To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

GaAs MES FET
NE9001

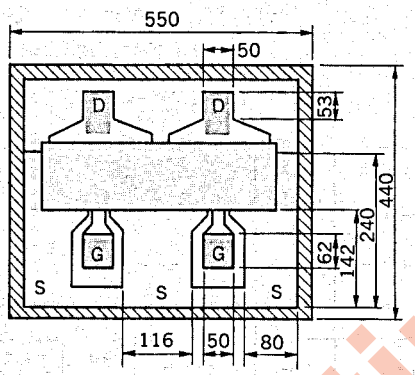
Ku-BAND POWER GaAs FET
N-CHANNEL GaAs MES FET

DESCRIPTION

The NE9001 is a power GaAs FET employing a 0.5 μm recessed gate for commercial,space amplifier and oscillator applications up to 20 GHz. The device incorporates N^+ doping with silicon nitride passivation and silicon dioxide glassivation for sperior scratch resistance and mechanical protection. The NE900100 is one cell of 750 μm gate width and is available in chip form. The NE900175, NE900176 and NE900189A are available in hermetically sealed ceramic packages.

PHYSICAL DIMENSIONS

NE900100*2 (CHIP) (Units in μm)



Die Thickness: 110 to 160 μm

Recommended Bonding Area

Glassivated Area

Plated Wraparound (G type)

FEATURES

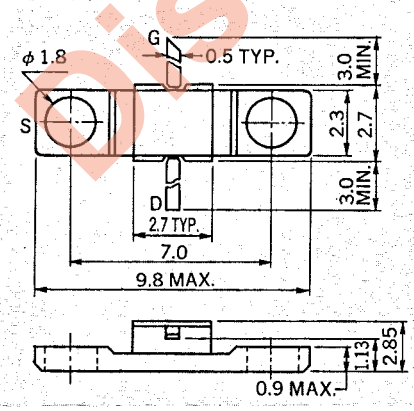
- Class A operation
- High output power
- High power added efficiency

ORDERING INFORMATION

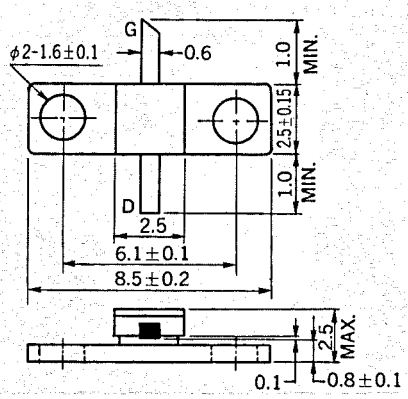
PART NUMBER	PACKAGE CODE
NE900100	00 (CHIP)
NE900100G*1	00 (CHIP)
NE900175	75
NE900176	76
NE900189A	89A

*1 The device has wraparound sidewall metallization for source grounding.

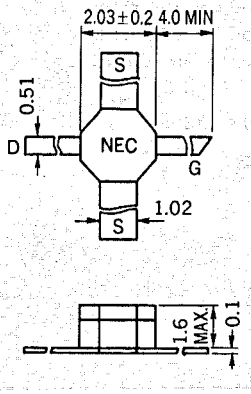
PACKAGE CODE - 75 (Units in mm)



PACKAGE CODE - 76 (Units in mm)



PACKAGE CODE - 89A (Units in mm)



*2 The NE900100 has one good cell on the two-cell chip.
The waffle pack is marked with a circle to indicate which side of the chip has the good cell.

