



SANYO Semiconductors

# DATA SHEET

An ON Semiconductor Company

## 2SC5415A — High-Frequency Low-Noise Amplifier Applications

NPN Epitaxial Planar Silicon Transistor

### Features

- High gain :  $|S_{21e}|^2=9\text{dB typ (f=1GHz)}$ .
- High cut-off frequency :  $f_T=6.7\text{GHz typ}$ .

### 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	$V_{CEO}$		12	V
Emitter-to-Base Voltage	$V_{EBO}$		2	V
Collector Current	$I_C$		100	mA
Collector Dissipation	$P_C$	When mounted on ceramic substrate (250mm <sup>2</sup> ×0.8mm)	800	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	$I_{CBO}$	$V_{CB}=10\text{V}, I_E=0\text{A}$			1.0	$\mu\text{A}$
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=1\text{V}, I_C=0\text{A}$			10	$\mu\text{A}$
DC Current Gain	hFE1	$V_{CE}=5\text{V}, I_C=30\text{mA}$	90*		270*	
	hFE2	$V_{CE}=5\text{V}, I_C=70\text{mA}$	70			

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\* : The 2SC5415A is classified by 30mA hFE as follows :

Marking	EA E	EA F
Rank	E	F
hFE	90 to 180	135 to 270

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93009AB TK IM TC-00002100 No. A1080-1/6

