

1. Description

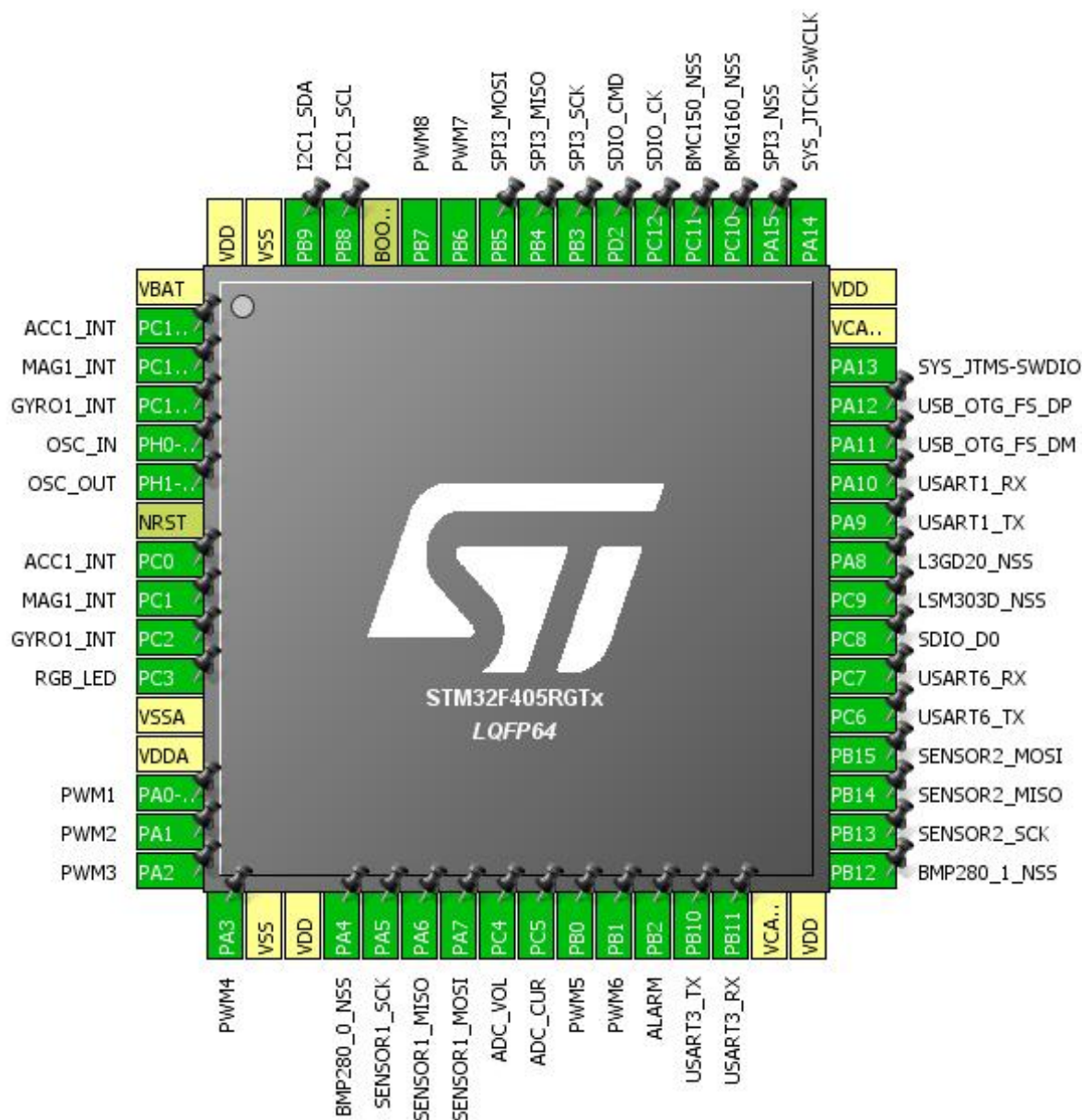
1.1. Project

| | |
|-----------------|--------------------|
| Project Name | F405 |
| Board Name | No information |
| Generated with: | STM32CubeMX 4.22.0 |
| Date | 10/26/2017 |

