

To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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NPN SILICON EPITAXIAL TRANSISTOR (WITH 2 DIFFERENT ELEMENTS) IN A 6-PIN THIN-TYPE SMALL MINI MOLD PACKAGE

DESCRIPTION

The μ PA833TF has two different built-in transistors (Q1 and Q2) for low noise amplification in the VHF band to UHF band.

FEATURES

- Low noise
 - Q1 : NF = 1.7 dB TYP. @ f = 2 GHz, $V_{CE} = 1$ V, $I_C = 3$ mA
 - Q2 : NF = 1.5 dB TYP. @ f = 2 GHz, $V_{CE} = 3$ V, $I_C = 3$ mA
- High gain
 - Q1 : $|S_{21e}|^2 = 3.5$ dB TYP. @ f = 2 GHz, $V_{CE} = 1$ V, $I_C = 3$ mA
 - Q2 : $|S_{21e}|^2 = 8.5$ dB TYP. @ f = 2 GHz, $V_{CE} = 3$ V, $I_C = 10$ mA
- 6-pin thin-type small mini mold package
- 2 different transistors on-chip (2SC5193, 2SC4959)

ON-CHIP TRANSISTORS

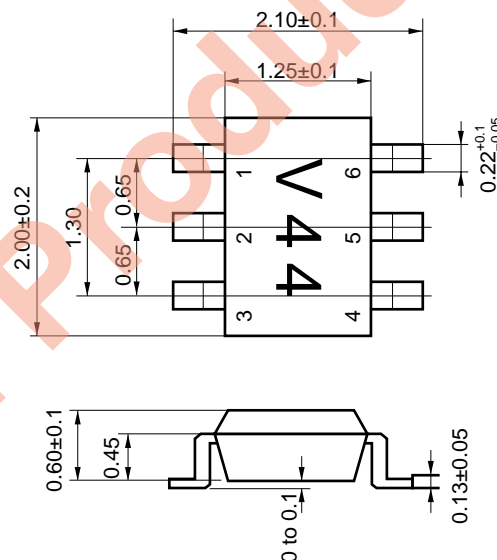
	Q1	Q2
3-pin small mini mold part No.	2SC5193	2SC4959

The μ PA836TF features the Q1 and Q2 in inverted positions.

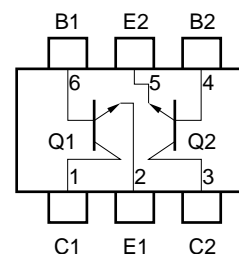
ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
μ PA833TF	Loose products (50 pcs)	8-mm wide embossed tape. Pin 6 (Q1 Base), pin 5 (Q2 Emitter), and pin 4 (Q2 Base) face perforated side of tape.
μ PA833TF-T1	Taping products (3 kpcs/reel)	

PACKAGE DRAWINGS (Unit:mm)



PIN CONFIGURATION (Top View)



PIN CONNECTIONS

- | | |
|-------------------|-----------------|
| 1. Collector (Q1) | 4. Base (Q2) |
| 2. Emitter (Q1) | 5. Emitter (Q2) |
| 3. Collector (Q2) | 6. Base (Q1) |

Caution is required concerning excess input, such as from static electricity, because the high-frequency process is used for this device.

The information in this document is subject to change without notice.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

PARAMETER	SYMBOL	RATING		UNIT
		Q1	Q2	
Collector to base voltage	V _{CBO}	9	9	V
Collector to emitter voltage	V _{CEO}	6	6	V
Emitter to base voltage	V _{EBO}	2	2	V
Collector current	I _C	100	30	mA
Total power dissipation	P _T	150 in 1 element	150 in 1 element	mW
		200 in 2 elements ^{Note}		
Junction temperature	T _j	150	150	°C
Storage temperature	T _{stg}	-65 to +150		°C

Note 110 mW must not be exceeded for 1 element.

(1) Q1

ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Collector cutoff current	I _{CBO}	V _{CB} = 5 V, I _E = 0			0.1	μA
Emitter cutoff current	I _{EBO}	V _{EB} = 1 V, I _C = 0			0.1	μA
DC current gain	h _{FE}	V _{CE} = 1 V, I _C = 3 mA ^{Note 1}	100		145	
Gain bandwidth product (1)	f _T	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz	4.0	4.5		GHz
Gain bandwidth product (2)	f _T	V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz		9.0		GHz
Feedback capacitance	C _{re}	V _{CB} = 1 V, I _E = 0, f = 1 MHz ^{Note 2}		0.75	0.85	pF
Insertion power gain (1)	S _{21e} ²	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz	2.5	3.5		dB
Insertion power gain (2)	S _{21e} ²	V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz		6.5		dB
Noise figure (1)	NF	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz		1.7	2.5	dB
Noise figure (2)	NF	V _{CE} = 3 V, I _C = 7 mA, f = 2 GHz		1.5		dB

Notes 1. Pulse measurement: PW ≤ 350 μs, Duty cycle ≤ 2%

2. Collector to base capacitance when measured with capacitance meter (automatic balanced bridge method), with emitter connected to guard pin of capacitance meter.

(2) Q2

ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Collector cutoff current	I_{CBO}	$V_{CB} = 5\text{ V}, I_E = 0$			0.1	μA
Emitter cutoff current	I_{EBO}	$V_{EB} = 1\text{ V}, I_C = 0$			0.1	μA
DC current gain	h_{FE}	$V_{CE} = 3\text{ V}, I_C = 10\text{ mA}$ ^{Note 1}	75		150	
Gain bandwidth product	f_T	$V_{CE} = 3\text{ V}, I_C = 10\text{ mA}, f = 2\text{ GHz}$		12		GHz
Feedback capacitance	C_{re}	$V_{CB} = 3\text{ V}, I_E = 0, f = 1\text{ MHz}$ ^{Note 2}		0.4	0.7	pF
Insertion power gain	$ S_{21e} ^2$	$V_{CE} = 3\text{ V}, I_C = 10\text{ mA}, f = 2\text{ GHz}$	7	8.5		dB
Noise figure	NF	$V_{CE} = 3\text{ V}, I_C = 3\text{ mA}, f = 2\text{ GHz}$		1.5	2.5	dB

Notes 1. Pulse measurement: $PW \leq 350\text{ }\mu\text{s}$, Duty cycle $\leq 2\%$

2. Collector to base capacitance when measured with capacitance meter (automatic balanced bridge method), with emitter connected to guard pin of capacitance meter.

