PRELIMINARY DATA SHEET

NEC

NPN SILICON EPITAXIAL TWIN TRANSISTOR | UPA827TF

FEATURES

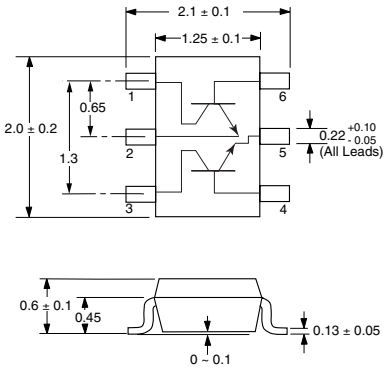
- **HIGH GAIN WITH LOW OPERATING CURRENT:**
  $|S_{21E}|^2$ = 9 dB TYP at f = 2 GHz, V_{CE} = 2 V, I_C = 7 mA
  $|S_{21E}|^2$ = 8.5 dB TYP at f = 2 GHz, V_{CE} = 1 V, I_C = 5 mA
- **SMALL PACKAGE STYLE:**
  2 NE686 die in a 2 mm x 1.25 mm x 0.6 mm package
- **Pb-FREE**

DESCRIPTION

The UPA827TF 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 low voltage/low current, low noise applications, and its high f_T makes it an excellent choice for portable wireless applications. 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			UPA827TF TS06		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
I_{CBO}	Collector Cutoff Current at V_{CB} = 5 V, I_E = 0	μA			0.1
I_{EBO}	Emitter Cutoff Current at V_{EB} = 1 V, I_C = 0	μA			0.1
h_{FE}	DC Current Gain[1] at V_{CE} = 2 V, I_C = 7 mA		70		140
f_T	Gain Bandwidth (1) at V_{CE} = 2 V, I_C = 7 mA, f = 2 GHz	GHz	10	13	
f_T	Gain Bandwidth (2) at V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz	GHz	8.5	12	
Cre	Feedback Capacitance[2] at V_{CB} = 2 V, I_E = 0, f = 1 MHz	pF		0.4	0.6
$\|S_{21E}\|^2$	Insertion Power Gain (1) at V_{CE} = 2 V, I_C =7 mA, f = 2 GHz	dB	7.5	9	
$\|S_{21E}\|^2$	Insertion Power Gain (2) at V_{CE} = 1 V, I_C =5 mA, f = 2 GHz	dB	7	8.5	
NF	Noise Figure (1) at V_{CE} = 2 V, I_C = 3 mA, f = 2 GHz	dB		1.5	2
NF	Noise Figure (2) at V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz	dB		1.5	2
h_{FE1}/h_{FE2}	h_{FE} ratio, V_{CE} = 2 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 capacitances meter.

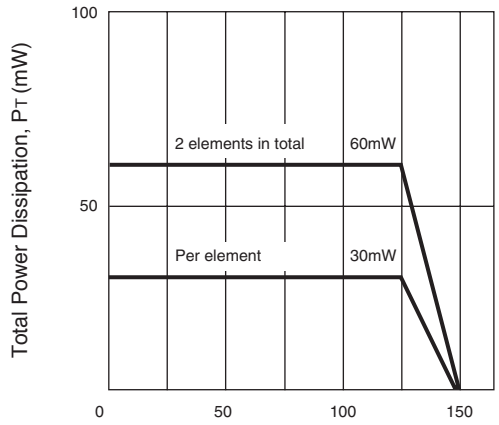
ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	5
V_{CEO}	Collector to Emitter Voltage	V	3
V_{EBO}	Emitter to Base Voltage	V	2
I_C	Collector Current	mA	10
P_T	Total Power Dissipation 1 Element 2 Elements	 mW mW	 30 60
T_J	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to +150

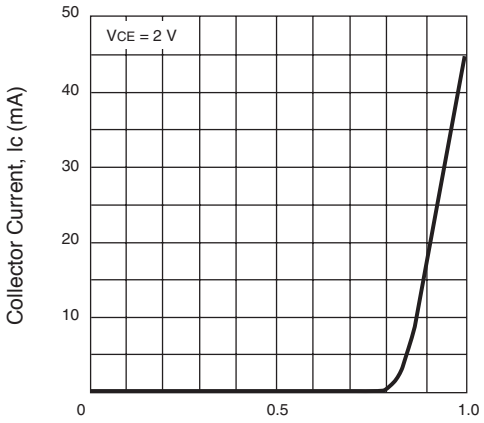
Note: 1.Operation in excess of any one of these parameters may result in permanent damage.

