



STM32L152

STM32L DISCOVERY

- D.Jugnon
- P.Reynaud
- Ph.Vincent

MMS/MCD

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AGENDA



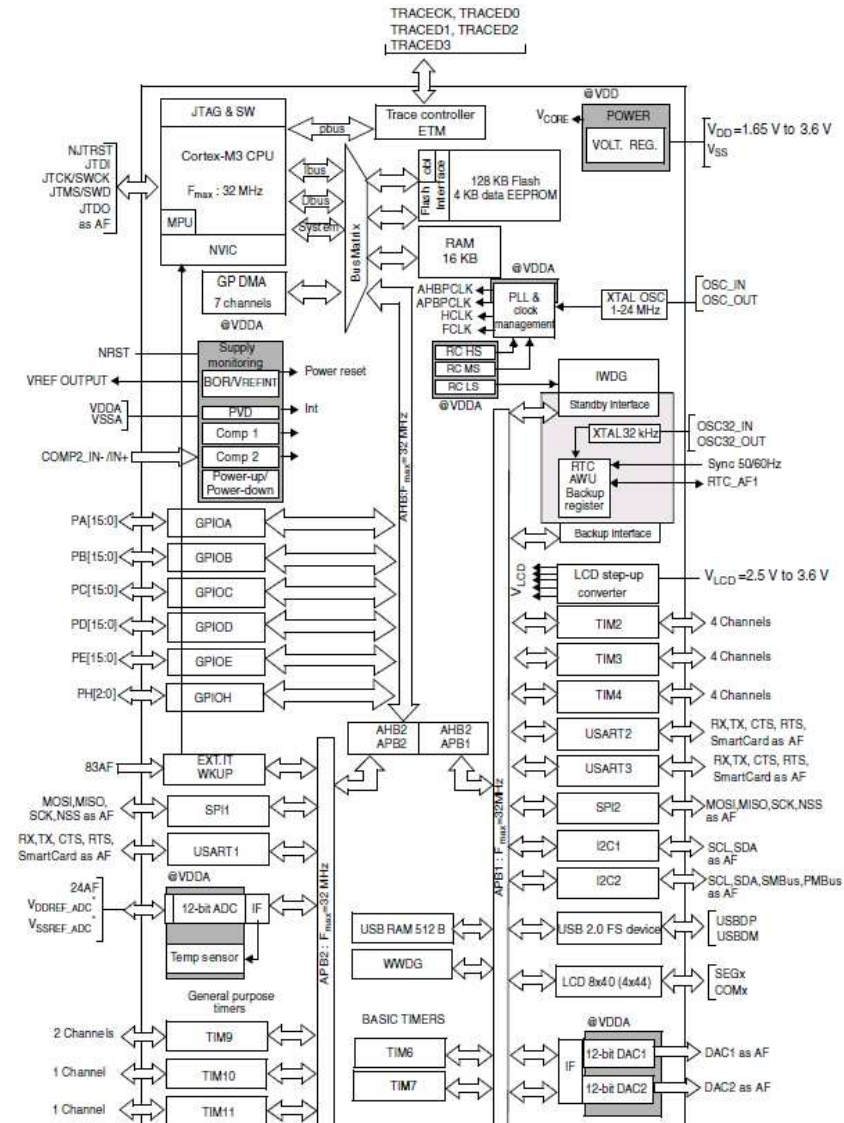
- STM32L Discovery kit – 15 mn
 - STM32L features
 - Block diagram
 - Low power modes
 - STM32L152 - Discovery Features
 - LCD - custom
 - Touch sensor principle
 - Idd Current measurement principle
 - Free pins on the board
 - E2e Forum

- Exercices
 - Start the IDE, loading the Demo project
 - Build with `template_main.c` instead `main.c`
 - Debug the new application
 - Update the application:
 - Function 1: To drive LCD contrast with slider
(Read touch sense value & LCD libs)
 - Function 2: To update the LED blink frequency with slider
 - With a loop,
 - Explain the best solution: SysTick, interrupts...

