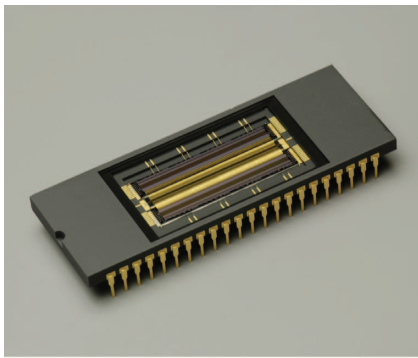


# InGaAs linear image sensors



G10768 series

## Near infrared image sensor (0.9 to 1.7 $\mu\text{m}$ ) with 1024 pixels and high-speed line rate

The G10768 series is a 1024-channel, high-speed infrared image sensor designed for applications such as foreign object screening and medical diagnostic equipment where a multichannel high-speed line rate is required. The signal processing circuit uses CTIA (capacitive transimpedance amplifiers) that allow signal readout while simultaneously integrating signals in all pixels via sample-and-hold circuits. A high-speed line rate is achieved through 8 output ports.

### Features

- 1024 pixels [pixel size: 25 × 100  $\mu\text{m}$  (G10768-1024D)  
25 × 25  $\mu\text{m}$  (G10768-1024DB)]
- High-speed line rate: 39000 lines/s max.
- High-speed data rate: 5 MHz typ. (6.67 MHz max.)
- Choice of 4 conversion efficiency levels
- Timing generator incorporated
- Low dark current
- Room temperature operation

### Applications

- Foreign object screening
- OCT (optical coherence tomography)
- Near infrared spectroscopy

### Related products (sold separately)

- InGaAs multichannel detector head C10854

### General ratings (Typ. Ta=25 °C)

Parameter	G10768-1024D	G10768-1024DB	Unit
Cooling	Non-cooled		-
Number of pixels	1024		pixels
Pixel pitch	25		$\mu\text{m}$
Pixel size (H × V)	25 × 100	25 × 25	$\mu\text{m}$
Spectral response range	0.9 to 1.7		$\mu\text{m}$
Defective pixel	Less than 1%		-

### Absolute maximum ratings

Parameter	Symbol	Value	Unit
Supply voltage	Vdd	-0.3 to +6.0	V
Clock pulse voltage	V $\phi$	-0.3 to +6.0	V
Reset pulse voltage	V(RESET)	-0.3 to +6.0	V
Gain selection terminal voltage	Vcfsel	-0.3 to +6.0	V
Operating temperature	Topr	-10 to +70	°C
Storage temperature	Tstg	-20 to +70	°C

Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

### Electrical characteristics (Ta=25 °C)

Parameter		Symbol	Min.	Typ.	Max.	Unit	
Supply voltage		Vdd	4.7	5.0	5.3	V	
Supply current		Ivdd	-	100	150	mA	
Sample and hold voltage 1		Vref1	-	2.5	-	V	
Sample and hold current 1		Iref1	-	-	1	mA	
Sample and hold voltage 2		Vref2	-	2.5	-	V	
Sample and hold current 2		Iref2	-	-	1	mA	
Output reset voltage		Vref3	-	2.5	-	V	
Output reset current		Iref3	-	-	1	mA	
Element bias	Supply voltage	INP	3.3	3.5	3.6	V	
	Supply current	-	-	-	1	mA	
Ground		Vss	-	0	-	V	
Clock frequency		-	0.5	5.0	6.67	MHz	
Clock pulse voltage	High	V $\phi$	4.7	5	5.3	V	
	Low		-	0	0.4	V	
Reset pulse voltage	High	V(RES)	4.7	5	5.3	V	
	Low		-	0	0.4	V	
Video output voltage	Vout+	High	Vout+(high)	-	4	-	V
		Low	Vout+(low)	-	2.5	-	
	Vout-	High	Vout-(high)	-	2.5	-	V
		Low	Vout-(low)	-	1	-	
Video data rate		fv	-	f	-	Hz	

### Specification (Ta=25 °C, fv=5MHz, Vdd=5 V, INP=3.5 V, Vref1=Vref2=Vref3=2.5 V, CE=1400 nV/e<sup>-</sup>, per 1 element)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Peak sensitivity wavelength	$\lambda_p$		-	1.55	-	$\mu\text{m}$
Saturation charge	Qsat	V $\phi$ =5 V	-	0.25	-	pC
Dark current	Id		-5	$\pm 1$	+5	pA
RMS noise voltage (readout noise)	N	Standard deviation Sample number 1000 Integration time 30 $\mu\text{s}$	-	2	6	mV rms
Saturation voltage amplitude	Vsat		-	2.5	-	V
Defective pixel *1	-	CE *2=1400 nV/e <sup>-</sup> (worst-case condition)	-	-	1	%

\*1: Pixels with dark current or RMS noise voltage higher than the maximum value.

