

Discover the STM32 with a free 32-bit Cortex-M0/0+ MCU Professional Developer's Package



Are You Ready To Upgrade 8/16-bit MCU Designs?

2

- The STM32F0 & STM32L0 Series Are Your Answer!
 - Modern 32-bit architecture with full support of STM32 and ARM Cortex-M Ecosystems
 - Free Professional Development Tools (STM32CubeMX + Keil MDK-ARM*)
 - STM32F0 portfolio well suited for a wide range of applications
 - Including Industrial, Motor Control, Home Automation/Security, Lighting, Peripherals and many more
 - Ultra-Low-Power STM32L0 ideal for battery powered or energy harvesting applications
 - No risk with STM32 10 year longevity commitment
 - Offers 32-bit performance at an 8-bit price point





STM32 Portfolio

3



1.5 billion STM32 embedding your innovations

High-performance

398 CoreMark
120 MHz
150 DMIPS



STM32 F2

608 CoreMark
180 MHz
225 DMIPS



STM32 F4

1 082 CoreMark
216 MHz
462 DMIPS



STM32 F7

Mainstream

106 CoreMark
48 MHz
38 DMIPS



STM32 F0

177 CoreMark
72 MHz
61 DMIPS



STM32 F1

245 CoreMark*
72 MHz
90 DMIPS
(*) from CCM-SRAM



STM32 F3

1 082 CoreMark
216 MHz
462 DMIPS



Ultra-low-power

75 CoreMark
32 MHz
26 DMIPS



STM32 LO

93 CoreMark
32 MHz
33 DMIPS



STM32 L1

273 CoreMark
80 MHz
100 DMIPS



STM32 L4

Cortex-M0
Cortex-M0+

Cortex-M3

Cortex-M4

Cortex-M7



Ultra low power modes

4

Best power consumption numbers with full flexibility



STM32L0 – WORLD CHAMPION AT HIGH-TEMPERATURE (125°C)

Typical Current at 125°C

25°C

STANDBY

1.35µA
230nA

STOP MODE

5.5µA*
340nA

LP SLEEP FLASH OFF - 32Khz

10µA
3.6µA

LP SLEEP FLASH ON - 32Khz

22.5µA
14.5µA

LP RUN FROM FLASH - 32Khz

28µA
18.5µA

SLEEP FLASH ON - FULL SPEED 32Mhz

47µA/Mhz
37µA/Mhz

RUN FROM FLASH - FULL SPEED 32Mhz

166µA/Mhz
139µA/Mhz



FAST WAKE UP

Stop to Run : 3.5µs
Standby to Run: 50µs

ULPBENCH SCORE

ULPBENCH™
An EEMBC Benchmark
135

*with RTC ON

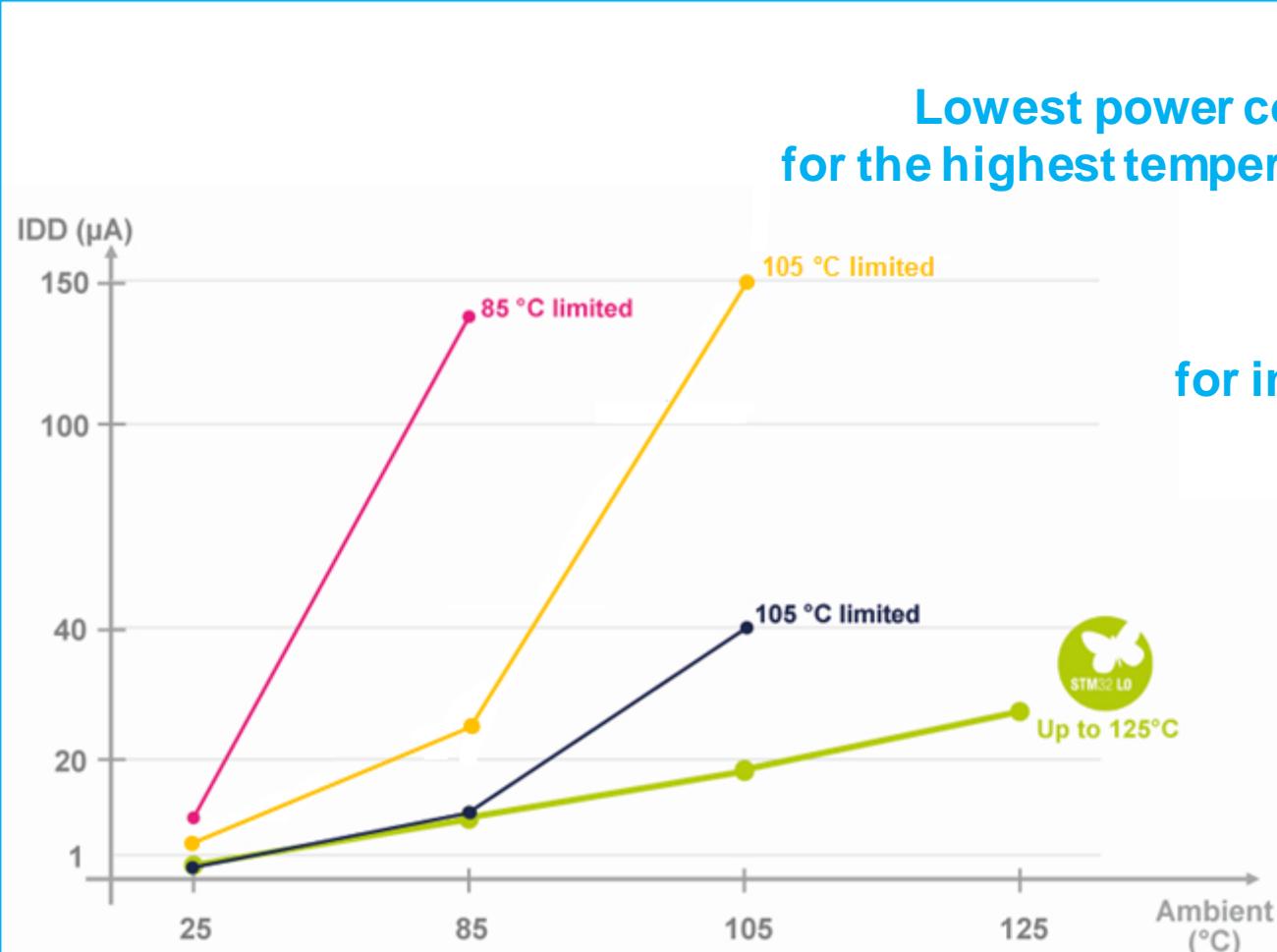


Champion whatever the Conditions

Industry leader at 125°C

5

Max. current value at lowest power mode vs. temperature capability



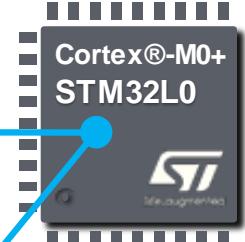
Lowest power consumption
for the highest temperature range

Premium choice
for industrial application

STM32L0 platform offers the
capability to control
leakage current

- STM32L0
- Competitor A
- Competitor F
- Competitor R

Note: Value based on competition datasheet, looking at lowest power mode with full RAM retention at VDD 3.0V.
All datasheet give same value for -40°C/+25°C temperature range.



Rich Analog features

**ADC: Lowest current consuming in the industry**

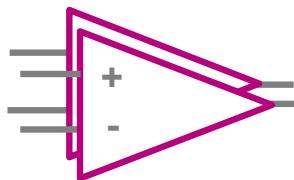
48uA at 100KSPS

Down to 1.65V

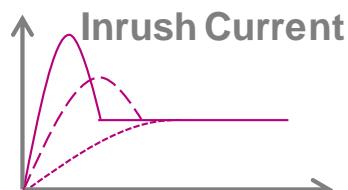
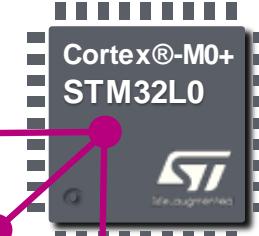
16-bit resolution capable

**2x built in Comparator**

Stop mode wake up capable

**Adaptive Inrush current**

Control current

 Reduce Consumption Decrease BOM cost Maximize battery life**Get STM32L0 innovation
into your application**

Gas/Water meter

Blood pressure
Glucose meter



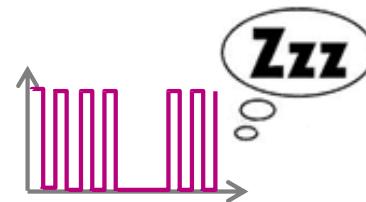
Smart Architecture

7

Digital features

Ultra Low Power TIMER

16-bit counter available in stop



Ultra Low Power UART

Communication available in stop mode

USB 2.0 FS Certified

Crystal-less /BCD¹



Built in LCD driver

Up to 8x48



Wide range of operation

1.71V to 3.6V @32MHz operation

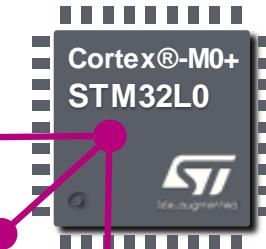


No compromise on CPU speed

Reduce Consumption

Decrease BOM cost

Maximize battery life



*Get STM32L0 innovation
into your application*



IoT/USB connected object

1. Battery Charger Detection

Large memory size, Full Security and features in small packages



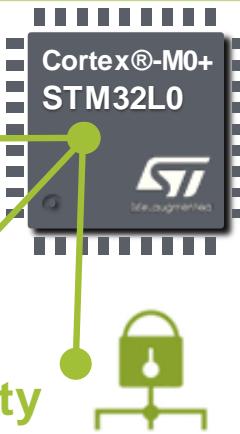
Large Memory size

Extended peripherals

Full Security and Safety

Package size down to 2x2mm

- Hardware encryption - AES
- Sector Flash Protection
- Full Flash Protection
- Unique ID (96-bit)
- Built-in ECC
- True RNG²
- Class B





