

NPN Epitaxial Planar Silicon Transistor

SANYO

EC3H04C

High-Frequency Low-Noise Amplifier and OSC Applications

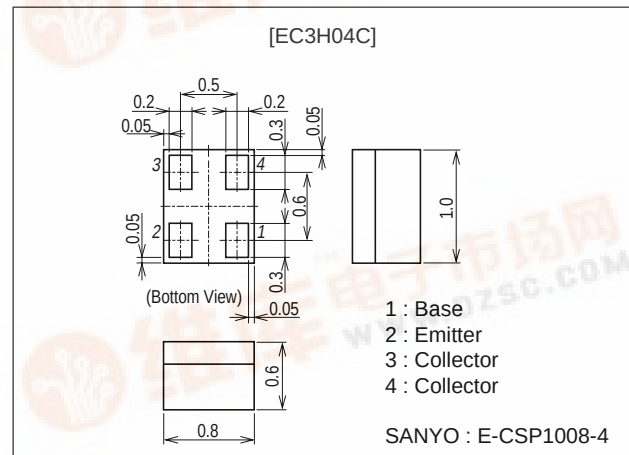
Features

- Low noise : NF=1.7dB typ (f=2GHz).
- High cut-off frequency : $f_T=8\text{GHz}$ typ ($V_{CE}=1\text{V}$).
- Low operating voltage.
- Ultraminiature (1008 size) and thin (0.6mm) leadless package.

Package Dimensions

unit : mm

2184



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	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}	$V_{CB}=5\text{V}, I_E=0$			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_T	$V_{CE}=1\text{V}, I_C=10\text{mA}$	6	8		GHz
Output Capacitance	C_{ob}	$V_{CB}=1\text{V}, f=1\text{MHz}$		1.1	1.5	pF
Reverse Transfer Capacitance	C_{re}	$V_{CB}=1\text{V}, f=1\text{MHz}$		0.85		pF
Forward Transfer Gain	$ S_{21e} _{21}$	$V_{CE}=1\text{V}, I_C=10\text{mA}, f=2\text{GHz}$	4	5		dB
	$ S_{21e} _{22}$	$V_{CE}=3\text{V}, I_C=20\text{mA}, f=1\text{GHz}$		12		dB
Noise Figure	NF	$V_{CE}=1\text{V}, I_C=10\text{mA}, f=2\text{GHz}$		1.7	2.5	dB

