

**2SC5647**

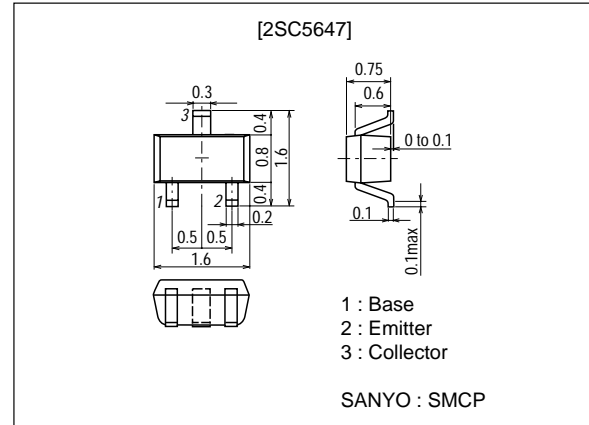
UHF to S Band Low-Noise Amplifier and OSC Applications

Features

- Low noise : NF=2.6dB typ (f=2GHz).
- High cutoff frequency : $f_T=9.0\text{GHz}$ typ ($V_{CE}=1\text{V}$).
: $f_T=11.5\text{GHz}$ typ ($V_{CE}=3\text{V}$).
- Low operating voltage.
- High gain : $|S_{21e}|^2=10.5\text{dB}$ typ (f=2GHz).

Package Dimensions

unit : 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		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.

- 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.

