

# AUTOMOTIVE RELAYS

## EQ1 SERIES

### DESCRIPTION

The new NEC EQ1 Series automotive relays are designed for motor and lamp control applications that require a high level of quality and performance. The EQ1 has a unique two-piece design for the magnetic circuit, which result in small size, light weight, and high productivity.

### FEATURES

- PC board mounting
- Same pin-layout as MR301
- Approx. 70% less relay volume than MR301
- Approx. 80% less relay space than MR301
- Approx. 90% less relay height than MR301
- Approx. 60% less relay weight than MR301

### APPLICATIONS

- Motor control
- Heater control
- Solenoid control
- Lamp control



EQ1 SERIES

### For Proper Use of Miniature Relays

#### DO NOT EXCEED MAXIMUM RATING

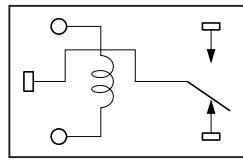
Do not use relay under excessive conditions such as over ambient temperature, over voltage and over current. Incorrect use could result in abnormal heating and damage to the relay or other parts.

#### READ CAUTIONS IN THE SELECTION GUIDE.

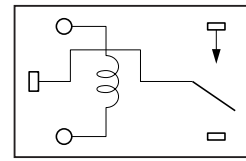
Read the cautions described in NEC's "Miniature Relays" (ER0046EJ\*) before dose designing your relay application.

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

SCHEMATIC (BOTTOM VIEW)

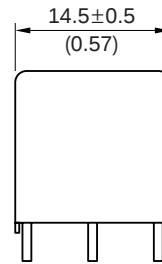
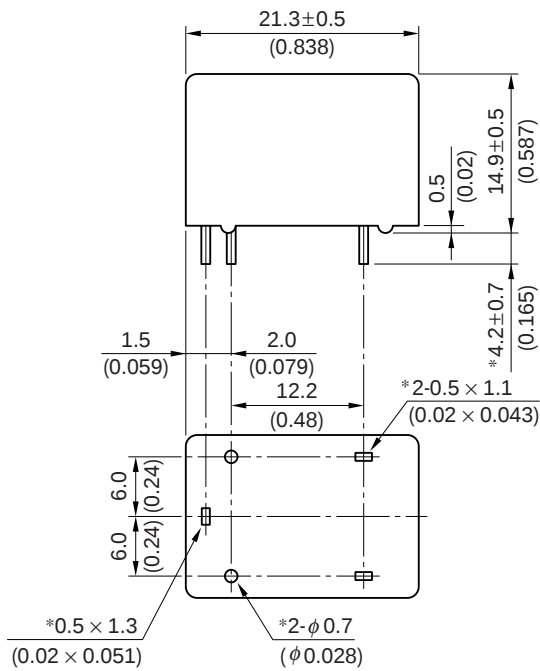


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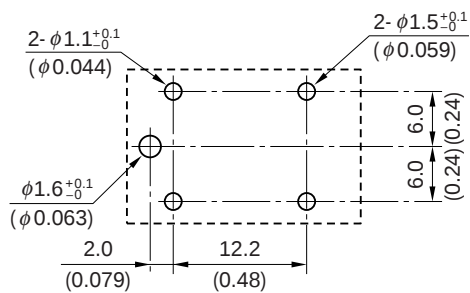
<1 Form a>

DIMENSIONS mm (inch)



\* After Soldering

PCB PAD LAYOUT mm (inch) (BOTTOM VIEW)



SPECIFICATION

(at 20°C)

| Items                             |                          | For motor control                                  |            | For lamp and LCR circuit control |            |
|-----------------------------------|--------------------------|----------------------------------------------------|------------|----------------------------------|------------|
|                                   |                          | EQ1-31000S                                         | EQ1-11040S | EQ1-11111S                       | EQ1-22111S |
| Contact Form                      |                          | 1 Form c                                           |            | 1 Form a                         |            |
| Contact Rating                    | Max. Switching Voltage   | 16 Vdc                                             |            |                                  |            |
|                                   | Max. Switching Current   | 35 A (at 16 Vdc)                                   |            |                                  |            |
|                                   | Contact Resistance       | Typical 5 mΩ (measured at 1 A) Initial             |            |                                  |            |
| Contact Material                  |                          | Silver oxide complex alloy                         |            |                                  |            |
| Operate Time (Excluding Bounce)   |                          | Typical 3 ms (at Nominal Voltage)                  |            |                                  |            |
| Release Time (Excluding Bounce) * |                          | Typical 4 ms (at Nominal Voltage)                  |            |                                  |            |
| Nominal Operate Power             |                          | 640 mW                                             | 1000 mW    |                                  | 800 mW     |
| Insulation Resistance             |                          | 100 MΩ (at 500 Vdc)                                |            |                                  |            |
| Breakdown Voltage                 | Between Open Contact     | 500 Vac min. (for 1 minute)                        |            |                                  |            |
|                                   | Between Coil and Contact | 500 Vac min. (for 1 minute)                        |            |                                  |            |
| Shock Resistance                  | Misoperation             | 98 m/s <sup>2</sup> (10 G)                         |            |                                  |            |
|                                   | Destructive Failure      | 980 m/s <sup>2</sup> (100 G)                       |            |                                  |            |
| Vibration Resistance              | Misoperation             | 10 to 300 Hz, 43 m/s <sup>2</sup> (4.4 G)          |            |                                  |            |
|                                   | Destructive Failure      | 10 to 500 Hz, 43 m/s <sup>2</sup> (4.4 G) 200 hour |            |                                  |            |
| Ambient Temperature               |                          | -40 to +85°C (-40 to 185°F)                        |            |                                  |            |
| Coil Temperature Rise             |                          | 60°C/W (108°F/W)                                   |            |                                  |            |
| Life Expectancy                   | Mechanical               | 1 × 10 <sup>6</sup> operations                     |            |                                  |            |
|                                   | Motor : 25 A lock        | 100 × 10 <sup>3</sup> operations                   |            | -                                |            |
|                                   | Lamp : 108 W Tungsten    | -                                                  |            | 100 × 10 <sup>3</sup> operations |            |
|                                   | Lamp : 120 W Halogen     | -                                                  |            | 100 × 10 <sup>3</sup> operations |            |
|                                   | LCR circuit : 70 A peak  | -                                                  |            | 100 × 10 <sup>3</sup> operations |            |
| Weight                            |                          | Approx. 9 g (0.32 oz)                              |            |                                  |            |