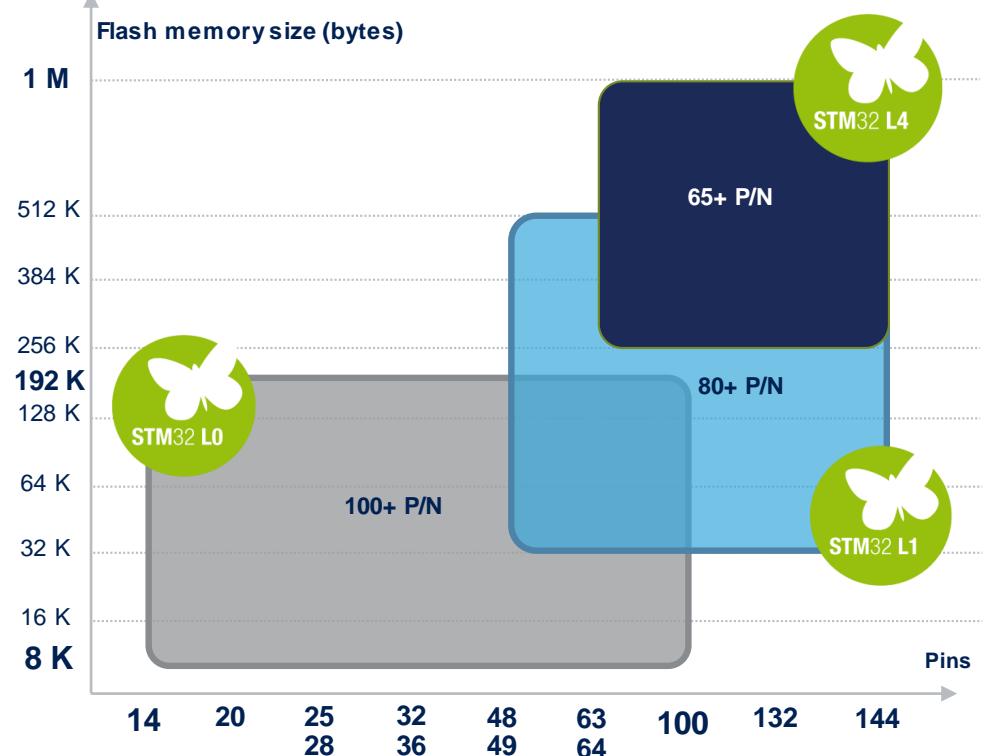
Make the Switch from 8-bit

9

STM32L0 is stretching the ultra-low-power portfolio

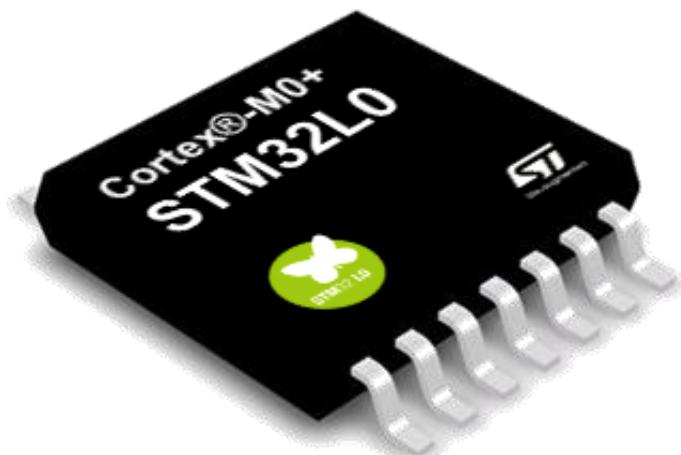
\$

STM32 tailored to your needs



*Designed to
Conserve your energy*

New comer into
STM32 Portfolio

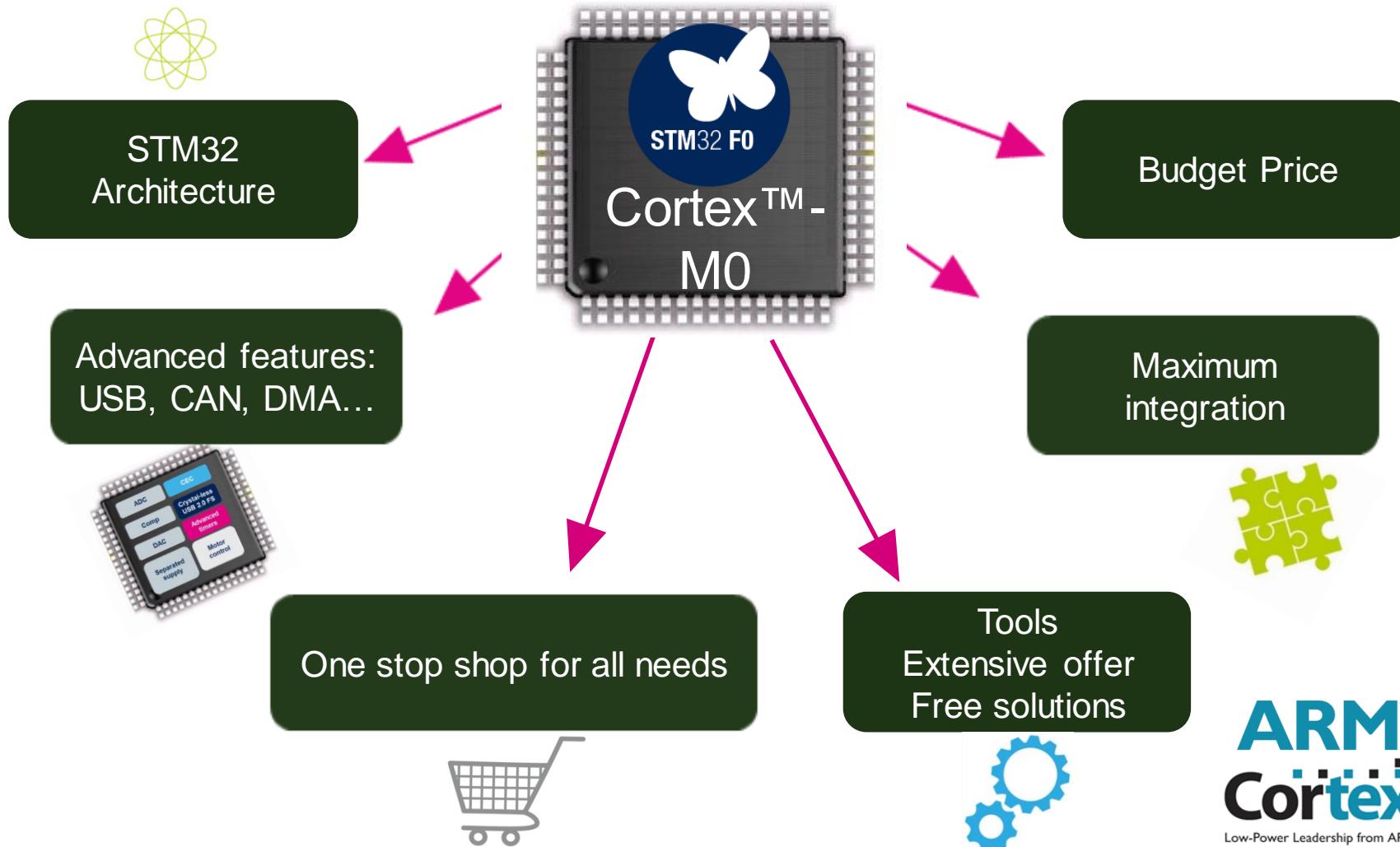


TSSOP14



STM32F0 at a Glance

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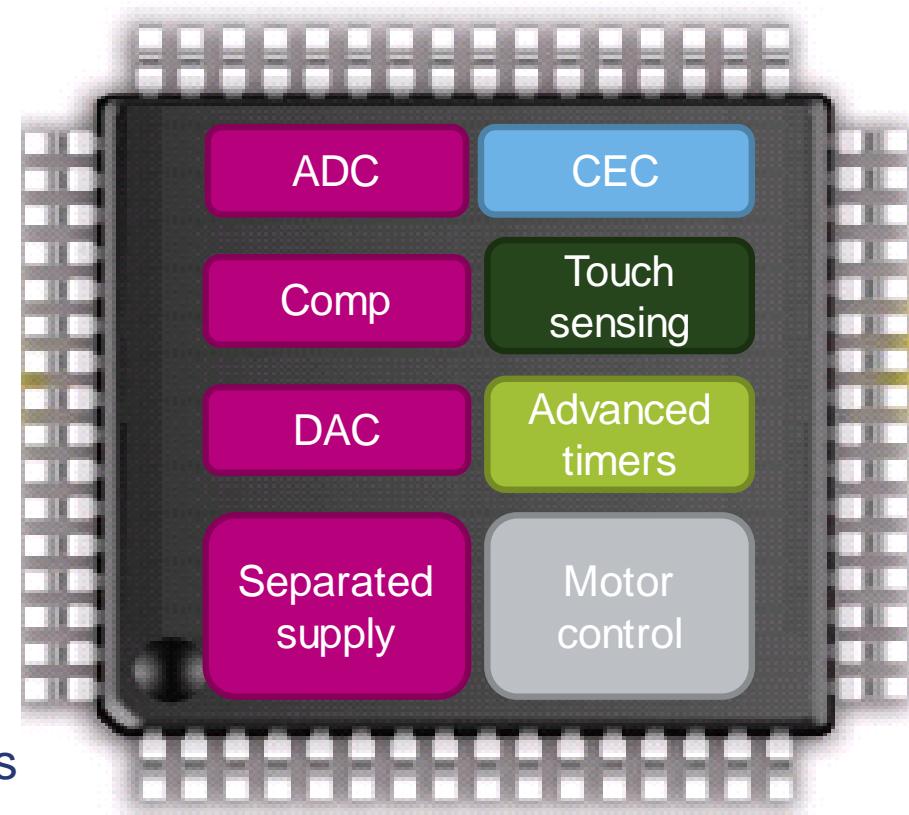


**ARM®
Cortex®**
Low-Power Leadership from ARM

Innovative Peripherals

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- Analog
 - 12 bit ADC with 1MSPS
 - 12 bit DAC
 - 2x Comparators
 - Separate supply for improved accuracy
- HDMI Consumer Electronics Control (CEC)
- Touch-sensing
 - Up to 18 keys
 - Key, slider and wheel
- Advanced timers
 - 32-bit and 16-bit PWM timers with 17 capture/compare input/outputs mapped on up to 28 pins
- Motor control
 - Permanent Magnet Synchronous Motors (PMSM)



Maximum Integration

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Meets industry safety specifications

- **Class B-ready** for appliance
- Hardware **RAM** parity check
- **Clock Security System (CSS)** for switching to back-up internal RC in case of external clock failure
- **2x Watchdogs (2x WDG)** capable of real-time code execution monitoring and ensuring the application integrity independently from system clock
- **Cyclic Redundancy Check (CRC)** with DMA support for embedded Flash-memory content-integrity checking



USB peripheral

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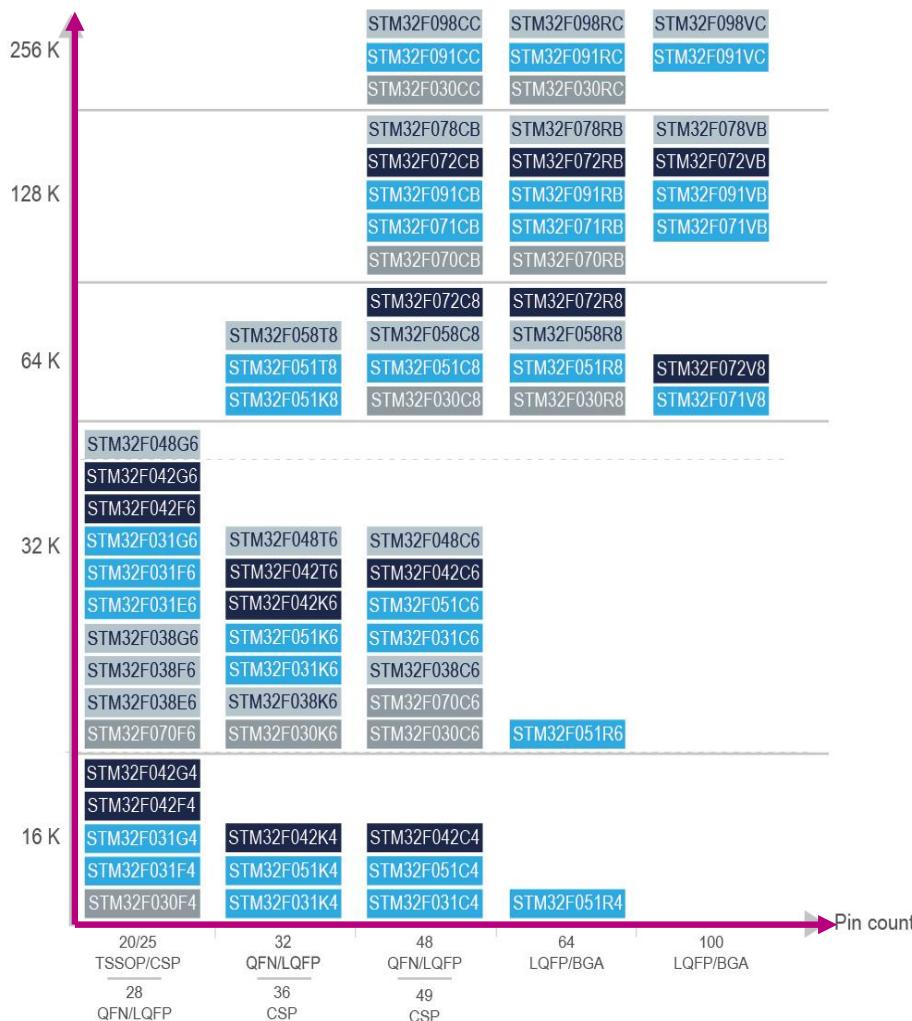
- Crystal-less* USB 2.0 FS interface (12Mbit/s) with D+/D- resistors
 - * Integrated on-chip 48 MHz oscillator with clock recovery system. No external resonator/ crystal needed (cost saving is in range of 0.10\$).
- Complies with Link Power Management feature (LPM) and Battery Charger Detection (BCD) specification 1.2
- USB FS Device Library with intuitive USB device class drivers API
 - Examples and demo based on a set of 6 classes (Audio, CCID, CDC, HID, VCP, MSC).
 - Easy development of applications using USB full speed transfer types (control, interrupt, bulk and isochronous).
- Device Firmware Upgrade on the field over USB (boot loader)

STM32F091

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STM32F0 portfolio



- ARM Cortex-M0 at 48 MHz – 38 DMIPS
- From 16 to 256 Kbytes of Flash memory
- Entry-level, cost-sensitive:



Hardware Development Tools

Development Tools adapted to your needs



STM32 Nucleo
Fast agile prototyping

\$10



Discovery Kits
Feature highlight, prototyping

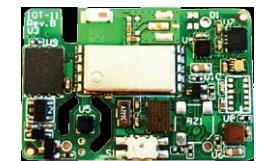
\$10 - \$25



Evaluation Boards
Full feature evaluation

\$250 - \$450

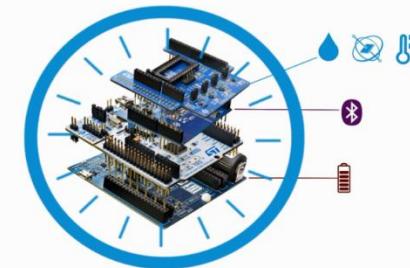
3rd Parties



Specialized
functionality
add-on



Connectivity, Sensors...



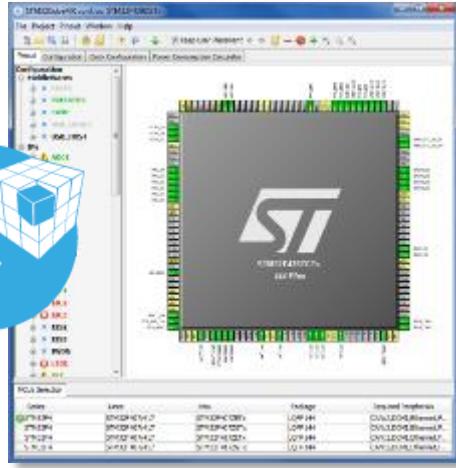
Full evaluation, Open hardware,
Optimization, Expansions, ...

