Ordering number:ENN6221

NPN Epitaxial Planar Silicon Transistor

2SC5501

VHF to UHF Low-Noise Wide-Band Amplifier Applications

Features

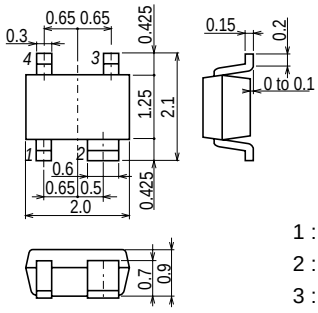
- Low noise : NF=1.0dB typ (f=1GHz).
- High gain : $|S21e|^2$=13dB typ (f=1GHz).
- High cutoff frequency : f_T=7GHz typ.
- Large allowable collector dissipation : P_C=500mW max.

Package Dimensions

unit:mm

2161

[2SC5501]



1 : Emitter
2 : Collector
3 : Emitter
4 : Base
SANYO : MCP4

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}		10	V
Emitter-to-Base Voltage	V_{EBO}		2	V
Collector Current	I_C		70	mA
Collector Dissipation	P_C	Mounted on a ceramic board (250mm²×0.8mm)	500	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=20mA	90*		270*	
Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=20mA	5	7		GHz
Output Capacitance	Cob	V_{CB}=10V, f=1MHz		0.75	1.2	pF
Reverse Transfer Capacitance	Cre	V_{CB}=10V, f=1MHz		0.4		pF

* : The 2SC5501 is classified by 20mA h_{FE} as follows :

Continued on next page.

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

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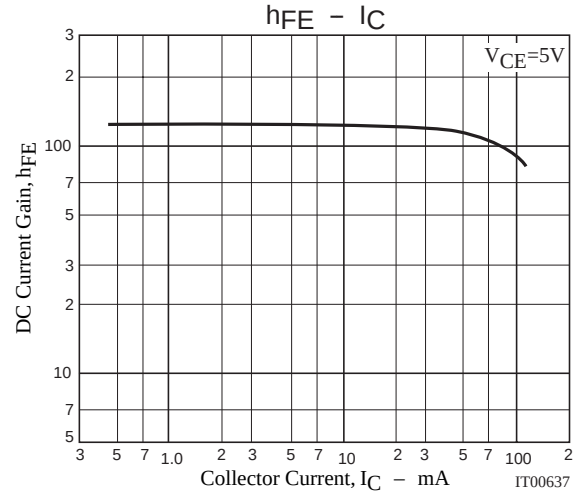
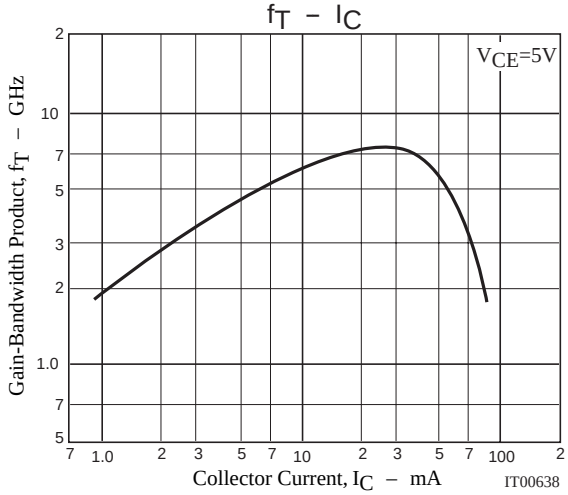
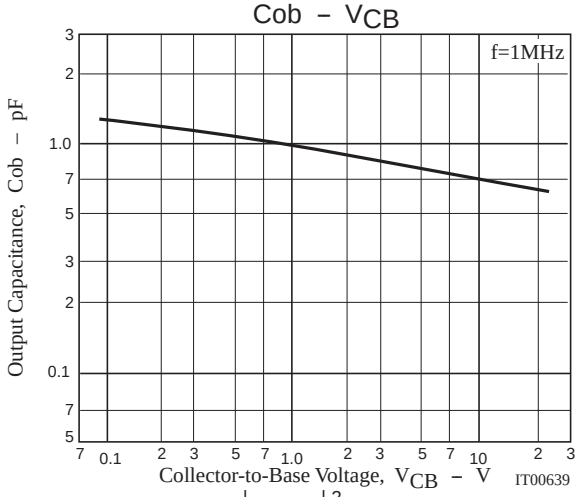
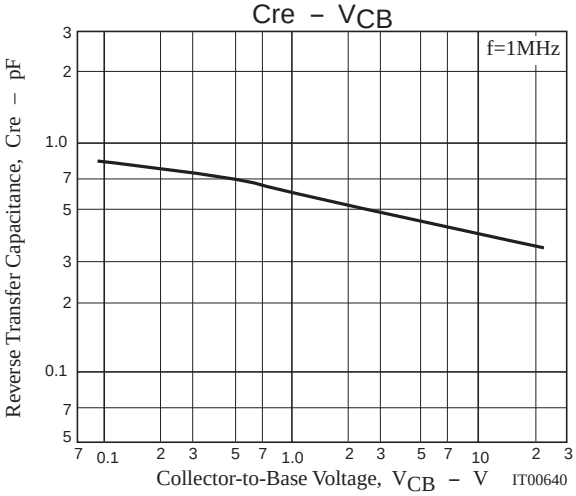
Continued from preceding page.

