

PRELIMINARY DATA SHEET

NEC

NPN SILICON EPITAXIAL TWIN TRANSISTOR

UPA831TF

FEATURES

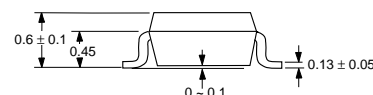
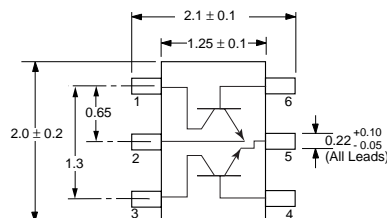
- **LOW NOISE:**
Q1: NF = 1.2 dB TYP at f = 1 GHz, V_{CE} = 3 V, I_c = 7 mA
Q2: NF = 1.4 dB TYP at f = 1 GHz, V_{CE} = 3 V, I_c = 7 mA
- **HIGH GAIN:**
Q1: |S_{21E}|² = 9.0 dB TYP at f = 1 GHz, V_{CE} = 3 V, I_c = 7 mA
Q2: |S_{21E}|² = 12.0 dB TYP at f = 1 GHz, V_{CE} = 3 V, I_c = 7 mA
- **6-PIN THIN-TYPE SMALL MINI MOLD PACKAGE**
- **2 DIFFERENT BUILT-IN TRANSISTORS**
(Q1: NE856, Q2: NE681)

DESCRIPTION

The UPA831TF has two different built-in transistors for low cost amplifier and oscillator applications in the VHF/UHF band. Low noise figures, high gain, high current capability, and medium output give this device high dynamic range with excellent linearity for two-stage amplifiers. This device is also ideally suited for use in a VCO/buffer amplifier application. The thinner package style allows for higher density designs.

OUTLINE DIMENSIONS (Units in mm)

Package Outline TS06 (Top View)



PIN CONNECTIONS

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

Note:

Pin 1 is the lower left most pin as the package lettering is oriented and read left to right.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE				UPA831TF TS06		
	SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
Q1	ICBO	Collector Cutoff Current at V _{CB} = 10 V, I _E = 0	μA			1
	IEBO	Emitter Cutoff Current at V _{EB} = 1 V, I _C = 0	μA			1
	hFE	DC Current Gain ¹ at V _{CE} = 3 V, I _C = 7 mA		100		145
	ft	Gain Bandwidth at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	GHz	3.0	4.5	
	Cre	Feedback Capacitance ² at V _{CB} = 3 V, I _E = 0, f = 1 MHz	pF		0.7	1.5
	S _{21E} ²	Insertion Power Gain at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	dB	7	9	
	NF	Noise Figure at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	dB		1.2	2.5
Q2	ICBO	Collector Cutoff Current at V _{CB} = 10 V, I _E = 0	μA			0.8
	IEBO	Emitter Cutoff Current at V _{EB} = 1 V, I _C = 0	μA			0.8
	hFE	DC Current Gain ¹ at V _{CE} = 3 V, I _C = 7 mA		70		150
	ft	Gain Bandwidth at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	GHz	4.5	7.0	
	Cre	Feedback Capacitance ² at V _{CB} = 3 V, I _E = 0, f = 1 MHz	pF		0.45	0.9
	S _{21E} ²	Insertion Power Gain at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	dB	10	12	
	NF	Noise Figure at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	dB		1.4	2.7

