

PRELIMINARY DATA SHEET

**NEC**

**NPN SILICON EPITAXIAL TWIN TRANSISTOR**

**UPA826TF**

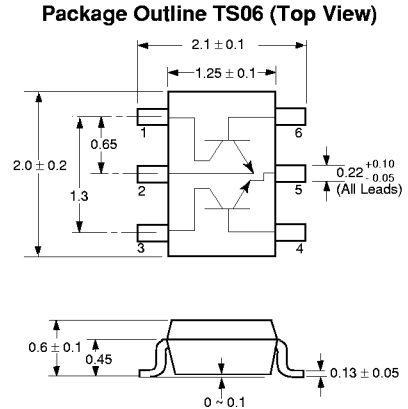
**FEATURES**

- **LOW NOISE AND HIGH GAIN**
- **OPERABLE AT LOW VOLTAGE**
- **SMALL FEEDBACK CAPACITANCE:**  
C<sub>re</sub> = 0.4 pF TYP
- **SMALL PACKAGE STYLE:**  
2 NE685 die in a 2 mm x 1.25 mm x 0.6 mm package

**DESCRIPTION**

The UPA826TF has two built-in low-voltage transistors which are designed for low-noise amplification in the VHF to UHF band. The two die are chosen from adjacent locations on the wafer. These features combined with the pin configuration make this device ideal for balanced or mirrored applications. This device is suitable for very low voltage/low current, and low noise applications. 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			UPA826TF TS06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I <sub>CBO</sub>	Collector Cutoff Current at V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0	μA			0.1
I <sub>EBO</sub>	Emitter Cutoff Current at V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0	μA			0.1
h <sub>FE</sub>	DC Current Gain <sup>1</sup> at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA		75	110	150
f <sub>T</sub>	Gain Bandwidth at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA, f = 2 GHz	GHz		12	
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		0.4	0.7
S <sub>21E</sub>   <sup>2</sup>	Insertion Power Gain at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA, f = 2 GHz	dB	7	8.5	
NF	Noise Figure at V <sub>CE</sub> = 3 V, I <sub>C</sub> = 3 mA, f = 2 GHz	dB		1.5	2.5
h <sub>FE1</sub> /h <sub>FE2</sub>	h <sub>FE</sub> Ratio, V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA h <sub>FE1</sub> = Smaller h <sub>FE</sub> value between Q1 and Q2 h <sub>FE2</sub> = Larger h <sub>FE</sub> value between Q1 and Q2		0.85	1.0	

