TRK-MPC5606B Fast Start kit Training

October 2013

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TRK-MPC5606B Fast Start Kit hardware contents

- StarterTRAK TRK-MPC5606B Evaluation Board
- USB cable
- Installation USB stick
- Instruction pamphlet

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TRK-MPC5606B Fast Start Kit software contents

- The TRK-MPC5606B Fast Start Kit contains Single installer that installs all software tools, documents and example projects:

1. RAppID init and RAppID pin wizard with permanent license
2. Utility to add RAppID generated code to CodeWarrior 10.5 Project
3. CodeWarrior for MPC56xx 10.5 SE
4. Low Level Drivers (LLDs) for MPC5606
5. High Level Drivers (HLDs) for StarterTRAK TRK-MPC5606B
6. RAppID Boot loader utility
7. FreeMASTER utility
8. Simple LED application examples that demonstrates the usage of software tools, LLDs and HLDs.

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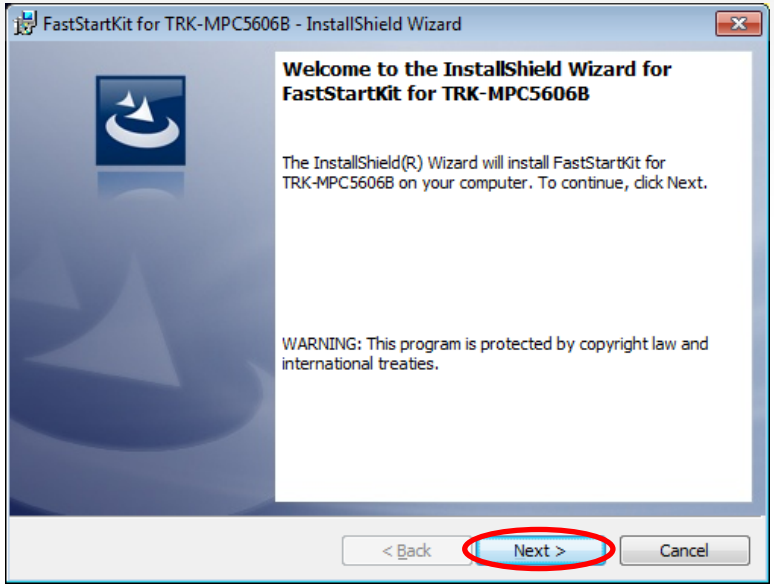
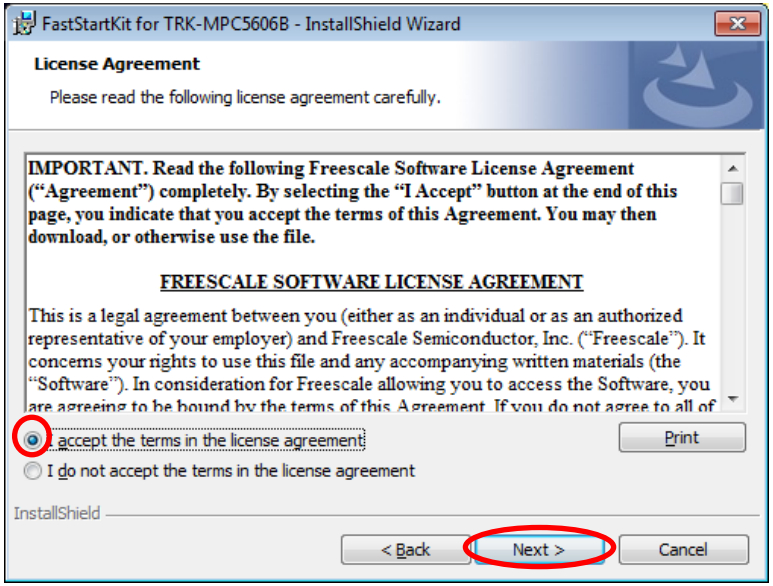
Installing Software tools

Start installation process by executing ***setup.exe*** located in the installation media.

Click on *Next*



Accept the License agreement and click on *Next*



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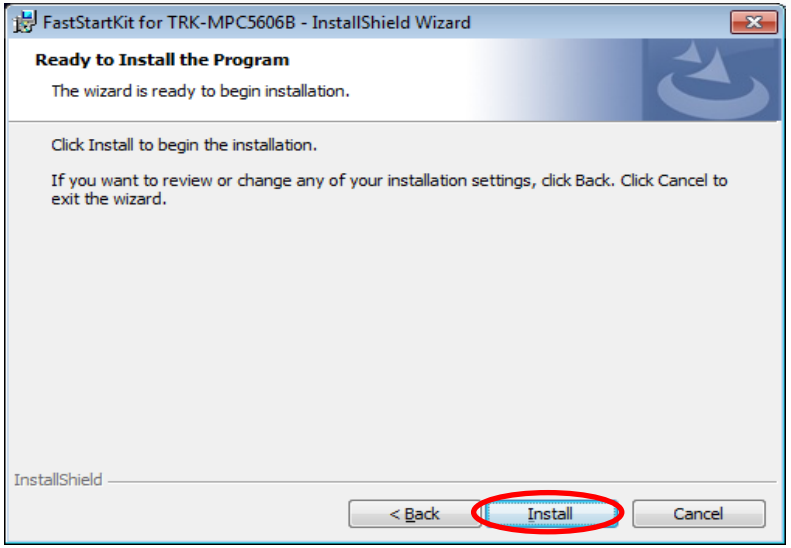
Installing Software tools

Select *Install to begin installation of Fast Start Kit tools.*



This will launch FreeMASTER installer.

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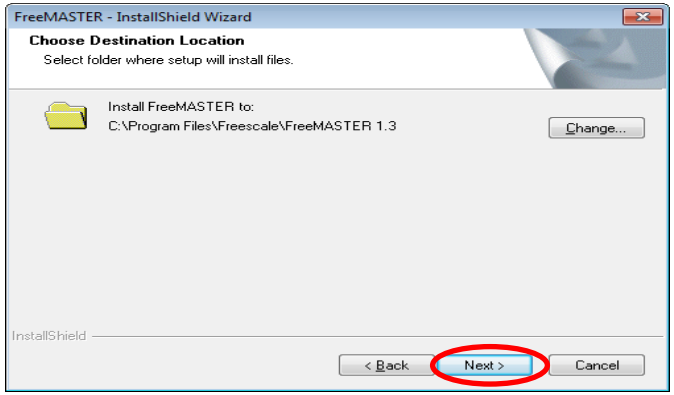
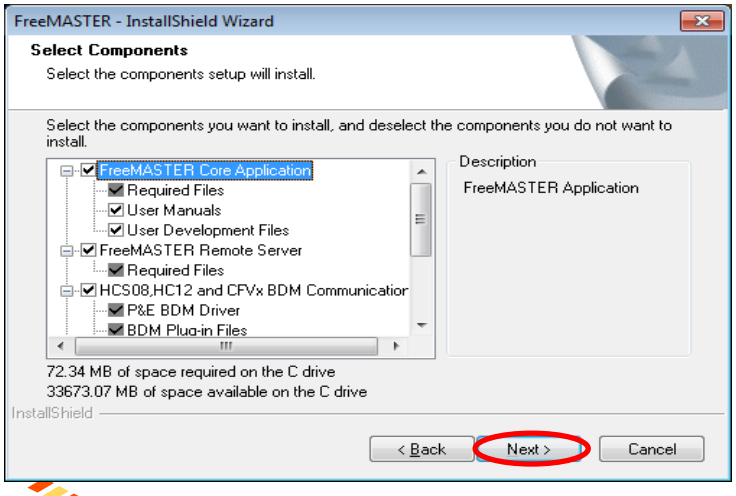
Installing Software tools – FreeMASTER

Accept license agreement and default installation directory by clicking on *Next*.

Accept default options in the “Select Components” window by selecting *Next*.





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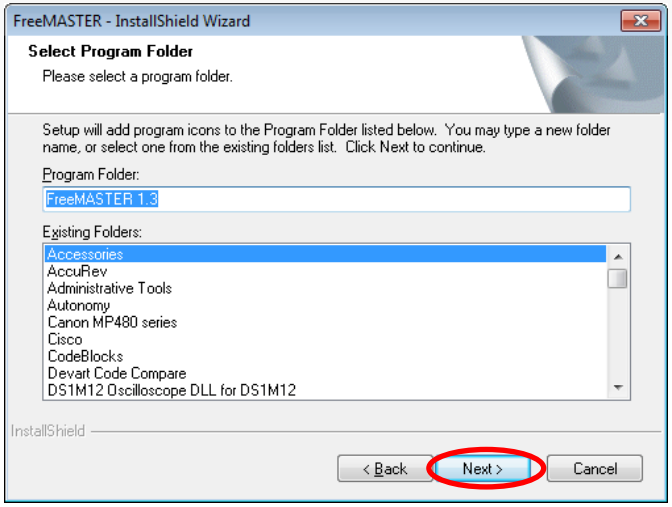
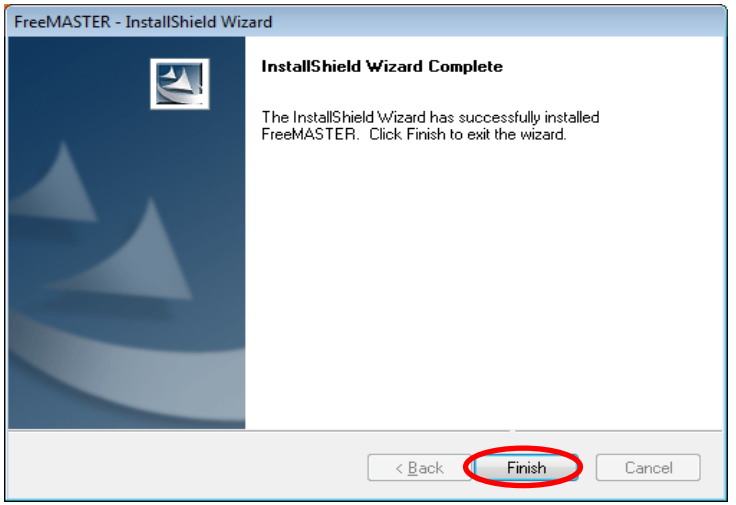
Installing Software tools – FreeMASTER

Accept default Program Folder by clicking on *Next*.



Select *Finish to complete FreeMASTER installation*. This will launch RAppID Init installer.



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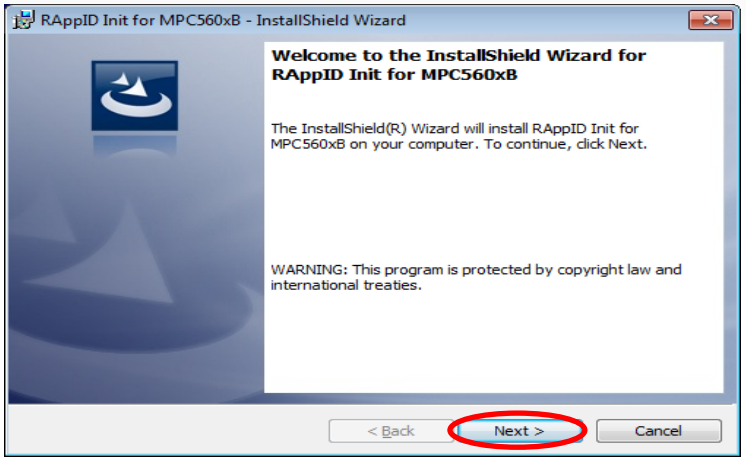
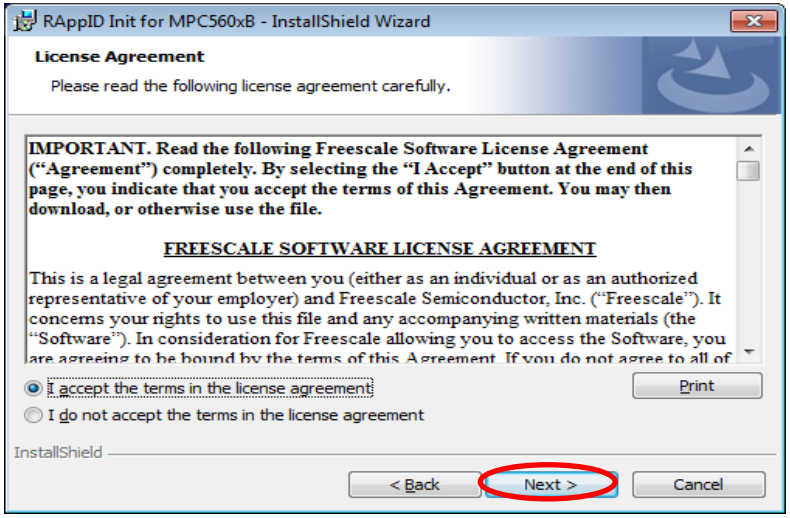
Installing Software tools – RAppID Init

Start RAppID Init installation by clicking on *Next* button



Accept license agreement and default directory location by clicking on *Next*



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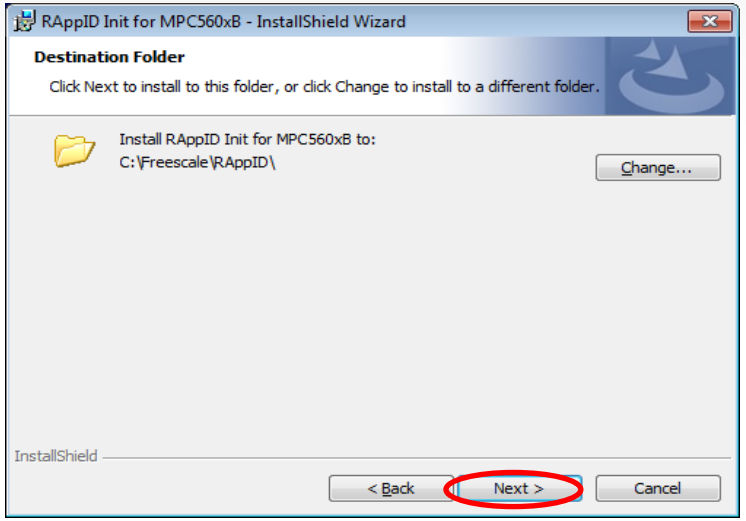
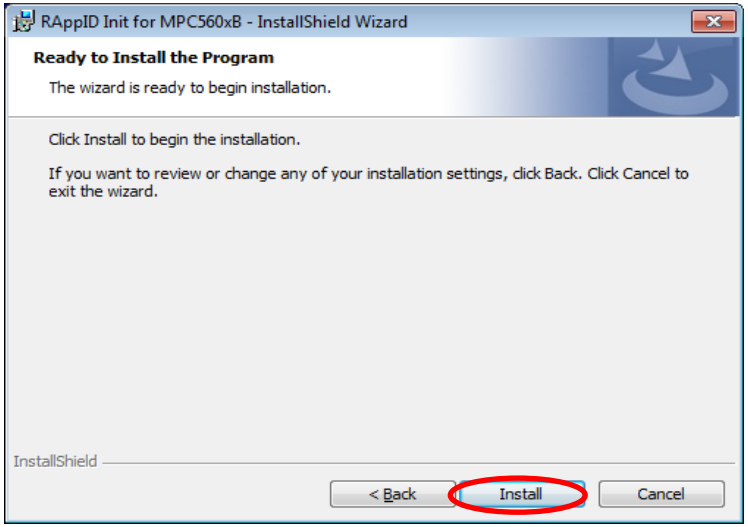
Installing Software tools – RAppID Init

Accept default location for destination folder by clicking on *Next*



Click On *Install* button



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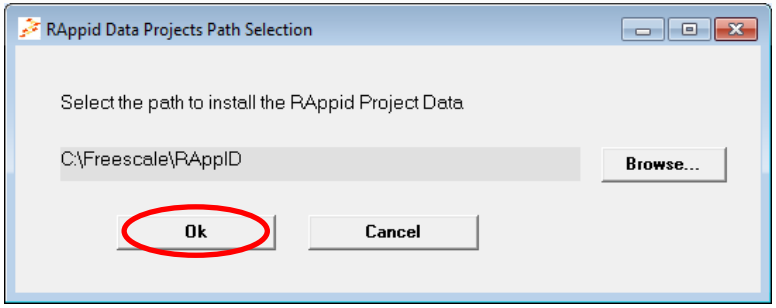
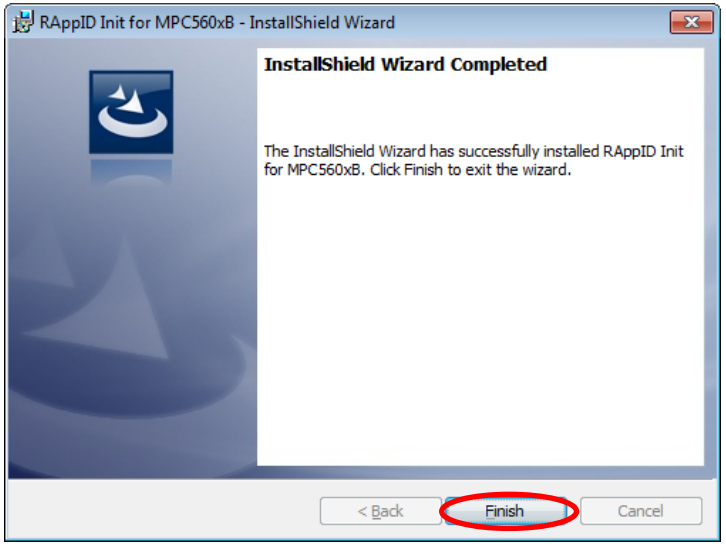
Installing Software tools – RAppID Init

Accept default location for RAppID project data folder by clicking on *Ok*



Click On *Finish* button to complete RAppID Init installation. This will launch RAppID Boot loader installer.



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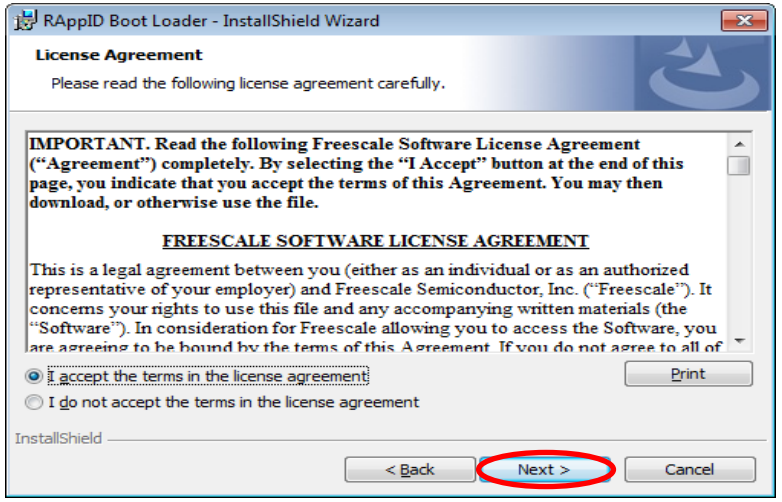
Installing Software tools – RAppID Boot loader

Click on *Next* to start RAppID boot loader installation.

Accept license agreement and click on Next



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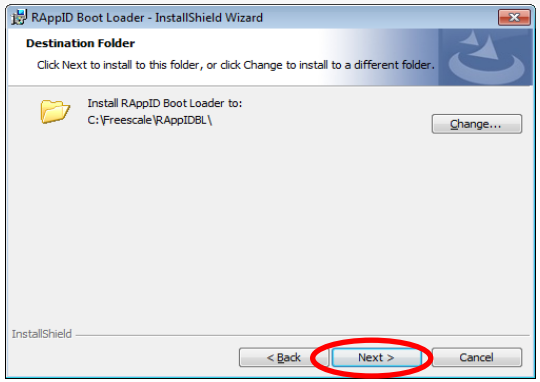
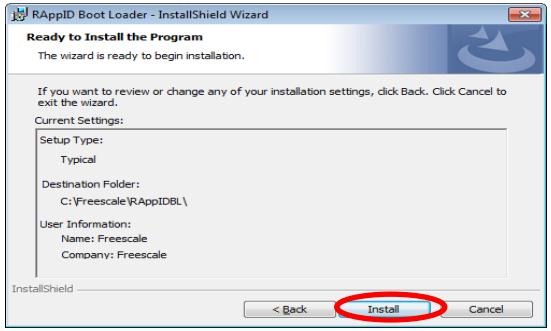
Installing Software tools – RAppID Boot loader

Accept default destination folder by accepting by clicking on *Next*.

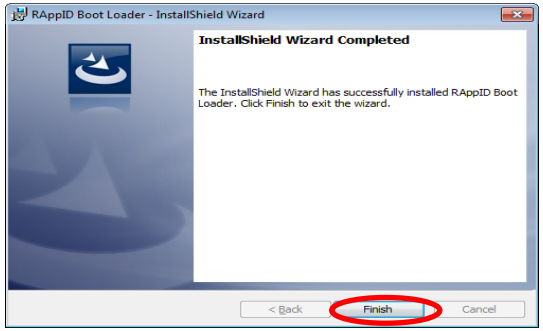


Start installation by selecting Install.



After installation is complete, select Finish to complete installation.

This will start CodeWarrior installation.



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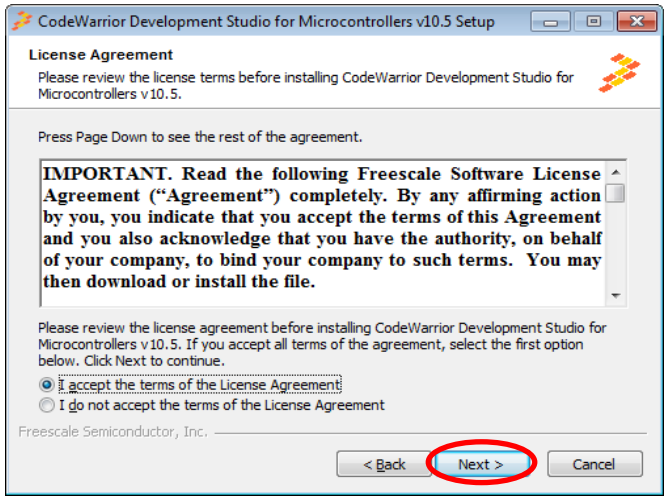
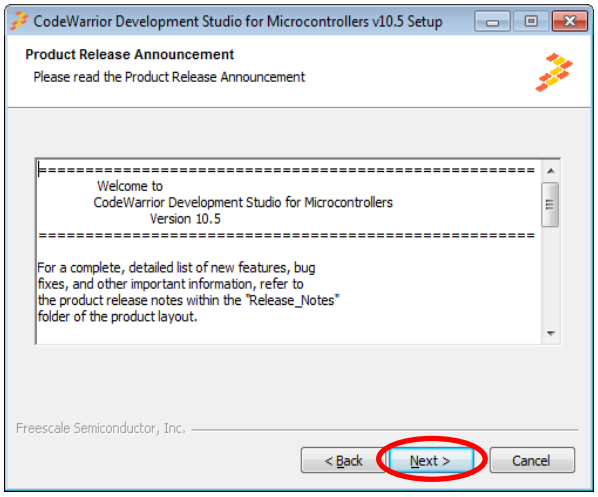
Installing Software tools - CodeWarrior

Start CodeWarrior installation by clicking on *Next*

Accept License agreement and Product Release announcement by clicking on *Next*





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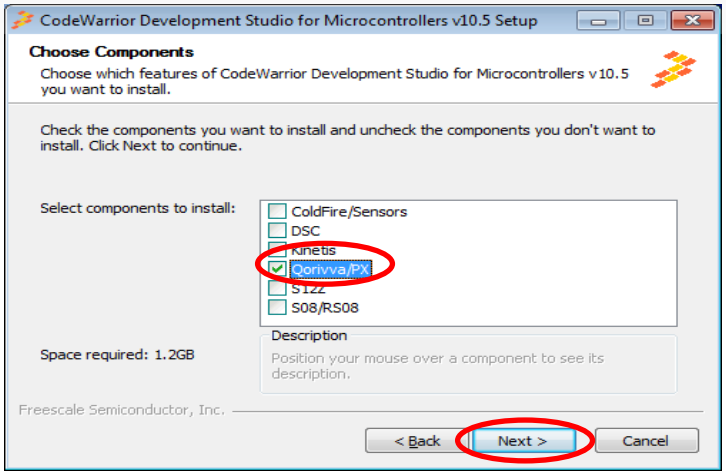
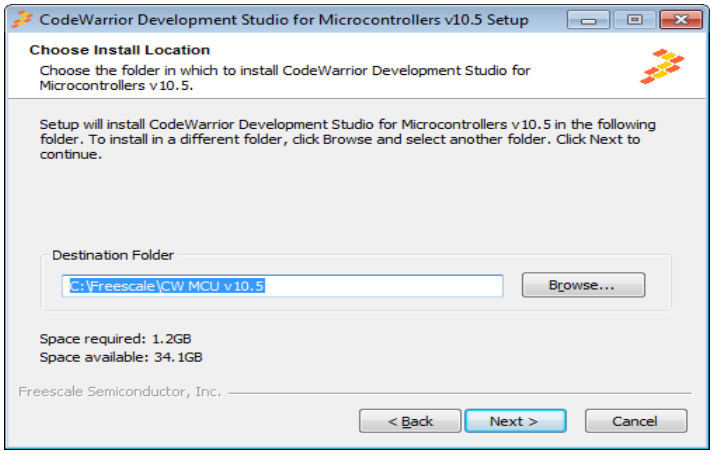
Installing Software tools - CodeWarrior

Choose Qorriva component and click on *Next*



Accept the default install location by selecting *Next*



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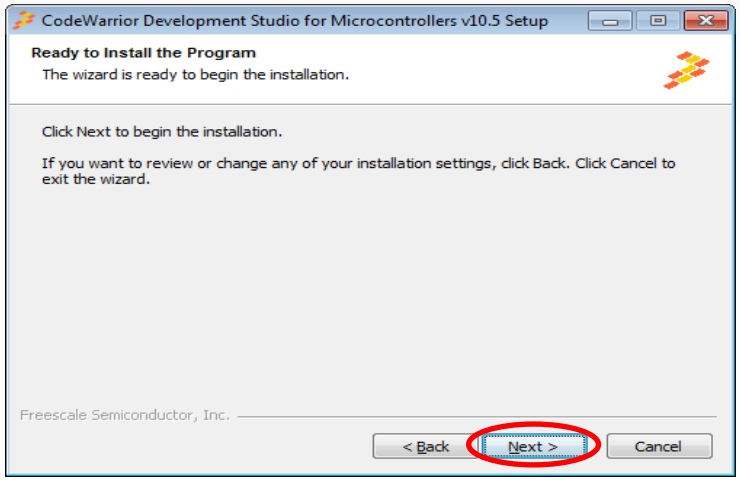
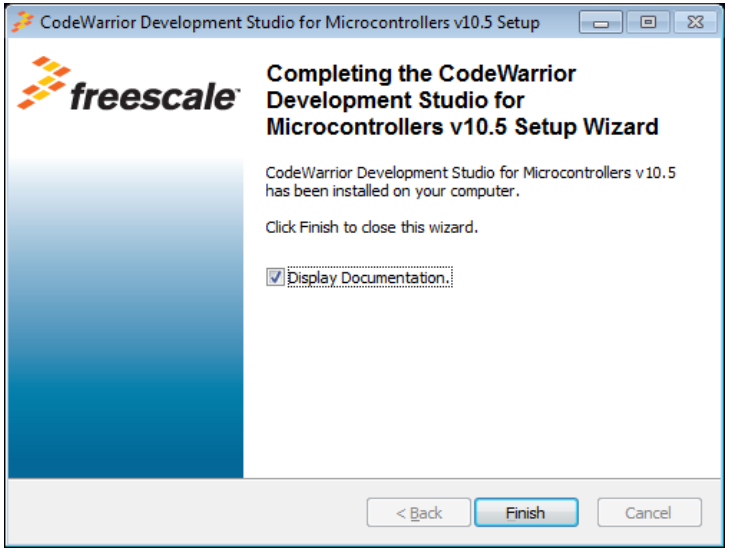
Installing Software tools - CodeWarrior

Select Next to begin CodeWarrior installation.



