To all our customers

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The semiconductor operations of Mitsubishi Electric and Hitachi were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Hitachi, Hitachi, Ltd., Hitachi Semiconductors, and other Hitachi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

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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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   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

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2SC5894

Silicon NPN Epitaxial
High Frequency Low Noise Amplifier / Oscillator

RENESAS

ADE-208-1605A (Z)

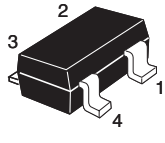
Rev.1
Nov. 2002

Features

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

Outline

CMPAK-4



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

Note: Marking is “WJ–“.

Absolute Maximum Ratings

(Ta = 25 °C)

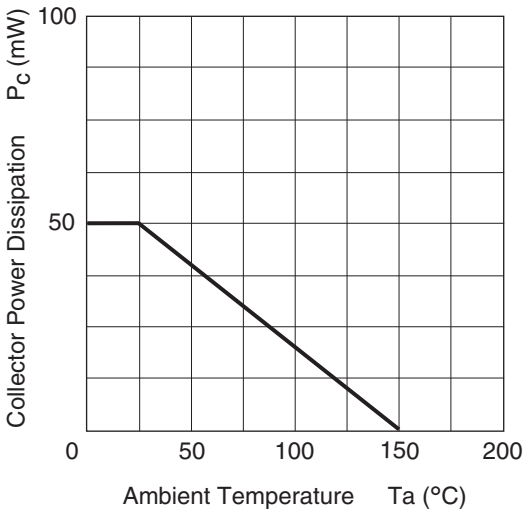
Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	12	V
Collector to emitter voltage	V_{CEO}	4.0	V
Emitter to base voltage	V_{EBO}	1.5	V
Collector current	I_C	12	mA
Collector power dissipation	Pc	50	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

Electrical Characteristics

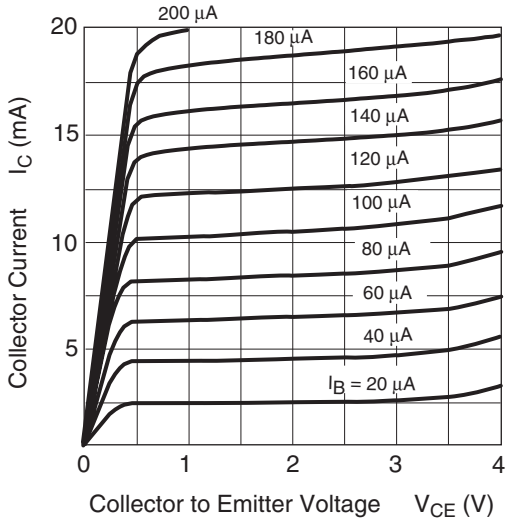
(Ta = 25°C)

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 = 10 mA
Collector output capacitance	C_{ob}	—	0.16	0.4	pF	V_{CB} = 2 V, I_E = 0, f = 1 MHz
Gain bandwidth product	f_T	16	20	—	GHz	V_{CE} = 2 V, I_C = 10 mA f = 2 GHz
Power gain	PG	13	17.5	—	dB	V_{CE} = 2 V, I_C = 10 mA, f = 1.8 GHz
Noise figure	NF	—	1.8	2.4	dB	V_{CE} = 2 V, I_C = 3 mA, f = 1.8 GHz

