ARM® Cortex®-M0

32-bit Microcontroller

NuMicro® Family
NuTiny-SDK-Mini55
User Manual

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www.nuvoton.com

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1 OVERVIEW

NuTiny-SDK-Mini55 is the specific development tool for NuMicro® Mini55 series. The NuTiny-SDK-Mini55 can used to develop and verify the application program easily.

NuTiny-SDK-Mini55 includes two portions. One is NuTiny-EVB-Mini55 and the other is Nu-Link-Me. NuTiny-EVB-Mini55 is the evaluation board and Nu-Link-Me is its Debug Adaptor. Thus, user does not need other additional ICE or debug equipment.

1.1 GENERAL DESCRIPTION

The NuMicro® Mini55 series 32-bit microcontroller is embedded with ARM® Cortex®-M0 core for industrial control and applications which require high performance, high integration, and low cost. The Cortex®-M0 is the newest ARM® embedded processor with 32-bit performance at a cost equivalent to the traditional 8-bit microcontroller.

The Mini55 series can run up to 48 MHz and operate at 2.1V ~ 5.5V, -40℃ ~ 105℃, and thus can afford to support a variety of industrial control and applications which need high CPU performance. The Mini55 series offers 17.5K-bytes embedded program flash, size configurable Data Flash (shared with program flash), 2K-byte flash for the ISP, and 2K-byte SRAM.

Many system level peripheral functions, such as I/O Port, Timer, UART, SPI, I2C, PWM, ADC, Watchdog Timer, Analog Comparator and Brown-out Detector, have been incorporated into the Mini55 series in order to reduce component count, board space and system cost. These useful functions make the Mini55 series powerful for a wide range of applications.

Additionally, the Mini55 series is equipped with ISP (In-System Programming) and ICP (In-Circuit Programming) functions, which allow the user to update the program memory without removing the chip from the actual end product. The Mini55 series also supports In-Application-Programming (IAP) function, user switches the code executing without the chip reset after the embedded flash updated.

2 INTRODUCTION TO NUTINY-SDK-MINI55

NuTiny-SDK-Mini55 uses the Mini55LDE as the target microcontroller. Figure 2.1-1 shows the NuTiny-SDK-Mini55 for the Mini55 series, wherein the left portion is called NuTiny-EVB-Mini55 and the right portion is Debug Adaptor called Nu-Link-Me.

NuTiny-EVB-Mini55

NuTiny-EVB-Mini55 is similar to other development boards. It can be used to develop and verify applications to emulate the real behavior. The on-board chip covers Mini55 series features. The NuTiny-EVB-Mini55 can be a real system controller to design user's target systems.

Nu-Link-Me

- Debug Adaptor

The Nu-Link-Me Debug Adaptor connects your PC's USB port to the user's target system (via Serial Wired Debug Port) and allows user to program and debug embedded programs on the target hardware. To use Nu-Link-Me Debug adaptor with IAR or Keil, please refer to "Nuvoton NuMicro® IAR ICE driver user manual "or "Nuvoton NuMicro® Keil ICE driver user manual" in detail. These two documents will be stored in the local hard disk when user installs each driver.

- Virtual COM Port

The Nu-Link-Me also supports virtual COM port function. The Nu-Link-Me can be used as a USB to UART virtual COM port, which connects to on-board Mini55LDE UART0. Virtual COM port function is defaulted to off. User can turn on all of the positions of switch to enable it.

2.1 NuTiny-SDK-Mini55 (PCB Board)

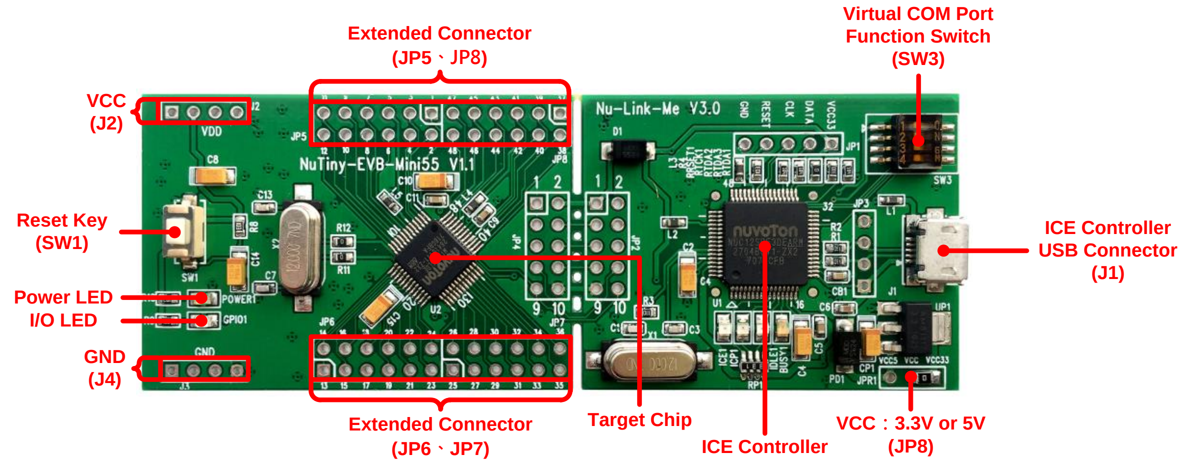


Figure 2.1-1 NuTiny-SDK-Mini55 (PCB Board)

2.2 Virtual COM Port Switch Description

The switch in Nu-Link-Me, SW3, determines that the virtual COM port function is enabled or disabled. When user turns on all of the positions of switch, the virtual COM port function will been enabled. By using virtual COM port function, user can access the USB device in the same way as it would access a standard COM port to Mini55LDE UART0. To use this function, user needs to install "VCOM Driver" at first. User can get "VCOM Driver" from NuMicroDVD in the folder "Software Utilities".

2.3 NuTiny-SDK-Mini55 Power Setting and Connector

2.3.1 Power Setting

- J1: USB port in Nu-Link-Me
- J2: V_{DD} Voltage connecter in NuTiny-EVB-Mini55

Model	JPR1	J1 USB port	J2 V_{DD}	MCU Voltage
Model 1	**Select VCC33 (default)**	**Connect to PC**	**DC 3.3V output**	**DC 3.3V**
Model 2	**Select VCC5**	**Connect to PC**	**DC 5V output**	**DC 5V**
Model 3*	**X**	**X**	**DC 2.1 V ~ 5.5 V Input**	**Voltage by J2 input**

X: Unused

Note *: Need to separate NuTiny-EVB-Mini55 and Nu-Link-Me

2.3.2 Debug Connector

- JP4: Connector in target board (NuTiny-EVB-Mini55) for connecting with Nuvoton ICE adaptor (Nu-Link-Me)
- JP2: Connector in ICE adaptor (Nu-Link-Me) for connecting with a target board (NuTiny-EVB-Mini55)

2.3.3 ICE USB Connector

- J1: Mini USB Connector in Nu-Link-Me connected to a PC USB port

2.3.4 Extended Connector

- JP5, JP6, JP7 and JP8: Show all chip pins in NuTiny-EVB-Mini55

2.3.5 Reset Button

- SW1: Reset button in NuTiny-EVB-Mini55

2.3.6 Power Connector

- J2: V_{DD} connector in NuTiny-EVB-Mini55
- J3: GND connector in NuTiny-EVB-Mini55

2.3.7 Virtual COM Port Function Switch

- SW3: Switch ON/OFF to enable or disable Nu-Link-Me virtual COM port function.

Function	Switch				Descriptions
	1	2	3	4	
Enable	ON	ON	ON	ON	Enable Nu-Link-Me virtual COM port function
Disable	OFF	OFF	OFF	OFF	Disable Nu-Link-Me virtual COM port function

2.4 Pin Assignment for Extended Connector

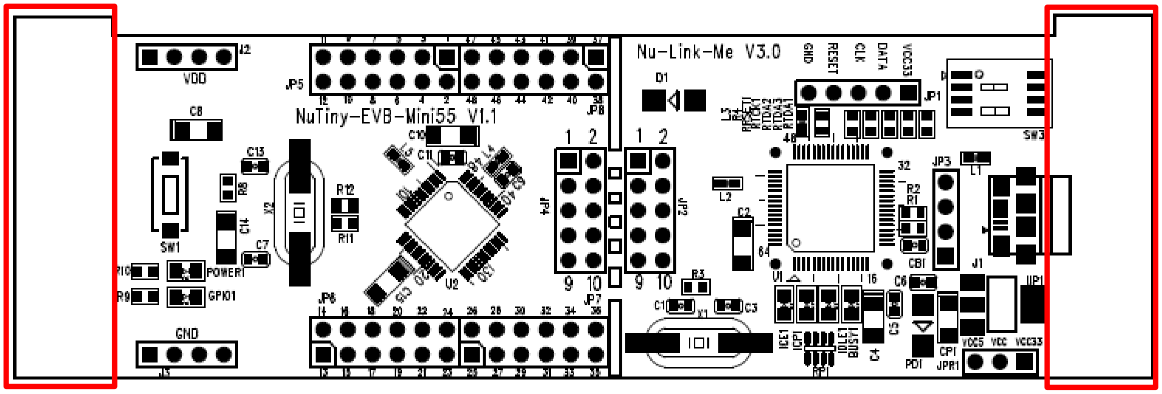
The NuTiny-EVB-Mini55 provides Mini55LDE on board and the extended connector for LQFP-48 pin. Table 2.4-1 is the pin assignment for Mini55LDE.

Pin No	Pin Function	Pin No	Pin Function
01	NC	25	P2.5, PWM3, TX1
02	P1.5, AIN5, ACMP0_P, TX1	26	P2.6, PWM4, ACMP1_O
03	nRESET	27	P2.7
04	P3.0, AIN6, ACMP1_N	28	NC
05	AV_{SS}	29	P4.6, ICE_CLK
06	P5.4, AIN8	30	P4.7, ICE_DAT
07	P3.1, AIN7, ACMP1_P	31	NC
08	P3.2, INT0, STADC, T0EX, ACMP1_P	32	P0.7, SPICLK
09	P3.4, T0, SDA, ACMP1_P, AIN9	33	P0.6, MISO
10	P3.5, T1, SCL, ACMP1_P, AIN10	34	P0.5, MOSI
11	P3.7	35	P0.4, SPISS, PWM5
12	NC	36	NC
13	NC	37	P0.1, RTSn, RX0, SPISS
14	P3.6, ACMP0_O, CKO, T1EX, AIN11	38	P0.0, CTSn, TX0
15	P5.1, XT_OUT	39	NC
16	P5.0, XT_IN	40	NC
17	V_{SS}	41	P5.3, AIN0, ADC_VREF
18	LDO_CAP	42	V_{DD}
19	P5.5	43	AV_{DD}
20	P5.2, INT1	44	P1.0, AIN1, ACMP0_P
21	NC	45	P1.2, AIN2, RX, ACMP0_P
22	P2.2, PWM0	46	P1.3, AIN3, TX, ACMP0_P, INT0
23	P2.3, PWM1	47	P1.4, AIN4, ACMP0_N, RX1
24	P2.4, PWM2, RX1	48	P1.6

Table 2.4-1 Pin Assignment for Mini55LDE

2.5 NuTiny-SDK-Mini55 PCB Placement

User can refer to Figure 2.5-1 for the NuTiny-SDK-Mini55 PCB placements.