\* with diode

COIL RATING

◆ SEALED TYPE

(at 20°C)

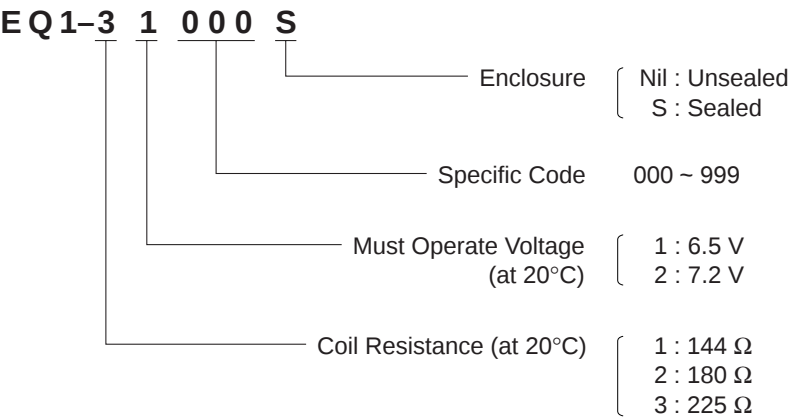
| Items                        |                 | Part Number | Nominal Voltage<br>(Vdc) | Coil Resistance<br>(Ω ±10%) | Must Operate Voltage<br>(Vdc) | Must Release Voltage<br>(Vdc) |
|------------------------------|-----------------|-------------|--------------------------|-----------------------------|-------------------------------|-------------------------------|
| Motor Control                | General-Purpose | EQ1-31000S  | 12                       | 225                         | 6.5                           | 0.9                           |
|                              | For Jump Start  | EQ1-11040S  |                          | 144                         | 6.5                           | 0.6                           |
| Lamp and LCR circuit control |                 | EQ1-22111S  |                          | 180                         | 7.2                           | 0.9                           |
|                              |                 | EQ1-11111S  |                          | 144                         | 6.5                           | 0.6                           |

◆ UNSEALED TYPE

(at 20°C)

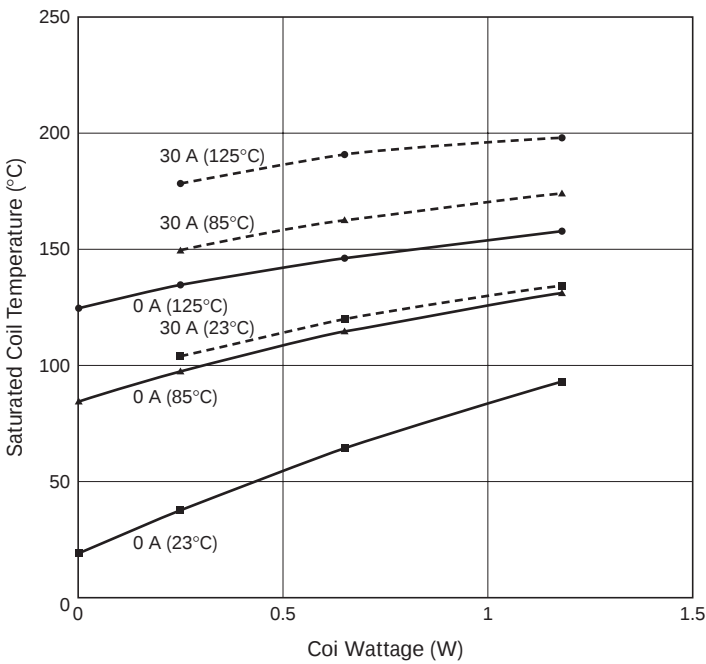
| Items                        |                 | Part Number | Nominal Voltage<br>(Vdc) | Coil Resistance<br>(Ω ±10%) | Must Operate Voltage<br>(Vdc) | Must Release Voltage<br>(Vdc) |
|------------------------------|-----------------|-------------|--------------------------|-----------------------------|-------------------------------|-------------------------------|
| Motor Control                | General-Purpose | EQ1-31000   | 12                       | 225                         | 6.5                           | 0.9                           |
|                              | For Jump Start  | EQ1-11040   |                          | 144                         | 6.5                           | 0.6                           |
| Lamp and LCR circuit control |                 | EQ1-22111   |                          | 180                         | 7.2                           | 0.9                           |
|                              |                 | EQ1-11111   |                          | 144                         | 6.5                           | 0.6                           |

