

NEC

NPN SILICON EPITAXIAL TWIN TRANSISTOR

UPA828TF

FEATURES

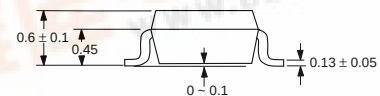
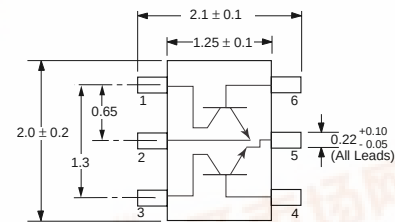
- LOW NOISE:**
NF = 1.3 dB TYP at $f = 2$ GHz, $V_{CE} = 2$ V, $I_c = 3$ mA
- HIGH GAIN:**
 $|S_{21E}|^2 = 8.5$ dB TYP at $f = 2$ GHz, $V_{CE} = 2$ V, $I_c = 20$ mA
- SMALL PACKAGE STYLE:**
2 NE687 die in a 2 mm x 1.25 mm x 0.6 mm package

DESCRIPTION

The UPA828TF 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, and low noise applications. The thinner package style allows for higher density designs.

OUTLINE DIMENSIONS (Unit in mm)

Package Outline TS06 (Top View)



PIN CONNECTIONS

- Collector (Q1)
- Emitter (Q1)
- Collector (Q2)
- Base (Q2)
- Emitter (Q2)
- Base (Q1)

Note:

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

ELECTRICAL CHARACTERISTICS (TA = 25°C)

PART NUMBER PACKAGE OUTLINE			UPA828TF TS06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
ICBO	Collector Cutoff Current at $V_{CB} = 5$ V, $I_E = 0$	μ A			0.1
IEBO	Emitter Cutoff Current at $V_{EB} = 1$ V, $I_C = 0$	μ A			0.1
hFE	DC Current Gain ¹ at $V_{CE} = 2$ V, $I_c = 20$ mA		70		140
fT	Gain Bandwidth at $V_{CE} = 2$ V, $I_c = 20$ mA, $f = 2$ GHz	GHz	9	11	
fT	Gain Bandwidth at $V_{CE} = 1$ V, $I_c = 10$ mA, $f = 2$ GHz	GHz	7	9	
Cre	Feedback Capacitance ² at $V_{CB} = 2$ V, $I_E = 0$, $f = 1$ MHz	pF		0.4	0.8
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 2$ V, $I_c = 20$ mA, $f = 2$ GHz	dB	7	8.5	
$ S_{21E} ^2$	Insertion Power Gain at $V_{CE} = 1$ V, $I_c = 10$ mA, $f = 2$ GHz	dB	6	7.5	
NF	Noise Figure at $V_{CE} = 2$ V, $I_c = 3$ mA, $f = 2$ GHz dB		1.3	2	
NF	Noise Figure at $V_{CE} = 1$ V, $I_c = 3$ mA, $f = 2$ GHz dB		1.3	2	
hFE1/hFE2	hFE ratio, $V_{CE} = 2$ V, $I_c = 20$ mA hFE1 = Smaller hFE value between Q1 and Q2 hFE2 = Larger hFE value between Q1 and Q2		0.85	1.0	

Notes: 1. Pulsed measurement, pulse width ≤ 350 μ s, 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.



