NEC

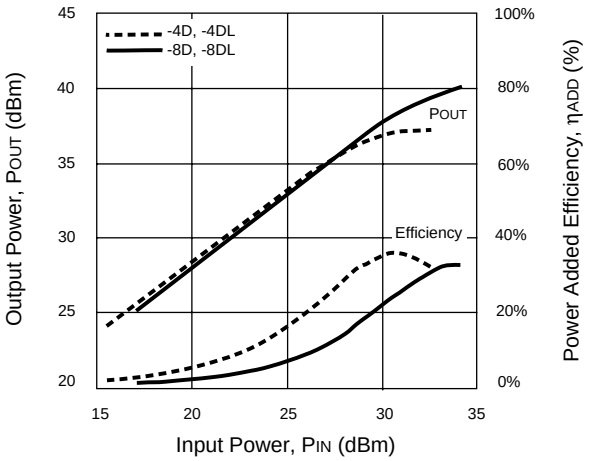
C-BAND INTERNALLY MATCHED POWER GaAs MESFET

NEZ7177-8D
NEZ7177-8DL
NEZ7177-4D
NEZ7177-4DL

FEATURES

- **HIGH P_{OUT}**
  9W (39.5 dBm) Typ P_{1dB} for NEZ7177-8D/8DL
  4.5W (36.5 dbm) Typ P_{1dB} for NEZ7177-4D/4DL
- **HIGH EFFICIENCY**
  33% η_{ADD} for 4.5W Device
  31% η_{ADD} for 9W Device
- **LOW IMD**
  -45 dBc IM3 @ 29 dBm P_{OUT} (SCL) -8DL
  -45 dBc IM3 @ 26 dBm P_{OUT} (SCL) -4DL
- **SiO_2 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 PACKAGE OUTLINE			NEZ7177-4D NEZ7177-4DL T-61			NEZ7177-8D NEZ7177-8DL T-61			
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**TEST CONDITIONS**
P_{1dB}	Output Power at P_{1dB}[1] I_{DSQ} = 0.8A, (RF Off) I_{DSQ} = 1.6A	 dBm dBm	 35.5	 36.5		 38.5	 39.5		V_{DS} = 10V f = 7.1 to 7.7 GHz
η_{ADD}	Power Added Efficiency @ P_{1dB}	%		33			31		Zs = Z_L = 50 Ω
I_{DS}	Drain Current at P_{1dB}	A		1.1	1.5		2.2	3.0	
G_L	Linear Gain	dB	7.5	8.5		7.0	8.0		
IM3 -XDL option only	3rd Order Intermodulation Distortion[3] at Pout = 26 dBm SCL[2] I_{DSQ} = 0.5 x I_{DSS} Pout = 29 dBm SCL[2] I_{DSQ} = 0.5 x I_{DSS}	 dBc dBc		 -45	 -42		 -45	 -42	V_{DS} = I0 V f_1 = 7.69 GHz f_2 = 7.70 GHz Equal Tones
I_{DSS}	Saturated Drain Current, V_{GS} = 0 V	A	1.0	2.3	3.5	2.0	4.5	7.0	
V_P	Pinch Off Voltage I_{DS} = 15 mA I_{DS} = 30 mA	 V V	 -3.5	 -2.0	 -0.5	 -3.5	 -2.0	 -0.5	V_{DS} = 2.5 V
g_m	Transconductance I_{DS} = I A I_{DS} = 2 A	 mS mS		 1300			 2600		
BV_{DGO}	Drain - Gate Breakdown Voltage I_{DG} = 15 mA I_{DG} = 30 mA	 V V	 20	 22		 20	 22		
$R_{TH(Ch-C)}$	Thermal Resistance (Channel to Case)	°C/W		5.0	6.0		2.5	3.0	
$\Delta T_{(CH-C)}$	Channel Temperature Rise[4]	˚C			48			48	

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

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

SYMBOLS	PARAMETERS	UNITS	RATINGS	
			NEZ7177-4D/4DL	NEZ7177-8D/8DL
V_{DS}	Drain to Source Voltage	V	15	15
V_{GS}	Gate to Source Voltage	V	-12	-12
V_{GD}	Gate to Drain Voltage	V	-18	-18
I_{DS}	Drain Current	A	I_{DSS}	I_{DSS}
I_{GRF}	Gate Current	mA	25	50
T_{CH}	Channel Temperature	°C	175	175
T_{STG}	Storage Temperature	°C	-65 to +175	-65 to +175
P_T	Total Power Dissipation	W	25	50

