# 1. Description

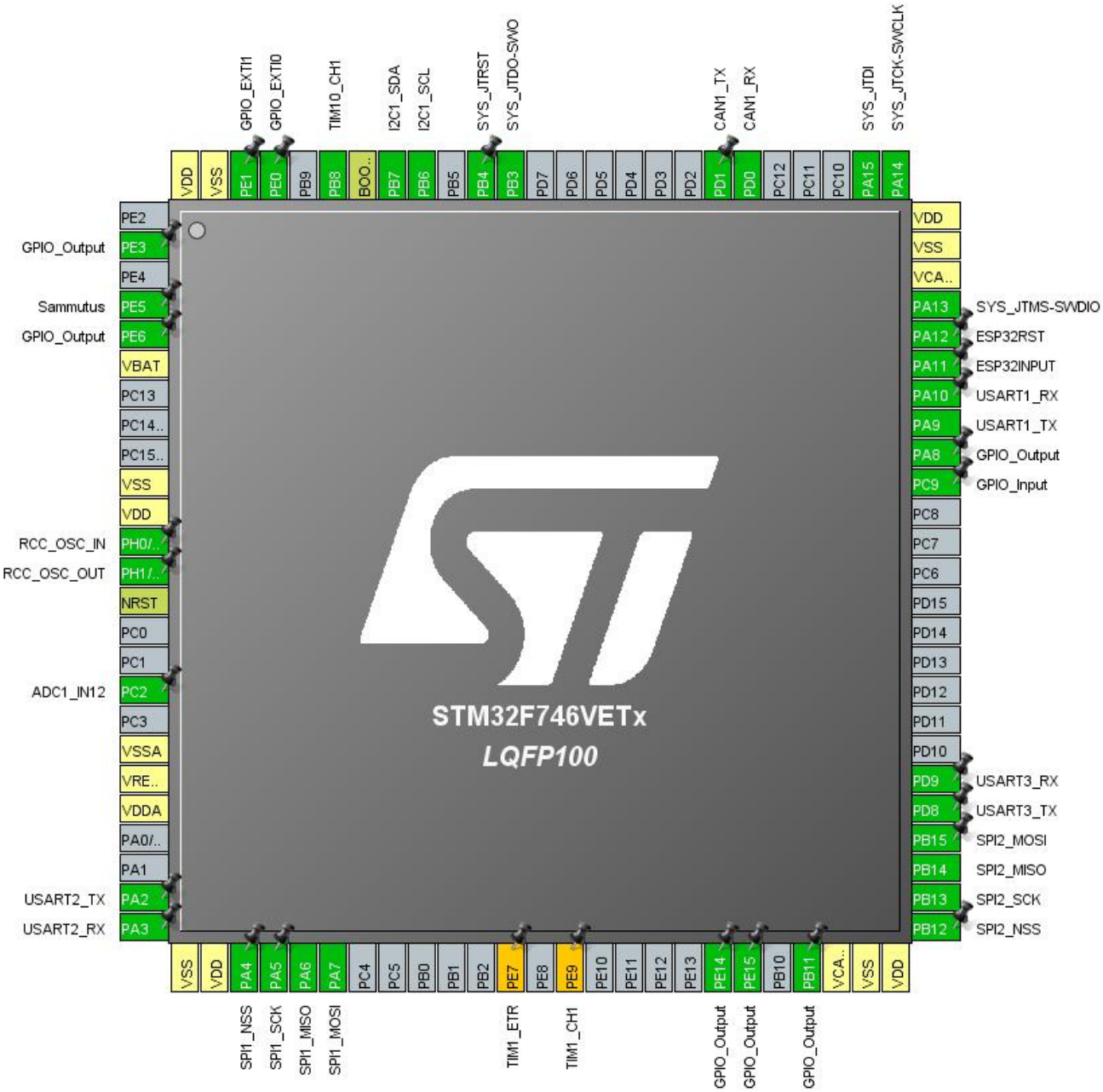
## 1.1. Project

| | |
|---|---|
| Project Name | ST_Arm746relekortti |
| Board Name | custom |
| Generated with: | STM32CubeMX 5.0.1 |
| Date | 01/03/2019 |