TYPICAL PERFORMANCE CURVES (T_A = 25˚C)

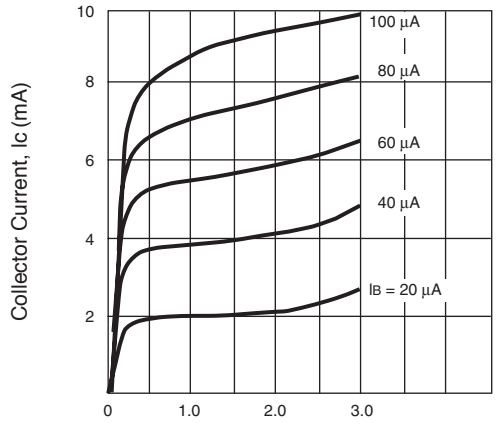
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



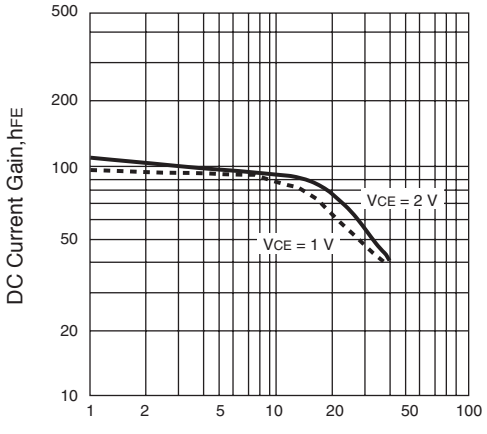
COLLECTOR CURRENT vs. DC BASE VOLTAGE



COLLECTOR CURRENT vs. EMITTER VOLTAGE

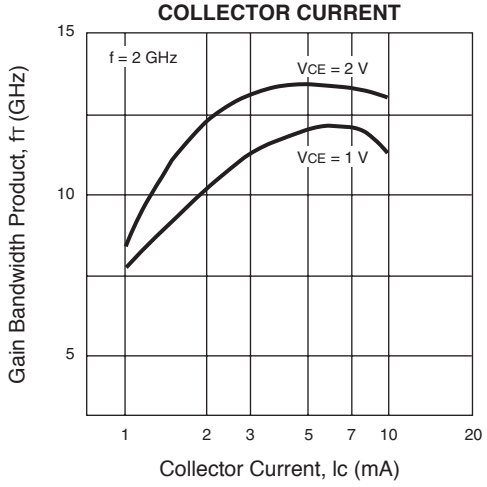


DC CURRENT GAIN vs. COLLECTOR CURRENT

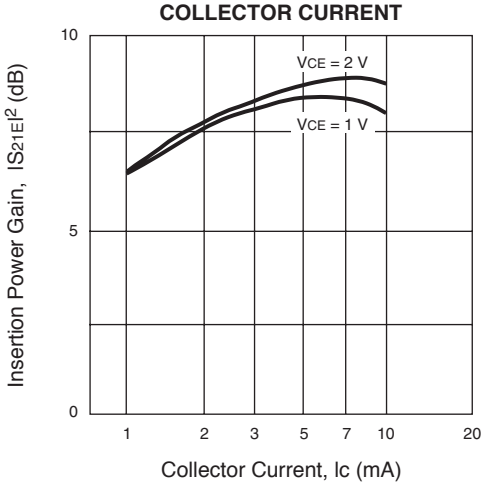


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

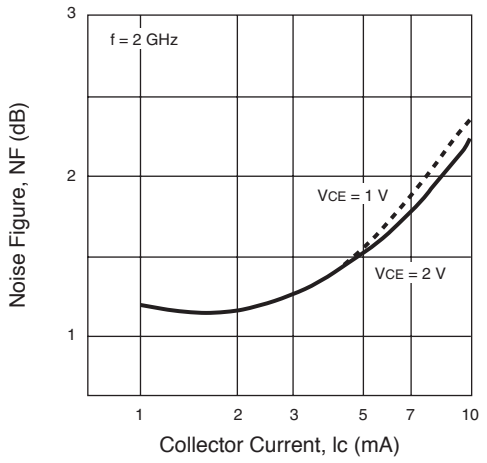
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



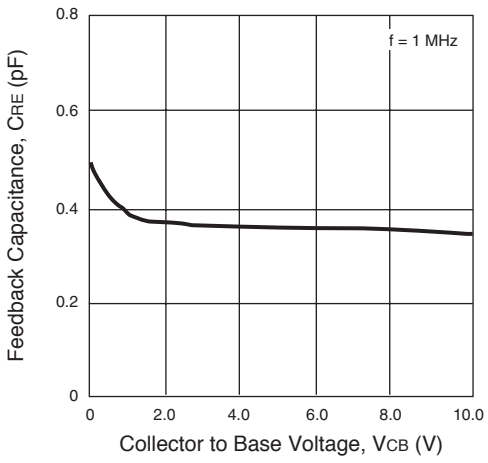
INSERTION POWER GAIN vs. COLLECTOR CURRENT



