

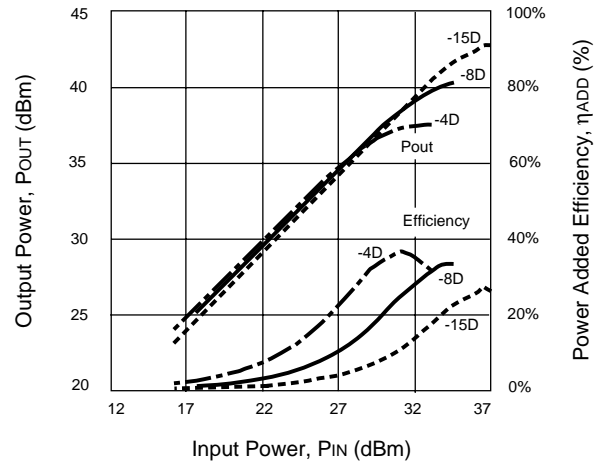
C-BAND INTERNALLY MATCHED POWER GaAs MESFET

NEZ7785-15D
NEZ7785-15DL
NEZ7785-8D
NEZ7785-8DL
NEZ7785-4D
NEZ7785-4DL

FEATURES

- **HIGH P_{OUT}**
18W (42.5 dBm) Typ P_{1dB} for NEZ7785-15D/15DL
9W (39.5 dBm) Typ P_{1dB} for NEZ7785-8D/8DL
4.5W (36.5 dbm) Typ P_{1dB} for NEZ7785-4D/4DL
- **HIGH EFFICIENCY**
33% η_{ADD} for 4.5W Device
31% η_{ADD} for 9W Device
30% η_{ADD} for 18W Device
- **LOW IMD**
-45 dBc IM3 @ 31.5 dBm (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**

OUTPUT POWER AND EFFICIENCY vs. INPUT POWER



ELECTRICAL CHARACTERISTICS (T_c = 25°C)

PART NUMBER			NEZ7785-4D NEZ7785-4DL T-61			NEZ7785-8D NEZ7785-8DL T-61			NEZ7785-15D NEZ7785-15DL T-65			TEST CONDITIONS
PACKAGE OUTLINE												
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} = 4.0 A	dBm dBm dBm	35.5	36.5		38.5	39.5		41.5	42.5		V _{DS} = 10V f = 7.7 to 8.5 GHz Z _s = Z _L = 50 Ω
η_{ADD}	Power Added Efficiency @ P _{1dB}	%		33			31			30		
I _{DS}	Drain Current at P _{1dB}	A		1.1	1.5		2.2	3.0		4.4	6.0	
GL	Linear Gain			7.0	8.0		6.5	7.5		6.0	7.0	V _{DS} = 10V f ₁ = 8.49 GHz f ₂ = 8.50 GHz 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 _{DS} P _{OUT} = 29 dBm SCL ² I _{DSQ} = 0.5 x I _{DS} P _{OUT} = 31.5 dBm SCL ² I _{DSQ} = 0.5 x I _{DS}	dBc dBc dBc		-45	-42		-45	-42		-45	-42	
I _{DS}	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
g _m	Transconductance I _{DS} = 1 A I _{DS} = 2 A I _{DS} = 4A	mS mS mS		1300			2600			5200		
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		
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: 1. P_{1DB}: Output Power at the 1dB Gain Compression Point. 2. SCL: Single Carrier Level. 3. Maximum Spec Applies to -XDL Option Only.
4. $\Delta T_{(CH-C)} = T_{CH} - T_c = 10 V \times I_{DSQ} \times R_{TH} (CH-C) \text{ MAX}$.

