



# EC3H09B

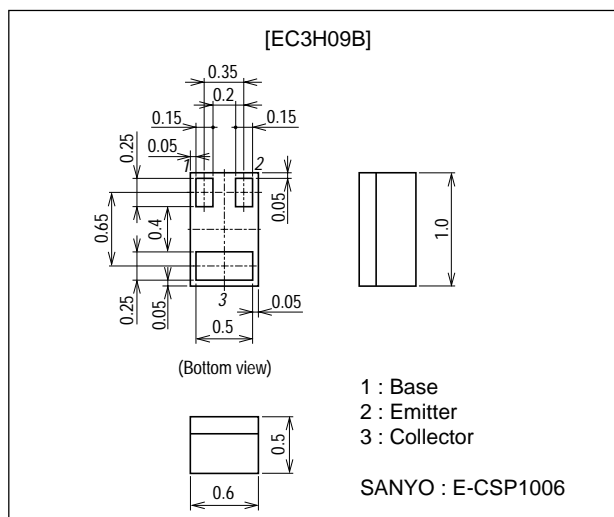
## High-Frequency Low-Noise Amplifier and OSC Applications

### Features

- Low noise : NF=1.5dB typ (f=2GHz).
- High cut-off frequency :  $f_T=6.5\text{GHz}$  typ ( $V_{CE}=1\text{V}$ ).  
:  $f_T=11.2\text{GHz}$  typ ( $V_{CE}=3\text{V}$ ).
- Low operating voltage.
- Ultraminiature (1006 size) and thin (0.5mm) leadless package.

### Package Dimensions

unit : mm  
2183



### 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	$V_{CEO}$		4	V
Emitter-to-Base Voltage	$V_{EBO}$		2	V
Collector Current	$I_C$		70	mA
Collector Dissipation	$P_C$		100	mW
Junction Temperature	$T_j$		150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

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

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	$I_{CB0}$	$V_{CB}=5\text{V}, I_E=0$			1.0	$\mu\text{A}$
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=1\text{V}, I_C=0$			10	$\mu\text{A}$
DC Current Gain	$h_{FE}$	$V_{CE}=1\text{V}, I_C=5\text{mA}$	100		160	
Gain-Bandwidth Product	$f_{T1}$	$V_{CE}=1\text{V}, I_C=5\text{mA}$	5	6.5		GHz
	$f_{T2}$	$V_{CE}=3\text{V}, I_C=30\text{mA}$	9.5	11.2		GHz
Output Capacitance	$C_{ob}$	$V_{CB}=1\text{V}, f=1\text{MHz}$		0.95	1.2	pF
Reverse Transfer Capacitance	$C_{re}$	$V_{CB}=1\text{V}, f=1\text{MHz}$		0.7	0.9	pF

Marking : J

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■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

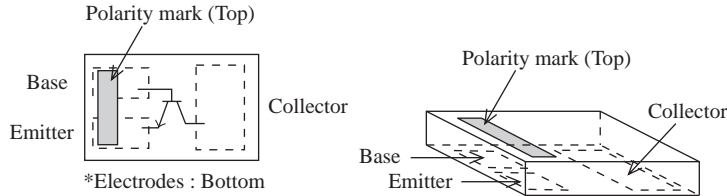
■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained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

