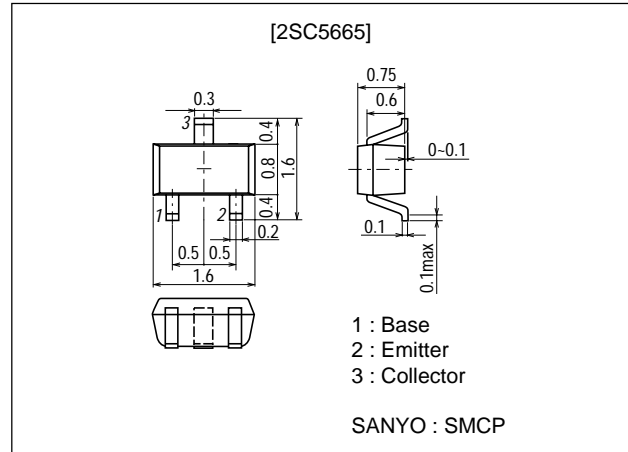


SANYO**High-Frequency Low-Noise Amplifier
and OSC Applications**

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Features

- Low-noise use : NF=1.5dB typ (f=2GHz).
- High cut-off frequency : $f_T=6.5\text{GHz}$ typ ($V_{CE}=1\text{V}$).
- Low operating voltage. : $f_T=11.2\text{GHz}$ typ ($V_{CE}=3\text{V}$).

Package Dimensionsunit : mm
2106A**Specifications****Absolute Maximum Ratings** at $T_a=25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	V_{CBO}		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	$^\circ\text{C}$

