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April 1, 2003

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# 2SC5820

Silicon NPN Epitaxial  
High Frequency Low Noise Amplifier / Oscillator

**RENESAS**

ADE-208-1604A (Z)

Rev.1  
Nov. 2002

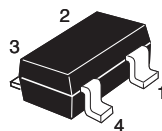
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## Features

- High gain bandwidth product  
 $f_T = 20$  GHz typ.
- High power gain and low noise figure;  
PG = 17.5 dB typ., NF = 1.15 dB typ. at  $f = 1.8$  GHz

## Outline

CMPAK-4



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

Note: Marking is "WU-".

## 2SC5820

### Absolute Maximum Ratings

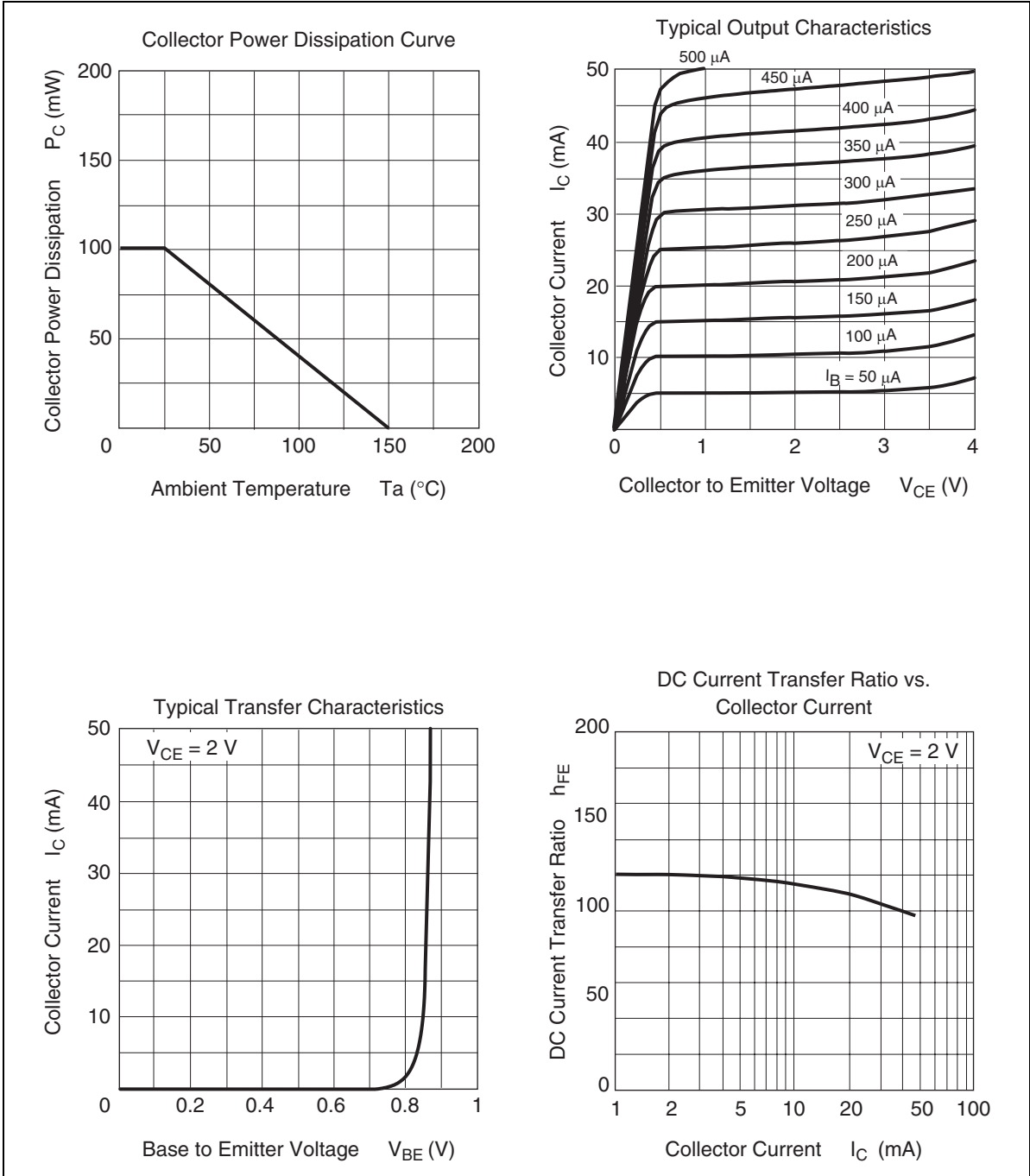
(Ta = 25 °C)

