

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

RENESAS

ADE-208-1533 (Z)

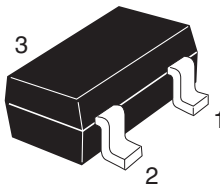
1st. Edition
Aug.2002

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:
 $P_c = 700$ 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, $R_s = 0$ 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

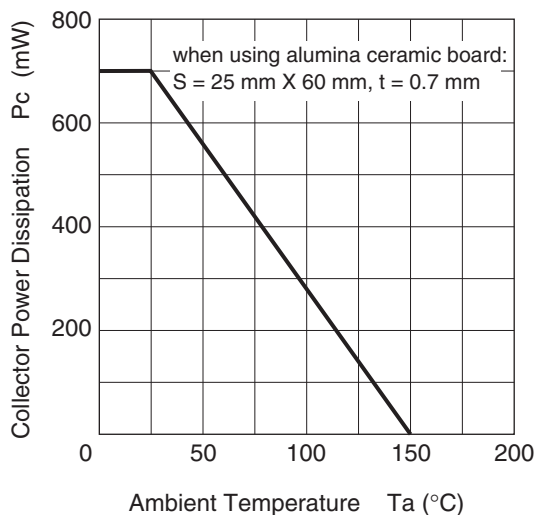
*When using alumina ceramic board (25 x 60 x 0.7 mm)

Electrical Characteristics

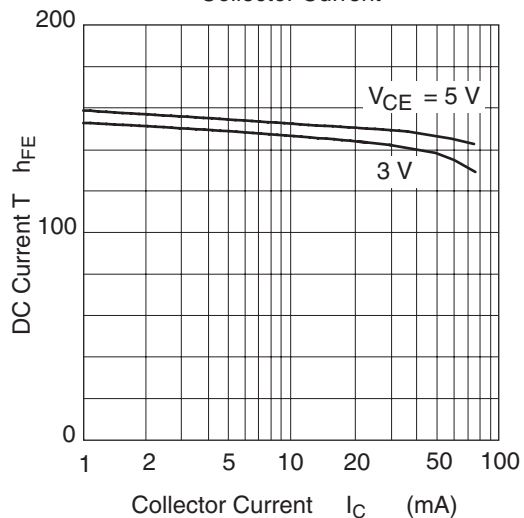
(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	20	—	—	V	$I_C = 10\mu\text{A}$, $I_E = 0$
Collector cutoff current	I_{CBO}	—	—	1	μA	$V_{CB} = 12\text{V}$, $I_E = 0$
Collector cutoff current	I_{CEO}	—	—	1	mA	$V_{CE} = 9\text{V}$, $R_{BE} = \infty$
Emitter cutoff current	I_{EBO}	—	—	10	μA	$V_{EB} = 1.5\text{V}$, $I_C = 0$
DC current transfer ratio	h_{FE}	100	150	200	V	$V_{CE} = 5\text{V}$, $I_C = 20\text{mA}$
Collector output capacitance	Cob	—	0.9	1.5	pF	$V_{CB} = 5\text{V}$, $I_E = 0$, $f = 1\text{MHz}$
Reverse transfer capacitance	Cre	—	0.85	—	pF	$V_{CB} = 5\text{V}$, $I_E = 0$, $f = 1\text{MHz}$
Gain bandwidth product	f_T	5.5	7.8	—	GHz	$V_{CE} = 5\text{V}$, $I_C = 30\text{mA}$, $f = 1\text{GHz}$
Forward transfer coefficient	$ S_{21} ^2$	—	11	—	dB	$V_{CE} = 5\text{V}$, $I_C = 30\text{mA}$, $f = 1\text{GHz}$
Power gain	PG	9.5	12	—	dB	$V_{CE} = 5\text{V}$, $I_C = 30\text{mA}$, $f = 900\text{MHz}$
Noise figure	NF	—	1.0	1.9	dB	$V_{CE} = 5\text{V}$, $I_C = 5\text{mA}$, $f = 900\text{MHz}$

