



SANYO Semiconductors

DATA SHEET

NPN Epitaxial Planar Silicon Transistor

EC4H07CA — UHF to S Band Low-Noise Amplifier and OSC Applications

Features

- Low noise : NF=1.5dB typ (f=2GHz).
- High cutoff frequency : f_T =10GHz typ (V_{CE} =1V).
 f_T =12.5GHz typ (V_{CE} =3V).
- Low operating voltage.
- High gain : $|S_{21e}|^2$ =9.5dB typ (f=2GHz).
- Ultraminiature (1008 size) and thin (0.6mm) leadless package .
- Halogen free compliance (UL94HB).

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		30	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_{CBO}	$V_{CB}=5\text{V}, I_E=0\text{A}$			1.0	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB}=1\text{V}, I_C=0\text{A}$			10	μA
DC Current Gain	h_{FE}	$V_{CE}=1\text{V}, I_C=5\text{mA}$	100		160	

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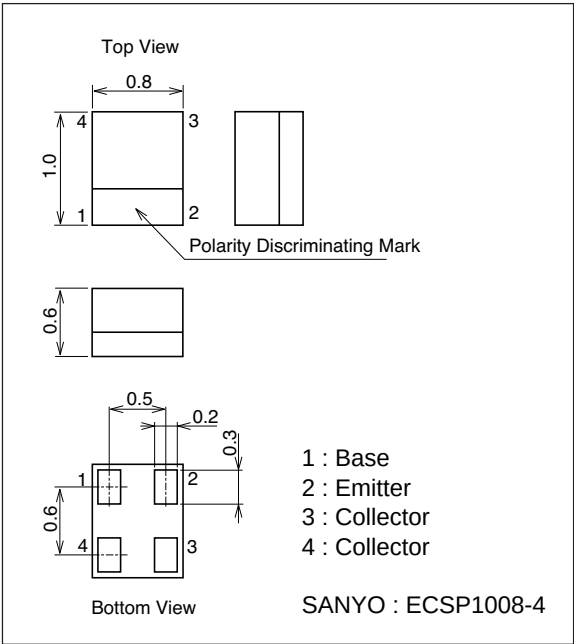
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Gain-Bandwidth Product	f_T1	$V_{CE}=1V, I_C=5mA$	8	10		GHz
	f_T2	$V_{CE}=3V, I_C=15mA$		12.5		GHz
Output Capacitance	C_{ob}	$V_{CB}=1V, f=1MHz$		0.55	0.7	pF
Reverse Transfer Capacitance	C_{re}	$V_{CB}=1V, f=1MHz$		0.4		pF
Forward Transfer Gain	$ S_{21e} ^{21}$	$V_{CE}=1V, I_C=5mA, f=2GHz$	8	9.5		dB
	$ S_{21e} ^{22}$	$V_{CE}=3V, I_C=15mA, f=2GHz$		10.5		dB
Noise Figure	NF	$V_{CE}=1V, I_C=3mA, f=2GHz$		1.5	2.3	dB

Package Dimensions

unit : mm (typ)
7036-003

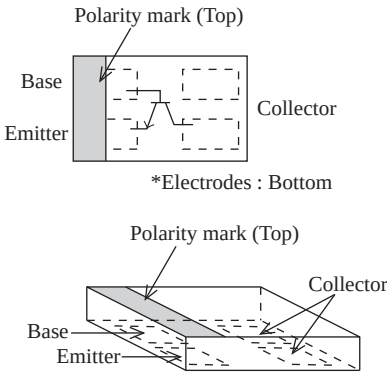


Marking (Top view)

