TOSHIBA

Leading Innovation

BU505MG/MCG/MCF
BU302MG/MCG/MCF

Users Guide

Rev.1.2

May 27th 2016

Doc. No. 4300-0296

On the subject of this document

- **This document is to introduce the development source and technical source tackled by TOSHIBA TELI CORPORATION.**
- **This article information described in this document contains an under development source and subject to change without notice.**
- **Please read operation manual carefully before you use the product at the first time, and use it properly. Product specifications, operation manual and other related documents are available in our HP to download. Please keep these materials in your hand so that you can read them at any time.**

  http://www.toshiba-teli.co.jp/en/products/industrial/

- **Please refer our HP or contact our sales person for your enquiry and the latest information.**

* Names and Logo might be trade mark or registered trade mark.

Table of contents

USB3 Vision Camera
Product range

USB3 Vision Camera Product range

Model name				Sensor	Optical Size	Output Resolution	Frame Rate
Mono chrome		Color					
BU030	Available	BU030C/CF	Available	ICX424A	1/3 inch	640(H) x 480(V)	125fps
BU031	Available			ICX414A	1/2 inch	640(H) x 480(V)	125fps
BU080	Available			ICX204A	1/3 inch	1,024(H) x 768(V)	40fps
BU130	Available	BU130C/CF	Available	ICX445A	1/3 inch	1,280(H) x 960(V)	30fps
BU132M	New			EV76C560	1/1.8 inch	1,280(H) x 1,024(V)	60fps
BU205M	Available	BU205MC/MCF	Under study	CMV2000	2/3 inch	2,048(H) x 1,088(V)	170fps
BU238M	Available	BU238MC/MCF	Available	IMX174	1/1.2 inch	1,920(H) x 1,200(V)	165fps
BU302MG	**New**	**BU302MCG/MCF**	**New**	**IMX252**	**1/1.8 inch**	**2,048(H) x 1,536(V)**	**120fps**
BU406M	Available	BU406MC/MCF	Available	CMV4000	1 inch	2,048(H) x 2,048(V)	90fps
BU505MG	**New**	**BU505MCG/MCF**	**New**	**IMX250**	**2/3 inch**	**2,448(H) x 2,048(V)**	**75fps**
DU657M	Available	DU657MC	Available	Own CMOS	1.1 inch	2,560(H) x 2,560(V)	55fps
DU806M	In plan	DU806MC/MCF	In plan	IMX255	1.0 inch	4,096(H) x 2,160(V)	40fps
DU1207M	In plan	DU1207MC/MCF	In plan	IMX253	1.1 inch	4,000(H) x 3,000(V)	30fps
BU602M	In plan	BU602MC/MCF	In plan	IMX178	1/1.8 inch	3,072(H) x 2,048(V)	TBD
		BU1203MC/MCF	Available	IMX226	1/1.7 inch	4,000(H) x 3,000(V)	30fps

Note :
- This documents does not confirm product release schedule as information in development plan are included.
- Contact our persons in charge of sales for your enquiry.
- BU602, BU1203 : mounted Rolling shutter type CMOS sensor

xxx(M)C : without IR cut filter
xxx(M)CF : with IR cut filter
xxx(M)G/(M)CG : with Dust-proof glass

May 2016

Ordering information for B/D series camera

Image Sensor Type

None : CCD Sensor
M : CMOS Sensor

Interface

U : USB3.0
G : Gigabit Ethernet
C : Camera Link

Optical Filter Type

None : without Optical filter or glass
F : with IR cut filter
G : with dust-proof glass
L : with Optical low-pass filter
M : with Opt-LPF + IR cut filter

Model Signature

B : B (Standard) series
D : D (Deluxe) series

Lens Mount

None : C mount
BG205MC(F) only
-CS : CS mount

Color Type

None : Black/White(B/W)
C : Color

Total Pixel Numbers

03 : 0.3 mega pixels
08 : 0.8 mega pixels
13 : 1.3 mega pixels
20 : 2.0 mega pixels
23 : 2.3 mega pixels
30 : 3.0 mega pixels
40 : 4.0 mega pixels
50 : 5.0 mega pixels
60 : 6.0 mega pixels
65 : 6.5 mega pixels
80 : 8.8 mega pixels
120 : 12.0 mega pixels

Image Size

0.3 Mega Pixels Type
0 : 1/3 type
1 : 1/2 type
0.8 Mega Pixels Type
0 : 1/3 type
1.3 Mega Pixels Type
0 : 1/3 type
2 : 1/1.8 type
2.0 Mega Pixels Type
2 : 1/1.8 type
5 : 2/3 type
2.3 Mega Pixels Type
8 : 1/1.2 type
8L : 1/1.2 type, Low-fps
3.0 Mega Pixels Type
2 : 1/1.8 type
2L : 1/1.8 type, Low-fps
4.0 Mega Pixels Type
6 : 1.0 type
5.0 Mega Pixels Type
5 : 2/3 type
5L : 2/3 type, Low-fps
6.0 Mega Pixels Type
2 : 1/1.8 type
6.5 Mega Pixels Type
7 : 1.1 type
8.8 Mega Pixels Type
6 : 1.0 type
12.0 Mega Pixels Type
3 : 1/1.7 type
7 : 1.1 type

Rev.1.06

Advantage of BU505/302

Advantage of BU505/BU302

Pregius

TELI original IP core

- High integration, by originally developed innovative technology, achieves super high speed response

High resolution, High sensitivity and High quality image

- Adopting Sony's IMX252(3M pixels)/IMX250(5M pixels) GS (Global Shutter) CMOS sensor
- High speed, high sensitivity and high image quality, surpassing CCD
- High color image quality with ACPI processing (only color model)

Advanced function

- Function with Sequential shutter, bulk trigger (frame burst), scalable, event notification and image buffer, etc.

Software

- Free supply of Software development kit "TeliCamSDK"

Quality warranty

- Full of 3 years warranty

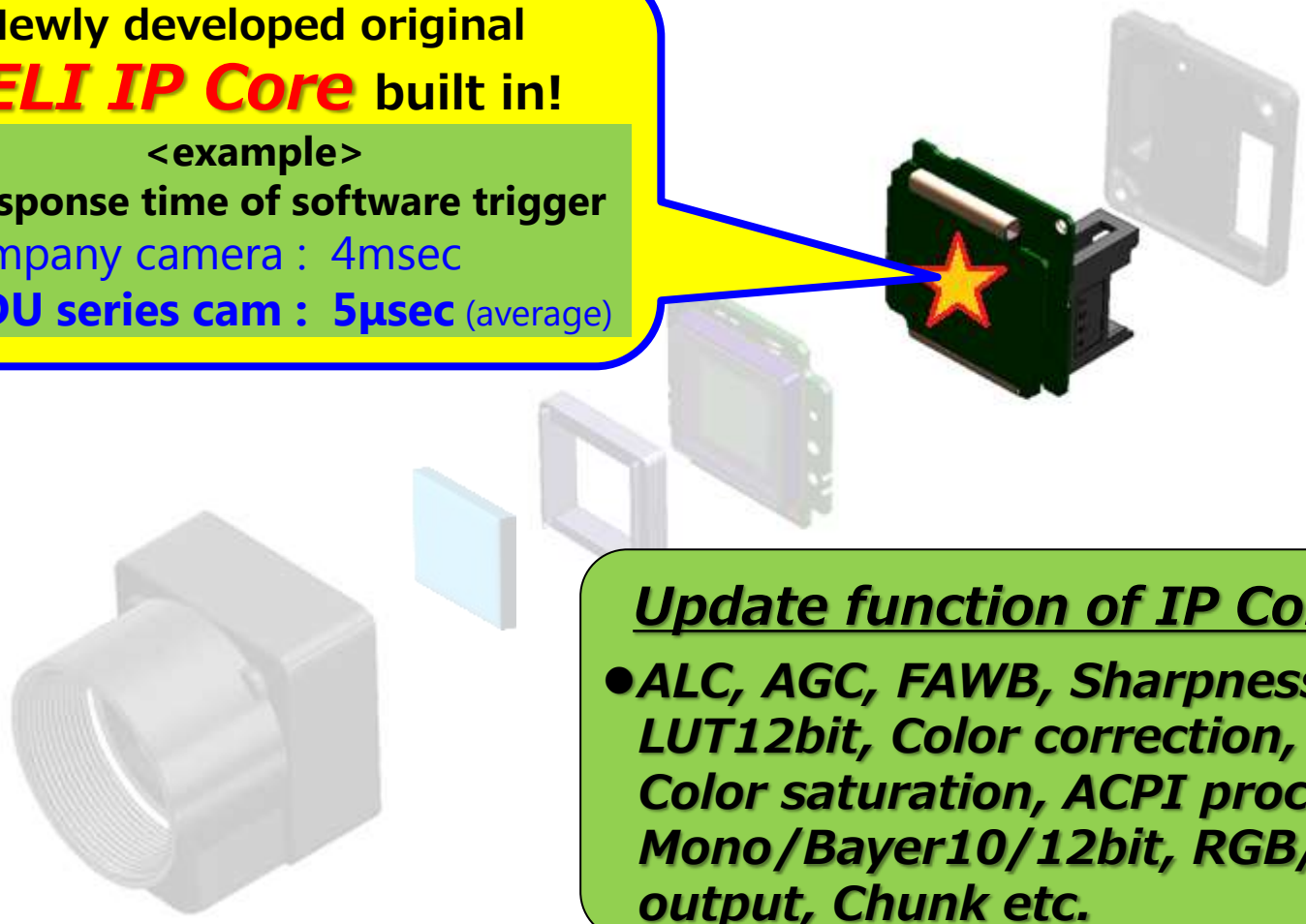
* Pregius or Pregius logo might be trade mark of Sony Corporation.

