To all our customers

Regarding the change of names mentioned in the document, such as Hitachi Electric and Hitachi XX, to Renesas Technology Corp.

The semiconductor operations of Mitsubishi Electric and Hitachi were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Hitachi, Hitachi, Ltd., Hitachi Semiconductors, and other Hitachi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Renesas Technology Home Page: http://www.renesas.com

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

RENESAS
Renesas Technology Corp.

BIC703M

Bias Controlled Monolithic IC
VHF/UHF RF Amplifier

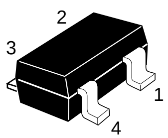
ADE-208-984D (Z)
5th. Edition
Mar. 2001

Features

- Bias Controlled Monolithic IC (No external DC biasing voltage on gate1.);
  To reduce using parts cost & PC board space.
- High |yfs| ;
  |yfs| = 29 mS typ. (f = 1kHz)
- Low noise;
  NF = 1.0 dB typ. (at f = 200 MHz), NF = 1.8 dB typ. (at f = 900 MHz)
- Withstanding to ESD;
  Build in ESD absorbing diode. Withstand up to 200V at C = 200pF, Rs = 0 conditions.
- Provide mini mold package; MPAK-4 (SOT-143Rmod)

Outline

MPAK-4



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

Notes: 1. Marking is “CZ–”.
2. BIC703M is individual type number of HITACHI BICMIC.

Absolute Maximum Ratings (Ta = 25°C)

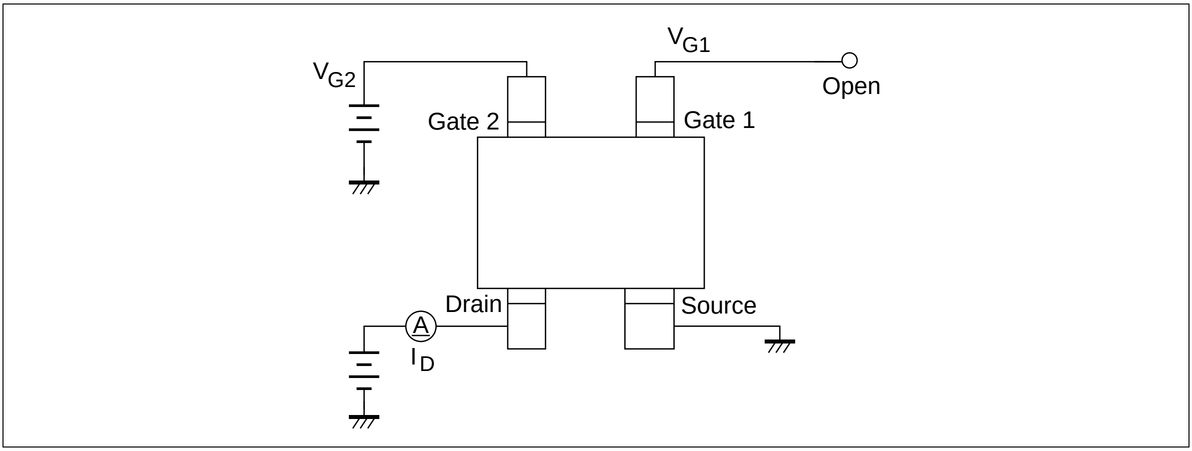
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	6	V
Gate1 to source voltage	V_{G1S}	+6 –0	V
Gate2 to source voltage	V_{G2S}	+6 –0	V
Drain current	I_D	30	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics (Ta = 25°C)

