ARM® Cortex®- M

32-bit Microcontroller

NuMaker-PFM-M487KM
User Manual
NuMicro® M480 Series

For additional information or questions, please contact: Nuvoton Technology Corporation.

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1 OVERVIEW

This user manual is aimed to give users a fast introduction to the use of NuMaker-PFM-M487KM board.

The NuMaker-PFM-M487KM consists of two parts, a M487KM platform and an on-board Nu-Link2-Me debugger and programmer. The NuMaker-PFM-M487KM allows users to quickly develop and easily program and debug application.

The NuMaker-PFM-M487KM offers M487KMCAN full pins extension connectors and Arduino UNO compatible extension connectors. It is an easy-to-develop platform for user to expand the functionality and build the applications. The NuMaker-PFM-M487KM also provides an ammeter connector, allows user to monitor the microcontroller's power consumption during development.

The Nu-Link2-Me is a debugger and programmer that supports on-line programming and debugging through SWD interface. The on-board 16 Mbit SPI Flash allows it able to off-line programming the target microcontroller. Nu-Link2-Me provides virtual COM port (VCOM) function to print out messages on PC. Nu-Link2-Me can be separated from NuMaker-PFM-M487KM, allowing user to use as a mass production programming tool.

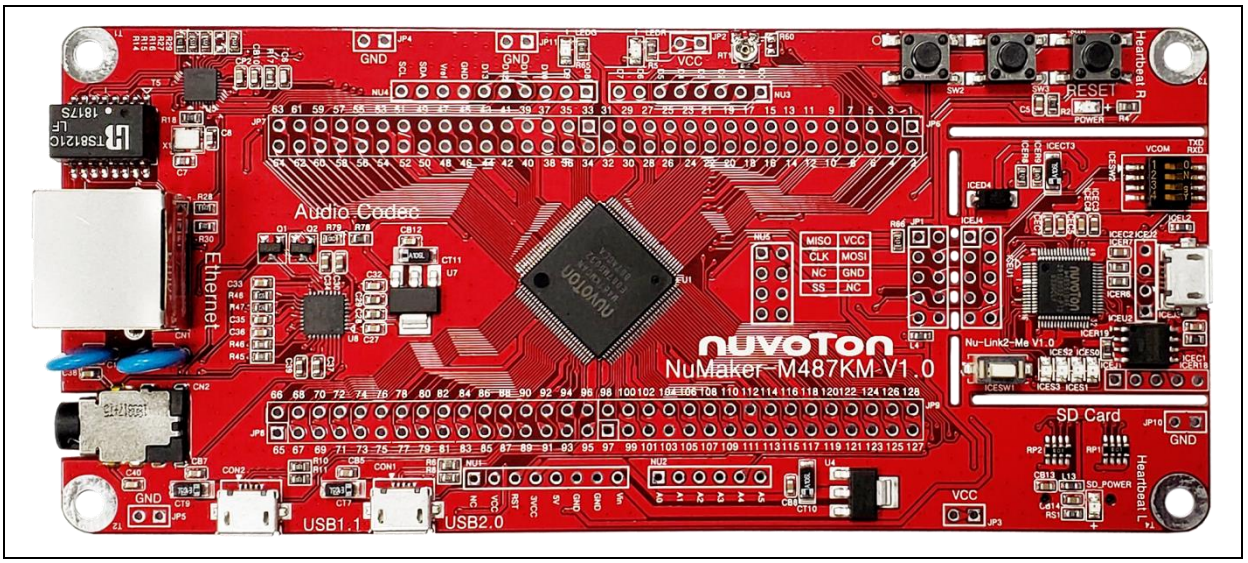

Figure 1-1 NuMaker-PFM-M487KM Board

1.1 M487 Series MCU Features

- M487KMCAN in LQFP128 package
- ARM® Cortex®-M4 core running up to 192 MHz with DSP extensions and FPU (Floating Point Unit)
- 2560 Kbytes Flash
- 160 Kbytes SRAM
- External Bus Interface (EBI)
- GPIO
- Peripheral DMA (PDMA)
- Timer
- PWM and BPWM

- Quadrature Encoder Interface (QEI)
- WDT and WWDT
- RTC
- UART
- Smart Card (ISO-7816-3) Host Interface
- I^2C
- SPI
- SPIM
- I^2S
- Universal Serial Control Interface (USCI)
- USB 2.0 High-Speed OTG / Host / Device
- USB 1.1 Full-Speed OTG / Host / Device
- CAN 2.0
- Ethernet MAC
- SD Host
- Cryptographic Accelerator
- CRC
- ADC
- DAC
- Comparator

1.2 NuMaker-PFM-M487KM Board Features

- On-board Nu-Link2-Me debugger and programmer:
  - Debug through SWD interface
  - On-line/off-line programming
  - Virtual COM port function
- Arduino UNO compatible interface
- M487 extended interface connectors
- Audio codec (NAU88L25) with Microphone In and Headphone Out
- Ethernet for network application
- USB 2.0 High-Speed OTG / Host / Device
- USB 1.1 Full-Speed OTG / Host / Device
- External SPI Flash which can be regarded as ROM module
- MicroSD Card slot for T-Flash
- Three push-buttons: one is for reset and the other two are for user-defined
- Four LEDs: one is for power indication and the other two are for user-defined

2 NUMAKER-PFM-M487KM BOARD OVERVIEW

2.1 Front View

Figure 2-1 shows the main components and connectors from the front side of NuMaker-PFM-M487KM board.

The following lists components and connectors from the front view:

- Target Chip: M487KMCAN (U1)
- Audio: Audio Codec NAU88L25 (U8), Headphone (CN2)
- Arduino UNO compatible interface connectors (NU1, NU2, NU3, NU4 and NU5)
- M487 extended interface connectors (JP6, JP7, JP8 and JP9)
- USB: USB 2.0 High-Speed OTG connector (CON1) and USB 1.1 OTG connector (CON2)
- Ethernet Transceivers: IP101GR (U5)
- Push-buttons (SW2, SW3)
- LEDs (LEDR and LEDG)
- Nu-Link2-Me
  - VCOM Switch
  - ICE Chip: M48SSIDAE(ICEU1)
  - ICE USB Connector(ICEJ3)
  - ICE Status LED(ICES0,ICES1, ICES2, ICES3)
  - Off-line Program Button(ICESW1)

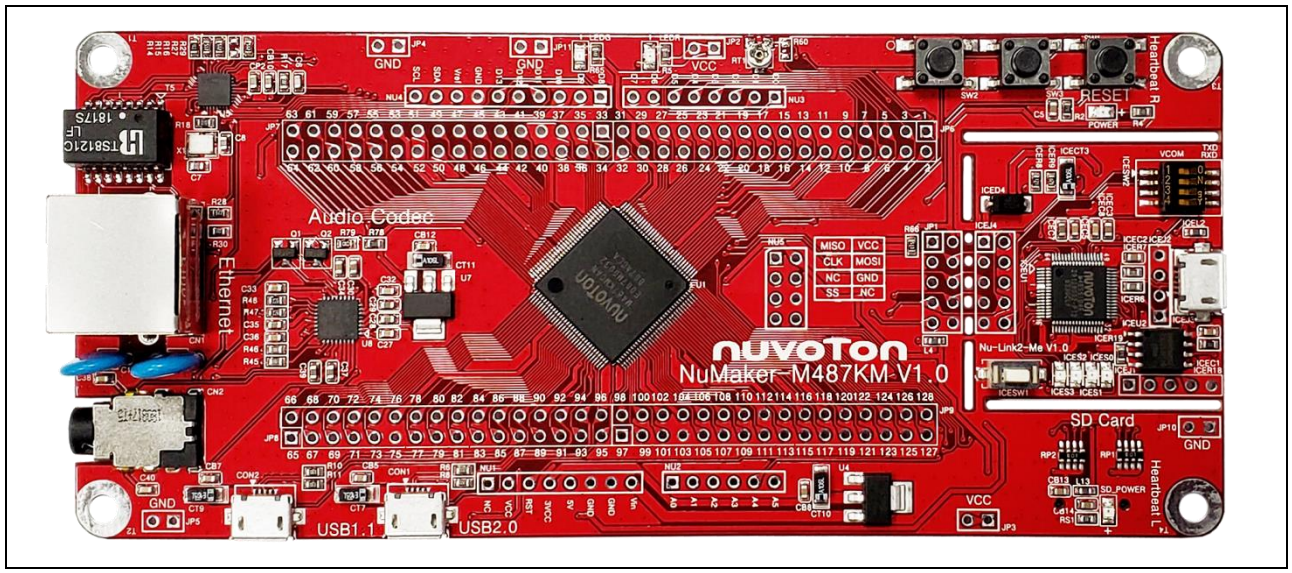

Figure 2-1 Front View of NuMaker-PFM-M487KM Board

2.2 Rear View

Figure 2-2 shows the main components and connectors from the rear side of NuMaker-PFM-M487KM board.

The following lists components and connectors from the rear view:

- MicroSD Card Slot: T-Flash slot (U9)
- Nu-Link2-Me
  - MCUVCC Power Switch (ICEJPR1)
  - ICEVCC Power Switch (ICEJPR2)

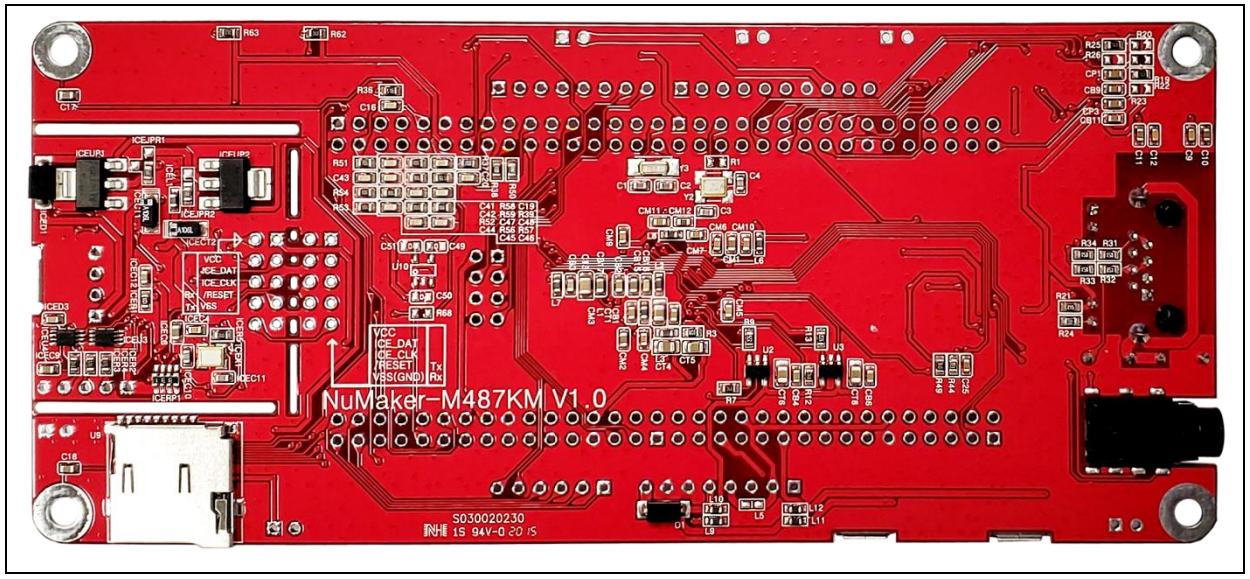

Figure 2-2 Rear View of NuMaker-PFM-M487KM Board

2.3 Arduino UNO Compatible Interface

Figure 2-3 shows the Arduino UNO compatible interface.

