To our customers,

Old Company Name in Catalogs and Other Documents

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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

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RENESAS

N-CHANNEL GaAs MES FET
NE850R599A

0.5 W C-BAND POWER GaAs FET
N-CHANNEL GaAs MES FET

DESCRIPTION

The NE850R599A power GaAs FET covers 2 GHz to 10 GHz frequency range for commercial amplifier, oscillator applications and so on.

The device incorporates Ti-AI gate and silicon dioxide glassivation. To reduce the thermal resistance, the device has a PHS. (Plated Heat Sink)

NEC's strigent quality assurance and test procedures assure the highest reliability and performance.

FEATURES

- Class A operation
- High power output
- High reliability

SELECTION CHART

PART NUMBER	PERFORMANCE SPECIFIED		
	Pout (*) (dBm)	GL (*) (dB)	USABLE FREQUENCY (GHz)
NE850R599A	25.5 min	9.5 typ	2 to 10

* specified at the condition at the last page

PHYSICAL DIMENSIONS
PACKAGE CODE-99
(unit: mm)
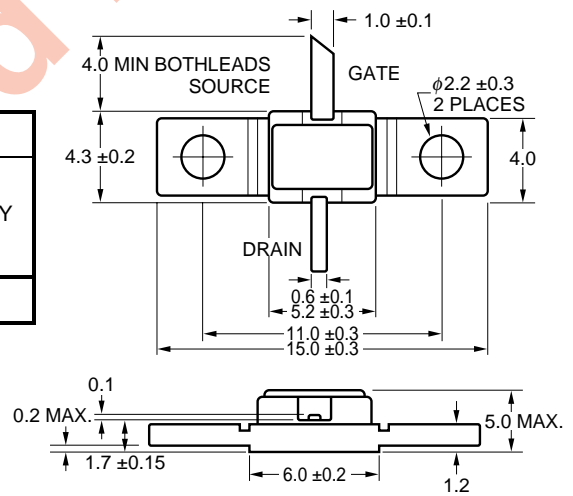
The information in this document is subject to change without notice.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage	V_{DSX}	15	V
Gate to Drain Voltage	V_{GDX}	−18	V
Gate to Source Voltage	V_{GSX}	−12	V
Total Power Disipation(*)	P_T	3.0	W
Drain Current	I_D	560	mA
Gate Current	I_G	3.0	mA
Channel Temperature	T_{ch}	175	°C
Storage Temperature	T_{stg}	−65 to 175	°C

*TC = 25°C

RECOMMENDING OPERATION RANDGE

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Drain to Source Voltage	V_{DS}	9	–	10	V
Channel Temperature	T_{ch}	–	–	130	°C
Input Power	Gcomp	–	–	3	dBcomp
Gate Resistance	Rg	–	–	1	kΩ

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Saturated Drain Current	Idss	220	–	430	mA	Vds = 2.5 V, Vgs = 0 V
Pinch-off Voltage	V_P	−3.0	–	−1.0	V	Vds = 2.5 V, Ids = 2 mA
Transconductance	gm	–	150	–	mS	Vds = 2.5 V, Ids = Idss
Thermal Resistance	R_{th}	–	–	60	°C/W	

PERFORMANCE SPECIFICATION (T_A = 25°C)

PART NUMBER		NE850R599A			UNIT	TEST CONDITIONS
PACKAGE CODE		99				
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.		
Output Power	P_O	25.5	–	–	dBm	Vds = 10 V Ids = 100 mA set
Gate to Source Current	Igs	−1.6	–	1.6	mA	f = 7.2 GHz, Rg = 1 kΩ Pin = 18.5 dBm (*)
Linear Gain	G_L	–	9.5	–	dB	Pin ≤ 7 dBm (**)

* : Pin for Pout specification.

