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Thank you for your understanding.

ROHM Co., Ltd.
April 1, 2024

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ROHM GROUP
LAPIS TECHNOLOGY

MK715x1 Evaluation Kit Mini（MK715x1EK1）
MK715x1 Evaluation Kit Mini Plus（MK715x1EK1P）
Hardware Manual

Issue Date: Dec. 1, 2020

ROHM SEMICONDUCTOR

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   [a] Where the Products are exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2 and NO_2
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   [d] Storage in high Electrostatic.

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2-4-8 Shinyokohama, Kouhoku-ku,
Yokohama 222-8575, Japan
http://www.lapis-tech.com/en/

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Preface

This document outlines the hardware of the MK715x1 evaluation kit Mini [MK715x1EK1] and MK715x1 evaluation kit Mini Plus [MK715XxEK1P] equipped with Bluetooth® 5 compatible Bluetooth low energy module MK715x1 [MK71521 or MK71511] made by Lapis Technology.

This evaluation kit is pre-installed with the AT command application that easily realizes Bluetooth® Low Energy communication by using a simple AT command via UART.

The following related documents are available, so please refer to them if necessary.

- MK71511 Data Sheet
- MK71521 Data Sheet
- MK715x1 Software Development Startup Guide
- BLE Tool User's Manual
- MK715x1 AT command application Quick Reference Guide
- MK715x1 AT command application User's Manual

Note: In this document, MK715x1 refers to both MK71511 and MK71521.

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1. Overview

1.1 Handling precautions

・MK715x1EK1/MK715x1EK1P can be used only for evaluating MK715x1. We do not take any responsibility for any direct or indirect damage caused by installing this product in your product.

・We are not responsible for any modification or illegal use of this development kit.

1.2 MK715x1EK1/MK715x1EK1Pconfiguration

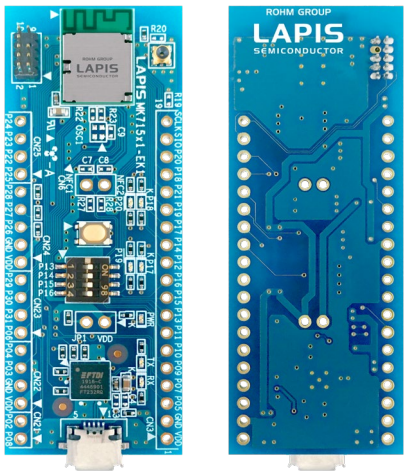
When you receive the MK715x1EK1/MK715x1EK1P, make sure that the following items are all included in the kit. If you find any broken or missing items, please contact the distributor where you purchased the product or the ROHM sales office.

MK715x1EK1 configuration

Component	Quantity
MK715x1 evaluation board	1

MK715x1EK1P configuration

Component	Quantity
MK715x1 evaluation board	1
USB cable	1
J-Link LITE	1



Top View Bottom View

Fig. 1-1: MK715x1EK1 appearance

1.3 Lineup

The MK715x1 evaluation kit has the following lineup depending on the installed modules and accessories.

Product name	Module	accessories
MK71511 evaluation kit Mini (MK71511EK1)	MK71511	-
MK71521 evaluation kit Mini (MK71521EK1)	MK71521	-
MK71511 evaluation kit Mini Plus (MK71511EK1P)	MK71511	USB cable、J-Link LITE
MK71521 evaluation kit Mini Plus (MK71521EK1P)	MK71521	USB cable、J-Link LITE

※J-Link LITE is licensed for MK71511EK1/MK71521EK1.
※Use of MK71511EK1/ MK71521EK1 for purposes other than evaluation is prohibited.

