### Photodetector

Hamamatsu can provide unbiased selection choices because we offer all types of photodetectors that meet your TOF (Time-Of-Flight) & FMCW (Frequency-Modulated-Continuous-Wave) LiDAR requirements.

* Customization of photodetectors is possible, please contact Hamamatsu for more information.
* For detailed information and product type numbers, please refer to individual datasheets.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sl/PIN Photodiode</th>
<th>InGaAs/PIN Photodiode</th>
<th>Si APD</th>
<th>Hybrid (Si APD+TIA)</th>
<th>SiPM/MPPC</th>
<th>InGaAs APD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser Detection Range</td>
<td>Short</td>
<td>Short to Medium</td>
<td>Medium</td>
<td>Medium to Long</td>
<td>Long</td>
<td></td>
</tr>
<tr>
<td>Gain</td>
<td>1</td>
<td>1</td>
<td>50-150</td>
<td>50-100</td>
<td>NP</td>
<td>10-30</td>
</tr>
<tr>
<td>Detection Sensitivity</td>
<td>Si = 905nm, InGaAs = 1550nm</td>
<td>&gt;90%</td>
<td>&gt;70%</td>
<td>&gt;70%</td>
<td>&gt;7%</td>
<td>&gt;72%</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>&gt;10V</td>
<td>&gt;20V</td>
<td>&lt;160V</td>
<td>&lt;160V</td>
<td>&lt;80V</td>
<td>&lt;50V</td>
</tr>
<tr>
<td>Readout Circuit</td>
<td>Complex</td>
<td>Complex</td>
<td>Simple</td>
<td>Simple</td>
<td>Complex</td>
<td>Complex</td>
</tr>
<tr>
<td>Array</td>
<td>Suitable</td>
<td>Suitable</td>
<td>Suitable</td>
<td>Suitable</td>
<td>Suitable</td>
<td>Suitable</td>
</tr>
<tr>
<td>Product Series</td>
<td>S13773</td>
<td>S14362</td>
<td>S14363</td>
<td>G8370</td>
<td>G13176</td>
<td>G12180</td>
</tr>
<tr>
<td></td>
<td>S12426</td>
<td>S12508</td>
<td>S14645</td>
<td>S13282</td>
<td>S13645</td>
<td>S14137</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>G8931</td>
<td>G14858</td>
</tr>
</tbody>
</table>

### Hamamatsu standard products

**Parameter**
- Sl/PIN Photodiode
- InGaAs/PIN Photodiode
- Sl APD
- Hybrid (Sl APD+TIA)
- SiPM/MPPC
- InGaAs APD

**LiDAR Detection Range**
- Short: Short to Medium
- Medium to Long: Long

**Gain**
- 1
- 50-150
- 10-30

**Detection Sensitivity**
- Si = 905nm: >90%
- InGaAs = 1550nm: >70%

**Operating Voltage**
- >10V
- >20V
- <160V

**Readout Circuit**
- Complex
- Simple

**Array**
- Suitable
- Suitable

**Product Series**
- S13773
- S14362
- S14363
- G8370
- G13176
- G12180
- S12426
- S12508
- S14645
- S13282
- S13645
- S14137
- G8931
- G14858

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### Evaluation Kit & Module

For quick evaluation, Hamamatsu provides evaluation kits and modules to help you save on costs and make your job easier.

- Evaluation board for photodetectors (APD+TIA, MPPC and others)
- Photodetector modules
Light Source
High-power laser diodes with sharp near field pattern (NFP) and far field pattern (FFP) that are close to Gaussian shape.

Hamamatsu standard pulsed laser diodes*

<table>
<thead>
<tr>
<th>Product Series</th>
<th>Type/Package</th>
<th>Output Power</th>
<th>Peak Emission Wavelength</th>
<th>Emitting Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>L11384</td>
<td>Metal Can</td>
<td>&gt;21W</td>
<td>870nm</td>
<td>70x10um</td>
</tr>
<tr>
<td>L11649</td>
<td>Metal Can</td>
<td>&gt;20W</td>
<td>870nm</td>
<td>200x10um</td>
</tr>
<tr>
<td>L11854</td>
<td>Metal Can</td>
<td>&gt;21W</td>
<td>905nm</td>
<td>70x10um</td>
</tr>
<tr>
<td>L14829</td>
<td>Surface Mount (SMD)</td>
<td>&gt;90W</td>
<td>905nm</td>
<td>230x10um</td>
</tr>
<tr>
<td>L14774</td>
<td>SMD with FET and Capacitor</td>
<td>&gt;100W</td>
<td>905nm</td>
<td>360x10um</td>
</tr>
<tr>
<td>L14828</td>
<td>SMD with FET and Capacitor</td>
<td>&gt;90W</td>
<td>905nm</td>
<td>230x10um</td>
</tr>
<tr>
<td>L14075</td>
<td>SMD with FET and Capacitor</td>
<td>&gt;100W</td>
<td>905nm</td>
<td>360x10um</td>
</tr>
</tbody>
</table>

* Customization of laser diodes is possible, please contact Hamamatsu for more information.
* For detailed information and product type number, please refer to individual datasheet.

