2SC4229

Silicon NPN Epitaxial

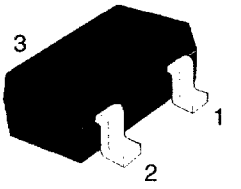
HITACHI

Application

UHF RF amplifier

Outline

MPAK



1. Emitter
2. Base
3. Collector

Absolute Maximum Ratings (Ta = 25°C)

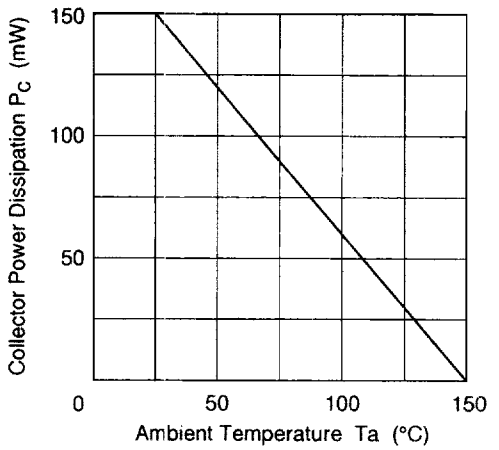
Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	30	V
Collector to emitter voltage	V_{CEO}	25	V
Emitter to base voltage	V_{EBO}	3	V
Collector current	I_C	20	mA
Collector power dissipation	P_C	150	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics (Ta = 25°C)

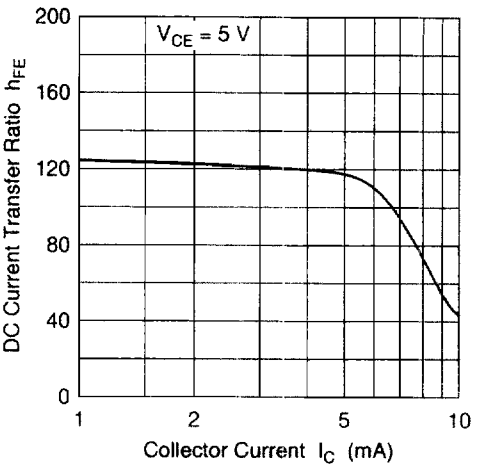
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	30	—	—	V	I_C = 10 µA, I_E = 0
Collector cutoff current	I_{CBO}	—	—	0.3	µA	V_{CB} = 15 V, I_E = 0
Collector cutoff current	I_{CEO}	—	—	10	µA	V_{CE} = 25 V, R_{BE} = ∞
Emitter cutoff current	I_{EBO}	—	—	1.0	µA	V_{EB} = 3 V, I_C = 0
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	—	5.0	V	I_C = 10 mA, I_B = 1 mA
DC current transfer ratio	h_{FE}	50	—	180		V_{CE} = 5 V, I_C = 2 mA
Collector output capacitance	Cob	—	0.6	0.8	pF	V_{CB} = 10 V, I_E = 0, f = 1MHz
Gain bandwidth product	f_T	0.7	1.0	—	GHz	V_{CE} = 5 V, I_C = 2 mA
Power gain	PG	10	15	—	dB	V_{CC} = 4 V, I_C = 2 mA, f = 900 MHz
Noise figure	NF	—	3.0	4.5	dB	V_{CC} = 4 V, I_C = 2 mA, f = 900 MHz
AGC voltage	V_{AGC}	1.8	—	2.7	V	V_{CC} = 4 V, I_C = 2 mA, f = 900 MHz P_{in} = –50dBm, GR = 30dB

Note: Marking is "UI–".

