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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2SC5890

Silicon NPN Epitaxial
UHF / VHF wide band amplifier

ADE-208-1533 (Z)

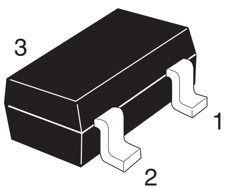
1st. Edition
Aug.2002

Features

- High gain bandwidth product:
  f_T = 7.8 GHz typ.
- High power gain and low noise figure;
  PG = 12 dB typ., NF = 1.0 dB typ. at f = 900 MHz
- High collector power dissipation:
  Pc = 700 mW when using alumina ceramic board (25 x 60 x 0.7 mm)
- High withstanding to ESD of collector to emitter:
  Withstand up to 700 V (only real value) at C = 200 pF, Rs = 0 condition.

Outline

MPAK



1. Emitter
2. Base
3. Collector

Note: Marking is “FS-”.

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	20	V
Collector to emitter voltage	V_{CEO}	12	V
Emitter to base voltage	V_{EBO}	1.5	V
Collector current	I_C	75	mA
Collector power dissipation	Pc	700*	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

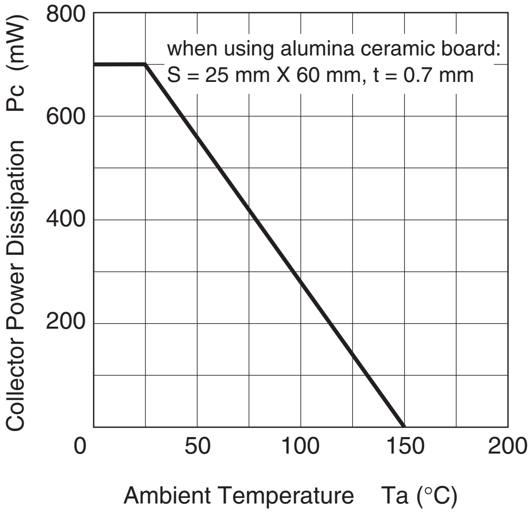
*When using alumina ceramic board (25 x 60 x 0.7 mm)

Electrical Characteristics

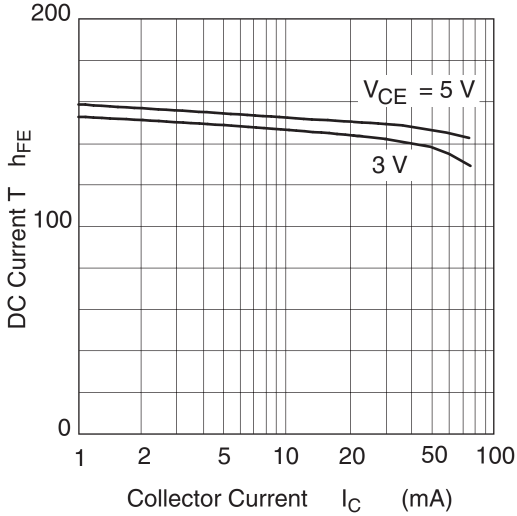
(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	20	—	—	V	$I_C = 10\mu A$, $I_E = 0$
Collector cutoff current	I_{CBO}	—	—	1	μA	$V_{CB} = 12$ V, $I_E = 0$
Collector cutoff current	I_{CEO}	—	—	1	mA	$V_{CE} = 9$ V, $R_{BE} = \infty$
Emitter cutoff current	I_{EBO}	—	—	10	μA	$V_{EB} = 1.5$ V, $I_C = 0$
DC current transfer ratio	h_{FE}	100	150	200	V	$V_{CE} = 5$ V, $I_C = 20$ mA
Collector output capacitance	Cob	—	0.9	1.5	pF	$V_{CB} = 5$ V, $I_E = 0$, f = 1 MHz
Reverse transfer capacitance	Cre	—	0.85	—	pF	$V_{CB} = 5$ V, $I_E = 0$, f = 1 MHz
Gain bandwidth product	f_T	5.5	7.8	—	GHz	$V_{CE} = 5$ V, $I_C = 30$ mA, f = 1 GHz
Forward transfer coefficient	$\|S21\|^2$	—	11	—	dB	$V_{CE} = 5$ V, $I_C = 30$ mA, f = 1 GHz
Power gain	PG	9.5	12	—	dB	$V_{CE} = 5$ V, $I_C = 30$ mA, f = 900 MHz
Noise figure	NF	—	1.0	1.9	dB	$V_{CE} = 5$ V, $I_C = 5$ mA, f = 900 MHz

