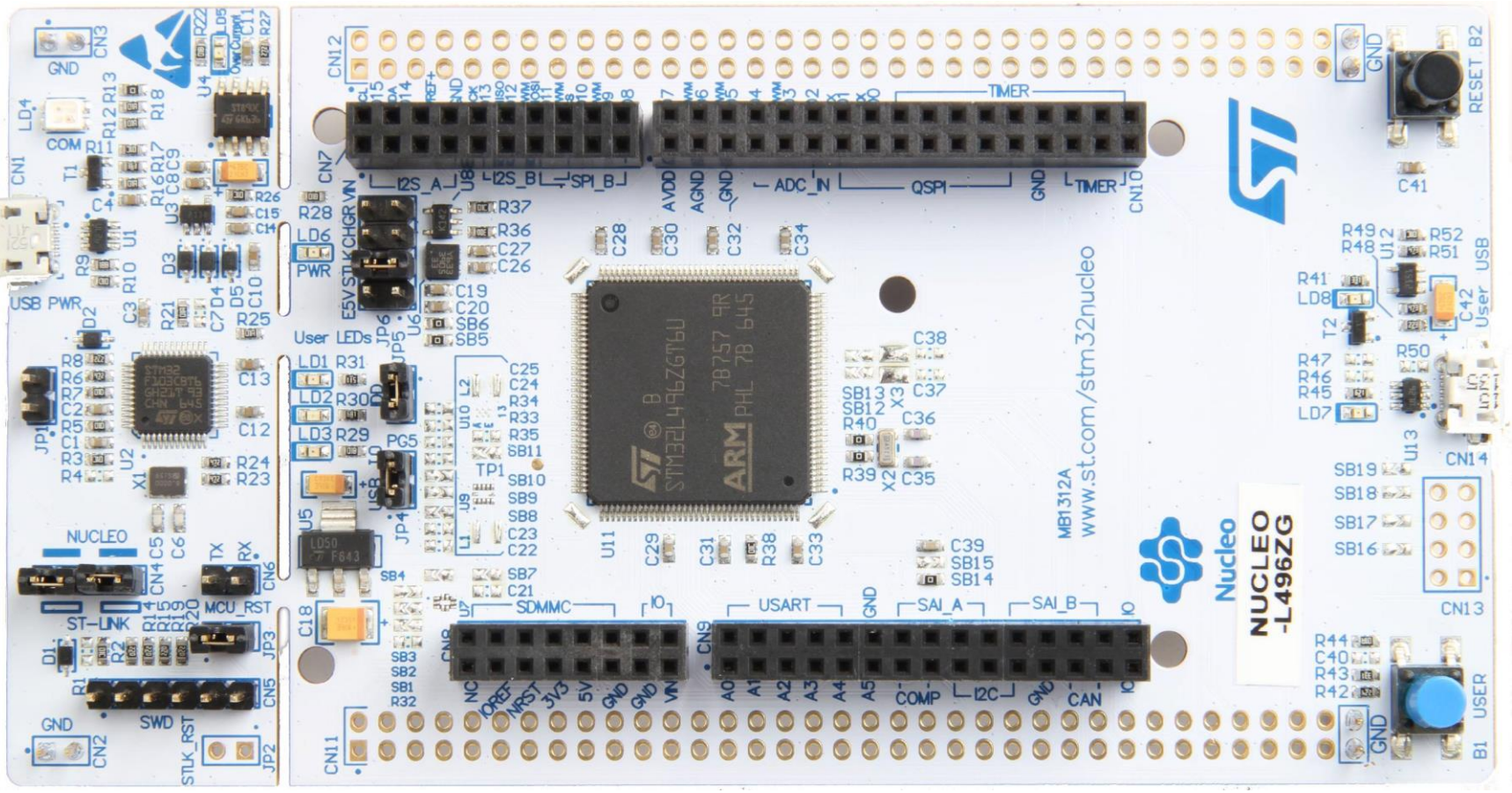
ARM Development Primer



ARM Peripherals 101

November 15, 2017

FRED EADY

DesignNews

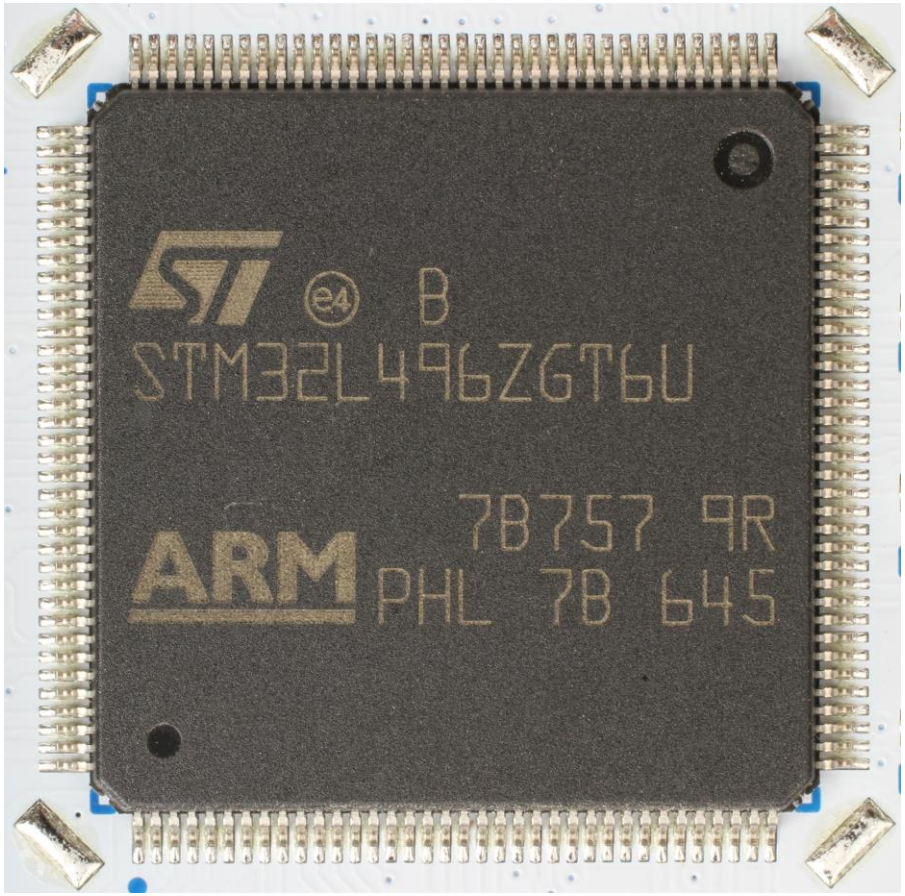
Presented by:

CEC CONTINUING EDUCATION CENTER

Digi-Key ELECTRONICS

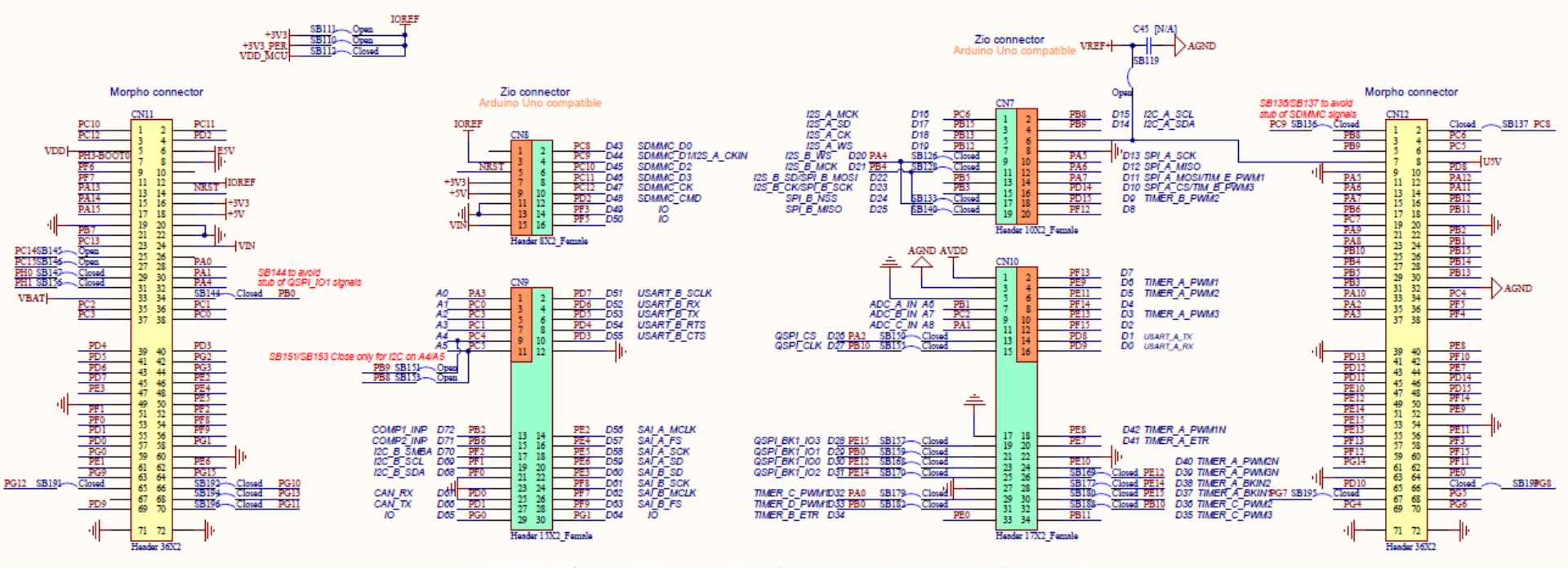
AGENDA

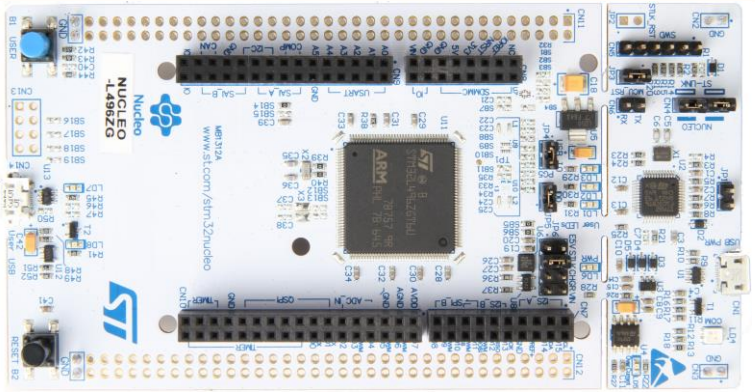
- I²C the STM32Cube Way
- UART the Old-Fashioned CMSIS Way
- Day 3's Done



