NEC

SILICON TRANSISTOR
μPA826TF

HIGH-FREQUENCY LOW-NOISE AMPLIFIER
NPN SILICON EPITAXIAL TWIN TRANSISTOR
(WITH BUILT-IN 6-PIN 2 × 2SC4959) THIN -TYPE SMALL MINI MOLD

FEATURES

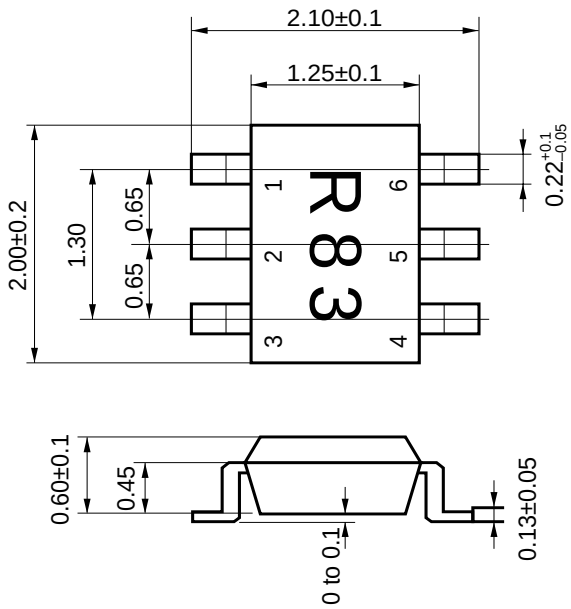
- Low noise and high gain
- Operable at low voltage
- Small feedback capacitance
  C_{re} = 0.4 pF TYP.
- Built-in 2 transistors (2 × 2SC4959)
- 6-pin thin-type small mini mold package adopted

ORDERING INFORMATION

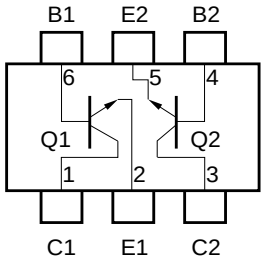
Part Number	Quantity	Packing Style
μPA826TF	Loose products (50 pcs)	Embossed tape 8 mm wide. Pin 6 (Q1 Base), Pin 5 (Q2 Emitter), Pin 4 (Q2 Base) face to perforation side of the tape.
μPA826TF-T1	Taping products (3 kpcs/reel)	

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

PACKAGE DRAWINGS (Unit: mm)



PIN CONFIGURATION (Top View)



PIN CONNECTIONS

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

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Parameter	Symbol	Rating	Unit
Collector to Base Voltage	V_{CBO}	9	V
Collector to Emitter Voltage	V_{CEO}	6	V
Emitter to Base Voltage	V_{EBO}	2	V
Collector Current	I_C	30	mA
Total Power Dissipation	P_T	150 in 1 element 200 in 2 elements[Note]	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−65 to 150	°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.

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ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

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
h_{FE} Ratio	h_{FE1}/h_{FE2}	V_{CE} = 3 V, I_C = 10 mA h_{FE1} = Smaller h_{FE} value among Q1 and Q2 h_{FE2} = Larger h_{FE} value among Q1 and Q2	0.85			

Notes 1. Pulse measurement $P_W \leq 350$ μs, Duty cycle ≤ 2%

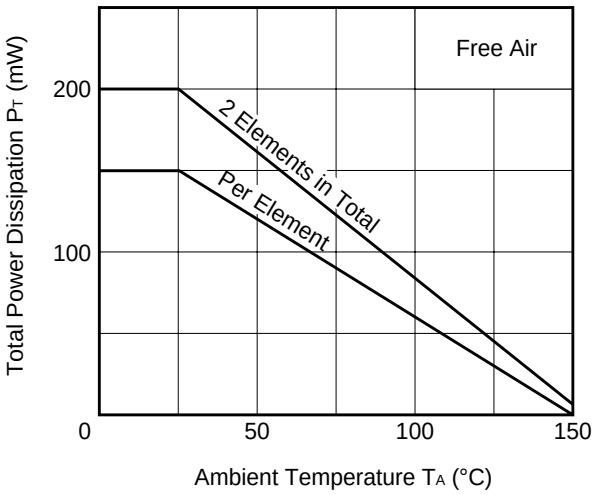
2. Capacitance between collector and base measured with a capacitance meter (auto-balancing bridge method). Emitter should be connected to the guard pin of capacitance meter.

