

NPN SILICON HIGH FREQUENCY TRANSISTOR

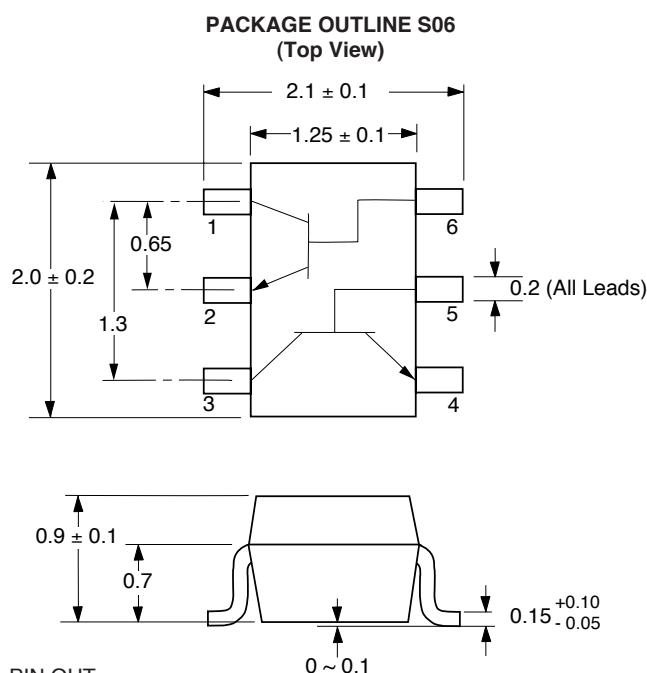
FEATURES

- **SMALL PACKAGE STYLE:**
2 NE681 Die in a 2 mm x 1.25 mm package
- **LOW NOISE FIGURE:**
NF = 1.4 dB TYP at 1 GHz
- **HIGH GAIN:**
 $IS_{21EI}^2 = 12$ dB TYP at 1 GHz
- **HIGH GAIN BANDWIDTH:** $f_T = 7$ GHz
- **LOW CURRENT OPERATION**

DESCRIPTION

The UPA802T is two NPN high frequency silicon epitaxial transistors encapsulated in an ultra small 6 pin SMT package. Each transistor is independently mounted and easily configured for either dual transistor or cascode operation. The high f_T , low voltage bias and small size make this device suited for various hand-held wireless applications.

OUTLINE DIMENSIONS (Units in mm)



ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			UPA802T S06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I _{CBO}	Collector Cutoff Current at V _{CB} = 10 V, I _E = 0	μA			0.8
I _{EBO}	Emitter Cutoff Current at V _{EB} = 1 V, I _C = 0	μA			0.8
h _{FE} ¹	Forward Current Gain at V _{CE} = 3 V, I _C = 7 mA		70	100	240
f _T	Gain Bandwidth at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	GHz	4.5	7.0	
C _{re} ²	Feedback Capacitance at V _{CB} = 3 V, I _E = 0, f = 1 MHz	pF			0.9
IS _{21EI} ²	Insertion Power Gain at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	dB	10	12	
NF	Noise Figure at V _{CE} = 3 V, I _C = 7 mA, f = 1 GHz	dB		1.4	1.7
h _{FE1} /h _{FE2}	h _{FE} Ratio: h _{FE1} = Smaller Value of Q ₁ , or Q ₂ h _{FE2} = Larger Value of Q ₁ or Q ₂		0.85		

Notes: 1. Pulsed measurement, pulse width ≤ 350 μs, duty cycle ≤ 2 %.

