DATA SHEET

NEC

GaAs MES FET

NE76184A

GENERAL PURPOSE FET N-CHANNEL GaAs MES FET

DESCRIPTION

NE76184A is a N-channel GaAs MES FET housed in ceramic package. The device is fabricated by ion implantation for improved RF and DC performance reliability and uniformity. Its excellent low noise and high associated gain make it suitable for DBS, TVRO, GPS and another commercial systems.

FEATURES

- Low noise figure & High associated gain
  NF = 0.8 dB TYP., G_a = 12 dB TYP. at f = 4 GHz

ORDERING INFORMATION

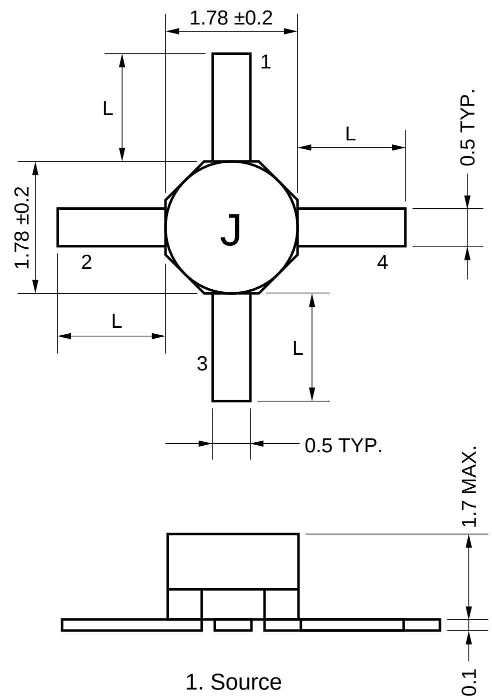
PART NUMBER	SUPPLYING FORM	LEAD LENGTH
NE76184A-SL	STICK	L = 1.7 mm MIN.
NE76184A-T1 NE76184A-T1A	Tape & reel	L = 1.0 ± 0.2 mm

ABSOLUTE MAXIMUM RATINGS (T_A = 25 ˚C)

Drain to Source Voltage	V_{DS}	5.0	V
Gate to Source Voltage	V_{GSO}	–5.0	V
Gate to Drain Voltage	V_{GDO}	–6.0	V
Drain Current	I_D	100	mA
Total Power Dissipation	P_{tot}	300	mW
Channel Temperature	T_{ch}	150	˚C
Storage Temperature	T_{stg}	–65 to +150	˚C

PACKAGE DIMENSIONS

(Unit: mm)



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

ELECTRICAL CHARACTERISTICS (T_A = 25 ˚C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS	
Gate to Source Leak Current	I_{GSO}	–	–	10	μA	V_{GS} = –5 V	
Saturated Drain Current	I_{DSS}	30	–	100	mA	V_{DS} = 3 V, V_{GS} = 0	
Gate to Source Cutoff Voltage	$V_{GS (off)}$	–0.5	–	–3.0	V	V_{DS} = 3 V, I_D = 100 μA	
Transconductance	g_m	20	45	–	mS	V_{DS} = 3 V, I_D = 10 mA	
Noise Figure	NF	–	0.8	1.4	dB	V_{DD} = 3 V I_D = 10 mA	f = 4 GHz
Associated Gain	G_a	–	12	–	dB		
Power Gain	G_s	–	6	–	dB		f = 12 GHz

I_{DSS} rank is specified as follows. (K: 30 to 100 mA, N: 30 to 65 mA, M: 55 to 100 mA)

