



SECURE CONNECTIONS  
FOR A SMARTER WORLD

# Motor Control: Rapid Design, Development and Deployment Using NXP MBDT

*Joaquin Liao/廖乾坤, NXP Semiconductors*



MATLAB EXPO

# OVERVIEW

- NXP Corporate Overview
- NXP Automotive platforms: S32K1 & S32K3
- NXP Model-Based Design Toolbox: Overview
- NXP Motor Control solutions on MBDT
- Additional Resources

# NXP Corporate Overview

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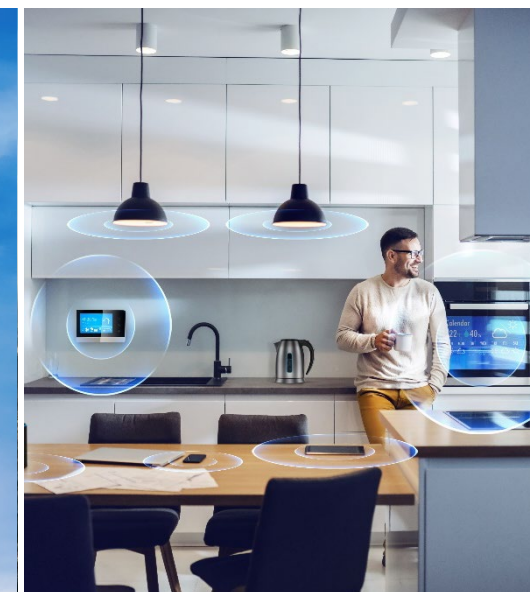




# SECURE CONNECTIONS FOR A SMARTER WORLD

**OUR DIGITALLY ENHANCED WORLD IS EVOLVING TO ANTICIPATE AND AUTOMATE**

NXP Semiconductors N.V. (NASDAQ: NXPI) enables a smarter, safer and more sustainable world through innovation. As the world leader in secure connectivity solutions for embedded applications, NXP is pushing boundaries in the automotive, industrial & IoT, mobile, and communication infrastructure markets.



# AUTOMOTIVE MARKET POSITIONS

## Technology Leadership

+

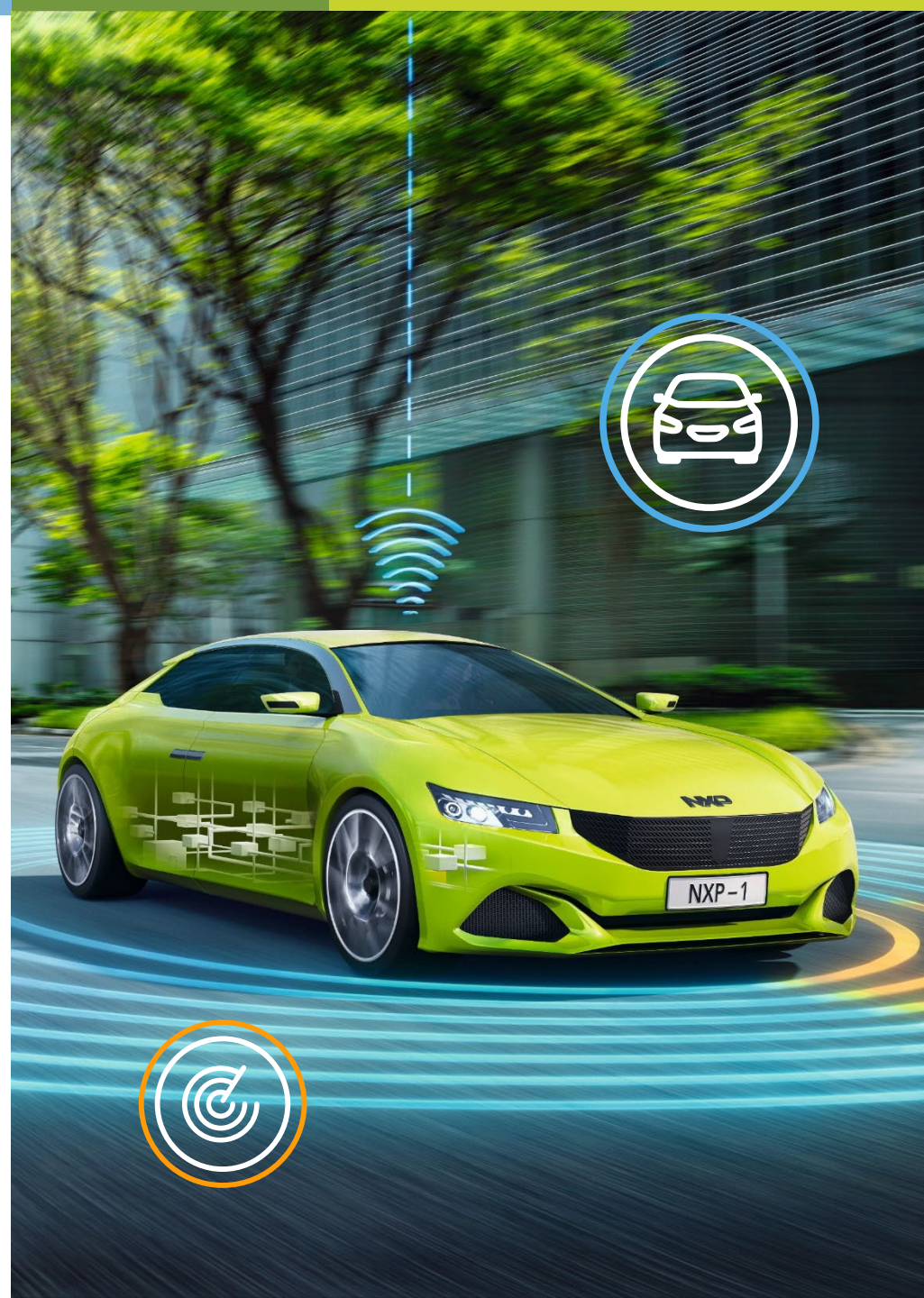
## Applications Leadership

- #1 Auto Processors
- #1 Auto Application Processors
- #1 Auto RF
- #1 Auto DSPs
- #1 Vehicle Network Processors
- #2 Auto Analog
- #2 Auto Microcontrollers

- #1 Car Infotainment
- #1 Digital Radio
- #1 Secure Car Access\*
- #1 In-Vehicle Networking\*
- #1 Radar\*
- #2 Powertrain



\*Excluding portions of the market not serviced by NXP products  
Source: Strategy Analytics, IHS Markit, NXP. Based on 2021 Auto TAM



# NXP Automotive platforms: S32K1 & S32K3

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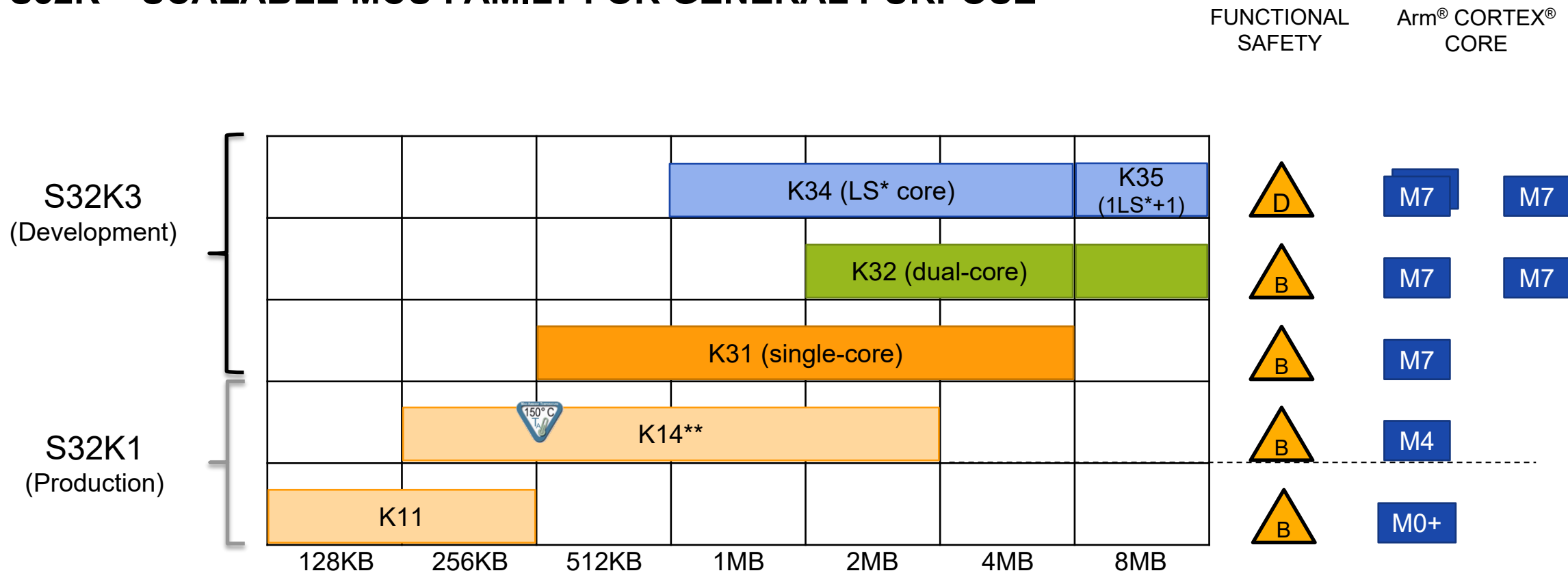
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# S32K – SCALABLE MCU FAMILY FOR GENERAL PURPOSE




**Product highlights:**

- ✓ Platform scalability and compatibility 平台可扩展性和兼容性
- ✓ Scalable performance 可扩展性能
- ✓ Functional safety 功能安全
- ✓ Advanced communication interface 先进的通讯接口
- ✓ Market-leading cyber security 市场领先的信息安全
- ✓ Over the air update ready 无线更新准备就绪
- ✓ Complete SW and tools eco-system 完整的软件和工具生态系统

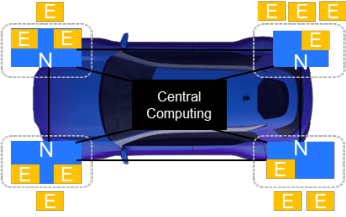
\* LS = lock step  
 \*\*AEC-Q100 Grade 0 device K142W and K144W