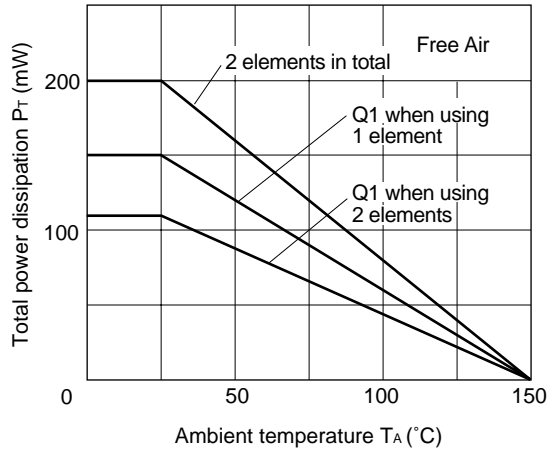
h_{FE} CLASSIFICATION

Rank	FB
Marking	V44
h_{FE} value of Q1	100 to 145
h_{FE} value of Q2	75 to 150

TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

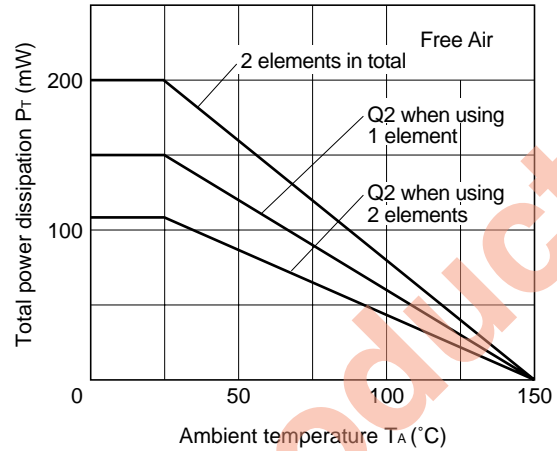
Q1

Total Power Dissipation vs. Ambient Temperature

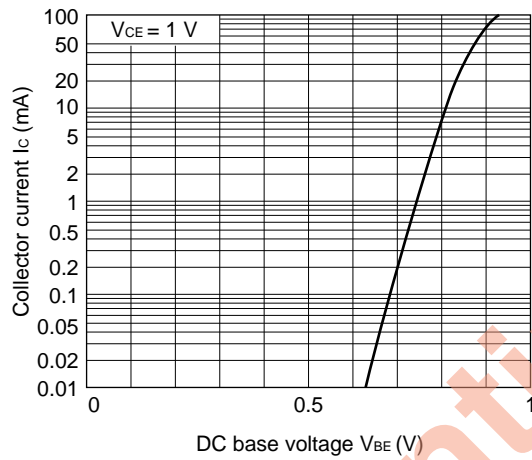


Q2

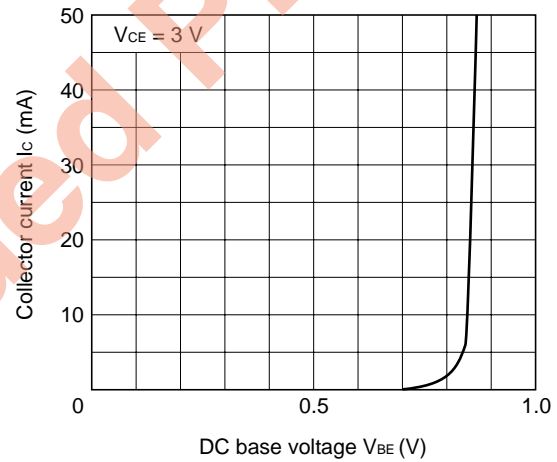
Total Power Dissipation vs. Ambient Temperature



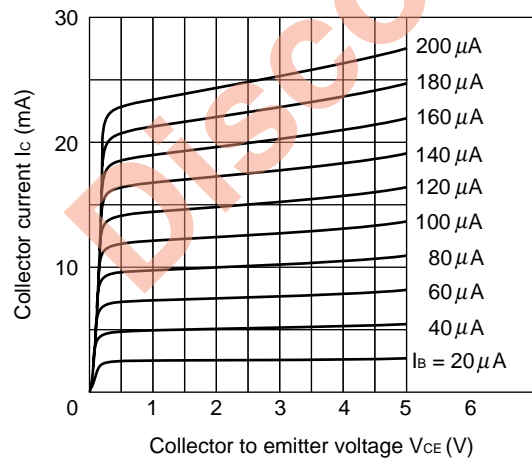
Collector Current vs. DC Base Voltage



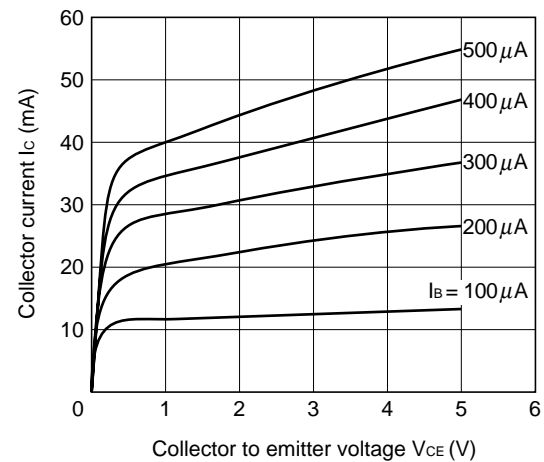
Collector Current vs. DC Base Voltage



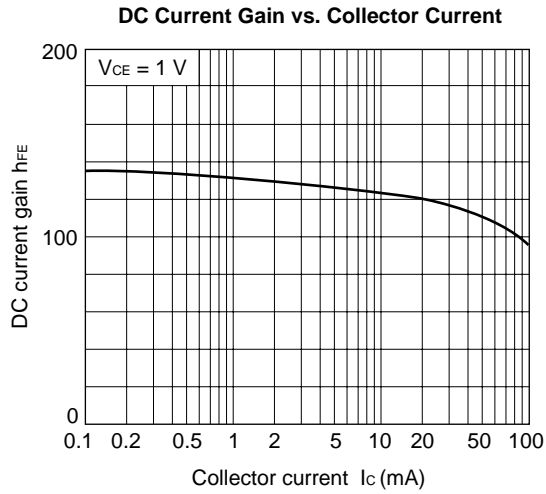
Collector Current vs. Collector to Emitter Voltage