Laser Diode Driver Board
Off-the-shelf driver boards allow you to quickly operate and evaluate the laser diode of your choice for your LiDAR design.
- Driver board for laser diode with FET and capacitor (C14364)
- Driver board for laser diode only (C14014)
Light Collimator

Attach a FAC lens to your laser diode to minimize the smile and side lobes of your output pattern.
- Custom coating possible to accommodate various wavelengths of laser
- Custom length offers
- Custom focal length to meet distance requirement

Product Series: J10919

LD (Laser Diode) bar

Laser emitting points

Fast axis

LD (Laser Diode) bar

Radiation angle spreading in elliptical cone shape

FAC lens

Laser emitting point

Hamamatsu

Other Components for LiDAR Design

Distance Image Sensor

- Fewer moving parts for a more reliable design
- Measures the distance of an object and provides image simultaneously using indirect time-of-flight method

Hamamatsu standard products*

<table>
<thead>
<tr>
<th>Product Series</th>
<th>Image Size</th>
<th>Number of Pixels</th>
<th>Pixel Pitch</th>
</tr>
</thead>
<tbody>
<tr>
<td>S11961</td>
<td>5.12 x 0.05 mm</td>
<td>272</td>
<td>20um</td>
</tr>
<tr>
<td>S11962</td>
<td>2.56 x 2.56 mm</td>
<td>72 x 72</td>
<td>40um</td>
</tr>
<tr>
<td>S11963</td>
<td>0.9 x 0.4 mm</td>
<td>168 x 128</td>
<td>30um</td>
</tr>
</tbody>
</table>

* For detailed information and product type number, please refer to individual datasheet.

Driver Board/Evaluation Kit

Driver board and evaluation kit that save on cost and make your life easier while evaluating the best mirror and distance area image sensor to use in your system.
- Driver board for distance area image sensor (C12647 & C12648)
DEVICES for LiDAR
ASSEMBLY/MANUFACTURING/TESTING

LED Light Source for UV Curing
- Shorten curing time with high intensity and custom wavelength
- UV LED source (365nm, 385nm, and 405nm)
- Simple design for ease of operation and shorter learning curve
- Custom head design for limited spacing
- Feedback control function permits stable irradiation
- Product Series: LC-L1V3 & LC-L1V5

Laser-Driven Light Source for Calibration/Testing
- High brightness, broadband laser-driven light source
- Compact and durable
- Product Series: EQ-99X & EQ-99XFC

Picosecond Light Pulser for Testing
- Ultra short, pulsed light source (picosecond) ideal for measuring detector response
- Stable output power and oscillating timing
- Interchangeable LD heads for 905 and 1550nm
- Product Series: PLP-10

High Resolution Silicon or InGaAs CMOS Camera for Inspection & Calibration
- High resolution CMOS camera
- Custom frame rate & exposure time
- High sensitivity at 905nm to 1700nm
WHY HAMAMATSU?

Unbiased Opinions Help You Select the Right Photonic Device
Not all technology is created equal! Hamamatsu’s complete offering in photonics technology allow us to be honest and transparent in recommending the right photonic devices that are the best fit for your LiDAR design.

The Market Leader of the Past, Present and Future
We have been the technology leader in providing photonic solutions in different industries for more than 50 years, and we have years of experience in providing automotive grade components (AEC Q100/Q101/Q102 Qualification, IATF 16949, and ISO 9001).

Customized for Your Unique Needs
90% of our business is from customization. We understand that customization of your component in the system is necessary, especially in the automotive industry for ADAS/Autonomous Vehicles.

Simplify Your Supply Chain
Hamamatsu will meet your needs via our extensive selection of photodetectors, light sources, optical lenses, supporting electronics, light sources, PLP and cameras used throughout design, assembly, manufacturing, and testing.

For product inquiry, email support@hamamatsu.com