NEC

SILICON TRANSISTOR
2SC5185

NPN EPITAXIAL SILICON TRANSISTOR IN SUPER MINI-MOLD PACKAGE FOR LOW-NOISE MICROWAVE AMPLIFICATION

FEATURES

- Low Noise
  NF = 1.3 dB TYP. @ V_{CE} = 2 V, I_C = 3 mA, f = 2 GHz
  NF = 1.3 dB TYP. @ V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz
- Super Mini-Mold package

ORDERING INFORMATION

PART NUMBER	QUANTITY	ARRANGEMENT
2SC5185-T1	3 000 units/reel	Embossed tape, 8 mm wide, pins No. 3 (base), and No. 4 (emitter) facing the perforations
2SC5185-T2		Embossed tape, 8 mm wide, pins No. 1 (collector) and No. 2 (emitter) facing the perforations

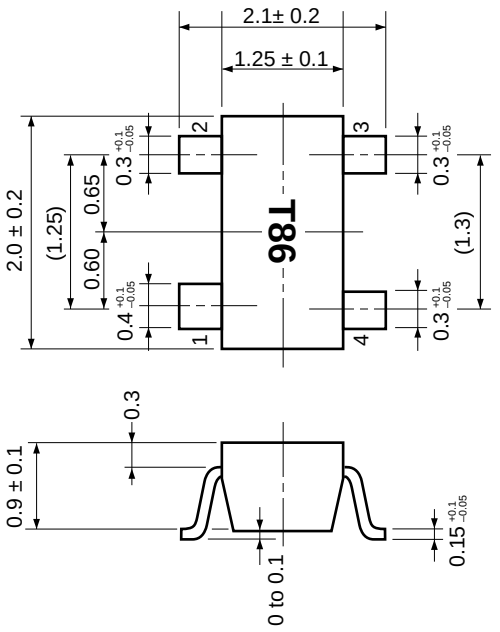
* Contact your NEC sales representative to order samples for evaluation.

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Collector to Base Voltage	V_{CBO}	5	V
Collector to Emitter Voltage	V_{CEO}	3	V
Emitter to Base Voltage	V_{EBO}	2	V
Collector Current	I_C	30	mA
Total Power Dissipation	P_T	90	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	–65 to +150	°C

PACKAGE DIMENSIONS

(Units: mm)



PIN CONNECTIONS

1. Collector
2. Emitter
3. Base
4. Emitter

Caution; This transistor uses high-frequency technology. Be careful not to allow excessive current to flow through the transistor, including static electricity.

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ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Collector Cutoff Current	I_{CBO}			100	nA	V_{CB} = 5 V, I_E = 0
Emitter Cutoff Current	I_{EBO}			100	nA	V_{EB} = 1 V, I_C = 0
DC Current Gain	h_{FE}	70		140		V_{CE} = 2 V, I_C = 20 mA*1
Insertion Power Gain (1)	$\|S_{21e}\|^2$	8	11		dB	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz
Insertion Power Gain (2)	$\|S_{21e}\|^2$	7.5	9		dB	V_{CE} = 1 V, I_C = 10 mA, f = 2 GHz
Noise Figure (1)	NF		1.3	2.0	dB	V_{CE} = 2 V, I_C = 3 mA, f = 2 GHz
Noise Figure (2)	NF		1.3	2.0	dB	V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz
Gain Bandwidth Product (1)	f_T	10	13		GHz	V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz
Gain Bandwidth Product (2)	f_T	8	11		GHz	V_{CE} = 1 V, I_C = 10 mA, f = 2 GHz
Feed-Back Capacitance	C_{re}		0.3	0.6	pF	V_{CB} = 2 V, I_E = 0, f = 1 MHz*2