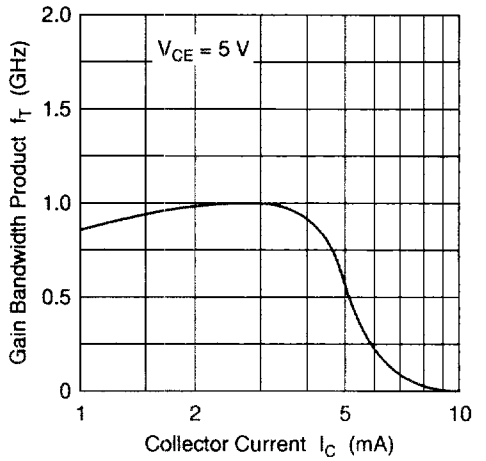
Maximum Collector Dissipation Curve



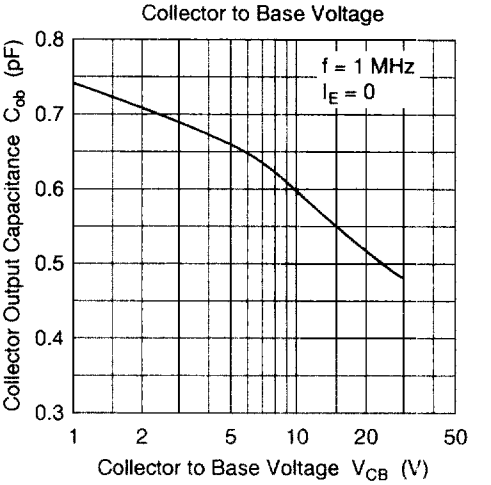
DC Current Transfer Ratio vs. Collector Current



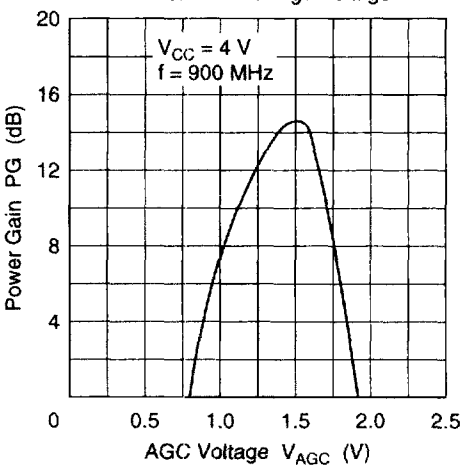
Gain Bandwidth Product vs. Collector Current



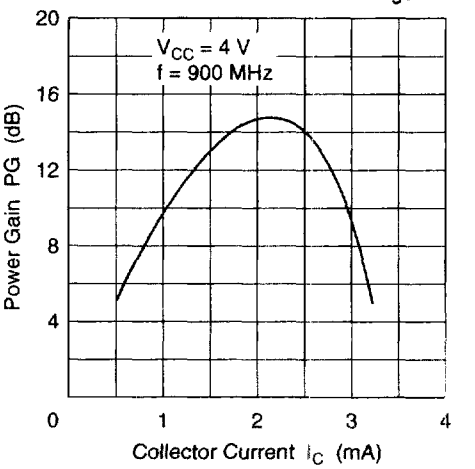
Collector Output Capacitance vs. Collector to Base Voltage



