



SANYO Semiconductors

DATA SHEET

NPN Epitaxial Planar Silicon Transistor

EC3H07BA — UHF to S Band Low-Noise Amplifier and OSC Applications

Features

- Low noise : NF=1.5dB typ (f=2GHz).
- High cutoff frequency : $f_T=10\text{GHz}$ typ ($V_{CE}=1\text{V}$),
 $f_T=12.5\text{GHz}$ typ ($V_{CE}=3\text{V}$).
- Low operating voltage.
- High gain : $|S_{21e}|^2=9.5\text{dB}$ typ (f=2GHz).
- Ultraminiature (1006 size) and thin (0.50mm) 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	hFE	$V_{CE}=1\text{V}, I_C=5\text{mA}$	100		160	
Gain-Bandwidth Product	f_{T1}	$V_{CE}=1\text{V}, I_C=5\text{mA}$	8	10		GHz
	f_{T2}	$V_{CE}=3\text{V}, I_C=15\text{mA}$		12.5		GHz

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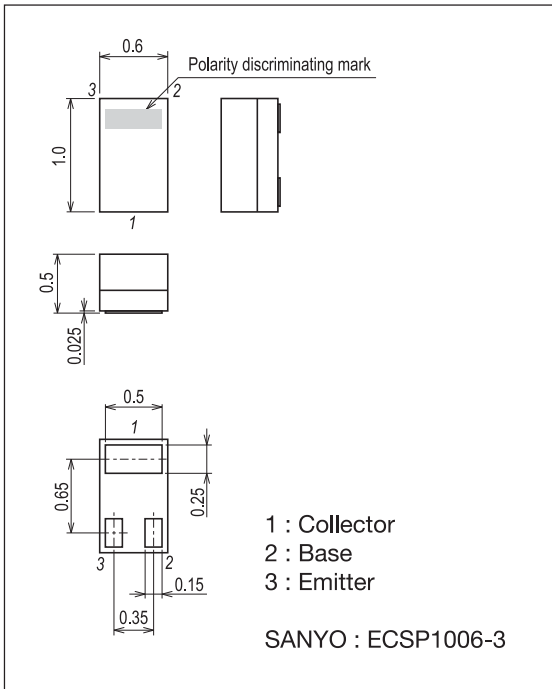
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output Capacitance	Cob	$V_{CB}=1V, f=1MHz$		0.55	0.7	pF
Reverse Transfer Capacitance	Cre	$V_{CB}=1V, f=1MHz$		0.4		pF
Forward Transfer Gain	S21e ²¹	$V_{CE}=1V, I_C=5mA, f=2GHz$	8	9.5		dB
	S21e 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)

7039A-005

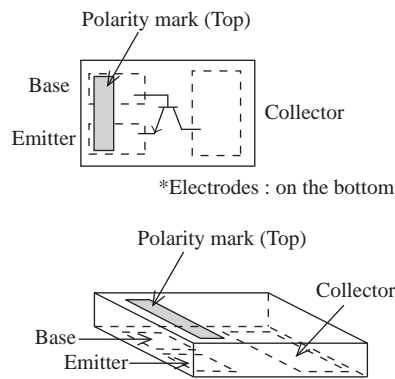


Marking (Top view)