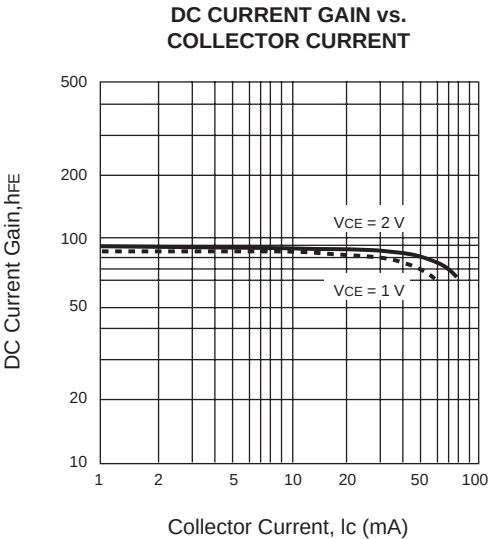
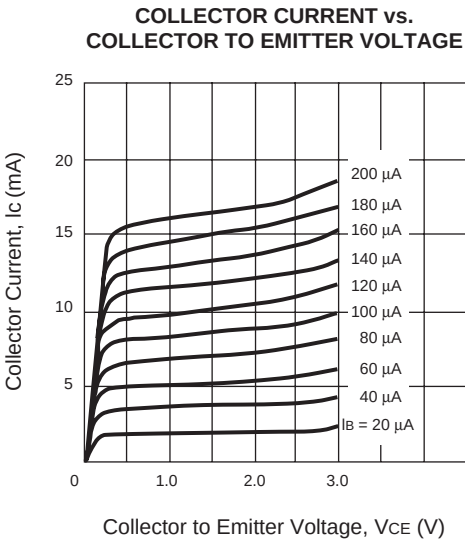
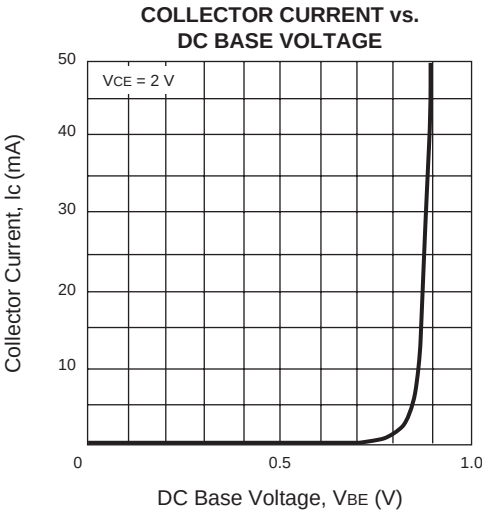
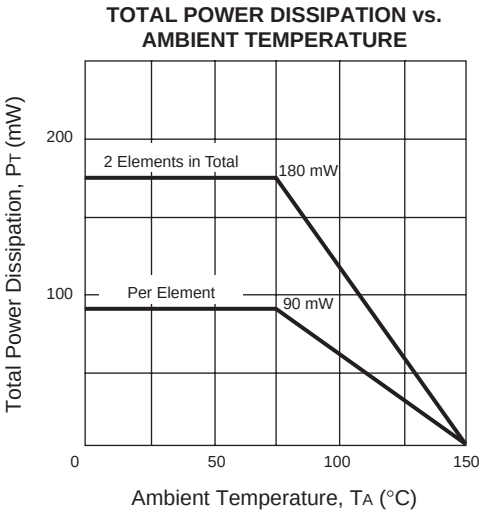
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ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