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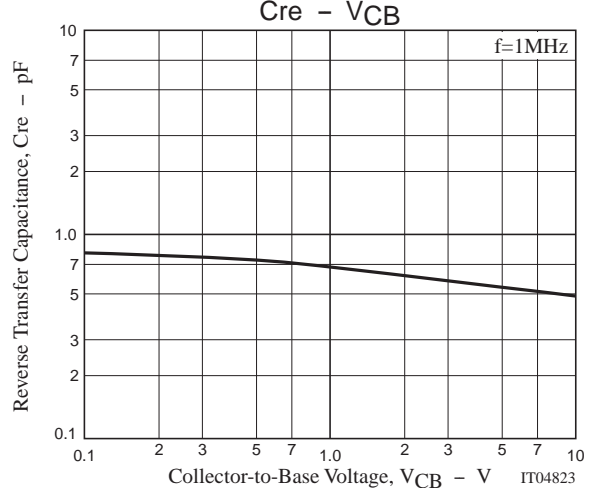
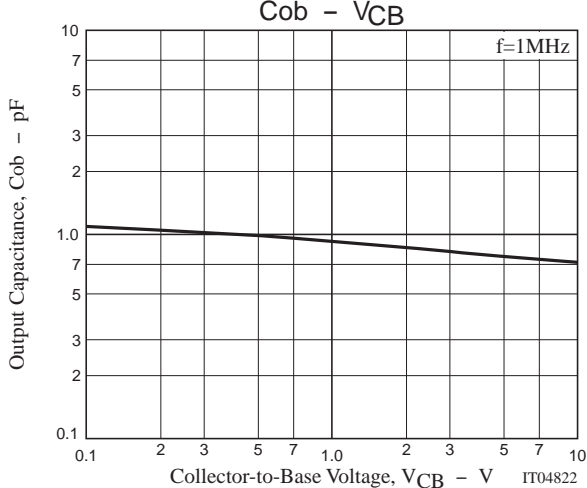
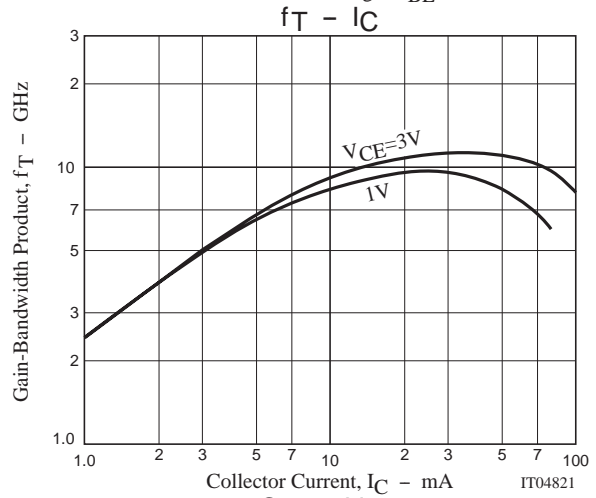
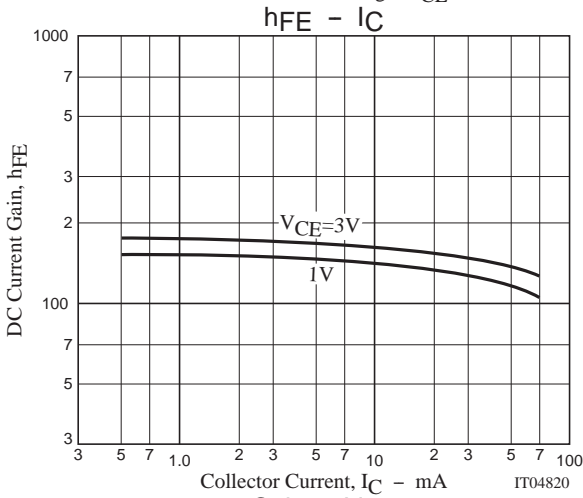
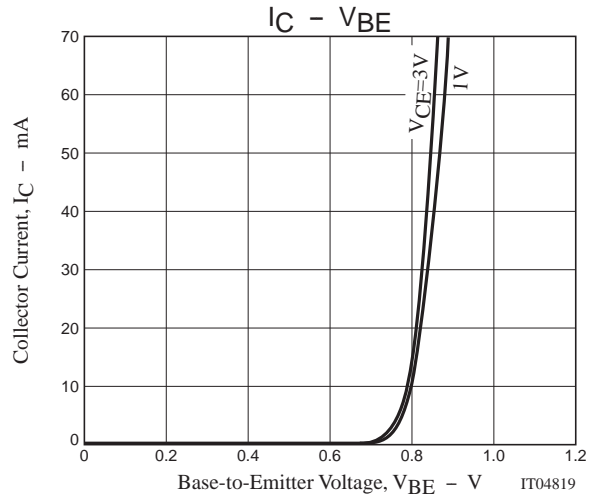
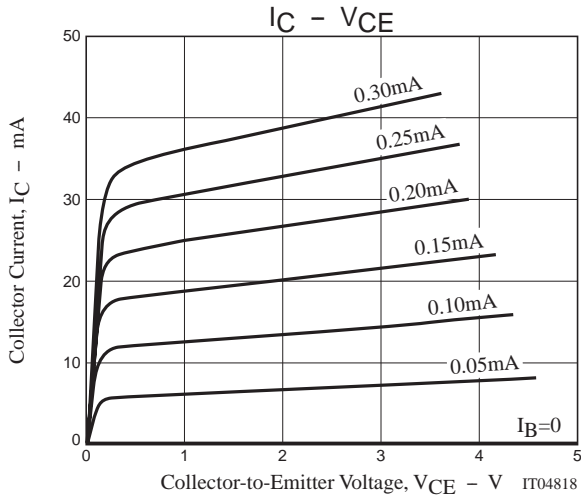
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Forward Transfer Gain	S21e  <sub>21</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =5mA, f=2GHz	5	6		dB
	S21e  <sub>22</sub>	V <sub>CE</sub> =3V, I <sub>C</sub> =30mA, f=2GHz	7.0	8.5		dB
Noise Figure	NF	V <sub>CE</sub> =1V, I <sub>C</sub> =5mA, f=2GHz		1.5	2.3	dB