## 1.2. MCU

| | |
|---|---|
| MCU Series | STM32F7 |
| MCU Line | STM32F7x6 |
| MCU name | STM32F746VETx |
| MCU Package | LQFP100 |
| MCU Pin number | 100 |

## 2. Pinout Configuration



# 3. Pins Configuration

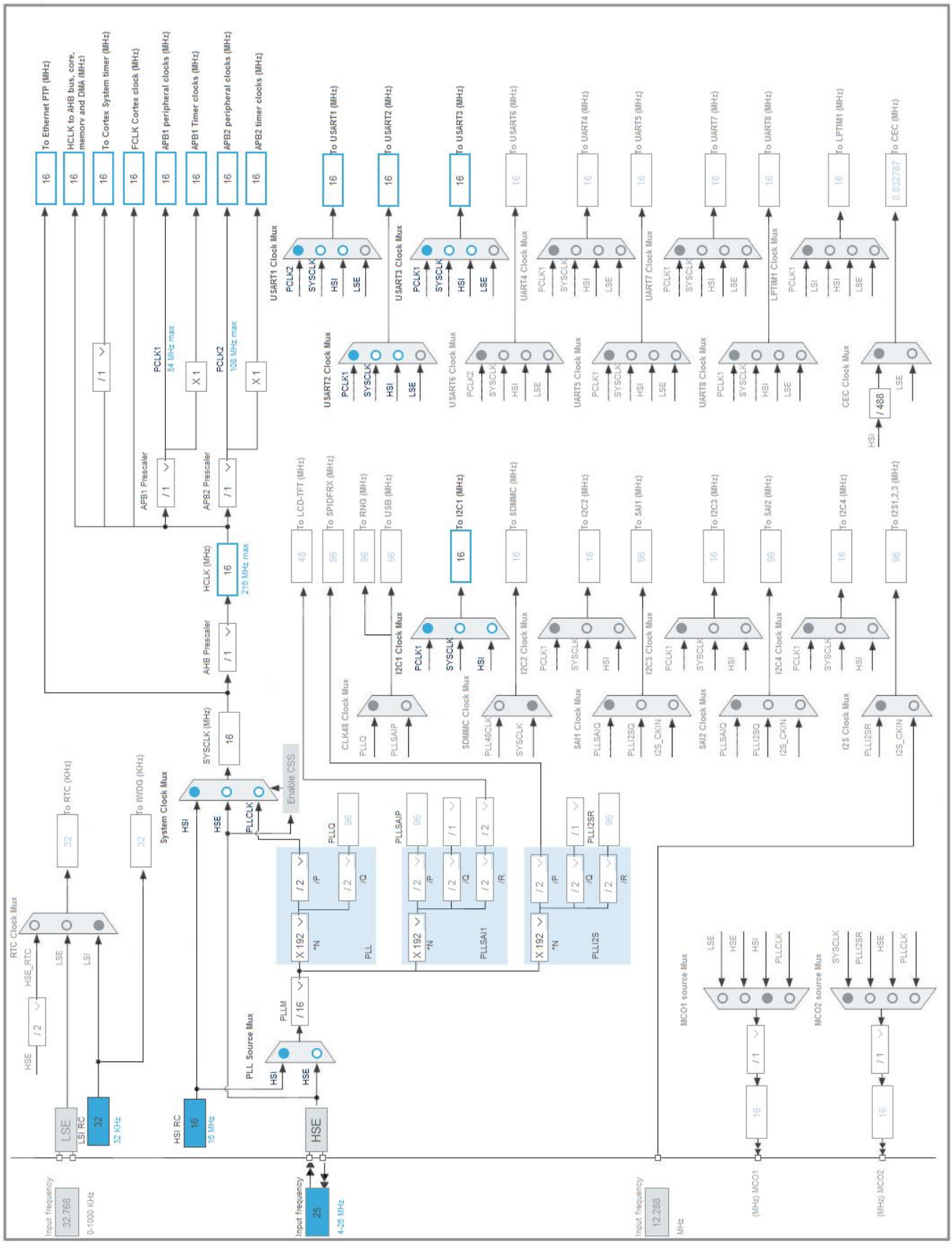
| Pin Number LQFP100 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 2 | PE3 * | I/O | GPIO_Output | |
| 4 | PE5 * | I/O | GPIO_Output | Sammutus |
| 5 | PE6 * | I/O | GPIO_Output | |
| 6 | VBAT | Power | | |
| 10 | VSS | Power | | |
| 11 | VDD | Power | | |
| 12 | PH0/OSC_IN | I/O | RCC_OSC_IN | |
| 13 | PH1/OSC_OUT | I/O | RCC_OSC_OUT | |
| 14 | NRST | Reset | | |
| 17 | PC2 | I/O | ADC1_IN12 | |
| 19 | VSSA | Power | | |
| 20 | VREF+ | Power | | |
| 21 | VDDA | Power | | |
| 24 | PA2 | I/O | USART2_TX | |
| 25 | PA3 | I/O | USART2_RX | |
| 26 | VSS | Power | | |
| 27 | VDD | Power | | |
| 28 | PA4 | I/O | SPI1_NSS | |
| 29 | PA5 | I/O | SPI1_SCK | |
| 30 | PA6 | I/O | SPI1_MISO | |
| 31 | PA7 | I/O | SPI1_MOSI | |
| 37 | PE7 ** | I/O | TIM1_ETR | |
| 39 | PE9 ** | I/O | TIM1_CH1 | |
| 44 | PE14 * | I/O | GPIO_Output | |
| 45 | PE15 * | I/O | GPIO_Output | |
| 47 | PB11 * | I/O | GPIO_Output | |
| 48 | VCAP_1 | Power | | |
| 49 | VSS | Power | | |
| 50 | VDD | Power | | |
| 51 | PB12 | I/O | SPI2_NSS | |
| 52 | PB13 | I/O | SPI2_SCK | |
| 53 | PB14 | I/O | SPI2_MISO | |
| 54 | PB15 | I/O | SPI2_MOSI | |
| 55 | PD8 | I/O | USART3_TX | |
| 56 | PD9 | I/O | USART3_RX | |
| 66 | PC9 * | I/O | GPIO_Input | |

