To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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

NE32484A

C to Ku BAND SUPER LOW NOISE AMPLIFIER
N-CHANNEL HJ-FET

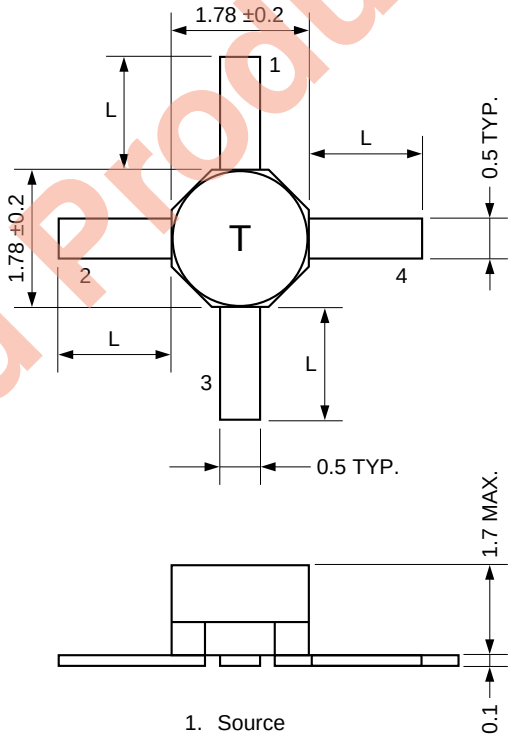
DESCRIPTION

The NE32484A is a Hetero Junction FET that utilizes the hetero junction to create high mobility electrons. Its excellent low noise and high associated gain make it suitable for DBS, TVRO and another commercial systems.

FEATURES

- Super Low Noise Figure & High Associated Gain
  NF = 0.6 dB TYP., Ga = 11.0 dB TYP. at f = 12 GHz
- Gate Length : $L_g \leq 0.25$ μm
- Gate Width : $W_g = 200$ μm

PACKAGE DIMENSIONS
(Unit: mm)



ORDERING INFORMATION

PART NUMBER	SUPPLYING FORM	LEAD LENGTH	MARKING
NE32484A-SL	STICK	L = 1.7 mm MIN.	T
NE32484A-T1	Tape & reel 1000 pcs./reel	L = 1.0 ± 0.2 mm	
NE32484A-T1A	Tape & reel 5000 pcs./reel	L = 1.0 ± 0.2 mm	

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

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}	150	°C
Storage Temperature	T_{stg}	–65 to +150	°C

RECOMMENDED OPERATING CONDITION (T_A = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	V_{DS}		2	3	V
Drain Current	I_D		10	20	mA
Input Power	P_{in}			0	dBm

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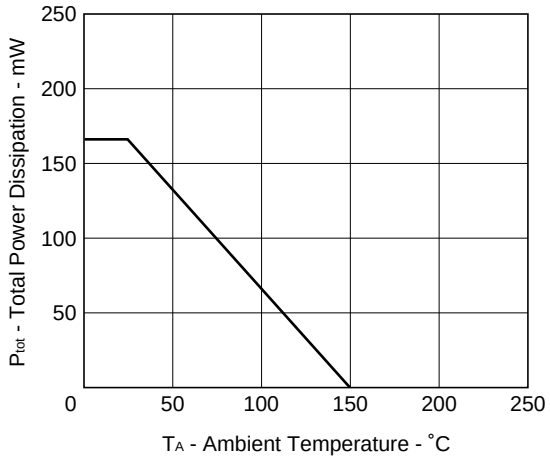
(Previous No. TC-2316)
Date Published July 1996 P
Printed in Japan

