

C to Ku BAND LOW NOISE AMPLIFIER  
N-CHANNEL GaAs MES FET

FEATURES

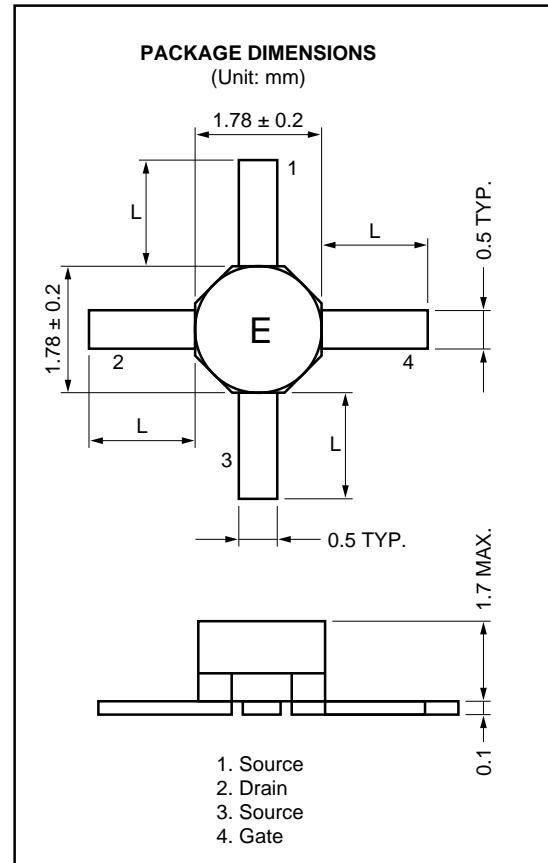
- Low noise figure & High associated gain  
NF = 1.6 dB TYP., Ga = 9.0 dB TYP. at f = 12 GHz
- Gate length:  $L_g = 0.3 \mu\text{m}$
- Gate width :  $W_g = 280 \mu\text{m}$

ORDERING INFORMATION

PART NUMBER	SUPPLYING FORM	LEAD LENGTH	MARKING
NE76084-SL	STICK	L = 1.7 mm MIN.	E
NE76084-T1	Tape & reel 1000 pcs./reel	L = $1.0 \pm 0.2$ mm	
NE76084-T1A	Tape & reel 5000 pcs./reel	L = $1.0 \pm 0.2$ mm	