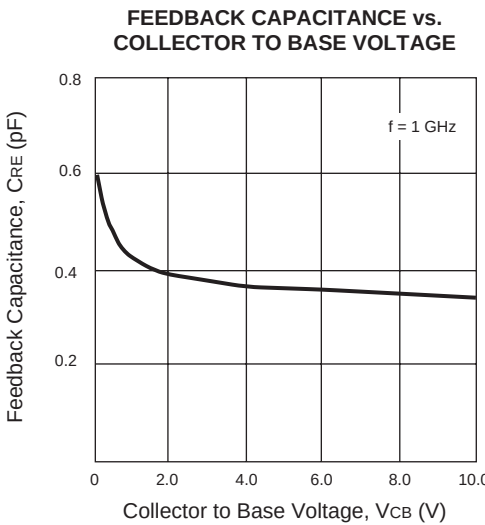
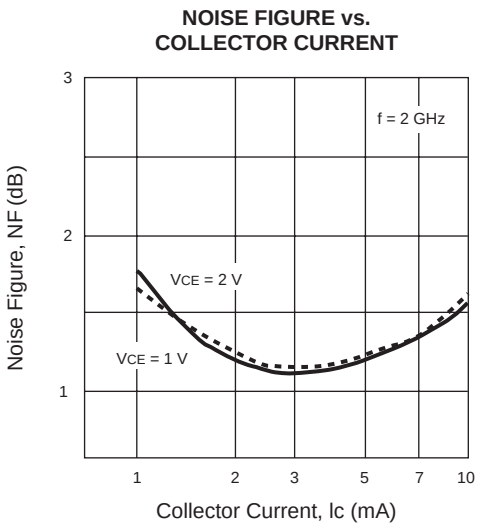
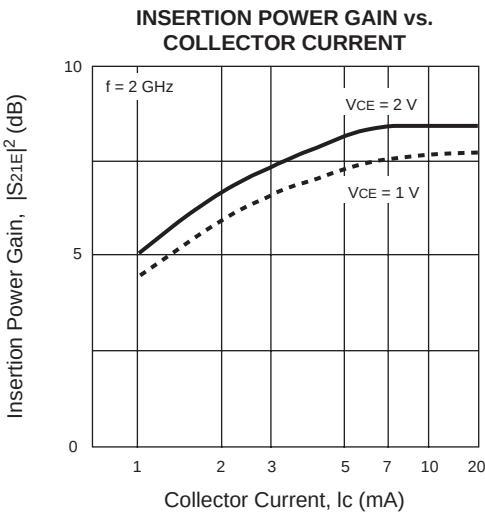
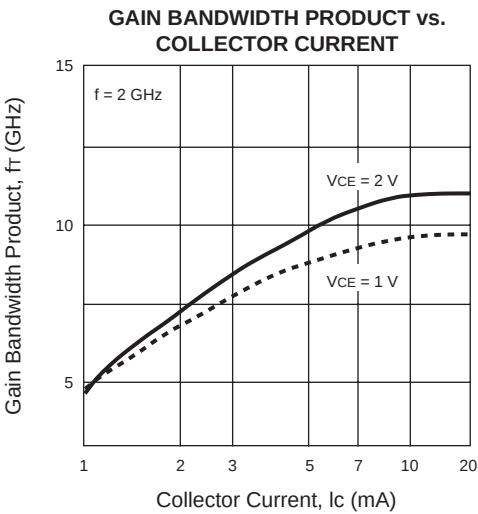
SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CBO}	Collector to Base Voltage	V	5
V _{CEO}	Collector to Emitter Voltage	V	3
V _{EBO}	Emitter to Base Voltage	V	2
I _C	Collector Current	mA	30
P _T	Total Power Dissipation 1 Element 2 Elements	mW mW	90 180
T _J	Junction Temperature	°C	150
T _{STG}	Storage Temperature	°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)



TYPICAL PERFORMANCE CURVES (T_A = 25°C)



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TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Q1

V_{CE} = 2 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	-6.87	2.42	171.77	0.02	84.43	0.99	-4.42
0.20	0.96	-13.71	2.40	164.17	0.04	79.61	0.99	-8.84
0.30	0.95	-20.79	2.42	157.17	0.07	74.54	0.97	-12.97
0.40	0.92	-27.69	2.39	150.27	0.09	69.50	0.95	-17.23
0.50	0.90	-34.82	2.39	143.98	0.10	65.17	0.92	-21.05
0.60	0.87	-42.10	2.36	138.23	0.12	60.29	0.90	-25.13
0.70	0.83	-49.35	2.34	132.19	0.14	56.25	0.87	-28.47
0.80	0.80	-56.87	2.32	126.78	0.15	52.12	0.84	-32.22
0.90	0.76	-64.78	2.32	120.75	0.16	48.48	0.81	-34.98
1.00	0.72	-72.15	2.26	115.35	0.17	45.16	0.77	-38.02
1.20	0.64	-88.71	2.22	104.80	0.18	38.79	0.72	-43.16
1.50	0.53	-115.63	2.10	89.64	0.20	31.12	0.63	-49.93
1.70	0.47	-133.52	1.99	80.39	0.20	27.37	0.59	-53.75
2.00	0.43	-161.16	1.81	68.21	0.20	23.31	0.53	-59.13
2.50	0.43	158.63	1.57	50.02	0.20	20.11	0.46	-67.98
3.00	0.48	131.49	1.35	35.61	0.20	20.44	0.41	-79.07

