Fiber Optic and Isolation Solutions for Renewable Energy Applications
Avago Technologies offers a wide range of fiber optic transmitters, receivers, and transceivers, and IGBT/Power MOSFET gate drivers, and optocoupler isolation products for wind turbine, wind farm and solar electric power generation applications.

Avago fiber optic, isolated gate driver, isolation amplifier and digital optocouplers are deployed in wind turbine farms and solar energy farms today. Applications include:

- Power rectifiers and inverter power assemblies
- Control and communication boards
- Turbine control units condition monitoring systems
- Wind farm networks
- Sun tracking control
- Communications boards
- Solar farm substation automation and protection relays
- Single- and three-phase inverters
- Battery chargers
- DC-to-DC converters,
- System control and monitoring

Avago has been involved with fiber technology and international standards bodies for decades. We have offered the industry’s best isolation technology, specifically designed and manufactured to meet the stringent requirements of applications in power generation systems for over 30 years.

Around the world our customers value what we do. We provide the components and technology to make their visions in the renewable energy markets grow and prosper.
Solar Power

Fiber Optic Components Solutions

Product Line Features

- Transceivers: Broad portfolio compliant to many protocols
- Connector types: LC, SC, MT-RJ
- Wavelength: 850 nm, 1310 nm
- Maximum transmission distance: 80km
- Multimode and Single-mode Fiber

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Data Rate</th>
<th>Distance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HFBR-1515BZ</td>
<td>650nm, Transmitter</td>
<td>DC – 10 MBd</td>
<td>40 m</td>
<td>200 m</td>
</tr>
<tr>
<td>HFBR-2515BZ</td>
<td>650nm, Receiver</td>
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<tr>
<td>HFBR-1505CZ</td>
<td>650nm, Transmitter</td>
<td>DC – 10 MBd</td>
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<td>400 m</td>
</tr>
<tr>
<td>HFBR-2505CZ</td>
<td>650nm, Receiver</td>
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<td>400 m</td>
</tr>
<tr>
<td>HFBR-1521Z</td>
<td>650 nm, Transmitter</td>
<td>DC – 5 MBd</td>
<td>20 m</td>
<td>–</td>
</tr>
<tr>
<td>HFBR-2521Z</td>
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</tr>
<tr>
<td>HFBR-1522Z</td>
<td>650 nm, Transmitter</td>
<td>DC – 1 MBd</td>
<td>45 m</td>
<td>–</td>
</tr>
<tr>
<td>HFBR-2522Z</td>
<td>650 nm, Receiver</td>
<td>DC – 1 MBd</td>
<td>45 m</td>
<td>–</td>
</tr>
<tr>
<td>HFBR-1528Z</td>
<td>650 nm, Transmitter</td>
<td>DC – 10 MBd</td>
<td>40 m</td>
<td>300 m</td>
</tr>
<tr>
<td>HFBR-2528Z</td>
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<td>40 m</td>
<td>300 m</td>
</tr>
</tbody>
</table>
| HFBR-1414Z  | 820 nm, Transmitter| DC – 5 MBd | –              | 1500 m| 2000 m
| HFBR-2412Z  | 820 nm, Receiver  | DC – 5 MBd | –              | 1500 m| 2000 m
| HFBR-1414Z  | 820 nm, Transmitter| DC – 20 MBd| –              | –     | 2700 m|
| HFBR-2416Z  | 820 nm, Receiver  | DC – 20 MBd| –              | –     | 2700 m|
| HFBR-1414Z  | 820 nm, Transmitter| DC – 160 MBd| –              | –     | 500 m |
| HFBR-2416Z  | 820 nm, Receiver  | DC – 160 MBd| –              | –     | 500 m |

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Wind Turbine Networking,
Control and Communications

Fiber Optic Components Solutions

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Wind Turbine Networking, Control and Communications

Fast Ethernet Fiber Optic Components

AFBR-5978Z Fast Ethernet Transceiver with DMI and SC-RJ connector

Features
- Compatible with electrical and optical performance of the POFAC recommendations for the Fast Ethernet over Plastic Optical Fiber (POF)
- Compatible with the electrical and optical performance of the Profinet recommendations the Fast Ethernet over POF and Hard-Clad Silica Fiber (HCS)
- 650nm operation
- Manufactured in an ISO 9001 certified facility
- DMI (Digital Diagnostics Monitoring Interface)
  - SFF-8472 Rev 9.3, provides real-time monitoring of:
    - Temperature
    - Supply voltage
    - Received optical power (Alarm/Warning flag)
- LVPECL signal detect output
- Temperature range –25°C to +85°C

Applications
- Factory automation at Fast Ethernet speeds
- Fast Ethernet networking over POF and HCS
- Link Distance up to 50 m POF or 100 m HCS

AFBR-5978Z Demonstration Kit
Solar and Wind Power

Avago Application Specific Optocoupler Solutions

Gate Driver Features
- High peak output current
- High Common Mode Rejection (CMR)
- Wide operating temperature range
- Fast switching
- Low supply current
- Integrated IGBT protection features
- Broad range of surface mount packages

Isolation Amplifier Features
- High gain accuracy
- High linearity
- High Common Mode Rejection (CMR)
- Optical A/D Solution with Worldwide Safety Approval
- Not affected by external magnetic fields

