

动手实验1

通过STM32CubeMX从零开始驱动STM32F746-DK并创建一个TouchGFX工程



- 熟悉STM32CubeMX中配置FMC、LTDC、FreeRTOS、GRAPHICS
- 了解如何使用STM32CubeMX创建TouchGFX的工程
- 了解TouchGFX Designer如何实现简单HelloWorld
- 使用开发工具进行开发、下载、编译、仿真、调试
 - Visual Studio
 - IAR/KEIL

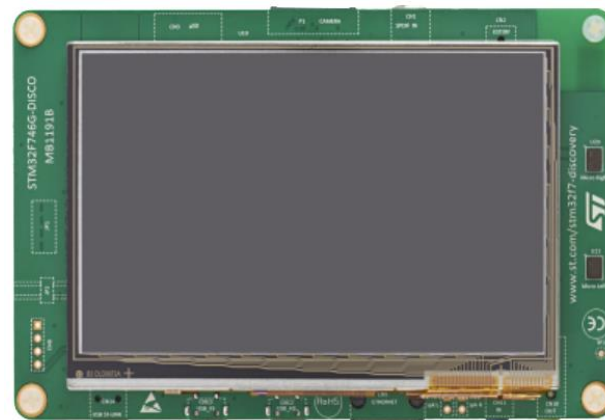
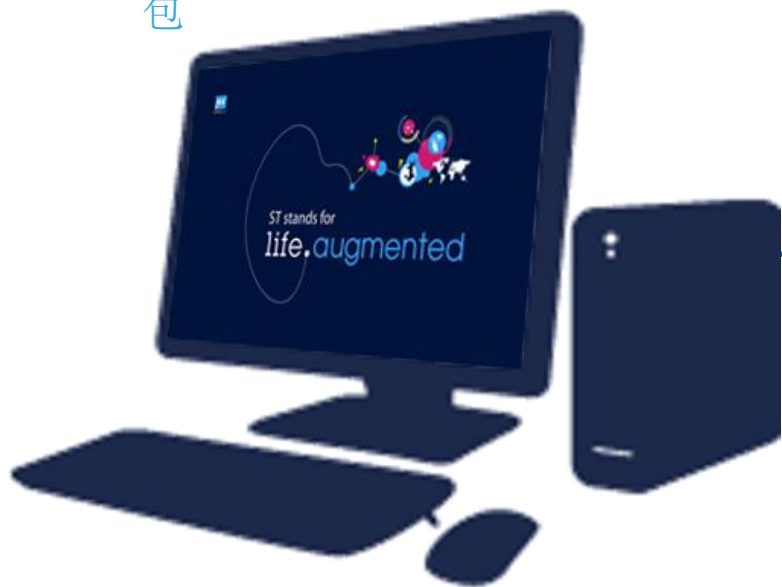


• 主机

- 安装STM32CubeMX 5.1.0
- 安装STM32CubeProgrammer或者ST-Link Utility
- 安装对应的IDE（IAR8.32）
- TouchGFX designer 4.10.0
- 在STM32CubeMX中载入STM32Cube F7 1.15.0 软件包

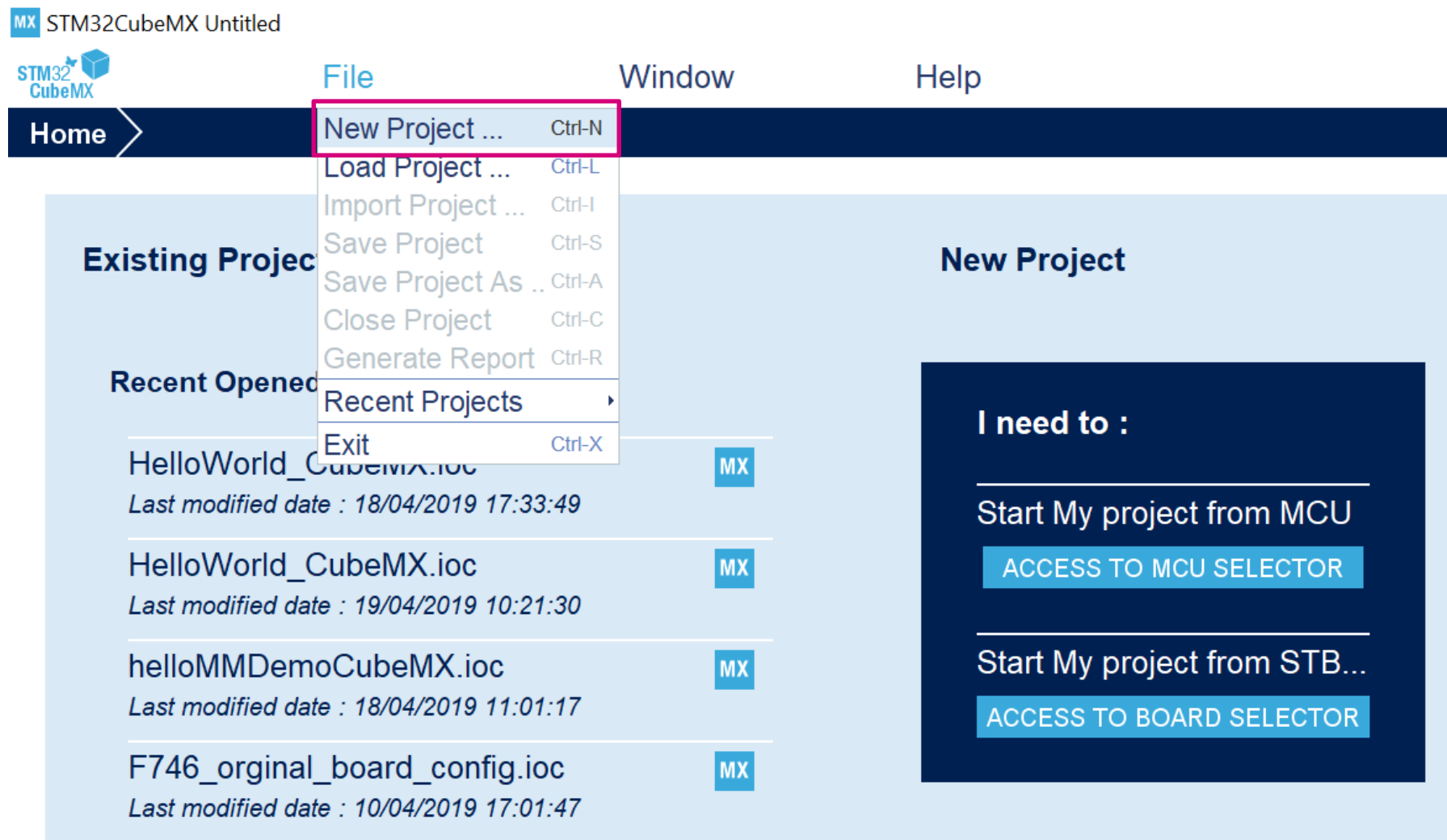
• GUI板

- STM32F746G-DISCO（演示用）
 - STM32F746NGH6
 - 272x480 LCD屏
 - 外扩SDRAM





- 新建项目





实现示例

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- 选择MCU型号（STM32F746NG）

MX New Project

MCU SelectorBoard Selector

MCU Filters

★📁🔍🔄

Part Number Search

STM32F746NG

Core

Series

Line

Package

Other

Price From 8.703 to 8.703

8.703

IO = 168

Eeprom = 0 (Bytes)

Flash = 1024 (kBytes)

Ram = 320 (kBytes)

Freq. = 216 (MHz)

FeaturesBlock DiagramDocs & ResourcesDatasheetBuyStart Project

★STM32F746NG

High-performance and DSP with FPU, ARM Cortex-M7 MCU with 1 Mbyte Flash, 216 MHz CPU, Art Accelerator, L1 cache, SDRAM, TFT

ACTIVE Active
Product is in mass production

Unit Price for 10kU (US\$) : 8.703

Boards: 32F746GDISCOVERY - STM32746G-EVAL

TFBGA216

The STM32F745xx and STM32F746xx devices are based on the high-performance ARM®Cortex®-M7 32-bit RISC core operating at up to 216 MHz frequency. The Cortex®-M7 core features a single floating point unit (SFPU) precision which supports all ARM®single-precision data-processing instructions and data types. It also implements a full set of DSP instructions and a memory protection unit (MPU) which enhances the application security. The STM32F745xx and STM32F746xx devices incorporate high-speed embedded memories with a Flash memory up to 1 Mbyte, 320 Kbytes of SRAM

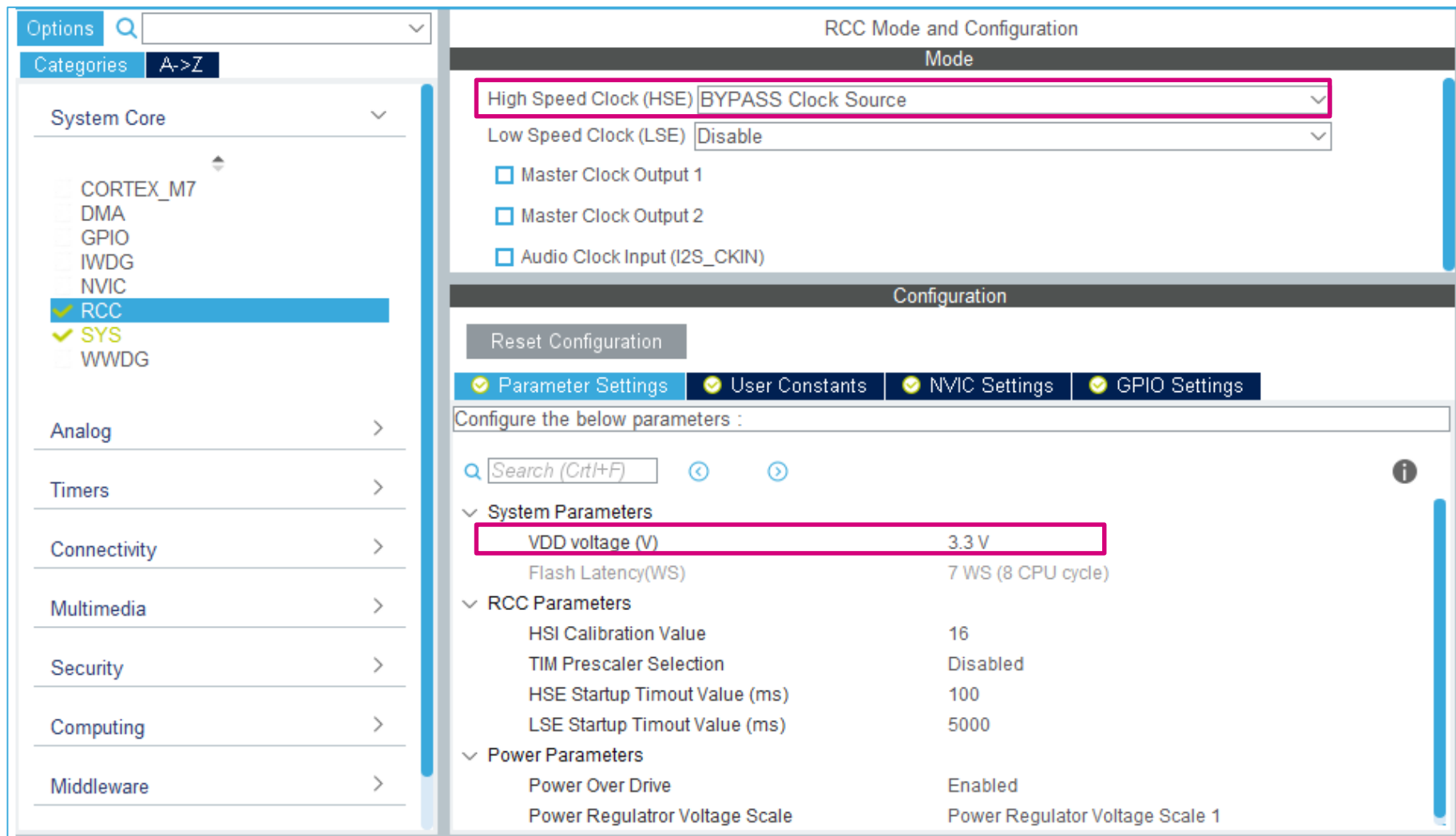
MCUs List: 1 item+ Display similar items

*	Par...	Reference	Mark...	Board	Pack...	Flash	RAM	IO	Freq.	GFX...	DDR	DE...	HDP	PKA	PWR	RF	TA...
☆	STM...	STM32F746NGHx	Active	32F7...	STM3...	TFB...	102...	320...	168	21...	0.0	0	0	0	0	0	0