Advantage of BU505/BU302

■ Extremely quick response by original IP core

Newly developed original
TELI IP Core **built in!**

<example>
response time of software trigger
A company camera : 4msec
BU/DU series cam : 5µsec (average)

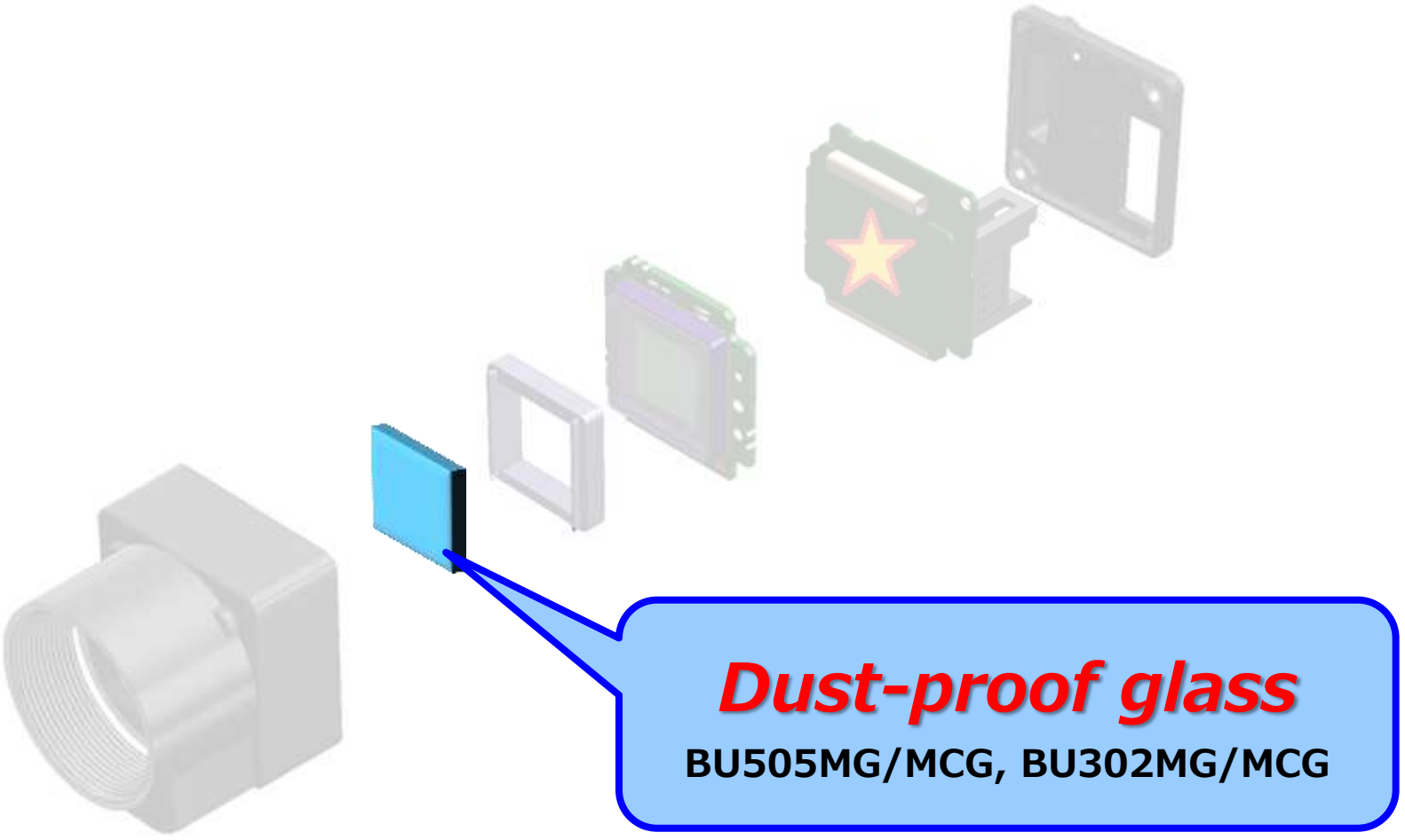


Update function of IP Core Ver4

- ***ALC, AGC, FAWB, Sharpness, LUT12bit, Color correction, HUE, Color saturation, ACPI processing, Mono/Bayer10/12bit, RGB/YUV output, Chunk etc.***

Advantage of BU505/BU302

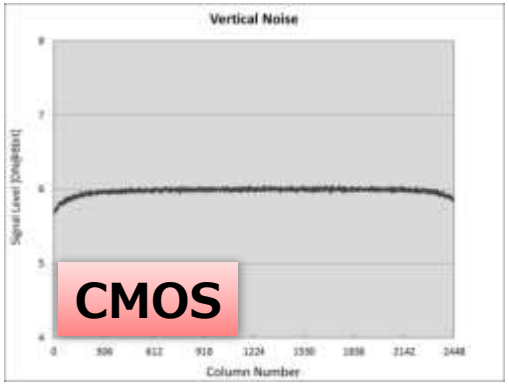
■Include Dust-proof glass as standard equipment

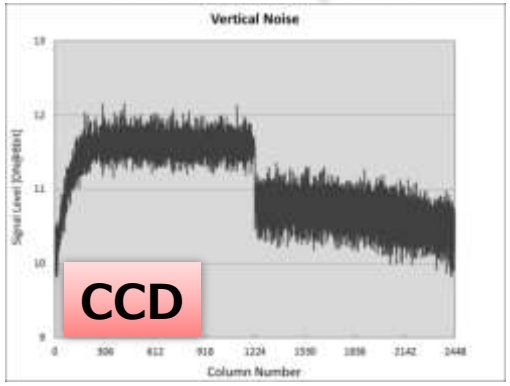


Advantage of BU505/BU302

■ Extreme low noise

CMOS : BU505M
CCD : CSCQS15BC23

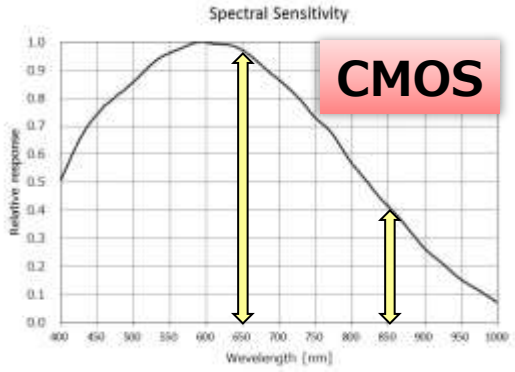


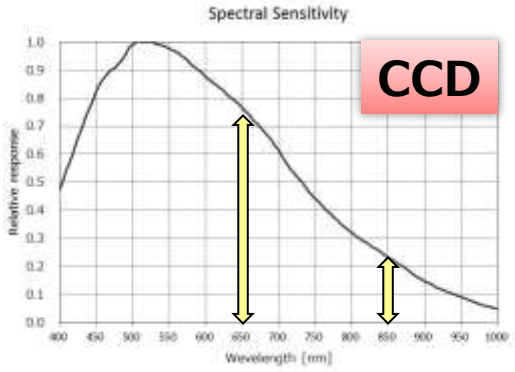


No bump between tap seen in case of 5M CCD, no fixed pattern noise of CMOS sensor. Low readout noise.

■ High IR sensitivity

CMOS : BU505M
CCD : CSCQS15BC23





Higher sensitivity in long wave comparing with 5M CCD. Advanced sensitivity with red LED and near IR applications.

■ Main applications

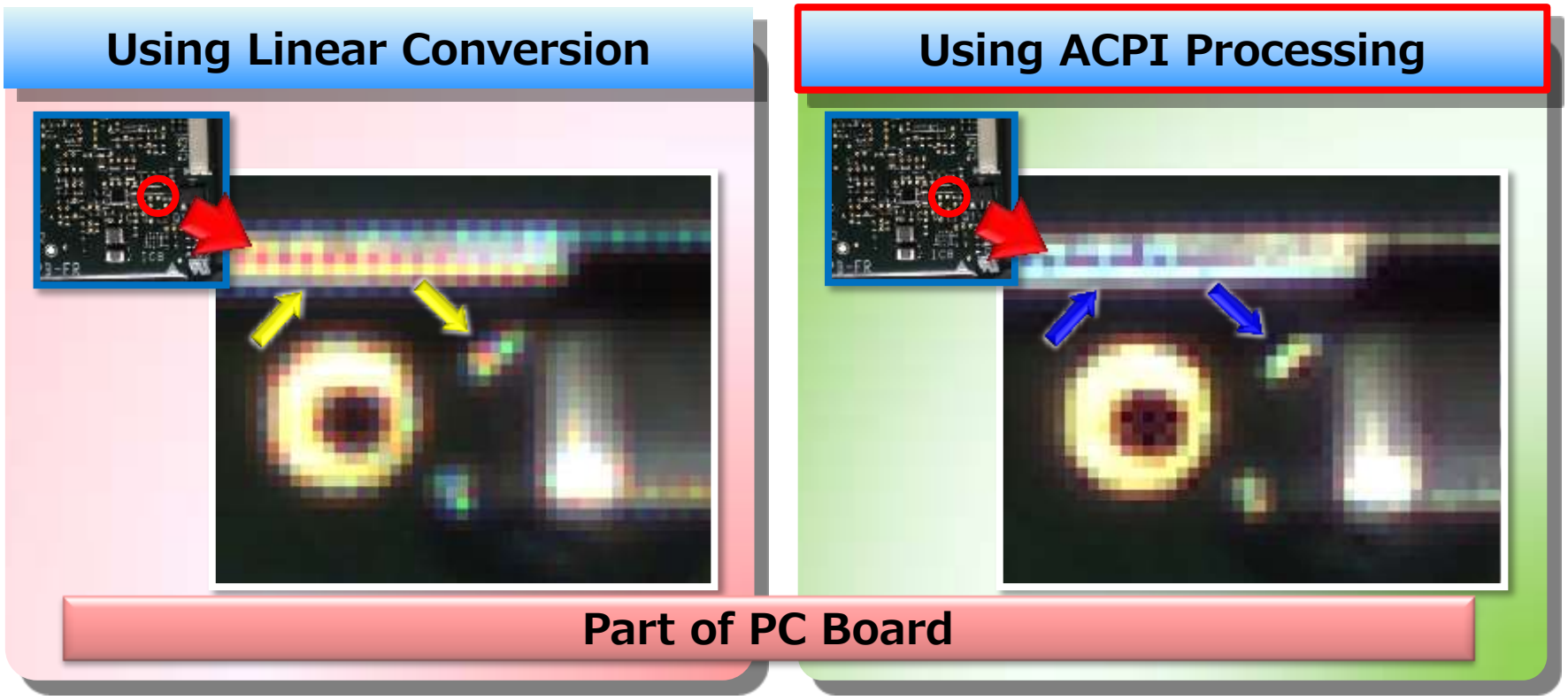
- Replacement 5M-CCD model with BU505M

BU302: Equivalent capability!