# 2SC5415A

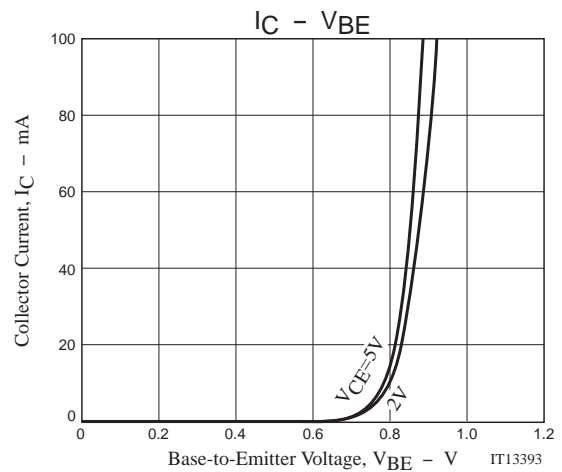
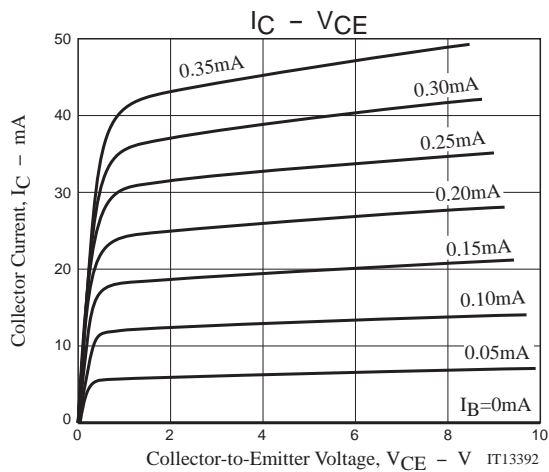
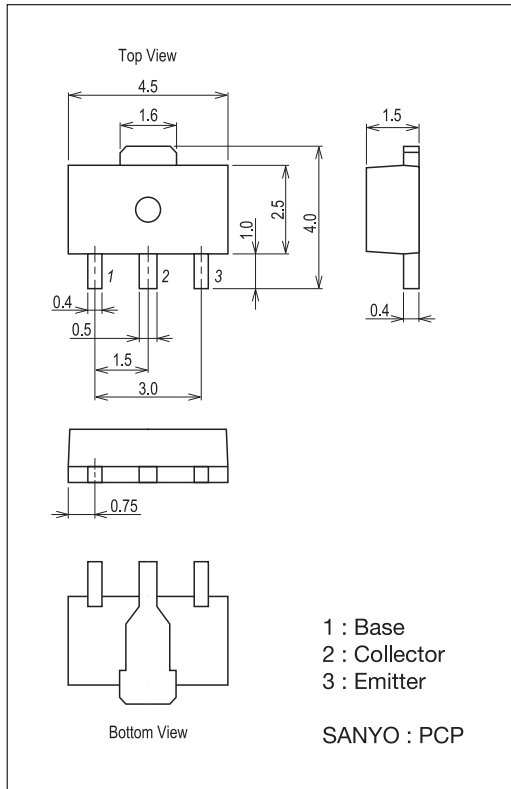
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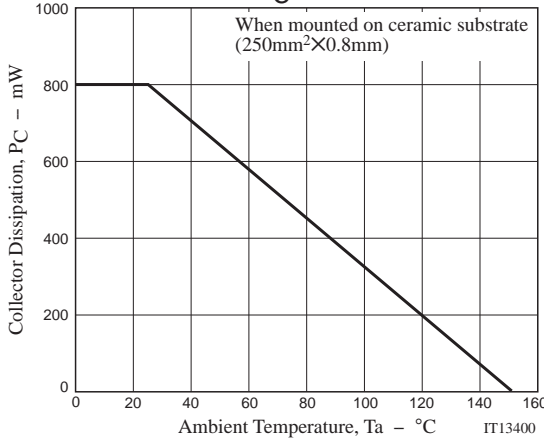
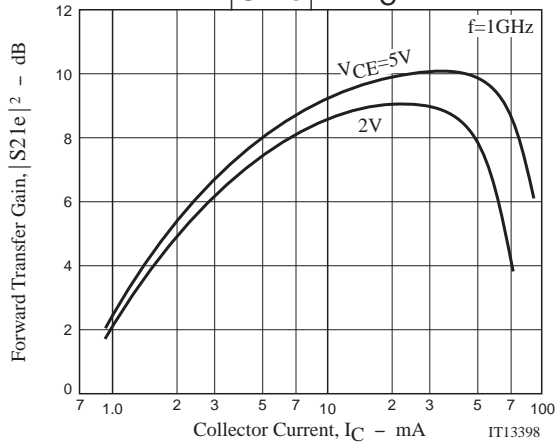
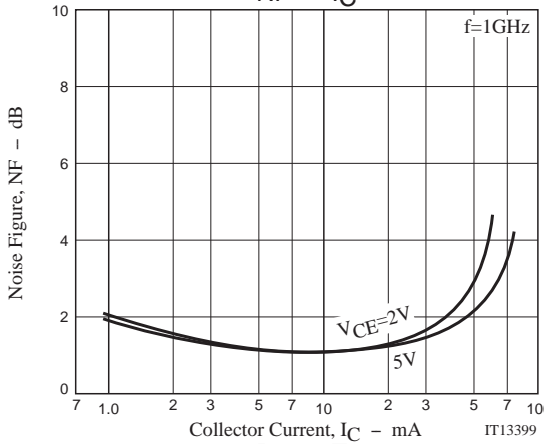
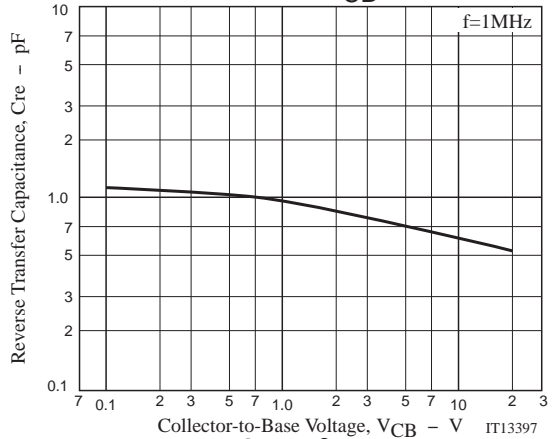
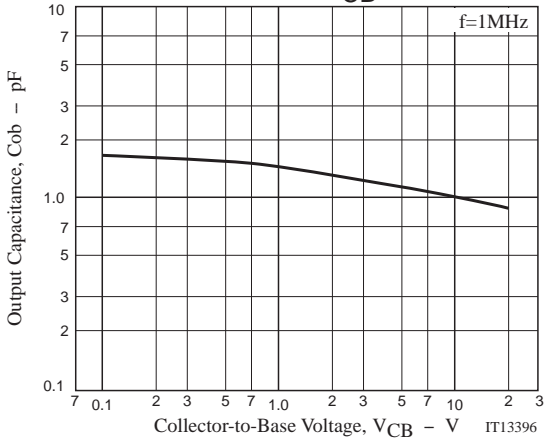
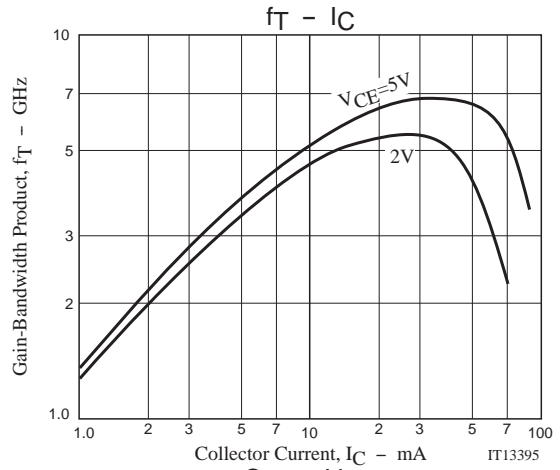
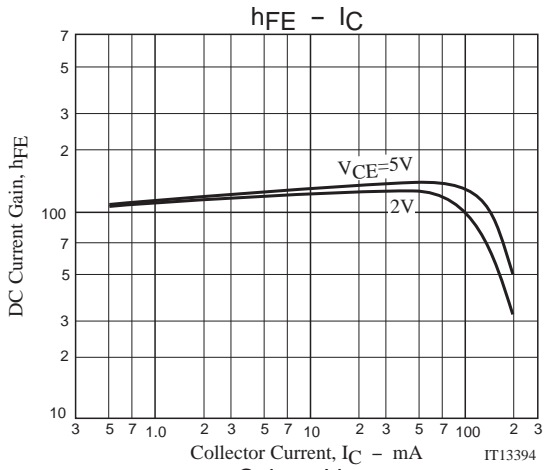
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Gain-Bandwidth Product	$f_T$	$V_{CE}=5V, I_C=30mA$	5	6.7		GHz
Output Capacitance	$C_{ob}$	$V_{CB}=5V, f=1MHz$		1.2	1.8	pF
Reverse Transfer Capacitance	$C_{re}$	$V_{CB}=5V, f=1MHz$		0.65		pF
Forward Transfer Gain	$ S_{21e} ^2$	$V_{CE}=5V, I_C=30mA, f=1GHz$	7.5	9		dB
Noise Figure	NF	$V_{CE}=5V, I_C=7mA, f=1GHz$		1.1	2.0	dB

