

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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

April 1st, 2010
Renesas Electronics Corporation

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

Send any inquiries to <http://www.renesas.com/inquiry>.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.
 - “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
 - “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
 - “Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

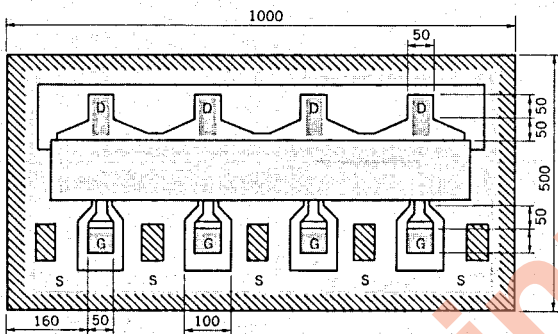
Ku-BAND POWER GaAs FET
N-CHANNEL GaAs MES FET

DESCRIPTION

The NE9004 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 superior scratch resistance and mechanical protection. The NE9004 is a four cell die of 3 000 μm gate width incorporating wrap-around source metallization and via hole source grounding for superior RF and thermal performance. The NE9004 is available in chip form or in the hermetically sealed package.

PHYSICAL DIMENSIONS

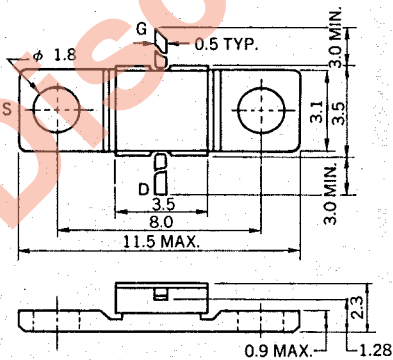
NE900400 (Chip)
(Units in μm)



Die Thickness: $60 \pm 20 \mu\text{m}$

- Recommended Bonding Area
- Glassivated Area
- Plated Wraparound Area and Via Hole detail.

PACKAGE CODE-74
(Units in mm)



FEATURES

- Class A operation
- High power added efficiency
- Broad band width
- Internally matched input

ORDERING INFORMATION

PART NUMBER	TYPICAL PERFORMANCE			
	PACKAGE CODE	$P_{O(1 \text{ dB})}$ (dBm)	USABLE FREQUENCY (GHz)	G_L (dB)
NE900400	00 (chip)	31	Up to 20	7
NE900474-13	74	31	13.5	7
NE900474-15	74	31	15.2	7

ABSOLUTE MAXIMUM RATINGS ($T_a = 25\text{ }^\circ\text{C}$)

Drain to Source Voltage	V_{DS}	20	V
Gate to Source Voltage	V_{GS}	-9	V
Drain Current	I_D	1200	mA
Gate Current	I_G	10	μA
Total Power Dissipation	P_T	7.5 ^{*1}	W

*1 $T_c = 50\text{ }^\circ\text{C}$ ELECTRICAL CHARACTERISTICS ($T_a = 25\text{ }^\circ\text{C}$)