Advantage of BU505/BU302

■ High color performance with ACPI processing (1)

- False color in the brightness edge part reduces by ACPI processing !



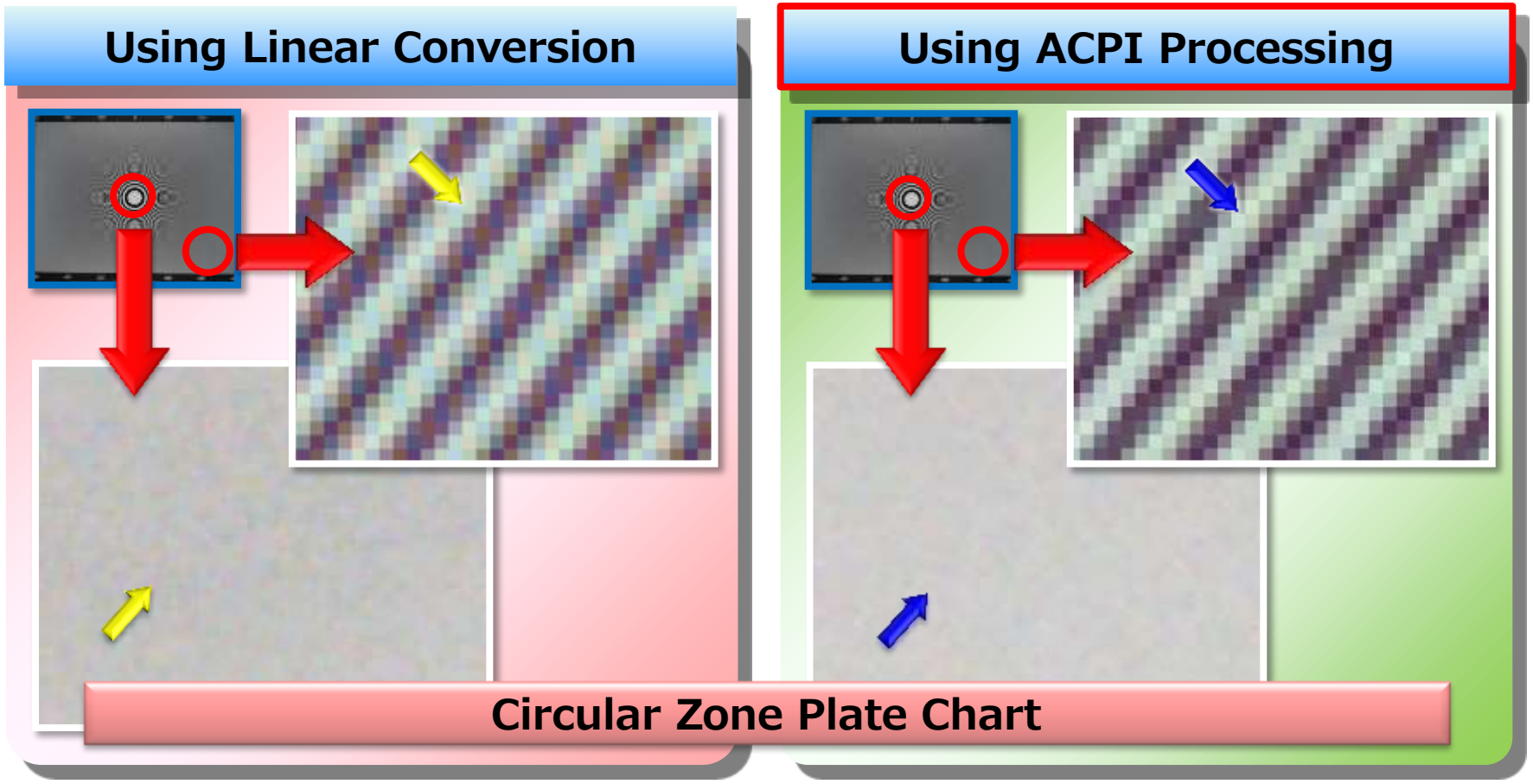
ACPI (Adaptive Color Plane Interpolation)

When RGB conversion (interpolation procedure) from Bayer pattern is in process, false color such as color shift and blur are likely to occur in edge part with general linear interpolation method. However, APCI processing can reduce occurrence of these false color and improve a resolution. And also, it reduce noise at the same time.

Advantage of BU505/BU302

■ High color performance with ACPI processing (2)

- Pseudo-color decreases and resolution improves !
- Color noise is reduced in the flat image by filter !

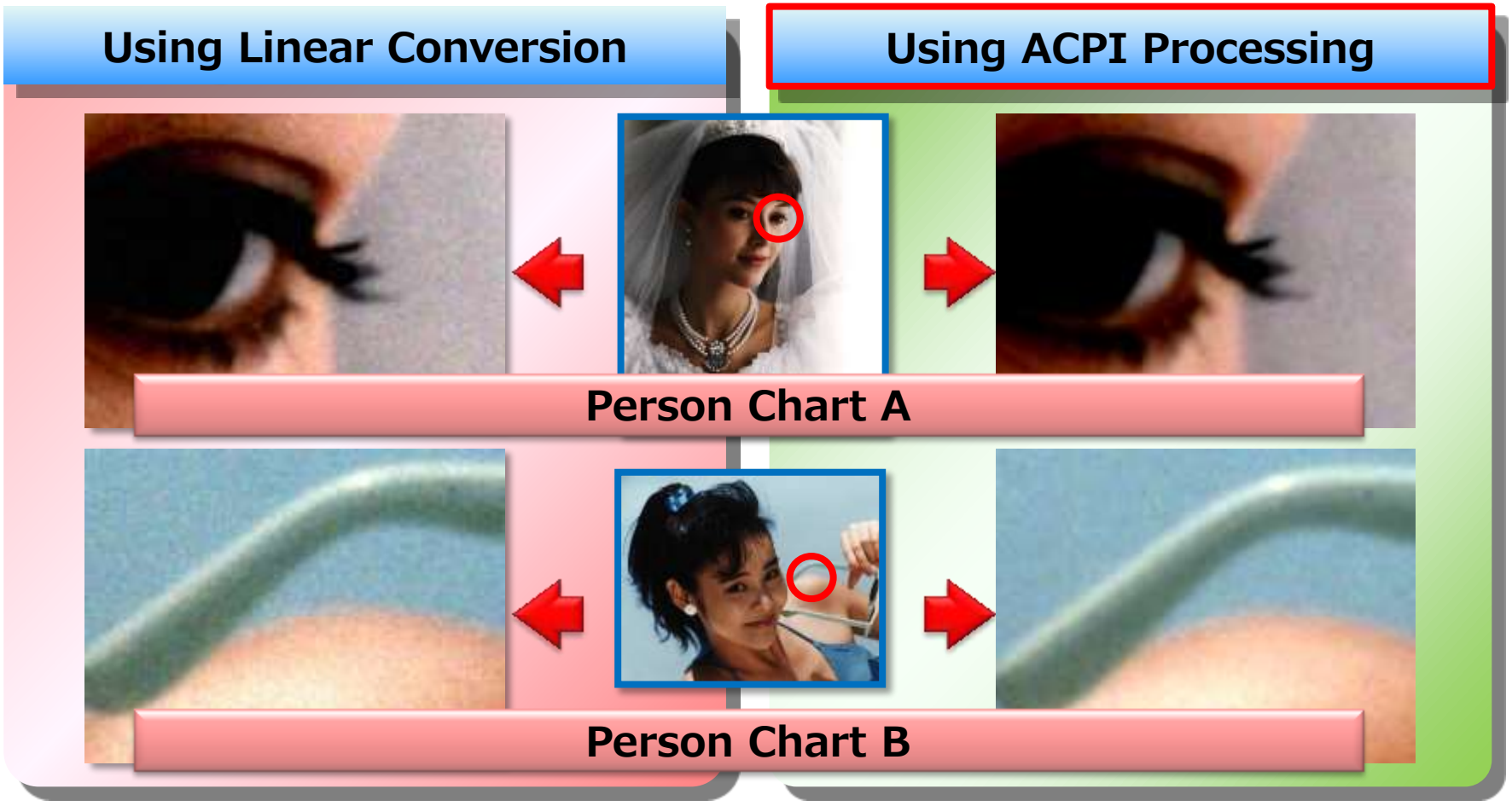


* Editing an image for explanation.

Advantage of BU505/BU302

■ High color performance with ACPI processing (3)

- Color noise is reduced in the flat image by filter !



* Editing an image for explanation.

