NETMF for MBED NUCLEO

History

Rev 0.10	2016/03/21	For .NET Micro Framework 4.4. Build system worked. Supported only timer, serial and gpio.
Rev 0.20	2016/05/13	Added NetmfComCheck.exe utility.

Contents

1. Overview

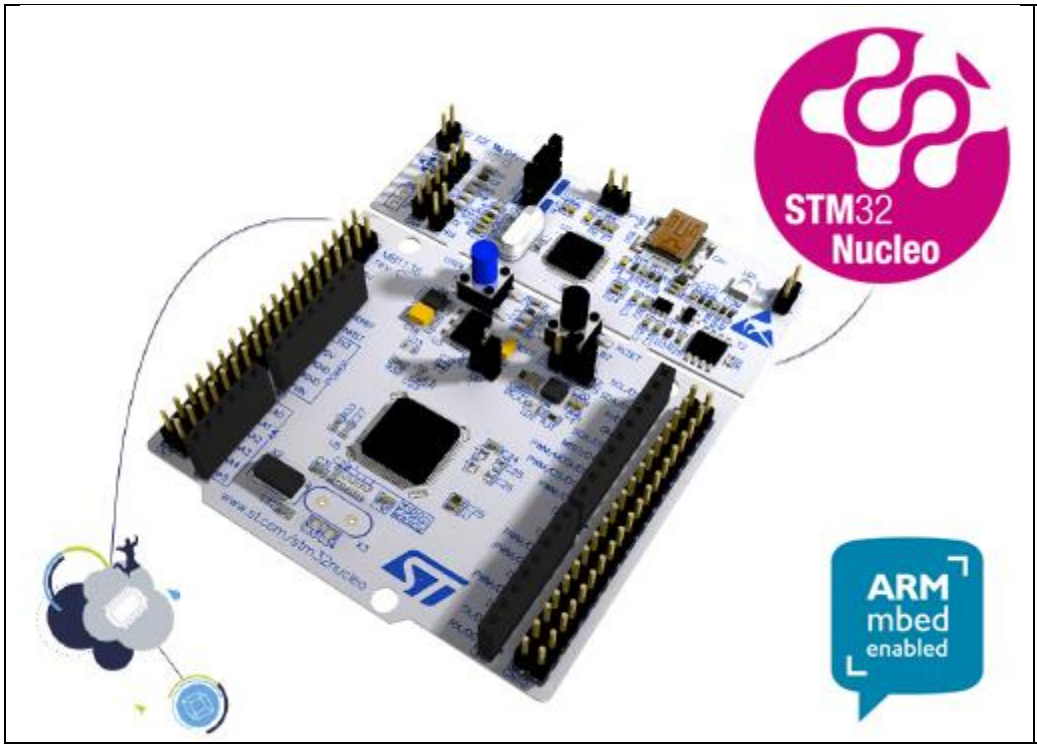
NETMF for MBED is targeted for MBED boards. The porting is being done, based on MBED SDK source files as much as possible (now no longer used).

This version supports

- NUCLEO F401RE
- NUCLEO L476RG
-

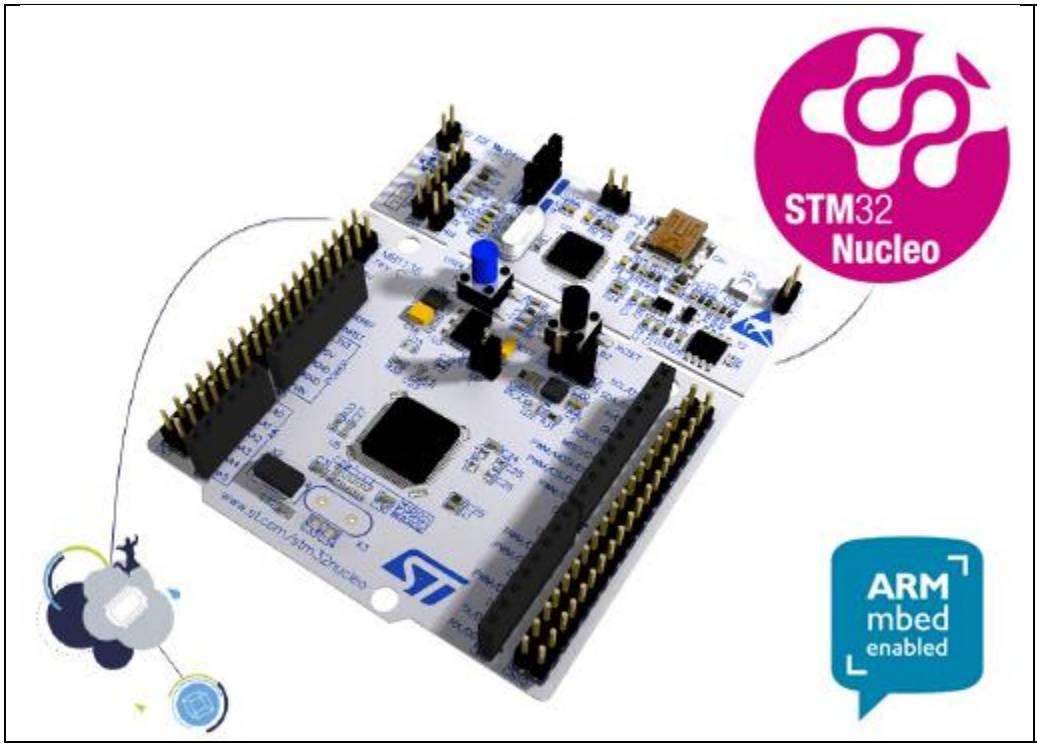
1.1. NUCLEO F401RE

http://www.st.com/web/catalog/tools/FM116/SC959/SS1532/LN1847/PF260000?icmp=nucleo-ipf_pron_pr-nucleo_feb2014&sc=nucleoF401RE-pr#



1.2. NUCLEO L476RG

http://www.st.com/web/catalog/tools/FM116/CL1620/SC959/SS1532/LN1847/PF261636?icmp=pf261636_pron_pr_sep2015&sc=nucleo-l476rg



2. How to use

2.1. NETMF 4.4 SDK Installation

- Execute MicroFrameworkSDK.MSI included in release\sdk folder.

Or download SDK installer from the following URL and execute it.

- https://github.com/NETMF/netmf-interpreter/releases/tag/v4.4-RTW-20-Oct-2015
-

2.2. Add DLL files

As of Today, there are no additional DLL files. Please skip this step.

