

### HIGH-FREQUENCY LOW-NOISE AMPLIFIER NPN SILICON EPITAXIAL TWIN TRANSISTOR (WITH BUILT-IN 6-PIN 2 × 2SC4226) THIN-TYPE SMALL MINI MOLD

The  $\mu$ PA821TF has 2 built-in low-voltage transistors which are designed for low-noise amplification in the VHF to UHF band.

#### FEATURES

- Low-noise  
NF = 1.2 dB TYP. @ f = 1 GHz,  $V_{CE} = 3V$ ,  $I_c = 7mA$
- High gain  
 $IS_{21eI^2} = 9.0$  dB TYP. @ f = 1 GHz,  $V_{CE} = 3V$ ,  $I_c = 7mA$
- 6-pin thin-type small mini mold package adopted
- Built-in 2 transistors (2 × 2SC4226)

#### ORDERING INFORMATION

Part Number	Quantity	Packing Style
$\mu$ PA821TF	Loose products (50 pcs)	Embossed tape 8 mm wide. Pin 6 (Q1 Base), Pin 5 (Q2 Emitter), Pin 4 (Q2 Base) face to perforation side of the tape.
$\mu$ PA821TF-T1	Taping products (3 kpcs/reel)	

**Remark** If you require an evaluation sample, please contact an NEC Sales Representative (unit sample quantity is 50 pcs).

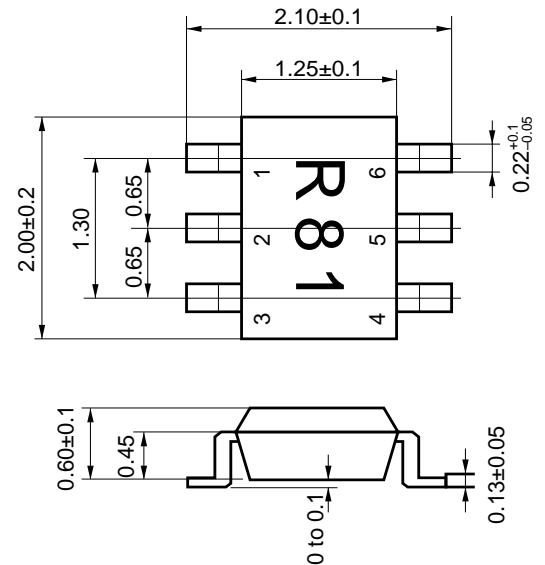
#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ C$ )

Parameter	Symbol	Rating	Unit
Collector to Base Voltage	$V_{CBO}$	20	V
Collector to Emitter Voltage	$V_{CEO}$	12	V
Emitter to Base Voltage	$V_{EBO}$	3	V
Collector Current	$I_c$	100	mA
Total Power Dissipation	$P_T$	150 in 1 element 200 in 2 elements <sup>Note</sup>	mW
Junction Temperature	$T_j$	150	$^\circ C$
Storage Temperature	$T_{stg}$	-65 to 150	$^\circ C$

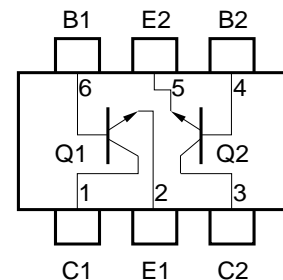
**Note** 110 mW must not be exceeded for 1 element.

**Caution is required concerning excess input, such as from static electricity, due to the high-precision fabrication processes used for this device.**

#### 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)    |

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Collector Cutoff Current	I <sub>CB0</sub>	V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0			1.0	μA
Emitter Cutoff Current	I <sub>EB0</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0			1.0	μA
DC Current Gain	h <sub>FE</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA <sup>Note 1</sup>	70		140	
Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA	3.0	4.5		GHz
Feedback Capacitance	C <sub>re</sub>	V <sub>CB</sub> = 3 V, I <sub>E</sub> = 0, f = 1 MHz <sup>Note 2</sup>		0.7	1.5	pF
Insertion Power Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz	7	9		dB
Noise Figure	NF	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz		1.2	2.5	dB
h <sub>FE</sub> Ratio	h <sub>FE1</sub> /h <sub>FE2</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA h <sub>FE1</sub> = Smaller h <sub>FE</sub> value among Q1 and Q2 h <sub>FE2</sub> = Larger h <sub>FE</sub> value among Q1 and Q2	0.85			

