

NPN SILICON RF TRANSISTOR (WITH 2 DIFFERENT ELEMENTS)
IN A 6-PIN LEAD-LESS MINIMOLD

FEATURES

- Low voltage operation
- 2 different built-in transistors (2SC5436, 2SC5786)
 - Q1: High-gain transistor
 $f_T = 12.0 \text{ GHz TYP.}, |S_{21e}|^2 = 9.0 \text{ dB TYP. @ } V_{CE} = 1 \text{ V}, I_C = 10 \text{ mA}, f = 2 \text{ GHz}$
 - Q2: Low phase distortion transistor suitable for 3 GHz or higher OSC applications
 $f_T = 20.0 \text{ GHz TYP.}, |S_{21e}|^2 = 13.0 \text{ dB TYP. @ } V_{CE} = 1 \text{ V}, I_C = 20 \text{ mA}, f = 2 \text{ GHz}$
 $NF = 1.4 \text{ dB TYP. @ } V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}, f = 2 \text{ GHz}, Z_S = Z_{opt}$
- 6-pin lead-less minimold package

BUILT-IN TRANSISTORS

	Q1	Q2
3-pin thin-type ultra super minimold part No.	2SC5436	2SC5786

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
μ PA861TD	50 pcs (Non reel)	• 8 mm wide embossed taping
μ PA861TD-T3	10 kpcs/reel	• Pin 1 (Q1 Collector), Pin 6 (Q1 Base) face the perforation side of the tape

Remark To order evaluation samples, contact your nearby sales office.
The unit sample quantity is 50 pcs.

Because this product uses high-frequency technology, avoid excessive static electricity, etc.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings		Unit
		Q1	Q2	
Collector to Base Voltage	V _{CBO}	5	9	V
Collector to Emitter Voltage	V _{CEO}	3	3	V
Emitter to Base Voltage	V _{EBO}	2	1.5	V
Collector Current	I _C	30	35	mA
Total Power Dissipation	P _{tot} ^{Note}	90	105	mW
		195 in 2 elements		
Junction Temperature	T _J	150		°C
Storage Temperature	T _{stg}	−65 to +150		°C

Note Mounted on 1.08 cm² × 1.0 mm (t) glass epoxy PCB

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

(1) Q1

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	—	—	100	nA
Emitter Cut-off Current	I _{EBO}	V _{EB} = 1 V, I _C = 0 mA	—	—	100	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 1 V, I _C = 10 mA	70	110	140	—
Gain Bandwidth Product	f _T	V _{CE} = 1 V, I _C = 10 mA, f = 2 GHz	10.0	12.0	—	GHz
Insertion Power Gain	S _{21e} ²	V _{CE} = 1 V, I _C = 10 mA, f = 2 GHz	7.0	9.0	—	dB
Noise Figure	NF	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz, Z _S = Z _{opt}	—	1.5	2.0	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 0.5 V, I _E = 0 mA, f = 1 MHz	—	0.4	0.8	pF

(2) Q2

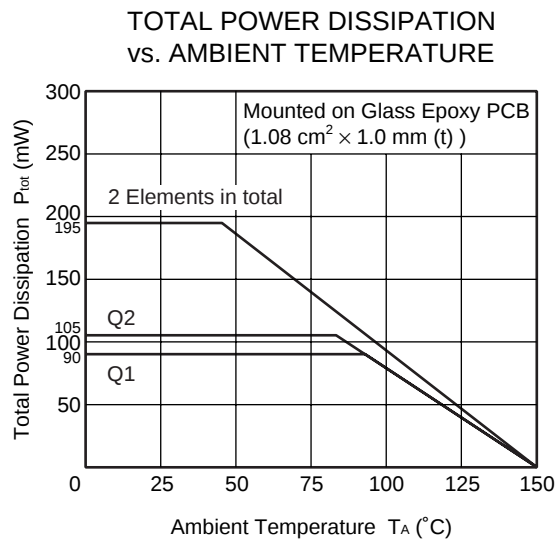
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	—	—	100	nA
Emitter Cut-off Current	I _{EBO}	V _{EB} = 1 V, I _C = 0 mA	—	—	100	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 1 V, I _C = 5 mA	50	75	100	—
Gain Bandwidth Product	f _T	V _{CE} = 1 V, I _C = 20 mA, f = 2 GHz	17.0	20.0	—	GHz
Insertion Power Gain	S _{21e} ²	V _{CE} = 1 V, I _C = 20 mA, f = 2 GHz	11.0	13.0	—	dB
Noise Figure	NF	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{opt}	—	1.4	2.5	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 0.5 V, I _E = 0 mA, f = 1 MHz	—	0.22	0.30	pF

- Notes** 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
2. Collector to base capacitance when the emitter grounded

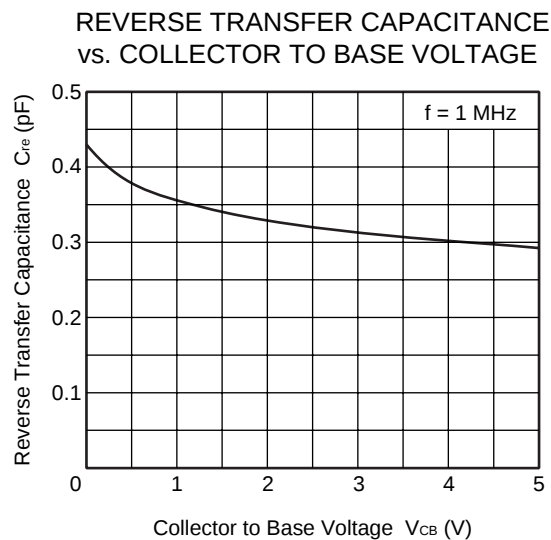
h_{FE} CLASSIFICATION

Rank	FB
Marking	vX
h _{FE} Value of Q1	70 to 140
h _{FE} Value of Q2	50 to 100

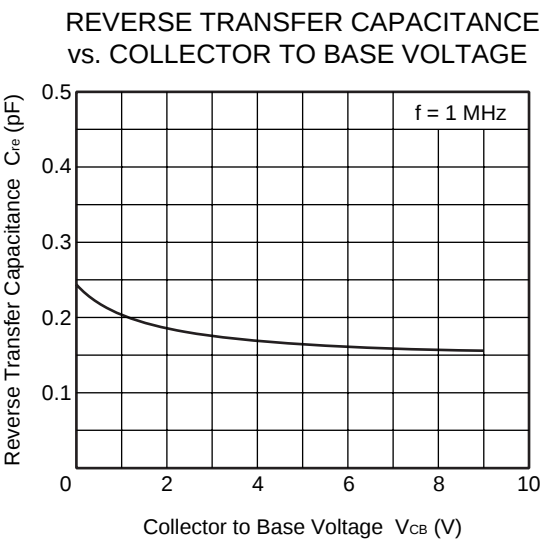
★ TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A = +25^{\circ}\text{C}$)



