

PRELIMINARY DATA SHEET

NEC

SILICON TRANSISTOR

2SC5436

NPN EPITAXIAL SILICON TRANSISTOR ULTRA SUPER MINI MOLD FOR HIGH-FREQUENCY LOW-NOISE AMPLIFICATION

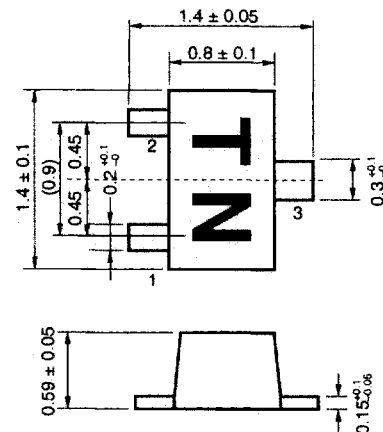
FEATURE

- Ultra super mini-mold thin flat package
(1.4 mm × 0.8 mm × 0.59 mm: TYP.)
- Contains same chip as 2SC5186

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

PARAMETER	SYMBOL	RATING	UNIT
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 (in mm)



PIN CONNECTIONS

- 1: Emitter
- 2: Base
- 3: Collector

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I _{CB0}	V _{CB} = 5 V, I _E = 0			100	nA
Emitter Cut-off Current	I _{EB0}	V _{EB} = 1 V, I _C = 0			100	nA
DC Current Gain	h _{FE}	V _{CE} = 2 V, I _C = 20 mA ^{Note 1}	70		130	
Reverse Transfer Capacitance	C _{re}	V _{CB} = 2 V, I _E = 0, f = 1 MHz ^{Note 2}		0.4	0.8	pF
Gain Bandwidth Product (1)	f _T (1)	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz	9.0	14.0		GHz
Gain Bandwidth Product (2)	f _T (2)	V _{CE} = 1 V, I _C = 10 mA, f = 2 GHz	7.0	12.0		GHz
Insertion Power Gain (1)	S _{21s} ² (1)	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz	8.5	10.0		dB
Insertion Power Gain (2)	S _{21s} ² (2)	V _{CE} = 1 V, I _C = 10 mA, f = 2 GHz	6.0	9.0		dB
Noise Figure (1)	NF (1)	V _{CE} = 2 V, I _C = 3 mA, f = 2 GHz		1.4	2.0	dB
Noise Figure (2)	NF (2)	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz		1.4	2.0	dB

Notes 1. Pulse measurement P_w ≤ 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.

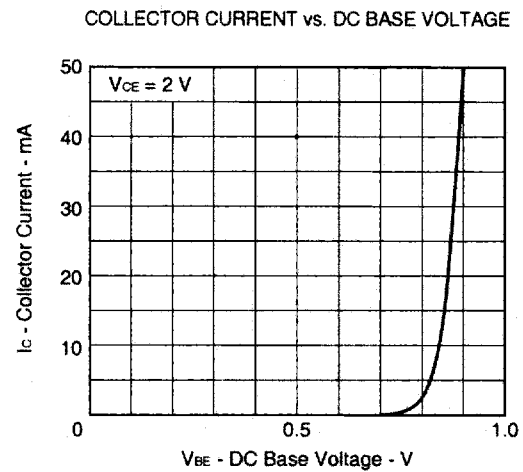
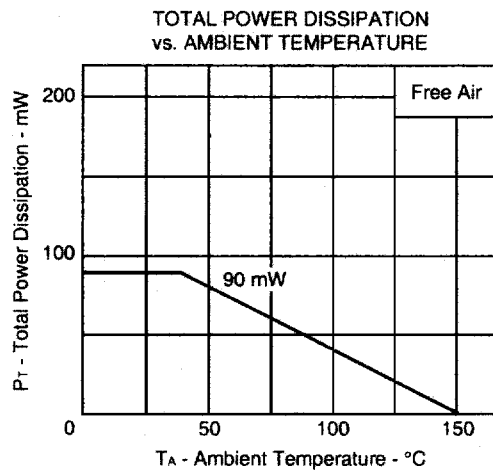
Because this product uses high-frequency process, avoid excessive input of static electricity, etc.

The information in this document is subject to change without notice.

