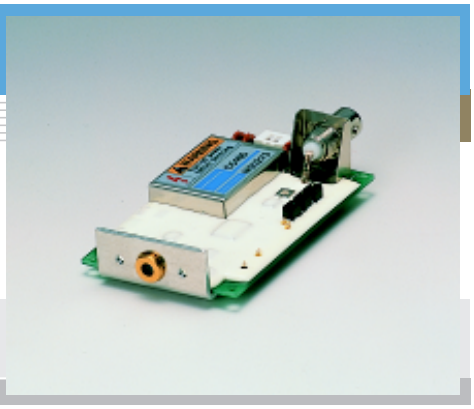
APD module
C5460 series

APD module integrated with peripheral circuits



Features

- Uses high sensitivity APD
  Two types of APDs with different active areas (ϕ1.5 mm, ϕ3.0 mm) are provided.
- On-board high sensitivity circuit optimized for APD evaluation
  An APD and a low-noise current-to-voltage amplifier circuit are mounted on a compact PC board. The current-to-voltage amplifier circuit features a low-noise configuration allowing low-light-level detection.
- Detects optical signals from fixed light (DC light)
  C5460 detects optical signals from fixed light (DC light) to 10 MHz pulsed light making it well suited for bar code readers and film scanners. C5460-01 covers a narrower bandwidth from fixed light (DC light) to 100 kHz pulsed light, but provides an excellent NEP of 20 fW/Hz$^{1/2}$ in the room temperature, making it suitable for fluorescence measurement and particle counters where low-light-level detection is essential.
- Built-in temperature-compensated bias power supply
  The bias power supply is controlled with a thermosensor to keep the APD gain constant. Gain variations are typically held within ±2.5 % at an ambient temperature of 25 ±10 ˚C. Ripple noise usually inherent to high-voltage power supplies is also minimized.
- Compact and lightweight
  The board is no larger than a typical business card.
- Low price
- Custom models with different dimensions and specifications are available

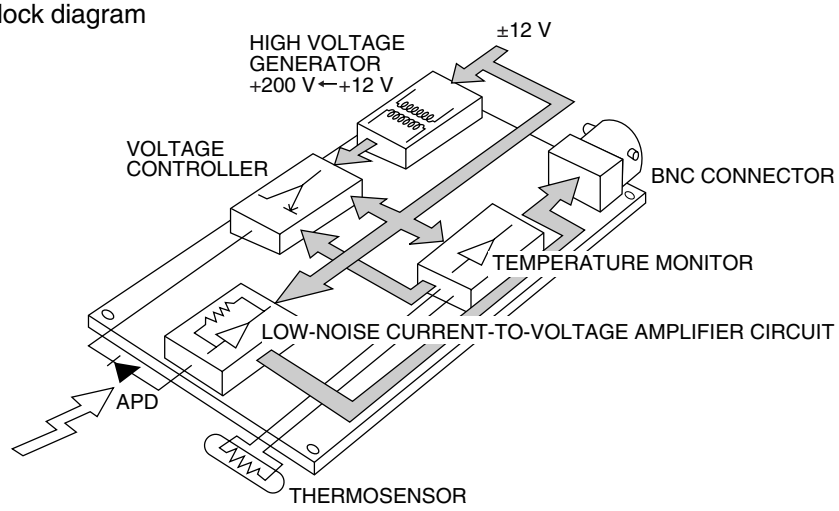
Applications

- Evaluation of APD
- Fluorescence measurement
- Bar code readers
- Particle counters
- Film scanners

■ Selection guide

Parameter	C5460	C5460-01	Unit
Active area	ϕ1.5	ϕ3.0	mm
Photo sensitivity	1.5 × 10^6	-1.5 × 10^8	V/W
Frequency bandwidth	DC to 10 M	DC to 100 k	Hz

■ Block diagram



KACCC0028EA

SOLID STATE DIVISION

HAMAMATSU

■ General ratings

Parameter	Symbol	Condition	C5460			C5460-01			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Power supply	Vs	+12 V	+11.4	+12	+12.6	+11.4	+12	+12.6	V
		-12 V	-11.4	-12	-12.6	-11.4	-12	-12.6	V
Current dissipation	-	+12 V	-	+30	+45	-	+35	+45	mA
		-12 V	-	-11	-16	-	-11	-16	mA
Board dimensions	-		80 × 50 × 23			80 × 50 × 23			mm
Weight	-		52			52			g

