

**2SC5504**

## UHF to S Band Low-Noise Amplifier Applications

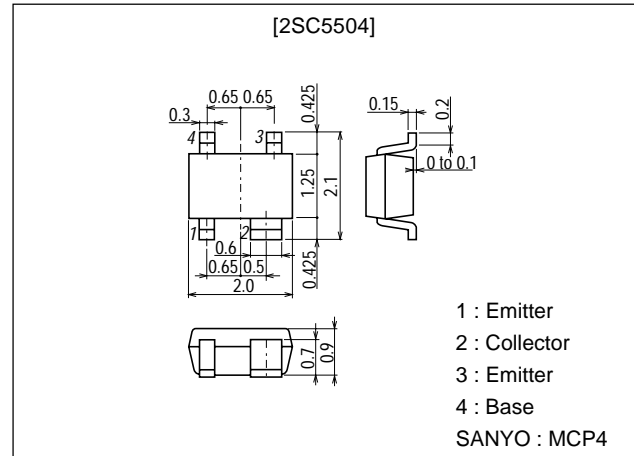
### Features

- Low noise : NF=0.9dB typ (f=1GHz).  
: NF=1.4dB typ (f=1.5GHz).
- High gain :  $|S_{21e}|^2=11\text{dB}$  typ (f=1GHz).
- High cutoff frequency :  $f_T=11\text{GHz}$  typ.
- Low voltage, low current operation.  
( $V_{CE}=1\text{V}$ ,  $I_C=1\text{mA}$ )  
:  $f_T=7\text{GHz}$  typ.  
:  $|S_{21e}|^2=6\text{dB}$  typ (f=1.5GHz).

### 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	$V_{CB0}$		20	V
Collector-to-Emitter Voltage	$V_{CEO}$		10	V
Emitter-to-Base Voltage	$V_{EBO}$		1.5	V
Collector Current	$I_C$		30	mA
Collector Dissipation	$P_C$	Mounted on a ceramic board (250mm <sup>2</sup> ×0.8mm)	300	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	$I_{CB0}$	$V_{CB}=10\text{V}$ , $I_E=0$			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	$h_{FE}$	$V_{CE}=5\text{V}$ , $I_C=10\text{mA}$	90*		270*	
Gain-Bandwidth Product	$f_T1$	$V_{CE}=5\text{V}$ , $I_C=10\text{mA}$	8	11		GHz
	$f_T2$	$V_{CE}=1\text{V}$ , $I_C=1\text{mA}$		7		GHz
Output Capacitance	$C_{ob}$	$V_{CB}=10\text{V}$ , f=1MHz		0.45	0.7	pF
Reverse Transfer Capacitance	$C_{re}$	$V_{CB}=10\text{V}$ , f=1MHz		0.25		pF

\* : The 2SC5504 is classified by 10mA  $h_{FE}$  as follows :