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

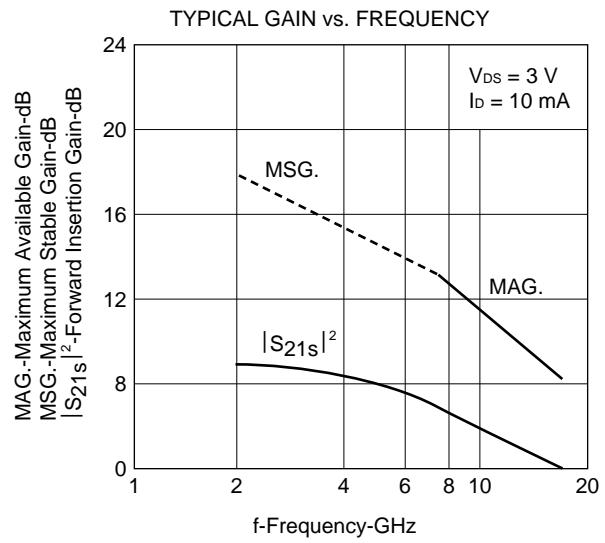
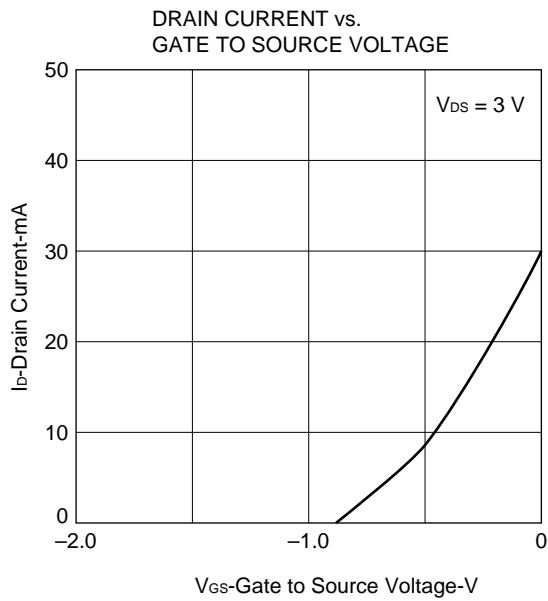
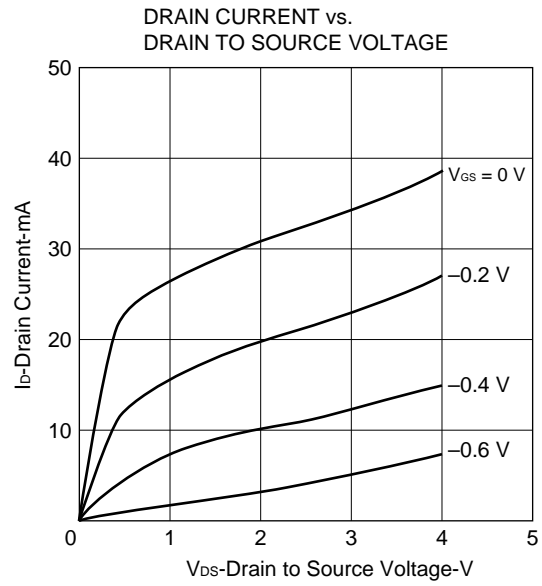
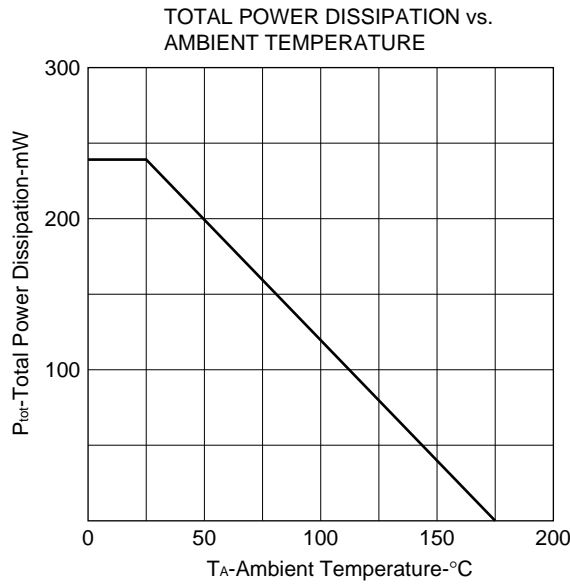
Drain to Source Voltage	$V_{DS}$	5.0	V
Gate to Source Voltage	$V_{GS}$	-3.0	V
Gate to Drain Voltage	$V_{GD}$	-5.0	V
Drain Current	$I_D$	$I_{DSS}$	mA
Total Power Dissipation	$P_{tot}$	240	mW
Channel Temperature	$T_{ch}$	175	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-65 to +175	$^\circ\text{C}$



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

PART NUMBER		NE76084			NE76084-2.4			UNIT	TEST CONDITIONS
PACKAGE CODE		84			84				
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
Gate to Source Leak Current	$I_{GSO}$			10			10	$\mu\text{A}$	$V_{GS} = -4 \text{ V}$
Saturated Drain Current	$I_{DSS}$	15	30	50	15	30	50	mA	$V_{DS} = 3 \text{ V}, V_{GS} = 0 \text{ V}$
Gate to Source Cutoff Voltage	$V_{GS(off)}$	-0.5	-0.8	-3.0	-0.5	-0.8	-3.0	V	$V_{DS} = 3 \text{ V}, I_{DS} = 100 \mu\text{A}$
Transconductance	$g_m$	30	40	70	30	40	70	mS	$V_{DS} = 3 \text{ V}, I_{DS} = 10 \text{ mA}$
Noise Figure	NF		1.6	1.8		1.8	2.4	dB	$V_{DS} = 3 \text{ V}, I_{DS} = 10 \text{ mA}$
Associated Gain	Ga	8.0	9.0		8.0	9.0		dB	f = 12 GHz

