

**CPH3004**

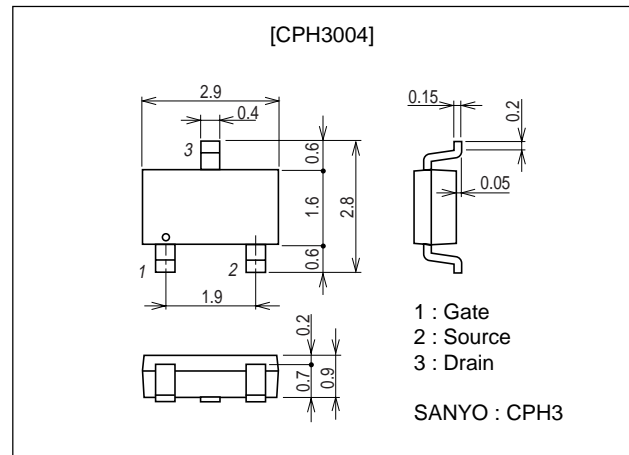
High-Frequency Medium-Power Amplifier Applications

Features

- High gain-bandwidth product
: $f_T=8.5\text{GHz}$ typ ($V_{CE}=3\text{V}$).
- High current : ($I_C=100\text{mA}$).
- Ultrasmall-sized package permitting applied sets to be made small and slim.
- Large collector dissipation (600mW max).

Package Dimensions

unit : mm
2152A



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}		6	V
Emitter-to-Base Voltage	V_{EBO}		2	V
Collector Current	I_C		100	mA
Collector Dissipation	PC	Mounted on a ceramic board (250mm ² X0.8mm)	600	mW
Junction Temperature	T_J		150	°C
Storage Temperature	T_{stg}		-55 to +150	°C