After installation is complete, select Finish to complete installation.



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RAppID Init Overview

- Intuitive, easy-to-use graphical user interface (GUI)
- Comprehensive initialization of the CPU, memory and peripherals
- Automatic DMA register setting from peripherals for basic modes
- Built-in consistency checks to minimize incorrect settings
- Automatic report generation of settings
- Efficient C and assembly code generation for compilers from companies such as Wind River®, Green Hills® and CodeWarrior
- Online documentation and built-in tool tips
- Installation comes with many example projects
- Generates complete infrastructure code for MCU startup

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RAppID Init Overview

- Provisions for revision management
- Automatic date and time stamps on generated code and reports
- Modular code generation—generate code for any or all peripherals
- Option to generate code for RAM or Flash
- Flexible Initialization sequence
- Project import/export capability for distributed development teams
- Wizards for eMIOS initialization and function settings

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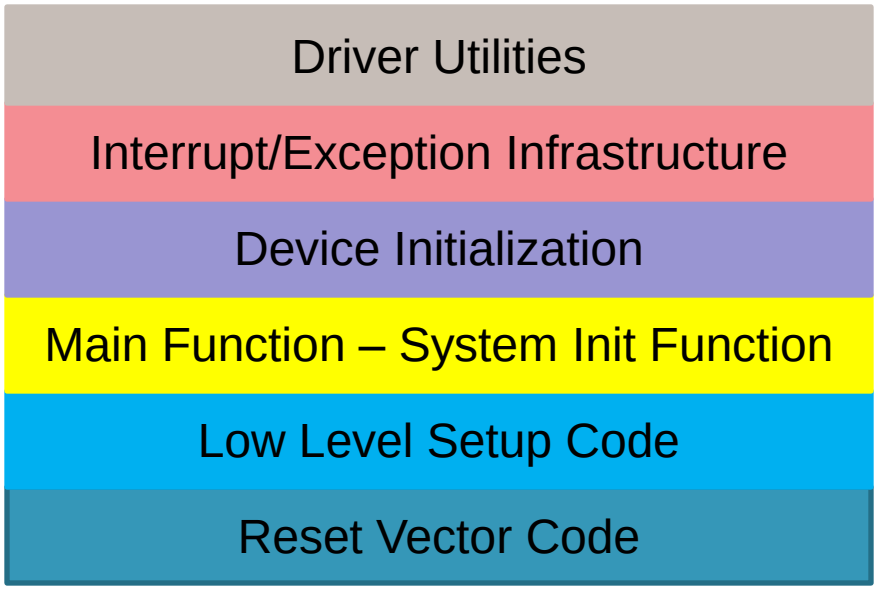
RAppID Generates What?



Low Functionality Drivers

Interrupt Vector Table, Handler, ISR functions

Device and Peripheral Initialization Code

Example Main, Init Sequence Function…

From Reset to Main, crt0, Stack,…

RCHW, Section Map…

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CodeWarrior project maker utility

- The Fast Start Kit for MPC5606B provides a utility to assist in adding RAppID generated code to a CodeWarrior project
- After creating a empty CodeWarrior project for the required microcontroller, the user can invoke the utility cw*pjmaker_0.1.exe* which will add RAppID generated code and sets up the CodeWarrior project by adding all the CodeWarrior setup variables to enable clean build.

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Low Level Driver code

- In the installation disk, the following low level driver code is provided
  - GPIO
  - ADC
  - UART
  - CAN

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GPIO Low Level Driver code

- **uint8_t GPIO_GetState (uint16_t ch)**
  - This function returns the state of requested GPIO pin

- **void GPIO_SetState (uint16_t ch, uint8_t value)**
  - This function sets the GPIO pin to the specified state

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ADC Low Level Driver code

- **uint16_t A2D_GetSingleCh_12bit(uint32_t ch)**
  - This function sets up, starts, and returns a conversion for a single 12-bit ADC1 channel
- **uint16_t A2D_GetSingleCh_10bit (uint32_t ch)**
  - This function Sets up, starts, and returns a conversion for a single 10-bit ADC0 channel
- **uint16_t A2D_GetChResult_12bit (uint32_t ch)**
  - This function returns the result for a single 12-bit ADC1 channel
- **uint16_t A2D_GetChResult_10bit (uint32_t ch)**
  - This function returns the result for a single 10-bit ADC0 channel
- **void A2D_SetupCh_12bit (uint32_t ch)**
  - This function sets up channel for the ADC1 converter
- **void A2D_SetupCh_10bit (uint32_t ch)**
  - This function sets up channel for the ADC0 converter

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UART Low Level Driver code

- **void UartTxMsg(uint8_t *u8TxData, uint32_t u32Size)**
  - This function transmits a message in buffer *u8TxData* of size *u32Size*
- **uint8_t UartRxDataByte(void)**
  - This function returns data from UART buffer
- **uint32_t UartRxNewDataSize(void)**
  - This function checks how much new data there is in UART buffer
- **uint8_t UartRxBufEmpty(void)**
  - This function checks if the UART buffer is empty
- **void UartBufInit(void)**
  - This function initializes UART Buffer
- **void UartRxFillBuf(void)**
  - This function fills the UART Buffer from the UART RX peripheral

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CAN Low Level Driver code

- **void SetCanRxFilter(uint32_t id, uint8_t mb, uint8_t ext)**
  - This function sets up the mailboxes on the specified CAN channel and works for standard and extended IDs.
- **void CanTxMsg (uint32_t id, uint8_t mb, uint8_t dlc, uint8_t data[], uint8_t ext)**
  - This function transmits a CAN message.
- **can_msg_struct CanRxMsg (uint8_t mb)**
  - This function receives a CAN message.
- **uint8_t CanRxMbFull (uint8_t mb)**
  - This function checks if CAN Mail box is full.
- **uint8_t CanTxMbEmpty (uint8_t mb)**
  - This function checks if CAN Mail box is empty.

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High Level Driver code

- In the installation disk, the following high level driver code is provided
  - Potentiometer
  - Photo Sensor
  - SBC

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Potentiometer High Level Driver code

- **uint16_t Pot_Get_Value(void)**
  - This function sets up, starts, and returns conversion value for Potentiometer channel (ANP0 of TRK-MPC5606B board).

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Photo Sensor High Level Driver code

- **uint16_t Photo_Sensor_Get_Value (void)**
  - This function sets up, starts, and returns conversion value for Photo sensor channel (ANP1 of TRK-MPC5606B board).

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SBC High Level Driver code

- **void SBC_Init_DBG(void)**
  - Sets up SBC in TRK-MPC5606B board to enable CAN. It is assumed that SBC is in Debug mode and watchdog refresh is required only on initialization.

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RAppID Bootloader utility

- The RAppID Boot Loader is a tool developed by Freescale to help with the development of software for Freescale MCUs by allowing the customer a method to update software of a MCU through a serial link using CCP.
- The RAppID Boot Loader works with the built in Boot Assist Module (BAM) included in the Freescale Qorivva & PX series family of parts.
- The Boot Loader provides a streamlined method for programming code into FLASH or RAM on either target EVBs or custom boards.
- The Boot Loader has two modes of operation, for use as a stand-alone PC desktop GUI utility, or for integration with different user required tools chains through a command line interface (i.e. Eclipse Plug-in, MatLab/SimuLink etc.).

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FreeMASTER utility

- FreeMASTER allows users to debug applications in true real-time through its ability to watch and modify variables.
- Remote control capability allows it to be used as a diagnostic tool for debugging customer applications remotely across a network.
- It is an outstanding tool for demonstrating algorithm or application execution and variable outputs.
- It provides monitoring/visualization of application variables in the same manner as a classical oscilloscope with a CRT.
- Simple RS232 native connection and other options possible on selected platforms (BDM, JTAG, CAN,...)
- Built-in support for standard variable types (integer, floating point, bit fields)

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LED Example Using RAppID Init

- The next few slides will demonstrate an example project that describes steps to configure MPC5606B, generate, build, flash and test the code using various tools provided with TRK-MPC5606B Fast Start Kit
- In this example we will use RAppID Init tool to configure and generate initialization code for MPC5606B
- We will use the GPIO, UART, ADC and CAN driver code supplied with the installation
- We will use CodeWarrior 10.5 to build the code
- We will use RAppID Boot loader utility to flash the code to the target
- The example turns on/off LEDs based on Switch input, Potentiometer input, UART and CAN commands.

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LED Example overview

- LED1 turns on when switch S1 is in pressed state and turned off when S1 is in un-pressed state
- LED2 is turned On/Off based on serial command input
- LED3 is turned On/Off based on CAN command input
- LED4 is turned On/Off based on potentiometer input

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Creating LED example using RAppID init tool

- The next few slides will demonstrate how to create RAppID project to configure all the pins and peripherals required for this example and generate code for CodeWarrior compiler.

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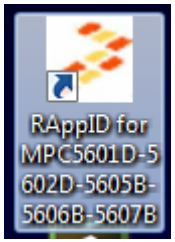
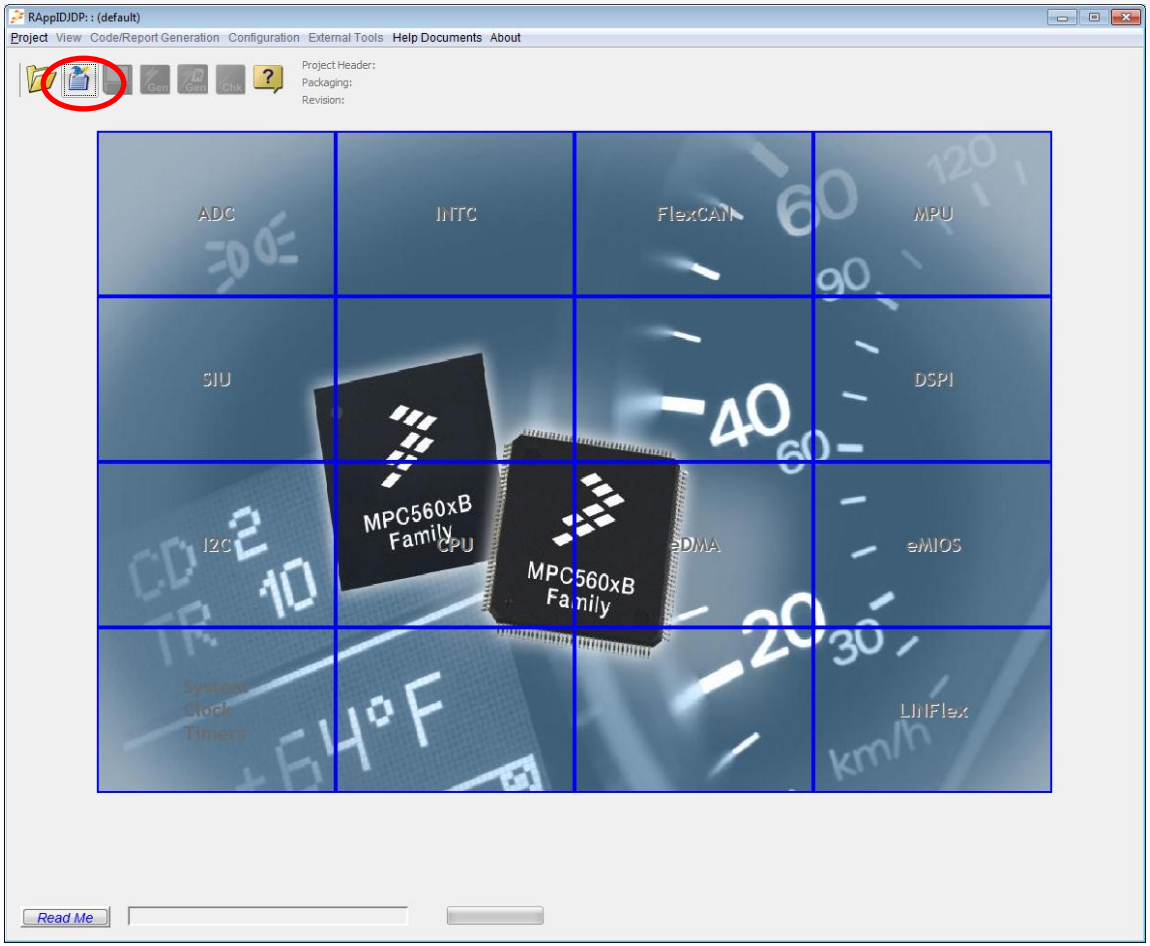
Create a New RAppID Project



Launch RAppID init by double clicking on RAppID init desktop icon



Start a new project by clicking on “New Project Wizard” button

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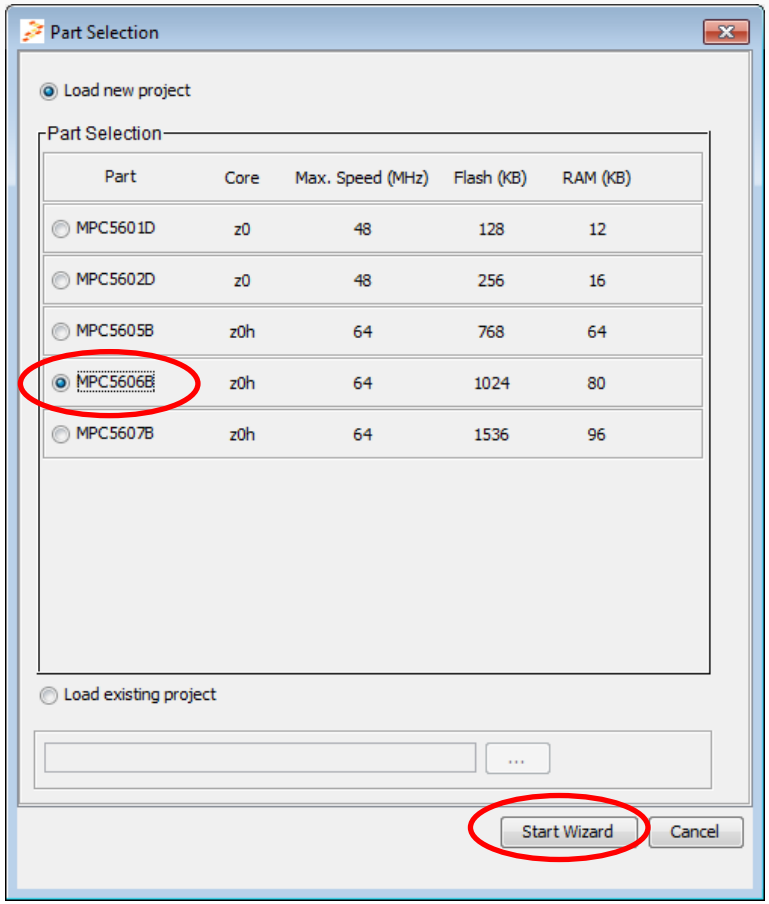
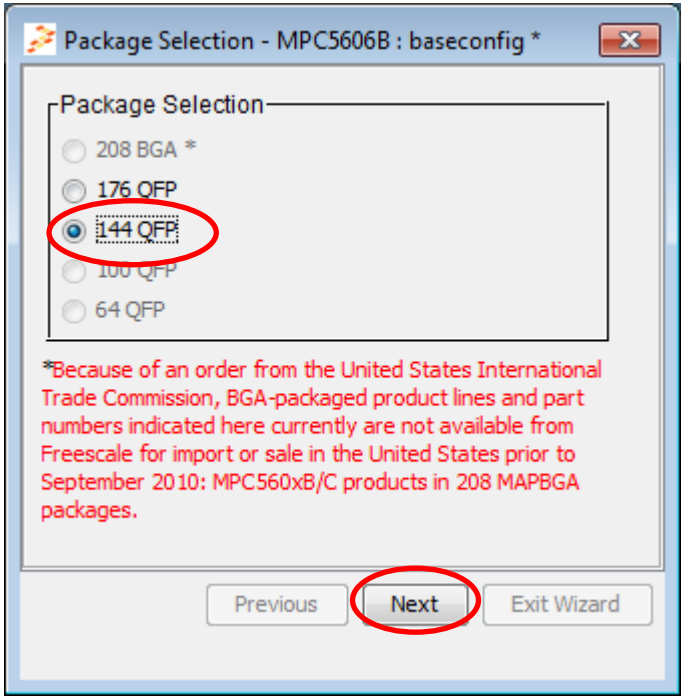
Select Part and Package



Select a Part MPC5606B and select Start Wizard



Select a Package 144 QFP and select Next

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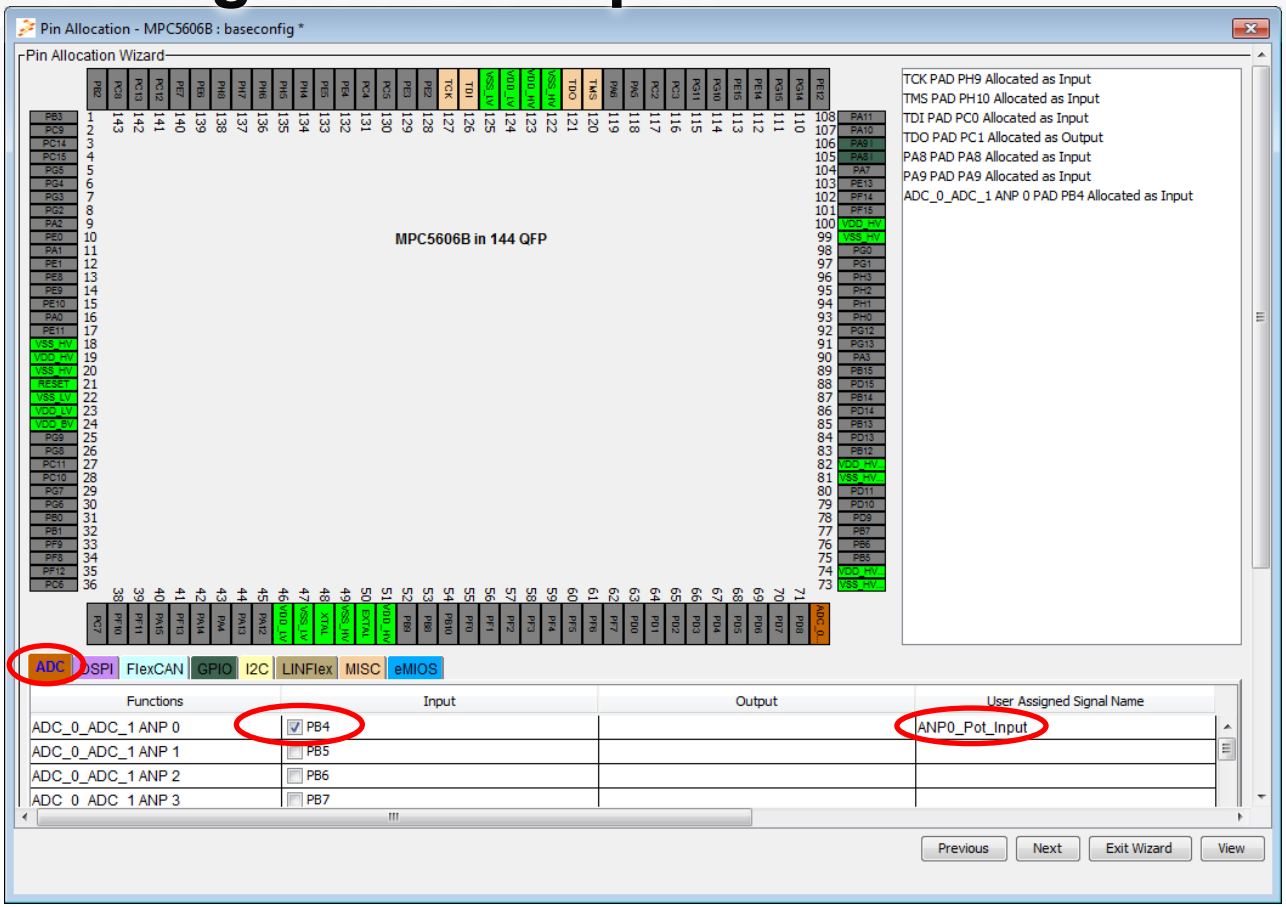
Configure ADC input



Potentiometer is connected to ANP0.
In ADC tab, configure PB4 as ADC input and add appropriate name in User Assigned Signal Name edit box.

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Configure DSPI pins

- TRK-MPC5606B contains MCZ3390S5EK system basis chip (SBC) with integrated CAN transceiver and LIN 2.0 interface.
- DSPI 1 is connected to SBC. We need to configure DSPI 1 as master and SBC as slave so that SBC can be configured to enable CAN by sending appropriate commands via DSPI 1.