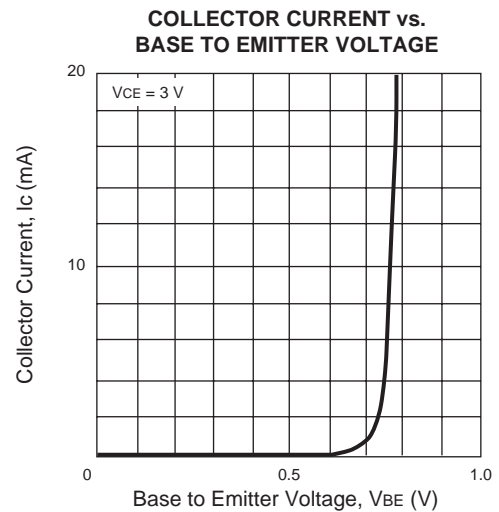
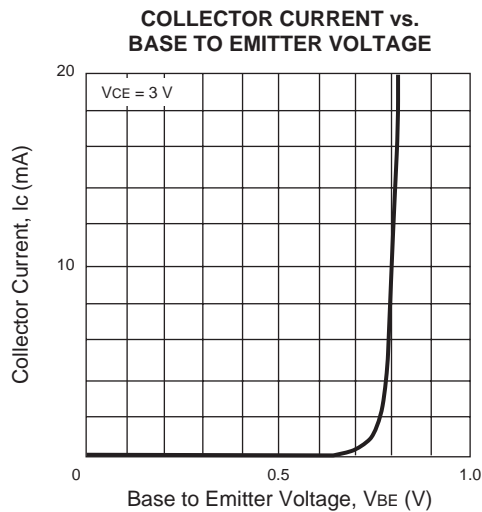
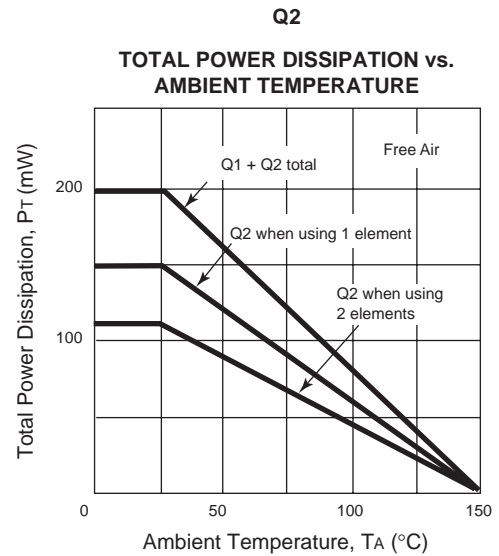
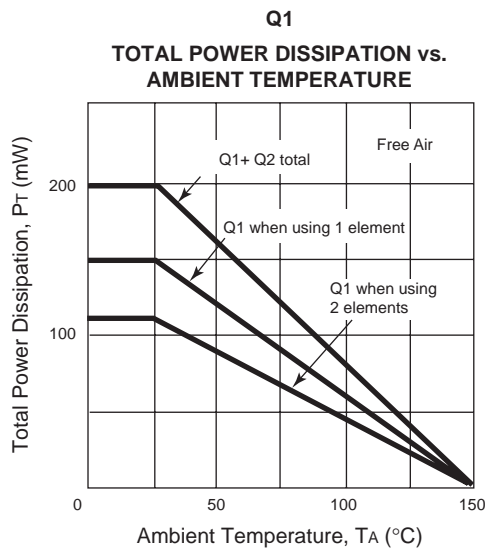
Notes: 1. Pulsed measurement, pulse width ≤ 350 μs, duty cycle ≤ 2 %.
2. Collector to base capacitance when measured with capacitance meter (automatic balanced bridge method), with emitter connected to guard pin of capacitances meter.

ABSOLUTE MAXIMUM RATINGS¹ ($T_A = 25^\circ\text{C}$)