NEZ7785-4D/4DL,-8D/8DL,-15D/15DL

ABSOLUTE MAXIMUM RATINGS¹ (T_c = 25 °C)

SYMBOLS	PARAMETERS	UNITS	RATINGS		
			NEZ7785-4D/4DL	NEZ7785-8D/8DL	NEZ7785-8D/8DL
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

Note:

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

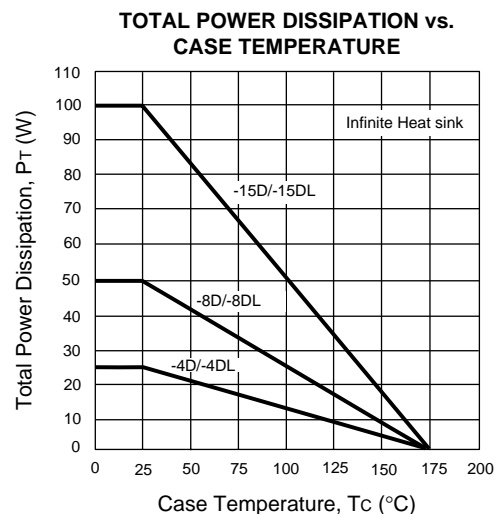
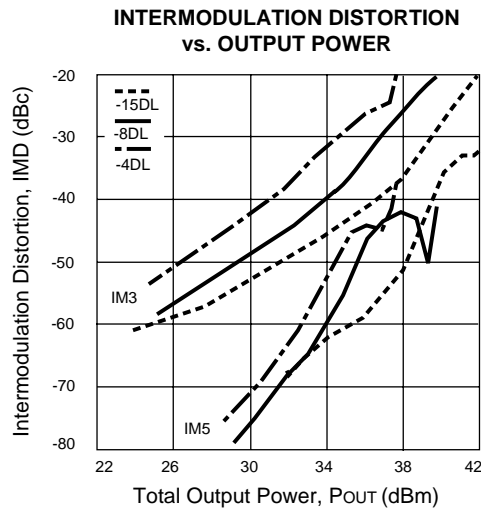
MAXIMUM OPERATING LIMITS

PART NUMBER	R _g MAX ¹ Ω	I _{GRF} MAX mA	V _{DS} MAX V
NEZ7785-4D/4DL	200	5	10
NEZ7785-8D/8DL	100	10	10
NEZ7785-15D/15DL	50	20	10

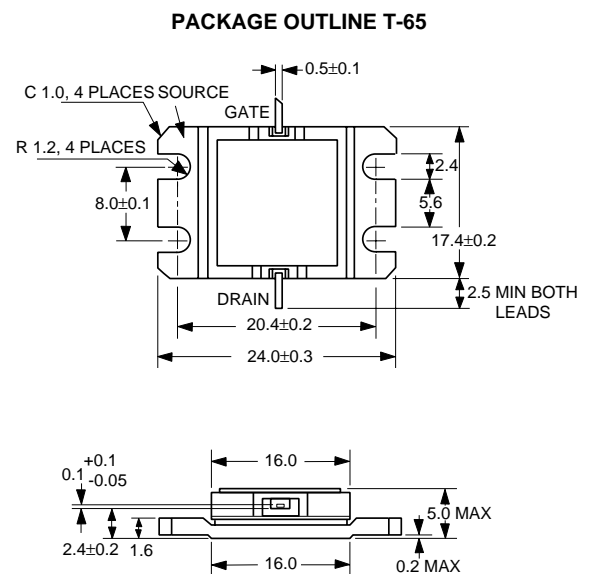
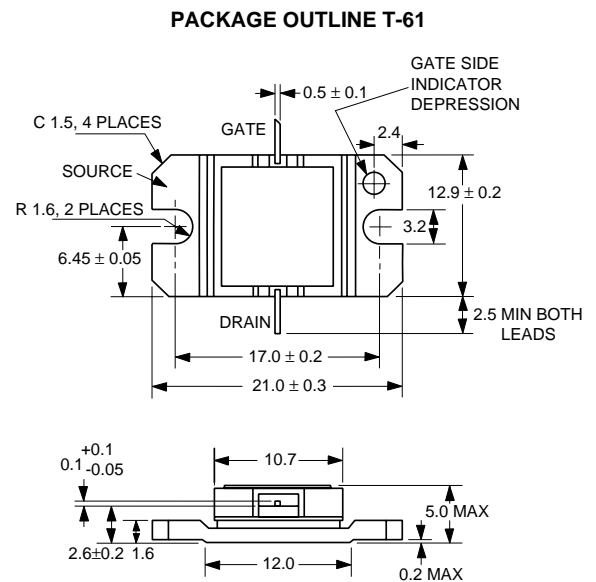
Note:

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

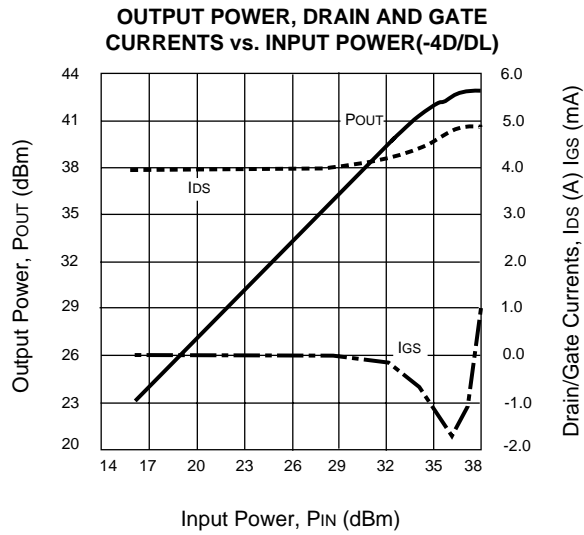
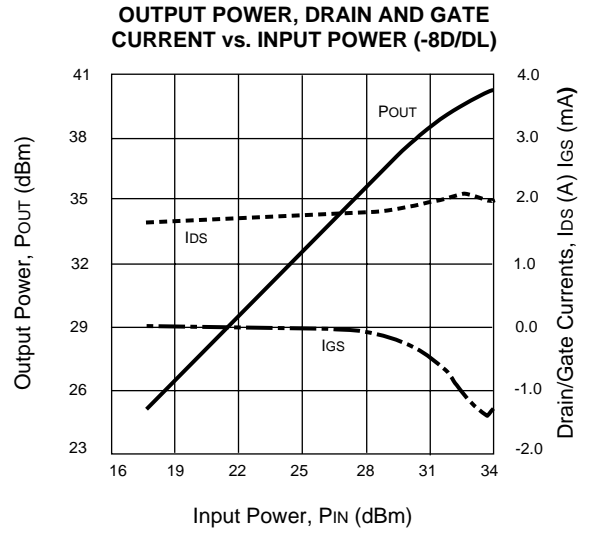
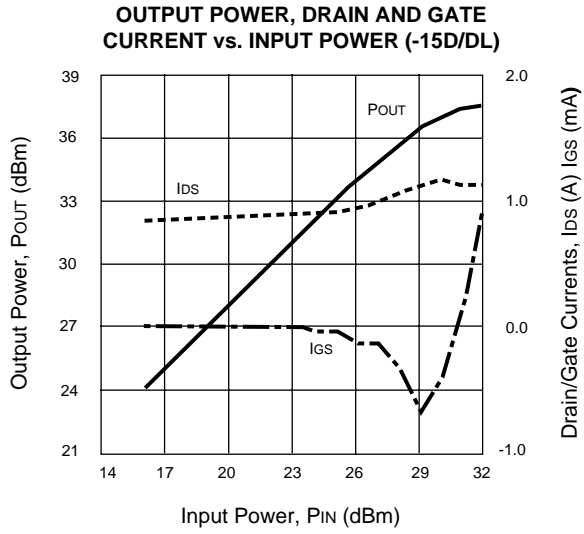
TYPICAL PERFORMANCE CURVES (T_c = 25°C)



OUTLINE DIMENSIONS (Units in mm)

