

BB402M

Build in Biasing Circuit MOS FET IC
VHF RF Amplifier

HITACHI

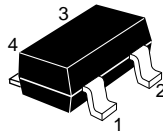
ADE-208-716A (Z)
2nd. Edition
Dec. 1998

Features

- Build in Biasing Circuit; To reduce using parts cost & PC board space.
- Low noise characteristics;
(NF = 1.7 dB typ. at f = 200 MHz)
- Withstanding to ESD;
Build in ESD absorbing diode. Withstand up to 240V at C=200pF, Rs=0 conditions.
- Provide mini mold packages; MPAK-4R(SOT-143 var.)

Outline

MPAK-4R



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

Notes: 1. Marking is "BX-".

2. BB402M is individual type number of HITACHI BBFET.

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

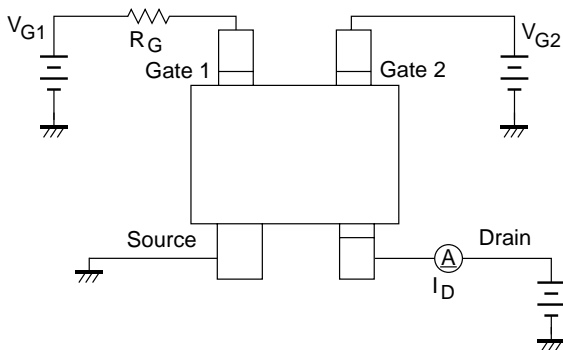
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	12	V
Gate1 to source voltage	V_{G1S}	+10 -0	V
Gate2 to source voltage	V_{G2S}	± 10	V
Drain current	I_D	25	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	$^\circ\text{C}$
Storage temperature	Tstg	-55 to +150	$^\circ\text{C}$

Electrical Characteristics ($T_a = 25^\circ\text{C}$)

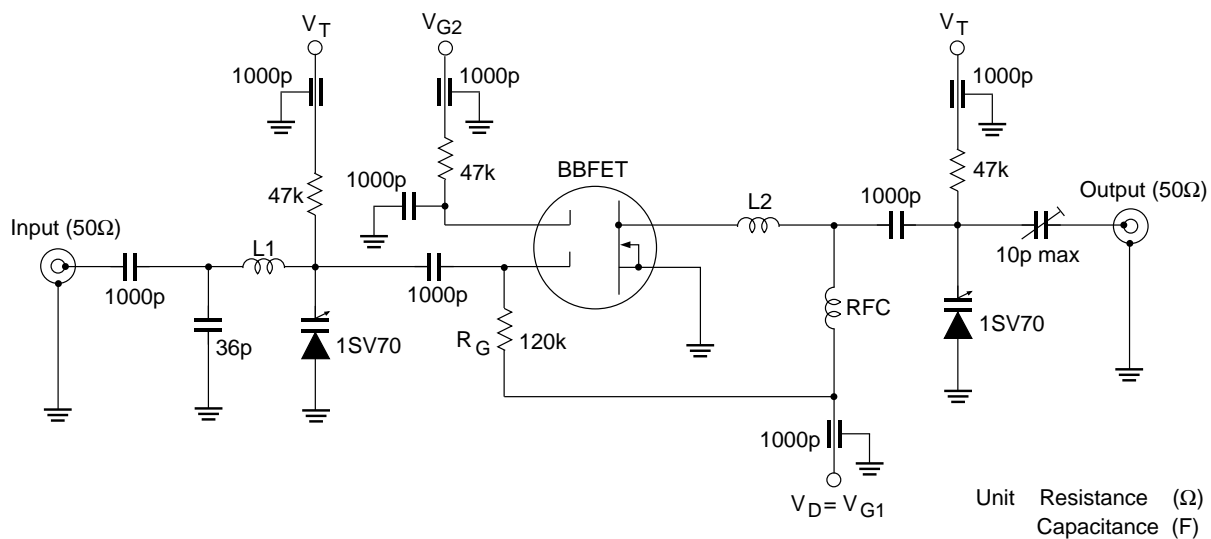
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	12	—	—	V	$I_D = 200\mu\text{A}$, $V_{G1S} = V_{G2S} = 0$
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+10	—	—	V	$I_{G1} = +10\mu\text{A}$, $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	± 10	—	—	V	$I_{G2} = \pm 10\mu\text{A}$, $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff current	I_{G1SS}	—	—	+100	nA	$V_{G1S} = +9\text{V}$, $V_{G2S} = V_{DS} = 0$
Gate2 to source cutoff current	I_{G2SS}	—	—	± 100	nA	$V_{G2S} = \pm 9\text{V}$, $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	0.4	0.7	1.0	V	$V_{DS} = 9\text{V}$, $V_{G2S} = 6\text{V}$, $I_D = 100\mu\text{A}$
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.4	0.7	1.0	V	$V_{DS} = 9\text{V}$, $V_{G1S} = 9\text{V}$, $I_D = 100\mu\text{A}$
Drain current	$I_{D(op)}$	9	13	18	mA	$V_{DS} = 9\text{V}$, $V_{G1} = 9\text{V}$, $V_{G2S} = 6\text{V}$ $R_G = 120\text{k}\Omega$
Forward transfer admittance	$ y_{fs} $	15	20	—	mS	$V_{DS} = 9\text{V}$, $V_{G1} = 9\text{V}$, $V_{G2S} = 6\text{V}$ $R_G = 120\text{k}\Omega$, $f = 1\text{kHz}$
Input capacitance	C_{iss}	2.2	3.0	4.0	pF	$V_{DS} = 9\text{V}$, $V_{G1} = 9\text{V}$
Output capacitance	C_{oss}	0.8	1.1	1.5	pF	$V_{G2S} = 6\text{V}$, $R_G = 120\text{k}\Omega$
Reverse transfer capacitance	C_{rss}	—	0.017	0.04	pF	$f = 1\text{MHz}$
Power gain	PG	22	26	—	dB	$V_{DS} = 9\text{V}$, $V_{G1} = 9\text{V}$, $V_{G2S} = 6\text{V}$
Noise figure	NF	—	1.7	2.2	dB	$R_G = 120\text{k}\Omega$, $f = 200\text{MHz}$

