14/02/2022

1. Description

1.1. Project

Project Name	fw_dsp_stm32f401
Board Name	custom
Generated with:	STM32CubeMX 6.4.0
Date	02/14/2022

1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F401
MCU name	STM32F401CCUx
MCU Package	UFQFPN48
MCU Pin number	48

1.3. Core(s) information

|	
Core(s)	Arm Cortex-M4

2. Pinout Configuration
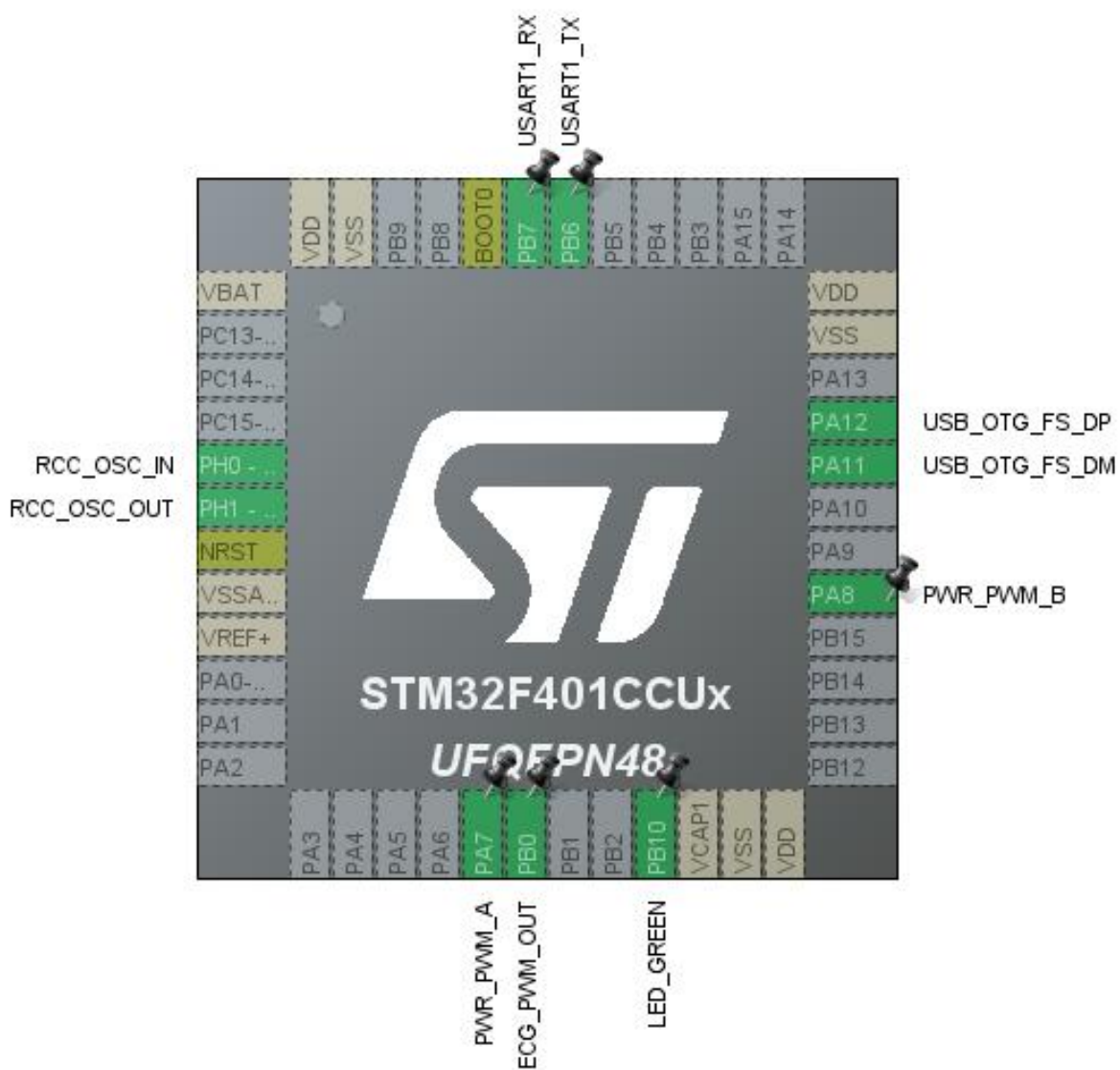
3. Pins Configuration

Pin Number UFQFPN48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
5	PH0 - OSC_IN	I/O	RCC_OSC_IN	
6	PH1 - OSC_OUT	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	VSSA/VREF-	Power		
9	VREF+	Power		
17	PA7	I/O	TIM1_CH1N	PWR_PWM_A
18	PB0	I/O	TIM3_CH3	ECG_PWM_OUT
21	PB10	I/O	TIM2_CH3	LED_GREEN
22	VCAP1	Power		
23	VSS	Power		
24	VDD	Power		
29	PA8	I/O	TIM1_CH1	PWR_PWM_B
32	PA11	I/O	USB_OTG_FS_DM	
33	PA12	I/O	USB_OTG_FS_DP	
35	VSS	Power		
36	VDD	Power		
42	PB6	I/O	USART1_TX	
43	PB7	I/O	USART1_RX	
44	BOOT0	Boot		
47	VSS	Power		
48	VDD	Power		