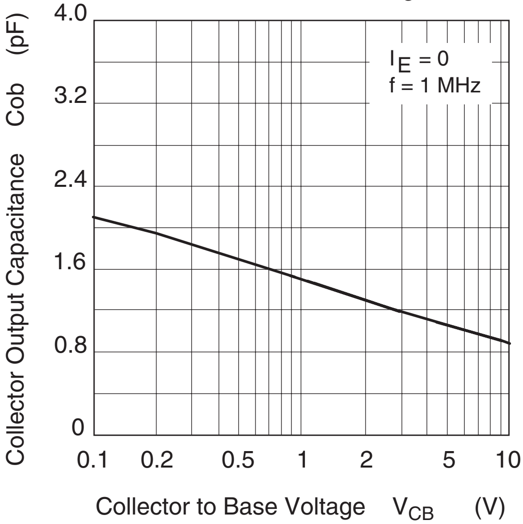
Collector Power Dissipation Curve



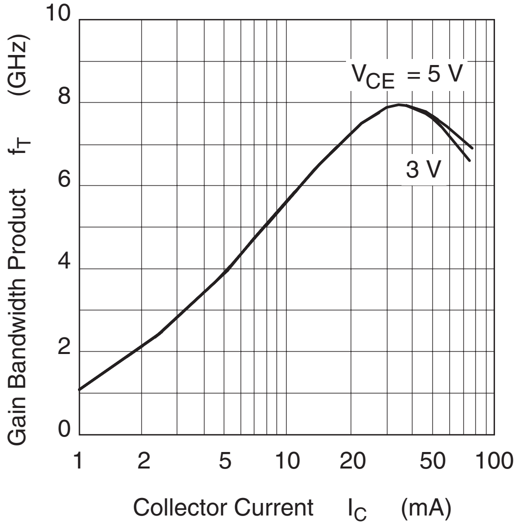
DC Current Transfer Ratio vs. Collector Current