Main Characteristics

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

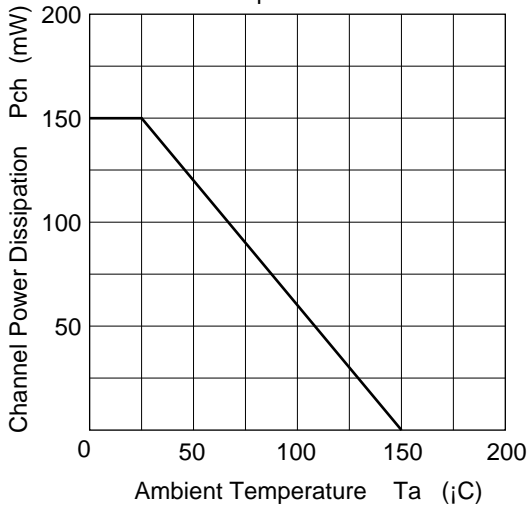


Power Gain, Noise Figure Test Circuit

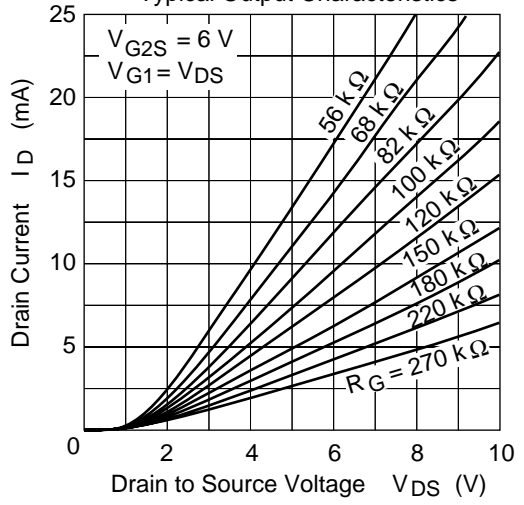


L1: ϕ 1mm Enameled Copper Wire, Inside dia 10mm, 2Turns
 L2: ϕ 1mm Enameled Copper Wire, Inside dia 10mm, 2Turns
 RFC: ϕ 1mm Enameled Copper Wire, Inside dia 5mm, 2Turns

