



DATA SHEET

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 nearby sales office. (Part number for sample order: NE4210S01-A)

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	$^\circ\text{C}$

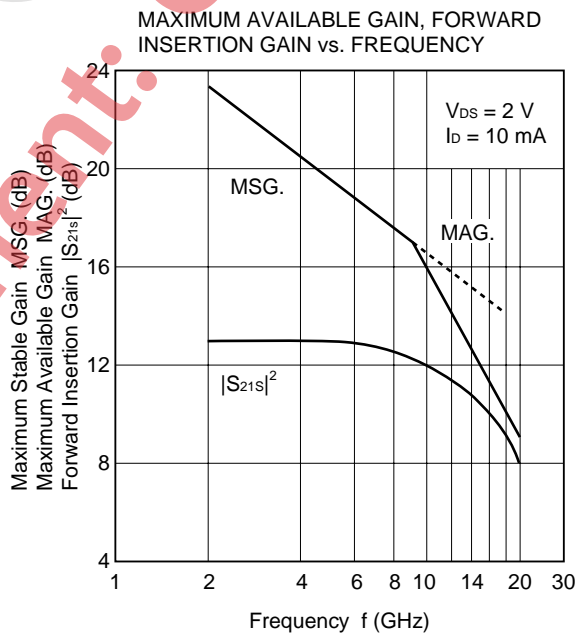
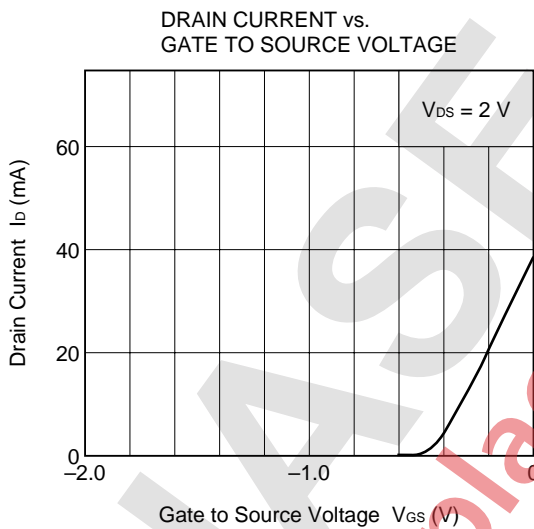
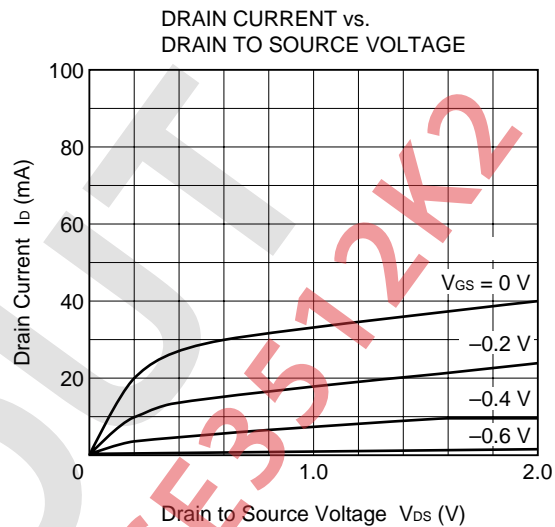
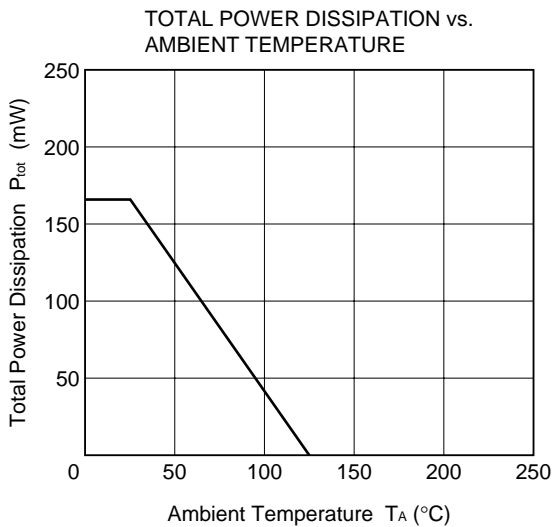
RECOMMENDED OPERATING CONDITIONS ($T_A = +25^\circ\text{C}$)

