CEL

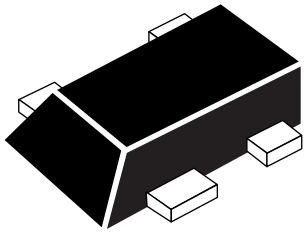
NPN SiGe RF TRANSISTOR

NESG2030M04

NPN SiGe HIGH FREQUENCY TRANSISTOR

FEATURES

- **SiGe TECHNOLOGY:**
  f_T = 60 GHz Process
- **LOW NOISE FIGURE:**
  NF = 0.9 dBm at 2 GHz
- **HIGH MAXIMUM STABLE GAIN:**
  MSG = 20 dB at 2 GHz
- **NEW LOW PROFILE M04 PACKAGE:**
  SOT-343 footprint, with a height of only 0.59 mm
  Flat lead style for better RF performance



M04

DESCRIPTION

NEC's NESG2030M04 is fabricated using NEC's state-of-the-art SiGe, wafer process. With a typical transition frequency of 60 GHz the NESG2030M04 is usable in applications from 100 MHz to over 10 GHz. Maximum DC current input of 35 mA provides a device with a usable current range of 250 μA to 25 mA. The NESG2030M04 provides excellent low voltage/low current performance.

NEC's new low profile/flat lead style "M04" package is ideal for today's portable wireless applications. The NESG2030M04 is an ideal choice for LNA and oscillator requirements in all mobile communication systems.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

		PART NUMBER EIAJ[1] REGISTERED NUMBER PACKAGE OUTLINE	NESG2030M04 2SC5761 M04			
	SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
DC	I_{CBO}	Collector Cutoff Current at V_{CB} = 5V, I_E = 0	nA			200
	I_{EBO}	Emitter Cutoff Current at V_{EB} = 0.5 V, I_C = 0	nA			200
	h_{FE}	DC Current Gain[2] at V_{CE} = 2 V, I_C = 5 mA		200		400
RF	C_{re}	Reverse Transfer Capacitance[3] at V_{CB} = 2 V, I_E = 0 mA, f = 1 GHz	pF		0.17	0.22
	NF	Noise Figure at V_{CE} = 2 V, I_C = 5 mA, f = 2 GHz, Z_{IN} = Z_{OPT}	dB		0.9	1.1
	G_a	Associated Gain at V_{CE} = 2 V, I_C = 5 mA, f = 2 GHz, Z_S = Z_{OPT}	GHz		16	
	MSG	Maximum Stable Gain[4] at V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	dB	18	20	
	$\|S_{21E}\|^2$	Insertion Power Gain at V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	dB	16	18	
	P_{1dB}	Output Power at 1 dB compression point V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	dBm		12	
	OIP_3	Third Order Intercept Point, V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	dBm		22	

Notes:

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

Date Published: June 22, 2005

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	8.0
V_{CEO}	Collector to Emitter Voltage	V	2.3
V_{EBO}	Emitter to Base Voltage	V	1.2
I_C	Collector Current	mA	35
P_T[2]	Total Power Dissipation	mW	80
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 • 1.0 mm (t) glass epoxy substrate

THERMAL RESISTANCE

SYMBOLS	PARAMETERS	UNITS	RATINGS
$R_{th\ j\text{-}c}$	Junction to Case Resistance	°C/W	150

ORDERING INFORMATION (Solder Contains Lead)

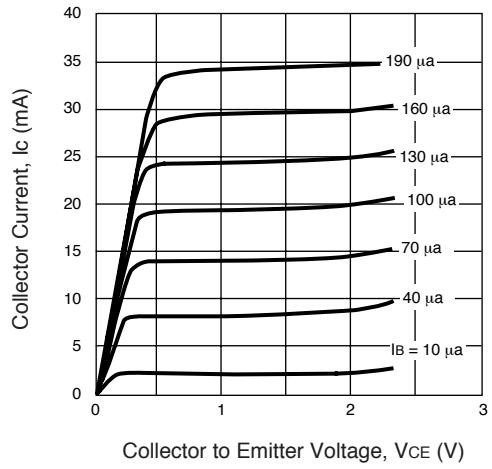
PART NUMBER	QUANTITY
NESG2030M04	50 pcs(non reel)
NESG2030M04-T2	3 kpcs/reel

ORDERING INFORMATION (Pb-Free)

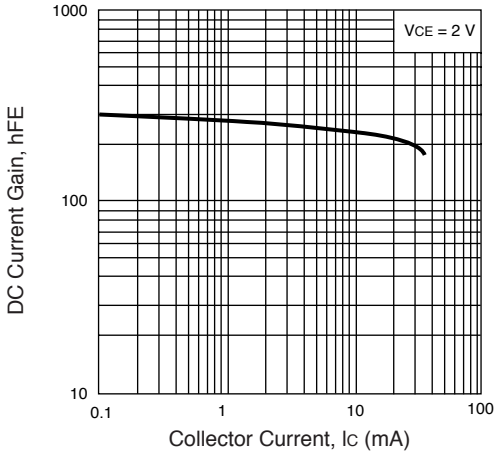
PART NUMBER	QUANTITY
NESG2030M04-A	50 pcs(non reel)
NESG2030M04-T2-A	3 kpcs/reel