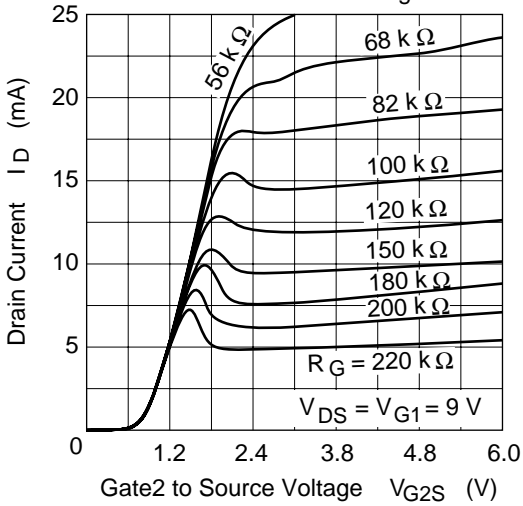
Maximum Channel Power Dissipation Curve



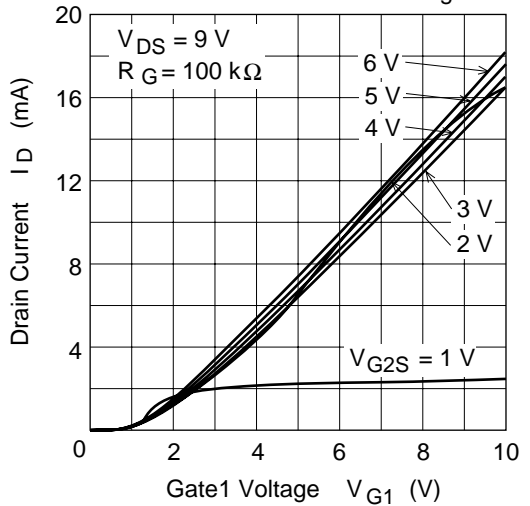
Typical Output Characteristics

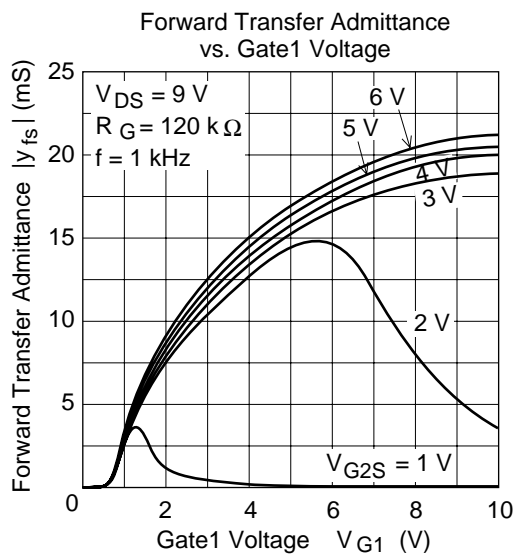
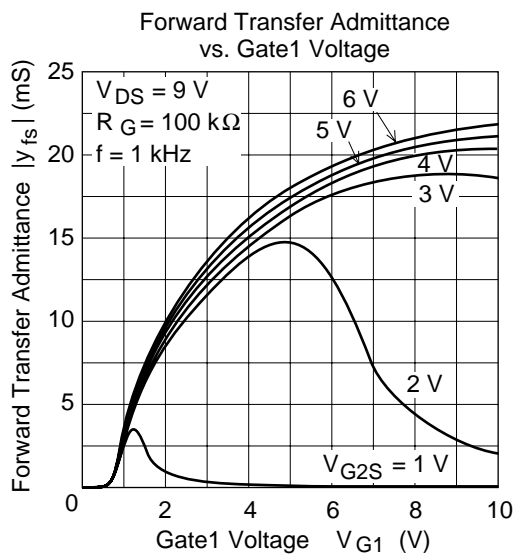
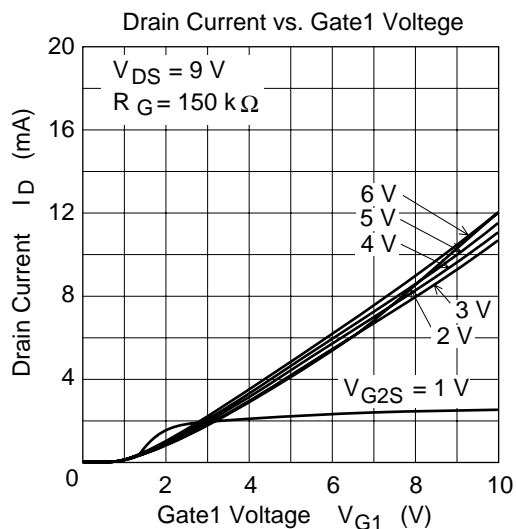
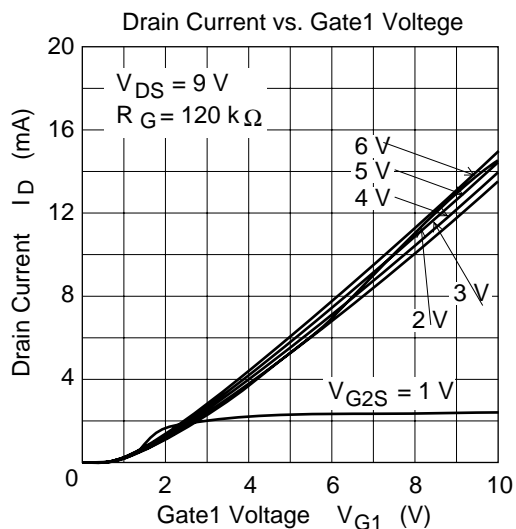


