

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>)

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HETERO JUNCTION FIELD EFFECT TRANSISTOR

NE4210S01

X to Ku BAND SUPER LOW NOISE AMPLIFIER N-CHANNEL HJ-FET

DESCRIPTION

The NE4210S01 is a Hetero Junction FET that utilizes the hetero junction to create high mobility electrons. Its excellent low noise and associated gain make it suitable for DBS and another commercial systems.

FEATURES

- Super Low Noise Figure & High Associated Gain
NF = 0.5 dB TYP. Ga = 13.0 dB TYP. @f = 12 GHz
- Gate Length: $L_g \leq 0.20 \mu\text{m}$
- Gate Width : $W_g = 160 \mu\text{m}$

ORDERING INFORMATION (PLAN)

Part Number	Marking	Supplying Form
NE4210S01-T1	L	Tape & reel 1 kp/reel
NE4210S01-T1B		Tape & reel 4 kp/reel

Remark To order evaluation samples, please contact your local NEC sales office. (Part number for sample order: NE4210S01)

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

Parameter	Symbol	Ratings	Unit
Drain to Source Voltage	V_{DS}	4.0	V
Gate to Source Voltage	V_{GS}	-3.0	V
Drain Current	I_D	I_{DSS}	mA
Gate Current	I_G	100	μA
Total Power Dissipation	P_{tot}	165	mW
Channel Temperature	T_{ch}	125	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +125	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS ($T_A = +25^\circ\text{C}$)

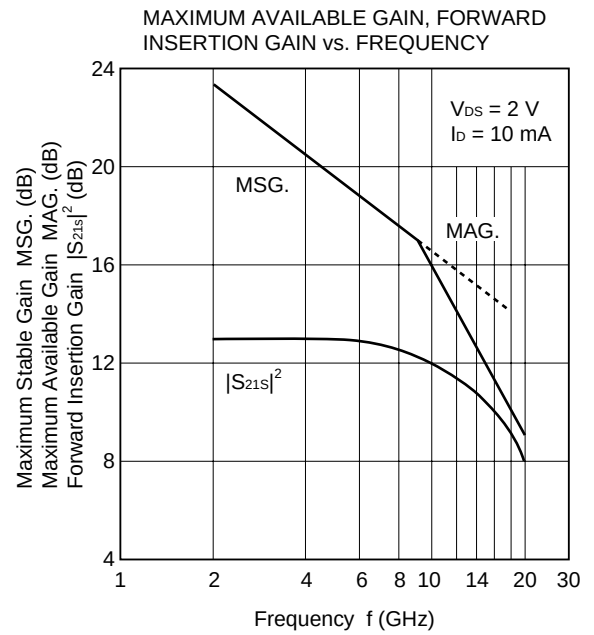
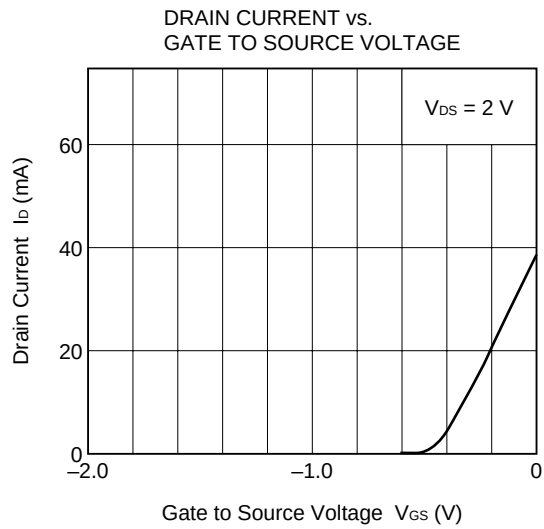
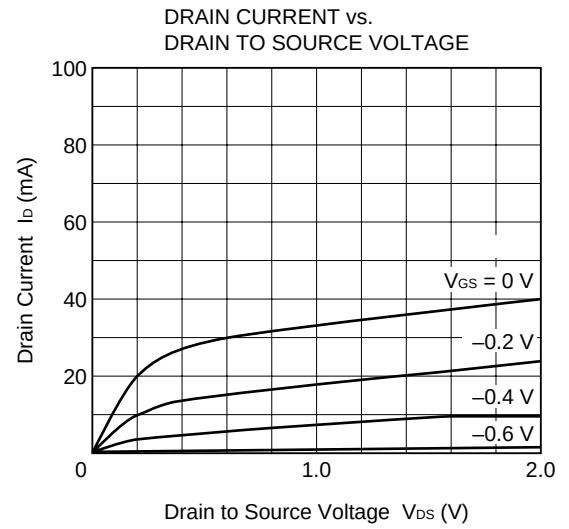
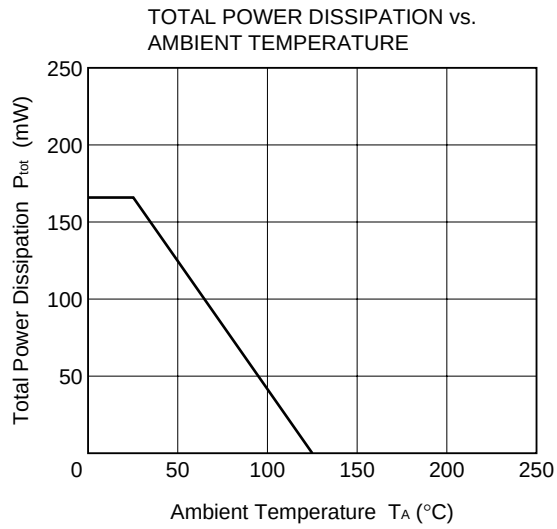
	Parameter	Symbol	MIN.	TYP.	MAX.	Unit
★	Drain to Source Voltage	V_{DS}	1	2	3	V
★	Drain Current	I_D	5	10	15	mA
	Input Power	P_{in}	—	—	0	dBm