ARM Development Primer

I²C the STM32Cube Way – Hardware Specifics





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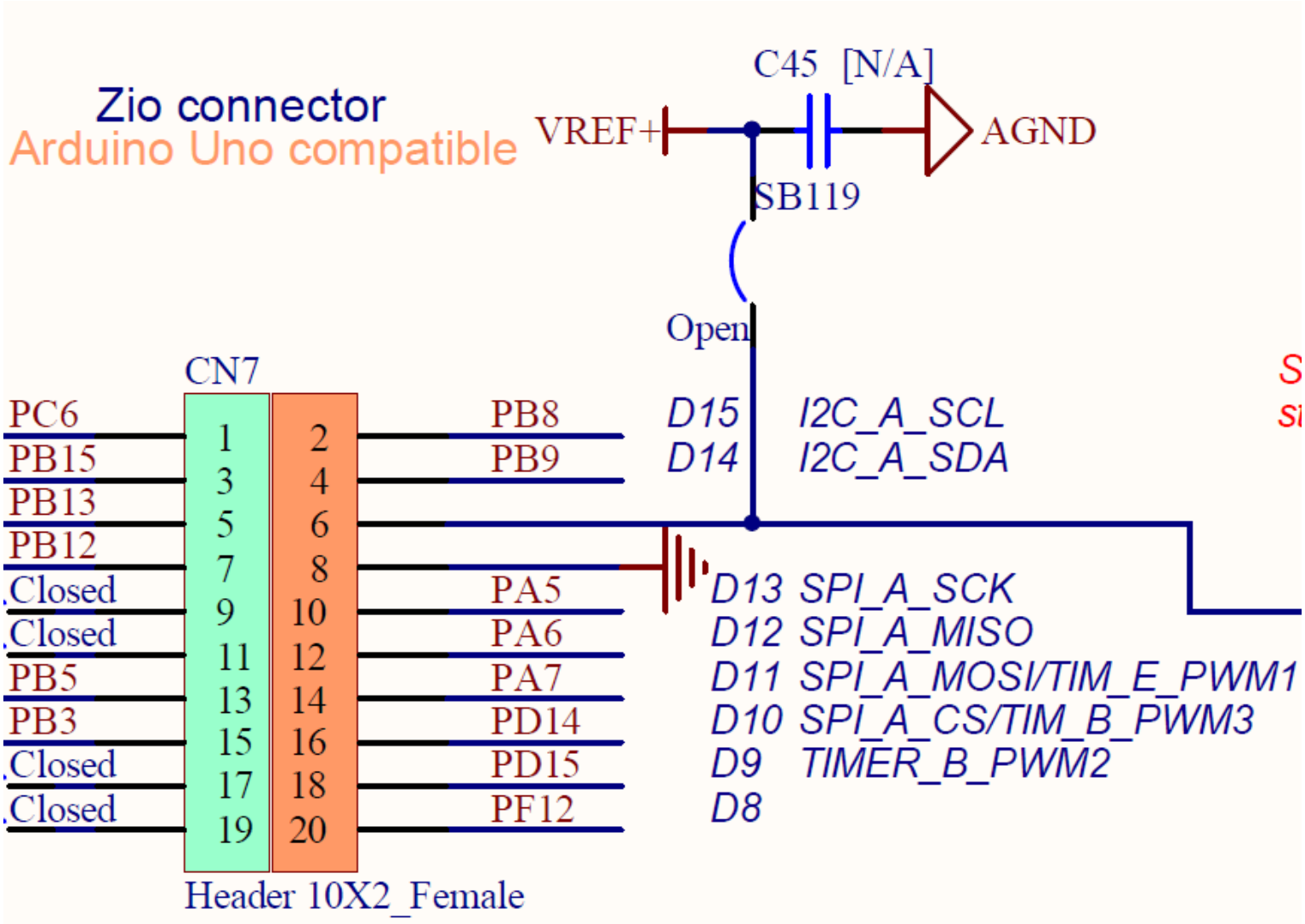
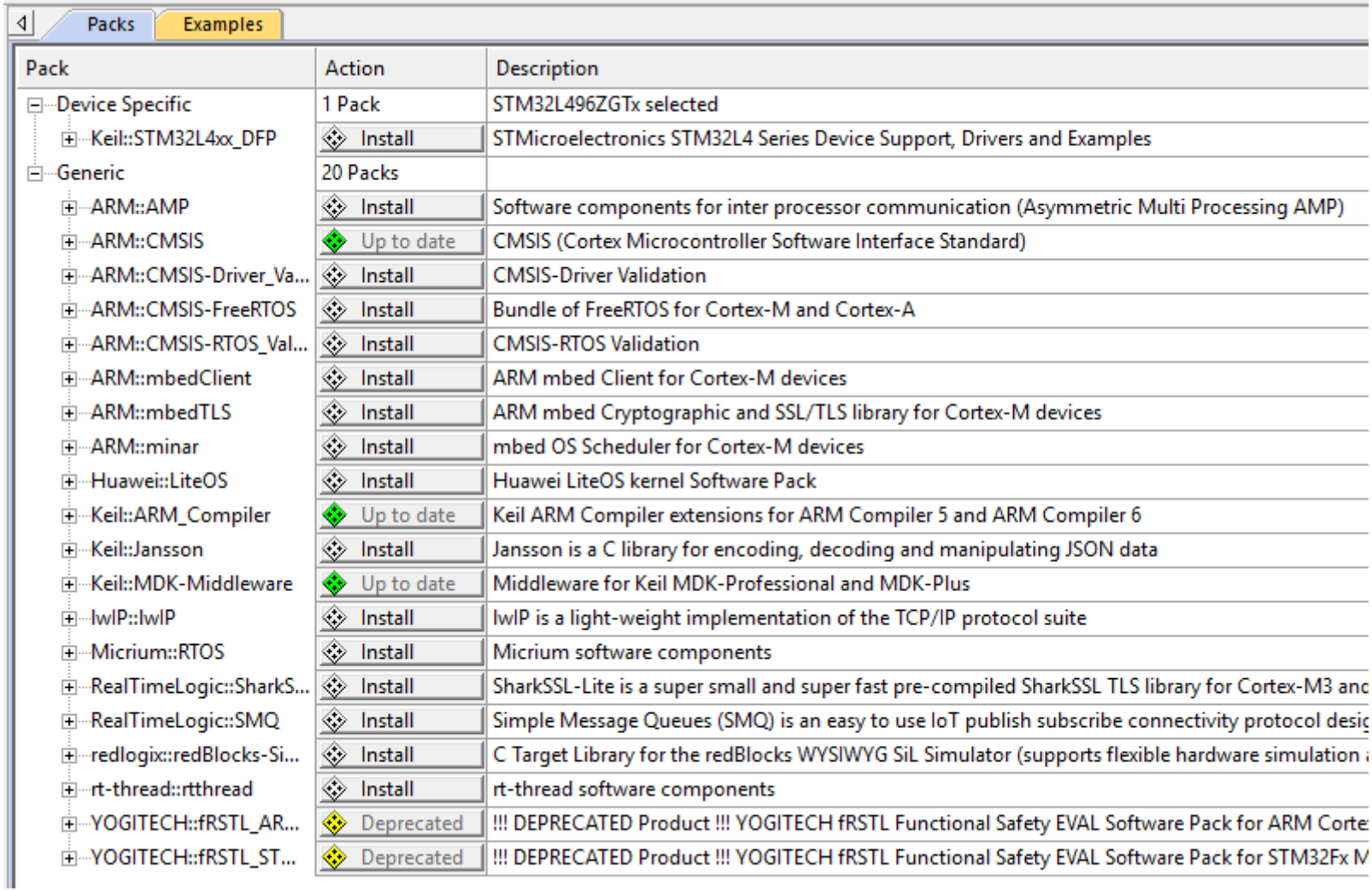


ARM Development Primer

I²C the STM32Cube Way – Install Packs



Pack	Action	Description
Device Specific	1 Pack	STM32L496ZGTx selected
Keil::STM32L4xx_DFP	Install	STMicroelectronics STM32L4 Series Device Support, Drivers and Examples
Generic	20 Packs	
ARM::AMP	Install	Software components for inter processor communication (Asymmetric Multi Processing AMP)
ARM::CMSIS	Up to date	CMSIS (Cortex Microcontroller Software Interface Standard)
ARM::CMSIS-Driver_Va...	Install	CMSIS-Driver Validation
ARM::CMSIS-FreeRTOS	Install	Bundle of FreeRTOS for Cortex-M and Cortex-A
ARM::CMSIS-RTOS_Val...	Install	CMSIS-RTOS Validation
ARM::mbedClient	Install	ARM mbed Client for Cortex-M devices
ARM::mbedTLS	Install	ARM mbed Cryptographic and SSL/TLS library for Cortex-M devices
ARM::minar	Install	mbed OS Scheduler for Cortex-M devices
Huawei::LiteOS	Install	Huawei LiteOS kernel Software Pack
Keil::ARM_Compiler	Up to date	Keil ARM Compiler extensions for ARM Compiler 5 and ARM Compiler 6
Keil::Jansson	Install	Jansson is a C library for encoding, decoding and manipulating JSON data
Keil::MDK-Middleware	Up to date	Middleware for Keil MDK-Professional and MDK-Plus
lwIP::lwIP	Install	lwIP is a light-weight implementation of the TCP/IP protocol suite
Micrium::RTOS	Install	Micrium software components
RealTimeLogic::SharkS...	Install	SharkSSL-Lite is a super small and super fast pre-compiled SharkSSL TLS library for Cortex-M3 and
RealTimeLogic::SMQ	Install	Simple Message Queues (SMQ) is an easy to use IoT publish subscribe connectivity protocol desig
redlogix::redBlocks-Si...	Install	C Target Library for the redBlocks WYSIWYG SiL Simulator (supports flexible hardware simulation
rt-thread::rtthread	Install	rt-thread software components
YOGITECH::fRSTL_AR...	Deprecated	!!! DEPRECATED Product !!! YOGITECH fRSTL Functional Safety EVAL Software Pack for ARM Corte
YOGITECH::fRSTL_ST...	Deprecated	!!! DEPRECATED Product !!! YOGITECH fRSTL Functional Safety EVAL Software Pack for STM32Fx M

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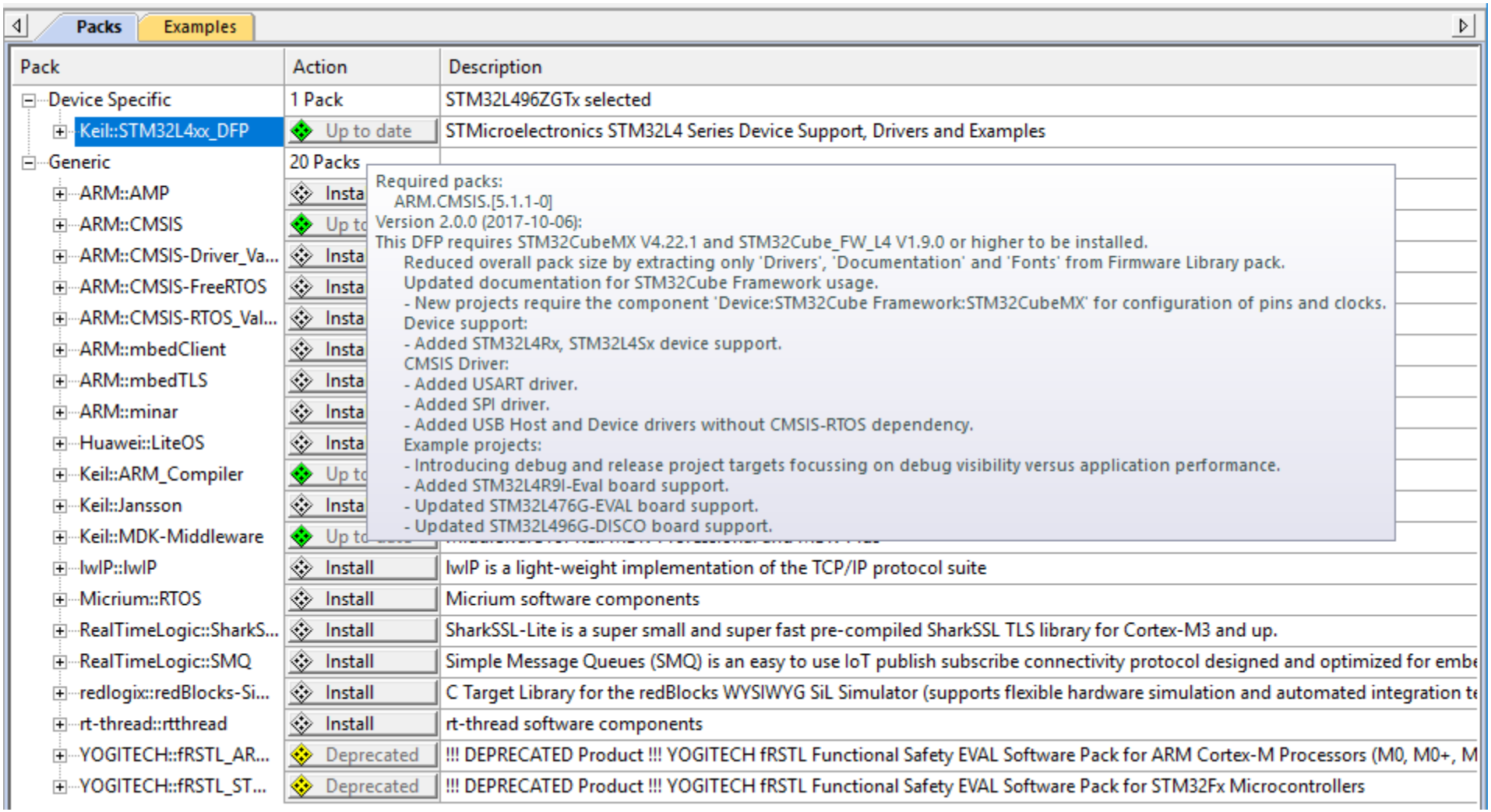
I²C the STM32Cube Way – Install Packs



