

## 1. Description

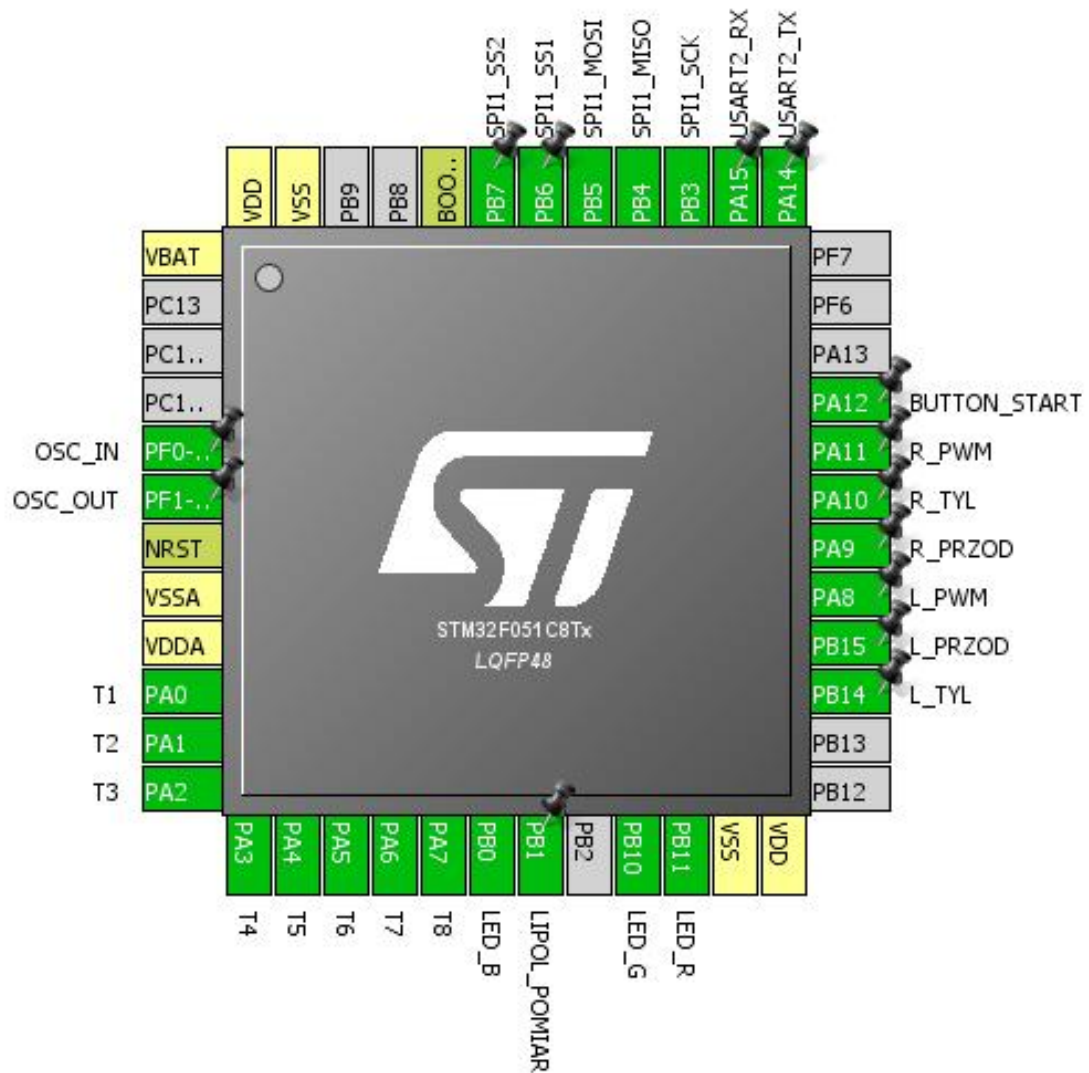
### 1.1. Project

Project Name	ProjektMX
Board Name	ProjektMX
Generated with:	STM32CubeMX 4.20.0
Date	05/23/2017

### 1.2. MCU

MCU Series	STM32F0
MCU Line	STM32F0x1
MCU name	STM32F051C8Tx
MCU Package	LQFP48
MCU Pin number	48

