Automotive Motor Control Development Solutions

Dual 3-Phase Sensorless BLDC Kit with Qorivva MPC5643L MCU

Target Automotive Applications

- Air conditioning units
- Automotive drives
- Compressors
- Fans
- Motor control
- Pumps
- Servo drives

Overview

The 3-phase sensorless BLDC motor control development kit demonstrates the advantages of the Qorivva MPC5643L MCU for motor control applications using 3-phase brushless DC motors (BLDC). This sample sensorless BLDC control design uses a 32-bit Qorivva MCU built on Power Architecture® technology optimized for a full range of automotive applications. This application utilizes a six-step approach for control of the 3-phase BLDC motor and it is implemented with functions from the automotive math and motor control libraries for the MPC5643L.

The application is designed for the Qorivva MPC5643L controller board with an encoder/ resolver interface and two 3-phase BLDC/PMSM low-voltage power stages equipped with a 3-phase MC33937A pre-driver. Beside the main control loop, the DS bus current and DC bus and phase voltages are monitored during the control process for overvoltage, undervoltage and overcurrent drive protection.

Freescale offers a broad portfolio of automotive MCUs, MPUs, analog integrated circuits and sensor solutions, along with extensive enablement and technical support, empowering you to create the next breakthrough automotive designs for powertrain, body, chassis and safety, infotainment and telematics, and in-vehicle networking applications.

3-Phase BLDC Development Kit: Qorivva MPC5643L

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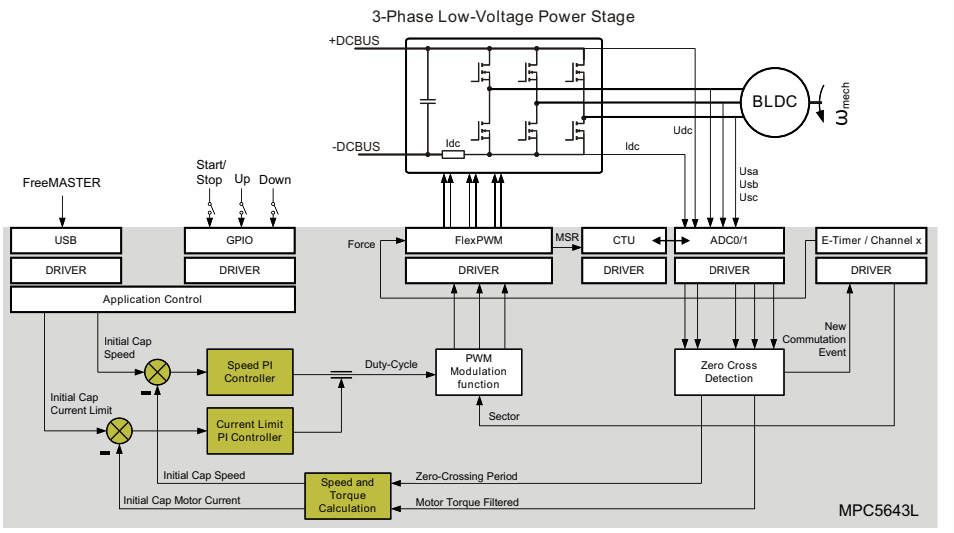
Demo Features

- MPC5643L controller board with doubled encoder/resolver interface
- Two 3-phase BLDC/PMSM low-voltage power stages (12 V/15 A) based on a SMARTMOS MC33397A pre-driver
- Two low-voltage BLDC motors with Hall encoder sensors
- Parameters:
  - 20 kHz PWM (50 µs period), back EMF voltage sensing every 50 µs, 1 ms speed control loop
- Software approach optimized for portability, low maintenance cost and speed
- Application, algorithms and drivers written purely in ANSI-C
- Layered software approach
- Algorithm layer not peripheral dependent
- Faults of DC bus overvoltage, overcurrent and undervoltage are processed
- FreeMASTER visualization support

Qorivva MPC5643L MCU Features

- Up to 120 MHz dual e200z4 32-bit Power Architecture core with 1 MB of flash
- Dual-core safety platform targeting ISO26262 ASILD and IEC61508 SIL3 integrity levels
- One FlexRay™, two FlexCAN and two LINFlex modules
- Lock step or decoupled parallel mode configuration
- Floating point unit
- VLE category for reduced code footprint
- Freescale SafeAssure functional safety solution

Motor Control Algorithm Concept



Qorivva MPC5643L MCU Motor Control Units

- 2x FlexPWM, four channels with four fault inputs
- 3x e-timers, including quadrature decode
- 2x 10-bit ADC modules with 2 x 12 channels (include four shared channels)
- Cross triggering unit with 32 input channels (eight events, 24 ADC commands)
- Fault collection unit

MC33937A Features

- Fully specified from 8 to 40 V (covers 12 and 24 V automotive systems)
- Extended operating range from 6 to 58 V (covers 12 and 42 V systems)
- Greater than 1.0 A gate drive capability with protection
- Protection against reverse charge injection from C_{GD} and C_{GS} of external FETs
- Dead-time is programmable via the SPI port
- Simultaneous output capability enabled via safe SPI command

MC33905 (System Basis Chip) Features

- 5 or 3.3 V voltage regulator with current, temperature and voltage protection
- Configuration and diagnostics accessible through the SPI
- One CAN and up to two LIN transceivers
- Window watchdog, two configurable input/output pins
- Very low quiescent current in low-power modes
- Stop (Vdd On) and sleep (Vdd Off) modes

For more information, visit freescale.com/automcdevkits

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