

# HAMAMATSU

HAMAMATSU PHOTONICS K.K.

SOLID STATE DIVISION

1126-1 ICHINO-CHO, HIGASHI-KU, HAMAMATSU CITY

435-8558, JAPAN

TEL:(81)53-434-3311, FAX:(81)53-434-5184

TO: U.A.B / I.F.A.E

Doc. No.(K34-B72037)

First Issued.(August,2,2010)

Tentative

## DELIVERY SPECIFICATION SHEET

(Back-Side CCD)

TYPE No. (S10892-04(X))

HAMAMATSU PHOTONICS K.K.  
SOLID STATE DIVISION

Approved by[Customer]

Approved by

\_\_\_\_\_  
Name

Hitoshi Asai

\_\_\_\_\_  
Title

\_\_\_\_\_  
Date

Checked by

Masaharu Muramatsu

Designed by

Hisanori Suzuki

Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**DELIVERY SPECIFICATION**

1. Prescription  
This specification prescribes it about back side CCD to deliver to your project.
2. Ratings and characteristics  
In accordance with Drawing No. K34-B72037
3. Dimension outline  
In accordance with Drawing No. K34-B72037
4. Device structure  
In accordance with Drawing No. K34-B72037
5. Timing chart  
In accordance with Drawing No. K34-B72037
6. Pin connections  
In accordance with Drawing No. K34-B72037
7. Protection Cover at delivery  
No. K34-B72037
8. Revise  
When a doubt occurred in this specification,  
I revise it after discussion immediately in both.

Notice

Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**2. Ratings and characteristics**

**2.1 General ratings**

Parameter	Specification
Pixel size	15 um (H) x 15 um (V)
Number of pixels	2080(H) x 4224(V) H:(512+8) x 4 V:(64+2048)+(2048+16+48)
Number of active pixels	2048(H) x 4096(V)
Active area	30.72mm(H) x 61.44mm(V)
Fill factor	100%
Vertical clock phase	3 phase
Horizontal clock phase	2 phase
Output circuit	1-stage MOSFET source follower with buffer amplifier external RL (typ 10kohm)
Number of output nodes	4
Package material	AlN
Window	No window (with protection cover at delivery)

**2.2 Absolute maximum ratings**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating temperature	T <sub>opr</sub>	-120	-	+30	deg. C
Storage temperature	T <sub>stg</sub>	-200	-	+70	deg. C
OD voltage	V <sub>OD</sub>	-25	-	+0.5	V
RD voltage	V <sub>RD</sub>	-18	-	+0.5	V
BB voltage	V <sub>BB</sub>	-0.5	-	+60	V
GR voltage	V <sub>GR</sub>	-0.5	-	+18	V
ISV voltage	V <sub>ISV</sub>	-18	-	+0.5	V
IGV voltage	V <sub>IG1V</sub> , V <sub>IG2V</sub>	-18	-	+0.5	V
SG voltage	V <sub>SG</sub>	-15	-	+15	V
OG voltage	V <sub>OG</sub>	-15	-	+15	V
RG voltage	V <sub>RG</sub>	-15	-	+15	V
TG voltage	V <sub>TG</sub>	-15	-	+15	V
Vertical clock voltage	V <sub>P1V</sub> , V <sub>P2V</sub> , V <sub>P3V</sub>	-15	-	+15	V
Horizontal clock voltage	V <sub>P1H</sub> , V <sub>P2H</sub> , V <sub>P3H</sub> , V <sub>P4H</sub>	-15	-	+15	V

Type No. Back Illuminated FFT-CCD	Doc. No. K34-B72037
-----------------------------------	---------------------

**2.3 Operating conditions**

Parameter	Symbol	Min.	Typ.	Max.	Unit	
Output transistor drain voltage	VOD <sup>1)</sup>	-22	-20	-18	V	
Reset drain voltage	VRD <sup>1)</sup>	-13	-12	-11	V	
Output gate voltage	VOG	-7	-5	-3	V	
Back bias voltage	VBB <sup>1)</sup>	+20	+30	+50	V	
Output transistor ground voltage	VSS	-	OPEN	-	V	
Guard ring voltage	VGR	-	GND	-	V	
Test point Vertical input source	VISV*	-13	-12	-11	V	
Test point Vertical input gate	VIG1V,VIG2V	-	GND	+3V	V	
Vertical shift register clock voltage	High	VP1VH VP2VH VP3VH	-6	-5	-4	V
	Low	VP1VL VP2VL VP3VL	+2	+3	+4	
Horizontal shift register clock voltage	High	VP1HH VP2HH VP3HH VP4HH	-7	-6	-5	V
	Low	VP1HL VP2HL VP3HL VP4HL	+2	+3	+4	
Summing gate voltage	High	VSGH	-7	-6	-5	V
	Low	VSGL	+4	+5	+6	
Reset gate voltage	High	VRGH	-7	-6	-5	V
	Low	VRGL	+4	+5	+6	
Transfer gate voltage	High	VTGH	-6	-5	-4	V
	Low	VTGL	+2	+3	+4	

