BIC701M

Bias Controlled Monolithic IC
VHF/UHF RF Amplifier

HITACHI

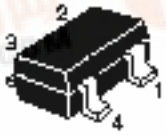
ADE-208-703C (Z)
4th. Edition
Nov. 1998

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.

BIC701M

Absolute Maximum Ratings (Ta = 25°C)

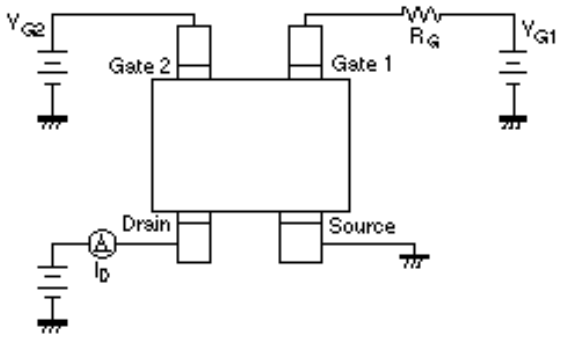
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	6	V
Gate1 to source voltage	V_{G1S}	+6 – 0	V
Gate2 to source voltage	V_{G2S}	+6 – 0	V
Drain current	I_D	20	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics (Ta = 25°C)

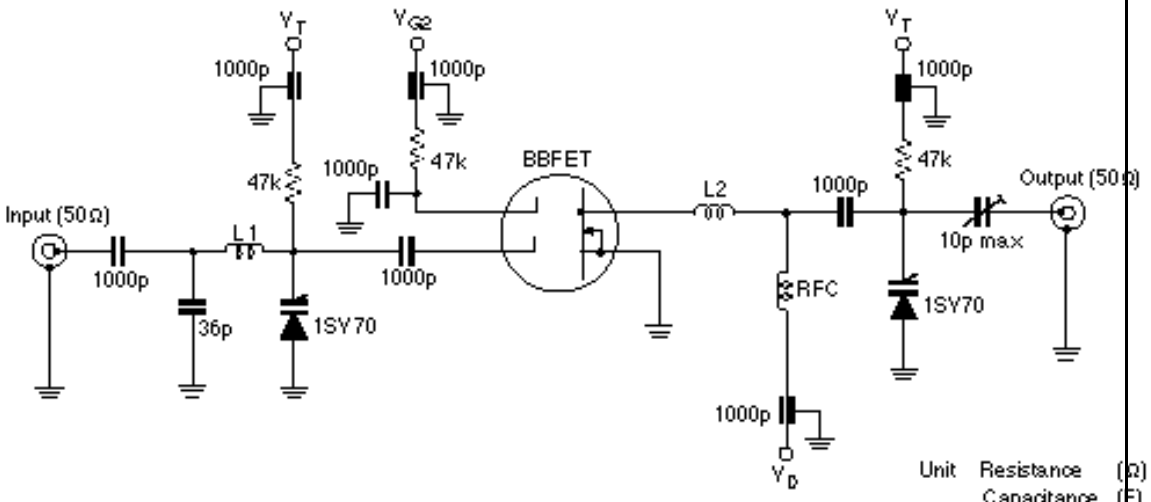
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	I_D = 200µA V_{G2S} = 0,V_{G1} = open
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	I_{G1} = +10µA V_{G2S} = V_{DS} = 0
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	+6	—	—	V	I_{G2} = +10µA 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)