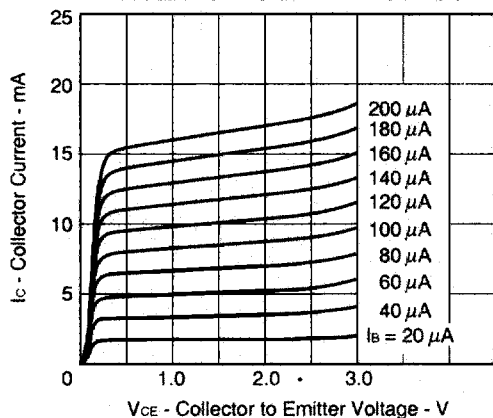
h_{FE} CLASSIFICATION

RANK	EB	FB
Marking	TN	TP
h _{FE}	75 to 100	90 to 130

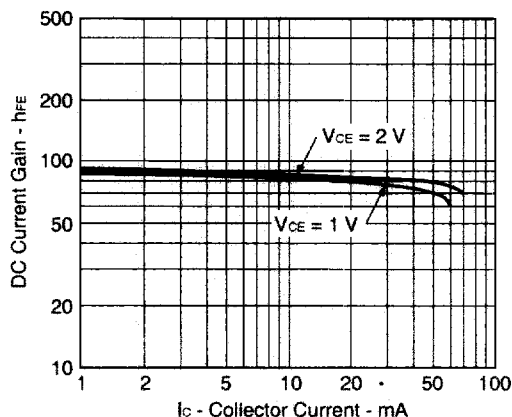
TYPICAL CHARACTERISTICS (T_A = 25 °C)



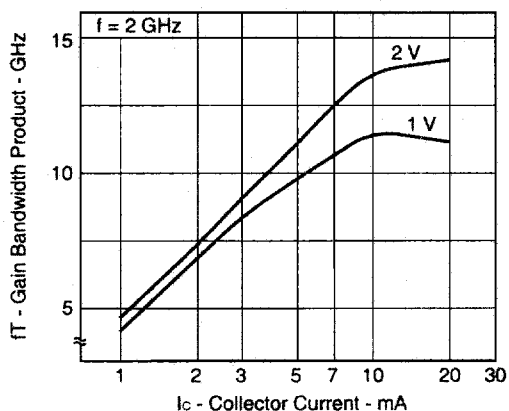
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



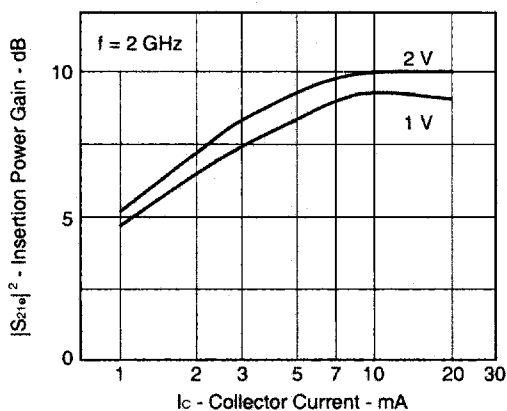
DC CURRENT GAIN vs. COLLECTOR CURRENT



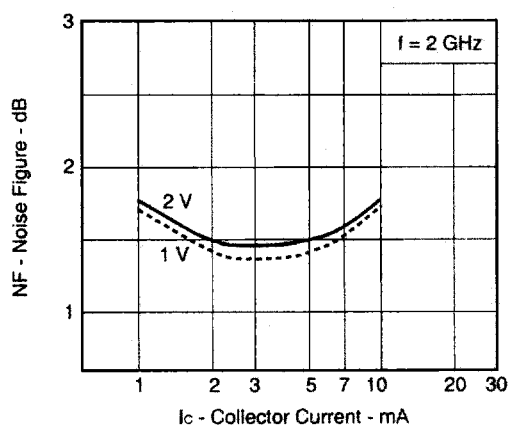
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



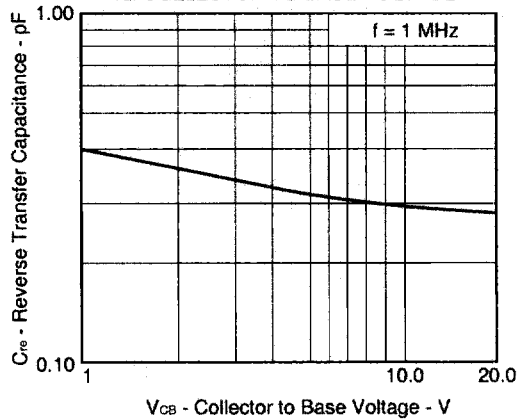
INSERTION POWER GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE vs. COLLECTOR CURRENT



REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



2SC5436 S PARAMETER

$V_{CE} = 1.0 \text{ V}$, $I_C = 1.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.960	-16.2	3.497	164.4	0.056	77.3	0.982	-10.2
400.00	0.879	-31.5	3.179	149.8	0.106	66.6	0.909	-19.9
600.00	0.812	-49.6	2.906	135.7	0.151	57.1	0.825	-31.6
800.00	0.772	-64.5	2.738	123.0	0.184	49.3	0.775	-41.8
1000.00	0.708	-77.3	2.636	113.7	0.208	41.9	0.724	-48.3
1200.00	0.641	-89.8	2.397	105.5	0.228	35.8	0.657	-53.4
1400.00	0.591	-102.4	2.167	96.0	0.243	32.2	0.583	-58.7
1600.00	0.554	-114.4	2.048	87.6	0.245	29.9	0.521	-64.5
1800.00	0.515	-125.0	1.899	81.0	0.242	26.7	0.481	-70.2
2000.00	0.478	-137.7	1.737	74.8	0.241	22.0	0.439	-75.1
2200.00	0.473	-150.1	1.612	67.4	0.244	19.1	0.397	-80.8
2400.00	0.482	-159.1	1.536	60.8	0.246	17.9	0.372	-88.3
2600.00	0.480	-166.4	1.481	56.2	0.242	17.3	0.362	-94.8
2800.00	0.475	-173.5	1.390	52.5	0.236	17.3	0.349	-99.6
3000.00	0.479	179.1	1.295	47.6	0.230	16.4	0.331	-104.6

$V_{CE} = 1.0 \text{ V}$, $I_C = 3.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.855	-29.1	8.760	154.8	0.051	72.3	0.921	-20.4
400.00	0.702	-54.5	7.301	135.0	0.089	58.0	0.751	-37.5
600.00	0.611	-78.6	6.101	118.6	0.116	50.2	0.614	-53.1
800.00	0.532	-95.9	5.216	106.8	0.132	45.3	0.526	-63.3
1000.00	0.465	-111.3	4.546	99.1	0.144	41.8	0.444	-69.8
1200.00	0.423	-126.3	3.995	92.1	0.156	40.0	0.374	-75.5
1400.00	0.406	-138.4	3.505	84.5	0.168	40.0	0.317	-82.2
1600.00	0.390	-148.8	3.097	78.8	0.173	41.1	0.276	-89.5
1800.00	0.371	-159.7	2.755	73.9	0.177	41.0	0.245	-96.5
2000.00	0.374	-171.2	2.493	69.3	0.183	39.3	0.214	-104.4
2200.00	0.392	-179.9	2.269	63.8	0.193	37.8	0.193	-114.8
2400.00	0.404	173.9	2.126	58.6	0.204	37.4	0.187	-125.9
2600.00	0.414	168.2	2.026	55.3	0.216	38.1	0.187	-134.2
2800.00	0.423	162.7	1.882	52.9	0.221	38.8	0.183	-142.6
3000.00	0.440	158.2	1.733	48.8	0.224	38.1	0.182	-150.9

$V_{CE} = 1.0 \text{ V}$, $I_C = 5.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.766	-38.7	12.311	147.9	0.048	68.9	0.861	-27.6
400.00	0.586	-70.1	9.469	126.0	0.077	55.2	0.637	-48.2
600.00	0.497	-95.5	7.440	110.1	0.098	49.8	0.494	-64.2
800.00	0.428	-113.3	6.115	99.8	0.111	47.5	0.405	-74.0
1000.00	0.381	-129.4	5.175	93.3	0.123	46.9	0.330	-80.8
1200.00	0.364	-143.9	4.470	87.0	0.136	46.4	0.272	-87.6
1400.00	0.361	-154.3	3.888	80.5	0.150	47.1	0.231	-96.0
1600.00	0.352	-163.5	3.409	75.6	0.160	48.5	0.202	-105.2
1800.00	0.346	-173.6	3.005	71.5	0.168	48.8	0.181	-114.0
2000.00	0.359	176.8	2.711	67.3	0.177	47.3	0.161	-125.9
2200.00	0.380	170.0	2.489	61.9	0.188	45.4	0.154	-138.9
2400.00	0.396	164.9	2.300	57.7	0.203	44.4	0.161	-150.7
2600.00	0.408	160.1	2.186	54.7	0.219	44.6	0.167	-158.4
2800.00	0.420	155.4	2.028	52.6	0.227	44.9	0.174	-167.2
3000.00	0.439	151.8	1.859	49.0	0.231	43.9	0.182	-174.9