4. Clock Tree Configuration
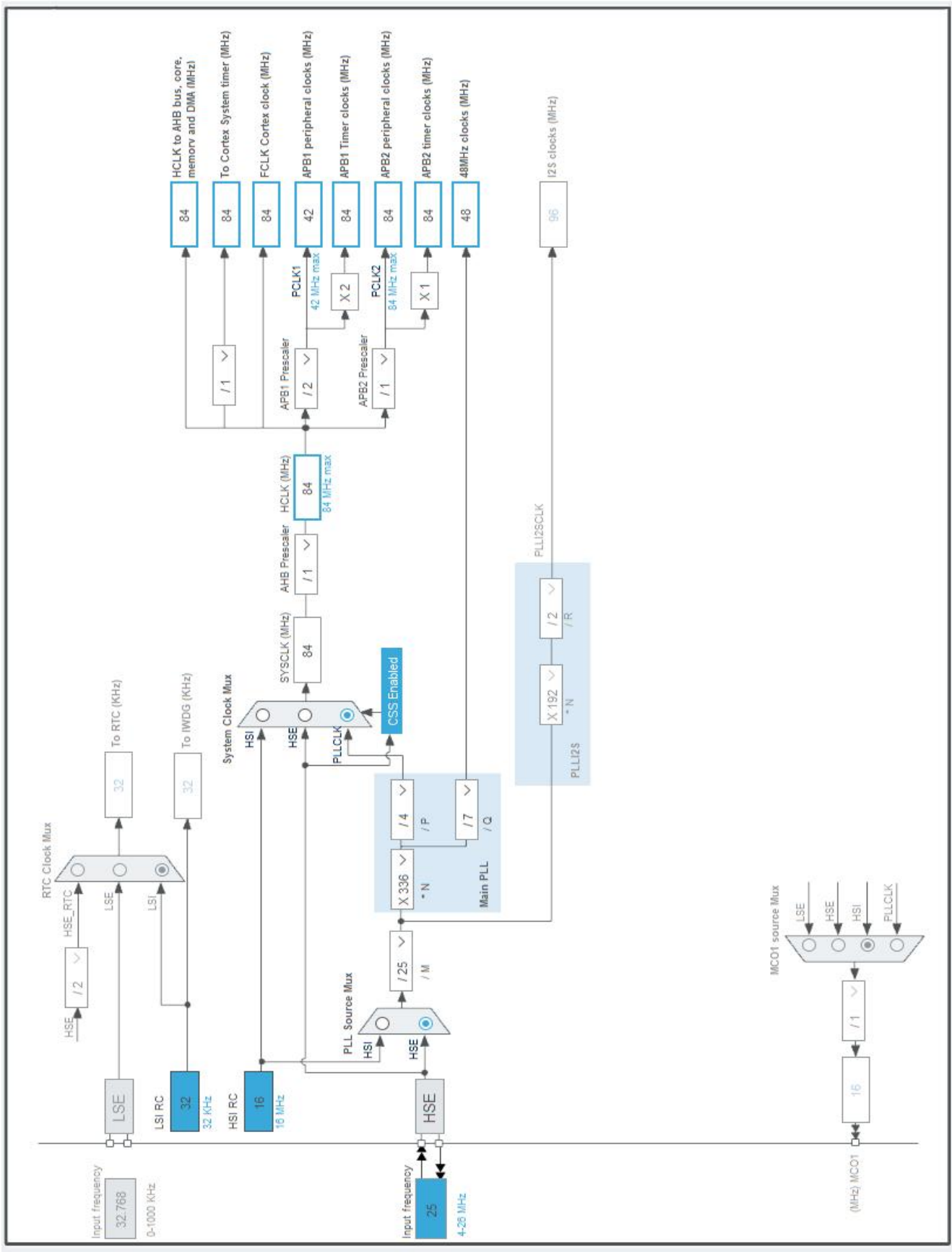
5. Software Project

5.1. Project Settings

Name	Value
Project Name	fw_dsp_stm32f401
Project Folder	D:\Penting\Skripsiku\Project\firmware\fw_dsp_stm32f401
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F4 V1.26.2
Application Structure	Advanced
Generate Under Root	Yes
Do not generate the main()	No
Minimum Heap Size	0x200
Minimum Stack Size	0x400

5.2. Code Generation Settings

Name	Value
STM32Cube MCU packages and embedded software	Copy only the necessary library files
Generate peripheral initialization as a pair of '.c/.h' files	Yes
Backup previously generated files when re-generating	No
Keep User Code when re-generating	Yes
Delete previously generated files when not re-generated	Yes
Set all free pins as analog (to optimize the power consumption)	No
Enable Full Assert	No

5.3. Advanced Settings - Generated Function Calls

Rank	Function Name	Peripheral Instance Name
1	SystemClock_Config	RCC
2	MX_GPIO_Init	GPIO
3	MX_DMA_Init	DMA
4	MX_USART1_UART_Init	USART1