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2. Hardware specifications

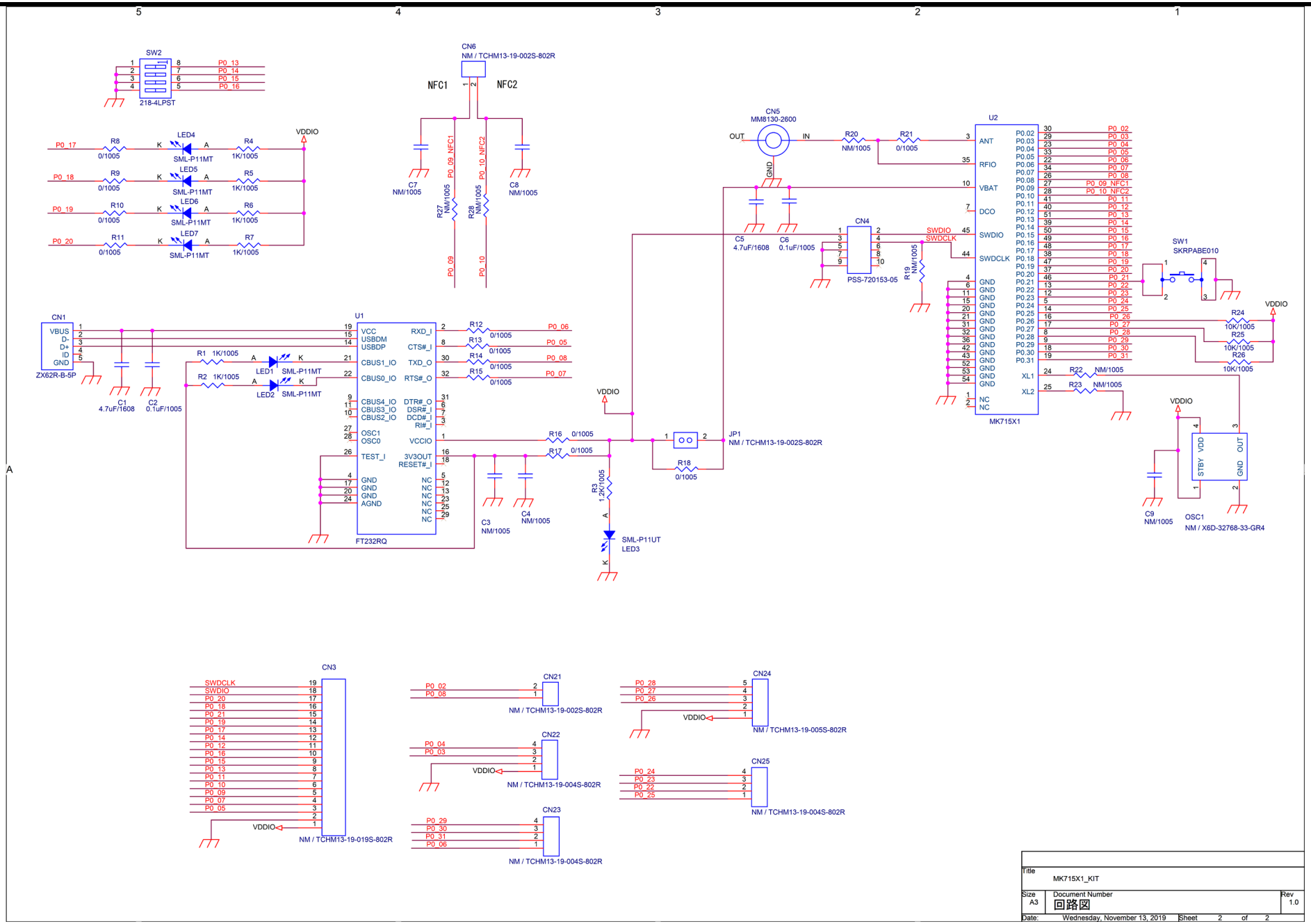
2.1 Circuit schematic

See next page

2.2 BOM List

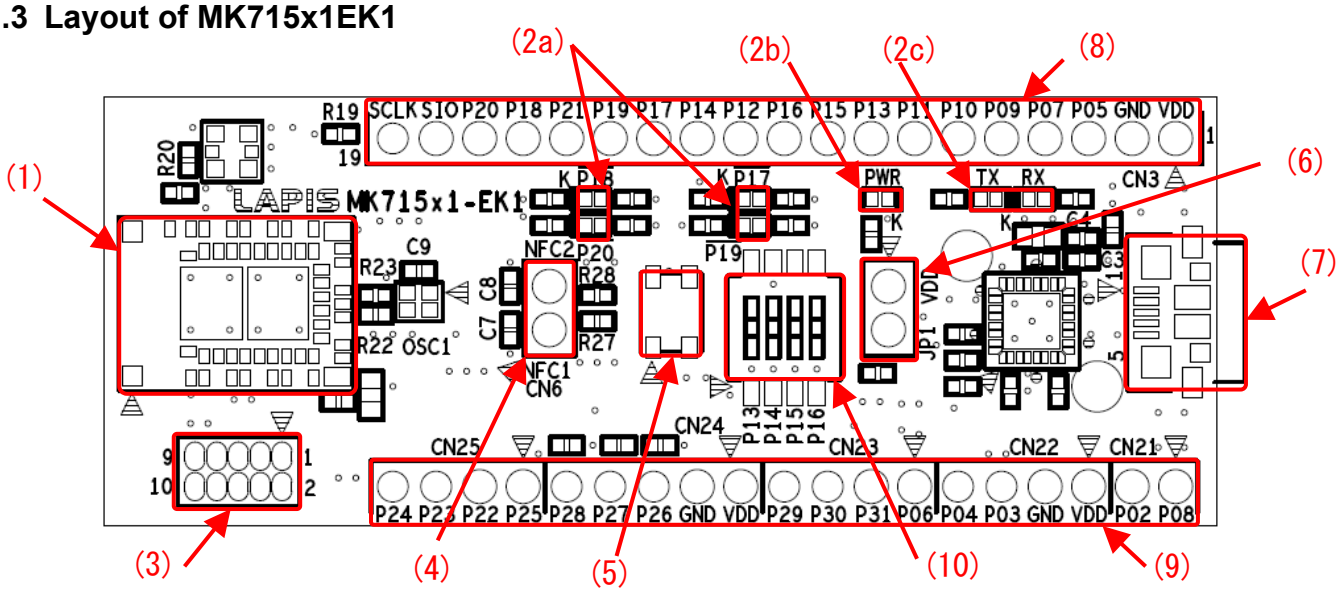
Reference	Value	Manufacturer	Model number
U1	—	FTDI	FT232RQ
U2	—	Lapis Technology	MK71511 or MK71521
LED1,LED2	—	ROHM	SML-P11MT
LED3	—	ROHM	SML-P11UT
LED4,LED5,LED6,LED7	—	ROHM	SML-P11MT
R1,R2	1k	ROHM	MCR01MZPJ102
R3	1.2k	ROHM	MCR01MZPJ122
R4,R5,R6,R7	1k	ROHM	MCR01MZPJ102
R8,R9,R10,R11	0	ROHM	MCR01MZPJ000
R12,R13,R14,R15,R16,R17,R18	0	ROHM	MCR01MZPJ000
R19,R20	NoMount	ROHM	
R21	0	ROHM	MCR01MZPJ000
R22,R23	NoMount	ROHM	
R24,R25,R26	10k	ROHM	MCR01MZPJ103
C1	4.7u	MURATA	GRM188R61C475KAAJ
C2	0.1u	MURATA	GRM155B31H104KE14D
