

NPN Epitaxial Planar Silicon Transistor



2SC5539

**VHF to UHF
Low-Noise Wide-Band Amplifier Applications**

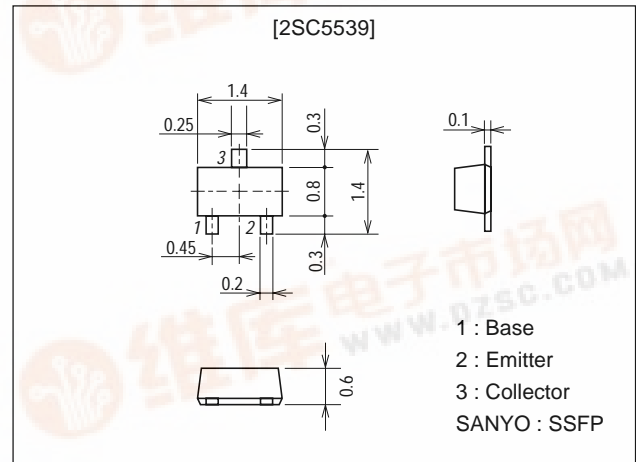
Features

- Low noise : NF=1.1dB typ (f=1GHz).
- High gain : $|S_{21e}|^2=12\text{dB typ (f=1GHz)}$.
- High cutoff frequency : $f_T=7.5\text{GHz typ}$.
- Ultrasmall, slim flat-lead package.
(1.4mm × 0.8mm × 0.6mm)

Package Dimensions

unit:mm

2159



Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	V _{CB0}		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		100	mW
Junction Temperature	T _J		150	°C
Storage Temperature	T _{stg}		-55 to +150	°C

Electrical Characteristics at Ta = 25°C

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I _{CB0}	V _{CB} =10V, I _E =0			1.0	μA
Emitter Cutoff Current	I _{EBO}	V _{EB} =1V, I _C =0			10	μA
DC Current Gain	h _{FE}	V _{CE} =5V, I _C =30mA	90		200	
Gain-Bandwidth Product	f _T	V _{CE} =5V, I _C =30mA	6	7.5		GHz
Output Capacitance	C _{ob}	V _{CB} =5V, f=1MHz		0.85	1.3	pF
Reverse Transfer Capacitance	C _{re}	V _{CB} =5V, f=1MHz		0.6		pF
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

