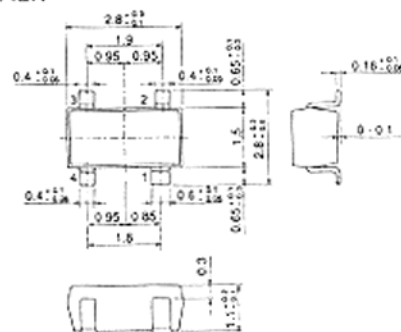


2SC4415

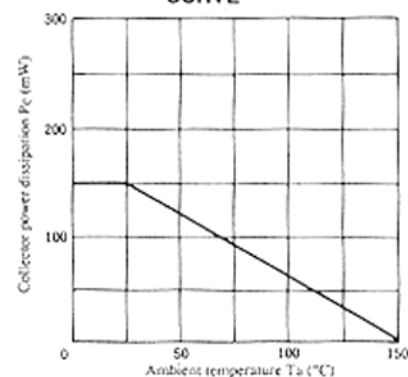
SILICON NPN EPITAXIAL
UHF TUNER RF AMPLIFIER



(MPAK-4)

■ ABSOLUTE MAXIMUM RATINGS ($T_a=25^\circ\text{C}$)

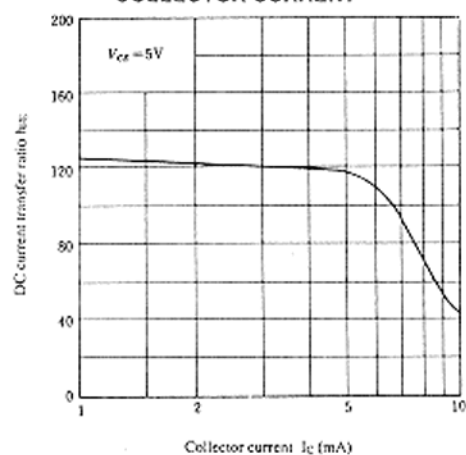
Item	Symbol	2SC4415	Unit
Collector to base voltage	V_{CBO}	30	V
Collector to emitter voltage	V_{CEO}	25	V
Emitter to base voltage	V_{EBO}	3	V
Collector current	I_C	20	mA
Collector power dissipation	P_C	150	mW
Junction temperature	T_j	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

MAXIMUM COLLECTOR DISSIPATION
CURVE■ ELECTRICAL CHARACTERISTICS ($T_a=25^\circ\text{C}$)

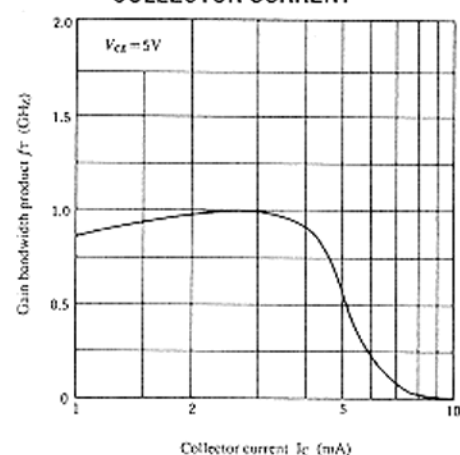
Item	Symbol	Test Condition	min.	typ.	max.	Unit
Collector to base breakdown voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}$, $I_E = 0$	30	—	—	V
Collector cutoff current	I_{CBO}	$V_{CB} = 15\text{V}$, $I_E = 0$	—	—	0.3	μA
Collector cutoff current	I_{CEO}	$V_{CE} = 25\text{V}$, $R_{BE} = \infty$	—	—	10	μA
Emitter cutoff current	I_{EBO}	$V_{EB} = 3\text{V}$, $I_C = 0$	—	—	1	μA
Collector to emitter saturation voltage	$V_{CE(sat)}$	$I_C = 10\text{mA}$, $I_B = 1\text{mA}$	—	—	5	V
DC current transfer ratio	h_{FE}	$V_{CE} = 5\text{V}$, $I_C = 2\text{mA}$	50	—	180	
Collector output capacitance	C_{ob}	$V_{CB} = 10\text{V}$, $I_E = 0$, $f = 1\text{MHz}$	—	0.65	0.9	pF
Gain bandwidth product	f_T	$V_{CE} = 5\text{V}$, $I_C = 2\text{mA}$	0.7	1.0	—	GHz
Power gain	PG	$V_{CC} = 4\text{V}$, $I_C = 2\text{mA}$, $f = 900\text{MHz}$	10	15	—	dB
Noise figure	NF	$V_{CC} = 4\text{V}$, $I_C = 2\text{mA}$, $f = 900\text{MHz}$	—	3.0	4.5	dB
AGC voltage	V_{AGC}	$V_{CC} = 4\text{V}$, $I_C = 2\text{mA}$, $f = 900\text{MHz}$ $P_{in} = -50\text{dBm}$, $GR = 30\text{dB}$	1.8	—	2.7	V