** : The same as the above except this.

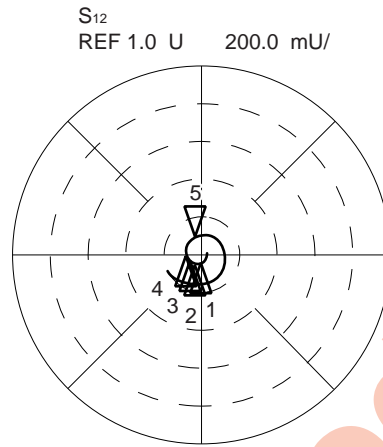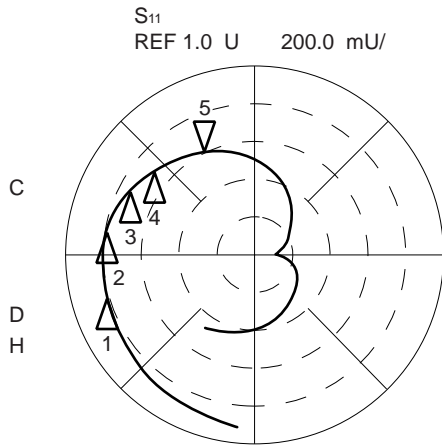**TYPICAL CHARACTERISTICS (T$_A$ = 25°C)**

OUTPUT POWER vs. INPUT POWER

V$_D$ = 10 V, f = 7.2 GHz
I$_D$ = 100 mA set
Rg = 1 kΩ

Pout

I$_D$ [mA]

I$_D$

140

120

100

Pout - Output Power - dBm

30

25

20

15

10   15   20

Pin - Input Power - dBm
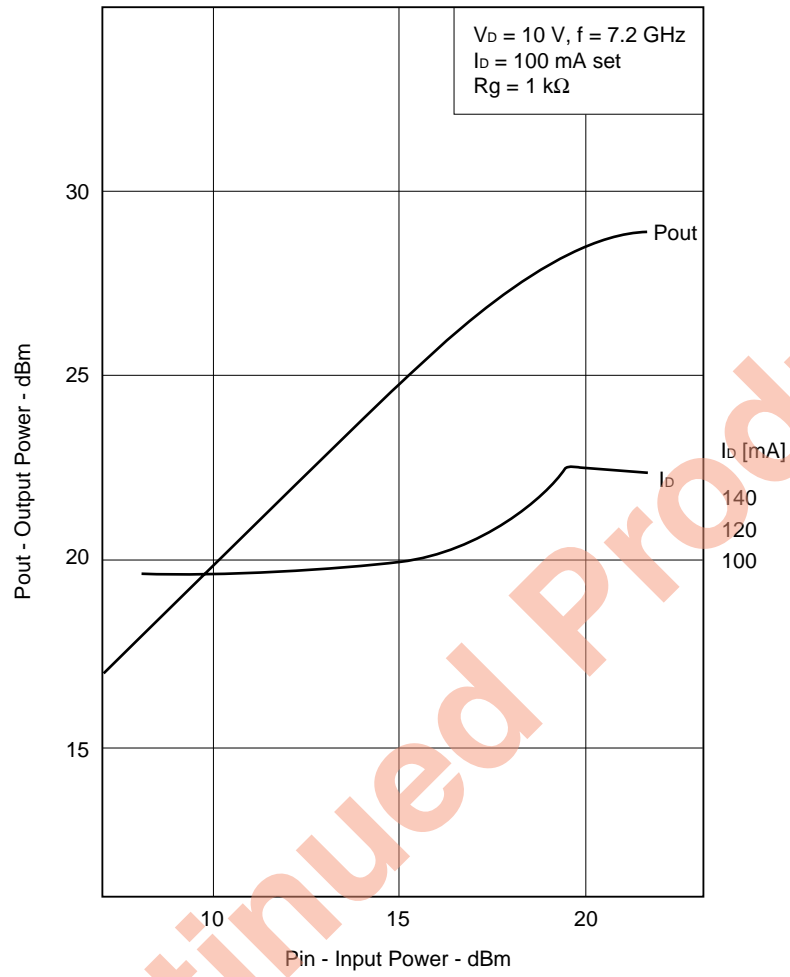
TYPICAL S-PARAMETERS (T$_A$ = 25°C)