Document No. TC–1914A
Date Published November 1989 M
Printed in Japan

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Drain to Source Voltage	V_{DS}	20	V	
Gate to Source Voltage	V_{GS}	-9	V	
Drain Current	I_D	300	mA	
Gate Current	I_G	2.6	mA	
Total Power Dissipation	P_T	1.5 *3	W	(NE900100 NE900175 NE900100G NE900176)
		1.15 *3	W	(NE900189A)

*3 T_c = 25 °C

ELECTRICAL CHARACTERISTICS (T_a = 25 °C)

CHARACTERISTIC	SYMBOL	NE900100, NE900100G NE900175, NE900176			NE900189A			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
Saturated Drain Current	I_{DSS}	150	225	300	150	225	300	mA	V_{DS} = 2.5 V, V_{GS} = 0 V
Pinch-off Voltage	V_P	-5	-3.5		-5	-3.5		V	V_{DS} = 2.5 V, I_{DS} = 5 mA
Transconductance	g_m		50			75		mS	V_{DS} = 2.5 V, I_{DS} = 90 mA
Thermal Resistance	R_{th}			100			130	°C/W	channel to case

PERFORMANCE SPECIFICATIONS (T_a = 25 °C)

CHARACTERISTIC	SYMBOL	NE900100, NE900100G NE900175			NE900176			NE900189A			UNIT	TEST CONDITIONS	
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.			
Output Power	P_{out}	22	23								dBm	V_{DS} = 8 V, $I_{DS} \leqq$ 90 mA*4, $I_{DS} \leqq$ 65 mA*5	f = 14.5 GHz, P_{in} = 15 dBm
						23		20.5	21.5		dBm		f = 8 GHz, P_{in} = 13 dBm*6
Output Power at 1 dB Gain Compression Point	$P_{O(1\,dB)}$		23								dBm	V_{DS} = 8 V, $I_{DS} \leqq$ 90 mA*4, $I_{DS} \leqq$ 65 mA*5	f = 14.5 GHz
						23			21		dBm		f = 8 GHz
Linear Gain	G_L		8								dB	V_{DS} = 8 V, $I_{DS} \leqq$ 90 mA*4, $I_{DS} \leqq$ 65 mA*5	f = 14.5 GHz
						9.5			9		dB		f = 8 GHz
Power Added Efficiency*7	η_{add}		27			30			27		%	V_{DS} = 8 V, P_{out} = $P_{O(1\,dB)}$	

*4 The condition for NE900100, NE900175 and NE900176

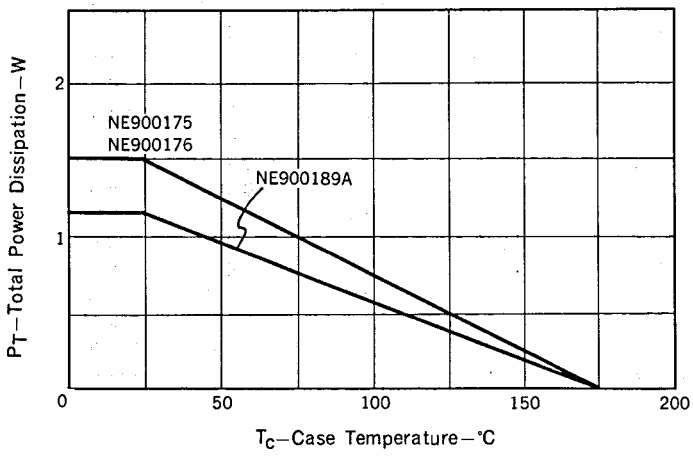
*5 The condition for NE900189A

*6 P_{in} = 15 dBm for NE900176

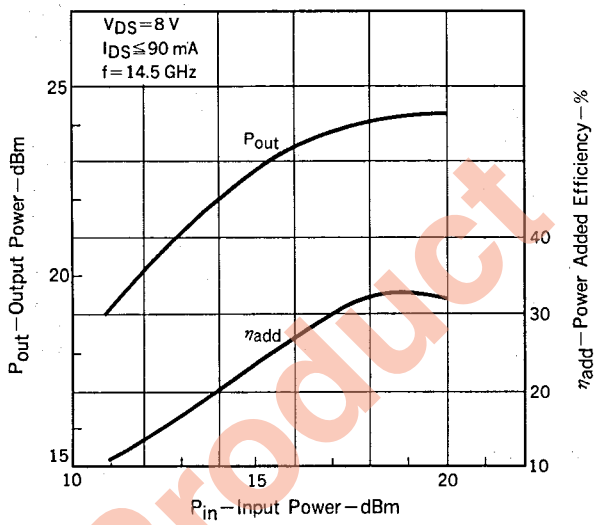
*7 $\eta_{add} = \frac{P_{out} - P_{in}}{V_{DS} \times I_{DS}} \times 100$

