
2SC4229

Silicon NPN Epitaxial

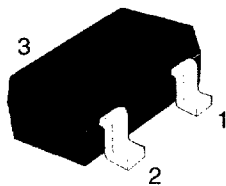
HITACHI

Application

UHF RF amplifier

Outline

MPAK



- 1. Emitter
- 2. Base
- 3. Collector

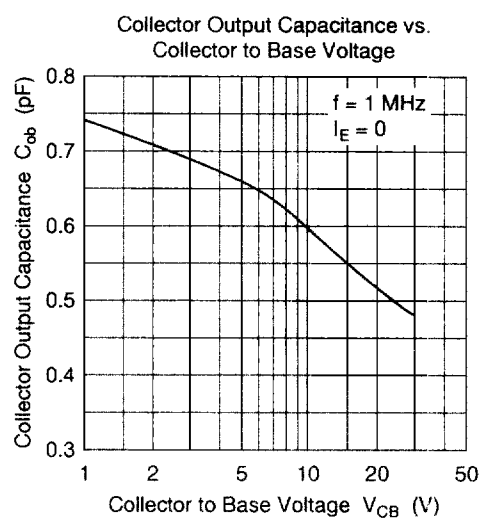
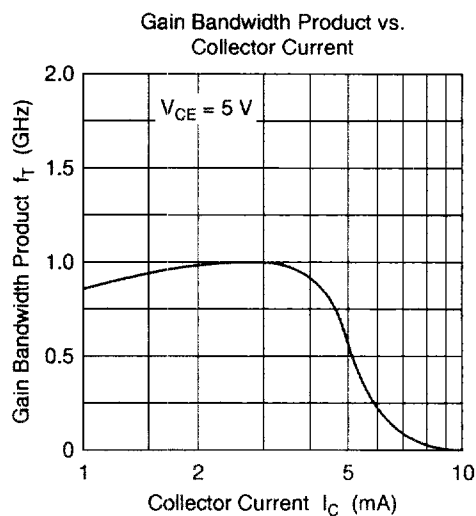
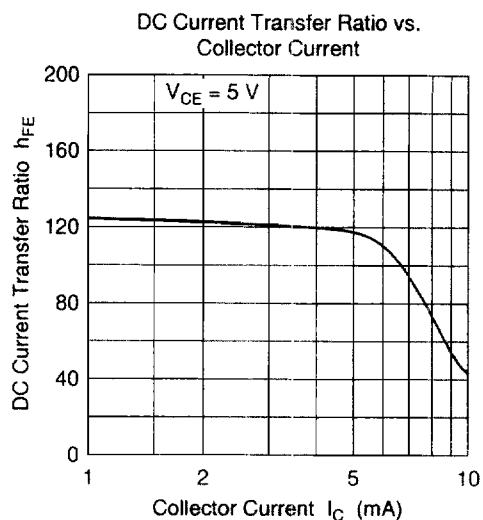
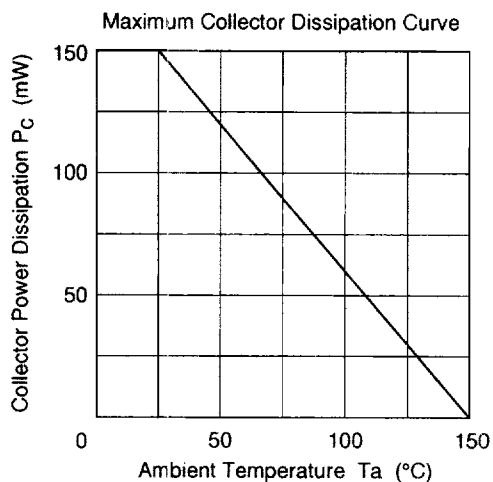
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

