BB201M

Build in Biasing Circuit MOS FET IC
UHF RF Amplifier

HITACHI

ADE-208-713A (Z)
2nd. Edition
Dec. 1998

Features

- Build in Biasing Circuit; To reduce useing parts cost & PC board space.
- Low noise characteristics;
  (NF = 2.0 dB typ. at f = 900 MHz)
- Withstanding to ESD;
  Build in ESD absorbing diode. Withstand up to 200V at C=200pF, Rs=0 conditins.
- Provide mini mold packages; MPAK-4R(SOT-143 var.)

Outline

MPAK-4R

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

Notes: 1. Marking is “AV–”.
2. BB201M is individual type number of HITACHI BBFET.

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

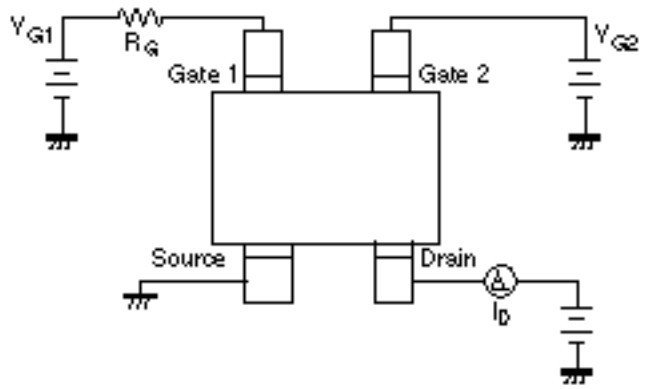
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	6	V
Gate1 to source voltage	V_{G1S}	+6 – 0	V
Gate 2 to source voltage	V_{G2S}	±6	V
Drain current	I_D	25	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics (Ta = 25°C)

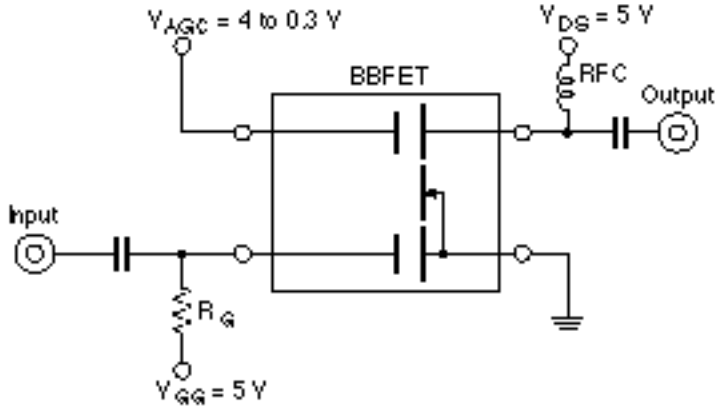
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	I_D = 200µA, V_{G1S} = V_{G2S} = 0
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	I_{G1} = +10µA, V_{G2S} = V_{DS} = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±6	—	—	V	I_{G2} = ±10µA, V_{G1S} = V_{DS} = 0
Gate1 to cutoff current	I_{G1SS}	—	—	+100	nA	V_{G1S} = +5V, V_{G2S} = V_{DS} = 0
Gate2 to cutoff current	I_{G2SS}	—	—	±100	nA	V_{G2S} = ±5V, V_{G1S} = V_{DS} = 0
Gate1 to source cutoff voltage	$V_{G1S(off)}$	0.2	0.45	0.8	V	V_{DS} = 5V, V_{G2S} = 4V I_D = 100µA
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.4	0.7	1.0	V	V_{DS} = 5V, V_{G1S} = 5V I_D = 100µA
Drain current	$I_{D(op)}$	10	15	20	mA	V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V R_G = 220kΩ
Forward transfer admittance	$\|y_{fs}\|$	16	22	—	mS	V_{DS} = 5V, V_{G1} = 5V, V_{G2S} =4V R_G = 220kΩ, f = 1kHz
Input capacitance	c_{iss}	1.2	1.7	2.2	pF	V_{DS} = 5V, V_{G1} = 5V
Output capacitance	c_{oss}	0.7	1.1	1.5	pF	V_{G2S} =4V, R_G = 220kΩ
Reverse capacitance	c_{rss}	—	0.012	0.03	pF	f = 1MHz
Power gain	PG	16	20	—	dB	V_{DS} = 5V, V_{G1} = 5V, V_{G2S} =4V
Noise figure	NF	—	2.0	3.0	dB	R_G = 220kΩ, f = 900MHz

