



### APD module integrated with peripheral circuits

#### Features

- **Uses a high sensitivity APD**  
Two types of APDs with different photosensitive areas ( $\phi 1.5$  mm,  $\phi 3.0$  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)**  
The C12703 detects optical signals from fixed light (DC light) to 10 MHz pulsed light making it well suited for bar code readers and film scanners. The C12703-01 covers a narrower bandwidth from fixed light (DC light) to 100 kHz pulsed light, but provides an excellent NEP of  $20 \text{ fW/Hz}^{1/2}$ , 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  $\pm 2.5\%$  at an ambient temperature of  $25 \pm 10$  °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 designed module with different dimensions and specifications are available.**

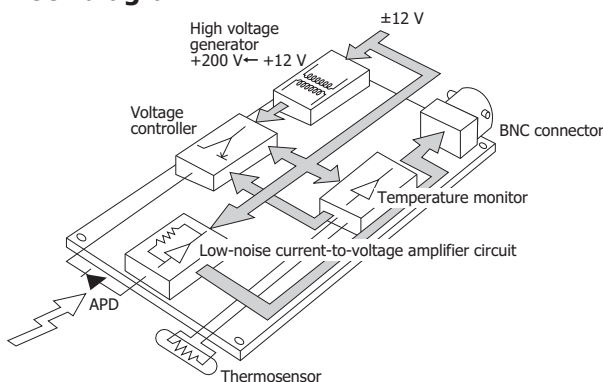
#### Applications

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

#### Selection guide

Type no.	Photosensitive area (mm)	Photosensitivity (V/W)	Frequency bandwidth (Hz)
C12703	$\phi 1.5$	$1.5 \times 10^6$	DC to 10 M
C12703-01	$\phi 3.0$	$-1.5 \times 10^8$	DC to 100 k

#### Block diagram



**Structure / Absolute maximum ratings (Ta=25 °C)**

Type no.	Condition	Power supply Vs (V)						Current dissipation ±12 V (mA)			Board dimensions (mm)	Weight (g)	Absolute maximum ratings				
		Min.			Typ.			Max.					Positive supply voltage Vp (V)	Negative supply voltage Vn (V)	Maximum incident light level (mW)	Operating temperature Topr (°C)	Storage temperature Tstg (°C)
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.							
C12703	+12 V	+11.4	+12	+12.6	-	+30	+45	80 × 50 × 22	38	+16	-16	10	0 to +60	-20 to +70			
	-12 V	-11.4	-12	-12.6	-	-11	-16										
C12703-01	+12 V	+11.4	+12	+12.6	-	+35	+45	80 × 50 × 22	38	+16	-16	10	0 to +60	-20 to +70			
	-12 V	-11.4	-12	-12.6	-	-11	-16										

**Electrical and optical characteristics (Typ. Ta=25 °C, Vcc=± 12 V, unless otherwise noted)**

■ Photoelectric section (APD)

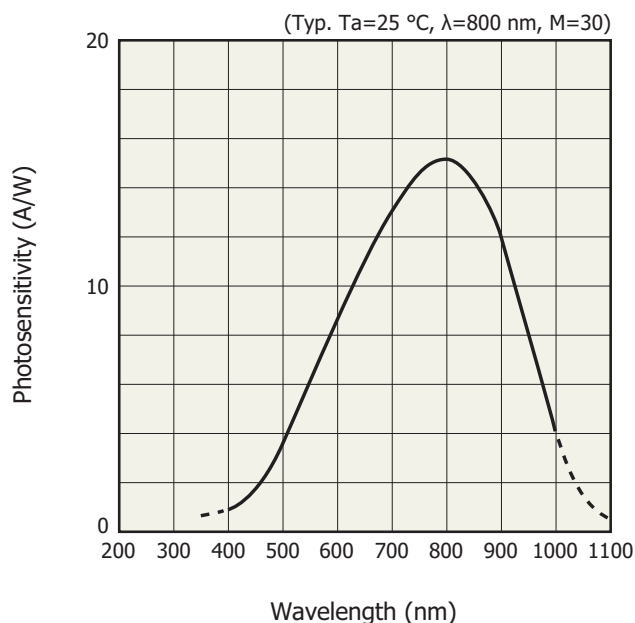
Type no.	Spectral response range λ (nm)	Peak sensitivity wavelength λp (nm)	Photosensitivity S λ=800 nm, Gain(M)=1 (A/W)	Temperature stability of gain*1 25 °C ± 10 °C, M=30 (%)	
				Typ.	Max.
C12703	400 to 1000	800	0.5	±2.5	±5
C12703-01				±2.5	±5