NUMBERING SYSTEM



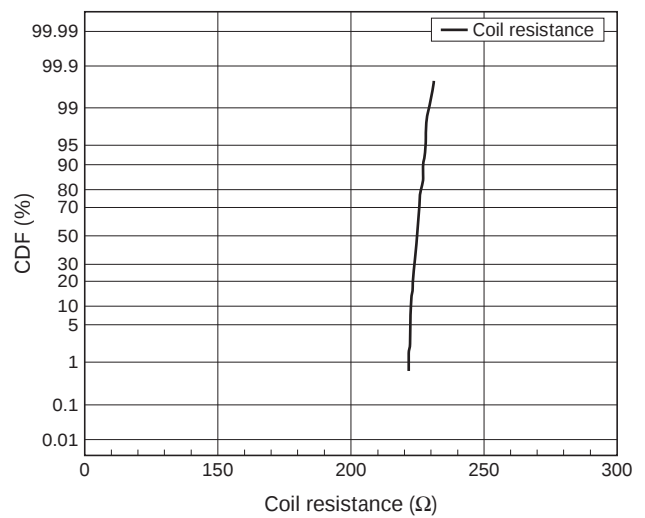
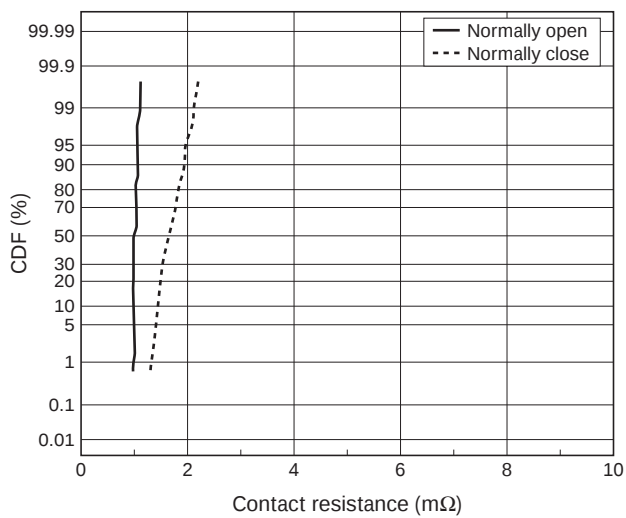
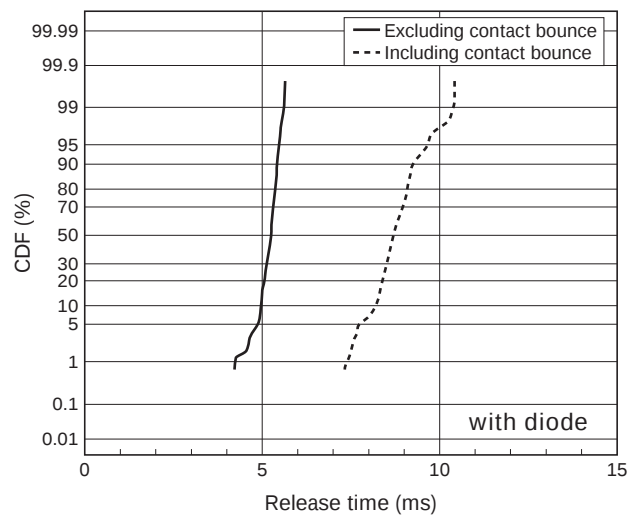
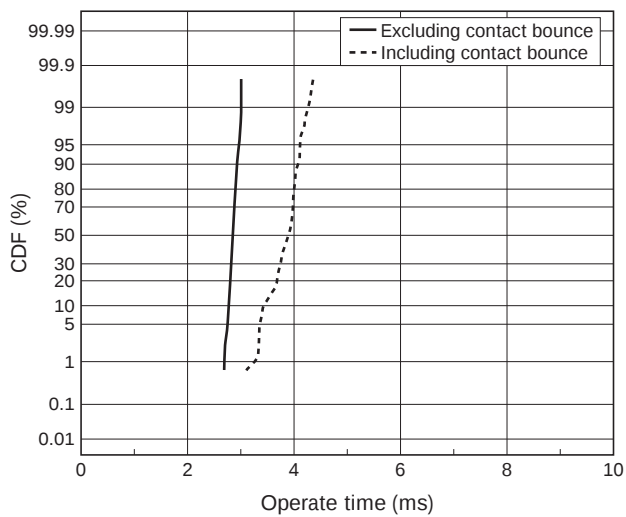
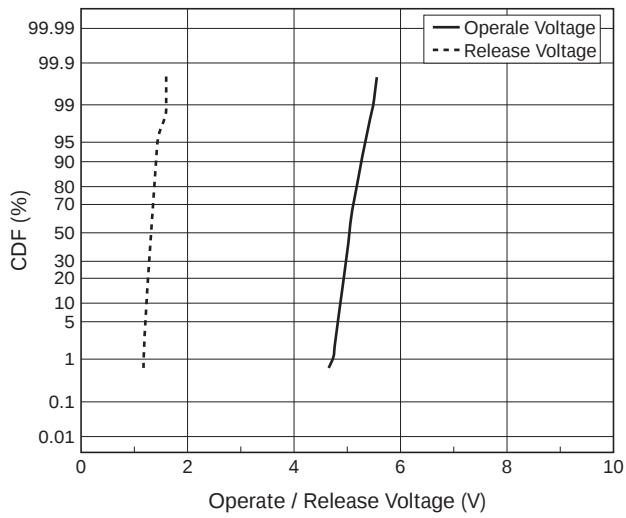
TECHNICAL DATA

Coil Temperature Rise

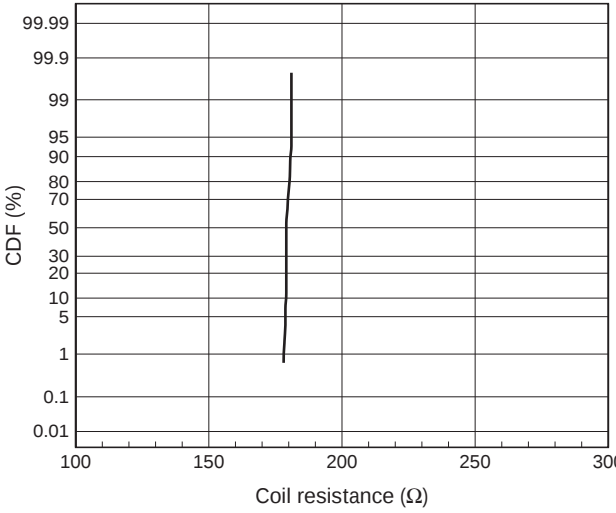
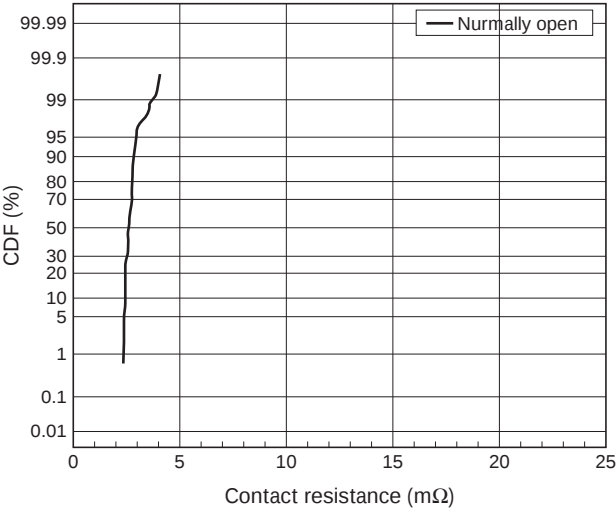
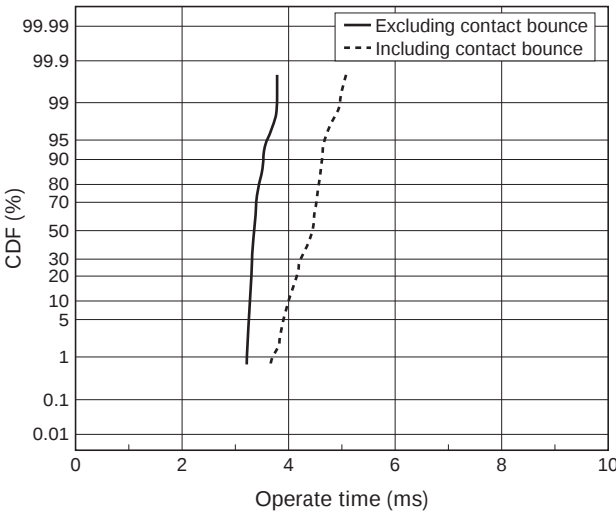
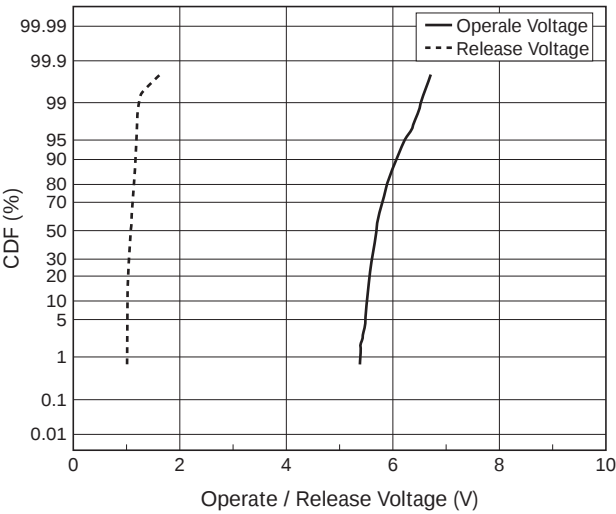