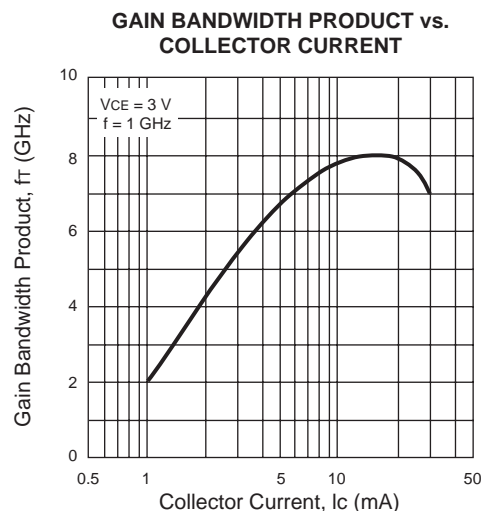
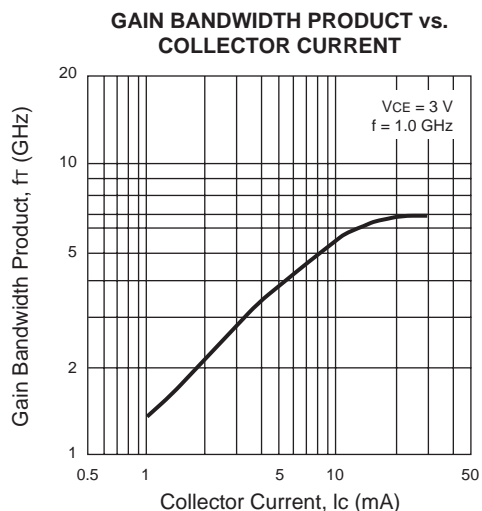
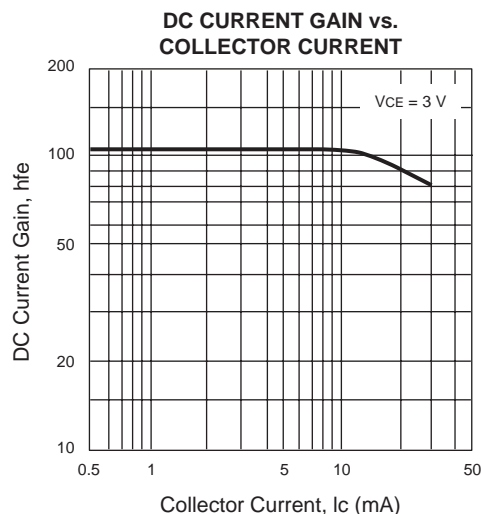
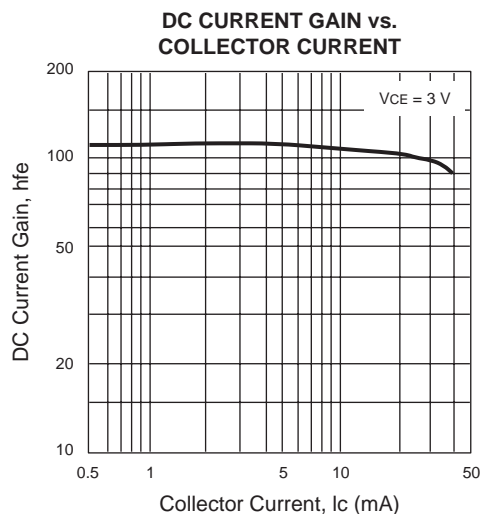
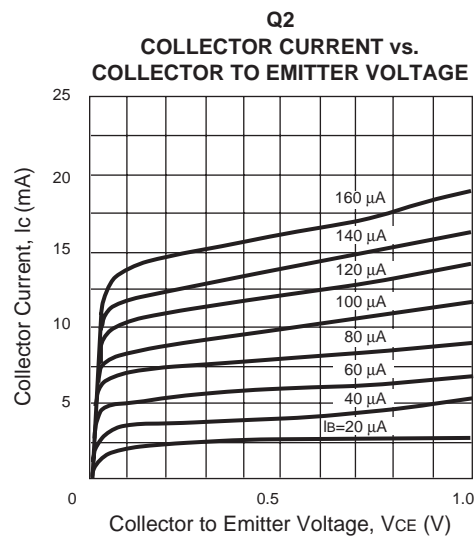
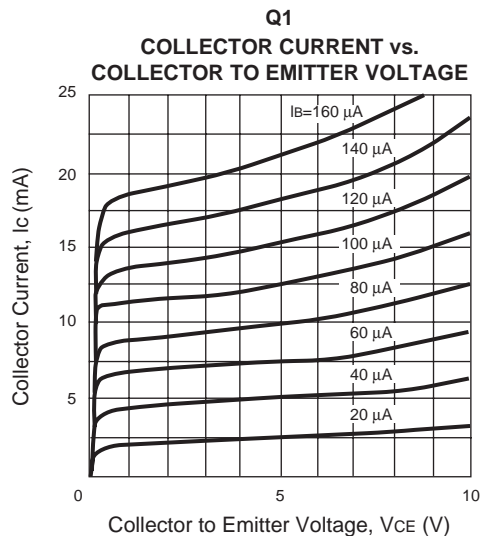
SYMBOLS	PARAMETERS	UNITS	RATINGS	
			Q1	Q2
V_{CB0}	Collector to Base Voltage	V	20	20
V_{CE0}	Collector to Emitter Voltage	V	12	10
V_{EB0}	Emitter to Base Voltage	V	3	1.5
I_c	Collector Current	mA	100	65
P_T	Total Power Dissipation ¹	mW	150	150
			200 ²	
T_J	Junction Temperature	$^\circ\text{C}$	150	150
T_{STG}	Storage Temperature	$^\circ\text{C}$	-65 to +150	

- Note: 1. Operation in excess of any one of these parameters may result in permanent damage.
 2. When operating both devices, the power dissipation for either device should not exceed 110 mW.

