

1 W L-BAND POWER GaAs HJ-FET

DESCRIPTION

The NE6510179A is a 1 W GaAs HJ-FET designed for middle power transmitter applications for mobile communication and wireless PC LAN systems. It is capable of delivering 1 W of output power (CW) with high linear gain, high efficiency and excellent distortion.

Reliability and performance uniformity are assured by NEC's stringent quality and control procedures.

FEATURES

- GaAs HJ-FET structure
- High output power : $P_{out} = +31.5$ dBm TYP. @ $V_{DS} = 3.5$ V, $I_{Dset} = 200$ mA, $f = 900$ MHz, $P_{in} = +20$ dBm
 $P_{out} = +32.5$ dBm TYP. @ $V_{DS} = 3.5$ V, $I_{Dset} = 200$ mA, $f = 1\ 900$ MHz, $P_{in} = +25$ dBm
 $P_{out} = +35.0$ dBm TYP. @ $V_{DS} = 5.0$ V, $I_{Dset} = 200$ mA, $f = 1\ 900$ MHz, $P_{in} = +25$ dBm
- High linear gain : $GL = 15$ dB TYP. @ $V_{DS} = 3.5$ V, $I_{Dset} = 200$ mA, $f = 900$ MHz, $P_{in} = 0$ dBm
 $GL = 10$ dB TYP. @ $V_{DS} = 3.5$ V, $I_{Dset} = 200$ mA, $f = 1\ 900$ MHz, $P_{in} = 0$ dBm
 $GL = 10$ dB TYP. @ $V_{DS} = 5.0$ V, $I_{Dset} = 200$ mA, $f = 1\ 900$ MHz, $P_{in} = 0$ dBm
- High power added efficiency : 70% TYP. @ $V_{DS} = 3.5$ V, $I_{Dset} = 200$ mA, $f = 900$ MHz, $P_{in} = +20$ dBm
58% TYP. @ $V_{DS} = 3.5$ V, $I_{Dset} = 200$ mA, $f = 1\ 900$ MHz, $P_{in} = +25$ dBm
56% TYP. @ $V_{DS} = 5.0$ V, $I_{Dset} = 200$ mA, $f = 1\ 900$ MHz, $P_{in} = +25$ dBm

ORDERING INFORMATION

Part Number	Package	Supplying Form
NE6510179A-T1	79A	<ul style="list-style-type: none"> • 12 mm wide embossed taping • Qty 1 kpcs/reel

Remark To order evaluation samples, consult your NEC sales representative (Part number for sample order: NE6510179A).

Caution Please handle this device at static-free workstation, because this is an electrostatic sensitive device.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

★ **ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)**

Operation in excess of any one of these parameters may result in permanent damage.

Parameter	Symbol	Ratings	Unit
Drain to Source Voltage	V _{DS}	8	V
Gate to Source Voltage	V _{GSO}	-4	V
Drain Current	I _D	2.8	A
Gate Forward Current	I _{GF}	25	mA
Gate Reverse Current	I _{GR}	25	mA
Total Power Dissipation	P _{tot}	15	W
Channel Temperature	T _{ch}	150	°C
Storage Temperature	T _{stg}	-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Test Condition	MIN.	TYP.	MAX.	Unit
Drain to Source Voltage	V _{DS}		-	3.5	5.5	V
Gain Compression	G _{comp}		-	-	5.0 ^{Note}	dB
Channel Temperature	T _{ch}		-	-	+110	°C