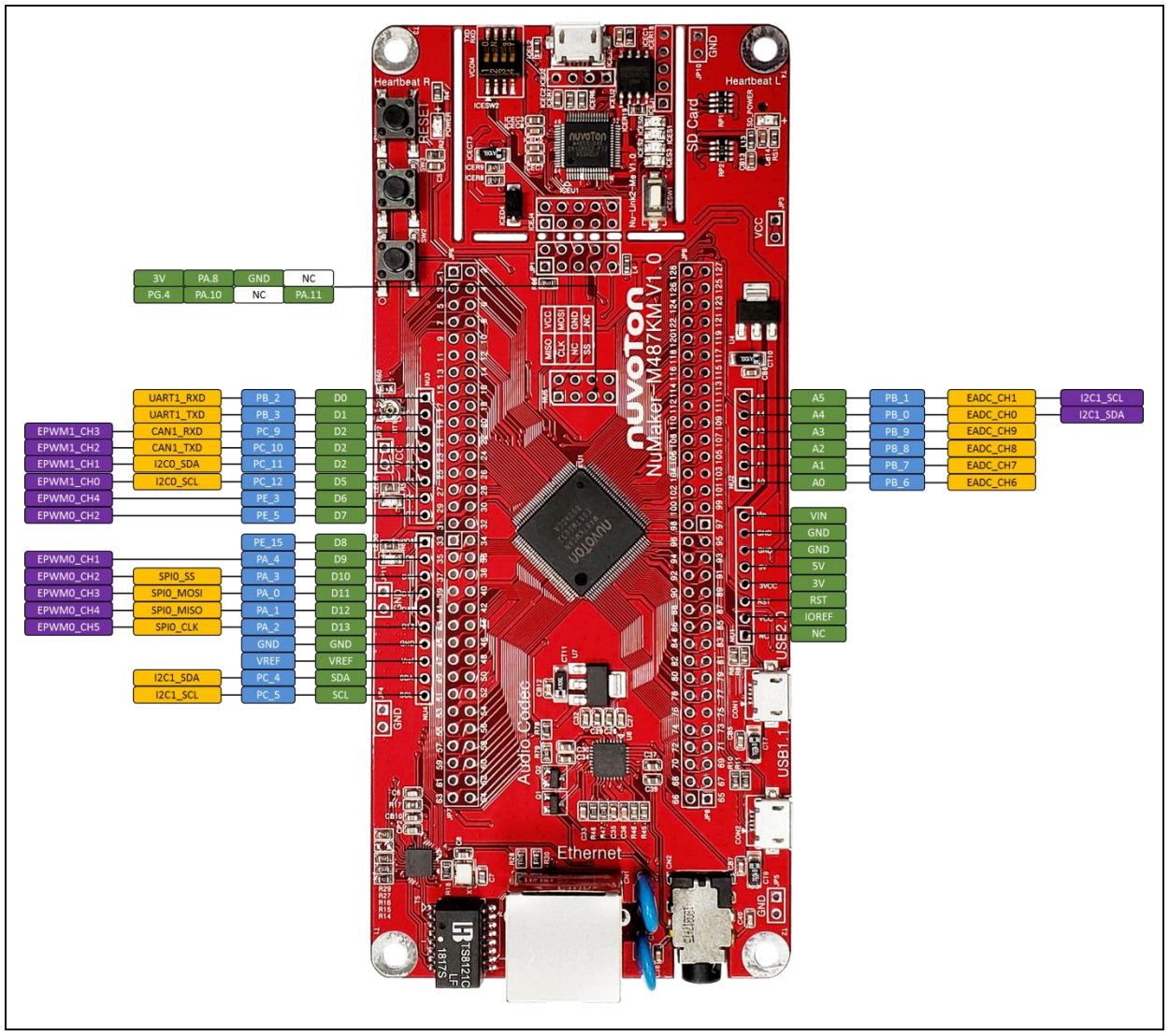

Figure 2-3 Arduino UNO Compatible Interface

Table 2-1 Arduino UNO Interface Mapping with M487KMCAN GPIO

Header		NuMaker-PFM-M487KM		Header		NuMaker-PFM-M487KM	
		Compatible to Arduino UNO	GPIO Pin of M487			Compatible to Arduino UNO	GPIO Pin of M487
NU1	NU1.1	NC	-	NU4	NU4.10	SCL	PC.5
	NU1.2	IOREF			NU4.9	SDA	PC.4
	NU1.3	RESET	RESET		NU4.8	VREF	-
	NU1.4	3VCC	-		NU4.7	GND	
	NU1.5	5VCC			NU4.6	D13	PA.2
	NU1.6	GND			NU4.5	D12	PA.1
	NU1.7	GND			NU4.4	D11	PA.0
	NU1.8	VIN			NU4.3	D10	PA.3
NU2	NU2.1	A0	PB.6		NU4.2	D9	PA.4
	NU2.2	A1	PB.7		NU4.1	D8	PE.15
	NU2.3	A2	PB.8	NU3	NU3.8	D7	PE.5
	NU2.4	A3	PB.9		NU3.7	D6	PE.3
	NU2.5	A4	PB.0		NU3.6	D5	PC.12
	NU2.6	A5	PB.1		NU3.5	D4	PC.11
					NU3.4	D3	PC.10
					NU3.3	D2	PC.9
					NU3.2	D1	PB.3
					NU3.1	D0	PB.2

Header		NuMaker-PFM-M487KM		Header		NuMaker-PFM-M487KM	
		Compatible to Arduino UNO	GPIO Pin of M487			Compatible to Arduino UNO	GPIO Pin of M487
NU5	NU5.1	MISO	PG.4	NU5	NU5.2	VCC	-
	NU5.3	CLK	PA.10		NU5.4	MOSI	PA.8
	NU5.5	NC	-		NU5.6	GND	-
	NU5.7	SS	PA.11		NU5.8	NC	-

2.4 Pin Assignment for Extended Connectors

The NuMaker-PFM-M487KM provides the M487KMCAN target chip onboard and extended connectors (JP6, JP7, JP8 and JP9) for LQFP128-pin. The Figure 2-4 shows the NuMaker-PFM-M487KMCAN extended connectors.

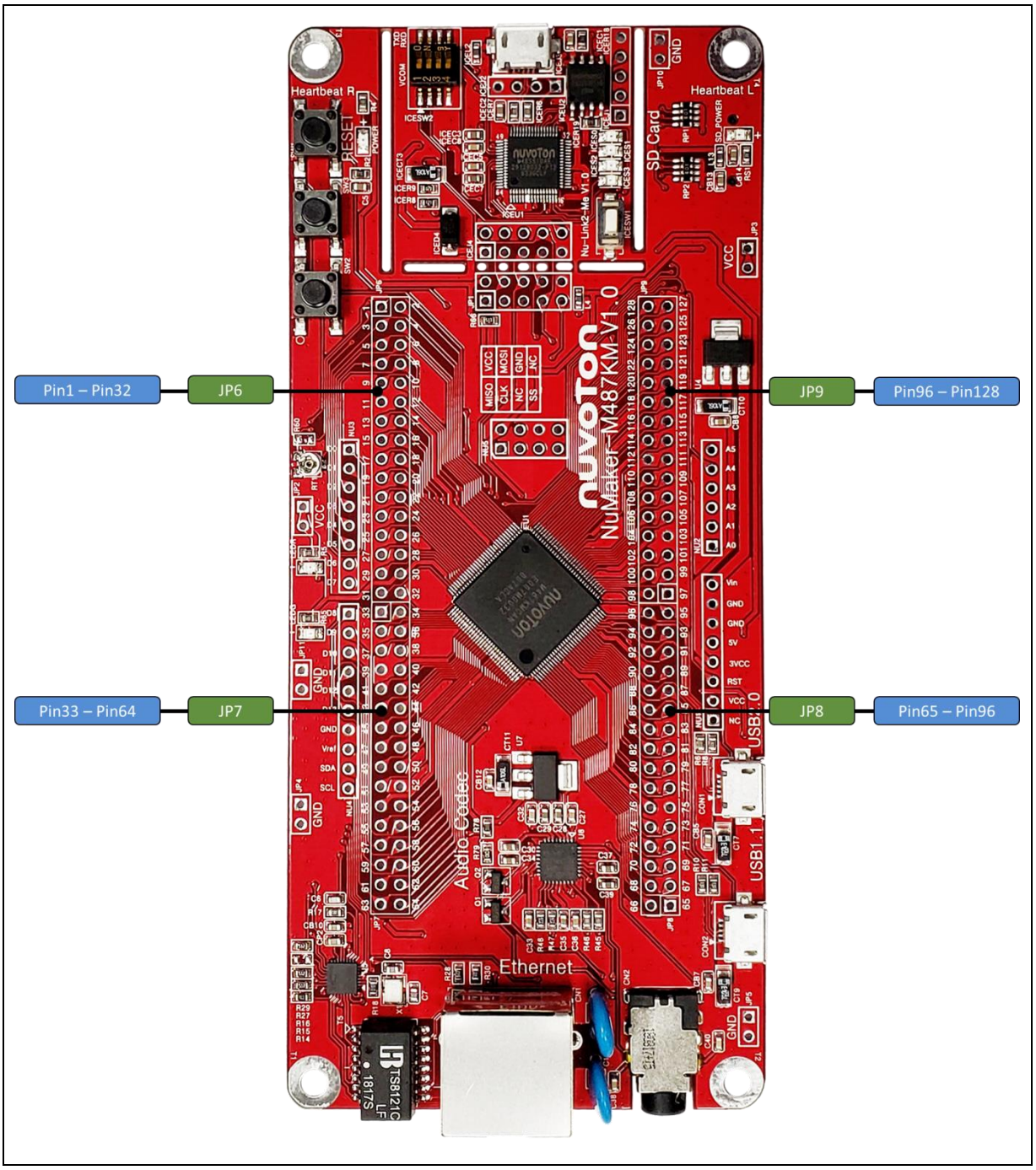

Figure 2-4 NuMaker-PFM-M487KMCAN Extended Connectors

Table 2-2 Extended Connector JP6 Interface with M487KMCAN GPIO

Header		NuMaker-PFM-M487KM		Header		NuMaker-PFM-M487KM	
		Pin No.	Function			Pin No	Function
JP6	JP6.1	1	PB.5	JP6	JP6.2	2	PB.4
	JP6.3	3	PB.3		JP6.4	4	OPA0_O
	JP6.5	5	PC.12		JP6.6	6	PC.11
	JP6.7	7	PC.10		JP6.8	8	PC.9
	JP6.9	9	OPA0_N		JP6.10	10	OPA0_P
	JP6.11	11	GND		JP6.12	12	3VCC
	JP6.13	13	PA.11		JP6.14	14	OPA1_O
	JP6.15	15	OPA1_N		JP6.16	16	OPA1_P
	JP6.17	17	JKDET		JP6.18	18	OPA2_O
	JP6.19	19	OPA2_N		JP6.20	20	OPA2_P
	JP6.21	21	PG.2		JP6.22	22	PG.3
	JP6.23	23	PG.4		JP6.24	24	SW3
	JP6.25	25	I2S0_BCLK		JP6.26	26	I2S0_MCLK
	JP6.27	27	I2S0_DI		JP6.28	28	I2S0_DO
	JP6.29	29	I2S0_LRCK		JP6.30	30	3VCC
	JP6.31	31	XT32_IN		JP6.32	32	XT32_OUT

Table 2-3 Extended Connector JP8 Interface with M487KMCAN GPIO

Header		NuMaker-PFM-M487KM		Header		NuMaker-PFM-M487KM	
		Pin No.	Function			Pin No	Function
JP7	JP7.1	33	LED_R	JP7	JP7.2	34	LED_G
	JP7.3	35	PH.6		JP7.4	36	PH.7
	JP7.5	37	XT1_IN		JP7.6	38	XT1_OUT
	JP7.7	39	GND		JP7.8	40	3VCC
	JP7.9	41	EMAC_MDC		JP7.10	42	EMAC_MDIO
	JP7.11	43	EMAC_TXD0		JP7.12	44	EMAC_TXD1
	JP7.13	45	EMAC_TXEN		JP7.14	46	JKEN#
	JP7.15	47	EMAC_REFCLK		JP7.16	48	EMAC_RXD0
	JP7.17	49	EMCAC_RXD1		JP7.18	50	EMAC_RXDV
	JP7.19	51	EMAC_RXERR		JP7.20	52	GND
	JP7.21	53	3VCC		JP7.22	54	LDO_CAP
	JP7.23	55	SD1_CMD		JP7.24	56	PA.4
	JP7.25	57	PA.3		JP7.26	58	PA.2
	JP7.27	59	PA.1		JP7.28	60	PA.0
	JP7.29	61	VDDIO		JP7.30	62	SD1_nCD
	JP7.31	63	PE.15		JP7.32	64	nRESET

Table 2-4 Extended Connector JP7 Interface with M487KMCAN GPIO

Header		NuMaker-PFM-M487KM		Header		NuMaker-PFM-M487KM	
		Pin No.	Function			Pin No	Function
JP8	JP8.1	65	ICEDAT	JP8	JP8.2	66	ICECLK
	JP8.3	67	I2C2_SCL		JP8.4	68	I2C2_SDA
	JP8.5	69	I2C1_SCL		JP8.6	70	I2C1_SDA
	JP8.7	71	PC.3		JP8.8	72	PC.2
	JP8.9	73	PC.1		JP8.10	74	PC.0
	JP8.11	75	GND		JP8.12	76	3VCC
	JP8.13	77	SD1_DAT3		JP8.14	78	SD1_DAT2
	JP8.15	79	NC		JP8.16	80	SD1_DAT0
	JP8.17	81	NC		JP8.18	82	SD1_CLK
	JP8.19	83	SW2		JP8.20	84	PD.13
	JP8.21	85	USB_VBUS		JP8.22	86	USB_D-
	JP8.23	87	USB_D+		JP8.24	88	USB_ID
	JP8.25	89	HSUSB_VRES		JP8.26	90	HSUSB_VDD33
	JP8.27	91	HSUSB_VBUS		JP8.28	92	HSUSB_D-
	JP8.29	93	HSUSB_VSS		JP8.30	94	HSUSB_D+
	JP8.31	95	HSUSB_VDD12_CAP		JP8.32	96	HSUSB_ID

Table 2-5 Extended Connector JP9 Interface with M487KMCAN GPIO

Header		NuMaker-PFM-M487KM		Header		NuMaker-PFM-M487KM	
		Pin No.	Pin Name			Pin No	Pin Name
JP9	JP9.1	97	NC	JP9	JP9.2	98	NC
	JP9.3	99	PE.5		JP9.4	100	NC
	JP9.5	101	PE.3		JP9.6	102	NC
	JP9.7	103	GND		JP9.8	104	3VCC
	JP9.9	105	PE.1		JP9.10	106	PE.0
	JP9.11	107	PH.8		JP9.12	108	PH.9
	JP9.13	109	PH.10		JP9.14	110	PH.11
	JP9.15	111	PD.14		JP9.16	112	GND
	JP9.17	113	LDO_CAP		JP9.18	114	3VCC
	JP9.19	115	USB_VBUS_ST		JP9.20	116	USB_VBUS_EN
	JP9.21	117	EADC0_CH14		JP9.22	118	TXD
	JP9.23	119	RXD		JP9.24	120	AVDD
	JP9.25	121	VREF		JP9.26	122	ADAVSS
	JP9.27	123	HSUSB_VBUS_ST		JP9.28	124	HSUSB_VBUS_EN
	JP9.29	125	PB.9		JP9.30	126	PB.8
	JP9.31	127	PB.7		JP9.32	128	PB.6

2.5 System Configuration

2.5.1 5V Power Source

- **ICEJ:** USB connector in Nu-Link-Me to program code and supplies 5V power from PC Host.
- **CON1:** USB 2.0 High-Speed OTG connector on NuMaker-PFM-M487KM board to supply 5V power from PC Host when this USB is a device that be decided by the ID pin of OTG cable and this ID pin is low.
- **CON2:** USB 1.1 OTG connector on NuMaker-PFM-M487KM board to supply 5V power from PC Host when this USB is a device that be decided by the ID pin of OTG cable and this ID pin is low.
- **NU1 pin5:** VDD5V voltage connector on NuMaker-PFM-M487KM board to supply 5V power from external power source.