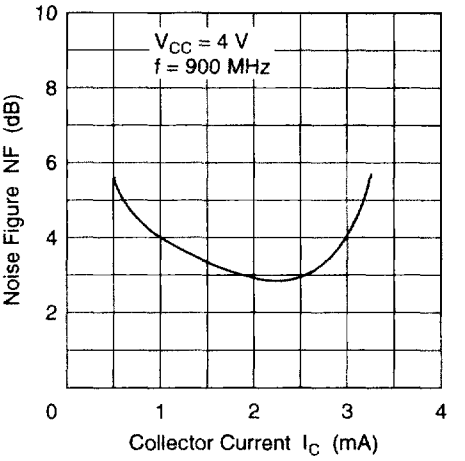
Power Gain vs. Agc Voltage



Power Gain vs. Collector Voltage

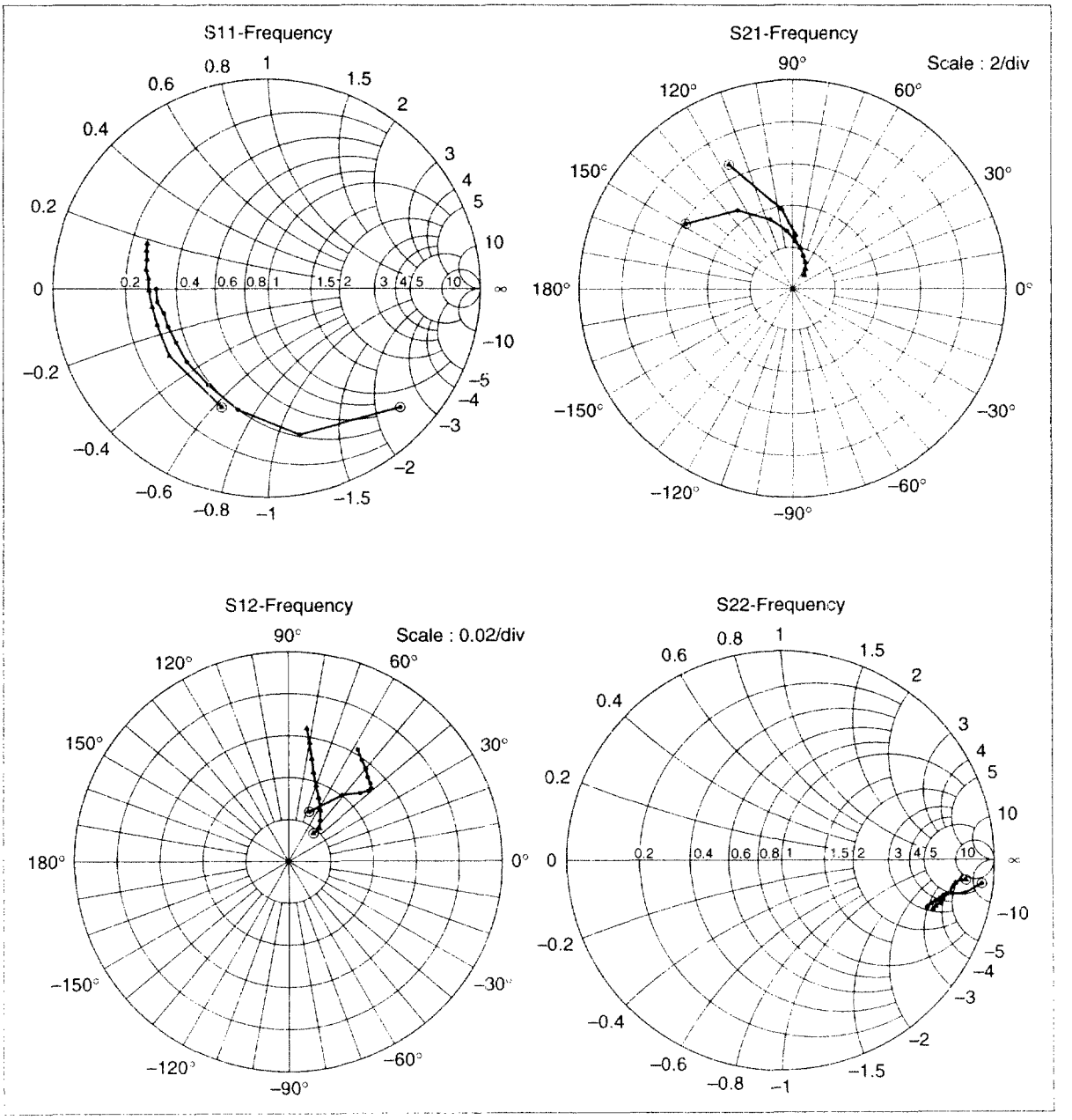