5	MX_TIM1_Init	TIM1
6	MX_TIM2_Init	TIM2
7	MX_TIM3_Init	TIM3
8	MX_TIM9_Init	TIM9
9	MX_USB_DEVICE_Init	USB_DEVICE

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32F4
Line	STM32F401
MCU	STM32F401CCUx
Datasheet	DS9716_Rev8

6.2. Parameter Selection

Temperature	25
Vdd	3.3

6.3. Battery Selection

Battery	Li-SOCL2(A3400)
Capacity	3400.0 mAh
Self Discharge	0.08 %/month
Nominal Voltage	3.6 V
Max Cont Current	100.0 mA
Max Pulse Current	200.0 mA
Cells in series	1
Cells in parallel	1

6.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.3	3.3
Voltage Source	Battery	Battery
Range	Scale2-Medium	No Scale
Fetch Type	FLASH/ART/PREFETCH	n/a
CPU Frequency	84 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator_LPLV Flash-PwrDwn
Clock Source Frequency	4 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	21.2 mA	10 µA
Duration	0.1 ms	0.9 ms
DMIPS	105.0	0.0
Ta Max	102.76	105
Category	In DS Table	In DS Table

6.5. Results

Sequence Time	1 ms	Average Current	2.13 mA
Battery Life	2 months, 5 days, 14 hours	Average DMIPS	105.0 DMIPS