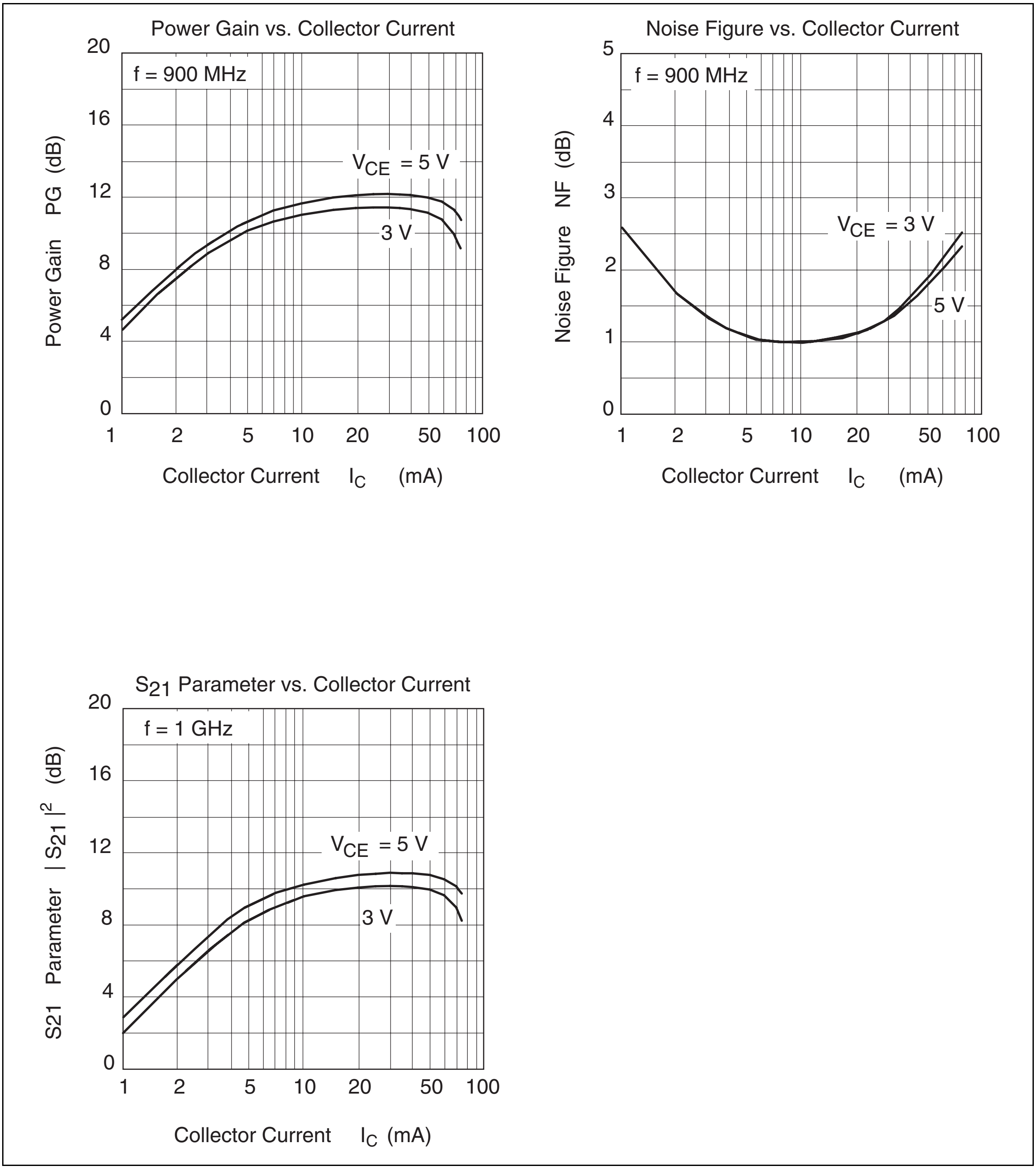


Collector Output Capacitance vs. Collector to Base Voltage



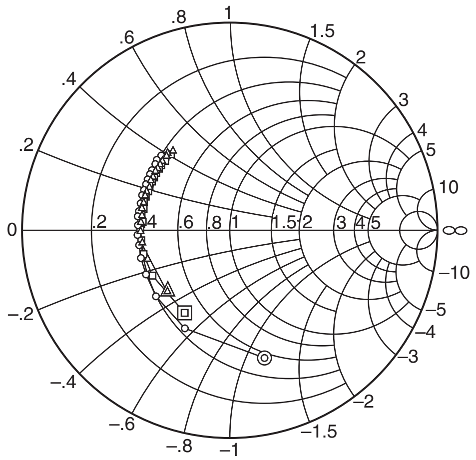
Gain Bandwidth Product vs. Collector Current




Power Gain vs. Collector Current
f = 900 MHz
VCE = 5 V
3 V
Power Gain PG (dB)
Collector Current IC (mA)
0
4
8
12
16
20
1
2
5
10
20
50
100
Noise Figure vs. Collector Current
f = 900 MHz
VCE = 3 V
5 V
Noise Figure NF (dB)
Collector Current IC (mA)
0
1
2
3
4
5
S21 Parameter vs. Collector Current
f = 1 GHz
VCE = 5 V
3 V
S21 Parameter | S21 |2 (dB)
Collector Current IC (mA)

