Ordering number : ENN6580

NPN Epitaxial Planar Silicon Transistor

EC3H04C

High-Frequency Low-Noise Amplifier and OSC Applications

Features

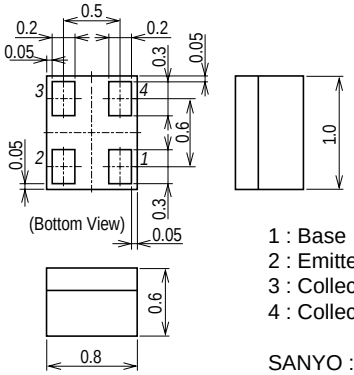
- Low noise : NF=1.7dB typ (f=2GHz).
- Hige cut-off frequency : f_T=8GHz typ (V_{CE}=1V).
- Low operating voltage.
- Ultraminiature (1008 size) and thin (0.6mm) leadless package.

Package Dimensions

unit : mm

2184

[EC3H04C]



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

SANYO : E-CSP1008-4

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}		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}=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}=1V, I_C=10mA	100		180	
Gain-Bandwidth Product	f_T	V_{CE}=1V, I_C=10mA	6	8		GHz
Output Capacitance	Cob	V_{CB}=1V, f=1MHz		1.1	1.5	pF
Reverse Transfer Capacitance	Cre	V_{CB}=1V, f=1MHz		0.85		pF
Forward Transfer Gain	$\|S21e\|^2_1$	V_{CE}=1V, I_C=10mA, f=2GHz	4	5		dB
	$\|S21e\|^2_2$	V_{CE}=3V, I_C=20mA, f=1GHz		12		dB
Noise Figure	NF	V_{CE}=1V, I_C=10mA, f=2GHz		1.7	2.5	dB

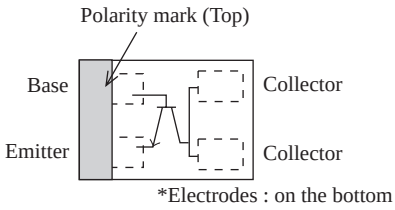
SANYO Electric Co.,Ltd. Semiconductor Company

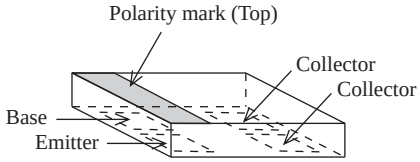
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

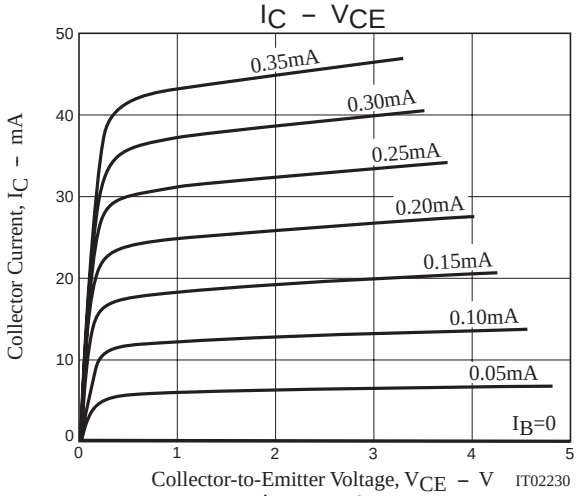
Type No. Indication (Top view)

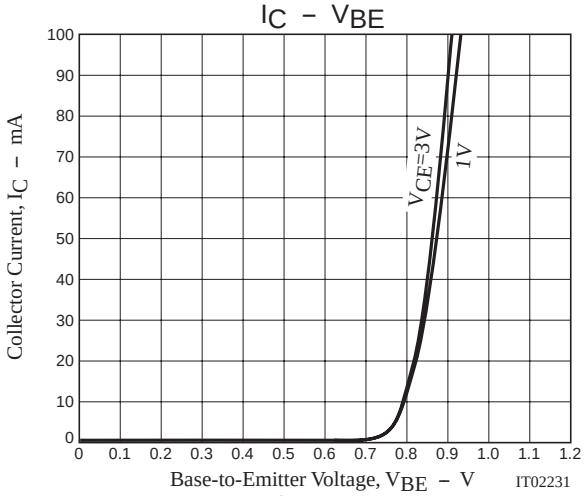
This product adopts a high-frequency process. Please be careful when handling it beause it is susceptible to static electricity.

