

BB502M

Build in Biasing Circuit MOS FET IC
UHF RF Amplifier

HITACHI

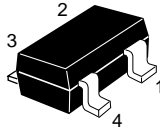
ADE-208-809B(Z)
3rd. Edition
Jun. 1999

Features

- Build in Biasing Circuit; To reduce using parts cost & PC board space.
- Low noise; NF = 1.6 dB typ. at f = 900 MHz
- High gain; PG = 22 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 "BS-".
 2. BB502M is individual type number of HITACHI BBFET.

Absolute Maximum Ratings (Ta = 25°C)

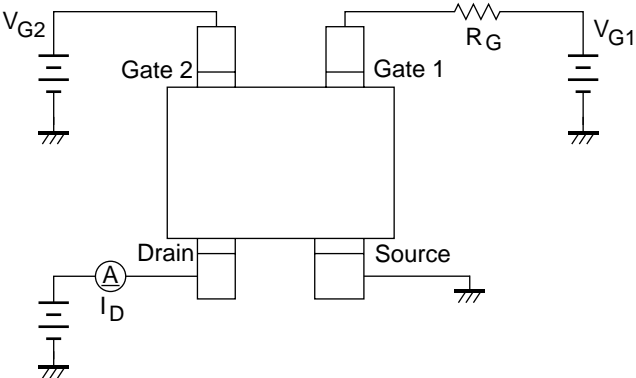
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	6	V
Gate1 to source voltage	V_{G1S}	+6 -0	V
Gate2 to source voltage	V_{G2S}	+6 -0	V
Drain current	I_D	20	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	-55 to +150	°C

Electrical Characteristics (Ta = 25°C)

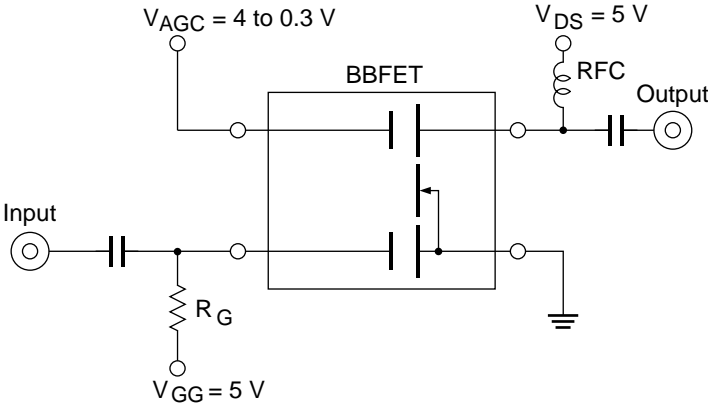
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	$I_D = 200\mu A$ $V_{G1S} = V_{G2S} = 0$
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	$I_{G1} = +10\mu A$ $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	+6	—	—	V	$I_{G2} = +10\mu A$ $V_{G1S} = V_{DS} = 0$
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	$V_{G2S} = +5V$ $V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	0.5	0.7	1.0	V	$V_{DS} = 5V, V_{G2S} = 4V$ $I_D = 100\mu A$
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.5	0.7	1.0	V	$V_{DS} = 5V, V_{G1S} = 5V$ $I_D = 100\mu A$
Drain current	$I_{D(op)}$	8	11	14	mA	$V_{DS} = 5V, V_{G1} = 5V$ $V_{G2S} = 4V, R_G = 180k\Omega$
Forward transfer admittance	$ y_{fs} $	20	25	30	mS	$V_{DS} = 5V, V_{G1} = 5V$ $V_{G2S} = 4V$ $R_G = 180k\Omega, f = 1kHz$
Input capacitance	C_{iss}	1.4	1.7	2.0	pF	$V_{DS} = 5V, V_{G1} = 5V$
Output capacitance	C_{oss}	0.7	1.1	1.5	pF	$V_{G2S} = 4V, R_G = 180k\Omega$
Reverse transfer capacitance	C_{rss}	—	0.02	0.05	pF	$f = 1MHz$
Power gain	PG	17	22	—	dB	$V_{DS} = 5V, V_{G1} = 5V$ $V_{G2S} = 4V, R_G = 180k\Omega$
Noise figure	NF	—	1.6	2.2	dB	$f = 900MHz$

