Surface mount type products

This document describes general precautions for using Hamamatsu opto-semiconductors of surface mount type packages (hereafter called "the product"). For silicone resin products, refer also to 5, "Silicone resin sealed products." For precautions on handing image sensors, refer also to precautions of "image sensors."

If the product comes with special precautions on the delivery specification sheet, then be sure to strictly comply with those instructions.

1. Handling

(1) Dust, contamination and scratch countermeasures

Dirt, stains, or scratches on the product may cause poor electrical and optical characteristics, so use caution on the following points:

- Perform work in a clean location.
- Wear clean gloves and handle the product with tweezers. Do not touch the product with bare hands. Dirt or stains on the window may cause a drop in light transmittance through the window. In the case of ultraviolet light detection, oil from the fingers can cause a 30% drop in sensitivity. Moreover, touching the terminals with bare hands may cause leakage between terminals or plating corrosion, or problems with solder wettability.
- Do not allow sharp or hard objects to come in contact with the window to prevent it from being scratched. Resin sealed types, plastic packages, and types with an anti-reflection coated window are vulnerable to scratches, so handle them carefully. If very small light spots are detected, then scratches on the window may be a problem.
- Take precautions to protect the window from contamination or scratches when packing or shipping equipment in which the product is installed.

(2) Removing contamination

- Use air blow to remove dust adhering to the window. It is recommended to use an ionizer.
- If oil or grease adheres to the window, then gently wipe it away with cotton swabs, etc. moistened with ethyl alcohol while taking care not to scratch the window. Strongly rubbing or rubbing the same section over and over might cause poor electrical and optical characteristics, or a loss of device reliability.
- When cleaning the window surface, do not rub it with dry cloth or cotton swab. Doing so may generate static electricity and lead to malfunctions.

(3) Cleaning

Avoid use of solvents as much as possible for cleaning. If such use is unavoidable, then keep the following points in mind:

- Use alcohol solvents such as ethyl alcohol. Some solvents may damage resin sealed types and plastic packages and cause package swelling.
- Before actual cleaning, check for any problems by testing out the cleaning methods in advance.
- Ultrasonic and steam cleaning may cause fatal damage to the product, so do not use such methods. Soak washing is recommended with the exception for image sensors. For image sensors, dust off using an air blower and then gently wipe off using ethyl alcohol on a cotton swab or something similar.
- If mounting components on a printed circuit board using no-clean solder, do not try to clean away the flux. Cleaning away the flux may cause problems such as electrical leaks between terminals and operating failures.

(4) Ultraviolet light and X-ray irradiation

Long-term exposure to UV or X-ray irradiation will cause product characteristics to deteriorate. Avoid exposing the product to any unnecessary UV or X-ray irradiation. The product usage environment may require countermeasures to block unnecessary UV or X-rays. Please avoid exposing the bonding sections of the ceramic base and glass to UV light.

(5) Vibration, impact, and stress

- If vibrations are applied to the product for long periods or if impacts are applied to the product with a high frequency, the package may be broken, causing the characteristics to deteriorate.
- When using the product with external stress applied, the inside or connection section of the product may break.
- For some products with optical filter, if excessive force or continuous vibration is applied to the filter section, the filter may come off.

(6) Temperature and humidity

- For some products with optical filter, the light transmittance may lower due to moisture absorption.
- When the plastic package type or resin sealed type is left under high temperature environment for long periods, the resin may turn yellow, causing the transmittance of short-wavelength light to lower.

(7) High-power light irradiation

- When the high-power light is irradiated on the plastic package type or resin sealed type, the resin may be damaged by its heat.
- The chip temperature may increase by high-power light irradiation. So, appropriate measures, such as heat dissipation are needed.
- Incidence of the strong background light or the light from a portion other than the light input window may adversely affect the output of the product. Take these points into consideration in the optical design phase.

