BIC701M

Bias Controlled Monolithic IC
VHF/UHF RF Amplifier

HITACHI

ADE-208-703C (Z)
4th. Edition
Nov. 1998

Features

- Bias Controlled Monolithic IC (No external DC biasing voltage on gate1.);
  To reduce using parts cost & PC board space.
- High gain;
  PG = 27 dB typ. (at f = 200 MHz), PG = 21.5 dB typ. (at f = 900 MHz)
- Low noise;
  NF = 1.1 dB typ. (at f = 200 MHz), NF = 1.75 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 packages; MPAK-4(SOT-143mod)

Outline

MPAK-4

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

Notes: 1. Marking is “AZ–”.
2. BIC701M is individual type number of HITACHI BICMIC.

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

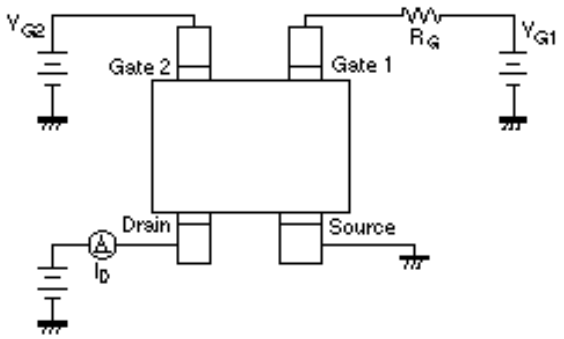
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	6	V
Gate1 to source voltage	V_{G1S}	+6 – 0	V
Gate2 to source voltage	V_{G2S}	+6 – 0	V
Drain current	I_D	20	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics (Ta = 25°C)

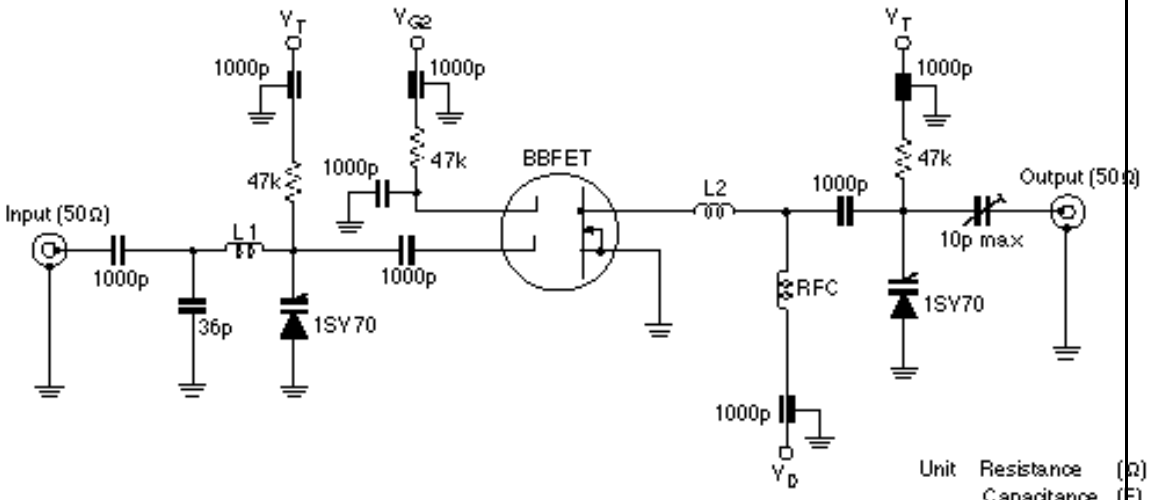
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	I_D = 200µA V_{G2S} = 0,V_{G1} = open
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	I_{G1} = +10µA V_{G2S} = V_{DS} = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	+6	—	—	V	I_{G2} = +10µA V_{G1S} = V_{DS} = 0
Gate1 to source cutoff current	I_{G1SS}	—	—	+100	nA	V_{G1S} = +5V V_{G2S} = 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	$V_{G2S(off)}$	0.5	0.7	1.0	V	V_{DS} = 5V, I_D = 100µA V_{G1} = open
Drain current	$I_{DS(op)}$	7	10	13	mA	V_{DS} = 5V , V_{G2S} = 4V V_{G1} = open
Forward transfer admittance	$\|y_{fs}\|$	22	27	32	mS	V_{DS} = 5V, I_D = 10mA V_{G2S} =4V, f = 1kHz
Input capacitance	c_{iss}	1.6	2.0	2.3	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}	—	0.024	0.05	pF	f = 1MHz
Power gain	PG1	23	27	—	dB	V_{DS} = 5V, V_{G2S} =4V V_{G1} = open
Noise figure	NF1	—	1.1	1.6	dB	f = 200MHz
Power gain	PG2	17	21.5	—	dB	V_{DS} = 5V, V_{G2S} =4V V_{G1} = open
Noise figure	NF2	—	1.75	2.3	dB	f = 900MHz