V_{DS} = 10 V, I_D = 100 mA set

S$_{11}$
REF 1.0 U   200.0 mU/

S$_{12}$
REF 1.0 U   200.0 mU/

MARKER 5
7.0 GH$_z$

S$_{11}$
  608.7   mU
  116.72 °

S$_{21}$
  1.9526 U
  90.981 °

S$_{12}$
  84.011 mU
  105.59 °

S$_{22}$
  478.65 mU
  161.08 °

S$_{21}$
REF 10.0 U   2.0 U/

S$_{22}$
REF 1.0 U   200.0 mU/

Marker

1:   3 GHz

2:   4 GHz

3:   5 GHz

4:   6 GHz

5:   7 GHz
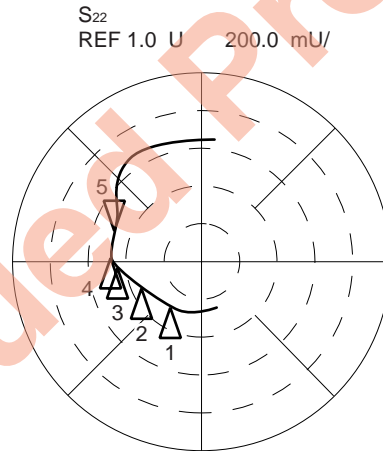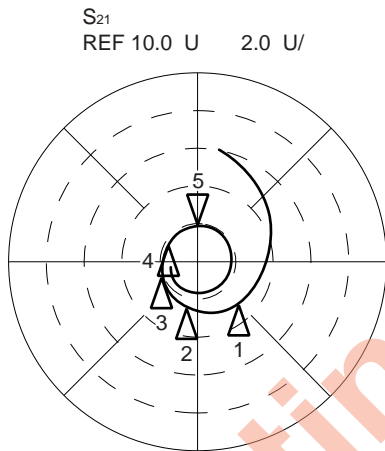
START   1.000000000 GHz