* Marking is {XC-}.

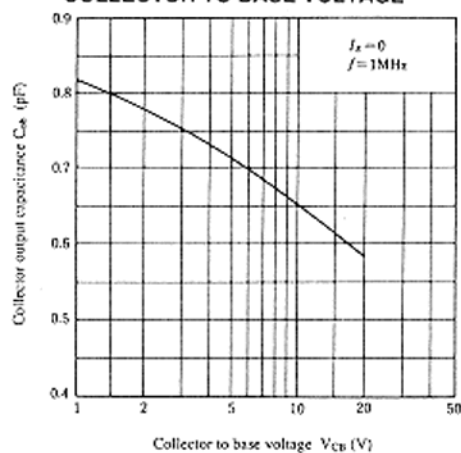
DC CURRENT TRANSFER RATIO VS.
COLLECTOR CURRENT



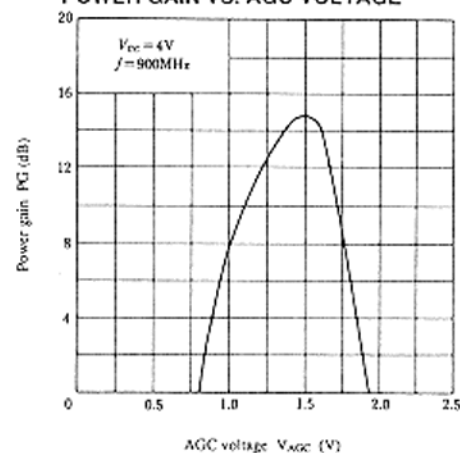
GAIN BANDWIDTH PRODUCT VS.
COLLECTOR CURRENT



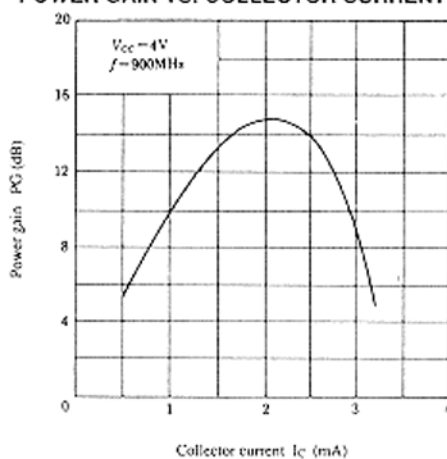
COLLECTOR OUTPUT CAPACITANCE VS.
COLLECTOR TO BASE VOLTAGE



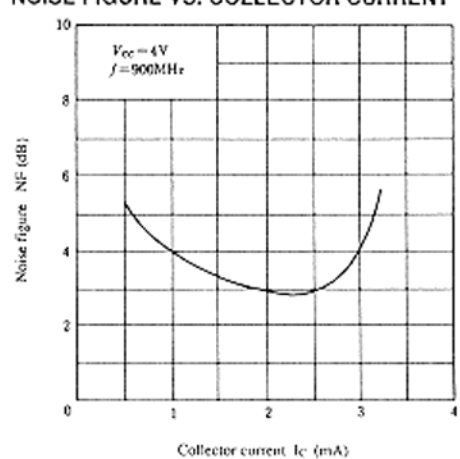