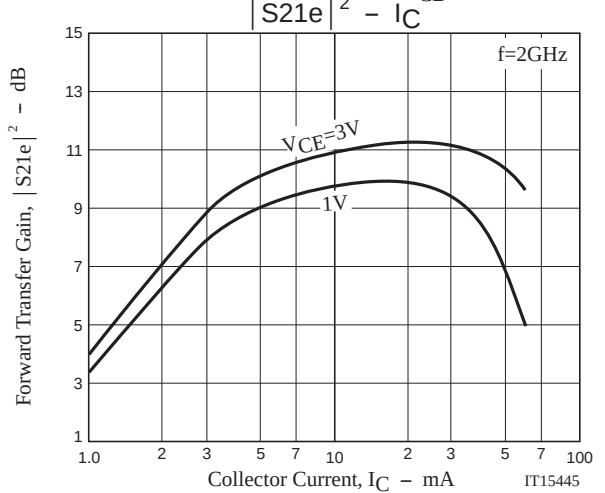
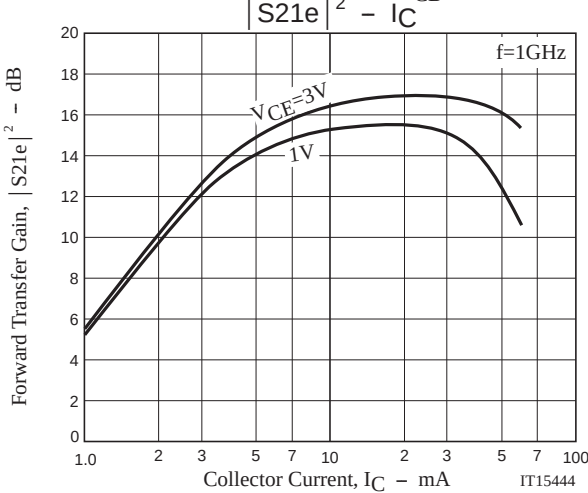
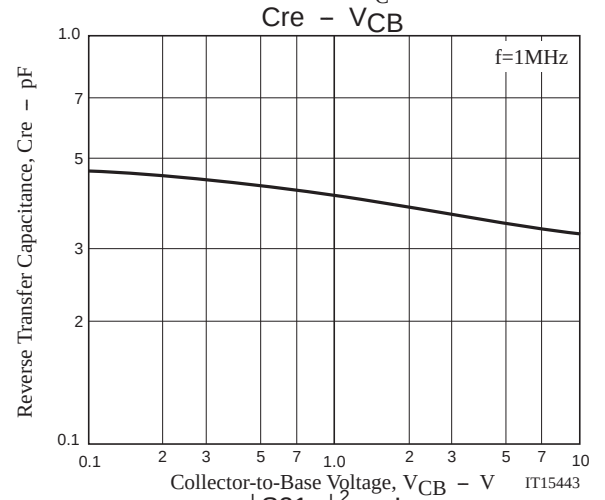
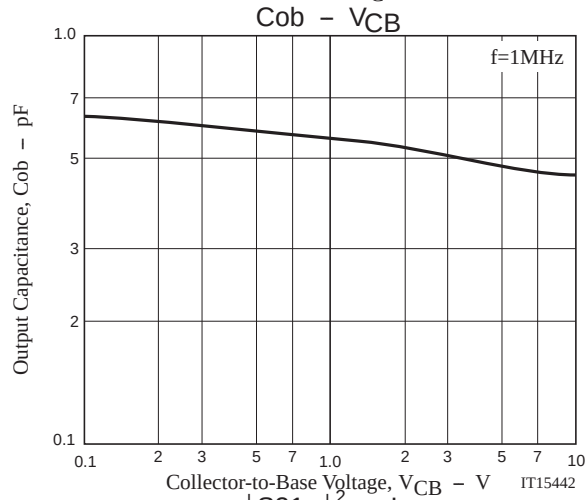
