

Motion Control

Overview

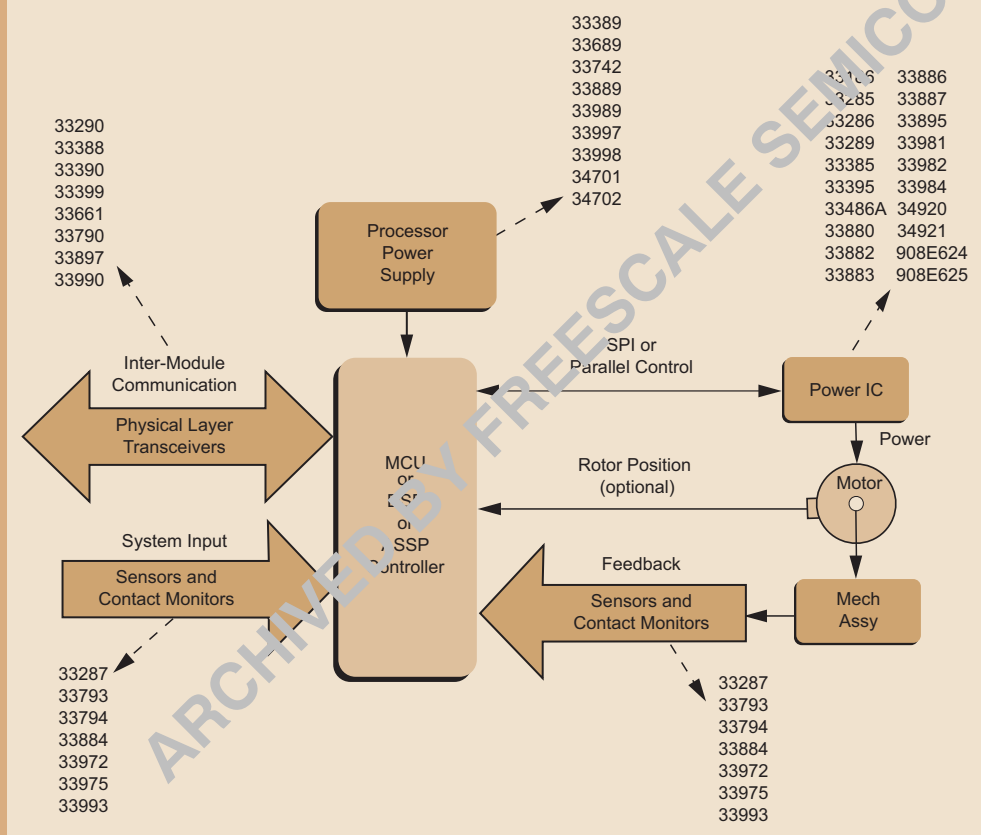
Motion control is the function of governing the physical displacement, movement, location or position of a mechanical assembly, driven by an intermittent duty motor.

Typical applications would include robotics, CNC machining, servos in RC antenna and dish positioners, marine autoconning, paper handlers in printers and copiers, and any other application in which a motor controls the position of a mechanical assembly.

Key Benefits

- > Provides system solutions when coupled with MCUs or DSPs
- > Enables key protection and performance functions
- > Provides system solution through highly integrated, robust, and reliable Freescale Semiconductor quality