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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

ELECTRICAL CHARACTERISTICS ($T_A = +25\text{ }^{\circ}\text{C}$)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	I_{GSO}	$V_{GS} = -3\text{ V}$	–	0.5	10	μA
Saturated Drain Current	I_{DSS}	$V_{DS} = 2\text{ V}, V_{GS} = 0\text{ V}$	15	40	70	mA
Gate to Source Cut off Voltage	$V_{GS(off)}$	$V_{DS} = 2\text{ V}, I_{DS} = 100\text{ }\mu\text{A}$	–0.2	–0.7	–2.0	V
Transconductance	g_m	$V_{DS} = 2\text{ V}, I_{DS} = 10\text{ mA}$	40	55	–	mS
Noise Figure	NF	$V_{DS} = 2\text{ V}, I_{DS} = 10\text{ mA}$ $f = 12\text{ GHz}$	–	0.50	0.70	dB
Associated Gain	G_a		11.0	13.0	–	dB

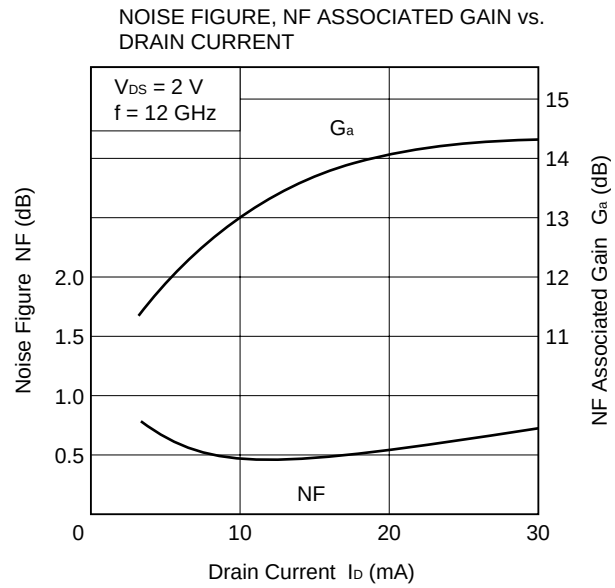
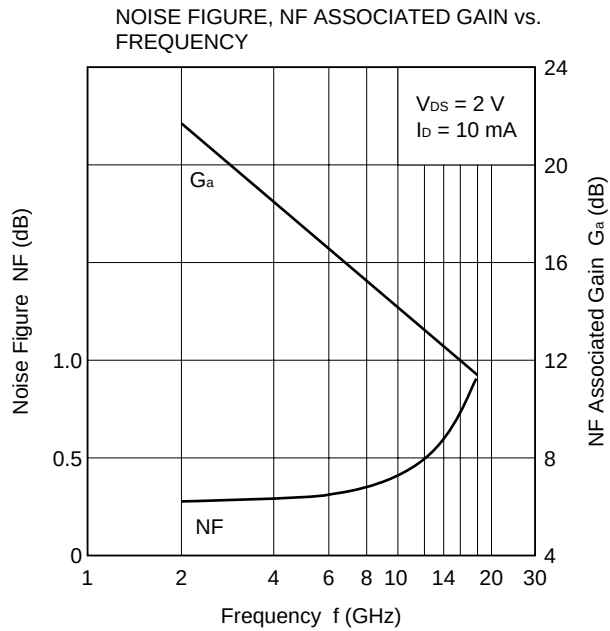
TYPICAL CHARACTERISTICS ($T_A = +25\text{ }^{\circ}\text{C}$)