- Add DLL files to C:\Program Files (x86)\Microsoft .NET Micro Framework\v4.4

2.3. Visual Studio Addon Installation

- For VS2013, Install NetmfVS2013.vsix
- For VS2015, Install NetmfVS14.vsix

2.4. Connect USB cable from PC and write firmware file

Connect USB cable to USB connector of the board,

- Copy tinyclrbnbl.bin on mapped drive.

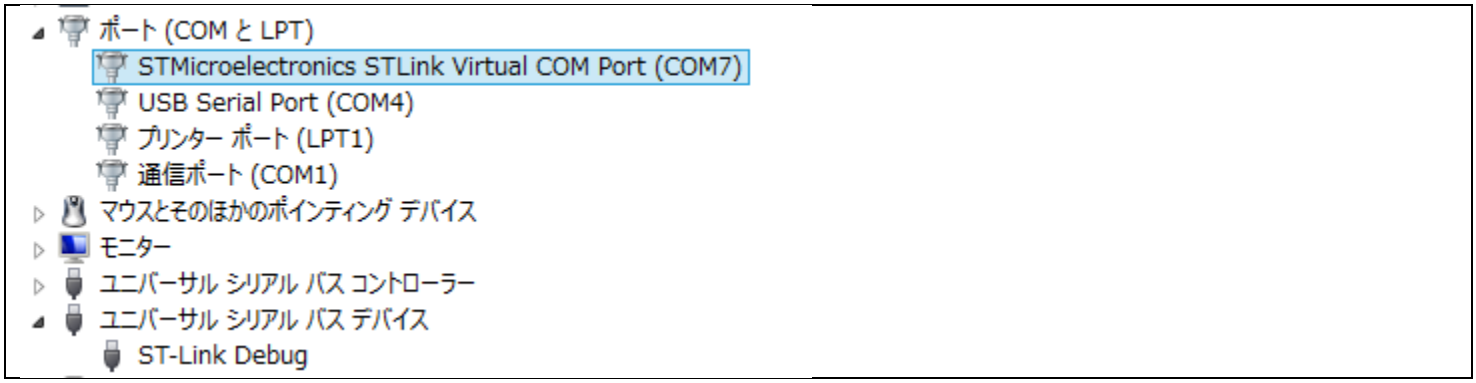
Execute NetmfComCheck utility included in release\tools folder in command prompt, push a reboot button of the board and check if correct boot messages are displayed.

Close command prompt to release virtual COM port.

```
C:\wkndeng\netmf-interpreter>netmfcomcheck
Serial ports:
COM1
COM7
Choose one:COM7
.NetMF v4.4.0.0
NUCLEOL476RG, Build Date:
       May 13 2016 11
:31:09
GNU Compiler version 4

TinyCLR (Build 4.4.0.0)

Starting
...
Created EE.
Start
ed Hardware.
MSdbgV1
?4
 Loading start at 803b570, end 804fb84

   Assembly: mscorlib (4.4.0.0)     Assembly: Microsoft.SPOT.Native (4
.4.0.0)     Assembly: Microsoft.SPOT.Hardware (4.4.0.0)
   Assembly: Microsoft.SPOT.Hardwar
e.Usb (4.4.0.0)
    Assembly: Microsoft.SPOT.Hardware.SerialPort (4.4.0.0)
   Assembly: Windows.Devices (4.4.0.0)     Assembly: Microsoft.SP
OT.Hardware.NUCLEOF401RE (4.4.0.0)  Loading Deployment Assemblies.

Attaching deployed file.
   Assembly: NetmfFan.Board.
NUCLEOL47
6RG (4.4.0.0)  Attaching deployed file.
   Assembly: SampleLED (1.0.0.0)  Resolving.

Ready.
```

2.5. Reboot and Check COM port number

- Check COM port number of STMicroelectronics STLink Virtual COM Port.
- The following example, the COM port is COM7.



- At default, the Virtual COM port is connected to PIN D0 and D1. Therefore D0 and D1 can not be used. There is workaround to change the connection of the Virtual COM port using frying wire.

2.6. Start Visual Studio 2015 or 2013

- Create Netmf program.

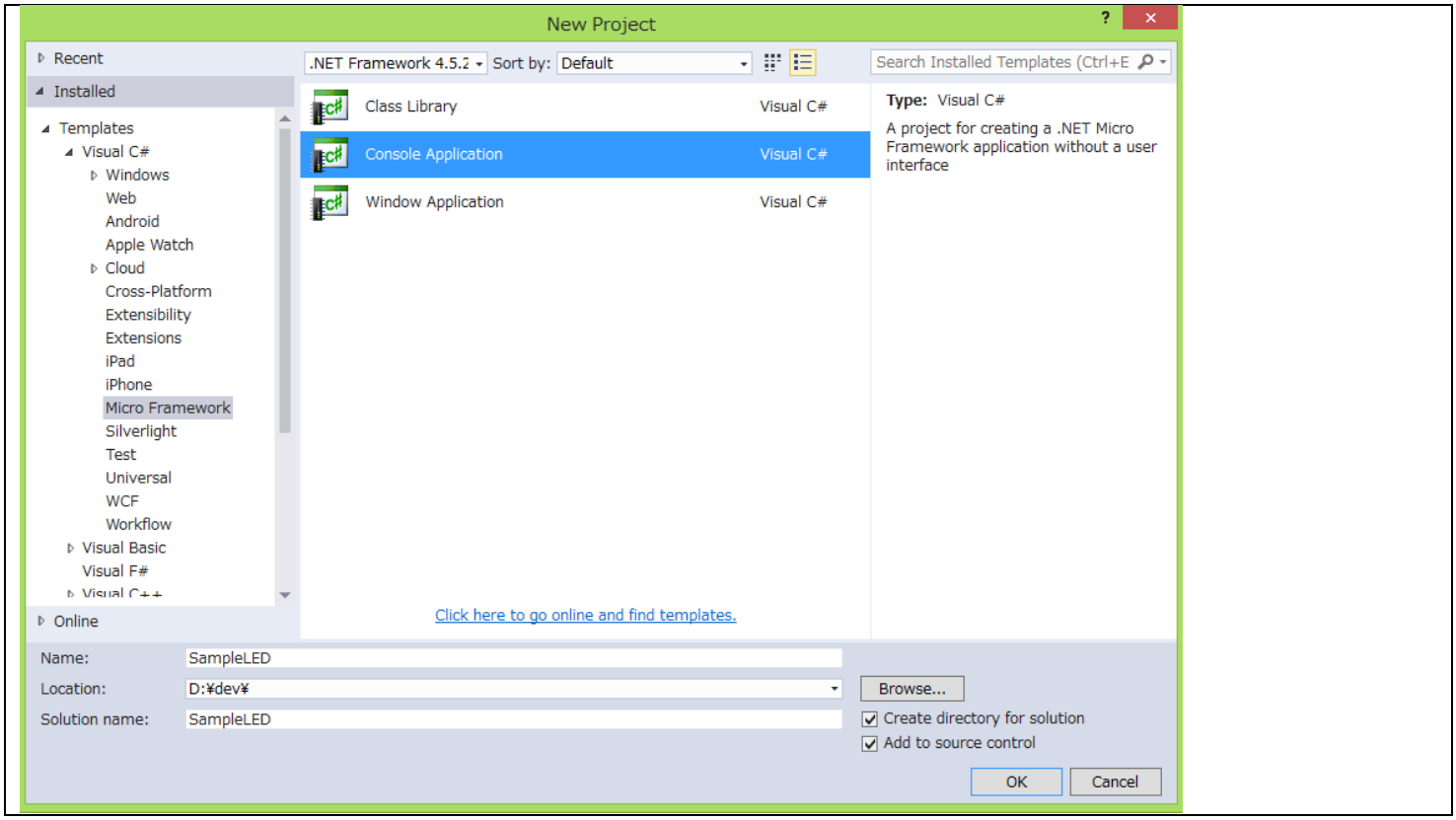
2.7. Example (SampleLED)

