

BB601M

Build in Biasing Circuit MOS FET IC
UHF RF Amplifier

HITACHI

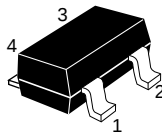
ADE-208-702C (Z)
4th. Edition
Nov. 1998

Features

- Build in Biasing Circuit; To reduce using parts cost & PC board space.
- High gain;
PG = 21.5 dB typ. at $f = 900$ MHz
- Low noise;
NF = 1.85 dB typ. at $f = 900$ 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 packages; MPAK-4R(SOT-143mod)

Outline

MPAK-4R



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

Notes: 1. Marking is "AT-".
2. BB601M is individual type number of HITACHI BBFET.

Absolute Maximum Ratings (Ta = 25°C)

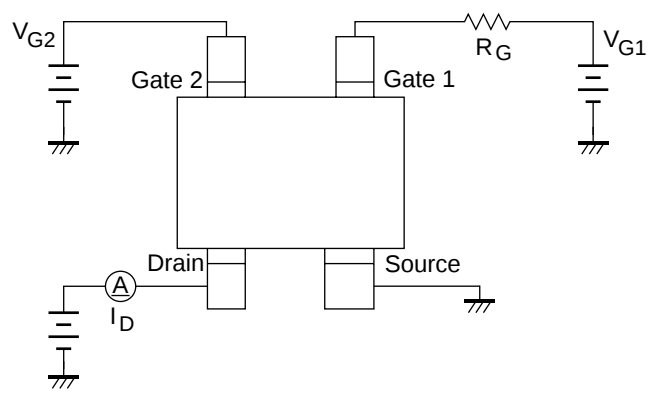
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	6	V
Gate1 to source voltage	V_{G1S}	+6 – 0	V
Gate2 to source voltage	V_{G2S}	+6 – 0	V
Drain current	I_D	20	mA
Channel power dissipation	Pch	150	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics (Ta = 25°C)

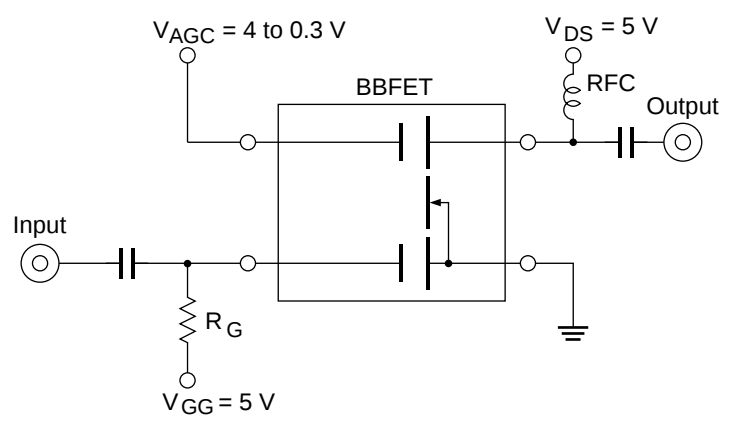
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	6	—	—	V	$I_D = 200\mu A$ $V_{G1S} = V_{G2S} = 0$
Gate1 to source breakdown voltage	$V_{(BR)G1SS}$	+6	—	—	V	$I_{G1} = +10\mu A$ $V_{G2S} = V_{DS} = 0$
Gate2 to source breakdown voltage	$V_{(BR)G2SS}$	+6	—	—	V	$I_{G2} = +10\mu A$ $V_{G1S} = V_{DS} = 0$
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	$I_{D(op)}$	7	10	13	mA	$V_{DS} = 5V, V_{G1} = 5V$ $V_{G2S} = 4V, R_G = 47k\Omega$
Forward transfer admittance	$ y_{fs} $	19	24	29	mS	$V_{DS} = 5V, V_{G1} = 5V$ $V_{G2S} = 4V$ $R_G = 47k\Omega, f = 1kHz$
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	$V_{G2S} = 4V, R_G = 47k\Omega$
Reverse transfer capacitance	C_{rss}	—	0.019	0.04	pF	$f = 1MHz$
Power gain	PG	17	21.5	—	dB	$V_{DS} = 5V, V_{G1} = 5V$ $V_{G2S} = 4V, R_G = 47k\Omega$
Noise figure	NF	—	1.85	2.4	dB	$f = 900MHz$

