

# **Code Tour**

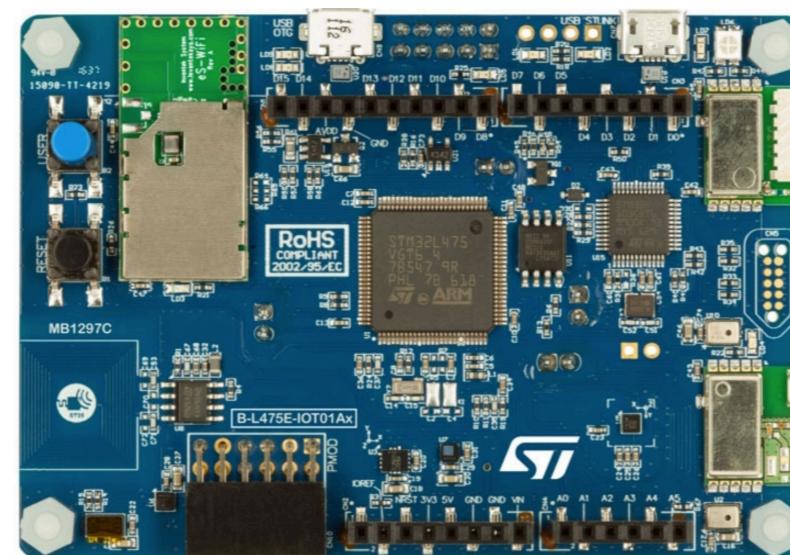
## **STM32 Discovery Kit IoT Node**

### **BSP Header File**

### **str32l475e\_iot01.h**

Norman McEntire

**BSP  
Board  
Support  
Package**



# BSP Header File Overview

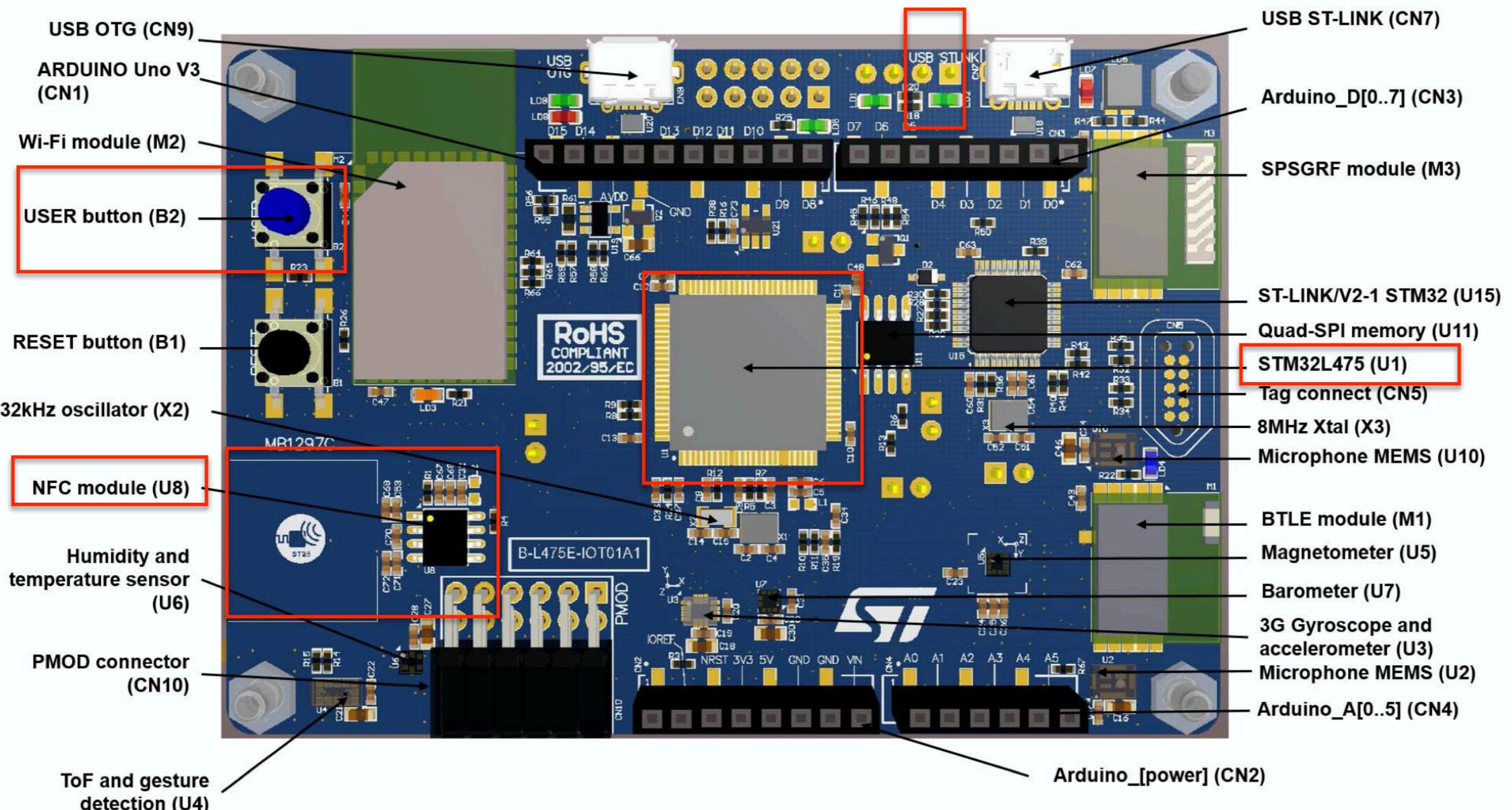
- BSP = **B**oard **S**upport **P**ackage
- Provide an easy-to-use C-language interface to access the board features
  - Examples
    - Turn Green LED2 On/Off
    - Read Blue Button State
    - Access NFC (Near Field Communications)