1)VBB=+50V,VRD,VISV,VOD=+5V at integration , VBB=+30V,VRD(VISV)=-12V,VOD=-20V at charge transfer

**2.4 Electrical characteristics**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Signal output frequency / node	fc	-	133	400	kHz
Vertical shift register capacitance	CP1V*	-	25	-	nF
	CP2V*	-			
	CP3V*	-			
Horizontal shift register capacitance	CP1H*	-	50	-	pF
	CP2H*	-			
	CP3H*	-			
	CP4H*	-			
Summing gate capacitance	CSG*	-	10	-	pF
Reset gate capacitance	CRG*	-	10	-	pF
Transfer gate capacitance	CTG	-	100	-	pF

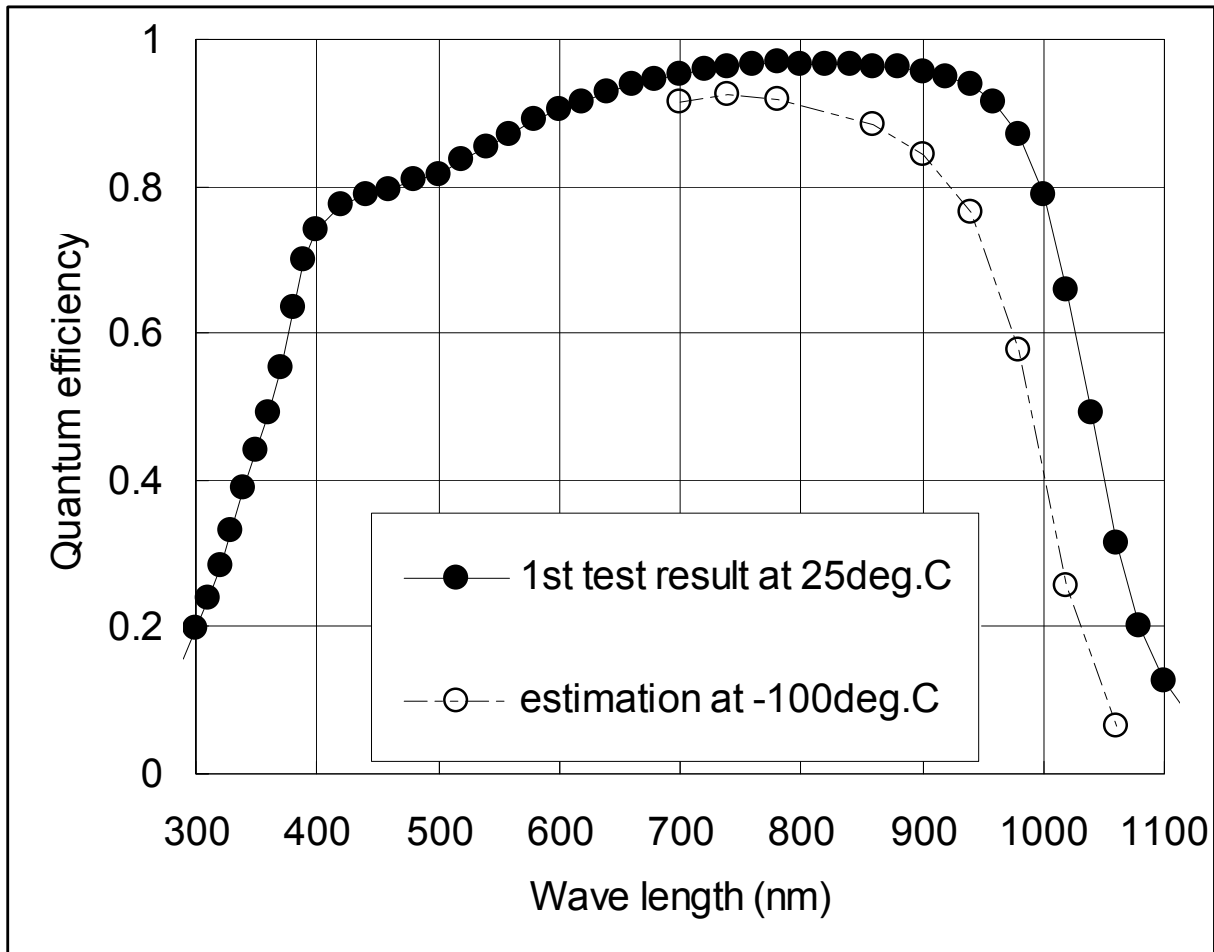
Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**2.5 Electrical and optical characteristics (Ta=-100deg. C)**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Saturation output voltage	Vsat		FwxSv		V
Full well capacity	Fw	90k	150k		e-
CCD node sensitivity	Sv	5	5.5		uV/e-
Dark current	DS			5	e-/pixel/h
Readout noise (133kHz)	Nr		4	5	e-rms
Dynamic range	DR		37500		
Quantum efficiency	QE		70( 400nm) 90( 650nm) 40(1000nm)		%
Photo response non uniformity	PRNU			±2.5	%
Charge transfer efficiency		0.999995			

