

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 μPA833TF 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

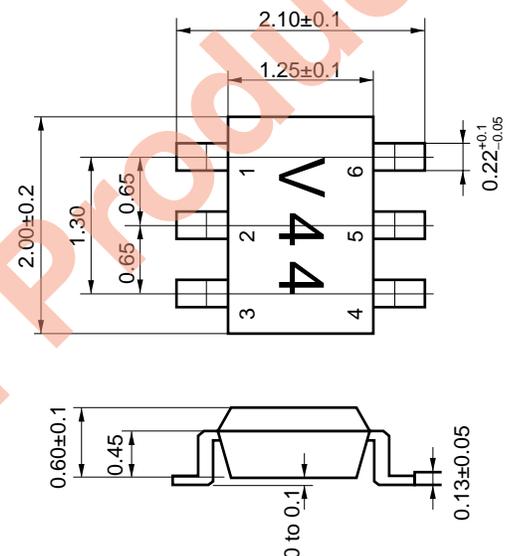
	Q1	Q2
3-pin small mini mold part No.	2SC5193	2SC4959

The μPA836TF features the Q1 and Q2 in inverted positions.

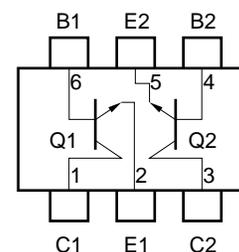
ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
μPA833TF	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.
μPA833TF-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 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} = 3 V, I _C = 10 mA ^{Note 1}	75		150	
Gain bandwidth product	f _T	V _{CE} = 3 V, I _C = 10 mA, f = 2 GHz		12		GHz
Feedback capacitance	C _{re}	V _{CB} = 3 V, I _E = 0, f = 1 MHz ^{Note 2}		0.4	0.7	pF
Insertion power gain	S _{21e} ²	V _{CE} = 3 V, I _C = 10 mA, f = 2 GHz	7	8.5		dB
Noise figure	NF	V _{CE} = 3 V, I _C = 3 mA, f = 2 GHz		1.5	2.5	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.

h_{FE} CLASSIFICATION

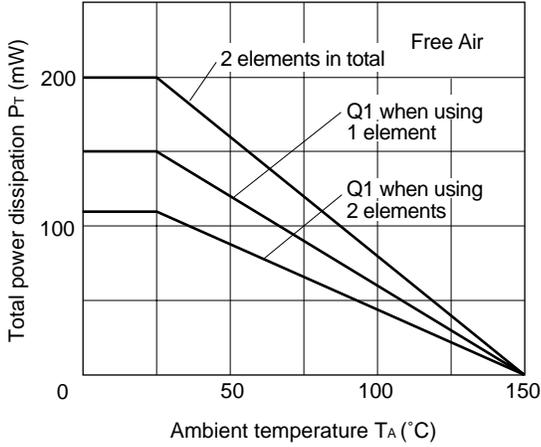
Rank	FB
Marking	V44
h _{FE} value of Q1	100 to 145
h _{FE} value of Q2	75 to 150

