NEC

LOW NOISE L TO Ku-BAND GaAs MESFET

NE76038

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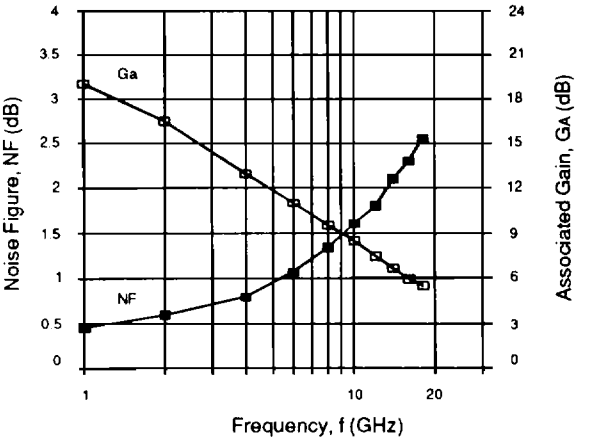
FEATURES

- **LOW NOISE FIGURE:** 1.8 dB typical at 12 GHz
- **HIGH ASSOCIATED GAIN:** 7.5 dB typical at 12 GHz
- **L_G = 0.3 µm, W_G = 280 µm**
- **LOW COST PLASTIC PACKAGING**
- **TAPE & REEL PACKAGING OPTION AVAILABLE**

NOISE FIGURE & ASSOCIATED GAIN vs. FREQUENCY
V_{DS} = 3 V, I_{DS} = 10 mA



DESCRIPTION

NE76038 is a high performance gallium arsenide metal semiconductor field effect transistor housed in a plastic package. Its low noise figure makes this device appropriate for use in the second or third stages of low noise amplifiers operating in the 1 - 14 GHz frequency range. The device is fabricated using ion implantation for improved RF and DC performance, reliability, and uniformity. These devices feature a recessed 0.3 micron gate and triple epitaxial technology.

NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER PACKAGE OUTLINE			NE76038 38		
SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
NF_{OPT}[1]	Optimum Noise Figure at V_{DS} = 3 V, I_{DS} = 10 mA f = 4 GHz f = 12 GHz	 dB dB		 0.8 1.8	 1.2
G_A	Associated Gain at V_{DS} = 3 V, I_{DS} = 10 mA f = 4 GHz f = 12 GHz	 dB dB	 12.0	 13.0 7.5	
I_{DSS}	Saturated Drain Current at V_{DS} = 3 V, V_{GS} = 0 V	mA	15	30	50
V_P	Pinch-off Voltage at V_{DS} = 3 V, I_{DS} = 0.1 mA	V	-3.0	-0.8	-0.5
g_m	Transconductance at V_{DS} = 3 V, I_{DS} = 10 mA	mS	30	40	70
I_{GSO}	Gate to Source Leakage Current at V_{GS} = -3 V	µA			10

Note:
1. Typical values of noise figures are those obtained when 50% of the devices from a large number of lots were individually measured in a circuit with the input individually tuned to obtain the minimum value. Maximum values are criteria established on the production line as a "go-no-go" screening test with the fixture tuned for the "generic" type but not for each specimen.

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

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain to Source Voltage	V	5
V_{GD}	Gate to Drain Voltage	V	-5
V_{GS}	Gate to Source Voltage	V	-3
I_{DS}	Drain Current	mA	I_{DSS}
P_{IN}	RF Input (CW)	dBm	+15
T_{CH}	Channel Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to +150
P_T	Total Power Dissipation	mW	240
R_{TH}[2, 3]	Thermal Resistance	°C/W	1250

Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.
2. R_{TH} for plastic package mounted on glass epoxy substrate is 965°C/W.
3. R_{TH} for chip mounted on copper heat sink is 190°C/W.