# S32K – BROAD RANGE OF TARGET APPLICATIONS


## Body and Comfort




Door Module



Zone Control




Seat Control




HVAC


## Motor Control




Traction Inverter




eCompressor




Pumps & eTurbo



Blowers / Fans




Trunk Opener




Window Lift


## Lighting



Front Lighting



Rear Lighting



Interior Lighting

## HMI



Steering Wheel



Switch Panels



Gear Shift



Touch




Door Handle

## IVI




Remote Amp




IO Controller


## Safety




SB Pretensioner




Passive Entry




Acoustic Alert



Exhaust Sensor




Occupancy Detection




Rain Light Sensor

## BMS





Battery Management System


## Power Conversion



DC-DC



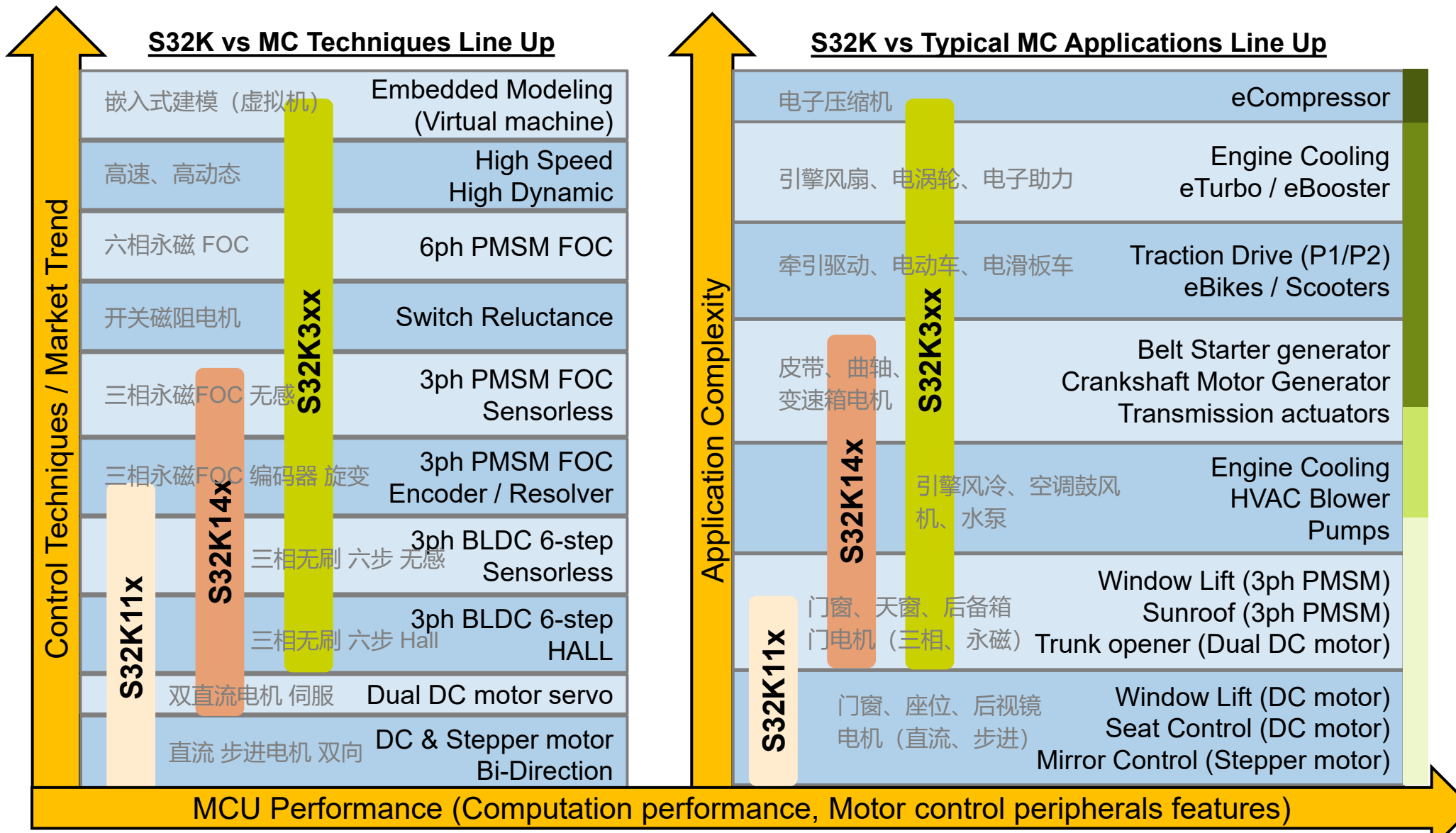
EV Charging



Wireless Charge



# S32K MOTOR CONTROL LINE-UP



Arm® Cortex®-M7

Arm® Cortex®-M4F

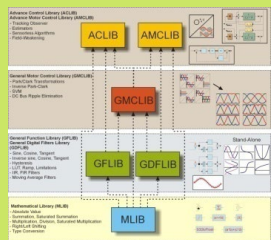
Arm® Cortex®-M0+

Power range	Power
Low power	12V, ~10A
Mid power	12V, ~70A
High power	48V, ~100A
High Voltage	> 200V

# MOTOR CONTROL ECOSYSTEM CONCEPT S32K

## Automotive Math and Motor Control Library Set

- **Precompiled software library** containing building blocks for a wide range of motor control applications
- Easy migration between platforms with minimized effort
- Production ready SW (SPICE Level 3, CMMI and ISO9001/TS16949)
- Control loop modeling with Matlab/Simulink® models



## Motor Control Application Tuning Tool (MCAT)

Tune your drive:

- Graphical User Interface, plugin to FreeMaster
- interfacing with the target MCU, modify software variables during runtime to tune your motor control algorithms to achieve control objectives (i.e. PI parameters)

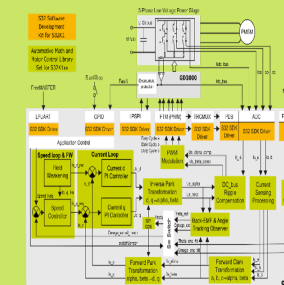


## Motor Control Reference SW

**PMSM / BLDC**

**Reference SW:**

- Sensorless / sensor based



**S32K1**  
**arm** M0+/M4F  
 CAN-FD  
 CSEC Security  
 ASIL B

**S32K3**  
**arm** M0+/M4F  
 CAN-FD  
 CSEC Security  
 ASIL B

## Model Based Design Toolbox (MBDT)

**MATLAB Simulink integrated tool chain** for configuring and generating software, and it can be used to execute motor control algorithms on NXP MCUs:

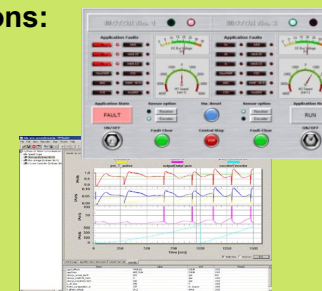
- Includes AMMCLib Library set
- plug in to MATLAB™/Simulink™ model-based design environment
- optimized for fast execution on our MCUs with bit-accurate results compared to Simulink® simulation



## FreeMASTER (Lite)

**Debugger for Real-time Applications:**

- Graphical User Interface
- View & Modify variables run-time
- Real-time Monitor Tool
- Track & trace your variables
- Demonstration Platform
- Design your own dashboard



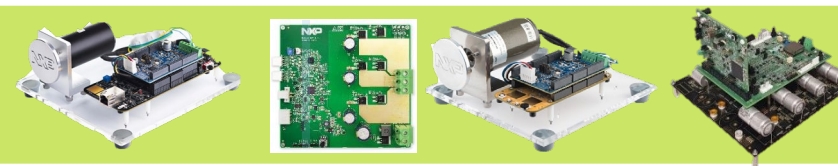
## RTD Real Time Drivers

- Peripheral Driver including: **High Level Interface** AUTOSAR 4.4 & **Low Level Interface**
- ISO26262 Compliance for all SW layers



## Motor Control Devkit

- 12V, 24V or 48V solutions
- 3phase or 6 phase Sensorless /sensor based
- Different power levels 6A, 25A, 2x80A



# Model-Based Design Toolbox (MBDT): Overview

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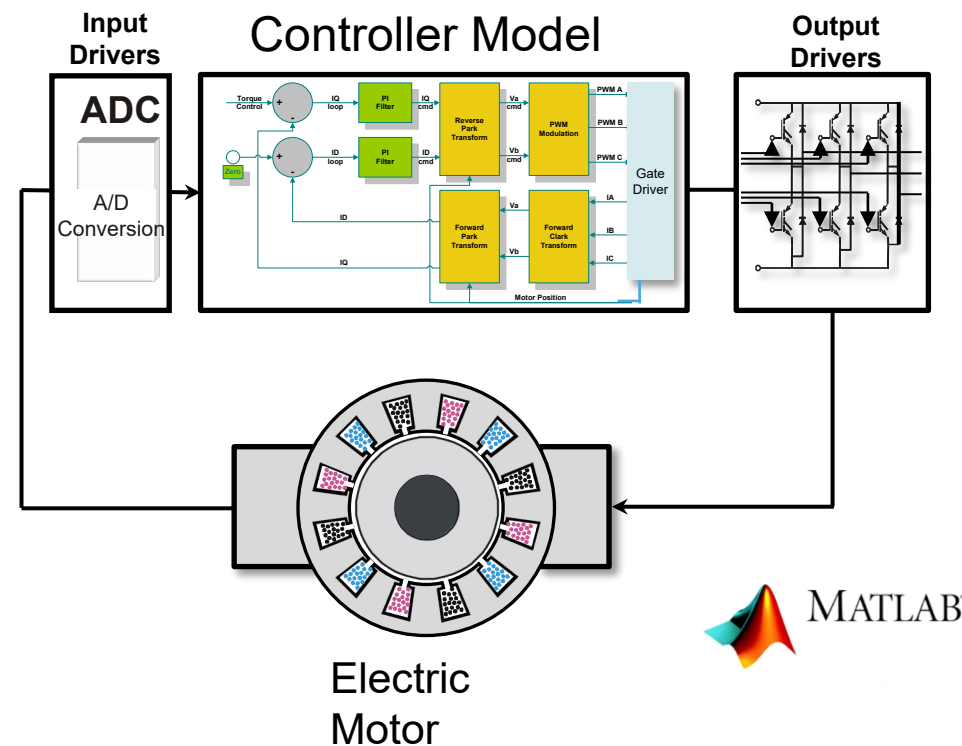
# MODEL BASED DESIGN TOOLBOX

NXP Model-Based Design Toolbox (**MBDT**) is a comprehensive collection of tools that plug into the MATLAB™ and Simulink™ model-based design environment to support fast prototyping and verification.

NXP 基于模型的设计工具箱 (MBDT) 是一个全面的工具集合, 可嵌入 MATLAB™ 和 Simulink™ 基于模型的设计环境以支持快速原型设计和验证。

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• MCU configuration</li> <li>• Code generation</li> <li>• Deployment on NXP MCUs directly from Simulink™</li> <li>• Software-in-the-Loop (SIL) and Processor-in-the-Loop (PIL)</li> <li>• Automotive Math and Motor Control Library</li> <li>• FreeMASTER for fine tuning and data visualization</li> <li>• <a href="http://www.nxp.com/mbdt">Online Community Support</a></li> </ul> | <ul style="list-style-type: none"> <li>• MCU配置</li> <li>• 代码生成</li> <li>• 直接从 Simulink™ 部署到 NXP MCU</li> <li>• 软件在环 (SIL) 和处理器在环 (PIL)</li> <li>• 汽车数学和电机控制库</li> <li>• FreeMASTER 用于微调和数据可视化</li> <li>• 在线社区支持</li> </ul> |
|--|--|

[www.nxp.com/mbdt](http://www.nxp.com/mbdt)



- |   |             |
|---|-------------|
| ✓ Reduce development & prototyping time | 减少开发和原型制作时间 |
| ✓ Faster Time to Market                 | 更快的上市时间     |
| ✓ Easy to use & reuse                   | 易于使用和重复使用   |
| ✓ Hardware independent simulation       | 硬件独立仿真      |

# MODEL BASED DESIGN TOOLBOX

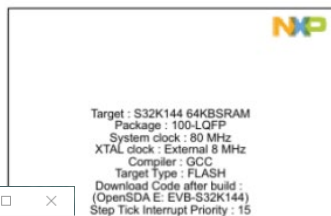
- MBDT from S32K1 to S32K3: Workflow and framework updates

- Using external configuration tools
- Code generation based on RTD support (MCAL drivers)

