

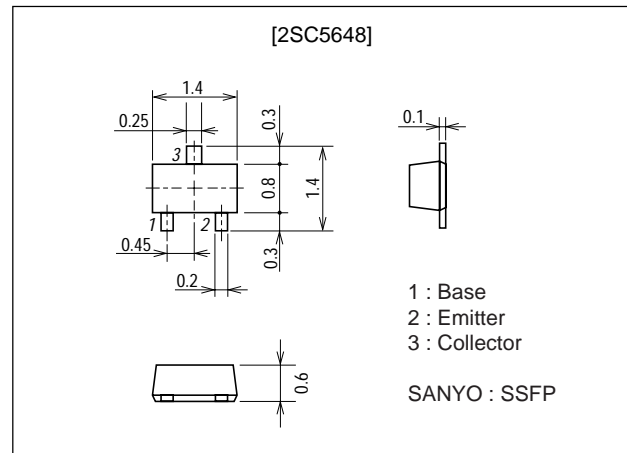
**2SC5648**

UHF to S Band Low-Noise Amplifier and OSC Applications

Features

- Low noise : NF=2.6dB typ (f=2GHz).
- High cutoff frequency : $f_T=9.0\text{GHz}$ typ ($V_{CE}=1\text{V}$).
- Low operating voltage.
- High gain : $|S_{21e}|^2=10.5\text{dB}$ typ (f=2GHz).
- Ultraminiature and thin flat lead package (1.4mmX0.8mmX0.6mm).

Package Dimensions

unit : mm
2159

Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	V_{CB0}		9	V
Collector-to-Emitter Voltage	V_{CE0}		4	V
Emitter-to-Base Voltage	V_{EB0}		2	V
Collector Current	I_C		20	mA
Collector Dissipation	P_C		80	mW
Junction Temperature	T_j		150	$^\circ\text{C}$
Storage Temperature	T_{stg}		-55 to +150	$^\circ\text{C}$

Marking : NH

Pay attention to handling since it is liable to be affected by static electricity due to the high-frequency process adopted.

