HiISP

FAQs

Issue 01

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About This Document

Purpose

This document describes solutions to the problems that may occur when you use the HiSilicon image signal processor (HiISP) for development.

NOTE

This document takes Hi3559A V100 as an example. Unless otherwise specified, the contents of Hi3559A V100 also apply to Hi3559C V100, Hi3556A V100, Hi3516CV500, Hi3516DV300, Hi3516AV300, Hi3556V200, Hi3559V200, Hi3516EV200, Hi3516EV300, Hi3516DV200, Hi3518EV300, and Hi3519A V100.

Related Version

The following table lists the product versions related to this document.

Product Name	Version
Hi3559A	V100
Hi3559C	V100
Hi3519A	V100
Hi3556A	V100
Hi3516C	V500
Hi3516D	V300
Hi3516A	V300
Hi3559	V200
Hi3556	V200
Hi3516E	V200
Hi3516E	V300
Hi3518E	V300
Hi3516D	V200

Intended Audience

This document is intended for:

- Technical support engineers
- Software development engineers

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 01(2019-09-12)

This issue is the first official release.

Section 1.1.22 is added.

Issue 00B03 (2019-04-12)

This issue is the third draft release.

Section 1.1.21 is added.

Issue 00B02 (2018-06-15)

This issue is the second draft release.

Section 1.2.8 is added.

Issue 00B01 (2018-03-15)

This issue is the first draft release.

Contents

1 FAQs

1.1 ISP

1.1.1 What Do I Do If the Overall Sharpness Is Insufficient?

[Symptom]

The image edge detail is blurry, showing similar the effect as defocus. The sharpness of large edges and textures for the Hi3559A V100 is lower than that for the benchmark.

[Cause Analysis]

The factors that affect the image sharpness include overall image luminance and contrast (AE, WB, gamma, and DCI), sharpening strength (sharpen), noise reduction strength (2DNR and 3DNR), and encoding bit rate. Therefore, when the overall image definition differs greatly from the definition required by customers, priority is given to adjustment of modules that affect the overall luminance and partial contrast, such as the gamma module. Then, perform the demosaic and sharpening operations.

[Solution]

Perform the following steps to gradually rule out possible causes of sharpness insufficiency and locate the issue:

1. Ensure that the sensor lens is clean, the lens film is removed, no single-edge is blurry, the f-stop is set to the minimum, and the focus is clear.
2. Ensure that the image luminance is appropriate. You can adjust the luminance by setting the **ae_compensation** parameter.
3. Correct the WB so that the image WB is normal.
4. Adjust the gamma value so that the overall image style and contrast reach customer requirements.
5. Set the encoding bit rate to a higher rate.
6. Adjust the demosaic parameters to avoid blurring of the demosaic interpolated image or unclear edges.
7. Read the current sharpening strength information by using the HiSilicon PQ Tools or manually set the sharpening strength to the maximum value.
   - Set **TextureStr** and **EdgeStr** to the maximum values.
   - Set **OverShoot** and **UnderShoot** to the maximum values.
   - Set **DetailCtrl** to **128**, and set **LumaWgt** to **127**.

- Adjust the **undershoot**, **overshoot**, and **shootSupStr** values based on the black/white border status of the image. If the image sharpness is too high, decrease **sharpenD** and **sharpenUD**. Repeat the preceding three steps. Then you can obtain the definition required by customers.

8. Disable the 2DNR and 3DNR modules or weaken the 2DNR/3DNR strength.

1.1.2 How Do I Improve Permeability When the Image Is Blurry?

[Symptom]

The image is blurry with low distinctness.

[Cause Analysis]

The distinctness is determined by the definition and contrast.

- If the definition or contrast is not high enough, the permeability is low.
- Besides, if the distinctness is low, you should check whether there is light leak.

[Solution]

1. Cover the place where light leaks. Note that there may be light leak on the back of the sensor board.
2. Improve the contrast by setting the gamma contrast to a larger value.
3. Adjust the LDCI to further improve the image contrast.
4. In a foggy or foggy-alike scenario, you can reduce the blur problem by using the dehaze function.
5. Improve the definition. For details, see section 1.1.1 and 1.1.3 .

1.1.3 What Do I Do If the Definition Is Low Under Low Illumination?

[Symptom]

The definition is low under low illumination.

[Cause Analysis]

- Cause A: The definition is closely related to the lens. Both the focal length and object distance affect the depth of field (a short focal length or a long object distance indicates a long depth of field) and cause the overall definition to differ.
- Cause B: There is a default linkage mechanism in the ISP software. To be specific, when noises are large, the sharpening strength is automatically decreased and the NR strength is increased. As a result, the image definition is lower in low illumination.

