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Customer Support Dept.  
April 1, 2003

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# BIC702M

## Bias Controlled Monolithic IC VHF/UHF RF Amplifier

# RENESAS

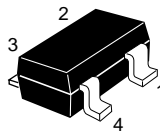
ADE-208-813D (Z)  
5th. Edition  
Mar. 2001

### Features

- Bias Controlled Monolithic IC (No external DC biasing voltage on gate1.);  
To reduce using parts cost & PC board space.
- High  $|y_{fs}|$  ;  
 $|y_{fs}| = 29 \text{ mS typ. (} f = 1\text{kHz)}$
- Low noise;  
 $NF = 1.0 \text{ dB typ. (at } f = 200 \text{ MHz), } NF = 1.6 \text{ dB typ. (at } f = 900 \text{ MHz)}$
- Withstanding to ESD;  
Build in ESD absorbing diode. Withstand up to 200V at  $C = 200\text{pF}$ ,  $R_s = 0$  conditions.
- Provide mini mold package; MPAK-4 (SOT-143Rmod)

### Outline

MPAK-4



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

- Notes:
1. Marking is "BZ-".
  2. BIC702M is individual type number of HITACHI BICMIC.

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

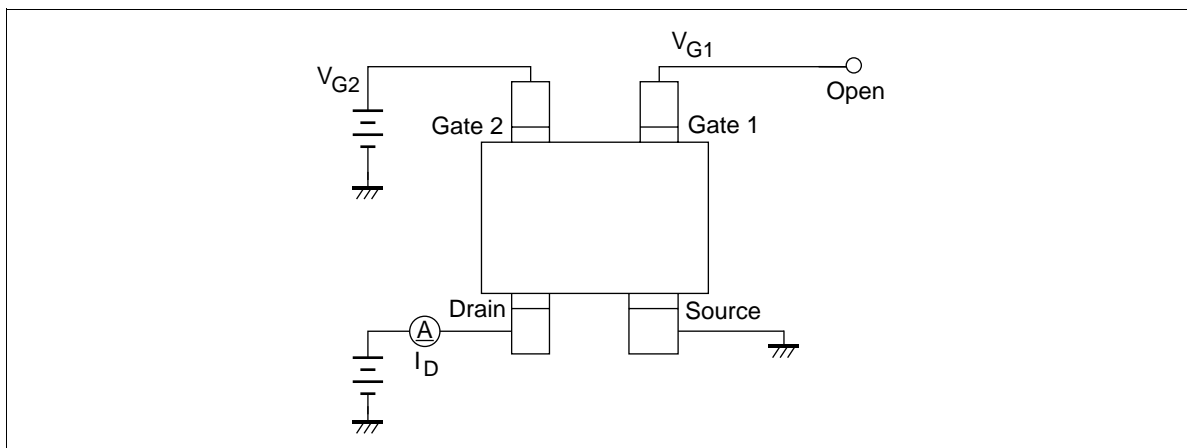
Item	Symbol	Ratings	Unit
Drain to source voltage	$V_{DS}$	6	V
Gate1 to source voltage	$V_{G1S}$	+6 -0	V
Gate2 to source voltage	$V_{G2S}$	+6 -0	V
Drain current	$I_D$	30	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	-55 to +150	°C

