

## 2 Safety Precautions

This section lists important precautions which users of semiconductor devices (and anyone else) should observe in order to avoid injury and damage to property, and to ensure safe and correct use of devices. Please be sure that you understand the meanings of the labels and the graphic symbol described below before you move on to the detailed descriptions of the precautions.

### [Explanation of labels]

|   |   |
|---|---|
|  | Indicates an imminently hazardous situation which will most likely result in death or serious injury if you do not follow instructions. |
|  | Indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.            |
|  | Indicates a potentially hazardous situation which, if not remedied, may result in minor injury or worse.                                |

### [Explanation of graphic symbol]

| Graphic symbol  | Meaning   |
|---|---|
|  | Indicates that caution is required (laser beam is dangerous to eyes). |

## 2.1 General Precautions Regarding Semiconductor Devices

### CAUTION

Do not use devices under conditions exceeding their absolute maximum ratings (e.g. current, voltage, power dissipation or temperature).

This may cause the device to break down, may degrade its performance, or cause it to catch fire or explode, resulting in injury.

Do not insert devices in the wrong orientation.

Make sure that the positive and negative terminals of power supplies are connected correctly. Otherwise, the rated maximum current or power dissipation may be exceeded and the device may break down or undergo performance degradation, causing it to catch fire or explode and resulting in injury.

When power to a device is on, do not touch the device's heat sink.

Heat sinks become hot, so you may burn your hand.

Do not touch the tips of device leads.

Because some types of device have leads with pointed tips, you may prick your finger.

When conducting any kind of evaluation, inspection or testing, be sure to connect the testing equipment's electrodes or probes to the pins of the device under test before powering it on.

Otherwise, you may receive an electric shock, causing injury.

Before grounding an item of measuring equipment or a soldering iron, check that there is no electrical leakage from it.

Electrical leakage may cause the device which you are testing or soldering to break down, or could give you an electric shock.

Always wear protective glasses when cutting the leads of a device with clippers or a similar tool.

If you do not, small bits of metal flying off the cut ends may damage your eyes.

## 2.2 Precautions Specific to Each Product Group

### 2.2.1 Optical Semiconductor Devices

#### **⚠ DANGER**

When a visible semiconductor laser is operating, do not look directly into the laser beam or look through the optical system.

This is highly likely to impair vision, and in the worst case, may cause blindness.

If it is necessary to examine the laser apparatus, for example, to inspect its optical characteristics, always wear the appropriate type of laser protective glasses according to JIS standard JISC6802.

#### **⚠ WARNING**

Ensure that the current flowing in an LED device does not exceed the device's maximum rated current. This is particularly important for resin-packaged LED devices, as excessive current may cause the package resin to blow up, scattering resin fragments and causing injury.

When testing the dielectric strength of a photocoupler, use testing equipment which can shut off the supply voltage to the photocoupler. If you detect a leakage current of more than 100  $\mu\text{A}$ , use the testing equipment to shut off the photocoupler's supply voltage; otherwise a large short-circuit current will flow continuously, and the device may break down or burst into flames, resulting in fire or injury.

When incorporating a visible semiconductor laser into a design, use the device's internal photodetector or a separate photodetector to stabilize the laser's radiant power so as to ensure that laser beams exceeding the laser's rated radiant power cannot be emitted.

If this stabilizing mechanism does not work and the rated radiant power is exceeded, the device may break down or the excessively powerful laser beams may cause injury.

### 2.2.2 Power Devices (IGBTs)

#### **⚠ DANGER**

Never touch a power device while it is powered on. Also, after turning off a power device, do not touch it until it has thoroughly discharged all remaining electrical charge.

Touching a power device while it is powered on or still charged could cause a severe electric shock, resulting in death or serious injury.

When conducting any kind of evaluation, inspection or testing, be sure to connect the testing equipment's electrodes or probes to the device under test before powering it on.

When you have finished, discharge any electrical charge remaining in the device.

Connecting the electrodes or probes of testing equipment to a device while it is powered on may result in electric shock, causing injury.

**▲WARNING**

Do not use devices under conditions which exceed their absolute maximum ratings (current, voltage, power dissipation, temperature etc.).

This may cause the device to break down, causing a large short-circuit current to flow, which may in turn cause it to catch fire or explode, resulting in fire or injury.

Use a unit which can detect short-circuit currents and which will shut off the power supply if a short-circuit occurs.

If the power supply is not shut off, a large short-circuit current will flow continuously, which may in turn cause the device to catch fire or explode, resulting in fire or injury.

When designing a case for enclosing your system, consider how best to prevent the user from shrapnel in the event of the device catching fire or exploding.

Flying shrapnel can cause injury.

When conducting any kind of evaluation, inspection or testing, always use protective safety tools such as a cover for the device. Otherwise you may sustain injury caused by the device catching fire or exploding.

Make sure that all metal casings in your design are grounded to earth.

Even in modules where a device's electrodes and metal casing are insulated, capacitance in the module may cause the electrostatic potential in the casing to rise.

Dielectric breakdown may cause a high voltage to be applied to the casing, causing electric shock and injury to anyone touching it.

When designing the heat radiation and safety features of a system incorporating high-speed rectifiers, remember to take the device's forward and reverse losses into account.

The leakage current in these devices is greater than that in ordinary rectifiers; as a result, if a high-speed rectifier is used in an extreme environment (e.g. at high temperature or high voltage), its reverse loss may increase, causing thermal runaway to occur. This may in turn cause the device to explode and scatter shrapnel, resulting in injury to the user.

**▲CAUTION**

When conducting any kind of evaluation, inspection or testing, either wear protective gloves or wait until the device has cooled properly before handling it.

Devices become hot when they are operated. Even after the power has been turned off, the device will retain residual heat which may cause a burn to anyone touching it.