AND9049/D

VITA Family Global Reset

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APPLICATION NOTE

Application Note Abstract

This application note explains the need for the extra reset of the storage node. This applies only to global shutter operating modes.

Problem Statement

Under certain circumstances, global shutter images taken by VITA sensors contain bright pixels. There can be several reasons for this: leakage or changing sequencer modes.

1. Leakage

In a global shutter, after exposure the integrated charge from each pixel is transferred to the pixel storage node. Since this is typically diffusion, it has some leakage. The storage nodes of some pixels are leakier than others, resulting in the bright spots that can be seen in images with larger frame times and the default timing.

The figure below shows the frame overhead time (gray), the row overhead time (red) and the line read time (green) for a frame of 6 lines. Note that it is not to scale. The upper part of the image shows the general case with the master global shutter mode. The storage node of each row is reset during the row overhead time of the previous frame. The time between 2 resets of the floating diffusion is therefore equal to 1/frame rate.

Typically, in triggered mode, there can be a significant time between two frames (low frame rate) and then the storage node will have much time to leak. But it is not limited to triggered mode, one can program the fr_length and mult_timer registers to have large frame times as well.

The frame time can be dominated either by the integration time or by the read out time (figure 2) or by the requested frame rate (figure 1). Typically, the former will be the case for small windows, where the readout time is small; the middle case happens for short integration times or for the CMOS out version since it takes 4x more time to readout a frame compared to the LVDS version.

In some cases (high frame time), it is better to do a global reset of the storage node in the FOT. The relevant time where leakage can occur is different for every line. The last line is the worst. In this case, the maximum time the storage node can leak is the readout time of the frame. The readout time is now relevant, not the frame time. It is pictured in the lower part of Figure 1.

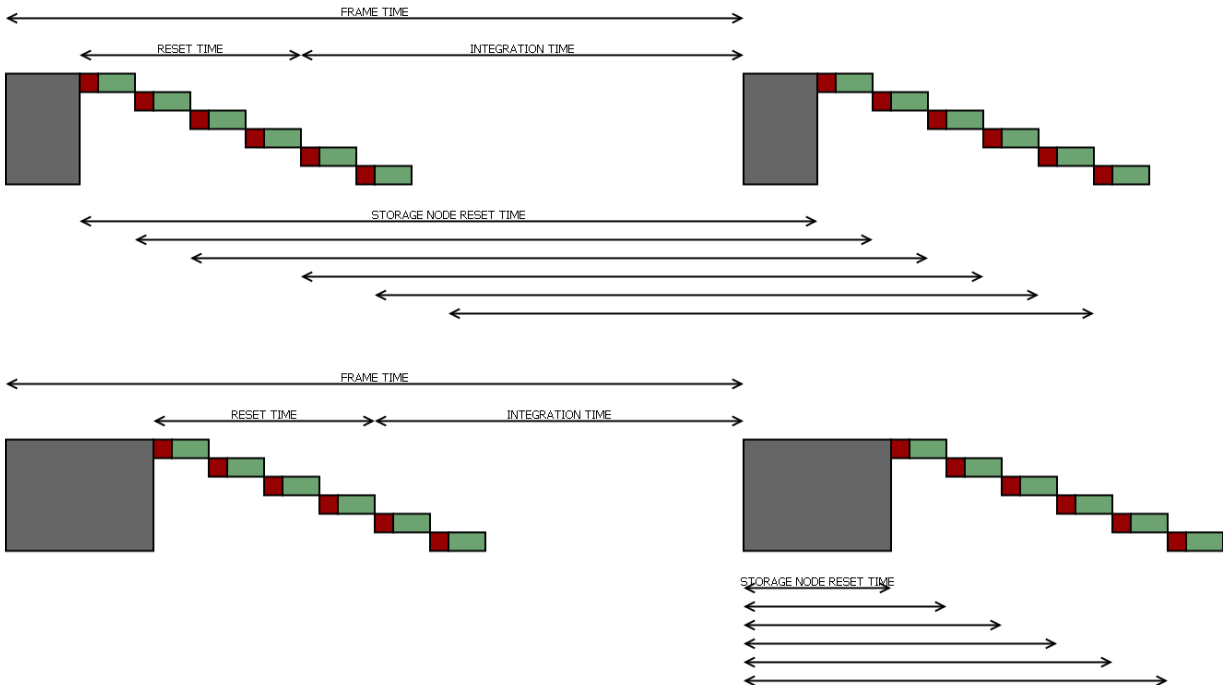

Figure 1. Comparison of Both Timings for an Application that is not Readout Time Limited

The extra global reset does increase the total frame overhead time, therefore reducing the maximum frame rate (shown in Figure 2). For full frame images, this has a very limited impact; for a small window this can be dominant, but when frame rate is important, the frame time shall be small anyway and PSNL is not an issue, so the normal timing will do just fine.

