

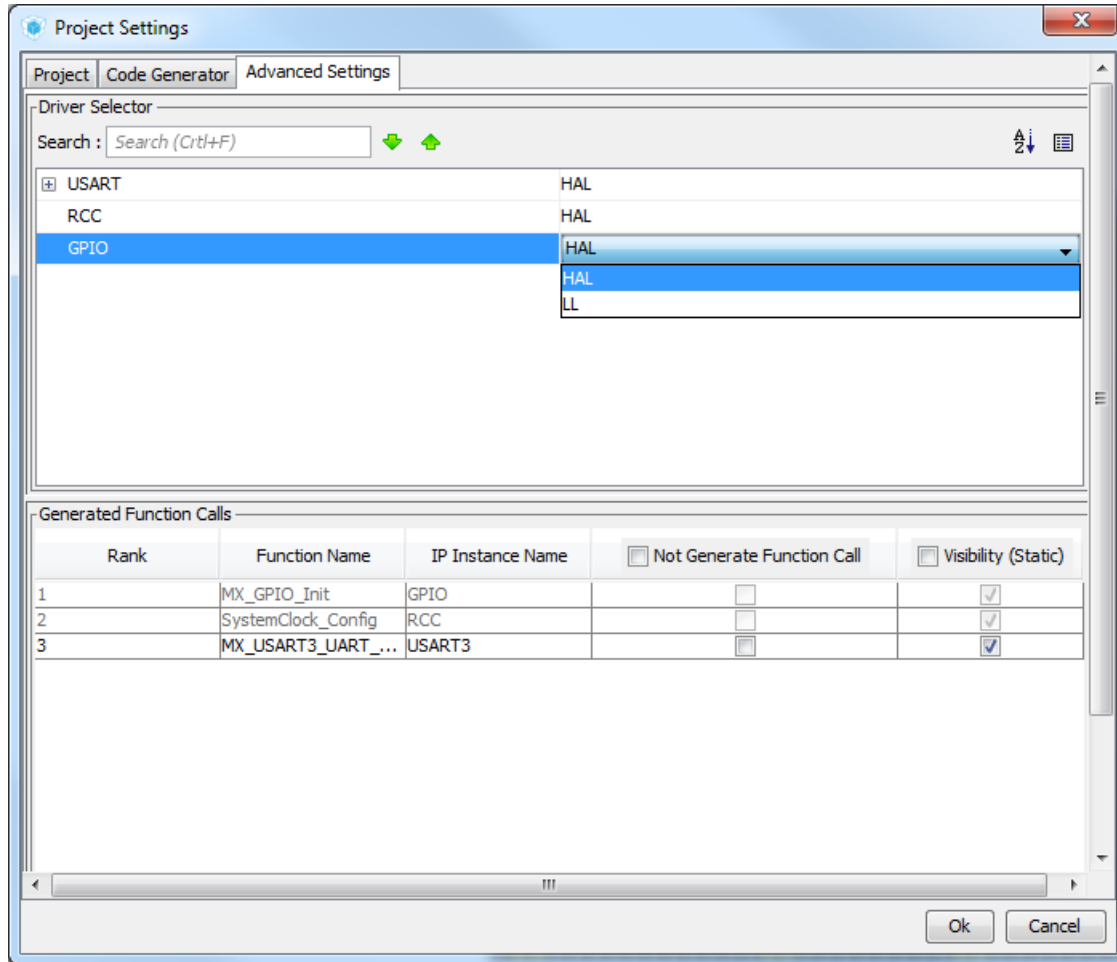
Advance topics

Agenda

- **Advance code generation options**
- Migrating STM32CubeMX project
- Power Consumption Calculator

Advanced code generation options

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- **Driver Selector***

Allows customer to select HAL(default) or LL APIs for generating initialization code

- **Generated Function Call**

Allows customization of initialization code

- Re-ordering of initialization code default sequence
- Disable generation of initialization code
- Allows generation of function definition without “static” keyword

Low-Layer API (LL API)