C3	NoMount	-	-
C4	NoMount	-	-
C5	4.7u	MURATA	GRM188R61C475KAAJ
C6	0.1u	MURATA	GRM155B31H104KE14D
C7	NoMount	-	-
C8	NoMount	-	-
C9	NoMount	-	-
OSC1	NoMount	River Eletec	X6D-32768-33-GR4
CN1	—	HIrose	ZX62R-B-5P(30)
CN21	NoMount	K.K. Tokiwa Shoko	TCHM13-19-002S-802R
CN22	NoMount	K.K. Tokiwa Shoko	TCHM13-19-004S-802R
CN23	NoMount	K.K. Tokiwa Shoko	TCHM13-19-004S-802R
CN24	NoMount	K.K. Tokiwa Shoko	TCHM13-19-005S-802R
CN25	NoMount	K.K. Tokiwa Shoko	TCHM13-19-004S-802R
CN3	NoMount	K.K. Tokiwa Shoko	TCHM13-19-019S-802R
CN4	—	HIROSUGI	PSS-720153-05
CN5	—	Murata	MM8130-2600
CN6	NoMount	K.K. Tokiwa Shoko	TCHM13-19-002S-802R
SW1	—	ALPS	SKRPABE010
SW2	—	CTS Electrocomponents	218-4LPST
JP1	NoMount	K.K. Tokiwa Shoko	TCHM13-19-002S-802R

