Ordering number:ENN6337

NPN Epitaxial Planar Silicon Transistor

2SC5541

UHF to S Band Low-Noise Amplifier Applications

Features

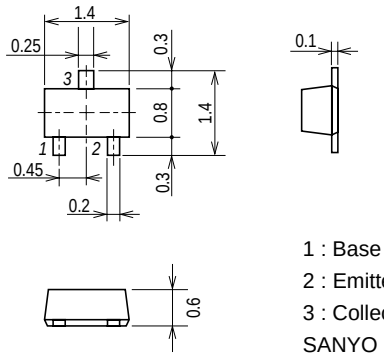
- Low noise : NF=1.2dB typ (f=2GHz).
- High gain : $|S21e|^2$=10dB typ (f=2GHz).
- High cutoff frequency : f_T=13GHz typ.
- Ultrasmall, slim flat-lead package.
  (1.4mm × 0.8mm × 0.6mm)

Package Dimensions

unit:mm

2159

[2SC5541]



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}		9	V
Collector-to-Emitter Voltage	V_{CEO}		6	V
Emitter-to-Base Voltage	V_{EBO}		1.5	V
Collector Current	I_C		30	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}=5V, 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		200	
Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA	10	13		GHz
Reverse Transfer Capacitance	Cre	V_{CB}=5V, f=1MHz		0.3	0.6	pF
Forward Transfer Gain	$\|S21e\|^2$ 1	V_{CE}=5V, I_C=10mA, f=2GHz	8	10		dB
	$\|S21e\|^2$ 2	V_{CE}=1V, I_C=3mA, f=2GHz		8		dB
Noise Figure	NF	V_{CE}=5V, I_C=5mA, f=2GHz		1.2	2.0	dB

Marking : RY

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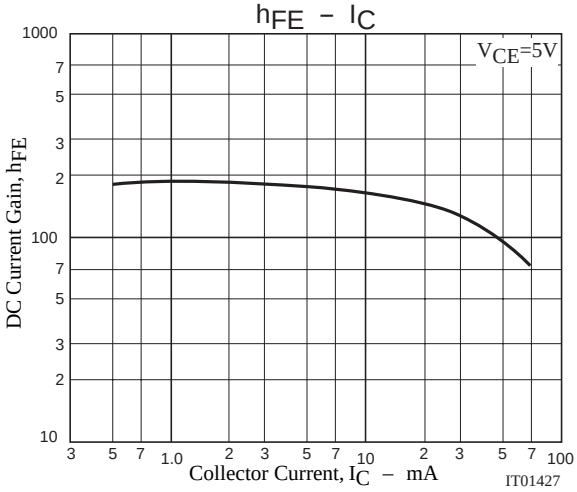
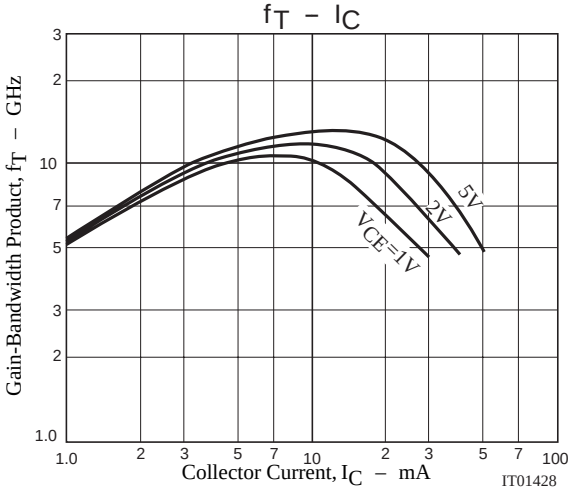
SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

