

NPN SILICON HIGH FREQUENCY TRANSISTOR

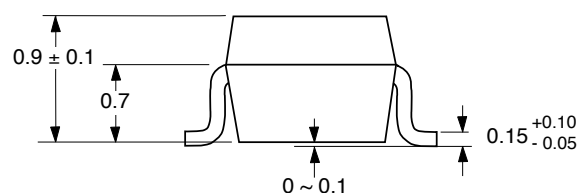
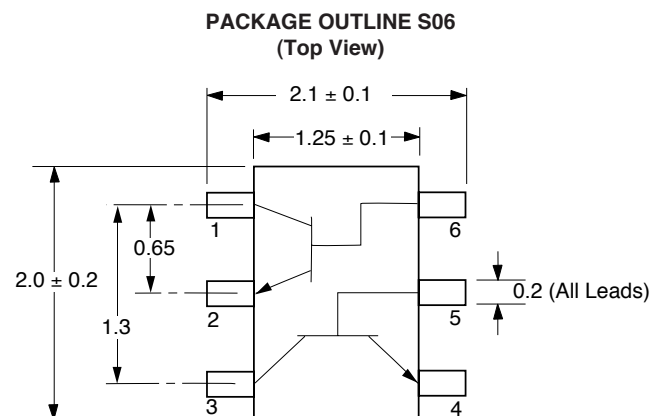
FEATURES

- **SMALL PACKAGE STYLE:**
2 NE686 Die in a 2 mm x 1.25 mm package
- **LOW NOISE FIGURE:**
NF = 1.5 dB TYP at 2 GHz
- **HIGH GAIN:**
 $IS_{21EI}^2 = 9$ dB TYP at 2 GHz
- **HIGH GAIN BANDWIDTH:** $f_T = 13$ GHz
- **LOW CURRENT OPERATION**

DESCRIPTION

The UPA807T 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)



PIN OUT

1. Collector Transistor 1
2. Emitter Transistor 1
3. Collector Transistor 2
4. Emitter Transistor 2
5. Base Transistor 2
6. Base Transistor 1

Note:

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

ELECTRICAL CHARACTERISTICS (TA = 25°C)

PART NUMBER PACKAGE OUTLINE			UPA807T S06		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
ICBO	Collector Cutoff Current at VCB = 5 V, IE = 0	μA			0.1
IEBO	Emitter Cutoff Current at VEB = 1 V, IC = 0	μA			0.1
hFE ¹	Forward Current Gain at VCE = 2 V, IC = 7 mA		70	100	140
fT	Gain Bandwidth at VCE = 2 V, IC = 7 mA, f = 2 GHz	GHz	10	13	
Cre ²	Feedback Capacitance at VCB = 2 V, IE = 0, f = 1 MHz	pF		0.4	0.6
IS _{21EI} ²	Insertion Power Gain at VCE = 2 V, IC = 7 mA, f = 2 GHz	dB	7.5	9	
NF	Noise Figure at VCE = 2 V, IC = 3 mA, f = 2 GHz	dB		1.5	2
hFE1/hFE2	hFE Ratio: hFE1 = Smaller Value of Q1, or Q2 hFE2 = Larger Value of Q1 or Q2		0.85		

