NEC

GaAs MES FET
NE72218

C to X BAND AMPLIFIER
C to X BAND OSC
N-CHANNEL GaAs MES FET

FEATURES

- High power gain in C to X band: G_S = 4.5 dB TYP. @ f = 12 GHz
- Gate length : L_g = 0.8 μm
- Gate width : W_g = 400 μm
- 4-pin super minimold package
- Tape & reel packaging only available

ORDERING INFORMATION

Part Number	Package	Supplying Form
NE72218-T1	4-pin super minimold	• 8 mm wide embossed taping • Pin 3 (Source), Pin 4 (Drain) face the perforation side of the tape • Qty 3 kpcs/reel
NE72218-T2		• 8 mm wide embossed taping • Pin 1 (Source), Pin 2 (Gate) face the perforation side of the tape • Qty 3 kpcs/reel

Remark To order evaluation samples, consult your NEC sales representative (Part number for sample order: NE72218).

ABSOLUTE MAXIMUM RATINGS (T_A = +25 °C)

Parameter	Symbol	Ratings	Unit
Drain to Source Voltage	V_{DS}	5.0	V
Gate to Source Voltage	V_{GS}	–5.0	V
Drain Current	I_D	I_{DSS}	mA
Total Power Dissipation	P_{tot}	250	mW
Channel Temperature	T_{ch}	125	°C
Storage Temperature	T_{stg}	–65 to +125	°C

Because this product uses high-frequency technology, avoid excessive static electricity, etc.

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The mark ★ shows major revised points.

ELECTRICAL CHARACTERISTICS (T_A = +25 °C)

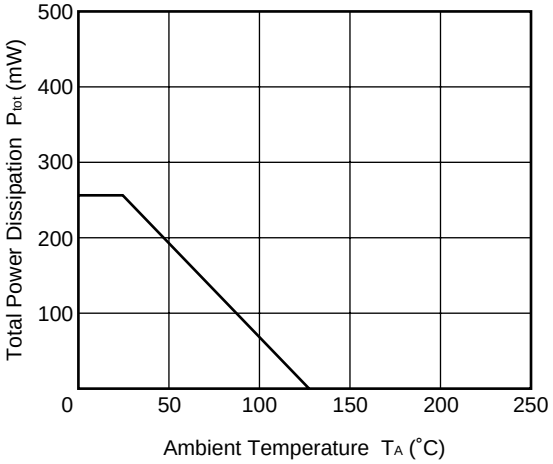
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Gate to Source Leak Current	I_{GSO}	V_{GS} = –5 V	–	1.0	10	μA
Saturated Drain Current	I_{DSS}	V_{DS} = 3 V, V_{GS} = 0 V	30	60	120	mA
Gate to Source Cutoff Voltage	$V_{GS (off)}$	V_{DS} = 3 V, I_D = 100 μA	–0.5	–2.0	–4.0	V
Transconductance	g_m	V_{DS} = 3 V, I_D = 30 mA	20	45	–	mS
Phase Noise	PN	V_{DS} = 3 V, I_D = 30 mA, f = 11 GHz, 100 kHz offset	–	–110	–	dBc/Hz
		V_{DS} = 3 V, I_D = 30 mA, f = 11 GHz, 10 kHz offset	–	–90	–	dBc/Hz
Power Gain	G_S	V_{DS} = 3 V, I_D = 30 mA, f = 12 GHz	–	4.5	–	dB
Output Power at 1 dB Gain Compression Point	$P_{O (1 dB)}$	V_{DS} = 3 V, I_D = 30 mA, f = 12 GHz	–	15.0	–	dBm

I_{DSS} CLASSIFICATION

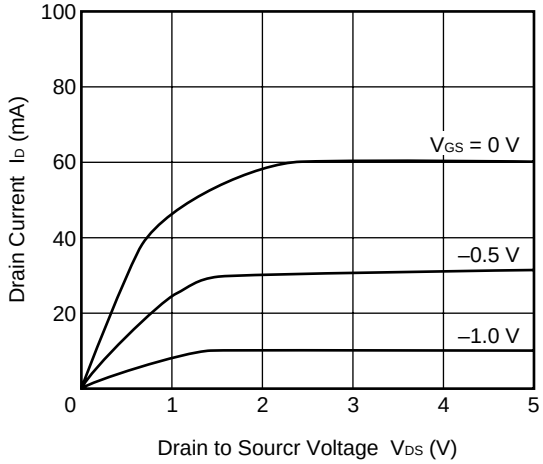
Rank	I_{DSS} (mA)	Marking
57	30 to 120	V57
58	65 to 120	V58
59	30 to 75	V59

TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25 °C)

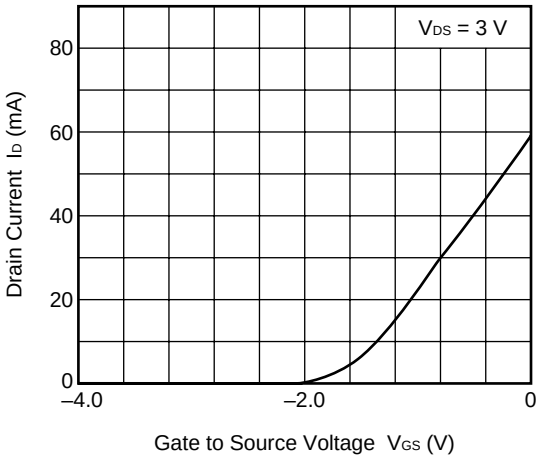
TOTAL POWER DISSIPATION vs.
AMBIENT TEMPERATURE



DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



DRAIN CURRENT vs.
GATE TO SOURCE VOLTAGE



Remark The graphs indicate nominal characteristics.

★ S-PARAMETERS
MAG. AND ANG.

V_{DS} = 3 V, I_D = 10 mA

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
2000	0.896	–41.7	2.732	135.1	0.067	62.7	0.709	–27.8
2500	0.849	–51.7	2.662	124.7	0.079	58.1	0.683	–34.1
3000	0.801	–62.1	2.623	114.4	0.091	52.2	0.657	–40.7
3500	0.741	–72.5	2.556	104.6	0.098	47.3	0.625	–46.9
4000	0.687	–83.1	2.484	95.1	0.105	43.8	0.594	–53.1
4500	0.630	–93.3	2.413	86.0	0.109	39.9	0.570	–59.3
5000	0.578	–103.7	2.337	76.9	0.114	37.7	0.549	–65.7
5500	0.534	–114.6	2.261	68.2	0.115	35.3	0.530	–71.7
6000	0.498	–126.0	2.186	59.7	0.117	35.0	0.512	–77.3
6500	0.466	–138.0	2.120	51.5	0.122	34.2	0.499	–81.8
7000	0.437	–151.0	2.050	43.3	0.125	33.5	0.476	–86.6
7500	0.411	–164.5	1.984	35.1	0.130	32.8	0.450	–91.7
8000	0.395	–177.9	1.923	27.3	0.135	34.4	0.423	–97.5
8500	0.395	167.8	1.877	19.2	0.148	33.4	0.402	–106.7
9000	0.408	152.7	1.822	10.8	0.160	31.6	0.381	–118.5
9500	0.435	138.7	1.763	2.1	0.175	29.8	0.377	–131.9
10000	0.477	125.5	1.700	–6.6	0.190	26.4	0.389	–146.7
10500	0.525	113.8	1.625	–15.2	0.203	22.3	0.410	–160.7
11000	0.572	103.8	1.538	–24.0	0.216	17.9	0.436	–174.4
11500	0.621	95.4	1.450	–32.9	0.228	12.5	0.457	172.5
12000	0.656	88.0	1.354	–41.2	0.237	6.5	0.472	160.0
12500	0.694	80.8	1.263	–49.5	0.244	0.2	0.484	146.1
13000	0.720	73.7	1.165	–58.1	0.248	–5.9	0.504	131.8
13500	0.744	66.6	1.070	–66.2	0.248	–12.0	0.543	118.3
14000	0.772	59.8	0.969	–74.2	0.247	–18.2	0.586	106.3
14500	0.803	52.6	0.869	–82.2	0.243	–24.5	0.645	97.0
15000	0.819	47.0	0.776	–88.5	0.235	–29.5	0.691	89.8
15500	0.837	42.5	0.696	–94.5	0.227	–34.5	0.734	84.4
16000	0.843	39.1	0.623	–99.9	0.222	–39.0	0.767	78.9
16500	0.848	36.8	0.557	–104.9	0.217	–43.0	0.784	73.2
17000	0.844	35.4	0.495	–109.7	0.211	–47.9	0.797	66.3
17500	0.847	33.2	0.444	–113.8	0.205	–51.7	0.802	58.7
18000	0.854	30.9	0.399	–117.7	0.195	–55.5	0.804	52.2