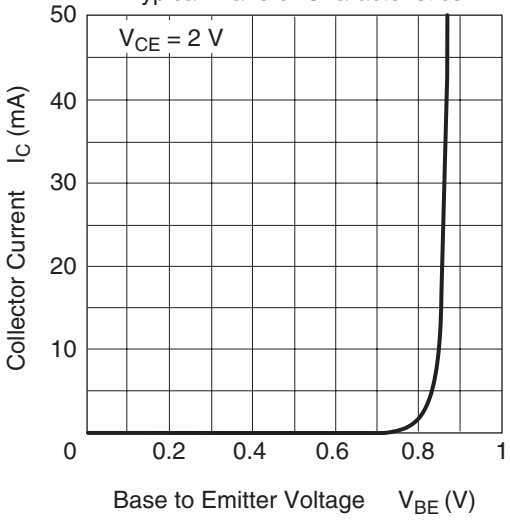
Collector Power Dissipation Curve



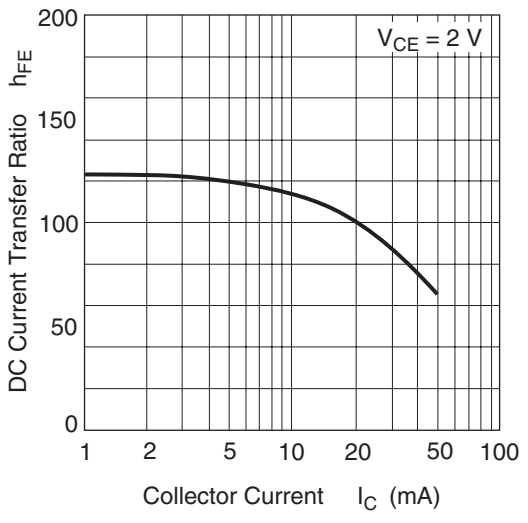
Typical Output Characteristics



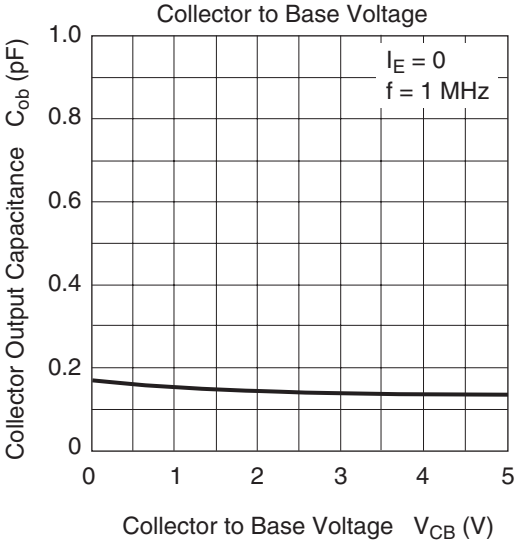
Typical Transfer Characteristics



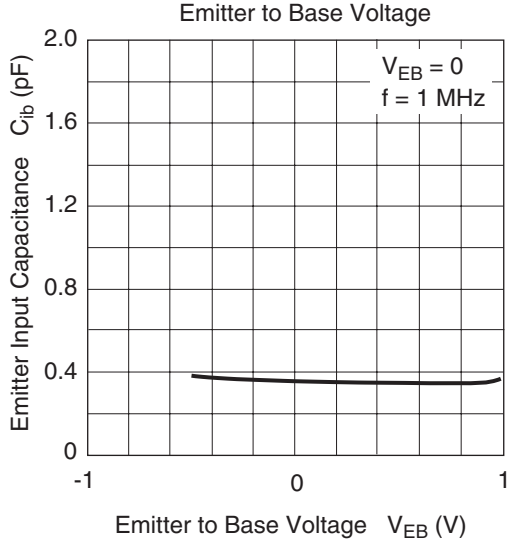
DC Current Transfer Ratio vs. Collector Current



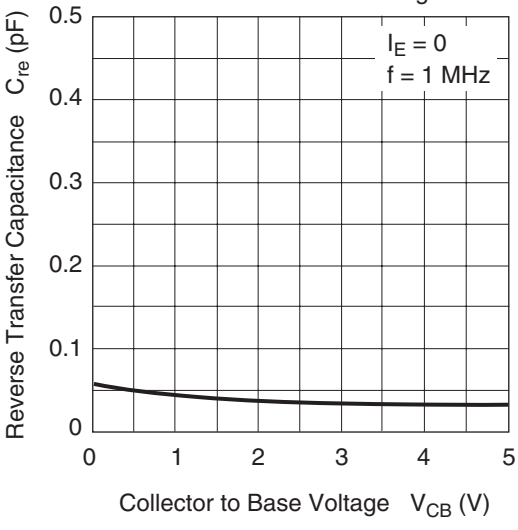
Collector Output Capacitance vs. Collector to Base Voltage