***1** Measured with pulses: Pulse width ≤ 350 μs, duty cycle ≤ 2 %, pulsed.

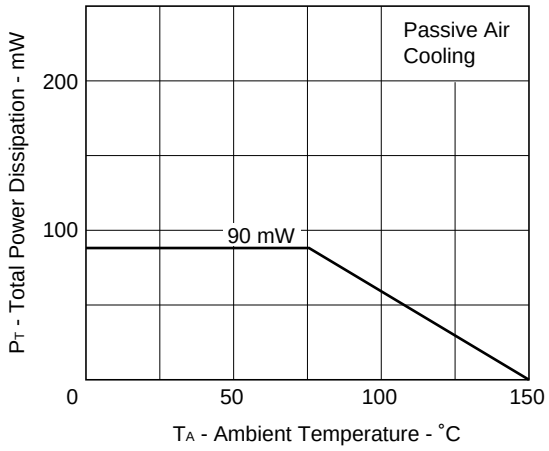
***2** Measured with a three-terminal bridge. The emitter and case terminal are connected to the guard terminal of the bridge.

h_{FE} Class

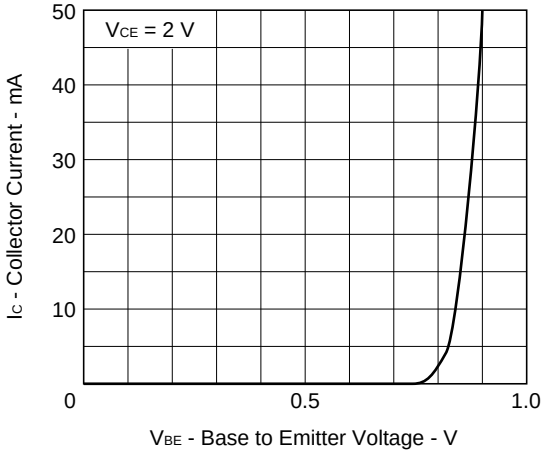
Class	FB
Marking	T86
h_{FE}	70 to 140

CHARACTERISTICS CURVES (T_A = 25 ˚C)

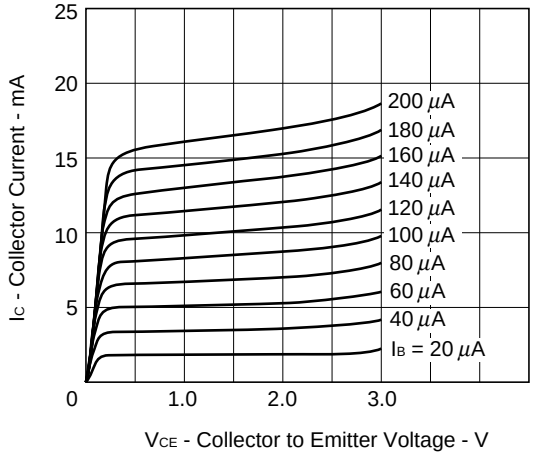
TOTAL POWER DISSIPATION
vs. AMBIENT TEMPERATURE



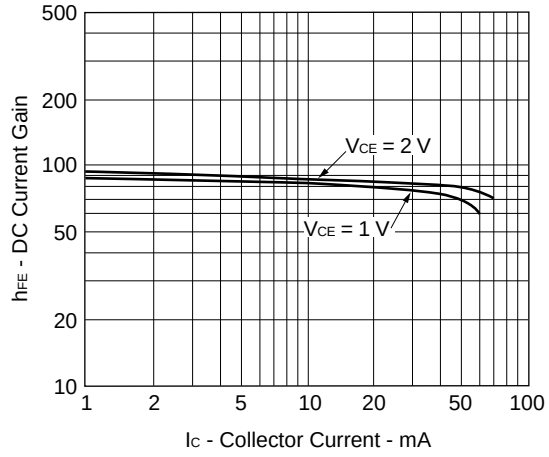
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



