International
IOR Rectifier
THE POWER MANAGEMENT LEADER

AEROSPACE & DEFENSE

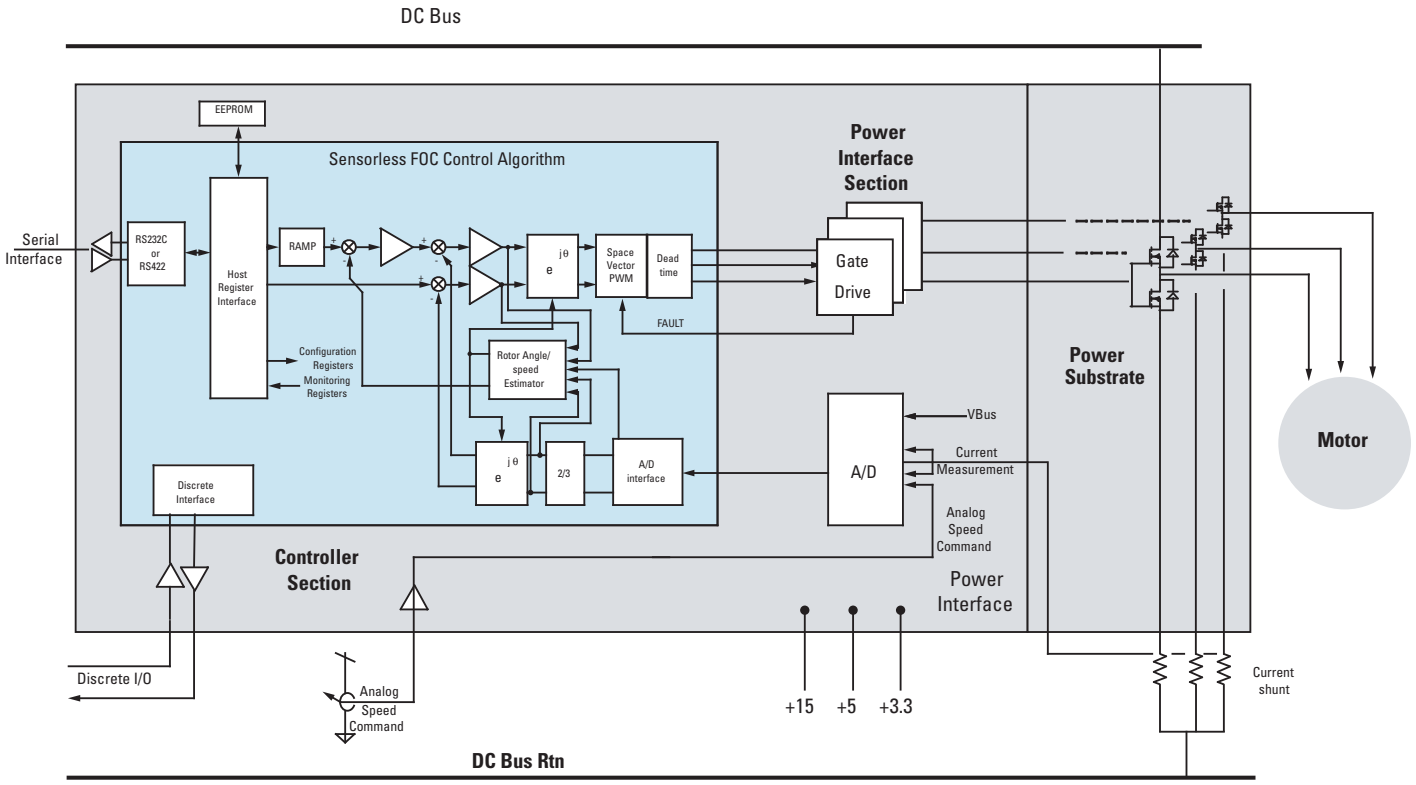
*i*Motion™* Digital Sensorless Motor Drive Module

The International Rectifier IRMCT3UF1 supports integration of PM motor systems requiring sensorless control of speed/torque over wide speed range (20:1) and performance (high starting torque, high speed). Sinusoidal commutation and field oriented control (FOC) combined with low loss PWM minimizes torque ripple, improves motor efficiency, and boosts torque per ampere.

IR's popular new sensorless ***i*MOTION** technology simplifies configuration of the controller to suit a wide variety of PMAC and BLDC type motors. Users can quickly evaluate the technology and then tailor the drive design to a particular application using the ServoDesigner™ development tool. Motion control products developed in this new software-less manner can thus be brought to market faster using the powerful register-mapped tools for configuration of motor and application parameters.