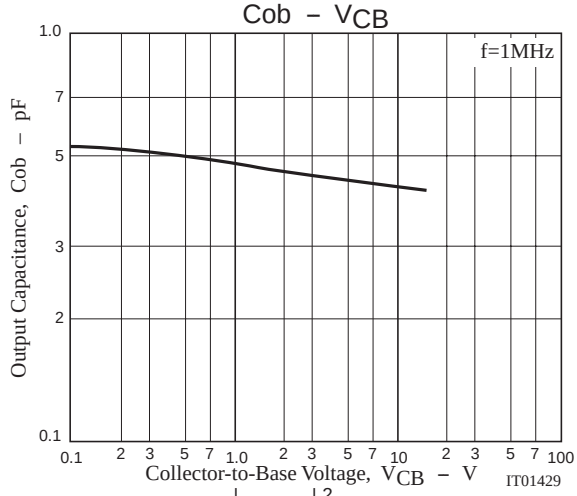
h_{FE} – I_C



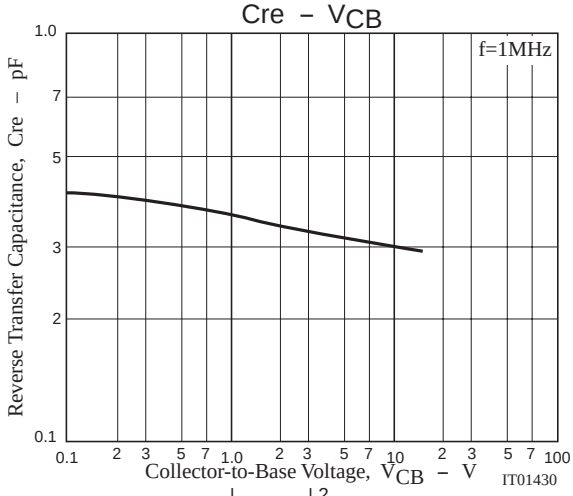
f_T – I_C



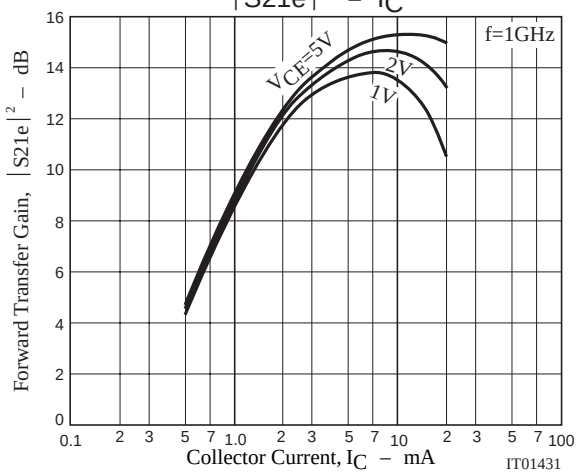
Cob – V_{CB}



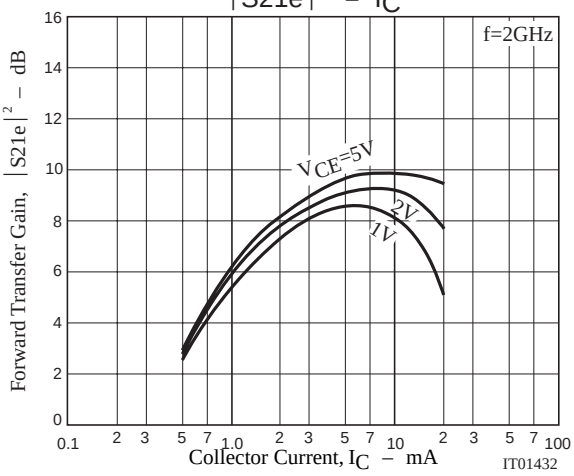
Cre – V_{CB}



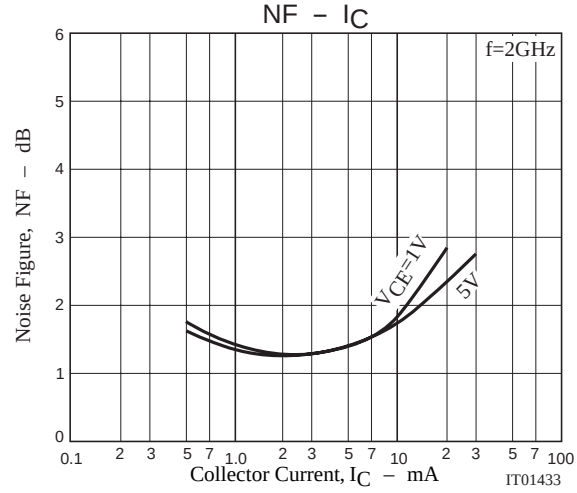
$|S21e|^2$ – I_C



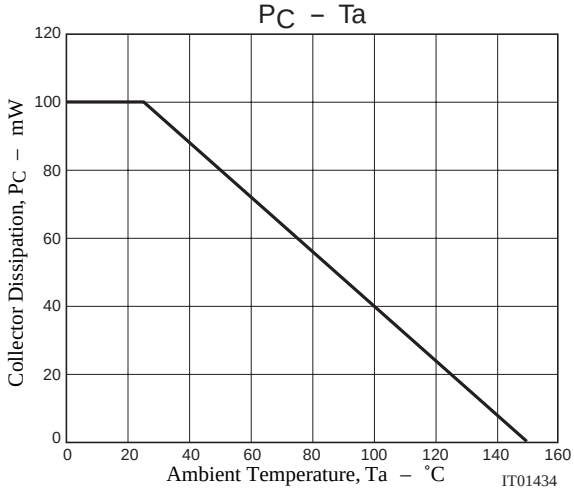
$|S21e|^2$ – I_C



NF – I_C



P_C – Ta



S Parameters (Common emitter)

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	0.972	–7.4	3.143	173.0	0.025	85.2	0.994	–4.9
200	0.963	–13.9	3.438	164.9	0.049	79.1	0.981	–9.6
400	0.928	–28.6	3.072	153.3	0.093	70.0	0.945	–18.7
600	0.885	–40.7	2.860	142.2	0.129	61.6	0.886	–27.2
800	0.833	–52.5	2.719	131.0	0.157	54.8	0.833	–33.8
1000	0.784	–62.8	2.701	119.8	0.182	49.1	0.801	–38.4
1200	0.731	–72.3	2.470	111.1	0.198	44.0	0.758	–43.5
1400	0.682	–80.9	2.272	103.8	0.208	40.3	0.716	–48.1
1600	0.640	–88.5	2.113	97.1	0.216	37.5	0.680	–51.8
1800	0.594	–96.0	1.848	92.1	0.215	35.8	0.624	–56.1
2000	0.563	–101.8	1.742	86.4	0.218	34.4	0.598	–58.7

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	0.924	–12.8	8.738	168.4	0.024	82.4	0.979	–8.9
200	0.883	–25.4	8.068	158.5	0.046	73.9	0.939	–17.3
400	0.795	–47.3	7.223	140.3	0.081	62.9	0.831	–30.8
600	0.694	–65.9	6.175	126.2	0.103	55.3	0.718	–40.5
800	0.609	–80.7	5.293	115.1	0.119	50.6	0.624	–47.1
1000	0.546	–92.1	4.576	106.6	0.131	48.1	0.549	–51.8
1200	0.496	–101.8	4.016	99.1	0.140	46.9	0.500	–55.0