Note Recommended maximum Gain Compression is 3.0 dB at V_{DS} > 4.2 V

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, unless otherwise specified, using NEC standard test fixture.)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Saturated Drain Current	I _{DSS}	V _{DS} = 2.5 V, V _{GS} = 0 V	-	2.4	-	A
Pinch-off Voltage	V _p	V _{DS} = 2.5 V, I _D = 14 mA	-2.0	-	-0.4	V
Gate to Drain Break Down Voltage	BV _{gd}	I _{gd} = 14 mA	12	-	-	V
Thermal Resistance	R _{th}	Channel to Case	-	5	8	°C/W
Output Power	P _{out}	f = 1.9 GHz, V _{DS} = 3.5 V,	31.5	32.5	-	dBm
Drain Current	I _D	P _{in} = +25 dBm, R _g = 100 Ω,	-	0.72	-	A
Power Added Efficiency	η _{add}	I _{Dset} = 200 mA (RF OFF)	50	58	-	%
Linear Gain ^{Note 1}	G _L	Note 2	-	10.0	-	dB

Notes 1. P_{in} = 0 dBm

2. DC performance is 100% testing. RF performance is testing several samples per wafer.

Wafer rejection criteria for standard devices is 1 reject for several samples.

TYPICAL RF PERFORMANCE FOR REFERENCE

(T_A = +25°C, unless otherwise specified, using NEC standard test fixture.)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Output Power	P _{out}	f = 900 MHz, V _{DS} = 3.5 V, P _{in} = +20 dBm, R _g = 100 Ω, I _{Dset} = 200 mA (RF OFF)	–	31.5	–	dBm
Drain Current	I _D		–	0.53	–	A
Power Added Efficiency	η _{add}		–	70	–	%
Linear Gain ^{Note}	G _L		–	15.0	–	dB

Note P_{in} = 0 dBm

TYPICAL RF PERFORMANCE FOR REFERENCE

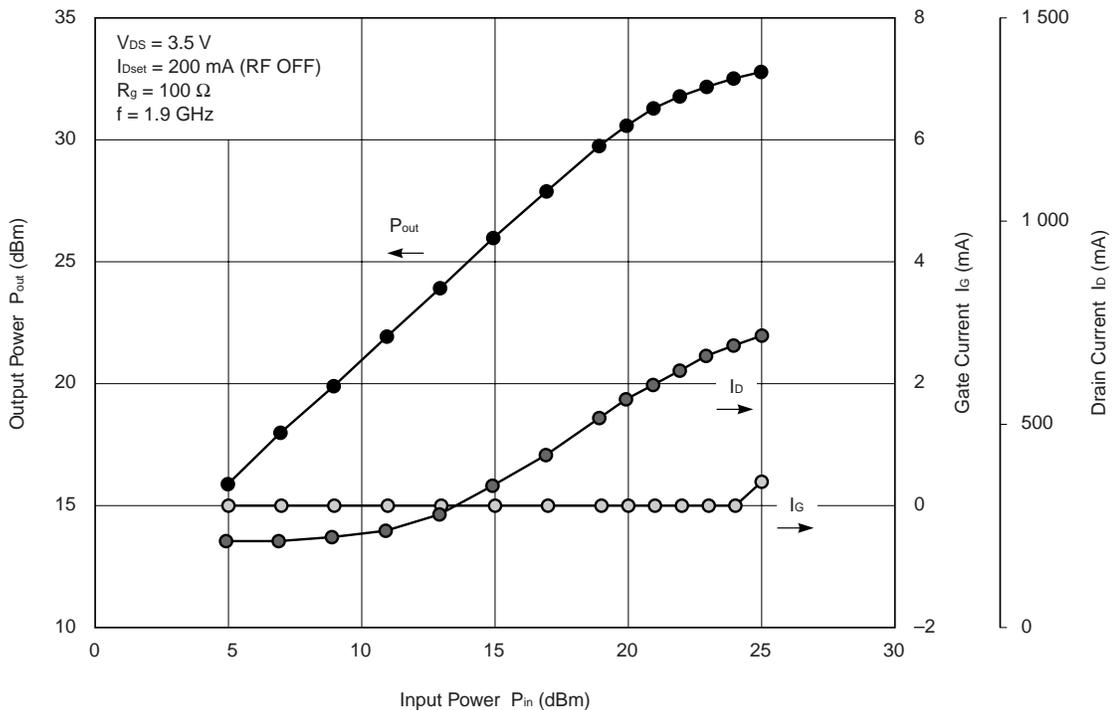
(T_A = +25°C, unless otherwise specified, using NEC standard test fixture.)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Output Power	P _{out}	f = 1.9 GHz, V _{DS} = 5.0 V, P _{in} = +25 dBm, R _g = 100 Ω, I _{Dset} = 200 mA (RF OFF)	–	35.0	–	dBm
Drain Current	I _D		–	1.2	–	A
Power Added Efficiency	η _{add}		–	56	–	%
Linear Gain ^{Note}	G _L		–	10.0	–	dB