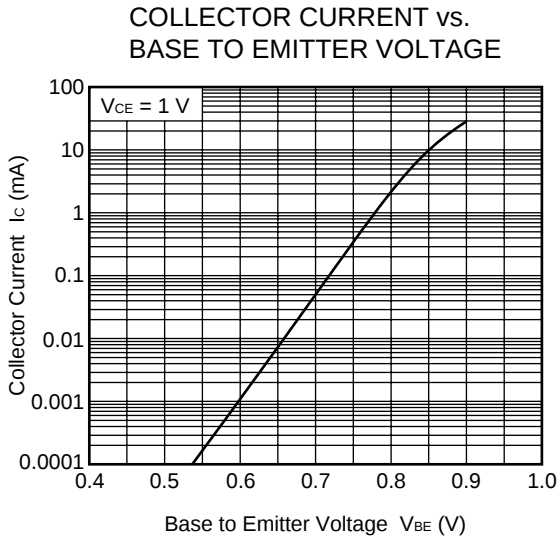
Q1



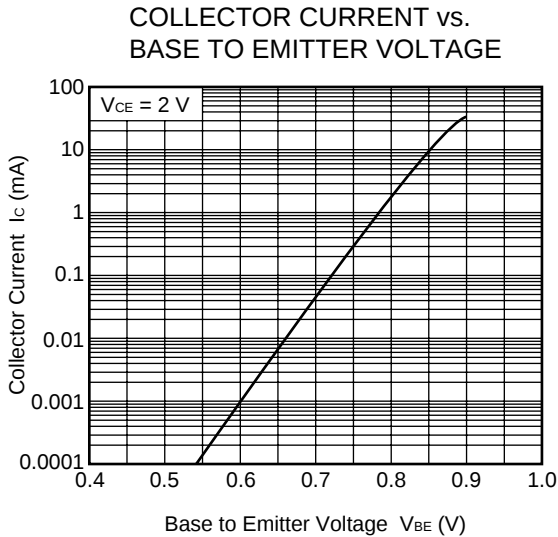
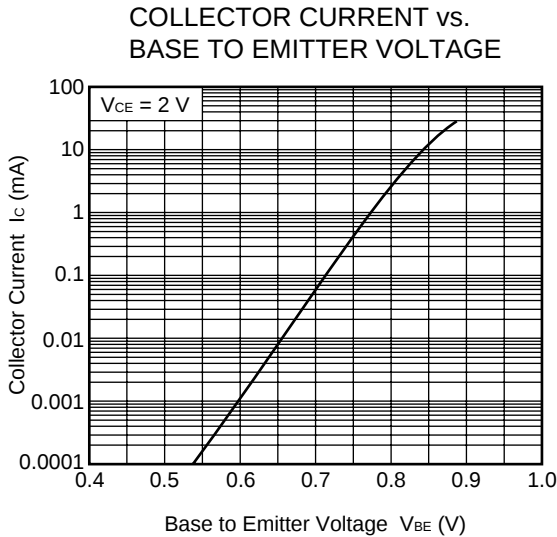
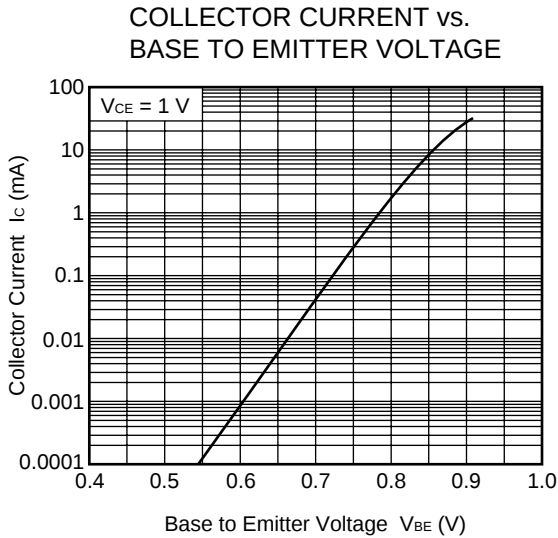
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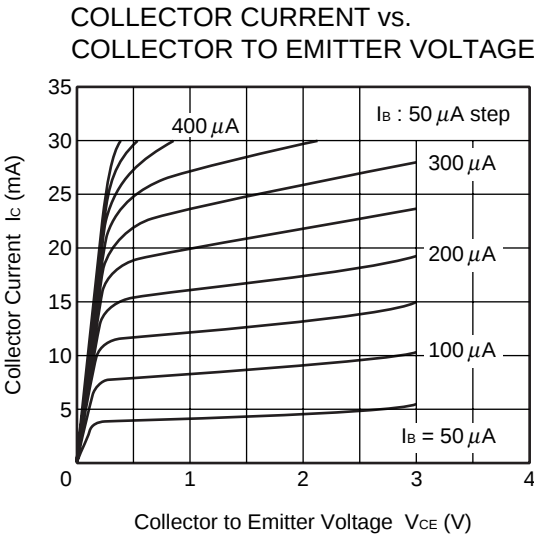
Q1



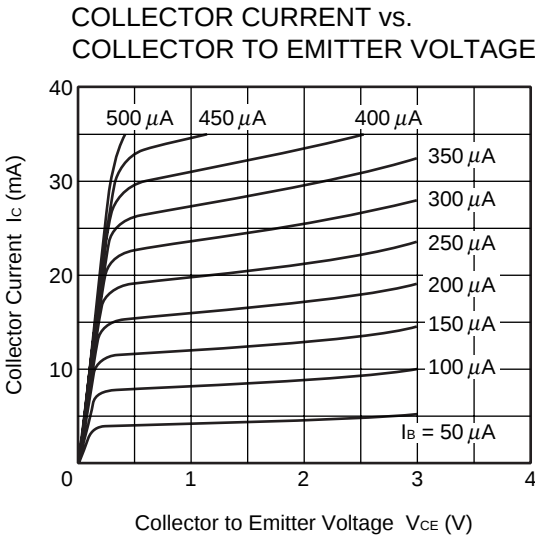
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Q1