Software Development Tools

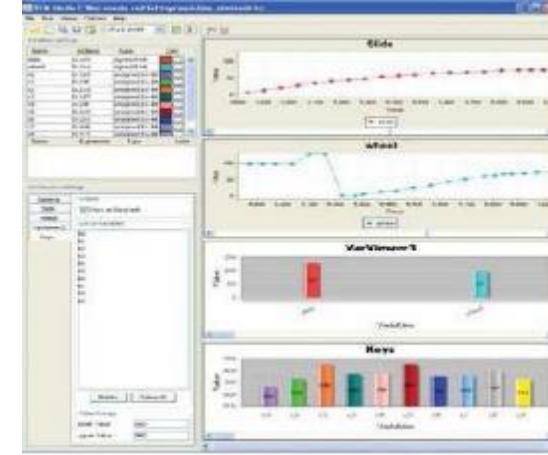
17

C/C++ Focus

A complete flow, from configuration up to monitoring



STM32CubeMX
Configure & Generate Code



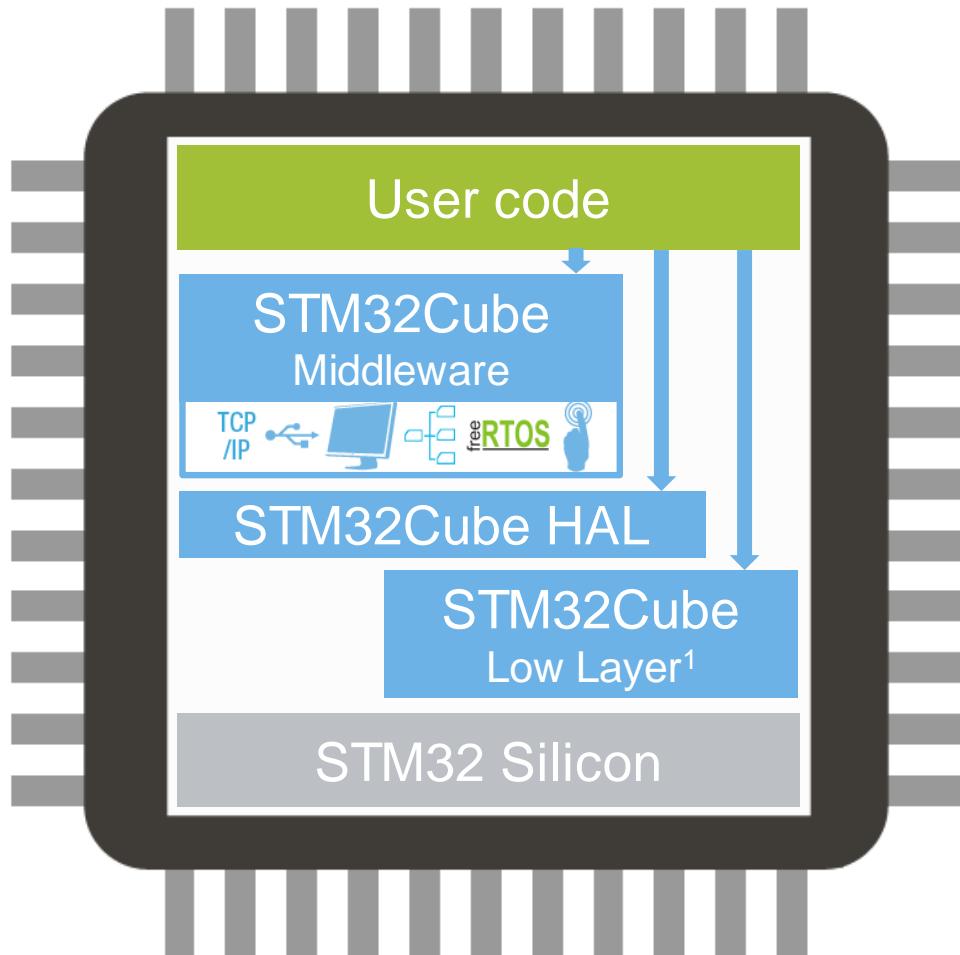
STMStudio
Monitor



STM32Cube Software

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STM32Cube Embedded Software – Even more choices for the developer



Three entry points for the user application

- **Middleware stacks**
TCP/IP (LwIP), USB H&D, Graphics (emWin), File System (FatFS), RTOS (FreeRTOS), Touch sensing
- **Hardware Abstraction Layer (HAL)**
- **Low Layer (LL)¹**
A new optimized layer

Information and Sharing

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Get connected to STM32 users !

ST.COM



ST MCU Finder



Various social media

[ST Forums on microcontrollers](#)
[Facebook.com/stm32](#)
[YouTube.com/STonlineMedia](#)
[Twitter.com/@ST_World](#)
[Mbed.org](#)



Information

MCU Selection

Communities and Social Media

- + Local trainings / Technical Support
- + Local Sales forces / Distributors

STM32 10 Year Longevity Commitment

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Part Number/ Keyword Cross Reference

Home Products Applications Support Sample & Buy About Contact My ST Login

Parametric Search

[Home](#) > [Resources](#) > [Product Longevity](#)

Product Longevity

Design Support Calculators
eDesignSuite
eCAD Models and Symbols
Flyers and Brochures
Presentations
Product Longevity
Technical Literature



Longevity Commitment

STMicroelectronics provides a minimum longevity commitment of 10 years for a set of products listed below.

STM32 and STM8 MCU

For STM32 ARM® Cortex®-M and STM8 microcontrollers the 10 years longevity commitment starts from the following dates:

- STM32F0 Series, starting January 1st 2016
- STM32F1 Series, starting January 1st 2016
- STM32F2 Series, starting January 1st 2016
- STM32F3 Series, starting January 1st 2016
- STM32F4 Series, starting January 1st 2016
- STM32F7 Series, starting January 1st 2016
- STM32L0 Series, starting January 1st 2016
- STM32L1 Series, starting January 1st 2016
- STM32L4 Series, starting January 1st 2016
- STM8AF Series, starting January 1st 2016
- STM8AL Series, starting January 1st 2016
- STM8L Series, starting January 1st 2016
- STM8S Series, starting January 1st 2016

Seminars

10 Nov STM32L4 hands-on workshop
25 Jan RFID / NFC Online course
08 Feb STM32F7 online course with hands-on exercises

Featured Videos

All

Bluetooth controlled robot made with NUCLEO-F072RB

STM32F7 The accelerated mechanisms of a smart architecture

Stepper motor basics

Introduction to the STM32 Open Development Environment

FDA4100LV and FDA450LV class D automotive audio amplifiers



life.augmented



Get Started In 3 Easy Steps!

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Download and activate Keil's free
MDK-ARM **professional IDE***



Download and install
STM32CubeMX and the
STM32CubeF0 / STM32CubeL0
embedded software packages



Purchase a Nucleo board or
Discovery kit for STM32F0 or
STM32L0 MCUs



Getting Started with the STM32 Developer's Package



Software Installation Guide

Requirements :

- Free Keil MDK for STM32F0/L0
- STM32CubeMx
- STM32 ST-LINK Utility

*** Run as Administrator to install the Software Packages on your PC**

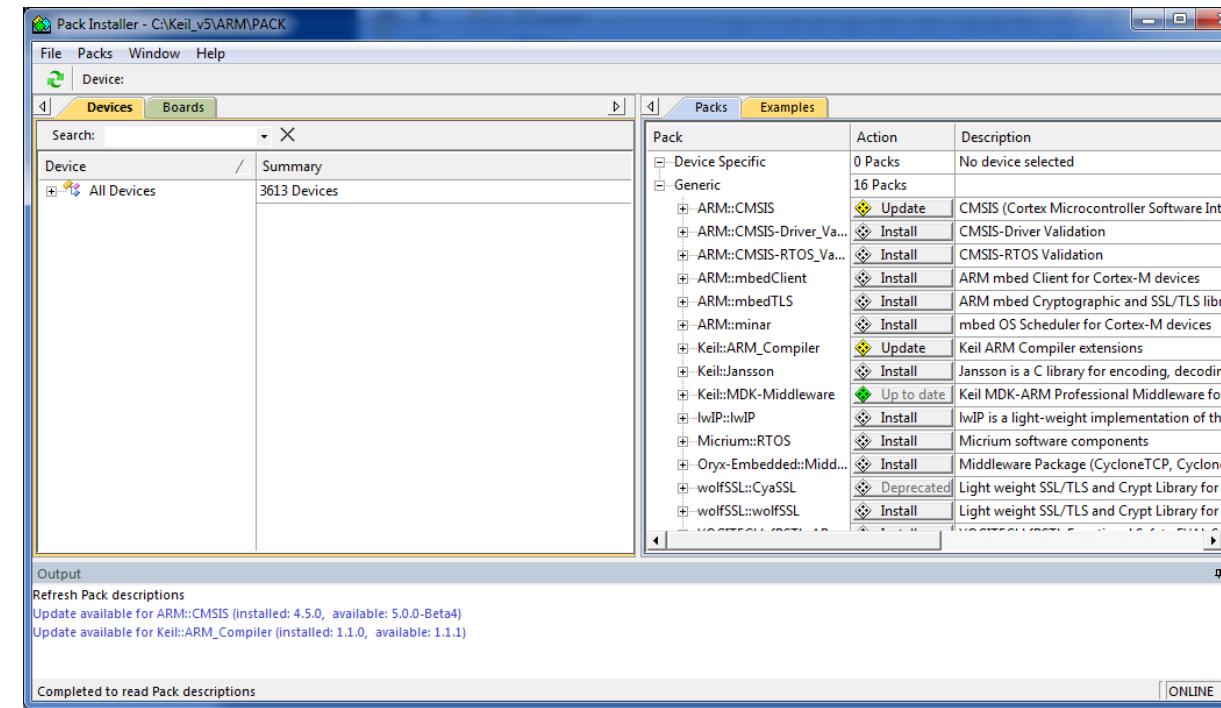




Free Keil MDK for STM32F0/L0 Installation

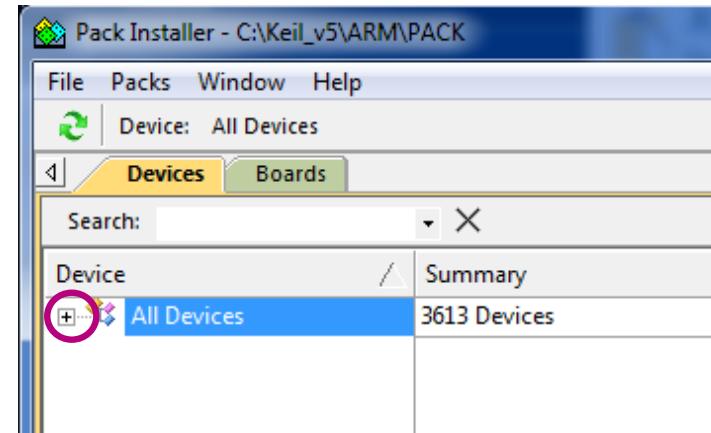
Keil MDK Installation

1. Register and Download the Keil MDK-ARM v5.xx from the Keil web page.
 - <http://www2.keil.com/stmicroelectronics-stm32/mdk>
2. Run the MDK5xx.exe installer.
3. After the installation, the Pack Installer window will open.

