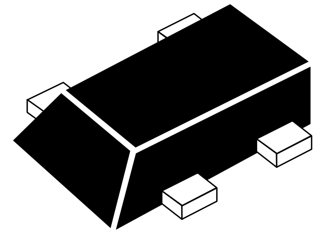
NEC's NPN SiGe HIGH FREQUENCY TRANSISTOR

NESG2021M05

FEATURES

- **HIGH BREAKDOWN VOLTAGE SiGe TECHNOLOGY**
  V_{CEO} = 5 V (Absolute Maximum)
- **LOW NOISE FIGURE:**
  NF = 0.9 dB at 2 GHz
  NF = 1.3 dB at 5.2 GHz
- **HIGH MAXIMUM STABLE GAIN:**
  MSG = 22.5 dB at 2 GHz
- **LOW PROFILE M05 PACKAGE:**
  SOT-343 footprint, with a height of only 0.59 mm
  Flat lead style for better RF performance
- **Pb Free**



M05

DESCRIPTION

NEC's NESG2021M05 is fabricated using NEC's high voltage Silicon Germanium process (UHS2-HV), and is designed for a wide range of applications including low noise amplifiers, medium power amplifiers, and oscillators.

NEC's low profile, flat lead style M05 Package provides high frequency performance for compact wireless designs.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

		PART NUMBER PACKAGE OUTLINE	NESG2021M05 M05			
	SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
RF	NF	Noise Figure at V_{CE} = 2 V, I_C = 3 mA, f = 5.2 GHz, $Z_S = Z_{SOPT}$, $Z_L = Z_{LOPT}$	dB		1.3	
	G_a	Associated Gain at V_{CE} = 2 V, I_C = 3 mA, f = 5.2 GHz, $Z_S = Z_{SOPT}$, $Z_L = Z_{LOPT}$	dB		10.0	
	NF	Noise Figure at V_{CE} = 2 V, I_C = 3 mA, f = 2 GHz, $Z_S = Z_{SOPT}$, $Z_L = Z_{LOPT}$	dB		0.9	1.2
	G_a	Associated Gain at V_{CE} = 2 V, I_C = 3 mA, f = 2 GHz, $Z_S = Z_{SOPT}$, $Z_L = Z_{LOPT}$	dB	15.0	18.0	
	MSG	Maximum Stable Gain[1] at V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz	dB	20.0	22.5	
	$\|S_{21}\|^2$	Insertion Power Gain at V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz	dB	17.0	19.0	
	P_{1dB}	Output Power at 1dB Compression Point at V_{CE} = 3 V, I_C = 12 mA, f = 2 GHz	dBm		9.0	
	OIP_3	Output 3rd Order Intercept Point at V_{CE} = 3 V, I_C = 12 mA, f = 2 GHz	dBm		17.0	
	f_T	Gain Bandwidth Product at V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz	GHz	20	25	
	C_{re}	Reverse Transfer Capacitance[2] at V_{CB} = 2 V, I_C = 0 mA, f = 1 GHz	pF		0.1	0.2
DC	I_{CBO}	Collector Cutoff Current at V_{CB} = 5V, I_E = 0	nA			100
	I_{EBO}	Emitter Cutoff Current at V_{EB} = 1 V, I_C = 0	nA			100
	h_{FE}	DC Current Gain[3] at V_{CE} = 2 V, I_C = 5 mA		130	190	260

Notes:

1. MSG = $\left|\frac{S_{21}}{S_{12}}\right|$
2. Collector to base capacitance is measured by capacitance meter (automatic balance bridge method) when emitter pin is connected to the guard pin.
3. Pulsed measurement, pulse width ≤ 350 μs, duty cycle ≤ 2 %.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	13.0
V_{CEO}	Collector to Emitter Voltage	V	5.0
V_{EBO}	Emitter to Base Voltage	V	1.5
I_C	Collector Current	mA	35
P_T[2]	Total Power Dissipation	mW	175
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.
2. Mounted on 1.08 cm^2 x 1.0 mm (t) glass epoxy PCB.

THERMAL RESISTANCE

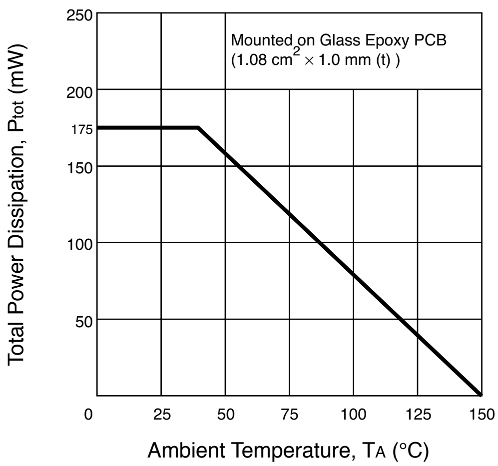
SYMBOLS	PARAMETERS	UNITS	RATINGS
$R_{th\ j\text{-}c}$	Junction to Case Resistance	°C/W	TBD

ORDERING INFORMATION

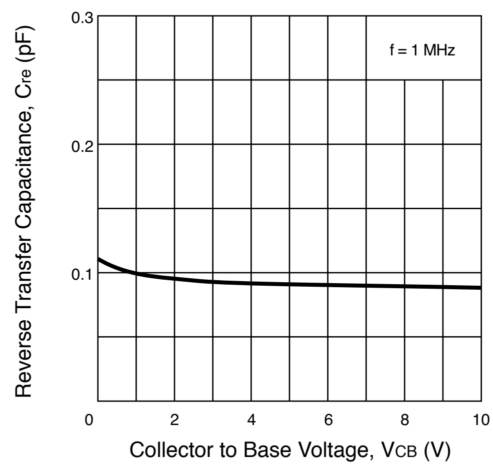
PART NUMBER	QUANTITY	SUPPLYING FORM
NESG2021M05-T1-A	3 kpcs/reel	• Pb Free • Pin 3 (Collector), Pin 4 (Emitter) face the perforation side of the tape • 8 mm wide embossed taping

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

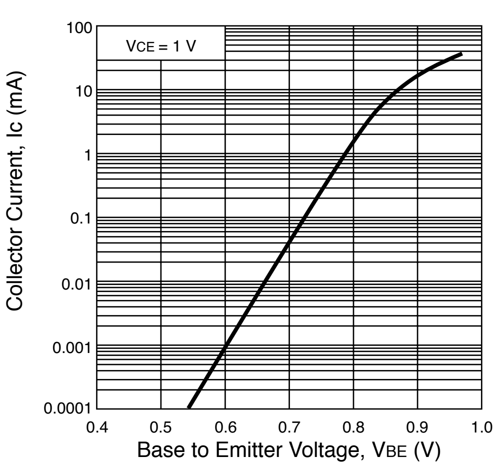
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