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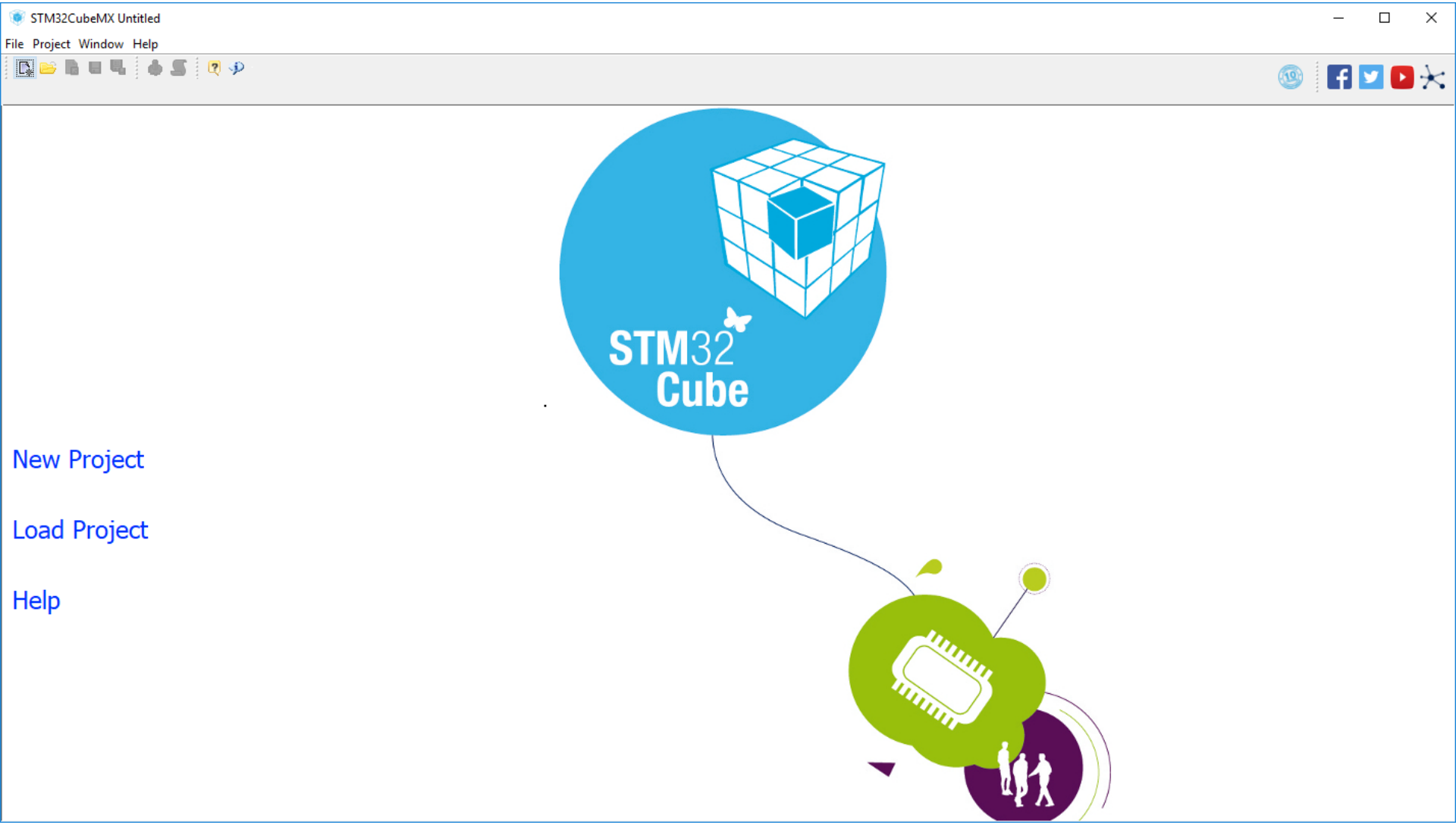
I²C the STM32Cube Way – Generate Project



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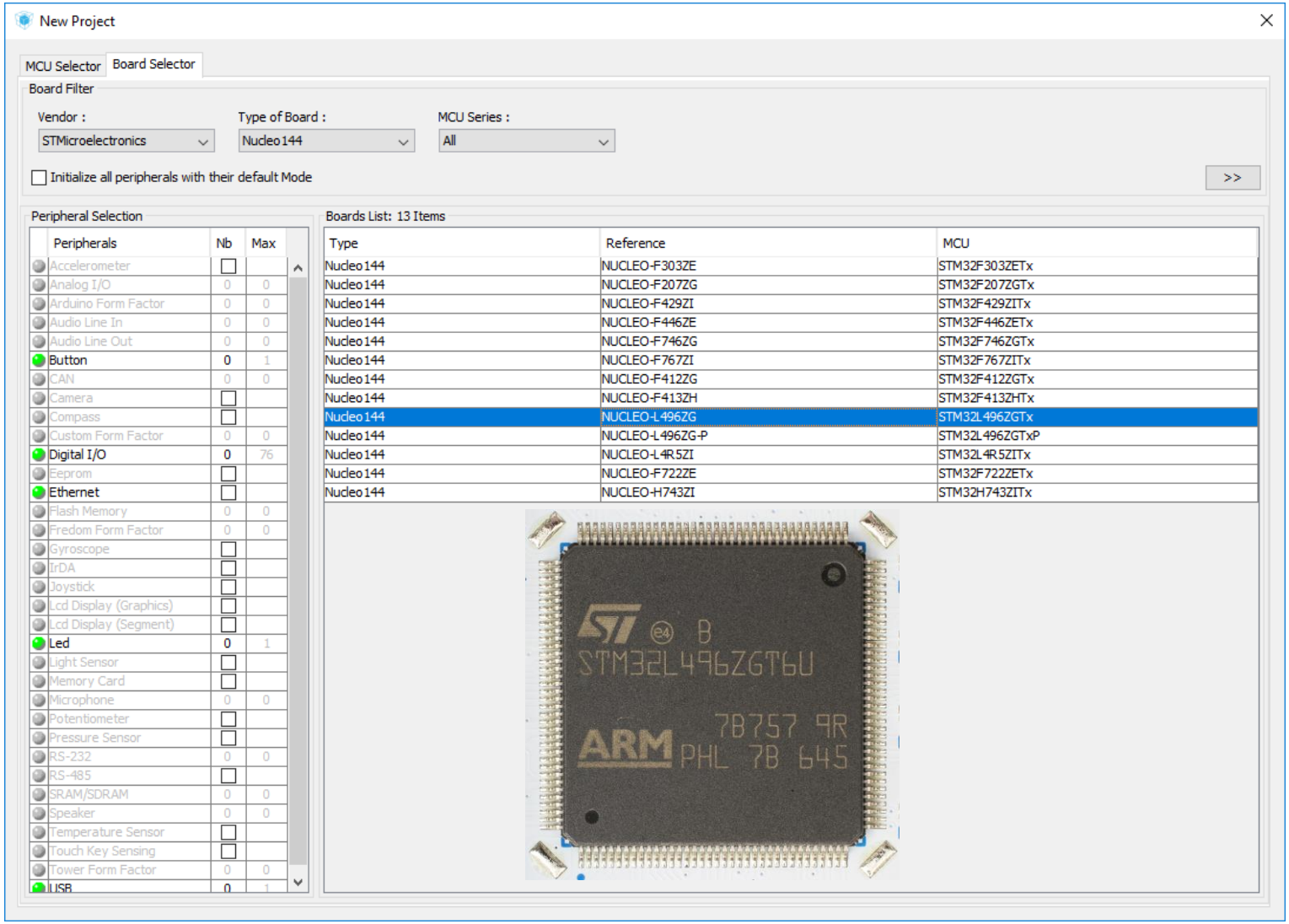

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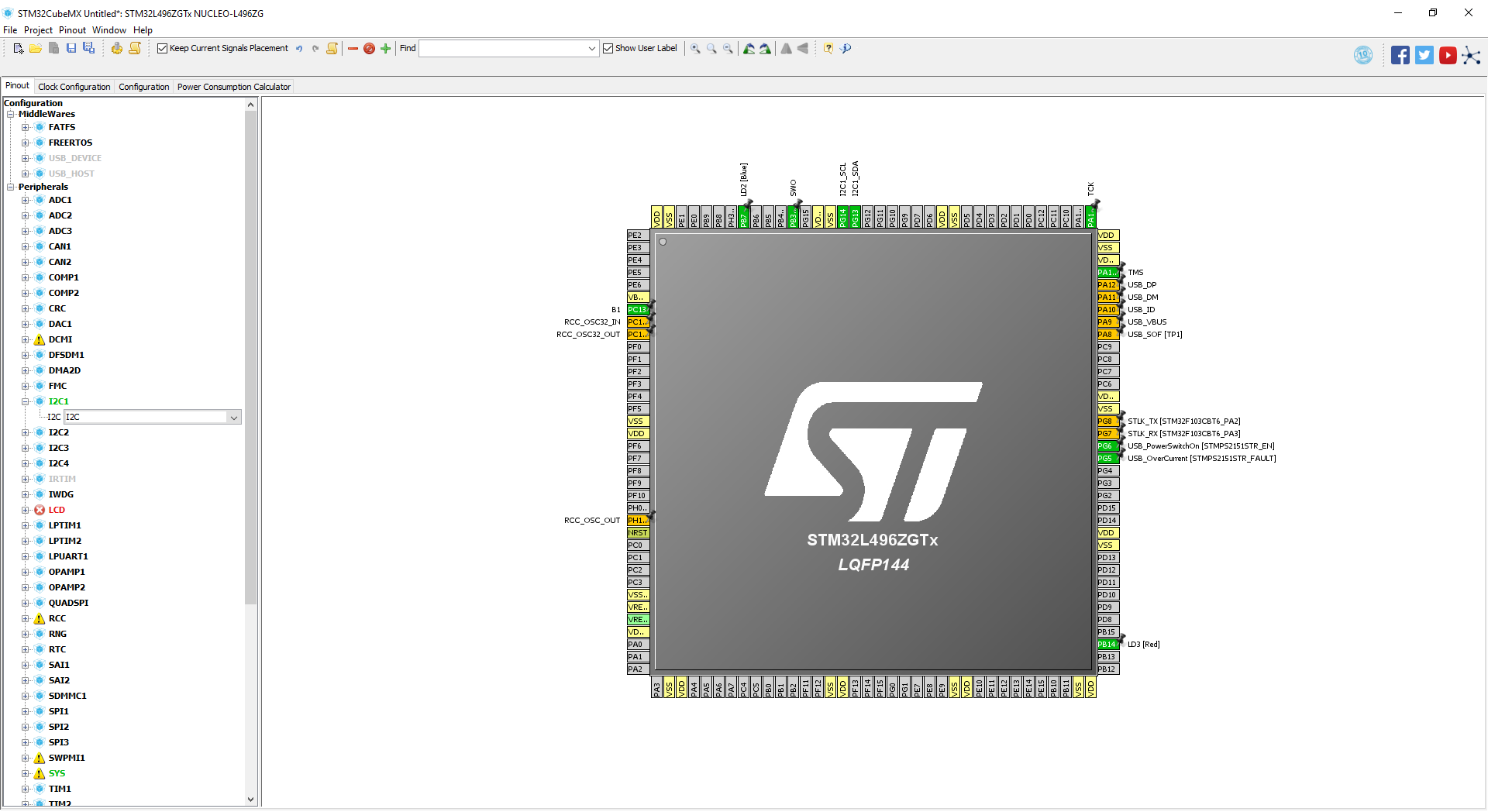