# RELAY CHARACTERISTICS DISTRIBUTION (INITIAL)

- EQ1-31000S
- 200 pieces



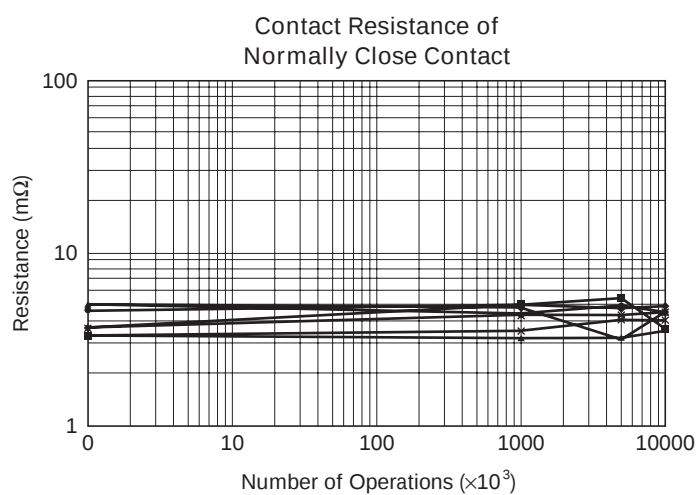
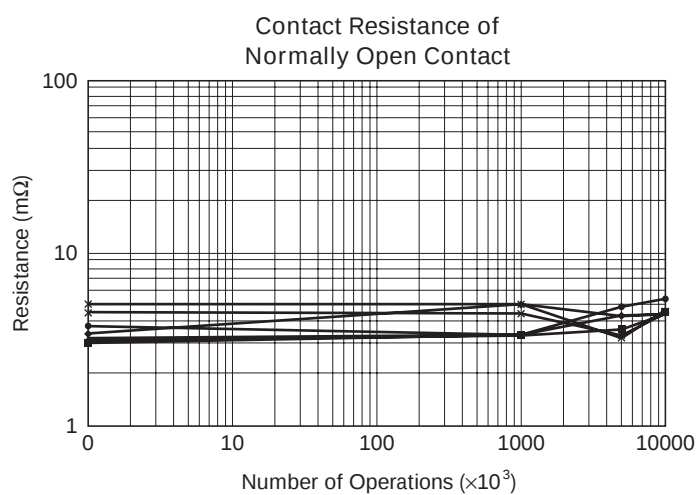
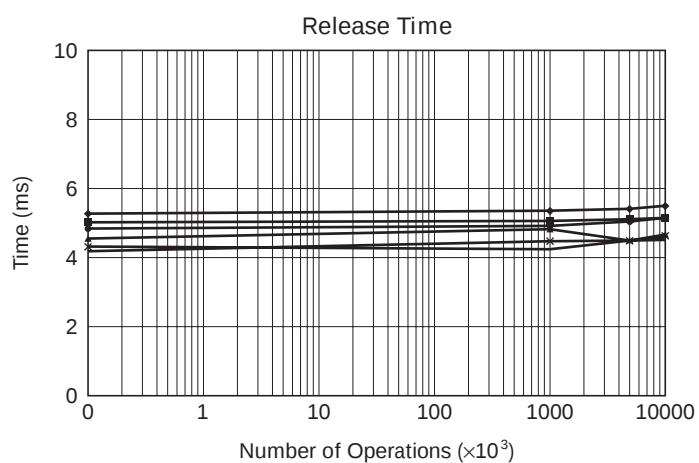
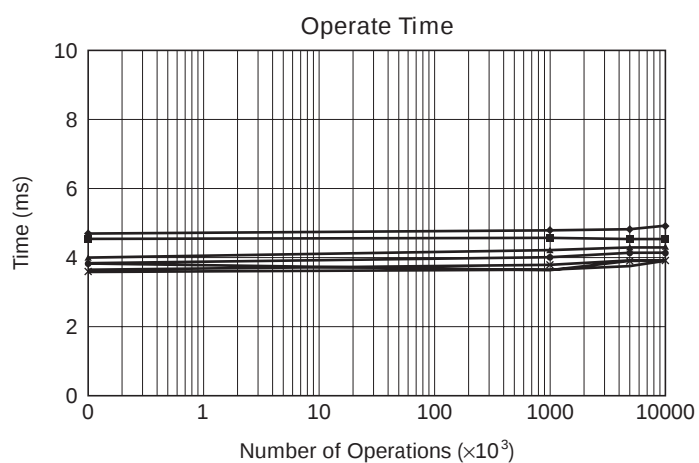
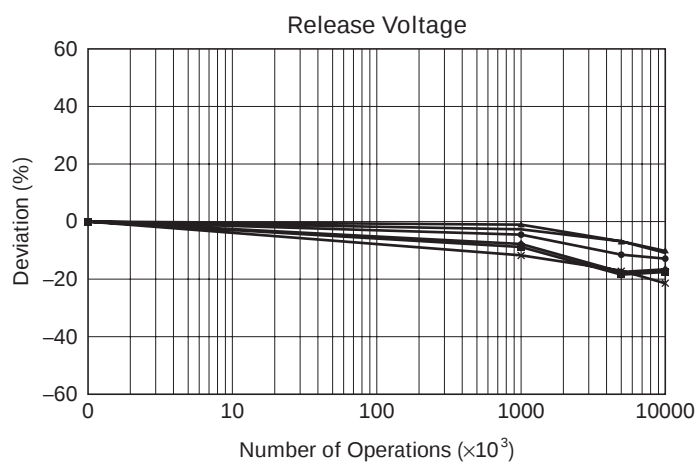
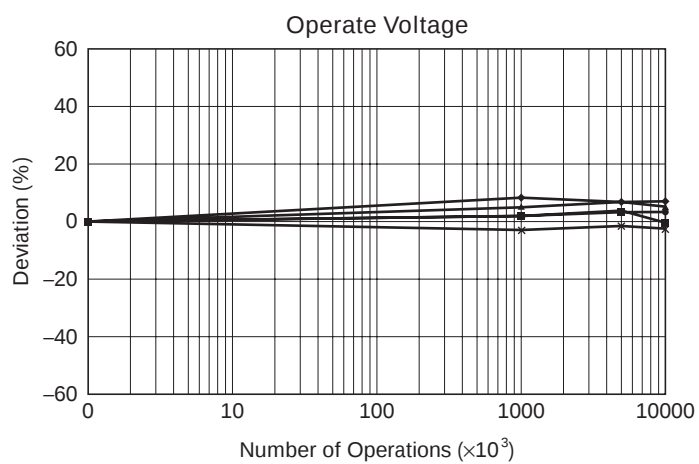
- EQ1-22111S
- 200 pieces



