

BB304M

Build in Biasing Circuit MOS FET IC
UHF/VHF RF Amplifier

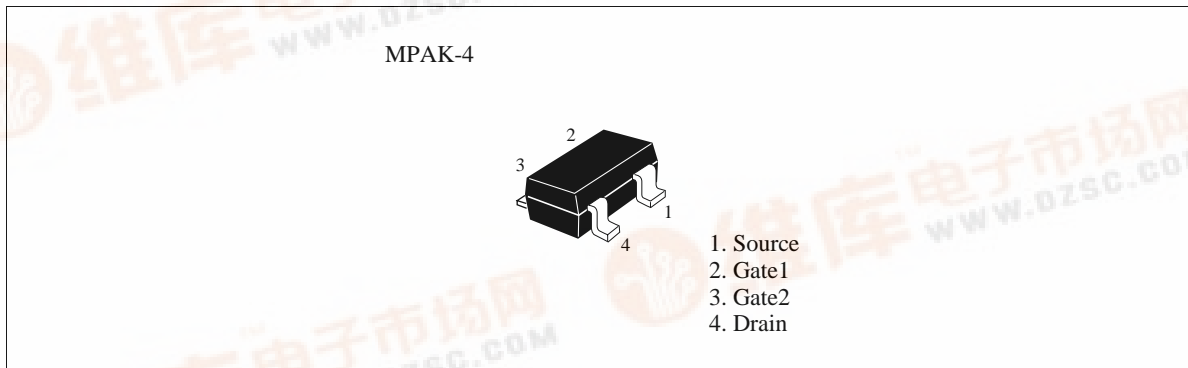
HITACHI

ADE-208-605C (Z)
4th. Edition
August 1998

Features

- Build in Biasing Circuit; To reduce using parts cost & PC board space.
- High gain;
(PG = 29 dB typ. at f = 200 MHz)
- Low noise characteristics;
(NF = 1.2 dB typ. at f = 200 MHz)
- Wide supply voltage range;
Applicable with 5V to 9V supply voltage.
- 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



- Note:
1. Marking is "DW-".
 2. BB304M is individual type number of HITACHI BBFET.

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Absolute Maximum Ratings (Ta = 25°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	°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	$V_{(BR)DSS}$	12	—	—	V	$I_D = 200\mu A, V_{G1S} = V_{G2S} = 0$
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+10	—	—	V	$I_{G1} = +10\mu A, V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	±10	—	—	V	$I_{G2} = \pm 10\mu A, V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff current	I_{G1SS}	—	—	+100	nA	$V_{G1S} = +9V, V_{G2S} = V_{DS} = 0$
Gate2 to source cutoff current	I_{G2SS}	—	—	±100	nA	$V_{G2S} = \pm 9V, V_{G1S} = V_{DS} = 0$
Gate1 to source cutoff voltage	$V_{G1S(off)}$	0.4	—	1.0	V	$V_{DS} = 5V, V_{G2S} = 4V$ $I_D = 100\mu A$
Gate2 to source cutoff voltage	$V_{G2S(off)}$	0.5	—	1.0	V	$V_{DS} = 5V, V_{G1S} = 5V$ $I_D = 100\mu A$