Item	Symbol	Ratings	Unit
Collector to base voltage	$V_{CBO}$	12	V
Collector to emitter voltage	$V_{CEO}$	4.0	V
Emitter to base voltage	$V_{EBO}$	1.5	V
Collector current	$I_C$	35	mA
Collector power dissipation	Pc	100	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	-55 to +150	°C

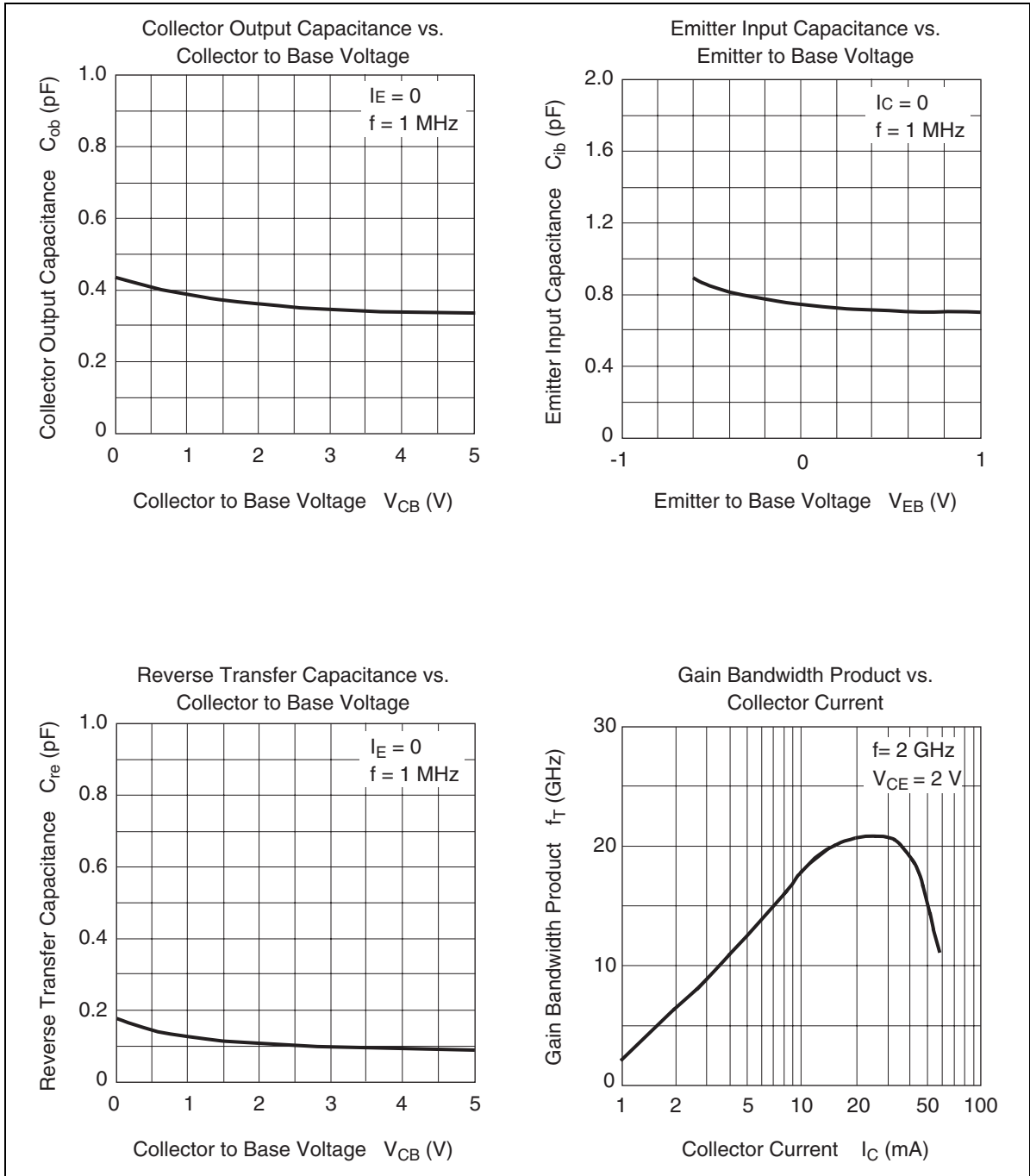
### Electrical Characteristics

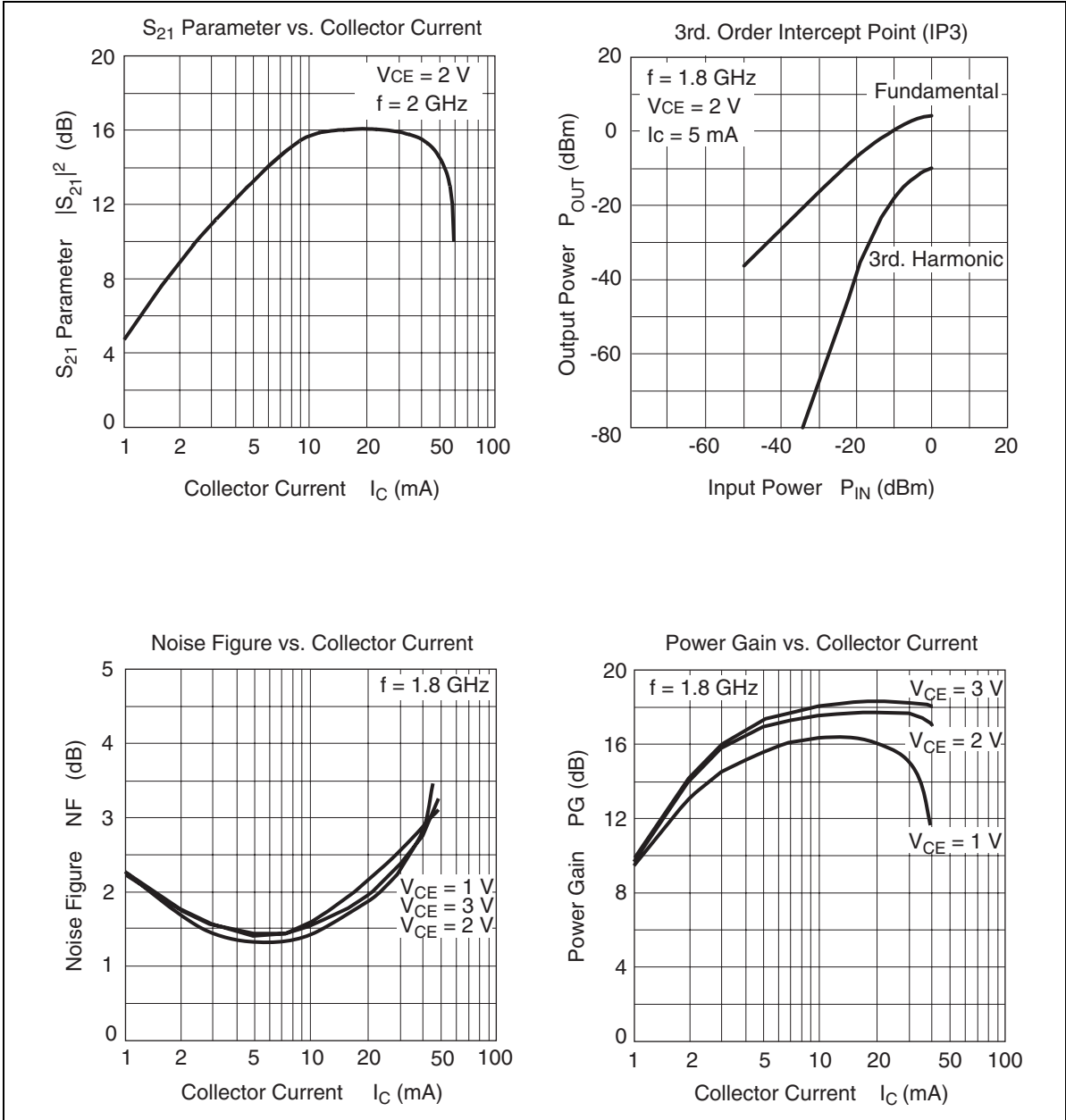
(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector cutoff current	$I_{CBO}$	—	—	1	μA	$V_{CB} = 12\text{ V}, I_E = 0$
Collector cutoff current	$I_{CEO}$	—	—	1	μA	$V_{CE} = 4\text{ V}, R_{BE} = \infty$
Emitter cutoff current	$I_{EBO}$	—	—	10	μA	$V_{EB} = 1.5\text{ V}, I_C = 0$
DC current transfer ratio	$h_{FE}$	70	110	150	—	$V_{CE} = 2\text{ V}, I_C = 20\text{ mA}$
Collector output capacitance	$C_{ob}$	—	0.3	0.6	pF	$V_{CB} = 2\text{ V}, I_E = 0, f = 1\text{ MHz}$
Gain bandwidth product	$f_T$	17	20	—	GHz	$V_{CE} = 2\text{ V}, I_C = 30\text{ mA}$ $f = 2\text{ GHz}$
Power gain	PG	13	17.5	—	dB	$V_{CE} = 2\text{ V}, I_C = 30\text{ mA},$ $f = 1.8\text{ GHz}$
Noise figure	NF	—	1.15	1.7	dB	$V_{CE} = 2\text{ V}, I_C = 5\text{ mA},$ $f = 1.8\text{ GHz}$
3rd. Order Intercept Point	IP3	—	10	—	dBm	$V_{CE} = 2\text{ V}, I_C = 5\text{ mA},$ $f = 1.8\text{ GHz}$