2SC5436 S PARAMETER

$V_{CE} = 1.0 \text{ V}$, $I_C = 7.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.678	-47.8	15.208	142.4	0.040	65.8	0.795	-34.1
400.00	0.499	-83.4	10.893	119.5	0.068	54.7	0.545	56.5
600.00	0.422	-109.1	8.182	104.1	0.086	51.6	0.408	-72.5
800.00	0.370	-127.1	6.587	95.4	0.100	51.3	0.326	-82.1
1000.00	0.340	-142.9	5.502	89.6	0.113	51.7	0.262	-89.6
1200.00	0.338	-156.1	4.726	83.9	0.127	51.6	0.215	-98.4
1400.00	0.342	-164.8	4.085	78.1	0.143	52.3	0.186	-108.4
1600.00	0.338	-173.0	3.560	73.7	0.155	53.4	0.166	-119.0
1800.00	0.338	177.9	3.132	70.0	0.165	53.6	0.153	-129.9
2000.00	0.356	169.6	2.820	66.1	0.176	52.0	0.143	-143.6
2200.00	0.378	164.0	2.585	60.9	0.188	49.6	0.146	-156.9
2400.00	0.394	159.7	2.389	57.0	0.205	58.3	0.159	-166.6
2600.00	0.407	155.2	2.266	54.3	0.222	48.1	0.171	-173.8
2800.00	0.422	151.3	2.102	52.4	0.232	48.3	0.182	178.9
3000.00	0.441	148.2	1.925	48.9	0.237	47.0	0.194	172.6

$V_{CE} = 1.0 \text{ V}$, $I_C = 10.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.590	-57.4	17.649	136.9	0.040	63.5	0.726	-40.2
400.00	0.429	-96.2	11.847	114.0	0.060	55.3	0.465	-63.8
600.00	0.369	-121.6	8.676	99.9	0.078	54.5	0.341	-79.4
800.00	0.334	-139.3	6.880	92.2	0.093	55.2	0.267	-89.2
1000.00	0.320	-154.2	5.687	87.1	0.107	56.0	0.215	-98.1
1200.00	0.327	-165.6	4.859	81.7	0.122	56.2	0.178	-108.5
1400.00	0.335	-172.7	4.189	76.2	0.139	56.5	0.158	-120.1
1600.00	0.333	-180.0	3.645	72.3	0.153	57.1	0.146	-131.9
1800.00	0.338	171.8	3.204	68.9	0.165	57.2	0.140	-143.9
2000.00	0.358	164.6	2.884	65.1	0.176	55.3	0.138	-157.9
2200.00	0.379	159.8	2.641	60.0	0.189	52.7	0.148	-169.7
2400.00	0.396	155.9	2.440	56.4	0.206	50.9	0.165	-177.6
2600.00	0.410	152.0	2.312	53.8	0.225	50.4	0.179	176.6
2800.00	0.427	148.4	2.142	52.0	0.235	50.3	0.193	170.0
3000.00	0.444	145.8	1.960	48.7	0.241	48.8	0.208	164.9

$V_{CE} = 1.0 \text{ V}$, $I_C = 20.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.418	-84.6	20.871	126.0	0.033	63.1	0.561	-52.7
400.00	0.345	-126.8	12.516	104.9	0.050	59.2	0.324	-76.6
600.00	0.326	-148.1	8.792	93.3	0.067	61.5	0.232	-92.4
800.00	0.319	-162.7	6.850	87.1	0.085	62.4	0.180	-103.1
1000.00	0.327	-174.0	5.641	82.8	0.101	63.3	0.146	-115.4
1200.00	0.344	178.7	4.797	77.9	0.118	62.8	0.130	-129.2
1400.00	0.353	174.3	4.109	73.1	0.136	62.2	0.124	-142.1
1600.00	0.354	168.6	3.580	69.7	0.153	62.0	0.125	-153.9
1800.00	0.363	162.0	3.133	66.6	0.165	61.9	0.129	-166.0
2000.00	0.386	156.7	2.827	63.0	0.178	59.7	0.139	-177.5
2200.00	0.407	153.2	2.579	58.2	0.191	56.7	0.156	173.9
2400.00	0.423	150.1	2.385	54.7	0.209	54.4	0.174	168.8
2600.00	0.438	146.7	2.260	52.4	0.228	53.6	0.191	164.7
2800.00	0.455	143.7	2.089	50.8	0.240	53.4	0.208	159.4
3000.00	0.473	141.8	1.912	47.3	0.245	51.5	0.225	155.9