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

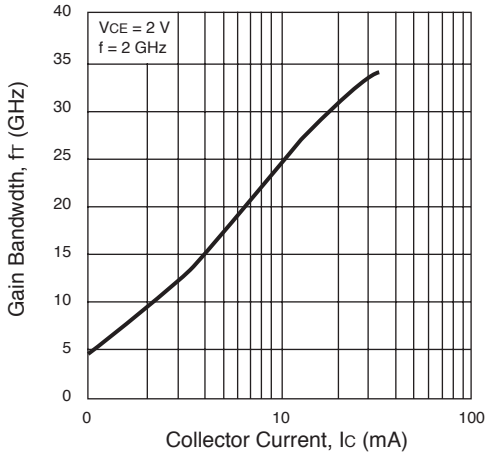
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



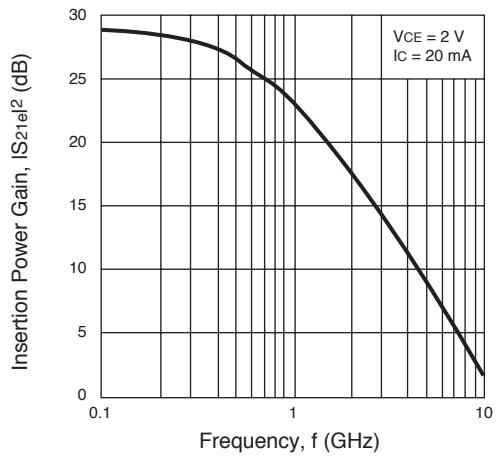
DC CURRENT GAIN vs. COLLECTOR CURRENT



GAIN BANDWIDTH vs. COLLECTOR CURRENT

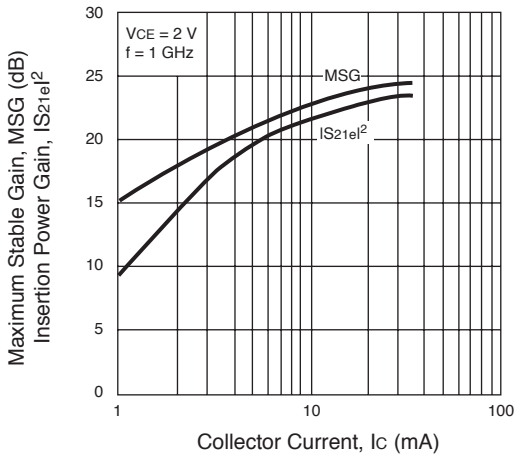


INSERTION POWER GAIN vs. FREQUENCY

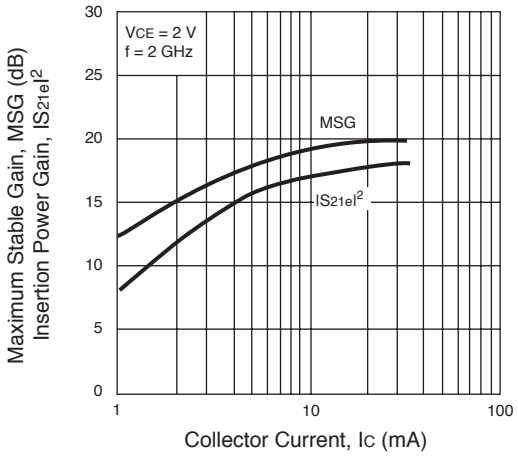


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

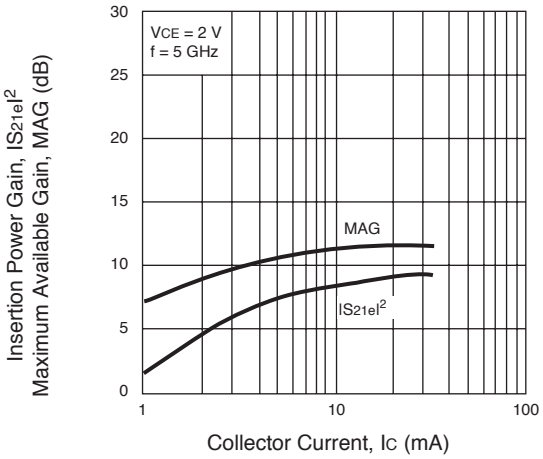
MAXIMUM STABLE GAIN, INSERTION POWER GAIN vs. COLLECTOR CURRENT



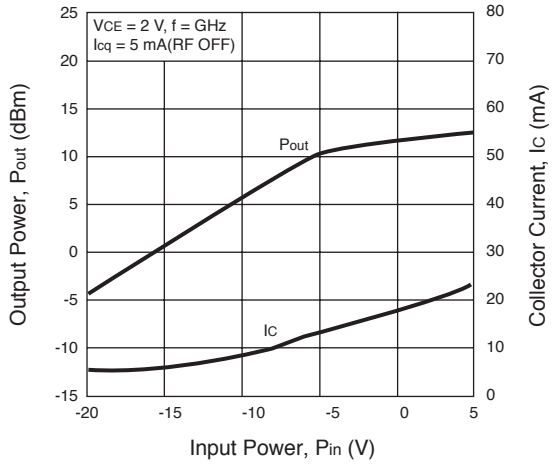
MAXIMUM STABLE GAIN, INSERTION POWER GAIN vs. COLLECTOR CURRENT



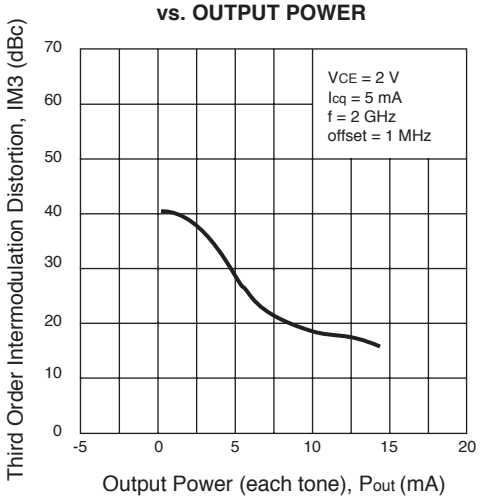