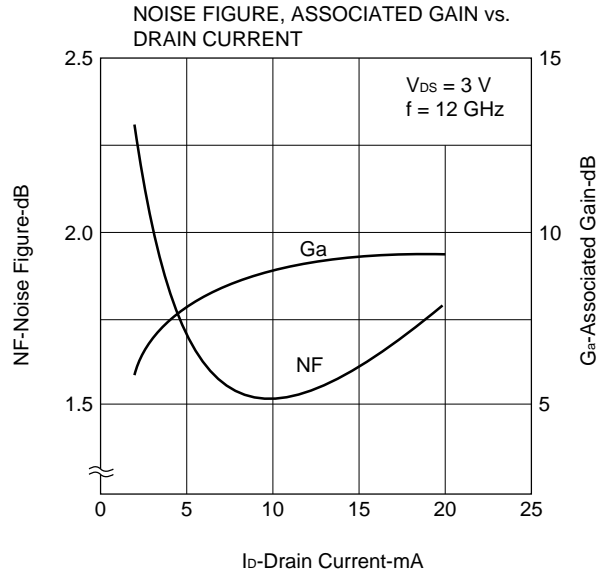
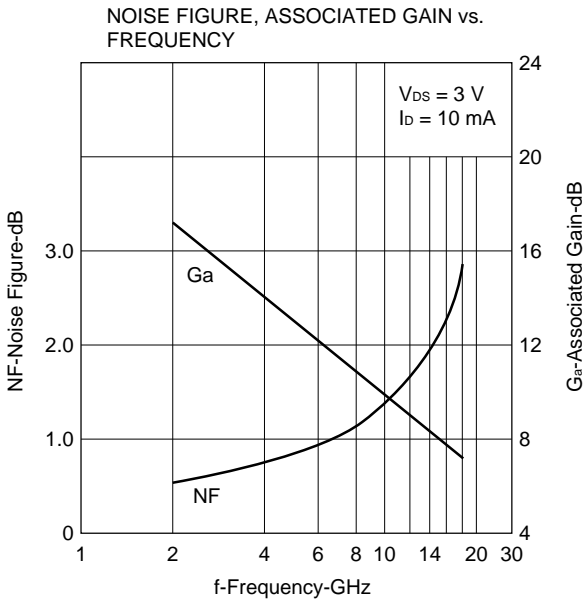
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)



Gain Calculations

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