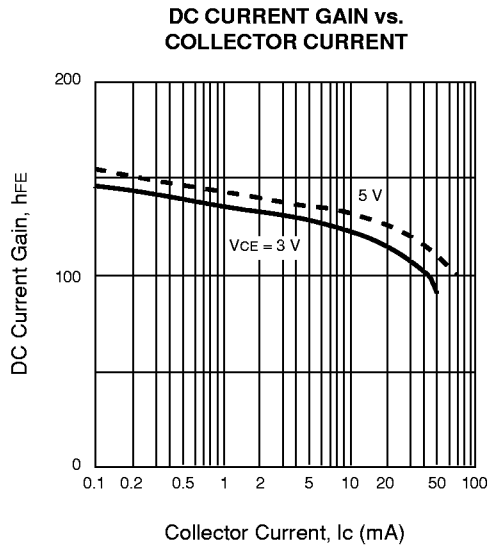
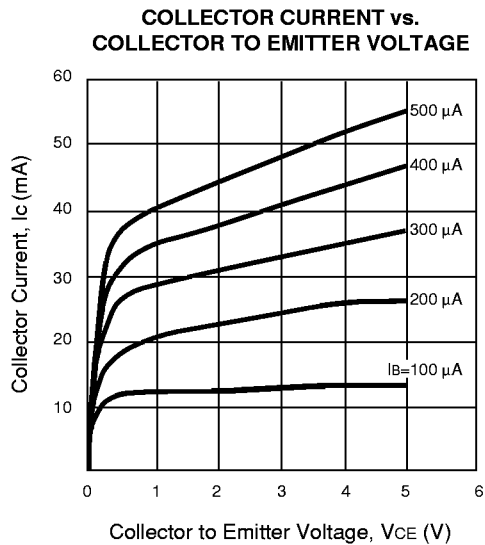
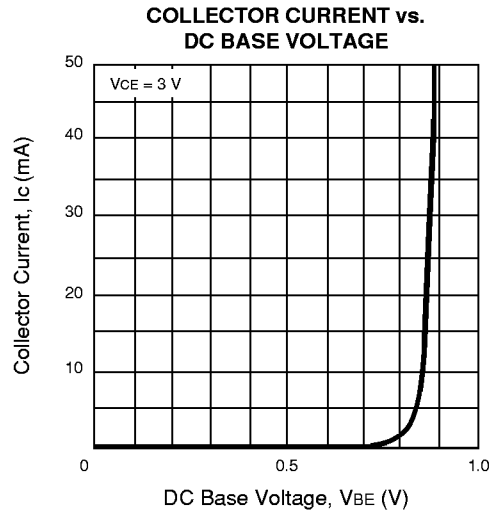
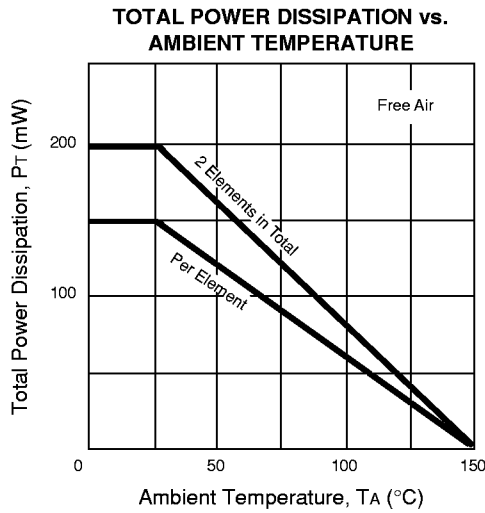
- Notes: 1. Pulsed measurement, pulse width ≤ 350 μs, duty cycle ≤ 2 %.  
2. Collector to base capacitance when measured with capacitance meter (automatic balanced bridge method), with emitter connected to guard pin of capacitances meter.

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** ( $T_A = 25^\circ\text{C}$ )