[Solution]

- For cause A, select the lenses of the same model from the same vendor for comparison tests.
- For cause B, the linkage mechanism parameters are available. You can balance the definition and NR to your preference. In low illumination, you can increase the 2DNR/3DNR strength to reduce the noise. You can also improve the sharpening strength to improve the sharpness of large edges. You can also adjust the demosaic parameters to avoid blurry edges out of image interpolation.

1.1.4 What Do I Do If the Image Definition Is Low and Black/White Borders Appear on Object Edges?

[Symptom]

The image definition is low or black/white borders appear on the edges of objects (such as fonts, leaves, or buildings).

[Cause Analysis]

The image definition is determined by the following two factors when the image is focused:

- NR strength. Higher NR strength indicates more blurred images.
- Sharpening strength. Higher sharpening strength indicates clearer images, and vice versa.

Generally the black/white borders appear on object edges because the sharpening strength is too high.However, the black/white borders appear after sharpening are an inevitable side effect of sharpening, especially strong sharpening. Proper black/white borders make the image feel more sharper.

[Solution]

To control the image definition and black/white borders, adjust the NR strength and sharpening strength as follows:

- If the image definition is low, decrease the 2DNR strength and improve the sharpening strength.
- When the image definition meets requirements
  - First, increase **ShootSupStr** to lessen the black/white borders of the image. When **ShootSupStr** is set to a large value, the black/white borders are narrowed and the amplitude of the black/white borders can be reduced without obviously compromising the definition of the image. However, if **ShootSupStr** is too large, the definition decreases obviously, causing the side effect of oil painting and aliasing.
  - If adjusting **ShootSupStr** cannot help suppress the black/white borders, decrease **overshoot** to narrow the white borders and **undershoot** to narrow the black borders. However, adjusting **overshoot** or **undershoot** affects the definition obviously.

1.1.5 What Do I Do If Image Aliasing Is Obvious?

[Symptom]

For an image after sharpening, aliasing appears on the large edges where the oblique angle is small and the contrast is high.

[Cause Analysis]

For an image before sharpening, aliasing exists, not too obvious on the large edges where the oblique angle is small and the contrast is high. After sharpening, aliasing is also enhanced. The aliasing is closely related to the oblique angle of the large edges with high contrast. The severity order of aliasing differs greatly according to the oblique angles.

[Solution]

To gradually rule out possible causes of aliasing and locate the issue, do as follows:

1. Ensure that the view angle and oblique angle of the edges where aliasing appear are the same as those of the benchmark. Compare the aliasing issue of the Hi3559A with that of the benchmark.

2. Disable the sharpen function and check whether the aliasing effect is reduced.
   - If aliasing becomes obvious on the large edges after sharpening is disabled, adjust the demosaic and 2DNR parameters. Generally, increasing the demosaic **DetailSmoothStr** parameter can obviously reduce the aliasing effect. However, you should properly adjust **DetailSmoothStr** to avoid fuzzy edges.
   - If image aliasing is unobvious after sharpening is disabled and becomes obvious after sharpening is enabled, you need to adjust the sharpen parameters to reduce the aliasing effect under acceptable definition change.

     Properly adjusting **EdgeStr** can significantly reduce the aliasing effect without significantly compromising the image definition. The **EdgeStr** parameter is a 32-byte array. By reducing **EdgeStr** of the segment with the largest coordinates, the aliasing effect can be obviously reduced. For example, decreasing the **EdgeStr** values of EdgeStr[20], EdgeStr[21], EdgeStr[31:22] of the segment with the largest coordinates, and retaining the **EdgeStr** values of EdgeStr[19:0] of the segment with small coordinates, the aliasing effect can be obviously reduced without significantly compromising the image definition. In addition, the EdgeStr strength curve must be adjusted as smoothly as possible. In addition, if **ShootSupStr** is too large, the aliasing effect is strengthened. Therefore, you should adjust **ShootSupStr** under acceptable black/white borders. Finally, increasing **EdgeFiltStr** can also reduce the aliasing effect.

1.1.6 What Do I Do If Grids Appear on Image Corners with the Vignetting Effect?

[Symptom]

Regular horizontal lines or vertical lines appear at random on the four image corners with the vignetting effect.

[Cause Analysis]

When the chief ray angle (CRA) of the lens does not match that of the sensor, light incidence through the lens causes Gr/Gb imbalance. As a result, crosstalk occurs. As there is no non-directional interpolation in the demosaic module, horizontal or vertical interpolation is used at random, and therefore the grids appear.

[Solution]

- Check whether the CRA of the used sensor matches that of the lens. If not, you are advised to replace the sensor or lens so that the CRAs match based on the document provided by the sensor vendor.

1.1.7 What Do I Do If Overexposure or Underexposure Occurs During AE?

[Symptom]

Overexposure or underexposure occurs during AE. The image quality is not improved after the **ae_compensation** parameter is adjusted.

[Cause Analysis]

You can obtain the exposure time and gain in the current status by calling HI_MPI_ISP_QueryInnerStateInfo.