(8) Electrical connection

- When the power is turned on, a surge (phenomenon that abnormally high voltage occurs instantaneously) may occur depending on the power supply, causing damage to the product. So, select an appropriate power supply.
- For products with multiple biases applied, the bias application order may be specified individually.

(9) External noise

- If the product is used in an environment where there are many electrical external noises, this may cause the product to malfunction. Take noise prevention measures for peripheral equipment.

(10) Various stresses

- Reducing (derating) stresses (temperature, humidity, voltage, current, electric power, etc.) to be applied to the product will extend the product service life (lower the failure ratio). It is recommended to reduce potential failures by setting values lower than the absolute maximum ratings stated in the datasheet. Additionally, avoid unnecessarily high stresses.

2. Storage

Carefully observe the product storage conditions listed in the delivery specification sheet. Do not let the product get wet or be exposed to direct sunlight, harmful gases or dust. Also avoid storing it in locations where sudden temperature changes may occur.

[Table 1] Storage conditions (unopened products)

Storage conditions	Cautions
Temperature: 15 °C to 35 °C Humidity: 45% to 75% Period: within 3 months	A sharp item coming in contact with the moisture-proof bag might open a hole in it so use caution.

(1) Storage precautions

- To prevent oxidation or contamination on the terminals and moisture absorption by the package, do not open the conductive moisture-proof bag until just before product use. Even if still packed in the moisture-proof bag, do not let the bag get wet or be exposed to direct sunlight, harmful gases or dust, or do not store it in locations where sudden temperature changes may occur. Also avoid humidity rise which may occur such as by turning off the night-time air conditioning.
- Do not lay a heavy object or load on the product or the bag. Also avoid stacking the products or bags when storing them.
- If storing the product in another case, then use a container not easily charged with static electricity.
- Placing the product in an unsatisfactory environment (exceeding conditions in Table 1) may cause poor solderability, rust on product terminals, or a drop in electrical characteristics. If there are storage conditions listed on the datasheet or delivery specification sheet, then be sure to comply with them.
- If there is a problem with the sealing of the moisture-proof packing, then the silica gel color will change from navy blue to red due to moisture absorption. So check for color change of the silica gel when opening. If you find this abnormality, then please contact us for assistance.

(2) Storage conditions after unpacking

After unpacking, store the product in accordance with the specified moisture sensitivity level (MSL), and use it within the specified period. For moisture sensitivity levels, see Table 2.
For the moisture sensitivity level of the products, see the individual specification sheets.

[Table 2] Storage conditions by moisture sensitivity level

Moisture sensitivity level (MSL)	Storage period	Storage temperature, humidity
1	Indefinitely	30 °C or less, 85% or less
2	1 year	30 °C or less, 60% or less
2a	4 weeks	
3	168 hours	
4	72 hours	
5	48 hours	
5a	24 hours	

(3) Tape packing products

- Tape unwound from a reel must not be left in that state for long periods.
- Do not bend the tape more than necessary.

3. Soldering

Most reflow soldering problems occur due to moisture absorption by sealing resin. Because reflow soldering involves heating the entire package, moisture that has been absorbed by the package expands drastically due to the soldering heat. This may cause problems such as separation between package material and chip or between chip and die bond material, and cracks in package. To prevent such problems, the following points must be observed.

(1) Baking (dehumidification)

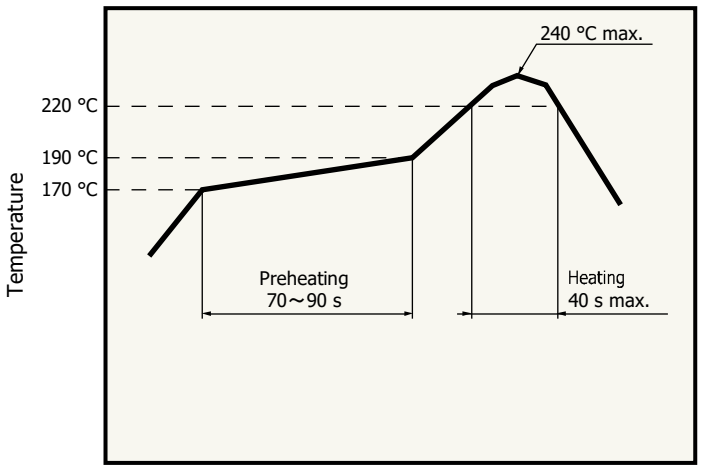
If the storage conditions (Tables 1 and 2) are exceeded, baking must be performed to dehumidify sealing resin. Note the following points when you perform baking.