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

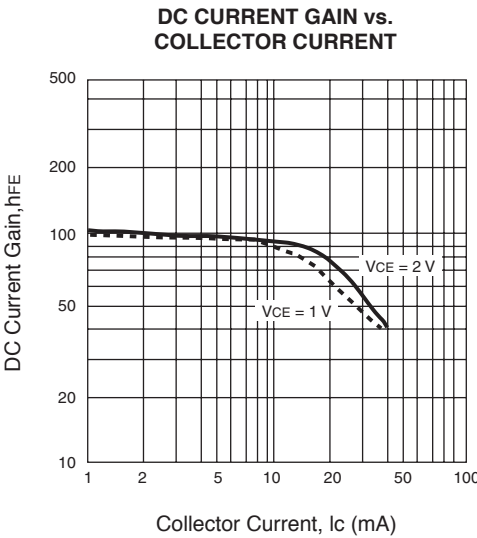
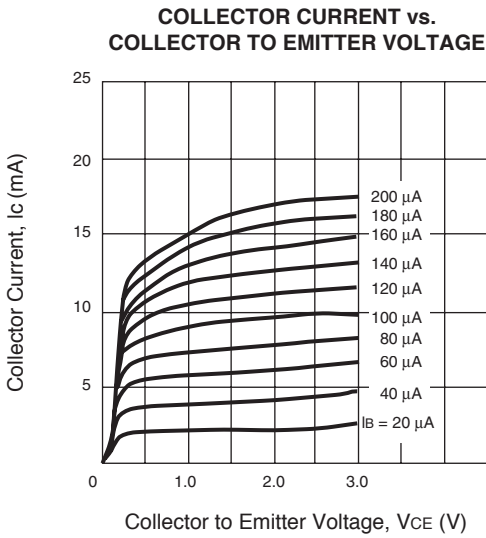
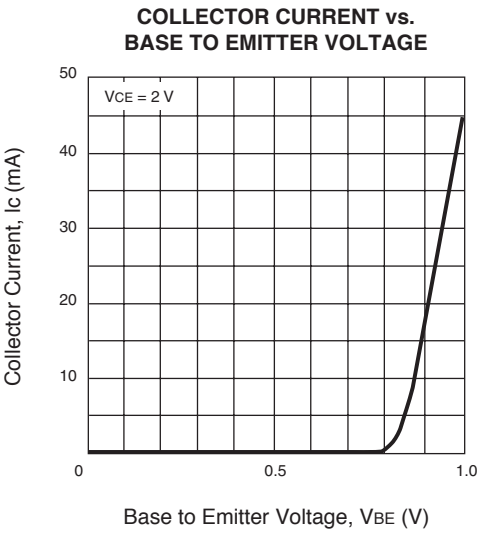
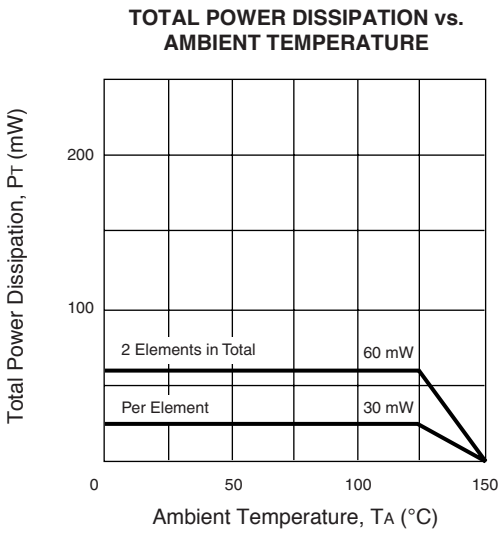
2. The emitter terminal should be connected to the ground terminal of the 3 terminal capacitance bridge. For Tape and Reel version use part number UPA807T-T1, 3K per reel.

