

PRELIMINARY DATA SHEET

# NEC

## NPN SILICON EPITAXIAL TWIN TRANSISTOR

## UPA834TF

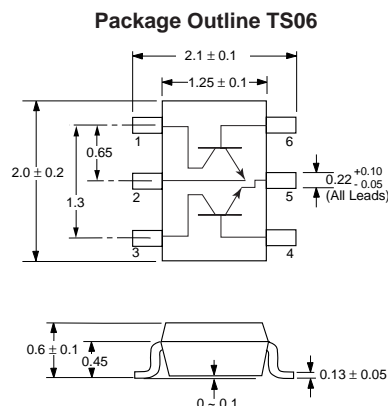
### FEATURES

- **LOW NOISE:**  
Q1: NF = 1.4 dB TYP at f = 1 GHz, V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA  
Q2: NF = 1.2 dB TYP at f = 1 GHz, V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA
- **HIGH GAIN:**  
Q1: |S<sub>21E</sub>|<sup>2</sup> = 12.0 dB TYP at f = 1 GHz, V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA  
Q2: |S<sub>21E</sub>|<sup>2</sup> = 9.0 dB TYP at f = 1 GHz, V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA
- **6-PIN THIN-TYPE SMALL MINI MOLD PACKAGE**
- **2 DIFFERENT BUILT-IN TRANSISTORS**  
(Q1: NE681, Q2: NE856)

### DESCRIPTION

The UPA834TF 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 and 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)



#### 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<sub>A</sub> = 25°C)

PART NUMBER PACKAGE OUTLINE				UPA834TF TS06		
	SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
Q1	I <sub>CBO</sub>	Collector Cutoff Current at V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0	μA			0.8
	I <sub>EBO</sub>	Emitter Cutoff Current at V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0	μA			0.8
	h <sub>FE</sub>	DC Current Gain <sup>1</sup> at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA		70		150
	f <sub>T</sub>	Gain Bandwidth at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz	GHz	4.5	7.0	
	C <sub>re</sub>	Feedback Capacitance <sup>2</sup> at V <sub>CB</sub> = 3 V, I <sub>E</sub> = 0, f = 1 MHz	pF		0.45	0.9
	S <sub>21E</sub>   <sup>2</sup>	Insertion Power Gain at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz	dB	10	12	
	NF	Noise Figure at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz	dB		1.4	2.7
Q2	I <sub>CBO</sub>	Collector Cutoff Current at V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0	μA			1.0
	I <sub>EBO</sub>	Emitter Cutoff Current at V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0	μA			1.0
	h <sub>FE</sub>	DC Current Gain <sup>1</sup> at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA		100		145
	f <sub>T</sub>	Gain Bandwidth at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz	GHz	3.0	4.5	
	C <sub>re</sub>	Feedback Capacitance <sup>2</sup> at V <sub>CB</sub> = 3 V, I <sub>E</sub> = 0, f = 1 MHz	pF		0.7	1.5
	S <sub>21E</sub>   <sup>2</sup>	Insertion Power Gain at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz	dB	7	9	
	NF	Noise Figure at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz	dB		1.2	2.5