Gain Calculations

$$MSG. = \left| \frac{S_{21}}{S_{12}} \right| \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}$$

$$MAG. = \left| \frac{S_{21}}{S_{12}} \right| (k \pm \sqrt{k^2 - 1}) \quad \Delta = S_{11} \cdot S_{22} - S_{21} \cdot S_{12}$$



S-PARAMETERS
MAG. AND ANG.

V_{DS} = 2 V, I_D = 10 mA

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
2000.0000	0.972	-21.0	4.436	153.9	0.026	73.8	0.621	-16.6
2500.0000	0.953	-27.3	4.435	147.1	0.033	69.6	0.610	-21.6
3000.0000	0.934	-34.1	4.443	139.9	0.039	63.7	0.592	-27.1
3500.0000	0.910	-40.2	4.385	132.9	0.044	60.0	0.579	-32.2
4000.0000	0.887	-45.8	4.306	126.3	0.047	54.4	0.564	-37.2
4500.0000	0.865	-51.1	4.244	120.0	0.051	50.2	0.554	-41.6
5000.0000	0.842	-55.5	4.164	114.1	0.054	46.6	0.546	-45.5
5500.0000	0.821	-60.0	4.129	108.3	0.057	42.8	0.538	-49.4
6000.0000	0.802	-64.8	4.122	102.6	0.061	40.6	0.531	-52.1
6500.0000	0.777	-70.2	4.151	96.5	0.067	37.6	0.519	-56.5
7000.0000	0.732	-76.4	4.175	89.8	0.071	33.0	0.495	-60.5
7500.0000	0.685	-83.4	4.179	82.9	0.073	28.7	0.460	-63.9
8000.0000	0.652	-91.3	4.184	76.2	0.077	25.6	0.423	-67.5
8500.0000	0.619	-100.8	4.210	69.1	0.082	23.0	0.385	-72.2
9000.0000	0.591	-111.0	4.189	61.5	0.086	18.0	0.344	-78.5
9500.0000	0.563	-120.7	4.131	54.4	0.091	13.4	0.301	-86.2
10000.0000	0.538	-129.7	4.070	47.4	0.094	10.7	0.270	-95.5
10500.0000	0.517	-138.8	4.023	40.3	0.099	6.5	0.250	-107.2
11000.0000	0.488	-148.6	3.963	33.2	0.103	1.7	0.236	-118.7
11500.0000	0.460	-158.9	3.905	26.1	0.104	-2.6	0.225	-127.6
12000.0000	0.433	-171.3	3.850	18.5	0.108	-7.1	0.215	-137.8
12500.0000	0.424	175.5	3.767	10.9	0.111	-11.2	0.194	-147.8
13000.0000	0.421	161.6	3.675	3.3	0.113	-16.9	0.166	-161.6
13500.0000	0.436	147.9	3.551	-4.2	0.112	-19.9	0.144	177.6
14000.0000	0.461	135.9	3.421	-11.5	0.112	-24.6	0.137	151.7
14500.0000	0.495	125.0	3.285	-18.5	0.113	-28.5	0.161	127.6
15000.0000	0.528	115.2	3.151	-25.9	0.111	-32.0	0.210	111.3
15500.0000	0.542	106.7	3.003	-32.3	0.109	-33.5	0.254	104.7
16000.0000	0.556	99.3	2.885	-39.0	0.108	-37.0	0.301	101.1
16500.0000	0.561	91.0	2.764	-46.4	0.107	-39.4	0.347	99.3
17000.0000	0.564	82.6	2.609	-53.3	0.108	-42.3	0.381	96.0
17500.0000	0.571	74.3	2.456	-59.7	0.106	-46.1	0.396	91.6
18000.0000	0.581	67.3	2.297	-65.8	0.103	-48.0	0.400	87.1