Noise Figure vs. Collector Current



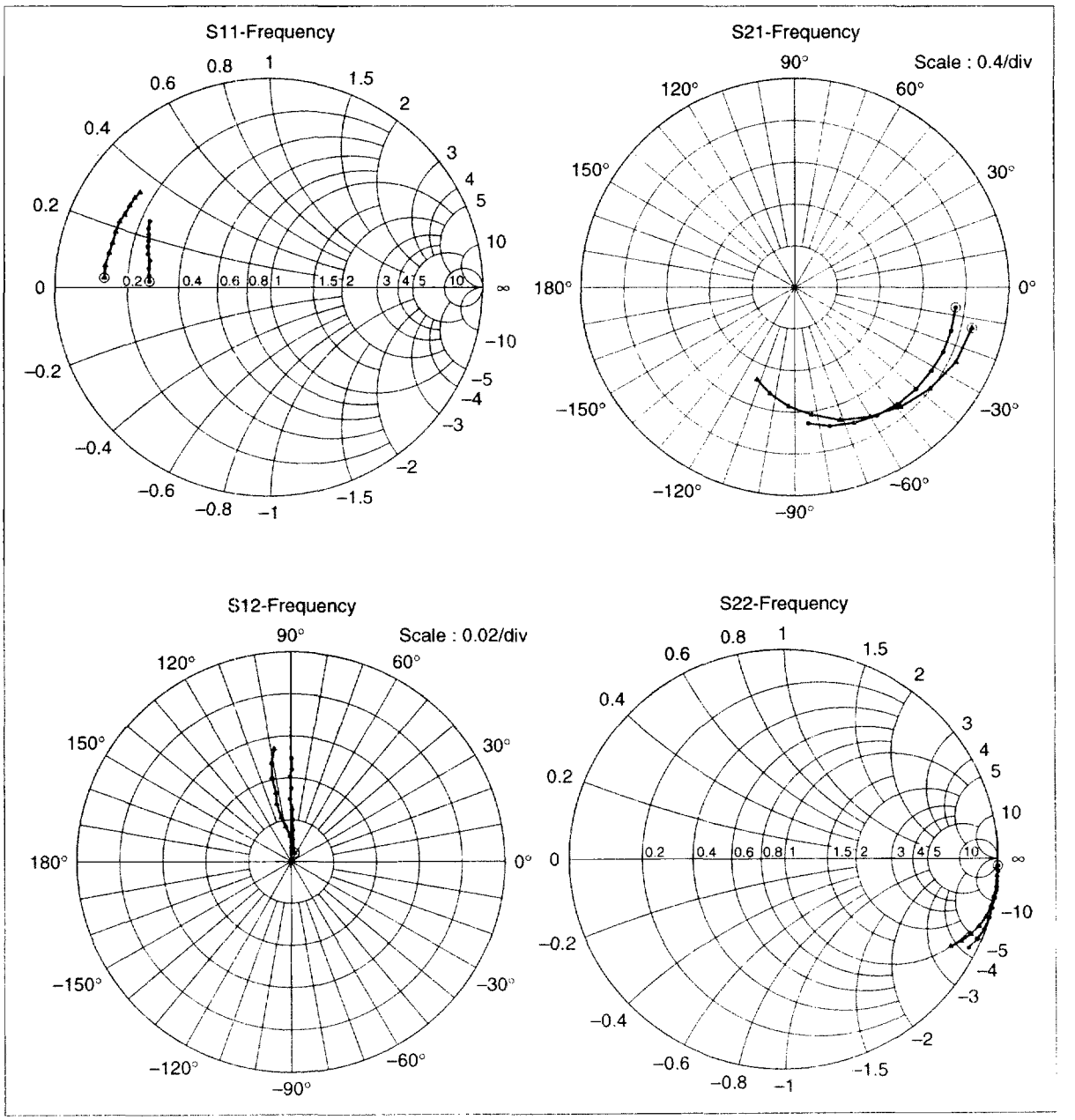
S Parameters (Emitter Common)