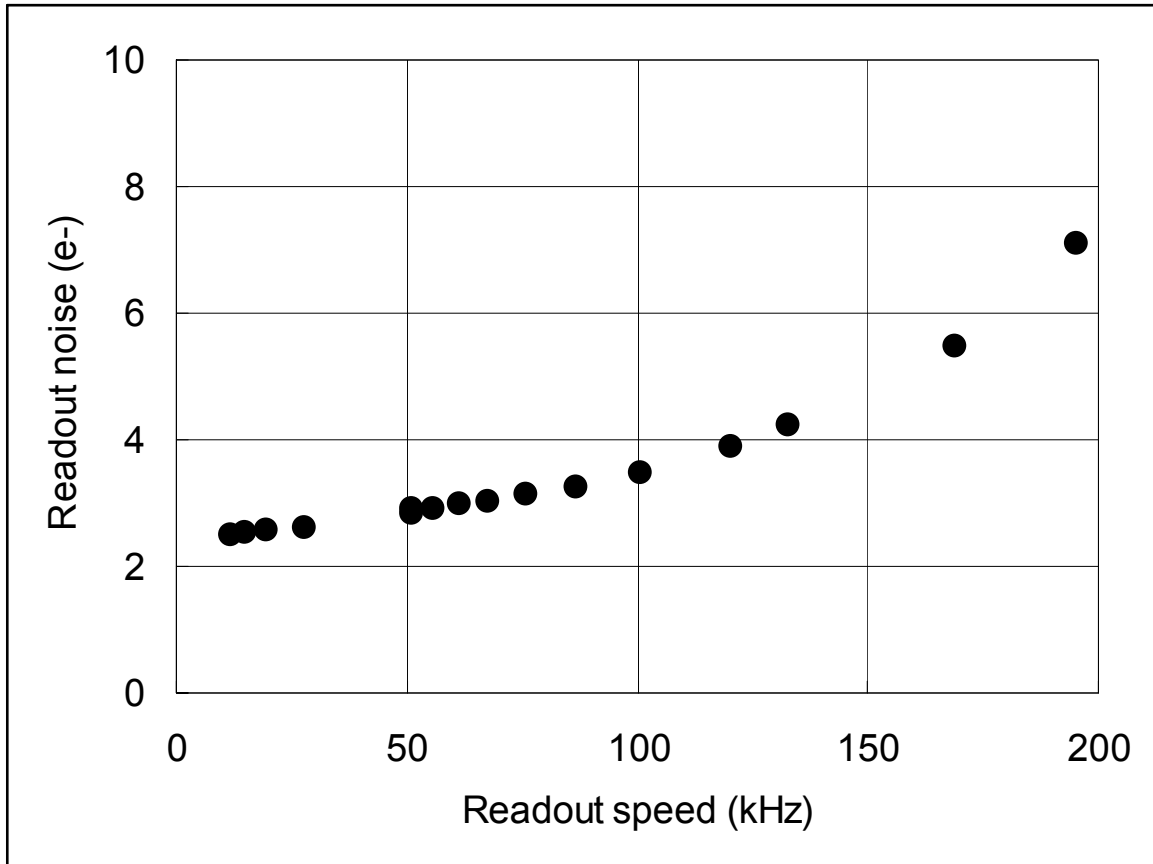
**2.6 Quantum efficiency curve (Ta=25deg. C)**



Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**2.7 Relationship between readout noise and readout speed.(Ta=-100deg.C)**



Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**2.8 Cosmetics****-Column defects<sup>2)</sup> not over 20.**

- 2) Defined columns with a defect as those with consecutive bad pixels over 200 pixels.  
The bad pixels are those with dark current more than 1000times of the nominal dark current of the other pixels or those with sensitivity to incoming light less than 80%.

**-White pixels<sup>3)</sup> < 500**

- 3) A white pixel if the dark generation rate is more than 100 e-/pixel/h at 173K.

