PRELIMINARY DATA SHEET

NEC

NPN SILICON EPITAXIAL TWIN TRANSISTOR

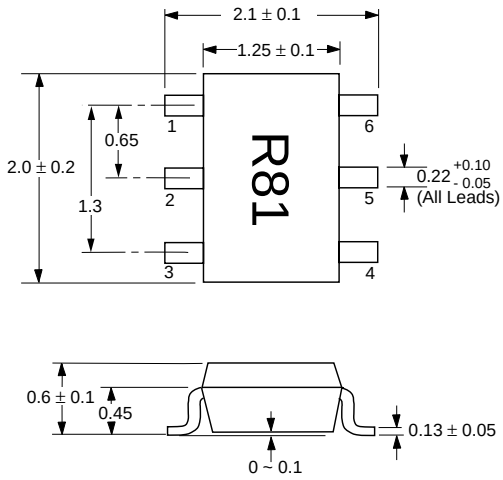
UPA821TF

FEATURES

- **LOW NOISE:**
  NF = 1.2 dB TYP at f = 1 GHz, V_{CE} = 3 V, I_C = 7 mA
- **HIGH GAIN:**
  $|S_{21E}|^2$ = 9.0 dB TYP at f = 1 GHz, V_{CE} = 3 V, I_C = 7 mA
- **SMALL PACKAGE STYLE:**
  2 NE856 die in a 2 mm x 1.25 mm x 0.6 mm package

OUTLINE DIMENSIONS (Units in mm)

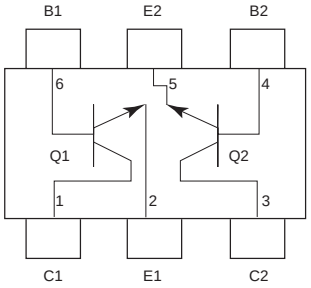
Package Outline TS06



DESCRIPTION

The UPA821TF 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. Low noise figures, high gain, and high current capability equate to wide dynamic range and excellent linearity. The thinner package style allows for higher density designs.

PIN CONFIGURATION (Top View)



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

Note: Pin 3 is identified with a circle on the bottom of the package.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			UPA821TF TS06		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
I_{CBO}	Collector Cutoff Current at V_{CB} = 10 V, I_E = 0	µA			1.0
I_{EBO}	Emitter Cutoff Current at V_{EB} = 1 V, I_C = 0	µA			1.0
h_{FE}	DC Current Gain[1] at V_{CE} = 3 V, I_C = 7 mA		70		140
f_T	Gain Bandwidth at V_{CE} = 3 V, I_C = 7 mA	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
h_{FE1}/h_{FE2}	h_{FE} ratio, V_{CE} = 3 V, I_C = 7 mA h_{FE1} = Smaller h_{FE} value between Q1 and Q2 h_{FE2} = Larger h_{FE} 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 capacitance meter.

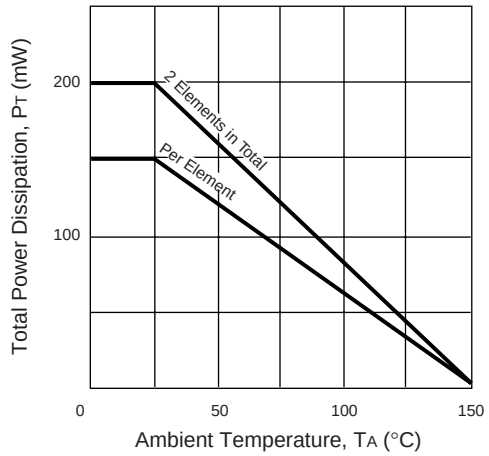
ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	20
V_{CEO}	Collector to Emitter Voltage	V	12
V_{EBO}	Emitter to Base Voltage	V	3
I_C	Collector Current	mA	100
P_T	Total Power Dissipation 1 Die 2 Die[2]	 mW mW	 150 200
T_J	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to +150

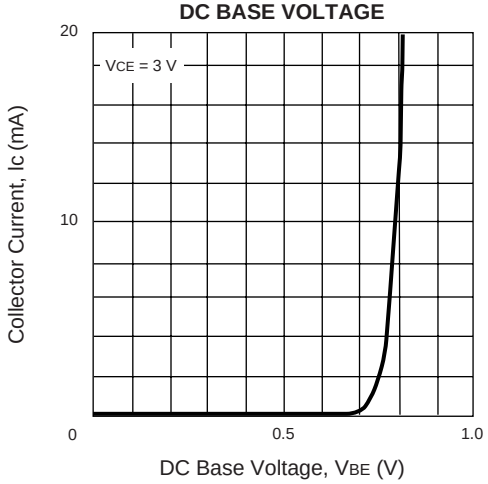
Note: 1. Operation in excess of any one of these parameters may result in permanent damage.
2. When operating both devices, the power dissipation for either device should not exceed 110 mW.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