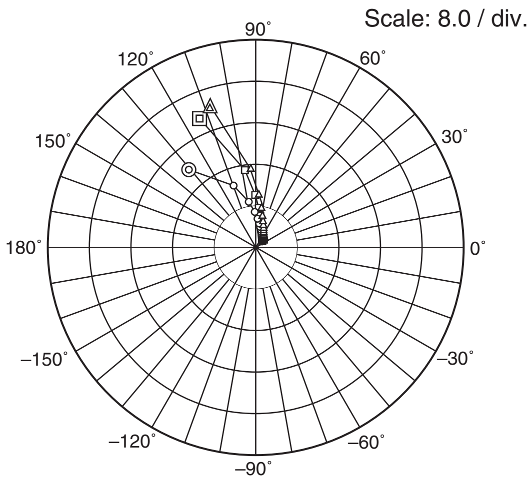
RENESAS

S11 Parameter vs. Frequency



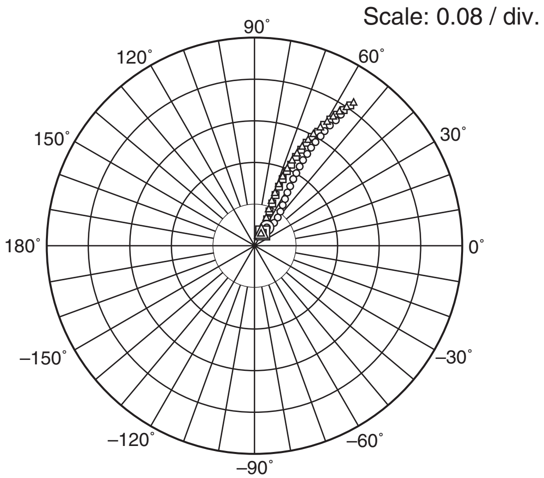
Condition: V_{CE} = 3 V, Z_O = 50 Ω
100 to 2000 MHz (100 MHz Step)
◎——○ (I_C = 10 mA)
▣——□ (I_C = 30 mA)
△——▵ (I_C = 50 mA)

S21 Parameter vs. Frequency



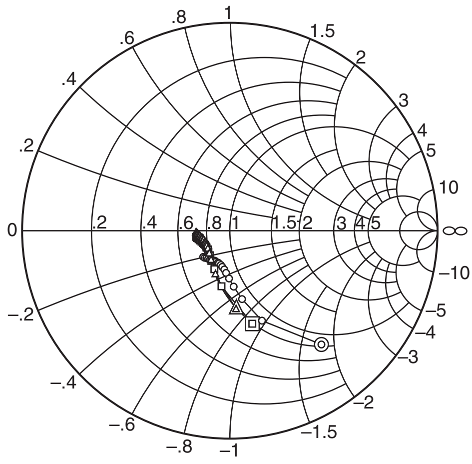
Condition: V_{CE} = 3 V, Z_O = 50 Ω
100 to 2000 MHz (100 MHz Step)
◎——○ (I_C = 10 mA)
▣——□ (I_C = 30 mA)
△——▵ (I_C = 50 mA)

S12 Parameter vs. Frequency



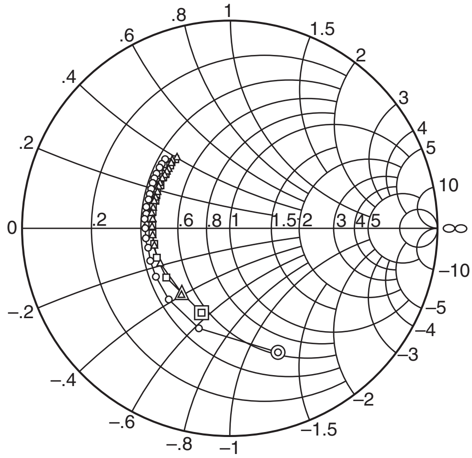
Condition: V_{CE} = 3 V, Z_O = 50 Ω
100 to 2000 MHz (100 MHz Step)
◎——○ (I_C = 10 mA)
▣——□ (I_C = 30 mA)
△——▵ (I_C = 50 mA)