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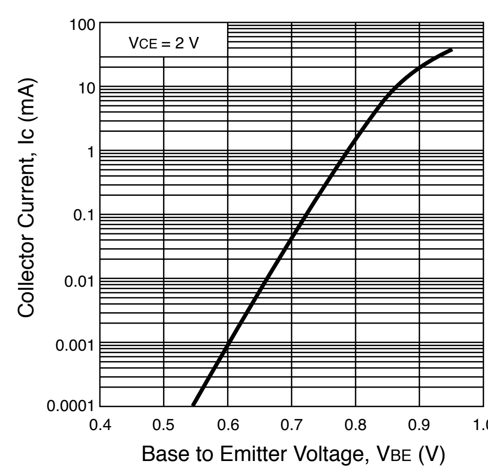
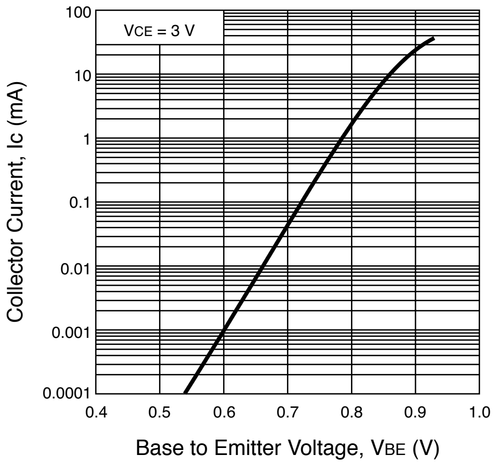
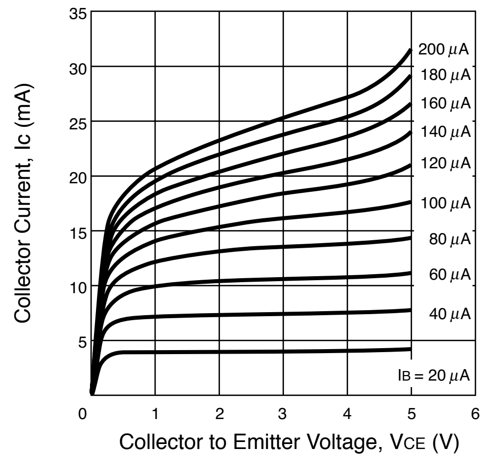


TYPICAL PERFORMANCE CURVES ($T_A = 25°C$)

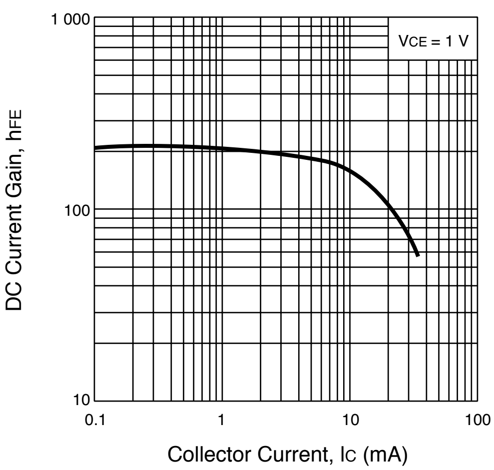
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



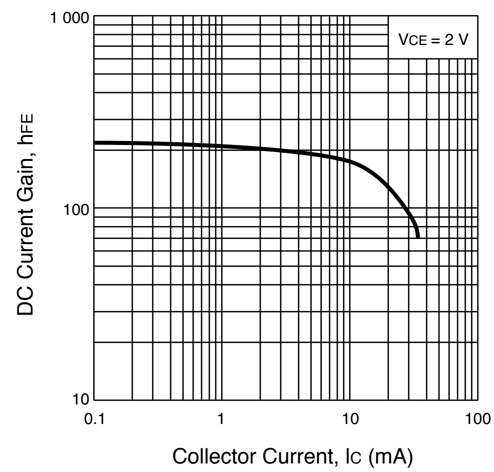
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



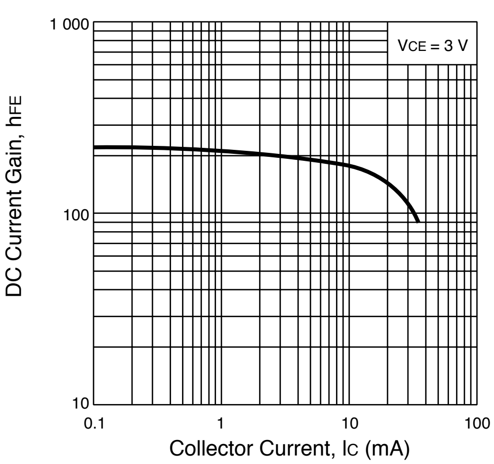
DC CURRENT GAIN vs. COLLECTOR CURRENT



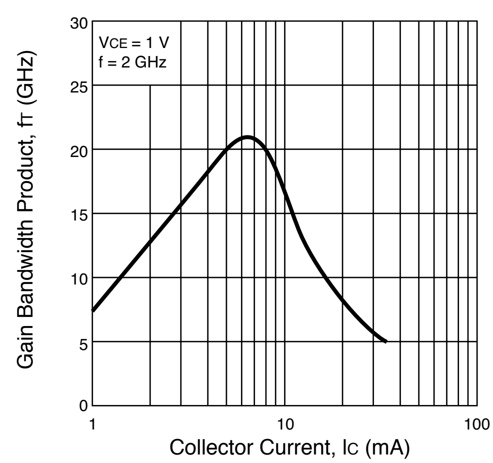
DC CURRENT GAIN vs. COLLECTOR CURRENT



DC CURRENT GAIN vs. COLLECTOR CURRENT

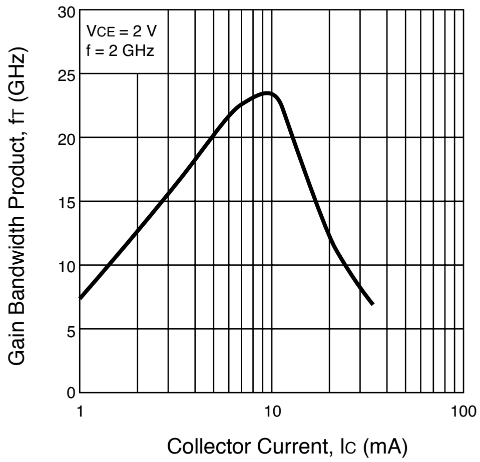


GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

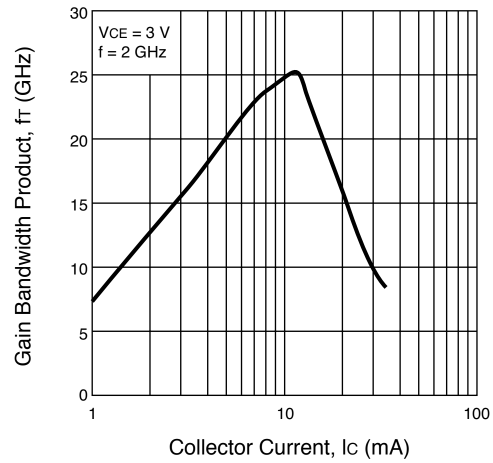


TYPICAL PERFORMANCE CURVES (TA = 25°C)

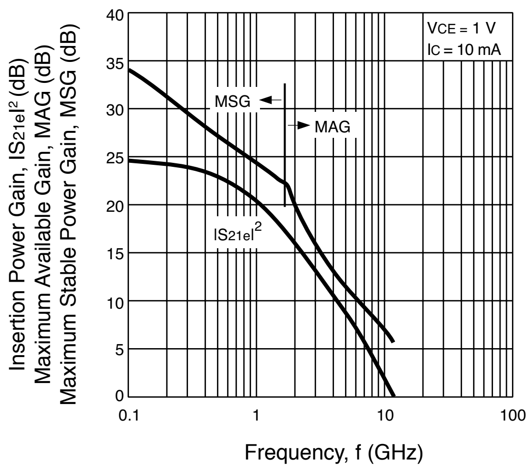
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



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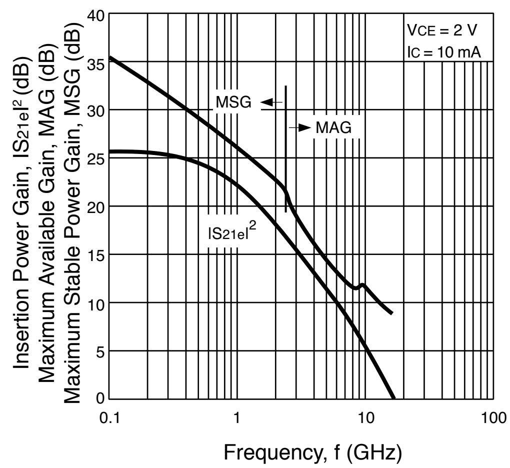