When to use what timing? In the example above, it would be better to use the timing with global reset since the read out time is << frame time. In the example below, however, the read out time is dominant and there is no need for the extra reset and the frame rate is reduced.

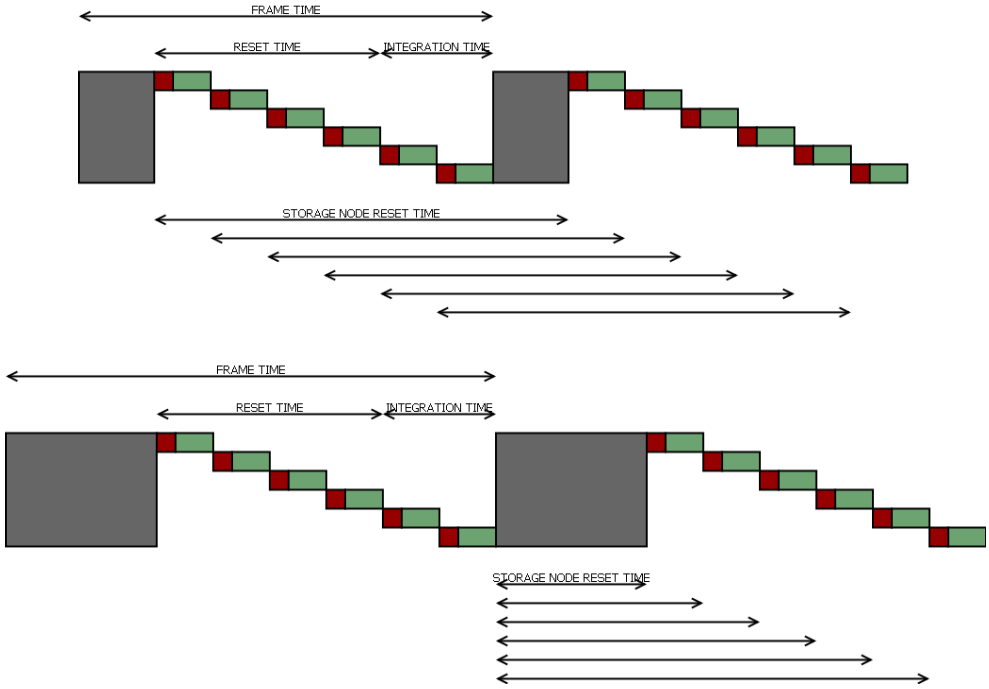

Figure 2. Comparison of Both Timings for an Application that is Readout Time Limited

In conclusion, there is no optimal timing for all applications. One should choose the best timing for the intended application.

2. Sequencer operation mode changes

Newly activated windows containing image lines which haven't been read in the previous frame also suffer from the fact that the corresponding storage nodes haven't been reset, or have been reset a significant time in the past. Therefore, the first frame after such a window change needs to be discarded.

Similarly, the first full readout after a subsampled readout suffers from the same artifacts (odd lines are brighter than the even lines).

These problems are also avoided by globally resetting all storage nodes during frame overhead.

It is recommended to activate the timing mentioned in this application note when it is required to frequently reposition the windows or to switch between subsampled and normal readout modes without losing frames.

IMPLEMENTATION FOR VITA1300

Globally resetting the storage nodes requires a different internal timing that should be uploaded through the SPI. These are of the same kind as the "required register uploads" as specified in the datasheet. The settings given below overrule whatever is mentioned in the datasheet for those registers. Any registers specified in the datasheet that are not mentioned here, remain valid.

Upload #	Address	Data	Description
1	384	0x1010	Reserved
2	385	0x729F	Reserved
3	386	0x729F	Reserved
4	387	0x729F	Reserved
5	388	0x729F	Reserved

Upload #	Address	Data	Description
6	389	0x701F	Reserved
7	390	0x701F	Reserved
8	391	0x549F	Reserved
9	392	0x549F	Reserved
10	393	0x541F	Reserved
11	394	0x541F	Reserved
12	395	0x101F	Reserved
13	396	0x101F	Reserved
14	397	0x1110	Reserved

IMPLEMENTATION FOR VITA2000 AND VITA5000

Globally resetting the storage nodes requires a different internal timing that should be uploaded through the SPI. These are of the same kind as the “required register uploads” as specified in the datasheet. The settings given below overrule whatever is mentioned in the datasheet for those registers. Any registers specified in the datasheet that are not mentioned here, remain valid.

Note that these uploads increase the ROT significantly, reducing the max frame rate. Usually, this shouldn’t be a concern.