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

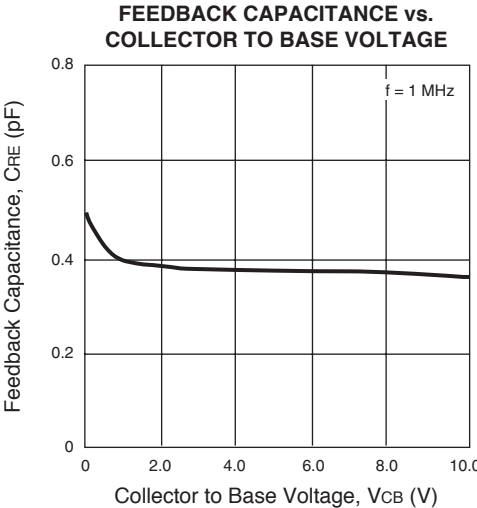
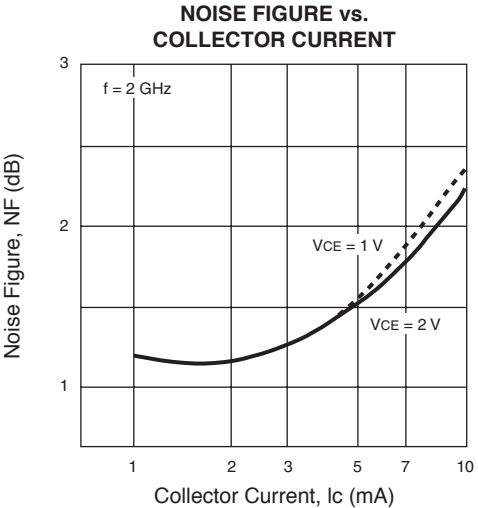
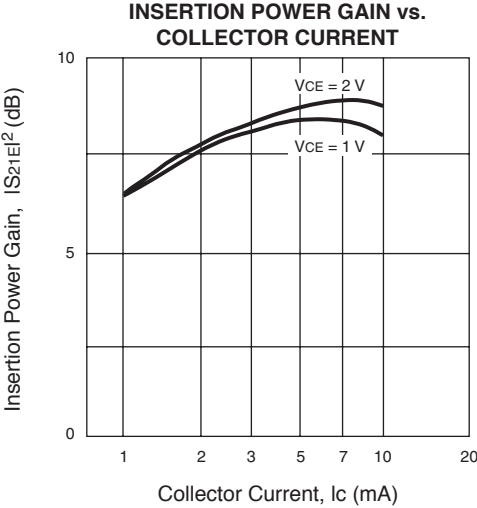
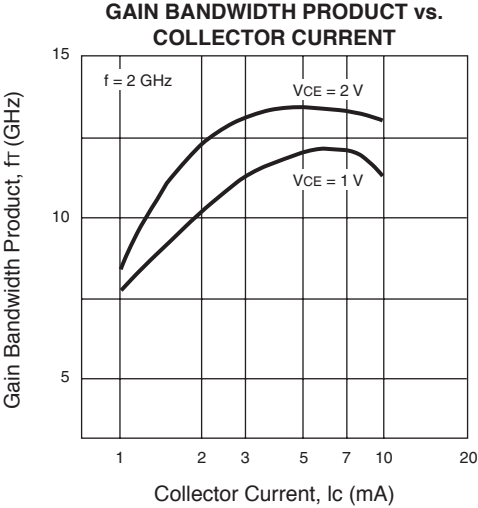
SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CBO}	Collector to Base Voltage	V	5
V _{CEO}	Collector to Emitter Voltage	V	3
V _{EBO}	Emitter to Base Voltage	V	2
I _C	Collector Current	mA	10
PT	Total Power Dissipation		
	1 Die	mW	30
	2 Die	mW	60
T _J	Junction Temperature	°C	150
T _{STG}	Storage Temperature	°C	-65 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)



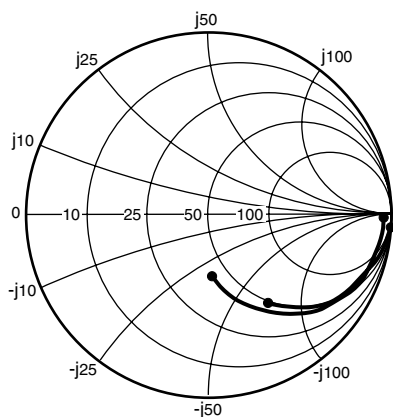
TYPICAL PERFORMANCE CURVES (T_A = 25°C)



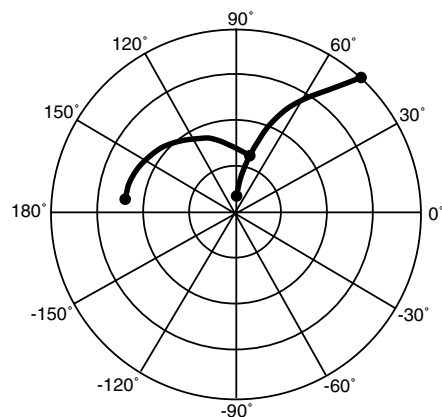
ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKAGING
UPA807T-T1-A	3000	Tape & Reel

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



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



UPA807T (Q1)

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

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.10	0.962	-1.96	3.029	171.72	0.018	87.63	0.990	-4.09	0.12	22.34
0.20	0.958	-8.94	3.004	168.23	0.035	82.52	0.984	-8.20	0.10	19.32
0.40	0.928	-18.56	2.938	157.25	0.068	74.99	0.960	-15.88	0.18	16.36
0.60	0.882	-27.04	2.842	147.17	0.097	68.55	0.924	-22.75	0.26	14.68
0.80	0.827	-35.09	2.709	137.91	0.121	62.88	0.883	-28.64	0.34	13.50
1.00	0.773	-42.12	2.535	129.87	0.141	58.23	0.843	-33.47	0.41	12.55
1.20	0.712	-48.31	2.414	122.20	0.157	54.56	0.801	-37.66	0.49	11.88
1.40	0.659	-53.74	2.271	115.57	0.170	51.59	0.768	-40.97	0.57	11.25
1.60	0.611	-58.52	2.136	109.66	0.181	49.24	0.735	-43.79	0.64	10.72
1.80	0.564	-62.92	2.027	104.33	0.192	47.40	0.714	-45.97	0.69	10.24
2.00	0.524	-66.81	1.917	99.44	0.200	45.99	0.687	-47.98	0.75	9.83
2.20	0.483	-70.60	1.820	94.75	0.208	44.89	0.670	-49.35	0.81	9.42
2.40	0.448	-73.91	1.757	90.45	0.214	44.05	0.645	-51.30	0.86	9.14
2.60	0.415	-77.47	1.688	86.67	0.223	43.32	0.630	-52.33	0.90	8.80
2.80	0.381	-80.66	1.628	82.67	0.229	42.65	0.613	-53.75	0.94	8.51
3.00	0.347	-83.65	1.585	79.07	0.236	42.57	0.591	-54.67	0.99	8.27