h_{FE} CLASSIFICATION

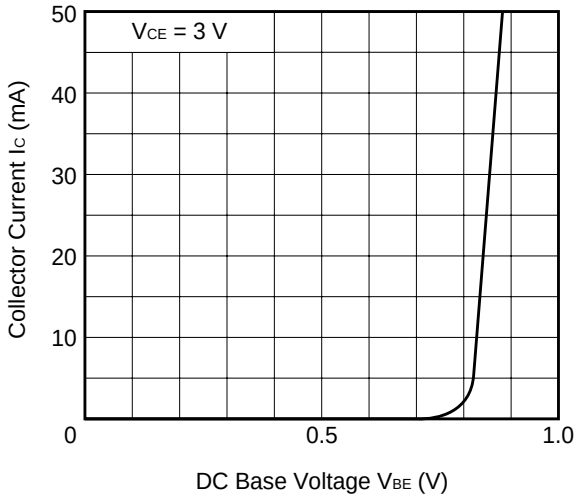
Rank	KB
Marking	R83
h_{FE} value	75 to 150

TYPICAL CHARACTERISTICS (T_A = 25 °C)

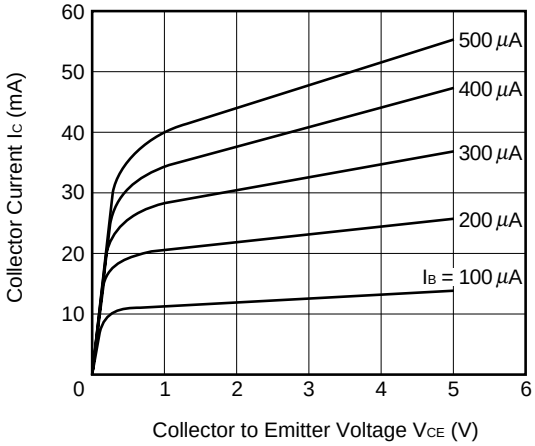
Total Power Dissipation vs. Ambient Temperature



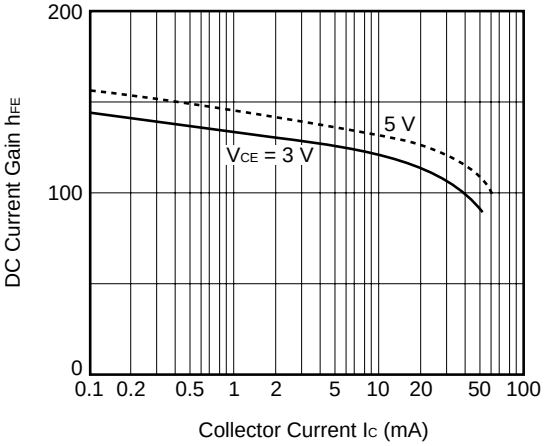
Collector Current vs. DC Base Voltage



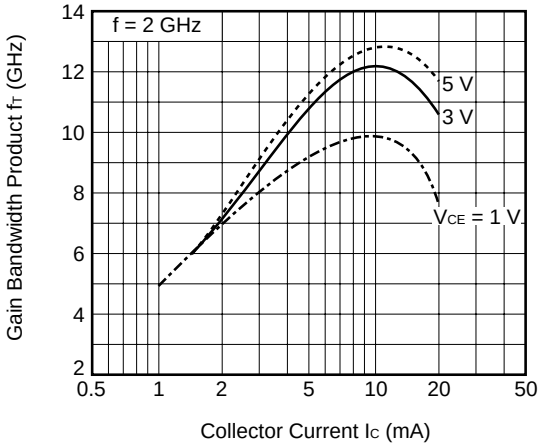
Collector Current vs.
Collector-to-Emitter Voltage