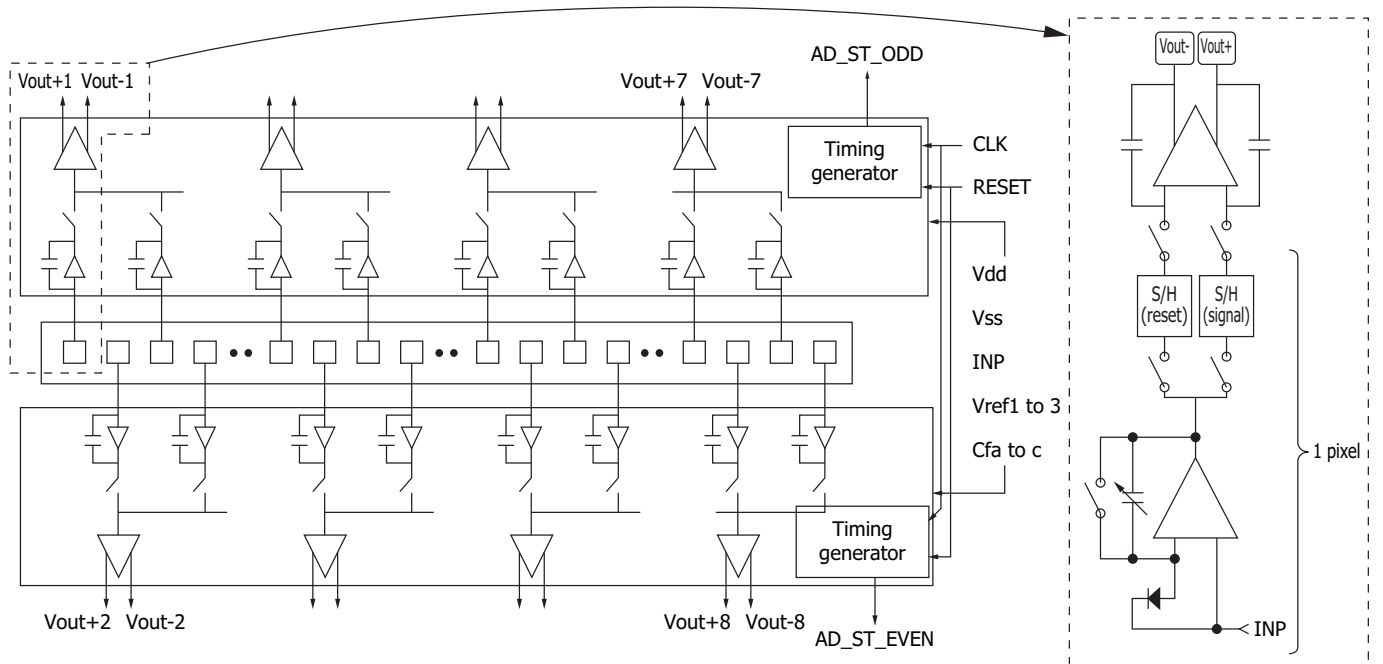
\*2: Conversion efficiency

### Selection logic of conversion efficiency

Parameter	Symbol	Typ.	Cfa	Cfb	Cfc
Conversion efficiency	CE	1400 nV/e <sup>-</sup>	H	L	L
		280 nV/e <sup>-</sup>	H	H	L
		70 nV/e <sup>-</sup>	H	L	H
		14 nV/e <sup>-</sup>	H	H	H

