NEC

GaAs MES FET

NE85002 SERIES

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

DESCRIPTION

The NE8500295 power GaAs FET covers 3.5 to 8.5 GHz frequency range with three different Class A, 2.0 W partially matched devices. Each packaged device has an input lumped element matching network.

NE8500200 is the six-cells recessed gate chip used in '95' package.

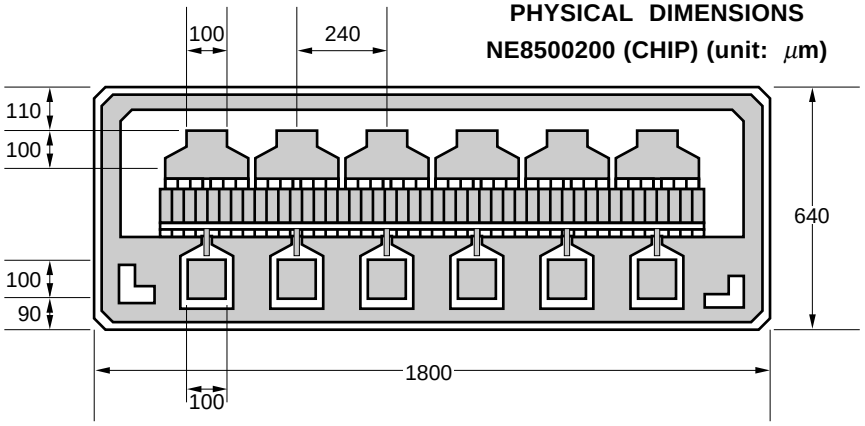
The device incorporates Ti-Al gate and silicon dioxide glassivation. To reduce the thermal resistance, the device has a PHS. (Plated Heat Sink)

NEC's strigent quality assurance and test procedures assure the highest reliability and performance.

FEATURES

- Class A operation
- High power output
- High reliability

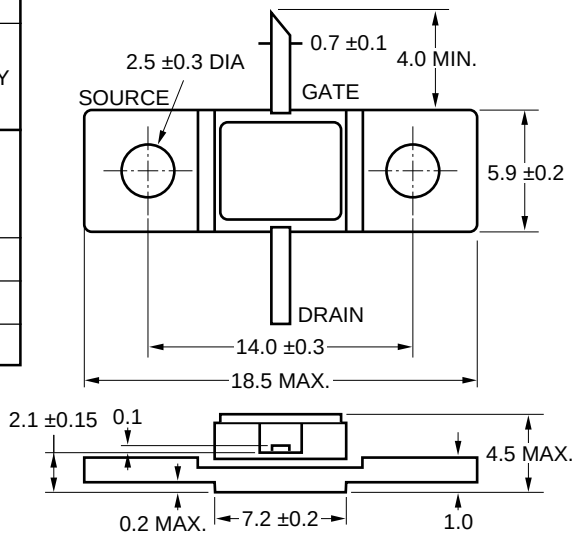
PHYSICAL DIMENSIONS
NE8500200 (CHIP) (unit: μm)



SELECTION CHART

PART NUMBER	PERFORMANCE SPECIFIED		
	Pout (**) (dBm)	G_L (**) (dB)	USABLE FREQUENCY (GHz)
NE8500200(*) NE8500200-WB(*) NE8500200-RG(*)	33.8 min	8.0 min	2.0 to 10
NE8500295-4	33.8 min	10.5 min	3.5 to 5.5
NE8500295-6	33.8 min	9.5 min	5.5 to 7.5
NE8500295-8	33.5 min	8.0 min	7.5 to 8.5

PACKAGE CODE-95 (unit: mm)



* GB, RG indicate a type of containers for chips.
WB: black carrier, RG: ring,

** Specified at the condition at the last page.

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ABSOLUTE MAXIMUM RATINGS (T_A = 25 ˚C)

Drain to Source Voltage	V_{DSX}	15	V
Gate to Source Voltage	V_{GSX}	–12	V
Gate to Drain Voltage	V_{GDX}	–18	V
Total Power Disipation(*)	P_T	13	W
Drain Current	I_D	2.5	A
Gate Current	I_G	13	mA
Channel Temperature	T_{ch}	175	˚C
Storage Temperature	T_{stg}	–65 to 175	˚C

*T_C = 25 ˚C

RECOMMENDING OPERATION RANDGE

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Drain to Source Voltage	V_{DS}	9	–	10	V
Channel Temperature	T_{ch}	–	–	130	˚C
Input Power	Gcomp	–	–	3	dBcomp
Gate Resistance	Rg	–	–	2	kΩ