■ Absolute maximum ratings (Ta=25 °C)

Parameter	Symbol	Value	Unit
Positive supply voltage	Vp	+16	V
Negative supply voltage	Vn	-16	V
Operating temperature	Topr	0 to +60	°C
Storage temperature	Tstg	-30 to +70	°C

■ Specification (Typ. Ta=25 °C, Vcc=±12 V, unless otherwise noted)

Photoelectric section (Si APD)

Parameter	Symbol	Condition	C5460	C5460-01	Unit
Active area	A		ϕ1.5	ϕ3.0	mm
Spectral response range	λ		400 to 1000		nm
Peak sensitivity wavelength	λp		800		nm
Photo sensitivity	S	λ=800 nm, Gain=1	0.5		A/W
Temperature stability of gain *	-	25 ± 10 °C, Gain=30	±2.5 Typ., ±5 Max.		%

High-speed amplifier section (C5460)

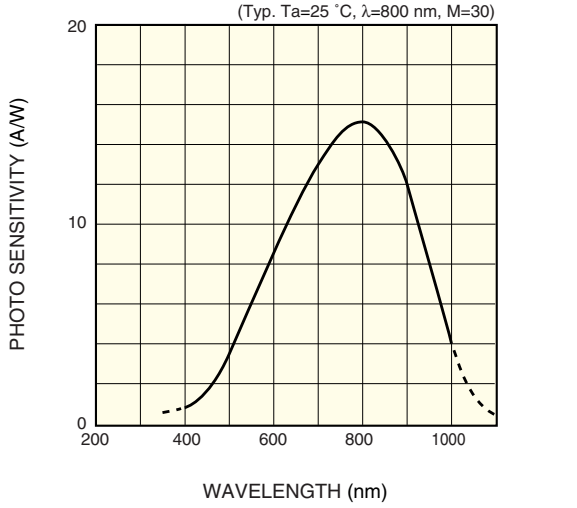
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Cut-off frequency	fc	High band, -3 dB	9	10	-	MHz
		Low band, -3 dB	-	DC	-	-
Noise equivalent power	NEP	f=10 MHz λ=800 nm	-	0.2	0.4	$pW/Hz^{1/2}$
Feedback resistance	-		-	10	-	kΩ
Photoelectric sensitivity *	-	APD include, λ=800 nm Gain=30	1.4×10^6	1.5×10^6	1.6×10^6	V/W
Maximum input light level	-		5.0	6.0	-	μW
Minimum detection limit	-		-	0.8	1.6	nWr.m.s.

High-speed amplifier section (C5460-01)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Cut-off frequency	fc	High band, -3 dB	80	100	-	kHz
		Low band, -3 dB	-	DC	-	-
Noise equivalent power	NEP	f=100 kHz λ=800 nm	-	0.02	0.04	$pW/Hz^{1/2}$
Feedback resistance	-		-	10	-	MΩ
Photoelectric sensitivity *	-	APD include, λ=800 nm Gain =30	-1.4×10^8	-1.5×10^8	-1.6×10^8	V/W
Maximum input light level	-		0.05	0.06	-	μW
Minimum detection limit	-		-	0.005	0.01	nWr.m.s.

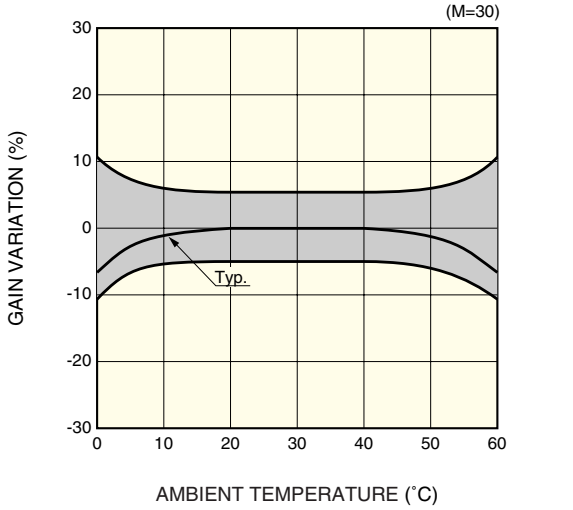
* Gain is set to 30 at the factory prior to shipping.

