MC58113 Series Motion Control ICs are members of PMD’s third-generation Magellan family and provide high-performance chip-based motion control for medical, scientific, automation, and robotic applications. Available in single IC, single axis versions, the MC58113 Series ICs are programmable devices which provide positioning, velocity, and torque control for DC brush, brushless DC, and step motors.

### Programmability

All of PMD’s Magellan Motion Control ICs provide a flexible and powerful instruction set to initialize and control motion axes, monitor performance, and synchronize overall machine behavior. Working with Magellan ICs, PMD’s powerful Pro-Motion® GUI makes it easy to graph and analyze system performance; while C-Motion® allows you to develop your own application using C/C++.

### Flexibility

There are four MC58113 Series ICs, each packaged in a single 100-pin TQFP operating at 3.3 V. The MC51113 provides dedicated control of DC-Brush motors, the MC53113 provides control of three-phase Brushless DC motors, the MC54113 provides control of two-phase step motors, and the MC58113 can be software selected to provide control of any of these motor types.

---

### FEATURES

- Single axis, single IC members of PMD’s Magellan® Motion IC family
- Position, velocity, and torque control
- DC brush, brushless DC, and step motor control
- S-curve, trapezoidal, velocity contouring, and electronic gearing profiles
- SPI (Serial Peripheral Interface), serial RS232/485, and CANbus communications
- 1.5 axes (primary and auxiliary encoder) control
- Advanced PID filter with velocity and acceleration feedforward
- High performance current control of each motor phase
- High/Low switching amplifier control with programmable deadtime and charge pump refresh
- Velocity, position and acceleration changes on-the-fly
- Programmable position loop time from 50 μsec to 1,600 μsec
- FOC (field oriented control) for digital current loop
- Incremental encoder quadrature input (up to 25 Mcounts/sec)
- Synch pin feature allows multiple axes to be synchronized to <1 μsec
- Internal motion trace NVRAM for performance optimization
- Overcurrent, over/undervoltage and overtemperature detect
- Directional limit switch, index, and home inputs
- Axis settled indicator, tracking window and automatic motion error detection
- Supports PMD’s Atlas® Digital Amplifier
- General-purpose analog input
- Programmable dual biquad filters
- Programmable acceleration and deceleration values
- Compact 100 pin TQFP package

### CONFIGURATION
### Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Configurations</strong></td>
<td>MC51113 - DC Brush motor version</td>
</tr>
<tr>
<td></td>
<td>MC53113 - Brushless DC motor version</td>
</tr>
<tr>
<td></td>
<td>MC54113 - Step motor version</td>
</tr>
<tr>
<td></td>
<td>MC58113 - multi-motor version (software selectable)</td>
</tr>
<tr>
<td><strong>Host communication options</strong></td>
<td>Serial RS232/485</td>
</tr>
<tr>
<td></td>
<td>CANbus 2.0B</td>
</tr>
<tr>
<td></td>
<td>SPI (Serial Peripheral Interface)</td>
</tr>
<tr>
<td><strong>Position Range</strong></td>
<td>-2,147,483,648 to +2,147,483,647 counts</td>
</tr>
<tr>
<td><strong>Velocity Range</strong></td>
<td>-32,767 to 32,767 counts/sample</td>
</tr>
<tr>
<td><strong>Jerk Range</strong></td>
<td>0 to 32,767 counts/sample³</td>
</tr>
<tr>
<td><strong>Serve Loop Range</strong></td>
<td>50 µsec to 1,600 msec per axis</td>
</tr>
<tr>
<td><strong>Position Error Resolution</strong></td>
<td>32 bits</td>
</tr>
<tr>
<td><strong>Commutation Rate</strong></td>
<td>20 kHz</td>
</tr>
<tr>
<td><strong>Microsteps per full step</strong></td>
<td>Programmable, up to 256</td>
</tr>
<tr>
<td><strong>Signal inputs axis 1</strong></td>
<td>QuadA/B, Index, Home, Hall A/B/C Axis, Pos/NegLimit</td>
</tr>
<tr>
<td><strong>Signal inputs axis 2</strong></td>
<td>QuadA/B, Index, Home</td>
</tr>
<tr>
<td><strong>Maximum Encoder Rate</strong></td>
<td>25 Mcounts/sec</td>
</tr>
<tr>
<td><strong>Internal trace buffer</strong></td>
<td>32 KB</td>
</tr>
<tr>
<td><strong>Internal NVRAM buffer</strong></td>
<td>2 KB</td>
</tr>
<tr>
<td><strong>Operating Temperature (Ta)</strong></td>
<td>-40º C to 85º C</td>
</tr>
<tr>
<td><strong>Supply Voltage Operating Range (Vcc)</strong></td>
<td>3.0 V to 3.6 V</td>
</tr>
<tr>
<td><strong>Package &amp; Dimensions</strong></td>
<td>100 pin TQFP, 14 x 14mm</td>
</tr>
</tbody>
</table>

### AMPLIFIER CONNECTION OPTIONS

**On-board PWM amplifier circuitry (DK Only)**

- **PWM output rate**: 20, 40, or 80 kHz
- **Current control modes**: FOC (field oriented control), A/B, third leg floating, voltage mode
- **Current loop rate**: 20 kHz
- **PWM output modes**: High/Low, Sign/Magnitude, 50/50

**External +/- 10V input amplifier**

- **AmplifierSPI bus serial DAC**: 16 bits
- **Pulse & Direction input amplifier**
  - Pulse and Direction output rate: up to 1.0 M pulses/sec

### ATLAS® Digital Amplifiers

ATLAS® Digital amplifiers are compact single-axis amplifiers that provide high performance torque control of DC brush, brushless DC, and step motors. They are packaged in a Compact or Ultra Compact solderable module and utilize standard through-hole pins for all connections.