S22 Parameter vs. Frequency



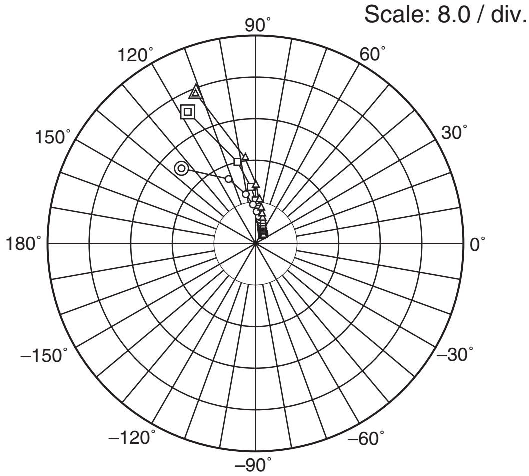
Condition: V_{CE} = 3 V, Z_O = 50 Ω
100 to 2000 MHz (100 MHz Step)
◎——○ (I_C = 10 mA)
▣——□ (I_C = 30 mA)
△——▵ (I_C = 50 mA)

S$_{11}$ Parameter vs. Frequency



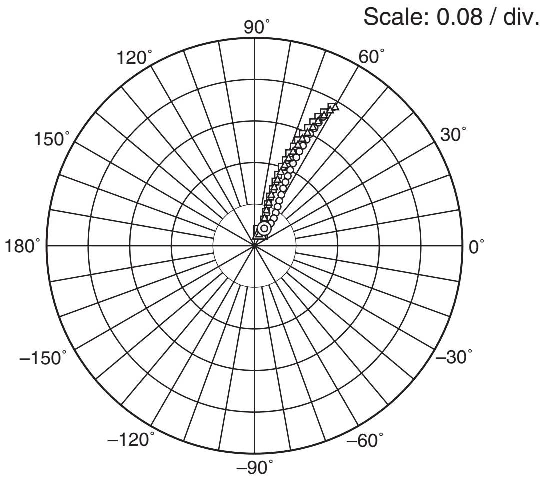
Condition: V_{CE} = 5 V, Z_O = 50 Ω
100 to 2000 MHz (100 MHz Step)
◎——○ (I_C = 10 mA)
▣——□ (I_C = 30 mA)
▲——△ (I_C = 50 mA)

S$_{21}$ Parameter vs. Frequency



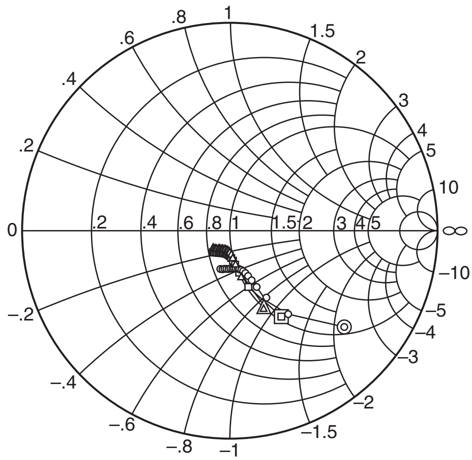
Condition: V_{CE} = 5 V, Z_O = 50 Ω
100 to 2000 MHz (100 MHz Step)
◎——○ (I_C = 10 mA)
▣——□ (I_C = 30 mA)
▲——△ (I_C = 50 mA)

S$_{12}$ Parameter vs. Frequency



Condition: V_{CE} = 5 V, Z_O = 50 Ω
100 to 2000 MHz (100 MHz Step)
◎——○ (I_C = 10 mA)
▣——□ (I_C = 30 mA)
▲——△ (I_C = 50 mA)

S$_{22}$ Parameter vs. Frequency



Condition: V_{CE} = 5 V, Z_O = 50 Ω
100 to 2000 MHz (100 MHz Step)
◎——○ (I_C = 10 mA)
▣——□ (I_C = 30 mA)
▲——△ (I_C = 50 mA)