Specification comparison

Specification Comparison (major CMOS mono chrome models)

Model		BU406M	BU205M	BU238M	BU302MG	BU505MG
interface		USB3.0 (Super Speed)			**USB3.0 (Super Speed)**	
Protocol		USB3 Vision Ver1.0			**USB3 Vision Ver1.0**	
Imaging element		1/1 inch CMOS CMV4000	2/3 inch CMOS CMV2000	1/1.2 inch CMOS IMX174LLJ-C	**1/1.8 inch CMOS IMX252LLR-C**	**2/3 inch CMOS IMX250LLR-C**
Max. output pixels		4M	2M	2.3M	**3M**	**5M**
Resolution		2048(H)x2048(V)	2048(H)x1088(V)	1920(H)x1200(V)	**2048(H)x1536(V)**	**2448(H)x2048(V)**
Max. frame rate (all pixels)		90fps	170fps	165fps	**120fps**	**75fps**
Pixel size		5.5x5.5µm	5.5x5.5µm	5.86x5.86µm	**3.45x3.45µm**	**3.45x3.45µm**
Protect glass/Optical filter		X		X	**[G] : with Dust-proof glass**	
Standard Sensitivity		3500lx, F11 (1/90s)	3800lx, F8 (1/200s)	3300lx, F8 (1/200s)	**3250lx, F5.6 (1/120s)**	**2100lx, F5.6 (1/75s)**
Minimum sensitivity		4lx	8lx	7lx	**7lx**	**5lx**
Gain	Manual	0~8[times] (Digital gain)		0~+18[dB] (Analog gain)	**0~+24[dB] (Analog gain)**	
	Auto	-		-	**O (update by July/2016)**	
Black level correction		-25~+25[%]		-25~+25[%]	**-25~+25[%]**	
Gamma correction		0.45~1.0		0.45~1.0	**0.45~1.0**	
LUT		Input: 10[bit] Output: 10[bit]		Input: 10[bit] Output: 10[bit]	**Input: 12[bit] Output: 12[bit]**	
Sharpness		-		-	**O (update by July/2016)**	
Pixel defect correction		Max. 256 pixels			**Max. 256 pixels**	
Test pattern out		O			**O**	
Image memory (number of images)		O (over 16 images)	O (over 30 images)	O (over 29 images)	**O (over 21 images)**	**O (over 13 images)**
Image re-sending		X (Bulk transfer Retry only)			**X (Bulk transfer Retry only)**	

Specification Comparison (major CMOS mono chrome models)

Model			BU406M	BU205M	BU238M	BU302MG	BU505MG
Exposure control	Manual		30µs~16s	30µs~16s	30µs~16s	**30µs~16s**	
	Auto		-		-	**O (update by July/2016)**	
Trigger shutter	Hardware		Edge, pulse width control (30µs~16s), +/- polarity			**Edge, pulse width control (30µs~16s), +/- polarity**	
	Software		USB3 Vision command			**USB3 Vision command**	
Bulk trigger			Max. 255 times			**Max. 255 times**	
Sequential shutter			Max. 16 entry			**Max. 16 entry**	
Trigger delay			0~2,000,000us			**0~2,000,000us**	
Synchronizing method			Bus sync / Internal sync			**Bus sync / Internal sync**	
Pixel format			Mono8		Mono8	**Mono8/10/12**	
Readout mode	All pixels		2048(H)x2048(V)	2048(H)x1088(V)	1920(H)x1200(V)	**2048(H)x1536(V)**	**2448(H)x2048(V)**
	Partial	Min. unit size	64(H)x64(V)		64(H)x64(V)	**64(H)x64(V)**	
		Offset setting unit	4(H)x2(V)		8(H)x2(V)	**8(H)x2(V)**	
		Number of windows	1		1	**1**	
		Window overlap	-		-	**-**	
	Binning reading (Digital image reduction)		X (by application)		X (by application)	**2x2 (H: Digital, V: Sensor)**	
	Decimation		1/2,1/4,1/8 line		X	**2x2**	
Image flip			Horizontal, Vertical			**Horizontal, Vertical**	
User memory	Set memory		15 Channel			**15 Channel**	
	Optional memory		64 bytes			**64 bytes**	

Specification Comparison (major CMOS mono chrome models)

Model		BU406M	BU205M	BU238M	BU302MG	BU505MG
GPIO	Connector	e-CON connector			**e-CON connector**	
	Input	1 system : TRIG(5V)			**2 system : TRIG(5V) (* 1 system: dual purpose I/O)**	
	Output	2 system : (5V) Arbitrary wave form/ EXPOSURE_ACTIVE/ FRAME_ACTIVE/ FRAME_TRANSFER/ FRAME_TRIGGER_WAIT/ UserOutput/ AcquisitionActive Switching			**2 system : (5V) (* 1 system: dual purpose I/O) Arbitrary wave form/ EXPOSURE_ACTIVE/ FRAME_ACTIVE/ FRAME_TRANSFER/ FRAME_TRIGGER_WAIT/ UserOutput/ AcquisitionActive Switching**	
Anti-chattering		O			**O**	
Anti-glitch		O			**O**	
Event notification		U3V_EVENT_TEST/ FrameTrigger/ FrameTriggerError/ FrameTriggerWait/ FrameTransferStart/ FrameTransferEnd/ ExposureStart/ ExposureEnd/ Timer0Start/ Timer0End			**U3V_EVENT_TEST/ FrameTrigger/ FrameTriggerError/ FrameTriggerWait/ FrameTransferStart/ FrameTransferEnd/ ExposureStart/ ExposureEnd/ Timer0Start/ Timer0End**	
Chunk		-			**O (update by July/2016)**	
BERT		O			**O**	

Specification Comparison (major CMOS mono chrome models)

Model		BU406M	BU205M	BU238M	BU302MG	BU505MG
Power supply		DC+5V±5% (from USB connector)			**DC+5V±5% (from USB connector)**	
Power consumption		below 2.7W		below 2.8W	**Below 3.2W**	**Below 3.2W**
Lens mount		C mount			**C mount**	
Overall dimensions (exclude mount, protrusion)		29(W)x29(H)x16(D)			**29(W)x29(H)x16(D)**	
Weight		32g		32g	**33g**	
Operation assurance	Operating temperature	0~40°C (below 50°C on cabinet surface)			**0~40°C (below 50°C on cabinet surface)**	
	Storage temperature and humidity	Temperature : -20~60°C Humidity : below 90% (No dew)			**Temperature : -20~60°C Humidity : below 90% (No dew)**	

Specification Comparison (major CMOS color models)

Model		BU406MC/MCF	BU238MC/MCF	BU302MCG/MCF	BU505MCG/MCF
Interface		USB3.0 (Super Speed)		**USB3.0 (Super Speed)**	
Protocol		USB3 Vision Ver1.0		**USB3 Vision Ver1.0**	
Imaging element		1/1 inch CMOS CMV4000	1/1.2 inch CMOS IMX174LQJ-C	**1/1.8 inch CMOS IMX252LQR-C**	**2/3 inch CMOS IMX250LQR-C**
Max. output pixel size		4M	2.3M	**3M**	**5M**
Resolution		2048(H)x2048(V)	1920(H)x1200(V)	**2048(H)x1536(V)**	**2448(H)x2048(V)**
Frame rate		90fps	165fps	**120fps**	**75fps**
Pixel size		5.5x5.5µm	5.86x5.86µm	**3.45x3.45µm**	**3.45x3.45µm**
Protect glass/ optical filter		[C]: no filter [CF]: with filter	[C]: no filter [CF]: with filter	**[CG]: with Dust-proof glass [CF]: with IR cut filter**	
Standard Sensitivity		4800lx, F8 (1/90s)	4100lx, F8 (1/200s)	**[CG]: 2400lx, F4 [CF]: 2650lx, F4 (1/120s)**	**[CG]: 3000lx, F5.6 [CF]: 3300lx, F5.6 (1/75s)**
Minimum sensitivity		10lx	[C]: 8lx, [CF]: 9lx	**[C]: 10lx, [CF]: 11lx**	**[C]: 6lx, [CF]: 7lx**
Gain	Manual	0~8[times] (Digital gain)	0~+18[dB] (Analog gain)	**0~+24[dB] (Analog gain)**	
	Auto	-	-	**O (update by July/2016)**	
Black level correction		-25~+25[%]	-25~+25[%]	**-25~+25[%]**	
White balance	Manual gain	R/B gain set separately 1~8[times]	R/B gain set separately 1~8[times]	**R/B gain set separately 1~8[times]**	
	One push	All area [C]: N/A [CF]: 2500~6500[K]	All area [C]: N/A [CF]: 2500~6500[K]	**All area [CG]: N/A [CF]: 2500~6500[K]**	
	Full auto	-	-	**O (update by July/2016)**	

Specification Comparison (major CMOS color models)

Model		BU406MC/MCF	BU238MC/MCF	BU302MCG/MCF	BU505MCG/MCF
Gamma correction		0.45~1.0	0.45~1.0	**0.45~1.0**	
LUT		Input : 10[bit] Output: 10[bit]	Input : 10[bit] Output: 10[bit]	**Input : 12[bit] Output: 12[bit]**	
Sharpness		-	-	**O (update by July/2016)**	
Color correction		-	-	**O**	
Saturation		-	-	**O**	
HUE		-	-	**O**	
Pixel defect correction		Max. 256 pixels		**Max. 256 pixels**	
Test pattern output		O		**O**	
Image memory (number of images)		O (over 16 images)	O (over 29 images)	**O (over 21 images)**	**O (over 13 images)**
Image re-sending		X (Bulk transfer Retry only)		**X (Bulk transfer Retry only)**	
Exp. cntrl	Manual	30µs~16s	30µs~16s	**30µs~16s**	**30µs~16s**
	Auto	-	-	**O (update by July/2016)**	
Trigger shutter	Hardware trigger	Edge, pulse width control (30µs~16s) +/- polarity		**Edge, pulse width control (30µs~16s) +/- polarity**	
	Software trigger	USB3 Vision command		**USB3 Vision command**	
Bulk trigger		Max. 255 times		**Max. 255 times**	
Sequential shutter		Max. 16 entry		**Max. 16 entry**	
Trigger delay		0~2,000,000us		**0~2,000,000us**	
Synchro. Method		Bus synchro/internal synchro		**Bus synchro / Internal synchro**	

Specification Comparison (major CMOS color models)

Model			BU406MC/MCF	BU238MC/MCF	BU302MCG/MCF	BU505MCG/MCF
Readout mode	All pixel scanning		2048(H)x2048(V)	1920(H)x1200(V)	**2048(H)x1536(V)**	**2448(H)x2048(V)**
	Partial reading	Min. unit size	64(H)x64(V)	64(H)x64(V)	**64(H)x64(V)**	
		Offset setting unit	4(H)x2(V)	8(H)x2(V)	**8(H)x2(V)**	
		Number of window	1	1	**1**	
		Window overlap	-	-	**-**	
	Binning reading (Digital image reduction)		X (by application)	X (by application)	**X (by application)**	
	Decimation		1/2, 1/4, 1/8 line	X	**2x2**	
Pixel format			Mono8	Mono8	**Bayer8/10/12,RGB/BGR,YUV422/411,Mono8**	
Image flip			Horizontal, Vertical		**Horizontal, Vertical**	
User mem.	Value set memory		15 Channel		**15 Channel**	
	Optional memory		64 bytes		**64 bytes**	