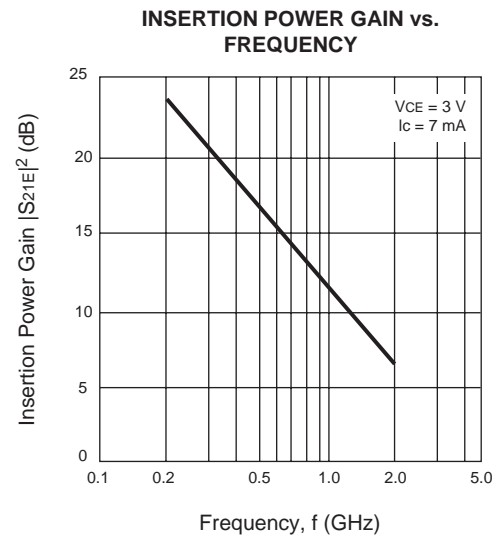
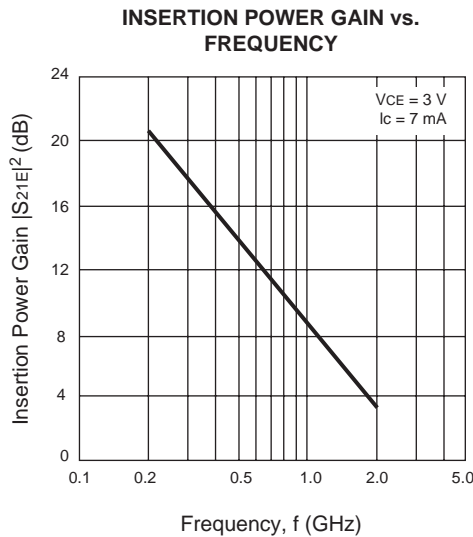
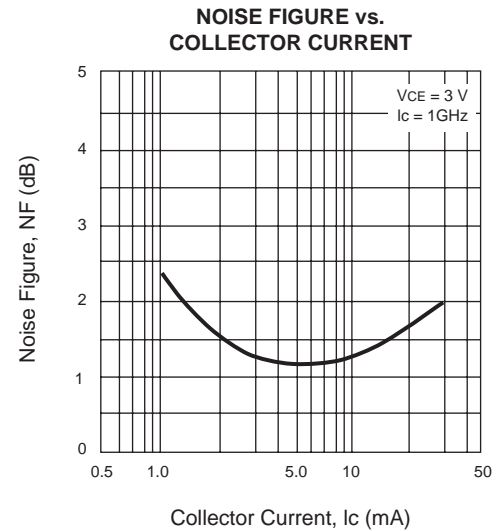
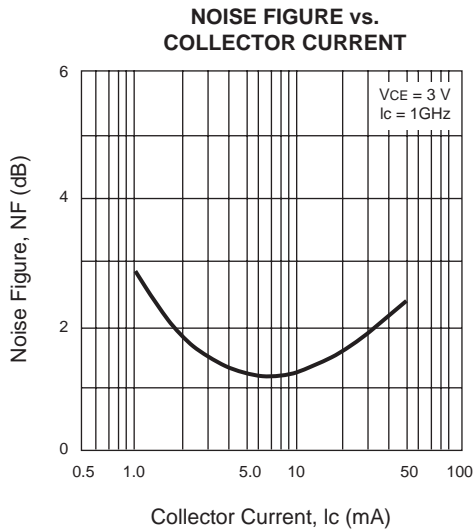
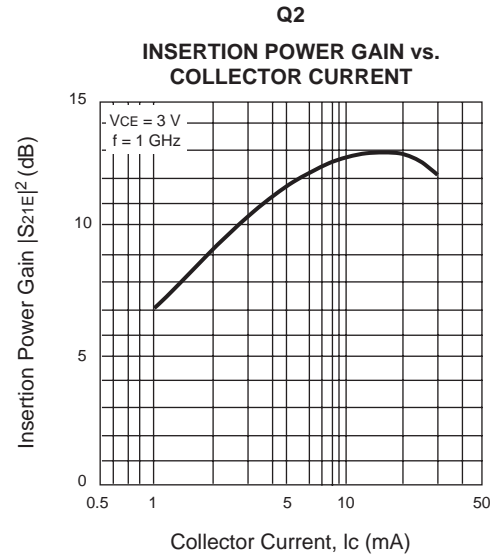
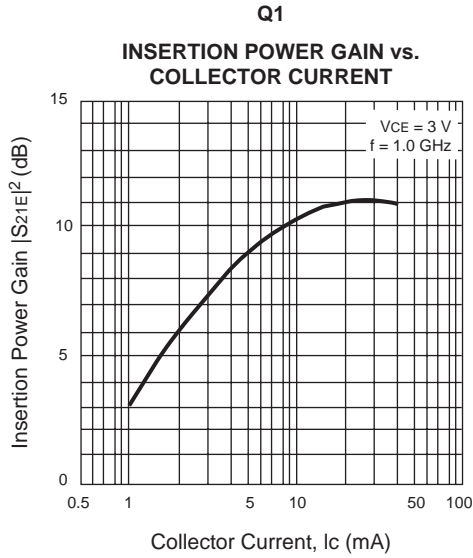
TYPICAL PERFORMANCE CURVES ($T_A = 25^\circ\text{C}$)