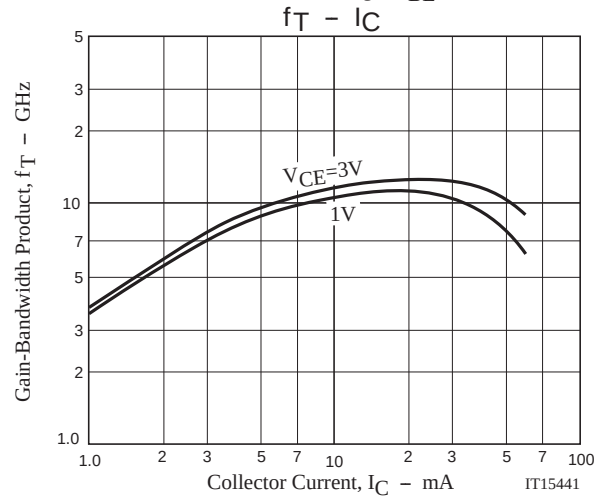
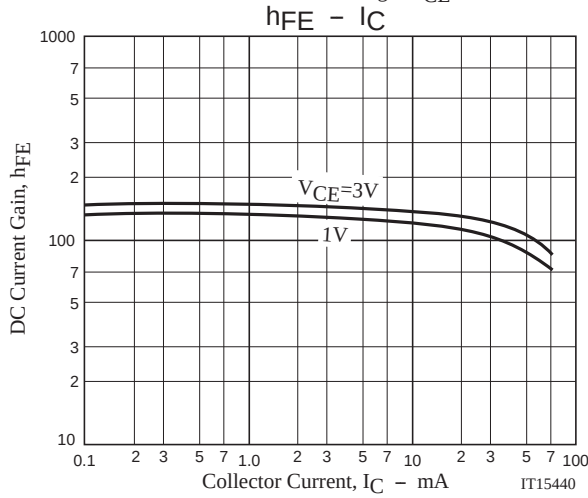
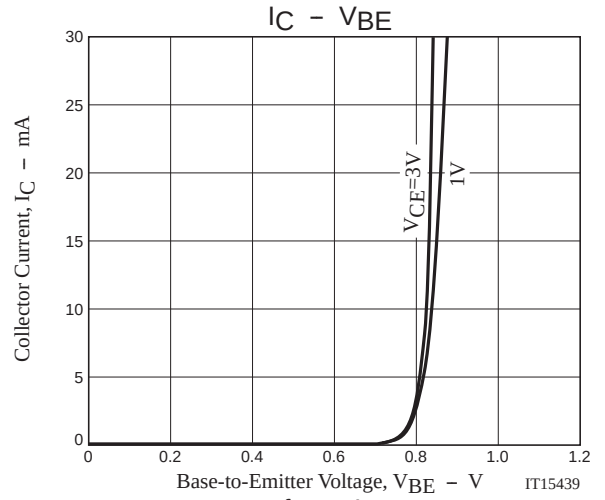
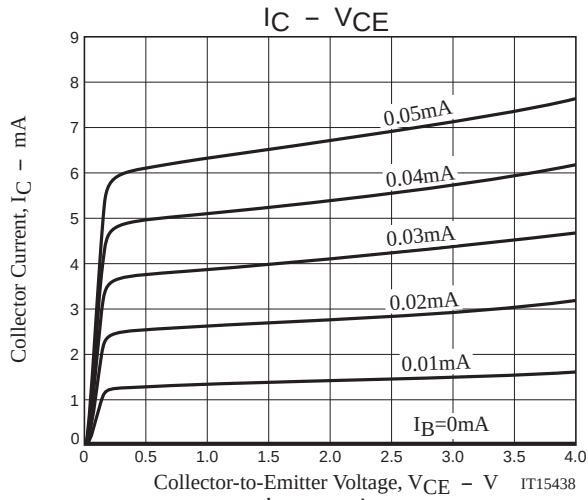