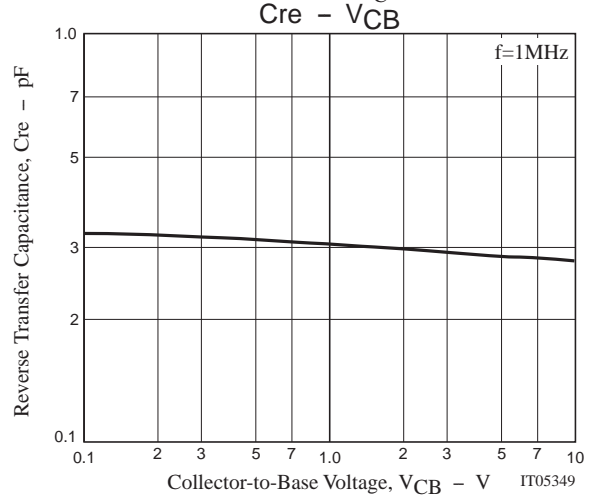
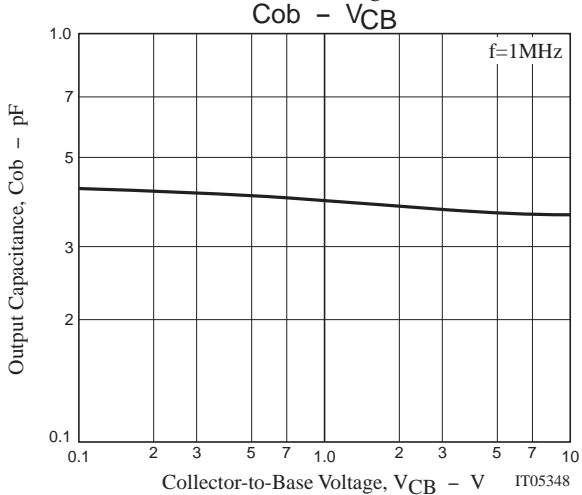
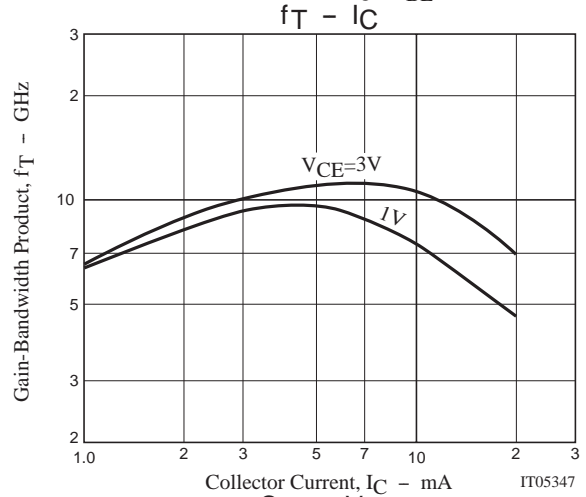
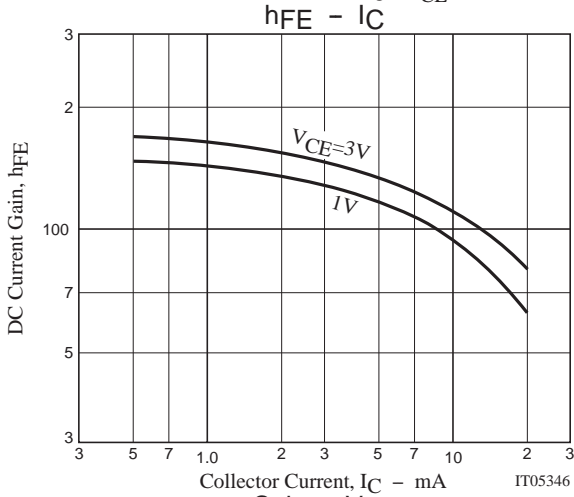
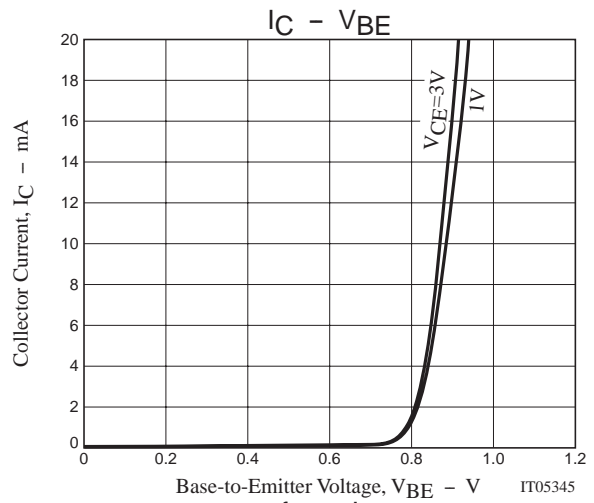
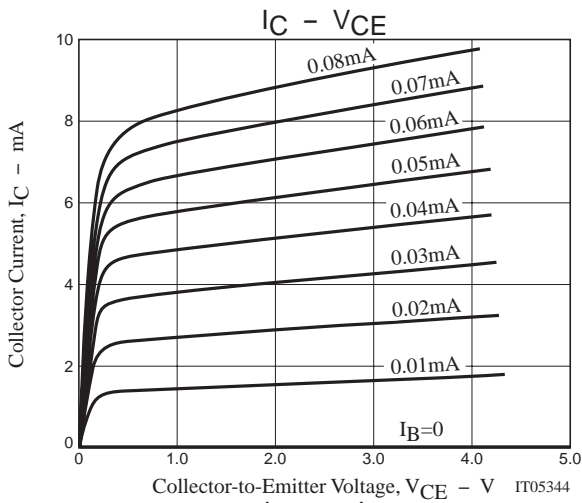