J2
VDD
C8
SW1
POWER1
GPIO1
GND
J3
JP5
NuTiny-EVB-Mini55 V1.1
JP8
JP6
JP7
U2
X2
R12
R11
C13
C14
C7
JP4
JP2
1 2
9 10
Nu-Link-Me V3.0
D1
GND
RESET
CLK
DATA
VCC33
JP1
SW3
JP3
L1
J1
U1
L2
C2
R3
X1
C1
C3
C4
C5
C6
R2
R1
CB1
PD1
CP1
JPR1
JP1
VCC5
VCC
VCC33

Note: The red parts are used for procedure, not in real board

Figure 2.5-1 NuTiny-SDK-Mini55 PCB Placement

3 HOW TO START NUTINY -SDK-MINI55 ON THE KEIL MVISION® IDE

3.1 Downloading and Installing Keil µVision® IDE Software

Please connect to the Keil company website (http://www.keil.com) to download the Keil µVision® IDE and install the RVMDK.

3.2 Downloading and Installing Nuvoton Nu-Link Driver

Please connect to Nuvoton NuMicro® website (http://www.nuvoton.com/NuMicro) to download the "*NuMicro® Keil µVision® IDE driver*" file. Please refer to section 6.1 for the detailed download flow. After the Nu-Link driver is downloaded, please unzip the file and execute the "*Nu-Link_Keil_Driver.exe*" to install the driver.

3.3 Hardware Setup

The hardware setup is shown as Figure 3.3-1

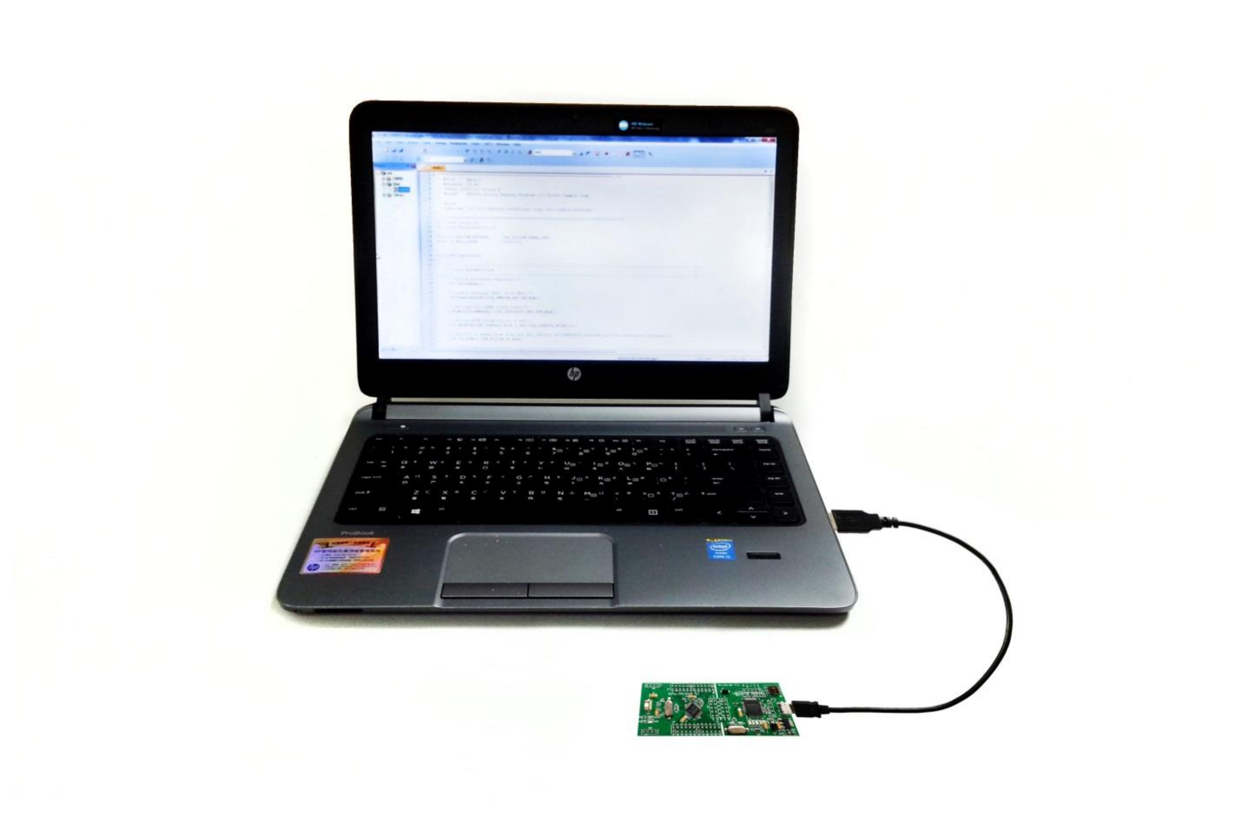
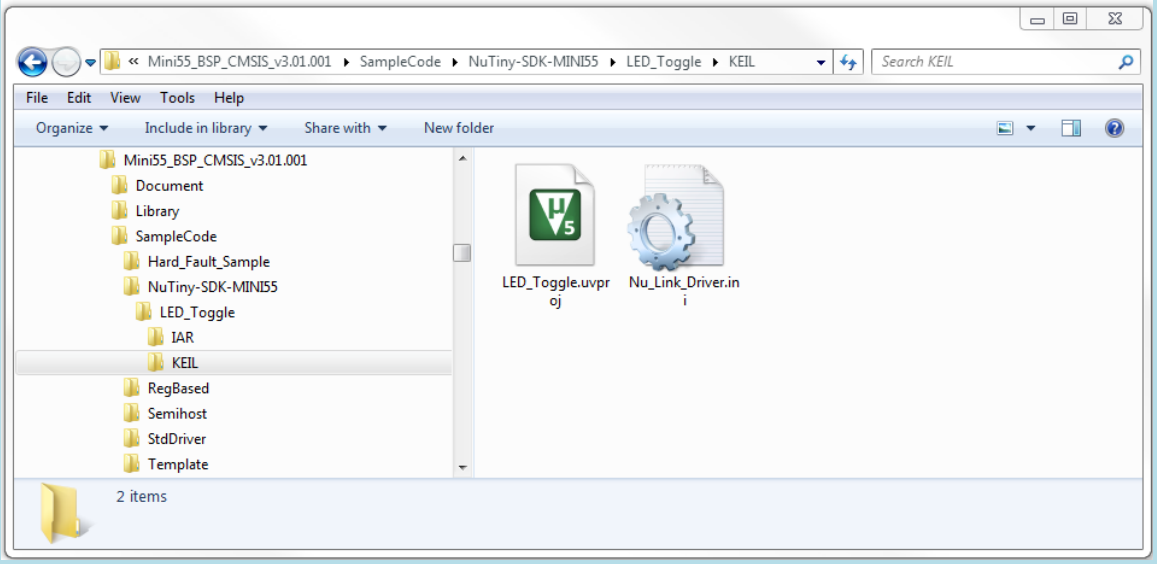


Figure 3.3-1 NuTiny-SDK-Mini55 Hardware Setup

3.4 Example Program

This example demonstrates downloading and debugging an application on a NuTiny-SDK-Mini55 board. The example file can be downloaded from Nuvoton NuMicro® website and found in the directory list shown in Figure 3.4-1.

Directory


Mini55_BSP_CMSIS_v3.01.001 ▸ SampleCode ▸ NuTiny-SDK-MINI55 ▸ LED_Toggle ▸ KEIL
Search KEIL
File Edit View Tools Help
Organize
Include in library
Share with
New folder
Mini55_BSP_CMSIS_v3.01.001
Document
Library
SampleCode
Hard_Fault_Sample
NuTiny-SDK-MINI55
LED_Toggle
IAR
KEIL
RegBased
Semihost
StdDriver
Template
LED_Toggle.uvproj
Nu_Link_Driver.ini
2 items

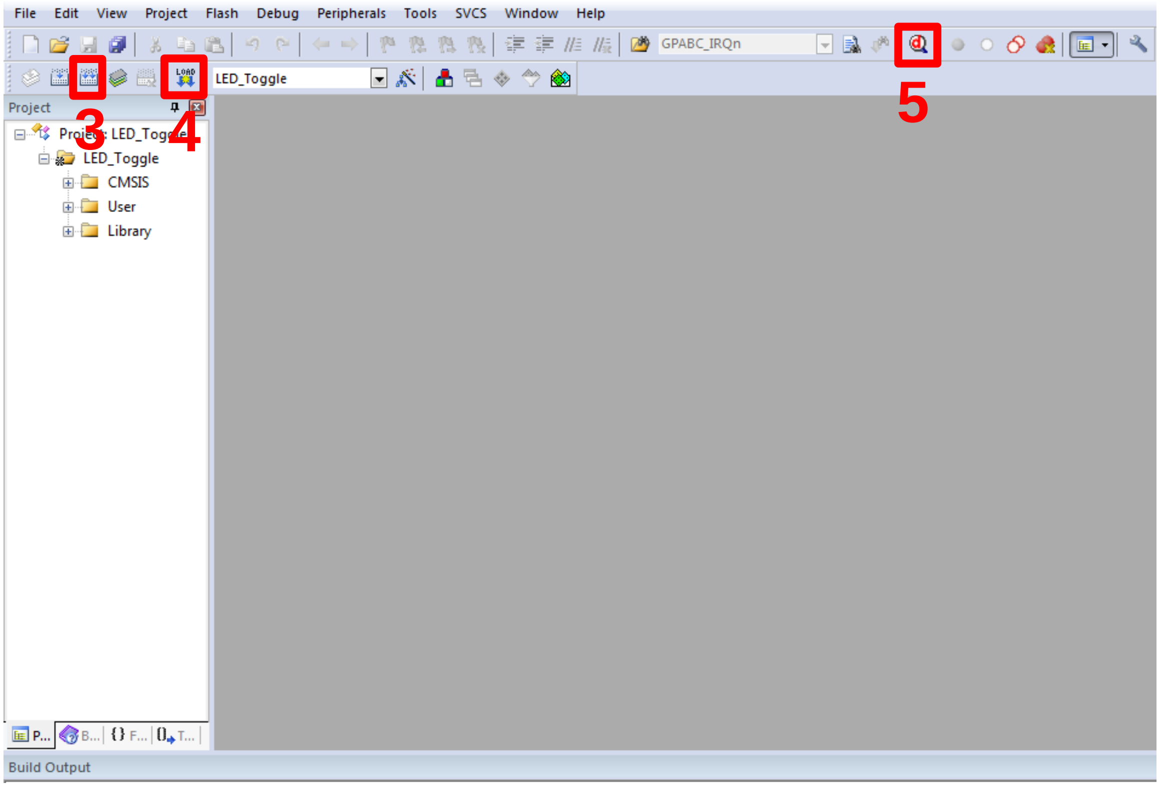
Figure 3.4-1 Example Directory

To use this example:

1. Open a project from the BSP installation folder (default as C:\Nuvoton) using the follwing path：

   \Mini55_BSP_CMSIS_v3.xx.xxx\SampleCode\NuTiny-SDK-MINI55\LED_Toggle\KEIL

2. Execute “**LED_Toggle.uvproj**”

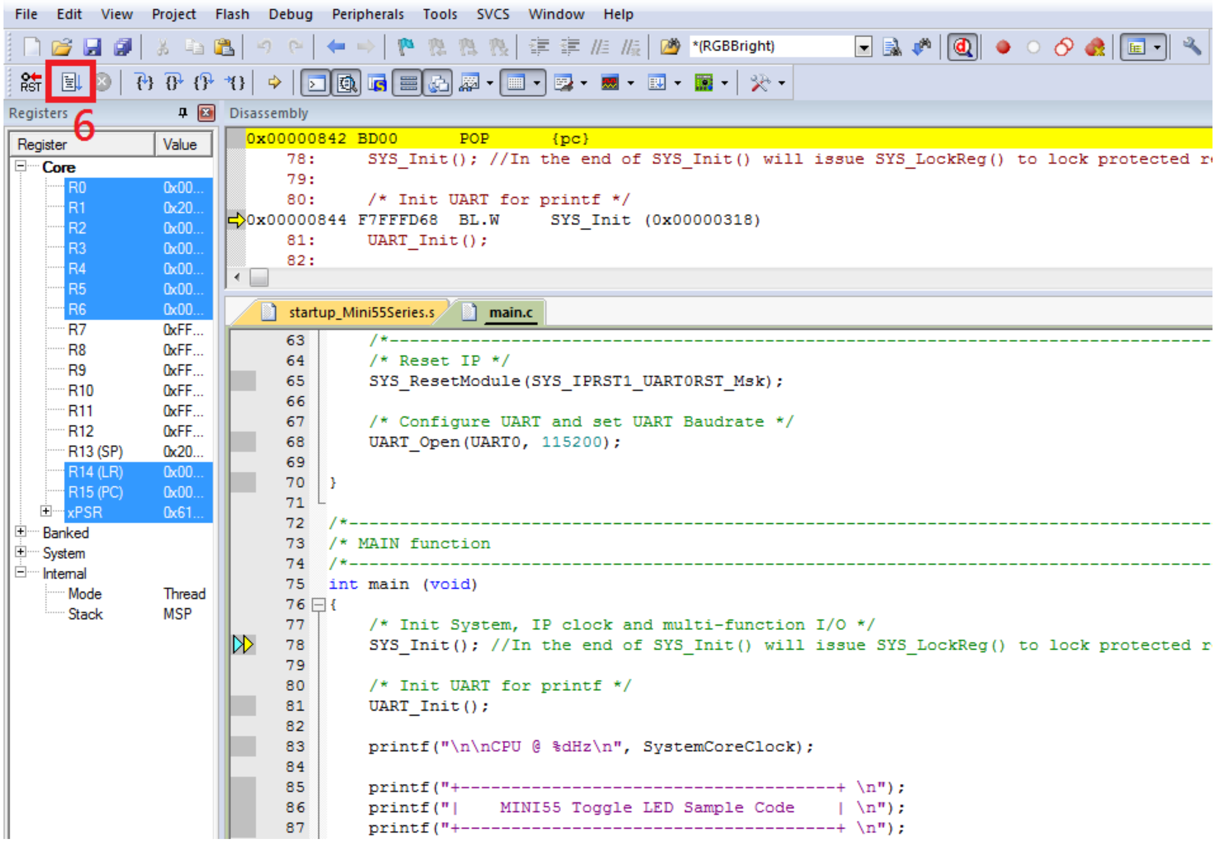

File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
GPABC_IRQn
LED_Toggle
3
4
5
Project
Project: LED_Toggle
LED_Toggle
CMSIS
User
Library
P... B... F... T...
Build Output

Enter compile mode interface

3. Compiler

4. Download the program code to Flash

5. Enter / Exit Debug mode


File
Edit
View
Project
Flash
Debug
Peripherals
Tools
SVCS
Window
Help
*(RGBBright)
RST
6
Registers
Disassembly
startup_Mini55Series.s
main.c

Register	Value
Core	
R0	0x00...
R1	0x20...
R2	0x00...
R3	0x00...
R4	0x00...
R5	0x00...
R6	0x00...
R7	0xFF...
R8	0xFF...
R9	0xFF...
R10	0xFF...
R11	0xFF...
R12	0xFF...
R13 (SP)	0x20...
R14 (LR)	0x00...
R15 (PC)	0x00...
xPSR	0x61...
Banked	
System	
Internal	
Mode	Thread
Stack	MSP

```
0x00000842 BD00      POP      {pc}
    78:     SYS_Init(); //In the end of SYS_Init() will issue SYS_LockReg() to lock protected r
    79:
    80:     /* Init UART for printf */
0x00000844 F7FFFD68  BL.W     SYS_Init (0x00000318)
    81:     UART_Init();
    82:
```

```c
    /*---------------------------------------------------------------------------------
    /* Reset IP */
    SYS_ResetModule(SYS_IPRST1_UART0RST_Msk);

    /* Configure UART and set UART Baudrate */
    UART_Open(UART0, 115200);

}

/*-------------------------------------------------------------------------------------
/* MAIN function
/*-------------------------------------------------------------------------------------
int main (void)
{
    /* Init System, IP clock and multi-function I/O */
    SYS_Init(); //In the end of SYS_Init() will issue SYS_LockReg() to lock protected r

    /* Init UART for printf */
    UART_Init();

    printf("\n\nCPU @ %dHz\n", SystemCoreClock);

    printf("+---------------------------------------+ \n");
    printf("|    MINI55 Toggle LED Sample Code      | \n");
    printf("+---------------------------------------+ \n");
```

Enter Debug mode interface

6. Execute the program
7. The I/O LED on the NuTiny-EVB-Mini55 board will be toggled on.

4 HOW TO START NUTINY -SDK-MINI55 ON THE IAR EMBEDDED WORKBENCH

4.1 Downloading and Installing IAR Embedded Workbench Software

Please connect to IAR company website (http://www.iar.com) to download the IAR Embedded Workbench and install the EWARM.

4.2 Downloading and Installing Nuvoton Nu-Link Driver

Please connect to Nuvoton NuMicro® website (http://www.nuvoton.com/NuMicro) to download the "*NuMicro® IAR EWARM Driver*" file. Please refer to section 6.2 for the detailed download flow. After the Nu-Link driver is downloaded, please unzip the file and execute the "*Nu-Link_IAR_Driver.exe*" to install the driver.

4.3 Hardware Setup

The hardware setup is shown as Figure 4.3-1.

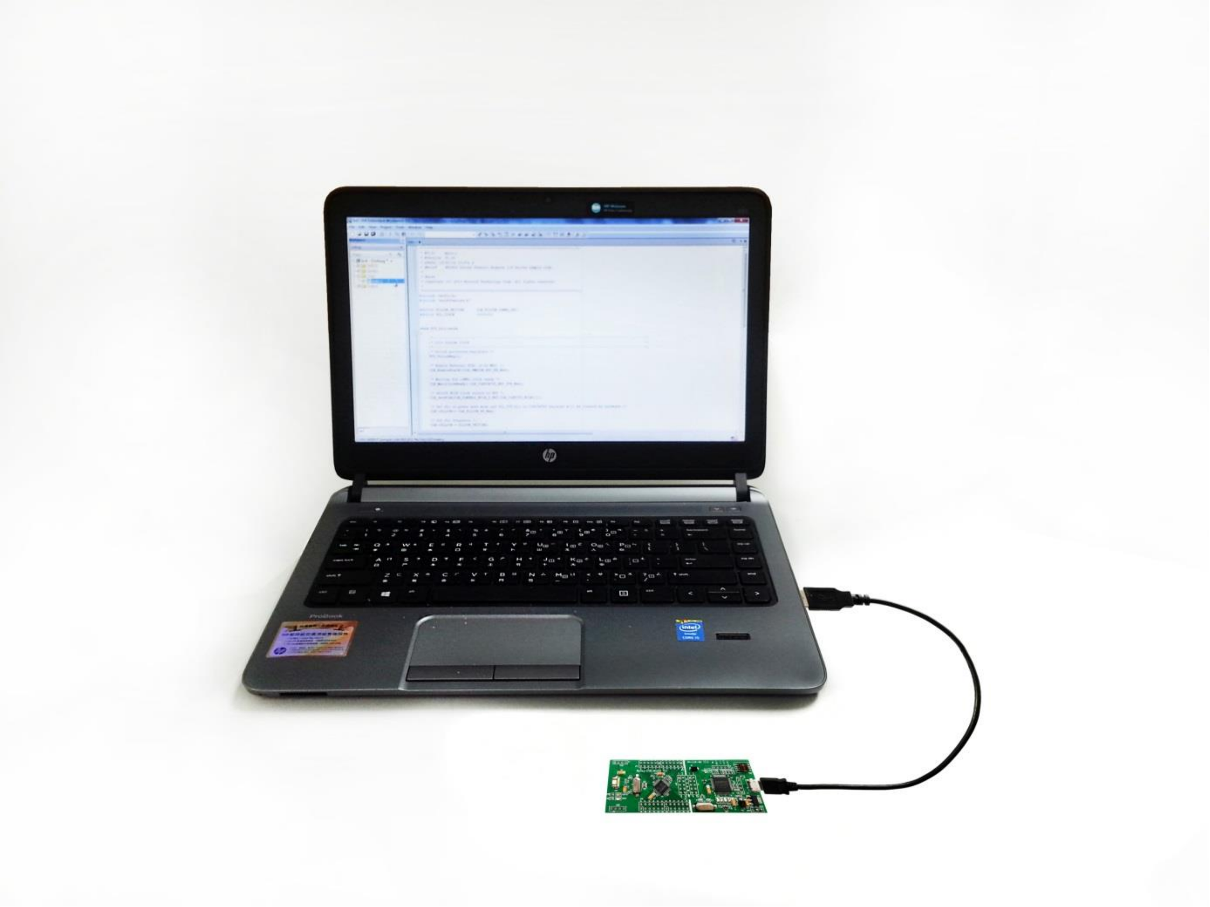
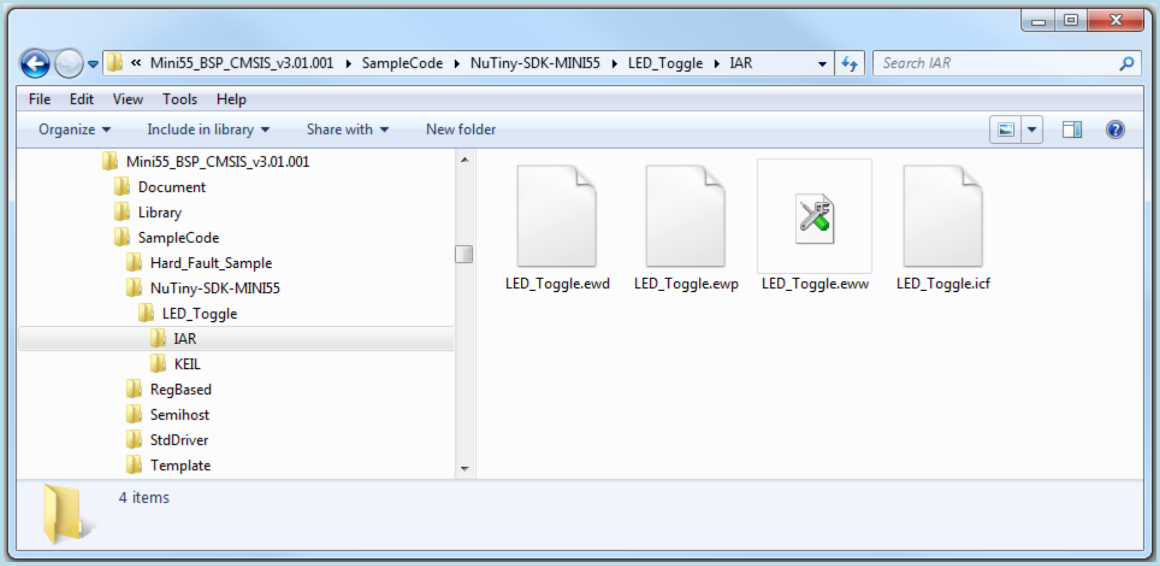


Figure 4.3-1 NuTiny-SDK-Mini55 Hardware Setup

4.4 Example Program

This example demonstrates downloading and debugging an application on a NuTiny-SDK-Mini55 board. The example file can be downloaded from Nuvoton NuMicro® website and found in the directory list shown in Figure 4.4-1.