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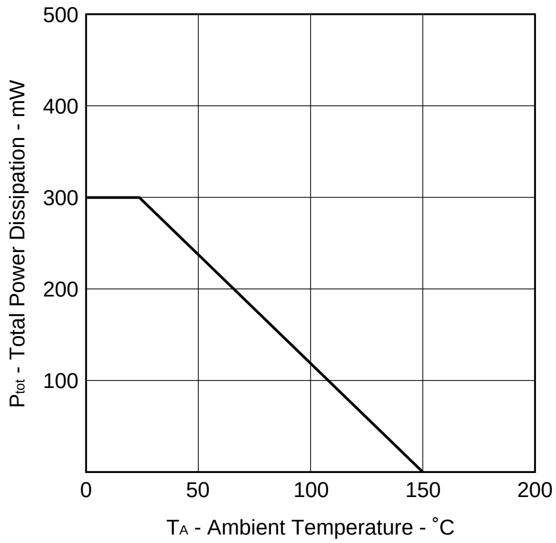
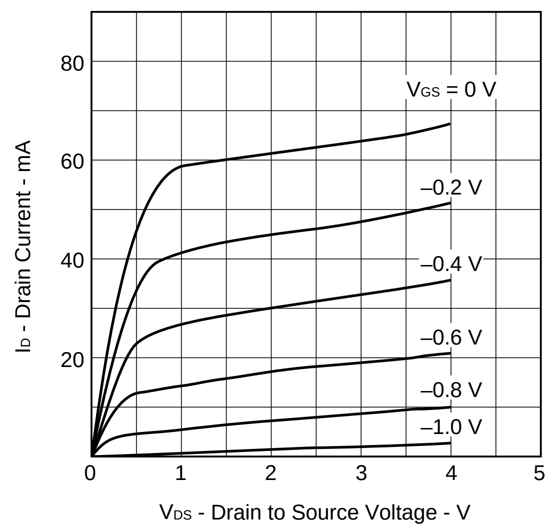
TYPICAL CHARACTERISTICS (T_A = 25 ˚C)

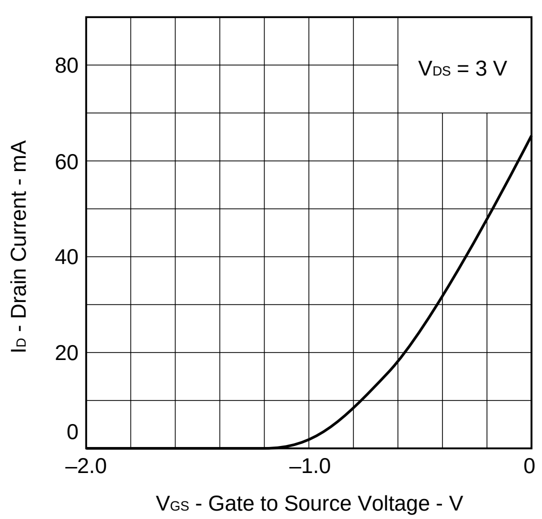
TOTAL POWER DISSIPATION vs.
AMBIENT TEMPERATURE



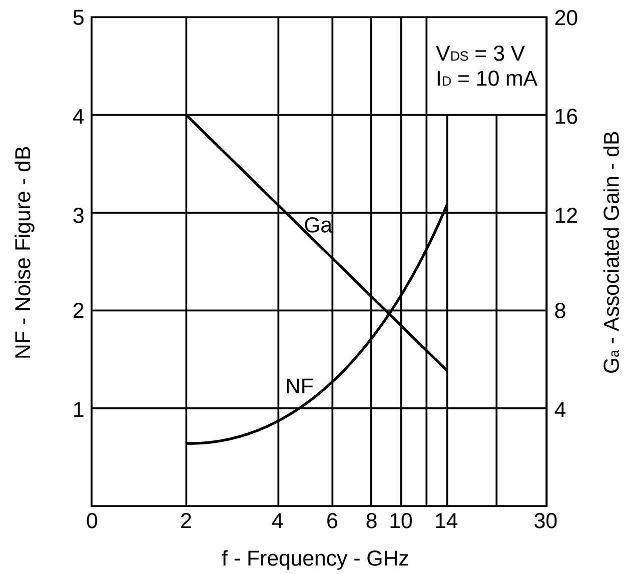
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



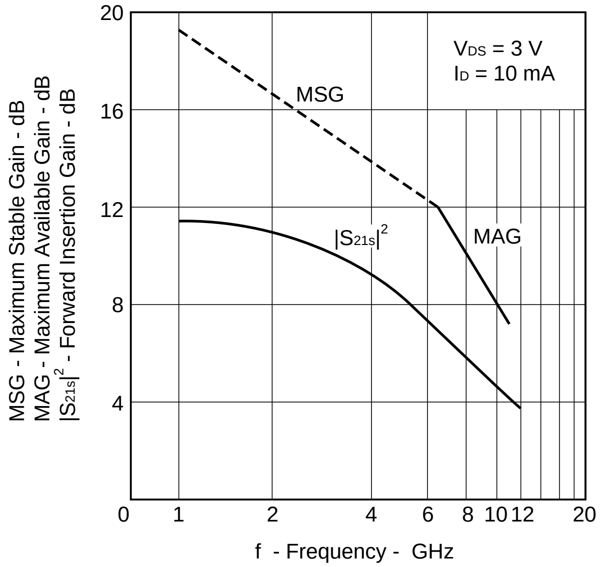
DRAIN CURRENT vs.
GATE TO SOURCE VOLTAGE



