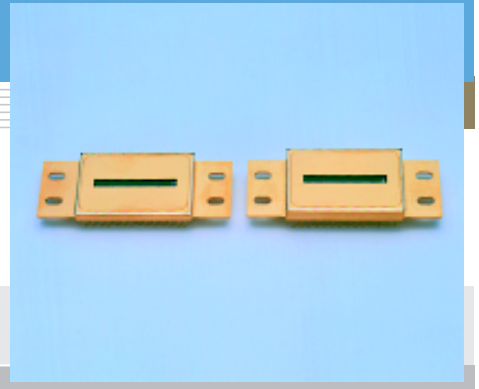


InGaAs linear image sensor G8050 to G8053 series

Image sensor for DWDM wavelength monitor



G8050 to G8053 series InGaAs linear image sensors are specifically designed as detectors for monitoring WDM in optical communications. These linear image sensors consist of an InGaAs photodiode array with each pixel connected to a charge amplifier array comprised of CMOS transistors, a CDS circuit, an offset compensation circuit, a shift register and a timing generator. These sensors deliver high sensitivity and stable operation in the near infrared spectral range. The package is hermetically sealed for high reliability and the window has an anti-reflective coating for efficient light detection.

Signal processing circuits on the CMOS chip allow selecting a feedback capacitance (Cf) of 10 pF or 0.5 pF by supplying an external voltage. The image sensor operates over a wide dynamic range when Cf=10 pF and delivers high gain when Cf=0.5 pF.

Features

- Wide dynamic range
- Low noise and low dark current
- Selectable gain
- Anti-saturation circuit
- CDS circuit *1
- Offset compensation circuit
- Simple operation (by built-in timing generator) *2
- High resolution: 25 μm pitch (512 ch)
- Low cross-talk
- 256 ch: 1 video line
512 ch: 2 video lines

Applications

- DWDM wavelength monitor
- Optical spectrum analyzer

■ Selection guide

Type No.	Cooling	Number of pixels	Pixel pitch (μm)	Pixel size [μm (H) × μm (V)]	Spectral response range (μm)	Defective pixel
G8050-256R	Non-cooled	256	50	50 × 250	0.9 to 1.7 (25 °C)	0
G8050-256S	One-stage TE-cooled				0.9 to 1.67 (-10 °C)	
G8051-512R	Non-cooled	512	25	25 × 250	0.9 to 1.7 (25 °C)	
G8051-512S	One-stage TE-cooled				0.9 to 1.67 (-10 °C)	
G8052-256D ^{*3}	Non-cooled	256	50	50 × 500	0.9 to 1.7 (25 °C)	
G8052-256R					0.9 to 1.67 (-10 °C)	
G8052-256S	One-stage TE-cooled	512	25	25 × 500	0.9 to 1.67 (-10 °C)	
G8053-512D ^{*3}	Non-cooled				0.9 to 1.7 (25 °C)	
G8053-512R					0.9 to 1.7 (25 °C)	
G8053-512S	One-stage TE-cooled				0.9 to 1.67 (-10 °C)	

*1: CDS (Correlated Double Sampling) circuit

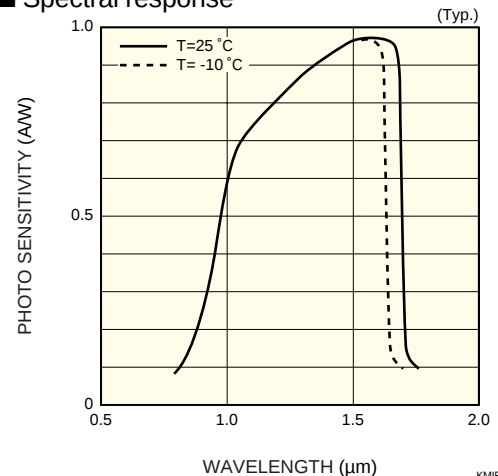
A major source of noise in charge amplifiers is the reset noise generated when the integration capacitance is reset. A CDS circuit greatly reduces this reset noise by holding the signal immediately after reset to find the noise differential.

*2: Timing generator

Different signal timings must be properly set in order to operate a shift register. In conventional image sensor operation, external PLDs (Programmable Logic Devices) are used to input the required timing signals. However, G8050 to G8053 series image sensors internally generate all timing signals on the CMOS chip just by supplying CLK and RESET pulses. This makes it simple to set the timings.

