

NPN EPITAXIAL SILICON TRANSISTOR IN 4-PIN MINI-MOLD PACKAGE FOR LOW-NOISE MICROWAVE AMPLIFICATION

FEATURES

- Low Noise
- $NF = 1.3 \text{ dB TYP. @ } V_{CE} = 2 \text{ V, } I_c = 3 \text{ mA, } f = 2 \text{ GHz}$
- $NF = 1.3 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_c = 3 \text{ mA, } f = 2 \text{ GHz}$
- 4-pin Mini-Mold package
EIAJ: SC-61

ORDERING INFORMATION

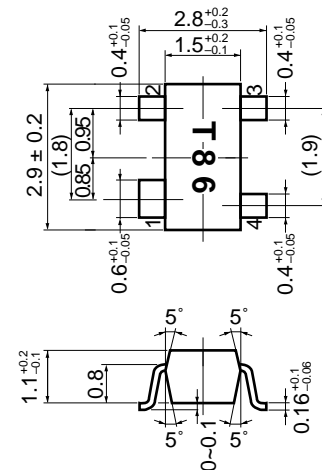
PART NUMBER	QUANTITY	ARRANGEMENT
2SC5183-T1	3 000 units/reel	Embossed tape, 8 mm wide, Pin No. 3 (base) and No. 4 (emitter) facing the perforations
2SC5183-T2		Embossed tape, 8 mm wide, Pins No. 1 (collector) and No. 2 (emitter) facing the perforations

* Contact your NEC sales representatives to order samples for evaluation (available in batches of 50).

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

Collector to Base Voltage	V_{CB0}	5	V
Collector to Emitter Voltage	V_{CE0}	3	V
Emitter to Base Voltage	V_{EB0}	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.