## 2. Pinout Configuration



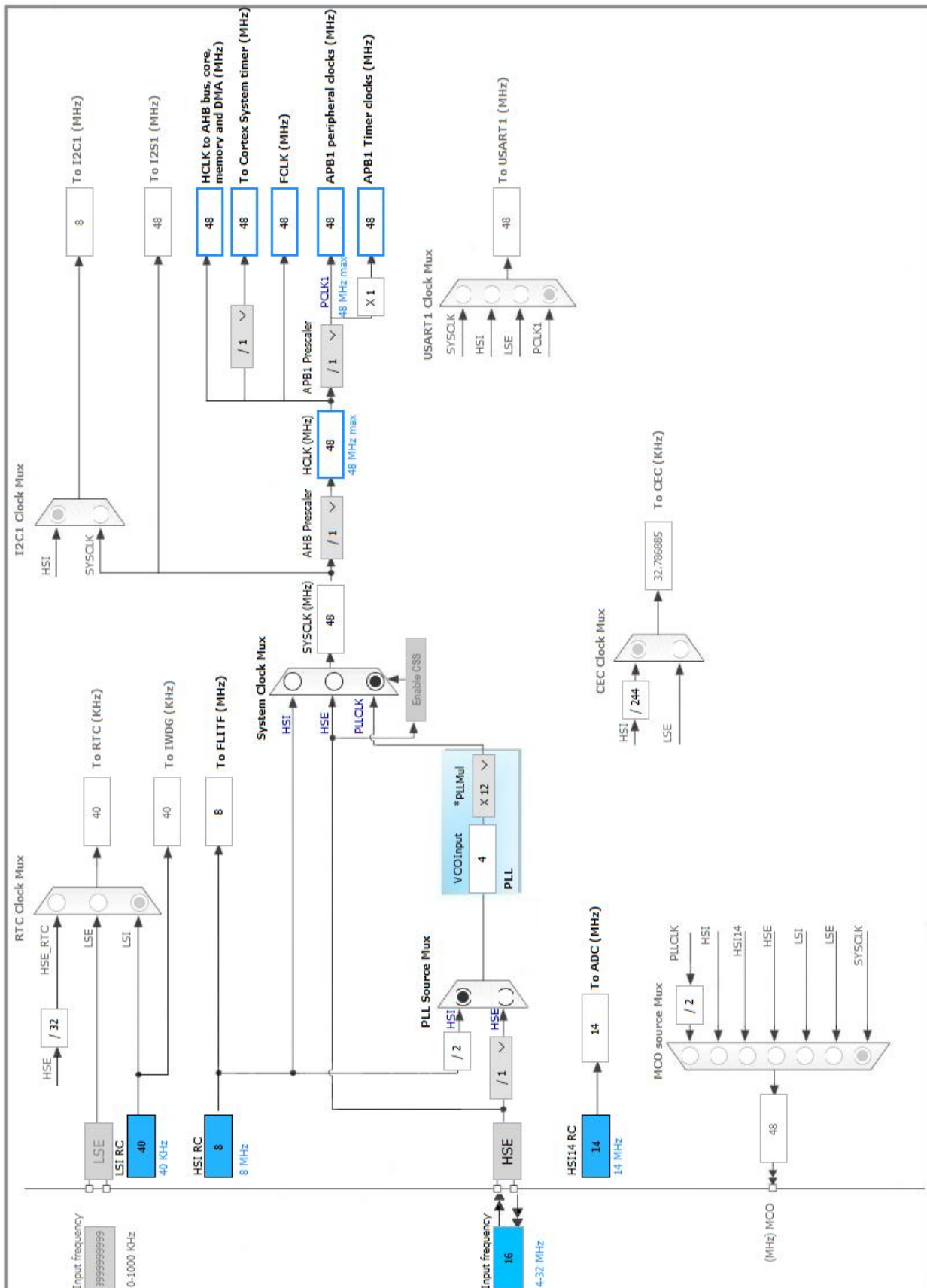
### 3. Pins Configuration

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
5	PF0-OSC_IN	I/O	RCC_OSC_IN	OSC_IN
6	PF1-OSC_OUT	I/O	RCC_OSC_OUT	OSC_OUT
7	NRST	Reset		
8	VSSA	Power		
9	VDDA	Power		
10	PA0	I/O	ADC_IN0	T1
11	PA1	I/O	ADC_IN1	T2
12	PA2	I/O	ADC_IN2	T3
13	PA3	I/O	ADC_IN3	T4
14	PA4	I/O	ADC_IN4	T5
15	PA5	I/O	ADC_IN5	T6
16	PA6	I/O	ADC_IN6	T7
17	PA7	I/O	ADC_IN7	T8
18	PB0	I/O	TIM3_CH3	LED_B
19	PB1	I/O	ADC_IN9	LIPOL_POMIAR
21	PB10	I/O	TIM2_CH3	LED_G
22	PB11	I/O	TIM2_CH4	LED_R
23	VSS	Power		
24	VDD	Power		
27	PB14 *	I/O	GPIO_Output	L_TYL
28	PB15 *	I/O	GPIO_Output	L_PRZOD
29	PA8	I/O	TIM1_CH1	L_PWM
30	PA9 *	I/O	GPIO_Output	R_PRZOD
31	PA10 *	I/O	GPIO_Output	R_TYL
32	PA11	I/O	TIM1_CH4	R_PWM
33	PA12 *	I/O	GPIO_Input	BUTTON_START
37	PA14	I/O	USART2_TX	
38	PA15	I/O	USART2_RX	
39	PB3	I/O	SPI1_SCK	
40	PB4	I/O	SPI1_MISO	
41	PB5	I/O	SPI1_MOSI	
42	PB6 *	I/O	GPIO_Output	SPI1_SS1
43	PB7 *	I/O	GPIO_Output	SPI1_SS2
44	BOOT0	Boot		
47	VSS	Power		