MOTION CONTROL BLOCK DIAGRAM



Freescale Ordering Information Note

Part Number	Product Highlights	Additional Information
DSP56F803	80 MHz; 40 MIPS; CAN, SCI, SPI, ADC, PWMs, Quadrature Decoder, Quad Timer; 31.5 K Program Flash; 512 K Program RAM; 4 K Data Flash; MCU-Friendly Instruction Set; OnCE for Debug; On-Chip Relaxation Oscillator; 2 K BootFLASH; External Memory Expansion; Up to 16 GPIO Available in a 100-Pin LQFP	www.freescale.com
DSP56F805	80 MHz; 40 MIPS; CAN; SCIs; SPI; ADC; PWMs; Quadrature Decoder; Quad Timer; 31.5 K Program Flash; 512 K Program RAM; 4 K Data Flash; 2 K Data RAM; MCU-Friendly Instruction Set; OnCE for Debug; On-Chip Relaxation Oscillator; 2 K BootFLASH; External Memory Expansion; Up to 32 GPIO Available in a 144-Pin LQFP	
DSP56F807	80 MHz; 40 MIPS; CAN; SCIs; SPI; ADCs; PWMs; Quadrature Decoder; Quad Timer; 60 K Program Flash; 2 K Program RAM; 8 K Data Flash; 4 K Data RAM; MCU-Friendly Instruction Set; OnCE for Debug; On-Chip Relaxation Oscillator; 2 K BootFLASH; External Memory Expansion; Up to 32 GPIO Available in a 160-Pin LQFP and 160 MAPBGA	
MC33186	150 mΩ H-Bridge	www.freescale.com/analogue
MC33285	Dual High-Side TMOS Driver	
MC33286	Dual High-Side TMOS Driver	
MC33287	Contact Monitoring and Dual Low-Side Protected Switch	
MC33289	Dual High-Side Switch for Inductive Loads, 2 x 40 mΩ	
MC33290	Serial ISO-9141 K-Line Interface	
MC33385	Quad Low-Side Switch (250 mΩ R _{DS(ON)})	
MC33388	Fault Tolerant CAN Interface	
MC33389	System Basis Chip with Low-Speed CAN	
MC33390	Serial Link ISO-9141 Bus Transceiver	
MC33393	MUX Stepper Motor Controller	
MC33399	Local Interconnect Network (LIN) Physical Layer	
MC33486A	Dual High-Side Switch for H-Bridge	
MC33661	eLIN – Enhanced LIN Physical Layer (Local Interconnect Network)	
MC33689	System Base Chip with Enhanced LIN Physical Interface	
MC33742	System Basis Chip with Enhanced High-Speed CAN	
MC33790	2-Channel DSI Physical Interface for Bus Masters	
MC33793	DSI Slave for Remote Sensing	
MC33794	Electric Field Imaging Device	
MC33880	Configurable Eight Output SPI Controlled Switch (10 Ω R _{DS(ON)})	
MC33882	Six Output Switch (0.3 Ω R _{DS(ON)}) with SPI and Parallel Input Control	
MC33883	H-Bridge Pre-Driver	
MC33884	Switch Monitor Interface	
MC33886	H-Bridge Driver (5.2 A)	
MC33887	H-Bridge Driver with Sleep Mode (5.2 A)	
MC33889	System Basis Chip with Low-Speed Fault Tolerant CAN	
MC33895	Quad H-Bridge with LIN transceiver	
MC33897	Single Wire CAN Transceiver	
MC33972	22 Input Multiple Switch Detection Interface with Suppressed Wake-Up	
MC33975	22 Input Multiple Switch Detection Interface with Higher Wetting Current	
MC33982	Self Protected 2 mΩ Switch with Diagnostic and Protection	
MC33984	Self Protected 4 mΩ Switch with Diagnostic and Protection	
MC33989	System Basis Chip with High-Speed CAN	
MC33990	Serial Link J-1850 Bus Transceiver	
MC33993	22 Input Multiple Switch Detection Interface	
MC33997	3.3/5.0 V Switching Power Supply	
MC33998	2.6/5.0 V Switching Power Supply	
MC34701	Dual Output Power Supply Switching (1.5 A)	
MC34702	Dual Output Power Supply Switching (3.0 A)	
MC34920	Quad H-Bridge Motor Driver	
MC34921	Power System Control IC	
MC34923	Full-Bridge PWM Motor Driver	
MC56F8300 Family	60 MHz, 60 MIPS, up to 576KB Flash, 36KB RAM and Off-Chip Memory, SCI, SPI, ADC, PWM, Quadrature Decoder, Quad Timer, FlexCAN™, GPIO, COP/Watchdog, PLL, MCU-style software stack support, JTAG/OnCE for debug, temperature sensor	www.freescale.com

Note: Search on the listed part number.

Design Challenges

There are several different kinds of motors used in motion control including brushless DC motors, brush-commutator permanent magnet DC motors, linear motors, and stepper motors. The system engineer must not only choose the right kind of motor for the mechanical task, but also choose the appropriate control loop schema encompassing both the mechanical and electrical time-variant response of the system. The tuning of this control loop is often performed in the design of the drive electronics. The design variables are made more numerous because each different type of motor has a unique set of requirements for the drive electronics. A further complication in the requirements of drive electronics, is electrical motors, which by their inductive nature, are prone to produce EMI, RFI, and destructive high energy transients. The design of drive electronics must prevent EMI and RFI, while being able to withstand transient over voltage and over current conditions.