AMPLIFIER PARAMETERS

 $V_{DS} = 2\text{ V}$, $I_D = 10\text{ mA}$

FREQUENCY MHz	GUmax dB	GAmax dB	$ S_{21} ^2$ dB	$ S_{12} ^2$ dB	K	Delay ns	Mason's U dB	G1 dB	G2 dB
2000.0000	27.67		12.94	-31.55	0.25	0.038	30.256	12.61	2.12
2500.0000	25.31		12.94	-29.62	0.32	0.038	28.341	10.35	2.02
3000.0000	23.75		12.95	-28.24	0.38	0.040	26.068	8.92	1.87
3500.0000	22.25		12.84	-27.19	0.44	0.039	25.369	7.64	1.77
4000.0000	21.07		12.68	-26.58	0.51	0.037	23.501	6.73	1.66
4500.0000	20.15		12.56	-25.82	0.57	0.035	22.666	6.00	1.59
5000.0000	19.29		12.39	-25.36	0.63	0.033	21.854	5.36	1.54
5500.0000	18.67		12.32	-24.81	0.68	0.032	21.290	4.87	1.48
6000.0000	18.21		12.30	-24.30	0.71	0.032	21.403	4.47	1.44
6500.0000	17.75		12.36	-23.49	0.72	0.034	21.682	4.03	1.37
7000.0000	16.97		12.41	-22.94	0.80	0.037	20.537	3.33	1.22
7500.0000	16.21		12.42	-22.70	0.90	0.038	19.541	2.75	1.04
8000.0000	15.69		12.43	-22.29	0.94	0.037	19.390	2.40	0.85
8500.0000	15.28		12.49	-21.76	0.96	0.040	19.809	2.10	0.70
9000.0000	14.85		12.44	-21.32	0.98	0.042	19.658	1.87	0.55
9500.0000	14.39	16.34	12.32	-20.83	1.00	0.040	19.512	1.65	0.41
10000.0000	14.01	15.53	12.19	-20.53	1.02	0.039	19.822	1.49	0.33
10500.0000	13.72	15.40	12.09	-20.11	1.01	0.040	20.318	1.35	0.28
11000.0000	13.39	14.90	11.96	-19.74	1.02	0.039	20.322	1.18	0.25
11500.0000	13.09	14.27	11.83	-19.67	1.06	0.039	19.926	1.03	0.22
12000.0000	12.81	13.92	11.71	-19.33	1.07	0.042	20.054	0.90	0.21
12500.0000	12.54	13.56	11.52	-19.11	1.08	0.042	20.125	0.86	0.17
13000.0000	12.28	13.16	11.31	-18.97	1.11	0.042	19.648	0.85	0.12
13500.0000	12.02	12.78	11.01	-19.05	1.14	0.042	19.328	0.92	0.09
14000.0000	11.80	12.51	10.68	-19.03	1.15	0.041	19.111	1.04	0.08
14500.0000	11.66	12.38	10.33	-18.96	1.14	0.039	19.447	1.22	0.11
15000.0000	11.58	12.32	9.97	-19.10	1.13	0.041	19.785	1.42	0.20
15500.0000	11.35	12.01	9.55	-19.25	1.16	0.036	19.151	1.51	0.29
16000.0000	11.22	11.95	9.20	-19.33	1.15	0.037	19.274	1.60	0.41
16500.0000	11.03	11.80	8.83	-19.41	1.15	0.041	18.894	1.64	0.56
17000.0000	10.67	11.40	8.33	-19.37	1.16	0.039	17.879	1.66	0.68
17500.0000	10.26	10.86	7.81	-19.46	1.21	0.035	16.470	1.72	0.74
18000.0000	9.77	10.19	7.22	-19.74	1.30	0.034	14.659	1.78	0.76