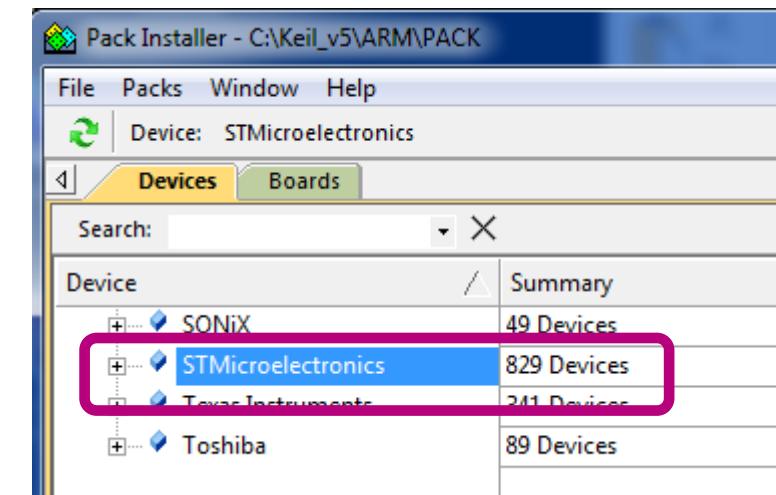


Keil MDK Installation

4. Click and Expand the “All Devices” in the Devices tab.

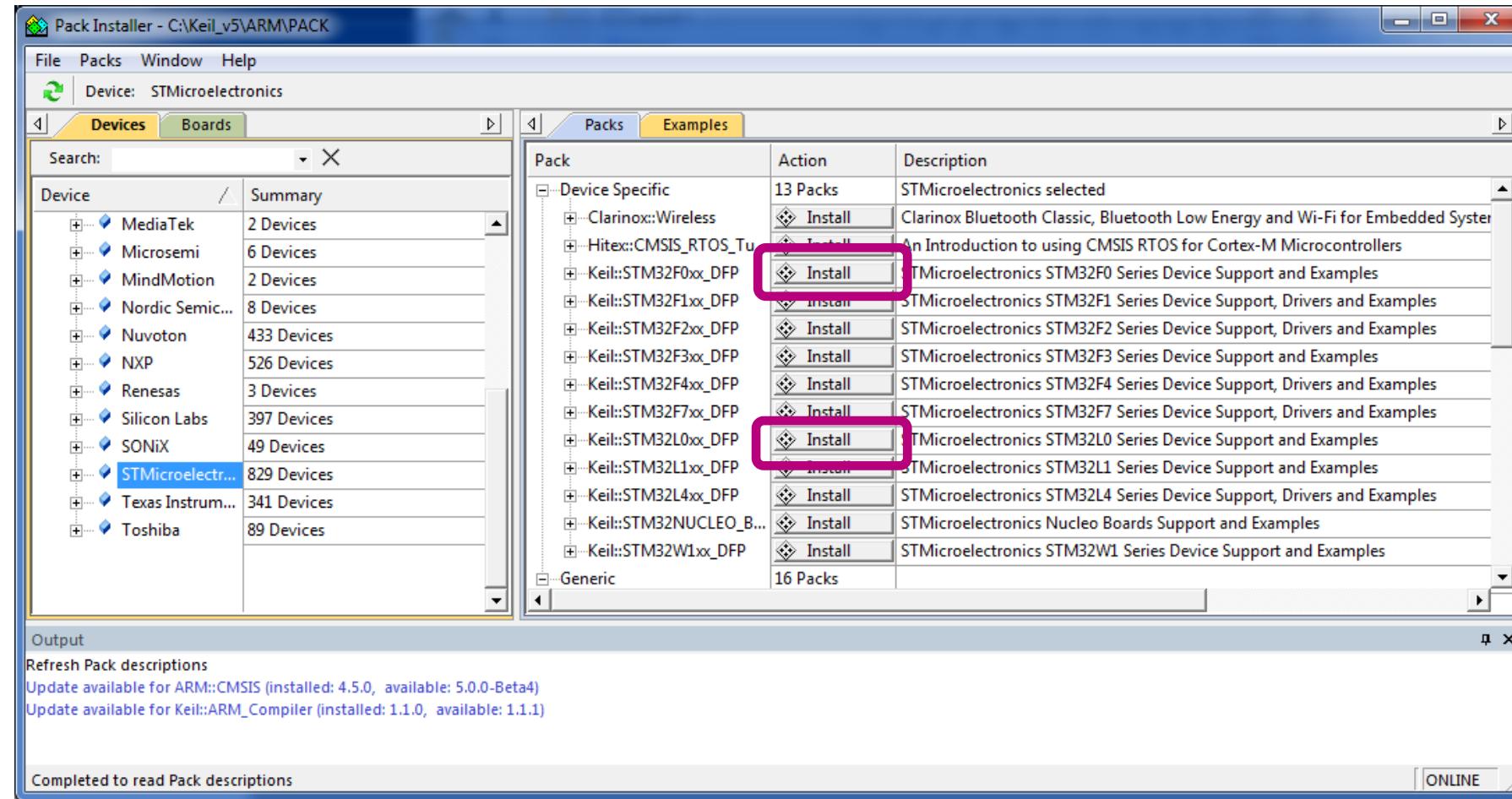


5. Locate and Click on “STMicroelectronics” in the list.



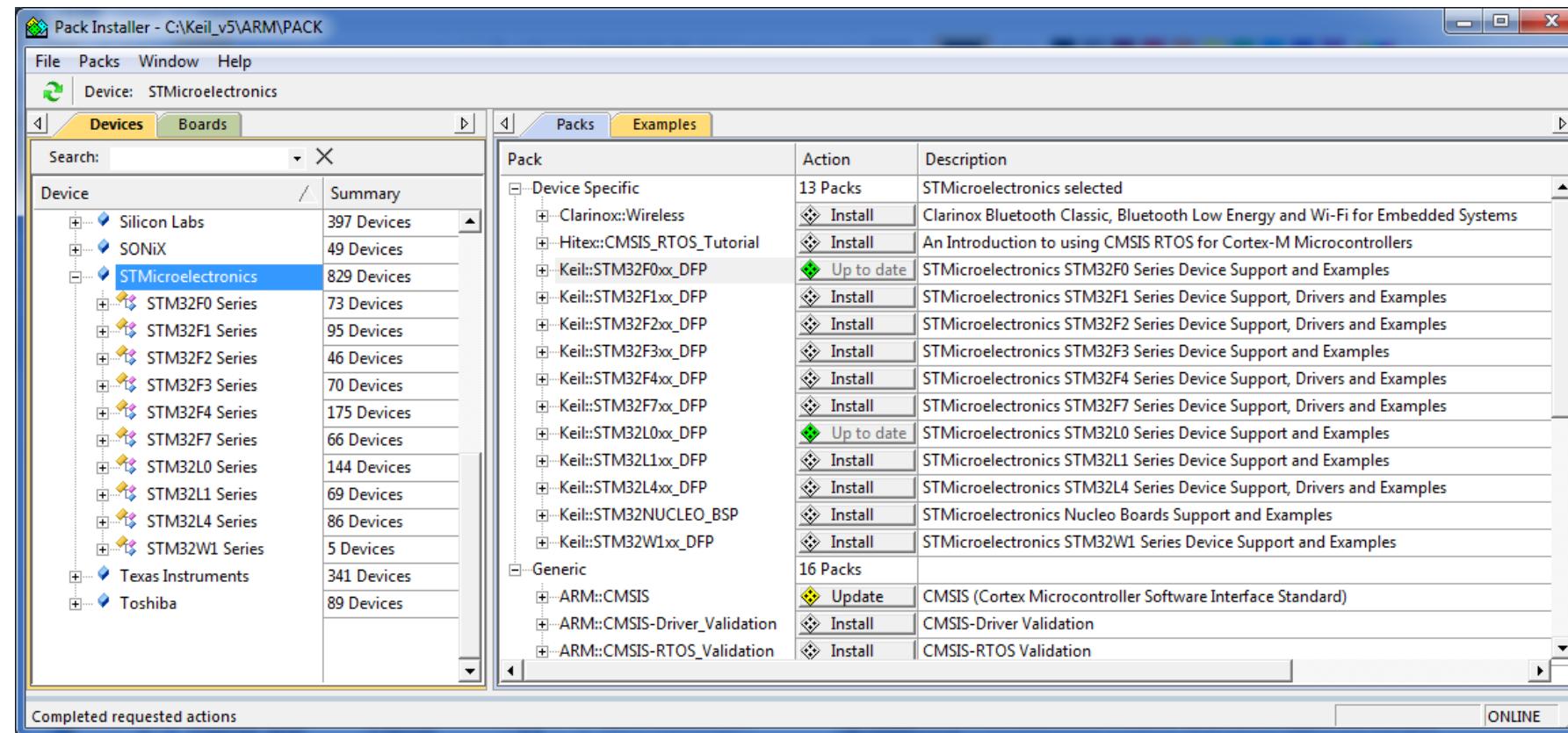
Keil MDK Installation

6. Click the “Install” buttons to load the family packs for the STM32F0 and STM32L0 series.



Keil MDK Installation

- After the STM32F0 and STM32L0 family packs are installed, Close the Pack Installer.

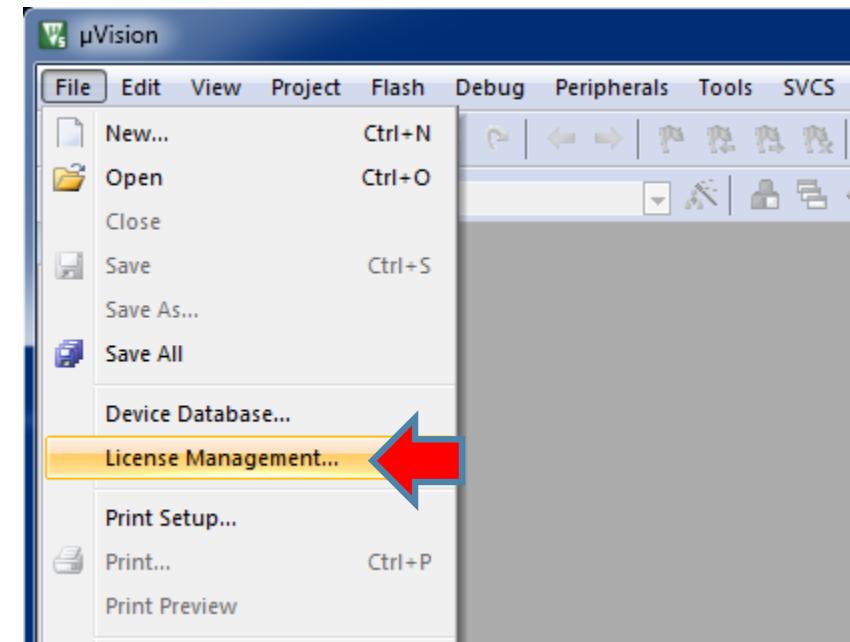


Free Keil MDK - Activation

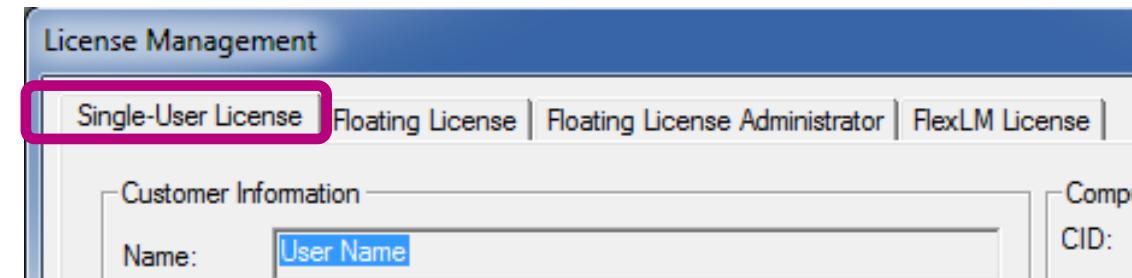
1. Click on the icon to start the Keil uVision5.



2. From the Menu, Open File > License Management...



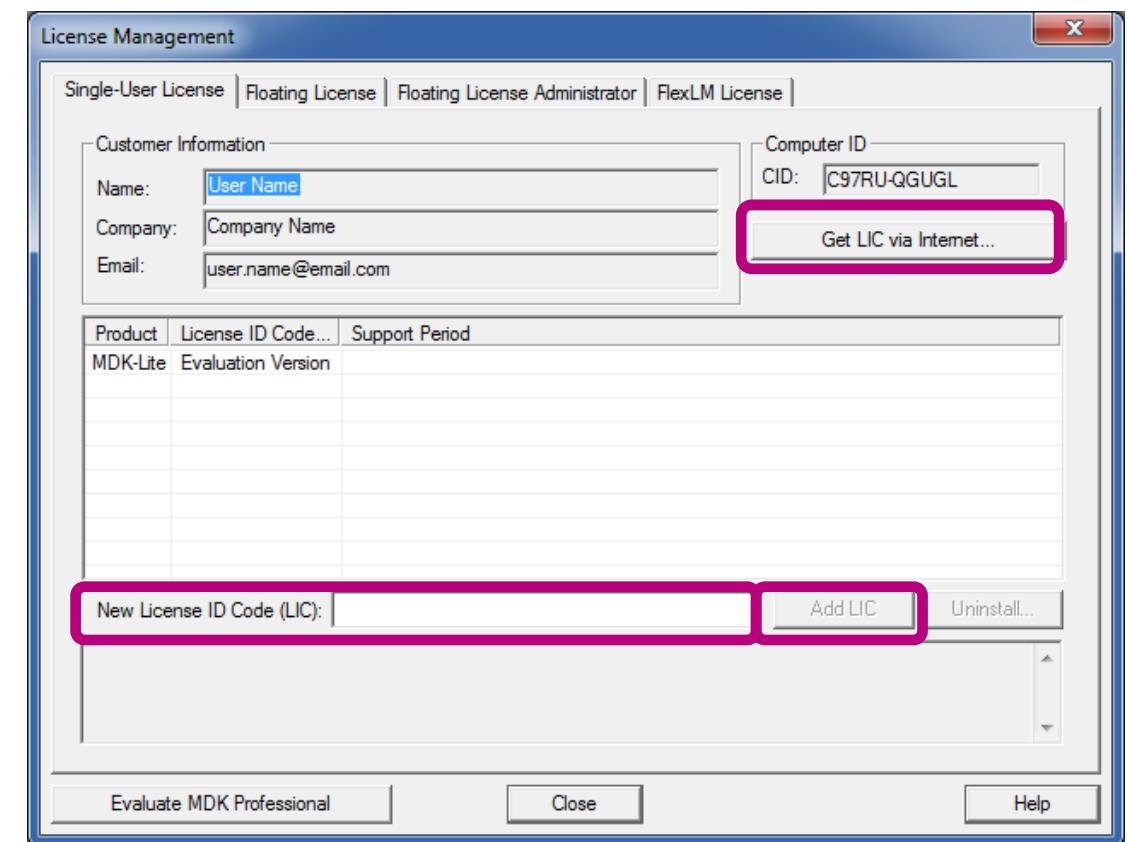
3. Select the Single-User License tab.

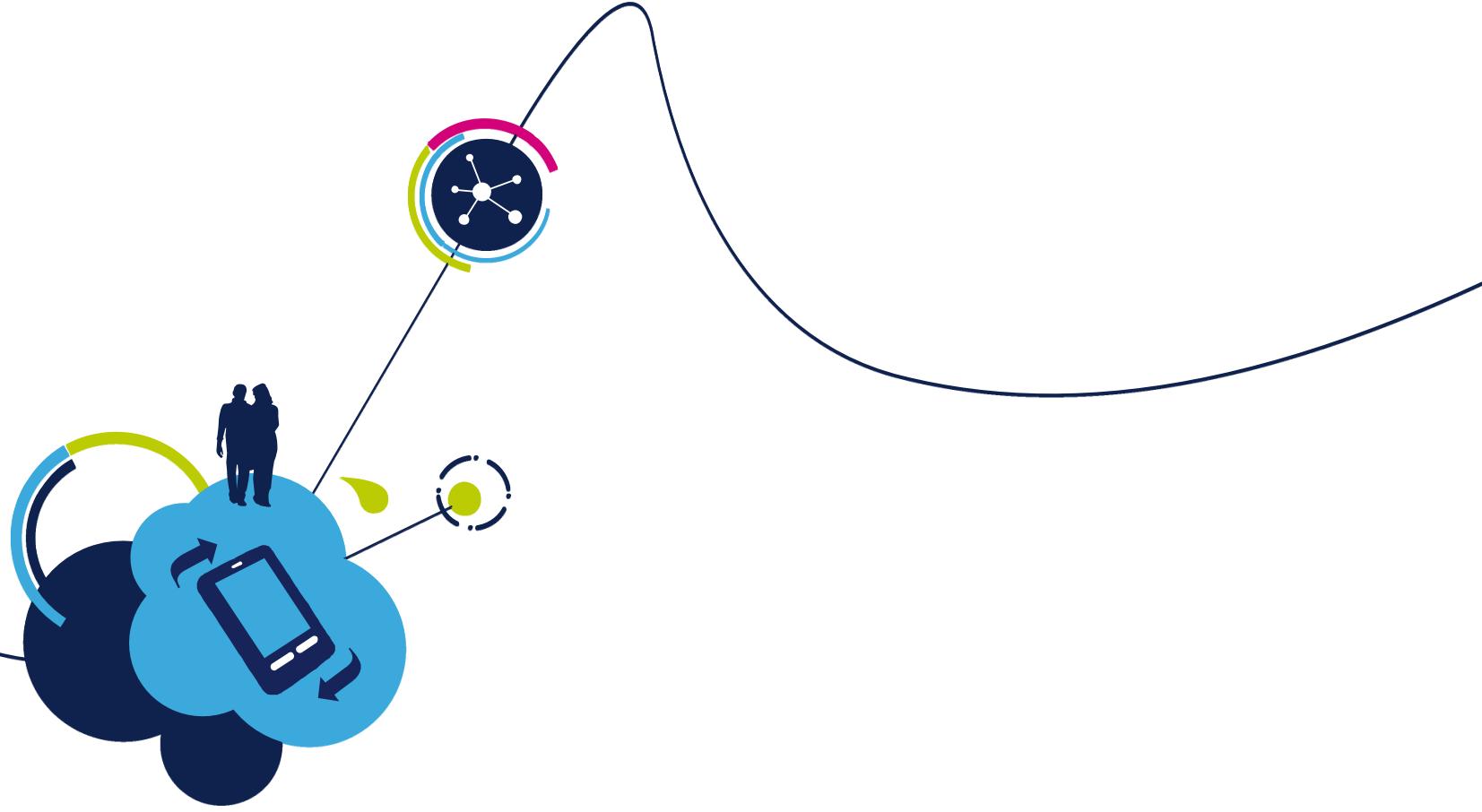


Free Keil MDK - Activation

3. Click the button **Get LIC via Internet (STEP 1)**. This action opens the License Management page on the Keil web site where you will enter the **PSN: U1E21-CM9GY-L3G4L** along with your contact information and click the button **Submit**.
 - An e-mail will be sent to you with the **License ID Code(LIC)**.

