2SK3001

GaAs HEMT
Low Noise Amplifier

HITACHI

ADE-208-597(Z)
1st. Edition
December 1997

Features

- Excellent low noise characteristics.
  Fmin = 0.8 dB typ. (3 V, 5 mA, 0.9 GHz)
- High associated gain.
  Ga = 18 dB typ. (3 V, 5 mA, 0.9 GHz)
- Small package. (CMPAK-4)

Outline

CMPAK-4

1. Source
2. Gate
3. Source
4. Drain

This document may, wholly or partially, be subject to change without notice.

This Device is sensitive to Electro Static Discharge.
It is recommended to adopt appropriate cautions when handling this transistor.

CAUTION
This product use GaAs. Since dust or fume of GaAs is highly poisonous to human body, please do not treat them mechanically in the manner which might expose to the Air. And it should never be thrown out with general industrial or domestic wastes.

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

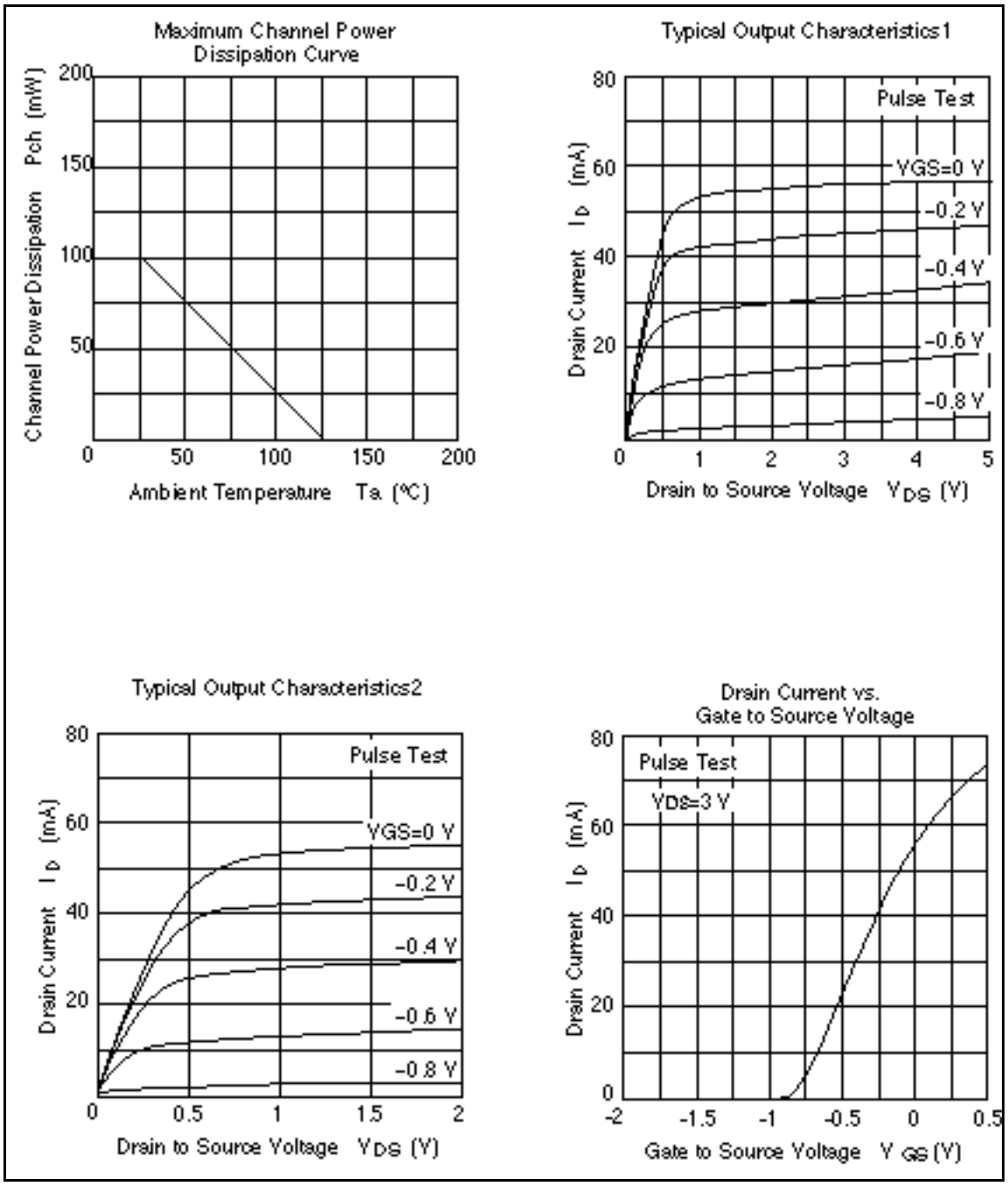
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	6	V
Gate to source voltage	V_{GSO}	–4	V
Gate to drain voltage	V_{GDO}	–4	V
Drain current	I_D	20	mA
Channel dissipation	Pch	100	mW
Channel temperature	Tch	125	°C
Storage temperature	Tstg	–55 to +125	°C