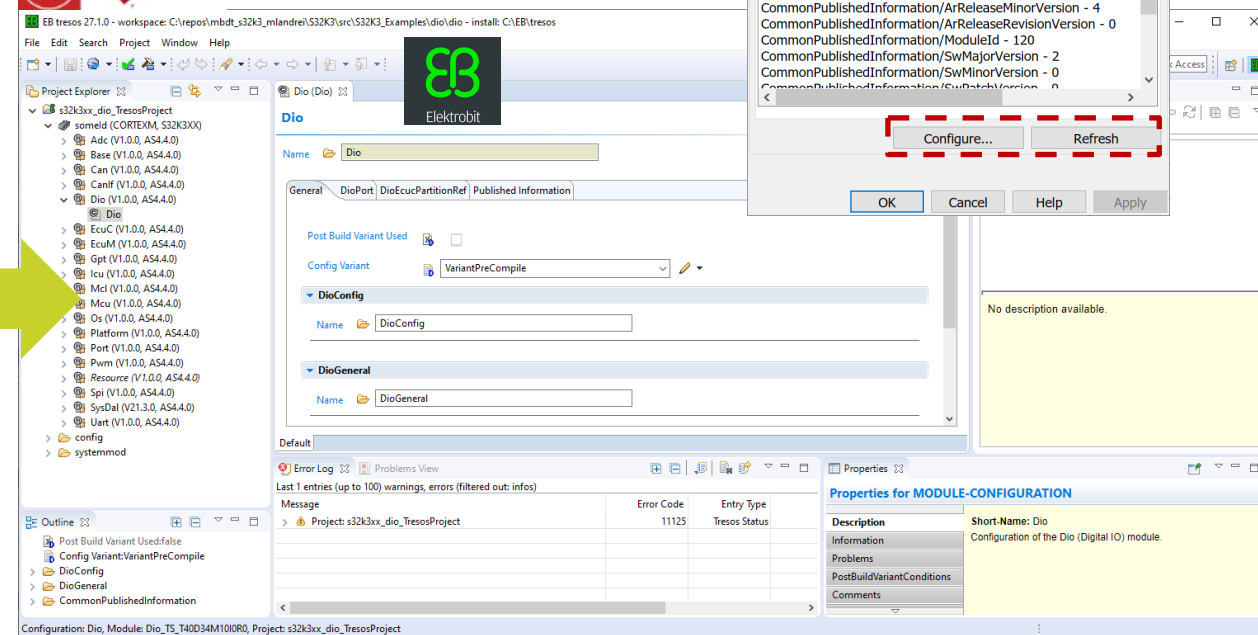
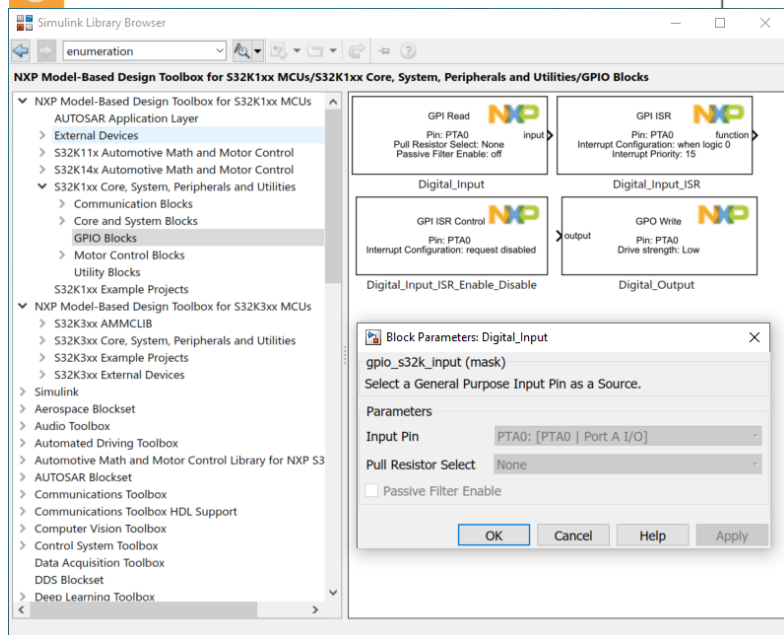
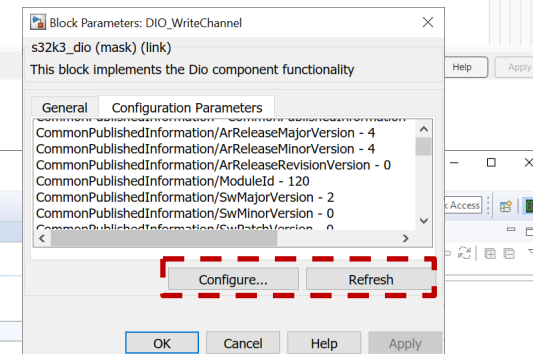
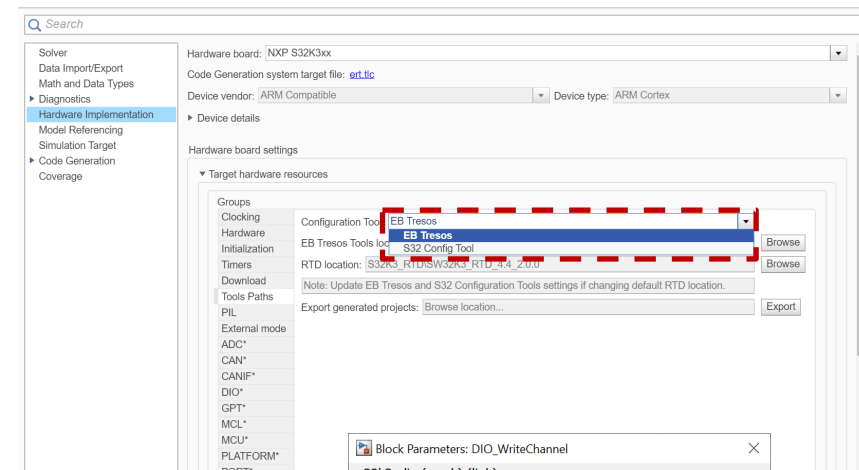
MBDT从S32K1到S32K3: workflow和框架更新



Model-Based Design Toolbox for S32K1xx 4.3.0



Model-Based Design Toolbox for S32K3xx 1.3.0



# HOW TO INSTALL

The screenshot displays the MATLAB R2022a environment. The 'Add-Ons' menu is highlighted with a red box. The 'Add-On Explorer' window is open, showing search results for 's32k'. The entry 'NXP\_Support\_Package\_S32K3xx' is highlighted with a red box. The installation guide window for the NXP Model-Based Design Toolbox for S32K3xx is also open, showing a wizard interface with a dropdown menu for selecting the toolbox revision (1.2.0) and several buttons for installation steps.

# MBDT OVERVIEW

- Designed to assist customers with embedded systems design and deployment on **NXP** MCUs  
适用于NXP微控制芯片
- External Tools integration for peripherals, pins and clocks configuration  
外设、引脚和时钟配置的外部工具集成
  - True MBD with **UNLIMITED CONFIGURATION MODE**  
无任何限制的“真”MBD
- MCU Peripherals Configuration & Control using NXP's Real-Time Drivers (**RTD**) for AUTOSAR® and non-AUTOSAR  
支持RTD, 支持AUTOSAR和non-AUTOSAR

**Built-in Tools, Config Tools, RTD/SDK Drivers, AMMCLIB**  
配置工具、底层驱动、库

**Simulink Blocks for Peripheral Control and Utilities**  
用于外设控制和实用程序的 Simulink 模块

**Documentation & Examples**  
文档和示例

**Simulink Library Browser**  
NXP Model-Based Design Toolbox for S32K3xx MCUs/S32K3xx Core, System, Peripherals and Utilities

- NXP Model-Based Design Toolbox for S32K3xx MCUs
  - S32K3xx AMMCLIB
    - AMCLIB
    - GDFLIB
    - GFLIB
    - GMCLIB
    - MLIB
  - S32K3xx Core, System, Peripherals and Utilities
    - CDD Blocks
    - Communication Blocks
    - IO Blocks
    - ISR Blocks
    - MCAL Blocks
    - Utility Blocks
  - S32K3xx Example Projects
  - S32K3xx External Devices
    - Battery Cell Controller
- Simulink
  - Automotive Math and Motor Control Library for NXP S32I
  - AUTOSAR Blockset
  - Control System Toolbox
  - Embedded Coder
    - Embedded Coder Support Package for ARM Cortex-M Prc
  - Fixed-Point Designer HDL Support
  - HDL Coder
  - HDL Verifier
  - Mixed-Signal Blockset
  - Report Generator
  - Robust Control Toolbox

**Documentation**  
NXP S32K3xx Simulink Blocks  
Learn detailed information about each Simulink block that is supported to be configured with this toolbox for S32K3xx MCU peripherals.

**Featured Examples**

- Adc Ctu 312 EBT
- Adc Ctu 312 S32CT
- Adc Single Read 312 EBT
- Adc Single Read 312 S32CT
- Adc Ctu 342 EBT
- Adc Single Read 342 S32CT

# MBDT FOR S32K3 – DEFAULT CONFIGURATION MODE

Model Browser: s32k3xx\_dio\_s32ct

Code for: s32k3xx\_dio\_s32ct

Explore all options:  
 1. Check HW and SW setup  
 2. Check this model settings  
 3. Generate Code, Build & Deploy on EVB

Variables: red\_led\_level, versionInfo

Toggle LED D33 red: Dio (Function: Dio\_FlipChannel, Channel: D33\_RED\_LED) → Level → red\_led\_level

Turn on LED D32 blue: Dio (Function: Dio\_ReadChannel, Channel: SW4) → Level → Dio\_WriteChannel (Function: Dio\_WriteChannel, Channel: D32\_BLUE\_LED)

Block Parameters: DIO\_ReadChannel

s32k3\_dio (mask) (link)

This block implements the Dio component functionality

General Configuration Parameters

Function: Dio\_ReadChannel

Channel Id: SW4

Input Simulation:

Available channels:  
 D32\_BLUE\_LED  
 D32\_GREEN\_LED  
 D32\_RED\_LED  
 D33\_GREEN\_LED  
 D33\_RED\_LED  
 SW4  
 SW5  
 DioChannel\_CAN0\_EN  
 DioChannel\_CAN0\_ERRN  
 DioChannel\_CAN0\_STB  
 CAN4\_EN  
 CAN4\_STB  
 CAN4\_ERRN  
 D33\_BLUE\_LED

Buttons: OK, Cancel, Help, Apply

Available AUTOSAR functionality for the selected MCAL Component  
 可选的MCAL组件函数

Options configured in the Default Project available for the selected Function  
 可选的函数参数

Default project configuration parameters for the selected MCAL Component  
 MCAL组件配置参数

Block Parameters: DIO\_ReadChannel

s32k3\_dio (mask) (link)

This block implements the Dio component functionality

General Configuration Parameters

Configuration Parameters List:  
 DioConfig/PTE\_L/DioChannel - CAN4\_ERRN D33\_BLUE\_LED  
 DioConfig/PTE\_L/DioPortId - 8  
 DioGeneral - DioGeneral  
 DioGeneral/DioDevErrorDetect - true  
 DioGeneral/DioEnableUserModeSupport - false  
 DioGeneral/DioFlipChannelApi - true  
 DioGeneral/DioMaskedWritePortApi - true  
 DioGeneral/DioMulticoreSupport - false  
 DioGeneral/DioReadZeroForUndefinedPortPins - false  
 DioGeneral/DioReversePortBits - false  
 DioGeneral/DioVersionInfoApi - true

Buttons: Configure..., Refresh, OK, Cancel, Help, Apply



# MBDT FOR S32K3 – UNLIMITED CONFIGURATION MODE

- Available RTD AUTOSAR MCAL functionality  
可用的 RTD AUTOSAR MCAL 功能
- Covering all the AUTOSAR 4.4 specification functions  
涵盖所有AUTOSAR 4.4规范功能

**AUTOSAR** Specification of DIO Driver  
AUTOSAR CP Release 4.4.0

Document Title	Specification of DIO Driver
Document Owner	AUTOSAR
Document Responsibility	AUTOSAR
Document Identification No	020
Document Status	Final
Part of AUTOSAR Standard	Classic Platform
Part of Standard Release	4.4.0

Document Change History			
Date	Release	Changed by	Change Description
2018-10-31	4.4.0	AUTOSAR Release Management	• Introduced MaskedWritePort API
2017-12-08	4.3.1	AUTOSAR Release Management	• Removed unused artifacts • Editorial changes
2016-11-30	4.3.0	AUTOSAR Release Management	• Removed SWS_Dio_00065 • Replaced content of "7.6.2 Runtime Errors" by "There are no runtime errors." • Replaced content of "7.6.3 Transient Faults" by "There are no transient faults"

MATLAB R2021b

my\_s32k3\_app - Simulink

Hardware Board: NXP S32K3xx

Block Parameters: DIO\_FlipChannel

s32k3\_dio (mask) (link)

This block implements the Dio component functionality

Function: **Dio\_FlipChannel**

Channel Id: [ ]

Input Simulation:

Toggle LED D33 red

Level: [red\_led\_level]