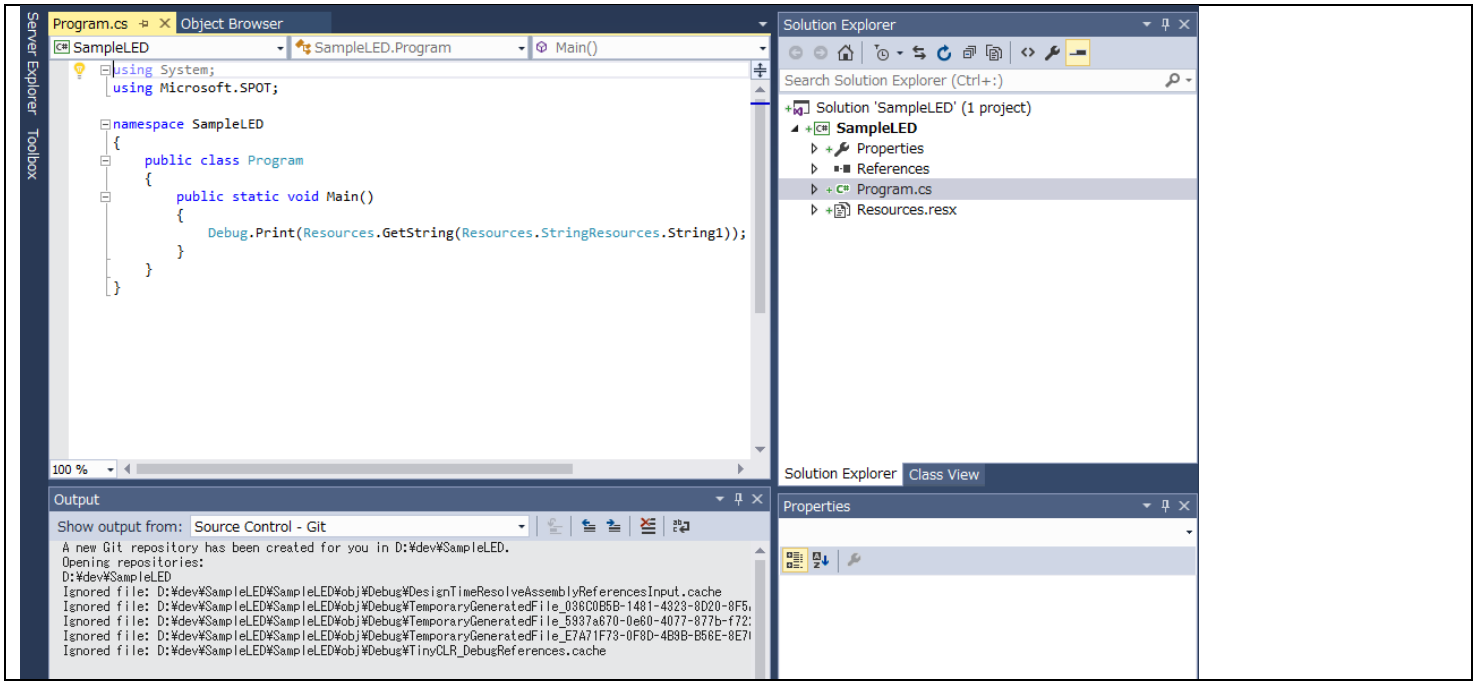
2.7.1. Launch Visual Studio 2013 or 2015

Select File - New - Project

Select Visual C# - Micro Framework, Console Application as a template.

