



# 2SC5645

## UHF to S Band Low-Noise Amplifier and OSC Applications

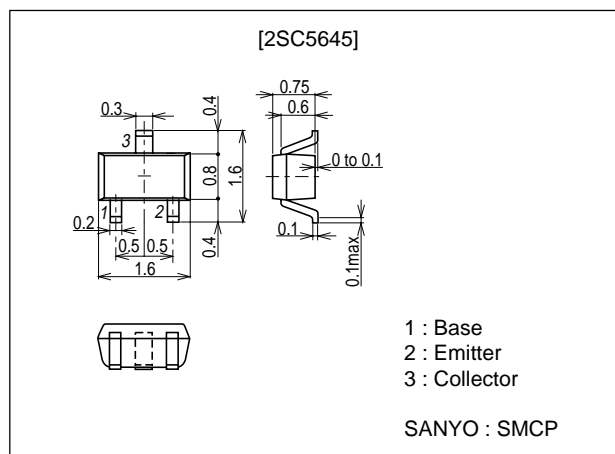
### Features

- 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-voltage operating .
- High gain :  $|S_{21e}|^2=9.5\text{dB typ (}f=2\text{GHz)}$ .

### Package Dimensions

unit : mm

2106A



### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	$V_{CB0}$		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	$^\circ\text{C}$