## Package Dimensions

unit : mm (typ)

7007B-004





## 2SC5415A

### 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	0.737	-51.3	11.929	142.2	0.046	65.0	0.836	-27.1
200	0.564	-86.8	8.854	118.5	0.070	54.3	0.649	-39.5
400	0.408	-129.5	5.231	95.2	0.097	51.5	0.454	-48.4
600	0.366	-155.0	3.667	82.0	0.121	53.7	0.394	-52.3
800	0.348	-175.8	2.811	70.0	0.147	55.3	0.370	-56.6
1000	0.338	169.4	2.332	62.6	0.175	56.2	0.368	-60.5
1200	0.346	156.6	2.000	54.2	0.205	55.7	0.361	-66.7
1400	0.350	145.7	1.739	47.3	0.235	54.9	0.363	-72.2
1600	0.360	136.1	1.557	40.6	0.267	53.7	0.371	-77.7
1800	0.365	126.2	1.428	34.4	0.300	51.7	0.383	-83.4
2000	0.369	116.9	1.306	29.3	0.334	49.2	0.385	-89.5

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.580	-67.4	17.590	130.8	0.040	62.8	0.715	-36.9
200	0.414	-104.9	11.116	109.3	0.059	58.5	0.490	-48.3
400	0.311	-145.7	6.099	90.2	0.091	60.9	0.338	-53.5
600	0.291	-168.2	4.213	79.2	0.125	62.4	0.294	-56.9
800	0.286	172.9	3.212	69.7	0.159	61.8	0.279	-61.6
1000	0.281	159.6	2.634	62.4	0.194	60.3	0.277	-65.9
1200	0.292	148.3	2.248	54.9	0.228	57.7	0.281	-71.7
1400	0.297	138.5	1.973	48.5	0.261	55.2	0.284	-77.2
1600	0.305	129.7	1.767	42.4	0.295	52.6	0.290	-82.7
1800	0.311	120.5	1.605	36.4	0.328	49.6	0.297	-88.5
2000	0.313	111.7	1.473	31.2	0.362	46.3	0.303	-93.9

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.432	-85.5	21.435	121.4	0.034	63.6	0.585	-45.4
200	0.313	-123.5	12.390	102.7	0.052	64.6	0.375	-54.0
400	0.263	-160.5	6.547	87.0	0.090	67.4	0.260	-57.1
600	0.257	-179.7	4.481	77.4	0.129	67.0	0.231	-60.9
800	0.260	163.3	3.408	68.8	0.168	64.8	0.224	-66.3
1000	0.258	151.6	2.792	62.1	0.206	62.3	0.224	-70.9
1200	0.271	141.6	2.378	55.1	0.243	58.7	0.231	-77.2
1400	0.270	133.1	2.085	49.1	0.278	55.4	0.236	-82.9
1600	0.282	124.5	1.867	43.2	0.313	52.2	0.242	-88.4
1800	0.288	115.4	1.697	37.5	0.346	48.7	0.249	-94.2
2000	0.290	107.0	1.558	32.3	0.380	45.0	0.256	-99.4