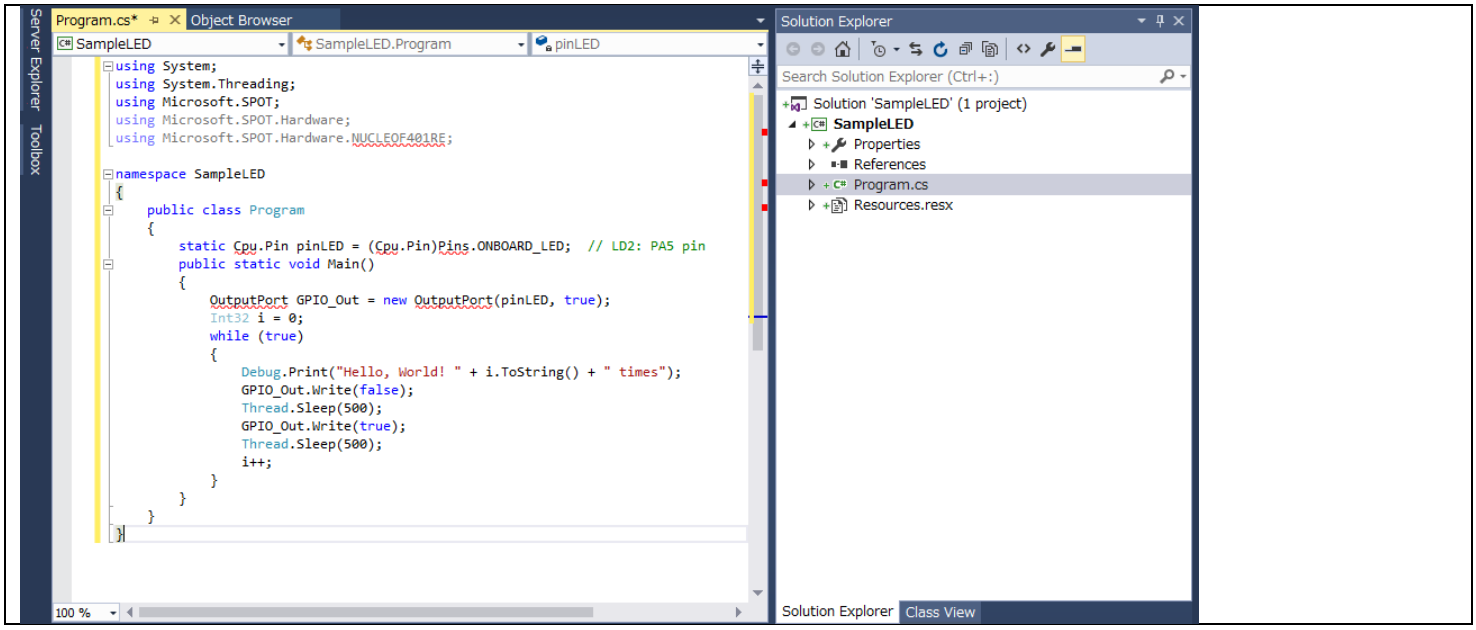
Input “SampleLED” as project name and solution name.





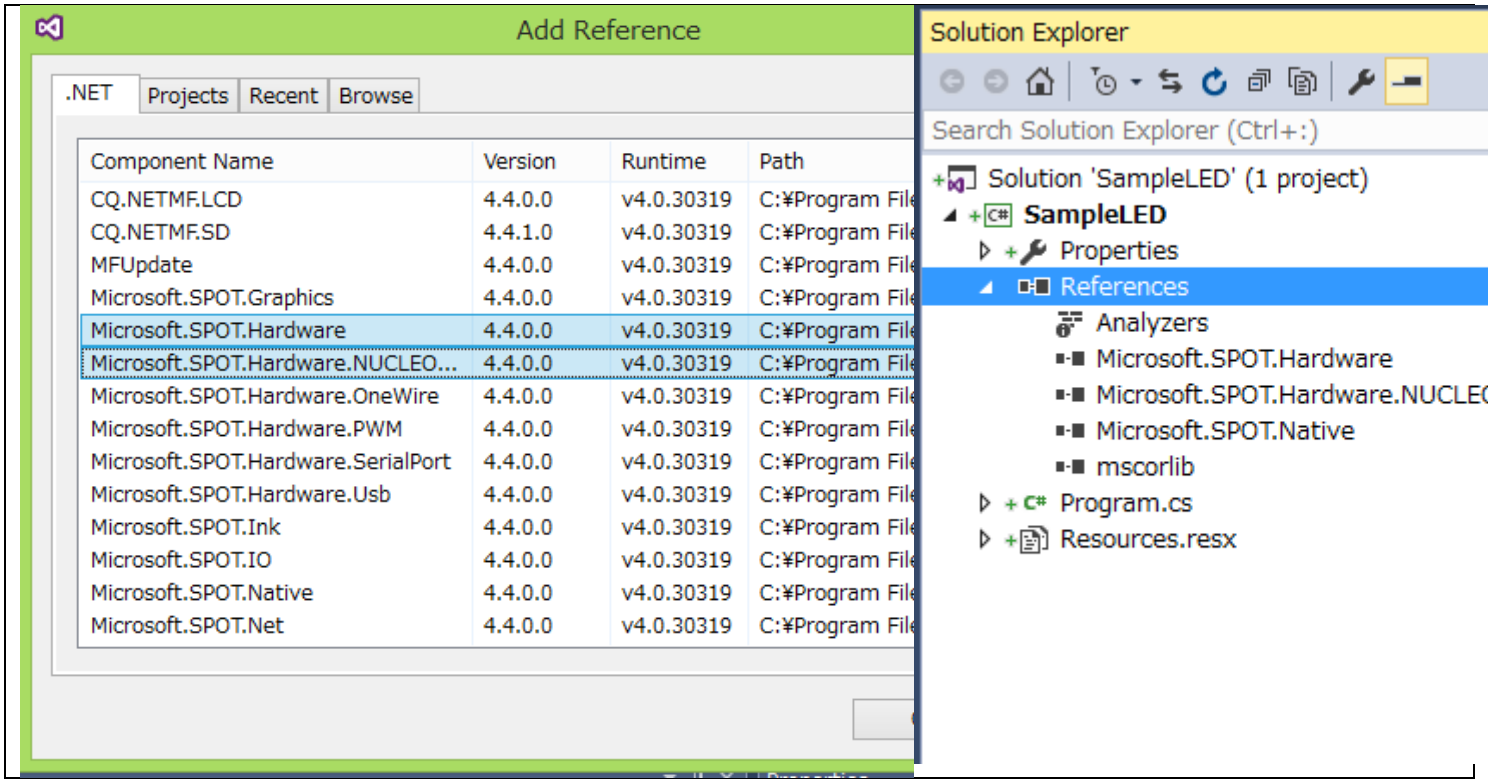
2.7.2. Enter program

```
using System;
using System.Threading;
using Microsoft.SPOT;
using Microsoft.SPOT.Hardware;
using Microsoft.SPOT.Hardware.NUCLEOF401RE;

namespace SampleLED
{
    public class Program
    {
        static Cpu.Pin pinLED = (Cpu.Pin)Pins.ONBOARD_LED;  // LD2: PA5 pin
        public static void Main()
        {
            OutputPort GPIO_Out = new OutputPort(pinLED, true);
            Int32 i = 0;
            while (true)
            {
                Debug.Print("Hello, World! " + i.ToString() + " times");
                GPIO_Out.Write(false);
                Thread.Sleep(500);
                GPIO_Out.Write(true);
                Thread.Sleep(500);
                i++;
            }
        }
    }
}
```



