

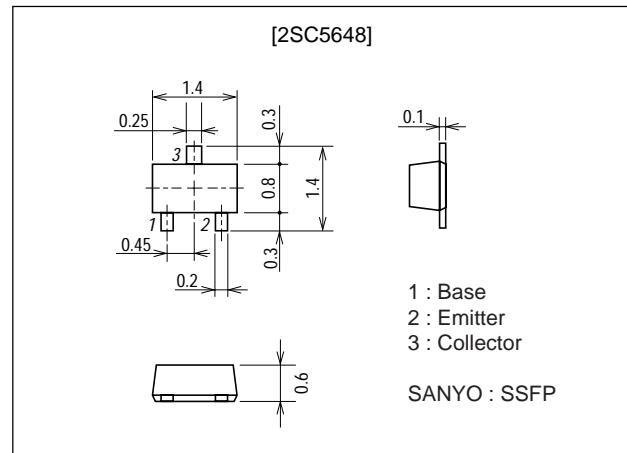
**2SC5648**

## 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.

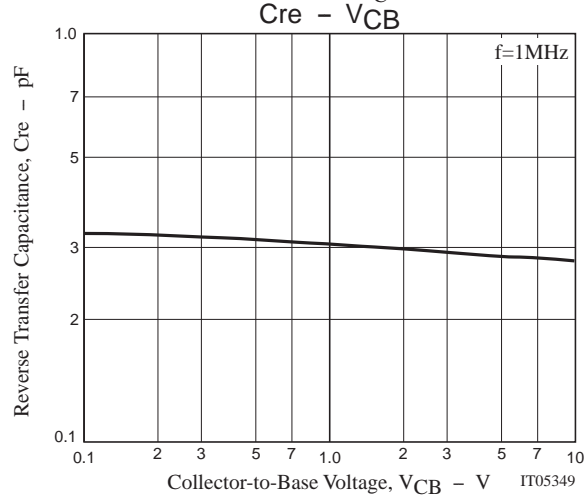
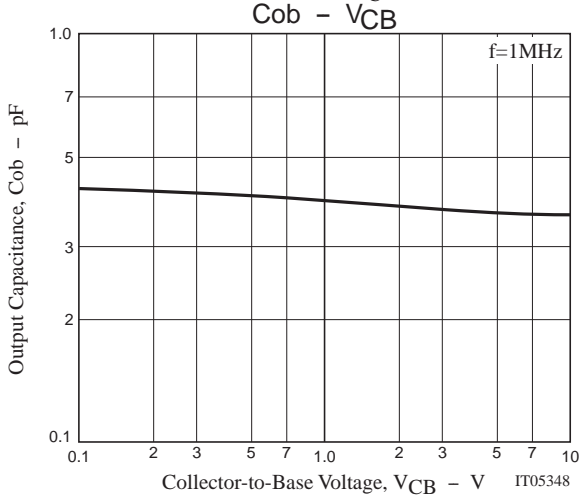
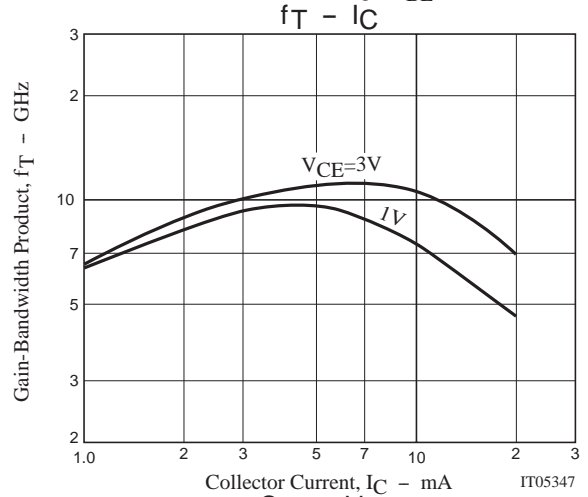
