

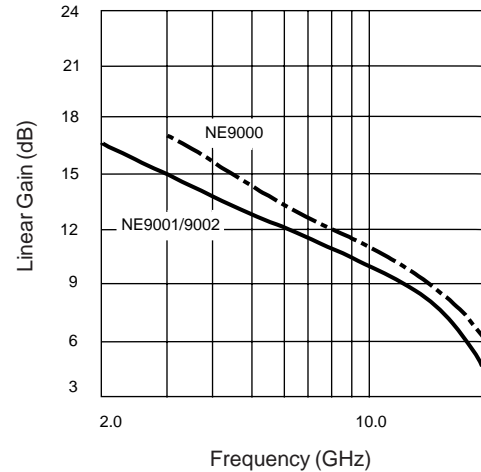
### FEATURES

- CLASS A OPERATION
- HIGH OUTPUT POWER  
P<sub>OUT</sub> = 26.5 dBm  
G<sub>1dB</sub> = 7 dB
- HIGH POWER ADDED EFFICIENCY

### DESCRIPTION

The NE9000, NE9001, and NE9002 are 0.5 micron recessed gate medium power GaAs FETs for commercial and space amplifier and oscillator applications to 20 GHz. Chip configurations available are: the NE900000, a one cell die of 400 μm gate width; the NE900100, a one cell die of 750 μm gate width; and the NE900200, a two cell die of 1500 μm total gate width. The series is available in chip form or a variety of hermetic ceramic packages. The NE900000, NE900100, and NE900200 are standard die without wrap-around source-metallization, while the NE900000G, NE900100G, and NE900200G have wrap-around source metallization. The series is space qualified.

TYPICAL LINEAR GAIN vs. FREQUENCY



### ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

PART NUMBER			NE900089A 89A			NE900000 NE900000G NE900075 00 (CHIP), 75			NE900100 NE900100G NE900175 00 (CHIP), 75			NE900200 NE900200G NE900275 00 (CHIP), 75		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
I <sub>DSS</sub>	Saturated Drain Current at V <sub>DS</sub> = 2.5 V, V <sub>GS</sub> = 0	mA	80	120	150	80	120	150	150	225	300	300	450	600
V <sub>P</sub>	Pinch-off Voltage at V <sub>DS</sub> = 2.5 V, I <sub>DS</sub> = 2.5 mA I <sub>DS</sub> = 5 mA I <sub>DS</sub> = 10 mA	V V V	-1.5	-3.5	-5	-1.5	-3.5	-5	-2	-3.5	-5	-2	-3.5	-5
g <sub>m</sub>	Transconductance at V <sub>DS</sub> = 2.5 V, I <sub>DS</sub> = 50 mA I <sub>DS</sub> = 90 mA I <sub>DS</sub> = 180 mA	mS mS mS		25			25			50			100	
R <sub>TH(C-C)</sub>	Thermal Resistance (Channel-to-Case)	°C/W			180			180			100			50
P <sub>T</sub>	Total Power Dissipation	W			0.8			0.8			1.5			3
P <sub>TEST</sub>	Power Output at Test Point P <sub>IN</sub> = 11 dBm, V <sub>DS</sub> = 8V, I <sub>D</sub> = 50mA, f = 8 GHz P <sub>IN</sub> = 12 dBm, V <sub>DS</sub> = 8V, I <sub>D</sub> = 50mA f = 14.5 GHz P <sub>IN</sub> = 15 dBm, V <sub>DS</sub> = 8V, I <sub>D</sub> = 90mA f = 14.5 GHz P <sub>IN</sub> = 19 dBm, V <sub>DS</sub> = 8 V, I <sub>D</sub> = 180 mA, f = 14.5	dBm dBm dBm dBm	19.5	20.5			19.5	20.5		22	23		25.5	26.5
P <sub>1dB</sub>	Output Power at 1 dB Compression Point, V <sub>DS</sub> = 8 V, I <sub>D</sub> = 50 mA, f = 8 GHz V <sub>DS</sub> = 8 V, I <sub>D</sub> = 50 mA, f = 14.5 GHz V <sub>DS</sub> = 8 V, I <sub>D</sub> = 90 mA, f = 14.5 GHz V <sub>DS</sub> = 8 V, I <sub>D</sub> = 180 mA, f = 14.5 GHz	dBm dBm dBm dBm		20.5				20			23			25
G <sub>1dB</sub>	Gain at 1 dB Compression Point V <sub>DS</sub> = 8 V, I <sub>D</sub> = 50 mA, f = 8 GHz V <sub>DS</sub> = 8 V, I <sub>D</sub> = 50 mA, f = 14.5 GHz V <sub>DS</sub> = 8 V, I <sub>D</sub> = 90 mA, f = 14.5 GHz V <sub>DS</sub> = 8 V, I <sub>D</sub> = 180 mA, f = 14.5 GHz	dB dB dB dB		9				8			7			7
η <sub>ADD</sub>	Power Added Efficiency V <sub>DS</sub> = 8 V, at P <sub>1dB</sub> Conditions.	%		27				27			27			26