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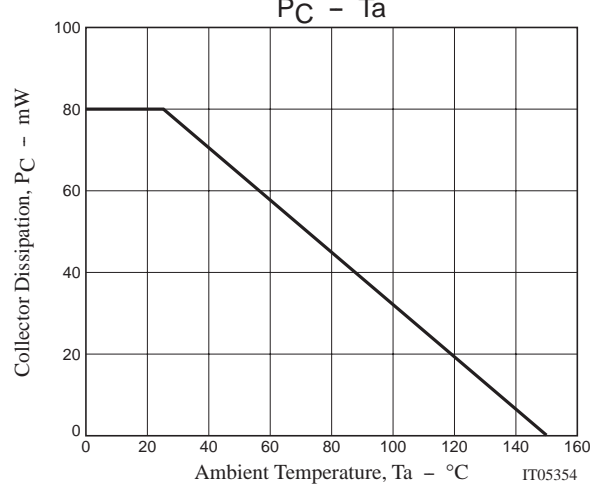
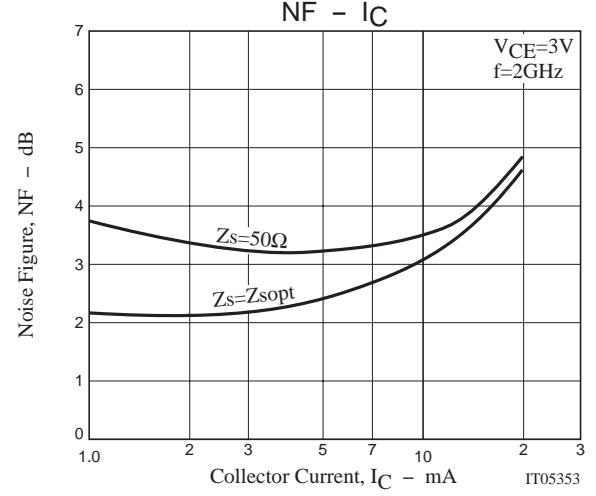
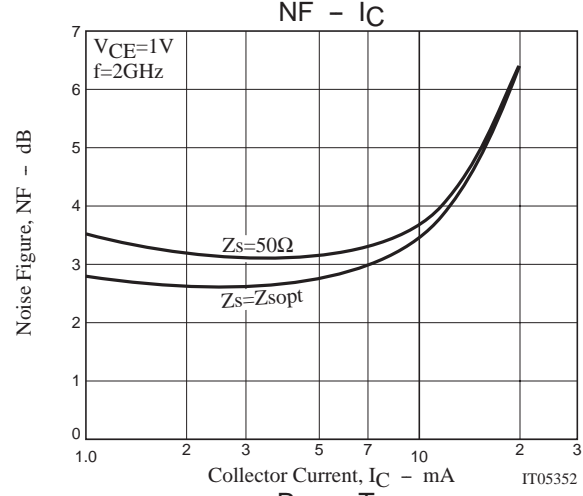
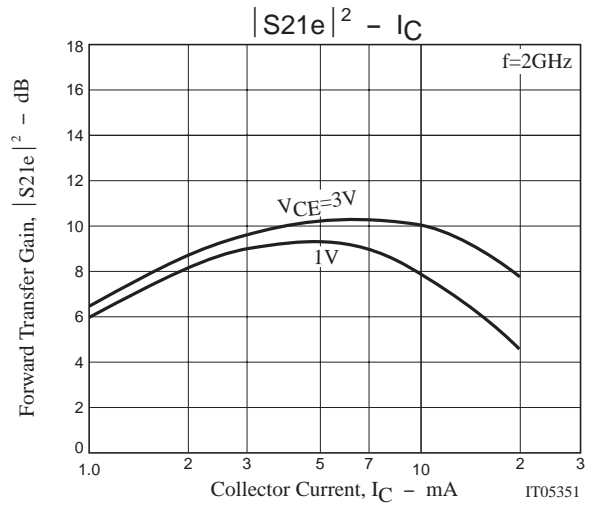
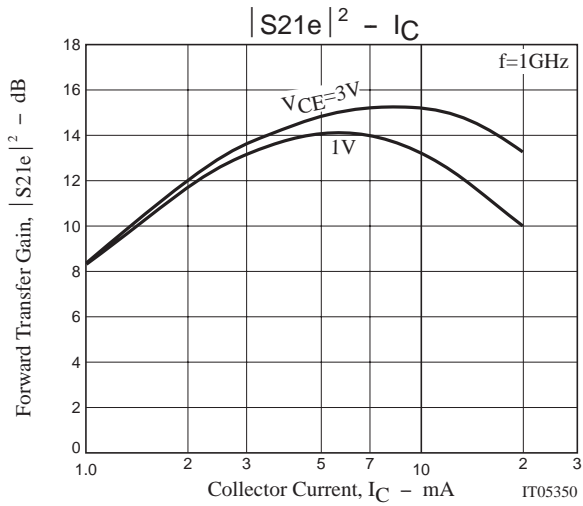
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