ELECTRICAL CHARACTERISTICS (T_A = 25 ˚C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Saturated Drain Current	Idss	950	–	1900	mA	Vds = 2.5 V, Vgs = 0 V
Pinch-off Voltage	V_P	–3.0	–	–1.0	V	Vds = 2.5 V, Ids = 8 mA
Transconductance	gm	–	600	–	mS	Vds = 2.5 V, Ids = Idss
Thermal Resistance	R_{th}	–	10	15	˚C/W	

PERFORMANCE SPECIFICATIONS (T_A = 25 °C)

PART NUMBER		NE8500200 NE8500200-WB NE8500200-RG			N8500295-4			NE8500295-6			NE8500295-8			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	P_O	33.8	–	–	–	–	–	–	–	–	–	–	–	dBm	Vds = 10 V Ids = 450 mA set Rg = 1kΩ f(*) pin(**)
		–	–	–	33.8	–	–	–	–	–	–	–	–	dBm	
		–	–	–	–	–	–	33.8	–	–	–	–	–	dBm	
		–	–	–	–	–	–	–	–	–	33.5	–	–	dBm	
Gate to source Current	Igs	–2.4	–	2.4	–2.4	–	2.4	–	–	–	–	–	–	mA	
		–	–	–	–	–	–	–2.4	–	2.4	–2.4	–	2.4	μA	
Linear Gain	G_L	8.0	–	–	10.5	–	–	9.5	–	–	8.0	–	–	dB	Pin = 18 dBm (***)

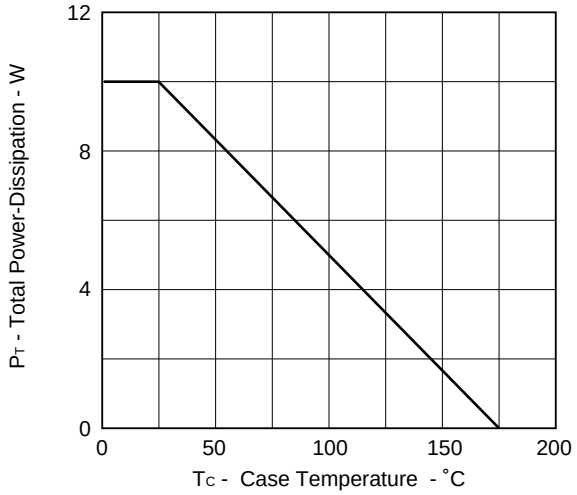
* Test frequencies are: NE8500200 @8.5 GHz, NE8500295-4 @4.2 GHz, NE8500295-6 @6.5 GHz, NE8500295-8 @8.5 GHz

** Test input power are: NE8500200 @27.0 dBm, NE8500295-4 @24.5 dBm, NE8500295-6 @25.5 dBm, NE8500295-8 @27.0dBm

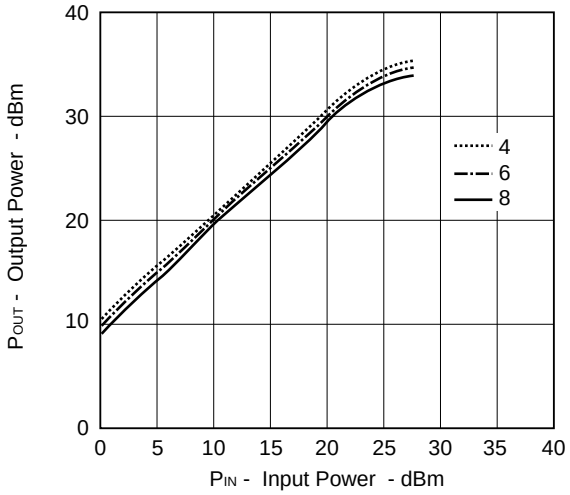
*** The conditions are the same as the above except this.

TYPICAL PERFORMANCE CURVE (T_A = 25 °C)

