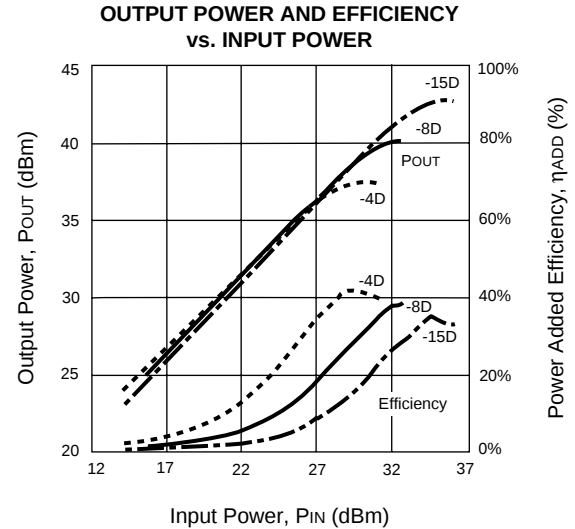


C-BAND INTERNALLY MATCHED POWER GaAs MESFET

NEZ5964-15D
NEZ5964-15DL
NEZ5964-8D
NEZ5964-8DL
NEZ5964-4D
NEZ5964-4DL

FEATURES

- HIGH P_{OUT}**
18W (42.5 dBm) Typ P_{1dB} for NEZ5964-15D/15DL
9W (39.5 dBm) Typ P_{1dB} for NEZ5964-8D/8DL
4.5W (36.5 dbm) Typ P_{1dB} for NEZ5964-4D/4DL
- HIGH EFFICIENCY**
37% η_{ADD} for 4.5W Device
35% η_{ADD} for 9W Device
33% η_{ADD} for 18W Device
- LOW IMD**
-45 dBc IM3 @ 31.5 dBm P_{OUT} (SCL) -15DL
-45 dBc IM3 @ 29 dBm P_{OUT} (SCL) -8DL
-45 dBc IM3 @ 26 dBm P_{OUT} (SCL) -4DL
- SiO₂ PASSIVATED CHIP**
For Power/Gain Stability Under RF Overdrive
- CLASS A OPERATION**
- INTERNALLY MATCHED (IN/OUT)**
- SUPERIOR GAIN FLATNESS**
- INDUSTRY COMPATIBLE HERMETIC PACKAGES**



ELECTRICAL CHARACTERISTICS (T_C = 25°C)

PART NUMBER			NEZ5964-4D NEZ5964-4DL T-61			NEZ5964-8D NEZ5964-8DL T-61			NEZ5964-15D NEZ5964-15DL T-65			TEST CONDITIONS
PACKAGE OUTLINE			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
P _{1dB}	Output Power at P _{1dB} ¹ I _{DSQ} = 0.8A, (RF Off) I _{DSQ} = 1.6A I _{DSQ} = 4.0A	dBm dBm dBm	35.5	36.5		38.5	39.5		41.5	42.5		V _{DS} = 10V f = 5.9 to 6.45 GHz Z _S = Z _L 50 ohms
η_{ADD}	Power Added Efficiency @ P _{1dB}	%		37			35			33		
I _{DS}	Drain Current at P _{1dB}	A		1.1	1.5		2.2	3.0		4.4	6.0	
GL	Linear Gain	dB	9.0	10.0		8.5	9.5		8.0	9.0		V _{DS} = 10V f ₁ = 6.44 GHz f ₂ = 6.45 GHz 2 Equal Tones
IM ₃ -XDL Option Only	3rd Order Intermodulation Distortion ³ at P _{out} = 26 dBm SCL ² , I _{DSQ} = 0.5 x I _{DSS} P _{out} = 29 dBm SCL ² , I _{DSQ} = 0.5 x I _{DSS} P _{out} = 31.5 dBm SCL ² , I _{DSQ} = 0.5 x I _{DSS}	dBc dBc dBc		-45	-42		-45	-42		-45	-42	
I _{DSS}	Saturated Drain Current, V _{GS} = 0 V	A	1.0	2.3	3.5	2.0	4.5	7.0	4.0	9.2	14.0	
V _P	Pinch Off Voltage I _{DS} = 15 mA I _{DS} = 30 mA I _{DS} = 60 mA	V V V	-3.5	-2.0	-0.5	-3.5	-2.0	-0.5	-3.5	-2.2	-0.5	V _{DS} = 2.5 V
BV _{DGO}	Drain - Gate Breakdown Voltage I _{DG} = 15 mA I _{DG} = 30 mA I _{DG} = 60 mA	V V V	20	22		20	22		20	22		
g _m	Transconductance I _{DS} = 1 A I _{DS} = 2 A I _{DS} = 4 A	mS mS mS		1300			2600			5200		
R _{TH(CH-C)}	Thermal Resistance (Channel to Case)	°C/W		5.0	6.0		2.5	3.0		1.3	1.5	
$\Delta T_{(CH-C)}$	Channel Temperature Rise ⁴	°C			48			48			60	