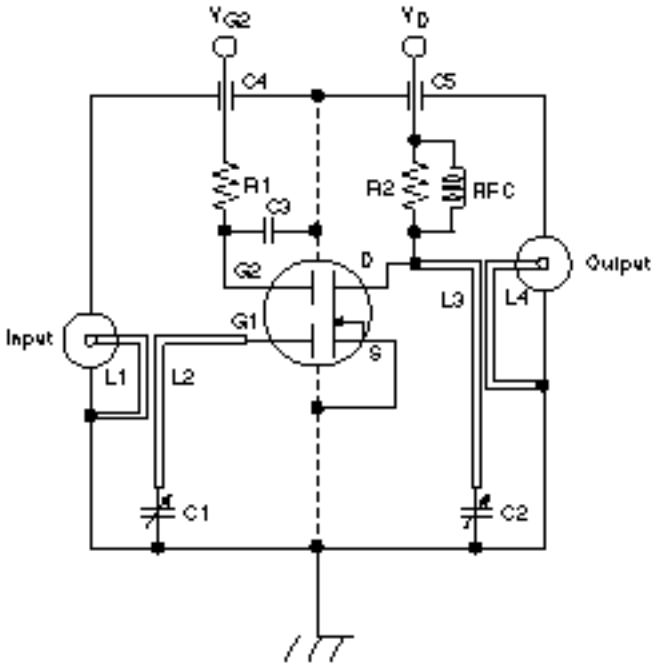


200MHz Power Gain, Noise Figure Test Circuit



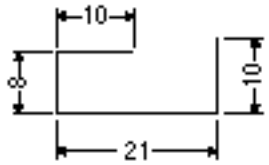
L1 : ϕ 1mm Enameled Copper Wire, Inside dia. 10mm, 2Turns
L2 : ϕ 1mm Enameled Copper Wire, Inside dia. 10mm, 2Turns
RFC : ϕ 1mm Enameled Copper Wire, Inside dia. 5mm, 2Turns

900MHz Power Gain, Noise Test Circuit

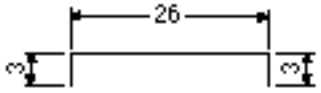


C1, C2 : Variable Capacitor (10pF MAX)
C3 : Disk Capacitor (1000pF)
C4, C5 : Air Capacitor (1000pF)
R1 : 47 kΩ
R2 : 4.7 kΩ

L1 :

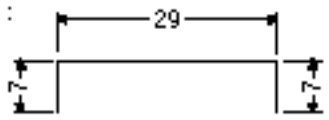


L2 :