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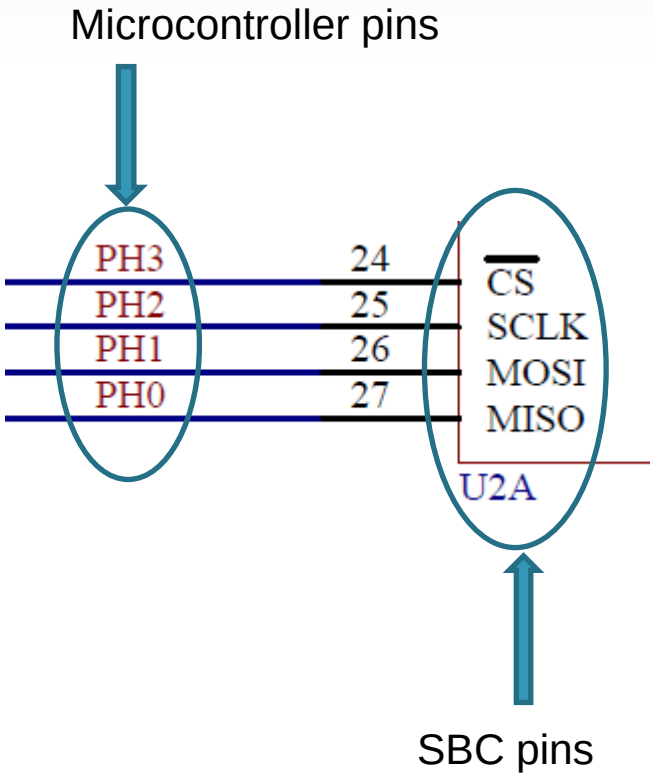
Configure DSPI pins

- The connection between DSPI 1 of microcontroller and SBC is shown in this picture
- Configure DSPI 1 pins as follows to enable communication with SBC.
  - PH3 is connected to CS pin of SBC. Configure PH3 as DSPI_1 Chip select 0 output
  - PH2 is connected to Clock input pin of SBC. Configure PH2 as DSPI_1 Clock output
  - PH1 is connected to MOSI pin of SBC. Configure PH1 as DSPI_1 Data output
  - PH0 is connected to MISO pin of SBC. Configure PH0 as DSPI_1 Data input



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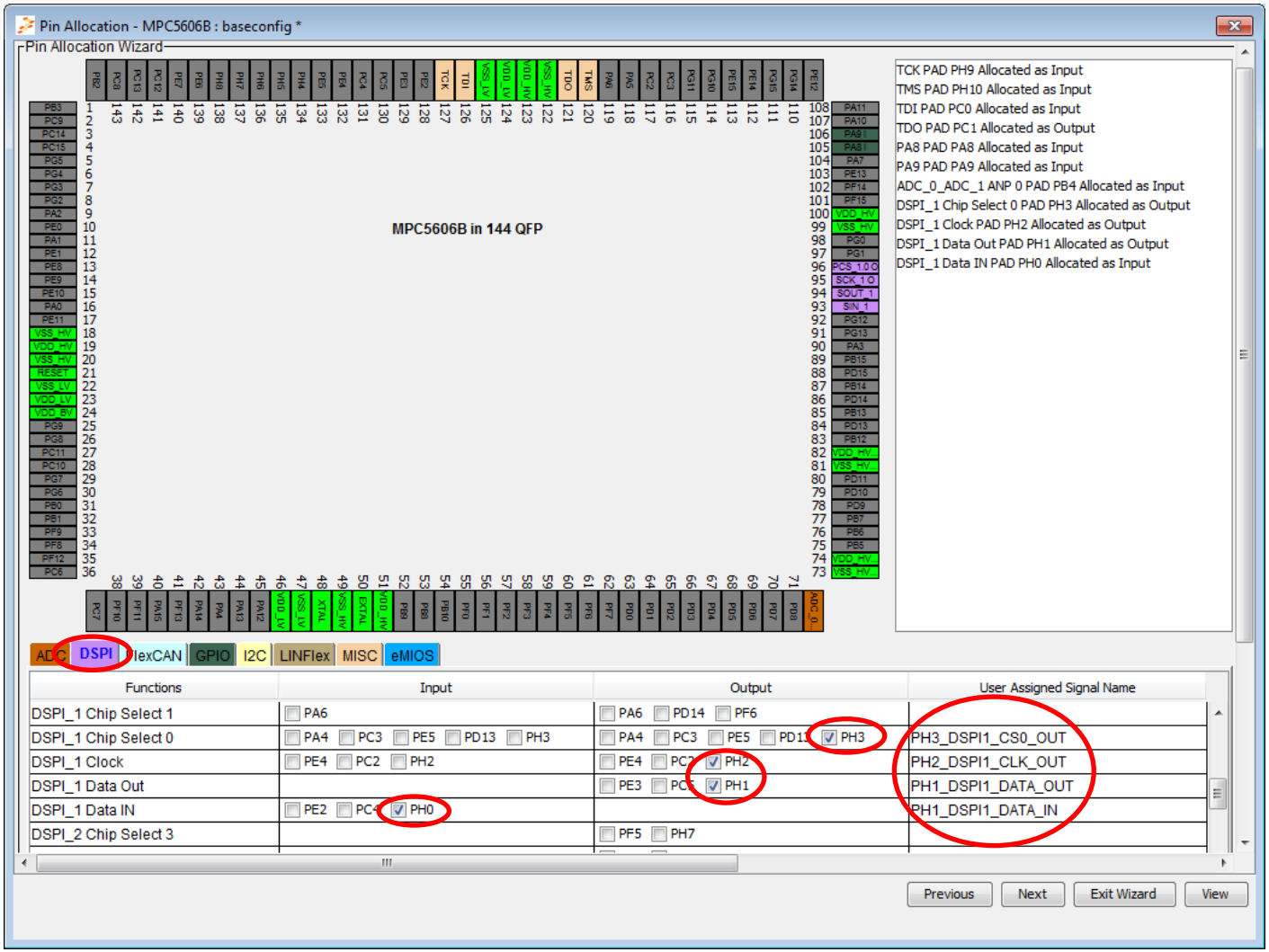
Configure DSPI pins



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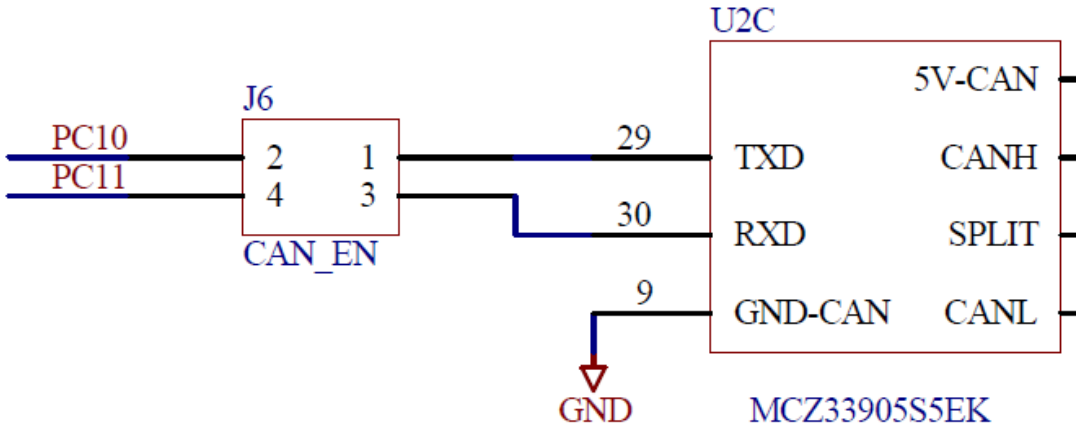
Configure FlexCAN pins

- The CAN TX and CAN RX pins of SBC are connected to the pins PC10 and PC11 of CAN 1 peripheral of the microcontroller.
- We need to configure PC10 as CAN 1 TX pin and PC11 as CAN 1 RX pin.



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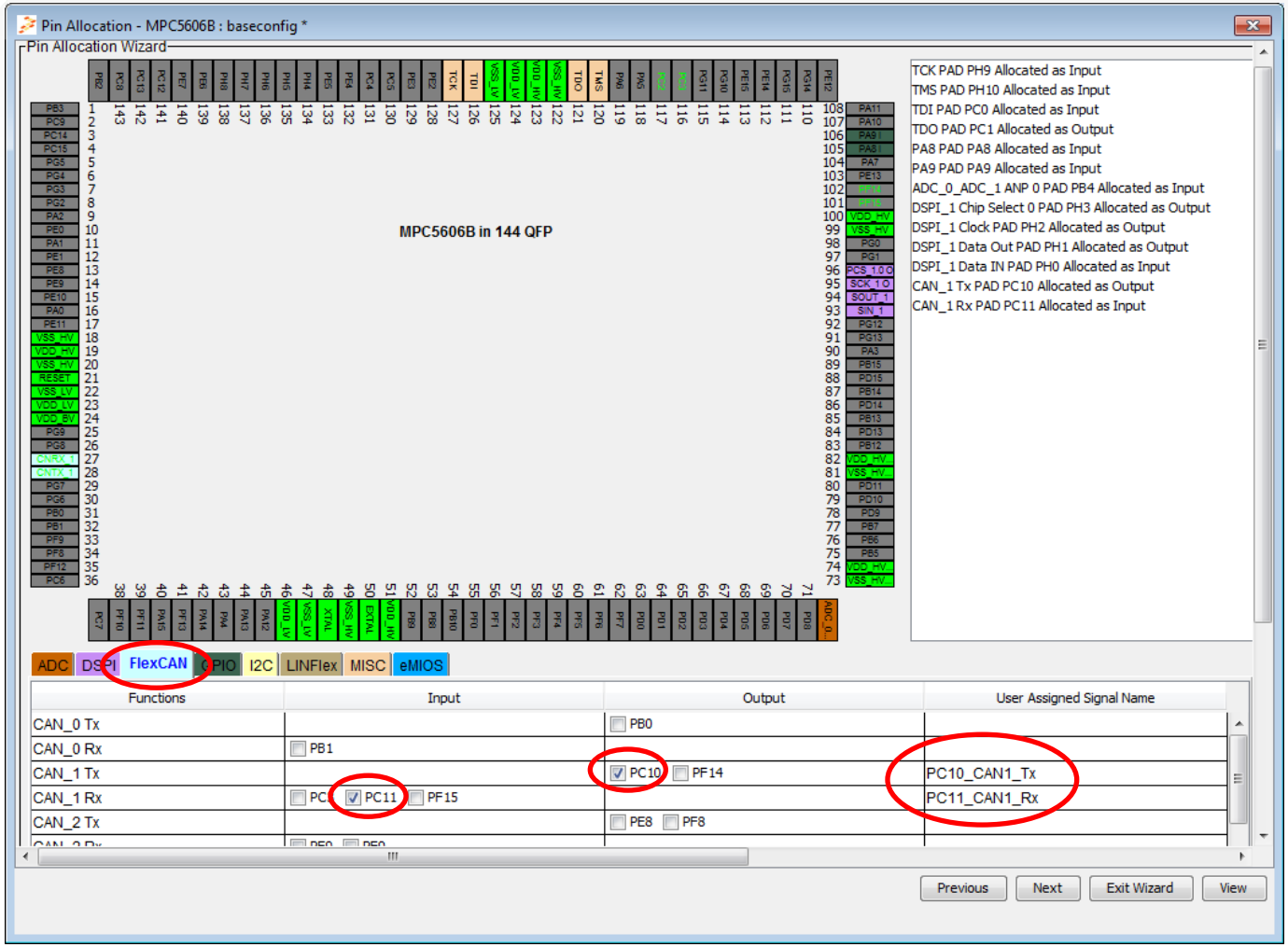
Configure FlexCAN pins



In FlexCAN tab, configure PC10 as CAN_1 Tx and PC11 as CAN_1 Rx pins and signal names.

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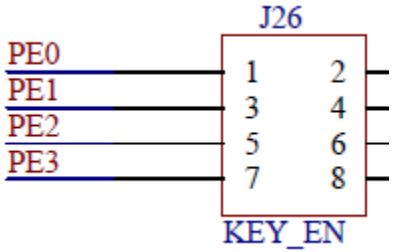
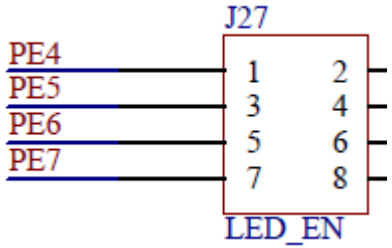
Configure GPIO pins

- In this example, we are using Switch S1 as input and the 4 LEDs as outputs.
- Switch S1 is connected to PE0. Configure PE0 as S1 input
- LED1 is connected to PE4. Configure PE4 as output
- LED2 is connected to PE5. Configure PE5 as output
- LED3 is connected to PE6. Configure PE6 as output
- LED4 is connected to PE7. Configure PE7 as output





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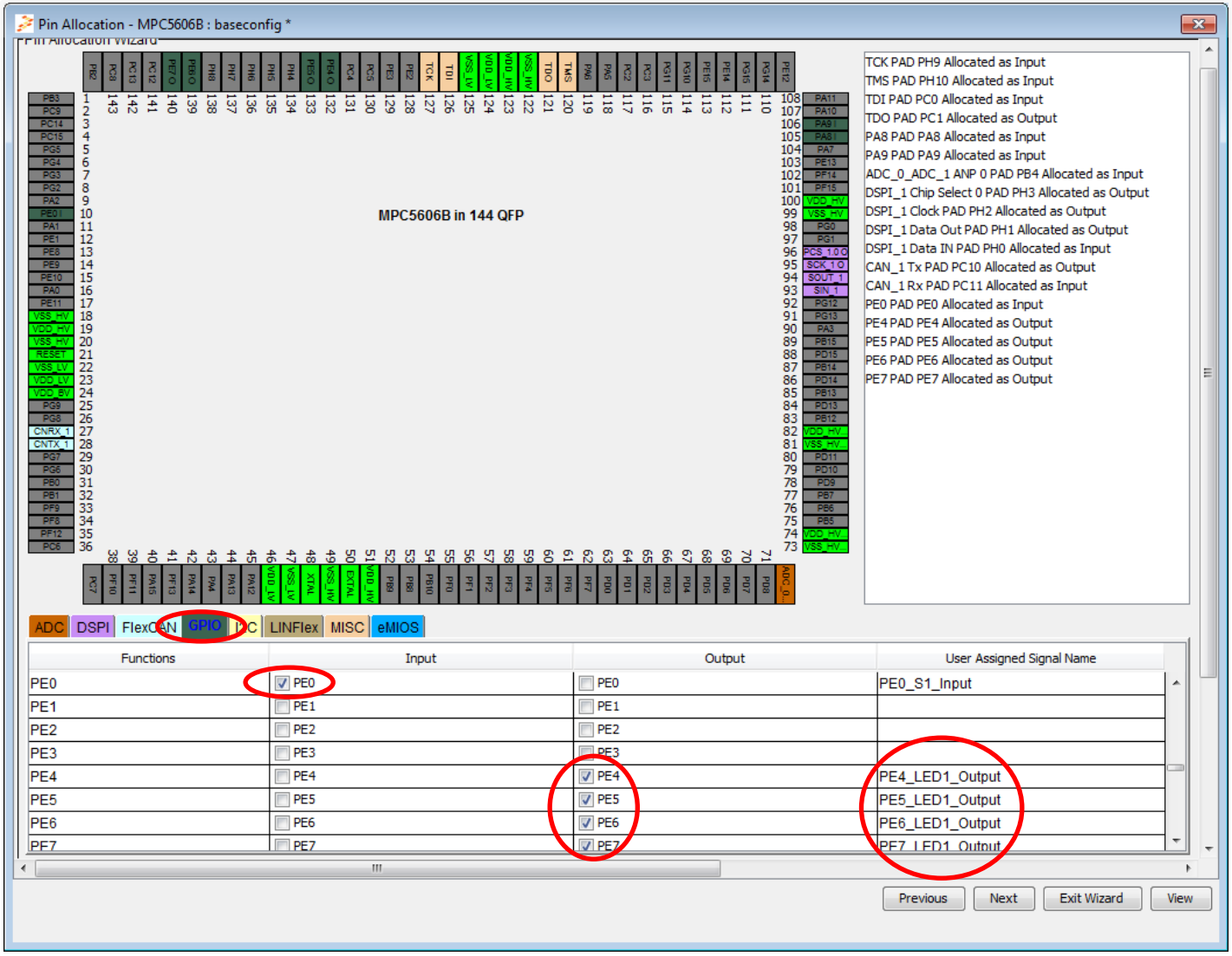
Configure GPIO pins



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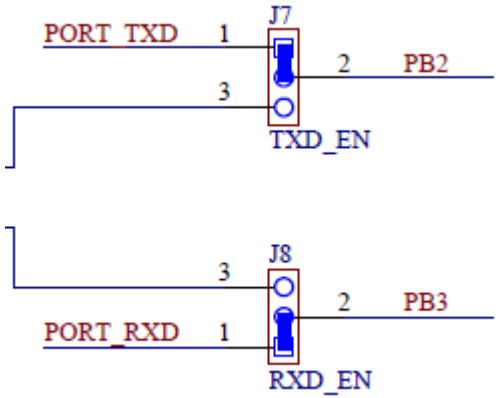
Configure LINFlex (UART) pins

- In this example, we will use Virtual serial port of TRK-MPC5606B board for serial communication.
- The PB2 and PB3 of microcontroller in TRK-MPC5606B board are connected to TX and RX pins of virtual serial port.
- We need to configure PB2 as LINFlex0 TX pin and PB3 as LINFlex0 RX pin.



RS232 CIRCUITRY

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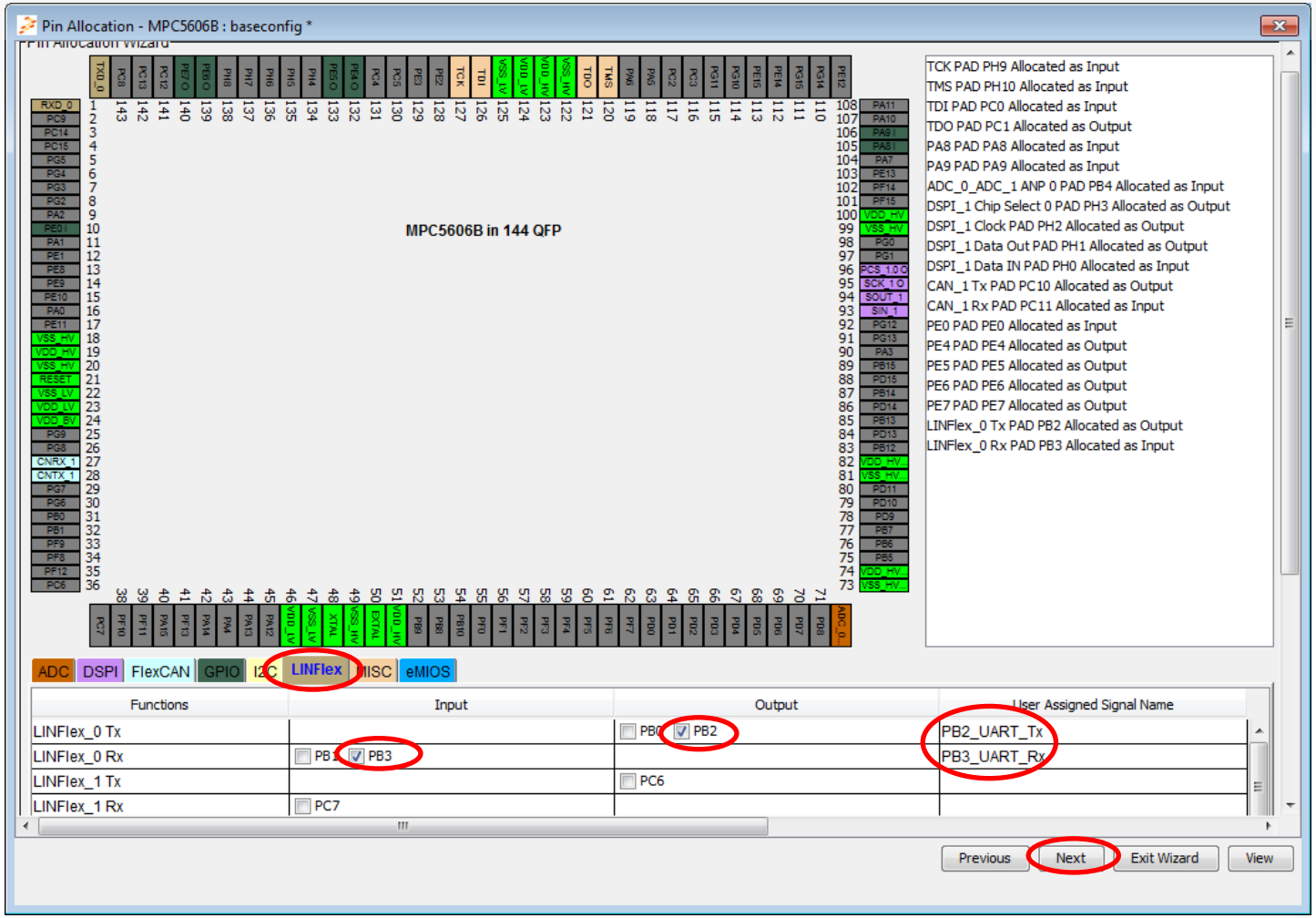
Configure LINFlex (UART) pins



In LINFlex tab, configure PB2 as LINFlex_0 Tx and PB3 as LINFlex_0 Rx pins and add user signal names.
Select Next and skip next two windows by selecting Next

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Configure Mode Entry

- RAppID tool generates code to set the microcontroller in DRUN mode at startup.
- In this example, we will use 16MHz Fast Internal Reference Clock (FIRC) as system clock source. Select 16MHz clock to be enabled in DRUN mode and enable XOSC in DRUN mode which is required as clock source for FlexCAN peripheral.

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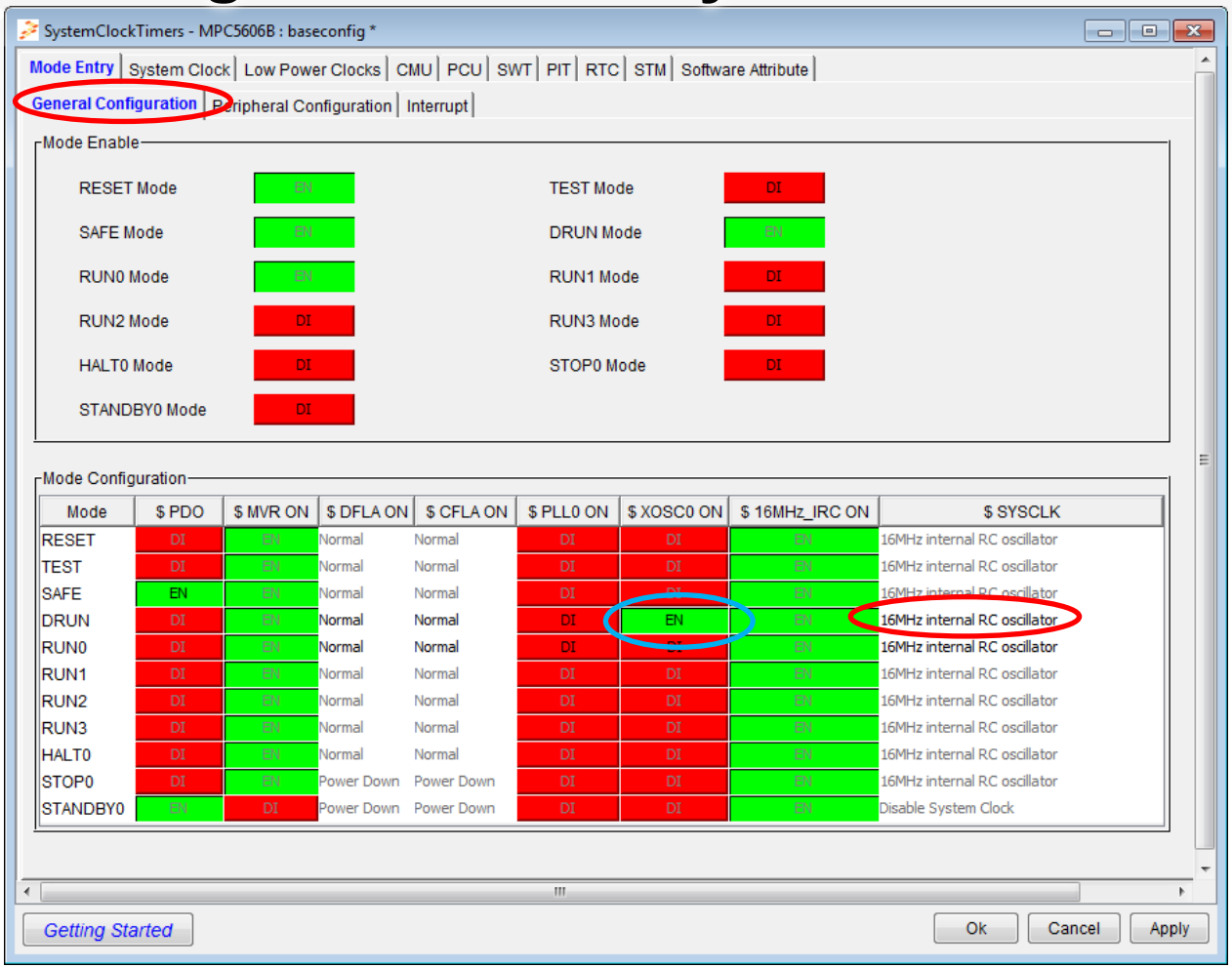
Configure Mode Entry



In General Configuration tab, enable XOSC in DRUN mode. This is required to power FlexCAN

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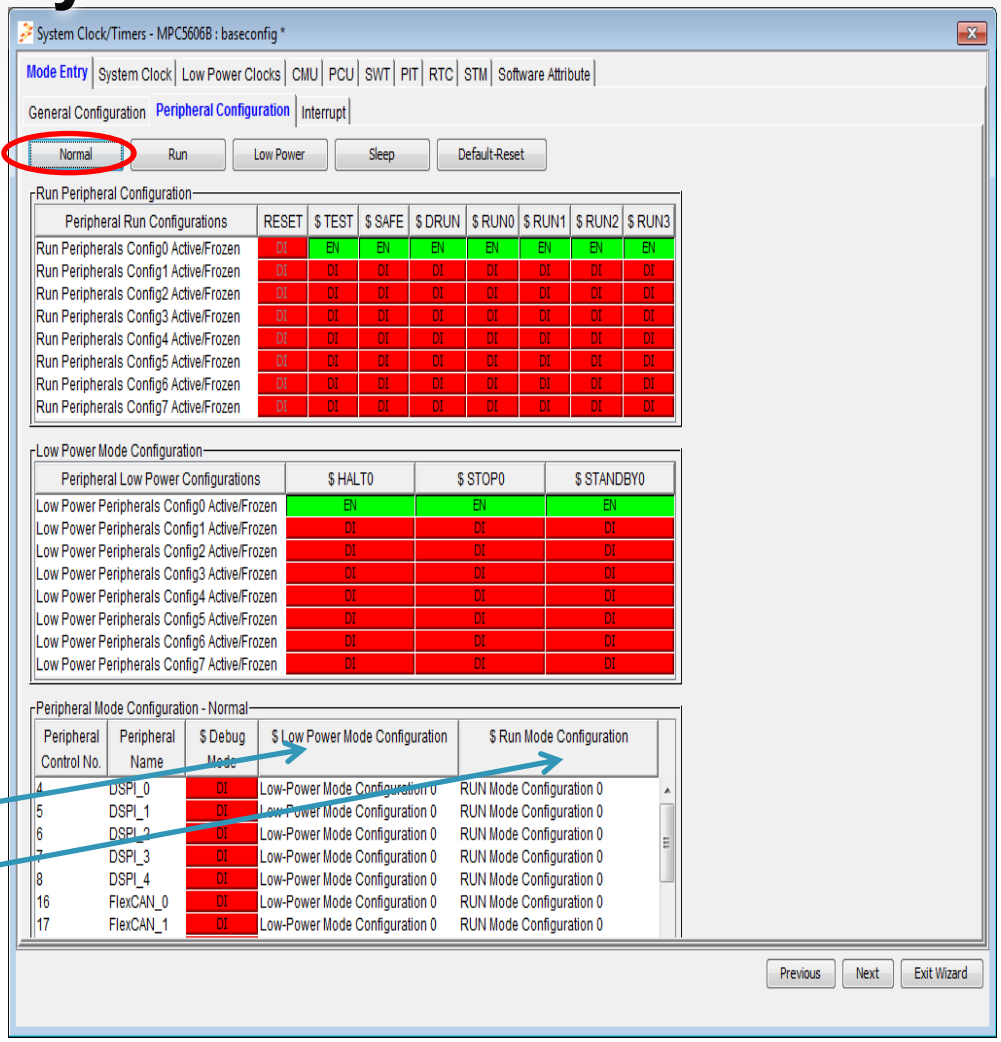
Configure Mode Entry

Configure the peripherals to be enabled during different operational modes.