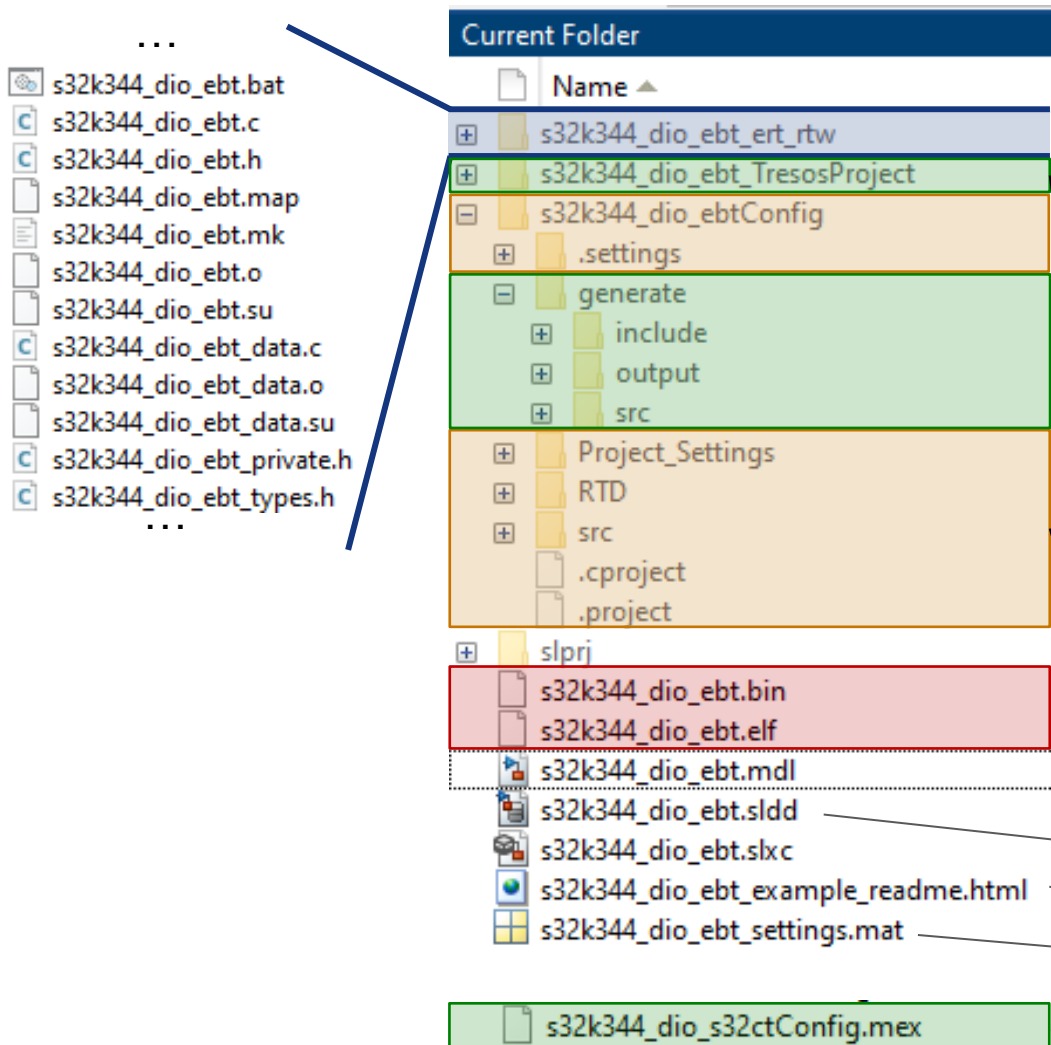
DIO\_FlipChannel

# MBDT FOR S32K3 – UNLIMITED CONFIGURATION MODE

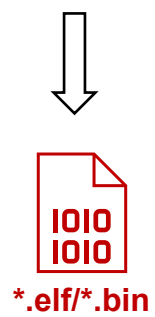
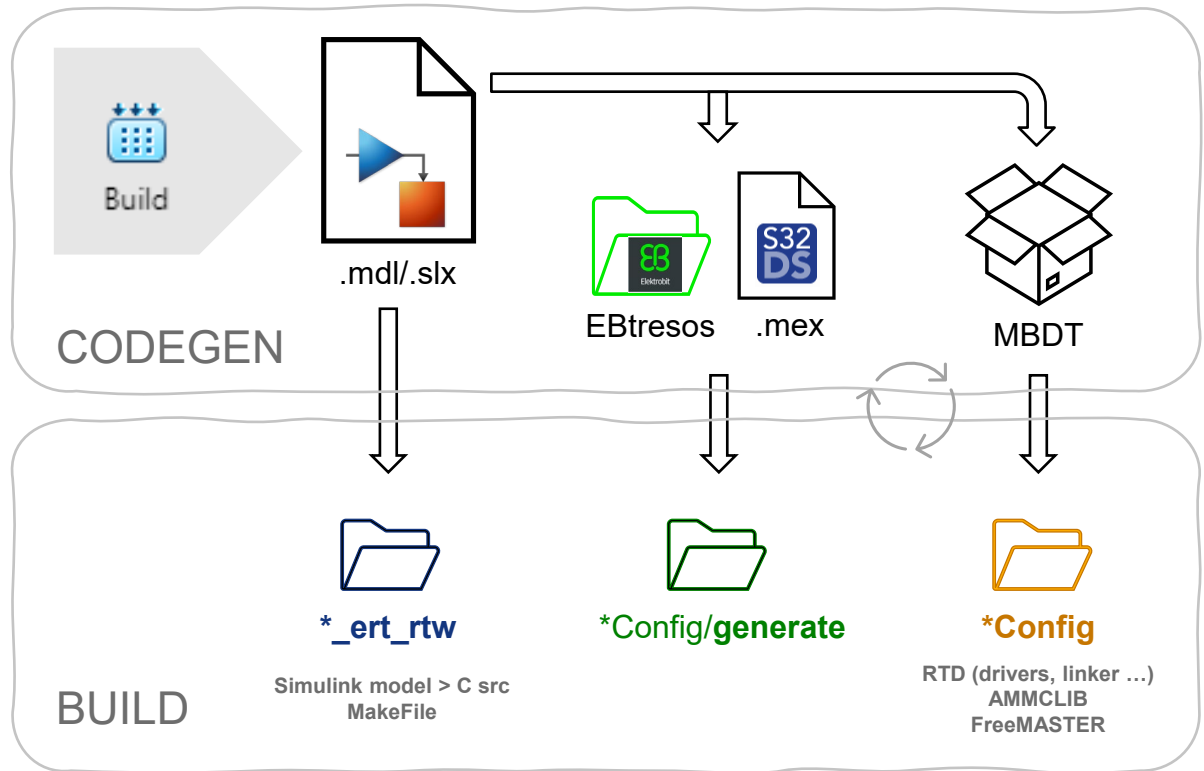
## External Configuration Tools

MCAL Components Configuration (Pins, Clocks, Peripherals)

# MBDT FOR S32K3 CODE GENERATION FLOW



- External EB tresos project\*** 外部EB配置工程
- S32DS project** S32DS工程
- Data types imported from RTD + custom data types** 数据字典
- Model Readme** 模型Readme
- Cached settings of the external config tools** 缓存信息
- External S32CT project\*** 外部CT配置工程



\* If deleted, the configuration will be reset to default settings  
 \* 如果删除, 配置将重置为默认设置

# MODEL-BASED DESIGN TOOLS USE CASES



<p>Pins, MCU, Clock and Peripheral configuration</p>	<p>Configured and driven by MBDT (NXP hardware support package). True MBD with unlimited configuration mode (K3 only)</p> <p>由 MBDT配置和驱动, 无任何配置限制, 可以实现真正的MBD (仅K3)</p>	<p>Configured and driven by Processor Expert / Configuration Tools and SDK/RTD in S32DS</p> <p>由 S32DS 中的PE/CT和 SDK/RTD 配置和驱动</p>
<p>Project files</p>	<p>Entire application built in Simulink™. The models include all SW and drivers needed in project</p> <p>全部模型在Simulink中实现, 项目中所有的软件算法和驱动程序均由模型/模块实现</p>	<p>Components of the application are built in Simulink™ and then integrated with configuration code and SDK/RTD drivers in IDE (S32DS)</p> <p>部分代码由模型生成, 然后在IDE (S32DS) 中与配置代码和 SDK/RTD驱动集成</p>
<p>Application development, build and deployment</p>	<p>Good for development and deployment, <b>not perfect for build and debug</b></p> <p>适合开发和部署, <b>不适合编译和调试</b></p>	<p>Final integration, build and deployment done from S32DS, full function support for build and debug</p> <p>从 S32DS 完成最终集成、构建和部署, 构建和调试的全功能支持</p>
<p>Hardware awareness</p>	<p>MBDT Framework: Simulink™ model can be split into a hardware independent component (algorithm) and a hardware-aware component (MCU configs and inputs/outputs drivers)</p> <p>MBDT 框架: Simulink™ 模型可以分为硬件独立组件 (算法模型) 和硬件依赖组件 (MCU配置、输入/输出驱动程序)</p>	<p>Simulink™ model can be hardware independent (if only algorithm component is generated by the model)</p> <p>Simulink™ 模型可以是独立于硬件的 (如果模型仅生成算法组件)</p>

# NXP MC solutions on MBDT

MATLAB EXPO



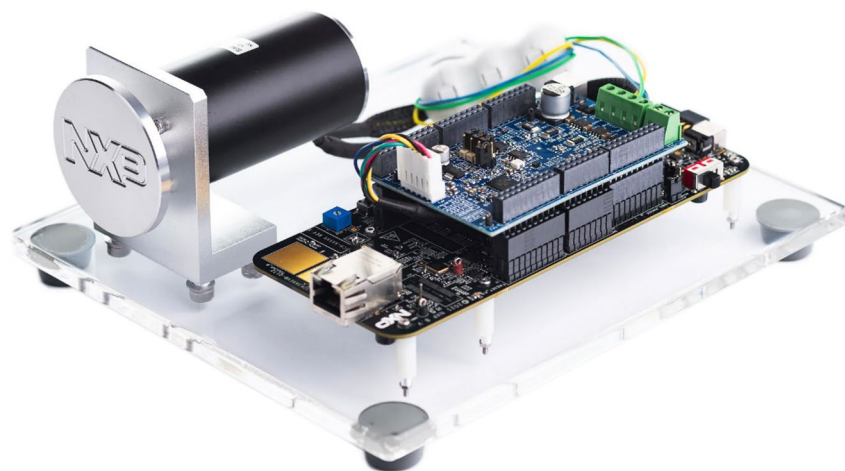
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# S32K344 BLDC AND PMSM MOTOR CONTROL DEVELOPMENT KIT: MCSPTTE1AK344



- 电机控制能力
  - 低压三相永磁电机 (BLDC 或 PMSM)
  - 电流传感器: 单路、双路和三路分流电流感应
  - 位置传感器: 霍尔/编码器/无传感器
- 软件特色
  - 正弦电机类型 (PMSM) 的弱磁场定向控制 (FOC)
  - 梯形电机类型 (BLDC) 的六步换向控制
  - 基于 RTD 高级 API (AUTOSAR 应用程序) 或低级 API (非 AUTOSAR) 构建的示例

- Motor Control Capabilities
  - Low voltage 3-phase permanent magnet motor (BLDC or PMSM)
  - Current sensor: Single, dual and triple shunt current sensing
  - Position sensor: Hall/encoder/sensorless
- Software Features
  - Field-oriented control (FOC) with field weakening for sinusoidal motor type (PMSM)
  - Six-step commutation control for trapezoidal motor type (BLDC)
  - Examples built on RTD high-level API (AUTOSAR applications) or low-level API (non-AUTOSAR)