## DURABILITY LIFE

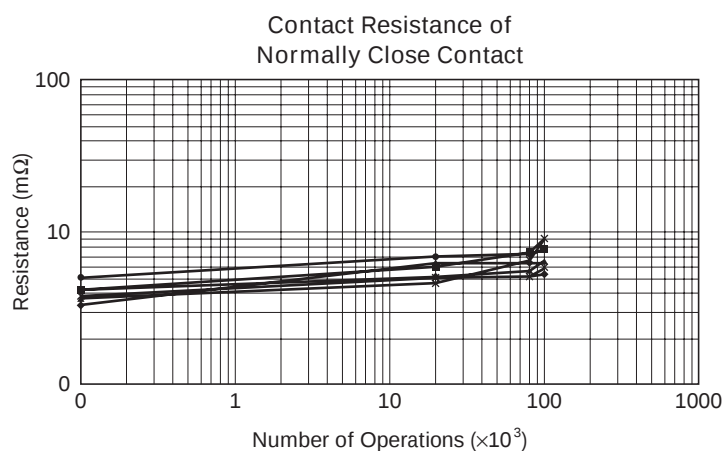
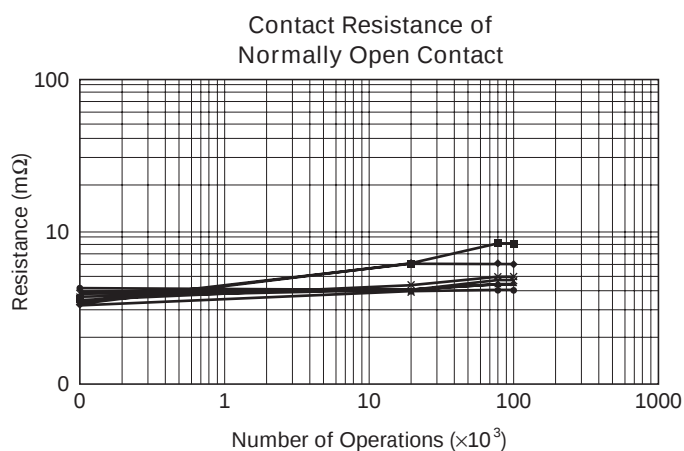
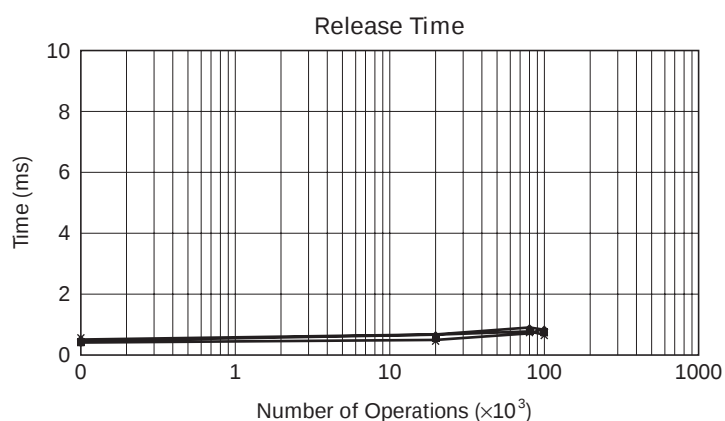
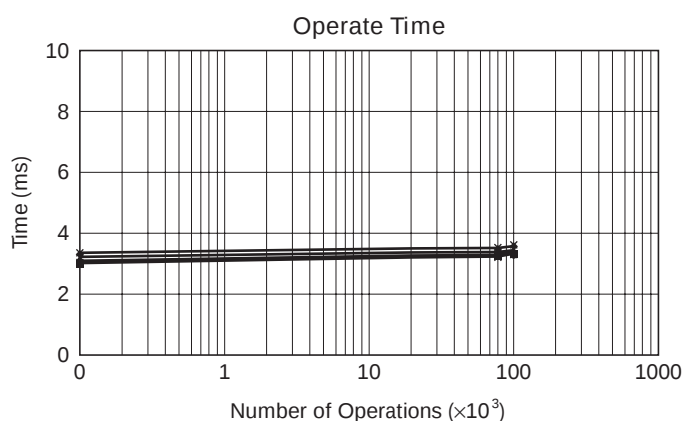
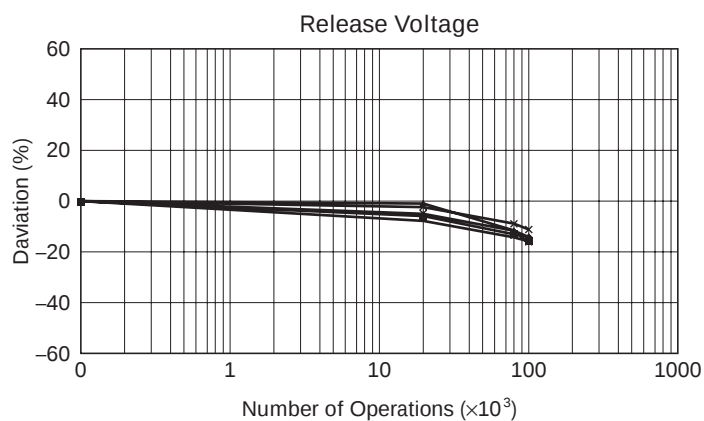
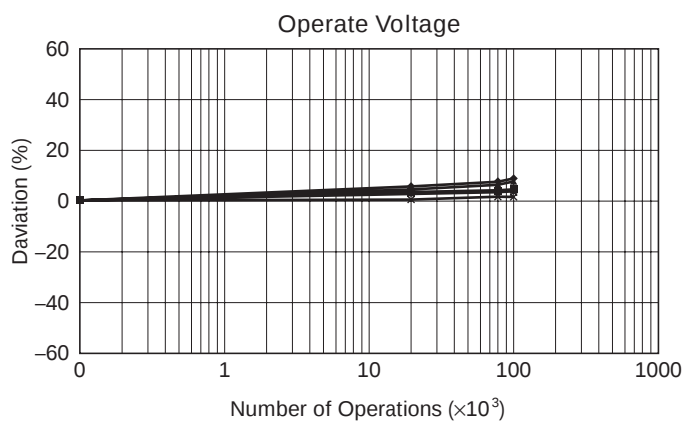
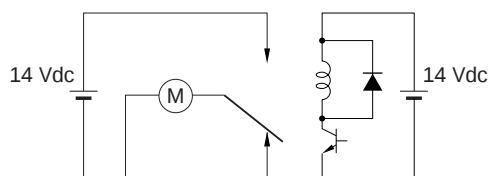
### Mechanical Life Test