Main Characteristics

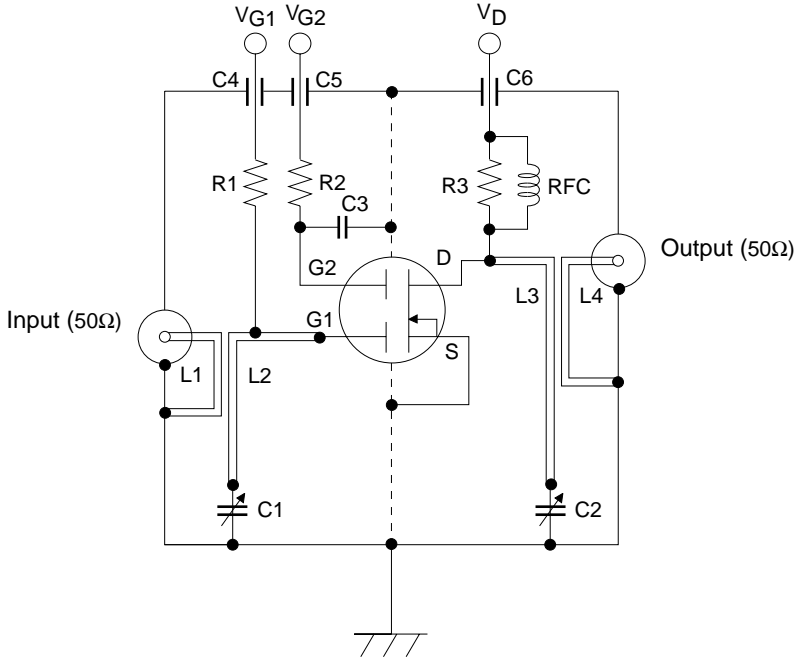
Test Circuit for Operating Items ($I_{D(op)}$, $|y_{fs}|$, C_{iss} , C_{oss} , C_{rss} , NF, PG)



Application Circuit

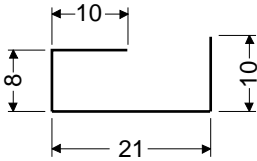


900MHz Power Gain, Noise Test Circuit

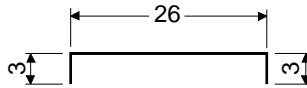


- C1, C2: Variable Capacitor (10pF MAX)
- C3: Disk Capacitor (1000pF)
- C4 to C6: Air Capacitor (1000pF)
- R1: 180 k Ω
- R2: 47 k Ω
- R3: 4.7 k Ω

L1:

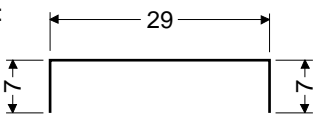


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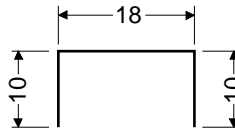


(ϕ 1mm Copper wire)
Unit: mm

L3:

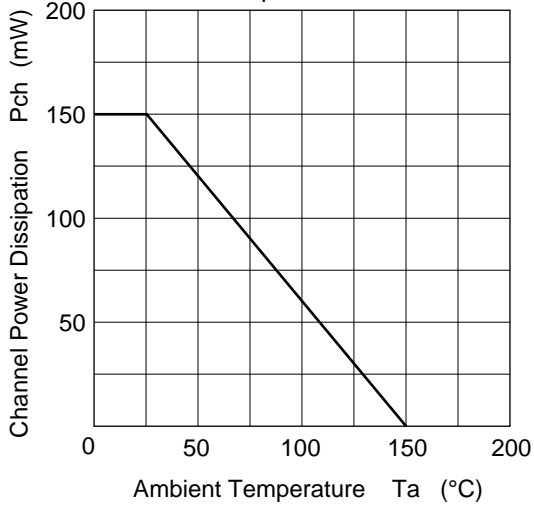


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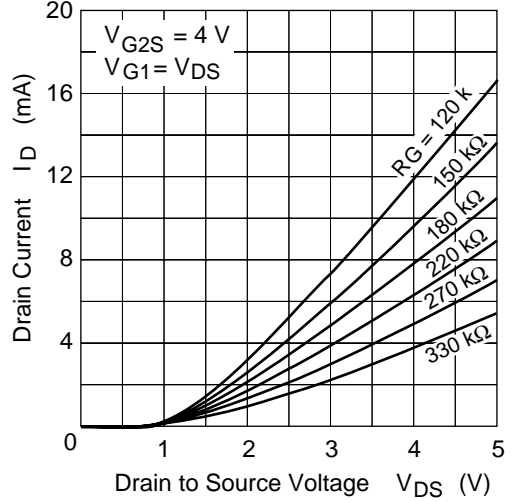