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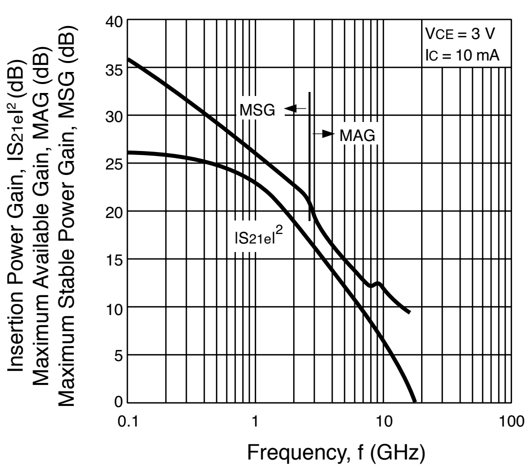

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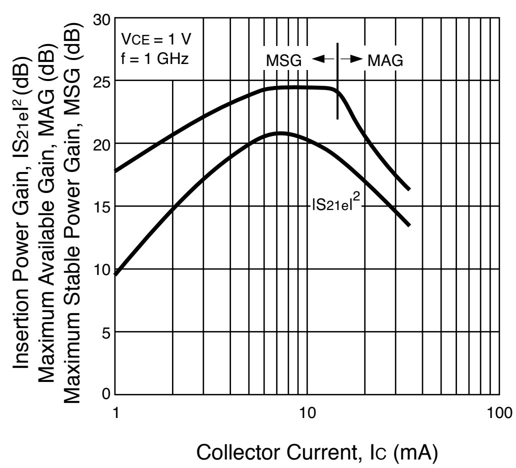

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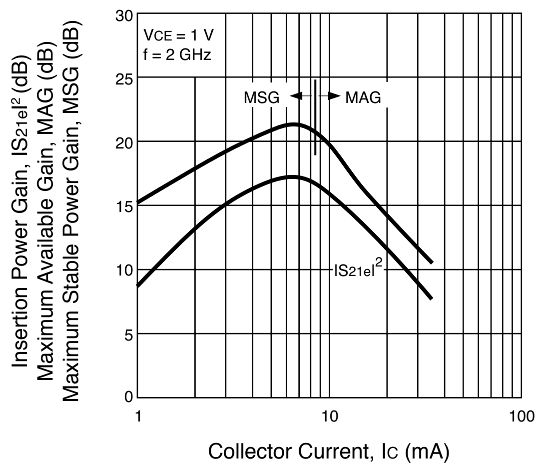

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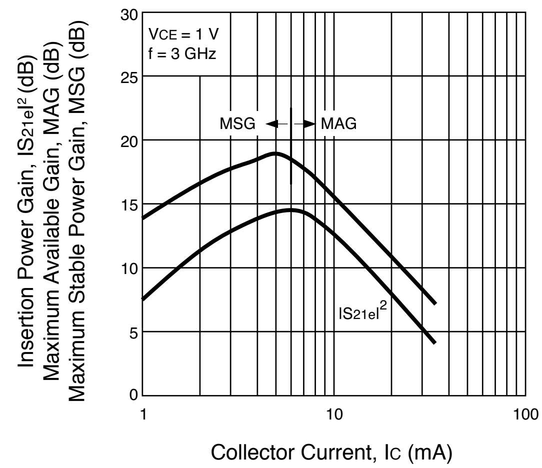

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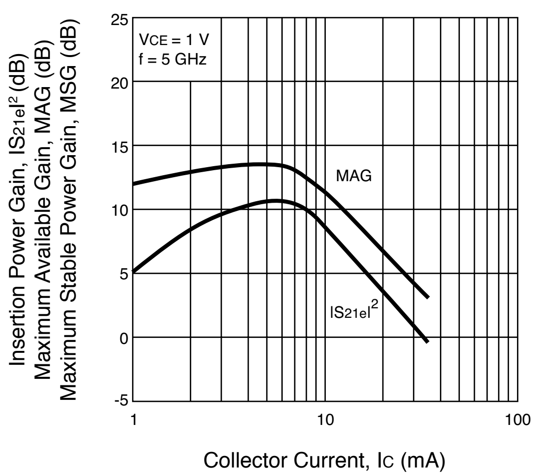

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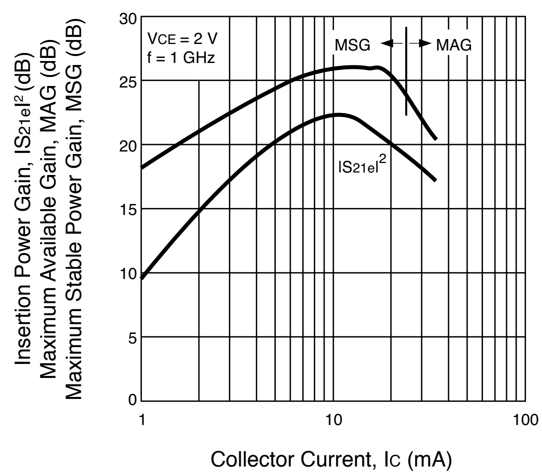

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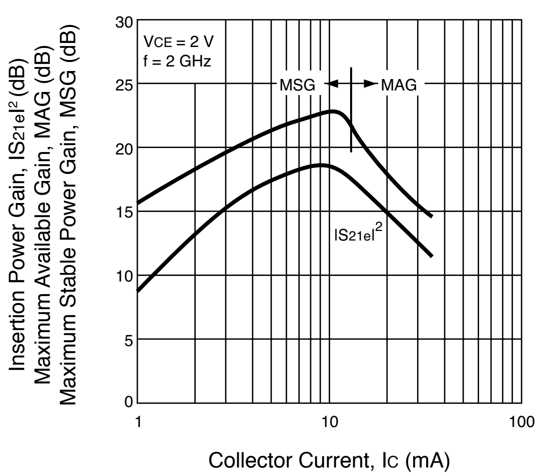

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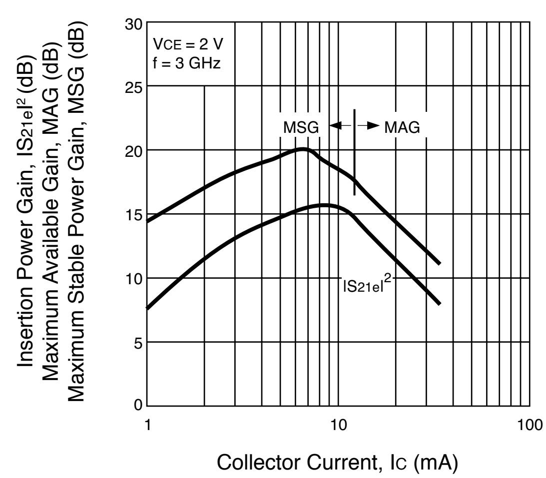

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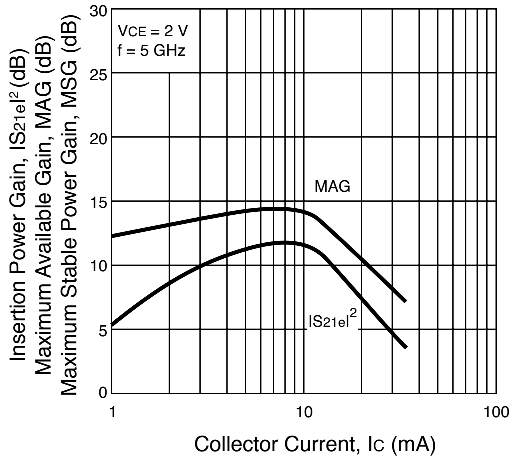