1.2. MCU

| | |
|----------------|---------------|
| MCU Series | STM32F4 |
| MCU Line | STM32F405/415 |
| MCU name | STM32F405RGTx |
| MCU Package | LQFP64 |
| MCU Pin number | 64 |

2. Pinout Configuration



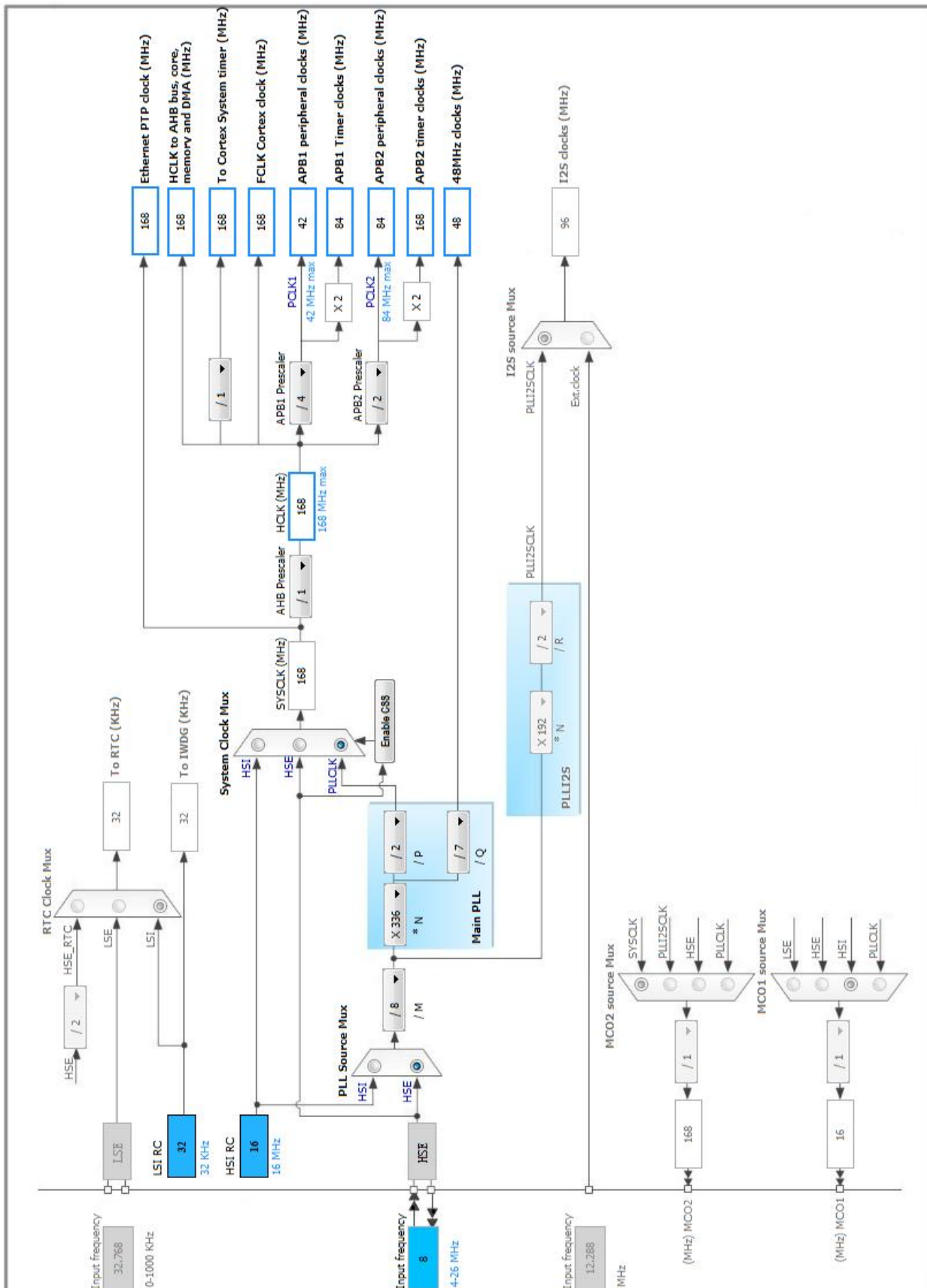
3. Pins Configuration

| Pin Number LQFP64 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|----------------------|---------------------------------------|----------|--------------------------|--------------|
| 1 | VBAT | Power | | |
| 2 | PC13-ANTI_TAMP | I/O | GPIO_EXTI13 | ACC1_INT |
| 3 | PC14-OSC32_IN | I/O | GPIO_EXTI14 | MAG1_INT |
| 4 | PC15-OSC32_OUT | I/O | GPIO_EXTI15 | GYRO1_INT |
| 5 | PH0-OSC_IN | I/O | RCC_OSC_IN | OSC_IN |
| 6 | PH1-OSC_OUT | I/O | RCC_OSC_OUT | OSC_OUT |
| 7 | NRST | Reset | | |
| 8 | PC0 | I/O | GPIO_EXTI0 | ACC1_INT |
| 9 | PC1 | I/O | GPIO_EXTI1 | MAG1_INT |
| 10 | PC2 | I/O | GPIO_EXTI2 | GYRO1_INT |
| 11 | PC3 * | I/O | GPIO_Output | RGB_LED |
