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

HETERO JUNCTION FIELD EFFECT TRANSISTOR

NE3210S01

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

DESCRIPTION

The NE3210S01 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 = 0.35 dB TYP. Ga = 13.5 dB TYP. at f = 12 GHz
- Gate Length: Lg ≤ 0.20 μm
- Gate Width : Wg = 160 μm

ORDERING INFORMATION (PLAN)

Part Number	Supplying Form	Marking
NE3210S01-T1	Tape & reel 1 000 pcs./reel	K
NE3210S01-T1B	Tape & reel 4 000 pcs./reel	

Remark For sample order, please contact your local NEC sales office. (Part number for sample order: NE3210S01)

ABSOLUTE MAXIMUM RATINGS (T_A = 25°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	IDSS	mA
Gate Current	I_G	100	μA
Total Power Dissipation	P_{tot}	165	mW
Channel Temperature	T_{ch}	125	°C
Storage Temperature	T_{stg}	–65 to +125	°C

RECOMMENDED OPERATING CONDITIONS (T_A = +25°C)

	Characteristics	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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Document No. P14067EJ2V0DS00 (2nd edition)
Date Published November 1999 N CP(K)
Printed in Japan

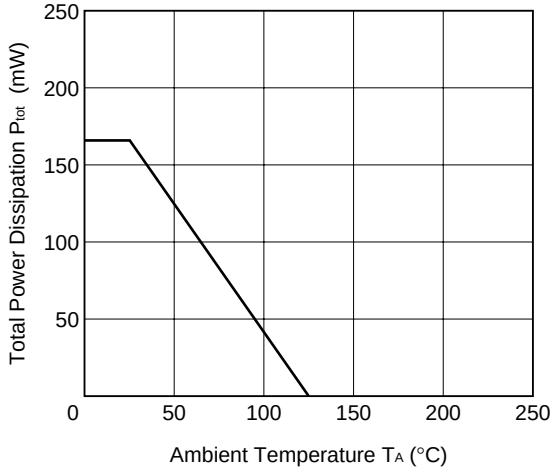
The mark ★ shows major revised points.

ELECTRICAL CHARACTERISTICS (T_A = +25 °C)

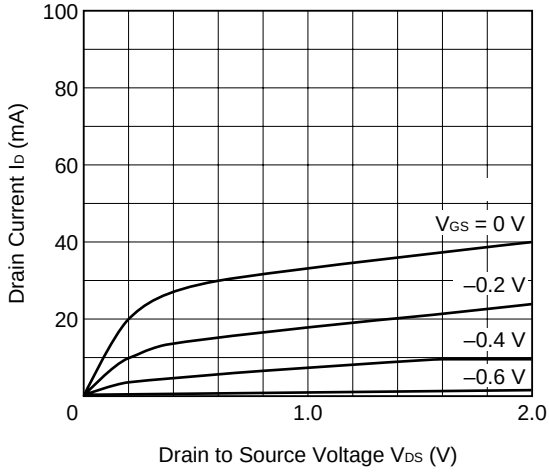
Characteristics	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	I_{GSO}	V_{GS} = –3 V	–	0.5	10	μA
Saturated Drain Current	I_{DSS}	V_{DS} = 2 V, V_{GS} = 0 V	15	40	70	mA
Gate to Source Cut off Voltage	$V_{GS (off)}$	V_{DS} = 2 V, I_{DS} = 100 μA	–0.2	–0.7	–2.0	V
Transconductance	g_m	V_{DS} = 2 V, I_{DS} = 10 mA	40	55	–	mS
Noise Figure	NF	V_{DS} = 2 V, I_{DS} = 10 mA f = 12 GHz	–	0.35	0.45	dB
Associated Gain	G_a		12.0	13.5	–	dB

TYPICAL CHARACTERISTICS (T_A = +25 °C)

