To all our customers

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

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# BIC703C

## Bias Controlled Monolithic IC
## VHF/UHF RF Amplifier

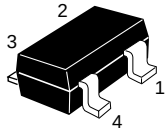
ADE-208-985D (Z)
5th. Edition
Mar. 2001

## 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; CMPAK-4 (SOT-343mod)

## Outline

CMPAK-4




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

Notes: 1. Marking is “CZ–”.
2. BIC703C is individual type number of HITACHI BICMIC.

## Absolute Maximum Ratings (Ta = 25°C)

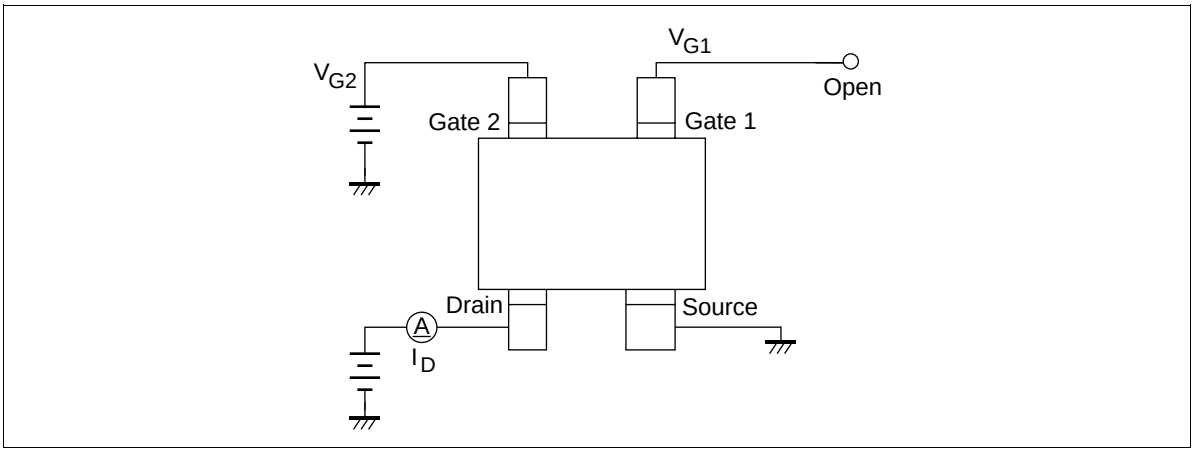
| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Drain to source voltage | $V_{DS}$ | 6 | V |
| Gate1 to source voltage | $V_{G1S}$ | +6<br>–0 | V |
| Gate2 to source voltage | $V_{G2S}$ | +6<br>–0 | V |
| Drain current | $I_D$ | 30 | mA |
| Channel power dissipation | Pch | 100 | mW |
| Channel temperature | Tch | 150 | °C |
| Storage temperature | Tstg | –55 to +150 | °C |

