

MONOLITHIC H BRIDGE DRIVER

DESCRIPTION

This IC is a monolithic H bridge driver employing a horizontal N-channel power MOS FET for its driver stage.

It is provided with forward/reverse and brake functions and is ideal as a driver circuit for a motor that winds or rewinds the film in a camera, or a motor for moving a lens.

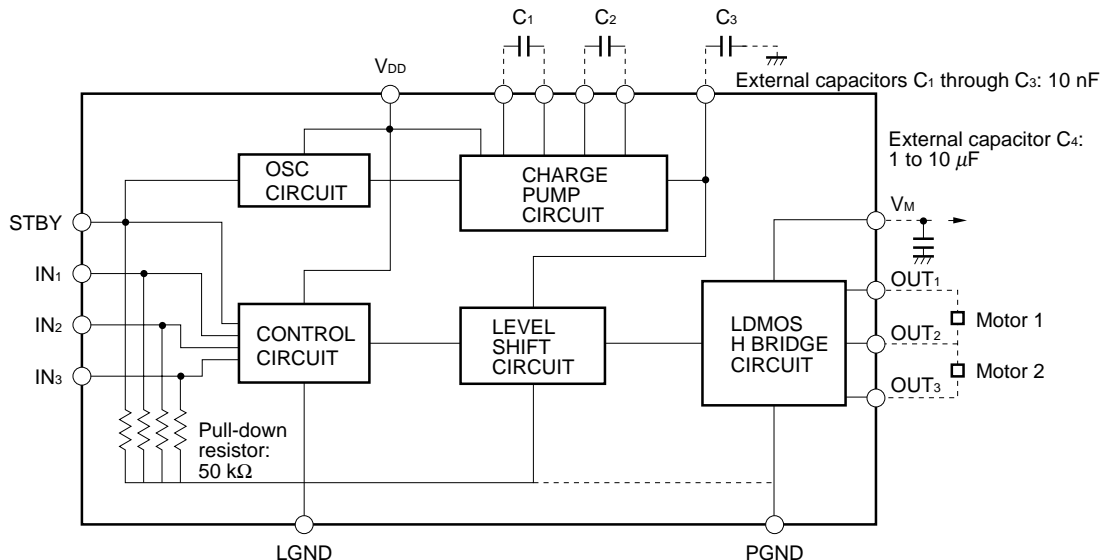
FEATURES

- High drive current $I_{DR1} = 0.5 \text{ A (DC)}$
 $I_{DR2} = 1 \text{ A: at } PW \leq 200 \text{ ms, duty cycle } \leq 50\%$
 $I_{DR3} = 3 \text{ A: at } PW \leq 200 \text{ ms, single pulse}$
- 1.5ch H bridge circuits
- Low ON resistance (sum of ON resistance of top and bottom FETs)
 $R_{ON} = 0.6 \Omega \text{ TYP. at } I_{DR} = 0.5 \text{ A}$
- Standby function that turns OFF charge pump circuit
- Low-voltage drive (2.5 V MIN.)
- Surface-mount mini-mold package: 20-pin plastic SOP (300 mil)

ORDERING INFORMATION

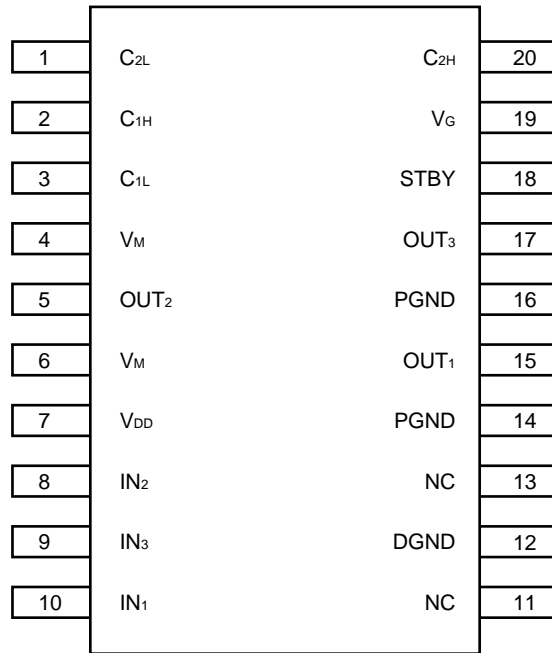
Part Number	Package
μ PD16823GS	20-pin plastic SOP (300 mil)