POWER DERATING CURVE



OUTPUT POWER vs. INPUT POWER



S-PARAMETER

NE8500295-6

V_{DS} = 10 V, I_{DS} = 450 mA, V_{GS} = –1.784 V, I_G = 0.0 mA, R_G = 1 kΩ

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.100	0.963	–59.2	16.698	149.4	0.003	29.7	0.373	–169.5
0.500	0.952	–149.1	5.714	97.6	0.016	22.8	0.463	–171.2
1.000	0.947	–173.8	3.033	74.2	0.017	20.0	0.485	–179.3
1.500	0.963	172.9	2.152	56.4	0.018	17.4	0.512	177.7
2.000	0.956	161.8	1.701	41.0	0.021	22.2	0.532	173.9
2.500	0.949	150.9	1.472	26.0	0.022	21.2	0.556	172.7
3.000	0.948	140.7	1.328	11.3	0.029	20.6	0.578	170.5
3.500	0.898	138.5	1.164	0.7	0.031	17.4	0.605	168.0
3.600	0.896	136.7	1.163	–2.0	0.032	18.2	0.607	167.3
3.700	0.889	134.9	1.167	–4.7	0.033	15.4	0.605	166.5
3.800	0.887	133.0	1.170	–7.9	0.035	15.2	0.609	165.5
3.900	0.879	130.7	1.169	–10.7	0.037	15.0	0.609	164.6
4.000	0.876	128.2	1.168	–13.3	0.036	11.0	0.607	163.2
4.200	0.862	123.7	1.204	–18.9	0.036	6.5	0.593	161.8
4.400	0.850	119.0	1.249	–25.3	0.037	6.6	0.591	159.7
4.500	0.847	116.0	1.278	–28.7	0.041	4.8	0.595	158.4
4.600	0.842	113.8	1.300	–32.3	0.042	3.4	0.596	157.5
4.800	0.828	108.1	1.357	–39.9	0.044	–0.6	0.604	155.4
5.000	0.813	101.8	1.432	–47.9	0.048	–6.9	0.616	152.3
5.200	0.789	95.5	1.515	–56.6	0.050	–13.7	0.632	149.6
5.400	0.759	88.7	1.612	–66.1	0.051	–19.8	0.651	146.8
5.500	0.737	85.4	1.648	–71.0	0.054	–23.9	0.664	146.0
5.600	0.710	82.3	1.703	–76.6	0.054	–28.4	0.681	144.5
5.800	0.649	76.0	1.806	–87.2	0.055	–38.6	0.717	141.8
6.000	0.560	69.8	1.926	–99.8	0.057	–47.4	0.757	140.0
6.200	0.454	65.1	2.045	–113.6	0.054	–60.5	0.806	137.1
6.400	0.324	66.6	2.120	–129.7	0.050	–76.3	0.850	133.3
6.500	0.264	73.2	2.118	–137.2	0.046	–82.7	0.871	131.2
6.600	0.227	86.0	2.110	–145.5	0.043	–92.3	0.887	128.9
6.800	0.245	116.2	2.033	–161.7	0.033	–107.8	0.905	124.4
7.000	0.344	127.7	1.924	–176.3	0.023	–123.6	0.920	120.2
7.200	0.437	126.9	1.815	171.4	0.012	–154.5	0.905	116.7
7.400	0.510	120.9	1.685	157.8	0.007	145.5	0.892	112.6
7.500	0.539	117.6	1.625	151.0	0.013	99.5	0.884	110.2
7.600	0.565	112.5	1.568	145.1	0.016	74.4	0.876	107.5
7.800	0.599	102.5	1.481	132.5	0.027	53.1	0.858	102.4
8.000	0.623	90.7	1.406	119.5	0.038	36.3	0.838	95.9
8.200	0.643	76.8	1.326	105.7	0.052	21.6	0.818	87.9
8.400	0.646	61.0	1.215	91.5	0.068	6.2	0.794	78.8
8.500	0.637	53.5	1.163	84.6	0.075	–1.9	0.779	74.7
8.600	0.645	45.4	1.104	77.5	0.079	–9.4	0.766	69.9
8.800	0.624	29.9	0.983	64.4	0.090	–25.4	0.741	62.2
9.000	0.610	16.0	0.868	52.6	0.096	–41.3	0.718	56.0
9.200	0.602	3.0	0.784	41.5	0.098	–53.1	0.704	51.5
9.400	0.581	–10.1	0.703	30.9	0.099	–66.1	0.691	48.5
9.500	0.574	–16.9	0.676	25.9	0.099	–69.3	0.693	47.0
9.600	0.568	–23.4	0.643	20.4	0.098	–73.6	0.685	45.8
9.800	0.538	–38.0	0.599	10.9	0.092	–83.3	0.682	44.6
10.000	0.514	–55.8	0.561	–0.6	0.090	–88.5	0.673	43.2