2SC5436 S PARAMETER

$V_{CE} = 1.0 \text{ V}$, $I_C = 30.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.374	-106.5	19.871	120.8	0.031	61.1	0.463	-57.8
400.00	0.358	-144.4	11.404	101.0	0.046	61.7	0.257	-81.0
600.00	0.355	-161.5	7.944	90.2	0.064	64.3	0.181	-96.4
800.00	0.356	-173.4	6.193	84.6	0.083	65.1	0.140	-107.7
1000.00	0.370	177.4	5.083	80.5	0.100	65.6	0.115	-121.6
1200.00	0.390	172.1	4.321	75.7	0.116	64.9	0.105	-136.6
1400.00	0.396	168.6	3.713	70.8	0.135	64.0	0.105	-150.0
1600.00	0.396	163.6	3.226	67.6	0.152	63.7	0.110	-161.7
1800.00	0.405	157.5	2.826	64.5	0.164	63.2	0.116	-173.6
2000.00	0.428	152.9	2.547	60.7	0.177	61.1	0.129	176.2
2200.00	0.448	149.8	2.299	56.5	0.191	57.9	0.147	169.0
2400.00	0.463	147.0	2.154	52.6	0.209	55.5	0.166	164.9
2600.00	0.477	143.8	2.040	50.2	0.227	54.6	0.183	161.1
2800.00	0.493	141.2	1.882	48.6	0.240	54.4	0.200	156.7
3000.00	0.511	139.4	1.725	45.0	0.245	52.7	0.217	153.5

$V_{CE} = 2.0 \text{ V}$, $I_C = 1.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.962	-14.6	3.530	165.5	0.048	79.4	0.984	-8.8
400.00	0.892	-28.5	3.230	151.9	0.090	68.8	0.922	-17.3
600.00	0.824	-45.2	2.976	138.6	0.131	59.6	0.845	-27.8
800.00	0.788	-59.4	2.820	126.3	0.162	52.3	0.802	-37.3
1000.00	0.728	-71.3	2.743	117.4	0.184	45.2	0.761	-43.3
1200.00	0.661	-82.8	2.519	109.6	0.203	39.3	0.699	-47.7
1400.00	0.604	-94.9	2.278	100.5	0.219	35.8	0.626	-52.3
1600.00	0.562	-106.7	2.162	92.0	0.223	33.5	0.564	-57.5
1800.00	0.521	-117.1	2.019	85.4	0.221	30.4	0.523	-62.7
2000.00	0.477	-129.4	1.854	79.2	0.220	25.9	0.482	-67.2
2200.00	0.463	-142.2	1.727	71.8	0.224	23.0	0.441	-71.7
2400.00	0.469	-152.0	1.643	65.2	0.227	21.7	0.411	-78.3
2600.00	0.465	-159.7	1.591	60.5	0.225	21.4	0.398	-84.4
2800.00	0.457	-167.1	1.497	56.7	0.220	21.6	0.385	-88.7
3000.00	0.457	-175.1	1.400	52.1	0.214	20.7	0.363	-92.8