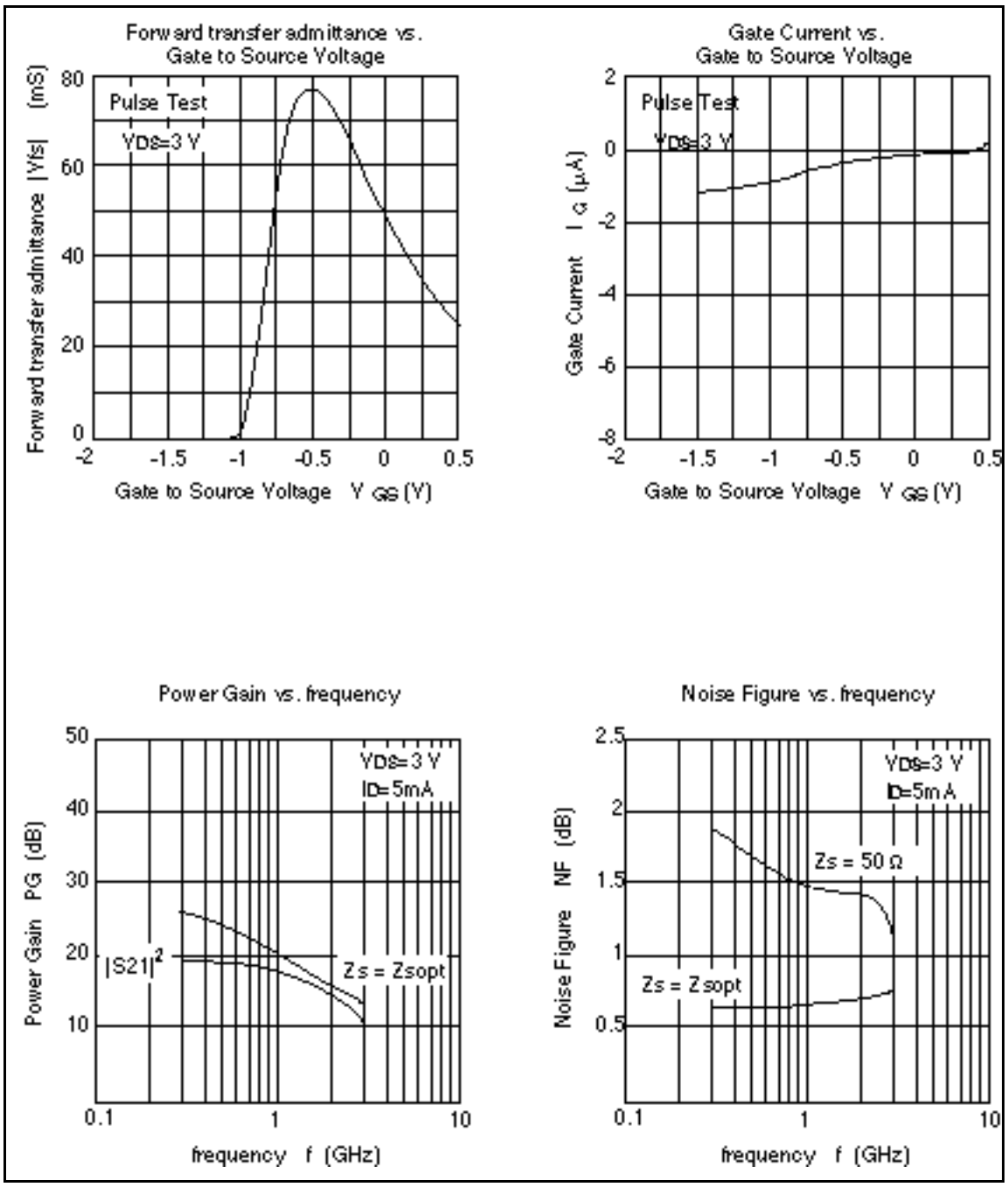
Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Gate to source leak current	I_{GSS}	—	—	–20	µA	V_{GS} = –4 V, V_{DS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	–0.5	—	–1.5	V	V_{DS} = 3V, I_D = 100 µA
Drain to source current	I_{DSS}	35	50	70	mA	V_{DS} = 3 V, V_{GS} = 0 Pulse test
Forward transfer admittance	$\|y_{fs}\|$	40	60	—	mS	V_{DS} = 3 V, I_D =10 mA f = 1 kHz
Power Gain	PG	15.0	18.0	—	dB	V_{DS} = 3 V, I_D = 5 mA f = 0.9 GHz
Noise Figure	NF	—	0.8	1.2	dB	
Associated gain	Ga	—	21.0	—	dB	V_{DS} = 3 V, I_D = 5 mA f = 0.8 Ghz, Zs =Zsopt
Minimum noise figure	Fmin	—	0.7	—	dB	
Associated gain	Ga	—	16.0	—	dB	V_{DS} = 3 V, I_D = 5 mA f = 1.8 Ghz, Zs = Zsopt
Minimum noise figure	Fmin	—	0.75	—	dB	

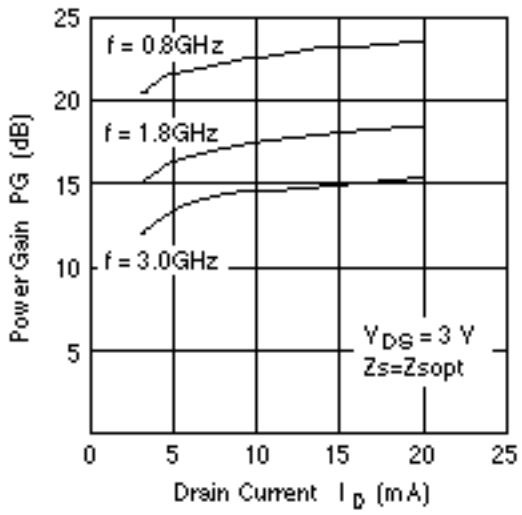
Note: Marking of 2SK3001 is “YX–”

