To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Not recommend for new design

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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Not recommend for new design

RENESAS

SILICON TRANSISTOR
2SC5195

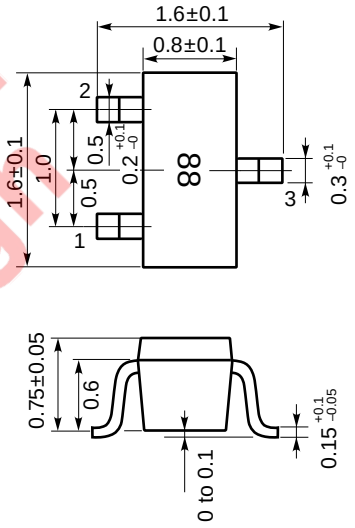
MICROWAVE LOW NOISE AMPLIFIER
NPN SILICON EPITAXIAL TRANSISTOR

FEATURES

- Low Voltage Operation, Low Phase Distortion
- Low Noise
  NF = 1.5 dB TYP. @V_{CE} = 3 V, I_C = 7 mA, f = 2 GHz
  NF = 1.5 dB TYP. @V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz
- Large Absolute Maximum Collector Current
  I_C = 100 mA
- Supercompact Mini Mold Package

PACKAGE DRAWINGS

(Unit: mm)



PIN CONNECTIONS
1. Emitter
2. Base
3. Collector

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
2SC5195	In-bulk products (50 pcs.)	Embossed tape 8 mm wide. Pin 3 (Collector) face to perforation side of the tape.
2SC5195-T1	Taped products (3 Kpcs/Reel)	

Remark If you require an evaluation sample, please contact an NEC Sales Representative. (Unit sample quantity is 50 pcs.)

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ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

PARAMETER	SYMBOL	RATING	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
Total Power Dissipation	P_T	125	mW
Junction Temperature	T_j	150	˚C
Storage Temperature	T_{stg}	–65 to +150	˚C

This device uses radio frequency technology. Take due precautions to protect it from excessive input levels such as static electricity.

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ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cutoff Current	I_{CBO}	V_{CB} = 5 V, I_E = 0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB} = 1 V, I_C = 0			100	nA
DC Current Gain	h_{FE}	V_{CE} = 1 V, I_C = 3 mA[Note 1]	80		160	
Insertion Power Gain	$\|S_{21e}\|^2$	V_{CE} = 1 V, I_C = 3 mA, f = 2.0 GHz	3	4		dB
Insertion Power Gain (1)	$\|S_{21e}\|^2$	V_{CE} = 3 V, I_C = 20 mA, f = 2.0 GHz		8		dB
Noise Figure (2)	NF	V_{CE} = 1 V, I_C = 3 mA, f = 2.0 GHz		1.7	2.5	dB
Noise Figure (1)	NF	V_{CE} = 3 V, I_C = 7 mA, f = 2.0 GHz		1.5		dB
Gain Bandwidth Product (2)	f_T	V_{CE} = 1 V, I_C = 3 mA, f = 2.0 GHz	4.5	5		GHz
Gain Bandwidth Product (1)	f_T	V_{CE} = 3 V, I_C = 20 mA, f = 2.0 GHz		9.5		GHz
Collector Capacitance	C_{re}	V_{CB} = 1 V, I_E = 0, f = 1.0 MHz[Note 2]		0.7	0.8	pF