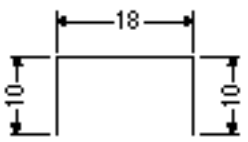


(ϕ 1mm Copper wire)
Unit : mm

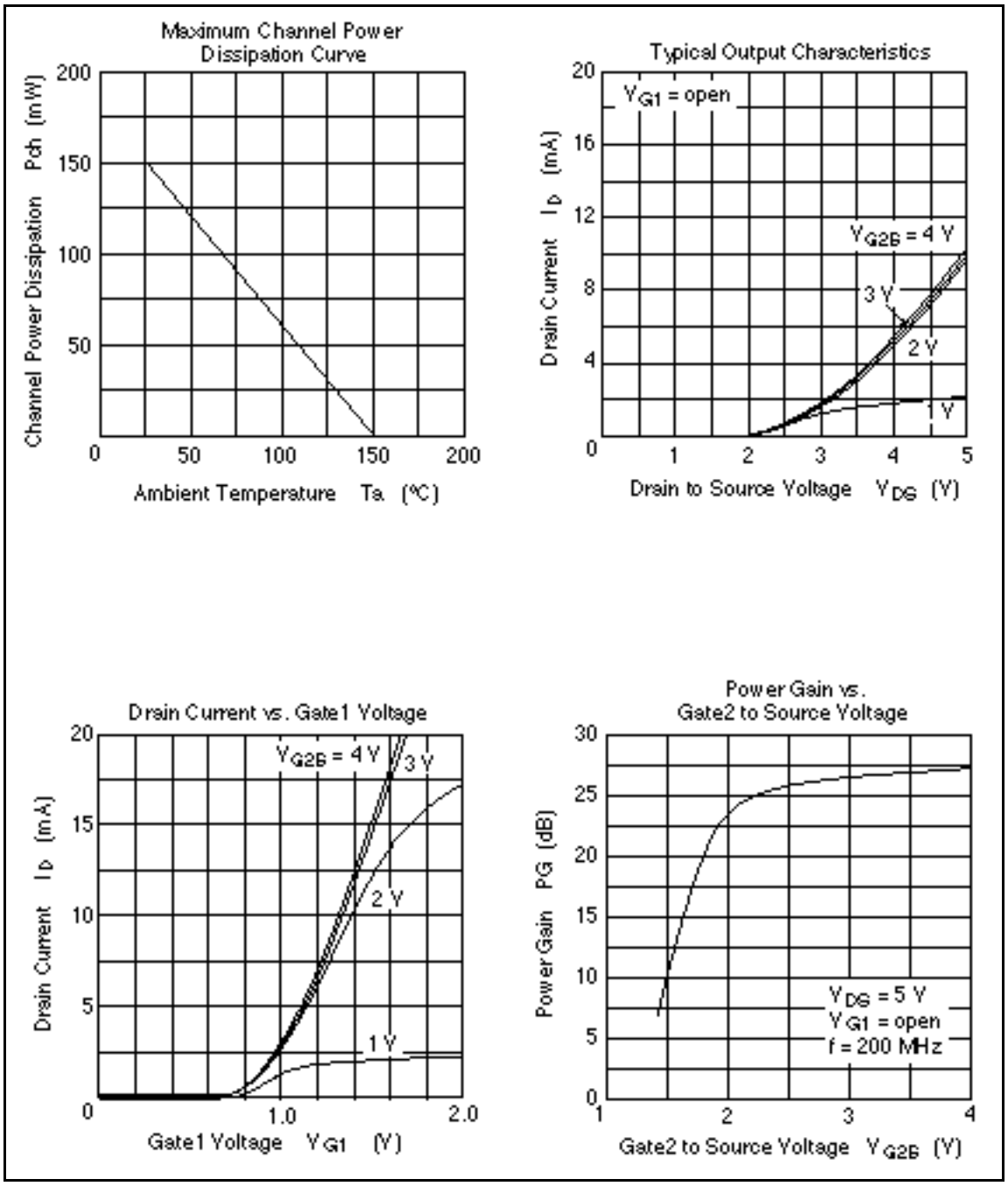
L3 :