Directory


« Mini55_BSP_CMSIS_v3.01.001 ▸ SampleCode ▸ NuTiny-SDK-MINI55 ▸ LED_Toggle ▸ IAR
Search IAR
File Edit View Tools Help
Organize ▾ Include in library ▾ Share with ▾ New folder
Mini55_BSP_CMSIS_v3.01.001
Document
Library
SampleCode
Hard_Fault_Sample
NuTiny-SDK-MINI55
LED_Toggle
IAR
KEIL
RegBased
Semihost
StdDriver
Template
LED_Toggle.ewd
LED_Toggle.ewp
LED_Toggle.eww
LED_Toggle.icf
4 items

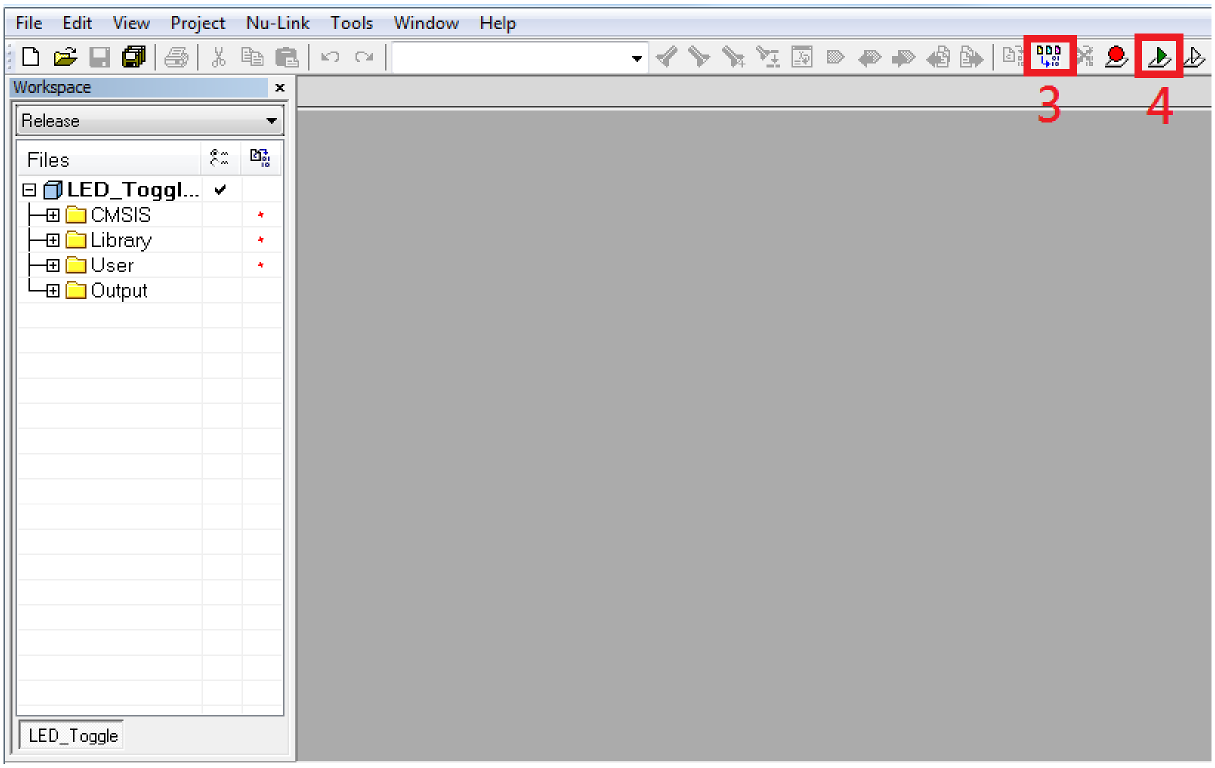
Figure 4.4-1 Example Directory

To use this example:

1. Open a project from the BSP installation folder (default as C:\Nuvoton) using the follwing path：

   \Mini55_BSP_CMSIS_v3.xx.xxx\SampleCode\NuTiny-SDK-MINI55\LED_Toggle\IAR

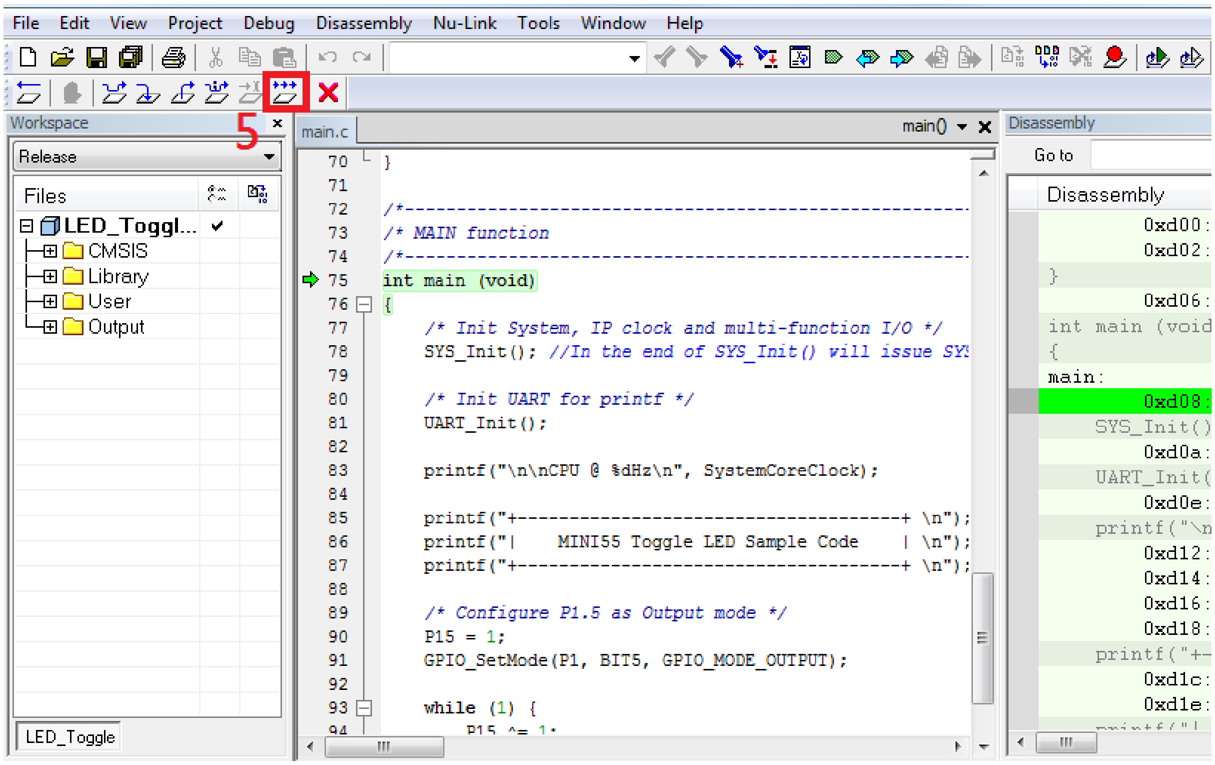
2. Execute “**LED_Toggle.eww**”


File
Edit
View
Project
Nu-Link
Tools
Window
Help
Workspace
Release
Files
LED_Toggl...
CMSIS
Library
User
Output
LED_Toggle
3
4

Enter compile mode interface

3. Compile and make

4. Download the program code to Flash and Enter Debug mode


File Edit View Project Debug Disassembly Nu-Link Tools Window Help
5
Workspace
Release
Files
LED_Toggl...
CMSIS
Library
User
Output
LED_Toggle
main.c
main()
Disassembly
Go to

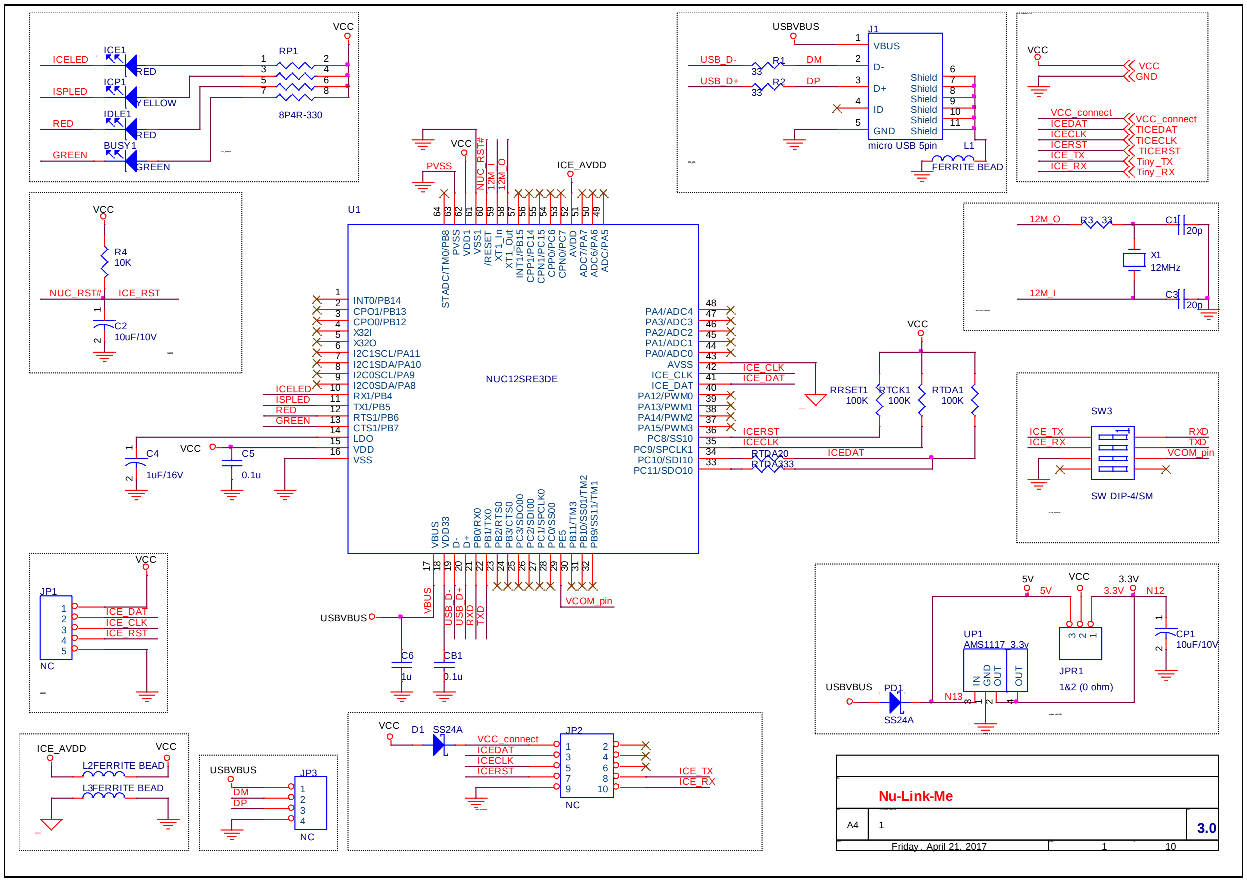
```
}

/*---------------------------------------------------------------
/* MAIN function
/*---------------------------------------------------------------
int main (void)
{
    /* Init System, IP clock and multi-function I/O */
    SYS_Init(); //In the end of SYS_Init() will issue SY

    /* Init UART for printf */
    UART_Init();

    printf("\n\nCPU @ %dHz\n", SystemCoreClock);

    printf("+-------------------------------------+ \n");
    printf("|    MINI55 Toggle LED Sample Code    | \n");
    printf("+-------------------------------------+ \n");

    /* Configure P1.5 as Output mode */
    P15 = 1;
    GPIO_SetMode(P1, BIT5, GPIO_MODE_OUTPUT);

    while (1) {
        P15 ^= 1;
```