Power Source	Connector	Comment
ICE_USB_VBUS	ICEJ3	ICEJ supplies the 5V power from PC Host. **Note**: L2 should be shorted 0ohm
HSUSB_VBUS	CON1	CON1 supplies the 5V power from PC Host. **Note**: L11 should be shorted 0ohm.
USB_VBUS	CON2	CON2 supplies the 5V power from PC Host. **Note**: L12 should be shorted 0ohm.
External 5V Source	NU1 pin5	NU1 pin5 supplies the 5V power from external power source. **Note**: L10 should be shorted 0ohm.

2.5.2 3.3V Power Source

- **ICEUP1:** The voltage regular converts the 5V source to 3.3V and supplies it to NuMaker-PFM-M487KM board.
- **U4:** The voltage regular converts the 5V source to 3.3V and supplies it to NuMaker-PFM-M487KM board.

Voltage Regular	5V Source	Comment
ICEUP1	ICE_USB_VBUS	ICEU1 convert ICE_USB_VBUS to 3.3V and supplies it to M487 platform board. **Note:** L4 should be shorted 0ohm
U4	HSUSB_VBUS	U4 convert HSUSB_VBUS to 3.3V and supplies it to M487 platform board. **Note:** L5 should be shorted 0ohm.
U4	USB_VBUS	U4 convert USB_VBUS to 3.3V and supplies it to M487 platform board. **Note:** L5 should be shorted 0ohm.

2.5.3 USB Connectors

- **ICEJ3:** USB connector (ICE) in Nu-Link-Me that connects to a PC's USB Host port to program code and supply power.
- **CON1:** USB 2.0 High-Speed connector (OTG) on NuMaker-PFM-M487KM board for USB OTG application use.
- **CON2:** USB 1.1 connector (OTG) on NuMaker-PFM-M487KM board for USB OTG application use.

2.5.4 Ethernet Connectors

- **CN1:** Ethernet connector (RJ-45) on NuMaker-PFM-M487KM board for application use.

2.5.5 Arduino UNO Compatible Interface Connectors

- **NU1, NU2, NU3, NU3 and NU5:** Arduino UNO compatible pins on the NuMaker-PFM-M487KM board.

2.5.6 Extended Connectors

- **JP6, JP7, JP8 and JP9:** Extended connectors interface pins on the NuMaker-PFM-M487KM board.

2.5.7 Phone Jack

- **CN2:** Phone jack connector on NuMaker-PFM-M487KM for audio application use.

2.5.8 MicroSD Card Slot

- **U9:** MicroSD card slot for application use.

2.5.9 Push-Buttons

- **SW1:** Reset button to reset the target chip on NuMaker-PFM-M487KM board.
- **SW2, SW3:** Only for application use.

2.5.10 LEDs

- **POWER:** The power LED indicates that the NuMaker-PFM-M487KM board is powered.
- **I/O1, I/O2 and I/O3:** Only for application use.

2.5.11 Heartbeat Sensor Pads

- **Heartbeat L:** The heartbeat sensor pad on the left hand.
- **Heartbeat R:** The heartbeat sensor pad on the right hand.

2.5.12 Power Connectors

- **JP2, JP3:** 3VCC connectors on the NuMaker-PFM-M487KM board.
- **JP4, JP5, JP10 and JP11:** GND connectors on the NuMaker-PFM-M487KM board.

2.6 Audio

NuMaker-PFM-M487KM features a Nuvoton NAU88L25 audio codec which is an ultra-low power high performance audio codec designed for headphone or headset application. It includes one I2S/PCM interface, one high quality stereo DACs, one mono ADC, a Class G stereo headphone amplifier, and industry leading advanced headset features.

The NAU88L25 connects to the NuMaker-PFM-M487KM via I^2C bus (M487 is I2C master) for control, the I^2C address of NUA88L25 is 0x1A by default, and via I^2S bus (M487 is I2S slave) for audio digital data. The Table 2-6 shows the pin mapping between NUC88L25 and M487KMCAN.

Table 2-6 NAU88L25 Mapping with NuMaker-PFM-M487KMCAN

NuMaker-PFM-M487KM	NAU88L25	Comment
I2C2_SCL	SCLK	I^2C clock output **Note**: The I^2C address of NAU88L25 is 0x1A by default.
I2C2_SDA	SDIO	I^2C data input/output **Note**: The I^2C address of NAU88L25 is 0x1A by default.
I2S0_BCLK	BCLK	I^2S bit clock output from NAU88L25
I2S0_MCLK	MCLK	I^2S master clock output from M487
I2S0_DI	ADCOUT	I^2S data input to NAU88L25
I2S0_DO	DACIN	I^2S data output from M487
I2S0_LRCK	FS	I^2S left right channel clock output from NAU88L25
PC.13	JKDET	To detect phone jack insertion and ejection
PE.13	JKEN#	To control phone jack output

The 3.5mm phone jack CN2 is used to attach the headset with microphone, the Figure 2-5 shows the phone jack diagram.

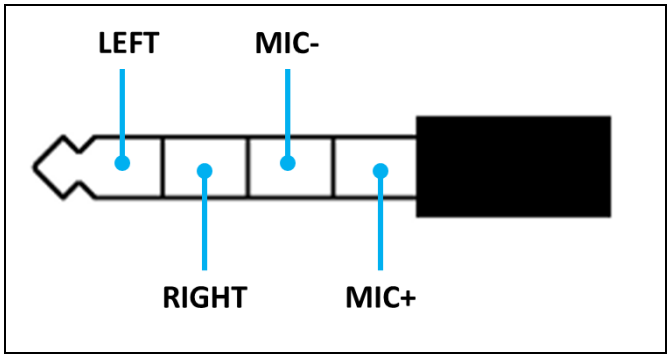

Figure 2-5 3.5mm Phone Jack Diagram

2.7 Heartbeat Sensor

NuMaker-PFM-M487KM features an on-board heartbeat sensor, it can detect the tiny electrical signal between human's right and left hand during each heartbeat. The tiny electrical signal passes through three stages of operational amplifiers which are built in M487KMCAN to amplify the differential electrical signal and filter the noise of environment. The Figure 2-6 shows the heartbeat sensor block diagram.

- **Heartbeat R/L Sensor Pads**
  The heartbeat sensor pads are used to detect the tiny electrical signal between human's right and left hand during each heartbeat.

- **OPA0 (Differential Amplifier and Filter)**
  OPA0 is used to amplify the differential electrical signal between right and left sensor pads and filter the DC bias then passes it to OPA1.

- **OPA1 (Bypass Filter and Input Buffer)**
  OPA1 is a bypass filter which is used to suppress 60Hz noise and pass the signal without the noise to OPA2.

- **OPA2 (Amplifier)**
  OPA2 is used to amplify the signal comes from OPA1 then passes it to the ADC channel of M487KMCAN to convert the analog signal to the digital signal.

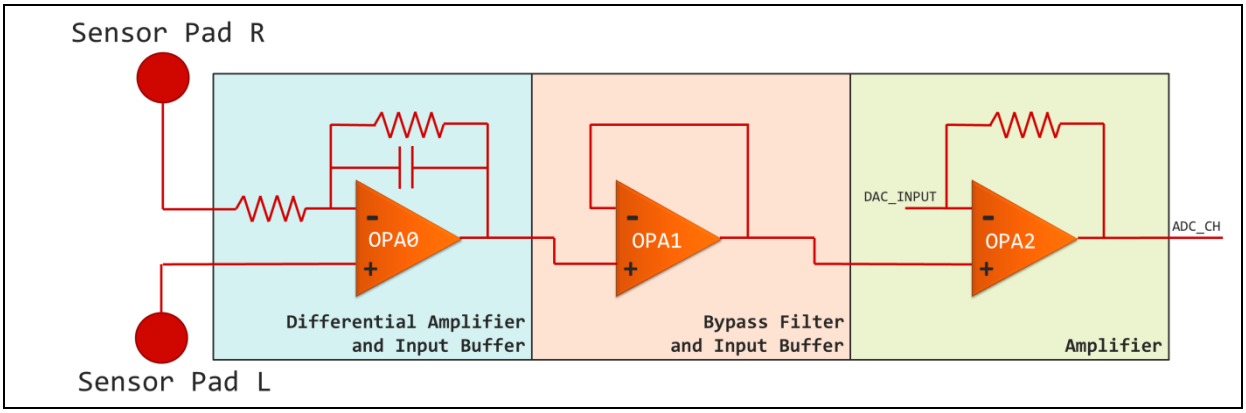

Figure 2-6 Heartbeat Sensor Block Diagram

The pins of heartbeat sensor are share with other function of NuMaker-PFM-M487KM, the Table 2-7 shows the usage of heartbeat sensor.

Table 2-7 Pin Usage of Heartbeat Sensor

M487JIDAE	Heartbeat Sensor	Alternative Function	Comment
PB.2	OPA0_O	D0	Short R69 to use the heartbeat function, otherwise it will be D0 of UNO Interface.
PB.1	OPA0_N	A5	Short R70 to use the heartbeat function, otherwise it will be A5 of UNO Interface.
PB.0	OPA0_P	A4	Short R71 to use the heartbeat function, otherwise it will be A4 of UNO Interface.
PA.10	OPA1_O	ICSP_CLK	Short R72 to use the heartbeat function, otherwise it will be CLK of UNO ICSP Interface.
PA.9	OPA1_N	ICSP_MISO	Short R73 to use the heartbeat function, otherwise it will be MISO of UNO Interface.
PA.8	OPA1_P	ICSP_MOSI	Short R74 to use the heartbeat function, otherwise it will be MOSI of UNO Interface.
PD.12	OPA2_O	-	Short R75 to use the heartbeat function, otherwise it will be PD.12 of M487KMCAN.
PD.11	OPA2_N	-	Short R76 to use the heartbeat function, otherwise it will be PD.11 of M487KMCAN.
PD.10	OPA2_P	-	Short R77 to use the heartbeat function, otherwise it will be PD.10 of M487KMCAN.
PB.12	DAC0_OUT	ICE_RXD	Short R68 to use the heartbeat function, otherwise it will be ICE_RXD of M487KMCAN.
PB.14	EADC0_CH14	-	Short R60 to use the heartbeat function, otherwise it will be PB.14 of M487KMCAN.

2.8 Nu-Link2-Me

The Nu-Link2-Me is a debugger and programmer that supports on-line programming and debugging through SWD interface. The on-board 16 Mbit SPI Flash allows it to off-line program the target microcontroller. Additionally, the Nu-Link2-Me provides virtual COM port (VCOM) function to print out messages on PC. Table 2-8 presents how to set the VCOM function by ICESW2.

ICESW2		
Pin	**Function**	**Comment**
1	TXD	**On**: Connect target chip PB.13 (UART0_TXD) to Nu-Link2-Me. **Off**: Disconnect target chip PB.13 (UART0_TXD) to Nu-Link2-Me.
2	RXD	**On**: Connect target chip PB.12 (UART0_RXD) to Nu-Link2-Me. **Off**: Disconnect target chip PB.12 (UART0_RXD) to Nu-Link2-Me.
Note: Pin 3 and 4 is unused.		

Table 2-8 ICESW2 VCOM function

2.9 PCB Placement

Figure 2-7 and Figure 2-8 show the front and rear placement of NuMaker-PFM-M487KM board.

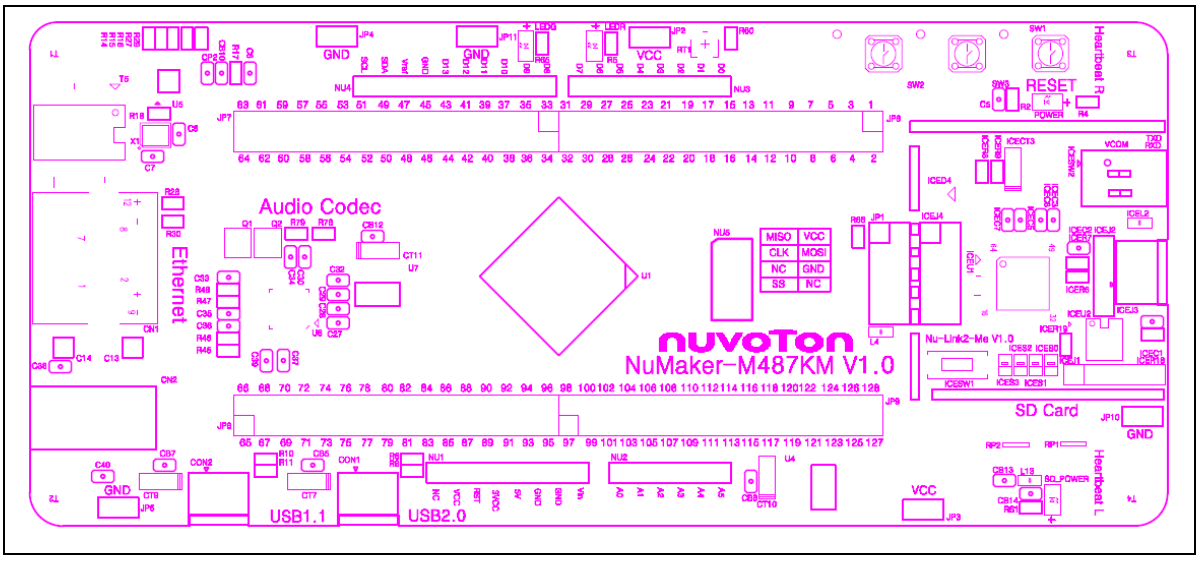

Figure 2-7 Front Placement

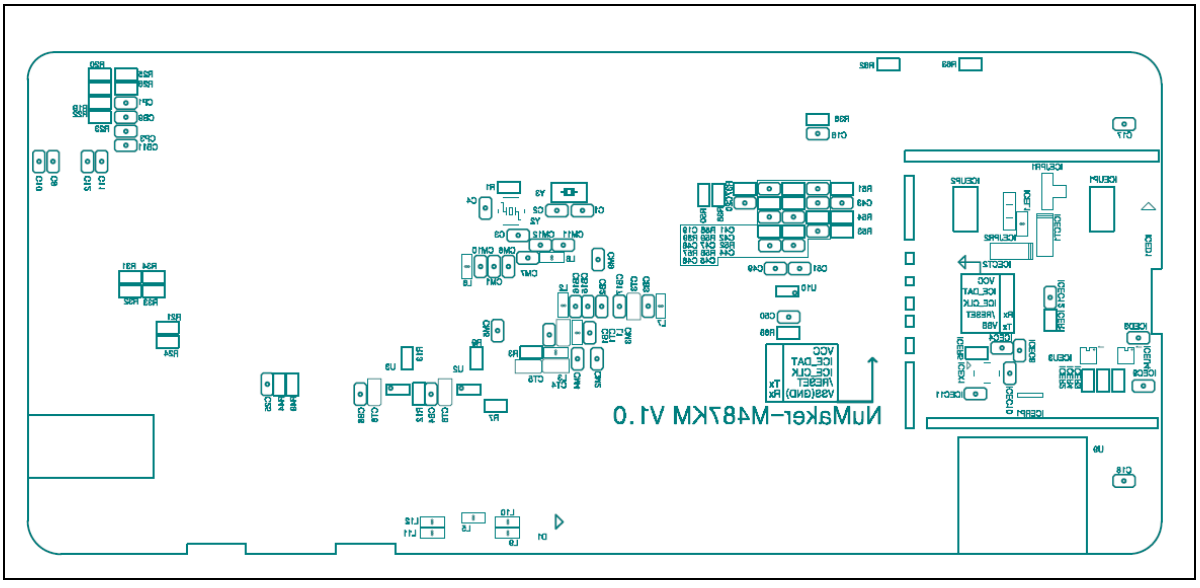

Figure 2-8 Rear Placement

3 QUICK START

3.1 Toolchains Supporting

Install the preferred toolchain. Please make sure at least one of the toolchains has been installed.

