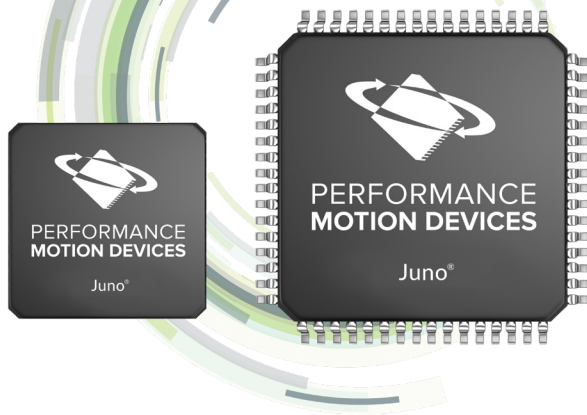


# Juno® Family of Velocity & Torque Control ICs



**The Juno Family of ICs** provide advanced velocity and torque control for Brushless DC, DC Brush, and step motors. They are the industry's first family of compact ICs with full four quadrant motion control, direct input quadrature encoder, profile generation, and advanced current control.

Juno ICs are targeted for medical, scientific, industrial, and robotic applications that need to minimize motor noise, vibration and power consumption. Juno ICs are easy to deploy with embedded motion commands, on-board intelligence, and direct analog and digital amplifier signal interfacing.

## Easy Integration

Juno ICs interface to external bridge-type switching amplifiers and utilize Performance Motion Device's proprietary current and switch-signal technology for ultra smooth operation. Depending on the type of motor controlled, Juno ICs provide motor commutation, microstep generation, pulse and direction input, internal profile generation, and much more.

## Integrated Safety Features

Juno ICs are equipped with advanced amplifier management features such as overcurrent, over/undervoltage, and overtemperature sense. A special outer control loop allows a wide range of motor-related control applications, including pressure, flow rate and temperature control.

## Flexible Offering

Juno ICs are offered in three major product groups:

- Juno Velocity Control ICs
- Juno Step Motor Control ICs
- Juno Torque Control ICs

No matter what your motor control application, there is a Juno IC that will take your application to a higher level.

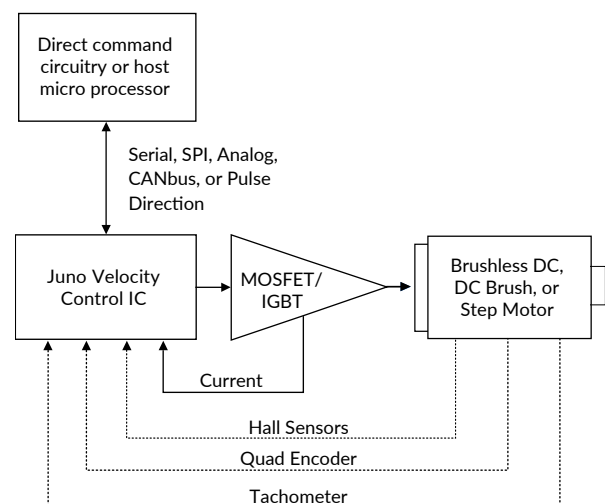
## MEET THE FAMILY

- **Velocity Control ICs:** Sophisticated velocity and torque control of 3-phase DC Brush and Brushless DC motors
- **Torque Control ICs:** Ultra precise torque control for 3-phase Brushless DC and DC Brush motors with direct analog or SPI command input
- **Step Motor Control ICs:** State of the art step motor control with pulse and direction or SPI command input