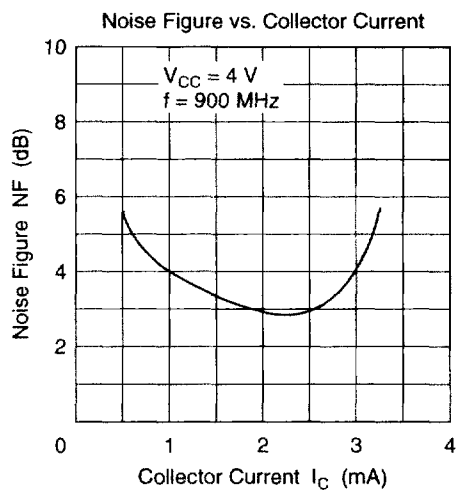
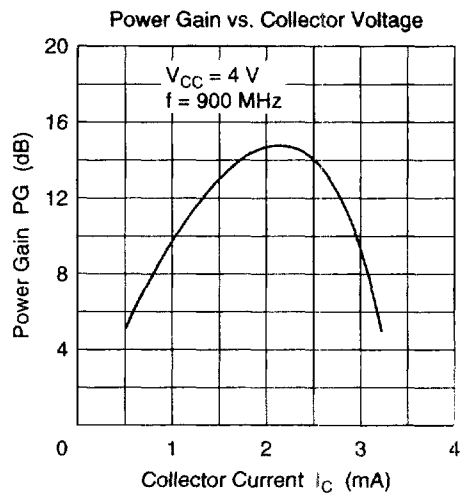
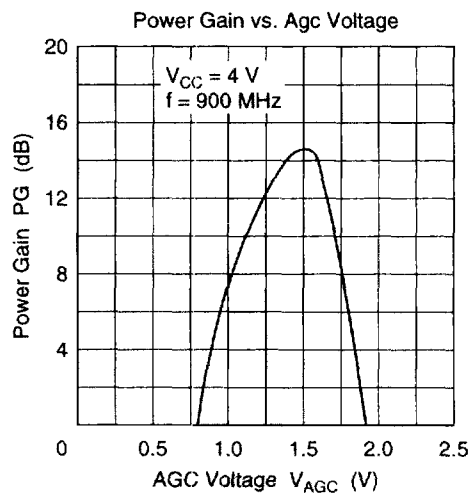
Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	30	V
Collector to emitter voltage	V_{CEO}	25	V
Emitter to base voltage	V_{EBO}	3	V
Collector current	I_C	20	mA
Collector power dissipation	P_C	150	mW
Junction temperature	T_j	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

Electrical Characteristics ($T_a = 25^\circ\text{C}$)

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

Note: Marking is "UI-".