| Pin Number LQFP100 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 67 | PA8 * | I/O | GPIO_Output | |
| 68 | PA9 | I/O | USART1_TX | |
| 69 | PA10 | I/O | USART1_RX | |
| 70 | PA11 * | I/O | GPIO_Input | ESP32INPUT |
| 71 | PA12 * | I/O | GPIO_Output | ESP32RST |
| 72 | PA13 | I/O | SYS_JTMS-SWDIO | |
| 73 | VCAP_2 | Power | | |
| 74 | VSS | Power | | |
| 75 | VDD | Power | | |
| 76 | PA14 | I/O | SYS_JTCK-SWCLK | |
| 77 | PA15 | I/O | SYS_JTDI | |
| 81 | PD0 | I/O | CAN1_RX | |
| 82 | PD1 | I/O | CAN1_TX | |
| 89 | PB3 | I/O | SYS_JTDO-SWO | |
| 90 | PB4 | I/O | SYS_JTRST | |
| 92 | PB6 | I/O | I2C1_SCL | |
| 93 | PB7 | I/O | I2C1_SDA | |
| 94 | BOOT0 | Boot | | |
| 95 | PB8 | I/O | TIM10_CH1 | |
| 97 | PE0 | I/O | GPIO_EXTI0 | |
| 98 | PE1 | I/O | GPIO_EXTI1 | |
| 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. Software Project

## 5.1. Project Settings

| Name | Value |
|---|---|
| Project Name | ST_Arm746relekortti |
| Project Folder | C:\PADS Projects\ST_Arm746relekortti |
| Toolchain / IDE | MDK-ARM V5 |
| Firmware Package Name and Version | STM32Cube FW_F7 V1.14.0 |

## 5.2. Code Generation Settings

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

# 6. Power Consumption Calculator report

6.1. Microcontroller Selection

| | |
|---|---|
| Series | STM32F7 |
| Line | STM32F7x6 |
| MCU | STM32F746VETx |
| Datasheet | 027590_Rev4 |