Marking : NK

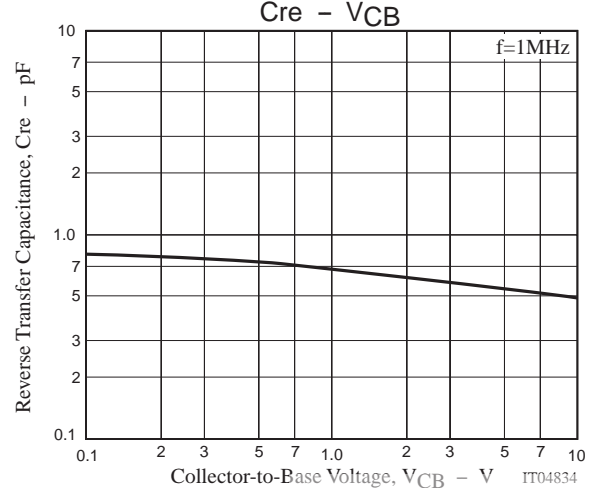
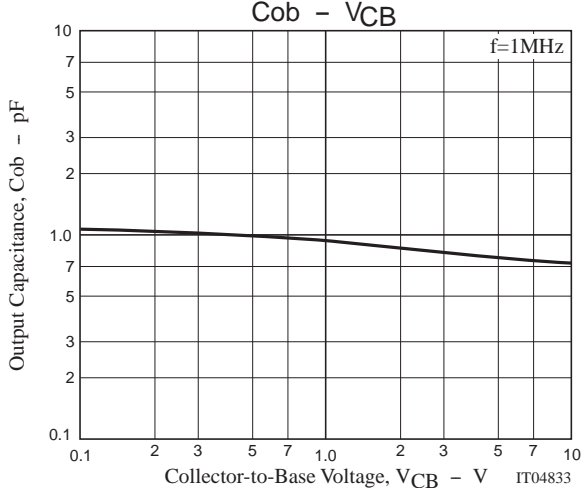
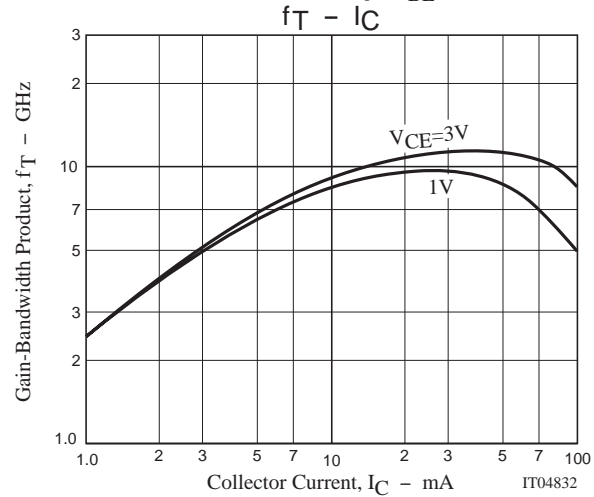
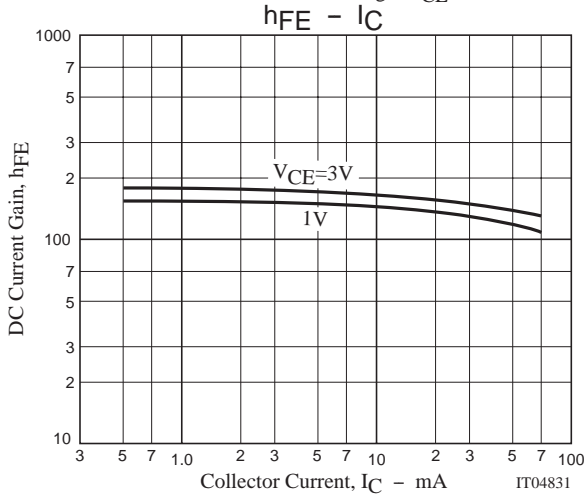
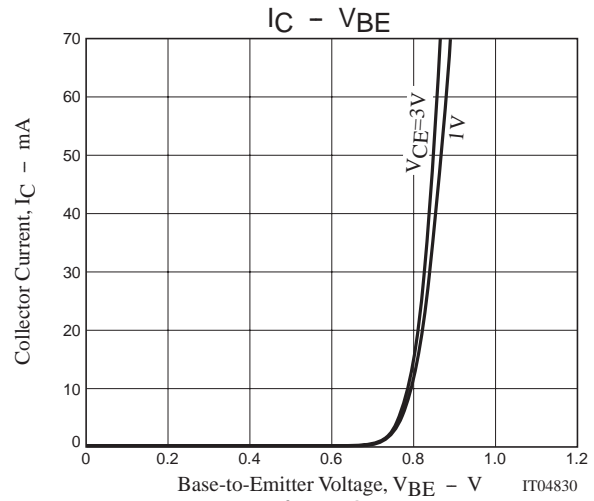
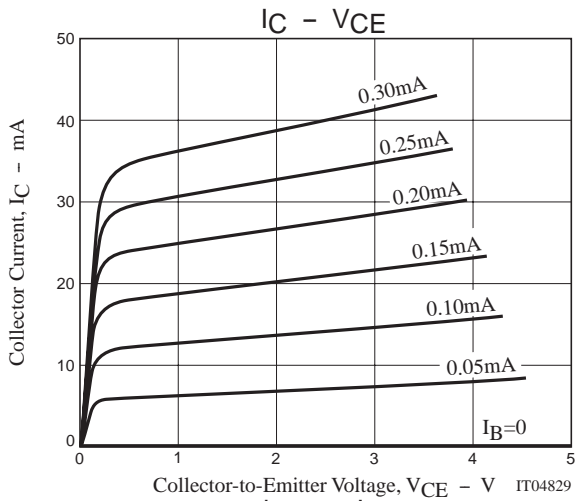
This product adopts a high-frequency process. Please be careful when handling it because it is susceptible to static electricity.

- 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.