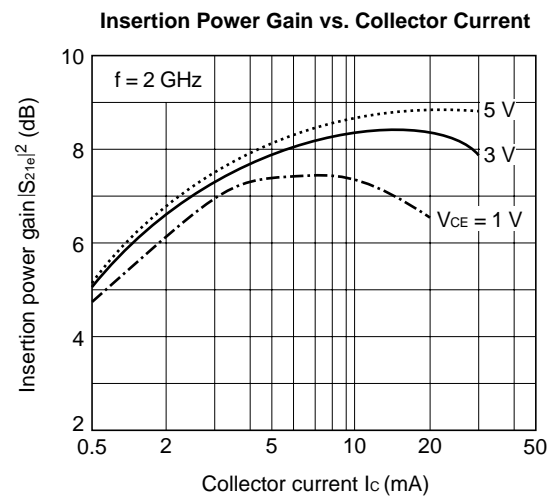
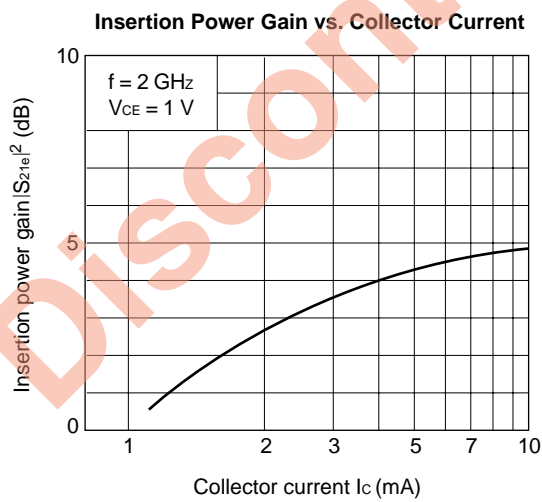
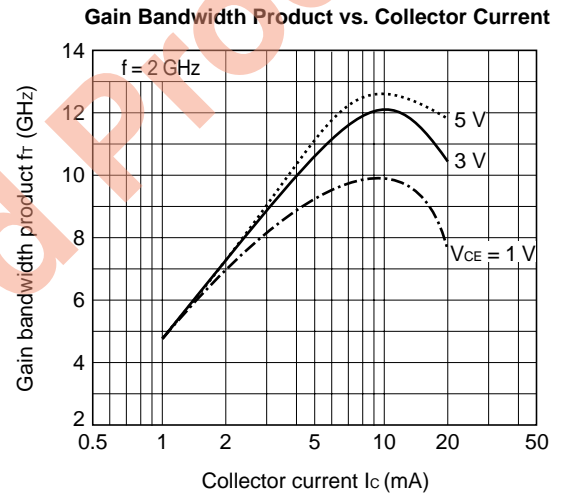
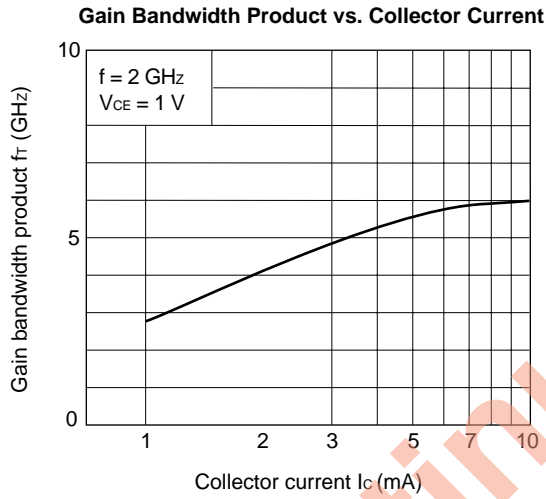
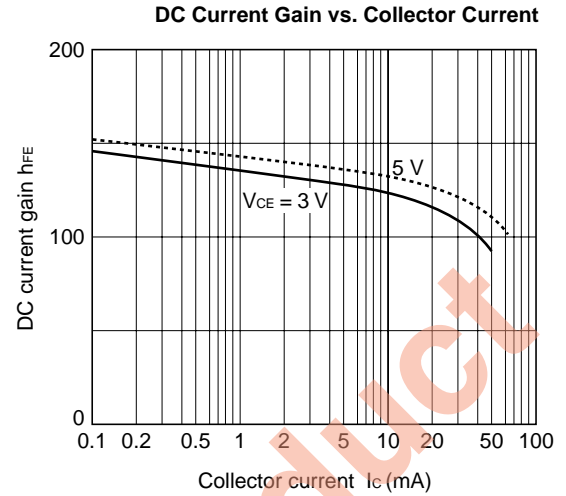
Collector Current vs. Collector to Emitter Voltage