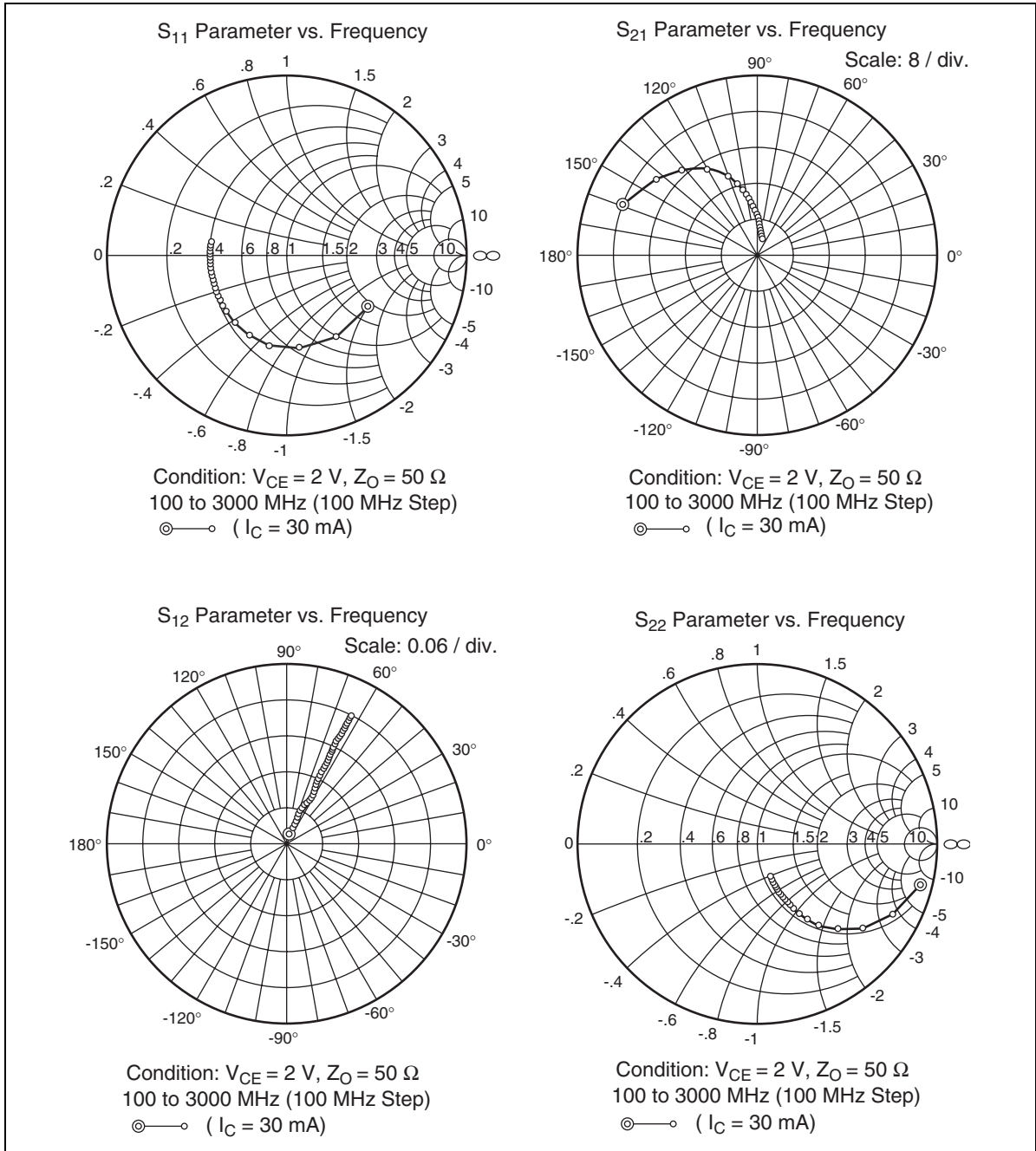


## 2SC5820





**2SC5820**





**S Parameter**

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

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.844	-24.6	15.26	159.9	0.0124	78.9	0.976	-16.4
200	0.835	-23.1	15.07	162.9	0.0153	84.0	0.973	-11.7
300	0.838	-34.2	14.59	154.8	0.0236	80.2	0.953	-17.5
400	0.809	-45.7	13.94	147.1	0.0311	72.5	0.919	-23.6
500	0.781	-56.2	13.16	139.9	0.0387	67.5	0.879	-29.0
600	0.745	-66.8	12.39	133.1	0.0441	61.6	0.828	-33.9
700	0.710	-76.0	11.71	127.7	0.0506	56.2	0.779	-38.6
800	0.688	-85.5	10.89	121.8	0.0537	52.0	0.728	-41.9
900	0.659	-93.5	10.16	117.0	0.0579	47.7	0.682	-45.4
1000	0.639	-101.0	9.47	112.8	0.0610	46.8	0.641	-47.4
1100	0.633	-107.3	8.77	108.6	0.0643	41.1	0.601	-49.8
1200	0.596	-115.4	8.40	105.2	0.0640	40.4	0.560	-51.8
1300	0.578	-121.8	7.92	101.5	0.0665	37.6	0.528	-54.0
