MC73110 Velocity & Torque Control IC

> 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 shootthrough 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)

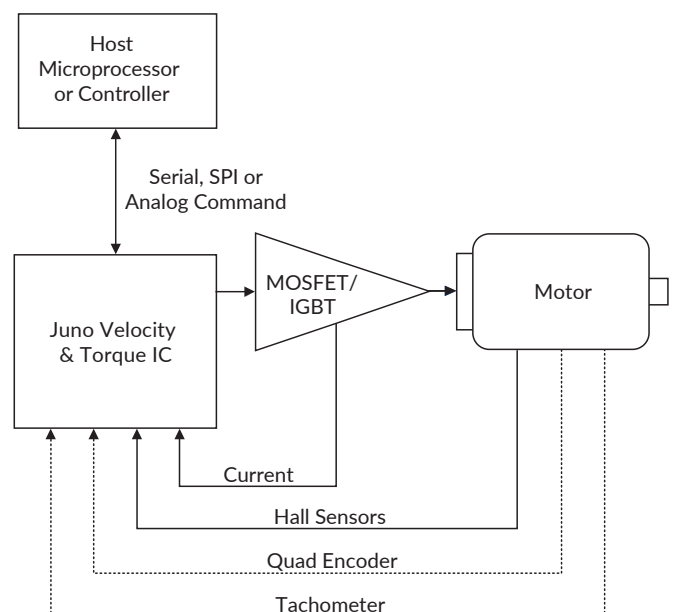## The MC73110 Velocity & Torque Control IC

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.
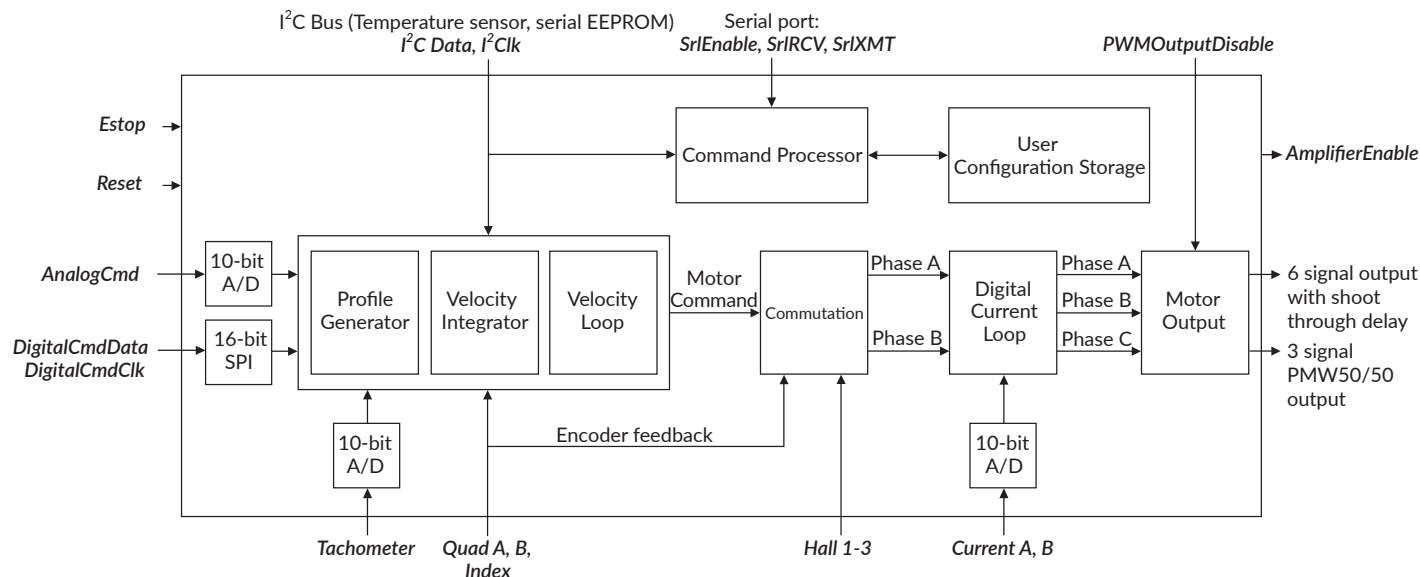
Two analog inputs for current feedback from the drive are provided. Commutation is software-programmable, and can occur using a six-step waveform or using a sinusoidal waveform. The MC73110 closes a velocity loop using a quadrature encoder or an analog signal from a tachometer. Velocity commands are 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 at 3.3 V.

