1. Description

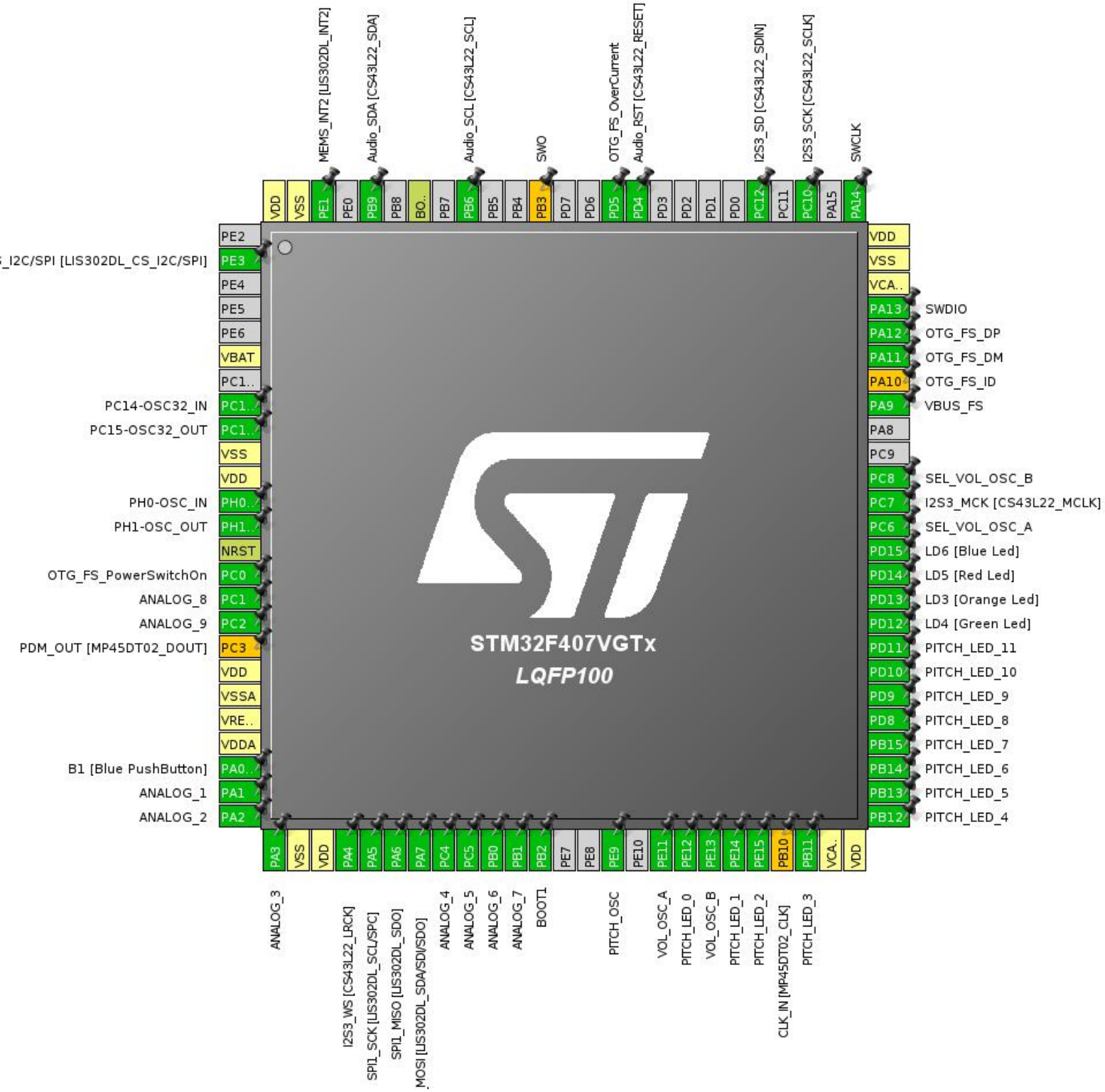
1.1. Project

Project Name	timbremin
Board Name	STM32F4DISCOVERY
Generated with:	STM32CubeMX 4.27.0
Date	12/07/2018