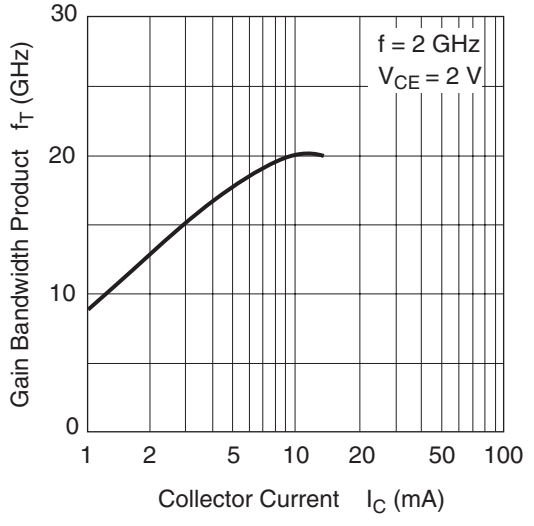
Emitter Input Capacitance vs. Emitter to Base Voltage



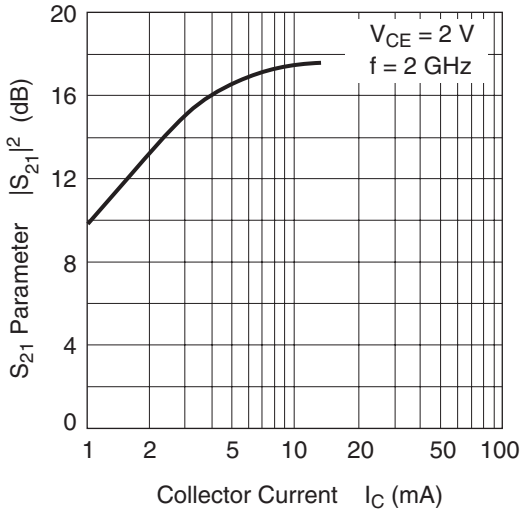
Reverse Transfer Capacitance vs. Collector to Base Voltage



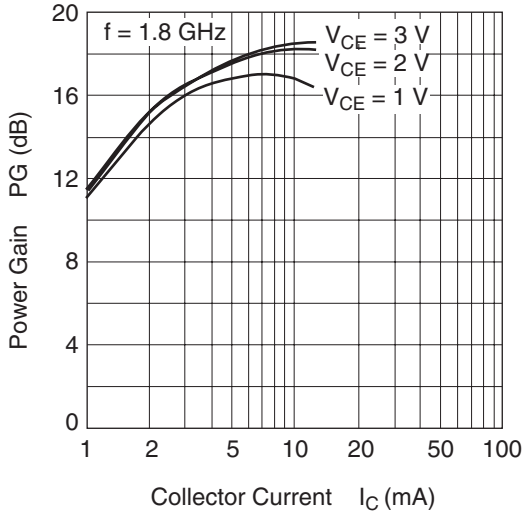
Gain Bandwidth Product vs. Collector Current