## Electrical Characteristics (Ta = 25°C)

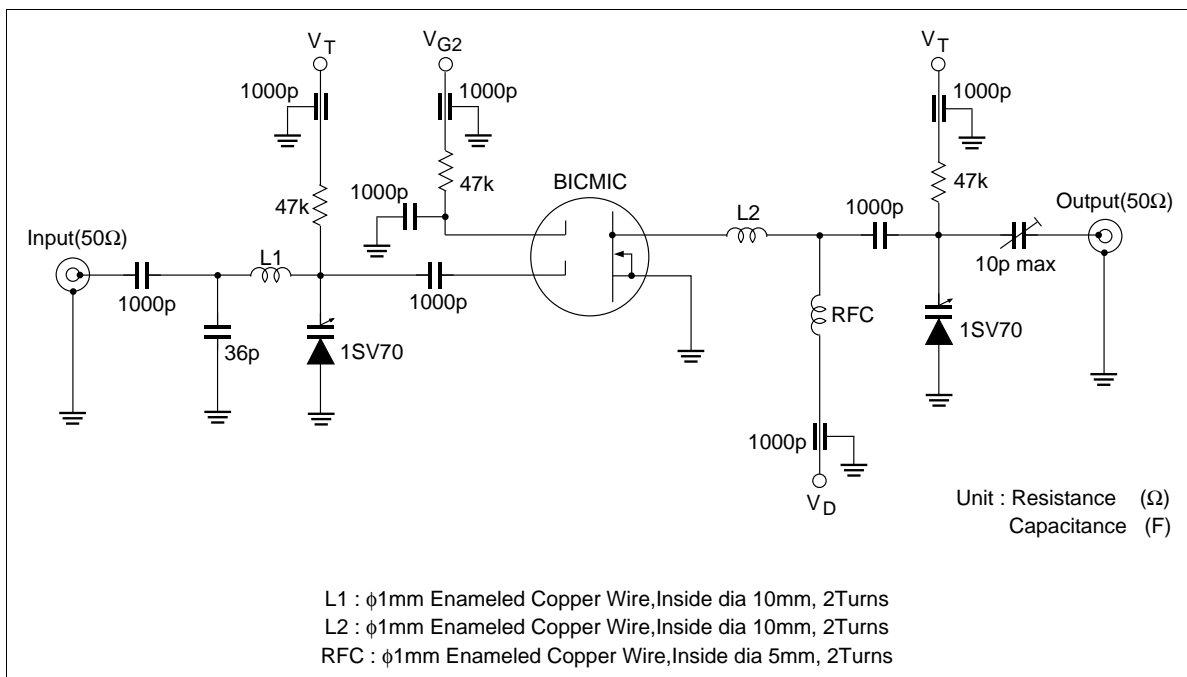
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	$I_D = 200\mu A$ $V_{G2S} = 0, V_{G1} = \text{open}$
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	$I_{G1} = +10\mu A, V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	+6	—	—	V	$I_{G2} = +10\mu A, V_{G1S} = V_{DS} = 0$
Gate2 to source cutoff current	$I_{G2SS}$	—	—	+100	nA	$V_{G2S} = +5V, V_{G1S} = V_{DS} = 0$
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.5	0.7	1.0	V	$V_{DS} = 5V, I_D = 100\mu A$ $V_{G1} = \text{open}$
Drain current	$I_{D(op)}$	10	13	16	mA	$V_{DS} = 5V, V_{G2S} = 4V$ $V_{G1} = \text{open}$
Forward transfer admittance	$ y_{fs} $	24	29	34	mS	$V_{DS} = 5V, I_D = 13mA$ $V_{G2S} = 4V, f = 1kHz$
Input capacitance	$C_{iss}$	1.6	2.0	2.3	pF	$V_{DS} = 5V, V_{G2S} = 4V$
Output capacitance	$C_{oss}$	0.7	1.1	1.5	pF	$V_{G1} = \text{open}$
Reverse transfer capacitance	$C_{rss}$	—	0.02	0.05	pF	$f = 1MHz$
Power gain	PG1	24	28.5	—	dB	$V_{DS} = 5V, V_{G2S} = 4V$ $V_{G1} = \text{open}$
Noise figure	NF1	—	1.0	1.5	dB	$f = 200MHz$
Power gain	PG2	18	23	—	dB	$V_{DS} = 5V, V_{G2S} = 4V$ $V_{G1} = \text{open}$
Noise figure	NF2	—	1.6	2.2	dB	$f = 900MHz$