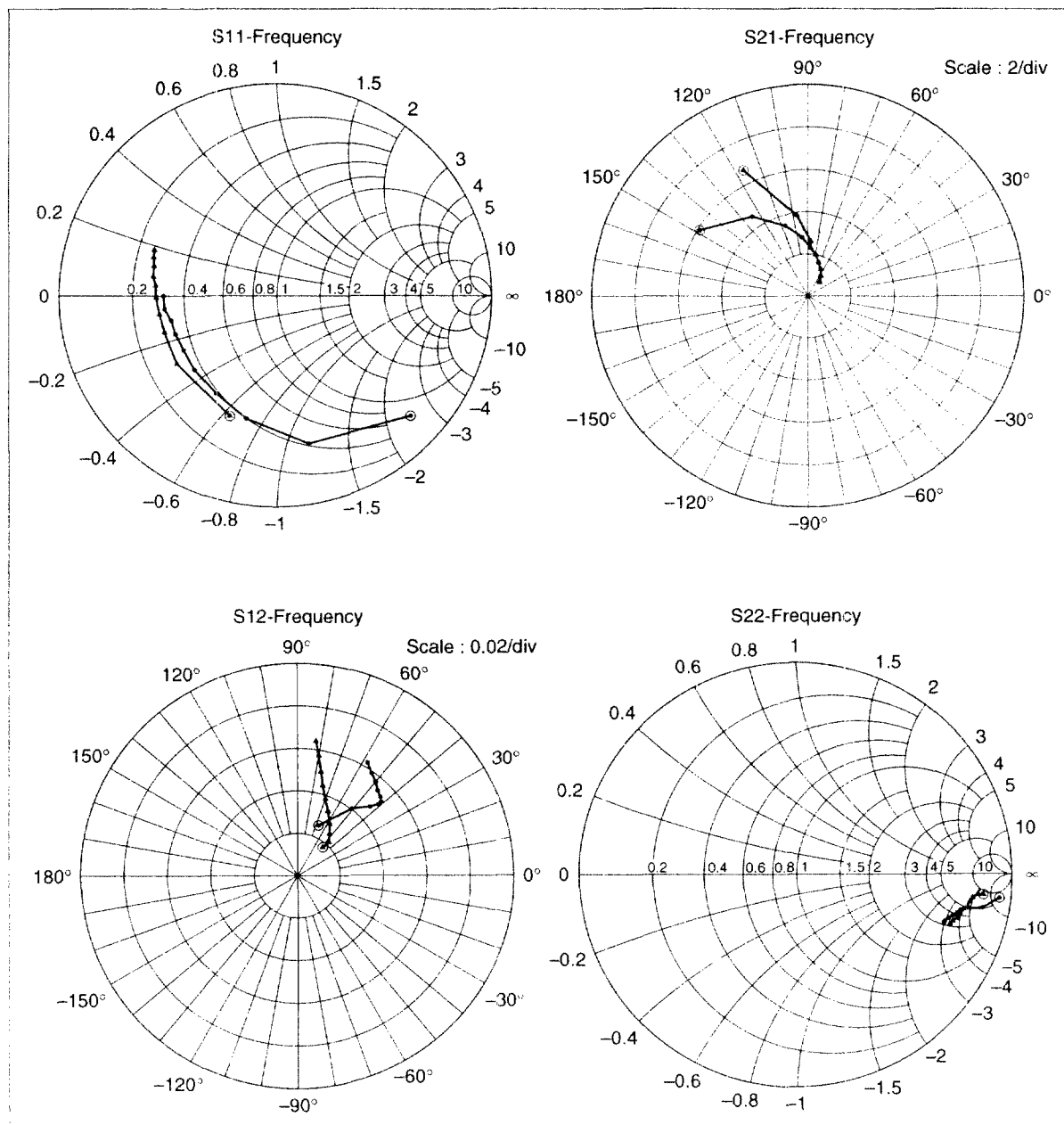




S Parameters (Emitter Common)

Test condition $V_{CE} = 5\text{ V}$, 100 MHz to 1000 MHz (100 MHz STEP), $Z_0 = 50\ \Omega$

$I_C = 5\text{ mA}$ ●
 $I_C = 10\text{ mA}$ ▲

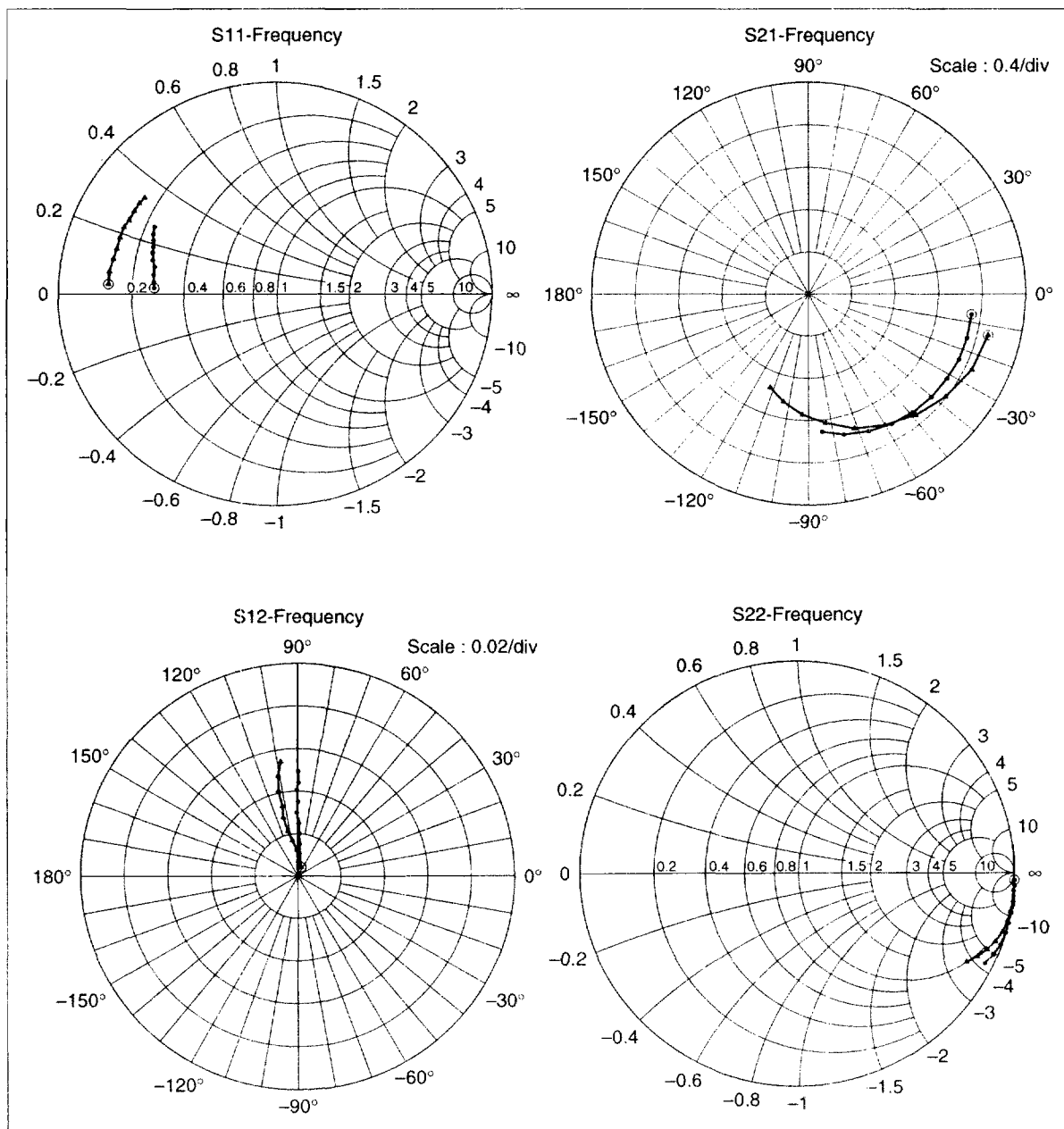


S Parameters (Base Common)