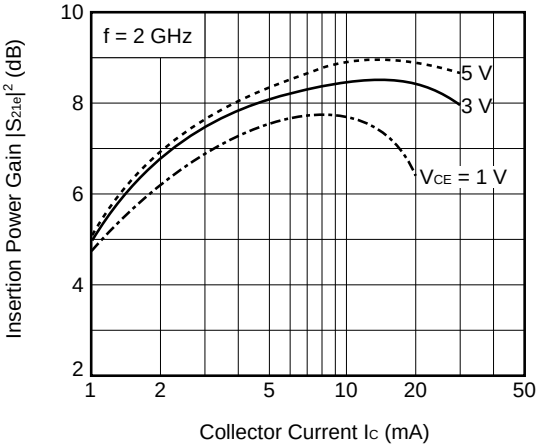
DC Current Gain vs. Collector Current



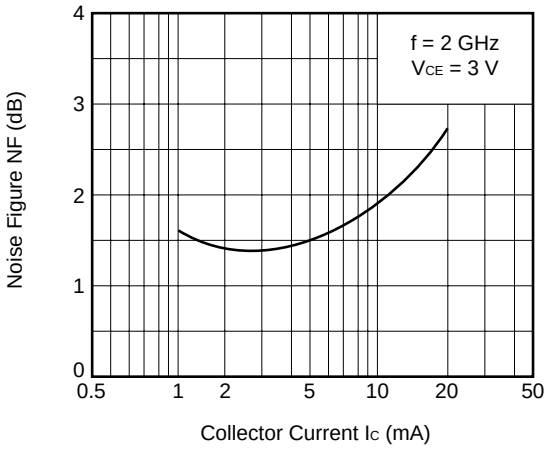
Gain Bandwidth Product vs. Collector Current



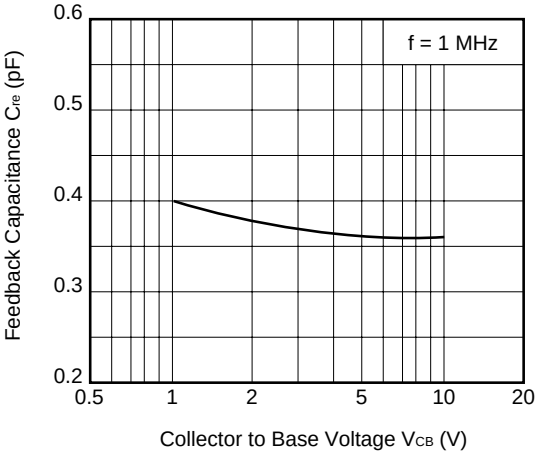
Insertion Power Gain vs. Collector Current



Noise Figure vs. Collector Current



Feedback Capacitance vs. Collector-to-Base Voltage



S PARAMETER Q1

V_{CE} = 3 V, I_C = 1 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.98	–5.93	2.38	172.32	.02	85.76	1.00	–3.86
.20	.97	–11.90	2.36	165.08	.04	81.15	.99	–7.44
.30	.95	–18.17	2.39	158.35	.06	76.27	.97	–11.14
.40	.93	–24.00	2.35	151.83	.07	72.22	.96	–14.73
.50	.90	–30.10	2.35	145.70	.09	68.30	.94	–18.02
.60	.87	–36.17	2.33	140.22	.10	64.18	.92	–21.42
.70	.84	–42.49	2.30	134.45	.12	60.68	.89	–24.18
.80	.80	–48.69	2.29	129.32	.13	56.90	.87	–27.47
.90	.76	–55.28	2.29	123.53	.14	53.94	.84	–29.94
1.00	.73	–61.26	2.24	118.31	.15	51.07	.81	–32.50
1.10	.68	–68.07	2.22	113.44	.16	48.11	.79	–34.89
1.20	.64	–74.79	2.19	108.30	.16	45.85	.76	–36.89
1.30	.60	–81.83	2.15	103.55	.17	43.33	.74	–39.11
1.40	.55	–89.00	2.12	98.67	.17	41.40	.72	–40.93
1.50	.51	–96.77	2.10	93.80	.18	39.24	.69	–42.90
1.60	.47	–104.09	2.05	89.19	.18	37.66	.67	–44.72
1.70	.43	–112.09	2.00	84.74	.19	36.24	.65	–46.39
1.80	.40	–120.45	1.95	80.45	.19	34.56	.63	–48.25
1.90	.37	–129.41	1.90	76.40	.19	33.39	.61	–49.75
2.00	.35	–138.38	1.84	72.75	.19	32.40	.60	–51.51
2.10	.33	–148.11	1.81	68.64	.19	31.72	.58	–52.83
2.20	.32	–157.58	1.76	64.92	.20	30.93	.57	–54.63
2.30	.31	–166.88	1.71	61.22	.20	30.18	.55	–56.25
2.40	.31	–176.01	1.66	58.06	.20	30.03	.54	–58.11
2.50	.31	175.03	1.62	54.64	.20	29.55	.53	–59.91
2.60	.31	166.46	1.58	51.50	.20	29.28	.51	–61.71
2.70	.32	159.62	1.53	48.49	.20	29.00	.50	–63.72
2.80	.33	152.04	1.49	45.50	.21	28.82	.49	–65.70
2.90	.34	145.83	1.46	42.65	.21	28.80	.48	–67.81
3.00	.35	140.64	1.41	40.02	.21	28.96	.47	–69.74