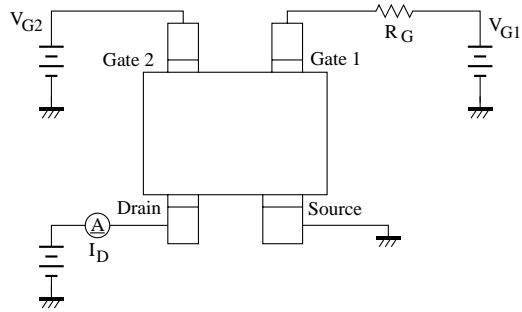
Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input capacitance	C_{iss}	2.3	2.8	3.6	pF	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$
Output capacitance	C_{oss}	0.9	1.3	2.0	pF	$R_G = 180k\Omega, f = 1MHz$
Reverse transfer capacitance	C_{rss}	0.003	0.02	0.05	pF	
Drain current	$I_{D(op)1}$	9	15	19	mA	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$ $R_G = 180k\Omega$
	$I_{D(op)2}$	—	13	—	mA	$V_{DS} = 9V, V_{G1} = 9V, V_{G2S} = 6V$ $R_G = 470k\Omega$
Forward transfer admittance	$ y_{fs} 1$	22	27	34	mS	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$ $R_G = 180k\Omega, f = 1kHz$
	$ y_{fs} 2$	—	27	—	mS	$V_{DS} = 9V, V_{G1} = 9V, V_{G2S} = 6V$ $R_G = 470k\Omega, f = 1kHz$
Power gain	PG1	24	29	32	dB	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$ $R_G = 180k\Omega, f = 200MHz$
	PG2	—	29	—	dB	$V_{DS} = 9V, V_{G1} = 9V, V_{G2S} = 6V$ $R_G = 470k\Omega, f = 200MHz$
Noise figure	NF1	—	1.2	1.9	dB	$V_{DS} = 5V, V_{G1} = 5V, V_{G2S} = 4V$ $R_G = 180k\Omega, f = 200MHz$
	NF2	—	1.2	—	dB	$V_{DS} = 9V, V_{G1} = 9V, V_{G2S} = 6V$ $R_G = 470k\Omega, f = 200MHz$

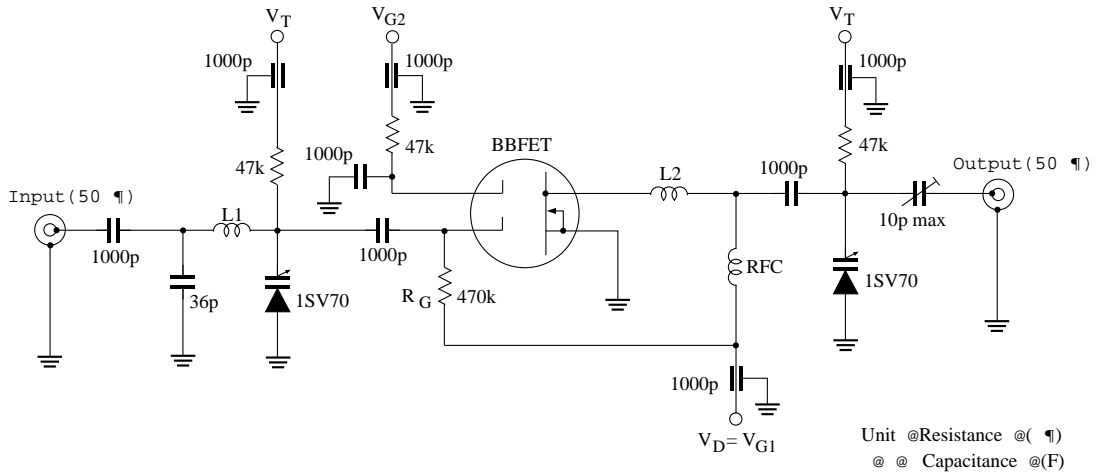
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Main Characteristics