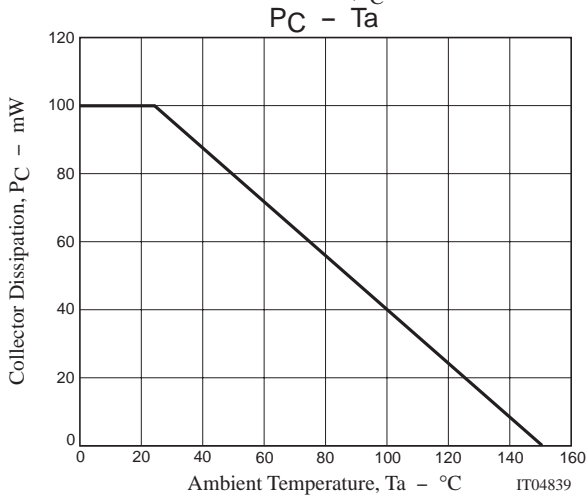
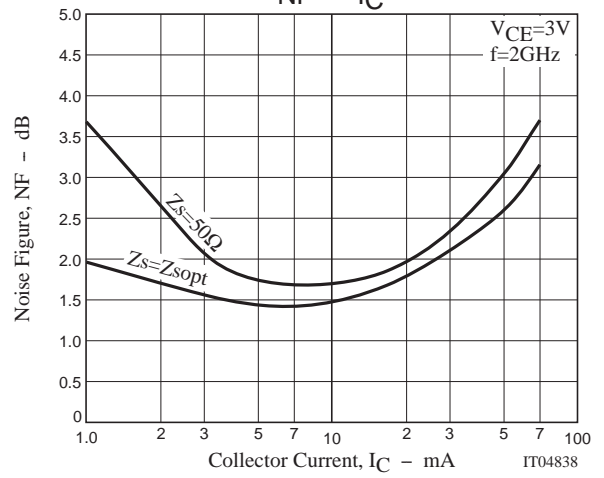
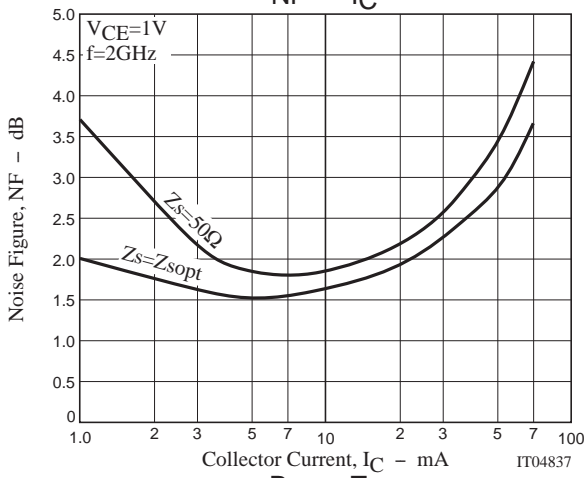
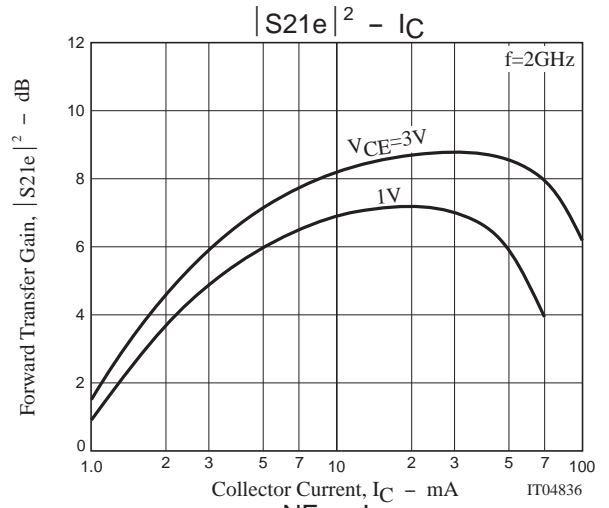
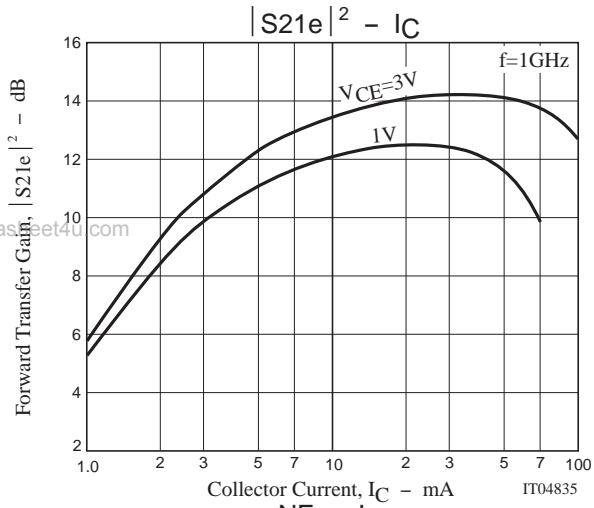
Electrical Characteristics at Ta=25°C

