Application note for CMV/CHR products

Handling Image Sensors

Change record

Issue	Date	Modification
v01	16/09/2014	Origination
v02	24/04/2015	Added: - Storage: effect on micro lenses and color filters - Excessive light
v03	16/12/2015	Added: - Note about vapor phase soldering

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Acronyms

- ESD: Electrostatic Discharge
- ESDS devices: Electro-Static Discharge Sensitive devices
- PGA: Pin Grid Array
- JLCC: J-Leaded Ceramic Chip carrier
- AR coating: Anti-Reflective coating
- IR coating: Infra-Red filter coating
- N2: Nitrogen
- IPA: Isopropyl Alcohol

Related Documents

- Datasheets of the CMOSIS standard product image sensors
- JESD625A: Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices

1 INTRODUCTION

This document will describe general procedures and practices best used when handling the CMOSIS standard product image sensors.

2 ESD PROTECTION

2.1 INTRODUCTION

As all integrated circuits, image sensors are sensitive to ESD. ESD can cause both hard ESD damage and soft ESD damage. Hard ESD damage will result in the immediate damage of the circuit and the circuit will not be functional anymore, or only partly functional. Soft ESD damage can result in changing characteristics and/or reduced lifetime of the circuit.

The implementation of an effective ESD control program is an investment which pays itself. The ESD protection requirements below are based on JEDEC standard JESD625A and CMOSIS recommends JESD625A as baseline for successful prevention of ESD damage.

2.2 MINIMUM REQUIREMENTS

The following table with minimum requirements is taken from JEDEC standard JESD625A

Item	**Minimum requirements**
ESD Protective Work surface	Where unprotected ESDS devices are handled, a grounded static protective work surface with a resistance to ground of less than 10^9 Ω shall be used.
ESD Protective Flooring or Floor Mats	Grounded flooring or floor mats are only required when personnel or mobile ESD protective workstations utilize floor grounding methods.
Personnel Grounding	Each person handling or within twelve (12) inches of unprotected ESDS devices shall be grounded using either: • Wrist straps that shall: - Provide a continuous electrical path from the user directly to ESD ground. - Have an integral resistance at the wrist band end of the grounding wire that will limit current to less than 0.5 mA through that specific path to ground at the highest power supply voltage that may be encountered. - Be worn by operators handling unprotected ESD devices when seated. • ESD protective footwear (heel straps, toe straps or shoes) that shall: - Provide a continuous electrical path from the user directly to the ESD protective flooring or floor mat. - Be worn on both feet. - Limit current to less than 0.5 mA through that specific path to ground at the highest power supply voltage that may be encountered. - NOT be relied upon for grounding of seated personnel.
Static Generating Sources and Charged Surfaces	• Nonessential and personal items shall not be placed on ESD protective work surfaces that are in use. • No item with an electrostatic potential greater than +/- 1000 volts (as measured with a field meter) shall be closer than 12 inches from unprotected ESDS devices. • Operations, equipment or clothing generating electrostatic potential greater than ±1,000 volts within twelve (12) inches of unprotected ESDS devices shall be neutralized or reduced to less than ±1,000 volts. • Charged items must not contact ESDS devices.

Item	Minimum requirements
ESD Protective Smocks	When ESD protective smocks are worn, they shall cover all personal garments above the waist except at the neck area.
Air Ionizers	Air ionizers may be used to reduce electrostatic potentials to less than ±1,000 volts within twelve (12) inches of unprotected ESDS devices if those voltages are not controlled by other means.
ESD Protected Area and Workstation Identification	ESD caution signs shall be posted at each ESD protected workstation or at the entrances of defined ESD protected areas.

JEDEC standard JESD625A section 11 explains methods to minimize static charging:

- Antistatic solutions: these can be used to minimize static charging of materials in the work area. They cannot be used directly on the image sensor due to the contamination risk
- Relative humidity: this is recommended to be in the 40% to 50% range, but minimum 30%
- Air ionizers
- ESD protective smocks
- Gloves: only dissipative, clean room compatible gloves can be used

Regular verification of the ESD safety is required. Table 2 in section 6.1 of JEDEC standard JESD625A provides information on frequency and acceptance limits for verification of ESD protective items.