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

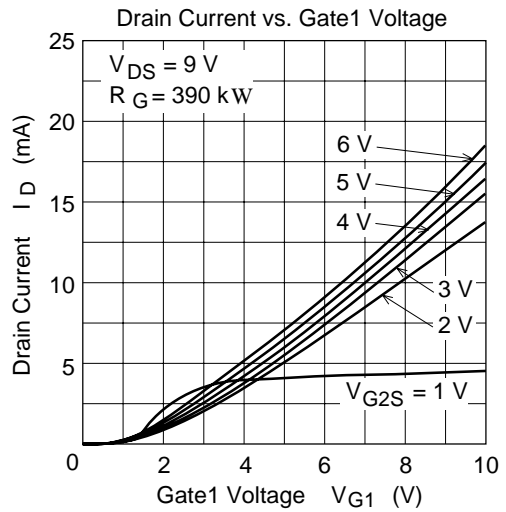
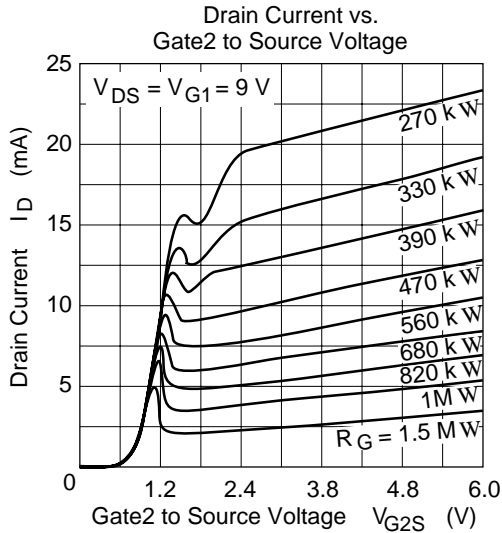
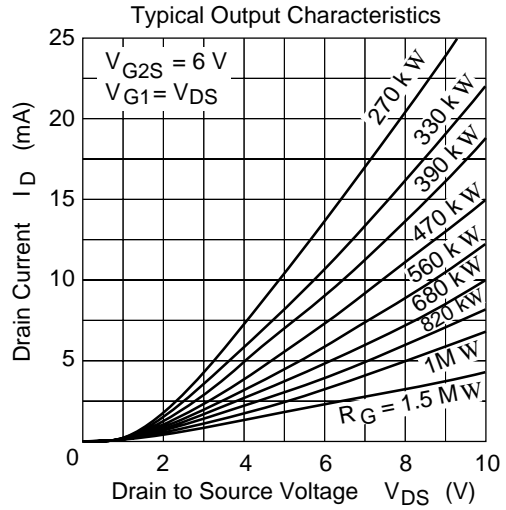
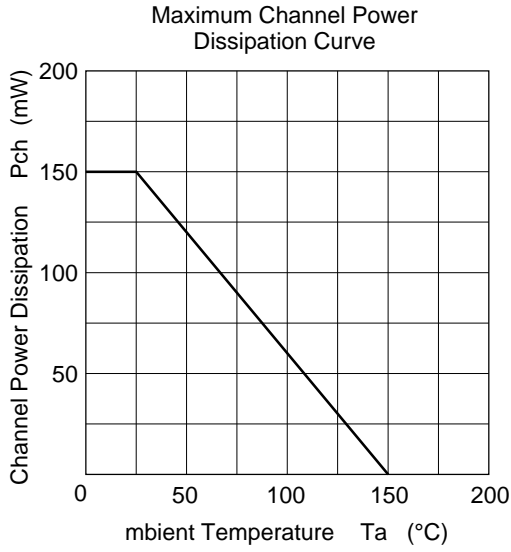