4. To activate the Software Product, copy the **LIC** from the email and paste it into the **New License ID Code (LIC) (STEP 2)** field of the “License Management...” dialog.
 - Click **Add LIC (STEP 3)**.





STM32CubeMX Installation

STM32CubeMX Installation

1. Download STM32CubeMX installer from www.st.com/stm32cube.

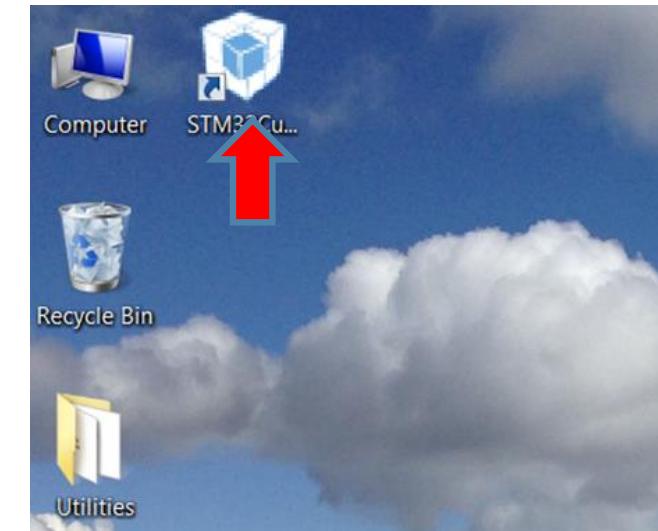
Part Number	Software Version	Marketing Status	Supplier	Order from ST
STM32CubeMX	4.15.1	Active	ST	Get Software

2. Unzip the file and run the SetupSTM32CubeMX-4.x.x.exe installer

- Java Run Time Environment 1.7 (version 1.7.0_45 or newer) is required. STM32Cube Installer will prompt user if Java download is required.

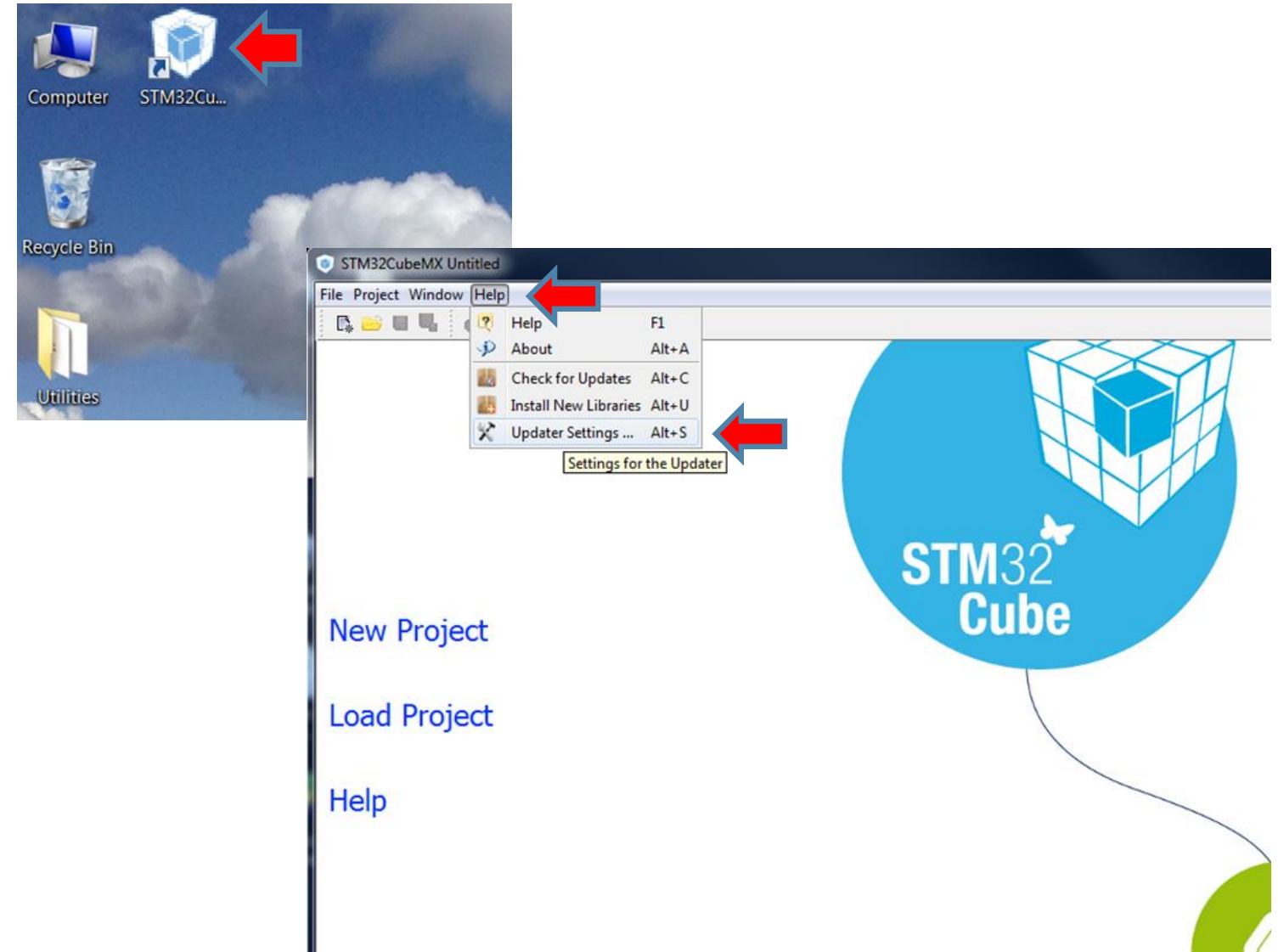
3. To complete the CubeMX installation you maybe prompted to restart your computer.

*After successful installation you will see a shortcut to the STM32CubeMX on your Desktop.



Proxy Server configuration (1 of 2)

- Start the STM32CubeMx



Proxy Server configuration (2 of 2)

- Select the “Connection Parameters” tab

- Configure your internet access

- Proxy Server Type

- No Proxy
 - Use System Proxy Parameters
 - Manual Configuration

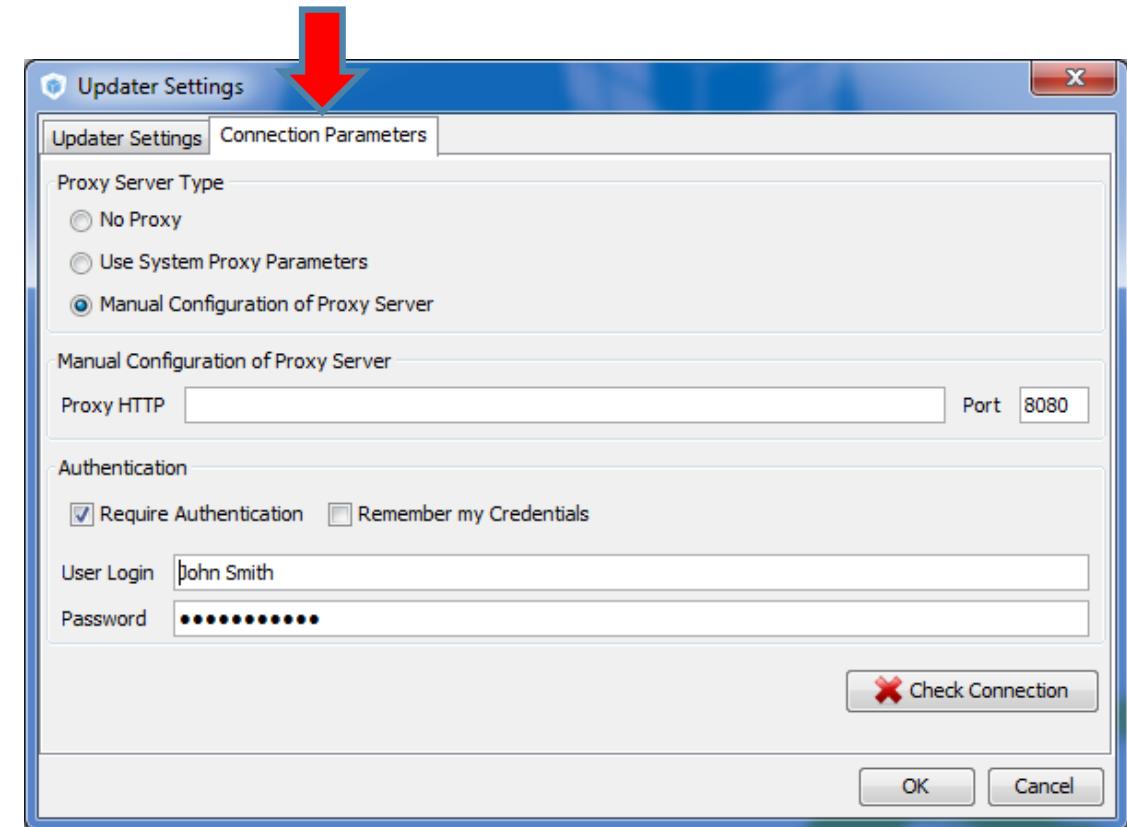
- Manual Configuration of proxy server

- Contact your IT administrator for proxy type, HTTP address, and Port.

- Confirm Internet Connection

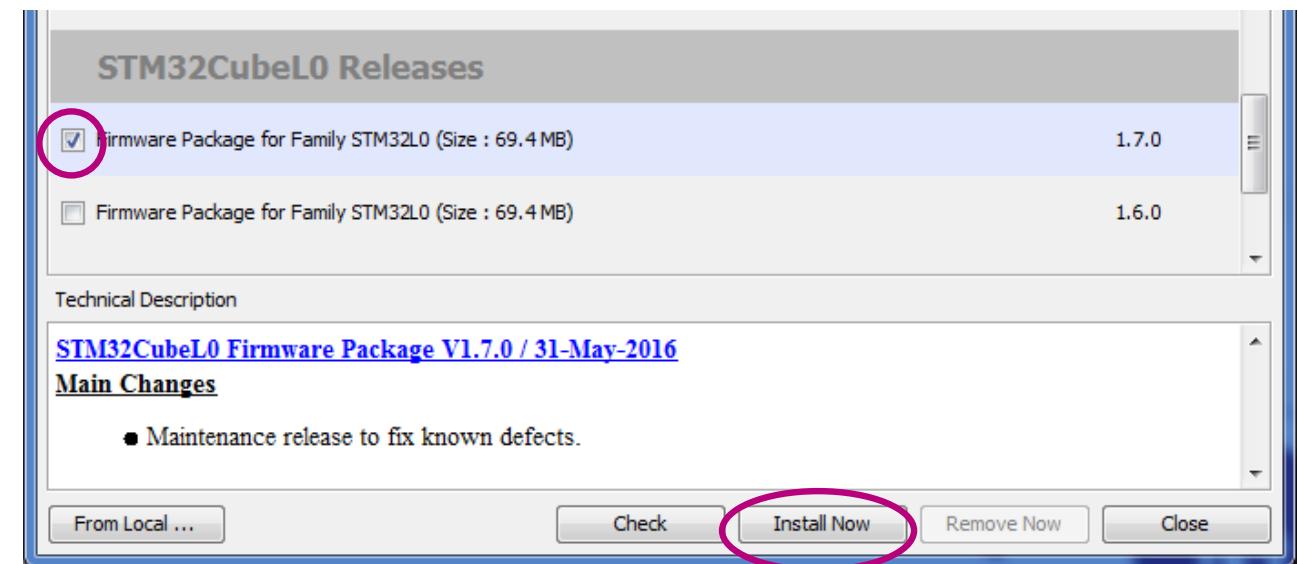
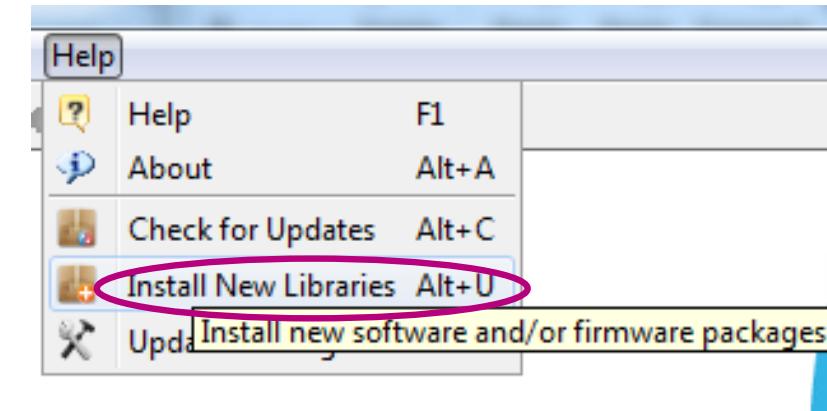
- Click on “Check Connection”