**-Black pixels<sup>4)</sup> < 750**

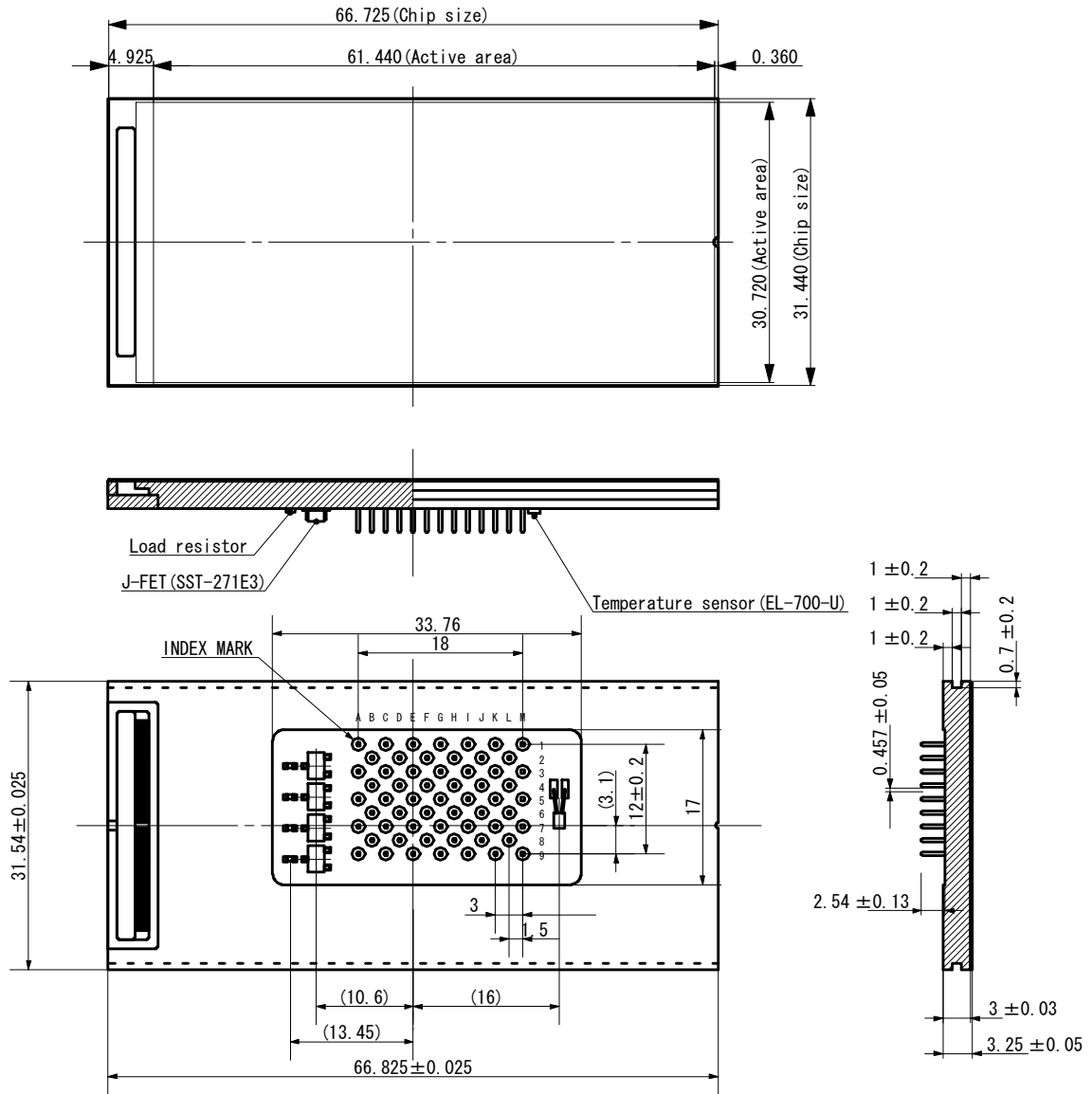
- 4) A black pixel with a response less than 80% of the local mean signal.

Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**3. Dimensional outline**

Unit : mm



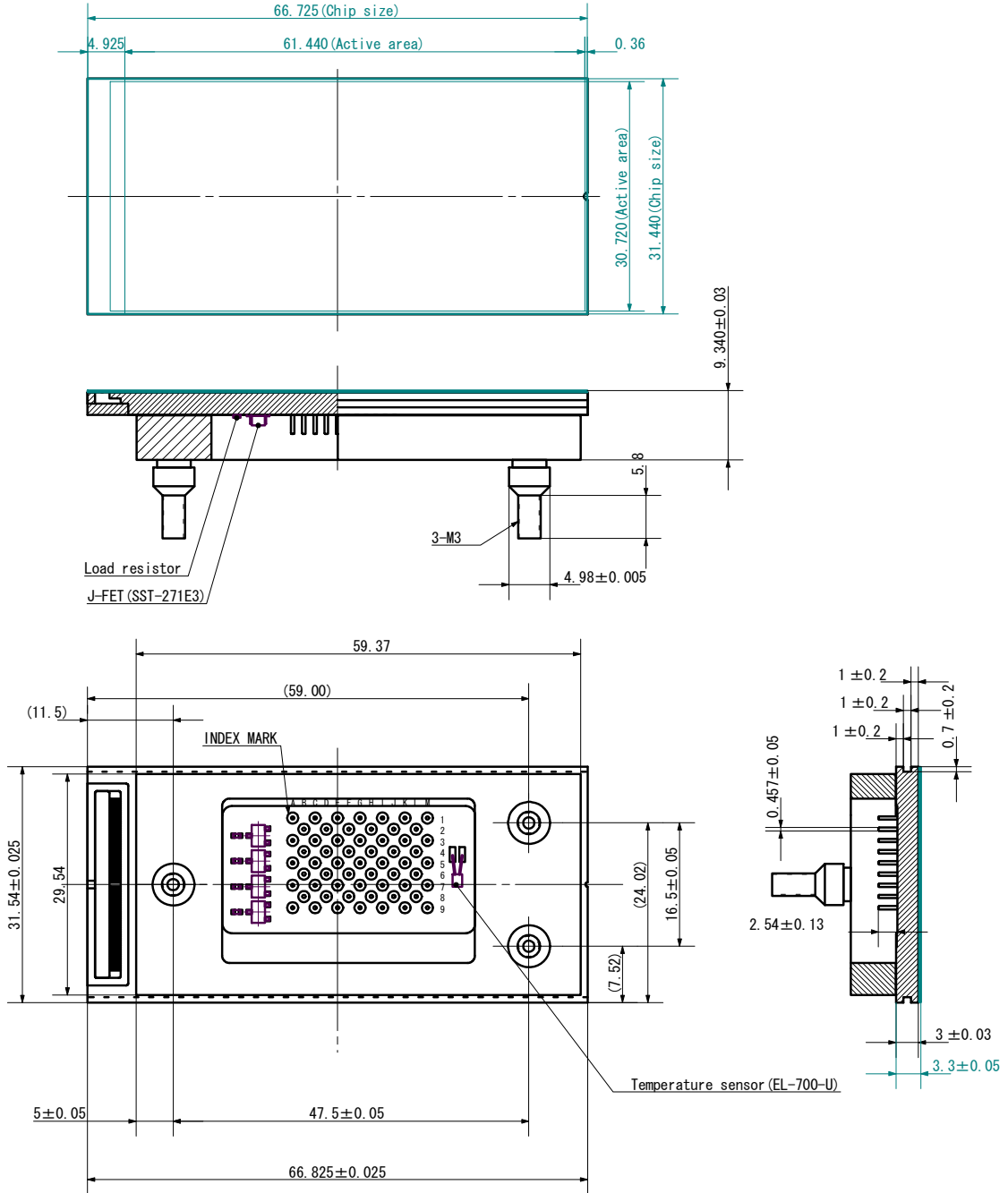


Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**4. Dimensional outline with PIN base**