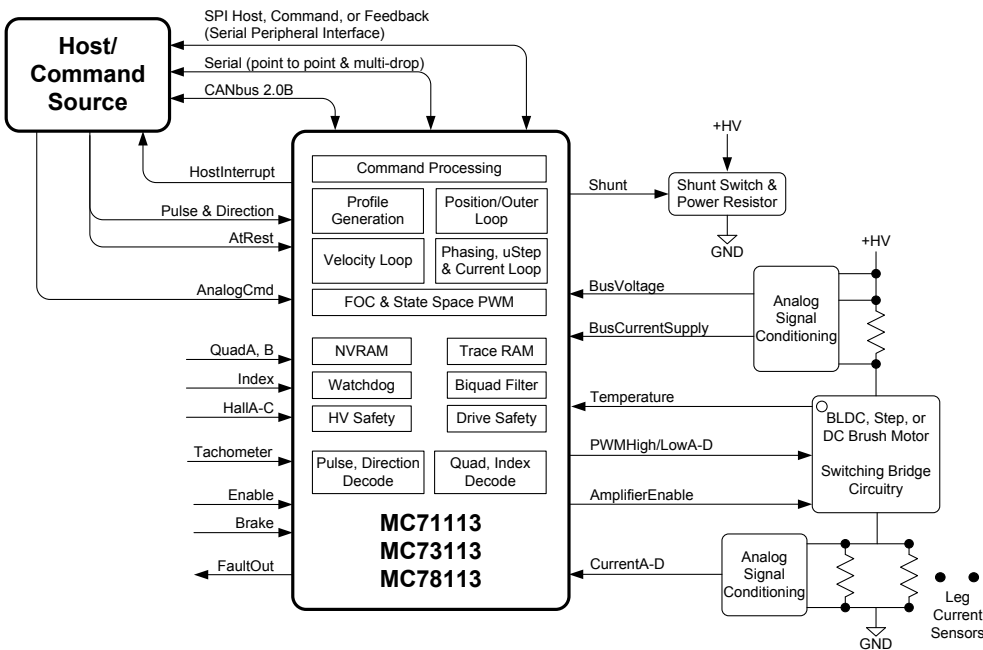
## FEATURES

- Controls 3-phase DC Brush, Brushless DC, or step motors
- High performance digital current loop
- Velocity loop with encoder or tachometer feedback
- Internal profile generator
- Sinusoidal or 6-step commutation
- Field oriented control
- Hall sensor inputs
- PWM output with shoot-through protection
- Direct analog signal input
- Serial port up to 460 kBaud
- Quadrature encoder input up to 40 Mcounts/sec
- NVRAM configuration load and trace memory
- Compact 64-pin TQFP and ultra-compact 56-pin VQFN packages
- High speed index input and capture
- SPI (serial peripheral interface) command input
- Brake signal input
- 10 kHz velocity loop
- 20, 40, 80, 120 kHz PWM rate
- 20 or 40 kHz commutation and current loop rate
- i2t current foldback protection
- Over and under-voltage protection
- Pulse and direction input

## CONFIGURATION



## TECHNICAL OVERVIEW



## PART NUMBERS

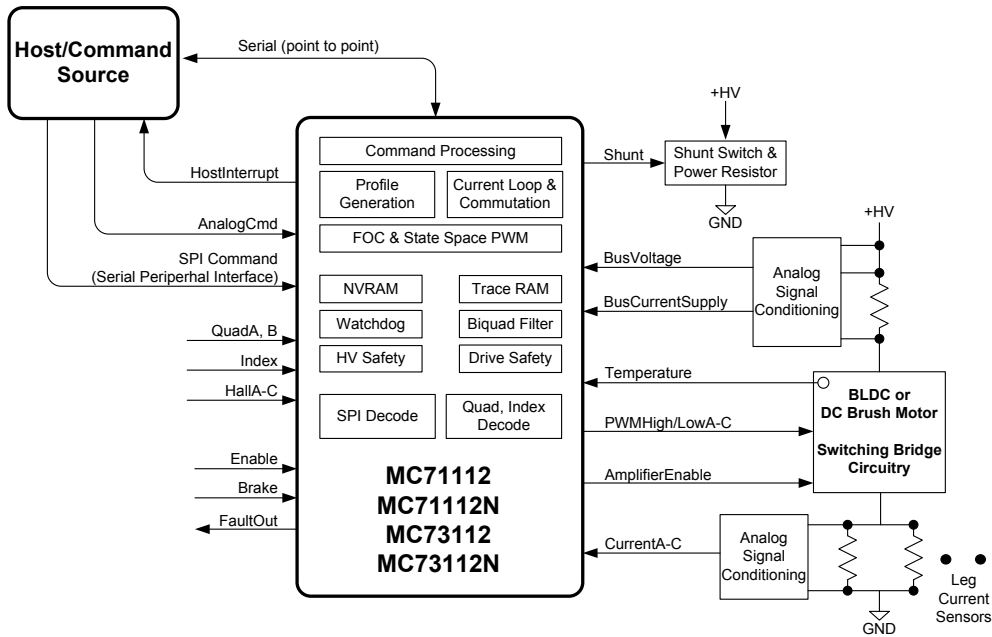
<b>MC71113</b>	64-pin TQFP DC Brush
<b>MC73113</b>	64-pin TQFP Brushless DC
<b>MC78113</b>	64-pin TQFP DC Brush Brushless DC Step (motor type user set)