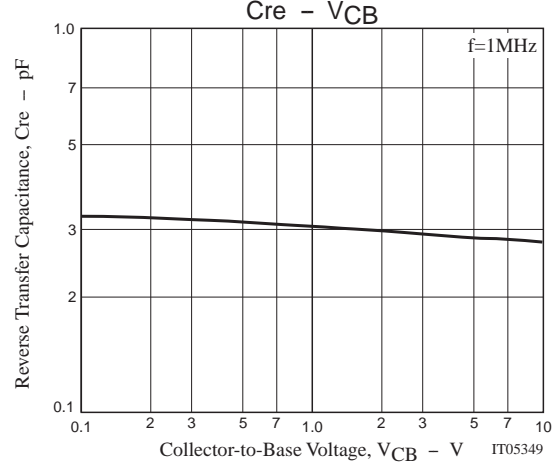
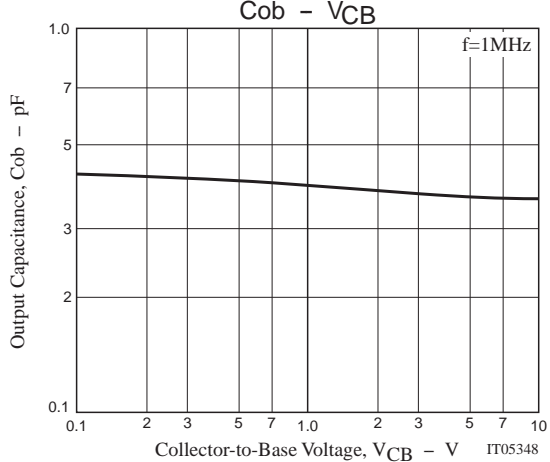
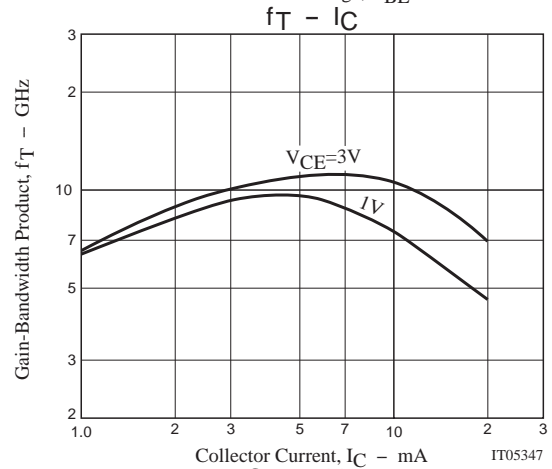
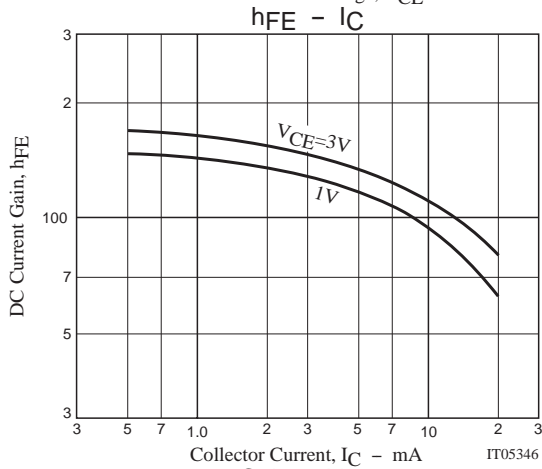
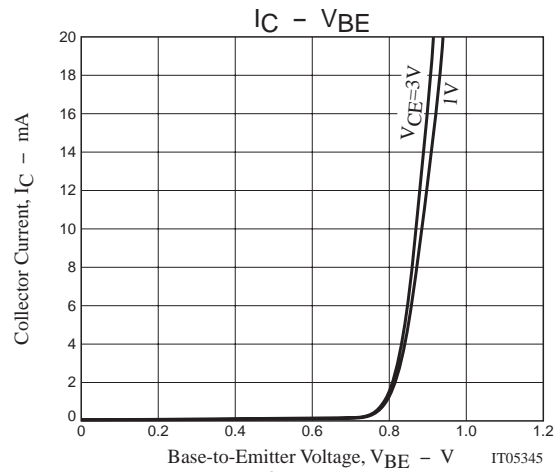
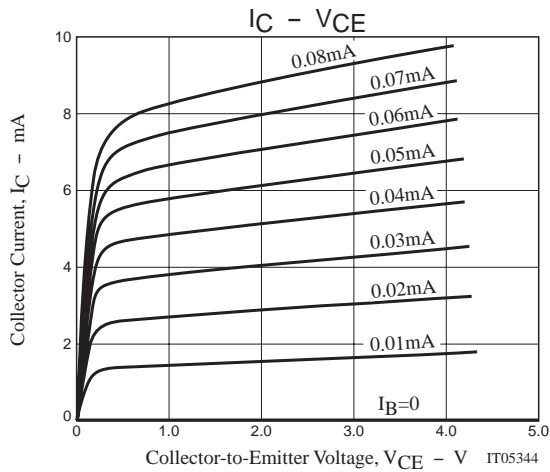
SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