Notes:

- P_{1dB}: Output Power at the 1dB Gain Compression Point.
- SCL: Single Carrier Level.

3. Maximum Spec Applies to -XDL Option Only.

4. $\Delta T_{(CH-C)} = T_{CH} - T_C = 10 V \times I_{DSQ} \times R_{TH(CH-C)} \text{ MAX.}$

ABSOLUTE MAXIMUM RATINGS¹ (T_C = 25 °C)

SYMBOLS	PARAMETERS	UNITS	RATINGS		
			NEZ5964-4D/4DL	NEZ5964-8D/8DL	NEZ5964-15D/15DL
V _{DS}	Drain to Source Voltage	V	15	15	15
V _{GS}	Gate to Source Voltage	V	-12	-12	-12
V _{GD}	Gate to Drain Voltage	V	-18	-18	-18
I _{DS}	Drain Current	A	I _{DSS}	I _{DSS}	I _{DSS}
I _{GRF}	Gate Current	mA	25	50	100
T _{CH}	Channel Temperature	°C	175	175	175
T _{STG}	Storage Temperature	°C	-65 to +175	-65 to +175	-65 to +175
P _T	Total Power Dissipation	W	25	50	100

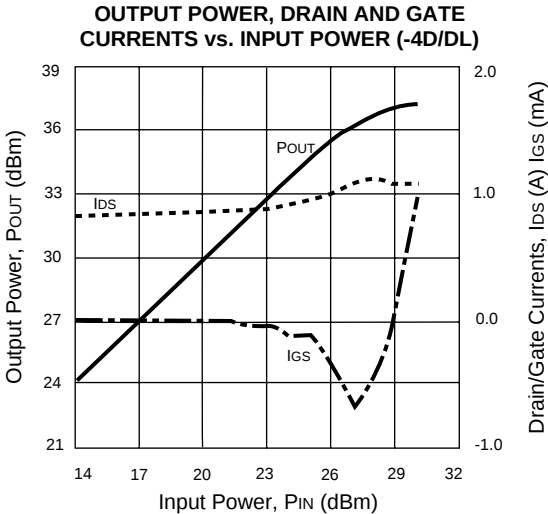
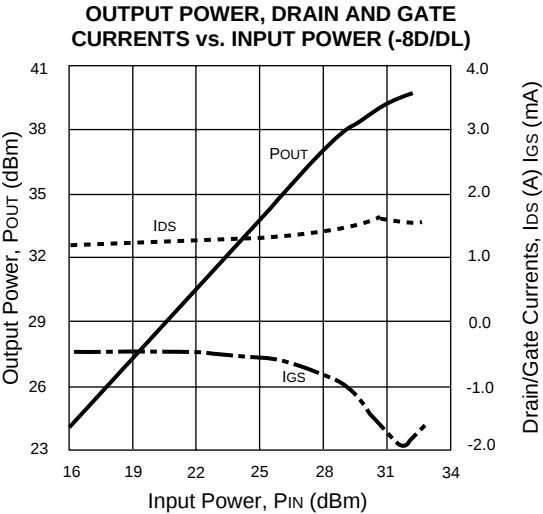
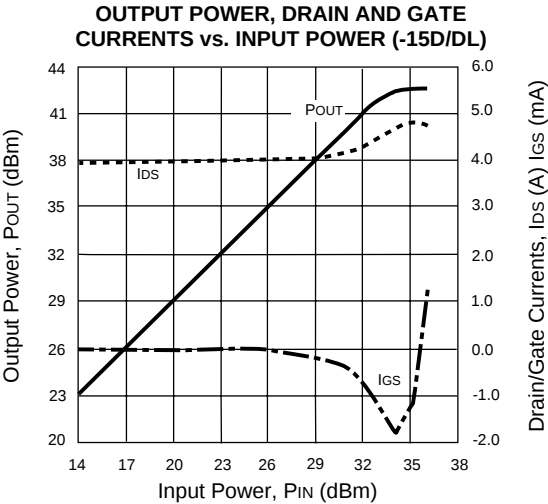
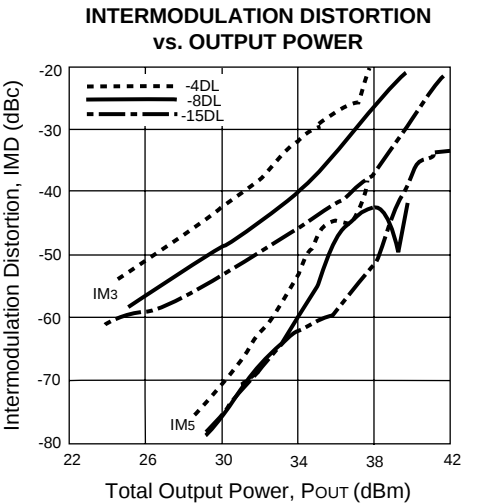
Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.