Select “Normal” configuration

This will enable the “peripheral run configuration” and “low power configuration” across different operational modes

Then it will assign these two configurations across all peripherals



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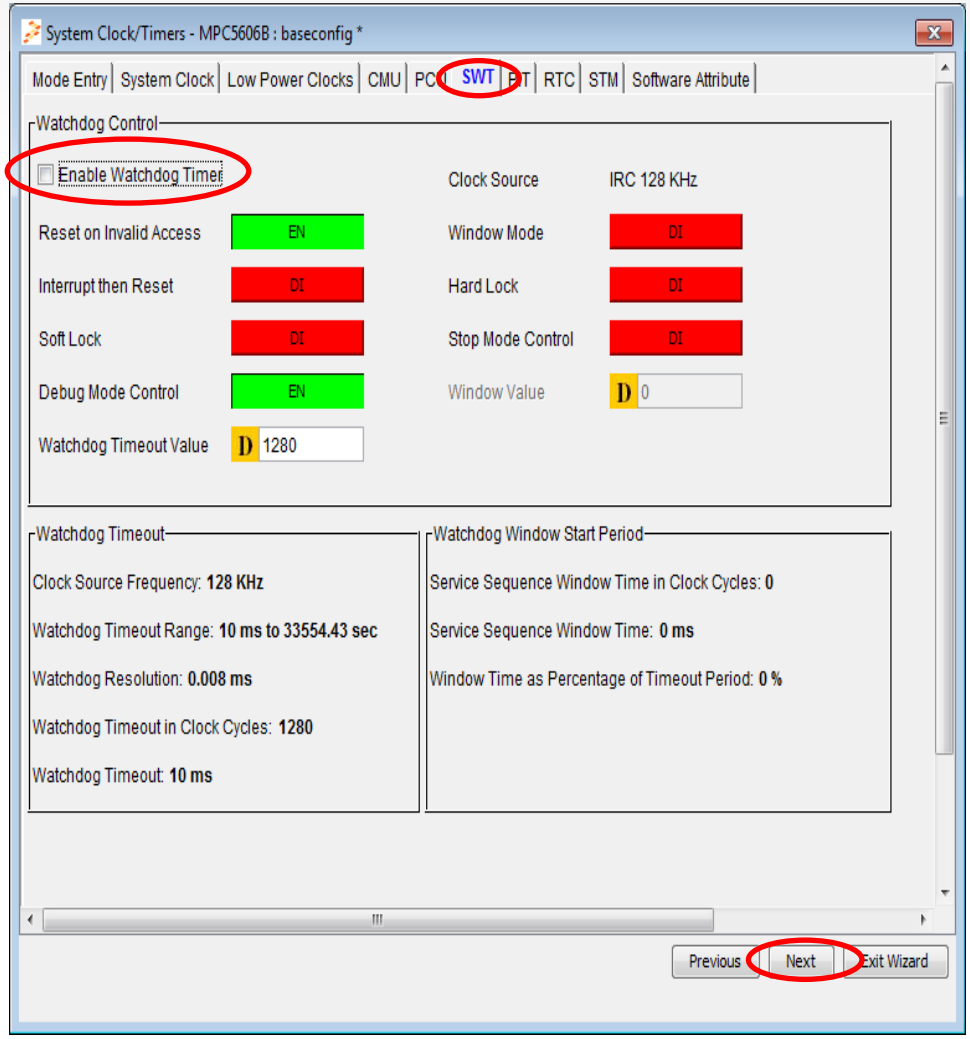
Disable Watchdog

By default, watchdog is enabled in MPC5606B. In this example, we will not use Watchdog feature. Disable Watchdog Timer in SWT tab .

This completes basic system configuration. Select Next to begin Peripheral configuration.



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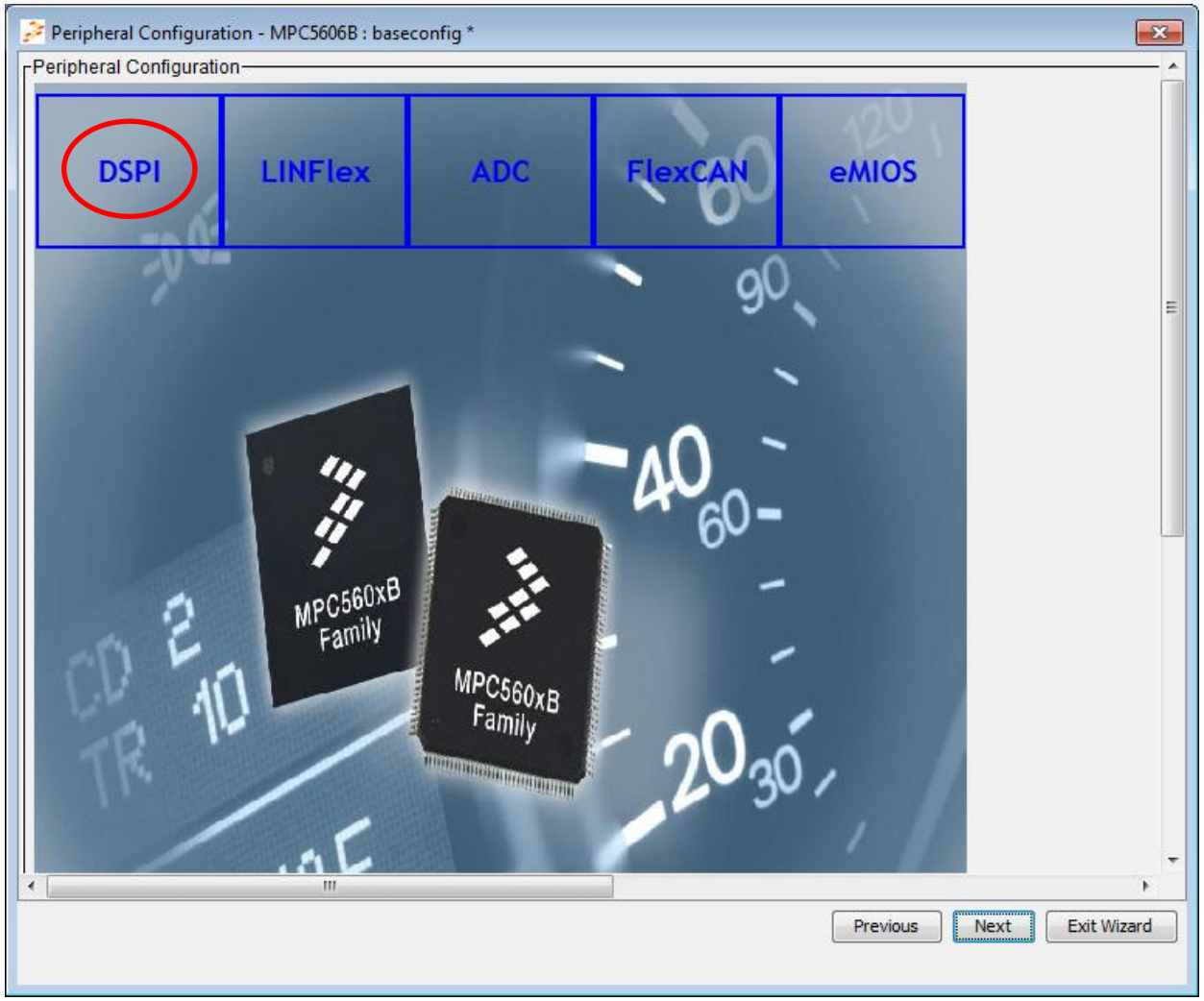
Configure Peripherals



In Peripheral Configuration window, select DSPI to configure DSPI peripheral

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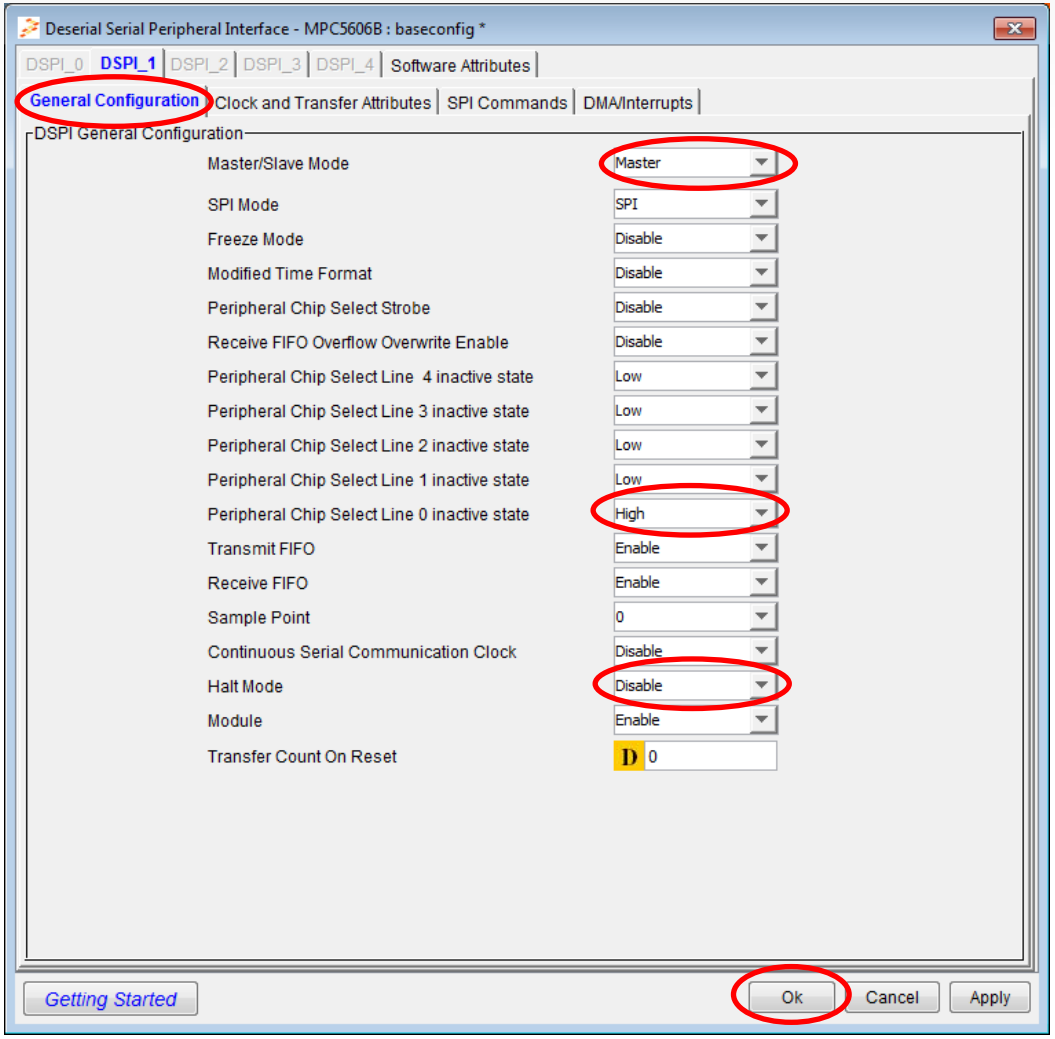
Configure DSPI 1

DSPI 1 should be set to master mode to send commands to SBC. Select Master mode

DSPI 1 Chip Select 0 is connected to SBC. Set Chip select 0 inactive state to High

Disable Halt mode

Select OK to finish DSPI 1 configuration



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Configure LINFlex 0

- We will use UART of LINFlex 0 to communicate serially via virtual serial port of TRK-MPC5606B board
- We will use baud rate of 115,200
- When Baud Rate Factor and Fractional Baud Rate Factor values are selected, RAppID automatically calculates and displays the resulting baud rate.

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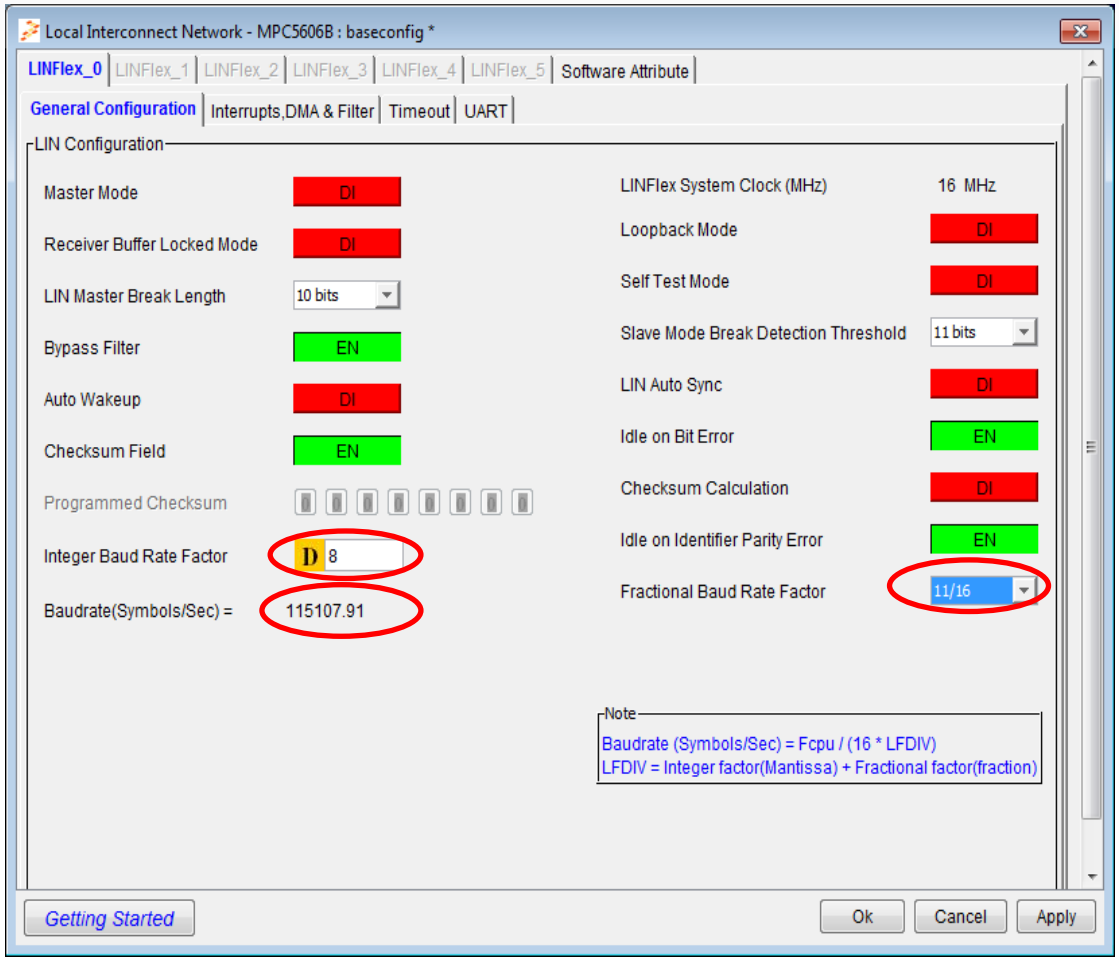
Configure LINFlex 0

Set Baud Rate Factor to 8

Set Fractional Baud Rate Factor to 11/16

This should set the Baud rate to approx. 115,200



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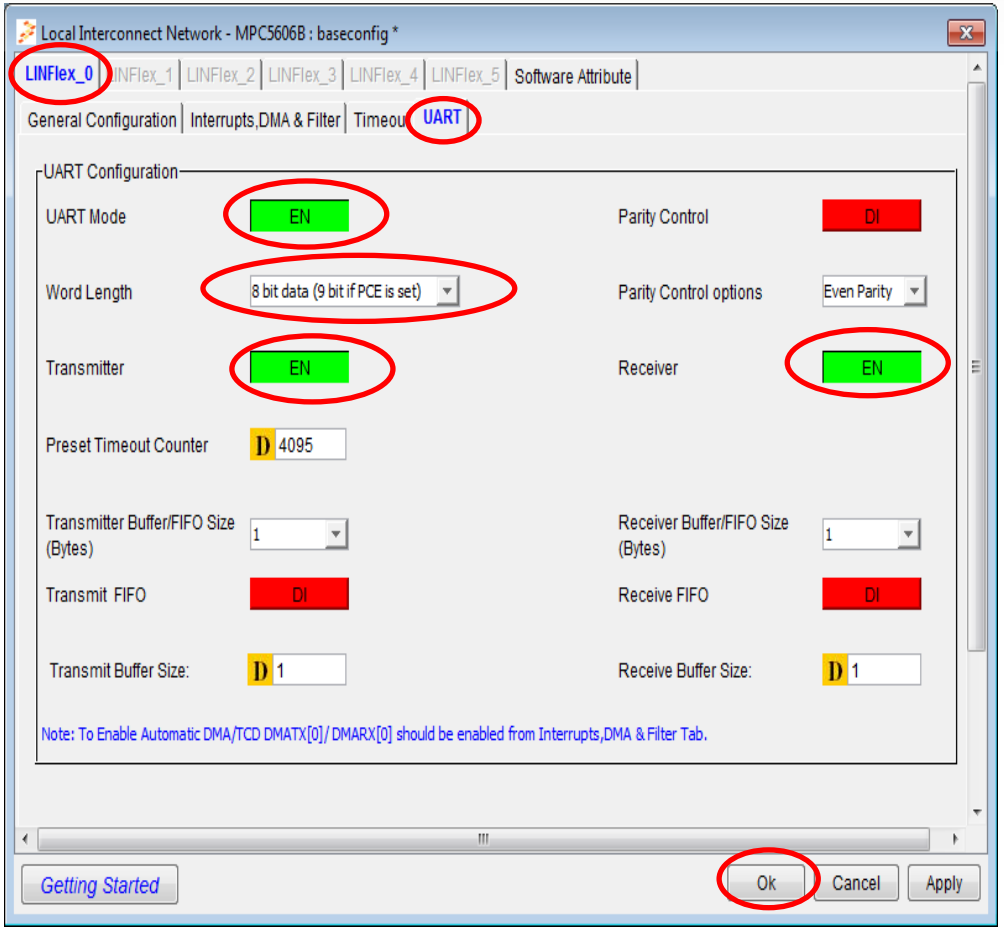
Configure LINFlex 0

In UART tab, Enable UART

Set Word Length to 8 bit data

Enable Transmitter and Receiver

Select OK to finish LINFlex 0 configuration



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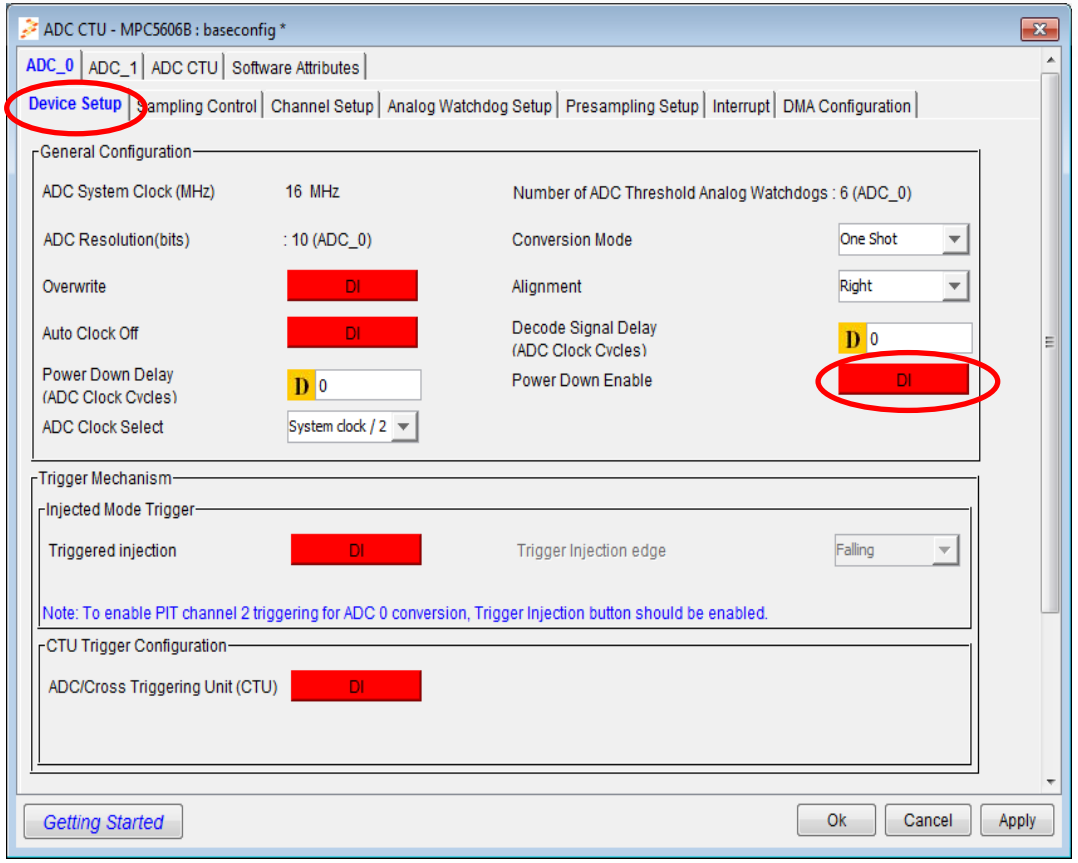
Configure ADC 0

In the Device Setup tab, Disable Power Down option to put ADC in normal mode



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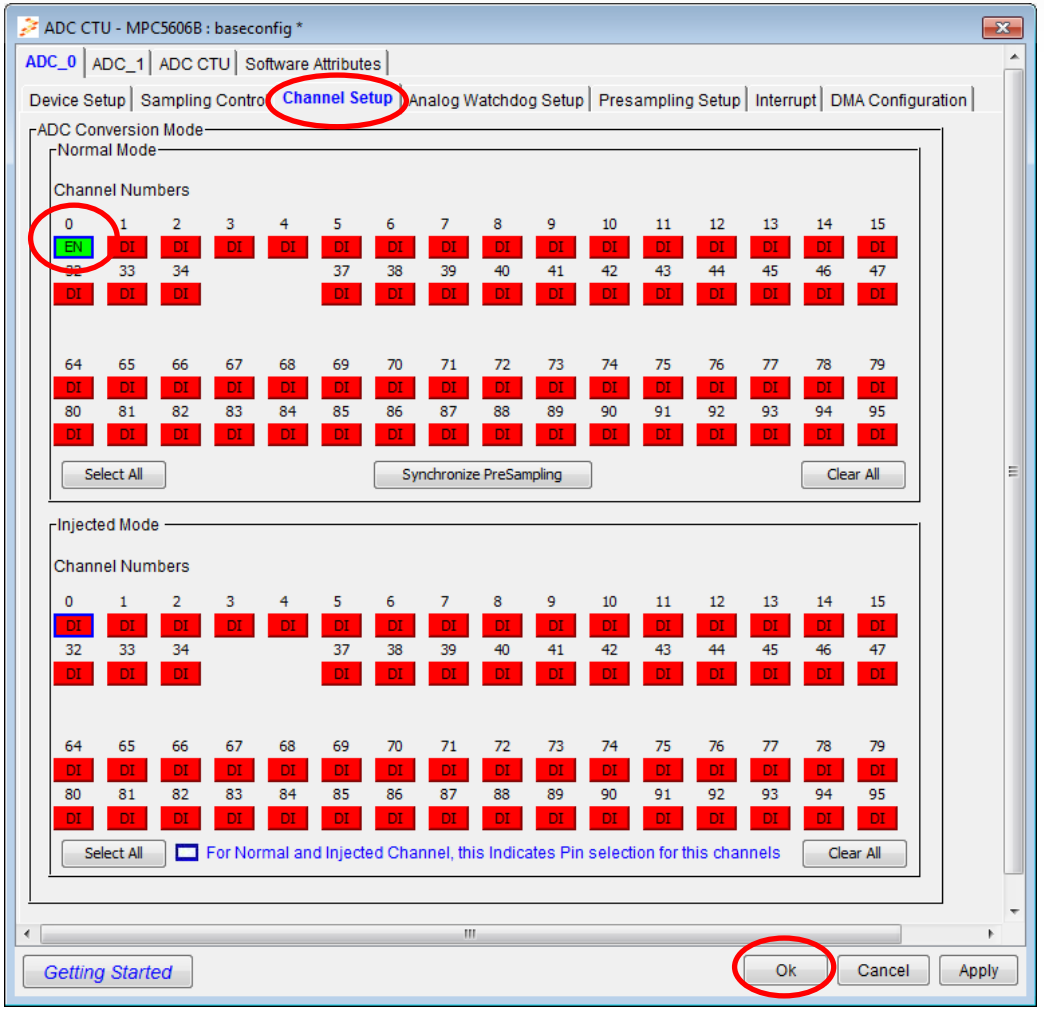
Configure ADC 0

The Potentiometer in TRK-MPC5606B board is connected to PB4 which is ADC Channel 0.
In this example we will use Normal conversion mode.
Enable Channel 0 in Normal mode

Select OK to finish ADC peripheral configuration.



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Configure FlexCAN 1

In TRK-MPC5606B board, the CAN 1 peripheral is connected to CAN transceiver in SBC.
In this example, we will use CAN speed of 500 k bits/sec.