## Electrical Characteristics (Ta = 25°C)

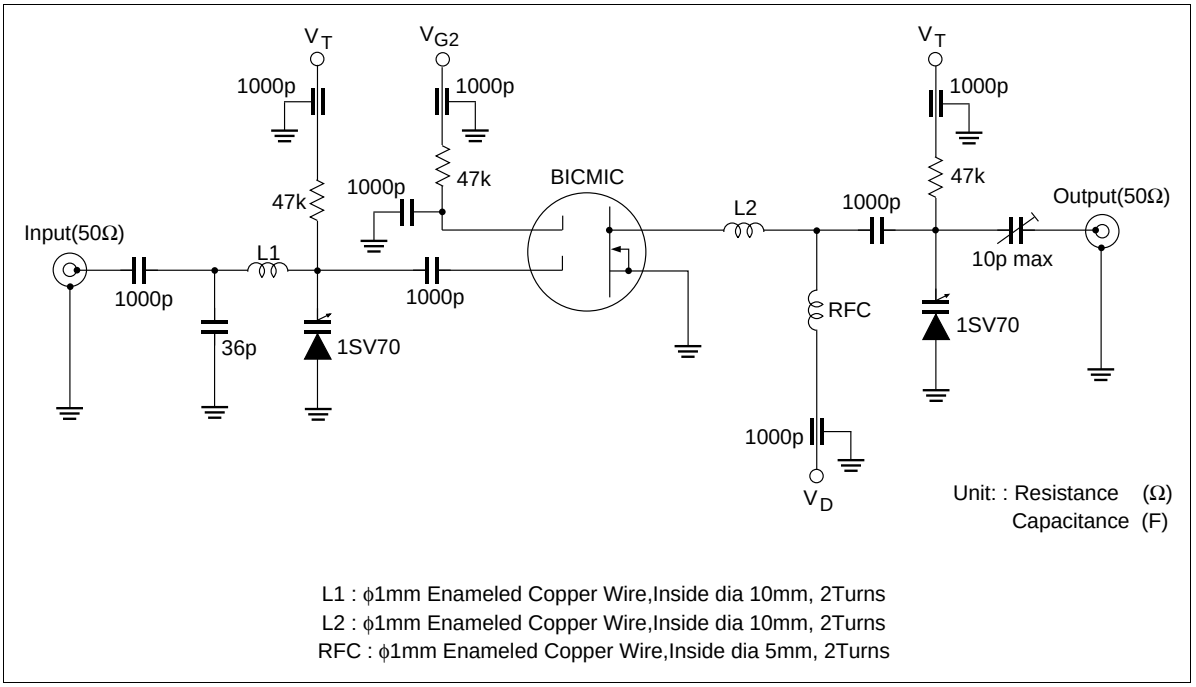
| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | 6 | — | — | V | $I_D$ = 200µA<br>$V_{G2S}$ = 0,$V_{G1}$ = open |
| Gate1 to source breakdown voltage | $V_{(BR)G1SS}$ | +6 | — | — | V | $I_{G1}$ = +1mA, $V_{G2S}$ = $V_{DS}$ = 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<br>$V_{G1}$ = open |
| Drain current | $I_{D(op)}$ | 12 | 15 | 18 | mA | $V_{DS}$ = 5V , $V_{G2S}$ = 4V<br>$V_{G1}$ = open |
| Forward transfer admittance | $\|y_{fs}\|$ | 24 | 29 | 34 | mS | $V_{DS}$ = 5V, $I_D$ = 15mA<br>$V_{G2S}$ =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<br>$V_{G1}$ = open |
| Noise figure | NF1 | — | 1.0 | 1.8 | dB | f = 200MHz |
| Power gain | PG2 | 17 | 22 | — | dB | $V_{DS}$ = 5V, $V_{G2S}$ =4V<br>$V_{G1}$ = 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)

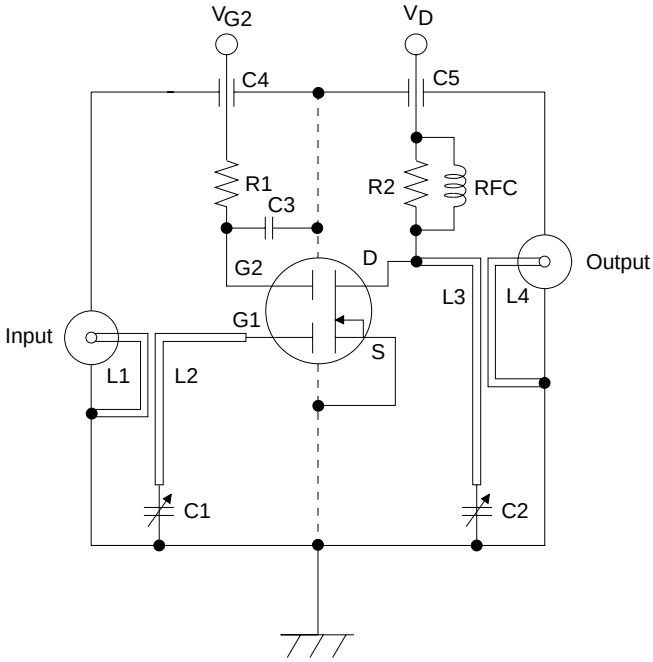



- **200 MHz Power Gain, Noise Figure Test Circuit**



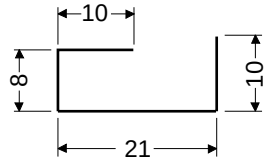

L1 : ϕ1mm Enameled Copper Wire,Inside dia 10mm, 2Turns
L2 : ϕ1mm Enameled Copper Wire,Inside dia 10mm, 2Turns
RFC : ϕ1mm Enameled Copper Wire,Inside dia 5mm, 2Turns