## SPECIFICATIONS – JUNO VELOCITY CONTROL ICs

Parameters	Value
<b>Motors supported</b>	3-phase Brushless DC, DC Brush, 2-phase step motor
<b>Operating modes</b>	Standalone: direct command input via external circuitry (onboard NVRAM holds configuration), Host command: microprocessor command input
<b>Control loops</b>	Position/outer loop, velocity loop, current loop
<b>Current control modes</b>	FOC (field oriented control), Third leg floating, Single-phase, Voltage mode (no current control)
<b>Commutation modes</b>	6-step (using Hall sensors) Sinusoidal (with quadrature encoder input)
<b>Motor output modes</b>	Individual high/low PWM, Sign/Magnitude PWM
<b>Microstep per full step</b>	Programmable up to 256 microsteps/full step
<b>Profile generator parameters</b>	Velocity, acceleration, deceleration
<b>Communication modes</b>	Point-to-point asynchronous serial, Multi-drop asynchronous serial, SPI, or CANbus 2.0
<b>Serial baud rate range</b>	1,200 to 460,800 baud
<b>CANbus baud rate range</b>	10,000 to 1,000,000 baud
<b>Internal trace RAM</b>	6,144 16-bit words
<b>Internal NVRAM</b>	1,024 16-bit words

Parameters	Value
<b>Velocity feedback options</b>	Quadrature encoder, Hall sensors, analog tachometer signal (12-bit A/D resolution)
<b>Position command options</b>	Pulse and direction, Digital SPI (16-bit resolution), Internal profile generator
<b>Velocity and torque command options</b>	Analog signal (12-bit A/D resolution), Digital SPI (16-bit resolution), Internal profile generator
<b>Control/status signals</b>	Enable, FaultOut, Hostinterrupt, Brake
<b>Motor drive signals</b>	PWM High/LowA-D, AmplifierEnable, CurrentA-D
<b>DC Bus safety signals</b>	Shunt, BusVoltage, BusCurrentSupply, Temperature
<b>Motor feedback signals</b>	QuadA, QuadB, Index, HallA-C, Tachometer, digital SPI
<b>Max quadrature rate</b>	40 Mcounts/second
<b>Max SPI frequency</b>	10 MHz
<b>Position/outer loop rate</b>	Programmable up to 10 kHz
<b>Velocity loop rate</b>	Programmable up to 10 kHz
<b>Current loop rate</b>	20 kHz
<b>Commutation rate</b>	20 kHz
<b>PWM rate</b>	20, 40, 80, 120 kHz
<b>Dimension</b>	64-pin TQFP: 12 mm x 12 mm including leads

## TECHNICAL OVERVIEW



## PART NUMBERS

<b>MC71112</b>	64-pin TQFP DC Brush
<b>MC7112N</b>	56-pin VQFN DC Brush
<b>MC73112</b>	64-pin TQFP Brushless DC
<b>MC73112N</b>	56-pin VQFN Brushless DC

