To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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

April 1st, 2010
Renesas Electronics Corporation

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

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RENESAS

SILICON TRANSISTOR

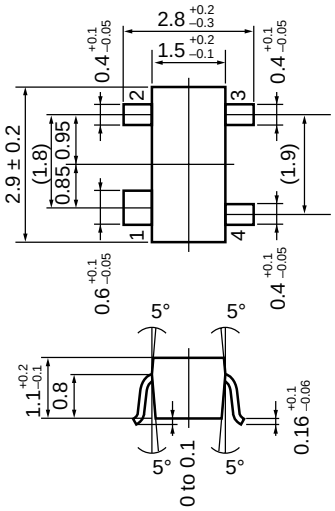
2SC5454

NPN EPITAXIAL SILICON TRANSISTOR
4-PIN MINI MOLD

FEATURE

- High gain, low noise
- Small reverse transfer capacitance
- Can operate at low voltage

PACKAGE DIMENSIONS (in mm)



PIN CONNECTIONS

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

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	50	mA
Total Power Dissipation	P_T	200	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	–65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I_{CBO}	V_{CB} = 5 V, I_E = 0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 1 V, I_C = 0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 3 V, I_C = 20 mA **Note 1**	75		150	
Gain Bandwidth Product	f_T	V_{CE} = 3 V, I_C = 20 mA, f = 2 GHz		14.5		GHz
Reverse Transfer Capacitance	C_{re}	V_{CB} = 3 V, I_E = 0, f = 1 MHz **Note 2**		0.3	0.5	pF
Insertion Power Gain	$\|S_{21e}\|^2$	V_{CE} = 3 V, I_C = 20 mA, f = 2 GHz	10	12.0		dB
Noise Figure	NF	V_{CE} = 3 V, I_C = 5 mA, f = 2 GHz		1.5	2.5	dB

Notes 1. Pulse measurement $P_W \leq 350$ μs, duty cycle ≤ 2 %

2. Collector to base capacitance measured by capacitance meter (automatic balance bridge method) when emitter pin is connected to the guard pin.

Because this product uses high-frequency process, avoid excessive input of static electricity, etc.

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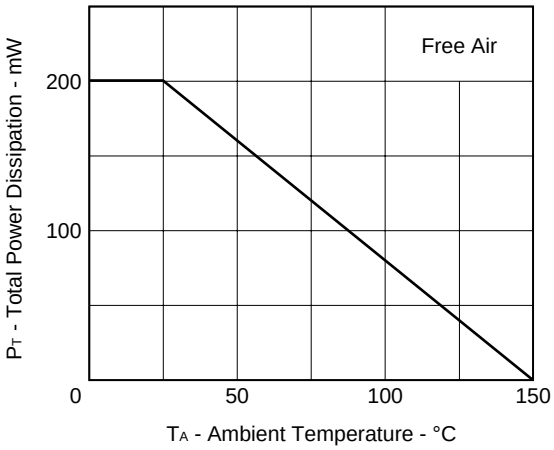
Date Published February 1998 N CP(K)
Printed in Japan

h_{FE} CLASSIFICATION

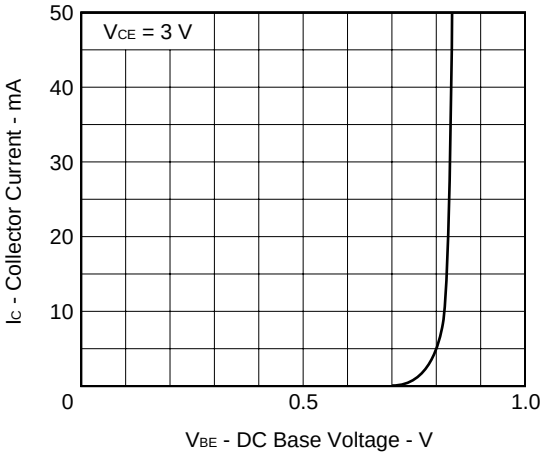
RANK	FB
Marking	R54
h_{FE}	75 to 150

TYPICAL CHARACTERISTICS (T_A = 25 °C)