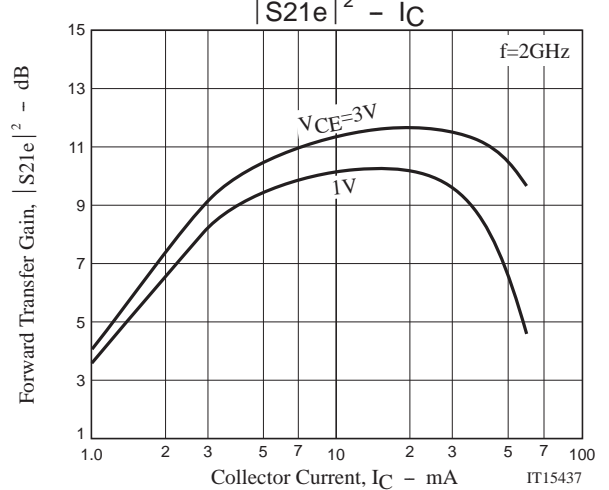
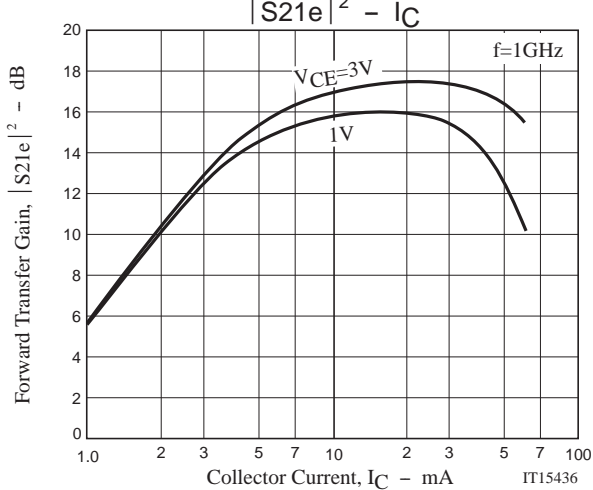
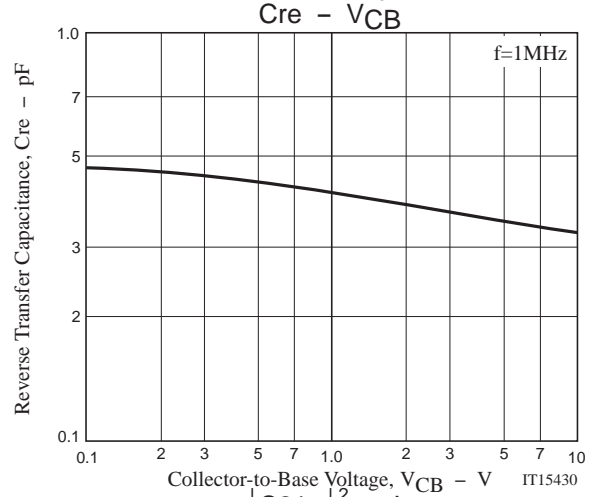
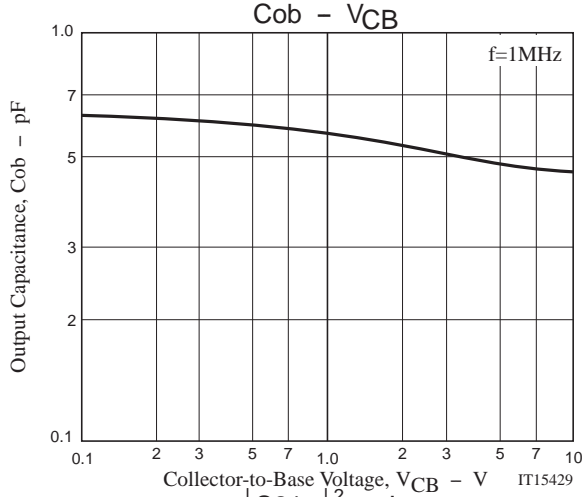