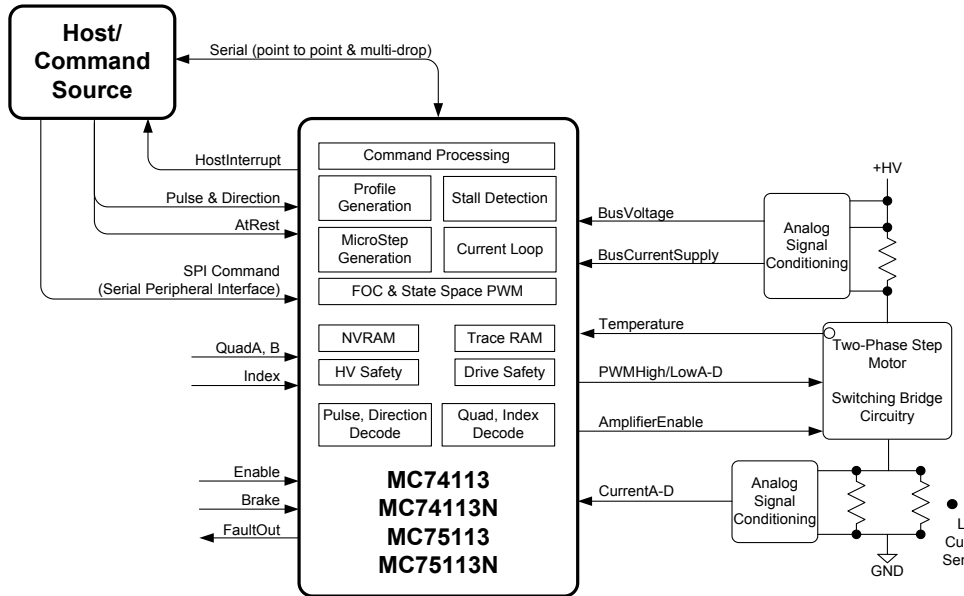
## SPECIFICATIONS – JUNO TORQUE CONTROL ICs

Parameters	Value
<b>Motors supported</b>	3-phase Brushless DC, DC Brush
<b>Operating modes</b>	Standalone: direct command input via external circuitry (onboard NVRAM holds configuration), Host command: microprocessor command input via serial
<b>Control loops</b>	Current loop
<b>Commutation modes</b>	6-step (using Hall sensors), Sinusoidal (with quadrature encoder input)
<b>Current control modes</b>	FOC (field oriented control), Third leg floating, Single-phase, Voltage mode (no current control)
<b>Motor output modes</b>	Individual high/low PWM, Sign/Magnitude PWM
<b>Communication modes</b>	Point-to-point asynchronous serial
<b>Serial baud rate range</b>	1,200 to 460,800 baud
<b>Internal trace RAM</b>	6,144 16-bit words
<b>Internal NVRAM</b>	1,024 16-bit words

Parameters	Value
<b>Torque command options</b>	Analog signal (12-bit A/D resolution), Digital SPI (16-bit resolution), Internal profile generator, Direct set register
<b>Control/status signals</b>	Enable, FaultOut, Hostinterrupt, Brake
<b>Motor drive signals</b>	PWM High/LowA-C, AmplifierEnable, CurrentA-C
<b>DC Bus safety signals</b>	Shunt, BusVoltage, BusCurrentSupply, Temperature
<b>Motor feedback signals</b>	QuadA, QuadB, Index, HallA-C
<b>Max quadrature rate</b>	40 Mcounts/second
<b>Max SPI frequency</b>	10 MHz
<b>Current loop rate</b>	20 kHz
<b>Commutation rate</b>	40 kHz
<b>PWM rate</b>	20, 40, 80, 120 kHz
<b>Dimension</b>	64-pin TQFP: 12 mm x 12 mm including leads 56-pin VQFN: 7.2 mm x 7.2 mm

# JUNO® STEP MOTOR CONTROL ICs

## TECHNICAL OVERVIEW



## PART NUMBERS

<b>MC74113</b>	64-pin TQFP Step motor with encoder
<b>MC74113N</b>	56-pin VQFN Step motor with encoder
<b>MC75113</b>	64-pin TQFP Step motor
<b>MC75113N</b>	56-pin VQFN Step motor

## SPECIFICATIONS – JUNO STEP MOTOR CONTROL ICs

Parameters	Value
<b>Motors supported</b>	2-phase step motor
<b>Operating modes</b>	Standalone: direct command input via external circuitry (onboard NVRAM holds configuration), Host command: microprocessor command input via serial
<b>Control loops</b>	Current loop
<b>Current control modes</b>	FOC (field oriented control), Voltage mode (no current control)
<b>Motor output modes</b>	Individual high/low PWM, Sign/Magnitude PWM
<b>Microstep per full step</b>	Programmable up to 256 microsteps/full step
<b>Stall detection</b>	Via encoder
<b>Profile generator parameters</b>	Velocity, acceleration, deceleration
<b>Communication modes</b>	Point-to-point asynchronous serial
<b>Serial baud rate range</b>	1,200 to 460,800 baud
<b>Internal trace RAM</b>	6,144 16-bit words
<b>Internal NVRAM</b>	1,024 16-bit words