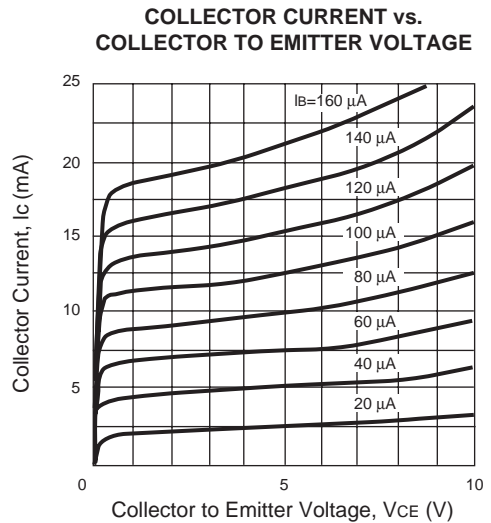
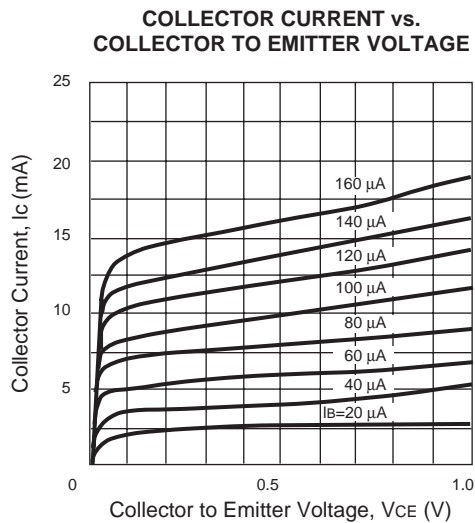
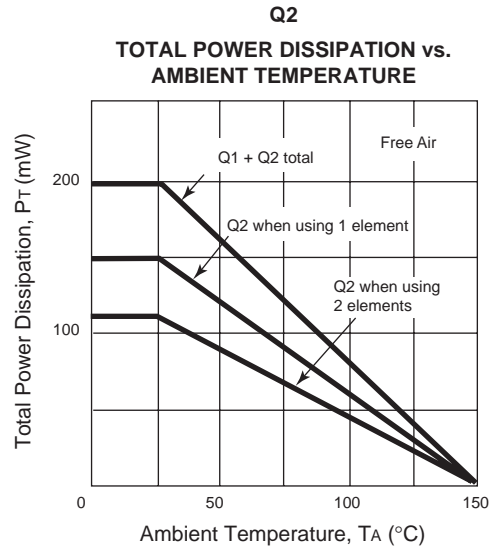
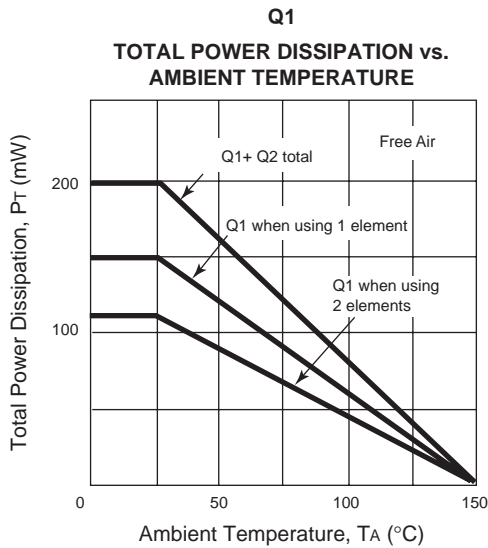
- Notes: 1. Pulsed measurement, pulse width ≤ 350 μs, duty cycle ≤ 2 %.  
2. Collector to base capacitance when measured with capacitance meter (automatic balanced bridge method), with emitter connected to guard pin of capacitances meter.

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** (T<sub>A</sub> = 25°C)