- In general, to prepare a product for reflow soldering, baking must be performed using a clean dryer for a duration of 3 to 5 hours at 150 °C or 12 to 15 hours at 120 °C These conditions may vary depending on the sealing method or product type (see the specification sheet for details). For resin sealed CMOS linear imaging sensors, refer to the precautions in "Resin sealed CMOS linear imaging sensors."
- Sticks, tape, and trays for product packing generally are not heat resistant. When baking, place the product in a different heat-resistant container.
- When using a dryer for baking, make sure the inside of the dryer is clean to prevent the product from being contaminated during heating.
- To prevent oxidation of the soldering terminals during baking, we recommend that you fill the dryer with nitrogen gas.

(2) Reflow soldering

The recommended temperature profile for reflow soldering varies depending on the product. Check the specification sheet for the preheating temperature and time, peak temperature and time, and the temperature gradient during temperature adjustments. The effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. When setting the reflow soldering conditions, check for any problems by testing out the reflow soldering methods in advance.

[Figure 1] Actual data example of temperature profile measured with our hot-air reflow oven for product testing (leadfree product)



(3) Flux

Use non-cleaning solder or rosin type flux. Using flux with relatively strong acid or alkali levels or inorganic flux may cause corrosion on the terminals.

(4) When using a soldering iron

- To prevent effects from electrostatic charges, use a grounded soldering iron whose insulation resistance is 10 MΩ or more.
- Set the soldering iron tip temperature by referring to the recommended condition of soldering temperature and time.
- Do not let the soldering iron directly contact the sections other than the electrodes of the product. Direct contact with the soldering iron may cause mechanical or optical damage.
- Do the soldering so that no stress is applied to the package section of the product. Soldering in a state where stress is applied will cause residual stress after the soldering that tends to cause deterioration.

(5) Soldering of bump connection products

Use a solder paste suitable for components with fine pitch terminals.

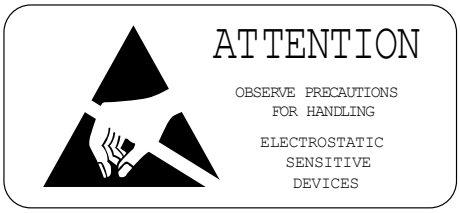
Before making bump connections, design a process that takes into account factors such as the solder paste, underfill resin, temperature conditions, and warping of the board due to heating.

If the packing was opened and the product left in that state for a long period of time, then oxidation will develop on the bump surfaces may impair electrical conduction. So mount the product as quickly as possible after opening the packing.

4. Static electricity management

The solid state division product or packing comes with an electrostatic warning label [Figure 6]. Handling of the products requires taking precautions on the following points to avoid damage and product deterioration due to static electricity.

[Figure 6] Electrostatic warning label



(1) Workplace and facilities, etc.

- Lay a conductive mat (750 kΩ to 1 GΩ) on the surface of the workbench and ground it.
- Use conductive flooring material or lay a conductive mat on the workplace floor and ground it.

Ground all manufacturing equipment and inspection devices.

- Keep moisture at approximately 50%. Low humidity tends to cause static electricity and high humidity is prone to moisture absorption.

