Ordering number : ENN7412

NPN Epitaxial Planar Silicon Transistor

SBFP540D

UHF to C Band Low Noise Amplifier, Oscillation Applications

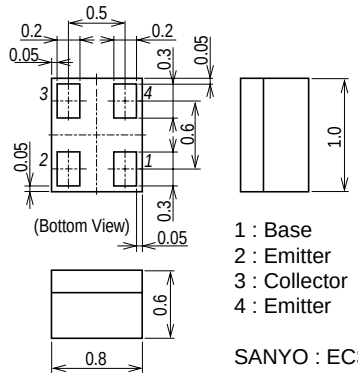
Features

- Low noise : NF=0.9dB typ (f=1.8GHz).
- High cutoff frequency : f_T=20GHz typ(V_{CE}=1V).
  : f_T=29GHz typ(V_{CE}=4V).
- Low voltage operation.
- High gain : $|S21e|^2$=17.5dB typ (V_{CE}=1V, f=1.8GHz).
  : $|S21e|^2$=18.5dB typ (V_{CE}=2V, f=1.8GHz).

Package Dimensions

unit : mm
2215

[SBFP540D]



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

SANYO : ECSP1008-4

Specifications

Absolute Maximum Ratings at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	V_{CBO}		14	V
Collector-to-Emitter Voltage	V_{CEO}		4.5	V
Emitter-to-Base Voltage	V_{EBO}		1	V
Collector Current	I_C		80	mA
Collector Dissipation	P_C		100	mW
Junction Temperature	Tj		150	°C
Storage Temperature	Tstg		-55 to +150	°C

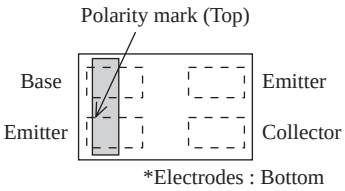
Electrical Characteristics at Ta=25°C

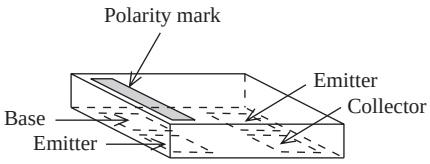
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I_{CBO}	V_{CB}=5V, I_E=0			200	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=1V, I_C=0			70	μA
DC Current Gain	h_{FE}	V_{CE}=3.5V, I_C=20mA	50		200	
Gain-Bandwidth Product	f_T1	V_{CE}=1V, I_C=10mA		20		GHz
	f_T2	V_{CE}=4V, I_C=50mA	22	29		GHz
Reverse Transfer Capacitance	Cre	V_{CB}=1V, f=1MHz		0.15	0.25	pF
Forward Transfer Gain	$|S21e|^2$1	V_{CE}=1V, I_C=10mA, f=1.8GHz		17.5		dB
	$|S21e|^2$2	V_{CE}=2V, I_C=20mA, f=1.8GHz	16	18.5		dB
Noise Figure	NF	V_{CE}=2V, I_C=5mA, f=1.8GHz		0.9	1.3	dB

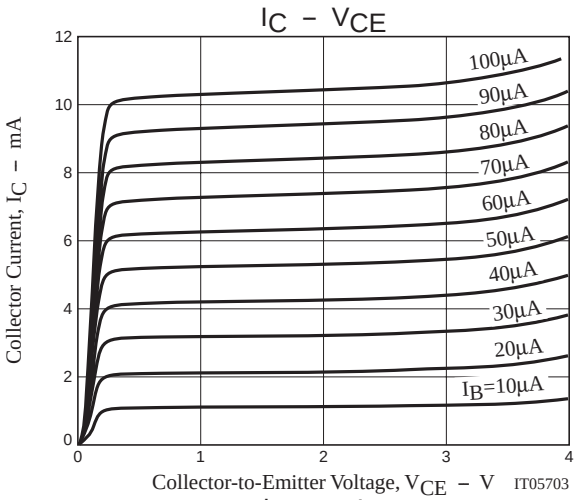
Marking : AF

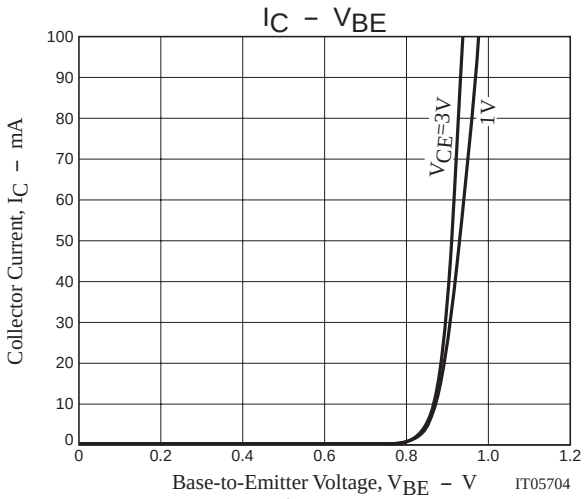
SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