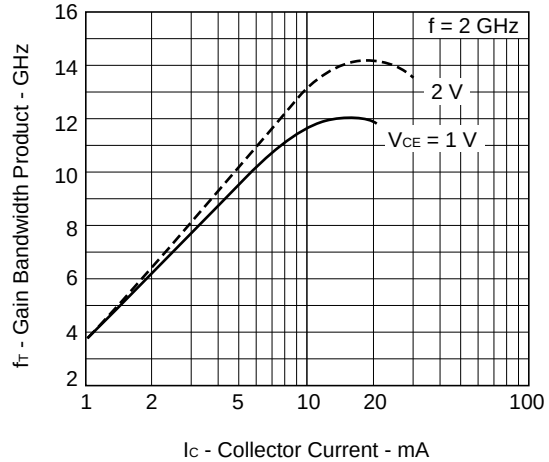
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



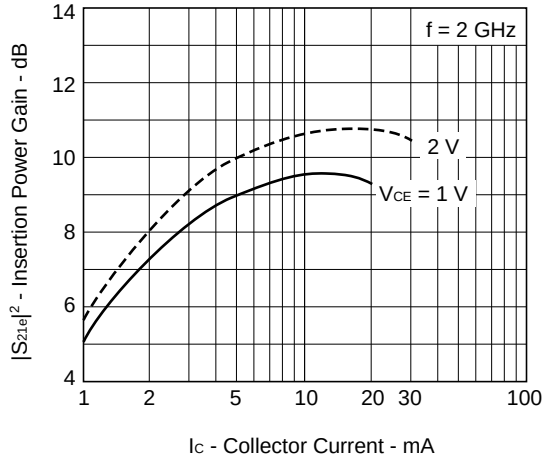
DC CURRENT GAIN vs.
COLLECTOR CURRENT



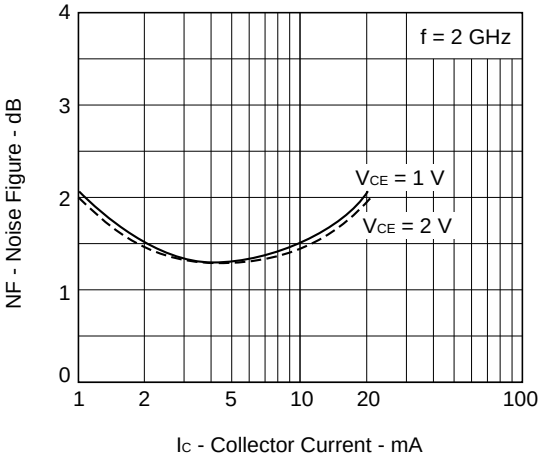
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



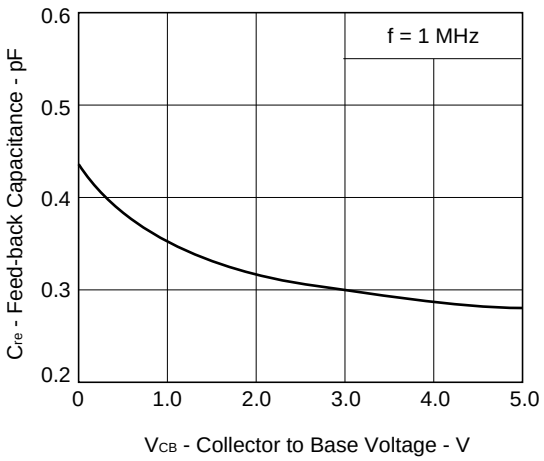
INSERTION POWER GAIN vs.
COLLECTOR CURRENT



NOISE FIGURE vs.
COLLECTOR CURRENT



FEED-BACK CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE



S-PARAMETER

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
600.00	0.856	–52.6	3.176	135.4	0.116	50.5	0.907	–29.6
800.00	0.745	–70.3	2.880	121.6	0.157	42.3	0.803	–36.5
1000.00	0.693	–85.9	2.664	109.0	0.182	36.5	0.715	–44.4
1200.00	0.625	–100.4	2.517	99.6	0.196	31.7	0.679	–51.0
1400.00	0.576	–116.1	2.285	90.9	0.210	26.5	0.622	–56.0
1600.00	0.558	–129.6	2.114	81.7	0.214	23.9	0.578	–61.4
1800.00	0.536	–139.6	1.990	75.0	0.210	20.9	0.546	–67.1
2000.00	0.501	–151.3	1.786	69.9	0.201	16.5	0.520	–70.7
2200.00	0.489	–163.7	1.603	62.0	0.205	12.4	0.488	–75.1