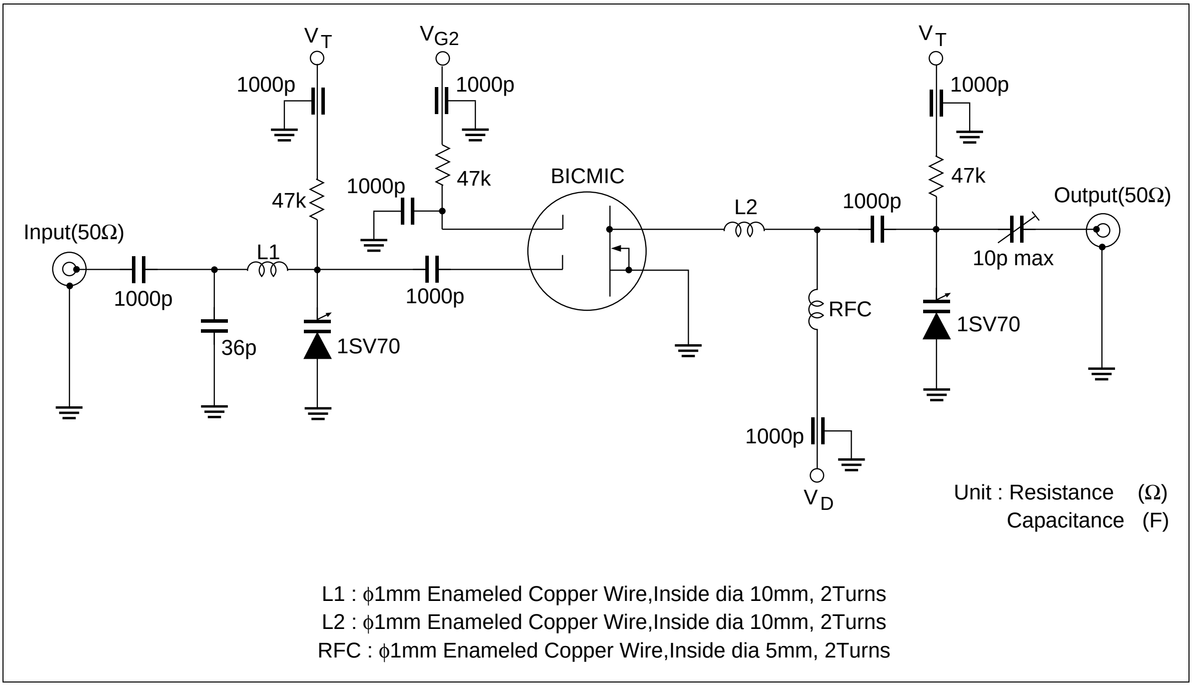
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	I_D = 200µA V_{G2S} = 0,V_{G1} = open
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	I_{G1} = +1mA, V_{G2S} = V_{DS} = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	+6	—	—	V	I_{G2} = +10µA, V_{G1S} = V_{DS} = 0
Gate2 to source cutoff current	I_{G2SS}	—	—	+100	nA	V_{G2S} = +5V, V_{G1S} = V_{DS} = 0
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.8	1.1	1.5	V	V_{DS} = 5V, I_D = 100µA V_{G1} = open
Drain current	$I_{D(op)}$	12	15	18	mA	V_{DS} = 5V , V_{G2S} = 4V V_{G1} = open
Forward transfer admittance	$\|y_{fs}\|$	24	29	34	mS	V_{DS} = 5V, I_D = 15mA V_{G2S} =4V, f = 1kHz
Input capacitance	c_{iss}	1.6	2.0	2.4	pF	V_{DS} = 5V, V_{G2S} =4V
Output capacitance	c_{oss}	0.6	1.0	1.4	pF	V_{G1} = open
Reverse transfer capacitance	c_{rss}	—	0.022	0.05	pF	f = 1MHz
Power gain	PG1	23	28	—	dB	V_{DS} = 5V, V_{G2S} =4V V_{G1} = open
Noise figure	NF1	—	1.0	1.8	dB	f = 200MHz
Power gain	PG2	17	22	—	dB	V_{DS} = 5V, V_{G2S} =4V V_{G1} = open
Noise figure	NF2	—	1.8	2.4	dB	f = 900MHz