TYPICAL NOISE PARAMETERS (T_A = 25°C)

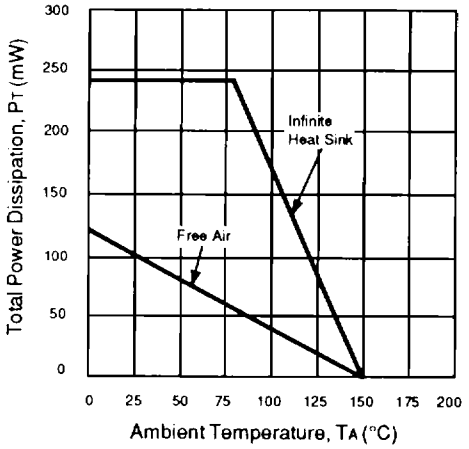
V_{DS} = 3 V, I_{DS} = 10 mA

FREQ. (GHz)	NF_{OPT} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG[1]	Rn/50
0.5	0.40	22.0	0.84	5	0.79
1.0	0.45	19.0	0.82	10	0.75
2.0	0.60	16.5	0.76	28	0.70
4.0	0.80	13.0	0.66	58	0.61
6.0	1.10	11.0	0.55	101	0.50
8.0	1.35	9.5	0.50	152	0.40
10.0	1.60	8.5	0.48	-166	0.31
12.0	1.80	7.5	0.54	-130	0.25
14.0	2.10	6.7	0.63	-105	0.20
16.0	2.30	6.0	0.70	-87	0.15
18.0	2.55	5.5	0.77	-75	0.12

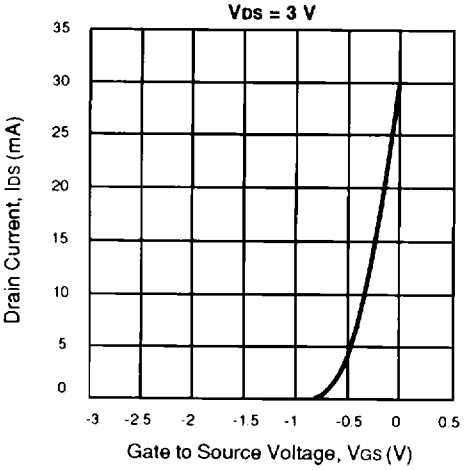
Note:
1. Γ_{OPT} is referenced to the bend of the lead, as shown on back page.

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

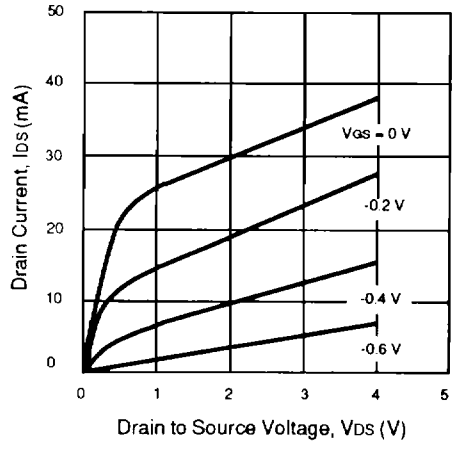
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE
V_{DS} = 3 V



DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



TYPICAL SCATTERING PARAMETERS[1] (T_A = 25°C)

V_{DS} = 3 V, I_{DS} = 10 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG[2]
(GHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG		(dB)
0.1	0.99	-2	3.29	178	0.006	101	0.63	-2	0.02	27.4
0.5	0.99	-9	3.29	171	0.013	82	0.63	-6	0.07	24.1
1.0	0.99	-17	3.25	163	0.02	78	0.62	-12	0.10	21.2
1.5	0.97	-25	3.25	155	0.03	71	0.61	-18	0.20	19.5
2.0	0.95	-34	3.22	147	0.04	66	0.60	-24	0.25	18.3
3.0	0.90	-51	3.15	131	0.06	57	0.58	-35	0.38	16.8
4.0	0.84	-68	3.07	115	0.08	47	0.54	-46	0.48	15.7
5.0	0.77	-86	2.97	99	0.09	37	0.50	-58	0.59	14.8
6.0	0.70	-106	2.83	84	0.10	28	0.45	-70	0.72	14.2
7.0	0.64	-126	2.66	69	0.11	21	0.41	-81	0.85	13.8
8.0	0.61	-145	2.51	55	0.11	16	0.37	-92	0.95	13.5
9.0	0.58	-165	2.37	42	0.11	10	0.33	-104	1.05	11.8
10.0	0.57	175	2.21	27	0.11	7	0.30	-118	1.15	10.5
11.0	0.58	156	2.05	15	0.12	3	0.27	-136	1.24	9.5
12.0	0.60	139	1.87	2	0.12	-0	0.27	-157	1.31	8.8
13.0	0.64	125	1.72	-10	0.12	-1	0.27	-178	1.30	8.4
14.0	0.67	114	1.57	-20	0.12	-2	0.30	164	1.29	7.9
15.0	0.71	104	1.45	-32	0.13	-4	0.34	150	1.17	8.1
16.0	0.74	95	1.32	-41	0.13	-8	0.39	135	1.14	7.8
17.0	0.77	86	1.19	-52	0.13	-12	0.44	122	1.07	7.9
18.0	0.78	80	1.09	-61	0.14	-17	0.46	111	1.09	7.0

