

**2SC5502**

## High-Frequency Low-Noise Amplifier Applications

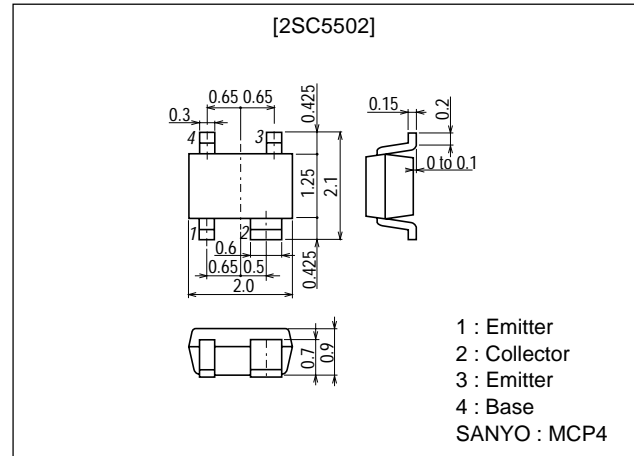
### Features

- Low noise :  $NF=1.1\text{dB}$  typ ( $f=1\text{GHz}$ ).
- High gain :  $|S_{21e}|^2=12\text{dB}$  typ ( $f=1\text{GHz}$ ).
- High cutoff frequency :  $f_T=8\text{GHz}$  typ.

### Package Dimensions

unit:mm

2161



### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	$V_{CBO}$		20	V
Collector-to-Emitter Voltage	$V_{CEO}$		12	V
Emitter-to-Base Voltage	$V_{EBO}$		2	V
Collector Current	$I_C$		100	mA
Collector Dissipation	$P_C$	Mounted on a ceramic board (250mm <sup>2</sup> ×0.8mm)	500	mW
Junction Temperature	$T_J$		150	°C
Storage Temperature	$T_{stg}$		-55 to +150	°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	$h_{FE1}$	$V_{CE}=5\text{V}, I_C=30\text{mA}$	90*		270*	
	$h_{FE2}$	$V_{CE}=5\text{V}, I_C=70\text{mA}$	80			
Gain-Bandwidth Product	$f_T$	$V_{CE}=5\text{V}, I_C=30\text{mA}$	6	8		GHz
Reverse Transfer Capacitance	$C_{re}$	$V_{CB}=5\text{V}, f=1\text{MHz}$		0.6	1.0	pF

\* : The 2SC5502 is classified by 30mA  $h_{FE}$  as follows :

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Marking	TY	
Rank	4	5
$h_{FE}$	90 to 180	135 to 270