S-PARAMETERS**MAG. AND ANG.****V_{DS} = 0 V, V_{GS} = 0 V**

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
2000.0000	0.990	-20.7	0.016	109.0	0.016	102.3	0.751	151.4
2500.0000	0.981	-27.1	0.022	103.4	0.020	103.6	0.751	145.4
3000.0000	0.978	-33.8	0.028	103.5	0.028	101.6	0.762	139.8
3500.0000	0.972	-40.2	0.035	102.0	0.033	100.1	0.756	134.2
4000.0000	0.966	-46.4	0.042	98.5	0.041	97.5	0.760	128.8
4500.0000	0.962	-52.4	0.052	96.0	0.050	94.8	0.761	122.4
5000.0000	0.957	-57.6	0.061	91.4	0.059	91.1	0.755	115.8
5500.0000	0.954	-63.3	0.070	88.1	0.070	86.6	0.755	109.2
6000.0000	0.949	-69.1	0.080	83.7	0.080	82.6	0.758	102.2
6500.0000	0.944	-75.8	0.092	77.8	0.092	77.9	0.757	95.4
7000.0000	0.930	-83.5	0.107	73.0	0.105	71.9	0.765	88.8
7500.0000	0.916	-92.8	0.121	66.5	0.120	66.3	0.773	83.4
8000.0000	0.905	-103.2	0.135	59.3	0.133	58.8	0.780	78.7
8500.0000	0.894	-114.6	0.147	51.6	0.146	51.6	0.793	75.3
9000.0000	0.885	-126.2	0.158	45.1	0.158	44.3	0.804	72.4
9500.0000	0.878	-137.1	0.169	38.3	0.168	38.2	0.809	69.6
10000.0000	0.871	-147.7	0.181	32.0	0.179	31.7	0.819	66.7
10500.0000	0.873	-158.2	0.193	25.6	0.192	25.5	0.821	63.6
11000.0000	0.875	-169.7	0.205	17.9	0.205	17.8	0.821	60.4
11500.0000	0.873	178.0	0.218	9.8	0.216	9.9	0.820	55.9
12000.0000	0.863	164.3	0.227	1.5	0.225	1.3	0.819	51.7
12500.0000	0.869	150.7	0.231	-7.0	0.231	-7.6	0.819	46.6
13000.0000	0.868	137.7	0.230	-15.4	0.230	-15.8	0.831	41.8
13500.0000	0.869	126.0	0.225	-22.7	0.226	-24.0	0.841	37.3
14000.0000	0.880	115.8	0.219	-29.7	0.217	-29.3	0.850	34.6
14500.0000	0.892	107.3	0.212	-33.7	0.213	-34.1	0.858	33.2
15000.0000	0.907	98.5	0.207	-39.4	0.206	-39.4	0.866	32.5
15500.0000	0.904	90.7	0.201	-43.9	0.199	-44.0	0.870	32.2
16000.0000	0.905	83.7	0.198	-48.1	0.199	-47.8	0.866	31.7
16500.0000	0.884	75.5	0.194	-53.0	0.191	-52.9	0.863	30.5
17000.0000	0.867	67.7	0.188	-58.1	0.188	-58.0	0.861	28.1
17500.0000	0.846	60.0	0.182	-62.4	0.182	-63.0	0.856	24.5
18000.0000	0.831	54.0	0.172	-67.1	0.174	-67.5	0.850	20.0

AMPLIFIER PARAMETERS

 $V_{DS} = 0\text{ V}$, $V_{GS} = 0\text{ V}$

FREQUENCY MHz	G _U max dB	G _A max dB	S ₂₁ ² dB	S ₁₂ ² dB	K	Delay ns	Mason's U dB	G ₁ dB	G ₂ dB
2000.0000	-15.19	-15.16	-36.00	-35.92	16.25	0.031	-33.488	17.21	3.60
2500.0000	-15.56	-15.55	-33.32	-33.83	19.06	0.031	-40.201	14.15	3.61
3000.0000	-13.78	-13.82	-31.18	-31.20	12.08	-0.001	-42.783	13.62	3.78
3500.0000	-12.82	-12.91	-29.06	-29.53	10.34	0.009	-36.658	12.55	3.69
4000.0000	-12.01	-12.15	-27.46	-27.66	8.42	0.019	-42.595	11.71	3.74
4500.0000	-10.64	-10.88	-25.71	-25.99	6.36	0.014	-38.655	11.32	3.75
5000.0000	-9.97	-10.27	-24.36	-24.54	5.48	0.025	-42.970	10.72	3.67
5500.0000	-8.93	-9.35	-23.06	-23.10	4.38	0.018	-39.542	10.47	3.66
6000.0000	-8.16	-8.69	-21.90	-21.98	3.80	0.025	-40.847	10.03	3.71
6500.0000	-7.40	-8.05	-20.76	-20.70	3.25	0.033	-49.494	9.66	3.70
7000.0000	-6.88	-7.62	-19.40	-19.61	3.05	0.027	-36.513	8.69	3.82
7500.0000	-6.50	-7.33	-18.38	-18.39	2.80	0.036	-53.452	7.93	3.94
8000.0000	-5.91	-6.83	-17.42	-17.50	2.54	0.040	-42.015	7.44	4.06
8500.0000	-5.40	-6.42	-16.66	-16.69	2.31	0.043	-52.459	6.96	4.30
9000.0000	-4.90	-6.03	-16.05	-16.02	2.12	0.036	-40.046	6.63	4.52
9500.0000	-4.45	-5.67	-15.46	-15.49	1.99	0.038	-51.895	6.39	4.62
10000.0000	-3.86	-5.22	-14.85	-14.95	1.83	0.035	-40.055	6.17	4.82
10500.0000	-3.21	-4.74	-14.30	-14.32	1.66	0.035	-48.996	6.23	4.86
11000.0000	-2.61	-4.26	-13.78	-13.78	1.52	0.043	-60.695	6.29	4.88
11500.0000	-2.16	-3.92	-13.24	-13.33	1.45	0.045	-39.289	6.23	4.86
12000.0000	-2.13	-3.90	-12.89	-12.97	1.44	0.046	-39.470	5.93	4.83
12500.0000	-1.81	-3.72	-12.74	-12.72	1.39	0.047	-38.276	6.10	4.83
13000.0000	-1.59	-3.62	-12.77	-12.76	1.37	0.047	-42.090	6.07	5.11
13500.0000	-1.50	-3.60	-12.94	-12.93	1.36	0.040	-31.392	6.11	5.34
14000.0000	-1.16	-3.42	-13.19	-13.28	1.33	0.039	-36.132	6.47	5.56
14500.0000	-0.79	-3.27	-13.48	-13.45	1.29	0.022	-40.171	6.90	5.80
15000.0000	-0.19	-2.83	-13.68	-13.74	1.23	0.032	-40.013	7.51	6.01
15500.0000	-0.41	-2.97	-13.93	-14.02	1.25	0.025	-36.170	7.37	6.15
16000.0000	-0.62	-3.10	-14.06	-14.03	1.26	0.024	-40.930	7.42	6.03
16500.0000	-1.71	-3.79	-14.26	-14.37	1.42	0.027	-37.301	6.62	5.94
17000.0000	-2.63	-4.43	-14.53	-14.54	1.57	0.028	-55.485	6.04	5.86
17500.0000	-3.61	-5.16	-14.82	-14.78	1.79	0.024	-40.919	5.47	5.74
18000.0000	-4.60	-5.92	-15.27	-15.19	2.07	0.026	-42.429	5.10	5.57

