Model-Based Design Toolbox S32K3xx Series

Quick Start Guide

Automatic Code Generation for the S32K3xx Family of Processors Version 1.1.0

Target Based Automatic Code Generation Tools For MATLABTM/SimulinkTM/StateflowTM Models working with Simulink Coder TM and Embedded Coder®



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1 Installation

Installing the Model-Based Design Toolbox is the first step in setting up and running automatic C code generation from MATLAB/Simulink for NXP's embedded target processors and development boards.

1.1 System Requirements

For a flawless development experience the minimum recommended PC platform is:

- *Windows*® *OS*: any x64 processor
- At least 4 GB of RAM
- At least 6 GB of free disk space.
- Internet connectivity for web downloads.

Operating System Supported

	SP Level	64-bit
Windows 7	SP1	Х
Windows 10		Х

1.2 Installation Steps

NXP's Model-Based Design Toolbox is delivered as MATLAB Toolbox Package that can be installed offline or online from MathWorks Add-ons. This document shows how to install the offline package, assuming you have already downloaded the file from NXP's <u>MBDT official</u> <u>download web page</u>.

To have the toolbox installed and configured properly the following actions should be executed:

- 1. Run the MATLAB toolbox package file *.mltbx downloaded from <u>NXP's Model-Based Design Toolbox web page</u> by pressing the **Download Eval** button.
- 2. Setup the MATLAB path for Model-Based Design Toolbox and generate the appropriate toolchain setting for the user MATLAB environment (it is recommended that the path does not contain spaces).

Each of these actions is explained in the following sub-chapters.

1.2.1 Run Add-on installer

Install the NXP's Model-Based Design Toolbox by double-clicking the *.mltbx file. This will activate the MATLAB Add-ons installer that will automatically start the installation process.

After the MATLAB opens, you will be prompted with the following options:

1. Indicate acceptance of the NXP Software License Agreement by selecting "I Accept" to proceed.

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23	Statistics and Machine Learning Toolbox version 1	1.6	MathWorks Toolbox		7 May 2020	÷
	Stateflow version 10.1		MathWorks Product		7 May 2020	Ε.

2. The rest of the process is silent and under MATLAB control. All the files will be automatically copied into default Add-Ons folder within the MATLAB

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	Vehicle Dynamics Blockset version 1.3				7 May 2020	:
	Trading Toolbox version 3.6				7 May 2020	:
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3	Statistics and Machine Learning Toolbox version 1	1.6	A MathWorks Toolbox		7 May 2020	:
	Stateflow version 10.1		A MathWorks Product		7 May 2020	: ,

The default location can be changed before installation by changing the Add-Ons path from MATLAB Preferences

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4 MATLAB	MATLAB Add-Ons Preferences		
Add-Ons App Designer Code Analyzer ▷ Colors Command History Command Window Comparison Current Folder	Installation Folder This is where MATLAB puts installed Add-Ons. C:\Users\\authority\Documents\MATLAB\Add-Ons Restore Default Folder		

Note: It is recommended to install the MATLAB and NXP Toolbox into a location that does not contains special characters, empty spaces, or mapped drives.

3. After a few minutes (~4-5min), the NXP's Model-Based Design Toolbox should be visible as new Add-ons.

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	NXP_MBDToolbox_S32K3xx version 1.1.0	Toolbox	NXP Model-Based Design Toolbox Team	20 December 2021	:
	Embedded Coder Support Package for ARM Cortex-M Processors version 19.2.3	📣 Hardware Support Package		27 November 2020	:
	NXP_MBDToolbox_\$12ZVMx version 1.4.0	Toolbox	NXP Model-Based Design Toolbox Team	12 November 2020	÷
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4. NXP's Model-Based Design Toolbox layout and Simulink Library are shown below



Model-Based Design Toolbox S32K3xx Series Quick Start Guide

5. NXP's Model-Based Design Toolbox documentation, help, and examples are fully integrated with the MATLAB development environment. Get more details by accessing the standard Help and **Supplemental Software** section:

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Documentation	Search Documentation	٩
CONTENTS	NXP Model-Based Design Toolbox for S32K3xx Series The NXPs Mode-Based Design Toolbox is a quick solution for fetting and rapid prototyping applications on top of NXP MCUs.	
Volv Moder Asade Lineage Hondox Margin Hondox Series (Stanghermental Software) Relaces Notes Quick Start Guide S3XXbx Simulus Biocles Product Homepage Community & Support Examples	R provides in integrated development environment and toolchain support for configuring and generating applications (including initialization notifies and device drivers) to execute complex applications (including initialization notifies) and device drivers) to execute complex applications (including initialization notifies) and device drivers) to execute complex applications (including initialization notifies) and execute drivers) to execute complex applications (including initialization notifies) and device drivers) to execute complex applications (including initialization notifies) and device drivers) to execute complex applications (including initialization notifies) and execute drivers). GCC complex and additional tools for debugging and real-time data visualization. SI2XXX: Modes device drivers (including applications with foreid downsade to sarget support in Multiple condors frainders application with foreid downsade to sarget support in Multiple complex intervent downsade to sarget support in Complex and additional tools for debugging and real-time data visualization. SI2XXX: Modes device drivers (including applications) and sensor drivers device drivers in Generate code for stratification application with foreid downsade to sarget support in Multiple complex intervent downsade application tools or EB Tresos) ComeSitystem tools for ADC. CAN, DIO, OPT 180, NCL, PVM, SPI UNITY tools: Multiple downsade to sarget support in Unity tools: Managet MV: Protein Data acquittion and sensor downsade to sarget tools automation tools and data downsade to sarget tools automation tools and tools: Complex VP. Protein Data acquittion and sensor downsade to target ADMINE tool automation tools and tools complex VP. Protein Data acquittion and tools: Complex VP. Protein Data acquittion application tools and tools: Complex VP. Protein Data acquittion and tools: Complex VP. Protein Data	applications).
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file:///C:/MATLAB/R2021/help/3ptoolbox/nxpmo	delbaseddesigntoolbox/doc/index.html	

1.2.2 Setting the Path for Model-Based Design Toolbox and Toolchain Generation

The Model-Based Design Toolbox uses the Toolchain mechanism exposed by the Simulink to enable automatic code generation with Embedded Coder toolbox. By default, the toolchain is configured for the MATLAB R2020a / R2020b / R2021a release. For any other MATLAB release, the user needs to execute a toolbox m-script to generate the appropriate settings for his/her installation environment.

This is done by changing the MATLAB Current Directory to the toolbox installation directory (e.g.: ..\MATLAB\Add-Ons\Toolboxes\NXP_MBDToolbox_S32K3xx\) and running the "mbd s32k3 path.m" and "mbd s32k3.target.create codertarget" scripts.

```
>> mbd_s32k3_path
Treating 'C[...]\S32K3\src' as MBD Toolbox installation root.
MBD Toolbox path prepended.
Registering the toolchain ...
C:\Windows\System32\where.exe
Successful.
Creating folders for the target 'NXP S32K3xx' in the folder
'C:\[...]\S32K3\src\mbdtbx_s32k3\codertarget\2021a'...
Creating the framework for the target 'NXP S32K3xx'...
Registering the target 'NXP S32K3xx'...
Done.
```

This mechanism requires users to install the <u>Embedded Coder Support Package for ARM Cortex-</u> <u>M Processor</u> as a prerequisite.

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	NXP_Support_Package_S32R version 1.3.0	Toolbox	NXP Model-Based Design Toolbox Team	11 November 20	19	÷
2.2	Simscape Electrical version 7.1	A MathWorks Product		24 September 20)	1
342	Simscape version 4.6	A MathWorks Product		24 September 20)	1

The "mbd_s32k3_path.m" script verifies the user setup dependencies and will issue instructions for a successful installation and configuration of the toolbox.

1.2.3 Installing EB Tresos (optional step)

Model-based Design Toolbox for S32K3xx provides support for 2 external configuration tools – NXP S32Configuration Tools (which is made available directly through the mltbx installer and requires no additional installation) and EB Tresos. To install this product, you will need to follow these instructions:

Go to the <u>nxp.com</u> website, log into your account (or make one for free). Then go to My NXP -> Licensing -> Software Licensing and Support:

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	Renew Expired Software>		Activate registration code >

You will find a Product list on the next page from which you should select **Automotive SW** – **S32K3 Standard Software.** From the Product Information page, you should find the item names **Automotive SW** – **EB tresos Studio** / **AUTOSAR Configuration Tool**.

NP	PRODUCTS	APPLICATIONS	DESIGN	SUPPORT	COMPANY
NXP > Software & Support	Product Inform	ation : Automotive SW -	S32K3 Standard	i Software	
Software & Support	Dura		. 41		
Product List	Proc	auct informa	ation		
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From the next page, select **EB tresos Studio 27.1.0**. Read the Software Terms and Conditions on the following page and click on **I Agree**.

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From this page, download (minimum) the files shown in the picture above. Note that when the download is complete, the .uip files might have been renamed to .gz or .zip. You will have to manually change the extensions of those files back to .uip, then simply run the **setup.exe** file. From that step, the EB Tresos wizard will guide you through the installation. Additionally, you can download from the same location (shown in the picture above) the EB Tresos installation guide (available in .pdf format). Note that you will require a license for this configuration tool, but it is made available on that same page (highlighted in yellow), for free.