1400	0.456	–110.4	3.562	92.8	0.148	46.6	0.463	–57.7
1600	0.423	–117.8	3.221	87.5	0.157	46.9	0.437	–59.9
1800	0.396	–124.7	2.950	82.2	0.165	47.3	0.422	–61.6
2000	0.371	–130.9	2.701	77.9	0.174	48.1	0.406	–63.1

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	0.878	–17.5	12.575	165.2	0.023	80.7	0.964	–11.8
200	0.816	–33.9	11.443	152.8	0.044	71.1	0.896	–22.3
400	0.692	–60.7	9.521	132.1	0.072	59.7	0.740	–37.5
600	0.582	–80.9	7.660	117.9	0.089	53.9	0.609	–46.5
800	0.501	–96.1	6.284	107.6	0.101	52.2	0.515	–52.0
1000	0.445	–107.9	5.301	99.9	0.113	51.9	0.445	–55.5
1200	0.407	–117.2	4.558	93.4	0.123	52.1	0.402	–57.6
1400	0.378	–125.2	3.988	88.0	0.134	52.7	0.372	–59.5
1600	0.355	–132.3	3.572	83.4	0.145	53.7	0.353	–60.9
1800	0.337	–138.4	3.234	78.9	0.155	54.5	0.341	–62.1
2000	0.319	–144.5	2.949	75.2	0.166	55.0	0.332	–63.0

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	0.791	–25.7	18.873	159.7	0.022	76.6	0.933	–16.5
200	0.700	–47.9	16.389	143.5	0.039	66.5	0.817	–29.5
400	0.548	–80.3	11.932	121.7	0.060	58.0	0.604	–45.1
600	0.455	–101.3	8.981	108.4	0.073	56.3	0.474	–51.5
800	0.399	–116.5	7.081	99.6	0.086	57.1	0.395	–54.9
1000	0.362	–127.9	5.836	93.3	0.098	58.5	0.344	–56.5
1200	0.339	–136.5	4.954	87.8	0.110	59.7	0.314	–57.5
1400	0.321	–143.7	4.295	83.3	0.123	61.0	0.293	–58.6
1600	0.308	–150.0	3.821	79.3	0.136	61.6	0.281	–59.3
1800	0.296	–155.3	3.450	75.4	0.150	61.7	0.273	–60.0
2000	0.286	–160.7	3.136	71.9	0.163	62.1	0.269	–60.6