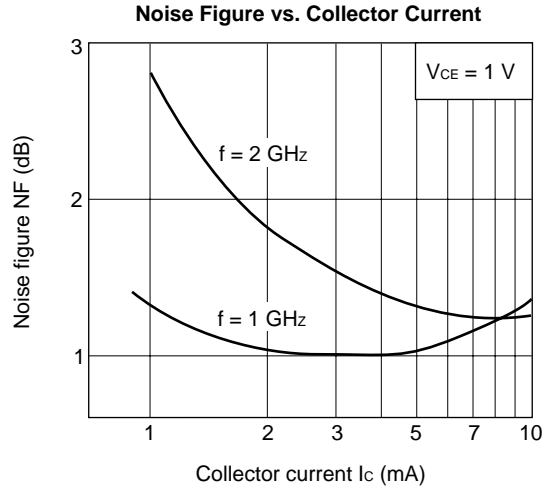
Q1



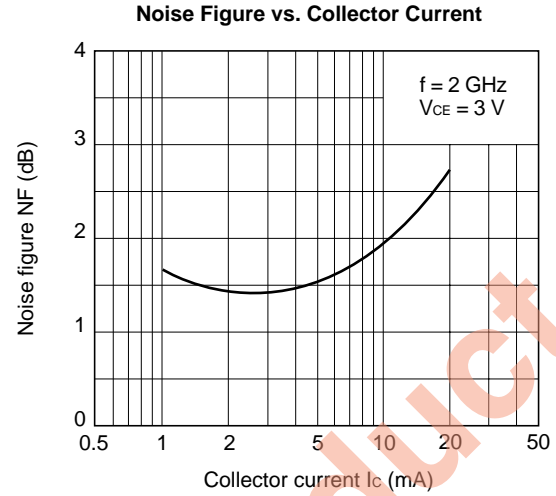
Q2



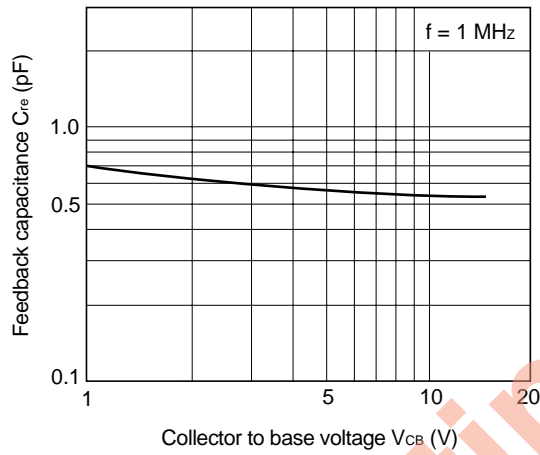
Q1



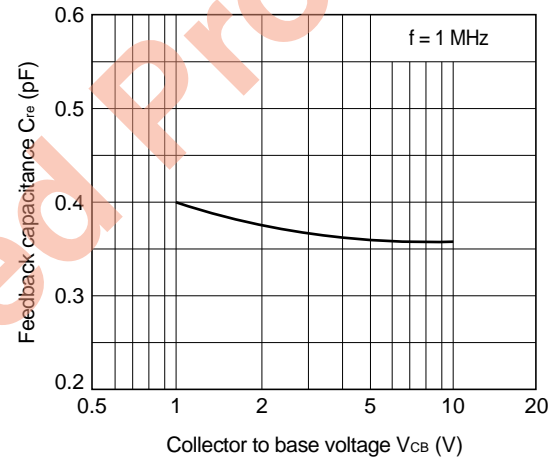
Q2



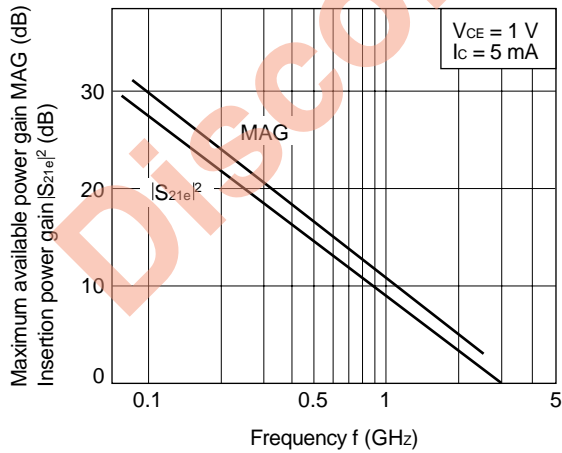
Feedback Capacitance vs. Collector to Base Voltage



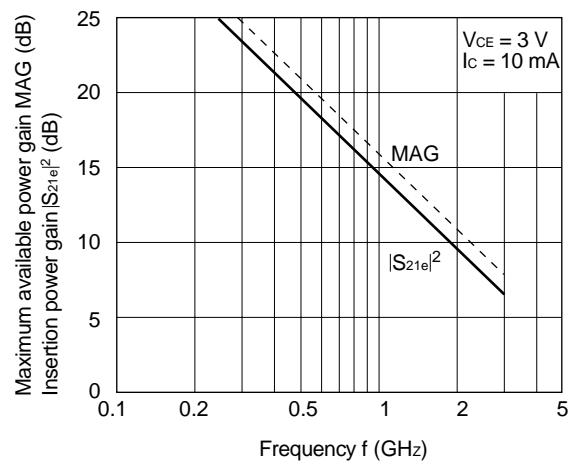
Feedback Capacitance vs. Collector to Base Voltage

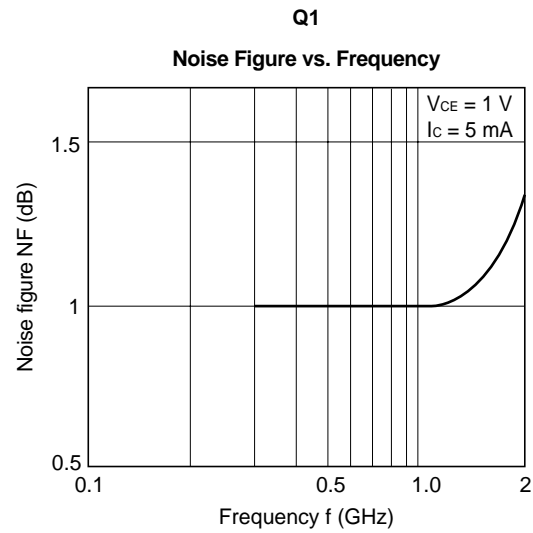


Maximum Available Gain, Insertion Power Gain vs. Frequency



Maximum Available Gain, Insertion Power Gain vs. Frequency





Discontinued Product

S-PARAMETERS Q1

$V_{CE} = 3\text{ V}$, $I_C = 1\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY GHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
.10	.97	-14.33	2.43	166.54	.04	80.24	.99	-7.18
.20	.95	-28.67	2.38	154.71	.07	70.60	.97	-13.99
.30	.91	-42.88	2.36	144.04	.10	62.11	.92	-19.89
.40	.87	-56.75	2.27	134.07	.13	54.03	.88	-25.53
.50	.83	-70.72	2.23	125.01	.15	47.25	.83	-29.96
.60	.79	-84.33	2.16	116.71	.16	40.79	.78	-34.25
.70	.75	-97.41	2.08	108.43	.17	35.62	.75	-37.36
.80	.71	-109.76	1.99	101.04	.17	31.08	.70	-40.60
.90	.68	-122.09	1.92	93.80	.18	26.89	.67	-43.12
1.00	.66	-133.22	1.82	87.30	.18	23.81	.64	-45.41
1.10	.64	-144.02	1.74	81.47	.18	21.08	.62	-47.82
1.20	.62	-154.11	1.66	75.63	.18	19.11	.60	-49.75
1.30	.61	-163.41	1.57	70.50	.17	17.32	.58	-51.90
1.40	.61	-172.15	1.50	65.55	.17	16.33	.57	-54.11
1.50	.61	179.69	1.43	60.93	.17	15.48	.56	-56.32
1.60	.61	172.31	1.36	56.58	.16	15.52	.54	-58.59
1.70	.61	165.55	1.29	52.57	.16	15.97	.54	-61.07
1.80	.62	159.12	1.24	48.65	.15	16.87	.53	-63.68
1.90	.63	153.12	1.18	44.96	.15	18.29	.52	-66.32
2.00	.63	147.73	1.12	41.71	.15	20.29	.52	-69.09
2.10	.64	142.54	1.08	38.29	.15	22.73	.51	-71.98
2.20	.65	137.65	1.03	35.21	.15	25.25	.51	-75.26
2.30	.66	133.23	.99	32.01	.15	27.87	.51	-78.60
2.40	.67	129.32	.95	29.64	.15	30.83	.50	-82.11
2.50	.67	125.32	.92	27.04	.15	33.50	.50	-85.80
2.60	.68	121.78	.88	24.60	.16	36.03	.50	-89.61
2.70	.69	118.50	.85	22.41	.17	38.41	.50	-93.50
2.80	.70	115.24	.82	20.14	.17	40.23	.50	-97.66
2.90	.71	112.33	.79	18.25	.18	41.83	.50	-101.66
3.00	.72	109.50	.76	16.28	.19	42.71	.50	-105.83