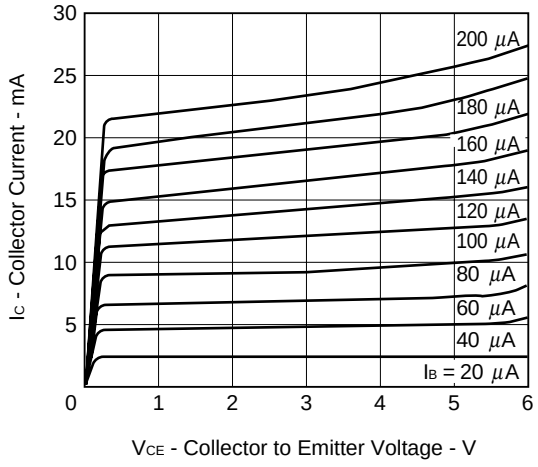
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



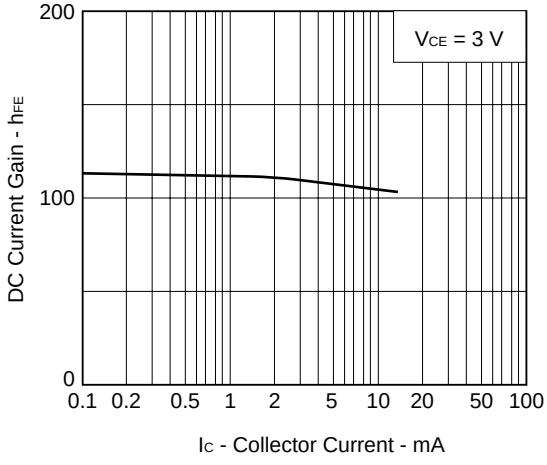
COLLECTOR CURRENT vs. DC BASE VOLTAGE



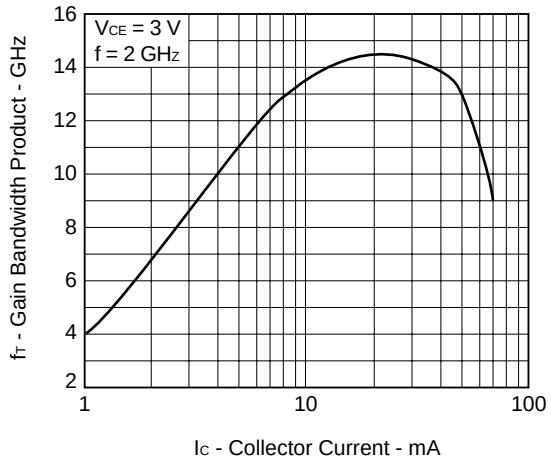
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



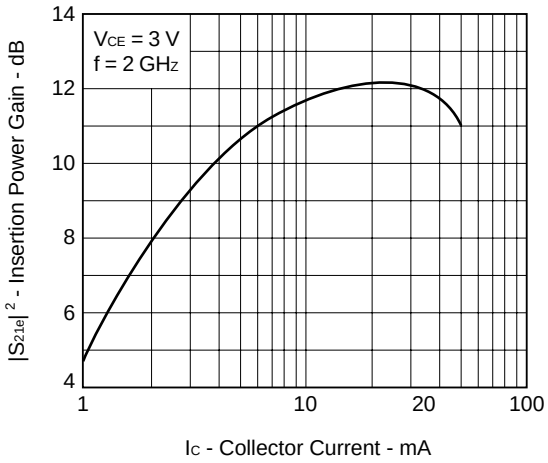
DC CURRENT GAIN vs. COLLECTOR CURRENT



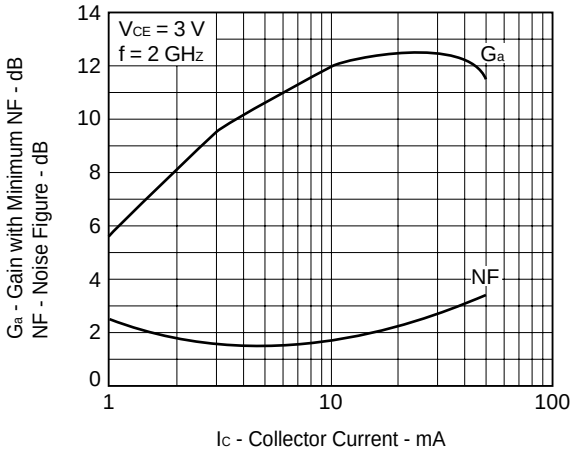
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