Main Characteristics

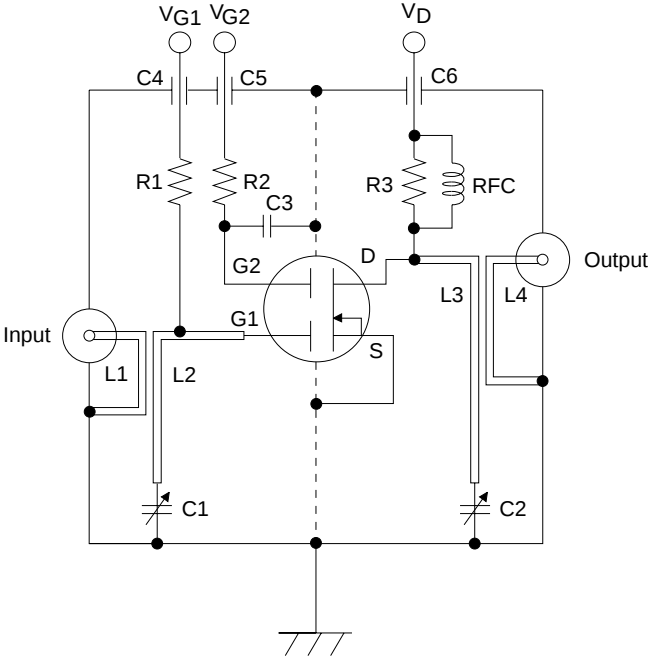
Test Circuit for Operating Items ($I_{D(op)}$, $|y_{fs}|$, C_{iss} , C_{oss} , C_{rss} , NF, PG)



Application Circuit

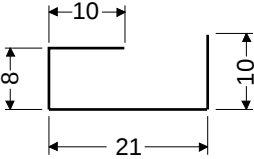


900MHz Power Gain, Noise Test Circuit

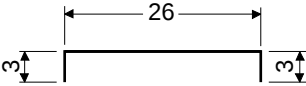


- C1, C2: Variable Capacitor (10pF MAX)
C3: Disk Capacitor (1000pF)
C4 — C6: Air Capacitor (1000pF)
R1: 47 k Ω
R2: 47 k Ω
R3: 4.7 k Ω

L1:

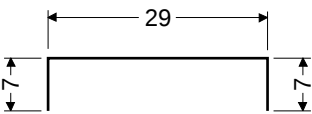


L2:

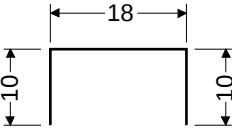


(ϕ 1mm Copper wire)
Unit: mm

L3:

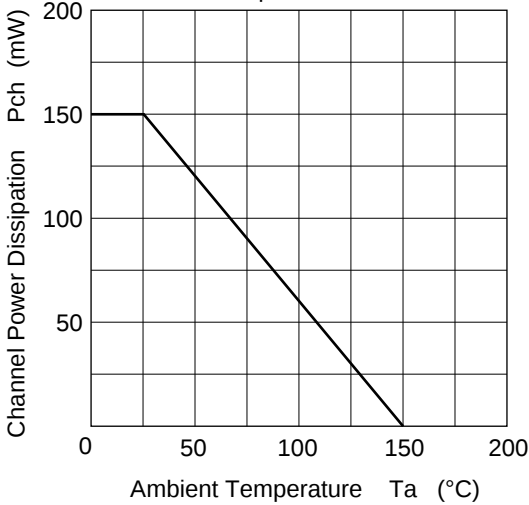


L4:

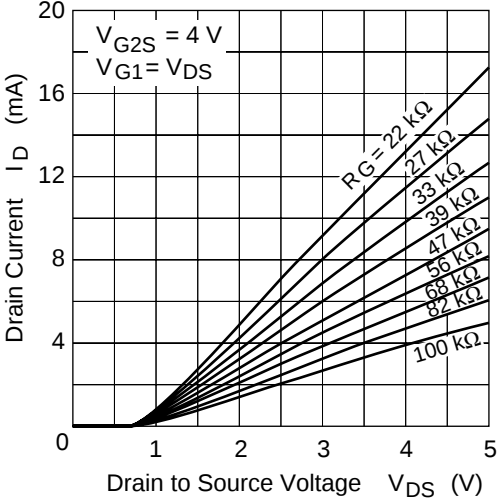


RFC: ϕ 1mm Copper wire with enamel 4turns inside dia 6mm

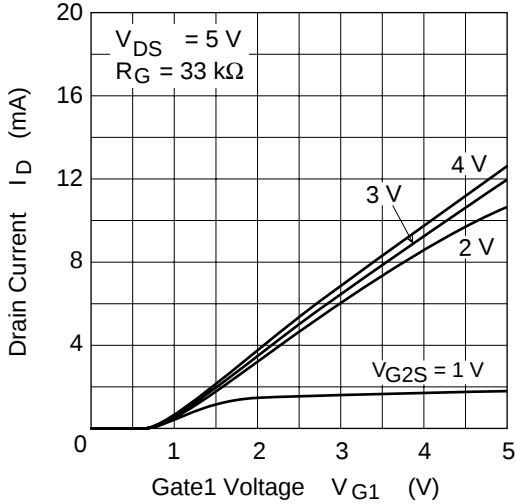
Maximum Channel Power
Dissipation Curve



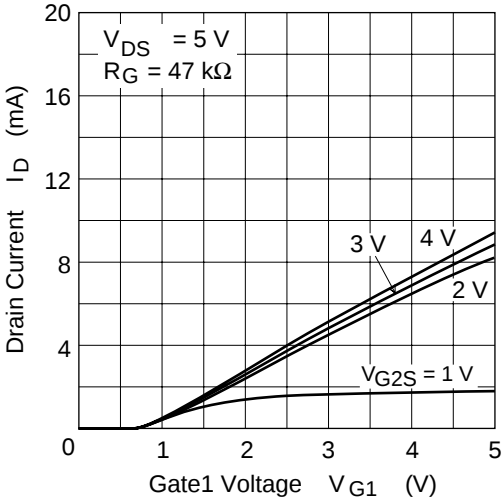