Parameters	Value
<b>Position command options (with AtRest signal)</b>	Pulse and direction, Digital SPI (16-bit resolution), Internal profile generator
<b>Control/status signals</b>	Enable, FaultOut, Hostinterrupt, Brake
<b>Motor drive signals</b>	PWM High/LowA-D, AmplifierEnable, CurrentA-D
<b>DC Bus safety signals</b>	BusVoltage, BusCurrentSupply, Temperature
<b>Motor feedback signals</b>	QuadA, QuadB, Index
<b>Max quadrature rate</b>	40 Mcounts/second
<b>Max SPI frequency</b>	10 MHz
<b>Current loop rate</b>	20 kHz
<b>Microstep synthesis rate</b>	40 kHz
<b>PWM rate</b>	20, 40, 80, 120 kHz
<b>Dimension</b>	64-pin TQFP: 12 mm x 12 mm including leads 56-pin VQFN: 7.2 mm x 7.2 mm

# Development Tools

## 1 EASY START-UP Developers Kit

### INCLUDES

- MC78113, MC73112N, or MC74113N Developer Kit boards
- Pro-Motion software
- Software Development Kit (SDK) with C-Motion
- Complete manual set
- Complete cable connector set

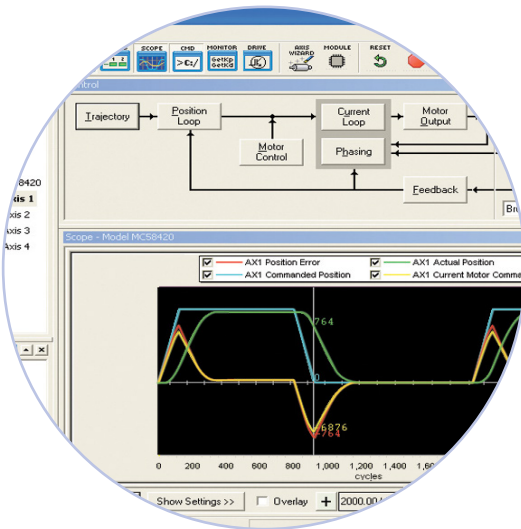


## 2 TUNE & OPTIMIZE Pro-Motion® GUI

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 PC/104, serial, CAN, Ethernet, and SPI communications

```
// code for executing a profile and tracing
// captured in this example could be used for tuning the Pro-Motion
// set the trace buffer wrap mode to a one time trace
PMDTraceMode(hAxis1, PMDTraceOneTime);

// set the processor variables that we want to capture
PMDSetTraceVariable(hAxis1, PMDTraceVariable1, PMDAxis1,
PMDSetTraceVariable(hAxis1, PMDTraceVariable2, PMDAxis1,
PMDSetTraceVariable(hAxis1, PMDTraceVariable3, PMDAxis1,
PMDSetTraceVariable(hAxis1, PMDTraceVariable4, PMDAxis1,

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

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

// set the profile parameters
PMDSetPosition(hAxis1, 200000);
PMDSetVelocity(hAxis1, 0x200000);
PMDSetAcceleration(hAxis1, 0x1000);
PMDSetDeceleration(hAxis1, 0x1000);

// execute the profile
PMDExecuteProfile(hAxis1);
```