Main Characteristics

Test Circuit for Operating Items ($I_{D(op)}$, |yfs|, Ciss, Coss, Crss, NF, PG)

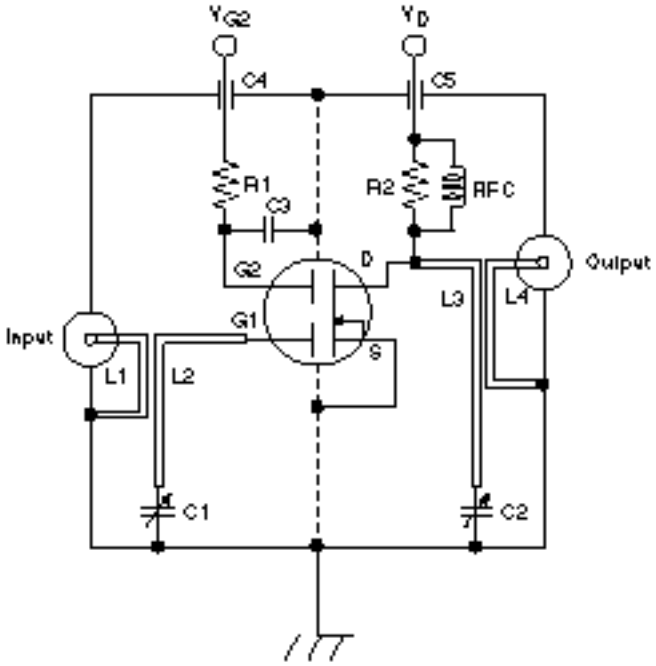


200MHz Power Gain, Noise Figure Test Circuit



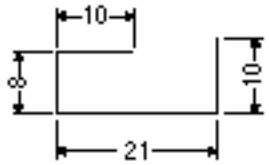
L1 : ϕ 1mm Enameled Copper Wire, Inside dia. 10mm, 2Turns
L2 : ϕ 1mm Enameled Copper Wire, Inside dia. 10mm, 2Turns
RFC : ϕ 1mm Enameled Copper Wire, Inside dia. 5mm, 2Turns

900MHz Power Gain, Noise Test Circuit

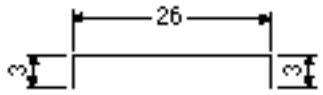


C1, C2 : Variable Capacitor (10pF MAX)
C3 : Disk Capacitor (1000pF)
C4, C5 : Air Capacitor (1000pF)
R1 : 47 kΩ
R2 : 4.7 kΩ

L1 :

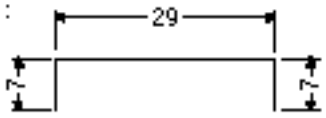


L2 :