S parameter

(VCE = 3V, I_C = 10 mA, Zo = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.635	-75.2	19.73	130.5	0.042	55.9	0.698	-51.2
200	0.524	-115.1	12.64	109.7	0.058	49.5	0.455	-70.6
300	0.483	-138.4	8.86	98.7	0.071	50.6	0.330	-80.4
400	0.462	-152.3	6.82	91.6	0.083	52.8	0.266	-86.8
500	0.454	-162.6	5.51	86.4	0.096	55.2	0.226	-91.9
600	0.448	-170.5	4.63	81.9	0.108	56.8	0.201	-96.3
700	0.451	-176.9	4.01	78.0	0.121	58.2	0.185	-99.5
800	0.448	177.1	3.54	74.2	0.134	59.0	0.175	-103.3
900	0.453	171.7	3.17	71.5	0.149	59.8	0.169	-106.3
1000	0.452	168.6	2.87	68.2	0.162	60.0	0.163	-109.9
1100	0.453	163.6	2.63	65.1	0.176	60.3	0.161	-112.3
1200	0.459	158.8	2.43	62.5	0.190	60.4	0.162	-116.0
1300	0.460	155.4	2.27	59.8	0.204	60.1	0.160	-118.1
1400	0.464	151.8	2.13	57.4	0.218	60.0	0.162	-121.1
1500	0.469	148.8	2.00	54.8	0.232	59.5	0.162	-124.7
1600	0.474	145.5	1.89	52.2	0.246	58.8	0.167	-126.3
1700	0.477	143.0	1.80	49.9	0.260	58.6	0.169	-129.4
1800	0.482	139.0	1.72	47.9	0.274	57.9	0.172	-132.4
1900	0.491	136.7	1.65	45.6	0.288	57.1	0.177	-134.6
2000	0.490	133.2	1.59	43.5	0.302	56.6	0.179	-137.2

(V_{CE} = 3V, I_C = 30 mA, Zo = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.449	-118.4	27.19	113.3	0.029	57.1	0.459	-76.8
200	0.431	-150.0	15.04	98.0	0.043	61.4	0.270	-98.5
300	0.429	-165.1	10.09	90.5	0.060	65.3	0.199	-112.0
400	0.428	-174.1	7.63	85.6	0.076	67.0	0.170	-121.5
500	0.430	179.3	6.12	81.7	0.093	67.6	0.152	-129.4
600	0.421	174.0	5.12	78.2	0.110	67.9	0.144	-135.4
700	0.431	169.6	4.42	75.3	0.126	67.8	0.139	-139.6
800	0.428	165.6	3.89	72.2	0.143	67.4	0.138	-144.1
900	0.438	161.3	3.48	69.8	0.160	66.9	0.137	-146.7
1000	0.436	157.8	3.15	66.9	0.176	65.9	0.138	-150.7
1100	0.436	154.0	2.88	64.2	0.193	65.3	0.138	-152.5
1200	0.445	150.5	2.66	62.3	0.209	64.3	0.142	-155.5
1300	0.446	147.5	2.49	59.7	0.225	63.4	0.141	-157.2
1400	0.446	144.6	2.33	57.5	0.240	62.5	0.146	-159.1
1500	0.451	141.6	2.19	55.0	0.256	61.2	0.148	-162.0
1600	0.454	138.6	2.07	53.0	0.272	60.2	0.151	-162.2
1700	0.457	136.2	1.98	50.6	0.287	59.3	0.155	-164.6
1800	0.459	132.6	1.88	49.0	0.301	58.2	0.158	-166.8
1900	0.473	130.7	1.80	46.6	0.317	57.0	0.163	-167.7
2000	0.465	127.4	1.73	44.9	0.331	55.9	0.165	-169.7