Power Gain, Noise Figure Test Circuit

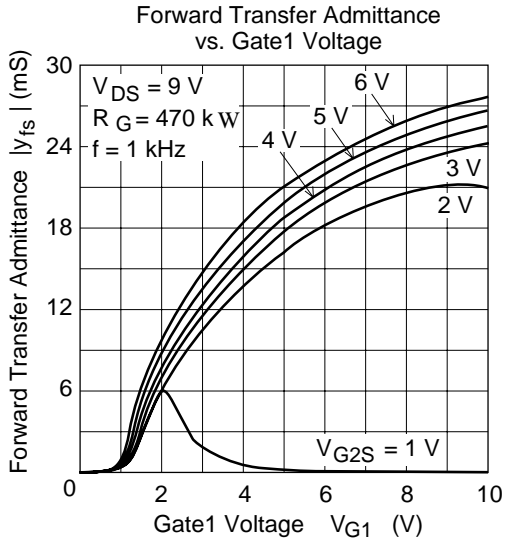
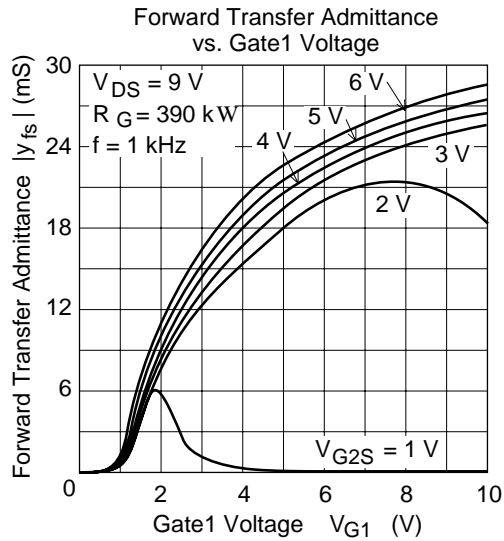
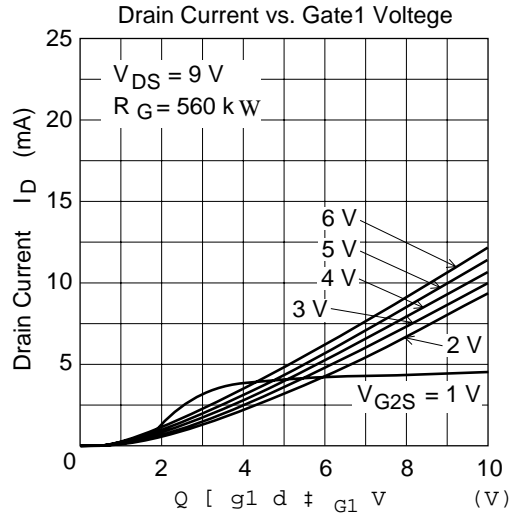
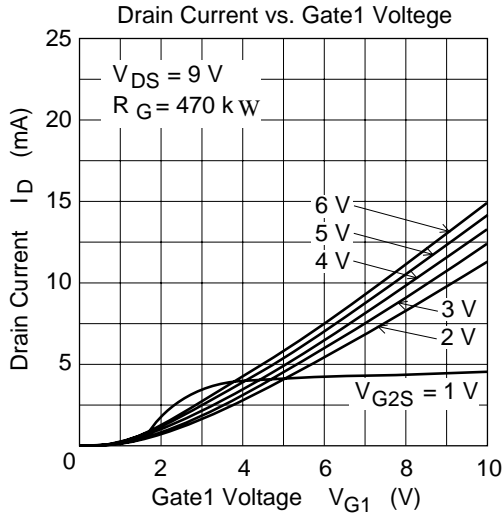