| 12 | VSSA | Power | | |
| 13 | VDDA | Power | | |
| 14 | PA0-WKUP | I/O | TIM2_CH1 | PWM1 |
| 15 | PA1 | I/O | TIM2_CH2 | PWM2 |
| 16 | PA2 | I/O | TIM2_CH3 | PWM3 |
| 17 | PA3 | I/O | TIM2_CH4 | PWM4 |
| 18 | VSS | Power | | |
| 19 | VDD | Power | | |
| 20 | PA4 * | I/O | GPIO_Output | BMP280_0_NSS |
| 21 | PA5 | I/O | SPI1_SCK | SENSOR1_SCK |
| 22 | PA6 | I/O | SPI1_MISO | SENSOR1_MISO |
| 23 | PA7 | I/O | SPI1_MOSI | SENSOR1_MOSI |
| 24 | PC4 | I/O | ADC1_IN14 | ADC_VOL |
| 25 | PC5 | I/O | ADC1_IN15 | ADC_CUR |
| 26 | PB0 | I/O | TIM3_CH3 | PWM5 |
| 27 | PB1 | I/O | TIM3_CH4 | PWM6 |
| 28 | PB2 * | I/O | GPIO_Output | ALARM |
| 29 | PB10 | I/O | USART3_TX | |
| 30 | PB11 | I/O | USART3_RX | |
| 31 | VCAP_1 | Power | | |
| 32 | VDD | Power | | |
| 33 | PB12 * | I/O | GPIO_Output | BMP280_1_NSS |
| 34 | PB13 | I/O | SPI2_SCK | SENSOR2_SCK |
| 35 | PB14 | I/O | SPI2_MISO | SENSOR2_MISO |
| 36 | PB15 | I/O | SPI2_MOSI | SENSOR2_MOSI |