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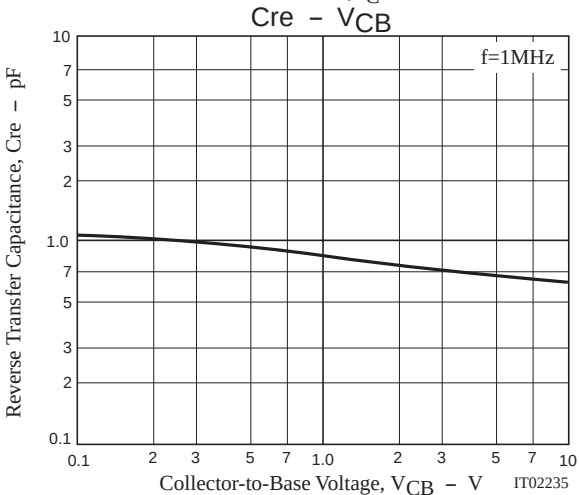
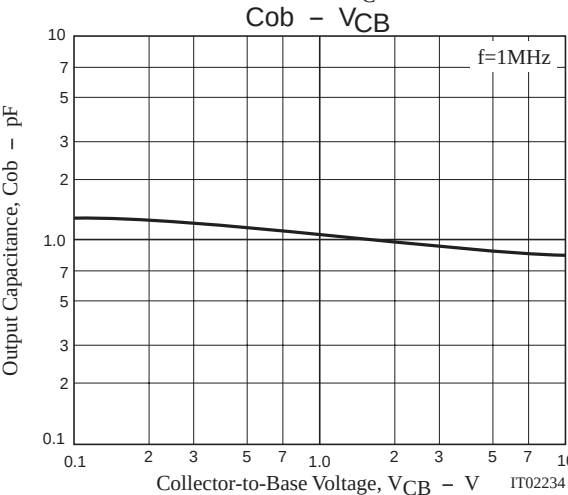
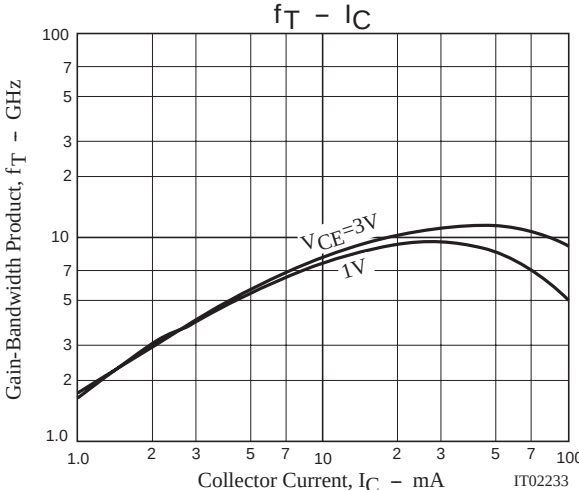
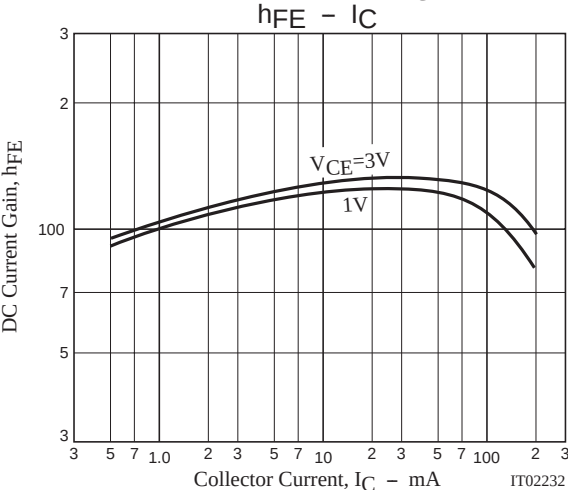
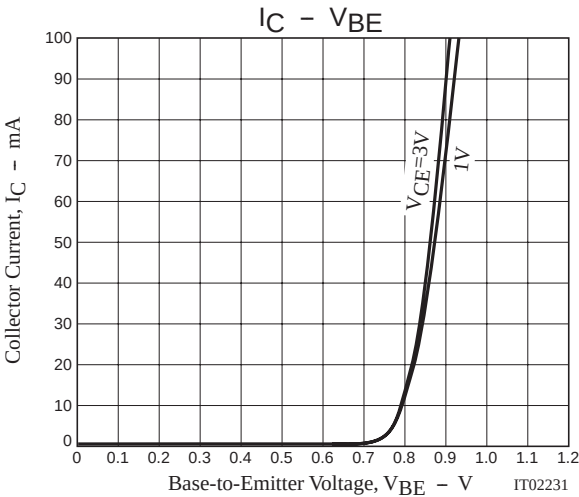
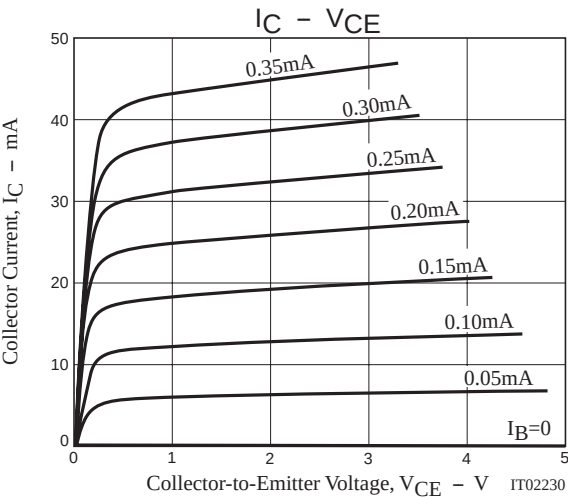
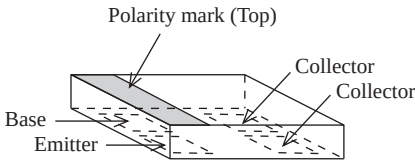
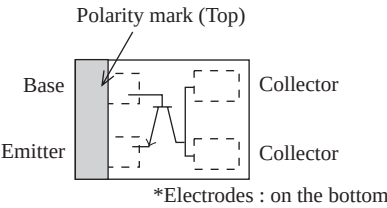
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Type No. Indication (Top view)