POWER GAIN VS. AGC VOLTAGE



POWER GAIN VS. COLLECTOR CURRENT



NOISE FIGURE VS. COLLECTOR CURRENT

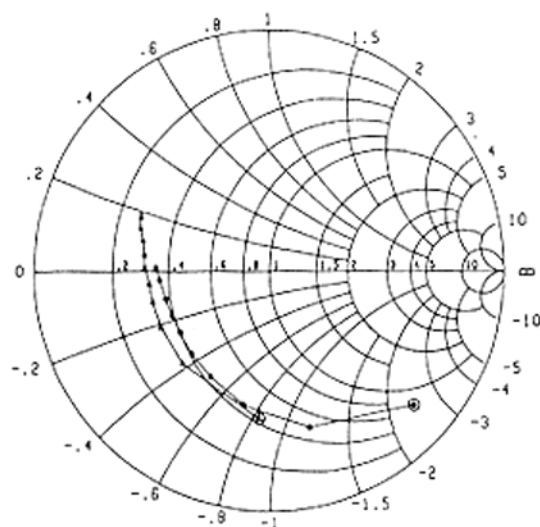


2SC4415

■ S PARAMETERS (Emitter Common)

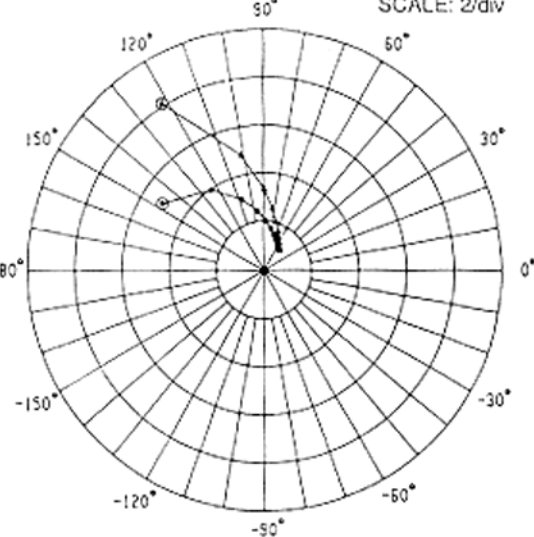
Test Condition: $V_{CE} = 5V$, 100MHz to 1000MHz (100MHz STEP) $I_C = 2mA$ $I_C = 5mA$ $Z_0 = 50\Omega$