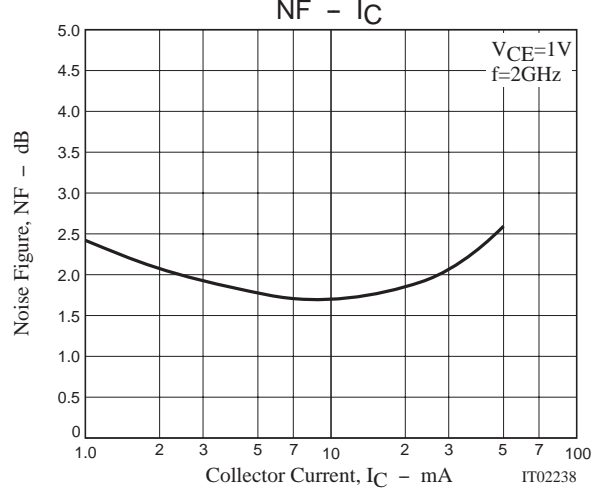
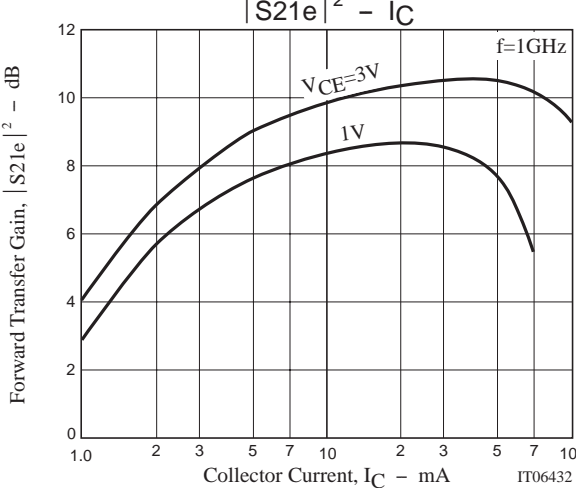
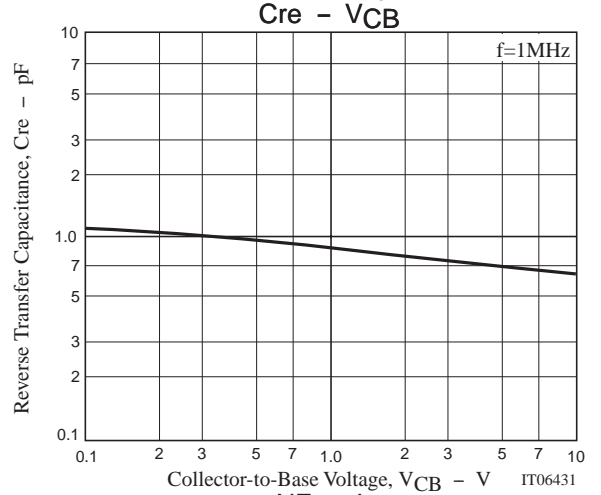
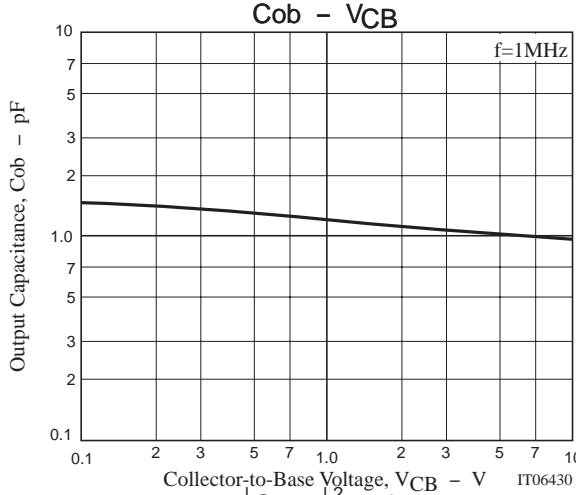
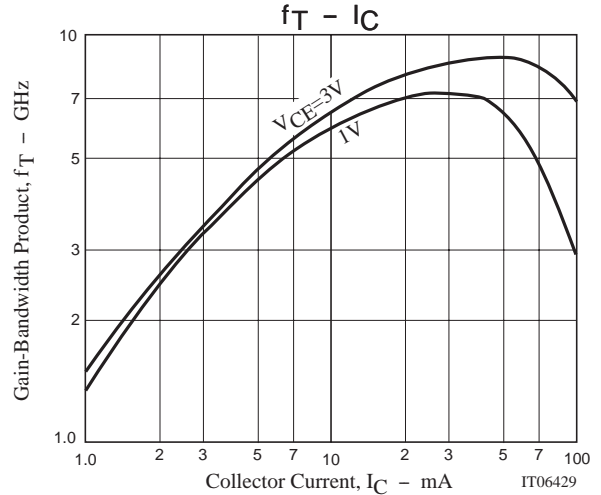
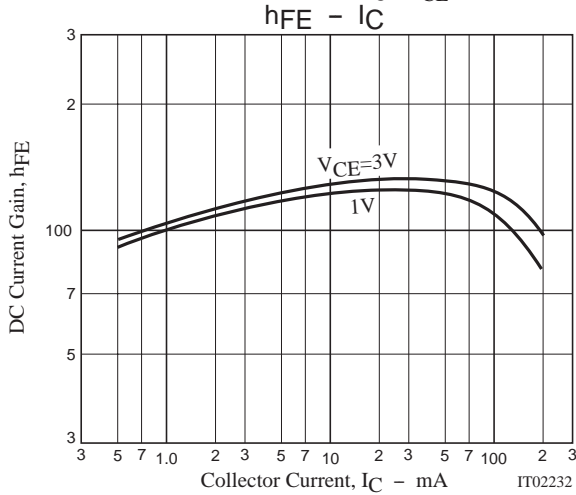
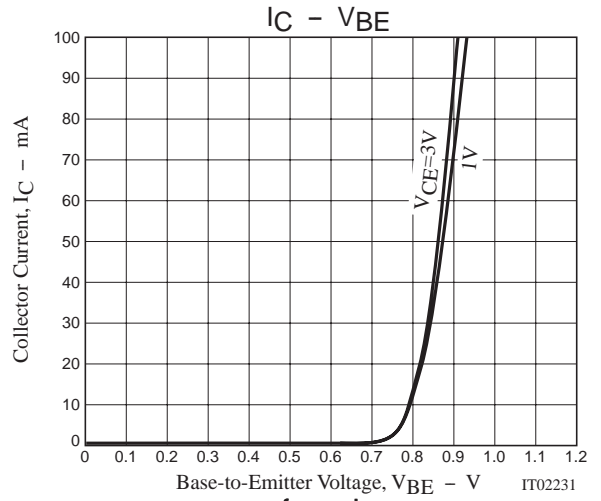
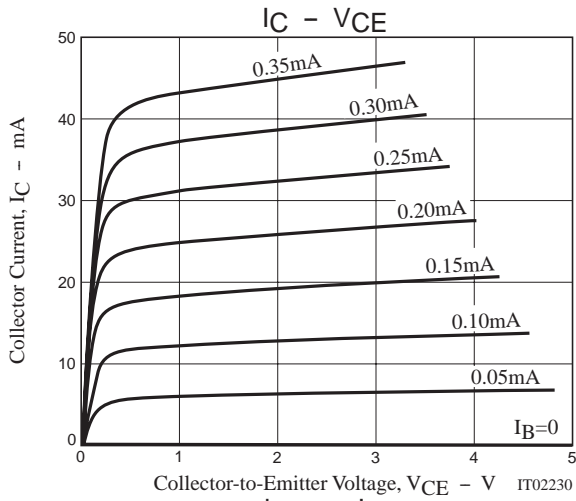
Electrical Characteristics