- KEIL MDK Nuvoton edition M0/M23
- IAR EWARM
- NuEclipse (GCC)(Windows)
- NuEclipse (GCC)(Linux)

3.2 Nuvoton Nu-Link Driver Installation

Download and install the latest Nuvoton Nu-Link Driver.

- Download and install Nu-Link_Keil_Driver when using Keil MDK.
- Download and install Nu-Link_IAR_Driver when using IAR EWARM.
- Skip this step when using NuEclipse.

Please install the Nu-Link USB Driver as well at the end of the installation. The installation is presented in Figure 3-1 and Figure 3-2.

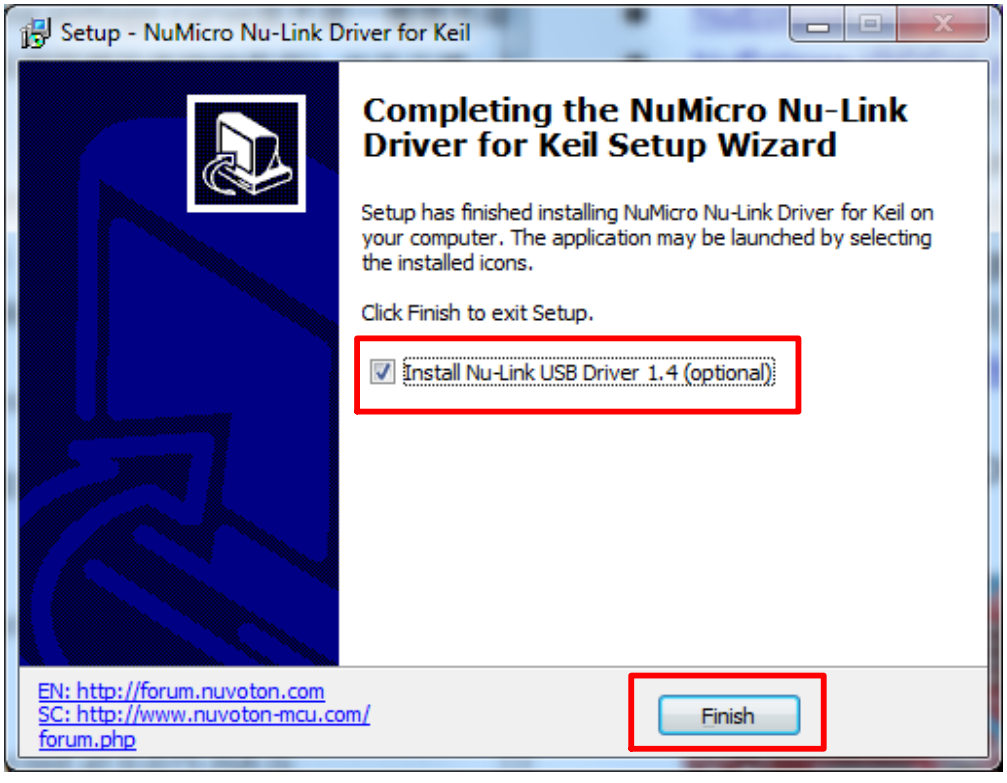

Figure 3-1 Nu-Link USB Driver Installation Setup

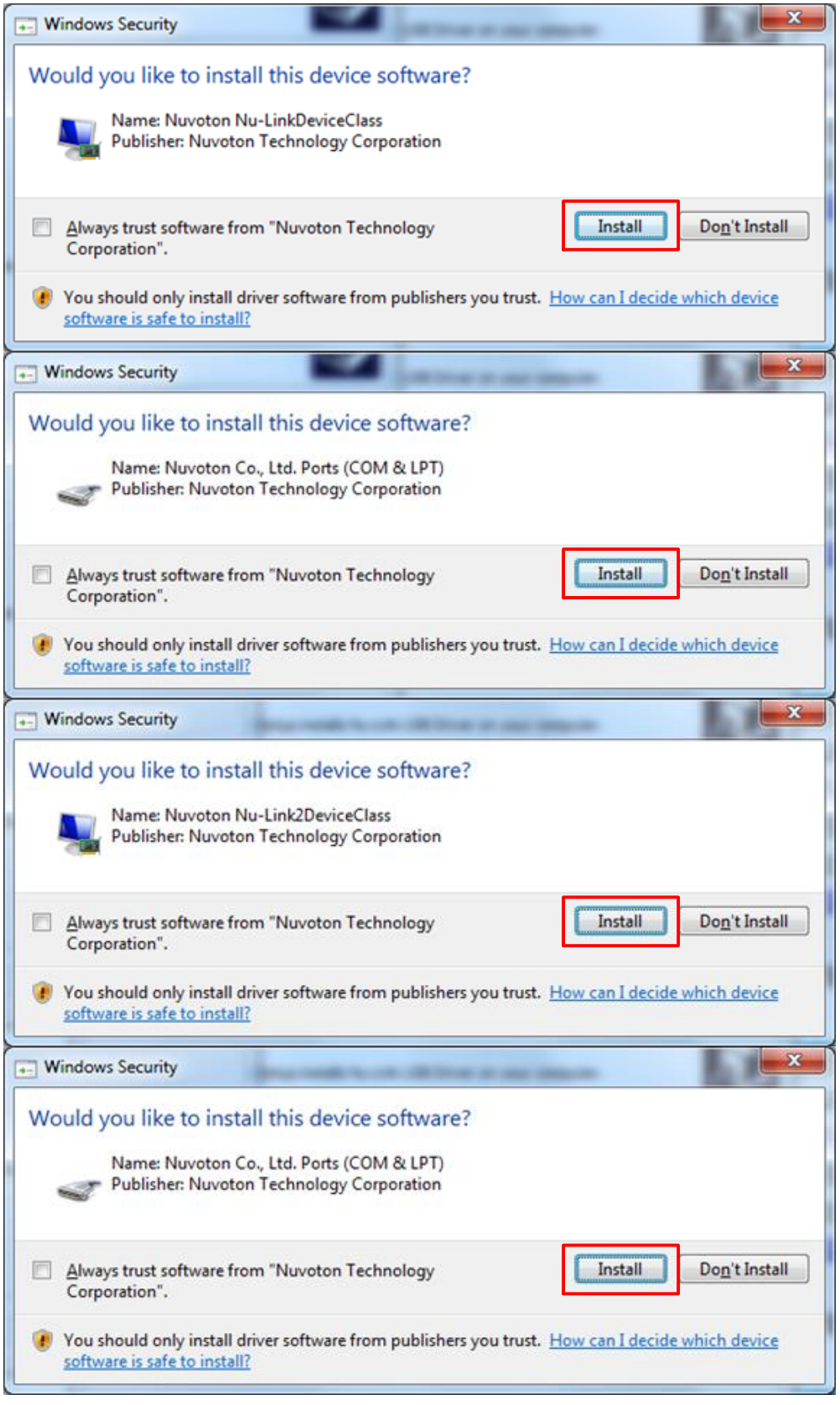

Figure 3-2 Nu-Link USB Driver Installation

3.3 BSP Firmware Download

Download and unzip the M480 Board Support Package (BSP).

3.4 Hardware Setup

1. Open the virtual COM (VCOM) function by changing Nu-Link2-Me VCOM Switch No. 1 and 2 to ON.

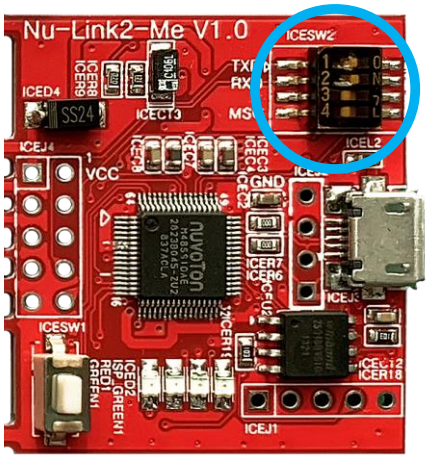

Figure 3-3 Open VCOM Function

2. Connect the ICE USB connector shown in Figure 3-4 to the PC USB port through USB cable.

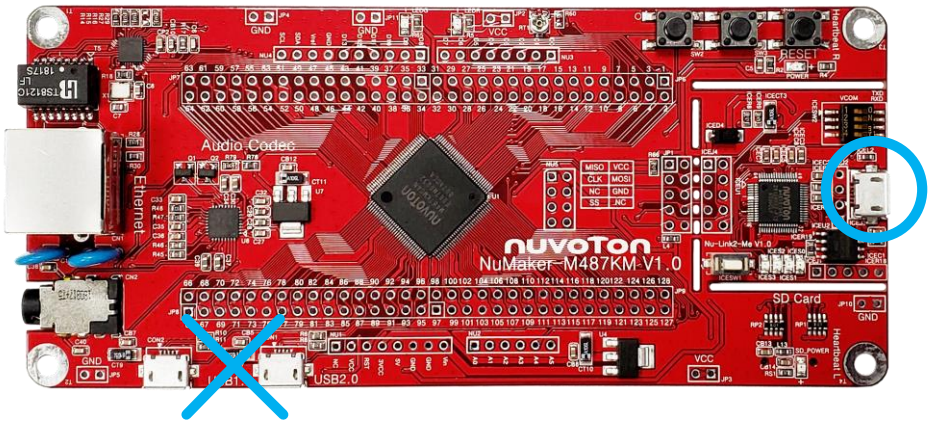

Figure 3-4 ICE USB Connector

3. Find the “Nuvoton Virtual COM Port” on the Device Manger as Figure 3-5.

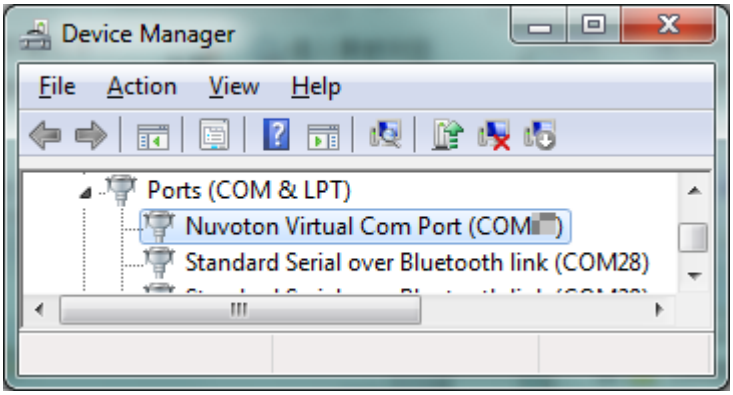

Figure 3-5 Device Manger

4. Open a serial port terminal, PuTTY for example, to print out debug message. Set the speed to 115200. Figure 3-6 presents the PuTTY session setting.

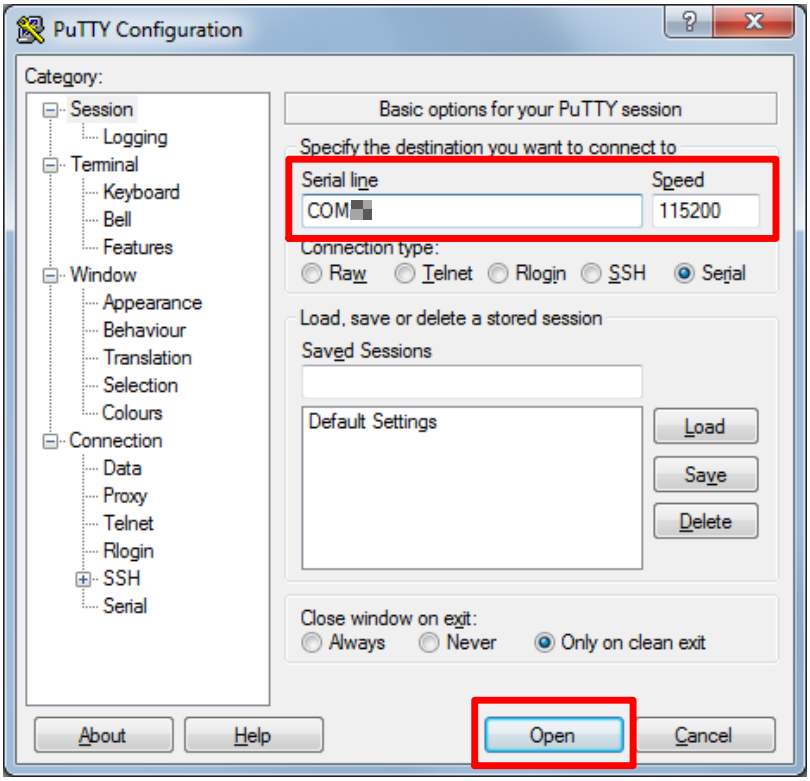

Figure 3-6 PuTTY Session Setting

3.5 Find the Example Project

Use the “Template” project as an example. The project can be found under the BSP folder as shown in Figure 3-7.