NOTE

For details about the HI_MPI_ISP_QueryInnerStateInfo MPI, see the *HiISP Development Reference*.

[Solution]

Based on the exposure time and gain in current status, do as follows:

- If the exposure effect is inconsistent with the current luminance, check the AI circuit. That is, the exposure time and gain are set to large values, but underexposure still occurs or the exposure time and gain are set to small values, but overexposure still occurs.
- If the exposure effect is consistent with the current luminance, query the 5-segment histogram for AE. If the gray scales are too dense and the data of some segments is 0, check the image width, image height, and video input (VI) mask.
- If the exposure information is inconsistent with the current luminance, check whether the related sensor register of the AE algorithm is correctly configured and takes effect. You can use I^2C/SPI to directly read the shutter and gain register status of the sensor.

1.1.8 How Do I Resolve the Luminance and Contrast Issues in the IR Scenario?

[Symptom]

In low illumination, when the infrared (IR) light is turned on, the image periphery becomes dark while the central portion of the image becomes too bright, and the detail is lost. The contrast in the highlighted regions is low and the image is blurred.

[Cause Analysis]

The IR light usually irradiates the central portion of the image. Overexposure and low contrast occur in the highlighted regions while the image periphery becomes dark.

[Solution]

- Ensure that the IR-Cut is switched to night mode.
- For the AE luminance adjustment, properly reduce the AE compensation value, and set **AEStrategyMode** to the AE_EXP_HIGHTLIGHT_PRIOR mode. If both **HistRatioSlope** and **MaxHistOffset** are set to large values, overexposure can be avoided.
- The image luminance reduced after AE luminance adjustment needs to be improved. Enable the DRC and adjust the DRC strength and DRC curve to improve the image luminance. However, the issue of low contrast is introduced with the luminance change. Therefore, the dehaze and DCI modules need to be adjusted as well.
- Enable the dehaze module, adjust the customized dehaze curve, and adjust the dehaze strength locally based on the luminance. The contrast in the highlighted regions can be increased without blackening the dark regions, thereby increasing the detail. Adjust the image contrast at the same time by using the DCI function.
- The image periphery is still dark. In this case, the shading function can be used to improve the luminance of the image periphery, with the luminance of the central portion hardly changes.

1.1.9 How Do I Adjust the AE, AWB, and CCM Parameters in IR Mode?

[Symptom]

In IR mode, the AE statistics are unstable and change frequently. In other cases, the AE converges to different luminance values in IR mode. For example, cover your hands with your hands, and then the brightness changes.

[Cause Analysis]

These phenomena are linked with AE and AWB configuration. After the AWB algorithm is enabled, the R and B components become abnormal. As a result, the large-area AE single colors are incorrectly determined, causing oscillation.

[Solution]

- In the IR scenario, the large-area single-color function (**bHistStatAdjust**) needs to be disabled when the HiSilicon AE library is used.
- If **WBGain** is enabled in the IR scenario, the image appears brighter. In this case, you are advised to configure the pixel skipping mode (**stHistConfig**) based on the sensor Bayer pattern type and count the R and G components to obtain proper luminance.
- In IR mode, you are advised to disable the AWB algorithm and set the saturation value to **0**. In this case, you are advised to allocate greater weights to the G and R channels in the CCM.
- If the AWB algorithm is required when the IR light is used, you are advised to set **u16ZoneSel** to **0** to use the global AWB statistics. In this case, the R and B channels are given a large multiplication coefficient in the AWB algorithm, resulting great noise in R and B channels. You are advised to give a greater weight to the G channel, and fewer weights to the R and B channels.

1.1.10 What Do I Do If Vertical Bars Occur on the Image in Low Illumination?

[Symptom]

For some sensors, vertical bars appear on the image in low illumination.

[Cause Analysis]

Vertical bars reflect the fixed pattern noise (FPN) of the sensor. The FPN is more obvious when the sensor digital gain increases. Currently, the software does not limit the sensor digital gain. The digital gain is large in low illumination, which results in obvious vertical bars.

[Solution]

Use the FPN algorithm module to weaken or remove the FPN.

1.1.11 How Do I Implement Backlight Compensation?

[Symptom]

The target object is dark in the backlight scenario.

[Cause Analysis]

In the backlight scenario, backlight compensation can be implemented by increasing the entire exposure luminance of the image.

[Solution]

Increase the AE weight of a specified region.

The static AE statistics of the Hi3559A V100 are divided into 15 x 17 zones. To change the luminance of a zone, you can change the AE weight of the zone by setting the weight table.

You can also call an MPI to increase the AE weight of the specified zone. Then exposure is performed on the specified zone based on the configured luminance to implement backlight compensation. Note that if the AE weight of the target object is too large, overexposure occurs in the bright zones around the target object.