1400	0.570	-128.0	7.47	98.3	0.0675	37.4	0.499	-55.4
1500	0.556	-133.1	7.04	95.6	0.0685	32.9	0.473	-57.1
1600	0.548	-138.8	6.68	92.5	0.0691	32.9	0.449	-58.0
1700	0.541	-143.6	6.37	90.1	0.0693	32.5	0.422	-59.0
1800	0.532	-149.0	6.08	87.5	0.0699	30.2	0.400	-60.6
1900	0.529	-153.1	5.77	85.0	0.0716	30.6	0.384	-60.7
2000	0.523	-157.1	5.53	83.2	0.0735	28.8	0.370	-62.1
2100	0.520	-162.0	5.29	80.4	0.0719	30.4	0.349	-62.5
2200	0.521	-164.7	5.03	79.1	0.0733	28.1	0.345	-63.6
2300	0.521	-168.8	4.86	76.4	0.0752	26.6	0.326	-64.0
2400	0.521	-172.0	4.67	74.4	0.0748	26.8	0.312	-64.8
2500	0.520	-175.7	4.53	72.3	0.0752	26.8	0.297	-65.6
2600	0.522	-178.4	4.33	70.6	0.0765	26.2	0.292	-66.7
2700	0.525	-178.2	4.21	68.6	0.0771	27.6	0.280	-67.8
2800	0.526	-175.6	4.05	67.2	0.0775	27.4	0.275	-68.9
2900	0.529	-172.4	3.91	64.8	0.0785	25.5	0.260	-69.5
3000	0.532	-169.7	3.82	62.7	0.0772	24.6	0.249	-70.5