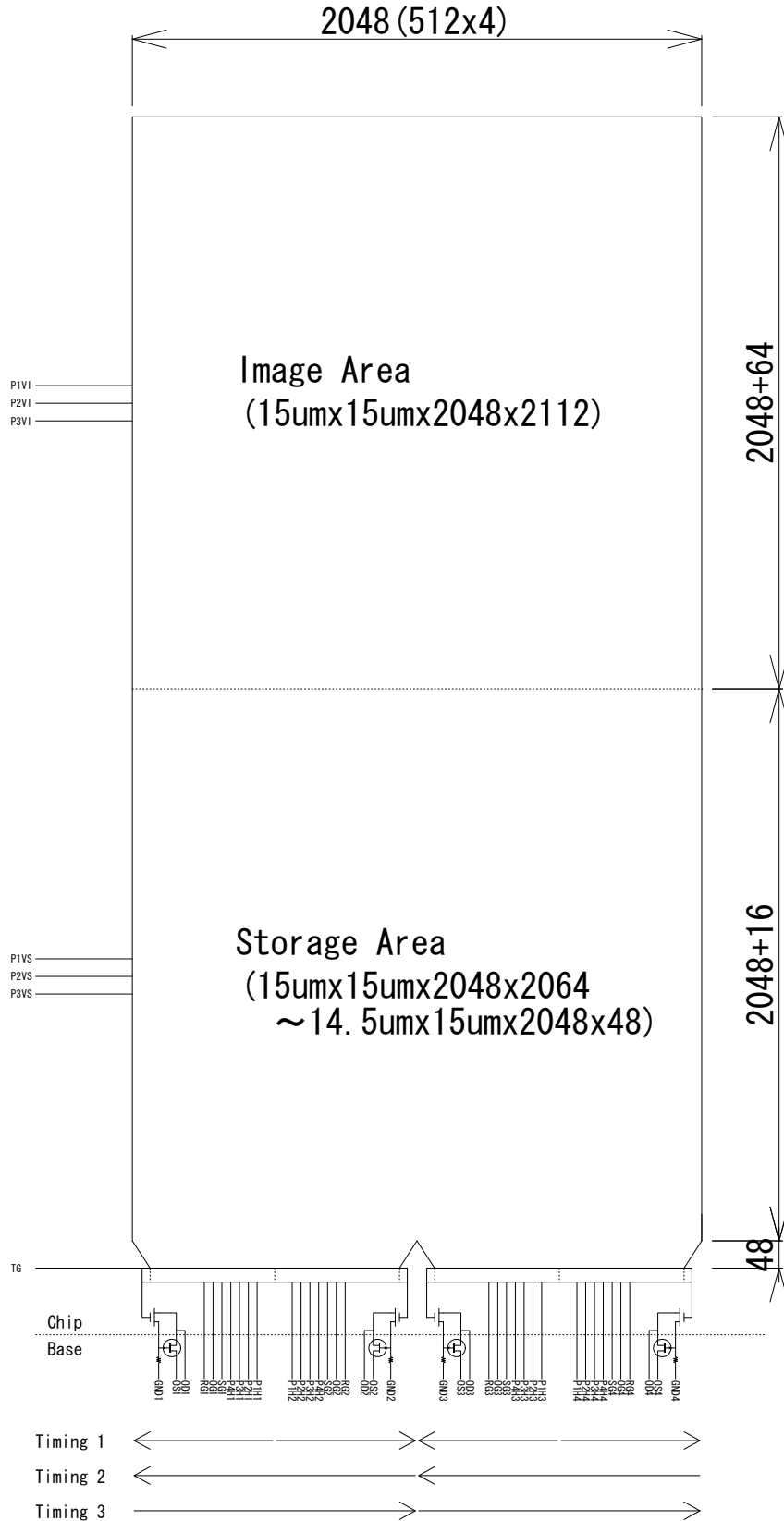
Unit : mm



Type No. Back Illuminated FFT-CCD

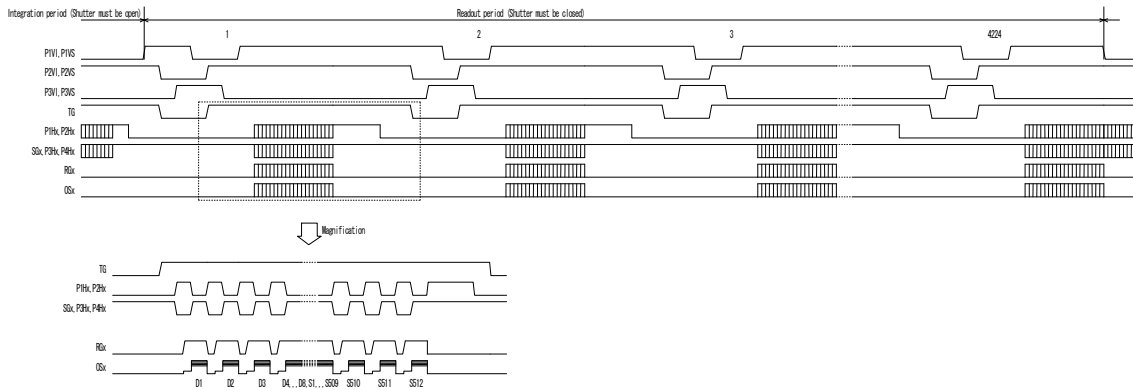
Doc. No. K34-B72037

**4. Device structure (Operating FFT-CCD or FT-CCD)**

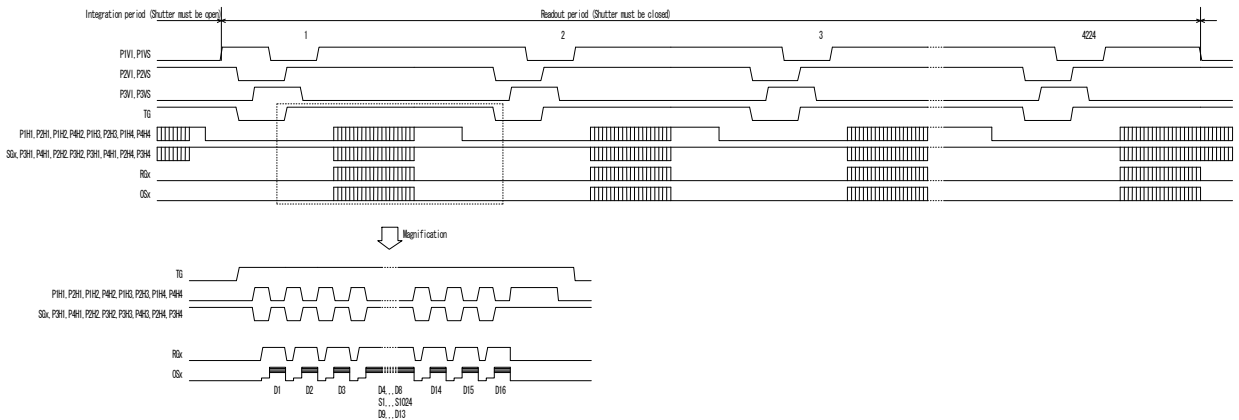


**5. Timing chart (FFT-CCD)**

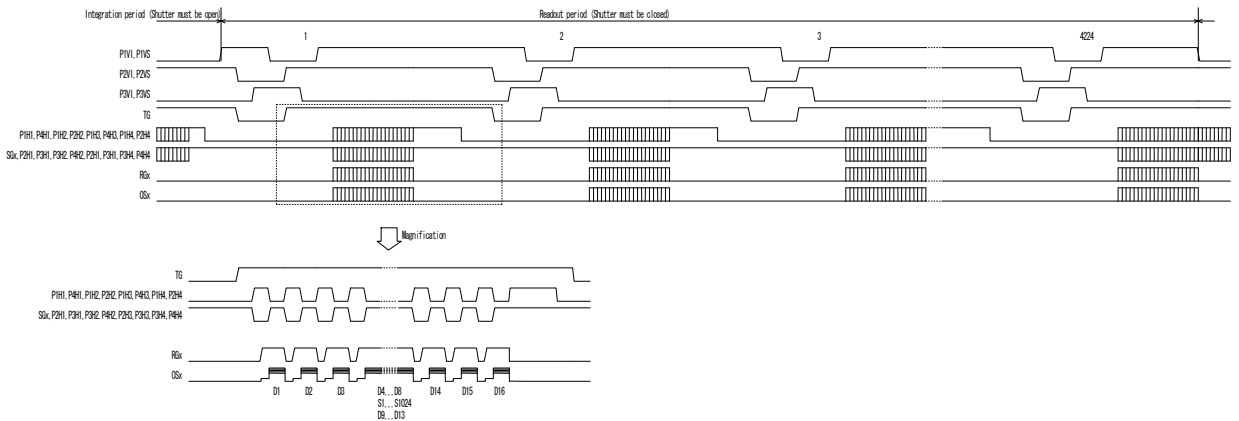
**[Timing 1]**



**[Timing 2]**



**[Timing 3]**



Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

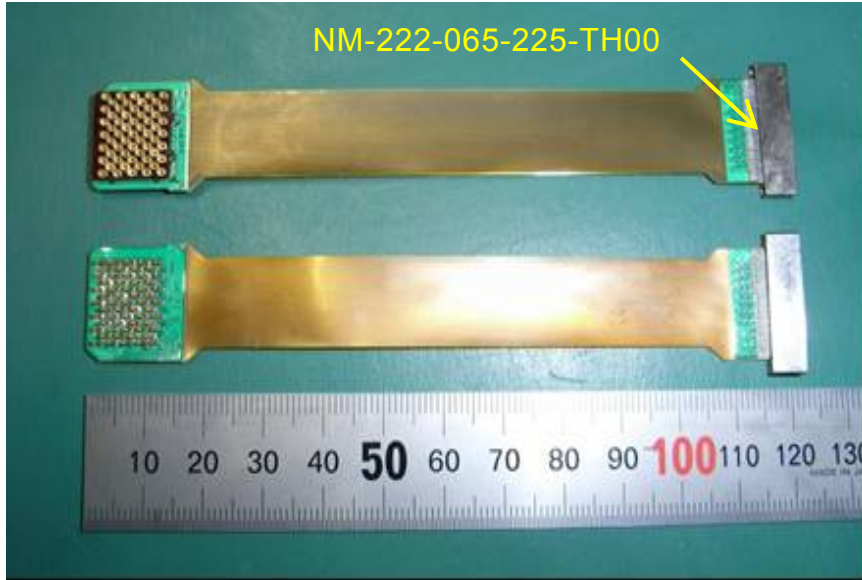
Parameter		Symbol	Min	Typ	Max	Unit
P1V,P2V,P3V,T G	Pulse width	Tp <sub>wv</sub>	10	30	-	us
	Rise and fall time	Tp <sub>rv</sub> ,Tp <sub>fv</sub>	10	-	-	ns