Note P_{in} = 0 dBm

TYPICAL CHARACTERISTICS (T_A = +25°C)

OUTPUT POWER, DRAIN CURRENT AND GATE CURRENT vs. INPUT POWER



Remark The graph indicates nominal characteristics.

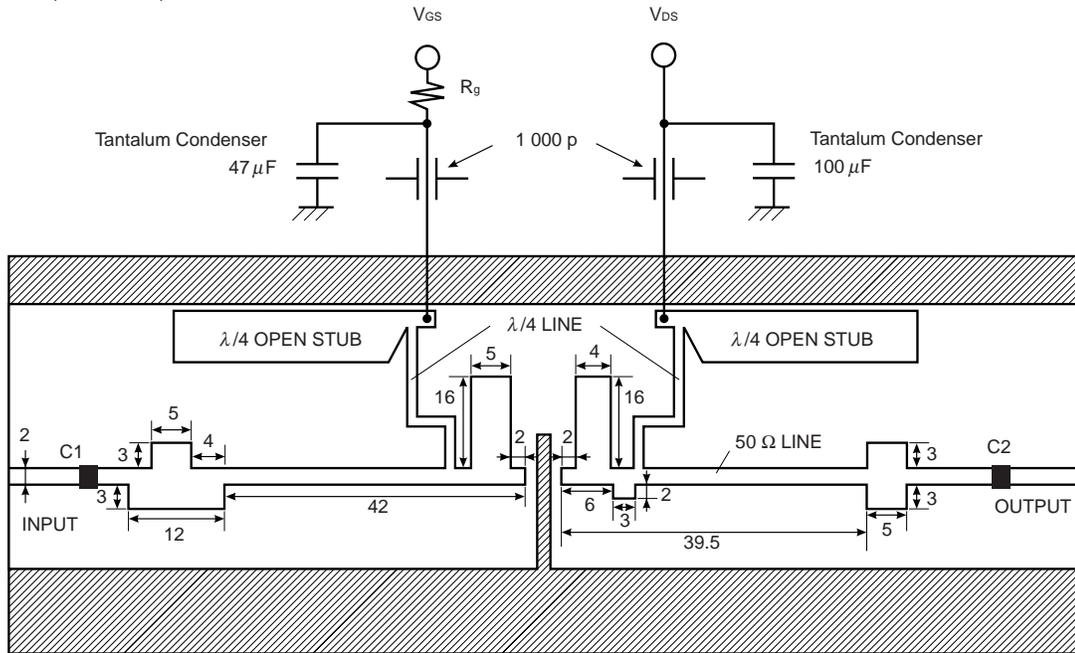
S-PARAMETERS

Test Conditions: $V_{DS} = 3.5\text{ V}$, $I_{Dset} = 200\text{ mA}$ (RF OFF)