★ AMPLIFER PARAMETERS

V_{DS} = 3 V, I_D = 10 mA

Frequency	GUmax	GAmax	$\|S_{21}\|^2$	$\|S_{12}\|^2$	K	Delay	Mason's U	G1	G2
MHz	dB	dB	dB	dB		ns	dB	dB	dB
2000	18.83		8.73	–23.44	0.39	0.058	23.662	7.06	3.04
2500	16.76		8.50	–22.04	0.48	0.058	23.219	5.53	2.73
3000	15.28		8.38	–20.86	0.55	0.057	22.068	4.45	2.45
3500	13.77		8.15	–20.17	0.66	0.055	20.102	3.47	2.15
4000	12.57		7.90	–19.54	0.75	0.053	19.595	2.77	1.89
4500	11.55		7.65	–19.22	0.85	0.051	18.153	2.19	1.71
5000	10.70		7.37	–18.90	0.93	0.050	17.841	1.76	1.56
5500	9.97	11.96	7.09	–18.81	1.03	0.048	16.857	1.46	1.43
6000	9.35	10.83	6.79	–18.66	1.10	0.047	16.530	1.24	1.32
6500	8.83	10.19	6.53	–18.30	1.13	0.045	16.398	1.06	1.25
7000	8.27	9.42	6.23	–18.03	1.20	0.045	15.252	0.92	1.11
7500	7.74	8.74	5.95	–17.73	1.26	0.046	13.995	0.80	0.98
8000	7.27	8.19	5.68	–17.42	1.32	0.043	12.822	0.74	0.86
8500	6.97	7.99	5.47	–16.60	1.26	0.045	12.769	0.74	0.77
9000	6.68	7.78	5.21	–15.90	1.21	0.047	12.379	0.79	0.68
9500	6.50	7.81	4.93	–15.16	1.14	0.049	12.271	0.91	0.66
10000	6.44	8.34	4.61	–14.44	1.04	0.048	12.698	1.12	0.71
10500	6.41		4.22	–13.87	0.95	0.048	13.096	1.40	0.80
11000	6.38		3.74	–13.31	0.88	0.049	13.357	1.72	0.92
11500	6.36		3.23	–12.86	0.81	0.049	13.657	2.12	1.02
12000	6.17		2.63	–12.50	0.78	0.046	13.187	2.44	1.10
12500	6.04		2.03	–12.27	0.76	0.046	12.458	2.85	1.16
13000	5.76		1.33	–12.09	0.77	0.048	10.685	3.17	1.27
13500	5.60		0.59	–12.10	0.77	0.045	9.478	3.50	1.52
14000	5.48		–0.28	–12.14	0.76	0.044	8.699	3.93	1.83
14500	5.60		–1.22	–12.28	0.72	0.044	8.737	4.49	2.33
15000	5.44		–2.21	–12.59	0.71	0.035	8.174	4.82	2.82
15500	5.45		–3.15	–12.88	0.67	0.033	8.590	5.24	3.36
16000	5.14		–4.11	–13.08	0.65	0.030	8.343	5.39	3.86
16500	4.58		–5.09	–13.29	0.65	0.028	7.597	5.52	4.15
17000	3.67		–6.12	–13.51	0.68	0.026	6.421	5.40	4.38
17500	2.90		–7.05	–13.77	0.75	0.023	4.782	5.48	4.47
18000	2.21		–7.98	–14.20	0.82	0.022	3.605	5.67	4.52

★ S-PARAMETERS
MAG. AND ANG.