Discontinued Product

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

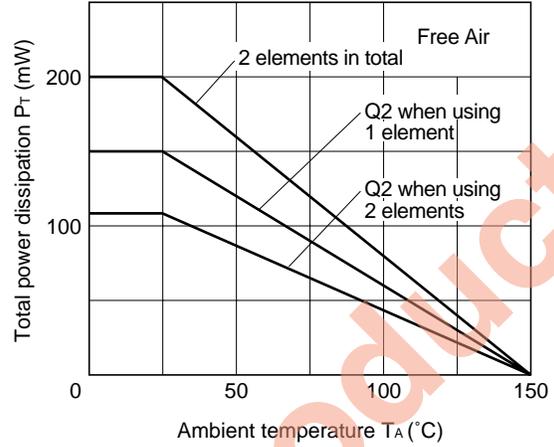
Q1

Total Power Dissipation vs. Ambient Temperature

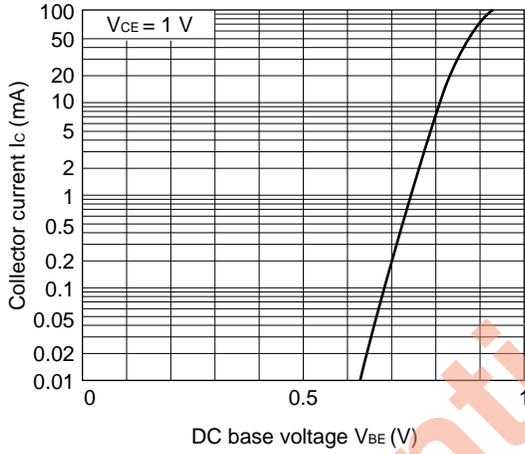


Q2

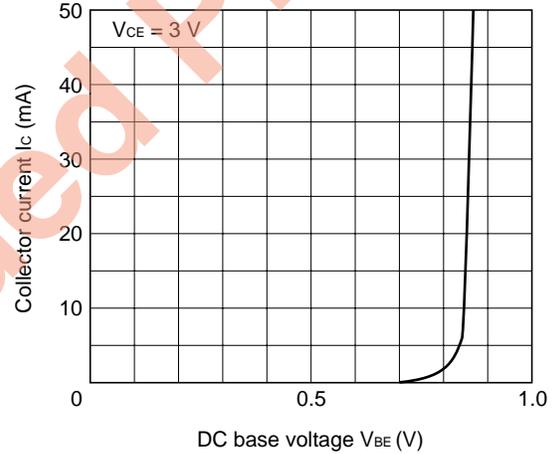
Total Power Dissipation vs. Ambient Temperature