Test Circuits

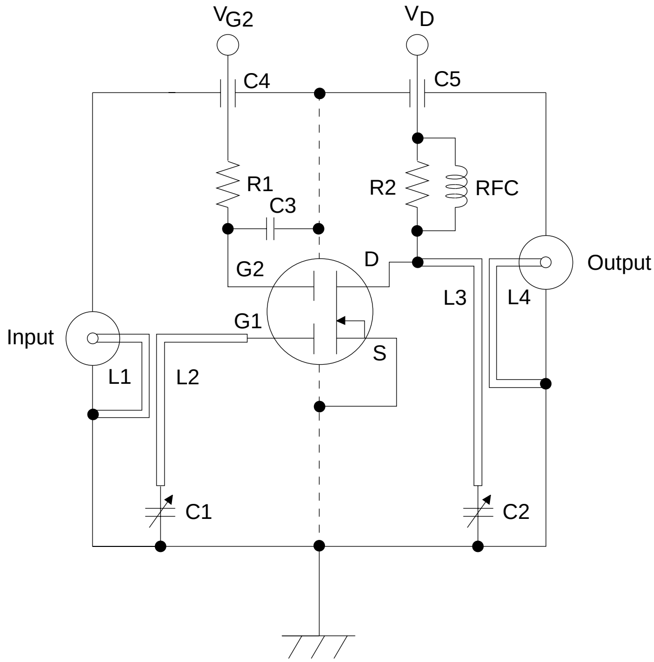
- **DC Biasing Circuit for Operating Characteristic Items** ($I_{D(op)}$, |yfs|, Ciss, Coss, Crss, NF, PG)



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

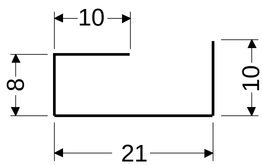


- **900 MHz Power Gain, Noise Figure Test Circuit**

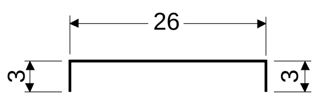


C1, C2	:	Variable Capacitor (10pF MAX)
C3	:	Disk Capacitor (1000pF)
C4, C5	:	Air Capacitor (1000pF)
R1	:	47 kΩ
R2	:	4.7 kΩ

L1:

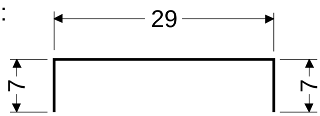


L2:

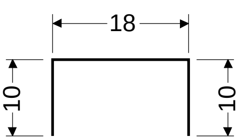


(φ1mm Copper wire)
Unit : mm

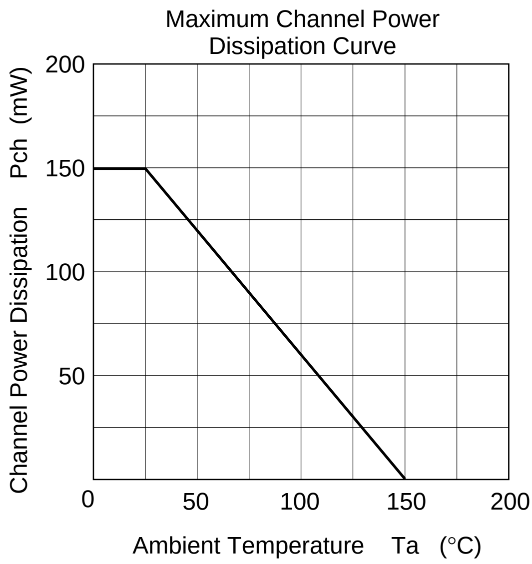
L3:

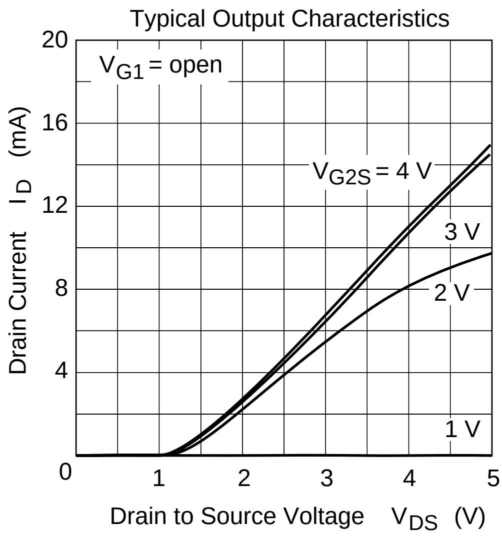


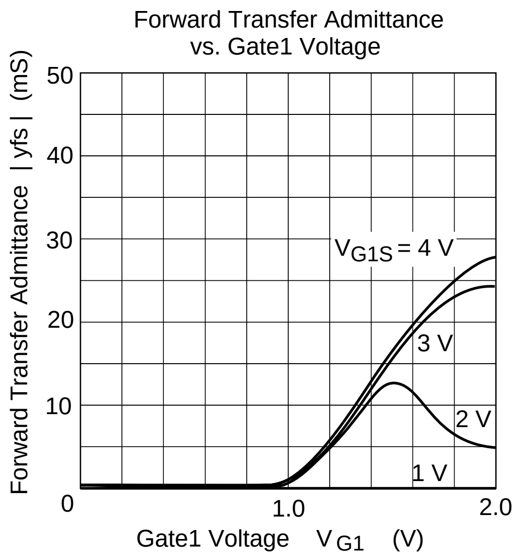
L4:

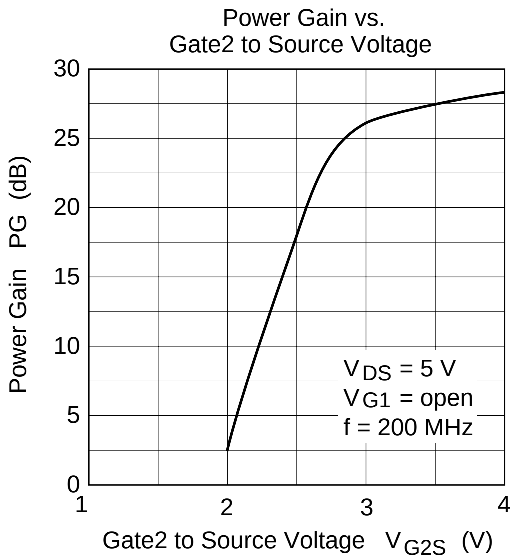


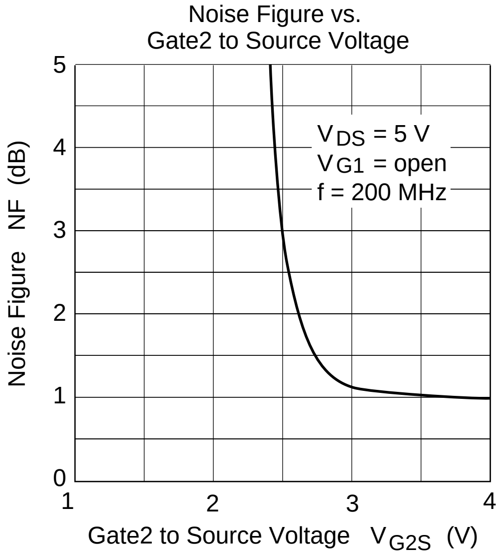
RFC : φ1mm Copper wire with enamel 4turns inside dia 6mm

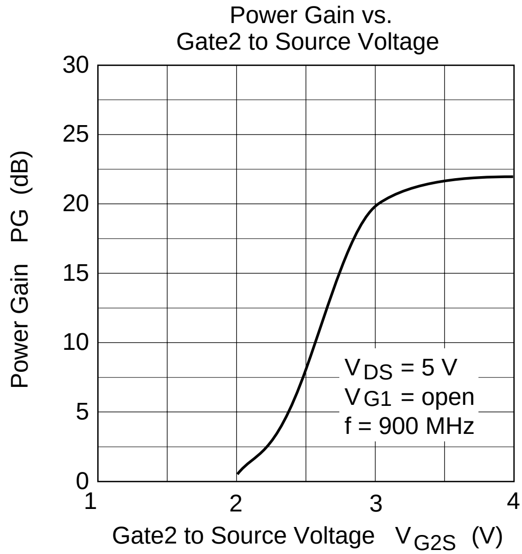

Maximum Channel Power
Dissipation Curve
Channel Power Dissipation Pch (mW)
200
150
100
50
0
50
100
150
200
Ambient Temperature Ta (°C)