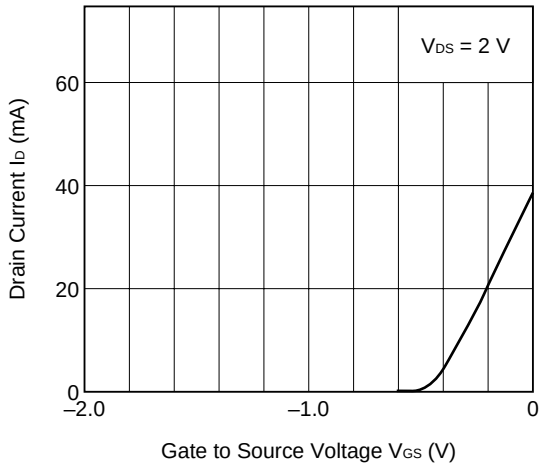
TOTAL POWER DISSIPATION vs.
AMBIENT TEMPERATURE



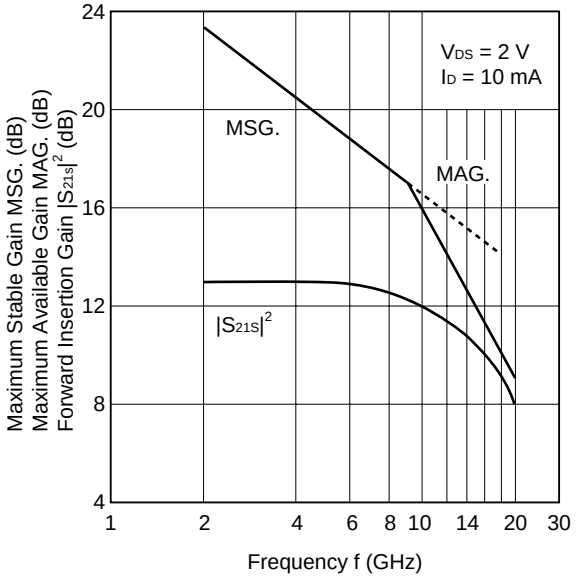
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



DRAIN CURRENT vs.
GATE TO SOURCE VOLTAGE



MAXIMUM AVAILABLE GAIN, FORWARD
INSERTION GAIN vs. FREQUENCY

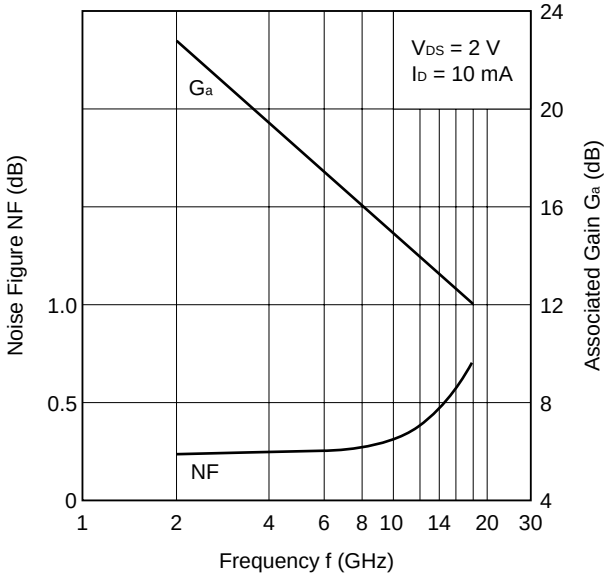


Gain Calculations

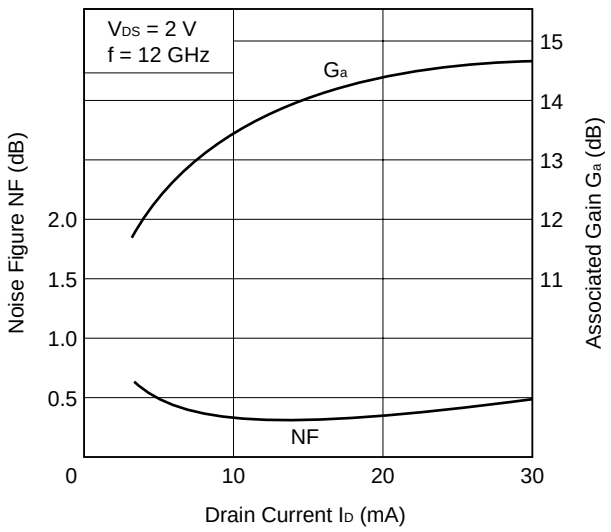
$$MSG. = \left|\frac{S_{21}}{S_{12}}\right| \qquad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}|\,|S_{21}|}$$

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

NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY



NOISE FIGURE, ASSOCIATED GAIN vs. DRAIN CURRENT



S-PARAMETERS

MAG. AND ANG.