V_{CE}=1V, 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	0.968	–8.3	3.360	172.1	0.029	84.1	0.992	–5.7
200	0.958	–15.5	3.297	164.7	0.057	77.6	0.974	–11.2
400	0.916	–32.1	3.354	150.2	0.107	68.2	0.939	–20.7
600	0.868	–45.1	2.806	138.1	0.147	58.7	0.867	–31.2
800	0.810	–57.8	2.590	126.8	0.177	51.5	0.800	–38.8
1000	0.758	–68.9	2.508	116.7	0.200	45.6	0.755	–43.8
1200	0.704	–79.0	2.307	107.8	0.215	40.8	0.708	–48.9
1400	0.656	–88.0	2.132	100.1	0.226	37.1	0.667	–53.5
1600	0.616	–95.8	1.994	93.3	0.235	34.1	0.634	–57.2
1800	0.571	–103.7	1.831	86.9	0.241	31.4	0.596	–61.3
2000	0.542	–109.8	1.714	81.3	0.242	29.8	0.572	–64.1

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	0.910	–15.2	8.785	167.2	0.028	80.4	0.972	–10.6
200	0.869	–29.1	8.118	155.9	0.053	71.7	0.919	–20.4
400	0.774	–53.8	7.103	136.8	0.091	60.0	0.799	–35.1
600	0.663	–75.3	5.903	122.4	0.114	51.9	0.672	–46.0
800	0.581	–91.1	4.976	111.1	0.130	47.6	0.577	–53.2
1000	0.530	–101.8	4.281	102.4	0.142	45.0	0.509	–58.2
1200	0.487	–111.7	3.727	95.0	0.151	44.4	0.460	–62.0
1400	0.453	–120.3	3.285	89.0	0.159	44.1	0.423	–65.2
1600	0.428	–127.7	2.963	83.7	0.168	44.3	0.396	–67.6
1800	0.403	–135.6	2.692	78.7	0.177	44.9	0.376	–69.6
2000	0.384	–142.0	2.471	74.4	0.185	45.6	0.361	–71.2

V_{CE}=1V, 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	0.857	–21.1	12.331	163.7	0.027	78.3	0.954	–13.8
200	0.792	–39.6	11.318	149.6	0.050	68.1	0.872	–25.8
400	0.658	–70.8	9.000	128.2	0.079	56.1	0.691	–43.2
600	0.561	–91.5	7.120	113.8	0.097	51.3	0.555	–52.7
800	0.493	–107.4	5.760	103.6	0.109	49.5	0.463	–58.7
1000	0.448	–119.9	4.816	96.1	0.120	49.4	0.401	–62.5
1200	0.418	–129.5	4.125	89.9	0.131	50.0	0.361	–65.2
1400	0.395	–137.6	3.602	84.5	0.141	51.0	0.332	–67.5
1600	0.378	–144.6	3.221	79.9	0.153	51.9	0.313	–69.2
1800	0.364	–150.5	2.915	75.6	0.165	52.5	0.300	–70.5
2000	0.351	–156.3	2.663	71.6	0.176	53.2	0.291	–71.9

V_{CE}=1V, 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	0.752	–33.0	18.187	156.6	0.026	74.2	0.901	–19.8
200	0.659	–59.8	15.275	138.5	0.044	62.9	0.760	–34.4
400	0.526	–97.2	10.561	116.3	0.064	53.9	0.535	–50.4
600	0.461	–118.5	7.741	103.8	0.077	53.6	0.410	–56.8
800	0.425	–133.0	6.044	95.4	0.090	55.1	0.341	–60.0
1000	0.404	–143.4	4.963	89.1	0.102	56.8	0.298	–61.8
1200	0.389	–151.3	4.204	83.7	0.115	58.5	0.274	–63.2
1400	0.377	–157.9	3.645	79.2	0.128	59.6	0.257	–64.6
1600	0.369	–163.4	3.245	75.2	0.143	60.7	0.248	–65.7
1800	0.360	–168.5	2.927	71.2	0.157	61.1	0.243	–66.6
2000	0.354	–173.2	2.663	67.7	0.171	61.5	0.242	–67.7

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