To all our customers

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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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Keep safety first in your circuit designs!

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2SC5820

Silicon NPN Epitaxial
High Frequency Low Noise Amplifier / Oscillator

RENESAS

ADE-208-1604A (Z)

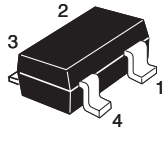
Rev.1
Nov. 2002

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–“.

Absolute Maximum Ratings

(Ta = 25 °C)

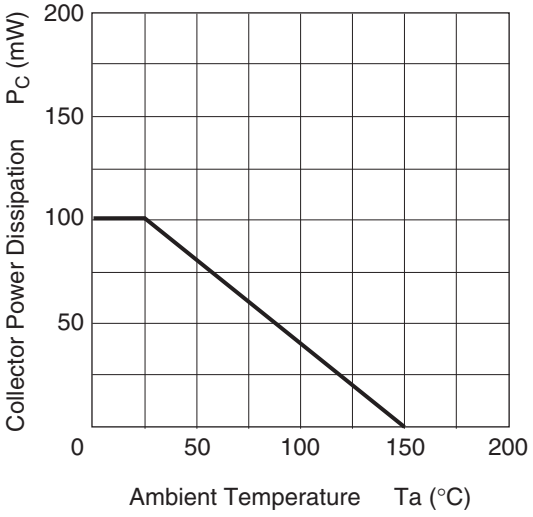
Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	12	V
Collector to emitter voltage	V_{CEO}	4.0	V
Emitter to base voltage	V_{EBO}	1.5	V
Collector current	I_C	35	mA
Collector power dissipation	Pc	100	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics

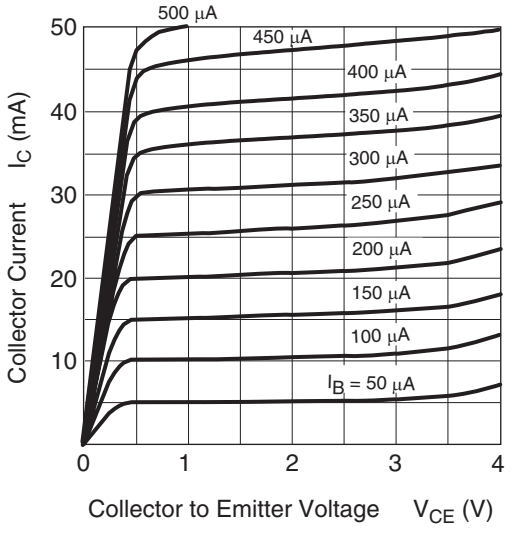
(Ta = 25°C)