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

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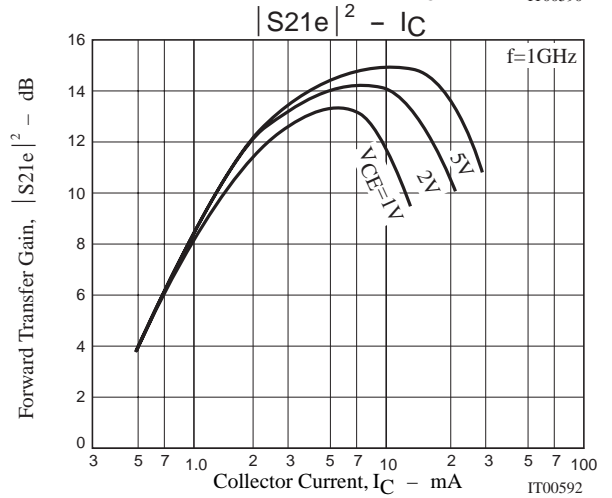
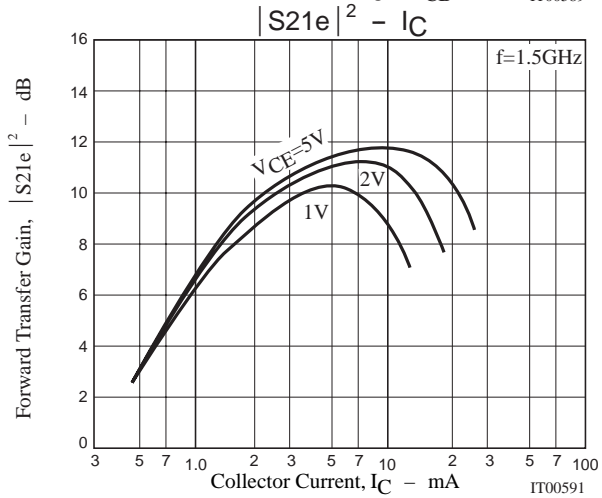
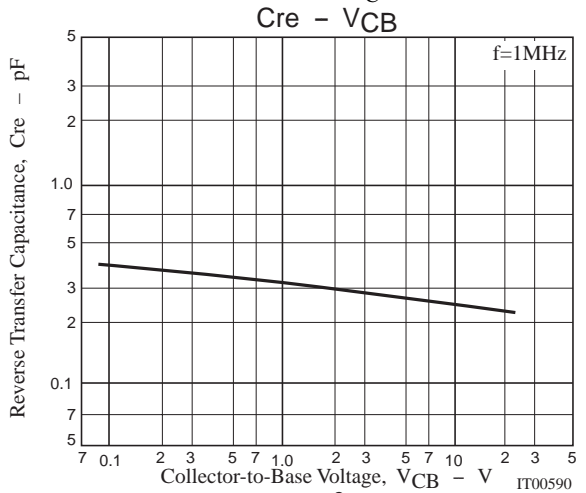
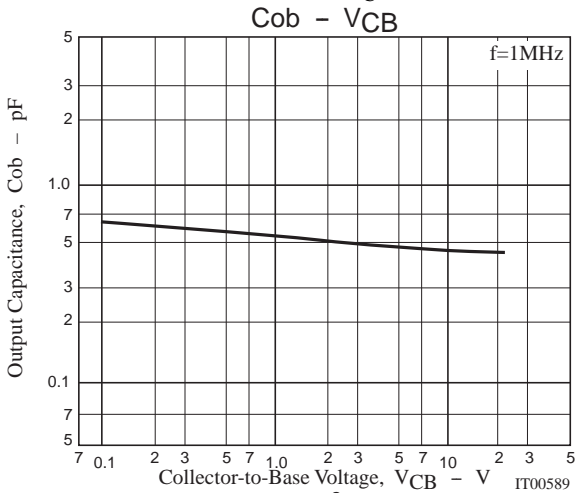
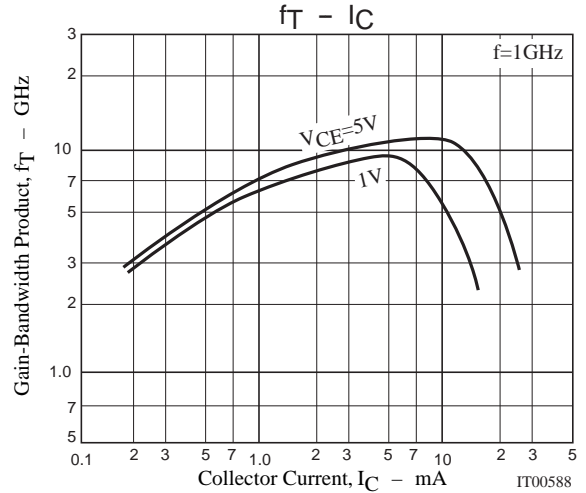
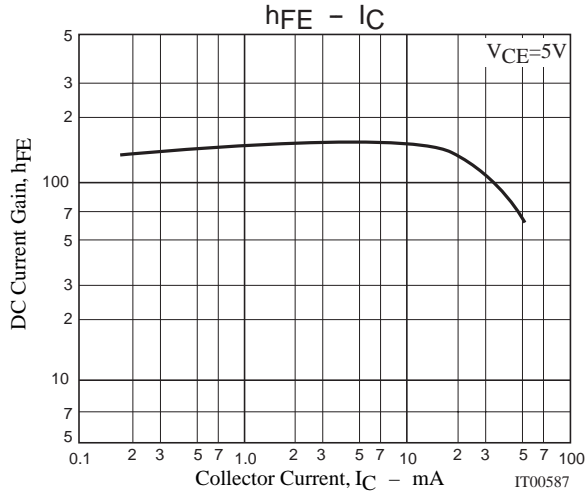
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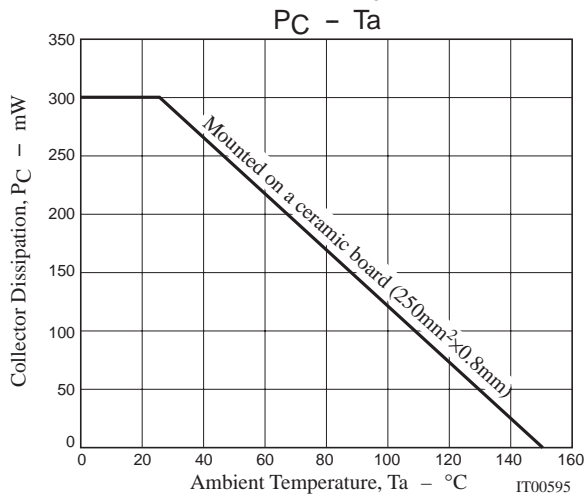