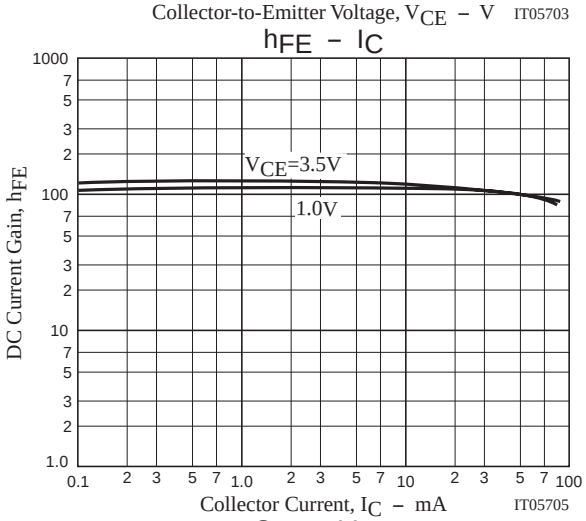
Electrical Connection (Top view)

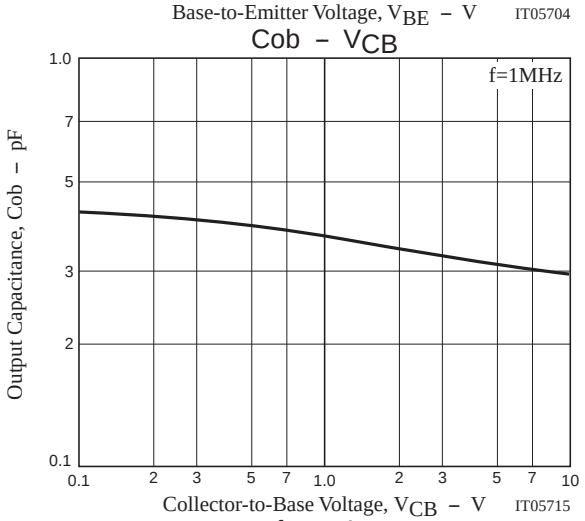


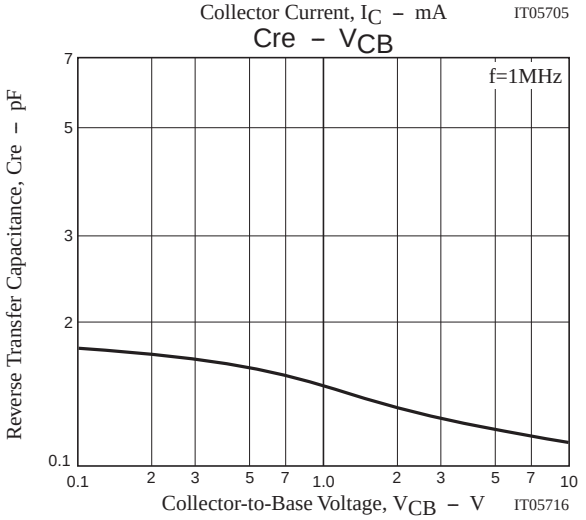


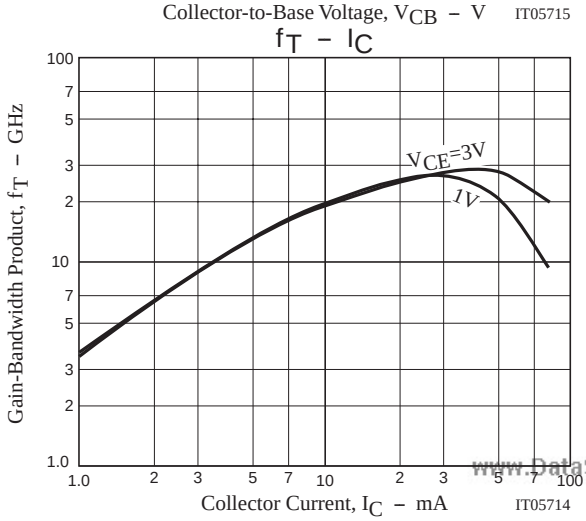


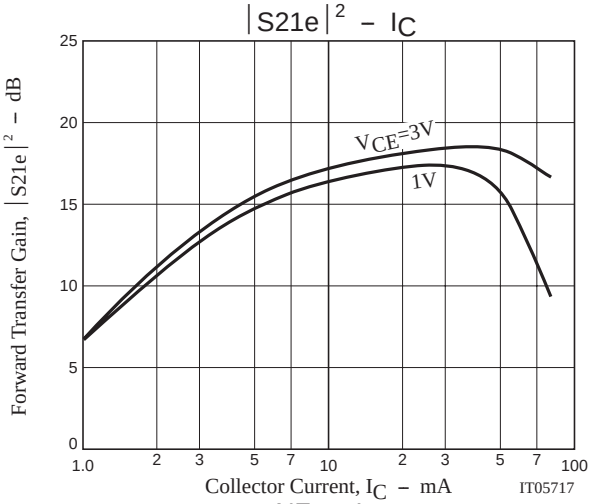