6.2. Parameter Selection

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

# 7. IPs and Middleware Configuration

## 7.1. ADC1

**mode: IN12**

### 7.1.1. Parameter Settings:

**ADCs_Common_Settings:**

| | |
|---|---|
| Mode | Independent mode |

**ADC_Settings:**

| | |
|---|---|
| Clock Prescaler | PCLK2 divided by 2 |
| 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 12 |
| Sampling Time | 3 Cycles |

**ADC_Injected_ConversionMode:**

| | |
|---|---|
| Number Of Conversions | 0 |

**WatchDog:**

| | |
|---|---|
| Enable Analog WatchDog Mode | false |

## 7.2. CAN1

**mode: Mode**

### 7.2.1. Parameter Settings:

**Bit Timings Parameters:**

| | |
|---|---|
| Prescaler (for Time Quantum) | 16 |
| Time Quantum | **1000.0 *** |
| Time Quanta in Bit Segment 1 | 1 Time |
| Time Quanta in Bit Segment 2 | 1 Time |

| | |
|---|---|
| ReSynchronization Jump Width | 1 Time |

**Basic Parameters:**

| | |
|---|---|
| Time Triggered Communication Mode | Disable |
| Automatic Bus-Off Management | Disable |
| Automatic Wake-Up Mode | Disable |
| No-Automatic Retransmission | Disable |
| Receive Fifo Locked Mode | Disable |
| Transmit Fifo Priority | Disable |

**Advanced Parameters:**

| | |
|---|---|
| Operating Mode | Normal |

## *7.3. I2C1*

### I2C: I2C

### 7.3.1. Parameter Settings:

**Timing configuration:**

| | |
|---|---|
| I2C Speed Mode | Standard Mode |
| I2C Speed Frequency (KHz) | 100 |
| Rise Time (ns) | 0 |
| Fall Time (ns) | 0 |
| Coefficient of Digital Filter | 0 |
| Analog Filter | Enabled |
| Timing | 0x00303D5B |

**Slave Features:**

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

## *7.4. RCC*

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

### 7.4.1. Parameter Settings:

**System Parameters:**

| | |
|---|---|
| VDD voltage (V) | 3.3 |
| Flash Latency(WS) | 0 WS (1 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 Over Drive | Disabled |
| Power Regulatror Voltage Scale | Power Regulator Voltage Scale 3 |

## *7.5. SPI1*

**Mode: Full-Duplex Master**

**Hardware NSS Signal: Hardware NSS Output Signal**

### 7.5.1. Parameter Settings:

**Basic Parameters:**

| | |
|---|---|
| Frame Format | Motorola |
| Data Size | 4 Bits |
| First Bit | MSB First |

**Clock Parameters:**

| | |
|---|---|
| Prescaler (for Baud Rate) | 2 |
| Baud Rate | **8.0 MBits/s *** |
| Clock Polarity (CPOL) | Low |
| Clock Phase (CPHA) | 1 Edge |

**Advanced Parameters:**

| | |
|---|---|
| CRC Calculation | Disabled |
| NSSP Mode | Enabled |
| NSS Signal Type | Output Hardware |

## *7.6. SPI2*

**Mode: Full-Duplex Master**

**Hardware NSS Signal: Hardware NSS Output Signal**

### 7.6.1. Parameter Settings:

**Basic Parameters:**

| | |
|---|---|
| Frame Format | Motorola |
| Data Size | 4 Bits |

| | |
|---|---|
| First Bit | MSB First |

**Clock Parameters:**

| | |
|---|---|
| Prescaler (for Baud Rate) | 2 |
| Baud Rate | **8.0 MBits/s *** |
| Clock Polarity (CPOL) | Low |
| Clock Phase (CPHA) | 1 Edge |

**Advanced Parameters:**

| | |
|---|---|
| CRC Calculation | Disabled |
| NSSP Mode | Enabled |
| NSS Signal Type | Output Hardware |