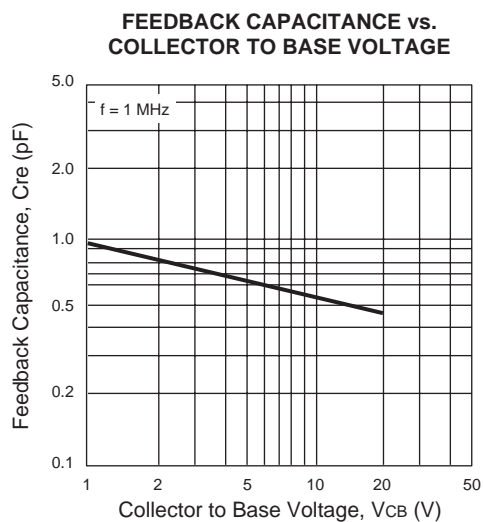
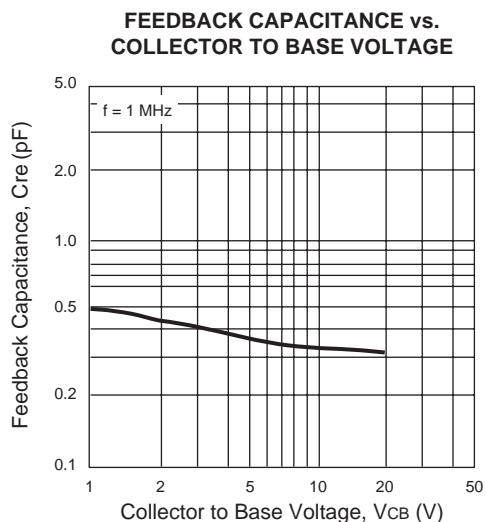
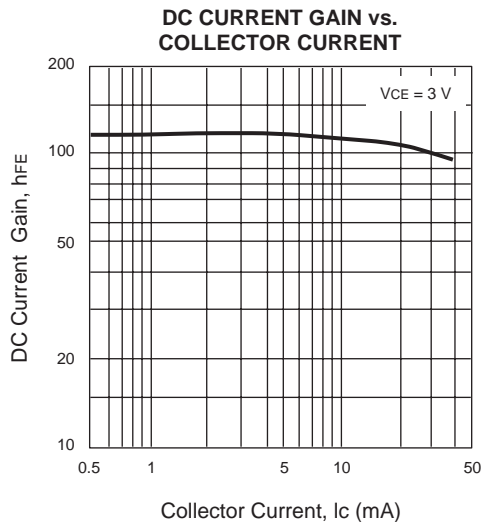
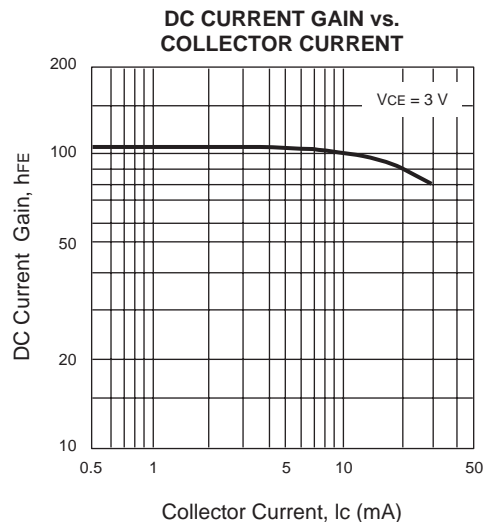
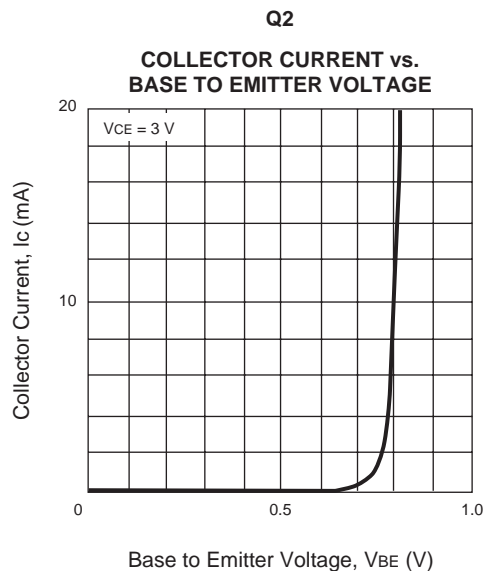
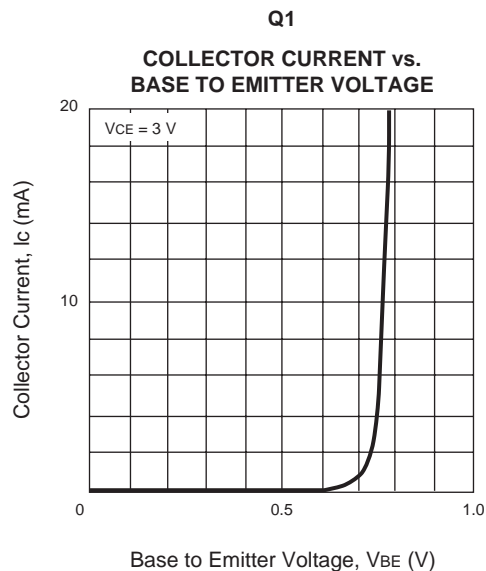
SYMBOLS	PARAMETERS	UNITS	RATINGS	
			Q1	Q2
V <sub>CB0</sub>	Collector to Base Voltage	V	20	20
V <sub>CE0</sub>	Collector to Emitter Voltage	V	10	12
V <sub>EB0</sub>	Emitter to Base Voltage	V	1.5	3
I <sub>c</sub>	Collector Current	mA	65	100
P <sub>T</sub>	Total Power Dissipation	mW	150	150
			200 <sup>2</sup>	
T <sub>J</sub>	Junction Temperature	°C	150	150
T <sub>STG</sub>	Storage Temperature	°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.