RFC: ϕ 1mm Copper wire with enamel 4turns inside dia 6mm

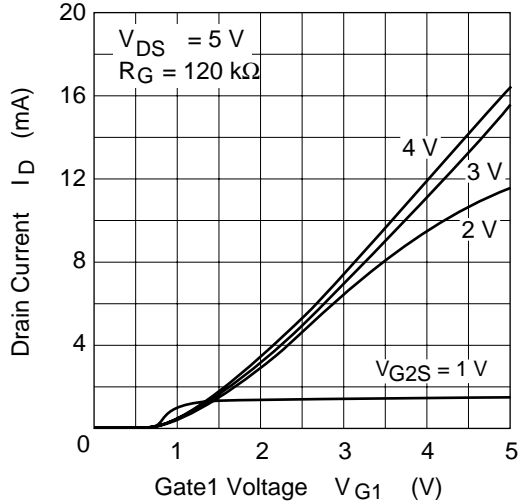
Maximum Channel Power Dissipation Curve



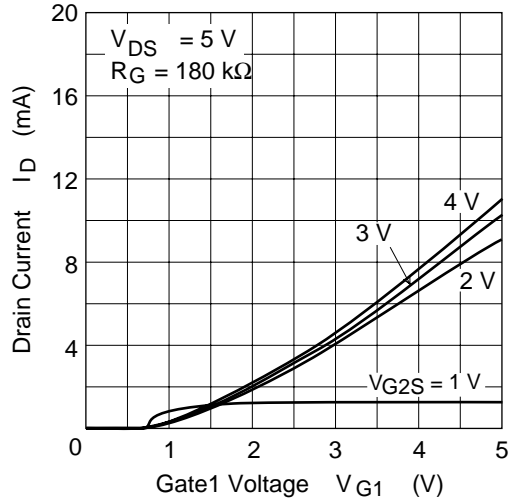
Typical Output Characteristics

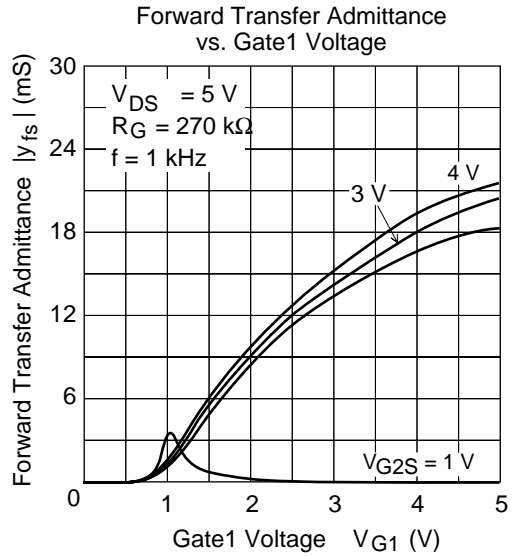
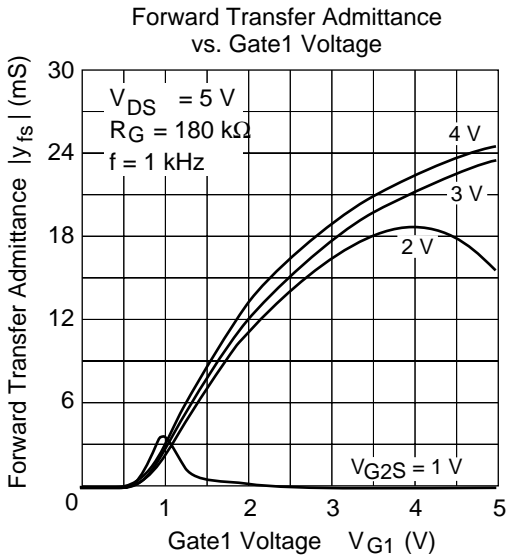
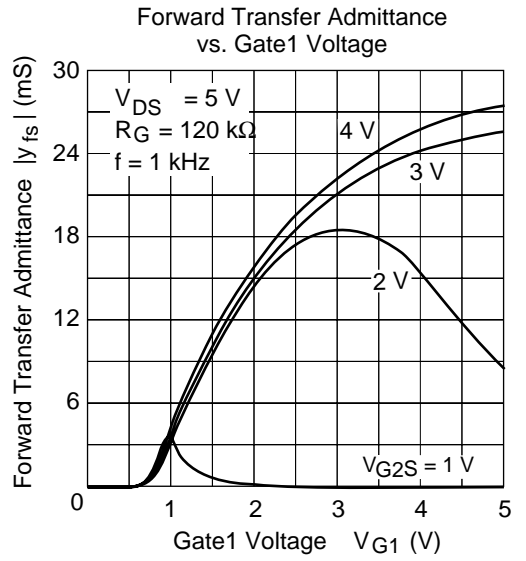
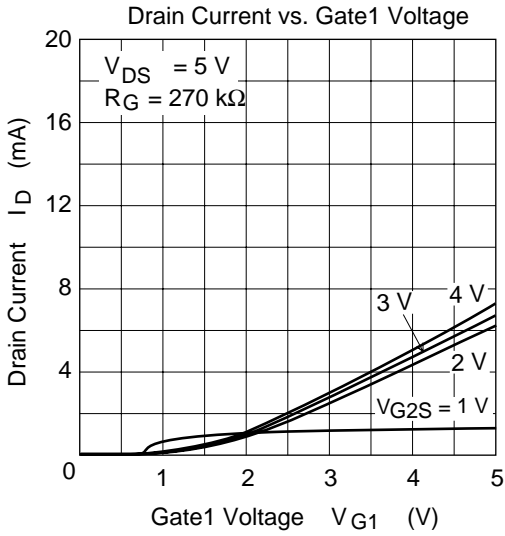