BLOCK DIAGRAM

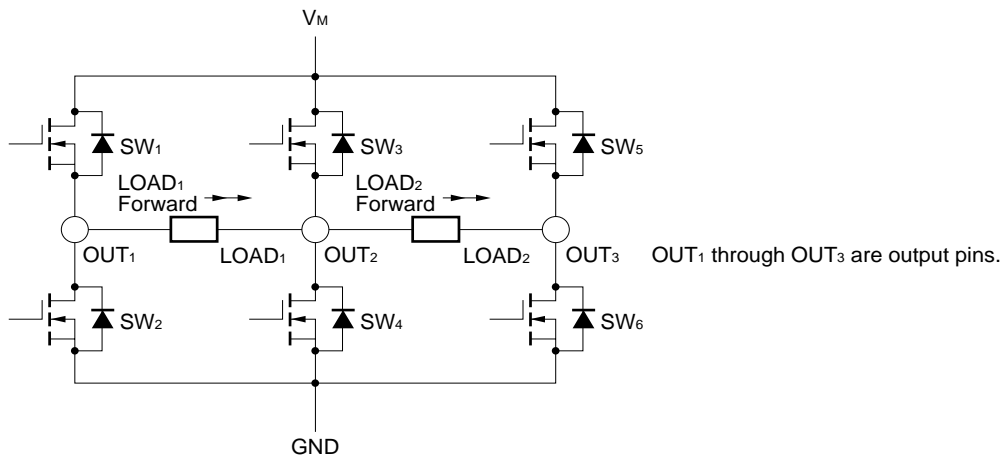


The information in this document is subject to change without notice.

PIN CONFIGURATION



INTERNAL CONNECTION



FUNCTION TABLE

Input Signal				Circuit Operation	Current Path
IN ₁	IN ₂	IN ₃	STBY		
L	H	L	H	1 CH forward mode	SW ₁ →LOAD ₁ →SW ₄
L	L	H	H	1 CH reverse mode	SW ₃ →LOAD ₁ →SW ₂
L	H	H	H	1 CH brake mode	SW ₂ (Di ₂) →LOAD ₁ →SW ₄
H	H	L	H	2 CH forward mode	SW ₃ →LOAD ₂ →SW ₆
H	L	H	H	2 CH reverse mode	SW ₅ →LOAD ₂ →SW ₄
H	H	H	H	2 CH brake mode	SW ₄ (Di ₄) →LOAD ₂ →SW ₆
×	L	L	H	Stop mode	
×	×	×	L	Standby mode	Charge pump ON/OFF

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	Condition	Ratings	Unit
(Positive) supply voltage	V _{DD}	When charge pump operates	-0.5 to +6.5	V
		When charge pump does not operate	-0.5 to +8.0	V
	V _M		-0.5 to +8.0	V
Gate drive voltage	V _G		15	V
Input voltage	V _{IN}		-0.5 to V _{DD} + 0.5	V
H bridge drive current Positive: MOS output stage forward current Negative: Output stage diode current	I _{DR}	DC	±0.5	A
		PW ≤ 200 ms, duty cycle ≤ 50%	±1.0	A
		PW ≤ 200 ms, single pulse	±3.0	A
Power dissipation	P _D		1.0	W
Operating temperature	T _A		-30 to +60	°C
Junction temperature	T _{j(peak)}		150	°C
Storage temperature	T _{stg}		-55 to +150	°C