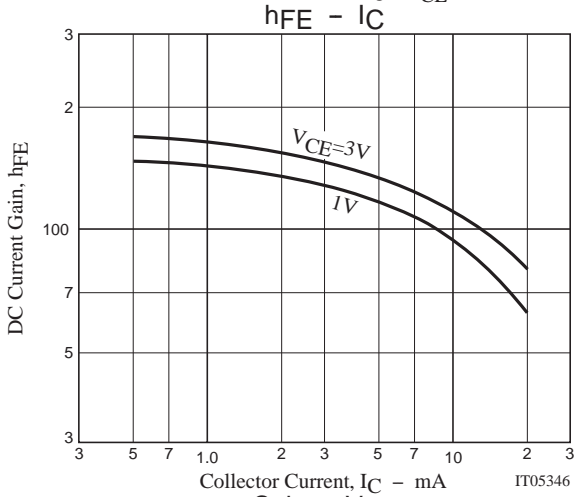
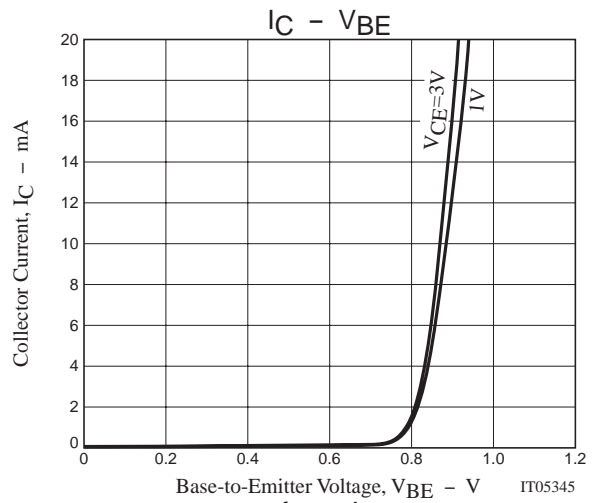
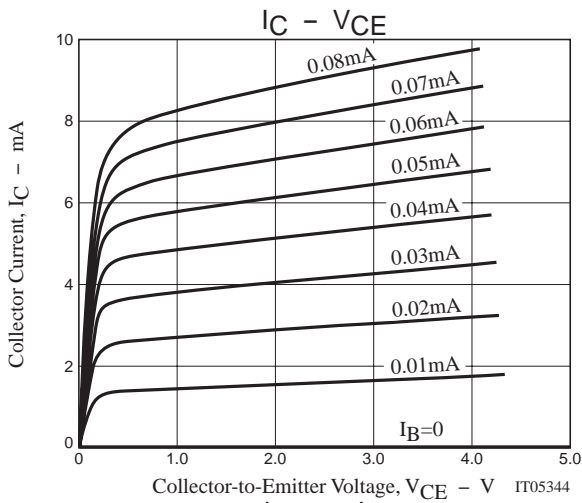
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- SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