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

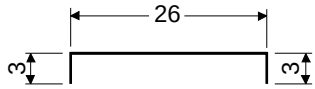



C1, C2 : Variable Capacitor (10pF MAX)
C3 : Disk Capacitor (1000pF)
C4, C5 : Air Capacitor (1000pF)
R1 : 47 kΩ
R2 : 4.7 kΩ

L1:

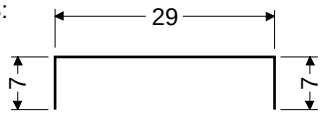



L2:

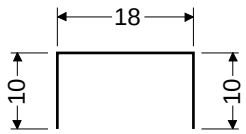



(ϕ1mm Copper wire)
Unit : mm

L3:

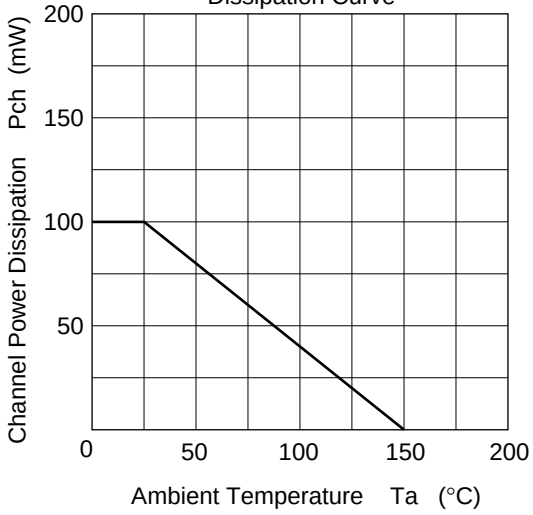



L4:

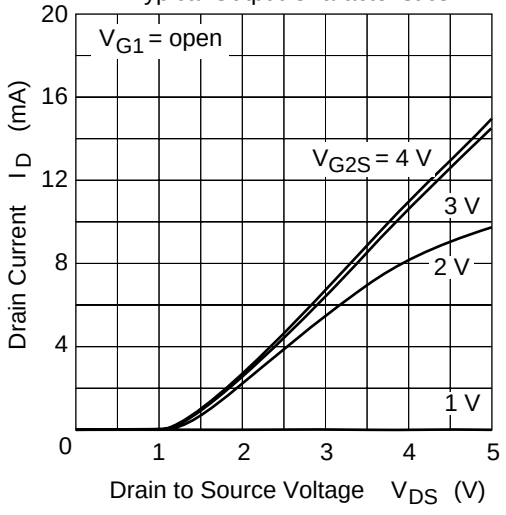



RFC : ϕ1mm Copper wire with enamel 4turns inside dia 6mm

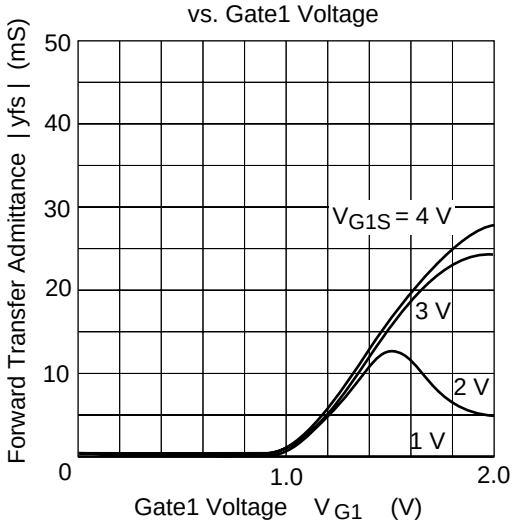
Maximum Channel Power Dissipation Curve



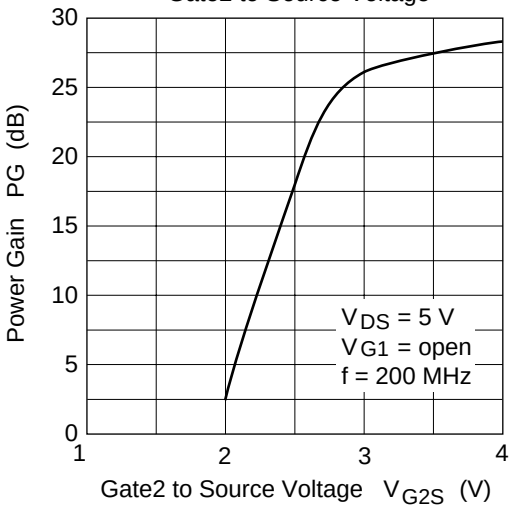

Typical Output Characteristics



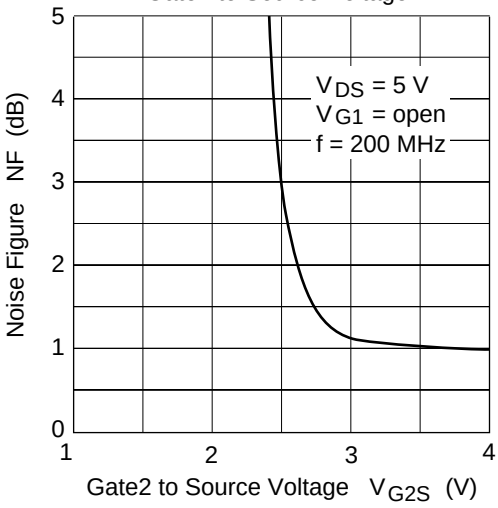

Forward Transfer Admittance vs. Gate1 Voltage



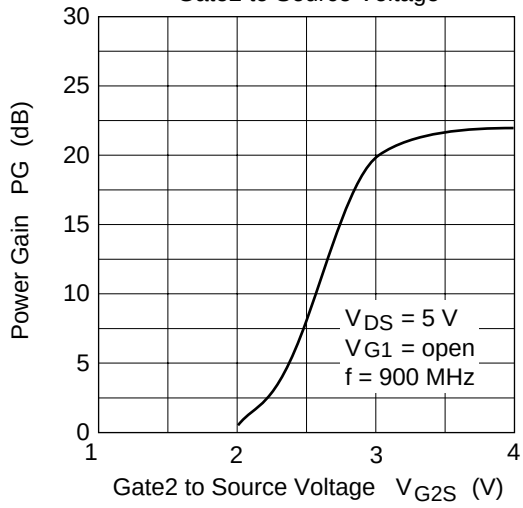

Power Gain vs. Gate2 to Source Voltage



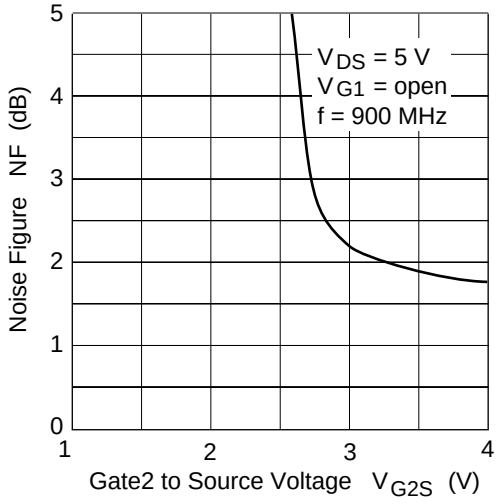
Noise Figure vs.
Gate2 to Source Voltage