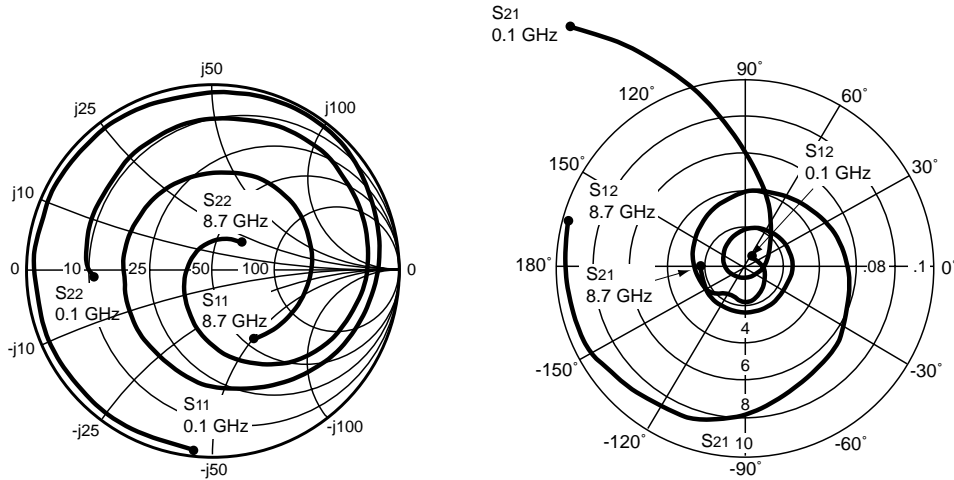


TYPICAL PERFORMANCE CURVES (T_C = 25°C)



NEZ7785-4D/4DL,-8D/8DL, -15D/15DL

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



NEZ7785-4D/4DL
VDS = 10.0 V, IDS = 800 mA

FREQUENCY GHz	S11		S21		S12		S22		K	S21 (dB)	MAG ¹ (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG			
0.1	0.960	-96.7	14.856	126.3	0.007	40.9	0.630	-177.3	0.18	23.4	33.2
0.2	0.957	-135.4	9.147	104.7	0.009	19.9	0.671	179.0	0.22	19.2	30.0
0.5	0.956	-174.0	4.012	74.3	0.010	3.8	0.693	168.6	0.50	12.0	26.0
1.0	0.958	159.5	2.093	42.6	0.011	-5.6	0.707	155.4	0.81	6.4	22.7
1.5	0.957	137.4	1.435	13.2	0.013	-11.0	0.714	141.0	1.04	3.1	19.1
2.0	0.955	119.1	1.118	-14.5	0.014	-24.9	0.739	125.8	1.10	0.9	17.0
2.5	0.942	101.0	0.940	-41.3	0.015	-39.7	0.753	109.6	1.47	-0.5	13.8
3.0	0.955	82.8	0.862	-67.2	0.017	-56.8	0.774	94.3	0.82	-1.2	17.0
3.5	0.963	63.3	0.837	-93.8	0.017	-77.7	0.790	79.0	0.44	-1.5	16.9
4.0	0.956	43.7	0.852	-121.5	0.021	-91.5	0.795	63.3	0.31	-1.3	16.0
4.5	0.914	25.0	0.868	-151.3	0.015	-113.4	0.807	45.7	1.54	-1.2	13.2
5.0	0.869	1.5	0.994	180.0	0.024	-144.1	0.793	27.8	1.23	-0.0	13.2
5.5	0.801	-26.8	1.222	147.2	0.028	161.3	0.775	7.9	1.58	1.7	11.9
6.0	0.689	-62.7	1.567	108.7	0.037	105.5	0.727	-14.7	1.98	3.9	10.5
6.5	0.559	-114.9	2.070	64.4	0.046	47.6	0.641	-41.3	2.18	6.3	10.3
6.7	0.515	-143.2	2.306	44.4	0.052	24.8	0.591	-53.1	2.07	7.2	10.5
6.9	0.490	-176.0	2.566	21.8	0.057	4.1	0.527	-67.0	1.95	8.1	10.9
7.1	0.495	149.6	2.710	-1.8	0.061	-19.0	0.456	-80.1	1.89	8.6	11.0
7.3	0.510	115.1	2.728	-26.7	0.067	-40.7	0.380	-94.4	1.81	8.7	10.8
7.5	0.527	85.0	2.680	-48.8	0.071	-63.5	0.312	-110.4	1.79	8.5	10.5
7.7	0.547	58.0	2.665	-71.1	0.079	-84.4	0.243	-129.8	1.65	8.5	10.5
7.9	0.544	33.6	2.598	-93.3	0.087	-107.1	0.187	-156.4	1.59	8.2	10.2
8.1	0.526	10.9	2.557	-114.8	0.089	-130.0	0.157	168.7	1.62	8.1	9.9
8.3	0.496	-11.7	2.479	-137.8	0.094	-151.8	0.151	123.7	1.64	7.8	9.5
8.5	0.456	-34.2	2.343	-159.7	0.095	-174.5	0.166	84.0	1.77	7.3	8.8
8.7	0.419	-59.8	2.277	179.9	0.098	164.9	0.180	54.3	1.82	7.1	8.4

