NEC

N-CHANNEL GaAs MES FET
NE960R2 SERIES

0.2 W X, Ku-BAND POWER GaAs MES FET

DESCRIPTION

The NE960R2 Series are 0.2 W GaAs MES FETs designed for middle power transmitter applications for X, Ku-band microwave communication systems. It is capable of delivering 0.2 watt of output power (CW) with high linear gain, high efficiency and low distortion and are suitable as driver amplifiers for our X, Ku-band NEZ Series amplifiers etc. The NE961R200 and the NE960R200 are available in chip form. The NE960R200 has a via hole source grounding and PHS (Plated Heat Sink) for superior RF performance. The NE960R275 is available in a hermetically sealed ceramic package. Reliability and performance uniformity are assured by NEC's stringent quality and control procedures.

★ FEATURES

- High Output Power : $P_{o\ (1\ dB)}$ = +25.0 dBm TYP.
- High Linear Gain : 10.0 dB TYP.
- High Power Added Efficiency: 35 % TYP. @V_{DS} = 9 V, I_{Dset} = 90 mA, f = 14.5 GHz

★ ORDERING INFORMATION

Part Number	Package	Supplying Form
NE960R200	00 (CHIP)	ESD protective envelope
NE961R200		
NE960R275	75	

Remark To order evaluation samples, please contact your local NEC sales office.
(Part number for sample order: NE960R200, NE960R275, NE961R200)

Caution Please handle this device at static-free workstation, because this is an electrostatic sensitive device.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

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The mark ★ shows major revised points.

★ ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Operation in excess of any one of these parameters may result in permanent damage.

Parameter	Symbol	Ratings	Unit
Drain to Source Voltage	V_{DS}	15	V
Gate to Source Voltage	V_{GSO}	–7	V
Drain Current	I_D	0.35	A
Gate Forward Current	I_{GF}	+2.5	mA
Gate Reverse Current	I_{GR}	–2.5	mA
Total Power Dissipation	P_T	2.5 (2.1[Note])	W
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	–65 to +175	°C

Note NE961R200

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Test Condition	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	V_{DS}		–	9.0	9.0	V
Gain Compression	Gcomp		–	–	3.0	dB
Channel Temperature	T_{ch}		–	–	+130	°C

★ ELECTRICAL CHARACTERISTICS

(T_A = +25°C, Unless otherwise specified, using NEC standard test fixture.)

