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
NE8004

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

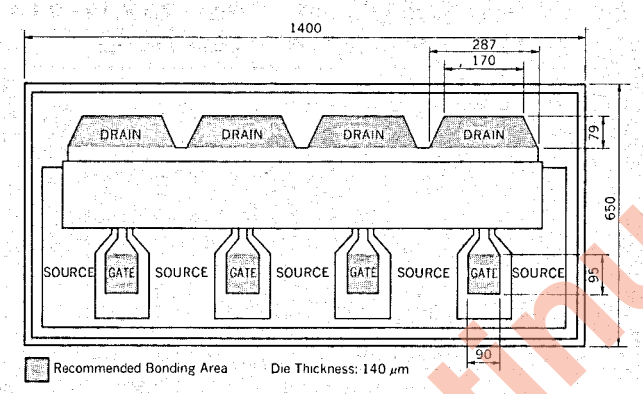
DESCRIPTION

The NE800495 power GaAs FET covers the 3.5 to 8.5 GHz frequency range with five different Class A, 2.0 W output power devices. Each packaged device has an input lumped element matching network.

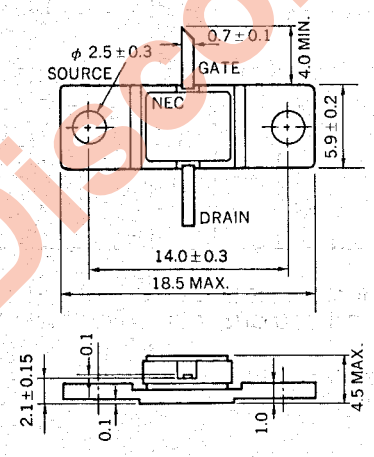
The NE800400 is the four-cell recessed gate chip used in "95" package. Recommended bias is 8 to 9 volts for CW operations and 13 volts for pulsed operation.

PHYSICAL DIMENSIONS

NE800400 (Chip)
(Units in μm)



PACKAGE CODE-95
(Units in mm)



FEATURES

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

ORDERING INFORMATION

NE PART NUMBER	PACKAGE CODE	TYPICAL PERFORMANCE		
		$P_{O(1\ dB)}$ (dBm)	USABLE FREQUENCY (GHz)	G_L (dB)
NE800400	00(CHIP)	33	2.0 to 10.0	8
NE800495-4	95	33	3.5 to 4.5	8.5
NE800495-5	95	33	4.5 to 5.5	8.5
NE800495-6	95	33	5.5 to 6.5	8
NE800495-7	95	33	6.5 to 7.5	8
NE800495-8	95	32.5	7.5 to 8.5	9.5

Document No. TC–1912A
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}	−14	V
Drain Current	I_D	1.6	A
Gate Current	I_G	10	mA
Total Power Dissipation	P_T	10*1	W
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	−65 to +175	°C

*1 T_c = 25 °C

ELECTRICAL CHARACTERISTICS (T_a = 25 °C)

PART NUMBER		NE800400			NE800495-4,5,6,7,8			UNIT	TEST CONDITIONS
PACKAGE CODE		CHIP			95				
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
Saturated Drain Current	I_{DSS}	0.9	1.2	1.6	0.9	1.2	1.6	A	V_{DS} = 2.5 V, V_{GS} = 0
Pinch-off Voltage	V_P	−5	−3.5		−5	−3.5		V	V_{DS} = 2.5 V, I_D = 8 mA
Transconductance	g_m		240			240		mS	V_{DS} = 2.5 V, I_D = 0.4 A
Thermal Resistance	R_{th}		15	16		15	16	°C/W	channel to case

PERFORMANCE SPECIFICATIONS (T_a = 25 °C)