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

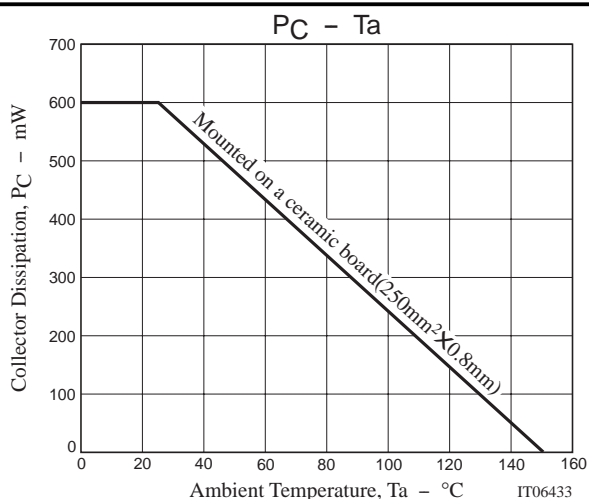
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I_{CBO}	$V_{CB}=5\text{V}, I_E=0$			1.0	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB}=1\text{V}, I_C=0$			10	μA
DC Current Gain	h_{FE}	$V_{CE}=1\text{V}, I_C=10\text{mA}$	100		180	
Gain-Bandwidth Product	f_{T1}	$V_{CE}=1\text{V}, I_C=10\text{mA}$	4.0	6.0		GHz
	f_{T2}	$V_{CE}=3\text{V}, I_C=30\text{mA}$	6.5	8.5		GHz
Output Capacitance	C_{ob}	$V_{CB}=1\text{V}, f=1\text{MHz}$		1.2	1.6	pF
Reverse Transfer Capacitance	C_{re}	$V_{CB}=1\text{V}, f=1\text{MHz}$		0.9		pF
Forward Transfer Gain	S _{21e} ₂₁	$V_{CE}=1\text{V}, I_C=10\text{mA}, f=1\text{GHz}$	6.5	8.5		dB
	S _{21e} ₂₂	$V_{CE}=3\text{V}, I_C=30\text{mA}, f=1\text{GHz}$	8.5	10.5		dB
Noise Figure	NF	$V_{CE}=1\text{V}, I_C=10\text{mA}, f=2\text{GHz}$		1.7	2.5	dB

Marking : GD

- 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.