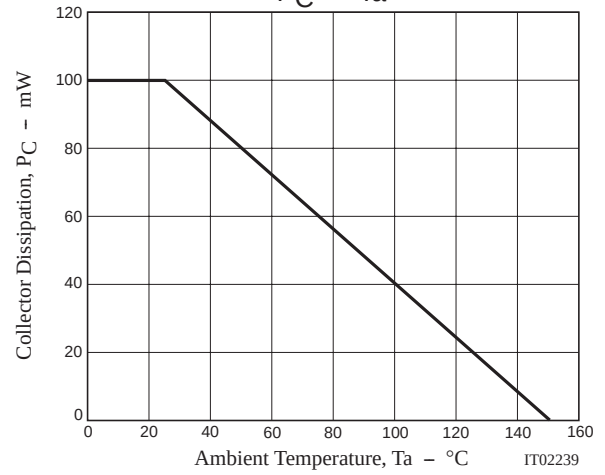
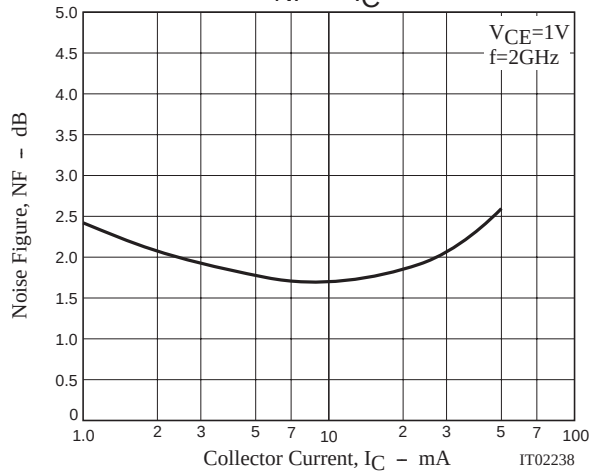
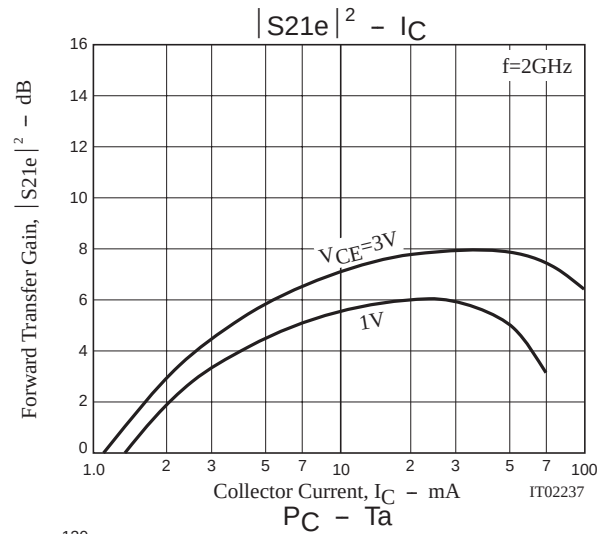
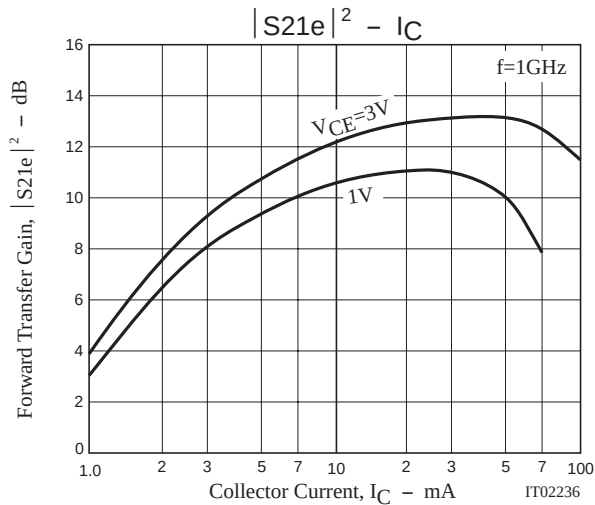