- 组件（系统需要）

- RCC配置

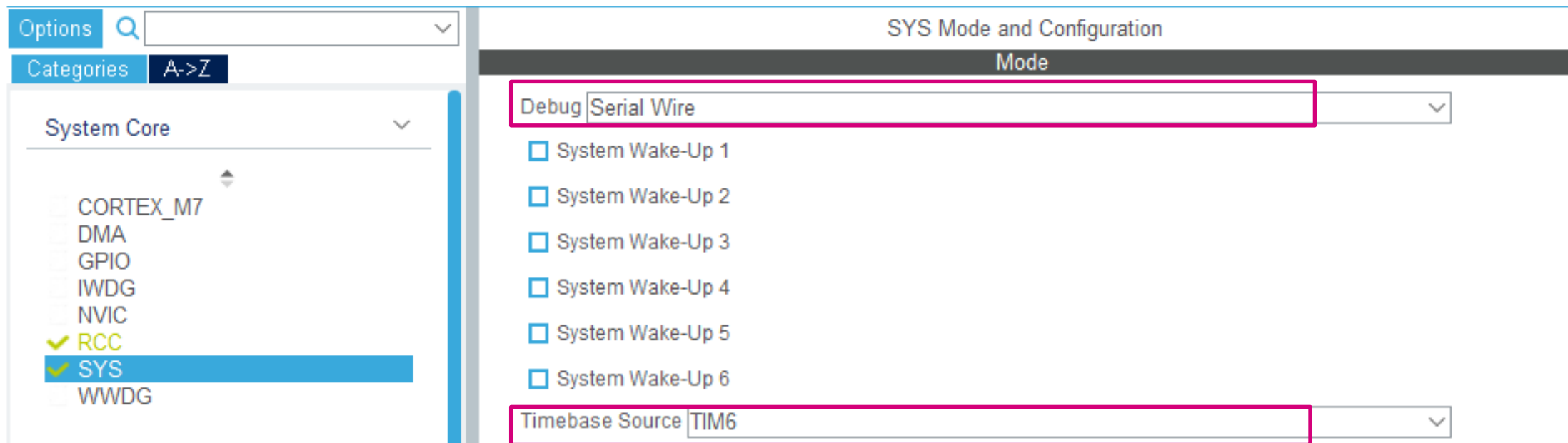




实现示例（续）

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- 组件（系统需要）
 - SYS配置





实现示例（续）

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- 组件（系统需要）

- Timer

The screenshot shows the STM32CubeMX configuration tool for the TIM7 timer. On the left, a sidebar lists various components under 'Options' and 'Categories'. Under 'Timers', TIM7 is selected and highlighted with a blue bar and a checkmark. The main panel is titled 'TIM7 Mode and Configuration' and is divided into two sections: 'Mode' and 'Configuration'.

Mode Section:

- ☒ Activated (highlighted with a pink box)
- ☐ One Pulse Mode

Configuration Section:

- A 'Reset Configuration' button is present.
- Below it are three tabs: 'User Constants' (checked), 'NVIC Settings' (checked), and 'DMA Settings' (checked). The 'Parameter Settings' tab is currently active and highlighted in blue.
- A text box says 'Configure the below parameters :'. Below this is a search bar labeled 'Search (Ctrl+F)' and navigation arrows.
- The 'Counter Settings' section is expanded, showing:
 - Prescaler (PSC - 16 bits value): 0
 - Counter Mode: Up
 - Counter Period (AutoReload Regist...): 0
 - auto-reload preload: Disable
- The 'Trigger Output (TRGO) Parameters' section is expanded, showing:
 - Trigger Event Selection: Reset (UG bit from TIMx_EGR)



实现示例（续）

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- 组件（GUI功能需要）

- I2C3配置
（用于触摸屏）

The screenshot displays the STM32CubeMX configuration interface. On the left, the 'Connectivity' tree lists various peripherals, with 'I2C3' selected and highlighted in blue. The right pane shows the 'I2C3 Mode and Configuration' settings. The 'Mode' dropdown is set to 'I2C'. Below this, the 'Configuration' section includes a 'Reset Configuration' button and several expandable settings: 'NVIC Settings', 'DMA Settings', 'GPIO Settings', 'Parameter Settings' (which is currently expanded), and 'User Constants'. The 'Parameter Settings' section contains a search bar and two expandable categories: 'Timing configuration' and 'Slave Features'. The 'Timing configuration' section is further expanded, showing parameters such as 'I2C Speed Mode' (Standard Mode), 'I2C Speed Frequency (KHz)' (100), 'Rise Time (ns)' (0), 'Fall Time (ns)' (0), 'Coefficient of Digital Filter' (0), 'Analog Filter' (Enabled), and 'Timing' (0x00C0EAF). The 'Slave Features' section is also expanded, showing parameters like 'Clock No Stretch Mode' (Disabled), 'General Call Address De...' (Disabled), 'Primary Address Length ...' (7-bit), 'Dual Address Acknowled...' (Disabled), and 'Primary slave address' (0).



实现示例（续）

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- 组件（GUI功能需要）
 - I2C硬件IO口的重映射

I2C I2C

Configuration

Reset Configuration

✓ NVIC Settings ✓ DMA Settings ✓ GPIO Settings

✓ Parameter Settings ✓ User Constants

Search Signals

Search (Ctrl+F) ☐ Show only Modified Pins

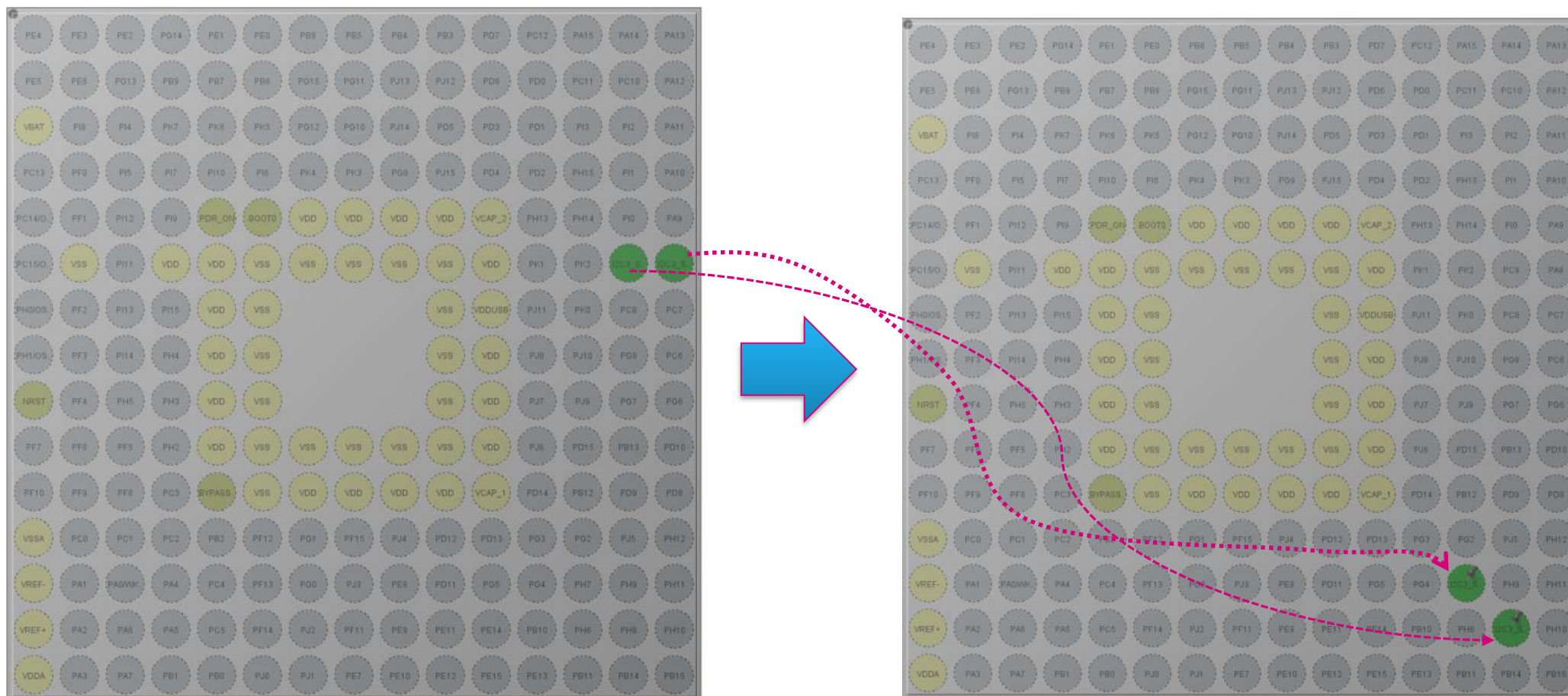
Pin Na...	Signal on...	GPIO ou...	GPIO mode	GPIO P...	Maximu...	User Label	Modified
PH7	I2C3_SCL	n/a	Alternate F...	Pull-up	Very High	LCD_SC...	✓
PH8	I2C3_SDA	n/a	Alternate F...	Pull-up	Very High	LCD_SD...	✓



实现示例（续）

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- 组件（GUI功能需要）
 - 默认I2C3关联引脚与实际硬件连接不一致，调整与硬件连接保持一致。

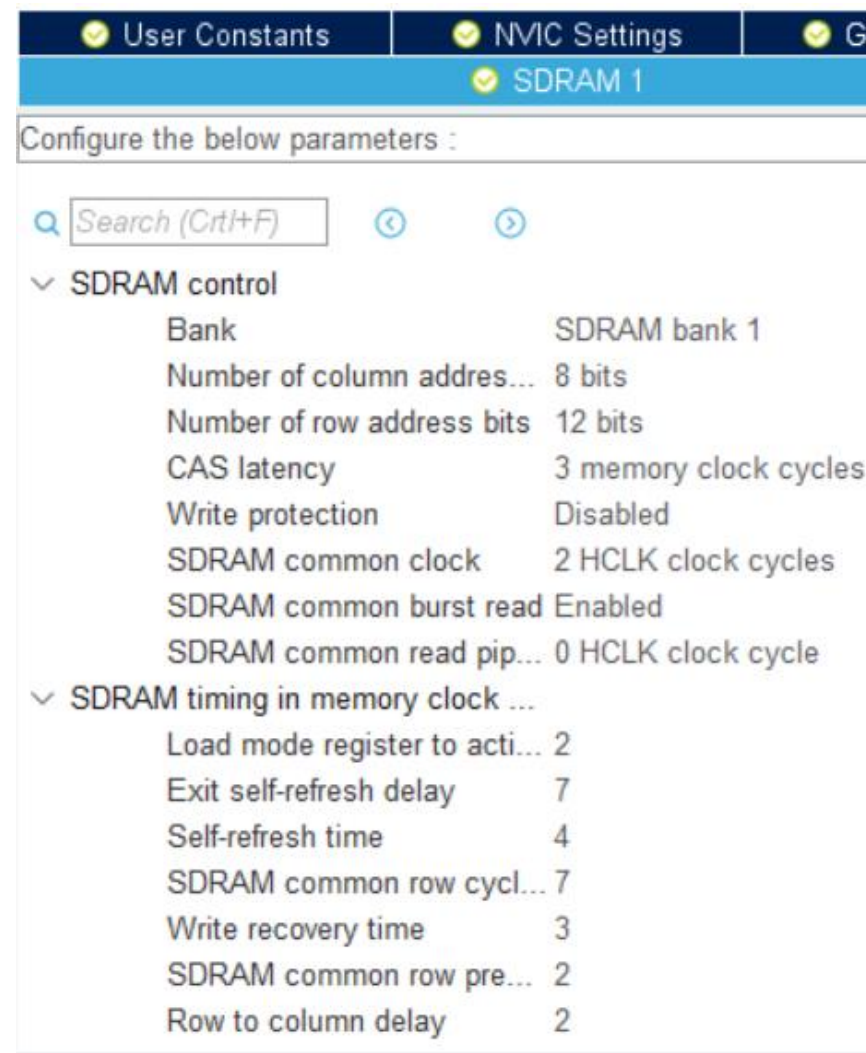
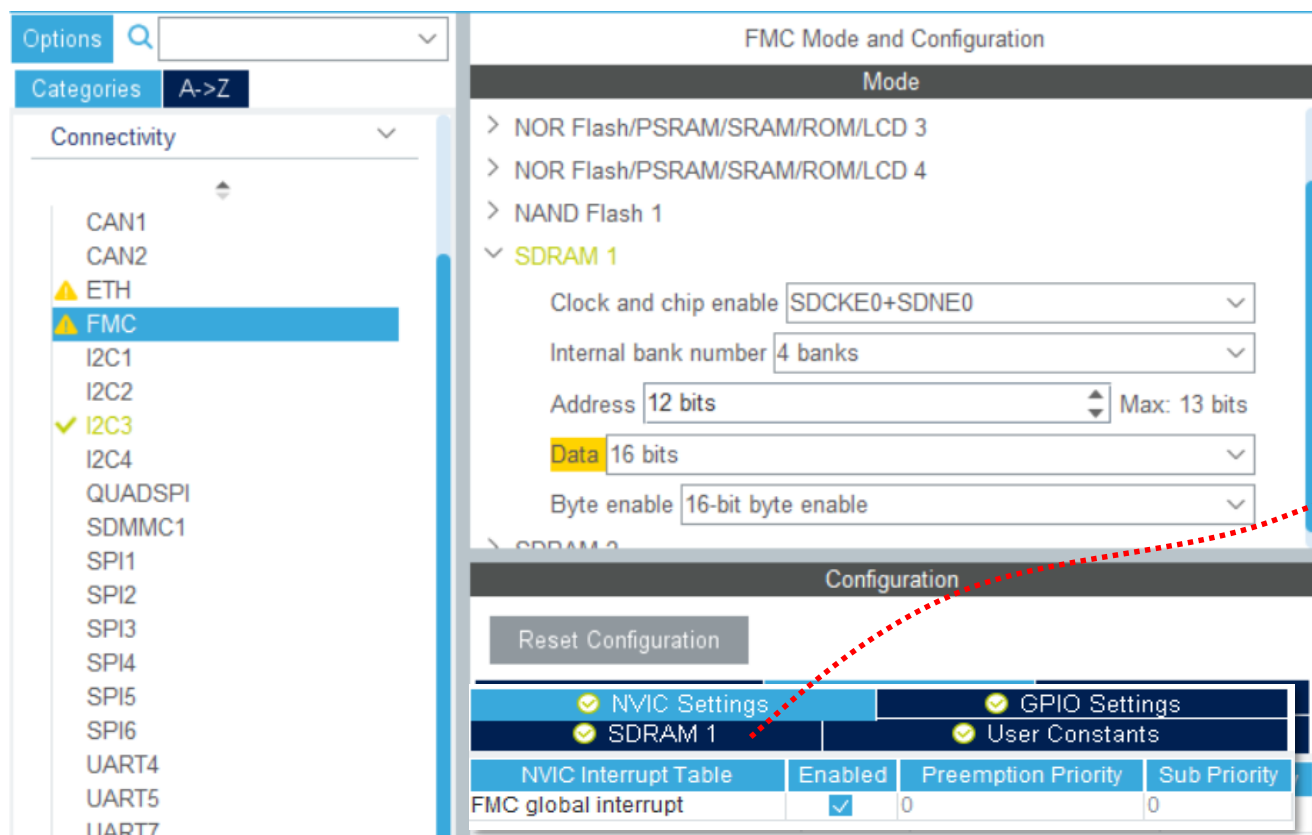