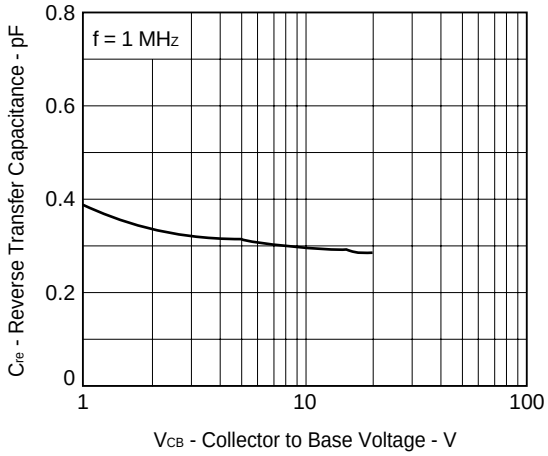
INSERTION POWER GAIN
vs. COLLECTOR CURRENT



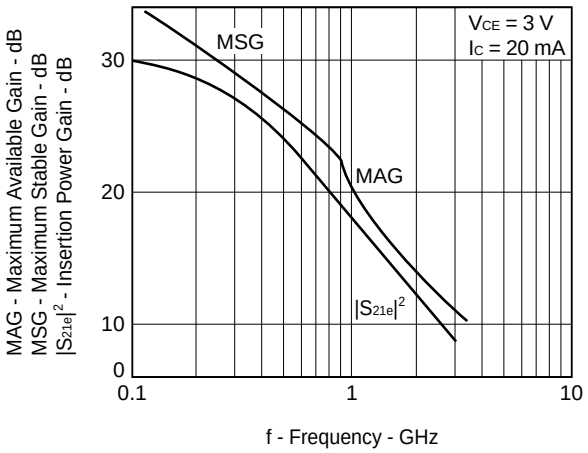
GAIN WITH MINIMUM NF/NOISE FIGURE
vs. COLLECTOR CURRENT



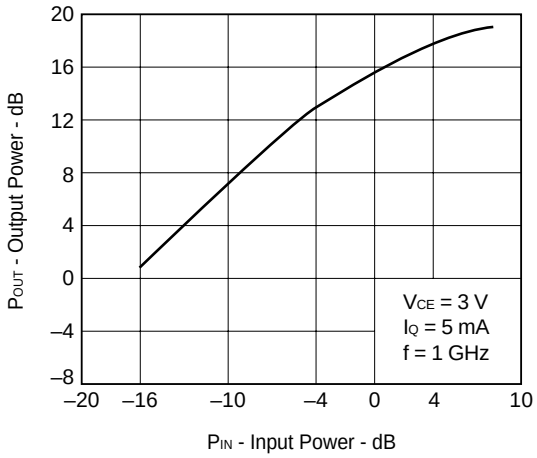
REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



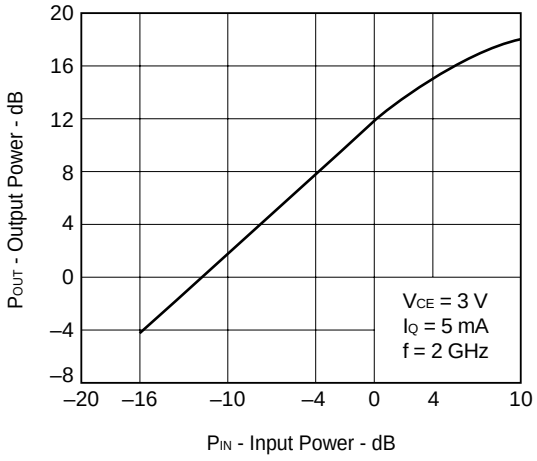
MAXIMUM AVAILABLE GAIN/
MAXIMUM STABLE GAIN/INSERTION
POWER GAIN vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER



OUTPUT POWER vs. INPUT POWER



2SC5454 S PARAMETER

V_{CE} = 3 V, I_C = 5 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.829	–19.2	14.261	164.7	0.015	78.1	0.972	–11.1
200.00	0.783	–37.0	13.252	150.7	0.029	69.1	0.913	–21.6
300.00	0.727	–54.1	12.245	139.2	0.040	59.1	0.843	–30.2
400.00	0.666	–68.7	10.804	129.3	0.048	52.8	0.764	–37.5
500.00	0.606	–82.9	9.964	118.9	0.053	49.2	0.699	–42.6
600.00	0.556	–95.8	9.028	111.1	0.057	44.9	0.645	–47.3
700.00	0.517	–106.6	8.120	104.1	0.061	42.4	0.591	–51.3
800.00	0.486	–117.5	7.393	98.0	0.063	40.0	0.557	–54.4
900.00	0.462	–126.8	6.709	92.5	0.065	39.3	0.518	–57.9
1000.00	0.446	–135.6	6.178	87.4	0.067	38.3	0.491	–60.3
1100.00	0.433	–143.5	5.702	82.9	0.069	38.2	0.470	–63.3
1200.00	0.426	–151.0	5.280	78.5	0.071	37.7	0.450	–65.9
1300.00	0.422	–157.9	4.919	74.6	0.072	38.3	0.433	–69.2
1400.00	0.420	–164.1	4.610	70.6	0.073	37.5	0.420	–71.6
1500.00	0.422	–170.2	4.331	67.0	0.075	37.7	0.408	–75.3
1600.00	0.424	–175.5	4.070	63.3	0.077	39.3	0.400	–78.3
1700.00	0.429	179.4	3.856	59.7	0.078	39.0	0.393	–81.8
1800.00	0.434	174.8	3.661	56.5	0.082	40.2	0.389	–84.7
1900.00	0.441	170.2	3.481	53.1	0.083	40.5	0.378	–89.2
2000.00	0.448	166.4	3.306	50.0	0.086	41.9	0.378	–91.4
2100.00	0.456	162.2	3.150	46.6	0.088	41.7	0.372	–96.5
2200.00	0.465	158.7	3.013	43.5	0.090	42.7	0.378	–98.3
2300.00	0.470	155.1	2.857	40.2	0.093	43.1	0.370	–104.0
2400.00	0.482	151.7	2.758	37.3	0.097	44.1	0.380	–105.1
2500.00	0.484	148.8	2.637	34.8	0.100	45.1	0.378	–110.7
2600.00	0.495	145.8	2.526	31.7	0.105	44.9	0.389	–112.3
2700.00	0.503	143.4	2.456	28.6	0.109	45.7	0.394	–117.8
2800.00	0.512	140.4	2.347	25.9	0.113	45.7	0.403	–120.2
2900.00	0.522	138.0	2.261	22.7	0.119	45.6	0.413	–125.1
3000.00	0.528	135.3	2.171	20.3	0.123	45.0	0.418	–128.1

V_{CE} = 3 V, I_C = 10 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.706	–27.6	23.264	159.2	0.014	75.1	0.940	–15.8
200.00	0.636	–52.0	20.474	141.9	0.026	64.8	0.837	–29.1
300.00	0.561	–73.4	17.706	128.5	0.033	57.4	0.724	–38.7
400.00	0.503	–90.1	14.932	118.5	0.039	52.2	0.628	–45.8
500.00	0.457	–105.7	12.978	109.0	0.042	50.5	0.557	–49.8
600.00	0.423	–119.0	11.348	102.1	0.046	49.0	0.503	–53.5
700.00	0.401	–130.0	9.988	96.1	0.049	48.7	0.457	–56.6
800.00	0.386	–140.1	8.935	90.8	0.052	48.1	0.424	–59.5
900.00	0.377	–148.8	8.023	86.3	0.055	48.0	0.394	–61.9
1000.00	0.373	–156.7	7.305	82.0	0.057	48.8	0.374	–64.3
1100.00	0.370	–163.6	6.687	78.2	0.061	48.6	0.355	–67.5
1200.00	0.371	–170.1	6.157	74.4	0.065	48.9	0.342	–69.5
1300.00	0.375	–175.8	5.720	70.9	0.068	49.7	0.326	–73.0
1400.00	0.378	178.9	5.332	67.6	0.071	50.0	0.320	–75.5
1500.00	0.384	174.1	4.997	64.4	0.074	50.5	0.309	–79.4
1600.00	0.389	169.7	4.693	61.1	0.078	50.2	0.307	–82.4
1700.00	0.397	165.8	4.450	58.0	0.081	50.4	0.298	–86.4
1800.00	0.403	162.1	4.192	55.0	0.084	50.5	0.296	–89.1
1900.00	0.413	158.6	3.978	51.8	0.089	49.8	0.289	–94.6
2000.00	0.420	155.7	3.791	49.0	0.092	49.7	0.293	–96.8
2100.00	0.431	152.1	3.590	46.1	0.096	49.8	0.286	–102.4
2200.00	0.441	149.5	3.450	43.2	0.100	49.5	0.292	–104.1
2300.00	0.447	146.4	3.276	40.3	0.103	49.3	0.289	–111.0
2400.00	0.461	143.8	3.139	37.8	0.107	48.9	0.296	–111.1
2500.00	0.462	141.3	3.011	35.5	0.111	49.2	0.293	–117.1
2600.00	0.475	138.7	2.882	32.7	0.117	48.7	0.307	–118.2
2700.00	0.484	136.9	2.803	29.9	0.122	48.2	0.315	–124.0
2800.00	0.494	134.2	2.689	27.4	0.127	47.3	0.323	–126.8
2900.00	0.504	132.3	2.588	24.5	0.132	46.8	0.334	–131.5
3000.00	0.511	129.7	2.493	22.3	0.136	46.1	0.341	–134.8