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- LL APIs enable expert developer to optimize their code down to register level
- Combination of LL APIs and HAL gives developer complete flexibility in developing their application
 - Ease of use and portability of HAL APIs
 - Optimize performance, code footprint and power consumption
- LL peripheral initialization service are functionality equivalent to STM32 SPL and provide easy migration path from older SPL to STM32Cube ecosystem
- LL only support simple peripheral. Complex peripherals are not supported
 - Simple peripheral such as RCC, ADC, GPIO, I2C, SPI, TIM, USART, etc
 - Complex peripherals not supported by LL include USB, SDMMC, FSMC, etc

Agenda

- Advance code generation options
- **Migrating STM32CubeMX project**
- Power Consumption Calculator

Migrating existing STM32CubeMX project to another STM32 MCU

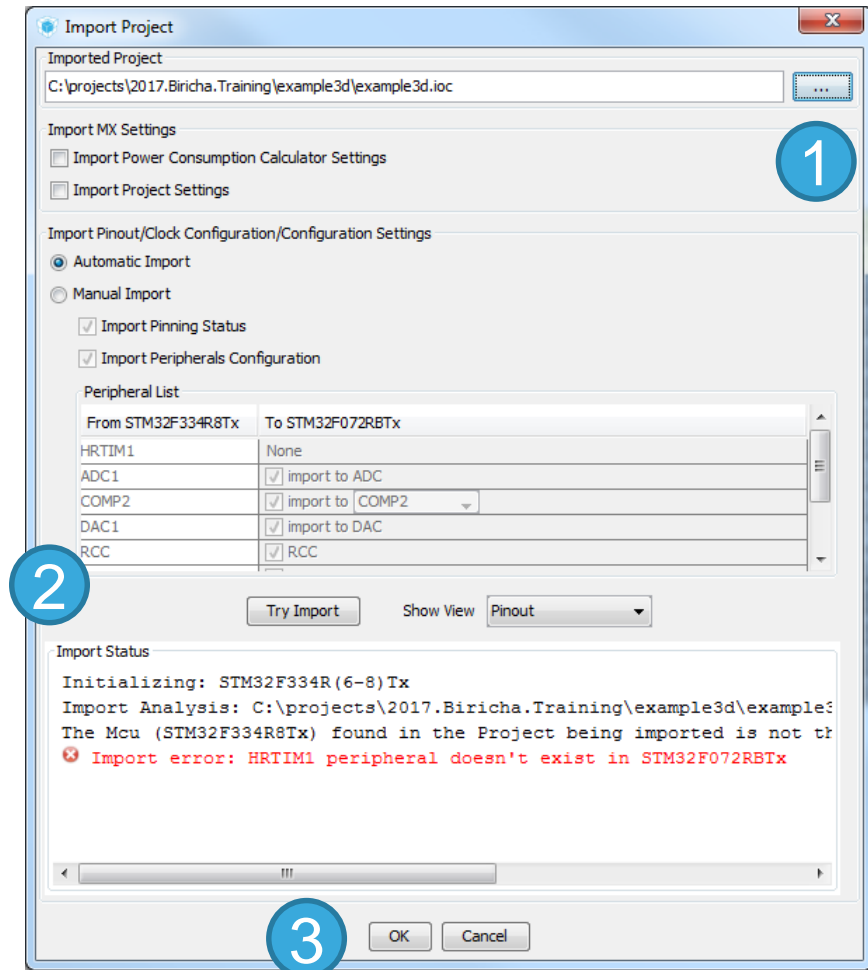
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- STM32CubeMX provides 2 methods for migrating
 - “Import Project” feature
 - “List Pinout Compatible MCU” feature
- Customer have selected device and want to migrate existing design to selected device
 - “Import Project” feature
- Customer have existing design and looking for pin compatible MCU
 - “List Pinout Compatible MCU” feature