NE8500295-8

V_{DS} = 10 V, I_{DS} = 450 mA, V_{GS} = –1.386 V, I_G = 0.0 mA, R_G = 1 kΩ

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.100	0.971	–54.8	17.977	150.9	0.004	35.4	0.427	–155.9
0.500	0.937	–146.3	6.354	98.2	0.016	24.0	0.464	–172.3
1.000	0.934	–174.0	3.391	74.5	0.018	22.3	0.492	–178.9
1.500	0.947	170.9	2.382	56.2	0.020	20.8	0.513	177.4
2.000	0.939	158.3	1.869	40.3	0.026	28.1	0.534	173.3
2.500	0.921	153.8	1.473	27.7	0.023	22.7	0.573	169.5
3.000	0.906	145.4	1.335	15.9	0.027	20.9	0.592	168.1
3.500	0.887	137.0	1.272	2.7	0.034	19.9	0.603	165.7
3.600	0.886	135.1	1.264	–0.2	0.034	20.2	0.603	165.0
3.700	0.877	133.2	1.269	–2.7	0.036	19.4	0.601	164.4
3.800	0.876	131.3	1.267	–5.6	0.038	14.9	0.605	163.0
3.900	0.869	128.9	1.265	–8.6	0.040	15.7	0.605	161.8
4.000	0.866	126.2	1.252	–11.1	0.041	10.2	0.602	160.3
4.200	0.851	121.7	1.285	–16.2	0.040	8.7	0.586	159.0
4.400	0.840	116.7	1.322	–22.3	0.042	7.7	0.582	156.6
4.500	0.836	113.9	1.343	–25.5	0.044	6.0	0.583	155.2
4.600	0.832	111.6	1.365	–29.0	0.047	5.7	0.583	154.3
4.800	0.821	105.7	1.415	–35.8	0.050	2.0	0.585	152.1
5.000	0.805	98.8	1.483	–43.6	0.056	–4.1	0.592	149.2
5.200	0.783	91.8	1.549	–51.8	0.059	–9.0	0.604	146.3
5.400	0.752	83.9	1.631	–60.6	0.062	–16.2	0.620	144.1
5.500	0.734	80.2	1.658	–64.9	0.065	–18.9	0.628	142.8
5.600	0.714	76.1	1.703	–70.0	0.066	–23.4	0.641	141.5
5.800	0.656	67.3	1.791	–79.7	0.070	–32.0	0.666	139.5
6.000	0.587	57.4	1.893	–90.6	0.073	–41.5	0.695	138.7
6.200	0.494	45.8	1.997	–102.5	0.075	–51.6	0.729	136.6
6.400	0.374	31.5	2.096	–116.3	0.076	–63.3	0.769	134.6
6.500	0.303	23.5	2.124	–122.7	0.075	–69.9	0.788	133.4
6.600	0.229	13.6	2.155	–129.9	0.073	–76.8	0.809	132.3
6.800	0.079	–26.8	2.143	–145.1	0.067	–89.3	0.840	129.0
7.000	0.116	–152.8	2.078	–159.4	0.063	–101.5	0.874	125.7
7.200	0.240	–179.6	2.008	–171.7	0.056	–113.7	0.886	123.0
7.400	0.352	164.3	1.894	174.2	0.046	–126.4	0.887	118.2
7.500	0.394	158.7	1.824	167.5	0.042	–134.1	0.883	115.9
7.600	0.436	151.2	1.768	161.2	0.039	–142.6	0.886	113.5
7.800	0.497	139.2	1.663	149.3	0.030	–163.8	0.872	108.6
8.000	0.536	126.7	1.587	137.2	0.025	165.8	0.858	102.2
8.200	0.564	113.4	1.530	124.8	0.018	116.4	0.849	94.9
8.400	0.575	98.5	1.455	110.7	0.027	66.5	0.846	86.0
8.500	0.570	91.0	1.413	103.5	0.033	49.5	0.843	81.5
8.600	0.577	81.8	1.369	96.0	0.040	31.6	0.834	76.1
8.800	0.541	63.6	1.245	80.9	0.058	–0.7	0.814	67.1
9.000	0.497	45.2	1.105	66.6	0.069	–26.2	0.773	59.8
9.200	0.439	27.2	0.960	53.7	0.073	–47.4	0.740	54.6
9.400	0.381	12.6	0.829	43.5	0.065	–60.9	0.730	53.4
9.500	0.354	3.8	0.787	38.6	0.067	–59.8	0.747	51.7
9.600	0.344	–4.1	0.736	33.3	0.073	–63.3	0.741	49.9
9.800	0.287	–19.2	0.655	25.2	0.074	–83.8	0.718	47.3
10.000	0.288	–34.5	0.622	17.0	0.068	–86.2	0.712	46.8

CHIP HANDLING

DIE ATTACHMENT

Die attach can be accomplished with a Au-Sn (300 ±10 ˚C) performs 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.

[MEMO]