Low-power Industrial Market
The advances in motor control and drive technologies coupled with growing industrial applications demanding higher motor performance have created a robust demand for low-power industrial motor projects. The use of brushless motor and drive technology is projected to grow to almost $2.5 billion in 2003. The greatest opportunities for new sales in factory automation segments are from material handling, packaging, machine tool equipment and semiconductor processing equipment. Yearly sales in 2003 will exceed yearly sales in 1998 by more than $75 million in each of these segments. In addition, the overwhelming majority of drives are sold for low horsepower applications. In fact, close to 90% of all AC drives by unit volume are sold for loads requiring 25 HP or less.

Typical Applications
Variable speed drives are common in heating, ventilation and air conditioning applications. In these applications, variable speed operation makes it simple to slow down the fan when air demand is lowered, reducing electricity usage. Another application is pump control, where variable speed control can help protect equipment during high or low volume operation. Industrial applications are numerous and include conveyor control, machine tool, material handling, and processing equipment.

Main Components of a Variable Speed Drive
A typical driver and power control system for variable speed motors has three main elements:

(1) microcontroller/DSP,
(2) gate driver optoisolator and
(3) insulated gate bipolar transistor (IGBT).

Gate Drive Optocouplers
Avago Technologies offers a broad range of gate drive optocouplers which provide uncompromising performance, a wide range of features, low cost, and high reliability solutions for motor drive applications.

All Avago’s gate drive optocouplers meet stringent motor drive requirements with high performance.

Current Sensing Optoisolators
Another big challenge in motor applications is the sensing of motor phase current and bus current. These measurements need to be made through the safety of an isolation barrier. For this purpose, Avago offers current sensing optoisolators with high common mode noise immunity, a low package profile, and zero offset.

Overall, current sensing optoisolators provide a precise, and reliable solution for motor parameter measurements.
1. Microcontroller / DSP
The recent advances in microcontroller and DSP technology have enabled the design of energy-efficient and cost-effective motor control systems. Using a microcontroller (MCU) or DSP with specialized pulse-width modulator interfaces and an integrated protection architecture allows designers to reduce total system cost and increase overall performance. With each generation of new DSP processors come more useful peripherals, increased functionality and reduced overall system cost, thus creating new market opportunities.

2. Gate Drive Optocouplers
Traditionally, optocouplers have been extensively used to isolate delicate, low-power and expensive electronic components from higher-power circuits. In addition, optocouplers provide an excellent means of interfacing circuits with a high voltage potential difference while reducing noise and interference. Specifically, optocouplers are optimized to provide high-output sourcing and sinking capabilities to drive inverters.

3. IGBTs
The most recent advances in drive technology have gone hand in hand with improvement in both the size and performance of power switching devices known as insulated gate bipolar transistors (IGBTs). Motor drives use IGBTs for their fast switching capabilities and high frequency operation.

For Further Details:
More specific information is available on the Avago Technologies' web site:
www.avagotech.com

Related Information on Avago Technologies Variable Speed Drive Components:
- AN-1255, “Optocouplers for Variable Speed Motor Control Electronics in Consumer Applications”
- AN1252, “Variable Speed Drives in Consumer Applications”
- AN1253, “Variable Speed Drives in High Power Industrial Applications”
- Product selection guide for Gate Drive and Current Sense Couplers, including IGBTs for variable Speed Drives
## Recommended Products

<table>
<thead>
<tr>
<th>Avago Technologies Gate Drive Optocoupler Device</th>
<th>HCPL-316J</th>
<th>HCPL-315J</th>
<th>HCPL-3150</th>
<th>HCPL-314J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Peak Output Current</td>
<td>2 A</td>
<td>0.5 A</td>
<td>0.5 A</td>
<td>0.4 A</td>
</tr>
<tr>
<td>Min. CMR</td>
<td>15 kV / µs</td>
<td>15 kV / µs</td>
<td>15 kV / µs</td>
<td>10 kV / µs</td>
</tr>
<tr>
<td>Max. Propagation Delay</td>
<td>0.5 µs</td>
<td>0.5 µs</td>
<td>0.5 µs</td>
<td>0.7 µs</td>
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<tr>
<td>UVLO (*)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Package Type</td>
<td>SO-16</td>
<td>SO-16</td>
<td>DIP 8</td>
<td>SO-16</td>
</tr>
<tr>
<td>IEC/EN/DIN EN60747-5-2</td>
<td>891 V peak / 3750 V rms</td>
<td>891 V peak / 3750 V rms</td>
<td>630 V peak / 3750 V rms (**)</td>
<td>891 V peak / 3750 V rms</td>
</tr>
</tbody>
</table>

(* Specified in the data sheet for T = 110°C
(**) Option 060 required

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### Recommended IGBT Devices

<table>
<thead>
<tr>
<th>Recommended IGBT Devices</th>
<th>Recommended Supplier</th>
<th>BV CES (min.)</th>
<th>IC @ 100°C</th>
<th>Package</th>
<th>TJ, TSTG</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRG4PC50UD</td>
<td>International Rectifier</td>
<td>600 V</td>
<td>27 A</td>
<td>TO-247AC</td>
<td>-55 to +150°C</td>
</tr>
<tr>
<td>HGTG20N60B3D</td>
<td>Fairchild</td>
<td>600 V</td>
<td>20 A (*)</td>
<td>TO-247</td>
<td>-40 to +150°C</td>
</tr>
<tr>
<td>SKP10N60</td>
<td>Infineon</td>
<td>600 V</td>
<td>10.9 A</td>
<td>TO-220AB</td>
<td>-55 to +150°C</td>
</tr>
</tbody>
</table>

(*) Specified in the data sheet for T = 110°C
Note: Data subject to change

### Avago Technologies Current Sensing Device

<table>
<thead>
<tr>
<th>Current Sensing Device</th>
<th>Package Type</th>
<th>Gain Tolerance</th>
<th>Non-linearity</th>
<th>IEC/EN/DIN EN 60747-5-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCPL-788J</td>
<td>SO-16</td>
<td>5%</td>
<td>0.4%</td>
<td>891 V peak / 3750 V rms</td>
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</tbody>
</table>
Figure 1. HCPL-314J Reference Design