



Outgoing Defect Specification

MT9M111

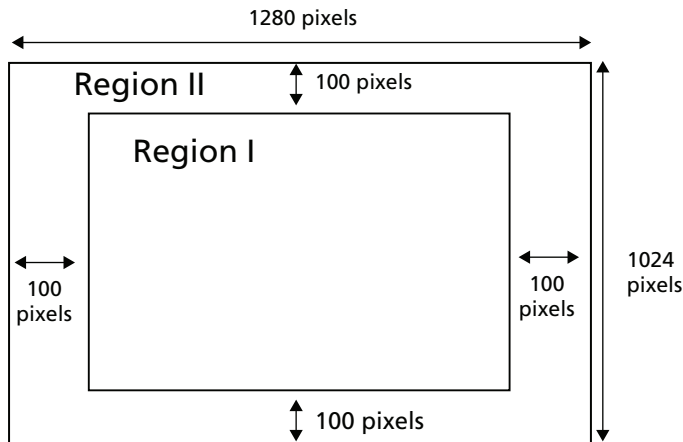
Introduction

This document defines outgoing defect specifications for the Micron® MT9M111 image sensor. Sensor defect regions as well as types of pixel and cluster defects are defined.

Sensor Defects

The sensor array is partitioned into two regions: Region I and Region II. These dimensions are defined in Figure 1.

Figure 1: Sensor Array





Defect Specifications

Table 1 and Table 2 specify the maximum number of defects for each of the regions defined in Figure 1.

Table 1: Defect Specification with no Defect Correction (SOC Bypass Mode)¹

| Defect Description | Number of Defects | | Definition ² |
|---|-------------------|-----------|-------------------------|
| | Region I | Region II | |
| Very hot, very bright, or very dark pixel defects | Total ≤50 | | 1, 3, 5 |
| Hot or bright pixel defects | Total ≤100 | | 2, 4 |
| Dark pixel defect | Total ≤100 | | 6 |
| Bright or dark cluster | 0 | 0 | 7, 8 |

- Notes: 1. All specifications address operation is at $T_A = 27^\circ\text{C} (\pm 1^\circ\text{C})$ and all supply voltages = 2.8V.
2. Definitions of defects are given on page 3.

Table 2: Defect Specification with Defect Correction Enabled (SOC YCbCr Mode)¹

| Defect Description | Number of Defects | | Definition ² |
|-----------------------------|-------------------|-----------|-------------------------|
| | Region I | Region II | |
| Bright or dark pixel defect | 0 | 0 | 9, 10 |
| Bright or dark cluster | 0 | 0 | 11, 12 |

- Notes: 1. All specifications address operation is at $T_A = 27^\circ\text{C} (\pm 1^\circ\text{C})$ and all supply voltages = 2.8V. Image sensor is tested without a lens. Multiple images are captured in YCbCr format and analysis is done in RGB format. Testing is done with default register settings, default frame timing, and using 0.5 lux incident at the sensor, which is approximately 15 lux incident at the camera module with a lens.
2. Definitions of defects are given on page 4.



Defect Definitions in Bayer Format

(with Defect Correction Disabled)

1. Very Hot Pixel Defect

A very hot pixel defect is defined as any single pixel that is greater than 50 percent of the full-scale output when the sensor is operated under no illumination. (Analog gain = 8x; exposure time = 20ms)

2. Hot Pixel Defect

A hot pixel is defined as any single pixel that is greater than 15 percent of the full-scale output when the sensor is operated under no illumination. (Analog gain = 8x; exposure time = 20ms)

3. Very Bright Pixel Defect

The sensor is illuminated to midlevel, about 400 LSBs to 700 LSBs. Within a color plane, each pixel is compared to the mean of the neighboring 11 x 11 pixels. If the pixel value is 50 percent or more above the mean, it is considered a very bright pixel defect. (Analog gain = 1; exposure time = 10ms)

4. Bright Pixel Defect

The sensor is illuminated to midlevel, about 400 LSBs to 700 LSBs. Within a color plane, each pixel is compared to the mean of the neighboring 11 x 11 pixels. If the pixel value is 15 percent or more above the mean, it is considered a bright pixel defect. (Analog gain = 1; exposure time = 10ms)

5. Very Dark Pixel Defect

The sensor is illuminated to midlevel, about 400 LSBs to 700 LSBs. Within a color plane, each pixel is compared to the mean of the neighboring 11 x 11 pixels. If the pixel value is 50 percent or more below the mean, it is considered a very dark pixel defect. (Analog gain = 1; exposure time = 10ms)

6. Dark Pixel Defect

The sensor is illuminated to midlevel, about 400 LSBs to 700 LSBs. Within a color plane, each pixel is compared to the mean of the neighboring 11 x 11 pixels. If the pixel value is 15 percent or more below the mean, it is considered a dark pixel defect. (Analog gain = 1; exposure time = 10ms)

7. Bright Cluster

Using Test 4 results, the defects within each color plane are examined. If any two adjacent pixels that are considered bright pixel defects are detected, they are then defined as a bright cluster.