STOP   11.000000000 GHz

C

D
H

4

S-PARAMETERS

V_{DS} = 10 V, I_D = 100 mA set

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1000	0.900	−96.30	6.110	81.26	0.036	5.397	0.252	−71.84
1050	0.895	−98.75	5.942	77.91	0.039	7.159	0.251	−75.73
1100	0.888	−102.6	5.814	73.72	0.037	11.60	0.258	−75.98
1150	0.875	−105.2	5.676	69.30	0.033	4.635	0.253	−78.34
1200	0.874	−107.3	5.507	66.37	0.041	−5.508	0.253	−81.17
1250	0.875	−110.1	5.375	62.72	0.040	0.873	0.252	−82.28
1300	0.871	−113.1	5.242	59.14	0.040	−10.47	0.257	−83.59
1350	0.867	−115.2	5.128	55.47	0.044	−20.80	0.263	−85.81
1400	0.860	−117.1	4.948	51.81	0.037	−13.44	0.258	−87.54
1450	0.861	−119.8	4.854	49.15	0.035	−23.07	0.266	−88.53
1500	0.858	−122.2	4.757	45.77	0.042	−17.76	0.263	−91.51
1550	0.854	−123.7	4.617	42.41	0.038	−26.38	0.260	−91.55
1600	0.852	−125.3	4.510	39.57	0.038	−36.77	0.266	−93.21
1650	0.857	−127.4	4.447	36.29	0.041	−30.60	0.265	−94.02
1700	0.854	−129.1	4.393	32.87	0.048	−26.48	0.269	−95.88
1750	0.846	−131.0	4.271	29.77	0.040	−32.56	0.265	−97.04
1800	0.847	−132.4	4.179	27.24	0.041	−31.32	0.268	−99.48
1850	0.841	−134.3	4.128	24.08	0.039	−41.40	0.268	−99.88
1900	0.838	−136.2	4.055	20.07	0.038	−31.81	0.276	−100.8
1950	0.830	−137.3	3.968	17.80	0.039	−49.03	0.274	−102.0
2000	0.830	−138.6	3.916	14.65	0.038	−44.64	0.275	−103.3
2050	0.826	−140.3	3.838	11.65	0.046	−39.83	0.275	−103.2
2100	0.828	−141.8	3.801	8.024	0.042	−51.18	0.280	−103.2
2150	0.819	−143.5	3.726	4.702	0.047	−45.96	0.275	−105.2
2200	0.821	−144.4	3.666	2.023	0.043	−53.85	0.275	−107.1
2250	0.816	−145.6	3.607	−0.586	0.047	−54.51	0.281	−108.2
2300	0.815	−147.2	3.558	−3.813	0.045	−57.19	0.279	−108.8
2350	0.816	−148.7	3.472	−7.529	0.037	−59.36	0.273	−110.4
2400	0.808	−149.4	3.436	−9.980	0.045	−63.20	0.282	−109.6
2450	0.814	−150.9	3.380	−12.30	0.042	−66.40	0.279	−110.0
2500	0.809	−152.4	3.398	−16.20	0.045	−67.23	0.275	−113.3
2550	0.810	−154.1	3.257	−18.90	0.044	−65.56	0.276	−113.4
2600	0.808	−155.1	3.193	−21.25	0.046	−59.85	0.272	−115.5
2650	0.812	−156.1	3.261	−24.38	0.056	−77.79	0.282	−114.4
2700	0.805	−157.2	3.184	−27.86	0.041	−79.52	0.279	−117.8
2750	0.805	−158.8	3.096	−30.79	0.045	−82.90	0.280	−118.5
2800	0.804	−160.6	3.128	−32.07	0.042	−80.19	0.276	−120.1
2850	0.797	−160.8	3.084	−36.54	0.048	−73.80	0.285	−122.7
2900	0.809	−162.1	3.003	−39.26	0.044	−70.97	0.284	−121.2
2950	0.803	−163.7	2.977	−41.12	0.045	−91.64	0.276	−123.2
3000	0.805	−164.7	3.029	−44.57	0.040	−85.92	0.281	−126.4
3050	0.796	−166.2	2.954	−48.06	0.042	−84.69	0.289	−126.6
3100	0.801	−167.8	2.917	−50.79	0.040	−87.25	0.282	−126.6
3150	0.806	−169.5	2.908	−53.83	0.046	−95.77	0.277	−128.7
3200	0.802	−169.8	2.914	−56.24	0.049	−83.38	0.282	−130.9
3250	0.796	−172.3	2.841	−60.29	0.045	−90.05	0.283	−132.6
3300	0.805	−172.6	2.815	−62.51	0.046	−94.76	0.287	−133.7
3350	0.792	−174.6	2.763	−65.51	0.050	−99.30	0.290	−135.9
3400	0.804	−175.1	2.769	−69.18	0.045	−98.47	0.292	−138.1
3450	0.801	−176.6	2.728	−71.17	0.043	−93.71	0.294	−138.7
3500	0.800	−178.1	2.680	−74.45	0.050	−98.69	0.295	−142.6
3550	0.798	−179.9	2.668	−77.70	0.054	−98.26	0.302	−143.2
3600	0.796	−178.7	2.633	−80.29	0.053	−107.5	0.298	−144.6

