Ordering number:ENN6341

NPN Epitaxial Planar Silicon Transistor

2SC5539

VHF to UHF
Low-Noise Wide-Band Amplifier Applications

Features

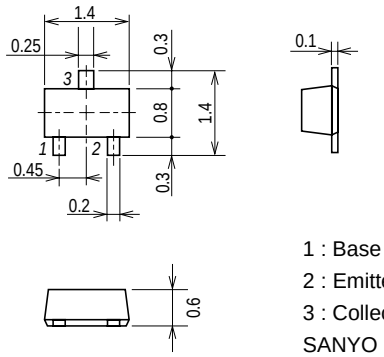
- Low noise : NF=1.1dB typ (f=1GHz).
- High gain : $|S21e|^2$=12dB typ (f=1GHz).
- High cutoff frequency : f_T=7.5GHz typ.
- Ultrasmall, slim flat-lead package.
  (1.4mm × 0.8mm × 0.6mm)

Package Dimensions

unit:mm

2159

[2SC5539]



1 : Base
2 : Emitter
3 : Collector
SANYO : SSFP

Specifications

Absolute Maximum Ratings at Ta = 25˚C

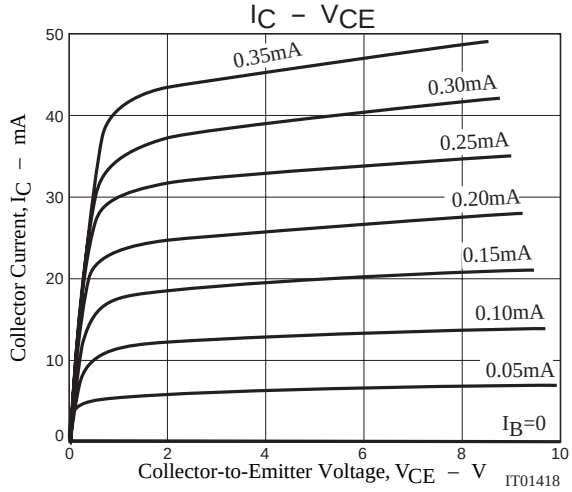
Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	V_{CBO}		20	V
Collector-to-Emitter Voltage	V_{CEO}		12	V
Emitter-to-Base Voltage	V_{EBO}		2	V
Collector Current	I_C		100	mA
Collector Dissipation	P_C		100	mW
Junction Temperature	Tj		150	˚C
Storage Temperature	Tstg		–55 to +150	˚C

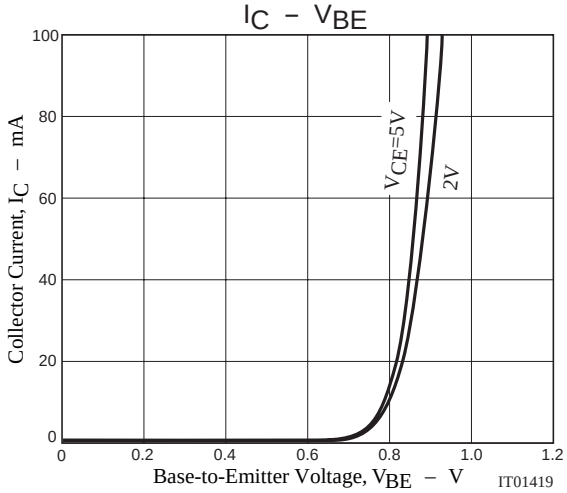
Electrical Characteristics at Ta = 25˚C

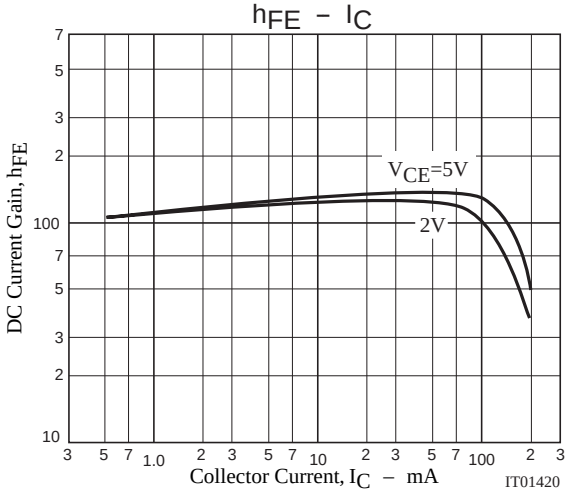
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I_{CBO}	V_{CB}=10V, I_E=0			1.0	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=1V, I_C=0			10	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=30mA	90		200	
Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=30mA	6	7.5		GHz
Output Capacitance	Cob	V_{CB}=5V, f=1MHz		0.85	1.3	pF
Reverse Transfer Capacitance	Cre	V_{CB}=5V, f=1MHz		0.6		pF
Forward Transfer Gain	$\|S21e\|^2$	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