$V_{CE} = 3\text{ V}$, $I_C = 3\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY GHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
.10	.91	-20.87	6.85	160.51	.04	76.06	.95	-14.18
.20	.84	-40.75	6.38	145.81	.06	64.42	.87	-26.10
.30	.77	-60.61	6.07	133.27	.08	55.69	.77	-34.95
.40	.69	-79.21	5.65	122.38	.10	49.28	.68	-41.90
.50	.62	-96.87	5.20	112.63	.11	45.15	.61	-46.55
.60	.57	-112.43	4.72	104.66	.12	41.99	.54	-50.59
.70	.52	-126.51	4.31	97.30	.12	40.07	.50	-53.40
.80	.49	-139.31	3.94	91.09	.13	38.98	.46	-55.90
.90	.47	-150.57	3.59	85.51	.13	38.14	.42	-58.00
1.00	.46	-160.97	3.31	80.44	.14	38.00	.40	-60.02
1.10	.46	-170.30	3.05	75.95	.14	37.60	.38	-62.10
1.20	.46	-178.72	2.83	71.60	.14	37.86	.36	-63.86
1.30	.46	173.69	2.64	67.73	.15	37.91	.34	-66.00
1.40	.47	166.63	2.47	63.86	.15	38.15	.33	-68.28
1.50	.47	160.24	2.32	60.26	.16	38.28	.32	-70.83
1.60	.48	154.42	2.19	56.86	.16	38.60	.31	-73.24
1.70	.49	149.16	2.07	53.60	.17	38.76	.30	-76.06
1.80	.50	144.23	1.96	50.43	.17	39.12	.29	-78.94
1.90	.51	139.58	1.86	47.34	.18	38.98	.28	-81.98
2.00	.52	135.44	1.77	44.29	.18	39.31	.28	-85.18
2.10	.53	131.39	1.70	41.48	.19	39.23	.27	-88.50
2.20	.54	127.65	1.62	38.94	.20	39.28	.26	-92.55
2.30	.55	124.36	1.55	36.05	.20	39.08	.26	-96.16
2.40	.57	121.18	1.49	33.64	.21	39.04	.26	-100.32
2.50	.58	118.19	1.43	31.34	.22	39.03	.26	-104.63
2.60	.59	115.58	1.38	28.95	.22	38.56	.26	-109.15
2.70	.60	112.99	1.33	26.70	.23	38.53	.26	-113.50
2.80	.61	110.43	1.29	24.45	.24	38.23	.26	-118.22
2.90	.62	108.13	1.24	22.28	.24	37.87	.26	-122.53
3.00	.63	105.91	1.20	20.22	.25	37.38	.26	-126.83

S-PARAMETERS Q1

$V_{CE} = 3\text{ V}$, $I_c = 5\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
.10	.85	-26.44	10.69	155.98	.03	73.46	.92	-19.86	
.20	.75	-51.20	9.61	139.24	.06	61.17	.79	-34.91	
.30	.64	-75.20	8.75	125.25	.07	54.17	.65	-44.33	
.40	.56	-96.72	7.76	113.92	.08	50.16	.55	-51.20	
.50	.49	-115.03	6.80	104.72	.09	48.17	.48	-55.56	
.60	.45	-130.31	5.95	97.69	.10	47.13	.42	-59.25	
.70	.42	-143.59	5.26	91.52	.11	46.84	.38	-61.89	
.80	.41	-155.39	4.72	86.26	.11	46.85	.35	-64.36	
.90	.40	-165.50	4.25	81.56	.12	46.62	.32	-66.67	
1.00	.40	-174.72	3.87	77.29	.13	46.83	.30	-68.91	
1.10	.40	177.10	3.55	73.37	.13	46.91	.28	-71.34	
1.20	.41	169.76	3.28	69.66	.14	46.94	.27	-73.69	
1.30	.41	163.14	3.04	66.19	.15	46.69	.25	-76.39	
1.40	.42	157.10	2.83	62.87	.16	46.57	.24	-79.41	
1.50	.43	151.58	2.66	59.70	.16	46.31	.23	-82.66	
1.60	.44	146.60	2.50	56.66	.17	45.94	.22	-86.03	
1.70	.45	142.01	2.36	53.73	.18	45.59	.22	-89.61	
1.80	.46	137.81	2.23	50.83	.19	45.07	.21	-93.69	
1.90	.48	133.84	2.12	48.10	.19	44.55	.21	-97.41	
2.00	.49	130.04	2.01	45.17	.20	44.01	.20	-101.67	
2.10	.50	126.68	1.93	42.52	.21	43.30	.20	-105.84	
2.20	.51	123.26	1.83	40.17	.22	42.61	.20	-111.09	
2.30	.52	120.32	1.76	37.50	.22	41.82	.19	-115.75	
2.40	.53	117.64	1.69	35.27	.23	41.27	.20	-120.90	
2.50	.54	114.93	1.62	32.99	.24	40.36	.20	-125.90	
2.60	.56	112.60	1.56	30.62	.25	39.55	.20	-131.14	
2.70	.57	110.25	1.50	28.52	.25	38.85	.20	-136.28	
2.80	.58	108.05	1.46	26.39	.26	38.08	.21	-141.19	
2.90	.59	105.95	1.41	24.29	.27	37.27	.21	-145.61	
3.00	.60	103.96	1.36	22.18	.27	36.49	.21	-149.97	