Test condition V_{CE} = 5 V, 100 MHz to 1000 MHz (100 MHz STEP), Z_O = 50 Ω
I_C = 5 mA
I_C = 10 mA



S Parameters (Base Common)

Test condition V_{CE} = 5 V, 100 MHz to 1000 MHz (100 MHz STEP), Z_O = 50 Ω
I_C = 5 mA
I_C = 10 mA



S Parameters (Emitter Common)

Test Condition V_{CE} = 5 V, I_C = 2 mA, Z_O = 50 Ω

Freq.	S11		S21		S12		S22	
(MHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.847	–42.5	5.910	148.0	0.025	67.6	0.951	–7.0
200	0.702	–77.7	4.593	124.5	0.039	51.2	0.879	–10.6
300	0.598	–103.7	3.528	108.2	0.046	43.6	0.828	–11.6
400	0.540	–121.4	2.817	97.2	0.049	41.3	0.799	–12.1
500	0.513	–137.6	2.325	88.3	0.051	41.7	0.781	–12.8
600	0.498	–149.7	1.984	81.1	0.052	43.6	0.767	–13.6
700	0.500	–159.1	1.719	74.6	0.054	46.7	0.756	–14.7
800	0.501	–166.9	1.522	68.8	0.056	49.8	0.745	–15.8
900	0.520	–173.8	1.355	63.3	0.058	54.4	0.734	–16.9
1000	0.524	–179.5	1.232	59.1	0.061	58.5	0.725	–18.1

Test Condition V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω

Freq.	S11		S21		S12		S22	
(MHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.606	–110.9	6.693	116.7	0.017	47.2	0.877	–6.3
200	0.559	–145.3	3.889	98.1	0.021	45.6	0.843	–6.9
300	0.543	–161.9	2.638	88.2	0.024	52.4	0.828	–8.0
400	0.546	–171.3	2.023	80.9	0.028	58.5	0.818	–9.3
500	0.555	–179.2	1.635	74.5	0.033	64.9	0.809	–10.7
600	0.562	174.6	1.378	68.8	0.038	70.3	0.799	–12.4
700	0.577	170.2	1.184	63.4	0.043	75.0	0.788	–14.0
800	0.583	165.7	1.045	58.5	0.049	77.8	0.777	–15.7
900	0.596	161.8	0.933	53.8	0.056	80.6	0.765	–17.3
1000	0.607	158.4	0.838	49.8	0.063	82.7	0.752	–18.8

Y Parameters (Emitter Common)

Test Condition V_{CE} = 5 V, I_C = 2 mA

Freq.	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
(MHz)	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	1.667	6.759	67.553	−13.446	−0.008	−0.287	0.062	0.464
200	4.668	13.547	64.179	−25.577	−0.052	−0.585	0.111	1.032
300	9.767	19.505	57.680	−37.926	−0.123	−0.884	0.233	1.545
400	16.044	23.355	48.275	−47.353	−0.213	−1.165	0.393	2.024
500	24.480	26.080	38.204	−55.929	−0.315	−1.449	0.565	2.495
600	33.133	25.858	26.008	−61.506	−0.443	−1.702	0.774	2.942
700	41.424	23.938	13.802	−63.603	−0.550	−1.953	1.009	3.362
800	48.522	19.437	1.525	−62.673	−0.695	−2.189	1.259	3.785
900	55.988	14.034	−9.614	−60.249	−0.808	−2.483	1.493	4.156
1000	59.232	6.384	−18.460	−54.455	−0.947	−2.696	1.753	4.499