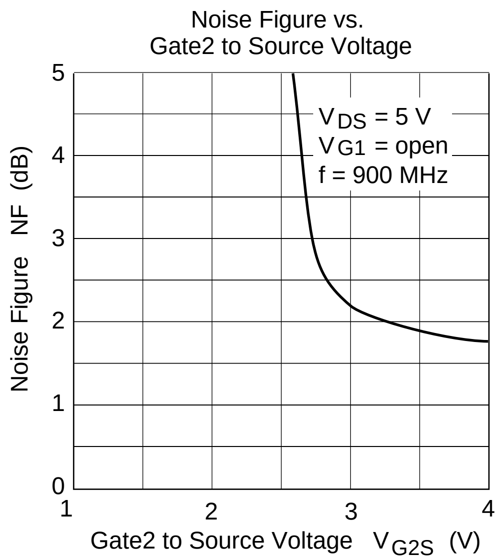

Typical Output Characteristics
Drain Current I_D (mA)
20
16
12
8
4
0
V_{G1} = open
V_{G2S} = 4 V
3 V
2 V
1 V
1
2
3
4
5
Drain to Source Voltage V_{DS} (V)

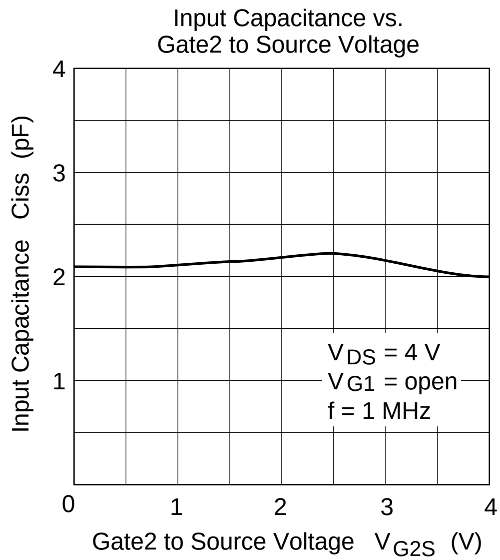

Forward Transfer Admittance
vs. Gate1 Voltage
Forward Transfer Admittance | yfs | (mS)
50
40
30
20
10
0
V_{G1S} = 4 V
3 V
2 V
1 V
1.0
2.0
Gate1 Voltage V_{G1} (V)

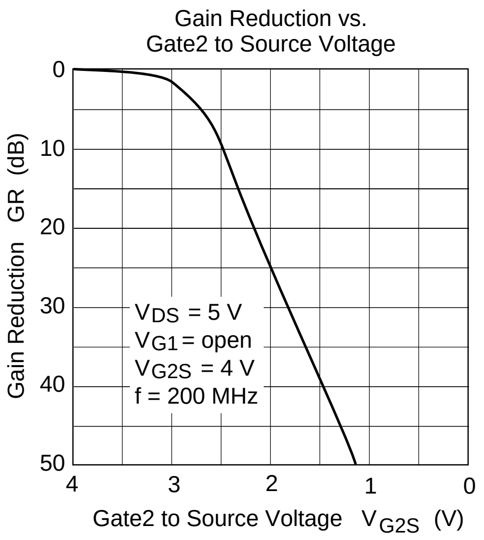

Power Gain vs.
Gate2 to Source Voltage
Power Gain PG (dB)
30
25
20
15
10
5
0
V_{DS} = 5 V
V_{G1} = open
f = 200 MHz
1
2
3
4
Gate2 to Source Voltage V_{G2S} (V)