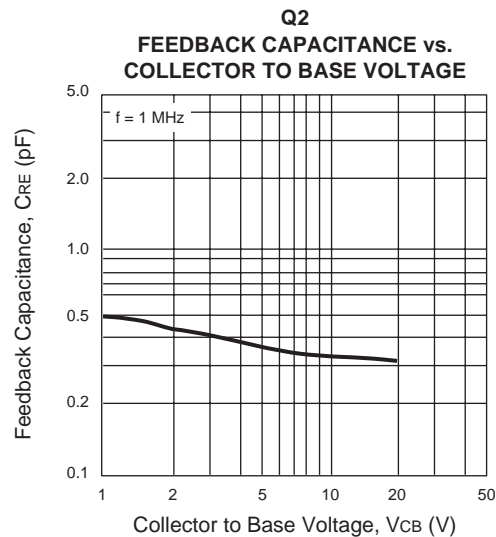
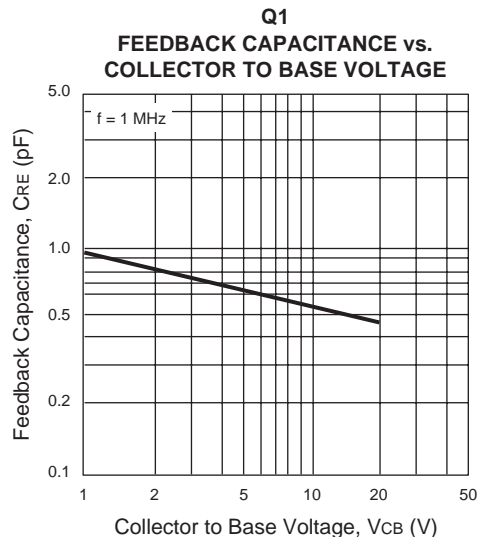
TYPICAL PERFORMANCE CURVES ($T_A = 25^\circ\text{C}$)



TYPICAL PERFORMANCE CURVES (T_A = 25°C)



TYPICAL PERFORMANCE CURVES (T_A = 25°C)



TYPICAL SCATTERING PARAMETERS

Q1

V_{CE} = 3 V, I_C = 1 mA, Z₀ = 50 Ω

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.97	-20.45	2.38	162.85	0.04	76.56	0.98	-8.59
0.20	0.94	-40.17	2.31	148.19	0.08	63.82	0.94	-16.05
0.30	0.90	-59.57	2.25	135.26	0.11	52.97	0.89	-22.20
0.40	0.86	-77.29	2.10	123.99	0.13	43.63	0.83	-27.30
0.50	0.82	-94.54	2.03	113.53	0.15	36.13	0.70	-31.16
0.60	0.79	-110.15	1.92	104.19	0.16	29.28	0.74	-34.67
0.70	0.76	-124.06	1.80	95.54	0.16	23.65	0.70	-37.55
0.80	0.74	-136.61	1.69	87.82	0.16	19.18	0.67	-40.06
0.90	0.72	-148.19	1.59	80.80	0.16	15.47	0.65	-42.54
1.00	0.71	-158.16	1.48	74.49	0.16	12.65	0.64	-44.88
1.20	0.70	-175.72	1.30	63.28	0.15	8.37	0.61	-49.79
1.50	0.71	162.88	1.09	49.18	0.13	7.58	0.59	-57.73
1.70	0.72	151.31	0.97	41.14	0.12	11.56	0.58	-64.34
2.00	0.75	136.95	0.83	31.08	0.11	23.61	0.57	-74.83
2.50	0.78	117.97	0.66	18.15	0.13	45.08	0.57	-95.23
3.00	0.81	103.52	0.54	10.02	0.19	50.48	0.58	-118.13