2. The emitter terminal should be connected to the ground terminal of the 3 terminal capacitance bridge.

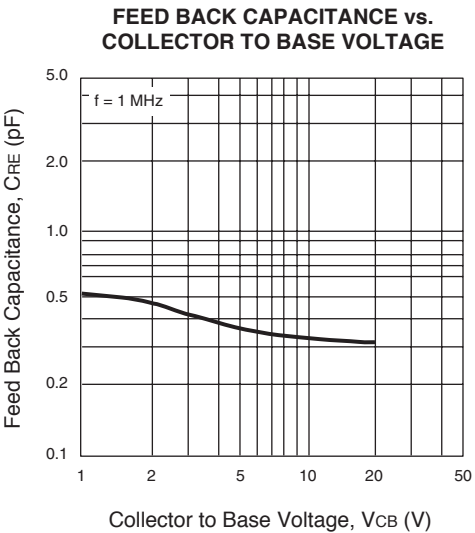
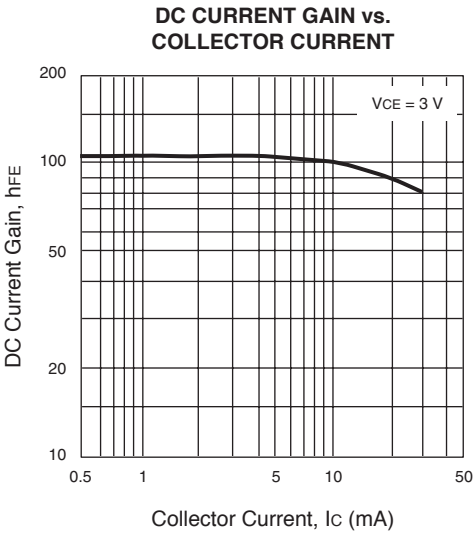
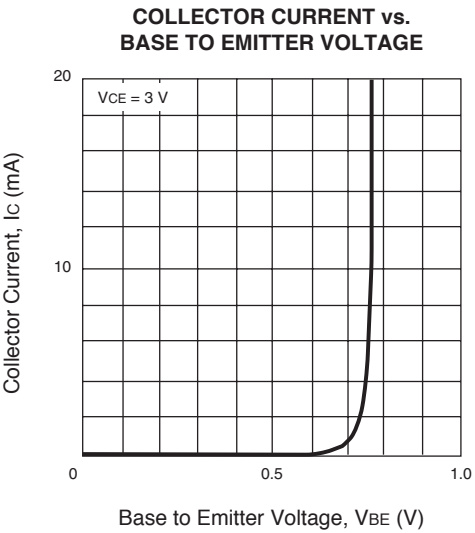
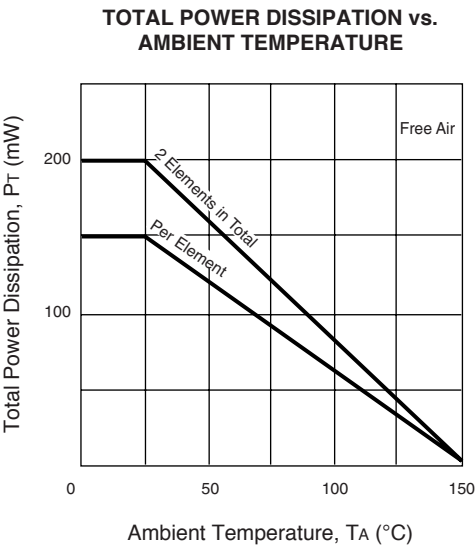
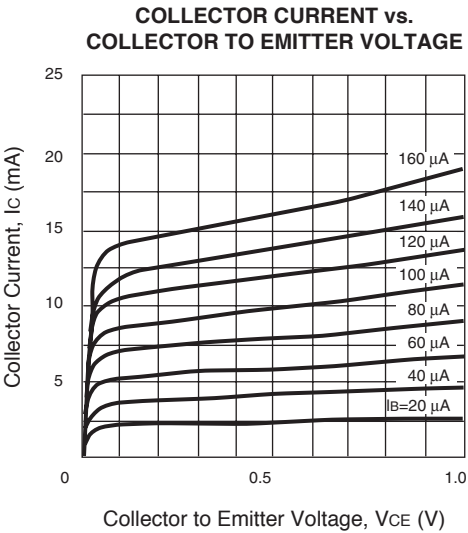
For Tape and Reel version use part number UPA802T-T1, 3K per reel.