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
600.00	0.624	–80.7	6.490	118.9	0.088	43.7	0.692	–46.8
800.00	0.521	–102.2	5.364	105.7	0.114	37.8	0.565	–54.6
1000.00	0.448	–117.6	4.631	94.9	0.131	36.3	0.470	–62.0
1200.00	0.412	–134.8	4.118	87.7	0.139	36.5	0.421	–66.8
1400.00	0.397	–151.6	3.564	80.3	0.150	35.3	0.369	–72.7
1600.00	0.405	–162.6	3.231	72.8	0.157	36.0	0.336	–78.6
1800.00	0.389	–171.8	2.954	68.5	0.157	36.8	0.315	–84.2
2000.00	0.384	177.6	2.612	64.6	0.160	35.2	0.301	–87.1
2200.00	0.394	167.9	2.313	58.6	0.168	31.5	0.277	–92.5

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
600.00	0.505	–96.4	7.878	110.7	0.074	39.4	0.565	–55.5
800.00	0.425	–119.5	6.280	98.7	0.095	41.7	0.446	–62.5
1000.00	0.363	–134.7	5.309	89.2	0.112	41.5	0.366	–69.6
1200.00	0.344	–152.8	4.632	83.2	0.125	42.5	0.318	–74.2
1400.00	0.352	–168.1	3.967	76.2	0.137	42.7	0.280	–80.5
1600.00	0.369	–177.0	3.586	69.6	0.147	44.0	0.254	–87.7
1800.00	0.357	174.4	3.255	66.1	0.152	45.1	0.242	–94.1
2000.00	0.363	165.0	2.870	62.6	0.158	43.1	0.228	–96.5
2200.00	0.374	157.4	2.537	57.1	0.168	39.5	0.214	–104.1

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
600.00	0.422	–110.6	8.698	105.2	0.063	43.6	0.475	–61.4
800.00	0.370	–132.4	6.795	94.4	0.086	44.0	0.373	–68.7
1000.00	0.320	–148.4	5.683	85.7	0.104	44.3	0.296	–75.8
1200.00	0.317	–166.0	4.902	80.4	0.117	47.1	0.257	–79.0
1400.00	0.334	–178.8	4.181	73.9	0.131	47.5	0.225	–87.9
1600.00	0.352	173.7	3.778	67.7	0.145	48.4	0.206	–95.6
1800.00	0.346	165.8	3.416	64.7	0.150	49.7	0.198	–102.7
2000.00	0.357	157.6	3.007	61.4	0.159	47.3	0.188	–105.8
2200.00	0.368	151.2	2.658	56.3	0.169	43.7	0.182	–114.3

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
600.00	0.371	–123.3	9.225	101.0	0.058	45.8	0.404	–66.0
800.00	0.336	–143.8	7.119	91.1	0.077	46.0	0.314	–73.4
1000.00	0.298	–160.3	5.917	83.2	0.099	47.5	0.246	–80.9
1200.00	0.306	–176.2	5.065	78.4	0.113	51.2	0.212	–84.1
1400.00	0.328	172.8	4.315	72.1	0.129	52.3	0.187	–94.9
1600.00	0.345	166.8	3.900	66.3	0.145	52.4	0.174	–104.0
1800.00	0.342	159.6	3.513	63.6	0.151	53.4	0.173	–111.5
2000.00	0.357	152.3	3.095	60.5	0.161	51.1	0.162	–114.7
2200.00	0.367	146.8	2.733	55.6	0.172	46.7	0.161	–123.5