Frequency MHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)						
550	0.940	179.9	2.859	92.3	0.020	21.9	0.803	177.2
600	0.938	178.6	2.699	92.6	0.020	24.3	0.808	177.2
650	0.943	177.5	2.440	91.9	0.020	25.3	0.806	176.5
700	0.940	176.9	2.316	91.5	0.021	26.7	0.807	176.3
750	0.939	175.8	2.098	91.2	0.020	28.0	0.802	175.3
800	0.948	175.1	2.008	90.3	0.021	29.6	0.796	175.5
850	0.949	174.9	1.826	92.0	0.020	31.2	0.802	173.7
900	0.938	174.1	1.772	90.5	0.022	32.0	0.804	174.5
950	0.940	173.2	1.691	92.5	0.020	36.4	0.808	173.7
1000	0.940	172.4	1.579	90.2	0.022	34.6	0.807	173.5
1050	0.940	171.9	1.545	92.7	0.021	39.3	0.806	172.8
1100	0.938	171.7	1.447	91.4	0.022	37.3	0.805	172.3
1150	0.940	171.1	1.432	91.0	0.022	40.5	0.807	171.9
1200	0.936	170.4	1.342	90.6	0.023	40.4	0.803	171.4
1250	0.935	170.1	1.325	91.3	0.022	42.5	0.803	171.3
1300	0.935	169.4	1.224	89.2	0.023	42.3	0.800	170.8
1350	0.933	169.9	1.232	90.2	0.023	47.0	0.806	171.4
1400	0.934	168.0	1.140	90.0	0.023	45.5	0.795	169.9
1450	0.937	167.5	1.105	88.5	0.024	46.1	0.804	169.5
1500	0.938	167.0	1.075	90.0	0.023	49.5	0.801	168.8
1550	0.938	166.4	1.045	90.3	0.024	49.6	0.803	168.7
1600	0.934	167.1	1.019	91.1	0.024	52.3	0.803	169.5
1650	0.936	165.1	0.997	89.7	0.025	53.3	0.803	167.6
1700	0.933	164.6	0.982	91.0	0.025	54.8	0.800	166.7
1750	0.934	163.7	0.936	89.6	0.026	54.6	0.803	166.6
1800	0.934	162.9	0.961	87.4	0.026	57.7	0.799	165.3
1850	0.934	162.1	0.905	90.9	0.026	55.6	0.804	165.4
1900	0.935	161.7	0.875	85.8	0.028	58.5	0.798	164.1
1950	0.931	160.7	0.855	89.3	0.026	58.2	0.800	164.1
2000	0.929	160.4	0.807	87.2	0.028	59.5	0.797	163.2
2050	0.929	158.8	0.796	89.3	0.027	58.0	0.802	162.6
2100	0.933	158.1	0.772	85.5	0.028	63.2	0.797	161.1
2150	0.928	156.6	0.769	92.6	0.027	60.2	0.792	160.5
2200	0.934	156.5	0.729	87.0	0.028	65.2	0.793	159.9
2250	0.930	155.5	0.716	92.2	0.027	65.6	0.795	159.9

APPLICATION CIRCUIT EXAMPLE

f = 1.9 GHz (Unit: mm)