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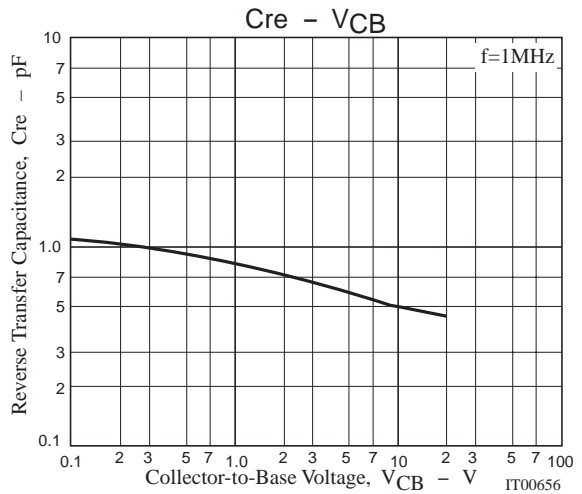
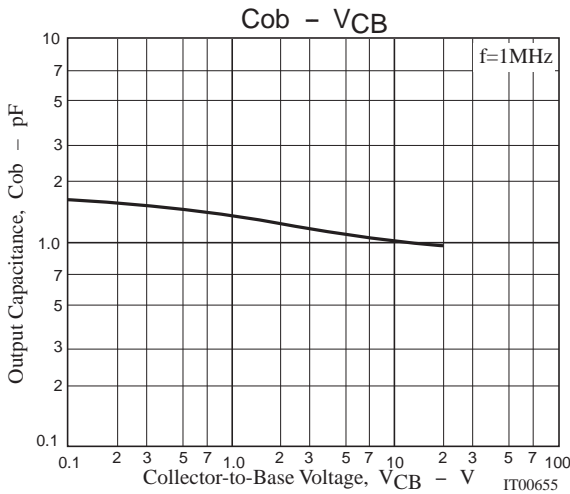
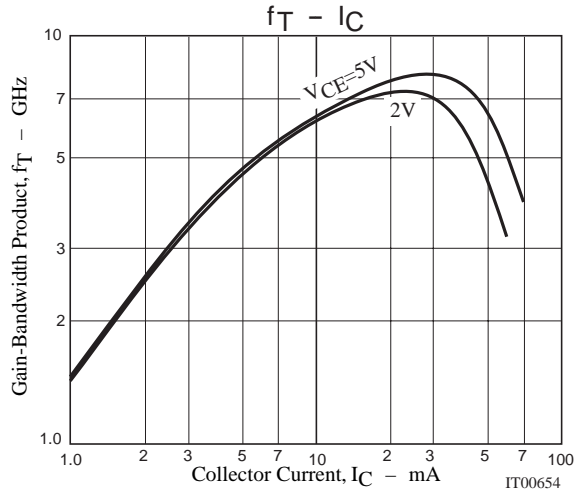
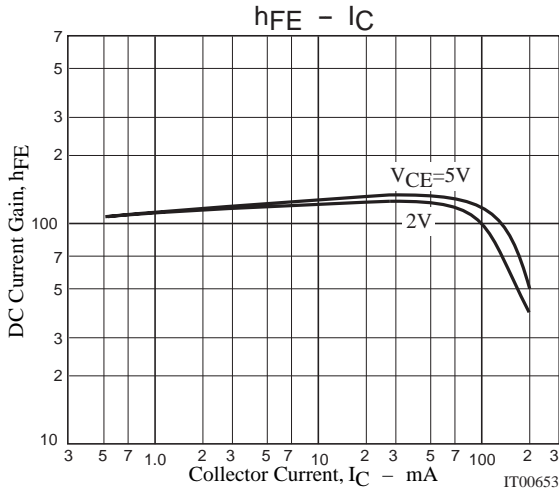
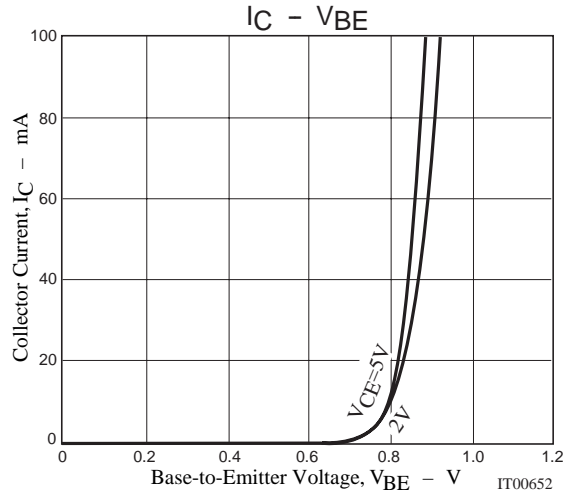
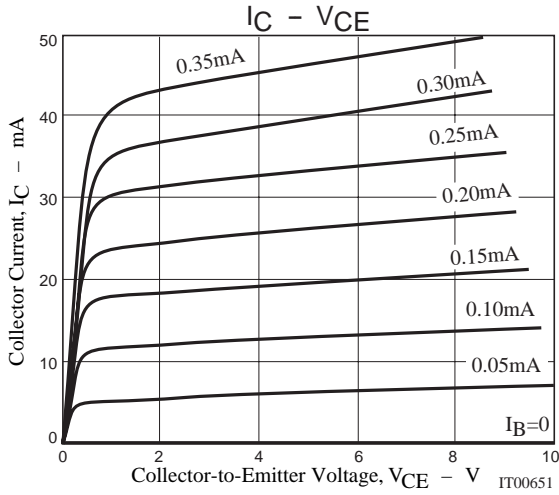