“Import Project” feature

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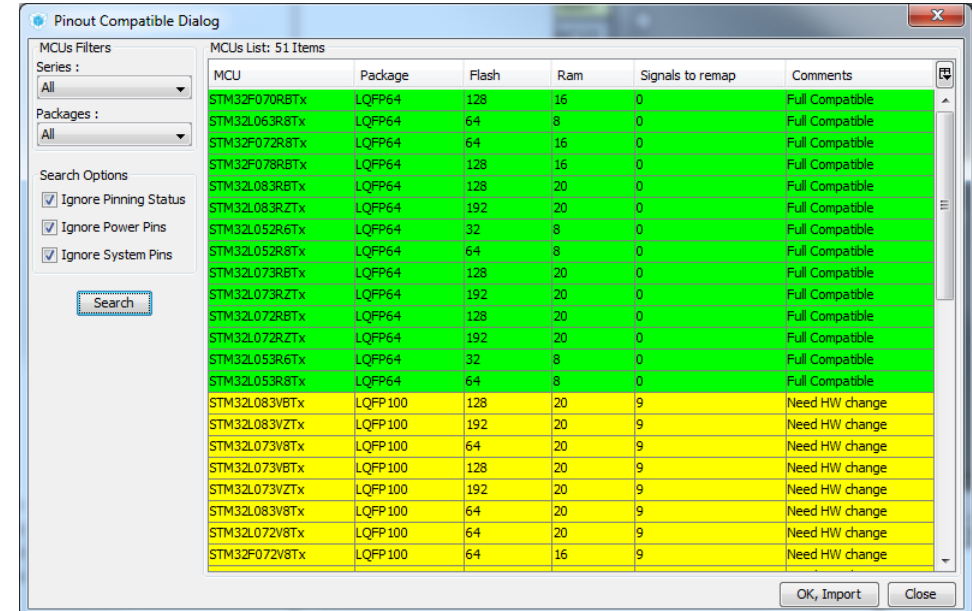
- STM32CubeMX
 - Create “New project...”
 - Select MCU you want to port into
 - Select File > Import Project ...
 - The following setting will be imported
 - Pin out, Clock Configuration, Configuration
- “Import Project” dialog box
 - Select STM32CubeMX project file that you want to import into new MCU
 - Inspect import status message
 - Select OK



“List Pinout Compatible MCU” feature

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- STM32CubeMX
 - Select Pinout tab
 - Select “Pinout > List Pinout Compatible MCUs”
- Pinout Compatible Dialog
 - Result
 - **Bright green** - exact match
 - **Light green** – partial match with hardware compatibility. Hardware compatibility can be ensured but some pin names could not be preserved.
 - **Yellow** - partial match without hardware compatibility. Not all signals can be assigned to the exact same pin location
 - Select “OK, Import”