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

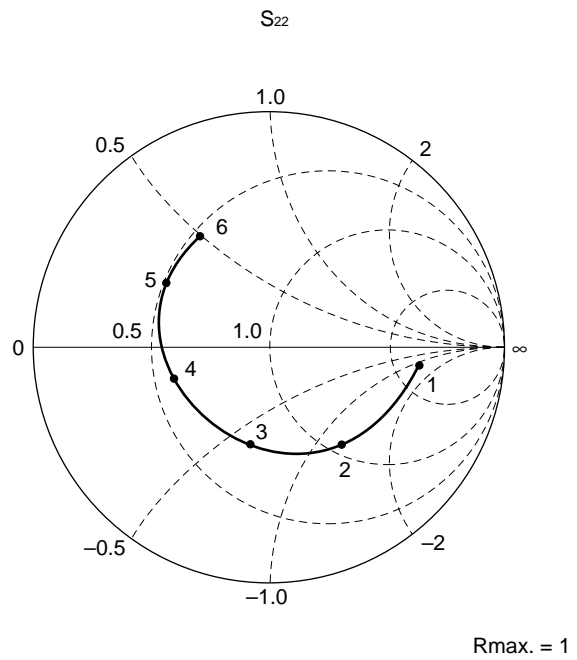
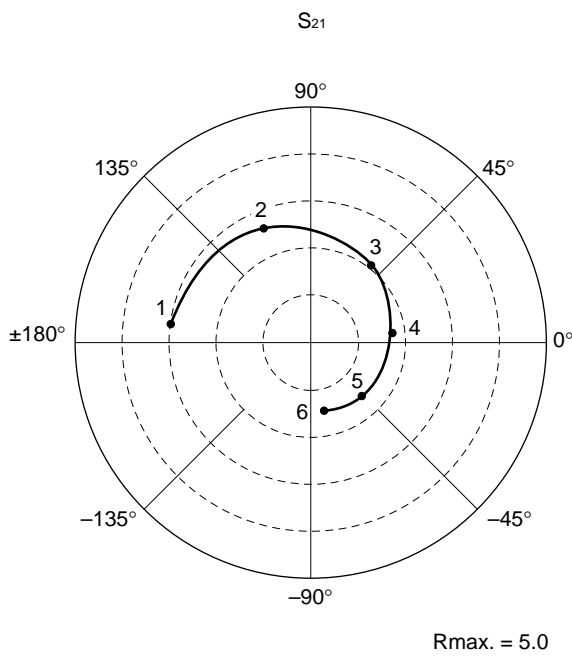
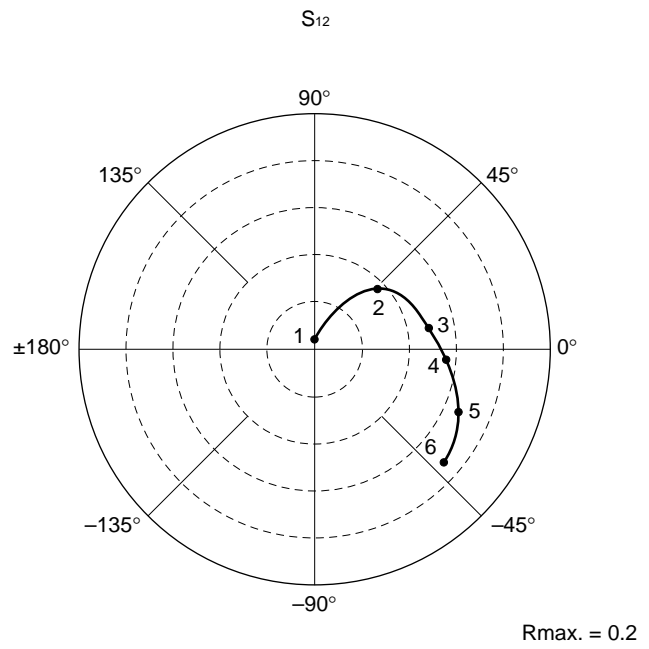
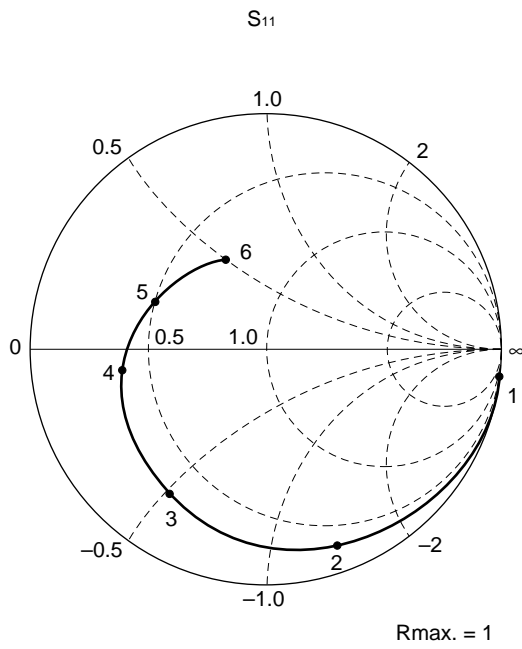