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

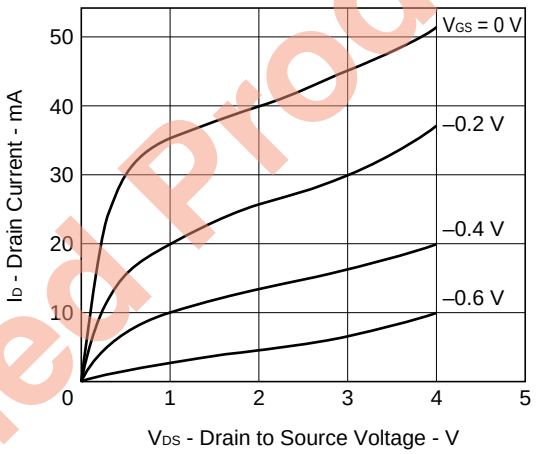
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Gate to Source Leak Current	I_{GSO}		0.5	10	μA	V_{GS} = –3 V
Saturated Drain Current	I_{DSS}	15	40	70	mA	V_{DS} = 2 V, V_{GS} = 0 V
Gate to Source Cutoff Voltage	$V_{GS(off)}$	–0.2	–0.8	–2.0	V	V_{DS} = 2 V, I_D = 100 μA
Transconductance	g_m	45	60		mS	V_{DS} = 2 V, I_D = 10 mA
Noise Figure	NF		0.6	0.7	dB	V_{DS} = 2 V, I_D = 10 mA, f = 12 GHz
Associated Gain	Ga	10.0	11.0		dB	

TYPICAL CHARACTERISTICS (T_A = 25 °C)

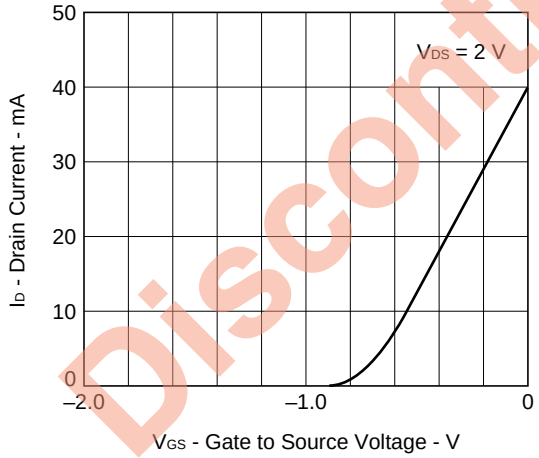
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



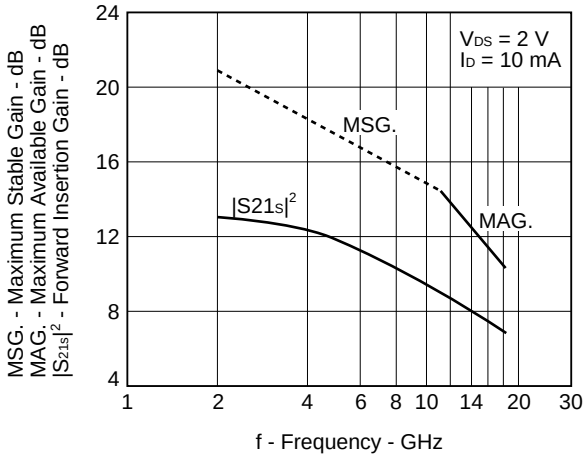
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE



MAXIMUM AVAILABLE GAIN, FORWARD INSERTION GAIN vs. FREQUENCY



Gain Calculations

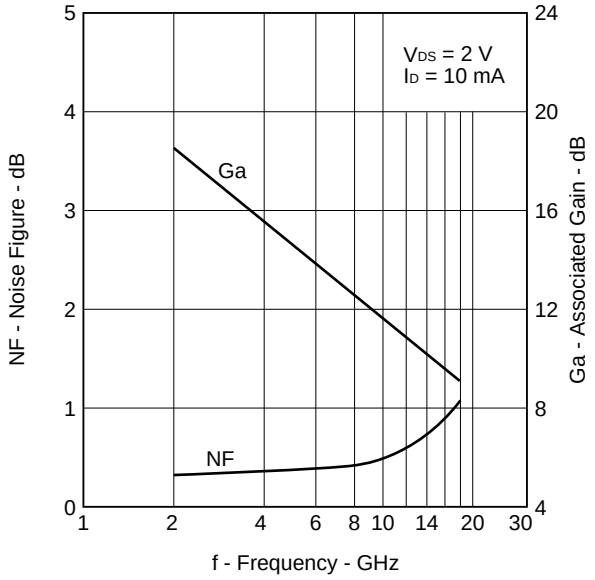
$$MSG. = \frac{|S_{21}|}{|S_{12}|}$$

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

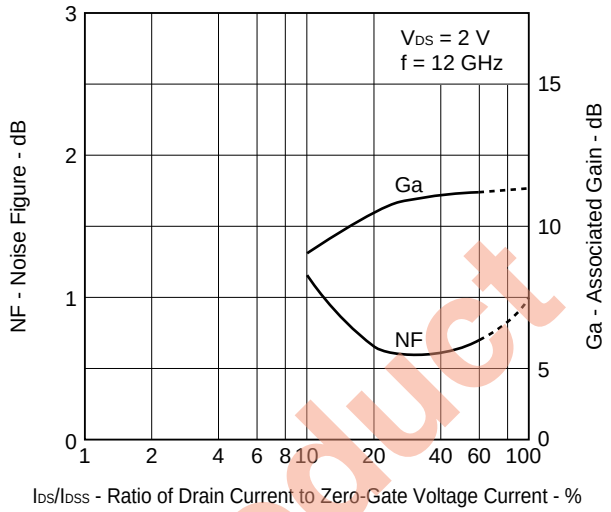
$$MAG. = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$$