RECOMMENDED OPERATING CONDITIONS (T_A = 25 °C)

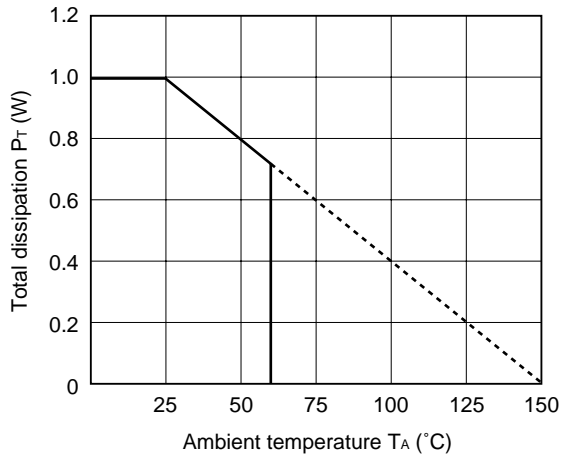
Parameter	Symbol	Condition	Ratings	Unit
(Positive) supply voltage	V _{DD}	When charge pump operates	2.5 to 6.0	V
		When charge pump does not operate	2.5 to 7.5	V
	V _M		-0.5 to +7.5	V
Gate drive voltage	V _G		11 to 14	V
Junction temperature	T _{j(peak)}		125	°C

ELECTRICAL CHARACTERISTICS (T_A = -30 °C to +60 °C)

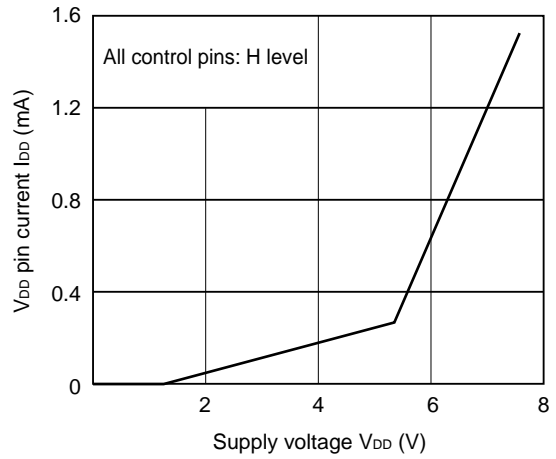
Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
V _{DD} pin current	I _{DD1}	V _{DD} = 5 V, with all control pins at high level			2.0	mA
	I _{DD2}	V _{DD} = 5 V, with all control pins at low level			10	μA
V _M pin current	I _M	T _A = 25 °C, with all control pins at low level			1.0	μA
		With all control pins at low level			10	μA
H bridge ON resistance	R _{ON}	I _{DR} = 0.5 A, V _{DD} = V _M = 5 V, T _A = 25 °C		0.6	0.8	Ω
Control pin high-level input voltage	V _{IH}		V _{DD} × 0.6			V
Control pin low-level input voltage	V _{IL}				V _{DD} × 0.2	V
Charge pump circuit turn-off time	t _{ONC}	V _{DD} = V _M = 5 V			1.0	ms
H bridge circuit turn-ON time	t _{ONH}	C ₁ = C ₂ = C ₃ = 10 nF I _{DR} = 0.5 A			10	μs
H bridge circuit turn-OFF time	t _{OFFH}				5.0	μs
Regenerative diode voltage drop	V _F	I _F = 0.5 A		1.0		V
Control pin input pull-down resistance	R _{IN}		25	50	75	kΩ