S11-FREQUENCY



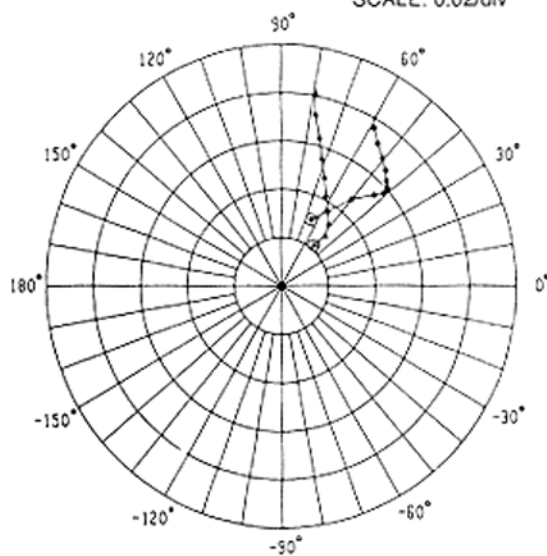
S21-FREQUENCY

SCALE: 2/div

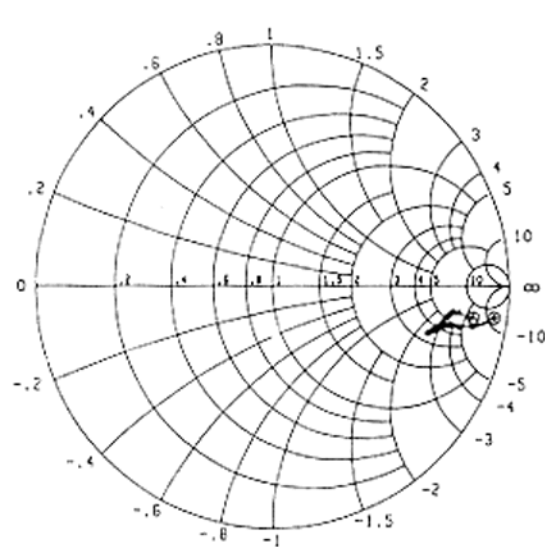


S12-FREQUENCY

SCALE: 0.02/div



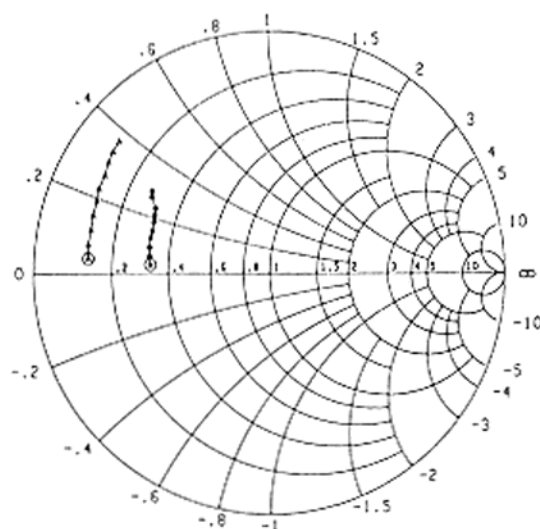
S22-FREQUENCY



■ S PARAMETERS (Base Common)

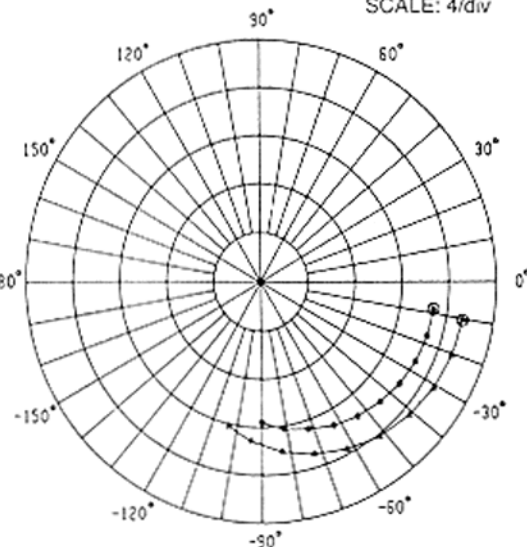
Test Condition: $V_{CE} = 5V$, 100MHz to 1000MHz (100MHz STEP) $I_C = 2mA$ ● $I_C = 5mA$ ▲ $Z_0 = 50\Omega$