Notes 1. Pulse Measurement: PW ≤ 350 μs, Duty cycle ≤ 2 %, Pulsed

2. Measured with 3-pin bridge, emitter and case should be connected to guard pin of bridge.

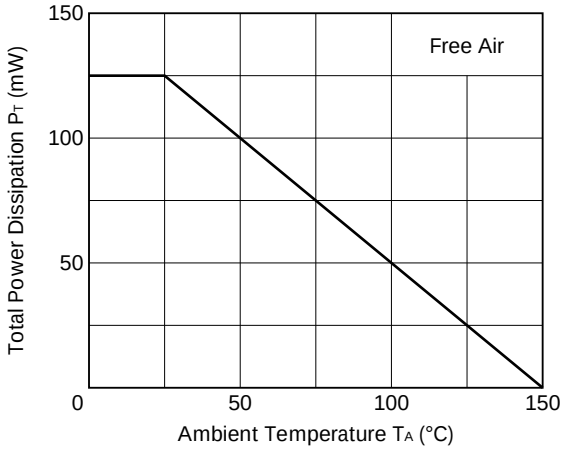
h_{FE} Classification

Rank	FB
Marking	88
h_{FE}	80 to 160

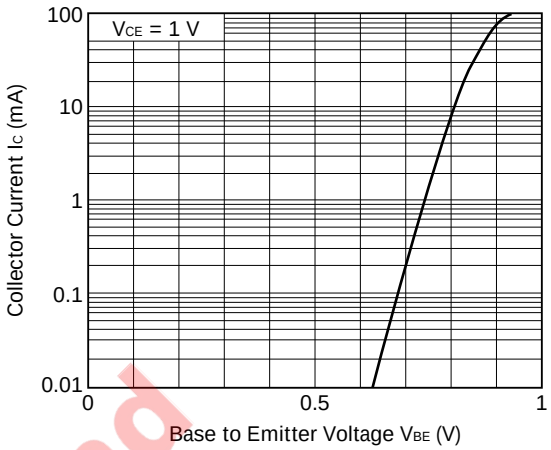
Not recommend for new design

TYPICAL CHARACTERISTICS (T_A = 25 °C)

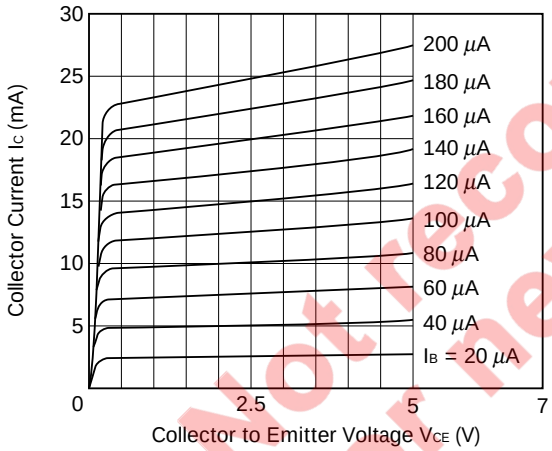
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



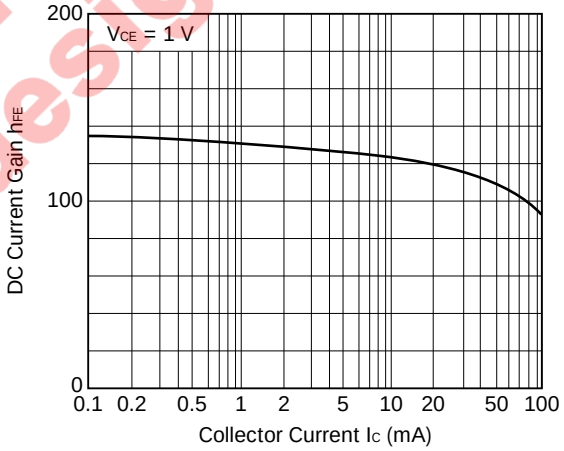
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



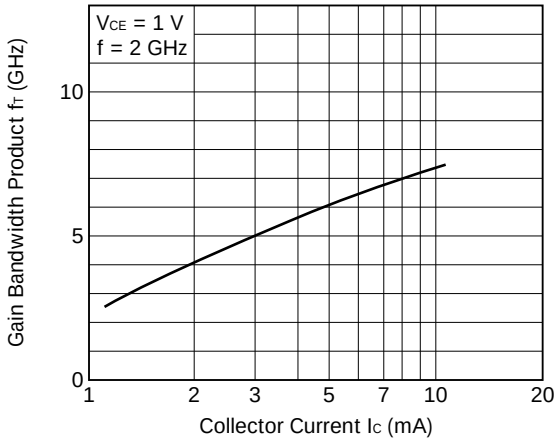
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