# BSP Header File Sections

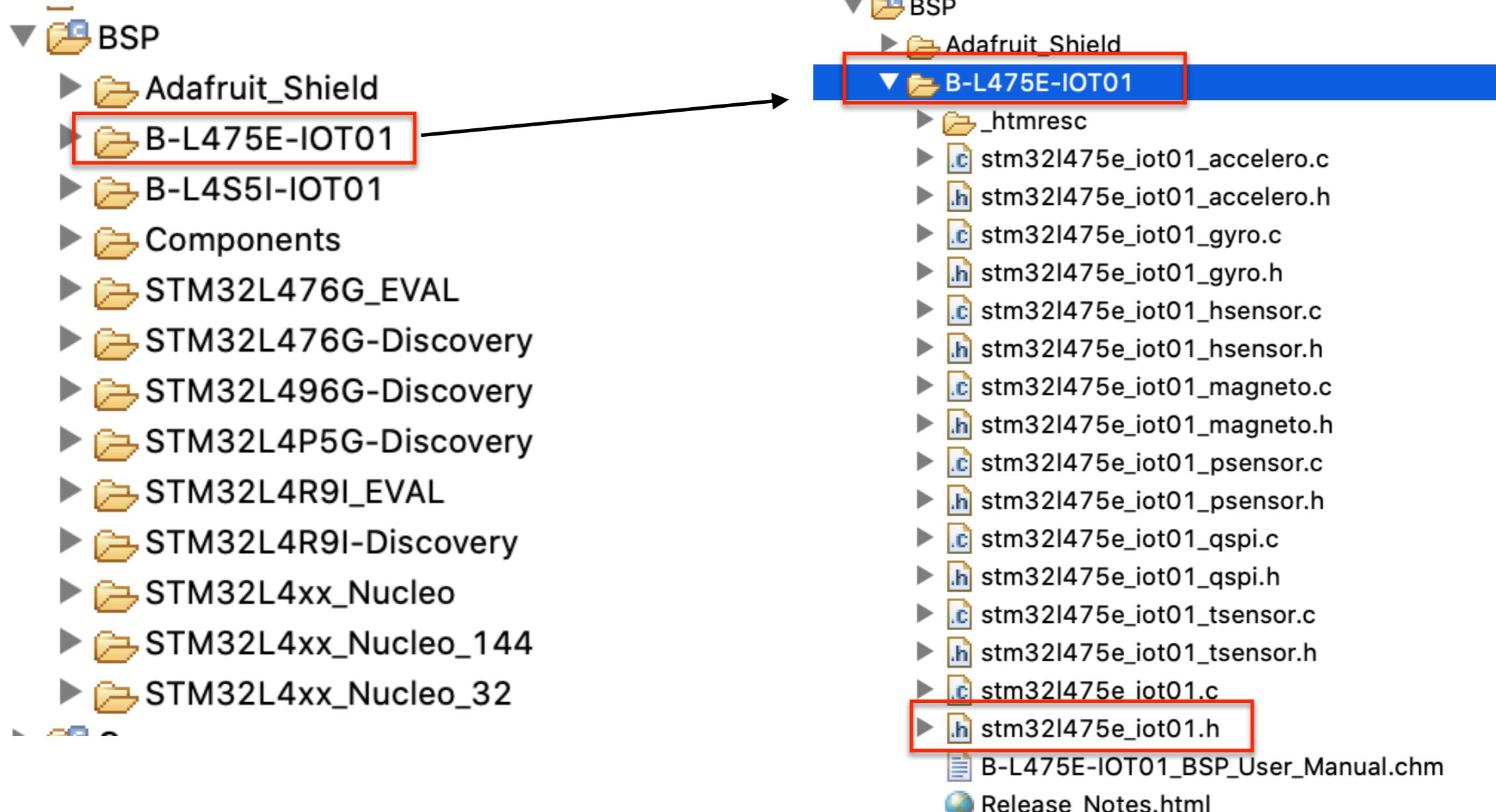
- Three Major Sections
  - Header Info
  - Data Structures
  - Functions