3 DEVICE HANDLING

As image sensors are sensitive to particle contamination, specific measures need to be taken when handling image sensors:

- Image sensors are preferable handled in a clean environment like a clean room or a laminar flow bench.
- Always use effective ESD protection (see section 2.2)
- Always handle image sensors wearing gloves that are both ESD safe and clean. Use the right size of gloves to avoid contacting the image sensor glass lid with the finger tips.
- Always use mouth protection to avoid saliva or other contamination. Saliva are known to be very difficult to clean, especially on surface coatings like AR and IR coating
- Always handle image sensors on the package, never touch the glass lid
- Avoid bending pins of PGA and JLCC package devices
- Avoid intermediate storage (e.g. during incoming inspection) in the neighborhood of particle sources (like moving parts of equipment)
- Always use ESD safe trays during handling and intermediate storage
- If the glass lid is contaminated, it should be cleaned as explained in section 4.3.

4 CLEANING

When cleaning image sensors, the ESD protection and handling requirements apply. Cleaning of the glass lid should always be avoided as one can never get a perfectly cleaned glass lid. If cleaning needs to be done, several methods can be used depending on the type and severity of the contamination. Ultrasonic cleaning is not appropriate due to the risk of damaging the image sensor.

4.1 BLOW OFF

Blowing off can be used to remove loose particles. The following applies when blowing off particles:

- Blow off particles can be done using clean nitrogen or ionized dry compressed air.
- The cleanliness of the N2/air and the equipment (air gun/N2 gun) is essential for a good result.
- Never blow towards other sensors
- When working under a flow bench, always blow out of the bench

4.2 WET WIPING

Wiping can be used to remove loose particles, fixed particles and surface contamination. The following applies when wiping glass lids:

- Always use wet wipes for cleaning the glass lid. The use of an ESD protective wipe is preferred; however some ESD protective wipes are not to be used as they easily scratch surface coatings like AR and IR coatings.
- Use IPA (Isopropyl Alcohol) as cleaning fluid. Other fluids (like acetone or methanol) are not preferred as they can contaminate the glass lid, degrade the glass lid attachment or etch the surface coating. Some fluids are known to be very toxic.
- Wipe gently in one direction and avoid wiping again with the same part of the wipe
- Avoid contamination of the IPA in the bottle by not dipping the wipe using the bottle. Always use a small intermediate canister.
- Using too much IPA might leave stains, using not enough IPA might cause small scratches.
- If the glass lid cannot be cleaned in 3 attempts, it might be damaged or the contamination cannot be removed.

4.3 LOCAL CLEANING

Local cleaning can be done using cotton tips and IPA. The following applies when cleaning glass lids locally:

- Always use wet cotton tips for cleaning the glass lid.
- Use IPA (Isopropyl Alcohol) as cleaning fluid. Other fluids (like acetone or methanol) are not preferred as they can contaminate the glass lid, degrade the glass lid attachment glue or etch the surface coating. Some fluids are known to be very toxic.
- Wipe gently in one direction and avoid wiping again with the same cotton tip
- Avoid contamination of the IPA in the bottle by not dipping the cotton tip in the bottle. Always use a small intermediate canister.
- Using too much IPA might leave stains, using not enough IPA might cause small scratches.
- If the glass lid cannot be cleaned in 3 attempts, it might be damaged or the contamination cannot be removed.

