



Outgoing Defect Specification

MT9M413

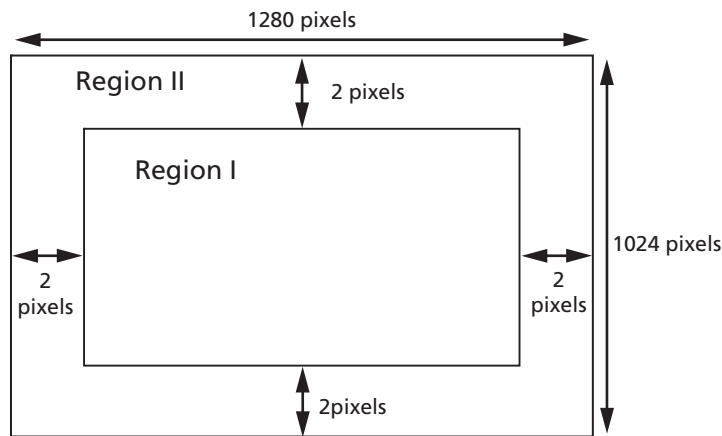
Introduction

This document defines outgoing defect specifications for Micron’s MT9M413 CMOS digital image sensor. The sensor defect regions, as well as types of pixel and cluster defects, are defined.

Sensor Defect Specifications

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 (Bayer Format)

Table 1 specifies the allowable number of defects for each of the regions defined in Figure 1 on page 1.

Table 1: Defect Specification

Defect Description	Region II		Definition
	Grade I	Grade II	
Very hot pixel defect	0	0	1
Very dark pixel defect	0	≤ 4	2
Point pixel defect	≤ 20	≤ 30	3
Clusters	0	≤ 2	4
Cluster size (number of defective pixels in a cluster)	N/A	≤ 3	–
Row/column defect	0	0	5

Notes: 1. All specifications address operation at $T_A = 25^\circ\text{C}$ ($\pm 3^\circ\text{C}$) and supply voltage = 3.3V. The image sensor is tested without a lens. Multiple images are captured and analyzed. Testing is done with default voltage settings (ADC reference = 1V) and default frame timing. Light source used is 2854K.



Defect Definitions

Definition 1: Very Hot Pixel Defect

A very hot pixel defect is defined as any single pixel that is 380 LSBs or more when the sensor is operated under no illumination. (Exposure time = 10ms)

Definition 2: Very Dark Pixel Defect

The sensor is illuminated to midlevel (about 400 LSBs to 700 LSBs). Within a color plane, if the pixel value is more than 95 percent below the local mean, it is considered a very dark pixel. The local mean is computed using a 13 x 13 pixel window. (Exposure time = 10ms)

Definition 3: Point Pixel Defect

When the sensor is illuminated to midlevel (about 400 LSBs to 700 LSBs), each pixel is compared to the mean of the neighboring 13 x 13 pixels. If the pixel value is more than ± 15 percent from the local mean, it is considered a point pixel defect. (ADC reference = 1V; exposure time = 10ms)

When the sensor is held in darkness, each pixel is compared to the mean of the neighboring 13 x 13 pixels. If the pixel value exceeds the local mean by more than 60 LSBs, it is considered a point pixel defect. (ADC Reference = 1V; exposure time = 10ms)

Definition 4: Clusters

The defects are examined using the results of definitions 1 through 3. A cluster defect is identified when two or more defective pixels can be found within a 3 x 3 pixel window. When a pixel belonging to a cluster can be enclosed in a 3 x 3 pixel window with a pixel belonging to another cluster, the two clusters are considered a single cluster. For color sensors, only pixels contained within the same color plane are examined for clusters.

Definition 5: Row/Column Defect

Using definition 3 conditions, a row/column defect is defined as a row/column whose mean value differs from the mean of its two neighboring rows/columns by more than:

- 20 LSBs in darkness, or
- 40 LSBs under mid-level illumination



Cluster

Figure 2 and Figure 3 represent the same sub-area of pixels. Figure 2 represents the raw pixel output; Figure 3 represents the pixel output separated by the color plane.

Clusters are analyzed by looking at one particular pixel and its surrounding 8 adjacent pixels within the same color plane (Figure 3). 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.

Figure 2: Defect and Cluster Fails

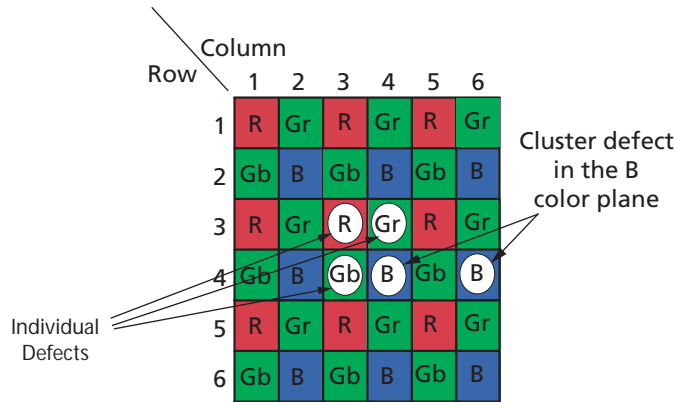
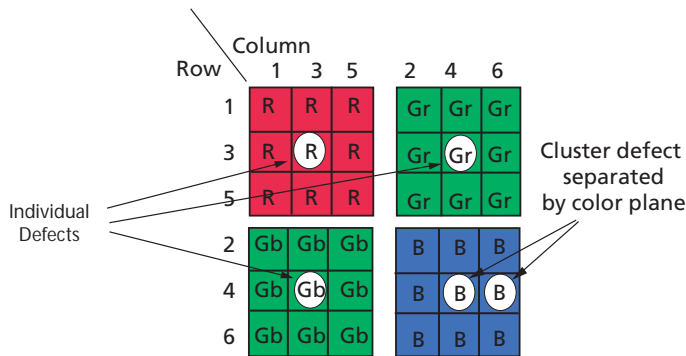


Figure 3: Defect and Cluster Fails—Separated by Color Plane



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Revision History

- Rev. B 12/03/2007
- Update Table 1, Defect Specification, on page 2 (remove Grade III)
 - Update Figure 2: “Defect and Cluster Fails,” on page 4
 - Update Figure 3: “Defect and Cluster Fails—Separated by Color Plane,” on page 4
- Rev. A11/2006
- Initial release