Note:

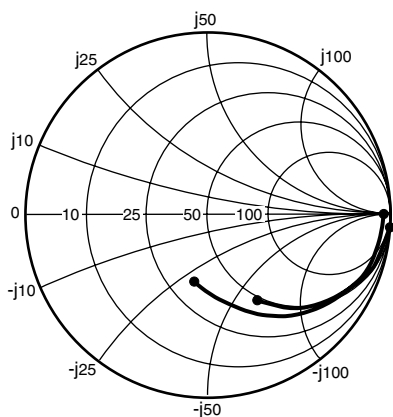
1. Gain Calculation:

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

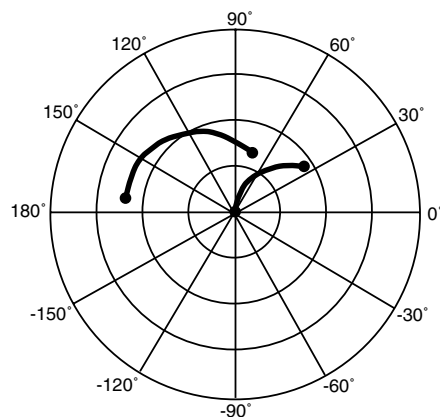
MAG = Maximum Available Gain

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



UPA807T (Q2)

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

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.10	0.962	-1.62	3.023	171.92	0.016	87.99	0.991	-3.62	0.12	22.83
0.20	0.961	-8.30	3.003	169.06	0.031	83.15	0.986	-7.34	0.09	19.80
0.40	0.935	-17.55	2.965	158.69	0.061	75.84	0.966	-14.42	0.17	16.84
0.60	0.894	-25.92	2.901	148.92	0.089	69.44	0.933	-20.98	0.25	15.15
0.80	0.843	-34.30	2.802	139.68	0.112	63.47	0.895	-26.92	0.32	13.97
1.00	0.792	-42.05	2.655	131.42	0.133	58.23	0.854	-32.14	0.39	13.01
1.20	0.730	-49.34	2.562	123.21	0.149	53.82	0.810	-36.91	0.47	12.35
1.40	0.675	-56.19	2.433	115.91	0.164	49.96	0.771	-40.99	0.54	11.72
1.60	0.624	-62.66	2.299	109.23	0.175	46.69	0.732	-44.55	0.61	11.18
1.80	0.574	-69.02	2.192	103.07	0.187	43.83	0.705	-47.64	0.66	10.70
2.00	0.533	-74.95	2.075	97.38	0.194	41.40	0.672	-50.59	0.72	10.29
2.20	0.493	-81.05	1.963	91.97	0.202	39.35	0.651	-52.80	0.78	9.87
2.40	0.462	-86.73	1.892	86.96	0.207	37.57	0.618	-55.53	0.83	9.60
2.60	0.435	-92.36	1.811	82.44	0.215	35.93	0.601	-57.47	0.87	9.26
2.80	0.410	-97.78	1.738	77.88	0.220	34.54	0.579	-59.60	0.92	8.98
3.00	0.385	-102.79	1.684	73.70	0.224	33.79	0.554	-61.25	0.96	8.76

Note:

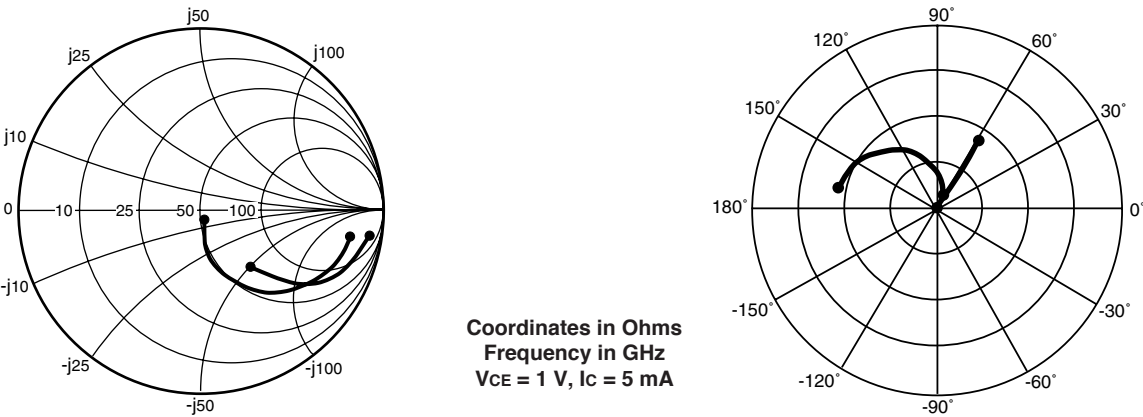
1. Gain Calculation:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (TA = 25°C)



UPA807T (Q1)
VCE = 1 V, Ic = 5 mA

FREQUENCY (GHz)	S11		S21		S12		S22		K	MAG (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.10	0.843	-10.23	11.043	167.54	0.017	83.02	0.955	-8.79	0.17	28.22
0.20	0.801	-22.30	10.550	156.06	0.032	76.32	0.913	-17.15	0.23	25.17
0.40	0.671	-41.12	9.111	136.87	0.056	67.09	0.793	-29.51	0.41	22.10
0.60	0.539	-54.78	7.622	122.59	0.073	62.22	0.683	-37.01	0.58	20.17
0.80	0.432	-64.35	6.368	112.11	0.087	60.06	0.601	-41.11	0.71	18.66
1.00	0.352	-71.08	5.396	104.18	0.099	59.29	0.545	-43.29	0.82	17.38
1.20	0.289	-75.50	4.664	97.80	0.110	59.27	0.506	-44.41	0.90	16.28
1.40	0.240	-78.43	4.095	92.46	0.121	59.38	0.481	-45.06	0.97	15.28
1.60	0.202	-80.40	3.653	87.93	0.132	59.61	0.464	-45.41	1.01	13.67
1.80	0.169	-80.85	3.293	83.81	0.144	59.70	0.454	-45.76	1.05	12.21
2.00	0.142	-80.11	3.000	80.15	0.155	59.82	0.446	-46.04	1.08	11.14
2.20	0.120	-78.17	2.763	76.75	0.167	59.82	0.441	-46.36	1.10	10.27
2.40	0.102	-74.75	2.561	73.55	0.179	59.77	0.435	-46.95	1.12	9.48
2.60	0.086	-70.60	2.390	70.71	0.191	59.58	0.431	-47.34	1.13	8.81
2.80	0.072	-64.00	2.245	67.87	0.203	59.26	0.427	-48.13	1.14	8.19
3.00	0.060	-54.64	2.120	65.23	0.215	58.85	0.421	-48.55	1.15	7.63

Note:

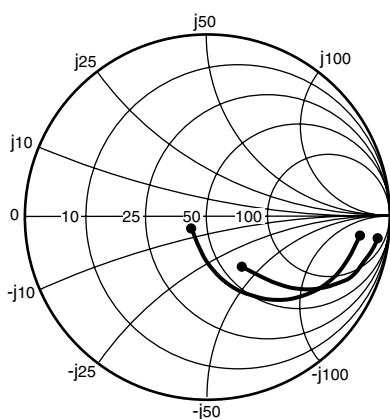
1. Gain Calculation:

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

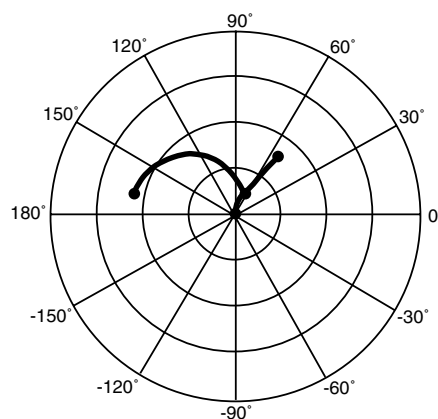
MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