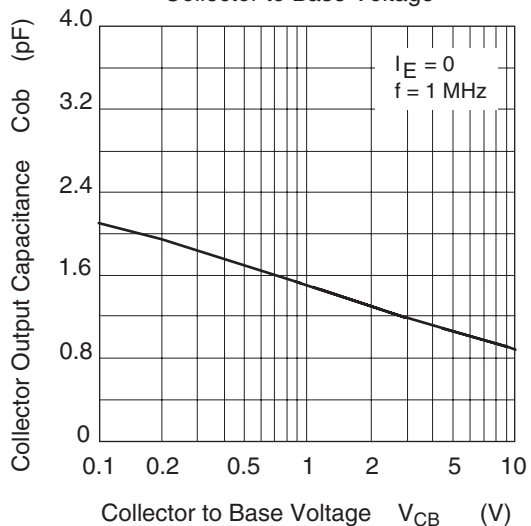
Collector Power Dissipation Curve



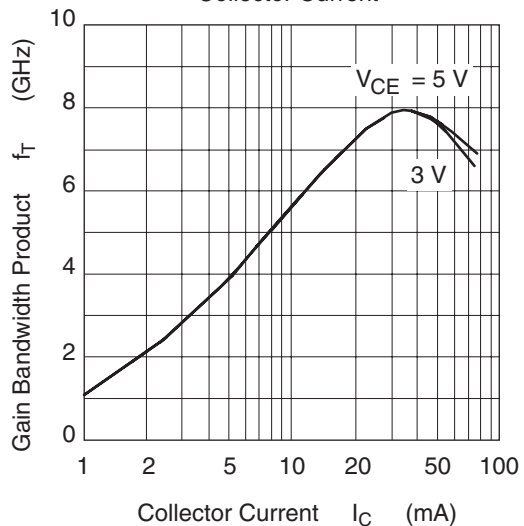
DC Current Transfer Ratio vs. Collector Current

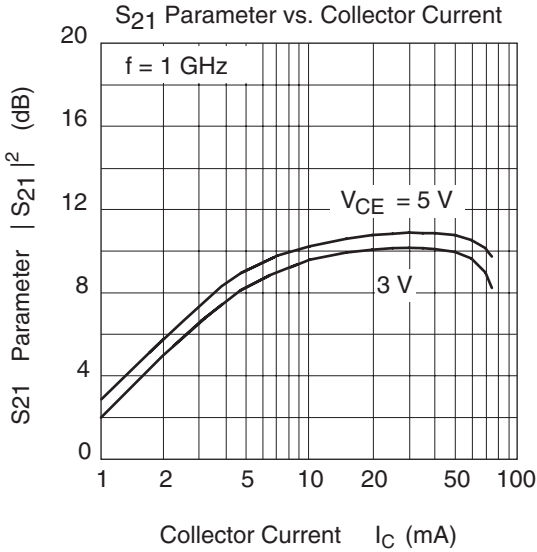
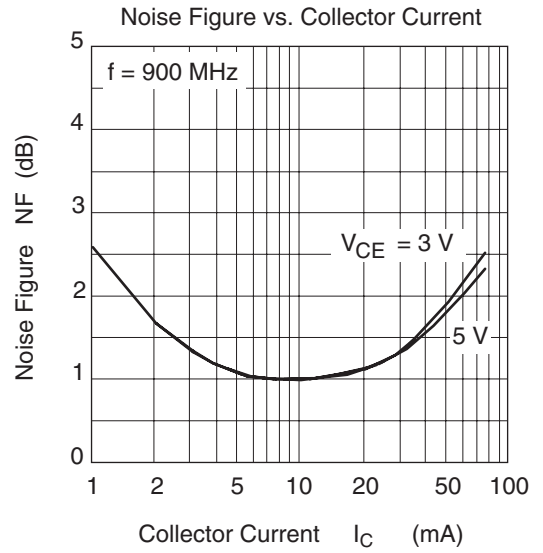
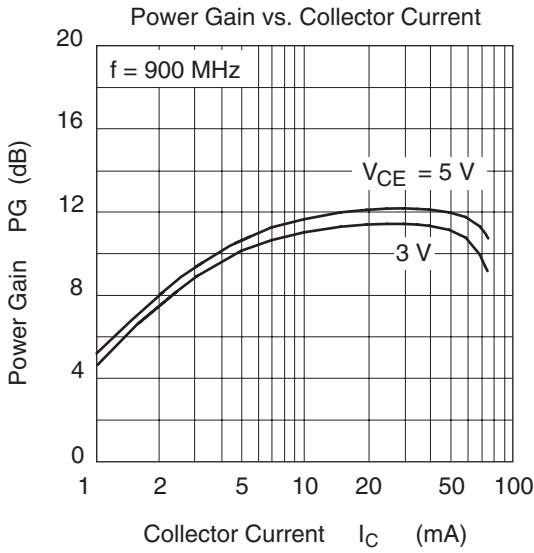