实现示例（续）

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- 组件（GUI功能需要）
 - FMC配置（STM32CubeMX中）





实现示例（续）

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- 组件（GUI功能需要）
 - FMC（GPIO Settings, 连接关系按照原理图配置）

SDRAM 1 User Constants NVIC Settings GPIO Settings							
Search Signals							
Search (Ctrl+F)							
☐ Show only Modified Pins							
Pin Name	Signal on Pin	GPIO output	GPIO mode	GPIO Pull-u	Maximum o	User Label	Modified
PF0	FMC_A0	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A0 [M...	✓
PF1	FMC_A1	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A1 [M...	✓
PF2	FMC_A2	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A2 [M...	✓
PF3	FMC_A3	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A3 [M...	✓
PF4	FMC_A4	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A4 [M...	✓
PF5	FMC_A5	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A5 [M...	✓
PF11	FMC_SDNR...	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_SDNR...	✓
PF12	FMC_A6	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A6 [M...	✓
PF13	FMC_A7	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A7 [M...	✓
PF14	FMC_A8	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A8 [M...	✓
PF15	FMC_A9	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A9 [M...	✓
PG0	FMC_A10	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A10 [...]	✓
PG1	FMC_A11	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A11 [...]	✓
PG4	FMC_BA0	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_BA0 [...]	✓
PG5	FMC_BA1	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_BA1 [...]	✓
PG8	FMC_SDCLK	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_SDCL...	✓
PG15	FMC_SDNC...	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_SDNC...	✓
PH3	FMC_SDNE0	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_SDNE...	✓
PH5	FMC_SDNWE	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_SDN...	✓



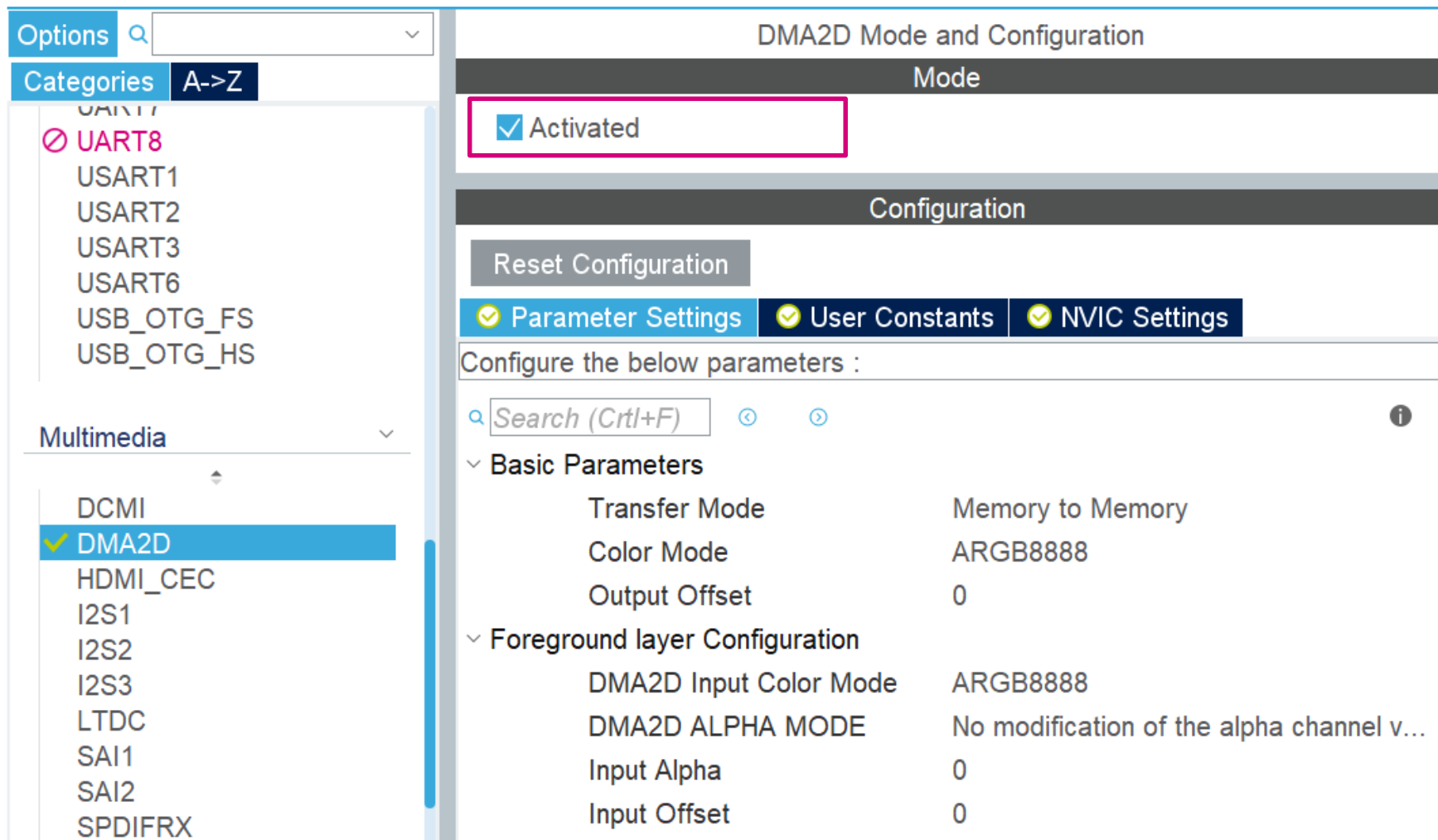
SDRAM 1 User Constants NVIC Settings GPIO Settings							
Search Signals							
Search (Ctrl+F)							
☐ Show only Modified Pins							
Pin Name	Signal on Pin	GPIO output	GPIO mode	GPIO Pull-u	Maximum o	User Label	Modified
PC3	FMC_SDCK...	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_SDCK...	✓
PD0	FMC_D2	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D2 [M...	✓
PD1	FMC_D3	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D3 [M...	✓
PD8	FMC_D13	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D13 [...]	✓
PD9	FMC_D14	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D14 [...]	✓
PD10	FMC_D15	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D15 [...]	✓
PD14	FMC_D0	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D0 [M...	✓
PD15	FMC_D1	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D1 [M...	✓
PE0	FMC_NBL0	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_NBL0 ...	✓
PE1	FMC_NBL1	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_NBL1 ...	✓
PE7	FMC_D4	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D4 [M...	✓
PE8	FMC_D5	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D5 [M...	✓
PE9	FMC_D6	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D6 [M...	✓
PE10	FMC_D7	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D7 [M...	✓
PE11	FMC_D8	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D8 [M...	✓
PE12	FMC_D9	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D9 [M...	✓
PE13	FMC_D10	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D10 [...]	✓
PE14	FMC_D11	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D11 [...]	✓
PE15	FMC_D12	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_D12 [...]	✓
PF0	FMC_A0	n/a	Alternate Fu...	No pull-up a...	Very High	FMC_A0 [M...	✓



实现示例（续）

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- 组件（GUI功能需要）
 - DMA2D





实现示例（续）

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- 组件（GUI功能需要）
 - DMA2D: 使能中断

Options ▼

Categories **A->Z**

- CORTEX_M7
- DMA
- GPIO
- IWDG
- NVIC
- ✓ RCC
- ✓ SYS
- WWDG

Analog >

DMA2D Mode and Configuration

Mode			
☒	Activated		

Configuration

☒ Parameter Settings ☒ User Constants ☒ NVIC Settings

NVIC Interrupt Table	Enabled	Preemption Priority	Sub Priority
DMA2D global interrupt	☒	5	0



实现示例（续）

16

- 组件（GUI功能需要）

- LTDC配置

（Parameter Settings）

LTDC Mode and Configuration

Mode

Display Type RGB888 (24 bits)

Configuration

Reset Configuration

Parameter Settings Layer Settings User Constants NVIC Settings GPIO Settings

Configure the below parameters :

Search (Ctrl+F)

Synchronization for Width

Horizontal Synchronization Width	41 pixels
Horizontal Back Porch	13 pixels
Active Width	480 pixels
Horizontal Front Porch	32 pixels
HSync Width	40
Accumulated Horizontal Back Porch Width	53
Accumulated Active Width	533
Total Width	565

Synchronization for Height

Vertical Synchronization Height	10 lines
Vertical Back Porch	2 lines
Active Height	272 lines
Vertical Front Porch	2 lines
VSynC Height	9
Accumulated Vertical Back Porch Height	11
Accumulated Active Height	283
Total Height	285

Signal Polarity

Horizontal Synchronization Polarity	Active Low
Vertical Synchronization Polarity	Active Low
Not Data Enable Polarity	Active Low
Pixel Clock Polarity	Normal Input

BackGround Color

Red	0
Green	0
Blue	0

这四个数据是自动计算的，校对是否正确

这四个数据是自动计算的，校对是否正确



实现示例（续）

17

- 组件（GUI功能需要）

- LTDC配置
- （Layer Settings）

Options

Categories

Connectivity

- CAN1
- CAN2
- ▲ ETH
- ▲ FMC
- I2C1
- I2C2
- I2C3
- I2C4
- QUADSPI
- SDMMC1
- SPI1
- SPI2
- SPI3
- SPI4
- SPI5
- SPI6
- UART4
- UART5
- UART7
- ⊗ UART8
- USART1
- USART2
- USART3
- USART6
- USB_OTG_FS
- USB_OTG_HS

Multimedia

- DCMI
- ✓ DMA2D
- HDMI_CEC
- I2S1
- I2S2
- I2S3
- ✓ LTDC
- SAI1
- SAI2
- SPDIFRX

LTDC Mode and Configuration

Mode

Display Type

Configuration

Reset Configuration

Parameter Settings Layer Settings User Constants NVIC Settings GPIO Settings

Configure the below parameters :

Search (Ctrl+F)

Number of Layers

Number of Layers	1 layer
------------------	---------

Windows Position

Layer 0 - Window Horizontal Start	0
Layer 0 - Window Horizontal Stop	480
Layer 0 - Window Vertical Start	0
Layer 0 - Window Vertical Stop	272

Pixel Parameters

Layer 0 - Pixel Format	RGB565
------------------------	--------

Blending

Layer 0 - Alpha constant for blending	255
Layer 0 - Default Alpha value	0
Layer 0 - Blending Factor1	Alpha constant x Pixel Alpha
Layer 0 - Blending Factor2	Alpha constant x Pixel Alpha

Frame Buffer

Layer 0 - Color Frame Buffer Start Address	0xC0000000
Layer 0 - Color Frame Buffer Line Length (Image Width)	480
Layer 0 - Color Frame Buffer Number of Lines (Image Height)	272

BackGround Color

Layer 0 - Blue	0
Layer 0 - Green	0
Layer 0 - Red	0



实现示例（续）

18

- 组件（GUI功能需要）
 - LTDC配置
（NVIC Settings）

The screenshot displays the STM32CubeMX configuration interface. On the left, the 'Multimedia' category is expanded, showing 'LTDC' selected. The main panel is titled 'LTDC Mode and Configuration'. Under the 'Mode' section, 'Display Type' is set to 'RGB888 (24 bits)'. The 'Configuration' section includes a 'Reset Configuration' button and tabs for 'Parameter Settings', 'Layer Settings', 'User Constants', 'NVIC Settings', and 'GPIO Settings'. The 'NVIC Settings' tab is active, showing the 'NVIC Interrupt Table'. A red dashed box highlights the 'LTDC global interrupt' row, which is checked under the 'Enabled' column. The 'LTDC global error interrupt' row is unchecked.