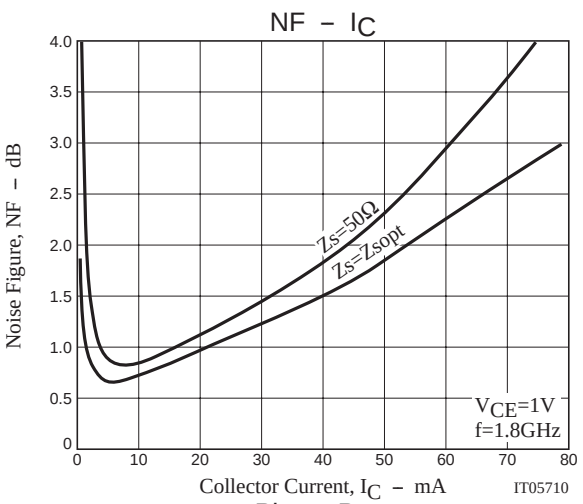


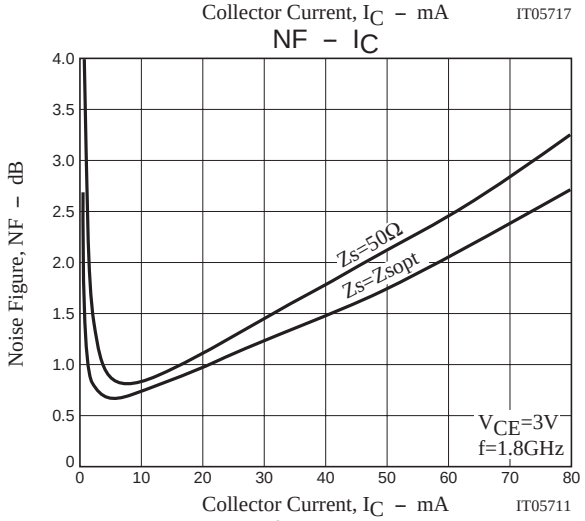


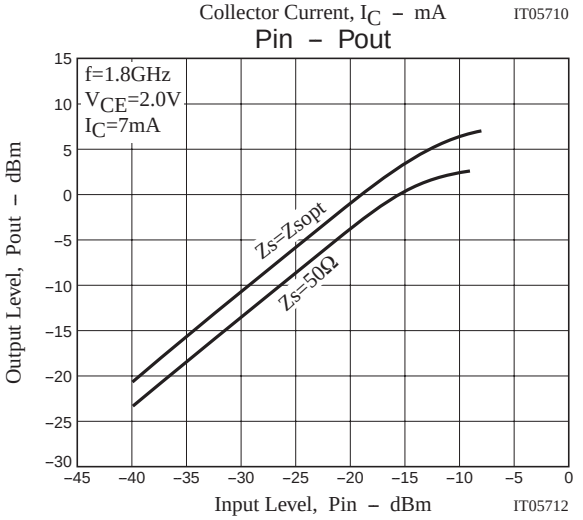


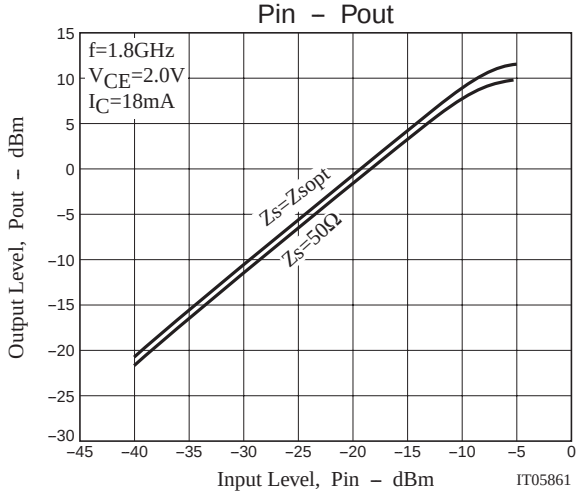


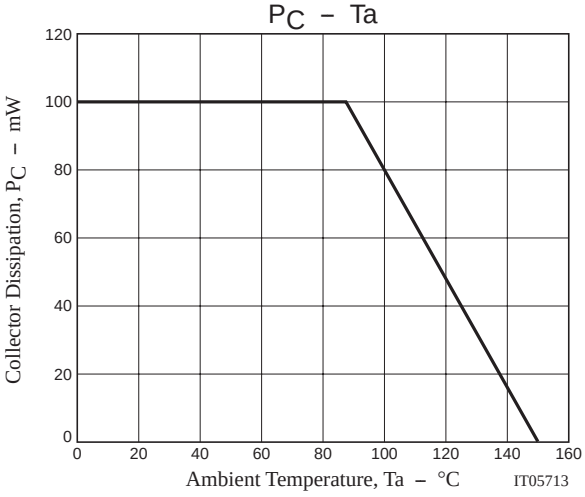












S Parameters (Common emitter)