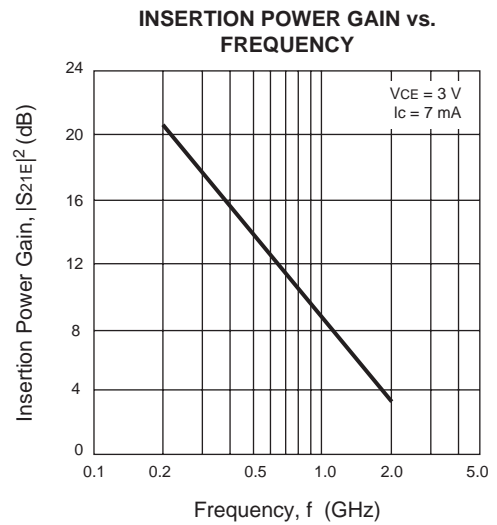
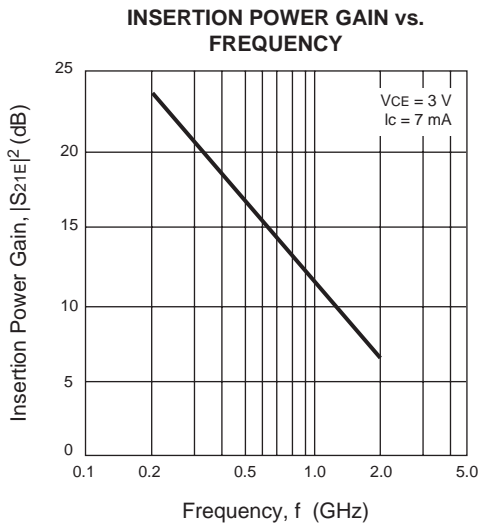
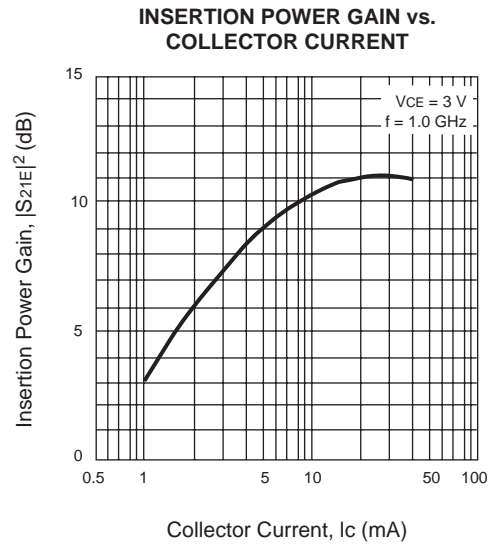
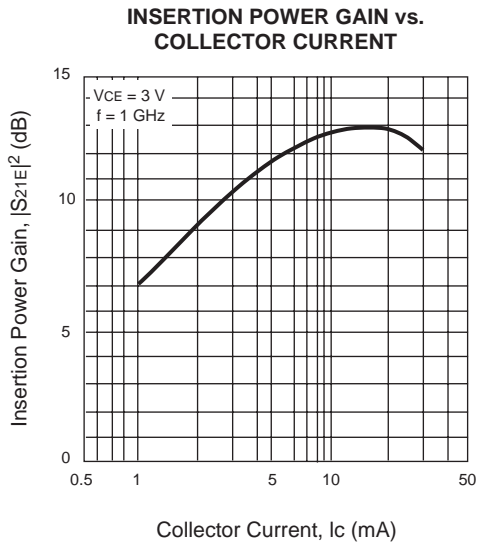
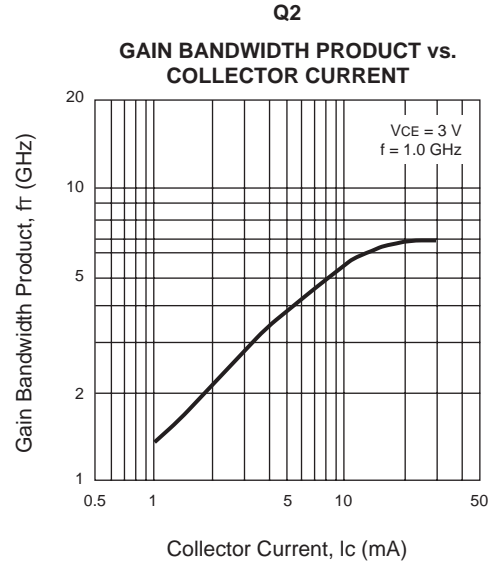
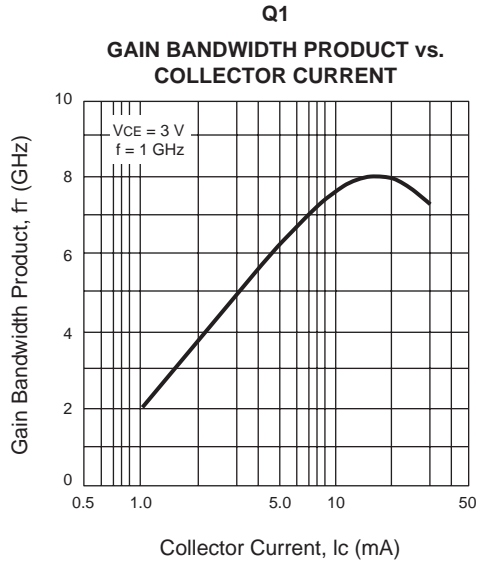
**TYPICAL PERFORMANCE CURVES** (T<sub>A</sub> = 25°C)