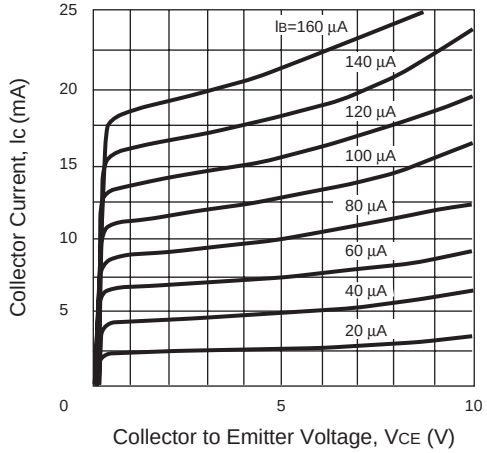
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



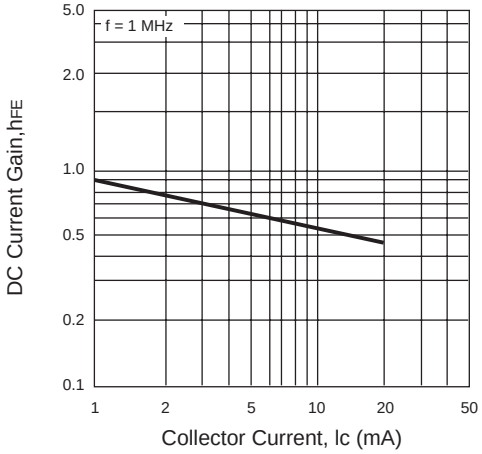
COLLECTOR CURRENT vs. DC BASE VOLTAGE



COLLECTOR CURRENT vs. EMITTER VOLTAGE

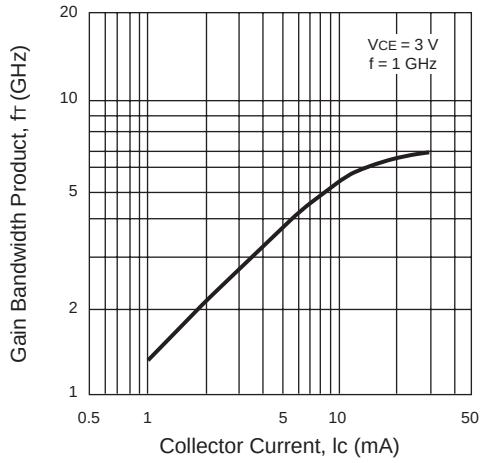


DC CURRENT GAIN vs. COLLECTOR CURRENT

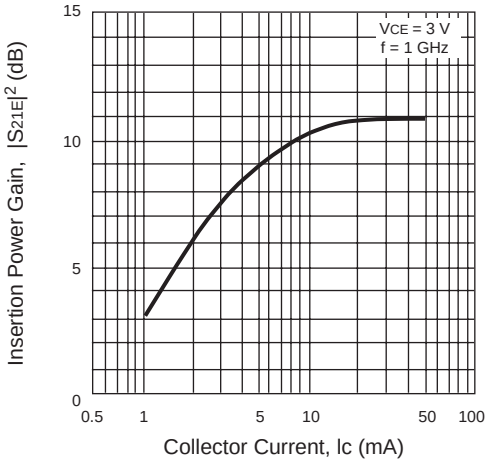


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

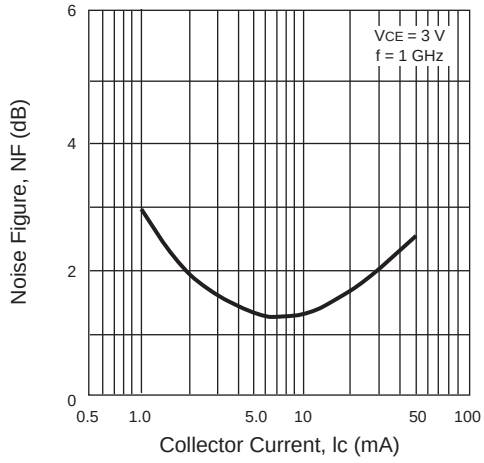
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



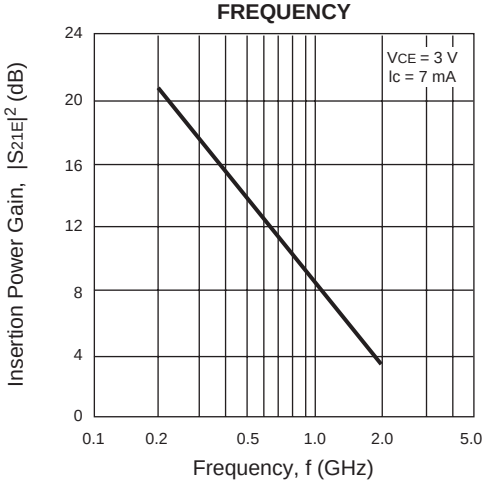
INSERTION POWER GAIN vs. COLLECTOR CURRENT