PART NUMBER		NE800400*2			NE800495-4,5			NE800495-6,7			NE800495-8			UNIT	TEST CONDITIONS	
PACKAGE CODE		CHIP			95			95			95					
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.			
Output Power *3	P_{out}				32	33								dBm	V_{DS} = 9 V, $I_D \leqq$ 600 mA	P_{in} = 25.0 dBm
		32	33					32	33					dBm		P_{in} = 26.0 dBm
											32	33		dBm		P_{in} = 26.5 dBm
Output Power at 1 dB Gain Compression Point *4	$P_{O(1\ dB)}$		33			33			33			32.5		dBm	V_{DS} = 9 V, $I_D \leqq$ 600 mA	
Linear Gain *4	G_L		8.0			8.5			8.0			7.5		dB	V_{DS} = 9 V, $I_D \leqq$ 600 mA	
Power Added Efficiency *5	η_{add}		37			40			37			35		%	V_{DS} = 9 V, $I_D \leqq$ 600 mA, $P_{out} = P_{O(1\ dB)}$	
Input Voltage Standing Wave Ratio *4	VSWR		2:1			2:1			2:1			2:1			V_{DS} = 9 V, $I_D \leqq$ 600 mA, $P_{out} = P_{O(1\ dB)}$	

*2 Four-cell chip; all cells are good.

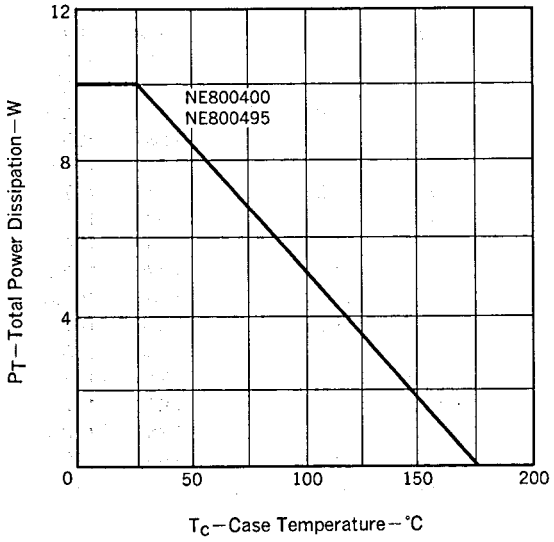
*3 Device are measured in a broadband amplifier circuit with the drain current between 400 to 700 mA. The gate current is limited to 10 mA. Test frequencies are: NE800495-4 @4.2 GHz, NE800495-5 @5.0 GHz, NE800495-6 @6.5 GHz, NE800495-7 @7.2 GHz, NE800495-8 @8.4 GHz.

*4 Amplifier performance in a circuit optimized at the center of the usable frequency band.

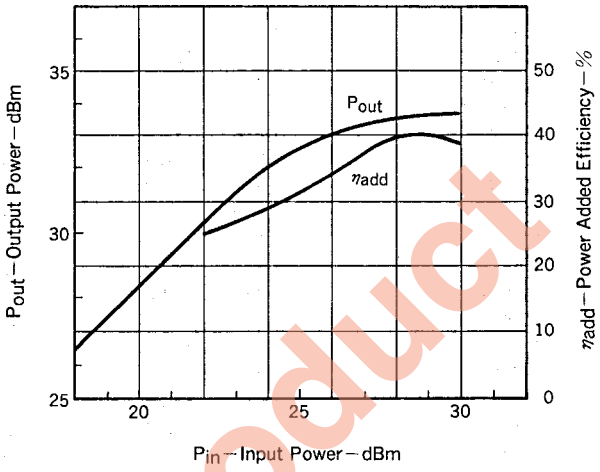
*5 $$\eta_{add} = \frac{P_O\ (1\ dB)}{V_{DS} \times I_D + P_{in}} \times 100\ (\%)$$

TYPICAL CHARACTERISTICS (T_a = 25 °C)