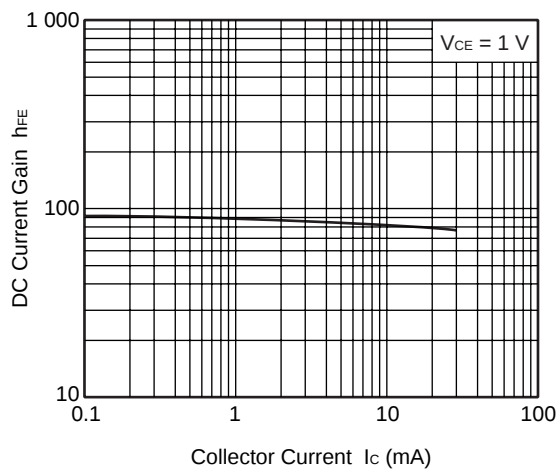


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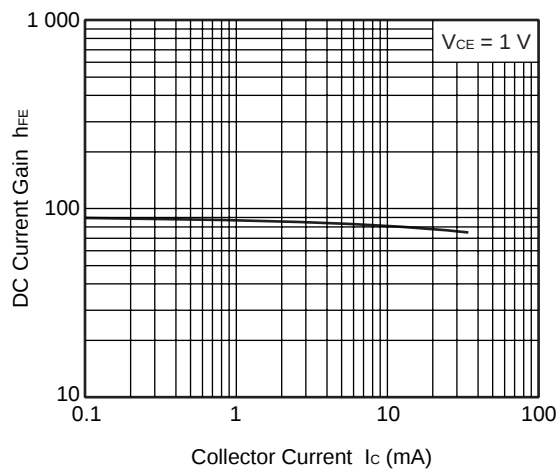
Q1

DC CURRENT GAIN vs.
COLLECTOR CURRENT

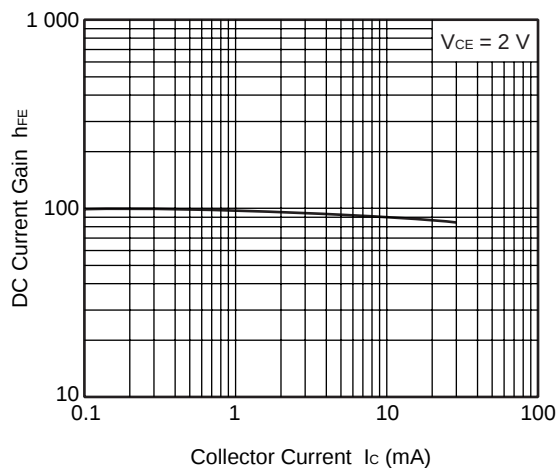


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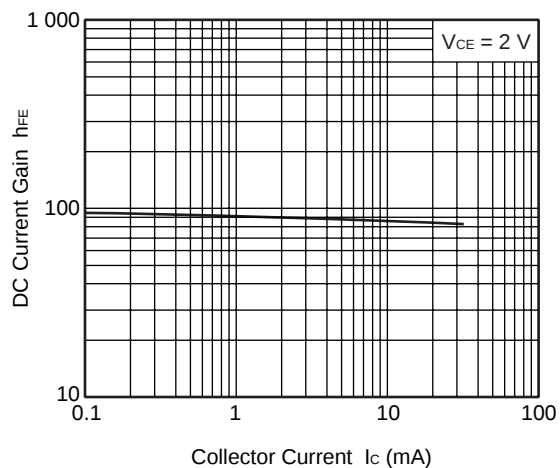
DC CURRENT GAIN vs.
COLLECTOR CURRENT



DC CURRENT GAIN vs.
COLLECTOR CURRENT

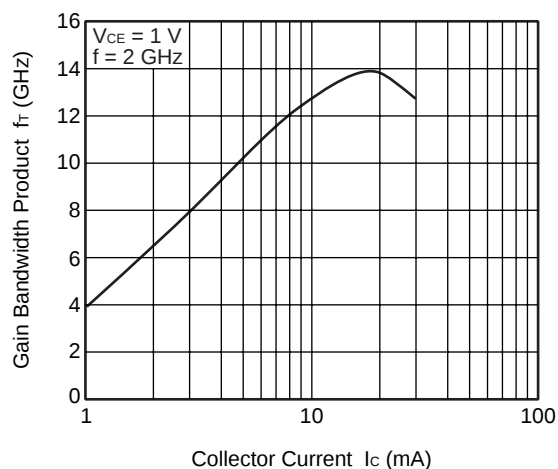


DC CURRENT GAIN vs.
COLLECTOR CURRENT



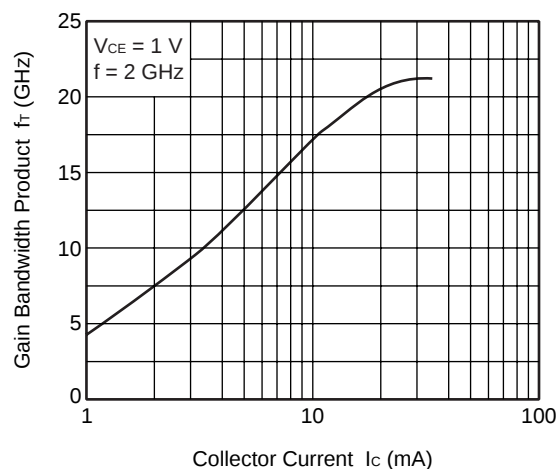
Q1

GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

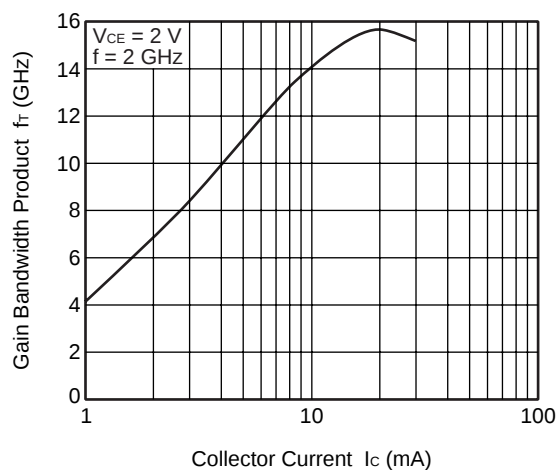


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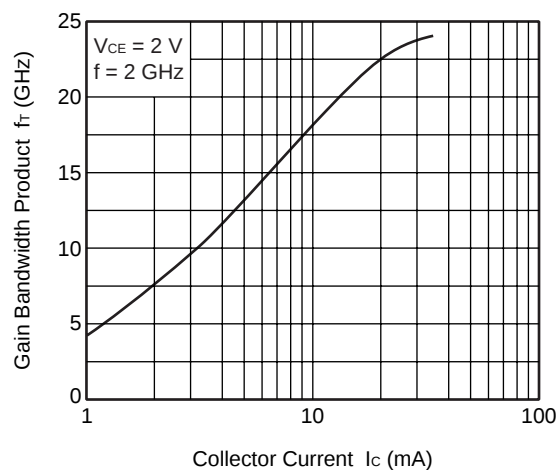
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