NVIC Interrupt Table	Enabled	Preemption Priority	Sub Priority
LTDC global interrupt	☒	5	0
LTDC global error interrupt	☐	5	0



实现示例（续）

19

- 组件（GUI功能需要）

- 根据硬件原理图
- 匹配GPIO Settings

Parameter Settings Layer Settings User Constants NVIC Settings GPIO Settings							
Search Signals							
Search (Ctrl+F)		☐ Show only Modified Pins					
Pin Name	Signal on Pin	GPIO outp...	GPIO mode	GPIO Pull-...	Maximum o...	User Label	Modified
PE4	LTDC_B0	n/a	Alternate F...	No pull-up ...	Low	LCD_B0 [R...	✓
PG12	LTDC_B4	n/a	Alternate F...	No pull-up ...	Low	LCD_B4 [R...	✓
PI9	LTDC_VSYNC	n/a	Alternate F...	No pull-up ...	Low	LCD_VSY...	✓
PI10	LTDC_HSYNC	n/a	Alternate F...	No pull-up ...	Low	LCD_HSY...	✓
PI14	LTDC_CLK	n/a	Alternate F...	No pull-up ...	Low	LCD_CLK [...]	✓
PI15	LTDC_R0	n/a	Alternate F...	No pull-up ...	Low	LCD_R0 [R...	✓
PJ0	LTDC_R1	n/a	Alternate F...	No pull-up ...	Low	LCD_R1 [R...	✓
PJ1	LTDC_R2	n/a	Alternate F...	No pull-up ...	Low	LCD_R2 [R...	✓
PJ2	LTDC_R3	n/a	Alternate F...	No pull-up ...	Low	LCD_R3 [R...	✓
PJ3	LTDC_R4	n/a	Alternate F...	No pull-up ...	Low	LCD_R4 [R...	✓
PJ4	LTDC_R5	n/a	Alternate F...	No pull-up ...	Low	LCD_R5 [R...	✓
PJ5	LTDC_R6	n/a	Alternate F...	No pull-up ...	Low	LCD_R6 [R...	✓
PJ6	LTDC_R7	n/a	Alternate F...	No pull-up ...	Low	LCD_R7 [R...	✓
PJ7	LTDC_G0	n/a	Alternate F...	No pull-up ...	Low	LCD_G0 [...]	✓
PJ8	LTDC_G1	n/a	Alternate F...	No pull-up ...	Low	LCD_G1 [...]	✓
PJ9	LTDC_G2	n/a	Alternate F...	No pull-up ...	Low	LCD_G2 [...]	✓
PJ10	LTDC_G3	n/a	Alternate F...	No pull-up ...	Low	LCD_G3 [...]	✓
PJ11	LTDC_G4	n/a	Alternate F...	No pull-up ...	Low	LCD_G4 [...]	✓
PJ13	LTDC_B1	n/a	Alternate F...	No pull-up ...	Low	LCD_B1 [R...	✓
PJ14	LTDC_B2	n/a	Alternate F...	No pull-up ...	Low	LCD_B2 [R...	✓
PJ15	LTDC_B3	n/a	Alternate F...	No pull-up ...	Low	LCD_B3 [R...	✓
PK0	LTDC_G5	n/a	Alternate F...	No pull-up ...	Low	LCD_G5 [...]	✓
PK1	LTDC_G6	n/a	Alternate F...	No pull-up ...	Low	LCD_G6 [...]	✓
PK2	LTDC_G7	n/a	Alternate F...	No pull-up ...	Low	LCD_G7 [...]	✓
PK4	LTDC_B5	n/a	Alternate F...	No pull-up ...	Low	LCD_B5 [R...	✓
PK5	LTDC_B6	n/a	Alternate F...	No pull-up ...	Low	LCD_B6 [R...	✓
PK6	LTDC_B7	n/a	Alternate F...	No pull-up ...	Low	LCD_B7 [R...	✓
PK7	LTDC_DE	n/a	Alternate F...	No pull-up ...	Low	LCD_DE [...]	✓



实现示例（续）

- 组件（GUI功能需要）
 - 另外LCD的需要配置如下2个GPIO，分别是控制背光，显示使能

组件构成

Options

Categories A->Z

System Core

CORTEX_M7

DMA

GPIO

IWDG

NVIC

RCC

SYS

WWDG

Analog

ADC1

ADC2

ADC3

DAC

Timers

Connectivity

CAN1

CAN2

ETH

FMC

I2C1

GPIO Mode and Configuration

Configuration

☐ Group By Peripherals

LTDC

GPIO

RCC

Single Mapped Signals

SYS

NVIC

FMC

Search Signals

Search (Ctrl+F)

☐ Show only Modified Pins

Pin N...	Signal o...	GPIO o...	GPIO m...	GPIO P...	Maximu...	User La...	Modified
PI12	n/a	High	Output ...	No pull-...	Low	LCD_DI...	☒
PI13	n/a	n/a	External...	No pull-...	n/a	LCD_INIT	☒
PK3	n/a	High	Output ...	No pull-...	Low	LCD_BL...	☒

PI12 Configuration :

GPIO output level

High

GPIO mode

Output Push Pull

GPIO Pull-up/Pull-down

No pull-up and no pull-down

Maximum output speed

Low

User Label

LCD_DISP [RK043FN48H-CT672B_DISP]

LCD_DISP:

0: LCD进入Sleep模式 1: Normal模式（上电默认拉高）

PI12 Configuration :

GPIO output level

High

GPIO mode

Output Push Pull

GPIO Pull-up/Pull-down

No pull-up and no pull-down

Maximum output speed

Low

User Label

LCD_DISP [RK043FN48H-CT672B_DISP]

LCD_BL_CTRL:

0: 关闭背光 1: 打开背光（上电默认拉高）

PK3 Configuration :

GPIO output level

High

GPIO mode

Output Push Pull

GPIO Pull-up/Pull-down

No pull-up and no pull-down

Maximum output speed

Low

User Label

LCD_BL_CTRL [STLD40DPUR_EN]