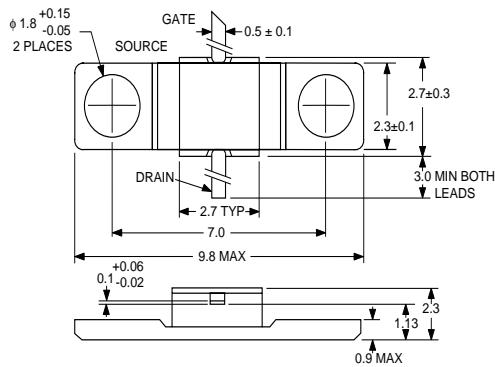
# NE9000, NE9001, NE9002 SERIES

## ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>DS</sub>	Drain to Source Voltage	V	20
V <sub>GS</sub>	Gate to Source Voltage	V	-9
I <sub>D</sub>	Drain Current NE900000, NE900075/89	mA	150
	NE900100, NE900175	mA	300
	NE900200, NE900275	mA	600
I <sub>G</sub>	Gate Current NE900000, NE900075/89	mA	1.3
	NE900100, NE900175	mA	2.6
	NE900200, NE900275	mA	5

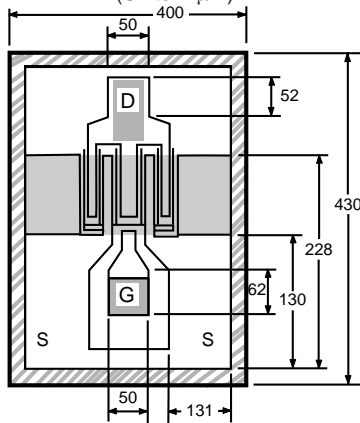
## OUTLINE DIMENSIONS (Units in mm)

### PACKAGE OUTLINE 75



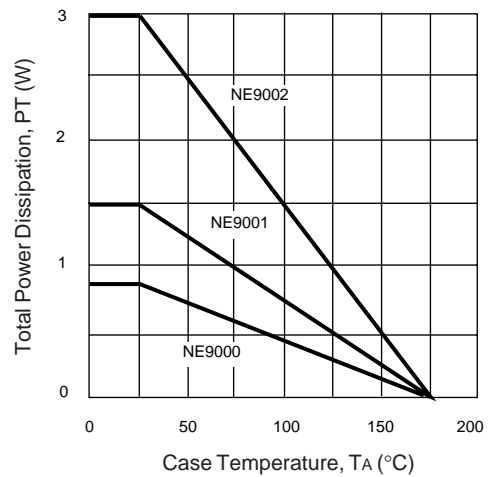
### NE900000 (CHIP)

(Units in  $\mu\text{m}$ )

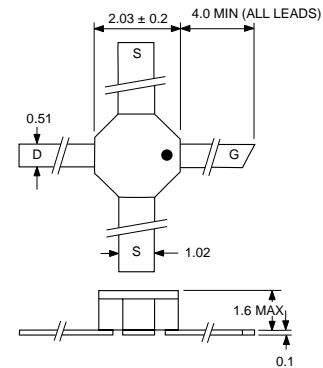


- Die Thickness: 110 to 160  $\mu\text{m}$
- Recommended Bonding Area.
- Glassivated Area
- Plated Wraparound (Optional)