# STM32 Discovery Kit

LED2



# Location of BSP Directories and Files



# Header Info

# stm32l475e\_iot01.h

## Part 1 - Doxygen

```
1 ⊕ /**
2 ****
3 * @file    stm32l475e_iot01.h
4 * @author  MCD Application Team
5 * @brief   STM32L475E_IOT01 board support package
6 ***1. You can use the Javadoc style, which consist of a C-style comment block starting with two *'s, like this:
7 *
8 * <pre>
9 * /**
10 *  * ... text ...
11 * /
12 * </pre>
13 * This software component is licensed by ST under BSD 3-clause license,
14 * the "License"; You may not use this file except in compliance with the
15 * License. You may obtain a copy of the License at:
16 *           opensource.org/licenses/BSD-3-Clause
17 ****
18 */
19
```

Doxygen markup for  
Auto-generated documentation  
(More in a moment)

# stm32l475e\_iot01.h

## Part 2 - Doxygen Tags

```
1 ⊕ /**
2 ****
3 * @file    stm32l475e_iot01.h
4 * @author  MCD Application Team
5 * @brief   STM32L475E IOT01 board support package
6 ****
7 * @attention
8 *
9 * <h2><center>&copy; Copyright (c) 2017 STMicroelectronics.
10 * All rights reserved.</center></h2>
11 *
12 * This software component is licensed by ST under BSD 3-Clause license,
13 * the "License"; You may not use this file except in compliance with the
14 * License. You may obtain a copy of the License at:
15 *                      opensource.org/licenses/BSD-3-Clause
16 *
17 ****
18 */
19
20 // Definitions for STM32L475E-IOT01
```

Doxygen Tags  
(More on next slide)

[https://www.doxygen.nl/  
index.html](https://www.doxygen.nl/index.html)

The screenshot shows the official Doxygen website at <https://www.doxygen.nl/>. The page has a blue header with the Doxygen logo. Below the header is a navigation bar with links for Home, Downloads, Documentation, Extensions, and Support. On the left, there's a sidebar with a navigation tree under 'Doxygen' and a 'About' section. The main content area features the title 'Doxygen' and the subtitle 'Generate documentation from source code'. It describes Doxygen as a tool for generating documentation from annotated C++ sources, supporting other languages like C, Objective-C, C#, PHP, Java, Python, IDL, Fortran, VHDL, and D.

Doxygen

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Doxygen

About

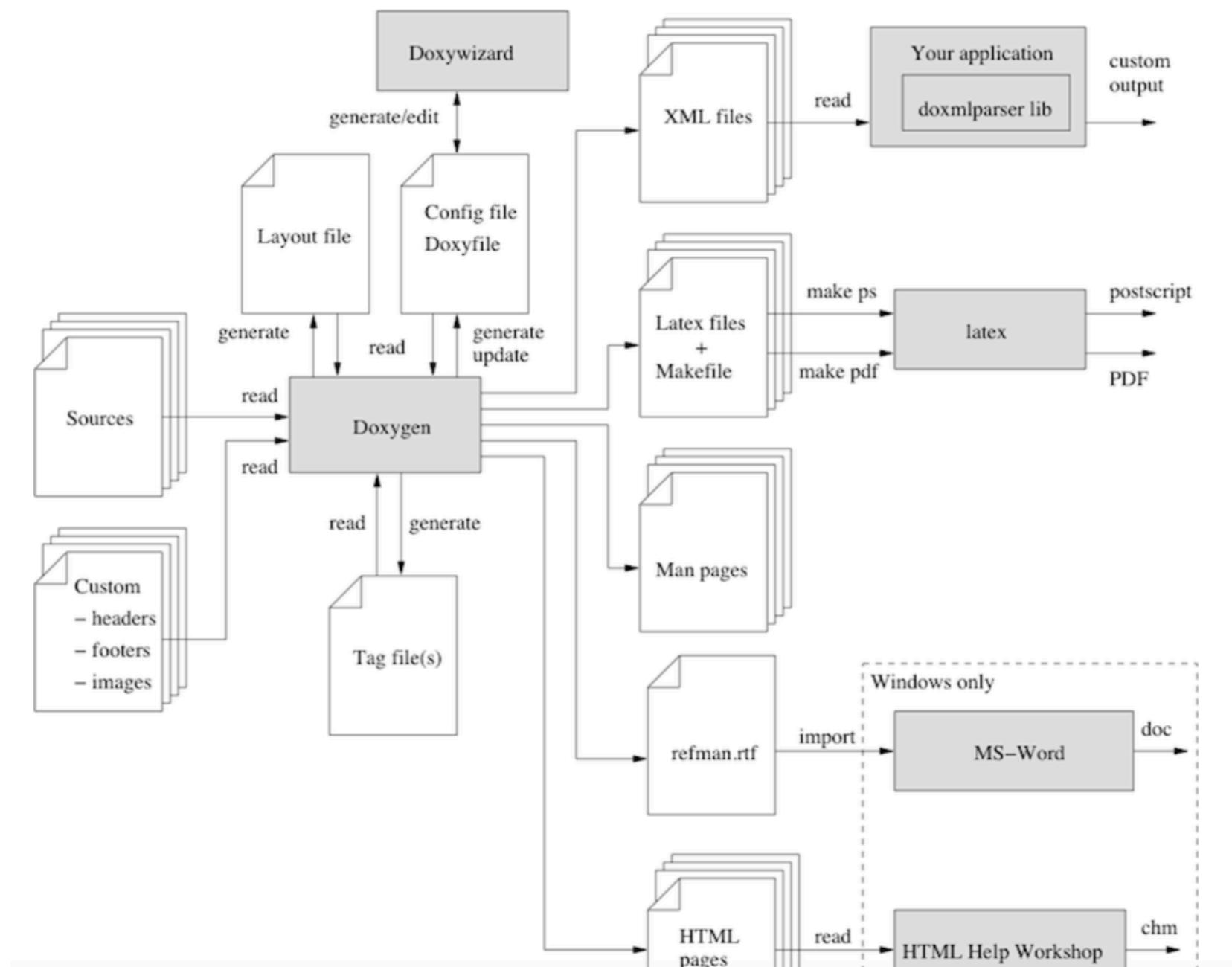
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**Doxygen**