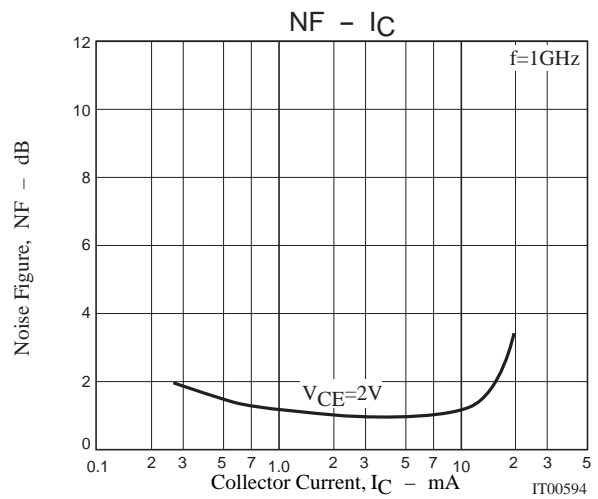
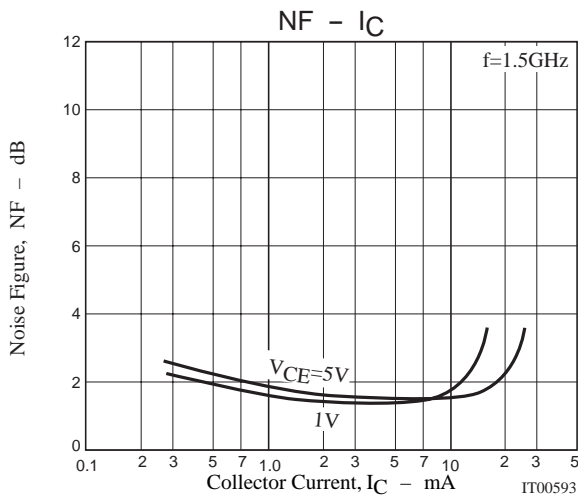
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Forward Transfer Gain	$ S_{21e} ^2 1$	$V_{CE}=5V, I_C=10mA, f=1.5GHz$	9	11		dB
	$ S_{21e} ^2 2$	$V_{CE}=1V, I_C=1mA, f=1.5GHz$		6		dB
Noise Figure	NF1	$V_{CE}=5V, I_C=5mA, f=1.5GHz$		1.4	3.0	dB
	NF2	$V_{CE}=2V, I_C=3mA, f=1GHz$		0.9		dB