	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

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	$V_{DS} = 2\text{ V}, I_{DS} = 10\text{ mA}$	–	0.50	0.70	dB
Associated Gain	G_a	$f = 12\text{ GHz}$	11.0	13.0	–	dB

TYPICAL CHARACTERISTICS (T_A = +25 °C)

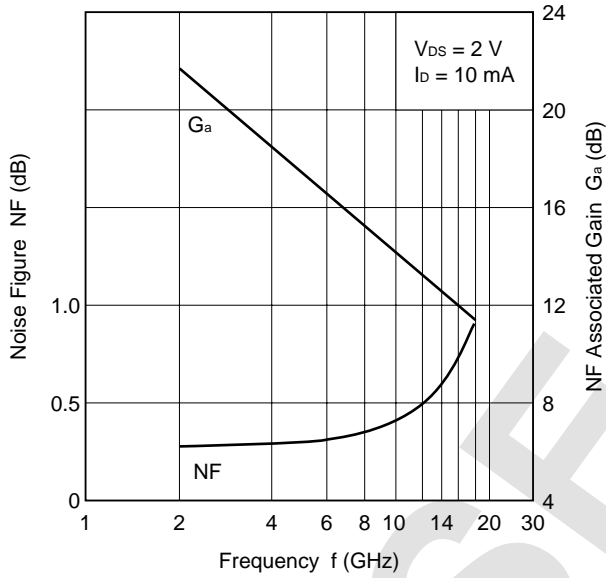


Gain Calculations

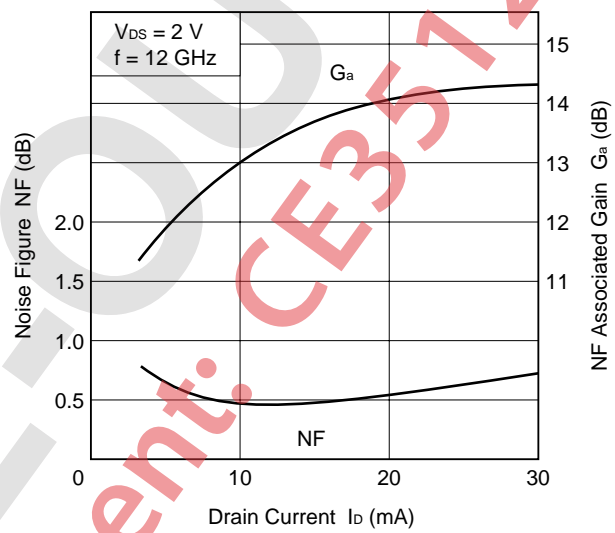
$$MSG. = \left| \frac{S_{21}}{S_{12}} \right| \quad K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}$$

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

NOISE FIGURE, NF ASSOCIATED GAIN vs. FREQUENCY



NOISE FIGURE, NF ASSOCIATED GAIN vs. DRAIN CURRENT



PHASER
 Drop-In Replacement: CE3572K2

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 V, I_D = 10 mA

FREQUENCY MHz	GU _{max} dB	GA _{max} 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 V, V_{GS} = 0 V

FREQUENCY MHz	GU _{max} dB	GA _{max} dB	S ₂₁ ² dB	S ₁₂ ² dB	K	Delay ns	Mason's U dB	G1 dB	G2 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 V, V_{GS} = -2.5 V

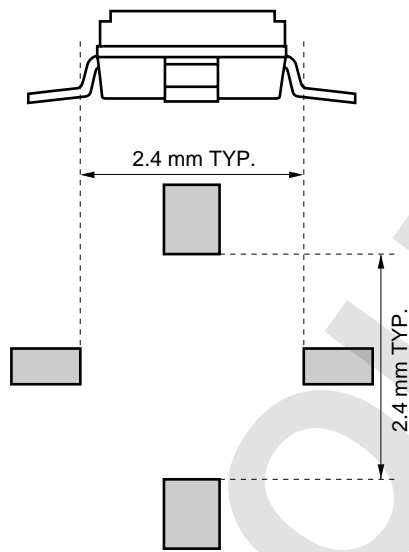
FREQUENCY MHz	GU _{max} dB	GA _{max} dB	S ₂₁ ² dB	S ₁₂ ² dB	K	Delay ns	Mason's U dB	G1 dB	G2 dB
2000.0000	5.45	-2.13	-27.93	-27.82	1.12	0.026	-28.423	18.97	14.41
2500.0000	3.65	-2.54	-25.89	-25.96	1.18	0.026	-29.391	15.27	14.27
3000.0000	3.32	-2.67	-24.34	-24.23	1.19	0.023	-27.770	14.51	13.16
3500.0000	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