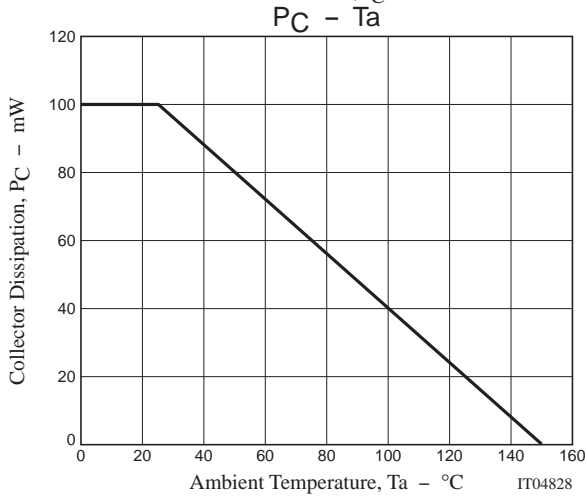
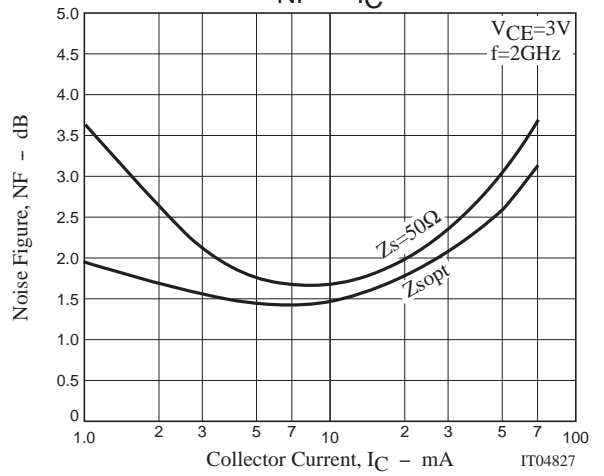
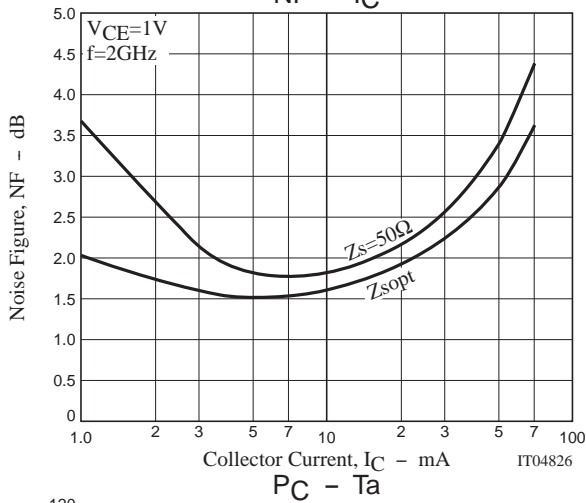
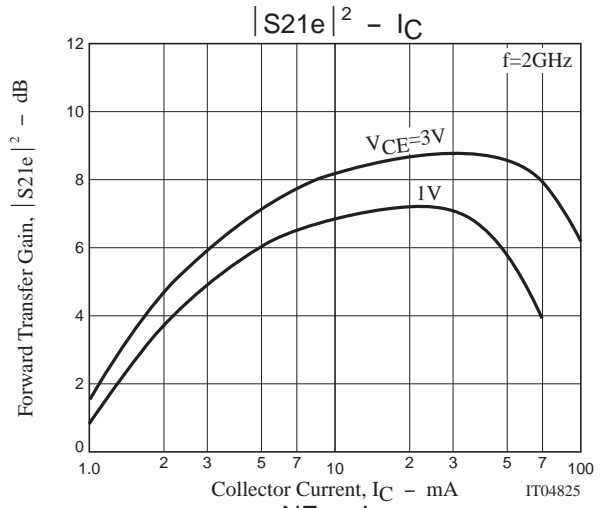
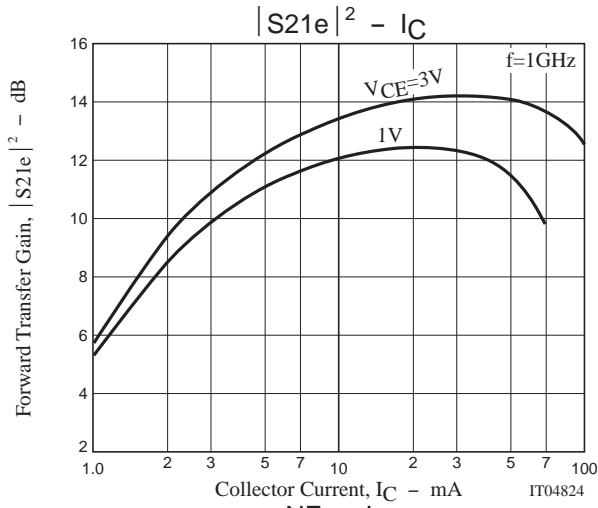
## Electrical Connection (Top view)