V_{CE}=1V, I_C=1mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.971	–12.2	2.571	168.3	0.020	80.9	0.994	–6.2
400	0.963	–23.7	2.260	158.6	0.040	75.5	0.972	–12.0
600	0.943	–36.8	2.528	150.1	0.060	68.3	0.944	–17.1
800	0.919	–48.6	2.506	140.7	0.076	61.9	0.911	–22.1
1000	0.903	–58.3	2.176	133.1	0.090	54.3	0.872	–26.7
1200	0.864	–72.4	2.570	125.6	0.102	49.6	0.833	–30.0
1400	0.835	–83.6	2.532	119.0	0.113	43.7	0.810	–33.2
1600	0.827	–90.8	2.156	113.6	0.116	37.8	0.760	–38.0
1800	0.795	–100.9	2.175	107.1	0.123	34.7	0.731	–39.0
2000	0.779	–108.3	1.992	101.8	0.127	31.0	0.710	–41.4
2200	0.751	–117.4	1.997	96.5	0.129	27.5	0.687	–43.6
2400	0.744	–123.6	1.822	92.2	0.130	24.1	0.670	–45.7
2600	0.728	–130.6	1.745	87.7	0.129	21.7	0.648	–47.7
2800	0.712	–137.5	1.695	83.4	0.128	19.5	0.630	–49.4
3000	0.704	–143.0	1.589	79.5	0.127	17.7	0.617	–51.1
3200	0.687	–149.6	1.582	75.6	0.125	16.3	0.605	–52.8
3400	0.683	–154.6	1.496	72.2	0.123	15.3	0.595	–54.6
3600	0.675	–159.9	1.441	68.9	0.120	14.5	0.585	–56.4
3800	0.668	–165.1	1.400	65.5	0.118	13.9	0.576	–58.1
4000	0.666	–169.5	1.330	62.3	0.116	13.7	0.569	–59.8
4200	0.658	–174.3	1.302	59.2	0.112	14.4	0.563	–61.6
4400	0.654	–178.6	1.253	56.2	0.111	14.9	0.558	–63.4
4600	0.653	177.2	1.205	53.4	0.108	15.9	0.552	–65.2
4800	0.648	173.0	1.173	50.6	0.106	17.5	0.547	–67.3
5000	0.648	169.1	1.122	48.0	0.106	19.2	0.543	–69.1
5200	0.645	165.2	1.095	45.4	0.103	21.2	0.539	–71.1
5400	0.643	161.5	1.065	42.9	0.103	24.0	0.534	–73.2
5600	0.642	157.8	1.030	40.5	0.104	26.3	0.531	–75.2
5800	0.639	154.2	1.004	38.1	0.105	29.1	0.528	–77.4
6000	0.639	150.7	0.971	35.8	0.107	31.7	0.523	–79.4

S Parameters (Common emitter)

V_{CE}=1V, I_C=5mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.868	–19.7	10.544	160.3	0.020	79.9	0.965	–13.4
400	0.836	–36.6	8.931	147.2	0.037	69.5	0.886	–25.0
600	0.764	–58.5	9.686	135.5	0.048	59.7	0.799	–33.7
800	0.713	–74.2	8.612	125.7	0.058	54.4	0.714	–41.0
1000	0.658	–89.1	7.808	116.6	0.064	50.3	0.635	–46.7
1200	0.592	–105.4	7.463	107.8	0.070	47.8	0.572	–50.3
1400	0.557	–116.7	6.715	101.6	0.074	44.8	0.529	–53.4
1600	0.533	–126.1	6.042	96.5	0.077	44.3	0.477	–56.6
1800	0.513	–134.2	5.454	91.9	0.081	43.3	0.443	–58.1
2000	0.498	–141.2	4.966	88.0	0.084	42.6	0.415	–59.8
2200	0.482	–148.1	4.580	84.2	0.088	42.7	0.392	–61.3
2400	0.476	–153.6	4.206	81.0	0.091	42.7	0.372	–62.7
2600	0.466	–159.4	3.928	77.8	0.094	42.6	0.355	–63.9
2800	0.459	–164.5	3.670	74.8	0.098	43.2	0.340	–65.0
3000	0.454	–169.0	3.438	72.0	0.101	43.6	0.328	–65.9
3200	0.449	–173.6	3.255	69.4	0.105	43.5	0.318	–67.3
3400	0.446	–177.7	3.071	66.8	0.109	43.8	0.309	–68.4
3600	0.444	178.4	2.919	64.3	0.113	44.1	0.302	–69.8
3800	0.442	174.6	2.783	61.8	0.117	44.2	0.295	–70.9
4000	0.441	171.1	2.650	59.4	0.121	44.2	0.289	–72.1
4200	0.440	167.6	2.538	57.1	0.126	44.2	0.283	–73.6
4400	0.439	164.3	2.431	54.8	0.131	44.2	0.279	–75.1
4600	0.440	161.0	2.331	52.5	0.136	44.4	0.275	–76.5
4800	0.439	157.9	2.244	50.3	0.141	44.2	0.271	–78.2
5000	0.439	154.8	2.157	48.2	0.146	44.0	0.268	–79.8
5200	0.439	151.8	2.086	46.0	0.150	43.6	0.265	–81.4
5400	0.439	148.9	2.016	43.9	0.156	43.2	0.263	–83.2
5600	0.440	145.9	1.949	41.8	0.162	42.8	0.259	–84.9
5800	0.440	143.2	1.886	39.7	0.167	42.4	0.257	–86.8
6000	0.441	140.4	1.828	37.7	0.172	42.1	0.255	–88.6

S Parameters (Common emitter)