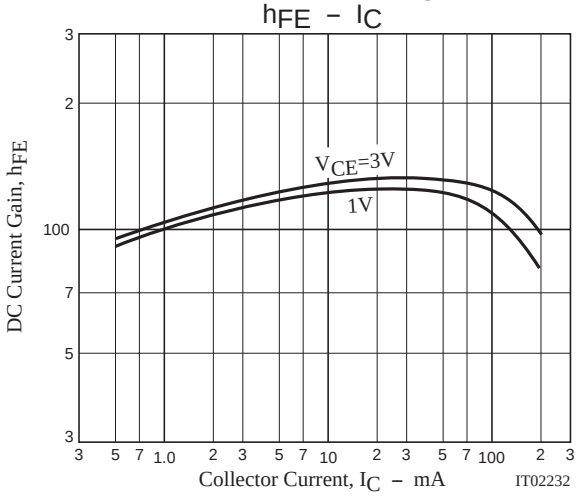
Electrical Connection (Top view)

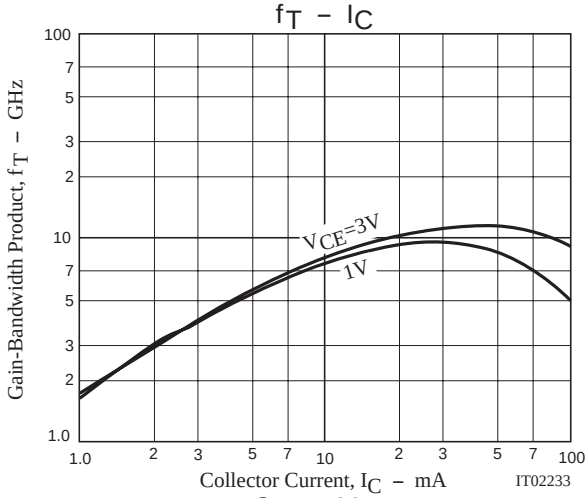


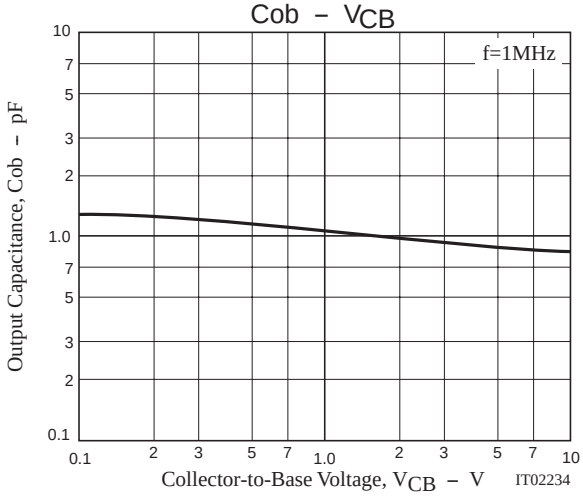


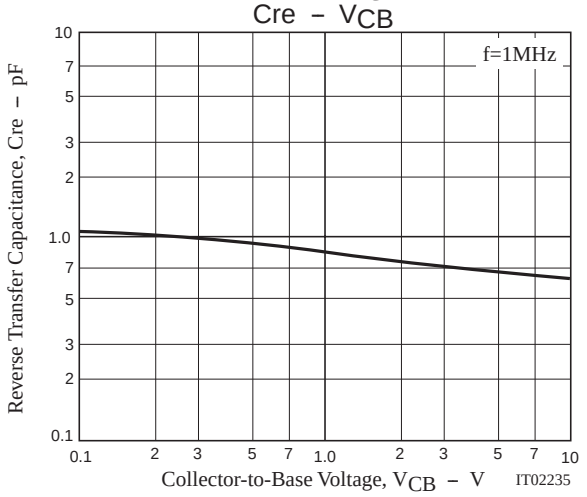


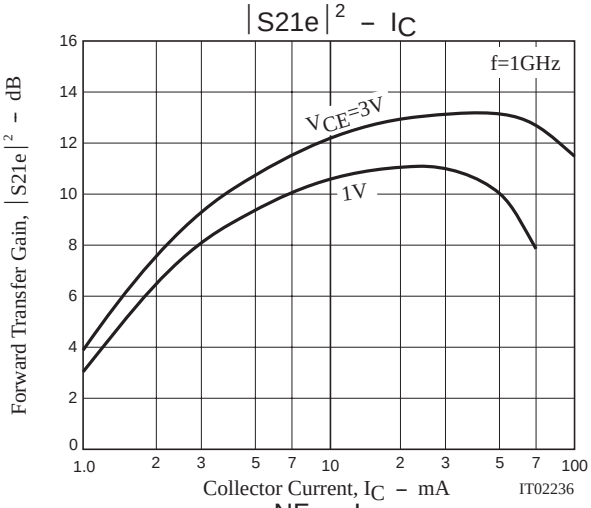


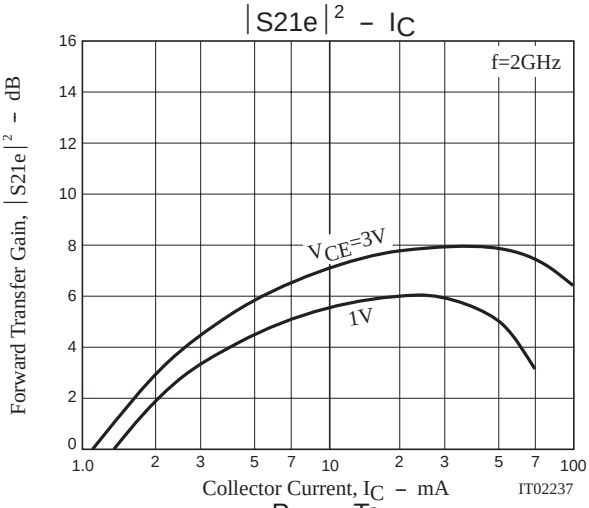


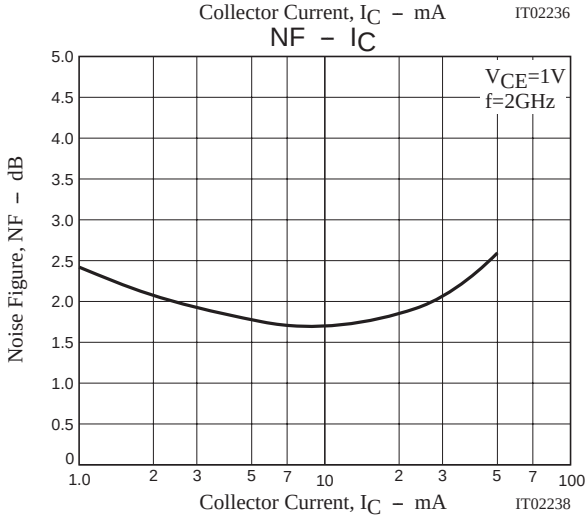


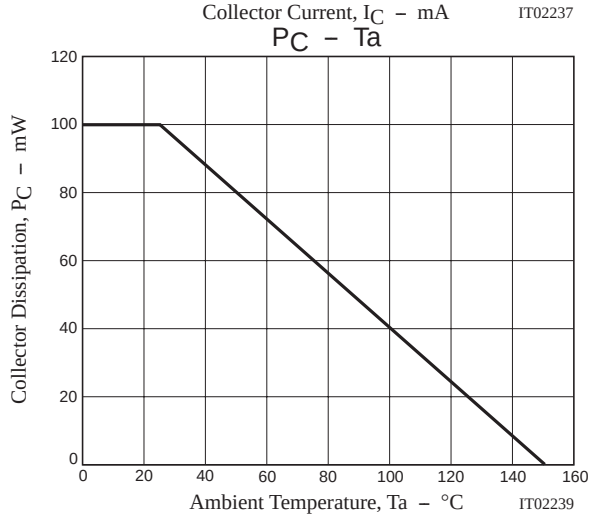












S Parameters (Common emitter)

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	0.925	–41.9	2.875	149.0	0.113	63.2	0.913	–21.9
400	0.835	–78.1	2.702	124.4	0.180	43.8	0.780	–36.1
600	0.758	–101.3	2.125	106.7	0.201	31.3	0.660	–44.2
800	0.716	–115.7	1.584	97.7	0.218	21.4	0.613	–50.5