$V_{CE} = 2.0 \text{ V}$, $I_C = 3.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.870	-25.6	8.863	156.7	0.044	73.4	0.935	-17.4
400.00	0.724	-48.2	7.556	138.0	0.078	61.2	0.784	-32.2
600.00	0.628	-70.6	6.416	122.1	0.105	53.1	0.652	-46.2
800.00	0.548	-86.8	5.549	110.2	0.120	48.2	0.568	-55.6
1000.00	0.473	-101.0	4.883	102.4	0.132	45.3	0.490	-60.9
1200.00	0.418	-115.3	4.315	95.6	0.144	43.1	0.420	-65.1
1400.00	0.390	-127.8	3.805	88.0	0.156	43.1	0.358	-69.9
1600.00	0.370	-138.8	3.375	82.1	0.162	44.2	0.311	-75.6
1800.00	0.346	-149.9	3.007	77.3	0.166	44.1	0.277	-81.1
2000.00	0.341	-162.2	2.727	72.6	0.172	42.3	0.245	-86.6
2200.00	0.354	-172.3	2.511	66.6	0.181	40.8	0.215	-93.9
2400.00	0.367	-179.2	2.331	62.1	0.193	40.4	0.199	-103.4
2600.00	0.376	174.5	2.225	58.6	0.205	41.2	0.193	-111.5
2800.00	0.383	168.5	2.073	56.0	0.211	41.8	0.181	-118.7
3000.00	0.397	163.2	1.911	52.3	0.213	41.4	0.174	-126.6

2SC5436 S PARAMETER

 $V_{CE} = 2.0 \text{ V}$, $I_C = 5.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.787	-33.8	12.596	150.3	0.041	69.6	0.883	-23.6
400.00	0.609	-61.4	9.951	129.3	0.068	58.5	0.678	-41.2
600.00	0.508	-85.4	7.969	113.4	0.089	53.0	0.534	-55.5
800.00	0.430	-102.2	6.609	102.9	0.102	50.3	0.447	-63.8
1000.00	0.371	-117.4	5.643	96.2	0.114	49.7	0.371	-68.6
1200.00	0.339	-132.1	4.902	90.0	0.127	49.0	0.311	-72.9
1400.00	0.327	-143.7	4.268	83.5	0.140	49.5	0.261	-78.4
1600.00	0.317	-153.8	3.748	78.5	0.150	51.0	0.225	-85.0
1800.00	0.306	-164.5	3.317	74.5	0.158	51.4	0.198	-91.6
2000.00	0.314	-175.4	2.992	70.3	0.167	50.0	0.172	-99.5
2200.00	0.333	176.4	2.749	64.9	0.178	48.0	0.152	-110.0
2400.00	0.349	170.8	2.551	60.3	0.192	47.0	0.145	-122.8
2600.00	0.360	165.4	2.418	57.7	0.207	47.2	0.145	-132.1
2800.00	0.373	160.3	2.252	55.6	0.216	47.9	0.144	-142.3
3000.00	0.391	156.1	2.067	52.1	0.221	46.7	0.144	-151.7

 $V_{CE} = 2.0 \text{ V}$, $I_C = 7.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.704	-41.2	15.691	145.2	0.040	68.4	0.827	-28.9
400.00	0.514	-72.8	11.586	122.7	0.061	57.3	0.589	-48.1
600.00	0.422	-97.4	8.906	107.2	0.079	54.6	0.447	-61.8
800.00	0.356	-114.6	7.201	98.2	0.092	54.0	0.364	-69.4
1000.00	0.315	-130.2	6.066	92.4	0.105	53.7	0.296	-74.0
1200.00	0.299	-144.6	5.212	86.7	0.118	54.1	0.245	-78.8
1400.00	0.298	-154.9	4.510	80.8	0.134	54.4	0.205	-85.2
1600.00	0.292	-164.2	3.937	76.4	0.146	55.6	0.176	-93.0
1800.00	0.289	-174.0	3.476	72.7	0.156	56.1	0.155	-101.2
2000.00	0.303	176.4	3.133	68.9	0.166	54.4	0.134	-111.6
2200.00	0.325	169.7	2.868	63.8	0.178	52.2	0.123	-125.2
2400.00	0.342	164.8	2.667	59.4	0.193	50.7	0.125	-139.4
2600.00	0.356	160.1	2.525	57.1	0.211	50.6	0.129	-149.1
2800.00	0.370	155.7	2.345	55.2	0.221	51.0	0.135	-159.7
3000.00	0.388	152.0	2.146	51.8	0.226	49.7	0.142	-169.0