Main Characteristics

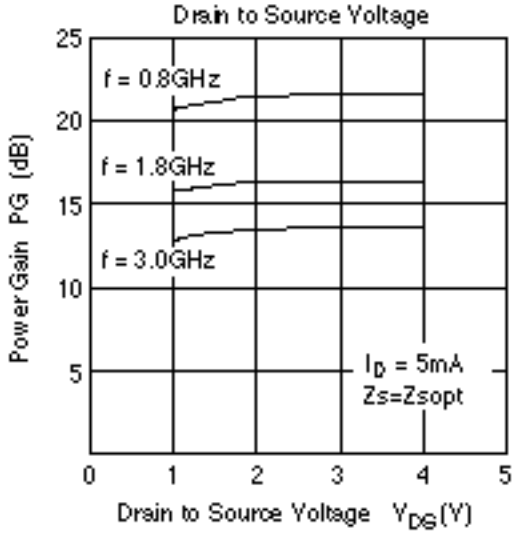



Forward transfer admittance vs.
Gate to Source Voltage
Pulse Test
VDS=3 V
Forward transfer admittance |Yfs| (mS)
Gate to Source Voltage V GS (V)
Gate Current vs.
Gate to Source Voltage
Pulse Test
VDS=3 V
Gate Current I G (µA)
Gate to Source Voltage V GS (V)
Power Gain vs. frequency
VDS=3 V
ID=5mA
|S21|2
Zs = Zsopt
Power Gain PG (dB)
frequency f (GHz)
Noise Figure vs. frequency
VDS=3 V
ID=5mA
Zs = 50 Ω
Zs = Zsopt
Noise Figure NF (dB)
frequency f (GHz)