**Generate documentation from source code**

Doxygen is the de facto standard tool for generating documentation from annotated C++ sources, but it also supports other popular programming languages such as C, Objective-C, C#, PHP, Java, Python, IDL (Corba, Microsoft, and UNO/OpenOffice flavors), Fortran, VHDL and to some extent D.

# Doxygen Block Diagram



# stm32l475e\_iot01.h

## Part 3 - License

```
1 ⊕ /**
2  ****
3  * @file    stm32l475e_iot01.h
4  * @author  MCD Application Team
5  * @brief   STM32L475E IOT01 board support package
6  ****
7  * @attention
8  *
9  * <h2><center>&copy; Copyright (c) 2017 STMicroelectronics.
10 * All rights reserved.</center></h2>
11 *
12 * This software component is licensed by ST under BSD 3-Clause license,
13 * the "License"; You may not use this file except in compliance with the
14 * License. You may obtain a copy of the License at:
15 *                      opensource.org/licenses/BSD-3-Clause
16 *
17 ****
18 */
19
20 // Datasheet reference: Datasheet
```



Open Source Software License

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licenses/BSD-3-Clause](https://opensource.org/licenses/BSD-3-Clause)

## The 3-Clause BSD License

SPDX short identifier: **BSD-3-Clause**

Further resources on t

*Note: This license has also been called the "New BSD License" or "Modified BSD License". See also the [2-clause BSD License](#).*

Copyright <YEAR> <COPYRIGHT HOLDER>

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

# stm32l475e\_iot01.h

## Part 4 - For All Header Files

```
19
20 /* Define to prevent recursive inclusion -----*/
21 #ifndef __STM32L475E_IOT01_H
22 #define __STM32L475E_IOT01_H
23
24 #ifdef __cplusplus
25 extern "C" {
26 #endif
27
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243
244
245
246
247
248 */
249 * @}
250 */
251 #ifdef __cplusplus
252 }
253#endif
254#endif /* __STM32L475E_IOT01_H */
255
256
257 /****** (C) COPYRIGHT STMicroelectronics *****END OF FILE****/
258
```