Enter Debug mode interface

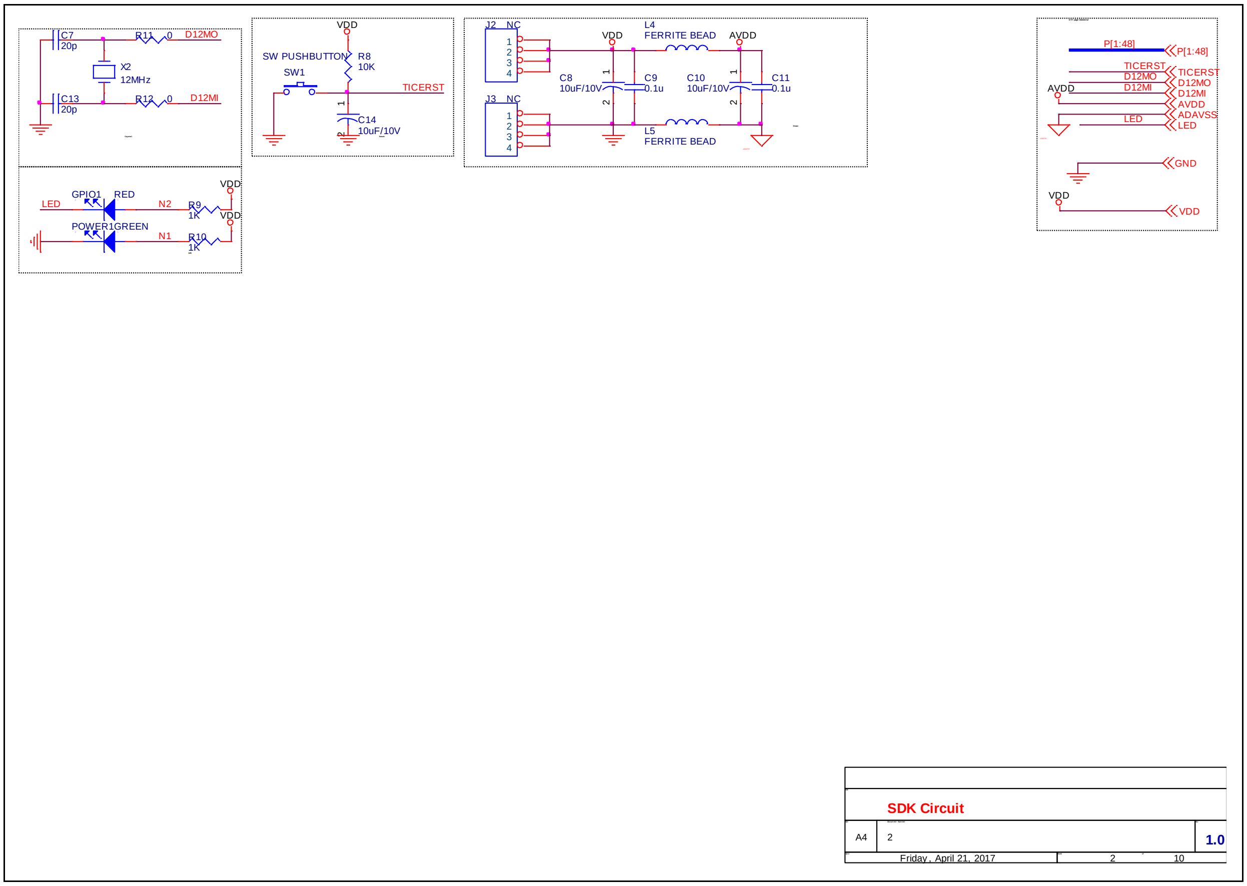
5. Execute the program
6. The I/O LED on the NuTiny-EVB-Mini55 board will be toggled on.

5 NUTINY-EVB-MINI55 SCHEMATIC

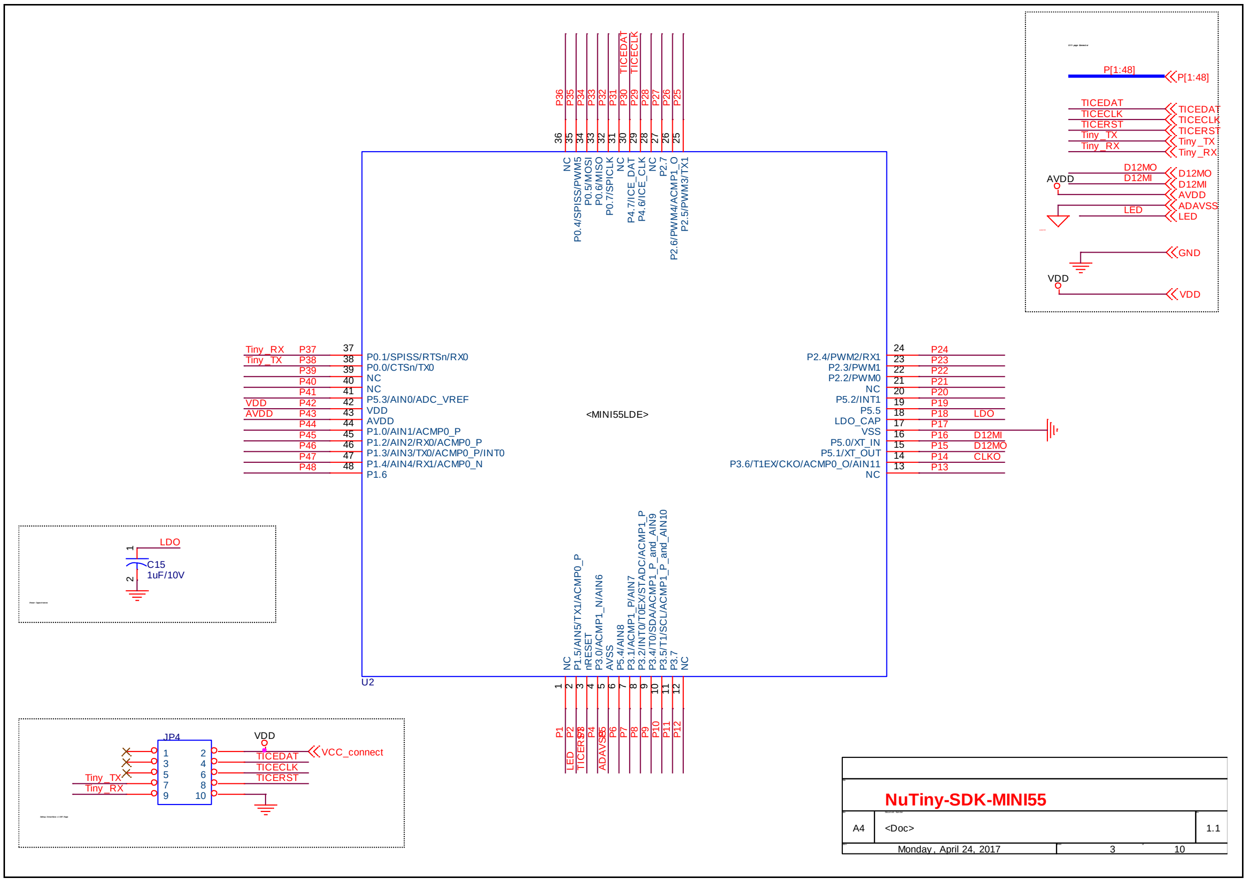
5.1 Nu-Link-Me Schematic


VCC
ICE1
ICELED
RED
RP1
8P4R-330
ICP1
ISPLED
YELLOW
IDLE1
RED
BUSY1
GREEN
USBVBUS
J1
VBUS
D-
D+
ID
GND
Shield
micro USB 5pin
USB_D-
USB_D+
R1
R2
33
DM
DP
L1
FERRITE BEAD
VCC
GND
VCC_connect
ICEDAT
ICECLK
ICERST
ICE_TX
ICE_RX
Tiny_TX
Tiny_RX
R4
10K
NUC_RST#
ICE_RST
C2
10uF/10V
U1
PVSS
NUC_RST#
12M_I
12M_O
ICE_AVDD
STADC/TM0/PB8
PVSS
VDD1
VSS1
/RESET
XT1_In
XT1_Out
INT1/PB15
CPP1/PC14
CPN1/PC15
CPP0/PC6
CPN0/PC7
AVDD
ADC7/PA7
ADC6/PA6
ADC/PA5
INT0/PB14
CPO1/PB13
CPO0/PB12
X32I
X32O
I2C1SCL/PA11
I2C1SDA/PA10
I2C0SCL/PA9
I2C0SDA/PA8
RX1/PB4
TX1/PB5
RTS1/PB6
CTS1/PB7
LDO
VDD
VSS
NUC12SRE3DE
PA4/ADC4
PA3/ADC3
PA2/ADC2
PA1/ADC1
PA0/ADC0
AVSS
ICE_CLK
ICE_DAT
PA12/PWM0
PA13/PWM1
PA14/PWM2
PA15/PWM3
PC8/SS10
PC9/SPCLK1
PC10/SDI10
PC11/SDO10
VBUS
VDD33
D-
D+
PB0/RX0
PB1/TX0
PB2/RTS0
PB3/CTS0
PC3/SDO00
PC2/SDI00
PC1/SPCLK0
PC0/SS00
PE5
PB11/TM3
PB10/SS01/TM2
PB9/SS11/TM1
C4
1uF/16V
C5
0.1u
RRSET1
RTCK1
RTDA1
100K
RTDA20
RTDA33
ICEDAT
12M_O
R3
33
C1
20p
X1
12MHz
12M_I
C3
20p
SW3
RXD
TXD
VCOM_pin
SW DIP-4/SM
JP1
ICE_DAT
ICE_CLK
ICE_RST
NC
USBVBUS
VBUS
USB_D-
USB_D+
RXD
TXD
VCOM_pin
C6
1u
CB1
0.1u
5V
3.3V
N12
UP1
AMS1117_3.3v
IN
GND
OUT
JPR1
1&2 (0 ohm)
CP1
10uF/10V
PD1
SS24A
N13
ICE_AVDD
L2FERRITE BEAD
L3FERRITE BEAD
JP3
D1
SS24A
JP2
Nu-Link-Me
A4
3.0
Friday, April 21, 2017