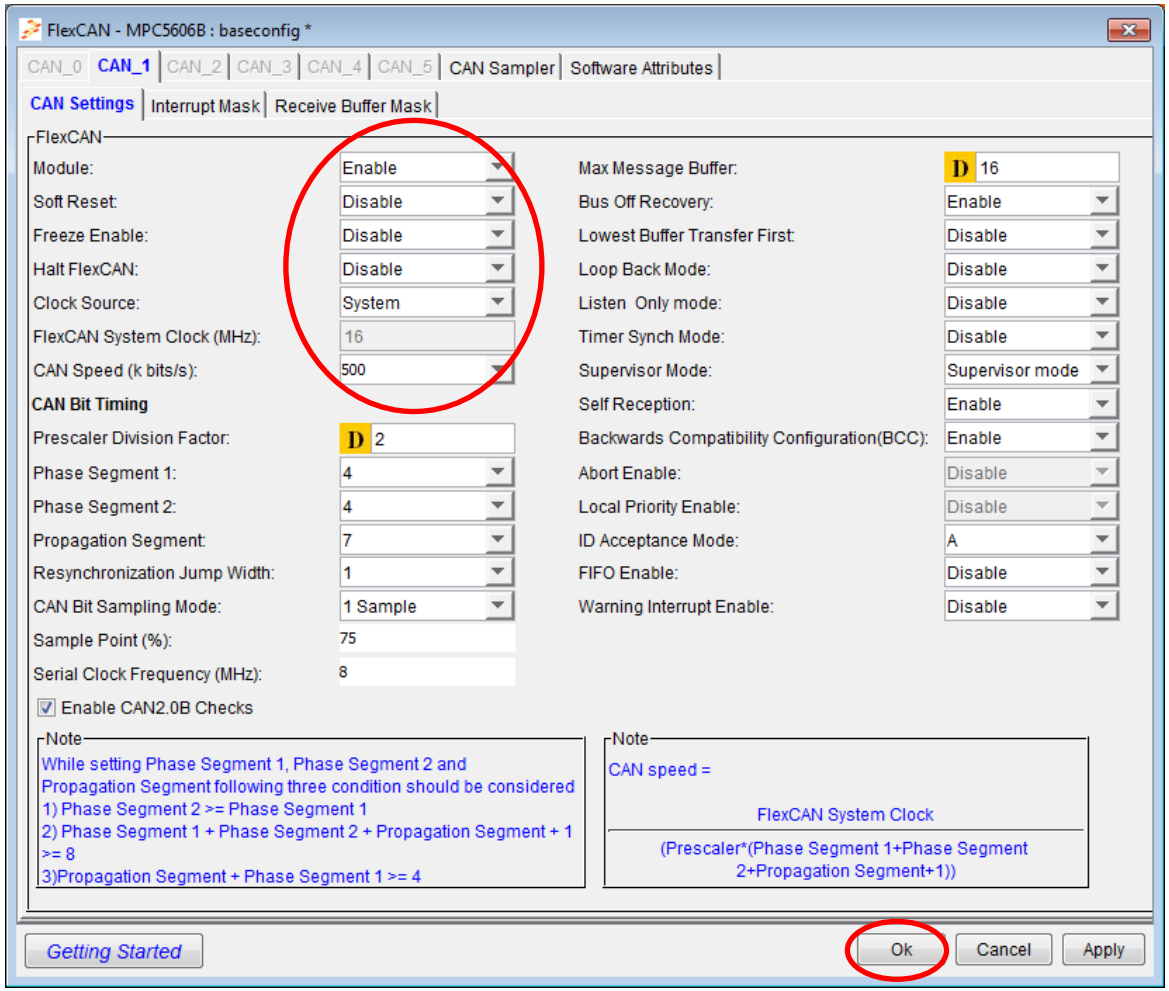
Enable CAN1 module

Disable Freeze and Halt modes

Set Clock Source to System

Set CAN speed to 500. RAppID will configure Phase segments and Propagation segment values automatically.

Select OK to finish CAN 1 configuration.



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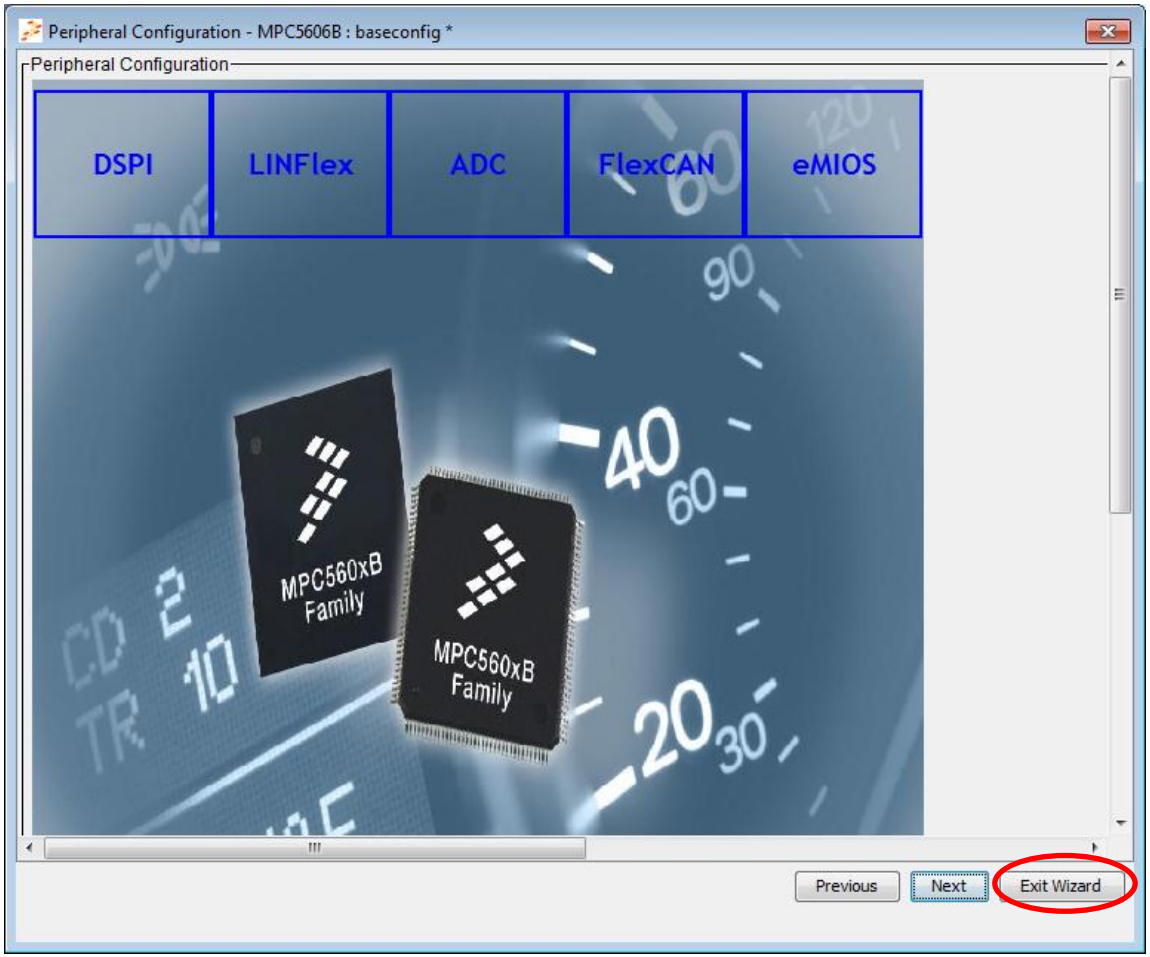
Exit Wizard

This completes Peripheral configuration. Select Exit Wizard.



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Code Generation

- We have completed all pin and peripheral configurations required for this LED project.
- Now we are ready to generate code. By default, RAppID generates code for RAM. In this example we will generate code for Flash.
- By default, RAppID generates code for all peripherals. In this example, we will select only the peripherals that are used in the example for code generation.

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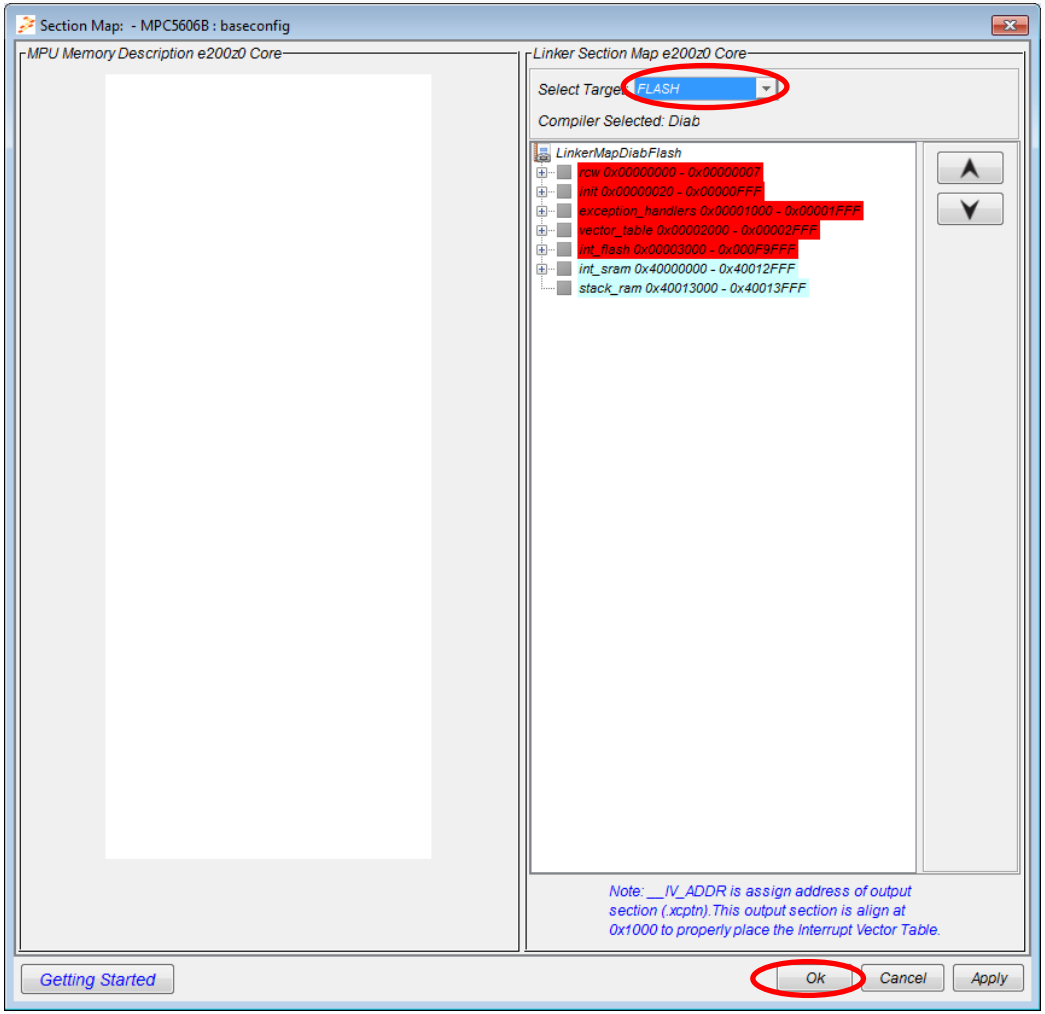
Configure Section Map



By Default, RAppID is configured to generate code for RAM. For this example, we will change the configuration to generate code for Flash.

From main RAppID window, select menu *View->View Section Map*.

Change Target to FLASH

Select Ok

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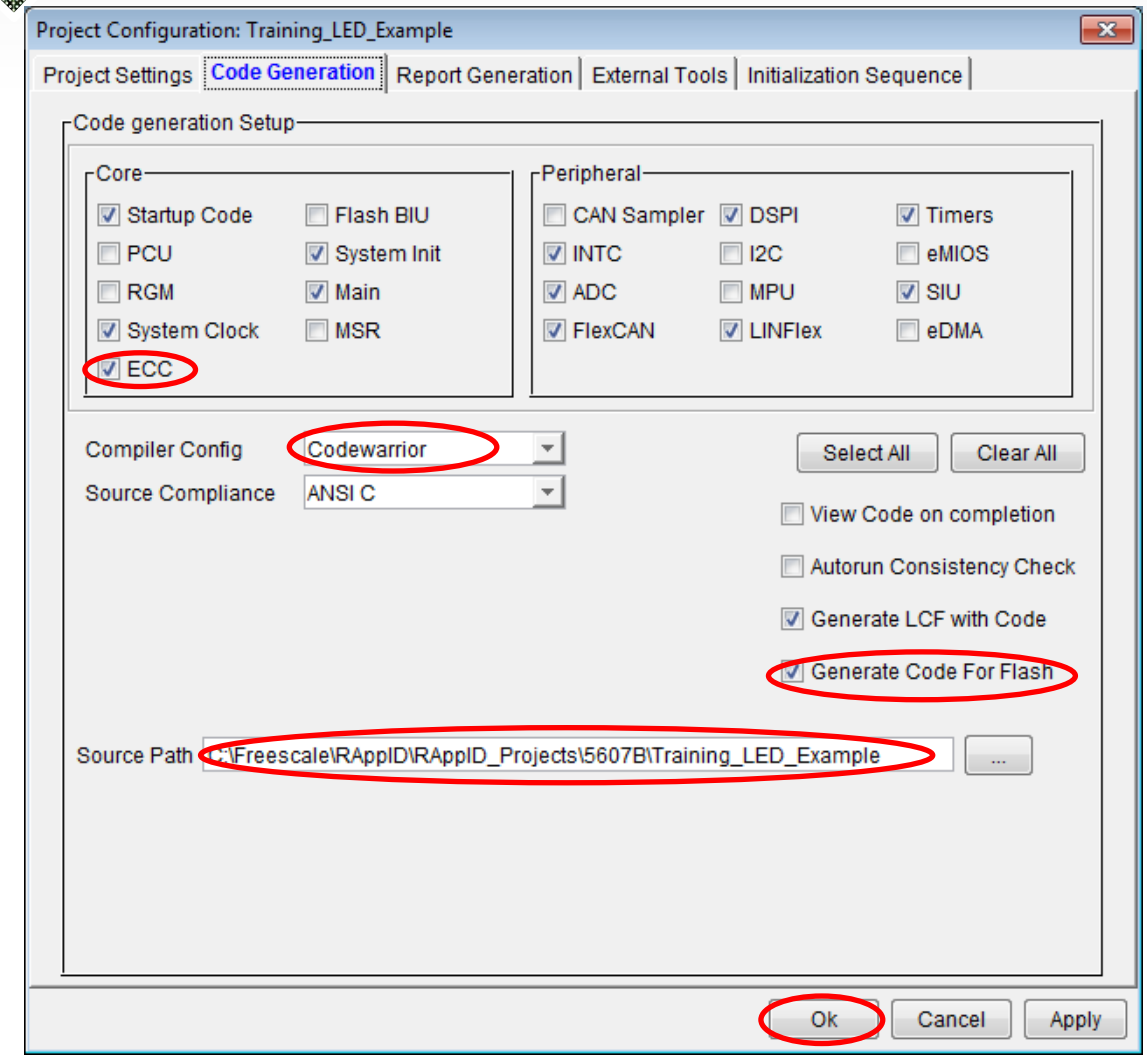
Configure Code Generation



From main RAppID window, select menu *Configuration->Code Generation*.

Unselect code generation option for unused peripherals as shown.

Check ECC for code generation. This is required to generate initialization code for SRAM and ECC register.

Select CodeWarrior compiler

Select Code for Flash option

Select the directory where code should be generated

Select Ok

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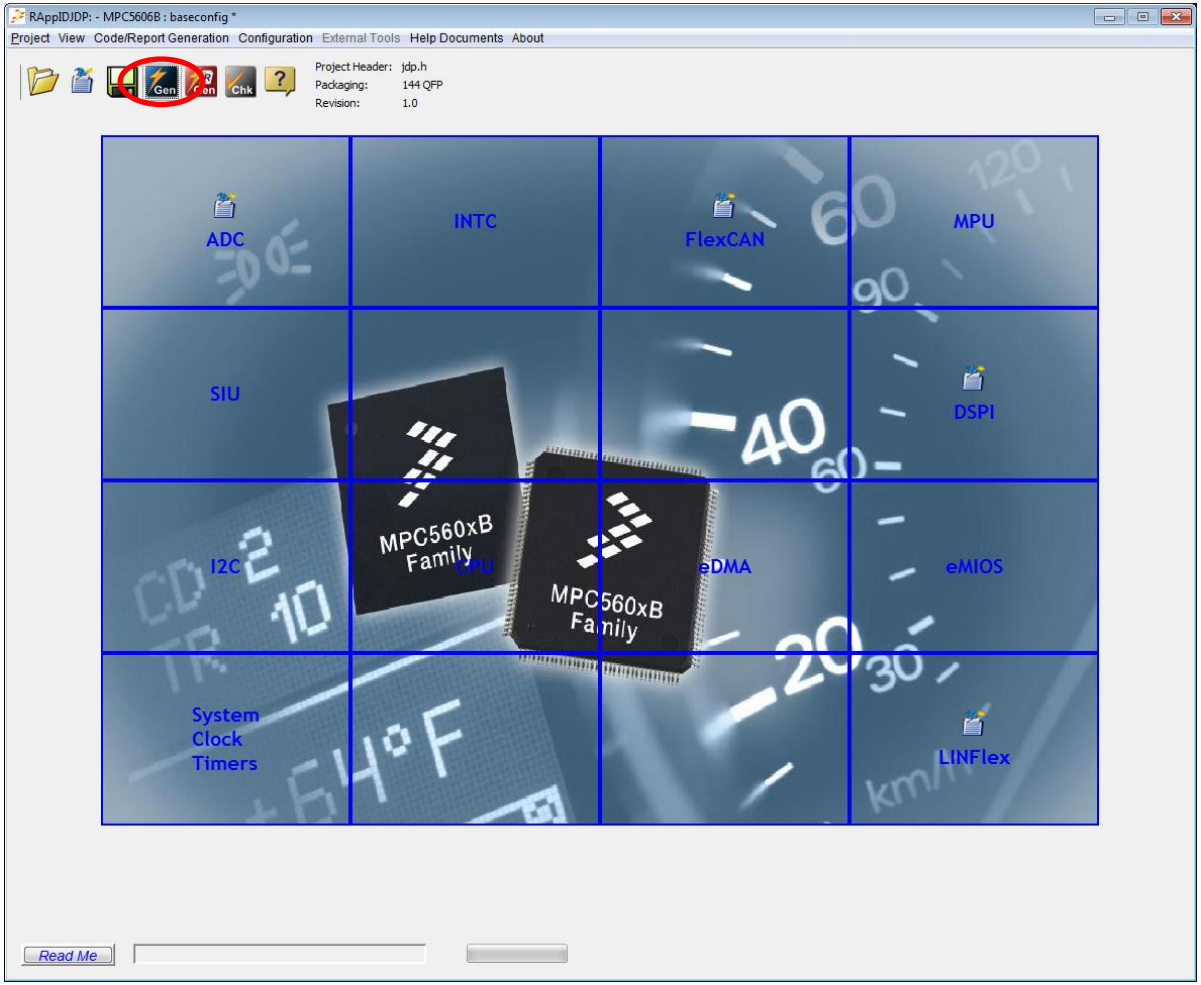
Generate code



Select Code Generation icon to generate code

Save the project when prompted

Now we are ready to build and run the project.

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Report Generation

- RAppID init tool can generate a comprehensive report on the project
- Since we have finished with configuration for this example, we are ready to generate a report for this project.

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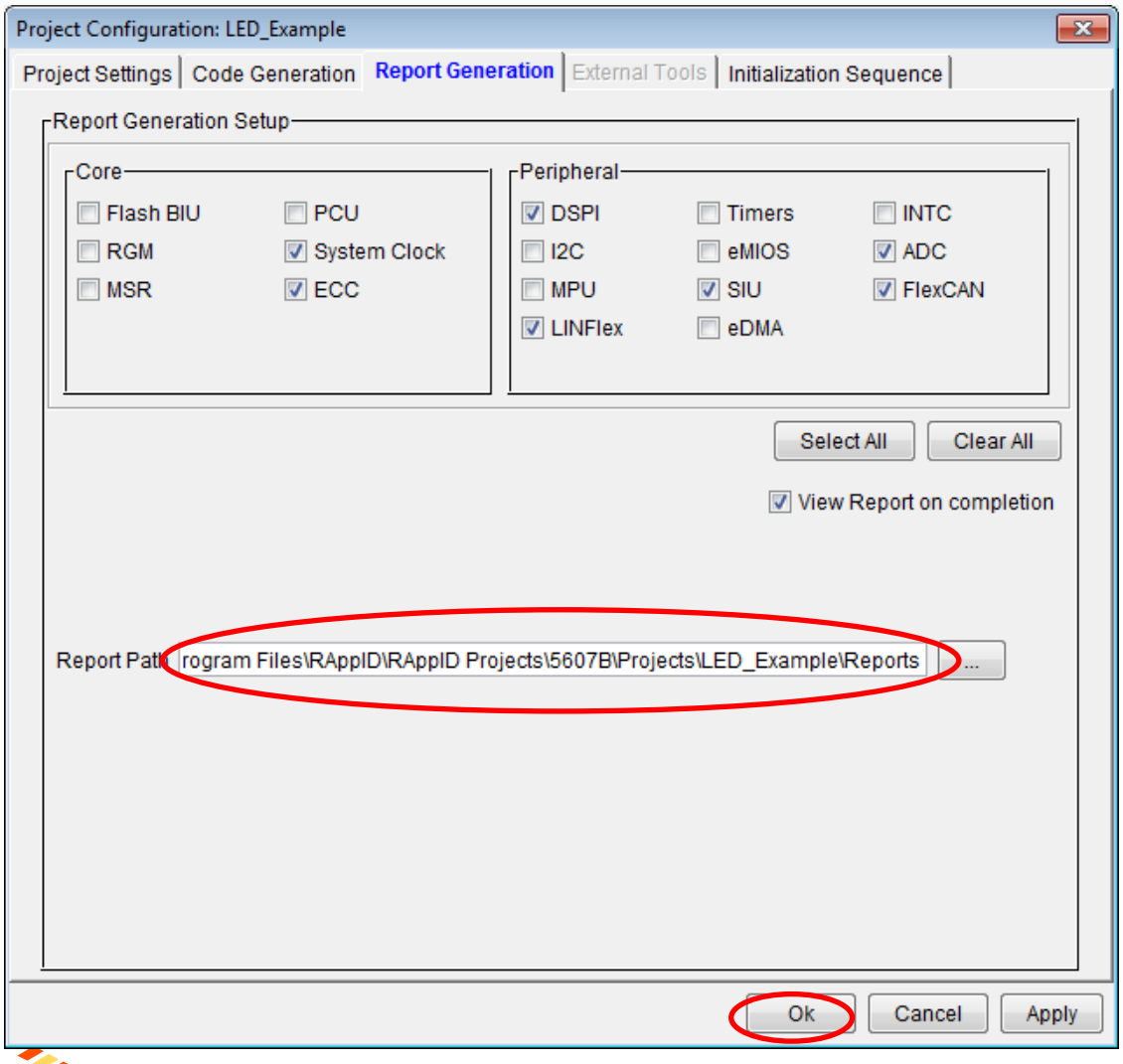
Configure Report Generation



From main RAppID window, select menu Configuration->Report Generation.