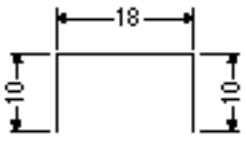


(ϕ 1mm Copper wire)
Unit : mm

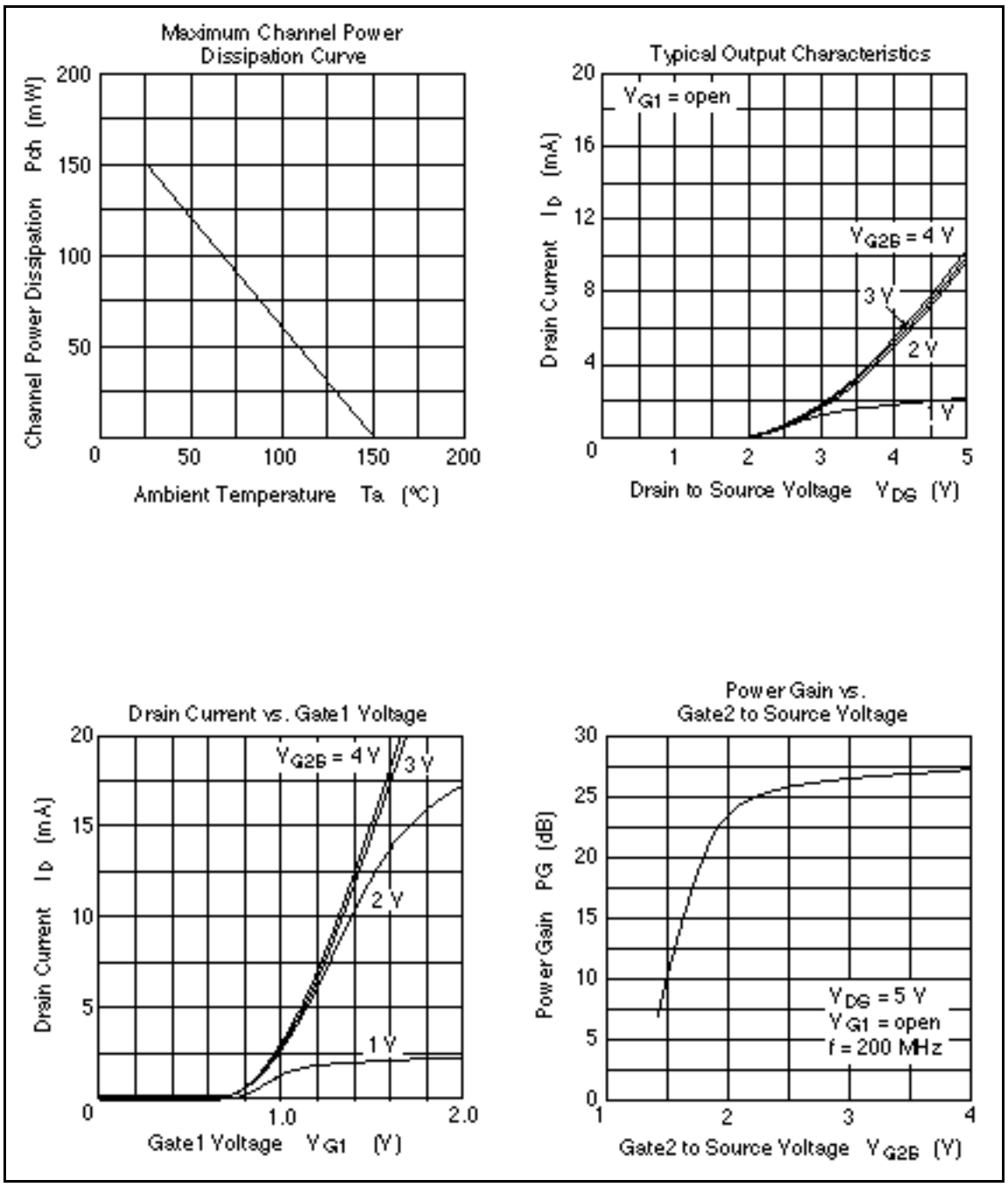
L3 :