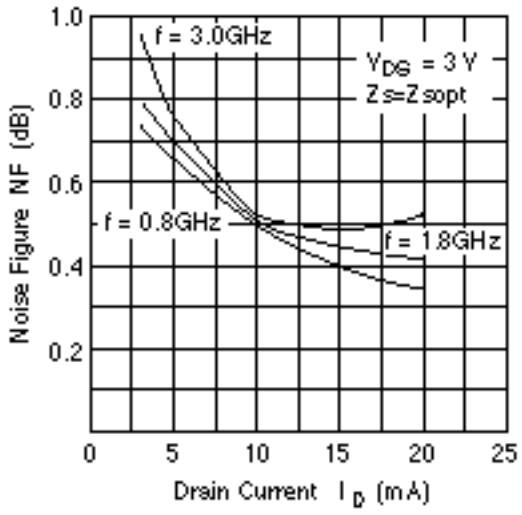
Power Gain vs. Drain Current



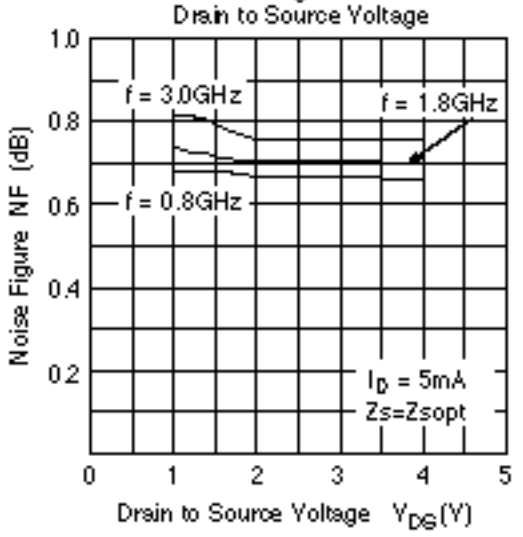
Power Gain vs.
Drain to Source Voltage



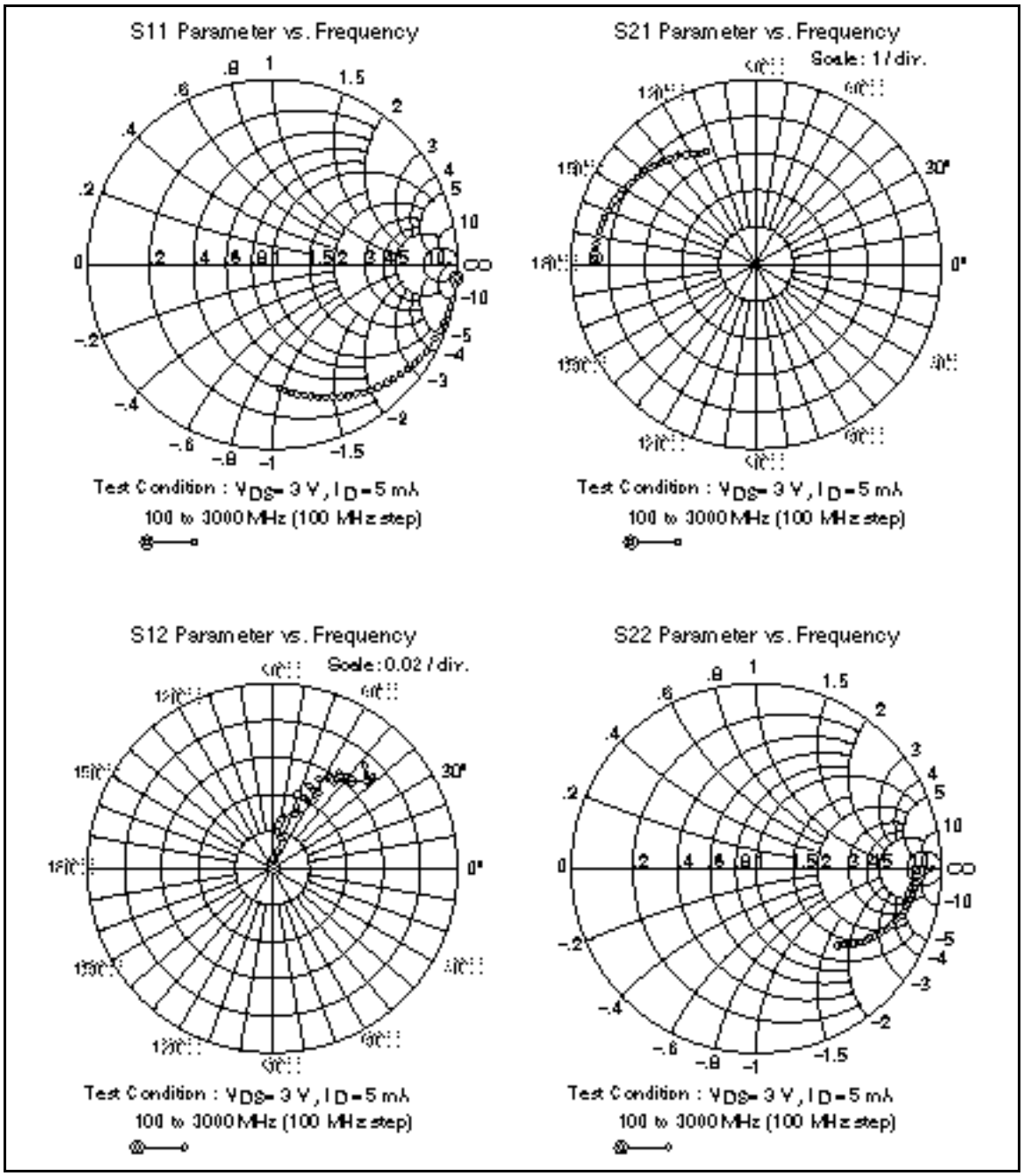
Noise Figure vs. Drain Current



Noise Figure vs.
Drain to Source Voltage



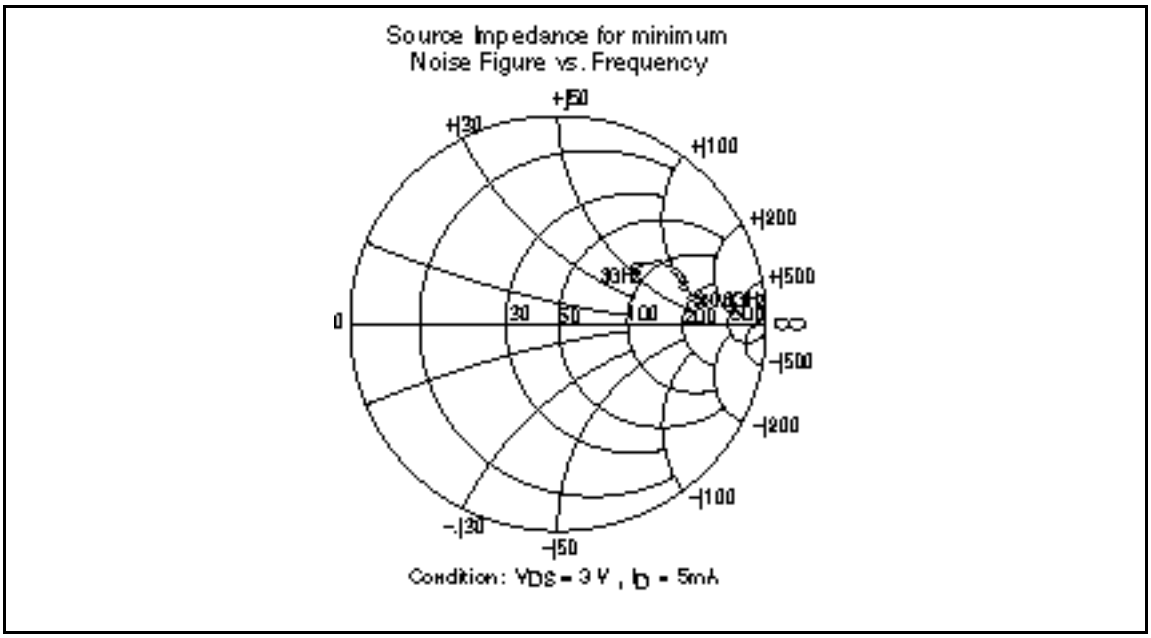
Sparameter (Smith Plot Zo=50W)



Sparameter (V_{DS} = 3 V, I_D = 5 mA, Zo = 50 Ω)

Freq (GHz)	S11 (Mag)	S11 (Ang)	S21 (Mag)	S21 (Ang)	S12 (Mag)	S12 (Ang)	S22 (Mag)	S22 (Ang)
0.1	0.998	–4.1	4.4	177.6	0.001	49.2	0.875	–1.2
0.2	0.995	–6.5	4.4	175.1	0.005	86.3	0.869	–3.1
0.3	0.993	–10.9	4.4	172.6	0.010	75.2	0.869	–5.1
0.4	0.990	–13.4	4.3	170.2	0.017	73.6	0.863	–6.7
0.5	0.989	–14.5	4.3	169.1	0.015	82.9	0.865	–7.1
0.6	0.981	–17.0	4.3	166.3	0.020	81.6	0.859	–9.0
0.7	0.976	–20.0	4.3	163.9	0.026	73.7	0.856	–10.6
0.8	0.965	–23.5	4.3	161.4	0.025	74.3	0.851	–12.1
0.9	0.956	–28.2	4.2	159.0	0.032	76.5	0.834	–14.0
1.0	0.949	–31.1	4.2	156.4	0.029	75.2	0.837	–15.4
1.1	0.942	–33.9	4.2	154.3	0.036	65.0	0.830	–16.8
1.2	0.930	–36.3	4.1	152.0	0.039	67.0	0.819	–18.4
1.3	0.918	–39.5	4.1	149.6	0.037	65.4	0.810	–20.1
1.4	0.903	–42.2	4.0	147.4	0.042	61.2	0.800	–21.8
1.5	0.895	–44.8	4.0	145.1	0.045	65.9	0.789	–23.1
1.6	0.882	–47.8	3.9	143.1	0.046	60.5	0.779	–24.4
1.7	0.869	–50.9	4.0	140.7	0.053	61.8	0.768	–26.0
1.8	0.856	–53.3	3.9	138.3	0.056	57.4	0.753	–27.2
1.9	0.843	–55.6	3.8	136.7	0.055	56.8	0.747	–28.7
2.0	0.826	–59.0	3.9	133.9	0.059	53.8	0.736	–30.4
2.1	0.814	–61.8	3.8	132.3	0.059	52.9	0.720	–31.5
2.2	0.800	–64.0	3.7	130.0	0.062	48.2	0.710	–32.6
2.3	0.785	–67.0	3.7	128.1	0.059	51.5	0.700	–34.4
2.4	0.767	–69.8	3.6	126.8	0.063	48.5	0.692	–35.4
2.5	0.751	–72.4	3.6	123.5	0.065	47.6	0.676	–36.7
2.6	0.742	–75.0	3.5	123.3	0.065	47.4	0.661	–37.9
2.7	0.719	–78.3	3.5	120.0	0.063	48.7	0.652	–39.2
2.8	0.710	–80.3	3.4	118.9	0.074	46.7	0.645	–40.0
2.9	0.689	–82.8	3.3	116.9	0.070	41.0	0.630	–41.4
3.0	0.675	–85.6	3.4	116.0	0.074	41.8	0.618	–43.7