 $V_{CE} = 2.0 \text{ V}$, $I_C = 10.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.617	-49.2	18.466	139.9	0.036	65.6	0.765	-34.0
400.00	0.434	-83.8	12.811	117.3	0.055	57.7	0.511	-53.7
600.00	0.356	-108.5	9.500	102.8	0.072	57.1	0.377	-66.5
800.00	0.307	-126.1	7.569	94.8	0.086	57.3	0.302	-73.5
1000.00	0.280	-141.8	6.310	89.6	0.100	58.4	0.242	-78.0
1200.00	0.277	-155.1	5.390	84.3	0.114	58.2	0.199	-83.3
1400.00	0.282	-164.0	4.665	78.9	0.130	58.3	0.166	-90.8
1600.00	0.280	-172.3	4.068	74.8	0.144	59.0	0.143	-100.2
1800.00	0.283	178.6	3.579	71.5	0.155	59.5	0.127	-110.3
2000.00	0.300	170.4	3.220	67.9	0.167	57.5	0.112	-123.7
2200.00	0.322	164.7	2.953	63.0	0.179	55.1	0.108	-138.9
2400.00	0.340	160.4	2.740	58.7	0.195	53.3	0.116	-152.8
2600.00	0.355	156.4	2.565	56.2	0.213	52.9	0.126	-161.9
2800.00	0.371	152.2	2.403	54.8	0.225	52.9	0.135	-171.8
3000.00	0.390	149.1	2.198	51.6	0.230	51.4	0.146	-179.7

2SC5436 S PARAMETER

$V_{CE} = 2.0 \text{ V}$, $I_C = 20.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.434	-70.0	22.783	129.5	0.029	64.5	0.625	-43.1
400.00	0.313	-110.0	14.092	108.0	0.045	62.6	0.374	-60.8
600.00	0.276	-133.8	10.021	95.9	0.062	63.3	0.267	-70.9
800.00	0.258	-150.7	7.839	89.6	0.079	64.2	0.210	-76.1
1000.00	0.258	-164.2	6.468	85.3	0.094	65.3	0.165	-80.1
1200.00	0.270	-173.6	5.484	80.6	0.109	64.6	0.134	-85.8
1400.00	0.281	-179.3	4.724	75.7	0.126	64.3	0.112	-95.1
1600.00	0.283	174.3	4.105	72.4	0.143	64.3	0.096	-107.2
1800.00	0.292	167.1	3.613	69.4	0.154	64.1	0.088	-121.0
2000.00	0.313	160.9	3.254	65.8	0.167	62.1	0.082	-138.8
2200.00	0.335	157.1	2.971	61.3	0.180	59.2	0.087	-156.0
2400.00	0.354	153.9	2.763	57.3	0.196	57.0	0.101	-168.3
2600.00	0.370	150.3	2.584	55.0	0.215	56.3	0.115	-176.6
2800.00	0.387	147.1	2.418	53.8	0.228	56.1	0.130	175.1
3000.00	0.406	144.9	2.215	50.6	0.233	54.5	0.145	169.0

$V_{CE} = 2.0 \text{ V}$, $I_C = 30.0 \text{ mA}$, $Z_0 = 50 \Omega$

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200.00	0.357	-83.5	23.436	125.1	0.026	64.0	0.559	-45.5
400.00	0.282	-125.0	13.927	104.5	0.042	64.8	0.324	-60.4
600.00	0.263	-146.7	9.793	93.3	0.058	65.9	0.229	-68.1
800.00	0.258	-161.7	7.627	87.6	0.075	67.1	0.181	-71.5
1000.00	0.264	-173.3	6.255	83.6	0.090	67.6	0.143	-74.0
1200.00	0.282	179.3	5.327	79.0	0.106	67.1	0.117	-78.2
1400.00	0.292	174.7	4.569	74.3	0.123	66.4	0.096	-86.2
1600.00	0.296	169.1	3.963	71.1	0.139	66.2	0.080	-98.2
1800.00	0.306	162.7	3.489	68.1	0.152	66.3	0.071	-112.8
2000.00	0.330	157.4	3.143	64.7	0.164	63.8	0.066	-132.0
2200.00	0.352	154.0	2.870	60.1	0.177	61.0	0.069	-151.7
2400.00	0.372	151.2	2.667	56.2	0.194	58.7	0.083	-166.8
2600.00	0.388	147.8	2.522	54.3	0.211	57.7	0.097	-175.3
2800.00	0.405	145.0	2.333	52.8	0.225	57.7	0.112	176.0
3000.00	0.424	143.1	2.133	49.5	0.231	56.0	0.128	169.8

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