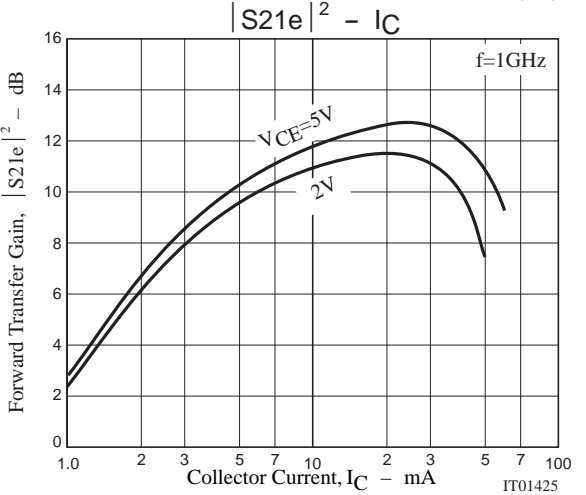
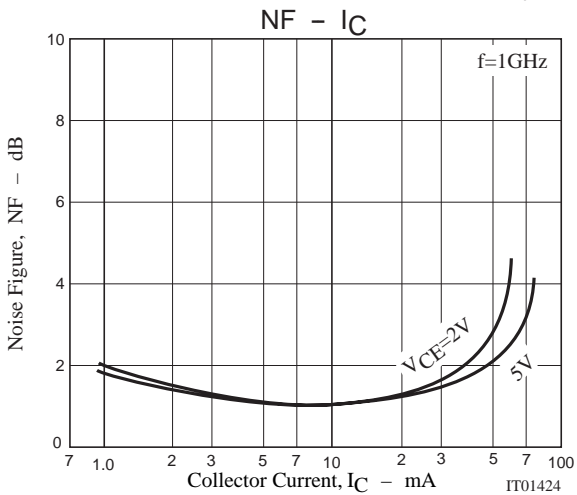
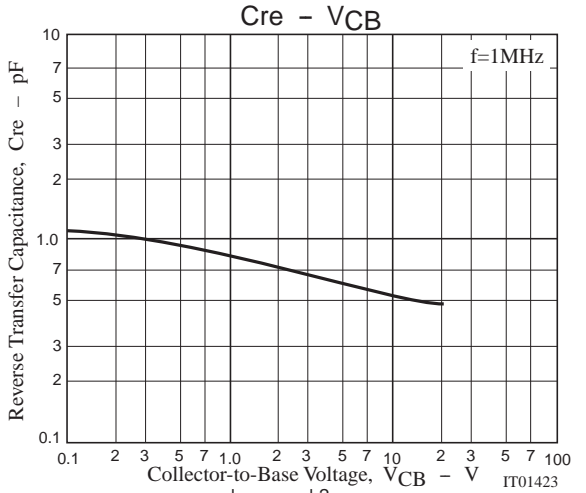
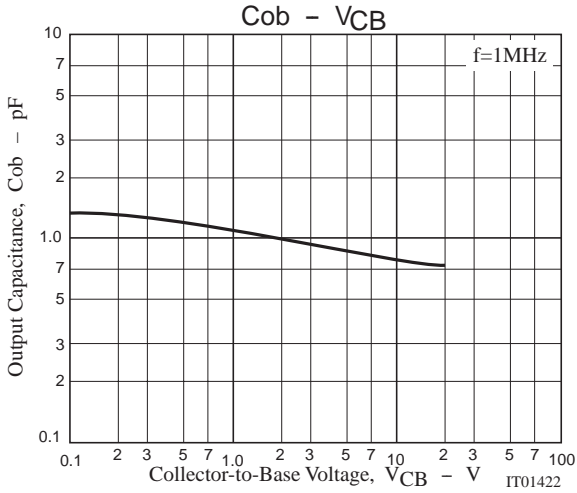
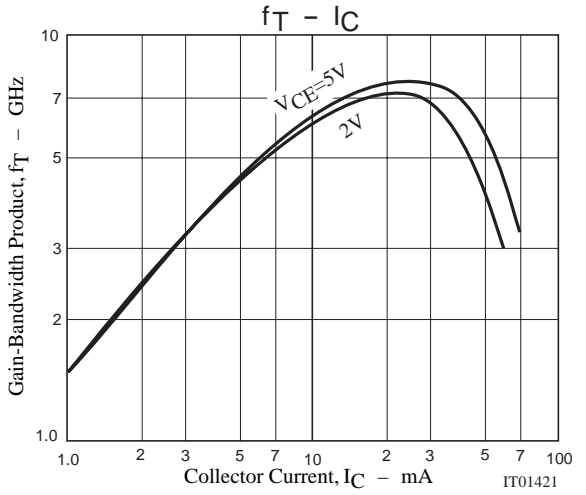
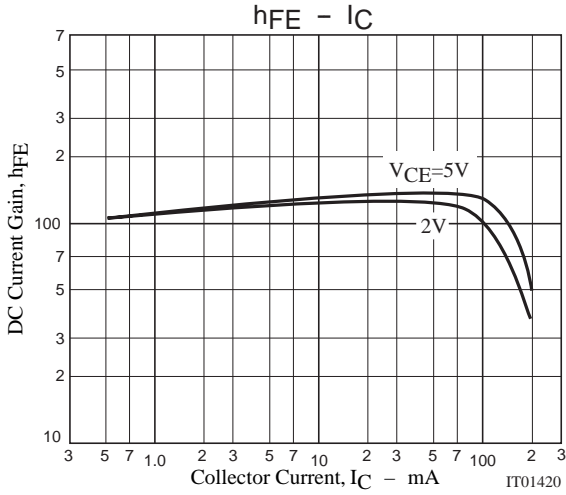
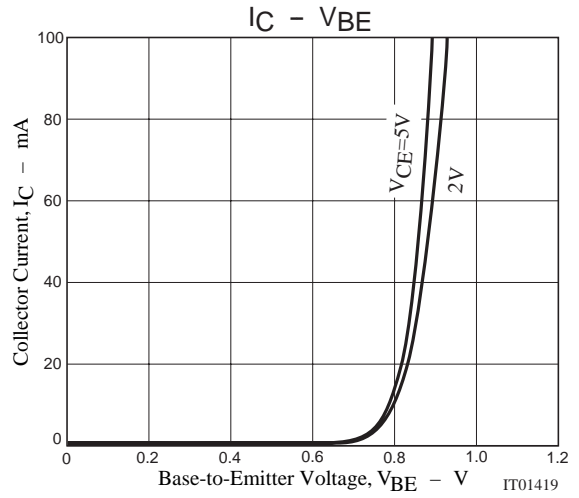
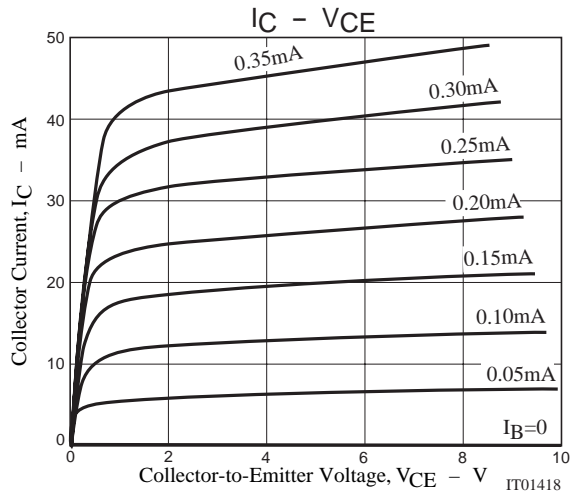
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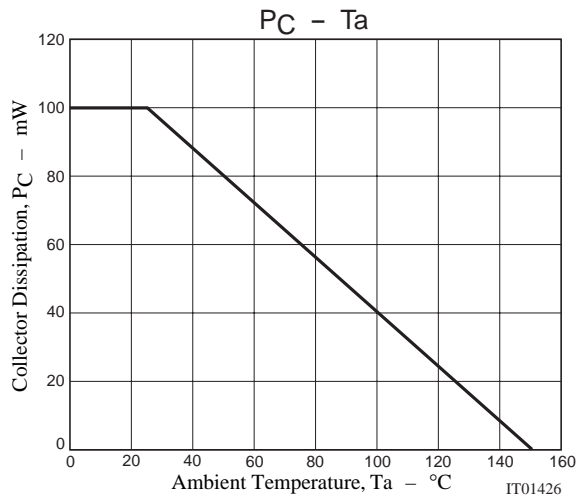
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S Parameters (Common emitter)