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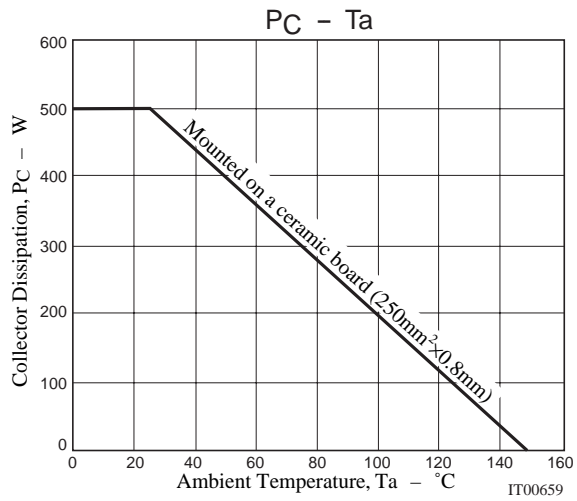
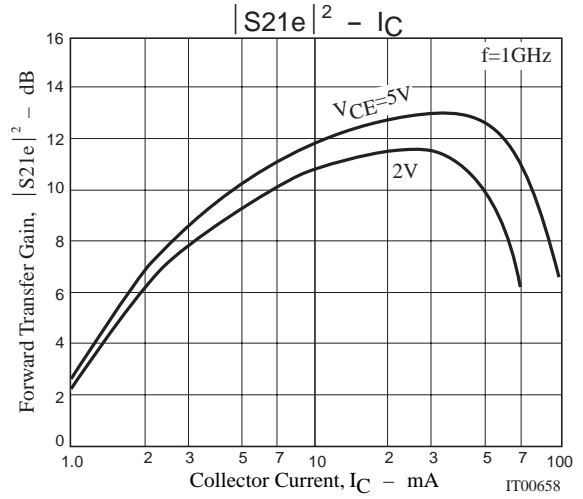
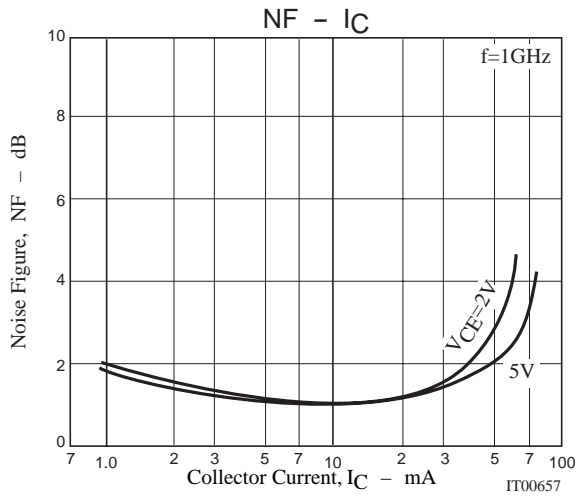
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Forward Transfer Gain	$ S_{21e} ^2$	$V_{CE}=5V, I_C=30mA, f=1GHz$	10	12		dB
Noise Figure	NF	$V_{CE}=5V, I_C=7mA, f=1GHz$		1.1	2.0	dB