Main Characteristics

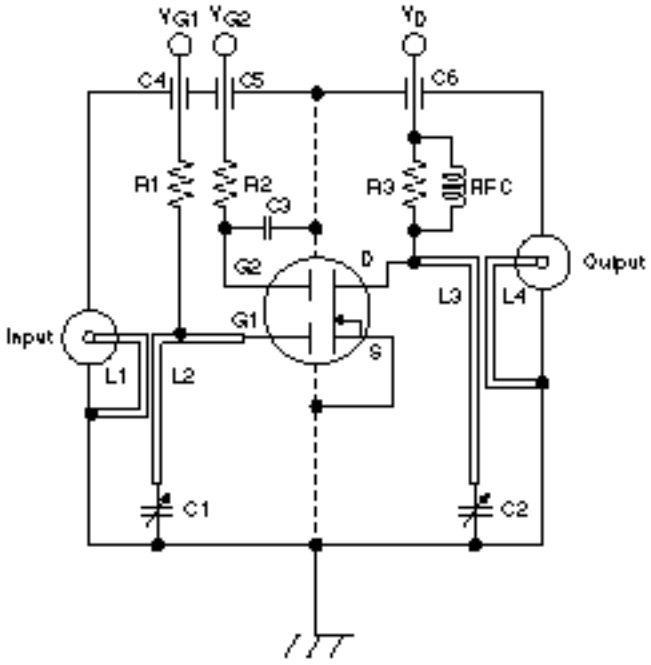
Test Circuit for Operating Items ($I_{D(op)}$, |yfs|, Ciss, Coss, Crss, NF, PG)



Application Circuit

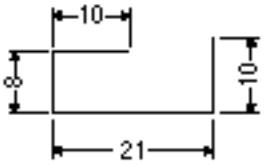


900MHz Power Gain, Noise Test Circuit

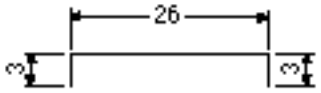


C1, C2 : Variable Capacitor (10pF MAX)
C3 : Disk Capacitor (1000pF)
C4 to C6 : Air Capacitor (1000pF)
R1 : 220 kΩ
R2 : 47 kΩ
R3 : 4.7 kΩ

L1 :

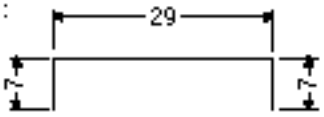


L2 :