Test Circuits

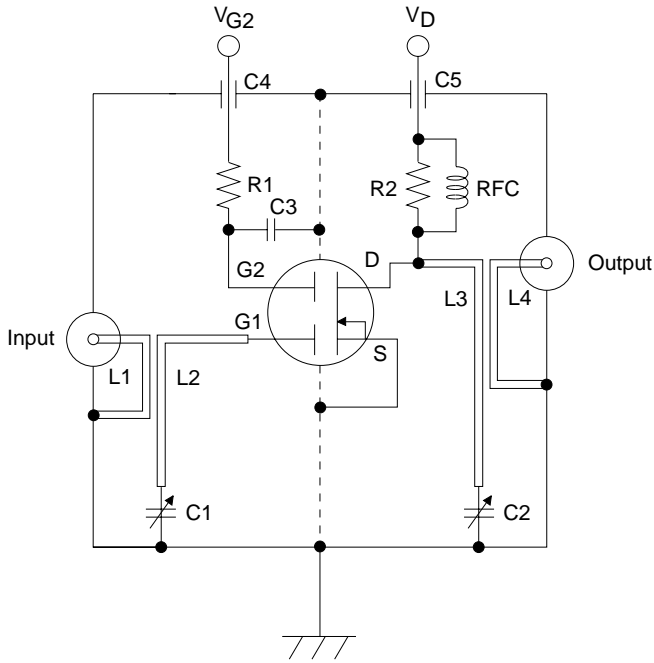
- DC Biasing Circuit for Operating Characteristic Items ( $I_{D(op)}$ ,  $|y_{fs}|$ ,  $C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$ , NF, PG)



- 200 MHz Power Gain, Noise Figure Test Circuit

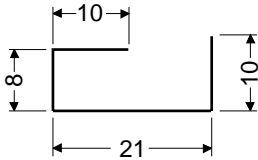


## • 900 MHz Power Gain, Noise Figure Test Circuit

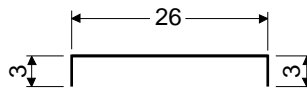


- C1, C2 : Variable Capacitor (10pF MAX)
- C3 : Disk Capacitor (1000pF)
- C4, C5 : Air Capacitor (1000pF)
- R1 : 47 k $\Omega$
- R2 : 4.7 k $\Omega$

L1:

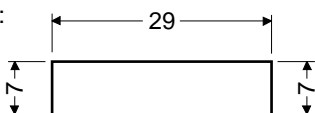


L2:

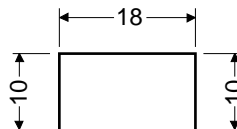


( $\phi$ 1mm Copper wire)  
Unit : mm

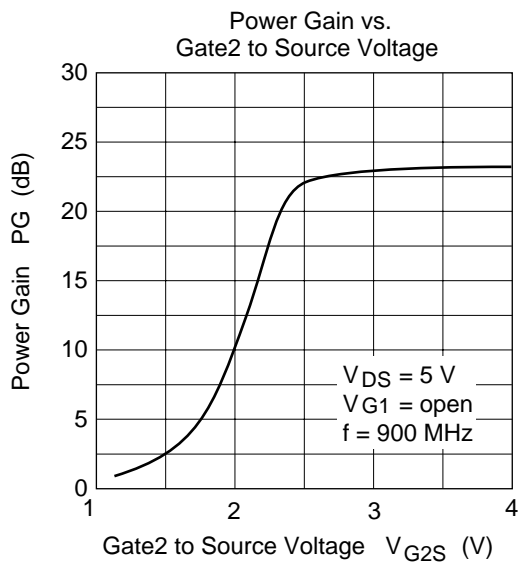
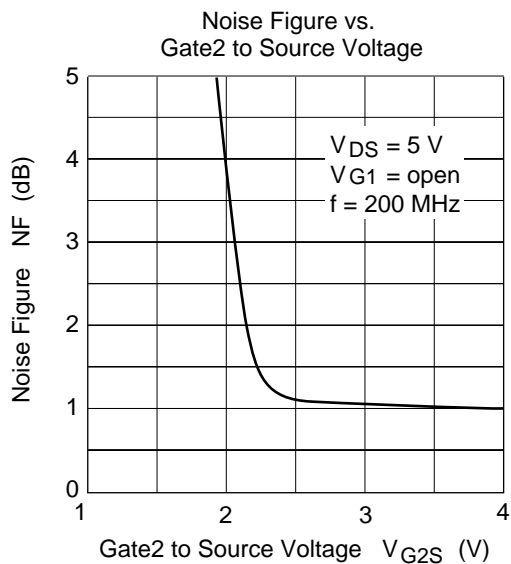
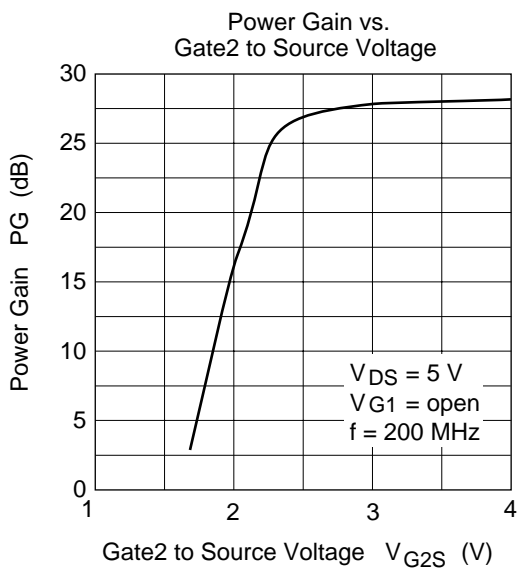
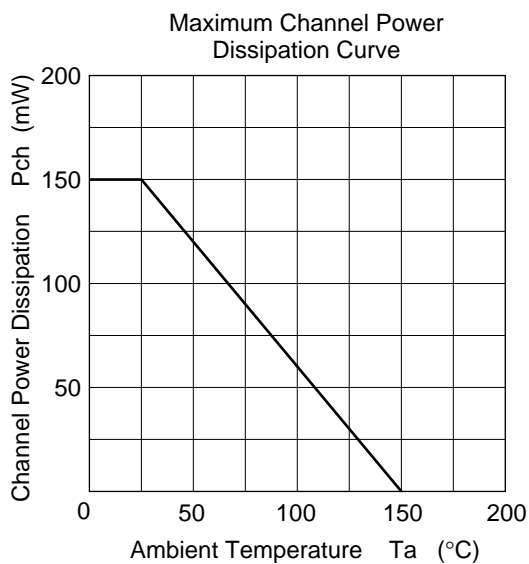
L3:

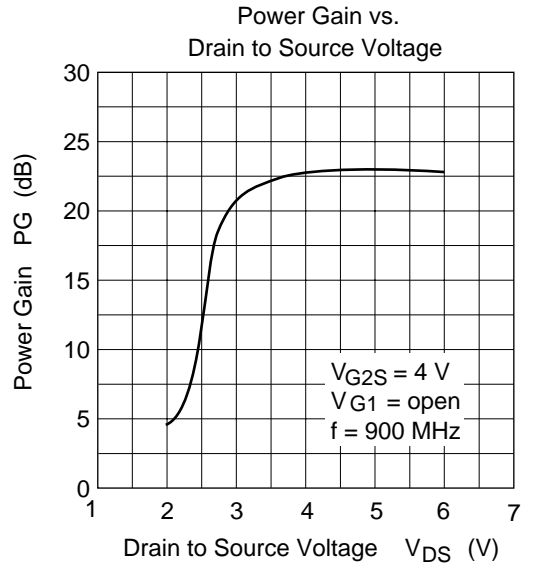
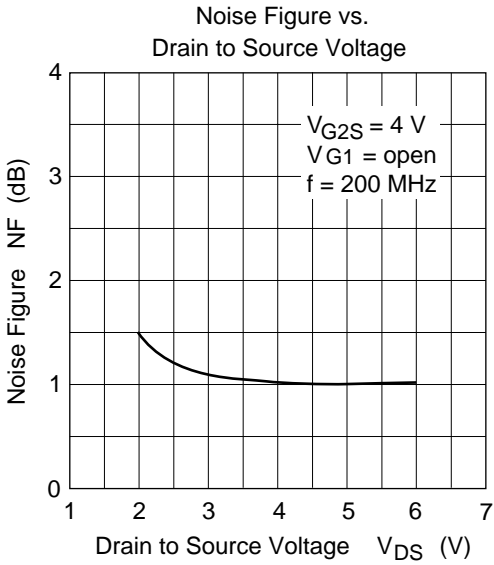
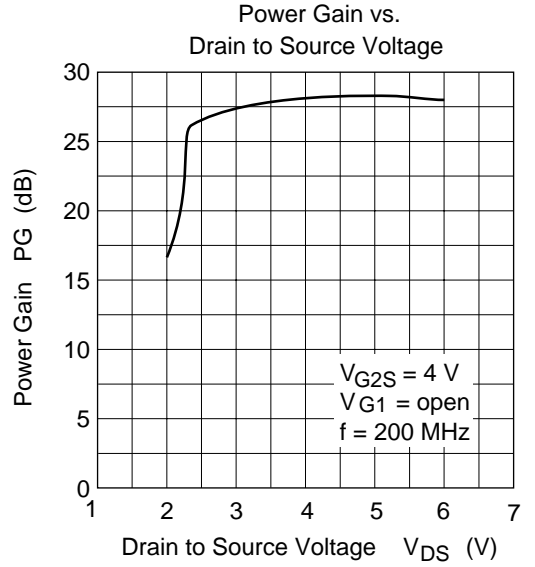
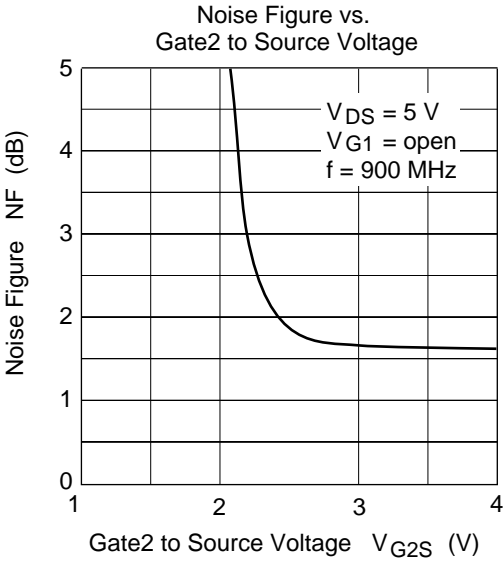


L4:



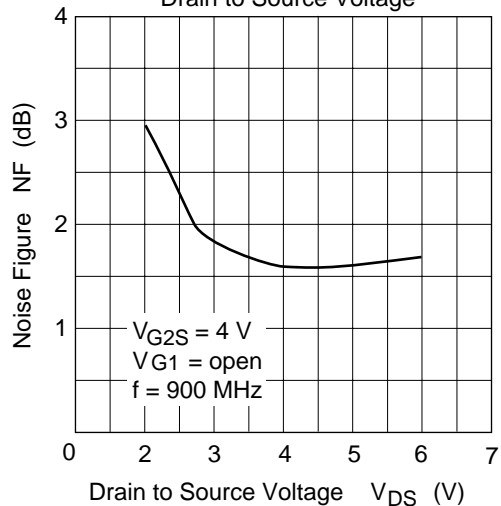
RFC :  $\phi$ 1mm Copper wire with enamel 4turns inside dia 6mm