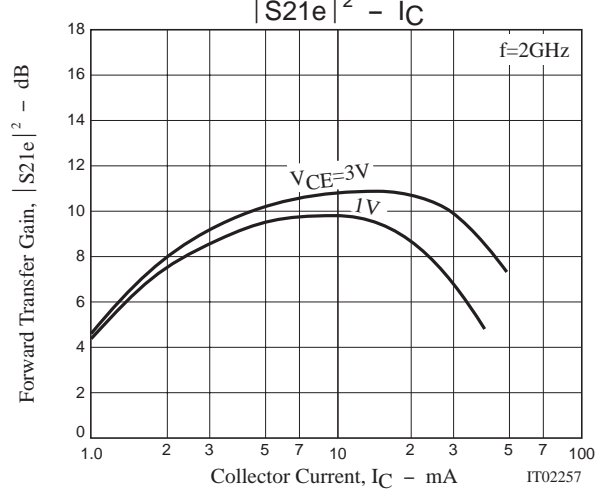
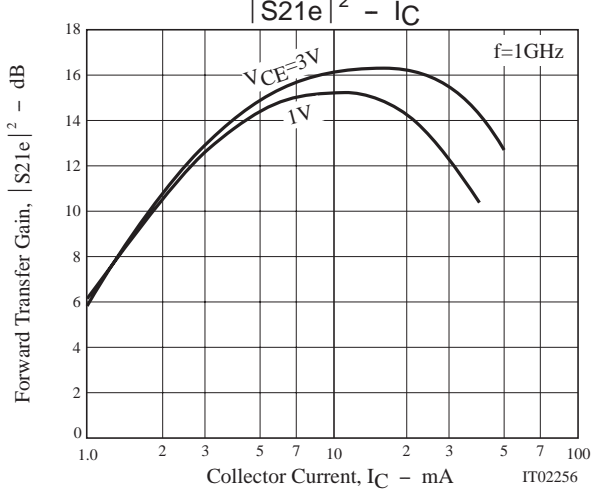
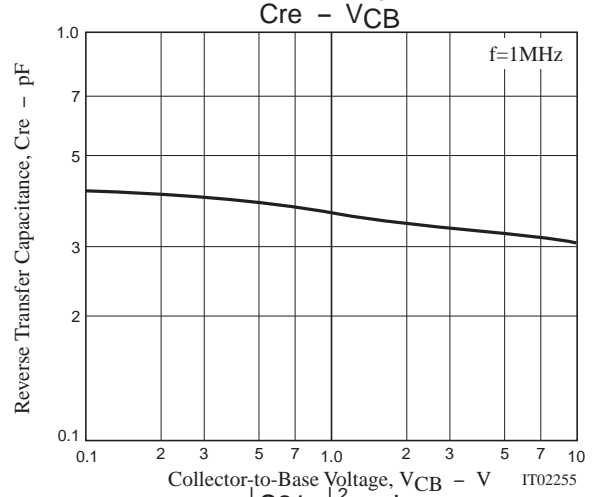
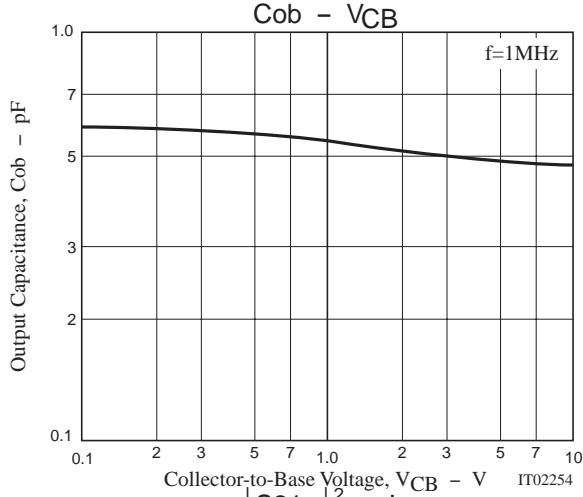
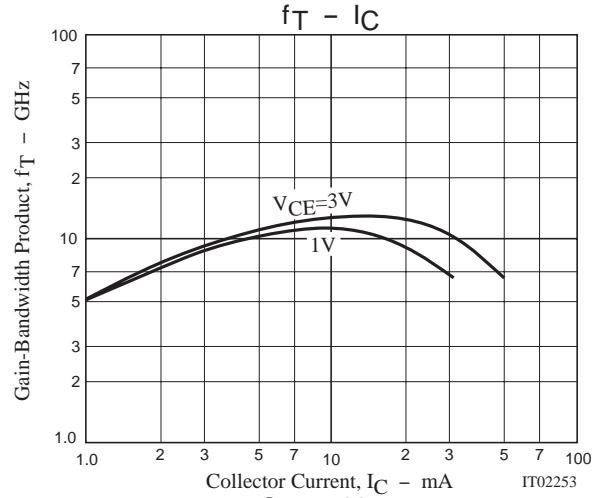
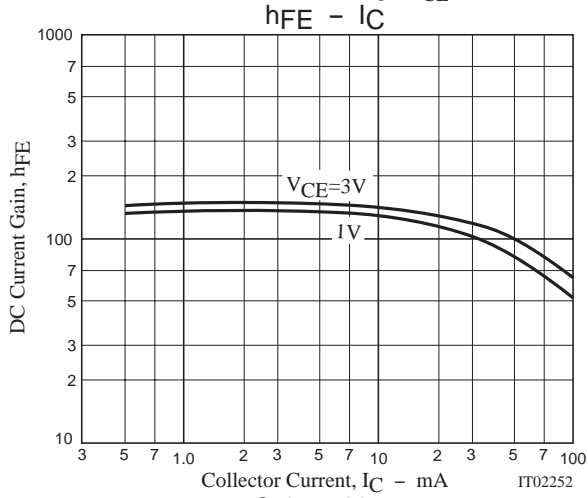
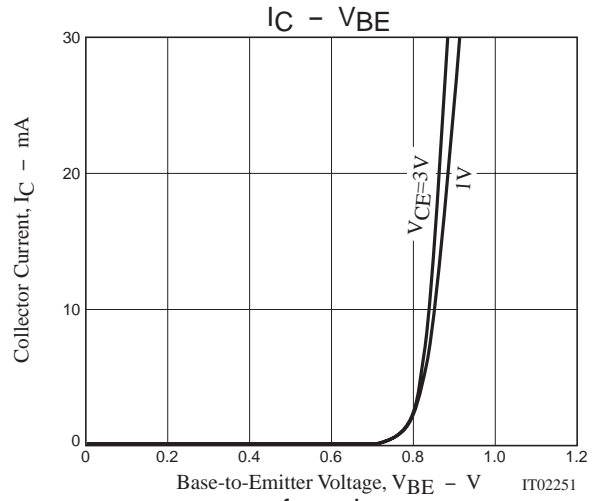
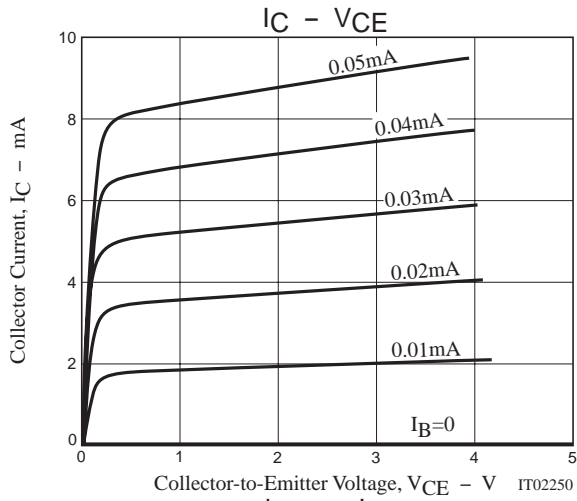
Electrical Characteristics at  $T_a=25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	$I_{CBO}$	$V_{CB}=5\text{V, }I_E=0$			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	$h_{FE}$	$V_{CE}=1\text{V, }I_C=5\text{mA}$	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
Output Capacitance	$C_{ob}$	$V_{CE}=1\text{V, }f=1\text{MHz}$		0.55	0.7	pF
Reverse Transfer Capacitance	$C_{re}$	$V_{CE}=1\text{V, }f=1\text{MHz}$		0.4		pF
Forward Transfer Gain	$ S_{21e} ^2_1$	$V_{CE}=1\text{V, }I_C=5\text{mA, }f=2\text{GHz}$	8	9.5		dB
	$ S_{21e} ^2_2$	$V_{CE}=3\text{V, }I_C=15\text{mA, }f=2\text{GHz}$		10.5		dB
Noise Figure	NF	$V_{CE}=1\text{V, }I_C=3\text{mA, }f=2\text{GHz}$		1.5	2.3	dB

