

Variable Speed Drive Applications in the Low-power Industrial Market

Application Note 1254

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 usage 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 material handling, packaging, machine tool 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.

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.

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, Agilent offers current sensing optoisolators with high common mode noise immunity, a low package profile, and zero offset. Overall, current sensing optoisolators provide advantageous, precise, and reliable solutions for motor parameter measurements.



Main Components of a Variable Speed Drive

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

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

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 microcontroller (MCU) or DSP with specialized pulse-width modulator interfaces and integrated protection architecture allows designers to reduce total system cost and increase overall performance. With each generation of DSP comes more useful peripherals, increasing functionality and reducing the 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 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 size and performance of power switching devices known as insulated gate bipolar transistors. Ideal for low level signal to power control, motor drives use IGBTs to provide fast, accurate operation, electronic signals to the motor, and quiet operation.

For Further Details:

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

www.agilent.com/view/optocouplers

Related Information on Agilent Variable Speed Drive Components:

- *“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

Agilent Gate Drive Optocoupler Device	HCPL-316J	HCPL-315J	HCPL-3150	HCPL-314J
Min. Peak Output Current	2 A	0.5 A	0.5 A	0.4 A
Min. CMR	15 kV / μ s	15 kV / μ s	15 kV / μ s	10 kV / μ s
Max. Propagation Delay	0.5 μ s	0.5 μ s	0.5 μ s	0.7 μ s
UVLO (*)	Yes	Yes	Yes	No
Package Type	SO-16	SO-16	DIP 8	SO-16
VDE 0884 [V _{iorm}] / UL [V _{iso}]	891 V _{peak} / 3750 V _{rms}	891 V _{peak} / 3750 V _{rms}	630 V _{peak} / 2500 V _{rms} (**)	891 V _{peak} / 3750 V _{rms}

(*) Under Voltage Lockout

(**) Option 060 required

Recommended IGBT Devices	Recommended Supplier	BV_{CES} (min.)	I_C @ 100°C	Package	T_J, T_{STG}
IRG4PC50UD	International Rectifier	600 V	27 A	TO-247AC	-55 to +150°C
HGTG20N60B3D	Fairchild	600 V	20 A (*)	TO-247	-40 to +150°C
SKP10N60	Infineon	600 V	10.9 A	TO-220AB	-55 to +150°C

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

Note: Data subject to change

Agilent Current Sensing Device	Package Type	Gain Tolerance	Non-linearity	VDE 0884 [V_{iorm}] / UL [V_{iso}]
HCPL-788J	SO-16	5%	0.4%	891 V _{peak} / 3750 V _{rms}

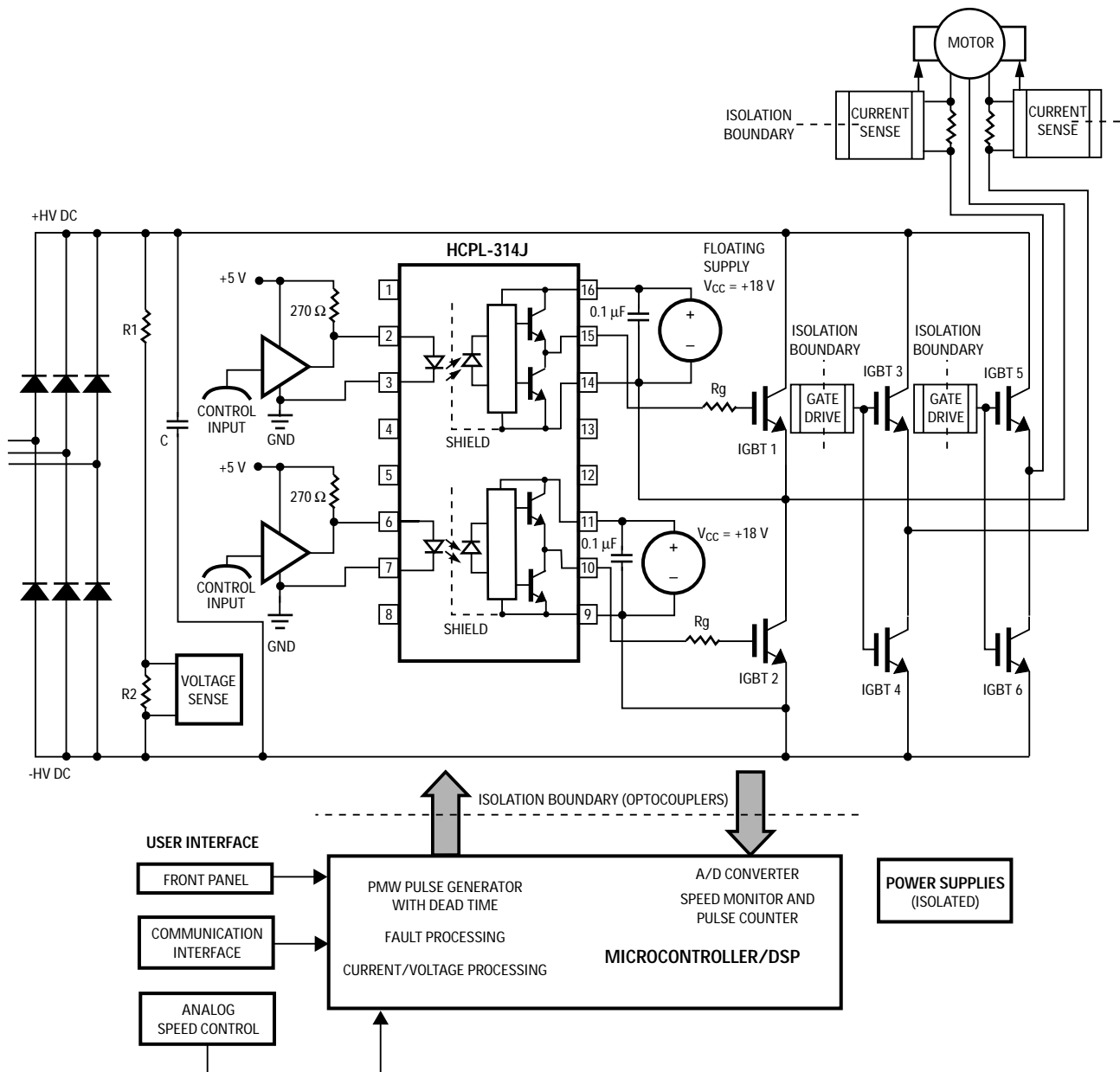


Figure 1. Reference Design HCPL-314J

www.agilent.com/semiconductors

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

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