1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F407/417
MCU name	STM32F407VGTx
MCU Package	LQFP100
MCU Pin number	100

2. Pinout Configuration



3. Pins Configuration

Pin Number LQFP100	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
2	PE3 *	I/O	GPIO_Output	CS_I2C/SPI [LIS302DL_CS_I2C/SPI]
6	VBAT	Power		
8	PC14-OSC32_IN	I/O	RCC_OSC32_IN	PC14-OSC32_IN
9	PC15-OSC32_OUT	I/O	RCC_OSC32_OUT	PC15-OSC32_OUT
10	VSS	Power		
11	VDD	Power		
12	PH0-OSC_IN	I/O	RCC_OSC_IN	PH0-OSC_IN
13	PH1-OSC_OUT	I/O	RCC_OSC_OUT	PH1-OSC_OUT
14	NRST	Reset		
15	PC0 *	I/O	GPIO_Output	OTG_FS_PowerSwitchOn
16	PC1	I/O	ADC1_IN11	ANALOG_8
17	PC2	I/O	ADC1_IN12	ANALOG_9
18	PC3 **	I/O	I2S2_SD	PDM_OUT [MP45DT02_DOUT]
19	VDD	Power		
20	VSSA	Power		
21	VREF+	Power		
22	VDDA	Power		
23	PA0-WKUP	I/O	GPIO_EXTI0	B1 [Blue PushButton]
24	PA1	I/O	ADC1_IN1	ANALOG_1
25	PA2	I/O	ADC1_IN2	ANALOG_2
26	PA3	I/O	ADC1_IN3	ANALOG_3
27	VSS	Power		
28	VDD	Power		
29	PA4	I/O	I2S3_WS	I2S3_WS [CS43L22_LRCK]
30	PA5	I/O	SPI1_SCK	SPI1_SCK [LIS302DL_SCL/SPC]
31	PA6	I/O	SPI1_MISO	SPI1_MISO [LIS302DL_SDO]
32	PA7	I/O	SPI1_MOSI	SPI1_MOSI [LIS302DL_SDA/SDI/SDO]
33	PC4	I/O	ADC1_IN14	ANALOG_4
34	PC5	I/O	ADC1_IN15	ANALOG_5
35	PB0	I/O	ADC1_IN8	ANALOG_6
36	PB1	I/O	ADC1_IN9	ANALOG_7
37	PB2 *	I/O	GPIO_Input	BOOT1