> CONFIGURATION

I²C Bus (Temperature sensor, serial EEPROM)
I²C Data, I²Clk

Serial port:
SrlEnable, SrlRCV, SrlXMT

PWMOutputDisable

Estop →

Reset →

AnalogCmd

DigitalCmdData
DigitalCmdClk

| 10-bit A/D | 16-bit SPI | Profile Generator | Velocity Integrator | Velocity Loop | Motor Command | Commutation | Digital Current Loop | Motor Output |

Command Processor — User Configuration Storage

→ *AmplifierEnable*

Phase A / Phase B → Digital Current Loop → Phase A / Phase B / Phase C → Motor Output

→ 6 signal output with shoot through delay
→ 3 signal PMW50/50 output

Motor Command — Commutation

10-bit A/D

Encoder feedback

10-bit A/D

Tachometer   *Quad A, B, Index*   *Hall 1-3*   *Current A, B*

> SPECIFICATIONS

Parameter	Value
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
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)
SPI input format	16-bit 2s complement encoded word
Max. SPI input rate	10 MHz (1.6 μs per 16-bit transmission)

Parameter	Value
Current loop rate	20 kHz
Commutation rate	10 kHz
Velocity loop rate	10 kHz
Max. quadrature rate (A, B, Index)	10 Mcounts/sec
PWM resolution	10-bit @ 20 kHz 9-bit @ 40 kHz
PWM output method	Symmetric 3-phase
Temperature sensor input	Using I2C bus
Serial EEPROM input	Using I2C bus
Storage temperature (Ts)	-65º C to 150º C
Operating temperature (Ta)	-40º C to 85º C
Operating current (Idd)	105mA
Nominal clock frequency (Fclk)	10.0 MHz
Supply voltage operating range (Vcc)	3.0 V to 3.6 V
Analog inputs	0 to 3.3 V
Dimensions	10mm x 10mm excluding leads

DevelopmentTools

① EASY START-UP
Developers Kit

Includes

- DK73110 Velocity & Torque Control IC Developer's Kit board
- Pro-Motion CD and User's Guide
- Development software CD with C-Motion and VB-Motion software
- Complete manual set
- Complete cable & prototyping connector set

② TUNE & OPTIMIZE
Pro-Motor GUI

Pro-Motor is a sophisticated, easy-to-use Windows-based exerciser program for use with PMD motion control ICs, modules, and boards.

Features

- Project window for accessing card parameters
- Ability to save and load settings
- Command window for direct text command entry

- Output window serves as a communications monitor that echoes all commands sent by Pro-Motor to the board
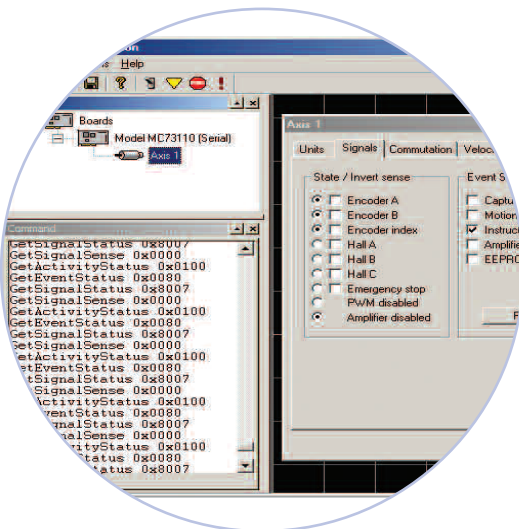
③ BUILD THE APP
C-Motion®

C-Motion is a complete, easy-to-use, motion programming language that includes a source library containing all the code required for communicating with PMD motion ICs, cards, and modules.