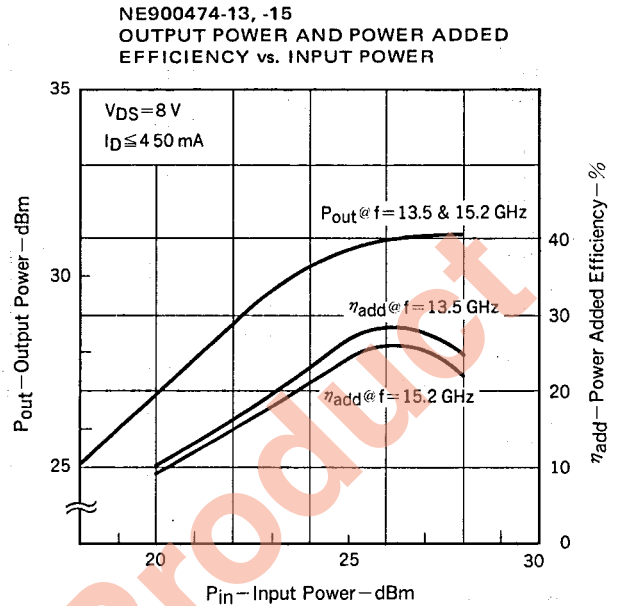
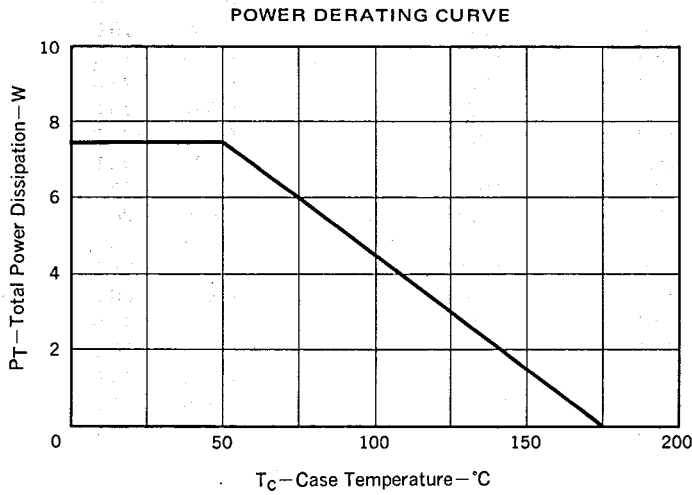
PART NUMBER		NE900400		NE900474-13, 15		UNIT	TEST CONDITIONS
PACKAGE CODE		00 (CHIP)		74			
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.			
Saturated Drain Current	I_{DSS}	400	800	1200		mA	$V_{DS} = 2.5\text{ V}, V_{GS} = 0$
Pinch-off Voltage	V_p	-5	-3	-1		V	$V_{DS} = 2.5\text{ V}, I_{DS} = 20\text{ mA}$
Transconductance	g_m	-	200	-		mS	$V_{DS} = 2.5\text{ V}, I_{DS} = 300\text{ mA}$
Thermal Resistance	R_{th}	-	-	20		$^\circ\text{C/W}$	channel to case

PERFORMANCE SPECIFICATIONS ($T_a = 25\text{ }^\circ\text{C}$)

PART NUMBER		NE900400, NE900474-13		NE900474-15		UNIT	TEST CONDITIONS	
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MIN.	TYP.			
Output Power	P_{out}	30.5	31.0	-	-	dBm	$V_{DS} = 8\text{ V},$ $I_D = 450\text{ mA}$	$P_{in} = 25.0\text{ dBm}, f = 13.5\text{ GHz}$
		-	-	30.5	31.0	dBm		$P_{in} = 25.5\text{ dBm}, f = 15.2\text{ GHz}$
Output Power at 1 dB Gain Compression Point	$P_{O(1\text{ dB})}$	-	31.0	-	-	dBm	$V_{DS} = 8\text{ V},$ $I_D = 450\text{ mA}$	$f = 13.5\text{ GHz}$
		-	-	-	31.0	dBm		$f = 15.2\text{ GHz}$
Linear Gain	G_L	-	7	-	7	dB	$V_{DS} = 8\text{ V},$ $I_D = 450\text{ mA}$	$f = 13.5\text{ GHz}$
		-	7	-	7	dB		$f = 15.2\text{ GHz}$
Power Added Efficiency *2	η_{add}	-	26	-	26	%	$V_{DS} = 8\text{ V},$ $I_D = 450\text{ mA}$	$f = 13.5\text{ GHz}$
		-	24	-	24	%		$f = 15.2\text{ GHz}$

$$*2 \eta_{add} = \frac{P_{out} - P_{in}}{V_{DS} \times I_D} \times 100 (\%)$$

TYPICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)



S-PARAMETER

NE900400 ($V_{DS} = 8\text{ V}$, $I_D = 450\text{ mA}$)