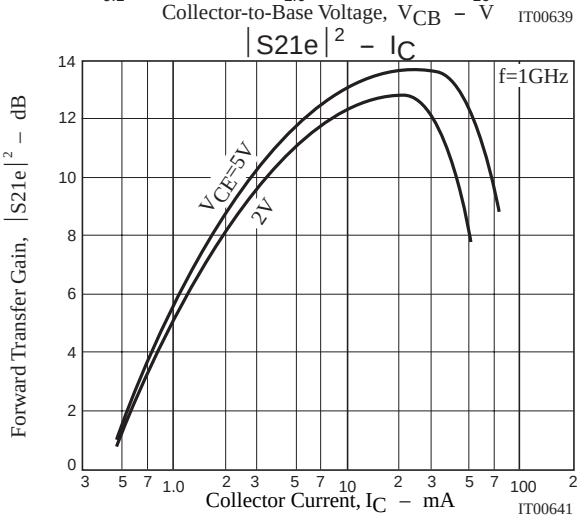
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Forward Transfer Gain	| S21e |^2 1	V_{CE}=5V, I_C=20mA, f=1GHz	10	13		dB
	| S21e |^2 2	V_{CE}=2V, I_C=3mA, f=1GHz		9		dB
Noise Figure	NF	V_{CE}=5V, I_C=7mA, f=1GHz		1.0	1.8	dB

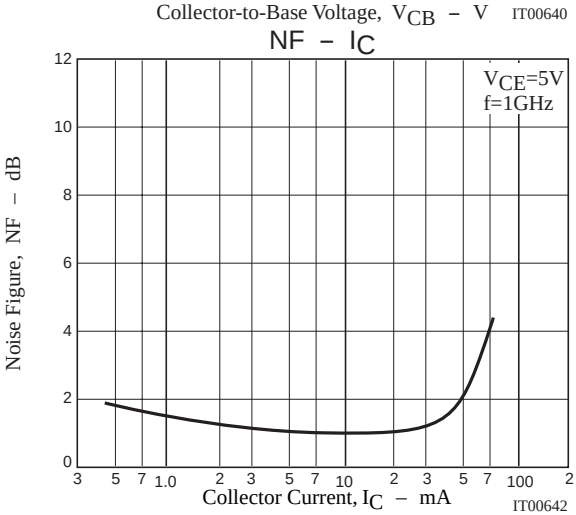


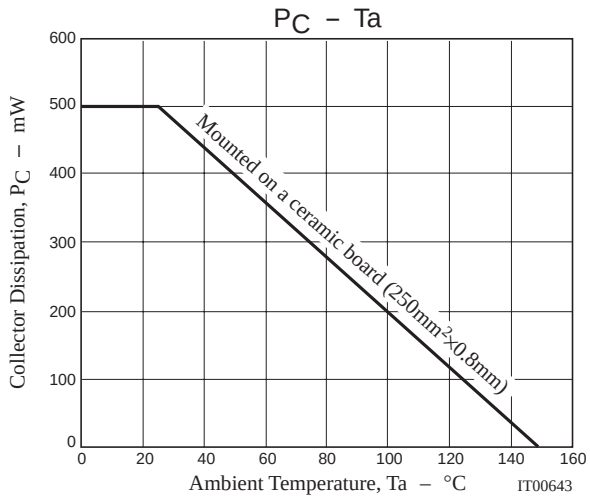












S Parameters (Common emitter)