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

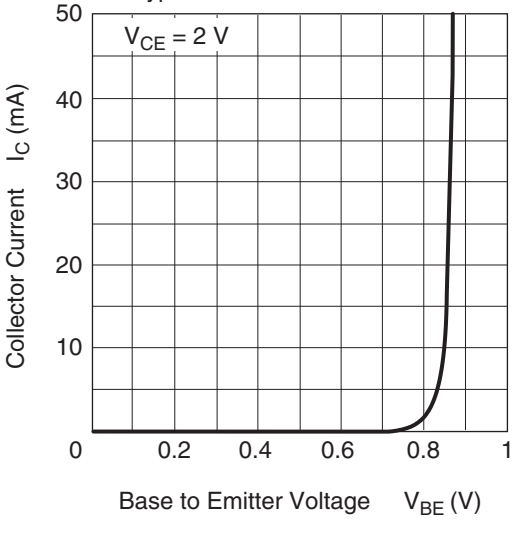
Collector Power Dissipation Curve



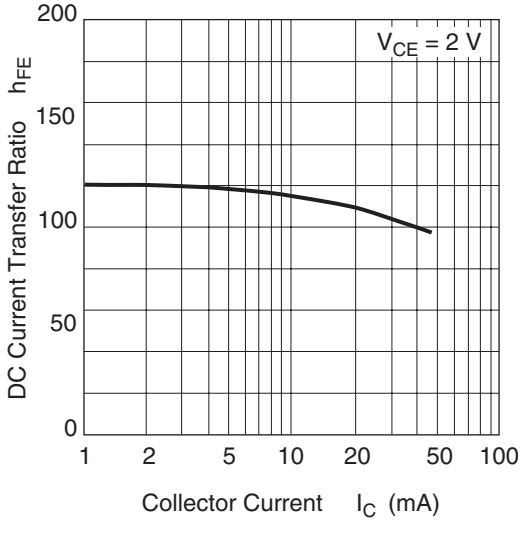
Typical Output Characteristics



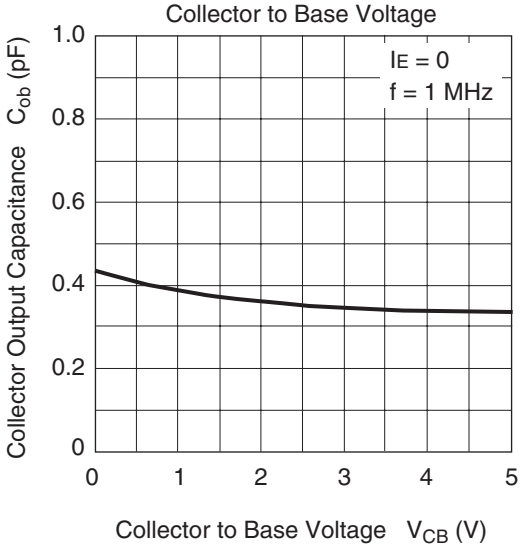
Typical Transfer Characteristics



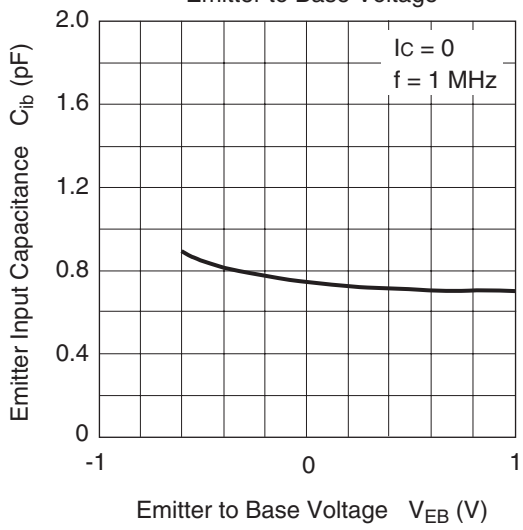
DC Current Transfer Ratio vs. Collector Current



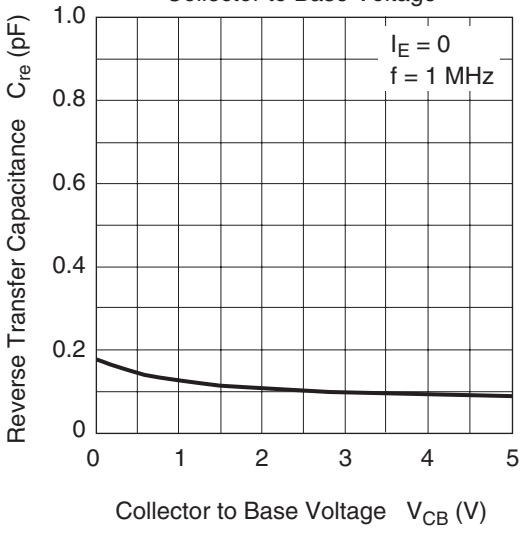
Collector Output Capacitance vs. Collector to Base Voltage