V_{CE}=1V, I_C=10mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.750	–28.2	18.567	154.3	0.018	74.4	0.926	–20.0
400	0.687	–52.3	15.444	138.2	0.030	65.2	0.787	–34.9
600	0.588	–80.0	15.344	123.8	0.040	59.5	0.665	–44.6
800	0.534	–97.7	12.865	113.7	0.047	56.1	0.566	–51.9
1000	0.481	–113.6	11.102	105.1	0.052	54.2	0.489	–57.2
1200	0.446	–126.5	9.656	98.5	0.057	54.1	0.431	–60.5
1400	0.426	–136.4	8.422	93.4	0.062	53.9	0.389	–63.6
1600	0.411	–144.5	7.440	89.3	0.067	53.5	0.350	–66.0
1800	0.403	–151.5	6.637	85.7	0.072	54.2	0.321	–67.7
2000	0.396	–157.6	5.998	82.5	0.078	54.2	0.298	–69.3
2200	0.390	–163.2	5.472	79.4	0.083	54.2	0.279	–70.9
2400	0.386	–168.0	5.020	76.7	0.088	54.1	0.262	–72.1
2600	0.382	–172.7	4.648	74.1	0.093	54.0	0.249	–73.2
2800	0.379	–176.8	4.326	71.6	0.098	54.1	0.237	–74.3
3000	0.377	179.3	4.041	69.3	0.104	54.0	0.228	–75.5
3200	0.376	175.5	3.803	67.0	0.110	53.7	0.221	–76.8
3400	0.375	172.2	3.588	64.8	0.115	53.7	0.213	–78.0
3600	0.374	168.7	3.399	62.6	0.121	53.0	0.207	–79.4
3800	0.375	165.5	3.231	60.4	0.128	52.3	0.202	–80.6
4000	0.374	162.5	3.077	58.3	0.134	51.7	0.197	–81.9
4200	0.374	159.4	2.940	56.2	0.140	51.2	0.193	–83.5
4400	0.375	156.5	2.814	54.1	0.146	50.6	0.189	–85.0
4600	0.376	153.7	2.696	52.1	0.152	49.7	0.186	–86.8
4800	0.377	150.9	2.593	50.1	0.158	48.8	0.183	–88.3
5000	0.378	148.3	2.494	48.1	0.165	48.1	0.181	–90.5
5200	0.378	145.6	2.405	46.1	0.170	47.4	0.179	–92.0
5400	0.380	143.0	2.321	44.2	0.176	46.5	0.176	–93.8
5600	0.380	140.4	2.245	42.2	0.182	45.6	0.174	–95.6
5800	0.381	137.9	2.171	40.4	0.189	44.5	0.173	–97.6
6000	0.382	135.3	2.105	38.5	0.195	43.6	0.171	–99.4

S Parameters (Common emitter)

V_{CE}=1V, I_C=20mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.549	–51.0	26.218	145.8	0.016	68.4	0.865	–26.6
400	0.497	–88.0	21.419	125.9	0.026	64.3	0.675	–43.6
600	0.432	–106.0	19.209	113.2	0.033	62.4	0.541	–53.2
800	0.400	–122.5	15.384	104.2	0.039	61.6	0.447	–59.7
1000	0.377	–135.3	12.749	97.6	0.045	61.2	0.380	–64.4
1200	0.363	–145.1	10.781	92.5	0.052	61.6	0.333	–67.9
1400	0.356	–152.9	9.307	88.4	0.057	61.9	0.296	–70.4
1600	0.351	–159.6	8.148	85.0	0.064	61.9	0.269	–72.8
1800	0.348	–165.4	7.237	81.9	0.070	62.5	0.245	–75.1
2000	0.346	–170.2	6.519	79.2	0.076	62.3	0.226	–77.0
2200	0.345	–174.9	5.931	76.6	0.082	61.5	0.211	–78.8
2400	0.343	–179.0	5.437	74.2	0.089	61.5	0.198	–80.2
2600	0.343	177.3	5.018	71.9	0.095	60.7	0.187	–81.7
2800	0.342	173.7	4.663	69.7	0.102	60.8	0.178	–83.0
3000	0.342	170.4	4.355	67.6	0.108	59.7	0.171	–84.2
3200	0.342	167.3	4.090	65.6	0.115	59.2	0.165	–86.0
3400	0.342	164.3	3.857	63.5	0.122	58.5	0.159	–87.7
3600	0.342	161.4	3.652	61.5	0.129	57.3	0.155	–89.3
3800	0.343	158.7	3.467	59.5	0.135	56.4	0.151	–90.7
4000	0.344	155.8	3.303	57.6	0.142	55.7	0.147	–92.5
4200	0.344	153.2	3.152	55.6	0.149	54.7	0.144	–93.7
4400	0.345	150.6	3.014	53.7	0.155	53.4	0.141	–95.8
4600	0.347	148.1	2.889	51.8	0.162	52.3	0.139	–97.8
4800	0.348	145.7	2.776	49.9	0.168	51.3	0.137	–100.0
5000	0.349	143.2	2.670	47.9	0.176	50.2	0.135	–101.8
5200	0.349	140.7	2.573	46.1	0.182	49.1	0.134	–103.8
5400	0.351	138.3	2.483	44.3	0.189	48.0	0.132	–105.6
5600	0.352	135.9	2.402	42.4	0.195	46.7	0.132	–107.9
5800	0.353	133.7	2.322	40.6	0.202	45.5	0.130	–110.2
6000	0.354	131.4	2.249	38.8	0.208	44.5	0.129	–112.2

S Parameters (Common emitter)