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

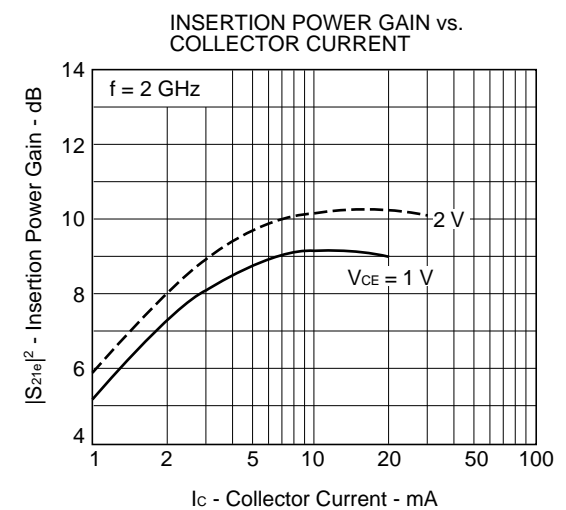
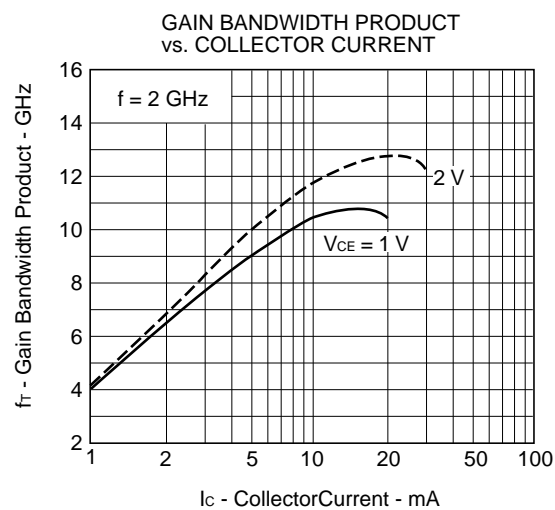
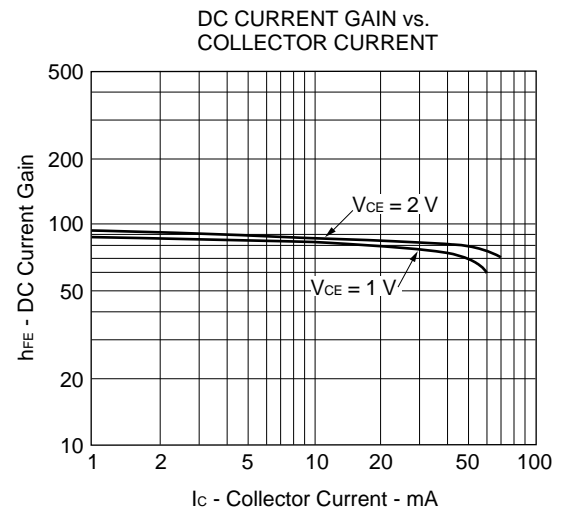
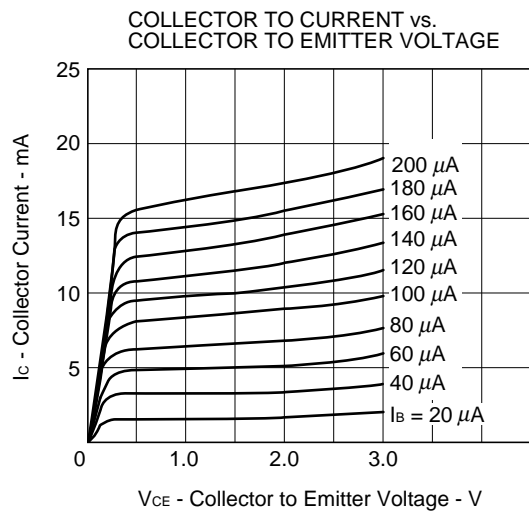
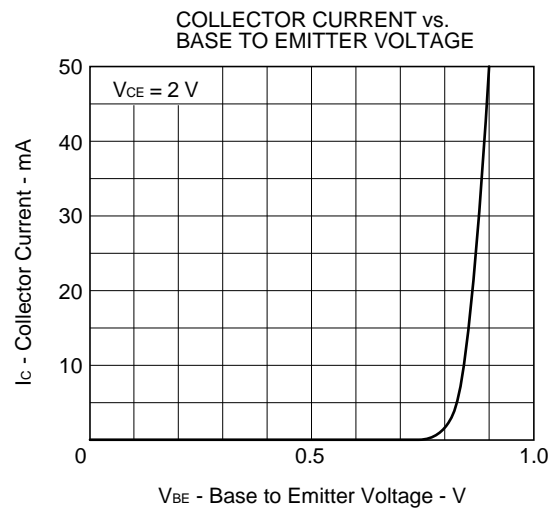
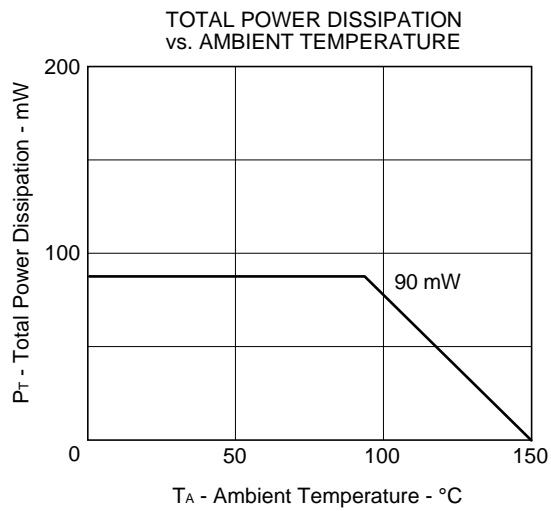
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Collector Cutoff Current	I _{CBO}			100	nA	V _{CB} = 5 V, I _E = 0
Emitter Cutoff Current	I _{EBO}			100	nA	V _{EB} = 1 V, I _C = 0
DC Current Gain	h _{FE}	70		140		V _{CE} = 2 V, I _C = 20 mA ^{*1}
Insertion Power Gain (1)	S _{21e} ²	7.5	10		dB	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz
Insertion Power Gain (2)	S _{21e} ²	7	8.5		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	9.5	12.5		GHz	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz
Gain Bandwidth Product (2)	f _T	7.5	10.5		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 mA, f = 1 MHz ^{*2}