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

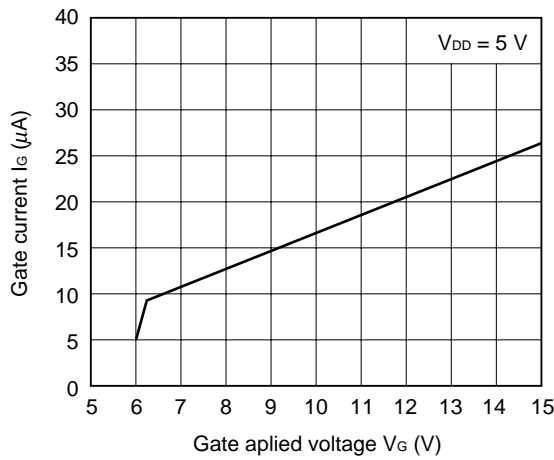
P_T vs. T_A Characteristics



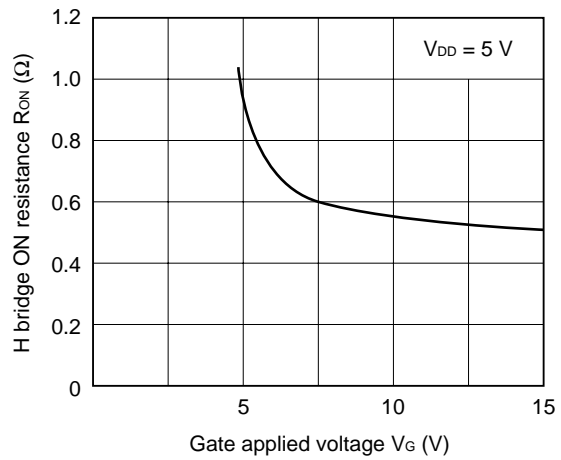