1000	0.729	–129.3	1.443	83.8	0.224	16.9	0.560	–58.6
1200	0.706	–140.2	1.328	74.8	0.217	13.4	0.550	–62.4
1400	0.707	–146.9	1.142	67.8	0.209	9.9	0.569	–66.0
1600	0.716	–151.9	0.980	61.1	0.203	7.2	0.548	–72.5
1800	0.698	–157.2	0.871	53.1	0.196	4.9	0.529	–77.0
2000	0.702	–164.2	0.877	52.1	0.177	9.6	0.560	–84.6
2200	0.700	–167.0	0.759	42.9	0.173	5.7	0.536	–87.6
2400	0.704	–172.3	0.744	43.0	0.156	13.7	0.588	–94.5
2600	0.704	–175.5	0.673	35.5	0.150	12.7	0.553	–98.5
2800	0.708	–179.8	0.652	35.8	0.143	23.7	0.615	–104.0
3000	0.709	177.0	0.604	30.5	0.142	25.3	0.575	–109.0

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	0.744	–82.8	10.317	130.5	0.083	49.0	0.696	–53.9
400	0.670	–122.0	6.592	108.4	0.105	36.0	0.462	–79.7
600	0.618	–141.5	4.594	98.8	0.112	32.7	0.344	–93.5
800	0.624	–152.3	3.565	90.3	0.122	32.6	0.297	–104.0
1000	0.627	–160.5	2.967	82.3	0.126	34.6	0.278	–111.7
1200	0.623	–165.9	2.504	76.9	0.132	37.0	0.265	–118.5
1400	0.621	–170.1	2.167	72.1	0.140	39.1	0.258	–124.4
1600	0.621	–174.2	1.932	67.6	0.148	40.3	0.261	–127.6
1800	0.614	–177.8	1.731	64.0	0.158	42.3	0.263	–131.6
2000	0.619	179.2	1.590	60.1	0.165	44.1	0.269	–133.5
2200	0.615	176.1	1.464	56.3	0.175	45.6	0.278	–137.0
2400	0.618	173.8	1.367	52.9	0.186	47.0	0.284	–138.7
2600	0.616	170.6	1.283	49.4	0.197	48.1	0.300	–141.1
2800	0.619	168.7	1.209	46.5	0.209	48.6	0.302	–143.1
3000	0.619	165.8	1.150	43.2	0.221	49.2	0.319	–144.9