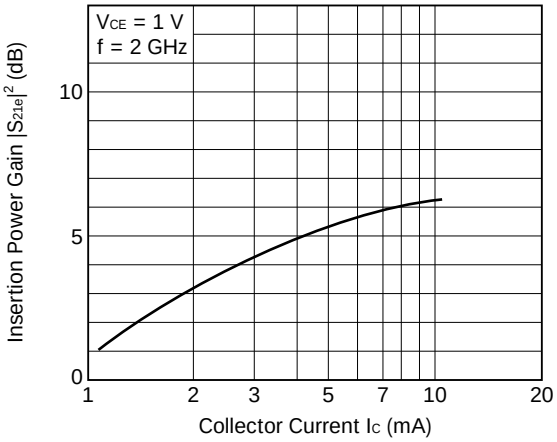
DC CURENT GAIN vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

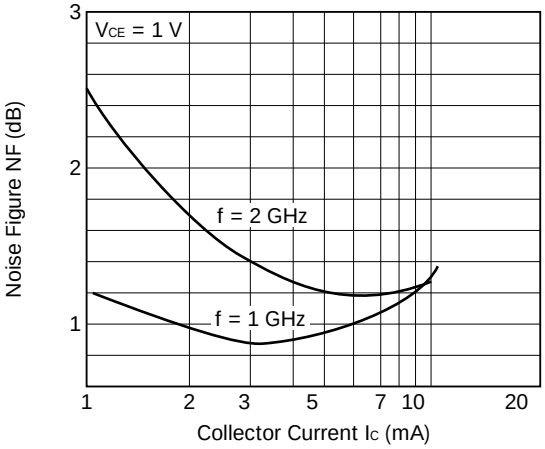


INSERTION GAIN vs. COLLECTOR CURRENT

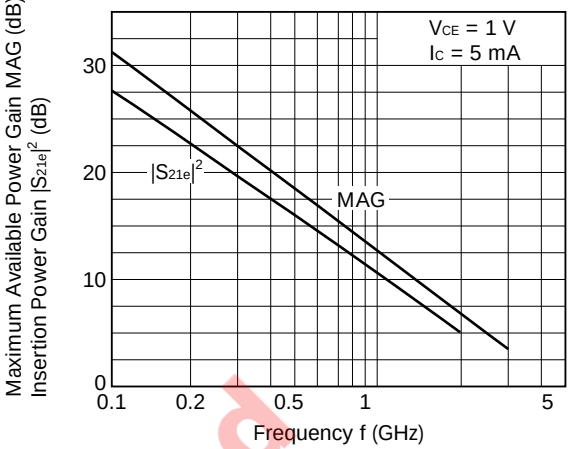


Not recommend for new design

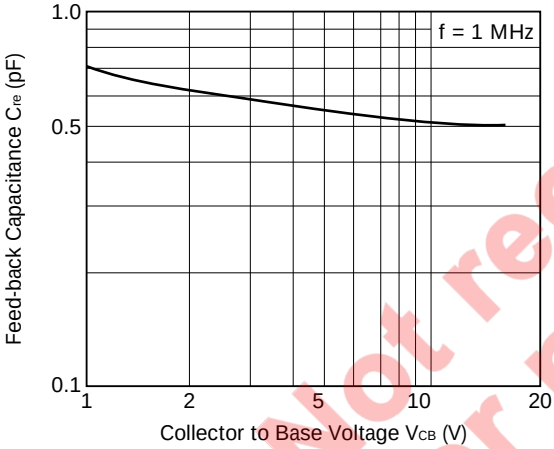
NOISE FIGURE vs.
COLLECTOR CURRENT



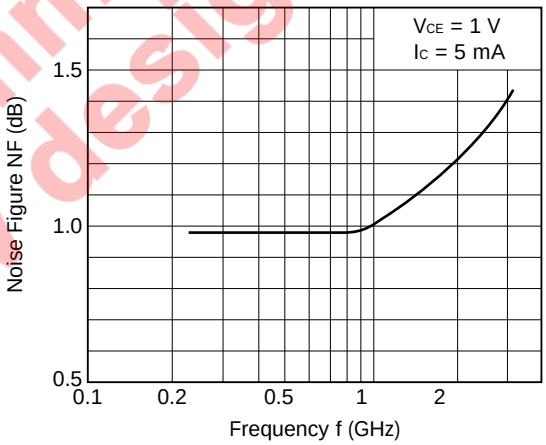
MAXIMUM AVAILABLE GAIN / INSERTION
POWER GAIN vs. FREQUENCY



FEED-BACK CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE



NOISE FIGURE vs. FREQUENCY



Not recommend for new design

S-PARAMETERS

V_{CE} = 1 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.996	–19.0	3.632	166.2	0.039	66.4	0.989	–7.6
200.00	0.960	–37.5	3.266	153.8	0.096	63.3	0.944	–17.9
300.00	0.959	–35.2	3.200	140.1	0.141	56.6	0.884	–27.3
400.00	0.934	–69.6	3.015	128.0	0.172	48.5	0.837	–33.3
500.00	0.848	–83.7	2.686	119.0	0.187	40.4	0.785	–38.9
600.00	0.768	–92.1	2.409	113.0	0.200	36.4	0.748	–40.8
700.00	0.763	–104.0	2.226	105.1	0.216	30.6	0.710	–46.6
800.00	0.733	–116.4	2.025	97.7	0.219	25.8	0.637	–47.7
900.00	0.697	–124.6	1.848	90.5	0.220	23.2	0.604	–51.2
1000.00	0.678	–137.7	1.703	86.1	0.218	21.1	0.361	–52.7
1100.00	0.667	–138.0	1.560	80.4	0.218	17.3	0.534	–57.6
1200.00	0.673	–147.0	1.510	75.9	0.212	13.7	0.514	–62.6
1300.00	0.676	–153.6	1.359	71.8	0.209	10.7	0.492	–64.8
1400.00	0.689	–160.2	1.270	70.0	0.207	9.7	0.478	–63.7
1500.00	0.671	–166.1	1.265	61.1	0.214	8.2	0.483	–69.4