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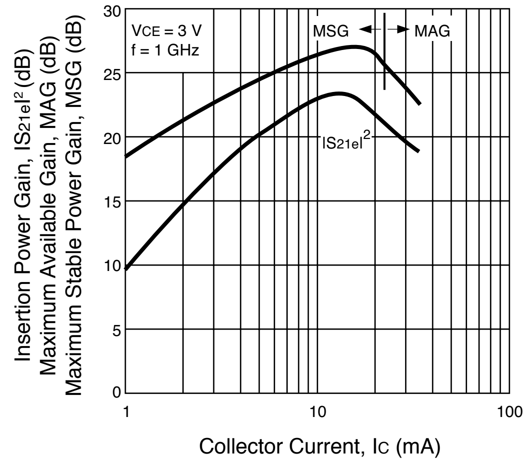

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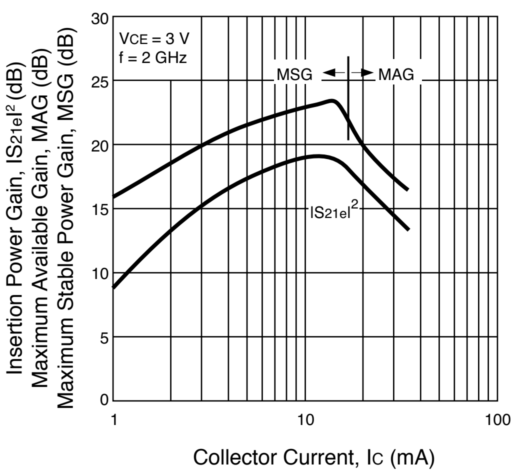

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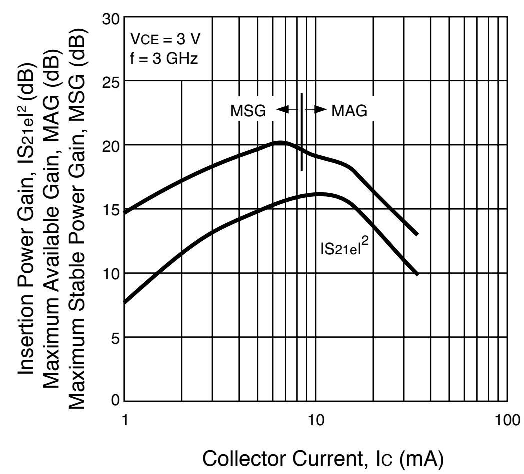

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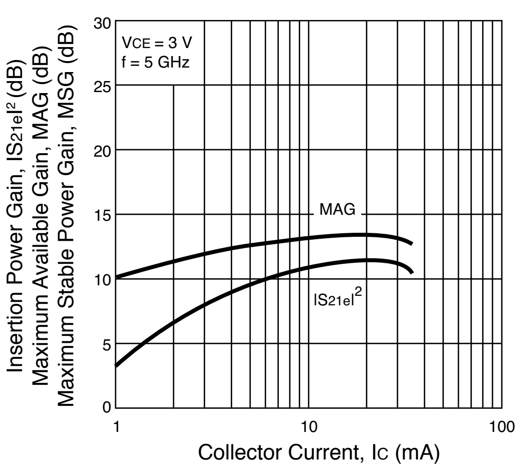
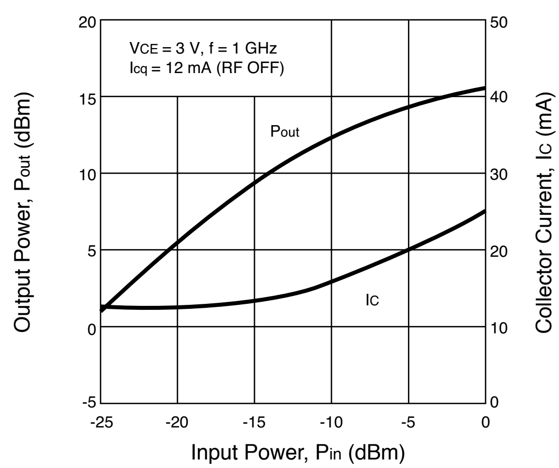


OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



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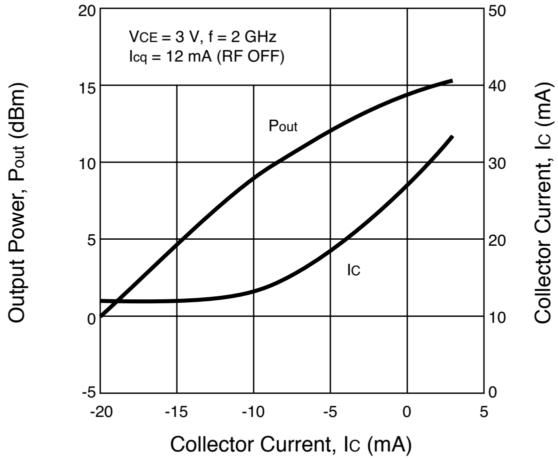
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



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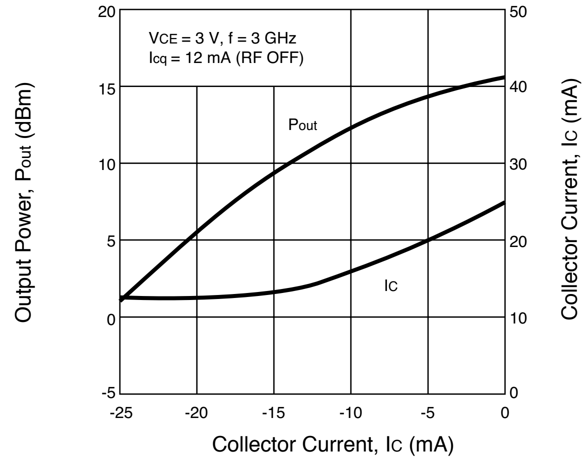

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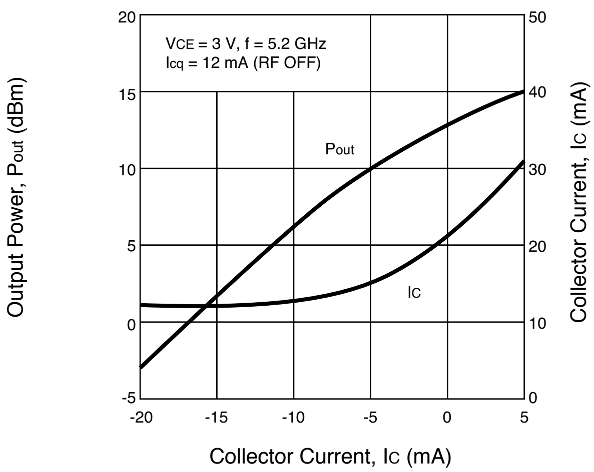
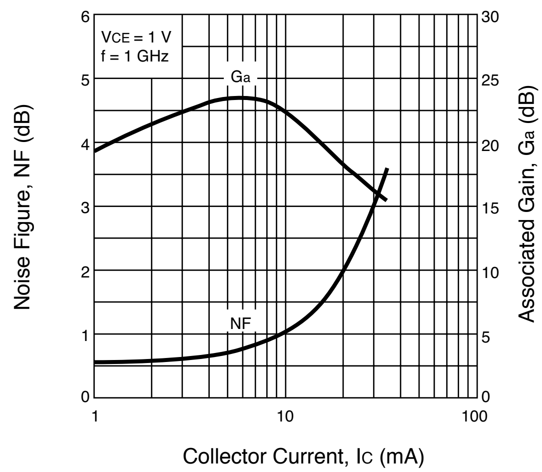


NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



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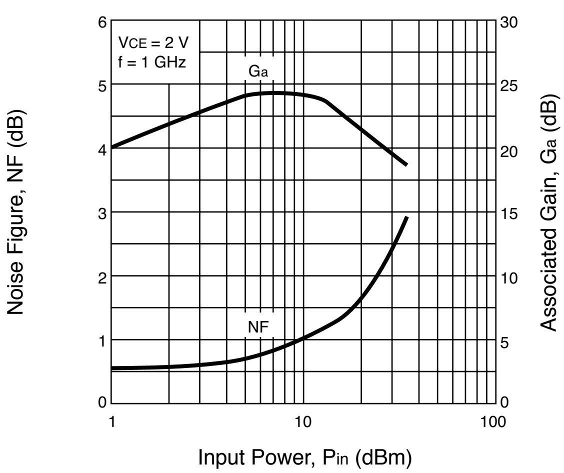

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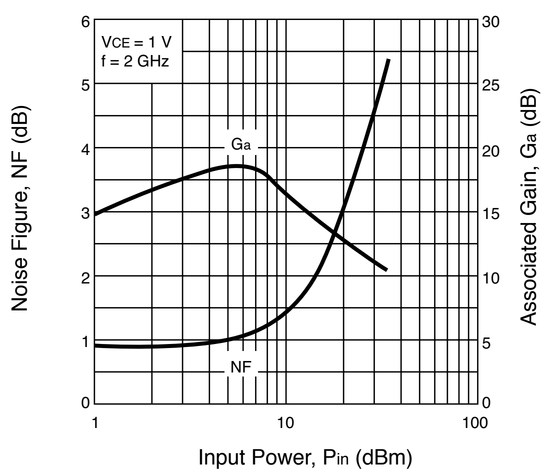

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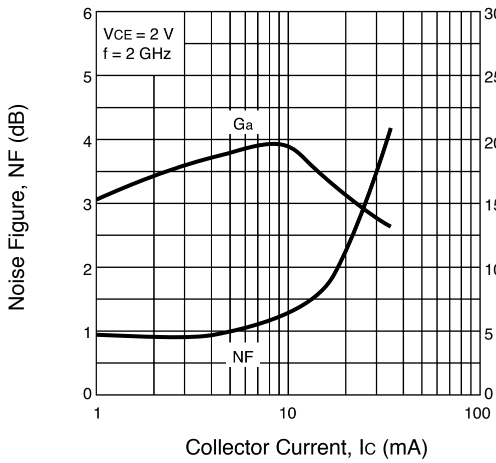

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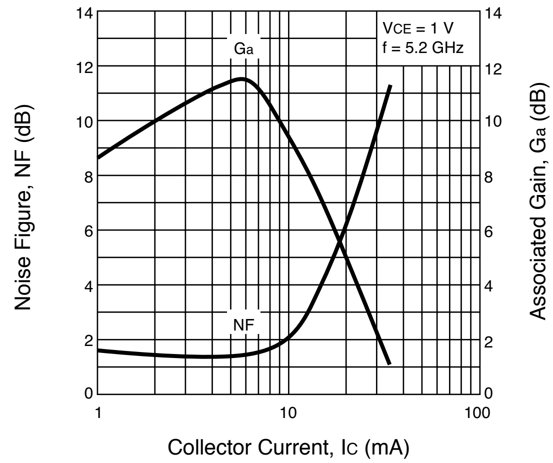

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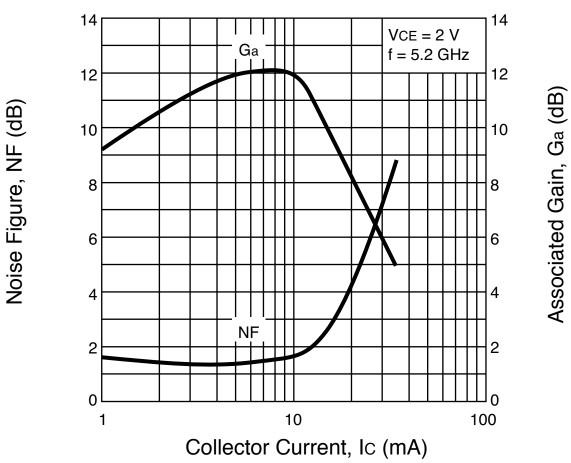

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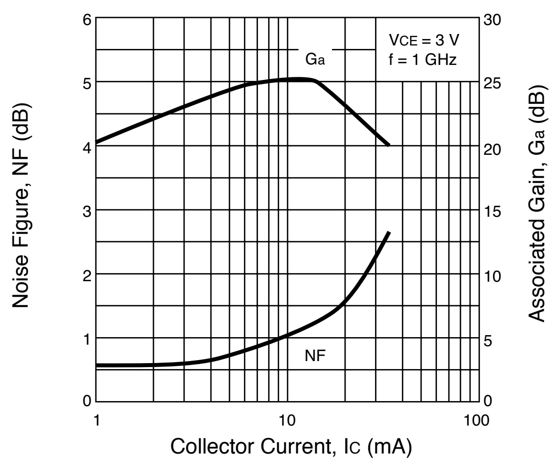

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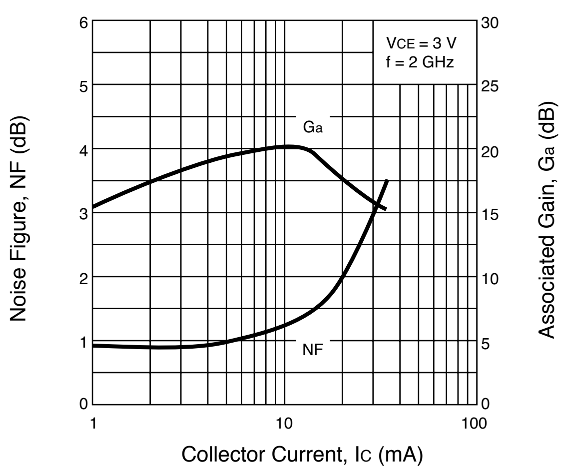

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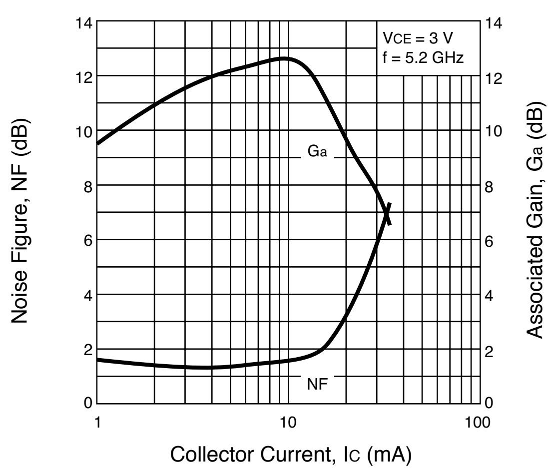
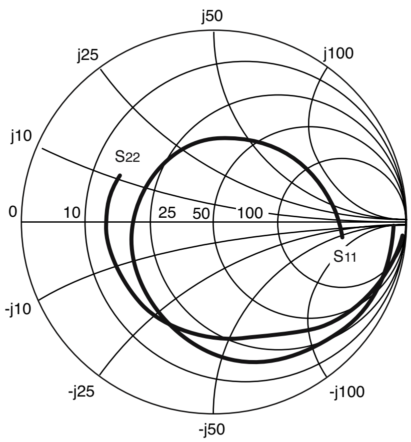
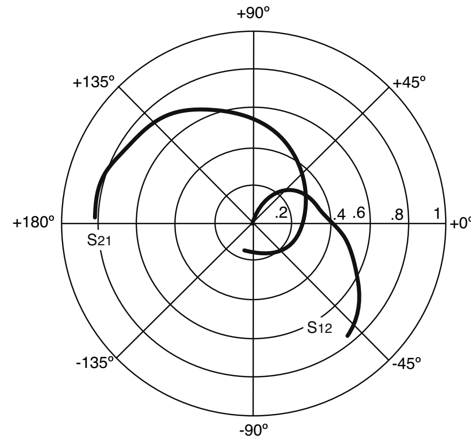