Pinout Compatible Dialog

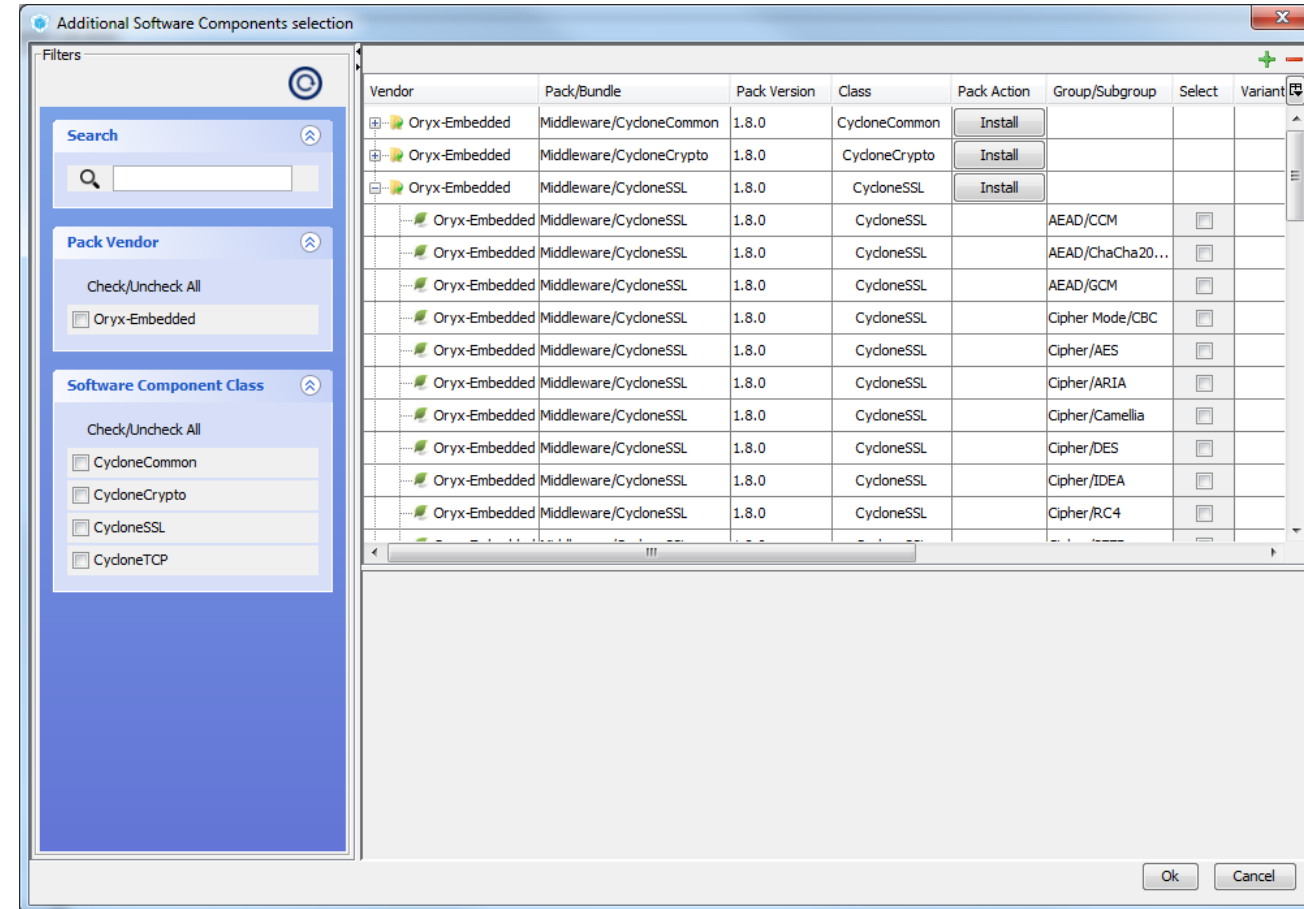
MCUs List: 51 Items

MCU	Package	Flash	Ram	Signals to remap	Comments
STM32F070RBTx	LQFP64	128	16	0	Full Compatible
STM32L063RBTx	LQFP64	64	8	0	Full Compatible
STM32F072RBTx	LQFP64	64	16	0	Full Compatible
STM32F078RBTx	LQFP64	128	16	0	Full Compatible
STM32L083RBTx	LQFP64	128	20	0	Full Compatible
STM32L083RZTx	LQFP64	192	20	0	Full Compatible
STM32L052R6Tx	LQFP64	32	8	0	Full Compatible
STM32L052R8Tx	LQFP64	64	8	0	Full Compatible
STM32L073RBTx	LQFP64	128	20	0	Full Compatible
STM32L073RZTx	LQFP64	192	20	0	Full Compatible
STM32L072RBTx	LQFP64	128	20	0	Full Compatible
STM32L072RZTx	LQFP64	192	20	0	Full Compatible
STM32L053R6Tx	LQFP64	32	8	0	Full Compatible
STM32L053R8Tx	LQFP64	64	8	0	Full Compatible
STM32L083V8Tx	LQFP100	128	20	9	Need HW change
STM32L083VZTx	LQFP100	192	20	9	Need HW change
STM32L073V8Tx	LQFP100	64	20	9	Need HW change
STM32L073VZTx	LQFP100	128	20	9	Need HW change
STM32L073V8Tx	LQFP100	192	20	9	Need HW change
STM32L083V8Tx	LQFP100	64	20	9	Need HW change
STM32L072V8Tx	LQFP100	64	20	9	Need HW change
STM32F072V8Tx	LQFP100	64	16	9	Need HW change

OK, Import Close

Additional software component selection 9

- 3rd party software packages can be added into repository via “Managed embedded software packages”
- Once added, 3rd party code can be added to STM32CubeMX project
- Feature is based on ARM KEIL CMSIS-Pack standard



Agenda

- Advance code generation options
- Migrating STM32CubeMX project
- **Power Consumption Calculator**

- The Power Consumption Calculator (PCC) uses a database of typical values to estimate power consumption, DMIPS, and battery life of STM32 MCUs.
- GUI tool integrated into the STM32CubeMX.
- Highly configurable scenarios with validity check.
- Battery selector, or define a custom battery.
- Facilitates comparison with other MCUs or other power options.
- Import, export and generate reports.

General PCC configuration panel.