1600.00	0.644	–170.8	1.240	55.7	0.213	8.9	0.471	–73.4
1700.00	0.649	–176.4	1.174	51.7	0.205	9.2	0.460	–75.1
1800.00	0.605	176.0	1.183	49.6	0.197	11.7	0.450	–79.2
1900.00	0.633	171.5	1.100	47.0	0.192	12.1	0.440	–82.6
2000.00	0.640	165.5	1.034	45.8	0.184	13.3	0.442	–86.1

V_{CE} = 1 V, I_C = 3 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.901	–31.1	9.543	159.0	0.034	54.0	0.961	–16.2
200.00	0.830	–59.6	8.103	141.0	0.086	54.4	0.833	–34.0
300.00	0.784	–82.6	7.226	124.9	0.114	47.5	0.713	–48.5
400.00	0.715	–99.4	6.213	113.7	0.129	42.1	0.612	–56.1
500.00	0.643	–114.2	4.933	106.2	0.134	38.1	0.526	–61.0
600.00	0.600	–125.5	4.331	101.2	0.141	36.4	0.481	–62.6
700.00	0.590	–136.3	3.869	94.3	0.149	33.6	0.437	–69.4
800.00	0.568	–147.0	3.448	88.3	0.151	32.7	0.368	–72.6
900.00	0.536	–153.2	3.051	83.5	0.153	32.9	0.332	–75.3
1000.00	0.535	–160.4	2.791	80.1	0.157	33.4	0.304	–77.1
1100.00	0.571	–166.9	2.349	73.8	0.160	32.5	0.299	–81.3
1200.00	0.536	–173.3	2.398	72.1	0.161	31.8	0.280	–88.2
1300.00	0.547	179.9	2.211	68.4	0.164	31.3	0.255	–91.3
1400.00	0.536	178.2	2.098	65.8	0.169	31.6	0.241	–95.0
1500.00	0.550	172.3	2.031	60.4	0.180	31.2	0.236	–95.7
1600.00	0.528	169.3	1.920	56.3	0.189	32.1	0.231	–100.8
1700.00	0.534	163.8	1.840	32.8	0.194	33.4	0.217	–105.1
1800.00	0.517	158.2	1.740	51.4	0.198	35.5	0.214	110.3
1900.00	0.541	154.5	1.654	47.4	0.202	36.2	0.211	–115.4
2000.00	0.550	150.2	1.558	48.0	0.203	36.7	0.216	–118.6