2SC5454 S PARAMETER

V_{CE} = 3 V, I_C = 20 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.550	–39.8	33.319	152.6	0.012	73.8	0.886	–21.4
200.00	0.478	–71.8	27.020	132.5	0.021	63.3	0.734	–36.5
300.00	0.420	–96.3	21.715	118.9	0.027	56.8	0.598	–45.6
400.00	0.381	–115.0	17.550	109.5	0.032	55.7	0.502	–51.2
500.00	0.363	–129.9	14.737	101.5	0.035	56.4	0.439	–54.1
600.00	0.351	–141.9	12.630	95.6	0.039	55.7	0.395	–57.3
700.00	0.344	–151.7	10.983	90.4	0.043	56.8	0.357	–59.7
800.00	0.344	–160.1	9.738	86.1	0.047	57.1	0.335	–61.7
900.00	0.343	–167.5	8.689	82.0	0.051	57.2	0.310	–64.5
1000.00	0.347	–173.7	7.876	78.3	0.055	57.8	0.294	–66.3
1100.00	0.350	–179.2	7.199	74.9	0.059	57.7	0.281	–69.5
1200.00	0.355	175.4	6.619	71.5	0.063	57.6	0.268	–72.1
1300.00	0.362	171.0	6.132	68.4	0.068	57.7	0.261	–75.9
1400.00	0.367	166.7	5.704	65.3	0.072	57.4	0.257	–78.1
1500.00	0.375	163.0	5.338	62.4	0.076	57.1	0.246	–82.3
1600.00	0.382	159.4	5.011	59.5	0.080	56.6	0.246	–86.2
1700.00	0.391	156.4	4.728	56.6	0.085	56.4	0.239	–90.0
1800.00	0.398	153.4	4.476	54.0	0.089	56.0	0.240	–93.9
1900.00	0.408	150.5	4.226	50.8	0.093	55.7	0.237	–99.8
2000.00	0.416	148.3	4.028	48.4	0.098	54.7	0.238	–102.1
2100.00	0.427	145.1	3.829	45.6	0.102	54.1	0.235	–108.6
2200.00	0.437	143.2	3.661	42.9	0.107	53.2	0.241	–109.3
2300.00	0.443	140.4	3.489	40.3	0.110	52.7	0.239	–116.7
2400.00	0.457	138.3	3.330	37.8	0.115	51.6	0.247	–117.1
2500.00	0.459	136.1	3.206	35.6	0.119	51.7	0.250	–124.4
2600.00	0.473	133.8	3.603	33.0	0.125	50.8	0.259	–124.2
2700.00	0.480	132.5	2.967	30.2	0.130	50.9	0.271	–131.1
2800.00	0.492	129.8	2.857	28.0	0.135	48.9	0.277	–133.2
2900.00	0.501	128.3	2.747	25.2	0.140	47.7	0.292	–138.6
3000.00	0.509	125.7	2.655	23.3	0.144	46.8	0.295	–141.0