STM32L152



Peripheral	STM32L15xCx	STM32L15Rx	STM32L15Vx
Flash - Kbytes	64	128	128
RAM - Kbytes	10	16	16
Timers	General-purpose	6	6
	Basic	2	2
Communication interfaces	SPI	2	2
	I ² C	2	2
	USART	3	3
	USB	1	1
GPIOs	37	51	83
12-bit synchronized ADC	1	1	1
Number of channels	16 channels	20 channels	24 channels
12-bit DAC	2	2	2
Number of channels	2	2	2
LCD (STM32L152xx Only)			
COM x SEG	4x16	4x32	4x44
Comparator	2	2	2
CPU frequency	32 MHz		
Operating voltage	1.8 V to 3.6 V (down to 1.65 V at power-down) with BOR option 1.65 V to 3.6 V without BOR option		
Operating temperatures	Ambient temperatures: -40 to +85 °C Junction temperature: -40 to +105 °C		
Packages	LQFP48, UFQFPN48	LQFP64, BGA64	LQFP100, BGA100

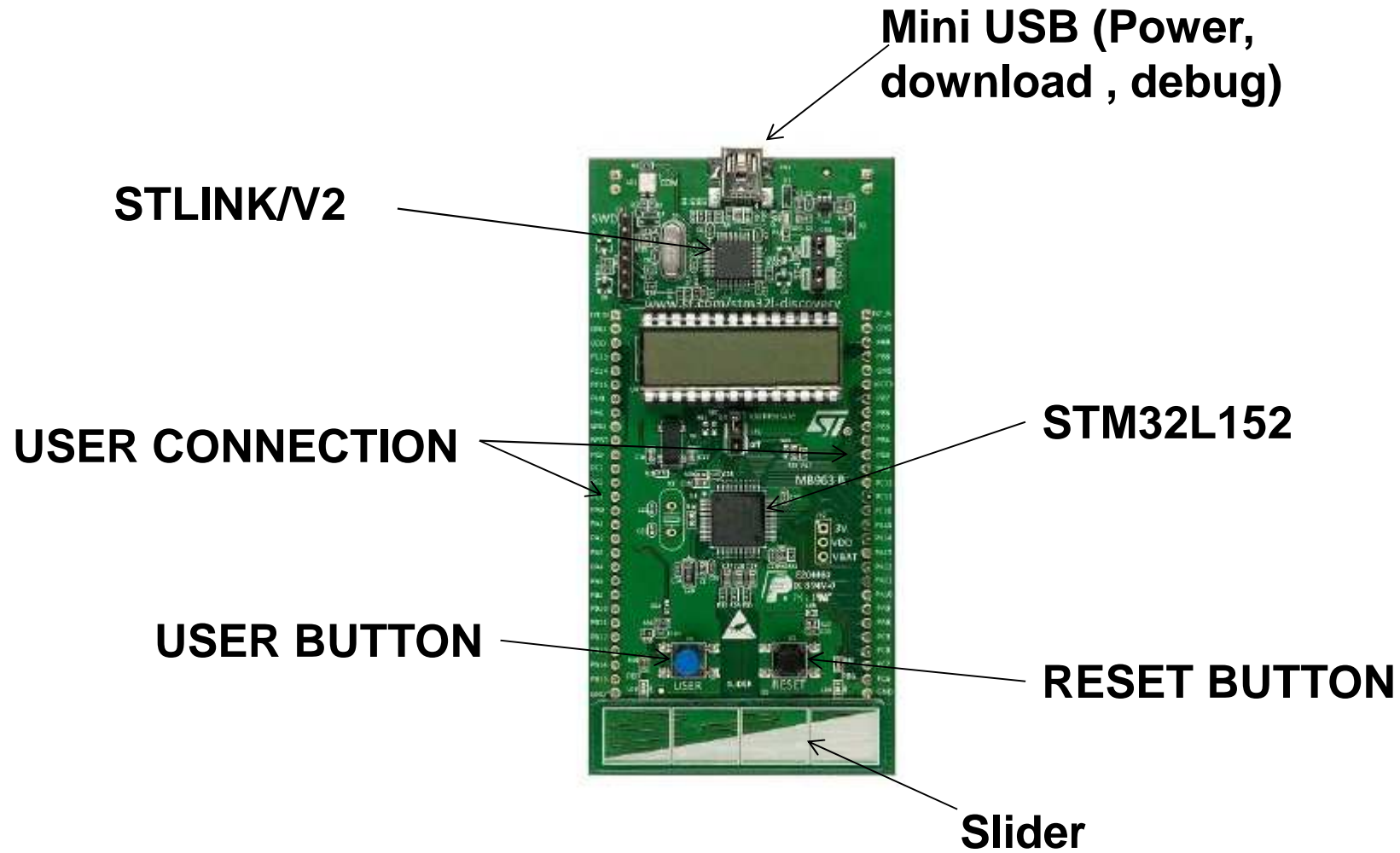


LOW POWER MODES

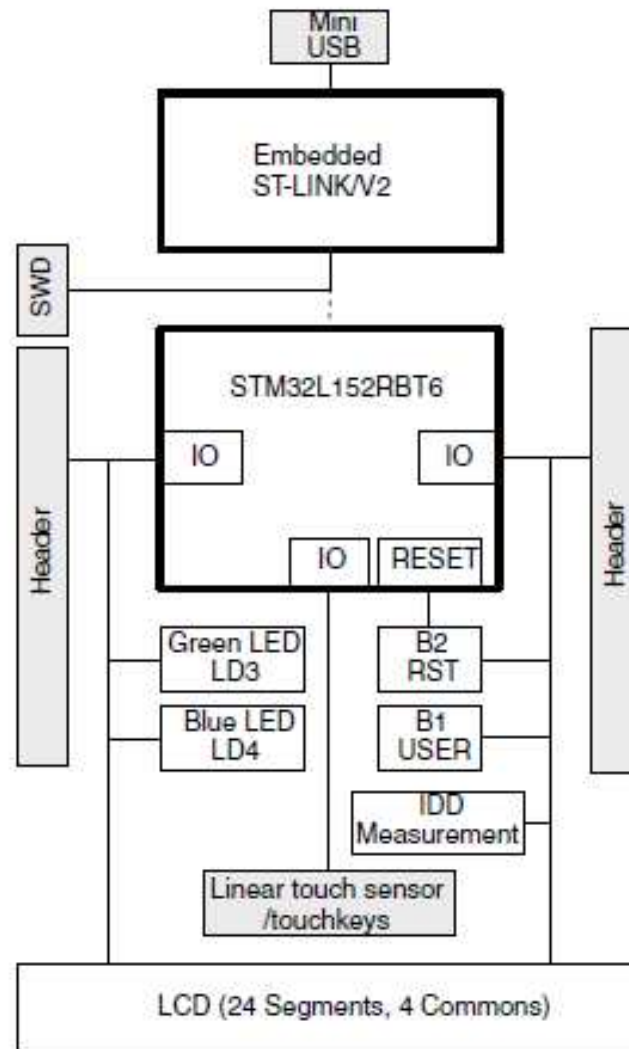


Low power run	regulator in low power mode, limited clock frequency, limited number of peripherals running
Sleep	Cortex-M3 core stopped, peripherals kept running.
Low power sleep	Cortex-M3 core stopped, limited clock frequency, limited number of peripherals running, regulator in low power mode
Stop mode	all clocks are stopped, regulator running, regulator in low power mode
Standby	VCORE domain powered off.