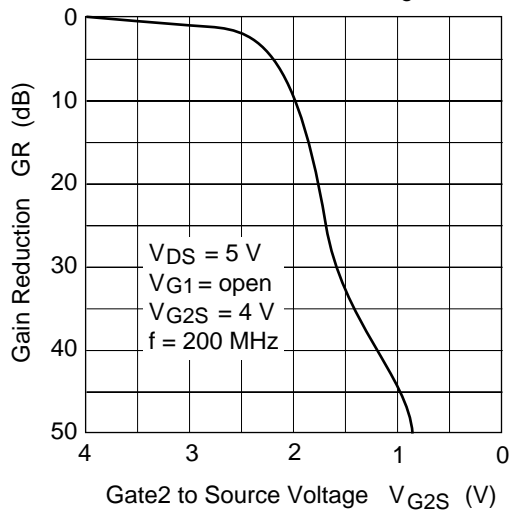




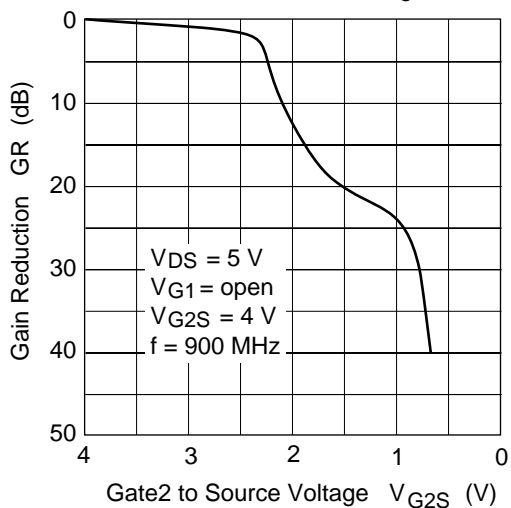
Noise Figure vs.  
Drain to Source Voltage



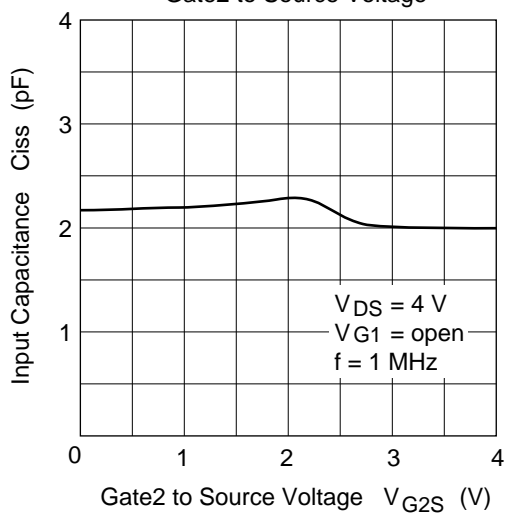
Gain Reduction vs.  
Gate2 to Source Voltage



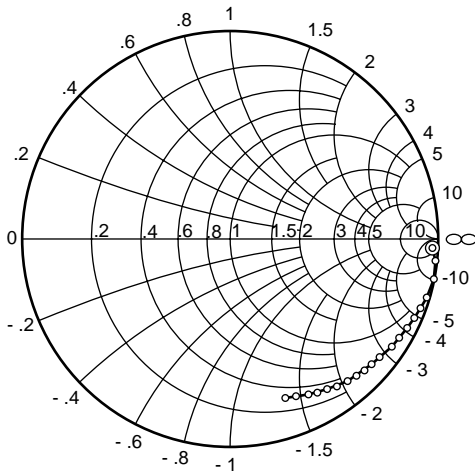
Gain Reduction vs.  
Gate2 to Source Voltage