6.6. Chart

Consumption Profile by Step
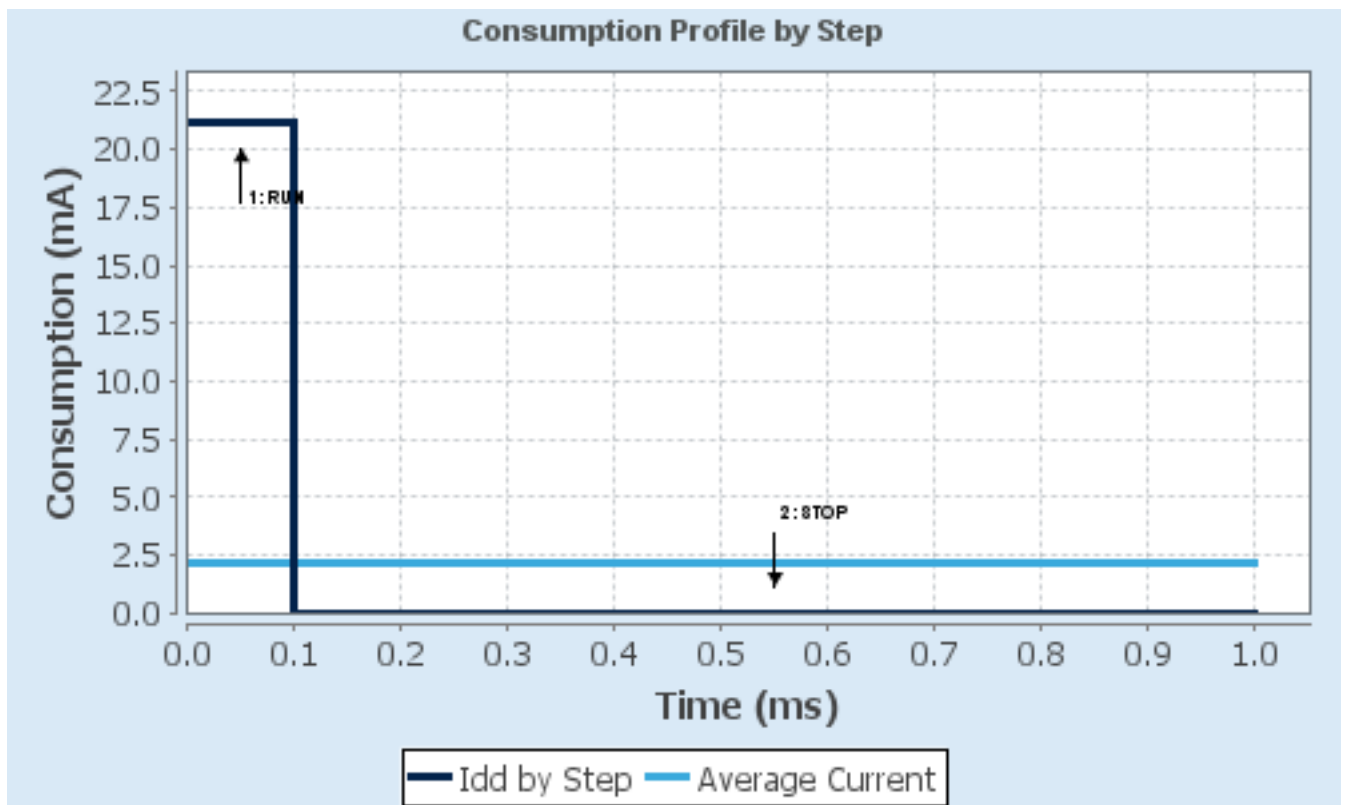
7. Peripherals and Middlewares Configuration

7.1. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

7.1.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	2 WS (3 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
TIM Prescaler Selection	Disabled
HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000

Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 2

7.2. SYS

Timebase Source: SysTick

7.3. TIM1

Clock Source   : Internal Clock

Channel1: PWM Generation CH1 CH1N

7.3.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**416 ***
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0
auto-reload preload	**Enable ***

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

Break And Dead Time management - BRK Configuration:

BRK State	Disable
BRK Polarity	High

Break And Dead Time management - Output Configuration:

Automatic Output State	Disable
Off State Selection for Run Mode (OSSR)	Disable
Off State Selection for Idle Mode (OSSI)	Disable
Lock Configuration	Off
Dead Time	**32 ***

PWM Generation Channel 1 and 1N:

Mode	PWM mode 1
Pulse (16 bits value)	**208 ***
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High
CHN Polarity	High
CH Idle State	Reset
CHN Idle State	Reset

7.4. TIM2
Clock Source   : Internal Clock
Channel3: PWM Generation CH3
7.4.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**41999 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**1999 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	**Enable ***

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

PWM Generation Channel 3:

Mode	PWM mode 1
Pulse (32 bits value)	**299 ***
Output compare preload	Enable
Fast Mode	Disable

CH Polarity   High

7.5. TIM3
mode: Clock Source
Channel3: PWM Generation CH3
7.5.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**255 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	**Enable ***

