Reset Method for Still Image Capture

Application Note 1220

Purpose

In still image capture mode, a special image reset function is needed to attenuate latent images that are superimposed on the final image. This image may be visible after a long period without a reset signal, such as in camera mode. The latent image will appear as a single horizontal band of different brightness. It may also appear as alternating darker rows after taking a full frame image immediately after being in sub-sampling mode.

Background

Pixels are not normally in reset. Reset operation (getting rid of previously stored charge) is accomplished with reset pulses rather than a steady signal. Each image acquisition is associated with one set of reset pulses (a pulse before start of exposure and a pulse before retrieving the dark value). Taking just one full resolution picture prior to the final picture injects just one set of extra reset pulses. This may not be sufficient to remove latent, or "ghost" images. The latent image, although attenuated, is still quite visible. Using the Fast Rolling reset option is the recommended methodology to do multiple fast resets.

Outline of Procedure

- Set the sensor into the shutter acquisition mode.
- Start a fast rolling reset by starting a shutter-mode acquisition.
- Wait until the SSF (Shutter Sync Flag) is set, indicating the end of a fast rolling reset.
- Terminate the current acquisition (without taking any data) and start a new shutter-mode acquisition.
- Iterate several times.

Procedure Details

1. Set the sensor to full-frame acquisition:
   Clear HAVG in ICTRL register – no horizontal averaging.
   Clear RSS and CSS in CONFIG register – no vertical or horizontal sub-sampling.

2. Set the sensor to shutter-mode acquisition:
   Set MODE bits to 0x01 in CONFIG register.

3. Set the integration time to be very long, so that data transfer does not start prematurely:
   Set ROWEXPH to 0x04 (1024 rows).
   Set ROWESPL to 0x00.

4. Set the sensor to unconditionally stop an acquisition in-progress when requested:
   Clear SFC in CONFIG register (Stop when Frame Complete).

5. Reset the STATUS register:
   Write 0x7E to STATUS location (this clears SSF flag).

6. Start acquisition:
   Set RUN bit in the CONTROL register.

7. Wait until the fast rolling reset ends:
   Monitor the STATUS register.
   Wait until SSF is set.

8. Stop the acquisition:
   Clear RUN bit in the CONTROL register.
   Wait 10 µs, just in case.

9. Iterate for the desired number of reset cycles:
   Goto Step 5

10. Clean up:
    Write 0x7E to STATUS location (this clears SSF flag).
    Set MODE bits to 00 in CONFIG register.
    Set SFC in CONFIG register (Stop when Frame Complete).

Timing analysis

The number of sensor cycles required for completion of one fast rolling reset cycle is given by:

1 + 104 x NRP

Where NRP is the number of rows to be acquired. In the case of no sub-sampling, it is the height of image, or 480.

The total number of cycles is therefore 49,921, or roughly 50k. At the cycle rate of 24 MHz, this comes out to be just a little over 2 milliseconds.

Using the Fast Rolling reset, 10-15 reset cycles are recommended to remove the latent image entirely. For 15 cycles, with a bit of an overhead, the delay caused by the image reset function should be around 1/30th of a second.

Sub-sampling Mode

In sub-sampling mode, the rows not being used in sub-sampling are not currently being reset along with the rows being used for sub-sampled images. The unused rows are not being reset and thus will need several reset levels to equalize to a fully reset condition. The use of fast rolling resets followed by a wait time is recommended to remove any image artifacts. 60 resets followed by a 200 ms wait is a good starting point. The number of resets and wait are a function of the integration time and scene brightness.

```
////////////////////////////////////////////////////////////////////////
//
// Sample code for Fast Rolling Reset
//
// A rolling reset occurs at the start of every shutter-mode
// acquisition. To perform more than one rolling reset a
// single frame capture is started and then stopped mid-way. This
// is then repeated.
//
////////////////////////////////////////////////////////////////////////


static void ImgSensor_Reset(UINT32 num)
        {
        int count;
        UINT8 status;

        // Fast Rolling Reset of Sensor
        //

        // Set the sensor to shutter-mode acquisition
        // Set MODE bits to 01 in CONFIG register
        WriteSenReg(rSENSOR_CONFIG, 0x01);

        // Set the integration time to be very long, so that data
        // transfer does not start prematurely
        // Set ROWEXPH to 0x04 (1024 rows)
        // Set ROWESPL to 0x00
        WriteSenReg(rSENSOR_ROWEXPH, 0x04);
        WriteSenReg(rSENSOR_ROWEXPL, 0x00);

        // Set the sensor to unconditionally stop an acquisition
        // in-progress when requested
        // Clear SFC in CONFIG register (Stop when Frame Complete)
        // Done above already: WriteSenReg(rSENSOR_CONFIG, 0x01);

        // Repeat for the desired number of reset cycles
        for (count = 0; count < num; count ++)
                {
                // Reset the STATUS register
                // Write 0x7E to STATUS location (this clears SSF flag).
                WriteSenReg(rSENSOR_STATUS, 0x7E);

                // Start acquisition
                // Set RUN bit in the CONTROL register.
                WriteSenReg(rSENSOR_CONTROL,0x04);

                // Wait until the fast rolling reset ends
                // Monitor the STATUS register.  Wait until SSF is set.
                do status = ReadSenReg(rSENSOR_STATUS);
                        while ((status & 0x40) == 0);

                // Stop the acquisition:
                // Clear RUN bit in the CONTROL register.
                WriteSenReg(rSENSOR_CONTROL,0x00);

                }

        // Clean up:
        // Write 0x7E to STATUS location (this clears SSF flag)
        WriteSenReg(rSENSOR_STATUS, 0x7E);
        }
```


January 15, 2001
5988-1953EN