Γoptimize (V_{DS} = 3 V, I_D = 5mA)

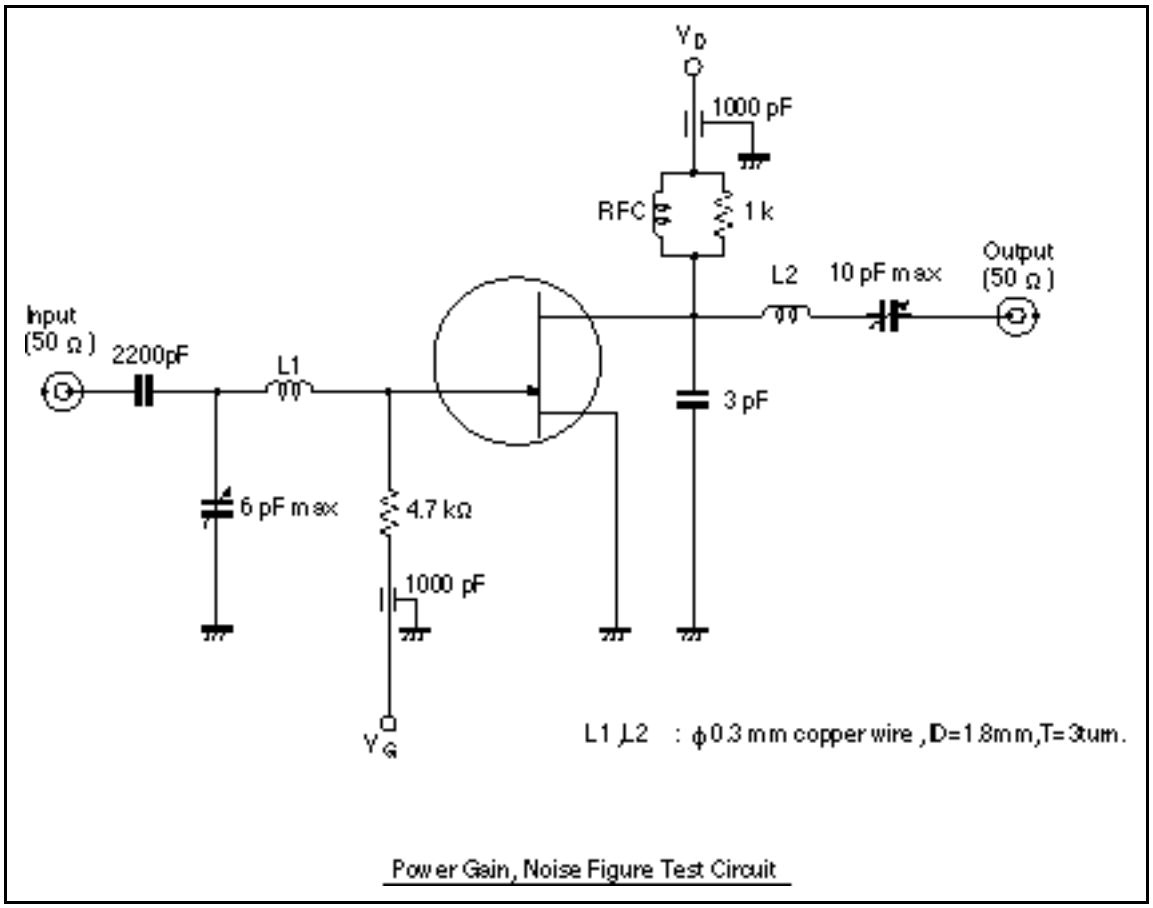


Noise parameter (V_{DS} = 3 V, I_D = 5 mA)