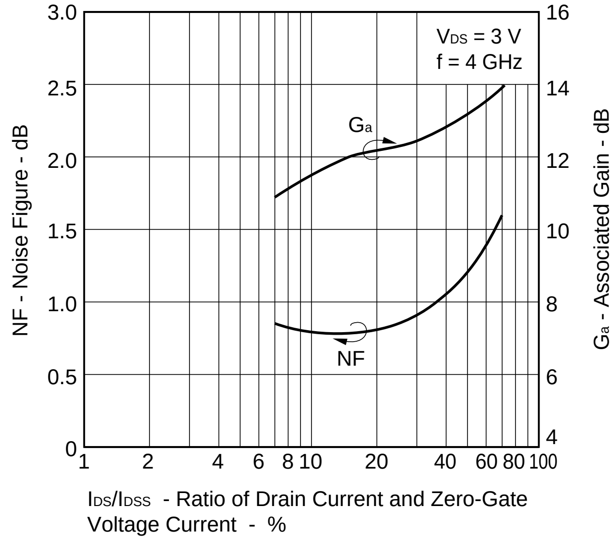
NOISE FIGURE, ASSOCIATED GAIN vs.
FREQUENCY



MAXIMUM AVAILABLE GAIN, FORWARD INSERTION GAIN vs. FREQUENCY



NOISE FIGURE, ASSOCIATED GAIN vs. RATIO OF DRAIN CURRENT AND ZERO-GATE VOLTAGE CURRENT

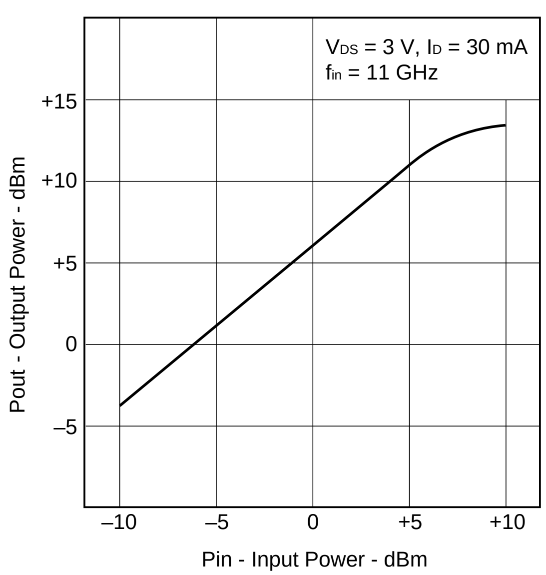


Gain Calculations

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

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