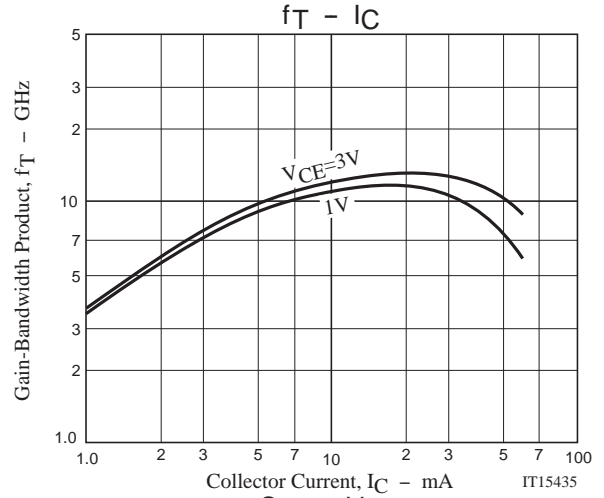
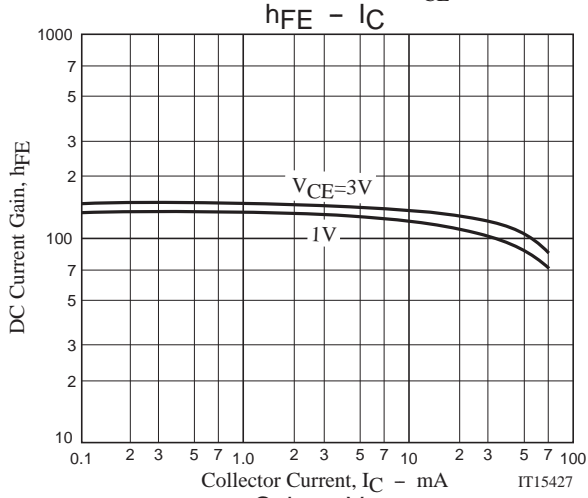
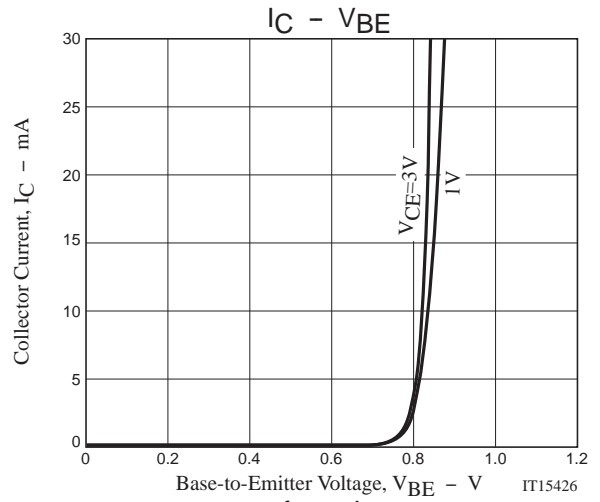
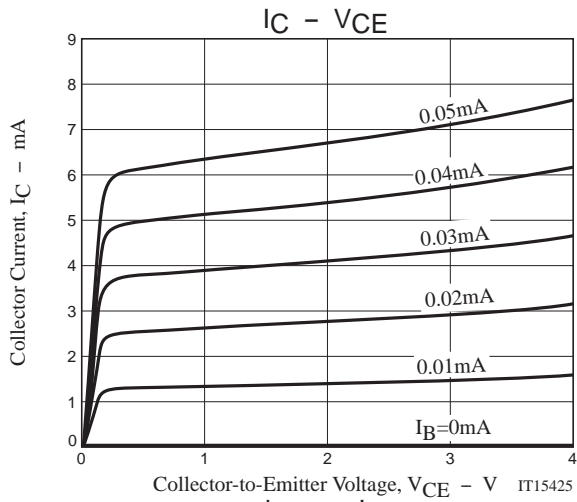