Specification Comparison (major CMOS color models)

Model		BU406MC/MCF	BU238MC/MCF	BU302MCG/MCF	BU505MCG/MCF
GPIO	Connector	e-CON connector		**e-CON connector**	
	Input	1 system : TRIG(5V)		**2 system : TRIG(5V) (* 1 system: dual purpose I/O)**	
	Output	2 system : (5V) Arbitrary wave form/ EXPOSURE_ACTIVE/ FRAME_ACTIVE/ FRAME_TRANSFER/ FRAME_TRIGGER_WAIT/ UserOutput/ AcquisitionActive Switching		**2 system : (5V) (* 1 system: dual purpose I/O) Arbitrary wave form/ EXPOSURE_ACTIVE/ FRAME_ACTIVE/ FRAME_TRANSFER/ FRAME_TRIGGER_WAIT/ UserOutput/ AcquisitionActive Switching**	
Anti-chattering		O		**O**	
Anti-glitch		O		**O**	
Event notification		U3V_EVENT_TEST/ FrameTrigger/ FrameTriggerError/ FrameTriggerWait/ FrameTransferStart/ FrameTransferEnd/ ExposureStart/ ExposureEnd/ Timer0Start/ Timer0End		**U3V_EVENT_TEST/ FrameTrigger/ FrameTriggerError/ FrameTriggerWait/ FrameTransferStart/ FrameTransferEnd/ ExposureStart/ ExposureEnd/ Timer0Start/ Timer0End**	
Chunk		-		**O (update by July/2016)**	
BERT		-		**O**	

Specification Comparison (major CMOS color models)

Model		BU406MC/MCF	BU238MC/MCF	BU302MCG/MCF	BU505MCG/MCF
Power supply		DC+5V±5% (from USB connector)		**DC+5V±5%** (from USB connector)	
Power consumption		Below 2.7W	Below 2.8W	**Below 4.0W**	**Below 4.0W**
Lens mount		C mount		**C mount**	
Overall dimensions (exclude mount, protrusion)		29(W)x29(H)x16(D)		**29(W)x29(H)x16(D)**	
Weight		32g	32g	**33g**	
Operation assurance	Operation temperature	0~40°C (below 50°C on cabinet surface)		**0~40°C (below 50°C on cabinet surface)**	
	Storage temperature and humidity	Temperature : -20~60°C Humidity : below 90% (No dew)		**Temperature : -20~60°C Humidity : below 90% (No dew)**	

Attention of camera function

■ Binning

- Binning combines 2(horizontal, with digital processing) x 2(vertical, in a sensor) pixels. (* Only B/W camera)
- Binning and scalable cannot be operated at the same time.

■ Decimation (Sub-sampling)

- 1/2 (horizontal and vertical) pixels are decimated in a sensor.
  (* For both B/W cameras, color cameras)
- Decimation and scalable cannot be operated at the same time.

■ Color camera functions

- For better image output performance, color models are shipped out with color masking function and saturation function on.
- Noise will increase slightly comparing with off status of these functions, nothing wrong with the camera however.

■ GPIO

- As for GPIO of this camera, line 0 is assigned only for input (for external trigger input) and line 1 is only for output.
- Line 2 can be switched for input or output.
- Input signal for line 2 can be used for external trigger input.

Advanced Function

Advanced function

BU505MG BU302MG
BU505MCG BU302MCG
BU505MCF BU302MCF

- **Event notice function** ･ BU/DU series function
- **Bulk trigger** ･････････ BU/DU series function
- **Sequential shutter** ･･･ CMOS model
- **Image buffer** ････････ CMOS model
- **Pixel defect correction** CMOS model
- **Bus synchronization** ･･ CCD/CMOS-GS model
- **BERT function** ･･･････ CMOS model

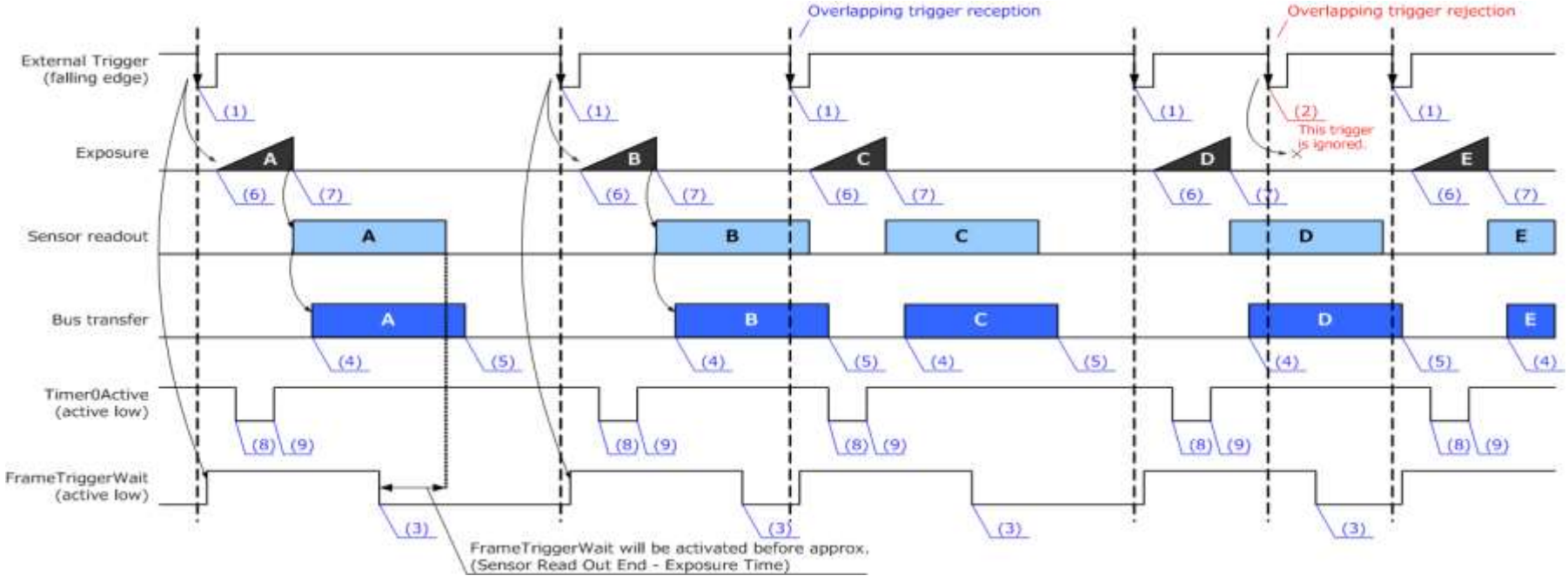
Advanced function (1)

BU505MG BU302MG
BU505MCG BU302MCG
BU505MCF BU302MCF

■ Event notification function :

- Camera status can be referred through USB3 by using event packet of USB3 Vision

(1) Frame Trigger : Reception of Frame Start Trigger
(2) Frame Trigger Error : Rejection of Frame Start Trigger
(3) Frame Trigger Wait : Start of waiting for Frame Start Trigger
(4) Frame Transfer Start : Start of transferring Streaming data
(5) Frame Transfer End : End of Transferring Streaming data
(6) Exposure Start : Start of Exposure
(7) Exposure End : End of Exposure
(8) Timer0Active : Start of Timer0
(9) Timer0End : End of Timer0

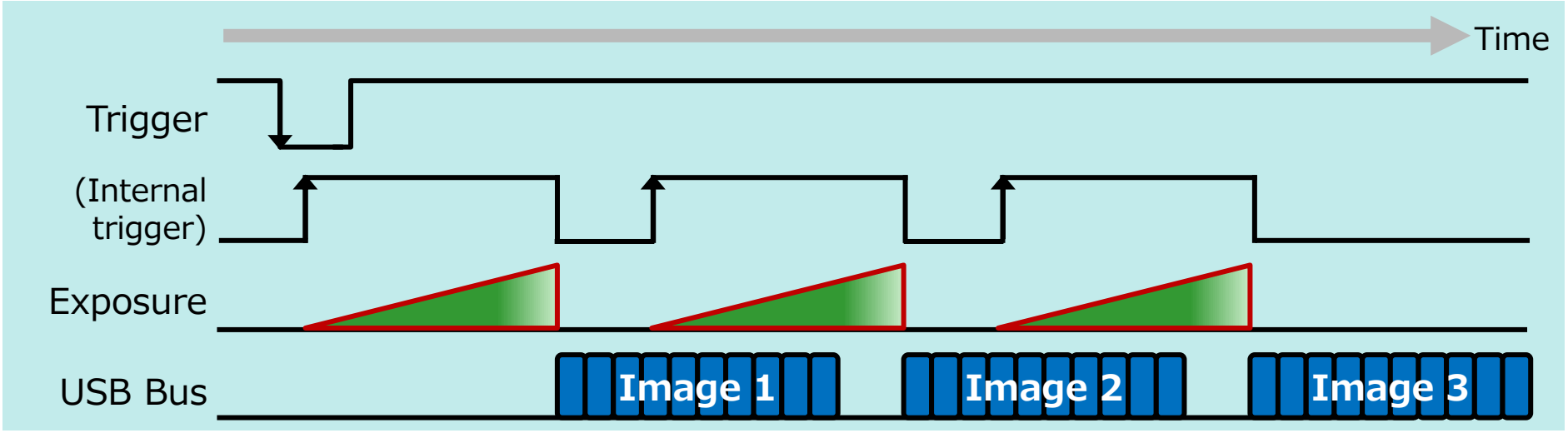


Advanced function (2)

BU505MG BU302MG
BU505MCG BU302MCG
BU505MCF BU302MCF

■ Bulk trigger (Trigger burst) mode :

- Exposure and image output of multiple times can be achieved by one time input of trigger signal
- Example of use :
  selecting the best image among several frames, measuring moving distance etc.