I_{DD} vs. V_{DD} Characteristics



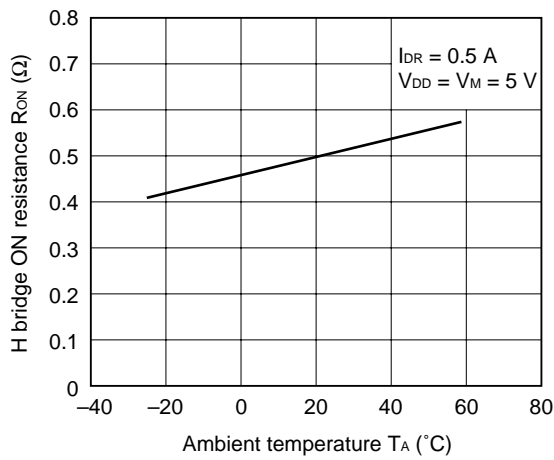
I_G vs. V_G Characteristics

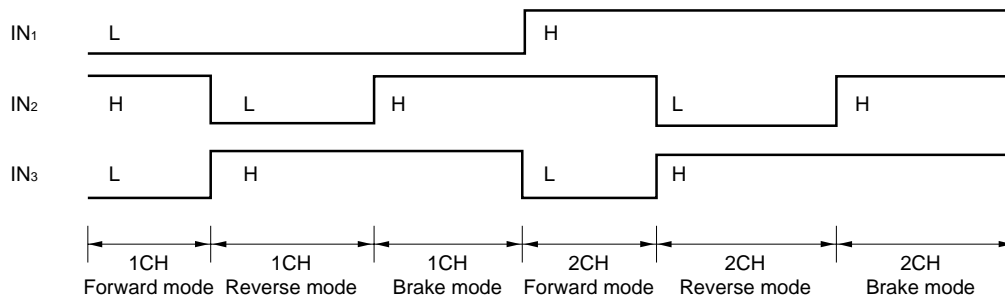
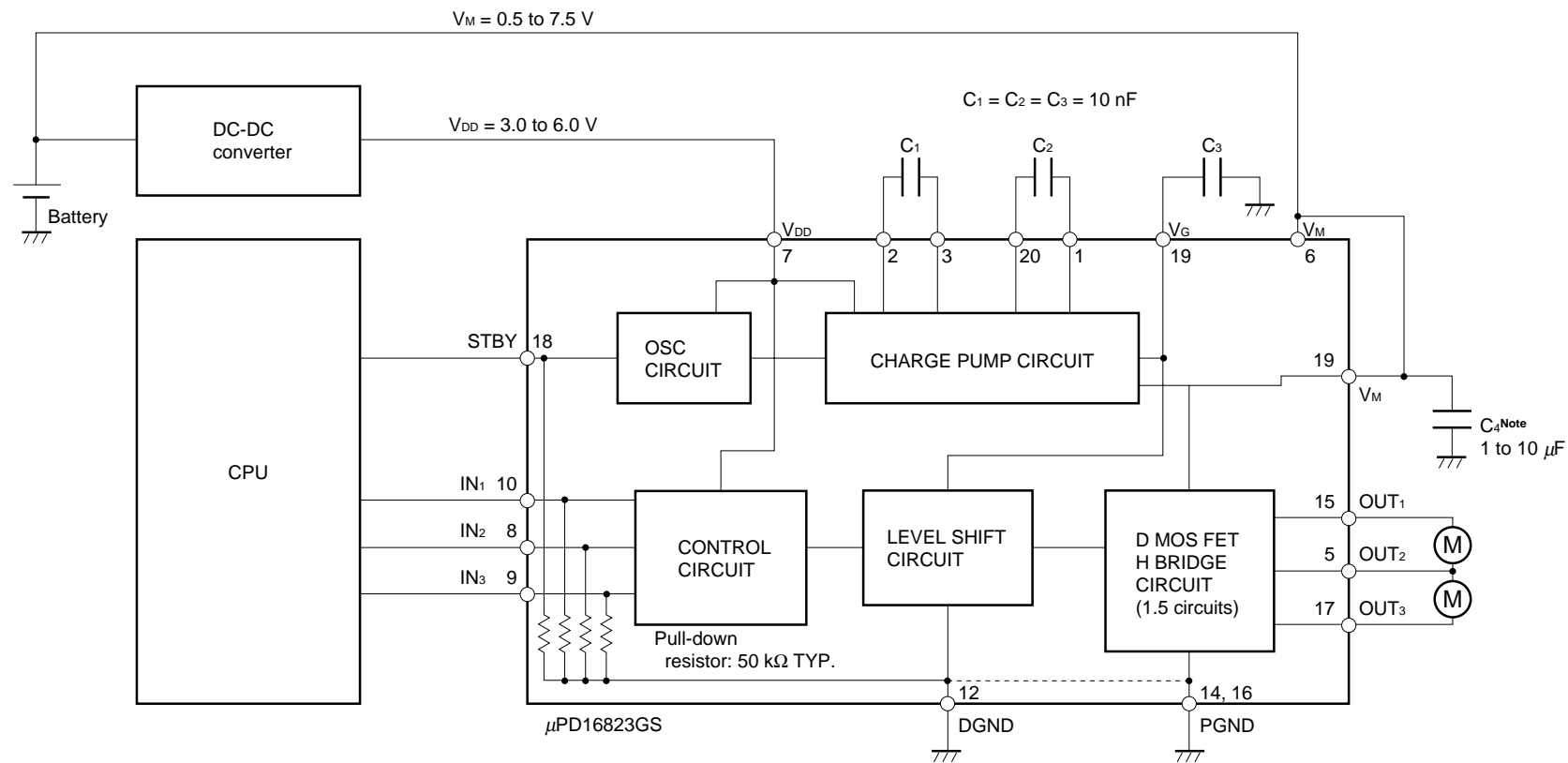