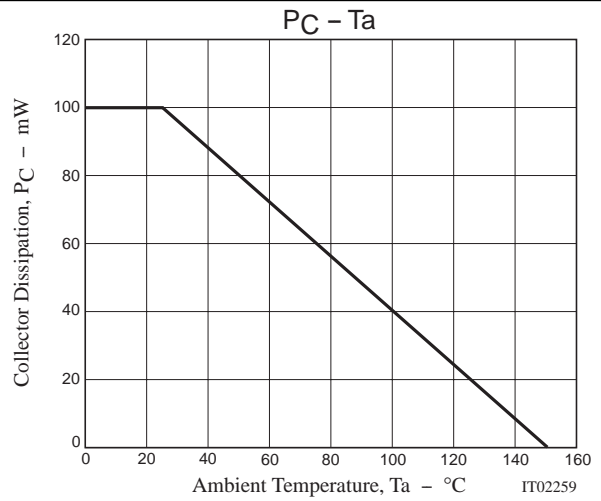
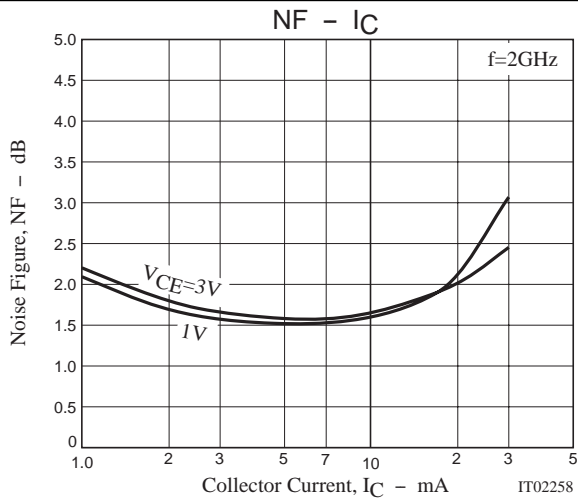
Marking : NF