This product adopts a high-frequency process. Please be careful when handling it because it is susceptible to static electricity.

Electrical Connection (Top view)



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S Parameters (Common emitter)

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.925	-41.9	2.875	149.0	0.113	63.2	0.913	-21.9
400	0.835	-78.1	2.702	124.4	0.180	43.8	0.780	-36.1
600	0.758	-101.3	2.125	106.7	0.201	31.3	0.660	-44.2
800	0.716	-115.7	1.584	97.7	0.218	21.4	0.613	-50.5
1000	0.729	-129.3	1.443	83.8	0.224	16.9	0.560	-58.6
1200	0.706	-140.2	1.328	74.8	0.217	13.4	0.550	-62.4
1400	0.707	-146.9	1.142	67.8	0.209	9.9	0.569	-66.0
1600	0.716	-151.9	0.980	61.1	0.203	7.2	0.548	-72.5
1800	0.698	-157.2	0.871	53.1	0.196	4.9	0.529	-77.0
2000	0.702	-164.2	0.877	52.1	0.177	9.6	0.560	-84.6
2200	0.700	-167.0	0.759	42.9	0.173	5.7	0.536	-87.6
2400	0.704	-172.3	0.744	43.0	0.156	13.7	0.588	-94.5
2600	0.704	-175.5	0.673	35.5	0.150	12.7	0.553	-98.5
2800	0.708	-179.8	0.652	35.8	0.143	23.7	0.615	-104.0
3000	0.709	177.0	0.604	30.5	0.142	25.3	0.575	-109.0

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.744	-82.8	10.317	130.5	0.083	49.0	0.696	-53.9
400	0.670	-122.0	6.592	108.4	0.105	36.0	0.462	-79.7
600	0.618	-141.5	4.594	98.8	0.112	32.7	0.344	-93.5
800	0.624	-152.3	3.565	90.3	0.122	32.6	0.297	-104.0
1000	0.627	-160.5	2.967	82.3	0.126	34.6	0.278	-111.7
1200	0.623	-165.9	2.504	76.9	0.132	37.0	0.265	-118.5
1400	0.621	-170.1	2.167	72.1	0.140	39.1	0.258	-124.4
1600	0.621	-174.2	1.932	67.6	0.148	40.3	0.261	-127.6
1800	0.614	-177.8	1.731	64.0	0.158	42.3	0.263	-131.6
2000	0.619	179.2	1.590	60.1	0.165	44.1	0.269	-133.5
2200	0.615	176.1	1.464	56.3	0.175	45.6	0.278	-137.0
2400	0.618	173.8	1.367	52.9	0.186	47.0	0.284	-138.7
2600	0.616	170.6	1.283	49.4	0.197	48.1	0.300	-141.1
2800	0.619	168.7	1.209	46.5	0.209	48.6	0.302	-143.1
3000	0.619	165.8	1.150	43.2	0.221	49.2	0.319	-144.9