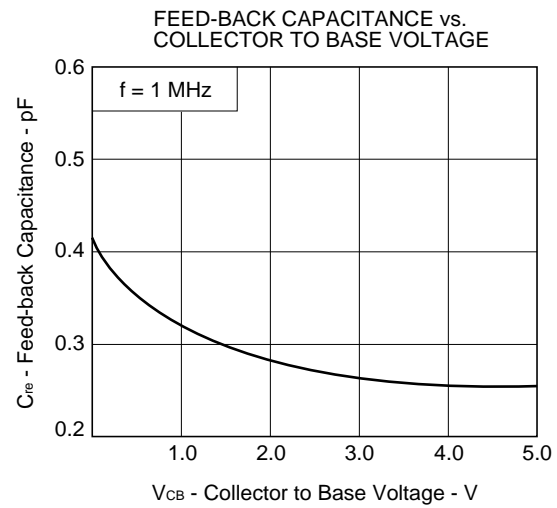
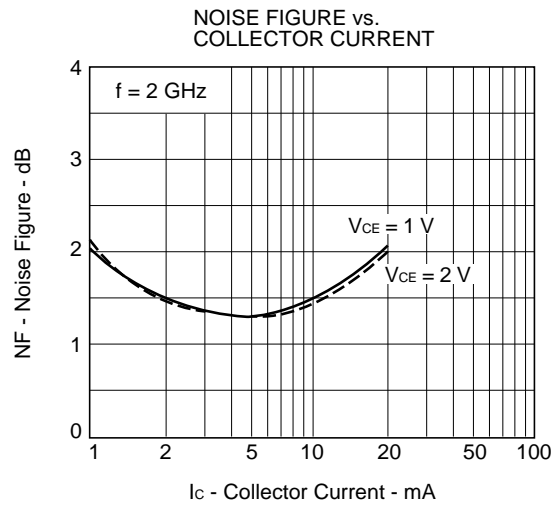
^{*1} Measured with pulses: Pulse width ≤ 350 μs, duty cycle ≤ 2 %, pulsed.

^{*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 ($T_A = 25\text{ }^{\circ}\text{C}$)



S-PARAMETERS $V_{CE} = 1\text{ V}$, $I_C = 1\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.939	-18.1	3.502	164.0	0.046	75.5	0.982	-10.2
400.00	0.896	-34.7	3.354	149.0	0.090	67.8	0.938	-19.8
600.00	0.821	-52.0	3.189	134.7	0.129	58.2	0.891	-28.9
800.00	0.754	-69.6	3.019	120.1	0.154	47.7	0.821	-37.2
1000.00	0.662	-86.6	2.797	107.6	0.180	40.3	0.750	-43.0
1200.00	0.587	-103.2	2.549	95.6	0.196	33.5	0.687	-49.7
1400.00	0.529	-121.1	2.353	84.9	0.203	26.1	0.627	-56.9
1600.00	0.480	-137.1	2.157	74.7	0.208	21.5	0.572	-61.4
1800.00	0.441	-154.9	1.961	66.2	0.215	16.7	0.527	-67.0
2000.00	0.436	-170.7	1.824	57.9	0.213	14.3	0.485	-70.8
2200.00	0.427	174.4	1.673	50.3	0.210	11.6	0.458	-75.3
2400.00	0.434	163.8	1.588	43.6	0.206	9.7	0.435	-81.6
2600.00	0.461	150.8	1.504	36.8	0.210	10.1	0.413	-85.1
2800.00	0.472	141.8	1.410	30.1	0.220	10.1	0.391	-91.6
3000.00	0.498	131.3	1.314	23.3	0.210	4.9	0.361	-102.3