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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	0.971	-13.1	3.176	166.5	0.047	79.7	0.975	-10.2
400	0.939	-25.7	3.090	153.7	0.089	70.4	0.946	-19.8
600	0.872	-36.9	2.916	142.1	0.123	59.5	0.878	-28.0
800	0.806	-49.0	2.622	131.1	0.155	53.0	0.838	-36.8
1000	0.782	-59.2	2.581	121.1	0.179	47.6	0.798	-43.8
1200	0.711	-69.6	2.440	111.0	0.193	42.4	0.757	-49.3
1400	0.656	-78.1	2.242	102.3	0.210	38.1	0.721	-55.4
1600	0.617	-86.0	2.116	95.2	0.220	34.0	0.682	-60.1
1800	0.551	-93.3	1.997	86.9	0.224	31.4	0.660	-63.8
2000	0.537	-100.8	1.848	82.7	0.228	27.8	0.615	-68.1
2200	0.482	-108.2	1.816	74.4	0.233	27.4	0.620	-70.7
2400	0.472	-113.9	1.663	69.5	0.238	24.0	0.591	-76.3
2600	0.439	-122.5	1.647	63.6	0.236	24.0	0.574	-77.5
2800	0.425	-126.1	1.529	58.2	0.239	23.0	0.554	-80.4
3000	0.423	-134.7	1.523	53.3	0.247	24.2	0.588	-80.3

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
200	0.828	-34.4	11.283	152.9	0.046	70.9	0.899	-25.1
400	0.701	-62.6	9.573	131.4	0.076	57.2	0.743	-44.4
600	0.599	-83.6	7.640	116.9	0.098	49.6	0.613	-57.0
800	0.522	-100.4	6.319	105.7	0.108	45.7	0.528	-65.6
1000	0.475	-112.6	5.241	98.5	0.119	44.0	0.458	-72.6
1200	0.436	-124.0	4.498	92.0	0.125	43.4	0.423	-76.9
1400	0.420	-132.7	3.954	86.0	0.131	44.9	0.404	-80.1
1600	0.401	-141.0	3.503	80.7	0.140	45.2	0.378	-83.7
1800	0.391	-147.6	3.186	75.8	0.148	45.6	0.369	-86.0
2000	0.387	-152.3	2.887	71.5	0.157	45.6	0.357	-88.6
2200	0.378	-158.0	2.663	67.2	0.168	45.3	0.353	-90.4
2400	0.377	-161.6	2.482	63.4	0.175	45.7	0.352	-94.5
2600	0.370	-166.2	2.298	59.8	0.181	46.2	0.329	-93.8
2800	0.365	-170.2	2.136	57.1	0.193	47.3	0.343	-89.8
3000	0.364	-172.7	2.045	54.0	0.206	46.9	0.400	-93.3

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V<sub>CE</sub>=1V, I<sub>C</sub>=10mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
200	0.709	-49.8	15.927	143.7	0.043	64.8	0.811	-34.2
400	0.565	-84.6	11.658	121.5	0.064	52.7	0.605	-54.7
600	0.484	-107.0	8.751	107.8	0.078	49.2	0.477	-66.3
800	0.435	-123.1	6.913	98.8	0.086	49.8	0.397	-73.6
1000	0.408	-135.0	5.714	91.7	0.097	50.7	0.356	-79.1
1200	0.390	-144.5	4.851	86.1	0.107	50.7	0.327	-83.0
1400	0.386	-152.0	4.211	81.2	0.115	51.8	0.307	-86.6
1600	0.380	-158.3	3.720	76.6	0.128	52.3	0.296	-89.0
1800	0.377	-164.1	3.347	72.4	0.138	53.3	0.287	-91.6
2000	0.377	-168.0	3.040	68.5	0.148	53.4	0.289	-92.7
2200	0.373	-172.1	2.780	64.8	0.160	53.0	0.290	-94.2
2400	0.372	-175.7	2.571	61.5	0.173	53.1	0.295	-98.2
2600	0.367	-178.3	2.397	57.8	0.182	53.7	0.274	-97.0
2800	0.365	178.9	2.231	55.1	0.197	53.9	0.291	-91.5
3000	0.367	176.1	2.136	52.3	0.209	52.1	0.351	-95.0