$$\Delta = S_{11} \cdot S_{22} - S_{21} \cdot S_{12}$$

NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY



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

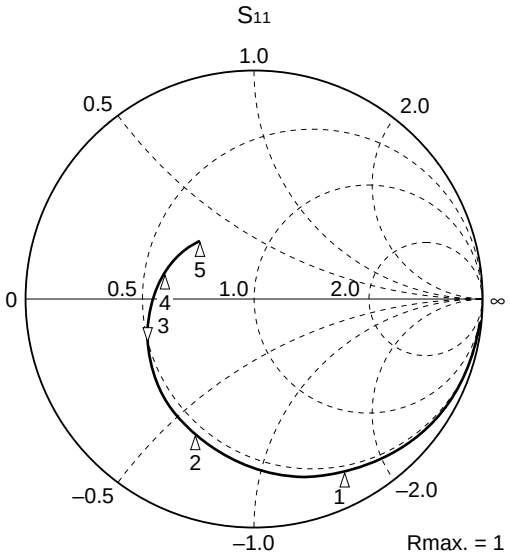


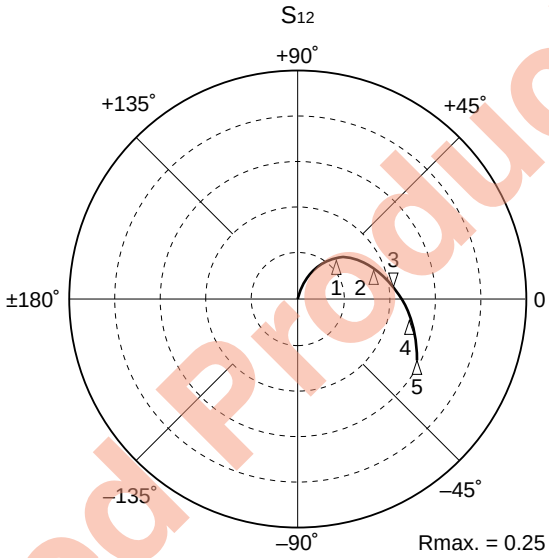
S-Parameters

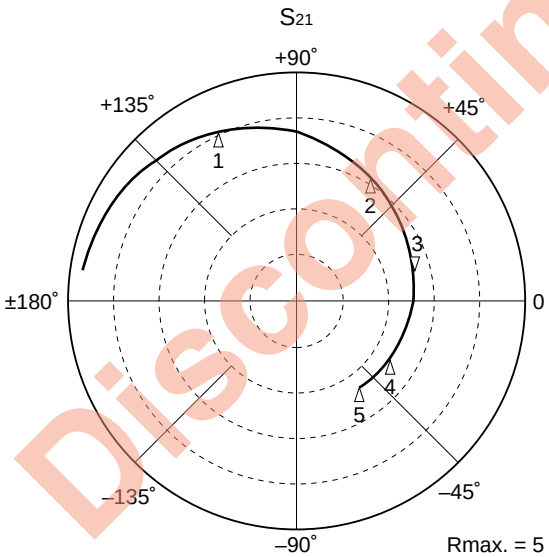
V_{DS} = 2 V, I_D = 10 mA

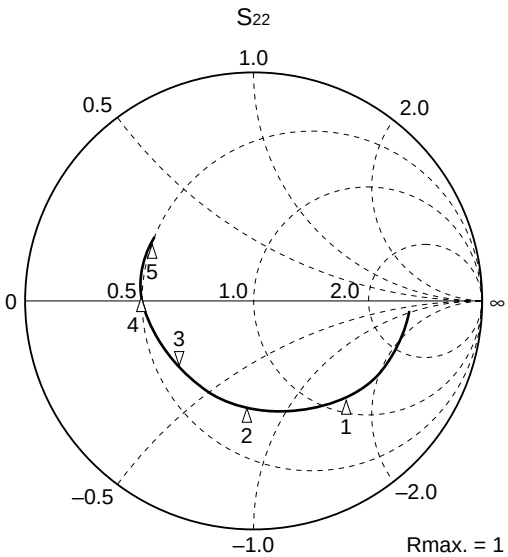
START 500 MHz, STOP 18 GHz, STEP 500 MHz

Marker
1: 4 GHz
2: 8 GHz
3: 12 GHz
4: 16 GHz
5: 18 GHz









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. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
500	.999	–8.3	4.699	171.5	.009	81.1	.667	–6.2
1 000	.990	–16.6	4.678	162.9	.019	78.1	.663	–12.3
1 500	.976	–24.9	4.611	154.1	.027	73.5	.654	–18.2
2 000	.952	–32.7	4.508	146.0	.035	67.5	.641	–24.2
2 500	.934	–40.5	4.424	138.0	.043	61.4	.626	–29.7
3 000	.908	–48.2	4.328	130.0	.051	58.8	.612	–35.8
3 500	.884	–55.8	4.222	122.2	.056	53.8	.598	–41.2
4 000	.858	–63.1	4.127	114.7	.062	48.5	.576	–47.1
4 500	.830	–70.5	4.022	107.2	.067	44.5	.559	–52.9
5 000	.802	–77.5	3.906	99.9	.072	40.4	.538	–58.7
5 500	.775	–84.5	3.793	92.7	.075	36.3	.516	–64.7
6 000	.746	–91.0	3.669	85.8	.078	32.6	.497	–70.9
6 500	.725	–97.4	3.552	79.0	.081	29.6	.481	–76.7
7 000	.702	–103.5	3.426	72.7	.083	27.2	.470	–82.9
7 500	.681	–109.2	3.324	66.3	.085	24.9	.460	–88.3
8 000	.659	–114.3	3.223	60.1	.088	21.9	.454	–93.6
8 500	.645	–119.4	3.126	54.4	.090	19.9	.450	–99.5
9 000	.625	–124.2	3.050	48.4	.092	17.3	.450	–104.7
9 500	.609	–128.9	2.984	43.1	.094	15.6	.449	–109.8
10 000	.592	–134.2	2.921	37.1	.097	14.1	.441	–116.2
10 500	.574	–139.4	2.868	31.5	.098	11.3	.433	–121.4
11 000	.556	–144.6	2.812	25.7	.100	9.6	.429	–128.7
11 500	.539	–149.9	2.759	20.0	.101	6.7	.424	–134.1
12 000	.526	–155.7	2.705	14.5	.102	6.1	.423	–139.5
12 500	.511	–161.1	2.645	8.3	.105	4.1	.421	–146.5
13 000	.499	–166.2	2.595	3.1	.107	1.9	.429	–153.1
13 500	.487	–171.1	2.543	–2.3	.110	–.5	.439	–157.9
14 000	.476	–175.9	2.496	–8.2	.113	–1.6	.448	–163.5
14 500	.463	179.9	2.464	–13.6	.115	–4.0	.460	–168.9
15 000	.449	175.4	2.441	–19.5	.120	–7.4	.468	–174.1
15 500	.433	169.9	2.408	–24.6	.122	–9.9	.484	–179.4
16 000	.420	164.6	2.383	–30.5	.125	–13.0	.486	175.2
16 500	.404	158.5	2.377	–36.4	.130	–16.5	.489	170.6
17 000	.385	151.0	2.365	–42.3	.134	–19.2	.499	164.2
17 500	.373	143.6	2.350	–48.6	.135	–22.7	.507	158.1
18 000	.357	135.1	2.321	–55.0	.143	–26.3	.518	152.3

