PERFORMANCE**MOTION**DEVICES

MC73110 **Motor Control** IC

The MC73110 Motor Control IC provides high performance digital current loop, velocity loop, and commutation, for brushless DC motors. This intelligent single-axis drive controller operates in internal velocity profile mode, velocity mode with an external velocity command signal, or torque mode with an external torque command signal. The MC73110 can be operated standalone, using pre-programmed parameters, or through the serial port using commands sent by a microprocessor.

The current loop provides software programmable P and I terms such as current limit and integration limit. Two symmetric 3-phase PWM (pulse width modulated) output modes are provided; 3-signal mode and 6-signal mode with shoot-through protection timing.

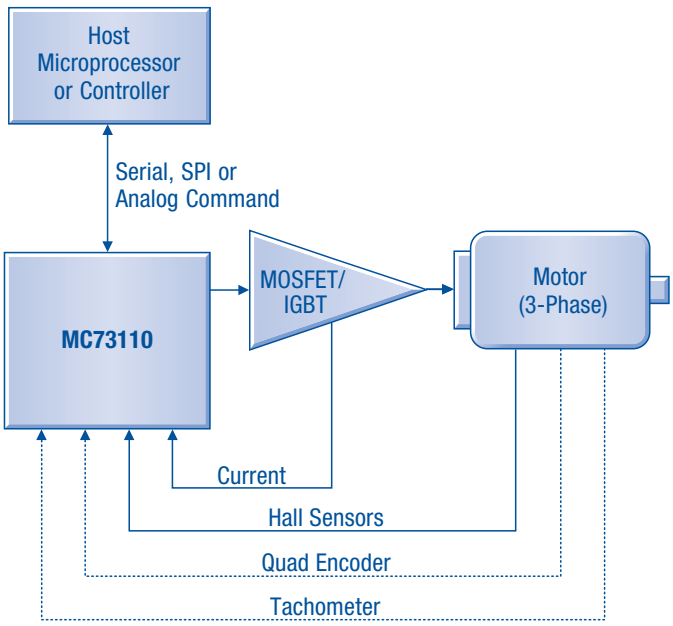
Two analog inputs for current feedback from the drive are provided. Commutation is software-programmable, and can occur using a six-step waveform or using a sinusoidal waveform. The MC73110 closes a velocity loop using a quadrature encoder or an analog signal from a tachometer. Velocity commands are provided by an internal profile generator, by a digital SPI 16-bit data stream, or by an analog signal. A programmable compensation filter closes the loop and determines the motor command.

To create a complete motion controller, the MC73110 is connected to a MOSFET or IGBT-based power stage. The MC73110 is packaged in a compact 64-pin TQFP (thin quad flat pack), and operates from 3.3 V.