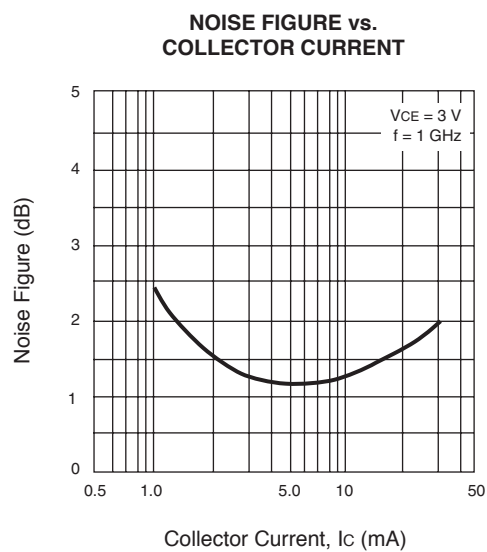
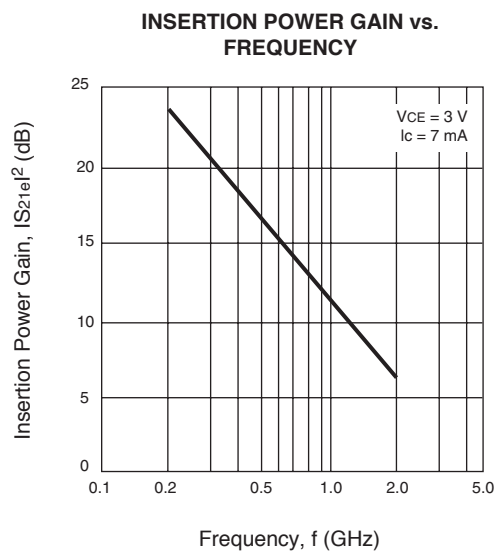
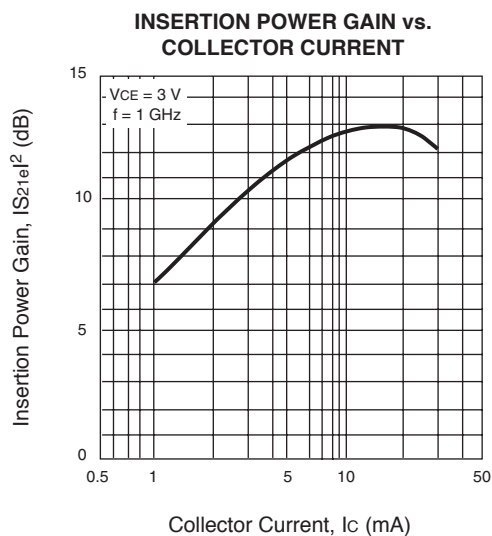
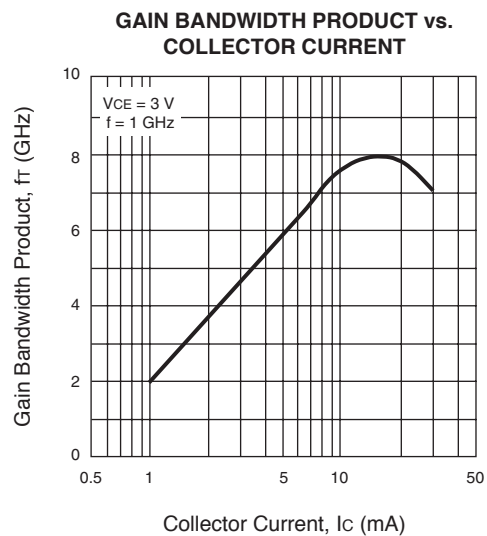
ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

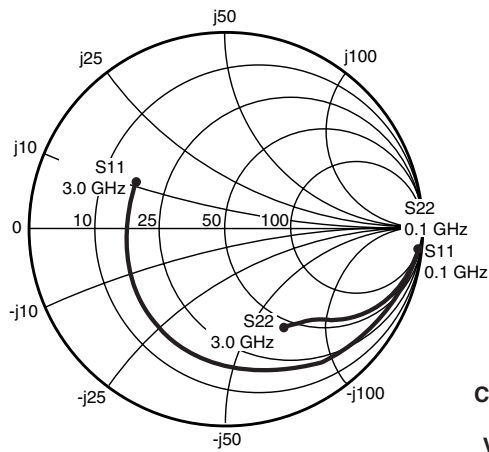
SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CB0}	Collector to Base Voltage	V	20
V _{CE0}	Collector to Emitter Voltage	V	10
V _{EB0}	Emitter to Base Voltage	V	1.5
I _C	Collector Current	mA	65
PT	Total Power Dissipation 1 Die 2 Die	mW mW	110 200
T _J	Junction Temperature	°C	150
T _{STG}	Storage Temperature	°C	-65 to +150

