Among several factors for PV to achieve grid-parity, reliability of the PV modules plays an important roll. Since it’s known that some of the cell defects such as edge chips/flakes, bumps of cell surface were proved to be source of infant mortality of the c-Si PV modules, therefore, to defect those defects is very important for c-Si cell manufacturers.

Due to the increasing BIPV and rooftop application, even for those defects that does not directly link to reliability issues such as water mark, surface stain, have to detected and considered as fail or secondary grade of cells for c-Si cell buyers.

Conventionally, those defects were visually inspected by operators. But, the inconsistent inspect result makes fully automatic optical inspection (AOI) solution becomes unavoidable equipment for c-Si cell lines.

Chroma 7200 series are specially designed for detection yield for wide variety of defects observed for c-Si cells for all sizes and crystallizations. Base on the process needs, three inspectors are available for both in-line and final sorting requirements.

**KEY FEATURES**

- Capable to integrate to any c-Si cell line due to compact sizes
- Adjustable criteria for different process application or model
- Flexible algorithms programming editor for mono-crystalline and multi-crystalline silicon solar cells
- Multiple interface to communication with manufacturing equipment or information system
- Various defects inspection capability from multilayer LED lighting design
- Flexible design that can easily integrate to your in-line printing system and sorting system
COLOR CLASSIFIER
MODEL 7211-D

The Chroma 7211-D c-Si cell color classifier was designed to provide high repetitive color classification for c-Si PV cells. CIE 1931 Lab color space and up to 60x60 grids for entire cell surface allows Chroma 7211-D to provide numeric color severities down to each of the 3600 blocks throughout the cell under test. By using the color information of each block and user-definable algorithm, user may determine the represented color for non-uniform color cells such as poly-crystalline cells or cells have uneven anti-reflection coating thickness.

Chroma 7211-D can be used right after anti-reflection coating process to ensure only cells with acceptable color uniformity go down to metallization process. And the fail cells may then be sent for re-work. It can also be integrated to in-line or off-line sorter for final inspection prior to shipping.
Defects caused by front-side (sunny side) printing process of c-Si PV cells may cause performance, reliability or appearance impact. Therefore, a reliable and repeatable inspection to detect defects such as losing Ag paste on busbars, gridline interruptions, printing shift or rotation, water mark etc., have to be detected and avoid shipping those cells to ensure shipping quality. Chroma 7212-HD c-Si cell front-side printing inspector equips with high resolution CCD camera and superior software algorithm to recognize the unwanted defects on front-side of c-Si PV cells.

Chroma 7212-HD can be used right after front-side process to retire cells with major defects. This allows best use of the capacity of the following process like I-V testing and sorting which is known to be one of the bottlenecks of c-Si cell line. It can also be integrated to in-line or off-line sorter for final inspection prior to shipping.

Defects caused by back-side printing process of c-Si PV cells will also cause performance, reliability impact. Among all the back-side printing defects, bumps caused by improper printing may cause high cell breakage rate during lamination of c-Si module process. Chroma 7213-AD c-Si cell back-side printing inspector uses unique lighting technique to detect common back-side printing defects plus most demanding bumps.

Another model Chroma 7213, with same inspection capability but was designed for special upward-detection. This brings unparalleled advantage against conventional downward-detection design. With upward detection, the cell can be checked without being flipped twice which helps to minimize the cell breakage and reduce the production line length.

Same as Chroma 7212-HD, Chroma 7213-AD can be used after back-side process to retire cells with major defects. It can also be integrated to in-line or off-line sorter for final inspection prior to shipping.
### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>7211-D</th>
<th>7212-HD</th>
<th>7213-AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera</td>
<td>1M color CCD</td>
<td>16M mono CCD</td>
<td>4M mono CCD</td>
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<td>Resolution</td>
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<td>Light Source</td>
<td>LED strobe light</td>
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<td>Dimension</td>
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<tr>
<td>Interface</td>
<td>Ethernet, Option : IO, RS-232</td>
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All specifications are subject to change without notice. Please visit our website for the most up to date specifications.

### Ordering Information

- **7211-D**: Solar Cell Color Classifier (Diffuser type)
- **7212-HD**: Solar Cell Frontside Printing & Surface Inspector (High Resolution)
- **7213-AD**: Solar Cell Backside Printing & Surface Inspector (Diffuser type)

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**Front View**

**Side View**