Not recommend for new design

V_{CE} = 1 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.812	–40.5	13.835	153.5	0.036	51.3	0.914	–22.7
200.00	0.733	–74.9	11.096	132.3	0.078	48.7	0.742	–43.0
300.00	0.672	–99.8	8.862	116.3	0.097	45.0	0.599	–61.4
400.00	0.604	–117.1	7.167	106.1	0.106	42.9	0.489	–69.5
500.00	0.539	–131.2	5.890	100.2	0.111	41.1	0.404	–74.3
600.00	0.540	–142.3	5.131	95.6	0.119	41.2	0.361	–75.8
700.00	0.532	–151.5	4.515	89.5	0.126	40.0	0.329	–83.5
800.00	0.513	–160.7	3.985	84.6	0.130	40.3	0.274	–89.3
900.00	0.498	–165.9	3.496	80.4	0.136	41.3	0.242	–93.2
1000.00	0.493	–172.6	3.196	77.4	0.144	42.1	0.220	–95.3
1100.00	0.483	–179.2	2.924	73.5	0.150	41.9	0.219	–99.1
1200.00	0.501	176.0	2.736	70.2	0.154	41.7	0.211	–107.3
1300.00	0.510	170.3	2.514	66.8	0.160	41.1	0.192	–112.5
1400.00	0.519	169.4	2.390	64.2	0.168	41.2	0.178	–117.6
1500.00	0.518	164.2	2.296	59.6	0.180	40.5	0.173	–119.2
1600.00	0.498	161.6	2.164	56.0	0.193	40.4	0.175	–125.0
1700.00	0.506	136.6	2.066	52.7	0.201	41.3	0.168	–132.1
1800.00	0.496	131.7	1.942	51.7	0.209	42.7	0.172	–137.9
1900.00	0.518	148.3	1.848	49.3	0.215	42.9	0.174	–143.2
2000.00	0.526	144.5	1.751	48.6	0.220	42.8	0.181	–145.3

V_{CE} = 1 V, I_C = 7 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.723	–48.8	17.674	148.0	0.040	43.6	0.869	–27.4
200.00	0.656	–88.8	13.024	125.3	0.069	46.3	0.656	–54.8
300.00	0.396	–114.3	10.093	110.2	0.082	44.9	0.510	–71.8
400.00	0.338	–131.1	7.935	101.3	0.092	44.8	0.406	–80.4
500.00	0.514	–143.7	6.491	96.3	0.098	45.6	0.327	–86.1
600.00	0.509	–153.9	5.611	92.0	0.107	46.7	0.288	–87.8
700.00	0.502	–161.6	4.884	86.5	0.115	46.3	0.269	–96.1
800.00	0.488	–169.7	4.301	82.1	0.121	46.7	0.226	–104.6
900.00	0.465	–174.3	3.766	78.5	0.129	47.9	0.200	–110.2
1000.00	0.473	179.6	3.446	75.7	0.139	48.5	0.181	–112.9
1100.00	0.467	173.2	3.139	72.1	0.147	48.3	0.183	–115.7
1200.00	0.485	169.4	2.924	69.1	0.154	47.8	0.184	–174.5
1300.00	0.494	164.3	2.690	65.9	0.161	47.1	0.170	–131.3
1400.00	0.502	164.1	2.561	63.4	0.171	46.8	0.160	–137.7
1500.00	0.504	159.1	2.445	59.0	0.184	45.7	0.155	–140.4
1600.00	0.485	156.9	2.307	53.7	0.198	45.1	0.163	–145.6
1700.00	0.493	152.2	2.200	52.6	0.207	45.6	0.162	–153.3
1800.00	0.487	147.7	2.063	51.8	0.217	46.3	0.172	–158.2
1900.00	0.509	144.7	1.964	50.0	0.224	46.4	0.176	–162.6
2000.00	0.517	141.1	1.854	48.9	0.230	46.0	0.184	–163.6