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

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
2000.0000	0.973	–21.2	4.450	154.2	0.022	75.9	0.550	–15.2
2500.0000	0.951	–27.7	4.453	147.1	0.028	71.2	0.538	–19.9
3000.0000	0.935	–34.3	4.439	140.3	0.033	66.7	0.523	–25.2
3500.0000	0.914	–40.6	4.389	133.5	0.038	63.5	0.511	–30.3
4000.0000	0.893	–46.3	4.314	127.3	0.042	57.7	0.500	–34.9
4500.0000	0.872	–51.4	4.230	121.1	0.045	54.5	0.495	–39.1
5000.0000	0.848	–55.9	4.158	115.3	0.048	49.7	0.492	–42.9
5500.0000	0.829	–60.0	4.118	109.9	0.050	48.2	0.484	–45.8
6000.0000	0.814	–64.8	4.130	104.3	0.053	46.1	0.482	–48.8
6500.0000	0.781	–70.1	4.149	98.3	0.058	42.8	0.472	–52.6
7000.0000	0.745	–76.3	4.180	91.8	0.063	40.4	0.450	–56.3
7500.0000	0.699	–82.7	4.170	85.3	0.065	36.6	0.423	–59.2
8000.0000	0.660	–90.3	4.184	78.7	0.070	33.7	0.393	–62.6
8500.0000	0.635	–99.8	4.197	71.7	0.074	29.4	0.360	–67.3
9000.0000	0.602	–109.5	4.171	64.7	0.077	25.4	0.327	–72.4
9500.0000	0.578	–118.3	4.109	57.9	0.081	22.3	0.290	–78.8
10000.0000	0.554	–127.2	4.063	51.3	0.086	18.9	0.268	–86.8
10500.0000	0.537	–135.2	4.030	44.6	0.092	15.3	0.251	–96.2
11000.0000	0.507	–144.1	3.978	37.6	0.095	10.8	0.233	–105.3
11500.0000	0.477	–154.0	3.950	30.8	0.099	5.9	0.224	–114.3
12000.0000	0.445	–166.2	3.906	23.5	0.103	2.1	0.211	–123.1
12500.0000	0.428	–179.6	3.851	16.0	0.108	–2.2	0.187	–132.5
13000.0000	0.418	165.3	3.762	8.5	0.110	–6.6	0.157	–146.2
13500.0000	0.430	150.6	3.642	1.1	0.111	–10.3	0.123	–164.0
14000.0000	0.453	137.9	3.517	–6.1	0.110	–14.8	0.110	169.0
14500.0000	0.486	126.7	3.395	–13.0	0.112	–19.6	0.125	141.4
15000.0000	0.513	116.7	3.259	–19.9	0.111	–22.0	0.161	121.7
15500.0000	0.526	108.4	3.150	–26.4	0.113	–25.6	0.207	113.4
16000.0000	0.531	100.4	3.046	–33.3	0.110	–29.3	0.255	109.0
16500.0000	0.539	91.1	2.911	–40.7	0.112	–32.1	0.299	105.4
17000.0000	0.533	82.1	2.739	–48.0	0.111	–36.1	0.329	101.5
17500.0000	0.537	72.2	2.573	–54.3	0.110	–40.1	0.343	95.9
18000.0000	0.546	64.7	2.400	–59.4	0.106	–41.6	0.347	90.6