CPH3004



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	0.947	-22.81	3.231	160.58	0.070	75.65	0.973	-13.49
200	0.889	-43.79	3.007	143.13	0.128	62.67	0.925	-25.53
400	0.761	-79.18	2.419	115.52	0.202	43.38	0.801	-43.13
600	0.661	-105.75	1.956	94.77	0.229	30.97	0.714	-54.83
800	0.596	-127.22	1.616	78.50	0.236	24.57	0.672	-62.09
1000	0.552	-145.54	1.396	65.52	0.230	20.91	0.667	-67.23
1200	0.529	-160.90	1.216	54.90	0.223	21.37	0.673	-71.32
1400	0.513	-175.26	1.087	47.22	0.221	25.24	0.702	-74.36
1600	0.500	170.66	0.985	39.19	0.226	31.93	0.729	-77.82
1800	0.490	158.18	0.905	33.01	0.249	39.10	0.761	-81.27
2000	0.487	145.77	0.839	27.68	0.291	44.29	0.789	-84.74
2200	0.484	133.76	0.761	24.60	0.339	44.84	0.809	-88.02
2400	0.480	122.85	0.720	22.48	0.390	46.18	0.813	-91.36
2600	0.479	112.47	0.691	19.68	0.465	45.35	0.825	-93.42
2800	0.479	102.91	0.663	19.72	0.539	41.54	0.821	-96.19
3000	0.479	93.38	0.667	18.15	0.598	36.38	0.818	-98.68

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.757	-49.10	12.112	143.20	0.059	65.17	0.836	-35.36
200	0.592	-83.55	8.946	120.35	0.089	52.95	0.640	-56.76
400	0.435	-125.49	5.382	96.34	0.123	48.16	0.445	-76.33
600	0.376	-149.94	3.778	82.77	0.151	48.08	0.381	-86.20
800	0.350	-168.20	2.922	72.17	0.182	48.44	0.365	-91.14
1000	0.333	177.69	2.408	63.15	0.214	48.58	0.371	-94.34
1200	0.323	165.77	2.055	55.46	0.249	47.09	0.380	-95.84
1400	0.314	154.34	1.812	49.22	0.279	45.45	0.397	-96.47
1600	0.305	143.50	1.635	42.64	0.314	44.46	0.413	-97.15
1800	0.299	133.84	1.490	36.67	0.353	42.82	0.430	-97.84
2000	0.299	124.55	1.389	31.00	0.396	39.93	0.437	-98.18
2200	0.293	114.85	1.269	26.40	0.430	36.09	0.454	-97.76
2400	0.286	106.80	1.189	22.66	0.461	34.59	0.456	-97.90
2600	0.289	99.20	1.138	18.45	0.510	32.38	0.457	-96.93
2800	0.288	91.93	1.080	15.19	0.546	28.70	0.457	-95.03
3000	0.289	84.12	1.049	11.81	0.574	25.18	0.469	-94.14

CPH3004

S Parameters (Common emitter)

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.603	-69.87	17.497	131.23	0.049	60.84	0.697	-50.94
200	0.446	-108.16	11.137	109.54	0.072	56.02	0.478	-73.46
400	0.356	-147.41	6.097	90.05	0.107	57.28	0.333	-92.92
600	0.327	-168.35	4.195	79.00	0.145	57.49	0.301	-101.40
800	0.314	176.49	3.212	70.03	0.184	56.16	0.302	-104.92
1000	0.304	164.15	2.631	62.31	0.225	54.13	0.312	-107.03
1200	0.297	153.76	2.248	55.35	0.263	50.82	0.326	-107.75
1400	0.289	142.98	1.979	49.62	0.300	47.80	0.341	-107.76
1600	0.282	132.57	1.783	43.28	0.338	45.61	0.356	-107.88
1800	0.274	123.62	1.626	37.76	0.379	42.87	0.368	-107.49
2000	0.276	115.05	1.517	32.33	0.422	39.26	0.370	-107.05
2200	0.265	105.07	1.389	27.57	0.453	34.72	0.379	-105.83
2400	0.254	97.62	1.303	23.89	0.481	32.54	0.380	-105.40
2600	0.256	90.82	1.252	19.70	0.527	29.85	0.369	-102.82
2800	0.254	83.73	1.188	16.43	0.558	25.84	0.371	-99.14
3000	0.248	76.43	1.155	12.68	0.582	22.48	0.381	-96.84

