

# Handling Procedures to Avoid Trapped Charges

## AN54886/D

### APPLICATION NOTE ABSTRACT

This application note provides guidelines on preventing the generation of trapped charges.

### INTRODUCTION

Image sensor products can be sensitive to electrical charges transferred from external electrical fields and stored in the pixel array ("trapped charge"). The trapped charge can create unwanted optical effects, which appear as random dark spots in the image, typically several pixels in diameter.

Improper handling of the image sensor generates trapped charges. Improper handling includes any operation that creates an electrostatic charge, for example, wiping the cover glass with non-ESD-protective wipes.

This application note discusses specific procedures to minimize creation of trapped charges. Refer to Application Note AN52561, *Image Sensor Handling Best Practices*, for general handling procedure recommendations.

### Prevention of Trap Charge

Trapped charges can be avoided by proper handling of the sensor. **onsemi** ensures proper handling throughout the manufacturing, testing, and shipping processes, and maintains testing procedures to ensure that image sensor products do not exhibit trapped charges when shipped. It is equally important for the customer to implement proper handling in receiving, testing, and board and system manufacturing operations at customer sites. The following guidelines should be observed when handling image sensors.

- Follow ESD protocols defined in JESD625-A. The handling protocols must be periodically tested to validate their effectiveness.
- Handle image sensor devices while wearing a grounded wrist strap and ESD protective gloves.
- Maintain a proper anti static environment where image sensor devices are handled. This environment includes grounded conductive surfaces and ionized air streams, as determined by ESD auditing.
- Limit physical contact with the sensor cover glass. Such contact can induce an electro static charge. All contact with the device must be done while wearing a grounded wrist strap.
- Do not use any protective tape to cover the glass. The application or removal of the tape can induce electrostatic charge.

- An electrostatic charge can be induced when cleaning the device; therefore, if cleaning of the glass lid is necessary, consider the following:
  - Always wear ESD protective nitrile gloves (recommended NiProtect CC529) when handling image sensors.
  - If possible, remove particles on top of the glass by blowing with an ionized-N2 gun. If N2 is not available, use an ionized clean dry-air gun. Ensure that the appropriate point of use filtering system is in place to prevent particle contamination from the ionizing gun.
  - If the above procedure does not remove the particle, use an ESD protective wipe (type S1091PRT from Puritech or RTMKC002 from distributor Hans J. Michael GMBH) to do a local cleaning with isopropyl alcohol (IPA), either extra pure or VLSI grade. Wet the wipe with the alcohol and then rub very gently over the glass lid.

CAUTION: Rubbing the glass, if not done properly, is known to induce the creation of trapped charges. It is important to use the correct ESD protective wipe.

### Returns

**onsemi** will accept returns of image sensors with only if the trapped charges are detected by the customer, during incoming acceptance testing and the customer have used proper handling procedures during acceptance testing. After the devices are accepted by the customer, **onsemi** will not be responsible for trapped charges in the devices.

- Unless otherwise agreed by customer and **onsemi**, customer has one month to complete acceptance testing after the date of shipment. After one month, **onsemi** will deem acceptance testing complete and the product units accepted.
- If a trapped charge is detected during acceptance test, notify **onsemi** according to the **onsemi** RMA procedure. **onsemi** will arrange to evaluate the parts.
- **onsemi** reserves the right to audit customer-handling procedures during unpacking and acceptance testing to ensure that these procedures are not causing the trapped charges. If improper handling is identified as the cause, **onsemi** will not accept return of the affected devices.
- **onsemi** will not be responsible for trapped charges observed after completion of acceptance test by the customer.

- In the event that **onsemi** accepts return of devices exhibiting trapped charges, **onsemi** reserves the right, at **onsemi**' sole discretion and as customer's sole and exclusive remedy, to refund the purchase price, or replace or rework the affected devices.

### Bake Recovery Procedure

The following bake out procedure is recommended to bake out trapped charges. The same procedure is applicable if the image sensors have already been mounted on a PCB.

**Equipment required:** A clean oven rated up to 150°C. It is recommended to clean the oven with IPA solution.

**Placement of the units or units mounted on a PCB:** It is recommended to place the units upside-down with the glass lid surface not in contact with any surface, to prevent baking on contaminants on to the glass lid.

A rack or railing can be used to brace the units. Ensure that the rack is also cleaned with IPA solution.

#### Bake-out procedure:

- Place the sensors in the oven for 24 hours at 150 degrees C.
- Let the units cool down for at least 2 hours.
- Place the sensors in the oven. Bake them at 150 degrees C for 2 hours. Bring them back to room temperature for 30 minutes. Repeat this bake cycle 5 times.

Alternately, if the units have already been mounted on a PCB, and if the components on the PCB cannot sustain temperature higher than 70°C; the trapped charge can be dispersed under bias at Ta = 70°C for a duration of 2–3 days.

**NOTE:** Please place the PCB in the oven such that the sensors are braced in an upside-down position to prevent baking on contaminants on to the glass lid.

### Disclaimer

**onsemi** is not responsible for damage caused by improper handling, baking or cleaning of the device.

**onsemi**, **ONSEMI**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### ADDITIONAL INFORMATION

#### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

#### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)