MAXIMUM OPERATING LIMITS

PART NUMBER	R _g MAX ¹ Ω	I _{GRF} MAX mA	V _{DS} MAX V
NEZ5964-4D/4DL	200	5	10
NEZ5964-8D/8DL	100	10	10
NEZ5964-15D/15DL	50	20	10

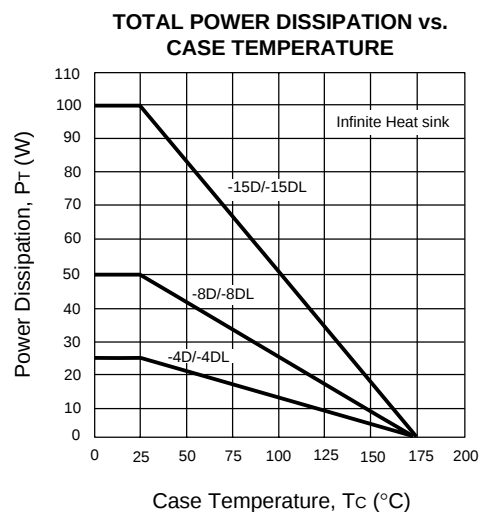
Note:
1. R_g MAX is the maximum recommended series resistance between the Gate Supply and the FET Gate.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)