*3: For G8052-256D and G8053-512D specifications, see the separate data sheets available from Hamamatsu.

■ Spectral response



KMIR80011EA

SOLID STATE DIVISION

■ Absolute maximum ratings

Parameter	Symbol	Value	Unit
Clock pulse voltage	V_{ϕ}	5.5	V
Operating temperature ^{*1}	T_{opr}	-40 to +70	°C
Storage temperature ^{*1}	T_{stg}	-40 to +85	°C

*1: Non condensation

■ Electrical characteristics (Ta=25 °C, V_{ϕ} =5 V)

Parameter		Symbol	Min.	Typ.	Max.	Unit
Supply voltage		Vdd	4.9	5.0	5.1	V
		Vref	-	1.26	-	
Ground		Vss	-	0	-	V
Element bias		INP	3.5	4.5	4.6	V
Clock frequency		f	0.1	-	4	MHz
Clock pulse voltage	high	Vφ	Vφ - 0.5	Vφ	Vφ + 0.5	V
	low		0	0	0.4	V
Clock pulse rise/fall times		tr φ	0	20	100	ns
		tf φ				
Clock pulse width		tpw φ	200	-	-	ns
Reset pulse voltage	high	V (RES)	Vφ - 0.5	Vφ	Vφ + 0.5	V
	low		0	0	0.4	V
Reset pulse rise/fall times		tr (RES)	0	20	100	ns
		tf (RES)				
Reset pulse width		tpw (RES)	6000	-	-	ns
Video output voltage	high	VH	-	4.4	INP	V
	low	VL	Vref	1.26	-	
Data rate		fv	-	f/8	-	Hz

■ Electrical and optical characteristics

General ratings (T=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Peak sensitivity wavelength	λ_p	-	1.55	-	μm
Saturation charge ^{*2}	Q _{sat}	-	30	-	pC
Photo response non-uniformity ^{*3}	PRNU	-	-	±5	%