D2502 TS IM TA-3664 No.7326-1/7

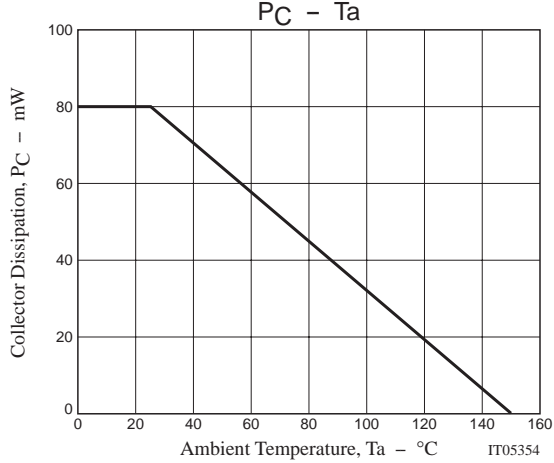
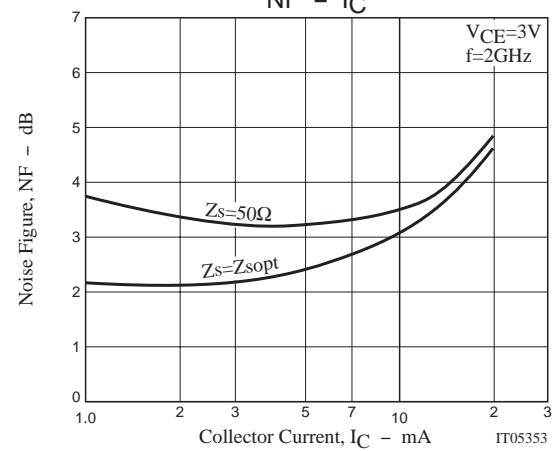
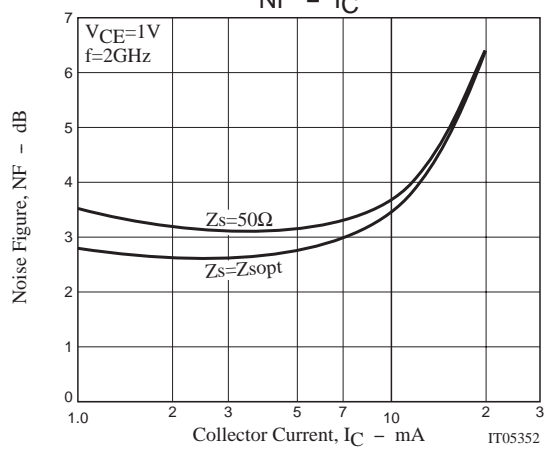
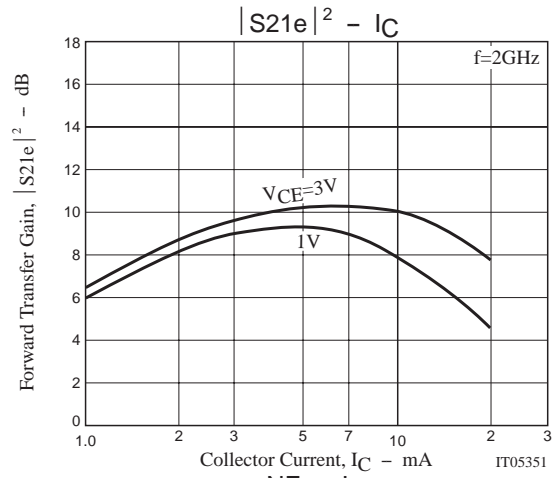
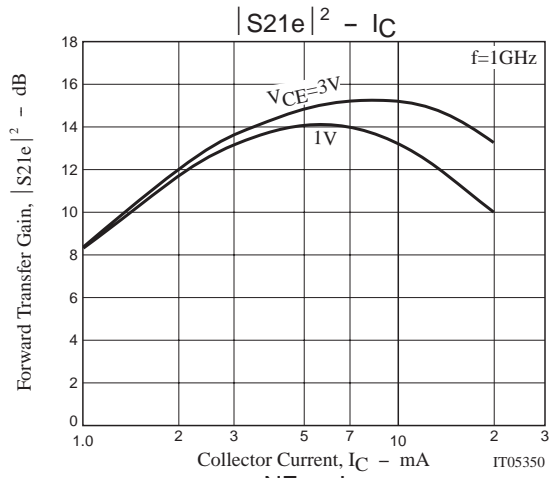
2SC5647

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

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



2SC5647



2SC5647

S Parameters (Common emitter)