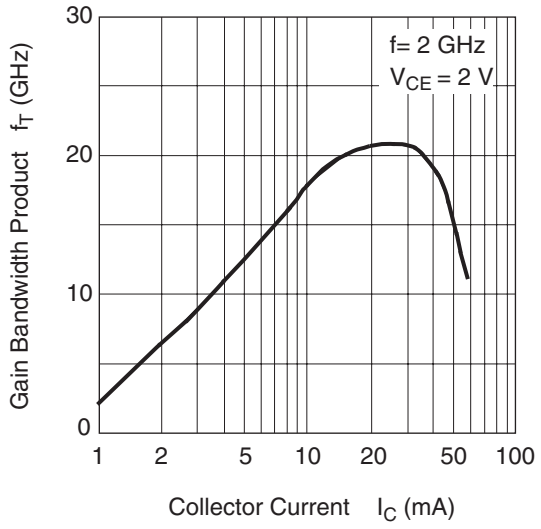
Emitter Input Capacitance vs. Emitter to Base Voltage



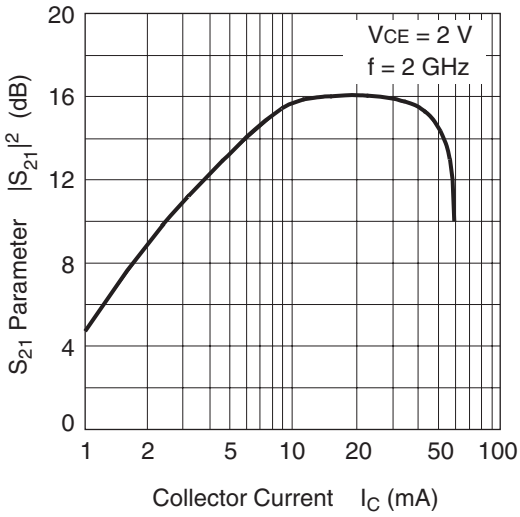
Reverse Transfer Capacitance vs. Collector to Base Voltage



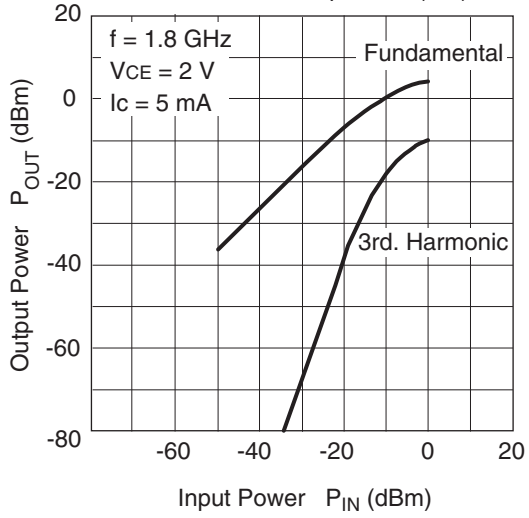
Gain Bandwidth Product vs. Collector Current