Advanced function (3-1)

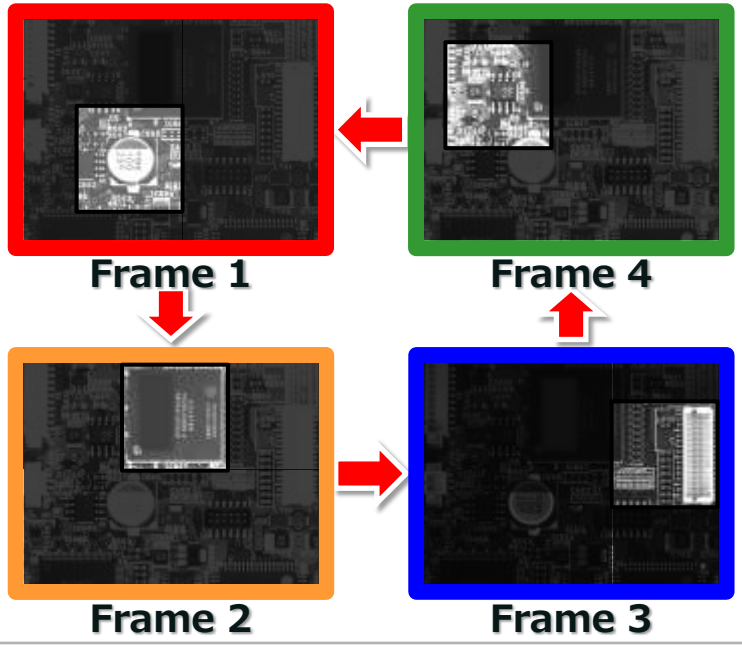
■ Sequential shutter mode

- Together with trigger mode, sequential shutter function of BU (CMOS) series can switch programed settings such as gain, exposure, AOI trigger delay in each time of trigger input with each frame.

<Ex.1>

Changing ROI position, Gain and Exposure Time every time

Sequential Shutter Setting : 4 shots



Memory Bank1	SEQ : Frame 1 ・Gain : 0dB ・Exposure : 2ms ・ROI Position :
Memory Bank2	
Memory Bank3	
Memory Bank4	
Memory Bank5	SEQ : Frame 3 ・Gain : 0dB ・Exposure : 1ms ・ROI Position :
Memory Bank6	
Memory Bank7	
Memory Bank8	
Memory Bank9	SEQ : Frame 2 ・Gain : +6dB ・Exposure : 2ms ・ROI Position :
Memory Bank10	
Memory Bank11	
Memory Bank12	
Memory Bank13	
Memory Bank14	
Memory Bank15	SEQ : Frame 4 ・Gain : +3dB ・Exposure : 2ms ・ROI Position :

Advanced function (3-2)

■ Sequential shutter mode

<Ex.2>

Changing Gain and Exposure Time every time

Sequential Shutter Setting : 4 shots

Trigger
(3 times)

Image data output
(3 frames)

First Shot

Gain: 0.5dB
Exp: 0.7msec

Second Shot

Gain: 3dB
Exp: 0.7msec

Third Shot

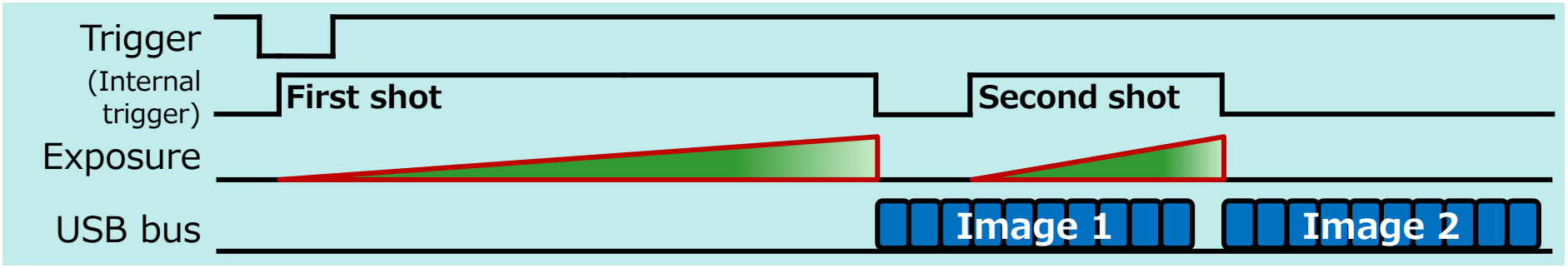
Gain: 8dB
Exp: 0.3msec

Advanced function (4)

BU505MG BU302MG
BU505MCG BU302MCG
BU505MCF BU302MCF

■ Sequential shutter with Bulk trigger mode

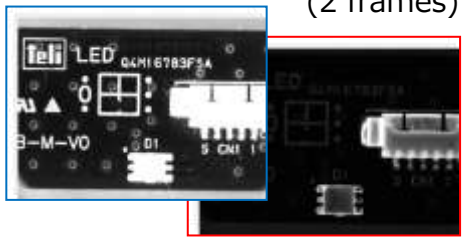
<Ex.3> Output multiple images of different shutter speed by one shot trigger



Bulk trigger setting : 2 shots
Sequential shutter setting : 2 sequences

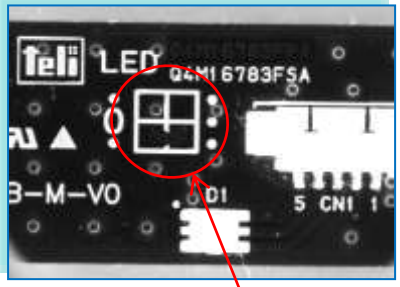
Trigger (1 time)

Image data output (2 frames)



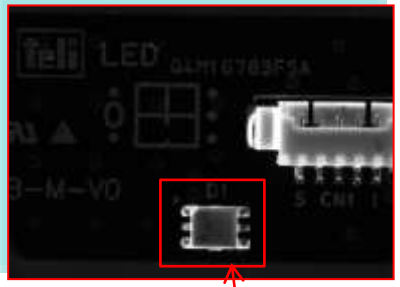
Inspection on multi items by one time trigger input !

First shot



Exposure time : 20msec

Second shot



Exposure time : 2msec

Silk inspection

Appearance inspection of scratch or dent

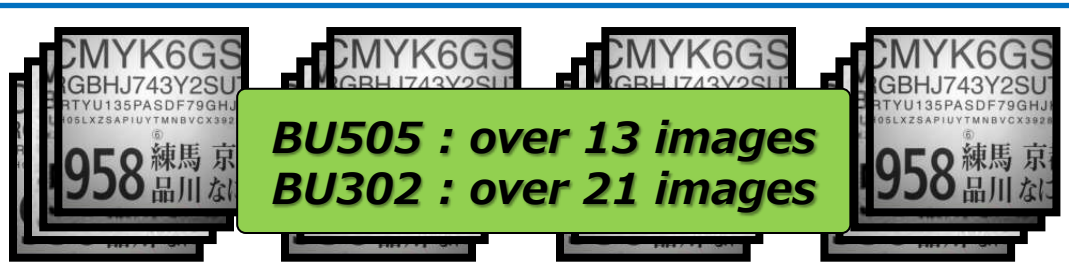
For example, appearance and silk lucking of parts can be inspected at the same time

Advanced function (5)

BU505MG BU302MG
BU505MCG BU302MCG
BU505MCF BU302MCF

■ Image buffer

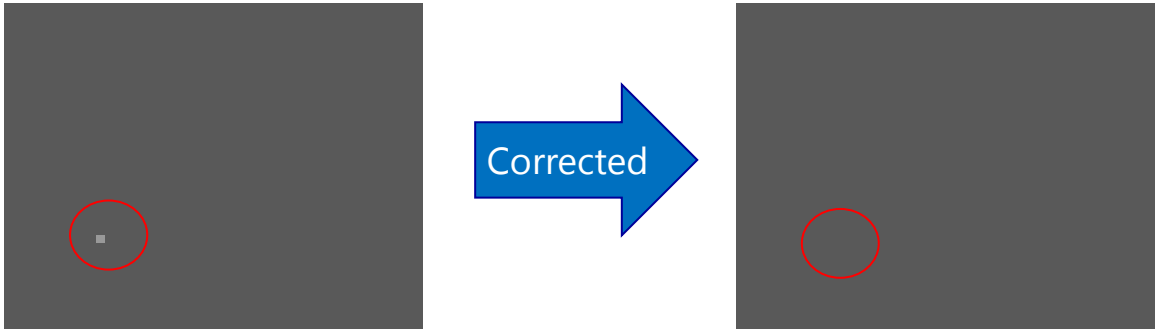
- As BU(CMOS) series have 64MB image buffer memory in it, recorded image data can be read from host PC at any time.



Frames can be recorded and read

■ Pixel defect correction

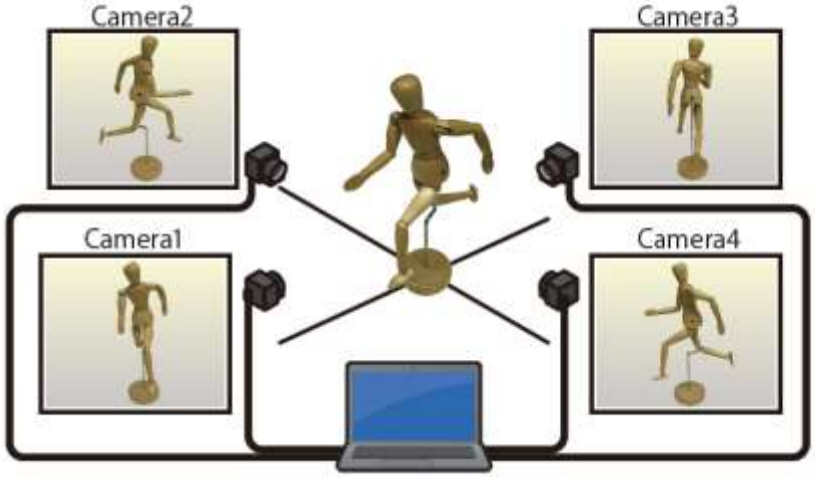
- BU(CMOS) series have correction function of pixel defect. This function can be switched on and off depend on occasion.

