



Automotive Motor Control Development Solutions

# 3-Phase Sensorless BLDC Kit with S12 MagniV MC9S12ZVML128 MCU

## Target Automotive Applications

- Actuators and valve controls
- Blower fan in HVAC systems
- Electric fuel, water and oil pumps
- Engine cooling fans
- Wind shield wipers

## Overview

This development kit featuring the MC9S12ZVML128 MCU helps you get your development started within minutes. You don't need to wait for your own hardware design to be available or start software development from scratch. This development kit offers you a fully documented, working setup for 3-phase sensorless brushless DC (BLDC) motor control.

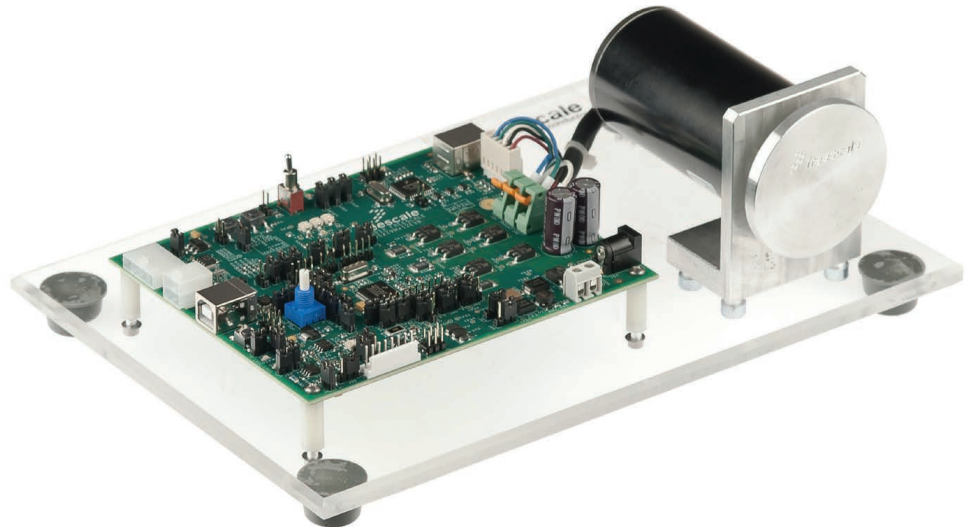
The hardware includes one evaluation board, featuring the MC9S12ZVML128 MCU equipped with six power MOSFETs to drive the 3-phase BLDC motor and a LIN interface.

The application software in this development kit provides a complete, easy-to-use solution for

BLDC sensorless motor control applications, covering speed control and torque limitation.

The complete hardware and software documentation will help you use and adapt this solution for your own application use cases.