OUTPUT POWER vs. INPUT POWER

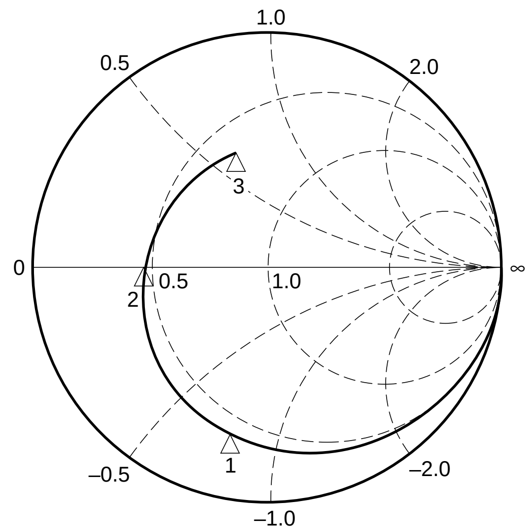


S-PARAMETERS

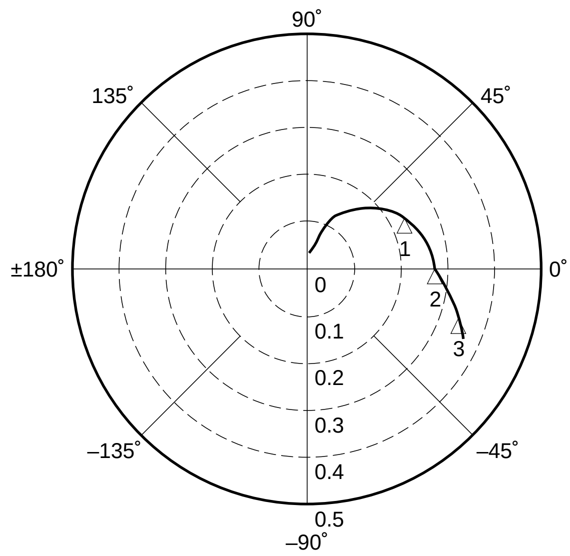
V_{DS} = 3 V, I_D = 10 mA

START 500 MHz STOP 12 GHz STEP 500 MHz

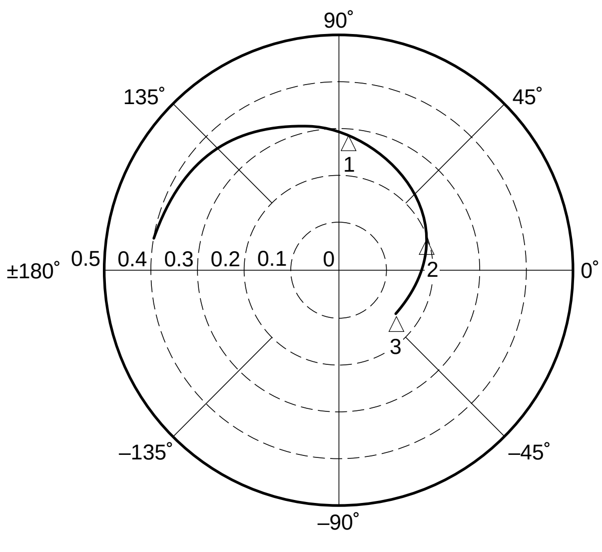
S_{11}



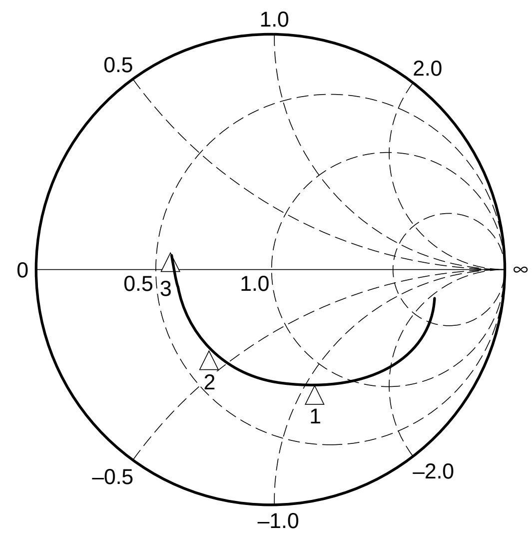
S_{12}



S_{21}



S_{22}



Marker

1. 4 GHz
2. 8 GHz
3. 12 GHz

S-PARAMETER

MAG. AND ANG.