 $V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.814	-29.5	9.022	154.0	0.047	75.7	0.930	-18.2
400.00	0.691	-54.3	7.707	132.8	0.077	64.2	0.801	-33.5
600.00	0.552	-76.7	6.431	116.4	0.103	54.4	0.679	-43.6
800.00	0.458	-97.4	5.442	102.2	0.120	48.2	0.572	-51.0
1000.00	0.377	-117.4	4.633	91.3	0.130	45.8	0.492	-55.9
1200.00	0.324	-137.3	3.974	81.8	0.143	41.6	0.432	-61.6
1400.00	0.302	-156.7	3.506	73.5	0.156	38.0	0.376	-67.2
1600.00	0.291	-174.1	3.114	66.0	0.163	37.7	0.343	-72.7
1800.00	0.293	169.8	2.770	59.3	0.177	35.6	0.308	-78.0
2000.00	0.307	156.1	2.540	52.8	0.192	33.1	0.274	-82.8
2200.00	0.329	145.5	2.297	46.8	0.201	30.8	0.251	-86.2
2400.00	0.361	137.1	2.160	41.1	0.220	30.0	0.222	-95.2
2600.00	0.386	128.9	2.017	35.7	0.225	26.7	0.204	-100.8
2800.00	0.408	121.5	1.904	30.0	0.244	26.2	0.188	-106.8
3000.00	0.433	113.5	1.760	24.1	0.251	21.4	0.190	-126.4

 $V_{CE} = 1\text{ V}$, $I_C = 5\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.711	−38.3	12.750	146.7	0.040	68.6	0.870	−24.6
400.00	0.545	−66.7	9.866	123.4	0.066	58.5	0.686	−40.6
600.00	0.408	−90.5	7.672	107.6	0.086	54.8	0.553	−49.8
800.00	0.330	−112.0	6.228	94.8	0.107	51.2	0.451	−56.2
1000.00	0.275	−135.4	5.180	85.2	0.118	48.8	0.385	−59.7
1200.00	0.248	−156.0	4.383	77.0	0.137	47.4	0.337	−65.0
1400.00	0.249	−175.0	3.837	69.7	0.147	46.0	0.294	−71.2
1600.00	0.251	167.3	3.385	62.9	0.163	43.1	0.257	−75.9
1800.00	0.264	153.7	2.991	56.8	0.176	42.2	0.224	−83.7
2000.00	0.295	143.5	2.740	51.0	0.193	38.8	0.195	−89.5
2200.00	0.319	133.6	2.476	45.5	0.203	35.9	0.183	−94.2
2400.00	0.339	127.8	2.317	40.3	0.221	34.3	0.163	−109.5
2600.00	0.380	120.5	2.161	35.3	0.233	30.8	0.141	−114.4
2800.00	0.405	115.7	2.042	29.6	0.253	30.2	0.133	−122.3
3000.00	0.425	108.2	1.880	24.1	0.263	24.5	0.152	−147.9

$V_{CE} = 1 \text{ V}$, $I_C = 7 \text{ mA}$, $Z_o = 50 \Omega$

FREQUENCY		S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
200.00	0.626	−44.6	15.305	141.4	0.039	71.6	0.817	−28.6	
400.00	0.446	−75.6	11.046	117.5	0.061	60.1	0.608	−44.8	
600.00	0.324	−100.3	8.281	102.6	0.081	54.9	0.475	−53.3	
800.00	0.259	−123.9	6.585	90.9	0.101	55.1	0.386	−58.3	
1000.00	0.227	−147.9	5.416	82.0	0.116	52.3	0.324	−62.0	
1200.00	0.218	−170.2	4.559	74.4	0.130	50.0	0.283	−66.1	
1400.00	0.235	174.1	3.971	67.5	0.151	49.2	0.243	−73.8	
1600.00	0.245	158.1	3.502	61.3	0.162	46.5	0.219	−79.1	
1800.00	0.262	145.6	3.087	55.6	0.181	44.9	0.193	−89.0	
2000.00	0.291	136.7	2.821	50.0	0.197	41.3	0.160	−94.3	
2200.00	0.319	127.8	2.558	44.8	0.206	37.0	0.157	−103.0	
2400.00	0.344	122.8	2.392	39.8	0.230	35.6	0.140	−116.8	
2600.00	0.385	116.5	2.223	34.9	0.238	33.3	0.123	−127.2	
2800.00	0.406	112.7	2.102	29.5	0.265	31.4	0.109	−140.7	
3000.00	0.424	103.3	1.934	24.1	0.270	25.9	0.143	−164.1	

