NEC

3 W 14 GHz INTERNALLY MATCHED POWER GaAs MESFET

NEZ1414-3E

FEATURES

- **HIGH OUTPUT POWER:** 34.5 dBm TYP
- **HIGH LINEAR GAIN:** 7.5 dB TYP
- **HIGH EFFICIENCY:** 30% TYP
- **INDUSTRY STANDARD PACKAGING**
- **INTERNALLY MATCHED FOR OPTIMUM PERFORMANCE IN 14.0 TO 14.5 GHz BAND**

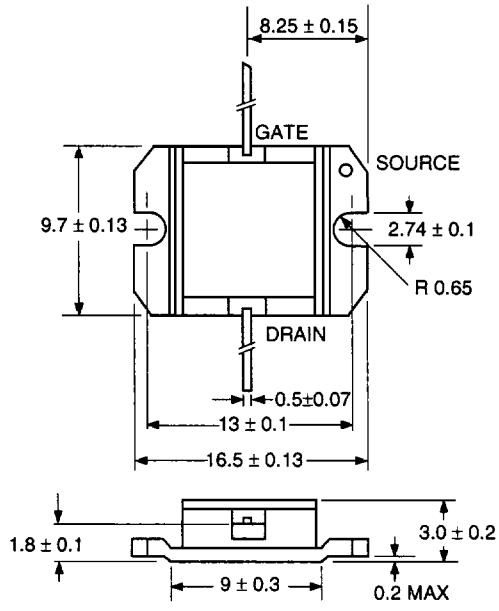
DESCRIPTION

The NEZ1414-3E is a Ku band GaAs MESFET designed for transmit amplifiers used in VSAT terminals. The device is internally matched for the 14.0 to 14.5 GHz band and can deliver 3 W of output power when biased with 10 V. The device incorporates a Wsi (tungsten silicide) gate structure for high reliability, SiO_2 glassivation for surface stability, and a plated heat sink for reduced thermal resistance.

The NEZ1414-3E transistors are manufactured to NEC's stringent quality assurance standards to ensure highest reliability and consistent superior performance.

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE X-17



ELECTRICAL CHARACTERISTICS (T_C = 25°C)

PART NUMBER			NEZ1414-3E			
SYMBOLS	**CHARACTERISTICS**	**UNITS**	**MIN**	**TYP**	**MAX**	**TEST CONDITIONS**
P_{1dB}	Power Out at 1dB Compression	dBm	33.5	34.5		f = 14.0 to 14.5 GHz V_{DS} = 10 V I_{DSQ} = 0.7 A Rg = 100 Ω
G_L	Linear Gain	dB	7.0	7.5		
η_{ADD}	Power Added Efficiency, P_{IN} = 32.0 dBM	%		30		
I_{DS}	Drain Current	A		0.9	1.1	
I_{DSS}	Saturated Drain Current	A	0.7	1.6	2.5	V_{DS} = 1.5 V, V_{GS} = 0 V
V_P	Pinch-off Voltage	V	-3.0	-1.3	-0.5	V_{DS} = 2.5 V; I_{DS} = 40 mA
BVGD	Gate-Drain Breakdown Voltage	V		15		I_{GD} = 40 mA
R_{TH}	Thermal Resistance	°C/W		5.5	7.0	Channel to Case

ABSOLUTE MAXIMUM RATINGS[1]

(T_C = 25 °C unless otherwise noted)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain to Source Voltage	V	15
V_{GS}	Gate to Source Voltage	V	-7
I_{DS}	Drain Current	A	I_{DSS}
I_{GF}	Gate Forward Current	mA	20
I_{GR}	Gate Reverse Current	mA	-20
P_T	Total Power Dissipation	W	15
T_{CH}	Channel Temperature	°C	175
T_{STG}	Storage Temperature	°C	-65 to +175

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

RECOMMENDED OPERATING LIMITS

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V_{DS}	Drain to Source Voltage	V	10	10	10
T_{CH}	Channel Temperature	°C			130
G_{COMP}	Gain Compression	dB			3.0
Rg	Gate Resistance	Ω		100	200