STM32L-DISCOVERY



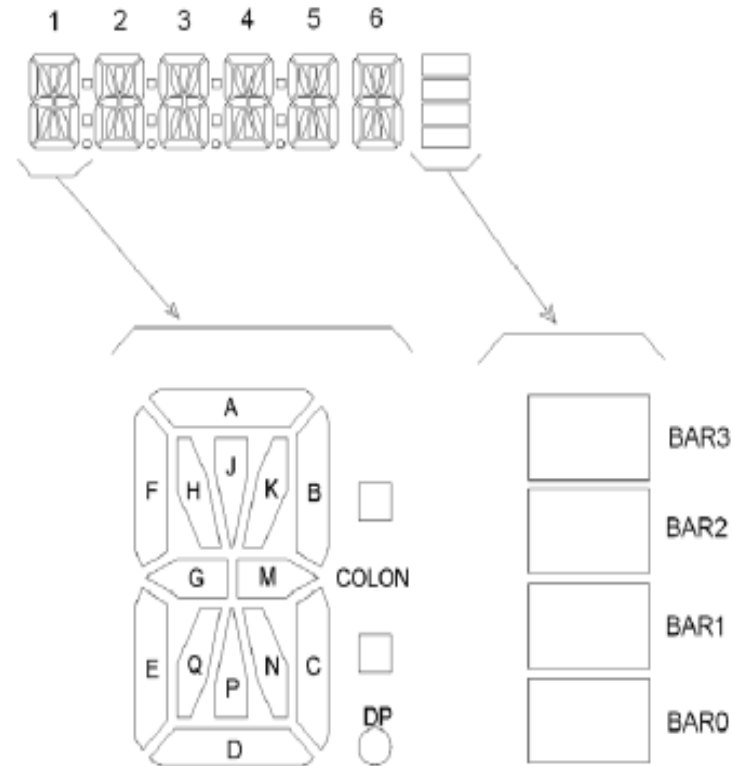
STM32L-DISCOVERY



LCD



- Custom LCD 6 digits 14 segments
- Directly driven by STM32L152
- 28 Outputs
- Driven by standard lib:
 - `stm32l1xx_lcd.c`
 - `stm32l_discovery_lcd.c`

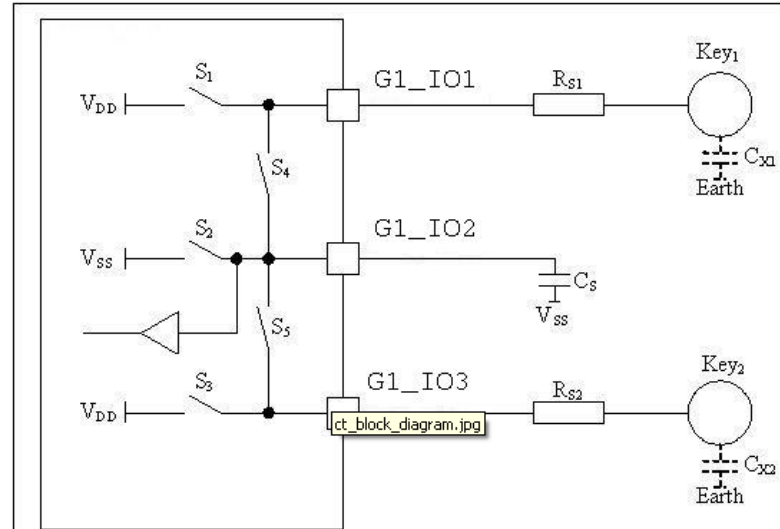
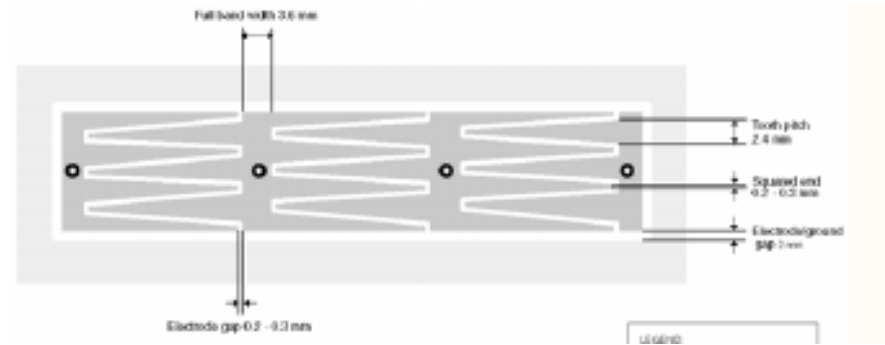