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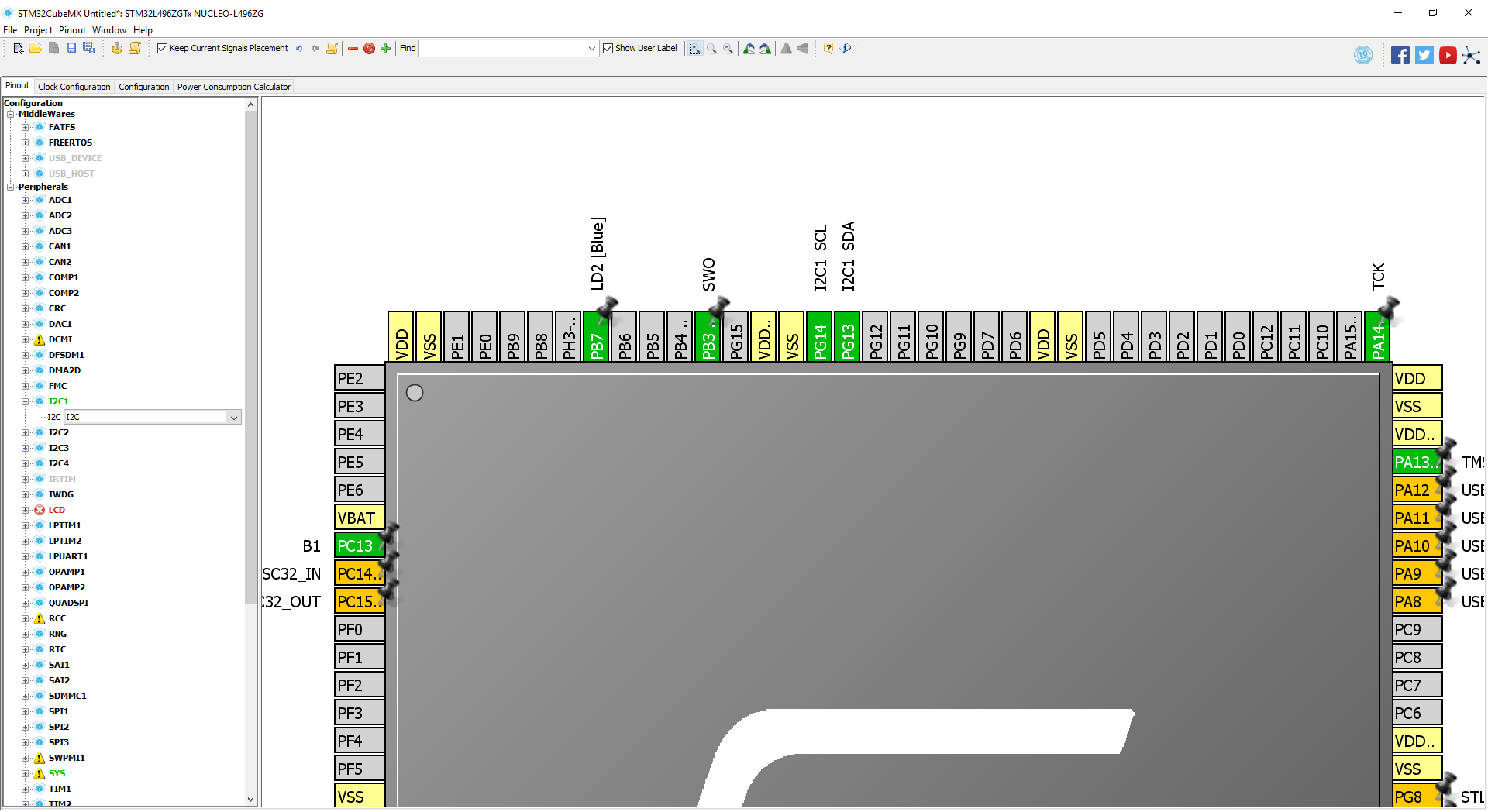

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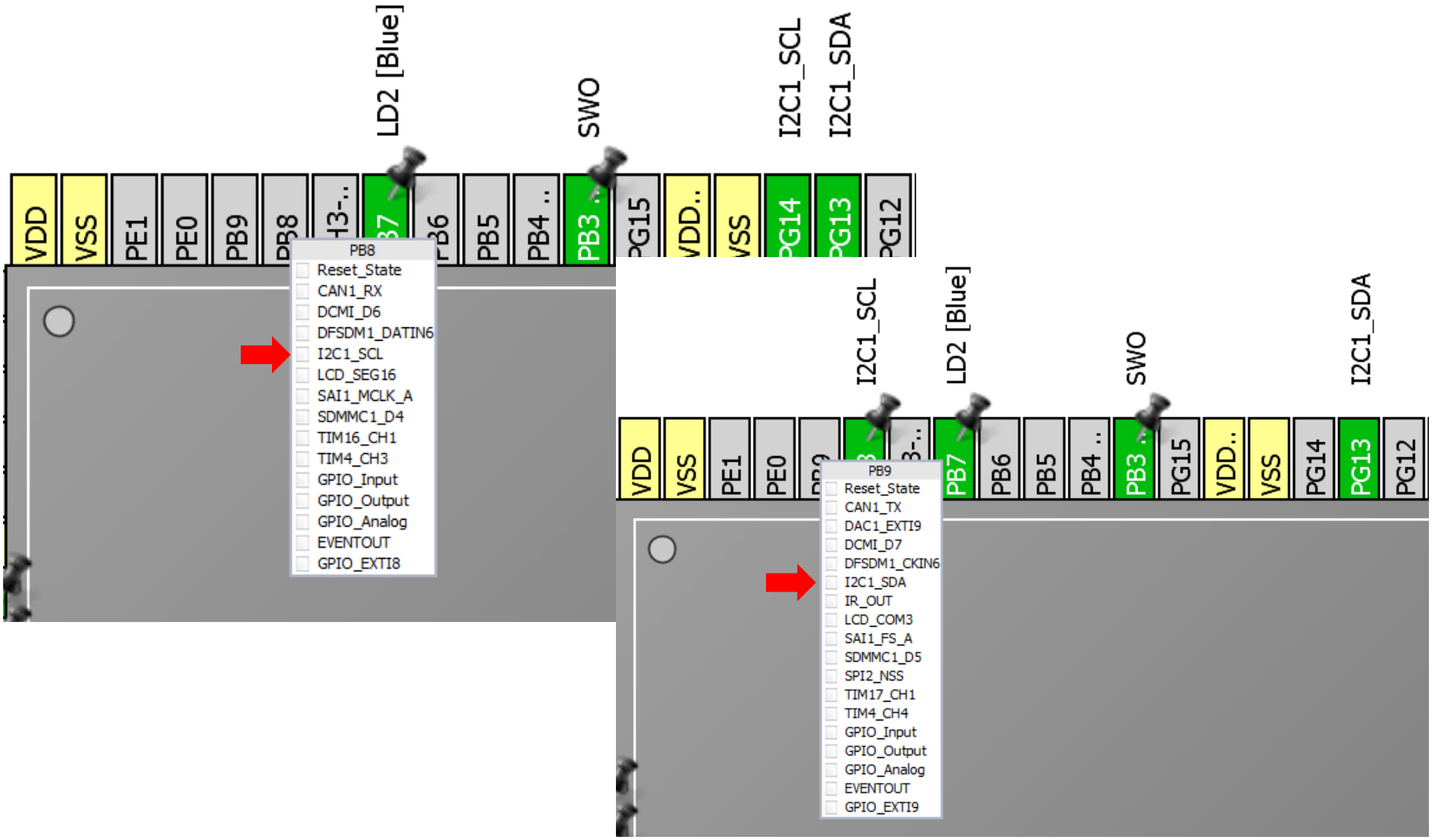

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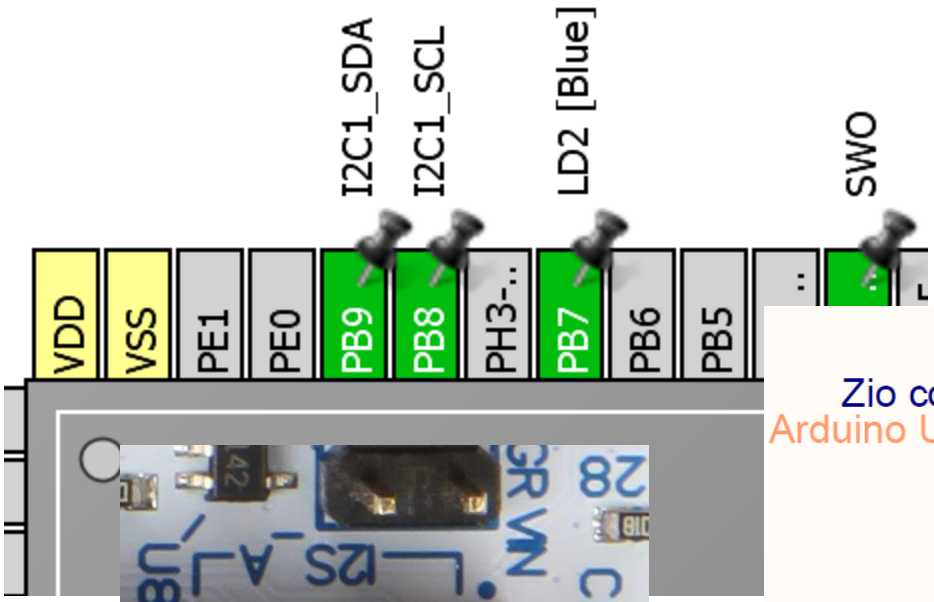