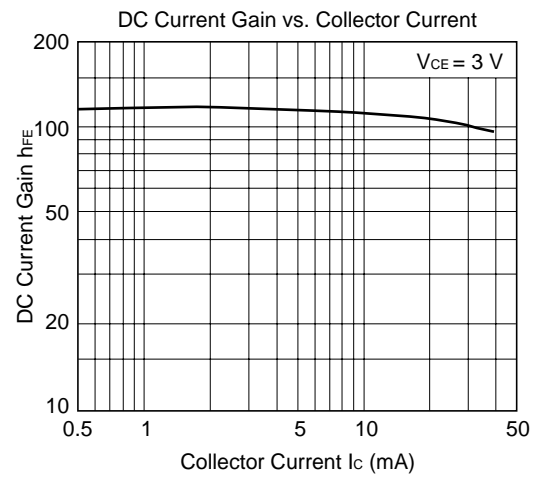
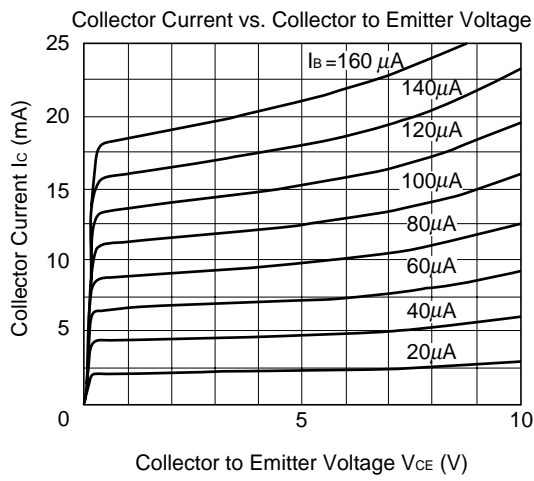
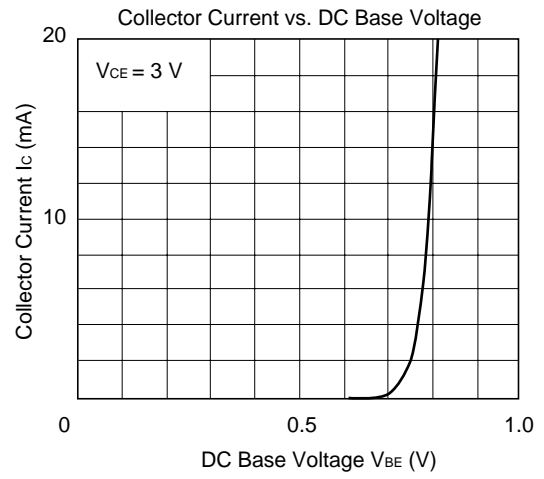
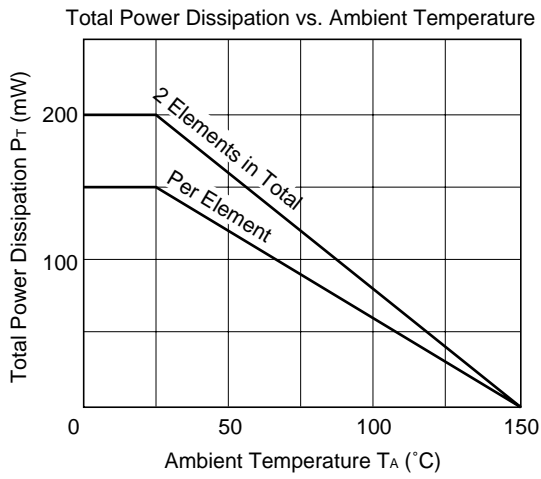
**Notes 1.** Pulse measurement P<sub>w</sub> ≤ 350 μs, Duty cycle ≤ 2 %