1.1.12 How Do I Implement the Manual Exposure Time Control with Automatic Gain or Manual Gain Control with Automatic Exposure Time?

[Solution]

To implement such a function, the AE mode is recommended. Set the upper and lower limits of the exposure time to the same value. In this way, exposure can be manually controlled. If **enAEMode** is set to **AE_MODE_SLOW_SHUTTER** and the exposure time exceeds the upper limit of a frame, the frame rate is automatically reduced. Similarly for the gains, set the upper and lower limits of **SysGain** to the same value.

1.1.13 How Do I Set the Maximum Gain?

[Symptom]

In low illumination, the maximum gain needs to be limited to obtain better image quality. However, the image flickers when AE is enabled after the values of **Dgain** and **ISPDgain** are limited.

[Cause Analysis]

The **Again** precision of most sensors is low. If the high-precision **Dgain** and **ISPDgain** are limited, the luminance cannot be accurately controlled and the image flickers the image flickers

[Solution]

The maximum values of **Again**, **Dgain**, and I**SPDgain** are not limited. Instead, the maximum system gain (**SystemGainMax**) is limited. **SystemGainMax** is calculated as follows: **SystemGainMax = Again** x **Dgain** x **ISPDgain**. The method of allocating the gain by the AE module can be ignored.

1.1.14 What Do I Do If AWB Is Susceptible to Interference?

[Symptom]

When hands swing or a car runs in the front of the lens (the car occupies most region of the image), AWB is susceptible to interference. As a result, the image has a color cast.

[Cause Analysis]

AWB is susceptible to the color skin or some car colors, which causes AWB errors.

[Solution]

- Set the AWB parameter **u16Speed** to decrease the convergence speed.

- Use the advanced AWB algorithm. If the ambient illuminants do not change, sunlight exerts no influence. Use the indoor light illuminants only and improve the advanced AWB algorithm attribute **u8Tolerance** can also help to resolve the issue.

1.1.15 What Do I Do If the Color Is Affected by the Black Level Offset at a High Color Temperature?

[Symptom]

At a too high or too low temperature, the image still has a color cast after AWB correction.

[Cause Analysis]

At a too high or too low temperature, the stability is affected when a sensor captures images. At a high temperature, the sensor black level has an offset, and the actual black level is several times the black level at the normal temperature. In this case, the image has a color cast after AWB correction. In the ideal case, the ratio of the red component to the green component is the same for the gray points with different luminance (R = K x G). R indicates the red component captured by the sensor, G is the green component captured by the sensor, and K is the ratio of the red component to the green component. The sensor offset is F0 at the ambient temperature and is F1 at a high temperature (F0 < F1).

- The gain of channel R at ambient temperature is calculated as follows: Nomal_R/G = (K x G + F0 – F0)/(G + F0 – F0) = K.
- The gain of channel R at high temperature is calculated as follows: High_R/G = (K x G + F1 – F0)/(G + F1 – F0)

  F0 < F1 (black level offset at high temperature)

According to the optical spectrum diagram of the sensor, most sensors show stronger photosensitivity to the green color than red or blue colors. K < 1; High_R/G – Nomal_R/G = (1 – K) x (F1 – F0)/(G + F1 – F0) > 0; High_R/G > Nomal_R/G Rgain = G/R = 1/(R/G)

Therefore, High_Rgain < Normal_Rgain, that is the red channel gain is small. It is inferred that gain of the channel B is also small at high temperature so that the image must have a green cast at high temperature.

[Solution]

High_R/G – Nomal_R/G = (1 – K) x (F1 – F0)/(G + F1 – F0).

G reflects the luminance. A larger G value indicates a smaller difference between High_R/G and Nomal_R/G. That is, higher luminance indicates less sensitivity to the black level offset. You are advised to increase the value of the AWB parameter **BlackLevel** (default value is 0x40 before) to reduce interference to the gain due to the black level offset.

1.1.16 How Do I Improve Luminance and Contrast in Low Illumination?

[Symptom]

In low illumination, the luminance and contrast of the image are not as good as those of the benchmark.

[Cause Analysis]

- Causes A: This issue may be caused by the f-stop variance. A smaller f-stop indicates larger aperture value and more light reaches the sensor.

- Cause B: This issue may be caused by sensor variance. The image quality in low illumination varies according to the optical-to-electrical conversion efficiency of the sensor.
- Cause C: The entire brightness differs. The dynamic ranges of the image focus on dark regions. The brightness and contrast of some products are adjusted to improve the visual effect.
- Cause D: For some products, the frame rate decreases and the exposure time increases in low illumination. In this way, the image looks brighter.
- Cause F: The contrast of the image may be decreased after the denoising algorithm processing in low illumination. In low illumination, there is a large amount of salt-and-pepper noise. When the NR algorithm over-processes the pepper noise, the salt noise is left. As a result, a white cast appears over the entire image.