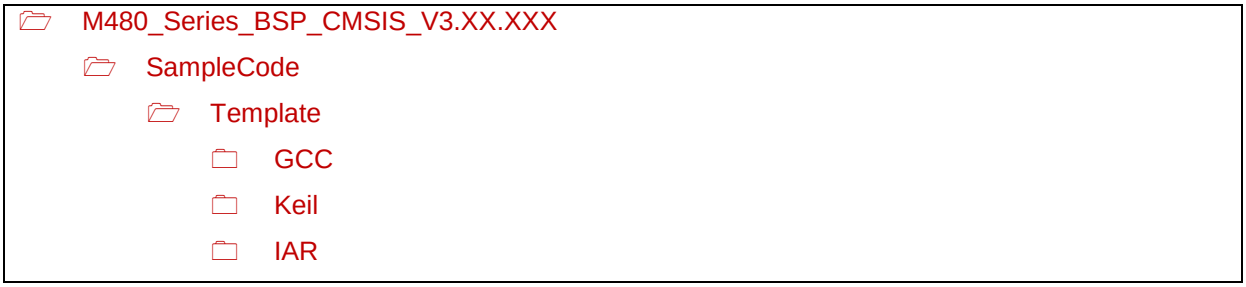

Figure 3-7 Template Project Folder Path

3.6 Execute the Project under Toolchains

Open and execute the project under the toolchain. The section 3.6.1, 0, and 3.6.3 describe the steps of executing project in Keil MDK, IAR EWARM and NuEclipse, respectively.

3.6.1 Keil MDK

This section provides steps to beginners on how to run a project by using Keil MDK.

1. Double click the “Template.uvproj” to open the project.

   Note: If Figure 3-8 warning message jumps out, please migrate to version 5 formats as shown in Figure 3-9. The “.uvproj” filename extension will change to “.uvprojx”.

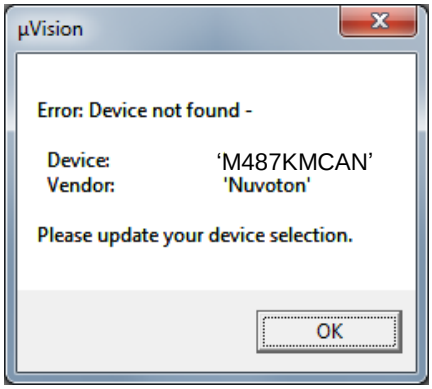

Figure 3-8 Warning Message of “Device not found”

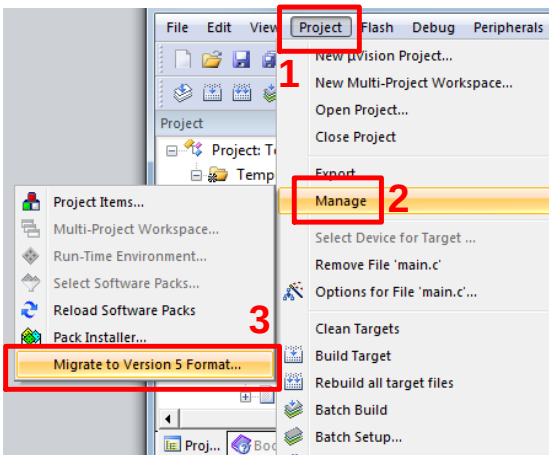

Figure 3-9 Project File Migrate to Version 5 Format

2. Make sure the debugger is “Nuvoton Nu-Link Debugger” as shown in Figure 3-10 and Figure 3-11.

   Note: If the dropdown menu in Figure 3-10 does not contain “Nuvoton Nu-Link Debugger” item, please rework section 3.2.

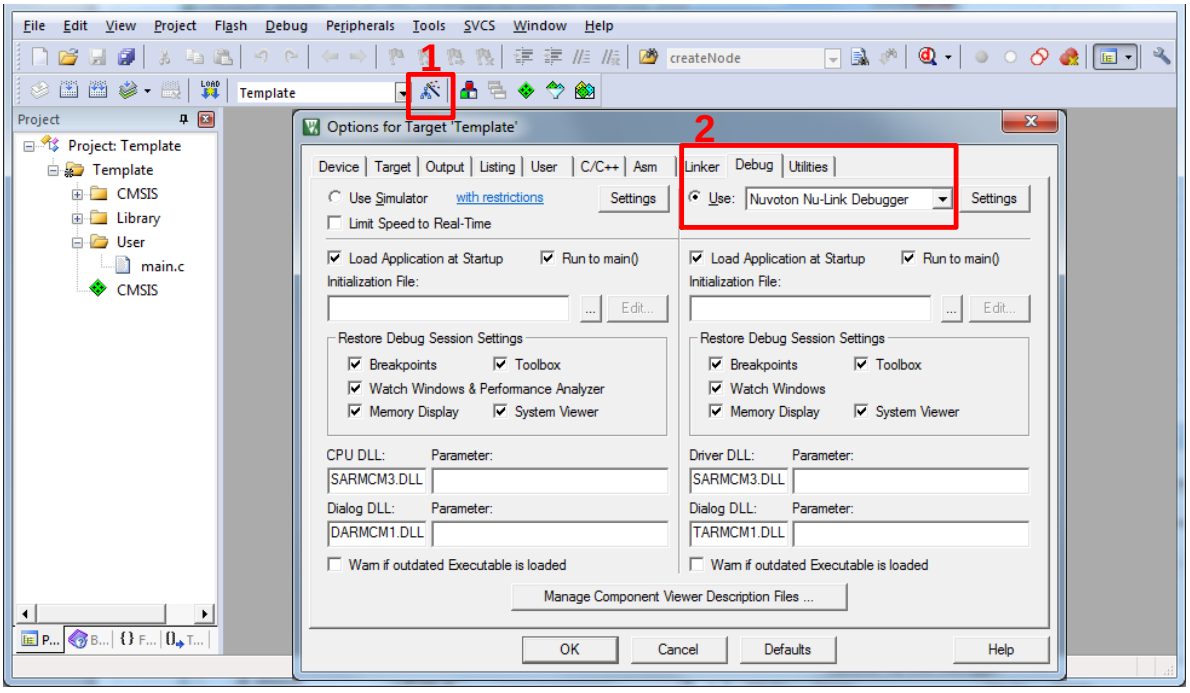

Figure 3-10 Debugger Setting in Options Window

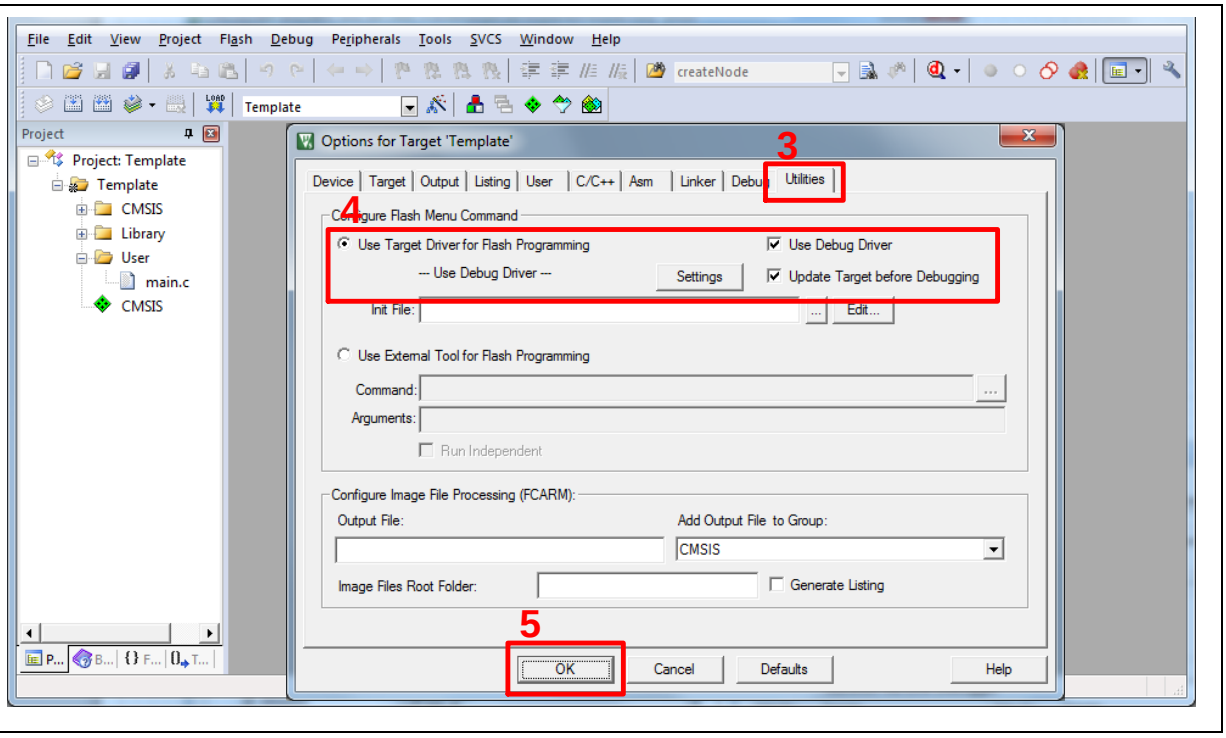

Figure 3-11 Programming Setting in Options Window

3. Rebuild all target files. After successfully compile the project, download code to the flash memory. Click “Start/Stop Debug Section” button can enter debug mode.

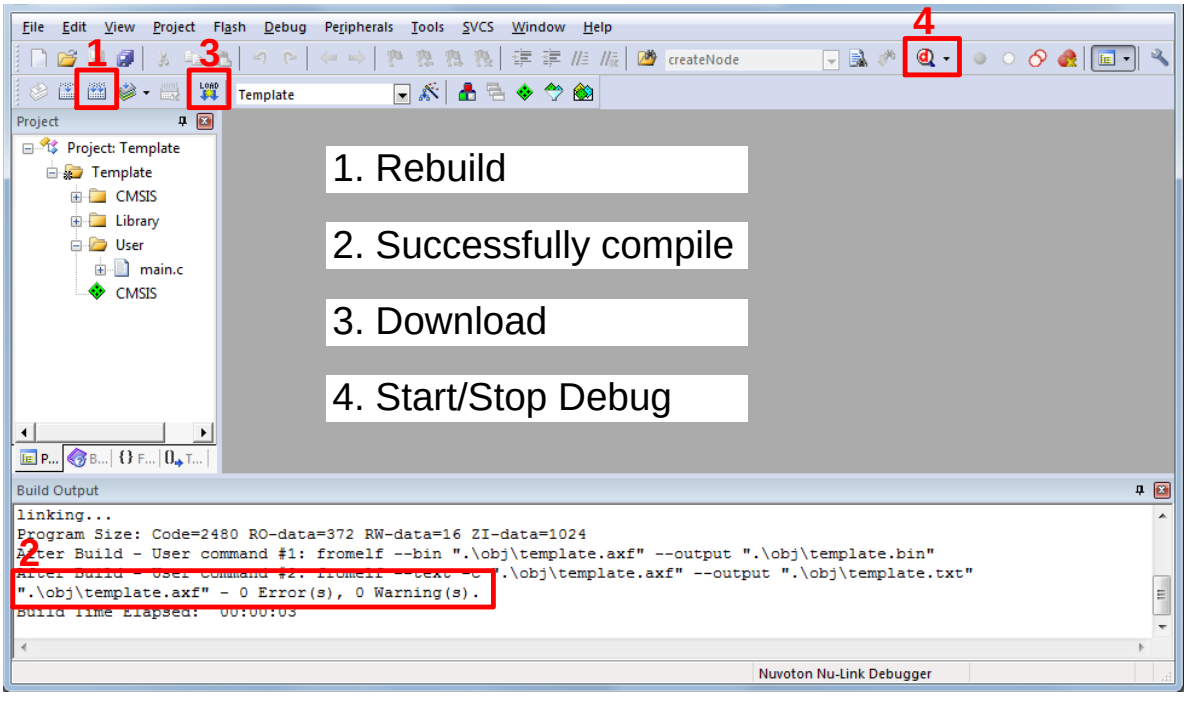

Figure 3-12 Compile and Download the Project

4. Figure 3-13 shows the debug mode under Keil MDK. Click “Run” and the debug message will be printed out as shown in Figure 3-14. User can debug the project under debug mode by checking

source code, assembly language, peripherals' registers, and setting breakpoint, step run, value monitor, etc.