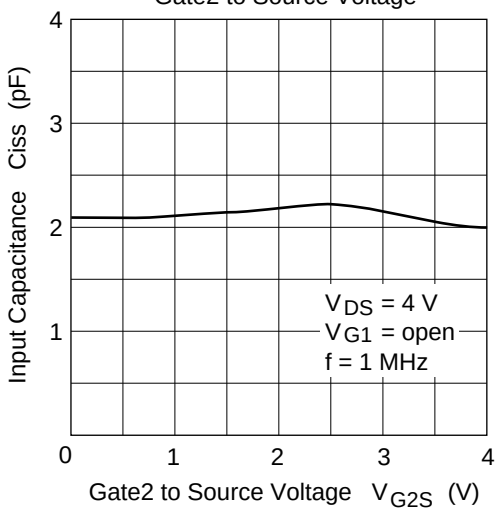

Power Gain vs.
Gate2 to Source Voltage

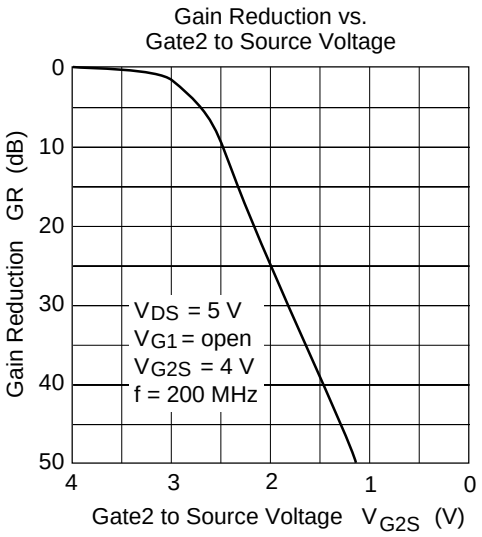


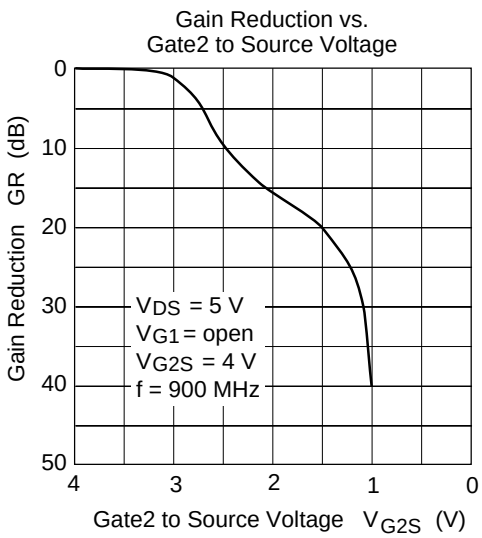

Noise Figure vs.
Gate2 to Source Voltage



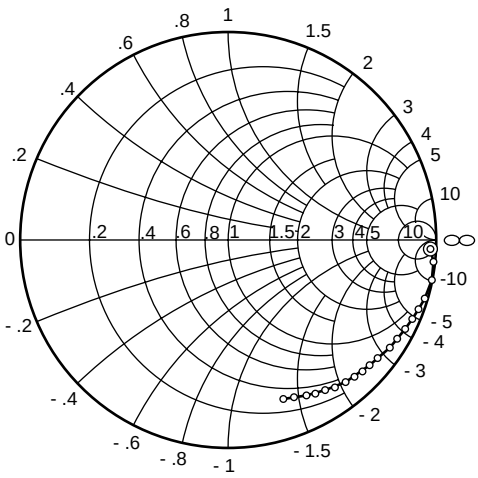

Input Capacitance vs.
Gate2 to Source Voltage




Gain Reduction vs.
Gate2 to Source Voltage
Gain Reduction GR (dB)
0
10
20
30
40
50
4
3
2
1
0
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

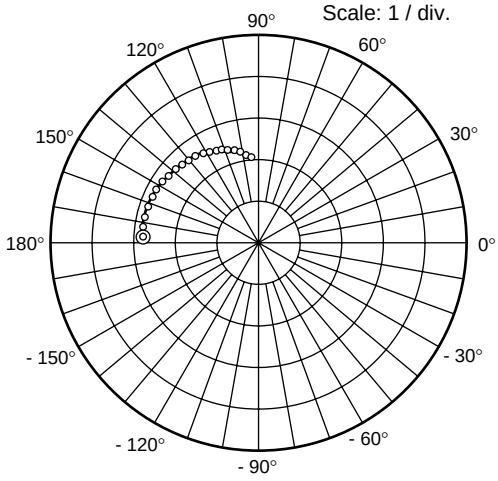



Test Condition: $V_{DS}$ = 5 V , $V_{G1}$ = open
$V_{G2S}$ = 4 V ,
Zo = 50 Ω

50 to 1000 MHz (50 MHz step)

S21 Parameter vs. Frequency

Scale: 1 / div.