S-PARAMETERS

MAG. AND ANG.

V_{DS} = 0 V, V_{GS} = -2.5 V

FREQUENCY MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
2000.0000	0.994	-12.8	0.040	74.2	0.041	74.9	0.982	-15.4
2500.0000	0.985	-16.9	0.051	69.4	0.050	68.3	0.981	-20.0
3000.0000	0.982	-21.3	0.061	65.3	0.061	64.1	0.976	-24.8
3500.0000	0.976	-25.4	0.070	59.3	0.070	59.2	0.973	-29.7
4000.0000	0.972	-29.2	0.079	54.6	0.079	54.1	0.966	-34.6
4500.0000	0.970	-33.0	0.087	50.3	0.087	49.3	0.965	-39.3
5000.0000	0.968	-36.0	0.095	45.4	0.094	45.1	0.962	-43.5
5500.0000	0.963	-38.8	0.101	41.6	0.102	41.3	0.961	-47.5
6000.0000	0.964	-41.7	0.109	39.3	0.110	38.9	0.957	-50.7
6500.0000	0.960	-44.3	0.121	36.6	0.119	35.6	0.956	-54.8
7000.0000	0.952	-47.2	0.135	31.2	0.134	31.9	0.957	-58.9
7500.0000	0.947	-50.8	0.148	26.5	0.148	26.4	0.949	-63.1
8000.0000	0.941	-55.4	0.161	22.0	0.161	21.5	0.939	-67.5
8500.0000	0.936	-61.1	0.176	16.5	0.176	16.7	0.932	-73.0
9000.0000	0.930	-67.1	0.193	10.4	0.194	10.0	0.923	-79.2
9500.0000	0.922	-73.3	0.208	4.1	0.209	3.6	0.913	-86.8
10000.0000	0.912	-78.7	0.221	-2.8	0.223	-2.8	0.903	-94.9
10500.0000	0.908	-84.2	0.236	-8.8	0.238	-9.3	0.900	-103.4
11000.0000	0.908	-89.3	0.253	-15.8	0.254	-16.1	0.900	-111.7
11500.0000	0.905	-94.9	0.267	-22.0	0.268	-23.0	0.899	-118.7
12000.0000	0.898	-101.4	0.284	-30.3	0.283	-30.7	0.906	-126.7
12500.0000	0.901	-108.7	0.300	-38.0	0.300	-38.8	0.899	-134.6
13000.0000	0.893	-117.4	0.316	-47.4	0.317	-47.8	0.894	-143.1
13500.0000	0.876	-127.1	0.328	-57.2	0.328	-57.8	0.880	-153.0
14000.0000	0.866	-138.2	0.334	-68.3	0.334	-68.9	0.877	-164.1
14500.0000	0.860	-149.8	0.332	-80.4	0.331	-80.9	0.875	-177.7
15000.0000	0.865	-161.4	0.320	-93.4	0.322	-93.4	0.877	168.2
15500.0000	0.866	-172.6	0.298	-104.7	0.298	-105.5	0.880	155.6
16000.0000	0.883	177.5	0.273	-115.0	0.272	-115.5	0.893	144.2
16500.0000	0.888	166.8	0.249	-125.2	0.248	-125.3	0.913	135.1
17000.0000	0.874	153.9	0.226	-135.9	0.223	-136.1	0.924	127.5
17500.0000	0.865	140.6	0.203	-147.2	0.199	-147.2	0.932	120.9
18000.0000	0.839	126.8	0.170	-156.8	0.171	-159.4	0.927	114.0