# S32K3XX MC BLOCK DIAGRAM – BLDC



MCU, Motor, circuits

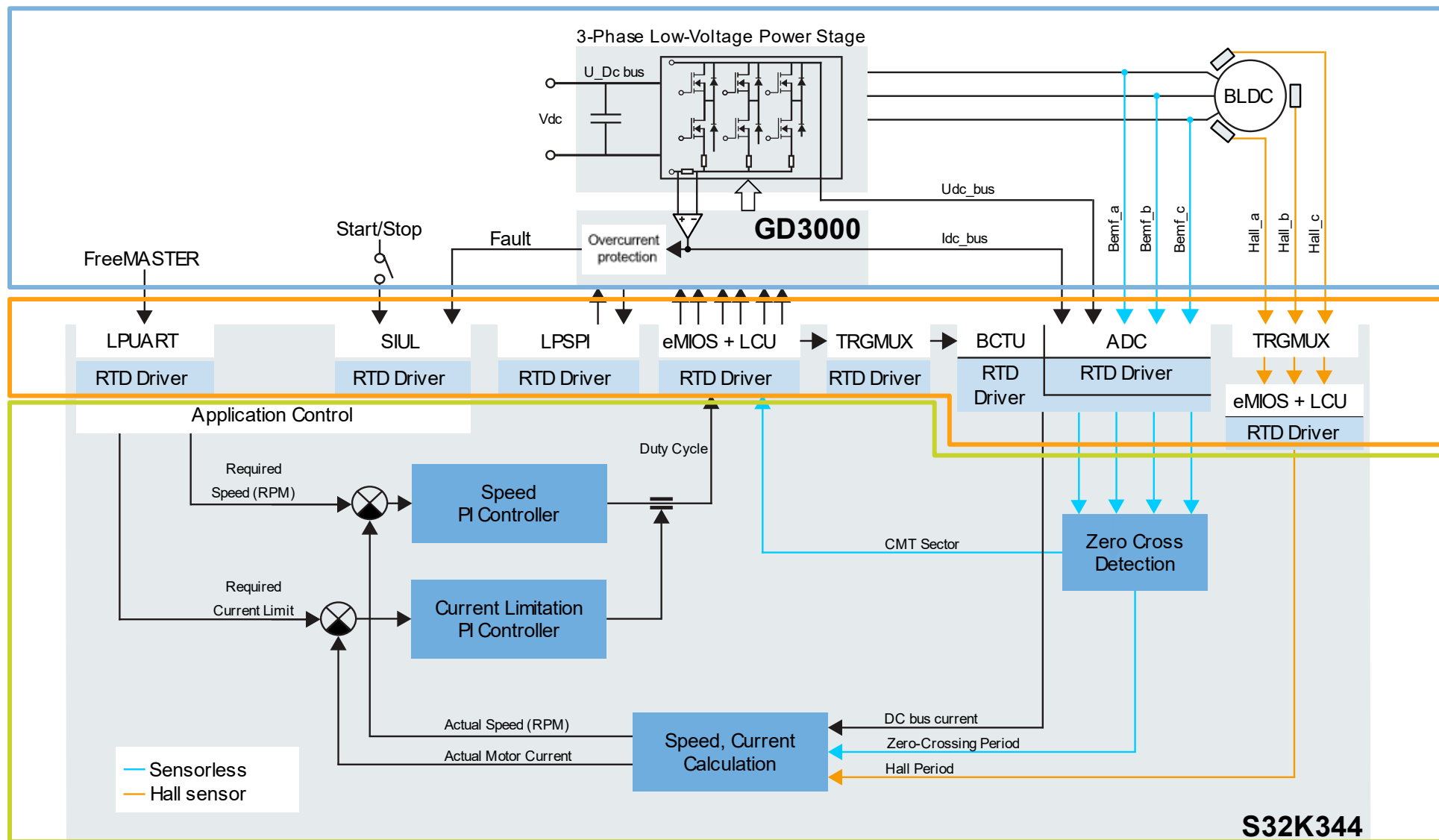
**MBDT**  
Drivers, Configs, APIs



App, Algorithm, Data processing

Real-Time Drivers for S32K3

Automotive Math and Motor Control Library Set for S32K3



S32K344

# S32K3XX MC BLOCK DIAGRAM – PMSM



MCU, Motor, circuits

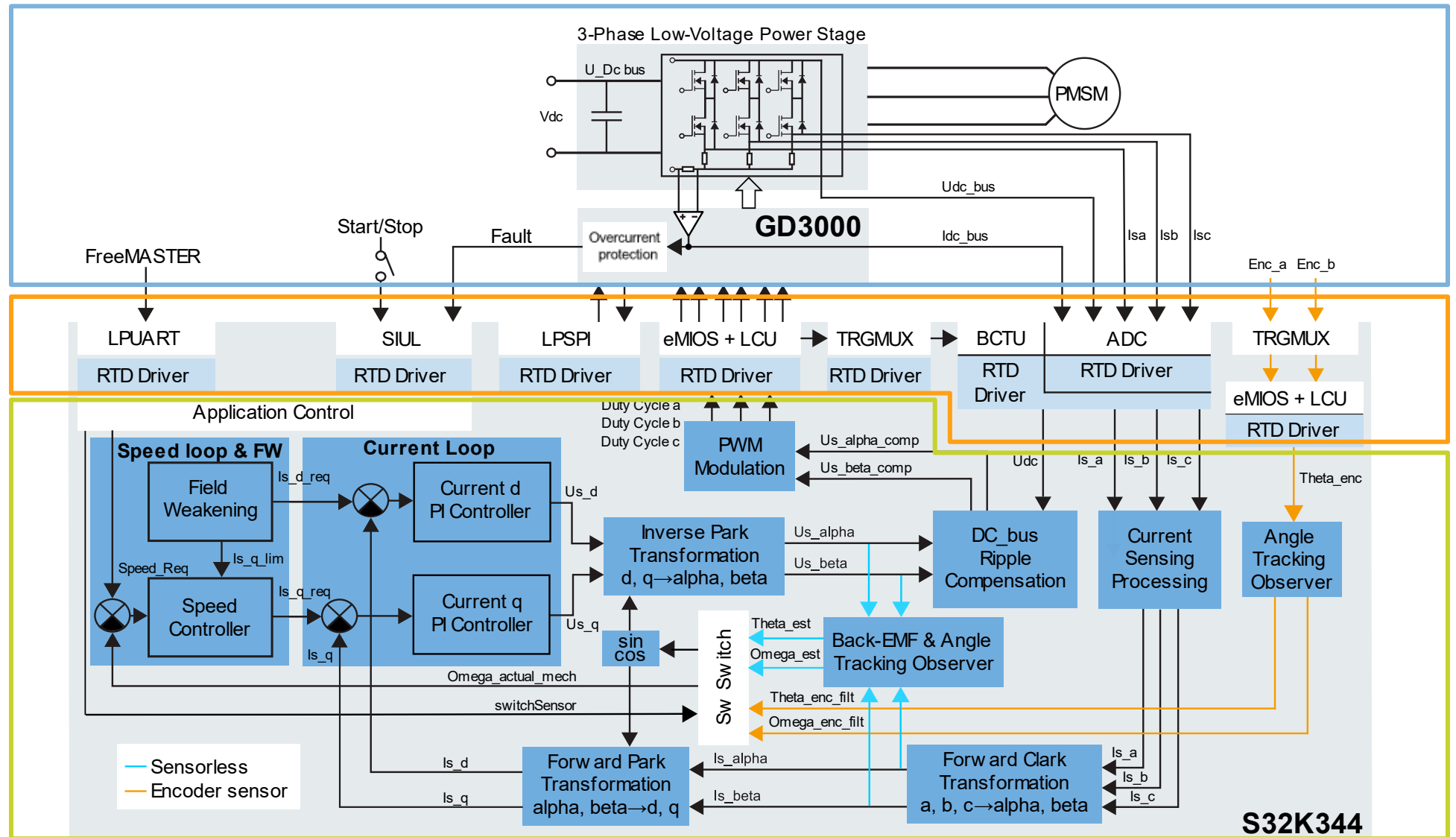
**MBDT**  
Drivers, Configs, APIs



App, Algorithm, Data processing

Real-Time Drivers for S32K3

Automotive Math and Motor Control Library Set for S32K3



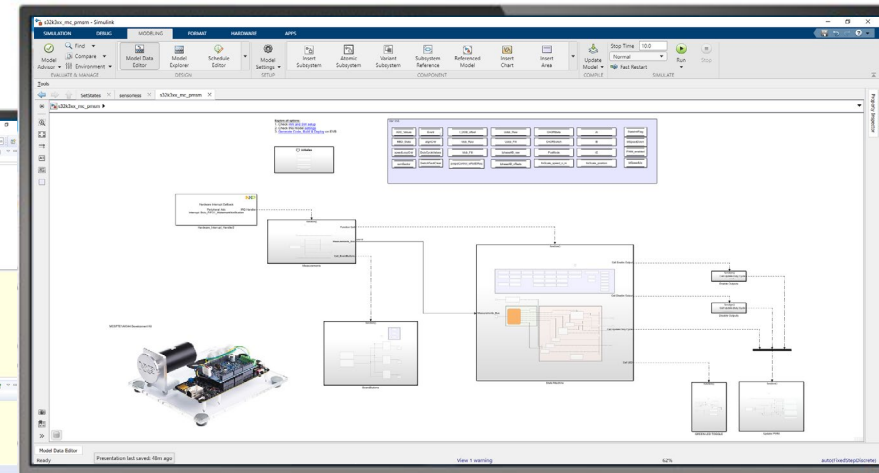
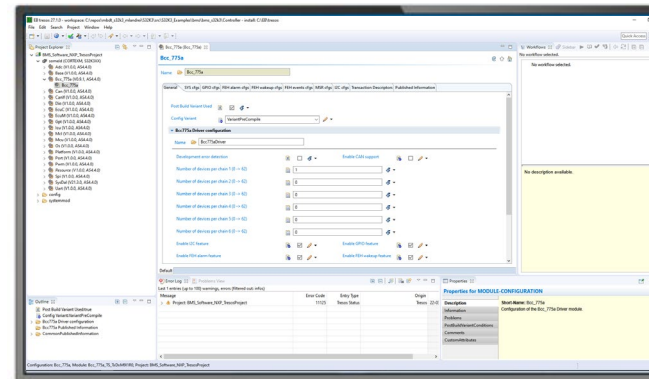
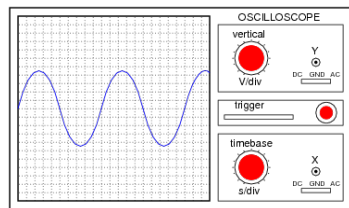
S32K344



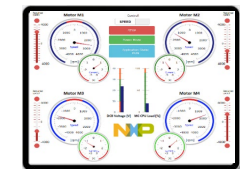
# RAPID PROTOTYPING – MBDT ENVIRONMENT

## Model-Based Design Toolbox for Simulink

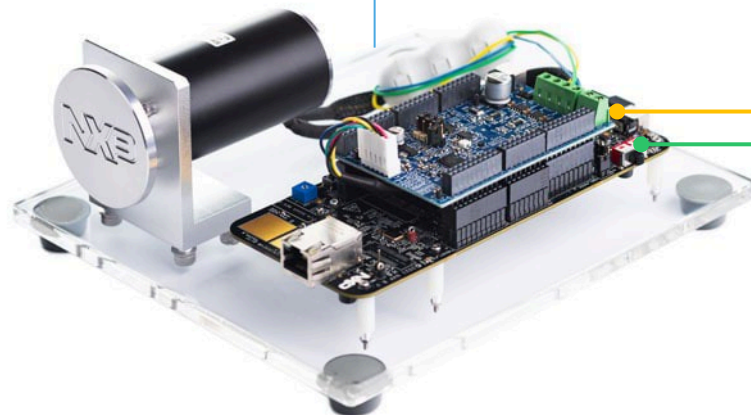
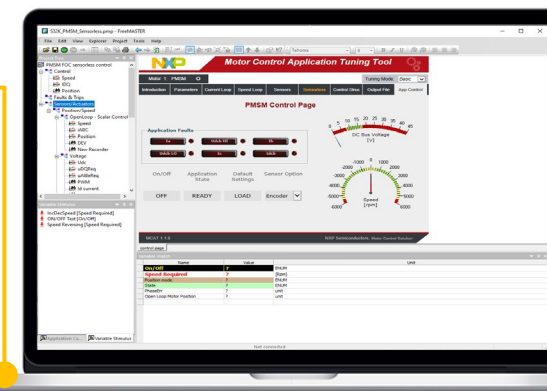
### External Configuration Tools Pins / Clock / Peripherals



### FreeMASTER Lite



### FreeMaster

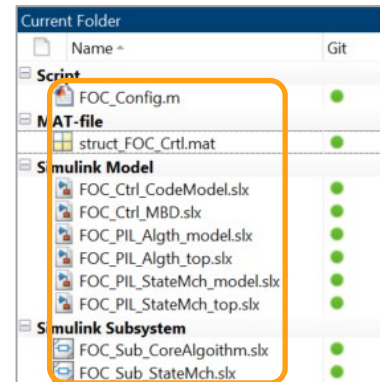


JTAG  
UART

# MBD MOTOR CONTROL DEMO OVER MBDT – OVERVIEW

## • Structure of MBD MC Frameworks - Layered Model

MBD电机控制框架：分层模型



**Combine with input and output ports to construct the top level MBD controller only model used to generate the code for integration.** 结合输入和输出端口构建用于生成集成代码的顶层MBD控制器模型。