life.augmented

22/05/2019



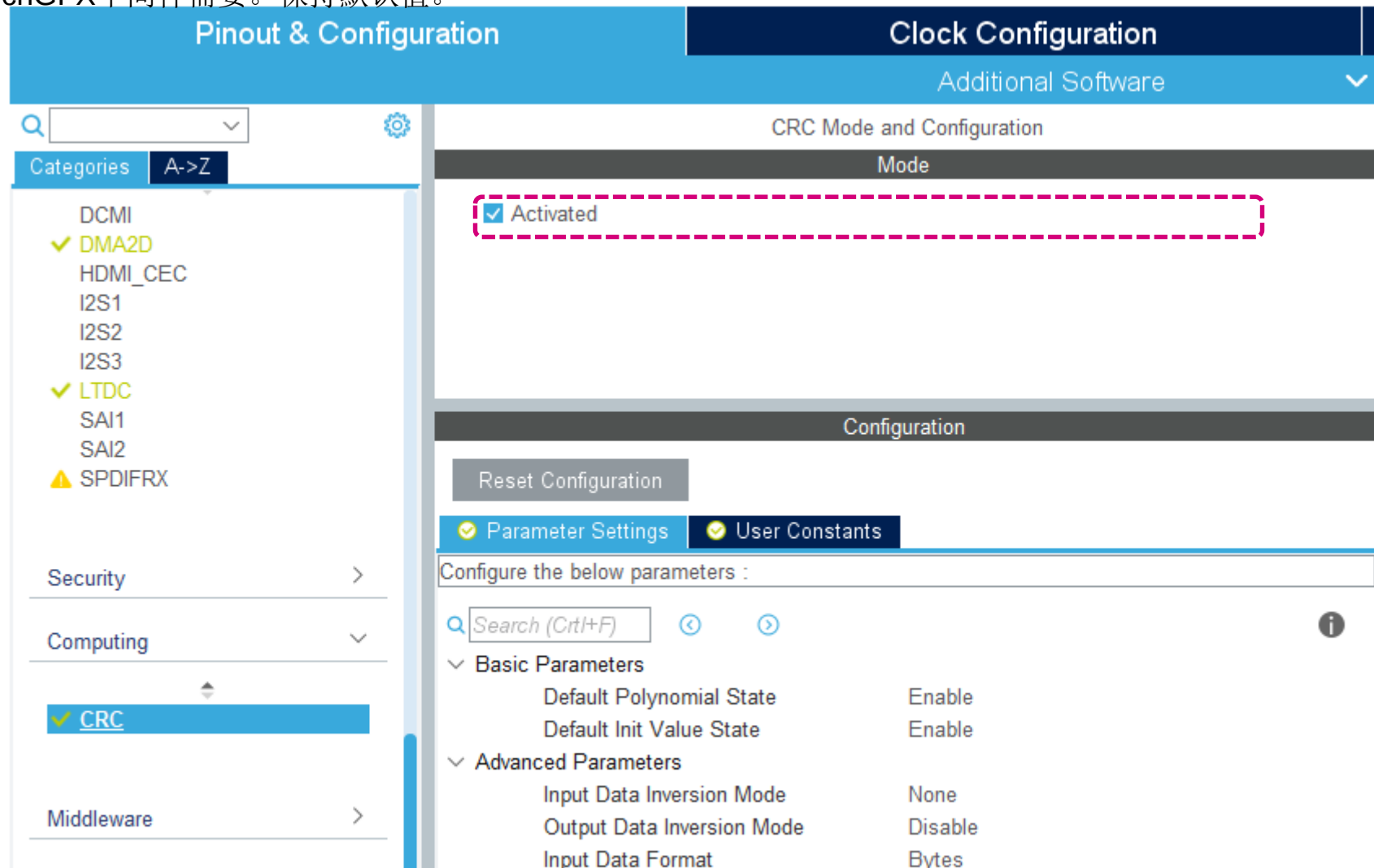
实现示例（续）

21

- IP组件（GUI功能需要）

- CRC

- TouchGFX中间件需要。保持默认值。





实现示例（续）

22

- IP组件（GUI功能需要）
 - NVIC配置

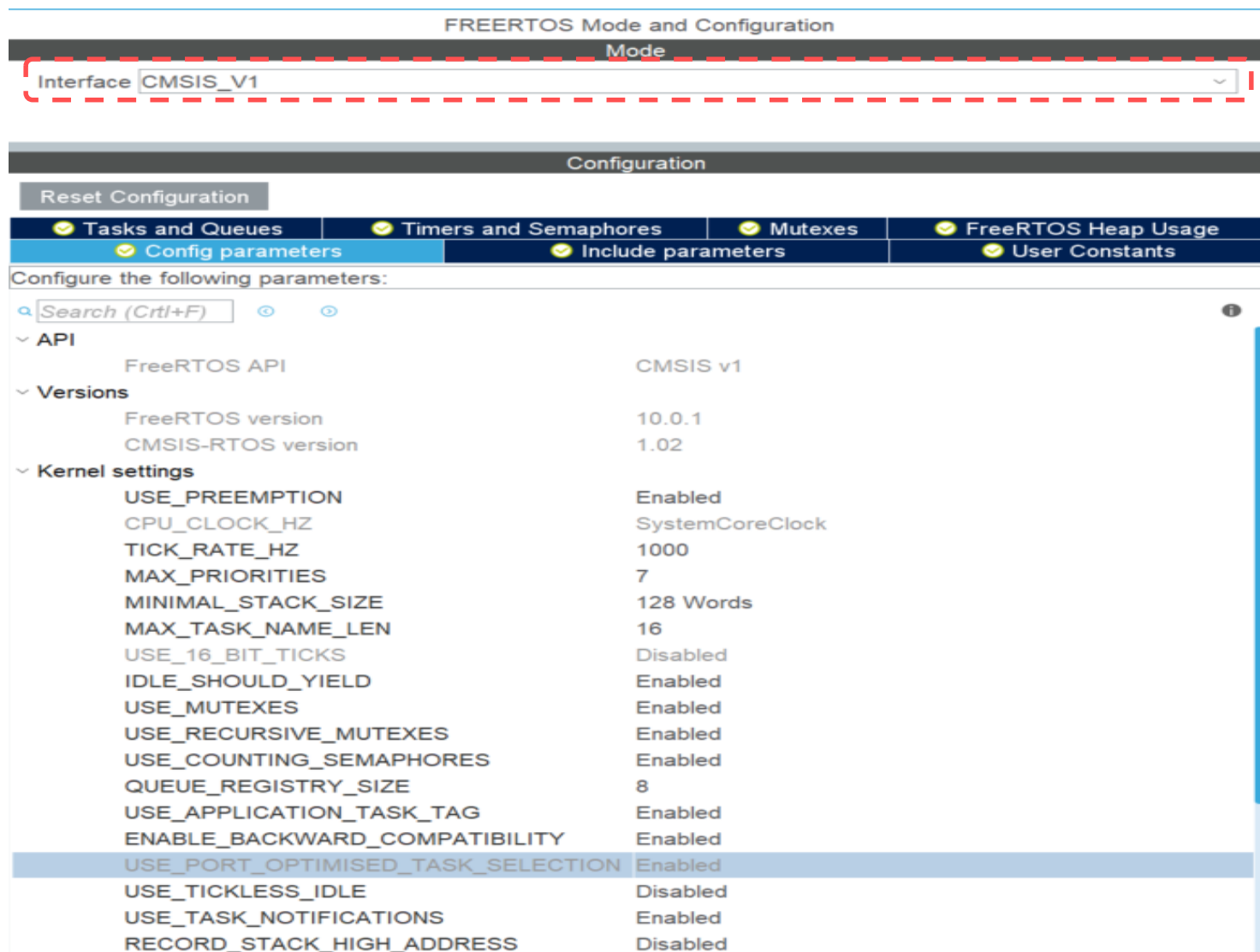
NVIC Interrupt Table	Enabled	Preemption P
Non maskable interrupt	☒	0
Hard fault interrupt	☒	0
Memory management fault	☒	0
Pre-fetch fault, memory access fault	☒	0
Undefined instruction or illegal state	☒	0
System service call via SWI instruction	☒	0
Debug monitor	☒	0
Pendable request for system service	☒	15
System tick timer	☒	15
PVD interrupt through EXTI line 16	☐	5
Flash global interrupt	☐	5
RCC global interrupt	☐	5
EXTI line[15:10] interrupts	☒	5
FMC global interrupt	☒	5
Time base: TIM6 global interrupt, DAC1 and DAC2 underrun error interr...	☒	0
TIM7 global interrupt	☐	5
I2C3 event interrupt	☐	5
I2C3 error interrupt	☐	5
HASH and RNG global interrupts	☐	5
FPU global interrupt	☐	5
LTDC global interrupt	☒	5
LTDC global error interrupt	☐	5
DMA2D global interrupt	☒	5



实现示例（续）

23

- 组件（中间件需要）
 - FreeRTOS
 - 使能FreeRTOS。





实现示例（续）

24

- 组件（中间件需要）

- FreeRTOS

- 2. 配置参数。

Configuration

Reset Configuration

Tasks and Queues	Timers and Semaphores	Mutexes	FreeRTOS Heap Usage
Config parameters	Include parameters	User Constants	

Configure the following parameters:

Search (Ctrl+F)

API

FreeRTOS API	CMSIS v1
Versions	
FreeRTOS version	10.0.1
CMSIS-RTOS version	1.02
Kernel settings	
USE_PREEMPTION	Enabled
CPU_CLOCK_HZ	SystemCoreClock
TICK_RATE_HZ	1000
MAX_PRIORITIES	7
MINIMAL_STACK_SIZE	128 Words
MAX_TASK_NAME_LEN	16
USE_16_BIT_TICKS	Disabled
IDLE_SHOULD_YIELD	Enabled
USE_MUTEXES	Enabled
USE_RECURSIVE_MUTEXES	Enabled
USE_COUNTING_SEMAPHORES	Enabled
QUEUE_REGISTRY_SIZE	8
USE_APPLICATION_TASK_TAG	Enabled
ENABLE_BACKWARD_COMPATIBILITY	Enabled
USE_PORT_OPTIMISED_TASK_SELECTION	Enabled
USE_TICKLESS_IDLE	Disabled
USE_TASK_NOTIFICATIONS	Enabled
RECORD_STACK_HIGH_ADDRESS	Disabled
Memory management settings	
Memory Allocation	Dynamic
TOTAL_HEAP_SIZE	32768 Bytes
Memory Management scheme	heap_4

构成



实现示例（续）

25

- 组件（中间件需要）

- FreeRTOS

- 3. 增加任务堆栈空间

- 调整Stack Size空间大小

☒ Mutexes	☒ FreeRTOS Heap Usage
☒ Tasks and Queues	☒ Timers and Semaphores
☒ Config parameters	☒ Include parameters
☒ User Constants	

Tasks								
Task N...	Priority	Stack ...	Entry F...	Code ...	Param...	Allocati...	Buffer ...	Contro...
default...	osPrio...	4096	StartD...	Default	NULL	Dyna...	NULL	NULL

Queues				
Queue Name	Queue Size	Item Size	Allocation	Control Blo...



Edit Task

Task Name

defaultTask

Priority

osPriorityNormal

Stack Size (Words)

4096

Entry Function

StartDefaultTask

Code Generation Option

Default

Parameter

NULL

Allocation

Dynamic

Buffer Name

NULL

Control Block Name

NULL

OK

Cancel



实现示例（续）

26

- 组件（GUI功能需要）

- TouchGFX

- （Parameter Settings）

- Parameter Settings
（参数设置）

The screenshot displays the STM32CubeMX configuration interface. On the left, the 'Multimedia' category is expanded, and 'GRAPHICS' is selected. The main window shows the 'GRAPHICS Mode and Configuration' settings. Under 'Mode', 'TouchGFX' is chosen for the 'Graphics Framework' and 'Display Parallel Interface using LTDC' for the 'Display Interface'. The 'Configuration' tab is active, showing a list of parameters for 'TouchGFX'. The parameters are organized into sections: 'Physical Display Size' (Width: 480, Height: 272), 'Frame Buffer' (LTDC Pixel Format: LTDC_PIXEL_FORMAT_RGB565, Frame Buffer Color Format: RGB565, Color Frame Buffer Depth: 16, Color Frame Buffer Start Address: 0xc0000000, Buffers Count: Double Buffered), 'Bitmap Cache Settings' (Bitmap Cache Address: 0, Bitmap Cache Size: 0, Bitmap Objects Count: 0), 'Instrumentation' (Timer For Instrumentation: Timer 7), 'Number of Layers' (GUI_NUM_LAYERS: 1), and 'SDRAM Instances' (SDRAM instance: SDRAM1_BANK1, SDRAM Refresh Count: 1647).

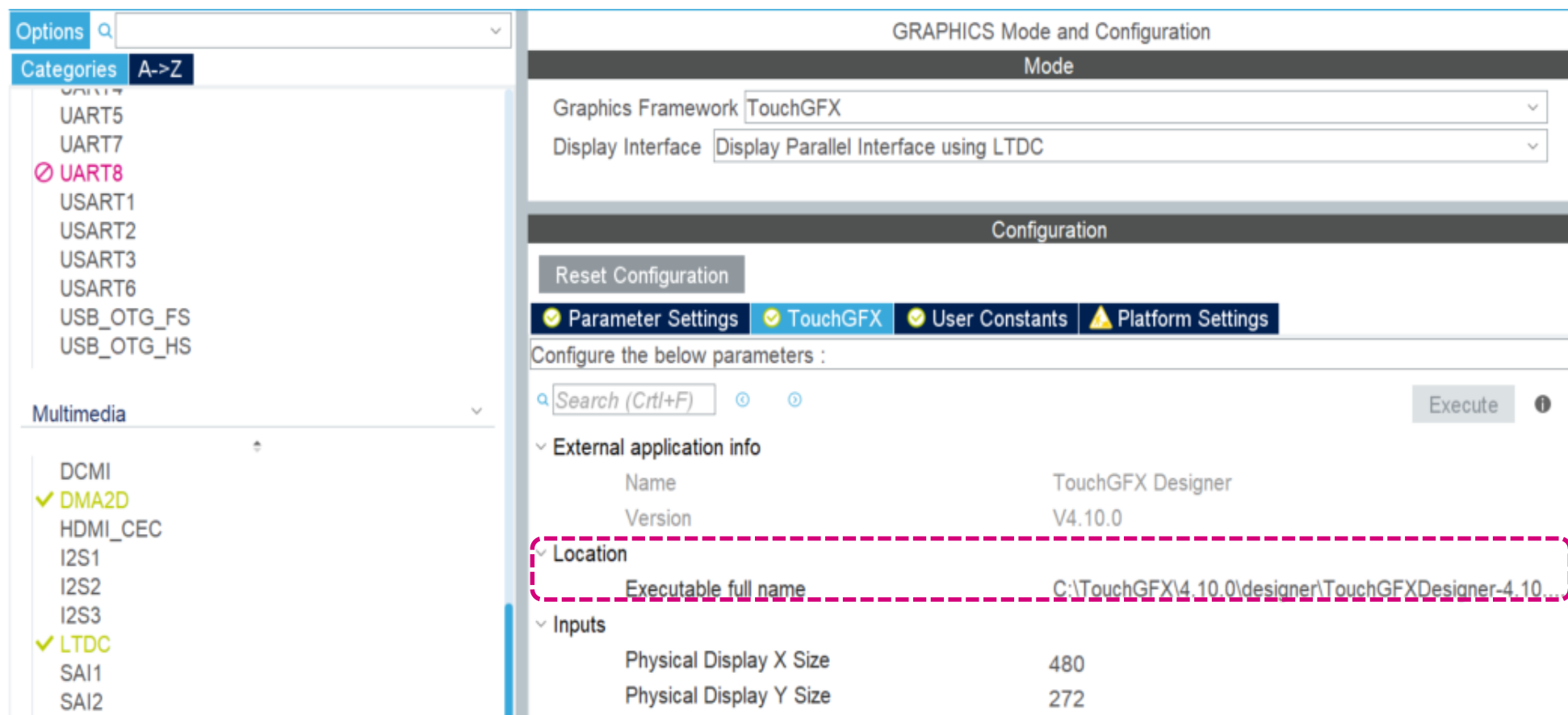


实现示例（续）

27

- 组件（GUI功能需要）
 - TouchGFX（GUI中间件）

TouchGFXDesigner默认安装路径：C:\TouchGFX\4.10.0\designer\TouchGFXDesigner-4.10.0.exe





实现示例（续）

28

- 组件（GUI功能需要）
 - TouchGFX（GUI中间件）
 - 指定显示屏复位引脚（STM32F746G-DISCO的LCD reset引脚是上电复位，所以LCD RESET Pin可以不配置）

