DATASHEET

# 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.

PERFORMANCE MOTION DEVICES
MOTION CONTROL AT ITS CORE

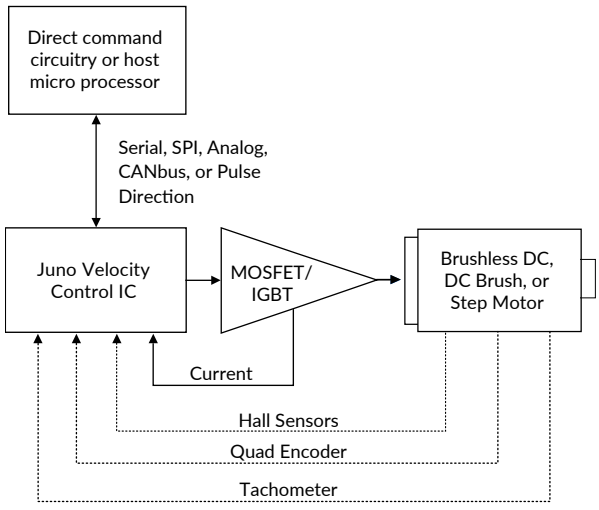
## MEET THE FAMILY

- **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

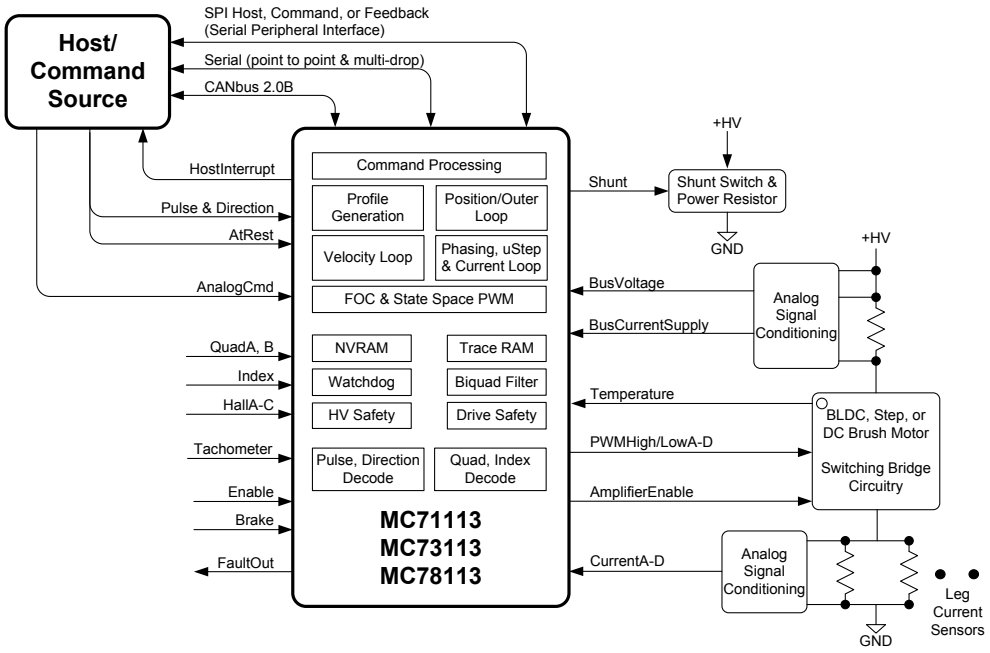
- Controls 3-phase DC Brush, Brushless DC, or step motors
- High performance digital current loop
- Velocity loop with encoder or tachometer feedback
- Internal profile generator
- Sinusoidal or 6-step commutation
- Field oriented control
- Hall sensor inputs
- PWM output with shoot-through protection
- 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



# JUNO® VELOCITY CONTROL ICs

## TECHNICAL OVERVIEW




## PART NUMBERS

| | |
|---|---|
| **MC71113** | 64-pin TQFP<br>DC Brush |
| **MC73113** | 64-pin TQFP<br>Brushless DC |
| **MC78113** | 64-pin TQFP<br>DC Brush<br>Brushless DC<br>Step<br>(motor type user set) |