MAXIMUM AVAILABLE GAIN, INSERTION POWER GAIN vs. COLLECTOR CURRENT



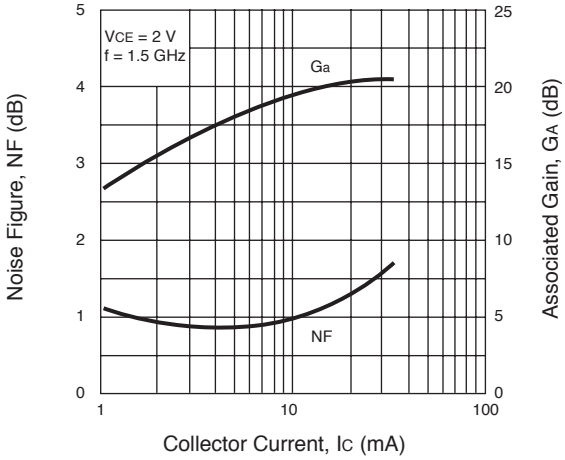
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



THIRD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER

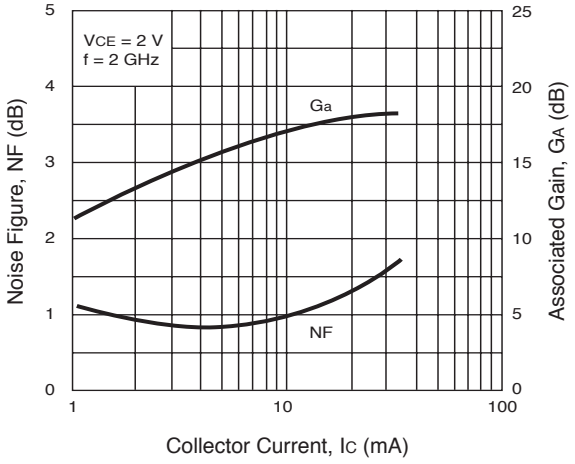


NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT

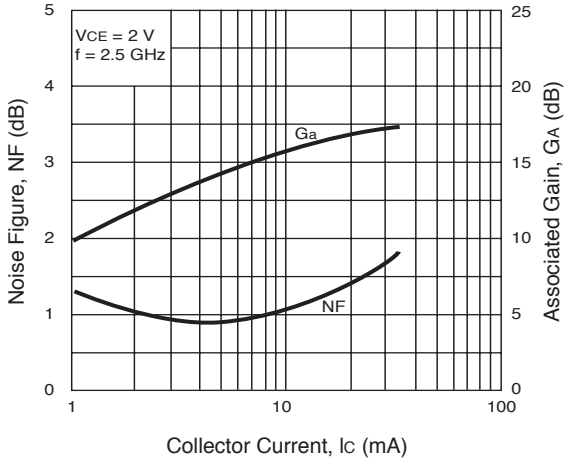


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

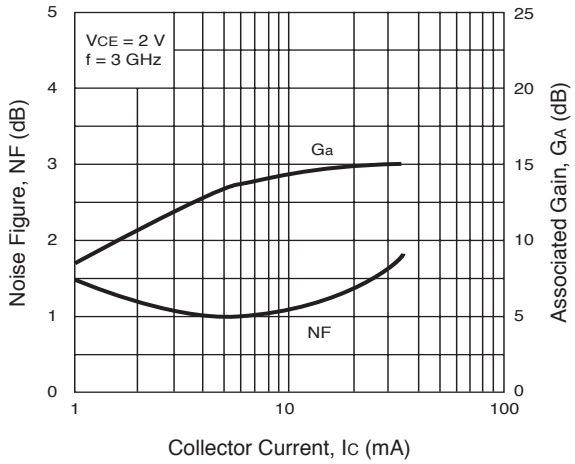
NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT



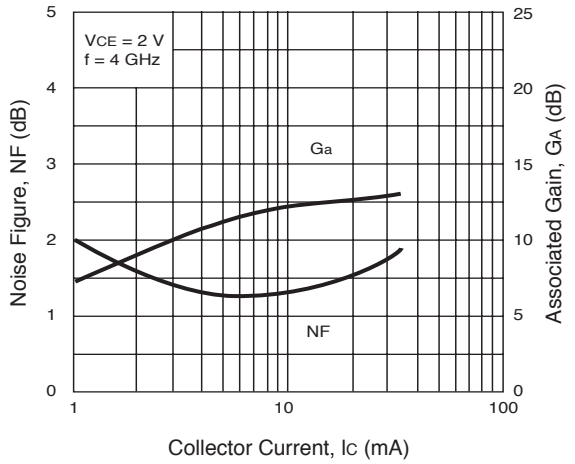
NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT



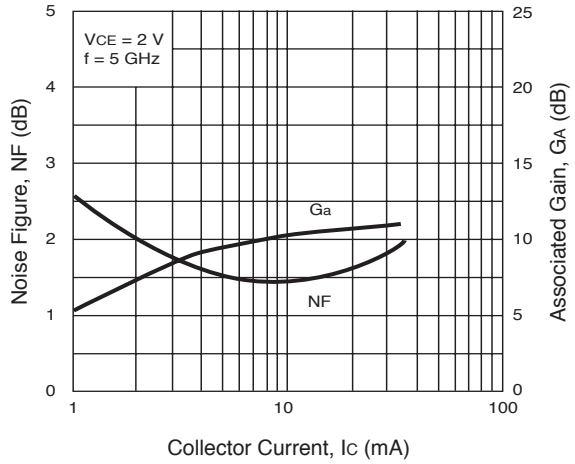
NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT



TYPICAL NOISE PARAMETERS (T_A = 25°C)

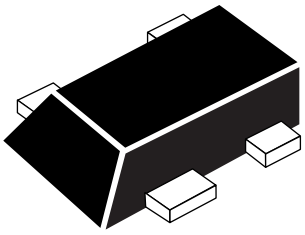
FREQ. (GHz)	NF_{MIN} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
V_{CE} = 2 V, I_C = 5 mA					
0.8	0.77	22.62	0.440	22.0	0.21
0.9	0.77	21.79	0.433	25.3	0.21
1.0	0.78	21.03	0.426	28.6	0.20
1.1	0.78	20.33	0.418	32.0	0.20
1.2	0.79	19.69	0.410	35.5	0.19
1.3	0.79	19.10	0.402	39.0	0.19
1.4	0.80	18.56	0.394	42.6	0.18
1.5	0.81	18.05	0.386	46.3	0.18
1.7	0.82	17.13	0.372	54.0	0.17
1.9	0.84	16.31	0.359	62.1	0.16
2.0	0.85	15.94	0.354	66.3	0.16
2.2	0.87	15.26	0.345	74.9	0.15
2.4	0.89	14.64	0.340	83.6	0.14
2.5	0.91	14.36	0.338	87.9	0.14
2.7	0.93	13.83	0.338	96.4	0.13
3.0	0.98	13.12	0.342	108.6	0.12
3.5	1.06	12.12	0.354	126.4	0.11
4.0	1.15	11.31	0.354	141.4	0.09
4.5	1.26	10.63	0.325	155.7	0.08
V_{CE} = 2 V, I_C = 10 mA					
0.8	0.95	24.28	0.264	18.6	0.18
0.9	0.95	23.43	0.261	21.8	0.18
1.0	0.95	22.65	0.257	25.1	0.18
1.1	0.95	21.93	0.253	28.5	0.17
1.2	0.95	21.27	0.249	32.0	0.17
1.3	0.95	20.65	0.244	35.6	0.17
1.4	0.96	20.08	0.239	39.3	0.17
1.5	0.96	19.54	0.234	43.2	0.16
1.7	0.96	18.56	0.226	51.5	0.16
1.9	0.97	17.70	0.219	60.4	0.15
2.0	0.98	17.30	0.216	65.0	0.15
2.2	0.99	16.56	0.213	74.6	0.14
2.4	1.00	15.89	0.213	84.2	0.14
2.5	1.01	15.58	0.214	88.9	0.13
2.7	1.03	15.00	0.219	98.1	0.13
3.0	1.06	14.23	0.229	108.6	0.12
3.5	1.12	13.13	0.249	110.7	0.11
4.0	1.19	12.23	0.258	142.4	0.10
4.5	1.27	11.48	0.243	156.3	0.10
V_{CE} = 2 V, I_C = 20 mA					
0.8	1.26	25.33	0.082	14.2	0.17
0.9	1.25	24.45	0.081	17.4	0.17
1.0	1.25	23.65	0.079	20.9	0.17
1.1	1.25	22.91	0.076	24.9	0.17
1.2	1.25	22.23	0.074	29.4	0.17
1.3	1.25	21.60	0.071	34.5	0.16
1.4	1.25	21.01	0.068	40.4	0.16
1.5	1.25	20.46	0.065	47.1	0.16
1.7	1.25	19.46	0.061	63.0	0.15
1.9	1.26	18.57	0.062	81.1	0.15

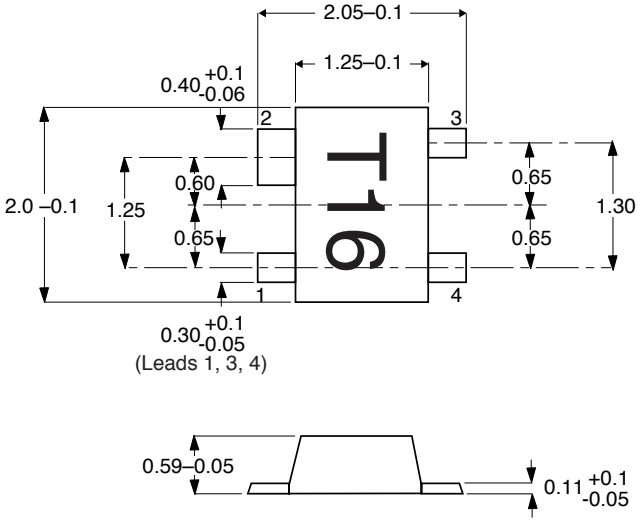
TYPICAL NOISE PARAMETERS (CONT')

FREQ. (GHz)	NF_{MIN} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
V_{CE} = 2 V, I_C = 20 mA					
2.0	1.26	18.16	0.064	90.1	0.15
2.2	1.27	17.40	0.072	106.5	0.15
2.4	1.28	16.71	0.083	119.5	0.14
2.5	1.28	16.39	0.090	124.8	0.14
2.7	1.30	15.79	0.105	133.5	0.14
3.0	1.32	14.97	0.128	143.2	0.13
3.5	1.36	13.81	0.159	154.7	0.13
4.0	1.42	12.84	0.175	164.5	0.12
4.5	1.48	12.02	0.169	176.7	0.12

OUTLINE DIMENSIONS (Units in mm)