AMPLIFIER PARAMETERS

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

FREQUENCY MHz	GUmax dB	GAmax dB	$\|S_{21}\|^2$ dB	$\|S_{12}\|^2$ dB	K	Delay nsec	Mason's U dB	G1 dB	G2 dB
2000.0000	27.26		12.97	–33.03	0.27	0.389	31.735	12.72	1.56
2500.0000	24.63		12.97	–31.20	0.38	0.040	27.870	10.18	1.48
3000.0000	23.33		12.95	–29.75	0.42	0.038	26.985	9.00	1.39
3500.0000	21.99		12.85	–28.44	0.47	0.038	26.594	7.83	1.32
4000.0000	20.87		12.70	–27.53	0.54	0.035	24.253	6.92	1.25
4500.0000	19.95		12.53	–26.98	0.60	0.034	23.581	6.21	1.22
5000.0000	19.11		12.38	–26.29	0.67	0.032	22.154	5.53	1.21
5500.0000	18.50		12.29	–26.00	0.73	0.030	22.043	5.05	1.16
6000.0000	18.19		12.32	–25.48	0.74	0.031	22.571	4.73	1.15
6500.0000	17.54		12.36	–24.70	0.79	0.034	21.992	4.09	1.09
7000.0000	16.92		12.42	–24.08	0.84	0.036	21.786	3.51	0.98
7500.0000	16.18		12.40	–23.76	0.94	0.036	20.486	2.92	0.86
8000.0000	15.65		12.43	–23.13	0.98	0.037	20.250	2.49	0.73
8500.0000	15.30		12.46	–22.59	1.00	0.039	20.283	2.24	0.60
9000.0000	14.85	16.16	12.40	–22.22	1.04	0.039	20.009	1.96	0.49
9500.0000	14.42	15.56	12.27	–21.80	1.06	0.038	19.986	1.77	0.38
10000.0000	14.09	15.25	12.18	–21.32	1.06	0.037	20.235	1.59	0.32
10500.0000	13.87	15.24	12.11	–20.75	1.04	0.037	21.050	1.48	0.28
11000.0000	13.52	14.66	11.99	–20.46	1.07	0.039	20.646	1.29	0.24
11500.0000	13.28	14.39	11.93	–20.07	1.07	0.038	20.667	1.12	0.22
12000.0000	12.99	13.98	11.83	–19.76	1.09	0.041	20.584	0.96	0.20
12500.0000	12.74	13.69	11.71	–19.35	1.09	0.042	20.774	0.88	0.15
13000.0000	12.45	13.26	11.51	–19.17	1.12	0.042	20.290	0.83	0.11
13500.0000	12.18	12.87	11.23	–19.12	1.14	0.041	19.748	0.89	0.07
14000.0000	11.97	12.58	10.92	–19.15	1.16	0.040	19.301	1.00	0.05
14500.0000	11.86	12.48	10.62	–19.02	1.15	0.038	19.613	1.17	0.07
15000.0000	11.70	12.27	10.26	–19.06	1.16	0.039	19.428	1.33	0.11
15500.0000	11.56	12.16	9.97	–18.90	1.14	0.036	19.651	1.41	0.19
16000.0000	11.41	11.97	9.67	–19.17	1.16	0.038	18.875	1.44	0.29
16500.0000	11.18	11.75	9.28	–19.03	1.16	0.041	18.560	1.49	0.41
17000.0000	10.70	11.16	8.75	–19.11	1.21	0.041	16.897	1.45	0.50
17500.0000	10.23	10.54	8.21	–19.15	1.27	0.035	15.483	1.48	0.54
18000.0000	9.70	9.85	7.60	–19.53	1.39	0.028	13.782	1.54	0.56

S-PARAMETERS

MAG. AND ANG.