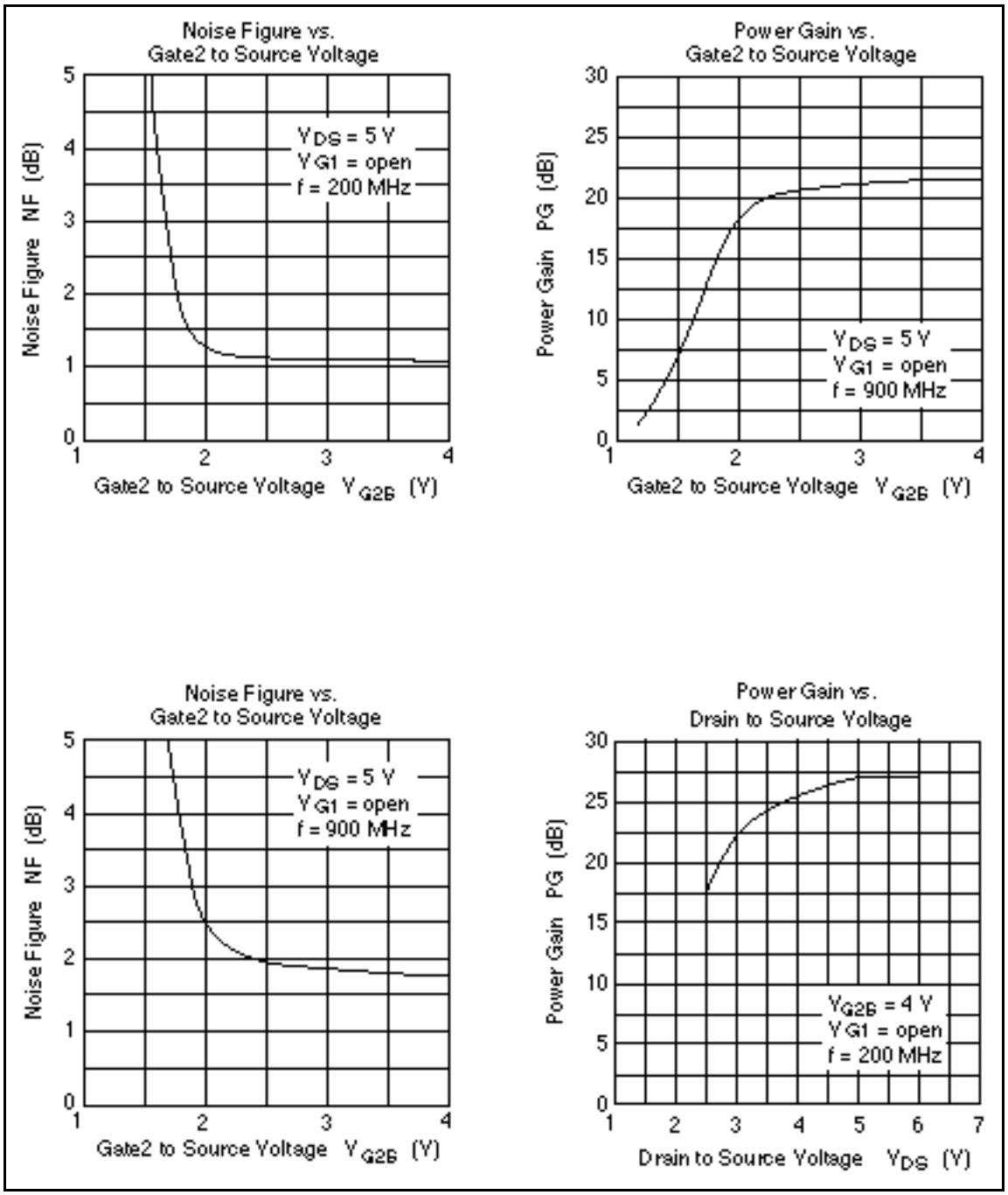