*IR's iMOTION (ai mo shan), representing the intelligent motion control; Motion Control Engine, and ServoDesigner are trademarks of International Rectifier.

Digital Sensorless Motor Drive Module Schematic



The IR Advantage

Designed for high reliability the *iMOTION™* IRMCT3UF1 is a complete motor drive housed within a compact 2" x 4" near hermetic package. This device has many advantages over traditional motor drive designs.

- The IRMCT3UF1 embedded Motion Control Engine™ (MCE) eliminates software programming
- Closed loop sensorless control requires no voltage feedback, minimizing additional hardware
- Complete sine-drive supports efficient 2 phase and quiet 3 phase center aligned and asymmetrical Space Vector Modulation (SVM) operation – up to 15khz max carrier frequency
- Configurable architecture supports a variety of PMAC/BLDC motors
- Accurate speed regulation, (1% or better) with integrated start and ramp functions
- Wide 20:1 controlled speed range – up to PWM-rate/2 max speed command rate
- Fast control loop computation time – 11µsec to support high speed motors
- Output current up to 15A continuous 20A peak (28 V_{DC} bus)
- Bus voltage up to 48 V_{DC} max
- Command/diagnostic RS232C interface with speed = 57.6 kbps
- Discrete I/O includes START/STOP, FAULT/FAULTCLR
- Low $R_{DS(on)}$ MOSFETS, mounted on low Rth = 1.5°C/W IMS substrate
  Uses IR's advanced HVIC Gate Drivers with matching delay characteristics
- Operating temperature range -40˚C to +85˚C
- Designed to vibration guidelines of DO-160

Motion Control Engine

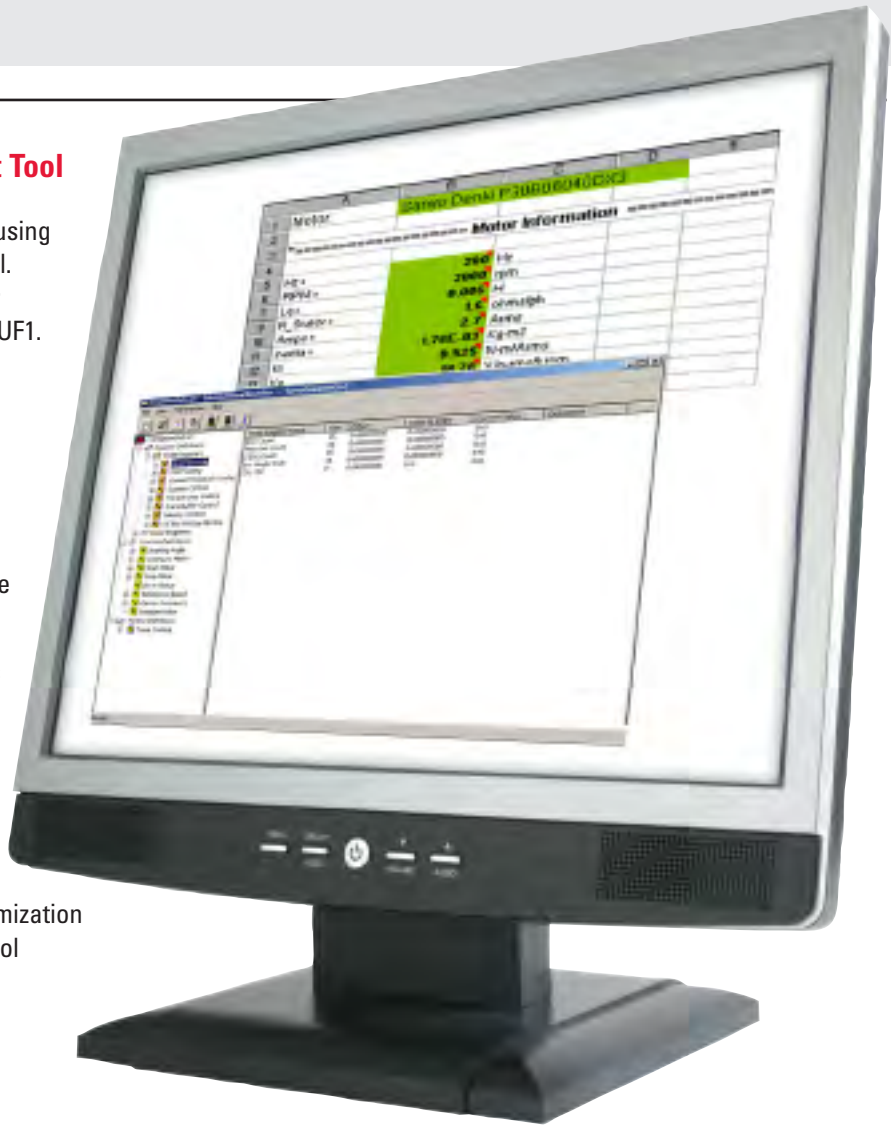
The heart of the IRMCT3UF1 is the digital motion control engine enabling rapid configuration control of motor parameters. This internal IC does not require programming to perform sensorless control. The built in start up and control algorithm enables a wide range of applications:

- Hardware based reduces FAA certification concerns
- The sensorless vector control algorithm includes a serial host interface with drive command parameters mapped to unique internal register locations in RAM. In addition to sensorless FOC, features such as start-up retry, phase loss detection, low loss PWM, regeneration breaking control, and various drive protections are all internal to the IC.
- Diagnostic features are embedded in this algorithm to enable rapid parameter identification and adjustment during development of a motor drive. Host communication logic contains an asynchronous communication interface to RS 232 and RS 422 communication ports. The user can write to and read from the pre-defined registers to configure and monitor the drive from these communication ports.

With this design approach and the versatility of the IC within the IRMCT3UF1 the drive can be configured for different applications. The flexibility of the control algorithm allows the user to implement speed/torque control on a wide variety of PMAC and BLDC motors with register based parameter modification while minimizing the component count and design effort.

PC Based ServoDesigner™ Development Tool

Motor design is simplified with the IRMCT3UF1 using IR's proprietary ServoDesigner development tool. This tool allows for easy menu based motor configuration and registry loading to the IRMCT3UF1. ServoDesigner is a free development tool and is included with the IRMCT3UF1.



Drive commissioning can be achieved in just a few steps:

1. Motor design and applications parameters are entered in the ServoDesigner spreadsheet
2. Spreadsheet translates high level parameters to digital domain parameters
3. Spreadsheet parameters are imported into the ServoDesigner program and then down-loaded to a module host register via RS232 interface

Motor performance monitoring and further optimization adjustments can be made with IR's motion control technology.

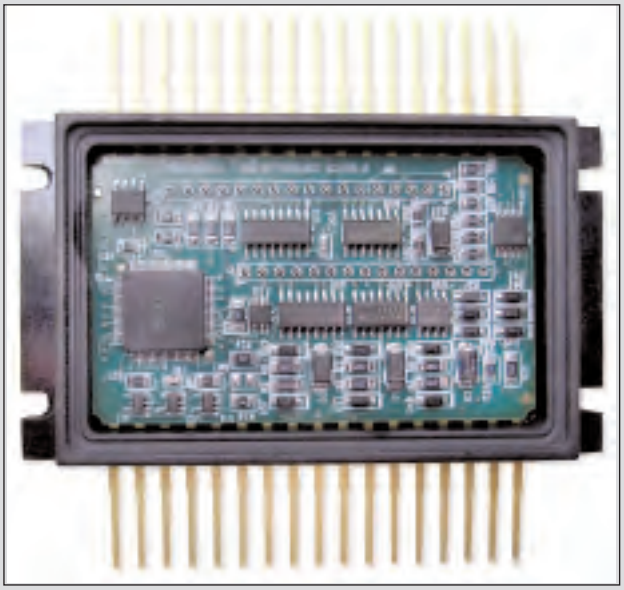
This menu based approach eliminates code development loops and dramatically reduces drive commissioning time.

Applications

The versatile IRMCT3UF1 motor drive module is applicable in any high reliability speed or torque control of a PMAC or BLDC motor. Applications include:

- Aircraft Fuel Pumps – Transfer and Boost Pump Systems
- Fans and Blowers – Turbo Cooling Systems
- Compressors/Fans – Environmental Control Systems
- Hydraulic Pumps – Actuation Systems
- Coolant Pumps – Laser and Electronics Cooling Systems
- Small Power Generators – Starting Systems
- Vetronics Traction – Propulsion Systems
- Hoist and Winches – Deploy/Retract Systems
- Actuators – Electro-Hydrostatic Actuators
- Robotics – Any robotic movement requiring speed or torque control

Application Specific PCB



HiRel *¡MOTION* Package

- Thermally conductive, Insulated Metal Substrate (IMS) for the power MOSFETS
- Lightweight plastic (2.0" x 4.0") ring frame and cover
- Internal PCB with motor control circuitry
- "Tri Seal" encapsulated to meet environmental conditions
- -40˚C to +85˚C operating temperature range
- Screened in accordance with the methods of MIL-STD-883
- Vibration performance in accordance with DO-160 design guidelines