



CPH3004

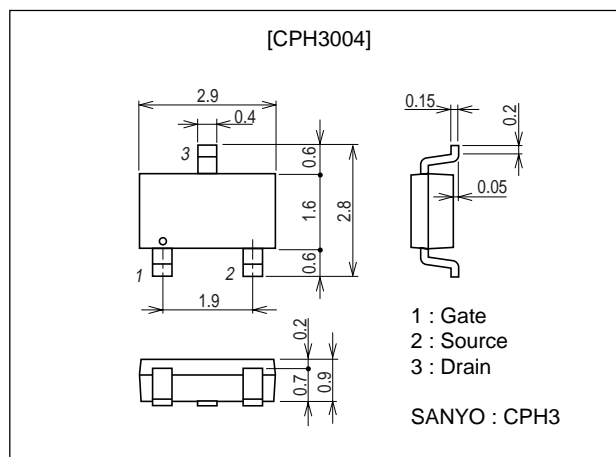
## High-Frequency Medium-Power Amplifier Applications

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

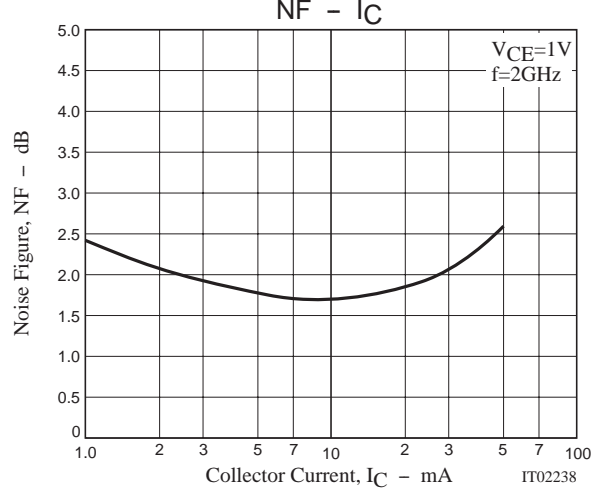
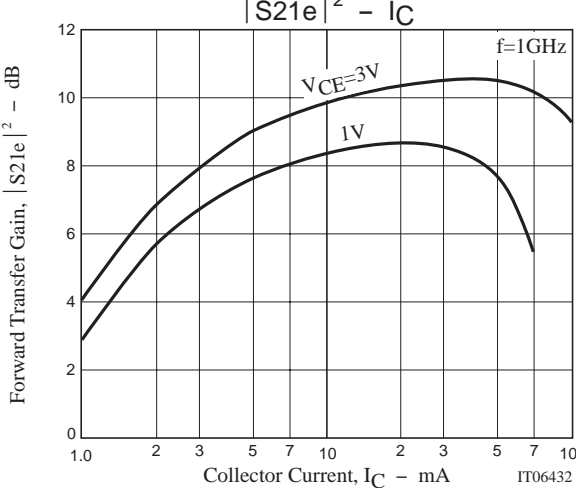
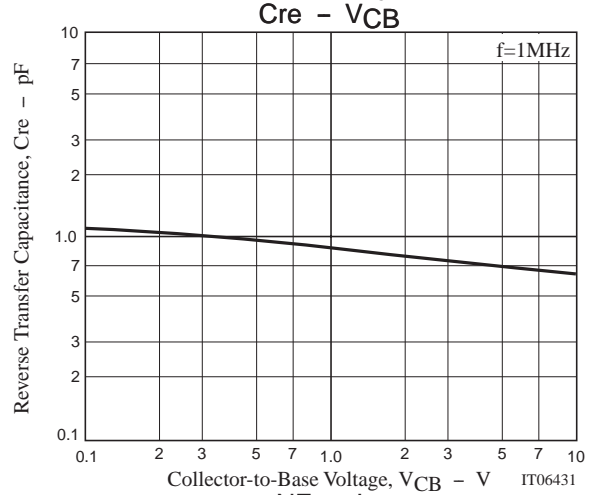
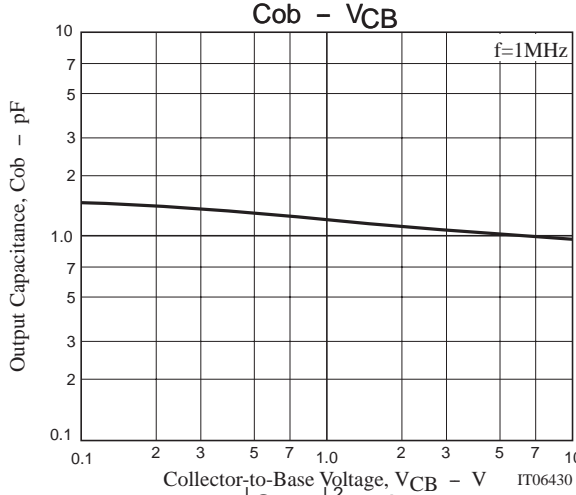
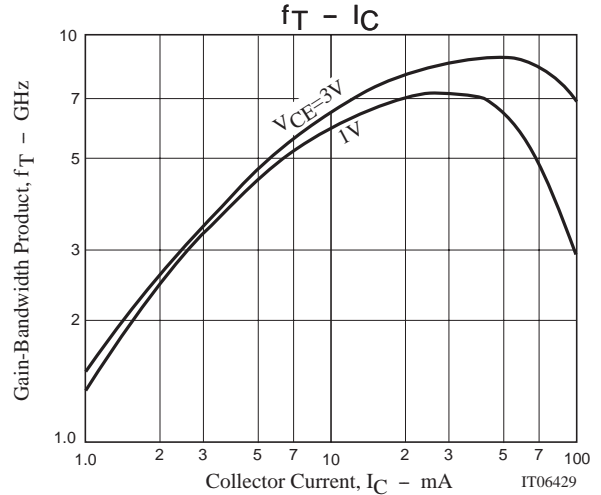
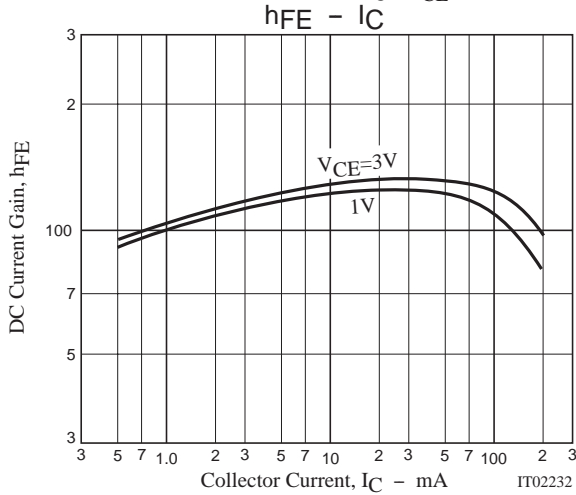
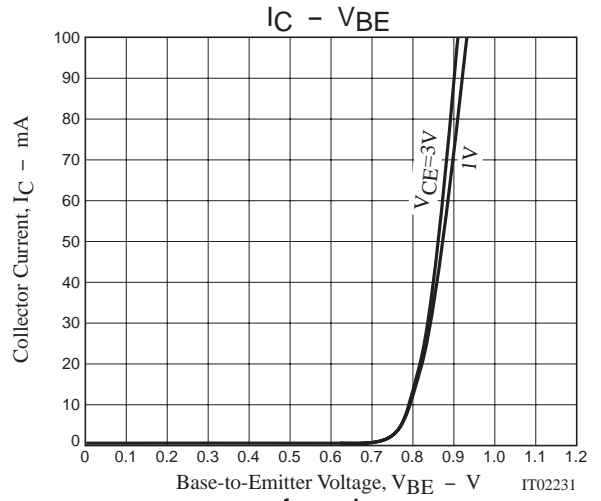
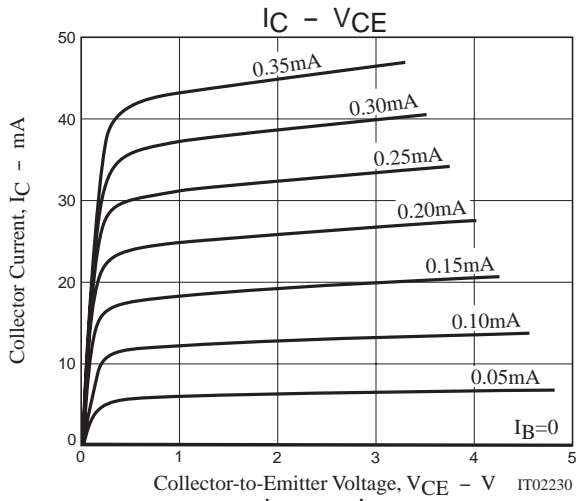
Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	$V_{CBO}$		9	V
Collector-to-Emitter Voltage	$V_{CEO}$		6	V
Emitter-to-Base Voltage	$V_{EBO}$		2	V
Collector Current	$I_C$		100	mA
Collector Dissipation	PC	Mounted on a ceramic board (250mm <sup>2</sup> X0.8mm)	600	mW
Junction Temperature	$T_J$		150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