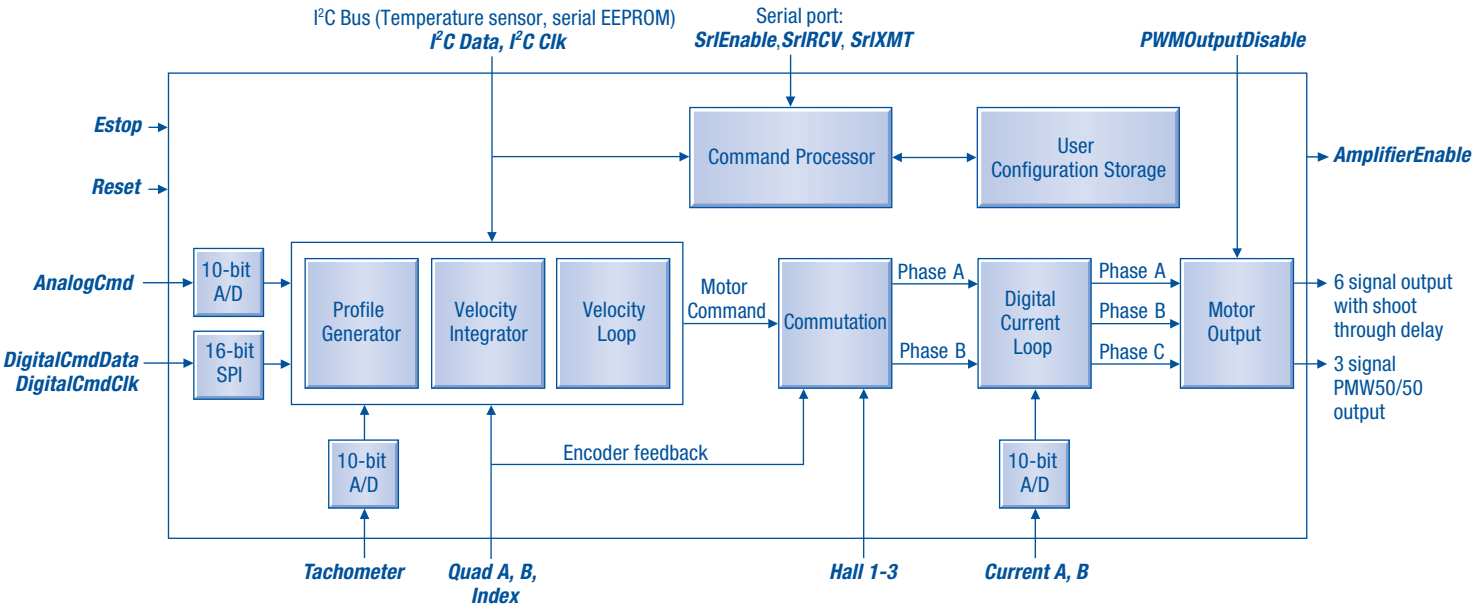
FEATURES

- Controls 3-phase brushless DC motors
- High performance digital current loop
- Velocity loop with encoder or tachometer feedback
- Internal velocity profile generator
- Sinusoidal or 6-step commutation
- Field oriented control
- Hall sensor inputs
- 6-signal PWM output with shoot-through protection
- Direct analog signal input
- Serial port up to 416 Kbaud
- Quadrature encoder input up to 10 Mcounts/sec
- Serial EEPROM or onboard flash configuration load
- High speed index input & capture
- SPI (synchronous peripheral interface) command input
- Emergency stop input
- 10 kHz velocity loop
- 20 kHz commutation and current loop
- 20 kHz or 40 kHz PWM output rate
- Compact 64-pin thin quad flat pack (TQFP)

CONFIGURATION



Technical**Overview**



SPECIFICATIONS

Motors supported
3-phase brushless DC

Motor output modes
3-signal PWM outputs, 6-signal PWM outputs with shoot-through protection

Control loops
Current/velocity, velocity integrator, profile generator

Commutation modes
6-step (using Hall sensors)
Sinusoidal (with Hall sensors and quadrature encoder input)
Field oriented control

Current loop rate
20 kHz

Commutation rate
10 kHz

Velocity loop rate
10 kHz

Max. quadrature rate (A, B, Index)
10 Mcounts/sec

Operating modes
Standalone: uses serial EEPROM or on-board user configuration storage
Serial port: commands sent by host processor

Serial communication modes
Point-to-point asynchronous
Multi-drop asynchronous

Serial baud rate range
1,200 to 416,667

Profile generator
Velocity contouring

Profile parameters
Velocity (32-bit resolution)
Acceleration (32-bit resolution)

Current feedback
Two analog signals (10-bit A/D resolution)

Velocity feedback
Analog tachometer signal (10-bit A/D resolution)

Velocity/torque/voltage command sensor options
Analog signal (10-bit A/D resolution)
Digital SPI datastream (16-bit resolution)
Serial port (live commands from host processor)

Temperature sensor input
Using I²C bus

Serial EEPROM input
Using I²C bus

SPI input format
16-bit 2s complement encoded word

Max. SPI input rate
10 MHz (1.6 µs per 16-bit transmission)

PWM resolution
10-bit @ 20 kHz
9-bit @ 40 kHz

PWM output method
Symmetric 3-phase

Storage temperature (T_s)
-65° C to 150° C

Operating temperature (T_a)
-40° C to 85° C

Operating current (I_{dd})
105mA

Nominal clock frequency (F_{clk})
10.0 MHz

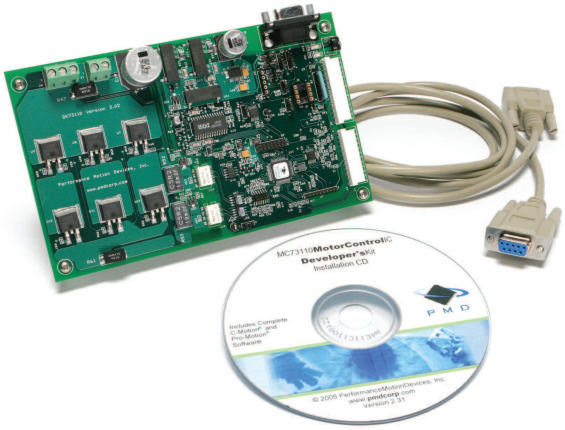
Supply voltage operating range (V_{cc})
3.0 V to 3.6 V

Analog inputs
0 to 3.3 V

Dimensions
12mm x 12mm

Development **Tools**

DEVELOPER'S KIT



PMD's DK73110 Developer's Kit is a complete, integrated intelligent amplifier that utilizes the MC73110 Motor Control IC and drives a 3-phase brushless motor at up to 10 amps. All features of the MC73110 can be exercised including analog velocity or torque control, commutation, current loop, and profile generation. The DK73110 can be used to prototype your motion hardware, develop your application code, or measure system performance. To create a complete functioning motion system, only a 3-phase brushless motor is required.