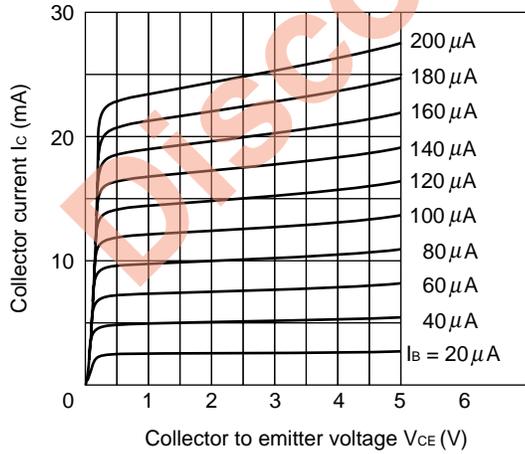
Collector Current vs. DC Base Voltage



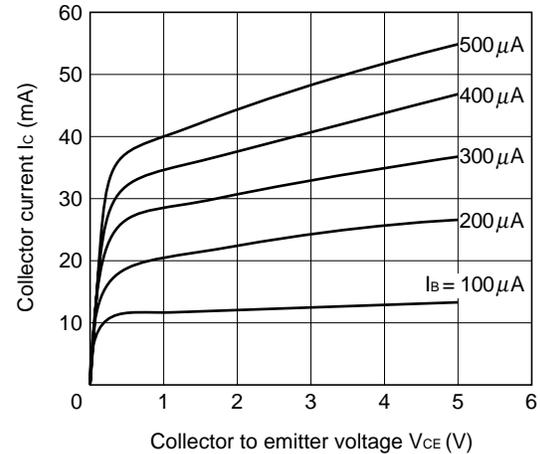
Collector Current vs. DC Base Voltage



Collector Current vs. Collector to Emitter Voltage

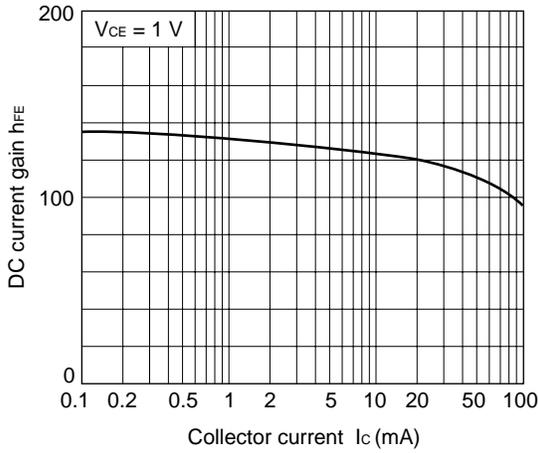


Collector Current vs. Collector to Emitter Voltage



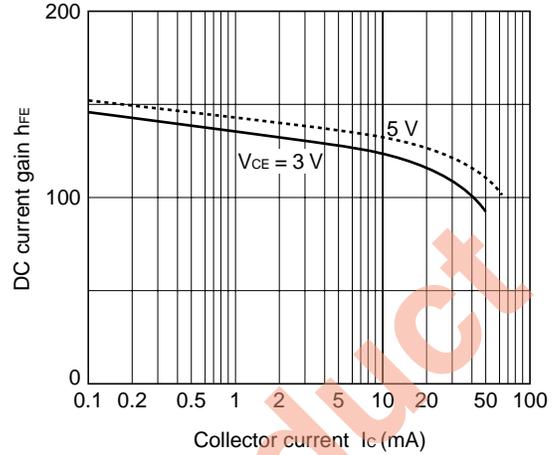
Q1

DC Current Gain vs. Collector Current

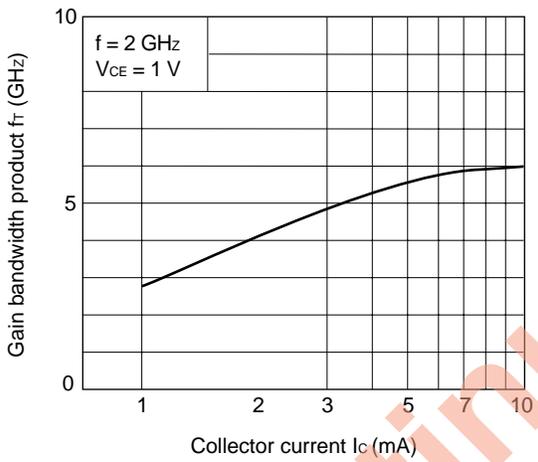


Q2

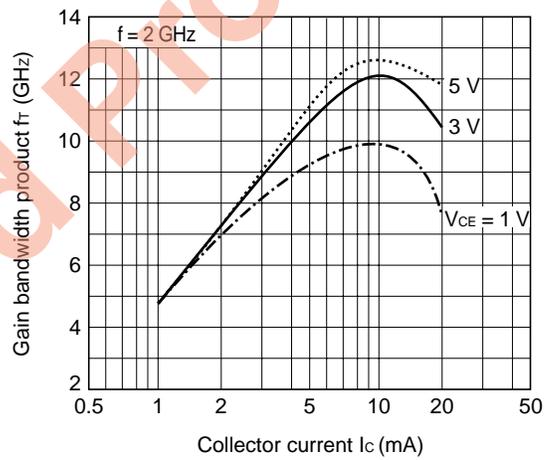
DC Current Gain vs. Collector Current



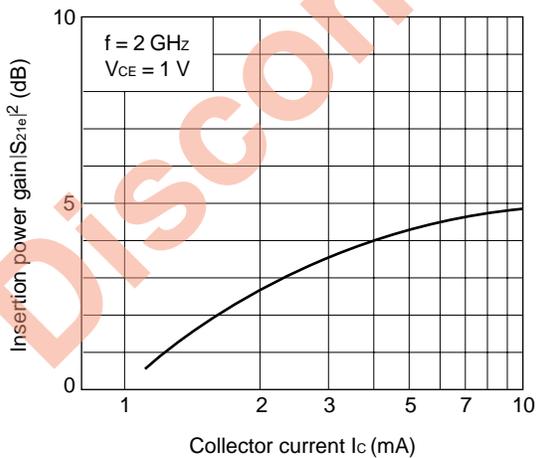
Gain Bandwidth Product vs. Collector Current