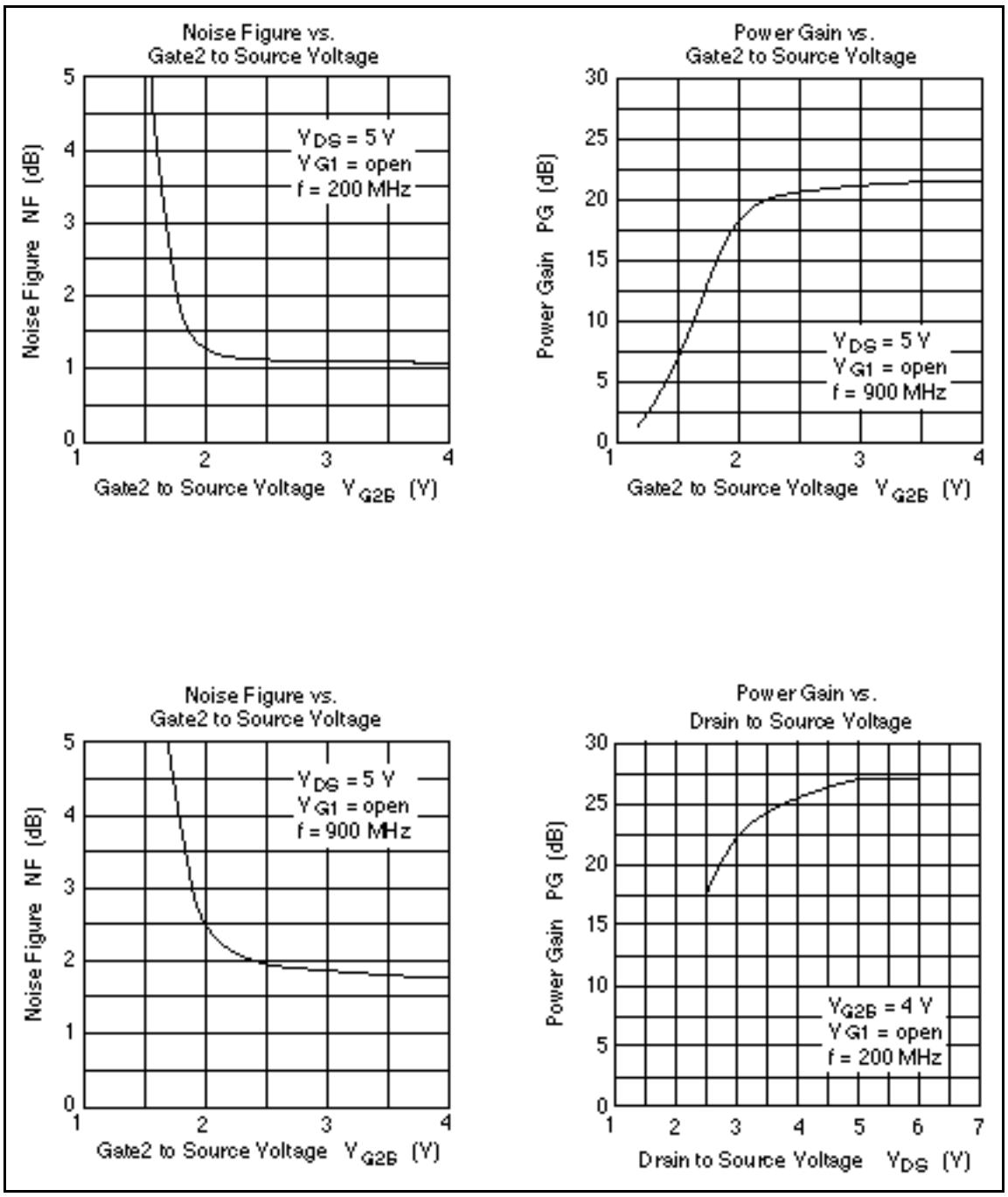


L4 :