S-PARAMETERS

V_{DS} = 10 V, I_D = 100 mA set

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
3650	0.793	177.5	2.610	−84.01	0.053	−109.0	0.307	−145.6
3700	0.800	176.0	2.585	−86.76	0.046	−113.1	0.312	−148.2
3750	0.800	175.1	2.566	−89.70	0.055	−113.7	0.316	−149.6
3800	0.792	173.5	2.519	−93.51	0.051	−118.8	0.322	−151.2
3850	0.794	172.4	2.550	−95.29	0.055	−120.8	0.326	−152.8
3900	0.792	171.3	2.484	−99.01	0.046	−121.1	0.329	−155.4
3950	0.789	169.8	2.439	−101.6	0.050	−118.9	0.336	−156.1
4000	0.792	168.8	2.481	−103.9	0.046	−116.2	0.350	−157.2
4050	0.789	167.8	2.411	−108.4	0.048	−114.5	0.346	−157.9
4100	0.789	166.0	2.371	−111.2	0.051	−128.0	0.367	−159.9
4150	0.786	164.7	2.342	−113.0	0.058	−128.7	0.364	−161.0
4200	0.785	164.3	2.344	−117.0	0.045	−133.2	0.362	−162.9
4250	0.782	163.3	2.299	−120.4	0.059	−136.2	0.372	−164.8
4300	0.778	161.8	2.270	−122.5	0.053	−139.3	0.377	−164.8
4350	0.778	160.6	2.260	−125.6	0.055	−139.7	0.385	−167.3
4400	0.774	159.7	2.196	−129.1	0.054	−138.5	0.391	−168.0
4450	0.770	158.9	2.156	−131.7	0.050	−141.2	0.385	−169.1
4500	0.780	157.8	2.160	−134.2	0.053	−143.6	0.397	−170.6
4550	0.766	157.3	2.119	−138.2	0.053	−146.3	0.406	−171.5
4600	0.764	156.1	2.098	−140.0	0.056	−142.9	0.410	−171.1
4650	0.766	156.0	2.042	−142.3	0.058	−152.6	0.412	−171.6
4700	0.766	155.2	2.039	−144.8	0.052	−151.4	0.412	−172.4
4750	0.753	154.2	2.013	−148.3	0.054	−155.2	0.421	−173.1
4800	0.757	154.1	1.983	−149.9	0.054	−153.1	0.419	−173.5
4850	0.753	152.6	1.990	−152.7	0.055	−161.9	0.426	−173.8
4900	0.747	152.3	1.947	−155.6	0.058	−164.0	0.432	−175.3
4950	0.749	151.8	1.930	−158.3	0.055	−162.6	0.437	−175.1
5000	0.751	151.2	1.920	−160.4	0.055	−167.0	0.437	−175.6
5050	0.734	150.5	1.914	−162.9	0.059	−170.5	0.439	−175.8
5100	0.735	149.8	1.880	−166.3	0.059	−176.2	0.448	−175.7
5150	0.735	149.4	1.865	−168.0	0.053	−169.1	0.445	−176.4
5200	0.737	148.8	1.849	−170.9	0.057	−168.5	0.448	−176.1
5250	0.735	148.8	1.830	−172.8	0.055	−174.5	0.452	−176.1
5300	0.731	148.7	1.831	−175.4	0.058	−180.0	0.450	−177.0
5350	0.726	147.9	1.830	−178.1	0.050	−177.8	0.456	−176.9
5400	0.724	146.8	1.811	179.5	0.059	179.5	0.460	−177.9
5450	0.716	147.4	1.802	176.7	0.053	−178.8	0.455	−177.6
5500	0.718	146.8	1.794	174.4	0.058	−179.8	0.465	−179.1
5550	0.714	145.8	1.780	171.8	0.059	173.2	0.458	−178.1
5600	0.716	145.3	1.780	168.9	0.061	170.6	0.463	−178.9
5650	0.706	145.2	1.769	167.0	0.063	168.9	0.466	−178.7
5700	0.700	144.7	1.759	164.6	0.061	165.8	0.461	−179.8
5750	0.706	144.2	1.759	161.9	0.062	162.2	0.473	−178.9
5800	0.697	143.5	1.762	159.7	0.060	163.4	0.466	179.8
5850	0.700	142.9	1.753	156.2	0.062	163.3	0.464	179.8
5900	0.697	142.7	1.750	154.6	0.068	159.8	0.472	−179.7
5950	0.694	141.6	1.754	152.1	0.064	154.2	0.467	179.1
6000	0.688	141.2	1.766	149.1	0.066	153.6	0.469	178.0
6050	0.681	140.5	1.726	146.4	0.073	152.2	0.465	177.2
6100	0.684	139.5	1.754	143.8	0.067	147.4	0.471	177.1
6150	0.676	138.9	1.761	142.1	0.067	145.8	0.471	176.4
6200	0.672	137.9	1.772	138.2	0.075	148.6	0.474	176.3
6250	0.673	137.4	1.739	135.8	0.067	146.6	0.469	175.1

