1. Description

1.1. Project

Project Name	marko_squared
Board Name	custom
Generated with:	STM32CubeMX 5.3.0
Date	03/02/2020

1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F405/415
MCU name	STM32F415RGTx
MCU Package	LQFP64
MCU Pin number	64

2. Pinout Configuration

3. Pins Configuration

Pin Number LQFP64	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		
12	VSSA	Power		
13	VDDA	Power		
14	PA0-WKUP	I/O	TIM5_CH1	RIGHT_MOTOR_PWM_PIN
15	PA1	I/O	GPIO_EXTI1	FLOOR_SENSOR_INT_PIN
16	PA2	I/O	GPIO_EXTI2	LEFT_SENSOR_INT_PIN
17	PA3	I/O	GPIO_EXTI3	RIGHT_SENSOR_INT_PIN
18	VSS	Power		
19	VDD	Power		
21	PA5	I/O	TIM2_CH1	LEFT_MOTOR_PWM_PIN
23	PA7	I/O	TIM3_CH2	ENCODER_L_B
25	PC5	I/O	GPIO_EXTI5	BUTTON_INT_PIN
29	PB10	I/O	I2C2_SCL	
30	PB11	I/O	I2C2_SDA	
31	VCAP_1	Power		
32	VDD	Power		
35	PB14 *	I/O	GPIO_Output	RIGHT_MOTOR_REVERSE
36	PB15 *	I/O	GPIO_Output	LEFT_MOTOR_REVERSE
46	PA13	I/O	GPIO_EXTI13	FRONT_SENSOR_INT_PIN
47	VCAP_2	Power		
48	VDD	Power		
51	PC10	I/O	UART4_TX	
52	PC11	I/O	UART4_RX	
53	PC12 *	I/O	GPIO_Output	YELLOW_LED
56	PB4	I/O	TIM3_CH1	ENCODER_L_A
58	PB6	I/O	TIM4_CH1	ENCODER_R_A
59	PB7	I/O	TIM4_CH2	ENCODER_R_B
60	BOOT0	Boot		
63	VSS	Power		
64	VDD	Power		

* The pin is affected with an I/O function

4. Clock Tree Configuration

5. Software Project

5.1. Project Settings

Name	Value
Project Name	marko_squared
Project Folder	/home/marko/Documents/embedded_workspace/marko_squared
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F4 V1.24.2

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	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

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32F4
Line	STM32F405/415
MCU	STM32F415RGTx
Datasheet	022063_Rev8

6.2. Parameter Selection

Temperature	25
Vdd	3.3

7. IPs and Middleware Configuration

7.1. I2C2

I2C: I2C

7.1.1. 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

7.2. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

7.2.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	1 WS (2 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

7.3. SYS

Timebase Source: SysTick

7.4. TIM2

Clock Source   : Internal Clock
Channel1: PWM Generation CH1
7.4.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**2400 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

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 1:

Mode	PWM mode 1
Pulse (32 bits value)	**799 ***
Fast Mode	Disable
CH Polarity	High

7.5. TIM3

Combined Channels: Encoder Mode
7.5.1. Parameter Settings:

Counter Settings:

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

Trigger Output (TRGO) Parameters:

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

Encoder:

Encoder Mode	**Encoder Mode TI1 and TI2 ***

_____ Parameters for Channel 1 _____

Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0

_____ Parameters for Channel 2 _____

Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0

7.6. TIM4

Combined Channels: Encoder Mode

7.6.1. Parameter Settings:

Counter Settings:

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

Trigger Output (TRGO) Parameters:

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

Encoder:

Encoder Mode	**Encoder Mode TI1 and TI2 ***

_____ Parameters for Channel 1 _____

Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0

_____ Parameters for Channel 2 _____

Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0

7.7. TIM5

mode: Clock Source

Channel1: PWM Generation CH1

7.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**2400 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

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 1:

Mode	PWM mode 1
Pulse (32 bits value)	**799 ***
Fast Mode	Disable
CH Polarity	High

7.8. TIM6

mode: Activated

7.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**48000 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**99 ***
auto-reload preload	Disable

Trigger Output (TRGO) Parameters:

Trigger Event Selection	Reset (UG bit from TIMx_EGR)

7.9. UART4

Mode: Asynchronous

7.9.1. Parameter Settings:

Basic Parameters:

Baud Rate	115200
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	1

Advanced Parameters:

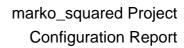|	
Data Direction	Receive and Transmit
Over Sampling	16 Samples

* User modified value

8. System Configuration

8.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
I2C2	PB10	I2C2_SCL	Alternate Function Open Drain	Pull-up	**Very High** *	
	PB11	I2C2_SDA	Alternate Function Open Drain	Pull-up	**Very High** *	
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	
TIM2	PA5	TIM2_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	LEFT_MOTOR_PWM_PIN
TIM3	PA7	TIM3_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	ENCODER_L_B
	PB4	TIM3_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	ENCODER_L_A
TIM4	PB6	TIM4_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	ENCODER_R_A
	PB7	TIM4_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	ENCODER_R_B
TIM5	PA0-WKUP	TIM5_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	RIGHT_MOTOR_PWM_PIN
UART4	PC10	UART4_TX	Alternate Function Push Pull	Pull-up	**Very High** *	
	PC11	UART4_RX	Alternate Function Push Pull	Pull-up	**Very High** *	
GPIO	PA1	GPIO_EXTI1	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	FLOOR_SENSOR_INT_PIN
	PA2	GPIO_EXTI2	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	LEFT_SENSOR_INT_PIN
	PA3	GPIO_EXTI3	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	RIGHT_SENSOR_INT_PIN
	PC5	GPIO_EXTI5	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	BUTTON_INT_PIN
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	**Medium** *	RIGHT_MOTOR_REVERSE
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	**Medium** *	LEFT_MOTOR_REVERSE
	PA13	GPIO_EXTI13	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	**n/a**	FRONT_SENSOR_INT_PIN
	PC12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	YELLOW_LED

8.2. DMA configuration

nothing configured in DMA service

8.3. 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	0	0
Debug monitor	true	0	0
Pendable request for system service	true	0	0
System tick timer	true	0	0
EXTI line1 interrupt	true	0	0
EXTI line2 interrupt	true	0	0
EXTI line3 interrupt	true	0	0
EXTI line[9:5] interrupts	true	1	0
I2C2 event interrupt	true	1	0
I2C2 error interrupt	true	1	0
EXTI line[15:10] interrupts	true	0	0
UART4 global interrupt	true	4	0
TIM6 global interrupt, DAC1 and DAC2 underrun error interrupts	true	1	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
TIM2 global interrupt	unused		
TIM3 global interrupt	unused		
TIM4 global interrupt	unused		
TIM5 global interrupt	unused		
FPU global interrupt	unused		

* User modified value

9. Software Pack Report