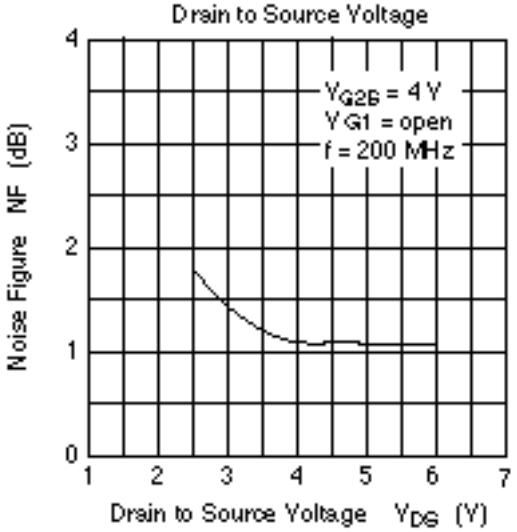


RFC : ϕ 1mm Copper wire with enamel 4turns inside dia. 6mm

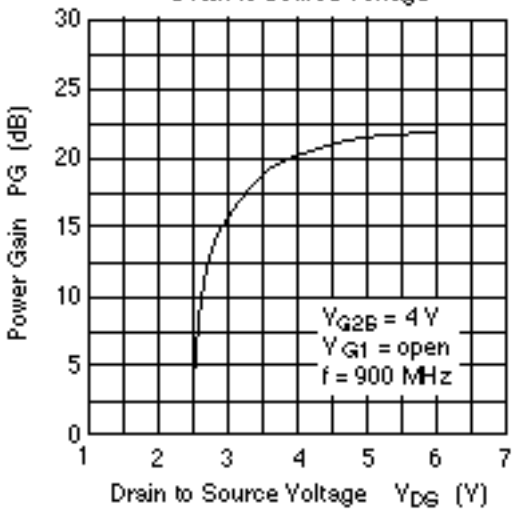

Maximum Channel Power Dissipation Curve
Channel Power Dissipation Pch (mW)
200
150
100
50
0
50
100
150
200
Ambient Temperature Ta (°C)
Typical Output Characteristics
VG1 = open
Drain Current ID (mA)
20
16
12
8
4
0
VG2S = 4 V
3 V
2 V
1 V
1
2
3
4
5
Drain to Source Voltage VDS (V)
Drain Current vs. Gate1 Voltage
Drain Current ID (mA)
20
15
10
5
0
VG2S = 4 V
3 V
2 V
1 V
1.0
2.0
Gate1 Voltage VG1 (V)
Power Gain vs. Gate2 to Source Voltage
Power Gain PG (dB)
30
25
20
15
10
5
0
VDS = 5 V
VG1 = open
f = 200 MHz
1
2
3
4
Gate2 to Source Voltage VG2S (V)


Noise Figure vs.
Gate2 to Source Voltage
Noise Figure NF (dB)
V_{DS} = 5 V
V_{G1} = open
f = 200 MHz
Gate2 to Source Voltage V_{G2S} (V)
Power Gain vs.
Gate2 to Source Voltage
Power Gain PG (dB)
V_{DS} = 5 V
V_{G1} = open
f = 900 MHz
Gate2 to Source Voltage V_{G2S} (V)
Noise Figure vs.
Gate2 to Source Voltage
Noise Figure NF (dB)
V_{DS} = 5 V
V_{G1} = open
f = 900 MHz
Gate2 to Source Voltage V_{G2S} (V)
Power Gain vs.
Drain to Source Voltage
Power Gain PG (dB)
V_{G2S} = 4 V
V_{G1} = open
f = 200 MHz
Drain to Source Voltage V_{DS} (V)

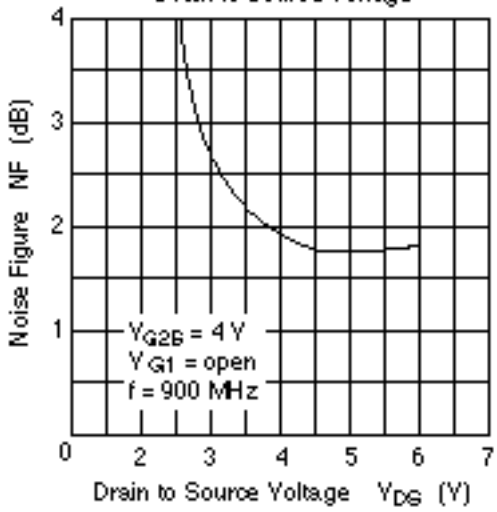
Noise Figure vs.
Drain to Source Voltage