Microcontroller Selected

Series: STM32L1
Line: STM32L151/152
MCU: STM32L151C6Tx
[Datasheet:](#) 17659_Rev11

Parameter Selection

Ambient Temperature (°C): 25
Vdd Power Supply (V): 3.6

Battery Selection

Select Battery

Battery: Not set
Capacity: 0.0 mAh
Self Discharge: 0.0 %/month
Nominal Voltage: 0.0 V
Max Cont Current: 0.0 mA
Max Pulse Current: 0.0 mA

In Series: 1
In Parallel: 1

Information Notes
Help

Sequence

Load Save Delete Compare

Transitions checker
☐ Enabled Show log

Sequence Table

Step	Mode	Vdd	Range/...	Memory	Clock C...	Src Freq	CPU/B...	Periph...	Add. C...	Step C...	Duration	DMIPS	Voltag...
1	RUN	3.6	Range1-...	FLASH	HSEBYP ...	16.0 MHz	32.0 MHz	ADC CO...	0 mA	13.08 mA	0.5 ms	33.0	Battery
2	LOWPO...	3.6	NoRange	FLASH	MSI AHB...	131.0 kHz	131.0 kHz		1 mA	1.05 mA	1 ms	0.13509...	Battery
3	STOP	3.6	NoRange	n/a	LSI RTC	37.0 kHz	0 Hz		0 mA	1.4 µA	3 ms	0.0	Battery
4	WU_FR...	3.6	NoRange	n/a	MSI	65.0 kHz	65.0 kHz		0 mA	1.45 mA	210.0 µs	0.0	Battery
5	RUN	3.6	Range1-...	FLASH	HSEBYP	8.0 MHz	8.0 MHz		0 mA	2.16 mA	3 ms	8.25	Battery

Step

Add Delete Duplicate Up Down Undo Redo

Display

Plot: All Steps Ext. Display

Results Charts

Consumption Profile by Step

Results Summary

Total Sequence Time **8 ms**
Battery Life Estimation **No battery selected !**

Average Consumption **1.86 mA**
Average DMIPS **9.2 DMIPS**

Sequence configuration.

Result overview.

General PCC parameters

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- MCU selection inherited from STM32CubeMX
 - Use the direct link to the datasheet to get more detailed information.
- Parameter selection
 - Temperature and voltage choice may be limited, depending on the selected MCU.
- Battery selection – select typical or define your own
 - Battery is defined by capacity, voltage, self discharge and current limitations.
- Information notes
 - Purpose is to warn about estimation limitations.

The screenshot displays a software interface for configuring PCC parameters. It is organized into five main sections, each with a title bar and a collapse/expand icon:

- Microcontroller Selected:** Displays the selected MCU details: Serie: STM32L1, Line: STM32L151/152, MCU: STM32L151C6Tx, and a link to the Datasheet (17659_Rev11).
- Parameter Selection:** Contains two dropdown menus: Ambient Temperature (°C) set to 25, and Vdd Power Supply (V) set to 3.6.
- Battery Selection:** Features a 'Select Battery' button and a table of battery parameters:

Battery:	Not set
Capacity:	0.0 mAh
Self Discharge:	0.0 %/month
Nominal Voltage:	0.0 V
Max Cont Current:	0.0 mA
Max Pulse Current:	0.0 mA

Below the table are two input fields: 'In Series' and 'In Parallel', both set to 1 with up/down arrows.
- Information Notes:** A section for displaying warnings or notes, currently empty.
- Help:** A section for user assistance, currently empty.

Building a sequence

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- A sequence is a set of ordered steps.

Load existing sequences and adapt them.

Compare sequences, even with different MCUs.

Check automatically if proposed power step transitions are valid.

Create new steps by adding or duplicating existing ones.