- **Voltage Input**: 12-56 VDC
- **Microstepping resolution**: 256
- **PWM frequency**: 20, 40, 80 kHz
- **Current Loop rate**: 20 kHz
- **Power rating options**: 75W, 250W, 500W

### Mechanical Dimensions

- **Ultra Compact size**: 1.05” x 1.05” x .53” (27mm x 27mm x 13mm)
- **Compact size**: 1.52” x 1.52” x .60” (39mm x 39mm x 15mm)
Development Tools

1. **EASY START-UP**
   **Developers Kit**

   Includes
   - MC58113 Developers 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-Motion® GUI**

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

   **Features**
   - Motion oscilloscope graphically displays processor parameters in real-time
   - Autotuning
   - Ability to save and load settings
   - Axis wizard
   - Distance and time units conversion
   - Motor-specific parameter setup
   - Axis shuttle performs programmable motion between two positions
   - Communications monitor echoes all commands sent by Pro-Motion to the board
   - Advanced Bode analysis for frequency machine response

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, boards, 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

   Example C-Motion code for executing a profile and tracing processor variables in the example could be used for tuning the PID filter:

   ```c
   // set the trace buffer wrap mode to a one time trace
   SetTraceMode(hAxis1, PMDTraceOneTime);
   // set the processor variables that we want to capture
   SetTraceVariable(hAxis1, PMDTraceVariable1, PMDAxis1, PMDTraceActualPosition);
   SetTraceVariable(hAxis1, PMDTraceVariable2, PMDAxis1, PMDTraceActualVelocity);
   SetTraceVariable(hAxis1, PMDTraceVariable3, PMDAxis1, PMDTraceCommandedVelocity);
   // 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);
   // set the profile parameters
   SetProfileMode(hAxis1, PMDTrapezoidalProfile);
   // set the profile parameters
   SetPosition(hAxis1, 200000);
   SetVelocity(hAxis1, 0x200000);
   SetAcceleration(hAxis1, 0x1000);
   SetDeceleration(hAxis1, 0x1000);
   // start the motion
   Update(hAxis1);
   ```
### PMD PRODUCT OVERVIEW

<table>
<thead>
<tr>
<th>No. Axes</th>
<th>VELOCITY &amp; TORQUE CONTROL ICs</th>
<th>MAGELLAN MOTION CONTROL ICs</th>
<th>ATLAS DIGITAL AMPLIFIERS</th>
<th>PRODIGY MOTION BOARDS</th>
<th>ION DIGITAL DRIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64-pin TQFP</td>
<td>144-pin TQFP</td>
<td>Compact: 20-pin solderable module</td>
<td>PCI, PC/104, Standalone: 5 V Machine Controller</td>
<td>Fully enclosed module</td>
</tr>
<tr>
<td>1, 2, 3, 4</td>
<td>100-pin TQFP</td>
<td></td>
<td>Ultra Compact: 19-pin solderable module</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Voltage
- 3.3 V
- 3.3 V
- 12 - 56 V
- 5 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
- MOSFET amplifier
- Torque/current control
- Field oriented control
- Trace buffer
- Multi-motor support
- SPI Interface
- MOSFET amplifier
- Position control
- Commutation
- Network communications
- Programmable (ION/CME only)
- General purpose user I/Os
- Torque/current control
- Field oriented control
- Pulse & direction input
- Programmable
- Signal conditioning
- General purpose user I/Os

#### Motor Types
- Brushless DC
- DC brush
- Step Motor
- 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 usec/axis
- 20 kHz – current
- 10 kHz – position

---

**FOR ORDERING MAGELLAN ICs**

**MC 58113**

- **Product Group:**
  - DK = Development Kit
  - MC = Motion Chip
- **Product Family:**
  - Magellan
- **Motor Type:**
  - 0 = IO
  - 1 = DC Brush
  - 3 = BLDC
  - 4 = (Micro) Step
  - 5 = Pulse & Direction
  - 8 = Multi-motor
- **# of Axes:**
  - 0 (IO only)
  - 1, 2, 3, or 4
- **# of ICs:**
  - 0 (IO only)
  - 1 or 2
- **IC Subtype:**
  - 3

To place an order or for additional information and questions, contact PMD customer service.

---

**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.

ATLAS, ION, Juno, Magellan, Navigator, Pilot, Prodigy, C-Motion and Pro-Motion are trademarks of Performance Motion Devices, Inc. All other trade names, brand names and company names are the property of their respective owners. 2017 Performance Motion Devices, Inc.