frequency (MHz)	S11		S21		S12		S22	
2000	0.918	-138	4.165	95	0.050	14	0.306	-133
3000	0.912	-153	2.848	81	0.051	4	0.348	-139
4000	0.911	-161	2.132	69	0.051	-3	0.391	-142
5000	0.912	-167	1.683	60	0.050	-8	0.436	-145
6000	0.914	-171	1.376	51	0.048	-12	0.481	-147
7000	0.916	-174	1.152	43	0.047	-16	0.524	-150
8000	0.919	-177	0.981	35	0.045	-19	0.565	-153
9000	0.921	-179	0.847	28	0.043	-22	0.603	-157
10000	0.923	179	0.740	21	0.042	-24	0.638	-160
11000	0.926	177	0.651	15	0.040	-26	0.670	-163
12000	0.928	175	0.578	8	0.038	-27	0.699	-167
13000	0.930	173	0.515	2	0.036	-29	0.725	-170
14000	0.932	171	0.462	-3	0.035	-30	0.748	-173
15000	0.934	170	0.417	-9	0.033	-30	0.769	-176
16000	0.936	168	0.377	-14	0.032	-31	0.788	-179
17000	0.938	167	0.343	-19	0.030	-31	0.806	178
18000	0.939	165	0.312	-23	0.029	-31	0.821	175

NE900474-13 ($V_{DS} = 8\text{ V}$, $I_D = 450\text{ mA}$)

frequency (MHz)	S11		S21		S12		S22	
2000	0.916	-167.0	2.518	68.9	0.025	4.9	0.381	-163.9
3000	0.911	178.1	1.715	49.4	0.024	-4.2	0.458	-170.5
4000	0.912	168.1	1.344	32.8	0.022	-1.1	0.515	-176.8
5000	0.904	159.5	1.169	17.4	0.025	3.5	0.562	177.8
6000	0.887	150.4	1.106	1.9	0.029	3.3	0.592	170.3
7000	0.854	138.4	1.126	-15.2	0.036	0.7	0.610	162.6
8000	0.794	121.4	1.226	-35.2	0.048	-8.4	0.628	152.9
9000	0.703	96.8	1.375	-60.6	0.056	-26.2	0.651	140.1
10000	0.580	61.0	1.526	-91.6	0.065	-49.7	0.676	124.5
11000	0.408	11.6	1.629	-127.5	0.061	-79.6	0.748	105.4
12000	0.237	-72.4	1.596	-168.0	0.038	-119.1	0.821	84.2
13000	0.368	-179.4	1.363	147.9	0.009	80.4	0.865	60.9
14000	0.581	127.5	1.056	107.2	0.060	11.6	0.861	41.9
15000	0.696	87.0	0.786	68.6	0.110	-23.1	0.832	26.2
16000	0.768	47.8	0.603	30.3	0.158	-50.8	0.816	13.6
17000	0.825	10.1	0.493	-11.6	0.223	-80.0	0.775	1.2
18000	0.808	-21.6	0.396	-54.6	0.263	-112.1	0.698	-8.7

NE900474-15 ($V_{DS} = 8\text{ V}$, $I_D = 150\text{ mA}$)

frequency (MHz)	S11		S21		S12		S22	
2000	0.906	-168.2	2.780	67.7	0.030	-0.6	0.399	-171.8
3000	0.904	176.5	1.880	47.4	0.029	-8.2	0.463	179.5
4000	0.903	166.9	1.455	30.3	0.028	-10.2	0.521	172.4
5000	0.891	159.4	1.242	14.8	0.030	-8.7	0.562	166.7
6000	0.873	151.7	1.162	-0.7	0.033	-9.9	0.593	159.1
7000	0.831	141.0	1.174	-17.9	0.039	-13.4	0.609	151.0
8000	0.758	124.1	1.267	-38.7	0.050	-22.5	0.628	139.8
9000	0.644	95.7	1.390	-65.7	0.062	-39.3	0.654	124.6
10000	0.528	50.5	1.446	-98.0	0.070	-64.7	0.680	106.2
11000	0.468	-5.7	1.380	-132.9	0.069	-94.2	0.747	84.7
12000	0.437	-61.6	1.206	-167.8	0.053	-127.3	0.808	64.2
13000	0.391	-110.3	0.947	160.1	0.019	-150.2	0.843	44.7
14000	0.548	-151.5	0.882	132.5	0.013	144.1	0.870	32.2
15000	0.630	160.1	0.769	97.4	0.039	19.0	0.883	19.7
16000	0.690	111.0	0.665	59.6	0.097	-23.4	0.869	9.7
17000	0.777	55.0	0.600	12.3	0.196	-64.5	0.806	-1.2
18000	0.675	14.4	0.333	-24.9	0.152	-123.6	0.701	3.2

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 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 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.

Discontinued Product

Discontinued Product