JN1
Long Shutter Guide

April. 6. 2020

System LSI Business
Samsung Electronics Co., Ltd.

	Name	Team	Position
Prepared by	TaeBum Kim	Sensor DEV. team(Solution)	Engineer
Approved by	-	Sensor DEV. team(Solution)	Director

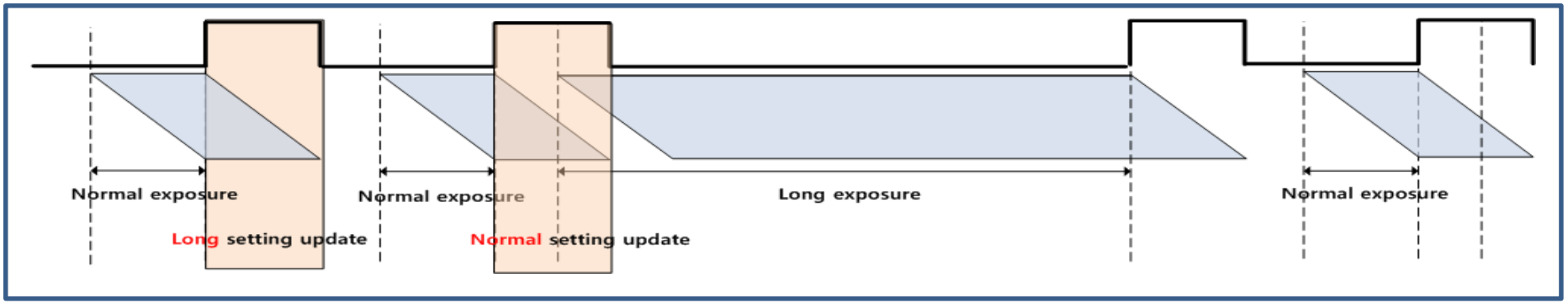
Revision No	Date	Description	Author(s)
0.0	‘21.04.06	Initial Version	TaeBum Kim

Long shutter mode

Long Shutter Mode Change / Capture Sequence

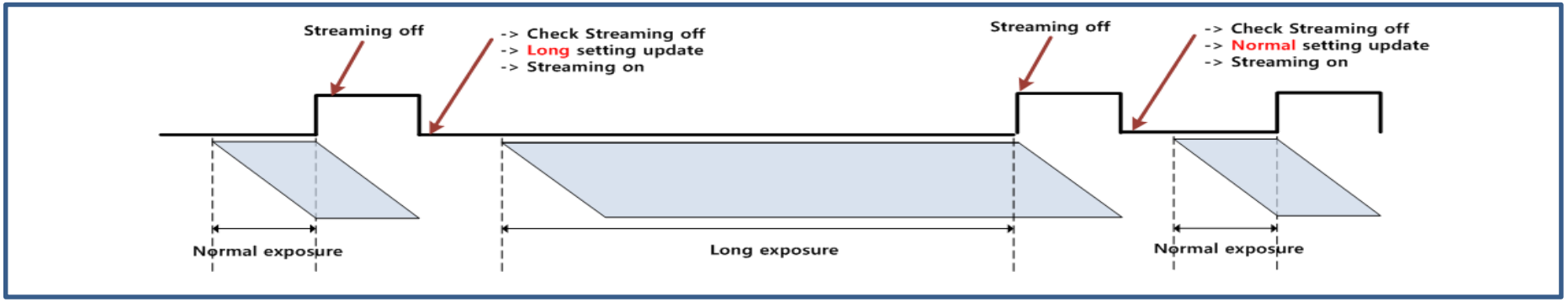
- There are two kinds of method for applying the Long Shutter Mode.

1. Without Stream on/off Sequence



2. With Stream on/off Sequence

After writing streaming-off command, check the sensor is entered to streaming-off state.
To ensure streaming-off state, check the frame counter (0x40000005) is FFh.