Freq (GHz)	Fmin[*1] (dB)	Ga (dB)	Gopt (Mag)	Gopt (Ang)	RN (Ω)	NF 50Ω[*2] (dB)	|S21|2[*2] (dB)	|S21|[*2] –
0.8	0.67	21.7	0.69	8.8	19.1	1.53	18.2	4.26
0.9	0.67	21.0	0.68	9.8	18.7	1.50	18.0	4.24
1.0	0.67	20.3	0.66	10.7	18.4	1.48	17.5	4.19
1.5	0.69	17.6	0.64	15.7	17.5	1.44	16.0	3.99
1.7	0.70	16.8	0.64	17.8	17.4	1.44	15.3	3.92
1.8	0.71	16.4	0.64	18.9	17.3	1.44	15.0	3.88
1.9	0.71	16.1	0.64	20.1	17.1	1.44	14.8	3.85
2.0	0.72	15.8	0.64	21.3	17.0	1.44	14.2	3.76
2.2	0.72	15.2	0.63	23.8	16.6	1.43	13.6	3.69
2.5	0.74	14.6	0.60	28.1	15.6	1.37	12.3	3.50
2.7	0.74	14.2	0.56	31.3	14.6	1.30	11.9	3.44
3.0	0.76	13.6	0.47	36.7	12.6	1.15	11.1	3.33

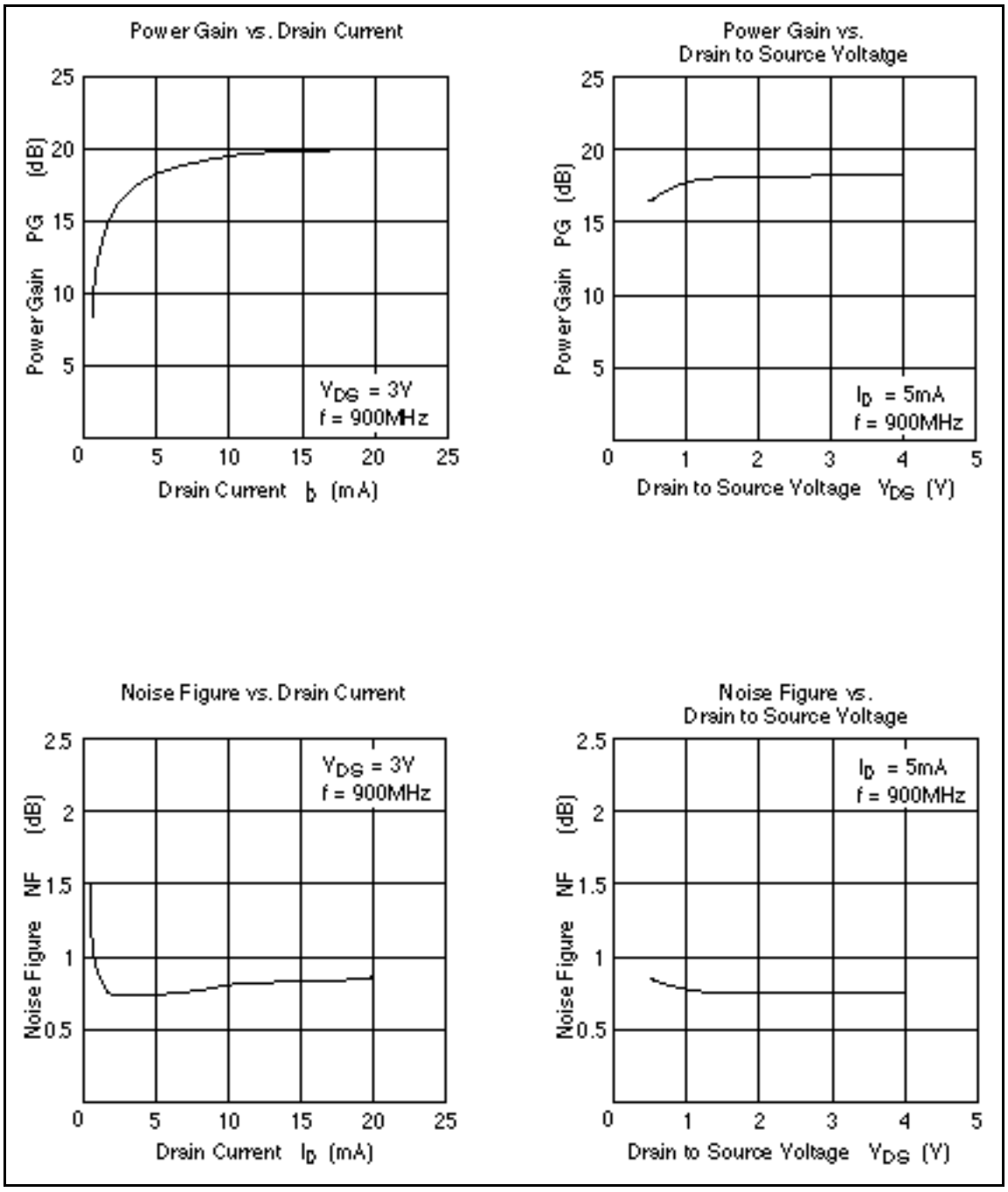
note 1. Input matched for minimum noise figure, Output for maximum gain.
2. Zs = ZL = 50 Ω

Test Fixture (f = 0.9 GHz)