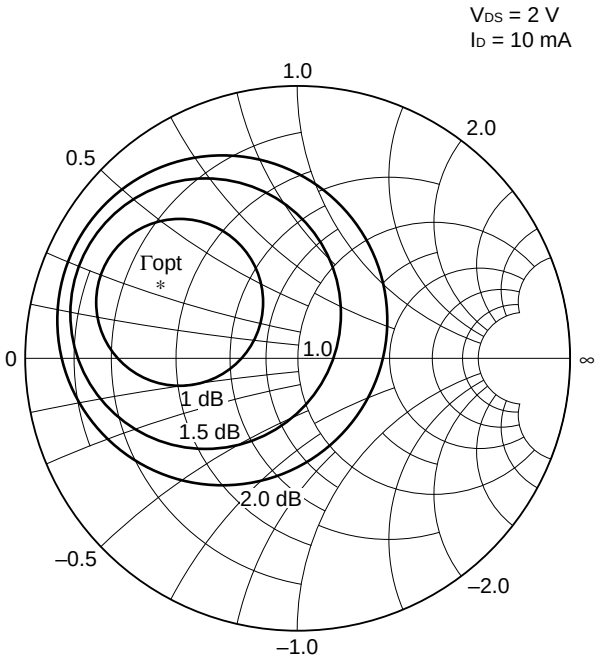
AMP. Parameters

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

FREQUENCY MHz	GUmax. dB	GAmax. dB	$\|S_{21}\|^2$ dB	$\|S_{12}\|^2$ dB	K	Delay ns	Mason's U dB	G_1 dB	G_2 dB
500	41.44		13.44	–40.86	.07	.048	35.043	25.44	2.56
1 000	32.97		13.40	–34.30	.11	.048	38.352	17.05	2.52
1 500	28.97		13.28	–31.48	.16	.048		13.27	2.42
2 000	25.67		13.08	–29.02	.25	.045	31.191	10.30	2.30
2 500	24.04		12.92	–27.43	.30	.044	28.650	8.97	2.16
3 000	22.31		12.73	–25.82	.33	.044	36.156	7.55	2.04
3 500	21.03		12.51	–24.99	.39	.044	33.054	6.60	1.92
4 000	19.86		12.31	–24.09	.44	.042	29.569	5.80	1.75
4 500	18.79		12.09	–23.41	.49	.041	29.880	5.07	1.63
5 000	17.79		11.83	–22.84	.54	.041	28.912	4.47	1.48
5 500	16.90		11.58	–22.48	.60	.040	27.197	3.98	1.34
6 000	16.06		11.29	–22.17	.66	.038	25.792	3.54	1.23
6 500	15.39		11.01	–21.78	.70	.038	26.436	3.24	1.14
7 000	14.73		10.70	–21.64	.75	.035	26.491	2.94	1.09
7 500	14.17		10.43	–21.36	.79	.036	27.296	2.70	1.03
8 000	13.64		10.17	–21.11	.83	.034	25.875	2.48	1.00
8 500	13.22		9.90	–20.94	.86	.031	27.068	2.34	.98
9 000	12.82		9.68	–20.77	.89	.033	26.311	2.15	.98
9 500	12.48		9.49	–20.57	.91	.030	27.718	2.01	.98
10 000	12.12		9.31	–20.30	.93	.033	30.819	1.87	.94
10 500	11.79		9.15	–20.17	.97	.031	26.188	1.73	.90
11 000	11.47		8.98	–20.02	1.00	.032	25.806	1.61	.88
11 500	11.17	13.30	8.81	–19.88	1.03	.032	23.528	1.49	.86
12 000	10.91	12.82	8.64	–19.81	1.05	.030	22.859	1.40	.86
12 500	10.61	12.38	8.45	–19.60	1.07	.034	21.908	1.31	.85
13 000	10.41	12.28	8.28	–19.39	1.07	.029	22.287	1.24	.89
13 500	10.21	12.13	8.11	–19.14	1.06	.030	22.459	1.18	.93
14 000	10.03	12.01	7.94	–18.96	1.06	.033	22.098	1.11	.97
14 500	9.91	12.01	7.83	–18.76	1.04	.030	22.242	1.05	1.03
15 000	9.80	12.12	7.75	–18.39	1.02	.033	22.991	.98	1.07
15 500	9.69	12.20	7.63	–18.26	1.01	.028	22.729	.90	1.16
16 000	9.56	12.02	7.54	–18.06	1.02	.033	21.370	.84	1.17
16 500	9.48	12.23	7.52	–17.75	1.00	.033	21.084	.77	1.19
17 000	9.42		7.48	–17.45	.98	.033	20.924	.70	1.24
17 500	9.36		7.42	–17.38	.98	.035	19.871	.65	1.29
18 000	9.26		7.31	–16.92	.95	.036	20.113	.59	1.36