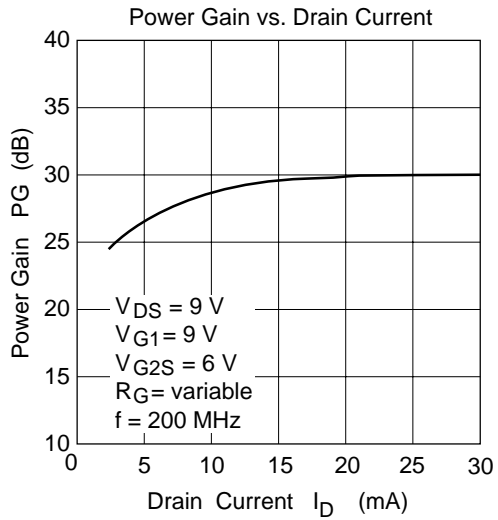
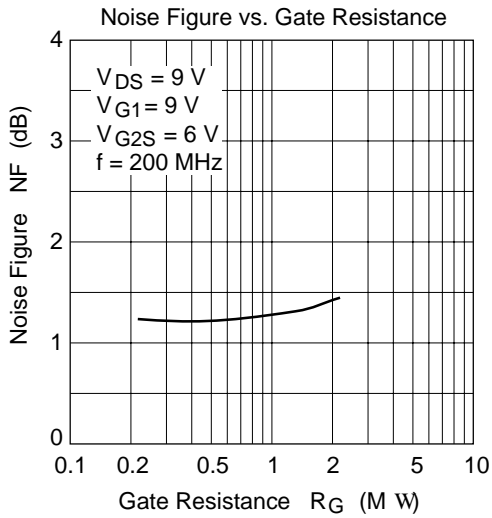
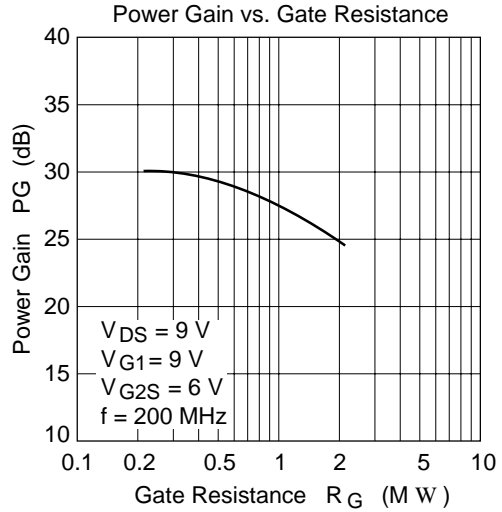
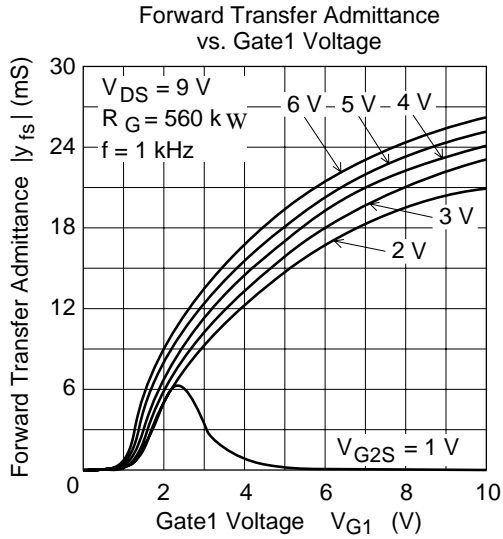
Unit @Resistance @(Ω)
@ @ Capacitance @(F)

