Ordering number:ENN6223

NPN Epitaxial Planar Silicon Transistor

2SC5504

UHF to S Band Low-Noise Amplifier Applications

Features

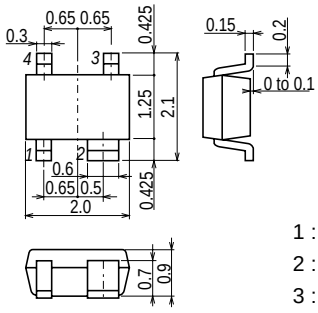
- Low noise : NF=0.9dB typ (f=1GHz).
  : NF=1.4dB typ (f=1.5GHz).
- High gain : $|S21e|^2$=11dB typ (f=1GHz).
- High cutoff frequency : f_T=11GHz typ.
- Low voltage, low current operation.
  (V_{CE}=1V, I_C=1mA)
  : f_T=7GHz typ.
  : $|S21e|^2$=6dB typ (f=1.5GHz).

Package Dimensions

unit:mm

2161

[2SC5504]



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}		1.5	V
Collector Current	I_C		30	mA
Collector Dissipation	P_C	Mounted on a ceramic board (250mm²×0.8mm)	300	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=10mA	90*		270*	
Gain-Bandwidth Product	f_T1	V_{CE}=5V, I_C=10mA	8	11		GHz
	f_T2	V_{CE}=1V, I_C=1mA		7		GHz
Output Capacitance	Cob	V_{CB}=10V, f=1MHz		0.45	0.7	pF
Reverse Transfer Capacitance	Cre	V_{CB}=10V, f=1MHz		0.25		pF

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

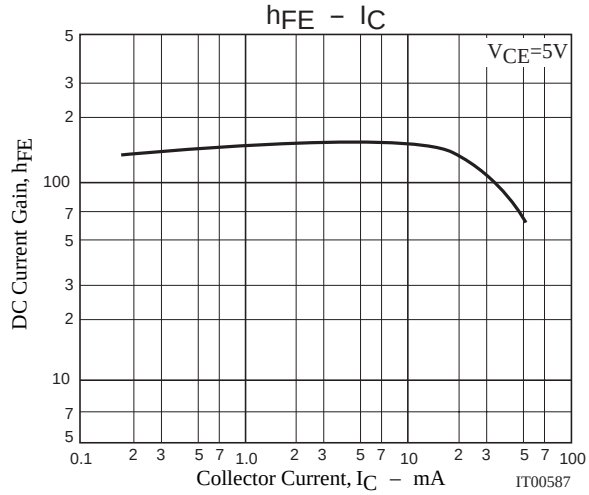
Marking	MN	
Rank	4	5
h_{FE}	90 to 180	135 to 270

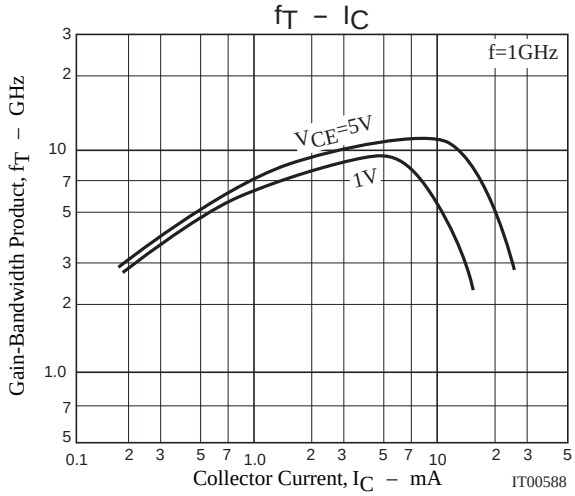
Continued on next page.

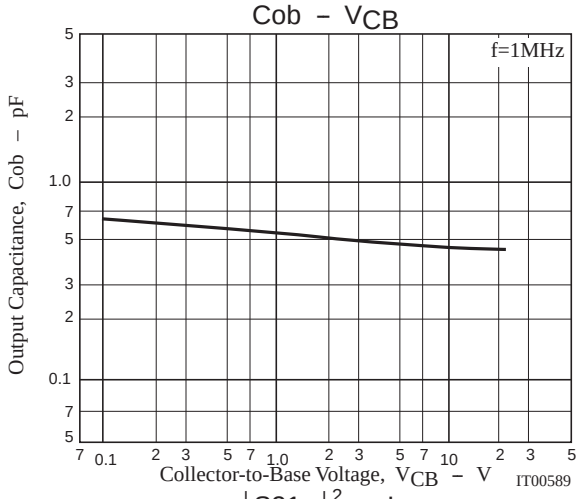
SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

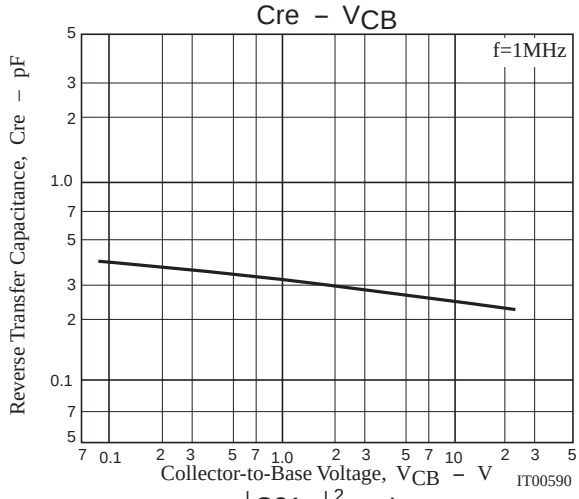
Continued from preceding page.