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.661	-108.8	13.770	119.9	0.064	44.3	0.568	-77.3
400	0.631	-141.8	7.901	101.6	0.078	39.0	0.383	-108.6
600	0.610	-156.0	5.378	94.8	0.088	40.0	0.311	-125.2
800	0.610	-164.7	4.111	87.7	0.099	44.1	0.288	-136.7
1000	0.616	-170.2	3.376	81.1	0.109	47.8	0.283	-144.2
1200	0.615	-174.4	2.848	76.4	0.122	50.3	0.280	-149.7
1400	0.613	-177.9	2.468	72.3	0.134	52.1	0.280	-154.3
1600	0.613	179.0	2.191	68.5	0.148	53.1	0.281	-156.9
1800	0.608	176.0	1.967	65.4	0.162	53.6	0.284	-159.6
2000	0.608	173.6	1.791	61.9	0.175	54.2	0.286	-161.4
2200	0.607	170.9	1.659	58.6	0.188	54.7	0.294	-163.0
2400	0.606	168.8	1.540	55.3	0.202	54.4	0.296	-164.8
2600	0.606	166.2	1.450	52.4	0.217	54.1	0.303	-165.3
2800	0.605	164.3	1.365	49.2	0.231	53.9	0.306	-167.0
3000	0.607	162.0	1.297	46.5	0.245	53.2	0.313	-167.6

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.623	-131.3	15.796	111.7	0.048	43.6	0.484	-100.8
400	0.623	-156.5	8.545	96.9	0.061	45.9	0.370	-132.7
600	0.613	-166.4	5.750	91.9	0.074	50.6	0.333	-147.4
800	0.615	-172.4	4.375	86.0	0.089	54.4	0.326	-156.2
1000	0.620	-176.6	3.571	80.0	0.103	58.0	0.328	-162.1
1200	0.619	-180.0	3.011	75.9	0.120	59.8	0.328	-166.1
1400	0.617	177.0	2.609	72.2	0.136	60.8	0.329	-169.3
1600	0.616	174.5	2.311	68.8	0.152	60.9	0.330	-171.7
1800	0.613	171.9	2.072	66.0	0.168	60.3	0.332	-174.0
2000	0.611	169.7	1.889	62.8	0.183	60.0	0.334	-175.5
2200	0.609	167.4	1.745	59.6	0.199	59.5	0.335	-176.8
2400	0.608	165.3	1.624	56.6	0.215	58.6	0.337	-178.2
2600	0.608	163.0	1.524	53.8	0.230	57.8	0.341	-179.0
2800	0.605	161.2	1.439	50.9	0.246	56.7	0.342	179.8
3000	0.606	159.3	1.365	48.2	0.261	55.6	0.344	179.1

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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
200	0.932	-38.6	3.040	152.2	0.088	65.7	0.943	-16.1
400	0.868	-69.7	2.804	129.9	0.143	47.6	0.845	-27.4
600	0.767	-92.6	2.258	113.8	0.166	33.5	0.733	-33.9
800	0.750	-111.5	1.795	101.5	0.187	27.4	0.671	-43.1
1000	0.736	-125.2	1.690	89.7	0.189	21.1	0.649	-47.0
1200	0.731	-134.4	1.409	80.9	0.182	17.0	0.631	-50.2
1400	0.734	-141.5	1.161	73.6	0.181	14.2	0.605	-55.7
1600	0.720	-148.8	1.098	66.8	0.179	10.9	0.587	-61.7
1800	0.708	-154.8	1.000	60.3	0.166	11.7	0.590	-65.4
2000	0.707	-160.8	0.926	57.7	0.154	12.4	0.598	-70.5
2200	0.704	-164.9	0.868	49.7	0.146	14.0	0.594	-75.1
2400	0.711	-170.0	0.784	49.1	0.137	18.1	0.612	-80.3
2600	0.703	-173.6	0.775	41.7	0.129	22.6	0.607	-85.1
2800	0.715	-177.9	0.677	41.8	0.127	29.7	0.629	-89.8
3000	0.702	178.8	0.703	36.0	0.126	36.4	0.627	-95.1