GND

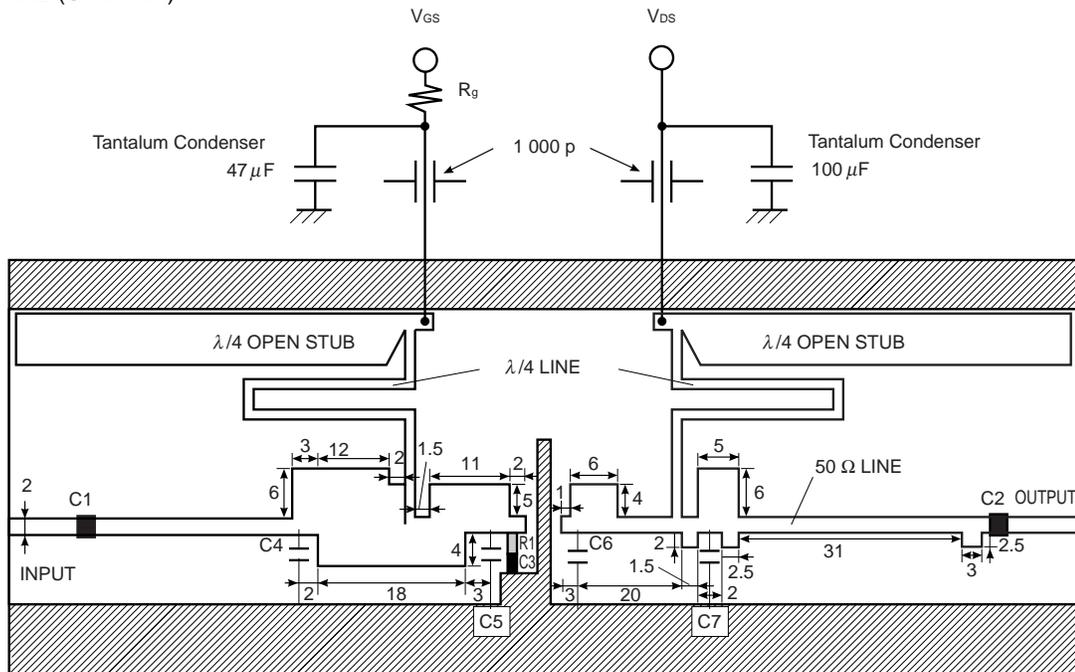
f = 1.9 GHz
 V_{DS} = 3.5 V
 I_{Dset} = 200 mA (RF OFF)

C1 = 30 pF R_g = 100 Ω
 C2 = 30 pF

Substrate: Teflon glass (ε_r = 2.6)
 t = 0.8 mm

APPLICATION CIRCUIT EXAMPLE

f = 900 MHz (Unit: mm)



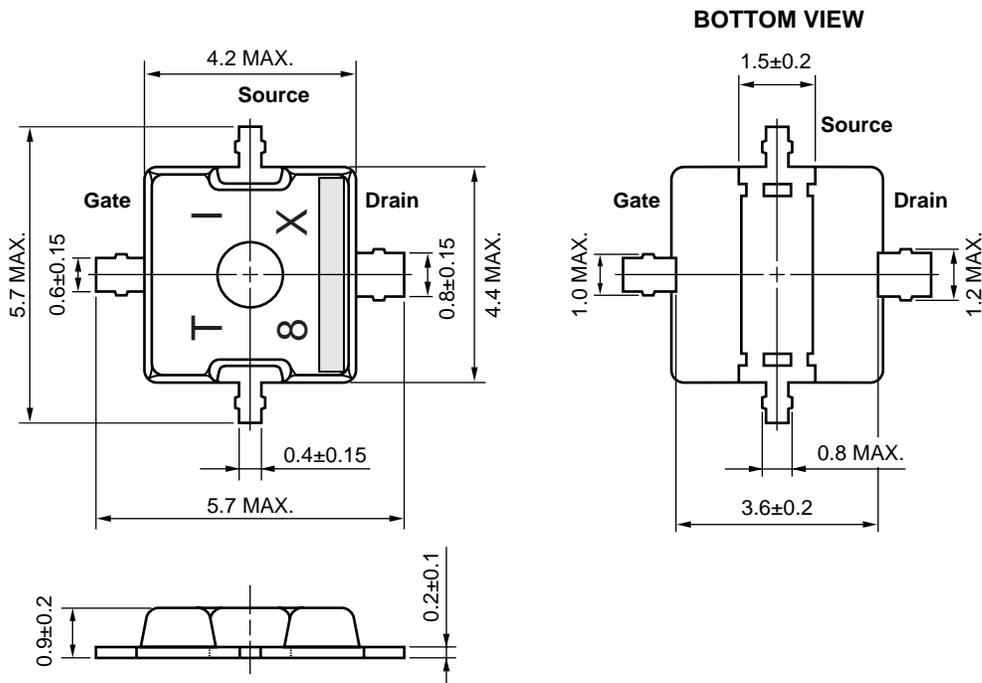
GND

f = 900 MHz
 V_{DS} = 3.5 V
 I_{Dset} = 200 mA (RF OFF)