This product adopts a high-frequency process. Please be careful when handling it because it is susceptible to static electricity.

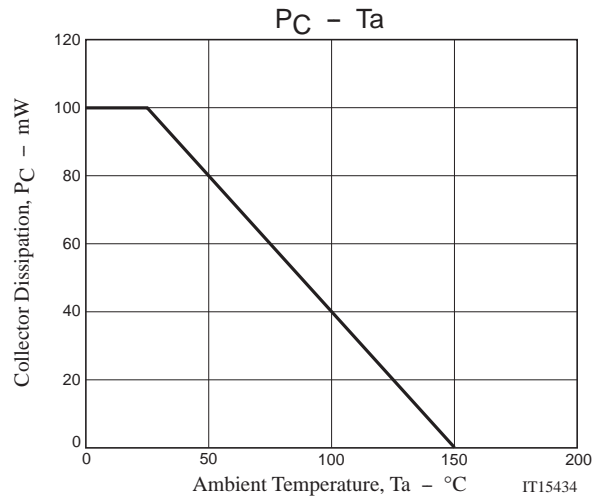
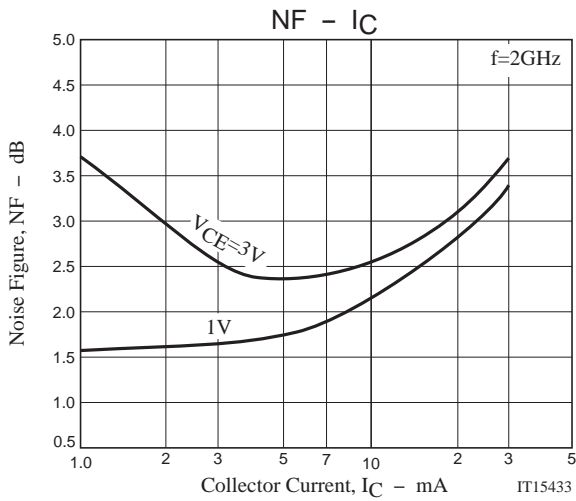
Electrical Connection (Top view)



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EC3H07BA



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} $	$\angle S_{22}$
200	0.977	-12.9	2.129	165.2	0.049	79.4	0.980	-11.0
400	0.967	-24.7	1.904	152.9	0.093	68.8	0.942	-21.2
600	0.947	-37.2	1.953	141.3	0.130	59.5	0.895	-30.4
800	0.905	-51.9	2.149	129.9	0.159	51.2	0.835	-38.3
1000	0.865	-60.1	1.877	118.8	0.181	44.5	0.785	-44.4
1200	0.801	-74.1	1.992	110.2	0.195	38.0	0.737	-50.4
1400	0.763	-81.3	1.765	102.7	0.204	32.5	0.701	-55.3
1600	0.694	-92.1	1.752	95.5	0.207	29.1	0.666	-59.2
1800	0.644	-100.8	1.654	89.3	0.208	25.6	0.645	-63.0
2000	0.608	-106.6	1.503	83.4	0.207	23.2	0.628	-66.4
2200	0.565	-116.9	1.490	78.4	0.206	22.1	0.613	-69.3
2400	0.550	-122.6	1.374	73.7	0.205	20.7	0.605	-72.5
2600	0.530	-132.5	1.362	69.4	0.204	20.1	0.601	-75.2
2800	0.529	-138.2	1.277	65.3	0.201	19.2	0.597	-78.3
3000	0.529	-145.2	1.231	61.3	0.198	18.9	0.594	-81.2

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.861	-29.8	8.777	154.1	0.042	68.0	0.873	-26.7
400	0.772	-58.5	8.091	135.6	0.068	54.9	0.709	-44.7
600	0.681	-81.6	6.957	120.5	0.083	47.3	0.581	-56.5
800	0.589	-108.1	6.398	106.9	0.091	43.8	0.491	-63.9
1000	0.536	-120.7	5.358	98.8	0.098	42.6	0.431	-69.0
1200	0.493	-133.0	4.646	92.1	0.103	42.8	0.388	-72.9
1400	0.462	-142.3	4.065	86.8	0.108	43.5	0.361	-75.9
1600	0.438	-150.5	3.603	82.4	0.113	44.7	0.344	-78.3
1800	0.424	-158.2	3.244	78.5	0.119	46.2	0.335	-80.3
2000	0.416	-164.7	2.947	74.9	0.125	47.4	0.330	-82.2
2200	0.416	-171.4	2.719	71.6	0.132	49.0	0.329	-84.2
2400	0.420	-177.2	2.525	68.3	0.139	49.9	0.331	-86.1
2600	0.430	177.6	2.361	65.2	0.147	51.0	0.337	-88.2
2800	0.439	173.4	2.213	62.1	0.154	51.6	0.343	-90.4
3000	0.449	169.7	2.084	59.1	0.162	52.3	0.349	-92.6

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S Parameters (Common emitter)