Q2

V_{CE} = 3 V, I_C = 1 mA, Z₀ = 50 Ω

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.98	-10.86	2.42	168.67	0.03	82.29	0.99	-5.27
0.20	0.96	-21.63	2.38	158.63	0.05	75.10	0.97	-10.32
0.30	0.93	-32.48	2.38	149.52	0.08	68.06	0.94	-15.03
0.40	0.90	-42.91	2.31	140.98	0.10	61.46	0.91	-19.41
0.50	0.87	-53.63	2.29	133.17	0.11	56.13	0.87	-22.87
0.60	0.83	-64.20	2.25	125.99	0.13	50.41	0.83	-26.69
0.70	0.79	-74.42	2.19	118.72	0.14	46.33	0.80	-29.29
0.80	0.75	-84.40	2.13	112.19	0.14	42.16	0.76	-32.26
0.90	0.71	-94.53	2.10	105.36	0.15	38.75	0.73	-34.46
1.00	0.68	-103.53	2.02	99.41	0.15	36.15	0.70	-36.40
1.20	0.62	-121.59	1.90	88.26	0.16	32.01	0.65	-40.20
1.50	0.57	-145.60	1.71	73.71	0.16	29.15	0.58	-45.97
1.70	0.55	-159.13	1.59	65.42	0.16	29.10	0.55	-49.98
2.00	0.55	-177.12	1.44	54.11	0.16	32.04	0.51	-57.16
2.50	0.57	159.65	1.24	37.59	0.17	41.52	0.44	-73.66
3.00	0.60	142.54	1.08	23.49	0.21	47.77	0.39	-97.59

TYPICAL SCATTERING PARAMETERS

Q1

VCE = 3 V, IC = 3 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.90	-29.24	6.73	156.08	0.04	70.94	0.93	-16.82
0.20	0.83	-56.61	6.15	138.83	0.07	55.92	0.82	-29.40
0.30	0.75	-82.38	5.66	124.38	0.09	46.12	0.79	-37.28
0.40	0.70	-104.35	5.08	112.82	0.10	39.45	0.61	-42.73
0.50	0.65	-122.97	4.52	102.90	0.11	35.38	0.54	-45.93
0.60	0.62	-138.09	4.00	94.98	0.11	32.50	0.49	-48.61
0.70	0.60	-150.60	3.57	88.01	0.11	30.78	0.45	-50.55
0.80	0.59	-161.35	3.21	82.00	0.11	30.02	0.42	-52.19
0.90	0.59	-170.46	2.90	76.74	0.12	29.88	0.40	-54.08
1.00	0.59	-178.60	2.65	71.87	0.12	30.03	0.38	-55.78
1.20	0.59	167.50	2.25	62.99	0.12	31.42	0.36	-59.72
1.50	0.61	150.72	1.82	51.53	0.13	34.65	0.33	-67.05
1.70	0.63	141.52	1.61	44.61	0.14	36.98	0.32	-73.46
2.00	0.66	130.09	1.38	35.44	0.15	39.97	0.31	-84.11
2.50	0.70	114.27	1.10	21.83	0.19	42.08	0.31	-105.22
3.00	0.75	102.28	0.91	10.82	0.22	41.10	0.33	-128.59

Q2

VCE = 3 V, IC = 3 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.92	-16.40	6.78	162.42	0.03	78.93	0.96	-10.26
0.20	0.87	-32.07	6.39	149.12	0.05	69.04	0.90	-19.01
0.30	0.80	-47.67	6.14	137.78	0.06	61.85	0.81	-25.29
0.40	0.73	-62.40	5.78	127.84	0.08	56.50	0.74	-30.21
0.50	0.65	-76.67	5.43	118.67	0.09	53.06	0.67	-33.01
0.60	0.59	-89.52	5.01	111.01	0.09	50.34	0.61	-35.62
0.70	0.53	-101.31	4.64	103.74	0.10	49.05	0.57	-36.97
0.80	0.49	-112.10	4.29	97.61	0.11	48.17	0.53	-38.30
0.90	0.45	-121.85	3.96	92.07	0.11	47.67	0.50	-39.13
1.00	0.43	-130.75	3.67	87.21	0.12	47.43	0.47	-39.97
1.20	0.40	-146.82	3.20	78.56	0.13	47.88	0.43	-41.51
1.50	0.39	-166.97	2.67	67.56	0.15	48.47	0.37	-44.78
1.70	0.39	-177.84	2.41	61.15	0.16	48.92	0.34	-47.49
2.00	0.41	168.36	2.11	52.04	0.18	49.48	0.30	-52.76
2.50	0.45	150.91	1.77	38.21	0.22	48.34	0.23	-67.38
3.00	0.51	138.06	1.52	25.73	0.27	45.20	0.16	-94.47