TYPICAL SCATTERING PARAMETERS ($T_A = 25°C$)





NESG2021M05
V_C = 2 V, I_C = 3 mA

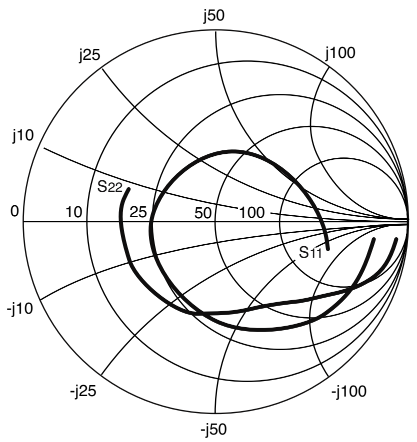
FREQUENCY	S11		S21		S12		S22		K	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.200	0.946	-10.22	8.272	171.72	0.010	77.40	0.972	-8.18	0.116	29.08
0.400	0.939	-21.17	8.157	162.07	0.019	72.44	0.949	-14.62	0.111	26.35
0.600	0.899	-31.03	7.778	151.63	0.026	65.01	0.911	-19.48	0.223	24.70
0.800	0.870	-41.43	7.582	143.03	0.033	59.52	0.882	-24.72	0.251	23.58
1.000	0.836	-50.89	7.300	135.01	0.039	54.23	0.852	-29.89	0.286	22.67
1.200	0.797	-60.01	7.021	127.25	0.045	49.42	0.824	-34.81	0.326	21.97
1.400	0.768	-68.73	6.712	120.08	0.049	45.04	0.794	-39.35	0.361	21.36
1.600	0.734	-77.22	6.429	113.09	0.053	41.07	0.766	-43.73	0.401	20.85
1.800	0.698	-85.25	6.108	106.35	0.056	37.28	0.739	-47.91	0.451	20.39
1.900	0.680	-89.09	5.952	103.34	0.057	35.63	0.727	-49.89	0.475	20.19
2.000	0.666	-92.89	5.832	99.77	0.058	33.76	0.714	-51.88	0.503	20.01
2.100	0.648	-96.89	5.707	96.86	0.059	32.38	0.702	-53.95	0.524	19.84
2.200	0.635	-100.52	5.555	93.97	0.060	30.84	0.694	-55.66	0.546	19.65
2.300	0.620	-104.26	5.426	91.03	0.061	29.56	0.684	-57.51	0.569	19.48
2.400	0.607	-107.86	5.288	88.16	0.062	28.09	0.675	-59.30	0.594	19.32
2.500	0.594	-111.38	5.162	85.36	0.063	26.83	0.667	-61.11	0.616	19.16
2.600	0.582	-115.04	5.056	82.39	0.063	25.53	0.658	-62.82	0.642	19.03
2.700	0.567	-118.51	4.943	79.90	0.064	24.45	0.652	-64.47	0.667	18.90
2.800	0.557	-122.08	4.823	77.07	0.064	23.28	0.644	-66.03	0.694	18.76
2.900	0.542	-125.65	4.722	74.51	0.065	22.42	0.636	-67.68	0.722	18.64
3.000	0.534	-128.55	4.589	72.07	0.065	21.17	0.631	-69.30	0.749	18.49
3.200	0.512	-135.89	4.408	67.05	0.066	19.53	0.621	-72.17	0.796	18.26
3.400	0.494	-142.68	4.222	62.21	0.066	17.95	0.612	-75.06	0.843	18.04
3.600	0.477	-149.48	4.051	57.47	0.067	16.46	0.604	-77.80	0.894	17.84
3.800	0.460	-156.31	3.895	52.88	0.067	15.34	0.598	-80.46	0.939	17.63
4.000	0.448	-163.14	3.749	48.36	0.068	14.14	0.593	-83.15	0.977	17.42
4.200	0.435	-170.10	3.618	43.92	0.069	13.00	0.590	-85.78	1.015	16.46
4.400	0.424	-176.87	3.485	39.60	0.069	11.95	0.587	-88.38	1.055	15.60
4.600	0.415	176.19	3.377	35.22	0.070	11.04	0.583	-91.04	1.090	15.02
4.800	0.406	169.47	3.260	31.03	0.070	10.09	0.582	-93.58	1.123	14.52
5.000	0.400	162.66	3.158	26.84	0.071	9.31	0.579	-96.11	1.154	14.09
5.200	0.397	156.06	3.061	22.72	0.072	8.50	0.578	-98.71	1.176	13.74
5.400	0.394	149.17	2.980	18.53	0.073	7.85	0.578	-101.47	1.182	13.50
5.600	0.394	142.89	2.893	14.46	0.074	6.87	0.578	-104.22	1.196	13.22
5.800	0.391	135.99	2.816	10.31	0.076	6.24	0.577	-106.93	1.209	12.93
6.000	0.391	129.51	2.737	6.38	0.078	5.18	0.576	-109.23	1.212	12.68
7.000	0.424	100.81	2.376	-13.77	0.086	-0.90	0.570	-125.13	1.225	11.58
8.000	0.458	75.19	2.092	-32.65	0.094	-7.03	0.561	-139.04	1.245	10.51
9.000	0.500	51.50	1.881	-51.57	0.108	-15.45	0.557	-154.26	1.145	10.09
10.000	0.556	29.26	1.705	-70.41	0.122	-25.25	0.557	-171.07	1.033	10.34
11.000	0.619	10.43	1.546	-89.24	0.138	-37.04	0.558	171.13	0.892	10.50
12.000	0.675	-5.98	1.396	-107.64	0.151	-49.36	0.551	154.30	0.787	9.65

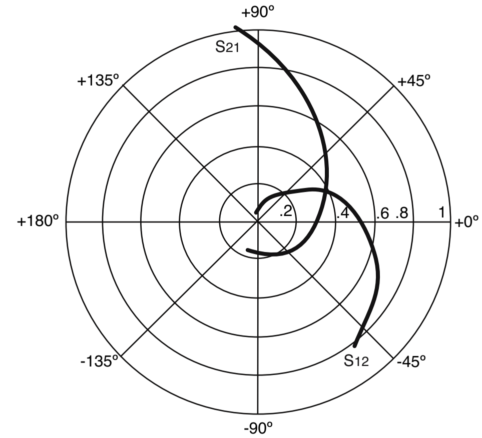
Note:
1. Gain Calculations:

$MAG = \frac{|S_{21}|}{|S_{12}|} \left(K \sqrt{K^2 - 1}\right)$. When $K \leq 1$, 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)