Unselect report generation option for unused peripherals

Select the directory where report should be generated

Select Ok

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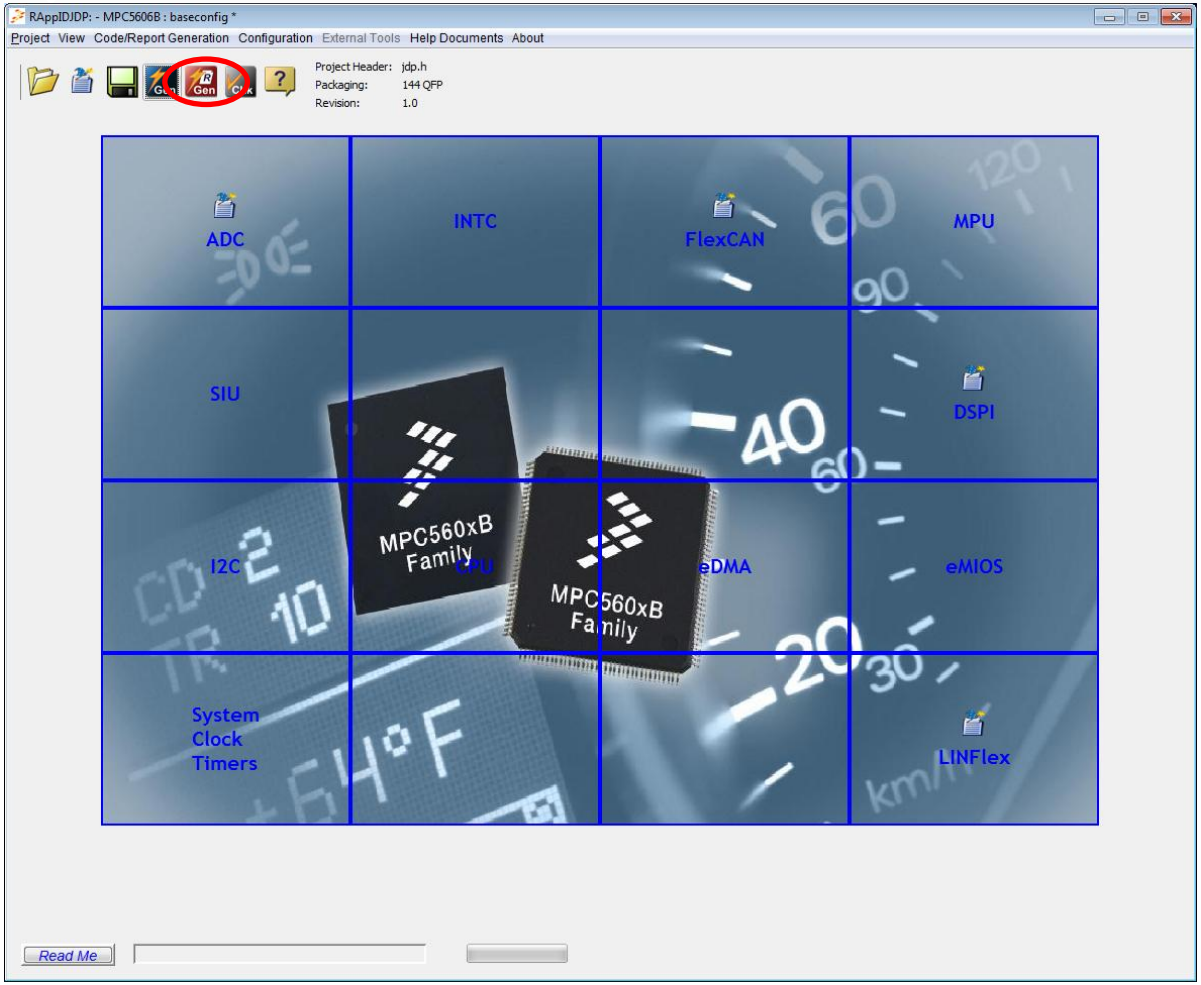
Generate Report



Select Report Generation icon to generate report

Save the project when prompted

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RAppID Init Project Report

- RAppID tool generates a detailed report of the project that covers
  - Initialization Technique, both system and peripheral
  - Detailed Pin Allocation report
  - Section Map report
  - A detailed report of configuration of each peripheral

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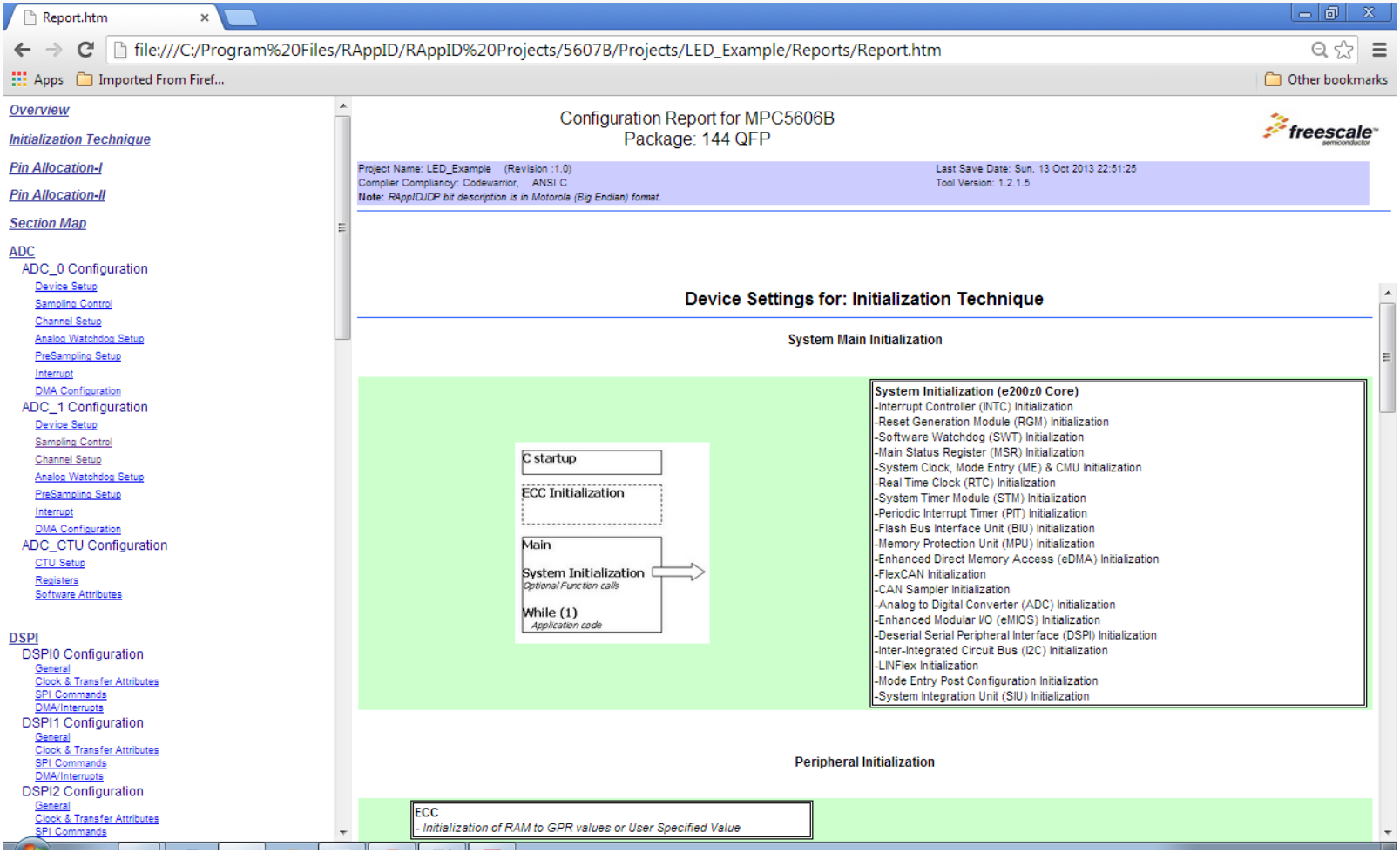
Project Report – Initialization Technique



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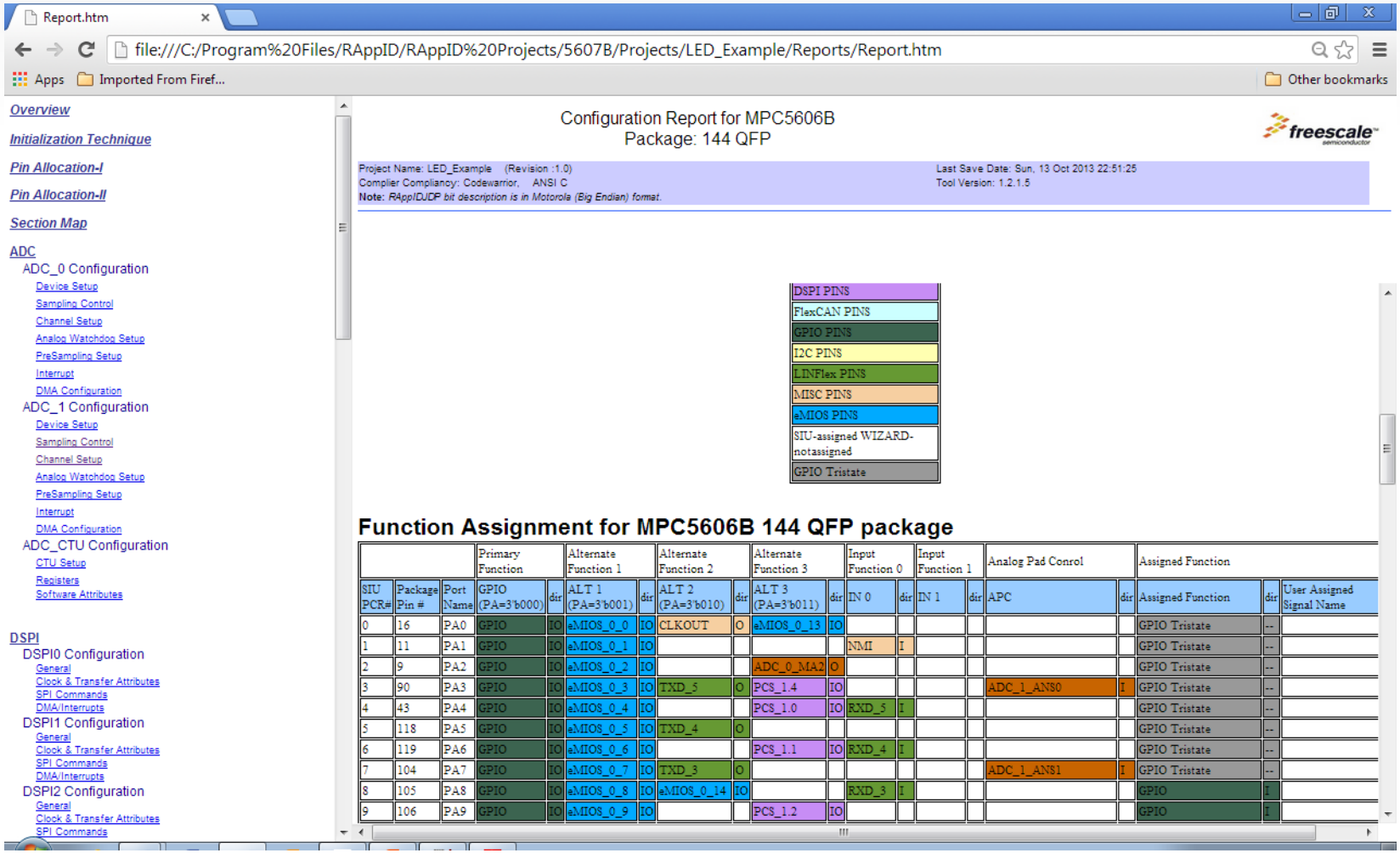
Project Report – Pin Allocation



		Primary Function		Alternate Function 1		Alternate Function 2		Alternate Function 3		Input Function 0		Input Function 1		Analog Pad Conrol		Assigned Function		
SIU PCR#	Package Pin #	Port Name	GPIO (PA=3'b000)	dir	ALT 1 (PA=3'b001)	dir	ALT 2 (PA=3'b010)	dir	ALT 3 (PA=3'b011)	dir	IN 0	dir	IN 1	dir	APC	dir	Assigned Function	dir	User Assigned Signal Name
0	16	PA0	GPIO	IO	eMIOS_0_0	IO	CLKOUT	O	eMIOS_0_13	IO							GPIO Tristate	--	
1	11	PA1	GPIO	IO	eMIOS_0_1	IO					NMI	I					GPIO Tristate	--	
2	9	PA2	GPIO	IO	eMIOS_0_2	IO			ADC_0_MA2	O							GPIO Tristate	--	
3	90	PA3	GPIO	IO	eMIOS_0_3	IO	TXD_5	O	PCS_1.4	IO					ADC_1_ANS0	I	GPIO Tristate	--	
4	43	PA4	GPIO	IO	eMIOS_0_4	IO			PCS_1.0	IO	RXD_5	I					GPIO Tristate	--	
5	118	PA5	GPIO	IO	eMIOS_0_5	IO	TXD_4	O									GPIO Tristate	--	
6	119	PA6	GPIO	IO	eMIOS_0_6	IO			PCS_1.1	IO	RXD_4	I					GPIO Tristate	--	
7	104	PA7	GPIO	IO	eMIOS_0_7	IO	TXD_3	O							ADC_1_ANS1	I	GPIO Tristate	--	
8	105	PA8	GPIO	IO	eMIOS_0_8	IO	eMIOS_0_14	IO			RXD_3	I					GPIO	I	
9	106	PA9	GPIO	IO	eMIOS_0_9	IO			PCS_1.2	IO							GPIO	I	

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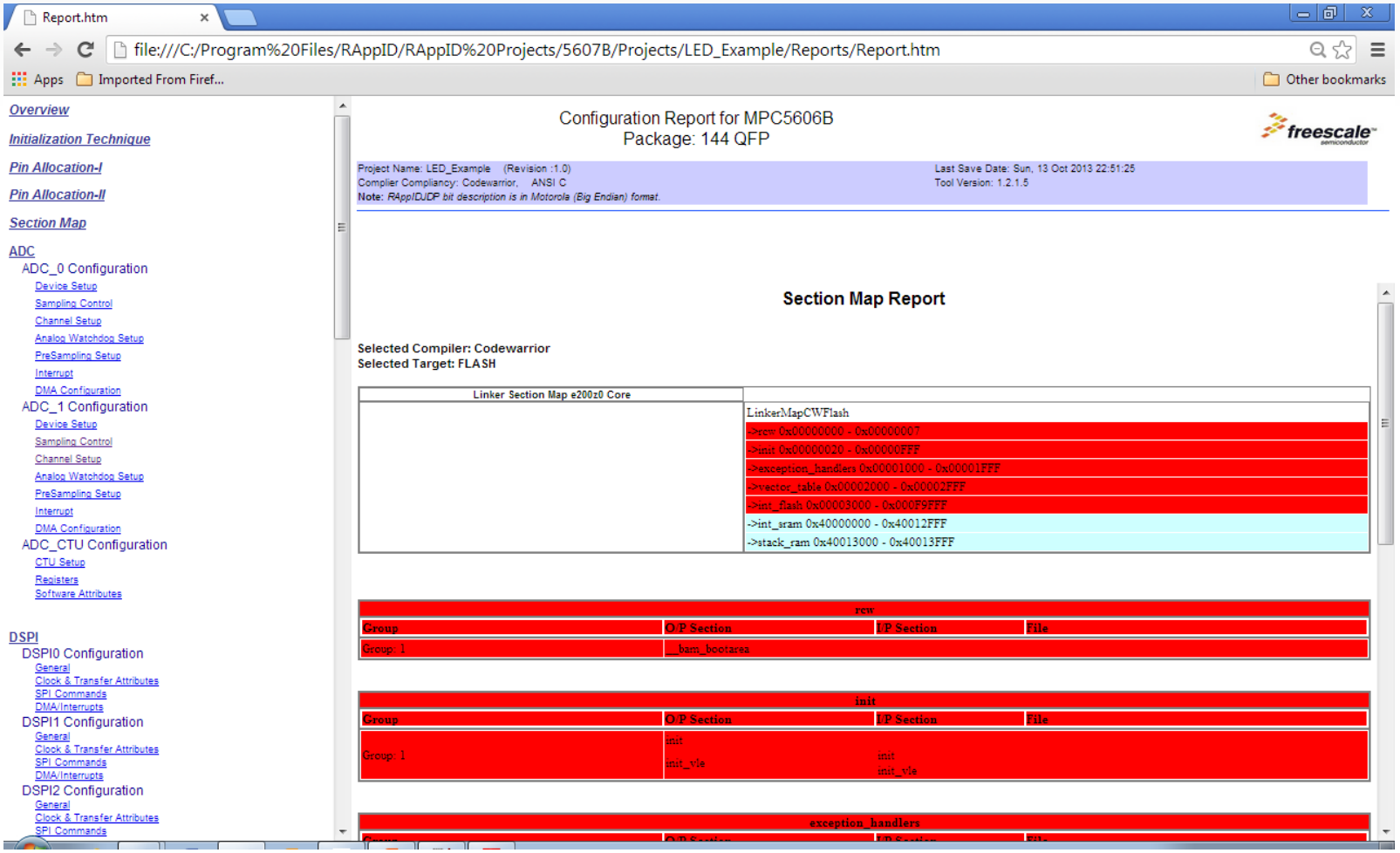
Project Report – Section Map



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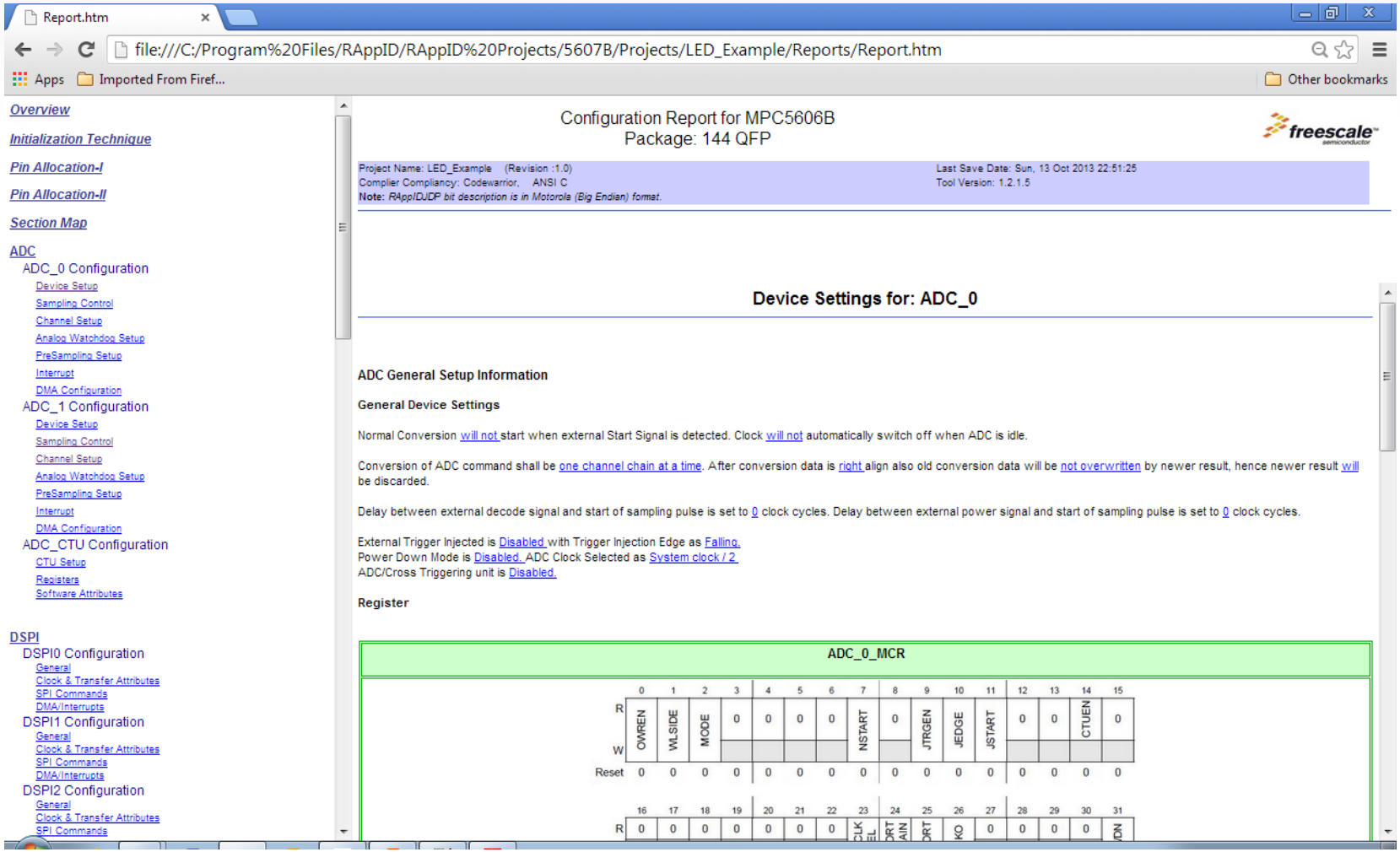
Project Report – Peripheral Configuration



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Edit main.c

- The main.c generated by RAppID initializes peripherals and includes an empty while loop. We have to add code to main.c to:
  - Turn on LED1 when Switch S1 is pressed and turn off when S1 is not pressed
  - Turn on LED2 when command '1' is sent serially and turn off LED2 when '0' is sent
  - Turn on LED3 when command '1' is sent via CAN and turn off LED3 when '0' is sent
  - Turn on LED4 when potentiometer input value is <=500 otherwise turn off LED4
- We will be using driver code supplied with the installation disk to perform low level functions. Copy the driver code to the directory where RAppID code was generated

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Edit main.c – Global variables

Add following global variables to main.c:

```
/* CAN messages to transmit */
unsigned char msgOKCAN[8] = {1,1,0,0,0,0,0,0};
unsigned char msgErrorCAN[8] = {1,0xFF,0,0,0,0,0,0};
/* UART menu string */
unsigned char menuString[] = "Press 1 to turn on and 0 to turn off LED2";
unsigned char newLine[2] = {0x0A, 0x0D};
uint8_t switchState;
uint16_t potValue;
```

Note: This example CodeWarrior project along with source code is provided with the installation disk. You can use Import project option to create this example project within CodeWarrior.

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Edit main function

Add following code to *main* function:

Add a call to driver to initialize SBC to enable CAN communication:

SBC_Init_DBG();

The 4 LEDs are active low and they turn on at start up. Turn them off:

GPIO_SetState(68, 1);

GPIO_SetState(69, 1);

GPIO_SetState(70, 1);

GPIO_SetState(71, 1);

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Edit main function (Continued)

We will receive CAN messages with CAN ID = 1. Add a call to CAN driver to setup mailbox 0 with Id = 1:

SetCanRxFilter(1, 0, 0);

Add a call to UART driver to initialize UART buffer:

UartBufInit();

Add a call to function that transmits a menu string via UART asking the user to type 1 to turn on LED2 and type 0 to turn off LED2

PrintMenu();

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Edit main function (Continued)

Within while loop, add function calls to process GPIO, UART, CAN and ADC peripherals.

```
while(1)
{
        ProcessGPIO();
        ProcessUART();
        ProcessCAN();
        ProcessADC();
 }
```


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Add ProcessUART function

We will add function *ProcessUART* to process messages received via UART. This function will call the UART driver functions to check if any UART message byte is received. If a byte is received with value ‘1’ , it will turn On LED2 and if a byte is received with value ‘0’, it will turn Off LED2. Bytes with any other values will be ignored. If any message byte is received, it will transmit the menu instructing user to send command to turn On/Off LED2. The code is shown below:

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Add ProcessUART function (Continued)

```
void ProcessUART(void)
{
    unsigned char data;
    UartRxFillBuf();                    /* Check if serial message received */
    if(UartRxBufEmpty() != 1)
    {
            data = UartRxDataByte();            /* If received data byte is 1, turn on LED2 */
            if (data == '1')
            {
                    GPIO_SetState(69, 0);
            }
            else if (data == '0')       /* If received data byte is 0, turn on LED2 */
            {
                    GPIO_SetState(69, 1);
            }
            PrintMenu();
    }
}
```


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Add PrintMenu function

We will add function *PrintMenu* to transmit a menu string via UART asking the user to type 1 to turn on LED2 and type 0 to turn off LED2. The code is shown below:

```
void PrintMenu(void)
{
    UartTxMsg((unsigned char *)newLine, 2);
    UartTxMsg((unsigned char *)menuString, 40);
    UartTxMsg((unsigned char *)newLine, 2);
}
```


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Add ProcessCAN function

We will add function *ProcessCAN* to process messages received via CAN. This function will call the CAN driver functions to check if any CAN message is received. If a CAN message is received with first data byte value of 1, it will turn On LED3 and if the first data byte value is 0, it will turn Off LED3.

If the first data byte is either 0 or 1, it will transmit CAN message ***msgOKCAN***, other wise it will transmit CAN message ***msgErrorCAN***. The code is shown below:

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Add ProcessCAN function (Continued)

```
void ProcessCAN(void)
{
    can_msg_struct msgCanRX;

    if (CanRxMbFull(0) == 1)              /* Check if CAN message received */
    {
            msgCanRX = CanRxMsg(0);
      if (msgCanRX.data[0] == 0)          /* If received data byte is 0, turn off LED3 and send positive response */
      {
            GPIO_SetState(70, 1);
            CanTxMsg (2, 1, 8, (uint8_t *)msgOKCAN, 0);
      }
      else if (msgCanRX.data[0] == 1)     /* If received data byte is 1, turn on LED3 and send positive response */
      {
            GPIO_SetState(70, 0);
            CanTxMsg (2, 1, 8, (uint8_t *)msgOKCAN, 0);
      }
```


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Add ProcessCAN function (Continued)

```
        else                    /* If received data byte is not 0 or 1, send a negative response */
        {
                CanTxMsg (2, 1, 8, (uint8_t *)msgErrorCAN, 0);
        }
    }
}
```


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Add ProcessGPIO function

We will add function *ProcessGPIO* to process input switch S1. If switch S1 is pressed, it will turn On LED1, otherwise turn Off LED1. The code is shown below:

```
void ProcessGPIO(void)
{
    switchState = GPIO_GetState(64); /* Check switch S1 state */
    if (switchState)          /* If Switch S1 is pressed, turn on LED1, other wise turn off LED1*/
    {
            GPIO_SetState(68, 0);
    }
    else
    {
            GPIO_SetState(68, 1);
    }
}
```


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Add ProcessADC function

We will add function *ProcessADC* to process potentiometer input. If potentiometer value is <=500, it will turn on LED1, otherwise turn off LED1. The code is shown below:

```
void ProcessADC(void)
{
    potValue = Pot_Get_Value();
    if(potValue <= 500)       /* If Potentiometer input is <= 500 turn on LED4, other wise turn off LED4 */
    {
            GPIO_SetState(71, 0);
    }
    else
    {
            GPIO_SetState(71, 1);
    }
}
```


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Edit main.c – Add include files and function prototypes

Add following include files to main.c:

#include "CANapi.h"

#include "sbc_hld.h"

#include "gpio_drv.h"

#include "UART_drv_api.h"

#include "pot_hld.h“

Add following function prototypes to main.c:

void ProcessUART(void);

void PrintMenu(void);

void ProcessCAN(void);

void ProcessGPIO(void);

void ProcessADC(void);

Note: This example CodeWarrior project along with source code is provided with the installation disk and is copied to your system during installation.