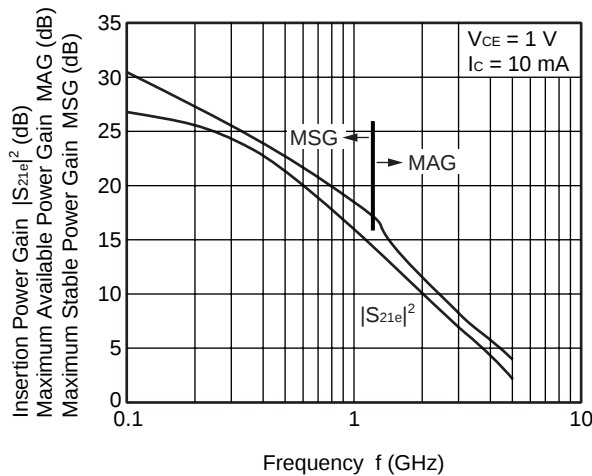


GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



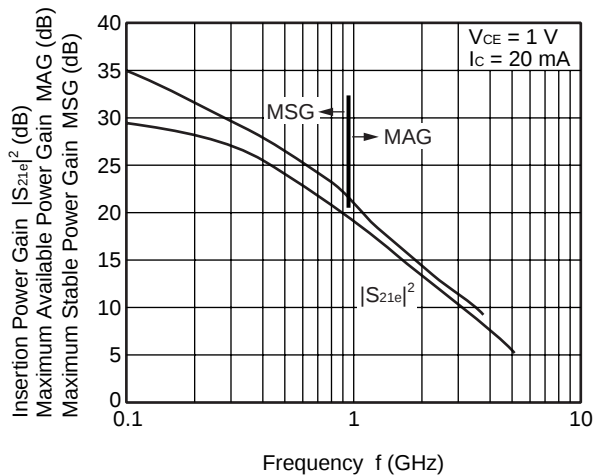
Q1

INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

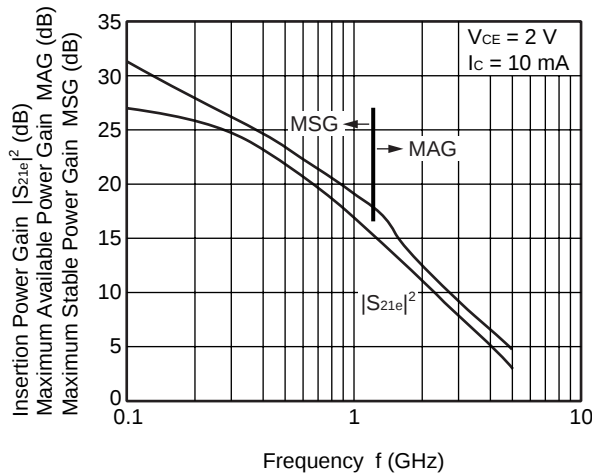


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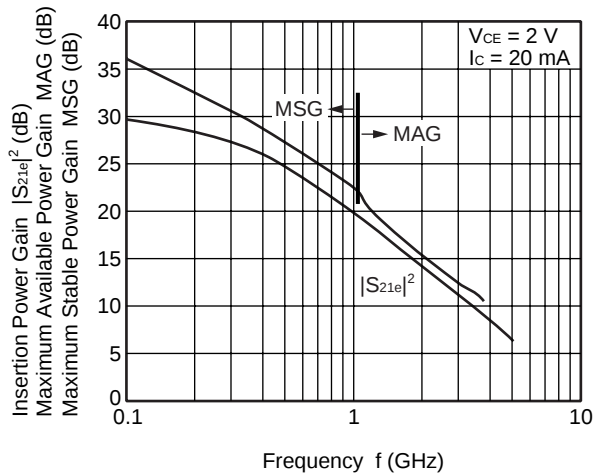
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