Upload #	Address	Data	Description
1	384	0x1010	Reserved
2	385	0x729F	Reserved
3	386	0x729F	Reserved
4	387	0x729F	Reserved
5	388	0x729F	Reserved
6	389	0x701F	Reserved
7	390	0x701F	Reserved
8	391	0x549F	Reserved
9	392	0x549F	Reserved
10	393	0x541F	Reserved
11	394	0x541F	Reserved
12	395	0x101F	Reserved
13	396	0x101F	Reserved
14	397	0x1110	Reserved
15	219	0x412E	Reserved
16	430	0x0100	Reserved
17	431	0x03F1	Reserved
18	432	0x03C5	Reserved
19	433	0x0341	Reserved
20	434	0x0141	Reserved
21	435	0x214F	Reserved
22	436	0x2145	Reserved
23	437	0x0141	Reserved
24	438	0x0101	Reserved
25	439	0x0B8C	Reserved
26	440	0x0B8C	Reserved

Upload #	Address	Data	Description
27	441	0x0B8C	Reserved
28	442	0x0B8C	Reserved
29	443	0x0381	Reserved
30	444	0x0181	Reserved
31	445	0x218F	Reserved
32	446	0x2185	Reserved
33	447	0x0181	Reserved
34	448	0x0100	Reserved
35	449	0x0100	Reserved
36	450	0x0BF1	Reserved
37	451	0x0BC3	Reserved
38	452	0x0BC2	Reserved
39	453	0x0341	Reserved
40	454	0x0141	Reserved
41	455	0x214F	Reserved
42	456	0x2145	Reserved
43	457	0x0141	Reserved
44	458	0x0101	Reserved
45	459	0x0B8C	Reserved
46	460	0x0B8C	Reserved
47	461	0x0B8C	Reserved
48	462	0x0B8C	Reserved
49	463	0x0381	Reserved
50	464	0x0181	Reserved
51	465	0x218F	Reserved
52	466	0x2185	Reserved
53	467	0x0181	Reserved
54	468	0x0100	Reserved
55	194[10]	0x0	Reserved
56	72[14:12]	0x3	Optimize CP setting
57	70[8:6]	0x3	Only required on VITA5000

IMPLEMENTATION FOR VITA25K

The same as for the other vita sensors applies here. However, since this pixel array is much bigger, the sensor may have increased row fpn compared to normal operation mode. This can be fixed by the changes in table below. Note that these uploads increase the ROT significantly, reducing the max frame rate. Usually, this shouldn't be a concern because there is no need to have global reset when running the sensor at max frame rate. If it is a concern, zero ROT should be used.

Upload #	Address	Data	Description
1	384	0x1010	Reserved
2	385	0x729F	Reserved
3	386	0x729F	Reserved
4	387	0x729F	Reserved

Upload #	Address	Data	Description
5	388	0x729F	Reserved
6	389	0x701F	Reserved
7	390	0x701F	Reserved
8	391	0x549F	Reserved
9	392	0x549F	Reserved
10	393	0x541F	Reserved
11	394	0x541F	Reserved
12	395	0x101F	Reserved
13	396	0x101F	Reserved
14	397	0x1110	Reserved
15	219	0x412E	Reserved
16	430	0x0100	Reserved
17	431	0x03F1	Reserved
18	432	0x03C5	Reserved
19	433	0x0341	Reserved
20	434	0x0141	Reserved
21	435	0x214F	Reserved
22	436	0x2145	Reserved
23	437	0x0141	Reserved
24	438	0x0101	Reserved
25	439	0x0B8C	Reserved
26	440	0x0B8C	Reserved
27	441	0x0B8C	Reserved
28	442	0x0B8C	Reserved
29	443	0x0381	Reserved
30	444	0x0181	Reserved
31	445	0x218F	Reserved
32	446	0x2185	Reserved
33	447	0x0181	Reserved
34	448	0x0100	Reserved
35	449	0x0100	Reserved
36	450	0x0BF1	Reserved
37	451	0x0BC3	Reserved
38	452	0x0BC2	Reserved
39	453	0x0341	Reserved
40	454	0x0141	Reserved
41	455	0x214F	Reserved
42	456	0x2145	Reserved
43	457	0x0141	Reserved
44	458	0x0101	Reserved
45	459	0x0B8C	Reserved
46	460	0x0B8C	Reserved
47	461	0x0B8C	Reserved
48	462	0x0B8C	Reserved
49	463	0x0381	Reserved
50	464	0x0181	Reserved

Upload #	Address	Data	Description
51	465	0x218F	Reserved
52	466	0x2185	Reserved
53	467	0x0181	Reserved
54	468	0x0100	Reserved
55	197[7:0]	0x0015	At least 21 black lines.
Supply change #	**Name**	**Value [V]**	
1	vdd_resfd	4.2	

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