NOISE FIGURE vs. COLLECTOR CURRENT



FEEDBACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Q1

V_{CE} = 2 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.97	-3.79	2.37	173.89	0.02	86.19	0.99	-3.35
0.20	0.96	-7.62	2.35	168.24	0.03	83.85	0.99	-6.52
0.30	0.95	-11.53	2.40	162.95	0.05	80.08	0.98	-9.88
0.40	0.94	-15.36	2.38	157.51	0.06	77.05	0.97	-13.07
0.50	0.92	-19.27	2.39	152.51	0.08	74.32	0.96	-16.16
0.60	0.90	-23.25	2.38	147.98	0.09	71.00	0.95	-19.49
0.70	0.88	-27.31	2.37	143.24	0.10	68.16	0.93	-22.31
0.80	0.86	-31.26	2.37	139.10	0.12	65.24	0.91	-25.62
0.90	0.83	-35.44	2.37	134.35	0.13	62.59	0.89	-28.16
1.00	0.80	-39.13	2.33	129.91	0.14	59.95	0.86	-31.26
1.20	0.74	-47.66	2.32	121.47	0.16	55.12	0.82	-36.57
1.50	0.63	-61.74	2.31	109.55	0.19	48.35	0.75	-44.21
1.70	0.56	-70.44	2.23	101.17	0.20	44.53	0.70	-48.82
2.00	0.46	-86.95	2.16	90.13	0.22	38.96	0.64	-55.67
2.50	0.27	-120.95	2.03	70.78	0.24	32.87	0.54	-65.96
3.00	0.20	-171.57	1.83	54.75	0.25	27.71	0.46	-77.11

Q2

V_{CE} = 2 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.97	-3.76	2.38	173.74	0.02	86.91	0.99	-3.32
0.20	0.96	-7.50	2.35	167.97	0.03	83.65	0.99	-6.56
0.30	0.95	-11.38	2.39	162.59	0.05	80.52	0.98	-9.72
0.40	0.94	-15.24	2.38	157.14	0.06	77.30	0.97	-12.95
0.50	0.92	-19.09	2.38	152.09	0.08	74.64	0.95	-15.89
0.60	0.91	-23.00	2.38	147.56	0.09	71.39	0.93	-19.16
0.70	0.89	-26.94	2.37	142.82	0.11	68.87	0.91	-21.99
0.80	0.86	-30.85	2.37	138.70	0.12	65.96	0.89	-25.12
0.90	0.84	-34.90	2.37	133.96	0.13	63.53	0.86	-27.55
1.00	0.82	-38.48	2.33	129.63	0.14	61.18	0.84	-30.48
1.20	0.76	-46.39	2.32	121.22	0.16	56.71	0.79	-35.31
1.50	0.67	-59.42	2.32	109.38	0.19	50.94	0.71	-42.55
1.70	0.61	-67.25	2.24	101.17	0.20	47.51	0.65	-47.09
2.00	0.53	-81.17	2.17	90.51	0.22	42.47	0.57	-53.85
2.50	0.38	-105.57	2.05	71.84	0.25	36.57	0.45	-64.55
3.00	0.30	-134.37	1.89	56.05	0.27	31.69	0.34	-77.62

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Q1

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.90	-6.40	6.38	170.12	0.02	84.82	0.98	-5.79
0.20	0.88	-12.71	6.21	161.60	0.03	80.22	0.96	-11.39
0.30	0.85	-19.07	6.16	153.85	0.04	76.19	0.93	-16.48
0.40	0.81	-25.04	6.00	146.67	0.06	72.09	0.90	-21.27
0.50	0.76	-31.15	5.84	140.06	0.07	69.59	0.85	-25.20
0.60	0.71	-36.82	5.65	134.24	0.08	66.27	0.81	-29.17
0.70	0.66	-42.59	5.49	128.01	0.09	64.30	0.77	-32.16
0.80	0.61	-48.04	5.32	122.51	0.10	61.95	0.73	-35.33
0.90	0.55	-53.11	5.12	116.88	0.10	60.14	0.70	-37.63
1.00	0.50	-57.87	4.92	111.77	0.11	59.19	0.67	-39.81
1.20	0.40	-66.68	4.51	102.30	0.12	56.73	0.61	-43.76
1.50	0.27	-79.47	3.95	90.17	0.15	53.86	0.54	-49.15
1.70	0.20	-88.30	3.60	83.36	0.16	52.11	0.50	-52.50
2.00	0.11	-108.97	3.18	74.09	0.18	49.45	0.45	-57.74
2.50	0.07	158.31	2.66	60.75	0.21	45.49	0.38	-64.84
3.00	0.16	118.39	2.29	48.87	0.24	40.58	0.32	-80.67