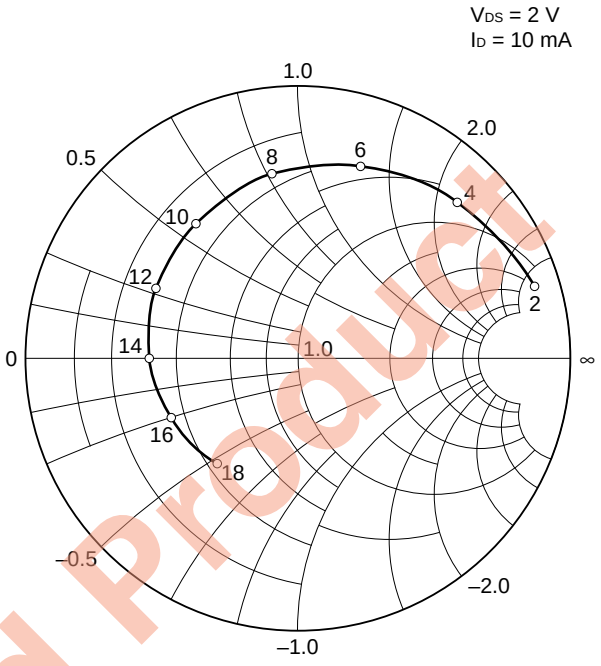
Noise Parameters

<TYPICAL CONSTANT NOISE FIGURE CIRCLE>



f = 12 GHz

<Γopt. vs. frequency>



START 2 GHz STOP 18 GHz STEP 2 GHz

<Noise Parameters>

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

Freq. (GHz)	NFmin. (dB)	Ga (dB)	Γopt.		Rn/50
			MAG.	ANG. (deg.)	
2.0	0.31	18.5	0.85	18	0.39
4.0	0.33	16.1	0.82	45	0.32
6.0	0.38	14.2	0.77	71	0.27
8.0	0.43	12.5	0.70	96	0.20
10.0	0.51	11.7	0.64	118	0.13
12.0	0.60	11.0	0.58	152	0.08
14.0	0.74	10.1	0.54	175	0.08
16.0	0.90	9.4	0.51	–161	0.06
18.0	1.10	9.0	0.48	–138	0.06

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” (C10535EJ7V0IF00).

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[Note]: None	IR30-00
Partial heating method	Terminal temperature: 230 ˚C or below, Flow time: 10 seconds or below, Exposure limit[Note]: None	

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

Caution 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 Hetero Junction field effect transistor with 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 law concerned.
Keep the Japanese law concerned and so on, especially in case of removal.

[MEMO]

[MEMO]

[MEMO]