V_{DS} = 3 V, I_D = 30 mA

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
2000	0.869	–46.6	3.275	131.7	0.058	65.5	0.622	–27.0
2500	0.809	–57.6	3.152	120.9	0.069	61.8	0.595	–32.9
3000	0.751	–68.9	3.059	110.3	0.080	57.2	0.569	–39.1
3500	0.686	–80.0	2.935	100.4	0.087	53.4	0.539	–44.6
4000	0.628	–91.4	2.815	90.8	0.094	51.0	0.514	–50.2
4500	0.571	–102.5	2.703	81.7	0.099	48.7	0.495	–56.0
5000	0.521	–113.8	2.589	72.8	0.105	47.6	0.477	–62.4
5500	0.477	–125.9	2.477	64.2	0.111	46.5	0.462	–67.9
6000	0.445	–137.9	2.373	55.9	0.116	46.0	0.450	–73.5
6500	0.421	–150.6	2.283	48.0	0.124	45.3	0.442	–77.7
7000	0.400	–164.3	2.193	40.1	0.132	43.9	0.423	–82.7
7500	0.384	–178.6	2.106	32.2	0.141	42.3	0.399	–87.5
8000	0.377	168.0	2.034	24.6	0.152	41.8	0.375	–93.2
8500	0.390	154.1	1.971	16.8	0.167	39.7	0.355	–102.6
9000	0.415	140.2	1.907	8.6	0.180	36.9	0.334	–115.1
9500	0.451	127.5	1.839	0.5	0.197	32.8	0.326	–130.0
10000	0.498	115.8	1.765	–8.0	0.211	28.7	0.340	–145.9
10500	0.551	105.5	1.680	–16.5	0.227	23.7	0.361	–161.6
11000	0.598	96.7	1.589	–24.7	0.238	18.1	0.388	–175.8
11500	0.645	89.2	1.499	–33.2	0.248	12.4	0.408	170.2
12000	0.678	82.5	1.401	–41.1	0.256	6.5	0.424	157.2
12500	0.717	75.9	1.309	–49.1	0.262	0.1	0.440	142.9
13000	0.740	69.1	1.210	–57.3	0.267	–6.8	0.463	128.4
13500	0.766	62.3	1.112	–65.4	0.262	–12.6	0.503	115.3
14000	0.793	55.7	1.015	–73.2	0.261	–18.9	0.551	103.4
14500	0.822	49.1	0.916	–80.8	0.253	–25.5	0.613	94.6
15000	0.838	43.8	0.818	–87.3	0.246	–30.0	0.662	88.1
15500	0.849	39.6	0.741	–93.0	0.239	–35.2	0.703	82.9
16000	0.855	36.2	0.664	–98.7	0.229	–39.9	0.740	77.7
16500	0.856	34.2	0.599	–103.7	0.225	–43.8	0.760	72.1
17000	0.851	32.8	0.535	–108.5	0.219	–48.4	0.774	65.3
17500	0.850	30.7	0.481	–112.9	0.213	–51.7	0.782	57.7
18000	0.856	28.6	0.432	–116.9	0.206	–56.3	0.787	51.6