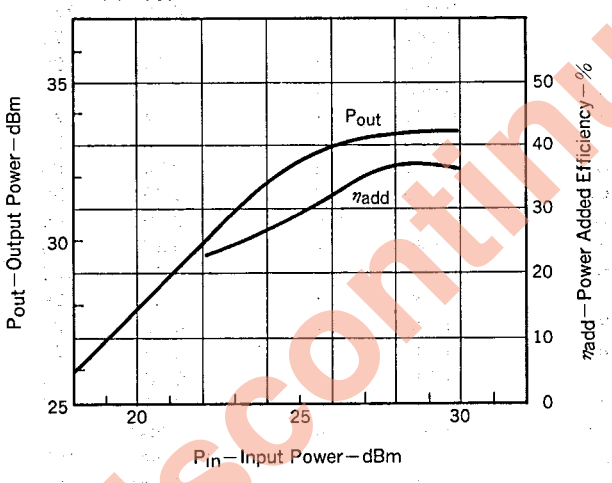
POWER DERATING CURVE



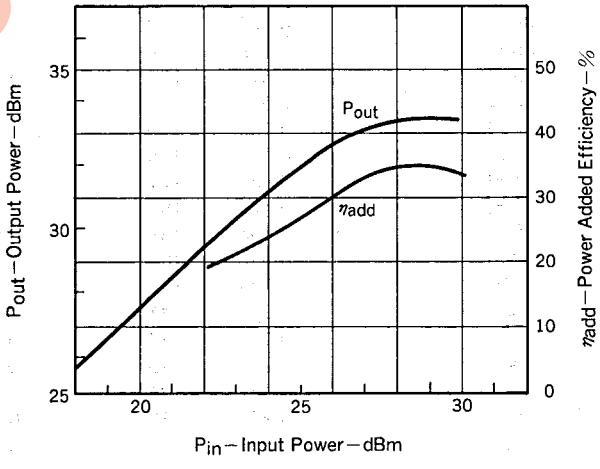
NE800495-4, -5
OUTPUT POWER AND POWER ADDED EFFICIENCY vs. INPUT POWER



NE800495-6, -7
OUTPUT POWER AND POWER ADDED EFFICIENCY vs. INPUT POWER



NE800495-8
OUTPUT POWER AND POWER ADDED EFFICIENCY vs. INPUT POWER



S-PARAMETER

NE800400 (V_{DS} = 9 V, I_D = 600 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
1000	0.909	−144.9	4.058	96.6	0.040	17.1	0.368	−157.0
2000	0.911	−163.6	2.046	76.5	0.040	8.9	0.437	−159.4
3000	0.914	−170.8	1.361	64.6	0.039	8.7	0.461	−156.4
4000	0.914	−174.5	0.992	52.3	0.036	9.9	0.531	−155.4
5000	0.916	−176.9	0.771	42.2	0.034	16.0	0.587	−155.1
6000	0.916	−179.1	0.618	32.9	0.032	21.2	0.640	−156.5
7000	0.915	179.1	0.509	25.7	0.032	40.5	0.677	−157.5
8000	0.908	177.2	0.444	19.1	0.056	27.9	0.697	−160.2
9000	0.921	176.4	0.375	10.8	0.038	33.1	0.747	−160.7
10000	0.924	175.3	0.325	4.9	0.042	38.5	0.779	−163.3
11000	0.920	174.0	0.288	−0.8	0.047	41.3	0.801	−164.6
12000	0.912	172.1	0.252	−6.2	0.051	42.5	0.820	−167.0
13000	0.908	170.3	0.224	−10.2	0.057	41.7	0.834	−169.2
14000	0.909	169.1	0.197	−13.3	0.060	41.2	0.845	−171.6
15000	0.911	168.8	0.176	−16.2	0.063	41.6	0.855	−172.7
16000	0.904	168.0	0.159	−20.0	0.068	40.4	0.859	−173.7
17000	0.885	166.6	0.144	−21.1	0.075	40.2	0.858	−175.1
18000	0.869	164.8	0.135	−22.6	0.082	35.9	0.860	−177.4

NE800495-4 (V_{DS} = 9 V, I_D = 600 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
3000	0.840	145	1.615	5	0.043	10	0.464	179
3200	0.816	141	1.655	−3	0.046	7	0.491	179
3400	0.785	138	1.725	−12	0.047	2	0.517	178
3600	0.739	134	1.825	−21	0.048	−6	0.549	180
3800	0.676	130	1.967	−33	0.048	−14	0.600	179
4000	0.588	128	2.139	−47	0.045	−27	0.674	177
4200	0.480	130	2.298	−63	0.039	−46	0.765	173
4400	0.414	145	2.357	−84	0.027	−78	0.848	165
4600	0.486	162	2.236	−107	0.016	−149	0.899	155
4800	0.627	164	1.947	−128	0.025	134	0.903	145
5000	0.745	159	1.618	−146	0.040	102	0.873	138
5200	0.823	153	1.322	−161	0.054	83	0.827	133
5400	0.874	147	1.095	−174	0.066	71	0.786	129
5600	0.903	141	0.918	174	0.076	61	0.754	125
5800	0.920	135	0.779	163	0.085	53	0.729	121
6000	0.926	129	0.667	153	0.093	46	0.708	118
6200	0.927	124	0.581	143	0.099	40	0.677	116
6400	0.924	119	0.509	134	0.107	34	0.660	112
6600	0.918	114	0.457	124	0.113	30	0.649	108
6800	0.911	109	0.414	115	0.121	25	0.639	105
7000	0.906	104	0.384	106	0.129	20	0.627	102
7200	0.905	101	0.364	99	0.136	18	0.621	101
7400	0.901	95	0.347	90	0.147	14	0.610	98
7600	0.899	89	0.338	80	0.158	8	0.600	95
7800	0.896	82	0.331	70	0.168	2	0.594	92
8000	0.896	74	0.328	59	0.180	−4	0.584	89