■ High-speed amplifier section

Type no.	Cutoff frequency fc -3 dB (Hz)						Noise equivalent power NEP f=10 MHz (C12703) f=100 kHz (C12703-01) λ=800 nm (pW/Hz <sup>1/2</sup> )F			Feed-back resistance (Ω)	Photoelectric sensitivity*1 Including APD λ=800 nm M=30 (V/W)			Maximum input light level (μW)			Minimum detection limit (nW rms)		
	High band			Low band			Min.	Typ.	Max.		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
	Min.	Typ.	Max.	Min.	Typ.	Max.													
C12703	9 M	10 M	-	-	DC	-	-	0.2	0.4	10 k	1.4 × 10 <sup>6</sup>	1.5 × 10 <sup>6</sup>	1.6 × 10 <sup>6</sup>	5.0	6.0	-	-	0.63	1.26
C12703-01	80 k	100 k	-	-	DC	-	-	0.02	0.04	10 M	-1.4 × 10 <sup>8</sup>	-1.5 × 10 <sup>8</sup>	-1.6 × 10 <sup>8</sup>	0.05	0.06	-	-	0.0063	0.013

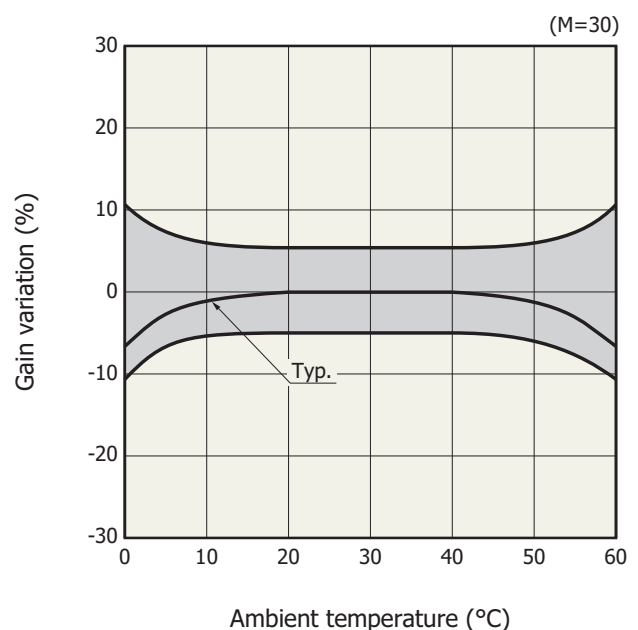
\*1: Gain is set to 30 at the factory prior to shipping.