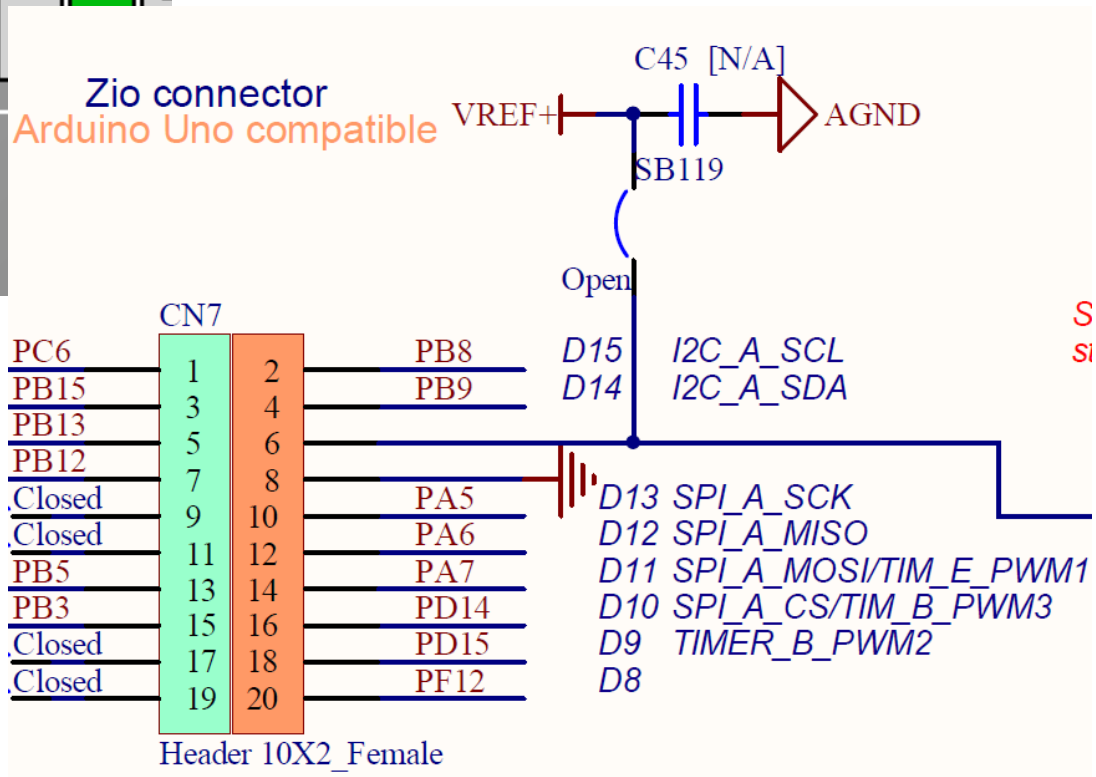

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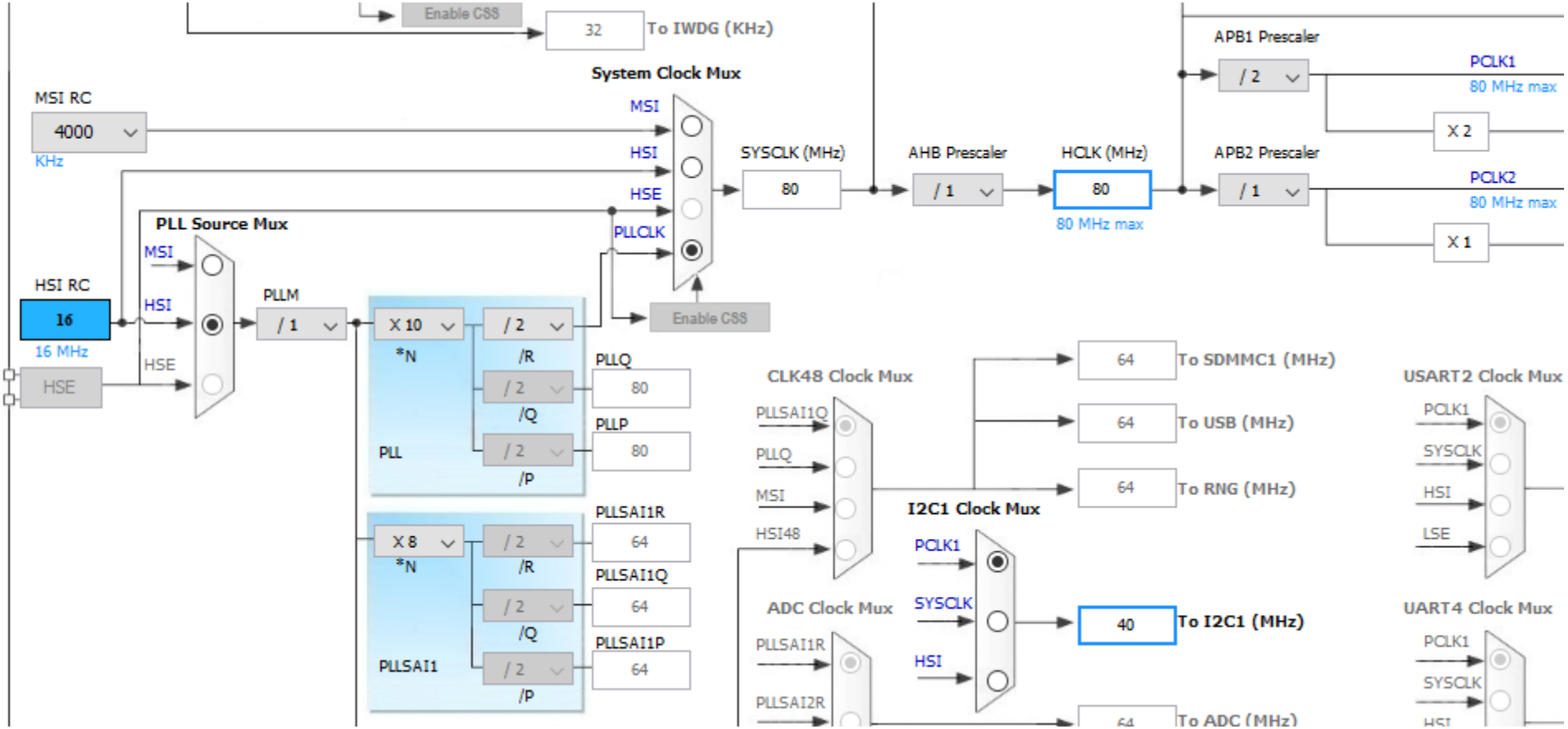

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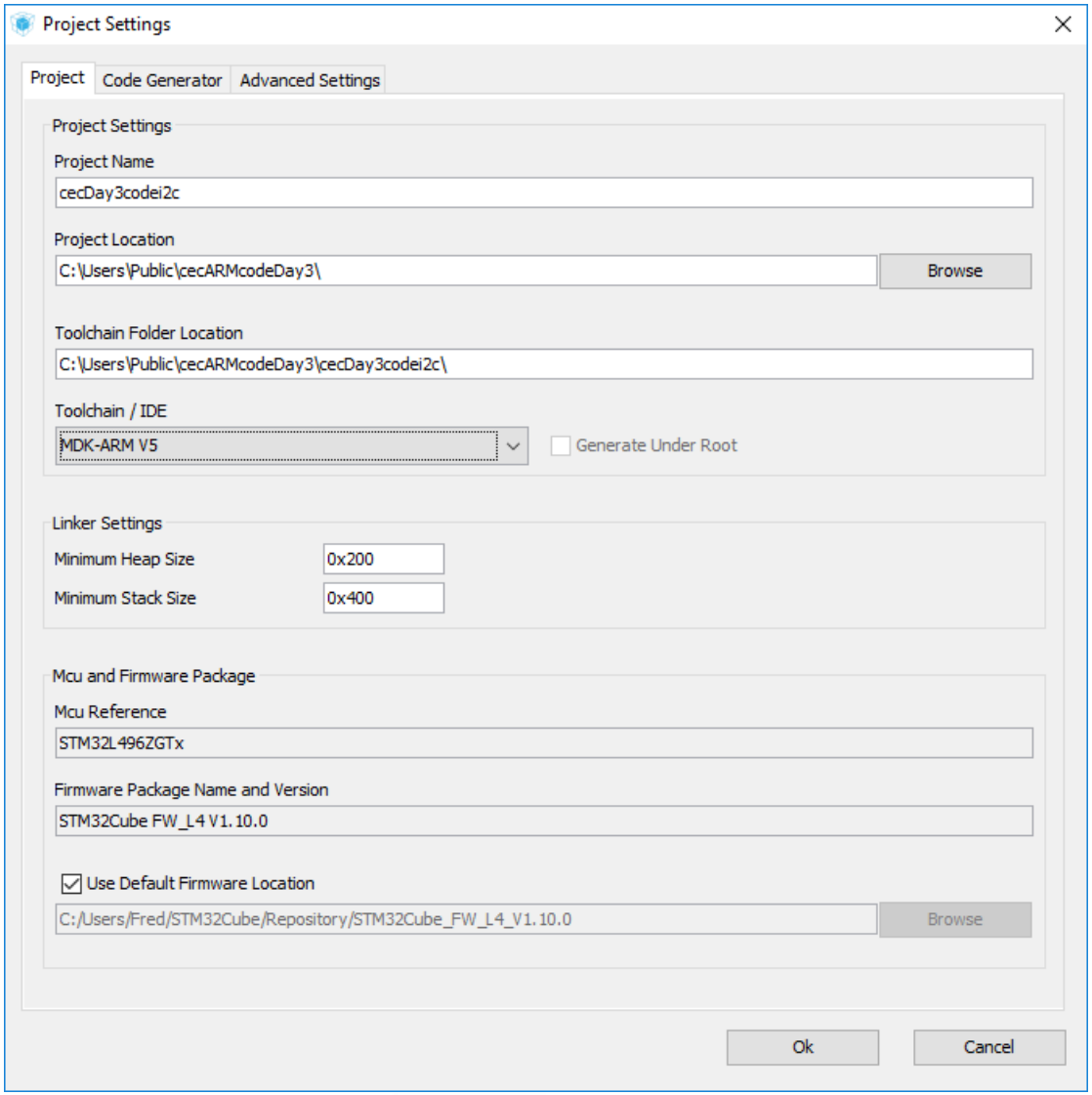