Freescale Semiconductor Solution

Freescale Semiconductor analog/mixed signal and power integrated circuits are designed to provide system solutions when coupled with MCUs or DSPs. In addition to being designed for easy interface and communication with most MCU and DSPs, Freescale Semiconductor's *SMARTMOS™* technology also enables the key protection and performance functions to be built monolithically within the silicon of the power IC. Instead of a printed circuit board loaded with discrete components (and a concomitant poor MTBF number), a system solution can be achieved with highly integrated, robust, and reliable Freescale Semiconductor products.

Typical Applications:

- > CNC machining
- > Robotics
- > HVAC mix louvers
- > Hard automation
- > Power-assisted operator controls
- > Process controls
- > Autopilots
- > Guidance/steering control
- > Servos and radio control
- > Airplane rotors
- > Dish positioners
- > Power adjustable beds
- > Remote pan and tilt motors
- > Printer paper handlers
- > Scanners

Loop Control Schema:

- > Rotation (CW/CCW)
- > Position
- > Step counter
- > Operator (open loop)

Power Control Schema:

- > On/Off
- > PWM
- > Linear
- > Stepper (pulse and hold)

Motor Types:

- > DC brushless commutator
- > Brushless DC
- > Stepper
- > Linear
- > Solenoid
- > Servos

Development Tools^{Note}

Tool Type	Product Name	Vendor	Description	Additional Information
Evaluation Kit	KIT33289DWEVB	Metrowerks	Automotive Dual High-Side Switch	www.metrowerks.com
Evaluation Kit	KIT33388DEVB	Metrowerks	Fault Tolerant CAN Interface	
Evaluation Kit	KIT33389DWEVB	Metrowerks	System Basis Chip	
Evaluation Kit	KIT33399DEVB	Metrowerks	Local Interconnect Network (LIN) Physical Layer	
Evaluation Kit	KIT33661DEVB	Metrowerks	LIN Enhanced Physical Interface	
Evaluation Kit	KIT33689DWEVB	Metrowerks	System Basis Chip with LIN Transceiver	
Evaluation Kit	KIT33742DWEVB	Metrowerks	System Basis Chip with Enhanced High-Speed CAN	
Evaluation Kit	KIT33793DEVB	Metrowerks	DSI Slave for Remote Sensing	
Evaluation Kit	KIT33794DWEVB	Metrowerks	Electric Field Sensing Device	
Evaluation Kit	KIT33880DWEVB	Metrowerks	Configurable Eight Output Switch with SPI	
Evaluation Kit	KIT33883DWEVB	Metrowerks	H-Bridge Pre-Driver	
Evaluation Kit	KIT33886DWEVB	Metrowerks	H-Bridge Integrated Circuit	
Evaluation Kit	KIT33887DWEVB	Metrowerks	225 mΩ 150°C and Sleep Mode and Current Sense	
Evaluation Kit	KIT33889DWEVB	Metrowerks	System Basis Chip with Low-Speed CAN	
Evaluation Kit	KIT33982PNBEVB	Metrowerks	Protected High-Current High-Side Switch	
Evaluation Kit	KIT33984PNBEVB	Metrowerks	Dual 4 mΩ Intelligent High-Current Self-Protected Silicon High-Side Switch	
Evaluation Kit	KIT33989DWEVB	Metrowerks	System Basis Chip with High-Speed CAN	
Evaluation Kit	KIT33993DWEVB	Metrowerks	22 Input Multiple Switch Detection Interface	
Evaluation Kit	KIT33997DWEVB	Metrowerks	3.3/5.0 V Switching Power Supply	
Evaluation Kit	KIT33998DWEVB	Metrowerks	2.6/5.0 V Switching Power Supply	
Evaluation Kit	KIT34701EKEVB	Metrowerks	1.5 A Switch-Mode Power Supply with Linear Regulator	
Evaluation Kit	KIT34702EKEVB	Metrowerks	3.0 A Switch-Mode Power Supply with Linear Regulator	
Hardware	EVM and other development tools for respective DSCs	Metrowerks	Helps developers simplify and speed development for digital signal processors.	

Note: Search on the listed product name.

Related Documentation^{Note}

Document Number	Description	Additional Information
APDPAK	Analog Pitch Book	www.freescale.com
BR1569	Analog ICs Integrated Solutions Applications	
SG1002	Analog Selector Guide	

Note: Search on the listed document number.

Learn More: Contact the Technical Information Center at +1-800-521-6274 or +1-480-768-2130. For more information about Freescale products, please visit www.freescale.com.