Isolated IGBT/PMBFET Gate Drivers

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Drive Current (Maximum)</th>
<th>Integrated Protection Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACNW3190</td>
<td>5.0 A</td>
<td>UVLO</td>
</tr>
<tr>
<td>ACPL-332, ACPL-333J</td>
<td>2.5 A</td>
<td>Active Miller Clamp, DESAT, UVLO</td>
</tr>
<tr>
<td>ACPL-H312, ACPL-K312, ACPL-3130</td>
<td>2.5 A</td>
<td>UVLO</td>
</tr>
<tr>
<td>ACPL-331, ACPL-330J</td>
<td>1.5 A</td>
<td>Active Miller Clamp, DESAT, UVLO</td>
</tr>
<tr>
<td>ACPL-P314, ACPL-W314-000E, HCPL-314J</td>
<td>0.6 A</td>
<td>—</td>
</tr>
<tr>
<td>ACPL-P302, ACPL-W302</td>
<td>0.4 A</td>
<td>—</td>
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</tbody>
</table>

Isolation Amplifiers

<table>
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<tr>
<th>Part Number</th>
<th>Gain Accuracy (25°C)</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACPL-C78A, ACPL-C780, ACPL-C784</td>
<td>±1% / ±3% / ±5%</td>
<td>Stretched SO-8 package, Differential output, High linearity, 1140 V high working voltage</td>
</tr>
<tr>
<td>HCPL-7510, HCPL-7520</td>
<td>±3% / ±5%</td>
<td>DIP-8 package, Single-ended output, High linearity</td>
</tr>
<tr>
<td>ACPL-796J</td>
<td>12 bits ENOB</td>
<td>16 bits of resolution, 74 dB min SNR, -40° C to 105° C operating temperature, SO-16 package, 1140 V high working voltage</td>
</tr>
</tbody>
</table>

Wind Power Circuit Diagram

Solar Power Circuit Diagram
Solar and Wind Power

Digital Optocouplers

Features
• 3.3V/5V supply
• Ultra Low Power (~2mA/ch power consumption)
• Multi-channel and bidirectional
• Broad range of surface mount packages
• Reinforced Insulation.
• Wide operating temperature range (up to 125°C)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACPL-M61U</td>
<td>SO-5</td>
<td>Extended temperature: -40 °C to 125 °C</td>
</tr>
<tr>
<td>ACPL-M61L, ACPL-061L, ACPL-064L, ACPL-W61L, ACPL-K64L</td>
<td>SO-5, SO-8, stretched SO-6, stretched SO-8</td>
<td>10MBd, ultra low power, -40 °C to 105 °C</td>
</tr>
<tr>
<td>ACPL-W60L, ACPL-K64L</td>
<td>Stretched SO-6, stretched SO-8</td>
<td>Smaller package, meets 8 mm creepage / clearance, high working voltage (&lt;1140 Vpeak)</td>
</tr>
<tr>
<td>HCNW137, HCNW2611</td>
<td>400 mil widebody</td>
<td>DTI &gt; 0.4 mm, high working voltage (&gt; 1414 Vpeak)</td>
</tr>
<tr>
<td>ACON2601</td>
<td>500 mil widebody</td>
<td>DTI &gt; 2 mm, high working voltage (&gt; 1768 Vrms), high isolation voltage (7500 Vrms)</td>
</tr>
<tr>
<td>ACSL-6210, ACSL-6400, ACSL-6410, ACSL-6420</td>
<td>SO-8, SO-16</td>
<td>10MBd, Multi-channel, bidirectional</td>
</tr>
<tr>
<td>ACPL-772L, ACPL-072L</td>
<td>DIP-8, SO-8</td>
<td>High speed (25 MBd), high operating temperature</td>
</tr>
</tbody>
</table>

Digital Optocouplers

Level
Shifting
HCPL-314J/315J
Gate Driver+Vdc
-Vdc
Series of Solar Cells
Power Out
Battery Cells

Charge
Controller/DC-DC Converter

ADC
Level
Shifting

Utility Power Measurement

Substation Transformer

Inverter System

Consumer Load

Battery Voltage Monitor

Battery Cells Monitor

µP

Decoding Circuit

HCPL-7800
Avago White Papers

• White Paper: Fiber Optics in Solar Energy
• White Paper: Industrial Fiber Optic Products for Wind Farm Applications
• Safety Considerations When Using Optocouplers and Alternative Isolators for Providing Protection Against Electrical Hazards

Selection Guides

• Optoisolation Products
• Isolation Product Solutions for Commercial and Industrial Applications
• Industrial Fiber Optic Components, Cabling and Accessories

Newsletters, Videos and Webinars

• Avago's Optocouplers Meeting Your Design Needs
• Webinars
• eNewsletter Signup
• Register for your own My Avago Web Page
• Optocoupler and Fiber Flash Videos

Optocoupler Application Notes

• Optocouplers

Spice Models and Evaluation Boards

• Optocoupler Spice Models
• Fiber Optic Evaluation Kits and Accessories

Wind Power Organizations

• American Wind Energy Association
• China Wind Power
• European Wind Energy Association (EWEA)
• Global Wind Energy Council
• Spanish Wind Energy Association (AEE)
• Wind Power Works

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• Authorized Distributors
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• Technical Support Request
• PCN Sign up
• Web Based Virtual Support

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www.avagotech.com/fiber
www.avagotech.com/optocouplers

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Asia Pacific: pacrim.components@avagotech.com

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