- Ambient Temperature : 23°C
- Frequency : 12.5 Hz (50% duty)
- Contact Load : No Load
- Number of Operations :  $10 \times 10^6$
- Samples : EQ1-31000S 10 pieces



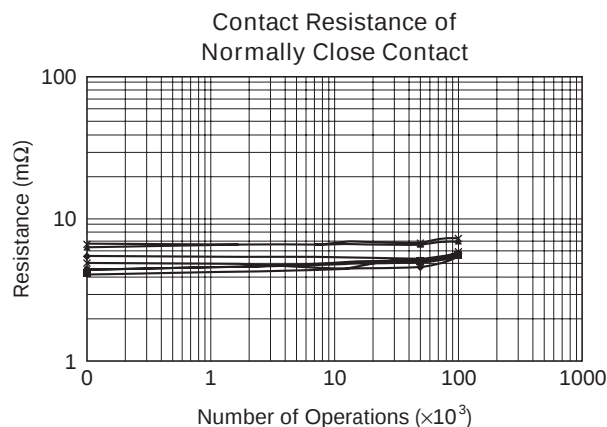
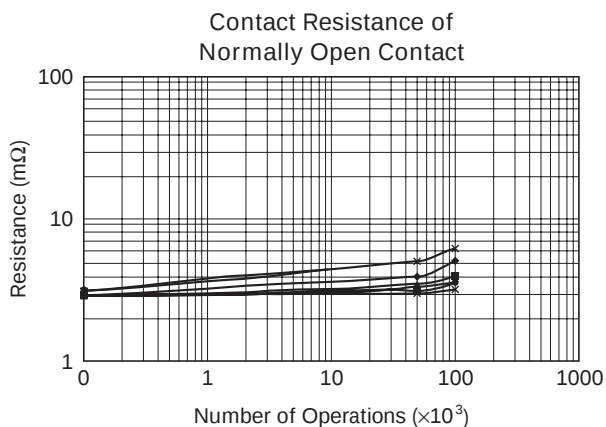
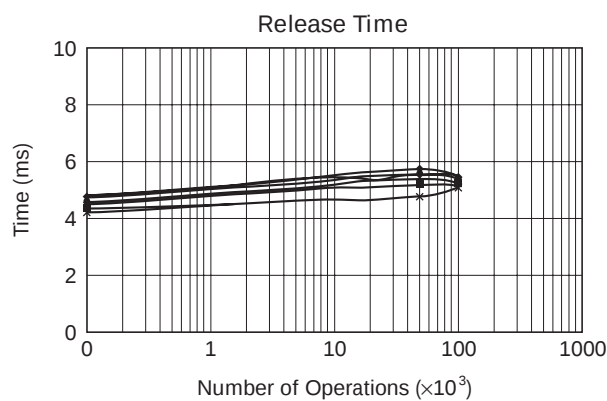
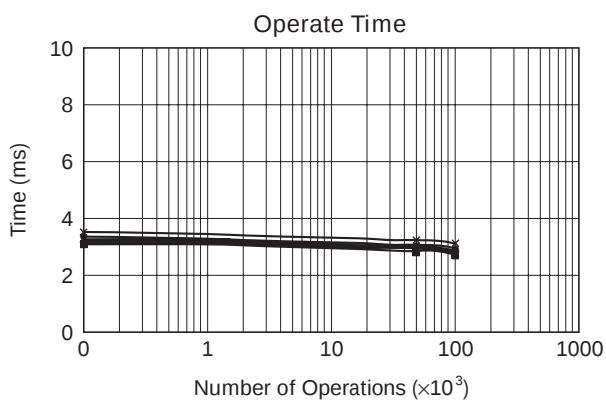
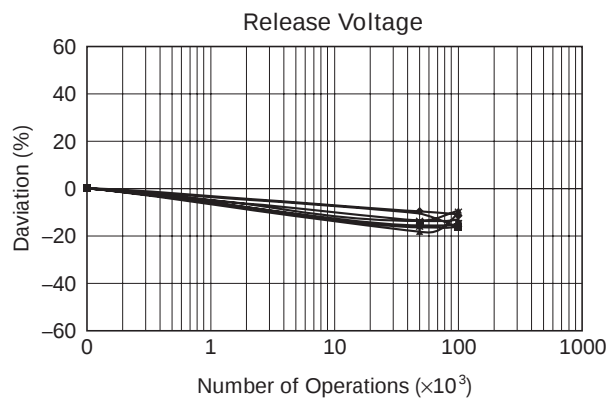
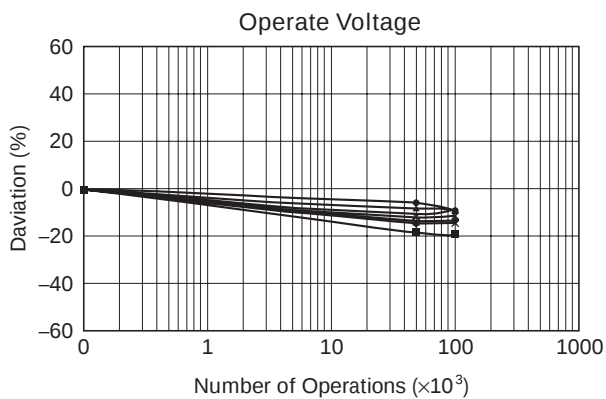
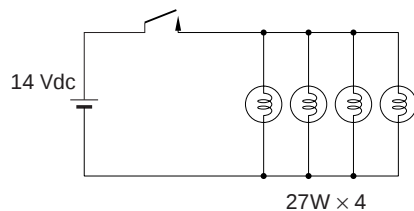
## Electrical Life Test 1