S-PARAMETERS

$V_{DS} = 3\text{ V}$ ,  $I_D = 10\text{ mA}$

START 500 MHz, STOP 18 GHz, STEP 500 MHz

- Marker  
 1: 500 MHz  
 2: 4 GHz  
 3: 8 GHz  
 4: 12 GHz  
 5: 16 GHz  
 6: 18 GHz



S-PARAMETERS

V<sub>DS</sub> = 3 V, I<sub>D</sub> = 10 mA

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
500	0.997	-9.4	2.917	170.5	0.012	83.2	0.620	-7.0
1000	0.989	-18.5	2.890	161.3	0.023	76.9	0.615	-13.9
1500	0.977	-27.6	2.853	152.2	0.034	70.6	0.607	-20.8
2000	0.960	-36.4	2.802	143.4	0.044	64.6	0.596	-27.4
2500	0.942	-44.9	2.749	134.8	0.053	58.9	0.584	-34.1
3000	0.923	-53.4	2.694	126.3	0.062	53.3	0.571	-40.8
3500	0.902	-61.7	2.638	118.0	0.069	47.9	0.556	-47.2
4000	0.879	-69.8	2.571	109.8	0.075	42.8	0.541	-54.0
4500	0.857	-77.6	2.507	101.8	0.081	38.0	0.524	-60.4
5000	0.834	-85.3	2.437	94.1	0.085	33.5	0.509	-67.0
5500	0.812	-92.8	2.371	86.4	0.089	29.2	0.493	-73.8
6000	0.792	-99.9	2.299	79.1	0.092	25.0	0.482	-80.5
6500	0.773	-106.6	2.231	71.9	0.094	21.5	0.468	-87.4
7000	0.756	-113.0	2.167	65.0	0.095	18.2	0.460	-93.9
7500	0.742	-119.1	2.106	58.4	0.096	15.2	0.452	-100.6
8000	0.728	-124.8	2.054	51.9	0.097	12.7	0.446	-107.1
8500	0.714	-130.3	2.004	45.5	0.098	10.3	0.443	-113.7
9000	0.700	-135.8	1.963	39.2	0.099	8.2	0.438	-119.7
9500	0.687	-141.1	1.927	33.0	0.100	6.3	0.438	-126.2
10000	0.673	-146.6	1.891	26.7	0.102	4.3	0.435	-133.0
10500	0.658	-151.9	1.858	20.5	0.102	2.2	0.437	-139.7
11000	0.644	-157.4	1.826	14.3	0.104	0.5	0.436	-146.8
11500	0.630	-162.9	1.792	8.1	0.105	-1.3	0.438	-153.5
12000	0.617	-168.4	1.765	2.1	0.107	-3.0	0.441	-160.4
12500	0.605	-173.7	1.736	-4.0	0.108	-4.6	0.446	-167.3
13000	0.592	-179.1	1.710	-10.0	0.110	-6.6	0.456	-173.8
13500	0.580	175.6	1.688	-16.0	0.113	-8.5	0.461	-180.0
14000	0.566	170.3	1.671	-22.2	0.116	-10.6	0.473	174.2
14500	0.552	164.7	1.658	-28.2	0.119	-13.3	0.480	167.8
15000	0.537	158.9	1.642	-34.6	0.123	-15.9	0.494	162.3
15500	0.519	152.7	1.634	-41.0	0.126	-19.1	0.505	155.5
16000	0.500	146.2	1.617	-47.5	0.130	-22.6	0.514	149.9
16500	0.480	139.0	1.607	-54.2	0.134	-26.4	0.526	143.4
17000	0.461	131.4	1.596	-61.0	0.138	-30.9	0.536	136.9
17500	0.441	123.4	1.579	-67.9	0.142	-35.5	0.551	130.9
18000	0.422	114.4	1.566	-75.1	0.145	-40.6	0.561	124.2

