



### 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 fW/Hz<sup>1/2</sup>, 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.**

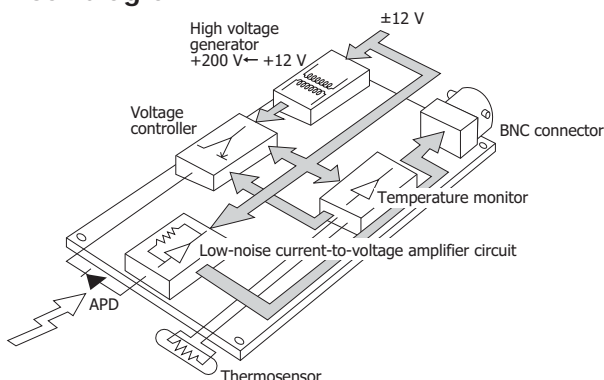
#### Applications

- 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.  | 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) |
|           |           |                     |      |       |                                |      |      |                       |            |                                |                                |                                   |                                 |                               |
| 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  |                       |            |                                |                                |                                   |                                 |                               |
|           | -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)

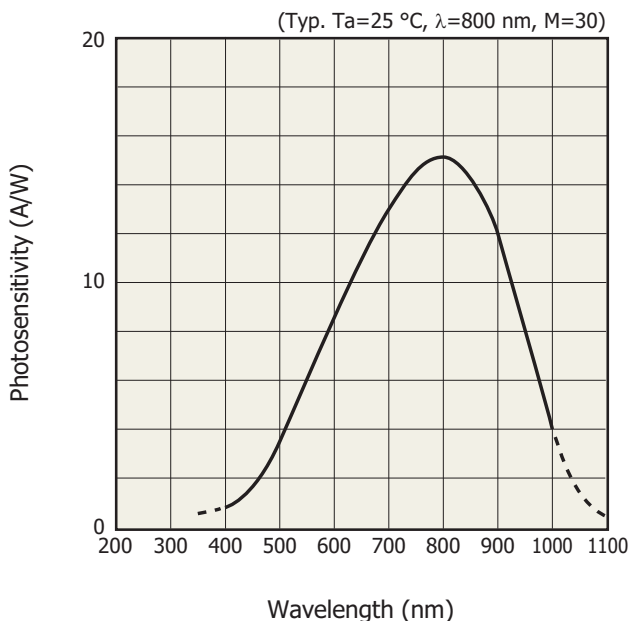
| Type no.  | Spectral response range λ (nm) | Peak sensitivity wavelength λp (nm) | Photosensitivity S λ=800 nm, Gain(M)=1 (A/W) | Temperature stability of gain*1 25 °C ± 10 °C, M=30 (%) |      |
|-----------|--------------------------------|-------------------------------------|--|---|------|
|   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

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 |

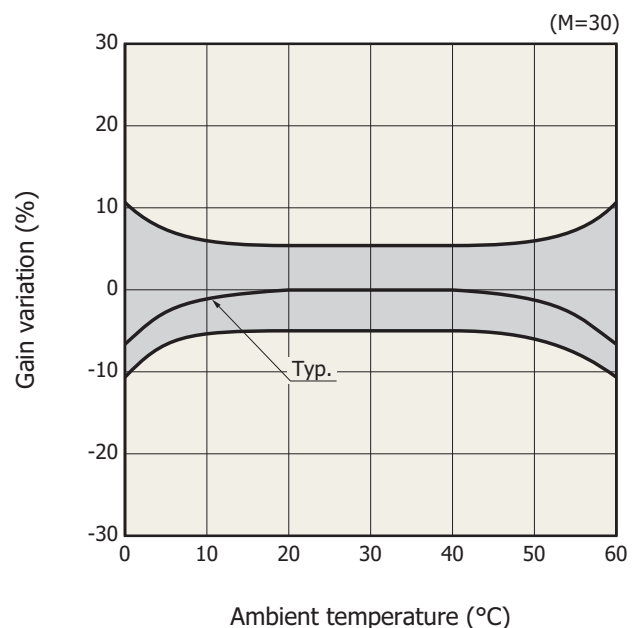
\*1: Gain is set to 30 at the factory prior to shipping.