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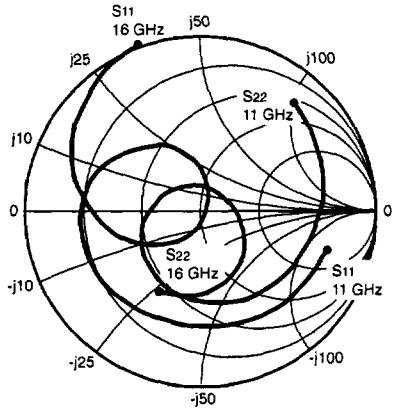
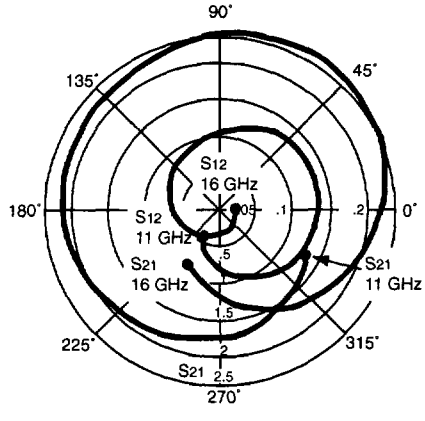
TYPICAL SCATTERING PARAMETERS





V_{DS} = 10 V, I_{DS} = 500 mA, V_{GS} = 1.1 V

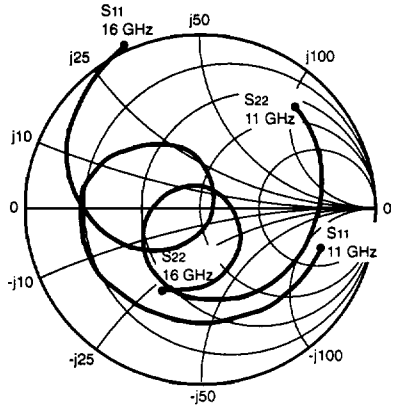
FREQUENCY	S11		S21		S12		S22		K	MAG[1]
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
11.00	0.767	-16.10	1.376	-27.10	0.021	9.30	0.817	49.50	2.03	12.4
11.50	0.678	-63.50	1.705	-66.20	0.028	-61.20	0.768	24.00	2.34	11.4
12.00	0.654	-115.70	1.911	-107.70	0.043	-122.00	0.675	-6.80	2.09	10.6
12.50	0.684	-158.50	2.102	-147.50	0.063	-170.40	0.597	-40.00	1.56	10.8
13.00	0.660	166.60	2.315	169.00	0.088	143.00	0.516	-79.50	1.36	10.6
13.50	0.512	134.40	2.343	126.20	0.106	100.00	0.440	-125.30	1.50	9.3
14.00	0.272	90.70	2.580	80.70	0.134	56.40	0.280	174.40	1.45	8.8
14.10	0.201	77.80	2.614	70.20	0.139	46.40	0.236	157.30	1.45	8.8
14.20	0.124	59.20	2.623	59.10	0.143	35.90	0.194	136.50	1.46	8.6
14.30	0.054	16.70	2.608	47.80	0.144	25.30	0.163	109.90	1.47	8.5
14.40	0.071	-84.10	2.570	36.50	0.145	14.40	0.149	78.40	1.49	8.4
14.50	0.152	-116.00	2.509	25.20	0.143	3.70	0.159	47.40	1.51	8.2
15.00	0.583	-176.40	1.997	-30.00	0.119	-48.30	0.335	-38.70	1.49	8.1
15.50	0.886	141.40	1.349	-81.10	0.079	-94.80	0.457	-82.40	1.08	10.6
16.00	1.001	113.00	0.845	-122.50	0.046	-127.70	0.504	-116.70	0.20	12.6

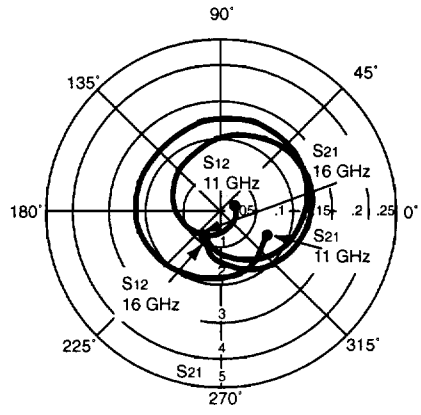
Note:
1. Gain Calculation:

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

MAG = Maximum Available Gain MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS





VDS = 10 V, IDS = 700 mA, VGS = 0.92 V

FREQUENCY	S11		S21		S12		S22		K	MAG[1]
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
11.00	0.757	-16.90	1.477	-26.70	0.022	20.30	0.822	51.00	1.69	13.5
11.50	0.666	-64.70	1.825	-65.80	0.026	-49.80	0.777	25.60	2.22	12.2
12.00	0.646	-117.50	2.042	-107.10	0.038	-114.60	0.687	-4.90	2.08	11.4
12.50	0.681	-160.40	2.252	-146.80	0.057	-165.60	0.612	-37.80	1.53	11.6
13.00	0.652	164.10	2.486	169.50	0.081	146.40	0.533	-76.90	1.35	11.3
13.50	0.496	130.40	2.519	126.60	0.099	103.00	0.452	-122.40	1.49	9.9
14.00	0.250	79.50	2.769	80.40	0.126	58.60	0.288	178.80	1.44	9.5
14.10	0.183	61.80	2.803	69.70	0.130	48.40	0.241	162.70	1.44	9.4
14.20	0.116	32.40	2.803	58.60	0.134	37.70	0.196	143.10	1.45	9.2
14.30	0.084	-24.60	2.778	47.20	0.135	27.00	0.160	117.70	1.47	9.1
14.40	0.125	-80.10	2.730	35.90	0.135	16.00	0.139	86.30	1.49	8.9
14.50	0.199	-108.30	2.655	24.60	0.133	5.40	0.142	53.10	1.50	8.8
15.00	0.617	-173.90	2.090	-30.40	0.110	-46.00	0.313	-37.30	1.46	8.7
15.50	0.907	142.70	1.400	-81.10	0.073	-92.10	0.439	-80.60	0.98	12.8
16.00	1.019	114.10	0.876	-122.20	0.042	-123.50	0.493	-114.60	-0.17	13.2

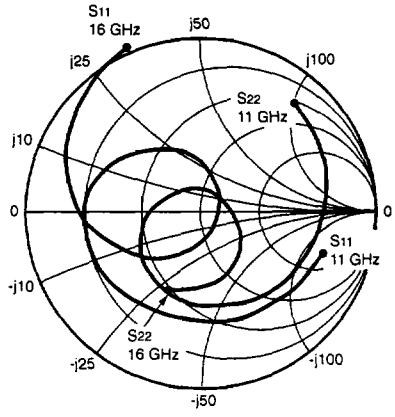
Note:

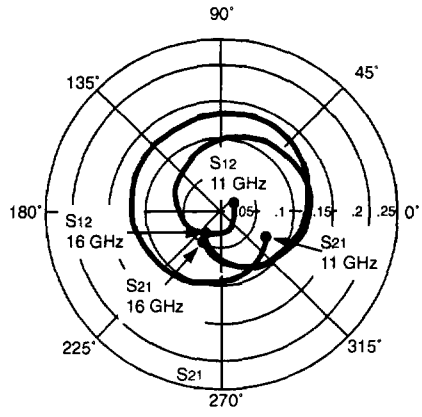
1. Gain Calculation:

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

TYPICAL SCATTERING PARAMETERS





VDS = 10 V, IDS = 900 mA, VGS = 0.74 V

FREQUENCY	S11		S21		S12		S22		K	MAG[1]
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
11.00	0.746	-18.10	1.531	-27.20	0.023	28.10	0.831	51.50	1.41	14.3
11.50	0.655	-66.30	1.889	-66.30	0.026	-41.10	0.791	26.10	2.01	12.9
12.00	0.637	-119.40	2.115	-107.50	0.036	-108.70	0.704	-4.50	2.04	11.9
12.50	0.675	-162.30	2.339	-147.10	0.054	-161.90	0.633	-37.50	1.51	12.2
13.00	0.641	161.90	2.585	169.00	0.076	149.00	0.557	-76.70	1.34	11.8
13.50	0.481	127.40	2.625	125.90	0.095	104.80	0.477	-122.00	1.48	10.3
14.00	0.235	70.90	2.889	79.30	0.121	59.90	0.311	-179.30	1.42	9.9
14.10	0.171	49.20	2.919	68.50	0.125	49.60	0.263	165.60	1.43	9.8
14.20	0.120	12.70	2.915	57.30	0.128	38.80	0.216	147.70	1.44	9.7
14.30	0.114	-40.40	2.882	45.80	0.129	28.00	0.174	125.10	1.45	9.5
14.40	0.163	-81.90	2.827	34.40	0.129	17.10	0.145	96.70	1.47	9.3
14.50	0.236	-107.30	2.744	23.20	0.127	6.70	0.137	63.90	1.49	9.2
15.00	0.641	-173.30	2.148	-31.80	0.105	-44.70	0.288	-34.40	1.44	9.2
15.50	0.921	143.00	1.434	-82.30	0.069	-90.50	0.417	-78.40	0.89	13.2
16.00	1.026	114.40	0.895	-123.30	0.040	-121.60	0.476	-112.50	-0.37	13.5

Note:
1. Gain Calculation:

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