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_T 1	$V_{CE}=1V, I_C=5mA$	5	6.5		GHz
	f_T 2	$V_{CE}=3V, I_C=30mA$	9.5	11.2		GHz
Output Capacitance	C_{ob}	$V_{CB}=1V, f=1MHz$		0.95	1.2	pF
Reverse Transfer Capacitance	C_{re}	$V_{CB}=1V, f=1MHz$		0.7	0.9	pF
Forward Transfer Gain	$ S_{21e} ^{21}$	$V_{CE}=1V, I_C=5mA, f=2GHz$	5	6		dB
	$ S_{21e} ^{22}$	$V_{CE}=3V, I_C=30mA, f=2GHz$	7.0	8.5		dB
Noise Figure	NF	$V_{CE}=1V, I_C=5mA, f=2GHz$		1.5	2.3	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	0.973	-15.90	3.638	167.29	0.050	79.91	0.977	-9.40
200	0.948	-31.19	3.482	155.57	0.095	70.33	0.946	-18.29
400	0.881	-58.99	3.073	134.82	0.166	54.39	0.847	-32.76
600	0.817	-82.35	2.684	117.37	0.205	41.95	0.745	-43.72
800	0.751	-100.32	2.310	103.16	0.226	33.75	0.660	-51.78
1000	0.716	-115.88	2.051	91.40	0.241	27.55	0.608	-57.99
1200	0.676	-128.75	1.832	80.86	0.245	22.89	0.562	-63.64
1400	0.645	-139.90	1.623	71.76	0.244	20.24	0.535	-67.36
1600	0.622	-149.21	1.484	63.80	0.243	18.33	0.521	-71.36
1800	0.597	-157.60	1.375	56.78	0.235	17.45	0.510	-75.10
2000	0.576	-165.50	1.265	50.45	0.232	17.98	0.502	-79.16
2200	0.561	-172.48	1.189	44.29	0.231	19.25	0.496	-83.13
2400	0.544	-178.67	1.096	39.32	0.226	20.11	0.497	-85.82
2600	0.537	174.51	1.044	35.03	0.226	23.31	0.497	-89.94
2800	0.526	168.64	0.985	30.51	0.230	26.53	0.498	-94.15
3000	0.524	162.85	0.945	27.09	0.237	29.18	0.500	-98.39

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.866	-32.91	12.661	156.28	0.045	72.01	0.898	-23.29
200	0.779	-60.72	10.936	137.67	0.078	58.69	0.765	-41.46
400	0.636	-99.74	7.611	113.72	0.112	46.99	0.544	-63.29
600	0.566	-124.52	5.620	99.23	0.128	43.52	0.419	-76.06
800	0.524	-139.66	4.366	89.54	0.145	42.78	0.351	-84.07
1000	0.513	-151.48	3.632	81.28	0.160	42.91	0.314	-90.89
1200	0.493	-161.01	3.087	74.54	0.174	43.71	0.286	-97.65
1400	0.483	-168.73	2.667	68.39	0.188	43.77	0.269	-101.52
1600	0.475	-175.51	2.387	62.84	0.206	43.96	0.260	-106.33
1800	0.464	178.02	2.155	57.63	0.220	43.91	0.254	-109.97
2000	0.456	172.06	1.961	52.90	0.235	43.59	0.256	-113.34
2200	0.448	166.58	1.823	48.32	0.255	43.40	0.251	-117.73
2400	0.433	161.66	1.680	44.30	0.267	42.03	0.240	-119.28
2600	0.434	156.29	1.591	40.69	0.285	42.26	0.245	-123.90
2800	0.426	151.59	1.498	36.47	0.305	41.45	0.242	-127.36
3000	0.429	147.16	1.426	33.28	0.322	40.63	0.243	-131.22