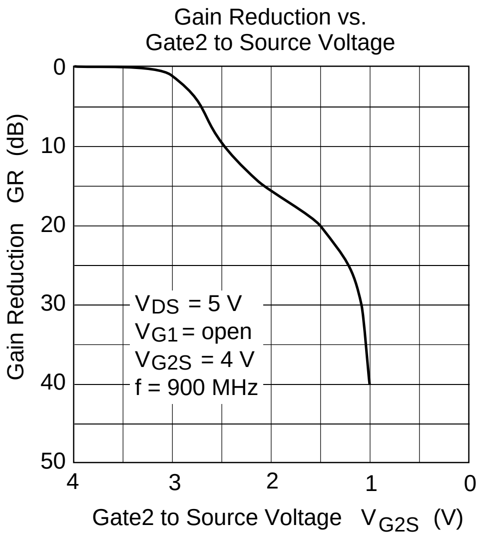

Noise Figure vs.
Gate2 to Source Voltage
Noise Figure NF (dB)
Gate2 to Source Voltage VG2S (V)
VDS = 5 V
VG1 = open
f = 200 MHz
0
1
2
3
4
5


Power Gain vs.
Gate2 to Source Voltage
Power Gain PG (dB)
Gate2 to Source Voltage VG2S (V)
VDS = 5 V
VG1 = open
f = 900 MHz
0
5
10
15
20
25
30

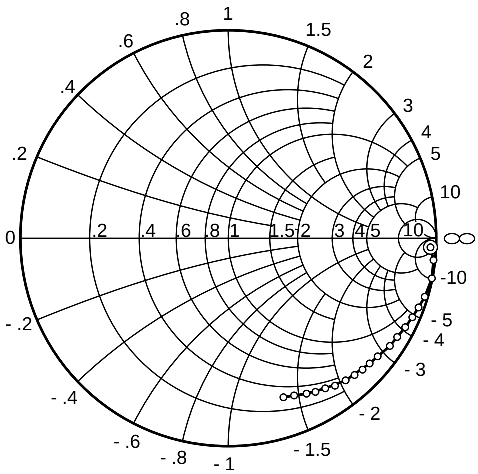

Noise Figure vs.
Gate2 to Source Voltage
Noise Figure NF (dB)
Gate2 to Source Voltage VG2S (V)
VDS = 5 V
VG1 = open
f = 900 MHz


Input Capacitance vs.
Gate2 to Source Voltage
Input Capacitance Ciss (pF)
Gate2 to Source Voltage VG2S (V)
VDS = 4 V
VG1 = open
f = 1 MHz


Gain Reduction vs.
Gate2 to Source Voltage
Gain Reduction GR (dB)
0
10
20
30
40
50
4
3
2
1
0
VDS = 5 V
VG1 = open
VG2S = 4 V
f = 200 MHz
Gate2 to Source Voltage VG2S (V)


Gain Reduction vs.
Gate2 to Source Voltage
Gain Reduction GR (dB)
0
10
20
30
40
50
4
3
2
1
0
VDS = 5 V
VG1 = open
VG2S = 4 V
f = 900 MHz
Gate2 to Source Voltage VG2S (V)

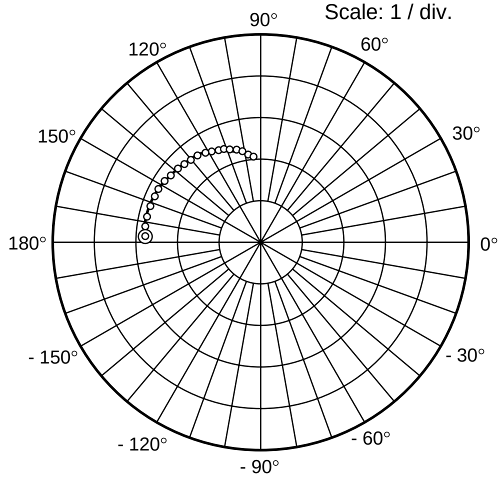
S11 Parameter vs. Frequency



Test Condition: V_{DS} = 5 V , V_{G1} = open
V_{G2S} = 4 V ,
Zo = 50 Ω

50 to 1000 MHz (50 MHz step)