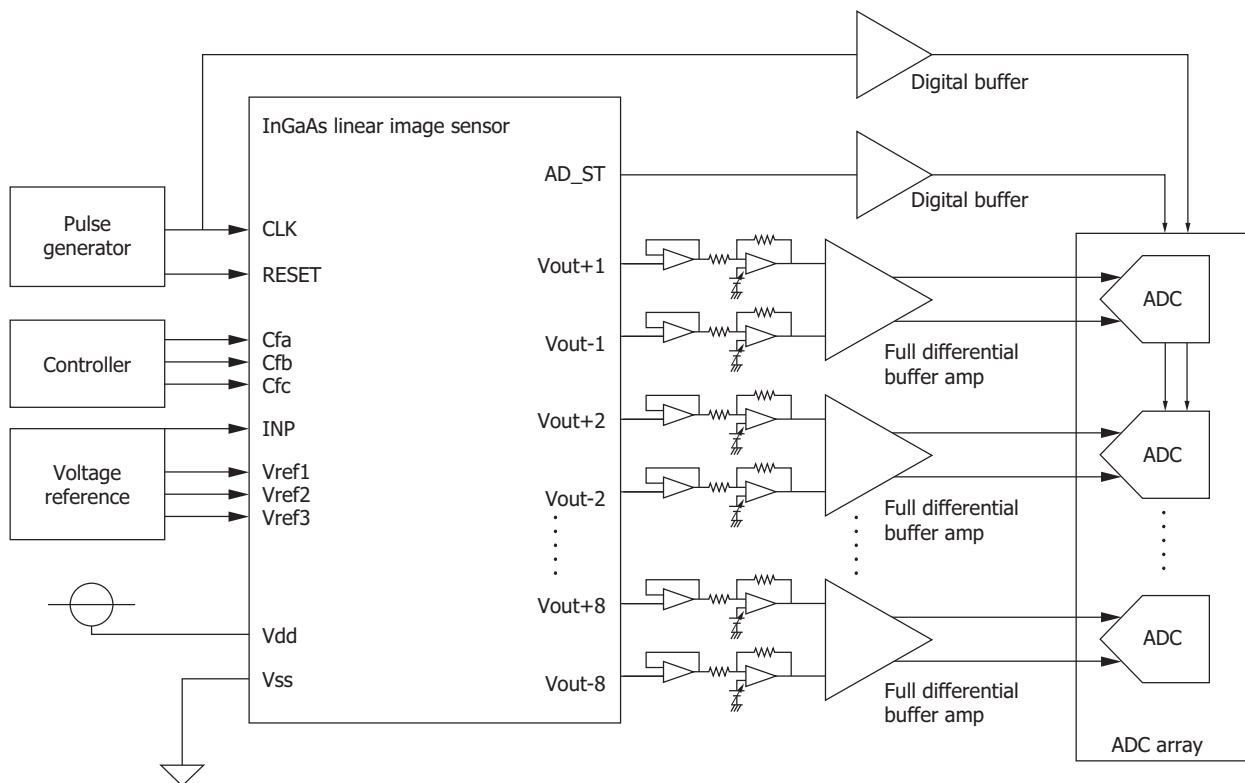
Note: L=0 V (Vss), H=5 V (Vdd)