(V_{CE} = 3V, I_C = 50 mA, Zo = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.424	-136.3	28.25	108.0	0.025	60.4	0.382	-86.3
200	0.426	-160.8	15.12	94.5	0.041	65.8	0.225	-108.8
300	0.433	-171.8	10.08	88.0	0.058	69.0	0.172	-122.9
400	0.437	-179.2	7.59	83.5	0.076	70.1	0.152	-132.5
500	0.440	175.1	6.09	80.1	0.093	70.2	0.141	-140.5
600	0.435	170.8	5.08	76.8	0.110	69.9	0.138	-146.0
700	0.443	166.5	4.39	73.9	0.128	69.4	0.134	-149.8
800	0.441	162.8	3.86	70.9	0.145	68.6	0.135	-153.3
900	0.446	158.4	3.44	68.4	0.163	67.8	0.136	-155.4
1000	0.447	155.7	3.11	65.9	0.179	66.8	0.138	-159.5
1100	0.444	152.5	2.86	63.3	0.196	65.9	0.138	-160.9
1200	0.455	148.4	2.64	61.0	0.212	64.8	0.143	-163.1
1300	0.455	145.9	2.47	58.5	0.229	63.6	0.142	-164.6
1400	0.463	142.3	2.31	56.5	0.244	62.7	0.147	-166.3
1500	0.462	140.1	2.17	54.0	0.261	61.3	0.151	-169.0
1600	0.466	137.4	2.05	51.9	0.276	60.3	0.153	-169.0
1700	0.469	135.1	1.97	50.0	0.291	59.1	0.157	-171.3
1800	0.474	131.2	1.87	48.3	0.306	58.0	0.161	-173.0
1900	0.481	129.6	1.79	46.0	0.321	56.7	0.165	-173.5
2000	0.476	126.4	1.72	44.0	0.336	55.6	0.166	-176.0

(V_{CE} = 5V, I_C = 10 mA, Zo = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.643	-69.1	20.28	134.6	0.038	60.7	0.719	-40.0
200	0.512	-107.8	13.36	113.9	0.053	54.0	0.485	-55.1
300	0.460	-130.9	9.51	102.7	0.064	54.8	0.362	-61.6
400	0.433	-146.9	7.33	95.6	0.075	57.2	0.295	-64.8
500	0.421	-157.7	5.96	90.2	0.087	59.4	0.256	-66.7
600	0.411	-166.4	5.01	85.6	0.098	61.2	0.230	-68.5
700	0.414	-173.0	4.34	81.7	0.111	62.2	0.212	-70.4
800	0.414	-179.6	3.83	78.0	0.123	63.5	0.200	-72.5
900	0.419	174.3	3.43	75.0	0.136	64.1	0.192	-74.5
1000	0.414	170.8	3.10	71.8	0.149	64.5	0.186	-76.9
1100	0.421	166.3	2.84	68.8	0.161	64.8	0.182	-78.9
1200	0.420	161.3	2.63	66.0	0.175	64.9	0.180	-81.9
1300	0.424	157.6	2.45	63.3	0.188	64.7	0.178	-84.6
1400	0.428	154.2	2.29	61.2	0.201	64.6	0.179	-87.2
1500	0.435	150.5	2.16	58.4	0.214	64.2	0.178	-90.2
1600	0.439	147.4	2.03	56.0	0.227	63.9	0.180	-93.1
1700	0.444	144.2	1.94	53.8	0.240	63.6	0.181	-96.2
1800	0.450	140.1	1.85	51.5	0.254	63.0	0.182	-99.2
1900	0.454	137.5	1.77	49.4	0.267	62.5	0.185	-102.2
2000	0.458	134.0	1.69	47.3	0.281	62.0	0.187	-105.3

(V_{CE} = 5V, I_C = 30 mA, Zo = 50 Ω)