## POWER DERATING CURVE

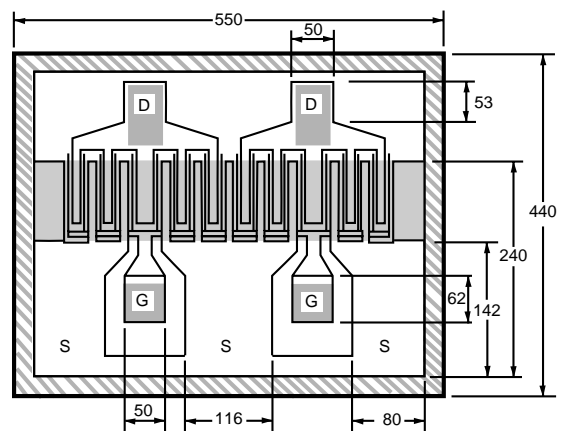


### PACKAGE OUTLINE 89A



### NE900100/NE900200 (CHIP)\*

(Units in  $\mu\text{m}$ )



## HANDLING PRECAUTIONS

### DIE ATTACHMENT

Die attach can be accomplished with Au-Ge (390 ± 10°C) preforms in a forming gas environment. Epoxy die attach is not recommended.

### BONDING

Gate and drain bonding wires should be semi-hard gold wire (3 to 8% elongation) 30 microns or less in diameter.

Bonding should be performed with a wedge tip that has a taper of approximately 15°. Die attach and bonding time should be kept to a minimum. As a general rule, the bonding operation should be kept within a 300°C to 10 minute curve. If longer periods are required, the tempera-

ture should be lowered.

### PRECAUTIONS

The user must operate in a clean, dry environment. The chip channel is glassivated for mechanical protection only and does not preclude the necessity of a clean environment.

The bonding equipment should be periodically checked for sources of surge voltage and should be properly grounded at all times. In fact, all test and handling equipment should be grounded to minimize the possibilities of static discharge.

# NE9000, NE9001, NE9002 SERIES

## TYPICAL SMALL SIGNAL SCATTERING PARAMETERS

### NE900000

$V_{DS} = 8\text{ V}$ ,  $I_D = 50\text{ mA}$

FREQUENCY (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000	.96	-42	3.00	148	.04	69	.80	-11
3000	.90	-59	2.71	136	.04	66	.78	-12
4000	.87	-73	2.48	125	.05	62	.76	-13
5000	.85	-85	2.28	114	.06	58	.74	-17
6000	.82	-94	2.10	105	.06	55	.72	-20
7000	.79	-103	1.94	96	.07	53	.71	-24
8000	.75	-112	1.79	88	.07	52	.70	-28
9000	.73	-120	1.64	80	.07	52	.70	-32
10000	.72	-128	1.51	73	.07	53	.70	-34
11000	.71	-134	1.38	67	.07	55	.71	-36
12000	.72	-140	1.27	62	.07	58	.71	-38
13000	.73	-144	1.17	58	.07	63	.71	-39
14000	.74	-147	1.09	54	.07	69	.71	-40
15000	.75	-149	1.04	51	.08	74	.71	-41
16000	.74	-151	1.01	48	.09	78	.70	-43
17000	.71	-152	1.03	45	.10	81	.69	-47
18000	.65	-155	1.10	40	.11	82	.68	-53