Options Categories A->Z

UART5
UART7
❌ UART8
USART1
USART2
USART3
USART6
USB_OTG_FS
USB_OTG_HS

Multimedia

DCMI

GRAPHICS Mode and Configuration

Mode

Graphics Framework TouchGFX

Display Interface Display Parallel Interface using LTDC

Configuration

Reset Configuration

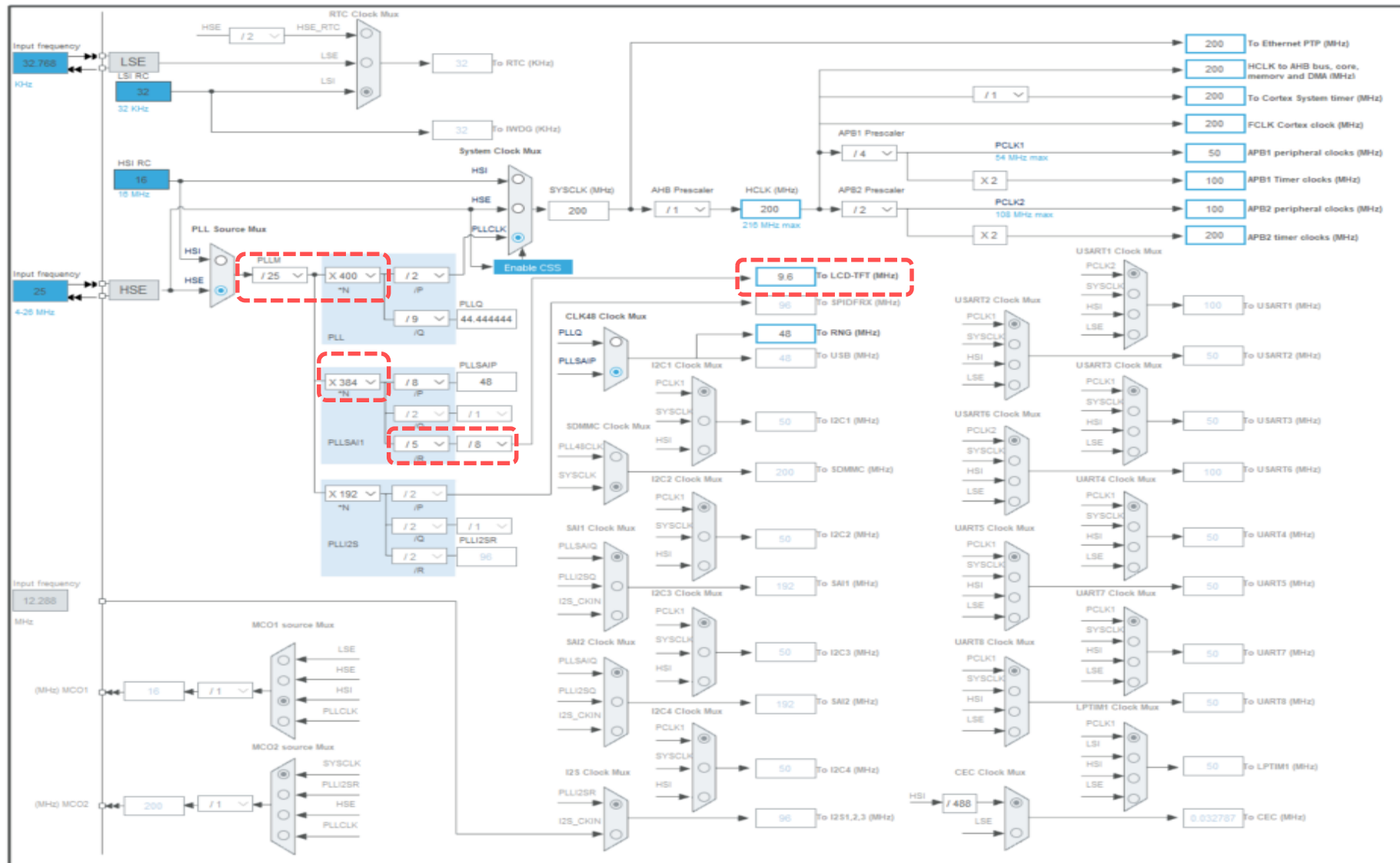
Parameter Settings TouchGFX User Constants Platform Settings

Platform proposal

BSP

Name	IPs or Components	Found Solutions	BSP API
LCD Reset Pin XRES	GPIO:Output	Undefined	Unknown

- LCD-TFT
=9.6MHz





实现示例（续）

30

• 设置工程

- 设置工程名、保存路径等
- STM32CubeMX支持生成IAR(EWARM)、MDK、TrueSTUDIO、SW4STM32等工程
 - 演示例中，采用IAR。
- 根据应用情况，调整堆栈大小
 - 演示例中，系统堆栈开销小，保持默认。
- 选择固件包版本，需要先添加固件包至STM32CubeMX
- 更多详细介绍请参考菜单栏Help/Help文档。

The screenshot displays the STM32CubeMX Project Manager interface. The interface is divided into three main tabs: Pinout & Configuration, Clock Configuration, and Project Manager. The Project Manager tab is active, showing the Project Settings, Code Generator, and Advanced Settings sections. The Project Settings section includes fields for Project Name (HelloWorld_CubeMX), Project Location (C:\workshop\STM32F746_GUI_handson\STM32F746_GUI_Hands_On\), Application Structure (Advanced), and Toolchain Folder Location (C:\workshop\STM32F746_GUI_handson\STM32F746_GUI_Hands_On\). The Code Generator section shows the Toolchain / IDE set to EWARM V8. The Advanced Settings section includes Linker Settings (Minimum Heap Size: 0x200, Minimum Stack Size: 0x400) and Mcu and Firmware Package (Mcu Reference: STM32F746NGHx, Firmware Package Name and Version: STM32Cube FW_F7 V1.15.0). A dropdown menu on the right shows the list of toolchains, with EWARM V8 selected.

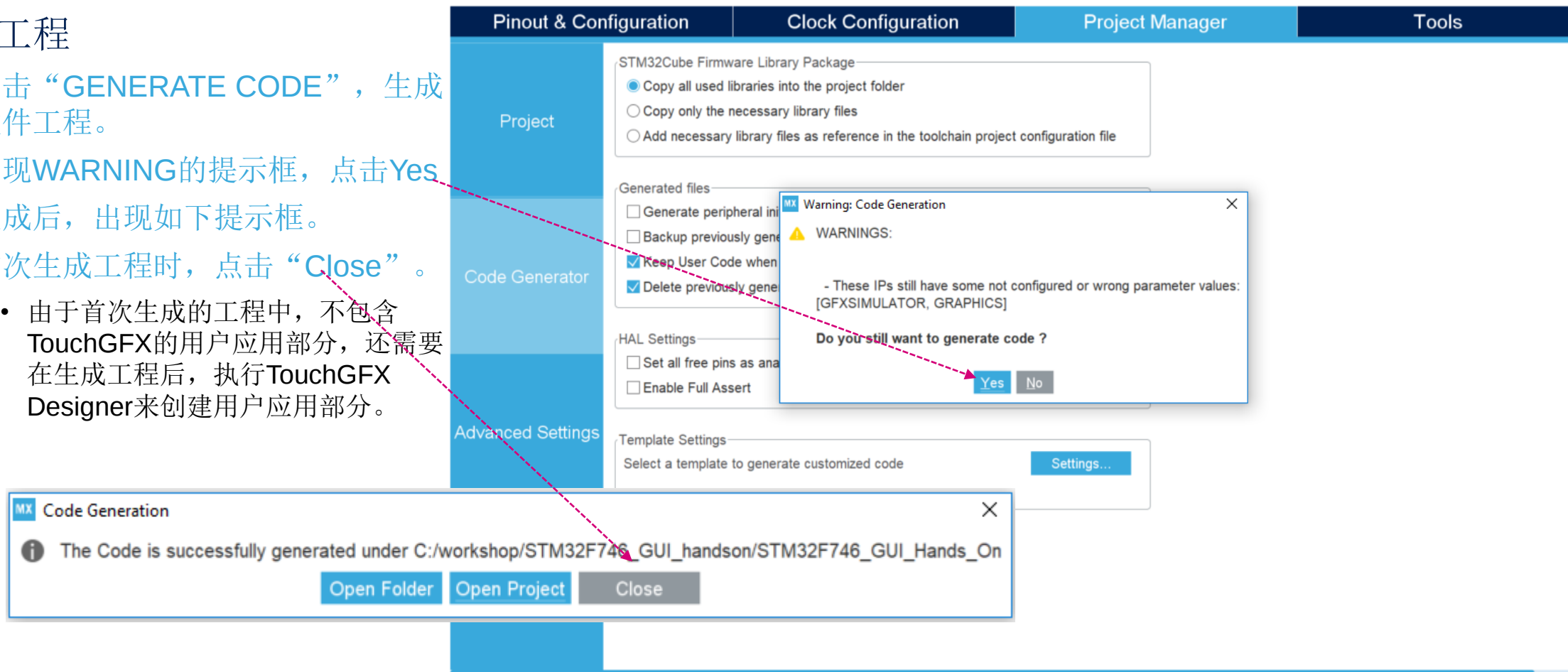


实现示例（续）

31

• 生成工程

- 点击“**GENERATE CODE**”，生成软件工程。
- 出现**WARNING**的提示框，点击**Yes**。
- 生成后，出现如下提示框。
- 首次生成工程时，点击“**Close**”。
 - 由于首次生成的工程中，不包含**TouchGFX**的用户应用部分，还需要在生成工程后，执行**TouchGFX Designer**来创建用户应用部分。





实现示例（续）

32

- 生成工程

通过右图步骤，回到
TouchGFX中间件的配
置界面，点击
“Execute”，
运行TouchGFX
Designer

Options

Categories A->Z

SPDIFRX

Security >

Computing >

CRC

Middleware >

FATFS

✓ FREERTOS

✓ GRAPHICS

LIBJPEG

LWIP

MBEDTLS

PDM2PCM

USB_DEVICE

USB_HOST

Application >

GRAPHICS Mode and Configuration

Mode

Graphics Framework TouchGFX

Display Interface Display Parallel Interface using LTDC

Configuration

Reset Configuration

✓ TouchGFX ✓ User Constants ⚠ Platform Settings

✓ Parameter Settings

Configure the below parameters :

Search (Ctrl+F)

External application info

Name	TouchGFX Designer
Version	V4.10.0

Location

Executable full name	C:\TouchGFX\4.10.0\designer\Touch...
----------------------	--------------------------------------

Inputs

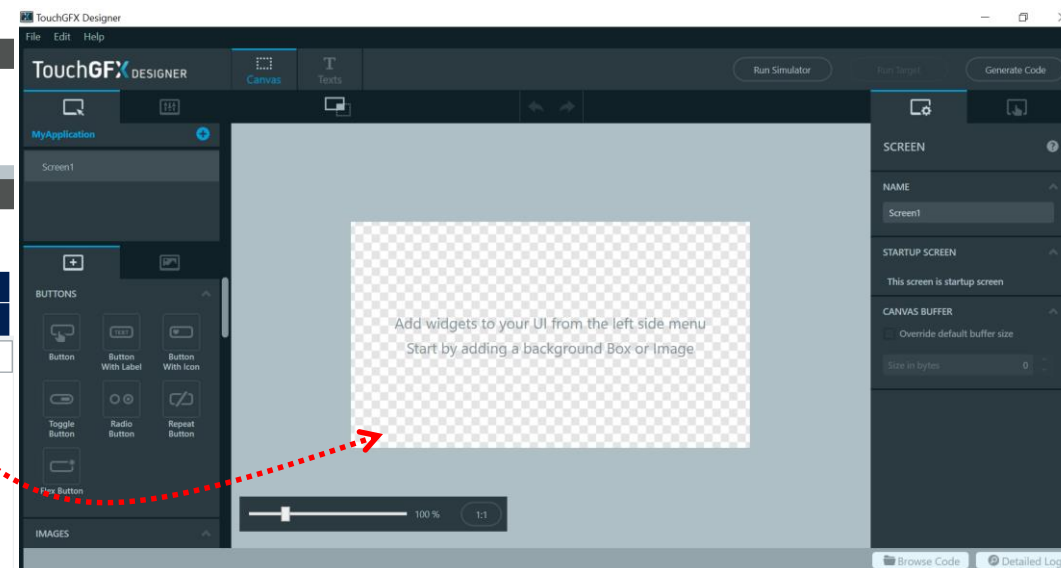
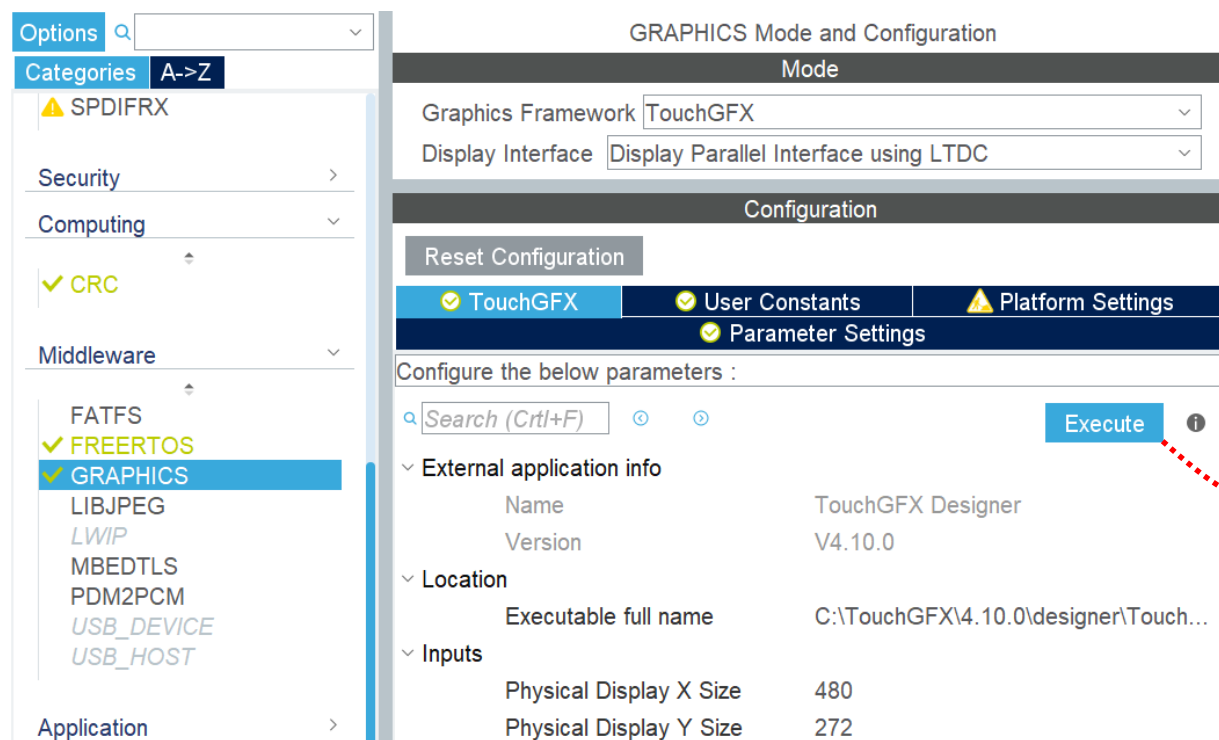
Physical Display X Size	480
Physical Display Y Size	272