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.828	-48.7	13.003	149.5	0.044	64.6	0.879	-25.1
200	0.741	-84.3	10.001	129.4	0.068	49.7	0.690	-40.4
400	0.666	-124.2	6.405	106.5	0.087	38.5	0.467	-53.3
600	0.640	-143.4	4.574	94.1	0.094	37.8	0.376	-57.5
800	0.626	-155.0	3.520	85.6	0.101	39.7	0.329	-60.6
1000	0.619	-163.0	2.852	79.0	0.108	42.9	0.301	-64.1
1200	0.613	-169.1	2.415	73.1	0.116	46.6	0.291	-67.1
1400	0.608	-174.2	2.098	67.9	0.125	50.0	0.287	-70.5
1600	0.604	-178.8	1.869	63.3	0.136	53.5	0.289	-73.7
1800	0.601	177.0	1.709	59.0	0.148	56.2	0.299	-76.4
2000	0.599	173.1	1.564	55.0	0.161	58.5	0.306	-79.5

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.731	-66.7	19.854	140.5	0.039	59.3	0.785	-37.3
200	0.649	-105.7	13.725	119.7	0.054	46.8	0.547	-55.9
400	0.605	-140.7	7.870	100.6	0.068	44.5	0.330	-71.5
600	0.591	-155.7	5.458	90.7	0.080	48.0	0.251	-77.2
800	0.585	-164.6	4.164	83.7	0.091	51.7	0.213	-81.2
1000	0.580	-170.7	3.383	78.2	0.105	55.6	0.195	-84.8
1200	0.575	-175.6	2.857	73.1	0.119	58.2	0.188	-87.8
1400	0.570	-179.9	2.476	68.7	0.134	60.0	0.186	-90.7
1600	0.568	176.3	2.204	64.6	0.150	61.3	0.188	-93.2
1800	0.563	172.6	1.995	60.6	0.167	62.1	0.193	-95.0
2000	0.560	169.2	1.822	57.0	0.184	62.4	0.197	-97.3

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.637	-88.2	26.053	131.0	0.032	55.5	0.668	-50.8
200	0.590	-126.0	16.158	111.8	0.043	47.8	0.422	-71.8
400	0.575	-153.8	8.749	96.1	0.057	52.2	0.247	-90.7
600	0.571	-164.9	5.965	88.0	0.072	57.5	0.187	-100.6
800	0.567	-171.7	4.528	82.2	0.089	61.1	0.161	-107.3
1000	0.563	-176.7	3.675	77.3	0.106	63.3	0.150	-112.0
1200	0.559	179.3	3.100	72.8	0.124	64.9	0.146	-115.0
1400	0.554	175.7	2.686	68.8	0.142	65.5	0.145	-117.6
1600	0.551	172.4	2.386	65.1	0.161	65.4	0.147	-119.1
1800	0.547	169.1	2.157	61.4	0.179	65.3	0.149	-119.9
2000	0.543	166.0	1.971	58.0	0.198	65.0	0.154	-120.5