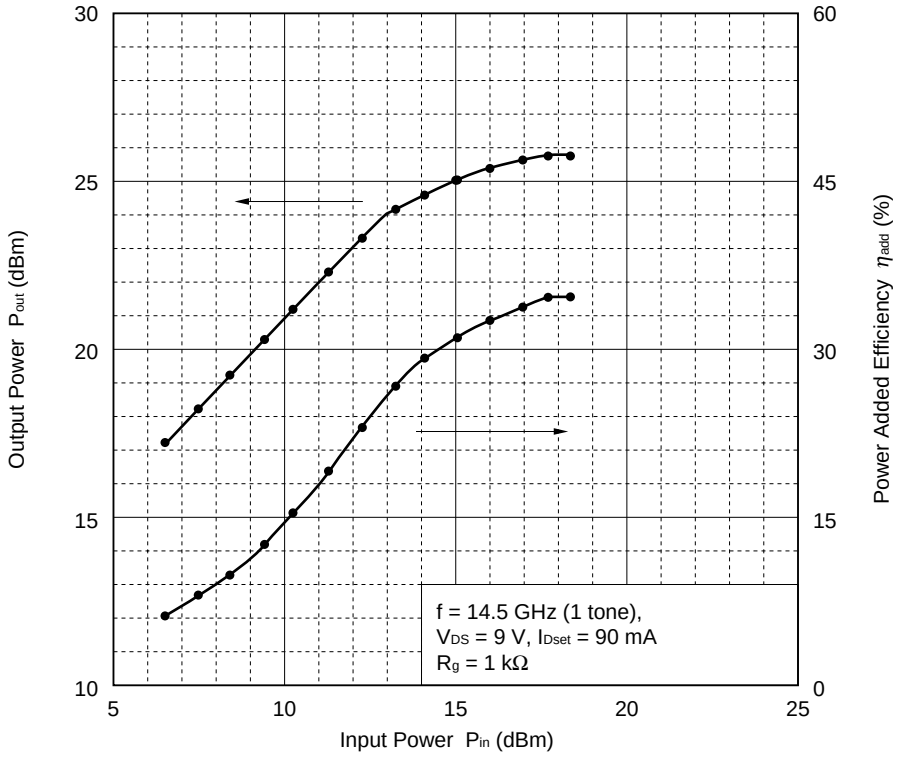
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Saturated Drain Current	I_{DSS}	V_{DS} = 1.5 V, V_{GS} = 0 V	0.09	0.2	0.35	A
Pinch-off Voltage	V_p	V_{DS} = 2.5 V, I_D = 1 mA	–2.5	–1.8	–0.5	V
Gate to Drain Break Down Voltage	BV_{gd}	I_{gd} = 1 mA	15	–	–	V
Thermal Resistance	R_{th}	Channel to Case	–	–	60 (70[Note])	°C/W
Output Power at P_{in} = +15 dBm	P_{out}	f = 14.5 GHz, V_{DS} = 9.0 V R_g = 1 kΩ I_{Dset} = 90 mA (RF OFF)	22.0	24.0	–	dBm
Output Power at 1 dB Gain Compression Point	$P_{o\ (1\ dB)}$		–	25.0	–	dBm
Power Added Efficiency at $P_{O\ (1dB)}$	η_{add}		–	35	–	%
Linear Gain	G_L		8.0	10.0	–	dB

Note NE961R200

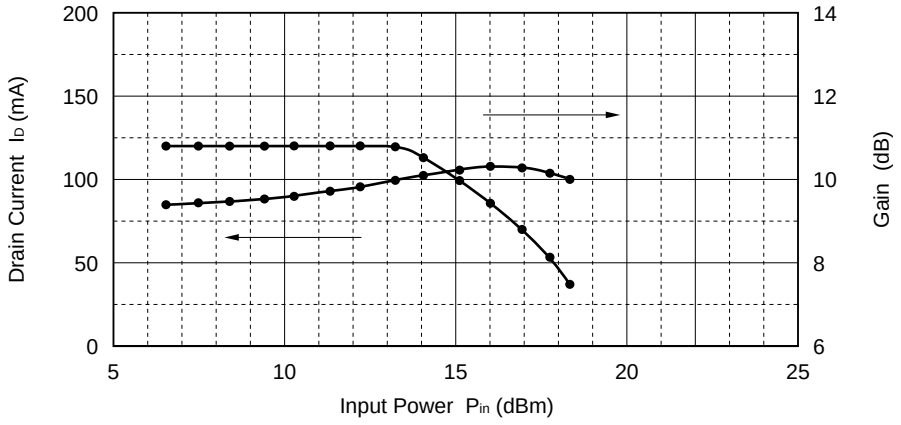
Remark DC and RF performance is 100 % testing.

TYPICAL CHARACTERISTICS (T_A = +25°C)