S-PARAMETERS

V_{DS} = 10 V, I_D = 100 mA set

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
6300	0.673	136.2	1.761	133.9	0.067	145.6	0.474	175.7
6350	0.672	135.2	1.779	130.4	0.076	139.1	0.468	173.6
6400	0.665	133.8	1.772	129.7	0.070	137.5	0.476	173.3
6450	0.661	133.6	1.805	126.8	0.073	138.4	0.466	172.5
6500	0.660	131.5	1.812	122.1	0.076	134.0	0.467	171.5
6550	0.652	130.5	1.787	119.7	0.079	133.7	0.467	170.7
6600	0.646	129.8	1.797	117.3	0.073	124.8	0.474	170.2
6650	0.643	128.1	1.890	114.0	0.074	124.6	0.480	168.8
6700	0.641	127.6	1.867	109.3	0.080	129.1	0.476	168.1
6750	0.641	124.7	1.780	107.8	0.076	123.8	0.479	166.7
6800	0.632	122.7	1.894	106.1	0.080	119.4	0.483	165.8
6850	0.618	122.5	1.929	99.61	0.081	116.9	0.479	164.2
6900	0.622	120.4	1.814	96.37	0.082	115.4	0.487	162.9
6950	0.617	119.0	1.860	95.75	0.079	113.1	0.485	162.6
7000	0.609	116.7	1.953	90.98	0.084	105.6	0.479	161.1
7050	0.598	115.3	1.914	85.62	0.083	103.6	0.489	160.1
7100	0.598	112.7	1.822	84.12	0.089	99.63	0.493	158.7
7150	0.579	111.1	1.909	82.30	0.082	100.9	0.495	157.1
7200	0.587	109.5	1.945	76.18	0.077	93.99	0.494	156.0
7250	0.579	107.9	1.813	72.58	0.091	86.22	0.501	155.4
7300	0.586	106.8	1.803	72.95	0.082	89.33	0.499	154.3
7350	0.558	104.6	1.900	68.02	0.099	84.74	0.492	153.6
7400	0.551	101.8	1.825	62.37	0.103	84.96	0.506	152.8
7450	0.549	102.0	1.766	62.55	0.090	79.45	0.506	150.8
7500	0.549	98.34	1.833	59.14	0.087	83.52	0.504	151.2
7550	0.523	98.06	1.823	54.87	0.101	81.97	0.510	150.3
7600	0.525	96.19	1.802	51.68	0.089	77.46	0.527	148.2
7650	0.512	94.71	1.797	50.20	0.092	75.80	0.541	147.6
7700	0.502	92.62	1.806	45.83	0.105	65.44	0.546	147.1
7750	0.492	90.54	1.747	42.90	0.100	70.43	0.554	146.6
7800	0.494	89.03	1.815	42.40	0.090	62.74	0.546	144.6
7850	0.474	87.15	1.823	37.71	0.090	63.89	0.553	144.7
7900	0.466	84.15	1.758	33.60	0.099	63.51	0.566	145.2
7950	0.464	82.45	1.751	33.24	0.104	64.87	0.577	143.1
8000	0.456	80.51	1.805	28.07	0.103	58.96	0.590	141.5
8050	0.448	79.68	1.793	23.09	0.108	51.05	0.600	140.3
8100	0.448	77.19	1.677	21.79	0.119	56.68	0.607	139.6
8150	0.433	76.01	1.813	19.75	0.116	51.33	0.596	138.9
8200	0.415	74.04	1.817	12.17	0.112	46.77	0.615	138.2
8250	0.420	72.88	1.669	10.33	0.113	40.59	0.606	136.9
8300	0.398	69.47	1.706	10.70	0.114	41.86	0.612	135.7
8350	0.395	67.87	1.814	5.233	0.109	39.53	0.632	135.7
8400	0.387	66.43	1.669	−0.649	0.117	32.83	0.620	135.1
8450	0.377	64.85	1.580	−0.080	0.117	28.57	0.639	132.6
8500	0.363	64.05	1.675	−1.574	0.120	26.11	0.638	133.2
8550	0.348	60.60	1.740	−6.843	0.123	24.97	0.651	132.1
8600	0.341	56.97	1.601	−11.40	0.131	19.21	0.644	131.3
8650	0.324	57.02	1.625	−10.09	0.126	15.81	0.661	129.4
8700	0.320	55.80	1.732	−13.17	0.118	15.02	0.652	129.3
8750	0.309	53.07	1.674	−22.01	0.123	14.08	0.653	128.0
8800	0.292	52.05	1.593	−20.57	0.127	4.286	0.657	127.1
8850	0.285	47.75	1.696	−21.64	0.134	2.527	0.666	127.8
8900	0.273	45.14	1.760	−28.79	0.123	9.053	0.662	127.0