P1H,P2H,P3H, P4H	Pulse width	Tp <sub>wh</sub>	1250	3750	-	ns
	Rise and fall time	Tp <sub>rh</sub> ,Tp <sub>fh</sub>	10	-	-	ns
	Duty ratio	-	-	50	-	%
SG	Pulse width	Tp <sub>ws</sub>	1250	3750	-	ns
	Rise and fall time	Tp <sub>rs</sub> ,Tp <sub>fs</sub>	10	-	-	ns
	Duty ratio	-	-	50	-	%
RG	Pulse width	Tp <sub>wr</sub>	100	1875	-	ns
	Rise and fall time	Tp <sub>rr</sub> ,Tp <sub>fr</sub>	5	-	-	ns
PxV-PyV,TG	Overlap time	Tv <sub>ovr</sub>	3	9	-	us
TG-P1H	Overlap time	To <sub>vr</sub>	3	9	-	us

Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

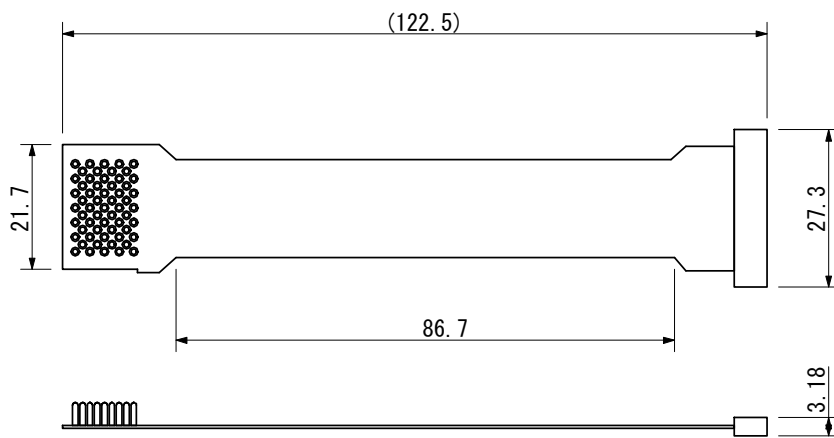
**6.1. Pin connections**

The CCD is delivered with the flexible cable.



