Automotive Motor Control Development Solutions

3-Phase Sensorless BLDC Kit with Qorivva MPC5604P MCU

BUILT ON Power ™

Description

The 3-phase sensorless BLDC motor control development kit with the Qorivva MPC5604P MCU is part of our embedded motion control series of development tools, and can be used in the testing and development of new control algorithms for BLDC motors. It can be supplied with a DC voltage source in the range of 5 to 50 V to support 12, 24 and 48 V automotive applications.

The set consists of:

- 3-phase BLDC motor
- 3-phase BLDC/PMSM low-voltage power stage
- MPC5604P controller board

The 3-phase BLDC/PMSM low-voltage power stage is based on the SMARTMOS MC33937A pre-driver integrated circuit. It operates on a wide range of input voltages, from 8 to 50 V, and is capable of driving currents of up to 10 A. The 3-phase BLDC/PMSM low-voltage power stage has overcurrent protection independent of the control board, where you choose the internal MC33937A DC bus operational amplifier with an overcurrent comparator. The current measuring circuitry is set up for 10 A full scale.

The MPC5604P controller board is based on the Qorivva MPC5604P MCU built on Power Architecture® technology designed to cover the automotive motor control area. It includes new motor control peripherals such as the FlexPWM, CTU, two ADC modules and two e-timer modules. The customer can take advantage of these modules to provide a deterministic motor control application with small core impact.

The integral part of this demonstrator is the sensorless BLDC motor control algorithm, which controls the speed and motor current depending on customer demands. It uses back EMF voltage sensing for recognizing the zero crossing events and for setting new commutation events. The algorithm is described in detail in the user manual and the dedicated application note.

Motor Control Algorithm Concept

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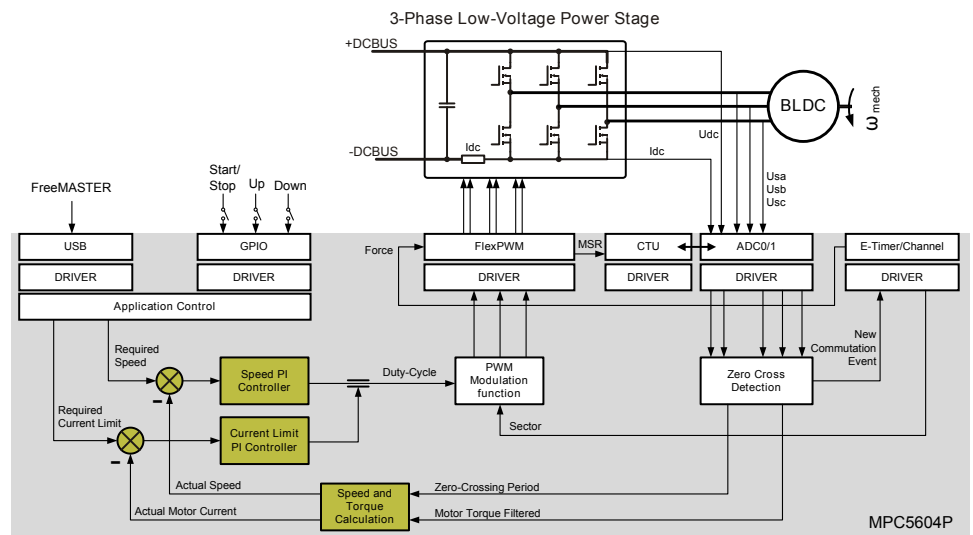
Target Automotive Applications

- Sensorless and sensor-based BLDC motor control applications

Board Features

- Input DC voltage: 8 to 42 V, extended to 50 V
- Output current: 10 A
- 3-phase MOSFET bridge inverter
- 3-phase MOSFET gate driver (MC33937A)
- DC bus voltage and current sensing
- Back EMF voltage sensing
- Phase current sensing
- Brake resistor switch
- Inputs for Hall, encoder and resolver sensors
- LIN, CAN and FlexRay™ interfaces

Product Features and Specifications

- User guide
- Device documentation for MPC5604P, MC33937A, MC33905
- Application support available from Freescale experts

BLDC Sensorless Algorithm Features

- Speed and current control loop
- Back EMF zero crossing algorithm
- Commutation events done independent of the core (without impact on interrupt latency)
- Motor speed range from 800 to 10,000 RPMs
- Application uses functions from the MPC5604P motor control library
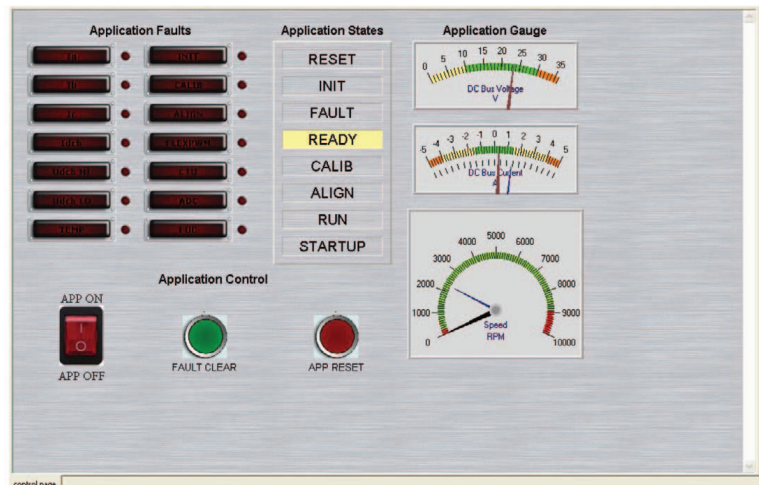- FreeMASTER user interface for easy application control

Qorivva MPC5604P MCU Features

- Up to 64 MHz e200z0h 32-bit Power Architecture core with 512 KB of flash and 40 KB of SRAM memory
- One FlexRay, two FlexCAN and two LINFlex modules

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FreeMASTER Control Page

- FlexPWM with four channels
- Two e-timers, including quadrature decode
- Two 10-bit ADC modules with 12 channels
- Cross triggering unit with 32 input channels
- Fault collection unit
- Freescale SafeAssure functional safety solution

MC33937A Features

- Fully specified from 8.0 to 40 V, covering 12 to 24 V automotive systems
- Extended operating range from 6.0 to 58 V, covering 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 the safe SPI command

For more information, visit freescale.com/automcdevkits