$V_{CE}=1V, I_C=1mA, Z_0=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.980	-4.64	3.184	173.92	0.018	87.45	0.989	-4.46
200	0.974	-9.08	3.149	168.04	0.037	81.31	0.985	-8.99
400	0.949	-17.90	3.074	156.88	0.074	74.92	0.961	-17.49
600	0.917	-26.50	2.982	146.19	0.105	68.33	0.931	-25.63
800	0.874	-34.19	2.846	136.13	0.130	61.26	0.889	-33.18
1000	0.834	-41.52	2.747	126.87	0.156	56.36	0.856	-39.69
1200	0.784	-48.34	2.632	117.51	0.174	50.83	0.813	-46.38
1400	0.735	-54.62	2.485	108.66	0.189	47.33	0.779	-51.51
1600	0.683	-60.42	2.378	100.84	0.206	44.50	0.750	-56.53
1800	0.631	-65.27	2.266	93.32	0.218	41.44	0.720	-61.00
2000	0.585	-69.61	2.150	86.30	0.228	38.58	0.700	-65.27
2200	0.537	-73.62	2.060	78.96	0.237	36.67	0.668	-69.40
2400	0.499	-76.51	1.924	73.23	0.244	33.19	0.644	-71.98
2600	0.461	-79.94	1.874	68.11	0.249	32.25	0.629	-75.82
2800	0.431	-82.38	1.769	62.29	0.256	30.78	0.610	-78.54
3000	0.403	-86.40	1.740	57.82	0.261	30.45	0.599	-82.32

$V_{CE}=1V, I_C=3mA, Z_0=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.940	-8.05	6.900	170.47	0.018	82.23	0.973	-6.55
200	0.916	-15.62	6.735	161.75	0.036	78.95	0.954	-12.89
400	0.847	-29.59	6.246	145.63	0.068	70.33	0.890	-24.03
600	0.766	-42.00	5.650	132.05	0.091	62.49	0.814	-33.09
800	0.678	-51.87	5.010	120.51	0.109	58.57	0.745	-40.07
1000	0.608	-60.41	4.527	110.61	0.127	54.45	0.689	-45.55
1200	0.539	-67.61	4.060	101.81	0.140	51.41	0.641	-50.89
1400	0.481	-73.78	3.652	93.86	0.152	50.45	0.605	-54.50
1600	0.433	-79.23	3.373	86.73	0.166	49.15	0.579	-58.22
1800	0.384	-83.57	3.087	80.47	0.175	48.56	0.556	-61.39
2000	0.345	-87.53	2.858	74.52	0.189	47.23	0.542	-64.54
2200	0.306	-91.18	2.670	68.63	0.201	46.27	0.525	-67.92
2400	0.275	-93.01	2.454	63.79	0.211	44.51	0.505	-69.53
2600	0.246	-96.79	2.349	59.54	0.219	44.41	0.502	-72.68
2800	0.221	-97.68	2.194	54.49	0.233	43.78	0.490	-75.21
3000	0.204	-103.64	2.114	50.98	0.245	43.82	0.482	-78.68

$V_{CE}=1V, I_C=5mA, Z_0=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.897	-10.85	9.509	167.50	0.018	78.84	0.957	-8.01
200	0.860	-20.99	9.048	156.52	0.035	78.42	0.924	-15.54
400	0.751	-38.88	7.900	137.52	0.063	66.85	0.827	-24.31
600	0.641	-52.71	6.723	1228.80	0.083	61.20	0.732	-35.56
800	0.543	-62.52	5.701	111.18	0.099	57.31	0.659	-41.25
1000	0.475	-71.29	4.975	101.88	0.113	56.31	0.610	-45.39
1200	0.413	-78.25	4.359	93.79	0.125	54.36	0.565	-49.69
1400	0.364	-84.25	3.854	86.68	0.139	54.26	0.539	-52.27
1600	0.323	-89.98	3.490	80.46	0.152	53.46	0.522	-55.64
1800	0.288	-94.38	3.189	74.56	0.163	52.95	0.509	-58.40
2000	0.254	-99.32	2.923	69.18	0.177	52.45	0.501	-61.31
2200	0.223	-103.64	2.718	63.57	0.191	51.87	0.488	-64.67
2400	0.196	-104.93	2.492	59.07	0.202	49.64	0.476	-66.11
2600	0.173	-110.64	2.373	55.28	0.218	50.38	0.476	-69.50
2800	0.153	-111.86	2.206	50.32	0.230	48.22	0.468	-72.24
3000	0.139	-119.39	2.118	47.36	0.244	48.56	0.467	-75.63