$V_{CE} = 3\text{ V}$, $I_c = 7\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
.10	.79	-31.67	14.14	152.27	.03	71.15	.88	-24.58	
.20	.67	-60.82	12.28	133.87	.05	59.89	.72	-41.34	
.30	.55	-87.90	10.67	119.07	.06	54.65	.57	-50.83	
.40	.47	-110.16	9.04	108.13	.07	52.59	.47	-57.33	
.50	.42	-127.95	7.66	99.95	.08	51.97	.40	-61.50	
.60	.39	-142.37	6.59	93.83	.09	51.63	.35	-65.05	
.70	.38	-154.76	5.76	88.35	.10	52.13	.32	-67.82	
.80	.37	-165.47	5.12	83.75	.11	52.11	.29	-70.62	
.90	.37	-174.83	4.59	79.53	.12	52.18	.27	-73.11	
1.00	.37	176.89	4.16	75.64	.13	52.20	.25	-75.82	
1.10	.38	169.63	3.81	72.18	.13	51.99	.23	-78.72	
1.20	.38	162.95	3.50	68.56	.14	51.72	.22	-81.78	
1.30	.39	156.98	3.25	65.42	.15	51.33	.21	-85.11	
1.40	.40	151.53	3.03	62.34	.16	50.81	.20	-88.95	
1.50	.41	146.63	2.83	59.33	.17	50.15	.19	-92.87	
1.60	.42	141.98	2.66	56.50	.18	49.40	.19	-97.18	
1.70	.44	137.93	2.51	53.72	.19	48.77	.18	-101.69	
1.80	.45	133.89	2.38	50.97	.20	48.00	.18	-106.30	
1.90	.46	130.36	2.26	48.32	.20	47.04	.18	-110.96	
2.00	.47	126.94	2.14	45.65	.21	46.10	.17	-116.39	
2.10	.48	123.80	2.05	43.03	.22	45.20	.17	-120.97	
2.20	.49	120.71	1.95	40.91	.23	44.15	.17	-126.84	
2.30	.50	118.00	1.87	38.45	.24	43.05	.18	-132.13	
2.40	.52	115.48	1.80	36.15	.24	42.04	.18	-137.40	
2.50	.53	113.00	1.73	33.97	.25	41.08	.18	-142.69	
2.60	.54	110.80	1.66	31.82	.26	39.96	.19	-148.07	
2.70	.55	108.67	1.60	29.74	.26	39.23	.19	-152.96	
2.80	.56	106.60	1.55	27.34	.27	38.14	.20	-157.19	
2.90	.58	104.57	1.50	25.66	.28	37.25	.21	-161.69	
3.00	.59	102.82	1.45	23.37	.29	36.23	.21	-165.54	

S-PARAMETERS Q1

$V_{CE} = 3\text{ V}$, $I_C = 10\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
GHZ	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
.10	.71	-39.03	18.58	147.71	.03	68.69	.83	-30.16	
.20	.57	-73.63	15.31	127.39	.05	59.38	.63	-48.07	
.30	.45	-102.58	12.43	112.73	.06	56.68	.49	-57.41	
.40	.39	-124.33	10.08	102.91	.07	56.27	.40	-63.51	
.50	.36	-141.02	8.36	95.89	.08	56.57	.34	-67.57	
.60	.35	-154.37	7.10	90.47	.09	56.86	.29	-71.19	
.70	.34	-165.44	6.16	85.73	.10	57.18	.26	-74.31	
.80	.34	-175.03	5.44	81.62	.11	57.18	.24	-77.41	
.90	.34	176.63	4.87	77.75	.12	57.09	.22	-80.56	
1.00	.35	169.25	4.40	74.22	.13	56.69	.21	-83.81	
1.10	.36	162.75	4.02	71.00	.14	56.34	.20	-87.55	
1.20	.37	156.83	3.70	67.77	.15	55.55	.19	-91.34	
1.30	.38	151.50	3.42	64.82	.16	54.83	.18	-95.70	
1.40	.39	146.60	3.19	61.79	.17	53.99	.17	-100.40	
1.50	.40	142.12	2.98	59.04	.17	53.03	.17	-104.99	
1.60	.41	138.03	2.80	56.45	.18	52.03	.16	-110.36	
1.70	.42	134.21	2.63	53.75	.19	51.04	.16	-115.48	
1.80	.43	130.67	2.50	51.05	.20	49.91	.16	-120.86	
1.90	.45	127.37	2.37	48.74	.21	48.75	.16	-126.15	
2.00	.46	124.22	2.25	46.04	.22	47.77	.16	-131.74	
2.10	.47	121.31	2.15	43.60	.23	46.48	.16	-136.39	
2.20	.48	118.37	2.05	41.36	.24	45.20	.17	-142.70	
2.30	.49	115.87	1.96	38.90	.25	43.97	.17	-147.46	
2.40	.50	113.55	1.89	36.95	.25	42.65	.18	-152.75	
2.50	.52	111.30	1.81	34.71	.26	41.70	.19	-157.66	
2.60	.53	109.28	1.74	32.62	.27	40.45	.19	-162.35	
2.70	.54	107.16	1.67	30.43	.28	39.28	.20	-166.91	
2.80	.55	105.27	1.62	28.76	.28	38.16	.21	-170.83	
2.90	.57	103.43	1.57	26.44	.29	37.04	.22	-174.49	
3.00	.58	101.61	1.51	24.93	.30	36.10	.23	-177.86	