TYPICAL SCATTERING PARAMETERS

Q1

VCE = 3 V, IC = 5 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.84	-37.26	10.52	150.99	0.04	67.19	0.89	-23.52
0.20	0.74	-70.72	9.17	131.67	0.06	52.38	0.72	-38.66
0.30	0.65	-100.04	7.97	116.47	0.07	44.81	0.58	-46.62
0.40	0.60	-122.73	6.76	105.34	0.08	41.17	0.48	-51.47
0.50	0.57	-139.98	5.74	96.73	0.09	39.62	0.42	-54.25
0.60	0.55	-153.16	4.95	89.92	0.09	38.83	0.37	-56.48
0.70	0.54	-163.95	4.33	84.13	0.10	38.89	0.34	-58.22
0.80	0.54	-173.01	3.85	78.92	0.10	39.22	0.31	-59.93
0.90	0.54	179.14	3.44	74.44	0.11	40.21	0.30	-61.82
1.00	0.54	172.20	3.13	70.19	0.11	40.98	0.28	-63.63
1.20	0.55	160.12	2.63	62.35	0.12	42.12	0.26	-68.02
1.50	0.58	145.43	2.12	51.94	0.14	43.44	0.23	-76.52
1.70	0.60	137.23	1.88	45.70	0.15	44.06	0.22	-84.21
2.00	0.63	126.82	1.60	37.07	0.17	43.80	0.22	-96.22
2.50	0.68	112.54	1.28	23.75	0.21	41.92	0.22	-120.22
3.00	0.72	101.25	1.06	12.85	0.24	38.40	0.25	-144.01

Q2

VCE = 3 V, IC = 5 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.87	-21.14	10.54	157.81	0.02	75.42	0.93	-14.27
0.20	0.78	-40.83	9.60	142.32	0.04	65.90	0.83	-24.65
0.30	0.68	-60.06	8.88	129.34	0.06	60.29	0.71	-30.56
0.40	0.58	-77.36	8.02	118.40	0.07	56.88	0.62	-34.29
0.50	0.50	-92.42	7.14	109.32	0.07	55.62	0.55	-35.99
0.60	0.44	-105.23	6.32	102.30	0.08	54.62	0.50	-37.17
0.70	0.40	-116.35	5.64	96.25	0.09	54.78	0.46	-37.50
0.80	0.37	-126.53	5.09	91.05	0.10	54.68	0.43	-38.10
0.90	0.35	-135.66	4.61	86.42	0.10	54.91	0.41	-38.22
1.00	0.34	-143.84	4.22	82.27	0.11	55.25	0.38	-38.54
1.20	0.33	-158.47	3.61	74.93	0.13	55.53	0.35	-39.34
1.50	0.33	-176.15	2.98	65.28	0.15	55.16	0.30	-41.72
1.70	0.34	174.48	2.67	59.53	0.17	54.56	0.27	-43.96
2.00	0.37	162.68	2.33	51.31	0.19	53.22	0.23	-48.42
2.50	0.42	147.53	1.94	38.54	0.24	49.58	0.16	-62.15
3.00	0.48	136.02	1.66	26.58	0.28	44.44	0.08	-95.21