5.2 SDK Circuit Schematic


C7
20p
R11
0
D12MO
X2
12MHz
C13
20p
R12
0
D12MI
VDD
SW PUSHBUTTON
R8
10K
SW1
TICERST
C14
10uF/10V
J2
NC
1
2
3
4
J3
NC
VDD
L4
FERRITE BEAD
AVDD
C8
10uF/10V
C9
0.1u
C10
10uF/10V
C11
0.1u
L5
FERRITE BEAD
P[1:48]
TICERST
D12MO
D12MI
AVDD
ADAVSS
LED
GND
VDD
GPIO1
RED
N2
R9
1K
POWER1GREEN
N1
R10
1K
SDK Circuit
A4
2
1.0
Friday , April 21, 2017
2
10

5.3 NuTiny-SDK-MINI55 Schematic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TICEDAT
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NC
P0.4/SPISS/PWM5
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P0.6/MISO
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VDD
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P0.1/SPISS/RTSn/RX0
P0.0/CTSn/TX0
NC
NC
P5.3/AIN0/ADC_VREF
VDD
AVDD
P1.0/AIN1/ACMP0_P
P1.2/AIN2/RX0/ACMP0_P
P1.3/AIN3/TX0/ACMP0_P/INT0
P1.4/AIN4/RX1/ACMP0_N
P1.6
<MINI55LDE>
P2.4/PWM2/RX1
P2.3/PWM1
P2.2/PWM0
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P5.2/INT1
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VSS
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D12MI
D12MO
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P3.0/ACMP1_N/AIN6
AVSS
P5.4/AIN8
P3.1/ACMP1_P/AIN7
P3.2/INT0/T0EX/STADC/ACMP1_P
P3.4/T0/SDA/ACMP1_P_and_AIN9
P3.5/T1/SCL/ACMP1_P_and_AIN10
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LED
TICERST
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TICERST
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Tiny_RX
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ADAVSS
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1uF/10V
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NuTiny-SDK-MINI55
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Monday, April 24, 2017
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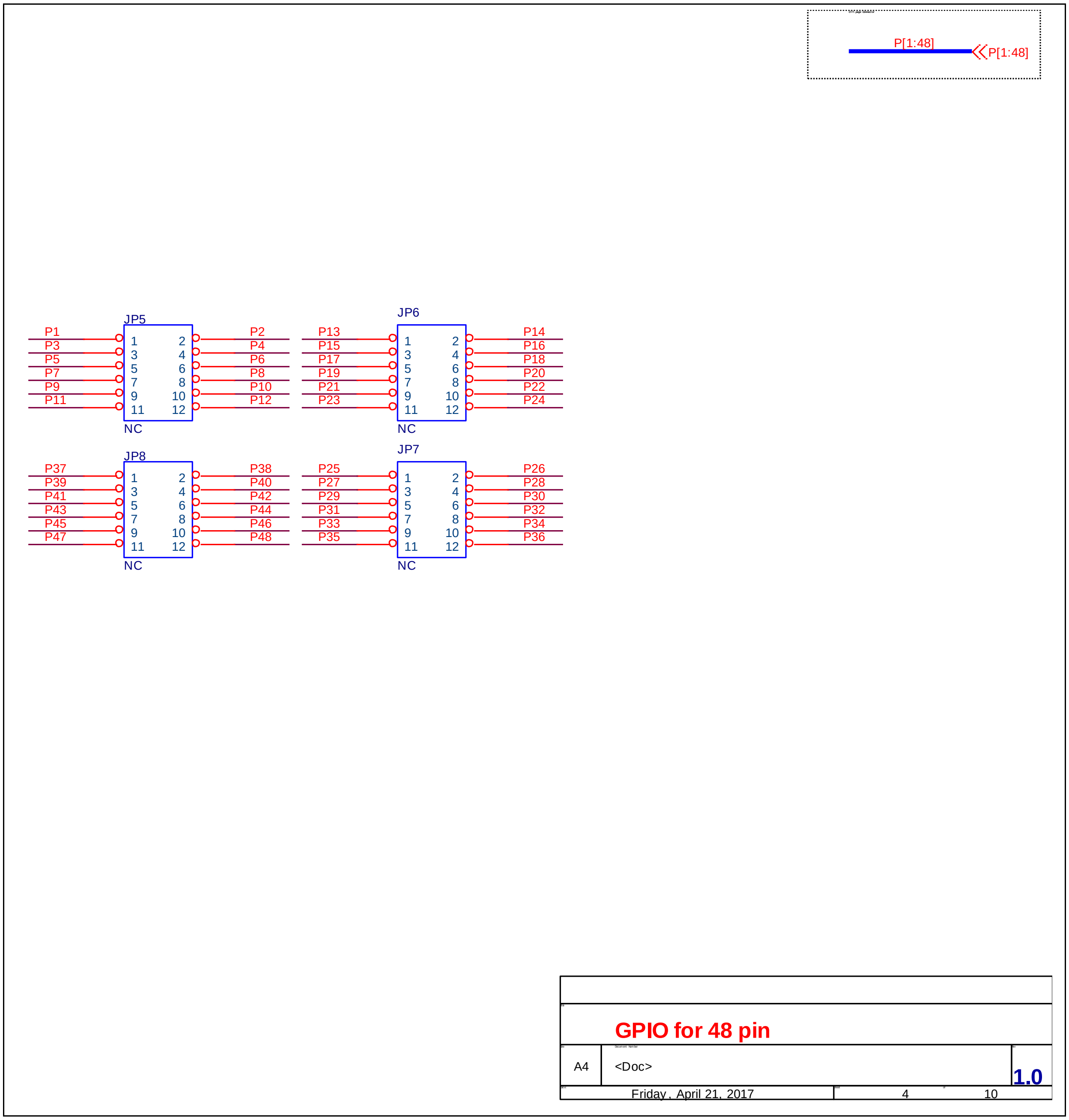
5.4 GPIO for 48 pin Schematic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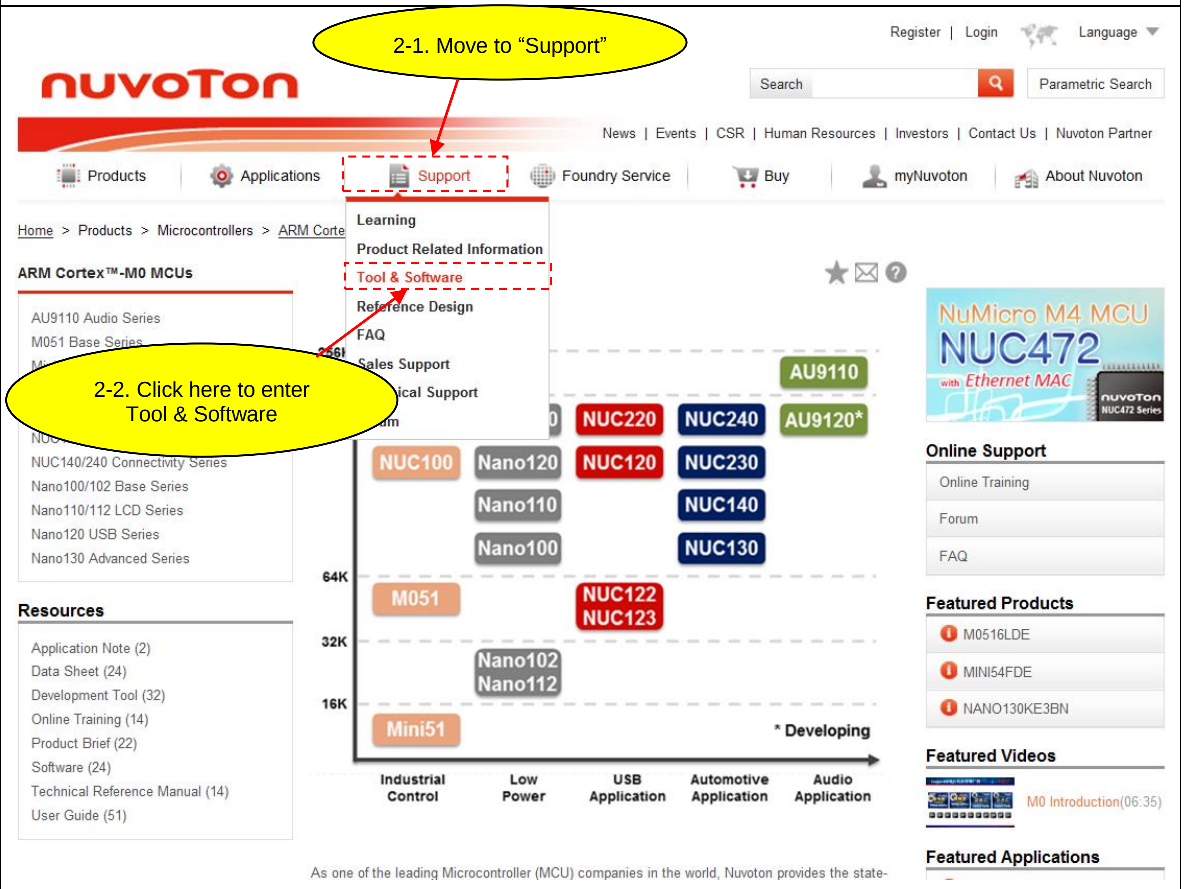
Step2	 2-1. Move to “Support” 2-2. Click here to enter Tool & Software