2.7.3. Add references

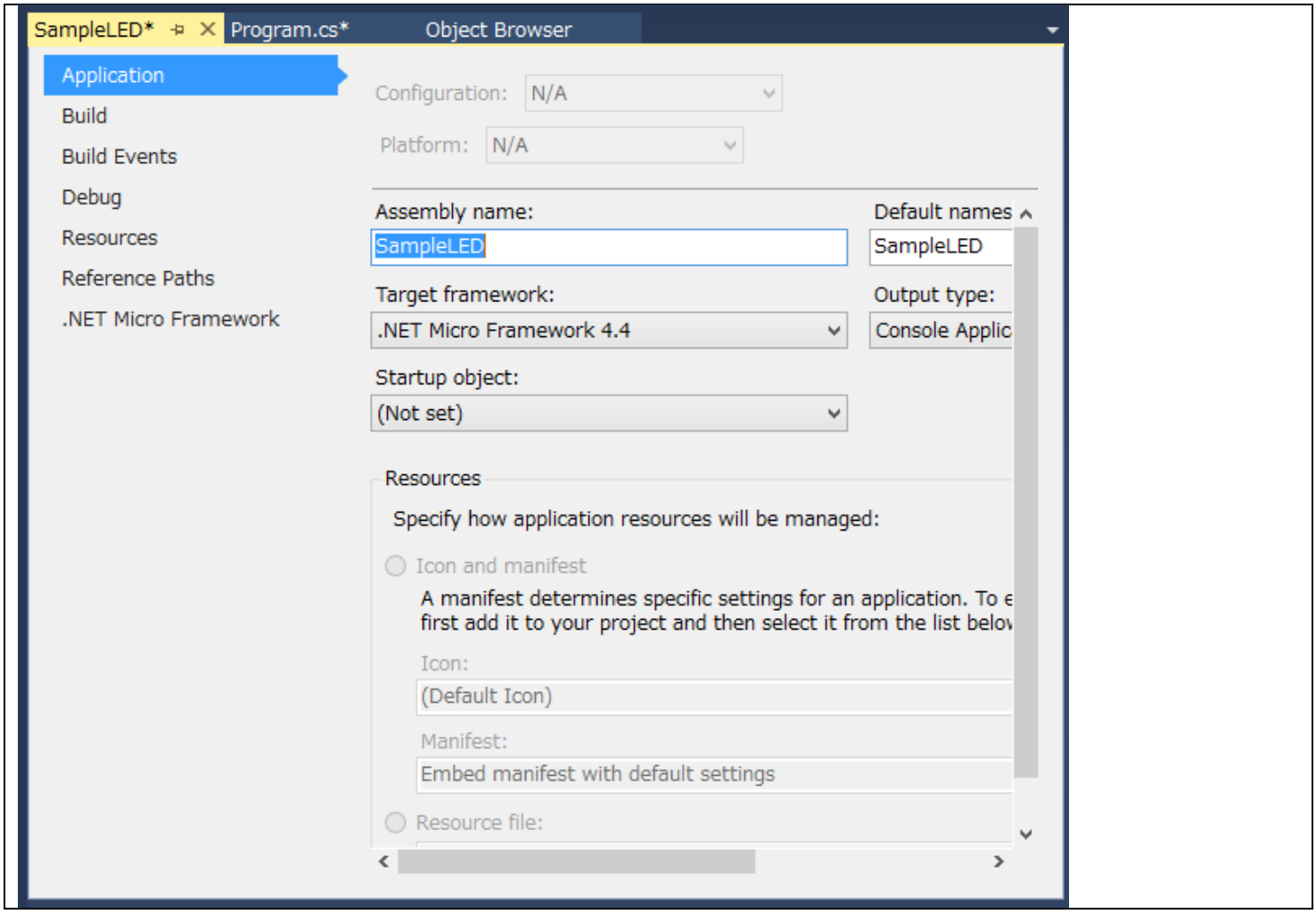
Right Click “References” in Solution Explorer and add Microsoft.SPOT.Hardware and NetmfFan.Board.NUCLEOF401RE