V<sub>CE</sub>=1V, I<sub>C</sub>=20mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
200	0.571	-71.7	17.704	133.8	0.038	60.1	0.677	-42.5
400	0.472	-110.6	11.551	112.1	0.053	51.3	0.465	-61.1
600	0.434	-132.2	8.287	100.3	0.065	52.2	0.359	-70.5
800	0.415	-145.7	6.393	92.4	0.076	54.2	0.303	-76.0
1000	0.405	-155.0	5.241	86.4	0.085	55.7	0.275	-80.7
1200	0.402	-162.7	4.397	81.2	0.096	57.3	0.258	-84.0
1400	0.404	-168.4	3.800	76.4	0.108	58.5	0.251	-86.9
1600	0.402	-173.4	3.349	72.2	0.122	58.8	0.249	-88.8
1800	0.403	-176.9	3.012	68.1	0.133	58.7	0.248	-92.0
2000	0.401	-179.8	2.722	64.5	0.145	58.7	0.253	-92.5
2200	0.401	176.6	2.498	60.9	0.158	58.4	0.264	-94.4
2400	0.404	173.7	2.297	57.8	0.169	57.9	0.272	-97.7
2600	0.401	171.4	2.151	54.3	0.182	58.6	0.254	-97.0
2800	0.396	169.5	2.012	51.8	0.199	58.0	0.273	-91.6
3000	0.400	167.2	1.919	48.9	0.211	56.0	0.337	-95.4

V<sub>CE</sub>=3V, I<sub>C</sub>=1mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
200	0.978	-11.3	3.288	167.6	0.041	80.9	0.973	-8.8
400	0.951	-22.6	3.167	156.1	0.078	72.6	0.950	-17.2
600	0.898	-33.0	2.983	146.6	0.109	62.5	0.897	-24.6
800	0.837	-42.3	2.805	132.8	0.137	56.1	0.858	-32.8
1000	0.805	-53.1	2.683	123.8	0.160	51.5	0.828	-39.1
1200	0.748	-60.9	2.484	116.0	0.178	46.6	0.794	-44.1
1400	0.707	-68.6	2.299	107.5	0.192	41.9	0.758	-50.0
1600	0.653	-77.0	2.152	99.1	0.202	38.4	0.720	-54.7
1800	0.599	-82.1	2.028	93.8	0.211	34.6	0.698	-58.4
2000	0.570	-90.8	1.913	85.2	0.212	32.7	0.659	-62.2
2200	0.519	-94.9	1.830	80.7	0.223	30.6	0.660	-65.2
2400	0.510	-102.7	1.775	72.9	0.223	28.5	0.635	-70.2
2600	0.458	-108.1	1.659	68.4	0.229	27.1	0.614	-71.9
2800	0.462	-113.4	1.644	62.7	0.224	27.2	0.596	-74.0
3000	0.428	-119.8	1.568	56.7	0.241	28.1	0.630	-74.6