## 2SC5820

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

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.717	-17.3	25.92	167.8	0.0073	84.9	0.967	-8.4
200	0.712	-34.2	24.87	156.2	0.0137	81.4	0.941	-17.1
300	0.699	-50.1	23.25	145.5	0.0205	73.7	0.896	-25.1
400	0.667	-65.5	21.32	136.0	0.0266	66.0	0.833	-32.8
500	0.635	-78.9	19.27	127.6	0.0319	62.0	0.766	-39.1
600	0.600	-91.5	17.37	120.5	0.0349	56.4	0.694	-44.3
700	0.572	-102.0	15.73	115.1	0.0403	52.7	0.632	-48.6
800	0.553	-112.1	14.26	109.6	0.0402	51.2	0.574	-51.7
900	0.533	-120.1	12.97	105.3	0.0445	46.0	0.525	-54.8
1000	0.522	-127.4	11.90	101.6	0.0472	47.2	0.484	-56.2
1100	0.515	-133.7	10.90	98.1	0.0476	43.4	0.446	-58.4
1200	0.499	-140.9	10.16	95.3	0.0477	44.4	0.410	-59.4
1300	0.492	-146.8	9.46	92.2	0.0505	43.3	0.381	-61.0
1400	0.490	-152.1	8.84	89.6	0.0509	43.8	0.357	-61.9
1500	0.484	-156.6	8.27	87.4	0.0520	39.7	0.335	-62.9
1600	0.484	-161.3	7.79	84.8	0.0533	41.0	0.316	-63.4
1700	0.482	-165.3	7.38	82.8	0.0540	41.4	0.295	-64.0
1800	0.481	-169.8	6.99	80.7	0.0548	40.0	0.277	-65.0
1900	0.481	-173.1	6.63	78.7	0.0578	41.6	0.265	-65.1
2000	0.481	-176.4	6.33	76.9	0.0601	39.9	0.252	-66.1
2100	0.483	179.9	6.02	74.8	0.0603	42.3	0.238	-66.1
2200	0.484	177.3	5.75	73.4	0.0610	39.9	0.232	-66.9
2300	0.488	174.4	5.52	71.4	0.0641	39.3	0.219	-67.2
2400	0.489	171.8	5.29	69.6	0.0646	39.5	0.209	-67.7
2500	0.491	169.0	5.10	67.8	0.0664	40.2	0.197	-68.0
2600	0.495	166.5	4.89	66.2	0.0678	39.7	0.194	-69.7
2700	0.501	164.3	4.73	64.6	0.0693	40.4	0.185	-71.0
2800	0.503	161.9	4.55	63.2	0.0705	40.2	0.181	-71.9
2900	0.508	159.6	4.39	61.4	0.0715	39.5	0.170	-72.9
3000	0.510	157.3	4.27	59.6	0.0717	37.3	0.162	-74.0