(2) Handling

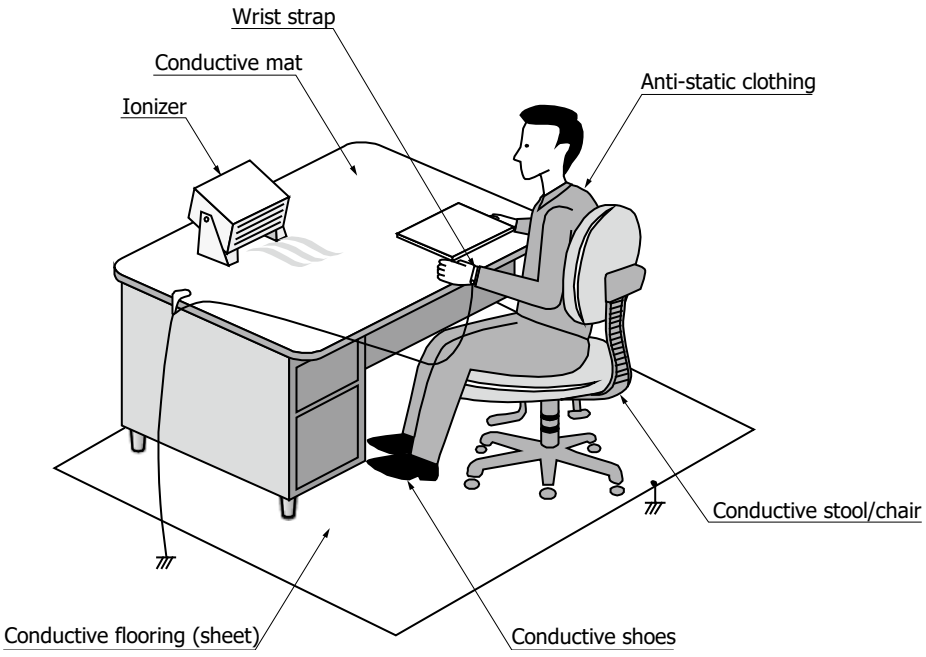
- Using an ionizer or similar item to eliminate electrical charges is recommended when handling the product.
- Wear anti-static clothing and conductive shoes (100 kΩ to 100 MΩ).
- Attach a wrist strap directly to the skin, and ground the strap. Be sure that a wrist strap to be used has protective resistance and that the resistance value measured while being attached is 750 kΩ to 35 MΩ. If the wrist strap does not include protective resistance, there is a risk of electric shock hazard due to electric leak. Also wear conductive finger sacks or gloves.
- Tools such as tweezers used to handle the product may sometimes become electrically charged. Connect a ground line as needed.
- Use a soldering iron with an insulation resistance of 10 MΩ or higher. The soldering iron tip should be grounded.
- If the product is induction-charged and contacts with a metal, excessive current may flow due to electrostatic discharge causing damage to the product. To prevent induction charging, keep objects (insulators such as plastic and vinyl, PC display monitors and keyboards, etc. that may possibly be electrically charged) away from the product. The product may be induction-charged even by just bringing such objects close to the product. If keeping such objects near the product is unavoidable, then use an ionizer, etc. to remove electrostatic charges from the objects that are apt to be electrostatically charged.
- Friction on the product causes electrostatic charges. If such friction is unavoidable, then remove the electrostatic charges using an ionizer, etc.
- Peripheral devices must be properly grounded so that no surges are applied to the product by a leakage voltage. Do not allow a voltage exceeding the absolute maximum ratings to be applied to the product from the measurement instrument, etc. (This tends to occur during ON/OFF switching of power sources, so use caution.) If there is the possibility of a surge voltage, insert a filter (made up of a resistor and capacitor) to protect the product. During operation do not attach or detach any connector, etc. that are connected to the power supply line or output line.

(3) Carrying, storage and packing

- Place the product on a conductive foam by inserting the leads into the foam (for shorting leads) and then put it in a conductive case. The PC board to mount the product should also be put in a conductive case. Also, avoid using a plastic or styrofoam case as they may generate static electricity by vibration during shipping, etc. causing breakdown or deterioration of the product.
- Use a conductive carrying case and storage shelf.
- Avoid storing the product near equipment that may generate high voltage or high electromagnetic fields.