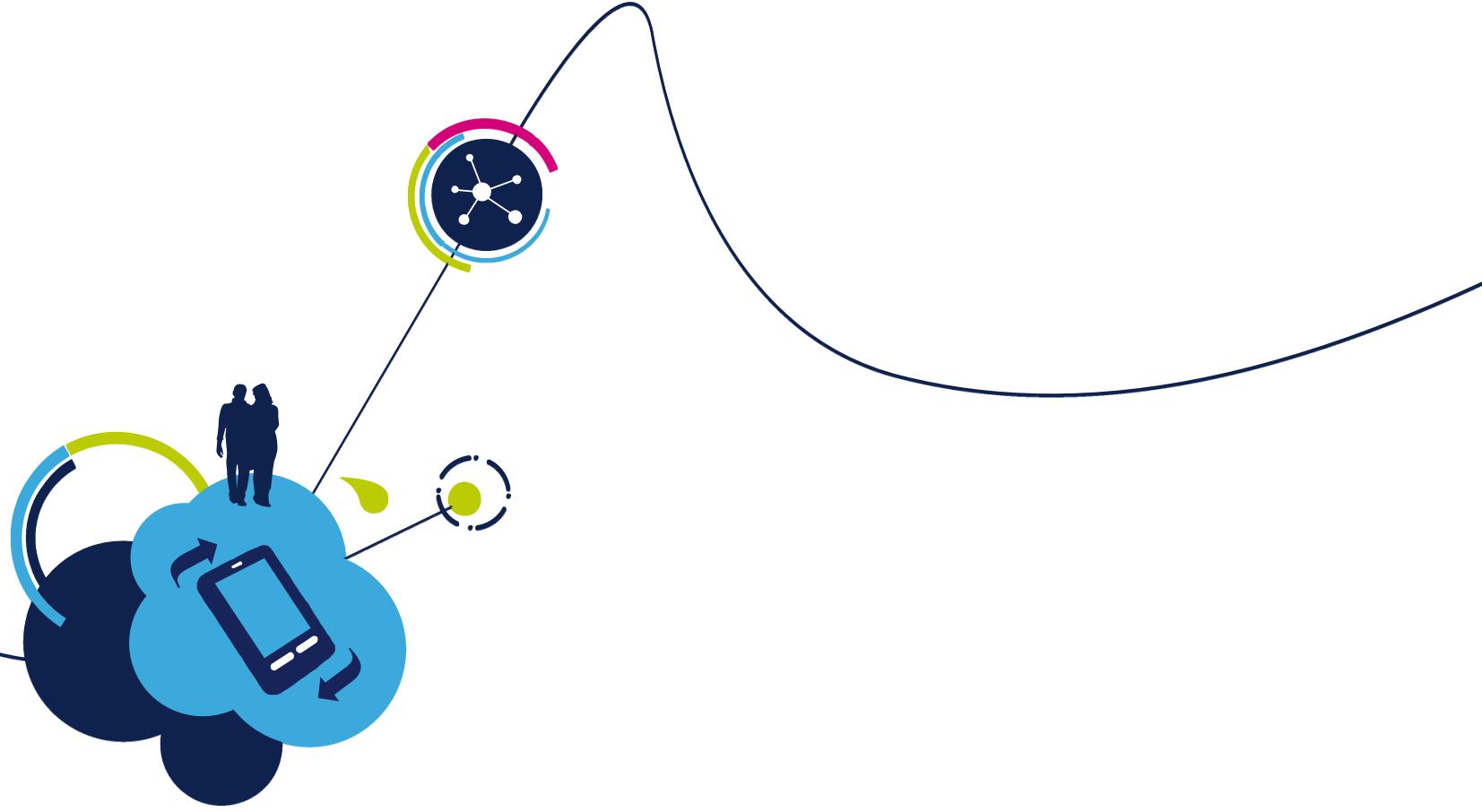
- Green CHECK Mark



STM32Cube Library Package Installation

- Select “**Install New Libraries**” from the **Help** menu
- Click “**Checkbox**” to install packages
 - STM32CubeL0 package (ver. 1.7.0 or higher)
- Release notes are displayed at the bottom.
- Click on “**Install Now**”





ST-Link Utility Installation

ST-Link Utility and Driver Installation

The ST-Link Utility allows typical flash program / erase / upload / download functions through the ST-LINK/V2 debugger.

- ❑ Embedded on the STM32F072 Discovery Board.
- ❑ Installs the Windows device drivers necessary for the ST-LINK/V2 debugger.

ST-Link Utility and Driver Installation

1. Download ST-Link Utility installer from,

http://www.st.com/content/st_com/en/products/embedded-software/development-tool-software/stsw-link004.html

Part Number	Software Version	Marketing Status	Supplier	Order from ST
STSW-LINK004	3.9.0	Active	ST	Get Software



2. Extract and Run the STM32 ST-LINK Utility_v3.x.x.exe installer.

After successful installation you will see the STM32 ST-Link Icon on your Desktop.



STM32Cube: Getting Started

- Blinking LED with the STM32L0 Discovery



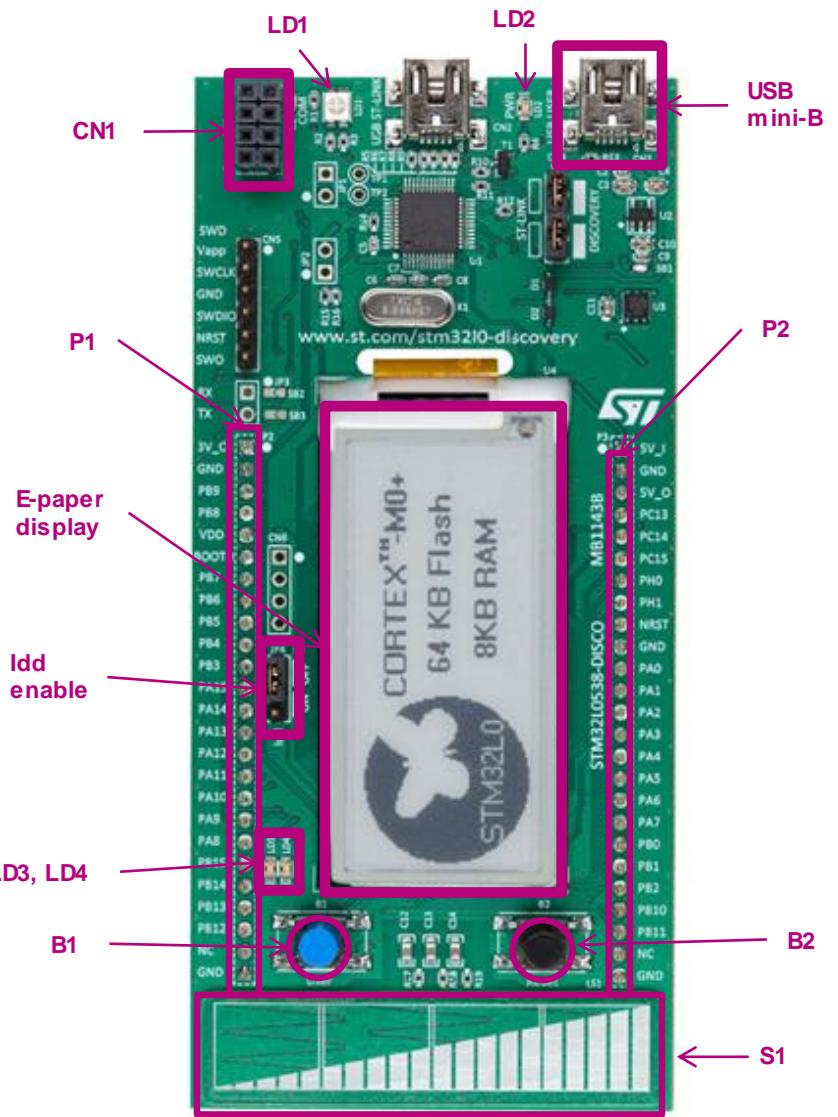
Embedded ST-Link and Target MCU

- ST-LINK/V2 programming and debugging tool integrated on-board the kit (STM32F103CBT6)
- Features
 - USB Connector (**CN2**)
 - ST-LINK MCU
 - 5 to 3V Voltage regulator
 - CN4 – MCU Program Jumper
 - CN5 – Application SWD connector
- STM32L053C8T6 MCU
 - Cortex-M0+ with MPU @ 32 MHz
 - 64kB Flash, 2 kB EEPROM, 8kB RAM, LQFP48 package



Board Features

- LEDs
 - LD1: ST-LINK Communication indicator
 - LD2: Power indicator
 - LD3-LD4: User LEDs
- Push-Buttons
 - B1: User/Wake-up (PA0)
 - B2: Reset (NRST)
- USB device mini-B connector
- 2.04" E-paper display
- Touch Slider/Buttons
 - S1: Touch sensing linear sensor
- Current (Idd) measurement circuit
- CN1 NFC Extension Connector
 - Can accept PLUG-CR95HF-B board
- Extension Connector
 - P1 and P2
 - All GPIOs are available for prototyping
 - Includes 5V, 3V and GND pins



Discovery Board Check

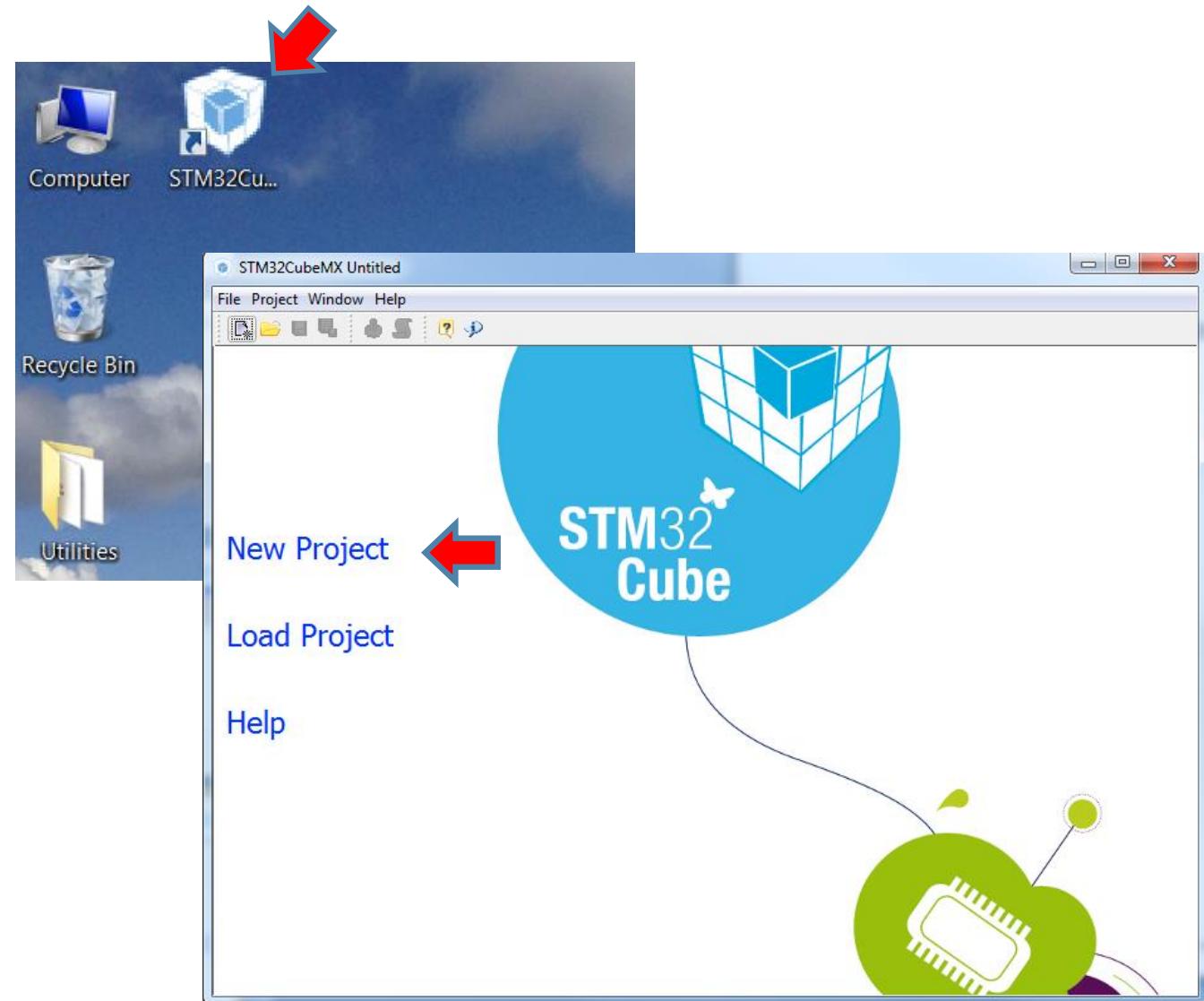
- Connect USB User to your PC
- LD1 and LD2 should be ON and solid RED (indicating board power available and ST-Link is functional)
- ePD should show STM32L0 logo and demo title then select demo message is displayed

Note: LD3 and LD4 will blink synchronously

- A brief test of the board
 - Follow on-screen instruction and use the Linear Touch Sensor (LTS) to select mouse or IDD consumption demo
 - ePD will change depending on mode

Creating a Project

- Launch the “STM32CubeMx”



- Click on “New Project”