This product adopts a high-frequency process. Please be careful when handling it because it is susceptible to static electricity.

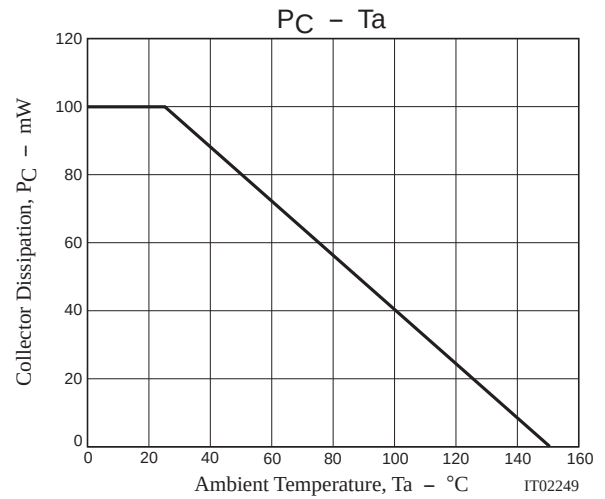
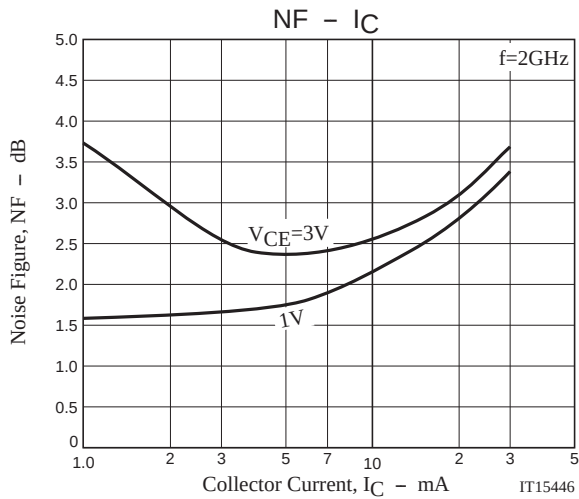
Electrical Connection (Top view)



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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} $	$\angle S_{22}$
200	0.967	-13.0	2.090	164.1	0.053	77.6	0.975	-11.7
400	0.936	-24.8	1.867	151.2	0.096	67.4	0.929	-22.2
600	0.887	-37.4	1.903	139.4	0.133	57.9	0.877	-31.4
800	0.824	-51.9	2.053	128.5	0.160	50.3	0.819	-39.0
1000	0.774	-60.3	1.812	118.0	0.181	44.3	0.772	-45.2
1200	0.719	-74.0	1.891	110.1	0.195	38.5	0.727	-51.3
1400	0.693	-81.6	1.699	103.1	0.206	33.6	0.694	-56.6
1600	0.650	-92.5	1.685	96.0	0.210	30.4	0.659	-61.2
1800	0.622	-101.1	1.600	89.8	0.213	26.7	0.636	-65.6
2000	0.603	-106.7	1.463	83.7	0.213	24.2	0.615	-69.5
2200	0.574	-116.0	1.449	78.4	0.212	22.8	0.597	-72.8
2400	0.565	-120.5	1.336	73.5	0.209	21.2	0.585	-76.2
2600	0.543	-128.5	1.316	69.0	0.207	20.7	0.577	-79.0
2800	0.536	-132.6	1.229	65.0	0.203	20.0	0.570	-82.1
3000	0.525	-138.2	1.184	61.3	0.199	20.0	0.568	-85.0

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.841	-30.2	8.564	152.7	0.045	66.7	0.858	-28.3
400	0.720	-59.5	7.792	133.7	0.069	53.3	0.680	-46.4
600	0.615	-83.4	6.650	119.1	0.083	46.9	0.553	-57.7
800	0.532	-109.0	5.986	106.8	0.091	44.1	0.469	-64.8
1000	0.493	-122.4	5.039	99.2	0.098	43.4	0.413	-69.8
1200	0.471	-134.5	4.386	92.8	0.104	43.8	0.375	-74.0
1400	0.459	-143.5	3.861	87.6	0.110	44.7	0.350	-77.7
1600	0.451	-150.6	3.438	83.0	0.116	45.9	0.334	-80.9
1800	0.446	-156.7	3.103	78.9	0.122	47.1	0.323	-83.9
2000	0.442	-161.4	2.818	75.2	0.128	48.4	0.316	-86.6
2200	0.440	-166.0	2.594	71.7	0.134	49.8	0.312	-89.3
2400	0.437	-169.9	2.402	68.5	0.141	51.0	0.311	-91.8
2600	0.435	-173.5	2.239	65.5	0.149	52.3	0.312	-94.1
2800	0.433	-176.7	2.096	62.7	0.156	53.3	0.313	-96.4
3000	0.432	-179.7	1.974	60.0	0.164	54.3	0.316	-98.6

