# AN52561/D

# Image Sensor Handling and Best Practices

**Application Note Abstract**

This application note describes minimal methods for customers to incorporate in their handling, storing, and cleaning processes for image sensors.

## INTRODUCTION

Integrated circuits, including image sensor products are sensitive to Electrostatic Discharge (ESD).

ESD events can cause immediate damage to a device so that it is no longer functional. The effect may also not be noticed until a considerable time has passed, with the unit operating to specifications for some time. ESD events also show up as shifts in device characteristics.

ESD events occur by improper handling of the image sensor. Improper handling includes any operation that creates an electrostatic discharge; for example, handling the device without a wrist strap. Environmental conditions also contribute to the likelihood of an ESD event.

The cost of an appropriate ESD control program is well offset by the savings achieved in avoiding damaged devices (see References [1] and [2]).

This application note discusses minimum required procedures to minimize the occurrence of an ESD event when handling image sensors. Requirements listed in this application note are based on IPC/JEDEC JESD625[3]. Image sensor customers should incorporate requirements of this Application Note along with IPC/JEDEC JESD625[3]

- *Air Ionizers* should conform to the following:
  - Table ionizers should be positioned so that the devices at the ESD-protected workstations are within the ionizer manufacturer's specified coverage area. The ionizer should be aimed at the devices and operator's hands rather than at the operator.
  - Ceiling ionizers should be oriented in relation to the work surfaces in keeping with the ionizer manufacturer's instructions.
  - Devices should not be brought closer to the ionizer than specified by the ionizer manufacturer.
  - There should be an unrestricted, straight line air flow between the ionizers and the unprotected devices.
  - Ionizer balance (positive and negative ions) should be verified according to IPC/JEDEC JESD625[3].
  - Ionizer charge decay performance should be verified using the method described in EOS/ESD-S3.1 according to IPC/JEDEC JESD625[3].
- *ESD Protective Smocks:*
  When worn, ESD protective smocks must accomplish the following:
  - The ESD protective smocks must be buttoned (except for the collar) whenever the wearer is at an ESD protected workstation or in a designated ESD protected area.
  - The ESD protective smock manufacturer's cleaning instructions should be followed to gain maximum effectiveness and utility from the smocks.
- *Gloves:*
  Only static dissipative Nitrile gloves must be used when handling ESDS devices.

## DEVICE HANDLING

This is a general guideline. Imaging sensors must be handled in an ESD safe area. A ground strap is required when handling the sensors in a non-ESD safe area. ESD safe gloves must be used.

While handling imaging sensors:

- Wear mouth protection (face mask) to minimize the risk of contaminating the glass lid through saliva or other particles.
- Wear gloves that are ESD safe. The gloves must be clean. Contaminated or dirty gloves need to be changed or cleaned.
- Finger tips of the gloves should be tight to reduce the risk of contaminating the glass lid.
- Always handle image sensors at the package; never touch the glass lids.
- Handle the pin grid package (PGA package) carefully to avoid bending the pins.

Static charge can be generated during any assembly or test process step. Ionizers should be used at each assembly or test process step requiring manual or automated handling of image sensors to avoid any artifacts or damage resulting from static charge.

## COVER GLASS CLEANING

### Purpose of Cleaning the Cover Glass

The packaging of image sensors requires high levels of cleanliness. High quality glass windows are used instead of typical ceramic or plastic encapsulation methods. In some sensors, special coating is placed on the glass to control spectral properties.

### Solder Paste and Flux

Solder Paste should be compatible with the BGA's solder. For details refer to applicable device datasheet. The flux type should be no-clean and Halide-free (no corrosive residue is allowed).

### Reflow Profile

In general, reflow profile considerations rely upon PCB material, solder paste manufacturer recommendations and the other electronic components on the same board. The package thickness and volume can affect the reflow profile requirement. Refer to the package dimensions on the product datasheet and the JEDEC Standard J STD 020 01[6].

Image Sensors parts may be moisture sensitive; use proper handling and baking techniques according to the moisture sensitivity classification IPC/JEDEC J STD 033[7].

## GLASS PROTECTIVE FILM

ON Semiconductor assembles and tests image sensors in a clean room environment. Customer manufacturing processes can generate contamination and are often not performed in a clean room environment. Glass contamination or damage compromises the quality and functionality of the image sensors. For added cover glass protection, ON Semiconductor offers an optional protective film on select image sensor devices.

Currently, ON Semiconductor uses two different protective films for this purpose. The first, used on devices with part numbers beginning with "A", "M", or "N", can withstand standard surface mount technology (SMT) reflow at a maximum temperature of 260°C. They are qualified according JEDEC J STD 020 01[6] reflow standards with 3× reflow test with no adverse material issues. The second, used on part numbers beginning with "K", cannot withstand high temperatures and is not intended for soldering using a reflow process. Neither of these protective films are qualified for any aqueous or chemical wash steps.