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

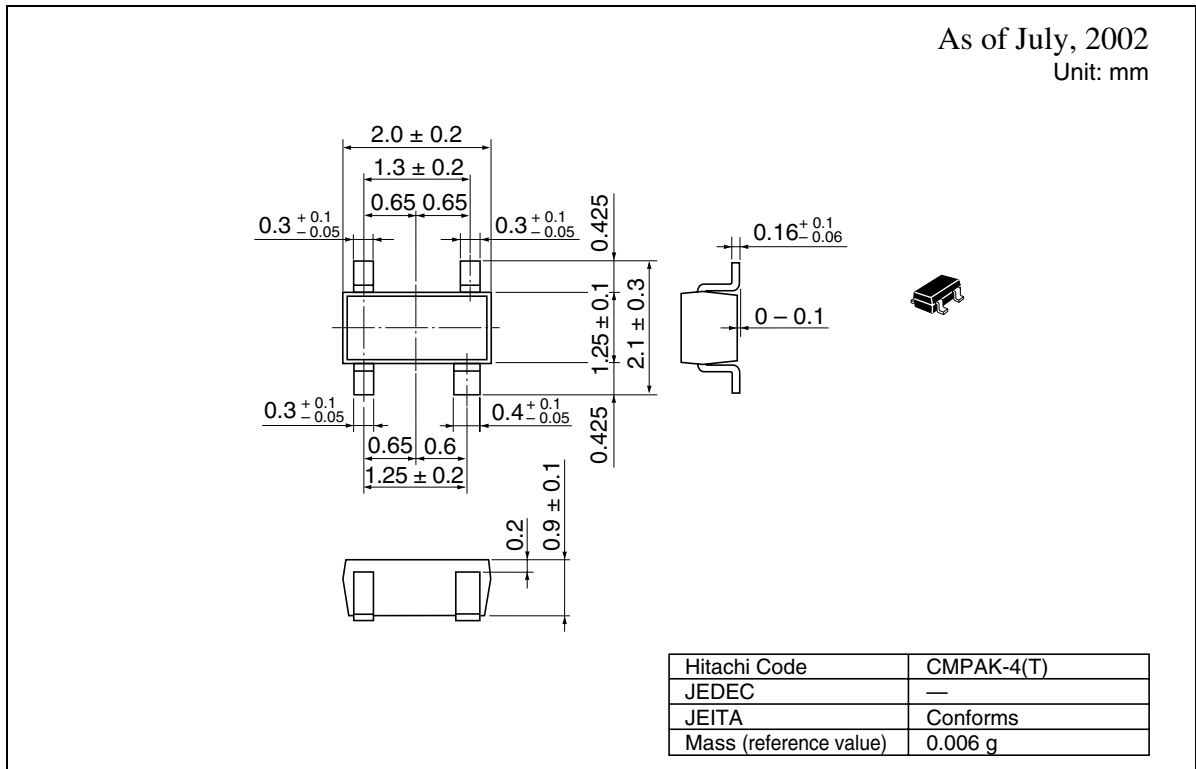
f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.556	-26.3	38.68	163.4	0.0065	88.2	0.937	-11.6
200	0.550	-50.8	35.60	148.3	0.0117	78.3	0.882	-23.2
300	0.537	-72.0	31.52	135.5	0.0174	71.3	0.805	-32.9
400	0.519	-90.7	27.37	125.0	0.0215	63.3	0.716	-41.4
500	0.501	-105.4	23.66	116.7	0.0252	62.0	0.633	-47.6
600	0.485	-118.3	20.55	110.2	0.0276	57.0	0.556	-52.3
700	0.475	-128.1	18.10	105.3	0.0310	54.2	0.495	-55.9
800	0.470	-137.3	16.09	100.7	0.0312	54.1	0.441	-58.4
900	0.462	-144.3	14.43	97.1	0.0352	51.7	0.397	-60.8
1000	0.460	-150.4	13.12	94.1	0.0369	53.1	0.362	-61.7
1100	0.460	-155.8	11.95	91.2	0.0389	50.4	0.330	-63.6
1200	0.458	-161.4	11.00	88.9	0.0397	52.5	0.302	-63.5
1300	0.457	-166.3	10.20	86.4	0.0425	51.5	0.280	-64.7
1400	0.460	-170.1	9.48	84.2	0.0441	53.3	0.260	-65.2
1500	0.457	-173.9	8.85	82.2	0.0452	49.4	0.242	-66.3
1600	0.462	-177.4	8.31	80.0	0.0469	50.7	0.227	-65.9
1700	0.462	179.3	7.84	78.4	0.0478	52.0	0.210	-66.4
1800	0.466	175.9	7.41	76.6	0.0496	49.7	0.198	-66.8
1900	0.467	173.3	7.02	74.8	0.0532	51.5	0.187	-67.2
2000	0.469	170.6	6.70	73.2	0.0548	50.1	0.178	-67.2
2100	0.474	167.8	6.36	71.4	0.0572	52.8	0.167	-67.3
2200	0.476	165.5	6.09	70.0	0.0574	50.9	0.161	-68.3
2300	0.480	163.3	5.82	68.3	0.0610	48.6	0.152	-68.2
2400	0.483	161.2	5.58	66.7	0.0616	49.0	0.143	-69.2
2500	0.486	159.0	5.37	65.0	0.0638	49.8	0.135	-69.8
2600	0.490	156.9	5.15	63.4	0.0661	48.6	0.131	-70.8
2700	0.497	155.3	4.97	62.1	0.0699	48.9	0.123	-72.9
2800	0.499	153.1	4.78	60.8	0.0715	49.3	0.122	-74.1
2900	0.505	151.4	4.61	59.2	0.0714	48.0	0.114	-75.4
3000	0.506	149.6	4.48	57.6	0.0713	46.7	0.106	-77.2

