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TN1478

Technical note

Defective pixel specification of the VD55G0 global shutter image sensor

Introduction

This document is the defective pixel specification of the VD55G0 global shutter image sensor.

1 Acronyms and abbreviations

Table 1. Acronyms and abbreviations

Acronym/abbreviation	Definition
AVDD	analog supply voltage (VDDA)
DVDD	digital supply voltage (Vcore)
FPS	frames per second
IR	infrared
ROI	region of interest
VDDIO	IO supply voltage

2 Context

2.1 Device overview

The VD55G0 device is a 0.4 megapixels global shutter image optimized for near infrared scenes. The table below outlines the key device parameters.

Table 2. **VD55G0 overview**

Item	Description
Pixel size	2.61 µm x 2.61 µm BSI pixel
Pixel resolution	644 x 604 pixels (including four borders)
Die size	2.6 x 2.5 mm
Sensor technology	3D stacked
Shutter	Global
CSI-2 serial interface data rate	Single lane transmitter up to 1.2 Gbps
Power supply (Min./Typ./Max.)	AVDD: 2.7/2.8/2.9 V VDDIO: 1.7/1.8/1.9 V VCORE (DVDD): 1.1/1.15/1.22 V
External clock frequency range	6 MHz – 27 MHz
Operating temperature (Tj)	-30°C to 85°C functional
Temperature sensor accuracy	±3°C in range -30°C to 85°C

Table 3. **Pixel array**

Array	Resolution in pixel
Visible data	640x600
Visible data + Borders	644x604

2.2 Test conditions

2.2.1 Voltage supply

The sensor is tested using nominal supply voltages.

Table 4. **Voltage supply**

Supply name	Voltage
VDDIO	1.80 V
AVDD	2.80 V
DVDD	1.15 V

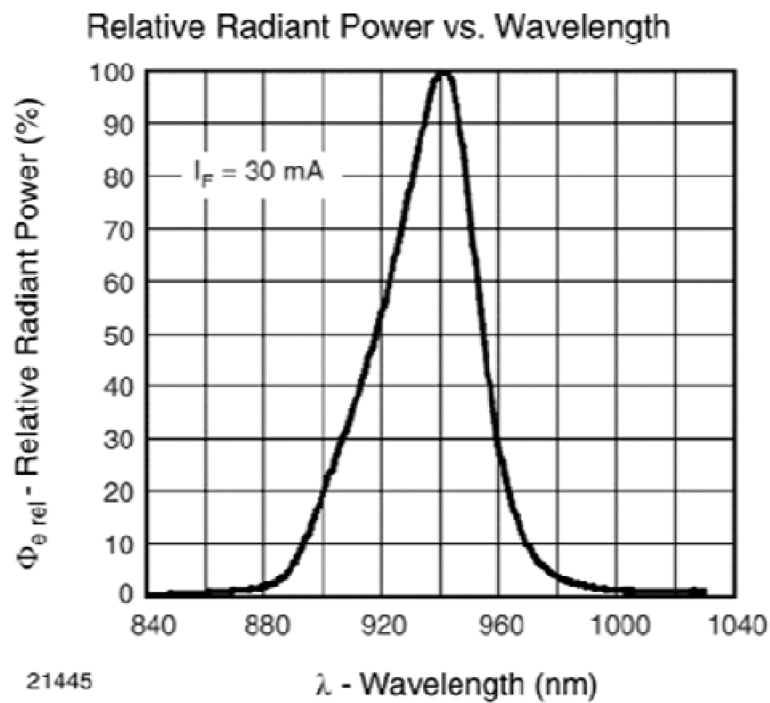
2.2.2 Lighting source

During the test, the following LED panel is used.

Table 5. **LED panel details**

Parameter	Value
Max intensity	100 µW/cm2
Intensity accuracy	± 5%
Light area	80 mm x 100 mm
Uniformity	± 3%

Figure 1. **Relative radiant power**



2.2.3 Temperature

The temperature is imposed by the prober chuck at 60°C.

3 Defect analysis

Images are taken in different lighting conditions. The images are then analyzed with a defect detection algorithm.

3.1 Image definition

Defectiveness is tested in dark and light conditions.

Note: IPs that correct the image are deactivated.

Table 6. Image definition

Parameters	Dark capture	Light capture
Light power	Off	19 mW in infrared (1)
Supplies	Nominal	Nominal
Integration time	66 ms	4 ms
Dark calibration	Off	Off
Number of frames	16	5
Analog gain	4	1

1. The light capture is done using an infrared light source to have roughly 75% of the maximum code.

3.2 Defect detection algorithms

The purpose of this algorithm is firstly to detect defect pixels, then to categorized them.