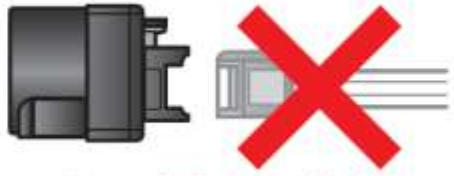


Advanced function (6)

■ Bus synchronization

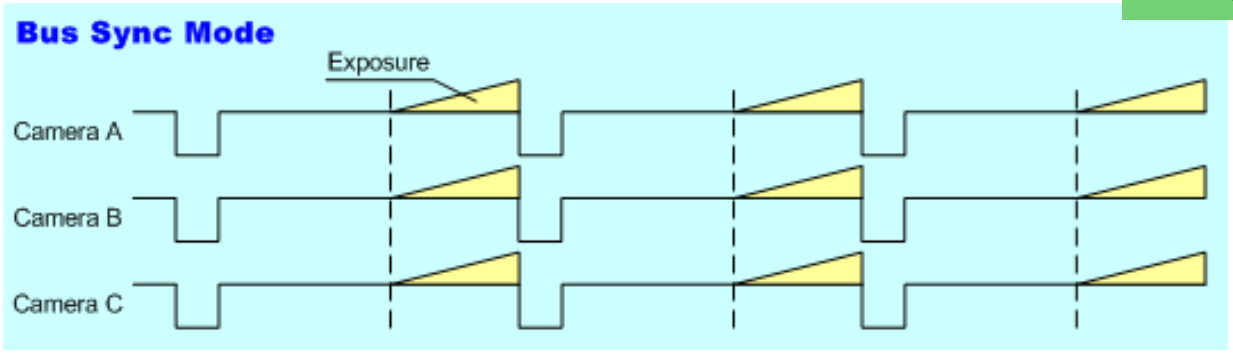
- Fully synchronized exposure timing among several cameras.





No cable needed for 'Trigger in' !

Applications:
Stereo camera
Motion capture

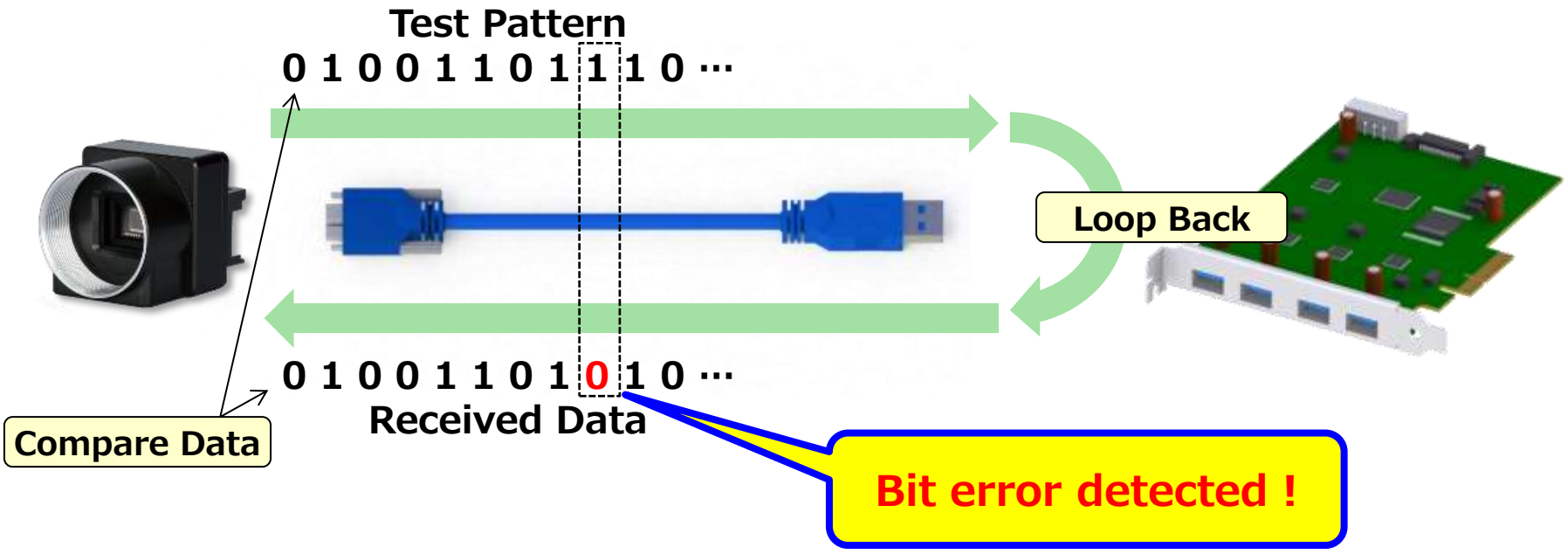


- Technical information of BERT function can download from following web site;
  http://www.toshiba-teli.co.jp/en/products/industrial/info/

Advanced function (7)

■ BERT (Bit Error Rate Test) = CMOS model

- "BERT Function" can easily check a signal quality including cable. With "BERT Function", signal quality can be checked under user's circumstances at starting up or change system.



Camera function list (all USB3.0 camera)

Color type		B/W	Color	B/W	B/W	B/W	Color	B/W	B/W	B/W	Color	**B/W**	**Color**	B/W	Color	**B/W**	**Color**	Color	B/W	Color
Resolution		0.3M	0.3M	0.3M	0.8M	1.3M	1.3M	1.3M	2.0M	2.3M	2.3M	**3.0M**	**3.0M**	4.0M	4.0M	**5.0M**	**5.0M**	12M	6.5M	6.5M
Imager		CCD	CCD	CCD	CCD	CCD	CCD	CMOS	CMOS	CMOS	CMOS	**CMOS**	**CMOS**	CMOS	CMOS	**CMOS**	**CMOS**	CMOS	CMOS	CMOS
TELI IP Core Version		V1	V1	V1	V1	V1	V1	V4	V2	V2	V2	**V4**	**V4**	V2	V2	**V4**	**V4**	V2	V3	V3
Category	**Function**	**BU030**	**BU030C BU030CF**	**BU031**	**BU080**	**BU130**	**BU130C BU130CF**	**BU132M**	**BU205M**	**BU238M**	**BU238MC BU238MCF**	**BU302MG**	**BU302MCG BU302MCF**	**BU406M**	**BU406MC BU406MCF**	**BU505MG**	**BU505MCG BU505MCF**	**BU1203MC BU1203MCF**	**DU657M**	**DU657MC**
USB3Vision	Bootstrap Registers	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
DeviceControl	DeviceControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
ImageFormatControl	ImageFormatSelector	O	-	O	O	O	-	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	Scalable	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	Binning	O	-	O	O	O	-	O	-	-	-	**O**	**-**	-	-	**O**	**-**	-	O	O
	Decimation	-	-	-	-	-	-	O	O	-	-	**O**	**O**	O	O	**O**	**O**	-	-	-
	Reverse	-	-	-	-	-	-	O	O	O	O	**O**	**O**	O	-	**O**	**O**	O	O	O
	PixelFormat	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	TestPattern	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
AcquisitionControl	AcquisitionControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	ImageBuffer	-	-	-	-	-	-	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	TriggerControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	ExposureControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
DigitalIOControl	DigitalIOControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
CounterAndTimerControl	TimerControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
AnalogControl	Gain	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	BlackLevel	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	Gamma	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	BalanceRatio	-	O	-	-	-	O	-	-	-	O	**-**	**O**	-	O	**-**	**O**	O	-	O
	BalanceWhiteAuto	-	O	-	-	-	O	-	-	-	O	**-**	**O**	-	O	**-**	**O**	O	-	O
	ColorCorrectionMatrix	-	O	-	-	-	O	-	-	-	-	**-**	**-**	-	-	**-**	**-**	-	-	-
LUTControl	LUTControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
UserSetControl	UserSetControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
EventControl	EventControl	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	FrameSynchronization	O	O	O	O	O	O	-	O	O	O	**O**	**O**	O	O	**O**	**O**	-	O	O
VenderUniqueControl	LEDIndicatorLuminance	O	O	O	O	O	O	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	AntiGlitch	O	-	O	O	O	-	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	AntiChattering	O	-	O	O	O	-	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
DPCControl	DPCControl	-	-	-	-	-	-	O	O	O	O	**O**	**O**	O	O	**O**	**O**	O	O	O
	SequentialShutterControl	-	-	-	-	-	-	O	O	O	O	**O**	**O**	O	O	**O**	**O**	-	O	O

Documents

Reference Documents

- **Product specifications**

  BU505MG/MCG/MCF,
  BU302MG/MCG/MCF

- **Operation manual**

  BU505MG/MCG/MCF,
  BU302MG/MCG/MCF

- **These documents are available in our HP to download;**

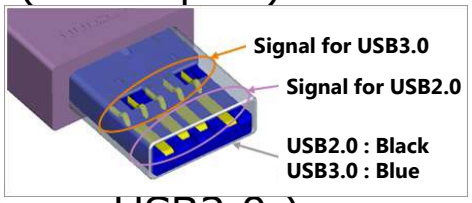
  http://www.toshiba-teli.co.jp/en/products/industrial/

[Appendix]
Introduction of USB3.0/USB3 Vision

About USB3.0/USB3 Vision

Outline of USB3.0 interface

- **Bit rate : 5Gbps max. (SuperSpeed)**
  - Can transfer Uncompressed HDTV (1920x1080) image in 60fps
- **Comm. Mode : Full duplex**
  - Improved in communication efficiency against USB2.0 (half duplex)
- **Bus power : 900mA max.**
  - Up to 4.5W with 5V supply
- **Lower compatibility**
  - USB3.0 device can be connected to USB2.0 port (works as USB2.0)
  - USB2.0 device can be connected to USB3.0 port



What's USB3 Vision?