| Pin Number LQFP64 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|----------------------|---------------------------------------|----------|--------------------------|-------------|
| 37 | PC6 | I/O | USART6_TX | |
| 38 | PC7 | I/O | USART6_RX | |
| 39 | PC8 | I/O | SDIO_D0 | |
| 40 | PC9 * | I/O | GPIO_Output | LSM303D_NSS |
| 41 | PA8 * | I/O | GPIO_Output | L3GD20_NSS |
| 42 | PA9 | I/O | USART1_TX | |
| 43 | PA10 | I/O | USART1_RX | |
| 44 | PA11 | I/O | USB_OTG_FS_DM | |
| 45 | PA12 | I/O | USB_OTG_FS_DP | |
| 46 | PA13 | I/O | SYS_JTMS-SWDIO | |
| 47 | VCAP_2 | Power | | |
| 48 | VDD | Power | | |
| 49 | PA14 | I/O | SYS_JTCK-SWCLK | |
| 50 | PA15 | I/O | SPI3_NSS | |
| 51 | PC10 * | I/O | GPIO_Output | BMG160_NSS |
| 52 | PC11 * | I/O | GPIO_Output | BMC150_NSS |
| 53 | PC12 | I/O | SDIO_CK | |
| 54 | PD2 | I/O | SDIO_CMD | |
| 55 | PB3 | I/O | SPI3_SCK | |
| 56 | PB4 | I/O | SPI3_MISO | |
| 57 | PB5 | I/O | SPI3_MOSI | |
| 58 | PB6 | I/O | TIM4_CH1 | PWM7 |
| 59 | PB7 | I/O | TIM4_CH2 | PWM8 |
| 60 | BOOT0 | Boot | | |
| 61 | PB8 | I/O | I2C1_SCL | |
| 62 | PB9 | I/O | I2C1_SDA | |
| 63 | VSS | Power | | |
| 64 | VDD | Power | | |

* The pin is affected with an I/O function

4. Clock Tree Configuration



5. IPs and Middleware Configuration

5.1. ADC1

mode: IN14

mode: IN15

5.1.1. Parameter Settings:

ADCs_Common_Settings:

| | |
|-------------------------------|--|
| Mode | Independent mode |
| Clock Prescaler | PCLK2 divided by 4 |
| Resolution | 12 bits (15 ADC Clock cycles) |
| Data Alignment | Right alignment |
| Scan Conversion Mode | Disabled |
| Continuous Conversion Mode | Disabled |
| Discontinuous Conversion Mode | Disabled |
| DMA Continuous Requests | Disabled |
| End Of Conversion Selection | EOC flag at the end of single channel conversion |

ADC_Regular_ConversionMode:

| | |
|------------------------------------|---|
| Number Of Conversion | 1 |
| External Trigger Conversion Source | Regular Conversion launched by software |
| External Trigger Conversion Edge | None |
| Rank | 1 |
| Channel | Channel 14 |
| Sampling Time | 3 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. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

5.3.1. 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 Timeout Value (ms) | 100 |
| LSE Startup Timeout Value (ms) | 5000 |

Power Parameters:

| | |
|-------------------------------|---------------------------------|
| Power Regulator Voltage Scale | Power Regulator Voltage Scale 1 |
|-------------------------------|---------------------------------|

5.4. SDIO

Mode: SD 1 bit

5.4.1. Parameter Settings:

SDIO parameters:

| | |
|-----------------------------|---|
| SDIOCLK clock divide factor | 0 |
|-----------------------------|---|

5.5. SPI1

Mode: Full-Duplex Master

5.5.1. 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 |

5.6. SPI2

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 | 21.0 MBits/s * |
| Clock Polarity (CPOL) | Low |
| Clock Phase (CPHA) | 1 Edge |

Advanced Parameters:

| | |
|-----------------|----------|
| CRC Calculation | Disabled |
| NSS Signal Type | Software |

5.7. SPI3

Mode: Full-Duplex Master

Hardware NSS Signal: Hardware NSS Output Signal

5.7.1. Parameter Settings:

Basic Parameters:

| | |
|--------------|-----------|
| Frame Format | Motorola |
| Data Size | 8 Bits |
| First Bit | MSB First |