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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} $	$\angle S_{22}$
200	0.703	-49.6	14.233	142.8	0.037	61.2	0.735	-40.1
400	0.552	-95.2	11.770	119.2	0.052	51.0	0.515	-59.4
600	0.487	-121.1	8.912	106.2	0.062	49.3	0.396	-69.4
800	0.459	-138.9	7.102	97.6	0.069	50.9	0.330	-75.3
1000	0.447	-149.2	5.824	91.8	0.078	52.7	0.290	-79.4
1200	0.443	-157.3	4.936	87.0	0.086	54.8	0.266	-83.0
1400	0.441	-163.4	4.289	82.8	0.094	56.5	0.252	-86.4
1600	0.441	-168.3	3.788	79.0	0.103	58.1	0.245	-89.4
1800	0.441	-172.3	3.395	75.6	0.112	59.2	0.242	-92.0
2000	0.441	-175.9	3.078	72.4	0.121	60.1	0.240	-94.6
2200	0.441	-179.1	2.819	69.5	0.131	61.0	0.241	-97.2
2400	0.440	178.0	2.604	66.6	0.140	61.6	0.243	-99.5
2600	0.439	175.4	2.421	64.0	0.150	62.1	0.247	-101.6
2800	0.438	172.8	2.265	61.4	0.160	62.5	0.251	-103.5
3000	0.437	170.4	2.130	59.0	0.170	62.8	0.256	-105.6

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.532	-87.8	18.878	128.8	0.030	56.3	0.595	-51.3
400	0.465	-129.5	13.327	108.1	0.040	53.8	0.379	-69.6
600	0.453	-147.8	9.493	98.4	0.049	56.7	0.287	-78.2
800	0.450	-158.5	7.329	92.1	0.059	59.7	0.241	-83.3
1000	0.449	-165.5	5.957	87.4	0.068	62.1	0.215	-87.0
1200	0.451	-170.8	5.016	83.3	0.079	64.3	0.202	-90.5
1400	0.453	-174.9	4.342	79.7	0.089	65.5	0.196	-93.6
1600	0.455	-178.5	3.827	76.3	0.100	66.4	0.195	-96.4
1800	0.456	178.5	3.422	73.2	0.110	67.1	0.196	-98.8
2000	0.457	175.8	3.101	70.3	0.121	67.3	0.198	-101.2
2200	0.457	173.4	2.836	67.5	0.131	67.6	0.202	-103.7
2400	0.457	171.1	2.618	64.9	0.142	67.7	0.208	-105.8
2600	0.457	169.0	2.433	62.4	0.153	67.7	0.213	-107.7
2800	0.455	166.8	2.276	59.9	0.164	67.4	0.219	-109.4
3000	0.455	164.8	2.140	57.6	0.175	67.4	0.225	-111.3

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.970	-11.8	2.139	165.4	0.043	78.6	0.980	-10.1
400	0.943	-22.5	1.897	153.5	0.080	69.5	0.942	-19.2
600	0.899	-34.1	1.962	142.6	0.111	60.9	0.899	-27.4
800	0.842	-47.1	2.116	132.3	0.135	53.7	0.849	-34.3
1000	0.796	-55.1	1.877	122.3	0.154	48.0	0.807	-40.0
1200	0.741	-68.0	1.989	114.7	0.168	42.5	0.766	-45.7
1400	0.717	-75.1	1.780	108.1	0.178	37.6	0.735	-50.7
1600	0.672	-85.9	1.794	101.1	0.183	34.4	0.700	-55.0
1800	0.645	-94.3	1.708	94.9	0.187	30.9	0.677	-59.3
2000	0.624	-100.0	1.568	88.8	0.187	28.4	0.656	-63.0
2200	0.592	-109.2	1.562	83.4	0.187	27.0	0.635	-66.2
2400	0.582	-113.6	1.435	78.5	0.185	25.5	0.622	-69.5
2600	0.554	-122.0	1.428	73.9	0.183	25.2	0.613	-72.2
2800	0.547	-126.0	1.329	69.9	0.179	24.6	0.606	-75.1
3000	0.531	-131.8	1.285	66.1	0.176	24.9	0.601	-78.0

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S Parameters (Common emitter)