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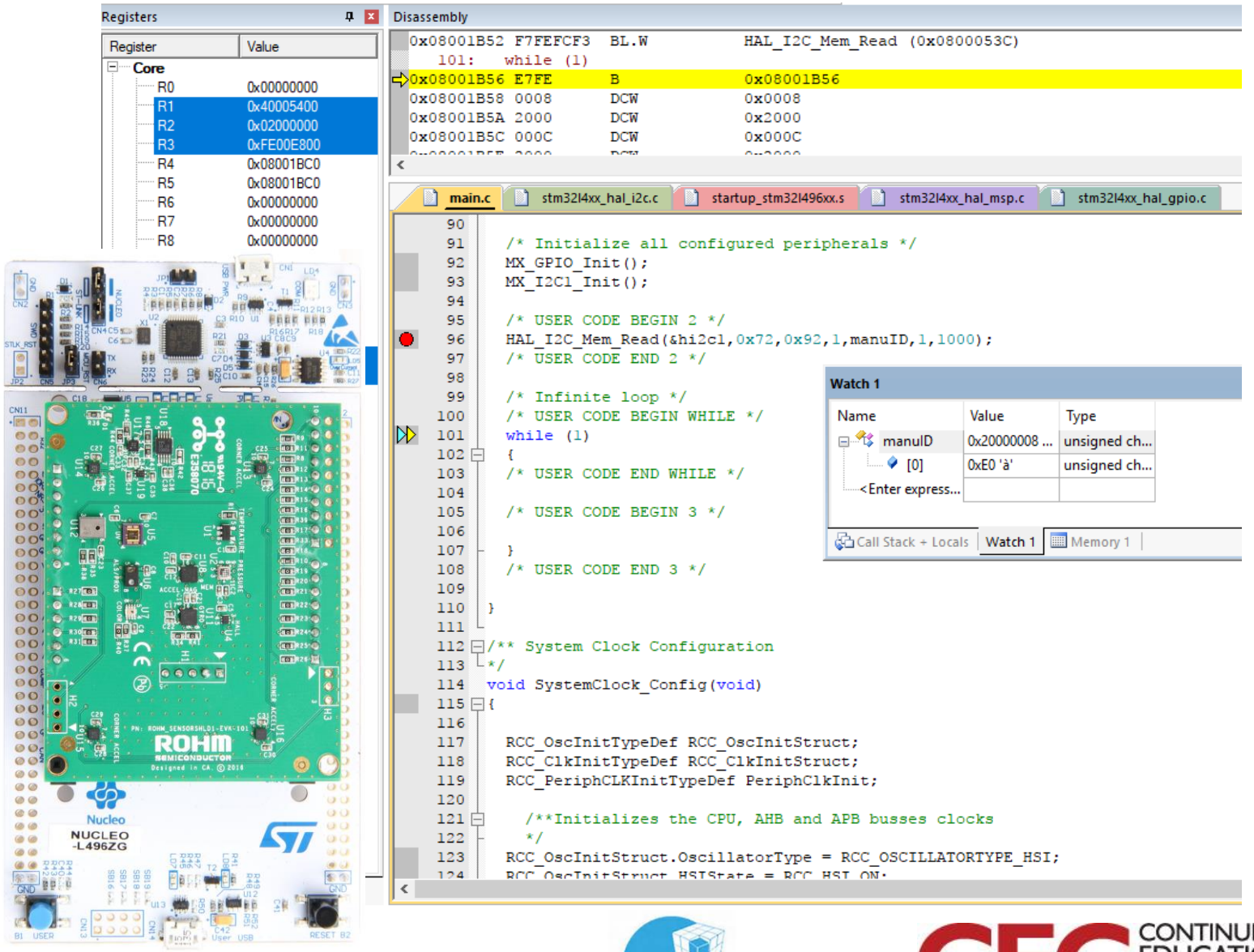
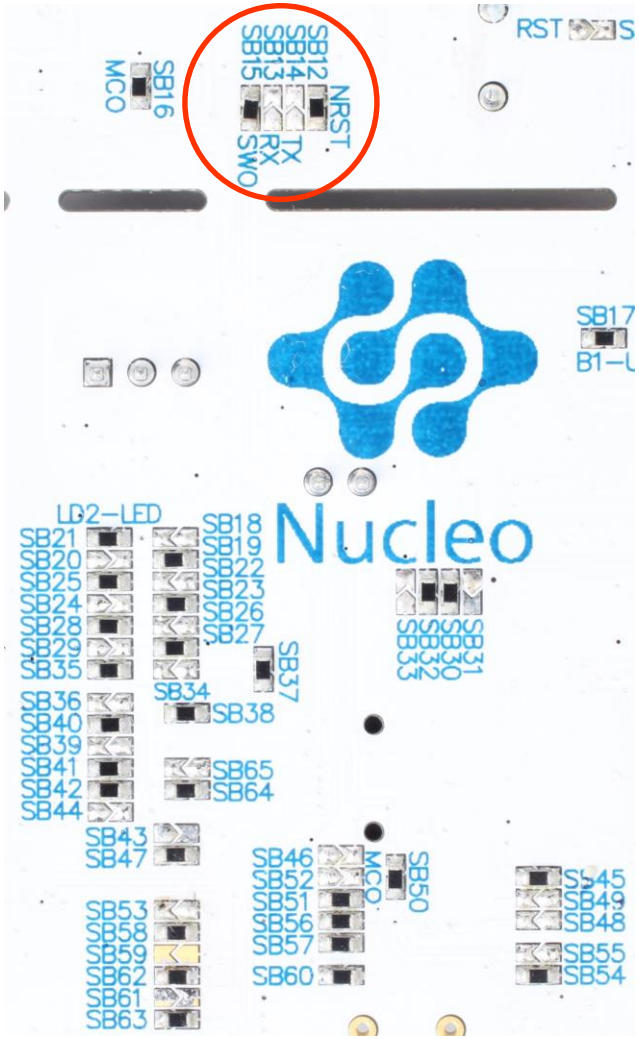
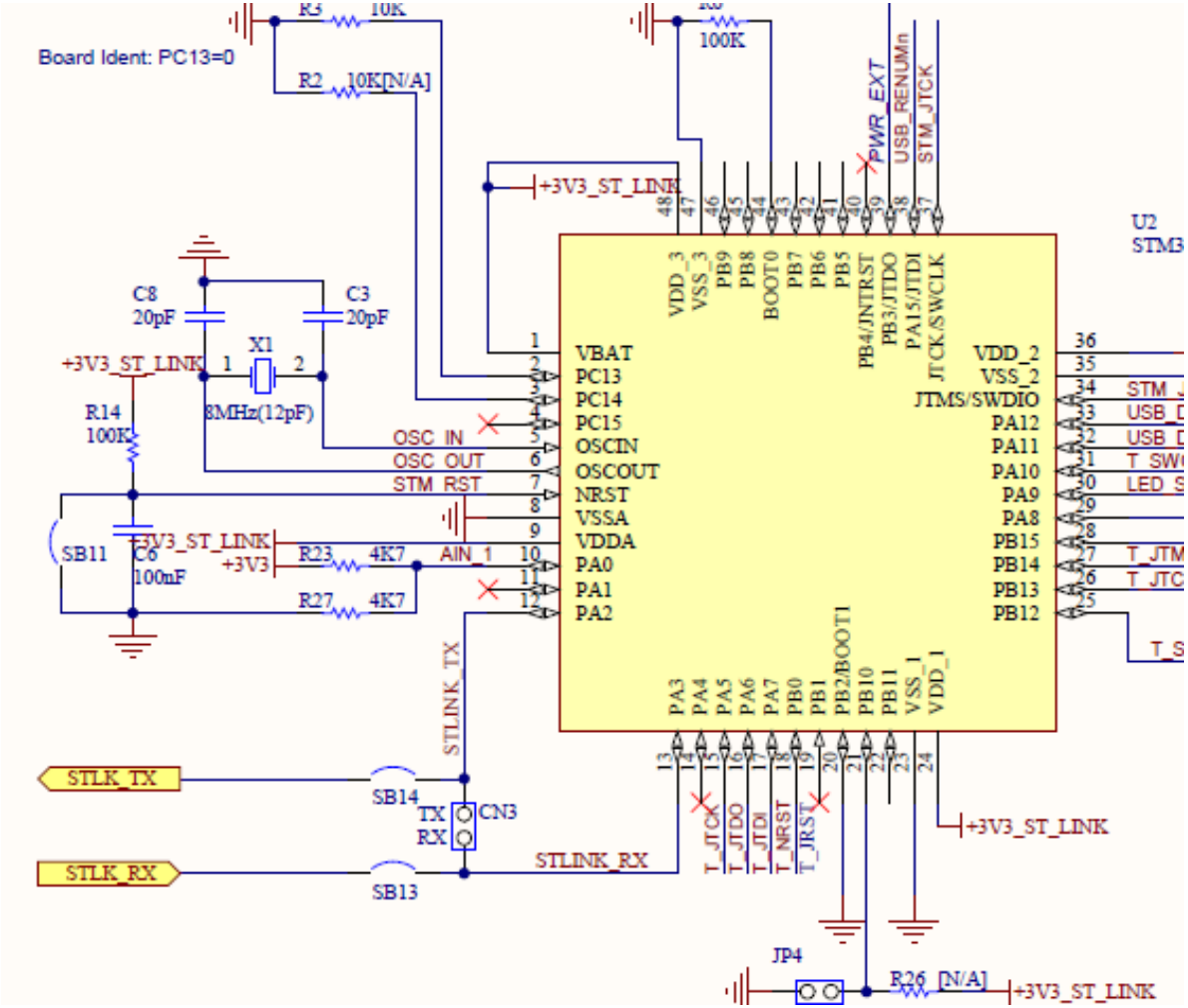
I²C the STM32Cube Way – Debug Project



ARM Development Primer

UART the Old-Fashioned CMSIS Way





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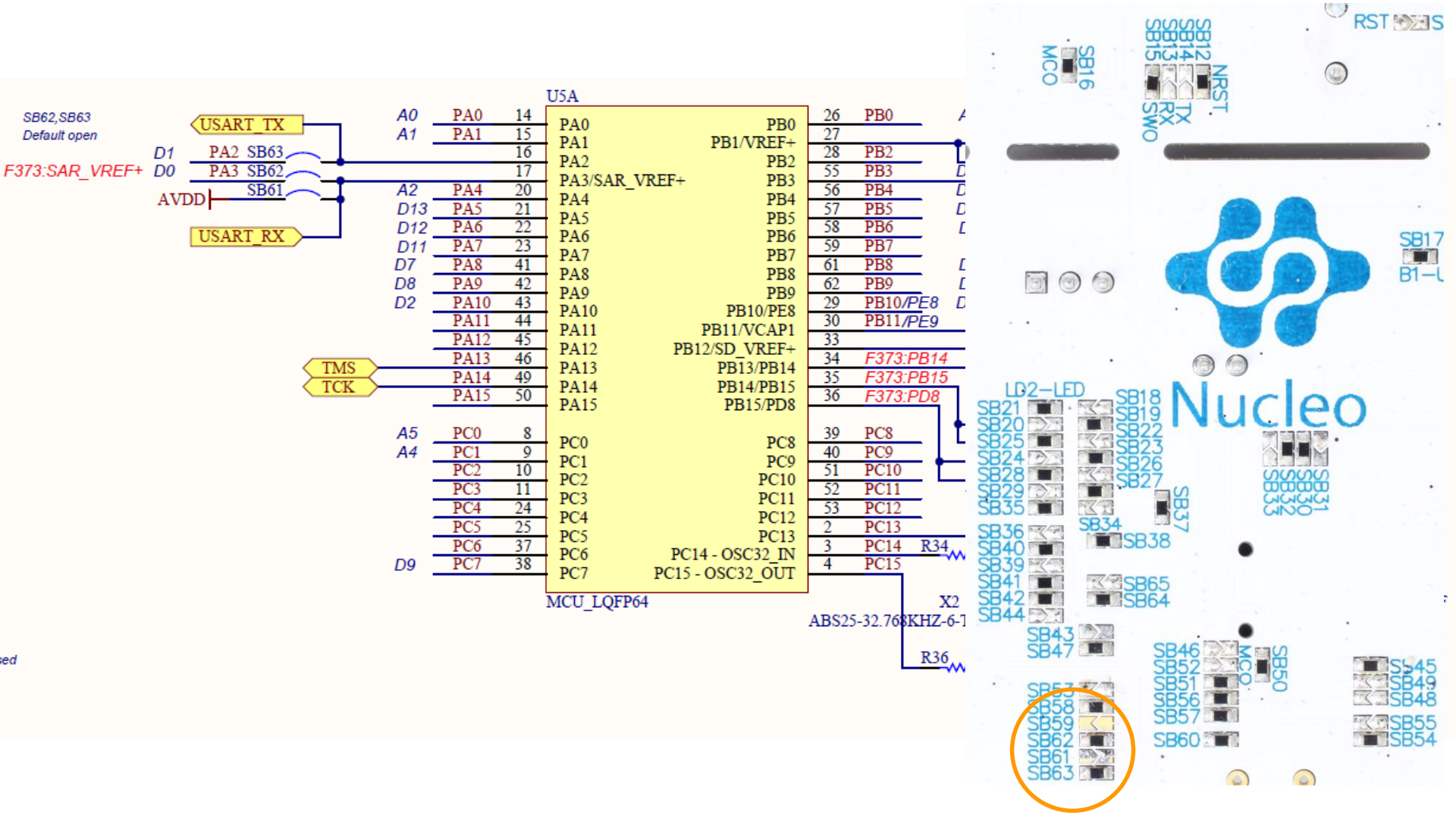

ARM Development Primer

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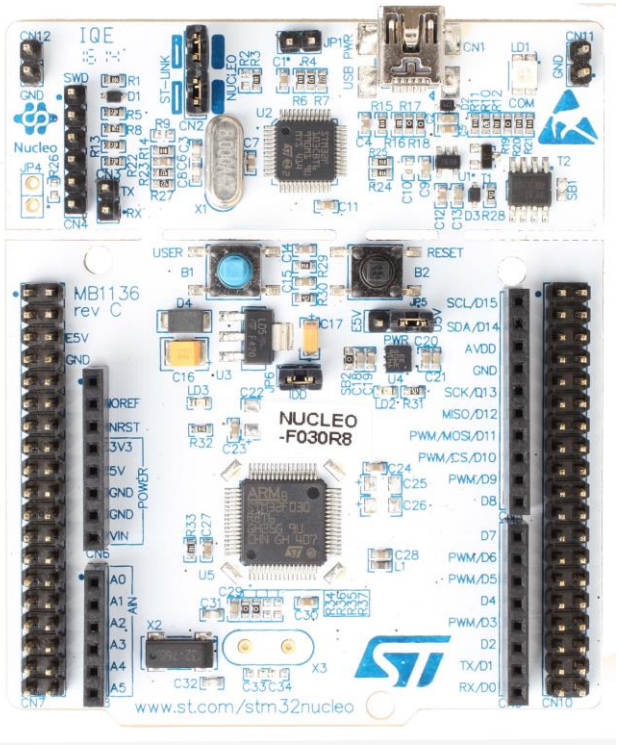