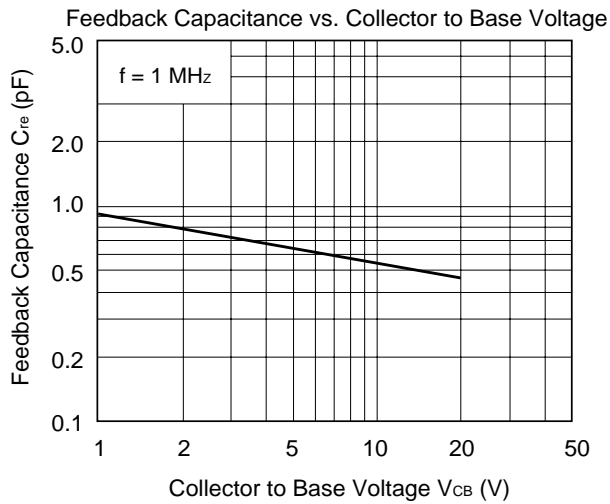
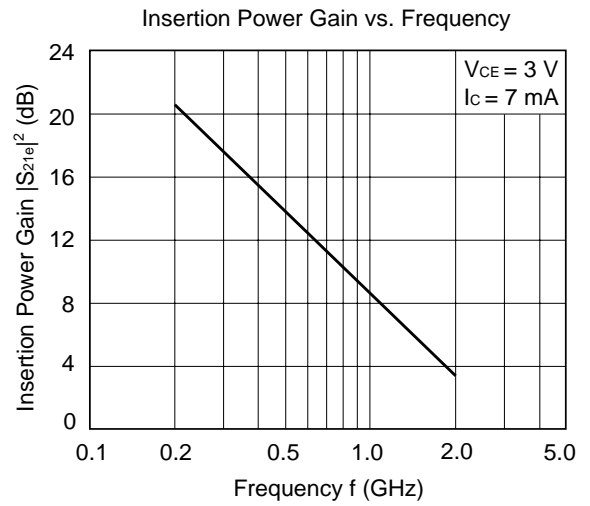
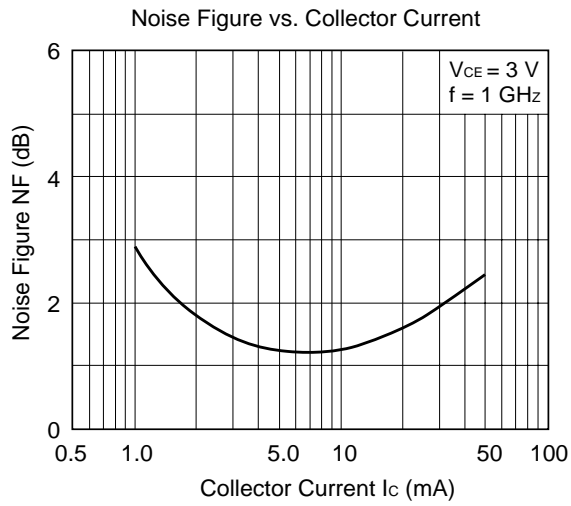
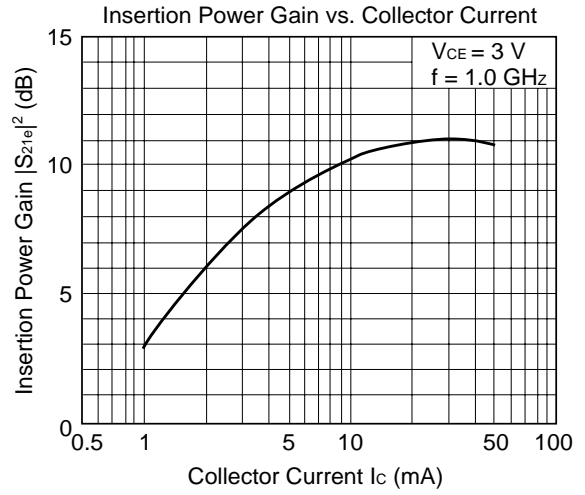
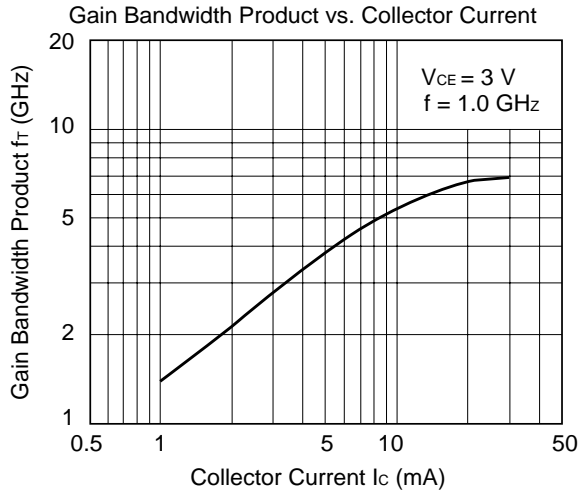
**2.** Capacitance between collector and base measured with a capacitance meter (auto-balancing bridge method). Emitter should be connected to the guard pin of capacitance meter.