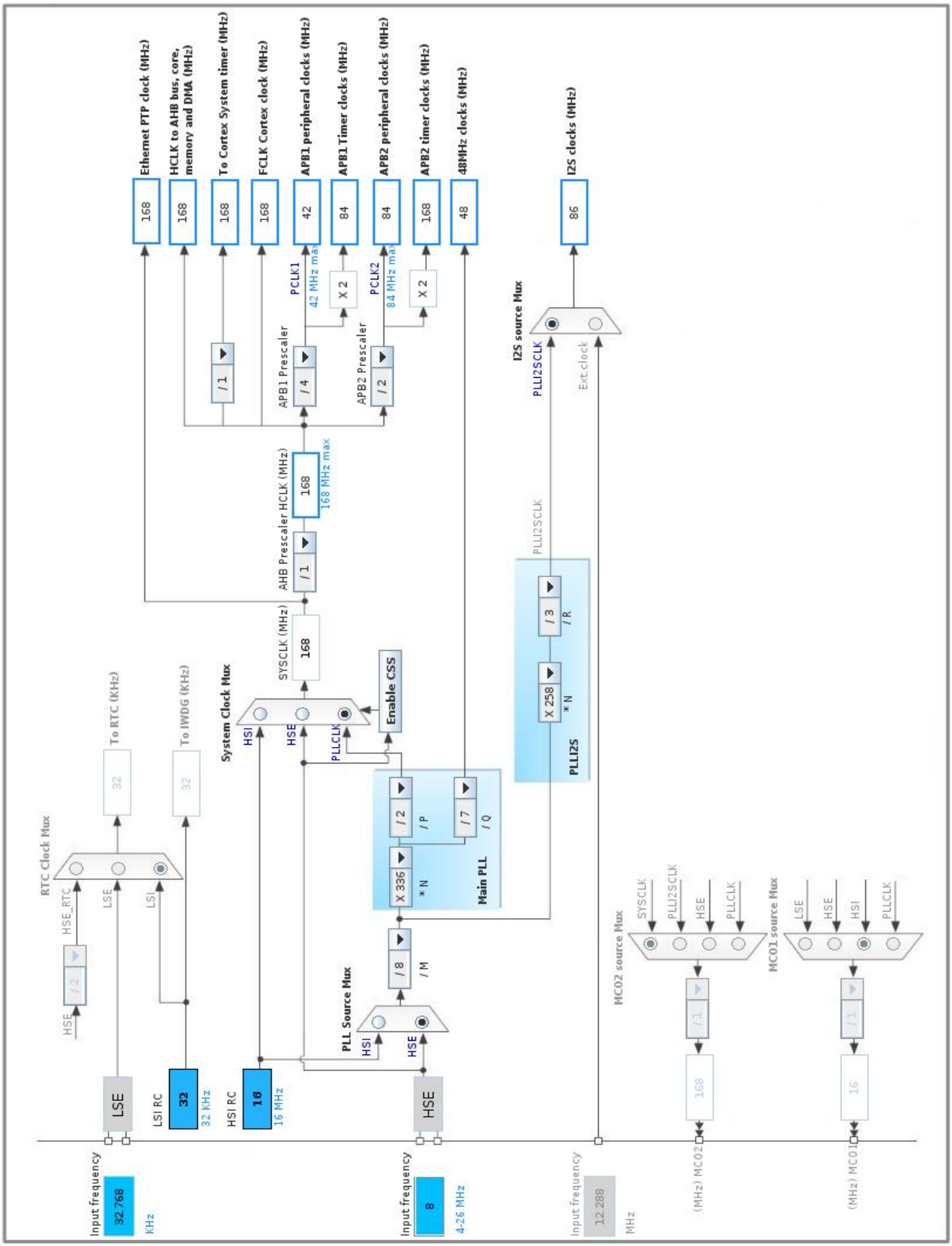
Pin Number LQFP100	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
40	PE9	I/O	TIM1_CH1	PITCH_OSC
42	PE11	I/O	TIM1_CH2	VOL_OSC_A
43	PE12 *	I/O	GPIO_Output	PITCH_LED_0
44	PE13	I/O	TIM1_CH3	VOL_OSC_B
45	PE14 *	I/O	GPIO_Output	PITCH_LED_1
46	PE15 *	I/O	GPIO_Output	PITCH_LED_2
47	PB10 **	I/O	I2S2_CK	CLK_IN [MP45DT02_CLK]
48	PB11 *	I/O	GPIO_Output	PITCH_LED_3
49	VCAP_1	Power		
50	VDD	Power		
51	PB12 *	I/O	GPIO_Output	PITCH_LED_4
52	PB13 *	I/O	GPIO_Output	PITCH_LED_5
53	PB14 *	I/O	GPIO_Output	PITCH_LED_6
54	PB15 *	I/O	GPIO_Output	PITCH_LED_7
55	PD8 *	I/O	GPIO_Output	PITCH_LED_8
56	PD9 *	I/O	GPIO_Output	PITCH_LED_9
57	PD10 *	I/O	GPIO_Output	PITCH_LED_10
58	PD11 *	I/O	GPIO_Output	PITCH_LED_11
59	PD12 *	I/O	GPIO_Output	LD4 [Green Led]
60	PD13 *	I/O	GPIO_Output	LD3 [Orange Led]
61	PD14 *	I/O	GPIO_Output	LD5 [Red Led]
62	PD15 *	I/O	GPIO_Output	LD6 [Blue Led]
63	PC6 *	I/O	GPIO_Output	SEL_VOL_OSC_A
64	PC7	I/O	I2S3_MCK	I2S3_MCK [CS43L22_MCLK]
65	PC8 *	I/O	GPIO_Output	SEL_VOL_OSC_B
68	PA9	I/O	USB_OTG_FS_VBUS	VBUS_FS
69	PA10 **	I/O	USB_OTG_FS_ID	OTG_FS_ID
70	PA11	I/O	USB_OTG_FS_DM	OTG_FS_DM
71	PA12	I/O	USB_OTG_FS_DP	OTG_FS_DP
72	PA13	I/O	SYS_JTMS-SWDIO	SWDIO
73	VCAP_2	Power		
74	VSS	Power		
75	VDD	Power		
76	PA14	I/O	SYS_JTCK-SWCLK	SWCLK
78	PC10	I/O	I2S3_CK	I2S3_SCK [CS43L22_SCLK]
80	PC12	I/O	I2S3_SD	I2S3_SD [CS43L22_SDIN]
85	PD4 *	I/O	GPIO_Output	Audio_RST [CS43L22_RESET]