## 2SC5645

V<sub>CE</sub>=3V, I<sub>C</sub>=5mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
200	0.839	-31.1	11.349	155.2	0.040	70.9	0.916	-22.0
400	0.723	-56.3	9.627	135.7	0.070	61.0	0.787	-38.3
600	0.610	-77.4	8.210	119.8	0.087	51.7	0.661	-50.6
800	0.535	-91.6	6.749	109.4	0.101	48.1	0.583	-58.0
1000	0.468	-106.1	5.728	101.1	0.107	47.9	0.507	-64.8
1200	0.435	-114.5	4.939	94.3	0.117	45.9	0.469	-68.7
1400	0.418	-122.7	4.335	88.5	0.127	45.9	0.429	-72.7
1600	0.394	-130.6	3.867	83.3	0.134	46.4	0.399	-75.7
1800	0.376	-138.2	3.497	78.6	0.141	46.4	0.390	-78.5
2000	0.364	-145.6	3.179	74.5	0.149	47.2	0.373	-80.8
2200	0.358	-150.0	2.907	70.0	0.158	47.8	0.377	-82.1
2400	0.354	-154.6	2.674	66.6	0.165	47.4	0.378	-85.6
2600	0.349	-157.2	2.513	62.5	0.172	47.9	0.356	-84.6
2800	0.342	-160.6	2.357	59.6	0.185	50.0	0.373	-81.1
3000	0.343	-163.4	2.253	56.6	0.196	49.0	0.435	-85.5

V<sub>CE</sub>=3V, I<sub>C</sub>=10mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
200	0.743	-42.4	16.570	147.1	0.038	66.4	0.850	-29.2
400	0.599	-72.5	12.565	125.5	0.060	57.3	0.657	-48.1
600	0.492	-95.5	9.637	111.5	0.071	53.1	0.526	-58.7
800	0.433	-111.2	7.714	102.1	0.082	51.5	0.447	-65.4
1000	0.396	-123.7	6.393	94.8	0.092	52.8	0.395	-70.6
1200	0.370	-133.7	5.443	89.1	0.101	52.2	0.359	-74.2
1400	0.359	-142.1	4.722	84.3	0.110	52.9	0.335	-76.6
1600	0.349	-149.7	4.192	79.5	0.122	54.0	0.319	-78.9
1800	0.343	-154.2	3.770	75.4	0.131	54.6	0.313	-81.4
2000	0.343	-159.3	3.434	71.4	0.142	54.5	0.309	-82.7
2200	0.337	-164.0	3.140	67.5	0.151	55.3	0.311	-84.0
2400	0.337	-168.2	2.910	64.4	0.163	54.4	0.315	-88.0
2600	0.332	-171.4	2.696	60.8	0.173	55.2	0.295	-86.2
2800	0.328	-173.4	2.516	58.1	0.186	55.3	0.313	-81.2
3000	0.330	-176.3	2.401	55.4	0.197	53.9	0.376	-86.3

V<sub>CE</sub>=3V, I<sub>C</sub>=20mA, Z<sub>O</sub>=50Ω

Freq(MHz)	S <sub>11</sub>	∠S <sub>11</sub>	S <sub>21</sub>	∠S <sub>21</sub>	S <sub>12</sub>	∠S <sub>12</sub>	S <sub>22</sub>	∠S <sub>22</sub>
200	0.622	-56.3	20.099	139.6	0.033	62.8	0.767	-35.4
400	0.482	-92.2	13.906	117.8	0.048	55.9	0.554	-53.5
600	0.414	-115.1	10.166	105.0	0.061	55.5	0.431	-62.3
800	0.378	-130.3	7.947	96.7	0.072	56.2	0.361	-67.1
1000	0.360	-141.1	6.534	90.5	0.082	57.9	0.323	-71.0
1200	0.348	-149.9	5.513	85.3	0.093	58.4	0.297	-73.7
1400	0.348	-156.3	4.777	80.7	0.103	59.5	0.284	-76.1
1600	0.343	-161.7	4.214	76.6	0.115	60.1	0.278	-77.8
1800	0.342	-166.9	3.800	72.6	0.127	59.9	0.274	-80.3
2000	0.341	-170.7	3.435	69.0	0.138	60.3	0.277	-81.6
2200	0.342	-174.6	3.140	65.5	0.149	59.8	0.282	-82.7
2400	0.343	-177.5	2.898	62.3	0.162	59.2	0.287	-86.8
2600	0.339	-179.8	2.700	58.9	0.171	59.3	0.270	-84.6
2800	0.337	178.0	2.512	56.3	0.186	58.6	0.293	-79.2
3000	0.339	175.6	2.399	53.8	0.200	57.7	0.355	-85.1

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