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

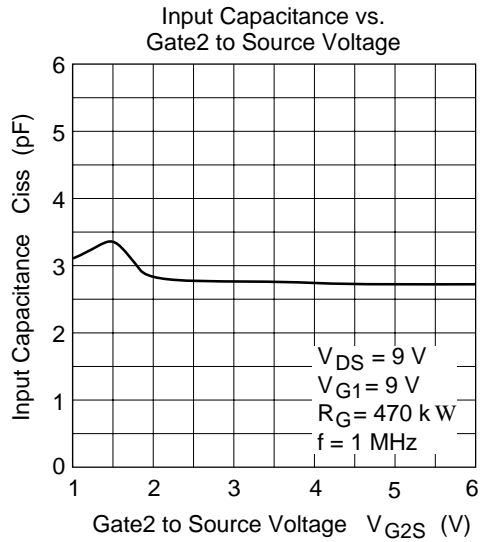
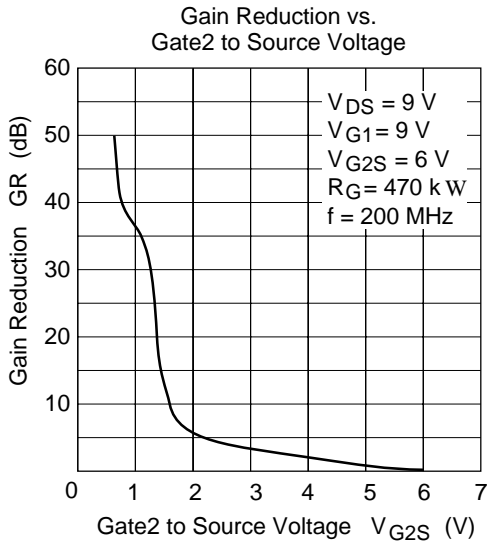
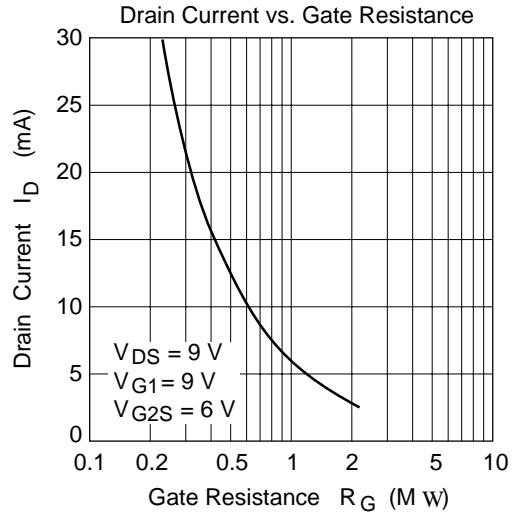
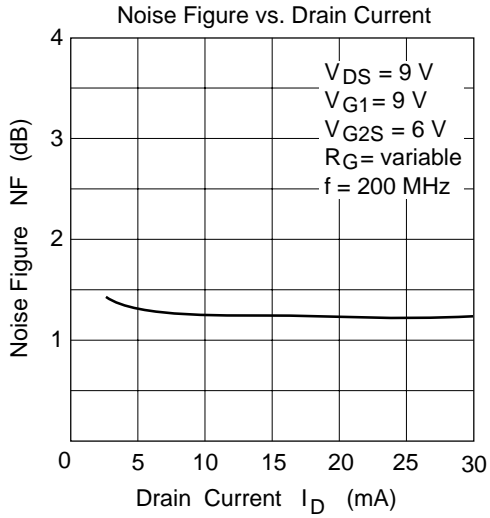


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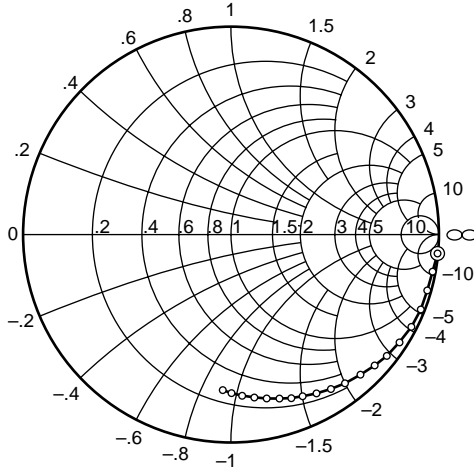




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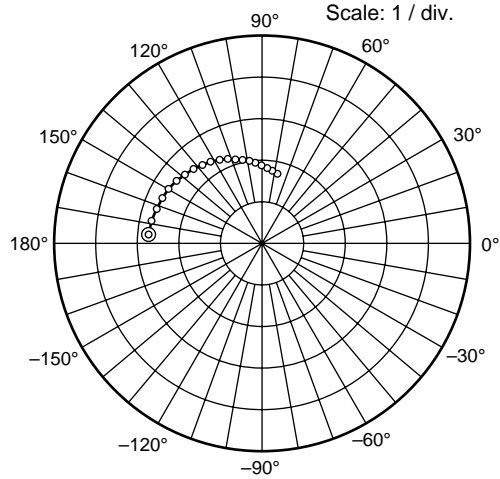