$V_{CE}=1V, I_C=20mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.462	-93.81	21.033	120.68	0.041	59.62	0.557	-66.01
200	0.367	-131.69	12.107	102.27	0.062	60.38	0.365	-89.70
400	0.333	-164.08	6.376	86.30	0.103	63.44	0.272	-107.68
600	0.318	178.74	4.352	76.68	0.147	62.63	0.261	-115.10
800	0.310	166.07	3.318	68.54	0.190	60.42	0.272	-117.48
1000	0.303	155.10	2.712	61.38	0.234	56.66	0.288	-118.99
1200	0.297	145.91	2.319	54.79	0.275	52.18	0.298	-118.23
1400	0.289	135.69	2.043	49.22	0.313	48.58	0.314	-117.02
1600	0.281	125.81	1.838	43.36	0.353	45.65	0.325	-116.44
1800	0.271	117.53	1.675	38.10	0.394	42.31	0.332	-116.14
2000	0.271	108.93	1.564	32.67	0.439	38.38	0.334	-114.78
2200	0.263	99.23	1.440	28.33	0.467	33.20	0.342	-113.07
2400	0.248	92.06	1.354	24.32	0.495	30.66	0.340	-112.59
2600	0.250	85.42	1.300	20.07	0.540	27.62	0.328	-108.93
2800	0.246	78.38	1.238	16.25	0.569	23.88	0.318	-105.31
3000	0.238	71.73	1.200	12.66	0.588	20.06	0.322	-101.84

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.409	-131.14	20.283	111.08	0.035	62.03	0.394	-89.76
200	0.398	-159.19	10.986	96.09	0.058	68.19	0.288	-116.22
400	0.396	-179.67	5.686	82.60	0.106	68.26	0.256	-132.26
600	0.390	167.86	3.870	73.62	0.155	65.34	0.257	-136.25
800	0.384	157.79	2.959	65.79	0.202	61.22	0.273	-136.20
1000	0.376	148.77	2.425	58.48	0.248	57.24	0.284	-136.09
1200	0.366	140.87	2.079	52.14	0.291	52.43	0.294	-134.62
1400	0.358	131.71	1.844	46.50	0.331	47.50	0.305	-133.35
1600	0.349	123.01	1.670	40.60	0.370	43.80	0.313	-132.14
1800	0.335	115.56	1.530	35.39	0.413	40.29	0.311	-131.40
2000	0.331	107.94	1.436	30.02	0.458	35.71	0.305	-130.19
2200	0.321	99.03	1.333	25.59	0.486	30.40	0.307	-127.64
2400	0.301	92.76	1.255	21.54	0.512	27.71	0.298	-126.89
2600	0.299	87.30	1.217	17.50	0.559	24.53	0.276	-124.61
2800	0.293	80.92	1.160	13.78	0.586	20.35	0.262	-118.66
3000	0.280	74.89	1.132	9.91	0.608	16.06	0.262	-113.72

CPH3004

S Parameters (Common emitter)

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.949	-21.12	3.509	162.08	0.056	77.73	0.980	-11.55
200	0.896	-40.55	3.287	145.80	0.102	65.16	0.937	-21.98
400	0.769	-73.88	2.708	119.55	0.166	47.83	0.828	-37.28
600	0.668	-100.03	2.209	99.43	0.191	35.55	0.748	-47.60
800	0.590	-121.88	1.827	83.44	0.198	30.06	0.710	-54.02
1000	0.540	-140.47	1.580	70.43	0.197	27.55	0.702	-58.64
1200	0.508	-156.49	1.367	59.94	0.194	29.34	0.709	-62.30
1400	0.489	-171.45	1.207	51.96	0.194	34.62	0.735	-65.38
1600	0.472	174.13	1.101	43.79	0.205	42.00	0.765	-68.38
1800	0.455	160.76	0.997	37.06	0.233	48.96	0.797	-71.58
2000	0.455	147.71	0.922	31.60	0.276	53.32	0.832	-74.60
2200	0.451	135.09	0.825	27.75	0.325	54.16	0.860	-77.24
2400	0.446	123.59	0.771	25.22	0.376	54.83	0.870	-80.45
2600	0.449	112.46	0.740	21.72	0.451	54.25	0.886	-81.91
2800	0.450	120.48	0.694	21.52	0.523	50.09	0.900	-84.42
3000	0.455	92.67	0.689	19.95	0.577	45.12	0.909	-86.59