$V_{CE} = 3\text{ V}$, $I_C = 20\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY		S11		S21		S12		S22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
.10	.52	-60.10	28.62	137.10	.02	67.35	.71	-41.30	
.20	.39	-103.44	19.94	115.16	.04	63.08	.48	-59.79	
.30	.33	-130.53	14.51	103.51	.05	63.34	.35	-68.39	
.40	.31	-148.95	11.26	96.02	.06	64.33	.28	-74.25	
.50	.30	-162.62	9.15	90.56	.07	65.01	.24	-78.55	
.60	.30	-172.99	7.69	86.27	.08	65.06	.21	-82.95	
.70	.31	178.35	6.63	82.36	.09	64.97	.19	-87.11	
.80	.31	170.80	5.84	78.82	.11	64.40	.18	-91.38	
.90	.32	164.26	5.21	75.55	.12	63.46	.16	-96.07	
1.00	.33	158.34	4.70	72.35	.13	62.64	.16	-100.35	
1.10	.34	153.02	4.28	69.45	.14	61.47	.15	-105.51	
1.20	.35	148.21	3.94	66.66	.15	60.45	.15	-110.63	
1.30	.36	143.86	3.63	63.96	.16	59.09	.15	-116.00	
1.40	.37	139.65	3.38	61.26	.17	58.05	.15	-121.72	
1.50	.38	135.96	3.16	58.61	.18	56.50	.15	-127.25	
1.60	.40	132.38	2.97	56.19	.19	55.17	.15	-133.07	
1.70	.41	129.06	2.79	53.72	.20	53.77	.15	-138.41	
1.80	.42	126.14	2.64	51.32	.21	52.54	.16	-143.83	
1.90	.43	123.11	2.50	48.96	.22	51.02	.16	-148.58	
2.00	.44	120.40	2.38	46.54	.23	49.64	.17	-153.87	
2.10	.46	117.80	2.27	44.17	.24	48.25	.18	-157.74	
2.20	.47	115.23	2.16	42.21	.25	46.65	.18	-162.91	
2.30	.48	112.96	2.07	39.64	.26	45.13	.19	-167.09	
2.40	.49	110.86	1.99	37.96	.27	43.59	.20	-171.04	
2.50	.50	108.77	1.90	35.67	.27	42.37	.21	-174.96	
2.60	.51	106.98	1.84	33.82	.28	40.93	.22	-178.81	
2.70	.53	105.14	1.77	31.79	.29	39.70	.23	-177.40	
2.80	.54	103.40	1.72	29.93	.30	38.37	.24	-174.62	
2.90	.55	101.60	1.65	28.01	.30	37.05	.25	-171.56	
3.00	.56	100.10	1.61	26.09	.31	35.76	.26	-168.73	

S-PARAMETERS Q2

V_{CE} = 3 V, I_c = 1 mA, Z₀ = 50 Ω

FREQUENCY		S11		S21		S12		S22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
.10	.98	-5.93	2.43	171.79	.02	85.64	.99	-3.75	
.20	.97	-11.82	2.41	164.40	.04	80.86	.99	-7.53	
.30	.95	-17.85	2.42	157.59	.05	76.45	.97	-11.10	
.40	.93	-23.59	2.39	151.04	.07	72.26	.95	-14.56	
.50	.90	-29.61	2.38	144.91	.09	68.73	.93	-17.91	
.60	.87	-35.62	2.37	139.49	.10	64.78	.90	-21.19	
.70	.84	-41.49	2.34	133.87	.11	61.52	.87	-23.71	
.80	.81	-47.40	2.32	128.66	.12	58.06	.85	-26.91	
.90	.77	-53.49	2.32	123.12	.13	55.30	.82	-29.05	
1.00	.73	-59.00	2.26	118.06	.14	52.86	.78	-31.52	
1.10	.69	-65.20	2.25	113.30	.15	50.42	.76	-33.73	
1.20	.65	-71.05	2.21	108.31	.16	48.61	.73	-35.51	
1.30	.62	-77.22	2.17	103.81	.16	46.62	.70	-37.59	
1.40	.58	-83.22	2.15	99.18	.17	45.21	.68	-39.34	
1.50	.54	-89.53	2.13	94.49	.17	43.82	.66	-41.12	
1.60	.51	-95.27	2.07	90.14	.18	42.57	.63	-42.89	
1.70	.47	-101.29	2.02	86.01	.18	41.68	.61	-44.56	
1.80	.45	-107.59	1.99	82.00	.18	40.66	.59	-46.38	
1.90	.42	-114.02	1.95	78.38	.19	40.08	.57	-47.99	
2.00	.40	-120.45	1.90	74.87	.19	39.57	.55	-49.87	
2.10	.38	-127.04	1.87	70.82	.19	39.19	.53	-51.49	
2.20	.36	-133.41	1.83	67.34	.20	38.84	.51	-53.44	
2.30	.35	-139.83	1.78	63.84	.20	38.49	.50	-55.39	
2.40	.34	-146.46	1.74	60.75	.20	38.49	.48	-57.67	
2.50	.33	-153.17	1.71	57.60	.21	38.43	.46	-59.91	
2.60	.32	-159.96	1.68	54.38	.21	38.28	.45	-62.31	
2.70	.32	-166.01	1.64	51.35	.22	38.20	.43	-64.97	
2.80	.32	-172.06	1.61	48.28	.22	38.44	.41	-67.87	
2.90	.32	-177.98	1.58	45.54	.23	38.28	.40	-70.94	
3.00	.33	177.01	1.54	42.57	.23	38.11	.38	-74.21	

V_{CE} = 3 V, I_c = 3 mA, Z₀ = 50 Ω

FREQUENCY		S11		S21		S12		S22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
.10	.93	-9.39	6.76	166.53	.02	82.60	.98	-7.24	
.20	.90	-18.39	6.46	155.80	.03	76.86	.94	-13.64	
.30	.84	-27.39	6.32	146.52	.05	71.65	.89	-18.91	
.40	.79	-35.83	6.06	138.21	.06	67.47	.83	-23.49	
.50	.72	-44.06	5.82	130.60	.07	64.58	.77	-26.46	
.60	.66	-51.67	5.54	123.94	.08	61.95	.72	-29.65	
.70	.59	-58.86	5.28	117.07	.09	60.46	.68	-31.43	
.80	.53	-65.57	5.01	111.07	.10	59.12	.64	-33.17	
.90	.48	-71.57	4.72	105.46	.10	57.98	.60	-34.36	
1.00	.43	-77.20	4.45	100.46	.11	57.39	.57	-35.31	
1.10	.38	-82.70	4.20	95.95	.12	56.96	.55	-36.47	
1.20	.34	-87.82	3.95	91.74	.13	56.54	.52	-37.08	
1.30	.31	-93.49	3.74	87.96	.13	56.14	.50	-37.96	
1.40	.28	-98.65	3.55	84.35	.14	55.72	.48	-38.83	
1.50	.26	-104.50	3.37	80.85	.15	55.21	.46	-39.70	
1.60	.24	-110.31	3.21	77.72	.15	54.91	.44	-40.63	
1.70	.22	-116.75	3.06	74.57	.16	54.46	.43	-41.65	
1.80	.21	-123.46	2.94	71.63	.17	53.91	.41	-42.70	
1.90	.20	-130.51	2.81	68.84	.18	53.57	.39	-43.76	
2.00	.19	-137.84	2.71	66.02	.18	53.01	.38	-44.95	
2.10	.18	-145.47	2.61	63.33	.19	52.38	.36	-46.23	
2.20	.18	-152.73	2.52	60.80	.20	51.91	.35	-47.64	
2.30	.18	-160.13	2.44	58.00	.21	51.17	.33	-49.19	
2.40	.18	-167.47	2.36	55.57	.22	50.80	.32	-50.82	
2.50	.19	-174.18	2.29	53.07	.22	49.89	.30	-52.82	
2.60	.20	179.79	2.23	50.72	.23	49.17	.28	-54.67	
2.70	.20	173.96	2.16	48.10	.24	48.35	.27	-56.94	
2.80	.21	168.73	2.10	45.81	.25	47.49	.25	-59.46	
2.90	.22	163.65	2.05	43.41	.26	46.43	.24	-62.59	
3.00	.24	159.82	1.99	41.14	.26	45.56	.22	-65.40	