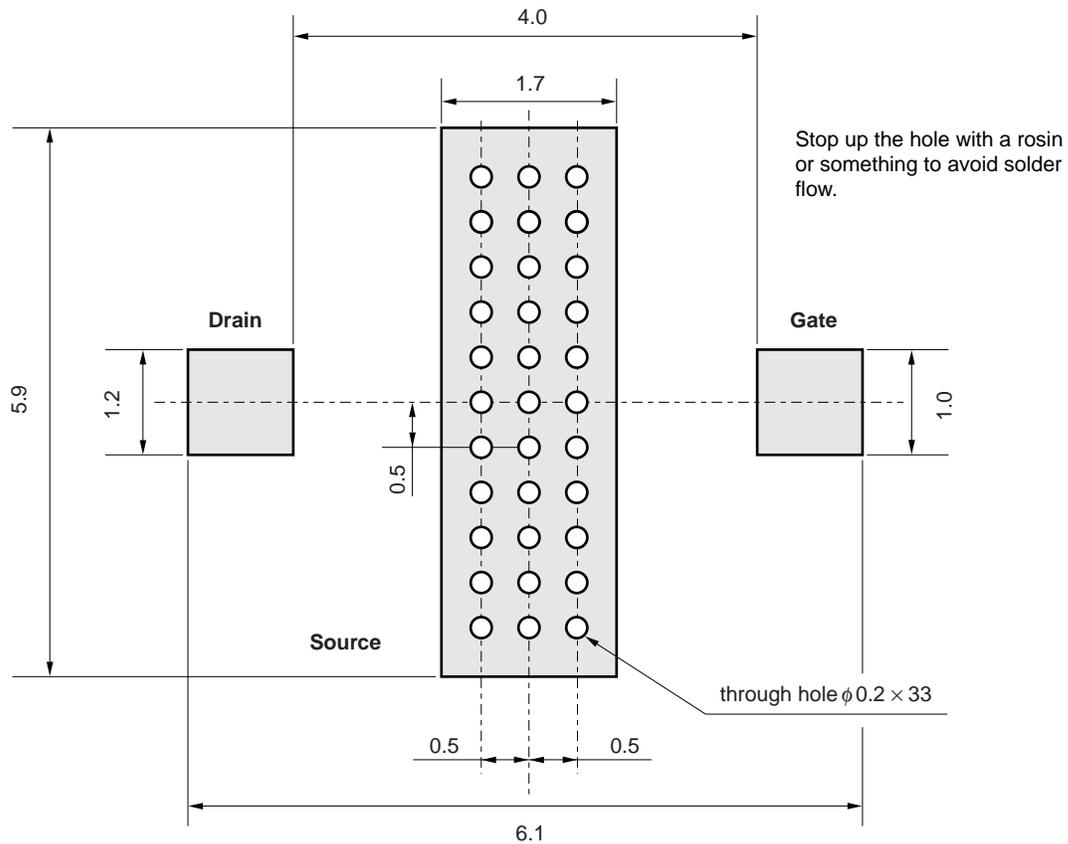
C1 = 30 pF C5 = 8 pF R1 = 30 Ω
 C2 = 30 pF C6 = 8 pF R_g = 100 Ω
 C3 = 30 pF C7 = 4 pF
 C4 = 3 pF

Substrate: Teflon glass (ε_r = 2.6)
 t = 0.8 mm

79A PACKAGE DIMENSIONS (Unit: mm)



79A PACKAGE RECOMMENDED P.C.B. LAYOUT (Unit: mm)



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: 2 times or less, Exposure limit: None ^{Note}	IR35-00-2
Partial Heating	Pin temperature: 260°C or below, Time: 5 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).

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.

- **The information in this document is current as of August, 2000. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
- NEC semiconductor products are classified into the following three quality grades:
"Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product 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": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.

(Note)

(1) "NEC" as used in this statement means NEC Corporation and also includes its majority-owned subsidiaries.

(2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).