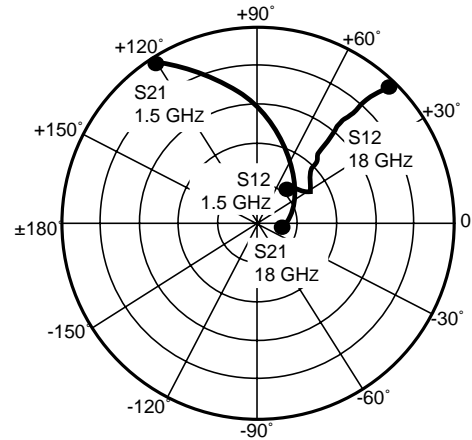
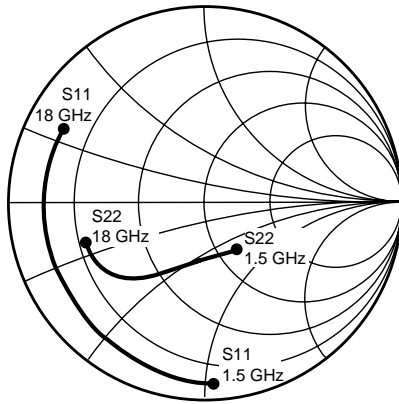
### NE900100

$V_{DS} = 8\text{ V}$ ,  $I_D = 90\text{ mA}$

FREQUENCY (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000	.91	-63	4.54	137	.05	63	.47	-26
3000	.82	-81	3.70	124	.05	55	.46	-33
4000	.77	-97	3.14	111	.06	51	.44	-38
5000	.75	-110	2.75	100	.06	48	.43	-43
6000	.74	-120	2.44	91	.07	47	.41	-47
7000	.74	-129	2.17	83	.07	48	.40	-53
8000	.73	-135	1.93	77	.07	49	.39	-58
9000	.72	-141	1.70	71	.07	52	.39	-64
10000	.72	-145	1.50	67	.07	55	.40	-70
11000	.72	-148	1.34	62	.07	60	.41	-76
12000	.72	-150	1.21	58	.07	65	.43	-81
13000	.73	-152	1.13	55	.08	70	.46	-86
14000	.73	-153	1.08	51	.08	74	.47	-90
15000	.74	-155	1.05	48	.09	78	.49	-94
16000	.73	-157	1.03	44	.10	80	.49	-98
17000	.71	-161	1.00	41	.12	82	.46	-102
18000	.67	-167	.93	36	.13	82	.41	-109

# NE9000, NE9001, NE9002 SERIES

## NE900200 TYPICAL SMALL SIGNAL SCATTERING PARAMETERS



### NE900200

V<sub>DS</sub> = 8 V, I<sub>D</sub> = 180 mA

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>		K	MAG <sup>1</sup>
	MAG	ANG	MAG	AN	MAG	ANG	MAG	ANG		
1.5	0.910	-88.000	4.852	123.000	0.057	48.000	0.286	-56.000	0.240	19.300
2.0	0.879	-106.000	4.143	112.000	0.065	41.000	0.274	-68.000	0.323	18.044
3.0	0.850	-129.000	3.077	93.000	0.070	34.000	0.267	-82.000	0.496	16.430
4.0	0.836	-143.000	2.413	79.000	0.075	32.000	0.281	-92.000	0.629	15.075
5.0	0.830	-153.000	1.983	69.000	0.077	30.000	0.303	-102.000	0.751	14.108
6.0	0.827	-160.000	1.693	60.000	0.082	33.000	0.331	-108.000	0.809	13.148
7.0	0.823	-165.000	1.490	52.000	0.081	34.000	0.368	-114.000	0.914	12.647
8.0	0.824	-170.000	1.342	44.000	0.086	38.000	0.406	-120.000	0.892	11.933
9.0	0.822	-174.000	1.196	36.000	0.091	42.000	0.443	-125.000	0.904	11.187
10.0	0.820	-178.000	1.100	29.000	0.100	45.000	0.484	-130.000	0.827	10.414
11.0	0.824	176.000	1.002	22.000	0.108	45.000	0.524	-134.000	0.739	9.674
12.0	0.818	172.000	0.920	15.000	0.117	48.000	0.554	-137.000	0.719	8.956
13.0	0.815	167.000	0.840	10.000	0.129	48.000	0.584	-141.000	0.671	8.137
14.0	0.815	163.000	0.784	4.000	0.146	49.000	0.601	-144.000	0.588	7.300
15.0	0.813	160.000	0.732	1.000	0.160	50.000	0.623	-146.000	0.534	6.604
16.0	0.811	157.000	0.690	-5.000	0.187	48.000	0.631	-151.000	0.454	5.670
17.0	0.815	154.000	0.647	-7.000	0.207	48.000	0.635	-156.000	0.437	4.949
18.0	0.811	153.000	0.627	-11.000	0.241	45.000	0.638	-162.000	0.369	4.153