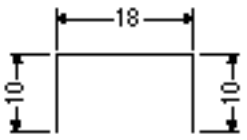


(ϕ 1mm Copper wire)
Unit : mm

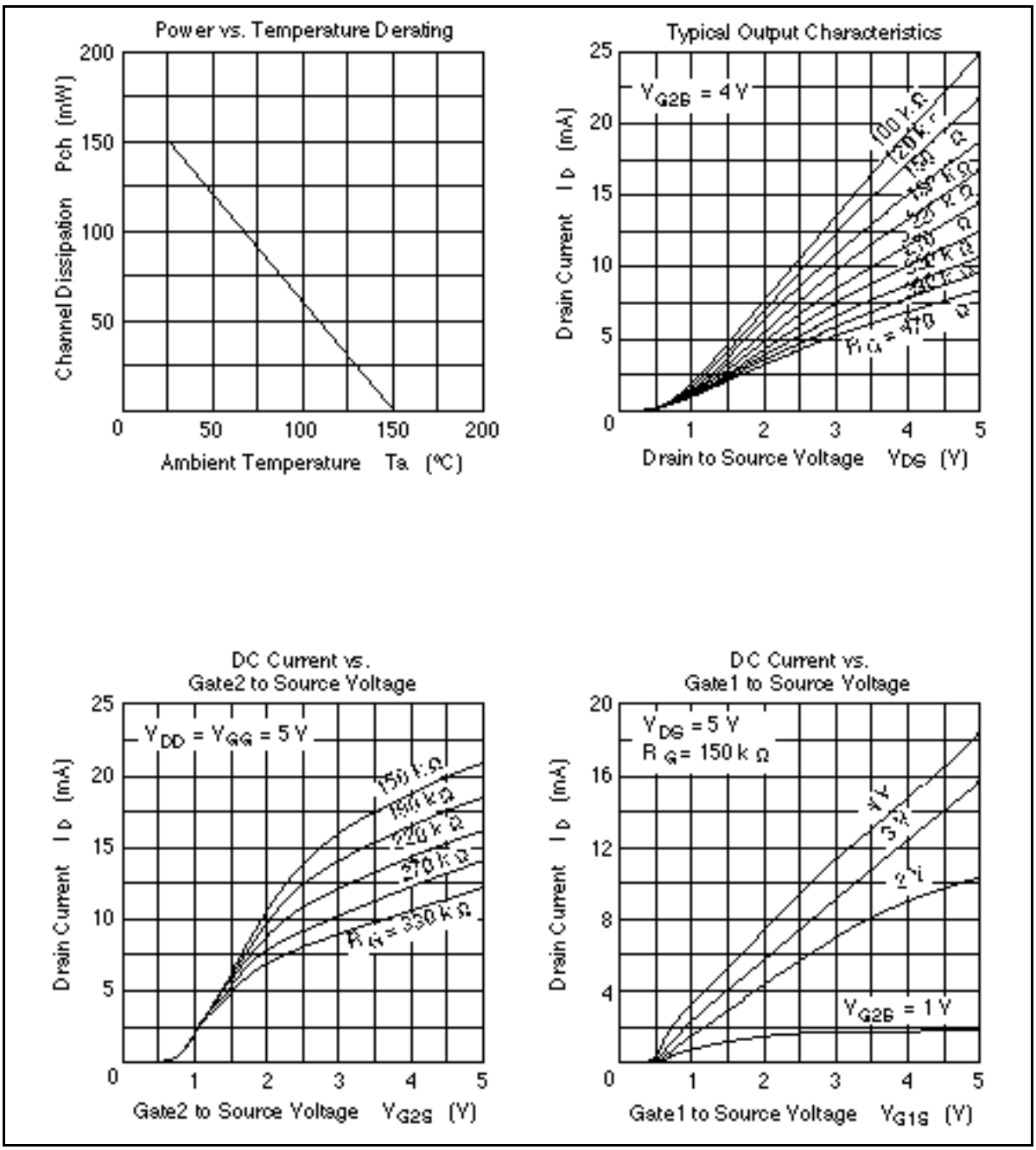
L3 :