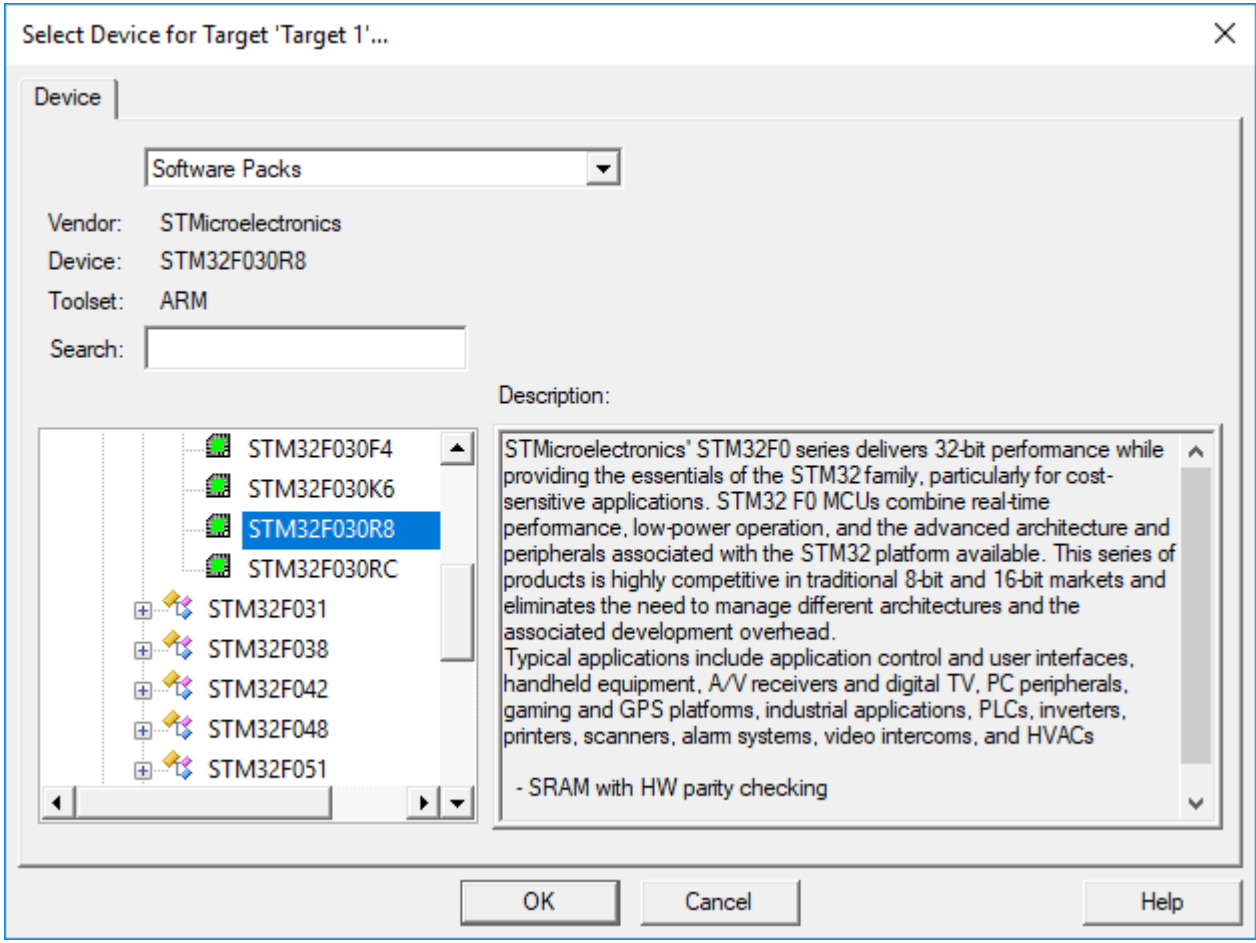

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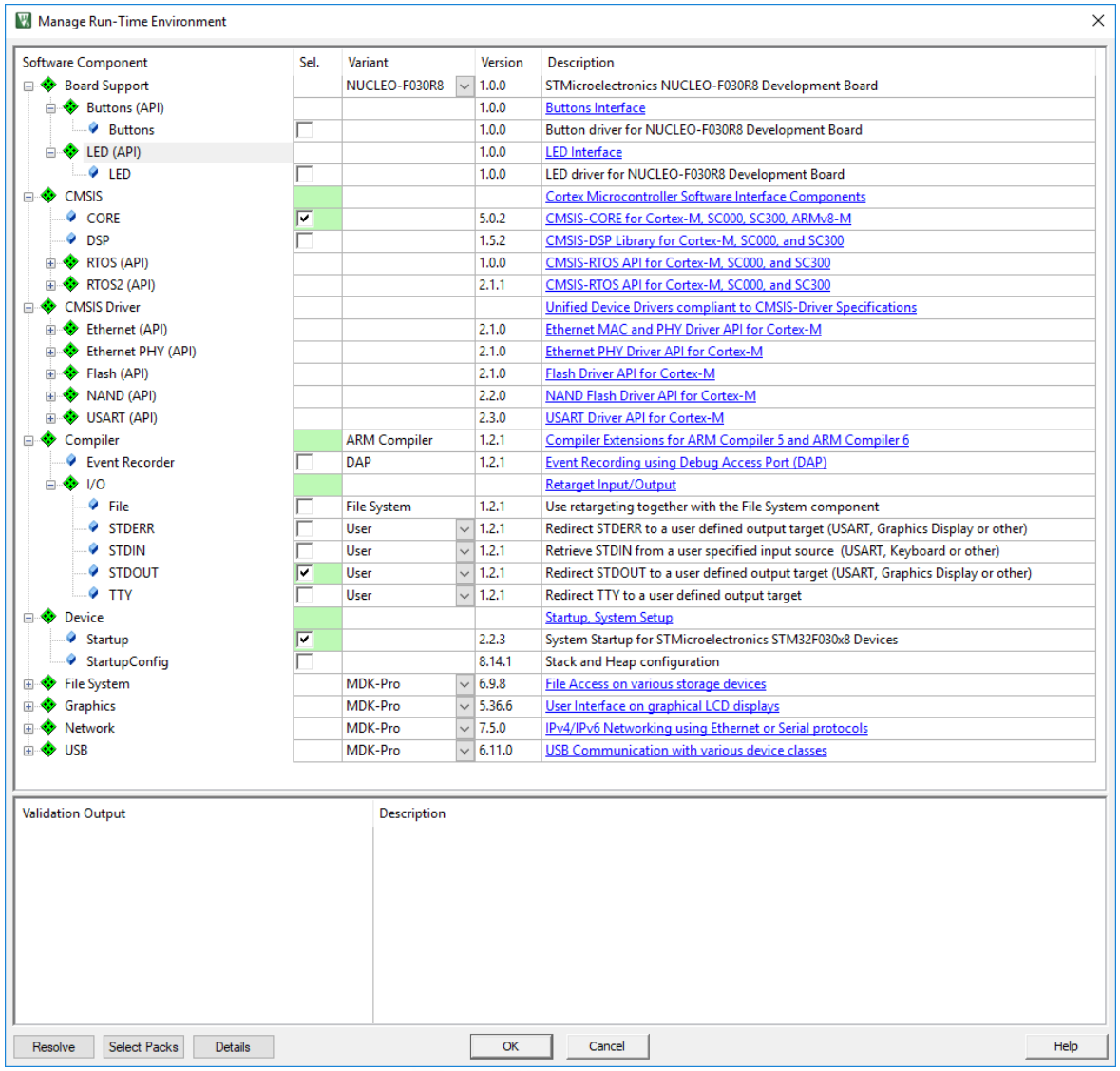

ARM Development Primer

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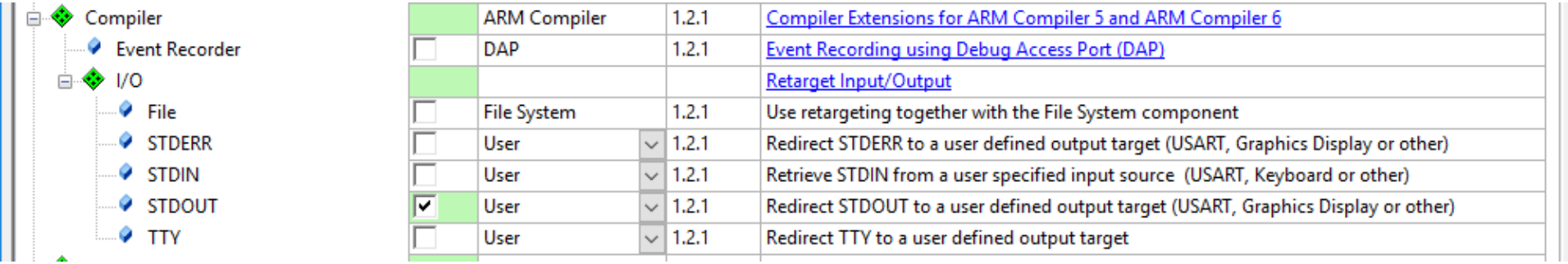
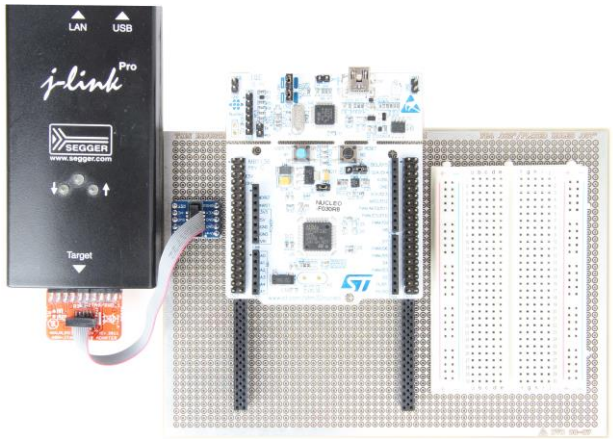
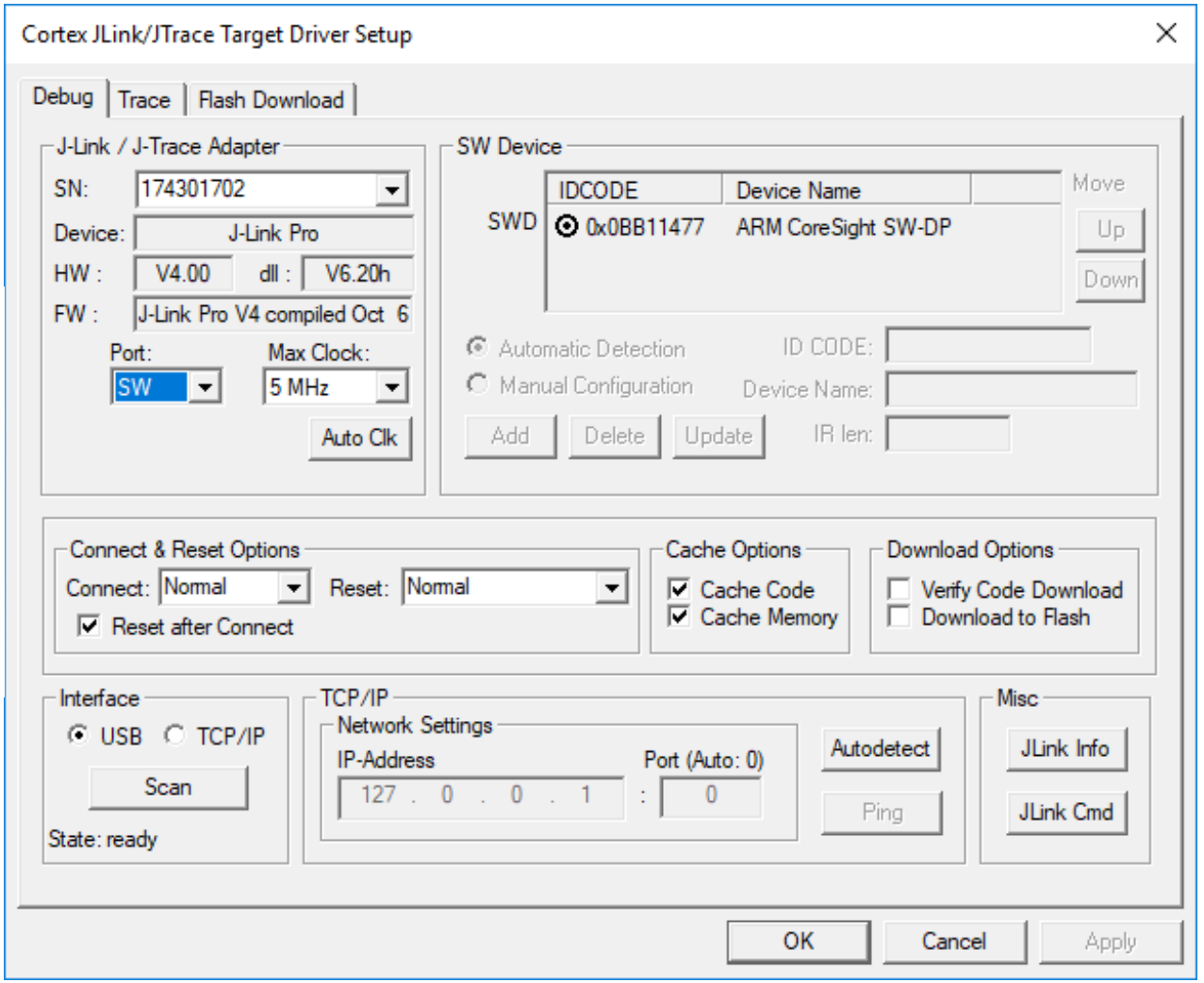



```
/*
 * Auto generated Run-Time-Environment Component Configuration File
 *      *** Do not modify ! ***
 *
 * Project: 'cecDay3codeUARTF030'
 * Target:  'CECSTM32F030 UART'
 */

#ifndef RTE_COMPONENTS_H
#define RTE_COMPONENTS_H


/*
 * Define the Device Header File:
 */
#define CMSIS_device_header "stm32f0xx.h"

#define RTE_Compiler_IO_STDOUT          /* Compiler I/O: STDOUT */
#define RTE_Compiler_IO_STDOUT_User     /* Compiler I/O: STDOUT User */

#endif /* RTE_COMPONENTS_H */
```