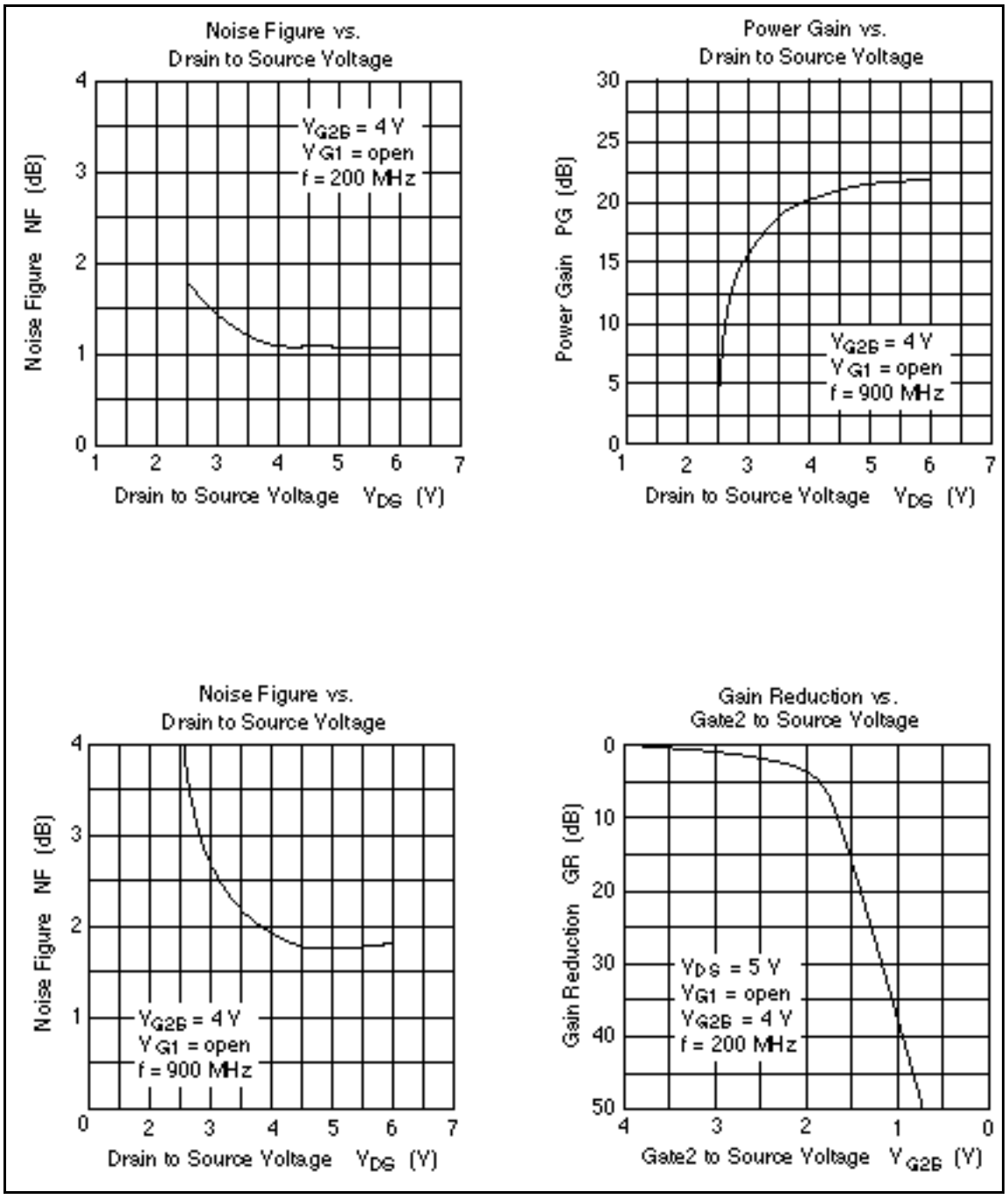
L4 :