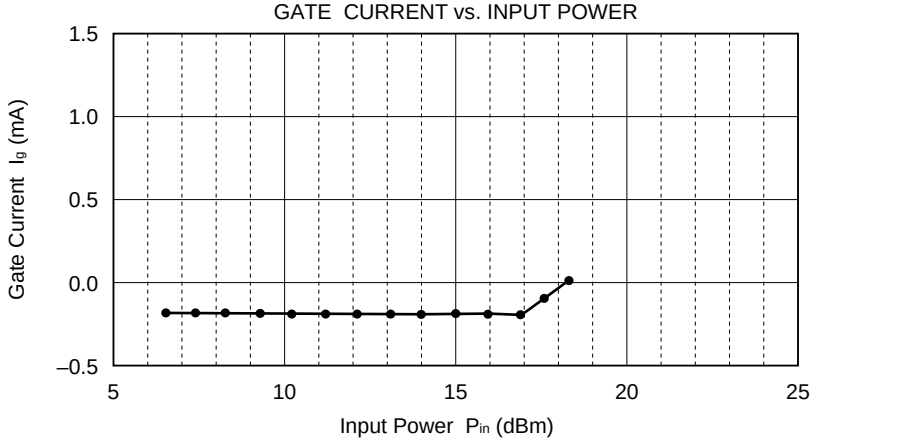
OUTPUT POWER AND POWER ADDED EFFICIENCY vs. INPUT POWER



DRAIN CURRENT AND GAIN vs. INPUT POWER



GATE CURRENT vs. INPUT POWER

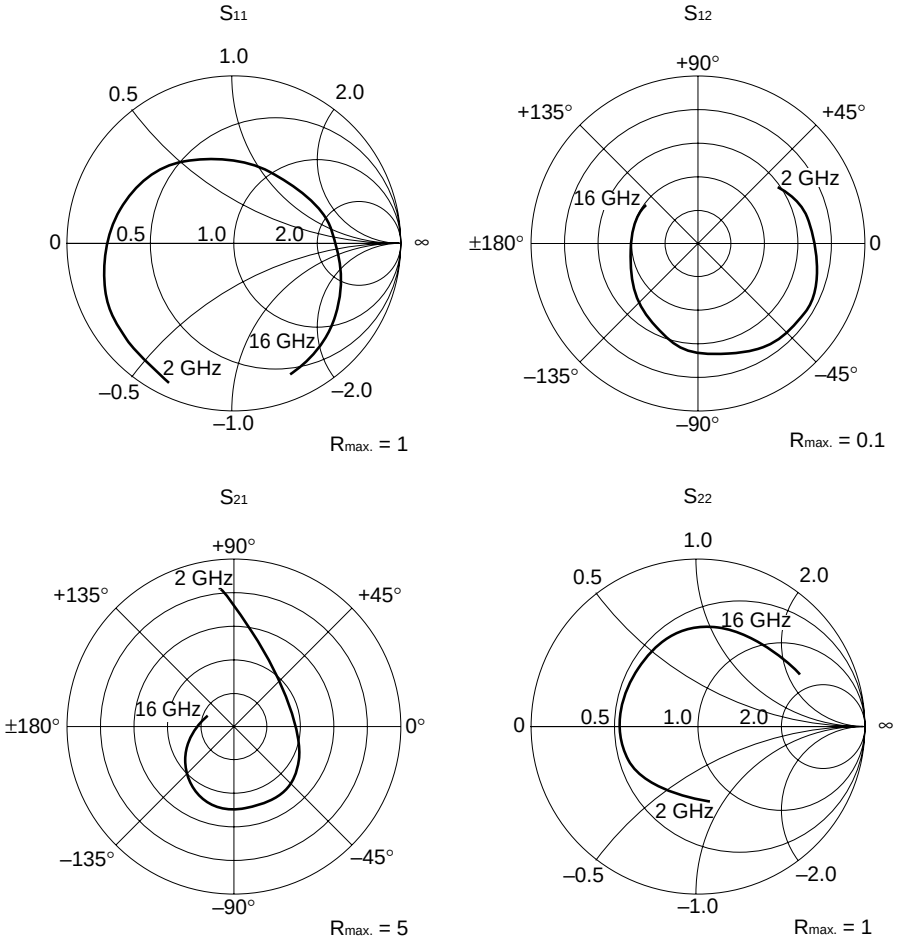


TYPICAL S-PARAMETER
[NE960R275]