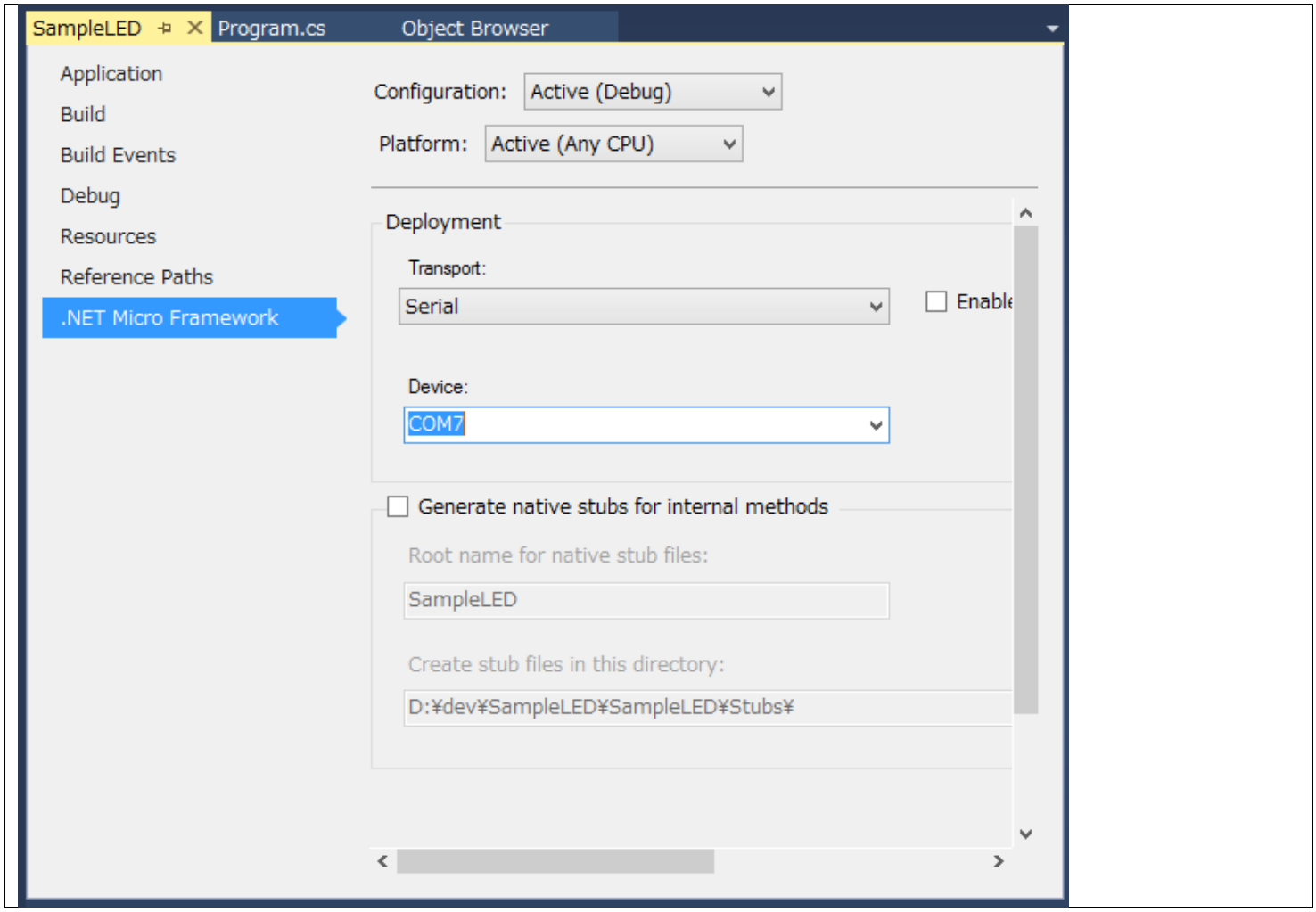
2.7.4. Confirm Property

Open Property of SampleLED and confirm configuration of “Application” and “.NET Micro Framework”.

Set Target framework as “.NET Micro Framework 4.4”