Pin Number LQFP100	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
86	PD5 *	I/O	GPIO_Input	OTG_FS_OverCurrent
89	PB3 **	I/O	SYS_JTDO-SWO	SWO
92	PB6	I/O	I2C1_SCL	Audio_SCL [CS43L22_SCL]
94	BOOT0	Boot		
96	PB9	I/O	I2C1_SDA	Audio_SDA [CS43L22_SDA]
98	PE1	I/O	GPIO_EXTI1	MEMS_INT2 [LIS302DL_INT2]
99	VSS	Power		
100	VDD	Power		

* The pin is affected with an I/O function

** The pin is affected with a peripheral function but no peripheral mode is activated

4. Clock Tree Configuration



5. IPs and Middleware Configuration

5.1. ADC1

mode: IN1

mode: IN2

mode: IN3

mode: IN8

mode: IN9

mode: IN11

mode: IN12

mode: IN14

mode: IN15

5.1.1. Parameter Settings:

ADCs_Common_Settings:

Mode	Independent mode

ADC_Settings:

Clock Prescaler	**PCLK2 divided by 6 ***
Resolution	12 bits (15 ADC Clock cycles)
Data Alignment	Right alignment
Scan Conversion Mode	Enabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	**Enabled ***
End Of Conversion Selection	**EOC flag at the end of all conversions ***

ADC_Regular_ConversionMode:

Number Of Conversion	**9 ***
External Trigger Conversion Source	Regular Conversion launched by software
External Trigger Conversion Edge	None
Rank	1
Channel	Channel 1
Sampling Time	**112 Cycles ***
Rank	**2 ***
Channel	**Channel 2 ***
Sampling Time	**112 Cycles ***
Rank	**3 ***
Channel	**Channel 3 ***
Sampling Time	**112 Cycles ***

Rank	**4 ***
Channel	**Channel 14 ***
Sampling Time	**112 Cycles ***
Rank	**5 ***
Channel	**Channel 15 ***
Sampling Time	**112 Cycles ***
Rank	**6 ***
Channel	**Channel 8 ***
Sampling Time	**112 Cycles ***
Rank	**7 ***
Channel	**Channel 9 ***
Sampling Time	**112 Cycles ***
Rank	**8 ***
Channel	**Channel 11 ***
Sampling Time	**112 Cycles ***
Rank	**9 ***
Channel	**Channel 12 ***
Sampling Time	**112 Cycles ***

ADC_Injected_ConversionMode:

Number Of Conversions	0

WatchDog:

Enable Analog WatchDog Mode	false

5.2. I2C1

I2C: I2C

5.2.1. Parameter Settings:

Master Features:

I2C Speed Mode	Standard Mode
I2C Clock Speed (Hz)	100000

Slave Features:

Clock No Stretch Mode	Disabled
Primary Address Length selection	7-bit
Dual Address Acknowledged	Disabled
Primary slave address	0
General Call address detection	Disabled

5.3. I2S3

Mode: Half-Duplex Master

mode: Master Clock Output

5.3.1. Parameter Settings:

Generic Parameters:

Transmission Mode	Mode Master Transmit
Communication Standard	I2S Philips
Data and Frame Format	16 Bits Data on 16 Bits Frame
Selected Audio Frequency	**48 KHz ***
Real Audio Frequency	**47.991 KHz ***
Error between Selected and Real	**-0.01 % ***

Clock Parameters:

Clock Source	I2S PLL Clock
Clock Polarity	Low

5.4. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

Low Speed Clock (LSE) : Crystal/Ceramic Resonator

5.4.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	5 WS (6 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000

Power Parameters:

Power Regulatror Voltage Scale	Power Regulator Voltage Scale 1

5.5. RNG

mode: Activated

5.6. SPI1

Mode: Full-Duplex Master

5.6.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	2
Baud Rate	**42.0 MBits/s ***
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

5.7. SYS

Debug: Serial Wire

Timebase Source: SysTick

5.8. TIM1

Clock Source : Internal Clock

Channel1: Input Capture direct mode

Channel2: Input Capture direct mode

Channel3: Input Capture direct mode

5.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**65535 ***

Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0

Trigger Output (TRGO) Parameters:

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

Input Capture Channel 1:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	**Division by 8 ***
Input Filter (4 bits value)	0

Input Capture Channel 2:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	**Division by 8 ***
Input Filter (4 bits value)	0

Input Capture Channel 3:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	**Division by 8 ***
Input Filter (4 bits value)	0

5.9. USB_OTG_FS

Mode: Host_Only

mode: Activate_VBUS

5.9.1. Parameter Settings:

Speed	Host Full Speed 12MBit/s
Enable internal IP DMA	Disabled
Signal start of frame	Disabled

5.10. FATFS

mode: USB Disk

5.10.1. Set Defines:

Version:

FATFS version	R0.12c

Function Parameters:

FS_READONLY (Read-only mode)	Disabled
FS_MINIMIZE (Minimization level)	Disabled
USE_STRFUNC (String functions)	Enabled with LF -> CRLF conversion
USE_FIND (Find functions)	Disabled
USE_MKFS (Make filesystem function)	Enabled
USE_FASTSEEK (Fast seek function)	Enabled
USE_EXPAND (Use f_expand function)	Disabled
USE_CHMOD (Change attributes function)	Disabled
USE_LABEL (Volume label functions)	Disabled
USE_FORWARD (Forward function)	Disabled

Locale and Namespace Parameters:

CODE_PAGE (Code page on target)	Latin 1
USE_LFN (Use Long Filename)	Disabled
MAX_LFN (Max Long Filename)	255
LFN_UNICODE (Enable Unicode)	ANSI/OEM
STRF_ENCODE (Character encoding)	UTF-8
FS_RPATH (Relative Path)	Disabled

Physical Drive Parameters:

VOLUMES (Logical drives)	1
MAX_SS (Maximum Sector Size)	512
MIN_SS (Minimum Sector Size)	512
MULTI_PARTITION (Volume partitions feature)	Disabled
USE_TRIM (Erase feature)	Disabled
FS_NOFSINFO (Force full FAT scan)	0

System Parameters:

FS_TINY (Tiny mode)	Disabled
FS_EXFAT (Support of exFAT file system)	Disabled
FS_NORTC (Timestamp feature)	Dynamic timestamp
NORTC_YEAR (Year for timestamp)	2015
NORTC_MON (Month for timestamp)	6
NORTC_MDAY (Day for timestamp)	4
FS_REENTRANT (Re-Entrancy)	Disabled
FS_TIMEOUT (Timeout ticks)	1000
SYNC_t (O/S sync object)	osSemaphoreId
FS_LOCK (Number of files opened simultaneously)	2