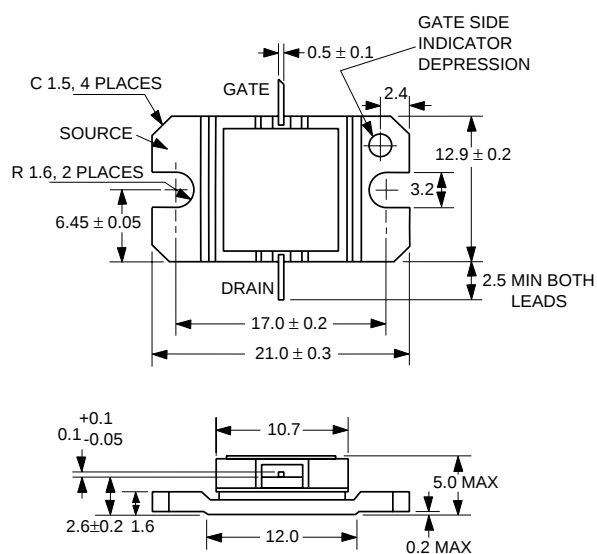
NEZ5964-4D/4DL, -8D/8DL, -15D/15DL

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

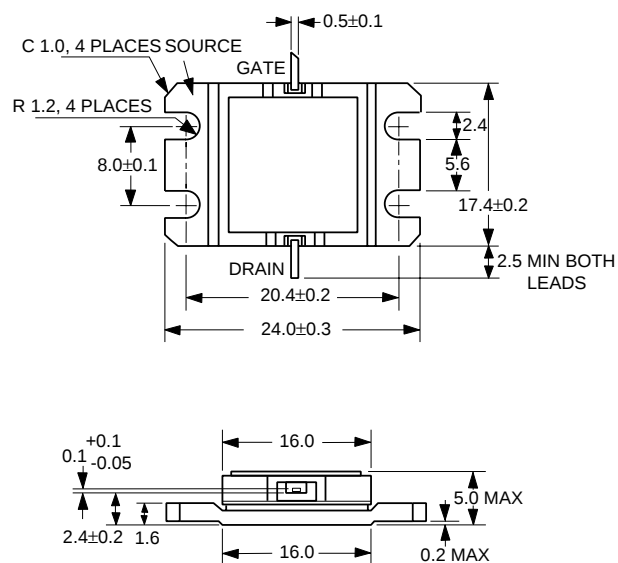


OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE T-61

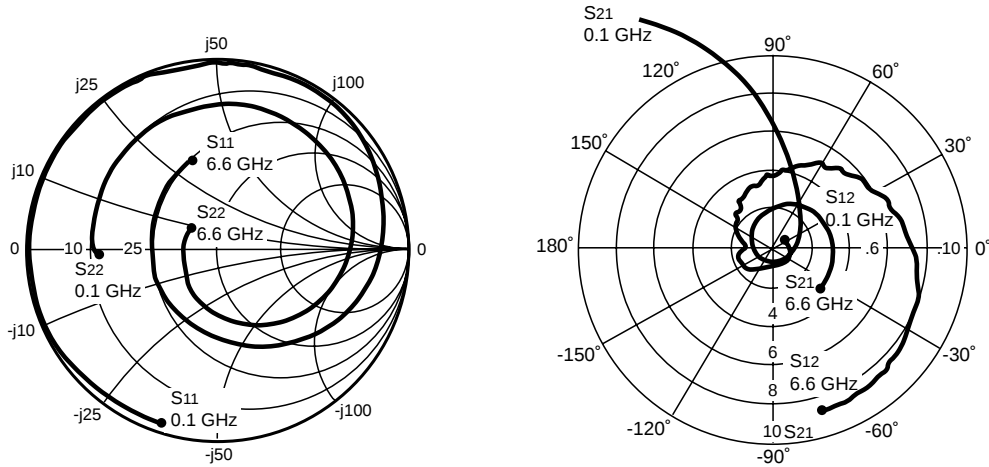


PACKAGE OUTLINE T-65



NEZ5964-4D/DL, -8D/DL, -15D/DL

TYPICAL SMALL SIGNAL SCATTERING PARAMETERS (T_c = 25°C)