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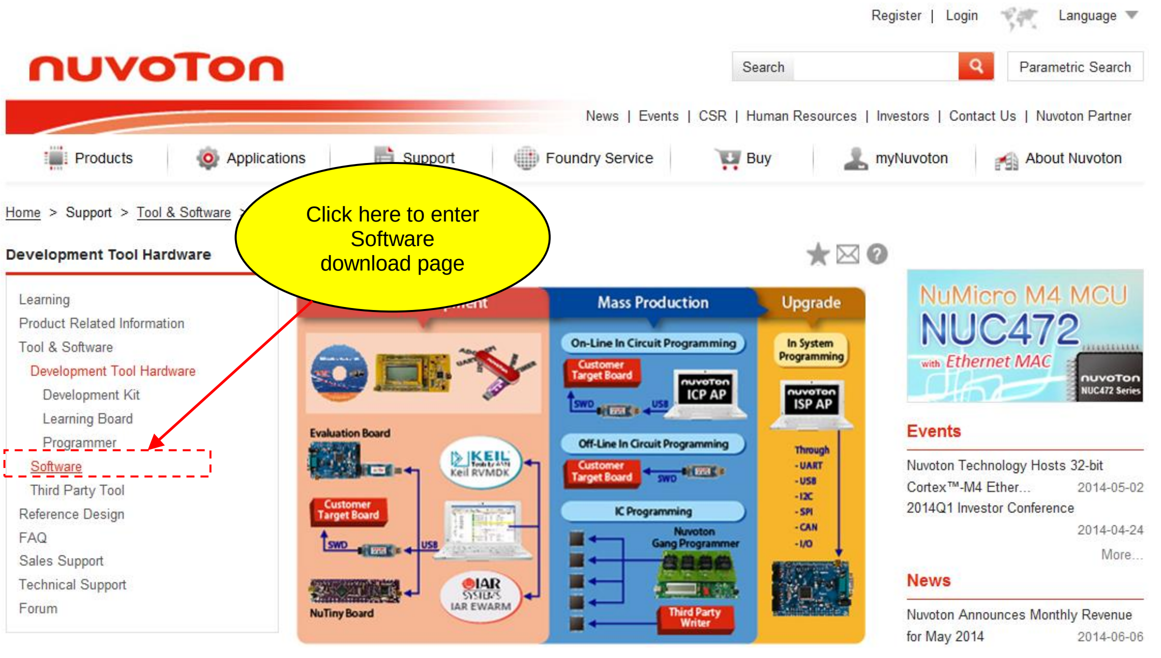
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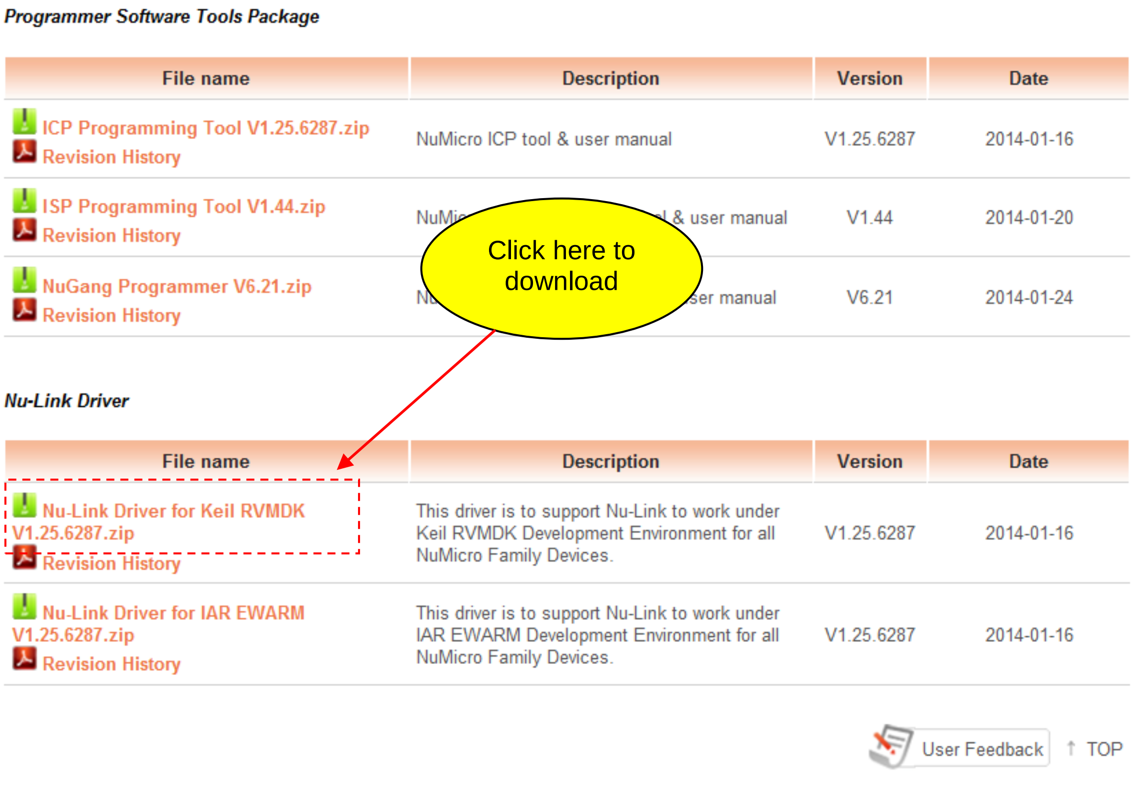

Programmer Software Tools Package

File name	Description	Version	Date
ICP Programming Tool V1.25.6287.zip Revision History	NuMicro ICP tool & user manual	V1.25.6287	2014-01-16
ISP Programming Tool V1.44.zip Revision History	NuMi … l & user manual	V1.44	2014-01-20
NuGang Programmer V6.21.zip Revision History	Nu … ser manual	V6.21	2014-01-24

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Nu-Link Driver for Keil RVMDK V1.25.6287.zip Revision History	This driver is to support Nu-Link to work under Keil RVMDK Development Environment for all NuMicro Family Devices.	V1.25.6287	2014-01-16
Nu-Link Driver for IAR EWARM V1.25.6287.zip Revision History	This driver is to support Nu-Link to work under IAR EWARM Development Environment for all NuMicro Family Devices.	V1.25.6287	2014-01-16

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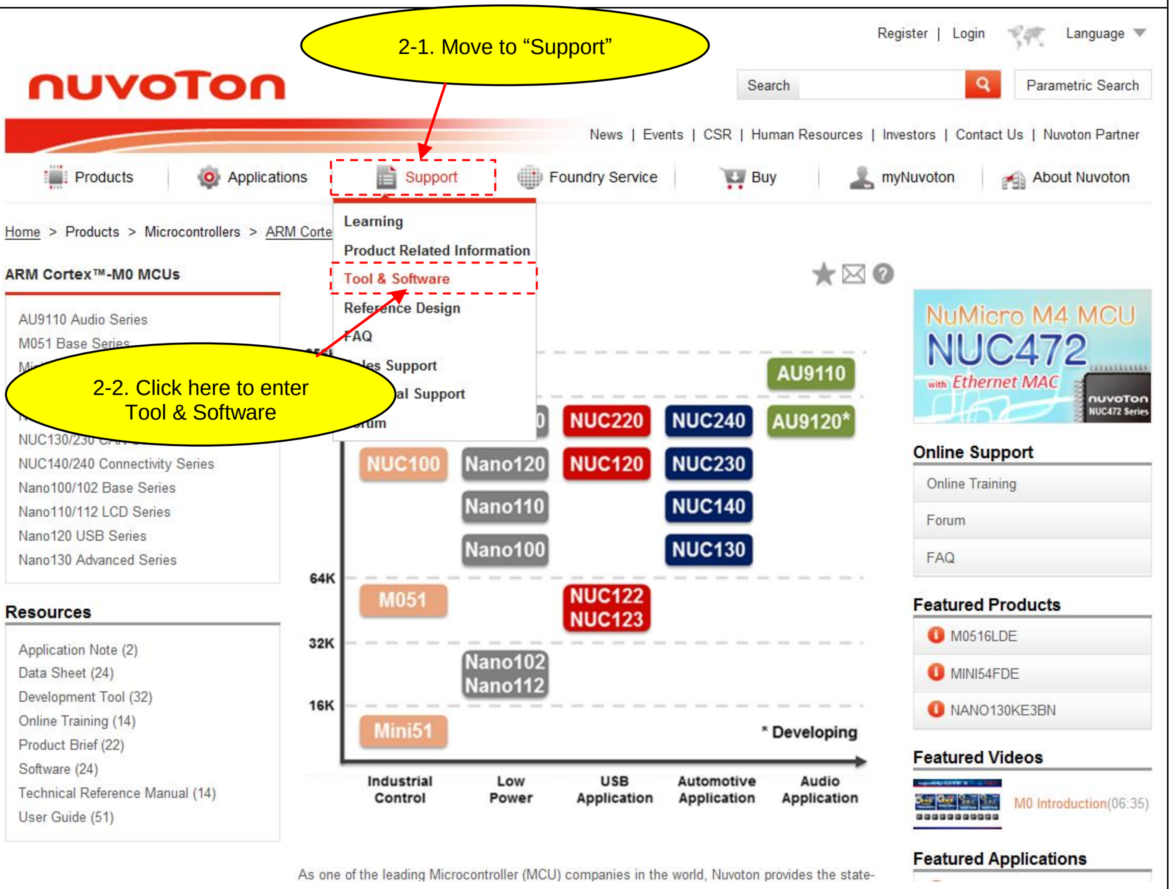
Step2	 2-1. Move to “Support” 2-2. Click here to enter Tool & Software Register | Login Language Search Parametric Search News | Events | CSR | Human Resources | Investors | Contact Us | Nuvoton Partner Products Applications Support Foundry Service Buy myNuvoton About Nuvoton Home > Products > Microcontrollers > ARM Corte Learning Product Related Information Tool & Software Reference Design FAQ ARM Cortex™-M0 MCUs AU9110 Audio Series M051 Base Series NUC140/240 Connectivity Series Nano100/102 Base Series Nano110/112 LCD Series Nano120 USB Series Nano130 Advanced Series Resources Application Note (2) Data Sheet (24) Development Tool (32) Online Training (14) Product Brief (22) Software (24) Technical Reference Manual (14) User Guide (51) AU9110 NUC220 NUC240 AU9120* NUC100 Nano120 NUC120 NUC230 Nano110 NUC140 Nano100 NUC130 64K M051 NUC122 NUC123 32K Nano102 Nano112 16K Mini51 * Developing Industrial Control Low Power USB Application Automotive Application Audio Application NuMicro M4 MCU NUC472 with Ethernet MAC Online Support Online Training Forum FAQ Featured Products M0516LDE MINI54FDE NANO130KE3BN Featured Videos M0 Introduction(06:35) Featured Applications As one of the leading Microcontroller (MCU) companies in the world, Nuvoton provides the state-