Test condition $V_{CE} = 5\text{ V}$, 100 MHz to 1000 MHz (100 MHz STEP), $Z_0 = 50\ \Omega$

$I_C = 5\text{ mA}$ ● ———— ●

$I_C = 10\text{ mA}$ ● ———— ▲



S Parameters (Emitter Common)

Test Condition $V_{CE} = 5\text{ V}$, $I_C = 2\text{ mA}$, $Z_O = 50\ \Omega$

Freq. (MHz)	S11		S21		S12		S22	
	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 $V_{CE} = 5\text{ V}$, $I_C = 5\text{ mA}$, $Z_O = 50\ \Omega$

Freq. (MHz)	S11		S21		S12		S22	
	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** $V_{CE} = 5\text{ V}$, $I_C = 2\text{ mA}$

Freq. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	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 $V_{CE} = 5\text{ V}$, $I_C = 5\text{ mA}$

Freq. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	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

2SC4229

S Parameters (Base Common)

Test Condition $V_{CE} = 5\text{ V}$, $I_C = 2\text{ mA}$, $Z_0 = 50\ \Omega$

Freq. (MHz)	S11		S21		S12		S22	
	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 $V_{CE} = 5\text{ V}$, $I_C = 5\text{ mA}$, $Z_0 = 50\ \Omega$

Freq. (MHz)	S11		S21		S12		S22	
	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)

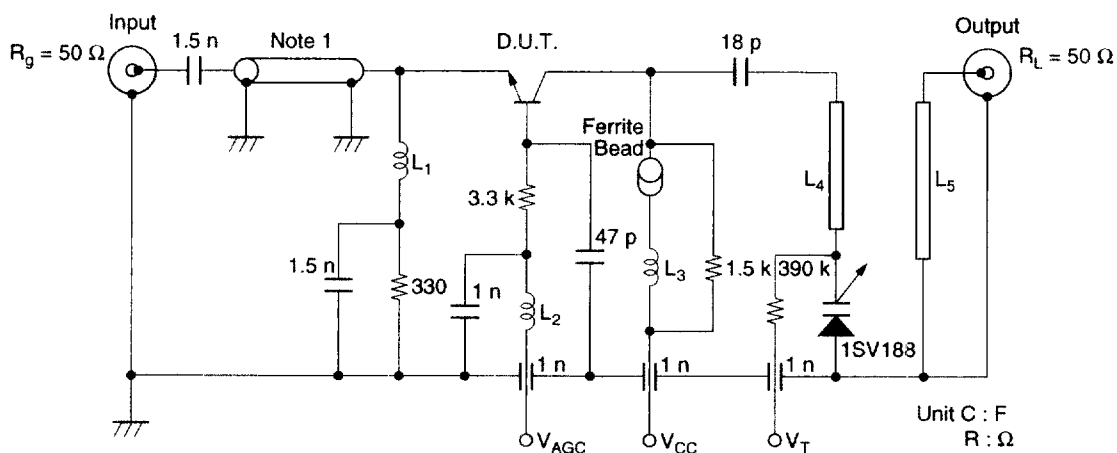
Test Condition $V_{CE} = 5\text{ V}$, $I_C = 2\text{ mA}$

Freq. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	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 $V_{CE} = 5\text{ V}$, $I_C = 5\text{ mA}$

Freq. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	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



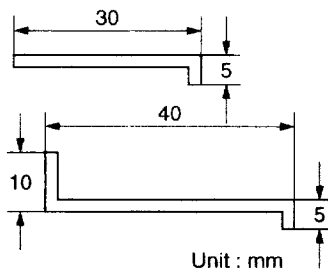
L₁ : Inside dia 3 mm, ϕ 0.5 mm Enameled Copper wire 7 Turns.

L₂ : Inside dia 3 mm, ϕ 0.3 mm Enameled Copper wire 13 Turns.

L₃ : Inside dia 3 mm, ϕ 0.5 mm Enameled Copper wire 9 Turns.

L₄ : $\phi 0.8$ Enameled Copper wire.

L_5 : $\phi 0.8$ Enameled Copper wire.



Note1 : 50 Ω Semirigid Cable.