**h<sub>FE</sub> CLASSIFICATION**

Rank	FB
Marking	R81
h <sub>FE</sub> value	70 to 140

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





**S PARAMETER Q1**

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

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.97	-20.45	2.38	162.85	.04	76.56	.98	-8.59
.20	.94	-40.17	2.31	148.19	.08	63.82	.94	-16.05
.30	.90	-59.57	2.25	135.26	.11	52.97	.89	-22.20
.40	.86	-77.29	2.10	123.99	.13	43.63	.83	-27.30
.50	.82	-94.54	2.03	113.53	.15	36.13	.78	-31.16
.60	.79	-110.15	1.92	104.19	.16	29.28	.74	-34.67
.70	.76	-124.06	1.80	95.54	.16	23.65	.70	-37.55
.80	.74	-136.61	1.69	87.82	.16	19.18	.67	-40.06
.90	.72	-148.19	1.59	80.80	.16	15.47	.65	-42.54
1.00	.71	-158.16	1.48	74.49	.16	12.65	.64	-44.88
1.10	.71	-167.38	1.39	68.76	.15	10.12	.62	-47.25
1.20	.70	-175.72	1.30	63.28	.15	8.37	.61	-49.79
1.30	.71	176.48	1.22	58.43	.14	7.41	.60	-52.21
1.40	.71	169.61	1.15	53.77	.13	7.31	.59	-54.99
1.50	.71	162.88	1.09	49.18	.13	7.58	.59	-57.73
1.60	.72	157.03	1.03	45.04	.12	9.20	.58	-61.04
1.70	.72	151.31	.97	41.14	.12	11.56	.58	-64.34
1.80	.73	146.29	.92	37.65	.11	14.82	.58	-67.77
1.90	.74	141.40	.87	34.21	.11	18.79	.57	-71.13
2.00	.75	136.95	.83	31.08	.11	23.61	.57	-74.83
2.10	.75	132.61	.79	27.91	.11	28.60	.57	-78.77
2.20	.76	128.64	.76	25.12	.11	33.65	.57	-82.60
2.30	.77	124.97	.72	22.56	.12	38.01	.57	-86.85
2.40	.77	121.29	.69	20.26	.12	41.76	.57	-90.91
2.50	.78	117.97	.66	18.15	.13	45.08	.57	-95.23
2.60	.79	114.71	.63	16.20	.14	47.62	.57	-99.78
2.70	.79	111.76	.60	14.55	.15	49.09	.57	-104.24
2.80	.80	108.85	.58	12.80	.16	49.98	.58	-109.00
2.90	.81	106.05	.56	11.46	.18	50.29	.58	-113.69
3.00	.81	103.52	.54	10.02	.19	50.48	.58	-118.13