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Create CodeWarrior project

- Now we are ready to compile and build the code. To do this,
  - create an empty CodeWarrior project
  - add RAppID generated code and driver code to the CodeWarrior project using CodeWarrior script utility – cw*pjmaker_0.1.exe*
  - Build the code using Codewarrior
- The next few slides explains these steps

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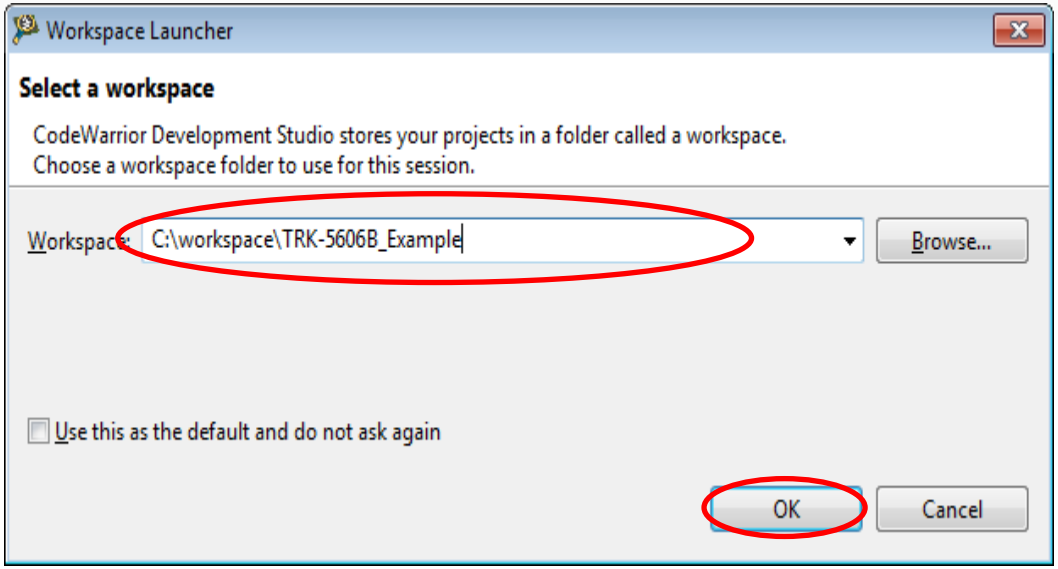
Create CodeWarrior project

Launch CodeWarrior 10.5 from Windows Start menu

Provide a workspace name

Select OK



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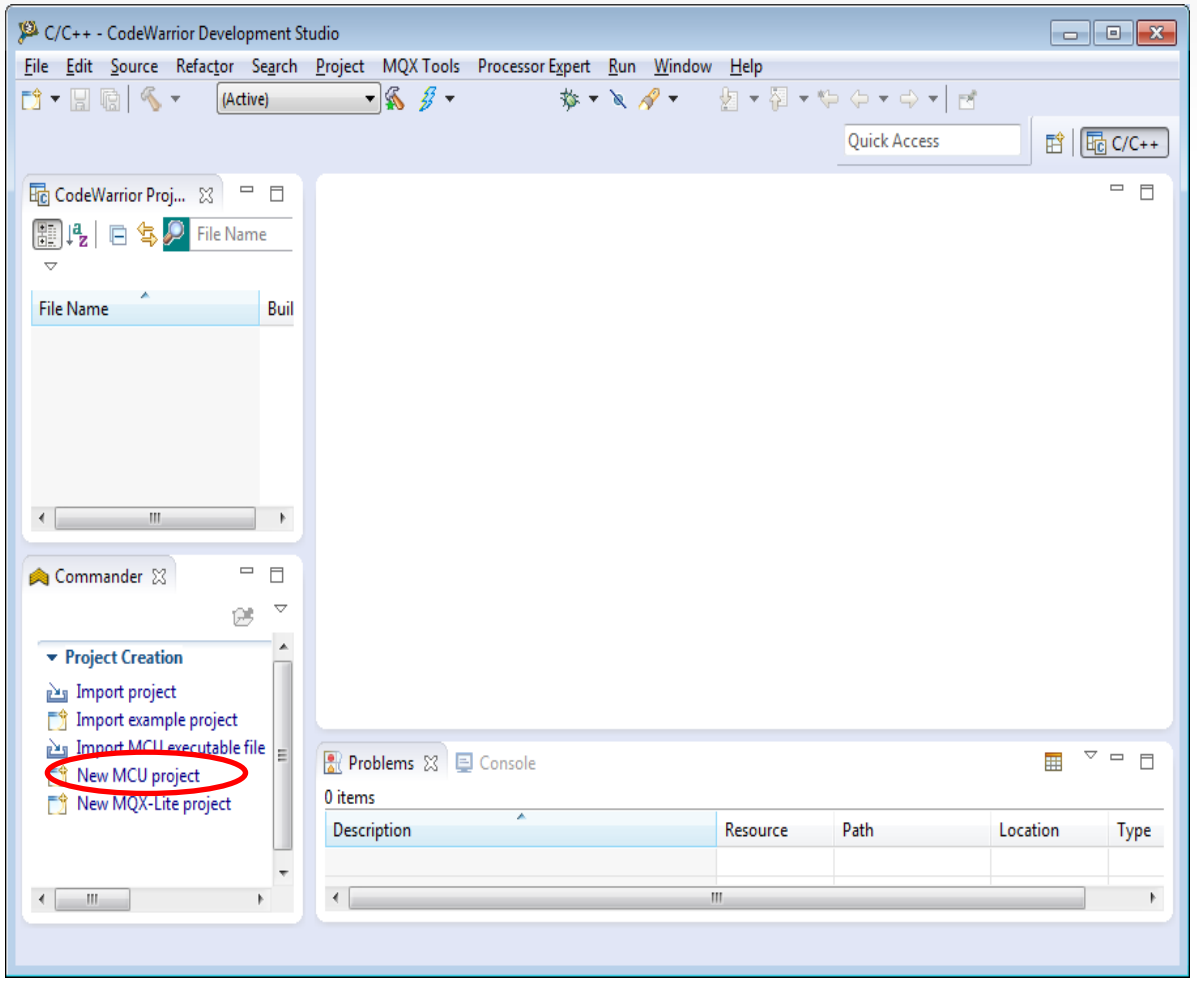
Create CodeWarrior project

We will first create a Bareboard project for MPC5606B

To create a new Bareboard project, Select “New MCU project” from Commander window.



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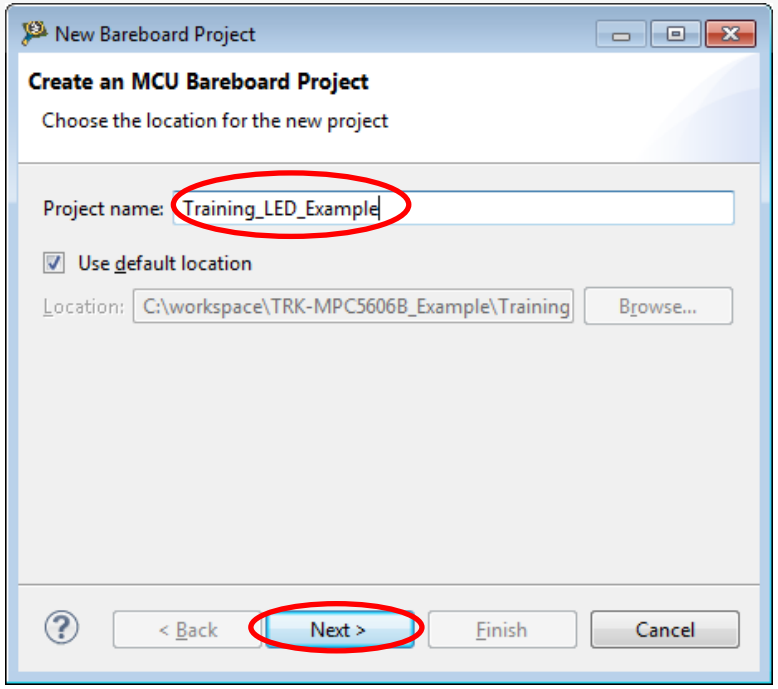
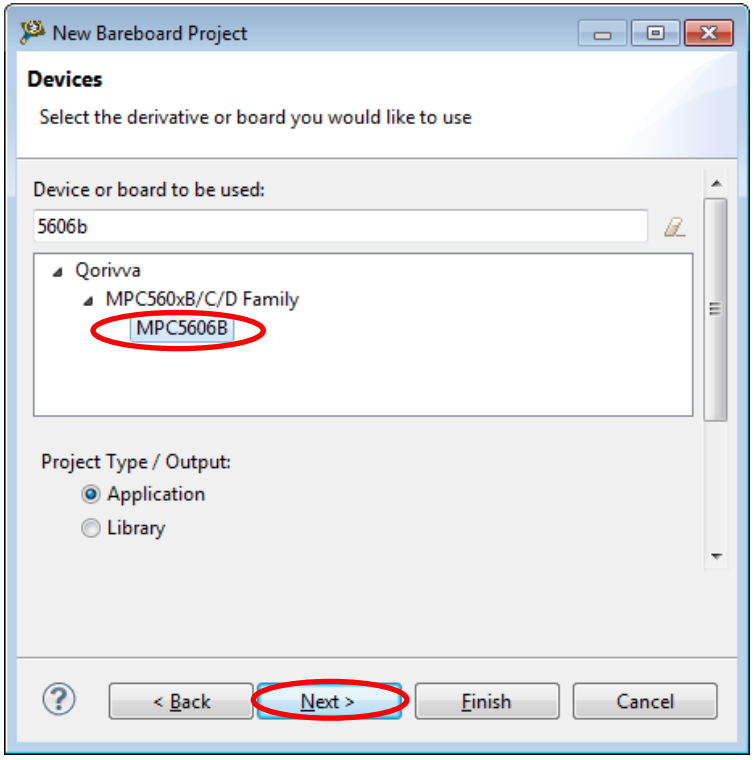
Create CodeWarrior project

Provide a name for the project – Training_LED_Example
select Next





Select Qorivva->MPC560xB/C/D->MPC5606B device from the list
Select Next

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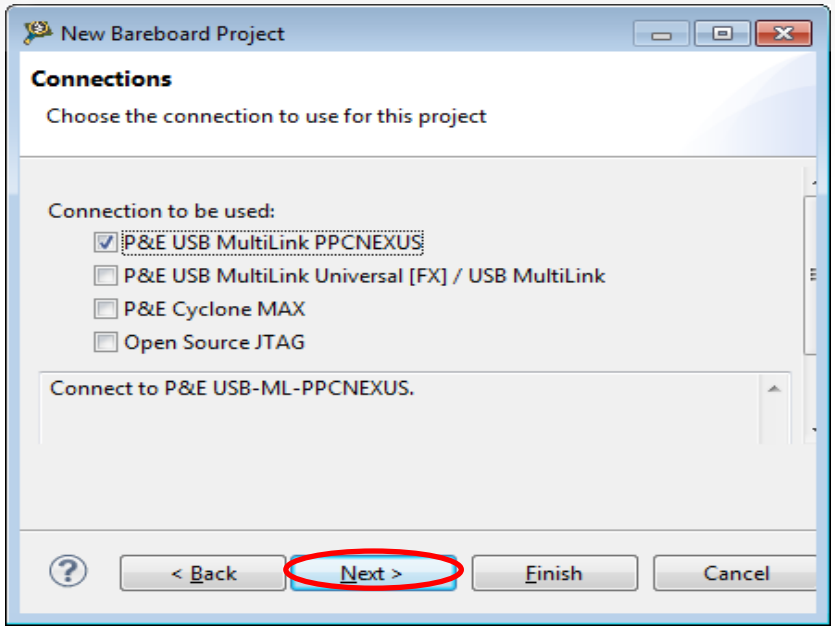
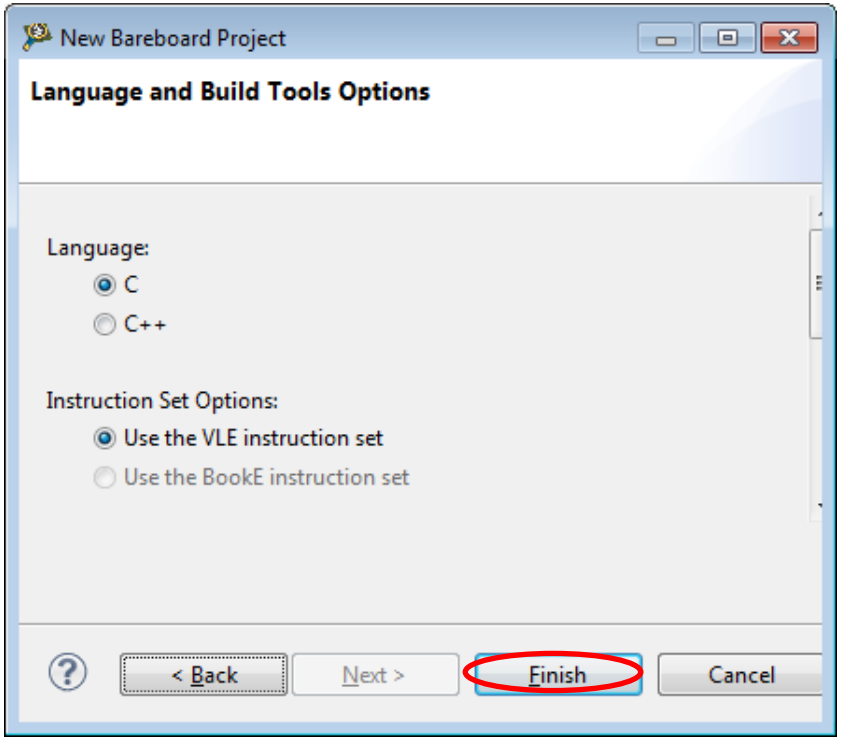
Create CodeWarrior project

Accept the default connection option and select Next





We will be using C code and VLE instructions for this example project. Accept the default options and select Finish

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Create CodeWarrior project

- When Finish is selected, CodeWarrior creates a new bareboard project with CodeWarrior generated code and linker file included in the project.
- Since we have generated code using RAppID for LED_Example project, we want to remove all the CodeWarrior generated code and add RAppID generated code and linker file along with the driver code to be included in the CodeWarrior project.
- This can be done using CodeWarrior project maker utility – cw*pjmaker_0.1.exe*
- First close the Training_LED_Example project by selecting menu Project->Close Project
- Run cw*pjmaker* utility which is provided with the installation disk: This can be done by selecting the file from the installed directory or by using the menu in RAppID - *External Tools->CWPjmaker*

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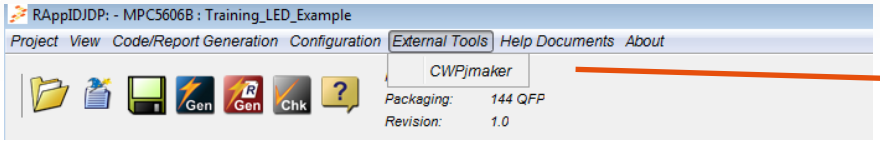
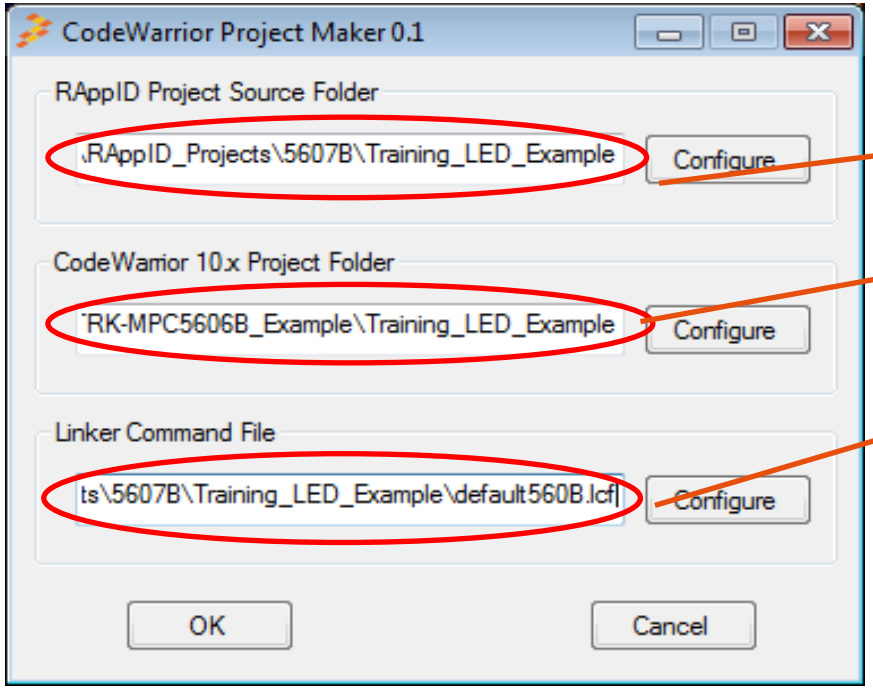
Run cwpjmaker utility



Execute cwpjmaker utility from RAppID menu



Provide directory path where RAppID code is generated

Provide directory path where CodeWarrior project is created

Provide the path of linker file created by RAppID tool

The script will remove CodeWarrior generated code from the project and will add all the code in the directory specified in the “RAppID Project Source Folder” edit box.
The script will also add/modify all the CodeWarrior project settings required to build Training_LED_Example project

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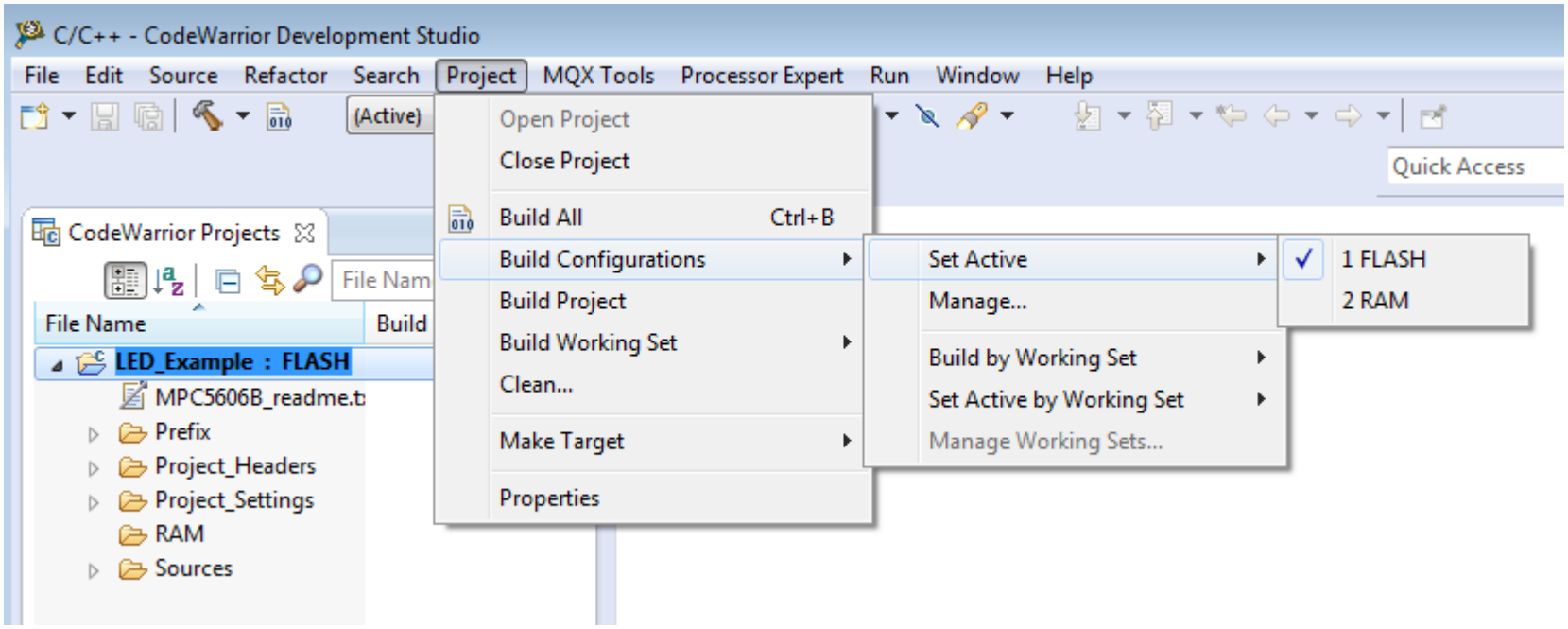
Create CodeWarrior project



Now re-open the LED_Example project by selecting menu Project->Open Project

Since we generated code for Flash, we need to change the build configuration to Flash. To do this, select menu Project->Build Configurations->Set Active->FLASH

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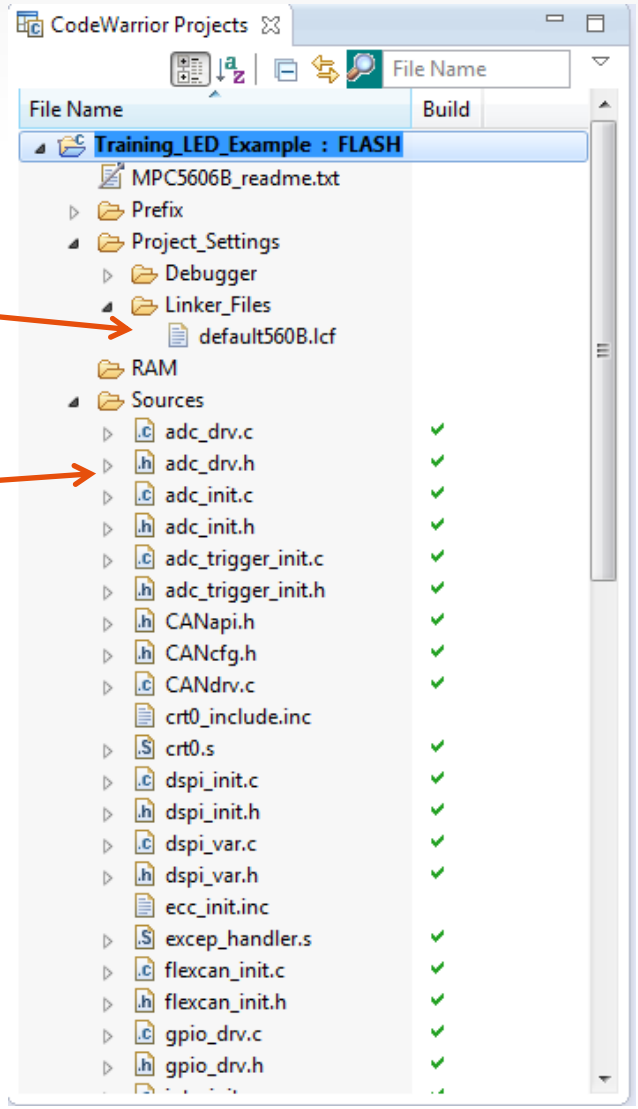
Create CodeWarrior project

Now the project should contain:

RAppID generated linker file

RAppID generated source files and driver code copied from the installation disk



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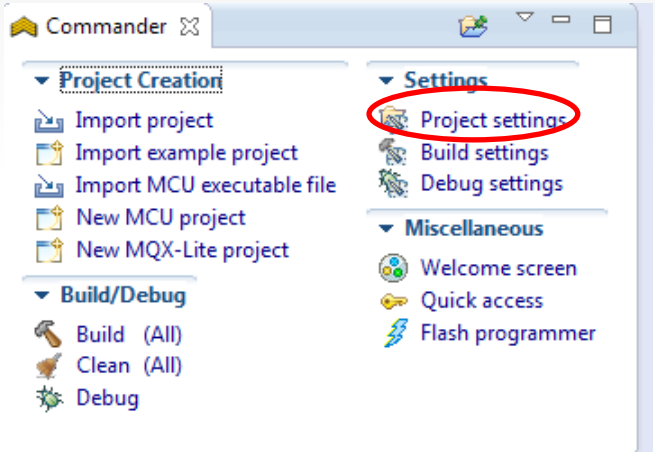
Create CodeWarrior project

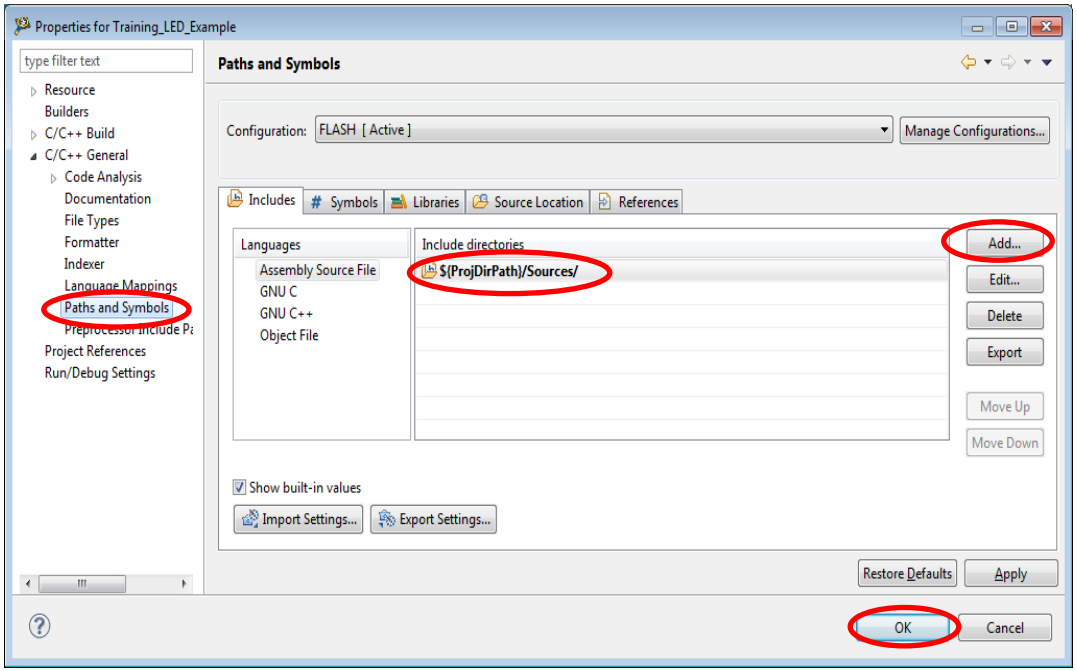
We have to add path of RAppID generated assembly source files to CodeWarrior path.

Select *Project Settings* menu from Commander window.