$V_{CE}=2V, I_C=30mA, Z_O=50\Omega$

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	-101.8	28.123	125.8	0.029	53.5	0.600	-57.7
200	0.578	-136.4	16.642	108.1	0.039	49.5	0.365	-79.2
400	0.575	-159.7	8.828	94.0	0.053	56.1	0.215	-99.5
600	0.573	-169.2	5.994	86.6	0.070	61.5	0.168	-110.4
800	0.570	-175.1	4.542	81.1	0.088	64.7	0.148	-117.6
1000	0.567	-179.4	3.681	76.5	0.106	66.6	0.140	-122.3
1200	0.562	177.0	3.109	72.2	0.125	67.5	0.137	-125.1
1400	0.558	173.6	2.690	68.3	0.144	67.7	0.138	-127.3
1600	0.555	170.6	2.391	64.6	0.163	67.3	0.140	-128.4
1800	0.551	167.5	2.161	61.1	0.183	66.8	0.143	-128.8
2000	0.547	164.4	1.975	57.7	0.202	65.9	0.146	-129.1

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.842	-43.0	13.211	152.2	0.035	68.0	0.905	-19.6
200	0.753	-76.7	10.474	132.8	0.056	53.0	0.746	-31.7
400	0.666	-116.6	6.960	109.6	0.073	41.7	0.542	-40.9
600	0.628	-137.8	5.029	96.7	0.081	40.2	0.452	-43.3
800	0.610	-150.4	3.885	87.9	0.086	42.6	0.409	-44.9
1000	0.602	-158.9	3.146	81.2	0.092	46.5	0.381	-47.0
1200	0.594	-165.4	2.663	75.3	0.100	50.4	0.371	-49.2
1400	0.589	-171.0	2.308	70.1	0.109	54.2	0.367	-52.0
1600	0.586	-175.8	2.054	65.5	0.118	57.8	0.369	-54.8
1800	0.581	179.7	1.876	61.1	0.129	60.5	0.378	-57.6
2000	0.578	175.5	1.713	57.1	0.141	63.5	0.383	-60.7

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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	0.745	-58.2	20.417	144.3	0.031	63.5	0.829	-28.7
200	0.648	-96.1	14.809	123.3	0.046	50.4	0.612	-42.6
400	0.583	-133.3	8.762	103.2	0.059	46.3	0.398	-51.2
600	0.565	-149.8	6.104	92.8	0.069	50.1	0.318	-52.4
800	0.555	-159.9	4.666	85.6	0.079	54.1	0.281	-53.1
1000	0.548	-166.9	3.797	79.9	0.091	57.7	0.263	-54.4
1200	0.542	-172.1	3.203	74.7	0.104	60.8	0.255	-56.1
1400	0.538	-176.8	2.771	70.3	0.117	62.8	0.252	-58.6
1600	0.535	179.3	2.460	66.2	0.132	64.6	0.254	-60.8
1800	0.532	1575.5	2.220	62.2	0.147	65.7	0.256	-63.3
2000	0.529	171.9	2.025	58.5	0.162	66.6	0.262	-65.9

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.600	-87.0	30.637	130.8	0.024	57.5	0.670	-42.9
200	0.544	-124.7	18.945	111.8	0.033	52.0	0.427	-56.2
400	0.526	-152.5	10.236	96.4	0.047	58.2	0.255	-61.9
600	0.521	-163.7	6.972	88.5	0.061	63.3	0.198	-62.0
800	0.517	-170.7	5.289	82.8	0.077	66.4	0.174	-62.5
1000	0.514	-175.5	4.281	78.2	0.093	68.4	0.163	-63.3
1200	0.509	-179.5	3.605	73.8	0.109	69.6	0.160	-65.1
1400	0.505	177.1	3.115	69.9	0.126	70.1	0.160	-67.5
1600	0.503	173.8	2.764	66.3	0.143	70.0	0.163	-69.4
1800	0.499	170.7	2.492	62.7	0.160	70.0	0.167	-71.5
2000	0.496	167.6	2.270	59.3	0.178	69.5	0.173	-73.5

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