Note:

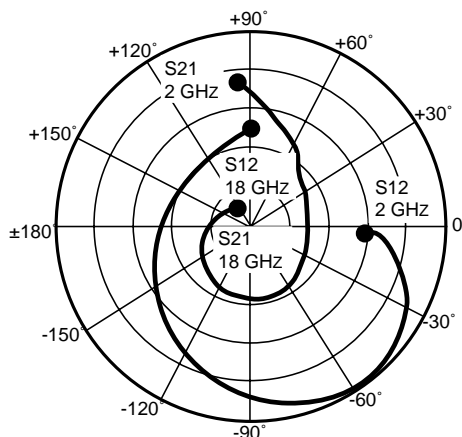
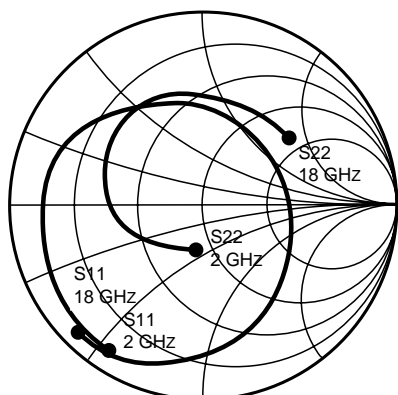
1. Gain Calculations:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SMALL SIGNAL SCATTERING PARAMETERS



NE900275

V<sub>ds</sub> = 8 V, I<sub>d</sub> = 180 mA

FREQUENCY GHZ	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>		K	MAG <sup>1</sup>
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		
2.0	0.900	-123.000	3.670	95.000	0.060	24.000	0.230	-97.000	0.325	17.865
3.0	0.900	-146.000	2.760	76.000	0.060	15.000	0.250	-117.000	0.397	16.628
4.0	0.870	-161.000	2.140	54.000	0.060	3.000	0.280	-131.000	0.698	15.523
5.0	0.860	-172.000	1.820	46.000	0.060	3.000	0.320	-143.000	0.850	14.819
6.0	0.850	-180.000	1.610	26.000	0.060	1.000	0.370	-152.000	0.974	14.287
7.0	0.850	172.000	1.510	16.000	0.060	-1.000	0.410	-161.000	0.972	14.008
8.0	0.830	162.000	1.500	1.000	0.060	-3.000	0.450	-170.000	1.051	12.595
9.0	0.770	151.000	1.520	-12.000	0.070	-5.000	0.480	-178.000	1.162	10.931
10.0	0.690	135.000	1.600	-34.000	0.080	-16.000	0.510	173.000	1.227	10.140
11.0	0.560	108.000	1.770	-51.000	0.090	-26.000	0.540	162.000	1.311	9.594
12.0	0.440	56.000	1.880	-80.000	0.100	-51.000	0.590	147.000	1.259	9.681
13.0	0.480	-19.000	1.770	-116.000	0.090	-85.000	0.610	128.000	1.408	9.136
14.0	0.690	-69.000	1.480	-146.000	0.070	-121.000	0.610	108.000	1.392	9.522
15.0	0.820	-97.000	1.110	-175.000	0.050	-165.000	0.570	85.000	1.624	8.835
16.0	0.900	-115.000	0.860	162.000	0.040	158.000	0.560	65.000	1.416	9.487
17.0	0.920	-126.000	0.650	141.000	0.040	114.000	0.580	48.000	1.498	7.938
18.0	0.940	-136.000	0.540	127.000	0.050	89.000	0.590	36.000	1.020	9.472

Note:

1. Gain Calculations:

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

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

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>

DATA SUBJECT TO CHANGE WITHOUT NOTICE

PRINTED IN USA ON RECYCLED PAPER -11/97