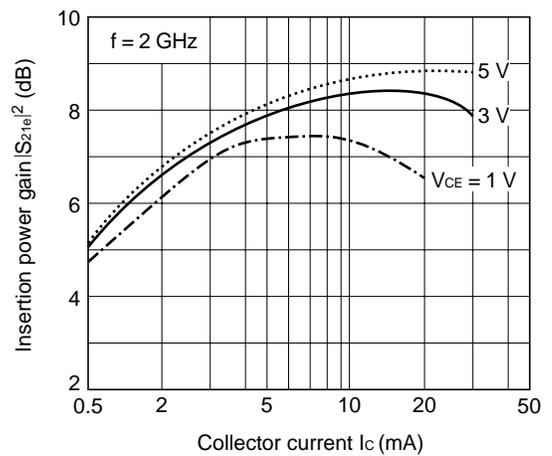
Gain Bandwidth Product vs. Collector Current



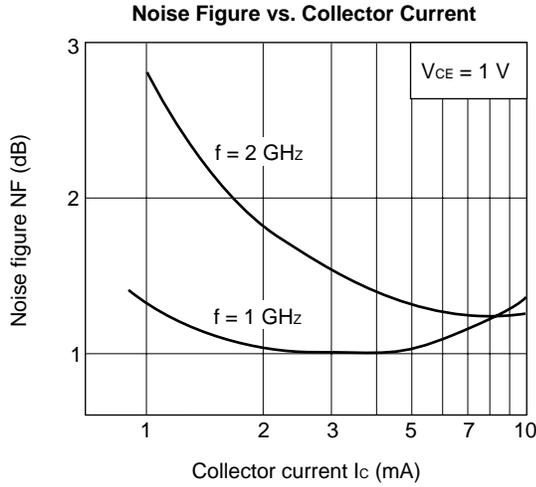
Insertion Power Gain vs. Collector Current



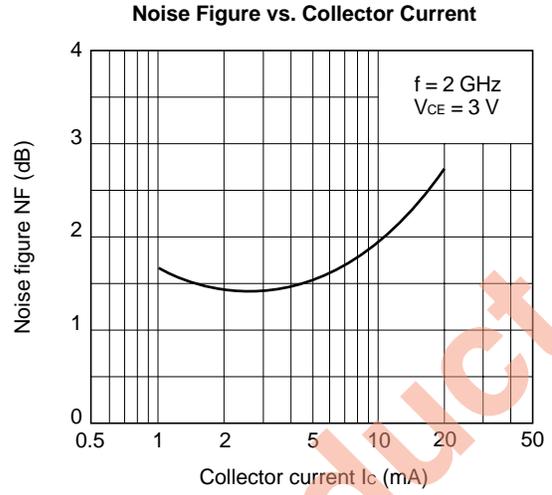
Insertion Power Gain vs. Collector Current