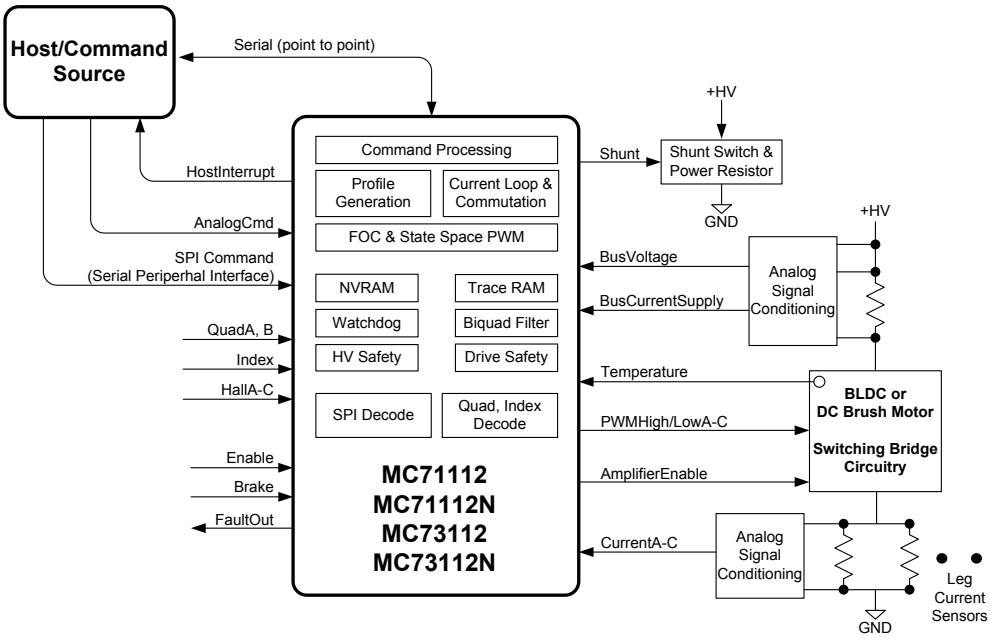
## SPECIFICATIONS — JUNO VELOCITY CONTROL ICS

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

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

# JUNO® TORQUE CONTROL ICs

## TECHNICAL OVERVIEW




## PART NUMBERS

| | |
|---|---|
| **MC71112** | 64-pin TQFP DC Brush |
| **MC71112N** | 56-pin VQFN DC Brush |
| **MC73112** | 64-pin TQFP Brushless DC |
| **MC73112N** | 56-pin VQFN Brushless DC |

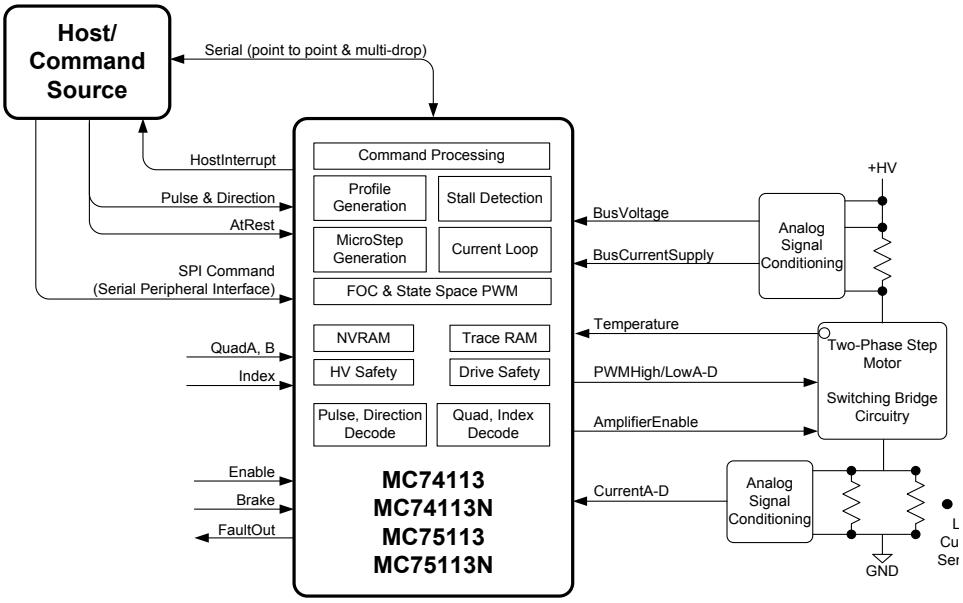
## SPECIFICATIONS — JUNO TORQUE CONTROL ICS

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

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

# JUNO® STEP MOTOR CONTROL ICs

## TECHNICAL OVERVIEW




## PART NUMBERS

| | |
|---|---|
| **MC74113** | 64-pin TQFP Step motor with encoder |
| **MC74113N** | 56-pin VQFN Step motor with encoder |
| **MC75113** | 64-pin TQFP Step motor |
| **MC75113N** | 56-pin VQFN Step motor |

## SPECIFICATIONS — JUNO STEP MOTOR CONTROL ICS

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

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

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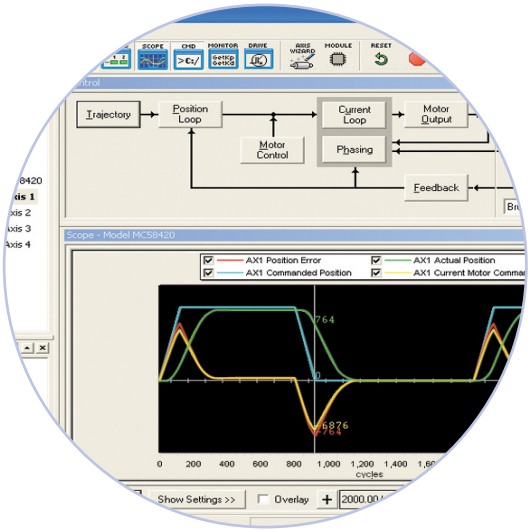


## 2 TUNE & OPTIMIZE
### Pro-Motion® GUI

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

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## 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