TYPICAL CHARACTERISTIC (T_a = 25 °C)

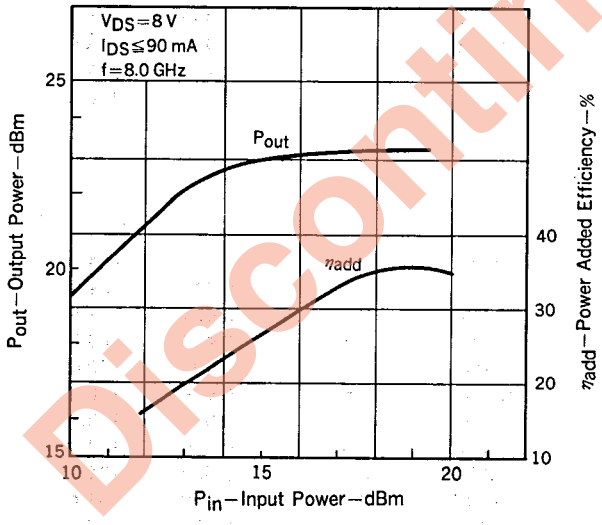
POWER DERATING CURVE



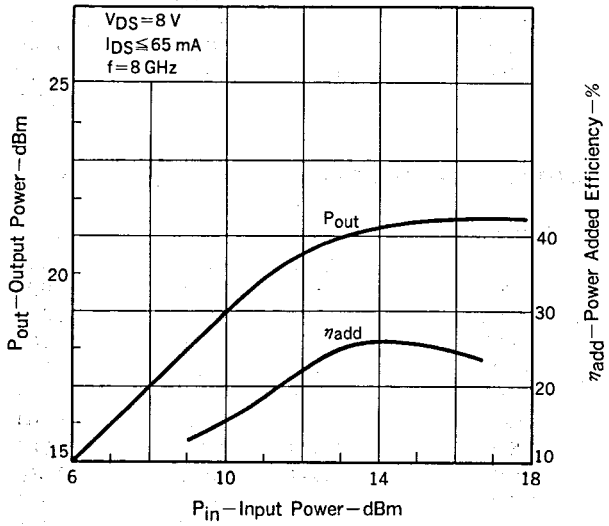
NE900175 OUTPUT POWER AND POWER ADDED EFFICIENCY vs. INPUT POWER



NE900176 OUTPUT AND POWER ADDED EFFICIENCY vs. INPUT POWER



NE900189A OUTPUT POWER AND POWER ADDED EFFICIENCY vs. INPUT POWER



NE900100 S-PARAMETER (V_{DS} = 8 V, I_{DS} = 90 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
2000	0.915	−59.1	3.985	137.0	0.048	59.7	0.546	−21.0
3000	0.846	−85.1	3.467	117.6	0.062	47.0	0.516	−31.4
4000	0.807	−106.6	2.998	102.8	0.069	38.9	0.460	−37.8
5000	0.782	−123.5	2.585	89.9	0.072	35.3	0.449	−45.5
6000	0.750	−138.4	2.231	78.2	0.070	28.6	0.409	−51.5
7000	0.713	−148.0	1.943	70.4	0.053	39.3	0.419	−54.3
8000	0.761	−158.9	1.787	60.3	0.125	38.8	0.397	−67.6
9000	0.767	−168.3	1.619	51.4	0.080	26.3	0.418	−70.3
10000	0.783	−175.3	1.459	42.9	0.081	27.7	0.412	−79.7
11000	0.775	178.7	1.348	35.7	0.082	25.5	0.420	−84.4
12000	0.760	172.5	1.219	27.6	0.080	27.1	0.407	−93.5
13000	0.759	165.8	1.144	20.4	0.082	27.9	0.423	−98.5
14000	0.778	159.7	1.058	13.2	0.081	28.8	0.420	−108.0
15000	0.791	155.8	1.000	6.5	0.085	33.3	0.452	−115.5
16000	0.777	151.6	0.930	−2.3	0.091	34.2	0.471	−122.7
17000	0.741	147.7	0.856	−8.3	0.104	36.6	0.489	−128.9
18000	0.733	140.4	0.819	−15.4	0.114	30.2	0.500	−138.9