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

PWM Generation Channel 3:

Mode	PWM mode 1
Pulse (16 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

7.6. TIM9
mode: Clock Source
7.6.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**83 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1999 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	**Enable ***

7.7. USART1

Mode: Asynchronous

7.7.1. Parameter Settings:

Basic Parameters:

Baud Rate	**1000000 ***
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	**2 ***

Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples

7.8. USB_OTG_FS

Mode: Device_Only

7.8.1. Parameter Settings:

Speed	Device Full Speed 12MBit/s
Low power	Disabled
Link Power Management	Disabled
VBUS sensing	Disabled
Signal start of frame	Disabled

7.9. USB_DEVICE

Class For FS IP: Communication Device Class (Virtual Port Com)

7.9.1. Parameter Settings:

Basic Parameters:

USBD_MAX_NUM_INTERFACES (Maximum number of supported interfaces)	1
USBD_MAX_NUM_CONFIGURATION (Maximum number of supported configuration)	1
USBD_MAX_STR_DESC_SIZ (Maximum size for the string descriptors)	512
USBD_SELF_POWERED (Enabled self power)	Enabled
USBD_DEBUG_LEVEL (USBD Debug Level)	0: No debug message

Class Parameters:

USB CDC Rx Buffer Size	**576 ***
USB CDC Tx Buffer Size	**640 ***

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7.9.2. Device Descriptor:

Device Descriptor:

VID (Vendor IDentifier)	1155
LANGID_STRING (Language Identifier)	English(United States)
MANUFACTURER_STRING (Manufacturer Identifier)	STMicroelectronics

Device Descriptor FS:

PID (Product IDentifier)	22336
PRODUCT_STRING (Product Identifier)	STM32 Virtual ComPort
CONFIGURATION_STRING (Configuration Identifier)	CDC Config
INTERFACE_STRING (Interface Identifier)	CDC Interface

* User modified value

8. System Configuration

8.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
RCC	PH0 - OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PH1 - OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
TIM1	PA7	TIM1_CH1N	Alternate Function Push Pull	No pull-up and no pull-down	Low	PWR_PWM_A
	PA8	TIM1_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	PWR_PWM_B
TIM2	PB10	TIM2_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	LED_GREEN
TIM3	PB0	TIM3_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	ECG_PWM_OUT
USART1	PB6	USART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
	PB7	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
USB_OTG_FS	PA11	USB_OTG_FS_DM	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
	PA12	USB_OTG_FS_DP	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	

8.2. DMA configuration

DMA request	Stream	Direction	Priority
USART1_RX	DMA2_Stream2	Peripheral To Memory	**High ***
USART1_TX	DMA2_Stream7	Memory To Peripheral	**Medium ***

USART1_RX: DMA2_Stream2 DMA request Settings:

Mode:	Normal
Use fifo:	Disable
Peripheral Increment:	Disable
Memory Increment:	**Enable ***
Peripheral Data Width:	Byte
Memory Data Width:	Byte

USART1_TX: DMA2_Stream7 DMA request Settings:

Mode:	Normal
Use fifo:	Disable
Peripheral Increment:	Disable
Memory Increment:	**Enable ***
Peripheral Data Width:	Byte
Memory Data Width:	Byte

8.3. NVIC configuration

8.3.1. NVIC

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
Memory management fault	true	0	0
Pre-fetch fault, memory access fault	true	0	0
Undefined instruction or illegal state	true	0	0
System service call via SWI instruction	true	0	0
Debug monitor	true	0	0
Pendable request for system service	true	0	0
System tick timer	true	15	0
TIM1 break interrupt and TIM9 global interrupt	true	2	0
USART1 global interrupt	true	1	0
DMA2 stream2 global interrupt	true	0	0
USB On The Go FS global interrupt	true	0	0
DMA2 stream7 global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
TIM1 update interrupt and TIM10 global interrupt	unused		
TIM1 trigger and commutation interrupts and TIM11 global interrupt	unused		
TIM1 capture compare interrupt	unused		
TIM2 global interrupt	unused		
TIM3 global interrupt	unused		
FPU global interrupt	unused		