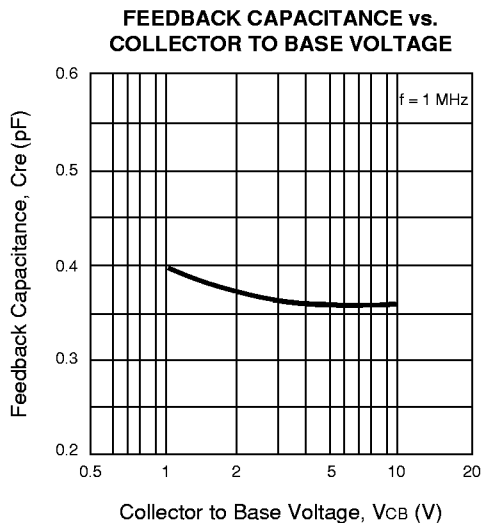
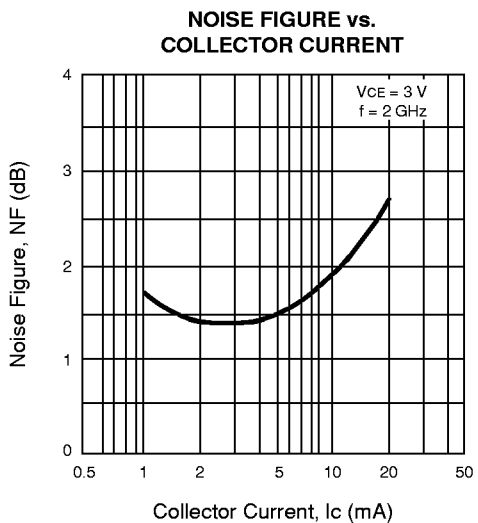
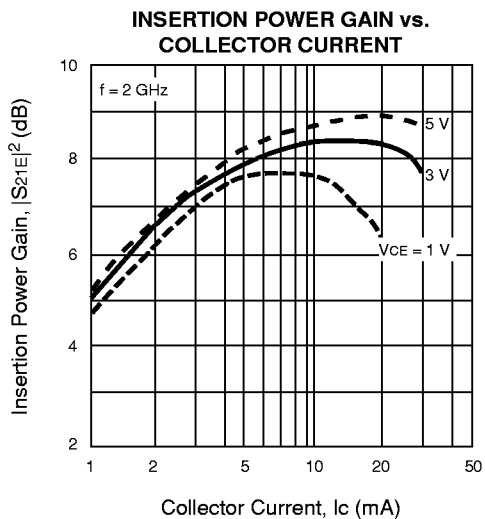
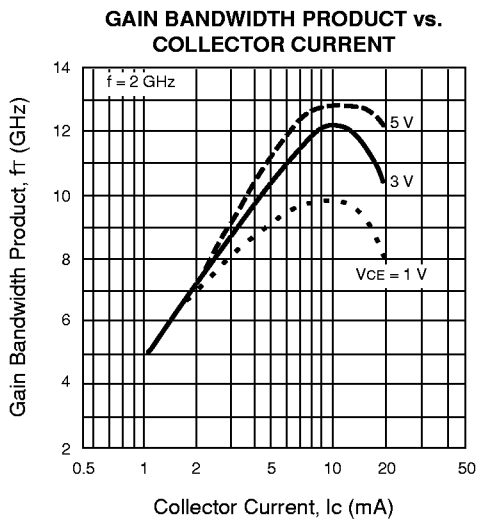
SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CB0</sub>	Collector to Base Voltage	V	9
V <sub>CE0</sub>	Collector to Emitter Voltage	V	6
V <sub>EB0</sub>	Emitter to Base Voltage	V	2
I <sub>C</sub>	Collector Current	mA	30
P <sub>T</sub>	Total Power Dissipation 1 Element 2 Elements <sup>2</sup>	mW mW	150 200
T <sub>J</sub>	Junction Temperature	°C	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** ( $T_A = 25^\circ\text{C}$ )



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



## TYPICAL SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)

### Q1

V<sub>CE</sub> = 3 V, I<sub>C</sub> = 1 mA, Z<sub>o</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	0.98	-5.93	2.38	172.32	0.02	85.76	1.00	-3.86
0.20	0.97	-11.90	2.36	165.08	0.04	81.15	0.99	-7.44
0.30	0.95	-18.17	2.39	158.35	0.06	76.27	0.97	-11.14
0.40	0.93	-24.00	2.35	151.83	0.07	72.22	0.96	-14.73
0.50	0.90	-30.10	2.35	145.70	0.09	68.30	0.94	-18.02
0.60	0.87	-36.17	2.33	140.22	0.10	64.18	0.92	-21.42
0.70	0.84	-42.49	2.30	134.45	0.12	60.68	0.89	-24.18
0.80	0.80	-48.69	2.29	129.32	0.13	56.90	0.87	-27.47
0.90	0.76	-55.28	2.29	123.53	0.14	53.94	0.84	-29.94
1.00	0.73	-61.26	2.24	118.31	0.15	51.07	0.81	-32.50
1.20	0.64	-74.79	2.19	108.30	0.16	45.85	0.76	-36.89
1.50	0.51	-96.77	2.10	93.80	0.18	39.24	0.69	-42.90
1.70	0.43	-112.09	2.00	84.70	0.19	36.24	0.65	-46.79
2.00	0.35	-138.38	1.84	72.75	0.19	32.40	0.60	-51.51
2.50	0.31	175.03	1.62	54.64	0.20	29.55	0.53	-59.91
3.00	0.35	140.64	1.41	40.02	0.21	28.96	0.47	-69.74