8. Dark Cluster

Using Test 6 results, the defects within a color plane are examined. If any two adjacent pixels that are considered dark pixel defects are detected, they are then defined as a dark cluster.



Defect Definitions in YCbCr Format

(with Defect Correction Enabled)

9. Bright Pixel Defect

Within each RGB color plane, each pixel is compared to the mean of the neighboring 11 x 11 pixels. If the pixel value is 35 percent or more above the mean, it is considered a bright pixel defect with 0.5 lux illumination incident on the sensor.

10. Dark Pixel Defect

Within each RGB color plane, each pixel is compared to the mean of the neighboring 11 x 11 pixels. If the pixel value is 35 percent or more below the mean, it is considered a dark pixel defect with 0.5 lux illumination incident on the sensor.

11. Bright Cluster

Using Test 9 results, the defects within each RGB color plane are examined. If any two adjacent pixels that are considered bright pixel defects are detected, they are then defined as a bright cluster.

12. Dark Cluster

Using Test 10 results, the defects within each RGB color plane are examined. If any two adjacent pixels that are considered dark pixel defects are detected, they are then defined as a dark cluster.



Cluster Defects

The figures below represent the same sub-area of pixels. The Figure 2 represents the raw pixel output; Figure 3 on page 6 represents the pixel output separated by color plane.

Clusters are analyzed by looking at one particular pixel and its surrounding 8 adjacent pixels within the same color plane, as seen in Figure 3 on page 6. For example, if the center pixel is a very dark pixel and any of its surrounding 8 pixels within the same color plane are very dark pixels then it is defined as a very dark cluster.

For the defect definitions in “Defect Definitions in Bayer Format” on page 3, each of R, Gr, Gb, B color planes shown in Figure 3 are analyzed.

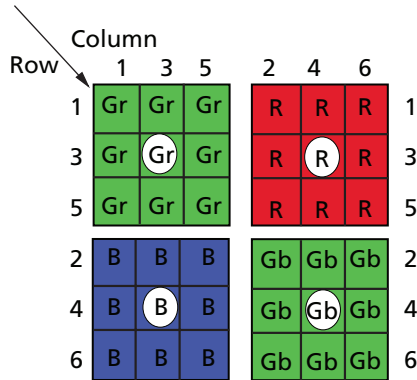
For the defect definitions in “Defect Definitions in YCbCr Format” on page 4, each of the R, G and B color planes are analyzed.

Figure 2: Raw Pixel Data

| | Column | | | | | |
|-----|--------|----|----|----|----|----|
| Row | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | Gr | R | Gr | R | Gr | R |
| 2 | B | Gb | B | Gb | B | Gb |
| 3 | Gr | R | Gr | R | Gr | R |
| 4 | B | Gb | B | Gb | B | Gb |
| 5 | Gr | R | Gr | R | Gr | R |
| 6 | B | Gb | B | Gb | B | Gb |



Figure 3: Pixel Output Separated by Color Plane



8000 S. Federal Way, P.O. Box 6, Boise, ID 83707-0006, Tel: 208-368-3900

prodmktg@micron.com www.micron.com Customer Comment Line: 800-932-4992

Micron, the M logo, and the Micron logo are trademarks of Micron Technology, Inc. All other trademarks are the property of their respective owners.

Products and specifications discussed herein are for evaluation and reference purposes only and are subject to change by Micron without notice. Products are only warranted by Micron to meet Micron's production data sheet specifications. All information discussed herein is provided on an "as is" basis, without warranties of any kind.



Revision History

| | |
|--|---------|
| Rev. D | 11/2006 |
| <ul style="list-style-type: none">• Updated Figure 1 on page 1, Figure 2 on page 5, and Figure 3 on page 6.• Updated Table 1 and Table 2 on page 2.• Called out appropriate sections in “Cluster Defects” on page 5. | |
| Rev. C | .5/2005 |
| <ul style="list-style-type: none">• YCbCr defect definitions added | |
| Rev. B | 12/2004 |
| <ul style="list-style-type: none">• Production release of document | |
| Rev. A | .6/2004 |
| <ul style="list-style-type: none">• Preliminary release of document | |