S PARAMETER Q1

V_{CE} = 3 V, I_C = 3 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.94	–9.29	6.55	168.08	.02	84.10	.98	–6.91
.20	.90	–18.39	6.32	157.85	.04	76.93	.95	–13.21
.30	.85	–27.47	6.21	148.76	.05	71.79	.91	–18.80
.40	.80	–36.15	5.98	140.53	.06	66.81	.86	–23.80
.50	.74	–44.62	5.77	133.00	.07	63.60	.81	–27.41
.60	.67	–52.69	5.51	126.23	.08	60.13	.76	–31.19
.70	.60	–60.71	5.28	119.27	.09	58.07	.72	–33.67
.80	.54	–68.45	5.03	113.12	.10	55.93	.68	–36.31
.90	.47	–75.60	4.76	107.23	.11	54.62	.64	–38.10
1.00	.42	–82.57	4.50	101.99	.11	53.45	.61	–39.74
1.10	.36	–89.81	4.25	97.09	.12	52.36	.58	–41.44
1.20	.32	–96.78	4.02	92.52	.13	51.59	.56	–42.63
1.30	.28	–104.70	3.80	88.51	.13	50.82	.54	–44.03
1.40	.24	–112.82	3.60	84.54	.14	50.32	.52	–45.49
1.50	.21	–122.39	3.42	80.83	.15	49.61	.50	–46.74
1.60	.19	–132.58	3.25	77.42	.15	48.93	.48	–48.15
1.70	.17	–143.90	3.10	74.15	.16	48.63	.46	–49.50
1.80	.16	–156.26	2.96	70.97	.16	47.95	.45	–51.09
1.90	.16	–168.80	2.83	67.97	.17	47.25	.44	–52.53
2.00	.16	179.12	2.70	64.83	.18	46.70	.42	–54.02
2.10	.16	167.80	2.60	62.14	.18	46.24	.41	–55.57
2.20	.17	157.86	2.50	59.47	.19	45.72	.40	–57.43
2.30	.19	149.77	2.40	56.62	.19	44.99	.39	–59.14
2.40	.20	142.43	2.31	54.07	.20	44.36	.37	–61.28
2.50	.22	136.13	2.24	51.62	.21	43.76	.36	–63.34
2.60	.23	130.97	2.16	49.11	.21	42.91	.35	–65.48
2.70	.25	126.43	2.09	46.64	.22	42.33	.34	–67.77
2.80	.26	122.06	2.02	44.41	.22	41.59	.33	–70.30
2.90	.28	118.64	1.96	42.02	.23	40.99	.32	–72.81
3.00	.29	115.80	1.89	39.81	.23	40.27	.31	–75.36