 $V_{CE} = 1 \text{ V}$, $I_C = 10 \text{ mA}$, $Z_o = 50 \Omega$

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.522	-52.6	17.862	135.4	0.037	67.1	0.753	-33.4
400.00	0.352	-85.4	12.003	111.9	0.059	58.8	0.528	-48.7
600.00	0.254	-113.2	8.704	98.2	0.073	60.9	0.407	-55.6
800.00	0.213	-137.8	6.819	87.5	0.095	57.5	0.323	-60.4
1000.00	0.202	-162.9	5.571	79.2	0.113	55.9	0.271	-64.3
1200.00	0.206	176.6	4.672	72.2	0.127	54.6	0.236	-70.0
1400.00	0.229	162.4	4.057	65.8	0.149	52.7	0.201	-76.8
1600.00	0.246	148.9	3.570	59.9	0.163	50.0	0.181	-84.0
1800.00	0.269	136.1	3.154	54.3	0.181	47.5	0.155	-93.3
2000.00	0.291	130.9	2.880	48.9	0.202	43.7	0.134	-102.0
2200.00	0.315	123.6	2.606	44.0	0.213	41.1	0.132	-113.6
2400.00	0.344	119.3	2.430	38.9	0.230	37.5	0.118	-131.8
2600.00	0.383	114.1	2.261	34.4	0.246	35.6	0.101	-143.1
2800.00	0.407	109.0	2.135	29.2	0.269	32.5	0.099	-156.8
3000.00	0.437	102.5	1.968	23.8	0.280	26.4	0.144	-177.6

 $V_{CE} = 1 \text{ V}$, $I_C = 20 \text{ mA}$, $Z_o = 50 \Omega$

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.339	-73.6	21.029	125.3	0.030	69.4	0.606	-42.1
400.00	0.229	-112.5	12.708	103.7	0.051	65.5	0.390	-54.8
600.00	0.185	-146.6	8.896	91.9	0.076	66.7	0.291	-60.3
800.00	0.191	-169.2	6.844	82.6	0.094	61.4	0.237	-63.9
1000.00	0.203	171.9	5.545	75.2	0.117	61.5	0.190	-69.2
1200.00	0.223	157.5	4.636	68.8	0.132	57.9	0.166	-76.1
1400.00	0.253	147.3	4.022	62.9	0.151	53.6	0.144	-84.7
1600.00	0.276	137.6	3.531	57.4	0.176	50.7	0.127	-99.6
1800.00	0.294	129.5	3.113	52.1	0.185	49.3	0.109	-112.8
2000.00	0.320	124.1	2.840	47.0	0.208	45.0	0.103	-131.8
2200.00	0.354	117.7	2.562	42.1	0.228	42.2	0.102	-141.3
2400.00	0.375	114.8	2.398	37.4	0.244	40.0	0.105	-167.8
2600.00	0.409	110.0	2.226	33.0	0.258	35.2	0.103	-176.7
2800.00	0.429	105.6	2.094	27.9	0.285	31.6	0.119	174.6
3000.00	0.459	99.1	1.936	22.4	0.296	26.4	0.166	164.1

$V_{CE} = 2\text{ V}$, $I_C = 1\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
MHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00		0.944	-16.2	3.536	165.1	0.039	79.8	0.983	-8.7
400.00		0.903	-31.6	3.412	151.1	0.074	68.9	0.953	-17.1
600.00		0.840	-47.7	3.270	137.7	0.108	60.6	0.911	-25.0
800.00		0.773	-63.7	3.130	123.8	0.133	51.5	0.853	-32.6
1000.00		0.684	-79.5	2.932	111.7	0.154	43.3	0.797	-37.9
1200.00		0.606	-96.4	2.693	100.0	0.172	36.6	0.735	-44.3
1400.00		0.539	-112.9	2.503	89.5	0.181	30.9	0.675	-50.7
1600.00		0.484	-128.8	2.298	79.2	0.181	26.2	0.628	-54.5
1800.00		0.432	-144.8	2.104	70.6	0.183	21.3	0.585	-59.8
2000.00		0.422	-161.6	1.968	62.3	0.184	18.9	0.553	-63.6
2200.00		0.408	-175.8	1.807	54.9	0.187	16.4	0.526	-67.9
2400.00		0.418	169.6	1.717	47.8	0.189	14.3	0.488	-72.5
2600.00		0.428	156.9	1.619	41.4	0.188	12.2	0.467	-75.4
2800.00		0.444	146.3	1.527	34.3	0.199	13.9	0.446	-81.4
3000.00		0.471	135.0	1.427	27.9	0.196	13.5	0.419	-91.1