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.370	-97.4	22.555	117.0	0.031	65.1	0.518	-49.0
200	0.288	-135.1	12.614	99.9	0.051	67.4	0.326	-55.8
400	0.260	-168.5	6.590	85.5	0.090	69.9	0.229	-58.1
600	0.259	174.8	4.499	76.4	0.131	68.6	0.207	-62.3
800	0.263	159.3	3.419	68.1	0.172	66.0	0.204	-68.3
1000	0.262	148.2	2.796	61.7	0.211	62.8	0.206	-73.2
1200	0.275	138.9	2.382	54.7	0.248	59.1	0.215	-79.6
1400	0.279	130.4	2.089	48.8	0.284	55.6	0.220	-85.4
1600	0.286	122.5	1.869	43.0	0.320	52.1	0.227	-91.1
1800	0.291	113.8	1.700	37.3	0.353	48.4	0.235	-97.0
2000	0.293	105.4	1.562	32.2	0.387	44.7	0.242	-102.2

## 2SC5415A

### S Parameters (Common emitter)

V<sub>CE</sub>=5V, 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>
100	0.752	-45.7	12.674	144.1	0.037	67.6	0.871	-21.6
200	0.575	-78.6	9.416	121.5	0.058	57.3	0.697	-32.2
400	0.391	-119.9	5.688	97.7	0.082	54.4	0.532	-38.3
600	0.334	-146.4	4.015	84.3	0.103	56.8	0.472	-41.5
800	0.307	-169.1	3.085	73.2	0.126	58.9	0.450	-45.4
1000	0.292	174.7	2.534	65.1	0.151	60.2	0.444	-49.5
1200	0.303	160.6	2.164	56.8	0.177	60.0	0.449	-54.6
1400	0.305	148.6	1.896	499.9	0.204	59.7	0.453	-59.6
1600	0.314	137.9	1.693	43.2	0.235	58.9	0.454	-65.0
1800	0.321	127.3	1.530	36.9	0.267	57.1	0.460	-70.0
2000	0.328	117.7	1.394	31.5	0.299	55.1	0.470	-76.4

V<sub>CE</sub>=5V, 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>
100	0.601	-58.4	18.468	133.9	0.033	65.7	0.765	-25.1
200	0.413	-92.4	12.043	112.1	0.049	61.0	0.603	-30.7
400	0.275	-132.7	6.703	92.4	0.078	63.3	0.509	-36.8
600	0.240	-157.9	4.641	81.3	0.107	64.8	0.470	-45.9
800	0.228	-179.9	3.536	71.9	0.137	64.6	0.438	-56.8
1000	0.221	164.7	2.889	64.8	0.168	63.6	0.408	-69.3
1200	0.232	151.6	2.462	57.2	0.199	61.5	0.371	-83.9
1400	0.238	140.6	2.154	51.0	0.229	59.5	0.334	-100.6
1600	0.249	131.1	1.924	44.8	0.259	57.3	0.298	-120.1
1800	0.257	120.9	1.740	38.8	0.290	54.6	0.265	-143.5
2000	0.262	111.5	1.589	33.6	0.322	51.6	0.246	-170.6

V<sub>CE</sub>=5V, I<sub>C</sub>=30mA, 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>
100	0.373	-79.4	24.799	120.4	0.026	67.6	0.598	-36.8
200	0.245	-114.8	14.190	102.5	0.043	69.5	0.418	-39.2
400	0.183	-154.3	7.472	87.6	0.077	71.8	0.331	-38.5
600	0.174	-175.8	5.102	78.5	0.112	70.9	0.310	-41.3
800	0.177	163.8	3.872	70.4	0.147	68.7	0.305	-46.3
1000	0.177	150.2	3.158	64.1	0.181	66.1	0.308	-51.0
1200	0.190	139.3	2.681	57.4	0.215	62.8	0.313	-57.0
1400	0.197	129.5	2.343	51.6	0.247	59.6	0.317	-62.4
1600	0.209	121.2	2.090	45.9	0.279	56.7	0.321	-67.8
1800	0.217	111.6	1.892	40.3	0.309	53.3	0.327	-73.6
2000	0.222	102.6	1.727	35.2	0.340	49.9	0.333	-78.9

V<sub>CE</sub>=5V, I<sub>C</sub>=50mA, 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>
100	0.308	-92.8	25.470	116.0	0.024	69.2	0.543	-36.8
200	0.221	-129.7	14.126	99.7	0.041	72.1	0.389	-36.4
400	0.190	-165.7	7.357	85.9	0.076	73.8	0.324	-35.3
600	0.189	176.0	5.012	77.4	0.111	72.5	0.309	-38.8
800	0.195	158.6	3.800	69.4	0.146	69.9	0.307	-44.2
1000	0.195	146.5	3.097	63.2	0.180	67.2	0.311	-49.3
1200	0.209	136.8	2.630	56.5	0.214	63.7	0.317	-55.6
1400	0.216	127.8	2.300	50.8	0.246	60.5	0.321	-61.3
1600	0.227	119.9	2.050	45.1	0.279	57.5	0.325	-66.9
1800	0.237	111.0	1.857	39.4	0.310	54.1	0.331	-72.8
2000	0.241	102.2	1.695	34.5	0.341	50.5	0.337	-78.3

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