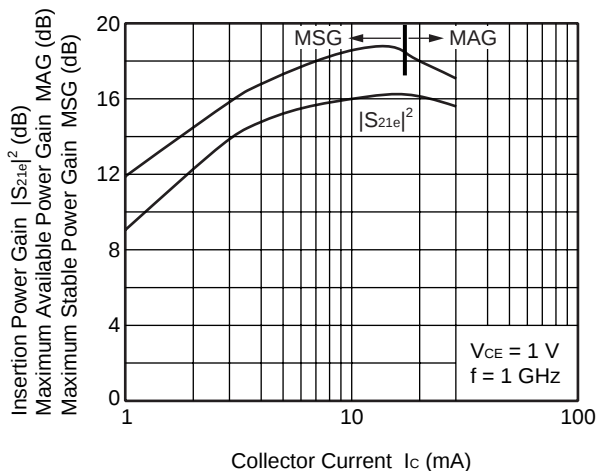


INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



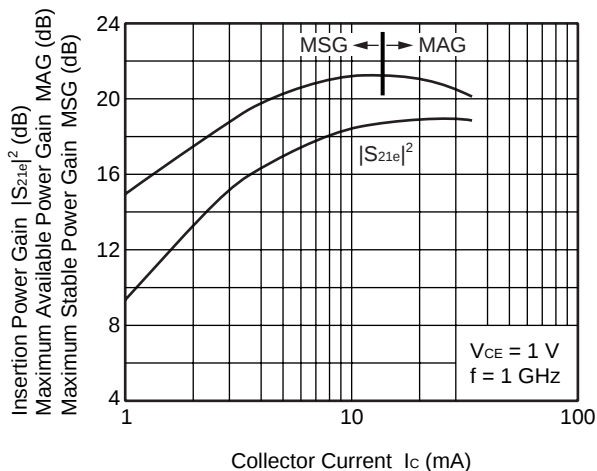
Q1

INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

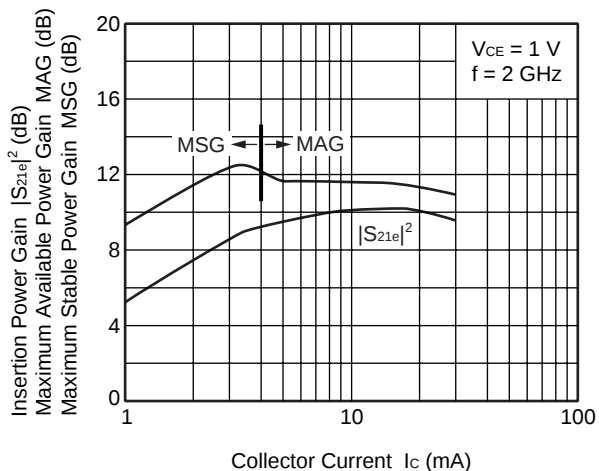


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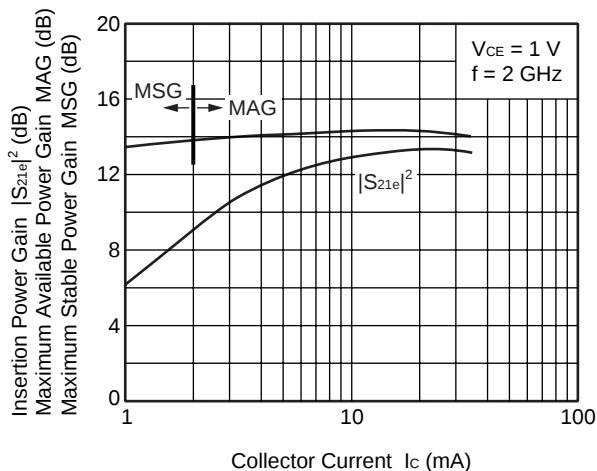
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



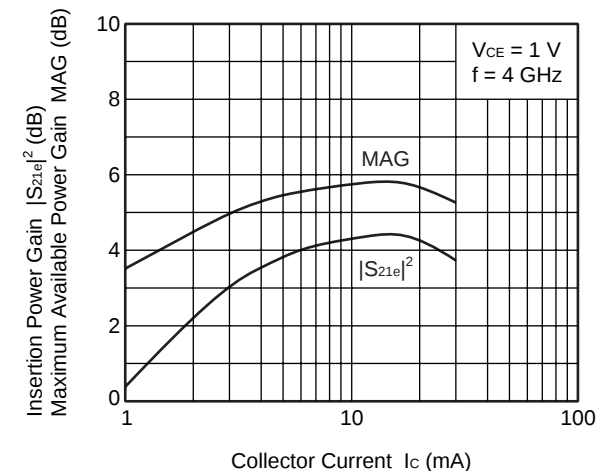
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



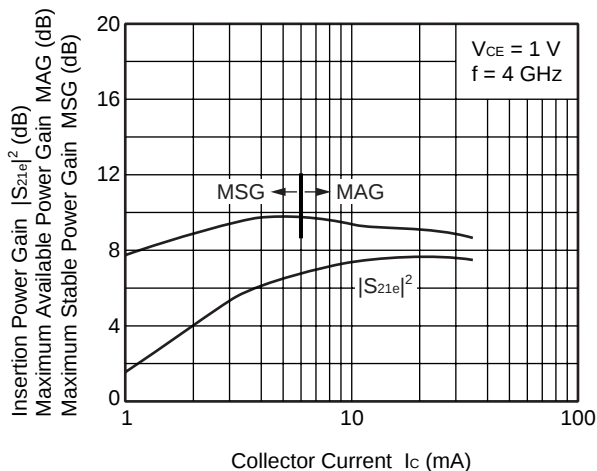
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

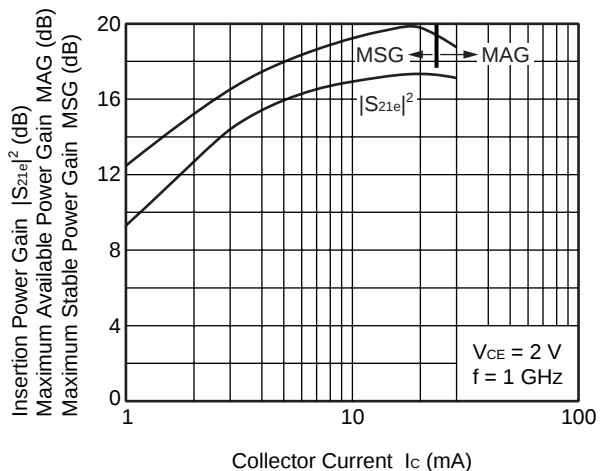


INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



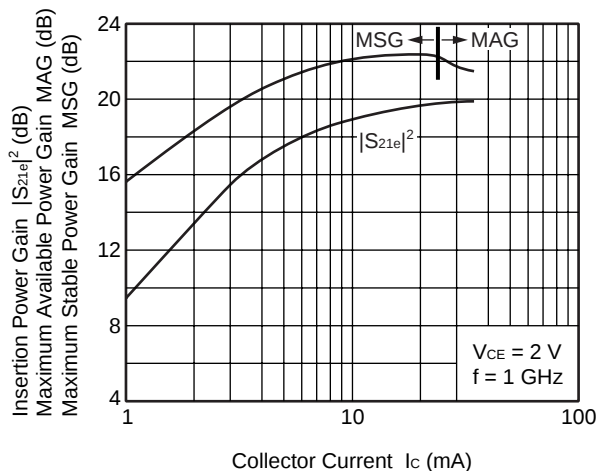
Q1

INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

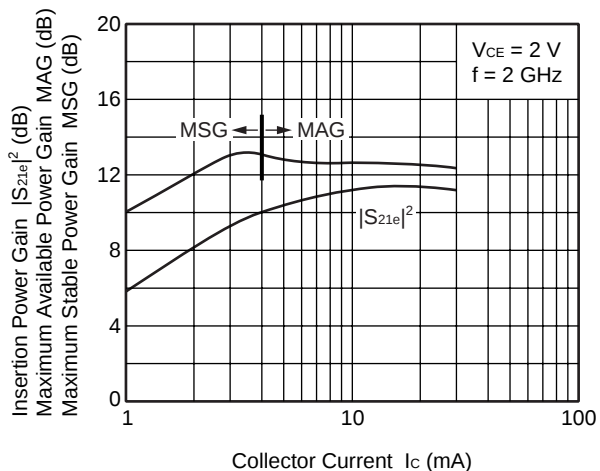


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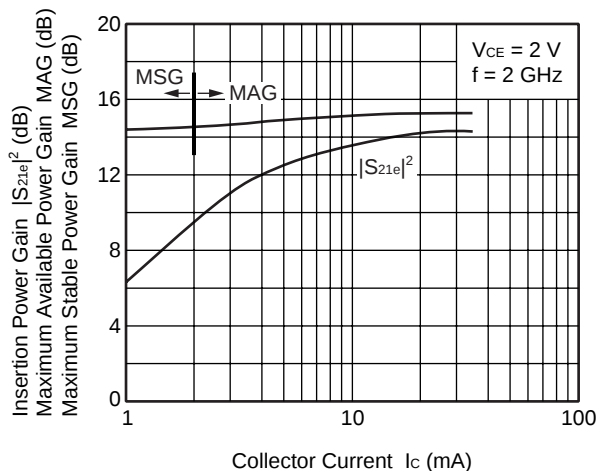
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