S11-FREQUENCY



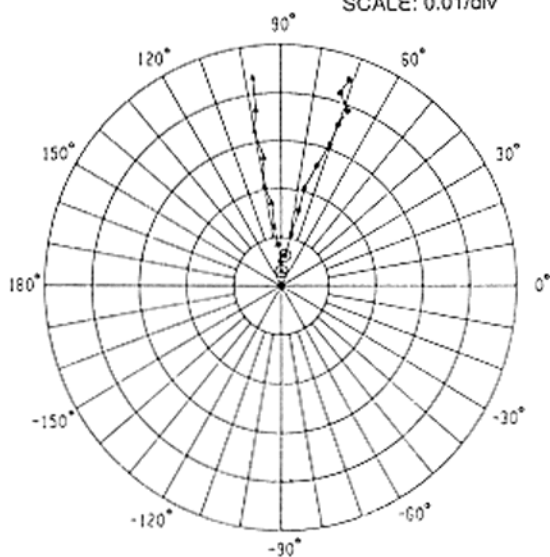
S21-FREQUENCY

SCALE: 4/div

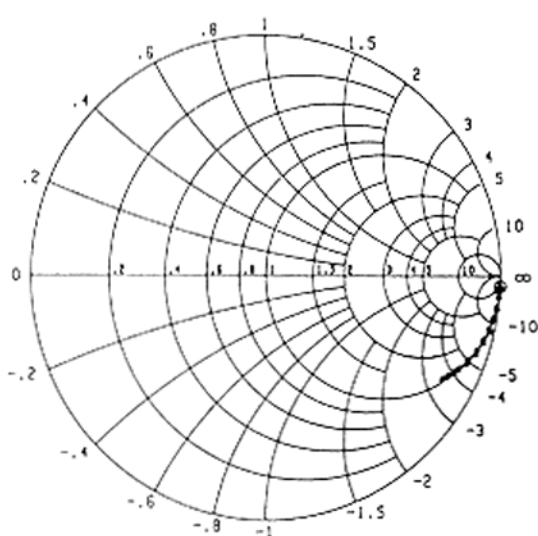


S12-FREQUENCY

SCALE: 0.01/div



S22-FREQUENCY



2SC4415

■ S PARAMETERS (Emitter Common)

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

FREQ. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.827	-42.1	5.080	147.5	0.030	65.2	0.945	-7.9
200	0.671	-75.3	3.963	124.1	0.047	50.2	0.861	-11.0
300	0.565	-101.4	3.050	107.7	0.055	43.5	0.805	-11.9
400	0.502	-120.0	2.444	96.3	0.058	41.2	0.775	-12.0
500	0.474	-134.3	2.028	87.5	0.061	41.6	0.752	-12.4
600	0.455	-146.5	1.727	79.8	0.062	44.0	0.735	-12.8
700	0.452	-156.5	1.513	73.3	0.065	46.9	0.721	-13.7
800	0.455	-165.6	1.334	67.5	0.068	50.7	0.710	-14.3
900	0.468	-175.7	1.205	62.0	0.072	55.1	0.696	-15.2
1000	0.482	-178.3	1.093	57.5	0.076	58.9	0.684	-16.3

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

FREQ. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.612	-94.4	8.121	122.0	0.022	50.4	0.857	-8.6
200	0.532	-134.1	4.815	101.2	0.028	47.3	0.796	-7.9
300	0.516	-153.2	3.314	89.6	0.032	51.7	0.774	-7.9
400	0.512	-165.8	2.530	81.6	0.037	57.5	0.763	-8.3
500	0.515	-174.4	2.040	74.7	0.042	63.1	0.753	-9.3
600	0.531	-178.0	1.709	68.9	0.048	67.6	0.743	-10.2
700	0.535	-172.6	1.482	63.7	0.055	71.8	0.733	-11.5
800	0.551	-166.7	1.304	58.7	0.063	75.1	0.722	-12.8
900	0.573	-162.1	1.153	53.9	0.072	78.3	0.710	-14.0
1000	0.587	-157.8	1.043	49.9	0.081	79.5	0.697	-15.3

■ Y PARAMETERS (Emitter Common)