V_{CE} = 1 V, I_C = 20 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.325	–150.0	9.545	94.3	0.049	48.3	0.281	–76.8
800.00	0.315	–165.4	7.257	85.9	0.074	55.5	0.219	–83.3
1000.00	0.299	179.0	5.989	79.1	0.099	54.4	0.173	–93.4
1200.00	0.321	167.3	5.079	74.9	0.112	57.8	0.142	–96.9
1400.00	0.348	159.9	4.323	68.9	0.130	56.9	0.135	–112.0
1600.00	0.362	156.0	3.909	63.7	0.147	57.3	0.135	–123.8
1800.00	0.363	150.1	3.506	61.4	0.155	57.5	0.142	–131.8
2000.00	0.378	144.6	3.088	58.5	0.166	55.4	0.133	–135.4
2200.00	0.388	140.0	2.725	53.8	0.178	50.1	0.141	–143.2

V_{CE} = 1 V, I_C = 30 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.339	–163.4	9.097	91.6	0.049	56.6	0.234	–81.2
800.00	0.341	–174.3	6.891	83.6	0.071	54.2	0.181	–87.8
1000.00	0.326	–172.0	5.682	77.1	0.094	57.0	0.143	–98.2
1200.00	0.353	161.4	4.801	73.0	0.113	60.1	0.118	–105.8
1400.00	0.383	155.6	4.089	67.2	0.130	59.0	0.114	–121.2
1600.00	0.393	151.7	3.700	62.0	0.148	58.1	0.122	–133.3
1800.00	0.394	146.8	3.313	59.9	0.155	58.9	0.130	–140.4
2000.00	0.411	141.7	2.918	57.0	0.168	56.4	0.125	–144.3
2200.00	0.418	137.7	2.573	52.2	0.177	50.6	0.134	–151.8

V_{CE} = 2 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.876	–48.7	3.238	138.5	0.098	51.8	0.929	–26.2
800.00	0.762	–64.8	2.975	125.2	0.133	45.8	0.834	–32.1
1000.00	0.709	–80.1	2.768	112.9	0.162	39.2	0.750	–39.1
1200.00	0.642	–93.7	2.632	103.6	0.175	34.5	0.720	–45.6
1400.00	0.590	–108.8	2.421	95.2	0.185	29.5	0.668	–50.5
1600.00	0.566	–122.4	2.241	86.0	0.190	27.7	0.627	–55.0
1800.00	0.545	–132.8	2.122	79.1	0.188	24.7	0.593	–60.1
2000.00	0.502	–144.4	1.911	73.9	0.181	20.0	0.568	–63.8
2200.00	0.483	–157.0	1.719	66.2	0.184	15.8	0.539	–67.7

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.648	–72.2	6.846	122.4	0.077	44.1	0.743	–40.3
800.00	0.530	–92.4	5.740	109.3	0.103	41.7	0.615	–46.9
1000.00	0.455	–107.9	4.984	98.3	0.119	38.4	0.521	–53.7
1200.00	0.404	–124.0	4.474	91.1	0.127	39.0	0.476	–58.0
1400.00	0.379	–141.2	3.890	83.8	0.138	38.4	0.423	–62.3
1600.00	0.376	–153.1	3.524	76.2	0.145	39.4	0.387	–66.8
1800.00	0.361	–163.1	3.241	71.6	0.145	40.1	0.365	–71.9
2000.00	0.351	–174.5	2.866	67.7	0.148	38.3	0.347	–74.3
2200.00	0.358	174.8	2.544	61.7	0.156	35.1	0.325	–78.9

V_{CE} = 2 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.516	–86.3	8.468	114.1	0.065	43.6	0.622	–47.0
800.00	0.419	–107.5	6.831	102.1	0.087	43.2	0.501	–53.3
1000.00	0.348	–122.7	5.794	92.4	0.105	43.2	0.415	–58.7
1200.00	0.318	–140.8	5.091	86.2	0.116	45.3	0.373	–62.0
1400.00	0.314	–157.5	4.374	79.4	0.126	46.6	0.328	–66.6
1600.00	0.324	–168.0	3.950	72.6	0.136	45.8	0.301	–71.5
1800.00	0.313	–177.0	3.603	68.9	0.139	47.9	0.282	–77.3
2000.00	0.315	172.4	3.177	65.4	0.146	45.7	0.270	–79.6
2200.00	0.324	163.4	2.815	60.0	0.154	42.2	0.253	–84.6