Note:

1. Gain Calculations:

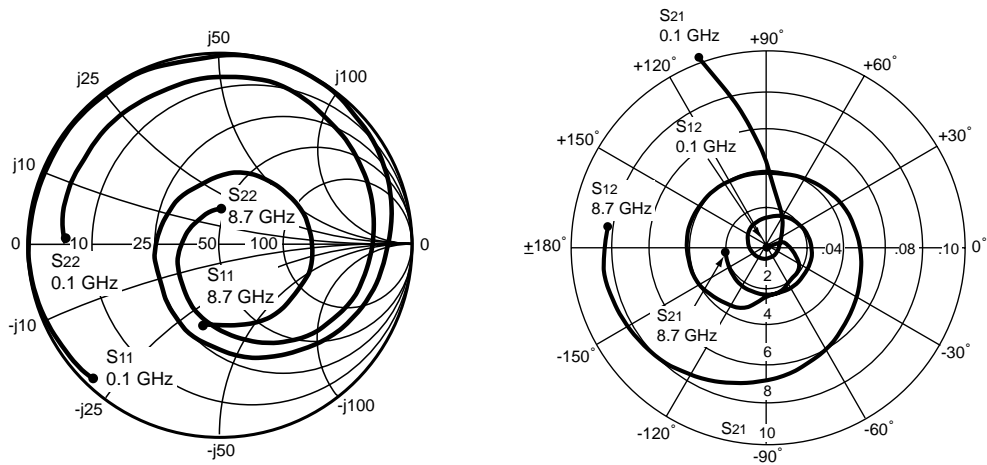
$$MAG = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } MSG = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