S11 Parameter vs. Frequency



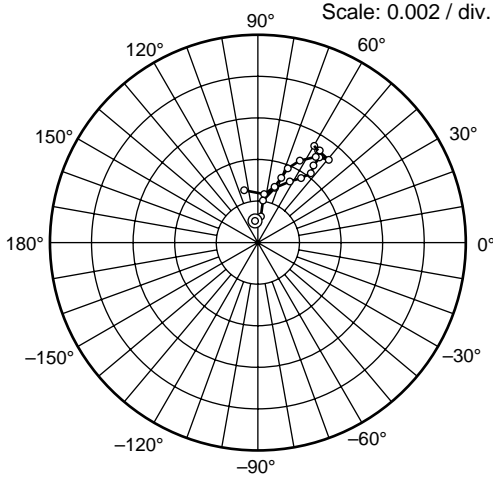
Test Condition : $V_{DS} = 9\text{ V}$, $V_{G1} = 9\text{ V}$
 $V_{G2S} = 6\text{ V}$, $R_G = 470\text{ k}\Omega$
 50 ~ 1000 MHz (50 MHz step)

S21 Parameter vs. Frequency



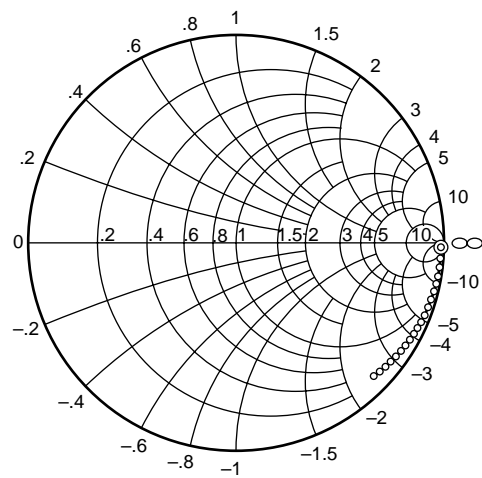
Test Condition : $V_{DS} = 9\text{ V}$, $V_{G1} = 9\text{ V}$
 $V_{G2S} = 6\text{ V}$, $R_G = 470\text{ k}\Omega$
 50 ~ 1000 MHz (50 MHz step)

S12 Parameter vs. Frequency



Test Condition : $V_{DS} = 9\text{ V}$, $V_{G1} = 9\text{ V}$
 $V_{G2S} = 6\text{ V}$, $R_G = 470\text{ k}\Omega$
 50 ~ 1000 MHz (50 MHz step)

S22 Parameter vs. Frequency



Test Condition : $V_{DS} = 9\text{ V}$, $V_{G1} = 9\text{ V}$
 $V_{G2S} = 6\text{ V}$, $R_G = 470\text{ k}\Omega$
 50 ~ 1000 MHz (50 MHz step)