This product adopts a high-frequency process. Please be careful when handling it because it is susceptible to static electricity.



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### S Parameters (Common emitter)

V<sub>CE</sub>=1V, 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	0.968	-16.79	3.373	167.02	0.048	77.62	0.989	-9.19
200	0.948	-32.71	3.196	155.02	0.096	70.00	0.949	-18.45
400	0.892	-60.75	2.773	133.42	0.163	52.10	0.852	-33.03
600	0.836	-82.24	2.374	117.30	0.200	39.55	0.754	-42.69
800	0.789	-99.34	2.035	103.34	0.224	30.36	0.687	-50.89
1000	0.759	-112.13	1.789	92.87	0.235	23.93	0.634	-55.97
1200	0.733	-122.32	1.576	83.42	0.234	19.37	0.606	-59.85
1400	0.712	-130.00	1.406	75.11	0.234	16.71	0.587	-63.42
1600	0.698	-137.30	1.287	68.08	0.229	14.31	0.581	-66.83
1800	0.683	-144.17	1.192	61.55	0.222	12.16	0.573	-70.08
2000	0.669	-149.80	1.099	55.50	0.214	11.54	0.571	-73.08
2200	0.659	-154.81	1.024	50.19	0.206	13.07	0.569	-77.16
2400	0.642	-160.21	0.952	45.92	0.202	13.29	0.554	-79.81
2600	0.635	-164.74	0.897	41.45	0.193	16.16	0.565	-83.22
2800	0.629	-169.41	0.837	37.89	0.188	19.54	0.568	-86.83
3000	0.619	-174.07	0.799	34.37	0.190	22.49	0.563	-91.67

V<sub>CE</sub>=1V, 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	0.849	-37.08	12.998	155.37	0.044	68.95	0.913	-25.28
200	0.777	-67.19	11.039	136.37	0.075	57.27	0.770	-45.63
400	0.674	-106.59	7.507	112.98	0.103	41.57	0.541	-69.90
600	0.626	-127.60	5.479	99.96	0.115	37.83	0.418	-82.80
800	0.601	-140.62	4.282	90.63	0.124	36.84	0.363	-91.97
1000	0.585	-148.69	3.528	83.85	0.133	38.00	0.321	-96.97
1200	0.566	-155.47	3.000	77.71	0.142	38.38	0.301	-101.59
1400	0.556	-160.27	2.601	72.26	0.150	42.15	0.287	-103.64
1600	0.548	-164.53	2.346	67.49	0.163	42.19	0.276	-105.98
1800	0.537	-168.47	2.124	62.94	0.173	42.68	0.268	-107.07
2000	0.526	-172.04	1.939	58.45	0.183	44.02	0.266	-108.83
2200	0.518	-175.49	1.789	54.03	0.198	44.36	0.260	-110.18
2400	0.507	-179.61	1.657	50.86	0.212	44.51	0.239	-112.95
2600	0.502	177.23	1.559	47.02	0.223	45.68	0.243	-113.25
2800	0.486	174.34	1.460	43.45	0.237	44.59	0.245	-114.77
3000	0.484	170.37	1.376	40.37	0.254	45.21	0.238	-117.97