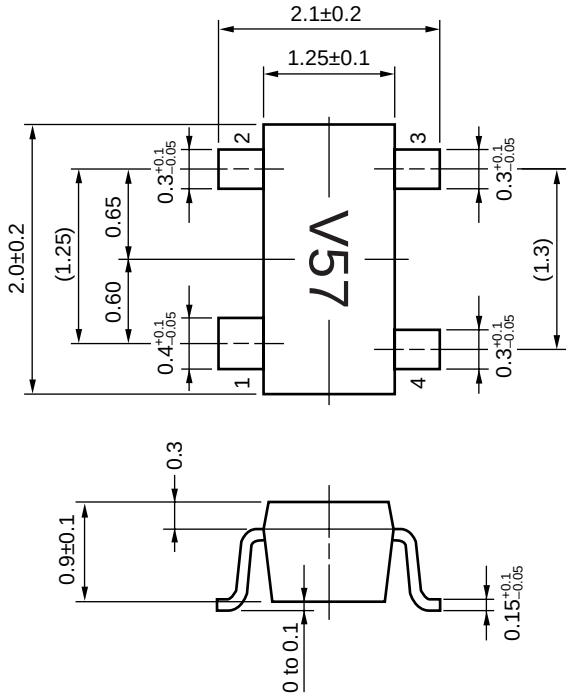
★ AMPLIFER PARAMETERS

V_{DS} = 3 V, I_D = 30 mA

Frequency	GUmax	GAmax	$\|S_{21}\|^2$	$\|S_{12}\|^2$	K	Delay	Mason's U	G1	G2
MHz	dB	dB	dB	dB		ns	dB	dB	dB
2000	18.54		10.30	–24.67	0.48	0.060	25.559	6.11	2.12
2500	16.47		9.97	–23.20	0.60	0.060	24.322	4.61	1.90
3000	15.02		9.71	–21.98	0.69	0.059	23.374	3.61	1.70
3500	13.60		9.35	–21.17	0.81	0.055	21.140	2.76	1.49
4000	12.50		8.99	–20.56	0.90	0.053	20.302	2.18	1.33
4500	11.56		8.64	–20.06	0.99	0.051	19.221	1.71	1.22
5000	10.76	12.40	8.26	–19.60	1.06	0.049	18.623	1.37	1.12
5500	10.04	11.39	7.88	–19.13	1.12	0.048	17.853	1.12	1.04
6000	9.45	10.67	7.51	–18.71	1.16	0.046	17.191	0.96	0.98
6500	8.96	10.19	7.17	–18.14	1.17	0.044	16.934	0.85	0.94
7000	8.43	9.57	6.82	–17.61	1.19	0.044	15.809	0.76	0.85
7500	7.92	8.97	6.47	–17.02	1.21	0.044	14.584	0.69	0.75
8000	7.49	8.51	6.16	–16.35	1.21	0.042	13.608	0.67	0.66
8500	7.20	8.35	5.90	–15.54	1.15	0.043	13.377	0.72	0.58
9000	6.94	8.21	5.61	–14.89	1.11	0.045	12.848	0.82	0.51
9500	6.77	8.40	5.29	–14.13	1.05	0.045	12.873	0.99	0.49
10000	6.70		4.93	–13.50	0.97	0.047	13.036	1.24	0.53
10500	6.69		4.51	–12.89	0.90	0.047	13.577	1.57	0.61
11000	6.66		4.03	–12.48	0.84	0.046	13.958	1.93	0.71
11500	6.64		3.52	–12.10	0.79	0.047	14.098	2.34	0.79
12000	6.47		2.93	–11.85	0.78	0.044	13.272	2.68	0.86
12500	6.40		2.34	–11.65	0.76	0.044	12.821	3.13	0.94
13000	6.15		1.66	–11.48	0.76	0.046	11.382	3.45	1.05
13500	6.03		0.92	–11.64	0.77	0.045	9.915	3.84	1.27
14000	6.01		0.13	–11.66	0.76	0.043	9.245	4.31	1.57
14500	6.16		–0.77	–11.93	0.72	0.043	9.477	4.88	2.05
15000	6.01		–1.74	–12.18	0.71	0.036	8.623	5.25	2.50
15500	5.91		–2.60	–12.43	0.68	0.032	8.952	5.55	2.96
16000	5.59		–3.56	–12.80	0.67	0.032	8.694	5.71	3.44
16500	5.03		–4.45	–12.95	0.67	0.028	7.908	5.74	3.74
17000	4.13		–5.43	–13.17	0.70	0.027	6.599	5.60	3.96
17500	3.31		–6.35	–13.43	0.77	0.024	4.769	5.56	4.10
18000	2.63		–7.29	–13.73	0.81	0.022	3.979	5.72	4.20

PACKAGE DIMENSIONS

4-PIN SUPER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

1. Source
2. Gate
3. Source
4. Drain

PRECAUTION

(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.
- Fix V_{GS} 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 and mounted 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: 235 °C or below, Time: 30 seconds or less (at 210 °C or higher), Count: 3 times or less, Exposure limit: None[Note]	IR35-00-3
VPS	Package peak temperature: 215 °C or below, Time: 40 seconds or less (at 200 °C or higher), Count: 3 times or less, Exposure limit: None[Note]	VP15-00-3
Wave Soldering	Soldering bath temperature: 260 °C or below, Time: 10 seconds or less, Count: 1 time, Exposure limit: None[Note]	WS60-00-1
Partial Heating	Pin temperature: 230 °C or below, Time: 10 seconds or less (per pin row), Exposure limit: None[Note]	–

Note After opening the dry pack, store it at 25 °C or less and 65 % RH or less for the allowable storage period.

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

For the details the recommended soldering conditions, refer to the document **SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E)**.

[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.