**S PARAMETER Q1**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 3 mA, Z<sub>0</sub> = 50 Ω

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.90	-29.42	6.73	156.08	.04	70.94	.93	-16.82
.20	.83	-56.61	6.15	138.83	.07	55.92	.82	-29.40
.30	.75	-82.38	5.66	124.38	.09	46.12	.70	-37.28
.40	.70	-104.35	5.08	112.82	.10	39.45	.61	-42.73
.50	.65	-122.97	4.52	102.90	.11	35.38	.54	-45.93
.60	.62	-138.09	4.00	94.98	.11	32.50	.49	-48.61
.70	.60	-150.60	3.57	88.01	.11	30.78	.45	-50.55
.80	.59	-161.35	3.21	82.00	.11	30.02	.42	-52.19
.90	.59	-170.46	2.90	76.74	.12	29.88	.40	-54.08
1.00	.59	-178.60	2.65	71.87	.12	30.03	.38	-55.78
1.10	.59	174.04	2.43	67.34	.12	30.52	.37	-57.60
1.20	.59	167.50	2.25	62.99	.12	31.42	.36	-59.72
1.30	.60	161.38	2.08	59.07	.12	32.31	.35	-61.84
1.40	.60	156.04	1.95	55.38	.13	33.59	.34	-64.46
1.50	.61	150.72	1.82	51.53	.13	34.65	.33	-67.05
1.60	.62	146.09	1.71	48.04	.13	35.76	.33	-70.23
1.70	.63	141.52	1.61	44.61	.14	36.98	.32	-73.46
1.80	.64	137.65	1.53	41.49	.14	38.11	.32	-76.96
1.90	.65	133.69	1.45	38.35	.15	38.91	.32	-80.43
2.00	.66	130.09	1.38	35.44	.15	39.97	.31	-84.11
2.10	.67	126.52	1.32	32.33	.16	40.67	.31	-88.21
2.20	.68	123.26	1.26	29.70	.16	41.25	.31	-92.12
2.30	.69	120.27	1.20	26.91	.17	41.76	.31	-96.67
2.40	.69	117.15	1.15	24.44	.18	42.09	.31	-100.78
2.50	.70	114.27	1.10	21.83	.19	42.08	.31	-105.22
2.60	.71	111.71	1.06	19.60	.19	42.18	.31	-109.89
2.70	.72	109.21	1.02	17.12	.20	42.29	.32	-114.66
2.80	.73	106.70	.97	14.96	.21	41.78	.32	-119.25
2.90	.74	104.47	.94	12.97	.22	41.42	.33	-124.21
3.00	.75	102.28	.91	10.82	.22	41.10	.33	-128.59

**S PARAMETER Q1**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 5 mA, Z<sub>0</sub> = 50  $\Omega$

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.84	-37.26	10.52	150.99	.04	67.19	.89	-23.52
.20	.74	-70.72	9.17	131.67	.06	52.38	.72	-38.66
.30	.65	-100.14	7.97	116.47	.07	44.81	.58	-46.62
.40	.60	-122.73	6.76	105.34	.08	41.17	.48	-51.47
.50	.57	-139.98	5.74	96.73	.09	39.62	.42	-54.25
.60	.55	-153.16	4.95	89.92	.09	38.83	.37	-56.48
.70	.54	-163.95	4.33	84.13	.10	38.89	.34	-58.22
.80	.54	-173.01	3.85	78.92	.10	39.22	.31	-59.93
.90	.54	179.14	3.44	74.44	.11	40.21	.30	-61.82
1.00	.54	172.20	3.13	70.19	.11	40.98	.28	-63.63
1.10	.55	165.80	2.86	66.20	.12	41.45	.27	-65.68
1.20	.55	160.12	2.63	62.35	.12	42.12	.26	-68.02
1.30	.56	154.92	2.43	58.82	.13	42.51	.25	-70.57
1.40	.57	150.12	2.27	55.44	.13	43.29	.24	-73.51
1.50	.58	145.43	2.12	51.94	.14	43.44	.23	-76.52
1.60	.59	141.31	1.99	48.73	.15	43.67	.23	-80.31
1.70	.60	137.23	1.88	45.70	.15	44.06	.22	-84.21
1.80	.61	133.70	1.78	42.72	.16	44.00	.22	-88.16
1.90	.62	130.17	1.68	39.69	.16	43.77	.22	-92.09
2.00	.63	126.82	1.60	37.07	.17	43.80	.22	-96.22
2.10	.64	123.64	1.53	34.06	.18	43.62	.22	-101.16
2.20	.65	120.71	1.46	31.55	.18	43.25	.22	-105.74
2.30	.66	117.99	1.40	28.81	.19	42.92	.22	-110.57
2.40	.67	115.08	1.33	26.41	.20	42.38	.22	-115.34
2.50	.68	112.54	1.28	23.75	.21	41.92	.22	-120.22
2.60	.68	110.13	1.23	21.72	.21	41.46	.22	-125.18
2.70	.69	107.78	1.18	19.41	.22	40.69	.23	-130.36
2.80	.70	105.52	1.14	17.04	.23	39.95	.24	-134.71
2.90	.71	103.31	1.10	15.04	.23	39.10	.24	-139.65
3.00	.72	101.25	1.06	12.85	.24	38.40	.25	-144.01