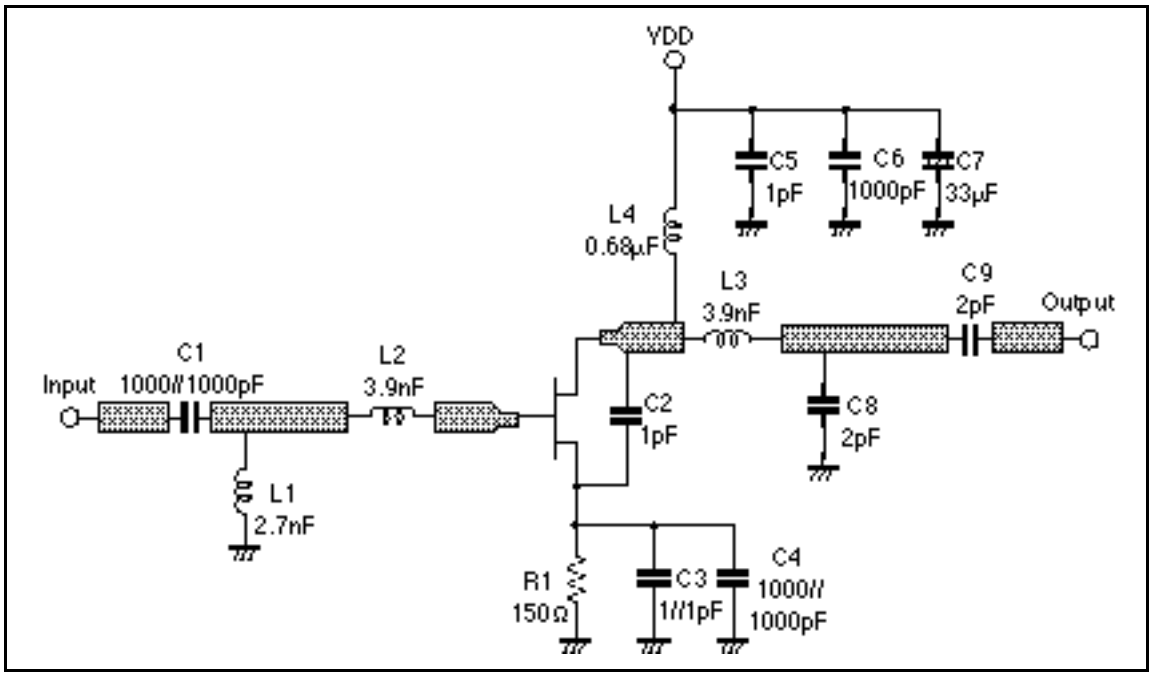


Power Gain, Noise Figure Test Circuit

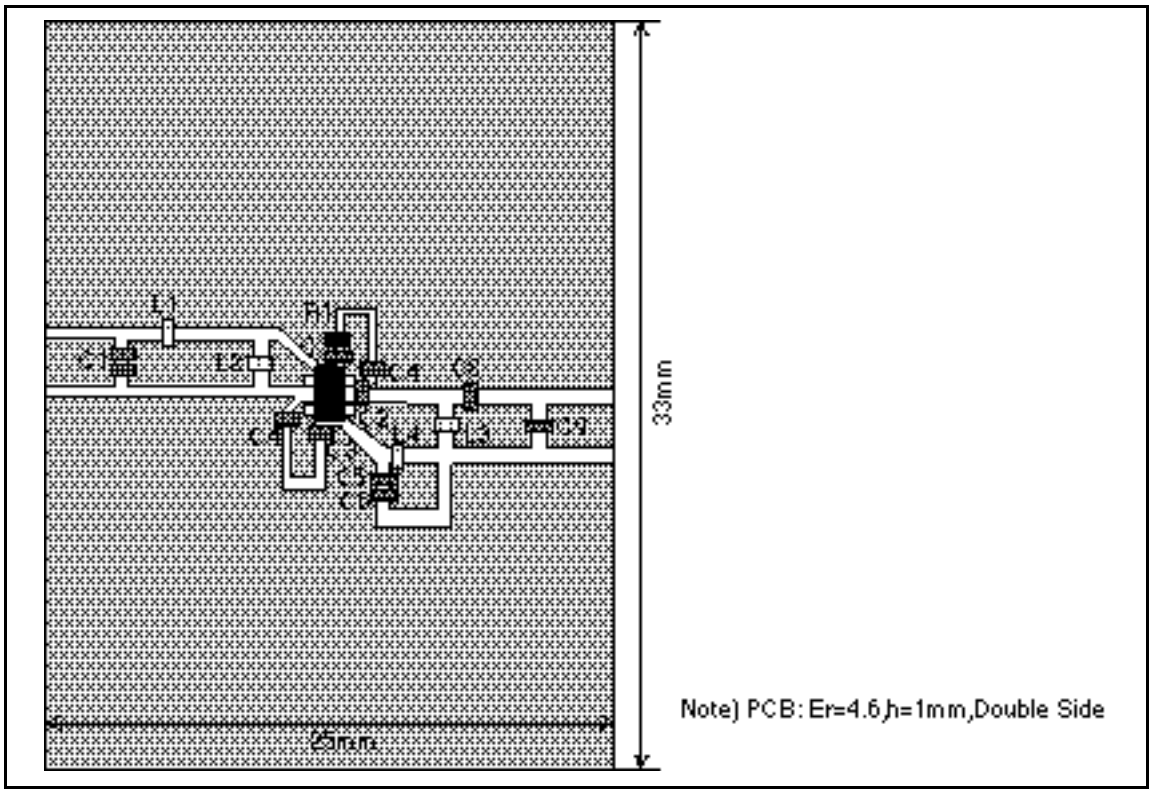
Characteristics (Test Fixture)



Application (f = 1.8 GHz LNA)