V_{CE} = 3 V, I_C = 30 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.459	–49.1	38.164	148.7	0.011	70.7	0.849	–24.6
200.00	0.404	–85.8	29.422	127.7	0.019	62.8	0.674	–40.3
300.00	0.368	–111.3	22.866	114.5	0.024	58.5	0.537	–48.1
400.00	0.347	–129.3	18.143	105.5	0.029	57.5	0.445	–53.4
500.00	0.341	–142.9	15.068	98.2	0.033	59.4	0.386	–55.5
600.00	0.337	–153.4	12.826	92.7	0.037	60.8	0.350	–57.7
700.00	0.337	–162.3	11.115	87.9	0.040	60.4	0.317	–60.2
800.00	0.340	–169.5	9.819	83.9	0.046	61.1	0.296	–62.3
900.00	0.343	–176.0	8.752	80.1	0.049	61.1	0.278	–64.4
1000.00	0.349	178.6	7.932	76.6	0.054	61.0	0.264	–66.5
1100.00	0.354	173.9	7.224	73.3	0.058	61.2	0.253	–70.0
1200.00	0.360	169.2	6.638	70.2	0.063	61.4	0.243	–72.3
1300.00	0.368	165.4	6.149	67.2	0.068	61.1	0.234	–76.6
1400.00	0.374	161.6	5.716	64.2	0.073	61.1	0.231	–79.1
1500.00	0.382	158.3	5.351	61.4	0.077	59.7	0.226	–83.8
1600.00	0.389	155.1	5.015	58.5	0.081	59.8	0.223	–87.6
1700.00	0.399	152.5	4.742	55.6	0.085	58.8	0.221	–92.5
1800.00	0.405	149.7	4.476	52.9	0.090	57.8	0.223	–95.9
1900.00	0.415	147.1	4.229	50.2	0.095	57.0	0.217	–101.9
2000.00	0.423	145.1	4.021	47.5	0.100	56.1	0.220	–103.7
2100.00	0.434	142.2	3.814	44.8	0.104	55.3	0.218	–111.0
2200.00	0.444	140.5	3.659	42.2	0.109	54.6	0.225	–111.8
2300.00	0.450	137.8	3.473	39.6	0.114	53.5	0.225	–120.1
2400.00	0.464	135.8	3.323	37.2	0.117	53.2	0.231	–119.7
2500.00	0.465	133.7	3.194	34.9	0.122	52.7	0.236	–127.5
2600.00	0.479	131.8	3.056	32.5	0.127	52.0	0.247	–127.2
2700.00	0.487	130.4	2.981	30.0	0.133	50.5	0.258	–134.1
2800.00	0.498	127.9	2.852	27.8	0.138	49.6	0.267	–136.0
2900.00	0.508	126.4	2.740	25.0	0.143	47.8	0.279	–141.3
3000.00	0.515	124.0	2.652	23.0	0.147	47.4	0.285	–144.2

2SC5454 S PARAMETER

V_{CE} = 5 V, I_C = 5 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.836	–18.3	14.254	165.1	0.014	78.2	0.970	–10.4
200.00	0.792	–35.6	13.300	151.4	0.027	69.3	0.920	–20.6
300.00	0.736	–52.0	12.328	140.2	0.038	60.4	0.849	–28.9
400.00	0.675	–66.1	10.931	130.3	0.046	54.1	0.776	–35.8
500.00	0.612	–80.1	10.126	119.9	0.051	49.6	0.715	–40.9
600.00	0.561	–92.6	9.208	112.1	0.055	45.8	0.659	–45.5
700.00	0.521	–103.4	8.276	105.2	0.059	43.1	0.608	–49.2
800.00	0.487	–113.9	7.567	99.0	0.061	41.3	0.572	–52.4
900.00	0.461	–123.3	6.874	93.5	0.063	39.9	0.536	–55.6
1000.00	0.442	–132.2	6.347	88.3	0.064	39.2	0.509	–58.1
1100.00	0.429	–140.1	5.862	83.8	0.066	38.8	0.486	–61.0
1200.00	0.419	–147.9	5.432	79.4	0.068	38.5	0.468	–63.8
1300.00	0.414	–154.8	5.068	75.4	0.069	38.8	0.450	–66.7
1400.00	0.410	–161.3	4.754	71.4	0.071	39.0	0.437	–69.4
1500.00	0.411	–167.3	4.461	67.8	0.073	39.6	0.425	–72.7
1600.00	0.413	–172.9	4.195	64.1	0.074	40.2	0.418	–75.6
1700.00	0.417	–178.1	3.983	60.7	0.076	40.6	0.407	–79.1
1800.00	0.421	177.1	3.779	57.3	0.078	41.3	0.405	–81.9
1900.00	0.428	172.3	3.582	53.7	0.080	41.6	0.396	–86.2
2000.00	0.434	168.4	3.411	50.7	0.083	43.0	0.395	–88.6
2100.00	0.442	164.0	3.253	47.0	0.086	43.6	0.386	–93.7
2200.00	0.452	160.5	3.114	44.2	0.089	43.9	0.392	–95.3
2300.00	0.457	156.7	2.969	40.9	0.091	44.6	0.383	–100.7
2400.00	0.468	153.2	2.846	37.9	0.094	45.5	0.393	–102.0
2500.00	0.470	150.3	2.733	35.5	0.097	46.2	0.387	–107.2
2600.00	0.481	147.2	2.621	32.0	0.102	46.8	0.401	–108.9
2700.00	0.490	144.8	2.540	29.2	0.107	47.2	0.408	–114.1
2800.00	0.500	141.7	2.432	26.5	0.112	47.1	0.415	–117.1
2900.00	0.509	139.3	2.340	23.2	0.116	46.7	0.426	–121.8
3000.00	0.517	136.4	2.250	21.0	0.121	46.5	0.428	–125.0