The kit also includes PMD's Pro-Motion GUI, an interactive Windows™-based exerciser, and C-Motion, which simplifies the development of motion applications using C/C++.

Features

- Integrated amplifier for driving a 3-phase brushless motor at up to 10 amps
- Complete board schematics in PDF and ORCAD format
- Includes a reference design for the amplifier
- Includes C-Motion® Application Program Interface, C-source code for developing applications using the MC73110 Motor Control IC in either a Windows™ or an embedded environment
- Includes Pro-Motion® Graphical User Interface (GUI)
- Serial port with baud rates up to 250K
- Standalone 4" x 7" card

C-MOTION® SOFTWARE

C-Motion is a "C" source code library that provides a convenient set of callable routines for controlling your MC73110 Motor Control IC.

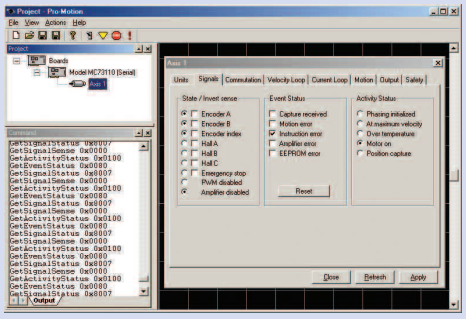
Features

- Axis virtualization
- Communicate to multiple processors
- Easily linked to any C/C++ application

Example C-Motion code for setting up velocity mode with analog command

```
// set up for automatic phase initialization
SetSignalSense(hAxis1, 0x380);
SetPhaseCounts(hAxis1, 2000);
// set PWM dead time
SetPWMDeadTime(hAxis1, 20);
// set commutation mode
SetCommutationMode(hAxis1, PMDCommutationModeSinusoidal);
// set velocity command source to analog
SetCommandSource(hAxis1, PMDAnalogCommand);
// enable current and velocity loops
SetLoopMode(hAxis1, PMDVelocityLoop|PMDCurrentLoop);
// set loop gains
SetLoopGain(hAxis1, PMDCurrentLoopKP, 64);
SetLoopGain(hAxis1, PMDVelocityLoopKP, 64);
// enable the amplifier
SetConditionMask(hAxis1, PMDAmpDisableMask, 0x0);
```

PRO-MOTION® GUI



PMD's Pro-Motion is a sophisticated, easy-to-use Windows-based exerciser program for use with MC73110 Motor Control chips and cards.

Features

- Project window for accessing card parameters
- Ability to save and load settings
- Distance and time units conversion
- Command window for direct text command entry
- Axis shuttle performs continuous back and forth motion between two velocities
- Output window serves as a communications monitor that echoes all commands sent by Pro-Motion to the card

FAMILY FEATURES

	MOTOR CONTROL IC	NAVIGATOR/PILOT	MAGELLAN	MOTION CARDS	ION DIGITAL DRIVE
No. Axes	1	1, 2, 4	1, 2, 3, 4	1, 2, 3, 4	1
Format	• 64-pin TQFP	• 132-pin PQFP • 100-pin PQFP	• 144-pin TQFP • 100-pin TQFP	• ISA • PCI • PC/104	• Fully enclosed module
Voltage	3.3 V	5 V	3.3 V	5 V	12 - 56 V
Function	• Velocity control • Torque/Current control • Commutation • Field oriented control	• Position control • Profile generation • Commutation	• Position control • Profile generation • Commutation • Network communications • Multi-motor support	• Position control • Profile generation • Commutation • Network communications • Signal conditioning • Analog output • Trace buffer	• Position control • Profile generation • Commutation • Network communications • Field oriented control • Torque/current control • Trace buffer • MOSFET Amplifier
Motor Types	• Brushless DC	• DC brush • Brushless DC • Pulse & direction • Microstep	• DC brush • Brushless DC • Pulse & direction • Microstep	• DC brush • Brushless DC • Pulse & direction • Microstep	• DC brush • Brushless DC • Microstep
Communication	• Standalone • RS232/485	• Parallel • RS232/485	• Parallel • RS232/485 • CANbus	• Through bus	• CANbus • RS232/485
Loop Rate	20 kHz	100 - 150 µsec/axis	50 - 75 µsec/axis	50 - 150 µsec/axis	40 kHz

HOW TO ORDER

The MC73110 is available in a single-axis, single chip configuration for brushless DC motors.

IC Part Number

MC73110☐.☐ Version (Call PMD)

Developer's Kit

DK73110☐.☐ Version (Call PMD)

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About Performance Motion Devices

Performance Motion Devices (PMD) is a worldwide leader in motion control chips, cards, and modules. Dedicated to providing cost-effective, high-performance motion systems to OEM customers, PMD utilizes extensive in-house expertise to minimize time-to-market and maximize customer satisfaction.

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