Coordinates in Ohms
Frequency in GHz
V_{CE} = 1 V, I_c = 5 mA



UPA807T (Q2)

V_{CE} = 1 V, I_c = 5 mA

FREQUENCY (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.10	0.845	-9.27	11.074	168.45	0.015	83.57	0.959	-7.84	0.16	28.73
0.20	0.809	-20.93	10.667	157.61	0.029	77.02	0.923	-15.57	0.22	25.67
0.40	0.693	-39.56	9.418	138.92	0.052	67.56	0.813	-27.50	0.39	22.61
0.60	0.565	-54.11	8.044	124.38	0.068	61.85	0.703	-35.26	0.55	20.73
0.80	0.456	-65.39	6.815	113.27	0.081	58.78	0.616	-39.97	0.69	19.26
1.00	0.373	-74.54	5.823	104.66	0.092	57.19	0.551	-42.88	0.79	18.02
1.20	0.305	-82.21	5.060	97.61	0.102	56.47	0.502	-44.74	0.88	16.95
1.40	0.254	-89.32	4.457	91.64	0.112	55.99	0.467	-46.16	0.95	15.98
1.60	0.214	-96.11	3.972	86.49	0.123	55.83	0.440	-47.03	1.01	14.55
1.80	0.182	-103.22	3.587	81.84	0.133	55.39	0.422	-48.16	1.05	12.97
2.00	0.158	-110.12	3.269	77.64	0.143	55.08	0.407	-49.09	1.08	11.86
2.20	0.139	-117.27	3.007	73.69	0.153	54.70	0.394	-50.04	1.10	10.95
2.40	0.126	-123.65	2.782	70.00	0.164	54.32	0.382	-50.96	1.13	10.13
2.60	0.116	-130.48	2.596	66.66	0.174	53.75	0.375	-51.87	1.14	9.46
2.80	0.108	-136.70	2.435	63.35	0.185	53.09	0.367	-52.94	1.15	8.83
3.00	0.102	-142.34	2.295	60.18	0.196	52.40	0.358	-53.58	1.16	8.25

Note:

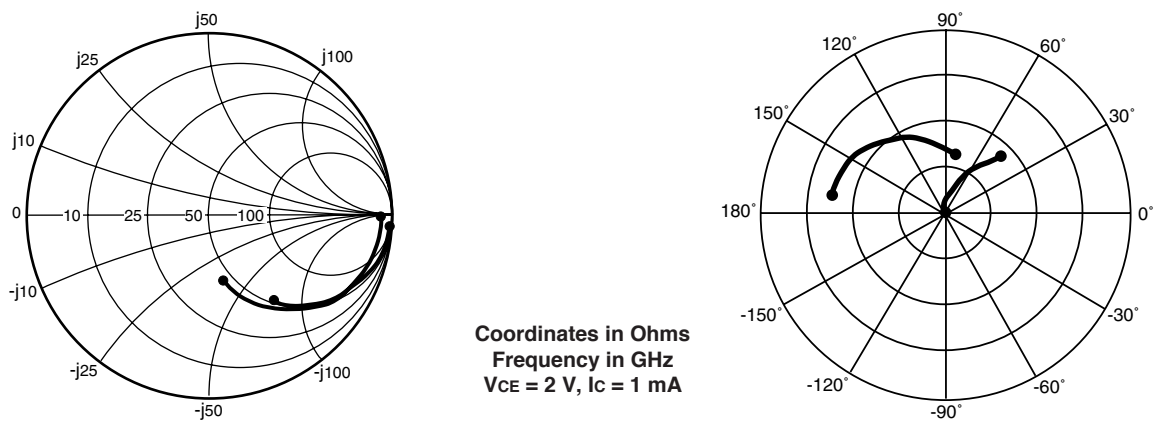
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MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (TA = 25°C)