## PMD PRODUCT FAMILY OVERVIEW

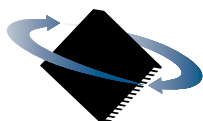
	# Axes	Motor Types	Format	Voltage	Communication	Features
<b>JUNO® VELOCITY &amp; TORQUE CONTROL ICs</b> 	1	<ul style="list-style-type: none"> <li>Brushless DC</li> <li>DC Brush</li> <li>Step Motor</li> </ul>	<ul style="list-style-type: none"> <li>64-pin TQFP</li> <li>56-pin VQFN</li> </ul>	3.3 V	<ul style="list-style-type: none"> <li>RS232/485</li> <li>CANbus</li> <li>SPI</li> </ul>	<ul style="list-style-type: none"> <li>Velocity control</li> <li>Current control</li> <li>Field oriented control</li> </ul>
<b>MAGELLAN® MOTION CONTROL ICs</b> 	1,2,3,4	<ul style="list-style-type: none"> <li>Brushless DC</li> <li>DC Brush</li> <li>Step Motor</li> </ul>	<ul style="list-style-type: none"> <li>144-pin TQFP</li> <li>100-pin TQF</li> </ul>	3.3 V	<ul style="list-style-type: none"> <li>RS232/485</li> <li>CANbus</li> <li>SPI</li> <li>Parallel</li> </ul>	<ul style="list-style-type: none"> <li>Position control</li> <li>Torque/current control</li> <li>Field oriented control</li> <li>Profile generation</li> </ul>
<b>ATLAS® DIGITAL AMPLIFIERS</b> 	1	<ul style="list-style-type: none"> <li>Brushless DC</li> <li>DC Brush</li> <li>Step Motor</li> </ul>	20-pin solderable module	12-56 V	<ul style="list-style-type: none"> <li>SPI</li> <li>Pulse and direction</li> </ul>	<ul style="list-style-type: none"> <li>Torque/current control</li> <li>Field oriented control</li> <li>MOSFET amplifier</li> </ul>
<b>ION®/CME N-SERIES DIGITAL DRIVES</b> 	1	<ul style="list-style-type: none"> <li>Brushless DC</li> <li>DC Brush</li> <li>Step Motor</li> </ul>	Fully enclosed PCB-mounted module	12-56 V	<ul style="list-style-type: none"> <li>Ethernet</li> <li>RS232/485</li> <li>CAN FD</li> <li>SPI</li> </ul>	<ul style="list-style-type: none"> <li>Position control</li> <li>Torque/current control</li> <li>Field oriented control</li> <li>Profile generation</li> <li>MOSFET amplifier</li> <li>Downloadable user code</li> </ul>
<b>ION® 500 &amp; 3000 DIGITAL DRIVES</b> 	1	<ul style="list-style-type: none"> <li>Brushless DC</li> <li>DC Brush</li> <li>Step Motor</li> </ul>	Fully enclosed cable-connected module	12-56 V 20-195 V	<ul style="list-style-type: none"> <li>Ethernet</li> <li>RS232/485</li> <li>CANbus</li> </ul>	<ul style="list-style-type: none"> <li>Position control</li> <li>Torque/current control</li> <li>Field oriented control</li> <li>Profile generation</li> <li>MOSFET amplifier</li> <li>Downloadable user code</li> </ul>
<b>PRODIGY® MOTION BOARDS</b> 	1,2,3,4	<ul style="list-style-type: none"> <li>Brushless DC</li> <li>DC Brush</li> <li>Step Motor</li> </ul>	<ul style="list-style-type: none"> <li>Machine Controller</li> <li>PC/104</li> <li>Standalone</li> </ul>	<ul style="list-style-type: none"> <li>5 V: PC/104 and Standalone</li> <li>12-56 V: Machine Controller</li> </ul>	<ul style="list-style-type: none"> <li>Ethernet</li> <li>RS232/485</li> <li>CANbus</li> <li>PC/104 bus</li> </ul>	<ul style="list-style-type: none"> <li>Position control</li> <li>Torque/current control</li> <li>Field oriented control</li> <li>Profile generation</li> <li>Downloadable user code</li> </ul>

C-Motion® is the common motion language for all Performance Motion Devices products.

## FOR ORDERING

MC 7 8 1 1 3						
<b>Product Group:</b> MC = Motion Chip DK = Developer Kit	<b>Product Family:</b> 7 Juno	<b>Motor Type:</b> 1 DC Brush 3 Brushless DC 4 Step with Encoder 5 Step 8 Multi-motor	<b>No of Axis:</b> 1	<b>No of ICs:</b> 1	<b>IC Subtype:</b> 2 Torque Control 3 All Others	<b>Package:</b> N 56-pin VQFN step and torque control only Blank 64-pin TQFP

To place an order email [purchaseorders@pmdcorp.com](mailto:purchaseorders@pmdcorp.com). For questions email [support@pmdcorp.com](mailto:support@pmdcorp.com)



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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.

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[MC71112N](#)