Not recommend for new design

V_{CE} = 1 V, I_C = 10 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.639	–61.3	20.675	147.3	0.035	48.8	0.804	–36.3
200.00	0.590	–102.5	14.774	119.3	0.061	44.7	0.574	–63.1
300.00	0.541	–127.6	10.985	105.4	0.073	46.2	0.440	–81.7
400.00	0.498	–143.4	8.497	97.6	0.082	48.6	0.345	–91.1
500.00	0.487	–154.2	6.903	93.3	0.090	50.6	0.273	–98.0
600.00	0.492	–163.1	5.954	89.4	0.100	52.1	0.239	–100.0
700.00	0.485	–169.6	5.156	84.3	0.109	51.9	0.230	–108.6
800.00	0.473	–176.8	4.503	80.3	0.117	52.2	0.202	–119.4
900.00	0.451	179.1	3.934	77.1	0.126	53.0	0.181	–126.3
1000.00	0.462	173.5	3.602	74.4	0.138	53.2	0.165	–129.6
1100.00	0.459	167.6	3.283	71.1	0.148	52.9	0.168	–131.0
1200.00	0.477	164.4	3.050	68.3	0.156	52.2	0.175	–139.3
1300.00	0.484	160.0	2.814	65.2	0.164	51.3	0.167	–147.1
1400.00	0.491	160.0	2.674	62.8	0.175	50.5	0.160	–154.1
1500.00	0.496	155.4	2.551	58.7	0.188	49.2	0.157	–157.1
1600.00	0.477	153.3	2.401	55.4	0.203	48.1	0.167	–161.0
1700.00	0.486	149.0	2.287	52.5	0.213	48.4	0.172	–168.2
1800.00	0.482	144.7	2.141	51.8	0.224	48.9	0.185	–171.8
1900.00	0.503	141.9	2.042	50.1	0.231	48.7	0.190	–175.4
2000.00	0.512	138.5	1.927	49.1	0.238	48.0	0.198	–175.5

V_{CE} = 3 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	1.007	–16.8	3.616	167.8	0.022	69.7	1.001	–5.4
200.00	0.975	–32.9	3.279	157.4	0.071	63.6	0.963	–13.4
300.00	0.977	–48.7	3.255	145.0	0.104	59.0	0.913	–20.9
400.00	0.962	–62.1	3.126	133.6	0.131	55.2	0.886	–25.4
500.00	0.881	–75.6	2.830	124.9	0.145	45.7	0.845	–30.3
600.00	0.797	–83.0	2.349	119.3	0.155	41.8	0.816	–31.5
700.00	0.792	–94.6	2.374	112.1	0.169	36.4	0.792	–36.4
800.00	0.756	–107.0	2.164	105.0	0.172	31.3	0.726	–37.0
900.00	0.721	–115.7	1.995	97.8	0.175	28.9	0.696	–39.7
1000.00	0.699	–123.7	1.839	93.4	0.174	27.0	0.652	–40.1
1100.00	0.688	–129.2	1.679	88.0	0.173	23.4	0.648	–44.7
1200.00	0.687	–138.5	1.636	83.5	0.169	20.0	0.597	–48.6
1300.00	0.685	–147.5	1.478	80.0	0.168	17.3	0.583	–50.2
1400.00	0.694	–153.3	1.419	78.7	0.166	16.4	0.568	–53.8
1500.00	0.674	–159.1	1.376	69.5	0.171	15.0	0.579	–54.5
1600.00	0.647	–164.2	1.352	63.9	0.170	15.9	0.567	–57.9
1700.00	0.654	–169.9	1.253	60.0	0.165	16.5	0.558	–58.9
1800.00	0.599	–177.9	1.296	57.1	0.158	19.6	0.546	–61.9
1900.00	0.630	177.0	1.199	54.8	0.156	20.8	0.533	–63.7
2000.00	0.630	170.4	1.129	53.0	0.149	22.6	0.533	–67.2