UPA807T (Q1)
VCE = 2 V, IC = 1 mA

FREQUENCY (GHz)	S11		S21		S12		S22		K	MAG (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
0.10	0.963	-1.86	3.046	171.80	0.016	87.84	0.991	-3.80	0.11	22.80
0.20	0.962	-8.32	3.022	168.73	0.032	82.94	0.986	-7.62	0.10	19.79
0.40	0.934	-17.28	2.964	158.29	0.061	75.87	0.964	-14.81	0.17	16.84
0.60	0.892	-25.24	2.877	148.61	0.088	69.78	0.931	-21.30	0.25	15.15
0.80	0.840	-32.80	2.752	139.68	0.110	64.35	0.894	-26.89	0.33	13.97
1.00	0.789	-39.43	2.583	131.90	0.129	59.87	0.856	-31.54	0.40	13.01
1.20	0.732	-45.25	2.469	124.40	0.144	56.36	0.817	-35.54	0.48	12.34
1.40	0.680	-50.38	2.330	117.91	0.157	53.50	0.784	-38.74	0.55	11.71
1.60	0.633	-54.84	2.195	112.11	0.167	51.24	0.753	-41.45	0.62	11.18
1.80	0.587	-58.98	2.089	106.89	0.178	49.49	0.732	-43.58	0.68	10.70
2.00	0.548	-62.56	1.976	102.08	0.185	48.15	0.706	-45.50	0.74	10.27
2.20	0.507	-66.04	1.878	97.47	0.193	47.15	0.690	-46.81	0.79	9.87
2.40	0.473	-69.01	1.813	93.28	0.200	46.45	0.665	-48.58	0.85	9.58
2.60	0.440	-72.16	1.745	89.51	0.208	45.81	0.651	-49.56	0.89	9.24
2.80	0.407	-74.98	1.682	85.66	0.215	45.27	0.633	-50.88	0.93	8.94
3.00	0.373	-77.40	1.639	82.07	0.221	45.24	0.613	-51.66	0.98	8.69

Note:

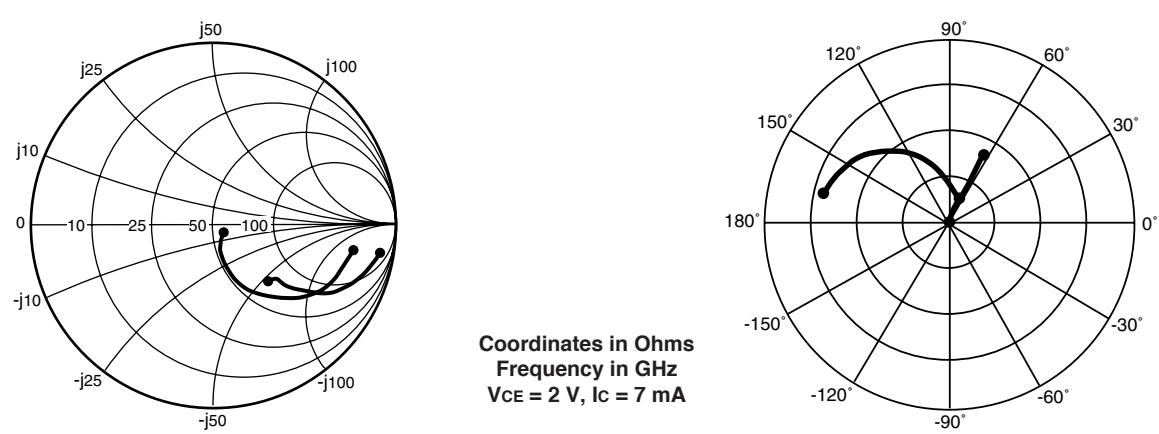
1. Gain Calculation:

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MAG = Maximum Available Gain

MSG = Maximum Stable Gain

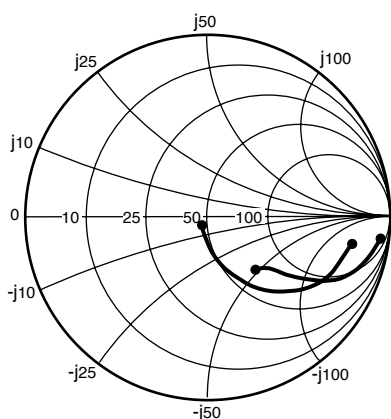
TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