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## 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} $	$\angle S_{22}$
100	0.979	-8.6	2.435	169.8	0.025	82.0	0.991	-5.6
200	0.966	-16.3	1.993	161.0	0.050	77.1	0.974	-11.3
400	0.932	-31.8	2.282	144.2	0.095	63.8	0.941	-20.8
600	0.882	-47.5	2.278	129.5	0.132	54.6	0.881	-29.4
800	0.823	-63.1	2.072	117.4	0.156	44.3	0.808	-38.7
1000	0.792	-74.7	1.987	104.9	0.173	37.5	0.784	-42.9
1200	0.720	-90.0	1.977	93.3	0.180	30.1	0.725	-49.8
1400	0.656	-104.0	1.983	81.4	0.193	25.4	0.693	-54.1
1600	0.621	-115.0	1.756	73.3	0.211	19.8	0.692	-57.9
1800	0.568	-127.6	1.708	63.1	0.204	16.8	0.690	-61.2
2000	0.530	-139.0	1.591	54.5	0.207	14.0	0.654	-65.4

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.940	-13.5	7.089	164.0	0.025	80.0	0.972	-9.4
200	0.881	-28.1	6.112	152.0	0.047	71.0	0.921	-19.1
400	0.790	-51.1	5.595	132.4	0.081	55.9	0.784	-34.4
600	0.667	-75.7	5.134	115.4	0.100	47.5	0.695	-42.0
800	0.557	-98.1	4.635	101.0	0.114	41.7	0.608	-48.6
1000	0.504	-111.7	3.914	90.3	0.125	38.4	0.530	-53.5
1200	0.440	-128.0	3.518	79.8	0.134	36.0	0.510	-57.1
1400	0.399	-141.1	3.082	71.0	0.142	34.6	0.490	-60.3
1600	0.373	-152.2	2.773	64.1	0.152	33.8	0.481	-63.4
1800	0.354	-162.0	2.483	56.9	0.162	31.3	0.461	-66.7
2000	0.334	-173.2	2.291	49.6	0.171	31.7	0.449	-69.7

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.977	-8.2	2.028	170.9	0.022	84.2	0.992	-5.1
200	0.974	-14.4	2.383	161.2	0.043	77.2	0.981	-9.7
400	0.928	-31.2	2.426	145.8	0.082	66.2	0.963	-17.3
600	0.888	-45.1	2.303	132.2	0.112	56.4	0.895	-27.1
800	0.860	-56.9	2.014	120.9	0.136	47.1	0.852	-33.5
1000	0.783	-73.3	2.089	108.1	0.157	40.7	0.839	-37.2
1200	0.752	-83.7	1.819	98.2	0.169	33.3	0.787	-43.9
1400	0.692	-97.1	1.795	86.7	0.173	28.7	0.733	-49.1
1600	0.631	-110.2	1.817	77.2	0.185	23.8	0.722	-53.1
1800	0.593	-121.0	1.776	67.3	0.185	20.0	0.720	-56.3
2000	0.536	-133.6	1.614	58.6	0.194	16.0	0.727	-59.5

$V_{CE}=2V, I_C=3mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.937	-12.7	6.627	165.7	0.021	81.5	0.977	-8.3
200	0.908	-23.8	5.867	154.3	0.040	72.0	0.932	-16.5
400	0.806	-46.9	5.944	134.3	0.069	58.6	0.831	-28.8
600	0.696	-68.4	5.198	119.0	0.090	50.8	0.739	-36.5
800	0.601	-86.7	4.512	106.5	0.103	44.5	0.658	-42.6
1000	0.508	-104.6	4.237	92.7	0.111	41.8	0.600	-46.5
1200	0.445	-118.8	3.739	83.1	0.120	39.6	0.570	-50.1
1400	0.389	-132.7	3.280	74.1	0.129	37.5	0.545	-53.4
1600	0.370	-142.1	2.948	67.2	0.140	34.9	0.540	-56.2
1800	0.339	-153.5	2.757	58.8	0.146	35.4	0.518	-59.2
2000	0.308	-166.6	2.491	52.2	0.156	34.3	0.523	-61.9