$V_{CE}=1V, I_C=10mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.760	-47.73	19.641	147.15	0.042	66.87	0.814	-34.53
200	0.643	-82.37	14.907	126.09	0.064	55.24	0.622	-57.00
400	0.529	-121.66	9.114	104.56	0.090	49.92	0.405	-80.69
600	0.493	-142.40	6.406	92.74	0.109	49.93	0.311	-94.97
800	0.470	-154.81	4.890	84.83	0.128	52.01	0.264	-104.53
1000	0.467	-164.08	4.015	77.98	0.150	52.31	0.246	-111.58
1200	0.460	-171.57	3.386	72.18	0.168	52.82	0.232	-119.56
1400	0.453	-178.17	2.916	66.85	0.189	52.14	0.224	-123.80
1600	0.451	176.26	2.601	61.96	0.211	51.27	0.221	-128.76
1800	0.444	170.62	2.345	57.29	0.229	50.17	0.220	-131.99
2000	0.439	165.17	2.130	53.05	0.250	49.26	0.223	-135.27
2200	0.434	159.62	1.968	48.98	0.271	48.40	0.221	-140.67
2400	0.418	155.46	1.819	45.02	0.288	46.39	0.210	-142.60
2600	0.420	150.61	1.718	41.86	0.306	45.52	0.220	-145.84
2800	0.413	146.05	1.617	37.82	0.326	43.96	0.216	-150.89
3000	0.418	142.11	1.540	34.56	0.344	42.94	0.217	-154.44

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V_{CE}=1V, I_C=30mA, Z_O=50Ω

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
100	0.564	-78.88	27.793	132.50	0.035	59.72	0.635	-54.80
200	0.499	-117.16	17.678	112.56	0.050	55.31	0.430	-81.31
400	0.469	-148.48	9.719	96.01	0.074	58.68	0.287	-108.63
600	0.466	-162.54	6.623	86.79	0.099	61.11	0.245	-124.23
800	0.458	-170.76	5.014	80.54	0.122	61.57	0.228	-134.22
1000	0.462	-177.08	4.087	74.56	0.147	61.13	0.224	-139.82
1200	0.458	177.39	3.430	69.50	0.171	59.97	0.228	-147.14
1400	0.455	172.21	2.957	64.66	0.197	59.16	0.226	-150.62
1600	0.456	167.74	2.629	60.38	0.221	56.51	0.231	-153.81
1800	0.450	162.98	2.368	56.01	0.242	55.02	0.233	-157.12
2000	0.446	158.06	2.144	52.06	0.265	53.62	0.237	-159.69
2200	0.445	153.26	1.987	48.32	0.288	51.32	0.239	-163.69
2400	0.426	149.46	1.839	44.39	0.306	48.60	0.230	-167.13
2600	0.432	144.79	1.737	41.66	0.328	47.68	0.239	-168.79
2800	0.425	140.76	1.636	37.82	0.349	45.49	0.241	-173.69
3000	0.430	137.35	1.560	34.71	0.369	43.34	0.244	-176.60

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	0.976	-14.07	3.602	168.75	0.040	81.40	0.981	-7.61
200	0.957	-27.92	3.521	158.07	0.077	72.40	0.959	-14.89
400	0.898	-53.12	3.162	138.86	0.138	57.73	0.880	-27.16
600	0.838	-75.05	2.823	122.46	0.175	46.08	0.789	-36.89
800	0.772	-92.77	2.443	108.76	0.197	38.15	0.715	-43.80
1000	0.734	-108.47	2.209	97.05	0.210	31.60	0.666	-49.31
1200	0.691	-121.27	1.969	86.65	0.215	27.46	0.619	-54.14
1400	0.655	-132.71	1.763	77.42	0.217	24.67	0.586	-57.82
1600	0.629	-142.67	1.619	69.41	0.217	22.52	0.571	-61.40
1800	0.599	-151.50	1.499	62.32	0.211	21.77	0.555	-64.88
2000	0.577	-159.75	1.383	55.54	0.209	22.72	0.554	-68.05
2200	0.557	-167.05	1.290	49.38	0.207	23.85	0.545	-71.45
2400	0.538	-173.71	1.190	44.12	0.205	25.28	0.539	-74.21
2600	0.531	179.47	1.140	39.85	0.205	27.97	0.540	-78.45
2800	0.517	173.31	1.063	34.90	0.210	32.21	0.542	-82.00
3000	0.511	166.83	1.024	31.52	0.218	34.96	0.543	-85.49