Clock Parameters:

| | |
|---------------------------|-----------------------|
| Prescaler (for Baud Rate) | 2 |
| Baud Rate | 21.0 MBits/s * |
| Clock Polarity (CPOL) | Low |
| Clock Phase (CPHA) | 1 Edge |

Advanced Parameters:

| | |
|-----------------|-----------------|
| CRC Calculation | Disabled |
| NSS Signal Type | Output Hardware |

5.8. SYS

Debug: Serial Wire

Timebase Source: SysTick

5.9. TIM2

Channel1: PWM Generation CH1

Channel2: PWM Generation CH2

Channel3: PWM Generation CH3

Channel4: PWM Generation CH4

5.9.1. 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

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)

PWM Generation Channel 1:

Mode PWM mode 1

Pulse (32 bits value) 0

Fast Mode Disable

CH Polarity High

PWM Generation Channel 2:

Mode PWM mode 1

Pulse (32 bits value) 0

Fast Mode Disable

CH Polarity High

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

5.10. TIM3

Channel3: PWM Generation CH3

Channel4: PWM Generation CH4

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

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)

PWM Generation Channel 3:

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

PWM Generation Channel 4:

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

5.11. TIM4

Channel1: PWM Generation CH1

Channel2: PWM Generation CH2

5.11.1. 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

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)

PWM Generation Channel 1:

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

PWM Generation Channel 2:

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

5.12. USART1

Mode: Asynchronous

5.12.1. 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 |

5.13. USART3

Mode: Asynchronous

5.13.1. 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 |

5.14. USART6

Mode: Asynchronous

5.14.1. 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 |

5.15. USB_OTG_FS

Mode: Device_Only

5.15.1. Parameter Settings:

| | |
|----------------------------|----------------------------|
| Speed | Device Full Speed 12MBit/s |
| Endpoint 0 Max Packet size | 64 Bytes |
| Enable internal IP DMA | Disabled |
| Low power | Disabled |
| Link Power Management | Disabled |
| VBUS sensing | Enabled |
| Signal start of frame | 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 | PC4 | ADC1_IN14 | Analog mode | No pull-up and no pull-down | n/a | ADC_VOL |
| | PC5 | ADC1_IN15 | Analog mode | No pull-up and no pull-down | n/a | ADC_CUR |
| I2C1 | PB8 | I2C1_SCL | Alternate Function Open Drain | Pull-up | Very High * | |
| | PB9 | I2C1_SDA | Alternate Function Open Drain | Pull-up | Very High * | |
| RCC | PH0-OSC_IN | RCC_OSC_IN | n/a | n/a | n/a | OSC_IN |
| | PH1-OSC_OUT | RCC_OSC_OUT | n/a | n/a | n/a | OSC_OUT |
| SDIO | PC8 | SDIO_D0 | Alternate Function Push Pull | No pull-up and no pull-down | Very High | |
| | PC12 | SDIO_CK | Alternate Function Push Pull | No pull-up and no pull-down | Very High | |
| | PD2 | SDIO_CMD | Alternate Function Push Pull | No pull-up and no pull-down | Very High | |
| SPI1 | PA5 | SPI1_SCK | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | SENSOR1_SCK |
| | PA6 | SPI1_MISO | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | SENSOR1_MISO |
| | PA7 | SPI1_MOSI | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | SENSOR1_MOSI |
| SPI2 | PB13 | SPI2_SCK | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | SENSOR2_SCK |
| | PB14 | SPI2_MISO | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | SENSOR2_MISO |
| | PB15 | SPI2_MOSI | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | SENSOR2_MOSI |
| SPI3 | PA15 | SPI3_NSS | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | |
| | PB3 | SPI3_SCK | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | |
| | PB4 | SPI3_MISO | Alternate Function Push Pull | No pull-up and no pull-down | Very High * | |
| | PB5 | SPI3_MOSI | Alternate Function Push Pull | No pull-up and no pull-down | Very High | |