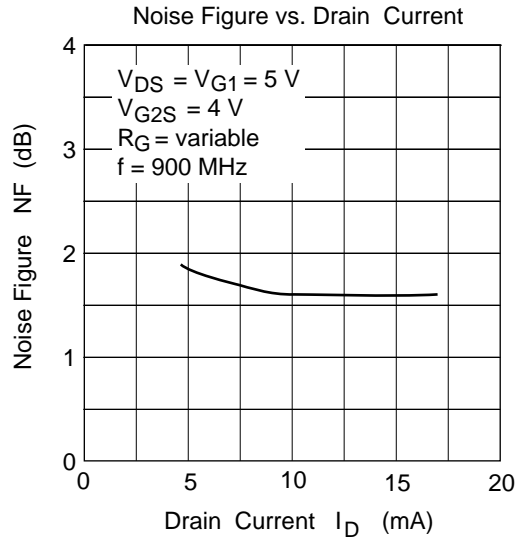
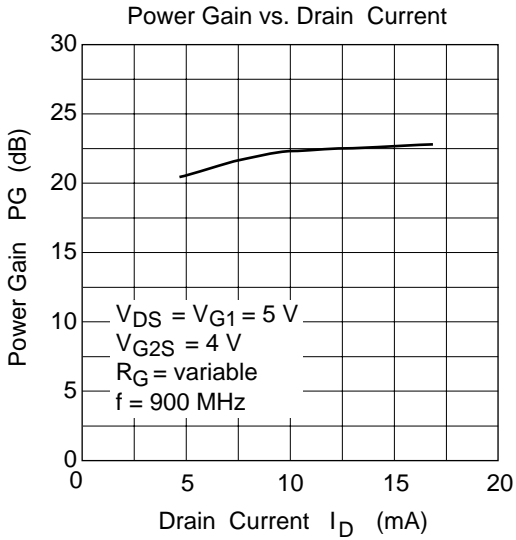
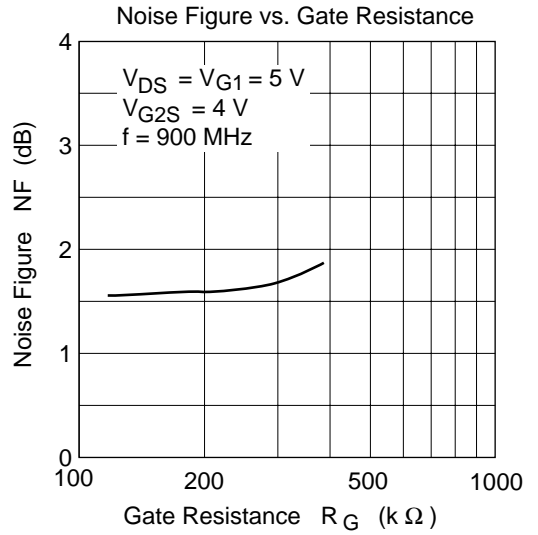
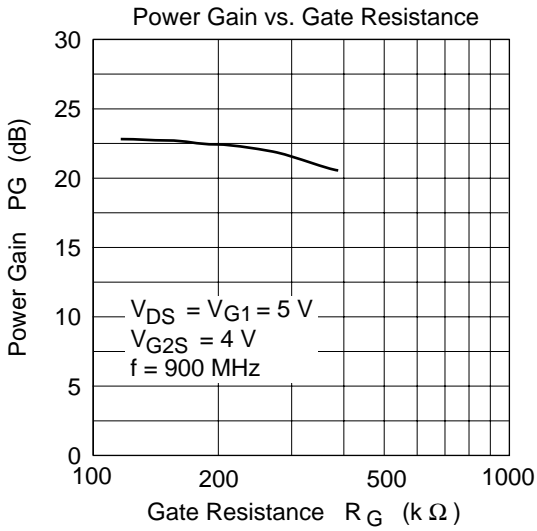
Drain Current vs. Gate1 Voltage