[Solution]

- For cause A, select the lenses of the same model from the same vendor for comparison tests.
- For cause B, select the same sensor for comparison tests.
- For cause C, adjust the AE parameters to ensure that the overall luminance is the same as that of the benchmark.
- For cause D, manually decrease the frame rate in the demo. Note that this method is not recommended in actual applications.
- For cause F, change the NR policy or adjust the gamma and DCI parameters to increase the overall contrast.

1.1.17 How Do I Remove the Directional Glitch near the Illuminant Characters?

[Symptom]

Directional glitch occurs near the illuminant characters in normal illumination as shown in Figure 1-1.

Figure 1-1 Directional glitch near the illuminant characters in normal illumination

[Cause Analysis]

- This problem is caused by improper parameter calibration in the global CAC module.

[Solution]

- Check whether the static coefficient for global CAC is proper. If not, re-calibrate the static coefficient as required. If you do not want to calibrate the global CAC static coefficient, disable the global CAC function. Figure 1-2 shows the comparison diagram when the global CAC is enabled and disabled with improper static coefficient.

Figure 1-2 Comparison diagram when the global CAC is enabled and disabled with improper static coefficient

1.1.18 How Do I Control the P-iris by Using the AE?

[Symptom]

After the P-iris and the driver are connected successfully, you can manually control the iris. However, the iris cannot be controlled by using the AE.

[Cause Analysis]

The AE is not configured with correct iris parameters.

[Solution]

- The AE route needs to be configured. Otherwise, the iris is adjusted only when the exposure time reaches its minimum value. However, it is difficult to use the minimum exposure time in actual use. Therefore, you need to configure the AE route to enable the aperture adjustment for scenarios before the exposure time reaches its minimum value.
- **pstAeSnsDft** -> **enMaxIrisFNO** and **enMinirisFNO** parameters are not configured in the **xxx_cmos.c** file. Do not mistake **enMinIrisFNOTarget** for **enMinirisFNO**. **enMinIrisFNOTarget** is used to configure the maximum and minimum exposure values through the MPI. **enMinirisFNO** is used to configure the maximum and minimum exposure values actually supported by the aperture. If **enMinirisFNO** is not configured, the AE considers that the maximum and minimum exposure values are both **0**.

1.1.19 What Do I Do If the DC-Iris Cannot Be Disabled in Auto Mode?

[Cause Analysis]

- If the DC-iris can be enabled and disabled in manual mode, the hardware is normally connected.
- The DC-iris is often used to avoid power frequency flicker. The exposure time for the AE anti-flicker function is a multiple of the power cycle. For example, for the 50 Hz power, the exposure time for the AE anti-flicker function is a multiple of 10 ms. In highlight environment, the exposure time is less than 10 ms when the maximum aperture value is used. To implement the anti-flicker function, the DC-iris with a smaller aperture value is required.
- According to the HiSilicon AE DC-iris algorithm, the DC-iris is disabled only when the exposure time reaches the minimum value. However, the default minimum value is 2

lines, which is equivalent to dozens of microseconds. In actual scenarios, such exposure time is impossible. Therefore, the DC-iris cannot be disabled. You can change the minimum exposure time to 10 ms to implement anti-flicker. You can also leave the minimum exposure time unconfigured and set the anti-flicker mode to normal mode, so that the exposure time remains unchanged after the exposure time is reduced to the minimum exposure time for anti-flicker. In this case, it is considered that the minimum exposure time is reached and the DC-iris is disabled.

1.1.20 What Do I Do If the Image Flickers When the AE Is Enabled?

[Symptom]

Sync problem: Specifically, one or two frames suddenly become brighter or darker than other frames, and then are restored to normal. Precision problem: Specifically, the image luminance changes continuously with different amplitudes. In other cases, the AE is occasionally unstable.

[Cause Analysis]

The image flicker problems when the AE is enabled come in two types: synchronization problem and precision problem.

- Sync problem: For most sensors, the gain configuration takes effect at the next frame and the exposure time configuration takes effect at the frame after the next frame. The configuration of **Isp_Dgain** takes effect at the next frame. With incorrect synchronization settings, flicker occurs when the gain and exposure time changes greatly. This problem commonly found in highlight scenarios and scenarios where anti-flicker is enabled.
- Precision problem: The luminance value calculated by the AE algorithm cannot be fully implemented when it is configured to the sensor because of the limitation of the gain precision.

  With a low gain precision, the luminance may change between two adjacent luminance values that can be implemented, and the correct luminance fails to be converged to. Therefore, image oscillations and flickers occur.

  [Solution]Sync problem: Configure the sensor sync register by calling **cmos_get_sns_regs_info** in the **xxx_cmos.c** file. Configure **u8Cfg2ValidDelayMax** for the ISP Dgain synchronization. You can modify the exposure time, gain, and ISP Dgain synchronization configuration to solve this problem.