8.3.2. NVIC Code generation

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	true
Hard fault interrupt	false	true	false
Memory management fault	false	true	false
Pre-fetch fault, memory access fault	false	true	false
Undefined instruction or illegal state	false	true	false
System service call via SWI instruction	false	true	false
Debug monitor	false	true	false
Pendable request for system service	false	true	false

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
System tick timer	false	true	true
TIM1 break interrupt and TIM9 global interrupt	false	true	true
USART1 global interrupt	false	true	true
DMA2 stream2 global interrupt	false	true	true
USB On The Go FS global interrupt	false	true	true
DMA2 stream7 global interrupt	false	true	true

* User modified value

9. System Views

9.1. Category view

9.1.1. Current

10. Docs & Resources

Type	Link
Datasheet	http://www.st.com/resource/en/datasheet/DM00086815.pdf
Reference manual	http://www.st.com/resource/en/reference_manual/DM00096844.pdf
Programming manual	http://www.st.com/resource/en/programming_manual/DM00046982.pdf
Errata sheet	http://www.st.com/resource/en/errata_sheet/DM00095523.pdf
Application note	http://www.st.com/resource/en/application_note/CD00167594.pdf
Application note	http://www.st.com/resource/en/application_note/CD00211314.pdf
Application note	http://www.st.com/resource/en/application_note/CD00249778.pdf
Application note	http://www.st.com/resource/en/application_note/CD00259245.pdf
Application note	http://www.st.com/resource/en/application_note/CD00264321.pdf
Application note	http://www.st.com/resource/en/application_note/CD00264342.pdf
Application note	http://www.st.com/resource/en/application_note/CD00264379.pdf
Application note	http://www.st.com/resource/en/application_note/DM00024853.pdf
Application note	http://www.st.com/resource/en/application_note/DM00040802.pdf
Application note	http://www.st.com/resource/en/application_note/DM00040808.pdf
Application note	http://www.st.com/resource/en/application_note/DM00042534.pdf
Application note	http://www.st.com/resource/en/application_note/DM00046011.pdf
Application note	http://www.st.com/resource/en/application_note/DM00072315.pdf
Application note	http://www.st.com/resource/en/application_note/DM00073742.pdf
Application note	http://www.st.com/resource/en/application_note/DM00073853.pdf
Application note	http://www.st.com/resource/en/application_note/DM00080497.pdf
Application note	http://www.st.com/resource/en/application_note/DM00081379.pdf
Application note	http://www.st.com/resource/en/application_note/DM00115714.pdf
Application note	http://www.st.com/resource/en/application_note/DM00129215.pdf
Application note	http://www.st.com/resource/en/application_note/DM00144612.pdf
Application note	http://www.st.com/resource/en/application_note/DM00156364.pdf

Application note   http://www.st.com/resource/en/application_note/DM00160482.pdf
Application note   http://www.st.com/resource/en/application_note/DM00213525.pdf
Application note   http://www.st.com/resource/en/application_note/DM00220769.pdf
Application note   http://www.st.com/resource/en/application_note/DM00226326.pdf
Application note   http://www.st.com/resource/en/application_note/DM00236305.pdf
Application note   http://www.st.com/resource/en/application_note/DM00257177.pdf
Application note   http://www.st.com/resource/en/application_note/DM00272912.pdf
Application note   http://www.st.com/resource/en/application_note/DM00281138.pdf
Application note   http://www.st.com/resource/en/application_note/DM00296349.pdf
Application note   http://www.st.com/resource/en/application_note/DM00315319.pdf
Application note   http://www.st.com/resource/en/application_note/DM00325582.pdf
Application note   http://www.st.com/resource/en/application_note/DM00327191.pdf
Application note   http://www.st.com/resource/en/application_note/DM00354244.pdf
Application note   http://www.st.com/resource/en/application_note/DM00380469.pdf
Application note   http://www.st.com/resource/en/application_note/DM00395696.pdf
Application note   http://www.st.com/resource/en/application_note/DM00431633.pdf
Application note   http://www.st.com/resource/en/application_note/DM00493651.pdf
Application note   http://www.st.com/resource/en/application_note/DM00536349.pdf
Application note   http://www.st.com/resource/en/application_note/DM00725181.pdf