实现示例（续）

33

- 执行TouchGFX Designer
 - 利用PC辅助设计工具，设计GUI应用

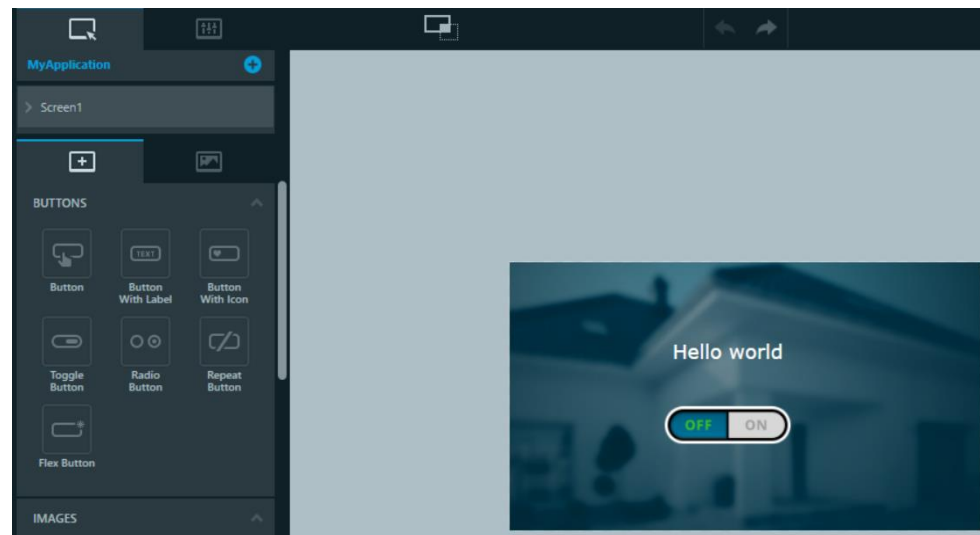
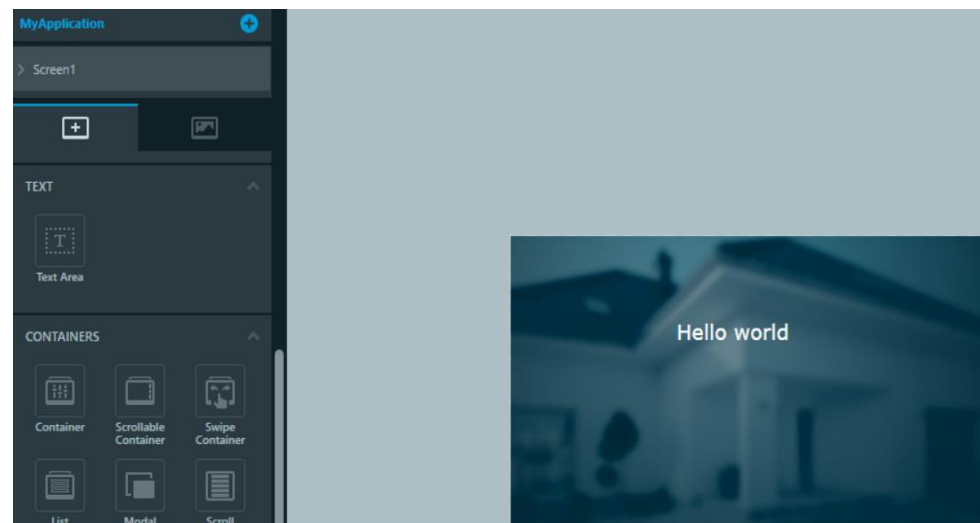
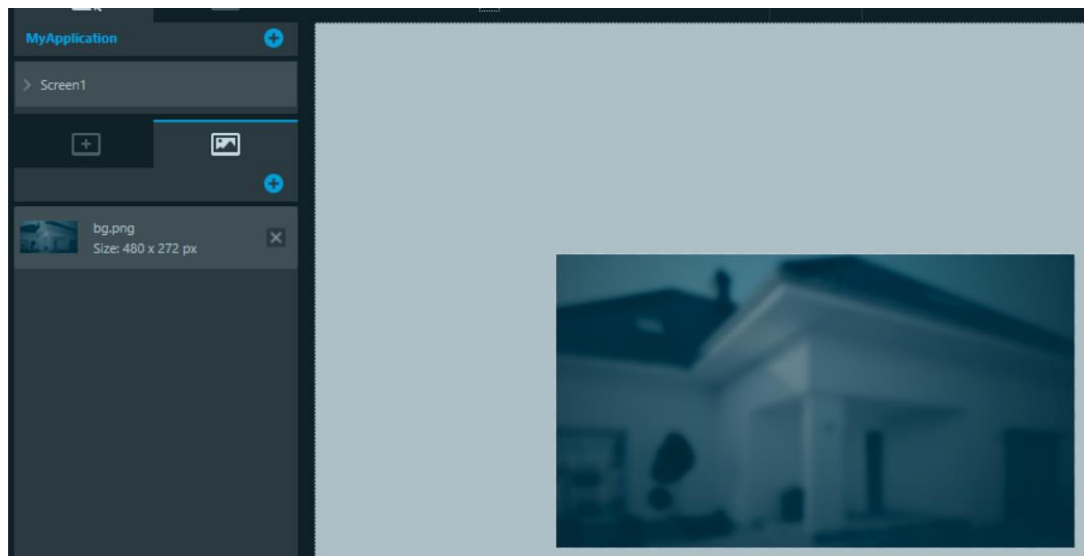




实现示例

34

- 执行TouchGFX Designer
 - 添加GUI应用。
 - 添加背景
 - 一串字符“HelloWorld”
 - 选择一个ToggleButton,然后





实现示例（续）

35

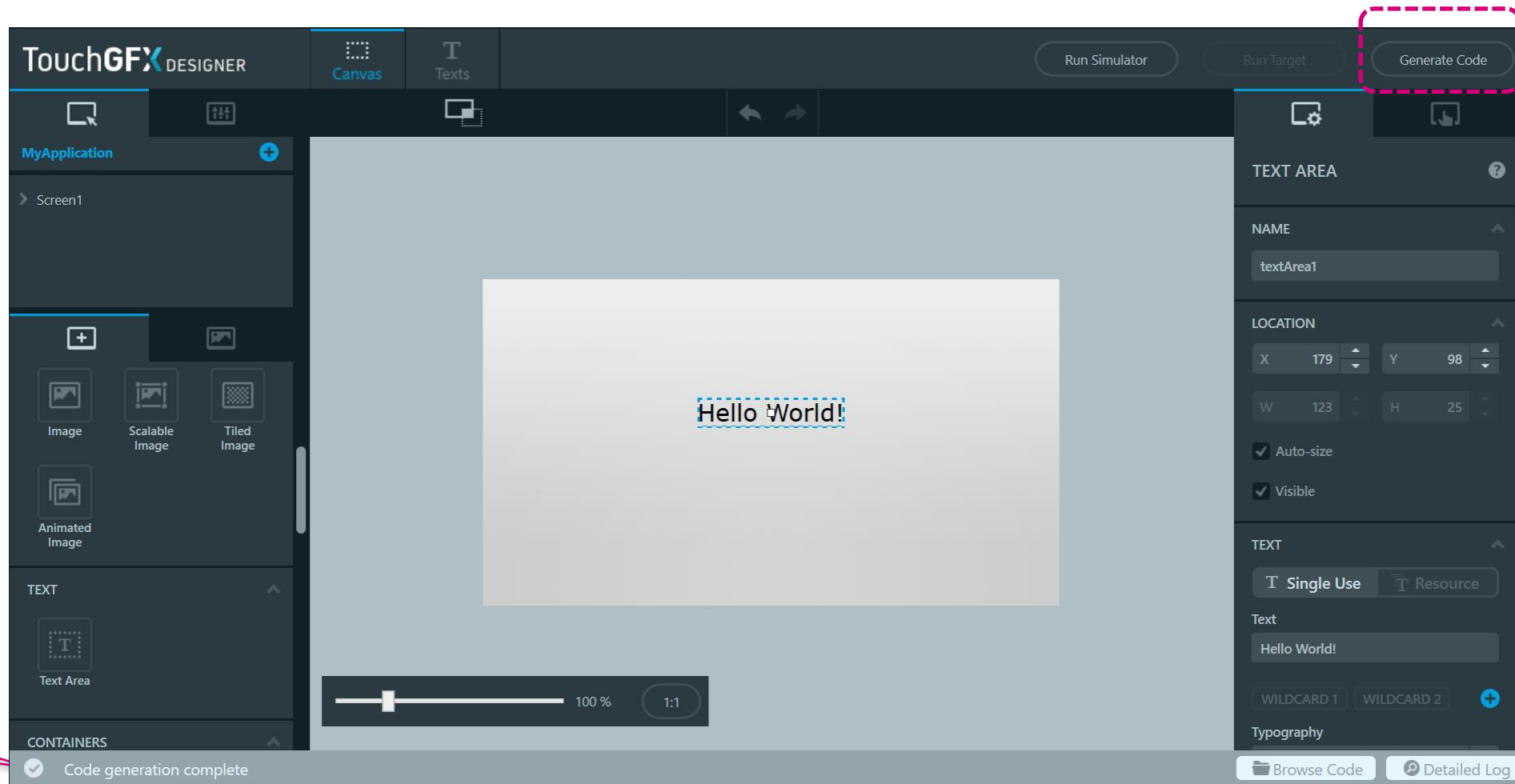
- 执行TouchGFX Designer

- 然后，点击右上角“Generate Code”，生成TouchGFX用户的应用代码。左下角会显示处理状态。
- 等待出现生成完成的提示后，关闭TouchGFX Designer，返回到STM32CubeMX。

注：详细TouchGFX Designer使用及GUI应用开发介绍，请参考：

[TouchGFX官网](#)

TouchGFX Designer
自带示例（通过
File\New选择）



代码生成
完成提示



检查生成的touchgfx工程文件

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检查生成的TouchGFX工程AvailableResolutions和PostGenerateCommand是否正确

"AvailableResolutions": [

{

"Width": 480,

"Height": 272

}

],

"PostGenerateCommand": "touchgfx update_project --project-file=../EWARM/HelloWorld_CubeMX.ewp --gui-group-name=Application/User/TouchGFX/gui --generated-group-name=Application/User/TouchGFX/generated && touchgfx update_project --project-file=simulator/msvs/Application.vcxproj && ruby updateMXProj.rb",



Name	Date modified	Type	Size
assets	4/19/2019 4:56 PM	File folder	
build	5/8/2019 1:21 PM	File folder	
config	4/19/2019 4:56 PM	File folder	
generated	4/19/2019 4:56 PM	File folder	
gui	4/19/2019 4:56 PM	File folder	
simulator	4/19/2019 4:56 PM	File folder	
target	4/19/2019 4:56 PM	File folder	
 HelloWorld_CubeMX_vs.touchgfx	5/8/2019 1:22 PM	TouchGFX 4.10.0 D...	5 KB
 output_CompileSimulator.log	5/8/2019 1:21 PM	Text Document	1 KB
 output_GenerateAssets.log	5/8/2019 1:36 PM	Text Document	1 KB
 output_PostGenerate.log	5/8/2019 1:36 PM	Text Document	1 KB

notepad++编辑

用于更新VisualStudio工程



重新生成工程

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- 至此，STM32CubeMX中配置工作完成。
- 再次点击STM32CubeMX中的“GENERATE CODE”，生成IDE工程。并且点击弹出菜单栏的“Open Project”。
- 工程中文件结构如图所示。