  Precision problem: Because the precision of the ISP Dgain is high, at least 2x ISP Dgain can be used to solve the precision problem. It is not recommended to restrict the Again, Dgain, and ISP Dgain separately to avoid precision errors. You can limit the system gain. The AE automatically allocates values for the three gains.

1.1.21 What Do I Do If Obvious Edge Noise Appears When the Fisheye Correction Is Performed in the VI Module?

[Symptom]

Currently, the fisheye correction is performed before 3DNR in the VI module. After fisheye correction, obvious edge noise is found but the central noise is mitigated.

[Cause Analysis]

BayerNR and NrLsc can be used to address the position-associated uneven noise layout due to fisheye correction. Currently, only the Shading module of Hi3516D V300/Hi3516C V500 provides BayerNR (**BNRLscGainLut**.**RGain**, **BNRLscGainLut**.**GrGain**, **BNRLscGainLut**.**GbGain**, and **BNRLscGainLut.BGain**). The **BNRLscGainLut** debugging is decoupled from the luminance correction of the Shading module.

[Solution]

Debug the NrLsc module of BayerNR, enable **NrLscEnable**, and debug **BNRLscGainLut**.**RGain**, **BNRLscGainLut**.**GrGain**, **BNRLscGainLut**.**GbGain**, and **BNRLscGainLut.BGain** in mesh shading.

Note that in **BNRLscGainLut.RGain**, **4096** indicates 1x while **8192** indicates 2x. Set the gain of the image edge to a larger value, so that the NrLsc function is enabled in BayerNR, which can reduce the noise at the edge. Set the gain of the image center to a smaller value, so that the BayerNR strength is weaker in the central portion. In this case, you need to adjust **CoarseStr** instead of **Finestr** for the BayerNR strength

1.1.22 What Do I Do If Image Flickering Persists in a Bright Scene Even If Anti-Flicker Is Enabled?

[Symptom]

In scene-auto mode where default AE route is configured, with the anti-flicker function enabled for the corresponding frequency, flickers still occur if the ambient light is bright but the required exposure is greater than the minimum anti-flicker exposure.

[Analysis]

The automatic anti-flicker function is restricted by the AE route. If the AE route is set to allocate the gain first, the total exposure will be greater than the minimum anti-flicker exposure, but the exposure time is still less than the minimum anti-flicker exposure time. In this case, automatic anti-flicker does not take effect.

[Solution]

Set the AE route to allocate the exposure time first. That is, when the gain is 1x or reaches the minimum expected value, but the exposure time reaches the minimum anti-flicker time, automatic anti-flicker can be achieved.

1.2 Sensor

1.2.1 What Do I Do If Image Crack Occurs When a Sensor Is Connected?

[Symptom]

If the Sony IMX477 sensor is connected to the Hi3559A V100, when the ambient luminance changes and the exposure time and gain are updated during AE, a bright line appears on the image that looks like a crack.

[Cause Analysis]

The analog gain register of the Sony IMX477 in slave mode takes effect in a real-time manner. When the ambient luminance changes, related sensor register is updated and configured by the AE module. When the analog gain is configured in the valid interval (non-blanking interval) of the image data but the analog gain does not take effect in the vertical blanking interval, the image has a bright line or appears to have a crack.

Most Sony sensors (such as IMX477, IMX377, and IMX277) in slave mode have the preceding issue, which requires that the analog gain must be configured in the vertical blanking interval. This ensures that updated values take effect in the blanking interval and no bad frames occur.

[Solution]

Configure the registers by using interrupts based on the ISP register configuration mechanism (or user-designed configuration mechanism) to ensure that the analog gain takes effect in the vertical blanking interval. When the service traffic of the customer application is heavy, the interrupt response may not function timely. As a result, the configured analog gain may not within the blanking interval, and the problem may persist. In this case, the interrupt handling service needs to be optimized to ensure the timely interrupt response.

1.2.2 What Do I Do If Image Flicker Occurs When a Sensor Is Connected?

[Symptom]