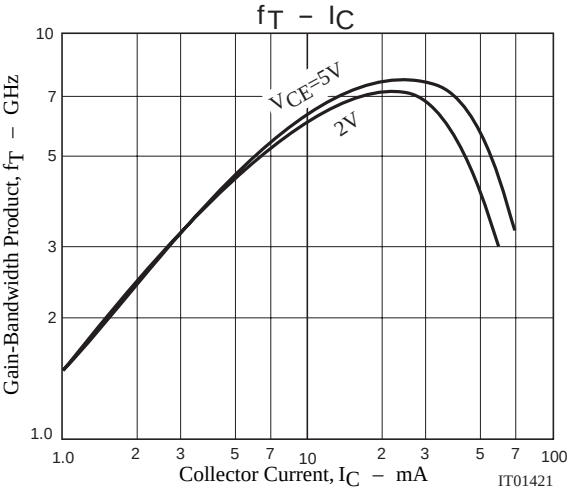
Marking : ND

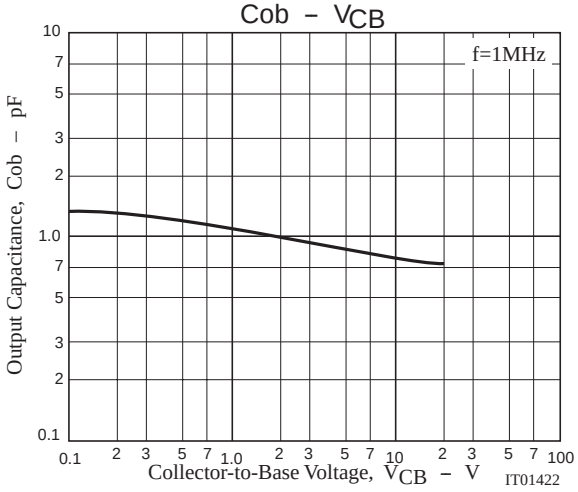
SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

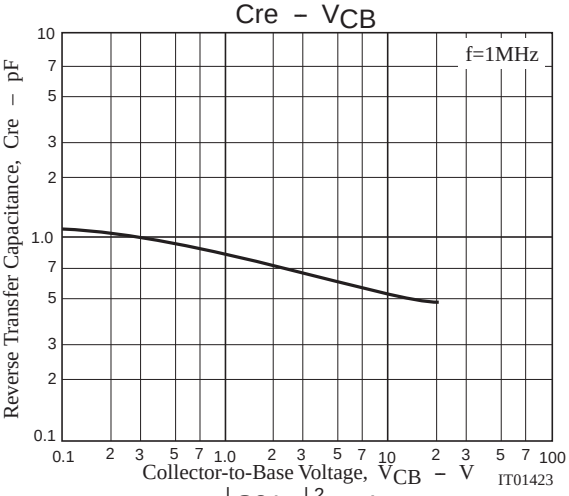

IC – VCE
0.35mA
0.30mA
0.25mA
0.20mA
0.15mA
0.10mA
0.05mA
IB=0
Collector Current, IC – mA
Collector-to-Emitter Voltage, VCE – V
IT01418