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

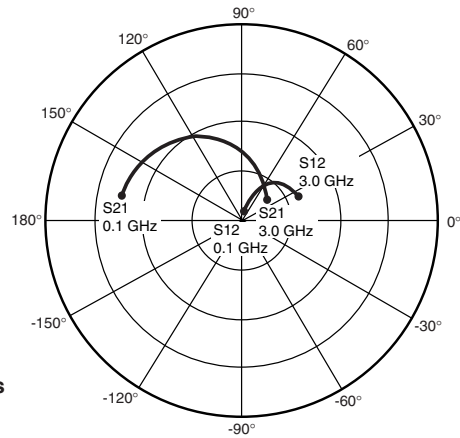
TYPICAL PERFORMANCE CURVES (T_A = 25°C)



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

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Coordinates in Ohms
Frequency in GHz
V_{CE} = 1 V, I_c = 1 mA
Z₀ = 50 Ω



UPA802T(Q1)

V_{CE} = 1 V, I_c = 1 mA

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	Gmag
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.958	-15.16	3.187	166.69	0.032	79.93	0.988	-6.58	0.09	19.96
0.20	0.928	-28.69	3.093	156.52	0.062	71.38	0.963	-12.80	0.13	16.97
0.40	0.848	-55.75	2.811	136.55	0.108	55.84	0.888	-22.64	0.24	14.15
0.60	0.760	-78.46	2.474	120.48	0.136	44.42	0.814	-29.45	0.35	12.60
0.80	0.687	-97.04	2.147	107.67	0.150	36.37	0.754	-34.20	0.47	11.54
1.00	0.633	-112.40	1.863	97.49	0.157	30.81	0.714	-37.74	0.58	10.75
1.20	0.596	-125.48	1.654	88.81	0.157	27.29	0.679	-40.65	0.71	10.23
1.40	0.569	-136.93	1.479	81.45	0.155	25.10	0.659	-43.13	0.84	9.79
1.60	0.551	-147.13	1.341	75.09	0.150	24.63	0.642	-45.30	0.98	9.51
1.80	0.540	-156.65	1.225	69.42	0.146	24.53	0.635	-47.38	1.11	7.24
2.00	0.531	-165.70	1.132	64.10	0.140	26.86	0.624	-49.27	1.27	5.96
2.20	0.526	-174.27	1.055	59.52	0.136	29.55	0.620	-51.13	1.40	5.14
2.40	0.520	-177.45	0.992	55.07	0.133	34.37	0.610	-53.10	1.54	4.38
2.60	0.520	-169.16	0.930	51.37	0.132	39.26	0.607	-54.72	1.64	3.77
2.80	0.517	-161.23	0.880	47.57	0.135	45.21	0.602	-56.65	1.71	3.21
3.00	0.520	-153.22	0.836	44.36	0.142	50.87	0.594	-58.18	1.74	2.70

Note:

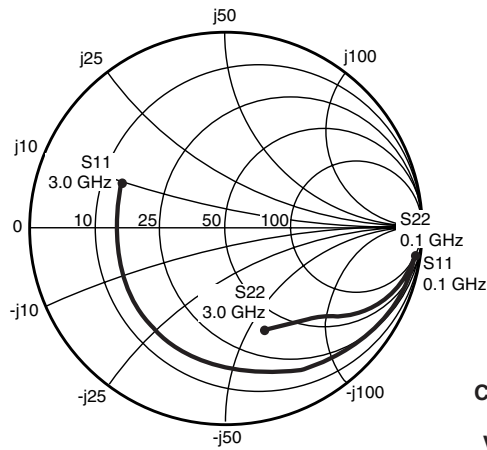
1. Gain Calculation:

$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

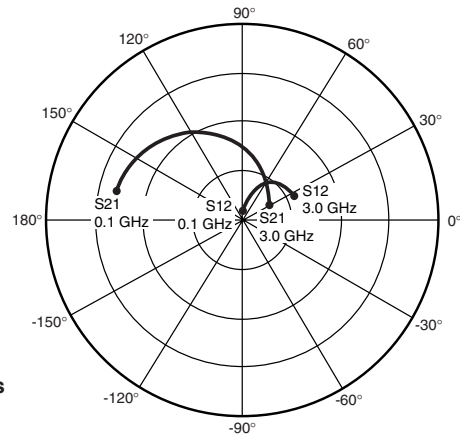
MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