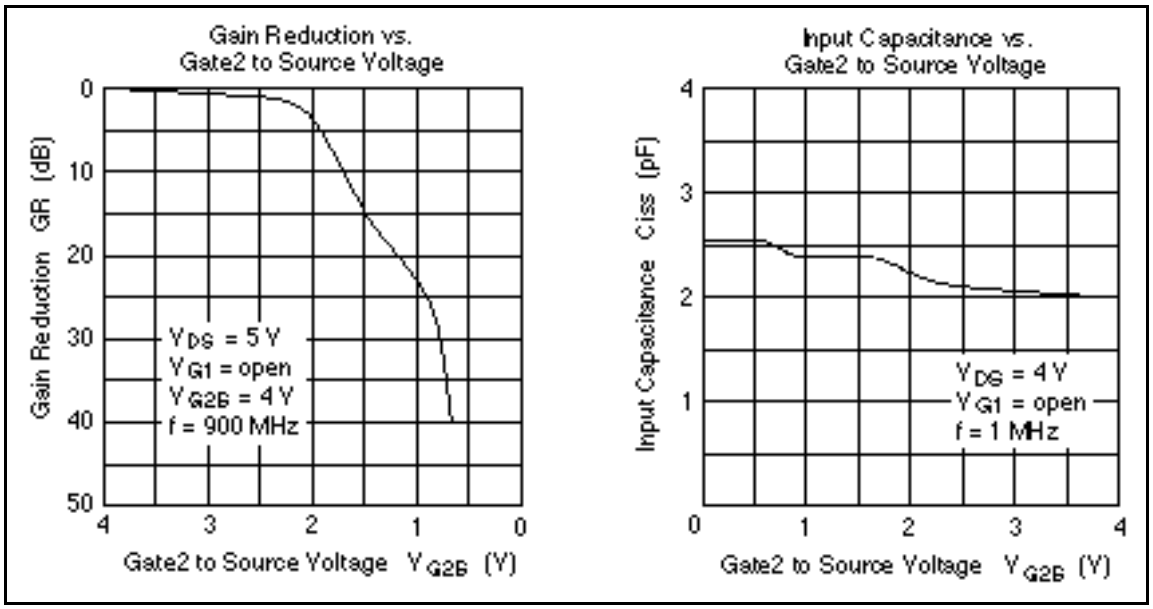


RFC : ϕ 1mm Copper wire with enamel 4turns inside dia. 6mm

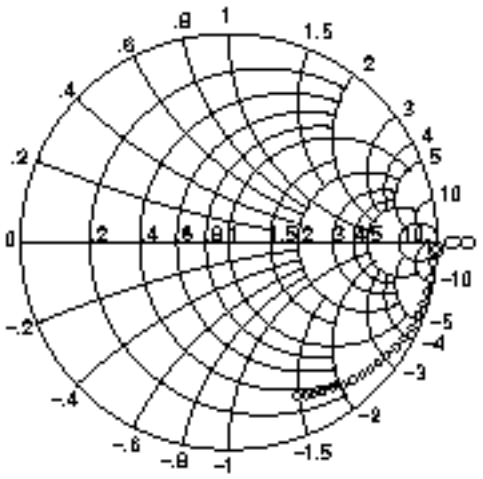

Maximum Channel Power Dissipation Curve
Channel Power Dissipation Pch (mW)
200
150
100
50
0
50
100
150
200
Ambient Temperature Ta (°C)
Typical Output Characteristics
V_{G1} = open
Drain Current I_D (mA)
20
16
12
8
4
0
V_{G2S} = 4 V
3 V
2 V
1 V
1
2
3
4
5
Drain to Source Voltage V_{DS} (V)
Drain Current vs. Gate1 Voltage
Drain Current I_D (mA)
20
15
10
5
0
V_{G2S} = 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)
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
Noise Figure NF (dB)
Drain to Source Voltage VDS (V)
VG2B = 4 V
VG1 = open
f = 200 MHz
Power Gain vs.
Drain to Source Voltage
Power Gain PG (dB)
Drain to Source Voltage VDS (V)
VG2B = 4 V
VG1 = open
f = 900 MHz
Noise Figure vs.
Drain to Source Voltage
Noise Figure NF (dB)
Drain to Source Voltage VDS (V)
VG2B = 4 V
VG1 = open
f = 900 MHz
Gain Reduction vs.
Gate2 to Source Voltage
Gain Reduction GR (dB)
Gate2 to Source Voltage VG2B (V)
VDS = 5 V
VG1 = open
VG2B = 4 V
f = 200 MHz


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
0
1
2
3
4
Gate2 to Source Voltage V_{G2S} (V)
V_{DS} = 4 V
V_{G1} = open
f = 1 MHz

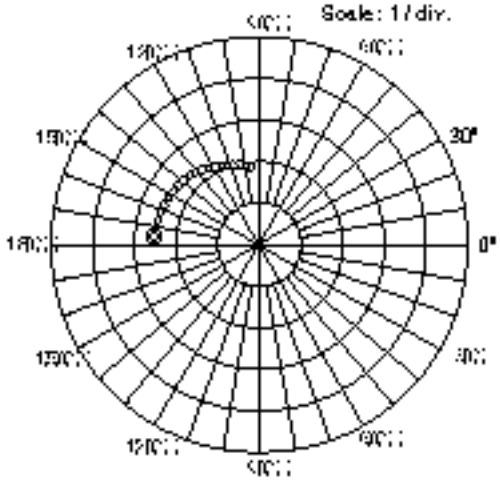
S11 Parameter vs. Frequency



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

50 to 1000 MHz (50 MHz step)

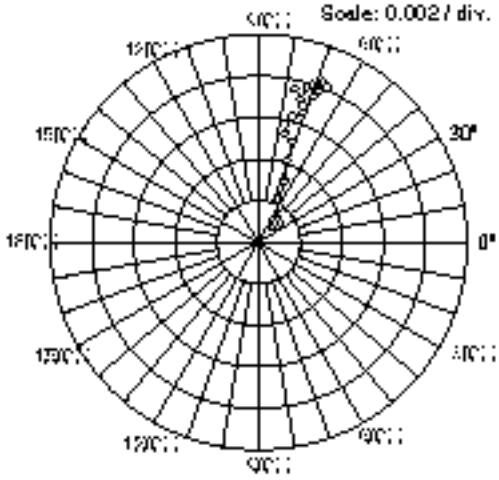
S21 Parameter vs. Frequency



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

50 to 1000 MHz (50 MHz step)