V_{CE}=1V, I_C=30mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.445	–81.5	28.718	138.9	0.015	76.3	0.815	–30.8
400	0.445	–116.1	22.581	118.0	0.024	65.0	0.608	–47.7
600	0.388	–126.0	19.567	107.7	0.030	65.4	0.473	–56.6
800	0.370	–139.0	15.579	100.0	0.036	65.4	0.388	–62.8
1000	0.353	–148.2	12.938	94.3	0.043	64.7	0.331	–67.2
1200	0.347	–156.2	10.900	89.9	0.049	65.1	0.288	–70.5
1400	0.343	–162.5	9.406	86.2	0.056	66.5	0.258	–73.2
1600	0.341	–168.2	8.231	83.1	0.063	66.9	0.230	–75.7
1800	0.341	–173.1	7.297	80.2	0.069	65.7	0.213	–77.9
2000	0.341	–177.3	6.572	77.7	0.076	65.2	0.196	–80.1
2200	0.341	178.7	5.971	75.3	0.083	65.0	0.183	–81.7
2400	0.340	175.2	5.479	73.0	0.089	64.0	0.172	–83.3
2600	0.340	171.8	5.057	70.8	0.096	63.6	0.163	–85.0
2800	0.340	168.7	4.698	68.7	0.104	63.1	0.155	–86.2
3000	0.340	165.7	4.386	66.7	0.110	61.9	0.149	–87.8
3200	0.340	162.9	4.118	64.7	0.117	61.0	0.144	–89.6
3400	0.341	160.1	3.883	62.8	0.124	60.2	0.140	–91.2
3600	0.342	157.6	3.676	60.8	0.131	59.0	0.136	–93.3
3800	0.343	154.9	3.489	58.9	0.138	58.1	0.132	–95.0
4000	0.344	152.3	3.323	56.9	0.145	57.0	0.129	–96.7
4200	0.345	149.9	3.171	55.0	0.152	55.8	0.127	–98.5
4400	0.346	147.4	3.033	53.1	0.159	54.8	0.125	–100.3
4600	0.347	145.2	2.908	51.3	0.166	53.5	0.123	–102.8
4800	0.348	142.7	2.795	49.4	0.172	52.3	0.122	–104.8
5000	0.350	140.4	2.688	47.6	0.180	51.1	0.121	–107.2
5200	0.350	138.0	2.591	45.7	0.186	49.8	0.120	–109.4
5400	0.352	135.7	2.498	43.9	0.193	48.7	0.118	–111.4
5600	0.353	133.5	2.417	42.1	0.200	47.4	0.117	–113.8
5800	0.353	131.4	2.337	40.3	0.206	46.2	0.117	–116.2
6000	0.354	128.9	2.265	38.5	0.212	44.9	0.117	–118.1

S Parameters (Common emitter)

V_{CE}=3V, I_C=1mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.975	–11.7	2.468	169.3	0.018	78.3	0.994	–4.9
400	0.967	–22.5	2.182	160.2	0.031	76.2	0.981	–9.6
600	0.950	–34.7	2.442	152.1	0.046	71.3	0.961	–13.9
800	0.928	–46.1	2.457	143.1	0.061	63.8	0.935	–18.1
1000	0.913	–55.4	2.115	135.8	0.072	58.3	0.907	–22.0
1200	0.876	–68.9	2.537	128.6	0.082	52.7	0.874	–25.1
1400	0.850	–79.9	2.533	122.1	0.092	46.9	0.856	–27.9
1600	0.843	–86.7	2.119	116.9	0.095	41.4	0.814	–32.2
1800	0.810	–96.9	2.178	110.3	0.101	38.7	0.788	–33.2
2000	0.795	–104.3	1.993	105.1	0.104	34.1	0.768	–35.4
2200	0.765	–113.5	2.021	99.8	0.107	30.5	0.748	–37.4
2400	0.756	–119.9	1.847	95.4	0.108	27.3	0.731	–39.4
2600	0.741	–126.9	1.765	90.9	0.107	24.9	0.711	–41.3
2800	0.722	–133.9	1.726	86.6	0.106	22.6	0.694	–42.8
3000	0.714	–139.6	1.611	82.7	0.105	20.9	0.682	–44.3
3200	0.695	–146.4	1.617	78.7	0.104	19.4	0.669	–45.9
3400	0.689	–151.7	1.529	75.3	0.102	18.1	0.660	–47.4
3600	0.681	–157.0	1.471	72.0	0.099	17.9	0.650	–49.0
3800	0.671	–162.3	1.433	68.5	0.097	17.3	0.641	–50.6
4000	0.669	–166.9	1.360	65.4	0.094	17.5	0.634	–52.1
4200	0.660	–172.0	1.333	62.2	0.092	18.2	0.628	–53.7
4400	0.655	–176.5	1.287	59.2	0.090	19.5	0.622	–55.4
4600	0.654	179.3	1.234	56.3	0.088	20.8	0.616	–57.0
4800	0.648	174.9	1.205	53.6	0.086	22.8	0.611	–58.8
5000	0.647	170.9	1.149	51.0	0.085	25.0	0.607	–60.5
5200	0.644	166.8	1.123	48.4	0.084	27.9	0.602	–62.3
5400	0.640	162.9	1.091	45.8	0.084	31.0	0.597	–64.1
5600	0.640	159.1	1.054	43.4	0.084	34.1	0.593	–65.9
5800	0.636	155.4	1.028	41.0	0.086	37.6	0.590	–67.8
6000	0.636	151.8	0.993	38.7	0.088	40.8	0.586	–69.6

S Parameters (Common emitter)