Spectral response



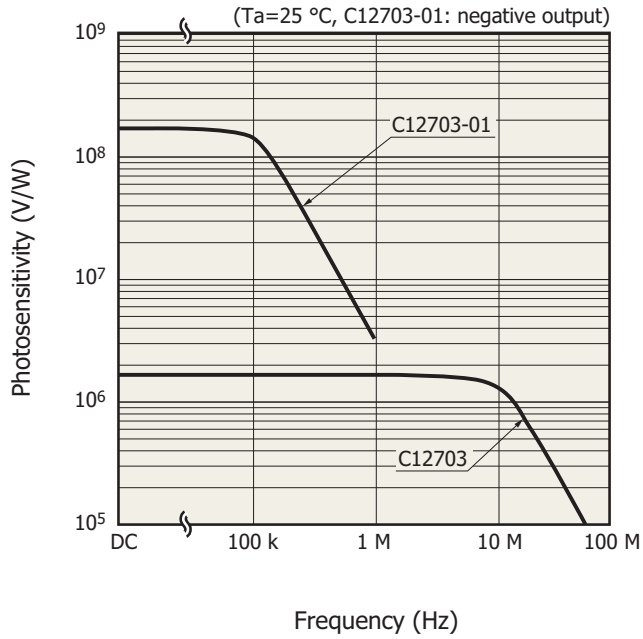
KACCB0013EA

Gain temperature characteristics



KACCB0020EB

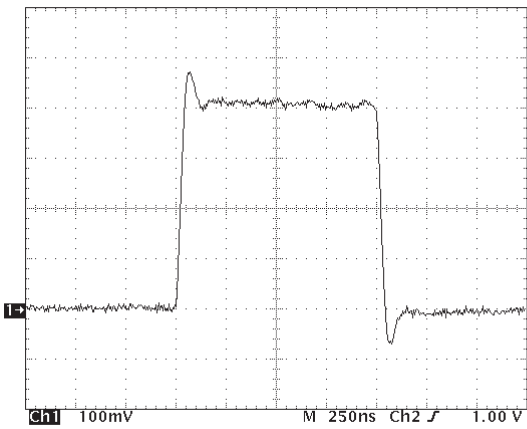
Frequency response



KACCB0339EA

Response to stepped light input

C12703

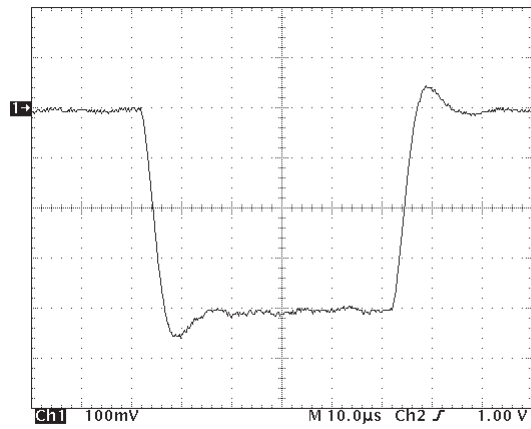


C1 Rise  
33.0ns

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

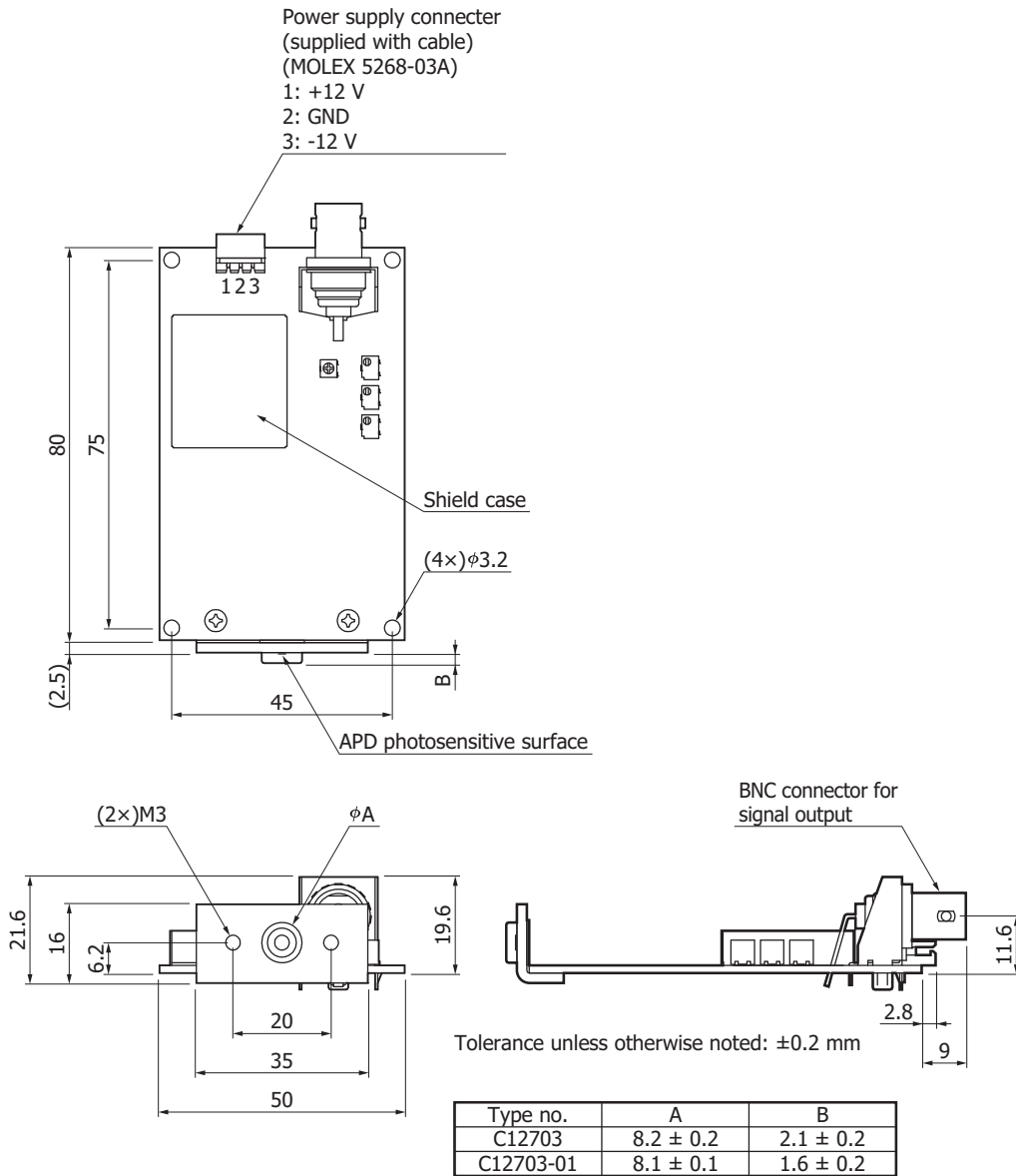


C1 Fall  
3.40μs

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)**



KACCA0323EA

**Accessories**

- Power supply cable
- Instruction manual

**Option (sold separately)**

Attachment adapters for FC and SMA connectors

| APD module | FC adapter | SMA adapter |
|------------|------------|-------------|
| 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

- Notice

Information described in this material is current as of December, 2013.

Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.

The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use.

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