NEZ7785-4D/4DL, -8D/8DL, -15D/-15DL

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



NEZ7785-8D/8DL

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	S ₂₁ (dB)	MAG ¹ (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG			
0.1	0.965	-134.9	10.517	108.5	0.004	11.1	0.802	178.3	0.12	20.4	34.1
0.2	0.971	-160.1	5.614	94.0	0.006	18.7	0.823	176.2	0.38	14.9	29.7
0.5	0.976	175.6	2.333	72.4	0.007	19.2	0.832	167.3	0.71	7.3	25.2
1.0	0.978	155.2	1.222	46.4	0.009	18.7	0.833	154.9	0.95	1.7	21.3
1.5	0.974	136.0	0.861	20.4	0.012	12.3	0.830	141.2	1.12	-1.3	16.4
2.0	0.970	119.2	0.692	-4.1	0.013	-2.3	0.841	127.0	1.21	-3.1	14.4
2.5	0.958	102.0	0.604	-28.3	0.017	-18.9	0.843	112.5	1.28	-4.3	12.3
3.0	0.966	83.9	0.576	-52.1	0.021	-30.6	0.847	98.9	0.85	-4.7	14.3
3.5	0.979	64.2	0.580	-77.3	0.021	-47.0	0.858	85.3	0.40	-4.7	14.4
4.0	0.949	45.6	0.590	-106.7	0.025	-64.9	0.872	72.6	0.53	-4.5	13.7
4.5	0.927	24.2	0.642	-133.2	0.023	-82.0	0.866	57.2	0.83	-3.8	14.4
5.0	0.865	-0.2	0.757	-161.6	0.034	-110.7	0.853	41.6	0.83	-2.4	13.4
5.5	0.781	-28.9	0.955	165.9	0.040	-156.0	0.848	24.6	0.81	-0.4	13.7
6.0	0.644	-65.4	1.256	127.0	0.041	147.0	0.824	5.9	1.37	1.9	11.2
6.5	0.456	-118.8	1.686	82.5	0.040	81.4	0.779	-16.8	2.16	4.5	10.1
6.7	0.382	-149.5	1.883	62.4	0.043	56.0	0.747	-26.7	2.25	5.4	10.1
6.9	0.335	171.1	2.103	40.0	0.046	32.0	0.698	-38.0	2.28	6.4	10.2
7.1	0.331	129.4	2.268	17.0	0.049	3.6	0.651	-48.8	2.25	7.1	10.3
7.3	0.370	90.1	2.368	-7.1	0.052	-22.0	0.586	-61.5	2.24	7.4	10.2
7.5	0.416	55.7	2.412	-31.4	0.058	-46.3	0.519	-75.3	2.11	7.6	10.1
7.7	0.452	27.0	2.440	-55.1	0.064	-69.1	0.440	-91.6	2.03	7.7	10.0
7.9	0.470	0.1	2.408	-79.4	0.072	-95.9	0.355	-112.1	1.97	7.6	9.5
8.1	0.469	-25.8	2.375	-103.0	0.077	-120.6	0.272	-138.9	2.00	7.5	9.1
8.3	0.451	-51.7	2.307	-127.7	0.082	-144.7	0.199	-177.0	2.05	7.2	8.6
8.5	0.431	-77.8	2.140	-152.2	0.084	-169.9	0.170	132.2	2.21	6.6	7.8
8.7	0.424	-103.6	2.003	-174.2	0.082	170.0	0.176	86.9	2.42	6.0	7.2

Note:

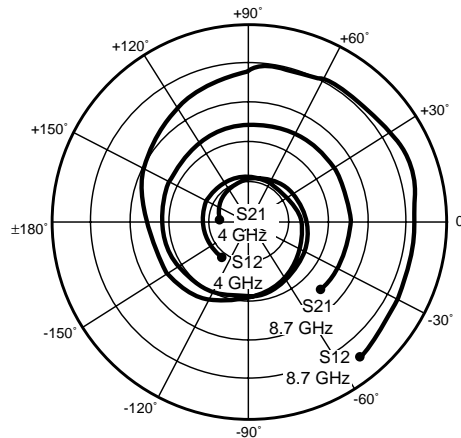
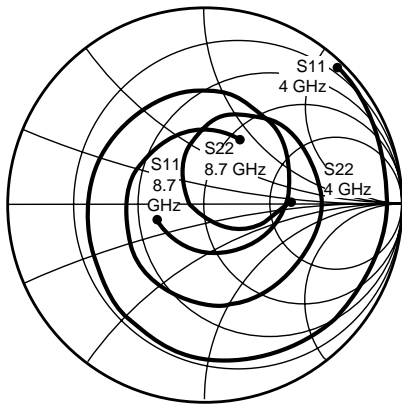
1. Gain Calculations:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