V_{CE}=3V, I_C=5mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.874	–18.0	10.856	161.8	0.014	81.8	0.974	–11.0
400	0.847	–33.7	9.289	149.2	0.027	70.7	0.911	–19.9
600	0.775	–53.8	10.092	137.9	0.038	62.4	0.838	–26.9
800	0.723	–69.0	9.134	128.1	0.046	57.6	0.766	–33.0
1000	0.669	–82.7	8.267	119.3	0.052	53.8	0.697	–37.6
1200	0.594	–98.9	8.044	110.1	0.058	51.0	0.640	–40.5
1400	0.553	–110.3	7.288	103.8	0.061	48.5	0.600	–43.0
1600	0.526	–119.7	6.547	98.6	0.064	47.7	0.550	–45.6
1800	0.501	–128.0	5.937	93.9	0.068	47.4	0.519	–46.6
2000	0.483	–135.2	5.407	89.9	0.071	46.6	0.492	–47.9
2200	0.464	–142.4	4.995	86.1	0.073	46.8	0.470	–49.0
2400	0.456	–148.2	4.588	82.8	0.077	46.8	0.451	–50.0
2600	0.443	–154.2	4.284	79.5	0.080	46.8	0.434	–50.8
2800	0.434	–159.6	4.005	76.5	0.083	47.1	0.419	–51.7
3000	0.428	–164.4	3.749	73.8	0.085	47.6	0.408	–52.4
3200	0.420	–169.2	3.549	71.1	0.088	47.9	0.398	–53.3
3400	0.417	–173.5	3.350	68.6	0.092	48.4	0.389	–54.2
3600	0.413	–177.6	3.181	66.1	0.096	48.4	0.381	–55.2
3800	0.411	178.3	3.031	63.6	0.100	48.9	0.374	–56.1
4000	0.411	174.7	2.886	61.2	0.103	48.8	0.369	–57.1
4200	0.408	171.1	2.764	58.9	0.107	49.2	0.364	–58.2
4400	0.407	167.5	2.645	56.6	0.112	49.0	0.360	–59.5
4600	0.407	164.1	2.535	54.4	0.116	49.4	0.355	–60.6
4800	0.406	160.9	2.438	52.3	0.121	49.0	0.351	–61.9
5000	0.406	157.7	2.344	50.1	0.126	49.0	0.348	–63.3
5200	0.406	154.5	2.263	48.0	0.130	48.9	0.344	–64.5
5400	0.406	151.4	2.187	45.9	0.135	48.6	0.340	–65.9
5600	0.406	148.6	2.112	43.8	0.140	48.4	0.338	–67.5
5800	0.407	145.6	2.044	41.8	0.145	47.8	0.335	–68.9
6000	0.408	142.7	1.980	39.8	0.150	47.6	0.332	–70.3

S Parameters (Common emitter)

V_{CE}=3V, I_C=10mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.770	–23.8	18.909	157.0	0.013	75.5	0.946	–15.3
400	0.720	–44.4	15.969	141.8	0.023	67.8	0.835	–26.7
600	0.608	–70.2	15.986	127.5	0.033	62.3	0.732	–34.3
800	0.546	–87.4	13.664	117.1	0.037	59.7	0.644	–39.9
1000	0.486	–103.0	11.898	108.3	0.043	57.5	0.571	–43.7
1200	0.438	–116.4	10.470	101.1	0.048	56.6	0.516	–46.1
1400	0.410	–126.9	9.173	95.7	0.053	56.2	0.474	–48.1
1600	0.391	–135.6	8.115	91.4	0.057	57.3	0.437	–49.4
1800	0.378	–142.9	7.249	87.6	0.060	56.5	0.409	–50.7
2000	0.368	–149.4	6.551	84.3	0.066	56.8	0.386	–51.5
2200	0.358	–155.5	5.978	81.2	0.070	57.4	0.368	–52.3
2400	0.353	–160.8	5.482	78.4	0.075	57.5	0.352	–53.0
2600	0.348	–165.9	5.076	75.8	0.079	57.7	0.338	–53.7
2800	0.344	–170.6	4.721	73.3	0.084	57.2	0.327	–54.2
3000	0.341	–174.9	4.410	70.9	0.089	57.1	0.318	–54.7
3200	0.338	–178.9	4.150	68.6	0.094	57.0	0.309	–55.4
3400	0.336	177.4	3.914	66.4	0.099	56.5	0.303	–56.3
3600	0.335	173.8	3.706	64.3	0.104	56.4	0.297	–57.2
3800	0.335	170.2	3.520	62.1	0.109	56.1	0.291	–58.0
4000	0.335	167.0	3.353	60.0	0.114	55.5	0.286	–58.9
4200	0.334	163.7	3.199	57.9	0.120	54.8	0.282	–59.9
4400	0.335	160.7	3.061	55.8	0.125	54.3	0.278	–61.1
4600	0.336	157.7	2.933	53.8	0.130	53.6	0.275	–62.2
4800	0.337	154.8	2.819	51.8	0.136	53.1	0.272	–63.4
5000	0.337	151.9	2.709	49.9	0.141	52.2	0.269	–64.8
5200	0.337	149.1	2.612	48.0	0.147	51.5	0.265	–66.0
5400	0.338	146.4	2.521	46.0	0.152	50.7	0.263	–67.4
5600	0.340	143.7	2.436	44.1	0.158	50.1	0.260	–68.8
5800	0.340	141.0	2.355	42.2	0.163	49.0	0.258	–70.3
6000	0.341	138.4	2.283	40.3	0.169	48.2	0.255	–71.7

S Parameters (Common emitter)