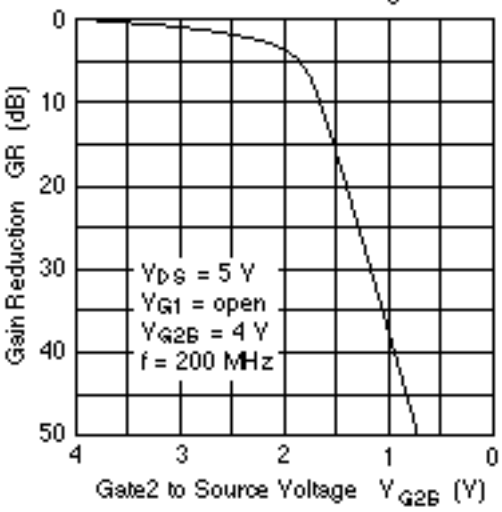
Power Gain vs.
Drain to Source Voltage

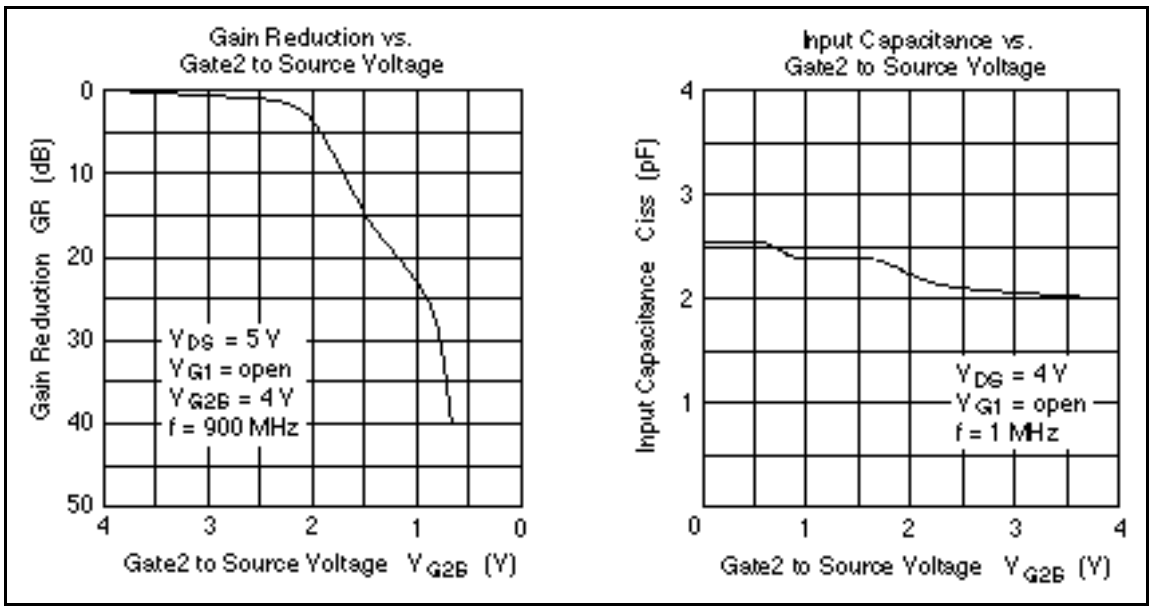


Noise Figure vs.
Drain to Source Voltage

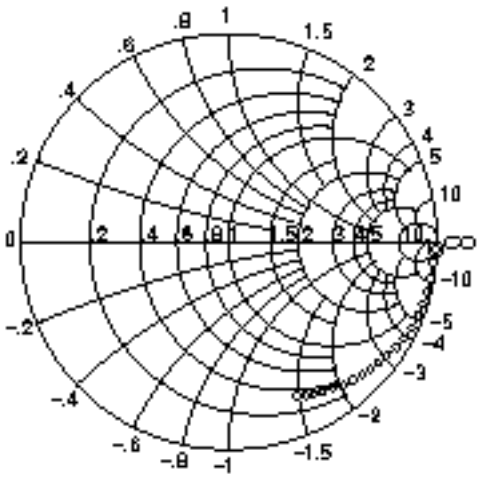


Gain Reduction vs.
Gate2 to Source Voltage




Gain Reduction vs.
Gate2 to Source Voltage
Gain Reduction GR (dB)
0
10
20
30
40
50
4
3
2
1
0
Gate2 to Source Voltage V_{G2S} (V)
V_{DS} = 5 V
V_{G1} = open
V_{G2S} = 4 V
f = 900 MHz
Input Capacitance vs.
Gate2 to Source Voltage
Input Capacitance Ciss (pF)
4
3
2
1
0
1
2
3
4
Gate2 to Source Voltage V_{G2S} (V)
V_{DS} = 4 V
V_{G1} = open
f = 1 MHz