- **Machine vision standard**
  - IEEE1394 by IIDC, Gig-E by GigE Vision
- **High band width of 5Gbps** (440MByte/s)
- **Easy connection with Plug & Play**
- **Standardized software interface with GenICam™**
- **Much improved robust than USB2.0**

High band width transfer

HIGH
Bandwidth

- Full use of high speed image sensor's feature … USB3.0
- High band width transfer by burst … USB3.0

Sensor : Sony IMX174
Resolution : 1920 x 1200 (2.3MP)

Gig-E Vision Camera	USB3 Vision Camera
Max. frame rate: 50fps	Max. frame rate: 165fps
Data rate: 115MB/s	Data rate: 380MB/s

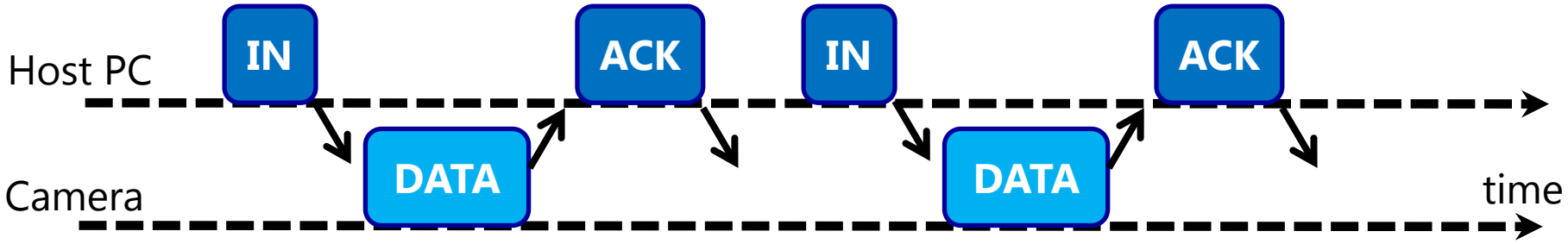
Sensor : CMOSIS CMV4000
Resolution : 2048 x 2048 (4.2MP)

Gig-E Vision Camera	USB3 Vision Camera
Max. frame rate: 25fps	Max. frame rate: 90fps
Data rate: 105MB/s	Data rate: 377MB/s

Burst transfer compliancy

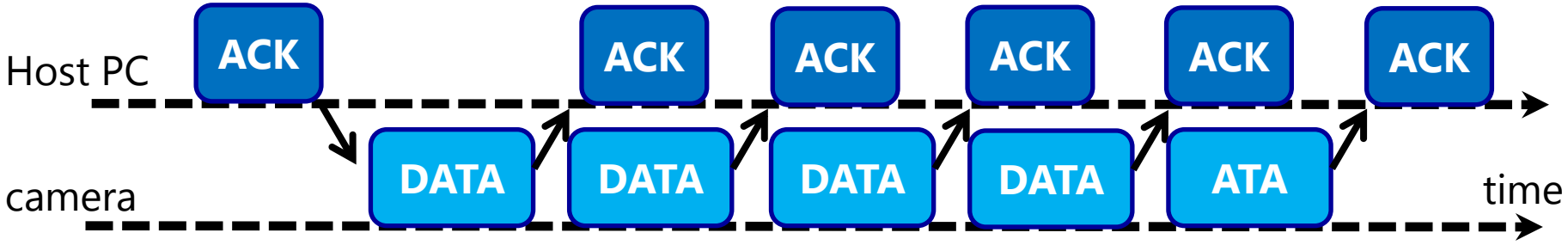
■USB2.0 : non compliancy to burst transfer

USB2.0 packet sequence cannot use bus band efficiently



■USB3.0 : compliancy to burst transfer

bus band can be used efficiently with burst transfer of USB3.0



System cost comparison

LOW COST

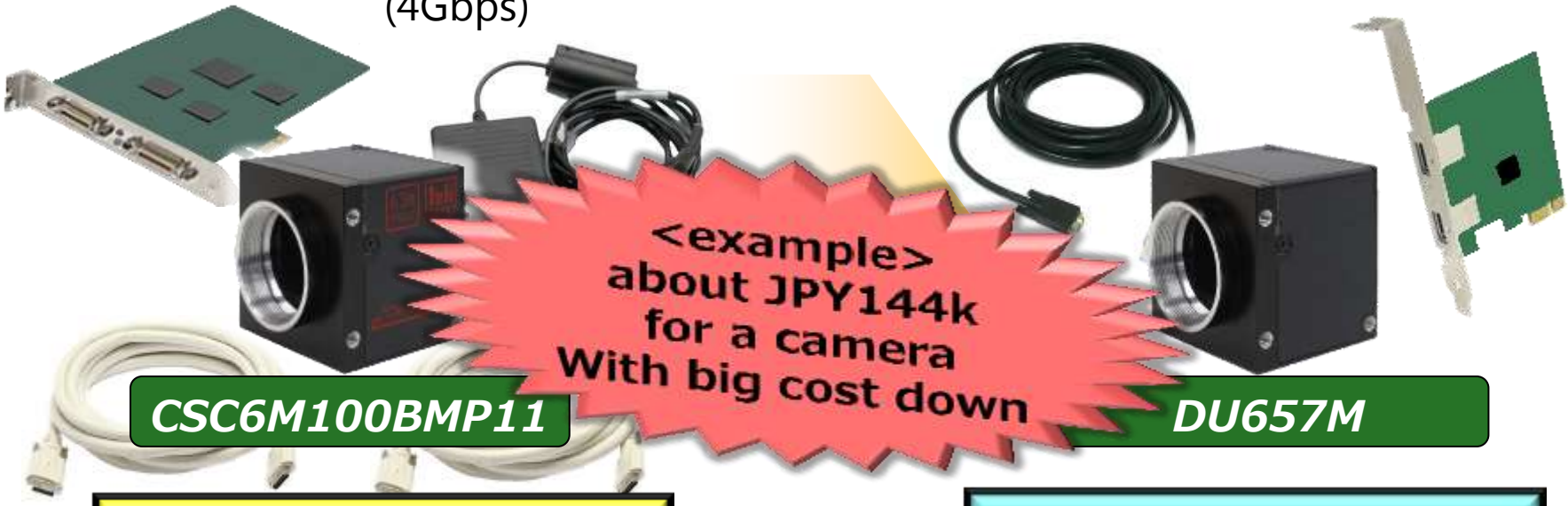
- Low cost accessories …USB3.0
- No power supply is needed …USB3.0

	USB3.0	Gig-E	1394.b	Camera Link
Frame grabber	Low	Low	Mid.	High
Cable	Low	Low	Mid.	High
Power supply	Bus	External/ PoE	Bus	External/ PoCL
Camera	Low	Mid.	Mid.	Low
System cost of 4 cameras	**Low**	**Mid.**	**Mid.**	**High**

Applicable range of USB3.0

CameraLink
Medium Configuration
(4Gbps)

USB3.0
(4Gbps)



A camera (CL-FullConfig)
About JPY420k

camera (6.5M)	: JPY280k
board	: JPY100k
cable	: JPY30k
(power)	: JPY10k

A camera (USB3 Vision)
About JPY276k

camera (6.5M)	: JPY260k
board	: JPY8k
cable	: JPY8k

Big cost down by replacing Camera Link system with USB3.0 system!

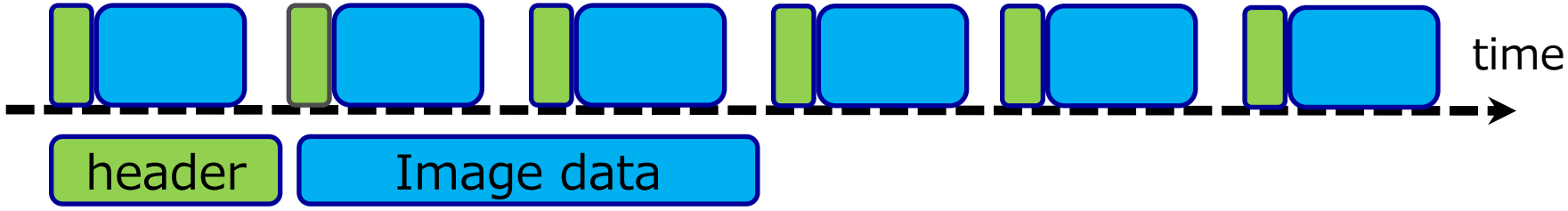
High reliability

HIGH
Reliability

- Reliable data transfer is ensured ···USB3.0
- Packet format, Appropriate for DMA transfer ···USB3 Vision

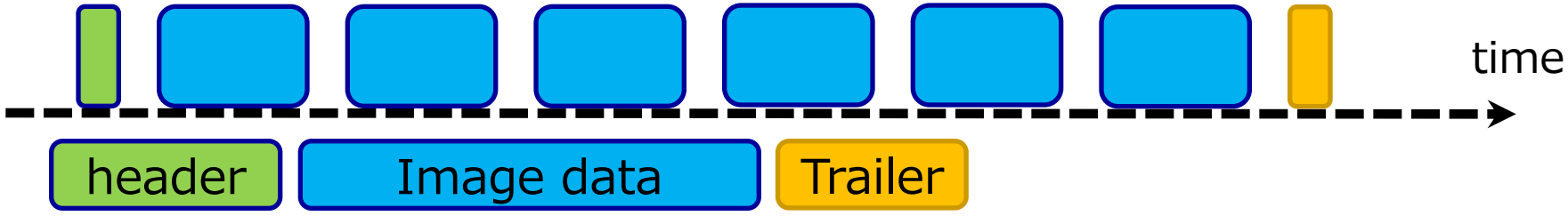
■UVC (USB Video Class) packet format

- CPU analyzes header, and separate it from image data.
- **Over head is bigger, CPU process and communication becomes unstable.**



■USB3 Vision packet format

- CPU processing and communication is stable because of less CPU load as image data is deployed on memory at one time by DMA transfer.




TOSHIBA
Leading Innovation