Typical Output Characteristics

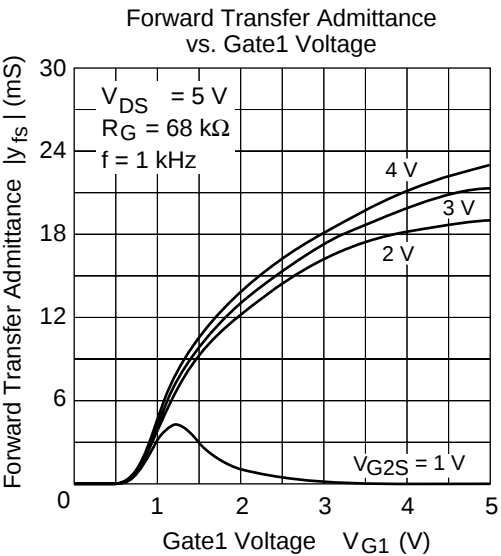
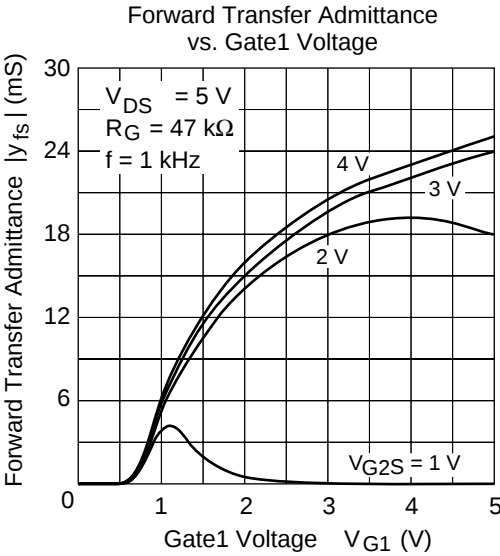
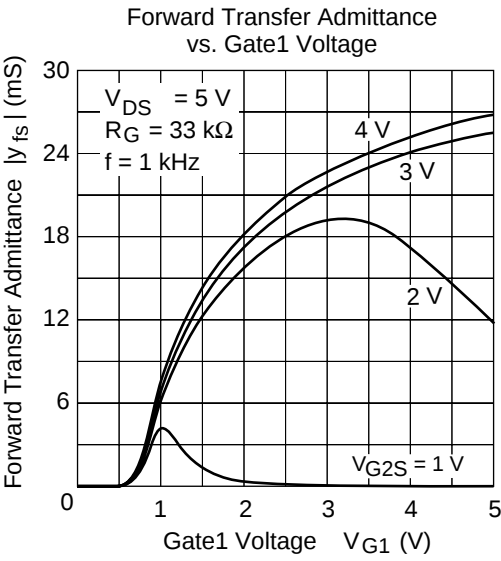
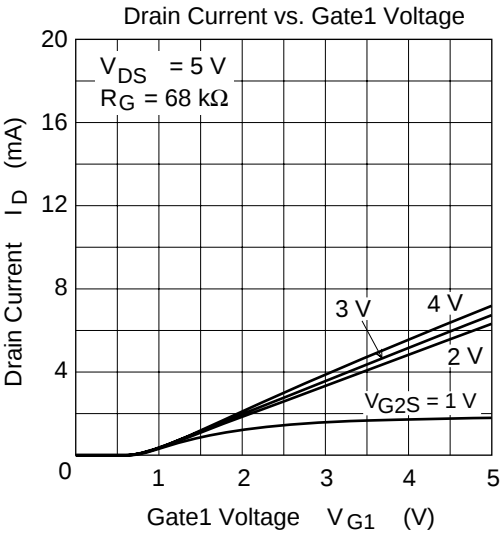