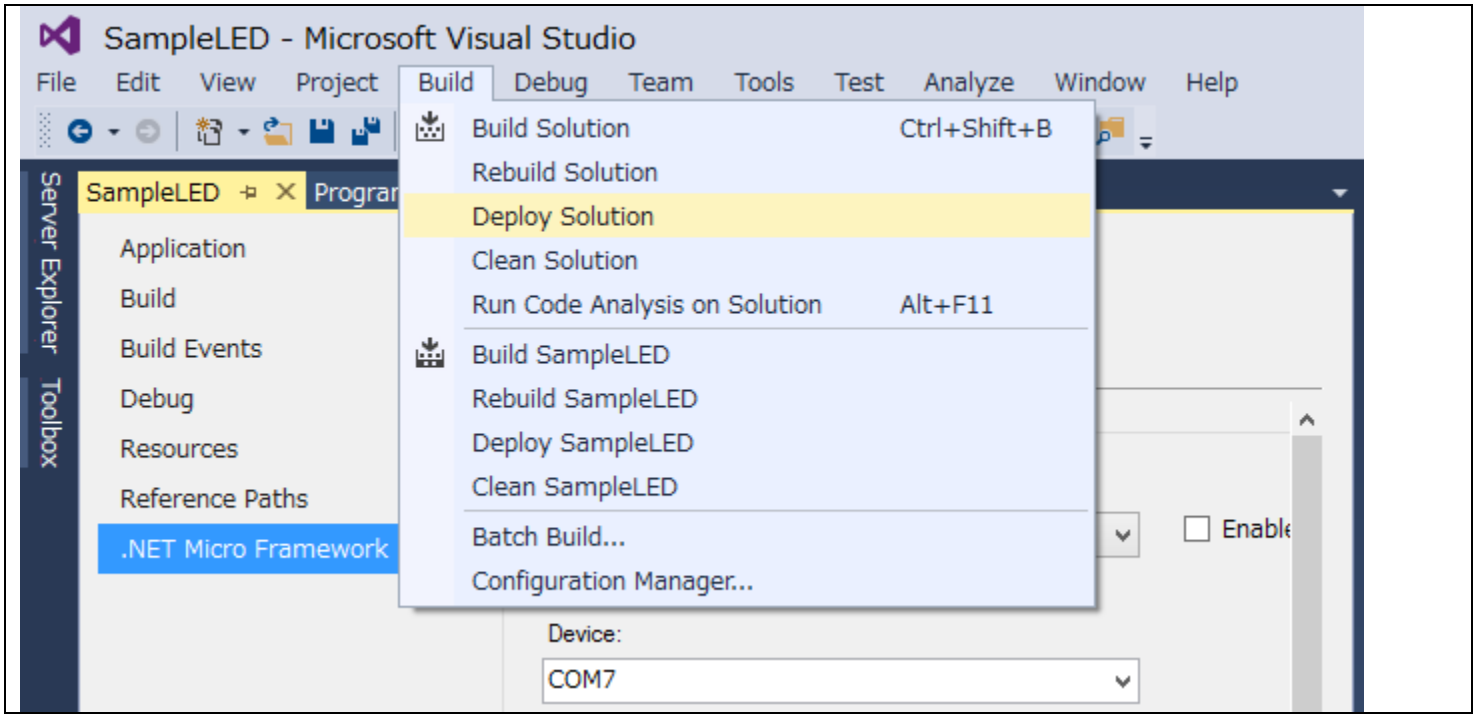


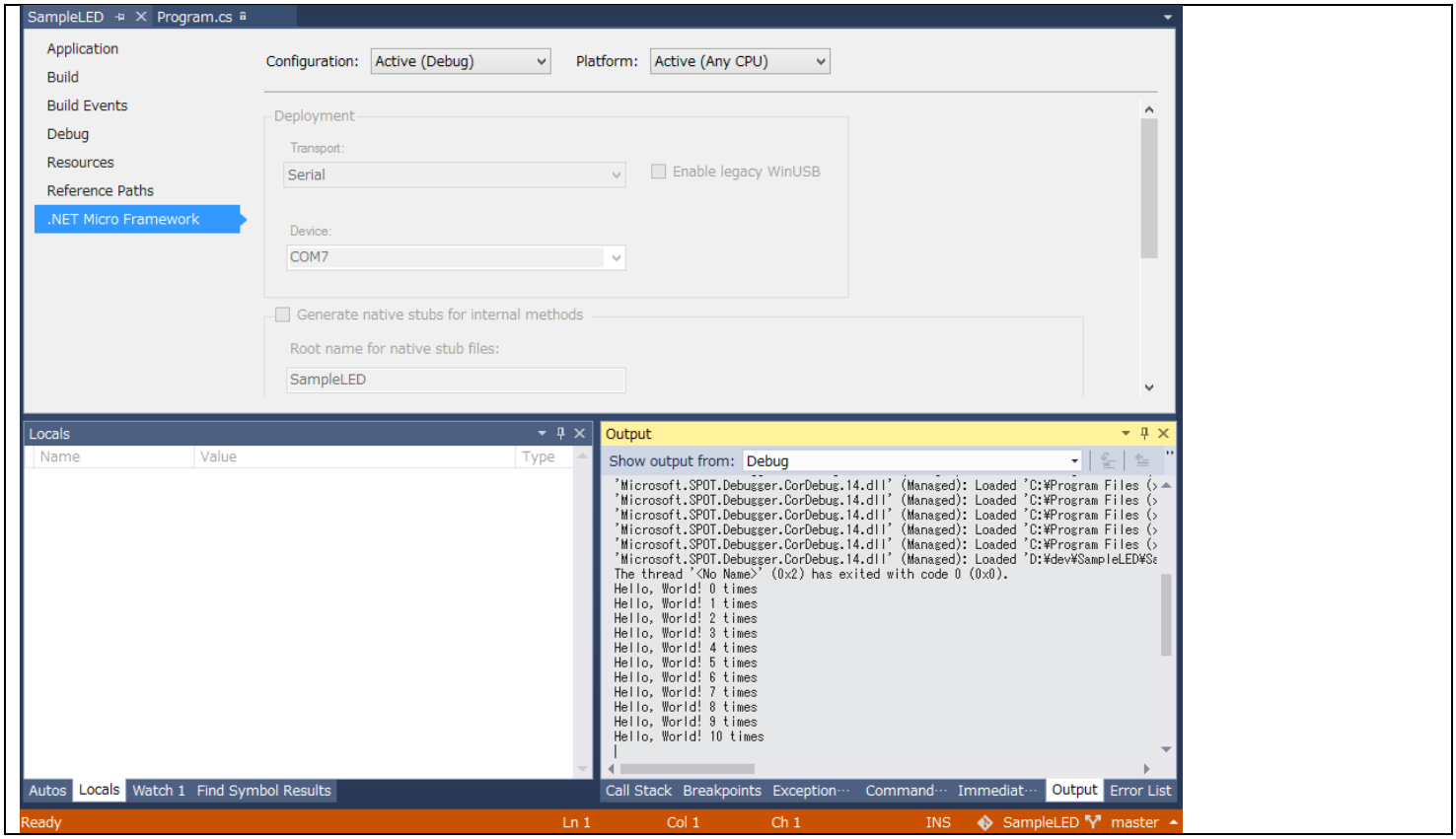
Set “Serial” in Transport of Deployment and set Virtual COM port.



2.7.5. Build and Execute

Select Build – Deploy Solution and push Start.


SampleLED - Microsoft Visual Studio
File Edit View Project Build Debug Team Tools Test Analyze Window Help
Build Solution Ctrl+Shift+B
Rebuild Solution
Deploy Solution
Clean Solution
Run Code Analysis on Solution Alt+F11
Build SampleLED
Rebuild SampleLED
Deploy SampleLED
Clean SampleLED
Batch Build...
Configuration Manager...
Server Explorer
Toolbox
SampleLED
Application
Build
Build Events
Debug
Resources
Reference Paths
.NET Micro Framework
Device:
COM7


SampleLED Program.cs
Application
Build
Build Events
Debug
Resources
Reference Paths
.NET Micro Framework
Configuration: Active (Debug)
Platform: Active (Any CPU)
Deployment
Transport:
Serial
Enable legacy WinUSB
Device:
COM7
Generate native stubs for internal methods
Root name for native stub files:
SampleLED
Locals
Name Value Type
Output
Show output from: Debug
'Microsoft.SPOT.Debugger.CorDebug.14.dll' (Managed): Loaded 'C:¥Program Files (
The thread '<No Name>' (0x2) has exited with code 0 (0x0).
Hello, World! 0 times
Hello, World! 1 times
Hello, World! 2 times
Hello, World! 3 times
Hello, World! 4 times
Hello, World! 5 times
Hello, World! 6 times
Hello, World! 7 times
Hello, World! 8 times
Hello, World! 9 times
Hello, World! 10 times
Autos Locals Watch 1 Find Symbol Results
Call Stack Breakpoints Exception··· Command··· Immediat··· Output Error List
Ready Ln 1 Col 1 Ch 1 INS SampleLED master

3. NUCLEO F401RE

3.1. Specification

Function	NUCLEO F401RE	Notes
RAM	96KB	Available Heap Memory Size about 48KB
FLASH	512KB	Available Flash Memory Size 128KB (0x08060000-0x08080000)
GPIO	○	See Pin Information
Serial	6 (COM1-COM6)	COM2: Default COM port to connect PC
SPI	3 channels	SPI1 (PA5, PA6, PA7), SP2 (PA13, PA14, PA15), SP3 (PC10, PC11. PC12)
I2C	1 channel	SDA: PB9, SCL: PB8
PWM	TBD	
Analog	7	PA1, PA2, PA3, PB0, PB1, PC4, PC5
USB function	N/A	Not built.

3.2. Pin Information

CN No.	Pin No.	Pin name	MCU pin	Function
Left connectors				
CN6 power	1	NC	-	-
	2	IOREF	-	3.3V Ref
	3	RESET	NRST	RESET
	4	+3V3	-	3.3V input/output
	5	+5V	-	5V output
	6	GND	-	Ground
	7	GND	-	Ground
	8	VIN	-	Power input
CN8 analog	1	A0	PA0	ADC1_0
	2	A1	PA1	ADC1_1
	3	A2	PA4	ADC1_4
	4	A3	PB0	ADC1_8
	5	A4	PC1 or PB9(1)	ADC1_11 (PC1) or I2C1_SDA (PB9)
	6	A5	PC0 or PB8(1)	ADC1_10 (PC0) or I2C1_SCL (PB8)
Right connectors				
CN5 digital	10	D15	PB8	I2C1_SCL
	9	D14	PB9	I2C1_SDA
	8	AREF	-	AVDD
	7	GND	-	Ground
	6	D13	PA5	SPI1_SCK

