



# **MPC5643L 3-phase PMSM Development Kit**

## **MTRCKTDPS5643L**

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The MTRCKTDPS5643L motor control development kit is ideal for applications requiring two PMSM motors, like active suspension or electric powertrain. The kit is designed to enable rapid prototyping and evaluation of the motor control application without having to wait for the final hardware design. The kit includes a 32-bit NXP® MPC5643L based controller board and the 3-phase low-voltage power stage board.

An integral part of the automotive motor control development kit is the application software which provides a complete reference implementation of the PMSM motor control application and also takes advantage of the Automotive Math and Motor Control Library Set.

The diagram illustrates the Motor Control Algorithm Concept for the MPC5643L, showing the integration of hardware and software components.

**Hardware Components:**

- 3-Phase Low-Voltage Power Stage:** A 12 Vdc source feeds a 3-phase inverter (PMSM) driven by PWM signals. It includes a Resolver Encoder and a Load.
- Resolver H/W:** Receives Sine and Cosine signals from the Resolver Encoder and provides a Reference (Ref) signal to the E-Timer.
- Application Control:** Includes USB and GPIO interfaces, and a Start/Stop switch.
- Control Blocks:** PWM, CTU (Counter/Timer Unit), ADC, and E-Timer (Event Timer) are shown as hardware blocks.
- Software Blocks:** Speed Controller, Field Weakening Controller, Current q Limitation PI Controller, Current d Limitation PI Controller, Inverse Park Transformation, Forward Park Transformation, DC bus Ripple Compensation, Current Sensing Processing, Angle Tracking Observer, and Software Switch.

**Signal Flow and Data:**

- Inputs:** Speed Req, Start/Stop, USB, GPIO, Faults, PWM, U<sub>dc</sub> bus, I<sub>sa</sub>, I<sub>sb</sub>, I<sub>sc</sub>, Sine, Cosine, Ref.
- Internal Signals:** I<sub>s\_q</sub>, I<sub>s\_d</sub>, I<sub>s\_q\_req</sub>, I<sub>s\_d\_req</sub>, U<sub>s\_q</sub>, U<sub>s\_d</sub>, U<sub>s\_alpha</sub>, U<sub>s\_beta</sub>, U<sub>dc</sub>, I<sub>sa\_comp</sub>, I<sub>sb\_comp</sub>, I<sub>sc\_comp</sub>, I<sub>sa</sub>, I<sub>sb</sub>, I<sub>sc</sub>, Sine, Cosine, Position Count, Theta<sub>actual\_el</sub>, Omega<sub>actual\_mech</sub>.
- Outputs:** PWM, Driver, CTU, ADC, E-Timer, Angle Tracking Observer, Software Switch.

The diagram is labeled **MPC5643L** in the bottom right corner.

The diagram illustrates the architecture of a Resolver Driver and Interface. It is divided into three main functional blocks:

- MPC5643L (Microcontroller):**
  - Tracking Observer Algorithm Software:** Processes Sine and Cosine samples to perform Tracking Observer Computation, outputting Position, Speed, and # Revolutions.
  - Cross Triggering Unit:** Manages synchronization between the ADC and the Timer.
  - ADC (Analog-to-Digital Converter):** Receives signals from the Resolver Physical Layer.
  - Timer:** Generates PWM signals for the power stage.
- 3-Phase Low-Voltage Power Stage:**
  - Powered by a 12 Vdc source and U<sub>Dc</sub> bus.
  - Generates PWM signals for the motor.
  - Monitors phase currents I<sub>sa</sub>, I<sub>sb</sub>, and I<sub>sc</sub>.
- Resolver Physical Layer:**
  - Differential Amplifier + Filter:** Processes the resolver signals to produce U<sub>cos</sub> and U<sub>sin</sub>.
  - Resolver Ref. Driver:** Generates a reference current I<sub>ref</sub> (20-100 mA) for the resolver.
- Motor and Resolver:**
  - The motor is driven by the power stage and provides feedback signals I<sub>sa</sub>, I<sub>sb</sub>, and I<sub>sc</sub>.
  - The resolver is connected to the motor and the reference driver, outputting U<sub>ref</sub> and GND.

View additional information for [MPC5643L 3-phase PMSM Development Kit](#).

**Note:** The information on this document is subject to change without notice.

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