



Automotive Motor Control Development Solutions

3-Phase PMSM Kit with Qorivva MPC5604P MCU

Target Automotive Applications

- Active suspension
- Braking and stability control
- Electric power steering
- DC bus
- Hybrid electric vehicles (HEV)
- Transmission and gearbox

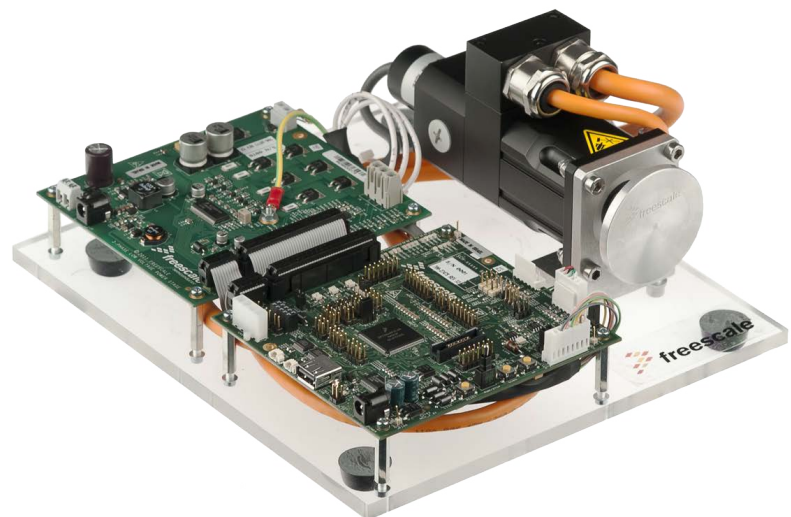
Overview

This development kit exhibits the suitability and advantages of the Qorivva MPC5604P MCU for motor control applications using a 3-phase permanent magnet synchronous motor (PMSM) with encoder and resolver position sensors. It serves as an example of a PMSM control design using the Freescale family of automotive motor control MCUs based on Power Architecture® technology. The application utilizes the vector control approach of the 3-phase PMSM motor implemented with functionality from the automotive math and motor control library set for MPC5604P. The application is designed for the MPC5604P controller board with a resolver interface and 3-phase PMSM low-voltage power stage equipped with a SMARTMOS MC33937A FET pre-driver. Beside the main control loop, the DC bus voltage and phase currents are monitored during the control process. They are used 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. This enables

you to create the next breakthrough automotive designs for powertrain, body, chassis, safety, infotainment, telematics and in-vehicle networking applications.

PMSM Development Kit: Qorivva MPC5604P MCU



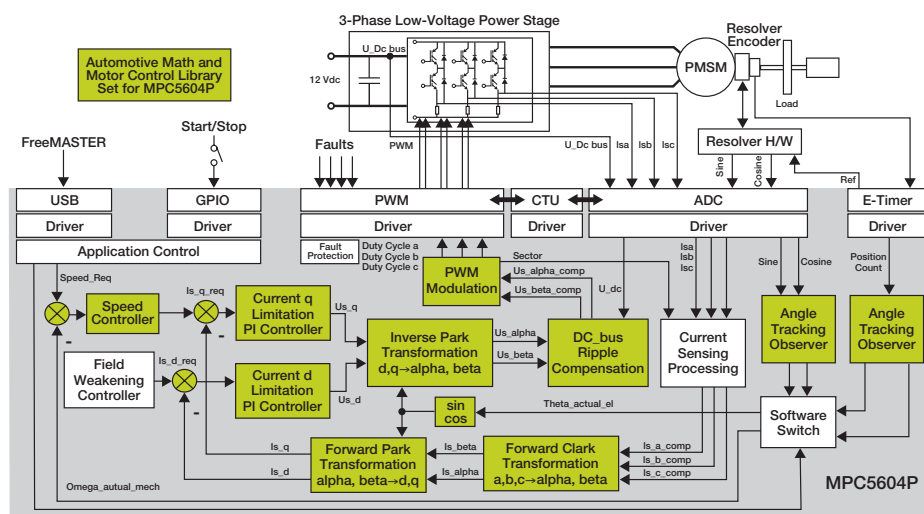
Demo Features

- Qorivva MPC5604P controller board with resolver/sin-cos and encoder interface
- 3-phase 10 A power stage with 3-phase MC33937A FET pre-driver
- Low-voltage permanent magnet synchronous motor with resolver and encoder
- Parameters:
 - 20 kHz PWM (50 μ s period), 100 μ s current control loop, 2 ms speed control loop
 - 10 kHz resolver excitation frequency
- Software approach optimized for portability, low maintenance cost and speed
- Application, algorithms and drivers written purely in ANSI-C
- Low-level peripheral driver approach
- Algorithm layer not peripheral dependent
- Field oriented control (torque and speed) of a 3-phase PMSM
- Faults of DC bus overvoltage, DC bus undervoltage and phase overcurrent are processed
- Position sensor selection (encoder or resolver) via FreeMASTER control
- FreeMASTER support

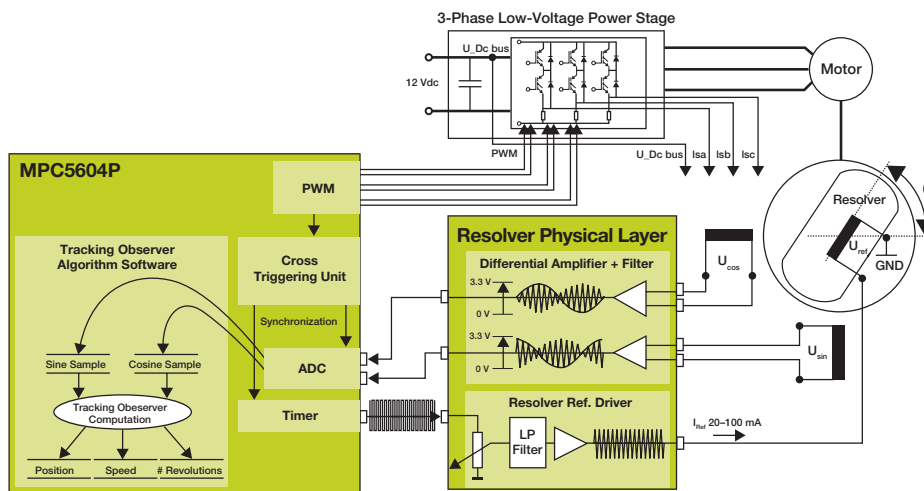
Qorivva MPC5604P MCU Features

- Up to 64 MHz e200z0 core, 32-bit Power Architecture[®] CPU with 512 KB of flash and 40 KB of SRAM memory
- One FlexRay, two FlexCAN and two LINFlex modules
- FlexPWM with four channels
- Two e-timer modules with quadrature decoder
- Two 10-bit ADC modules with 12 channels
- Cross triggering unit with 32 input channels
- Fault collection unit

Motor Control Algorithm Concept



Resolver Driver and Interface



MC33937A Features

- Fully specified from 8.0 to 40 V covers 12 and 24 V automotive systems
- Extended operating range from 6.0 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
- Deadtime 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 diagnostic 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