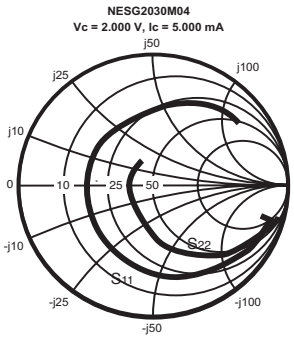
PACKAGE OUTLINE M04
FLAT LEAD 4-PIN THIN TYPE SUPER MINIMOLD



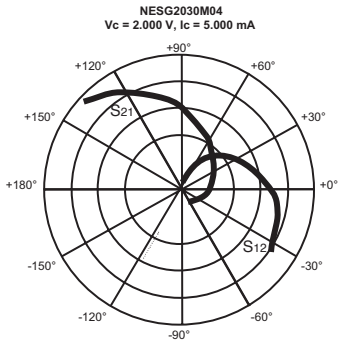


PIN CONNECTIONS
1. Emitter
2. Collector
3. Emitter
4. Base

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)



0.100 to 12.000GHz by 0.100



0.100 to 12.000GHz by 0.100

NESG2030M04
Vc = 2 V, Ic = 5 mA

FREQUENCY	S11		S21		S12		S22		MAG[1]	K
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	(dB)	
0.10	0.880	- 15.9	11.079	176.4	0.010	81.3	1.072	1.2	30.33	- 0.13
0.20	0.917	- 16.4	11.423	166.9	0.020	76.8	0.972	- 13.5	27.67	0.08
0.30	0.912	- 22.9	10.960	160.1	0.028	71.1	0.917	- 19.9	25.95	0.14
0.40	0.884	- 31.7	10.799	153.7	0.036	66.4	0.884	- 24.8	24.77	0.17
0.50	0.870	- 37.6	10.505	148.6	0.043	62.5	0.848	- 30.7	23.89	0.18
0.60	0.832	- 45.4	10.169	143.2	0.049	58.6	0.820	- 34.6	23.14	0.21
0.70	0.815	- 52.2	9.830	138.3	0.055	55.2	0.784	- 39.2	22.51	0.23
0.80	0.785	- 59.0	9.524	133.2	0.060	51.6	0.742	- 43.4	21.98	0.26
0.90	0.755	- 65.4	9.156	128.9	0.065	48.9	0.721	- 46.7	21.49	0.29
1.00	0.734	- 71.6	8.829	124.6	0.069	46.2	0.686	- 50.5	21.07	0.31
1.10	0.703	- 77.9	8.446	120.6	0.073	43.6	0.663	- 53.6	20.65	0.34
1.20	0.685	- 83.7	8.165	116.5	0.076	41.2	0.631	- 57.1	20.31	0.36
1.30	0.663	- 89.9	7.848	112.8	0.079	38.9	0.606	- 59.8	19.97	0.39
1.40	0.644	- 95.4	7.554	109.3	0.082	36.9	0.582	- 62.9	19.65	0.41
1.50	0.625	-100.9	7.255	105.9	0.084	35.0	0.560	- 65.5	19.36	0.44
1.60	0.608	-106.1	6.959	102.6	0.086	33.2	0.538	- 68.1	19.08	0.46
1.70	0.590	-111.5	6.714	99.5	0.088	31.6	0.521	- 70.5	18.82	0.49
1.80	0.577	-116.7	6.482	96.5	0.090	30.1	0.502	- 72.9	18.58	0.51
1.90	0.565	-121.4	6.206	93.7	0.091	28.7	0.486	- 74.8	18.33	0.54
2.00	0.552	-126.2	5.992	90.9	0.092	27.4	0.470	- 77.0	18.12	0.56
2.10	0.543	-131.2	5.811	88.1	0.094	26.0	0.454	- 79.2	17.92	0.58
2.20	0.533	-135.6	5.598	85.6	0.095	25.0	0.442	- 81.1	17.70	0.61
2.30	0.526	-140.1	5.404	83.2	0.096	23.9	0.429	- 82.4	17.50	0.63
2.40	0.521	-144.3	5.214	80.8	0.097	22.9	0.418	- 84.3	17.29	0.65
2.50	0.514	-148.5	5.052	78.4	0.098	22.0	0.407	- 85.7	17.11	0.68
2.60	0.511	-152.6	4.901	76.1	0.099	21.1	0.398	- 87.2	16.95	0.70
2.70	0.507	-156.5	4.748	73.8	0.100	20.3	0.386	- 88.8	16.76	0.72
2.80	0.504	-160.3	4.607	71.8	0.101	19.4	0.378	- 90.1	16.59	0.74
2.90	0.502	-163.7	4.463	69.6	0.102	18.7	0.369	- 91.4	16.42	0.76
3.00	0.498	-167.6	4.358	67.5	0.103	18.0	0.361	- 92.9	16.27	0.78
3.50	0.495	176.3	3.814	57.7	0.107	14.8	0.327	- 98.3	15.52	0.87
4.00	0.496	161.7	3.399	48.6	0.111	12.0	0.298	-102.6	14.85	0.95
4.50	0.502	148.2	3.067	39.8	0.116	9.5	0.273	-107.0	13.45	1.02
5.00	0.512	135.5	2.802	31.3	0.121	7.1	0.249	-111.5	12.05	1.07
5.50	0.526	123.3	2.577	22.9	0.125	4.3	0.226	-117.7	11.07	1.11
6.00	0.544	112.1	2.380	14.8	0.130	1.7	0.206	-125.8	10.30	1.15
6.50	0.564	101.8	2.198	6.7	0.134	- 1.4	0.192	-135.4	9.60	1.18
7.00	0.590	92.5	2.036	- 1.1	0.139	- 4.5	0.183	-147.1	9.05	1.19
8.00	0.645	76.9	1.746	- 16.1	0.144	- 10.7	0.179	-172.0	8.09	1.21
9.00	0.700	65.4	1.499	- 30.0	0.149	- 16.8	0.185	163.7	7.32	1.20
10.00	0.751	55.9	1.293	- 43.0	0.151	- 23.1	0.190	141.0	6.69	1.19
11.00	0.789	46.7	1.141	- 55.2	0.155	- 29.3	0.205	121.6	6.26	1.16
12.00	0.809	37.0	1.040	- 66.6	0.163	- 35.4	0.228	111.6	6.00	1.11