2SC5647

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	0.790	-17.56	12.114	161.90	0.018	79.20	0.905	-10.27
200	0.723	-32.63	10.916	146.76	0.034	72.20	0.844	-18.72
400	0.563	-55.98	8.394	124.70	0.055	62.43	0.714	-29.01
600	0.445	-71.85	6.553	109.97	0.071	59.99	0.623	-34.44
800	0.364	-82.88	5.260	99.45	0.086	59.13	0.569	-37.86
1000	0.311	-92.59	4.431	91.17	0.099	59.93	0.541	-40.82
1200	0.271	-100.20	3.812	84.04	0.111	59.53	0.516	-44.43
1400	0.239	-108.12	3.323	77.56	0.126	59.52	0.507	-47.02
1600	0.214	-114.70	2.994	71.96	0.141	59.17	0.502	-50.47
1800	0.191	-121.18	2.716	66.67	0.153	58.97	0.497	-53.79
2000	0.171	-128.71	2.476	61.56	0.169	58.86	0.498	-57.16
2200	0.152	-136.05	2.306	56.24	0.185	57.79	0.493	-60.87
2400	0.135	-140.35	2.108	51.97	0.199	55.89	0.488	-62.69
2600	0.122	-149.70	2.007	48.35	0.213	55.96	0.495	-66.94
2800	0.108	-156.65	1.861	43.55	0.229	54.18	0.490	-70.03
3000	0.110	-165.38	1.783	40.65	0.245	54.31	0.491	-73.88

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	0.982	-4.21	3.100	174.07	0.017	89.16	0.990	-4.16
200	0.978	-8.28	3.098	168.64	0.035	82.59	0.986	-8.44
400	0.957	-16.34	3.021	157.91	0.067	75.73	0.967	-16.41
600	0.929	-24.16	2.940	147.74	0.097	68.51	0.937	-24.18
800	0.889	-31.44	2.820	138.24	0.122	62.90	0.901	-31.11
1000	0.853	-38.19	2.732	129.30	0.146	58.22	0.872	-37.55
1200	0.806	-44.72	2.614	120.32	0.165	52.93	0.833	-44.09
1400	0.760	-50.47	2.479	111.61	0.181	49.58	0.797	-48.91
1600	0.716	-55.72	2.400	103.70	0.197	46.26	0.770	-54.03
1800	0.662	-60.40	2.304	96.29	0.210	43.82	0.743	-58.49
2000	0.618	-64.61	2.183	89.33	0.218	41.13	0.742	-62.68
2200	0.573	-67.87	2.089	82.12	0.231	38.51	0.694	-66.82
2400	0.535	-70.93	1.957	76.27	0.239	34.92	0.666	-69.35
2600	0.495	-74.06	1.921	71.05	0.246	33.82	0.653	-73.21
2800	0.467	-76.13	1.808	65.30	0.252	32.34	0.636	-76.37
3000	0.442	-79.74	1.774	61.07	0.257	32.64	0.624	-79.57