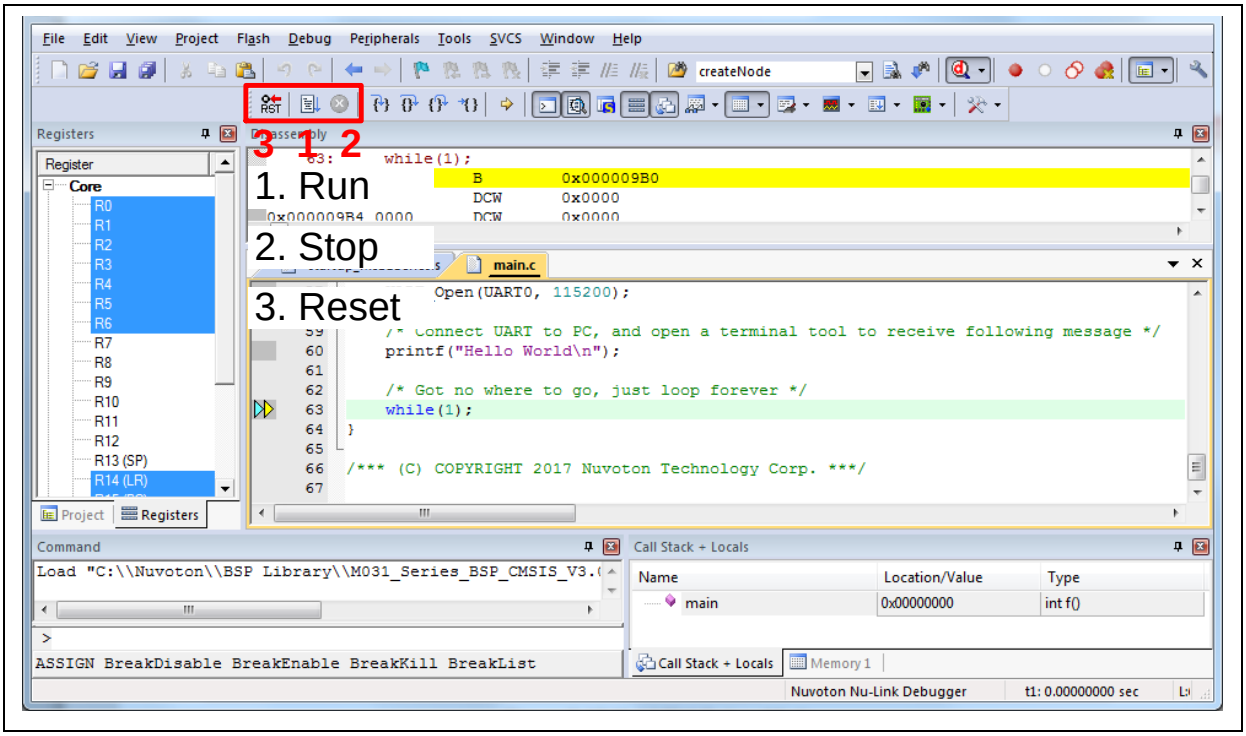

Figure 3-13 Keil MDK Debug Mode

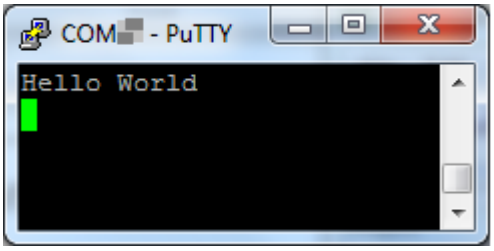

Figure 3-14 Debug Message on Serial Port Terminal Windows

3.6.2 IAR EWARM

This section provides steps to beginners on how to run a project by using IAR EWARM.

1. Double click the “Template.eww” to open the project.
2. Make sure the toolbar contain “Nu-Link” item as shown in Figure 3-15.

   Note: If the toolbar does not contain “Nu-Link” item, please rework section 3.2.

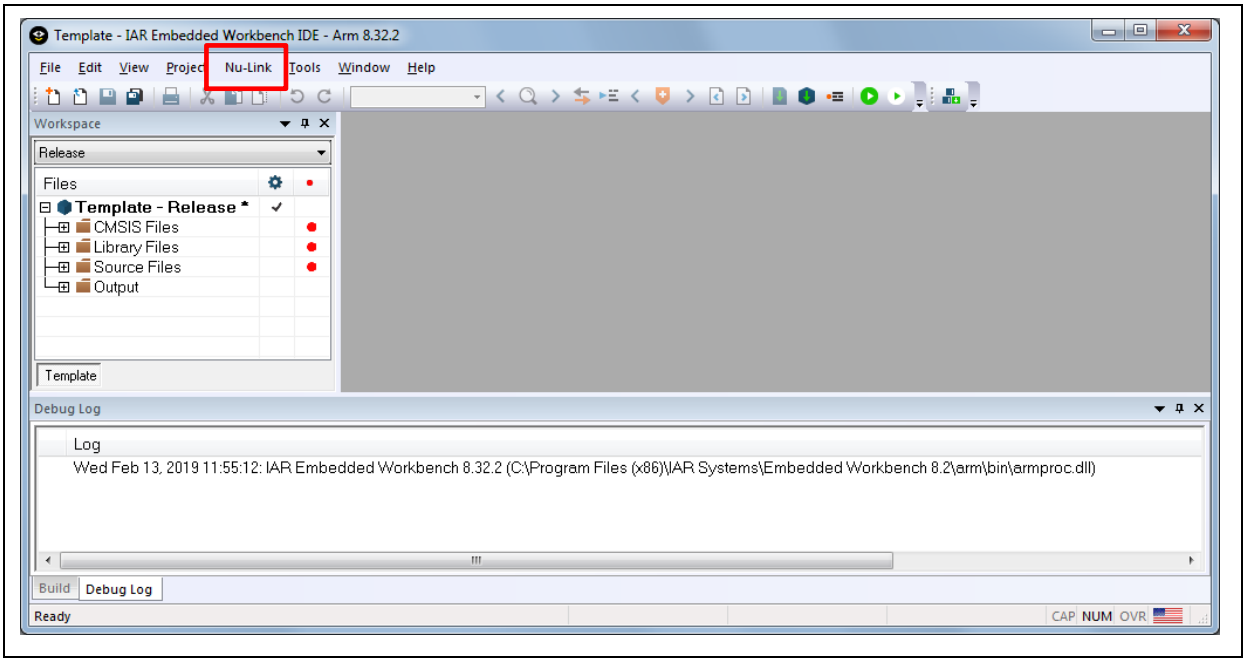

Figure 3-15 IAR EWARM Window

3. Make target file as presented in Figure 3-16. After successfully compile the project, download code to the flash memory and enter debug mode.

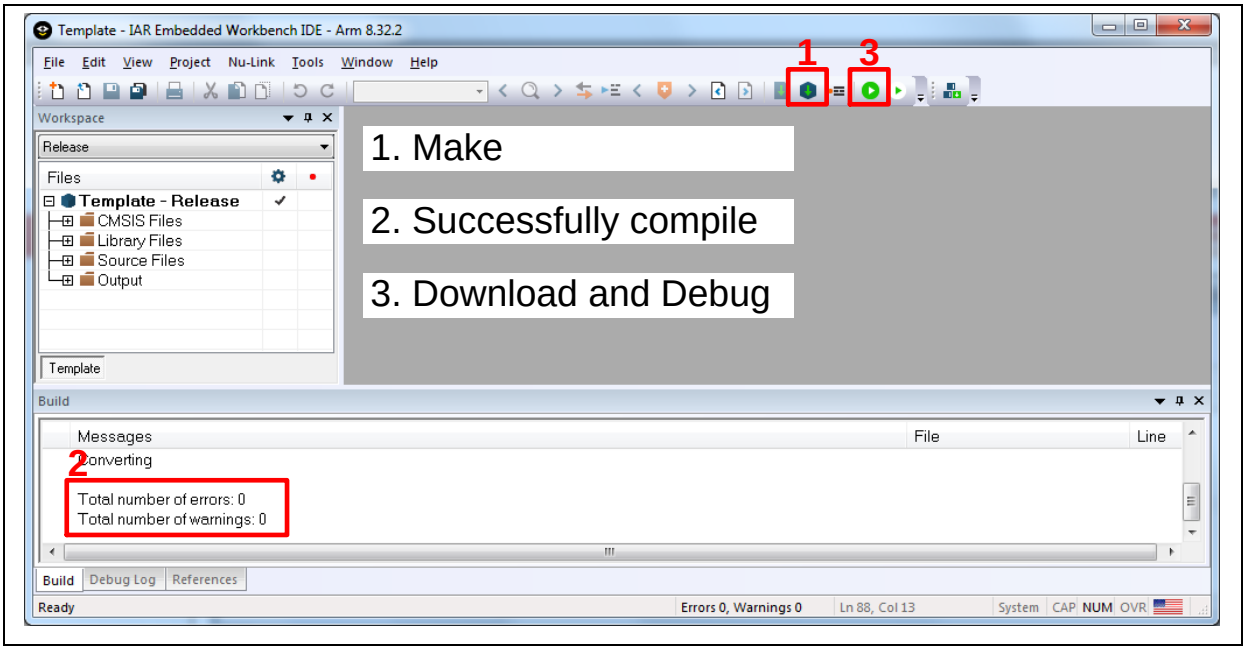

Figure 3-16 Compile and Download the Project

4. Figure 3-17 shows the debug mode under IAR EWARN. Click “Go” and the debug message will be printed out as shown in Figure 3-18. User can debug the project under debug mode by checking source code, assembly language, peripherals’ registers, and setting breakpoint, step run, value monitor, etc.

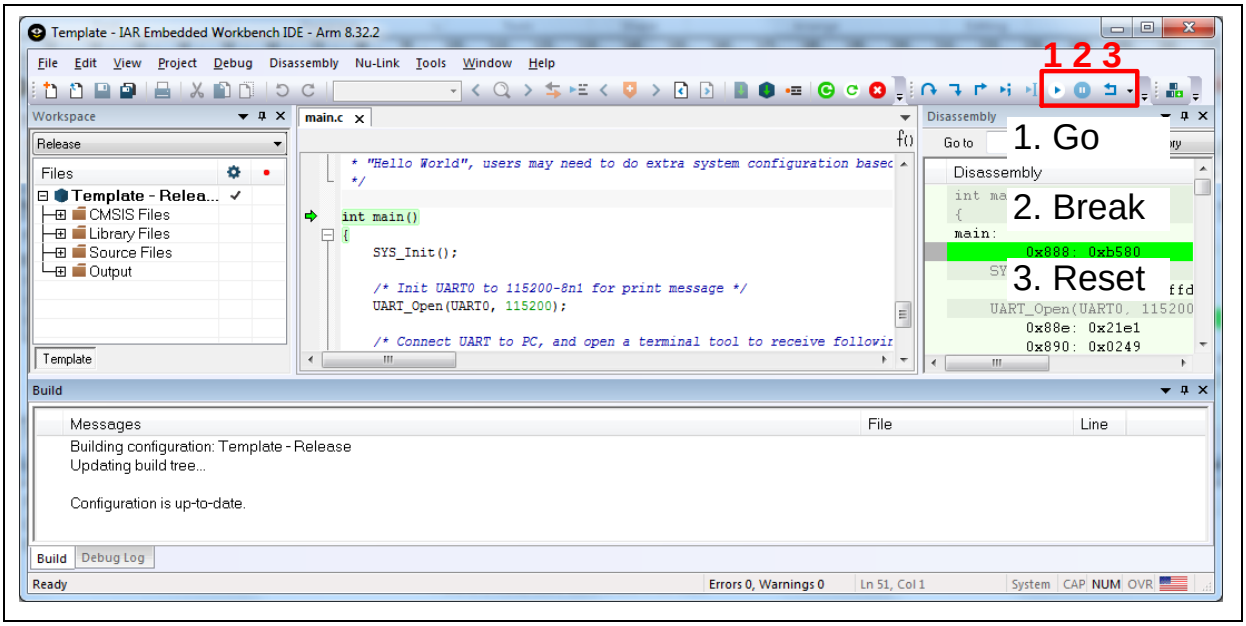

Figure 3-17 IAR EWARM Debug Mode

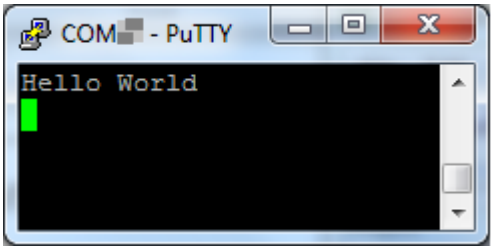

Figure 3-18 Debug Message on Serial Port Terminal Windows

3.6.3 NuEclipse

For more information about how to use NuEclipse, please refer to the NuEclipse User Manual.

4 NUMAKER-PFM-M487KM SCHEMATICS

4.1 Nu-Link2-Me

Figure 4-1 shows the Nu-Link2-Me circuit. The Nu-Link2-Me is a debugger and programmer that supports on-line programming and debugging through SWD interface.