Drain Current vs. Gate2 to Source Voltage

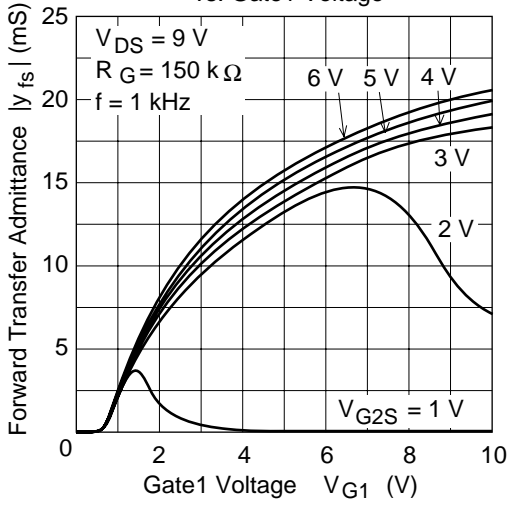


Drain Current vs. Gate1 Voltage

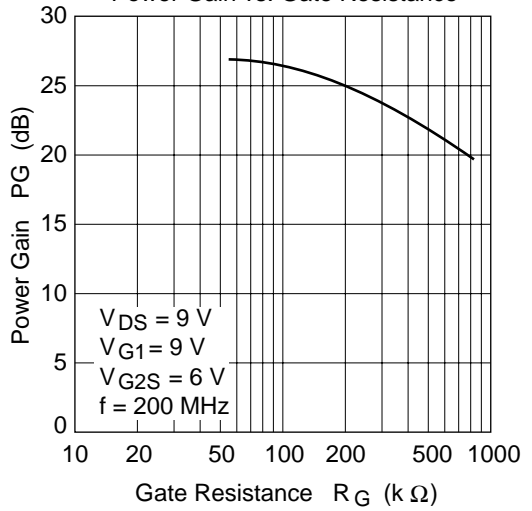




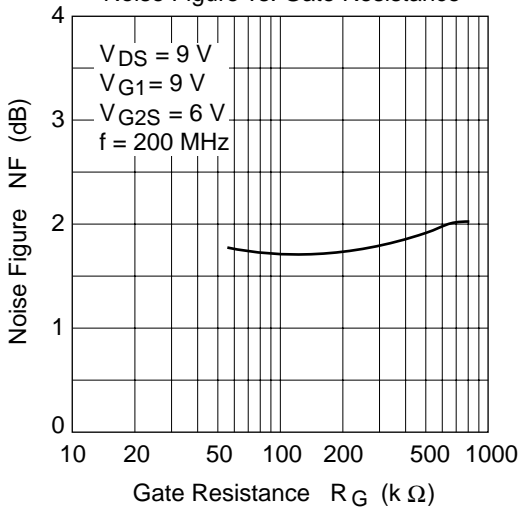
Forward Transfer Admittance vs. Gate1 Voltage