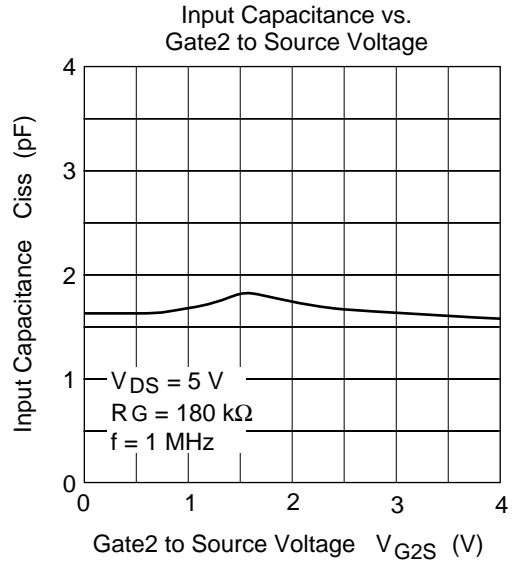
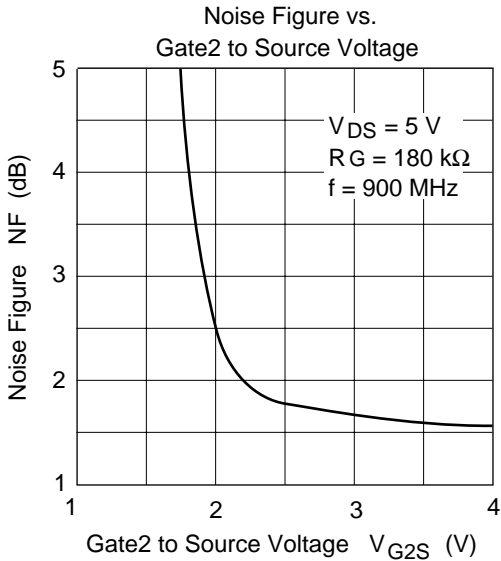
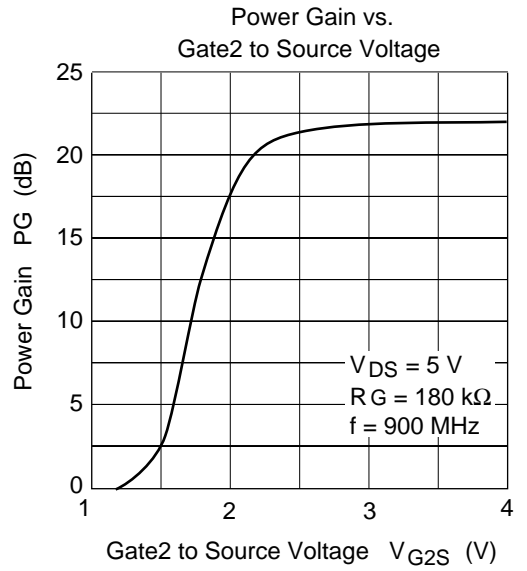
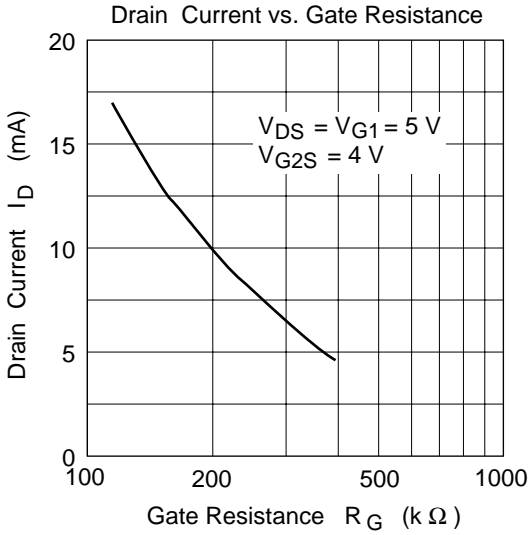