TOUCH SENSE

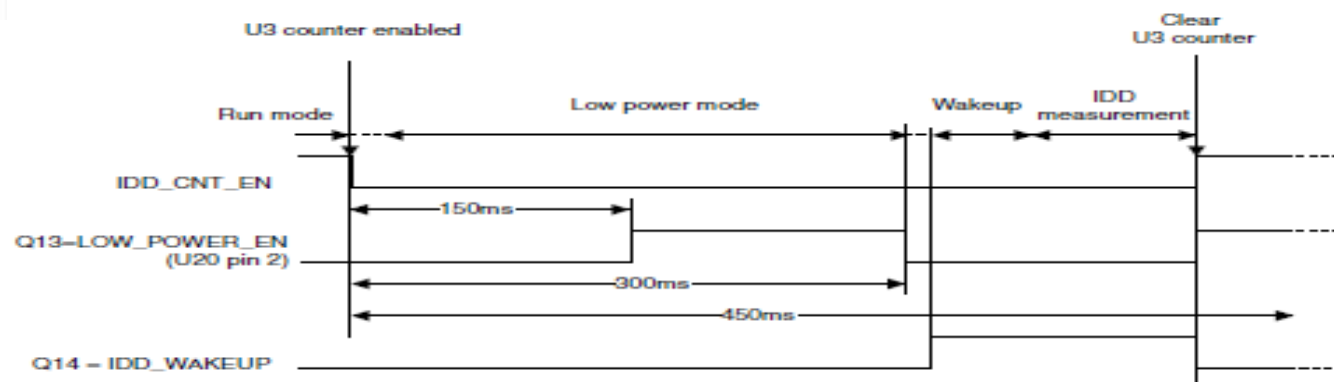
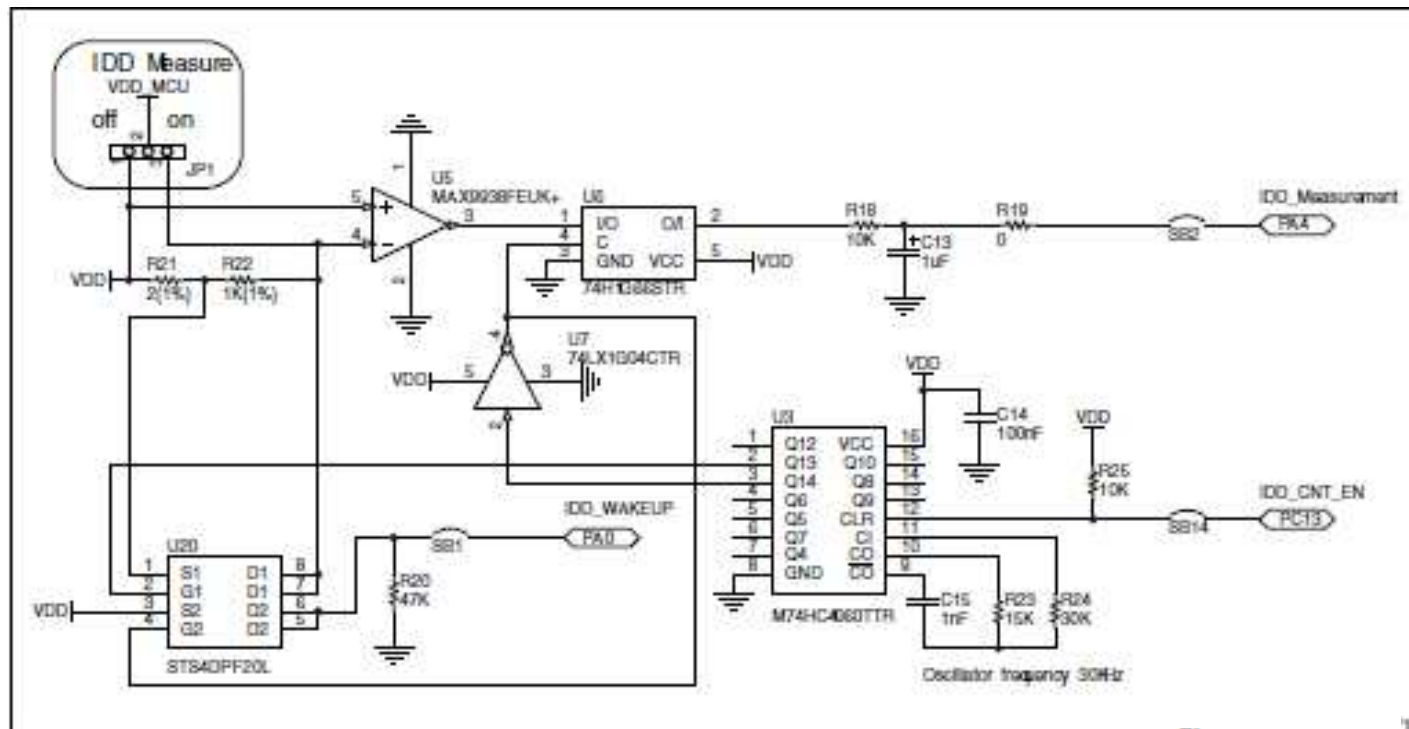