4.4 SPECIAL MEASURES FOR OPEN IMAGE SENSORS

Open image sensors (without glass lid) are very sensitive to bond wire damage and sensor contamination. Therefore the following applies when handling open image sensors:

- Special care should be taken to avoid touching the bonding wires
- Always handle open sensors in a clean room environment
- Cleaning is possible, but difficult. Only local cleaning (with cotton tip and IPA) is suitable for open sensors. Blowing off particles is possible, but care should be taken not to damage the bonding wires by using too much air/N2 pressure
- If possible, intermediate storage should be done facing down to avoid contamination
- If possible, temporary protection (like a temporary glass lid) should be used to protect the open image sensor

5 STORAGE

Storage of image sensors should be done in a dark, dry, clean and ESD safe environment. Temperature limits are listed in the datasheet, but storage temperature is preferred between 20°C and 40°C and relative humidity is preferred between 30% and 60%. Avoid storage in environments with high temperature, high humidity, ionizing radiation, electromagnetic fields or mechanical stress. Storage outside these limits could lead to pin plating deterioration (resulting in solder issues), condensation on the glass or deterioration of the color filters and micro lenses.

6 SOLDERING

6.1 MANUAL SOLDERING

Use partial heating method and use a soldering iron with temperature control. The soldering iron tip temperature is not to exceed 350°C with a 270°C maximum pin temperature, 2 seconds maximum duration per pin. Avoid global heating of the ceramic package during soldering. Failure to do so may alter device performance and reliability.

6.2 REFLOW SOLDERING

The figure below shows the maximum recommended thermal profile for a reflow soldering system. If the temperature/time profile exceeds these recommendations, damage to the image sensor can occur.

Always refer to the specific sensor datasheets to get an accurate temperature profile for that specific device.

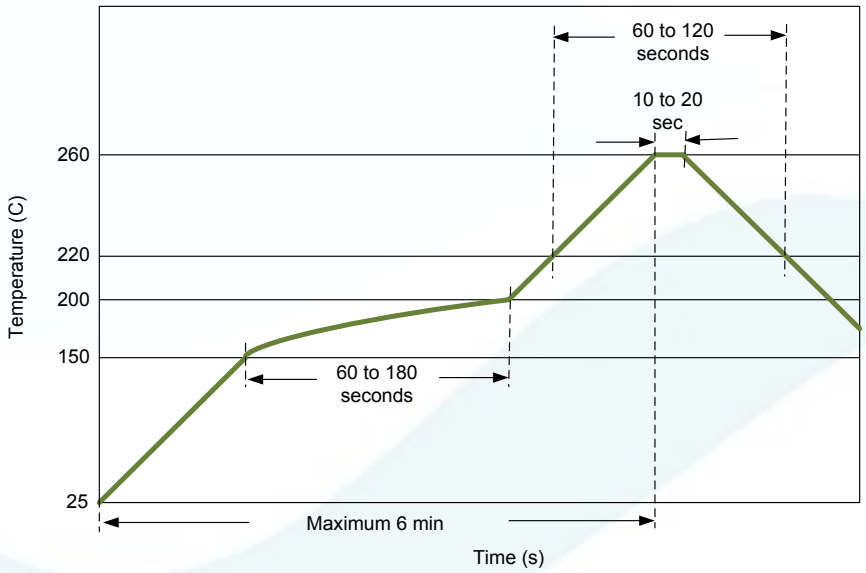

FIGURE 1: REFLOW SOLDERING PROFILE

6.3 SOLDERING RECOMMENDATIONS

Image sensors with color filter arrays (CFA) and micro lenses are especially sensitive to high temperatures. Prolonged heating at elevated temperatures may result in deterioration of the performance of the sensor. Best solution will be flow soldering or manual soldering of a socket and plug in the sensor at latest stage of the assembly/test process. The BGA solution allows more flexibility for the routing of the camera PCB. Third party custom sockets for every standard product in through-hole and SMT variant are available. Please contact us for a list of vendors and sockets.

The use of vapor phase soldering is strongly discouraged. Although this process is usually recommended when handling temperature-sensitive devices, irreparable damage can occur to the image sensor's cover glass when this technique is used. It's recommended for all CMV and CHR products to use convection ovens instead.

7 EXCESSIVE LIGHT

Excessive light falling on the sensor can cause heating up the micro lenses and color filters. This heat can cause deforming of the lenses and/or deterioration of the lenses and color filters by making them more opaque, increasing the heat up even more. Avoid shining high intensity light upon the sensors for extended periods of time. In case of lasers, they can cause heat up but can also damage the silicon die itself.