Coordinates in Ohms
Frequency in GHz
V_{CE} = 1 V, I_c = 1 mA
Z₀ = 50 Ω



UPA802T(Q2)

V_{CE} = 1 V, I_c = 1 mA

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	Gmag
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.957	-14.40	3.197	167.02	0.030	80.47	0.989	-6.14	0.09	20.25
0.20	0.931	-28.20	3.113	157.17	0.059	71.80	0.966	-12.02	0.13	17.25
0.40	0.856	-55.36	2.858	137.29	0.103	56.14	0.894	-21.53	0.23	14.41
0.60	0.770	-78.82	2.541	120.96	0.132	44.20	0.819	-28.30	0.34	12.86
0.80	0.697	-98.60	2.222	107.64	0.147	35.41	0.756	-33.20	0.46	11.80
1.00	0.646	-115.24	1.934	96.85	0.154	29.00	0.710	-37.02	0.57	11.00
1.20	0.611	-129.46	1.718	87.54	0.154	24.60	0.670	-40.30	0.70	10.47
1.40	0.590	-141.68	1.533	79.60	0.153	21.50	0.645	-43.31	0.82	10.02
1.60	0.579	-152.33	1.383	72.70	0.148	20.19	0.623	-46.01	0.97	9.72
1.80	0.575	-161.59	1.258	66.56	0.144	19.08	0.615	-49.02	1.08	7.65
2.00	0.574	-170.02	1.158	60.84	0.137	20.45	0.600	-51.86	1.25	6.29
2.20	0.576	-177.47	1.071	55.92	0.131	22.10	0.594	-54.76	1.38	5.42
2.40	0.576	175.74	1.002	51.22	0.126	26.20	0.580	-57.65	1.56	4.60
2.60	0.580	169.40	0.938	47.30	0.124	30.61	0.578	-60.58	1.67	4.00
2.80	0.579	163.57	0.884	43.32	0.124	36.59	0.572	-63.54	1.78	3.41
3.00	0.581	157.88	0.839	39.98	0.128	42.78	0.563	-66.31	1.84	2.87

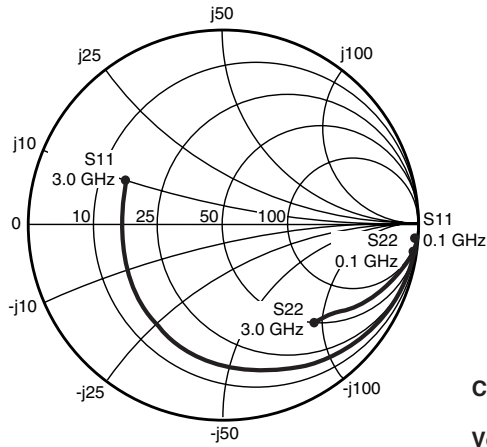
Note:

1. Gain Calculation:

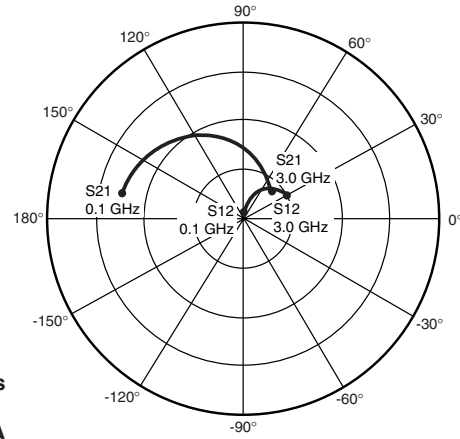
$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

Coordinates in Ohms
Frequency in GHz
V_{CE} = 2.5 V, I_c = 1 mA
Z₀ = 50 Ω



UPA802T(Q1)