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.860	-26.1	8.815	155.1	0.036	70.2	0.886	-23.5
400	0.751	-51.1	8.013	137.6	0.060	56.9	0.728	-39.0
600	0.640	-72.9	7.041	123.2	0.073	50.4	0.607	-48.7
800	0.540	-97.9	6.530	110.6	0.082	47.5	0.522	-54.6
1000	0.493	-111.2	5.544	102.9	0.088	46.6	0.465	-58.6
1200	0.460	-124.5	4.888	96.1	0.094	46.8	0.424	-62.1
1400	0.442	-134.0	4.317	90.7	0.100	47.5	0.397	-65.1
1600	0.429	-142.0	3.859	86.0	0.105	48.7	0.379	-67.8
1800	0.421	-148.8	3.490	81.7	0.111	50.0	0.366	-70.4
2000	0.416	-153.9	3.171	78.0	0.117	51.3	0.357	-72.8
2200	0.411	-159.0	2.921	74.4	0.123	52.7	0.351	-75.3
2400	0.408	-163.2	2.704	71.2	0.130	53.9	0.347	-77.6
2600	0.404	-167.1	2.521	68.1	0.137	55.4	0.347	-79.9
2800	0.401	-170.5	2.358	65.3	0.144	56.3	0.346	-82.0
3000	0.399	-173.8	2.220	62.6	0.151	57.4	0.349	-84.3

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.739	-41.1	14.914	146.7	0.031	64.0	0.787	-32.7
400	0.576	-80.8	12.688	124.1	0.046	54.5	0.578	-48.8
600	0.485	-107.2	9.905	110.4	0.056	52.1	0.455	-56.5
800	0.436	-127.5	8.026	100.8	0.063	53.3	0.384	-60.6
1000	0.416	-139.3	6.615	94.7	0.071	55.0	0.341	-63.2
1200	0.407	-148.6	5.629	89.6	0.079	57.0	0.313	-65.7
1400	0.403	-155.6	4.899	85.3	0.087	58.5	0.296	-68.0
1600	0.401	-161.3	4.330	81.5	0.095	59.9	0.287	-70.4
1800	0.400	-165.9	3.882	78.0	0.103	61.1	0.281	-72.6
2000	0.400	-169.9	3.518	74.8	0.112	62.2	0.277	-74.9
2200	0.399	-173.4	3.221	71.8	0.120	63.1	0.275	-77.4
2400	0.398	-176.5	2.973	69.0	0.129	63.7	0.276	-79.7
2600	0.396	-179.3	2.763	66.3	0.138	64.4	0.278	-82.0
2800	0.395	-178.0	2.582	63.8	0.147	64.7	0.280	-84.1
3000	0.394	-175.4	2.427	61.4	0.157	65.3	0.284	-86.3

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.570	-66.3	22.324	135.8	0.025	59.4	0.670	-40.8
400	0.446	-113.3	15.550	112.6	0.036	56.8	0.449	-54.8
600	0.413	-135.6	11.148	101.8	0.045	58.4	0.346	-60.0
800	0.401	-149.0	8.622	94.9	0.054	61.4	0.294	-62.2
1000	0.398	-157.6	7.010	89.9	0.063	63.6	0.264	-63.8
1200	0.399	-164.1	5.910	85.7	0.072	65.8	0.247	-65.7
1400	0.400	-169.0	5.114	82.0	0.082	67.0	0.238	-67.8
1600	0.402	-173.0	4.508	78.7	0.091	67.9	0.234	-70.2
1800	0.403	-176.4	4.031	75.6	0.101	68.5	0.233	-72.5
2000	0.404	-179.3	3.650	72.6	0.111	68.9	0.232	-74.9
2200	0.405	-178.1	3.335	69.9	0.121	69.3	0.234	-77.5
2400	0.404	-175.6	3.075	67.3	0.130	69.4	0.237	-80.0
2600	0.404	-173.5	2.854	64.8	0.141	69.6	0.241	-82.3
2800	0.403	-171.2	2.668	62.4	0.151	69.5	0.245	-84.5
3000	0.403	-169.1	2.506	60.1	0.161	69.6	0.251	-86.7

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