Not recommend for new design

V_{CE} = 3 V, I_C = 3 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.917	–25.8	9.668	161.9	0.022	49.8	0.976	–11.1
200.00	0.852	–49.6	8.385	146.2	0.064	56.6	0.883	–24.7
300.00	0.808	–70.7	7.736	130.9	0.088	52.8	0.778	–36.0
400.00	0.742	–86.4	6.482	119.3	0.103	47.0	0.695	–41.4
500.00	0.657	–101.0	5.525	111.8	0.109	43.1	0.621	–45.2
600.00	0.594	–111.4	4.878	106.9	0.114	42.0	0.579	–45.6
700.00	0.578	–122.9	4.396	100.2	0.121	39.2	0.537	–50.4
800.00	0.553	–134.5	3.948	94.4	0.123	37.7	0.469	–51.0
900.00	0.517	–141.4	3.515	89.0	0.127	38.1	0.434	–52.3
1000.00	0.506	–149.2	3.201	85.6	0.130	38.6	0.402	–52.1
1100.00	0.491	–155.4	2.930	81.2	0.133	38.0	0.396	–55.7
1200.00	0.499	–163.1	2.760	77.5	0.134	37.5	0.364	–60.4
1300.00	0.507	–170.8	2.539	74.0	0.137	37.2	0.342	–61.6
1400.00	0.513	–173.8	2.423	71.7	0.141	37.7	0.328	–63.8
1500.00	0.505	–179.5	2.346	66.3	0.150	37.4	0.327	–64.1
1600.00	0.485	176.9	2.233	62.1	0.157	38.5	0.320	–67.3
1700.00	0.490	171.1	2.118	58.7	0.163	39.7	0.306	–68.6
1800.00	0.468	164.9	2.017	56.9	0.167	42.2	0.295	–71.9
1900.00	0.492	160.6	1.907	53.0	0.172	43.2	0.283	–74.2
2000.00	0.499	155.6	1.804	53.5	0.175	44.1	0.285	–77.3

V_{CE} = 3 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.844	–32.2	14.254	157.1	0.026	43.6	0.949	–15.0
200.00	0.757	–62.0	11.790	138.2	0.059	51.0	0.806	–32.6
300.00	0.687	–85.1	9.852	122.3	0.077	49.6	0.674	–45.0
400.00	0.609	–101.4	8.167	111.7	0.086	47.2	0.575	–30.2
500.00	0.544	–116.0	6.786	105.3	0.093	45.6	0.496	–52.9
600.00	0.502	–127.4	5.941	100.6	0.098	46.1	0.436	–52.3
700.00	0.489	–137.9	5.275	94.6	0.105	45.0	0.418	–57.1
800.00	0.470	–148.2	4.669	89.6	0.108	44.8	0.358	–57.9
900.00	0.441	–154.3	4.119	85.1	0.113	46.0	0.325	–58.8
1000.00	0.437	–161.6	3.749	82.0	0.120	47.0	0.300	–58.2
1100.00	0.423	–168.4	3.443	78.2	0.126	46.9	0.297	–61.3
1200.00	0.437	–174.3	3.209	74.9	0.130	46.8	0.274	–66.8
1300.00	0.446	178.9	2.964	71.7	0.135	46.5	0.253	–68.2
1400.00	0.453	176.9	2.806	69.3	0.142	46.7	0.238	–70.0
1500.00	0.448	171.6	2.696	64.8	0.152	46.1	0.236	–70.3
1600.00	0.434	168.9	2.552	61.0	0.163	46.3	0.231	–74.0
1700.00	0.440	163.3	2.434	57.9	0.171	47.0	0.217	–76.1
1800.00	0.428	157.8	2.291	56.5	0.178	48.6	0.208	–80.2
1900.00	0.451	154.0	2.178	54.8	0.185	49.2	0.199	–83.4
2000.00	0.459	149.5	2.056	53.5	0.190	49.4	0.201	–86.7