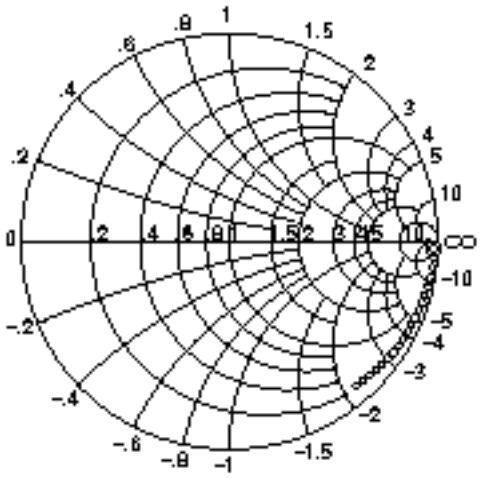
S12 Parameter vs. Frequency



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)

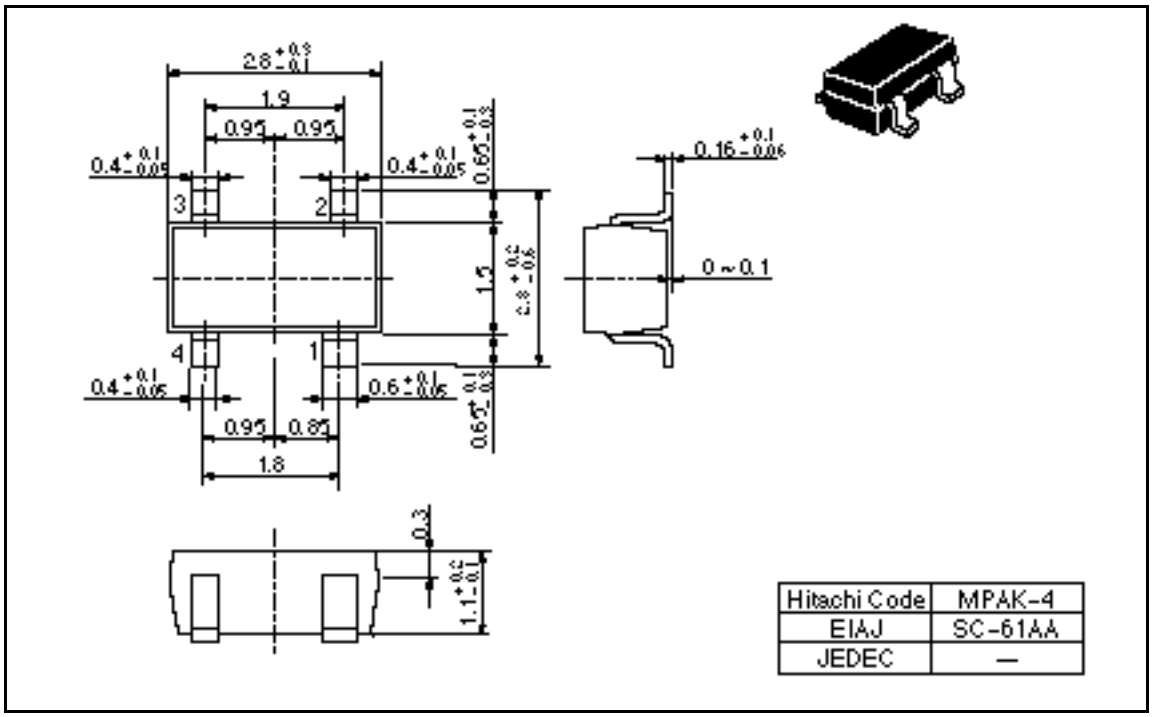
BIC701M

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



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