NEZ5964-4D/4DL

V_{DS} = 10.0 V, I_{DS} = 800 mA

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂		S ₂₁ (dB)	K	MAG ¹ (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG			
0.1	0.947	-107.2	13.855	120.4	0.007	36.0	0.633	-177.3	0.27	22.8	32.9
0.2	0.958	-142.9	8.208	99.3	0.008	15.4	0.661	178.4	0.26	18.2	30.1
0.5	0.964	-177.3	3.525	69.5	0.009	3.2	0.674	167.7	0.53	10.9	25.9
1.0	0.968	158.0	1.854	35.9	0.009	-16.8	0.693	153.0	0.73	5.3	23.1
1.5	0.963	137.0	1.271	3.9	0.010	-25.6	0.708	137.0	1.13	2.0	18.8
2.0	0.961	119.1	1.008	-25.9	0.010	-41.1	0.734	120.4	1.33	0.0	16.5
2.5	0.951	101.9	0.873	-53.7	0.011	-57.7	0.750	103.1	1.66	-1.1	14.2
3.0	0.960	83.2	0.837	-82.8	0.011	-79.9	0.761	84.9	1.15	-1.5	16.3
3.5	0.975	63.3	0.864	-112.9	0.012	-104.1	0.763	65.7	0.27	-1.2	18.5
4.0	0.967	42.9	0.942	-145.0	0.016	-128.7	0.752	45.3	0.21	-0.5	17.6
4.2	0.958	34.7	0.997	-158.1	0.018	-159.6	0.750	36.4	0.38	-0.0	17.4
4.4	0.939	25.6	1.060	-171.4	0.013	177.5	0.733	27.1	1.52	0.5	14.8
4.6	0.912	16.9	1.143	174.7	0.014	179.2	0.717	18.2	2.07	1.1	13.2
4.8	0.890	7.4	1.261	160.6	0.018	165.7	0.704	8.5	1.91	2.0	12.9
5.0	0.859	-3.7	1.404	144.8	0.023	148.4	0.684	-2.6	1.88	2.9	12.4
5.2	0.816	-14.2	1.621	125.9	0.029	126.1	0.632	-13.1	2.07	4.1	11.5
5.4	0.748	-27.7	1.836	108.2	0.034	100.3	0.590	-24.6	2.40	5.2	10.7
5.6	0.656	-45.2	2.135	89.5	0.043	75.5	0.541	-39.4	2.36	6.5	10.4
5.8	0.542	-69.5	2.483	67.7	0.055	49.0	0.466	-58.0	2.20	7.9	10.3
6.0	0.420	-104.4	2.878	43.5	0.064	19.8	0.377	-81.3	2.06	9.1	10.6
6.2	0.345	-156.5	3.201	16.7	0.077	-10.8	0.274	-115.9	1.76	10.1	11.1
6.4	0.377	146.0	3.370	-12.7	0.086	-44.0	0.200	-165.7	1.50	10.5	11.7
6.6	0.470	104.7	3.352	-41.9	0.090	-73.4	0.193	140.5	1.30	10.5	12.4
6.8	0.528	74.1	3.171	-68.6	0.091	-101.6	0.221	99.9	1.22	10.0	12.5

Note:

1. Gain Calculations:

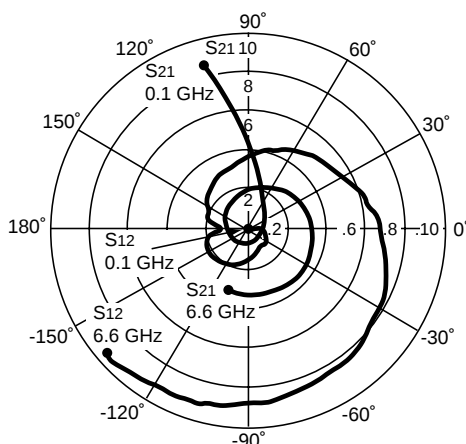
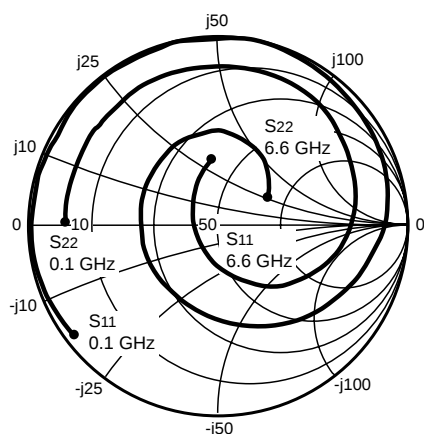
$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

NEZ5964-4D/DL, -8D/DL, -15D/DDL

TYPICAL SMALL SIGNAL SCATTERING PARAMETERS (T_C = 25°C)