S PARAMETER Q1

V_{CE} = 3 V, I_C = 5 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.90	–12.12	10.05	165.07	.02	82.08	.97	–9.12
.20	.84	–23.51	9.49	152.86	.03	74.99	.92	–17.06
.30	.77	–34.84	9.08	142.06	.05	69.42	.85	–23.23
.40	.69	–45.03	8.52	132.57	.06	65.57	.78	–28.22
.50	.60	–54.58	7.94	123.96	.07	63.02	.72	–31.57
.60	.52	–62.89	7.32	116.79	.08	60.80	.66	–34.45
.70	.44	–70.48	6.74	109.99	.08	59.78	.62	–36.34
.80	.38	–77.63	6.21	104.22	.09	58.73	.58	–38.08
.90	.32	–84.12	5.71	99.08	.10	57.98	.55	–39.38
1.00	.28	–90. 92	5.28	94.41	.11	57.45	.53	–40.58
1.10	.23	–97.81	4.90	90.40	.11	56.92	.50	–41.81
1.20	.20	–105.44	4.56	86.53	.12	56.41	.48	–42.73
1.30	.17	–114.52	4.27	83.13	.13	55.94	.46	–43.87
1.40	.14	–124.74	4.01	79.77	.13	55.49	.45	–45.20
1.50	.13	–137.90	3.78	76.56	.14	54.85	.43	–46.37
1.60	.11	–152.33	3.58	73.63	.15	54.15	.42	–47.87
1.70	.11	–167.88	3.39	70.79	.15	53.69	.40	–49.23
1.80	.11	177.28	3.23	67.93	.16	52.89	.39	–50.80
1.90	.12	163.98	3.08	65.32	.17	52.20	.38	–52.29
2.00	.13	152.80	2.93	62.58	.18	51.42	.37	–54.00
2.10	.14	143.82	2.81	60.07	.18	50.75	.36	–55.75
2.20	.16	136.52	2.70	57.67	.19	50.10	.35	–57.73
2.30	.17	130.81	2.59	55.05	.20	49.15	.33	–59.61
2.40	.19	126.04	2.50	52.83	.20	48.36	.32	–62.01
2.50	.21	121.76	2.41	50.64	.21	47.56	.31	–64.32
2.60	.22	118.20	2.33	48.15	.22	46.64	.30	–66.89
2.70	.24	115.10	2.25	45.92	.22	45.70	.29	–69.48
2.80	.25	111.94	2.17	43.83	.23	44.66	.28	–72.54
2.90	.27	109.74	2.10	41.74	.24	43.87	.27	–75.25
3.00	.28	107.74	2.03	39.80	.24	42.91	.26	–78.22

S PARAMETER Q1

V_{CE} = 3 V, I_C = 10 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.82	–17.52	16.52	159.99	.02	80.28	.94	–12.68
.20	.72	–33.22	14.93	144.21	.03	72.82	.85	–22.43
.30	.60	–46.83	13.32	131.03	.04	68.07	.75	–28.43
.40	.49	–57.62	11.65	120.45	.05	65.62	.67	–32.14
.50	.40	–65.90	10.15	112.22	.06	65.03	.60	–34.25
.60	.33	–72.93	8.90	105.92	.07	63.86	.56	–35.78
.70	.27	–79.33	7.89	100.37	.08	63.74	.52	–36.80
.80	.22	–85.38	7.07	95.73	.08	63.50	.49	–37.69
.90	.18	–91.73	6.39	91.61	.09	63.16	.46	–38.46
1.00	.15	–98.81	5.83	87.88	.10	62.77	.45	–39.30
1.10	.12	–107.45	5.35	84.47	.11	62.22	.43	–40.19
1.20	.10	–118.22	4.95	81.32	.11	61.85	.41	–41.01
1.30	.08	–133.80	4.62	78.49	.12	61.19	.40	–42.05
1.40	.07	–153.77	4.31	75.63	.13	60.72	.39	–43.42
1.50	.07	–176.19	4.05	72.83	.14	59.79	.38	–44.69
1.60	.07	164.45	3.82	70.28	.15	59.22	.36	–46.17
1.70	.08	149.79	3.61	67.81	.15	58.31	.35	–47.69
1.80	.10	138.91	3.42	65.32	.16	57.24	.34	–49.53
1.90	.11	131.52	3.26	62.88	.17	56.34	.33	–51.25
2.00	.13	125.94	3.12	60.46	.18	55.55	.32	–53.15
2.10	.15	121.31	2.98	58.25	.19	54.57	.31	–55.05
2.20	.16	117.28	2.85	56.06	.19	53.65	.30	–57.33
2.30	.18	114.88	2.74	53.72	.20	52.42	.29	–59.70
2.40	.20	111.75	2.64	51.59	.21	51.55	.28	–62.40
2.50	.21	109.57	2.54	49.58	.22	50.37	.27	–65.07
2.60	.23	107.60	2.45	47.36	.22	49.19	.26	–67.95
2.70	.24	105.45	2.36	45.20	.23	48.18	.25	–71.01
2.80	.26	103.59	2.29	43.25	.24	47.05	.24	–74.44
2.90	.27	102.11	2.21	41.26	.25	45.94	.23	–78.01
3.00	.29	100.79	2.14	39.46	.25	45.03	.21	–81.46

S PARAMETER Q2

V_{CE} = 3 V, I_C = 1 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
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

S PARAMETER Q2

V_{CE} = 3 V, I_C = 3 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
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	103.60	.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 PARAMETER Q2

V_{CE} = 3 V, I_C = 5 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	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

S PARAMETER Q2

V_{CE} = 3 V, I_C = 10 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	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

M4 96.5