### Q2

V<sub>CE</sub> = 3 V, I<sub>C</sub> = 1 mA, Z<sub>o</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	0.98	-5.93	2.43	171.79	0.02	85.64	0.99	-3.75
0.20	0.97	-11.82	2.41	164.40	0.04	80.86	0.99	-7.53
0.30	0.95	-17.85	2.42	157.59	0.05	76.45	0.97	-11.10
0.40	0.93	-23.59	2.39	151.04	0.07	72.26	0.95	-14.56
0.50	0.90	-29.61	2.38	144.91	0.09	68.73	0.93	-17.91
0.60	0.87	-35.62	2.37	139.49	0.10	64.78	0.90	-21.19
0.70	0.84	-41.49	2.34	133.87	0.11	61.52	0.87	-23.71
0.80	0.81	-47.40	2.32	128.66	0.12	58.06	0.85	-26.91
0.90	0.77	-53.49	2.32	123.12	0.13	55.30	0.82	-29.05
1.00	0.73	-59.00	2.26	118.06	0.14	52.86	0.78	-31.52
1.20	0.65	-71.05	2.21	108.31	0.16	48.61	0.73	-35.51
1.50	0.54	-89.53	2.13	94.49	0.17	43.82	0.66	-41.12
1.70	0.47	-101.29	2.02	86.01	0.18	41.68	0.61	-44.56
2.00	0.40	-120.45	1.90	74.87	0.19	39.57	0.55	-49.87
2.50	0.33	-153.17	1.71	57.60	0.21	38.43	0.46	-59.91
3.00	0.33	177.01	1.54	42.57	0.23	38.11	0.38	-74.21

**TYPICAL SCATTERING PARAMETERS** ( $T_A = 25^\circ\text{C}$ )**Q1**VCE = 3 V, IC = 3 mA, ZO = 50  $\Omega$ 

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.94	-9.29	6.55	168.08	0.02	84.10	0.98	-6.91
0.20	0.90	-18.39	6.32	157.85	0.04	76.93	0.95	-13.21
0.30	0.85	-27.47	6.21	148.76	0.05	71.79	0.91	-18.80
0.40	0.80	-36.15	5.98	140.53	0.06	66.81	0.86	-23.80
0.50	0.74	-44.62	5.77	133.00	0.07	63.60	0.81	-27.41
0.60	0.67	-52.69	5.51	126.23	0.08	60.13	0.76	-31.19
0.70	0.60	-60.71	5.28	119.27	0.09	58.07	0.72	-33.67
0.80	0.54	-68.45	5.03	113.12	0.10	55.93	0.68	-36.31
0.90	0.47	-75.60	4.76	107.23	0.11	54.62	0.64	-38.10
1.00	0.42	-82.57	4.50	101.09	0.11	53.45	0.61	-39.74
1.20	0.32	-96.78	4.02	92.52	0.13	51.59	0.56	-42.63
1.50	0.21	-122.39	3.42	80.83	0.15	49.61	0.50	-46.74
1.70	0.17	-143.90	3.10	74.15	0.16	48.63	0.46	-49.50
2.00	0.16	-179.12	2.70	64.83	0.18	46.70	0.42	-54.02
2.50	0.22	136.13	2.24	51.62	0.21	43.76	0.36	-63.34
3.00	0.29	115.80	1.89	39.81	0.23	40.27	0.31	-75.36