Test Condition V_{CE} = 5 V, I_C = 5 mA

Freq.	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
(MHz)	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	12.186	22.124	125.460	−60.901	−0.033	−0.358	0.142	0.569
200	31.220	30.351	84.056	−93.716	−0.125	−0.667	0.280	1.184
300	48.707	25.371	39.816	−98.179	−0.227	−0.931	0.532	1.664
400	58.928	16.476	10.854	−89.321	−0.333	−1.197	0.710	2.096
500	64.974	4.453	−10.374	−76.524	−0.460	−1.470	0.896	2.508
600	65.588	−6.699	−22.820	−62.078	−0.575	−1.708	1.108	2.931
700	65.289	−15.236	−29.399	−49.731	−0.687	−1.997	1.315	3.313
800	61.116	−22.425	−32.174	−38.168	−0.837	−2.202	1.573	3.703
900	57.148	−28.202	−32.984	−28.950	−0.991	−2.456	1.823	4.090
1000	52.783	−32.233	−32.007	−21.590	−1.143	−2.672	2.107	4.403

S Parameters (Base Common)

Test Condition V_{CE} = 5 V, I_C = 2 mA, Z_O = 50 Ω

Freq.	S11		S21		S12		S22	
(MHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.554	176.3	1.538	–7.7	0.004	76.2	0.999	–1.9
200	0.559	173.3	1.535	–15.5	0.010	87.8	1.001	–4.1
300	0.566	169.9	1.531	–23.8	0.015	88.8	1.002	–6.3
400	0.568	166.4	1.516	–32.0	0.020	89.1	1.003	–8.6
500	0.583	163.6	1.500	–40.5	0.024	90.1	1.004	–11.2
600	0.597	160.4	1.478	–48.9	0.029	91.6	1.003	–13.8
700	0.605	157.7	1.447	–57.7	0.035	90.4	0.999	–16.8
800	0.615	154.6	1.412	–66.6	0.041	91.2	0.993	–19.8
900	0.628	152.7	1.365	–76.1	0.044	89.9	0.979	–23.1
1000	0.640	149.7	1.307	–84.4	0.049	90.0	0.962	–26.1

Test Condition V_{CE} = 5 V, I_C = 5 mA, Z_O = 50 Ω

Freq.	S11		S21		S12		S22	
(MHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.762	175.4	1.715	–13.1	0.003	75.5	0.999	–2.4
200	0.764	171.1	1.676	–25.1	0.007	95.9	1.001	–4.8
300	0.761	166.5	1.599	–37.5	0.012	97.2	1.000	–7.5
400	0.757	162.5	1.517	–49.0	0.017	100.7	0.997	–10.3
500	0.761	158.6	1.427	–60.5	0.022	104.1	0.990	–13.2
600	0.764	154.6	1.334	–71.4	0.028	105.2	0.980	–16.4
700	0.761	151.6	1.233	–82.4	0.033	103.3	0.962	–19.6
800	0.761	147.8	1.137	–92.7	0.041	102.8	0.942	–22.7
900	0.761	144.7	1.042	–102.7	0.048	101.7	0.917	–25.7
1000	0.759	141.9	0.944	–112.1	0.054	98.9	0.885	–28.4

Y Parameters (Base Common)