**Spectral response**



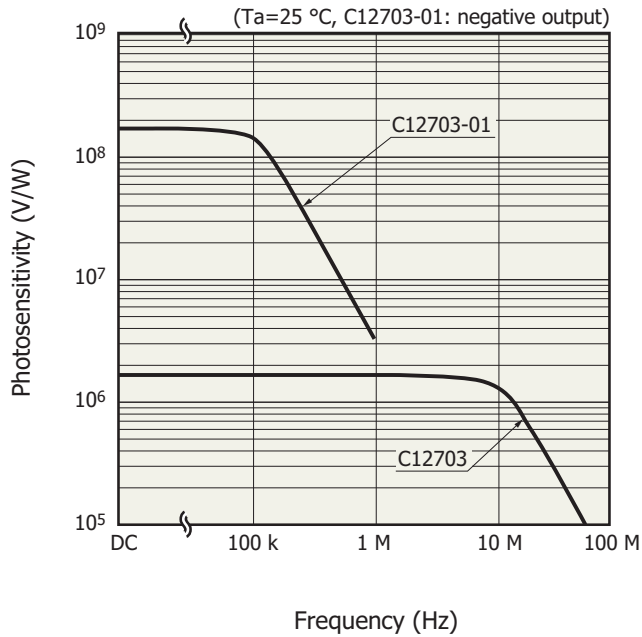
KACCB0013EA

**Gain temperature characteristics**



KACCB0020EB

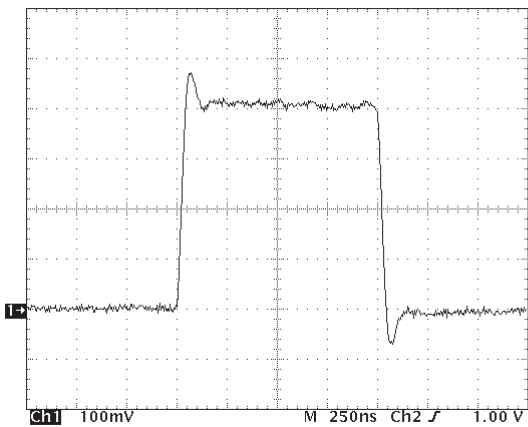
**Frequency response**



KACCB0339EA

**Response to stepped light input**

C12703

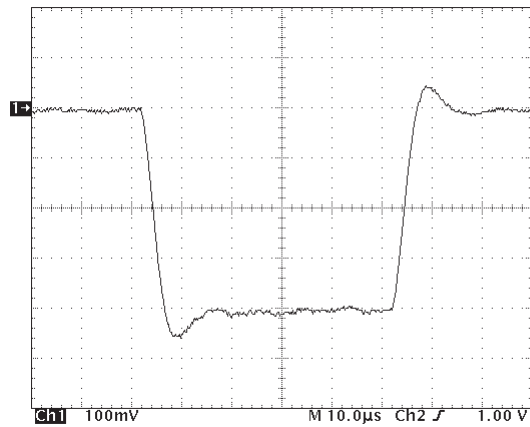


C1 Rise  
33.0ns

C1 Fall  
34.5ns

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

C12703-01

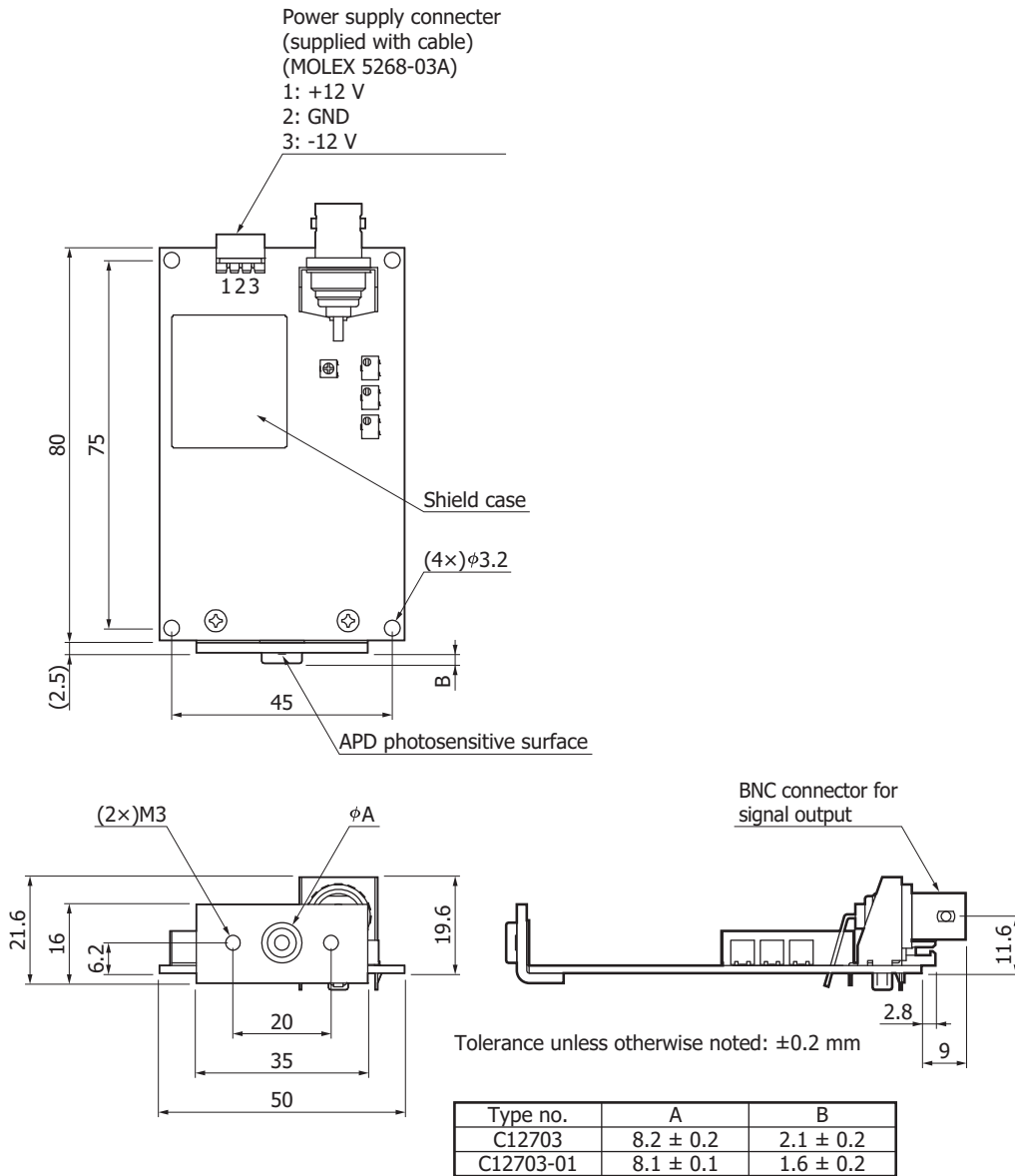


C1 Fall  
3.40μs

C1 Rise  
3.45μs

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

**Dimensional outline (unit: mm)**



KACCA0323EB

**Accessories**

- Power supply cable
- CD-ROM (Instruction manual)

### Option (sold separately)

#### Fiber adapter A8407/A8424 series

The A8407/A8424 series fiber adapters are designed to couple the APD module to an optical fiber. Two types are available for FC and SMA connectors. Using this adapter allows efficiently coupling the APD module to a GI-50/125 multi-mode fiber. This adapter screws on for easy attachment.

Note: Optical fiber is needed separately.



A8407 series (FC type)



A8424 series (SMA type)

APD module	Fiber adapter (FC type)	Fiber adapter (SMA type)
C12703	A8407-05	A8424-05
C12703-01	A8407-05A	A8424-05A

### Precaution

- (1) This product incorporates a high-voltage power supply. To prevent electrical hazards, do not remove the mold material.
- (2) Recommended termination resistance for this module is from 10 k $\Omega$  to 1 M $\Omega$ .  
Terminating with a low-resistance resistor such as 50  $\Omega$  affects the output drive capacity, and may cause poor linearity.

### Related information

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

- Precautions
- Disclaimer

Information described in this material is current as of September 2017.

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