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

FREQUENCY	S11		S21		S12		S22	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
500.0000	0.993	–14.4	3.919	166.5	0.022	80.3	0.716	–9.9
1000.0000	0.971	–28.4	3.820	153.5	0.042	71.6	0.702	–19.1
1500.0000	0.936	–41.9	3.714	140.9	0.061	62.0	0.682	–28.2
2000.0000	0.896	–54.8	3.562	129.0	0.079	54.1	0.652	–36.8
2500.0000	0.850	–67.4	3.388	117.8	0.092	46.4	0.623	–44.8
3000.0000	0.808	–79.4	3.238	107.0	0.103	39.9	0.592	–52.6
3500.0000	0.761	–91.3	3.069	96.4	0.112	33.5	0.563	–60.9
4000.0000	0.720	–102.7	2.909	86.4	0.120	27.5	0.533	–68.1
4500.0000	0.681	–113.9	2.765	77.0	0.125	22.2	0.501	–75.7
5000.0000	0.647	–124.4	2.623	67.9	0.127	17.6	0.475	–83.5
5500.0000	0.615	–134.9	2.485	59.1	0.131	13.6	0.454	–91.4
6000.0000	0.588	–144.8	2.365	50.7	0.131	9.6	0.437	–98.9
6500.0000	0.566	–154.5	2.252	42.6	0.133	6.5	0.425	–107.1
7000.0000	0.547	–163.6	2.151	34.7	0.135	3.7	0.418	–114.4
7500.0000	0.531	–172.4	2.064	27.3	0.136	1.9	0.414	–121.8
8000.0000	0.517	178.7	1.985	19.6	0.139	–0.8	0.415	–129.3
8500.0000	0.503	169.6	1.909	12.2	0.141	–3.0	0.418	–136.4
9000.0000	0.492	160.5	1.843	5.0	0.143	–5.3	0.418	–143.7
9500.0000	0.482	151.1	1.783	–2.5	0.148	–7.3	0.417	–151.0
10000.0000	0.475	141.3	1.726	–9.6	0.152	–9.4	0.419	–158.4
10500.0000	0.475	131.5	1.668	–17.0	0.156	–11.3	0.418	–166.4
11000.0000	0.477	121.6	1.613	–23.8	0.160	–13.8	0.421	–174.2
11500.0000	0.481	112.1	1.554	–31.0	0.165	–16.2	0.431	177.3
12000.0000	0.489	102.7	1.503	–38.0	0.170	–18.8	0.441	169.6

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

FREQUENCY	S11		S21		S12		S22	
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
500.0000	0.990	–16.6	5.304	165.1	0.019	79.5	0.617	–10.3
1000.0000	0.957	–32.6	5.115	150.9	0.037	71.5	0.599	–19.9
1500.0000	0.911	–47.6	4.866	137.4	0.052	62.3	0.577	–28.9
2000.0000	0.860	–62.0	4.587	124.8	0.065	55.0	0.545	–37.4
2500.0000	0.805	–75.5	4.282	113.3	0.075	48.7	0.515	–44.9
3000.0000	0.755	–88.4	4.009	102.5	0.085	42.9	0.485	–52.1
3500.0000	0.707	–100.7	3.741	92.1	0.092	38.2	0.456	–59.4
4000.0000	0.663	–112.5	3.493	82.3	0.097	33.6	0.431	–66.6
4500.0000	0.626	–124.0	3.275	73.3	0.103	30.2	0.404	–73.7
5000.0000	0.594	–134.8	3.078	64.5	0.107	26.7	0.382	–81.2
5500.0000	0.566	–145.4	2.888	56.2	0.110	23.3	0.365	–88.5
6000.0000	0.546	–155.4	2.729	48.2	0.114	21.3	0.351	–96.3
6500.0000	0.528	–165.1	2.581	40.6	0.118	18.6	0.343	–104.1
7000.0000	0.513	–174.3	2.455	33.0	0.122	17.1	0.339	–111.7
7500.0000	0.501	176.9	2.344	25.8	0.128	14.8	0.340	–119.3
8000.0000	0.490	167.9	2.242	18.5	0.133	13.1	0.343	–126.8
8500.0000	0.480	158.9	2.151	11.3	0.139	10.6	0.350	–133.8
9000.0000	0.472	149.8	2.069	4.2	0.147	7.6	0.350	–141.3
9500.0000	0.466	140.6	1.997	–2.7	0.153	5.5	0.352	–148.9
10000.0000	0.465	130.8	1.924	–9.7	0.161	2.2	0.355	–156.2
10500.0000	0.468	121.2	1.855	–16.8	0.168	–0.6	0.357	–165.0
11000.0000	0.476	112.0	1.791	–23.4	0.175	–4.6	0.363	–173.1
11500.0000	0.483	102.7	1.727	–30.4	0.182	–7.6	0.373	178.2
12000.0000	0.494	93.9	1.665	–37.2	0.189	–10.6	0.385	169.9