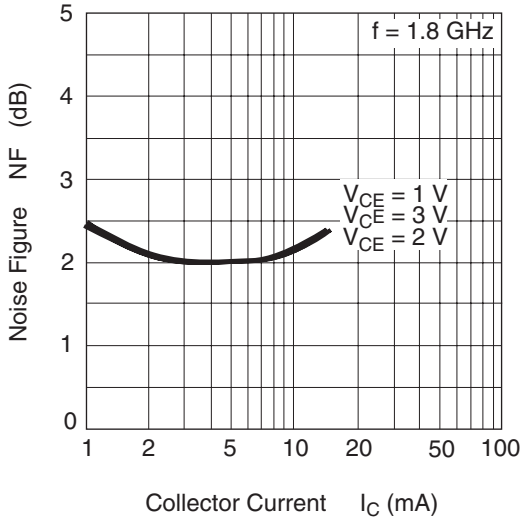
S_{21} Parameter vs. Collector Current



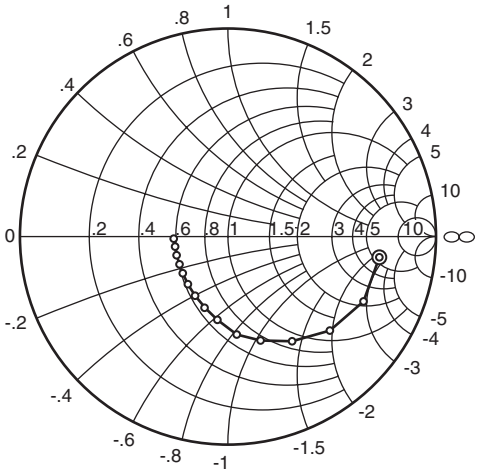
Power Gain vs. Collector Current



Noise Figure vs. Collector Current

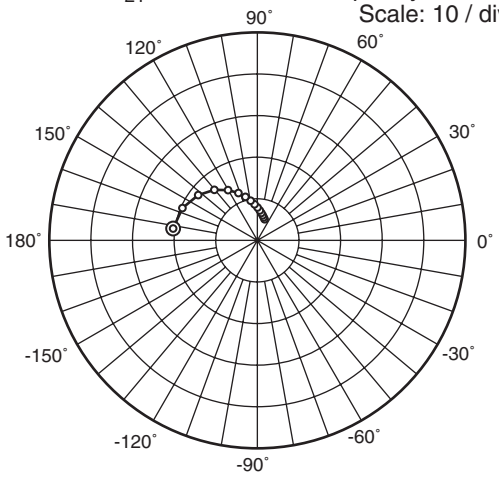


S_{11} Parameter vs. Frequency



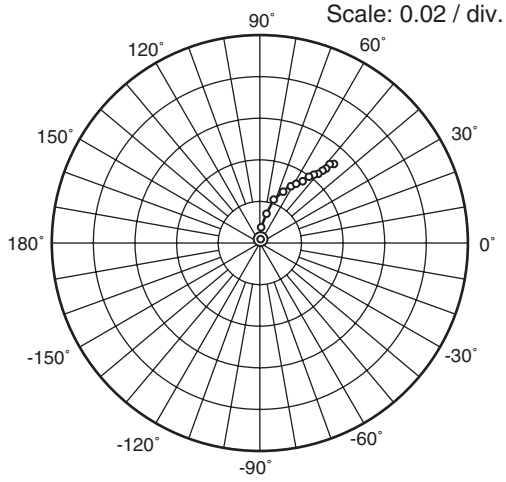
Condition: V_{CE} = 2 V, Z_O = 50 Ω
100 to 2900 MHz (200 MHz Step)
(I_C = 10 mA)

S_{21} Parameter vs. Frequency



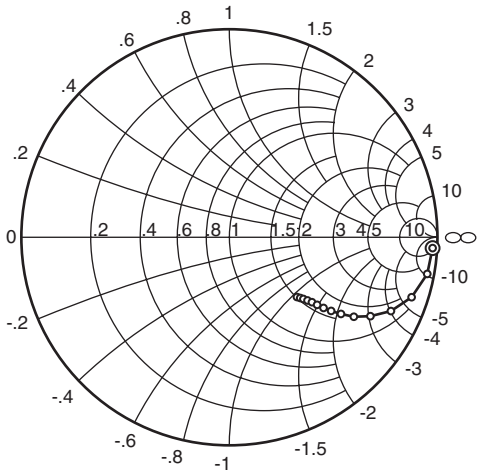
Condition: V_{CE} = 2 V, Z_O = 50 Ω
100 to 2900 MHz (200 MHz Step)
(I_C = 10 mA)

S_{12} Parameter vs. Frequency



Condition: V_{CE} = 2 V, Z_O = 50 Ω
100 to 2900 MHz (200 MHz Step)
(I_C = 10 mA)

S_{22} Parameter vs. Frequency



Condition: V_{CE} = 2 V, Z_O = 50 Ω
100 to 2900 MHz (200 MHz Step)
(I_C = 10 mA)