Q2

V_{CE} = 2 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	-6.74	2.44	171.33	0.02	84.61	0.99	-4.39
0.20	0.96	-13.51	2.41	163.49	0.04	79.80	0.98	-8.74
0.30	0.94	-20.37	2.43	156.32	0.06	74.82	0.96	-12.93
0.40	0.92	-27.07	2.39	149.41	0.08	69.31	0.94	-17.05
0.50	0.89	-33.96	2.39	143.02	0.10	65.85	0.91	-20.67
0.60	0.86	-40.84	2.37	137.27	0.12	61.45	0.88	-24.51
0.70	0.83	-47.75	2.34	131.22	0.13	57.88	0.85	-27.55
0.80	0.80	-54.58	2.32	125.82	0.14	54.28	0.81	-30.99
0.90	0.76	-61.78	2.31	119.93	0.15	51.24	0.78	-33.61
1.00	0.72	-68.15	2.25	114.65	0.16	48.38	0.74	-36.17
1.20	0.64	-82.34	2.20	104.41	0.18	43.56	0.68	-40.86
1.50	0.54	-103.94	2.09	90.06	0.19	38.22	0.60	-47.35
1.70	0.48	-117.50	1.98	81.41	0.20	35.84	0.54	-51.11
2.00	0.43	-138.81	1.84	69.85	0.21	33.47	0.48	-57.05
2.50	0.39	-171.15	1.64	52.42	0.22	32.53	0.38	-68.86
3.00	0.41	163.33	1.45	37.62	0.24	33.20	0.30	-86.04

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Q1

V_{CE} = 2 V, I_C = 5 mA, Z₀ = 50 Ω

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.87	-14.09	10.64	163.29	0.02	79.93	0.95	-11.97
0.20	0.81	-27.42	9.95	150.51	0.04	72.08	0.88	-22.31
0.30	0.73	-40.88	9.52	139.49	0.05	66.23	0.79	-30.28
0.40	0.64	-53.67	8.93	129.93	0.06	61.90	0.71	-36.76
0.50	0.55	-65.97	8.31	121.13	0.07	59.41	0.64	-41.09
0.60	0.48	-77.45	7.63	113.73	0.08	57.14	0.58	-45.05
0.70	0.40	-88.32	7.00	106.72	0.09	55.84	0.53	-47.68
0.80	0.34	-99.03	6.43	100.97	0.10	55.02	0.49	-50.09
0.90	0.30	-109.36	5.89	95.86	0.11	54.11	0.45	-52.09
1.00	0.26	-120.28	5.43	91.26	0.11	53.70	0.43	-53.78
1.20	0.21	-143.41	4.67	83.34	0.13	52.72	0.38	-57.08
1.50	0.20	-178.69	3.84	73.31	0.15	50.94	0.32	-62.84
1.70	0.21	162.38	3.42	67.63	0.16	49.64	0.30	-66.88
2.00	0.25	141.55	2.93	59.55	0.18	47.47	0.26	-74.05
2.50	0.32	120.25	2.38	47.59	0.22	43.28	0.21	-90.62
3.00	0.40	107.18	1.99	36.87	0.25	38.39	0.18	-114.1020