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

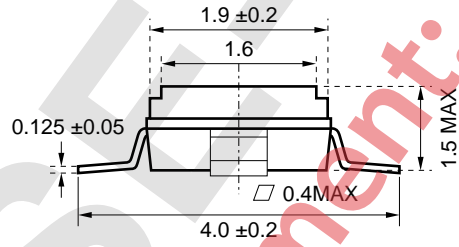
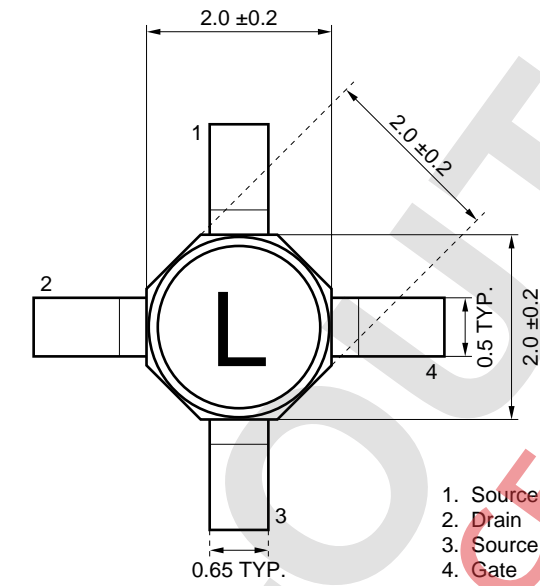
Freq. (GHz)	NF _{min.} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
2.0	0.29	20.7	0.94	12	0.38
4.0	0.30	18.7	0.80	26	0.33
6.0	0.33	17.0	0.66	44	0.26
8.0	0.38	15.4	0.50	68	0.18
10.0	0.43	14.1	0.38	97	0.11
12.0	0.50	13.0	0.29	133	0.09
14.0	0.59	12.3	0.27	177	0.08
16.0	0.71	11.8	0.33	-129	0.11
18.0	0.86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

TYPICAL MOUNT PAD LAYOUT



PHASE-OUT
Drop-In Replacement: CE3512K2

PACKAGE DIMENSIONS (Unit: mm)



PHA S

Drop-In Replacement:

E3572K2

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

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).

NOTICE

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. California Eastern Laboratories and Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
2. California Eastern Laboratories has used reasonable care in preparing the information included in this document, but California Eastern Laboratories does not warrant that such information is error free. California Eastern Laboratories and Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
3. California Eastern Laboratories and Renesas Electronics do not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of California Eastern Laboratories or Renesas Electronics or others.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. California Eastern Laboratories and Renesas Electronics assume no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. "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 etc. "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc. Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. California Eastern Laboratories and Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by California Eastern Laboratories or Renesas Electronics.
6. You should use the Renesas Electronics products described in this document within the range specified by California Eastern Laboratories, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. California Eastern Laboratories shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or systems manufactured by you.
8. Please contact a California Eastern Laboratories sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. California Eastern Laboratories and Renesas Electronics assume no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.
10. It is the responsibility of the buyer or distributor of California Eastern Laboratories, who distributes, disposes of, or otherwise places the Renesas Electronics product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, California Eastern Laboratories and Renesas Electronics assume no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of California Eastern Laboratories.
12. Please contact a California Eastern Laboratories sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

NOTE 1: "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

NOTE 2: "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

NOTE 3: Products and product information are subject to change without notice.

CEL Headquarters • 4590 Patrick Henry Drive, Santa Clara, CA 95054 • Phone (408) 919-2500 • www.cel.com

For a complete list of sales offices, representatives and distributors,
Please visit our website: www.cel.com/contactus