**Equivalent circuit**



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**Connection example**

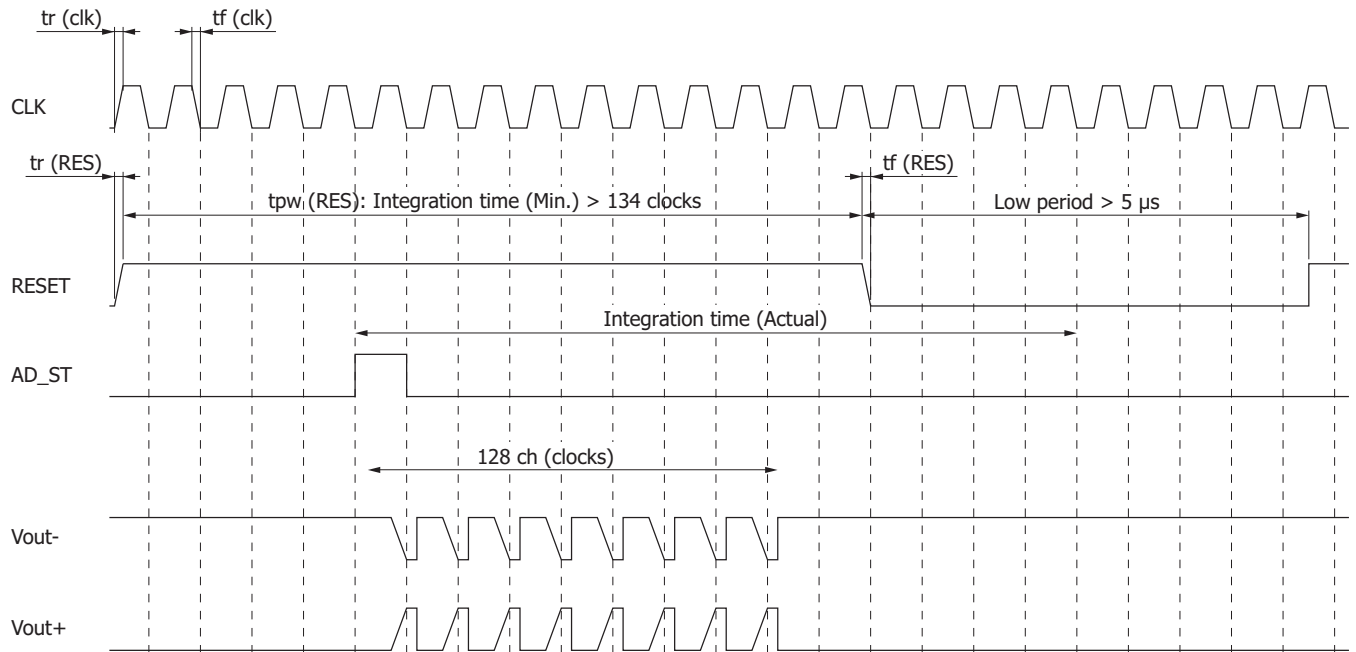


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**Notes:**

- Sensor video output is fully differential, so use fully differential buffers to receive the sensor output.
- To obtain the fastest line rate, the odd and even pixels should be operated simultaneously so that the 8-port output is read out in parallel.

**Timing chart**

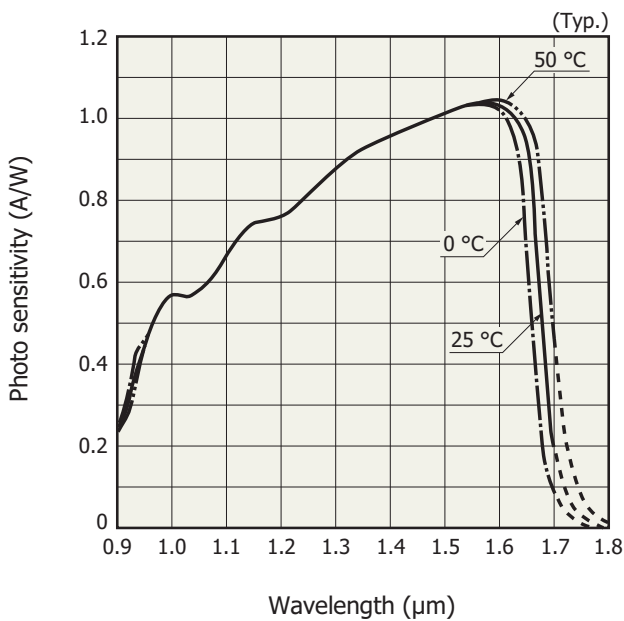


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Parameter	Symbol	Min.	Typ.	Max.	Unit	
Clock pulse width	$tpw\phi$	80	100	-	ns	
Clock pulse rise/fall times	$t_r(\text{clk}), t_f(\text{clk})$	0	20	30	ns	
Reset pulse width	High Low	$tpw(\text{RES})$	134	-	-	clocks
			$8 * 2$	-	-	
Reset pulse rise/fall times	$t_r(\text{RES}), t_f(\text{RES})$	0	20	30	ns	

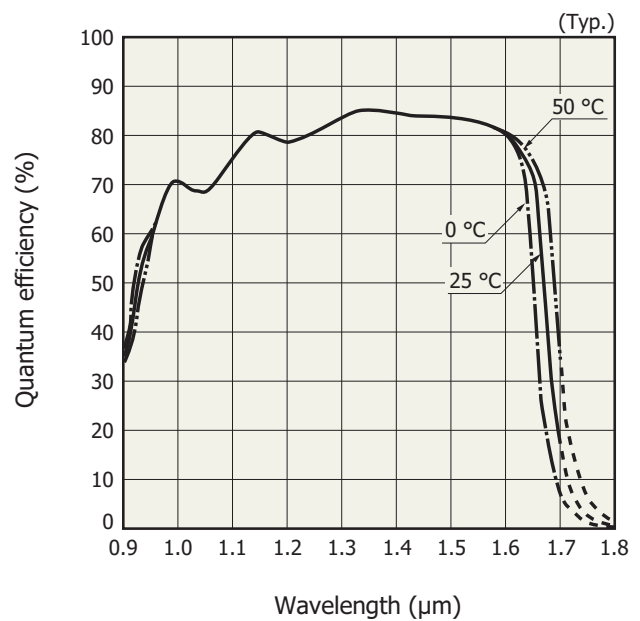
\*2: 5  $\mu\text{s}$  Min.