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S-PARAMETERS

V_{DS} = 10 V, I_D = 100 mA set

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
8950	0.252	44.80	1.668	−33.03	0.128	−0.579	0.658	124.9
9000	0.241	39.42	1.639	−33.48	0.119	−5.253	0.661	124.1
9050	0.234	41.14	1.761	−36.65	0.138	−8.699	0.676	124.3
9100	0.218	36.41	1.664	−43.72	0.137	−9.496	0.663	122.9
9150	0.203	31.53	1.628	−45.15	0.129	−12.08	0.669	122.1
9200	0.192	30.99	1.687	−47.67	0.134	−14.24	0.661	121.9
9250	0.173	26.47	1.697	−53.09	0.134	−18.59	0.673	121.0
9300	0.174	23.57	1.614	−56.48	0.140	−22.14	0.677	120.7
9350	0.158	20.05	1.653	−59.31	0.142	−20.59	0.665	119.8
9400	0.144	17.66	1.630	−63.97	0.147	−27.71	0.667	118.7
9450	0.128	13.97	1.546	−66.47	0.133	−27.34	0.671	119.0
9500	0.126	9.956	1.561	−68.23	0.140	−32.37	0.667	117.6
9550	0.127	6.481	1.533	−72.72	0.153	−33.10	0.658	116.7
9600	0.121	5.077	1.438	−75.84	0.156	−38.62	0.670	116.5
9650	0.110	3.637	1.447	−75.57	0.149	−42.66	0.672	114.8
9700	0.109	4.067	1.519	−77.20	0.150	−46.77	0.672	113.8
9750	0.131	3.414	1.469	−82.87	0.146	−47.18	0.663	113.9
9800	0.138	3.054	1.401	−82.48	0.156	−50.65	0.665	110.7
9850	0.158	0.468	1.521	−83.30	0.154	−55.58	0.674	110.8
9900	0.183	−7.143	1.554	−89.71	0.149	−62.12	0.667	107.9
9950	0.222	−13.38	1.533	−91.88	0.154	−64.86	0.661	107.2
10000	0.245	−28.70	1.572	−93.34	0.154	−65.39	0.657	107.2
10050	0.267	−33.44	1.671	−97.42	0.145	−72.22	0.661	106.1
10100	0.292	−43.24	1.674	−104.6	0.143	−69.50	0.654	104.6
10150	0.310	−52.39	1.588	−108.6	0.142	−74.24	0.643	103.8
10200	0.322	−58.81	1.655	−111.6	0.138	−77.51	0.648	102.9
10250	0.333	−65.58	1.673	−117.2	0.141	−76.76	0.656	101.4
10300	0.360	−72.24	1.608	−122.2	0.145	−80.85	0.644	101.5
10350	0.367	−77.32	1.590	−125.1	0.136	−83.24	0.638	100.9
10400	0.359	−81.18	1.602	−128.2	0.144	−81.89	0.637	98.96
10450	0.377	−87.62	1.557	−133.9	0.145	−88.64	0.639	97.47
10500	0.396	−90.01	1.513	−138.3	0.147	−89.12	0.641	97.20
10550	0.397	−94.75	1.501	−140.1	0.154	−92.74	0.640	95.18
10600	0.403	−98.32	1.461	−144.9	0.147	−95.22	0.641	94.67
10650	0.412	−102.0	1.464	−148.1	0.141	−95.01	0.645	94.17
10700	0.415	−104.7	1.421	−151.4	0.151	−99.52	0.645	92.00
10750	0.428	−107.8	1.402	−154.6	0.153	−105.1	0.644	91.51
10800	0.433	−111.2	1.369	−157.6	0.155	−98.48	0.645	89.84
10850	0.436	−114.7	1.375	−161.7	0.154	−109.9	0.641	87.67
10900	0.441	−116.1	1.350	−163.9	0.154	−109.6	0.645	87.30
10950	0.459	−118.4	1.295	−166.8	0.167	−111.8	0.642	86.78
11000	0.457	−121.8	1.315	−171.0	0.157	−122.7	0.640	85.71

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[MEMO]

[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.