Sequence Table

Step	Mode	Vdd	Range/Scale	Memory	Clock Config	Src Freq	CPU/Bus...	Peripherals	Add. Cur...	Step Cur...	Duration	DMIPS	Voltage ...
1	RUN	3.6	Range1-High	FLASH	HSEBYP PLL	16.0 MHz	32.0 MHz		0 mA	9.6 mA	0.5 ms	33.0	Battery
2	LOWPOWER_RUN	3.6	NoRange	FLASH	MSI AHBDIV1	131.0 kHz	131.0 kHz		0 mA	48 µA	1 ms	0.13509375	Battery
3	STOP	3.6	NoRange	n/a	LSI RTC	37.0 kHz	0 Hz		0 mA	1.4 µA	3 ms	0.0	Battery
4	WU_FROM_STOP	3.6	NoRange	n/a	MSI	65.0 kHz	65.0 kHz		0 mA	1.45 mA	210.0 µs	0.0	Battery
5	RUN	3.6	Range1-High	FLASH	HSEBYP	8.0 MHz	8.0 MHz						

Log for current sequence

Results for the current sequence (selected MCU: STM32L151C6Tx)

Check transition between step 1 (RUN, Range1-High) and step 2 (LOWPOWER_RUN, NoRange)
Possible next step(s): RUN [Range1-High, Range2-Medium, Range3-Low]
Possible next step(s): LOWPOWER_RUN [NoRange]
===== Transition allowed !

Check transition between step 2 (LOWPOWER_RUN, NoRange) and step 3 (STOP, NoRange)
Possible next step(s): RUN [Range1-High, Range2-Medium, Range3-Low]
Possible next step(s): LOWPOWER_RUN [NoRange]
Possible next step(s): SLEEP [Range1-High, Range2-Medium, Range3-Low]
Possible next step(s): LOWPOWER_SLEEP [NoRange]
Possible next step(s): STOP [NoRange]
===== Transition allowed !

Check transition between step 3 (STOP, NoRange) and step 4 (RUN, Range1-High)
Possible next step(s): WU_FROM_STOP [NoRange]
===== Transition not possible !

Power consumption step definition 1/2

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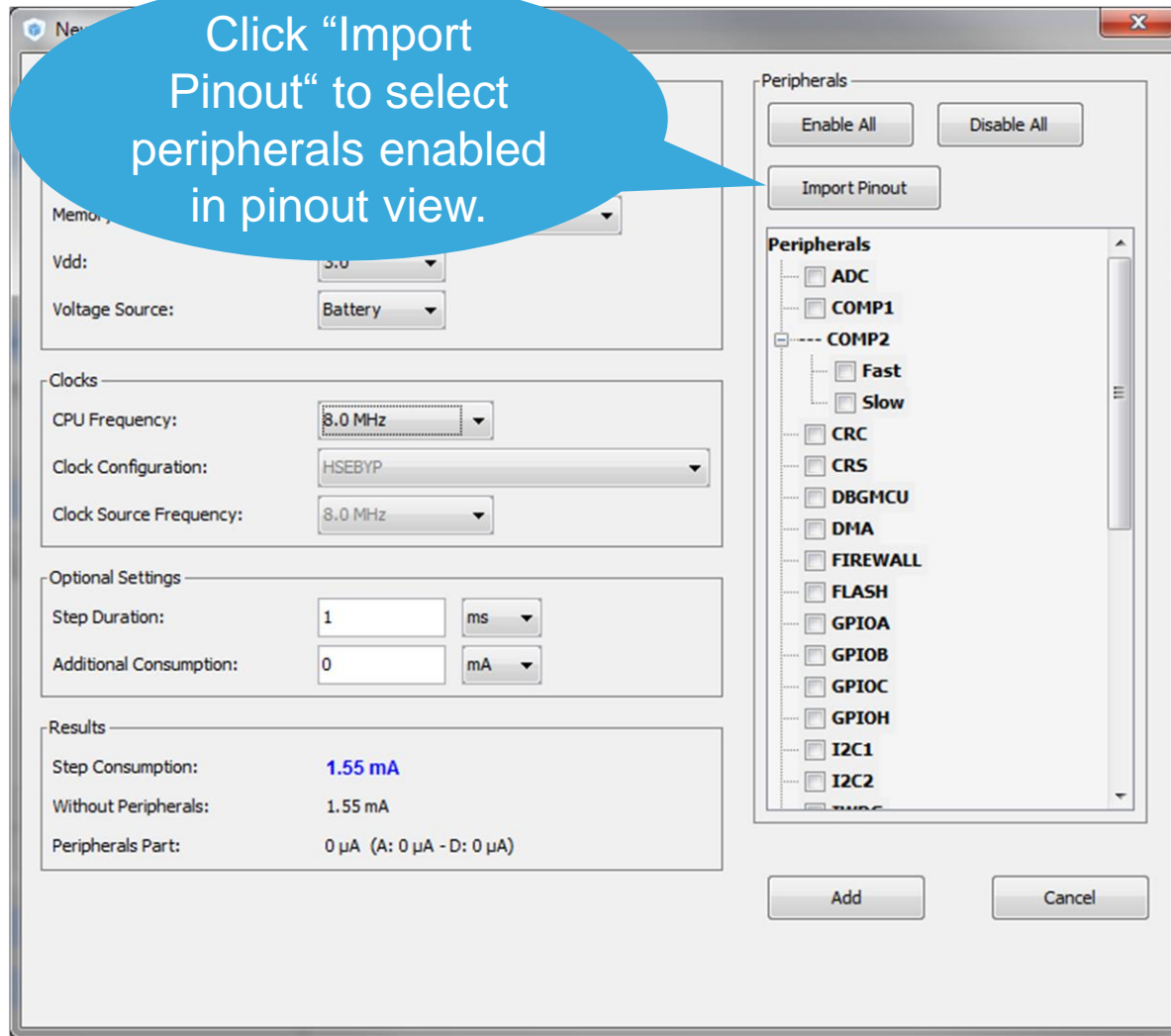
1. Power mode selection determines availability of peripherals.
2. Regulator setting balances performance and consumption.
3. Select the memory from which the code is executed, as well as prefetch and bus options.
4. Vdd – the choice in PCC is limited compared to actual possibilities.
5. This option is present for battery life calculation purposes.