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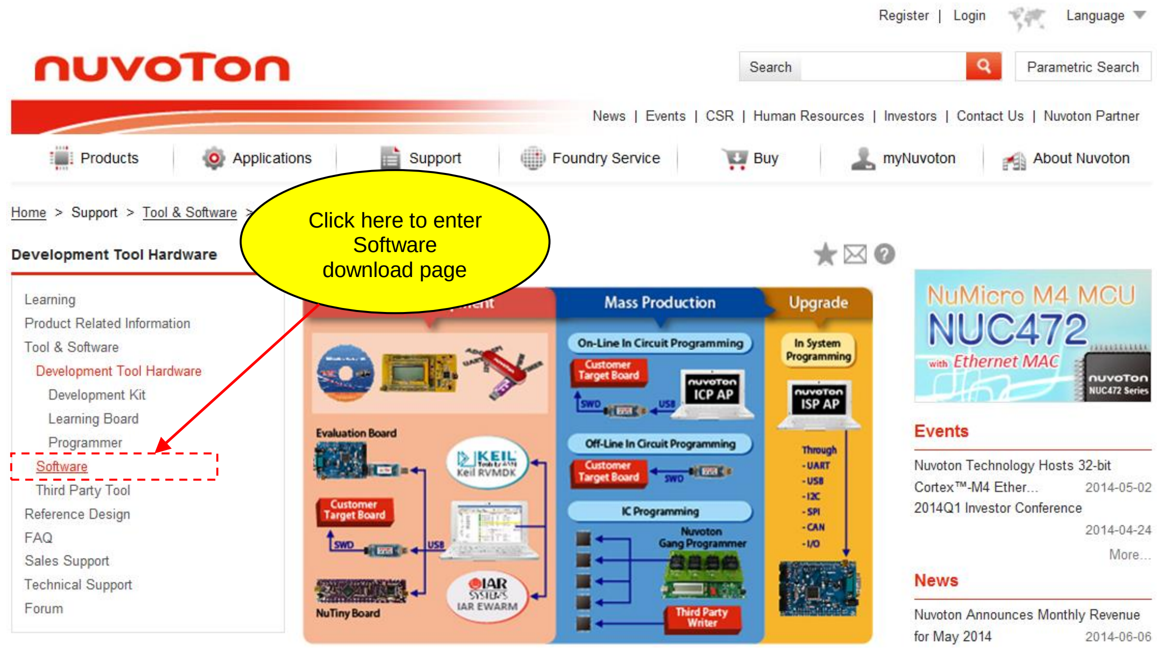
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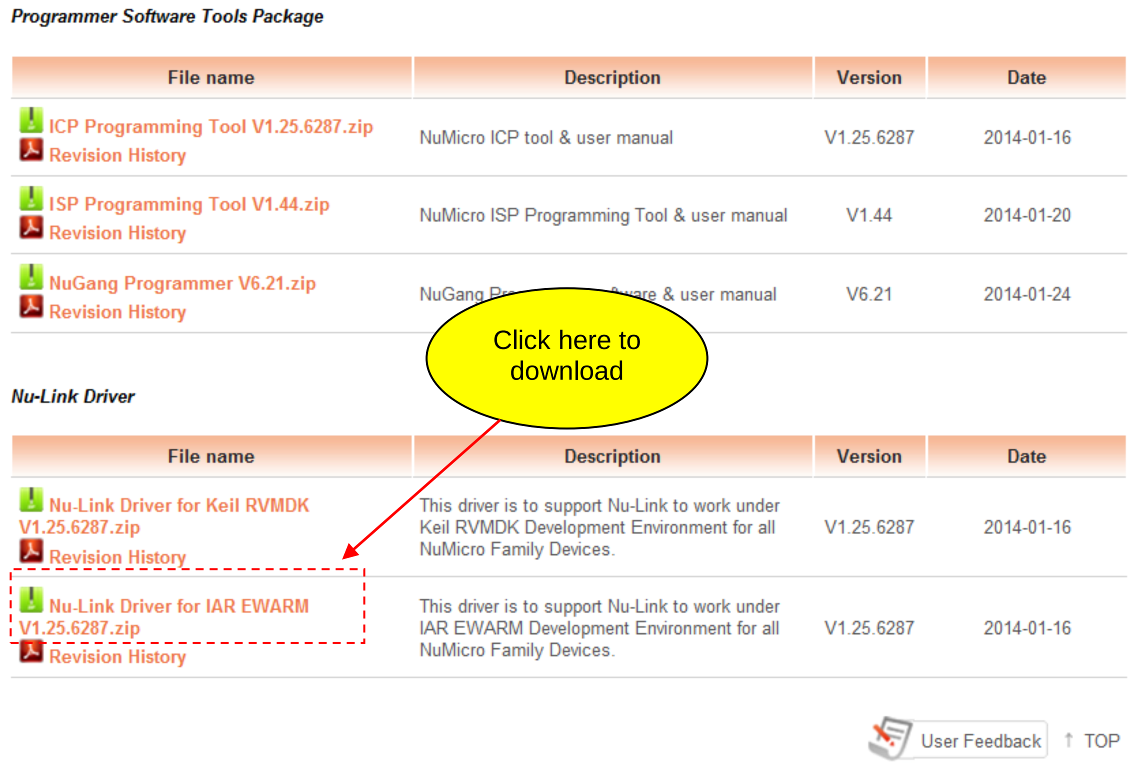
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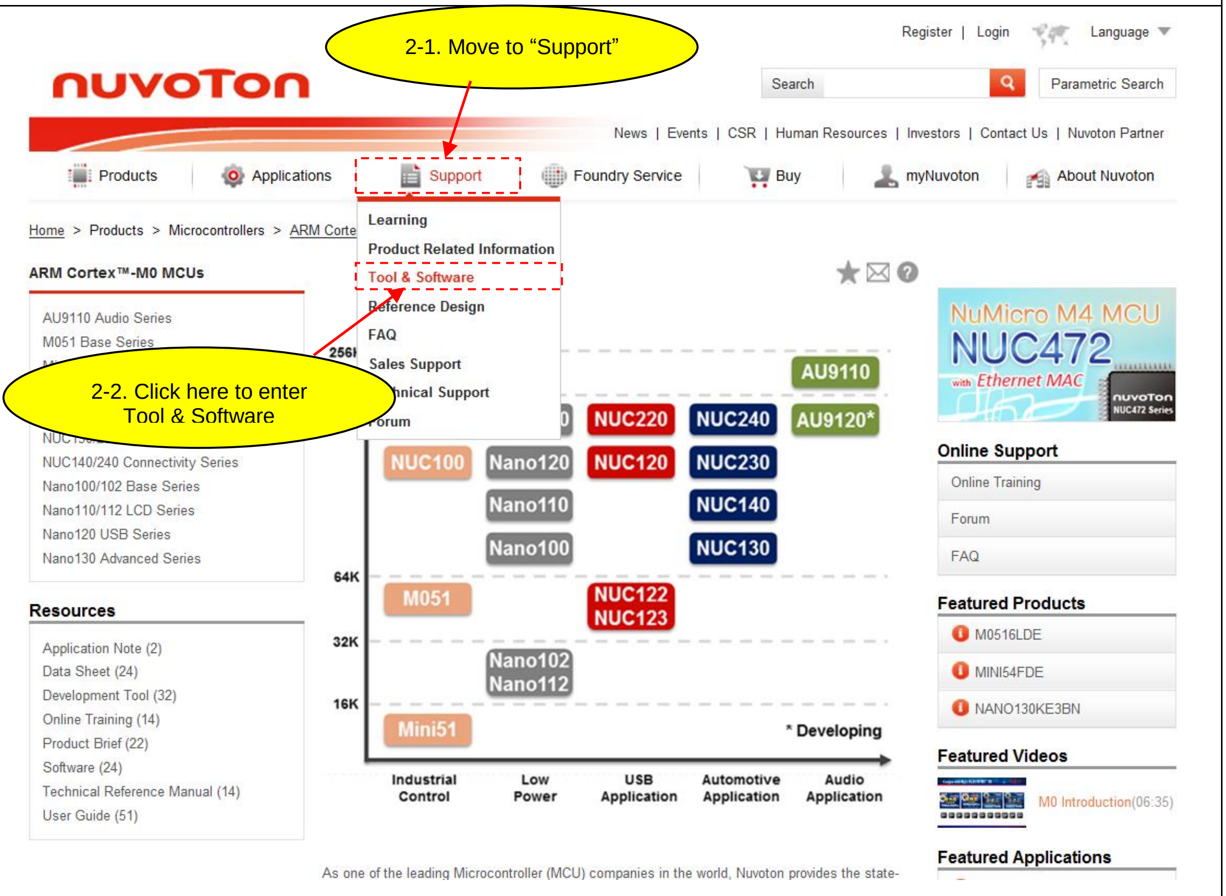
Step 2	 2-1. Move to “Support” 2-2. Click here to enter Tool & Software

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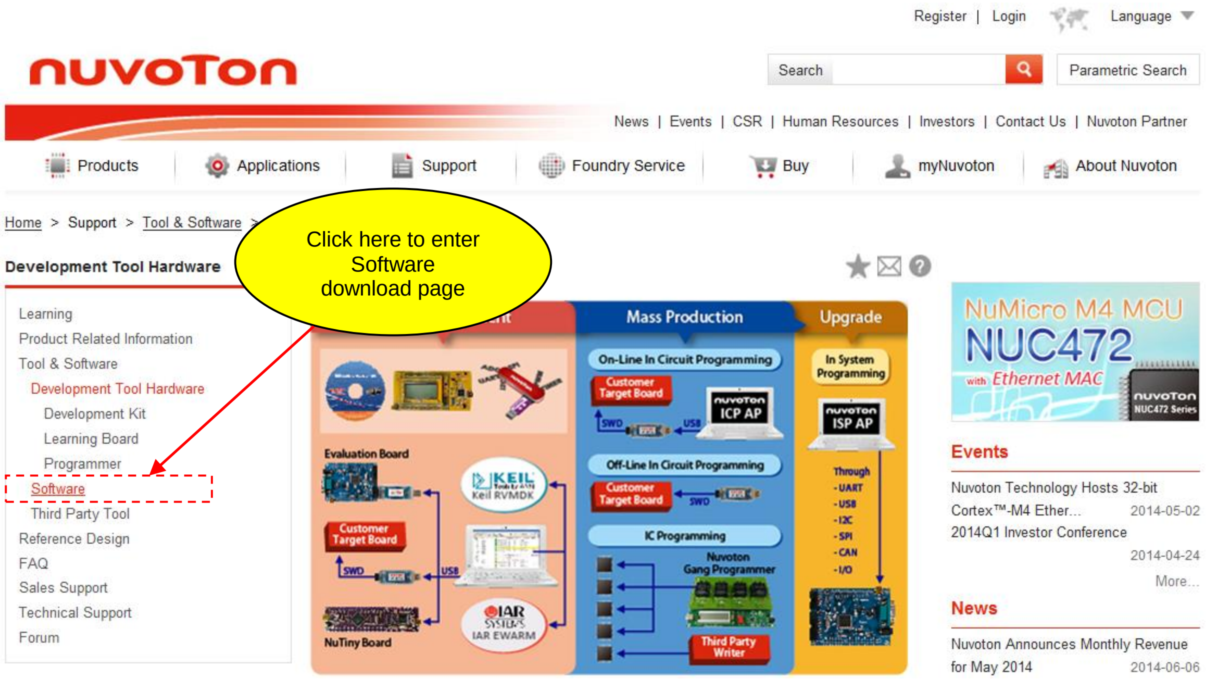
Step 3	 Click here to enter Software download page Register | Login Language Search Parametric Search News | Events | CSR | Human Resources | Investors | Contact Us | Nuvoton Partner Products Applications Support Foundry Service Buy myNuvoton About Nuvoton Home > Support > Tool & Software > Development Tool Hardware Learning Product Related Information Tool & Software Development Tool Hardware Development Kit Learning Board Programmer Software Third Party Tool Reference Design FAQ Sales Support Technical Support Forum Mass Production Upgrade On-Line In Circuit Programming Customer Target Board ICP AP In System Programming ISP AP Evaluation Board Keil RVMDK Off-Line In Circuit Programming Through - UART - USB - I2C - SPI - CAN - I/O IC Programming Nuvoton Gang Programmer IAR EWARM NuTiny Board Third Party Writer NuMicro M4 MCU NUC472 with Ethernet MAC NUC472 Series Events Nuvoton Technology Hosts 32-bit Cortex™-M4 Ether... 2014-05-02 2014Q1 Investor Conference 2014-04-24 More... News Nuvoton Announces Monthly Revenue for May 2014 2014-06-06
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7 REVISION HISTORY

Date	Revision	Description
2017.06.28	1.00	1. Preliminary version.

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