**Q2**VCE = 3 V, IC = 3 mA, ZO = 50  $\Omega$ 

FREQUENCY (GHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.93	-9.39	6.76	166.53	0.02	82.60	0.98	-7.24
0.20	0.90	-18.39	6.46	155.80	0.03	76.86	0.94	-13.64
0.30	0.84	-27.39	6.32	146.52	0.05	71.65	0.89	-18.91
0.40	0.79	-35.83	6.06	138.21	0.06	67.47	0.83	-23.49
0.50	0.72	-44.06	5.82	103.60	0.07	64.58	0.77	-26.46
0.60	0.66	-51.67	5.54	123.94	0.08	61.95	0.72	-29.65
0.70	0.59	-58.86	5.28	117.07	0.09	60.46	0.68	-31.43
0.80	0.53	-65.57	5.01	111.07	0.10	59.12	0.64	-33.17
0.90	0.48	-71.57	4.72	105.46	0.10	57.98	0.60	-34.36
1.00	0.43	-77.20	4.45	100.46	0.11	57.39	0.57	-35.31
1.20	0.34	-87.82	3.95	91.74	0.13	56.54	0.52	-37.08
1.50	0.26	-104.50	3.37	80.85	0.15	55.21	0.46	-39.70
1.70	0.22	-116.75	3.06	74.57	0.16	54.46	0.43	-41.65
2.00	0.19	-137.84	2.71	66.02	0.18	53.01	0.38	-44.95
2.50	0.19	-174.18	2.29	53.07	0.22	49.89	0.30	-52.82
3.00	0.24	159.82	1.99	41.14	0.26	45.56	0.22	-65.40

TYPICAL SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)

## Q1

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 10 mA, Z<sub>o</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	0.82	-17.52	16.52	159.99	0.02	80.28	0.94	-12.68
0.20	0.72	-33.22	14.93	144.21	0.03	72.82	0.85	-22.43
0.30	0.60	-46.83	13.32	131.03	0.04	68.07	0.75	-28.43
0.40	0.49	-57.62	11.65	120.45	0.05	65.62	0.67	-32.14
0.50	0.40	-65.90	10.15	112.22	0.06	65.03	0.60	-34.25
0.60	0.33	-72.93	8.90	105.92	0.07	63.86	0.56	-35.78
0.70	0.27	-79.33	7.89	100.37	0.08	63.74	0.52	-36.80
0.80	0.22	-85.38	7.07	95.73	0.08	63.50	0.49	-37.69
0.90	0.18	-91.73	6.39	91.61	0.09	63.16	0.46	-38.46
1.00	0.15	-98.81	5.83	87.88	0.10	62.77	0.45	-39.30
1.20	0.10	-118.22	4.95	81.32	0.11	61.85	0.41	-41.01
1.50	0.07	-176.19	4.05	72.82	0.14	59.79	0.38	-44.69
1.70	0.08	149.79	3.61	67.81	0.15	58.31	0.35	-47.69
2.00	0.13	125.94	3.12	60.46	0.18	55.55	0.32	-53.15
2.50	0.21	109.57	2.54	49.58	0.22	50.37	0.27	-65.07
3.00	0.29	100.79	2.14	39.46	0.25	45.03	0.21	-81.46

## Q2

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 10 mA, Z<sub>o</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	0.79	-18.18	17.81	156.05	0.02	79.00	0.92	-14.07
0.20	0.67	-33.75	15.65	139.27	0.03	72.98	0.80	-22.91
0.30	0.55	-46.32	13.67	125.80	0.04	69.74	0.69	-27.06
0.40	0.44	-55.16	11.71	115.64	0.05	69.07	0.61	-28.96
0.50	0.37	-61.11	10.03	108.02	0.06	68.93	0.56	-29.47
0.60	0.31	-65.90	8.70	102.30	0.07	68.67	0.52	-29.62
0.70	0.26	-69.64	7.66	97.45	0.07	68.49	0.49	-29.55
0.80	0.23	-73.22	6.84	93.31	0.08	68.26	0.46	-29.57
0.90	0.20	-76.64	6.18	89.63	0.09	68.18	0.44	-29.61
1.00	0.18	-80.09	5.63	86.38	0.10	67.74	0.43	-29.60
1.20	0.14	-88.42	4.80	80.51	0.12	66.68	0.40	-29.99
1.50	0.10	-107.91	3.94	72.79	0.15	64.56	0.36	-31.58
1.70	0.08	-126.27	3.53	68.12	0.16	62.66	0.33	-33.11
2.00	0.09	-158.61	3.08	61.31	0.19	59.98	0.29	-35.72
2.50	0.13	164.55	2.57	50.55	0.24	54.48	0.22	-42.08
3.00	0.20	146.66	2.21	40.11	0.28	48.32	0.14	-51.14

## ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
UPA826TF-T1	3000	Tape & Reel

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