+

结合 Simscape 电机模型运行 MIL、SIL 或 PIL 进行有限状态机仿真和验证

**Combine with Simscape motor model to run MIL, SIL or PIL for finite state machine simulation and verification**

**SW state machine**

**Core FOC Algorithm model**

结合理想电机模型运行MIL、SIL或PIL进行算法仿真或验证

**Combine with ideal motor model run MIL, SIL or PIL for algorithm simulation or verification**

结合 MBDT 块构建顶层 MBD MC 模型

**Combine with MBDT blocks to construct the top level MBD MC model.**

Simulink subsystem

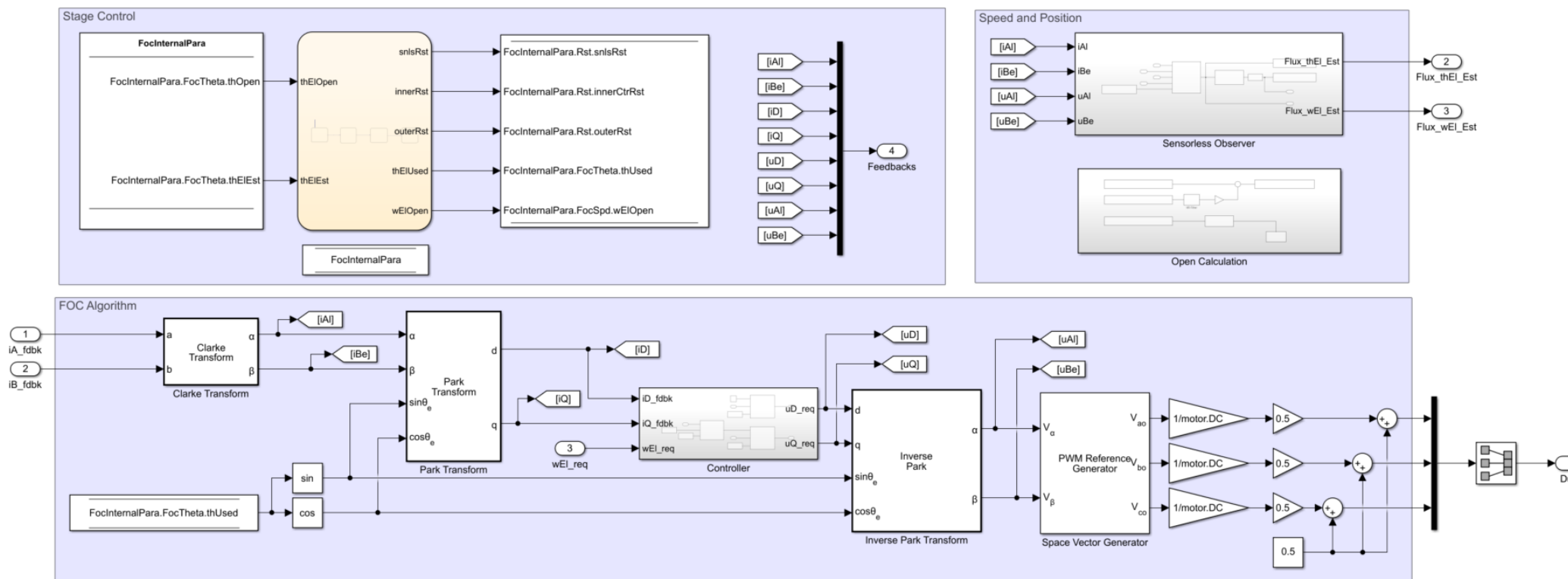
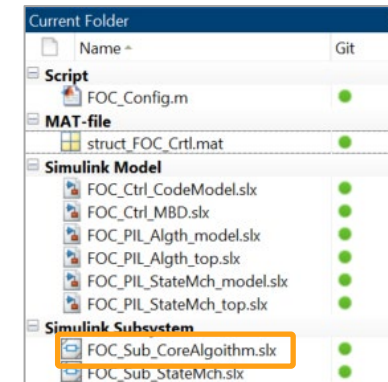
Simulink Model

# MBD MOTOR CONTROL DEMO OVER MBDT – DETAILS

- Core FOC Algorithm model

- HW independent

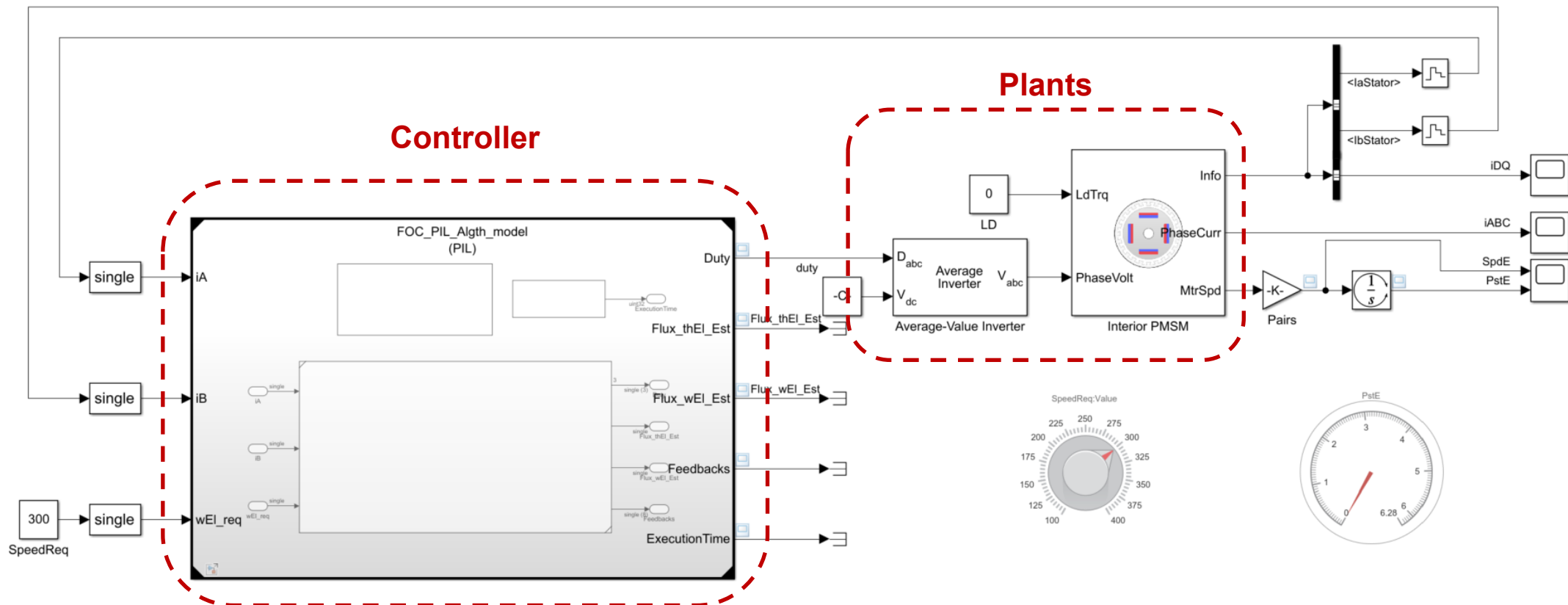
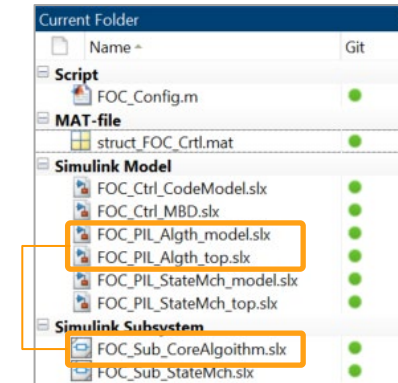
FOC核心算法模型



# MBD MOTOR CONTROL DEMO OVER MBDDT – DETAILS

- SIL or PIL model for Core Field Oriented Control Algorithm model
  - It's easy to switch between SIL and PIL

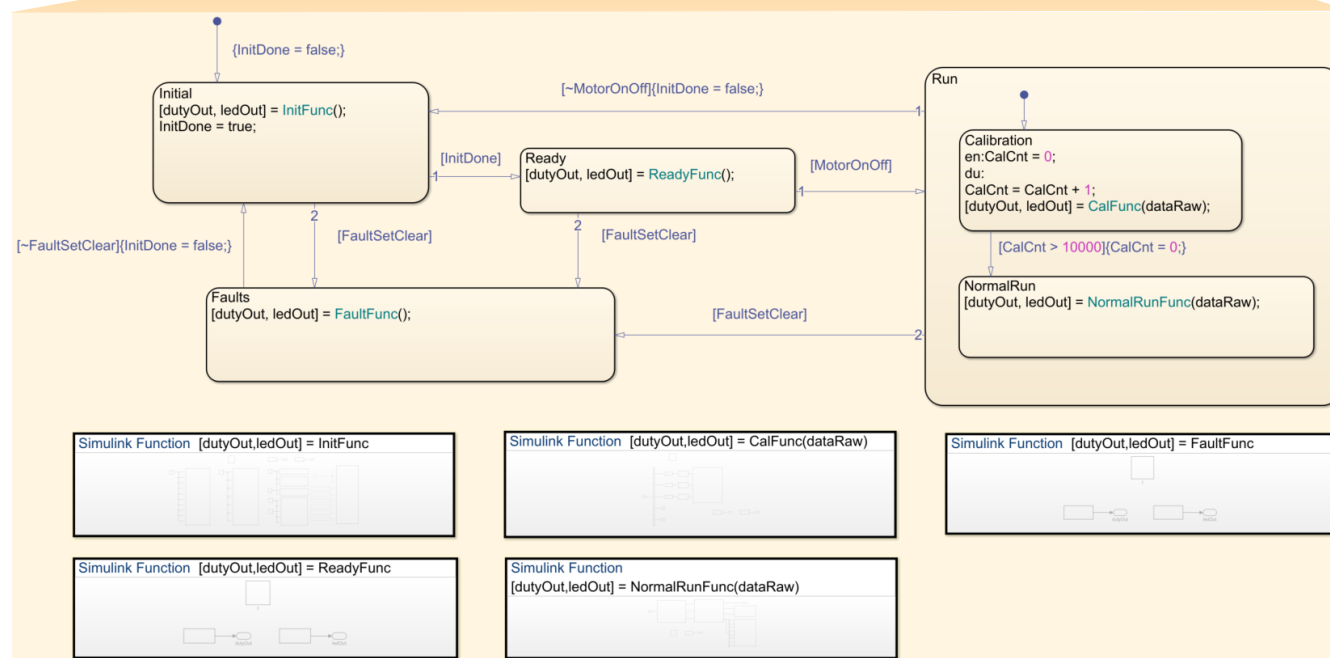
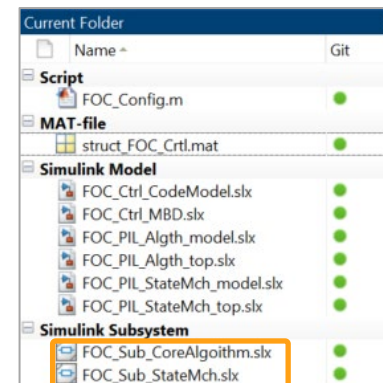
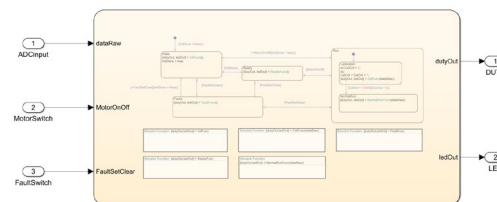
FOC核心算法模型及其SIL/PIL模型



# MBD MOTOR CONTROL DEMO OVER MBDT – DETAILS

- Finite state machine model
  - HW independent
  - Upper layer for Core FOC Algorithm model