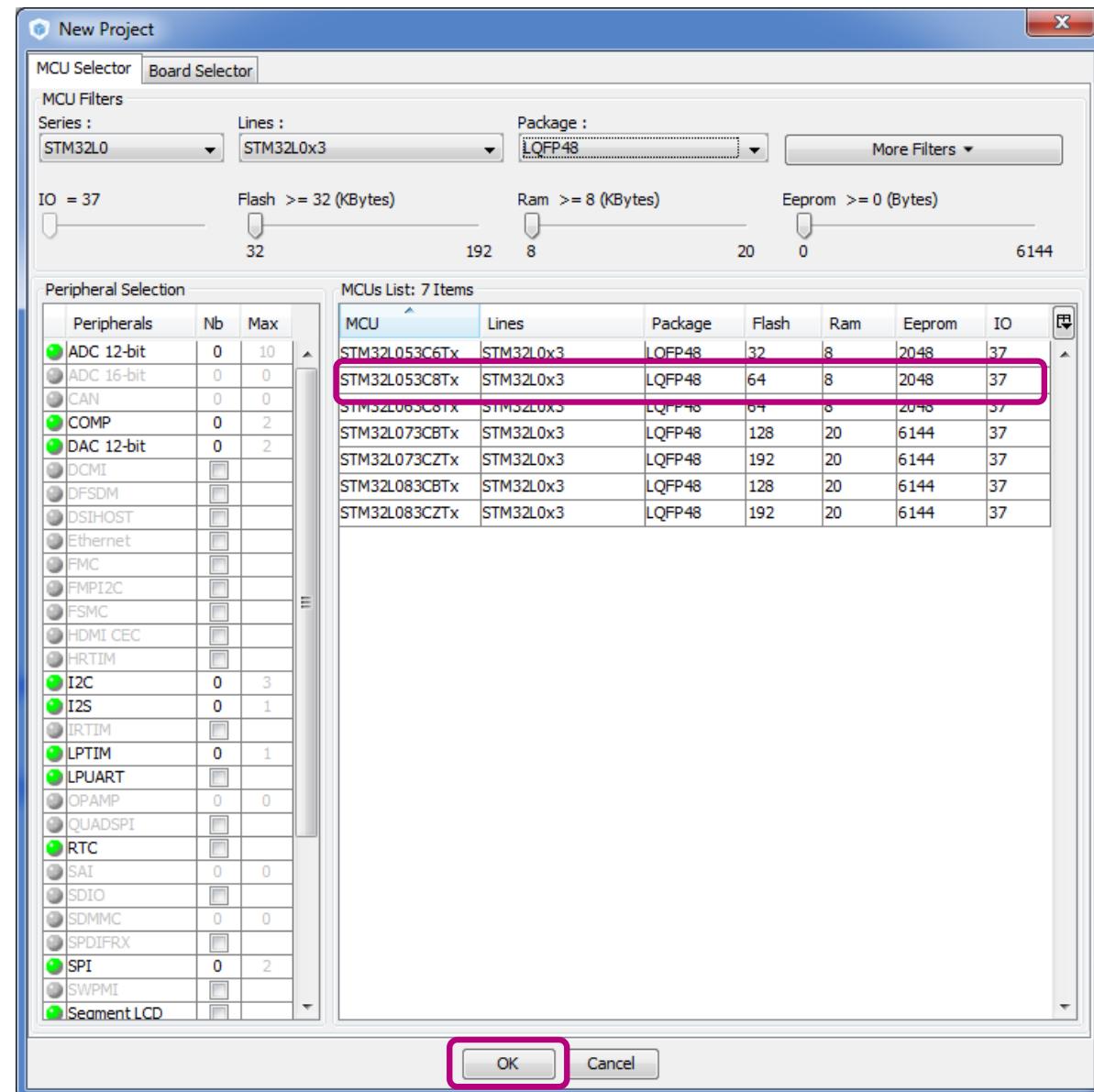
Select MCU

Filter by:

- Series
 - STM32L0
- Line
 - STM32L0x3
- Package
 - LQFP48
- Peripherals

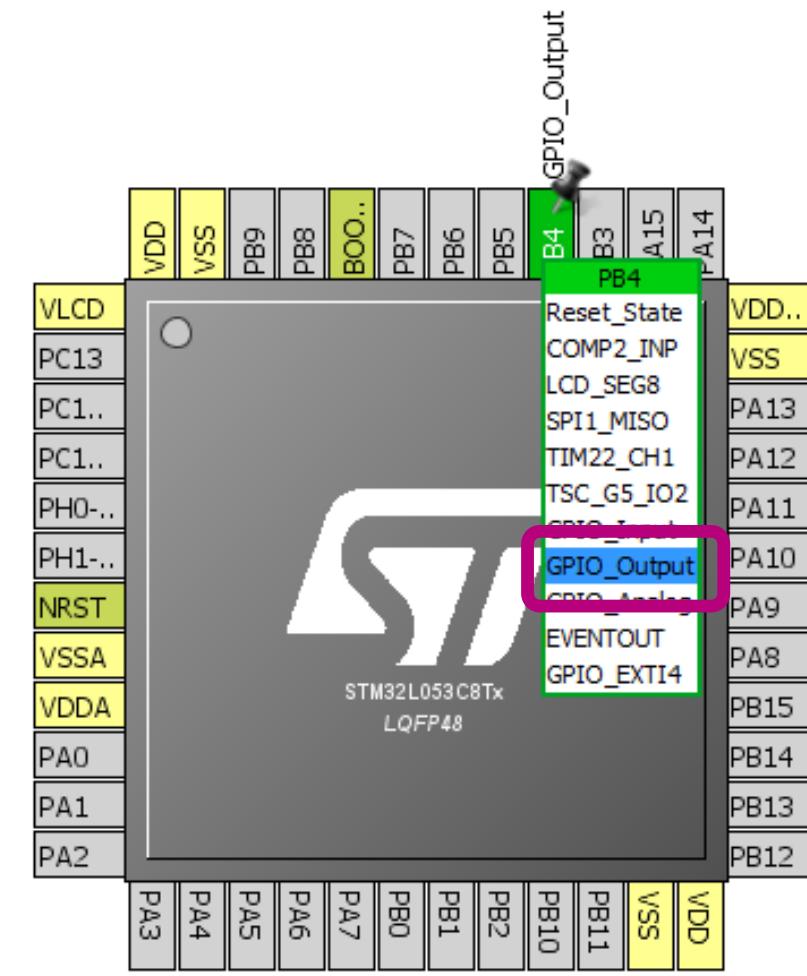
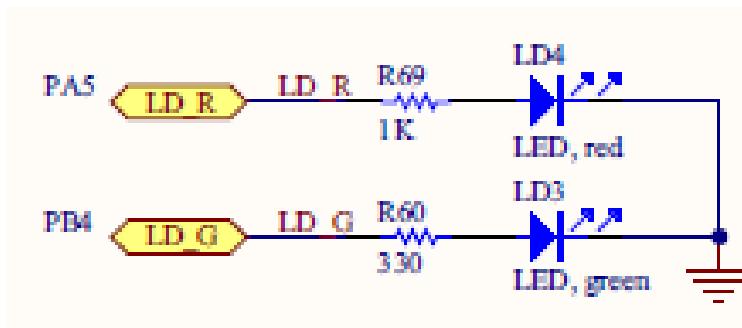
Find and Select the
STM32L053C8Tx

- 64kB Flash
- Click “OK”



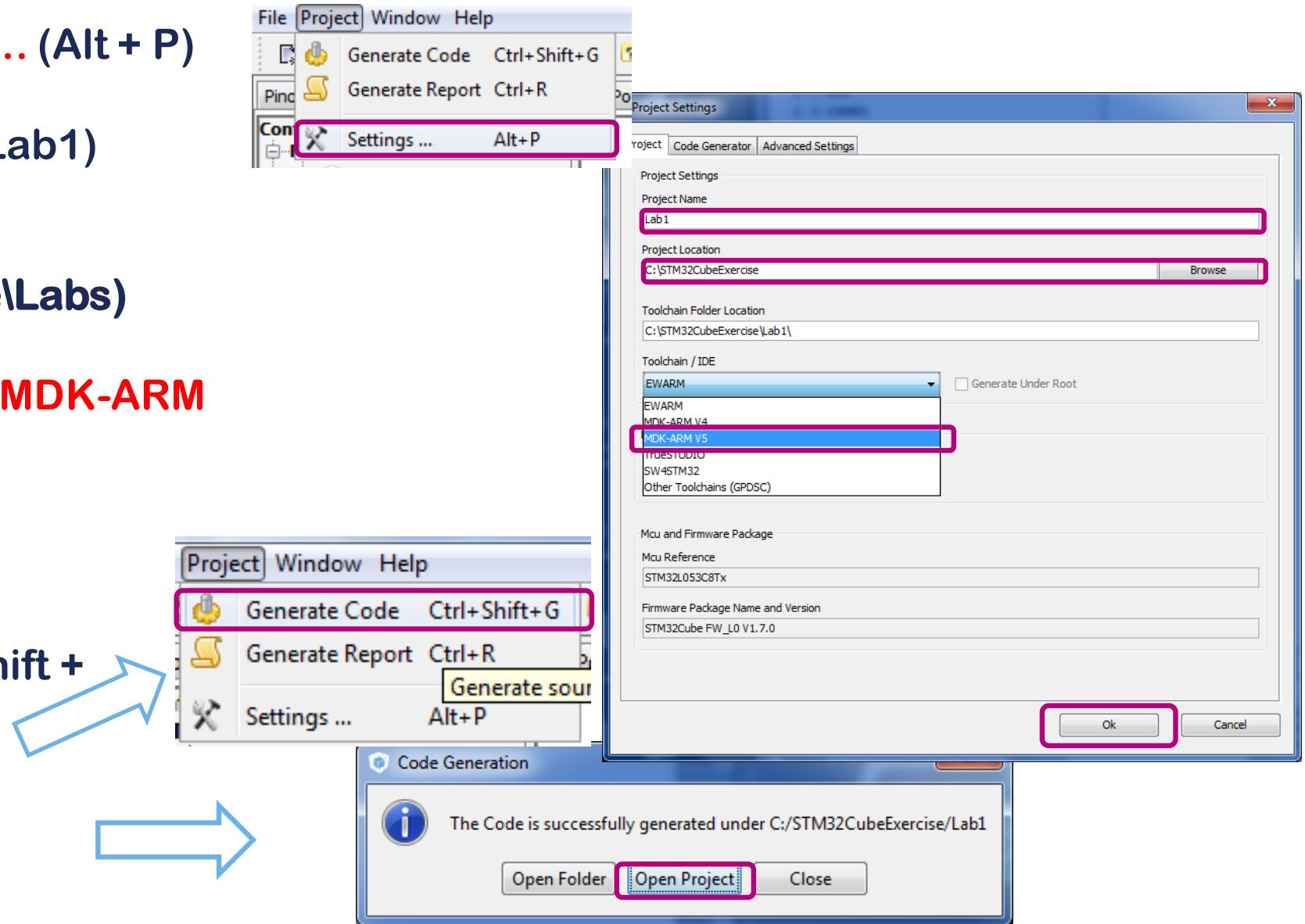
Pin Configuration

- The **GREEN LED (LD3)**, on the STM32L053 Discovery board, is connected to GPIO PB4 (pin 40).
 - UM1775 has all the schematic details
- Left-click PB4 and set it to **GPIO_Output** mode



Generate Source Code

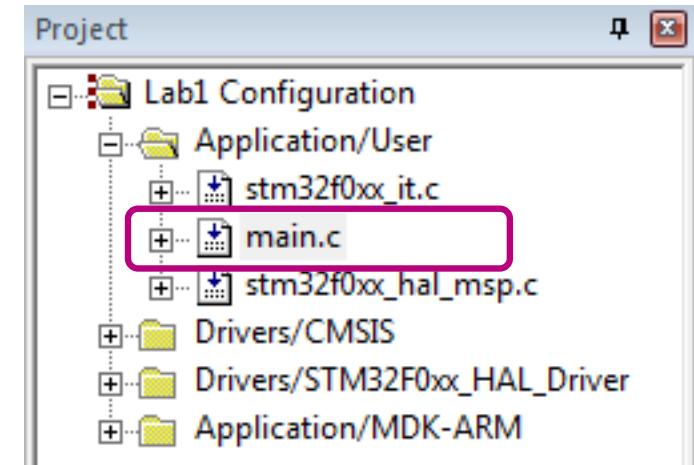
- Open Project > Settings... (Alt + P)
- Type the project name (Lab1)
- Set the project location (C:\STM32CubeExercise\Labs)
- Set the IDE Toolchain to MDK-ARM V5
- Click OK
- Generate Code (Ctrl + Shift + G)
- Click Open Project



Add Code

- MDK-ARM IDE should now be open.
- Expand the file tree and open the **main.c** file
- Add the following code **inside the while(1) loop**
 - Line 90 in “main.c”
 - Add within “USER CODE BEGIN 3” / “USER CODE END 3” section (this will preserve your code after code regeneration)

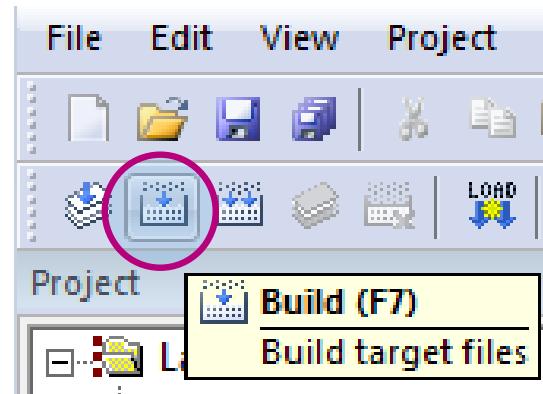
```
HAL_GPIO_TogglePin(GPIOB, GPIO_PIN_4);  
HAL_Delay(100);
```



```
83     /* Infinite loop */  
84     /* USER CODE BEGIN WHILE */  
85     while (1)  
86     {  
87         /* USER CODE END WHILE */  
88  
89         /* USER CODE BEGIN 3 */  
90         HAL_GPIO_TogglePin(GPIOB, GPIO_PIN_4);  
91         HAL_Delay(100);  
92     }  
93     /* USER CODE END 3 */
```

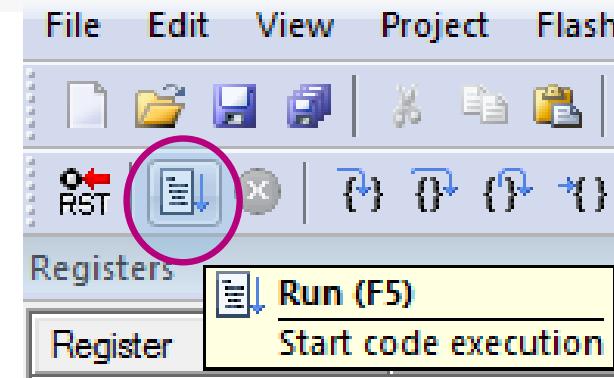
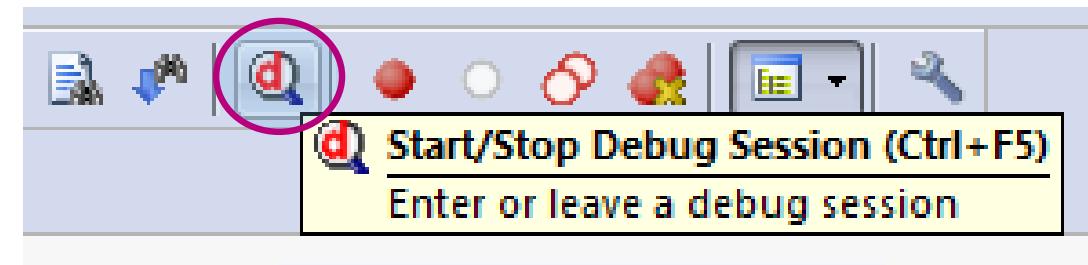
Build the Project

- Click the “Build” button, or use menu Project > Build target.



```
linking...
Program Size: Code=2800 RO-data=252 RW-data=8 ZI-data=1024
"Lab1\Lab1.axf" - 0 Error(s), 0 Warning(s).
Build Time Elapsed: 00:00:13
```

- Click the “Start/Stop Debug Session” button (CTRL + F5)
- Click the “Run” button (F5)
- Enjoy the flashing LED!