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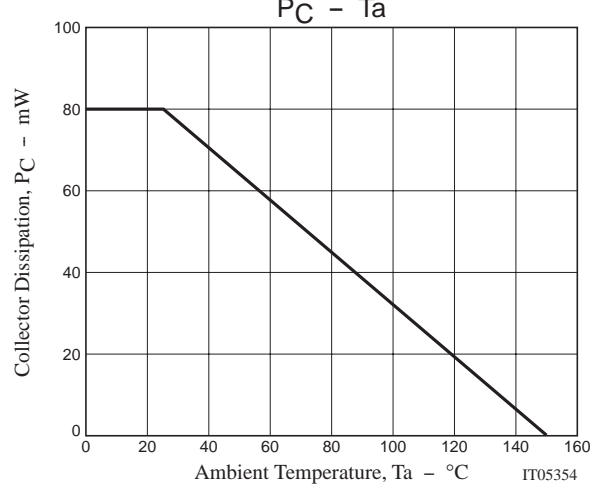
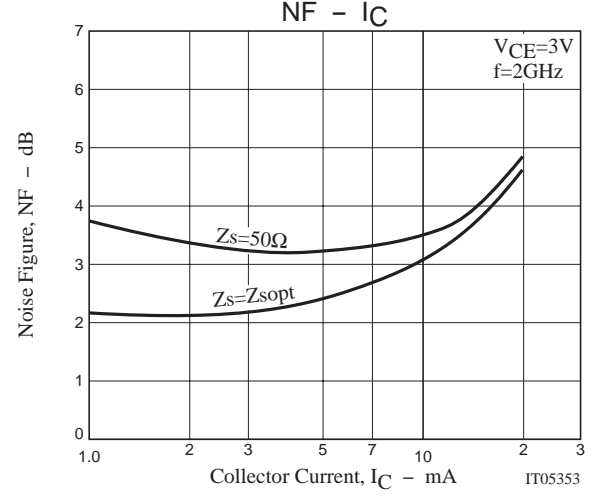
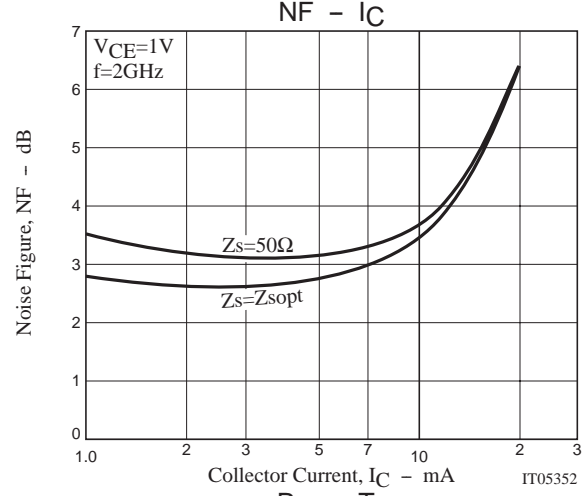
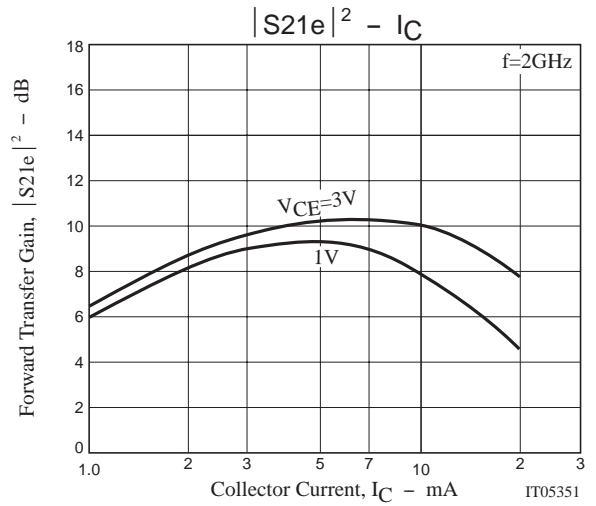
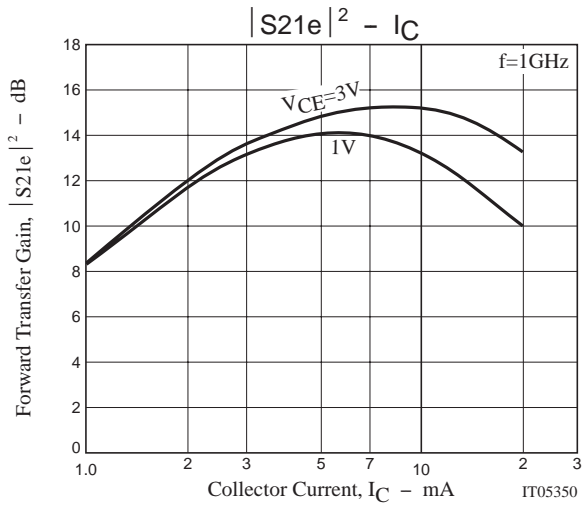
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

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	$\mu A$
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=1V, I_C=0$			10	$\mu A$
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  <sub>21</sub>	$V_{CE}=1V, I_C=3mA, f=2GHz$	7.5	9.0		dB
	S21e  <sub>22</sub>	$V_{CE}=3V, I_C=7mA, f=2GHz$	9.0	10.5		dB
Noise Figure	NF	$V_{CE}=1V, I_C=3mA, f=2GHz$		2.6	3.5	dB



# 2SC5648



## 2SC5648

### 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

## 2SC5648

V<sub>CE</sub>=1V, I<sub>C</sub>=10mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
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<sub>CE</sub>=3V, I<sub>C</sub>=1mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
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<sub>CE</sub>=3V, I<sub>C</sub>=3mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
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

## 2SC5648

V<sub>CE</sub>=3V, I<sub>C</sub>=5mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
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<sub>CE</sub>=3V, I<sub>C</sub>=10mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
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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