NE800495-5 (V_{DS} = 9 V, I_D = 600 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
3000	0.857	159	1.730	20	0.042	29	0.485	–160
3200	0.831	157	1.734	6	0.042	20	0.509	–160
3400	0.806	151	1.781	3	0.043	24	0.515	–157
3600	0.762	145	1.916	–10	0.046	19	0.572	–157
3800	0.713	138	2.103	–17	0.047	14	0.635	–160
4000	0.634	139	2.292	–31	0.043	7	0.707	–162
4200	0.512	144	2.378	–44	0.033	–6	0.795	–166
4400	0.440	157	2.448	–65	0.017	–20	0.874	–171
4600	0.481	173	2.453	–84	0.003	130	0.909	179
4800	0.611	177	2.212	–106	0.031	124	0.894	169
5000	0.754	172	1.894	–124	0.053	104	0.874	161
5200	0.855	166	1.563	–143	0.074	97	0.833	156
5400	0.914	160	1.301	–155	0.089	81	0.787	153
5600	0.945	155	1.089	–173	0.105	77	0.752	150
5800	0.954	149	0.904	–176	0.114	69	0.721	148
6000	0.959	143	0.749	171	0.125	66	0.698	145
6200	0.976	138	0.659	165	0.136	60	0.683	142
6400	0.968	134	0.585	149	0.150	55	0.662	141
6600	0.945	132	0.527	146	0.161	50	0.642	141
6800	0.916	126	0.470	131	0.169	46	0.620	139
7000	0.910	119	0.436	128	0.183	40	0.603	134
7200	0.922	113	0.420	110	0.200	36	0.595	130
7400	0.950	106	0.422	106	0.221	30	0.598	126
7600	0.970	99	0.423	89	0.244	26	0.597	123
7800	0.962	93	0.419	83	0.261	19	0.583	122
8000	0.937	85	0.405	69	0.271	14	0.558	120

NE800495-6 (V_{DS} = 9 V, I_{DS} = 600 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
3000	0.880	144	1.309	7	0.043	22	0.478	176
3200	0.869	141	1.287	1	0.046	20	0.500	175
3400	0.858	137	1.279	–6	0.048	19	0.515	174
3600	0.841	133	1.282	–12	0.051	19	0.528	173
3800	0.826	129	1.304	–19	0.054	17	0.549	171
4000	0.808	125	1.343	–26	0.059	13	0.575	170
4200	0.786	120	1.394	–33	0.061	10	0.597	168
4400	0.757	115	1.461	–42	0.063	5	0.621	167
4600	0.718	109	1.549	–51	0.065	–1	0.652	165
4800	0.663	103	1.657	–62	0.066	–7	0.695	162
5000	0.591	96	1.774	–74	0.063	–16	0.750	159
5200	0.496	90	1.882	–88	0.059	–25	0.802	156
5400	0.383	87	1.978	–103	0.047	–34	0.853	152
5600	0.273	94	2.030	–120	0.033	–40	0.900	146
5800	0.236	117	2.019	–137	0.016	–26	0.936	138
6000	0.300	135	1.924	–155	0.016	54	0.947	131
6200	0.401	135	1.792	–172	0.039	62	0.917	124
6400	0.491	129	1.624	171	0.060	55	0.885	117
6600	0.557	119	1.469	156	0.080	46	0.854	111
6800	0.602	109	1.330	143	0.098	38	0.824	106
7000	0.633	98	1.212	130	0.114	30	0.794	102
7200	0.655	88	1.131	120	0.129	23	0.773	100
7400	0.674	75	1.056	107	0.145	15	0.748	96
7600	0.688	60	0.998	94	0.162	5	0.726	92
7800	0.705	44	0.950	80	0.177	–5	0.703	88
8000	0.721	27	0.898	66	0.190	–15	0.675	84