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	0.947	-7.39	7.023	170.80	0.016	87.53	0.976	-6.22
200	0.926	-14.15	6.828	162.56	0.033	79.54	0.963	-12.10
400	0.863	-27.21	6.359	147.39	0.062	72.10	0.902	-22.53
600	0.785	-38.49	5.801	134.19	0.086	64.10	0.831	-31.19
800	0.704	-47.60	5.189	122.77	0.104	59.84	0.763	-38.11
1000	0.637	-55.35	4.720	113.22	0.121	55.90	0.711	-43.59
1200	0.570	-62.24	4.276	104.25	0.134	53.18	0.661	-48.69
1400	0.510	-68.01	3.858	96.35	0.145	52.02	0.626	-52.19
1600	0.460	-72.74	3.553	89.55	0.160	50.93	0.600	-56.00
1800	0.414	-76.54	3.276	83.22	0.169	49.80	0.577	-59.10
2000	0.372	-80.58	3.032	77.40	0.183	48.90	0.562	-62.38
2200	0.332	-83.52	2.837	71.31	0.196	47.59	0.540	-65.66
2400	0.301	-84.61	2.608	66.41	0.206	45.77	0.521	-66.97
2600	0.271	-87.36	2.499	62.31	0.217	45.97	0.516	-70.25
2800	0.246	-88.29	2.334	57.19	0.228	43.75	0.503	-72.80
3000	0.230	-93.01	2.249	53.74	0.238	45.10	0.497	-75.94

2SC5647

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	0.914	-9.39	9.445	168.58	0.017	85.01	0.968	-7.36
200	0.883	-18.11	9.067	158.60	0.033	79.17	0.942	-14.13
400	0.787	-33.64	8.064	140.96	0.059	69.73	0.858	-25.21
600	0.688	-46.19	7.025	126.79	0.080	62.55	0.769	-33.54
800	0.595	-55.36	6.045	115.37	0.095	60.36	0.693	-39.46
1000	0.525	-63.74	5.331	106.00	0.111	57.67	0.643	-43.99
1200	0.461	-69.74	4.711	97.73	0.122	55.55	0.596	-48.45
1400	0.407	-75.56	4.183	90.52	0.134	55.11	0.569	-50.94
1600	0.365	-80.10	3.809	84.27	0.148	54.32	0.545	-54.21
1800	0.326	-83.73	3.485	78.49	0.160	54.09	0.530	-57.07
2000	0.289	-87.26	3.193	73.22	0.174	53.36	0.521	-59.81
2200	0.256	-90.55	2.985	67.38	0.188	52.39	0.504	-63.16
2400	0.229	-91.48	2.731	62.95	0.198	49.90	0.488	-64.12
2600	0.206	-94.05	2.605	59.18	0.210	50.03	0.487	-67.57
2800	0.182	-95.06	2.429	54.38	0.223	49.09	0.475	-70.12
3000	0.168	-101.12	2.332	51.07	0.238	49.01	0.476	-73.01

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	0.833	-13.55	12.957	164.54	0.017	86.30	0.950	-8.98
200	0.788	-25.76	11.964	151.29	0.031	73.45	0.901	-16.77
400	0.641	-45.13	9.726	130.85	0.052	67.99	0.780	-27.64
600	0.522	-58.57	7.869	116.11	0.070	62.14	0.684	-33.93
800	0.434	-68.03	6.454	105.48	0.082	61.75	0.617	-38.12
1000	0.373	-75.94	5.505	97.08	0.097	60.68	0.578	-40.91
1200	0.326	-82.26	4.763	89.82	0.111	60.92	0.546	-44.25
1400	0.288	-87.99	4.167	83.20	0.124	60.80	0.529	-46.41
1600	0.257	-93.26	3.758	77.71	0.138	60.19	0.519	-49.35
1800	0.227	-97.38	3.421	72.32	0.152	59.04	0.511	-52.04
2000	0.200	-102.17	3.124	67.27	0.166	59.51	0.508	-55.02
2200	0.175	-107.18	2.901	62.01	0.183	58.22	0.497	-58.48
2400	0.152	-108.10	2.649	57.93	0.194	56.04	0.486	-59.63
2600	0.134	-114.11	2.525	54.31	0.207	55.95	0.490	-63.15
2800	0.117	-115.19	2.346	49.60	0.220	54.66	0.487	-65.86
3000	0.109	-123.96	2.244	46.64	0.235	54.47	0.484	-69.55

- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of December, 2002. Specifications and information herein are subject to change without notice.