Not recommend for new design

V_{CE} = 3 V, I_C = 7 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.770	–40.0	18.346	132.6	0.023	36.3	0.939	–20.0
200.00	0.666	–73.3	14.212	131.4	0.054	48.3	0.733	–39.5
300.00	0.588	–97.6	11.480	116.0	0.068	48.8	0.585	–32.1
400.00	0.516	–114.1	9.252	106.4	0.077	49.5	0.483	–56.7
500.00	0.471	–128.3	7.604	100.8	0.083	49.7	0.406	–58.3
600.00	0.446	–139.5	6.608	96.4	0.089	51.0	0.372	–57.1
700.00	0.436	–148.8	5.788	91.0	0.097	50.8	0.341	–61.9
800.00	0.422	–158.0	5.104	86.6	0.102	50.9	0.287	–63.3
900.00	0.398	–163.6	4.477	82.8	0.109	52.1	0.256	–64.2
1000.00	0.398	–170.5	4.074	79.8	0.117	52.9	0.233	–62.9
1100.00	0.391	–177.1	3.744	76.3	0.125	52.8	0.233	–65.9
1200.00	0.404	177.9	3.472	73.4	0.131	32.5	0.218	–72.5
1300.00	0.413	172.1	3.212	70.3	0.138	52.0	0.198	–74.5
1400.00	0.420	170.7	3.041	68.0	0.146	51.8	0.184	–76.2
1500.00	0.419	165.7	2.904	63.8	0.157	50.9	0.181	–76.5
1600.00	0.407	163.4	2.752	60.4	0.169	50.6	0.179	–81.1
1700.00	0.414	158.2	2.621	57.4	0.178	50.8	0.165	–84.2
1800.00	0.408	153.0	2.462	56.5	0.187	51.9	0.159	–89.7
1900.00	0.429	149.8	2.340	54.7	0.194	52.1	0.152	–93.8
2000.00	0.437	143.6	2.212	53.5	0.200	52.0	0.155	–97.4

V_{CE} = 3 V, I_C = 10 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.686	–46.4	21.798	147.0	0.027	33.4	0.895	–23.1
200.00	0.580	–84.7	16.506	125.3	0.048	47.1	0.657	–45.9
300.00	0.506	–109.6	12.733	110.8	0.060	50.4	0.506	–58.0
400.00	0.447	–126.2	10.027	102.2	0.069	52.6	0.408	–62.1
500.00	0.420	–139.2	8.183	97.3	0.076	54.4	0.336	–63.5
600.00	0.408	–149.9	7.058	93.3	0.084	56.0	0.306	–61.2
700.00	0.401	–157.8	6.167	88.4	0.092	55.7	0.283	–66.1
800.00	0.391	–166.1	5.399	84.4	0.099	56.1	0.235	–68.5
900.00	0.370	–171.1	4.744	81.0	0.107	57.0	0.206	–69.5
1000.00	0.373	–177.6	4.311	78.2	0.117	57.3	0.188	–67.6
1100.00	0.369	176.0	3.939	75.0	0.126	57.0	0.191	–70.4
1200.00	0.383	171.9	3.667	72.3	0.132	56.6	0.178	–78.4
1300.00	0.392	166.9	3.381	69.4	0.140	55.9	0.159	–81.3
1400.00	0.399	165.9	3.207	67.1	0.149	53.3	0.146	–83.4
1500.00	0.400	161.2	3.064	63.2	0.161	54.2	0.143	–83.7
1600.00	0.390	139.2	2.884	60.0	0.173	53.4	0.143	–89.1
1700.00	0.397	154.5	2.741	57.1	0.183	53.4	0.131	–94.0
1800.00	0.394	149.5	2.584	56.2	0.193	54.1	0.127	–101.0
1900.00	0.414	146.5	2.457	54.6	0.201	54.1	0.123	–106.2
2000.00	0.423	142.7	2.314	53.6	0.208	53.7	0.128	–109.6

Not recommend for new design

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