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

FREQ. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	1.846	6.610	58.495	-12.213	-0.025	-0.353	0.069	0.604
200	4.960	12.784	54.920	-24.149	-0.094	-0.700	0.222	1.124
300	10.041	18.234	48.456	-34.863	-0.185	-1.051	0.419	1.651
400	16.338	21.634	39.382	-43.332	-0.308	-1.353	0.648	2.107
500	23.015	23.365	29.641	-48.655	-0.428	-1.646	0.922	2.531
600	30.278	22.832	18.593	-52.068	-0.554	-1.918	1.222	2.911
700	36.954	20.870	8.575	-52.991	-0.685	-2.209	1.478	3.301
800	43.367	16.920	-1.426	-51.534	-0.828	-2.492	1.750	3.626
900	49.869	9.719	-12.069	-49.092	-1.063	-2.812	2.050	4.041
1000	53.209	3.674	-18.813	-44.233	-1.239	-3.122	2.344	4.388

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

FREQ. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	8.343	16.659	132.170	-57.655	-0.035	-0.385	0.094	0.633
200	22.326	25.361	94.819	-92.722	-0.109	-0.755	0.250	1.130
300	36.268	25.572	53.457	-102.620	-0.204	-1.114	0.455	1.633
400	47.706	19.590	19.975	-99.396	-0.324	-1.429	0.688	2.064
500	54.237	11.406	-3.987	-87.617	-0.442	-1.752	0.937	2.504
600	58.916	1.838	-20.669	-74.912	-0.631	-2.105	1.172	2.941
700	58.620	-6.039	-29.532	-61.002	-0.768	-2.402	1.436	3.336
800	57.181	-14.645	-35.727	-48.025	-1.004	-2.721	1.733	3.774
900	55.047	-21.966	-38.596	-36.450	-1.259	-3.080	2.069	4.177
1000	50.983	-26.870	-38.291	-27.311	-1.548	-3.332	2.444	4.550

■ S PARAMETERS (Base Common)

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

FREQ. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.505	175.7	1.481	-8.6	0.006	82.7	0.999	-2.4
200	0.511	171.6	1.475	-17.3	0.011	78.5	0.995	-4.8
300	0.517	167.9	1.461	-26.4	0.016	76.5	0.991	-7.5
400	0.521	163.8	1.440	-35.4	0.021	76.2	0.985	-10.1
500	0.523	160.5	1.409	-44.4	0.026	73.0	0.975	-12.8
600	0.530	156.7	1.373	-53.7	0.031	70.4	0.962	-15.7
700	0.537	153.7	1.331	-62.6	0.035	70.0	0.948	-18.7
800	0.548	150.8	1.273	-72.0	0.039	68.5	0.927	-21.6
900	0.584	147.7	1.225	-81.3	0.042	72.5	0.903	-24.7
1000	0.596	145.6	1.155	-90.0	0.045	71.3	0.876	-27.6

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

FREQ. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.768	175.4	1.738	-10.3	0.003	89.6	0.999	-2.5
200	0.773	171.1	1.724	-20.4	0.005	93.0	0.997	-4.9
300	0.773	166.7	1.700	-30.9	0.009	95.3	0.994	-7.6
400	0.780	162.5	1.663	-41.2	0.012	97.0	0.988	-10.4
500	0.784	158.0	1.619	-51.9	0.017	96.8	0.979	-13.4
600	0.796	154.3	1.556	-62.4	0.021	99.8	0.964	-16.5
700	0.799	150.1	1.488	-72.5	0.027	97.9	0.947	-19.7
800	0.814	146.2	1.409	-82.9	0.032	99.9	0.925	-22.9
900	0.824	142.8	1.314	-93.9	0.037	98.3	0.891	-26.2
1000	0.831	139.2	1.219	-103.4	0.043	97.9	0.859	-29.1

■ Y PARAMETERS (Base Common)