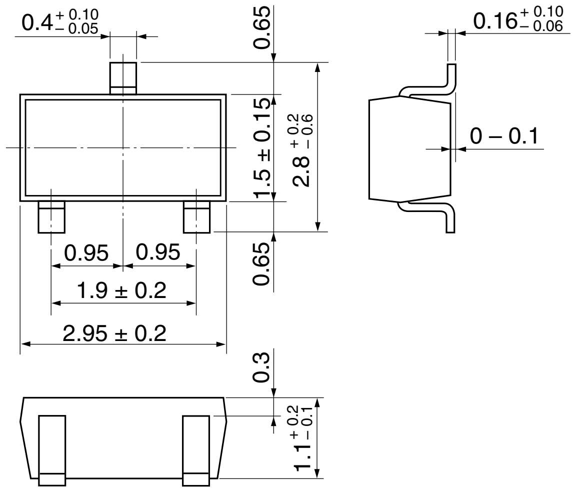
	S11		S21		S12		S22	
f (MHz)	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
100	0.430	-108.9	28.25	118.1	0.026	61.8	0.482	-59.0
200	0.387	-142.7	16.05	102.5	0.040	65.5	0.283	-72.0
300	0.380	-158.5	10.90	94.7	0.055	69.2	0.205	-77.8
400	0.374	-168.7	8.27	89.8	0.070	70.7	0.165	-81.7
500	0.375	-176.5	6.67	85.8	0.085	71.8	0.143	-84.6
600	0.376	177.6	5.59	82.3	0.101	72.1	0.130	-87.9
700	0.384	172.9	4.82	79.4	0.116	71.7	0.121	-90.6
800	0.383	167.8	4.24	76.5	0.131	71.6	0.116	-93.5
900	0.388	164.0	3.78	73.8	0.147	71.3	0.112	-96.9
1000	0.385	159.5	3.43	70.9	0.162	70.6	0.111	-99.9
1100	0.390	155.7	3.13	68.4	0.177	69.7	0.111	-102.7
1200	0.398	152.4	2.90	66.2	0.192	69.2	0.111	-106.2
1300	0.396	148.1	2.70	63.8	0.207	68.2	0.112	-108.8
1400	0.406	146.2	2.53	61.7	0.221	67.4	0.114	-111.8
1500	0.407	142.5	2.37	59.2	0.236	66.4	0.115	-115.0
1600	0.408	139.8	2.25	57.1	0.250	65.4	0.118	-117.5
1700	0.414	137.8	2.13	54.9	0.265	64.4	0.122	-120.7
1800	0.420	133.6	2.04	53.1	0.278	63.5	0.124	-123.7
1900	0.428	131.5	1.94	50.9	0.292	62.5	0.128	-126.6
2000	0.427	128.4	1.86	49.2	0.306	61.3	0.131	-129.1

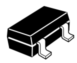
(V_{CE} = 5V, I_C = 50 mA, Zo = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.392	-125.2	30.12	111.6	0.023	62.6	0.411	-67.0
200	0.380	-153.9	16.44	97.6	0.037	67.6	0.235	-78.0
300	0.379	-167.5	11.03	90.8	0.053	70.8	0.170	-82.6
400	0.380	-175.1	8.33	86.2	0.069	72.1	0.139	-86.5
500	0.381	178.8	6.68	82.5	0.085	72.2	0.121	-89.3
600	0.381	173.2	5.59	79.4	0.100	72.3	0.111	-93.0
700	0.390	168.9	4.82	76.5	0.116	71.7	0.105	-95.3
800	0.389	165.1	4.25	73.5	0.132	71.1	0.102	-98.9
900	0.394	160.4	3.79	71.2	0.148	70.7	0.101	-101.5
1000	0.393	157.7	3.43	68.6	0.163	69.7	0.100	-105.7
1100	0.396	153.6	3.13	66.0	0.178	69.0	0.100	-107.8
1200	0.403	150.0	2.89	63.8	0.193	67.9	0.103	-111.8
1300	0.407	147.4	2.70	61.4	0.209	67.0	0.103	-113.8
1400	0.410	144.0	2.52	59.2	0.223	66.1	0.106	-117.1
1500	0.411	141.2	2.36	57.0	0.238	65.0	0.108	-120.5
1600	0.414	138.5	2.25	54.9	0.253	64.0	0.113	-122.6
1700	0.416	136.4	2.13	52.6	0.267	63.0	0.115	-125.9
1800	0.428	132.5	2.03	50.6	0.281	62.0	0.118	-128.8
1900	0.436	130.7	1.94	48.6	0.295	60.9	0.123	-131.2
2000	0.431	127.3	1.87	46.8	0.309	59.8	0.124	-134.1

Package Dimensions

As of January, 2002
Unit: mm





Hitachi Code	MPAK(T)
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.011 g

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