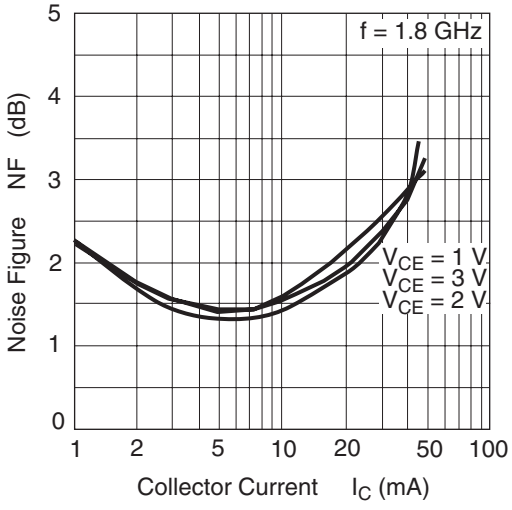
S_{21} Parameter vs. Collector Current



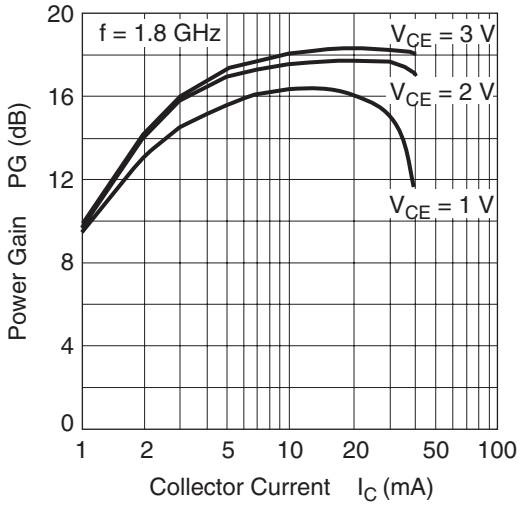
3rd. Order Intercept Point (IP3)



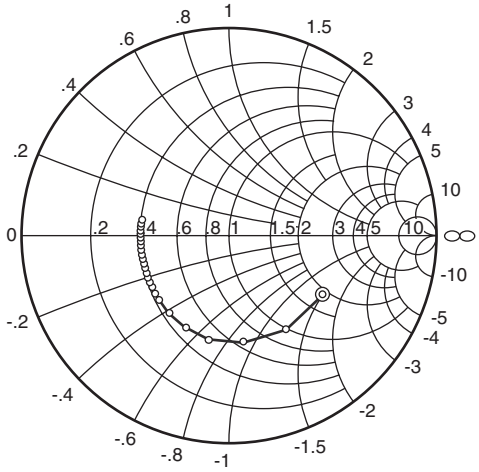
Noise Figure vs. Collector Current



Power Gain vs. Collector Current

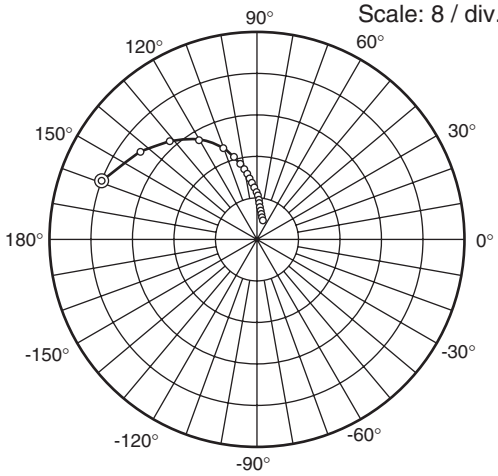


S_{11} Parameter vs. Frequency



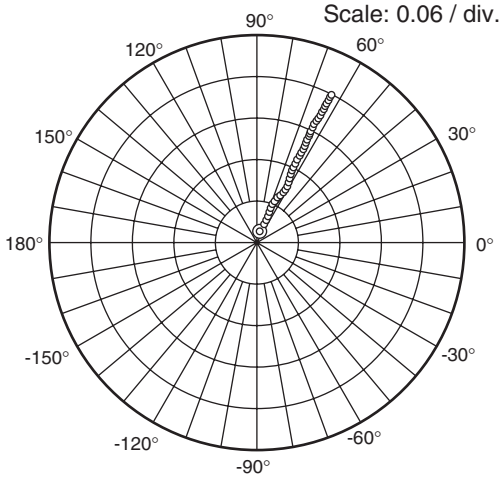
Condition: V_{CE} = 2 V, Z_O = 50 Ω
100 to 3000 MHz (100 MHz Step)
◎——○ (I_C = 30 mA)