V_{CE}=2V, I_C=1mA, Z_O=50Ω

Freq (MHz)	| S_{11} |	∠ S_{11}	| S_{21} |	∠ S_{21}	| S_{12} |	∠ S_{12}	| S_{22} |	∠ S_{22}
100	0.974	–20.4	2.443	162.5	0.043	75.9	0.983	–8.7
200	0.950	–39.4	2.257	147.7	0.079	63.0	0.940	–16.6
400	0.906	–72.8	1.847	124.5	0.132	42.9	0.853	–28.8
600	0.852	–102.1	2.016	103.8	0.155	28.8	0.780	–35.7
800	0.809	–124.4	1.713	88.6	0.156	18.6	0.704	–43.6
1000	0.796	–139.9	1.299	74.7	0.165	11.5	0.694	–48.2
1200	0.764	–155.0	1.287	63.6	0.152	6.8	0.653	–54.7
1400	0.744	–167.3	1.213	54.0	0.145	3.8	0.666	–59.2
1600	0.734	–177.3	1.089	45.7	0.139	0.6	0.702	–63.9
1800	0.722	173.3	0.929	36.6	0.131	–2.1	0.709	–69.2
2000	0.711	164.9	0.791	28.5	0.118	4.1	0.707	–74.8

V_{CE}=2V, I_C=3mA, Z_O=50Ω

Freq (MHz)	| S_{11} |	∠ S_{11}	| S_{21} |	∠ S_{21}	| S_{12} |	∠ S_{12}	| S_{22} |	∠ S_{22}
100	0.914	–30.2	6.935	155.9	0.041	71.2	0.946	–16.6
200	0.870	–54.3	5.731	139.8	0.070	55.6	0.826	–29.5
400	0.765	–100.1	5.112	113.5	0.098	36.8	0.634	–44.7
600	0.703	–129.1	4.069	95.7	0.109	28.5	0.544	–50.2
800	0.677	–147.3	3.250	83.3	0.112	24.8	0.481	–55.8
1000	0.645	–163.5	2.768	72.4	0.114	23.8	0.447	–60.1
1200	0.635	–173.9	2.366	63.5	0.114	25.2	0.444	–64.2
1400	0.624	176.9	2.068	55.4	0.119	25.1	0.441	–68.6
1600	0.623	169.5	1.794	48.5	0.122	24.9	0.462	–72.3
1800	0.616	161.8	1.631	41.1	0.127	28.8	0.449	–77.7
2000	0.603	154.4	1.472	34.7	0.135	30.5	0.474	–81.4

V_{CE}=2V, I_C=7mA, 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	0.828	–44.7	13.964	147.3	0.036	62.9	0.855	–28.9
200	0.730	–84.2	11.969	126.2	0.055	47.9	0.655	–45.7
400	0.642	–129.8	7.972	101.7	0.071	37.6	0.430	–60.7
600	0.603	–154.1	5.753	87.4	0.078	37.5	0.342	–66.5
800	0.593	–167.7	4.413	78.1	0.087	38.7	0.304	–70.9
1000	0.584	–177.5	3.548	69.6	0.097	39.3	0.285	–74.8
1200	0.577	174.2	2.983	62.4	0.106	40.8	0.282	–78.8
1400	0.571	166.8	2.574	55.4	0.118	41.8	0.280	–83.5
1600	0.566	159.7	2.283	49.5	0.130	42.1	0.293	–86.5
1800	0.566	154.0	2.027	42.8	0.141	41.9	0.301	–90.5
2000	0.560	148.0	1.834	36.8	0.156	41.0	0.311	–94.5

V_{CE}=2V, 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	0.770	–56.0	18.252	142.4	0.033	60.2	0.796	–35.9
200	0.675	–99.1	14.590	119.8	0.048	46.3	0.559	–54.3
400	0.604	–142.2	8.907	97.2	0.060	42.0	0.361	–67.8
600	0.584	–160.9	6.149	85.3	0.071	42.6	0.282	–74.3
800	0.575	–173.4	4.720	76.6	0.082	45.0	0.249	–79.0
1000	0.568	177.3	3.802	68.5	0.094	46.6	0.240	–82.3
1200	0.562	169.7	3.203	61.8	0.106	46.8	0.239	–86.3
1400	0.558	163.2	2.738	55.2	0.120	46.6	0.243	–90.2
1600	0.555	157.1	2.400	49.5	0.134	46.2	0.251	–93.9
1800	0.551	150.6	2.171	43.4	0.148	45.5	0.264	–96.9
2000	0.549	145.3	1.950	37.7	0.164	44.0	0.272	–100.7