TEST CONDITIONS: V_{DS} = 9 V, I_{Dset} = 90 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
2.0	0.89	–113	3.99	98	0.057	34	0.42	–79
3.0	0.86	–129	2.88	80	0.058	15	0.46	–85
4.0	0.85	–138	2.29	65	0.057	10	0.43	–94
5.0	0.84	–140	1.99	51	0.057	7	0.41	–110
6.0	0.81	–144	1.78	39	0.059	5	0.44	–125
7.0	0.83	–152	1.77	27	0.060	3	0.49	–135
8.0	0.81	–163	1.82	15	0.062	3	0.53	–141
9.0	0.75	–176	1.89	0	0.062	1	0.52	–150
10.0	0.71	166	2.12	–19	0.064	0	0.47	–167
11.0	0.62	140	2.42	–44	0.072	–17	0.45	164
12.0	0.48	86	2.50	–78	0.074	–46	0.50	129
13.0	0.54	20	2.32	–113	0.065	–88	0.56	94
14.0	0.69	–20	1.77	–144	0.049	–132	0.59	68
15.0	0.80	–45	1.30	–166	0.040	–176	0.61	44
16.0	0.81	–66	1.03	167	0.039	149	0.67	27

START 2 GHz, STOP 16 GHz, STEP 1 GHz



★ **[NE960R200]**

TEST CONDITIONS: V_{DS} = 9 V, I_{Dset} = 90 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
2.0	0.87	–97	7.60	–166	0.061	104	0.36	–49
3.0	0.84	–117	3.84	–147	0.062	124	0.34	–64
4.0	0.82	–131	2.98	–135	0.065	159	0.33	–74
5.0	0.82	–139	2.46	–109	0.069	–173	0.34	–85
6.0	0.82	–145	2.10	–82	0.069	141	0.37	–93
7.0	0.81	–148	1.85	–54	0.064	–118	0.40	–99
8.0	0.79	–150	1.57	–29	0.059	–72	0.43	–103
9.0	0.77	–153	1.45	1	0.072	–47	0.47	–106
10.0	0.79	–157	1.33	30	0.059	–13	0.50	–108
11.0	0.80	–162	1.23	56	0.057	24	0.51	–110
12.0	0.80	–169	1.17	82	0.070	56	0.52	–114
13.0	0.82	–176	1.13	104	0.043	79	0.54	–118
14.0	0.84	–178	0.95	129	0.061	128	0.55	–122
15.0	0.83	178	0.83	165	0.048	137	0.57	–126
16.0	0.84	175	0.78	–165	0.049	–172	0.57	–129
17.0	0.83	173	0.74	–137	0.044	–131	0.57	–132
18.0	0.84	170	0.59	–112	0.061	–106	0.56	–142

Caution S-parameters include bond wires.

Gate : Total 2 wires, 1 per bond pad, 300 μm long each wire.

Drain : Total 2 wires, 1 per bond pad, 300 μm long each wire.

Source : No bond wires.

Wire : 25 μm diameter, gold.

★ **[NE961R200]**

TEST CONDITIONS: V_{DS} = 9 V, I_{Dset} = 90 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
2.0	0.85	–92	8.08	–152	0.056	112	0.40	–39
3.0	0.80	–114	3.83	–146	0.058	136	0.36	–52
4.0	0.78	–128	3.17	–135	0.060	172	0.34	–60
5.0	0.77	–142	2.64	–108	0.064	–154	0.33	–70
6.0	0.77	–143	2.25	–80	0.067	–117	0.34	–80
7.0	0.76	–146	1.99	–52	0.066	–88	0.37	–87
8.0	0.74	–149	1.71	–28	0.065	–40	0.40	–94
9.0	0.74	–152	1.60	2	0.082	–11	0.44	–98
10.0	0.74	–157	1.47	30	0.072	29	0.47	–99
11.0	0.74	–163	1.37	57	0.076	70	0.49	–103
12.0	0.74	–171	1.29	83	0.102	107	0.50	–107
13.0	0.76	–176	1.25	107	0.074	133	0.52	–111
14.0	0.77	178	1.06	131	0.113	180	0.52	–117
15.0	0.77	175	0.96	167	0.098	–165	0.53	–122
16.0	0.78	172	0.89	–162	0.114	–117	0.54	–127
17.0	0.77	168	0.88	–134	0.115	–76	0.52	–131
18.0	0.78	164	0.68	–107	0.165	–55	0.52	–141

Caution S-parameters include bond wires.