V_{CE} = 2 V, I_C = 7 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.424	–98.0	9.465	108.4	0.057	46.2	0.534	–51.9
800.00	0.354	–119.6	7.465	97.4	0.077	44.3	0.423	–56.5
1000.00	0.288	–135.3	6.261	88.6	0.094	45.8	0.347	–61.8
1200.00	0.276	–154.1	5.434	83.2	0.108	49.5	0.309	–64.5
1400.00	0.282	–169.3	4.646	76.8	0.120	51.0	0.271	–69.3
1600.00	0.299	–178.4	4.193	70.4	0.135	51.3	0.249	–75.3
1800.00	0.292	172.9	3.807	67.3	0.138	52.4	0.234	–81.3
2000.00	0.300	163.6	3.352	64.1	0.147	50.2	0.225	–83.6
2200.00	0.311	156.1	2.967	59.0	0.156	46.2	0.211	–89.9

V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.355	–108.7	10.153	104.0	0.049	45.7	0.460	–55.1
800.00	0.303	–129.9	7.890	94.0	0.072	47.6	0.368	–59.4
1000.00	0.252	–147.5	6.574	85.9	0.092	50.3	0.297	–63.7
1200.00	0.251	–165.0	5.657	81.0	0.104	55.0	0.261	–66.4
1400.00	0.267	–179.1	4.826	74.9	0.120	54.8	0.230	–71.4
1600.00	0.285	173.5	4.355	68.9	0.133	54.6	0.212	–78.0
1800.00	0.282	165.6	3.944	66.2	0.139	55.7	0.199	–84.9
2000.00	0.293	157.4	3.471	63.1	0.150	53.8	0.194	–86.9
2200.00	0.304	150.9	3.068	58.3	0.157	48.9	0.184	–94.0

V_{CE} = 2 V, I_C = 20 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.272	–133.9	10.869	97.1	0.043	50.8	0.344	–59.0
800.00	0.250	–152.1	8.291	88.6	0.066	52.7	0.280	–60.9
1000.00	0.225	–170.8	6.856	81.7	0.088	56.0	0.219	–65.3
1200.00	0.240	174.6	5.838	77.6	0.103	60.5	0.196	–67.1
1400.00	0.262	164.8	4.970	71.8	0.119	59.3	0.172	–73.4
1600.00	0.282	159.6	4.491	66.3	0.135	60.0	0.158	–81.8
1800.00	0.285	153.8	4.047	64.1	0.142	60.2	0.152	–90.0
2000.00	0.300	147.4	3.563	61.2	0.151	57.6	0.149	–92.5
2200.00	0.310	142.9	3.146	56.7	0.163	52.7	0.144	–101.2

V_{CE} = 2 V, I_C = 30 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.259	–147.5	10.783	94.6	0.039	54.2	0.310	–57.9
800.00	0.248	–163.4	8.199	86.6	0.065	57.4	0.248	–58.8
1000.00	0.235	179.7	6.764	80.1	0.086	57.8	0.200	–62.6
1200.00	0.253	166.8	5.739	76.1	0.104	61.4	0.178	–63.0
1400.00	0.282	159.3	4.886	70.4	0.117	61.0	0.158	–71.1
1600.00	0.298	155.7	4.416	65.1	0.134	60.9	0.144	–78.7
1800.00	0.301	149.9	3.975	63.0	0.140	62.0	0.139	–88.2
2000.00	0.317	144.6	3.499	60.1	0.151	59.5	0.139	–89.6
2200.00	0.326	140.4	3.089	55.6	0.161	54.4	0.134	–99.5

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