Restoring the STM32L053-Discovery DEMO



life.augmented

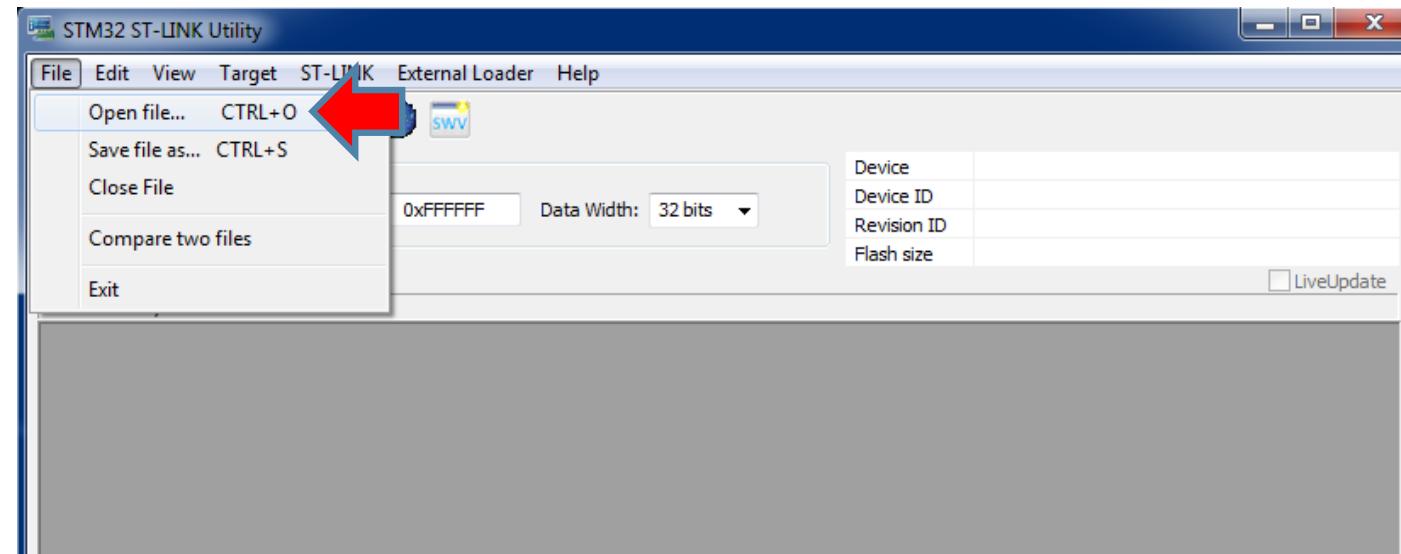


Restoring Discovery DEMO

- Start the STM32 ST-LINK Utility

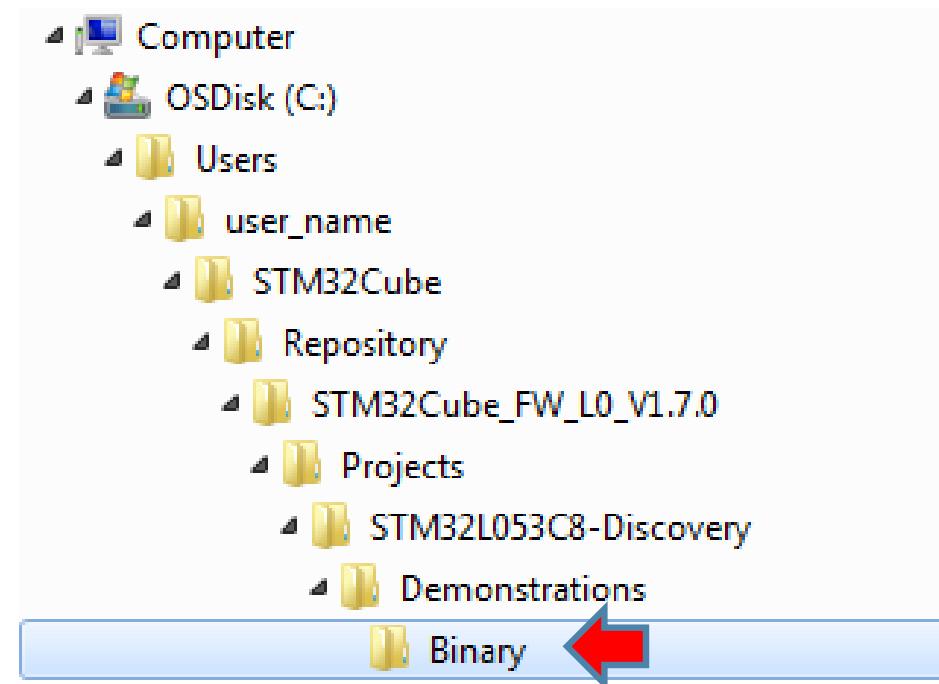


- Click on “File” > “Open file...”



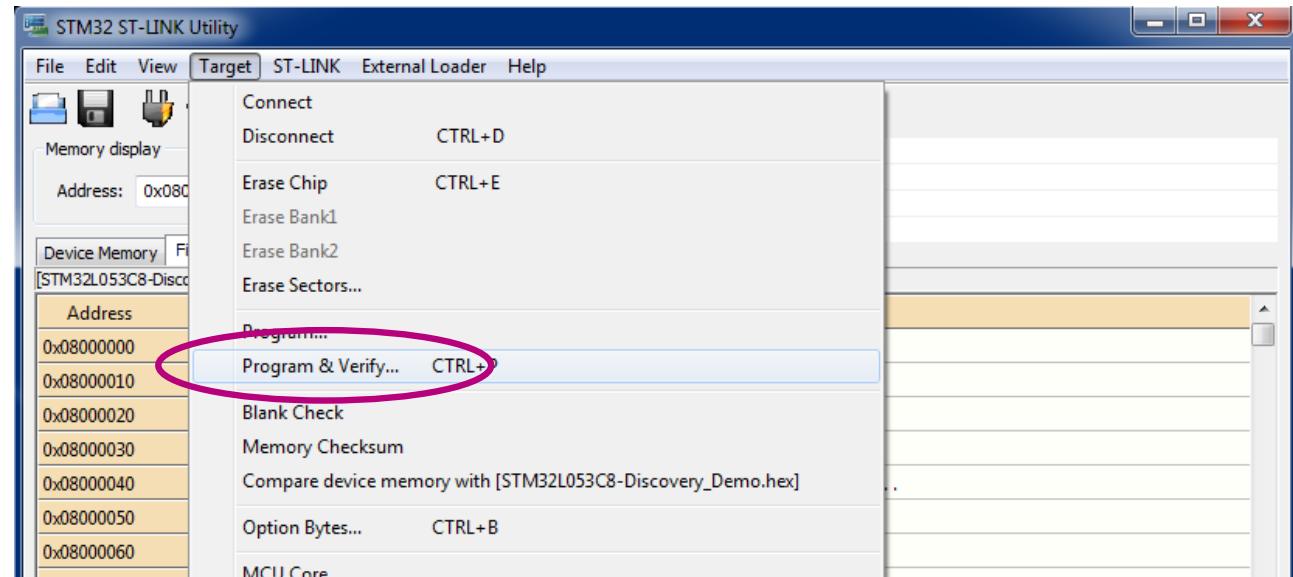
Restoring Discovery DEMO

- Select the “**STM32L053C8-Discovery_DEMO.hex**” file located in the displayed Binary folder path.
 - Note: The “user_name” folder is your Windows user name.

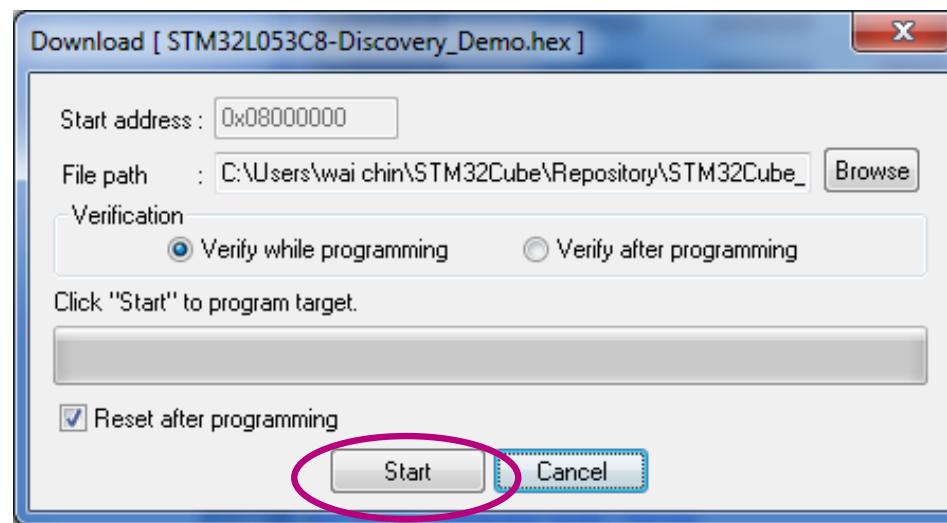


Restoring Discovery DEMO

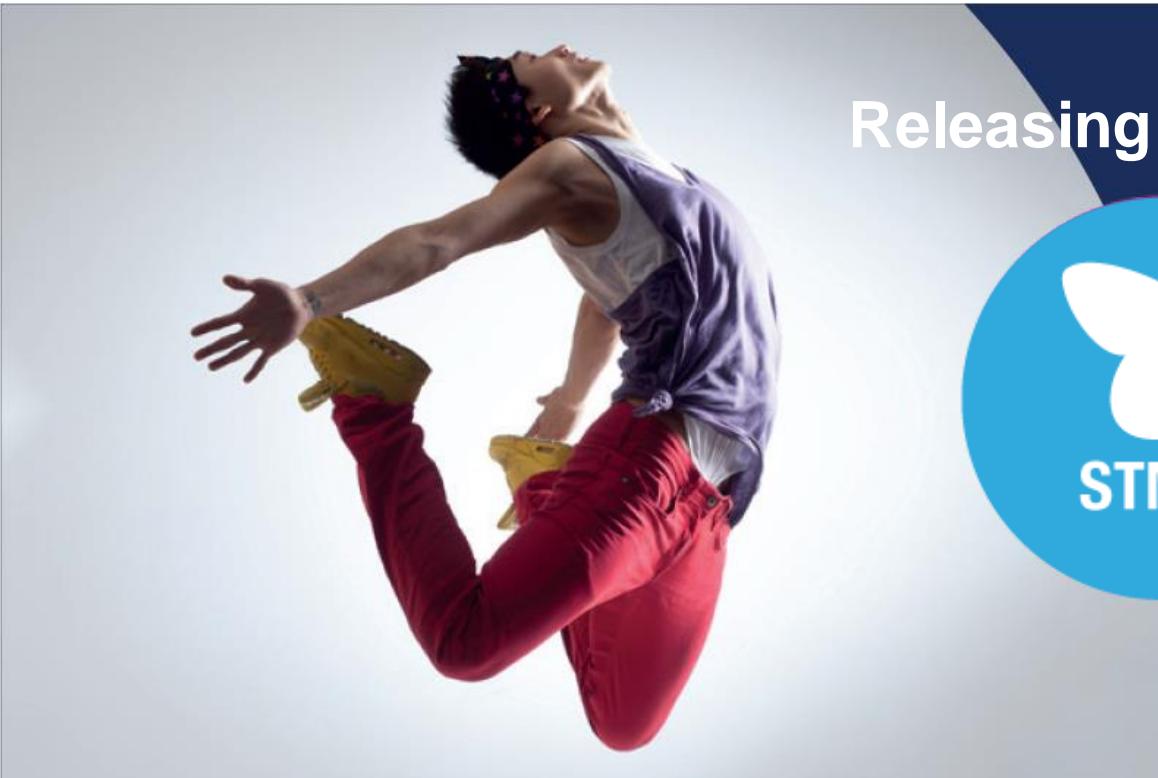
- Click “Target” > “Program & Verify...”



- Click “Start” Button to restore the DEMO.



Thank You !



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54

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