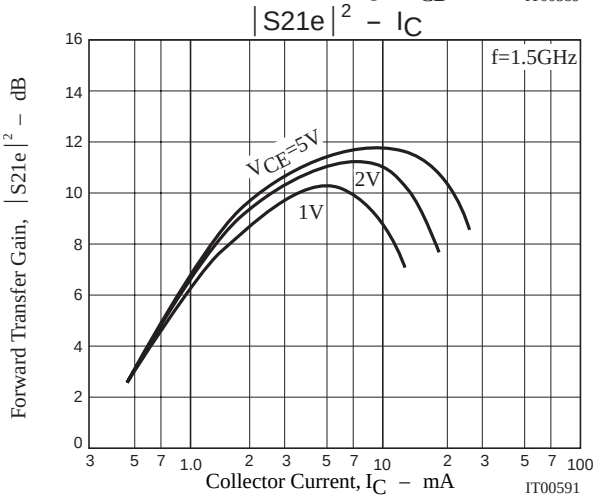
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Forward Transfer Gain	| S21e |^2 1	V_{CE}=5V, I_C=10mA, f=1.5GHz	9	11		dB
	| S21e |^2 2	V_{CE}=1V, I_C=1mA, f=1.5GHz		6		dB
Noise Figure	NF1	V_{CE}=5V, I_C=5mA, f=1.5GHz		1.4	3.0	dB
	NF2	V_{CE}=2V, I_C=3mA, f=1GHz		0.9		dB

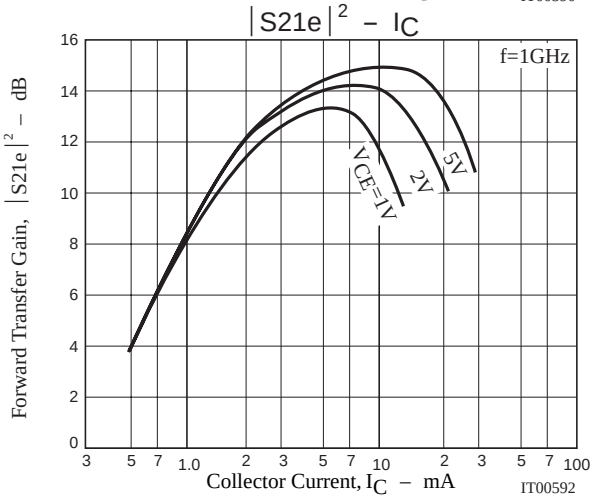


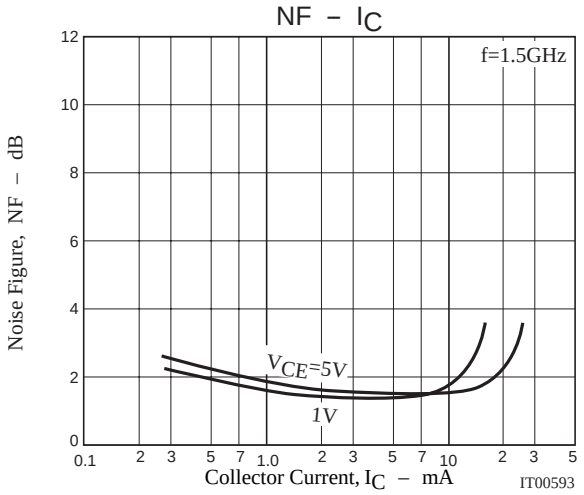


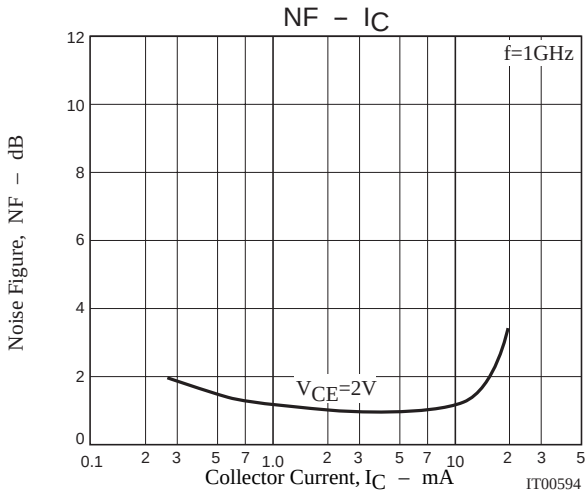


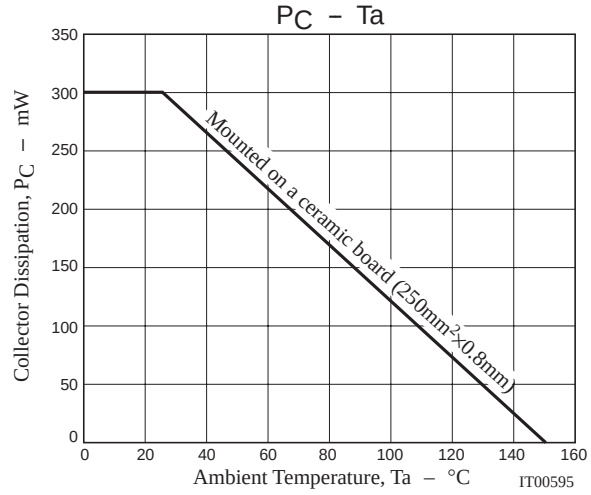












S Parameters (Common emitter)

V_{CE}=1V, 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	0.979	–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

V_{CE}=1V, 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	0.940	–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=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
100	0.977	–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=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
100	0.937	–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

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	0.984	–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=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
100	0.950	–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=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
100	0.905	–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

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	0.823	–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