Drain Current vs. Gate1 Voltage

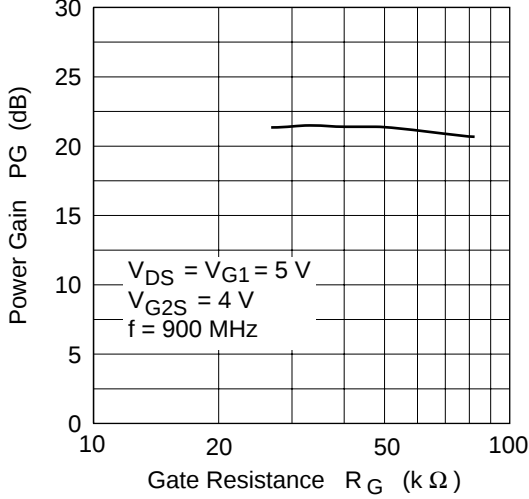


Drain Current vs. Gate1 Voltage

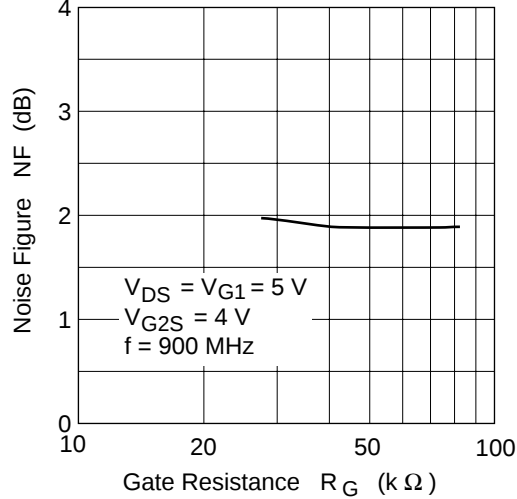




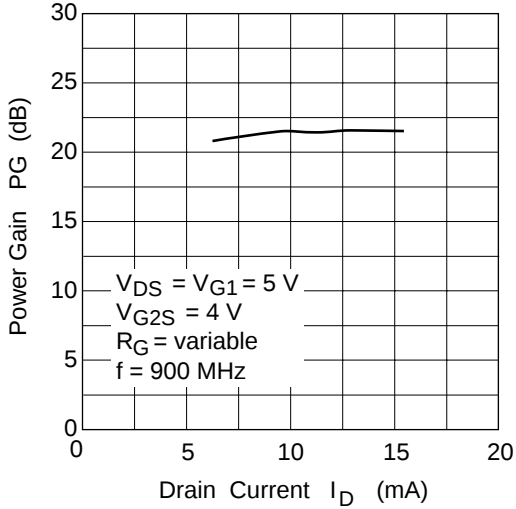
Power Gain vs. Gate Resistance