**Spectral response (photo sensitivity)**



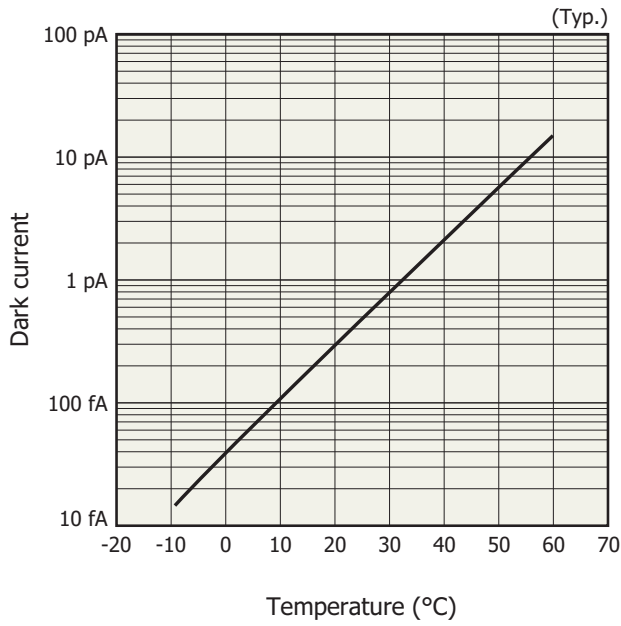
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**Spectral response (quantum efficiency)**



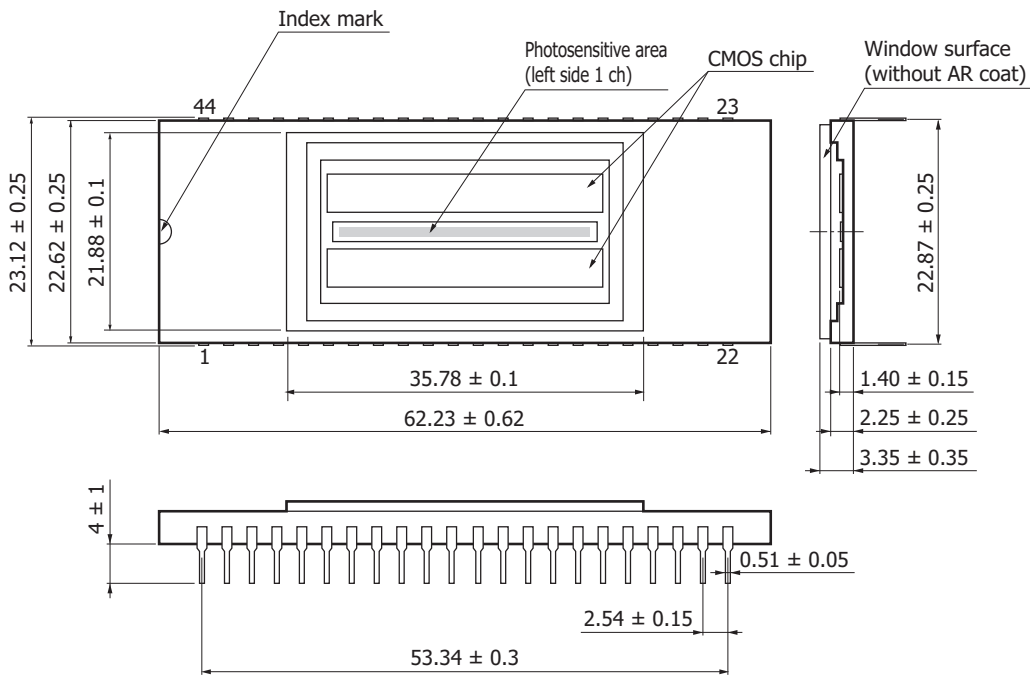
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**Dark current vs. temperature**