V_{CE} = 2.5 V, I_c = 1 mA

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	Gmag
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.961	-13.74	3.109	167.68	0.025	81.01	0.992	-5.18	0.09	21.01
0.20	0.936	-25.96	3.034	158.68	0.048	73.40	0.973	-10.17	0.12	18.03
0.40	0.866	-51.02	2.803	140.07	0.085	58.87	0.915	-18.43	0.23	15.20
0.60	0.784	-72.59	2.512	124.70	0.108	47.90	0.854	-24.40	0.33	13.65
0.80	0.709	-90.73	2.212	112.14	0.121	40.02	0.803	-28.70	0.45	12.61
1.00	0.652	-106.09	1.938	102.04	0.127	34.59	0.767	-31.93	0.56	11.83
1.20	0.609	-119.38	1.731	93.28	0.128	31.16	0.736	-34.55	0.70	11.31
1.40	0.578	-131.20	1.553	85.91	0.127	29.20	0.717	-36.80	0.83	10.88
1.60	0.556	-141.82	1.408	79.52	0.123	28.96	0.701	-38.74	0.97	10.59
1.80	0.540	-151.78	1.289	73.82	0.119	29.44	0.694	-40.60	1.11	8.33
2.00	0.528	-161.28	1.188	68.51	0.115	32.25	0.684	-42.21	1.28	7.00
2.20	0.519	-170.30	1.105	63.86	0.111	35.73	0.680	-43.79	1.42	6.13
2.40	0.512	-179.05	1.037	59.43	0.110	41.40	0.670	-45.38	1.56	5.34
2.60	0.508	172.23	0.970	55.60	0.110	47.08	0.668	-46.67	1.66	4.70
2.80	0.505	163.81	0.915	51.86	0.114	53.76	0.664	-48.22	1.71	4.12
3.00	0.506	155.42	0.868	48.52	0.121	59.74	0.658	-49.36	1.72	3.60

Note:

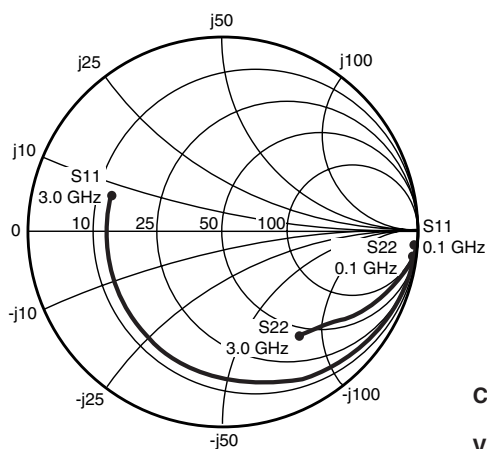
1. Gain Calculation:

$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

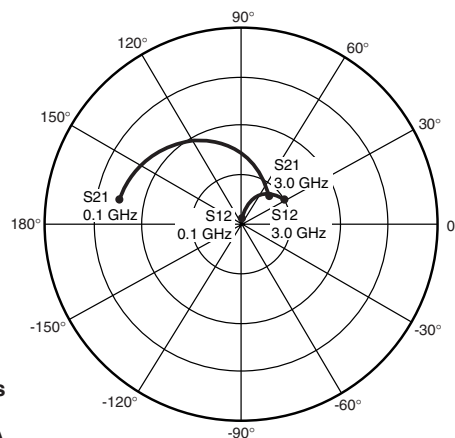
MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



Coordinates in Ohms
Frequency in GHz
V_{CE} = 2.5 V, I_C = 1 mA
Z₀ = 50 Ω



UPA802T(Q2)