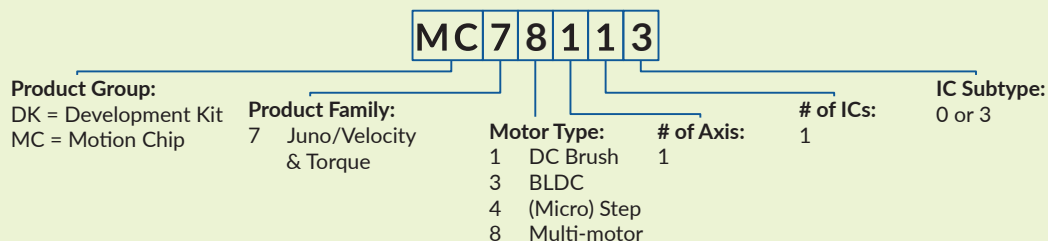**C-Motion features include:**

- Extensive library of commands for virtually all motion design needs
- Develop embeddable C/C++ applications
- Complete, functional examples
- Supports serial, CAN, Ethernet, and SPI communications

```
                ...code for executing a profile and trac...
           ...captured in this example could be used for tuning the P...

        ...trace buffer wrap mode to a one time trace
        ...raceMode(hAxis1, PMDTraceOneTime);

        ...t the processor variables that we want to capture
        ...tTraceVariable(hAxis1, PMDTraceVariable1, PMDAxis1,
        ...etTraceVariable(hAxis1, PMDTraceVariable2, PMDAxis1,
        SetTraceVariable(hAxis1, PMDTraceVariable3, PMDAxis1, P...

        // set the trace to begin when we issue the next update command
        SetTraceStart(hAxis1, PMDTraceConditionNextUpdate);

        // set the trace to stop when the MotionComplete event occurs
        SetTraceStop(hAxis1, PMDTraceConditionEventStatus,
            PMDEventMotionCompleteBit, PMDTraceStateHigh);
        SetProfileMode(hAxis1, PMDTrapezoidalProfile);

        ...set the profile parameters
        ...tPosition(hAxis1, 200000);
        ...Velocity(hAxis1, 0x200000);
        ...celeration(hAxis1, 0x1000);
        ...eleration(hAxis1, 0x1000);

        ...tion
        ...;
```

	VELOCITY & TORQUE CONTROL ICs	MAGELLAN® MOTION CONTROL ICs	ATLAS® DIGITAL AMPLIFIERS	PRODIGY® MOTION BOARDS	ION® DIGITAL DRIVES
No. Axes	1	1, 2, 3, 4	1	1, 2, 3, 4	1
Format	• 64-pin TQFP	• 144-pin TQFP • 100-pin TQFP	• Compact: 20-pin solderable module • Ultra Compact: 19-pin solderable module	• PCI • PC/104 • Standalone • Machine Controller	• Fully enclosed module
Voltage	3.3 V	3.3 V	12 - 56 V	PCI, PC/104, Standalone: 5 V Machine Controller: 12 - 56 V	12 - 56 V / 20 - 195 V
Features	• Velocity control • Commutation • Torque/current control • Field-oriented control	• Position control • Commutation • Network communications • Torque/current control • Field oriented control • Profile generation • Multi-motor support	• Torque/current control • Field oriented control • Trace buffer • Pulse & direction input • Multi-motor support • SPI Interface • MOSFET amplifier	• Position control • Commutation • Network communications • Torque/current control • Field oriented control • Profile generation • Multi-motor support • PWM output • Analog output • Trace buffer • Programmable • Signal conditioning • General purpose user I/Os	• Position control • Commutation • Network communications • Torque/current control • Field oriented control • Profile generation • Trace buffer • MOSFET amplifier • Pulse & direction input • Programmable (ION/CME only) • General purpose user I/Os (ION/CME only)
Motor Types	• Brushless DC	• DC brush • Brushless DC • Step Motor	• DC brush • Brushless DC • Step Motor	• DC brush • Brushless DC • Step Motor	• DC brush • Brushless DC • Step Motor
Communication	• Standalone • RS232/485	• Parallel • RS232/485 • CANbus • SPI	• SPI	• Ethernet • RS232/485 • CANbus • PCI and PC/104 bus	• Ethernet • RS232/485 • CANbus
Loop Rate	20 kHz – current 10 kHz – velocity	50 – 75 µsec/axis	20 kHz – current	50 – 150 µsec/axis	20 kHz – current 10 kHz – position

> FOR ORDERING VELOCITY & TORQUE CONTROL ICs

MC 7 8 1 1 3

Product Group:
DK = Development Kit
MC = Motion Chip

Product Family:
7   Juno/Velocity & Torque

Motor Type:
1   DC Brush
3   BLDC
4   (Micro) Step
8   Multi-motor

# of Axis:
1

# of ICs:
1

IC Subtype:
0 or 3

To place an order or for additional information and questions, contact PMD customer support
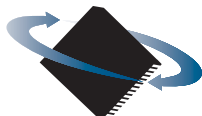
PERFORMANCE MOTION DEVICES
MOTION CONTROL AT ITS CORE

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About Performance Motion Devices

Performance Motion Devices (PMD) is a worldwide leader in motion control ICs, boards 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.