R_{ON} vs. V_G Characteristics



R_{ON} vs. T_A Characteristics

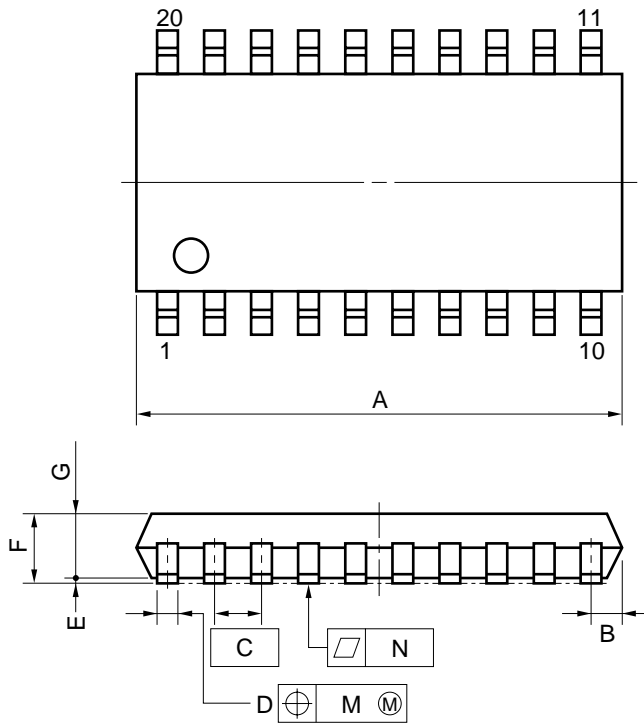




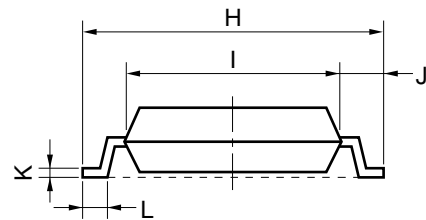
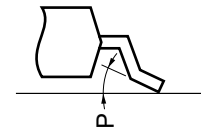
Note It is recommended to connect an external capacitor of 1 to 10 μF between V_M and GND to protect the gate of the D MOS FET from voltage surge.

PACKAGE DIMENSION

20 PIN PLASTIC SOP (300 mil)



detail of lead end



NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	13.00 MAX.	0.512 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.40 ^{+0.10} _{-0.05}	0.016 ^{+0.004} _{-0.003}
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.55	0.061
H	7.7±0.3	0.303±0.012
I	5.6	0.220
J	1.1	0.043
K	0.20 ^{+0.10} _{-0.05}	0.008 ^{+0.004} _{-0.002}
L	0.6±0.2	0.024 ^{+0.008} _{-0.009}
M	0.12	0.005
N	0.10	0.004
P	3° ^{+7°} _{-3°}	3° ^{+7°} _{-3°}

P20GM-50-300B, C-4

RECOMMENDED SOLDERING CONDITIONS

It is recommended to solder this product under the conditions shown below.

For soldering methods and conditions other than those listed below, consult NEC.

For details of the recommended soldering conditions, refer to Information Document “**Semiconductor Device Mounting Technology Manual**” (C10535E).

Soldering Method	Soldering Condition	Symbol of Recommended Soldering
Infrared reflow	Package peak temperature: 235 °C, Time: 30 seconds MAX. (210 °C MIN.) Number of times: 2 MAX., Number of days: None ^{Note} , Flux: Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.)	IR35-00-2
VPS	Package peak temperature: 215 °C, Time: 40 seconds MAX. (200 °C MIN.) Number of times: 2 MAX., Number of days: None ^{Note} , Flux: Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.)	VP15-00-2
Wave soldering	Package peak temperature: 260 °C, Time: 10 seconds MAX., Preheating temperature: 120 °C MAX., Number of times: 1, Flux: Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.)	WS60-00-1

Note The number of days during which the product can be stored at 25 °C 65% RH MAX. after the dry pack was opened.

Caution Do not use two or more soldering methods in combination.

REFERENCE DOCUMENTS

Document Name	Document No.
NEC Semiconductor Device Reliability/Quality Control System	C11745E
Guide to Quality Assurance for Semiconductor Devices	MEI-1202
Safe Operating Area of Power MOS FET	TEA-1037

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"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.