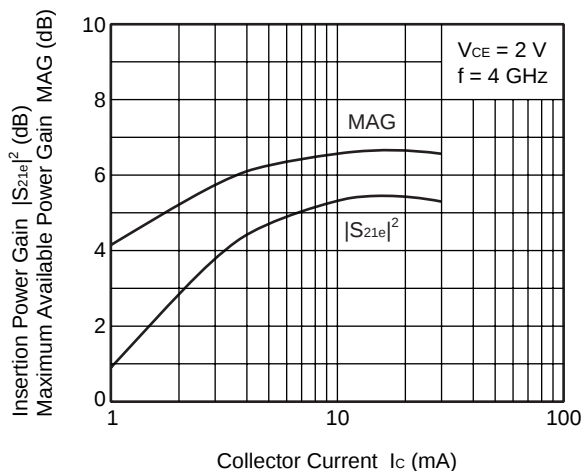
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



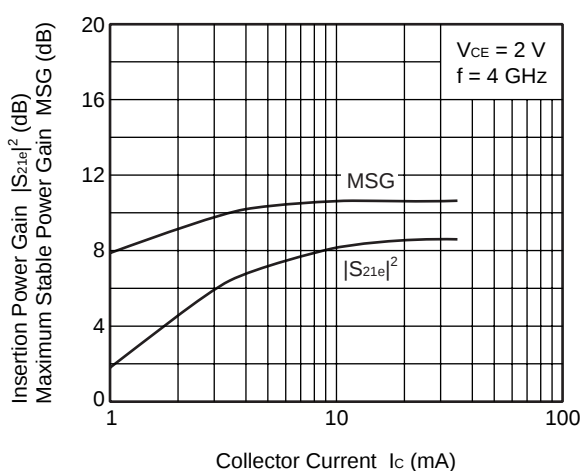
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

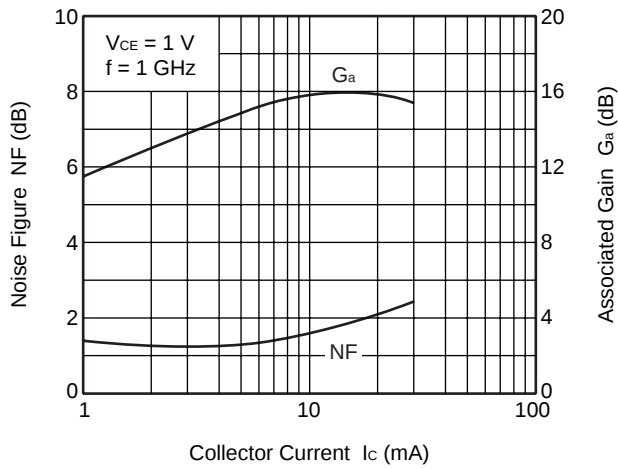


INSERTION POWER GAIN, MSG
vs. COLLECTOR CURRENT



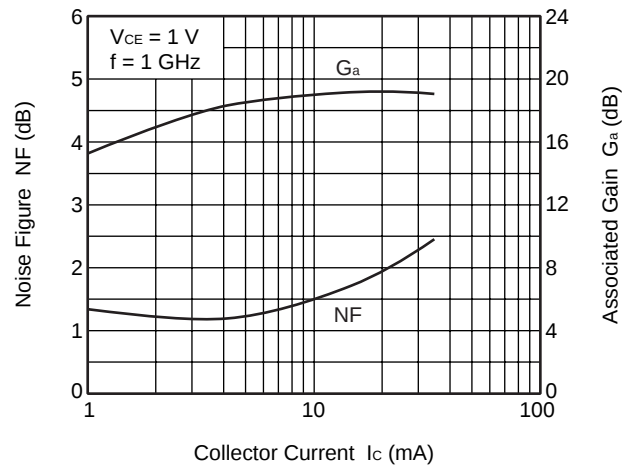
Q1

NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

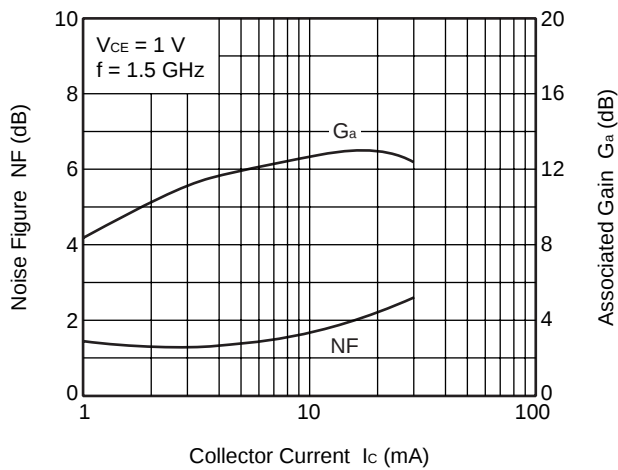


Q2

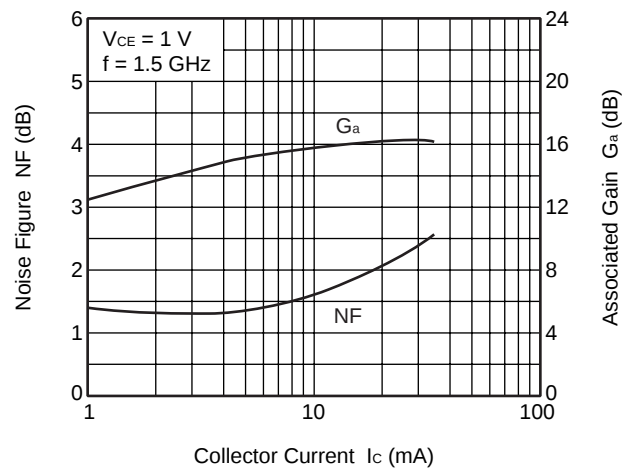
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



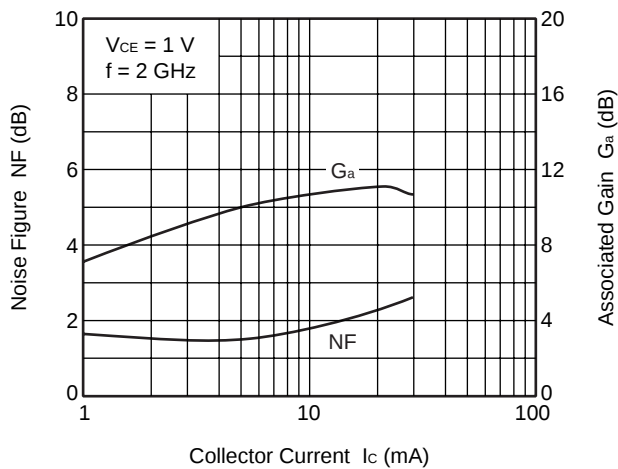
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



