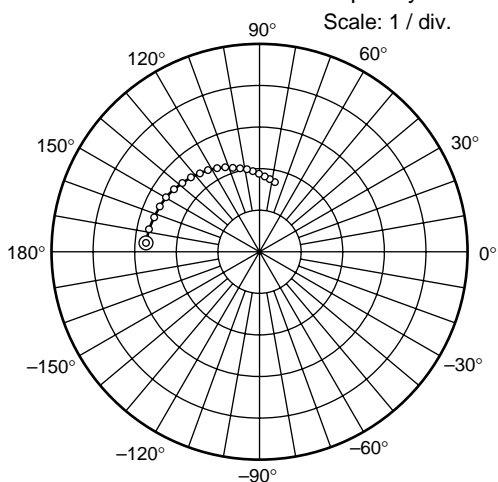
S11 Parameter vs. Frequency



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)

⊙—○

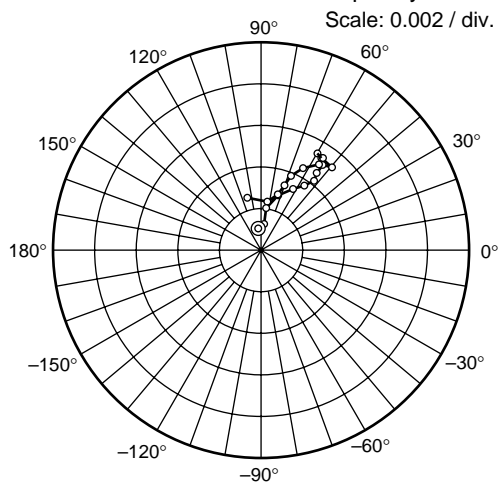
S21 Parameter vs. Frequency



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)

⊙—○

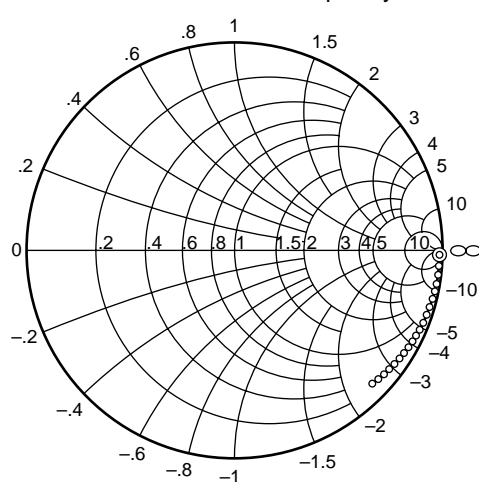
S12 Parameter vs. Frequency



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)

⊙—○

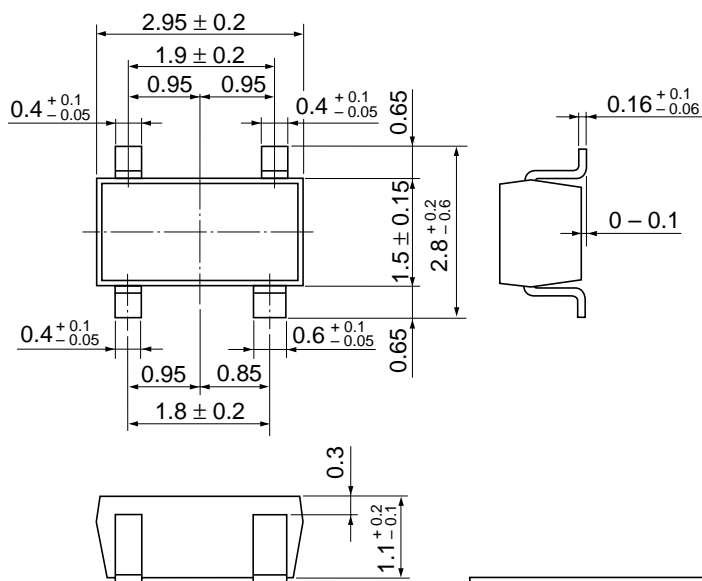
Sparameter ($V_{DS} = V_{GI} = 9V$, $V_{G2S} = 6V$, $R_G = 470k\Omega$, $Z_0 = 50\Omega$)

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

As of January, 2001

Unit: mm



Hitachi Code	MPAK-4
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.013 g

Cautions

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HITACHI

Hitachi, Ltd.

Semiconductor & Integrated Circuits.

Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL	NorthAmerica	: http://semiconductor.hitachi.com/
	Europe	: http://www.hitachi-eu.com/hel/ecg
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For further information write to:Hitachi Semiconductor
(America) Inc.179 East Tasman Drive,
San Jose, CA 95134

Tel: <1> (408) 433-1990

Fax: <1> (408) 433-0223

Hitachi Europe GmbH
Electronic Components GroupDornacher Straße 3
D-85622 Feldkirchen, Munich

Germany

Tel: <49> (89) 9 9180-0

Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.

Electronic Components Group.

Whitebrook Park

Lower Cookham Road

Maidenhead

Berkshire SL6 8YA, United Kingdom

Tel: <44> (1628) 585000

Fax: <44> (1628) 585160

Hitachi Asia Ltd.

Hitachi Tower

16 Collyer Quay #20-00,

Singapore 049318

Tel: <65>-538-6533/538-8577

Fax: <65>-538-6933/538-3877

URL: <http://www.hitachi.com.sg>

Hitachi Asia Ltd.

(Taipei Branch Office)

4/F, No. 167, Tun Hwa North Road,

Hung-Kuo Building,

Taipei (105), Taiwan

Tel: <886>-(2)-2718-3666

Fax: <886>-(2)-2718-8180

Telex: 23222 HAS-TP

URL: <http://www.hitachi.com.tw>

Hitachi Asia (Hong Kong) Ltd.

Group III (Electronic Components)

7/F., North Tower,

World Finance Centre,

Harbour City, Canton Road

Tsim Sha Tsui, Kowloon,

Hong Kong

Tel: <852>-(2)-735-9218

Fax: <852>-(2)-730-0281

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