Q2

V_{CE} = 2 V, I_C = 5 mA, Z₀ = 50 Ω

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.87	-13.54	10.54	162.00	0.02	80.48	0.94	-11.69
0.20	0.80	-26.19	9.77	148.74	0.04	73.48	0.87	-21.26
0.30	0.72	-38.63	9.27	137.38	0.05	68.44	0.77	-27.99
0.40	0.63	-49.88	8.60	127.63	0.06	65.14	0.69	-32.99
0.50	0.54	-59.77	7.92	118.86	0.07	63.41	0.62	-35.87
0.60	0.47	-68.54	7.20	111.69	0.08	61.89	0.56	-38.30
0.70	0.41	-75.97	6.55	105.17	0.09	61.08	0.51	-39.59
0.80	0.35	-82.95	5.99	99.70	0.10	60.63	0.47	-40.79
0.90	0.31	-89.34	5.47	94.96	0.11	60.13	0.44	-41.55
1.00	0.28	-95.57	5.05	90.71	0.12	59.77	0.41	-42.06
1.20	0.23	-108.52	4.37	83.80	0.14	58.88	0.36	-43.16
1.50	0.18	-130.79	3.60	73.93	0.16	56.83	0.30	-45.15
1.70	0.17	-146.39	3.24	68.27	0.18	55.32	0.27	-46.69
2.00	0.18	-168.80	2.83	60.37	0.21	52.64	0.21	-49.56
2.50	0.22	163.35	2.35	48.33	0.26	47.65	0.13	-58.20
3.00	0.29	145.87	2.02	37.27	0.30	41.79	0.05	-87.46

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TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Q1

V_{CE} = 2 V, I_C = 10 mA, Z₀ = 50 Ω

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.75	-21.25	18.39	156.90	0.02	77.20	0.89	-17.80
0.20	0.64	-40.55	16.34	140.45	0.03	69.69	0.77	-30.80
0.30	0.51	-58.49	14.49	126.78	0.04	65.76	0.65	-38.64
0.40	0.41	-73.72	12.55	116.10	0.05	64.03	0.56	-43.82
0.50	0.32	-86.53	10.81	107.94	0.06	63.08	0.49	-46.87
0.60	0.26	-98.65	9.39	101.73	0.07	62.52	0.44	-49.28
0.70	0.22	-110.38	8.27	96.47	0.08	62.35	0.40	-50.98
0.80	0.19	-122.98	7.38	92.04	0.09	62.04	0.37	-52.53
0.90	0.16	-136.32	6.63	88.10	0.10	61.54	0.34	-53.99
1.00	0.15	-150.20	6.04	84.48	0.10	61.35	0.32	-55.48
1.20	0.14	-177.47	5.10	78.09	0.12	59.95	0.29	-58.71
1.50	0.17	152.02	4.13	69.70	0.15	57.49	0.25	-65.42
1.70	0.20	138.84	3.67	64.75	0.16	55.54	0.23	-70.84
2.00	0.24	125.28	3.13	57.58	0.19	52.37	0.20	-80.75
2.50	0.32	111.91	2.53	46.95	0.22	46.88	0.16	-104.52
3.00	0.39	102.41	2.12	36.99	0.26	40.73	0.15	-134.83

Q2

V_{CE} = 2 V, I_C = 10 mA, Z₀ = 50 Ω

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.75	-19.94	18.04	155.05	0.02	78.63	0.88	-16.88
0.20	0.63	-37.17	15.75	137.91	0.03	72.31	0.75	-27.99
0.30	0.50	-51.43	13.66	124.24	0.04	69.65	0.63	-33.45
0.40	0.40	-61.93	11.63	113.99	0.06	68.34	0.54	-36.33
0.50	0.33	-69.47	9.93	106.39	0.07	68.06	0.48	-37.48
0.60	0.28	-76.10	8.60	100.66	0.08	67.81	0.43	-38.05
0.70	0.24	-81.76	7.55	95.75	0.09	67.13	0.40	-38.12
0.80	0.21	-87.66	6.74	91.57	0.10	66.95	0.37	-38.22
0.90	0.18	-93.58	6.07	87.88	0.11	66.28	0.34	-38.12
1.00	0.16	-99.63	5.53	84.54	0.12	65.72	0.32	-38.04
1.20	0.13	-113.93	4.70	78.47	0.14	64.27	0.29	-38.23
1.50	0.11	-140.96	3.85	70.36	0.17	61.30	0.24	-39.44
1.70	0.12	-158.80	3.45	65.54	0.19	59.28	0.21	-40.33
2.00	0.14	179.16	2.99	58.43	0.22	55.73	0.16	-42.20
2.50	0.20	155.56	2.48	47.37	0.27	49.39	0.08	-46.33
3.00	0.27	141.08	2.11	36.88	0.31	42.38	0.00	134.74