Note: It is not always necessary to provide all the anti-electrostatic measures stated above. Implement these measures according to the extent of deterioration or damage that may occur.

[Figure 7] Electrostatic countermeasure example



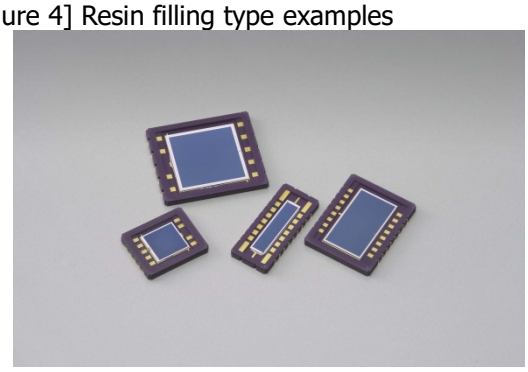
5. Silicone resin sealed products

Silicone resin used in opto-semiconductors has high optical transparency. Because silicone resin is characterized by low resistance to heat and humidity and easy swelling due to organic solvents (except alcohol), extra care must be taken for the following:

- For cleaning solvents, use ethyl alcohol or other types of alcohol solvents. Other organic solvents can soak into the silicone resin and cause swelling due to the increased volume. This phenomenon can lead to resin cracking or wire disconnection.
- To clean the entire product, soak and wash in alcohol solvent. Do not use ultrasonic cleaning. When cleaning in running water, keep it under one minute. Check that there is no problem with the cleaning method by experimenting in advance.

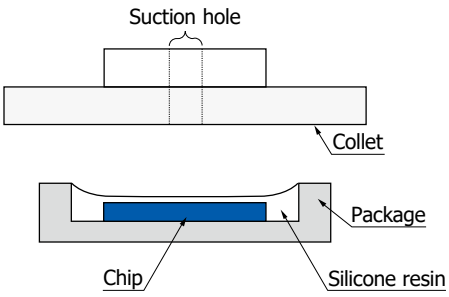
[Resin filling type]

[Figure 4] Resin filling type examples



Do not touch the surface of silicone resin. Silicone resin is soft. Applying external force on it can cause scratches to its surface and short-circuit or breaks due to wire deformation.
When using a vacuum type mounter, make sure that the nozzle does not come in contact with the silicone resin surface. The silicone resin surface is designed to be lower than the package outer frame.

[Figure 5] Example of a vacuum type mounter



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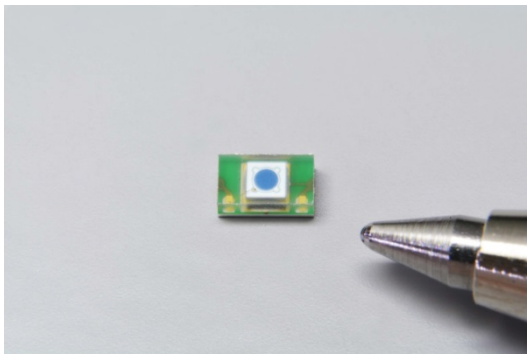
[Plastic package]

[Figure 6] Plastic package example



- The photosensitive area is protected by a transparent silicone resin. When compared with a glass window material, the silicone resin exhibits slight unevenness and is prone to scratches. Be careful in handling it, and pay attention to these characteristics during optical design.
- In a hot environment, the silicone resin softens, so it becomes even more prone to scratches and sticks to things more easily. As such, do not allow anything to come in contact with the product's silicone resin in a hot environment.
- To remove foreign substances that adhere to the product surface, apply an air blower. If this does not work, then gently wipe them away with a cotton swab or the like moistened with a small amount of ethyl alcohol.
- Fine scratches on the surface may be restored by heating at 40 °C for about one minute.

6. Handling in cardboard boxes

The product comes shipped in cardboard boxes. When handling cardboard boxes, comply with warning labels displayed on the cardboard box.

[Figure 8] Warning displays on cardboard box