## 7.7. SYS

**Debug: JTAG (5 pins)**

**Timebase Source: SysTick**

## 7.8. TIM1

**Slave Mode: External Clock Mode 1**

## 7.9. TIM10

**mode: Activated**

**Channel1: PWM Generation CH1**

### 7.9.1. 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 |

**PWM Generation Channel 1:**

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

## 7.10. USART1

### Mode: Asynchronous

### 7.10.1. 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 |
| Single Sample | Disable |

**Advanced Features:**

| | |
|---|---|
| Auto Baudrate | Disable |
| 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 |

## 7.11. USART2

### Mode: Asynchronous

### 7.11.1. 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 |
| Single Sample | Disable |

**Advanced Features:**

| | |
|---|---|
| Auto Baudrate | Disable |

| | |
|---|---|
| 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 |

## *7.12. USART3*

### Mode: Asynchronous

### 7.12.1. 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 |
| Single Sample | Disable |

**Advanced Features:**

| | |
|---|---|
| Auto Baudrate | Disable |
| 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**

# 8. System Configuration

## 8.1. GPIO configuration

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| ADC1 | PC2 | ADC1_IN12 | Analog mode | No pull-up and no pull-down | n/a | |
| CAN1 | PD0 | CAN1_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PD1 | CAN1_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| I2C1 | PB6 | I2C1_SCL | Alternate Function Open Drain | Pull-up | **Very High *** | |
| | PB7 | I2C1_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 | |
| SPI1 | PA4 | SPI1_NSS | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PA5 | SPI1_SCK | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PA6 | SPI1_MISO | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PA7 | SPI1_MOSI | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| SPI2 | PB12 | SPI2_NSS | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PB13 | SPI2_SCK | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PB14 | SPI2_MISO | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PB15 | SPI2_MOSI | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| SYS | PA13 | SYS_JTMS-SWDIO | n/a | n/a | n/a | |
| | PA14 | SYS_JTCK-SWCLK | n/a | n/a | n/a | |
| | PA15 | SYS_JTDI | n/a | n/a | n/a | |

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| | PB3 | SYS_JTDO-SWO | n/a | n/a | n/a | |
| | PB4 | SYS_JTRST | n/a | n/a | n/a | |
| TIM10 | PB8 | TIM10_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | |
| USART1 | PA9 | USART1_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PA10 | USART1_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| USART2 | PA2 | USART2_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PA3 | USART2_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| USART3 | PD8 | USART3_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PD9 | USART3_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| Single Mapped Signals | PE7 | TIM1_ETR | Alternate Function Push Pull | No pull-up and no pull-down | Low | |
| | PE9 | TIM1_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | |
| GPIO | PE3 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | |
| | PE5 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | Sammutus |
| | PE6 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | |
| | PE14 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | |
| | PE15 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | |
| | PB11 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | |
| | PC9 | GPIO_Input | Input mode | No pull-up and no pull-down | n/a | |
| | PA8 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | |
| | PA11 | GPIO_Input | Input mode | No pull-up and no pull-down | n/a | ESP32INPUT |
| | PA12 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | ESP32RST |
| | PE0 | GPIO_EXTI0 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | |
| | PE1 | GPIO_EXTI1 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | |

## *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 |
| PVD interrupt through EXTI line 16 | unused | | |
| Flash global interrupt | unused | | |
| RCC global interrupt | unused | | |
| EXTI line0 interrupt | unused | | |
| EXTI line1 interrupt | unused | | |
| ADC1, ADC2 and ADC3 global interrupts | unused | | |
| CAN1 TX interrupts | unused | | |
| CAN1 RX0 interrupts | unused | | |
| CAN1 RX1 interrupt | unused | | |
| CAN1 SCE interrupt | unused | | |
| TIM1 update interrupt and TIM10 global interrupt | unused | | |
| I2C1 event interrupt | unused | | |
| I2C1 error interrupt | unused | | |
| SPI1 global interrupt | unused | | |
| SPI2 global interrupt | unused | | |
| USART1 global interrupt | unused | | |
| USART2 global interrupt | unused | | |
| USART3 global interrupt | unused | | |
| FPU global interrupt | unused | | |

*** User modified value**

# 9. Software Pack Report