Collector Output Capacitance vs. Collector to Base Voltage

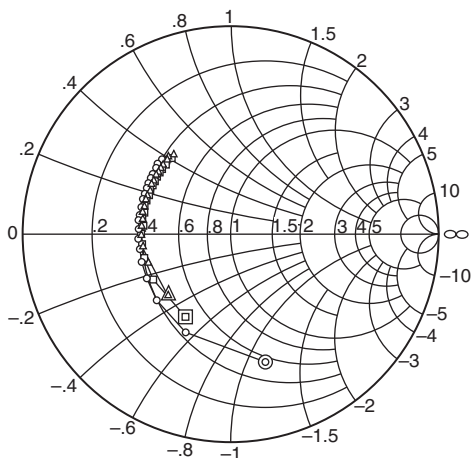


Gain Bandwidth Product vs. Collector Current





S11 Parameter vs. Frequency



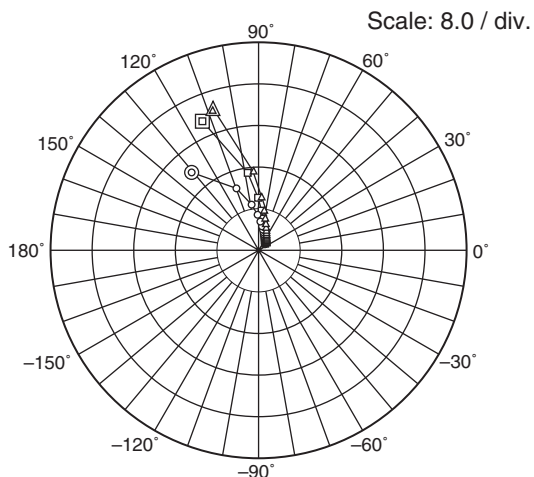
Condition: $V_{CE} = 3\text{ V}$, $Z_O = 50\ \Omega$
 100 to 2000 MHz (100 MHz Step)

⊙—○ ($I_C = 10\text{ mA}$)

⊠—□ ($I_C = 30\text{ mA}$)

▲—△ ($I_C = 50\text{ mA}$)

S21 Parameter vs. Frequency



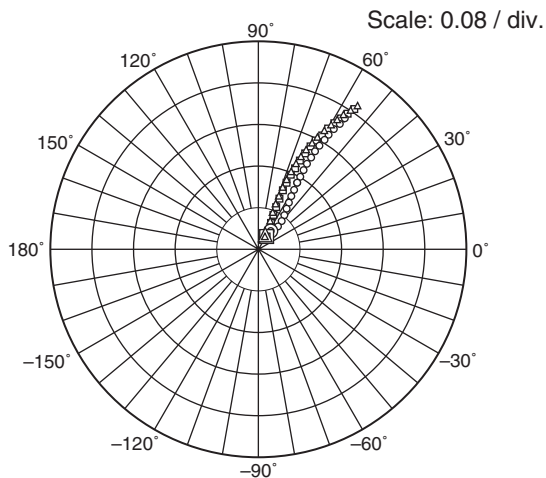
Condition: $V_{CE} = 3\text{ V}$, $Z_O = 50\ \Omega$
 100 to 2000 MHz (100 MHz Step)

⊙—○ ($I_C = 10\text{ mA}$)

⊠—□ ($I_C = 30\text{ mA}$)

▲—△ ($I_C = 50\text{ mA}$)