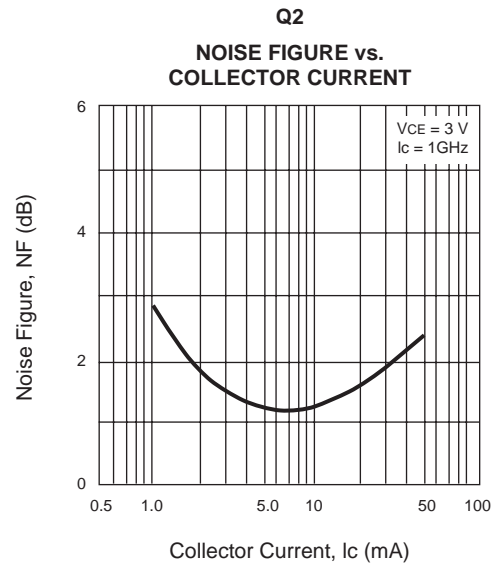
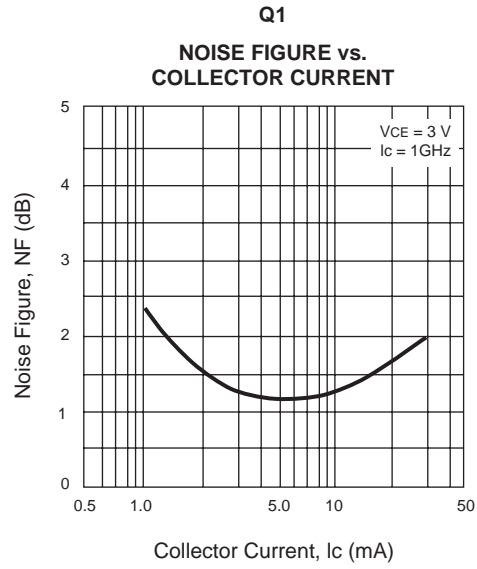


**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ )



TYPICAL PERFORMANCE CURVES (T<sub>A</sub> = 25°C)



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

## TYPICAL SCATTERING PARAMETERS

### Q1

VCE = 3 V, IC = 1 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.98	-10.78	2.41	169.01	0.03	82.67	0.99	-5.20
0.20	0.96	-21.46	2.38	159.18	0.05	75.20	0.98	-10.20
0.30	0.93	-32.33	2.38	150.24	0.07	68.08	0.95	-14.68
0.40	0.90	-43.06	2.31	141.69	0.09	61.29	0.92	-19.11
0.50	0.86	-53.99	2.29	133.94	0.11	55.59	0.89	-22.74
0.60	0.83	-65.11	2.25	126.69	0.12	49.63	0.85	-26.47
0.70	0.79	-75.84	2.20	119.35	0.14	44.96	0.82	-29.32
0.80	0.75	-86.87	2.15	112.56	0.14	40.36	0.78	-32.30
0.90	0.71	-98.16	2.12	105.57	0.15	36.37	0.75	-34.43
1.00	0.67	-108.55	2.03	99.27	0.15	33.12	0.72	-36.33
1.20	0.61	-129.95	1.91	87.38	0.16	27.62	0.67	-39.93
1.50	0.56	-159.25	1.70	71.93	0.16	22.71	0.62	-44.84
1.70	0.55	-176.04	1.56	63.04	0.15	21.49	0.59	-47.97
2.00	0.56	162.45	1.38	51.49	0.14	22.61	0.56	-53.25
2.50	0.60	135.44	1.15	35.10	0.14	31.12	0.53	-64.21
3.00	0.65	116.76	0.96	22.15	0.16	40.55	0.51	-79.12