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	0.885	-27.59	12.804	158.98	0.036	72.81	0.919	-18.67
200	0.806	-51.67	11.316	141.97	0.065	62.97	0.806	-33.45
400	0.649	-87.77	8.294	118.38	0.097	51.37	0.600	-51.61
600	0.561	-112.50	6.258	103.49	0.115	46.54	0.472	-61.44
800	0.507	-128.21	4.928	93.38	0.129	45.93	0.394	-67.46
1000	0.484	-141.12	4.122	85.20	0.143	46.14	0.350	-72.22
1200	0.460	-151.51	3.508	78.17	0.158	46.72	0.319	-77.35
1400	0.446	-160.21	3.037	72.04	0.173	46.78	0.299	-80.01
1600	0.437	-167.47	2.718	66.44	0.187	46.84	0.286	-83.67
1800	0.423	-174.51	2.451	61.29	0.202	46.90	0.279	-86.94
2000	0.415	179.14	2.234	56.62	0.217	47.19	0.274	-90.29
2200	0.407	172.97	2.069	51.91	0.233	46.61	0.265	-94.06
2400	0.392	167.89	1.900	47.68	0.248	46.16	0.254	-95.15
2600	0.392	162.21	1.803	44.31	0.265	45.33	0.257	-99.53
2800	0.383	157.32	1.688	39.78	0.283	44.75	0.249	-102.43
3000	0.390	152.58	1.607	36.62	0.300	44.54	0.249	-105.80

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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	0.795	-38.83	20.116	150.98	0.034	71.48	0.850	-27.09
200	0.667	-68.89	16.006	130.98	0.055	59.34	0.677	-45.00
400	0.517	-106.98	10.232	108.83	0.081	53.97	0.454	-63.68
600	0.457	-129.59	7.307	96.42	0.098	53.52	0.345	-73.72
800	0.424	-143.24	5.632	88.34	0.117	54.12	0.287	-80.01
1000	0.417	-153.63	4.623	81.35	0.137	54.80	0.256	-84.72
1200	0.404	-162.53	3.919	75.61	0.154	55.07	0.235	-91.08
1400	0.397	-169.68	3.377	70.16	0.173	54.91	0.222	-94.48
1600	0.394	-175.88	3.005	65.29	0.193	53.77	0.216	-98.90
1800	0.386	178.14	2.707	60.74	0.211	53.13	0.210	-102.78
2000	0.382	172.14	2.457	56.49	0.229	52.13	0.210	-105.89
2200	0.378	165.97	2.275	52.14	0.249	50.73	0.203	-110.23
2400	0.360	161.52	2.086	48.28	0.266	48.89	0.194	-112.42
2600	0.367	156.28	1.973	45.29	0.283	48.55	0.198	-117.32
2800	0.359	151.26	1.850	41.08	0.304	47.16	0.191	-121.17
3000	0.364	147.35	1.757	38.08	0.321	45.84	0.193	-125.07

V_{CE}=3V, I_C=30mA, Z_O=50Ω

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
100	0.610	-59.72	30.149	138.49	0.029	64.74	0.708	-40.43
200	0.490	-95.34	20.431	117.93	0.044	61.00	0.494	-61.10
400	0.404	-131.27	11.585	100.08	0.067	60.86	0.306	-79.35
600	0.385	-149.05	7.980	90.46	0.090	62.74	0.235	-90.20
800	0.371	-159.04	6.070	83.97	0.110	63.56	0.200	-98.49
1000	0.375	-166.62	4.943	78.09	0.134	63.10	0.188	-103.89
1200	0.371	-173.58	4.162	73.16	0.156	62.14	0.179	-112.07
1400	0.370	-179.09	3.590	68.34	0.179	61.01	0.174	-115.63
1600	0.370	175.69	3.177	63.92	0.201	59.02	0.174	-121.09
1800	0.366	170.49	2.862	59.86	0.219	57.50	0.174	-124.53
2000	0.365	165.26	2.596	55.95	0.241	55.78	0.177	-127.77
2200	0.365	159.72	2.401	52.04	0.264	53.87	0.176	-133.31
2400	0.348	155.45	2.206	48.51	0.281	51.40	0.166	-136.62
2600	0.353	150.78	2.083	45.71	0.302	50.38	0.176	-139.63
2800	0.349	146.26	1.949	41.64	0.321	48.56	0.171	-145.90
3000	0.357	142.59	1.853	38.66	0.342	46.93	0.174	-149.31

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