V_{CE} = 2.5 V, I_C = 1 mA

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	Gmag
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.960	-12.87	3.120	168.01	0.023	81.72	0.993	-4.73	0.09	21.39
0.20	0.939	-25.48	3.052	159.33	0.044	73.80	0.976	-9.36	0.12	18.40
0.40	0.873	-50.50	2.847	140.93	0.079	59.29	0.922	-17.18	0.22	15.55
0.60	0.793	-72.66	2.579	125.40	0.103	47.91	0.862	-23.00	0.33	14.00
0.80	0.719	-91.93	2.290	112.39	0.116	39.33	0.809	-27.36	0.44	12.96
1.00	0.664	-108.57	2.015	101.75	0.122	33.12	0.769	-30.79	0.55	12.17
1.20	0.624	-123.04	1.803	92.38	0.124	28.81	0.734	-33.73	0.68	11.64
1.40	0.598	-135.77	1.616	84.42	0.123	25.96	0.711	-36.46	0.81	11.20
1.60	0.582	-146.93	1.460	77.51	0.119	24.89	0.691	-38.85	0.96	10.90
1.80	0.574	-156.82	1.331	71.33	0.115	24.36	0.682	-41.54	1.09	8.83
2.00	0.570	-165.76	1.222	65.61	0.110	26.19	0.669	-44.01	1.26	7.41
2.20	0.570	-173.69	1.129	60.65	0.106	28.67	0.663	-46.54	1.41	6.49
2.40	0.569	179.04	1.055	55.96	0.102	33.64	0.649	-48.97	1.59	5.63
2.60	0.570	172.27	0.985	51.94	0.101	39.03	0.648	-51.47	1.70	5.02
2.80	0.569	166.04	0.927	48.02	0.103	45.91	0.641	-53.98	1.79	4.40
3.00	0.569	160.07	0.878	44.54	0.107	52.65	0.634	-56.30	1.83	3.85

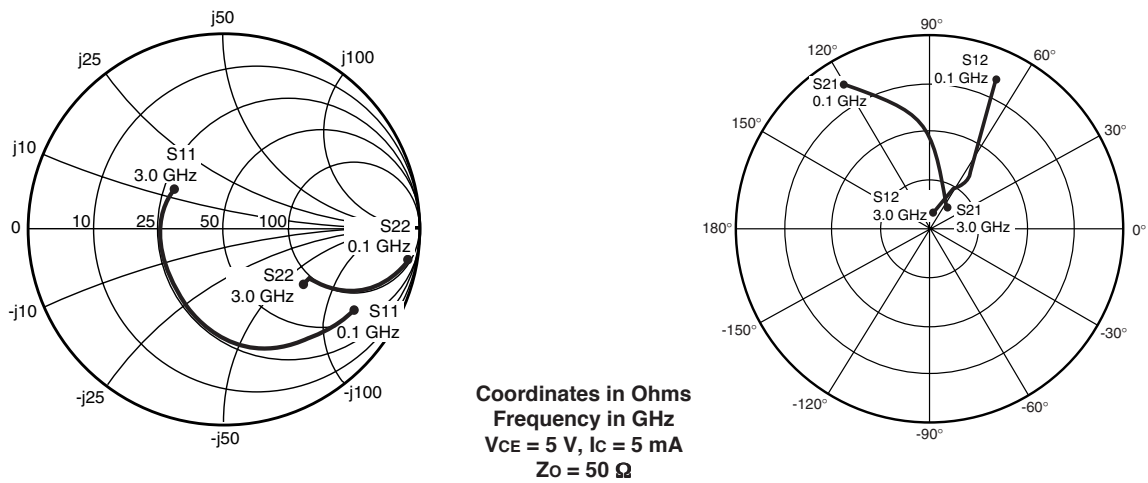
Note:

1. Gain Calculation:

$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

UPA802T(Q1)

V_{CE} = 5 V, I_c = 5 mA

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	Gmag
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.824	-25.25	13.043	159.74	0.019	76.03	0.956	-11.30	0.15	28.42
0.20	0.738	-47.27	11.730	143.72	0.033	65.58	0.867	-19.95	0.27	25.47
0.40	0.566	-83.01	8.848	120.53	0.050	54.81	0.704	-28.18	0.50	22.47
0.60	0.457	-107.67	6.700	106.46	0.060	52.18	0.610	-30.60	0.70	20.51
0.80	0.395	-125.58	5.286	97.09	0.067	52.99	0.561	-31.32	0.86	18.97
1.00	0.358	-139.68	4.336	90.05	0.074	55.02	0.536	-31.84	0.99	17.66
1.20	0.335	-151.26	3.675	84.25	0.082	57.29	0.522	-32.43	1.08	14.80
1.40	0.318	-161.37	3.186	79.25	0.090	59.48	0.516	-33.24	1.14	13.17
1.60	0.309	-170.29	2.819	74.86	0.099	61.60	0.513	-33.99	1.19	11.94
1.80	0.300	-178.64	2.525	70.74	0.108	63.26	0.513	-34.99	1.22	10.89
2.00	0.294	173.52	2.291	66.94	0.117	64.82	0.514	-35.94	1.23	10.00
2.20	0.290	166.20	2.100	63.40	0.128	65.97	0.516	-36.91	1.24	9.23
2.40	0.288	159.02	1.942	59.98	0.138	67.03	0.516	-38.01	1.24	8.52
2.60	0.289	151.93	1.804	56.88	0.149	67.72	0.516	-38.86	1.24	7.89
2.80	0.290	145.02	1.689	53.83	0.160	68.34	0.516	-39.93	1.23	7.33
3.00	0.295	138.35	1.587	50.95	0.172	68.64	0.514	-40.64	1.23	6.78