**Dimension of Flexible Cable**

Unit : mm



Circuit side connector (<http://www.airborn.com/> : "N" series connectors)



Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

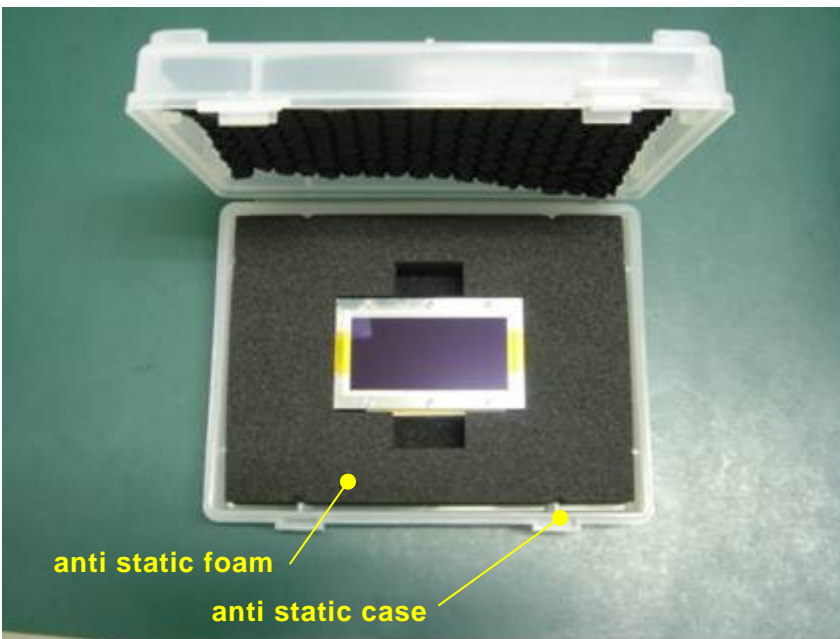
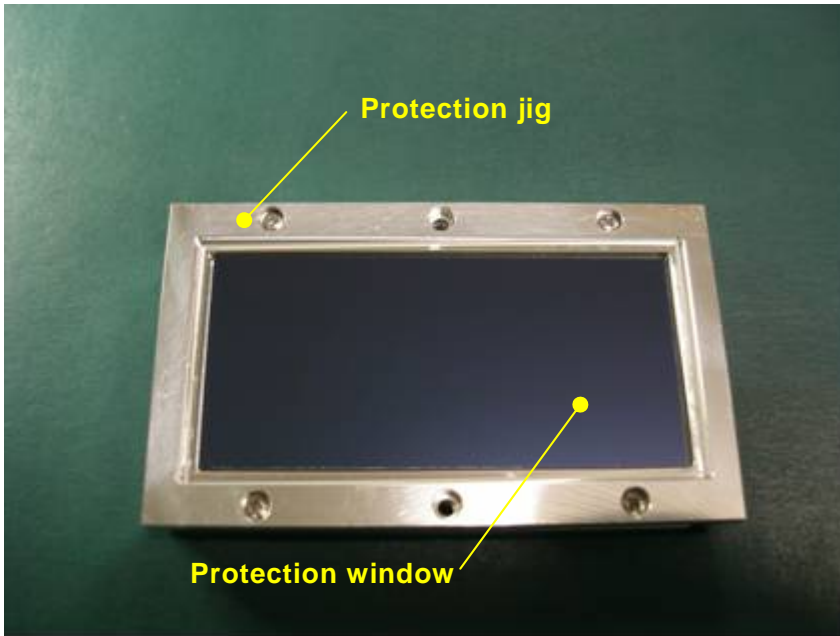
**6.2. Relation between the connector and signal node.**

Node	Connector No.	Node	Connector No.	Node	Connector No.
OS4	34	RG4	7	P4H4	61
OS3	36	VSS	6	P3VS	60
Th	10	VGR	14	P4H1	51
OS2	38	RG1	45	P3H1	20
OS1	41	P1H3	24	P2H4	55
GND4	35	RG3	30	P1VS	22
OD3	42	ISV	49	P2VS	54
OD2	43	RG2	47	P2H1	53
GND1	40	P1H2	15	SG4	26
RD4	5	SG3	56	P1H4	58
OG2	4	IG2V	62	TG	25
Th	2	IG1V	17	P1H1	57
OG3	13	SG2	48	SG1	21
RD1	11	P4H3	27	GND	63
OG4	9	P2H3	29		
RD2	3	P3VI	18		
RD3	1	P2H2	50		
OG1	44	P4H2	16		
OD4	8	P3H3	23		
GND3	37	P1VI	28		
VBB	46	P2VI	19		
GND2	39	P3H2	52		
OD1	12	P3H4	59		

Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**6. Protection cover when shipping.**



Type No. Back Illuminated FFT-CCD

Doc. No. K34-B72037

**Notice**

The customer is responsible for use of the device in accordance with HAMAMATSU's operating specifications and ratings.

The device described in these operating specifications should be used by persons who are accustomed to the properties of photoelectronics devices, and have expertise in handling and operating them. It should not be used by persons who are not experienced or trained in the necessary precautions surrounding their use.

The information in these operating specifications is subject to change without prior notice.

Information furnished by HAMAMATSU is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omissions.