 $V_{CE} = 2\text{ V}$, $I_C = 3\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
MHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00		0.827	-25.9	9.104	156.0	0.037	77.0	0.943	-15.4
400.00		0.713	-47.8	7.914	136.1	0.068	59.6	0.831	-28.1
600.00		0.582	-67.5	6.749	120.1	0.088	56.1	0.731	-37.2
800.00		0.476	-85.7	5.790	106.1	0.103	51.5	0.632	-44.0
1000.00		0.381	-103.9	4.988	95.3	0.118	45.6	0.555	-47.6
1200.00		0.322	-123.1	4.304	85.7	0.125	43.7	0.501	-52.6
1400.00		0.285	-141.8	3.812	77.4	0.137	39.8	0.445	-57.0
1600.00		0.258	-160.4	3.399	69.8	0.148	41.5	0.408	-61.2
1800.00		0.248	-178.5	3.026	63.2	0.162	39.1	0.370	-65.2
2000.00		0.263	165.2	2.776	56.6	0.168	37.1	0.339	-69.6
2200.00		0.276	152.1	2.523	50.7	0.182	35.0	0.324	-73.6
2400.00		0.300	142.8	2.368	45.1	0.192	33.1	0.292	-78.0
2600.00		0.337	133.1	2.218	39.8	0.206	31.3	0.273	-81.2
2800.00		0.353	125.5	2.095	33.7	0.222	29.5	0.252	-86.9
3000.00		0.381	115.9	1.935	27.9	0.225	25.9	0.228	-102.4

 $V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
MHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00		0.734	-32.7	12.966	149.3	0.035	74.4	0.894	-20.4
400.00		0.576	-57.2	10.301	126.8	0.059	60.1	0.735	-34.3
600.00		0.432	-77.6	8.183	111.1	0.078	55.5	0.616	-42.1
800.00		0.337	-96.1	6.721	98.3	0.092	55.5	0.520	-47.2
1000.00		0.263	-116.6	5.619	88.8	0.106	51.3	0.455	-50.3
1200.00		0.216	-138.0	4.788	80.4	0.121	51.2	0.404	-53.7
1400.00		0.206	-160.4	4.191	73.1	0.136	48.5	0.363	-58.4
1600.00		0.191	-179.5	3.722	66.5	0.144	47.4	0.329	-61.8
1800.00		0.199	161.0	3.298	60.3	0.158	45.1	0.298	-67.4
2000.00		0.230	150.7	3.024	54.5	0.167	41.0	0.266	-72.0
2200.00		0.250	138.1	2.741	48.8	0.189	40.0	0.264	-75.7
2400.00		0.273	131.2	2.565	43.7	0.200	38.1	0.228	-82.1
2600.00		0.313	124.0	2.394	38.8	0.217	36.0	0.204	-86.1
2800.00		0.341	117.4	2.257	33.2	0.225	33.6	0.193	-90.5
3000.00		0.362	109.1	2.089	27.8	0.249	28.1	0.171	-112.3