Electrical Characteristics at Ta=25°C

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I_{CBO}	$V_{CB}=5V, I_E=0$			1.0	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB}=1V, I_C=0$			10	μA
DC Current Gain	h_{FE}	$V_{CE}=1V, I_C=5mA$	100		160	
Gain-Bandwidth Product	f_T1	$V_{CE}=1V, I_C=3mA$	7.0	9.0		GHz
	f_T2	$V_{CE}=3V, I_C=7mA$	9.5	11.5		GHz
Output Capacitance	C_{ob}	$V_{CB}=1V, f=1MHz$		0.4	0.55	pF
Reverse Transfer Capacitance	C_{re}	$V_{CB}=1V, f=1MHz$		0.3	0.45	pF
Forward Transfer Gain	S21e 21	$V_{CE}=1V, I_C=3mA, f=2GHz$	7.5	9.0		dB
	S21e 22	$V_{CE}=3V, I_C=7mA, f=2GHz$	9.0	10.5		dB
Noise Figure	NF	$V_{CE}=1V, I_C=3mA, f=2GHz$		2.6	3.5	dB



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S Parameters (Common emitter)

$V_{CE}=1V, I_C=1mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.975	-4.69	3.271	174.19	0.017	86.57	0.990	-4.46
200	0.967	-9.35	3.226	168.53	0.036	81.15	0.986	-9.02
400	0.944	-18.44	3.180	157.59	0.069	74.00	0.964	-17.39
600	0.914	-27.19	3.053	147.60	0.100	67.62	0.934	-25.54
800	0.878	-35.19	2.941	137.79	0.126	60.48	0.898	-32.90
1000	0.840	-42.88	2.837	128.85	0.150	55.64	0.866	-39.53
1200	0.797	-49.78	2.695	119.89	0.167	50.14	0.829	-45.95
1400	0.749	-56.22	2.538	111.34	0.181	46.03	0.797	-51.01
1600	0.704	-62.19	2.429	103.70	0.195	42.97	0.770	-56.19
1800	0.656	-67.22	2.313	96.49	0.208	40.30	0.748	-60.45
2000	0.615	-71.82	2.198	89.64	0.216	37.18	0.724	-64.71
2200	0.572	-75.76	2.087	82.66	0.227	34.50	0.704	-68.61
2400	0.536	-78.65	1.944	77.11	0.233	30.58	0.680	-71.01
2600	0.505	-81.98	1.883	72.19	0.237	29.99	0.669	-74.54
2800	0.477	-84.06	1.781	66.70	0.242	27.82	0.654	-77.49
3000	0.453	-88.40	1.736	62.72	0.247	27.65	0.644	-80.39

$V_{CE}=1V, I_C=3mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.930	-8.16	6.955	171.09	0.019	87.97	0.976	-6.49
200	0.912	-15.84	6.776	162.89	0.034	78.79	0.960	-12.94
400	0.850	-30.47	6.326	147.83	0.066	70.57	0.902	-23.88
600	0.778	-43.47	5.767	134.71	0.089	61.62	0.832	-33.28
800	0.702	-54.35	5.193	123.13	0.105	56.02	0.764	-40.62
1000	0.636	-63.64	4.705	113.55	0.121	52.20	0.710	-46.69
1200	0.572	-71.64	4.243	104.85	0.132	48.88	0.663	-52.32
1400	0.516	-78.53	3.810	97.18	0.142	46.93	0.627	-55.91
1600	0.472	-84.61	3.514	90.29	0.155	45.41	0.601	-59.97
1800	0.427	-89.72	3.229	84.10	0.164	44.67	0.582	-63.36
2000	0.390	-94.47	2.976	78.19	0.172	43.50	0.567	-66.41
2200	0.356	-98.24	2.776	72.34	0.183	42.81	0.551	-69.72
2400	0.326	-101.04	2.544	67.62	0.190	40.68	0.535	-71.51
2600	0.299	-104.46	2.424	63.69	0.198	40.64	0.532	-74.24
2800	0.277	-106.02	2.259	58.71	0.206	39.58	0.524	-76.62
3000	0.262	-110.57	2.171	55.54	0.216	40.40	0.521	-79.45