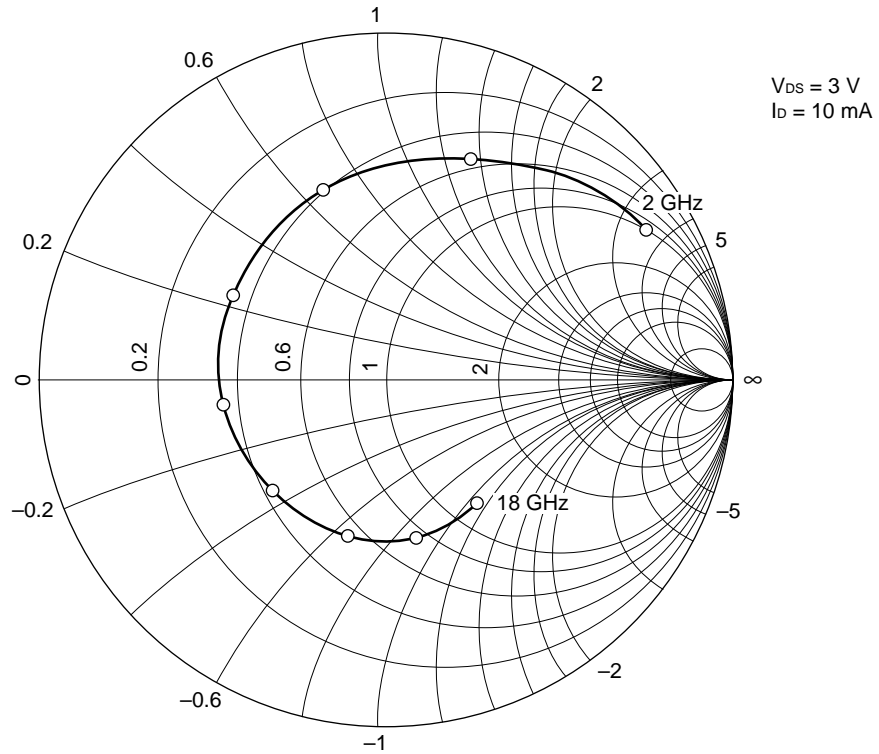
AMP. PARAMETERS

$V_{DS} = 3\text{ V}$ ,  $I_D = 10\text{ mA}$

FREQUENCY MHz	GUmax. dB	GAmix. dB	S <sub>21</sub>   <sup>2</sup> dB	S <sub>12</sub>   <sup>2</sup> dB	K	Delay ns	Mason's U dB	G1 dB	G2 dB
500	33.02		9.30	-38.67	0.08	0.051	35.846	21.62	2.10
1000	27.83		9.22	-32.75	0.13	0.051	32.671	16.55	2.06
1500	24.50		9.11	-29.44	0.19	0.051	30.124	13.39	2.00
2000	21.87		8.95	-27.17	0.25	0.049	27.520	11.02	1.91
2500	20.08		8.78	-25.50	0.30	0.048	26.456	9.48	1.81
3000	18.61		8.61	-24.22	0.35	0.047	25.794	8.29	1.71
3500	17.32		8.42	-23.24	0.40	0.046	24.722	7.30	1.60
4000	16.14		8.20	-22.47	0.46	0.046	23.833	6.44	1.50
4500	15.13		7.98	-21.87	0.52	0.044	23.043	5.75	1.39
5000	14.20		7.74	-21.38	0.57	0.043	22.182	5.16	1.30
5500	13.39		7.50	-21.02	0.63	0.043	21.487	4.68	1.21
6000	12.66		7.23	-20.76	0.69	0.041	20.671	4.28	1.15
6500	12.01		6.97	-20.55	0.75	0.040	20.221	3.96	1.08
7000	11.44		6.72	-20.42	0.80	0.038	19.654	3.69	1.03
7500	10.93		6.47	-20.33	0.85	0.037	19.247	3.47	0.99
8000	10.48		6.25	-20.25	0.90	0.036	18.929	3.27	0.96
8500	10.09		6.04	-20.16	0.94	0.035	18.779	3.10	0.95
9000	9.71		5.86	-20.08	0.99	0.035	18.378	2.93	0.93
9500	9.40	11.93	5.70	-19.99	1.02	0.034	18.331	2.77	0.93
10000	9.06	11.21	5.53	-19.85	1.06	0.035	17.972	2.62	0.91
10500	8.76	10.66	5.38	-19.80	1.10	0.034	17.332	2.47	0.92
11000	8.47	10.23	5.23	-19.68	1.13	0.034	16.850	2.33	0.91
11500	8.19	9.84	5.07	-19.58	1.17	0.034	16.224	2.20	0.92
12000	7.96	9.56	4.94	-19.45	1.19	0.033	15.764	2.08	0.94
12500	7.73	9.29	4.79	-19.32	1.21	0.034	15.275	1.98	0.96
13000	7.55	9.13	4.66	-19.16	1.21	0.033	15.008	1.87	1.01
13500	7.37	8.95	4.55	-18.96	1.22	0.033	14.639	1.78	1.04
14000	7.24	8.85	4.46	-18.75	1.21	0.034	14.410	1.68	1.10
14500	7.11	8.76	4.39	-18.50	1.20	0.034	14.165	1.58	1.14
15000	7.00	8.73	4.31	-18.21	1.17	0.035	14.046	1.48	1.21
15500	6.91	8.67	4.27	-17.98	1.16	0.036	13.754	1.36	1.28
16000	6.76	8.52	4.17	-17.70	1.16	0.036	13.255	1.25	1.33
16500	6.67	8.47	4.12	-17.43	1.14	0.037	12.958	1.14	1.41
17000	6.57	8.39	4.06	-17.18	1.13	0.038	12.636	1.04	1.47
17500	6.48	8.34	3.97	-16.98	1.12	0.038	12.338	0.94	1.57
18000	6.39	8.24	3.90	-16.78	1.12	0.040	11.963	0.85	1.64

NOISE PARAMETERS

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



Start 2 GHz, Stop 18 GHz, Step 2 GHz

<Noise Parameter>

$V_{DS} = 3\text{ V}$ ,  $I_D = 10\text{ mA}$

Freq. (dB)	NF <sub>MIN.</sub> (dB)	Ga (dB)	$\Gamma_{opt.}$		Rn/50
			MAG.	ANG. (deg.)	
2.0	0.55	16.9	0.88	31	0.51
4.0	0.62	14.0	0.72	69	0.46
6.0	0.81	12.3	0.60	107	0.37
8.0	1.10	11.0	0.52	148	0.32
10.0	1.25	10.1	0.46	-175	0.26
12.0	1.60	9.0	0.45	-138	0.21
14.0	1.90	8.1	0.45	-104	0.17
16.0	2.25	7.6	0.45	-78	0.11
18.0	2.75	7.0	0.48	-52	0.10

**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” (C10535E).

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 law concerned and so on, especially in case of removal.**



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"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

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: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.