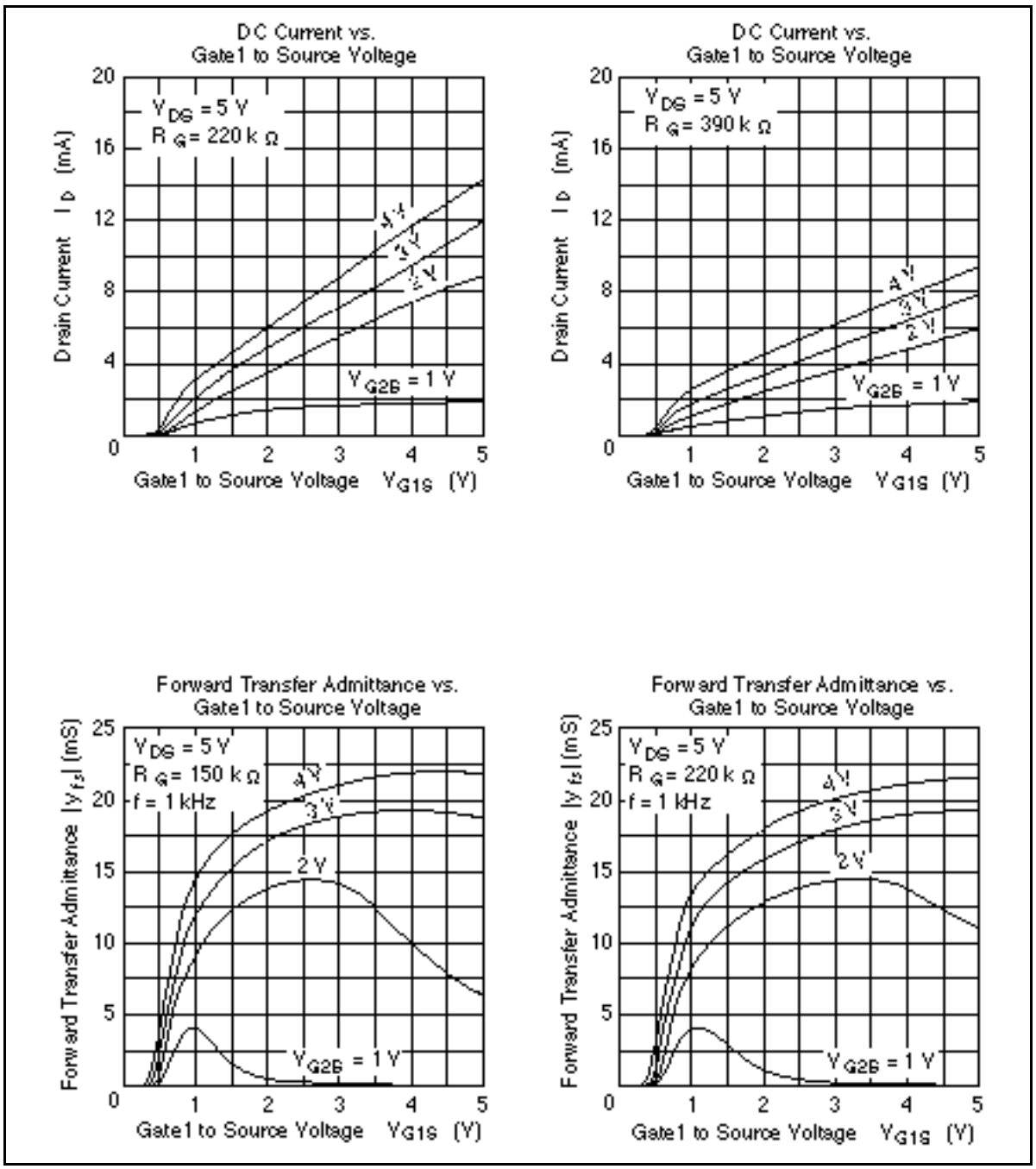