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|------------|----------------|----------------|--|-----------------------------|----------------|------------|
| | | | | | * | |
| SYS | PA13 | SYS_JTMS-SWDIO | n/a | n/a | n/a | |
| | PA14 | SYS_JTCK-SWCLK | n/a | n/a | n/a | |
| TIM2 | PA0-WKUP | TIM2_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM1 |
| | PA1 | TIM2_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM2 |
| | PA2 | TIM2_CH3 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM3 |
| | PA3 | TIM2_CH4 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM4 |
| TIM3 | PB0 | TIM3_CH3 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM5 |
| | PB1 | TIM3_CH4 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM6 |
| TIM4 | PB6 | TIM4_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM7 |
| | PB7 | TIM4_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM8 |
| USART1 | PA9 | USART1_TX | Alternate Function Push Pull | Pull-up | Very High * | |
| | PA10 | USART1_RX | Alternate Function Push Pull | Pull-up | Very High * | |
| USART3 | PB10 | USART3_TX | Alternate Function Push Pull | Pull-up | Very High * | |
| | PB11 | USART3_RX | Alternate Function Push Pull | Pull-up | Very High * | |
| USART6 | PC6 | USART6_TX | Alternate Function Push Pull | Pull-up | Very High * | |
| | PC7 | USART6_RX | Alternate Function Push Pull | Pull-up | 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 * | |
| GPIO | PC13-ANTI_TAMP | GPIO_EXTI13 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | ACC1_INT |
| | PC14-OSC32_IN | GPIO_EXTI14 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | MAG1_INT |
| | PC15-OSC32_OUT | GPIO_EXTI15 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | GYRO1_INT |
| | PC0 | GPIO_EXTI0 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | ACC1_INT |
| | PC1 | GPIO_EXTI1 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | MAG1_INT |
| | | | | | | |

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|----|------|-------------|--|-----------------------------|-----------|--------------|
| | PC2 | GPIO_EXTI2 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | GYRO1_INT |
| | PC3 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | RGB_LED |
| | PA4 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | BMP280_0_NSS |
| | PB2 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | ALARM |
| | PB12 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | BMP280_1_NSS |
| | PC9 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | LSM303D_NSS |
| | PA8 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | L3GD20_NSS |
| | PC10 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | BMG160_NSS |
| | PC11 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | BMC150_NSS |

6.2. DMA configuration

nothing configured in DMA service

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 | 0 | 0 |
| Debug monitor | true | 0 | 0 |
| Pendable request for system service | true | 0 | 0 |
| System tick timer | true | 0 | 0 |
| PVD interrupt through EXTI line 16 | unused | | |
| Flash global interrupt | unused | | |
| RCC global interrupt | unused | | |
| EXTI line0 interrupt | unused | | |
| EXTI line1 interrupt | unused | | |
| EXTI line2 interrupt | unused | | |
| ADC1, ADC2 and ADC3 global interrupts | unused | | |
| TIM2 global interrupt | unused | | |
| TIM3 global interrupt | unused | | |
| TIM4 global interrupt | unused | | |
| I2C1 event interrupt | unused | | |
| I2C1 error interrupt | unused | | |
| SPI1 global interrupt | unused | | |
| SPI2 global interrupt | unused | | |
| USART1 global interrupt | unused | | |
| USART3 global interrupt | unused | | |
| EXTI line[15:10] interrupts | unused | | |
| SDIO global interrupt | unused | | |
| SPI3 global interrupt | unused | | |
| USB On The Go FS global interrupt | unused | | |
| USART6 global interrupt | unused | | |
| FPU global interrupt | unused | | |

* User modified value

7. Power Consumption Calculator report

7.1. Microcontroller Selection

| | |
|-----------|---------------|
| Series | STM32F4 |
| Line | STM32F405/415 |
| MCU | STM32F405RGTx |
| Datasheet | 022152_Rev8 |

7.2. Parameter Selection

| | |
|-------------|-----|
| Temperature | 25 |
| Vdd | 3.3 |