S Parameter

(V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.890	-4.5	9.05	175.5	0.0030	85.7	0.992	-2.0
200	0.892	-9.2	8.88	171.1	0.0064	89.8	0.994	-4.5
300	0.910	-13.9	8.84	166.5	0.0105	91.0	0.991	-6.7
400	0.885	-18.7	8.69	162.1	0.0139	90.5	0.984	-9.4
500	0.876	-23.6	8.57	157.8	0.0185	87.8	0.978	-12.0
600	0.857	-28.5	8.45	153.4	0.0231	84.4	0.966	-14.6
700	0.838	-33.6	8.46	149.2	0.0271	81.0	0.953	-17.2
800	0.825	-38.3	8.13	145.0	0.0316	77.6	0.935	-19.5
900	0.801	-43.0	7.93	141.1	0.0355	73.4	0.914	-21.8
1000	0.776	-47.5	7.56	137.4	0.0392	70.9	0.895	-23.6
1100	0.793	-52.0	7.27	133.2	0.0432	66.5	0.872	-25.9
1200	0.728	-56.8	7.35	129.9	0.0459	63.5	0.849	-28.0
1300	0.700	-61.3	7.15	126.4	0.0487	60.5	0.827	-29.9
1400	0.674	-65.6	6.94	123.1	0.0510	57.0	0.804	-31.4
1500	0.649	-69.7	6.73	120.0	0.0531	54.5	0.783	-33.0
1600	0.624	-74.0	6.54	117.0	0.0555	52.5	0.763	-34.6
1700	0.598	-78.1	6.34	113.9	0.0576	50.7	0.741	-35.9
1800	0.567	-82.7	6.22	111.0	0.0581	48.6	0.719	-37.3
1900	0.554	-86.7	6.00	107.8	0.0610	45.8	0.699	-38.4
2000	0.526	-89.8	5.81	106.2	0.0613	44.9	0.685	-39.6
2100	0.501	-95.3	5.67	102.5	0.0624	42.4	0.660	-40.5
2200	0.487	-97.3	5.33	101.4	0.0642	40.6	0.657	-41.3
2300	0.471	-102.5	5.32	98.0	0.0646	39.5	0.629	-42.4
2400	0.455	-106.5	5.17	95.6	0.0658	38.0	0.615	-43.4
2500	0.434	-111.3	5.08	93.1	0.0663	36.1	0.596	-44.4
2600	0.424	-114.1	4.87	91.5	0.0666	35.2	0.590	-45.2
2700	0.405	-119.3	4.79	88.7	0.0665	35.1	0.572	-46.0
2800	0.396	-121.9	4.63	87.6	0.0677	33.4	0.567	-47.1
2900	0.385	-127.7	4.56	84.3	0.0685	32.2	0.547	-47.5
3000	0.374	-132.6	4.49	81.6	0.0677	31.1	0.530	-48.1

(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	0.831	-5.8	13.33	174.2	0.0032	85.5	0.988	-2.4
200	0.835	-11.9	13.12	168.6	0.0065	90.4	0.989	-5.4
300	0.844	-18.0	13.04	162.9	0.0101	89.2	0.985	-8.2
400	0.821	-24.2	12.70	157.4	0.0133	88.6	0.974	-11.4
500	0.804	-30.4	12.41	152.0	0.0174	84.4	0.962	-14.5
600	0.779	-36.7	12.07	146.7	0.0216	81.4	0.944	-17.6
700	0.747	-42.7	11.79	141.8	0.0253	77.7	0.921	-20.5
800	0.727	-48.7	11.27	136.8	0.0291	73.9	0.894	-23.1
900	0.695	-54.4	10.82	132.4	0.0319	69.5	0.865	-25.5
1000	0.666	-59.9	10.26	128.0	0.0350	67.6	0.838	-27.4
1100	0.661	-64.8	9.78	123.8	0.0383	62.8	0.808	-29.6
1200	0.601	-70.4	9.57	120.3	0.0399	60.6	0.778	-31.5
1300	0.570	-75.5	9.16	116.7	0.0421	57.8	0.753	-33.1
1400	0.542	-80.3	8.78	113.4	0.0439	55.3	0.726	-34.4
1500	0.516	-85.0	8.40	110.3	0.0454	53.3	0.702	-35.7
1600	0.491	-89.6	8.06	107.4	0.0476	52.5	0.680	-36.8
1700	0.466	-94.2	7.74	104.5	0.0489	50.1	0.658	-37.8
1800	0.440	-99.2	7.48	101.7	0.0492	49.1	0.636	-38.7
1900	0.423	-103.7	7.17	98.9	0.0509	46.8	0.616	-39.5
2000	0.403	-107.6	6.88	97.2	0.0521	46.0	0.603	-40.4
2100	0.383	-113.4	6.65	93.9	0.0522	43.8	0.580	-40.8
2200	0.373	-116.2	6.30	92.6	0.0539	42.9	0.575	-41.5
2300	0.358	-121.5	6.18	89.8	0.0543	42.5	0.553	-42.2
2400	0.347	-125.9	5.97	87.7	0.0554	40.9	0.540	-42.8
2500	0.333	-131.2	5.81	85.5	0.0557	40.7	0.524	-43.5
2600	0.326	-134.6	5.57	83.9	0.0558	40.4	0.519	-44.0
2700	0.314	-140.2	5.43	81.5	0.0579	39.8	0.505	-44.6
2800	0.311	-143.3	5.24	80.3	0.0586	38.4	0.500	-45.4
2900	0.304	-149.0	5.12	77.6	0.0593	38.0	0.484	-45.6
3000	0.301	-153.8	5.00	75.4	0.0585	37.0	0.471	-46.1