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	0.744	-54.61	20.098	146.36	0.041	63.26	0.830	-38.46
200	0.664	-91.71	15.053	125.03	0.057	49.61	0.635	-64.12
400	0.600	-128.66	9.029	104.15	0.078	43.88	0.418	-92.00
600	0.572	-145.12	6.310	94.13	0.094	45.10	0.332	-107.03
800	0.564	-155.02	4.843	86.30	0.101	46.33	0.298	-116.65
1000	0.553	-160.68	3.953	80.70	0.115	49.04	0.272	-122.54
1200	0.538	-166.08	3.348	75.88	0.131	49.55	0.257	-125.73
1400	0.526	-169.57	2.920	70.79	0.145	51.15	0.246	-129.15
1600	0.522	-172.62	2.602	66.59	0.161	52.21	0.239	-131.00
1800	0.513	-175.68	2.344	62.48	0.175	52.26	0.229	-131.76
2000	0.501	-178.84	2.145	58.31	0.191	52.49	0.223	-134.35
2200	0.493	177.69	1.982	54.28	0.208	52.76	0.217	-135.36
2400	0.485	174.42	1.831	51.23	0.225	51.63	0.199	-139.04
2600	0.480	171.65	1.725	47.98	0.239	51.38	0.199	-139.54
2800	0.464	168.72	1.624	44.29	0.258	50.51	0.191	-140.56
3000	0.457	165.14	1.523	41.28	0.275	48.68	0.185	-142.36

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V<sub>CE</sub>=1V, I<sub>C</sub>=30mA, 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	0.575	-89.68	28.249	132.16	0.032	55.71	0.666	-61.14
200	0.563	-127.25	17.791	112.23	0.042	50.70	0.473	-93.27
400	0.562	-153.10	9.670	96.26	0.060	52.22	0.339	-123.23
600	0.557	-162.57	6.599	88.53	0.074	57.08	0.301	-137.20
800	0.554	-168.54	5.027	82.26	0.094	59.83	0.293	-143.84
1000	0.547	-172.35	4.085	77.32	0.112	61.67	0.281	-149.65
1200	0.535	-176.01	3.455	73.04	0.126	61.05	0.269	-152.59
1400	0.528	-178.43	3.012	68.78	0.150	60.68	0.263	-154.98
1600	0.520	179.21	2.684	64.94	0.169	60.12	0.257	-157.14
1800	0.512	176.62	2.419	61.21	0.185	59.47	0.248	-159.25
2000	0.504	174.49	2.214	57.44	0.206	58.32	0.239	-161.57
2200	0.493	171.77	2.052	53.73	0.223	57.35	0.232	-162.89
2400	0.485	168.47	1.890	50.78	0.240	55.22	0.216	-167.73
2600	0.473	165.31	1.784	47.90	0.260	53.81	0.205	-167.00
2800	0.465	162.52	1.675	44.25	0.280	53.36	0.200	-169.04
3000	0.456	159.36	1.587	41.33	0.298	51.09	0.196	-173.01

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	0.970	-15.47	3.608	168.02	0.038	80.41	0.991	-7.75
200	0.951	-30.01	3.500	156.99	0.074	71.14	0.961	-15.58
400	0.900	-56.20	3.095	137.61	0.135	55.53	0.878	-28.05
600	0.848	-77.42	2.674	122.02	0.167	43.47	0.789	-37.24
800	0.807	-94.03	2.306	109.09	0.188	35.30	0.722	-43.82
1000	0.771	-106.70	2.033	98.22	0.199	27.52	0.677	-48.89
1200	0.739	-117.20	1.784	88.90	0.203	24.35	0.644	-51.98
1400	0.719	-125.86	1.594	80.93	0.200	21.77	0.621	-55.03
1600	0.698	-133.28	1.465	73.97	0.198	19.48	0.611	-58.34
1800	0.684	-140.05	1.348	67.57	0.194	18.63	0.610	-60.96
2000	0.664	-145.84	1.251	61.77	0.187	17.16	0.600	-63.68
2200	0.647	-151.62	1.156	55.85	0.181	19.36	0.602	-67.40
2400	0.632	-157.11	1.075	51.61	0.177	19.72	0.580	-69.63
2600	0.625	-161.79	1.014	47.22	0.172	23.14	0.587	-72.38
2800	0.612	-166.55	0.942	43.17	0.168	25.73	0.595	-76.01
3000	0.599	-171.46	0.894	39.52	0.171	30.41	0.589	-79.78