有限状态机模型，下层结合FOC算法模型

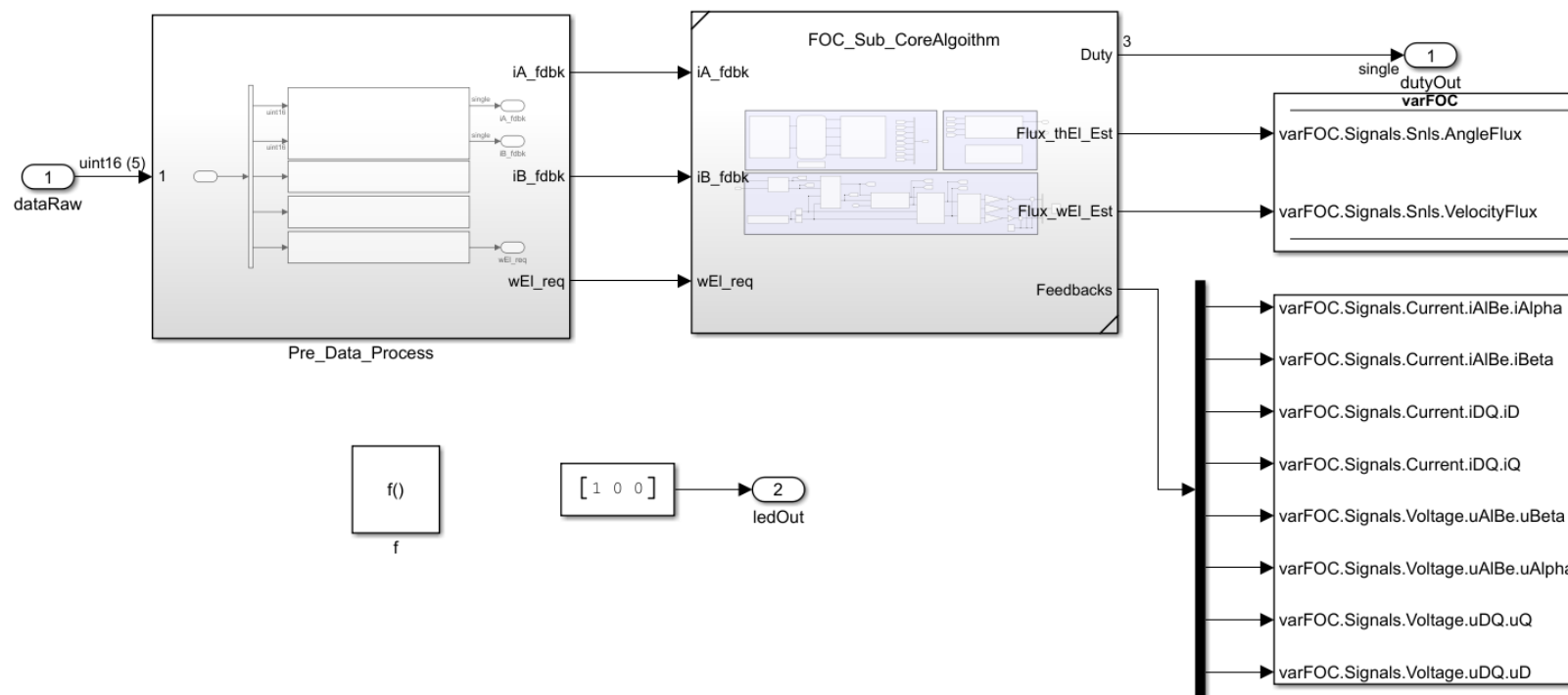
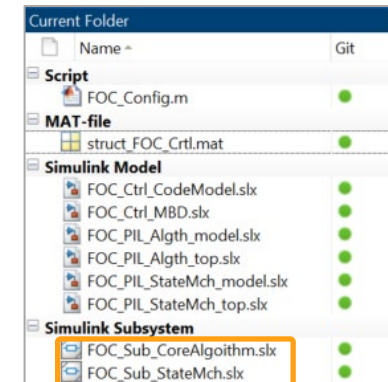


# MBD MOTOR CONTROL DEMO OVER MBDDT – DETAILS

- Finite state machine model (continued)

- Data preprocessing

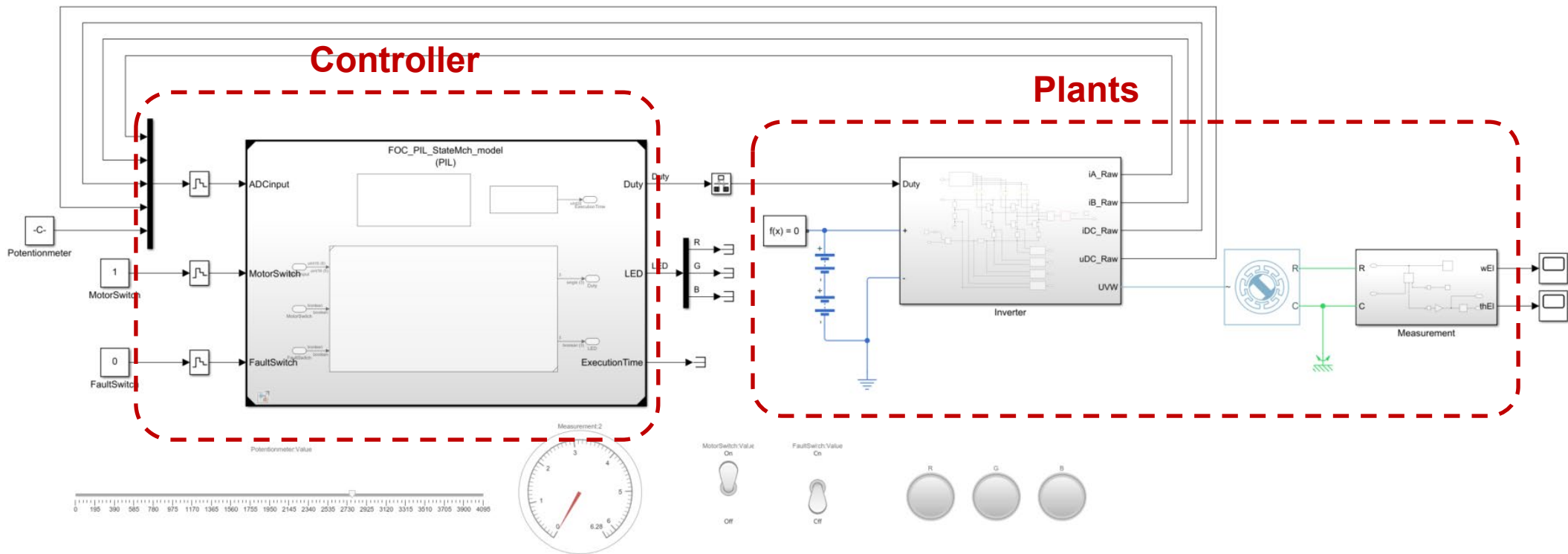
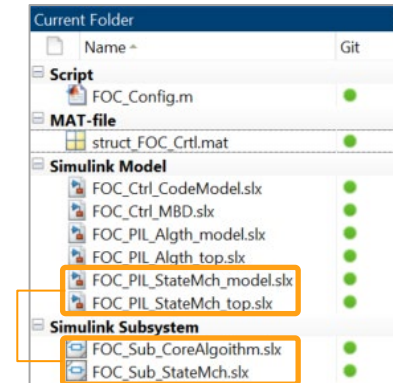
有限状态机模型，输入/输出的数据处理，以及分层模型结合方式



# MBD MOTOR CONTROL DEMO OVER MBDDT – DETAILS

- SIL or PIL model for finite state machine
  - It's easy to switch between SIL and PIL

有限状态机模型的SIL/PIL测试



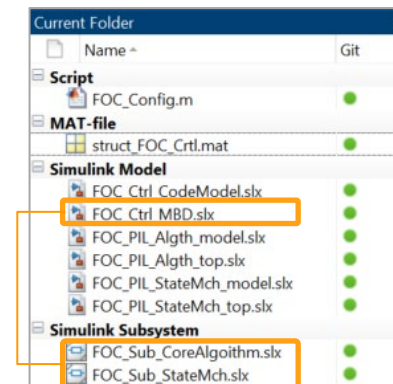
# MBD MOTOR CONTROL DEMO OVER MBDT – DETAILS

- The top level MBD MC Framework

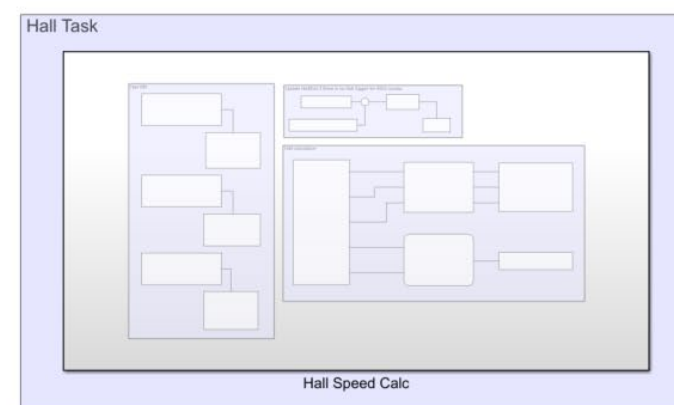
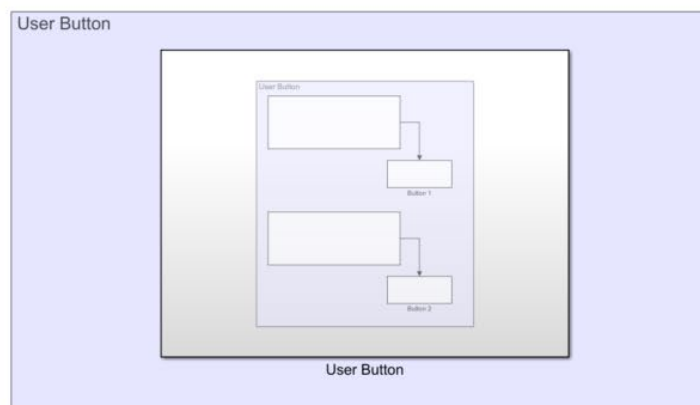
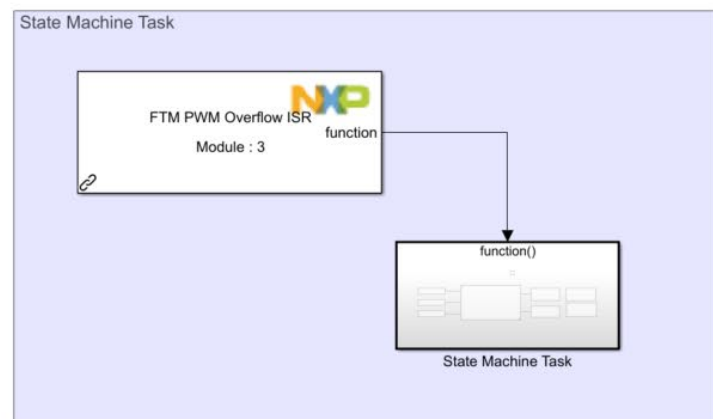
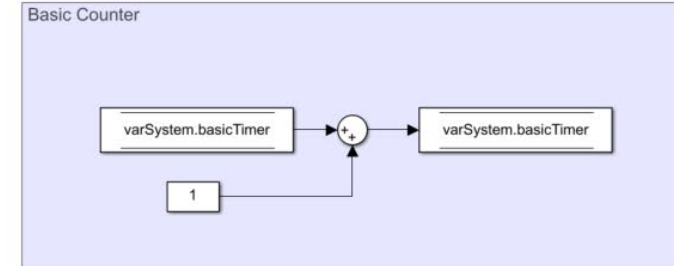
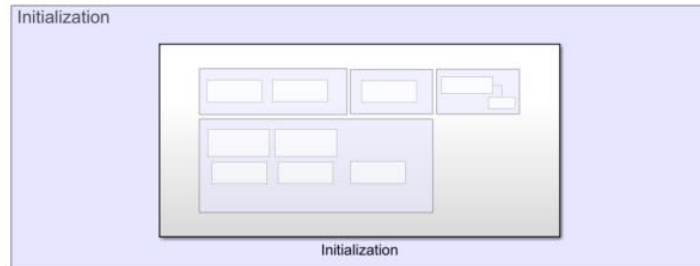
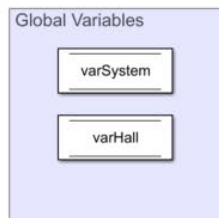
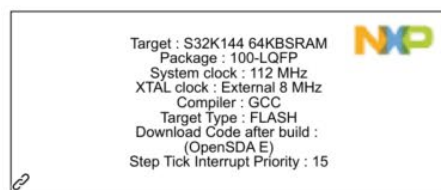


- Peripheral control done via MBDT

- Five tasks: initialization, basic counter, user button, hall speed calculation and state machine