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

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
200	0.739	-48.0	14.353	144.8	0.036	62.0	0.762	-37.5
400	0.613	-92.6	12.310	121.1	0.053	51.3	0.552	-56.6
600	0.545	-118.4	9.444	107.1	0.062	48.8	0.428	-67.0
800	0.500	-136.6	7.554	97.4	0.070	49.6	0.357	-73.3
1000	0.471	-147.1	6.164	91.2	0.077	51.3	0.313	-77.5
1200	0.450	-155.6	5.195	86.3	0.085	53.1	0.286	-81.0
1400	0.433	-162.7	4.491	82.2	0.093	54.8	0.269	-83.6
1600	0.422	-169.0	3.955	78.5	0.101	56.3	0.260	-85.7
1800	0.417	-175.0	3.541	75.3	0.110	57.7	0.256	-87.4
2000	0.417	179.5	3.215	72.3	0.119	58.9	0.255	-88.9
2200	0.421	174.4	2.952	69.3	0.128	59.5	0.259	-90.5
2400	0.430	169.9	2.735	66.4	0.138	60.1	0.264	-92.0
2600	0.441	166.0	2.549	63.5	0.148	60.5	0.273	-93.7
2800	0.451	162.6	2.387	60.7	0.158	60.5	0.282	-95.5
3000	0.461	159.9	2.243	57.9	0.167	60.5	0.291	-97.6

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

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
200	0.577	-86.1	19.236	130.6	0.029	59.4	0.620	-48.1
400	0.518	-128.2	14.120	108.8	0.041	53.0	0.409	-66.0
600	0.496	-146.3	10.087	98.3	0.050	55.5	0.313	-74.6
800	0.479	-157.0	7.764	91.5	0.058	58.5	0.264	-79.9
1000	0.463	-164.3	6.273	86.6	0.068	60.8	0.237	-83.8
1200	0.451	-170.3	5.254	82.5	0.077	62.6	0.220	-87.1
1400	0.441	-175.6	4.527	79.0	0.087	64.0	0.212	-89.7
1600	0.435	179.4	3.982	75.8	0.097	65.1	0.210	-91.7
1800	0.434	174.7	3.562	72.9	0.108	65.8	0.210	-93.2
2000	0.438	170.2	3.235	70.0	0.118	66.2	0.212	-94.5
2200	0.445	166.1	2.965	67.3	0.129	66.4	0.218	-95.8
2400	0.455	162.5	2.746	64.5	0.140	66.5	0.226	-96.9
2600	0.466	159.4	2.558	61.7	0.151	66.1	0.236	-98.3
2800	0.476	156.5	2.395	59.0	0.162	65.6	0.247	-99.8
3000	0.486	154.3	2.248	56.3	0.172	65.3	0.258	-101.7

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

Freq(MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
200	0.980	-11.6	2.136	166.6	0.040	78.8	0.984	-9.4
400	0.974	-22.2	1.898	155.3	0.076	71.1	0.954	-18.2
600	0.959	-33.7	1.977	144.5	0.108	62.6	0.917	-26.3
800	0.926	-46.9	2.173	133.9	0.134	54.8	0.867	-33.3
1000	0.892	-54.6	1.907	123.2	0.154	48.4	0.823	-39.0
1200	0.832	-67.9	2.065	114.9	0.168	42.0	0.780	-44.5
1400	0.797	-74.5	1.818	107.7	0.177	36.5	0.747	-49.2
1600	0.728	-85.2	1.841	100.5	0.181	33.2	0.712	-52.9
1800	0.677	-93.4	1.740	94.4	0.183	29.5	0.691	-56.7
2000	0.638	-99.2	1.588	88.4	0.183	27.1	0.673	-60.0
2200	0.589	-109.2	1.585	83.4	0.182	26.0	0.657	-62.8
2400	0.572	-114.6	1.455	78.7	0.180	24.6	0.648	-65.9
2600	0.542	-124.8	1.459	74.2	0.180	24.3	0.642	-68.5
2800	0.540	-130.5	1.362	70.1	0.177	23.5	0.637	-71.5
3000	0.534	-137.9	1.321	66.1	0.175	23.4	0.633	-74.3