**S PARAMETER Q1**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA, Z<sub>0</sub> = 50 Ω

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.79	-44.32	13.71	146.95	.04	64.19	.84	-28.71
.20	.67	-82.73	11.45	126.15	.05	50.70	.64	-44.98
.30	.59	-113.49	9.41	111.03	.07	45.71	.49	-52.71
.40	.55	-134.72	7.67	100.87	.07	44.09	.40	-57.18
.50	.52	-150.16	6.37	93.24	.08	43.89	.35	-59.82
.60	.52	-161.98	5.44	87.20	.08	44.29	.31	-62.08
.70	.51	-171.56	4.71	81.95	.09	44.90	.28	-63.86
.80	.51	-179.64	4.17	77.28	.10	45.68	.26	-65.85
.90	.52	173.30	3.73	73.14	.10	46.53	.24	-67.95
1.00	.52	167.06	3.38	69.28	.11	47.24	.23	-70.01
1.10	.53	161.26	3.08	65.48	.12	47.44	.22	-72.42
1.20	.54	156.05	2.83	61.95	.12	47.51	.21	-75.34
1.30	.54	151.22	2.61	58.77	.13	47.41	.20	-78.33
1.40	.55	146.81	2.44	55.41	.14	47.76	.19	-81.85
1.50	.56	142.49	2.28	52.20	.14	47.48	.19	-85.78
1.60	.57	138.66	2.14	49.11	.15	47.27	.18	-90.06
1.70	.58	134.85	2.02	46.08	.16	47.00	.18	-94.72
1.80	.59	131.54	1.91	43.25	.17	46.66	.18	-99.13
1.90	.60	128.16	1.81	40.43	.17	45.91	.18	-103.95
2.00	.61	125.10	1.72	37.91	.18	45.50	.18	-108.59
2.10	.62	122.05	1.64	34.92	.19	44.78	.18	-114.11
2.20	.63	119.27	1.57	32.41	.20	44.24	.18	-118.98
2.30	.64	116.70	1.50	29.76	.20	43.38	.18	-124.21
2.40	.65	113.87	1.43	27.41	.21	42.59	.18	-129.50
2.50	.66	111.51	1.37	25.17	.22	41.98	.19	-134.34
2.60	.67	109.16	1.32	22.83	.22	41.02	.19	-139.54
2.70	.68	106.97	1.27	20.70	.23	40.16	.20	-144.26
2.80	.69	104.65	1.22	18.35	.24	39.22	.21	-148.76
2.90	.70	102.63	1.18	16.37	.25	38.29	.22	-153.16
3.00	.71	100.68	1.14	14.21	.25	37.45	.23	-157.18



**S PARAMETER Q2**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 1 mA, Z<sub>0</sub> = 50 Ω

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.97	-20.79	2.52	162.21	.04	76.22	.98	-8.81
.20	.93	-40.50	2.43	147.42	.08	63.75	.93	-16.39
.30	.89	-59.73	2.35	134.45	.11	53.38	.87	-22.34
.40	.84	-76.87	2.20	123.37	.13	44.64	.81	-27.24
.50	.80	-93.28	2.11	113.14	.14	38.01	.76	-30.90
.60	.76	-107.72	1.99	104.15	.15	32.06	.71	-34.29
.70	.74	-120.25	1.85	96.02	.16	27.52	.68	-36.96
.80	.71	-131.32	1.74	88.78	.15	24.29	.65	-39.46
.90	.69	-141.35	1.64	82.34	.15	21.95	.62	-41.97
1.00	.68	-150.05	1.53	76.48	.15	20.46	.60	-44.52
1.10	.68	-157.96	1.44	71.18	.15	19.32	.58	-47.14
1.20	.67	-165.04	1.36	66.07	.14	19.44	.57	-50.06
1.30	.67	-171.63	1.29	61.58	.14	20.32	.56	-52.97
1.40	.67	-177.36	1.23	57.26	.13	22.04	.54	-56.38
1.50	.67	176.90	1.17	52.95	.13	24.64	.53	-59.83
1.60	.67	171.98	1.11	49.02	.13	27.93	.52	-63.99
1.70	.68	166.97	1.06	45.23	.13	32.01	.51	-68.26
1.80	.68	162.82	1.02	41.90	.13	35.88	.50	-72.94
1.90	.69	158.53	.98	38.32	.13	39.86	.49	-77.61
2.00	.69	154.69	.94	35.40	.14	44.56	.48	-82.95
2.10	.70	150.93	.91	32.13	.15	48.10	.47	-88.66
2.20	.70	147.32	.88	29.30	.16	51.51	.46	-94.50
2.30	.71	144.13	.84	26.66	.17	53.73	.46	-100.96
2.40	.72	140.81	.81	24.15	.19	54.94	.45	-107.69
2.50	.72	137.73	.79	21.71	.21	55.71	.45	-114.70
2.60	.73	134.85	.76	19.47	.23	55.82	.45	-122.04
2.70	.73	132.23	.74	17.56	.24	55.39	.45	-129.51
2.80	.74	129.37	.72	15.32	.26	54.32	.45	-137.20
2.90	.75	126.78	.69	13.76	.28	53.05	.45	-144.79
3.00	.75	124.46	.68	11.96	.30	51.65	.46	-152.23