ARM Development Primer

UART the Old-Fashioned CMSIS Way

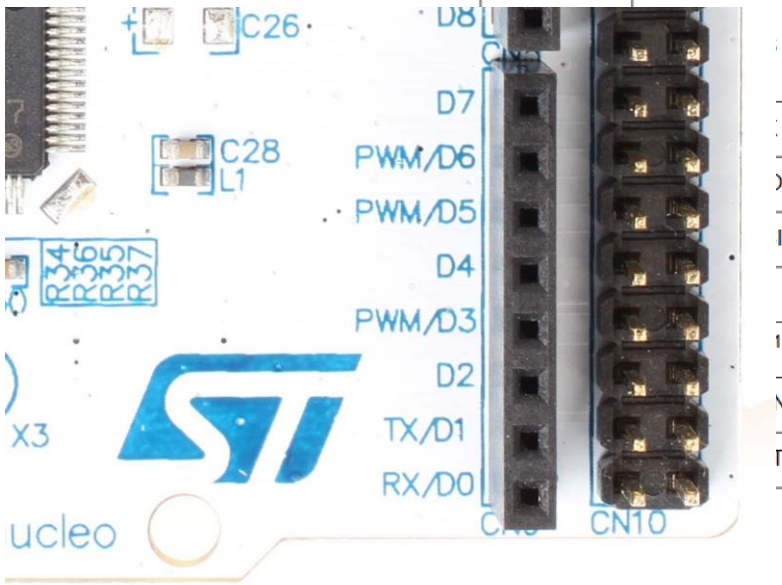




ARM Development Primer

UART the Old-Fashioned CMSIS Way

Pin name	AF0	AF1	AF2	AF3	AF4	AF5	AF6
PA0	-	USART1_CTS(2) USART2_CTS(1)(3)	-	-	USART4_TX(1)	-	-
PA1	EVENTOUT	USART1_RTS(2) USART2_RTS(1)(3)	-	-	USART4_RX(1)	TIM15_CH1N(1)	-
PA2	TIM15_CH1(1)(3)	USART1_TX(2) USART2_TX(1)(3)	-	-	-	-	-
PA3	TIM15_CH2(1)(3)	USART1_RX(2) USART2_RX(1)(3)	-	-	-	-	-
		USART1_CK(2) USART2_CK(1)(3)	-	-	TIM14_CH1	USART6_TX(1)	-
		-	-	-	-	USART6_RX(1)	-
)		TIM3_CH1	TIM1_BKIN	-	USART3_CTS(1)	TIM16_CH1	EVENTOUT
I		TIM3_CH2	TIM1_CH1N	-	TIM14_CH1	TIM17_CH1	EVENTOUT
		USART1_CK	TIM1_CH1	EVENTOUT	-	-	-
1)(3)		USART1_TX	TIM1_CH2	-	I2C1_SCL(1)(2)	MCO(1)	-
N		USART1_RX	TIM1_CH3	-	I2C1_SDA(1)(2)	-	-
T		USART1_CTS	TIM1_CH4	-	-	SCL	-



ARM Development Primer

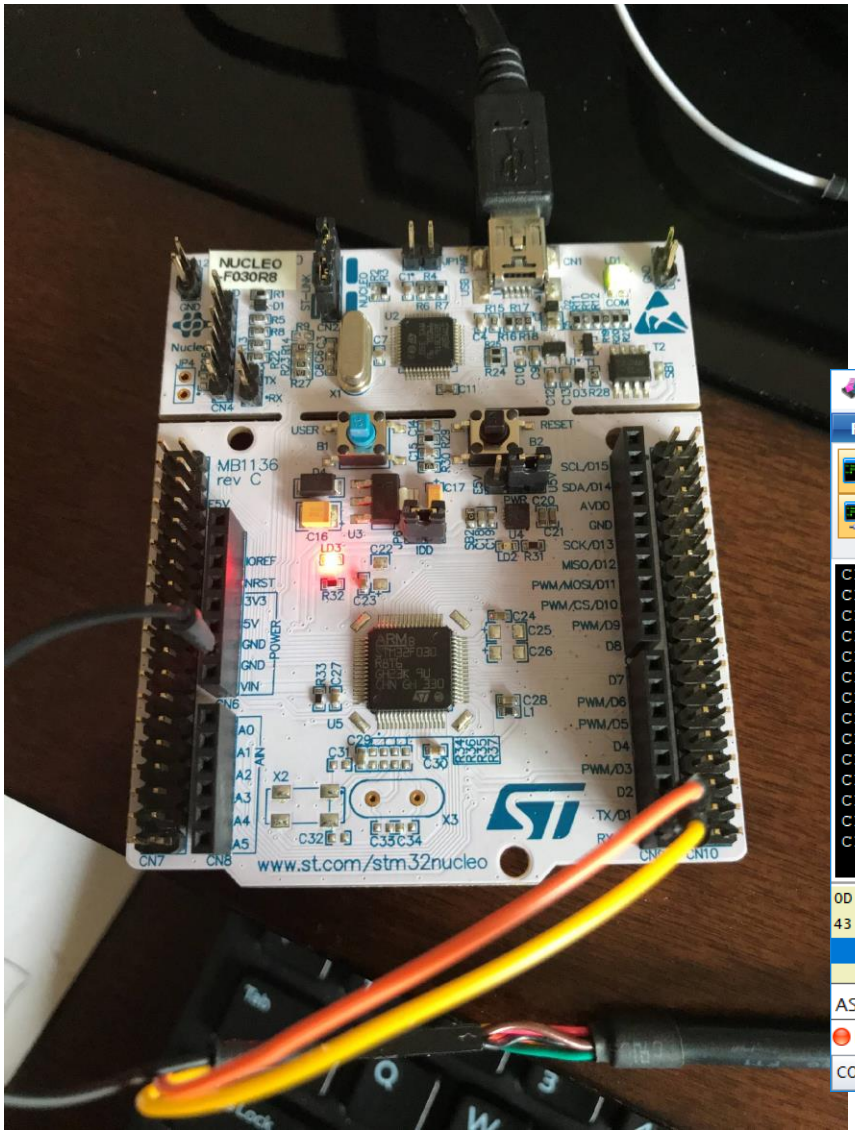
UART the Old-Fashioned CMSIS Way

stm32f030x8.h | stdout_USART.c

```
59  #define GPIO_AFRL_AFRL0_Pos 4* 0
60  #define GPIO_AFRL_AFRL1_Pos 4* 1
61  #define GPIO_AFRL_AFRL2_Pos 4* 2
62  #define GPIO_AFRL_AFRL3_Pos 4* 3
63  #define GPIO_AFRL_AFRL4_Pos 4* 4
64  #define GPIO_AFRL_AFRL5_Pos 4* 5
65  #define GPIO_AFRL_AFRL6_Pos 4* 6
66  #define GPIO_AFRL_AFRL7_Pos 4* 7
67
68  #define GPIO_AFRL_AFRH8_Pos   4* 0
69  #define GPIO_AFRL_AFRH9_Pos   4* 1
70  #define GPIO_AFRL_AFRH10_Pos  4* 2
71  #define GPIO_AFRL_AFRH11_Pos  4* 3
72  #define GPIO_AFRL_AFRH12_Pos  4* 4
73  #define GPIO_AFRL_AFRH13_Pos  4* 5
74  #define GPIO_AFRL_AFRH14_Pos  4* 6
75  #define GPIO_AFRL_AFRH15_Pos  4* 7
76 /**
77    Initialize stdout
78    \return          0 on success, or -1 on error.
79  */
80  int stdout_init (void)
81  {
82  #ifdef RTE_Compiler_IO_STDOUT_User
83    RCC->AHBENR  |=  (RCC_AHBENR_GPIOAEN);          // Enable GPIOA clock
84    RCC->APB1ENR |=  (RCC_APB1ENR_USART2EN);        // Enable USART#2 clock
85    //Configure PA3 to USART2_RX, PA2 to USART2_TX
86    GPIOA->MODER  &= ~(GPIO_MODER_MODER2 | GPIO_MODER_MODER3);
87    GPIOA->MODER  |= (GPIO_MODER_MODER2_1 | GPIO_MODER_MODER3_1);
88    GPIOA->AFR[0] &= ~((15ul << GPIO_AFRL_AFRL2_Pos) | (15ul << GPIO_AFRL_AFRL3_Pos));
89    GPIOA->AFR[0] |= ((1ul << GPIO_AFRL_AFRL2_Pos) | (1ul << GPIO_AFRL_AFRL3_Pos));
90
91    USARTx->CR1 &= ~USART_CR1_PCE;      //No parity control
92    USARTx->CR1 &= ~USART_CR2_STOP;     //1 stop bit
93    USARTx->CR1 &= ~USART_CR3_CTSE;     //No hardware flow control
94    USARTx->CR1 &= ~USART_CR3_RTSE;     //No hardware flow control
95    USARTx->BRR = (SystemCoreClock/115200);       //Baud Rate of 115200
96    USARTx->CR1 |= USART_CR1_RE;    //Receive enable
97    USARTx->CR1 |= USART_CR1_TE;    //Transmit enable
98    USARTx->CR1 |= USART_CR1_UE;    //USART enable
99  #endif
100   return (0);
101 }
```

ARM Development Primer

Day 3's Done




```
73  //****************************************
74  //* MAIN - Display Messages
75  //****************************************
76  int main (void) {
77    SystemCoreClockConfigure();
78    SystemCoreClockUpdate();
79
80  #ifdef RTE_Compiler_IO_STDOUT_User
81    stdout_init();
82  #endif
83
84    SysTick_Config(SystemCoreClock / 1000);
85
86    for (;;)
87    {
88     printf ("CEC STM32F030R8 UART\n\r");
89     delay_ms(100);
90    }
91
92  }
```

Serial Input/Output Monitor

File Edit View Configuration

ASCII HEX

ASCII Send HEX Send

```
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
CEC STM32F030R8 UART
```

```
0D
43 45 43 20 53 54 4D 33 32 46 30 33 30 52 38 20 55 41 52 54 0A
```

ASCII Send

DSR DTR DCD RTS CTS RXD Ring TXD Error Break

COM3 8N1 115200 R 0 C 0 R3892 C Disconnect

Macro List

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