The screenshot shows the 'New Step' dialog box with the following settings:

- Power/Memory:**
 - Power Mode: RUN
 - Power Consumption Range: Range1-High
 - Memory Fetch Type: FLASH
 - Vdd: 3.6
 - Voltage Source: Battery (selected from a dropdown menu showing Battery and Vbus)
- Clocks:**
 - CPU Frequency: --Choose--
 - Clock Configuration: (empty dropdown)
 - Clock Source Frequency: (empty dropdown)
- Optional Settings:**
 - Step Duration: 1 ms
 - Additional Consumption: 0 mA
- Results:**
 - Step Consumption: 0 μ A
 - Without Peripherals: 0 μ A
 - Peripherals Part: 0 μ A (A: 0 μ A - D: 0 μ A)
- Peripherals:**
 - Buttons: Enable All, Disable All, Import Pinout
 - Peripherals List (all checked): ADC, COMP1, COMP2, Fast, Slow, CRC, DAC, DMA, FLASH, GPIOA, GPIOB, GPIOC, GPIOH, I2C1, I2C2, IWDG, PVD/BOR, and others.
 - Buttons: Add, Cancel

Power consumption step definition 2/2

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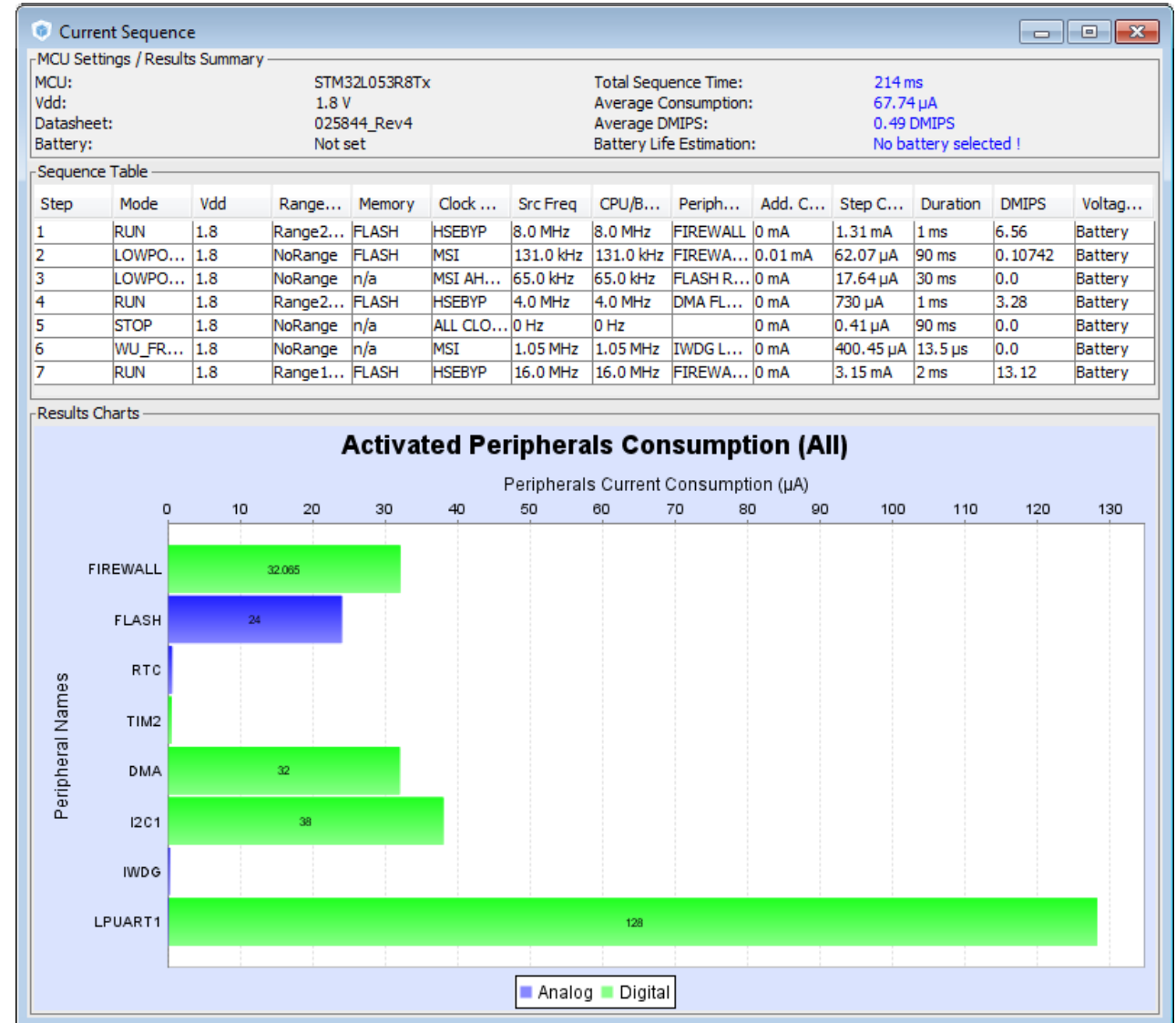


- Clock
 - Frequency choice is limited by power consumption range
 - Available clock configurations depend on available data and other settings
- Peripherals
 - Choose clock gating to peripherals.
 - Import selection from pinout tab.
- Optional settings
 - Additional consumption is represented by estimated pin load