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

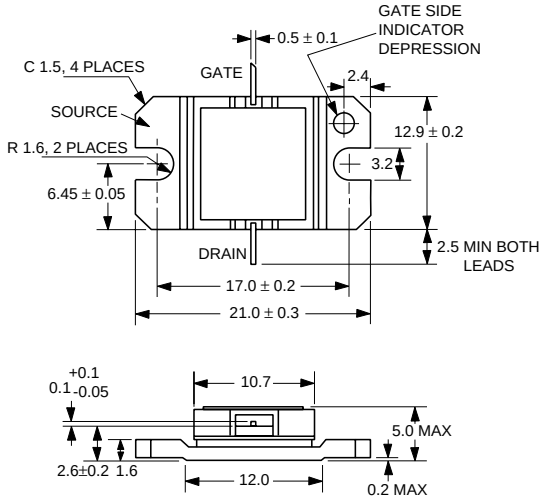
MAXIMUM OPERATING LIMITS

PART NUMBER	Rg MAX[1] Ω	I_{GRF} MAX mA	V_{DS} MAX V
NEZ7177-4D/4DL	200	5	10
NEZ7177-8D/8DL	100	10	10

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

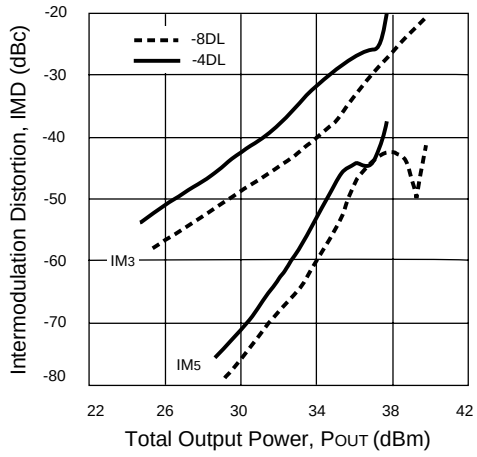
OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE T-61

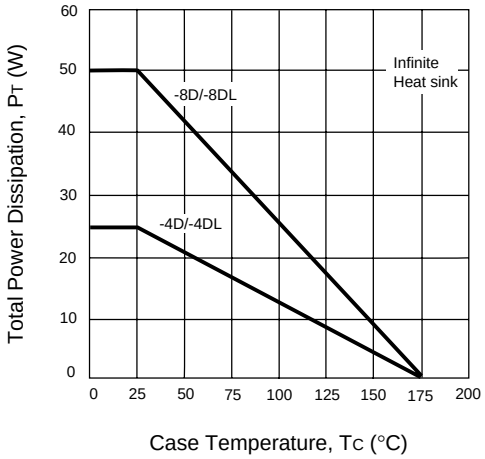


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

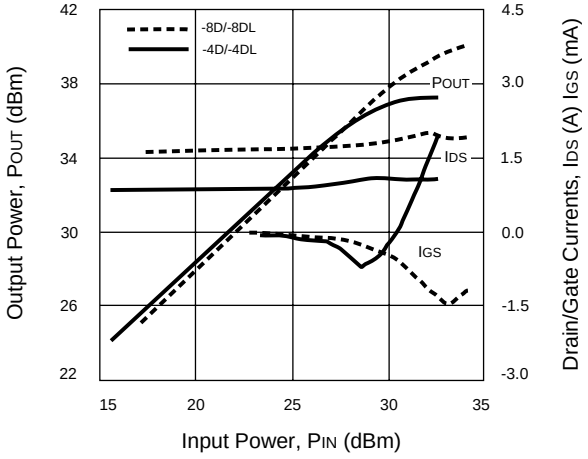
INTERMODULATION DISTORTION vs. OUTPUT POWER



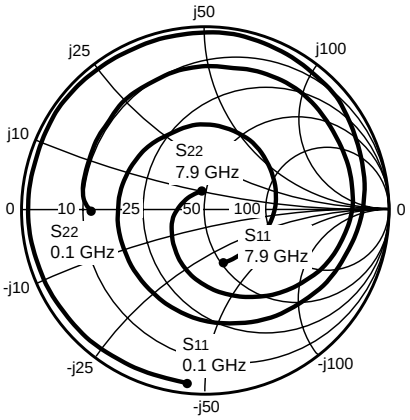
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