Long shutter mode - With Stream On/Off sequence

Normal to Long Shutter (full size 32s)

```
s60284000
s01000000   //Stream Off

s0340FBD4  //frame length  lines
s0202FBC8 // Shutter

s07020500  // Frame Length Line Shifter / Line Length PCK Shifter
s07040500  // Coarse_integration_time_shifter

s01000100  // Stream On
```

Return to Normal (full size 10fps)

```
s60284000
s01000000  // Stream Off

s0340**** //frame_length_lines
s0202**** //coarse integration time

s07020000  // Frame Length Line Shifter / Line Length PCK Shifter
s07040000  // Coarse_integration_time_shifter


s01000100  // Stream On
```

**** : insert appropriate AE values

Reg. Setting Values for each EIT

Unfixed shifter value

sec	0x0202	0x0340	0x0702	0x0704
1	FBC8	FBD4	0000	0000
2	FBC8	FBD4	0100	0100
4	FBC8	FBD4	0200	0200
8	FBC8	FBD4	0300	0300
16	FBC8	FBD4	0400	0400
32	FBC8	FBD4	0500	0500

Formula for long shutter setting

- Shutter = ($\frac{HEX2DEC(4000\_0342)\times HEX2DEC(4000\_0202)\times(2^{4000\_0704})}{560*10\text{^}6}$)
- 0x4000_0340 ≥ 0x4000_0202 + 12d

All these values are available when 0x40000342 is 0x21F0.
If there should be other 0x4000_0342 value, please request other setting values to FAE

APPENDIX – Shutter time example (Full mode)

Assuming VT_PIX is 560 Mhz, 4000_0342 : h'21F0

Unfixed Shifter Values

Long shutter (s)	0x4000_0202	0x4000_0340	0x4000_0702	0x4000_0704	Long shutter (s)	0x4000_0202	0x4000_0340	0x4000_0702	0x4000_0704
1	FBC8	FBD4	0000	0000	17	85C2	85CE	0500	0500
2	FBC8	FBD4	0100	0100	18	8DA0	8DAC		
3	BCD6	BCE2	0200	0200	19	957F	958B		
4	FBC8	FBD4			20	9D5D	9D69		
5	9D5D	9D69	0300	0300	21	A53B	A547		
6	BCD6	BCE2			22	AD19	AD25		
7	DC4F	DC5B			23	B4F8	B504		
8	FBC8	FBD4			24	BCD6	BCE2		
9	8DA0	8DAC	0400	0400	25	C4B4	C4C0		
10	9D5D	9D69			26	CC93	CC9F		
11	AD19	AD25			27	D471	D47D		
12	BCD6	BCE2			28	DC4F	DC5B		
13	CC93	CC9F			29	E42D	E439		
14	DC4F	DC5B			30	EC0C	EC18		
15	EC0C	EC18			31	F3EA	F3F6		
16	FBC8	FBD4			32	FBC8	FBD4		

Table. 1 Shutter time example (Full mode)

APPENDIX – Shutter time example (Full mode)