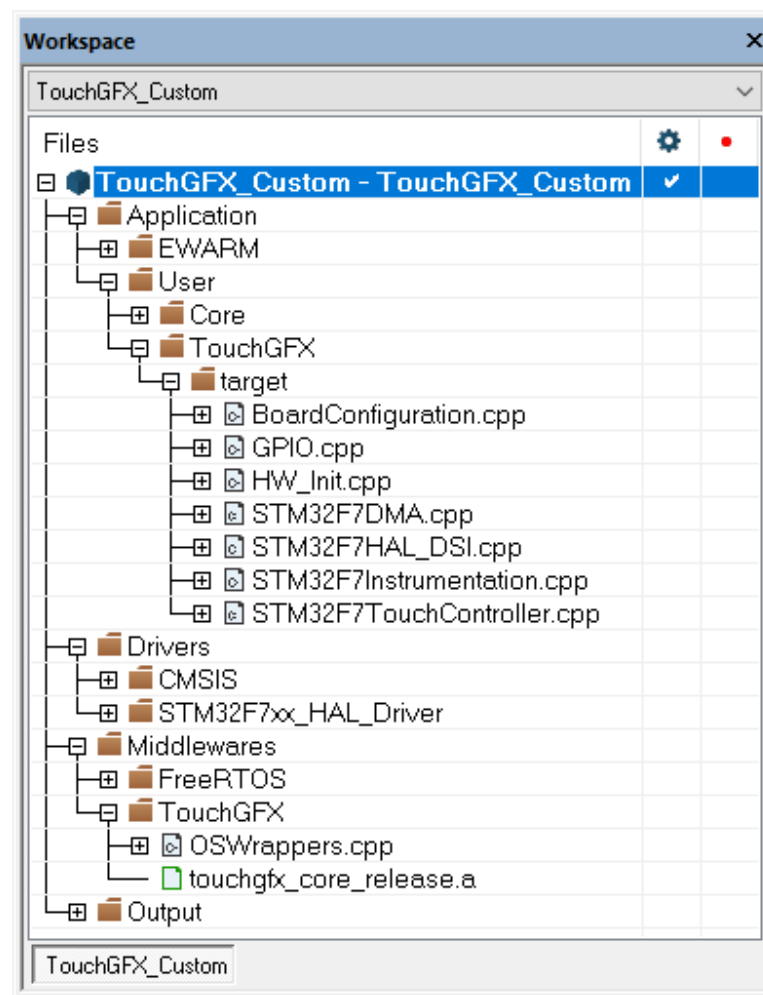


图1. IDE工程文件结构
(运行TouchGFX Designer前)

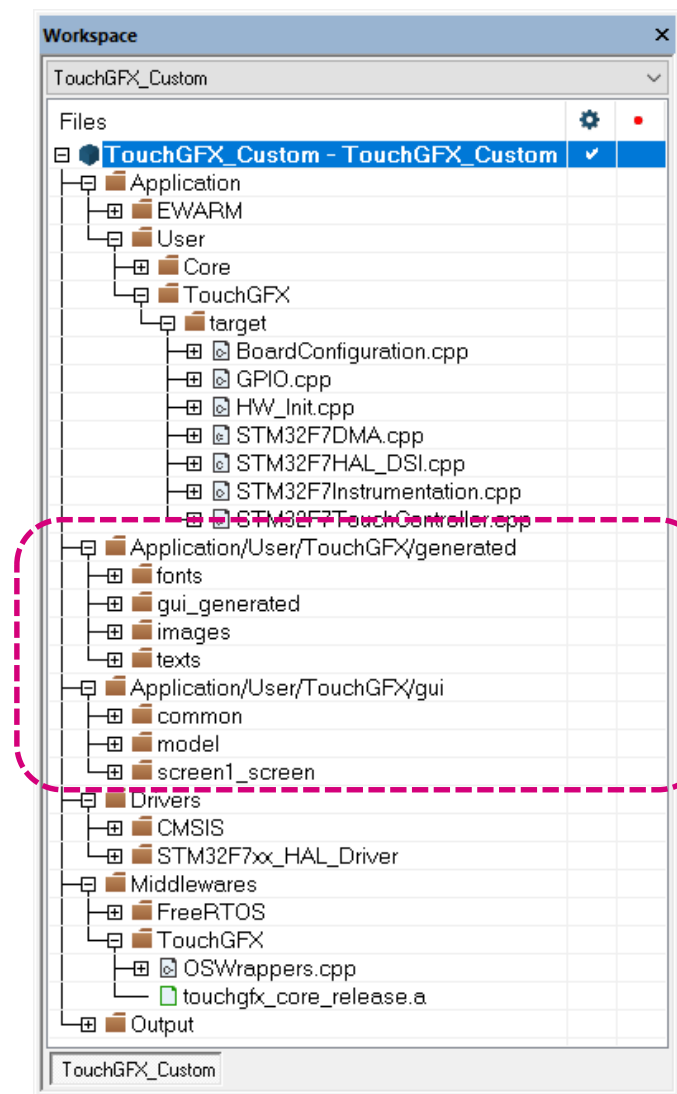


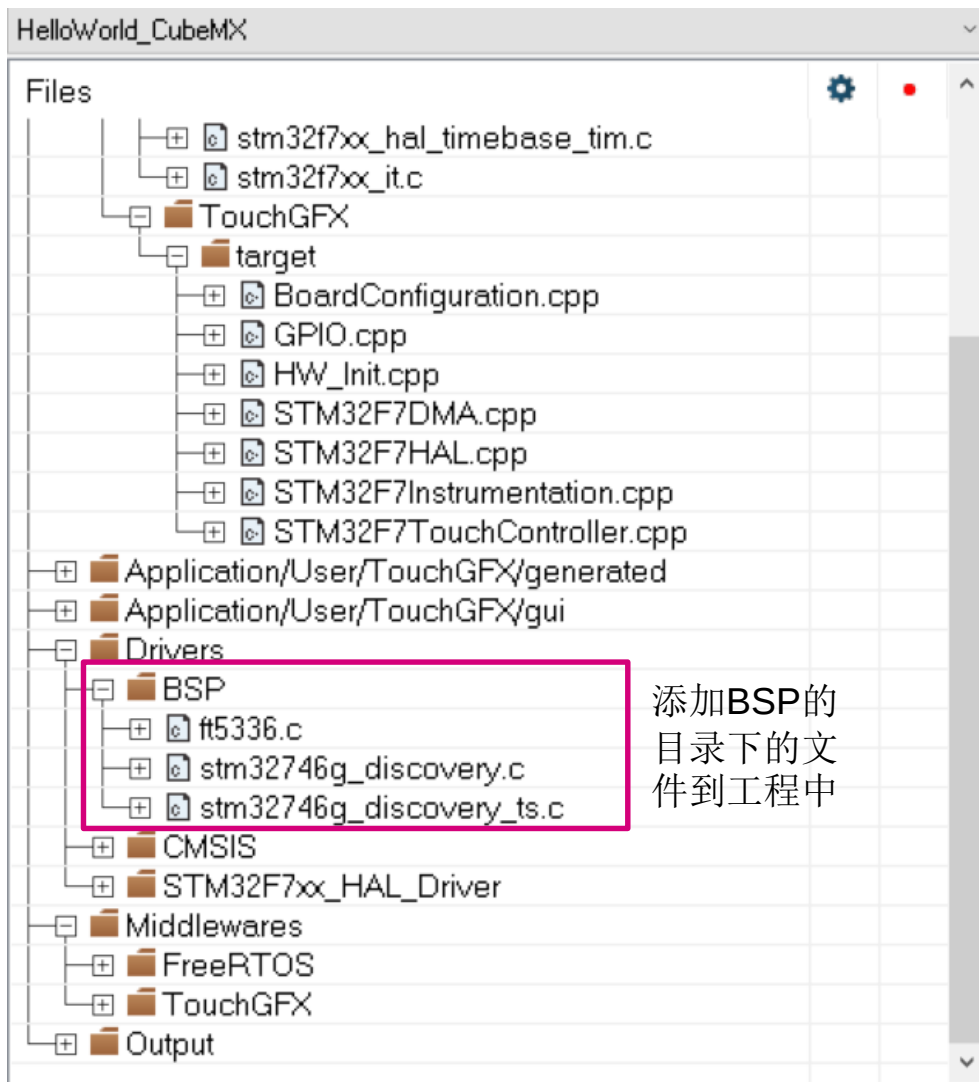
图2. IDE工程文件结构
(运行TouchGFX Designer后)



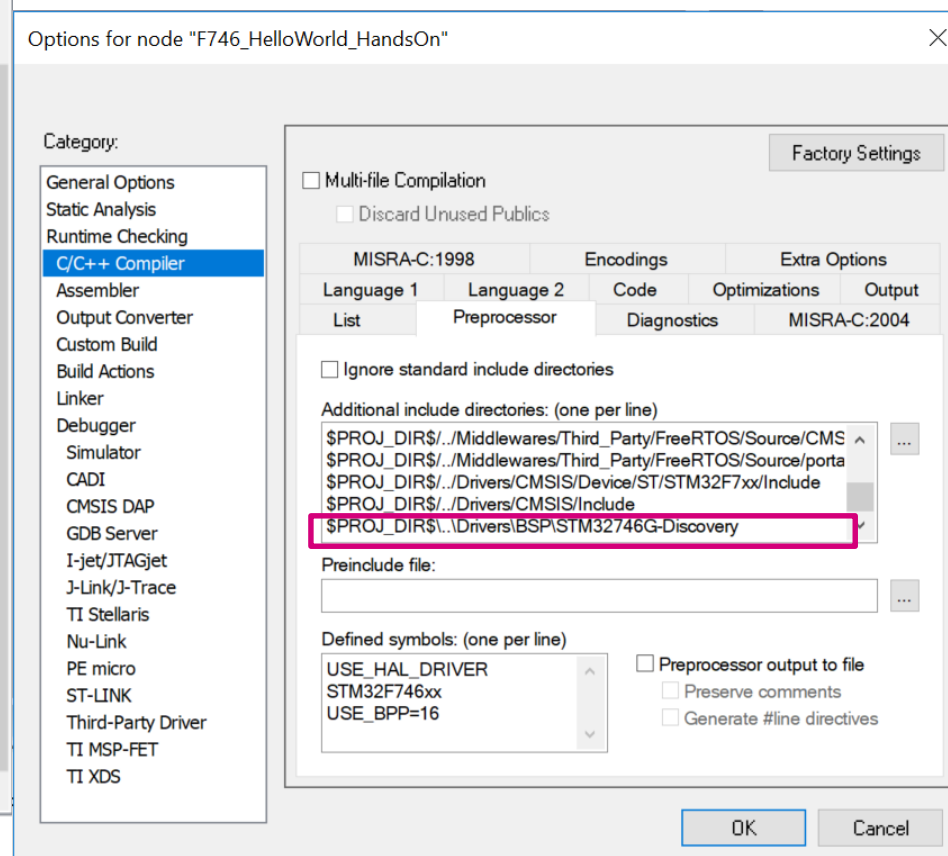
添加触摸屏驱动

38

最后需要移植ft5336的驱动到生成的工程中
代码在如下的压缩包



1. 拷贝BSP到driver下。
2. 对 `\\TouchGFX\\target\\STM32F7TouchController.cpp` 添加ft5335驱动.(可用比较工具比较差异)



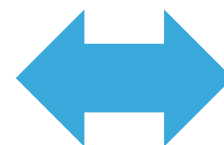
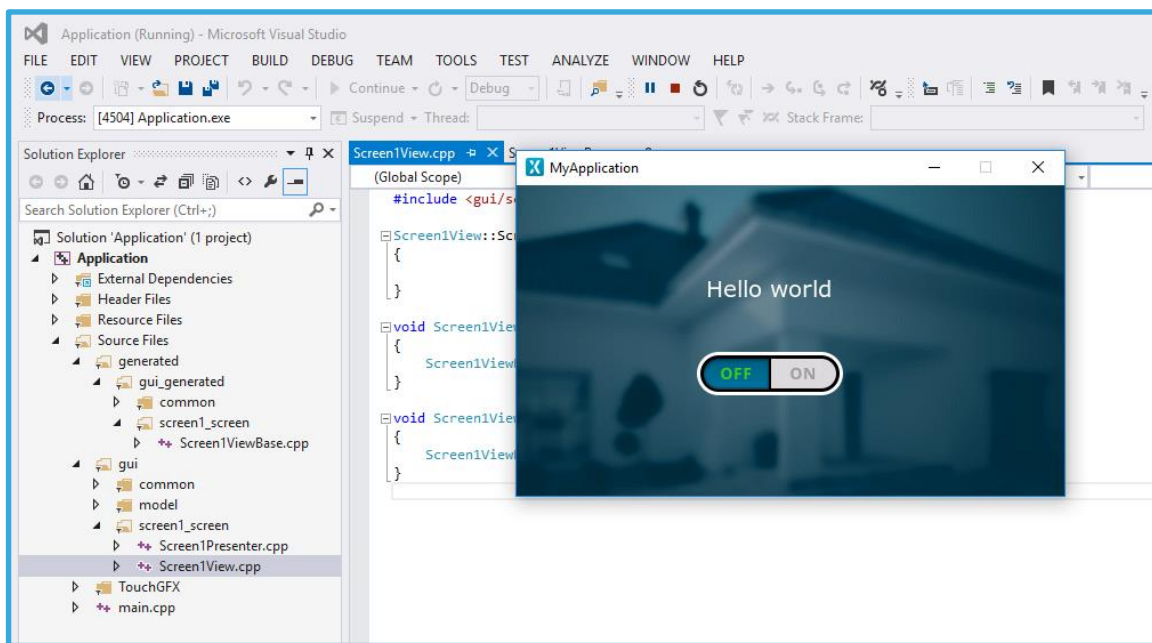


期望实现结果

39

实验完成期望的运行结果如下所示:

- 1.在Visual Studio 上仿真
 - 显示Hello World
 - 触控按钮可以ON/OFF
- 2.在STM32F746Discovery板上运行
 - 显示Hello World
 - 触控按钮可以ON/OFF





Thank you !