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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	0.984	-7.3	2.351	170.9	0.019	82.9	0.995	-4.3
200	0.972	-14.5	2.601	161.7	0.035	78.6	0.980	-8.6
400	0.931	-29.8	2.531	147.0	0.068	66.9	0.962	-16.0
600	0.900	-41.9	2.221	134.6	0.093	58.4	0.904	-24.1
800	0.846	-56.0	2.273	122.1	0.117	50.2	0.871	-29.8
1000	0.790	-69.8	2.177	110.5	0.130	43.8	0.842	-34.4
1200	0.747	-81.0	2.029	100.0	0.148	37.0	0.829	-38.5
1400	0.730	-89.7	1.705	90.6	0.151	32.1	0.785	-43.4
1600	0.657	-103.7	1.796	80.7	0.157	28.3	0.747	-47.6
1800	0.589	-116.5	1.694	71.1	0.159	24.4	0.768	-50.5
2000	0.580	-124.6	1.649	61.8	0.163	22.0	0.747	-54.0

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.950	-11.1	7.168	166.0	0.018	82.7	0.984	-6.9
200	0.906	-23.2	6.141	155.1	0.034	73.0	0.947	-13.8
400	0.826	-42.9	5.815	136.7	0.059	60.9	0.849	-25.4
600	0.708	-63.7	5.385	120.8	0.076	53.2	0.777	-31.3
800	0.592	-83.2	4.977	106.8	0.089	47.9	0.707	-36.5
1000	0.531	-95.9	4.305	95.7	0.097	45.1	0.640	-40.1
1200	0.450	-110.7	3.951	84.7	0.105	42.7	0.622	-43.2
1400	0.398	-123.0	3.451	76.0	0.113	40.9	0.608	-46.1
1600	0.360	-133.7	3.117	69.1	0.122	40.1	0.599	-48.8
1800	0.335	-143.5	2.826	61.6	0.131	38.5	0.581	-51.5
2000	0.303	-154.7	2.609	54.2	0.138	39.1	0.575	-54.2

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.905	-15.7	10.429	163.2	0.017	79.4	0.968	-9.3
200	0.857	-29.2	9.413	149.9	0.032	71.9	0.905	-17.7
400	0.718	-55.6	8.366	128.9	0.053	57.9	0.776	-28.6
600	0.587	-77.1	7.030	112.7	0.067	53.1	0.679	-34.0
800	0.478	-96.4	6.038	99.4	0.077	49.8	0.616	-37.7
1000	0.396	-112.2	5.154	88.1	0.085	49.6	0.573	-40.2
1200	0.338	-126.5	4.519	79.1	0.096	47.8	0.554	-42.7
1400	0.307	-136.7	3.875	71.4	0.105	46.7	0.543	-45.5
1600	0.288	-146.3	3.451	65.6	0.116	46.0	0.534	-47.9
1800	0.257	-159.8	3.166	58.0	0.126	45.4	0.530	-50.4
2000	0.244	-169.2	2.869	51.8	0.136	44.8	0.530	-53.2

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$V_{CE}=5V, I_C=10mA, Z_0=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.823	-23.7	17.240	157.6	0.016	76.9	0.936	-13.0
200	0.723	-44.7	15.217	140.6	0.028	66.8	0.833	-22.2
400	0.541	-76.8	11.540	116.7	0.044	57.6	0.666	-31.0
600	0.404	-101.7	8.813	100.5	0.055	56.0	0.578	-34.0
800	0.337	-119.3	6.969	90.2	0.065	55.7	0.531	-35.9
1000	0.296	-132.6	5.686	81.4	0.076	55.7	0.503	-37.6
1200	0.266	-146.2	4.861	73.9	0.087	55.2	0.492	-39.7
1400	0.246	-157.8	4.174	66.7	0.099	54.0	0.487	-42.4
1600	0.234	-167.9	3.708	61.5	0.111	53.3	0.488	-44.9
1800	0.225	-178.1	3.353	55.1	0.123	51.4	0.489	-47.8
2000	0.219	172.1	3.034	49.3	0.135	50.6	0.492	-50.6

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