For C++ Code

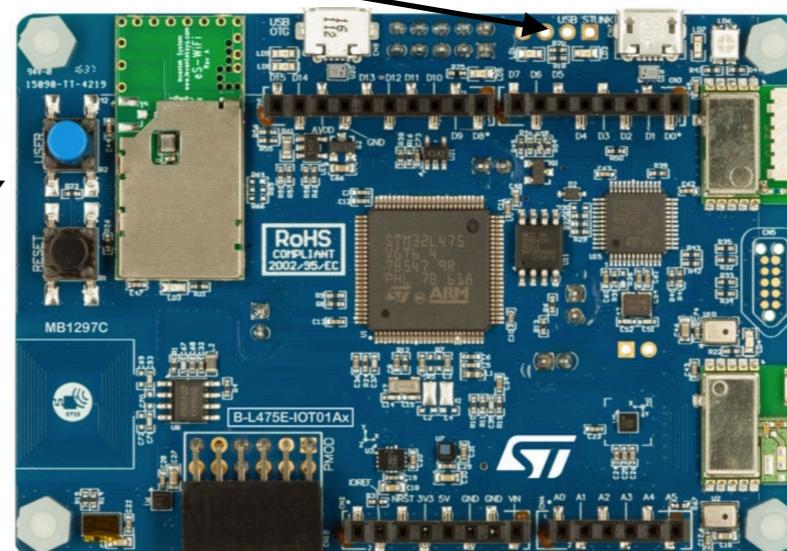
Prevent  
Multiple  
Includes

# Data Structures

# stm32l475e\_iot01.h

## Part 5 - ...\_TypeDef

```
43/* @defgroup STM32L475E_IOT01_LOW_LEVEL_Exported_Types LOW LEVEL Exported Types
44 * @{
45 */
46typedef enum
47{
48    LED2 = 0,
49    LED_GREEN = LED2,
50}Led_TypeDef;
51
52
53typedef enum
54{
55    BUTTON_USER = 0
56}Button_TypeDef;
57
58typedef enum
59{
60    BUTTON_MODE_GPIO = 0,
61    BUTTON_MODE_EXTI = 1
62}ButtonMode_TypeDef;
63
64typedef enum
65{
66    COM1 = 0,
67    COM2 = 0,
68}COM_TypeDef;
69/**@
70 * @}
71 */
```



# stm32l475e\_iot01.h

## Part 6 - USE\_...

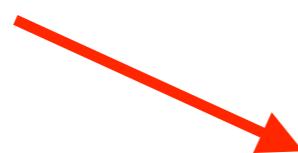
```
76
77 /*
78     * @brief Define for STM32L475E_IOT01 board
79     */
80 #if !defined (USE_STM32L475E_IOT01)
81     #define USE_STM32L475E_IOT01
82 #endif
83
```

Use this  
To indicate  
That we are using  
This header file

# stm32l475e\_iot01.h

## Part 7 - LED2

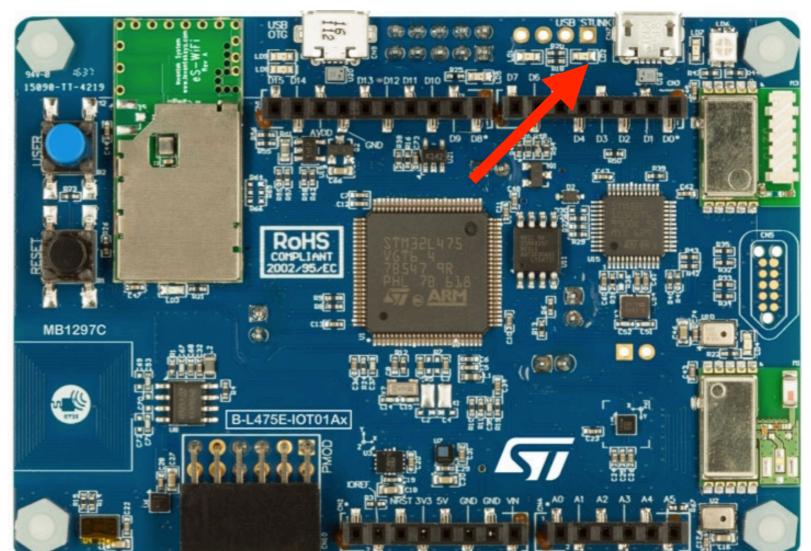
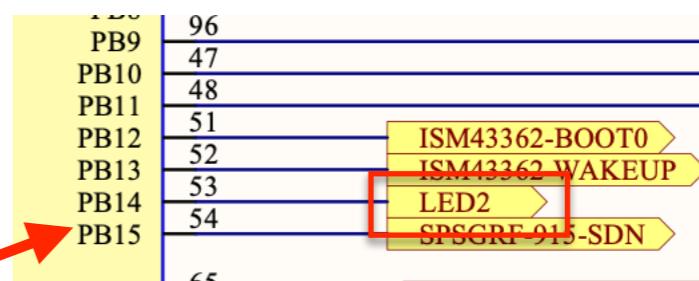
To know how  
Many LEDs  
You have



```
83  
84 #define LEDn ((uint8_t)1)  
85  
86 #define LED2_PIN GPIO_PIN_14  
87 #define LED2_GPIO_PORT GPIOB  
88 #define LED2_GPIO_CLK_ENABLE() __HAL_RCC_GPIOB_CLK_ENABLE()  
89 #define LED2_GPIO_CLK_DISABLE() __HAL_RCC_GPIOB_CLK_DISABLE()  
90  
91  
92 #define LEDx_GPIO_CLK_ENABLE(__INDEX__) do{if((__INDEX__) == 0) LED2_GPIO_CLK_ENABLE();}while(0)  
93  
94 #define LEDx_GPIO_CLK_DISABLE(__INDEX__) do{if((__INDEX__) == 0) LED2_GPIO_CLK_DISABLE();}while(0)  
95  
96
```