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



NEZ7785-15D/15DL

Vds = 10.0 V, Ids = 4000 mA

FREQUENCY GHz	S11		S21		S12		S22		K	S21 (dB)	MAG ¹ (dB)
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG			
4.0	0.967	44.000	0.750	177.700	0.023	-125.500	0.438	3.800	1.107	-2.499	13.143
4.5	0.956	19.900	0.963	125.300	0.024	174.900	0.136	-55.000	1.721	-0.327	11.091
5.0	0.931	-9.300	1.167	69.900	0.023	109.500	0.217	120.500	2.304	1.341	10.640
5.5	0.878	-47.900	1.403	13.100	0.022	34.400	0.459	74.800	2.568	2.941	11.115
6.0	0.770	-99.300	1.707	-46.600	0.033	-50.700	0.574	34.200	2.077	4.645	11.229
6.5	0.615	-168.000	1.983	-109.400	0.047	-129.600	0.592	-10.800	2.032	5.946	10.453
7.0	0.566	115.200	2.231	-173.600	0.056	166.700	0.551	-56.400	1.828	6.970	10.741
7.2	0.570	89.500	2.284	162.000	0.063	147.500	0.529	-77.500	1.622	7.174	10.971
7.4	0.545	64.600	2.322	135.700	0.069	120.800	0.494	-100.400	1.636	7.317	10.599
7.5	0.524	52.500	2.384	122.800	0.072	112.500	0.482	-113.000	1.598	7.546	10.659
7.6	0.512	40.900	2.398	109.700	0.073	95.400	0.459	-127.000	1.666	7.597	10.396
7.7	0.482	28.100	2.454	96.900	0.079	86.300	0.451	-140.700	1.580	7.797	10.448
7.8	0.456	16.300	2.474	83.200	0.079	71.900	0.427	-156.200	1.672	7.868	10.168
7.9	0.424	2.700	2.515	70.000	0.082	59.000	0.410	-171.600	1.676	8.011	10.065
8.0	0.389	-9.700	2.539	56.100	0.083	44.600	0.397	171.900	1.728	8.093	9.891
8.1	0.354	-27.600	2.573	42.400	0.086	33.300	0.385	154.900	1.709	8.209	9.852
8.3	0.278	-63.100	2.568	13.400	0.086	5.600	0.368	120.000	1.836	8.192	9.468
8.4	0.250	-84.300	2.579	-0.300	0.086	-7.900	0.364	103.700	1.864	8.229	9.409
8.5	0.248	-111.000	2.571	-14.600	0.086	-20.700	0.364	88.400	1.864	8.202	9.395
8.6	0.239	-135.300	2.551	-29.600	0.087	-34.200	0.370	72.100	1.856	8.134	9.332
8.7	0.259	-162.100	2.492	-43.500	0.089	-50.700	0.365	58.200	1.841	7.931	9.175
8.8	0.289	175.800	2.467	-58.300	0.086	-62.500	0.365	43.600	1.879	7.843	9.174
8.9	0.325	156.200	2.393	-72.300	0.082	-75.700	0.355	32.100	1.984	7.579	8.972
9.0	0.369	136.300	2.313	-87.200	0.087	-92.200	0.329	18.200	1.906	7.284	8.771
9.2	0.455	106.000	2.157	-115.800	0.082	-120.000	0.264	-7.800	2.066	6.677	8.319
9.4	0.549	80.800	2.005	-142.400	0.078	-141.900	0.180	-37.000	2.155	6.042	8.010
9.5	0.587	70.400	1.962	-155.400	0.079	-155.500	0.143	-60.700	2.084	5.854	8.027
9.6	0.633	58.600	1.920	-169.500	0.079	-169.000	0.111	-98.300	1.993	5.666	8.154
9.8	0.714	37.200	1.763	161.500	0.076	162.200	0.151	-176.700	1.879	4.925	8.251
10.0	0.773	15.200	1.599	133.200	0.072	135.600	0.266	142.200	1.757	4.077	8.412

Note:

1. Gain Calculations:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

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

CEL CALIFORNIA EASTERN LABORATORIES • Headquarters • 4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 988-3500 • Telex 34-6393 • FAX (408) 988-0279
24-Hour Fax-On-Demand: 800-390-3232 (U.S. and Canada only) • Internet: <http://WWW.CEL.COM>

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