CN No.	Pin No.	Pin name	MCU pin	Function
CN5 digital	5	D12	PA6	SPI1_MISO
	4	D11	PA7	TIM1_CH1N or SPI1_MOSI
	3	D10	PB6	TIM4_CH1 or SPI1_CS
	2	D9	PC7	TIM3_CH2
	1	D8	PA9	-
CN9 digital	8	D7	PA8	-
	7	D6	PB10	TIM2_CH3
	6	D5	PB4	TIM3_CH1
	5	D4	PB5	-
	4	D3	PB3	TIM2_CH2
	3	D2	PA10	-
	2	D1	PA2	USART2_TX
	1	D0	PA3	USART2_RX

CN7 odd pins		CN7 even pins		CN10 odd pins		CN10 even pins	
Pin No.	Name	Name	Pin No.	Pin No.	Name	Name	Pin No.
1	PC10	PC11	2	1	PC9	PC8	2
3	PC12	PD2	4	3	PB8	PC6	4
5	VDD	E5V	6	5	PB9	PC5	6
7	BOOT0(1)	GND	8	7	AVDD	U5V(2)	8
9	-	-	10	9	GND	-	10
11	-	IOREF	12	11	PA5	PA12	12
13	PA13(3)	RESET	14	13	PA6	PA11	14
15	PA14(3)	+3V3	16	15	PA7	PB12	16
17	PA15	+5V	18	17	PB6	-	18
19	GND	GND	20	19	PC7	GND	20
21	PB7	GND	22	21	PA9	PB2	22
23	PC13	VIN	24	23	PA8	PB1	24
25	PC14	-	26	25	PB10	PB15	26
27	PC15	PA0	28	27	PB4	PB14	28
29	PH0	PA1	30	29	PB5	PB13	30
31	PH1	PA4	32	31	PB3	AGND	32
33	VBAT	PB0	34	33	PA10	PC4	34
35	PC2	PC1 or PB9(4)	36	35	PA2	-	36
37	PC3	PC0 or PB8(4)	38	37	PA3	-	38

1. Default state of BOOT0 is 0. It can be set to 1 when a jumper is on pin5-7 of CN7.Two unused jumpers are available on CN11 and CN12 (bottom side of the board).
2. U5V is 5 V power from ST-LINK/V2-1 USB connector and it rises before +5V
3. PA13 and PA14 share with SWD signals connected to ST-LINK/V2-1, it is not recommend to use them as IO pins if ST-LINK part is not cut.

Extracted from DM00105823.pdf

4. NUCLEO L476RG

4.1. Specification

Function	NUCLEO F401RE	Notes
RAM	128KB	Available Heap Memory Size about 84KB
FLASH	1024KB	Available Flash Memory Size 128KB (0x08060000-0x08080000)
GPIO	○	See Pin Information

Serial	5 (COM1-COM5)	COM2: Default COM port to connect PC COM1: RX-PA10, TX-PB6 COM2: RX-PA3, TX-PA2 COM3: RX-PD9, TX-PD8 COM4: RX-PC11, TX-PC10 COM5: RX-PD2, TX-PC12
SPI	3 channels	SPI1 (PA5, PA6, PA7), SP2 (PB10, PC2, PC3), SP3 (PC10, PC11. PC12)
I2C	1 channel	SDA: PB9, SCL: PB8
PWM	TBD	
Analog	7	PA1, PA2, PA3, PB0, PB1, PC4, PC5
USB function	N/A	Not built

4.2. Pin Information

CN No.	Pin No.	Pin name	MCU pin	Function
Left connectors				
CN6 power	1	NC	-	-
	2	IOREF	-	3.3V Ref
	3	RESET	NRST	RESET
	4	+3V3	-	3.3V input/output
	5	+5V	-	5V output
	6	GND	-	Ground
	7	GND	-	Ground
	8	VIN	-	Power input
CN8 analog	1	A0	PA0	ADC12_IN5
	2	A1	PA1	ADC12_IN6
	3	A2	PA4	ADC12_IN9
	4	A3	PB0	ADC12_IN15
	5	A4	PC1 or PB9(1)	ADC123_IN2 (PC1) or I2C1_SDA (PB9)
	6	A5	PC0 or PB8(1)	ADC123_IN1 (PC0) or I2C1_SCL (PB8)
Right connectors				
CN5 digital	10	D15	PB8	I2C1_SCL
	9	D14	PB9	I2C1_SDA
	8	AREF	-	AVDD
	7	GND	-	Ground
	6	D13	PA5	SPI1_SCK
	5	D12	PA6	SPI1_MISO
	4	D11	PA7	TIM17_CH1 or SPI1_MOSI
	3	D10	PB6	TIM4_CH1 or SPI1_CS

CN No.	Pin No.	Pin name	MCU pin	Function
CN5 digital	2	D9	PC7	TIM3_CH2
	1	D8	PA9	-
CN9 digital	8	D7	PA8	-
	7	D6	PB10	TIM2_CH3
	6	D5	PB4	TIM3_CH1
	5	D4	PB5	-
	4	D3	PB3	TIM2_CH2
	3	D2	PA10	-
	2	D1	PA2	USART2_TX
	1	D0	PA3	USART2_RX

CN7 odd pins		CN7 even pins		CN10 odd pins		CN10 even pins	
Pin No.	Name	Name	Pin No.	Pin No.	Name	Name	Pin No.
1	PC10	PC11	2	1	PC9	PC8	2
3	PC12	PD2	4	3	PB8	PC6	4
5	VDD	E5V	6	5	PB9	PC5	6
7	BOOT0(1)	GND	8	7	AVDD	U5V(2)	8
9	-	-	10	9	GND	-	10
11	-	IOREF	12	11	PA5	PA12	12
13	PA13(3)	RESET	14	13	PA6	PA11	14
15	PA14(3)	+3V3	16	15	PA7	PB12	16
17	PA15	+5V	18	17	PB6	PB11	18
19	GND	GND	20	19	PC7	GND	20
21	PB7	GND	22	21	PA9	PB2	22
23	PC13	VIN	24	23	PA8	PB1	24
25	PC14	-	26	25	PB10	PB15	26
27	PC15	PA0	28	27	PB4	PB14	28
29	PH0	PA1	30	29	PB5	PB13	30
31	PH1	PA4	32	31	PB3	AGND	32
33	VBAT	PB0	34	33	PA10	PC4	34
35	PC2	PC1 or PB9(4)	36	35	PA2	-	36
37	PC3	PC0 or PB8(4)	38	37	PA3	-	38

Extracted from DM00105823.pdf

5. Reference

- UM1724 User manual STM32 Nucleo-64 boards (DM00105823.pdf)