You just  
Focus on  
LED2\_PIN

Notice use  
of do{...}while(0)

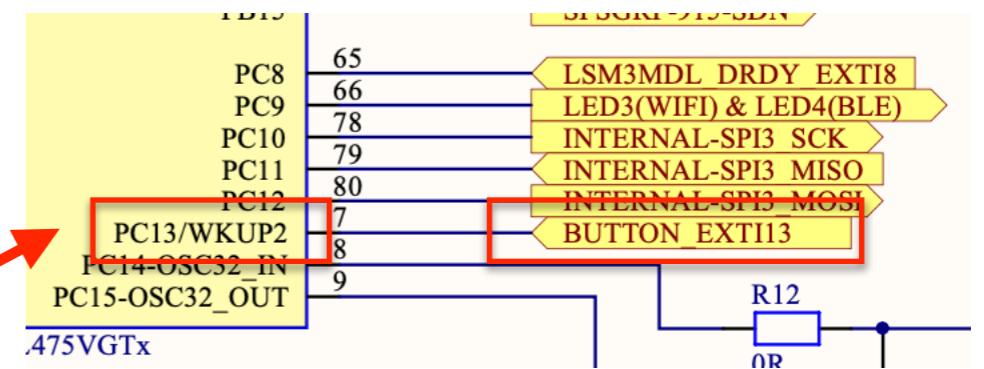


# stm32l475e\_iot01.h

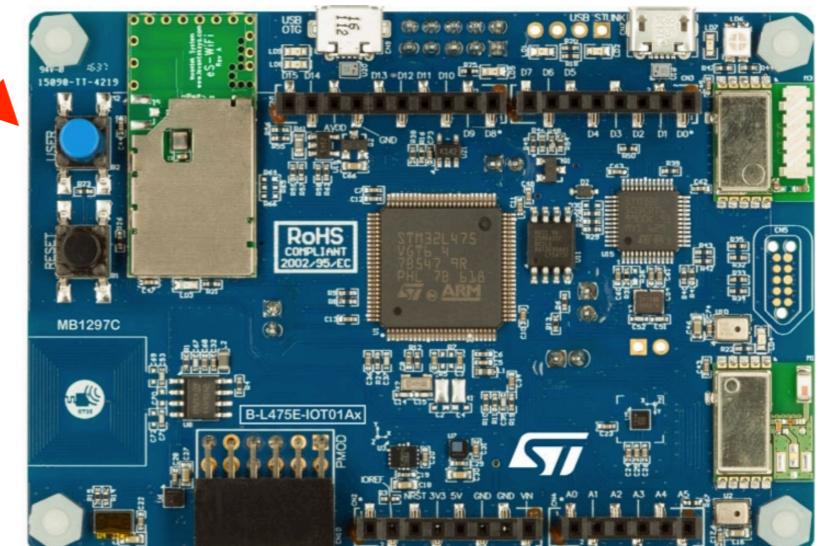
## Part 8 - USER\_BUTTON

To know how  
Many Buttons  
You have

```
96 /* Only one User/Wakeup button */  
97 #define BUTTONNn ((uint8_t)1)  
98  
100 /**  
101 * @brief Wakeup push-button  
102 */  
103 #define USER_BUTTON_PIN GPIO_PIN_13  
104 #define USER_BUTTON_GPIO_PORT GPIOC  
105 #define USER_BUTTON_GPIO_CLK_ENABLE() __HAL_RCC_GPIOC_CLK_ENABLE()  
106 #define USER_BUTTON_GPIO_CLK_DISABLE() __HAL_RCC_GPIOC_CLK_DISABLE()  
107 #define USER_BUTTON_EXTI_IRQn EXTI15_10_IRQn  
108
```



