

# Variable Speed Drive Applications in the Consumer Market

## Application Note 1252

### Consumer Market

Over the years variable speed drive has shown success and wide acceptance in the motor market. The AC motor market is projected to grow to 1.4 billion dollars in 2004. Concurrently the brushless motor market is projected to grow to 2.5 billion dollars in 2003. In coming years the motor technology used in consumer applications will be influenced by the industrial application success. The fast growing consumer market encompasses a wide variety of applications, both new and growing established ones, for example: washers, dryers, air-conditioners, power tools, and home appliances.

### Typical Applications

The combination of established technology and a cost-effective system solution will help to drive the huge increase in variable speed motors used in consumer applications such as air-conditioners, washers, refrigerators and home appliances. All these mass-market applications require high efficiency, compact size and cost-effective system solutions without compromising reliability.

### Gate Drive Optocouplers

Agilent 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 of Agilent's gate drive optocouplers meet stringent motor drive requirements with high performance.



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## **Main Components of a Variable Speed Drive**

A typical driver and power control system of a variable speed motor comprises three main elements:

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

### **1. Microcontroller / DSP**

The demand for electronic motor control is increasing rapidly, not only in the computer peripheral market but also in home appliances. These mass-market applications require low power consumption and low cost microcontrollers / DSPs with PWM generation. In addition, manufacturers need to offer a range of timers for accurate motor control and speed measurement.

The DSPs are giving designers a greater capacity for more complex algorithms that will result in more efficient motors, greater system capabilities and more opportunities for product differentiation. The transition to DSPs in the consumer market will soon become widespread, resulting in bigger and better breakthroughs in appliance motor-control systems.

### **2. Gate Drive Optocouplers**

The electronic system of a motor comprises two stages: the low voltage controller and the power module. Within such a system, it is important to protect and insulate the two stages from switching transients and single point failures. At the same time it is necessary to provide level shifting and signal isolation of the interface control and feedback. The advanced gate driver optocoupler features match perfectly with the stringent requirements of motor drive and control.

### **3. IGBTs**

IGBTs are voltage-controlled power transistors that have higher current densities than equivalent high-voltage power MOSFETs. They are faster and offer far superior drive and output characteristics than power bipolar transistors. IGBTs are therefore a more cost-effective solution in motor applications.

### **For Further Details:**

More specific information is available on the Agilent Optocoupler web site:

[www.agilent.com/view/optocouplers](http://www.agilent.com/view/optocouplers)

### **Related Information on Agilent Variable Speed Drive Components:**

- *“Optocouplers for Variable Speed Motor Control Electronics in Consumer Applications”*
- AN1254, *“Variable Speed Drives in Low Power Industrial 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**

<b>Agilent Gate Drive Optocoupler Device</b>	<b>HCPL-0314</b>	<b>HCPL-314J</b>	<b>HCPL-3140</b>	<b>HCPL-J314</b>
Min. Peak Output Current	0.4 A	0.4 A	0.4 A	0.4 A
Min. CMR	10 kV / $\mu$ s	10 kV / $\mu$ s	10 kV / $\mu$ s	10 kV / $\mu$ s
Max. Propagation Delay	0.7 $\mu$ s	0.7 $\mu$ s	0.7 $\mu$ s	0.7 $\mu$ s
Package Type	SO-8	SO-16	DIP 8	DIP 8
IEC/EN/DIN EN60747-5-2 [V <sub>iorm</sub> ] / UL [V <sub>iso</sub> ]	566 V <sub>peak</sub> / 3750V <sub>rms</sub>	891 V <sub>peak</sub> / 3750 V <sub>rms</sub>	630 V <sub>peak</sub> / 3750 V <sub>rms</sub> (*)	891 V <sub>peak</sub> / 3750 V <sub>rms</sub>

(\*) Option 060 required

<b>Recommended IGBT Device</b>	<b>Recommended Supplier</b>	<b>BV<sub>CEs</sub> (min.)</b>	<b>I<sub>c</sub> @ 100°C</b>	<b>Package</b>	<b>T<sub>J</sub>, T<sub>STG</sub></b>
IRG4BC10KD	International Rectifier	600 V	5 A	TO-220AB	-55 to +150°C
SGH40N60UFD	Fairchild	600 V	20 A	TO-3P	-55 to +150°C
SKP04N60	Infineon	600 V	4.9 A	TO-220AB	-55 to +150°C