NESG2021M05
V_C = 2 V, I_C = 10 mA

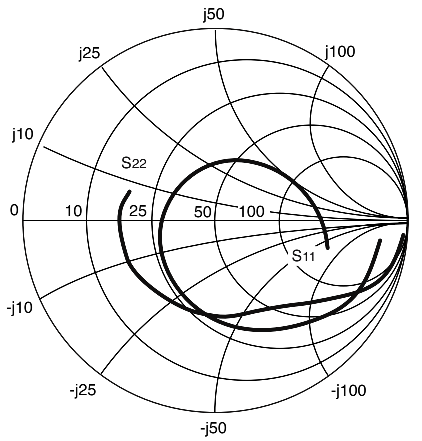
FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.200	0.835	-18.33	18.609	164.84	0.009	73.71	0.939	-11.48	0.213	33.02
0.400	0.800	-36.01	17.628	151.31	0.017	66.68	0.888	-20.34	0.223	30.16
0.600	0.710	-50.52	15.880	137.47	0.022	58.05	0.812	-25.78	0.397	28.52
0.800	0.652	-64.61	14.469	126.84	0.027	52.84	0.752	-31.20	0.468	27.30
1.000	0.599	-76.81	13.111	117.68	0.031	48.60	0.701	-35.65	0.543	26.32
1.200	0.547	-88.10	11.932	109.42	0.034	45.39	0.660	-39.59	0.616	25.49
1.400	0.499	-98.31	10.858	101.97	0.036	42.54	0.624	-42.97	0.697	24.78
1.600	0.462	-108.24	9.921	95.30	0.039	40.50	0.594	-46.10	0.761	24.09
1.800	0.435	-116.36	9.119	89.35	0.041	39.45	0.573	-48.85	0.820	23.52
1.900	0.416	-120.82	8.756	86.43	0.041	38.46	0.561	-50.39	0.860	23.25
2.000	0.404	-124.99	8.425	83.54	0.043	37.36	0.552	-51.94	0.882	22.94
2.100	0.394	-129.72	8.079	80.95	0.044	37.05	0.544	-53.41	0.906	22.65
2.200	0.388	-133.57	7.804	78.27	0.045	36.82	0.537	-54.69	0.920	22.39
2.300	0.376	-137.01	7.527	75.70	0.046	36.39	0.528	-55.96	0.957	22.16
2.400	0.363	-140.84	7.268	73.27	0.047	35.52	0.523	-57.37	0.986	21.93
2.500	0.355	-145.21	7.030	70.90	0.048	34.63	0.517	-58.93	1.002	21.40
2.600	0.350	-149.58	6.789	68.43	0.049	34.27	0.514	-60.07	1.012	20.73
2.700	0.345	-152.78	6.585	66.17	0.050	33.96	0.510	-61.47	1.026	20.18
2.800	0.339	-155.91	6.380	63.83	0.051	33.60	0.506	-62.69	1.048	19.62
2.900	0.330	-160.03	6.192	61.57	0.052	33.00	0.502	-64.17	1.072	19.12
3.000	0.321	-163.86	6.014	59.47	0.053	31.95	0.500	-65.60	1.089	18.72
3.200	0.317	-171.54	5.677	55.12	0.056	31.36	0.495	-67.87	1.101	18.14
3.400	0.304	-178.51	5.387	50.95	0.058	29.95	0.492	-70.57	1.133	17.49
3.600	0.301	173.87	5.117	46.87	0.060	28.82	0.489	-72.80	1.144	16.99
3.800	0.295	167.80	4.882	42.83	0.062	28.19	0.488	-75.42	1.160	16.51
4.000	0.289	159.42	4.662	38.91	0.065	26.09	0.488	-77.81	1.168	16.08
4.200	0.293	153.58	4.468	34.94	0.068	25.28	0.488	-80.64	1.161	15.75
4.400	0.283	146.90	4.288	31.10	0.070	23.77	0.490	-83.16	1.181	15.31
4.600	0.290	139.04	4.116	27.23	0.073	21.76	0.487	-85.55	1.175	14.99
4.800	0.290	134.00	3.963	23.45	0.075	21.21	0.490	-88.36	1.172	14.69
5.000	0.290	126.31	3.822	19.78	0.077	19.02	0.491	-90.56	1.182	14.36
5.200	0.300	120.69	3.688	15.96	0.081	17.40	0.493	-93.37	1.157	14.18
5.400	0.298	115.01	3.576	12.32	0.083	16.28	0.495	-95.96	1.163	13.90
5.600	0.307	108.67	3.457	8.51	0.086	13.74	0.497	-98.83	1.147	13.71
5.800	0.312	103.62	3.352	4.77	0.089	12.57	0.497	-101.79	1.142	13.48
6.000	0.313	96.60	3.272	1.28	0.091	10.20	0.496	-103.74	1.141	13.27
7.000	0.364	75.35	2.819	-17.05	0.105	0.71	0.493	-119.80	1.099	12.37
8.000	0.405	54.52	2.488	-34.45	0.117	-9.22	0.488	-133.25	1.076	11.59
9.000	0.452	34.92	2.253	-52.44	0.133	-19.76	0.485	-148.66	1.003	11.97
10.000	0.511	16.26	2.046	-70.36	0.146	-30.51	0.484	-165.49	0.934	11.47
11.000	0.574	0.34	1.857	-88.49	0.159	-41.99	0.476	176.50	0.863	10.69
12.000	0.628	-13.79	1.706	-106.37	0.170	-53.94	0.464	160.26	0.790	10.01

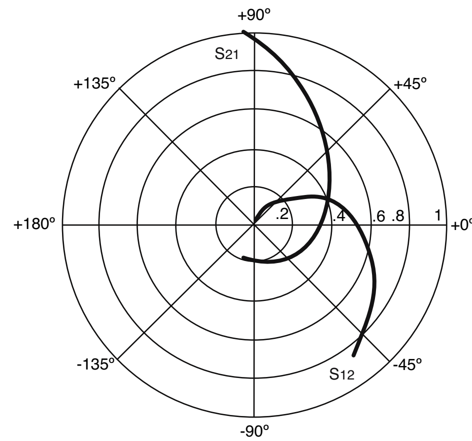
Note:
1. Gain Calculations:

$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \sqrt{K^2-1}\right)$. When K ≤ 1, 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)