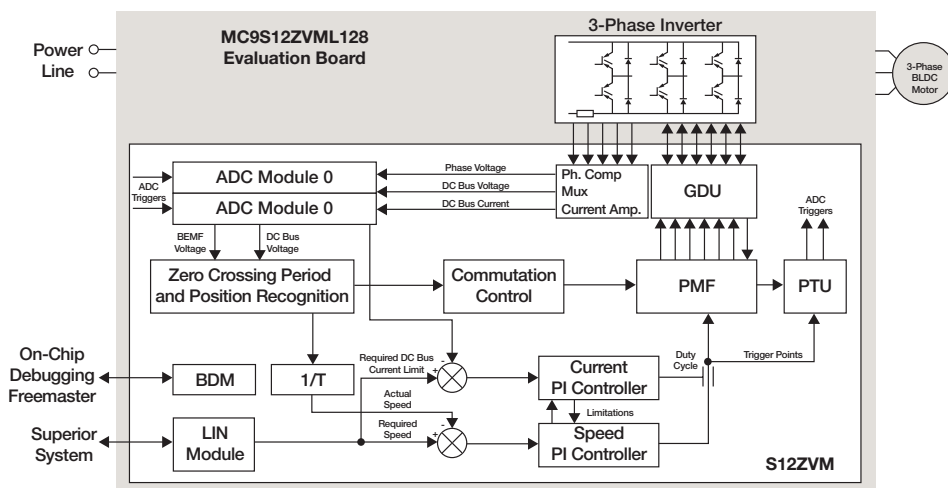
## 3-Phase Sensorless BLDC Kit



## Development Kit Features

- MC9S12ZVML128 evaluation board including 3-phase 10 A BLDC/PMSM low-voltage power stage
- 24 V BLDC motor
- FreeMASTER visualization
- 20 KHz PWM switching frequency
- 1 ms speed control loop
- Sensorless control using back EMF zero crossing detection
- DC bus overvoltage, overcurrent and undervoltage fault detection
- Hardware support for HALL sensor-based motor control

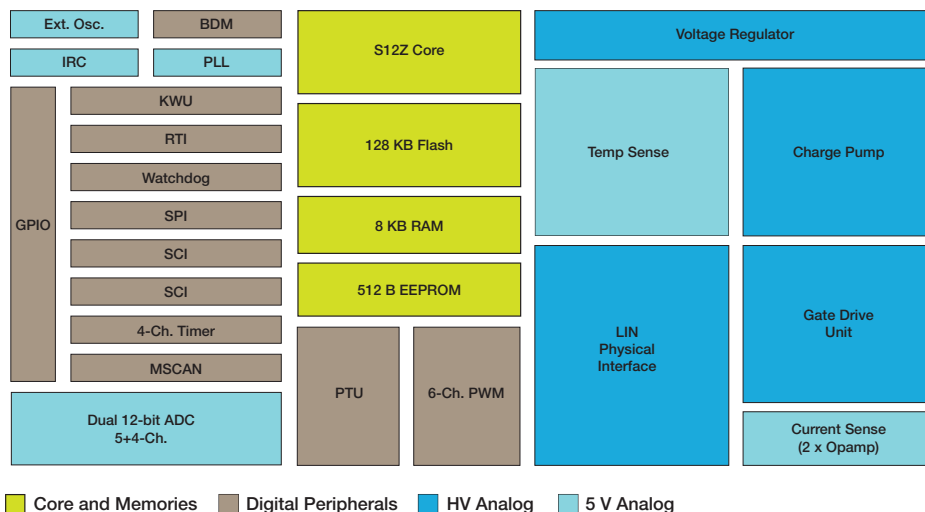
## Sensorless Motor Control Algorithm Concept



## MC9S12ZVML128 Features

- Enhanced S12Z core at 50 MHz bus speed
- Up to 128 KB flash, 512 B EEPROM and 8 KB RAM
- PMF module for motor control PWM generation
- Dual 12-bit analog-to-digital converter (ADC)
- Programmable trigger unit to synchronize ADC conversions
- Built-in automotive voltage regulator operating between 3.5 and 40 V
- Built-in LIN physical layer meets automotive OEM specifications for LIN conformance and EMC requirements
- Built-in gate drive unit with charge pump, protected low-side and high-side gate drivers capable of driving six external MOSFET up to 100 percent duty cycle
- Two built-in current sense operational amplifiers

## MC9S12ZVML128: S12 MagniV Mixed-Signal MCU



The MC9S12ZVML128 is part of the S12 MagniV portfolio of mixed-signal MCUs, offering smart and optimized integration of high-voltage analog components. The MC9S12ZVML128 product family integrates an automotive voltage regulator operating between 3.5 and 40 volts, a LIN physical layer and a gate drive unit made of three low-side and three high-side drivers to control up to six external MOSFETs.

The S12ZVM family combines all the elements needed to build a very compact and power-efficient 3-phase BLDC motor control platform. It reduces PCB space and manufacturing complexity to simplify your design and increase overall quality through integration.

For more information, visit [freescale.com/automcdevkits](http://freescale.com/automcdevkits)

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