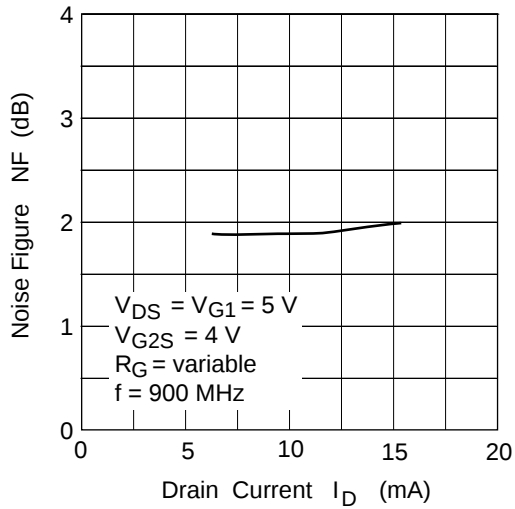
Noise Figure vs. Gate Resistance

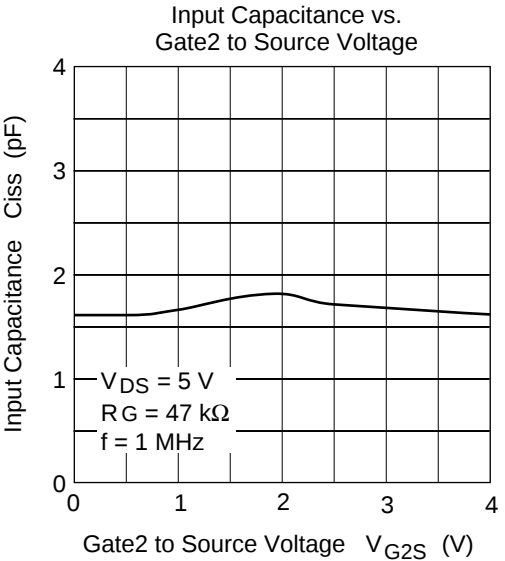
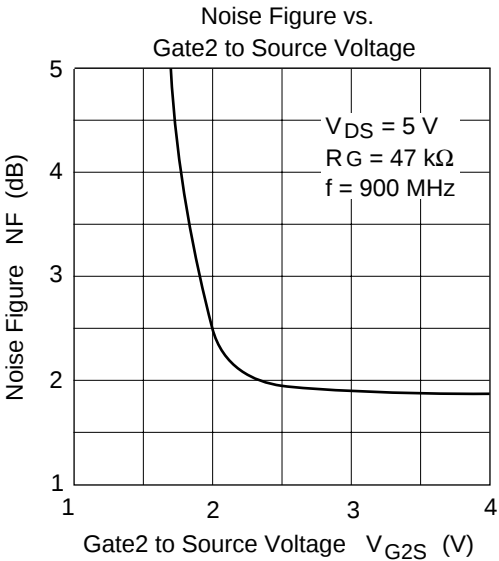
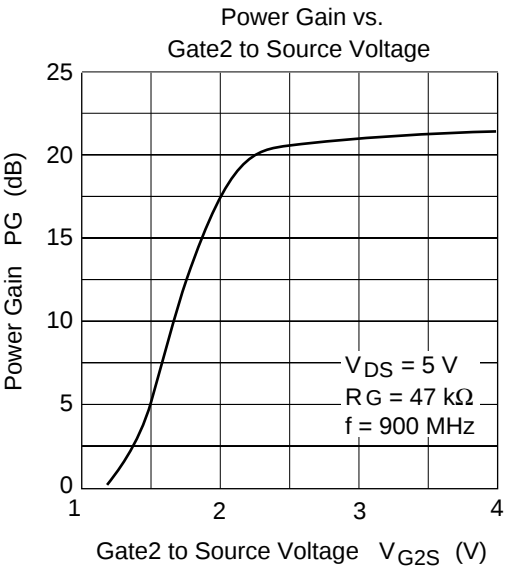
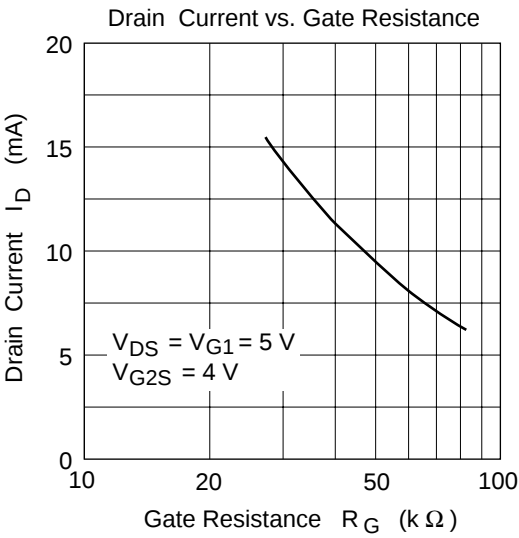