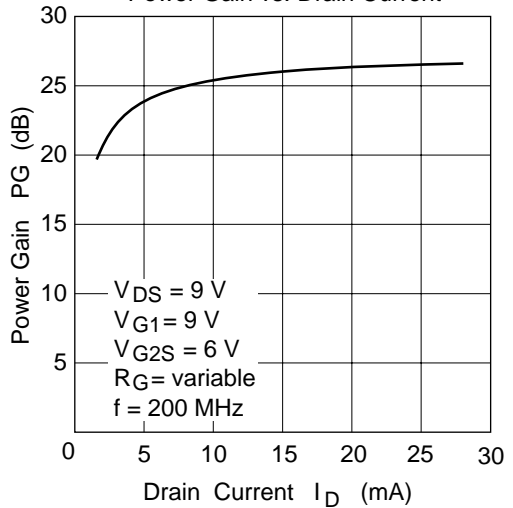
Power Gain vs. Gate Resistance

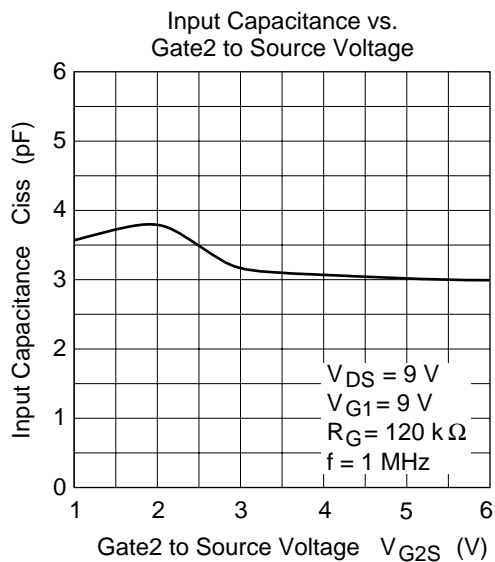
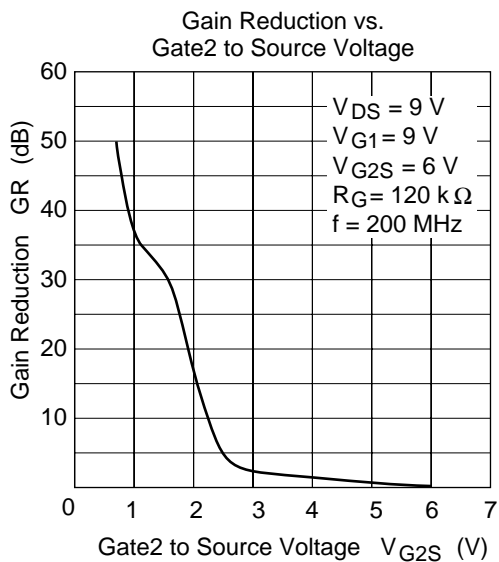
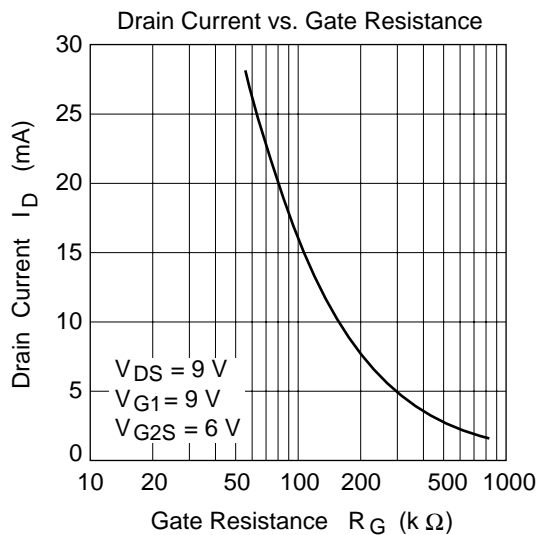
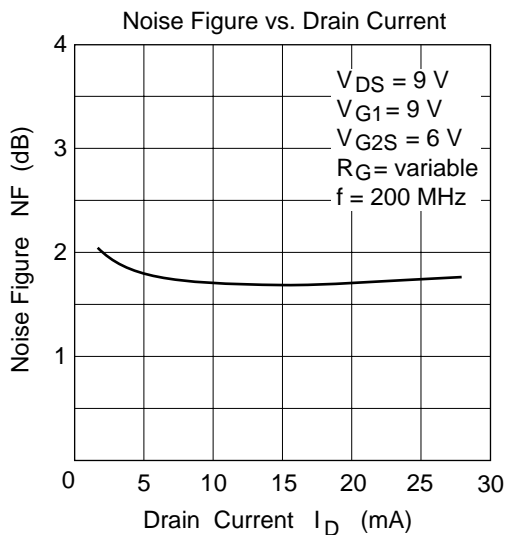