- Ambient Temperature : 23°C
- Frequency : 0.2s ON, 9.8s OFF, 0.1 Hz
- Contact Load : 14 Vdc, 25 A, Locked motor
- Number of Operations :  $200 \times 10^3$
- Samples : EQ1-31000S 10 pieces



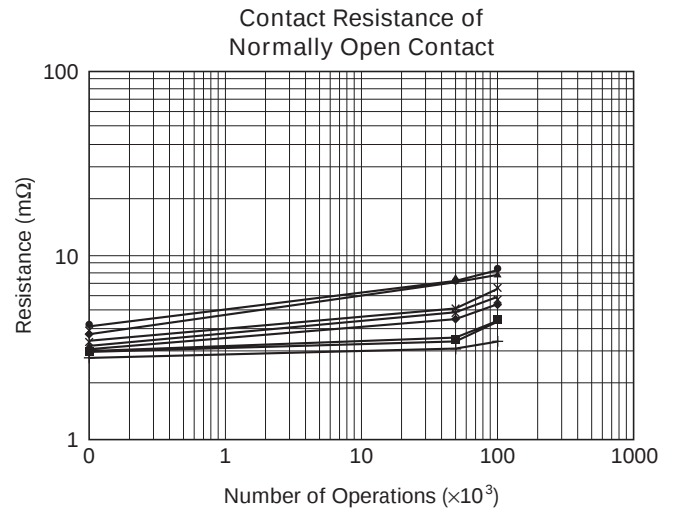
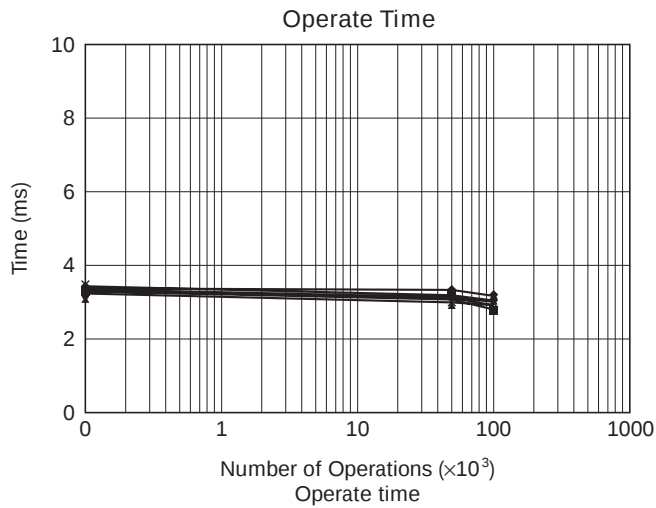
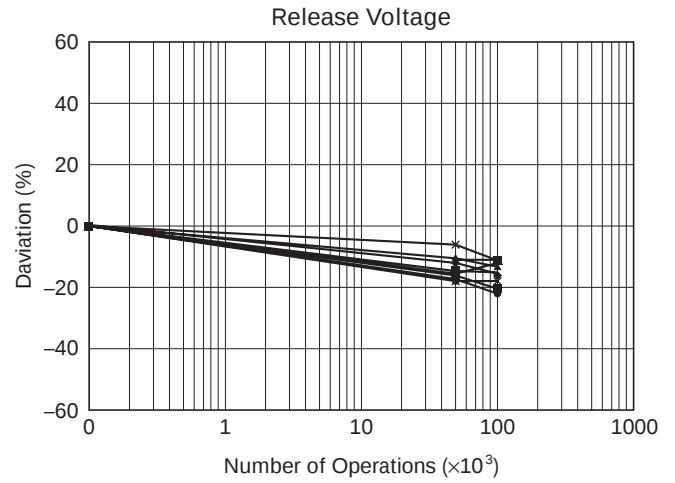
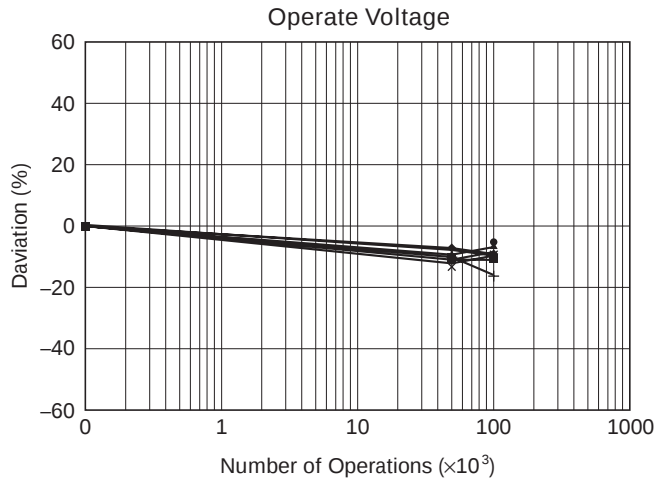
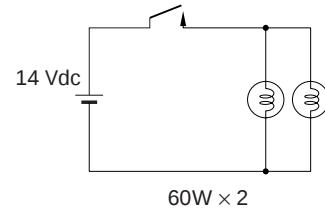
### Electrical Life Test 2