V_{CE} = 5 V, I_C = 10 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.722	–26.0	23.176	159.8	0.013	77.0	0.943	–14.8
200.00	0.653	–49.0	20.533	142.9	0.024	65.3	0.844	–27.7
300.00	0.575	–69.4	17.914	129.9	0.032	57.6	0.738	–36.6
400.00	0.512	–86.2	15.194	119.8	0.037	52.9	0.647	–43.5
500.00	0.462	–101.1	13.254	110.1	0.041	51.2	0.575	–47.5
600.00	0.423	–113.9	11.637	103.2	0.045	49.3	0.522	–51.5
700.00	0.398	–125.2	10.262	97.1	0.047	48.9	0.475	–54.3
800.00	0.379	–135.3	9.193	92.0	0.050	48.9	0.443	–56.8
900.00	0.367	–144.3	8.257	87.4	0.054	48.6	0.413	–59.6
1000.00	0.361	–152.5	7.531	82.8	0.057	49.3	0.392	–61.6
1100.00	0.357	–159.6	6.895	79.0	0.059	49.6	0.374	–64.4
1200.00	0.356	–166.5	6.370	75.2	0.062	49.8	0.358	–66.6
1300.00	0.358	–172.4	5.906	71.9	0.065	50.2	0.345	–69.7
1400.00	0.361	–177.9	5.512	68.4	0.069	50.1	0.338	–72.1
1500.00	0.367	177.1	5.172	65.1	0.072	50.4	0.327	–75.9
1600.00	0.371	172.4	4.856	62.0	0.075	50.7	0.321	–78.9
1700.00	0.379	168.4	4.615	58.6	0.079	50.8	0.313	–82.6
1800.00	0.385	164.5	4.332	55.8	0.083	50.9	0.313	–85.5
1900.00	0.395	160.7	4.123	52.5	0.086	50.8	0.304	–90.4
2000.00	0.402	157.9	3.914	49.8	0.089	51.2	0.308	–92.6
2100.00	0.413	153.9	3.734	46.9	0.093	50.7	0.300	–98.1
2200.00	0.424	151.3	3.579	44.1	0.098	50.6	0.305	–99.6
2300.00	0.429	148.2	3.390	41.2	0.101	50.7	0.299	–106.1
2400.00	0.443	145.4	3.257	38.6	0.105	50.3	0.305	–106.8
2500.00	0.444	142.9	3.135	36.2	0.109	50.2	0.306	–112.7
2600.00	0.458	140.2	2.999	33.5	0.114	49.8	0.319	–113.7
2700.00	0.467	138.4	2.909	30.5	0.119	50.0	0.325	–119.6
2800.00	0.477	135.5	2.797	28.1	0.124	48.8	0.332	–122.0
2900.00	0.487	133.7	2.695	25.2	0.129	48.2	0.345	–127.6
3000.00	0.495	131.0	2.592	22.9	0.133	47.2	0.348	–130.5