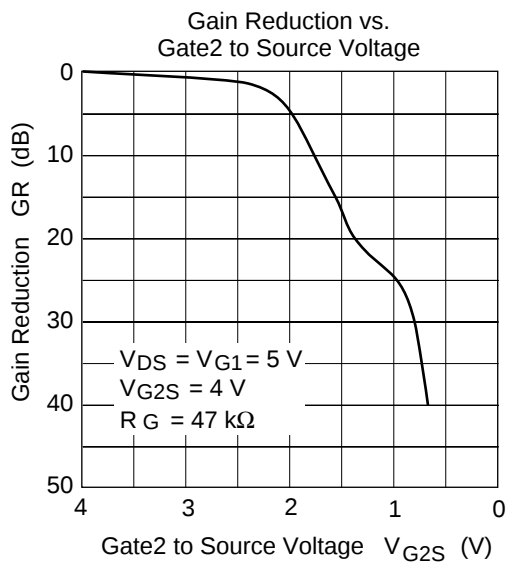
Power Gain vs. Drain Current



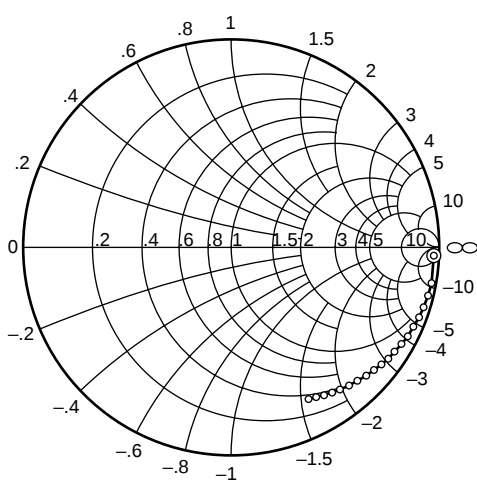
Noise Figure vs. Drain Current







S11 Parameter vs. Frequency

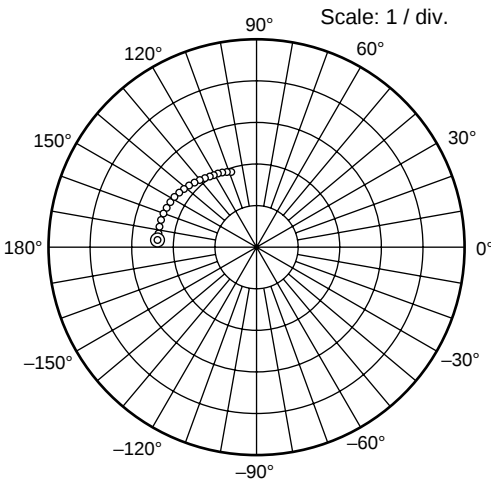


Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 47\text{ k}\Omega$,
 $Z_0 = 50\text{ }\Omega$

50 — 1000 MHz (50 MHz step)



S21 Parameter vs. Frequency

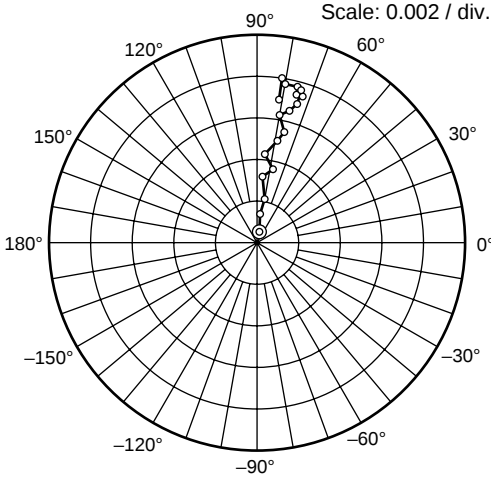


Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 47\text{ k}\Omega$,
 $Z_0 = 50\text{ }\Omega$

50 — 1000 MHz (50 MHz step)



S12 Parameter vs. Frequency

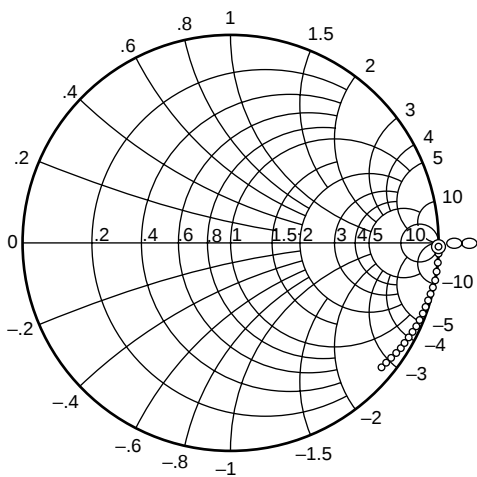


Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 47\text{ k}\Omega$,
 $Z_0 = 50\text{ }\Omega$

50 — 1000 MHz (50 MHz step)



S22 Parameter vs. Frequency



Test Condition: $V_{DS} = 5\text{ V}$, $V_{G1} = 5\text{ V}$
 $V_{G2S} = 4\text{ V}$, $R_G = 47\text{ k}\Omega$,
 $Z_0 = 50\text{ }\Omega$

50 — 1000 MHz (50 MHz step)