$V_{CE}=3V, I_C=5mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.779	-41.56	12.737	146.53	0.047	67.91	0.867	-28.40
200	0.608	-72.82	9.767	124.23	0.076	57.48	0.687	-45.90
400	0.422	-112.21	6.061	99.72	0.107	52.54	0.492	-61.13
600	0.338	-137.50	4.280	85.86	0.133	52.50	0.421	-68.74
800	0.299	-157.09	3.314	75.12	0.161	53.23	0.406	-72.90
1000	0.277	-172.85	2.719	66.34	0.190	53.25	0.413	-75.75
1200	0.262	173.61	2.305	58.72	0.222	52.10	0.425	-77.87
1400	0.253	160.59	2.022	52.60	0.253	51.33	0.444	-79.47
1600	0.244	148.11	1.814	45.91	0.286	50.50	0.469	-80.34
1800	0.238	136.92	1.643	39.99	0.323	49.67	0.488	-81.81
2000	0.241	126.31	1.522	34.32	0.367	46.94	0.505	-82.35
2200	0.238	114.64	1.376	29.75	0.399	43.15	0.528	-82.73
2400	0.235	105.30	1.285	25.91	0.430	42.16	0.541	-83.73
2600	0.244	95.83	1.218	21.43	0.477	40.19	0.547	-83.20
2800	0.245	87.83	1.140	18.17	0.517	36.79	0.557	-81.52
3000	0.253	79.75	1.101	15.11	0.542	33.77	0.579	-80.79

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.630	-57.55	18.699	135.58	0.041	64.44	0.751	-39.73
200	0.443	-92.32	12.462	113.38	0.062	59.36	0.532	-57.35
400	0.308	-131.52	6.975	93.17	0.095	60.62	0.367	-70.31
600	0.260	-155.17	4.805	81.79	0.130	60.74	0.326	-77.02
800	0.241	-173.26	3.675	72.84	0.164	60.25	0.326	-80.49
1000	0.227	171.74	2.998	65.10	0.201	57.93	0.342	-83.50
1200	0.218	159.66	2.548	58.34	0.238	55.59	0.359	-85.14
1400	0.211	146.76	2.225	52.67	0.271	52.99	0.378	-86.08
1600	0.207	134.53	1.994	46.53	0.306	51.13	0.401	-86.46
1800	0.201	123.75	1.806	40.83	0.347	49.44	0.420	-87.12
2000	0.206	113.62	1.669	35.79	0.390	45.62	0.435	-87.60
2200	0.202	101.00	1.519	31.06	0.420	41.35	0.453	-87.32
2400	0.196	91.99	1.415	27.21	0.449	39.83	0.464	-87.05
2600	0.207	83.59	1.351	22.95	0.496	37.26	0.472	-85.59
2800	0.208	75.84	1.266	19.70	0.526	33.66	0.476	-83.58
3000	0.211	67.98	1.223	16.24	0.551	30.41	0.493	-81.82

CPH3004

S Parameters (Common emitter)