### Q2

VCE = 3 V, IC = 1 mA, Z0 = 50 Ω

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.97	-20.79	2.52	162.21	0.04	76.22	0.98	-8.81
0.20	0.93	-40.50	2.43	147.42	0.08	63.75	0.93	-16.39
0.30	0.89	-59.73	2.35	134.45	0.11	53.38	0.87	-22.34
0.40	0.84	-76.87	2.20	123.37	0.13	44.64	0.81	-27.24
0.50	0.80	-93.28	2.11	113.14	0.14	38.01	0.76	-30.90
0.60	0.76	-107.72	1.99	104.15	0.15	32.06	0.71	-34.29
0.70	0.74	-120.25	1.85	96.02	0.16	27.52	0.68	-36.96
0.80	0.71	-131.32	1.74	88.78	0.15	24.29	0.65	-39.46
0.90	0.69	-141.35	1.64	82.34	0.15	21.95	0.62	-41.97
1.00	0.68	-150.05	1.53	76.48	0.15	20.46	0.60	-44.52
1.20	0.67	-165.04	1.36	66.07	0.14	19.44	0.57	-50.06
1.50	0.67	176.90	1.17	52.95	0.13	24.64	0.53	-59.83
1.70	0.68	166.97	1.06	45.23	0.13	32.01	0.51	-68.26
2.00	0.69	154.69	0.94	35.40	0.14	44.56	0.48	-82.95
2.50	0.72	137.73	0.79	21.71	0.21	55.71	0.45	-114.70
3.00	0.75	124.46	0.68	11.96	0.30	51.65	0.46	-152.23

## 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	0.92	-16.30	6.78	163.07	0.02	78.39	0.97	-10.08
0.20	0.87	-31.98	6.40	150.08	0.05	68.80	0.91	-18.72
0.30	0.80	-47.80	6.19	138.86	0.06	61.19	0.83	-25.37
0.40	0.73	-63.07	5.85	128.99	0.08	55.07	0.76	-30.73
0.50	0.66	-78.19	5.54	119.82	0.09	51.31	0.69	-34.06
0.60	0.59	-92.43	5.14	111.99	0.09	47.96	0.64	-36.91
0.70	0.53	-106.02	4.78	104.35	0.10	45.84	0.59	-38.80
0.80	0.48	-118.85	4.43	97.95	0.10	44.63	0.55	-40.46
0.90	0.45	-130.67	4.09	92.12	0.11	43.53	0.52	-41.67
1.00	0.42	-141.99	3.79	86.84	0.11	42.97	0.50	-42.81
1.20	0.39	-162.31	3.28	77.80	0.12	42.90	0.46	-44.90
1.50	0.39	172.48	2.71	66.35	0.13	43.15	0.41	-48.61
1.70	0.41	159.29	2.42	59.69	0.14	43.43	0.39	-51.48
2.00	0.44	143.19	2.09	50.44	0.16	44.03	0.36	-56.48
2.50	0.50	123.60	1.70	37.06	0.19	43.82	0.33	-68.06
3.00	0.56	109.84	1.42	25.09	0.22	42.20	0.30	-84.05

### 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	0.90	-29.30	6.71	155.29	0.04	71.05	0.93	-16.80
0.20	0.82	-56.11	6.09	137.78	0.07	56.98	0.81	-28.76
0.30	0.73	-80.82	5.56	123.40	0.09	48.29	0.68	-35.65
0.40	0.67	-101.56	4.95	111.97	0.10	42.87	0.59	-40.13
0.50	0.62	-118.49	4.38	102.51	0.11	39.94	0.52	-42.64
0.60	0.59	-131.80	3.86	94.93	0.11	38.27	0.47	-44.51
0.70	0.57	-142.87	3.44	88.40	0.11	37.56	0.43	-45.87
0.80	0.56	-152.14	3.11	82.68	0.12	37.77	0.40	-47.30
0.90	0.55	-159.99	2.82	77.69	0.12	38.47	0.38	-48.65
1.00	0.54	-166.88	2.59	73.06	0.13	39.41	0.36	-50.22
1.20	0.55	-178.59	2.21	64.68	0.13	41.56	0.32	-54.00
1.50	0.56	167.41	1.84	53.63	0.15	45.41	0.28	-62.05
1.70	0.57	159.71	1.66	46.97	0.17	47.04	0.25	-70.04
2.00	0.60	149.93	1.45	37.59	0.19	48.39	0.22	-85.71
2.50	0.64	136.23	1.20	23.63	0.25	47.57	0.19	-125.28
3.00	0.68	125.06	1.02	11.49	0.31	42.77	0.23	-169.77