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**Dimensional outline (unit: mm)**



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## Pin connections

Pin no.	Pin connection	Input/output	Function and recommended connection
1	NC	-	No connection
2	Cfa	Input	Signal for selecting the conversion efficiency in the CMOS chip
3	Cfb		
4	Cfc		
5	RESET_EVEN	Input (CMOS logic)	Reset pulse for initializing the whole amplifier in CMOS chip. Integration time is determined by the high pulse period.
6	CLK_EVEN	Input (CMOS logic)	Clock pulse for operating timing generator in CMOS chip.
7	AD_ST_EVEN	Output	Digital start signal for A/D conversion
8	Vout-2	Output	Analog video signal (-)
9	Vout+2	Output	Analog video signal (+)
10	Vout-4	Output	Analog video signal (-)
11	Vout+4	Output	Analog video signal (+)
12	Vout-6	Output	Analog video signal (-)
13	Vout+6	Output	Analog video signal (+)
14	Vout-8	Output	Analog video signal (-)
15	Vout+8	Output	Analog video signal (+)
16	Vss	Input	Ground for the whole sensor
17	NC	-	No connection
18	NC	-	No connection
19	Vref3	Input	Supply voltage for operating the signal processing circuit in the CMOS chip
20	Vref2		
21	Vref1		
22	NC	-	No connection
23	INP	Input	Reset voltage for the charge amplifier array in the CMOS chip
24	NC	-	No connection
25	NC	-	No connection
26	NC	-	No connection
27	NC	-	No connection
28	NC	-	No connection
29	Vss	Input	Ground for the whole sensor
30	Vout+7	Output	Analog video signal (+)
31	Vout-7	Output	Analog video signal (-)
32	Vout+5	Output	Analog video signal (+)
33	Vout-5	Output	Analog video signal (-)
34	Vout+3	Output	Analog video signal (+)
35	Vout-3	Output	Analog video signal (-)
36	Vout+1	Output	Analog video signal (+)
37	Vout-1	Output	Analog video signal (-)
38	AD_ST_ODD	Output	Digital start signal for A/D conversion
39	CLK_ODD	Input (CMOS logic)	Clock pulse for operating timing generator in CMOS chip.
40	RESET_ODD	Input (CMOS logic)	Reset pulse for initializing the whole amplifier in CMOS chip. Integration time is determined by the high pulse period.
41	Vss	Input	Ground for the whole sensor
42	Vdd	Input	Supply voltage for operating the whole sensor circuit
43	NC	-	No connection
44	NC	-	No connection

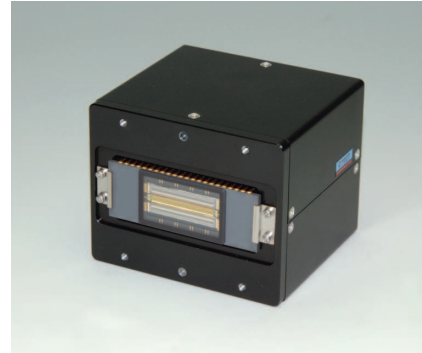
## Multichannel detector head C10854 (sold separately)

The C10854 is a multichannel detector head suitable for applications where high-speed infrared imaging is required, such as sorting machines and SD-OCT (spectral domain-optical coherence tomography). The Hamamatsu G10768 series InGaAs near-infrared linear image sensor (sold separately) can be easily installed in the C10854.

This C10854 comes with application software (Dcam-CL) that runs on Windows 7 (32-bit, 64-bit). It can be used to control the C10854 from the PC. The application software also includes a function library exclusively for the C10854, allowing you to develop your own software more efficiently.

## Features

- High-speed operation: 5 MHz
- Line rate: 31.25 kHz
- 1024 pixels (128 pixels × 8 ports)
- CameraLink



## Electrostatic countermeasures

This device has a built-in protection circuit against static electrical charges. However, to prevent destroying the device with electrostatic charges, take countermeasures such as grounding yourself, the workbench and tools to prevent static discharges. Also protect this device from surge voltages which might be caused by peripheral equipment.

## Related information

[www.hamamatsu.com/sp/ssd/doc\\_en.html](http://www.hamamatsu.com/sp/ssd/doc_en.html)

- Precautions
  - Disclaimer
  - Image sensors

Information described in this material is current as of July, 2015.

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