Assuming VT_PIX is 560 Mhz, 4000_0342 : 21F0

Fixed Shifter Values

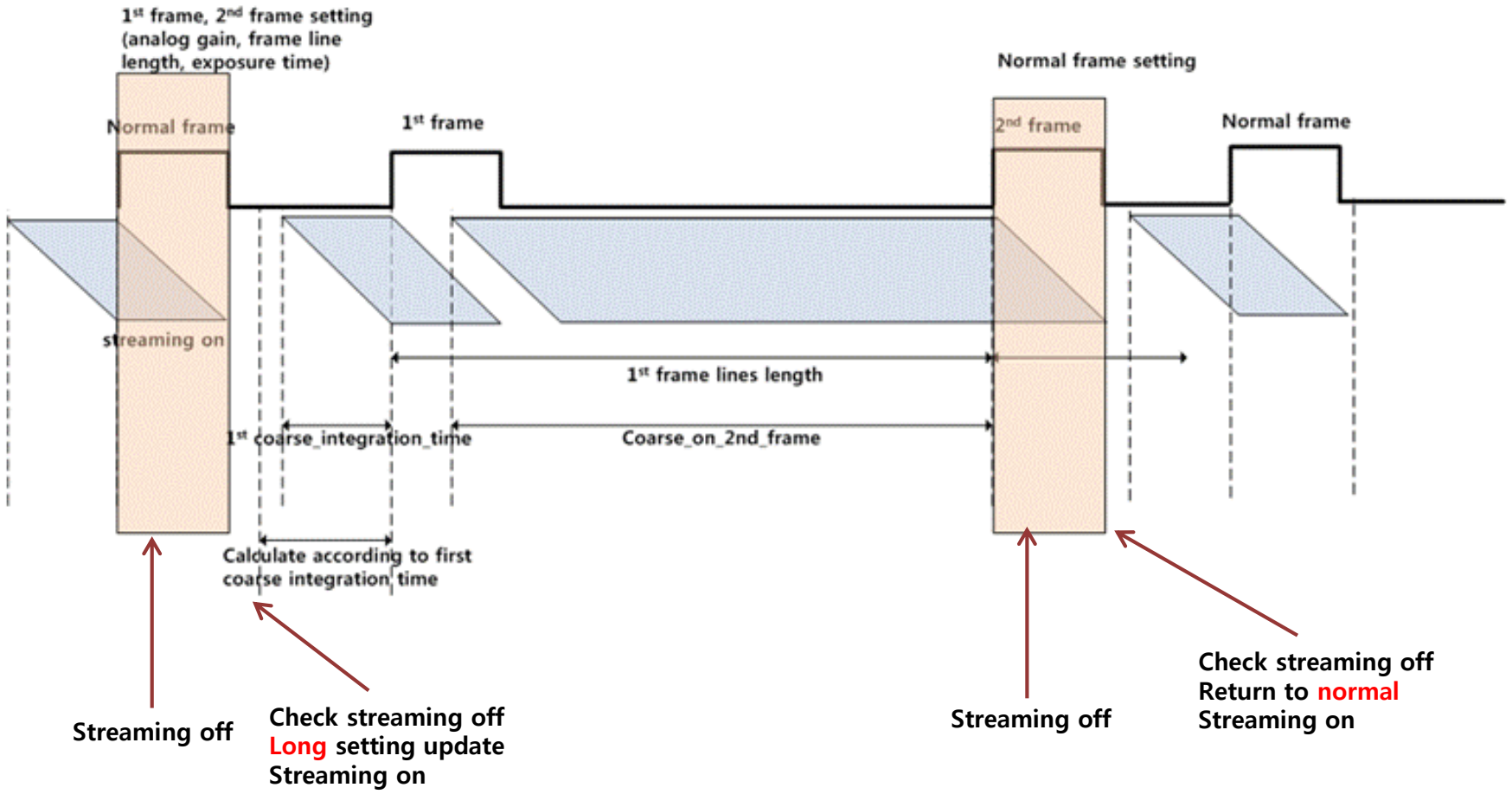
Long shutter (s)	0x4000_0202	0x4000_0340	0x4000_0702	0x4000_0704	Long shutter (s)	0x4000_0202	0x4000_0340	0x4000_0702	0x4000_0704
1	03EF	03FB	0600	0600	17	42E1	42ED	0600	0600
2	07DE	07EA			18	46D0	46DC		
3	0BCD	0BD9			19	4ABF	4ACB		
4	0FBC	0FC8			20	4EAE	4EBA		
5	13AB	13B7			21	529D	52A9		
6	179A	17A6			22	568C	5698		
7	1B89	1B95			23	5A7C	5A88		
8	1F79	1F85			24	5E6B	5E77		
9	2368	2374			25	625A	6266		
10	2757	2763			26	6649	6655		
11	2B46	2B52			27	6A38	6A44		
12	2F35	2F41			28	6E27	6E33		
13	3324	3330			29	7216	7222		
14	3713	371F			30	7606	7612		
15	3B03	3B0F			31	79F5	7A01		
16	3EF2	3EFE			32	7DE4	7DF0		

Table. 2 Shutter time example (Full mode)

Long shutter mode - Frame bracketing (for MTK)

Long Shutter Mode Change / Capture Sequence

- Long shutter is applied at only 2nd frame after streaming on.
- Use only for capture mode.