## 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	0.87	-21.09	10.58	158.69	0.02	76.37	0.94	-14.02
0.20	0.79	-40.93	9.70	143.52	0.04	65.52	0.84	-24.75
0.30	0.69	-60.74	9.05	130.65	0.05	58.91	0.73	-31.35
0.40	0.59	-79.32	8.25	119.70	0.06	54.93	0.64	-35.74
0.50	0.51	-96.36	7.41	110.29	0.07	52.81	0.58	-38.18
0.60	0.45	-111.30	6.58	102.97	0.08	51.55	0.52	-39.98
0.70	0.40	-125.02	5.89	96.43	0.09	51.22	0.49	-40.96
0.80	0.37	-137.56	5.31	91.07	0.09	50.87	0.46	-41.93
0.90	0.35	-149.03	4.81	86.20	0.10	50.93	0.43	-42.70
1.00	0.34	-159.60	4.40	81.84	0.10	51.15	0.41	-43.47
1.20	0.33	-178.09	3.74	74.24	0.12	51.48	0.38	-45.31
1.50	0.35	160.09	3.04	64.24	0.13	50.97	0.34	-49.34
1.70	0.37	148.92	2.71	58.30	0.15	50.56	0.32	-52.38
2.00	0.41	135.38	2.32	49.98	0.17	49.47	0.29	-58.03
2.50	0.47	118.87	1.88	37.68	0.20	46.59	0.25	-71.18
3.00	0.54	107.01	1.58	26.31	0.24	42.59	0.22	-89.88

### 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	0.83	-36.95	10.41	149.93	0.04	67.41	0.87	-23.15
0.20	0.72	-69.61	9.00	130.38	0.06	54.36	0.70	-36.92
0.30	0.62	-97.36	7.70	115.33	0.07	48.48	0.56	-43.33
0.40	0.56	-117.96	6.47	104.59	0.08	46.08	0.46	-46.73
0.50	0.53	-133.20	5.47	96.45	0.09	45.55	0.40	-48.28
0.60	0.51	-145.02	4.72	89.97	0.10	45.75	0.35	-49.37
0.70	0.50	-154.27	4.13	84.56	0.10	46.29	0.32	-50.23
0.80	0.49	-162.17	3.68	79.59	0.11	47.21	0.29	-50.94
0.90	0.49	-168.79	3.31	75.30	0.12	48.13	0.27	-51.90
1.00	0.49	-174.60	3.02	71.24	0.13	48.87	0.25	-53.05
1.20	0.50	175.37	2.56	63.72	0.14	49.97	0.22	-56.22
1.50	0.52	163.26	2.11	53.63	0.17	50.87	0.18	-64.21
1.70	0.53	156.57	1.90	47.43	0.19	50.65	0.15	-73.44
2.00	0.56	147.71	1.65	38.70	0.22	49.28	0.11	-94.06
2.50	0.61	135.31	1.36	25.02	0.27	45.44	0.11	-153.25
3.00	0.66	124.98	1.16	13.38	0.32	39.42	0.18	-163.89



## 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	0.82	-25.55	13.98	155.09	0.02	74.20	0.91	-17.27
0.20	0.71	-49.26	12.46	138.19	0.04	63.64	0.77	-28.79
0.30	0.59	-72.38	11.17	124.11	0.05	58.57	0.65	-34.68
0.40	0.49	-92.62	9.74	112.93	0.06	56.34	0.57	-38.01
0.50	0.41	-109.93	8.41	104.27	0.07	55.60	0.51	-39.47
0.60	0.37	-124.76	7.29	97.81	0.07	55.26	0.46	-40.56
0.70	0.33	-138.09	6.42	92.16	0.08	55.61	0.43	-41.10
0.80	0.32	-150.18	5.72	87.44	0.09	55.90	0.40	-41.73
0.90	0.31	-161.02	5.15	83.20	0.09	56.11	0.38	-42.38
1.00	0.30	-170.86	4.68	79.33	0.10	56.24	0.36	-43.03
1.20	0.31	172.28	3.95	72.27	0.12	55.78	0.34	-44.92
1.50	0.33	152.94	3.20	63.14	0.14	54.94	0.31	-49.12
1.70	0.36	143.12	2.85	57.57	0.15	53.87	0.29	-52.68
2.00	0.40	131.11	2.44	49.63	0.17	52.00	0.26	-58.94
2.50	0.46	116.26	1.97	37.83	0.21	47.73	0.22	-73.73
3.00	0.52	105.43	1.71	26.77	0.24	42.93	0.19	-94.79