■ Spectral response



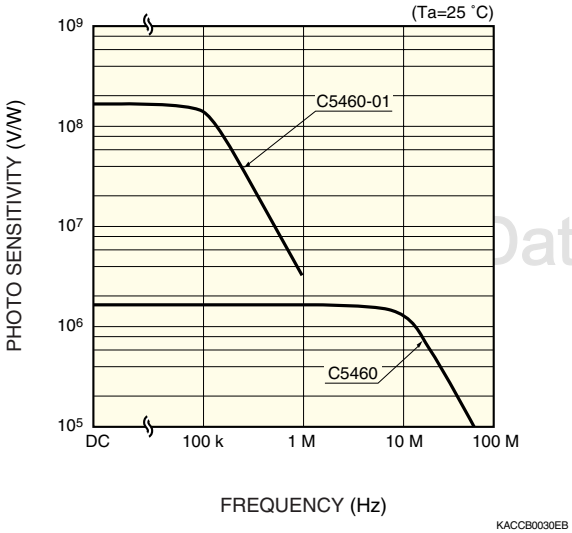
KACCB0013EA

■ Gain temperature characteristic



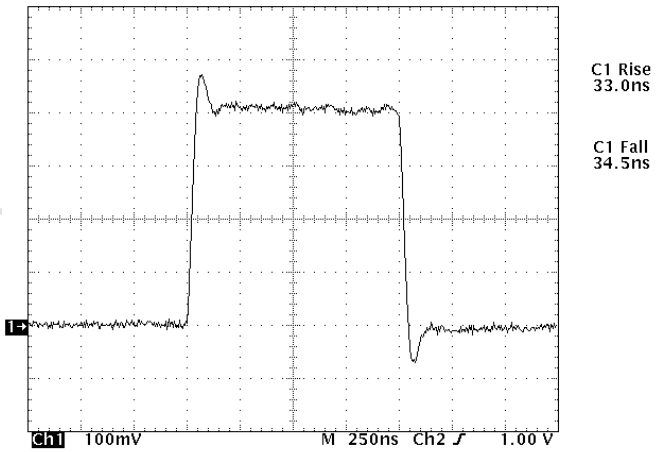
KACCB0020EB

■ Frequency response



KACCB0030EB

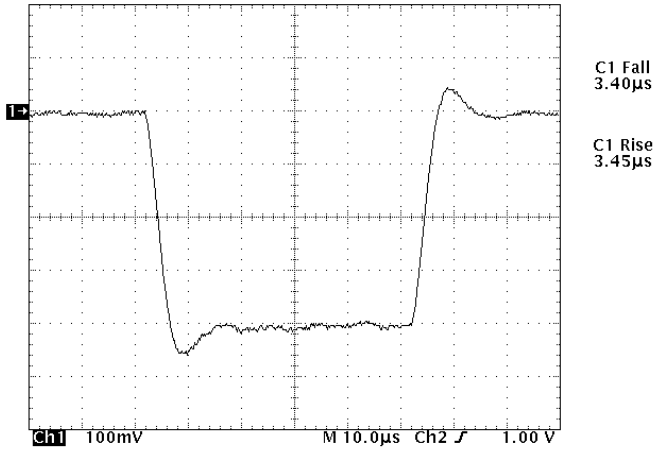
■ Response to stepped light (C5460)



Ta=25 °C, gain M=30, input pulse width=1 µs
X-axis: 250 ns/div., Y-axis: 100 mV/div.