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

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
2000.0000	0.987	–21.3	0.013	103.3	0.015	109.1	0.775	151.9
2500.0000	0.984	–27.9	0.019	103.6	0.020	102.3	0.786	145.8
3000.0000	0.978	–34.8	0.024	106.2	0.026	106.6	0.786	140.4
3500.0000	0.973	–41.5	0.031	102.7	0.033	105.2	0.787	134.6
4000.0000	0.967	–47.7	0.039	99.2	0.039	101.9	0.786	129.0
4500.0000	0.964	–53.6	0.048	97.3	0.048	99.3	0.783	123.0
5000.0000	0.959	–59.1	0.056	95.2	0.057	94.9	0.782	116.4
5500.0000	0.954	–64.8	0.067	90.9	0.068	90.9	0.781	109.7
6000.0000	0.948	–70.7	0.077	85.9	0.079	86.8	0.782	103.2
6500.0000	0.944	–77.9	0.087	81.4	0.090	81.4	0.781	96.6
7000.0000	0.934	–85.5	0.102	76.1	0.104	76.8	0.785	90.2
7500.0000	0.920	–95.5	0.117	70.0	0.118	70.2	0.796	84.7
8000.0000	0.906	–106.1	0.132	62.7	0.132	62.9	0.802	80.4
8500.0000	0.893	–117.9	0.144	55.8	0.144	55.2	0.814	76.7
9000.0000	0.885	–129.6	0.155	48.4	0.158	48.7	0.819	73.8
9500.0000	0.877	–140.4	0.167	41.9	0.166	42.2	0.830	70.7
10000.0000	0.873	–151.4	0.177	35.7	0.179	35.9	0.832	67.9
10500.0000	0.876	–162.1	0.190	28.8	0.193	29.2	0.836	64.3
11000.0000	0.874	–173.2	0.205	21.9	0.206	21.4	0.838	60.7
11500.0000	0.874	174.1	0.219	13.9	0.218	13.5	0.837	56.5
12000.0000	0.867	160.1	0.228	5.1	0.229	5.2	0.839	52.1
12500.0000	0.870	146.2	0.232	–4.0	0.232	–3.5	0.838	47.3
13000.0000	0.872	132.8	0.230	–11.4	0.232	–11.6	0.845	42.8
13500.0000	0.874	121.0	0.227	–19.4	0.227	–19.7	0.854	38.5
14000.0000	0.884	110.6	0.218	–26.4	0.221	–25.5	0.862	35.9
14500.0000	0.899	101.9	0.211	–30.5	0.215	–30.6	0.871	34.0
15000.0000	0.904	92.9	0.208	–35.0	0.208	–35.4	0.879	33.5
15500.0000	0.907	85.1	0.201	–39.5	0.201	–40.0	0.882	33.0
16000.0000	0.907	77.7	0.198	–43.9	0.200	–44.0	0.876	32.4
16500.0000	0.900	69.3	0.198	–49.3	0.198	–49.5	0.877	30.8
17000.0000	0.881	60.5	0.192	–54.4	0.194	–54.5	0.878	28.5
17500.0000	0.860	52.8	0.183	–59.2	0.186	–60.2	0.875	25.4
18000.0000	0.846	46.0	0.176	–63.5	0.176	–63.9	0.866	21.4

AMPLIFIER PARAMETERS

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

FREQUENCY MHz	GUmax dB	GAmax dB	$\|S_{21}\|^2$ dB	$\|S_{12}\|^2$ dB	K	Delay nsec	Mason's U dB	G1 dB	G2 dB
2000.0000	–18.01	–18.00	–37.95	–36.77	27.53	–0.027	–32.707	15.95	3.98
2500.0000	–15.58	–15.57	–34.65	–34.03	16.79	–0.001	–37.496	14.90	4.17
3000.0000	–14.62	–14.69	–32.43	–31.68	13.52	–0.015	–35.198	13.63	4.18
3500.0000	–13.19	–13.31	–30.17	–29.75	10.24	0.019	–36.355	12.79	4.19
4000.0000	–12.04	–12.23	–28.13	–28.14	8.39	0.019	–38.318	11.90	4.18
4500.0000	–10.79	–11.09	–26.37	–26.30	6.41	0.011	–39.156	11.45	4.13
5000.0000	–9.94	–10.33	–24.99	–24.83	5.35	0.011	–43.704	10.95	4.11
5500.0000	–8.97	–9.49	–23.51	–23.31	4.40	0.024	–41.071	10.45	4.09
6000.0000	–8.21	–8.84	–22.26	–22.06	3.82	0.028	–38.980	9.93	4.11
6500.0000	–7.41	–8.19	–21.17	–20.87	3.27	0.025	–36.002	9.66	4.09
7000.0000	–6.75	–7.66	–19.85	–19.67	2.94	0.029	–38.253	8.95	4.15
7500.0000	–6.16	–7.19	–18.62	–18.54	2.69	0.034	–44.914	8.11	4.35
8000.0000	–5.64	–6.76	–17.60	–17.59	2.48	0.041	–52.360	7.48	4.48
8500.0000	–5.17	–6.40	–16.82	–16.81	2.30	0.038	–43.933	6.94	4.71
9000.0000	–4.71	–6.06	–16.18	–16.03	2.11	0.041	–38.048	6.65	4.83
9500.0000	–4.13	–5.61	–15.56	–15.61	1.97	0.036	–45.414	6.36	5.07
10000.0000	–3.68	–5.31	–15.03	–14.94	1.83	0.035	–41.367	6.22	5.13
10500.0000	–2.85	–4.73	–14.41	–14.28	1.64	0.038	–36.934	6.34	5.22
11000.0000	–2.26	–4.30	–13.78	–13.72	1.52	0.039	–40.336	6.26	5.27
11500.0000	–1.68	–3.90	–13.20	–13.21	1.43	0.044	–41.533	6.28	5.25
12000.0000	–1.53	–3.82	–12.86	–12.82	1.41	0.049	–46.170	6.04	5.29
12500.0000	–1.29	–3.67	–12.68	–12.69	1.38	0.051	–40.248	6.14	5.25
13000.0000	–1.13	–3.65	–12.75	–12.71	1.37	0.041	–43.093	6.20	5.43
13500.0000	–0.94	–3.56	–12.88	–12.86	1.35	0.044	–43.034	6.27	5.68
14000.0000	–0.70	–3.47	–13.21	–13.13	1.33	0.039	–32.688	6.62	5.89
14500.0000	–0.17	–3.27	–13.51	–13.33	1.28	0.023	–31.483	7.15	6.19
15000.0000	0.15	–3.09	–13.65	–13.66	1.27	0.025	–40.622	7.39	6.42
15500.0000	0.09	–3.15	–13.95	–13.92	1.27	0.025	–38.265	7.51	6.52
16000.0000	–0.24	–3.31	–14.06	–14.00	1.30	0.024	–39.573	7.50	6.32
16500.0000	–0.48	–3.42	–14.06	–14.05	1.32	0.030	–46.013	7.22	6.35
17000.0000	–1.43	–4.00	–14.34	–14.24	1.44	0.028	–37.600	6.51	6.40
17500.0000	–2.60	–4.72	–14.76	–14.60	1.63	0.027	–33.228	5.85	6.31
18000.0000	–3.60	–5.38	–15.08	–15.09	1.87	0.024	–44.662	5.47	6.01