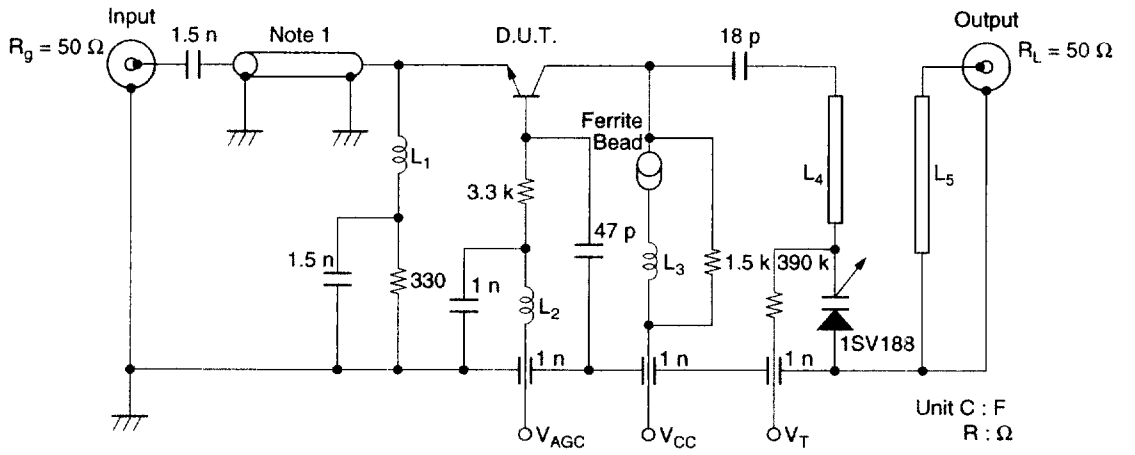
Test Condition V_{CE} = 5 V, I_C = 2 mA

Freq.	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
(MHz)	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	69.274	–6.510	–67.616	12.982	–0.054	–0.177	0.062	0.464
200	68.907	–11.584	–64.291	24.545	–0.059	–0.446	0.111	1.032
300	67.557	–17.761	–57.913	36.381	–0.110	–0.660	0.233	1.545
400	64.500	–23.139	–48.669	45.329	–0.180	–0.859	0.393	2.024
500	62.935	–28.802	–38.770	53.433	–0.250	–1.047	0.565	2.495
600	59.471	–34.407	–26.782	58.563	–0.331	–1.240	0.774	2.942
700	55.685	–38.256	–14.811	60.241	–0.459	–1.409	1.009	3.362
800	50.611	–41.641	–2.783	58.889	–0.564	–1.595	1.259	3.785
900	47.059	–44.543	8.121	56.093	–0.685	–1.672	1.493	4.156
1000	41.579	–46.267	16.706	49.955	–0.806	–1.804	1.753	4.499

Test Condition V_{CE} = 5 V, I_C = 5 mA

Freq.	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
(MHz)	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	137.754	–38.565	–125.601	60.332	–0.108	–0.212	0.142	0.569
200	115.431	–62.847	–84.336	92.532	–0.155	–0.517	0.280	1.184
300	88.828	–72.075	–40.347	96.515	–0.304	–0.733	0.532	1.664
400	70.159	–71.946	–11.564	87.225	–0.377	–0.899	0.710	2.096
500	55.036	–71.033	9.478	74.016	–0.436	–1.038	0.896	2.508
600	43.301	–67.554	21.712	59.147	–0.533	–1.223	1.108	2.931
700	36.519	–63.650	28.083	46.417	–0.629	–1.317	1.315	3.313
800	29.677	–59.092	30.601	34.465	–0.736	–1.501	1.573	3.703
900	24.996	–55.518	31.160	24.860	–0.832	–1.634	1.823	4.090
1000	21.739	–520.92	29.901	17.187	–0.963	–1.730	2.107	4.403

Power Gain and Noise figure Test Circuit



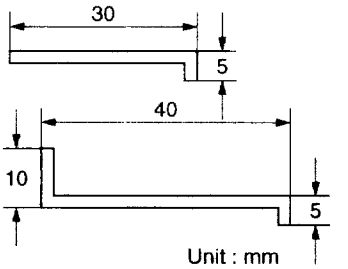
L_1 : Inside dia 3 mm, ϕ0.5 mm Enameled Copper wire 7 Turns.

L_2 : Inside dia 3 mm, ϕ0.3 mm Enameled Copper wire 13 Turns.

L_3 : Inside dia 3 mm, ϕ0.5 mm Enameled Copper wire 9 Turns.

L_4 : ϕ0.8 Enameled Copper wire.

L_5 : ϕ0.8 Enameled Copper wire.



Note1 : 50 Ω Semirigid Cable.