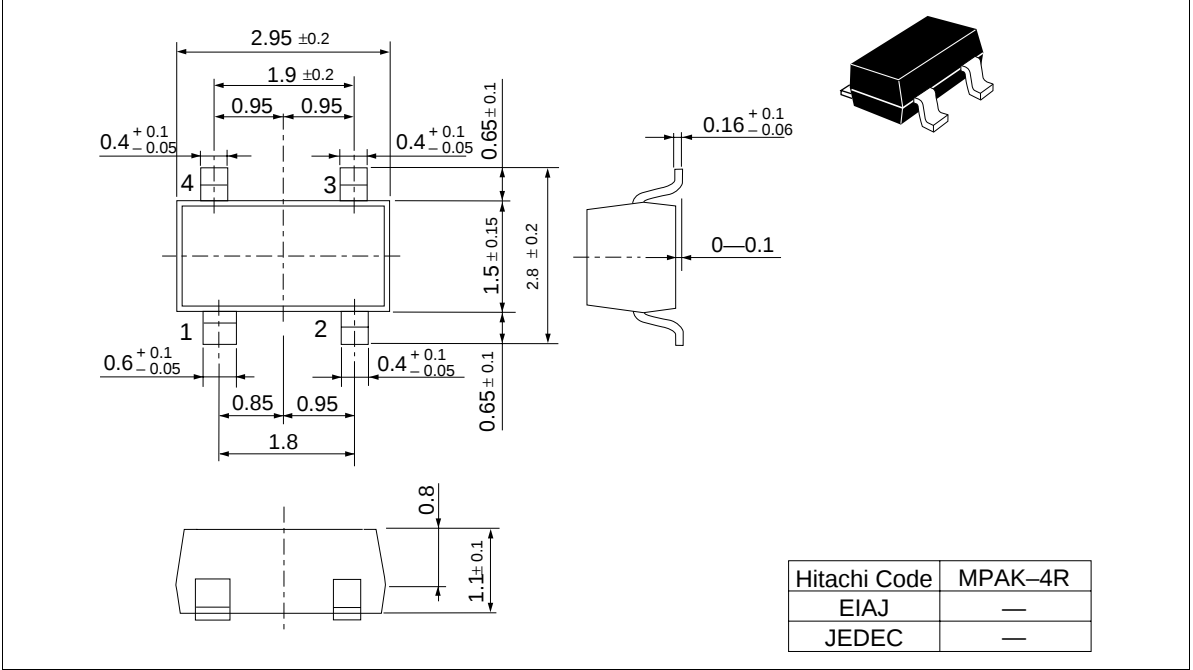


Sparameter ($V_{DS} = V_{G1} = 5V$, $V_{G2S} = 4V$, $R_G = 47k\Omega$, $Z_0 = 50\Omega$)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
50	0.974	-2.8	2.40	176.4	0.00057	78.1	0.997	-2.0
100	0.974	-10.0	2.38	172.2	0.00144	82.4	0.998	-4.2
150	0.974	-13.6	2.38	168.4	0.00211	78.7	0.997	-6.0
200	0.965	-16.5	2.37	164.1	0.00316	84.8	0.995	-8.1
250	0.963	-20.0	2.35	160.4	0.00358	76.3	0.994	-10.2
300	0.953	-23.7	2.32	156.8	0.00431	84.0	0.992	-12.2
350	0.947	-26.8	2.30	152.9	0.00503	79.0	0.990	-14.2
400	0.942	-29.6	2.28	148.6	0.00545	76.6	0.987	-16.2
450	0.929	-32.8	2.26	144.9	0.00630	80.3	0.984	-18.1
500	0.923	-35.4	2.21	141.2	0.00646	76.1	0.981	-20.2
550	0.912	-38.5	2.19	137.6	0.00693	73.7	0.977	-22.1
600	0.903	-41.2	2.15	134.2	0.00732	72.9	0.974	-24.1
650	0.886	-44.2	2.12	130.6	0.00729	74.6	0.971	-26.0
700	0.879	-46.8	2.08	127.4	0.00733	72.0	0.967	-27.8
750	0.873	-49.2	2.06	124.3	0.00762	74.5	0.962	-29.7
800	0.859	-52.4	2.03	120.8	0.00756	73.7	0.959	-31.7
850	0.846	-55.4	2.00	117.3	0.00772	75.5	0.955	-33.6
900	0.836	-58.0	1.96	114.3	0.00775	79.6	0.951	-35.5
950	0.827	-60.4	1.93	111.0	0.00801	81.7	0.946	-37.3
1000	0.815	-62.8	1.89	108.0	0.00704	81.0	0.942	-39.4

Package Dimensions

Unit: mm



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