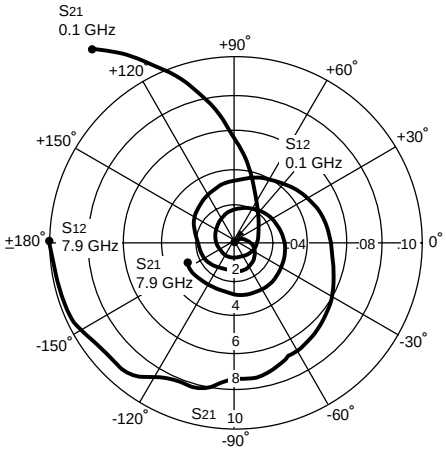


OUTPUT POWER, DRAIN AND GATE CURRENTS vs. INPUT POWER



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





NEZ7177-4D/4DL
V_{DS} = 10.0 V, I_{DS} = 800 mA

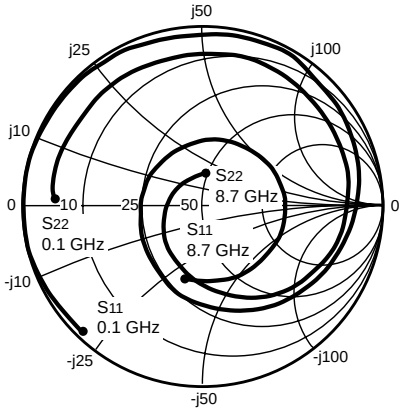
FREQUENCY	S11		S21		S12		S22		K	S21	MAG[1]
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)	(dB)
0.1	.964	-96.7	13.227	126.5	.007	39.2	.623	-178.2	0.18	22.4	32.7
0.2	.961	-135.6	8.162	104.3	.008	19.7	.659	178.3	0.27	18.2	30.0
0.5	.960	-173.9	3.583	73.2	.009	10.4	.680	168.7	0.66	11.0	26.0
1.0	.959	162.3	2.441	41.5	.011	1.0	.694	154.4	0.73	7.7	23.4
1.5	.959	138.5	1.299	9.9	.013	-8.4	.709	140.2	1.11	2.2	18.0
2.0	.952	119.9	1.092	-18.4	.014	-26.2	.733	124.1	1.19	0.7	16.3
3.0	.953	80.9	0.864	-74.8	.016	-61.8	.776	92.1	0.85	-1.2	17.3
4.0	.922	37.6	0.901	-134.7	.015	-108.6	.806	58.5	1.32	-0.9	14.5
5.0	.801	-19.0	1.230	157.3	.021	176.3	.803	19.8	1.86	1.7	12.2
5.5	.717	-52.9	1.501	121.3	.031	130.4	.789	-1.2	1.66	3.5	12.0
6.0	.581	-105.9	2.002	74.0	.045	59.6	.714	-28.3	1.86	6.0	11.1
6.3	.508	-148.6	2.354	42.3	.055	17.8	.641	-45.5	1.84	7.4	11.0
6.5	.478	178.0	2.596	19.0	.058	-8.5	.581	-58.0	1.86	8.2	11.1
6.7	.465	141.6	2.807	-5.1	.066	-31.7	.520	-71.1	1.71	8.9	11.3
6.9	.460	105.8	3.011	-31.2	.072	-54.5	.453	-85.9	1.61	9.5	11.6
7.0	.455	88.2	3.038	-44.5	.074	-68.5	.419	-93.3	1.62	9.6	11.5
7.1	.448	71.9	3.039	-57.8	.079	-77.6	.389	-101.2	1.58	9.6	11.3
7.2	.431	55.8	3.040	-70.3	.080	-91.1	.352	-112.1	1.63	9.6	11.1
7.3	.414	39.6	2.915	-82.9	.088	-102.8	.314	-122.4	1.61	9.2	10.6
7.4	.395	23.3	2.902	-96.1	.087	-116.3	.268	-134.4	1.70	9.2	10.3
7.5	.380	6.7	2.897	-106.9	.098	-128.8	.228	-148.4	1.58	9.2	10.2
7.6	.358	-10.2	2.841	-120.1	.098	-139.7	.185	-164.4	1.65	9.0	9.9
7.7	.332	-29.7	2.867	-132.6	.104	-155.7	.144	175.5	1.60	9.1	9.8
7.8	.318	-49.5	2.819	-144.8	.104	-168.2	.116	150.4	1.64	9.0	9.6
7.9	.307	-70.0	2.759	-158.7	.108	178.2	.091	117.1	1.63	8.8	9.4

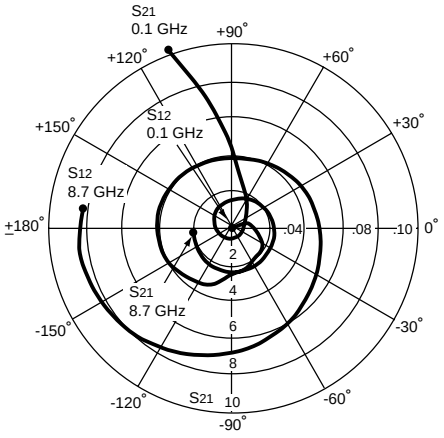
Note:
1. Gain Calculations:

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

MAG = Maximum Available Gain
MSG = Maximum Stable Gain

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





NEZ7177-8D/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	0.965	-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:

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