Q2

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.90	-6.34	6.39	169.68	0.02	84.84	0.98	-5.82
0.20	0.88	-12.58	6.20	160.94	0.03	80.33	0.96	-11.25
0.30	0.85	-18.91	6.14	153.06	0.04	76.31	0.92	-16.31
0.40	0.82	-24.80	5.97	145.83	0.06	73.00	0.88	-20.79
0.50	0.77	-30.57	5.79	139.18	0.07	70.49	0.83	-24.41
0.60	0.73	-36.24	5.59	133.26	0.08	67.69	0.79	-28.04
0.70	0.68	-41.66	5.41	127.08	0.09	65.74	0.74	-30.52
0.80	0.63	-46.88	5.23	121.55	0.10	63.80	0.70	-33.20
0.90	0.58	-51.46	5.02	116.05	0.11	62.24	0.66	-35.07
1.00	0.53	-55.76	4.80	111.07	0.11	61.38	0.63	-36.80
1.20	0.45	-63.47	4.39	102.03	0.13	59.31	0.57	-39.71
1.50	0.35	-74.44	3.84	90.52	0.15	56.69	0.49	-43.54
1.70	0.30	-82.13	3.52	84.07	0.17	54.93	0.44	-46.16
2.00	0.24	-95.31	3.13	74.96	0.19	52.36	0.38	-49.40
2.50	0.17	-125.55	2.66	61.81	0.23	48.10	0.29	-56.28
3.00	0.16	-165.06	2.31	49.68	0.27	43.08	0.20	-66.61

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Q1

V_{CE} = 2 V, I_C = 7 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.79	-10.59	12.26	165.48	0.01	83.48	0.96	-8.71
0.20	0.74	-20.57	11.58	153.36	0.03	77.65	0.91	-16.50
0.30	0.67	-30.03	10.98	142.68	0.04	73.57	0.84	-22.47
0.40	0.59	-38.34	10.23	133.14	0.05	70.32	0.77	-27.22
0.50	0.52	-45.42	9.42	124.76	0.06	68.50	0.72	-30.47
0.60	0.45	-51.28	8.61	117.78	0.07	66.94	0.67	-33.23
0.70	0.38	-56.02	7.87	111.39	0.07	65.98	0.62	-35.02
0.80	0.33	-59.86	7.22	105.98	0.08	65.26	0.59	-36.80
0.90	0.28	-63.19	6.63	101.18	0.09	64.24	0.56	-38.15
1.00	0.24	-65.89	6.12	96.90	0.10	63.87	0.53	-39.31
1.20	0.17	-70.37	5.29	89.57	0.11	62.59	0.49	-41.59
1.50	0.08	-78.15	4.37	80.22	0.13	60.52	0.44	-45.40
1.70	0.04	-88.25	3.92	74.77	0.15	58.88	0.42	-48.34
2.00	0.03	118.89	3.40	67.28	0.17	56.41	0.38	-53.28
2.50	0.12	102.62	2.80	55.99	0.21	51.57	0.32	-63.74
3.00	0.21	98.26	2.38	45.77	0.24	45.88	0.27	-77.81

Q2

V_{CE} = 2 V, I_C = 7 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.79	-10.37	12.25	164.70	0.01	82.96	0.95	-8.66
0.20	0.74	-20.08	11.49	152.30	0.03	78.29	0.90	-16.20
0.30	0.68	-29.16	10.81	141.44	0.04	74.48	0.82	-21.74
0.40	0.60	-36.85	10.00	131.96	0.05	71.50	0.76	-25.90
0.50	0.53	-43.25	9.14	123.66	0.06	70.09	0.69	-28.46
0.60	0.47	-48.47	8.31	116.90	0.07	68.61	0.64	-30.60
0.70	0.42	-52.50	7.57	110.84	0.08	67.97	0.60	-31.88
0.80	0.37	-56.05	6.92	105.69	0.08	67.35	0.56	-32.88
0.90	0.34	-59.04	6.36	101.15	0.09	66.54	0.53	-33.54
1.00	0.30	-61.69	5.87	97.08	0.10	66.31	0.51	-34.05
1.20	0.25	-66.62	5.07	90.12	0.12	64.95	0.46	-35.02
1.50	0.19	-75.77	4.24	81.19	0.14	63.09	0.41	-36.74
1.70	0.16	-84.55	3.82	75.92	0.16	61.07	0.37	-38.42
2.00	0.12	-101.92	3.34	68.51	0.18	58.41	0.32	-40.40
2.50	0.10	-148.42	2.79	57.44	0.23	53.55	0.25	-45.38
3.00	0.14	170.66	2.41	46.77	0.27	47.51	0.17	-52.42

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
UPA827TF-T1-A	3000	Tape & Reel, Pb-Free