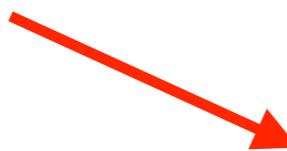
You just  
Focus on  
USER\_BUTTON\_PIN



# stm32l475e\_iot01.h

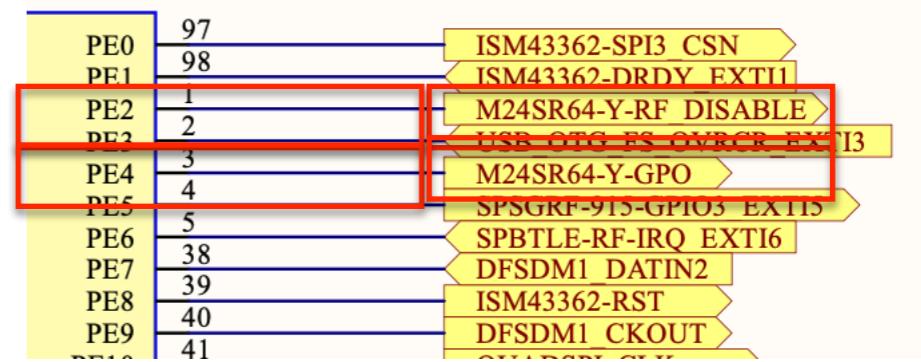
## Part 9 - NFC

To know how  
Many Buttons  
You have

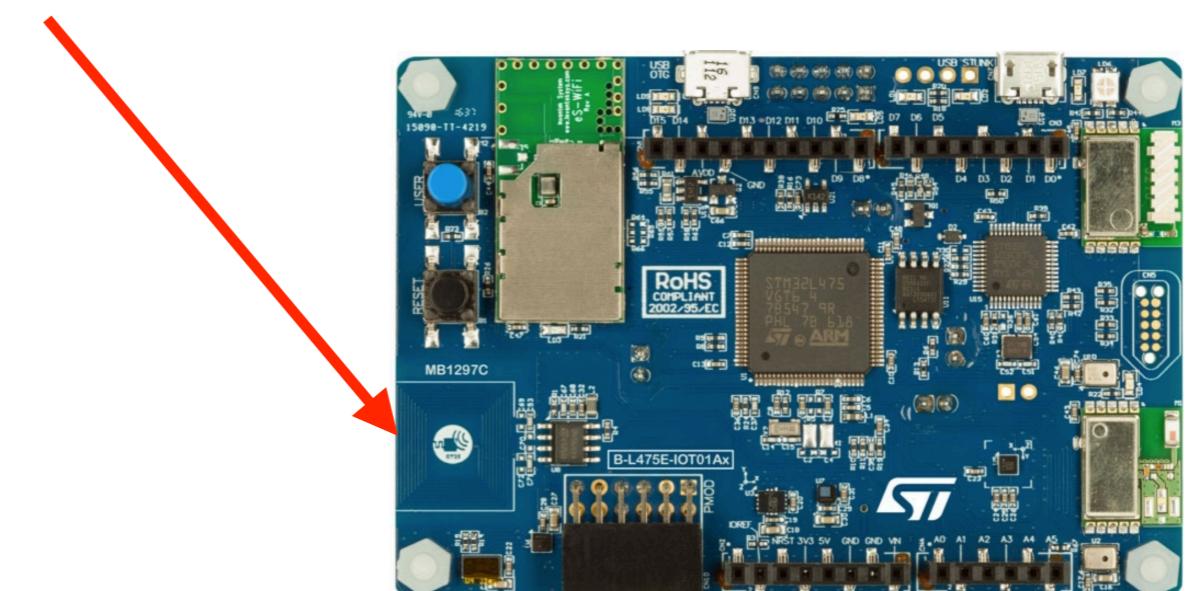


```
108  
109 /*  
110     * @brief NFC Gpio PINs  
111 */
```

```
112 #define NFC_GPIO_GPO_PIN          GPIO_PIN_4  
113 #define NFC_GPIO_GPO_PIN_PORT      GPIOE  
114 #define NFC_GPIO_RFDISABLE_PIN      GPIO_PIN_2  
115 #define NFC_GPIO_RFDISABLE_PIN_PORT GPIOE  
116 #define NFC_GPIO_CLK_ENABLE()       __HAL_RCC_GPIOE_CLK_ENABLE();  
117 #define NFC_GPIO_CLK_DISABLE()      __HAL_RCC_GPIOE_CLK_DISABLE();  
118
```



You just  
Focus on  
NFC\_GPIO\_...