NEZ5964-8D/8DL

V_{DS} = 10.0 V, I_{DS} = 1600 mA

FREQUENCY	S11		S21		S12		S22		K	S21	MAG ¹
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)	(dB)
0.1	0.952	-140.0	8.776	105.5	0.005	34.1	0.799	179.0	0.54	18.8	32.4
0.2	0.975	-163.2	4.698	90.6	0.005	10.7	0.805	175.7	0.36	13.4	29.7
0.5	0.980	173.5	1.952	67.4	0.005	14.7	0.808	166.4	0.87	5.8	25.9
1.0	0.985	152.3	1.045	37.5	0.006	1.7	0.813	152.5	0.87	0.3	22.4
1.5	0.977	131.5	0.746	7.3	0.007	-4.4	0.811	138.4	1.53	-2.5	15.9
2.0	0.972	113.2	0.625	-21.3	0.009	-16.9	0.823	123.6	1.51	-4.0	14.1
2.5	0.962	95.1	0.580	-48.9	0.010	-35.9	0.821	108.2	1.85	-4.7	12.3
3.0	0.967	74.7	0.604	-78.4	0.011	-60.7	0.821	91.8	1.13	-4.3	15.1
3.5	0.974	52.0	0.684	-110.3	0.013	-87.0	0.814	74.5	0.33	-3.2	17.2
4.0	0.944	27.4	0.838	-145.8	0.017	-117.8	0.799	55.8	0.65	-1.5	16.9
4.2	0.923	17.1	0.934	-160.7	0.020	-152.6	0.796	47.5	0.76	-0.5	16.6
4.4	0.892	4.8	1.051	-176.4	0.015	-178.1	0.778	38.5	2.01	0.4	12.6
4.6	0.853	-6.4	1.230	165.2	0.015	174.1	0.796	31.4	2.24	1.7	12.8
4.8	0.798	-20.7	1.433	146.9	0.022	160.8	0.779	21.2	1.90	3.1	12.6
5.0	0.718	-38.0	1.675	126.6	0.029	129.0	0.751	10.2	2.07	4.4	11.7
5.2	0.623	-60.7	1.996	103.8	0.036	95.2	0.705	-1.8	2.24	6.0	11.1
5.4	0.507	-92.1	2.362	79.0	0.047	62.1	0.628	-17.0	2.19	7.4	10.8
5.6	0.421	-136.0	2.777	51.2	0.056	26.9	0.519	-34.9	2.08	8.8	11.0
5.8	0.414	171.2	3.134	20.6	0.070	-7.9	0.367	-60.0	1.76	9.9	11.4
6.0	0.465	124.2	3.374	-11.8	0.081	-43.4	0.205	-97.7	1.49	10.5	12.0
6.2	0.481	86.7	3.426	-44.5	0.088	-77.6	0.132	-178.7	1.34	10.6	12.3
6.4	0.421	55.6	3.344	-76.4	0.092	-108.7	0.228	122.6	1.32	10.4	12.1
6.6	0.301	27.3	3.198	-107.4	0.095	-138.8	0.333	95.6	1.38	10.0	11.5
6.8	0.146	-7.6	3.000	-138.0	0.097	-167.8	0.394	75.3	1.51	9.5	10.6
7.0	0.083	-125.5	2.888	-168.8	0.100	164.6	0.412	57.6	1.55	9.2	10.2

Note:

1. Gain Calculations:

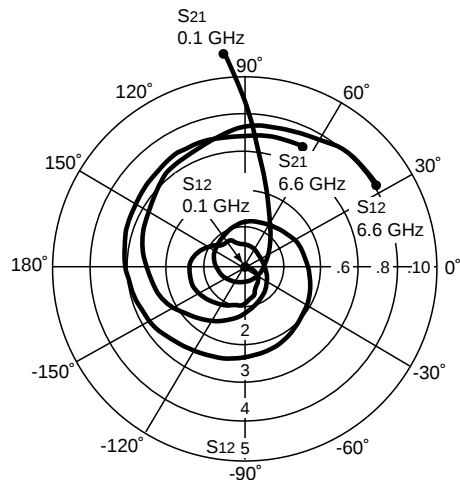
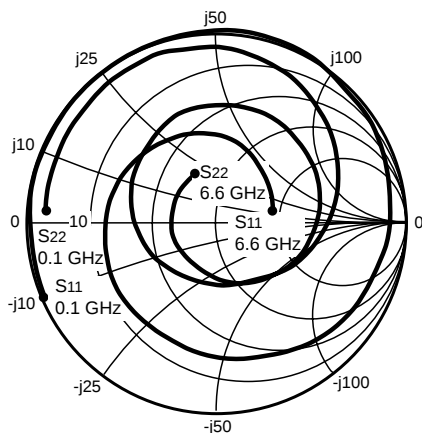
$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