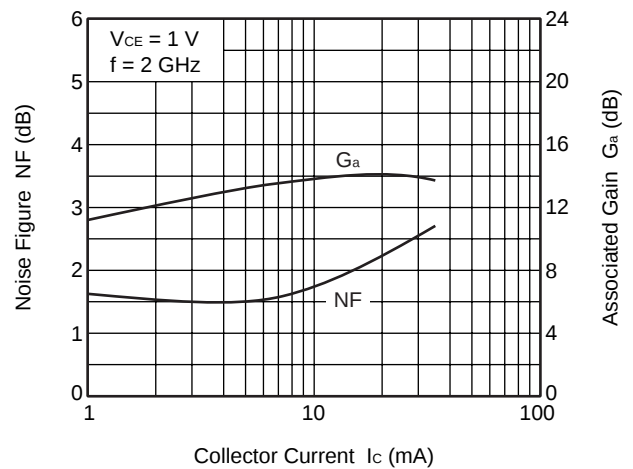
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

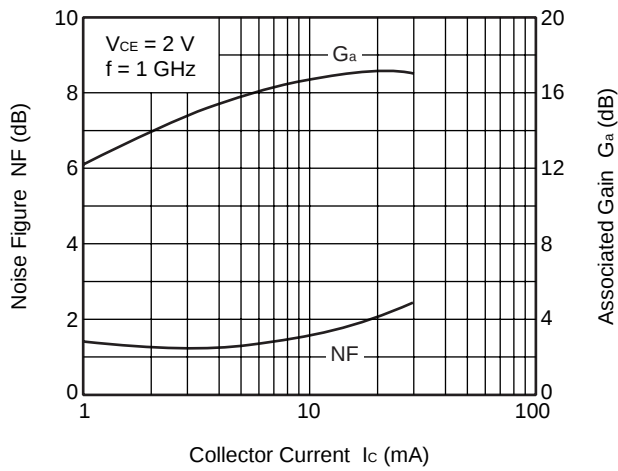


NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



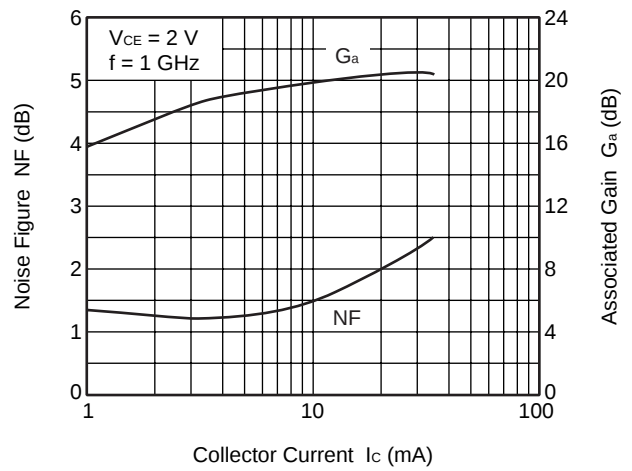
Q1

NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

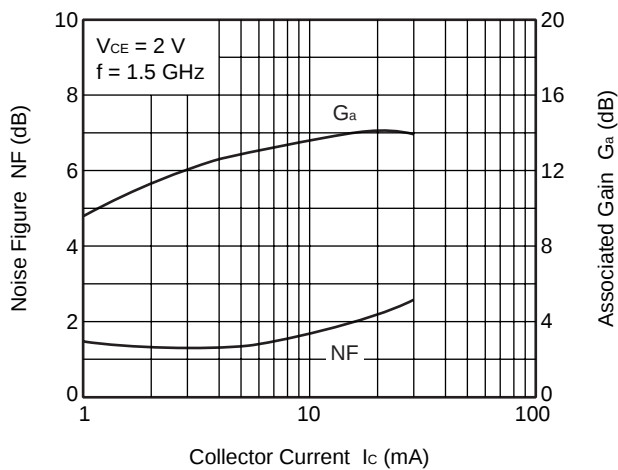


Q2

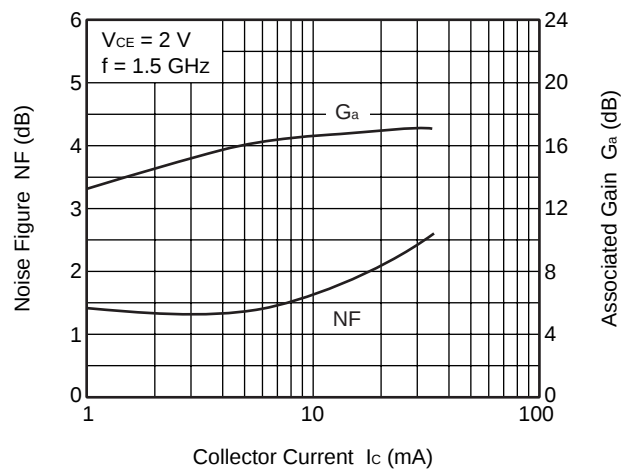
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



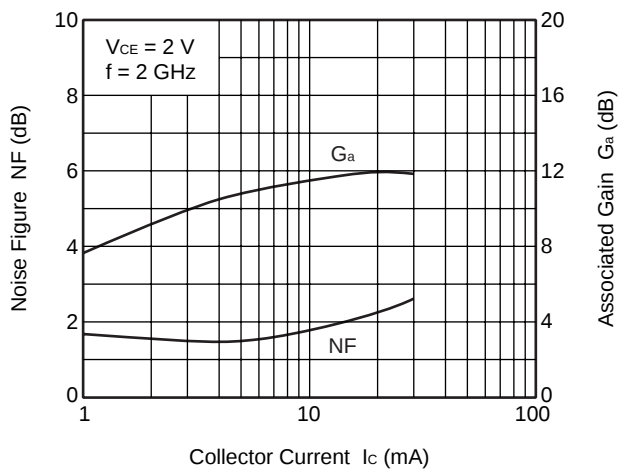
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