Sequence consumption profile display

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- Possible to detach the charts to external display for presentation purposes
- Several different views selectable
 - Plot current vs time
 - Pie chart
 - Consumption of peripherals



Output and generating report

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2. Power Plugin report

2.1. Microcontroller Selection

Serie	STM32L1
Line	STM32L151/152
MCU	STM32L151C6Tx
Datasheet	17659 Rev11

2.2. Parameter Selection

Temperature	25
Vdd	3.6

2.3. Sequence

Step	STEP1	STEP2	STEP3	STEP4	STEP5
Mode	RUN	LOWPOWER_RUN	STOP	WU_FROM_STOP	RUN
Range	Range1-High	NoRange	NoRange	NoRange	Range1-High
Fetch type	FLASH	FLASH	n/a	n/a	FLASH
Clock Config.	HSEBYP PLL	MSI AHBDIV1	LSI RTC	MSI	HSEBYP
Clock Source Freq.	16.0 MHz	131.0 kHz	37.0 kHz	65.0 kHz	8.0 MHz
CPU Freq.	32.0 MHz	131.0 kHz	0 Hz	65.0 kHz	8.0 MHz
Periph.	ADC COMP1 DAC DMA GPIOA GPIOH IWDG RTC				

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- An optional step is to generate a PDF report.
- The PDF report is also available without PCC.
- Complete project includes these files :
 - Project.ioc
 - Project.pcs
 - Project.pdf
 - Project.txt
 - Project.jpg
 - ... and the generated project for a supported development environment.