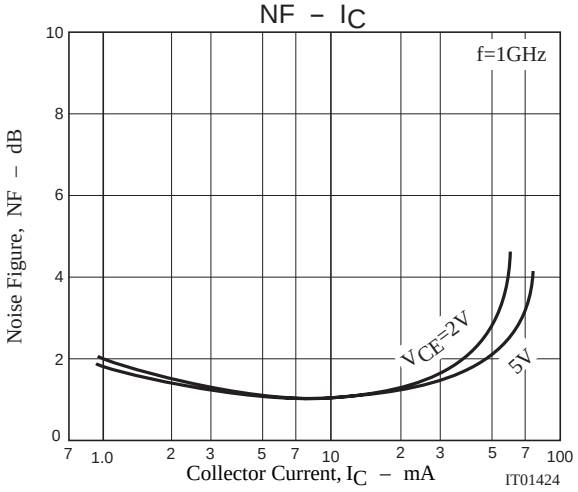

IC – VBE
VCE=5V
2V
Collector Current, IC – mA
Base-to-Emitter Voltage, VBE – V
IT01419

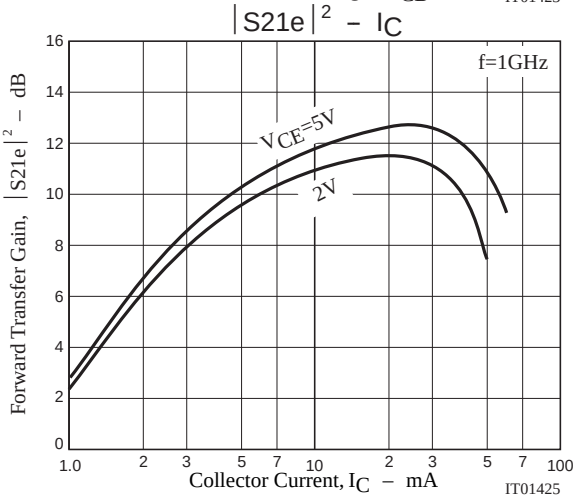

hFE – IC
VCE=5V
2V
DC Current Gain, hFE
Collector Current, IC – mA
IT01420

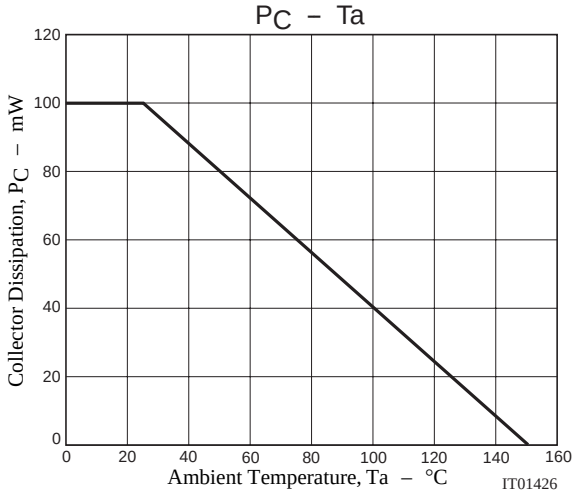

fT – IC
VCE=5V
2V
Gain-Bandwidth Product, fT – GHz
Collector Current, IC – mA
IT01421


Cob – VCB
f=1MHz
Output Capacitance, Cob – pF
Collector-to-Base Voltage, VCB – V
IT01422


Cre – VCB
f=1MHz
Reverse Transfer Capacitance, Cre – pF
Collector-to-Base Voltage, VCB – V
IT01423


NF – IC
f=1GHz
VCE=2V
5V
Noise Figure, NF – dB
Collector Current, IC – mA
IT01424


|S21e|2 – IC
f=1GHz
VCE=5V
2V
Forward Transfer Gain, |S21e|2 – dB
Collector Current, IC – mA
IT01425



S Parameters (Common emitter)

V_{CE}=2V, I_C=5mA, Z_O=50Ω

Freq (MHz)	$\lvert S_{11} \rvert$	$\angle S_{11}$	$\lvert S_{21} \rvert$	$\angle S_{21}$	$\lvert S_{12} \rvert$	$\angle S_{12}$	$\lvert S_{22} \rvert$	$\angle S_{22}$
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=50Ω

Freq (MHz)	$\lvert S_{11} \rvert$	$\angle S_{11}$	$\lvert S_{21} \rvert$	$\angle S_{21}$	$\lvert S_{12} \rvert$	$\angle S_{12}$	$\lvert S_{22} \rvert$	$\angle S_{22}$
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

V_{CE}=2V, I_C=20mA, Z_O=50Ω

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=50Ω

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=50Ω

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

V_{CE}=5V, I_C=10mA, Z_O=50Ω

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_O=50Ω

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