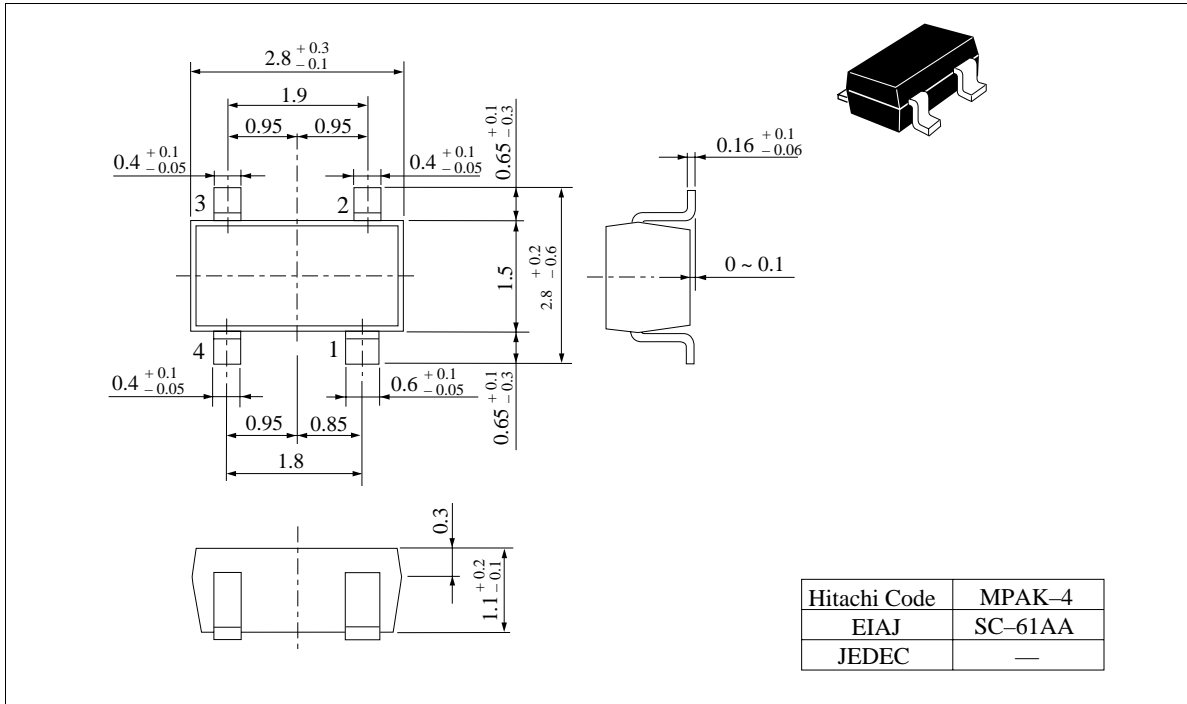
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Sparameter ($V_{DS} = V_{G1} = 9V$, $V_{G2S} = 6V$, $R_G = 470k\Omega$, $Z_o = 50\Omega$)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
50	0.996	-5.3	2.74	174.0	0.00096	98.6	0.985	-1.9
100	0.993	-10.9	2.73	168.0	0.00130	84.4	0.991	-4.5
150	0.987	-16.6	2.68	162.3	0.00203	83.6	0.990	-6.5
200	0.978	-21.9	2.66	156.3	0.00285	72.3	0.988	-9.4
250	0.972	-27.4	2.63	150.4	0.00335	69.7	0.985	-11.6
300	0.954	-33.2	2.57	144.3	0.00385	68.3	0.982	-14.0
350	0.943	-38.2	2.50	138.7	0.00455	63.2	0.979	-16.2
400	0.925	-43.2	2.43	133.3	0.00488	55.4	0.975	-18.4
450	0.910	-48.0	2.37	128.0	0.00526	59.8	0.971	-21.0
500	0.893	-52.5	2.30	122.6	0.00522	56.1	0.967	-23.0
550	0.880	-57.4	2.24	117.5	0.00498	53.2	0.962	-25.2
600	0.861	-62.1	2.17	112.7	0.00512	49.1	0.957	-27.3
650	0.847	-66.1	2.10	108.1	0.00497	53.4	0.952	-29.4
700	0.829	-69.9	2.02	103.6	0.00455	53.6	0.947	-31.6
750	0.816	-74.1	1.96	99.1	0.00418	51.6	0.943	-33.7
800	0.804	-78.2	1.91	94.8	0.00372	55.7	0.937	-35.8
850	0.791	-82.4	1.85	80.4	0.00329	62.4	0.933	-38.0
900	0.779	-86.1	1.79	86.3	0.00275	73.0	0.928	-40.0
950	0.764	-89.5	1.73	82.2	0.00233	82.4	0.921	-42.1
1000	0.753	-92.4	1.68	78.3	0.00258	105.1	0.918	-44.2

Package Dimensions

Unit: mm



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