The pixels that highlight significant deviation compared to a localized pixel mean can be calculated in absolute values (for captures without light). Alternatively, they can be calculated using a percentage (for captures in light).

- “Local pixels mean value” are calculated using a flat kernel of 41x41.
- Each time a pixel differs from the local mean by an absolute value or a relative threshold, the pixel is identified as a “failing pixel”. The corresponding fail map is generated for a future fail categorization process.

Once the defect map is generated, the defect categorization algorithm sorts the failed pixels. This process detects single, couplet, cluster, row, and column defects.

3.2.1 Defect detection

Figure 2. Defect detection flow

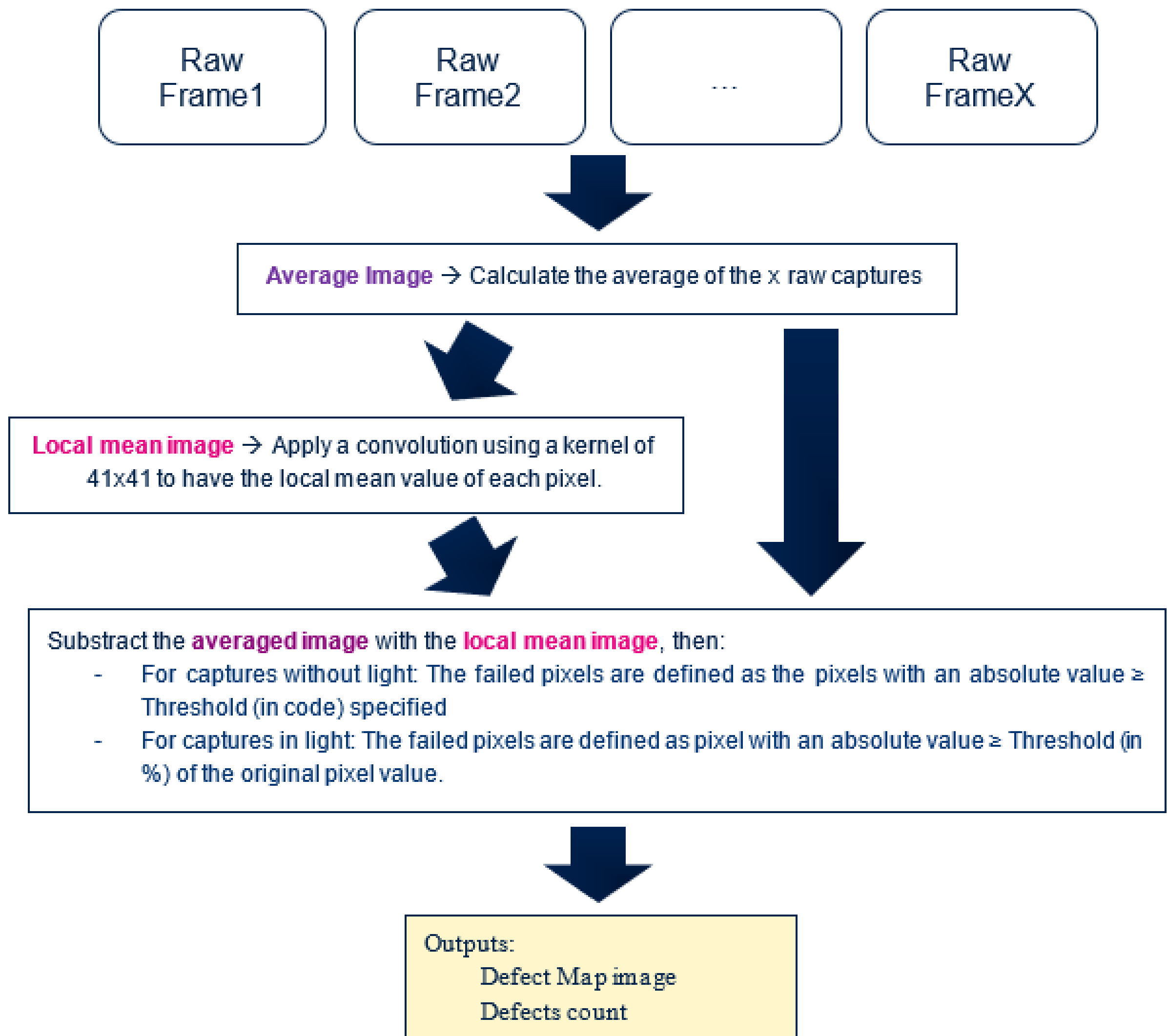


Table 7. Defect detection summary

Capture name	Image qty	Tint (ms)	Threshold
Dark	16	66	mean (kernel) ±25 lsb
Light	5	4	mean (kernel) ±12%