- Surface charge transfert
- Based on capacitance charge-discharge
- Drived by the dedicated ST library: STM32TSL

STMTouch At your fingertips










IDD measurement circuit



QUIZ: Current !

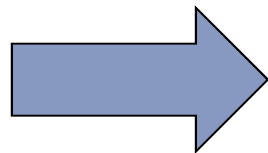


4	LD3 and LD4 OFF		STM32L consumption measured in Run mode (4 MHz)	0.85 mA
			STM32L consumption measured in Sleep mode (4 MHz)	0.26mA
5			STM32L consumption measured in Run mode (32 KHz)	7.7µA
			STM32L consumption measured in low power sleep mode (32 KHz)	4 µa
6			STM32L consumption measured in Stop mode, RTC ON	1.5µA
			STM32L consumption measured in Stop mode, RTC OFF	0.35µA
7			STM32L consumption measured in Standby mode	0,24µA

I/O free



- 28 I/O used by LCD
- 6 I/O used by Touch sense
- 3 I/O used by Current measurement



5 Free I/Os

Forum – Document references – www.st.com

- Forum:E2e Forum STM32L-DISCOVERY:
<https://my.st.com/public/STe2ecommunities/mcu/default.aspx>

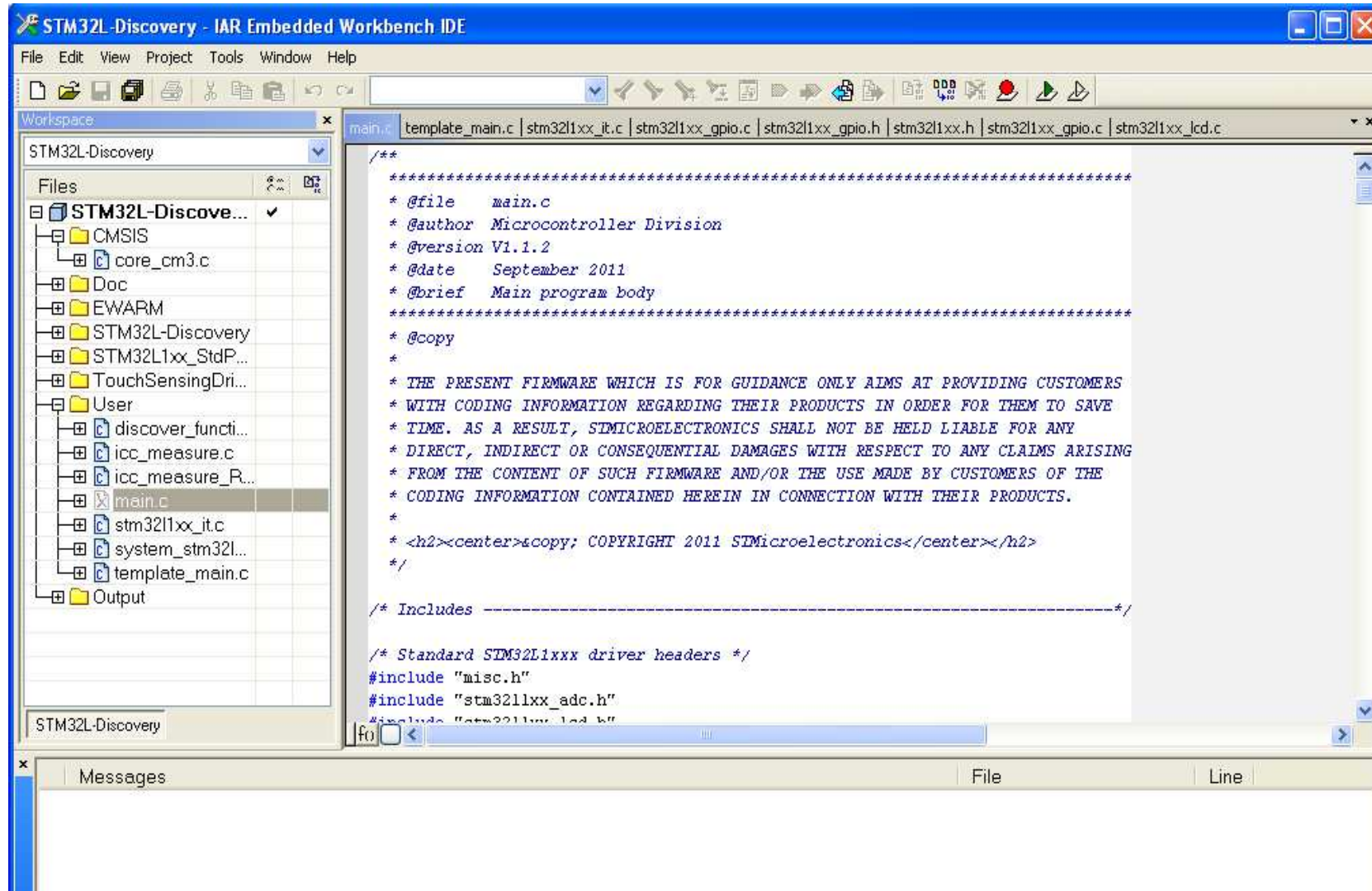
- Documents on www.st.com
 - **STM32L151xx Data sheet**
 - **RM0072 Reference manual**
 - **UM1079 User manual STM32L-DISCOVERY**
 - **STMTouch Microcontrollers** www.st.com/STMTouch

- Projects on
<https://www.st.com/stonline/stappl/resourceSelector/app?page=resourceSelector&doctype=FIRMWARE&FamilyID=141>
 - **stm32l-discovery_fw_pack.zip:**
 - Demo project & thermometer project.



- To connect Discovery on PC.
- To launch STM32 IDE
- Open workspace « STM32L-Discovery.eww »
- Run , Break , Continue.
- Watch variables