AMP PARAMETERS

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

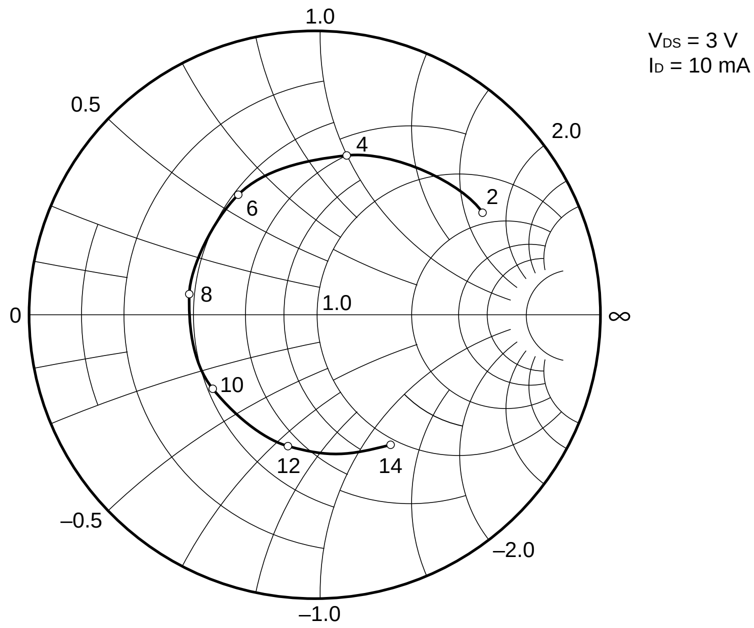
FREQUENCY MHz	$GU_{max.}$ dB	$GA_{max.}$ dB	$\lvert S_{21}\rvert^2$ dB	$\lvert S_{12}\rvert^2$ dB	K	Delay ns	Mason's U dB	G_1 dB	G_2 dB
500.0000	33.77		11.86	–33.16	0.07	0.072	49.375	18.78	3.13
1000.0000	27.00		11.64	–27.43	0.14	0.072		12.40	2.95
1500.0000	23.21		11.40	–24.28	0.23	0.070	29.663	9.10	2.72
2000.0000	20.48		11.03	–22.09	0.30	0.066	28.208	7.04	2.41
2500.0000	18.30		10.60	–20.74	0.37	0.062	25.690	5.57	2.14
3000.0000	16.68		10.21	–19.78	0.43	0.060	25.762	4.60	1.88
3500.0000	15.16		9.74	–18.99	0.50	0.059	24.501	3.76	1.66
4000.0000	13.90		9.28	–18.42	0.57	0.056	23.383	3.17	1.45
4500.0000	12.80		8.83	–18.06	0.64	0.052	21.885	2.71	1.25
5000.0000	11.84		8.38	–17.91	0.72	0.051	20.810	2.35	1.11
5500.0000	10.97		7.91	–17.68	0.79	0.049	20.093	2.06	1.00
6000.0000	10.24		7.48	–17.62	0.86	0.046	18.766	1.84	0.92
6500.0000	9.59		7.05	–17.50	0.92	0.045	18.307	1.67	0.86
7000.0000	9.03		6.65	–17.40	0.98	0.044	17.776	1.54	0.84
7500.0000	8.55	10.85	6.29	–17.35	1.03	0.041	17.422	1.44	0.82
8000.0000	8.13	10.17	5.95	–17.13	1.05	0.042	17.410	1.35	0.82
8500.0000	7.72	9.49	5.62	–17.05	1.09	0.041	16.680	1.27	0.83
9000.0000	7.35	8.99	5.31	–16.87	1.12	0.040	16.073	1.20	0.84
9500.0000	7.00	8.57	5.02	–16.60	1.14	0.042	15.587	1.15	0.83
10000.0000	6.69	8.20	4.74	–16.38	1.15	0.040	14.945	1.11	0.84
10500.0000	6.39	7.84	4.44	–16.16	1.16	0.041	14.161	1.11	0.83
11000.0000	6.12	7.58	4.16	–15.89	1.16	0.038	13.620	1.12	0.85
11500.0000	5.86	7.31	3.83	–15.67	1.16	0.040	12.913	1.14	0.89
12000.0000	5.67	7.19	3.54	–15.37	1.14	0.039	12.582	1.19	0.94