Gate : Total 2 wires, 1 per bond pad, 300 μm long each wire.

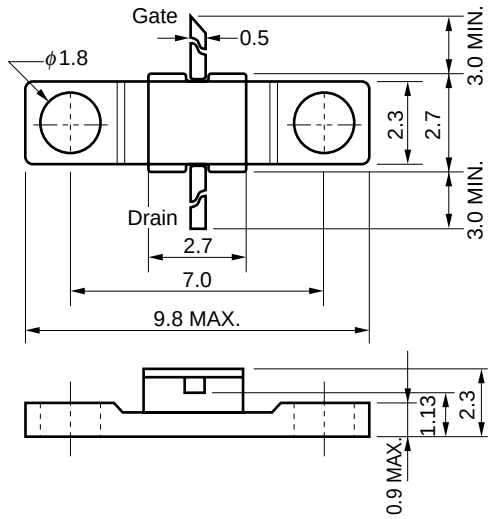
Drain : Total 2 wires, 1 per bond pad, 300 μm long each wire.

Source : Total 4 wires, 1 per bond pad, 300 μm long each wire.

Wire : 25 μm diameter, gold.

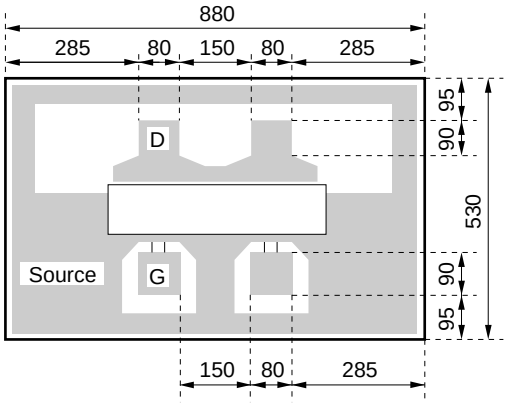
★ PACKAGE DIMENSIONS

PACKAGE CODE-75 (Unit: mm)



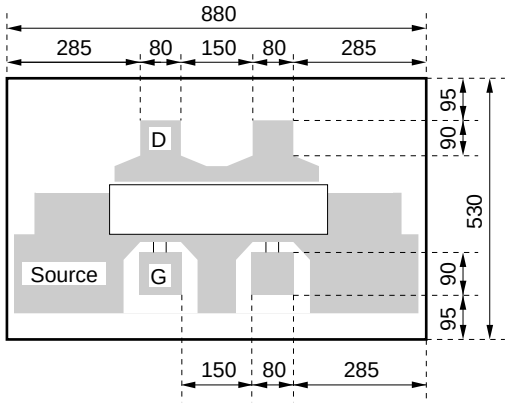
PHYSICAL DIMENSIONS

NE960R200 (CHIP) (Unit: μm)



Remark Chip thickness: 100 μm
G : Gate
D : Drain
Source is grounded through via hole.

NE961R200 (CHIP) (Unit: μm)



Remark Chip thickness: 140 μm
G : Gate
D : Drain

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Partial Heating	Pin temperature: 260°C Time: 5 seconds or less (per pin row) Exposure limit: None[Note]	–

Note After opening the dry pack, keep it in a place below 25°C and 65 % RH for the allowable storage period.

Caution Do not use different soldering methods together (except for partial heating).

★ 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 to 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]

[MEMO]

[MEMO]

Caution

The Great Care must be taken in dealing with the devices in this guide.
The reason is that the material of the devices is GaAs (Gallium Arsenide), which is designated as harmful substance according to the law concerned.
Keep the law concerned and so on, especially in case of removal.

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