$V_{CE} = 2\text{ V}$, $I_c = 7\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
MHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00		0.653	-37.7	15.782	144.1	0.034	69.7	0.853	-23.8
400.00		0.475	-63.8	11.759	120.9	0.055	65.6	0.666	-37.6
600.00		0.338	-84.5	8.990	106.0	0.071	60.1	0.546	-43.9
800.00		0.255	-104.5	7.211	94.1	0.084	55.5	0.460	-47.5
1000.00		0.200	-125.2	5.957	85.3	0.102	56.3	0.397	-50.5
1200.00		0.166	-150.4	5.029	77.6	0.121	55.0	0.360	-53.1
1400.00		0.168	-171.1	4.395	71.0	0.132	53.0	0.319	-58.2
1600.00		0.168	168.4	3.883	64.7	0.148	50.3	0.290	-62.7
1800.00		0.184	151.8	3.442	58.9	0.162	48.1	0.254	-69.2
2000.00		0.215	141.5	3.142	53.4	0.179	44.4	0.232	-72.5
2200.00		0.242	129.3	2.855	48.1	0.182	42.2	0.217	-78.3
2400.00		0.264	124.5	2.660	42.9	0.204	39.4	0.189	-89.1
2600.00		0.310	119.2	2.476	38.4	0.218	36.0	0.169	-91.6
2800.00		0.331	112.8	2.334	33.0	0.240	34.1	0.156	-93.9
3000.00		0.350	108.0	2.164	27.8	0.250	29.0	0.153	-118.7

 $V_{CE} = 2\text{ V}$, $I_c = 10\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
MHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00		0.551	-43.3	18.674	138.6	0.031	69.7	0.800	-27.6
400.00		0.373	-69.6	12.955	115.2	0.051	65.3	0.590	-39.9
600.00		0.248	-90.3	9.543	101.3	0.068	62.3	0.478	-45.3
800.00		0.188	-112.1	7.543	90.6	0.082	62.2	0.403	-47.7
1000.00		0.144	-137.4	6.175	82.4	0.098	58.4	0.352	-50.5
1200.00		0.135	-163.1	5.195	75.3	0.117	57.7	0.317	-53.2
1400.00		0.144	176.0	4.525	69.2	0.134	53.6	0.281	-57.5
1600.00		0.159	156.1	3.994	63.3	0.150	52.1	0.259	-61.9
1800.00		0.176	138.6	3.529	57.9	0.160	51.2	0.228	-68.3
2000.00		0.210	131.3	3.231	52.7	0.179	47.0	0.201	-71.4
2200.00		0.237	125.1	2.933	47.6	0.194	44.2	0.185	-81.2
2400.00		0.267	119.1	2.740	42.7	0.207	41.5	0.162	-90.7
2600.00		0.302	114.0	2.555	38.2	0.219	38.3	0.143	-90.9
2800.00		0.340	111.0	2.396	32.7	0.236	35.2	0.127	-101.1
3000.00		0.360	103.5	2.205	27.7	0.256	29.8	0.134	-127.4

 $V_{CE} = 2\text{ V}$, $I_c = 20\text{ mA}$, $Z_o = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
MHz		MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00		0.367	-54.7	22.865	129.1	0.026	73.5	0.682	-33.0
400.00		0.223	-82.7	14.270	107.1	0.045	68.7	0.477	-42.2
600.00		0.142	-107.6	10.122	95.3	0.062	67.7	0.389	-44.6
800.00		0.108	-137.1	7.845	86.0	0.084	67.2	0.327	-46.8
1000.00		0.108	-170.1	6.376	78.6	0.101	63.4	0.291	-48.1
1200.00		0.122	168.0	5.346	72.3	0.118	60.7	0.260	-52.5
1400.00		0.141	148.9	4.638	66.6	0.135	57.8	0.232	-57.7
1600.00		0.159	137.5	4.087	61.3	0.152	56.9	0.209	-62.8
1800.00		0.193	127.3	3.611	56.1	0.169	52.1	0.184	-70.4
2000.00		0.217	123.6	3.297	51.2	0.183	50.3	0.158	-76.2
2200.00		0.245	117.4	2.987	46.3	0.203	46.5	0.147	-84.1
2400.00		0.278	113.9	2.801	41.7	0.221	43.5	0.127	-95.5
2600.00		0.314	110.1	2.597	37.3	0.232	40.0	0.110	-104.8
2800.00		0.335	106.1	2.458	32.2	0.260	36.6	0.096	-109.1
3000.00		0.357	99.8	2.259	26.7	0.262	30.8	0.117	-143.4

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