NEZ5964-4D/4DL, -8D/8DL, -15D/15DL

TYPICAL SMALL SIGNAL SCATTERING PARAMETERS (T_c = 25°C)



NEZ5964-15D/15DL

V_{DS} = 10.0 V, I_{DS} = 4000 mA

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	S ₂₁	MAG ¹
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)	(dB)
0.1	0.989	-155.7	5.839	95.3	0.001	30.9	0.901	177.3	0.58	15.3	37.6
0.2	0.989	-171.6	2.801	81.8	0.002	25.6	0.901	175.0	0.58	8.9	31.4
0.5	0.989	172.2	1.092	54.9	0.003	20.6	0.906	165.7	0.71	0.7	25.6
1.0	0.989	154.4	0.556	16.9	0.003	11.3	0.917	150.0	0.94	-5.0	22.6
1.5	0.988	137.8	0.412	-16.7	0.007	10.9	0.927	131.6	0.50	-7.7	17.6
2.0	0.986	119.0	0.379	-52.0	0.008	-5.4	0.922	108.4	0.45	-8.4	16.7
2.5	0.983	99.0	0.421	-89.3	0.011	-28.2	0.884	78.9	0.42	-7.5	15.8
3.0	0.977	77.9	0.556	-132.0	0.015	-62.4	0.771	40.9	0.59	-5.0	15.6
3.2	0.972	68.2	0.642	-152.5	0.018	-81.2	0.681	20.8	0.76	-3.8	15.5
3.4	0.967	59.2	0.748	-174.7	0.019	-100.8	0.560	-5.6	1.11	-2.5	13.9
3.6	0.959	48.6	0.861	160.9	0.021	-123.9	0.435	-40.7	1.44	-1.3	12.1
3.8	0.950	37.0	0.959	134.8	0.026	-153.2	0.354	-87.9	1.43	-0.3	11.7
4.0	0.937	24.2	1.057	108.4	0.027	164.4	0.374	-138.1	1.54	0.4	11.5
4.2	0.921	10.5	1.134	82.2	0.019	126.5	0.438	-177.9	2.46	1.0	11.0
4.4	0.900	-4.2	1.243	57.3	0.017	104.2	0.510	150.9	2.89	1.8	11.1
4.6	0.874	-20.8	1.366	32.3	0.015	71.5	0.569	125.5	3.40	2.7	11.3
4.8	0.837	-40.5	1.551	5.9	0.013	28.2	0.602	101.2	4.29	3.8	11.4
5.0	0.787	-62.8	1.760	-22.0	0.015	-13.5	0.614	77.1	4.19	4.9	11.5
5.2	0.741	-88.4	2.020	-51.4	0.019	-59.4	0.609	52.1	3.59	6.1	11.7
5.4	0.687	-117.3	2.278	-82.4	0.026	-97.1	0.570	25.1	3.02	7.1	11.7
5.6	0.640	-149.4	2.548	-114.7	0.037	-139.6	0.521	-4.9	2.38	8.1	11.7
5.8	0.594	176.2	2.798	-148.3	0.048	-177.8	0.431	-39.0	2.08	8.9	11.7
6.0	0.546	140.6	3.061	177.3	0.059	144.6	0.344	-79.8	1.83	9.7	11.8
6.2	0.478	103.0	3.263	140.8	0.070	106.9	0.264	-130.2	1.67	10.2	11.8
6.4	0.389	60.7	3.425	103.3	0.079	69.4	0.251	170.4	1.55	10.6	11.9
6.6	0.298	8.6	3.373	63.5	0.085	32.1	0.272	114.4	1.54	10.5	11.6
6.8	0.266	-54.6	3.154	24.4	0.086	-6.6	0.268	62.9	1.65	9.9	10.9
7.0	0.317	-109.4	2.821	-12.4	0.082	-43.1	0.218	1.9	1.92	9.0	9.8

Note:

1. Gain Calculations:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

EXCLUSIVE NORTH AMERICAN AGENT FOR **NEC** RF, MICROWAVE & OPTOELECTRONIC SEMICONDUCTORS

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10/16/2000