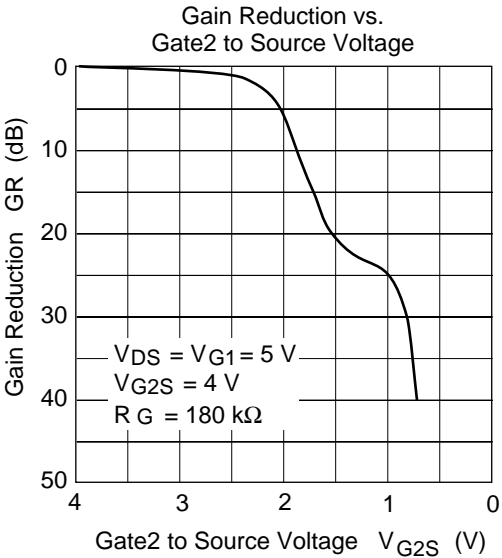
Drain Current vs. Gate1 Voltage



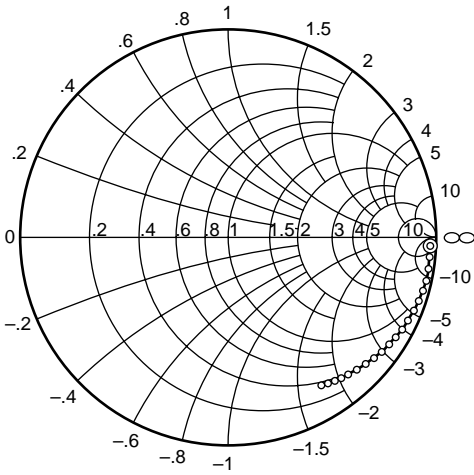








S11 Parameter vs. Frequency

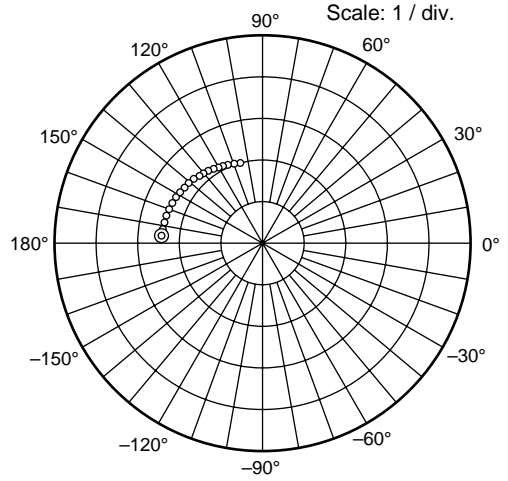


Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 180\text{ k}\Omega$,
 $Z_0 = 50\ \Omega$

50 to 1000 MHz (50 MHz step)



S21 Parameter vs. Frequency

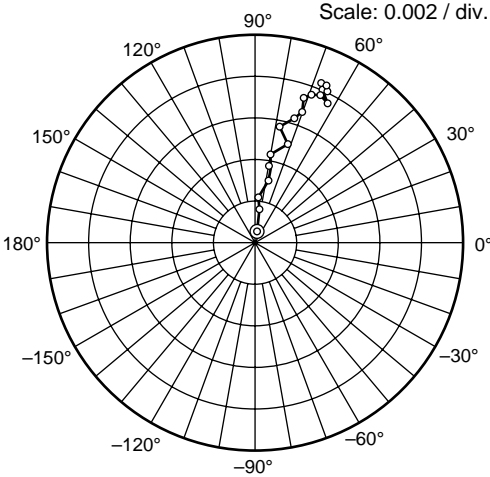


Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 180\text{ k}\Omega$,
 $Z_0 = 50\ \Omega$

50 to 1000 MHz (50 MHz step)



S12 Parameter vs. Frequency

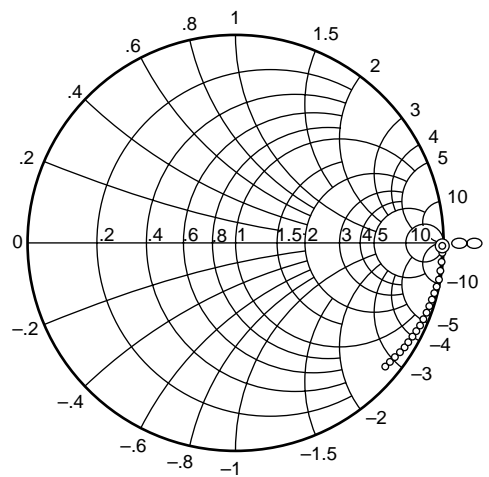


Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 180\text{ k}\Omega$,
 $Z_0 = 50\ \Omega$

50 to 1000 MHz (50 MHz step)



S22 Parameter vs. Frequency



Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 180\text{ k}\Omega$,
 $Z_0 = 50\ \Omega$

50 to 1000 MHz (50 MHz step)