NE900100G S-PARAMETER (V_{DS} = 8 V, I_{DS} = 90 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
2000	0.933	−54.7	3.801	139.1	0.049	57.4	0.493	−26.6
3000	0.889	−78.6	3.401	123.2	0.065	45.4	0.493	−31.4
4000	0.856	−98.5	2.979	108.3	0.074	34.4	0.436	−42.9
5000	0.828	−113.9	2.596	95.4	0.078	26.8	0.438	−51.6
6000	0.802	−127.9	2.282	84.1	0.081	17.8	0.399	−60.6
7000	0.765	−137.9	1.991	75.2	0.067	13.2	0.406	−63.2
8000	0.798	−147.8	1.843	65.6	0.108	28.1	0.402	−74.9
9000	0.799	−156.9	1.661	56.6	0.088	4.3	0.412	−77.5
10000	0.803	−164.4	1.519	48.0	0.088	1.3	0.405	−87.0
11000	0.797	−171.1	1.395	40.3	0.089	−3.7	0.413	−91.5
12000	0.785	−178.0	1.278	31.3	0.087	−9.3	0.408	−101.1
13000	0.781	175.1	1.181	23.9	0.084	−12.3	0.415	−105.5
14000	0.783	169.7	1.087	15.8	0.082	−17.8	0.422	−115.6
15000	0.776	167.0	0.999	9.6	0.076	−20.8	0.446	−121.6
16000	0.783	163.4	0.946	1.6	0.075	−23.8	0.472	−128.6
17000	0.755	158.7	0.877	−5.3	0.071	−25.1	0.486	−132.3
18000	0.745	153.5	0.832	−12.5	0.074	−27.0	0.503	−140.0

NE900175 S-PARAMETER (V_{DS} = 8 V, I_{DS} = 90 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
2000	0.886	−99.1	3.596	107.2	0.052	33.8	0.475	−44.4
3000	0.837	−129.5	2.828	82.5	0.058	19.9	0.446	−61.9
4000	0.821	−149.5	2.330	63.1	0.056	8.1	0.451	−77.4
5000	0.800	−164.4	2.006	46.6	0.051	3.1	0.468	−89.3
6000	0.787	−176.9	1.851	31.6	0.051	6.1	0.495	−99.6
7000	0.765	169.8	1.789	16.6	0.053	8.5	0.509	−108.5
8000	0.724	153.8	1.804	0.4	0.059	11.0	0.523	−115.8
9000	0.673	132.0	1.883	−17.4	0.072	8.4	0.519	−124.3
10000	0.641	103.8	2.056	−37.9	0.093	0.6	0.522	−134.7
11000	0.665	69.9	2.283	−63.7	0.132	−18.2	0.520	−153.4
12000	0.698	27.2	2.481	−96.1	0.157	−59.5	0.481	172.3
13000	0.587	−30.8	2.432	−134.6	0.107	−114.1	0.381	133.7
14000	0.489	−101.4	1.949	−172.7	0.067	−150.0	0.324	84.7
15000	0.645	−170.3	1.686	149.4	0.047	158.3	0.293	64.5
16000	0.750	134.1	1.175	109.8	0.036	100.1	0.352	43.9
17000	0.825	94.6	0.738	77.3	0.037	63.7	0.412	29.0
18000	0.884	68.9	0.448	50.3	0.029	25.9	0.444	17.4