NE800495-7 (V_{DS} = 9 V, I_D = 600 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
5000	0.740	101	1.451	–59	0.069	–2	0.675	160
5200	0.692	94	1.551	–70	0.071	–9	0.710	157
5400	0.626	87	1.663	–81	0.070	–16	0.750	154
5600	0.541	79	1.773	–94	0.065	–25	0.796	150
5800	0.436	72	1.872	–109	0.058	–34	0.845	145
6000	0.315	69	1.942	–124	0.046	–43	0.889	140
6200	0.206	78	1.968	–141	0.029	–46	0.917	133
6400	0.179	110	1.936	–158	0.014	–21	0.929	126
6600	0.250	128	1.862	–175	0.021	43	0.925	119
6800	0.343	127	1.753	169	0.040	51	0.902	112
7000	0.422	120	1.637	154	0.062	46	0.871	106
7200	0.480	111	1.534	141	0.081	41	0.838	102
7400	0.530	99	1.431	127	0.101	31	0.808	97
7600	0.563	85	1.349	114	0.119	22	0.791	93
7800	0.586	70	1.293	100	0.137	12	0.775	88
8000	0.602	54	1.243	86	0.154	2	0.749	83
8200	0.615	37	1.183	71	0.167	–9	0.718	77
8400	0.626	17	1.115	56	0.177	–20	0.679	71
8600	0.638	–3	1.038	41	0.180	–31	0.633	66
8800	0.663	–24	0.965	27	0.182	–42	0.597	63
9000	0.693	–44	0.891	13	0.180	–53	0.566	60
9200	0.733	–64	0.820	–1	0.173	–63	0.537	57
9400	0.777	–83	0.746	–15	0.164	–73	0.510	54
9600	0.818	–100	0.672	–27	0.149	–83	0.489	51
9800	0.852	–116	0.602	–39	0.135	–91	0.472	49
10000	0.877	–131	0.537	–51	0.120	–98	0.463	45

NE800495-8 (V_{DS} = 9 V, I_D = 600 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
5000	0.729	98	1.456	–53	0.081	–4	0.625	157
5200	0.686	90	1.539	–63	0.084	–10	0.650	154
5400	0.627	80	1.626	–74	0.087	–18	0.682	152
5600	0.554	68	1.712	–85	0.086	–27	0.715	149
5800	0.466	54	1.791	–97	0.084	–36	0.751	146
6000	0.363	36	1.855	–110	0.079	–47	0.787	141
6200	0.258	11	1.897	–124	0.070	–59	0.818	136
6400	0.175	–30	1.904	–139	0.058	–73	0.844	131
6600	0.171	–88	1.875	–153	0.042	–87	0.857	125
6800	0.240	–129	1.815	–168	0.024	–108	0.859	119
7000	0.322	–154	1.729	179	0.008	–173	0.852	113
7200	0.389	–171	1.643	167	0.018	95	0.840	108
7400	0.443	174	1.557	154	0.035	71	0.830	103
7600	0.486	160	1.488	142	0.055	59	0.822	98
7800	0.516	147	1.440	131	0.073	48	0.815	93
8000	0.530	134	1.401	119	0.093	37	0.802	88
8200	0.535	121	1.365	106	0.111	27	0.785	81
8400	0.532	107	1.327	94	0.124	17	0.760	75
8600	0.520	93	1.287	81	0.137	8	0.725	69
8800	0.505	76	1.263	69	0.152	0	0.697	65
9000	0.487	57	1.244	56	0.171	–10	0.674	59
9200	0.469	36	1.215	43	0.182	–21	0.639	53
9400	0.464	12	1.186	30	0.191	–31	0.602	48
9600	0.480	–13	1.164	16	0.199	–42	0.564	42
9800	0.515	–39	1.133	2	0.201	–53	0.524	36
10000	0.575	–64	1.098	–13	0.201	–64	0.486	31

CHIP HANDLING

DIE ATTACHMENT

Die attach can be accomplished with either 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 diameter. The source should be connected with gold ribbon or mesh.

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.

[MEMO]