S12 Parameter vs. Frequency



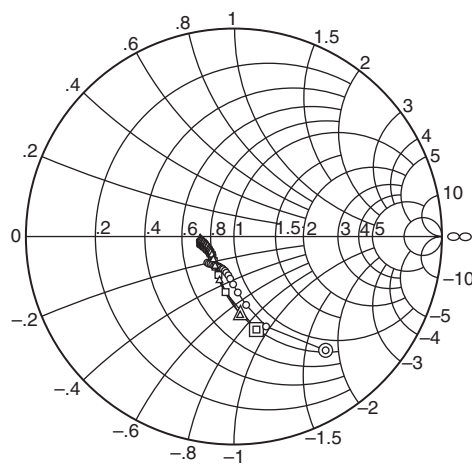
Condition: $V_{CE} = 3\text{ V}$, $Z_O = 50\ \Omega$
 100 to 2000 MHz (100 MHz Step)

⊙—○ ($I_C = 10\text{ mA}$)

⊠—□ ($I_C = 30\text{ mA}$)

▲—△ ($I_C = 50\text{ mA}$)

S22 Parameter vs. Frequency



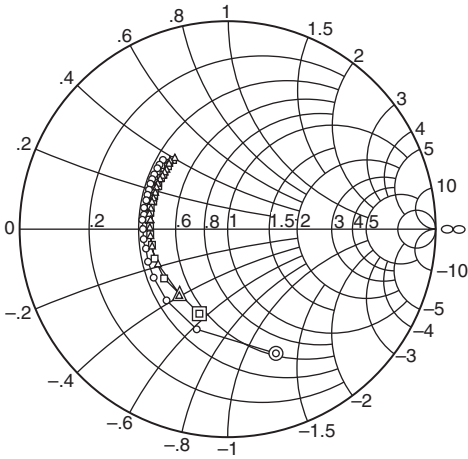
Condition: $V_{CE} = 3\text{ V}$, $Z_O = 50\ \Omega$
 100 to 2000 MHz (100 MHz Step)

⊙—○ ($I_C = 10\text{ mA}$)

⊠—□ ($I_C = 30\text{ mA}$)

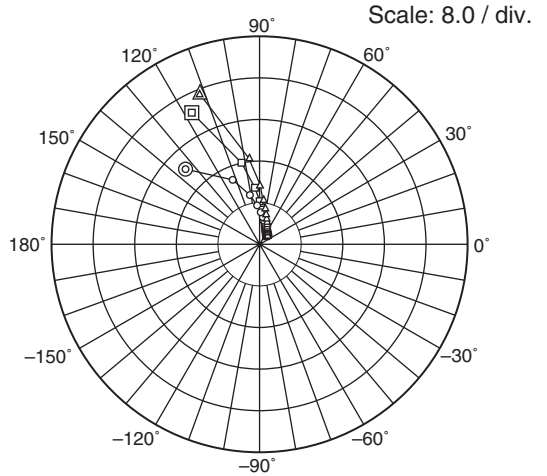
▲—△ ($I_C = 50\text{ mA}$)

S11 Parameter vs. Frequency



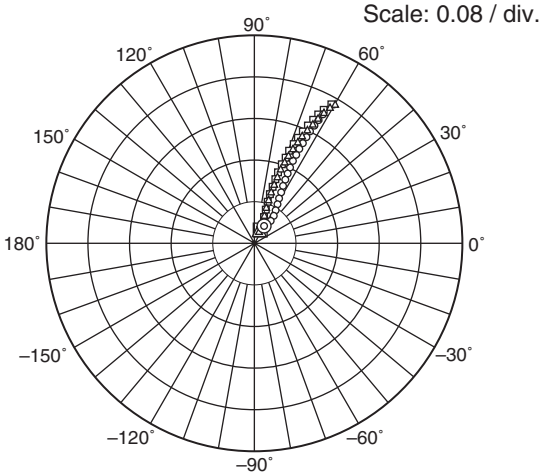
Condition: $V_{CE} = 5\text{ V}$, $Z_O = 50\ \Omega$
 100 to 2000 MHz (100 MHz Step)
 ○—○ ($I_C = 10\text{ mA}$)
 □—□ ($I_C = 30\text{ mA}$)
 ▲—▲ ($I_C = 50\text{ mA}$)