Noise Figure vs. Gate Resistance

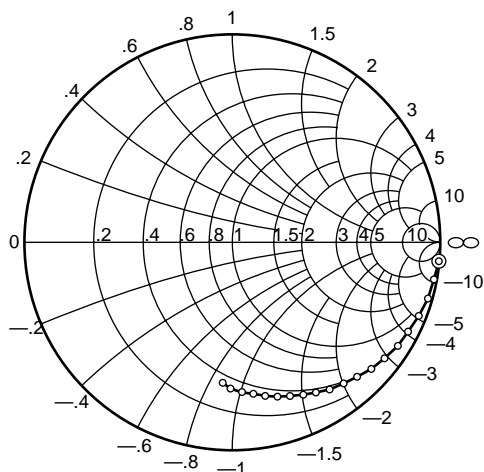


Power Gain vs. Drain Current





S11 Parameter vs. Frequency

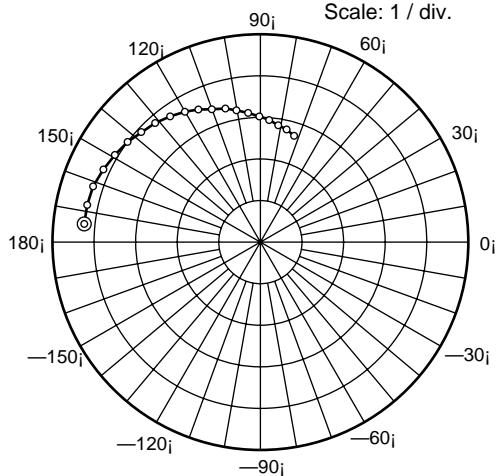


Test Condition : $V_{DS}=9\text{ V}$, $V_{G1}=9\text{ V}$
 $V_{G2S}=6\text{ V}$, $R_G=120\text{ k}\Omega$
 50 1000 MHz (50 MHz step)



S21 Parameter vs. Frequency

Scale: 1 / div.

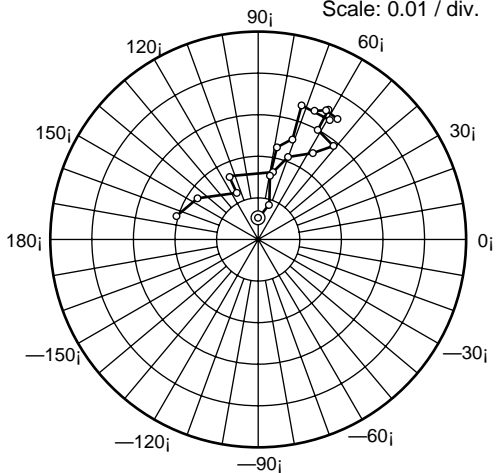


Test Condition : $V_{DS}=9\text{ V}$, $V_{G1}=9\text{ V}$
 $V_{G2S}=6\text{ V}$, $R_G=120\text{ k}\Omega$
 50 1000 MHz (50 MHz step)



S12 Parameter vs. Frequency

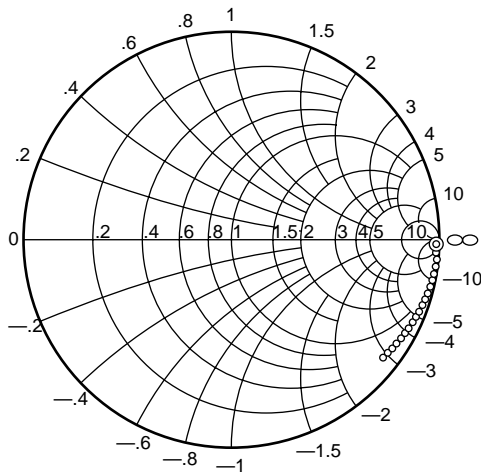
Scale: 0.01 / div.