Input Capacitance vs.  
Gate2 to Source Voltage

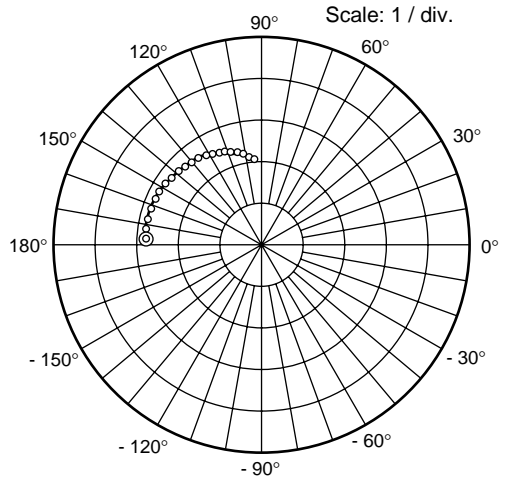


**S11 Parameter vs. Frequency**



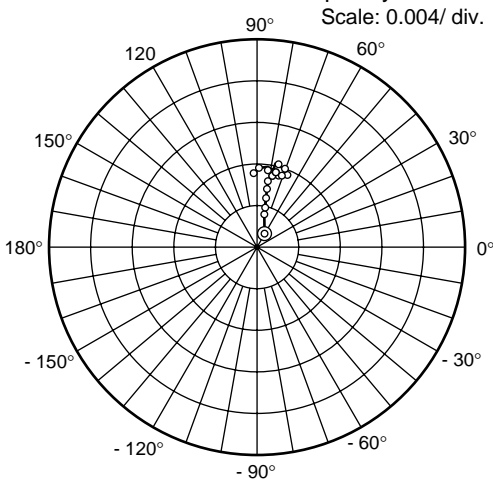
Test Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = \text{open}$   
 $V_{G2S} = 4\text{ V}$ ,  
 $Z_0 = 50\ \Omega$   
 50 to 1000 MHz (50 MHz step)

**S21 Parameter vs. Frequency**



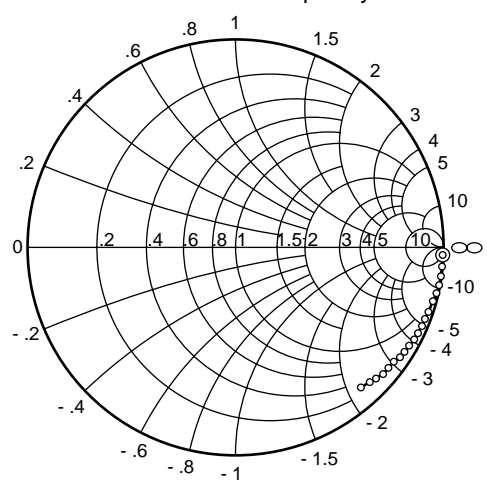
Test Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = \text{open}$   
 $V_{G2S} = 4\text{ V}$ ,  
 $Z_0 = 50\ \Omega$   
 50 to 1000 MHz (50 MHz step)

**S12 Parameter vs. Frequency**



Test Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = \text{open}$   
 $V_{G2S} = 4\text{ V}$ ,  
 $Z_0 = 50\ \Omega$   
 50 to 1000 MHz (50 MHz step)

**S22 Parameter vs. Frequency**



Test Condition:  $V_{DS} = 5\text{ V}$ ,  $V_{G1} = \text{open}$   
 $V_{G2S} = 4\text{ V}$ ,  
 $Z_0 = 50\ \Omega$   
 50 to 1000 MHz (50 MHz step)

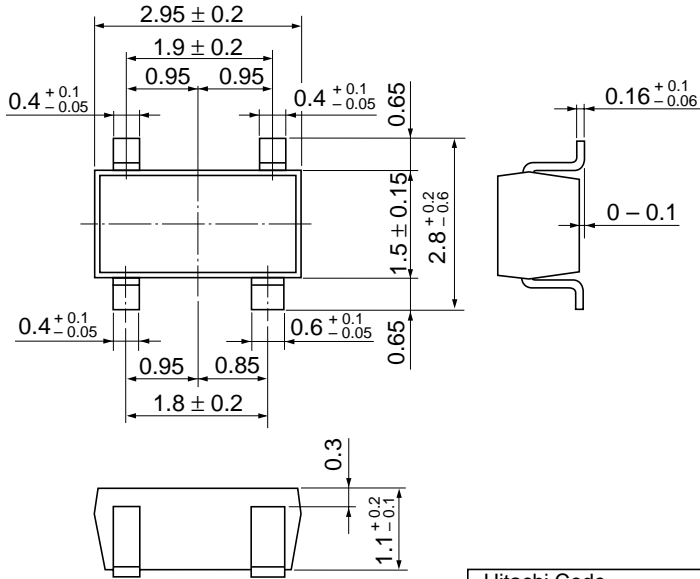
Sparameter ( $V_{DS} = 5\text{ V}$ ,  $V_{G2S} = 4\text{ V}$ ,  $V_{G1} = \text{open}$ ,  $Z_o = 50\ \Omega$ )

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
50	0.998	-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

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