AMPLIFIER PARAMETERS

 $V_{DS} = 0\text{ V}$, $V_{GS} = -2.5\text{ V}$

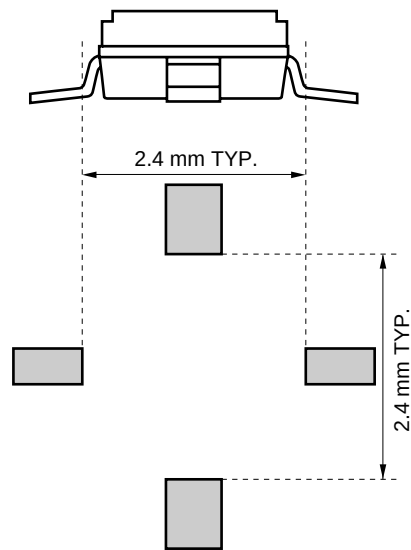
FREQUENCY MHz	GUmax dB	GAmax dB	$ S_{21} ^2$ dB	$ S_{12} ^2$ dB	K	Delay ns	Mason's U dB	G1 dB	G2 dB
2000.0000	5.45	-2.13	-27.93	-27.82	1.12	0.026	-28.423	18.97	14.41
2500.0000	3.65	-2.54	-25.89	-25.96	1.18	0.026	-29.391	15.27	14.27
3000.0000	3.32	-2.67	-24.34	-24.23	1.19	0.023	-27.770	14.51	13.16
3500.0000	2.83	-2.75	-23.07	-23.05	1.21	0.033	-49.384	13.23	12.67
4000.0000	2.30	-2.91	-22.10	-22.00	1.23	0.026	-33.498	12.62	11.78
4500.0000	2.73	-2.68	-21.18	-21.19	1.20	0.024	-30.661	12.24	11.67
5000.0000	2.73	-2.61	-20.47	-20.50	1.19	0.027	-39.320	11.96	11.25
5500.0000	2.68	-2.61	-19.91	-19.86	1.18	0.021	-37.388	11.44	11.15
6000.0000	2.93	-2.52	-19.26	-19.20	1.17	0.013	-34.861	11.45	10.75
6500.0000	3.36	-2.26	-18.34	-18.49	1.15	0.015	-26.993	11.02	10.68
7000.0000	3.59	-2.11	-17.41	-17.46	1.12	0.030	-31.857	10.29	10.72
7500.0000	3.29	-2.11	-16.61	-16.62	1.12	0.026	-45.807	9.86	10.05
8000.0000	2.84	-2.21	-15.87	-15.87	1.13	0.025	-35.681	9.43	9.28
8500.0000	2.78	-2.18	-15.09	-15.10	1.13	0.031	-40.714	9.05	8.82
9000.0000	2.69	-2.14	-14.31	-14.26	1.12	0.034	-35.203	8.72	8.28
9500.0000	2.37	-2.23	-13.63	-13.60	1.13	0.035	-35.298	8.24	7.77
10000.0000	2.00	-2.34	-13.10	-13.03	1.14	0.038	-37.411	7.75	7.35
10500.0000	2.23	-2.22	-12.55	-12.47	1.13	0.034	-31.948	7.58	7.20
11000.0000	2.80	-1.90	-11.94	-11.89	1.09	0.039	-36.170	7.54	7.20
11500.0000	3.15	-1.69	-11.47	-11.44	1.08	0.034	-27.602	7.44	7.17
12000.0000	3.69	-1.33	-10.94	-10.97	1.05	0.046	-30.925	7.14	7.48
12500.0000	3.99	-1.10	-10.46	-10.45	1.03	0.043	-25.841	7.27	7.19
13000.0000	3.91	-0.98	-9.99	-9.98	1.03	0.052	-30.075	6.95	6.96
13500.0000	3.12	-1.26	-9.68	-9.68	1.04	0.055	-29.034	6.33	6.47
14000.0000	2.86	-1.36	-9.53	-9.51	1.05	0.061	-29.463	6.01	6.38
14500.0000	2.55	-1.54	-9.58	-9.60	1.06	0.067	-31.274	5.84	6.29
15000.0000	2.47	-1.64	-9.90	-9.85	1.07	0.073	-37.889	5.99	6.38
15500.0000	1.95	-1.97	-10.52	-10.52	1.10	0.062	-29.488	6.01	6.47
16000.0000	2.23	-1.99	-11.28	-11.31	1.11	0.057	-34.340	6.57	6.93
16500.0000	2.46	-1.97	-12.07	-12.11	1.11	0.057	-38.158	6.76	7.78
17000.0000	1.68	-2.33	-12.92	-13.03	1.15	0.059	-32.987	6.27	8.34
17500.0000	0.92	-2.67	-13.87	-14.04	1.21	0.063	-30.080	6.00	8.79
18000.0000	-1.59	-4.11	-15.41	-15.35	1.47	0.054	-26.585	5.28	8.53