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
200	0.762	-71.5	11.124	135.7	0.068	53.9	0.752	-41.9
400	0.670	-111.1	7.542	113.1	0.090	40.4	0.516	-61.8
600	0.604	-132.1	5.338	102.6	0.100	35.6	0.379	-70.5
800	0.605	-145.2	4.172	93.9	0.108	36.0	0.320	-78.9
1000	0.604	-154.3	3.488	85.6	0.113	37.6	0.286	-84.5
1200	0.601	-160.4	2.943	80.0	0.118	39.7	0.264	-88.7
1400	0.599	-165.3	2.535	75.2	0.125	41.7	0.251	-93.6
1600	0.597	-169.8	2.265	70.8	0.133	43.7	0.247	-98.3
1800	0.590	-173.6	2.027	67.0	0.140	45.8	0.244	-101.4
2000	0.594	-177.1	1.853	63.4	0.150	47.8	0.250	-105.1
2200	0.590	179.9	1.711	59.2	0.158	49.5	0.253	-108.4
2400	0.594	177.0	1.584	56.1	0.168	50.8	0.264	-111.4
2600	0.593	174.1	1.493	52.3	0.179	51.9	0.270	-114.9
2800	0.597	171.7	1.393	49.5	0.191	53.0	0.281	-117.2
3000	0.594	169.0	1.333	46.1	0.203	53.6	0.290	-120.8

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
200	0.660	-94.3	15.608	125.5	0.054	49.6	0.618	-60.0
400	0.603	-131.8	9.377	105.6	0.069	42.5	0.389	-84.8
600	0.572	-148.7	6.448	97.9	0.079	43.2	0.284	-97.7
800	0.570	-158.0	4.947	90.6	0.089	46.3	0.242	-108.4
1000	0.576	-164.8	4.073	83.7	0.099	49.9	0.223	-116.7
1200	0.575	-169.6	3.433	78.9	0.110	52.4	0.211	-122.8
1400	0.572	-173.7	2.965	74.9	0.121	54.5	0.205	-128.1
1600	0.571	-177.1	2.628	71.0	0.134	55.7	0.205	-131.6
1800	0.568	179.7	2.353	67.9	0.146	56.4	0.205	-135.1
2000	0.569	177.2	2.141	64.5	0.158	56.9	0.208	-137.3
2200	0.568	174.4	1.977	61.1	0.172	57.3	0.214	-139.7
2400	0.568	172.2	1.828	57.9	0.185	57.6	0.219	-141.3
2600	0.569	169.5	1.718	54.8	0.198	57.4	0.228	-143.1
2800	0.569	167.6	1.611	51.8	0.212	57.4	0.233	-144.4
3000	0.572	165.4	1.530	49.0	0.226	56.9	0.242	-145.8

EC3H04C

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.587	-116.9	18.878	117.0	0.042	48.5	0.505	-78.6
400	0.571	-147.6	10.531	100.4	0.055	48.9	0.325	-107.8
600	0.556	-160.0	7.129	94.6	0.068	52.3	0.256	-123.6
800	0.558	-167.1	5.430	88.4	0.081	55.9	0.234	-135.0
1000	0.564	-172.2	4.435	82.3	0.094	60.1	0.227	-143.1
1200	0.563	-175.9	3.735	78.1	0.108	61.6	0.224	-148.6
1400	0.561	-179.2	3.225	74.5	0.123	62.8	0.222	-152.9
1600	0.561	178.1	2.853	71.1	0.138	62.9	0.223	-155.7
1800	0.558	175.3	2.549	68.3	0.153	62.6	0.224	-158.4
2000	0.558	173.1	2.320	65.2	0.167	62.3	0.227	-160.2
2200	0.558	170.8	2.136	62.1	0.183	62.0	0.230	-161.5
2400	0.556	168.7	1.981	59.0	0.197	61.3	0.234	-163.0
2600	0.558	166.4	1.854	56.2	0.212	60.6	0.241	-163.6
2800	0.557	164.7	1.743	53.3	0.226	59.7	0.243	-164.5
3000	0.559	162.6	1.648	50.7	0.240	58.6	0.249	-165.2

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