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

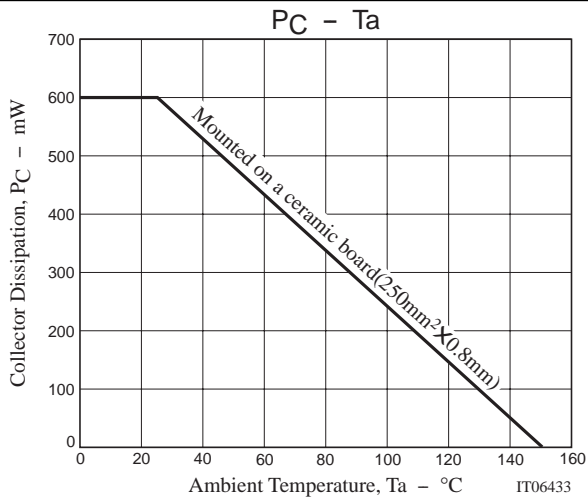
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	$I_{CBO}$	$V_{CB}=5\text{V}, I_E=0$			1.0	$\mu\text{A}$
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=1\text{V}, I_C=0$			10	$\mu\text{A}$
DC Current Gain	$h_{FE}$	$V_{CE}=1\text{V}, I_C=10\text{mA}$	100		180	
Gain-Bandwidth 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	S21e 21	$V_{CE}=1\text{V}, I_C=10\text{mA}, f=1\text{GHz}$	6.5	8.5		dB
	S21e 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.
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# 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

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