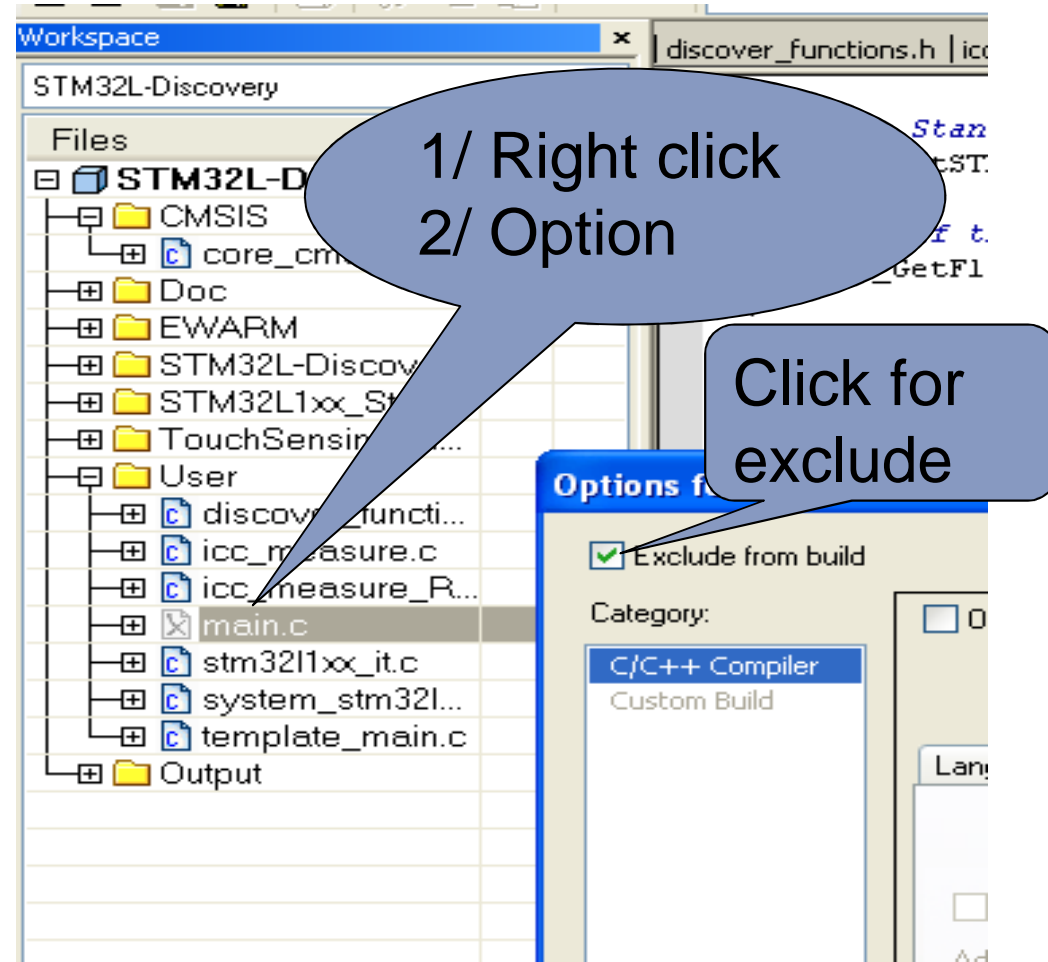
IAR: EWARM



Template_main.c



- For exercise:
 1. Exclude the « main.c »
 2. Include the « template_main.c »
 3. Build
 4. Debug



Exercice 1



- To update main program: Function1
- Specifications: With slider, update the LCD contrast.

Usefull functions:

- **TSL_Action(); // To scan the slider**
- **Slider_value_p(); // To display the slider value**
- **SLIDER_POSITION // Return the slider value: 0 to 255**
- **LCD_ContrastConfig(LCD_Contrast_Level_0); // contrast min**
- **LCD_ContrastConfig(LCD_Contrast_Level_7); //contrast max**

Exercice 2



- To update main program: Function2
- Specifications: With slider, update the LED blink frequency. The 2 leds will be in opposite state.

Usefull functions:

- **TSL_Action(); // To scan the slider**
- **Slider_value_p(); // To display the slider value**
- **SLIDER_POSITION // To return the slider value**
- **GPIO_HIGH(a,b) ; // To set port a pin b to high**
- **GPIO_LOW(a,b) ; // To reset port a pin b to low**
- **GPIO_TOGGLE(a,b) ; // To inverse the port a pin b level**