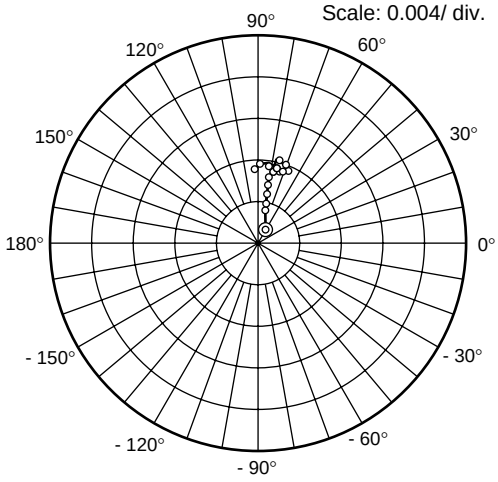



Test Condition: $V_{DS}$ = 5 V , $V_{G1}$ = open
$V_{G2S}$ = 4 V ,
Zo = 50 Ω

50 to 1000 MHz (50 MHz step)

S12 Parameter vs. Frequency

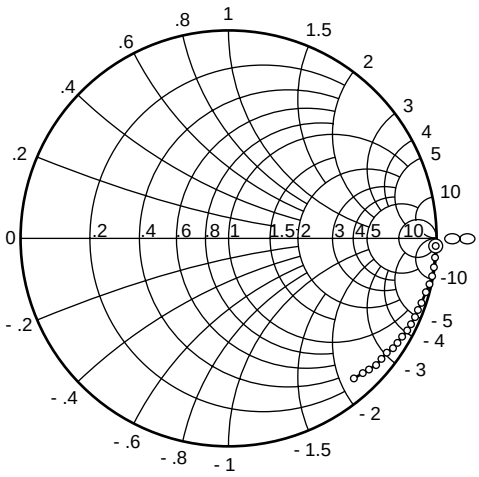
Scale: 0.004/ div.




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)

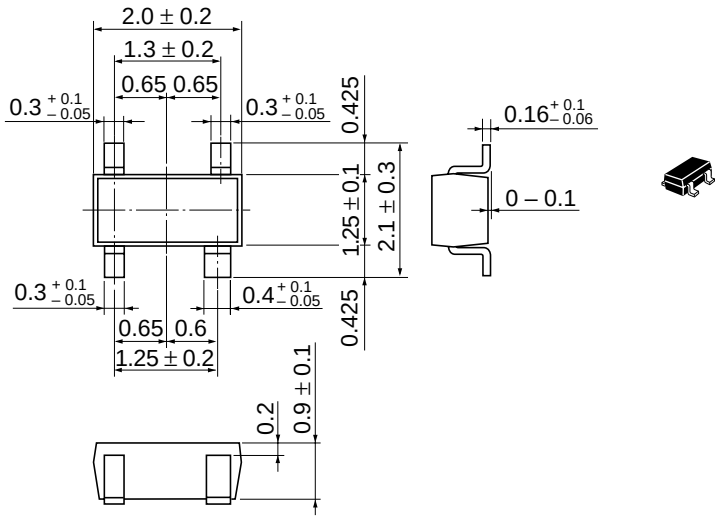
**Sparameter** ($V_{DS}$ = 5 V, $V_{G2S}$ = 4 V, $V_{G1}$ = open, Zo = 50 Ω)

| | 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 | CMPAK-4(T) |
| JEDEC | — |
| EIAJ | Conforms |
| Mass (reference value) | 0.006 g |

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**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/
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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 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
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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
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Colophon 2.0