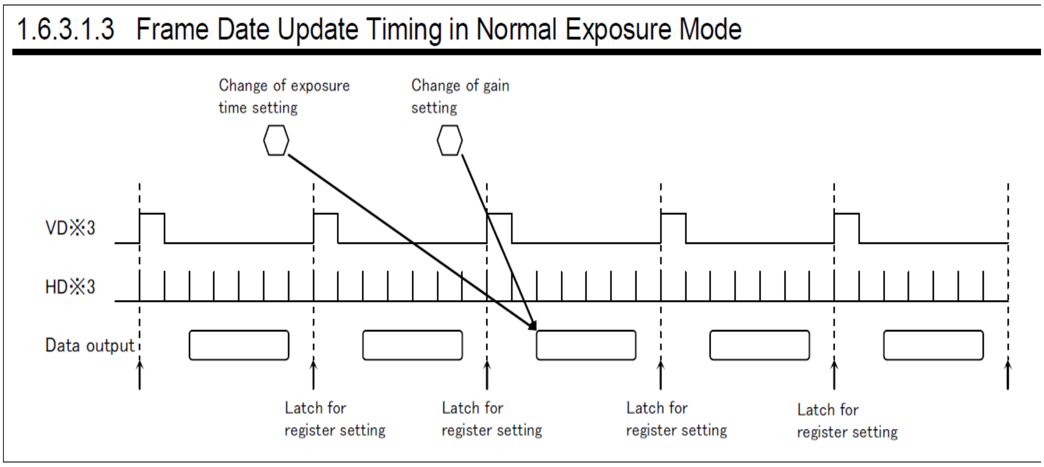
When a Panasonic sensor is connected, if the ambient luminance changes, the image flickers significantly during AE. This issue disappears when a sensor of other brands is connected.

[Cause Analysis]

The Panasonic sensors update the shutter register and gain register at frame *N*. The updated value of the shutter register takes effect at frame $N + 2$, and the updated value of the gain register takes effect at frame $N + 1$. To ensure that the updated values of the shutter register and gain register take effect at the same time, you are advised to update the shutter register first, and then update the gain register a frame later.

Figure 1-3 shows the update timing of the Panasonic sensor, and the update timing for of other sensors are the same.

Figure 1-3 Update timing of the Panasonic sensor



[Solution]

The HiSilicon ISP has designed a set of register configuration mechanism for the preceding issue to ensure that registers take effect at the same frame after configuration, so that the image flicker issue is avoided.

To be specific, call cmos_get_sns_regs_info() in **xxx_cmos.c** to configure the parameters such as **u8DelayFrmNum**. **u8DelayFrmNum** indicates the number of delayed frames for register configuration. Each register to be configured has a parameter **u8DelayFrmNum**. For details, see the **xxx_cmos.c** file.

1.2.3 How Do I Enable Anti-flicker at 50 Hz/60 Hz for Different Sensors?

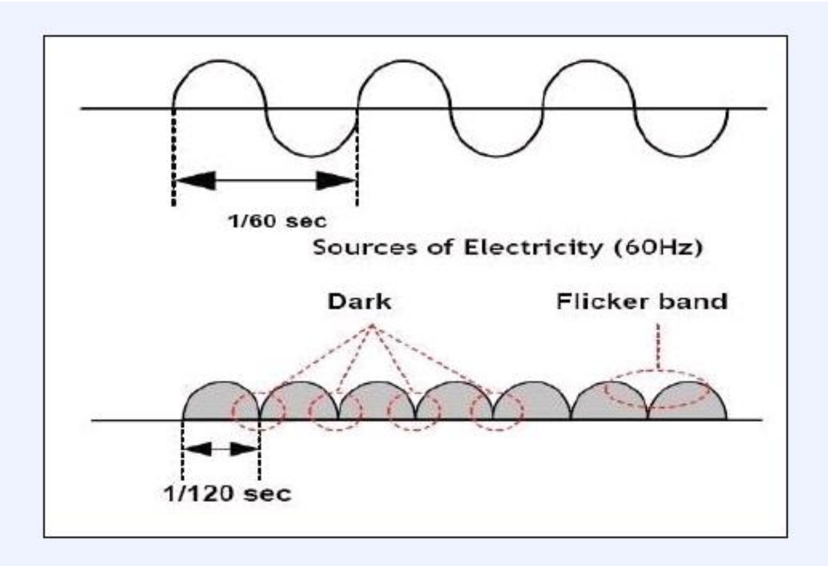
[Symptom]

When the default settings of the parameters for the HiSilicon SDK are used, anti-flicker does not work after being enabled.

[Cause Analysis]

Figure 1-4 shows the wave form of alternating current.

Figure 1-4 Wave form of alternating current



The starting exposure time varies according to sensor lines. If the exposure time is short, some pixel lines are exposed when the pixel luminance is high while others are exposed when the pixel luminance is low. Even the sensor lines retain the same exposure time, their accumulated energy is different. The same line in the adjacent frames and the lines in the same frame have different luminance. As a result, the image flicker occurs.

If the exposure time is an integral multiple of the energy accumulation period, the overall luminance of a frame is consistent. The exposure time must be an integral multiple of 1/100s at 50 Hz or an integral multiple of 1/120s at 60 Hz.