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	0.867	-31.32	13.163	158.43	0.036	72.67	0.930	-20.32
200	0.799	-57.72	11.570	140.89	0.062	60.10	0.811	-36.80
400	0.684	-95.53	8.263	117.78	0.091	46.15	0.594	-57.52
600	0.622	-117.42	6.172	104.00	0.102	41.13	0.464	-67.59
800	0.587	-131.73	4.880	94.39	0.113	40.83	0.396	-74.82
1000	0.562	-140.79	4.044	87.36	0.119	41.10	0.353	-78.48
1200	0.543	-148.48	3.418	81.25	0.130	41.47	0.322	-81.14
1400	0.532	-153.64	2.983	75.97	0.142	43.39	0.306	-82.48
1600	0.519	-158.24	2.669	70.74	0.150	45.09	0.295	-84.21
1800	0.510	-162.43	2.411	66.30	0.159	45.01	0.290	-84.74
2000	0.498	-165.75	2.199	61.85	0.169	46.92	0.283	-85.85
2200	0.484	-170.11	2.024	57.26	0.182	49.20	0.281	-88.24
2400	0.476	-174.47	1.863	54.14	0.194	47.49	0.261	-89.10
2600	0.467	-178.08	1.753	50.36	0.206	48.56	0.266	-88.83
2800	0.455	179.00	1.634	46.50	0.219	49.39	0.267	-90.22
3000	0.447	174.76	1.536	43.70	0.229	48.85	0.260	-92.67

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$V_{CE}=3V, I_C=10mA, Z_O=50\Omega$

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	0.771	-45.05	20.792	150.58	0.032	69.91	0.866	-30.29
200	0.679	-78.66	16.411	130.13	0.053	55.62	0.686	-51.47
400	0.584	-116.88	10.301	108.37	0.071	46.72	0.452	-74.77
600	0.542	-135.32	7.317	97.53	0.084	48.29	0.344	-85.87
800	0.525	-146.54	5.624	89.73	0.093	48.59	0.299	-93.67
1000	0.514	-153.16	4.628	83.80	0.106	51.39	0.264	-98.43
1200	0.494	-158.86	3.894	78.36	0.115	53.88	0.242	-101.02
1400	0.483	-163.05	3.376	74.03	0.136	54.38	0.230	-102.97
1600	0.475	-166.71	3.014	69.51	0.148	54.71	0.222	-104.72
1800	0.469	-170.02	2.712	65.29	0.160	54.13	0.212	-105.32
2000	0.458	-173.05	2.474	61.37	0.176	55.40	0.207	-104.93
2200	0.445	-176.54	2.274	57.27	0.191	56.39	0.204	-106.24
2400	0.439	179.77	2.093	54.29	0.206	53.64	0.184	-108.58
2600	0.430	176.83	1.965	50.85	0.223	53.47	0.182	-107.06
2800	0.414	173.71	1.841	47.44	0.238	52.52	0.179	-106.11
3000	0.408	170.38	1.725	44.36	0.256	51.77	0.173	-106.92

$V_{CE}=3V, I_C=30mA, Z_O=50\Omega$

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	0.593	-71.61	31.509	138.07	0.025	60.92	0.729	-46.42
200	0.535	-109.79	21.047	117.38	0.040	55.16	0.510	-73.03
400	0.504	-141.59	11.799	99.86	0.054	54.25	0.324	-99.37
600	0.493	-154.02	8.060	91.58	0.070	59.83	0.258	-112.17
800	0.487	-161.10	6.164	85.15	0.085	61.28	0.237	-120.88
1000	0.479	-165.40	5.024	80.37	0.102	62.37	0.217	-125.73
1200	0.467	-169.58	4.235	75.94	0.119	63.82	0.204	-129.11
1400	0.457	-172.02	3.663	71.95	0.135	62.37	0.196	-129.95
1600	0.450	-174.70	3.241	68.39	0.154	62.67	0.188	-131.46
1800	0.442	-176.99	2.934	63.98	0.173	61.17	0.180	-131.51
2000	0.432	-179.45	2.665	60.62	0.187	60.24	0.169	-133.74
2200	0.421	177.74	2.461	57.05	0.205	59.33	0.167	-132.95
2400	0.414	174.32	2.265	54.03	0.220	58.39	0.149	-138.28
2600	0.406	171.15	2.125	51.14	0.242	57.25	0.141	-135.47
2800	0.394	168.11	1.993	47.61	0.257	55.56	0.135	-136.77
3000	0.387	165.37	1.871	44.80	0.272	53.24	0.127	-139.05

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