S-PARAMETERS

MAG. AND ANG.

V_{DS} = 0 V, V_{GS} = –2.5 V

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
2000.0000	0.993	–13.3	0.041	75.0	0.041	75.0	0.986	–15.4
2500.0000	0.987	–17.7	0.051	70.4	0.052	70.7	0.982	–19.9
3000.0000	0.982	–22.2	0.062	65.3	0.062	65.9	0.979	–24.7
3500.0000	0.978	–26.7	0.072	60.3	0.072	59.3	0.974	–29.7
4000.0000	0.975	–30.7	0.080	55.1	0.080	54.9	0.969	–34.6
4500.0000	0.970	–34.4	0.088	50.6	0.087	50.1	0.968	–39.2
5000.0000	0.968	–37.5	0.095	46.0	0.095	46.5	0.967	–43.4
5500.0000	0.965	–40.3	0.103	42.9	0.102	42.5	0.965	–47.5
6000.0000	0.966	–43.4	0.111	40.2	0.111	40.2	0.957	–50.8
6500.0000	0.963	–45.9	0.123	37.4	0.122	37.0	0.961	–54.9
7000.0000	0.959	–48.8	0.136	33.0	0.137	32.9	0.955	–59.3
7500.0000	0.947	–52.6	0.149	27.8	0.148	28.0	0.950	–63.5
8000.0000	0.944	–57.6	0.164	23.0	0.162	23.0	0.939	–68.5
8500.0000	0.939	–63.2	0.180	17.7	0.178	17.9	0.930	–74.1
9000.0000	0.928	–69.2	0.196	12.0	0.196	12.0	0.920	–80.4
9500.0000	0.922	–75.5	0.212	5.5	0.211	5.2	0.915	–87.9
10000.0000	0.913	–81.2	0.224	–1.0	0.224	–1.2	0.903	–95.8
10500.0000	0.912	–86.2	0.240	–7.0	0.239	–7.3	0.899	–104.5
11000.0000	0.913	–91.2	0.255	–13.1	0.257	–13.3	0.906	–111.8
11500.0000	0.909	–96.6	0.271	–19.6	0.273	–20.1	0.906	–119.1
12000.0000	0.904	–102.7	0.289	–27.3	0.288	–27.0	0.913	–126.6
12500.0000	0.905	–109.8	0.307	–34.7	0.305	–34.6	0.900	–134.7
13000.0000	0.897	–118.1	0.324	–43.7	0.324	–43.6	0.887	–143.4
13500.0000	0.884	–127.9	0.339	–53.8	0.338	–53.7	0.879	–153.5
14000.0000	0.869	–139.1	0.346	–64.3	0.343	–64.5	0.874	–164.8
14500.0000	0.868	–150.3	0.345	–76.4	0.345	–76.3	0.875	–177.8
15000.0000	0.866	–161.6	0.333	–88.1	0.334	–88.3	0.877	169.0
15500.0000	0.867	–172.6	0.311	–99.3	0.313	–98.7	0.882	156.9
16000.0000	0.872	177.4	0.294	–109.3	0.289	–109.7	0.897	146.1
16500.0000	0.885	166.6	0.269	–119.0	0.268	–119.1	0.905	136.8
17000.0000	0.870	153.6	0.251	–129.3	0.246	–129.4	0.926	128.7
17500.0000	0.871	139.7	0.226	–140.8	0.227	–140.2	0.927	122.1
18000.0000	0.855	124.6	0.198	–151.5	0.198	–152.4	0.923	115.3