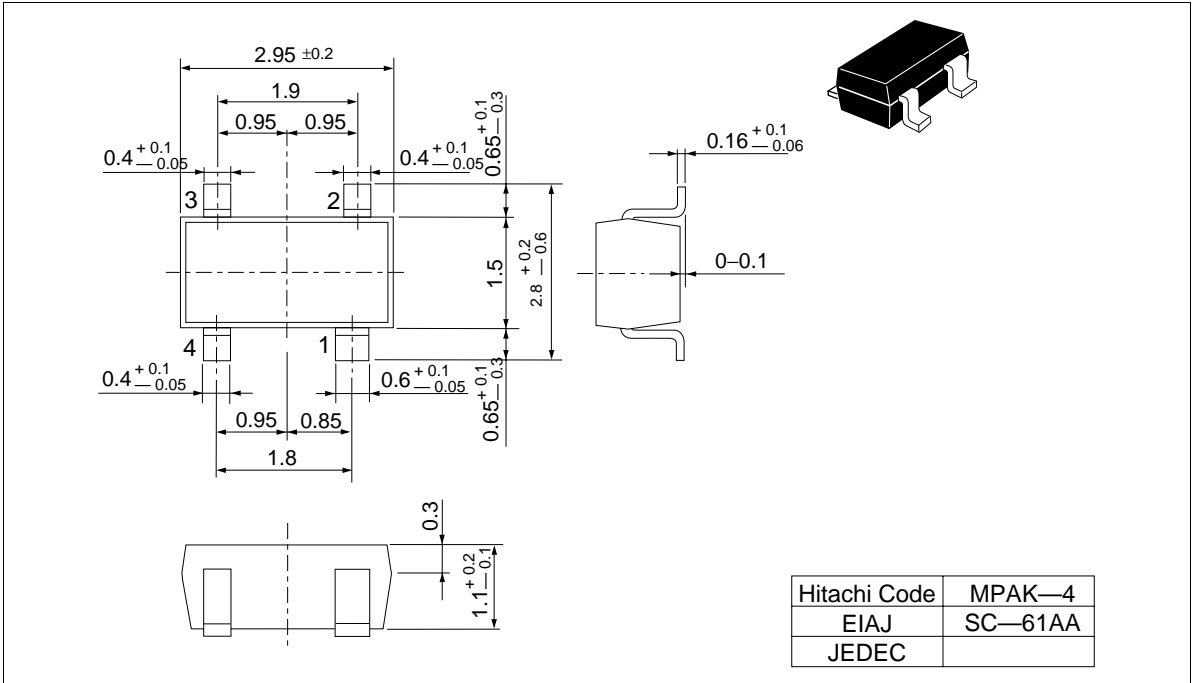


Sparameter ($V_{DS} = V_{G1} = 5V$, $V_{G2S} = 4V$, $R_G = 180k\Omega$, $Z_o = 50\Omega$)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
50	0.994	-2.8	2.52	176.2	0.00072	88.6	0.995	-2.2
100	0.994	-5.7	2.51	172.4	0.00161	80.9	0.998	-4.0
150	0.991	-9.2	2.50	168.1	0.00230	86.6	0.997	-6.2
200	0.985	-12.5	2.47	164.1	0.00297	78.0	0.996	-8.2
250	0.985	-15.5	2.46	160.0	0.00374	78.9	0.994	-10.2
300	0.975	-18.7	2.43	156.4	0.00436	80.6	0.992	-12.2
350	0.969	-22.0	2.40	152.3	0.00507	70.9	0.990	-14.2
400	0.962	-24.9	2.38	148.6	0.00557	77.3	0.989	-16.3
450	0.954	-27.7	2.35	144.6	0.00625	72.4	0.987	-18.5
500	0.945	-30.8	2.31	141.0	0.00663	70.0	0.984	-20.4
550	0.935	-33.8	2.28	136.7	0.00721	70.5	0.981	-22.4
600	0.925	-36.6	2.25	133.4	0.00747	68.4	0.978	-24.3
650	0.918	-39.5	2.21	130.3	0.00761	65.6	0.975	-26.4
700	0.909	-42.5	2.18	126.1	0.00807	65.6	0.972	-28.3
750	0.898	-45.0	2.14	122.9	0.00828	67.6	0.969	-30.2
800	0.887	-47.8	2.09	119.5	0.00801	65.1	0.965	-32.2
850	0.874	-50.6	2.07	116.0	0.00815	63.6	0.961	-34.2
900	0.862	-53.0	2.03	112.7	0.00832	65.1	0.958	-36.1
950	0.855	-55.5	1.99	109.4	0.00738	61.8	0.954	-37.9
1000	0.845	-58.1	1.95	106.1	0.00802	65.8	0.951	-39.8

Package Dimensions

Unit: mm



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