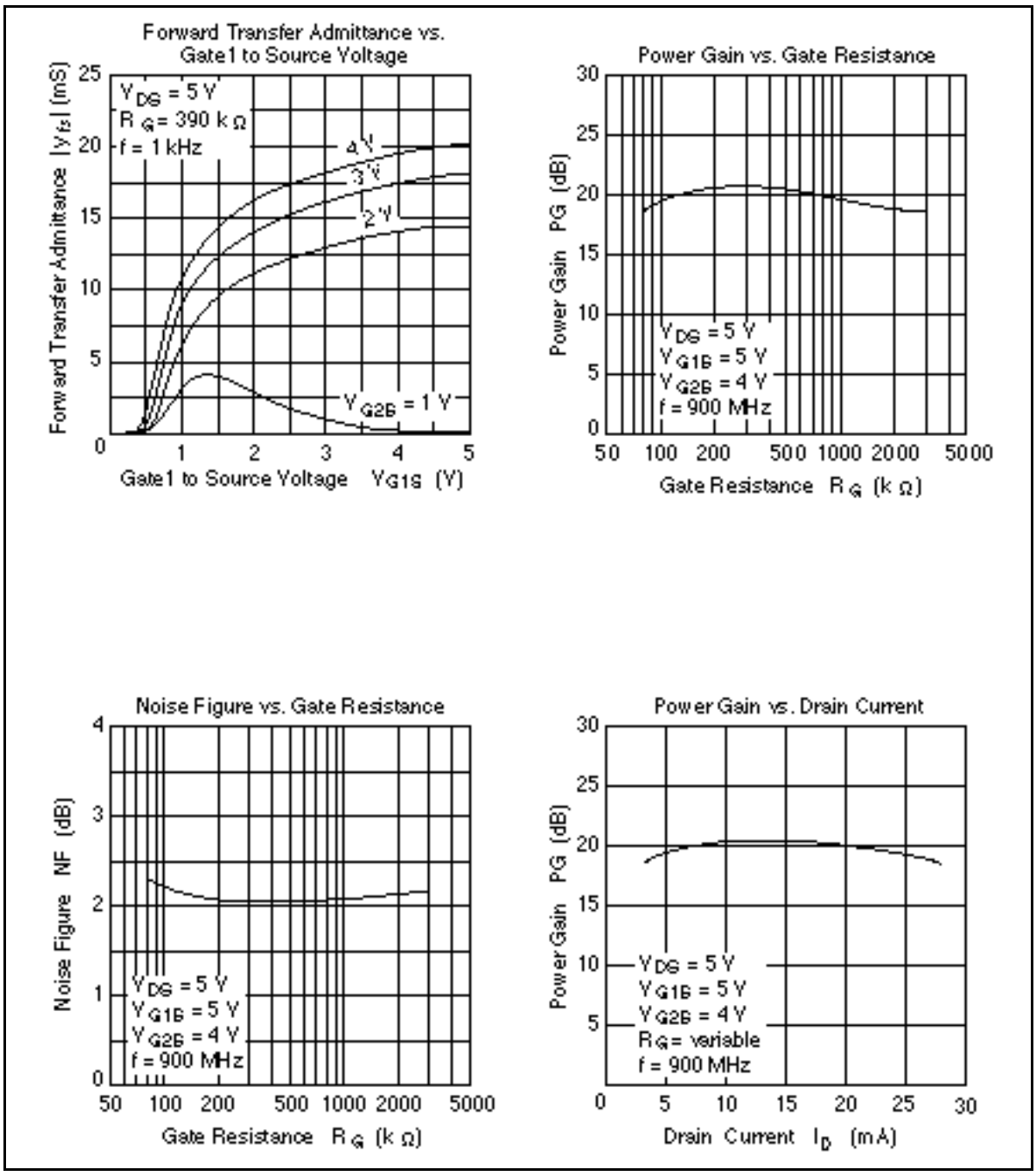
L4 :