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Q1

V_{CE} = 2 V, I_C = 20 mA, Z_o = 50 Ω

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.56	-32.81	27.95	148.87	0.02	75.30	0.81	-23.54
0.20	0.42	-58.87	22.23	128.52	0.03	70.35	0.64	-37.09
0.30	0.30	-78.37	17.58	115.09	0.04	68.59	0.51	-43.16
0.40	0.23	-94.58	14.16	106.19	0.05	68.35	0.43	-46.08
0.50	0.18	-109.66	11.73	99.79	0.06	68.61	0.38	-47.60
0.60	0.15	-124.96	9.97	94.85	0.07	68.48	0.34	-48.85
0.70	0.13	-140.67	8.66	90.57	0.08	68.04	0.31	-49.96
0.80	0.12	-156.60	7.65	86.95	0.08	67.57	0.29	-51.00
0.90	0.12	-171.52	6.85	83.61	0.09	66.89	0.27	-52.09
1.00	0.13	-175.13	6.20	80.43	0.10	66.27	0.26	-53.64
1.20	0.15	-154.42	5.21	74.78	0.12	64.40	0.24	-57.12
1.50	0.19	-135.04	4.20	67.22	0.15	61.17	0.21	-65.08
1.70	0.21	-126.81	3.73	62.80	0.17	58.57	0.19	-71.65
2.00	0.26	-117.40	3.17	55.90	0.19	55.05	0.17	-83.64
2.50	0.33	-107.46	2.55	46.23	0.23	48.66	0.14	-112.73
3.00	0.40	-99.59	2.14	36.41	0.27	42.04	0.14	-146.05

Q2

V_{CE} = 2 V, I_C = 20 mA, Z_o = 50 Ω

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.56	-29.15	27.12	146.32	0.02	77.78	0.80	-21.74
0.20	0.41	-48.92	20.90	125.74	0.03	74.05	0.63	-31.76
0.30	0.31	-60.35	16.10	113.19	0.04	72.89	0.51	-34.75
0.40	0.24	-68.27	12.87	104.89	0.05	73.12	0.44	-35.38
0.50	0.19	-74.29	10.65	98.93	0.06	72.74	0.39	-34.92
0.60	0.16	-80.26	9.05	94.42	0.07	72.28	0.36	-34.40
0.70	0.14	-85.96	7.87	90.42	0.08	71.80	0.33	-33.68
0.80	0.12	-92.36	6.97	86.91	0.09	71.03	0.31	-33.35
0.90	0.11	-99.97	6.25	83.77	0.11	70.29	0.29	-33.01
1.00	0.10	-107.48	5.67	80.84	0.12	69.37	0.28	-32.76
1.20	0.08	-126.82	4.79	75.44	0.14	67.25	0.25	-32.69
1.50	0.09	-159.16	3.92	68.12	0.17	63.75	0.21	-33.54
1.70	0.10	-175.51	3.50	63.56	0.19	61.27	0.18	-34.18
2.00	0.13	-167.06	3.03	56.95	0.22	57.22	0.14	-34.48
2.50	0.20	-149.55	2.50	46.34	0.27	50.20	0.06	-30.22
3.00	0.28	-137.58	2.13	35.99	0.32	42.85	0.03	93.61

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
UPA828TF-T1	3000	Tape & Reel