$V_{CE}=1V, I_C=5mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.884	-11.16	9.698	168.46	0.018	83.01	0.960	-8.05
200	0.851	-21.68	9.305	157.96	0.034	75.36	0.931	-15.67
400	0.752	-40.79	8.207	139.84	0.061	66.67	0.839	-27.70
600	0.654	-56.10	7.067	125.31	0.080	59.72	0.747	-36.85
800	0.567	-67.23	6.040	113.95	0.094	55.60	0.672	-43.03
1000	0.502	-77.42	5.290	104.74	0.107	52.31	0.619	-47.70
1200	0.446	-85.68	4.643	96.68	0.116	51.10	0.575	-52.29
1400	0.400	-92.90	4.109	89.46	0.128	50.47	0.549	-55.27
1600	0.362	-99.51	3.714	83.39	0.139	49.89	0.533	-58.50
1800	0.329	-104.08	3.385	77.69	0.148	49.35	0.518	-61.26
2000	0.299	-109.43	3.093	72.46	0.159	49.61	0.514	-64.09
2200	0.271	-114.23	2.873	67.22	0.171	48.46	0.502	-67.17
2400	0.245	-116.70	2.615	62.82	0.179	46.74	0.488	-68.25
2600	0.225	-121.18	2.489	59.17	0.188	46.98	0.493	-71.74
2800	0.206	-123.28	2.309	54.41	0.200	46.50	0.489	-74.12
3000	0.198	-128.83	2.208	51.43	0.210	46.23	0.489	-76.70

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V_{CE}=1V, I_C=10mA, Z_O=50Ω

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
100	0.770	-18.08	12.754	163.03	0.018	77.79	0.912	-10.38
200	0.709	-34.04	11.598	148.51	0.032	71.18	0.854	-19.14
400	0.572	-59.63	9.081	126.83	0.054	60.81	0.722	-30.52
600	0.468	-77.64	7.150	112.24	0.066	57.68	0.626	-36.80
800	0.394	-90.16	5.750	101.92	0.078	56.78	0.569	-40.60
1000	0.353	-101.06	4.863	93.51	0.090	56.14	0.536	-43.68
1200	0.317	-109.56	4.179	86.47	0.100	56.36	0.509	-47.34
1400	0.289	-117.32	3.633	80.28	0.111	56.41	0.498	-49.64
1600	0.270	-123.75	3.270	74.80	0.124	55.56	0.494	-53.02
1800	0.249	-128.92	2.948	69.59	0.135	55.52	0.492	-55.55
2000	0.233	-135.17	2.679	64.74	0.145	55.77	0.493	-58.99
2200	0.216	-140.62	2.476	59.73	0.158	53.86	0.487	-62.22
2400	0.197	-143.75	2.260	55.61	0.168	52.78	0.486	-63.78
2600	0.188	-149.14	2.141	52.22	0.180	52.41	0.493	-67.24
2800	0.173	-153.06	1.979	47.73	0.191	52.50	0.491	-70.21
3000	0.173	-157.72	1.894	44.90	0.203	52.48	0.497	-73.38

V_{CE}=3V, I_C=1mA, Z_O=50Ω

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
100	0.977	-4.47	3.224	174.24	0.017	85.16	0.991	-4.24
200	0.971	-8.81	3.216	168.73	0.033	80.59	0.988	-8.39
400	0.950	-17.51	3.137	158.22	0.064	75.90	0.967	-16.36
600	0.922	-25.97	3.042	148.15	0.092	67.54	0.938	-24.12
800	0.883	-33.19	2.906	138.53	0.116	61.73	0.900	-31.05
1000	0.850	-40.49	2.821	129.85	0.138	55.94	0.871	-37.23
1200	0.807	-47.17	2.686	121.05	0.156	50.85	0.831	-43.65
1400	0.763	-53.33	2.550	112.56	0.169	46.87	0.797	-48.27
1600	0.715	-59.07	2.437	105.11	0.184	43.90	0.774	-53.09
1800	0.670	-63.45	2.329	97.86	0.194	41.20	0.747	-57.32
2000	0.629	-67.75	2.200	91.13	0.202	37.98	0.725	-61.22
2200	0.585	-71.43	2.097	84.11	0.215	34.96	0.698	-65.16
2400	0.553	-74.17	1.961	78.56	0.218	31.93	0.678	-67.34
2600	0.517	-77.41	1.902	73.61	0.223	30.66	0.663	-70.71
2800	0.491	-79.67	1.785	68.02	0.228	28.72	0.648	-73.43
3000	0.469	-82.84	1.752	64.13	0.233	28.98	0.637	-76.17