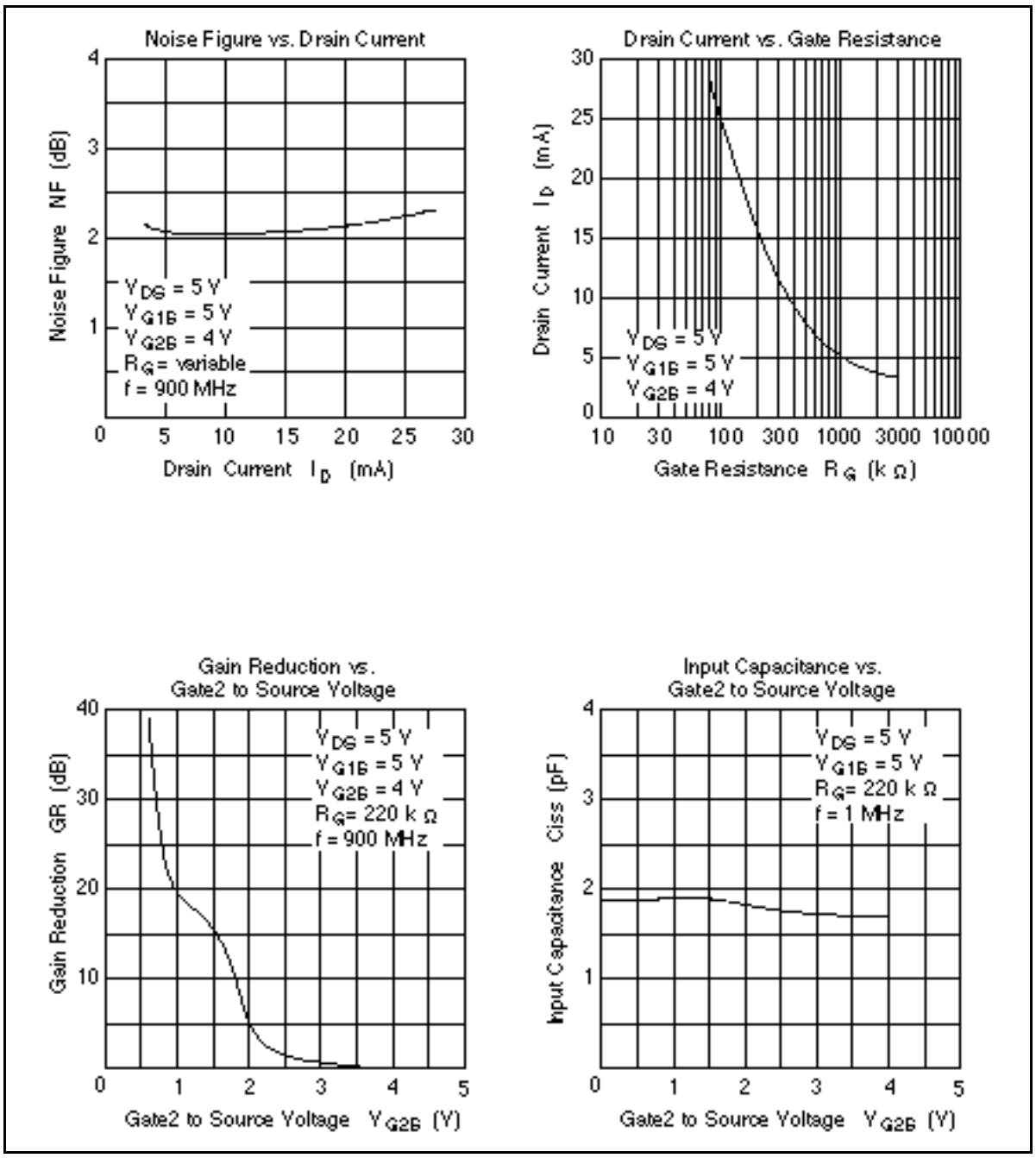


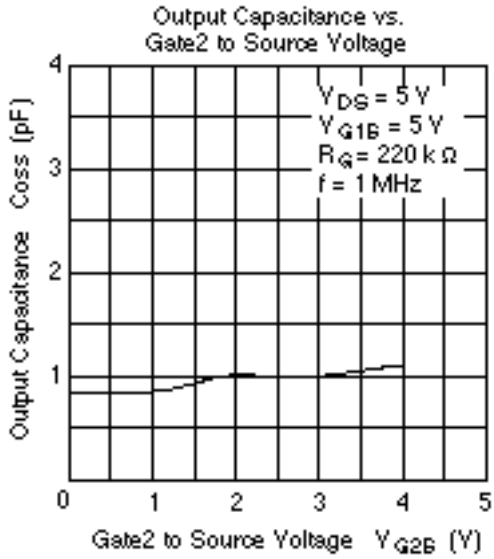
RFC : ϕ1mm Copper wire with enamel 4turns inside dia 6mm


Power vs. Temperature Derating
Channel Dissipation Pch (mW)
200
150
100
50
0
50
100
150
200
Ambient Temperature Ta (°C)
Typical Output Characteristics
Drain Current I D (mA)
V_{G2S} = 4 V
25
20
15
10
5
0
1
2
3
4
5
Drain to Source Voltage V_{DS} (V)
DC Current vs.
Gate2 to Source Voltage
Drain Current I D (mA)
V_{DD} = V_{GG} = 5 V
150 kΩ
180 kΩ
220 kΩ
270 kΩ
R_G = 330 kΩ
25
20
15
10
5
0
1
2
3
4
5
Gate2 to Source Voltage V_{G2S} (V)
DC Current vs.
Gate1 to Source Voltage
Drain Current I D (mA)
V_{DS} = 5 V
R_G = 150 kΩ
V_{G2S} = 1 V
20
16
12
8
4
0
1
2
3
4
5
Gate1 to Source Voltage V_{G1S} (V)


DC Current vs.
Gate1 to Source Voltege
V_{DS} = 5 V
R_G = 220 k Ω
Drain Current I_D (mA)
4 V
3 V
2 V
V_{G2S} = 1 V
Gate1 to Source Voltage V_{G1S} (V)
DC Current vs.
Gate1 to Source Voltege
V_{DS} = 5 V
R_G = 390 k Ω
Drain Current I_D (mA)
4 V
3 V
2 V
V_{G2S} = 1 V
Gate1 to Source Voltage V_{G1S} (V)
Forward Transfer Admittance vs.
Gate1 to Source Voltage
V_{DS} = 5 V
R_G = 150 k Ω
f = 1 kHz
Forward Transfer Admittance $|y_{fs}|$ (mS)
4 V
3 V
2 V
V_{G2S} = 1 V
Gate1 to Source Voltage V_{G1S} (V)
Forward Transfer Admittance vs.
Gate1 to Source Voltage
V_{DS} = 5 V
R_G = 220 k Ω
f = 1 kHz
Forward Transfer Admittance $|y_{fs}|$ (mS)
4 V
3 V
2 V
V_{G2S} = 1 V
Gate1 to Source Voltage V_{G1S} (V)