顶层电机控制框架模型：基于MBDT的外设、时钟配置，其他非FOC算法任务

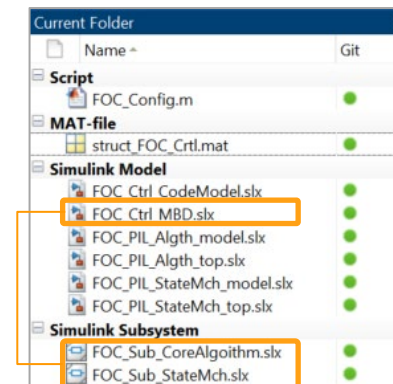




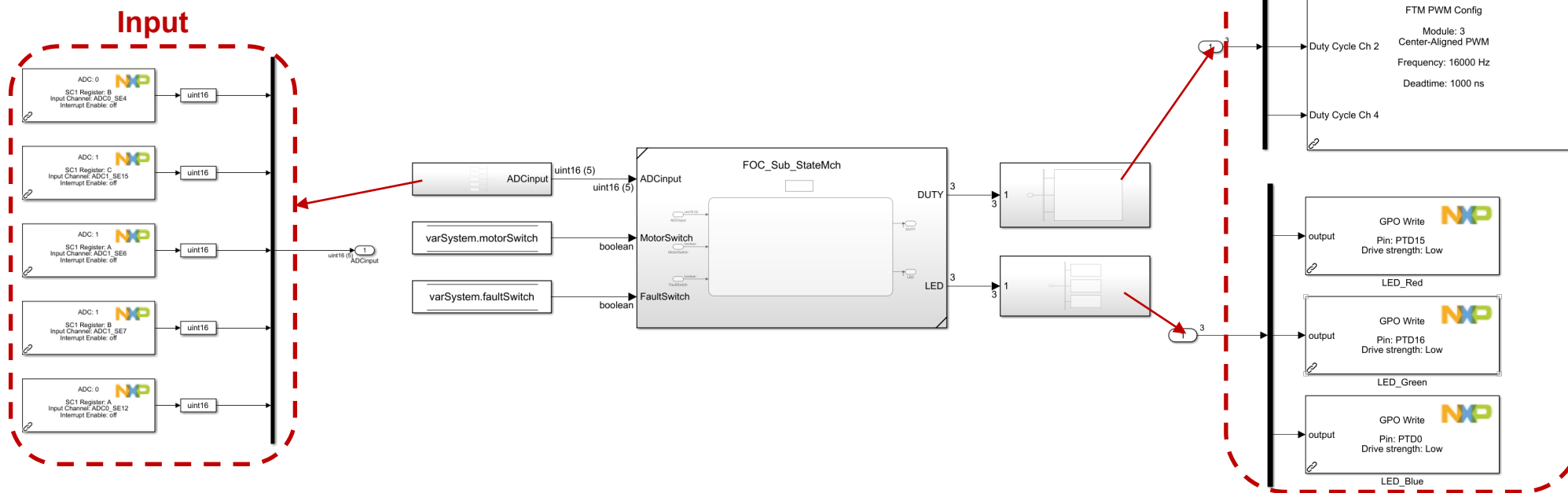
# MBD MOTOR CONTROL DEMO OVER MBDT – DETAILS

- The top level MBD MC model
  - The input interface and output interface through MBDT blocks

顶层模型：状态机模型和MCU模块的结合方法

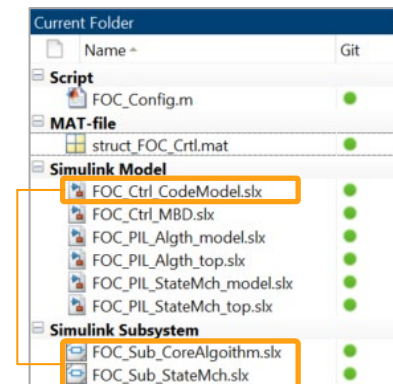


Output

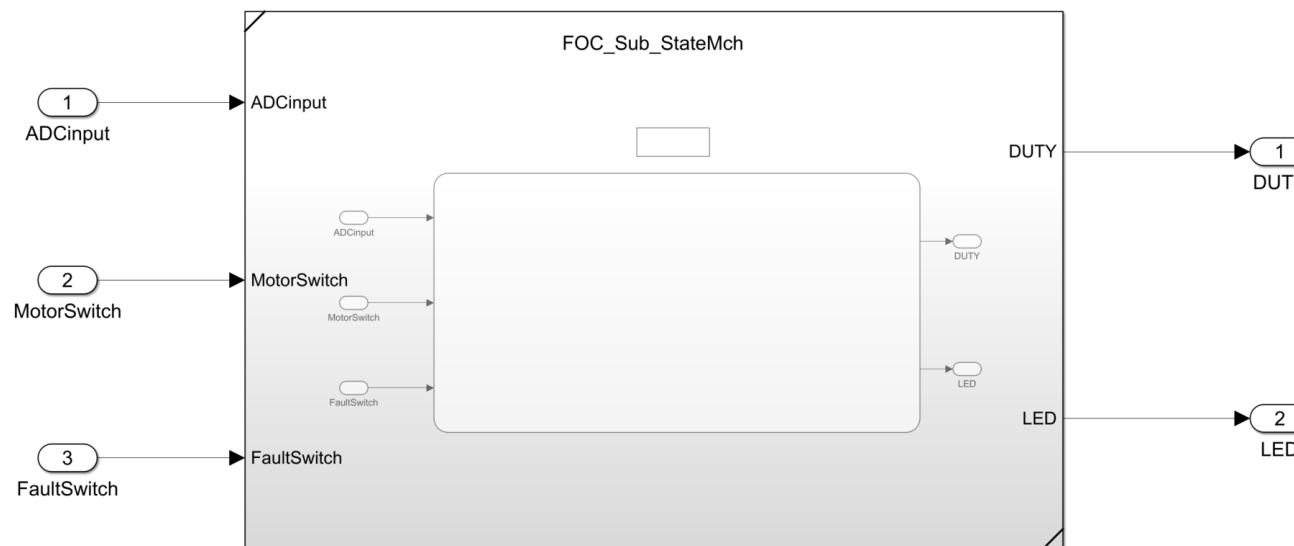


# MBD MOTOR CONTROL DEMO OVER MBDT – DETAILS

- The top level MBD controller-only model
  - The model is only used to generate C code
  - Developer integrates the generated code with configuration code and SDK/RTD in IDE (S32DS)



顶层模型：通过S32DS集成开发，仅生成算法部分的代码，驱动由S32DS配置和实现



# Additional resources

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**MATLAB EXPO**



SECURE CONNECTIONS  
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# MBDT USEFUL LINKS AND SOURCES

- Hardware

- [S32K Automotive General-Purpose Microcontrollers](#)
- [S32K344 Brushless Direct Current and Permanent Magnet Synchronous Motor Control Development Kit](#)
- [HVBMS Reference Design Bundle using ETPL](#)

- Software

- [Model-Based Design Toolbox \(MBDT\)](#)
- [Automotive Math and Motor Control Library \(AMMCLib\)](#)
- [Real-Time Drivers \(RTD\)](#)

- Community

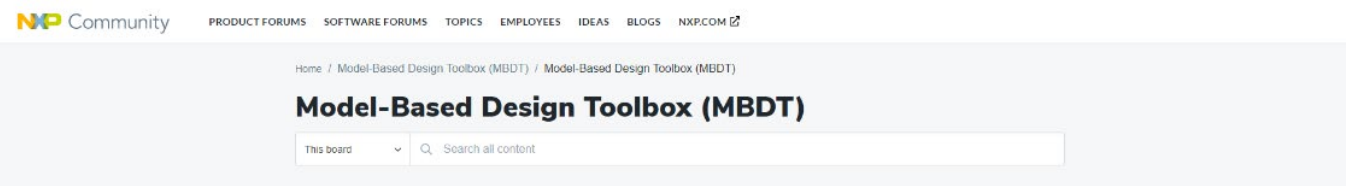
- [MBDT Community](#)
- WeChat public account: autoMBD

The screenshot shows the NXP Community website interface. At the top, there is a navigation bar with 'LANGUAGE', 'HELP', and 'SIGN IN' options. Below this, the page title is 'Model-Based Design Toolbox (MBDT)'. A search bar is present with the text 'All community' and 'Search all content'. The main content area is titled 'Model-Based Design Tools for Matlab and Simulink Support' and displays a grid of nine toolboxes:

- S32K1xx**: Includes How to, Tutorials, Videos, and FAQ.
- MPC57xx**: Includes How to, Tutorials, Videos, and FAQ.
- S12ZVM**: Includes How to, Tutorials, and Videos.
- S32K3xx**: Includes How to, Tutorials, Videos, and FAQ.
- HCP**: Includes How to, Tutorials, and Videos.
- MathWorks**: Includes Motor Control, Embedded Coder®, Stateflow®, Simscape™, Videos, Support Packages, and Polyspace.
- i.MX RT**: Includes How to, Tutorials, Videos, and FAQ.
- Kinetis V**: Includes How to, Tutorials, and Videos.
- DSC**: Includes How to, Tutorials, and Videos.

At the bottom of the grid, a note states: 'The Model-Based Design Toolbox provides an integrated development environment and toolchain for configuring and generating all of the necessary software automatically. Learn more.'

# ADDITIONAL RESOURCES & SUPPORT



## MBDT Beginner's Guide

W1: MBDT Introduction

W2: How-To SPI

W3: How-To CAN

W4: How-To PWM

W5: How-To LIN

W6: How-To PIL

W7: How-To Timers

### Webinars

MW: Motor Control: S32K

MW: Motor Control: i.MX RT

Motor Control: BLDC/PMSM

Motor Control: Design Application

MW: Code Generation and Verification

MW: Speed Up Applications Development with MBDT

MW: Rapid Prototyping of Embedded Designs with MBDT

MW: AUTOSAR SW on S32K1/MPC

AUTOSAR SW on S32K3

MW: Deploying BMS algorithm on S32K1

MW: Deploying Deep Learning SOC algorithm on S32K3

MW: HIL Testing of Balance of Plant Controller of Fuel Cell System

MW: Vision

FreeMASTER

MW: Automotive DevOps for MBD with AWS

MW: Integrating AI-Based Virtual Sensors into Model-Based Design

### Announcement

MBDT for HCP Release Announcement:  
NXP Model-Based Design Toolbox for High-Performance Computing Platform (HCP) - version 1.1.0 RFP

Model-Based Design Tools for Matlab and Simulink Support

<p><b>S32K1xx</b></p> <ul style="list-style-type: none"> <li>How-to</li> <li>Tutorials</li> <li>Videos</li> <li>FAQ</li> </ul>	<p><b>MPC57xx</b></p> <ul style="list-style-type: none"> <li>How-to</li> <li>Tutorials</li> <li>Videos</li> <li>FAQ</li> </ul>	<p><b>S12ZVM</b></p> <ul style="list-style-type: none"> <li>How-to</li> <li>Tutorials</li> <li>Videos</li> </ul>
<p><b>S32K3xx</b></p> <ul style="list-style-type: none"> <li>How-to</li> <li>Tutorials</li> <li>Videos</li> <li>FAQ</li> </ul>	<p><b>HCP</b></p> <ul style="list-style-type: none"> <li>How-to</li> <li>Tutorials</li> <li>Videos</li> </ul>	<p><b>MathWorks</b></p> <ul style="list-style-type: none"> <li>Motor Control</li> <li>Embedded Coder®</li> <li>Stateflow™</li> <li>Simulink™</li> <li>Videos</li> <li>Support Packages</li> <li>Polyspace</li> </ul>
<p><b>i.MX RT</b></p> <ul style="list-style-type: none"> <li>How-to</li> <li>Tutorials</li> <li>Videos</li> <li>FAQ</li> </ul>	<p><b>Kinetis V</b></p> <ul style="list-style-type: none"> <li>How-to</li> <li>Tutorials</li> <li>Videos</li> </ul>	<p><b>DSC</b></p> <ul style="list-style-type: none"> <li>How-to</li> <li>Tutorials</li> <li>Videos</li> </ul>

The Model-Based Design Toolbox provides an integrated development environment and toolchain for configuring and generating all of the necessary software automatically. Learn more.

### Discussions

- MPC5748G PIL timeout error

by [chamioncham](#) yesterday • Latest post 9 hours ago by [chamioncham](#)
- MLIB and SPI compilation error

by [engineer\\_atlita](#) 3 hours ago • Latest post yesterday by [engineer\\_atlita](#)
- Code generated by mbdtool not excute on the MPC574...

by [m13871761742](#) on 04-05-2020 04:32 PM • Latest post Tuesday by [eusebio\\_bivoli](#)

### ASK A QUESTION

- 0 1
- 0 1
- 0 9

### Contents

- NXP Model-Based Design Tools Knowledge Base 94
- Hotfixes
- S32K1xx
- MPC57xx
- S12ZVM
- i.MX RT
- Kinetis V

## PMSM Control Workshop

Course Main Page

M1: Environment Setup

M2: PMSM and FOC

M3: System Partitioning

M4: PWM Modulation

M5: V/f Scalar Control

M6: Current Sensing

M7: Torque Control

M8: Speed Control

M9: Position Observer

M10: Sensorless Speed Control

## BLDC Control Workshop

Course Main Page

1. Introduction

2. Application Partitioning

3. Input Commands

4. BLDC Motor Theory

5. Hall Sensors

6. Commutation

7. Commutation Algorithm

8. Power Stage Config

9. Open Loop Control

10. Speed Estimator

11. Closed Loop Control

12. Motor Control System



# MATLAB EXPO

Thank you



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