5.10.2. IPs instances:

USBH:

USBH instance	USB Host MSC FS

Use dma template	Disabled

5.11. USB_HOST

Class for FS IP: Mass Storage Host Class

5.11.1. Parameter Settings:

Host Configuration:

USBH_MAX_NUM_ENDPOINTS (Maximum number of endpoints)	2
USBH_MAX_NUM_INTERFACES (Maximun number of interfaces)	2
USBH_MAX_NUM_SUPPORTED_CLASS (Maximun number of supported class)	1
USBH_MAX_NUM_CONFIGURATION (Maximun number of supported configuration)	1
USBH_KEEP_CFG_DESCRIPTOR (Keep the configuration into RAM)	Enabled
USBH_MAX_SIZE_CONFIGURATION (Maximun size in bytes for the Configuration Descriptor)	256
USBH_MAX_DATA_BUFFER (Maximun size of temporary data)	512
USBH_DEBUG_LEVEL (USBH Debug Level)	0: No debug message

CMSIS_RTOS:

USBH_USE_OS (Enable the support of an RTOS)	Disabled

*** User modified value**

6. System Configuration

6.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC1	PC1	ADC1_IN11	Analog mode	No pull-up and no pull-down	n/a	ANALOG_8
	PC2	ADC1_IN12	Analog mode	No pull-up and no pull-down	n/a	ANALOG_9
	PA1	ADC1_IN1	Analog mode	No pull-up and no pull-down	n/a	ANALOG_1
	PA2	ADC1_IN2	Analog mode	No pull-up and no pull-down	n/a	ANALOG_2
	PA3	ADC1_IN3	Analog mode	No pull-up and no pull-down	n/a	ANALOG_3
	PC4	ADC1_IN14	Analog mode	No pull-up and no pull-down	n/a	ANALOG_4
	PC5	ADC1_IN15	Analog mode	No pull-up and no pull-down	n/a	ANALOG_5
	PB0	ADC1_IN8	Analog mode	No pull-up and no pull-down	n/a	ANALOG_6
	PB1	ADC1_IN9	Analog mode	No pull-up and no pull-down	n/a	ANALOG_7
I2C1	PB6	I2C1_SCL	Alternate Function Open Drain	Pull-up	Low	Audio_SCL [CS43L22_SCL]
	PB9	I2C1_SDA	Alternate Function Open Drain	Pull-up	Low	Audio_SDA [CS43L22_SDA]
I2S3	PA4	I2S3_WS	Alternate Function Push Pull	No pull-up and no pull-down	Low	I2S3_WS [CS43L22_LRCK]
	PC7	I2S3_MCK	Alternate Function Push Pull	No pull-up and no pull-down	Low	I2S3_MCK [CS43L22_MCLK]
	PC10	I2S3_CK	Alternate Function Push Pull	No pull-up and no pull-down	Low	I2S3_SCK [CS43L22_SCLK]
	PC12	I2S3_SD	Alternate Function Push Pull	No pull-up and no pull-down	Low	I2S3_SD [CS43L22_SDIN]
RCC	PC14-OSC32_IN	RCC_OSC32_IN	n/a	n/a	n/a	PC14-OSC32_IN
	PC15-OSC32_OUT	RCC_OSC32_OUT	n/a	n/a	n/a	PC15-OSC32_OUT
	PH0-OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	PH0-OSC_IN
	PH1-OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	PH1-OSC_OUT
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	Low	SPI1_SCK [LIS302DL_SCL/SPC]
	PA6	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	Low	SPI1_MISO [LIS302DL_SDO]
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	Low	SPI1_MOSI [LIS302DL_SDA/SDI/SDO]
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	SWDIO
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	SWCLK