Note:

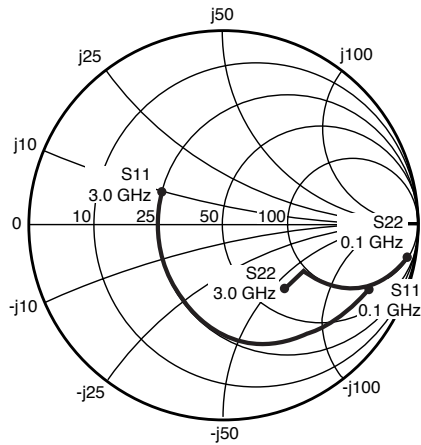
1. Gain Calculation:

$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

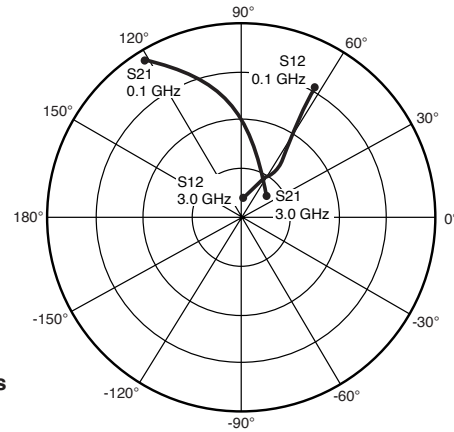
MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



Coordinates in Ohms
Frequency in GHz
V_{CE} = 5 V, I_c = 5 mA
Z₀ = 50 Ω



UPA802T(Q2)

V_{CE} = 5 V, I_c = 5 mA

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	Gmag
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.823	-24.36	13.414	160.23	0.017	76.18	0.959	-10.44	0.15	28.98
0.20	0.743	-46.52	12.139	144.45	0.030	65.94	0.877	-18.55	0.26	26.02
0.40	0.575	-82.78	9.280	121.05	0.046	54.57	0.717	-26.47	0.49	23.03
0.60	0.467	-108.62	7.075	106.49	0.055	51.23	0.621	-28.79	0.69	21.10
0.80	0.408	-127.86	5.599	96.62	0.062	51.37	0.568	-29.56	0.85	19.57
1.00	0.377	-143.07	4.595	89.14	0.068	52.88	0.537	-30.23	0.98	18.27
1.20	0.362	-155.37	3.896	82.94	0.075	54.71	0.518	-31.06	1.08	15.41
1.40	0.354	-165.68	3.376	77.52	0.082	56.53	0.506	-32.27	1.15	13.76
1.60	0.352	-174.22	2.977	72.75	0.090	58.55	0.497	-33.34	1.20	12.47
1.80	0.353	178.37	2.666	68.30	0.098	59.82	0.492	-35.02	1.23	11.45
2.00	0.356	171.97	2.416	64.18	0.107	61.15	0.488	-36.66	1.25	10.54
2.20	0.358	166.50	2.210	60.30	0.115	62.13	0.485	-38.36	1.26	9.75
2.40	0.360	161.52	2.038	56.62	0.125	63.09	0.480	-40.00	1.27	9.00
2.60	0.363	157.00	1.893	53.22	0.135	63.71	0.479	-41.73	1.27	8.38
2.80	0.364	152.78	1.770	49.89	0.145	64.24	0.477	-43.44	1.26	7.79
3.00	0.364	148.84	1.663	46.72	0.156	64.58	0.473	-44.93	1.26	7.23

Note:

1. Gain Calculation:

$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
UPA802T-T1-A	3000	Tape & Reel

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