S-PARAMETERS Q2

$V_{CE} = 3\text{ V}$, $I_C = 5\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY GHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
.10	.89	-12.31	10.46	162.72	.02	81.62	.96	-9.77
.20	.83	-23.63	9.75	149.86	.03	74.55	.90	-17.75
.30	.75	-34.70	9.25	138.82	.04	69.69	.81	-23.24
.40	.66	-44.55	8.62	129.30	.06	66.77	.74	-27.15
.50	.57	-53.23	7.96	120.72	.06	64.98	.68	-29.45
.60	.50	-60.42	7.27	113.73	.07	63.78	.62	-31.18
.70	.43	-66.51	6.64	107.23	.08	63.28	.58	-32.03
.80	.37	-71.94	6.08	101.84	.09	62.73	.55	-32.89
.90	.33	-76.60	5.57	97.19	.10	62.37	.52	-33.36
1.00	.29	-81.19	5.15	92.96	.10	62.23	.49	-33.76
1.10	.26	-85.79	4.77	89.24	.11	61.85	.47	-34.33
1.20	.23	-90.41	4.45	85.71	.12	61.60	.45	-34.67
1.30	.21	-95.79	4.17	82.52	.13	61.06	.43	-35.08
1.40	.19	-100.84	3.91	79.44	.14	60.78	.42	-35.79
1.50	.17	-106.89	3.70	76.63	.14	60.08	.40	-36.32
1.60	.16	-113.52	3.50	73.79	.15	59.69	.39	-37.17
1.70	.15	-120.69	3.33	71.22	.16	58.93	.37	-38.02
1.80	.14	-128.54	3.18	68.57	.17	58.47	.36	-38.84
1.90	.13	-136.73	3.04	66.08	.18	57.63	.34	-40.00
2.00	.13	-145.48	2.92	63.46	.19	57.05	.33	-40.74
2.10	.13	-153.95	2.81	61.14	.20	56.13	.32	-42.01
2.20	.13	-161.96	2.71	58.79	.20	55.20	.30	-43.19
2.30	.14	-169.65	2.61	56.38	.21	54.17	.29	-44.77
2.40	.15	-177.12	2.53	53.98	.22	53.43	.27	-46.33
2.50	.15	176.33	2.45	51.77	.23	52.54	.26	-48.08
2.60	.17	170.73	2.37	49.49	.24	51.49	.24	-49.77
2.70	.18	165.64	2.31	47.17	.25	50.53	.22	-51.64
2.80	.19	160.85	2.24	45.04	.26	49.38	.21	-54.34
2.90	.20	156.69	2.18	42.82	.27	48.22	.19	-56.82
3.00	.22	153.43	2.12	40.65	.27	47.15	.17	-59.19

$V_{CE} = 3\text{ V}$, $I_C = 10\text{ mA}$, $Z_0 = 50\ \Omega$

FREQUENCY GHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
.10	.79	-18.18	17.81	156.05	.02	79.00	.92	-14.07
.20	.67	-33.75	15.65	139.27	.03	72.98	.80	-22.91
.30	.55	-46.32	13.67	125.80	.04	69.74	.69	-27.06
.40	.44	-55.16	11.71	115.64	.05	69.07	.61	-28.96
.50	.37	-61.11	10.03	108.02	.06	68.93	.56	-29.47
.60	.31	-65.90	8.70	102.30	.07	68.67	.52	-29.62
.70	.26	-69.64	7.66	97.45	.07	68.49	.49	-29.55
.80	.23	-73.22	6.84	93.31	.08	68.26	.46	-29.57
.90	.20	-76.64	6.18	89.63	.09	68.18	.44	-29.61
1.00	.18	-80.09	5.63	86.38	.10	67.74	.43	-29.60
1.10	.15	-84.01	5.17	83.43	.11	67.32	.41	-29.87
1.20	.14	-88.42	4.80	80.51	.12	66.68	.40	-29.99
1.30	.12	-94.33	4.47	77.83	.13	65.96	.38	-30.36
1.40	.11	-100.18	4.18	75.30	.14	65.40	.37	-30.99
1.50	.10	-107.91	3.94	72.79	.15	64.56	.36	-31.58
1.60	.09	-116.38	3.72	70.38	.15	63.80	.34	-32.25
1.70	.08	-126.27	3.53	68.12	.16	62.66	.33	-33.11
1.80	.08	-137.48	3.36	65.70	.17	62.05	.32	-33.82
1.90	.08	-148.12	3.21	63.57	.18	60.90	.31	-34.82
2.00	.09	-158.61	3.08	61.31	.19	59.98	.29	-35.72
2.10	.09	-168.26	2.96	59.03	.20	58.90	.28	-36.80
2.20	.10	-176.89	2.85	56.80	.21	57.81	.26	-37.90
2.30	.11	176.30	2.74	54.71	.22	56.71	.25	-39.12
2.40	.12	170.07	2.66	52.56	.23	55.52	.24	-40.48
2.50	.13	164.55	2.57	50.55	.24	54.48	.22	-42.08
2.60	.14	160.22	2.49	48.36	.25	53.37	.21	-43.45
2.70	.16	156.24	2.41	46.36	.26	52.12	.19	-44.76
2.80	.17	152.57	2.34	44.39	.27	50.92	.17	-46.97
2.90	.19	149.35	2.29	42.02	.27	49.67	.16	-49.05
3.00	.20	146.66	2.21	40.11	.28	48.32	.14	-51.14

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.