**S PARAMETER Q2**

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

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.90	-29.30	6.71	155.29	.04	71.05	.93	-16.80
.20	.82	-56.11	6.09	137.78	.07	56.98	.81	-28.76
.30	.73	-80.85	5.56	123.40	.09	48.29	.68	-35.65
.40	.67	-101.56	4.95	111.97	.10	42.87	.59	-40.13
.50	.62	-118.49	4.38	102.51	.11	39.94	.52	-42.64
.60	.59	-131.80	3.86	94.93	.11	38.27	.47	-44.51
.70	.57	-142.87	3.44	88.40	.11	37.56	.43	-45.87
.80	.56	-152.14	3.11	82.68	.12	37.77	.40	-47.30
.90	.55	-159.99	2.82	77.69	.12	38.47	.38	-48.65
1.00	.54	-166.88	2.59	73.06	.13	39.41	.36	-50.22
1.10	.54	-173.10	2.39	68.79	.13	40.39	.34	-51.85
1.20	.55	-178.59	2.21	64.68	.13	41.56	.32	-54.00
1.30	.55	176.42	2.07	61.03	.14	42.83	.31	-56.35
1.40	.55	171.90	1.95	57.31	.15	44.25	.29	-59.16
1.50	.56	167.41	1.84	53.63	.15	45.41	.28	-62.05
1.60	.57	163.59	1.74	50.19	.16	46.21	.26	-66.12
1.70	.57	159.71	1.66	46.97	.17	47.04	.25	-70.04
1.80	.58	156.43	1.58	43.76	.18	47.53	.24	-74.96
1.90	.59	153.08	1.51	40.55	.19	47.85	.23	-79.98
2.00	.60	149.93	1.45	37.59	.19	48.39	.22	-85.71
2.10	.60	146.93	1.40	34.56	.21	48.56	.21	-92.39
2.20	.61	144.08	1.34	31.82	.22	48.55	.20	-99.18
2.30	.62	141.48	1.29	28.94	.23	48.56	.19	-107.58
2.40	.63	138.74	1.25	26.22	.24	48.08	.19	-116.23
2.50	.64	136.23	1.20	23.63	.25	47.57	.19	-125.28
2.60	.65	133.79	1.16	20.97	.26	46.88	.19	-134.70
2.70	.66	131.63	1.13	18.63	.28	46.03	.20	-144.38
2.80	.67	129.33	1.09	16.09	.29	45.03	.20	-153.65
2.90	.68	127.06	1.06	14.06	.30	43.72	.22	-162.12
3.00	.68	125.06	1.02	11.49	.31	42.77	.23	-169.77