V_{CE}=1V, I_C=10mA, Z_O=50Ω

Freq(MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
200	0.661	–108.8	13.770	119.9	0.064	44.3	0.568	–77.3
400	0.631	–141.8	7.901	101.6	0.078	39.0	0.383	–108.6
600	0.610	–156.0	5.378	94.8	0.088	40.0	0.311	–125.2
800	0.610	–164.7	4.111	87.7	0.099	44.1	0.288	–136.7
1000	0.616	–170.2	3.376	81.1	0.109	47.8	0.283	–144.2
1200	0.615	–174.4	2.848	76.4	0.122	50.3	0.280	–149.7
1400	0.613	–177.9	2.468	72.3	0.134	52.1	0.280	–154.3
1600	0.613	179.0	2.191	68.5	0.148	53.1	0.281	–156.9
1800	0.608	176.0	1.967	65.4	0.162	53.6	0.284	–159.6
2000	0.608	173.6	1.791	61.9	0.175	54.2	0.286	–161.4
2200	0.607	170.9	1.659	58.6	0.188	54.7	0.294	–163.0
2400	0.606	168.8	1.540	55.3	0.202	54.4	0.296	–164.8
2600	0.606	166.2	1.450	52.4	0.217	54.1	0.303	–165.3
2800	0.605	164.3	1.365	49.2	0.231	53.9	0.306	–167.0
3000	0.607	162.0	1.297	46.5	0.245	53.2	0.313	–167.6

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	0.623	–131.3	15.796	111.7	0.048	43.6	0.484	–100.8
400	0.623	–156.5	8.545	96.9	0.061	45.9	0.370	–132.7
600	0.613	–166.4	5.750	91.9	0.074	50.6	0.333	–147.4
800	0.615	–172.4	4.375	86.0	0.089	54.4	0.326	–156.2
1000	0.620	–176.6	3.571	80.0	0.103	58.0	0.328	–162.1
1200	0.619	–180.0	3.011	75.9	0.120	59.8	0.328	–166.1
1400	0.617	177.0	2.609	72.2	0.136	60.8	0.329	–169.3
1600	0.616	174.5	2.311	68.8	0.152	60.9	0.330	–171.7
1800	0.613	171.9	2.072	66.0	0.168	60.3	0.332	–174.0
2000	0.611	169.7	1.889	62.8	0.183	60.0	0.334	–175.5
2200	0.609	167.4	1.745	59.6	0.199	59.5	0.335	–176.8
2400	0.608	165.3	1.624	56.6	0.215	58.6	0.337	–178.2
2600	0.608	163.0	1.524	53.8	0.230	57.8	0.341	–179.0
2800	0.605	161.2	1.439	50.9	0.246	56.7	0.342	179.8
3000	0.606	159.3	1.365	48.2	0.261	55.6	0.344	179.1

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	0.932	–38.6	3.040	152.2	0.088	65.7	0.943	–16.1
400	0.868	–69.7	2.804	129.9	0.143	47.6	0.845	–27.4
600	0.767	–92.6	2.258	113.8	0.166	33.5	0.733	–33.9
800	0.750	–111.5	1.795	101.5	0.187	27.4	0.671	–43.1
1000	0.736	–125.2	1.690	89.7	0.189	21.1	0.649	–47.0
1200	0.731	–134.4	1.409	80.9	0.182	17.0	0.631	–50.2
1400	0.734	–141.5	1.161	73.6	0.181	14.2	0.605	–55.7
1600	0.720	–148.8	1.098	66.8	0.179	10.9	0.587	–61.7
1800	0.708	–154.8	1.000	60.3	0.166	11.7	0.590	–65.4
2000	0.707	–160.8	0.926	57.7	0.154	12.4	0.598	–70.5
2200	0.704	–164.9	0.868	49.7	0.146	14.0	0.594	–75.1
2400	0.711	–170.0	0.784	49.1	0.137	18.1	0.612	–80.3
2600	0.703	–173.6	0.775	41.7	0.129	22.6	0.607	–85.1
2800	0.715	–177.9	0.677	41.8	0.127	29.7	0.629	–89.8
3000	0.702	178.8	0.703	36.0	0.126	36.4	0.627	–95.1