NESG2021M05
V_C = 3 V, I_C = 10 mA

FREQUENCY	S11		S21		S12		S22		K	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.200	0.844	-16.85	19.298	165.77	0.009	73.06	0.952	-11.06	0.211	33.36
0.400	0.811	-32.92	18.324	152.74	0.016	67.44	0.905	-19.79	0.216	30.53
0.600	0.726	-46.53	16.590	139.26	0.021	59.10	0.831	-25.17	0.384	28.90
0.800	0.668	-59.65	15.198	128.81	0.026	54.18	0.772	-30.65	0.452	27.67
1.000	0.613	-71.14	13.847	119.81	0.030	49.71	0.721	-35.23	0.524	26.69
1.200	0.560	-81.77	12.631	111.57	0.033	46.76	0.679	-39.28	0.592	25.85
1.400	0.510	-91.34	11.532	104.15	0.035	43.86	0.642	-42.78	0.670	25.15
1.600	0.469	-100.95	10.563	97.46	0.038	41.47	0.611	-46.00	0.732	24.45
1.800	0.440	-108.53	9.736	91.48	0.040	40.43	0.588	-48.80	0.788	23.88
1.900	0.419	-112.66	9.348	88.61	0.041	39.40	0.577	-50.37	0.826	23.61
2.000	0.406	-116.96	9.002	85.71	0.042	38.36	0.567	-51.92	0.850	23.32
2.100	0.393	-121.27	8.651	83.03	0.043	37.91	0.558	-53.43	0.872	23.02
2.200	0.387	-125.25	8.351	80.39	0.044	37.60	0.551	-54.69	0.884	22.74
2.300	0.373	-128.43	8.061	77.80	0.045	37.21	0.541	-55.98	0.922	22.53
2.400	0.358	-132.02	7.787	75.37	0.046	36.24	0.536	-57.39	0.948	22.29
2.500	0.349	-136.40	7.531	73.02	0.047	35.38	0.529	-58.93	0.965	22.03
2.600	0.341	-140.83	7.285	70.54	0.048	34.94	0.525	-60.05	0.976	21.77
2.700	0.336	-143.85	7.063	68.27	0.050	34.76	0.521	-61.46	0.989	21.53
2.800	0.328	-147.06	6.852	65.93	0.050	34.32	0.517	-62.67	1.011	20.70
2.900	0.317	-150.78	6.656	63.69	0.051	33.55	0.512	-64.16	1.034	20.00
3.000	0.308	-154.74	6.456	61.59	0.052	32.39	0.510	-65.52	1.050	19.55
3.200	0.300	-162.50	6.101	57.25	0.055	31.79	0.504	-67.75	1.066	18.89
3.400	0.284	-169.31	5.794	53.12	0.057	30.45	0.502	-70.40	1.097	18.19
3.600	0.278	-177.22	5.505	49.06	0.059	29.14	0.498	-72.55	1.108	17.68
3.800	0.270	176.82	5.257	45.04	0.061	28.53	0.496	-75.14	1.125	17.17
4.000	0.261	167.94	5.025	41.16	0.064	26.40	0.496	-77.46	1.138	16.71
4.200	0.264	161.89	4.815	37.21	0.067	25.56	0.495	-80.27	1.128	16.40
4.400	0.252	155.07	4.623	33.39	0.068	24.16	0.498	-82.73	1.152	15.94
4.600	0.256	146.49	4.443	29.57	0.071	22.11	0.495	-85.07	1.145	15.62
4.800	0.255	141.22	4.278	25.82	0.074	21.44	0.497	-87.83	1.143	15.32
5.000	0.253	132.87	4.128	22.19	0.076	19.26	0.498	-89.97	1.154	14.97
5.200	0.263	126.75	3.987	18.45	0.080	17.81	0.499	-92.72	1.129	14.82
5.400	0.259	120.73	3.871	14.80	0.081	16.61	0.502	-95.26	1.137	14.53
5.600	0.268	113.69	3.745	11.09	0.085	14.16	0.504	-98.12	1.119	14.37
5.800	0.271	108.52	3.638	7.37	0.087	12.97	0.504	-101.02	1.117	14.13
6.000	0.272	100.98	3.543	3.87	0.089	10.69	0.504	-102.94	1.118	13.89
7.000	0.323	78.36	3.066	-14.37	0.103	1.22	0.500	-118.80	1.078	13.04
8.000	0.365	56.67	2.714	-31.64	0.115	-8.64	0.495	-131.93	1.058	12.27
9.000	0.412	36.71	2.466	-49.54	0.130	-18.84	0.495	-147.10	0.987	12.79
10.000	0.472	17.92	2.252	-67.30	0.143	-29.28	0.497	-163.71	0.919	11.98
11.000	0.537	2.07	2.061	-85.38	0.156	-40.61	0.491	178.36	0.843	11.20
12.000	0.594	-12.05	1.899	-103.31	0.168	-52.43	0.481	162.26	0.772	10.53

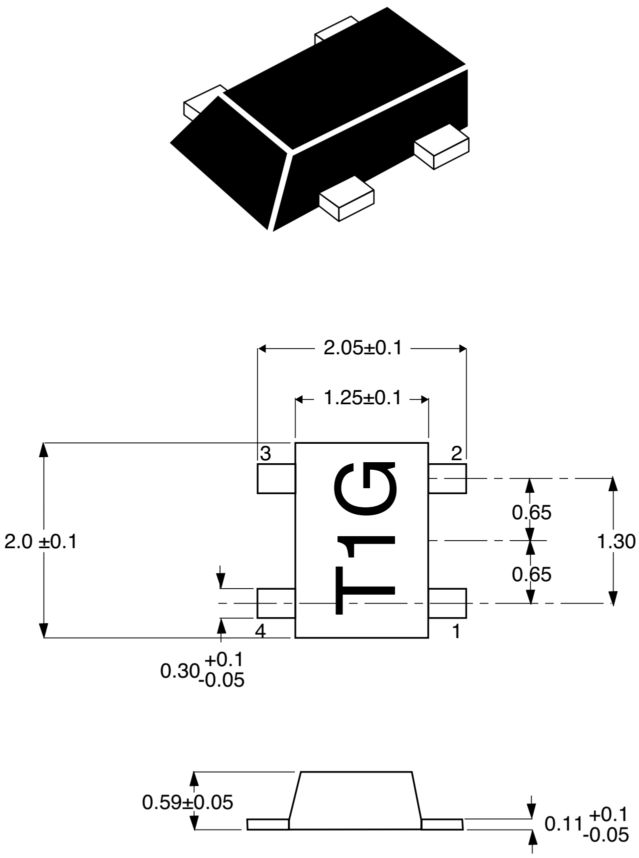
Note:
1. Gain Calculations:

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

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)

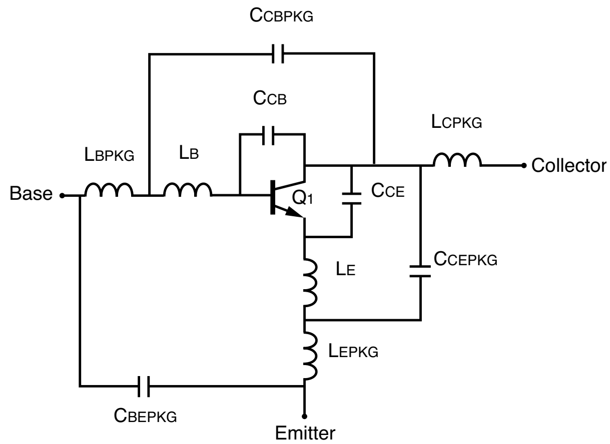
PACKAGE OUTLINE M05
FLAT LEAD 4-PIN THIN TYPE SUPER MINIMOLD



PIN CONNECTIONS
1. Base
2. Emitter
3. Collector
4. Emitter

NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS(1)

Parameters	Q1	Parameters	Q1
IS	4.429e-15	MJC	0.108
BF	331	XCJC	1
NF	1.141	CJS	0
VAF	15	VJS	0.75
IKF	31e-3	MJS	0
ISE	5.324e-15	FC	0.8
NE	1.609	TF	4e-12
BR	17.10	XTF	10
NR	1.102	VTF	5
VAR	2.70	ITF	0.5
IKR	26.09e-3	PTF	20
ISC	100e-18	TR	0
NC	1.197	EG	1.11
RE	1.6	XTB	1.3
RB	1.0	XTI	5.2
RBM	50e-3	KF*	0
IRB	1e-4	AF*	1
RC	5.0		
CJE	459.9e-15		
VJE	767.5e-3		
MJE	64.7e-3		
CJC	109.4e-15		
VJC	0.67		

(1) Gummel-Poon Model

ADDITIONAL PARAMETERS

Parameters	NESG2021M05
C_{CB}	0.001 pF
C_{CE}	0.18 pF
L_B	0.35 nH
L_E	0.16 nH
C_{CBPKG}	0.03 pF
C_{CEPKG}	0.001 pF
C_{BEPKG}	0.03 pF
L_{BPKG}	0.9 nH
L_{CPKG}	1.2 nH
L_{EPKG}	0.17 nH

MODEL TEST CONDITIONS
Frequency: 0.1 to 6 GHz
Bias: V_{CE} = 2 V, I_C = 1 mA to 10 mA
Date: 09/2003

CEL California Eastern Laboratories

4590 Patrick Henry Drive
Santa Clara, CA 95054-1817
Telephone: (408) 919-2500
Facsimile: (408) 988-0279

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL's understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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