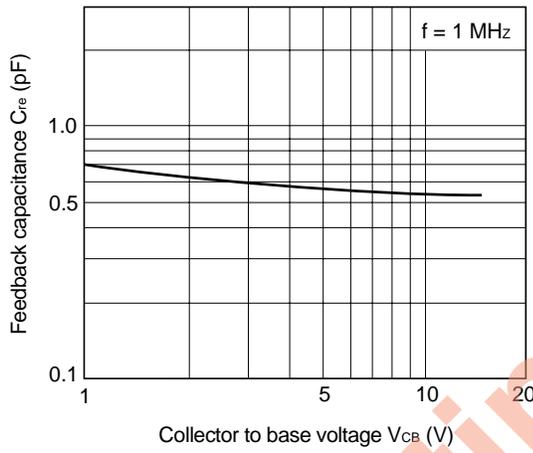
Q1



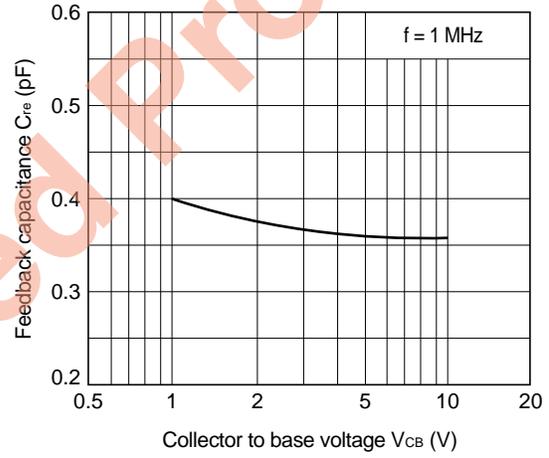
Q2



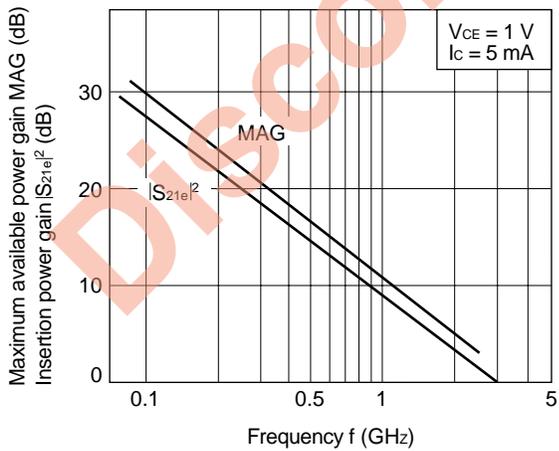
Feedback Capacitance vs. Collector to Base Voltage



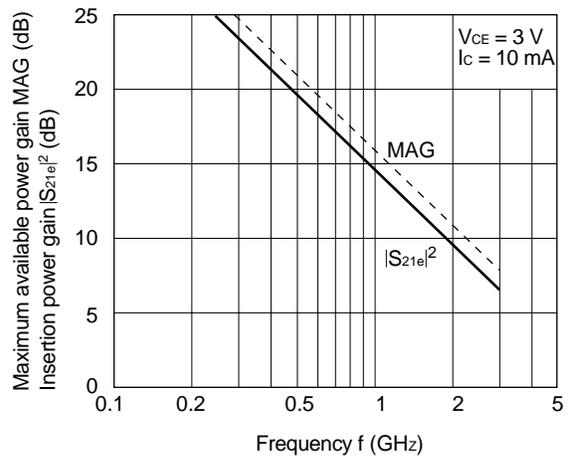
Feedback Capacitance vs. Collector to Base Voltage

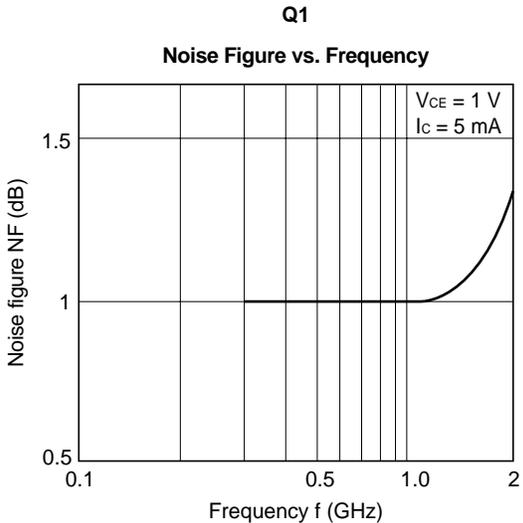


Maximum Available Gain, Insertion Power Gain vs. Frequency



Maximum Available Gain, Insertion Power Gain vs. Frequency





Discontinued Product

S-PARAMETERS Q1

V_{CE} = 3 V, I_c = 1 mA, Z₀ = 50 Ω

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 V, I_c = 3 mA, Z₀ = 50 Ω

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 V, I_c = 5 mA, Z₀ = 50 Ω

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 V, I_c = 7 mA, Z₀ = 50 Ω

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 V, I_c = 10 mA, Z₀ = 50 Ω

FREQUENCY	S11		S21		S12		S22	
	GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
.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 V, I_c = 20 mA, Z₀ = 50 Ω

FREQUENCY	S11		S21		S12		S22	
	GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
.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 GHz	S11		S21		S12		S22	
	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 GHz	S11		S21		S12		S22	
	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 V, I_c = 5 mA, Z₀ = 50 Ω

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 V, I_c = 10 mA, Z₀ = 50 Ω

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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NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

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.