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

FREQUENCY MHz	$GU_{max.}$ dB	$GA_{max.}$ dB	$\lvert S_{21}\rvert^2$ dB	$\lvert S_{12}\rvert^2$ dB	K	Delay ns	Mason's U dB	G_1 dB	G_2 dB
500.0000	33.74		14.49	–34.36	0.09	0.079	38.817	17.17	2.08
1000.0000	26.88		14.18	–28.71	0.19	0.079	41.142	10.77	1.93
1500.0000	23.20		13.74	–25.66	0.29	0.075	31.251	7.71	1.75
2000.0000	20.60		13.23	–23.68	0.38	0.070	29.809	5.84	1.53
2500.0000	18.51		12.63	–22.51	0.47	0.064	27.934	4.53	1.34
3000.0000	16.90		12.06	–21.42	0.55	0.060	27.066	3.67	1.16
3500.0000	15.48		11.46	–20.70	0.63	0.058	26.502	3.00	1.01
4000.0000	14.27		10.86	–20.27	0.72	0.054	24.356	2.51	0.89
4500.0000	13.24		10.30	–19.73	0.79	0.050	24.031	2.16	0.77
5000.0000	12.34		9.76	–19.43	0.87	0.048	22.392	1.89	0.69
5500.0000	11.51		9.21	–19.15	0.94	0.047	20.841	1.68	0.62
6000.0000	10.83		8.72	–18.90	1.00	0.044	20.194	1.54	0.57
6500.0000	10.19	12.13	8.24	–18.55	1.04	0.042	19.396	1.42	0.54
7000.0000	9.66	11.34	7.80	–18.25	1.08	0.042	19.008	1.33	0.53
7500.0000	9.16	10.79	7.40	–17.85	1.09	0.040	18.783	1.26	0.53
8000.0000	8.75	10.29	7.01	–17.50	1.10	0.040	18.372	1.19	0.55
8500.0000	8.35	9.85	6.65	–17.17	1.12	0.040	17.707	1.14	0.57
9000.0000	7.98	9.48	6.32	–16.68	1.11	0.039	17.361	1.10	0.57
9500.0000	7.65	9.10	6.01	–16.32	1.11	0.039	16.512	1.07	0.57
10000.0000	7.33	8.81	5.68	–15.87	1.10	0.039	16.047	1.06	0.59
10500.0000	7.03	8.50	5.37	–15.51	1.10	0.039	15.174	1.07	0.59
11000.0000	6.79	8.33	5.06	–15.16	1.09	0.037	14.844	1.11	0.61
11500.0000	6.55	8.15	4.75	–14.80	1.07	0.039	14.143	1.16	0.65
12000.0000	6.34	8.02	4.43	–14.48	1.05	0.038	13.483	1.22	0.70

NOISE PARAMETERS

<$\Gamma_{opt.}$ vs. frequency>



START 2 GHz, STOP 14 GHz, STEP 2 GHz

<Noise Parameter>

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

Freq. (GHz)	$NF_{MIN.}$ (dB)	G_a (dB)	$\Gamma_{opt.}$ MAG.	$\Gamma_{opt.}$ ANG.(deg.)	$R_n/50$
2.0	0.65	16.0	0.75	37	0.52
4.0	0.80	12.2	0.66	78	0.42
6.0	1.25	10.3	0.56	124	0.33
8.0	1.75	8.5	0.49	166	0.20
10.0	2.10	7.6	0.47	–151	0.28
12.0	2.65	6.5	0.45	–112	0.49
14.0	3.20	5.5	0.46	–64	0.56

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

<TYPES OF SURFACE MOUNT DEVICE>

For more details, refer to our document “SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL” (IEI-1207).

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package’s surface temperature: 230 ˚C or below, Reflow time: 30 seconds or below (210 ˚C or higher), Number of reflow process: 1, Exposure limit*: None	IR30-00
Partial heating method	Terminal temperature: 230 ˚C or below, Flow time: 10 seconds or below, Exposure limit*: None	

***** Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 ˚C and relative humidity at 65 % or less.

Note Do not apply more than a single process at once, except for “Partial heating method”.

PRECAUTION Avoid high static voltage and electric fields, because this device is MES FET with GaAs shottky barrier gate.

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 Japanese law concerned.
Keep the Japanese law concerned and so on, especially in case of removal.

[MEMO]