3.2.2 Defect categorization

Figure 3. Defect categorization flow

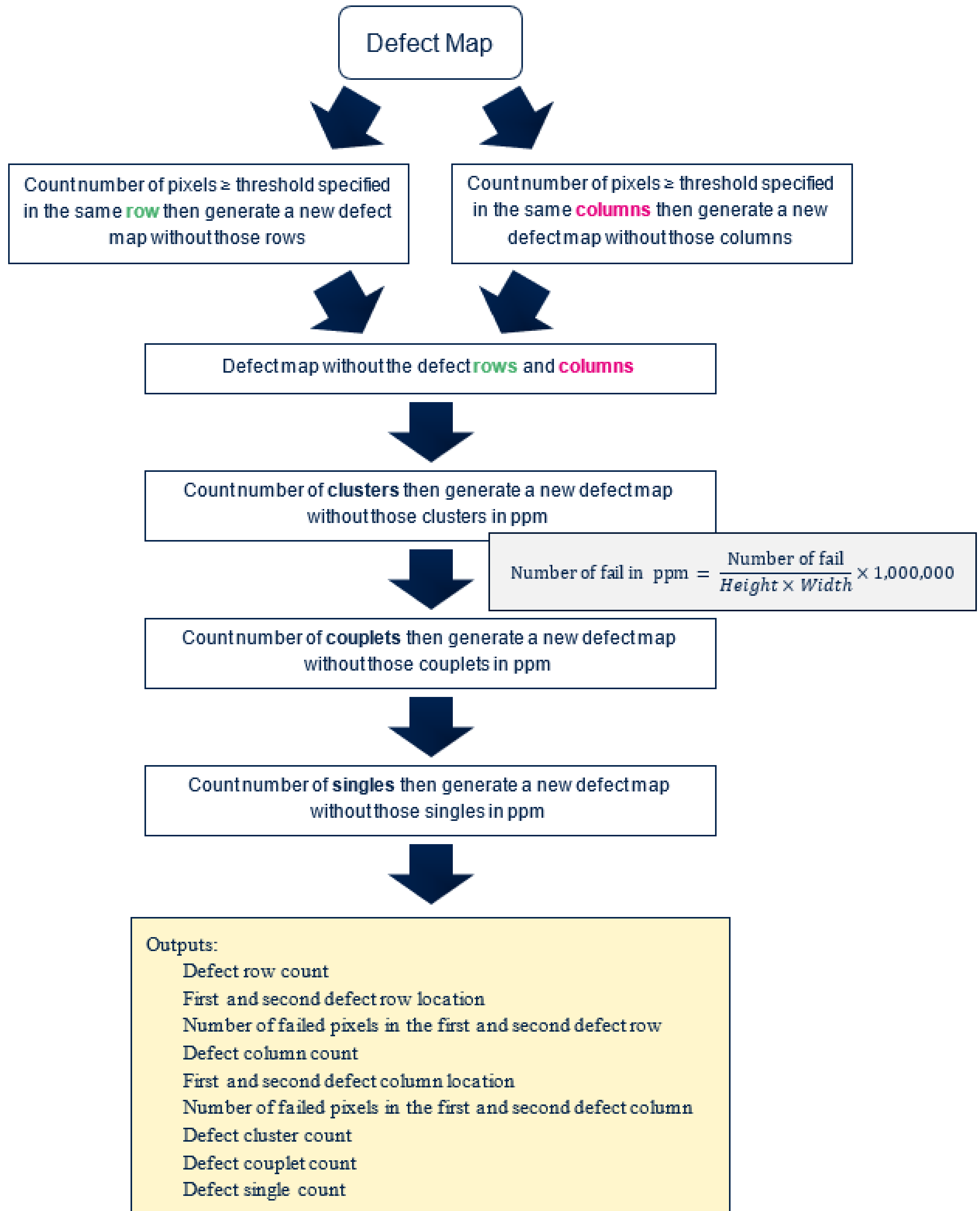


Figure 4. Examples of categorized defective pixels

Singlet	Couplet	Cluster

3.3 Defect limits

Table 8. Defect details

Comment	Max defect in dark	Max defect in light
Defect row count	0	0
Defect column count	0	0
Single defect count in ppm	1000 (ppm)	100 (ppm)
Couplet defect count in ppm	30 (ppm)	30 (ppm)
Clusters count	0	0

Revision history

Table 9. **Document revision history**

Date	Version	Changes
22-Aug-2024	1	Initial release

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