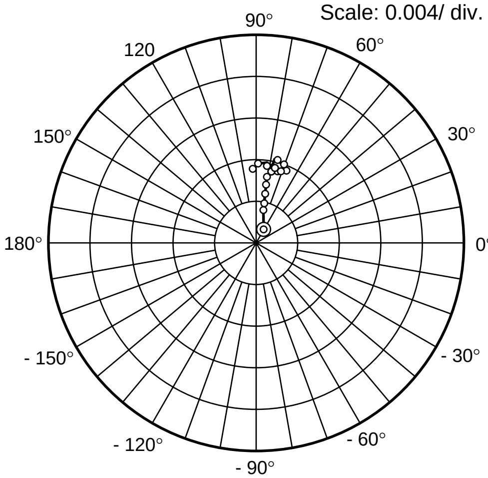
S21 Parameter vs. Frequency



Test Condition: V_{DS} = 5 V , V_{G1} = open
V_{G2S} = 4 V ,
Zo = 50 Ω

50 to 1000 MHz (50 MHz step)

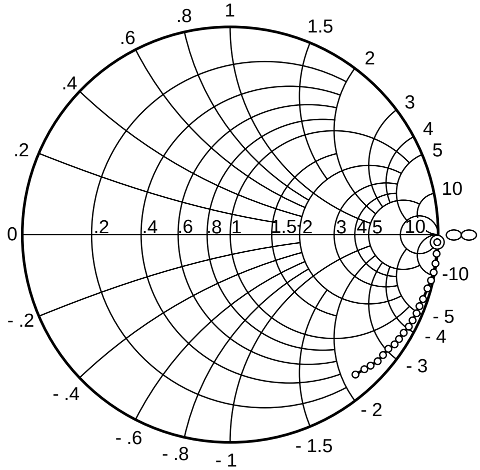
S12 Parameter vs. Frequency



Test Condition: V_{DS} = 5 V , V_{G1} = open
V_{G2S} = 4 V ,
Zo = 50 Ω

50 to 1000 MHz (50 MHz step)

S22 Parameter vs. Frequency



Test Condition: V_{DS} = 5 V , V_{G1} = open
V_{G2S} = 4 V ,
Zo = 50 Ω

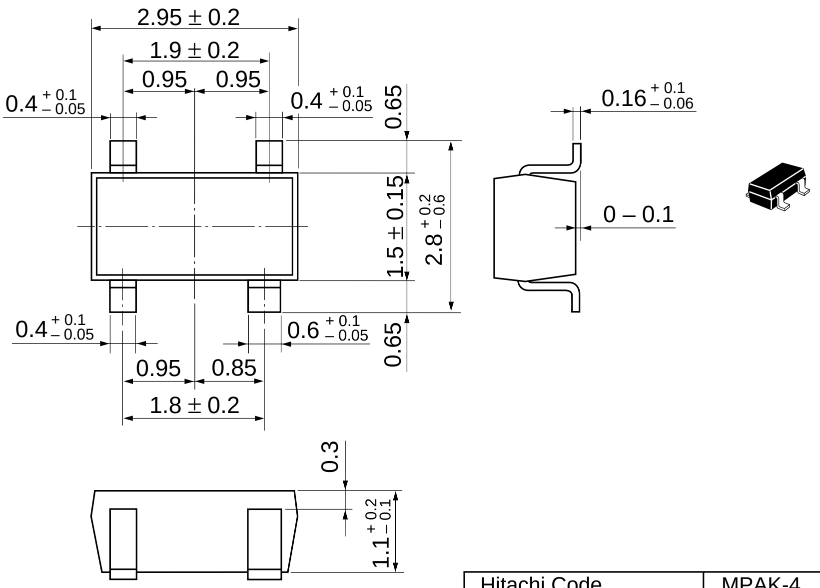
50 to 1000 MHz (50 MHz step)

Sparameter (V_{DS} = 5 V, V_{G2S} = 4 V, V_{G1} = open, Zo = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	**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

As of January, 2001
Unit: mm



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

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi’s or any third party’s patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party’s rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi’s sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi’s sales office for any questions regarding this document or Hitachi semiconductor products.

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
Asia : http://sicapac.hitachi-asia.com
Japan : http://www.hitachi.co.jp/Sicd/indx.htm

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 Group
Dornacher Straβe 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
URL : http://www.hitachi.com.hk

Colophon 2.0