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
TIM1	PE9	TIM1_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	PITCH_OSC
	PE11	TIM1_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	VOL_OSC_A
	PE13	TIM1_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	VOL_OSC_B
USB_OTG_FS	PA9	USB_OTG_FS_VBUS	Input mode	No pull-up and no pull-down	n/a	VBUS_FS
	PA11	USB_OTG_FS_DM	Alternate Function Push Pull	No pull-up and no pull-down	Low	OTG_FS_DM
	PA12	USB_OTG_FS_DP	Alternate Function Push Pull	No pull-up and no pull-down	Low	OTG_FS_DP
Single Mapped Signals	PC3	I2S2_SD	Alternate Function Push Pull	No pull-up and no pull-down	Low	PDM_OUT [MP45DT02_DOUT]
	PB10	I2S2_CK	Alternate Function Push Pull	No pull-up and no pull-down	Low	CLK_IN [MP45DT02_CLK]
	PA10	USB_OTG_FS_ID	Alternate Function Push Pull	No pull-up and no pull-down	Low	OTG_FS_ID
	PB3	SYS_JTDO-SWO	n/a	n/a	n/a	SWO
GPIO	PE3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CS_I2C/SPI [LIS302DL_CS_I2C/SPI]
	PC0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	OTG_FS_PowerSwitchOn
	PA0-WKUP	GPIO_EXTI0	**External Event Mode with Rising edge trigger detection ***	No pull-up and no pull-down	n/a	B1 [Blue PushButton]
	PB2	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	BOOT1
	PE12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_0
	PE14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_1
	PE15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_2
	PB11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_3
	PB12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_4
	PB13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_5
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_6
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_7
	PD8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_8
	PD9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_9
	PD10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_10
	PD11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	PITCH_LED_11
	PD12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LD4 [Green Led]
	PD13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LD3 [Orange Led]
	PD14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LD5 [Red Led]
	PD15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LD6 [Blue Led]
	PC6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SEL_VOL_OSC_A
	PC8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SEL_VOL_OSC_B
	PD4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Audio_RST

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
						[CS43L22_RESET]
	PD5	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	OTG_FS_OverCurrent
	PE1	GPIO_EXTI1	**External Event Mode with Rising edge trigger detection ***	No pull-up and no pull-down	n/a	MEMS_INT2 [LIS302DL_INT2]

6.2. DMA configuration

DMA request	Stream	Direction	Priority
ADC1	DMA2_Stream0	Peripheral To Memory	Low

ADC1: DMA2_Stream0 DMA request Settings:

Mode:	**Circular ***
Use fifo:	Disable
Peripheral Increment:	Disable
Memory Increment:	**Enable ***
Peripheral Data Width:	Half Word
Memory Data Width:	Half Word

6.3. NVIC configuration

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	3	0
Debug monitor	true	3	0
Pendable request for system service	true	0	0
System tick timer	true	2	0
SPI3 global interrupt	true	0	0
DMA2 stream0 global interrupt	true	0	0
USB On The Go FS global interrupt	true	1	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
ADC1, ADC2 and ADC3 global interrupts	unused		
TIM1 break interrupt and TIM9 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		
I2C1 event interrupt	unused		
I2C1 error interrupt	unused		
SPI1 global interrupt	unused		
HASH and RNG global interrupts	unused		
FPU global interrupt	unused		

*** User modified value**

7. Power Consumption Calculator report

7.1. Microcontroller Selection

Series	STM32F4
Line	STM32F407/417
MCU	STM32F407VGTx
Datasheet	022152_Rev8

7.2. Parameter Selection

Temperature	25
Vdd	3.3

8. Software Project

8.1. Project Settings

Name	Value
Project Name	timbremin
Project Folder	/home/gerd/Documents/Elektronik/theremin/timbremin/workspace/timbremin/Soft
Toolchain / IDE	SW4STM32
Firmware Package Name and Version	STM32Cube FW_F4 V1.21.0

8.2. Code Generation Settings

Name	Value
STM32Cube Firmware Library Package	Copy only the necessary library files
Generate peripheral initialization as a pair of '.c/.h' files	No
Backup previously generated files when re-generating	No
Delete previously generated files when not re-generated	Yes
Set all free pins as analog (to optimize the power consumption)	No

9. Software Pack Report