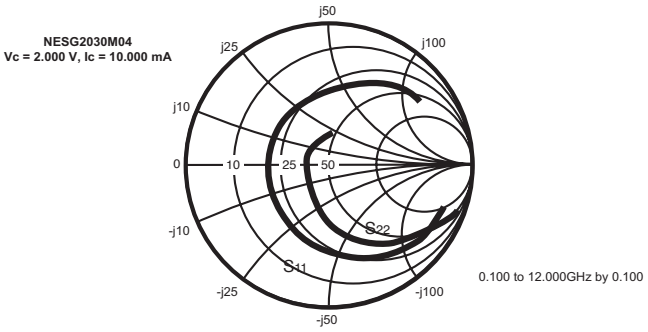
Note:

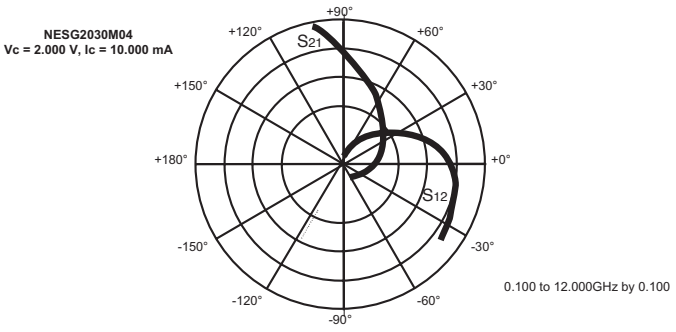
1. Gain Calculations:

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





NESG2030M04
V_{DS} = 2 V, I_{DS} = 10 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		MAG[1]	K
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	(dB)	
0.10	0.843	- 18.3	17.945	175.1	0.010	82.5	1.060	- 0.7	32.56	- 0.11
0.20	0.861	- 21.3	18.266	163.8	0.019	73.7	0.951	- 17.8	29.85	0.12
0.30	0.842	- 29.5	17.254	155.5	0.026	67.8	0.882	- 25.7	28.15	0.19
0.40	0.802	- 40.1	16.649	148.2	0.034	63.3	0.835	- 32.1	26.93	0.22
0.50	0.776	- 47.3	15.854	142.3	0.040	58.8	0.790	- 39.3	26.01	0.25
0.60	0.730	- 56.4	15.040	136.3	0.045	55.3	0.749	- 44.1	25.26	0.28
0.70	0.704	- 64.0	14.268	131.0	0.050	52.3	0.706	- 49.5	24.57	0.31
0.80	0.667	- 71.6	13.490	125.7	0.054	49.3	0.656	- 54.5	24.01	0.35
0.90	0.635	- 78.8	12.769	121.3	0.057	46.6	0.629	- 58.3	23.51	0.38
1.00	0.610	- 85.4	12.100	117.0	0.060	44.6	0.591	- 62.6	23.03	0.41
1.10	0.581	- 92.3	11.435	113.0	0.063	42.6	0.563	- 66.1	22.59	0.45
1.20	0.561	- 98.2	10.861	109.2	0.065	41.0	0.532	- 70.0	22.20	0.48
1.30	0.541	-104.7	10.311	105.7	0.068	39.4	0.506	- 73.1	21.83	0.51
1.40	0.524	-110.4	9.810	102.4	0.070	38.0	0.482	- 76.5	21.47	0.54
1.50	0.508	-116.0	9.335	99.3	0.072	36.7	0.461	- 79.3	21.14	0.57
1.60	0.494	-121.3	8.887	96.3	0.074	35.5	0.440	- 82.3	20.82	0.60
1.70	0.481	-126.8	8.494	93.4	0.075	34.6	0.424	- 84.8	20.52	0.62
1.80	0.471	-132.0	8.130	90.7	0.077	33.7	0.407	- 87.6	20.25	0.65
1.90	0.462	-136.7	7.765	88.2	0.079	32.7	0.392	- 89.7	19.95	0.67
2.00	0.453	-141.5	7.450	85.7	0.080	32.0	0.378	- 92.2	19.68	0.70
2.10	0.448	-146.3	7.166	83.2	0.081	31.3	0.365	- 94.6	19.45	0.72
2.20	0.442	-150.6	6.881	80.9	0.083	30.6	0.354	- 96.8	19.19	0.75
2.30	0.439	-154.8	6.624	78.7	0.084	29.9	0.343	- 98.4	18.95	0.77
2.40	0.437	-158.9	6.378	76.5	0.086	29.2	0.333	-100.6	18.71	0.79
2.50	0.433	-162.8	6.156	74.4	0.087	28.8	0.323	-102.1	18.48	0.81
2.60	0.434	-166.7	5.954	72.4	0.089	28.1	0.316	-103.9	18.26	0.82
2.70	0.431	-170.3	5.751	70.3	0.090	27.6	0.306	-105.9	18.06	0.84
2.80	0.431	-173.8	5.571	68.4	0.091	27.2	0.300	-107.3	17.85	0.86
2.90	0.430	-177.0	5.391	66.5	0.093	26.6	0.291	-109.1	17.64	0.88
3.00	0.430	179.5	5.238	64.6	0.095	26.2	0.285	-110.5	17.43	0.89
3.50	0.434	164.9	4.558	55.6	0.102	23.4	0.255	-117.4	16.51	0.96
4.00	0.439	151.7	4.043	47.1	0.110	21.0	0.229	-123.2	15.19	1.01
4.50	0.448	139.5	3.636	38.9	0.117	18.0	0.206	-129.4	13.59	1.05
5.00	0.462	128.0	3.310	30.9	0.125	14.7	0.184	-136.6	12.56	1.07
5.50	0.478	117.0	3.034	23.0	0.133	11.1	0.167	-146.4	11.69	1.10
6.00	0.498	106.8	2.795	15.3	0.140	7.4	0.155	-158.5	10.97	1.11
6.50	0.521	97.3	2.582	7.7	0.147	3.5	0.152	-172.3	10.32	1.12
7.00	0.549	88.8	2.391	0.2	0.152	- 0.5	0.155	173.5	9.78	1.13
8.00	0.609	74.5	2.052	- 14.1	0.160	- 8.7	0.175	147.8	8.83	1.14
9.00	0.670	63.9	1.767	- 27.6	0.164	- 16.5	0.199	125.4	8.07	1.14
10.00	0.724	55.1	1.530	- 40.3	0.167	- 24.1	0.218	104.0	7.43	1.13
11.00	0.765	46.3	1.352	- 52.4	0.169	- 31.6	0.240	87.7	6.97	1.12
12.00	0.786	36.9	1.238	- 63.6	0.174	- 38.7	0.253	79.4	6.66	1.09