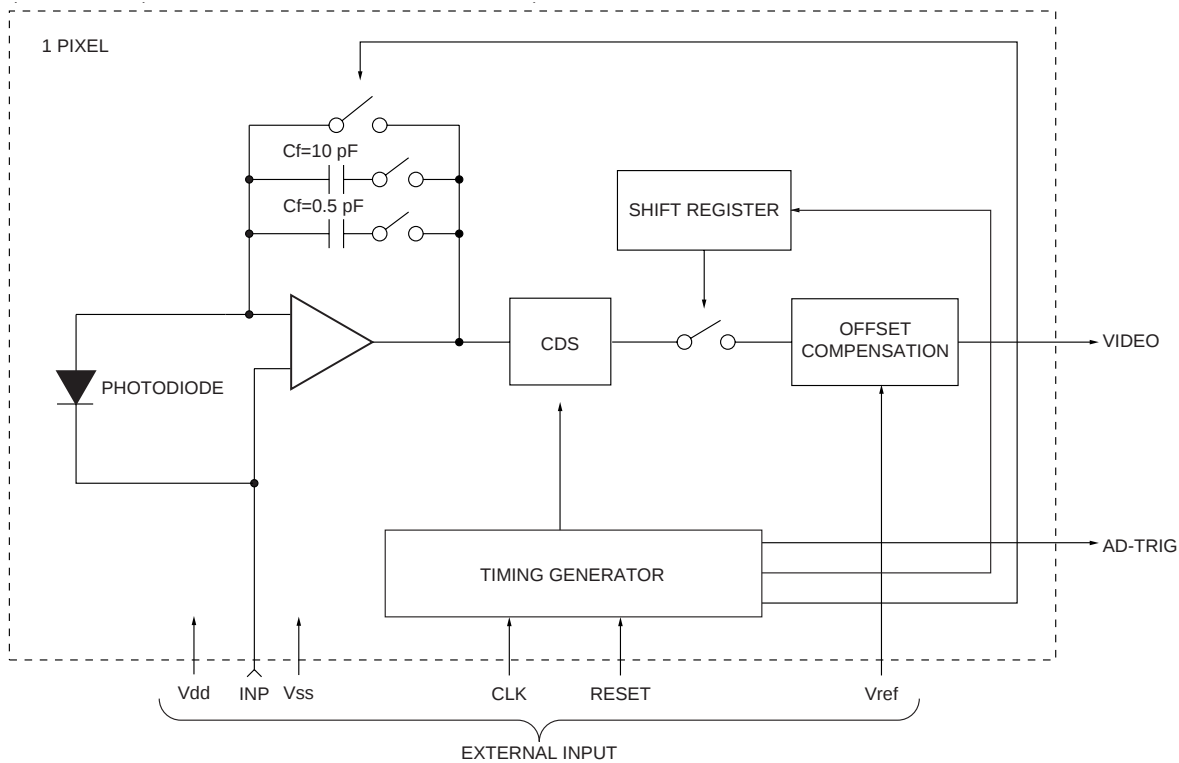
*2: V_{ϕ} =5 V, Cf=10 pF

*3: 50 % of saturation, 10 ms integration time, after dark output subtraction, excluding first and last pixels.

Dark current characteristics (T=25 °C)

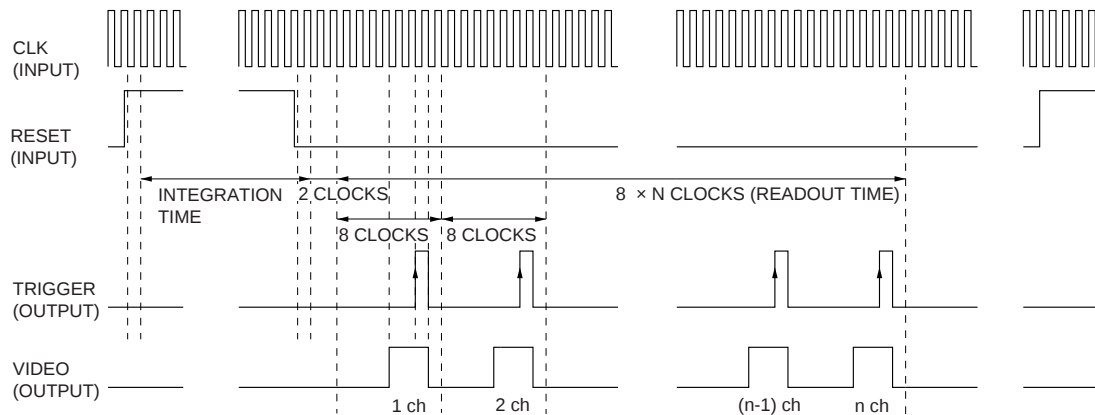
Parameter	Symbol	Min.	Typ.	Max.	Unit
G8050 series	I _D	-	2	20	pA
G8051 series		-	1.5	15	
G8052 series		-	4	40	
G8053 series		-	6	60	