S21 Parameter vs. Frequency



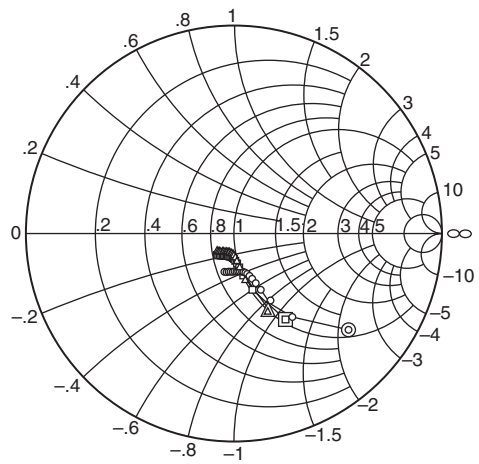
Condition: $V_{CE} = 5\text{ V}$, $Z_O = 50\ \Omega$
 100 to 2000 MHz (100 MHz Step)
 ○—○ ($I_C = 10\text{ mA}$)
 □—□ ($I_C = 30\text{ mA}$)
 ▲—▲ ($I_C = 50\text{ mA}$)

S12 Parameter vs. Frequency



Condition: $V_{CE} = 5\text{ V}$, $Z_O = 50\ \Omega$
 100 to 2000 MHz (100 MHz Step)
 ○—○ ($I_C = 10\text{ mA}$)
 □—□ ($I_C = 30\text{ mA}$)
 ▲—▲ ($I_C = 50\text{ mA}$)

S22 Parameter vs. Frequency



Condition: $V_{CE} = 5\text{ V}$, $Z_O = 50\ \Omega$
 100 to 2000 MHz (100 MHz Step)
 ○—○ ($I_C = 10\text{ mA}$)
 □—□ ($I_C = 30\text{ mA}$)
 ▲—▲ ($I_C = 50\text{ mA}$)

S parameter(VCE = 3V, I_c = 10 mA, Z_o = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	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

2SC5890

($V_{CE} = 3V$, $I_C = 30\text{ mA}$, $Z_o = 50\ \Omega$)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.449	-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

($V_{CE} = 3V$, $I_C = 50 \text{ mA}$, $Z_o = 50 \Omega$)

f (MHz)	S11		S21		S12		S22	
	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

2SC5890

($V_{CE} = 5V$, $I_C = 10\text{ mA}$, $Z_o = 50\ \Omega$)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.643	-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

($V_{CE} = 5V$, $I_C = 30 \text{ mA}$, $Z_o = 50 \Omega$)

f (MHz)	S11		S21		S12		S22	
	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

2SC5890

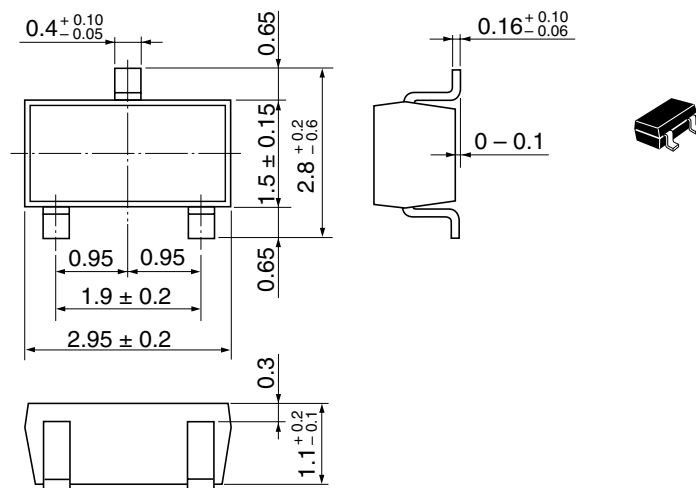
($V_{CE} = 5V$, $I_C = 50\text{ mA}$, $Z_o = 50\ \Omega$)

f (MHz)	S11		S21		S12		S22	
	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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