Long shutter mode – Frame bracketing (for MTK)

Normal to Long Shutter (full size 32s)

```
s60284000
s01000000    //streaming off

s03340001 //Dynamic frame rate enable
s0E000201
s0E040003

s0E100005    //**** Shutter of 1st frame
s0E120020    //**** Analog gain of 1st Frame  //x1
s0E14FBC8    //**** Shutter of 2nd frame
s0E160020    //**** Analog gain of 2nd Frame  //x1

s07040500    //**** shifter for shutter

s01000100   //streaming on
```

**** : insert appropriate AE values

Return to Normal

```
s60284000
s01000000    //streaming off

s03340000
s0E000000
s0E040000

s0E100000    //**** Shutter of 1st frame
s0E120000    //**** Analog gain of 1st Frame  //x1
s0E140000   //**** Shutter of 2nd frame
s0E160000    //**** Analog gain of 2nd Frame  //x1

s07040000    //**** shifter for shutter

s01000100   //streaming on
```

All these values are available when 0x40000342 is 0x21F0.
If there should be other 0x4000_0342 value, please request other setting values to FAE

Long shutter mode – Frame bracketing (for MTK)

Normal to Long Shutter (full size 32s)

```
s60284000
s01000000    //streaming off

s03340001 //Dynamic frame rate enable
s0E000201
s0E040003

s0E100005    //**** Shutter of 1st frame
s0E120020    //**** Analog gain of 1st Frame  //x1
s0E14FBC8    //**** Shutter of 2nd frame
s0E160020    //**** Analog gain of 2nd Frame  //x1

s07040500    //**** shifter for shutter

s01000100    //streaming on
```

**** : insert appropriate AE values

Reg. Setting Values for each EIT

Unfixed shifter value

sec	0x0E14	0x0704
1	FBC8	0000
2	FBC8	0100
4	FBC8	0200
8	FBC8	0300
16	FBC8	0400
32	FBC8	0500

Formula for long shutter setting

- Shutter = ($\frac{HEX2DEC(4000\_0342)\times HEX2DEC(4000\_0E14)\times(2^{4000\_0704})}{560*10\text{^}6}$)
- User don't have to care about **0x4000_0340**

All these values are available when 0x40000342 is 0x21F0.
If there should be other 0x4000_0342 value, please request other setting values to FAE

APPENDIX – Shutter time example (Full mode, Frame bracketing)

Assuming VT_PIX is 560 Mhz, 4000_0342 : h'21F0

Unfixed Shifter Values

Long shutter (s)	0x4000_0E14	0x4000_0704	Long shutter (s)	0x4000_0E14	0x4000_0704
1	FBC8	0000	17	85C2	0500
2	FBC8	0100	18	8DA0	
3	BCD6	0200	19	957F	
4	FBC8		20	9D5D	
5	9D5D	0300	21	A53B	
6	BCD6		22	AD19	
7	DC4F		23	B4F8	
8	FBC8		24	BCD6	
9	8DA0	0400	25	C4B4	
10	9D5D		26	CC93	
11	AD19		27	D471	
12	BCD6		28	DC4F	
13	CC93		29	E42D	
14	DC4F		30	EC0C	
15	EC0C		31	F3EA	
16	FBC8		32	FBC8	

Table. 1 Shutter time example (Full mode, Frame bracketing)

APPENDIX – Shutter time example (Full mode, Frame bracketing)

Assuming VT_PIX is 560 Mhz, 4000_0342 : h'21F0

Fixed Shifter Values

Long shutter (s)	0x4000_0E14	0x4000_0704	Long shutter (s)	0x4000_0E14	0x4000_0704
1	03EF	0600	17	42E1	0600
2	07DE		18	46D0	
3	0BCD		19	4ABF	
4	0FBC		20	4EAE	
5	13AB		21	529D	
6	179A		22	568C	
7	1B89		23	5A7C	
8	1F79		24	5E6B	
9	2368		25	625A	
10	2757		26	6649	
11	2B46		27	6A38	
12	2F35		28	6E27	
13	3324		29	7216	
14	3713		30	7606	
15	3B03		31	79F5	
16	3EF2		32	7DE4	

Table. 2 Shutter time example (Full mode, Frame bracketing)