■ Equivalent circuit



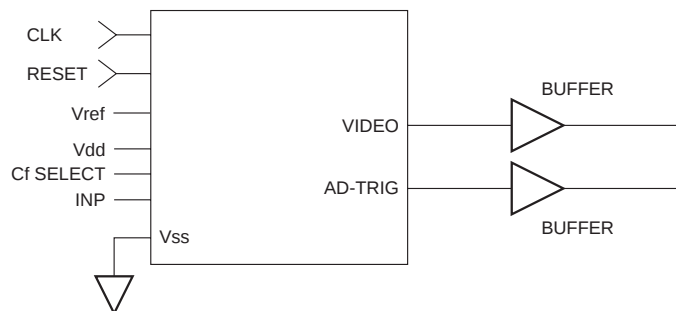
■ Timing chart

KMIRC0010EB



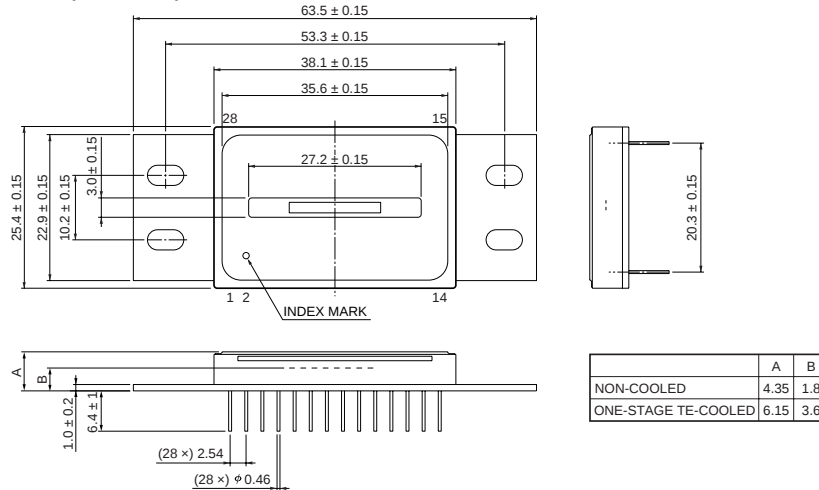
■ Basic circuit connection

KMIRC0011EA



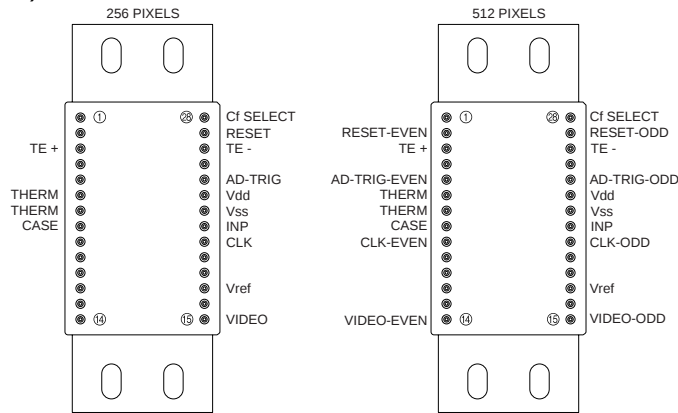
KMIRC0012EA

Dimensional outline (unit: mm)



KMIRA0010EA

Pin connection (top view)



KMIRC0013EA

Terminal name	Input/Output	Function and recommended connection
CLK	Input (CMOS logic compatible)	Clock pulse for operating the CMOS shift register
RESET	Input (CMOS logic compatible)	Reset pulse for initializing the feedback capacitance in the charge amplifier formed on the CMOS chip. The width of the reset pulse is integration time.
Vdd	Input	Supply voltage for operating the signal processing circuit on the CMOS chip.
Vss	-	Ground for the signal processing circuit on the CMOS chip.
INP	Input	Reset voltage for the charge amplifier array on the CMOS chip.
Cf SELECT	Input	Voltage that determines the feedback capacitance (Cf) on the CMOS chip. Cf=10 pF at 0 V, and Cf=0.5 pF at 5 V.
CASE	-	This terminal is electrically connected to the package.
THERM	-	Thermistor for monitoring temperature inside the package. No connection for room temperature operation type.
TE+, TE-	-	Power supply terminal for the thermoelectric cooler that cools the photodiode array. No connection for room temperature operation type.
AD-TRIG	Output	Digital signal for AD conversion; positive polarity
VIDEO	Output	Analog video signal; positive polarity
Vref	Input	Reset voltage for the offset compensation circuit on the CMOS chip

HAMAMATSU

Information furnished by HAMAMATSU is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omissions. Specifications are subject to change without notice. No patent rights are granted to any of the circuits described herein. ©2002 Hamamatsu Photonics K.K.

HAMAMATSU PHOTONICS K.K., Solid State Division

1126-1 Ichino-cho, Hamamatsu City, 435-8558 Japan, Telephone: (81) 053-434-3311, Fax: (81) 053-434-5184, <http://www.hamamatsu.com>

U.S.A.: Hamamatsu Corporation: 360 Foothill Road, P.O.Box 6910, Bridgewater, N.J. 08807-0910, U.S.A., Telephone: (1) 908-231-0960, Fax: (1) 908-231-1218

Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49) 08152-3750, Fax: (49) 08152-2658

France: Hamamatsu Photonics France S.A.R.L.: 8, Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: 33-(1) 69 53 71 00, Fax: 33-(1) 69 53 71 10

United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, United Kingdom, Telephone: (44) 1707-294888, Fax: (44) 1707-325777

North Europe: Hamamatsu Photonics Norden AB: Smidesvägen 12, SE-171 41 Solna, Sweden, Telephone: (46) 8-509-031-00, Fax: (46) 8-509-031-01

Italy: Hamamatsu Photonics Italia S.R.L.: Strada della Moia, 1/E, 20020 Arese, (Milano), Italy, Telephone: (39) 02-935-81-733, Fax: (39) 02-935-81-741

Cat. No. KMIR1009E04
Feb. 2002 DN