V_{CE}=5V, I_C=1mA, 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	0.976	–19.2	2.316	164.1	0.032	77.8	0.987	–7.2
200	0.959	–37.0	2.392	149.7	0.061	65.3	0.948	–14.1
400	0.917	–69.6	2.007	127.7	0.103	46.0	0.888	–22.7
600	0.869	–97.2	1.894	108.5	0.122	32.3	0.817	–30.4
800	0.826	–120.3	1.743	92.9	0.128	22.0	0.747	–36.9
1000	0.806	–136.9	1.422	79.5	0.131	15.4	0.763	–40.2
1200	0.774	–152.3	1.345	68.1	0.127	9.6	0.739	–45.5
1400	0.754	–164.6	1.206	58.0	0.123	5.5	0.734	–50.3
1600	0.745	–174.8	1.056	49.4	0.111	6.4	0.747	–55.0
1800	0.720	174.6	1.005	41.1	0.101	5.3	0.793	–59.3
2000	0.714	166.3	0.812	32.7	0.093	11.4	0.775	–64.6

V_{CE}=5V, I_C=3mA, 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	0.935	–25.8	7.126	157.7	0.031	72.3	0.959	–12.4
200	0.864	–52.5	6.521	141.2	0.054	58.0	0.864	–23.1
400	0.790	–91.4	5.128	117.8	0.080	40.8	0.690	–35.7
600	0.705	–123.6	4.426	98.9	0.086	33.0	0.609	–40.1
800	0.658	–145.1	3.730	85.6	0.091	28.7	0.558	–44.2
1000	0.646	–157.6	2.953	75.4	0.095	27.1	0.521	–48.0
1200	0.628	–169.6	2.542	66.4	0.097	26.5	0.516	–51.6
1400	0.613	–179.5	2.221	57.9	0.098	29.5	0.516	–55.5
1600	0.607	172.2	1.974	51.2	0.102	32.8	0.528	–59.4
1800	0.607	164.8	1.697	43.6	0.105	33.7	0.534	–63.7
2000	0.599	157.5	1.578	36.9	0.113	36.4	0.527	–68.2

V_{CE}=5V, I_C=7mA, 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	0.844	–39.2	14.003	150.3	0.028	65.9	0.886	–22.4
200	0.748	–74.3	12.502	129.9	0.044	50.9	0.712	–35.2
400	0.637	–120.9	8.689	105.1	0.059	41.2	0.515	–45.0
600	0.586	–146.5	6.395	90.2	0.066	40.3	0.423	–48.3
800	0.569	–161.6	4.930	80.2	0.073	41.5	0.387	–50.9
1000	0.556	–172.8	3.990	71.7	0.082	42.2	0.373	–53.7
1200	0.551	178.3	3.338	64.2	0.090	44.5	0.367	–57.2
1400	0.543	170.4	2.882	57.2	0.100	45.9	0.363	–61.2
1600	0.539	163.2	2.554	51.2	0.111	46.8	0.374	–64.7
1800	0.537	156.7	2.275	44.9	0.122	46.8	0.384	–68.6
2000	0.532	150.5	2.055	38.6	0.134	46.1	0.390	–72.6

V_{CE}=5V, 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	0.668	–72.1	29.572	134.7	0.022	56.8	0.729	–36.1
200	0.572	–116.7	20.212	112.4	0.031	49.1	0.496	–48.2
400	0.527	–151.7	11.297	93.7	0.042	52.5	0.325	–52.4
600	0.514	–167.7	7.718	83.3	0.054	55.4	0.273	–53.6
800	0.511	–177.8	5.834	75.9	0.066	57.4	0.258	–55.7
1000	0.506	174.1	4.677	68.7	0.080	58.1	0.250	–58.7
1200	0.504	167.1	3.940	62.5	0.093	57.3	0.253	–62.5
1400	0.501	161.0	3.357	56.2	0.107	56.5	0.258	–66.5
1600	0.497	155.2	2.957	51.1	0.122	55.5	0.269	–70.6
1800	0.497	149.4	2.652	45.3	0.136	54.0	0.276	–74.5
2000	0.495	144.1	2.384	39.7	0.151	51.6	0.288	–78.5

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