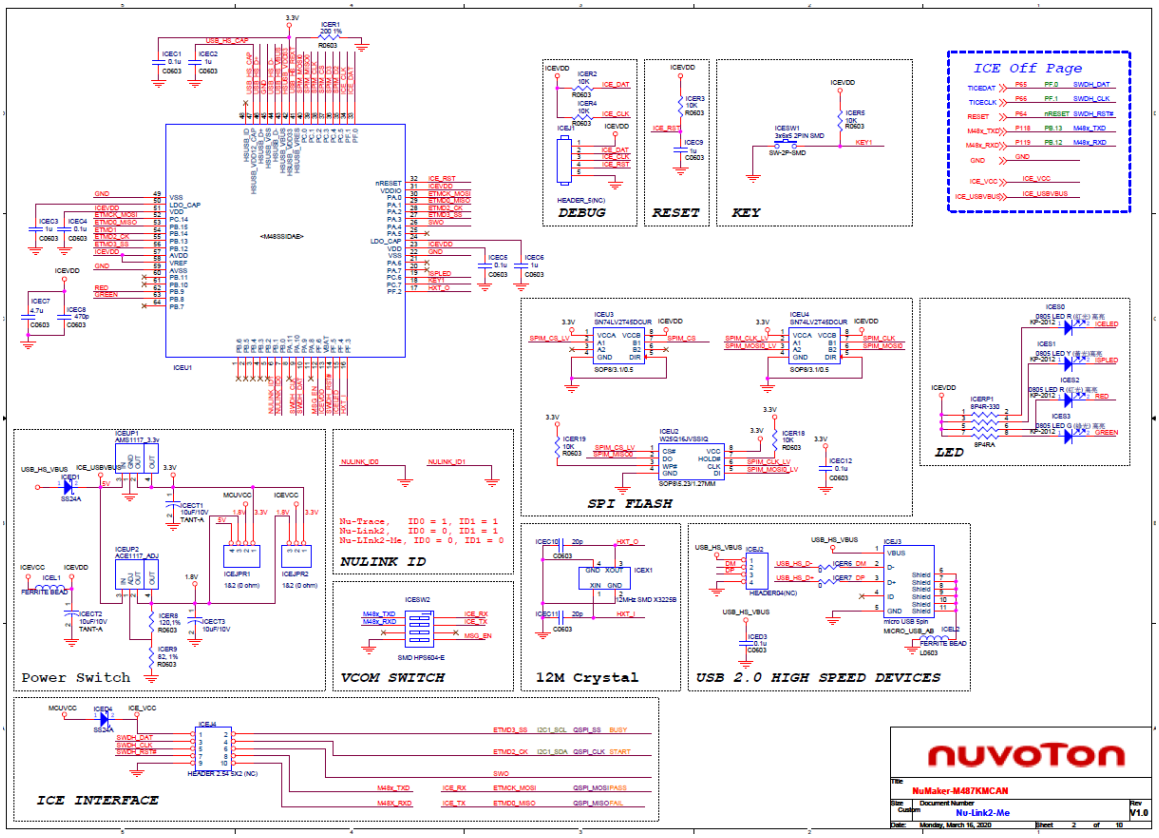

Figure 4-1 Nu-Link2-Me Circuit

4.2 M487KMCAN

Figure 4-2 shows the pin assignment of the M487KMCAN.

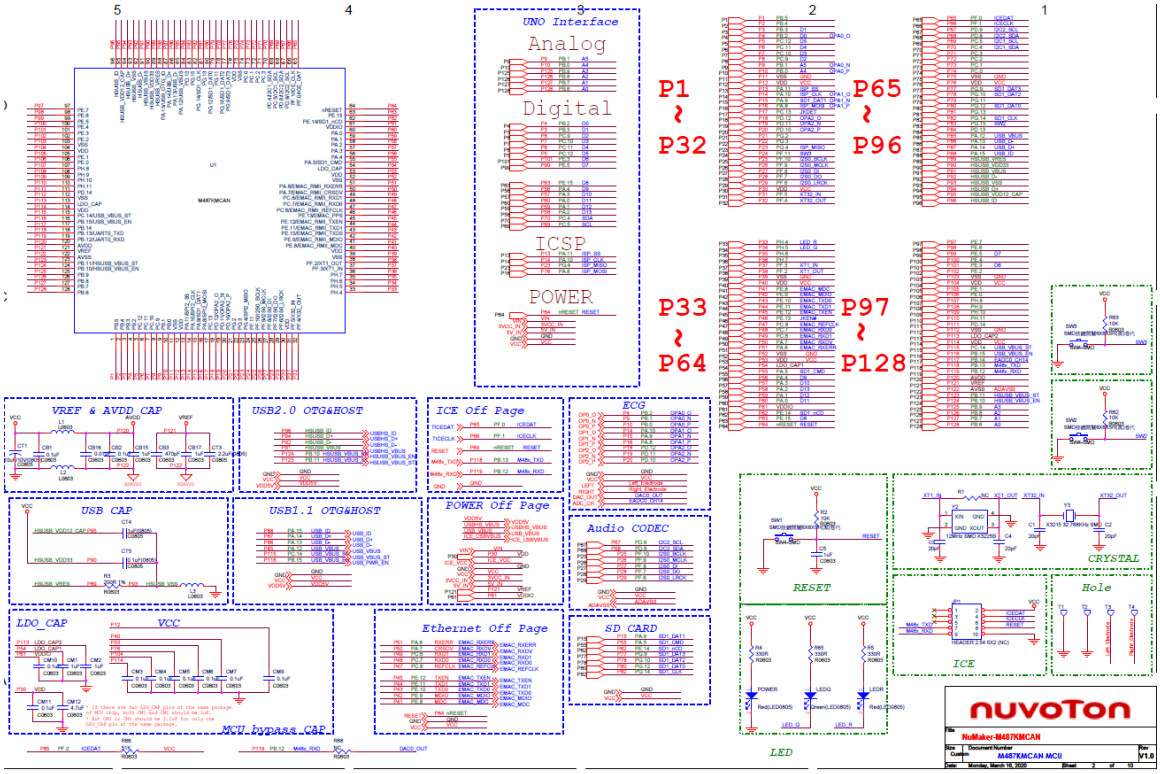

Figure 4-2 M487KMCAN Pin Assignment

4.3 Power Supply

Figure 4-3 shows power configurations of NuMaker-PFM-M487KM board.

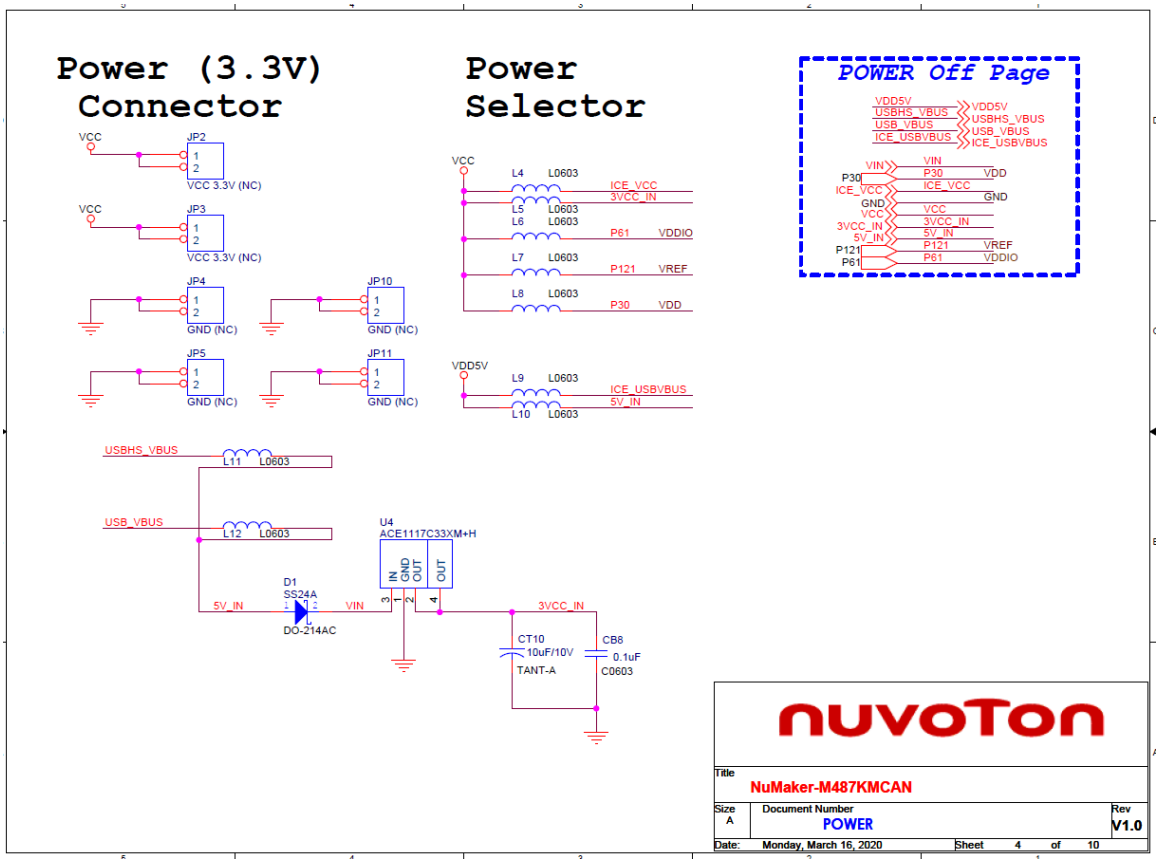

Figure 4-3 Power Circuit and Configurations

4.4 Arduino UNO Compatible Interface

Figure 4-4 shows the Arduino UNO compatible interface of NU1, NU2, NU5, NU6 and NU7 connectors.

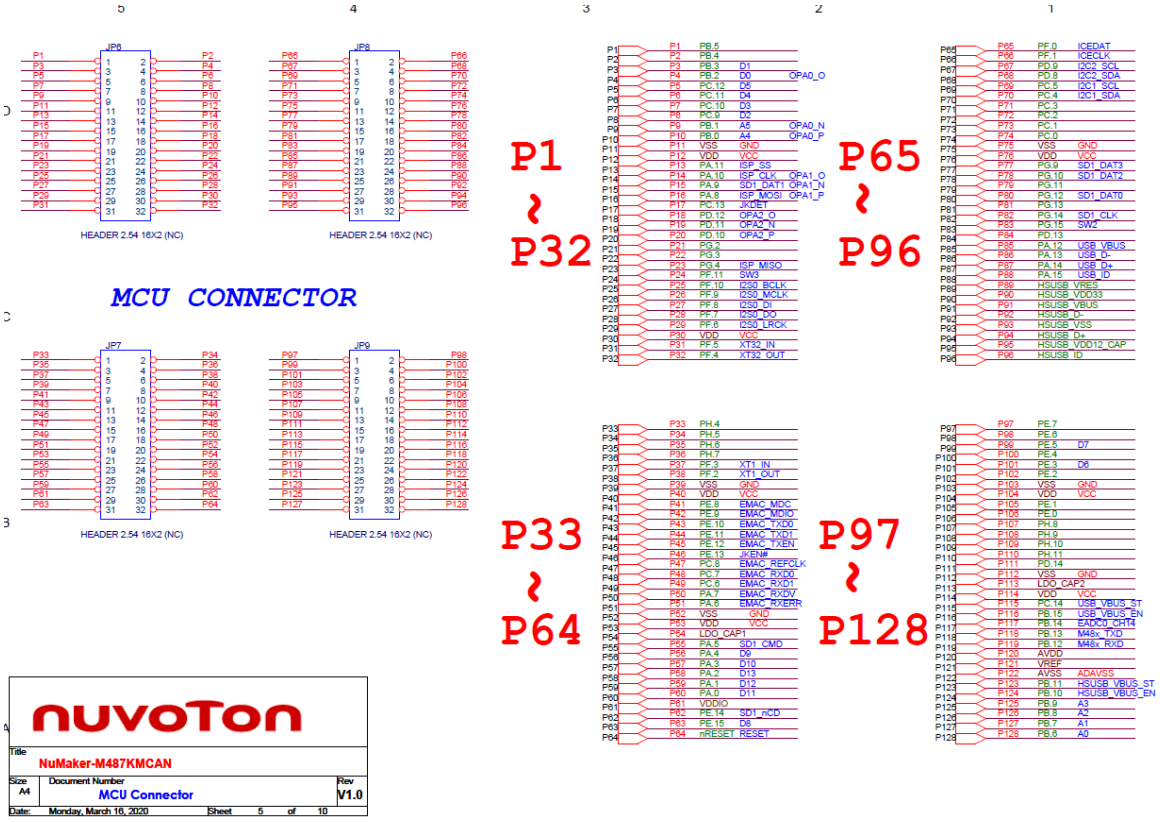

Figure 4-4 Arduino UNO Compatible Interface

4.5 MicroSD Card

Figure 4-5 shows the MicroSD Card circuit on the NuMaker-PFM-M487KM board.

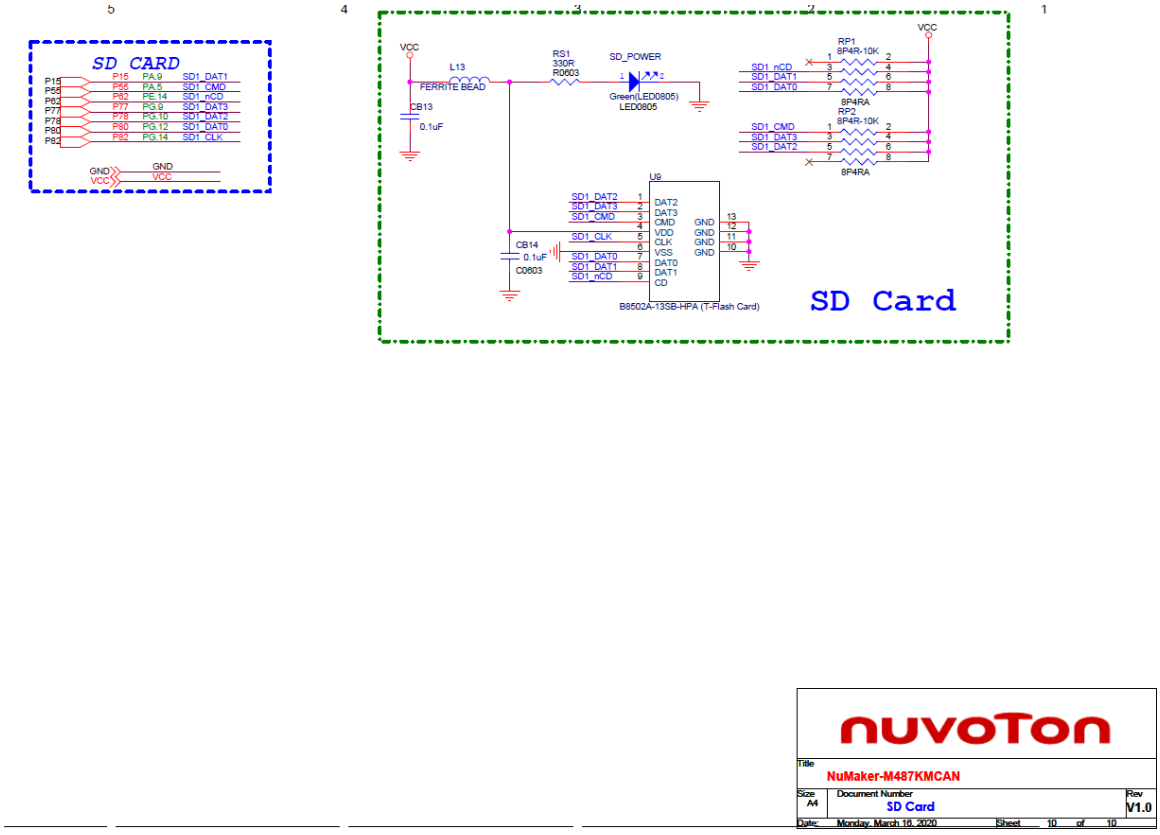

Figure 4-5 MicroSD Card Circuit

4.6 USB 2.0 HS OTG and USB 1.1 FS OTG

Figure 4-6 shows the USB 2.0 HS OTG and USB 1.1 FS OTG circuits on the NuMaker-PFM-M487KM board.