TYPICAL SCATTERING PARAMETERS

Q1

VCE = 3 V, IC = 7 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.79	-44.32	13.71	146.95	0.04	64.19	0.84	-28.71
0.20	0.67	-82.73	11.45	126.15	0.05	50.70	0.64	-44.98
0.30	0.59	-113.49	9.41	111.03	0.07	45.71	0.49	-52.71
0.40	0.55	-134.72	7.67	100.87	0.07	44.09	0.40	-57.18
0.50	0.52	-150.16	6.37	93.24	0.08	43.89	0.35	-59.82
0.60	0.52	-161.98	5.44	87.80	0.08	44.29	0.31	-62.08
0.70	0.51	-171.56	4.71	81.95	0.09	44.90	0.28	-63.86
0.80	0.51	-179.64	4.17	77.28	0.10	45.68	0.26	-65.85
0.90	0.52	173.30	3.73	73.14	0.10	46.53	0.24	-67.95
1.00	0.52	167.06	3.38	69.28	0.11	47.24	0.23	-70.01
1.20	0.54	156.05	2.83	61.95	0.12	47.51	0.21	-75.34
1.50	0.56	142.49	2.28	52.20	0.14	47.48	0.19	-85.78
1.70	0.58	134.85	2.02	46.08	0.16	47.00	0.18	-94.72
2.00	0.61	125.10	1.72	37.91	0.18	45.50	0.18	-108.59
2.50	0.66	111.51	1.37	25.17	0.22	41.98	0.19	-134.34
3.00	0.71	100.68	1.14	14.21	0.25	37.45	0.23	-157.18

Q2

VCE = 3 V, IC = 3 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.82	-25.53	13.87	154.03	0.02	74.13	0.90	-17.35
0.20	0.70	-48.93	12.25	136.79	0.04	64.47	0.76	-28.32
0.30	0.58	-70.56	10.84	122.67	0.05	60.39	0.63	-33.36
0.40	0.48	-88.76	9.35	111.78	0.06	58.88	0.55	-35.74
0.50	0.41	-103.39	8.02	103.61	0.07	58.61	0.49	-36.45
0.60	0.36	-115.73	6.95	97.46	0.08	58.55	0.44	-36.82
0.70	0.33	-126.32	6.11	92.14	0.08	58.93	0.41	-36.53
0.80	0.31	-135.93	5.46	87.62	0.09	59.18	0.38	-36.68
0.90	0.30	-144.44	4.92	83.59	0.10	59.34	0.36	-36.49
1.00	0.29	-152.17	4.48	79.82	0.11	59.51	0.34	-36.62
1.20	0.29	-165.53	3.81	73.17	0.13	59.39	0.31	-37.07
1.50	0.30	178.39	3.12	64.12	0.15	58.27	0.27	-39.05
1.70	0.32	169.88	2.80	58.72	0.17	57.18	0.24	-41.01
2.00	0.35	159.36	2.43	50.86	0.20	55.01	0.20	-44.79
2.50	0.41	145.66	2.02	38.61	0.24	50.13	0.13	-57.04
3.00	0.47	135.02	1.73	26.84	0.29	44.44	0.05	-97.11

TYPICAL SCATTERING PARAMETERS

Q2

VCE = 3 V, IC = 10 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.75	-31.69	18.15	149.45	0.02	72.88	0.86	-20.87
0.20	0.60	-59.65	15.27	130.00	0.04	64.34	0.68	-31.44
0.30	0.46	-83.01	12.63	115.55	0.05	61.90	0.56	-34.79
0.40	0.38	-100.85	10.36	105.74	0.05	62.10	0.48	-35.76
0.50	0.33	-114.89	8.65	98.71	0.06	62.36	0.43	-35.53
0.60	0.30	-126.72	7.39	93.39	0.07	62.91	0.39	-35.09
0.70	0.28	-136.66	6.44	88.76	0.08	63.12	0.36	-34.48
0.80	0.27	-145.74	5.71	84.77	0.09	63.61	0.34	-34.25
0.90	0.27	-153.56	5.13	81.10	0.10	63.35	0.32	-33.89
1.00	0.26	-160.53	4.66	77.73	0.11	63.27	0.31	-33.85
1.20	0.27	-172.68	3.95	71.54	0.13	62.53	0.28	-34.09
1.50	0.29	-173.18	3.23	63.03	0.16	60.56	0.24	-35.98
1.70	0.30	-165.76	2.89	58.07	0.17	58.92	0.22	-37.60
2.00	0.34	-156.32	2.51	50.27	0.20	56.28	0.17	-40.62
2.50	0.40	-143.83	2.08	38.52	0.25	50.51	0.10	-50.92
3.00	0.46	-133.92	1.77	27.15	0.30	44.27	0.02	-101.29

BUILT-IN TRANSISTORS

	Q1	Q2
3-pin small mini mold part No.	NE85630	NE68130

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
UPA831TF-T1	3000	Tape & Reel

The UPA834TF features the Q1 and Q2 in inverted positions.

EXCLUSIVE NORTH AMERICAN AGENT FOR **NEC** RF, MICROWAVE & OPTOELECTRONIC SEMICONDUCTORS

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 PRINTED IN USA ON RECYCLED PAPER -2/99