In all cases, the protective film at a minimum covers the glass directly above the active array of packaged image sensors. The actual size and shape of the protective film varies by device and package type. Refer to the applicable device datasheet for configuration details by product.

### Required Removal Procedure

For all devices, the protective film should be removed prior to testing of the final product, as the film may impact optical test results if present. Removal of the protective film must be performed using standard ESD precautions in a controlled humidity environment. Use of ionization fans focused on the device during tape removal is required to avoid creating a charge that could impair the performance of the sensor. It is required to peel the protective film with tweezers in a smooth steady motion, in a parallel direction to its placement on the glass, with no twisting, and with the ionized air aimed directly at the newly exposed tape/glass interface, as shown below.

Since the protective film could potentially adhere to other surfaces, it should be disposed of immediately after removal. Protective film should not be reapplied to the sensor.

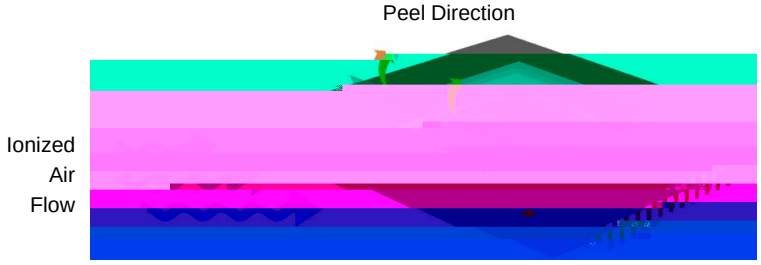


**Figure 1. Glass Protective Film**

ON Semiconductor does not guarantee that the protective film adhesive will not leave a residue on the glass after removal. In the event that some residue remains, the glass can be cleaned per the required process described in the section *"Cover Glass Cleaning"*.

## STORING UNMOUNTED IMAGE SENSORS

### Short-Term Storage

Unsealed devices should always be stored under the

## SAFE STORAGE REQUIREMENTS

### Moisture Absorption

If the customer cannot mount the product within the specified time limit, or factory conditions exceed the specified maximum temperature and/or humidity level, then the customer can abate moisture absorption by following any of the safe storage methods to maintain the floor life:

**Dry Pack:** The calculated shelf life for dry packed SMD packages while in a MBB, when stored in an environment maintained at < 40°C/ 90% RH is a minimum of 12 months.

**Dry Cabinet at 10% RH:** Integrated circuits not sealed in a MBB may be placed in a dry atmosphere cabinet maintained at ≤10% RH up to a maximum time specified in IPC/JEDEC J STD 033[7]. If the time limit is exceeded, bake is required to restore the floor life.

**Dry Cabinet at 5% RH:** Integrated circuits not sealed in a MBB may be placed in a dry atmosphere cabinet maintained at ≤5% RH for an unlimited shelf life equivalent to storage in a MBB.

**CAUTION:** Image sensors (surface mounted or otherwise) with a cavity will gather water vapor if placed in a high water vapor pressure environment. The environment can be a high relative humidity and/or temperature for an extended period. Baking the image sensor for an extended period may remove the previously gathered water vapor from the cavity. ON Semiconductor recommends preventing the ingress of water vapor by storing the image sensor in one of the three methods mentioned above.

### Solderability Degradation

If the customer cannot mount the product within 24 months after the assembly date, ON Semiconductor recommends performing a solderability test in order to check for lead condition (discoloration, etc.) prior to mounting the product.

The customer can abate solderability degradation by storing the product in a nitrogen environment.

## DRYING PROCEDURES AND REQUIREMENTS

Product that are not handled or stored within required conditions must undergo bake for drying prior to reflow to reset floor life. Re-sealing in an MBB with a desiccant is required if product is not used after bake.

Refer to JEDEC standard IPC/JEDEC J STD 033[7], IPC 610[8] for the bake conditions.

## REFERENCES


[1] Enhancing Profits With Effective ESD Control by Stephen Halperin, in collaboration with Ron Gibson Dec 1, 2004, Conformity http://www.conformity.com/artman/publish/printer_107.shtml

[2] White paper: *A Case for Lowering Component Level HBM/MM ESD Specifications and Requirements.*

[3] IPC/JEDEC JESD625 Requirements for handling electrostatic discharge sensitive (ESDS) devices.

[4] IPC/JEDEC Standard No. 22 C101.01.

[5] IPC-7095L: Chapter 6: Printed Circuit assembly design considerations and Chapter 7: Assembly of BGA on printed circuit boards.

[6] Reference: JSTD020 01 Jedec Standard for Moisture/Reflow Classification.

[7] IPC/JEDEC J-STD-033 Handling, packing, Shipping, and Use of Moisture/Reflow Sensitive Surface Mount Devices.

[8] IPC 610: Acceptability of electrical assemblies.

[9] SOLDERM/D: ON Semiconductor's Soldering and Mounting Techniques Reference Manual.





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