$V_{CE}=3V, I_C=20mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.469	-75.08	23.526	125.40	0.034	63.19	0.615	-50.35
200	0.323	-111.33	14.022	105.79	0.053	64.70	0.406	-66.57
400	0.248	-149.36	7.483	89.06	0.091	66.72	0.286	-78.33
600	0.222	-170.40	5.102	79.42	0.130	65.77	0.270	-84.00
800	0.214	173.40	3.893	71.30	0.169	64.18	0.280	-87.35
1000	0.207	159.99	3.160	64.48	0.209	61.08	0.305	-89.37
1200	0.200	148.64	2.680	58.00	0.248	57.29	0.325	-90.87
1400	0.197	136.01	2.346	52.65	0.281	53.88	0.342	-91.65
1600	0.194	123.71	2.098	46.80	0.320	51.75	0.362	-91.82
1800	0.188	114.25	1.903	41.57	0.360	49.16	0.382	-92.05
2000	0.192	103.32	1.762	36.28	0.403	44.73	0.394	-92.11
2200	0.190	90.59	1.601	31.80	0.432	40.43	0.410	-91.09
2400	0.182	81.96	1.491	28.15	0.460	38.80	0.417	-90.86
2600	0.193	73.91	1.422	23.86	0.503	35.57	0.418	-88.19
2800	0.192	65.55	1.336	20.58	0.535	31.76	0.429	-85.77
3000	0.194	57.81	1.293	17.05	0.555	28.81	0.444	-83.32

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.350	-93.00	26.070	118.38	0.030	67.05	0.507	-58.00
200	0.262	-130.39	14.664	101.24	0.049	69.07	0.326	-72.82
400	0.230	-163.20	7.661	86.71	0.092	71.61	0.240	-83.45
600	0.216	178.59	5.194	77.89	0.133	68.72	0.239	-88.66
800	0.212	164.64	3.947	70.42	0.171	65.66	0.258	-92.09
1000	0.207	152.56	3.208	63.58	0.213	62.66	0.283	-93.04
1200	0.202	142.15	2.732	57.63	0.254	57.99	0.305	-94.52
1400	0.197	129.73	2.383	52.38	0.287	54.39	0.326	-95.82
1600	0.198	118.78	2.134	46.72	0.326	51.70	0.345	-95.42
1800	0.191	108.57	1.932	41.75	0.369	48.92	0.366	-95.27
2000	0.196	98.49	1.789	36.48	0.411	44.53	0.371	-95.31
2200	0.195	86.04	1.630	31.97	0.438	39.81	0.389	-94.20
2400	0.186	77.79	1.517	28.17	0.469	38.12	0.392	-93.33
2600	0.195	70.26	1.442	24.37	0.514	34.88	0.390	-90.47
2800	0.193	61.36	1.366	20.90	0.542	30.79	0.395	-87.76
3000	0.194	54.04	1.319	17.42	0.559	27.70	0.417	-85.60

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.324	-99.40	26.343	116.86	0.029	67.94	0.484	-59.45
200	0.255	-135.74	14.664	100.25	0.049	70.86	0.310	-74.06
400	0.230	-166.99	7.616	86.18	0.090	72.11	0.229	-83.82
600	0.221	175.89	5.170	77.45	0.132	69.47	0.230	-90.34
800	0.218	162.77	3.925	69.99	0.172	65.80	0.243	-92.40
1000	0.213	150.66	3.198	63.39	0.215	63.01	0.279	-94.70
1200	0.208	140.94	2.703	57.21	0.255	58.21	0.298	-95.85
1400	0.205	129.39	2.368	52.11	0.289	54.38	0.319	-96.22
1600	0.202	117.93	2.119	46.49	0.329	51.91	0.340	-95.64
1800	0.196	108.39	1.922	41.35	0.370	48.90	0.358	-96.43
2000	0.201	98.85	1.779	36.17	0.413	44.26	0.365	-95.52
2200	0.199	86.39	1.618	31.78	0.442	39.63	0.383	-94.61
2400	0.191	77.41	1.511	28.00	0.471	37.67	0.392	-94.09
2600	0.198	70.48	1.440	23.84	0.515	34.36	0.392	-92.13
2800	0.197	62.36	1.363	20.56	0.540	30.50	0.394	-88.88
3000	0.197	54.74	1.313	16.90	0.561	27.39	0.407	-86.75

- 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 February, 2004. Specifications and information herein are subject to change without notice.