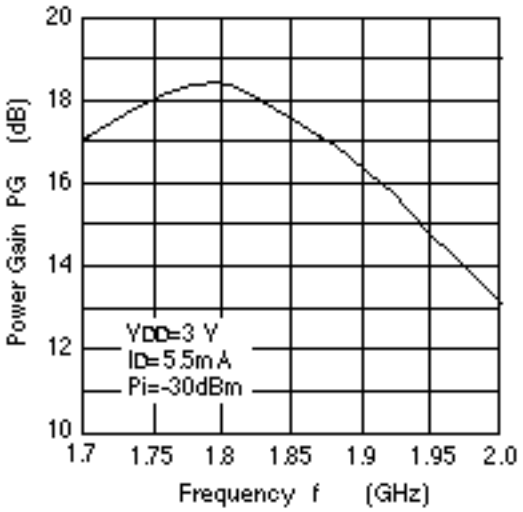


PCB Pattern & Parts Layouts

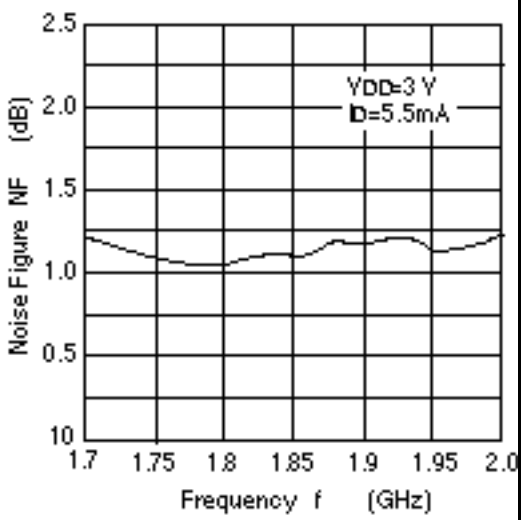


Characteristics

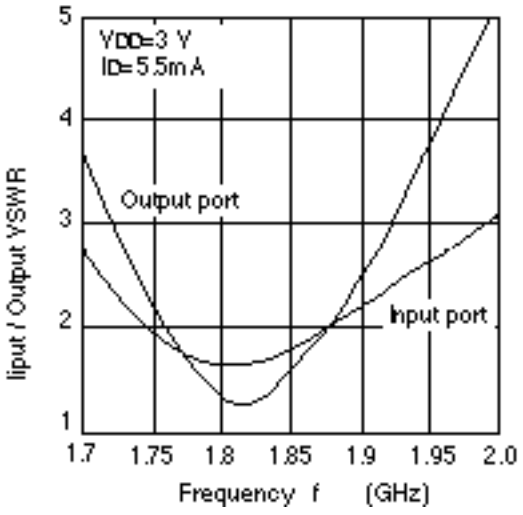
Power Gain vs. Frequency



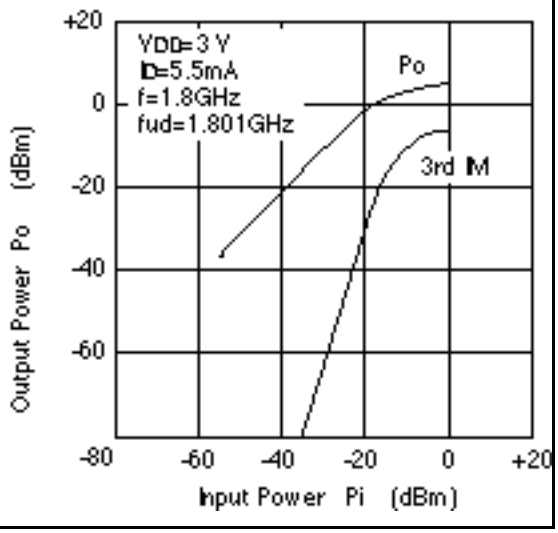
Noise Figure vs. Frequency



VSWR vs. Frequency

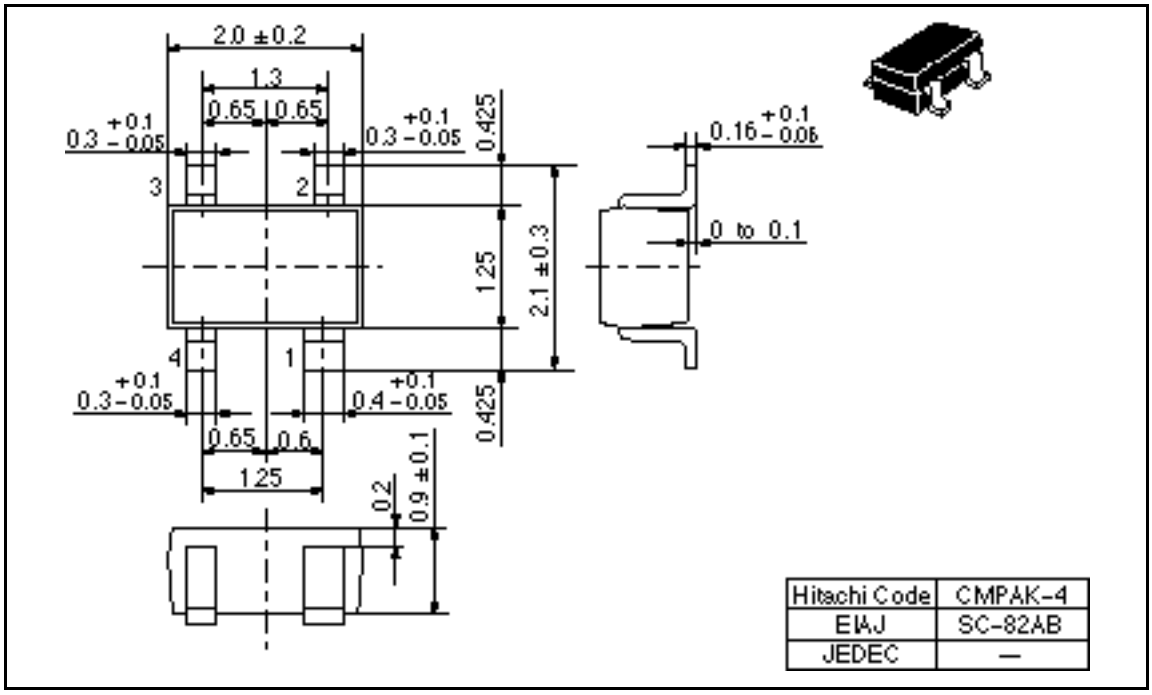


Output Power vs. Input Power



Package Dimensions

Unit: mm



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