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
48	VDD	Power		

\* The pin is affected with an I/O function

## 4. Clock Tree Configuration



## 5. IPs and Middleware Configuration

### 5.1. ADC

mode: IN0

mode: IN1

mode: IN2

mode: IN3

mode: IN4

mode: IN5

mode: IN6

mode: IN7

mode: IN9

#### 5.1.1. Parameter Settings:

##### ADC\_Settings:

Clock Prescaler	Asynchronous clock mode
Resolution	ADC 12-bit resolution
Data Alignment	Right alignment
Scan Conversion Mode	Forward
Continuous Conversion Mode	<b>Enabled *</b>
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	<b>Enabled *</b>
End Of Conversion Selection	<b>End of sequence of conversion *</b>
Overrun behaviour	<b>Overrun data overwritten *</b>
Low Power Auto Wait	Disabled
Low Power Auto Power Off	Disabled

##### ADC\_Regular\_ConversionMode:

Sampling Time	<b>239.5 Cycles *</b>
External Trigger Conversion Source	Regular Conversion launched by software
External Trigger Conversion Edge	None

##### WatchDog:

Enable Analog WatchDog Mode	false
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## 5.2. RCC

### High Speed Clock (HSE): Crystal/Ceramic Resonator

#### 5.2.1. Parameter Settings:

##### System Parameters:

VDD voltage (V)	3.3
Prefetch Buffer	Enabled
Flash Latency(WS)	1 WS (2 CPU cycle)

##### RCC Parameters:

HSI Calibration Value	16
HSI14 Calibration Value	16
HSE Startup Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000

## 5.3. SPI1

### Mode: Full-Duplex Master

#### 5.3.1. Parameter Settings:

##### Basic Parameters:

Frame Format	Motorola
Data Size	4 Bits
First Bit	MSB First

##### Clock Parameters:

Prescaler (for Baud Rate)	<b>8 *</b>
Baud Rate	<b>6.0 MBits/s *</b>
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

##### Advanced Parameters:

CRC Calculation	Disabled
NSSP Mode	<b>Disabled *</b>
NSS Signal Type	Software

## 5.4. SYS

Timebase Source: SysTick

## 5.5. TIM1

Clock Source : Internal Clock

Channel1: PWM Generation CH1

Channel4: PWM Generation CH4

### 5.5.1. Parameter Settings:

#### Counter Settings:

Prescaler (PSC - 16 bits value)	47 *
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value )	999 *
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0
auto-reload preload	Disable

#### Trigger Output (TRGO) Parameters:

Master/Slave Mode	Disable (no sync between this TIM (Master) and its Slaves)
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

#### Clear Input:

Clear Input Source	Disable
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#### PWM Generation Channel 1:

Mode	PWM mode 1
Pulse (16 bits value)	0
Fast Mode	Disable
CH Polarity	High
CH Idle State	Reset

#### PWM Generation Channel 4:

Mode	PWM mode 1
Pulse (16 bits value)	0



Fast Mode	Disable
CH Polarity	High
CH Idle State	Reset

## 5.6. TIM2

### Channel3: PWM Generation CH3

### Channel4: PWM Generation CH4

#### 5.6.1. Parameter Settings:

##### Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value )	0
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

##### Trigger Output (TRGO) Parameters:

Master/Slave Mode	Disable (no sync between this TIM (Master) and its Slaves)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

##### Clear Input:

Clear Input Source	Disable
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##### PWM Generation Channel 3:

Mode	PWM mode 1
Pulse (32 bits value)	0
Fast Mode	Disable
CH Polarity	High

##### PWM Generation Channel 4:

Mode	PWM mode 1
Pulse (32 bits value)	0
Fast Mode	Disable
CH Polarity	High

## 5.7. TIM3

### mode: Clock Source

### Channel3: PWM Generation CH3

### 5.7.1. 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	Disable (no sync between this TIM (Master) and its Slaves)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