Note: Data subject to change

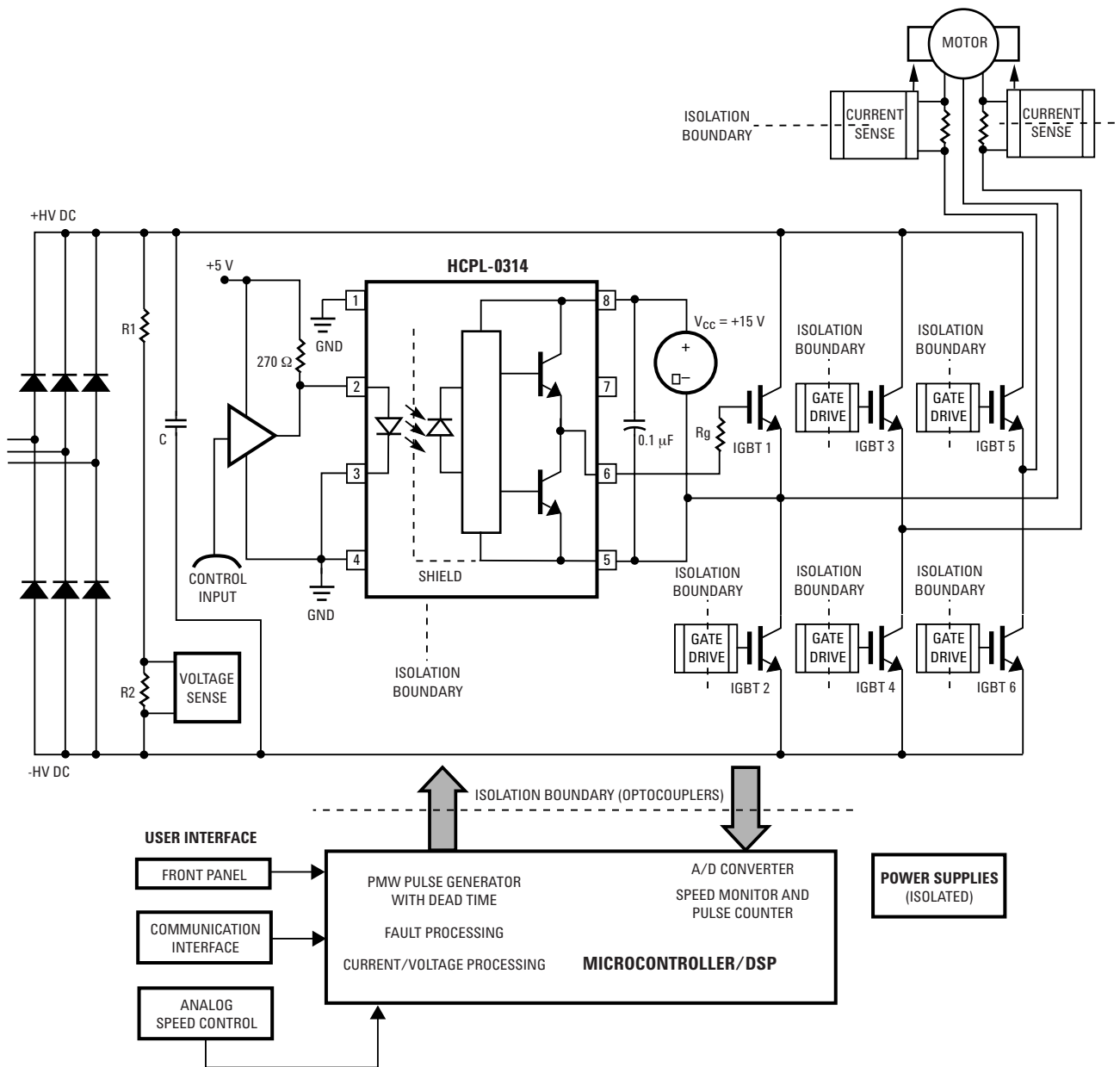


Figure 1. Reference Design HCPL-0314

[www.agilent.com/semiconductors](http://www.agilent.com/semiconductors)

For product information and a complete list of distributors, please go to our web site.

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