**S PARAMETER Q2**

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

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.83	-36.95	10.41	149.93	.04	67.41	.87	-23.15
.20	.72	-69.61	9.00	130.38	.06	54.36	.70	-36.92
.30	.62	-97.36	7.70	115.33	.07	48.48	.56	-43.33
.40	.56	-117.96	6.47	104.59	.08	46.08	.46	-46.73
.50	.53	-133.20	5.47	96.45	.09	45.55	.40	-48.28
.60	.51	-145.02	4.72	89.97	.10	45.75	.35	-49.37
.70	.50	-154.27	4.13	84.56	.10	46.29	.32	-50.23
.80	.49	-162.17	3.68	79.59	.11	47.21	.29	-50.94
.90	.49	-168.79	3.31	75.30	.12	48.13	.27	-51.90
1.00	.49	-174.60	3.02	71.24	.13	48.87	.25	-53.05
1.10	.49	-179.99	2.77	67.35	.13	49.47	.23	-54.36
1.20	.50	175.37	2.56	63.72	.14	49.97	.22	-56.22
1.30	.50	170.99	2.38	60.38	.15	50.55	.20	-58.24
1.40	.51	167.14	2.25	57.00	.16	50.91	.19	-61.34
1.50	.52	163.26	2.11	53.63	.17	50.87	.18	-64.21
1.60	.52	159.95	1.99	50.49	.18	50.85	.16	-68.73
1.70	.53	156.57	1.90	47.43	.19	50.65	.15	-73.44
1.80	.54	153.53	1.80	44.40	.20	50.10	.14	-79.56
1.90	.55	150.58	1.72	41.65	.21	49.55	.12	-86.25
2.00	.56	147.71	1.65	38.70	.22	49.28	.11	-94.06
2.10	.57	144.98	1.59	35.74	.23	48.70	.11	-104.12
2.20	.58	142.44	1.53	32.92	.24	47.88	.10	-114.99
2.30	.59	140.07	1.47	30.23	.25	47.17	.10	-127.57
2.40	.60	137.58	1.41	27.68	.26	46.25	.10	-141.02
2.50	.61	135.31	1.36	25.02	.27	45.44	.11	-153.25
2.60	.62	133.07	1.31	22.56	.28	44.32	.12	-164.94
2.70	.63	131.02	1.28	20.38	.29	43.24	.13	-174.58
2.80	.64	128.83	1.23	17.84	.30	41.94	.14	176.60
2.90	.65	126.81	1.20	15.67	.31	40.75	.16	170.26
3.00	.66	124.98	1.16	13.38	.32	39.42	.18	163.89

**S PARAMETER Q2**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA, Z<sub>0</sub> = 50 Ω

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.78	-43.98	13.56	145.65	.04	65.30	.83	-28.08
.20	.64	-81.06	11.15	124.63	.05	53.73	.62	-42.31
.30	.55	-109.37	9.00	109.90	.07	50.12	.47	-48.09
.40	.50	-128.61	7.29	100.27	.07	49.49	.39	-50.66
.50	.48	-142.36	6.05	93.07	.08	50.25	.33	-51.72
.60	.47	-152.78	5.16	87.38	.09	50.94	.29	-52.25
.70	.46	-161.04	4.49	82.41	.10	51.76	.26	-52.80
.80	.46	-168.03	3.98	77.92	.11	52.62	.23	-53.35
.90	.46	-173.82	3.57	74.02	.12	53.24	.21	-54.00
1.00	.46	-179.09	3.24	70.24	.13	53.84	.19	-55.03
1.10	.47	176.20	2.97	66.63	.14	53.96	.18	-56.17
1.20	.47	171.98	2.75	63.22	.15	53.97	.16	-58.07
1.30	.48	168.07	2.55	60.08	.16	53.98	.15	-60.12
1.40	.49	164.50	2.40	56.83	.17	53.80	.14	-63.36
1.50	.50	160.99	2.25	53.72	.18	53.24	.12	-66.67
1.60	.50	157.91	2.13	50.70	.19	52.57	.11	-72.24
1.70	.51	154.69	2.02	47.63	.20	52.05	.09	-78.75
1.80	.52	151.94	1.92	44.73	.21	51.25	.08	-87.51
1.90	.53	149.12	1.83	41.86	.22	50.40	.07	-97.71
2.00	.54	146.49	1.75	39.20	.23	49.60	.07	-110.79
2.10	.55	143.89	1.68	36.30	.24	48.74	.06	-127.63
2.20	.56	141.54	1.62	33.80	.25	47.70	.06	-144.64
2.30	.57	139.30	1.55	31.21	.26	46.78	.07	-160.83
2.40	.58	136.93	1.50	28.56	.27	45.56	.08	-175.36
2.50	.59	134.74	1.44	26.11	.28	44.37	.09	174.41
2.60	.60	132.62	1.39	23.72	.29	43.25	.11	166.38
2.70	.61	130.60	1.35	21.44	.30	41.87	.13	159.99
2.80	.62	128.48	1.31	18.83	.31	40.71	.14	154.42
2.90	.63	126.53	1.27	16.82	.32	39.19	.16	150.20
3.00	.64	124.73	1.23	14.52	.33	38.05	.18	146.24

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