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	0.762	–71.5	11.124	135.7	0.068	53.9	0.752	–41.9
400	0.670	–111.1	7.542	113.1	0.090	40.4	0.516	–61.8
600	0.604	–132.1	5.338	102.6	0.100	35.6	0.379	–70.5
800	0.605	–145.2	4.172	93.9	0.108	36.0	0.320	–78.9
1000	0.604	–154.3	3.488	85.6	0.113	37.6	0.286	–84.5
1200	0.601	–160.4	2.943	80.0	0.118	39.7	0.264	–88.7
1400	0.599	–165.3	2.535	75.2	0.125	41.7	0.251	–93.6
1600	0.597	–169.8	2.265	70.8	0.133	43.7	0.247	–98.3
1800	0.590	–173.6	2.027	67.0	0.140	45.8	0.244	–101.4
2000	0.594	–177.1	1.853	63.4	0.150	47.8	0.250	–105.1
2200	0.590	179.9	1.711	59.2	0.158	49.5	0.253	–108.4
2400	0.594	177.0	1.584	56.1	0.168	50.8	0.264	–111.4
2600	0.593	174.1	1.493	52.3	0.179	51.9	0.270	–114.9
2800	0.597	171.7	1.393	49.5	0.191	53.0	0.281	–117.2
3000	0.594	169.0	1.333	46.1	0.203	53.6	0.290	–120.8

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	0.660	–94.3	15.608	125.5	0.054	49.6	0.618	–60.0
400	0.603	–131.8	9.377	105.6	0.069	42.5	0.389	–84.8
600	0.572	–148.7	6.448	97.9	0.079	43.2	0.284	–97.7
800	0.570	–158.0	4.947	90.6	0.089	46.3	0.242	–108.4
1000	0.576	–164.8	4.073	83.7	0.099	49.9	0.223	–116.7
1200	0.575	–169.6	3.433	78.9	0.110	52.4	0.211	–122.8
1400	0.572	–173.7	2.965	74.9	0.121	54.5	0.205	–128.1
1600	0.571	–177.1	2.628	71.0	0.134	55.7	0.205	–131.6
1800	0.568	179.7	2.353	67.9	0.146	56.4	0.205	–135.1
2000	0.569	177.2	2.141	64.5	0.158	56.9	0.208	–137.3
2200	0.568	174.4	1.977	61.1	0.172	57.3	0.214	–139.7
2400	0.568	172.2	1.828	57.9	0.185	57.6	0.219	–141.3
2600	0.569	169.5	1.718	54.8	0.198	57.4	0.228	–143.1
2800	0.569	167.6	1.611	51.8	0.212	57.4	0.233	–144.4
3000	0.572	165.4	1.530	49.0	0.226	56.9	0.242	–145.8

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	0.587	–116.9	18.878	117.0	0.042	48.5	0.505	–78.6
400	0.571	–147.6	10.531	100.4	0.055	48.9	0.325	–107.8
600	0.556	–160.0	7.129	94.6	0.068	52.3	0.256	–123.6
800	0.558	–167.1	5.430	88.4	0.081	55.9	0.234	–135.0
1000	0.564	–172.2	4.435	82.3	0.094	60.1	0.227	–143.1
1200	0.563	–175.9	3.735	78.1	0.108	61.6	0.224	–148.6
1400	0.561	–179.2	3.225	74.5	0.123	62.8	0.222	–152.9
1600	0.561	178.1	2.853	71.1	0.138	62.9	0.223	–155.7
1800	0.558	175.3	2.549	68.3	0.153	62.6	0.224	–158.4
2000	0.558	173.1	2.320	65.2	0.167	62.3	0.227	–160.2
2200	0.558	170.8	2.136	62.1	0.183	62.0	0.230	–161.5
2400	0.556	168.7	1.981	59.0	0.197	61.3	0.234	–163.0
2600	0.558	166.4	1.854	56.2	0.212	60.6	0.241	–163.6
2800	0.557	164.7	1.743	53.3	0.226	59.7	0.243	–164.5
3000	0.559	162.6	1.648	50.7	0.240	58.6	0.249	–165.2