NOISE PARAMETERS

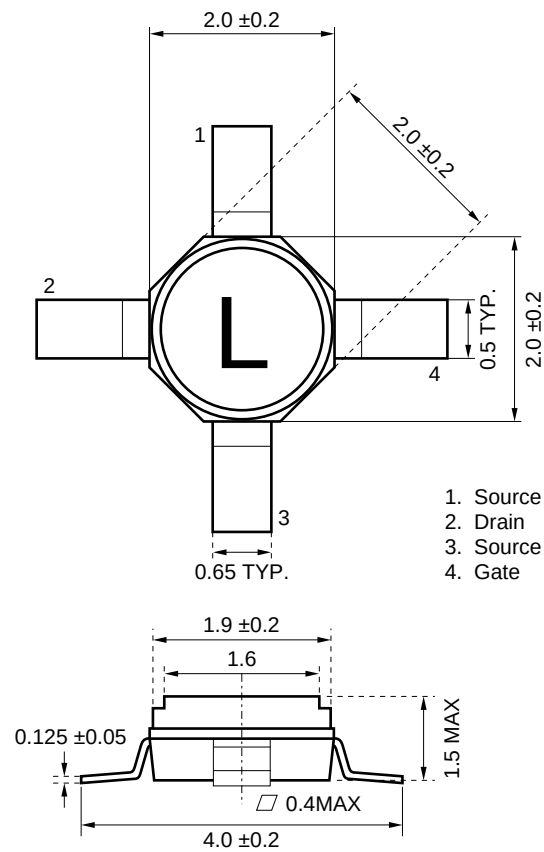
$V_{DS} = 2\text{ V}$, $I_D = 10\text{ mA}$

Freq. (GHz)	$NF_{min.}$ (dB)	G_a (dB)	Γ_{opt}		Rn/50
			MAG.	ANG.	
2.0	0.29	20.7	0.94	12	0.38
4.0	0.30	18.7	0.80	26	0.33
6.0	0.33	17.0	0.66	44	0.26
8.0	0.38	15.4	0.50	68	0.18
10.0	0.43	14.1	0.38	97	0.11
12.0	0.50	13.0	0.29	133	0.09
14.0	0.59	12.3	0.27	177	0.08
16.0	0.71	11.8	0.33	-129	0.11
18.0	0.86	11.2	0.39	-82	0.23

TYPICAL MOUNT PAD LAYOUT



PACKAGE DIMENSIONS (Unit: mm)



NOTE ON CORRECT USE

- (1) Because this device is a GaAs MES FET with a Schottky barrier gate structure, it is necessary that sufficient care be taken regarding static electricity and strong electric fields.
Take measures against static electricity and make sure the body is earthed when mounting the device.
- (2) Follow the procedure below when operating the device by a gate-and-drain-independent dual power supply.
Directly ground both the source pins.
 V_{GS} = fixed to approximately -4 V.
Increase V_{DS} to a predetermined voltage level (within the recommended operating range of V_{DS}).
Adjust V_{GS} in line with a predetermined I_D .
- (3) It is recommended that the bias application circuit be able to have a fixed voltage and current.
- (4) Adjust the I/O matching circuit after turning the bias OFF.

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
Infrared Reflow	Package peak temperature: 230 °C or below Time: 30 seconds or less (at 210 °C) Count: 1, Exposure limit : None ^{Note}	IR30-00-1
Partial Heating	Pin temperature: 230 °C Time: 10 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).

[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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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

Special: 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, life support systems or medical equipment for life support, etc.

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