- Ambient Temperature : 23°C
- Frequency : 1s ON, 29s OFF
- Contact Load : 14 Vdc, 108 W, Tungsten Lamp
- Number of Operations :  $100 \times 10^3$
- Samples : EQ1-22111S 10 pieces



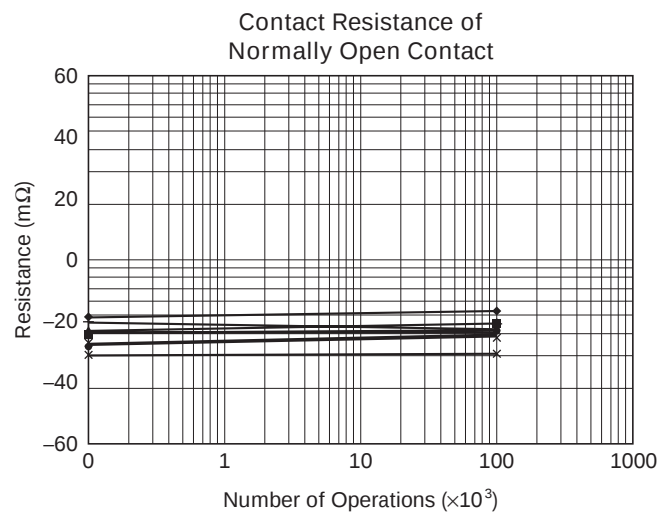
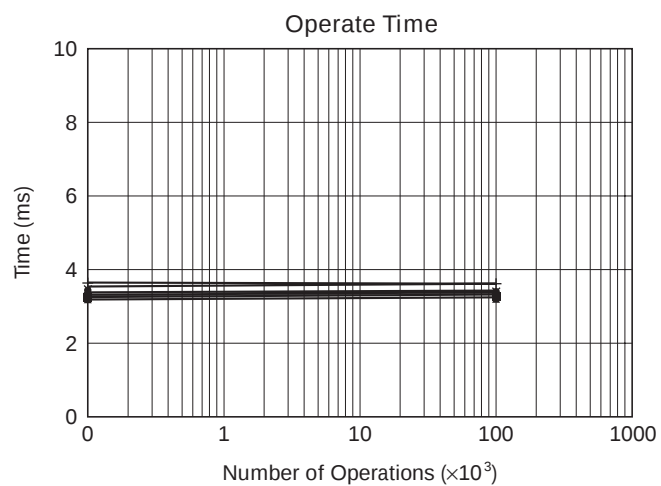
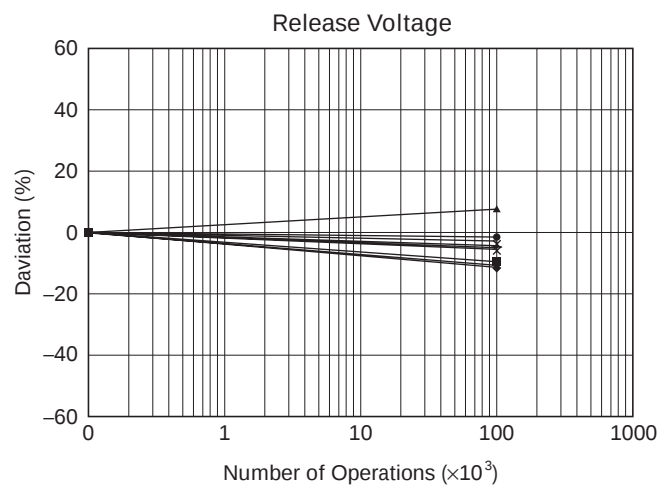
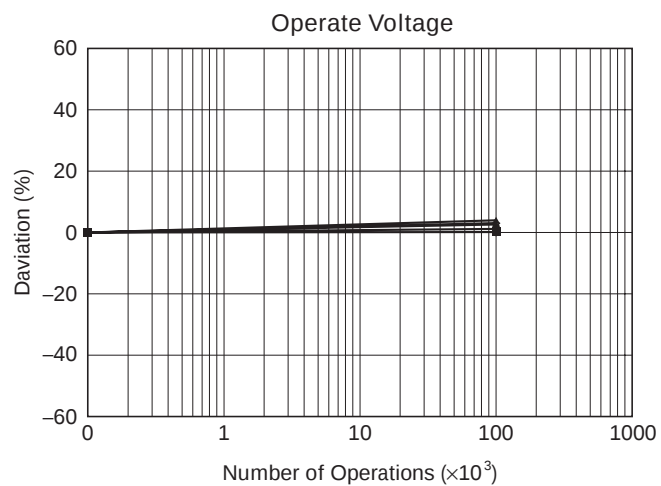
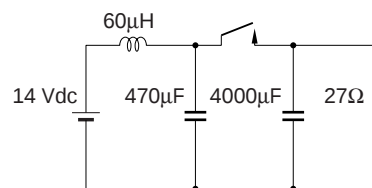
### Electrical Life Test 3

- Ambient temperature : 23°C
- Frequency : 1s ON, 29s OFF
- Contact load : 14 Vdc, 120 W, Halogen Lamp
- Number of operations :  $100 \times 10^3$
- Samples : EQ1-22111S, 10 pieces



Electrical Life Test 4

- Ambient temperature : 23°C
- Frequency : 20ms ON, 3.98s OFF
- Contact load : 14 Vdc, LCR circuit
- Number of operations :  $100 \times 10^3$
- Samples : EQ1-22111S, n=10



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While NEC Corporation has been making continuous effort to enhance the reliability of its electronic components, 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 electronic component, customer 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 NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.