2 Run Models

2.1 Examples Library & Help

NXP's Model-Based Design Toolbox comes with an Examples Library collection that lets you test different MCU on-chip modules and run complex applications.

The Examples Library mbd_s32k3_examples.slx can be opened from "{Model Based Design Install Directory}\S32K3_Examples folder or directly from the Simulink Library Browser main window



Each category contains multiple examples that showcase different Model-Based Design Toolbox capabilities that are categorized into different groups.

The examples are also available from standard MATLAB Help for NXP's Model-Based Design Toolbox Example.

2.2 Hardware Setup

All examples provided with the Model-Based Design Toolbox were developed on XS32K3X4EVB-Q257 as the primary hardware target.



2.3 A "Hello World" Example

If the hardware setup is completed successfully, then all ingredients are present for running successfully the Model-Based Design Toolbox for S32K3xx specific examples.

Navigate to "\S32K3_Examples\dio" folder and open the s32k3xx_dio.mdl Simulink model.

This model programs the S32K3X4 EVB to toggle the D33 red LED every 0.1 seconds. Additionally, if SW4 is pressed, the D32 blue LED should turn on.

Follow the next steps to run the example:

1. Open and README.html file to understand the hardware and software requirements for running the application

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DIO Example - OVERVIEW	
The s32k3xx_dio.mdl example shows how to use DIO ReadChannel, WriteChannel and FlipChannel functionalities.	
After the application is deployed on target, the D33 LED should blink RED every 0.1 second. If SW4 is pressed, D32 should turn on BLUE. The state of the D33 RED LED is stored ins red_led_level variable. The versionInfo variable stores the version information of this module, including module id, vendor id and vendor specific version numbers.	ide the
Note: the initialization settings for the components used in this example represent just a default EB Tresos available configuration. Users can change the configuration of the application requirements.	to fit special
TOOLCHAIN SUPPORTED	
- S32 Design Studio 3.4	
HARDWARE REQUIREMENTS	
- Mini/micro USB cable	
- EVB-S32K3XX board	
- Personal Computer	
PREPARE THE DEMO	
- Connect a USB cable between the host PC and the OpenSDA USB port on the target board.	
- Open the s32k3xx_dio.mdl. Read all the instructions within the model.	
- Build and Download the program to the target board.	
RUNNING THE DEMO	
- The D33 LED should blink RED every 0.1 seconds. If SW4 is pressed, D32 should turn on BLUE.	
CUSTOMIZATION OPTIONS	
Fully customizable for any input and output pins.	

2. Open the Simulink Model Configuration Parameters and select the appropriate MCU (S32K344 in this case).

Solver Solver Data Import/Export Math and Data Types Diagnostics Hardware Implementation Model Referencing Simulation Target Code Generation Coverage Target hardware resources Clocking Hardware Devine Part: S32K344 S32K344 VMM Dominoad User Paths PiL External mode ADA ADA PWM Dio GPT Son Son<th>Configuration Parameters: s32k3x</th><th>c_dio/Configuration (Active)</th><th>_</th><th></th><th>×</th>	Configuration Parameters: s32k3x	c_dio/Configuration (Active)	_		×
Solver NXP S32K3xx • Data Import/Export Math and Data Types Code Generation system target file. ert.llc Diagnostics Device vendor: ARM Compatible • Device type: ARM Cortex Hardware Implementation Model Referencing Simulation Target • Device details • Code Generation Cocking Hardware resources • Target hardware Part: S32K344 • • Clocking Hardware Hardware Nare Part: S32K344 • • PIL External mode ADC CAN PWM DIO GPT POID GPT Evin Evin Evin Evin Evin Evin	Q Search				
Diagnostics	Solver Data Import/Export Math and Data Types • Diagnostics Hardware Implementation Model Referencing Simulation Target • Code Generation Coverage	Hardware board: NXP S32K3xx Code Generation system target file: ert.ltc Device vendor: ARM Compatible Device type: ARM Cortex Device details Hardware board settings Target hardware resources Clocking Hardware Timers Download User Paths PIL External mode ADC CAN PWM DIO GPT SPI Diagnostics	v		•
OK Cancel Help App		OK Cancel H	lelp	Ар	• ply

3. Press the Build Model button and wait until the code is generated, compiled, and downloaded to the evaluation board. Alternatively, you can press on the text highlighted in the model to start the process automatically.

If you see the LEDs toggling, congratulations! You succeeded in running your first example created with

Model-Based Design Toolbox for S32K3xx

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