2SC5454 S PARAMETER

V_{CE} = 5 V, I_C = 20 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.584	–36.1	33.272	153.6	0.012	73.1	0.896	–19.7
200.00	0.503	–65.9	27.312	134.0	0.020	63.7	0.751	–34.7
300.00	0.434	–89.4	22.196	120.4	0.027	58.1	0.618	–43.4
400.00	0.385	–107.3	18.070	110.8	0.031	56.3	0.526	–48.9
500.00	0.361	–122.5	15.219	102.7	0.034	56.6	0.459	–51.9
600.00	0.341	–135.0	13.079	96.8	0.038	57.0	0.415	–54.6
700.00	0.331	–145.4	11.392	91.4	0.042	57.1	0.374	–56.9
800.00	0.327	–154.4	10.113	87.1	0.046	57.1	0.353	–58.8
900.00	0.325	–162.3	9.025	83.0	0.049	57.2	0.326	–61.5
1000.00	0.326	–169.1	8.193	79.2	0.054	57.6	0.312	–63.2
1100.00	0.329	–175.0	7.486	75.8	0.057	57.9	0.300	–65.7
1200.00	0.334	179.1	6.878	72.4	0.061	58.2	0.288	–68.2
1300.00	0.338	174.5	6.379	69.3	0.066	58.0	0.278	–71.6
1400.00	0.344	169.9	5.935	66.2	0.070	57.7	0.270	–74.6
1500.00	0.352	165.9	5.566	63.2	0.074	57.3	0.263	–78.1
1600.00	0.358	162.1	5.220	60.3	0.078	57.4	0.260	–81.1
1700.00	0.367	158.9	4.949	57.4	0.082	57.0	0.255	–85.8
1800.00	0.373	155.7	4.651	54.6	0.087	56.6	0.254	–88.9
1900.00	0.385	152.7	4.411	51.8	0.091	55.6	0.248	–94.5
2000.00	0.391	150.3	4.195	49.0	0.096	55.2	0.250	–96.7
2100.00	0.403	147.2	3.990	46.3	0.099	54.3	0.246	–103.1
2200.00	0.414	145.1	3.817	43.9	0.104	53.8	0.252	–104.1
2300.00	0.421	142.2	3.633	41.0	0.108	53.5	0.247	–111.5
2400.00	0.435	140.0	3.488	38.6	0.113	52.6	0.256	–112.0
2500.00	0.436	137.8	3.349	36.3	0.116	52.3	0.258	–118.4
2600.00	0.450	135.4	3.203	33.9	0.121	51.7	0.269	–118.7
2700.00	0.459	134.0	3.126	31.2	0.127	51.2	0.275	–125.1
2800.00	0.470	131.3	2.995	28.7	0.132	49.6	0.285	–127.4
2900.00	0.481	129.7	2.881	26.0	0.137	48.8	0.296	–133.1
3000.00	0.489	127.2	2.788	24.0	0.141	48.0	0.302	–136.2

V_{CE} = 5 V, I_C = 30 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.508	–42.8	38.283	149.9	0.011	72.3	0.861	–22.9
200.00	0.433	–76.3	30.011	129.4	0.019	61.8	0.692	–37.6
300.00	0.378	–100.7	23.555	116.0	0.023	59.8	0.558	–45.6
400.00	0.342	–119.6	18.822	107.1	0.028	59.3	0.472	–50.4
500.00	0.332	–133.8	15.690	99.5	0.032	59.2	0.411	–52.5
600.00	0.321	–145.1	13.390	93.9	0.036	61.0	0.369	–54.9
700.00	0.317	–154.9	11.613	89.1	0.041	60.5	0.337	–57.0
800.00	0.316	–163.1	10.259	84.9	0.045	60.7	0.315	–58.5
900.00	0.318	–169.9	9.171	81.1	0.048	61.6	0.297	–60.9
1000.00	0.323	–176.1	8.300	77.5	0.053	60.8	0.283	–62.7
1100.00	0.326	178.5	7.579	74.2	0.058	60.9	0.271	–65.6
1200.00	0.332	173.3	6.964	71.1	0.062	61.2	0.263	–67.9
1300.00	0.339	169.1	6.463	68.1	0.066	61.0	0.256	–71.6
1400.00	0.345	165.0	6.012	65.1	0.071	60.2	0.248	–74.6
1500.00	0.354	161.5	5.620	62.3	0.074	59.9	0.241	–78.7
1600.00	0.359	158.0	5.271	59.4	0.080	59.6	0.242	–82.4
1700.00	0.369	155.0	4.972	56.4	0.083	58.7	0.236	–86.8
1800.00	0.376	152.4	4.693	54.0	0.088	58.0	0.233	–90.5
1900.00	0.387	149.5	4.454	51.2	0.092	57.5	0.229	–96.2
2000.00	0.393	147.5	4.222	48.6	0.097	56.9	0.232	–97.9
2100.00	0.405	144.4	4.035	45.7	0.102	56.3	0.232	–104.8
2200.00	0.416	142.5	3.850	43.2	0.107	54.9	0.233	–106.3
2300.00	0.422	139.9	3.660	40.5	0.111	54.1	0.231	–114.3
2400.00	0.436	137.9	3.517	38.0	0.115	54.0	0.240	–113.8
2500.00	0.438	135.7	3.360	36.0	0.119	53.1	0.240	–120.9
2600.00	0.453	133.5	3.235	33.6	0.124	52.5	0.254	–121.0
2700.00	0.461	132.3	3.147	31.0	0.130	51.6	0.262	–127.4
2800.00	0.473	129.6	3.010	28.6	0.135	50.2	0.270	–129.8
2900.00	0.483	128.1	2.905	25.9	0.140	49.3	0.283	–135.7
3000.00	0.491	125.6	2.800	23.9	0.144	48.1	0.286	–138.5

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