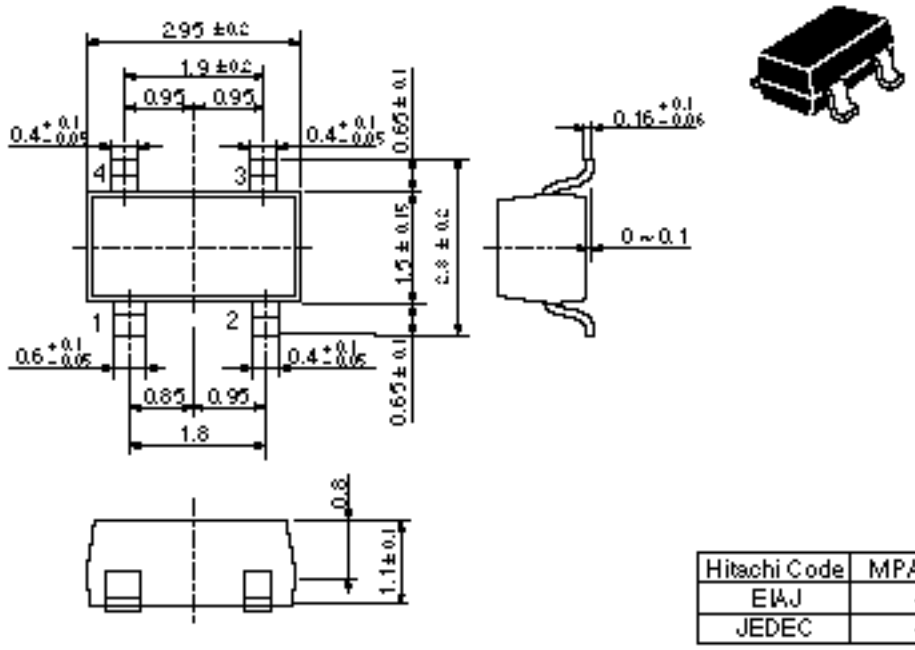

Forward Transfer Admittance vs. Gate1 to Source Voltage
Forward Transfer Admittance |yfs| (mS)
VDS = 5 V
RG = 390 kΩ
f = 1 kHz
4 V
3 V
2 V
VG2S = 1 V
Gate1 to Source Voltage VG1S (V)
Power Gain vs. Gate Resistance
Power Gain PG (dB)
VDS = 5 V
VG1S = 5 V
VG2S = 4 V
f = 900 MHz
Gate Resistance RG (kΩ)
Noise Figure vs. Gate Resistance
Noise Figure NF (dB)
VDS = 5 V
VG1S = 5 V
VG2S = 4 V
f = 900 MHz
Gate Resistance RG (kΩ)
Power Gain vs. Drain Current
Power Gain PG (dB)
VDS = 5 V
VG1S = 5 V
VG2S = 4 V
RG = variable
f = 900 MHz
Drain Current ID (mA)


Noise Figure vs. Drain Current
Noise Figure NF (dB)
Drain Current I_D (mA)
V_{DS} = 5 V
V_{G1S} = 5 V
V_{G2S} = 4 V
R_G = variable
f = 900 MHz
Drain Current vs. Gate Resistance
Drain Current I_D (mA)
Gate Resistance R_G (k Ω)
V_{DS} = 5 V
V_{G1S} = 5 V
V_{G2S} = 4 V
Gain Reduction vs.
Gate2 to Source Voltage
Gain Reduction GR (dB)
Gate2 to Source Voltage V_{G2S} (V)
V_{DS} = 5 V
V_{G1S} = 5 V
V_{G2S} = 4 V
R_G = 220 k Ω
f = 900 MHz
Input Capacitance vs.
Gate2 to Source Voltage
Input Capacitance Ciss (pF)
Gate2 to Source Voltage V_{G2S} (V)
V_{DS} = 5 V
V_{G1S} = 5 V
R_G = 220 k Ω
f = 1 MHz


Output Capacitance vs.
Gate2 to Source Voltage
V_{DS} = 5 V
V_{G1S} = 5 V
R_G = 220 kΩ
f = 1 MHz
Output Capacitance Coss (pF)
Gate2 to Source Voltage V_{G2S} (V)
0
1
2
3
4
5

Package Dimensions

Unit: mm



Hitachi Code	MPAK-4R
EIAJ	—
JEDEC	—

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/sicdindex.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/index.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