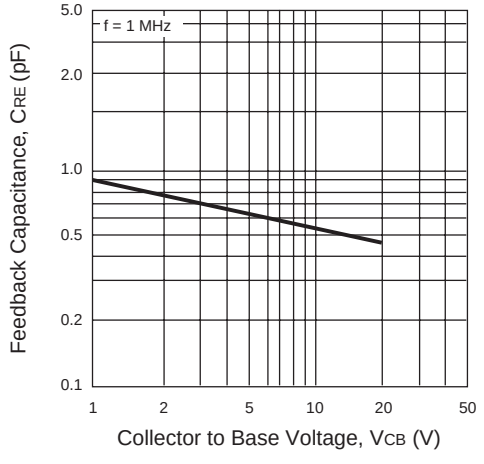
NOISE FIGURE vs. COLLECTOR CURRENT



INSERTION POWER GAIN vs. FREQUENCY



FEEDBACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



TYPICAL SCATTERING PARAMETERS

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	.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
1.20	.70	-175.72	1.30	63.28	.15	8.37	.61	-49.79
1.50	.71	162.88	1.09	49.18	.13	7.58	.59	-57.73
1.70	.72	151.31	.97	41.14	.12	11.56	.58	-64.34
2.00	.75	136.95	.83	31.08	.11	23.61	.57	-74.83
2.50	.78	117.97	.66	18.15	.13	45.08	.57	-95.23
3.00	.81	103.52	.54	10.02	.19	50.48	.58	-118.13

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	.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
1.20	.67	-165.04	1.36	66.07	.14	19.44	.57	-50.06
1.50	.67	176.90	1.17	52.95	.13	24.64	.53	-59.83
1.70	.68	166.97	1.06	45.23	.13	32.01	.51	-68.26
2.00	.69	154.69	.94	35.40	.14	44.56	.48	-82.95
2.50	.72	137.73	.79	21.71	.21	55.71	.45	-114.70
3.00	.75	124.46	.68	11.96	.30	51.65	.46	-152.23

TYPICAL SCATTERING PARAMETERS

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	.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
1.20	.59	167.50	2.25	62.99	.12	31.42	.36	-59.72
1.50	.61	150.72	1.82	51.53	.13	34.65	.33	-67.05
1.70	.63	141.52	1.61	44.61	.14	36.98	.32	-73.46
2.00	.66	130.09	1.38	35.44	.15	39.97	.31	-84.11
2.50	.70	114.27	1.10	21.83	.19	42.08	.31	-105.22
3.00	.75	102.28	.91	10.82	.22	41.10	.33	-128.59

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	.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
1.20	.55	-178.59	2.21	64.68	.13	41.56	.32	-54.00
1.50	.56	167.41	1.84	53.63	.15	45.41	.28	-62.05
1.70	.57	159.71	1.66	46.97	.17	47.04	.25	-70.04
2.00	.60	149.93	1.45	37.59	.19	48.39	.22	-85.71
2.50	.64	136.23	1.20	23.63	.25	47.57	.19	-125.28
3.00	.68	125.06	1.02	11.49	.31	42.77	.23	-169.77

TYPICAL SCATTERING PARAMETERS

Q1

V_{CE} = 3 V, I_C = 7 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	-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
1.20	.54	156.05	2.83	61.95	.12	47.51	.21	-75.34
1.50	.56	142.49	2.28	52.20	.14	47.48	.19	-85.78
1.70	.58	134.85	2.02	46.08	.16	47.00	.18	-94.72
2.00	.61	125.10	1.72	37.91	.18	45.50	.18	-108.59
2.50	.66	111.51	1.37	25.17	.22	41.98	.19	-134.34
3.00	.71	100.68	1.14	14.21	.25	37.45	.23	-157.18

Q2

V_{CE} = 3 V, I_C = 7 mA, Z_0 = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	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
1.20	.47	171.98	2.75	63.22	.15	53.97	.16	-58.07
1.50	.50	160.99	2.25	53.72	.18	53.24	.12	-66.67
1.70	.51	154.69	2.02	47.63	.20	52.05	.09	-78.75
2.00	.54	146.49	1.75	39.20	.23	49.60	.07	-110.79
2.50	.59	134.74	1.44	26.11	.28	44.37	.09	174.41
3.00	.64	124.73	1.23	14.52	.33	38.05	.18	146.24

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
UPA821TF-T1	3000	Tape & Reel