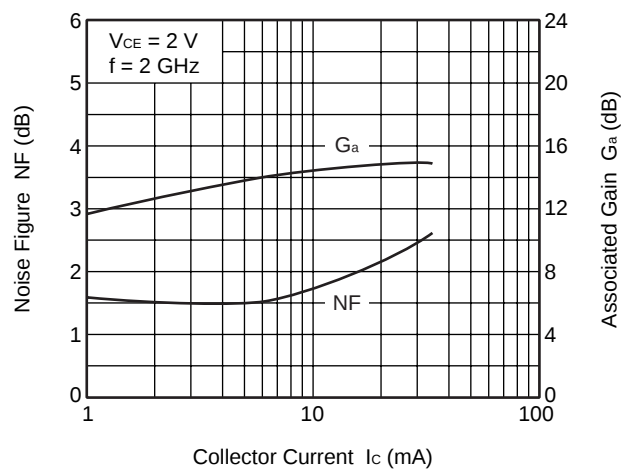
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS Q1

V_{CE} = 1 V, I_C = 1 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.953	-9.4	3.604	172.6	0.024	87.4	0.992	-3.9
0.2	0.949	-16.5	3.622	166.4	0.048	80.4	0.983	-8.3
0.3	0.929	-24.4	3.536	160.4	0.071	74.7	0.968	-12.7
0.4	0.911	-33.0	3.494	153.1	0.093	69.7	0.944	-16.9
0.5	0.878	-41.3	3.396	146.7	0.113	64.9	0.918	-21.2
0.6	0.843	-49.5	3.304	140.2	0.131	60.1	0.886	-25.2
0.7	0.809	-57.6	3.187	134.3	0.148	55.6	0.853	-29.2
0.8	0.778	-65.3	3.088	128.2	0.162	51.2	0.815	-33.1
0.9	0.743	-73.7	2.966	122.4	0.173	47.2	0.779	-36.8
1.0	0.706	-81.2	2.850	117.0	0.183	43.4	0.743	-40.4
1.1	0.676	-88.7	2.728	111.9	0.190	39.9	0.709	-43.7
1.2	0.645	-96.0	2.604	106.8	0.197	36.8	0.679	-46.6
1.3	0.620	-103.0	2.476	102.5	0.201	33.7	0.650	-49.2
1.4	0.600	-109.7	2.371	98.2	0.205	31.1	0.623	-51.7
1.5	0.583	-116.3	2.260	94.4	0.208	28.8	0.601	-54.0
1.6	0.572	-122.3	2.160	90.5	0.210	26.6	0.580	-56.1
1.7	0.557	-127.7	2.067	86.9	0.211	24.8	0.562	-57.9
1.8	0.546	-133.5	1.979	83.3	0.211	23.3	0.545	-59.5
1.9	0.537	-138.7	1.897	80.5	0.211	21.7	0.529	-61.2
2.0	0.532	-143.7	1.824	77.2	0.211	20.6	0.513	-62.6
2.1	0.526	-148.1	1.752	74.5	0.209	19.4	0.502	-64.1
2.2	0.525	-152.4	1.687	71.5	0.208	18.6	0.489	-65.7
2.3	0.522	-156.3	1.643	69.0	0.207	17.7	0.479	-67.0
2.4	0.515	-160.1	1.580	66.7	0.206	16.8	0.468	-68.5
2.5	0.515	-164.2	1.531	64.1	0.205	16.4	0.459	-70.1
2.6	0.511	-167.7	1.486	62.2	0.203	15.3	0.456	-71.8
2.7	0.506	-171.3	1.441	59.8	0.202	14.8	0.448	-73.4
2.8	0.503	-175.1	1.391	57.6	0.201	14.3	0.442	-74.9
2.9	0.487	-177.6	1.347	55.4	0.200	14.0	0.432	-76.3
3.0	0.483	-179.3	1.295	53.6	0.199	13.8	0.425	-78.4
4.0	0.527	147.4	1.047	32.9	0.193	19.5	0.390	-99.9
5.0	0.572	117.8	0.831	15.6	0.223	23.6	0.388	-126.5

V_{CE} = 1 V, I_C = 3 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.870	-14.4	9.420	168.6	0.023	84.3	0.972	-8.5
0.2	0.841	-28.3	9.168	158.1	0.044	74.5	0.936	-17.1
0.3	0.802	-41.3	8.615	149.1	0.064	67.4	0.884	-25.0
0.4	0.745	-54.5	8.091	139.3	0.079	61.6	0.820	-32.1
0.5	0.687	-66.5	7.456	131.5	0.093	56.2	0.756	-38.4
0.6	0.636	-77.7	6.864	124.4	0.103	52.0	0.690	-43.9
0.7	0.591	-88.3	6.327	118.1	0.111	48.4	0.631	-48.8
0.8	0.551	-98.4	5.831	112.2	0.118	45.7	0.577	-53.3
0.9	0.522	-108.1	5.364	107.1	0.123	43.3	0.531	-57.3
1.0	0.494	-116.6	4.968	102.3	0.128	41.5	0.488	-60.9
1.1	0.473	-124.8	4.605	98.3	0.131	40.1	0.452	-64.2
1.2	0.455	-132.6	4.280	94.4	0.134	39.0	0.423	-67.2
1.3	0.447	-139.2	3.993	91.1	0.137	38.1	0.398	-70.0
1.4	0.437	-146.0	3.748	87.9	0.140	37.4	0.375	-72.4
1.5	0.437	-151.7	3.519	84.9	0.143	37.0	0.357	-74.6
1.6	0.434	-156.4	3.315	82.1	0.145	36.6	0.340	-76.7
1.7	0.430	-161.6	3.140	79.5	0.148	36.4	0.326	-78.5
1.8	0.430	-166.2	2.974	76.8	0.151	36.5	0.312	-80.1
1.9	0.431	-170.3	2.828	74.7	0.153	36.4	0.300	-81.6
2.0	0.433	-174.2	2.701	72.3	0.156	36.3	0.289	-83.3
2.1	0.434	-177.7	2.575	70.2	0.158	36.4	0.279	-84.9
2.2	0.434	179.4	2.466	67.8	0.162	36.5	0.270	-86.5
2.3	0.435	176.4	2.387	66.0	0.164	36.7	0.262	-88.1
2.4	0.435	173.4	2.289	64.3	0.168	36.6	0.254	-89.8
2.5	0.438	170.7	2.202	62.2	0.171	36.8	0.248	-91.7
2.6	0.436	168.0	2.133	60.7	0.173	36.6	0.244	-93.5
2.7	0.437	164.8	2.061	58.8	0.177	36.4	0.239	-95.5
2.8	0.434	162.2	1.982	57.0	0.180	36.2	0.236	-97.3
2.9	0.425	160.3	1.912	55.5	0.183	36.0	0.230	-99.8
3.0	0.422	159.0	1.836	54.2	0.186	35.8	0.226	-102.2
4.0	0.481	133.1	1.430	36.1	0.226	36.4	0.229	-129.1
5.0	0.534	109.7	1.125	20.6	0.275	28.9	0.257	-158.3