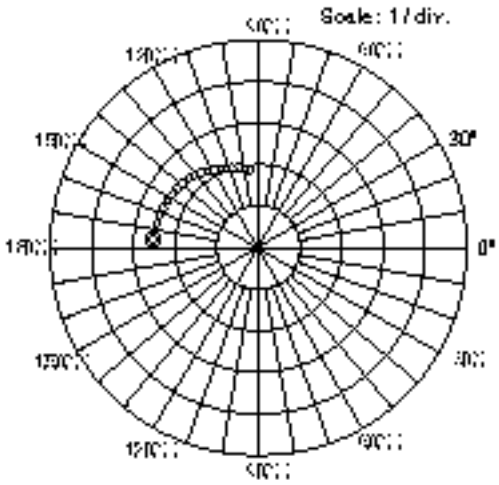
S11 Parameter vs. Frequency



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

50 to 1000 MHz (50 MHz step)

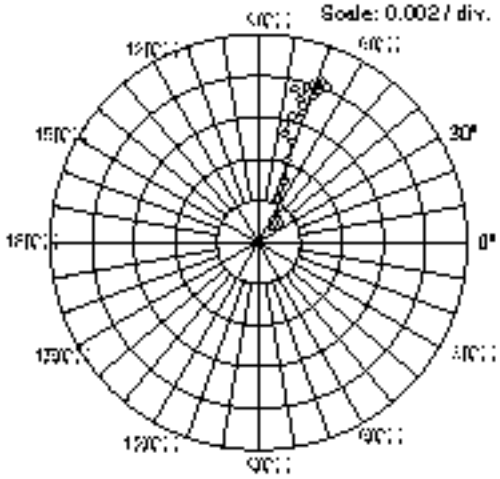
S21 Parameter vs. Frequency



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

50 to 1000 MHz (50 MHz step)

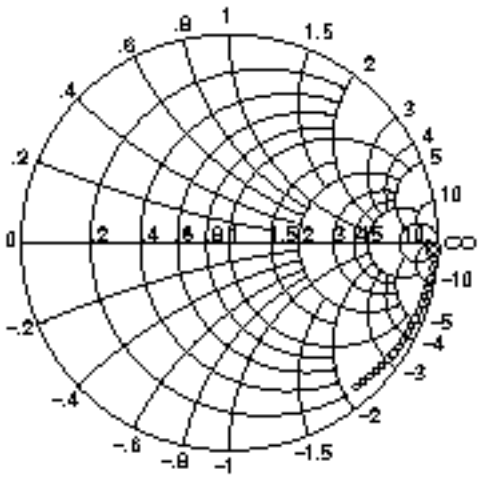
S12 Parameter vs. Frequency



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

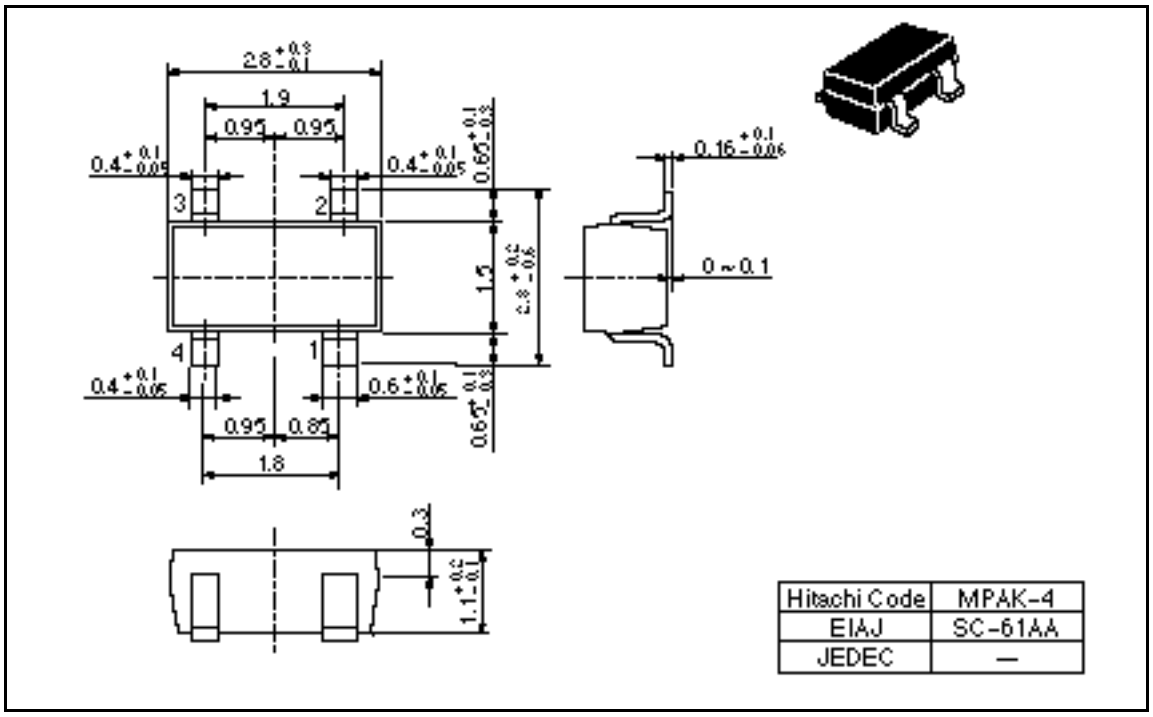
50 to 1000 MHz (50 MHz step)