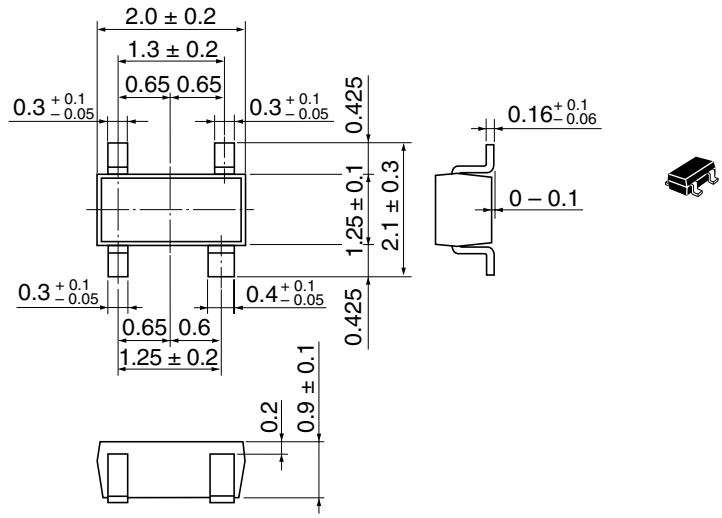
(V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.730	-8.4	20.44	172.0	0.0032	93.3	0.978	-3.0
200	0.728	-17.0	20.06	164.3	0.0060	87.1	0.977	-6.8
300	0.722	-25.5	19.61	156.7	0.0090	88.5	0.967	-10.4
400	0.694	-34.2	18.78	149.4	0.0123	86.4	0.946	-14.4
500	0.666	-42.6	17.90	142.5	0.0158	79.7	0.922	-18.2
600	0.630	-50.8	16.93	136.0	0.0191	77.0	0.888	-21.6
700	0.590	-58.5	15.94	130.4	0.0219	73.3	0.853	-24.5
800	0.559	-65.8	14.95	124.9	0.0250	70.9	0.815	-27.0
900	0.523	-72.5	13.98	120.2	0.0271	66.4	0.776	-29.2
1000	0.491	-79.2	13.06	115.8	0.0294	65.3	0.742	-30.7
1100	0.472	-84.8	12.25	111.8	0.0310	62.0	0.709	-32.5
1200	0.430	-91.4	11.57	108.4	0.0331	60.2	0.678	-33.5
1300	0.403	-97.2	10.90	105.2	0.0337	58.6	0.651	-34.5
1400	0.381	-102.9	10.29	102.2	0.0359	56.6	0.627	-35.2
1500	0.360	-108.2	9.73	99.4	0.0365	55.4	0.604	-35.9
1600	0.342	-113.7	9.22	96.8	0.0386	55.2	0.585	-36.5
1700	0.325	-119.0	8.77	94.3	0.0400	53.6	0.566	-36.9
1800	0.309	-124.8	8.36	91.9	0.0404	53.5	0.549	-37.3
1900	0.299	-130.0	7.97	89.6	0.0423	51.8	0.533	-37.6
2000	0.289	-134.9	7.61	87.8	0.0437	52.4	0.522	-38.0
2100	0.279	-140.9	7.28	85.3	0.0439	50.0	0.505	-38.2
2200	0.274	-144.7	6.95	83.7	0.0451	50.0	0.498	-38.6
2300	0.268	-150.1	6.72	81.7	0.0464	49.2	0.484	-39.0
2400	0.264	-154.8	6.46	79.8	0.0478	48.9	0.475	-39.5
2500	0.262	-160.0	6.23	77.9	0.0483	48.5	0.464	-39.8
2600	0.260	-163.9	6.00	76.4	0.0494	47.9	0.458	-40.2
2700	0.258	-169.2	5.80	74.5	0.0510	48.6	0.449	-40.6
2800	0.259	-172.6	5.60	73.1	0.0516	47.4	0.445	-41.1
2900	0.261	-177.2	5.43	71.1	0.0525	47.0	0.434	-41.5
3000	0.263	178.8	5.27	69.3	0.0533	46.4	0.427	-41.8

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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