AMPLIFIER PARAMETERS

V_{DS} = 0 V, V_{GS} = –2.5 V

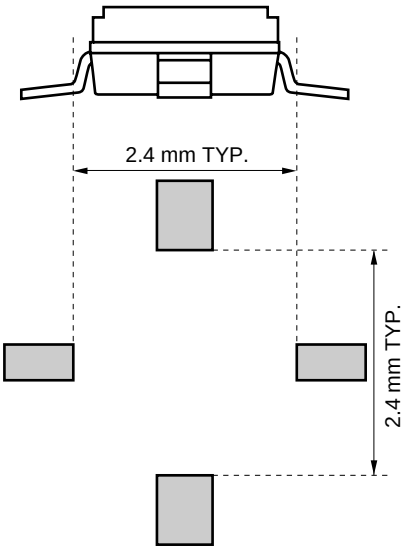
FREQUENCY MHz	GUmax dB	GAmax dB	$\|S_{21}\|^2$ dB	$\|S_{12}\|^2$ dB	K	Delay nsec	Mason's U dB	G1 dB	G2 dB
2000.0000	6.59	–1.81	–27.69	–27.72	1.09	0.037	–41.579	18.66	15.62
2500.0000	4.66	–2.29	–25.78	–25.76	1.14	0.026	–37.612	15.91	14.53
3000.0000	4.16	–2.37	–24.10	–24.15	1.16	0.028	–32.931	14.46	13.79
3500.0000	3.77	–2.45	–22.90	–22.89	1.16	0.027	–30.070	13.70	12.97
4000.0000	3.27	–2.57	–21.96	–21.97	1.18	0.029	–46.684	13.12	12.12
4500.0000	3.06	–2.59	–21.12	–21.17	1.19	0.025	–36.484	12.23	11.95
5000.0000	3.35	–2.46	–20.43	–20.42	1.16	0.026	–36.357	11.96	11.82
5500.0000	3.47	–2.35	–19.76	–19.86	1.16	0.017	–32.225	11.57	11.66
6000.0000	3.33	–2.41	–19.10	–19.12	1.16	0.015	–46.847	11.70	10.73
6500.0000	4.33	–2.04	–18.22	–18.27	1.12	0.015	–34.379	11.37	11.18
7000.0000	4.16	–2.07	–17.36	–17.24	1.11	0.025	–30.925	10.93	10.58
7500.0000	3.50	–2.14	–16.54	–16.59	1.13	0.029	–37.284	9.90	10.14
8000.0000	3.26	–2.14	–15.68	–15.80	1.13	0.026	–31.894	9.67	9.28
8500.0000	3.09	–2.15	–14.91	–15.00	1.13	0.030	–33.177	9.30	8.70
9000.0000	2.57	–2.31	–14.16	–14.16	1.14	0.032	–60.851	8.60	8.13
9500.0000	2.64	–2.21	–13.47	–13.52	1.13	0.036	–37.108	8.25	7.87
10000.0000	2.13	–2.37	–13.01	–13.00	1.15	0.036	–47.342	7.79	7.36
10500.0000	2.50	–2.17	–12.40	–12.44	1.13	0.033	–36.990	7.72	7.18
11000.0000	3.39	–1.82	–11.86	–11.80	1.09	0.034	–33.577	7.81	7.45
11500.0000	3.74	–1.63	–11.33	–11.29	1.07	0.036	–31.606	7.62	7.45
12000.0000	4.38	–1.32	–10.79	–10.80	1.05	0.043	–33.886	7.37	7.79
12500.0000	4.37	–1.23	–10.26	–10.32	1.04	0.041	–33.321	7.42	7.22
13000.0000	4.00	–1.27	–9.79	–9.78	1.04	0.050	–40.261	7.08	6.71
13500.0000	3.67	–1.30	–9.38	–9.42	1.05	0.056	–36.338	6.61	6.44
14000.0000	3.15	–1.46	–9.22	–9.30	1.06	0.059	–31.349	6.12	6.25
14500.0000	3.16	–1.48	–9.24	–9.24	1.06	0.067	–48.824	6.09	6.31
15000.0000	2.83	–1.66	–9.54	–9.52	1.07	0.065	–38.005	6.02	6.35
15500.0000	2.44	–1.92	–10.14	–10.09	1.10	0.062	–31.130	6.05	6.53
16000.0000	2.65	–1.85	–10.64	–10.80	1.10	0.055	–27.440	6.21	7.08
16500.0000	2.64	–2.01	–11.41	–11.43	1.11	0.054	–47.034	6.65	7.40
17000.0000	2.61	–1.99	–12.01	–12.17	1.12	0.057	–28.001	6.14	8.48
17500.0000	1.77	–2.46	–12.90	–12.88	1.16	0.064	–33.848	6.18	8.49
18000.0000	–0.05	–3.35	–14.05	–14.06	1.31	0.059	–33.797	5.71	8.29