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## S Parameters (Common emitter)

$V_{CE}=2V, I_C=1mA, Z_O=50\Omega$

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>
100	0.965	-24.2	2.014	161.0	0.046	73.8	0.973	-10.2
200	0.940	-45.5	2.365	143.6	0.086	60.0	0.926	-17.5
400	0.878	-85.2	2.060	117.9	0.134	38.5	0.852	-27.4
600	0.824	-114.7	1.796	97.5	0.153	24.5	0.743	-37.5
800	0.804	-134.1	1.391	81.6	0.155	14.5	0.712	-43.3
1000	0.765	-152.3	1.309	68.5	0.153	7.9	0.734	-47.8
1200	0.765	-163.6	1.032	56.6	0.141	3.7	0.704	-54.7
1400	0.745	-175.6	0.952	46.7	0.128	2.7	0.681	-61.5
1600	0.725	173.8	0.897	39.4	0.117	1.5	0.700	-67.4
1800	0.727	165.5	0.840	31.4	0.105	8.8	0.735	-72.8
2000	0.715	157.0	0.713	23.8	0.095	13.8	0.769	-79.0

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$V_{CE}=2V, I_C=5mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.840	-41.5	10.284	149.7	0.041	65.7	0.884	-24.5
200	0.757	-78.0	9.025	128.9	0.062	49.3	0.706	-39.6
400	0.675	-122.7	6.076	104.0	0.082	36.1	0.492	-53.7
600	0.623	-149.7	4.636	87.6	0.090	33.2	0.403	-59.4
800	0.610	-164.5	3.574	76.9	0.095	33.9	0.360	-64.1
1000	0.603	-174.9	2.854	67.6	0.104	34.1	0.346	-68.0
1200	0.563	175.3	2.448	59.2	0.111	35.9	0.336	-73.3
1400	0.586	167.4	2.118	51.8	0.120	38.0	0.344	-77.5
1600	0.581	160.0	1.882	45.2	0.132	38.7	0.357	-81.4
1800	0.581	153.6	1.677	38.3	0.141	38.8	0.368	-86.0
2000	0.577	147.1	1.488	31.6	0.157	39.9	0.380	-90.8

$V_{CE}=2V, I_C=10mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.727	-60.0	17.305	141.4	0.035	59.3	0.787	-36.3
200	0.643	-104.1	13.452	118.3	0.050	47.3	0.553	-55.0
400	0.587	-145.0	8.031	96.0	0.064	41.8	0.354	-68.8
600	0.571	-163.3	5.556	83.7	0.076	43.9	0.279	-75.8
800	0.565	-175.3	4.249	74.8	0.088	45.6	0.248	-81.0
1000	0.557	175.5	3.425	66.6	0.102	46.6	0.240	-84.2
1200	0.554	167.8	2.884	59.3	0.116	47.0	0.240	-88.6
1400	0.550	161.2	2.480	52.6	0.129	47.4	0.243	-93.2
1600	0.547	154.8	2.182	46.6	0.146	46.2	0.254	-96.7
1800	0.543	148.5	1.964	40.2	0.160	45.2	0.267	-99.7
2000	0.541	142.8	1.764	34.3	0.178	43.6	0.279	-103.9

$V_{CE}=2V, I_C=20mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.601	-88.1	25.245	130.6	0.028	55.8	0.668	-48.8
200	0.565	-129.8	16.396	109.1	0.039	48.4	0.428	-69.0
400	0.552	-160.2	9.005	91.0	0.054	50.8	0.262	-85.3
600	0.547	-173.8	6.121	81.0	0.069	54.5	0.208	-93.6
800	0.545	176.8	4.625	73.2	0.086	55.2	0.192	-99.7
1000	0.541	169.2	3.717	65.8	0.103	55.3	0.185	-103.8
1200	0.537	162.4	3.129	59.3	0.121	53.9	0.190	-107.6
1400	0.535	156.6	2.687	52.8	0.138	52.7	0.197	-111.1
1600	0.531	150.6	2.374	47.5	0.156	50.4	0.206	-113.7
1800	0.529	144.9	2.130	41.4	0.173	48.4	0.216	-117.0
2000	0.525	139.4	1.919	35.6	0.191	46.0	0.229	-119.4