#### Clear Input:

Clear Input Source	Disable
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#### PWM Generation Channel 3:

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

## 5.8. TIM6

mode: Activated

### 5.8.1. Parameter Settings:

#### Counter Settings:

Prescaler (PSC - 16 bits value)	<b>4799 *</b>
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value )	<b>9 *</b>
auto-reload preload	Disable

#### Trigger Output (TRGO) Parameters:

Trigger Event Selection	Reset (UG bit from TIMx_EGR)
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## 5.9. TIM14

mode: Activated

### 5.9.1. 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

## 5.10. TIM16

mode: Activated

### 5.10.1. 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
Repetition Counter (RCR - 8 bits value)	0
auto-reload preload	Disable

## 5.11. USART2

Mode: Asynchronous

### 5.11.1. Parameter Settings:

#### Basic Parameters:

Baud Rate	38400
Word Length	8 Bits (including Parity)
Parity	<b>Even *</b>
Stop Bits	1

#### Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples
Single Sample	Disable

**Advanced Features:**

TX Pin Active Level Inversion	Disable
RX Pin Active Level Inversion	Disable
Data Inversion	Disable
TX and RX Pins Swapping	Disable
Overrun	Enable
DMA on RX Error	Enable
MSB First	Disable

**\* User modified value**

## 6. System Configuration

### 6.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC	PA0	ADC_IN0	Analog mode	No pull-up and no pull-down	n/a	T1
	PA1	ADC_IN1	Analog mode	No pull-up and no pull-down	n/a	T2
	PA2	ADC_IN2	Analog mode	No pull-up and no pull-down	n/a	T3
	PA3	ADC_IN3	Analog mode	No pull-up and no pull-down	n/a	T4
	PA4	ADC_IN4	Analog mode	No pull-up and no pull-down	n/a	T5
	PA5	ADC_IN5	Analog mode	No pull-up and no pull-down	n/a	T6
	PA6	ADC_IN6	Analog mode	No pull-up and no pull-down	n/a	T7
	PA7	ADC_IN7	Analog mode	No pull-up and no pull-down	n/a	T8
	PB1	ADC_IN9	Analog mode	No pull-up and no pull-down	n/a	LIPOL_POMIAR
RCC	PF0-OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	OSC_IN
	PF1-OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	OSC_OUT
SPI1	PB3	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PB4	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	High *	
	PB5	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	High *	
TIM1	PA8	TIM1_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	L_PWM
	PA11	TIM1_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	R_PWM
TIM2	PB10	TIM2_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	LED_G
	PB11	TIM2_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	LED_R
TIM3	PB0	TIM3_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	LED_B
USART2	PA14	USART2_TX	Alternate Function Push Pull	Pull-up	High *	
	PA15	USART2_RX	Alternate Function Push Pull	Pull-up	High *	
GPIO	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	L_TYL
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	L_PRZOD
	PA9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	R_PRZOD
	PA10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	R_TYL
	PA12	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	BUTTON_START
	PB6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SPI1_SS1
	PB7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SPI1_SS2

## 6.2. DMA configuration

DMA request	Stream	Direction	Priority
ADC	DMA1_Channel1	Peripheral To Memory	<b>Very High *</b>

### ADC: DMA1\_Channel1 DMA request Settings:

Mode: **Circular \***  
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
System service call via SWI instruction	true	0	0
Pendable request for system service	true	0	0
System tick timer	true	0	0
DMA1 channel 1 interrupt	true	0	0
TIM6 global and DAC underrun error interrupts	true	0	0
PVD interrupt through EXTI Line16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
ADC and COMP interrupts (COMP interrupts through EXTI lines 21 and 22)	unused		
TIM1 break, update, trigger and commutation interrupts	unused		
TIM1 capture compare interrupt	unused		
TIM2 global interrupt	unused		
TIM3 global interrupt	unused		
TIM14 global interrupt	unused		
TIM16 global interrupt	unused		
SPI1 global interrupt	unused		
USART2 global interrupt	unused		

\* User modified value

## ***7. Power Consumption Calculator report***

### 7.1. Microcontroller Selection

Series	STM32F0
Line	STM32F0x1
MCU	STM32F051C8Tx
Datasheet	022265_Rev6

### 7.2. Parameter Selection

Temperature	25
Vdd	3.3



## 8. Software Project

### 8.1. Project Settings

Name	Value
Project Name	ProjektMX
Project Folder	D:\OneDrive\Programowanie\Roboty\Linefollower - LFANT\ProjektMX
Toolchain / IDE	SW4STM32
Firmware Package Name and Version	STM32Cube FW_F0 V1.7.0

### 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	Yes
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