NOISE PARAMETERS

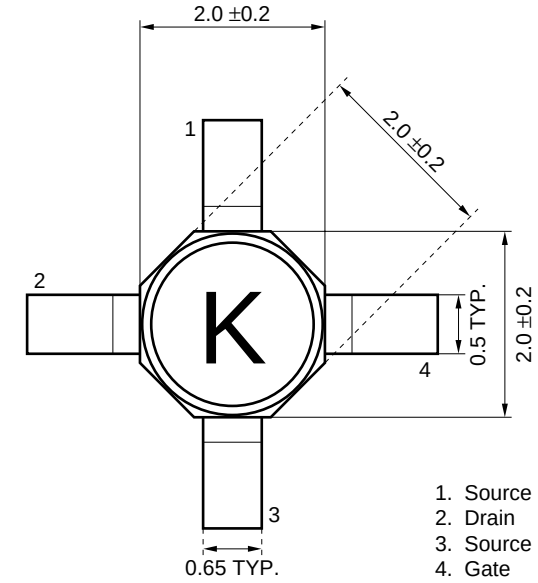
V_{DS} = 2 V, I_D = 10 mA

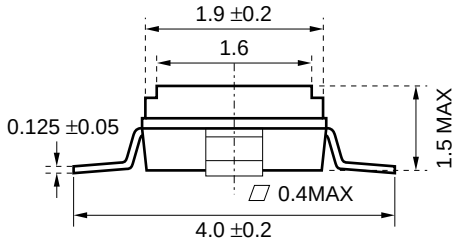
Freq. (GHz)	NF_{min}. (dB)	G_a (dB)	Γopt		Rn/50
			MAG.	ANG.	
2.0	0.25	21.2	0.94	12	0.38
4.0	0.26	19.5	0.80	26	0.33
6.0	0.28	18.2	0.66	44	0.26
8.0	0.30	16.2	0.50	68	0.18
10.0	0.32	14.7	0.38	97	0.11
12.0	0.34	13.5	0.29	133	0.09
14.0	0.42	12.9	0.27	177	0.08
16.0	0.56	12.3	0.33	–129	0.11
18.0	0.72	11.9	0.39	–82	0.23

TYPICAL MOUNT PAD LAYOUT



PACKAGE DIMENSIONS (Unit: mm)





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[Note]: None	IR30-00-1
Partial Heating	Pin temperature: 230 °C Time: 10 seconds or less (per pin row) Exposure limit[Note]: None	–

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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