KACCC0128EA

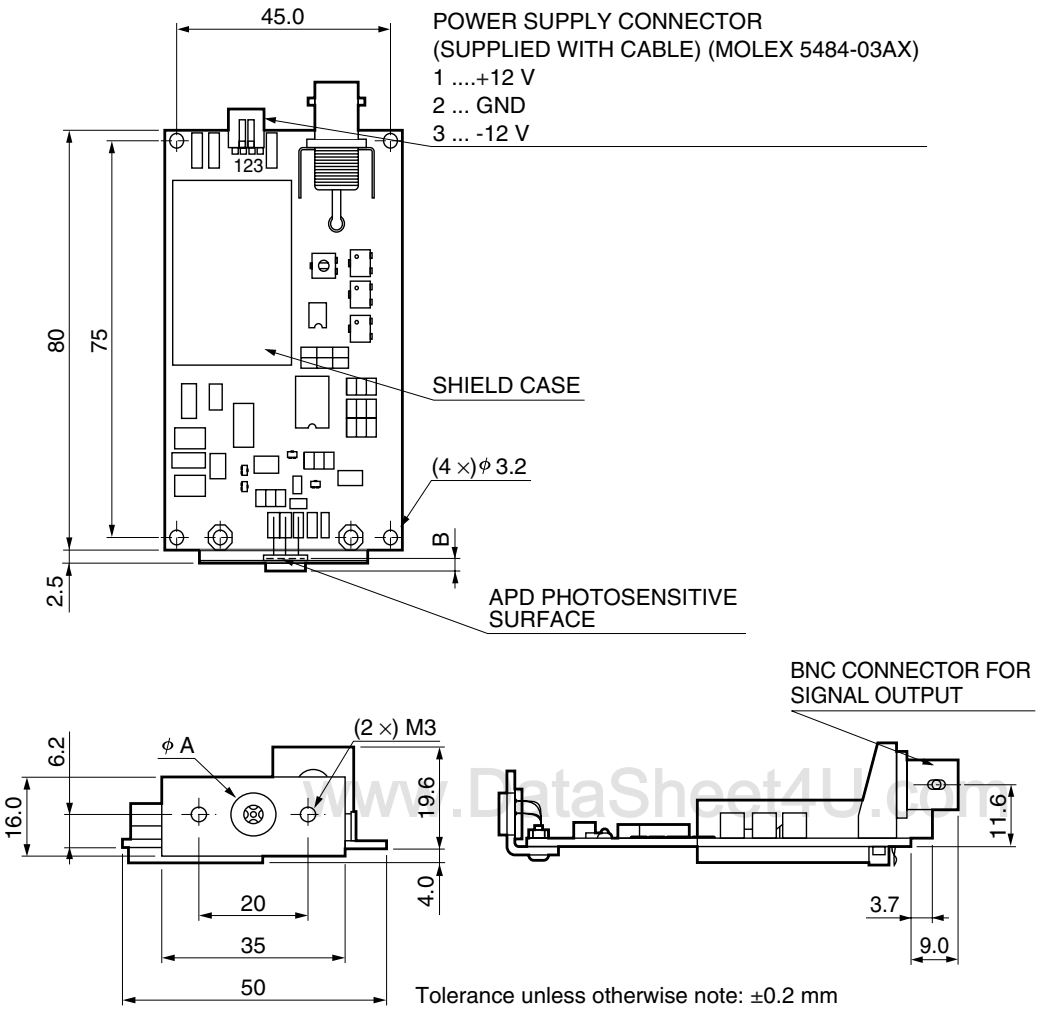
■ Response to stepped light (C5460-01)



Ta=25 °C, gain M=30, input pulse width=50 µs
X-axis: 10 µs/div., Y-axis: 100 mV/div.

KACCC0129EA

■ Dimensional outline (unit: mm)



TYPE No.	A	B
C5460	8.2 ± 0.2	2.0 ± 0.2
C5460-01	8.1 ± 0.1	1.4 ± 0.2

KACCA0019EB

■ Attachment adapters for FC and SMA connectors

APD module	FC adapter	SMA adapter
C5460	A8407-05	A8424-05
C5460-01	A8407-05A	A8424-05A

(1) This product incorporates a high-voltage power supply. To prevent electrical hazards, do not remove the mold material.

(2) Do not terminate the output with a 50 Ω load, because this will cause oscillations.

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. KACC1010E04
Jun. 2001 DN