V_{CE}=3V, I_C=20mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.604	–33.8	30.487	151.6	0.010	77.2	0.897	–20.3
400	0.523	–63.2	25.012	132.4	0.020	65.5	0.743	–32.8
600	0.423	–90.5	21.161	117.0	0.027	64.2	0.622	–40.0
800	0.377	–108.2	17.068	107.4	0.033	64.0	0.534	–44.4
1000	0.345	–122.3	14.146	100.2	0.038	65.3	0.470	–47.4
1200	0.326	–133.6	11.985	94.8	0.043	64.7	0.421	–49.1
1400	0.314	–142.2	10.335	90.3	0.049	63.4	0.381	–50.3
1600	0.306	–150.0	9.054	86.8	0.053	64.9	0.357	–51.8
1800	0.300	–156.5	8.045	83.6	0.059	64.4	0.333	–52.6
2000	0.297	–162.0	7.244	80.8	0.065	64.5	0.314	–53.1
2200	0.294	–167.4	6.584	78.2	0.070	64.4	0.298	–53.7
2400	0.292	–172.0	6.029	75.7	0.076	64.0	0.285	–54.2
2600	0.290	–176.3	5.565	73.5	0.081	63.6	0.275	–54.7
2800	0.289	179.6	5.168	71.3	0.087	63.3	0.266	–55.1
3000	0.288	176.1	4.822	69.2	0.092	62.8	0.258	–55.6
3200	0.289	172.5	4.529	67.1	0.098	62.1	0.252	–56.4
3400	0.288	169.3	4.267	65.2	0.104	61.2	0.246	–57.2
3600	0.289	166.1	4.040	63.2	0.110	60.7	0.241	–58.2
3800	0.289	163.0	3.834	61.3	0.116	59.9	0.236	–59.1
4000	0.289	160.1	3.647	59.3	0.122	58.6	0.232	–59.8
4200	0.292	157.3	3.482	57.4	0.128	58.2	0.229	–60.9
4400	0.292	154.5	3.329	55.5	0.133	56.8	0.226	–62.1
4600	0.293	152.0	3.187	53.6	0.140	56.0	0.223	–63.2
4800	0.294	149.2	3.063	51.7	0.145	55.1	0.221	–64.5
5000	0.295	146.6	2.942	49.9	0.152	54.0	0.218	–65.8
5200	0.296	143.9	2.836	48.0	0.157	53.0	0.216	–67.0
5400	0.298	141.5	2.735	46.2	0.163	51.9	0.213	–68.6
5600	0.299	139.1	2.644	44.4	0.169	50.8	0.211	–69.9
5800	0.300	136.7	2.556	42.7	0.175	49.9	0.209	–71.3
6000	0.301	134.1	2.473	40.9	0.181	48.6	0.206	–72.8

S Parameters (Common emitter)

V_{CE}=3V, I_C=30mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.477	–42.7	37.774	147.8	0.012	73.4	0.862	–22.1
400	0.398	–77.5	29.431	126.6	0.019	69.1	0.693	–35.3
600	0.338	–103.2	22.957	112.6	0.025	69.6	0.569	–41.9
800	0.312	–120.2	18.116	103.7	0.030	68.3	0.485	–45.8
1000	0.296	–133.1	14.796	97.3	0.035	69.7	0.426	–48.1
1200	0.287	–142.9	12.448	92.4	0.042	68.5	0.382	–49.9
1400	0.282	–150.3	10.705	88.2	0.048	69.5	0.349	–51.0
1600	0.280	–157.8	9.325	85.2	0.053	68.8	0.324	–52.0
1800	0.276	–163.8	8.283	82.3	0.059	68.1	0.303	–52.5
2000	0.275	–168.8	7.453	79.6	0.065	68.0	0.286	–53.0
2200	0.275	–173.7	6.767	77.2	0.071	67.3	0.272	–53.7
2400	0.274	–177.8	6.195	74.9	0.077	66.6	0.260	–54.2
2600	0.274	178.2	5.720	72.7	0.083	66.3	0.251	–54.6
2800	0.273	174.6	5.306	70.6	0.089	65.5	0.243	–55.0
3000	0.274	171.5	4.949	68.7	0.095	64.9	0.236	–55.7
3200	0.274	168.1	4.644	66.7	0.100	64.1	0.230	–56.3
3400	0.275	165.1	4.376	64.8	0.106	62.8	0.225	–57.2
3600	0.275	162.3	4.141	62.9	0.113	62.3	0.221	–58.2
3800	0.277	159.2	3.930	61.0	0.119	61.0	0.217	–58.9
4000	0.278	156.7	3.741	59.1	0.125	59.9	0.214	–60.0
4200	0.280	154.1	3.568	57.2	0.131	58.9	0.210	–61.0
4400	0.280	151.3	3.409	55.4	0.137	57.9	0.208	–61.9
4600	0.281	149.0	3.267	53.6	0.143	56.8	0.206	–63.3
4800	0.283	146.3	3.139	51.7	0.149	55.8	0.202	–64.8
5000	0.284	143.9	3.017	50.0	0.155	54.5	0.200	–65.8
5200	0.285	141.6	2.906	48.2	0.161	53.5	0.198	–67.2
5400	0.287	138.9	2.801	46.4	0.168	52.5	0.194	–68.7
5600	0.288	136.9	2.707	44.6	0.173	51.3	0.194	–70.1
5800	0.290	134.3	2.617	42.9	0.179	50.0	0.191	–71.9
6000	0.290	132.0	2.532	41.1	0.185	49.0	0.188	–73.3

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