# Functions

# stm32l475e\_iot01.h

## Version Function

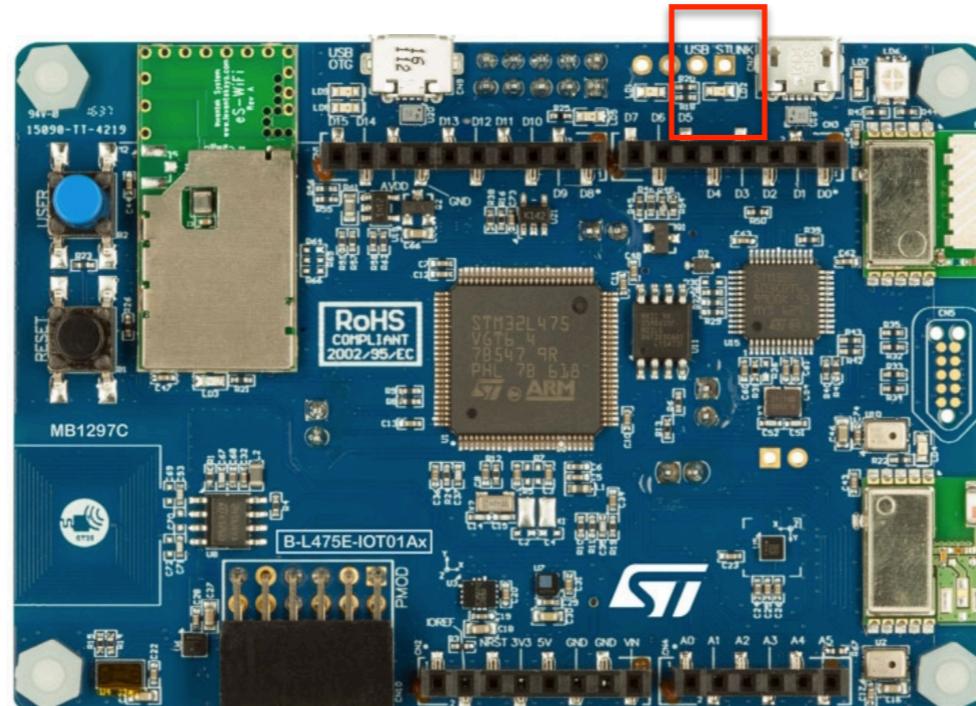
```
221
222 /* @defgroup STM32L475E_IOT01_LOW_LEVEL_Exported_Functions LOW LEVEL Exported Functions
223   * @{
224   */
225 uint32_t BSP_GetVersion(void);
---
```

# stm32l475e\_iot01.h

## LED Functions

```
226 void BSP_LED_Init(Led_TypeDef Led);  
227 void BSP_LED_DeInit(Led_TypeDef Led);  
228 void BSP_LED_On(Led_TypeDef Led);  
229 void BSP_LED_Off(Led_TypeDef Led);  
230 void BSP_LED_Toggle(Led_TypeDef Led);
```

LED2



```
45 */  
46 @typedef enum  
47 {  
48     LED2 = 0,  
49     LED_GREEN = LED2,  
50 }Led_TypeDef;  
51
```

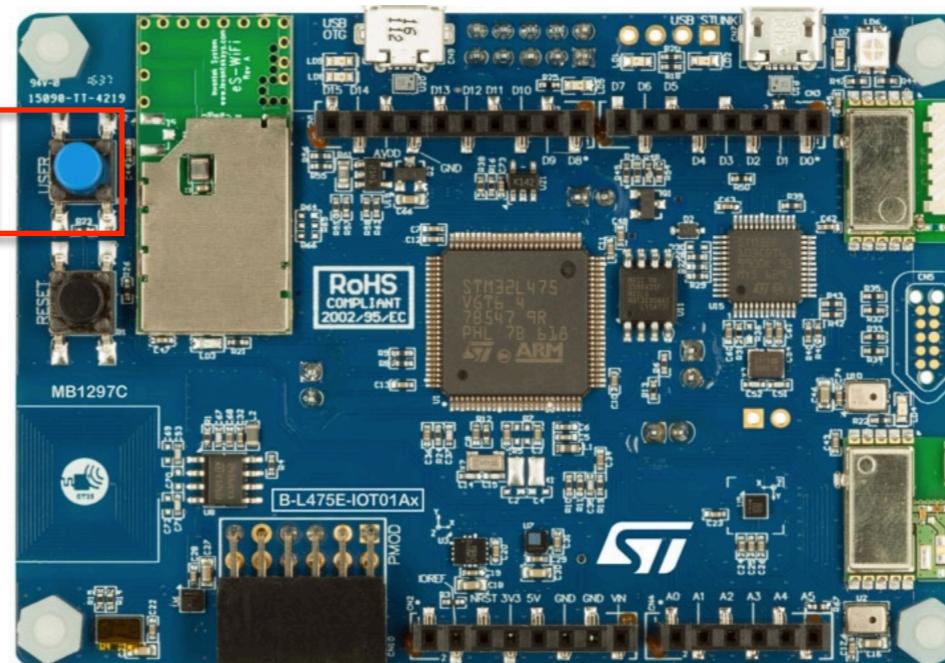
# stm32l475e\_iot01.h

## Push Button Functions

```
231 void BSP_PB_Init(Button_TypeDef Button, ButtonMode_TypeDef ButtonMode);  
232 void BSP_PB_DeInit(Button_TypeDef Button);  
233 uint32_t BSP_PB_GetState(Button_TypeDef Button);
```

```
52  
53 typedef enum  
54 {  
55     BUTTON_USER = 0  
56 }Button_TypeDef;  
57
```

Button



# Summary

- BSP = **B**oard **S**upport **P**ackage
- Provide an easy-to-use C-language interface to access the board features
  - Examples
    - Turn Green LED2 On/Off
    - Read Blue Button State
    - Access NFC (Near Field Communications)
- Three Major Sections
  - Header Info
  - Data Structures
  - Functions