Under *Paths and Symbols->Assembly Source Files*, add a new include directory: *${ProjDirPath}/Sources/*

Select *OK*





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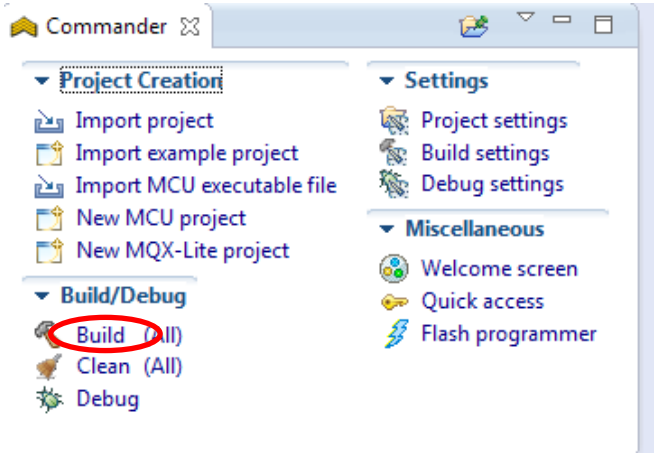
Build project

To build Training_LED_Example project , select Build from Commander window



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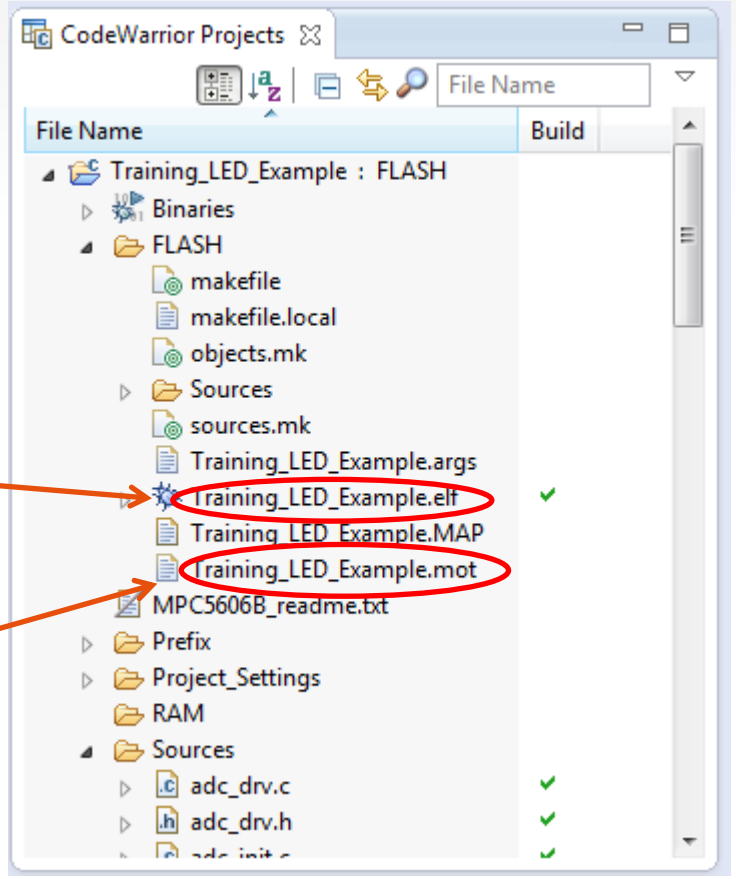
Build project

The build command will produce 2 executable files:

Training_LED_Example.elf (executable with debug symbols)

Training_LED_Example.mot (S-record)



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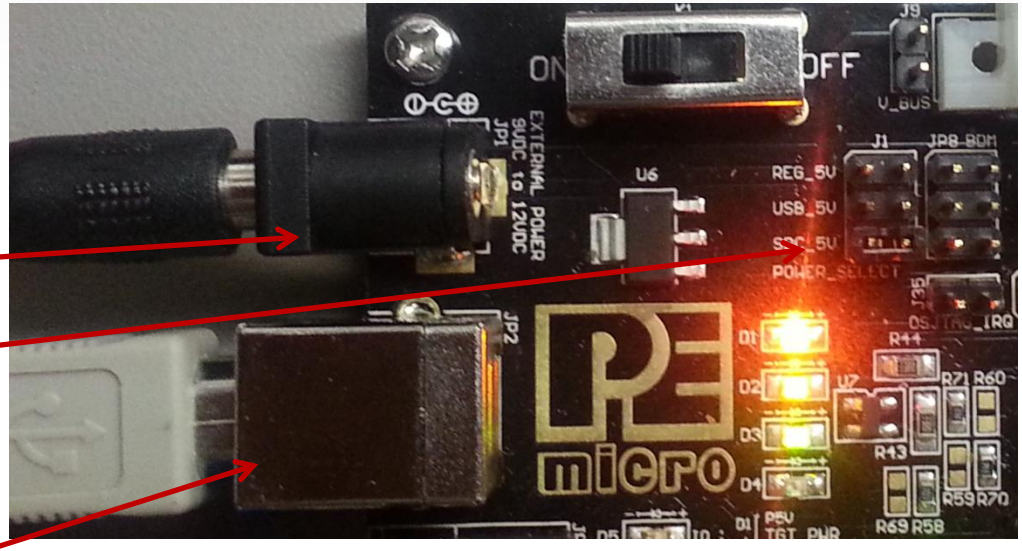
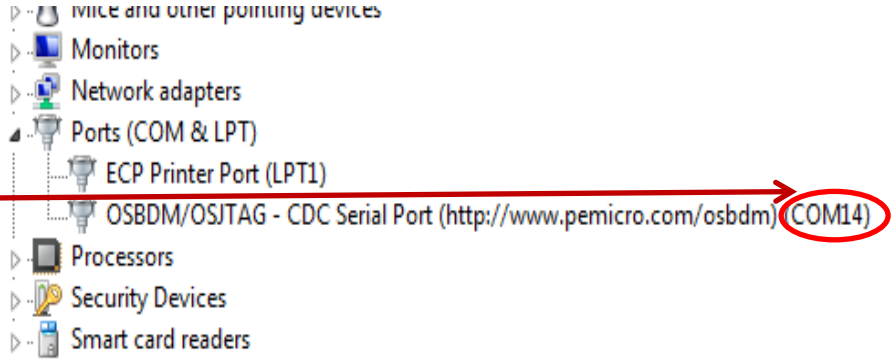
Jumper settings and Power connections

- Since we are using CAN in this example, we need to enable CAN.
- To enable CAN, the board needs to power SBC using external 12V supply.
- Connect jumpers across SBC_5V of J1
- Connect External power to JP1
- Connect your computer to JP2 via USB cable. This connection provides virtual serial port. Confirm this by checking available COM ports in Windows Device manager. In the example shown, the COM port assigned is COM14





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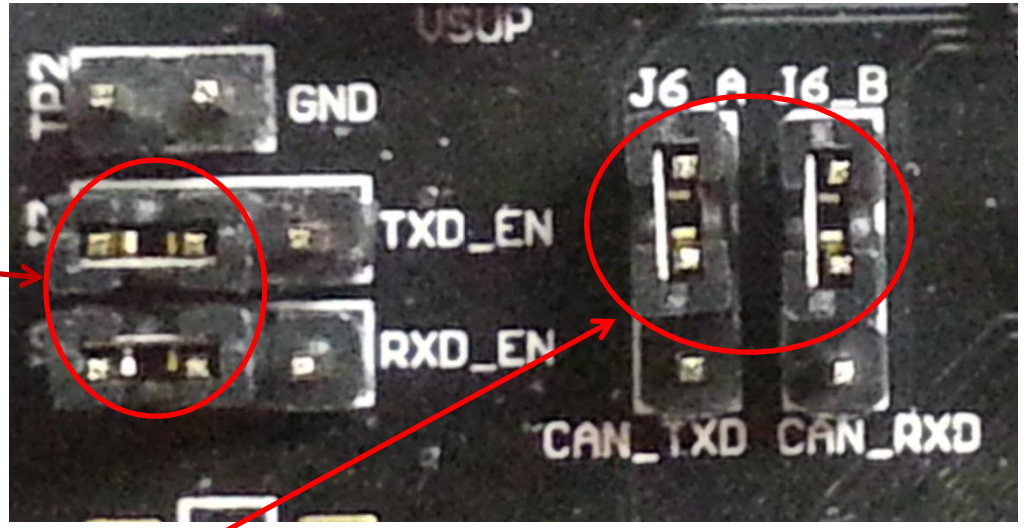
Jumper settings and Power connections

- In this example, we will use Virtual serial port for UART communication. To enable this, connect jumper J7 (TXD_EN) and J8 (RXD_EN) to position 1-2
- To enable CAN communication, connect J6_A (CAN_TXD) and J6_B (CAN_RXD) to position 1-2.



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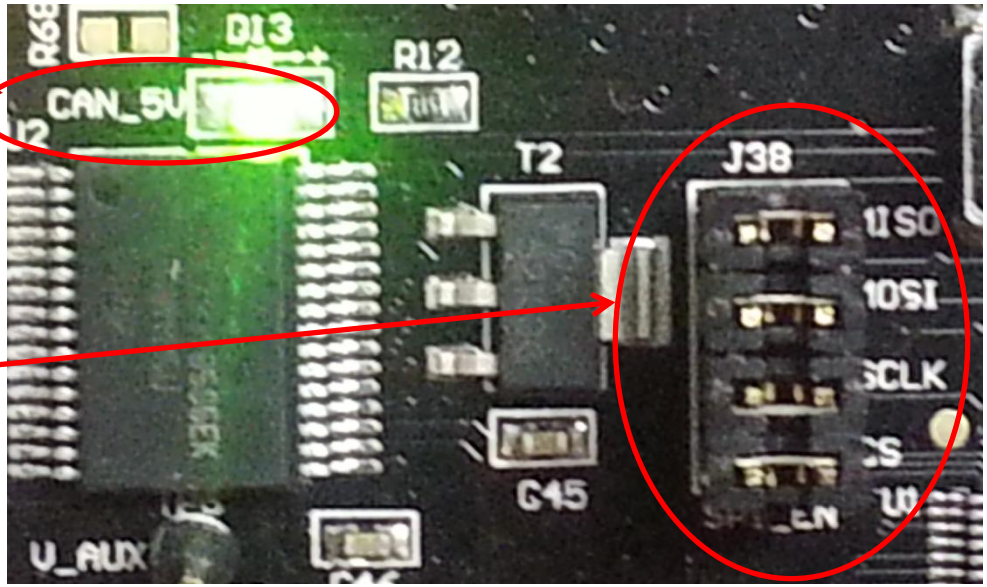
Jumper settings and Power connections

- The CAN_5v should be lit when SBC is powered
- In this example, we will use DSPI 1 to communicate with SBC. To enable DSPI, connect all 4 jumpers in J38



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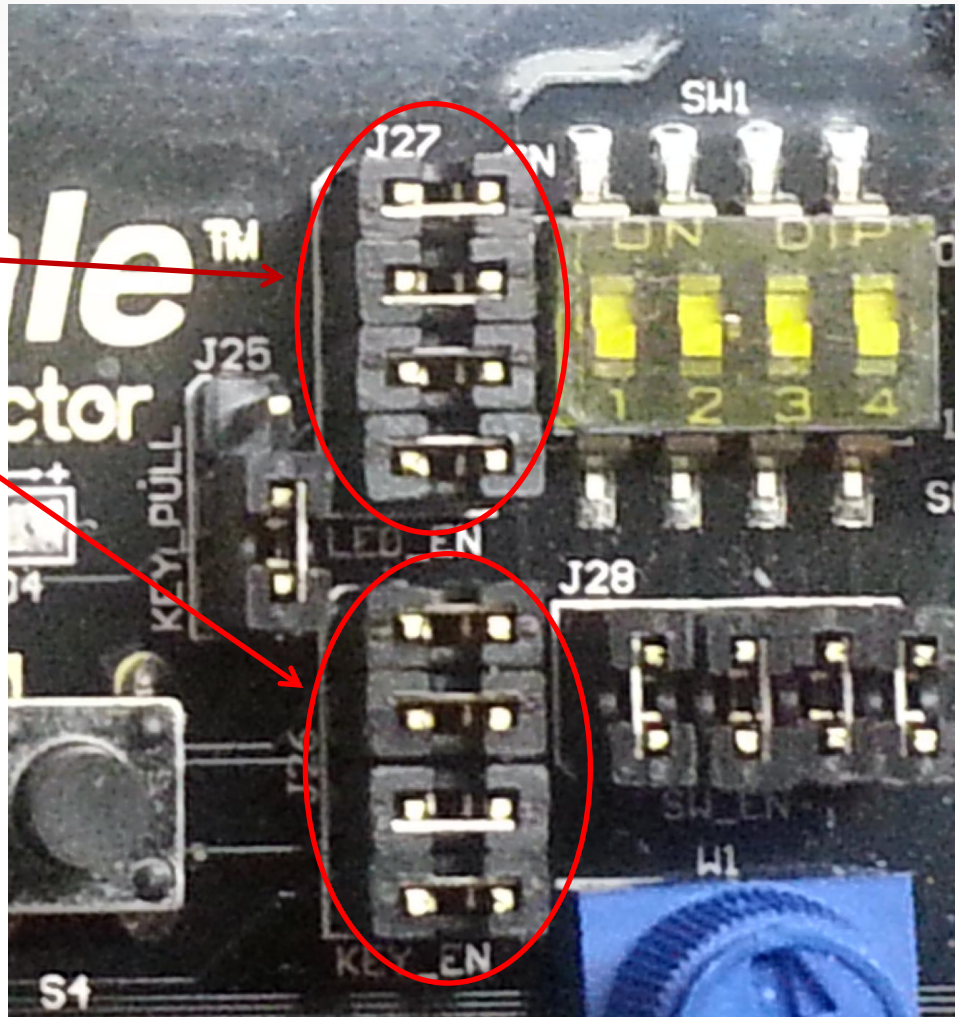
Jumper settings and Power connections

- To enable LEDs, connect all 4 jumpers in J27
- To enable input switches, connect all 4 jumpers in J26



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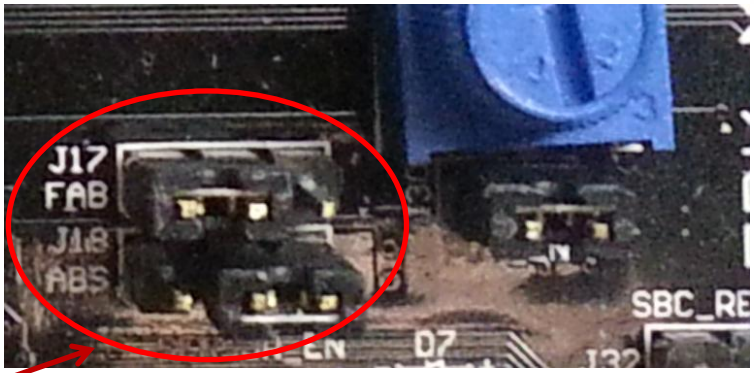
Flash code to target

- Before Flashing the code, make sure the TRK-MPC5606B board is connected to external power and to your computer via USB cable
- Set the jumper of J17 to position 1-2 which pulls FAB high and jumper J18 to position 2-3 to set ABS low
- We will use RAppID Bootloader utility to flash S-record file Training_LED_Example.mot using serial port



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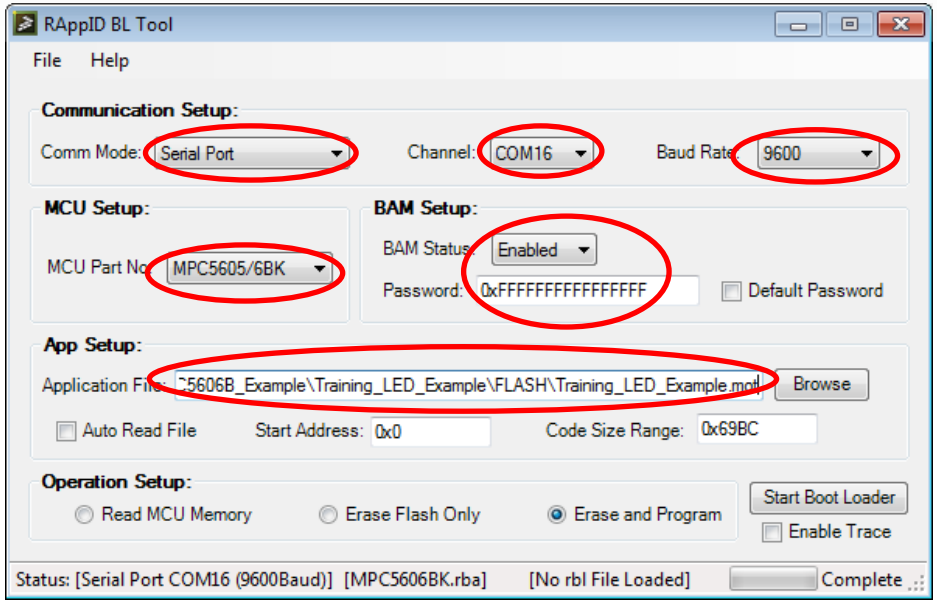
Flash code to target

- Launch RAppID bootloader utility from Windows Start menu
- Select Serial Port as Comm Mode
- Select the correct COM channel
- Select 9600 baud
- Select MPC5605/6BK as MCU part number
- Set BAM status as Enabled
- Enter password as 0xFFFFFFFFFFFFFFFF
- Enter the path for the file to be flashed: Training_LED_Example.mot
- Select Start Boot Loader button to start the flash process



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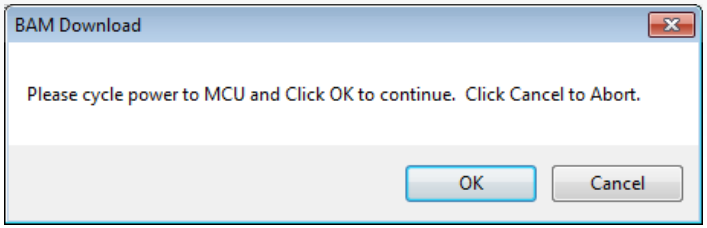
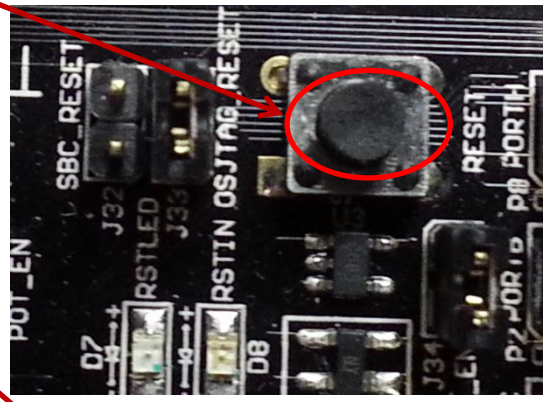
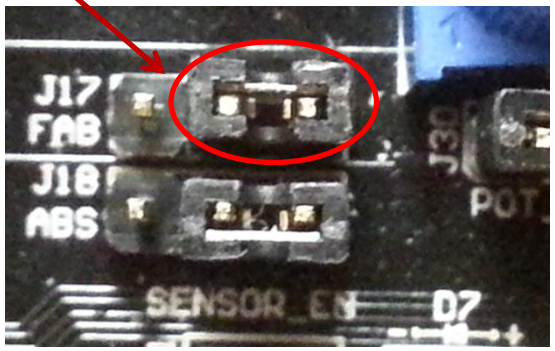
Flash code to target

- When asked to cycle power to MCU, press the reset button on the board. Flashing process should start.





- After Flash is complete, Move the jumper J17 to position 2-3 to pull FAB low.
- Turn the power off to the module and re-apply the power
- The code should be running now.



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Testing code

- Press switch S1 to turn on LED1 and release S1 to turn it off
- Send serial command 1 to turn on LED2 and 0 to turn it off
- Send CAN command with first byte = 1 to turn on LED3 and first byte = 0 to turn off LED3
- Turn the potentiometer halfway to observe LED4 turning On/Off

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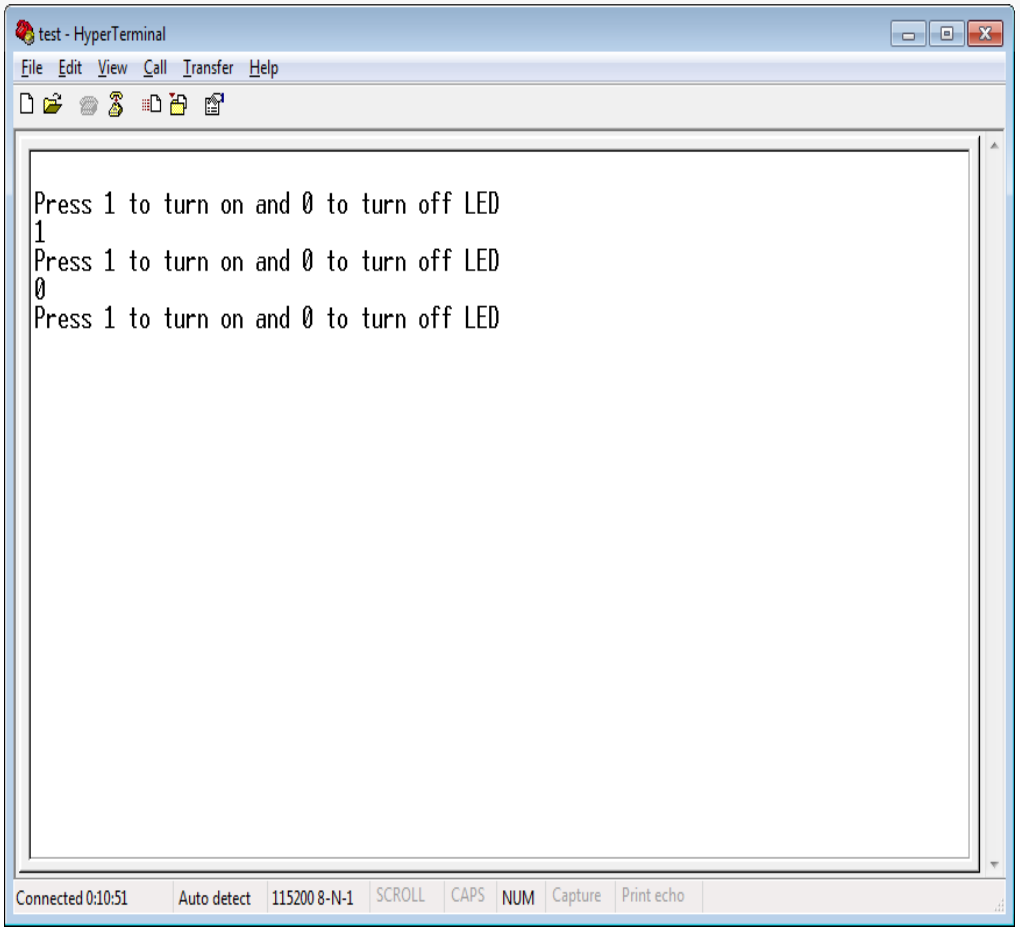
Serial command to turn On/Off LED2

Use a terminal tool like HyperTerminal or PuTTY to send serial command to turn LED2 On/Off

Set the connection parameters to 115200 baud, 8 Data bits, No parity and 1 Stop bits

When you press 1, LED2 should turn On and when you press 2, LED2 should turn Off.



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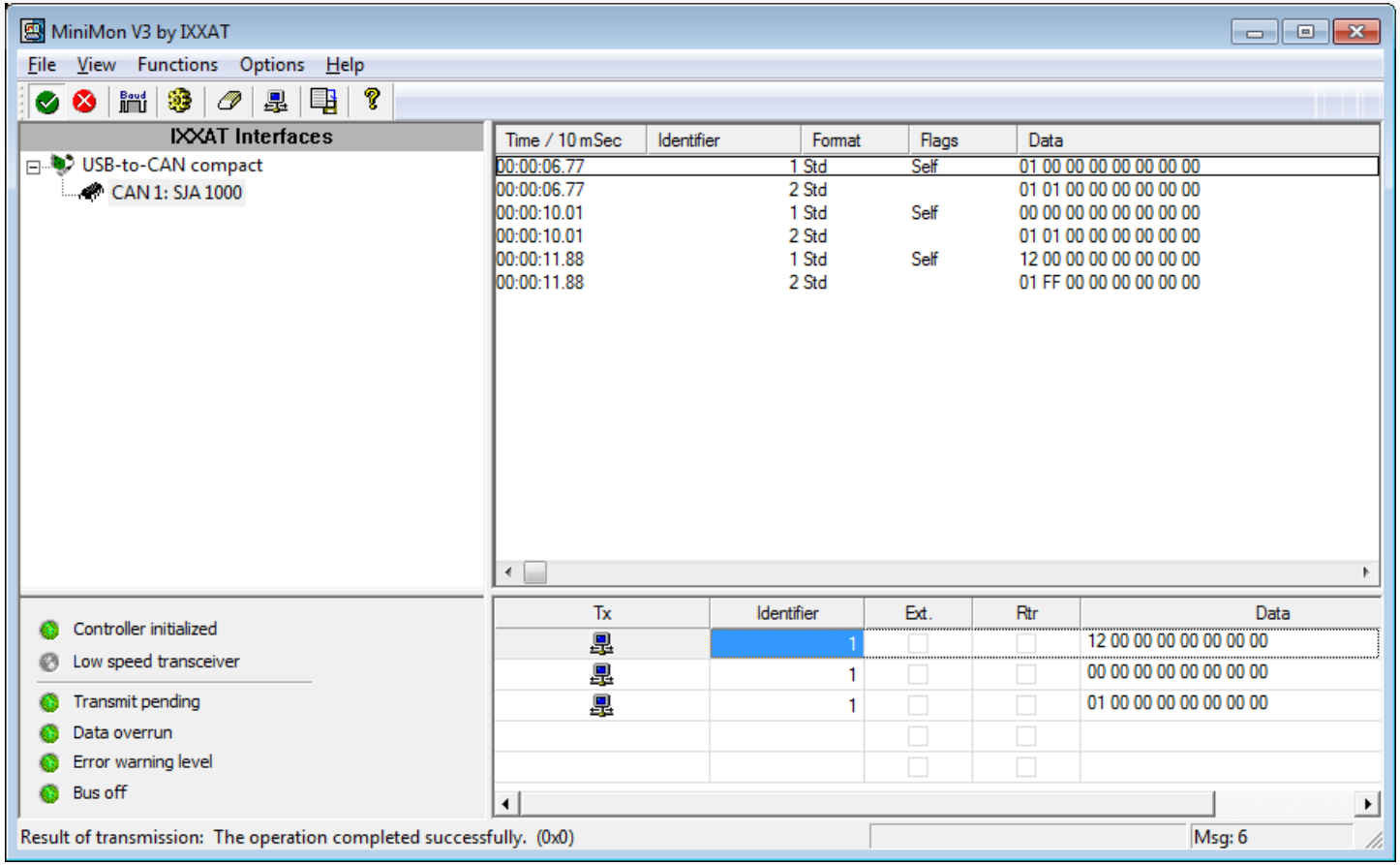
CAN command to turn On/Off LED3



Using a CAN communication tool like CANalyzer or IXXAT MiniMon,
Send CAN command ID = 1 and first data byte = 1 to turn on LED3
Send CAN command ID = 1 and first data byte = 0 to turn off LED3

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Training Summary

- Overview of tools provided with Fast Start Kit for TRK-MPC5606B
- Utilized RAppID Init Tools for fast and easy infrastructure configuration and code generation
- Generated comprehensive report on the project using RAppID Init tool
- Utilized supporting tools provided with the kit to help build and flash code on to the target
- Described setting up and using the TRK-MPC5606B evaluation board

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