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

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
50	0.994	–3.1	2.54	175.5	0.00132	50.0	0.978	–2.4
100	0.993	–6.6	2.52	171.0	0.00201	59.8	0.981	–5.1
150	0.988	–10.5	2.51	166.4	0.00228	66.1	0.979	–7.5
200	0.983	–14.1	2.49	161.6	0.00323	66.7	0.979	–10.1
250	0.977	–17.9	2.46	157.2	0.00420	70.2	0.976	–12.7
300	0.970	–21.8	2.43	152.8	0.00514	71.9	0.974	–15.1
350	0.963	–25.4	2.40	148.6	0.00532	76.1	0.971	–17.6
400	0.951	–28.8	2.37	143.7	0.00629	74.2	0.969	–20.1
450	0.943	–32.4	2.34	139.4	0.00665	70.8	0.966	–22.4
500	0.933	–35.4	2.29	135.1	0.00700	71.6	0.962	–24.9
550	0.918	–39.1	2.25	131.1	0.00756	69.3	0.958	–27.3
600	0.906	–42.0	2.21	127.2	0.00790	68.1	0.954	–29.7
650	0.895	–45.5	2.17	123.0	0.00836	67.6	0.951	–32.2
700	0.882	–48.7	2.13	119.4	0.00820	66.1	0.946	–34.4
750	0.879	–51.1	2.09	115.6	0.00818	65.9	0.942	–36.8
800	0.860	–54.6	2.05	111.7	0.00819	66.5	0.938	–39.2
850	0.845	–58.3	2.02	107.8	0.00798	70.7	0.933	–41.5
900	0.835	–60.7	1.96	104.2	0.00787	71.9	0.929	–43.8
950	0.827	–63.3	1.92	100.5	0.00727	73.1	0.924	–46.2
1000	0.812	–66.4	1.88	97.0	0.00758	75.6	0.919	–48.5

Package Dimensions

Unit: mm



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 & IC Div.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL
North America : http:semiconductor.hitachi.com/
Europe : http://www.hitachi-eu.com/hel/ecg
Asia (Singapore) : http://www.has.hitachi.com.sg/grp3/sicd/index.htm
Asia (Taiwan) : http://www.hitachi.com.tw/E/Product/SICD_Frame.htm
Asia (HongKong) : http://www.hitachi.com.hk/eng/bo/grp3/index.htm
Japan : http://www.hitachi.co.jp/Sicd/indx.htm

For further information write to:

Hitachi Semiconductor (America) Inc.
2000 Sierra Point Parkway
Brisbane, CA. 94005-1897
Tel: c1s (800) 285-1601
Fax: c1s (303) 297-0447

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: c49s (89) 9 9180-0
Fax: c49s (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: c44s (1628) 585000
Fax: c44s (1628) 778322

Hitachi Asia Pte Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building, No.167,
Tun-Hwa North Road, Taipei (105)
Tel: c886s (2) 2718-3666
Fax: c886s (2) 2718-8180

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: c852s (2) 735 9218
Fax: c852s (2) 730 0281
Telex: 40815 HITECHX