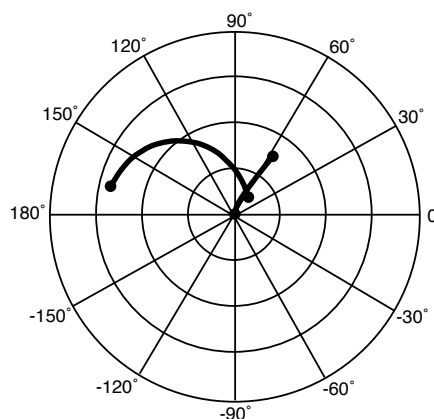
UPA807T (Q1)
V_{CE} = 2 V, I_c = 7 mA

FREQUENCY	S11		S21		S12		S22		K	MAG
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.805	-11.77	13.775	166.06	0.014	82.53	0.955	-9.08	0.18	29.79
0.20	0.754	-24.34	12.965	153.40	0.028	76.07	0.903	-17.39	0.28	26.73
0.40	0.607	-43.28	10.749	133.10	0.048	67.97	0.770	-28.70	0.48	23.53
0.60	0.473	-55.82	8.690	118.92	0.062	64.39	0.659	-34.59	0.66	21.45
0.80	0.372	-63.72	7.108	108.93	0.075	63.30	0.585	-37.22	0.79	19.79
1.00	0.299	-68.64	5.946	101.48	0.086	63.17	0.538	-38.37	0.88	18.39
1.20	0.244	-71.13	5.093	95.54	0.097	63.46	0.508	-38.84	0.95	17.18
1.40	0.201	-71.73	4.442	90.57	0.109	63.67	0.490	-39.13	1.00	15.69
1.60	0.169	-71.23	3.943	86.36	0.120	63.90	0.478	-39.31	1.04	13.92
1.80	0.143	-68.54	3.538	82.53	0.131	63.94	0.472	-39.62	1.07	12.70
2.00	0.123	-64.48	3.212	79.11	0.143	63.96	0.469	-39.95	1.09	11.70
2.20	0.108	-59.14	2.947	75.98	0.154	63.85	0.466	-40.33	1.10	10.85
2.40	0.099	-52.53	2.722	73.02	0.166	63.75	0.464	-40.96	1.12	10.08
2.60	0.090	-45.90	2.533	70.41	0.177	63.47	0.462	-41.40	1.12	9.41
2.80	0.085	-38.03	2.374	67.79	0.189	63.13	0.459	-42.20	1.13	8.79
3.00	0.081	-29.31	2.235	65.37	0.201	62.72	0.456	-42.63	1.14	8.23

Note:
1. Gain Calculation:
$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right)$$
. When $K \leq 1$, 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 ($T_A = 25^\circ\text{C}$)

Coordinates in Ohms
Frequency in GHz
 $V_{CE} = 2\text{ V}$, $I_C = 7\text{ mA}$



UPA807T (Q2)
 $V_{CE} = 2\text{ V}$, $I_C = 7\text{ mA}$

FREQUENCY	S11		S21		S12		S22		K	MAG
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.10	0.809	-10.62	13.836	167.10	0.013	83.43	0.959	-8.02	0.18	30.35
0.20	0.764	-22.77	13.157	155.16	0.025	76.87	0.915	-15.61	0.26	27.29
0.40	0.630	-41.69	11.201	135.28	0.043	68.25	0.793	-26.53	0.46	24.14
0.60	0.498	-55.31	9.243	120.72	0.057	63.92	0.683	-32.68	0.63	22.11
0.80	0.394	-65.19	7.659	110.07	0.068	61.99	0.602	-35.85	0.76	20.50
1.00	0.315	-72.82	6.455	101.95	0.079	61.19	0.547	-37.57	0.87	19.14
1.20	0.255	-78.94	5.555	95.38	0.089	60.93	0.507	-38.62	0.94	17.97
1.40	0.209	-84.50	4.862	89.82	0.099	60.70	0.480	-39.50	1.00	16.92
1.60	0.173	-89.77	4.312	85.02	0.109	60.62	0.459	-40.04	1.04	14.72
1.80	0.144	-95.21	3.880	80.67	0.119	60.22	0.445	-40.98	1.07	13.49
2.00	0.122	-100.74	3.525	76.72	0.130	59.84	0.435	-41.88	1.09	12.47
2.20	0.105	-106.37	3.233	73.03	0.140	59.38	0.425	-42.81	1.11	11.59
2.40	0.093	-111.55	2.983	69.57	0.150	58.94	0.416	-43.74	1.13	10.79
2.60	0.084	-117.18	2.776	66.44	0.161	58.29	0.412	-44.70	1.14	10.12
2.80	0.077	-122.47	2.599	63.32	0.171	57.59	0.406	-45.80	1.14	9.50
3.00	0.071	-127.14	2.445	60.36	0.182	56.86	0.400	-46.51	1.15	8.92

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

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CEL CALIFORNIA EASTERN LABORATORIES • Headquarters • 4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 988-3500 • Telex 34-6393 • FAX (408) 988-0279

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