S_{21} Parameter vs. Frequency



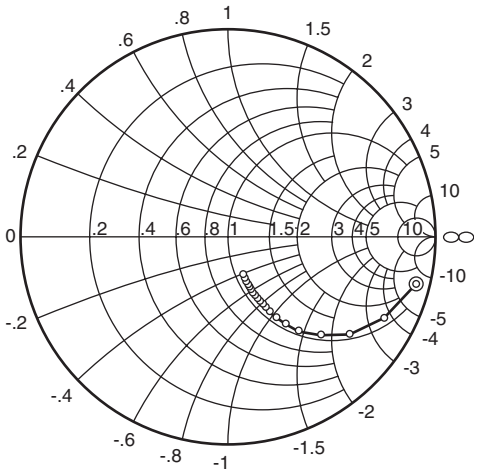
Condition: V_{CE} = 2 V, Z_O = 50 Ω
100 to 3000 MHz (100 MHz Step)
◎——○ (I_C = 30 mA)

S_{12} Parameter vs. Frequency



Condition: V_{CE} = 2 V, Z_O = 50 Ω
100 to 3000 MHz (100 MHz Step)
◎——○ (I_C = 30 mA)

S_{22} Parameter vs. Frequency



Condition: V_{CE} = 2 V, Z_O = 50 Ω
100 to 3000 MHz (100 MHz Step)
◎——○ (I_C = 30 mA)

S Parameter

(V_{CE} = 2 V, I_C = 5 mA, Z_O = 50 Ω)

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

(V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω)

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

(V_{CE} = 2 V, I_C = 20 mA, Z_O = 50 Ω)

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

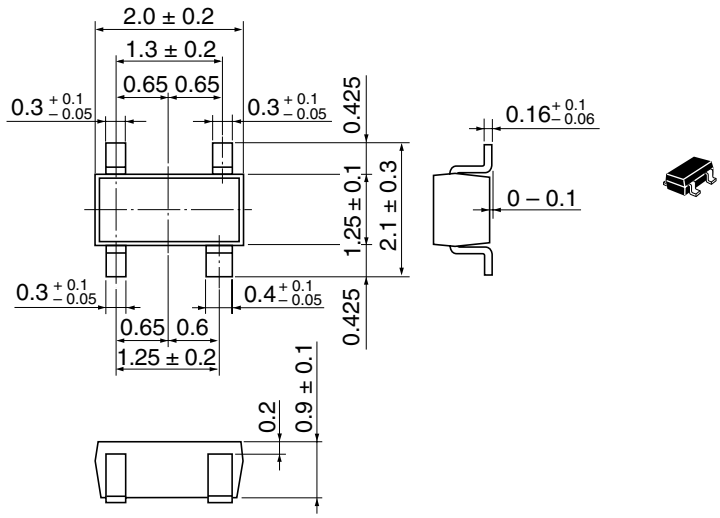
(V_{CE} = 2 V, I_C = 30 mA, Z_O = 50 Ω)

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

As of July, 2002

Unit: mm



Hitachi Code	CMPAK-4(T)
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.006 g

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Sales Offices

HITACHI

Hitachi, Ltd.
Semiconductor & Integrated Circuits
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: (03) 3270-2111 Fax: (03) 3270-5109

URL http://www.hitachisemiconductor.com/

For further information write to:

Hitachi Semiconductor (America) Inc.
179 East Tasman Drive
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe Ltd.
Electronic Components Group
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Europe GmbH
Electronic Components Group
Dornacher Str 3
D-85622 Feldkirchen
Postfach 201, D-85619 Feldkirchen
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00
Singapore 049318
Tel : <65>-6538-6533/6538-8577
Fax : <65>-6538-6933/6538-3877
URL : http://semiconductor.hitachi.com.sg

Hitachi Asia Ltd.
(Taipei Branch Office)
4/F, No. 167, Tun Hwa North Road
Hung-Kuo Building
Taipei (105), Taiwan
Tel : <886>-(2)-2718-3666
Fax : <886>-(2)-2718-8180
Telex : 23222 HAS-TP
URL : http://semiconductor.hitachi.com.tw

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon Hong Kong
Tel : <852>-2735-9218
Fax : <852>-2730-0281
URL : http://semiconductor.hitachi.com.hk

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