## 2SC5820

( $V_{CE} = 2\text{ V}$ ,  $I_C = 30\text{ mA}$ ,  $Z_o = 50\ \Omega$ )

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.441	-34.8	45.76	160.6	0.0061	84.2	0.913	-13.6
200	0.449	-65.1	40.75	143.5	0.0110	78.8	0.838	-26.7
300	0.455	-88.7	34.81	129.9	0.0153	69.4	0.741	-37.1
400	0.455	-107.9	29.32	119.4	0.0185	63.3	0.641	-45.5
500	0.451	-122.1	24.83	111.5	0.0223	61.5	0.558	-51.2
600	0.450	-133.9	21.25	105.6	0.0238	58.6	0.485	-55.6
700	0.449	-142.5	18.53	101.1	0.0280	55.9	0.428	-58.5
800	0.451	-150.6	16.36	97.0	0.0284	57.8	0.378	-60.4
900	0.449	-156.4	14.62	93.7	0.0321	55.5	0.340	-62.8
1000	0.449	-161.7	13.25	91.1	0.0347	57.7	0.308	-63.1
1100	0.453	-166.3	12.05	88.4	0.0360	55.5	0.279	-64.9
1200	0.455	-171.0	11.05	86.3	0.0364	58.0	0.256	-64.1
1300	0.457	-175.0	10.23	84.0	0.0399	56.7	0.236	-65.2
1400	0.460	-178.3	9.50	82.0	0.0413	58.5	0.220	-65.5
1500	0.460	178.5	8.86	80.2	0.0438	54.8	0.204	-66.2
1600	0.466	175.5	8.32	78.1	0.0437	55.1	0.190	-65.9
1700	0.466	172.7	7.84	76.5	0.0465	56.5	0.176	-65.8
1800	0.471	169.8	7.41	74.8	0.0481	55.4	0.165	-66.4
1900	0.472	167.4	7.02	73.2	0.0517	56.0	0.157	-66.9
2000	0.476	165.0	6.69	71.6	0.0540	54.4	0.149	-66.8
2100	0.480	162.7	6.35	69.9	0.0560	56.9	0.139	-67.3
2200	0.483	160.5	6.08	68.5	0.0573	55.2	0.134	-67.8
2300	0.487	158.7	5.81	66.9	0.0604	52.3	0.126	-67.7
2400	0.489	156.8	5.56	65.4	0.0617	53.6	0.117	-68.2
2500	0.493	154.9	5.35	63.8	0.0633	53.4	0.110	-68.8
2600	0.497	153.0	5.14	62.2	0.0659	51.6	0.107	-70.8
2700	0.504	151.6	4.96	60.9	0.0690	52.2	0.101	-72.8
2800	0.507	149.5	4.77	59.6	0.0711	52.9	0.099	-73.4
2900	0.511	148.0	4.59	58.1	0.0714	50.9	0.091	-76.1
3000	0.515	146.3	4.47	56.5	0.0717	49.4	0.085	-78.0

Package Dimensions



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