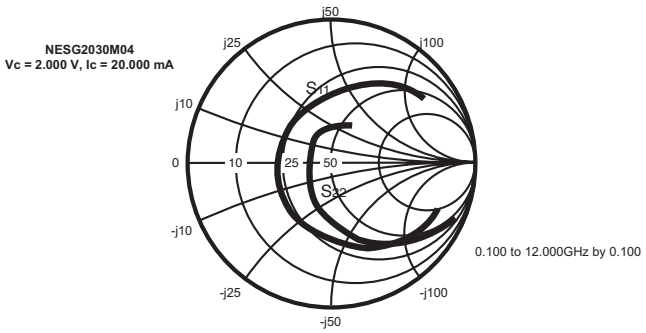
Note:

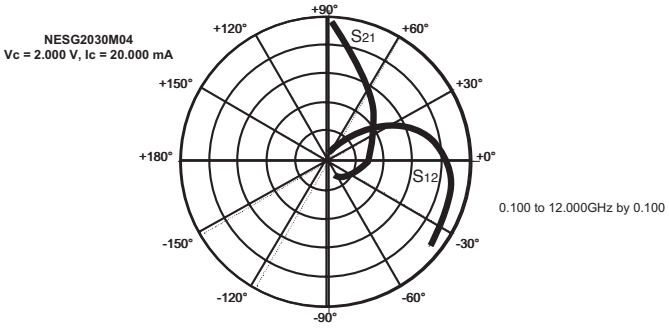
1. Gain Calculations:

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





NESG2030M04
V_{DS} = 2 V, I_{DS} = 20 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		MAG[1]	K
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	(dB)	
0.10	0.786	- 21.3	25.785	173.5	0.009	84.5	1.044	- 2.9	34.58	- 0.13
0.20	0.783	- 27.1	25.691	160.2	0.018	70.6	0.924	- 22.3	31.53	0.16
0.30	0.750	- 36.9	23.773	150.7	0.025	64.7	0.840	- 31.8	29.79	0.25
0.40	0.700	- 49.4	22.359	142.5	0.031	60.2	0.778	- 39.8	28.59	0.29
0.50	0.667	- 57.6	20.800	136.0	0.036	56.6	0.725	- 47.9	27.61	0.32
0.60	0.619	- 67.9	19.318	129.8	0.040	53.2	0.675	- 53.5	26.80	0.37
0.70	0.590	- 76.2	17.984	124.4	0.044	50.7	0.628	- 59.6	26.10	0.40
0.80	0.554	- 84.4	16.687	119.2	0.047	48.2	0.575	- 65.2	25.48	0.45
0.90	0.525	- 92.1	15.577	114.9	0.050	46.7	0.546	- 69.2	24.94	0.49
1.00	0.502	- 99.0	14.563	110.8	0.053	45.2	0.510	- 74.0	24.41	0.52
1.10	0.479	-106.4	13.636	107.0	0.055	43.8	0.482	- 77.8	23.95	0.56
1.20	0.462	-112.4	12.805	103.5	0.057	42.7	0.453	- 82.1	23.50	0.60
1.30	0.447	-119.0	12.055	100.2	0.059	41.8	0.429	- 85.5	23.08	0.63
1.40	0.435	-124.8	11.384	97.2	0.061	41.1	0.408	- 89.2	22.69	0.66
1.50	0.423	-130.5	10.772	94.3	0.063	40.2	0.390	- 92.3	22.32	0.69
1.60	0.414	-135.7	10.209	91.6	0.065	39.5	0.372	- 95.7	21.96	0.72
1.70	0.406	-141.2	9.703	89.0	0.067	38.9	0.358	- 98.3	21.61	0.74
1.80	0.401	-146.1	9.243	86.5	0.069	38.4	0.345	-101.5	21.27	0.76
1.90	0.395	-150.8	8.810	84.2	0.071	38.0	0.332	-103.9	20.95	0.79
2.00	0.391	-155.4	8.424	82.0	0.072	37.4	0.321	-106.7	20.65	0.81
2.10	0.389	-160.0	8.071	79.7	0.074	36.9	0.311	-109.3	20.37	0.83
2.20	0.387	-164.0	7.735	77.6	0.076	36.5	0.303	-111.8	20.05	0.85
2.30	0.386	-168.0	7.433	75.6	0.078	36.2	0.293	-113.8	19.79	0.87
2.40	0.387	-171.7	7.147	73.6	0.080	35.5	0.286	-116.1	19.53	0.88
2.50	0.386	-175.4	6.886	71.7	0.082	35.2	0.279	-118.1	19.25	0.90
2.60	0.389	-178.9	6.649	69.8	0.083	34.6	0.272	-120.2	19.02	0.91
2.70	0.388	177.9	6.413	67.9	0.085	34.1	0.265	-122.3	18.76	0.92
2.80	0.389	174.7	6.207	66.1	0.088	33.5	0.260	-124.1	18.51	0.93
2.90	0.390	171.7	6.003	64.3	0.089	33.3	0.254	-126.1	18.27	0.95
3.00	0.391	168.5	5.819	62.6	0.091	32.7	0.249	-127.7	18.05	0.96
3.50	0.399	155.4	5.046	54.1	0.101	30.0	0.226	-136.1	16.90	1.00
4.00	0.407	143.5	4.465	46.1	0.111	27.0	0.205	-143.5	14.98	1.03
4.50	0.418	132.5	4.009	38.3	0.121	23.4	0.187	-152.0	13.81	1.05
5.00	0.432	122.0	3.642	30.7	0.131	19.4	0.171	-161.7	12.87	1.07
5.50	0.450	112.0	3.333	23.1	0.139	15.1	0.163	-173.7	12.05	1.08
6.00	0.472	102.6	3.066	15.6	0.148	10.9	0.164	173.3	11.36	1.09
6.50	0.496	93.8	2.832	8.3	0.155	6.2	0.172	160.4	10.73	1.09
7.00	0.525	85.9	2.621	1.1	0.162	1.6	0.186	148.1	10.20	1.10
8.00	0.588	72.5	2.251	- 12.7	0.170	- 7.4	0.221	127.1	9.26	1.10
9.00	0.651	62.5	1.940	- 25.9	0.175	- 16.1	0.254	107.8	8.49	1.10
10.00	0.707	54.3	1.682	- 38.3	0.177	- 24.6	0.282	88.7	7.85	1.10
11.00	0.750	45.8	1.488	- 50.2	0.178	- 32.8	0.306	73.7	7.36	1.09
12.00	0.771	36.6	1.367	- 61.2	0.182	- 40.3	0.316	64.9	7.01	1.08

Note:

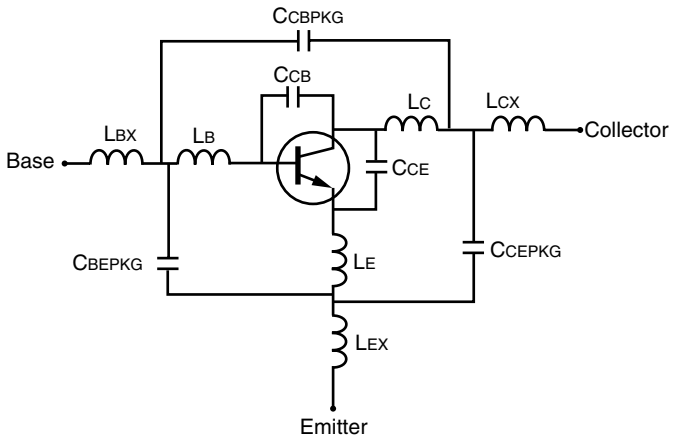
1. Gain Calculations:

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

NESG2030M04 NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS (1)

Parameters	Q1	Parameters	Q1
IS	2.42e-13	MJC	0.16
BF	382	XCJC	1
NF	1.025	CJS	0
VAF	87	VJS	0.75
IKF	100	MJS	0
ISE	5.2e-13	FC	0.5
NE	2.806	TF	3e-12
BR	15.7	XTF	2
NR	1.02	VTF	0.1
VAR	1.307	ITF	0.001
IKR	0.037	PTF	0
ISC	9e-14	TR	50e-12
NC	2.194	EG	1.11
RE	2.2	XTB	0
RB	4	XTI	3
RBM	1	KF	120e-15
IRB	0.007	AF	1.37
RC	4.2		
CJE	0.4e-12		
VJE	0.98		
MJE	0.25		
CJC	0.12e-12		
VJC	0.63		

(1) Gummel-Poon Model

ADDITIONAL PARAMETERS

Parameters	NESG2030M04
CCB	0.07e-12
CCE	0.05e-12
LB	0.9e-9
LC	0.5e-9
LE	0.14e-9
CCBPKG	0.001e-12
CCEPKG	0.2e-12
CBEPK	0.1e-12
LBX	0.2e-9
LCX	0.2e-9
LEX	0.1e-9

MODEL RANGE

Frequency: 0.1 to 12 GHz
Bias: V_{CE} = 0.5 V to 3 V, I_C = 1 mA to 30 mA
Date: 12/2001

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	
Lead (Pb)	< 1000 PPM	-A	-AZ
		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.