V_{DS} = 3 V, I_{DS} = 30 mA

0.1	0.99	-2	4.36	178	0.004	94	0.57	-2	0.04	30.4
0.5	0.99	-10	4.36	171	0.011	82	0.57	-6	0.08	26.0
1.0	0.98	-19	4.30	161	0.02	78	0.57	-12	0.14	23.2
1.5	0.96	-28	4.27	153	0.03	72	0.56	-18	0.24	21.4
2.0	0.93	-37	4.19	144	0.04	67	0.55	-24	0.33	20.2
3.0	0.86	-56	4.02	127	0.05	58	0.52	-35	0.47	18.5
4.0	0.79	-74	3.83	111	0.07	49	0.48	-45	0.60	17.4
5.0	0.71	-93	3.62	95	0.08	41	0.44	-56	0.74	16.5
6.0	0.64	-114	3.37	80	0.08	35	0.39	-67	0.87	15.8
7.0	0.58	-134	3.13	66	0.09	29	0.35	-78	1.00	15.2
8.0	0.55	-154	2.91	52	0.09	26	0.32	-88	1.09	12.9
9.0	0.53	-173	2.71	39	0.10	22	0.29	-100	1.16	11.8
10.0	0.53	167	2.51	26	0.10	20	0.26	-114	1.21	10.9
11.0	0.55	149	2.31	14	0.11	16	0.23	-132	1.24	10.1
12.0	0.58	133	2.11	1	0.11	13	0.23	-155	1.25	9.5
13.0	0.63	120	1.94	-9	0.12	10	0.24	-178	1.21	9.2
14.0	0.66	110	1.77	-20	0.13	8	0.27	163	1.17	8.8
15.0	0.70	101	1.65	-31	0.14	3	0.31	149	1.05	9.3
16.0	0.73	92	1.50	-41	0.14	-2	0.36	134	1.03	9.0
17.0	0.76	84	1.35	-51	0.15	-7	0.41	121	1.01	9.0
18.0	0.78	78	1.23	-59	0.15	-12	0.45	110	1.00	8.7

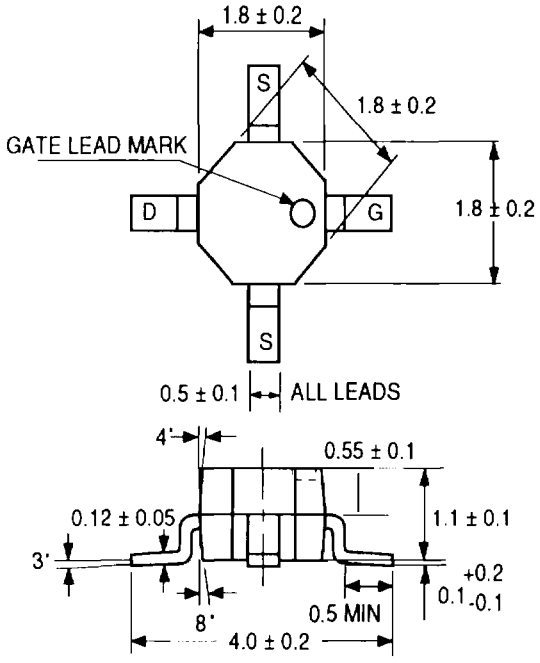
Note:
1. S-Parameters are de-embedded to the bend of the lead as shown on back page.
2. Gain calculations:

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

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 38



ORDERING INFORMATION

PART NUMBER	AVAILABILITY	PACKAGE OUTLINE
NE76038	Bulk up to 1 K	38
NE76038-T1	1K/Reel	38