[Solution]

The Hi3559A V100 ISP supports anti-flicker. The exposure time of the sensor is measured by line. The conversion ratio of lines to seconds varies depending on sensor type. You need to set the **u32LinesPer500ms** parameter to implement anti-flicker based on the hardware configuration. The value of **u32LinesPer500ms** is half of the line frequency. The parameter value is calculated as follows:

u32LinesPer500ms = Pixel clock frequency/(Image width + Width of the horizontal blanking interval/2

1.2.4 What Do I Do If Yellow Ellipses Appears on the Image Output from the Sensor?

[Symptom]

Color casts in the concentric form, usually a yellow ellipse, appear on the image.

[Cause Analysis]

The chief ray angle (CRA) of sensor does not match the lens.

[Solution]

- Use the ISP lens shading correction (LSC) module to solve this issue. The default parameters cannot match each type of lens. You should conduct correction based on the actual lens used. Among the lens parameters, the length of the rear focus and the aperture value are most influential.
- In low illumination, if the normal correction parameters in normal illumination are used, the noise around is obvious and the luminance is high. Therefore, in low illumination, you can use the correction table that limits the maximum gain or disable the LSC function.

1.2.5 How Do I Avoid the Yellow and Green Color Problem in the Bright and Dark Regions in Built-in Sensor Mode?

[Symptom]

Yellow and green colors in the bright and dark regions, and the purple fringing in the motion regions are obvious in built-in sensor mode.

[Cause Analysis]

After the long and short frame data is synthesized and compress it by segment in the sensor, the colors are not linear at the turning point. This problem is brought by the raw data.

[Solution]

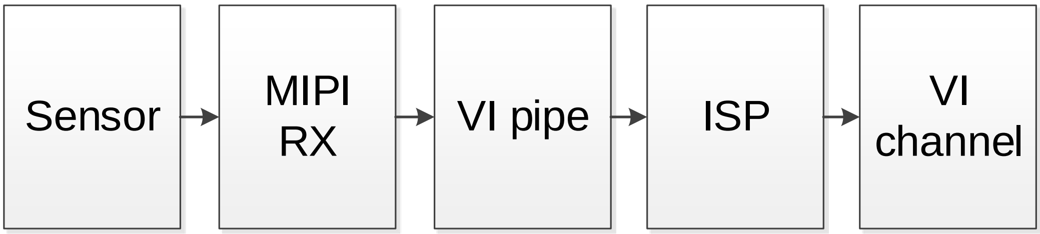
- The multi-frame combination WDR mode is recommended.
- Reduce the luminance. Do not locate the regions with abnormal colors in the regions of interest (RIOs).

1.2.6 How Do I Implement Image Cropping?

[Description]

Figure 1-5 shows the modules that support image cropping.

Figure 1-5 Diagram of the modules that support image cropping



[Solution]

- Generally, the sensor supports cropping internally, but the switchover of the cropping size is slow.
- The MIPI and LVDS of the MIPI RX module supports cropping and the start point can be configured.
- VI pipes support cropping.
- The ISP module supports cropping. Send only valid images after cropping to the ISP module. Otherwise, the image processing is spoiled if abnormal image data is sent to the ISP.
- VI channels support cropping as well. However, cropping does not happen here.

1.2.7 How Do I Understand the Access Performance?

[Description]

- The MIPI/LVDS/SLVS-EC access performance for serial inputs is influenced by the following factors: single-lane rate and VI/ISP working frequency.

  For details of the MIPI single-lane rate (unit: bit/s), see the *Hi3559A/C V100 Ultra-HD Mobile Camera SoC Data Sheet*. For details of the single-lane rate (unit: bit/s) of the sensor, see the sensor sequence.

  The VI/ISP frequency can be the same as the PCLK at the parallel port (unit: pixel/s). Generally, the sensor sequence provides only the single-lane rate, which can be used for the calculation. Assume that the sensor single-lane rate is 1.14 Gbit/s, the lane number is 4, and the data is 12 bits/pixel, then:

  Total data volume = 1.14 Gbit/s x 4 = 4.56 Gbit/s

  Total pixel frequency = (4.56 x 1000 Mbit/s)/(12 bit/pixel) = 380 Mpixel/s
- For details of the DC interfaces for parallel inputs, see the *Hi3559A/C V100 Ultra-HD Mobile Camera SoC Data Sheet.*

1.2.8 Adjustment Restriction Between Two Frames in IMX334 WDR Mode

[Description]

The RHS1 register in IMX334 4K@30 fps WDR mode has the following restrictions:

RHS1 (N + 1) ≥ RHS1 (N) + 2 x BRL – 2 x VMAX + 2

The current BRL is equal to 2200. VMAX at 30 fps is equal to 2250. Then, RHS1 (N + 1) ≥ RHS1 (N) – 98

That is, in terms of RHS1, there is a 98-line restriction between two frames in the case of 30 fps. Since SHR0 ≥ RHS1 + 9, there is also a restriction between two frames of the SHR0 register. This restriction causes the switching of the current frame rate. For example, pictures cannot be switched smoothly when the frame rate is increased or when the long frame mode and WDR mode are switched.