Test Condition : $V_{DS}=9\text{ V}$, $V_{G1}=9\text{ V}$
 $V_{G2S}=6\text{ V}$, $R_G=120\text{ k}\Omega$
 50 1000 MHz (50 MHz step)



S22 Parameter vs. Frequency



Test Condition : $V_{DS}=9\text{ V}$, $V_{G1}=9\text{ V}$
 $V_{G2S}=6\text{ V}$, $R_G=120\text{ k}\Omega$
 50 1000 MHz (50 MHz step)

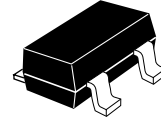
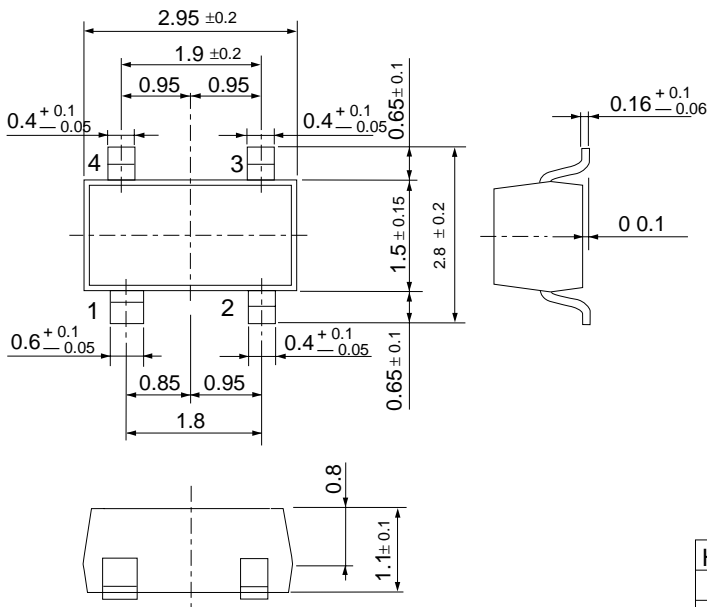


Sparameter ($V_{DS} = V_{G1} = 9V$, $V_{G2S} = 6V$, $R_G = 120k\Omega$, $Z_0 = 50\Omega$)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
50	0.988	-5.2	2.13	174.1	0.00052	90.0	0.985	-1.3
100	0.986	-10.4	2.13	167.9	0.00087	72.5	0.993	-3.6
150	0.979	-16.0	2.12	161.6	0.00156	79.4	0.992	-5.5
200	0.964	-21.5	2.08	155.2	0.00226	78.4	0.990	-7.5
250	0.948	-26.9	2.04	149.1	0.00254	71.0	0.987	-9.6
300	0.939	-32.0	2.00	143.0	0.00339	72.0	0.985	-11.4
350	0.920	-37.3	1.95	137.3	0.00335	59.0	0.982	-13.3
400	0.904	-42.3	1.91	131.5	0.00338	66.3	0.978	-15.3
450	0.885	-47.1	1.86	125.7	0.00351	62.2	0.974	-17.1
500	0.864	-51.7	1.81	120.1	0.00347	56.6	0.970	-18.9
550	0.848	-56.5	1.76	115.1	0.00355	61.5	0.966	-21.0
600	0.826	-60.9	1.70	110.1	0.00300	61.4	0.961	-22.7
650	0.808	-65.0	1.66	104.7	0.00289	51.1	0.957	-24.5
700	0.789	-69.4	1.61	100.3	0.00246	57.6	0.952	-26.6
750	0.773	-73.7	1.56	95.4	0.00211	70.0	0.947	-28.3
800	0.755	-77.9	1.51	90.5	0.00166	77.5	0.943	-30.2
850	0.735	-82.1	1.47	85.9	0.00165	114.5	0.937	-32.2
900	0.721	-86.3	1.42	81.3	0.00123	114.5	0.933	-34.1
950	0.703	-90.7	1.39	76.9	0.00176	145.8	0.927	-35.9
1000	0.677	-93.9	1.34	72.4	0.00204	164.0	0.923	-37.9

Package Dimensions

Unit: mm



Hitachi Code	MPAK—4R
EIAJ	
JEDEC	

Cautions

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