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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	0.879	-25.5	8.922	156.6	0.034	71.6	0.902	-21.8
400	0.802	-49.7	8.195	139.6	0.058	58.8	0.759	-37.1
600	0.712	-70.6	7.274	125.1	0.073	51.1	0.640	-47.3
800	0.606	-96.1	6.933	111.3	0.082	47.4	0.550	-53.6
1000	0.544	-108.6	5.868	102.9	0.088	45.8	0.488	-57.7
1200	0.490	-121.9	5.168	95.6	0.093	45.7	0.443	-61.0
1400	0.452	-131.6	4.542	90.1	0.098	46.2	0.414	-63.4
1600	0.421	-140.5	4.042	85.4	0.103	47.4	0.395	-65.4
1800	0.400	-148.8	3.647	81.3	0.108	48.7	0.384	-67.2
2000	0.388	-155.8	3.311	77.6	0.114	49.9	0.377	-68.9
2200	0.383	-163.4	3.056	74.2	0.120	51.4	0.375	-70.8
2400	0.384	-169.9	2.836	70.9	0.127	52.5	0.376	-72.8
2600	0.391	-175.6	2.651	67.8	0.134	53.7	0.380	-74.9
2800	0.398	179.6	2.483	64.7	0.141	54.4	0.384	-77.2
3000	0.407	175.4	2.338	61.7	0.148	55.3	0.389	-79.5

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.770	-40.0	15.161	148.5	0.031	67.0	0.810	-30.3
400	0.634	-78.7	13.259	126.0	0.046	54.9	0.613	-46.4
600	0.544	-104.7	10.498	111.4	0.056	52.2	0.488	-54.7
800	0.479	-125.3	8.574	100.8	0.063	52.3	0.412	-59.3
1000	0.442	-136.8	7.032	94.2	0.070	53.6	0.365	-62.1
1200	0.416	-146.4	5.950	88.9	0.077	55.2	0.334	-64.3
1400	0.395	-154.3	5.151	84.6	0.085	57.1	0.316	-66.1
1600	0.381	-161.4	4.539	80.9	0.092	58.4	0.305	-67.7
1800	0.373	-168.0	4.063	77.5	0.100	59.7	0.299	-69.1
2000	0.370	-174.2	3.685	74.4	0.109	60.9	0.298	-70.6
2200	0.373	-179.9	3.380	71.5	0.117	61.8	0.299	-72.4
2400	0.380	174.9	3.128	68.6	0.126	62.3	0.305	-74.2
2600	0.390	170.6	2.914	65.7	0.135	62.7	0.312	-76.2
2800	0.399	166.9	2.726	62.9	0.144	62.7	0.319	-78.4
3000	0.409	163.9	2.558	60.2	0.153	62.9	0.327	-80.7

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.608	-64.5	22.947	137.8	0.025	62.0	0.697	-37.8
400	0.494	-111.9	16.560	113.6	0.037	57.0	0.484	-51.9
600	0.455	-133.7	11.918	101.9	0.045	57.9	0.378	-57.5
800	0.430	-147.0	9.187	94.4	0.053	60.1	0.322	-60.3
1000	0.412	-155.8	7.428	89.2	0.062	62.3	0.290	-62.2
1200	0.397	-162.8	6.229	84.9	0.071	64.3	0.270	-64.1
1400	0.386	-168.9	5.365	81.3	0.079	65.4	0.259	-65.7
1600	0.379	-174.6	4.716	78.0	0.089	66.4	0.254	-67.4
1800	0.376	-179.9	4.215	75.1	0.098	67.2	0.253	-68.7
2000	0.378	175.0	3.819	72.3	0.108	67.7	0.254	-70.1
2200	0.385	170.5	3.498	69.5	0.117	68.1	0.259	-71.9
2400	0.393	166.4	3.234	66.8	0.127	68.0	0.266	-73.8
2600	0.404	163.0	3.008	64.1	0.137	68.0	0.276	-75.8
2800	0.414	159.9	2.812	61.4	0.147	67.7	0.285	-78.1
3000	0.424	157.5	2.637	58.8	0.157	67.4	0.294	-80.5

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