V_{CE}=3V, I_C=3mA, Z_O=50Ω

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
100	0.937	-7.60	7.066	171.34	0.017	83.63	0.980	-6.04
200	0.920	-14.73	6.972	163.44	0.033	78.33	0.966	-11.95
400	0.862	-28.36	6.503	148.88	0.060	69.17	0.912	-22.38
600	0.793	-40.71	5.974	135.99	0.082	62.44	0.843	-31.26
800	0.716	-50.68	5.355	124.98	0.099	58.00	0.776	-38.23
1000	0.652	-59.69	4.887	115.54	0.115	53.64	0.727	-44.03
1200	0.589	-67.27	4.427	106.66	0.127	50.65	0.676	-49.38
1400	0.532	-73.84	4.000	98.75	0.134	48.50	0.640	-52.99
1600	0.487	-79.43	3.689	92.14	0.148	47.41	0.614	-56.62
1800	0.440	-84.11	3.394	85.80	0.156	46.22	0.592	-59.61
2000	0.404	-88.38	3.127	80.15	0.164	44.94	0.579	-62.95
2200	0.366	-91.86	2.920	74.35	0.176	43.44	0.560	-65.94
2400	0.335	-94.08	2.679	69.62	0.183	41.50	0.537	-67.22
2600	0.308	-96.66	2.555	65.72	0.191	42.23	0.535	-69.99
2800	0.282	-97.90	2.377	60.79	0.197	40.34	0.523	-72.68
3000	0.271	-102.11	2.285	57.61	0.209	40.82	0.518	-74.78

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V_{CE}=3V, I_C=5mA, Z_O=50Ω

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
100	0.899	-9.89	9.718	169.21	0.016	84.10	0.972	-7.26
200	0.871	-19.27	9.407	159.58	0.030	77.38	0.946	-14.14
400	0.785	-36.01	8.424	142.50	0.057	67.79	0.866	-25.58
600	0.693	-50.14	7.393	128.48	0.076	60.47	0.778	-34.24
800	0.605	-60.47	6.381	117.34	0.090	56.98	0.703	-40.66
1000	0.541	-70.18	5.640	108.16	0.103	53.96	0.650	-45.44
1200	0.479	-77.42	4.988	100.04	0.113	52.25	0.603	-49.88
1400	0.429	-83.93	4.431	92.72	0.122	51.54	0.573	-52.73
1600	0.389	-89.86	4.034	86.63	0.134	51.00	0.554	-55.83
1800	0.353	-94.17	3.681	80.89	0.144	49.87	0.536	-58.62
2000	0.319	-98.64	3.366	75.79	0.152	49.55	0.525	-61.58
2200	0.288	-102.61	3.120	70.25	0.165	48.50	0.513	-64.33
2400	0.260	-104.71	2.847	65.80	0.173	46.68	0.496	-65.17
2600	0.239	-108.27	2.710	62.33	0.184	46.41	0.497	-68.10
2800	0.220	-109.22	2.514	57.48	0.192	45.66	0.490	-70.39
3000	0.209	-114.12	2.403	54.56	0.200	46.18	0.491	-72.83

V_{CE}=3V, I_C=10mA, Z_O=50Ω

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
100	0.814	-14.23	13.482	165.49	0.015	83.43	0.953	-9.10
200	0.766	-26.96	12.563	152.95	0.029	75.11	0.907	-17.10
400	0.644	-48.56	10.378	133.04	0.050	65.71	0.788	-28.66
600	0.538	-64.52	8.476	118.42	0.066	59.58	0.691	-35.79
800	0.454	-75.75	6.985	107.80	0.076	58.12	0.615	-40.17
1000	0.403	-85.44	5.983	99.38	0.088	57.19	0.574	-43.73
1200	0.354	-93.51	5.174	92.13	0.100	56.06	0.541	-47.13
1400	0.319	-100.31	4.529	85.63	0.110	56.11	0.521	-49.27
1600	0.292	-106.42	4.071	80.17	0.122	56.38	0.513	-52.19
1800	0.266	-111.30	3.693	75.00	0.131	55.83	0.501	-54.69
2000	0.243	-116.42	3.363	70.20	0.144	55.58	0.498	-57.51
2200	0.222	-121.23	3.109	65.08	0.155	54.24	0.490	-60.49
2400	0.201	-123.53	2.823	61.19	0.164	52.66	0.482	-61.32
2600	0.185	-128.70	2.684	57.79	0.175	52.72	0.488	-64.37
2800	0.168	-130.16	2.483	53.18	0.188	52.33	0.483	-66.84
3000	0.165	-135.42	2.374	50.48	0.198	51.81	0.486	-69.60

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