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

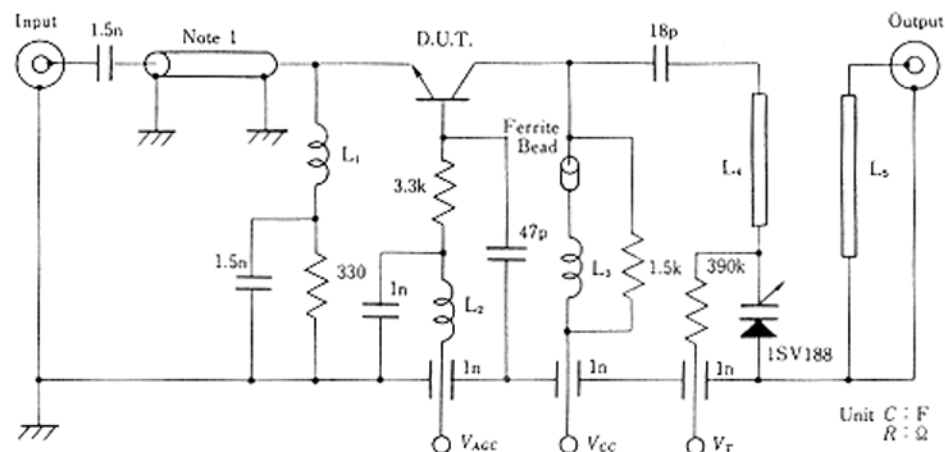
FREQ. (MHz)	Yib (mS)		Yfb (mS)		Yrb (mS)		Yob (mS)	
	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	60.385	-5.353	-58.564	11.610	-0.044	-0.251	0.069	0.604
200	60.009	-10.942	-55.142	23.025	-0.128	-0.424	0.222	1.124
300	58.731	-16.029	-48.875	33.212	-0.234	-0.600	0.419	1.651
400	56.060	-20.943	-40.030	41.224	-0.340	-0.755	0.648	2.107
500	53.150	-24.405	-30.563	46.124	-0.494	-0.885	0.922	2.531
600	49.540	-28.245	-19.815	49.158	-0.669	-0.992	1.222	2.911
700	46.322	-31.029	-10.053	49.690	-0.793	-1.092	1.478	3.301
800	42.863	-33.481	-0.325	47.908	-0.922	-1.134	1.750	3.626
900	38.788	-38.143	10.019	45.051	-0.988	-1.229	2.050	4.041
1000	35.501	-39.293	16.470	39.845	-1.105	-1.265	2.344	4.388

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

FREQ. (MHz)	Yib (mS)		Yfb (mS)		Yrb (mS)		Yob (mS)	
	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	140.572	-40.749	-132.264	57.022	-0.059	-0.248	0.094	0.633
200	117.285	-66.986	-95.069	91.592	-0.140	-0.375	0.250	1.130
300	89.975	-76.528	-53.912	100.987	-0.251	-0.519	0.455	1.633
400	68.046	-79.170	-20.663	97.331	-0.364	-0.636	0.688	2.064
500	50.746	-75.460	3.050	85.113	-0.495	-0.752	0.937	2.504
600	38.788	-72.238	19.497	71.971	-0.541	-0.837	1.172	2.941
700	29.756	-66.107	28.096	57.666	-0.668	-0.934	1.436	3.336
800	22.183	-61.618	33.994	44.251	-0.729	-1.053	1.733	3.774
900	17.260	-57.319	36.528	32.273	-0.809	-1.098	2.069	4.177
1000	13.588	-52.962	35.847	22.760	-0.896	-1.218	2.444	4.550

2SC4415

■ POWER GAIN AND NOISE FIGURE TEST CIRCUIT

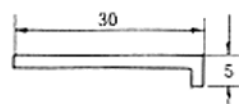


L₁ : Inside dia 3mm, ϕ 0.5mm Enameled Copper Wire 7 Turns.

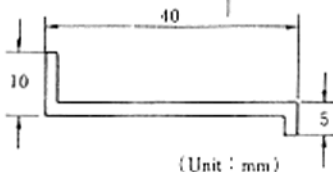
L₂ : Inside dia 3mm, ϕ 0.3mm Enameled Copper Wire 13 Turns.

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

L₄ : ϕ 0.8mm Enameled Copper Wire.



L₅ : ϕ 0.8mm Enameled Copper Wire.



Note1 : 50Ω Semirigid Cable.

(Unit : mm)