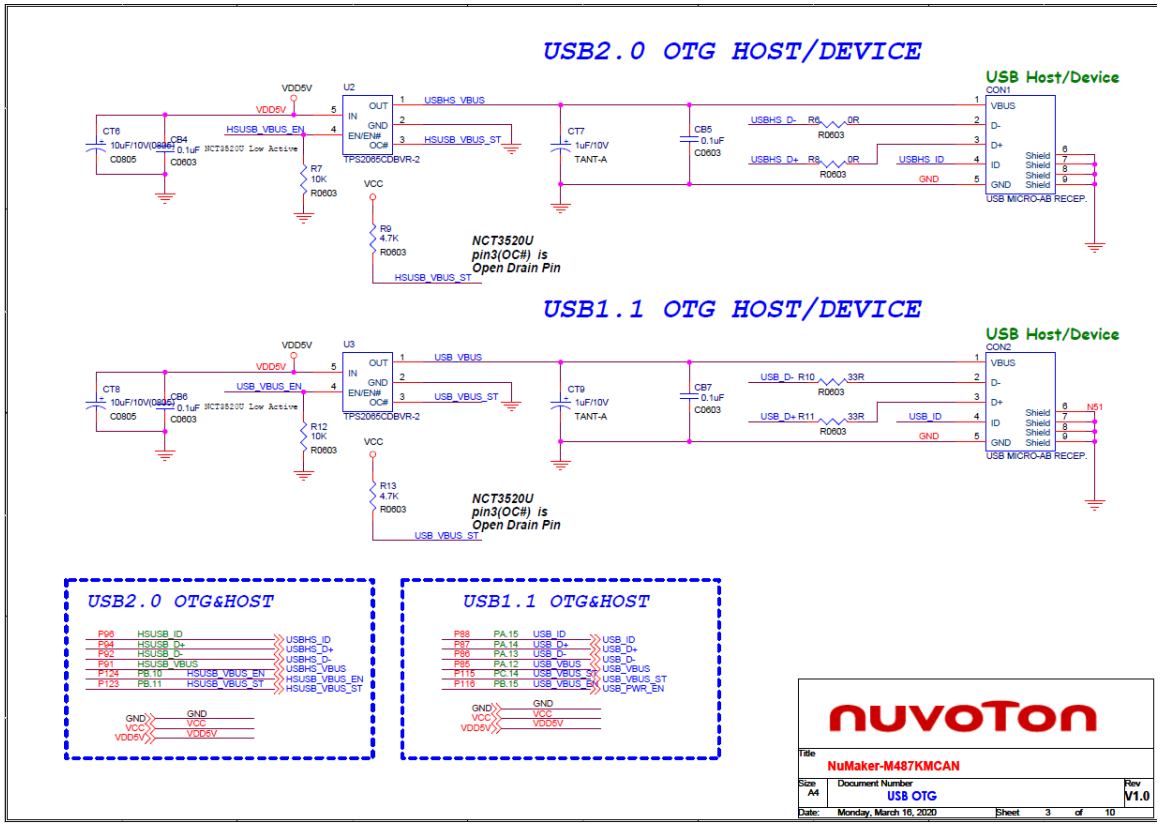

Figure 4-6 USB HS OTG and FS OTG Circuits

4.7 Ethernet

Figure 4-7 shows the Ethernet interface for networking application on the NuMaker-PFM-M487KM board.

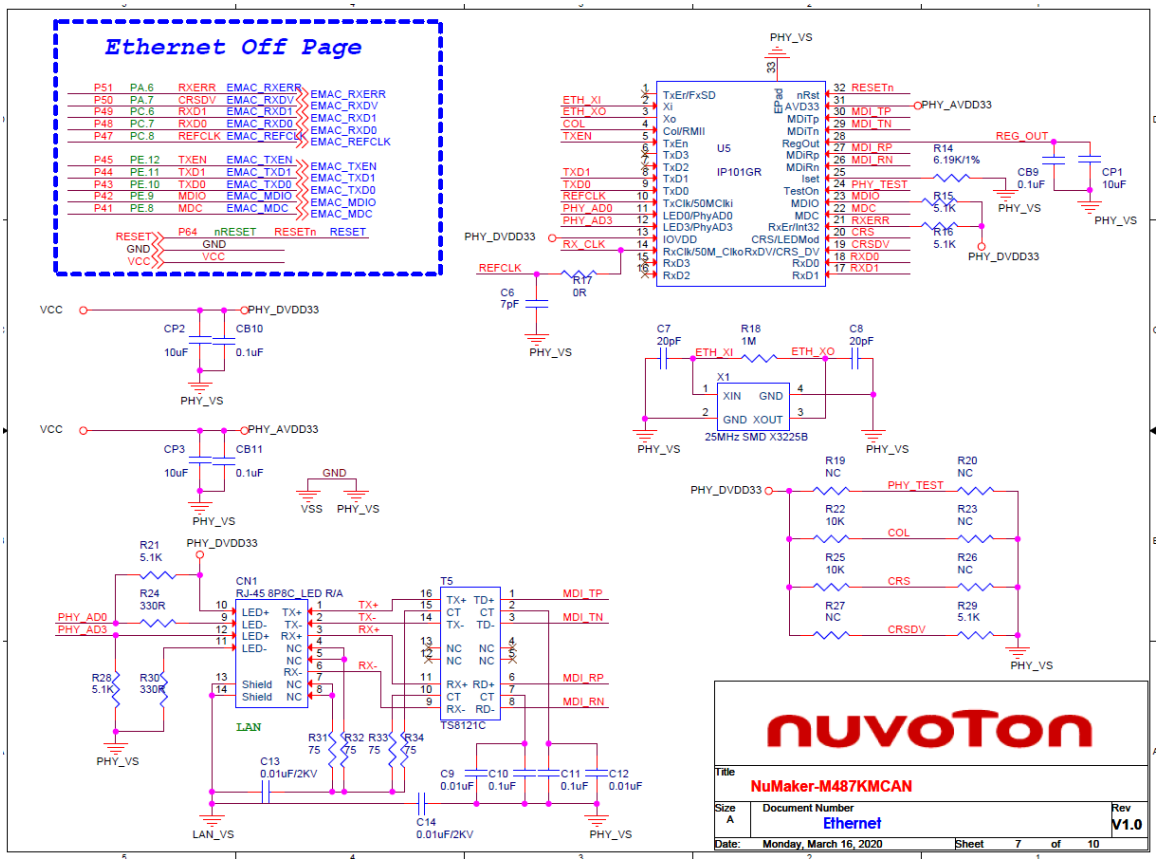

Figure 4-7 Ethernet Circuit

4.8 24-bit Stereo Audio Codec

Figure 4-8 shows the audio codec application circuit based on NAU88L25 to simplify implementation of complete audio system solutions.

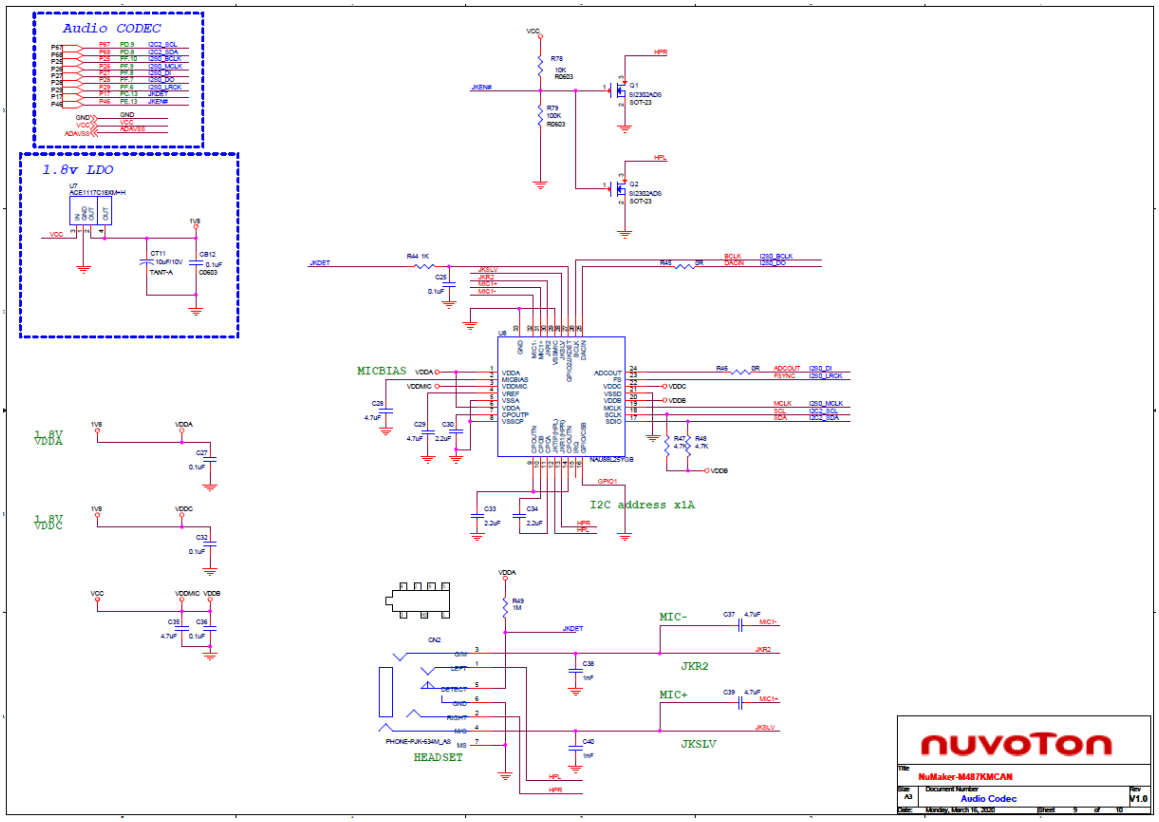

Figure 4-8 Audio Codec Circuit

4.9 Heartbeat Sensor

Figure 4-9 shows the heartbeat sensor application circuit on the NuMaker-PFM-M487KM board.

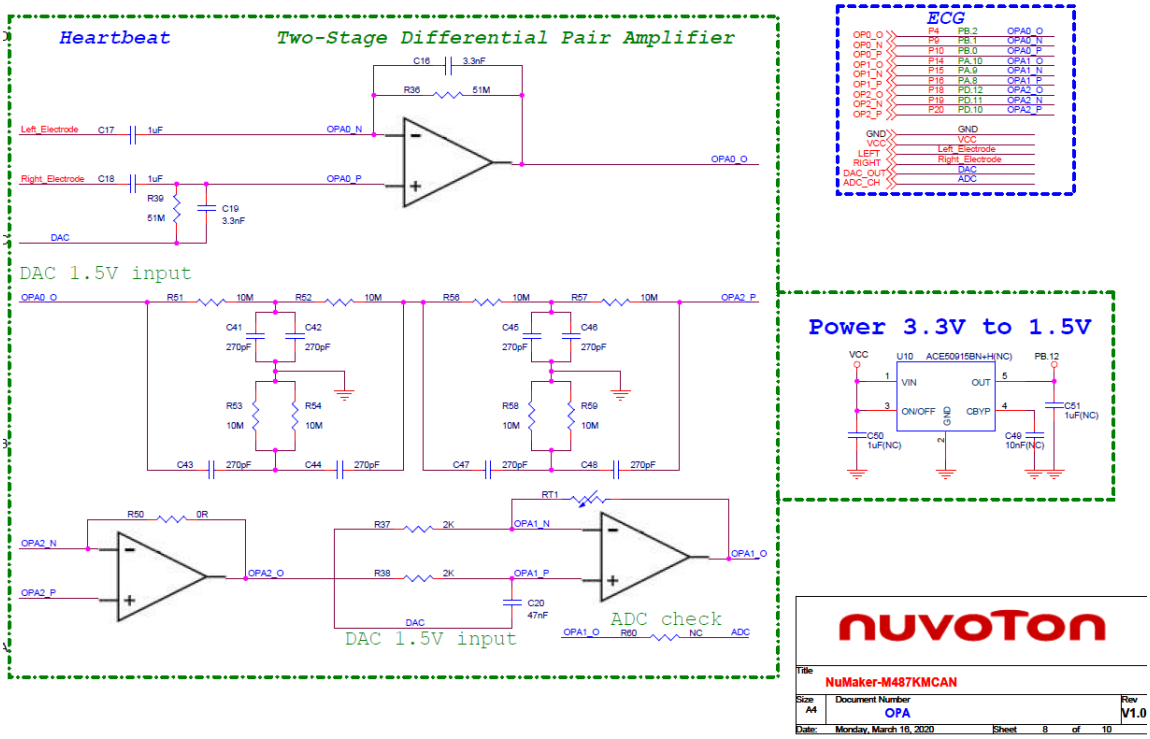

Figure 4-9 Heartbeat Sensor Circuits

5 REVISION HISTORY

Date	Revision	Description
2020.04.30	1.00	1. Initially issued.

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

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