NE900176 S-PARAMETER (V_{DS} = 8 V, I_{DS} = 90 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
2000	0.872	−91.6	4.577	108.7	0.046	35.0	0.527	−50.2
3000	0.812	−120.1	3.602	84.0	0.049	22.6	0.509	−69.8
4000	0.797	−139.9	2.941	64.0	0.045	14.6	0.518	−87.0
5000	0.789	−154.7	2.506	46.7	0.043	12.3	0.548	−101.6
6000	0.773	−167.0	2.233	31.3	0.041	19.0	0.577	−113.5
7000	0.754	−179.5	2.084	16.0	0.046	24.3	0.603	−124.9
8000	0.721	165.4	2.024	−0.1	0.056	28.1	0.624	−135.1
9000	0.690	143.9	2.046	−19.1	0.072	20.2	0.650	−148.8
10000	0.680	114.2	2.045	−42.8	0.092	3.2	0.664	−168.0
11000	0.710	79.7	1.877	−70.6	0.098	−26.4	0.630	162.6
12000	0.729	48.8	1.521	−96.3	0.083	−65.2	0.531	130.5
13000	0.702	24.1	1.206	−116.6	0.055	−107.2	0.428	104.4
14000	0.620	10.8	0.945	−132.6	0.037	−152.3	0.401	89.8
15000	0.696	−2.8	0.848	−149.3	0.036	162.8	0.428	75.8
16000	0.725	−14.7	0.689	−166.9	0.043	113.3	0.465	61.7
17000	0.821	−22.1	0.617	−174.8	0.025	72.9	0.484	54.1
18000	0.872	−34.3	0.645	168.6	0.019	178.9	0.526	47.9

NE900189A S-PARAMETER (V_{DS} = 8 V, I_D = 90 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
2000	0.822	−83.0	4.081	111.2	0.047	54.1	0.573	−33.0
3000	0.728	−117.0	3.442	84.1	0.060	44.6	0.528	−46.7
4000	0.659	−146.9	2.926	60.4	0.069	39.9	0.489	−60.7
5000	0.623	−173.7	2.534	39.1	0.080	37.5	0.459	−76.7
6000	0.619	163.0	2.227	19.3	0.095	34.9	0.435	−94.9
7000	0.633	143.5	1.990	0.6	0.115	30.1	0.429	−115.4
8000	0.646	126.5	1.810	−17.5	0.140	25.2	0.444	−136.3
9000	0.652	108.9	1.666	−36.0	0.170	15.8	0.473	−158.8
10000	0.655	89.2	1.519	−55.3	0.201	4.4	0.516	178.1
11000	0.668	68.4	1.344	−74.5	0.225	−8.5	0.570	154.7
12000	0.654	51.6	1.130	−90.8	0.233	−18.9	0.624	134.4
13000	0.719	44.6	1.108	−107.6	0.277	−29.4	0.740	116.5
14000	0.719	30.6	0.930	−130.3	0.282	−44.6	0.828	95.7
15000	0.674	19.1	0.694	−161.0	0.271	−55.9	0.954	71.3
16000	0.718	16.7	0.122	−33.3	0.306	−47.4	0.857	24.8
17000	0.879	−9.1	0.777	−119.1	0.442	−73.7	0.402	34.2
18000	0.879	−31.8	0.791	−154.6	0.454	−96.5	0.533	35.5

CHIP HANDLING

DIE ATTACHMENT

Die attach can be accomplished with a Au-Sn (300±10 °C) preforms in a forming gas environment. Epoxy die attach is not recommended.

BONDING

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

Bonding should be performed with a widge 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 280 °C — 5 minute curve. If longer periods are required, the temperature 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.

[MEMO]