### Q2

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	0.78	-43.98	13.56	145.65	0.04	65.30	0.83	-28.08
0.20	0.64	-81.06	11.15	124.63	0.05	53.73	0.62	-42.31
0.30	0.55	-109.37	9.00	109.90	0.07	50.12	0.47	-48.09
0.40	0.50	-128.61	7.29	100.27	0.07	49.49	0.39	-50.66
0.50	0.48	-142.36	6.05	93.07	0.08	50.25	0.33	-51.72
0.60	0.47	-152.78	5.16	87.38	0.09	50.94	0.29	-52.25
0.70	0.46	-161.04	4.49	82.41	0.10	51.76	0.26	-52.80
0.80	0.46	-168.03	3.98	77.92	0.11	52.62	0.23	-53.35
0.90	0.46	-173.82	3.57	74.02	0.12	53.24	0.21	-54.00
1.00	0.46	-179.09	3.24	70.24	0.13	53.84	0.19	-55.03
1.20	0.47	171.98	2.75	63.22	0.15	53.97	0.16	-58.07
1.50	0.50	160.99	2.25	53.72	0.18	53.24	0.12	-66.67
1.70	0.51	154.69	2.02	47.63	0.20	52.05	0.09	-78.75
2.00	0.54	146.49	1.75	39.20	0.23	49.60	0.07	-110.79
2.50	0.59	134.74	1.44	26.11	0.28	44.37	0.09	174.41
3.00	0.64	124.73	1.23	14.52	0.33	38.05	0.18	146.24

## TYPICAL SCATTERING PARAMETERS

## Q1

V<sub>CE</sub> = 3 V, I<sub>C</sub> = 10 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
0.10	0.75	-31.91	18.36	150.69	0.02	72.56	0.87	-20.90
0.20	0.61	-60.80	15.66	131.59	0.04	63.19	0.70	-32.54
0.30	0.48	-86.66	13.17	116.85	0.04	59.71	0.57	-36.87
0.40	0.39	-107.49	10.90	106.51	0.05	59.23	0.49	-38.88
0.50	0.33	-124.54	9.12	99.07	0.06	59.61	0.44	-39.52
0.60	0.31	-138.94	7.79	93.48	0.07	59.77	0.40	-39.85
0.70	0.29	-151.59	6.79	88.62	0.08	60.28	0.38	-40.07
0.80	0.28	-162.92	6.01	84.41	0.08	60.52	0.36	-40.48
0.90	0.28	-172.78	5.38	80.67	0.09	60.56	0.34	-41.09
1.00	0.28	178.41	4.88	77.11	0.10	60.42	0.33	-41.78
1.20	0.30	163.65	4.11	70.70	0.12	59.73	0.30	-43.79
1.50	0.33	146.82	3.32	62.07	0.14	57.93	0.28	-48.56
1.70	0.35	138.10	2.95	56.81	0.15	56.34	0.26	-52.45
2.00	0.39	127.57	2.52	49.37	0.18	53.90	0.23	-59.39
2.50	0.46	114.12	2.04	37.82	0.22	48.85	0.19	-75.87
3.00	0.52	103.96	1.71	27.21	0.25	43.16	0.16	-99.87

## BUILT-IN TRANSISTORS

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

## ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
UPA834TF-T1	3000	Tape & Reel

The UPA831TF features the Q1 and Q2 in inverted positions.

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

**CEL** CALIFORNIA EASTERN LABORATORIES • Headquarters • 4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 988-3500 • Telex 34-6393 • FAX (408) 988-0279

24-Hour Fax-On-Demand: 800-390-3232 (U.S. and Canada only) • Internet: <http://WWW.CEL.COM>

DATA SUBJECT TO CHANGE WITHOUT NOTICE



PRINTED IN USA ON RECYCLED PAPER -2/99