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.969	-22.2	2.804	161.2	0.036	74.9	0.986	-6.7
200	0.939	-44.4	2.293	146.2	0.066	62.3	0.948	-13.9
400	0.891	-81.0	2.036	121.5	0.102	41.0	0.845	-25.2
600	0.843	-109.9	1.811	101.4	0.117	27.9	0.814	-30.0
800	0.787	-134.0	1.760	85.8	0.121	18.6	0.780	-35.6
1000	0.776	-149.4	1.342	72.5	0.117	13.6	0.730	-41.8
1200	0.739	-164.5	1.290	61.6	0.108	10.0	0.748	-46.6
1400	0.732	-175.0	1.102	51.6	0.099	10.0	0.776	-51.6
1600	0.730	175.5	0.953	43.8	0.090	14.9	0.783	-57.2
1800	0.712	166.0	0.787	34.7	0.083	19.5	0.781	-62.8
2000	0.702	157.5	0.773	28.1	0.086	32.9	0.774	-68.6

$V_{CE}=5V, I_C=7mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.809	-43.4	13.671	148.9	0.030	64.5	0.878	-22.7
200	0.716	-80.4	11.979	127.1	0.046	50.7	0.697	-35.7
400	0.612	-126.9	7.867	102.7	0.060	41.3	0.502	-44.8
600	0.573	-150.3	5.706	88.1	0.068	41.7	0.422	-47.7
800	0.559	-164.9	4.406	78.0	0.077	42.7	0.393	-50.5
1000	0.546	-176.1	3.550	69.1	0.086	44.8	0.375	-53.7
1200	0.542	175.1	3.010	61.3	0.095	46.0	0.379	-57.3
1400	0.538	167.5	2.560	54.0	0.106	47.5	0.378	-61.6
1600	0.535	160.7	2.280	47.8	0.119	48.3	0.386	-65.8
1800	0.533	153.8	2.036	41.0	0.131	47.9	0.394	-70.2
2000	0.529	147.7	1.836	34.6	0.145	48.0	0.409	-74.4

$V_{CE}=5V, I_C=10mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.748	-51.9	18.026	144.6	0.028	63.3	0.831	-27.1
200	0.648	-93.0	14.173	122.7	0.041	50.7	0.629	-40.7
400	0.565	-136.3	8.983	98.8	0.054	45.6	0.432	-49.0
600	0.538	-157.4	6.282	85.9	0.064	46.4	0.364	-51.1
800	0.530	-170.4	4.798	76.7	0.075	48.4	0.333	-53.8
1000	0.523	179.9	3.880	68.4	0.086	49.9	0.319	-56.9
1200	0.517	171.5	3.275	61.2	0.098	51.1	0.320	-60.6
1400	0.513	164.5	2.807	54.3	0.111	51.5	0.323	-65.0
1600	0.512	158.1	2.470	48.4	0.125	50.7	0.336	-68.5
1800	0.511	151.6	2.227	41.8	0.139	50.1	0.341	-73.4
2000	0.508	145.6	2.001	35.8	0.155	49.0	0.354	-77.5

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$V_{CE}=5V, I_C=30mA, Z_0=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.546	-89.2	31.405	129.4	0.021	59.0	0.673	-40.3
200	0.508	-129.7	19.738	108.7	0.030	53.9	0.441	-52.2
400	0.493	-159.3	10.703	91.5	0.043	58.1	0.286	-56.2
600	0.490	-172.8	7.268	81.6	0.057	60.6	0.241	-57.9
800	0.490	178.0	5.510	74.2	0.073	61.3	0.226	-60.3
1000	0.485	170.7	4.415	67.0	0.088	60.6	0.221	-63.9
1200	0.484	164.0	3.712	60.6	0.104	59.9	0.227	-68.0
1400	0.480	158.1	3.177	54.3	0.120	58.3	0.233	-72.1
1600	0.480	152.7	2.769	49.0	0.137	56.4	0.243	-75.9
1800	0.479	146.8	2.513	42.9	0.153	54.0	0.253	-80.5
2000	0.479	141.5	2.265	37.3	0.170	51.6	0.265	-84.7

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