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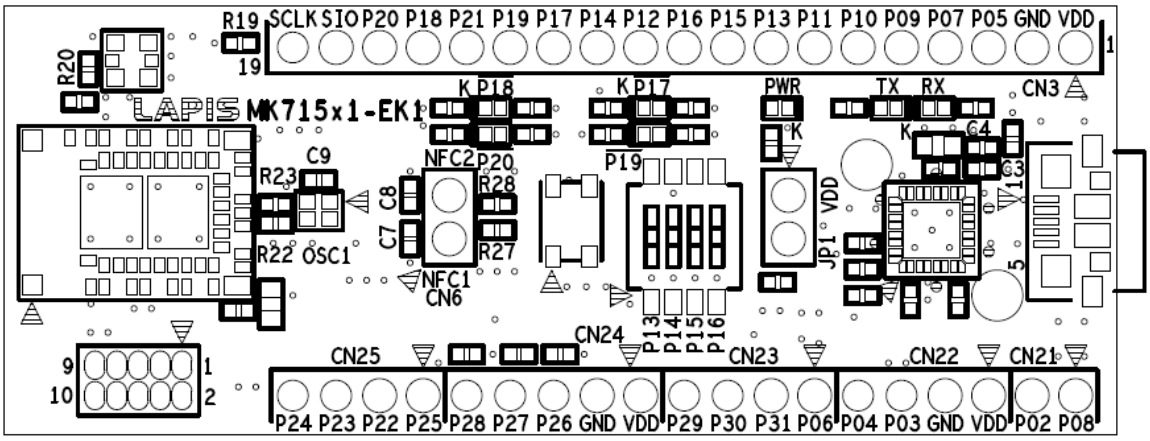
2.3 Layout of MK715x1EK1



No	Name	Description	Symbol	(Maker) Part.NO	Remarks
(1)	MK715X1	Bluetooth® low energy module	U2	(LAPIS) MK71511 or MK71521	
(2a)	—	General-purpose LED×4	LED4-LED7	(ROHM) SML-P11MT	Green
(2b)	—	Power LED × 1	LED3	(ROHM) SML-P11UT	Red
(2c)	—	UART status LED×2	LED1-LED2	(ROHM) SML-P11MT	Green
(3)	PSS-720153-05	J-Link	CN4	PSS-720153-05	
(4)	—	NFC Interface	CN6		Valid for only MK71521
(5)	Reset Switch	Module Reset	SW1	(ALPS) SKRPABE010	
(6)	—	Current measurement Interface	JP1	NoMount	Shorted by R18 at shipment
(7)	USB Interface	Micro USB Interface	CN1	(Hirose) ZX62R-B-5P(30)	UART, +5V-DC power supply
(8)	—	external Interface	CN3	NoMount	GPIO, external power supply
(9)	—	external Interface	CN21-CN25	NoMount	GPIO, external power supply
(10)	DIPSW-4	Switch	SW2	(CTS Elec.) 218-4LPST	

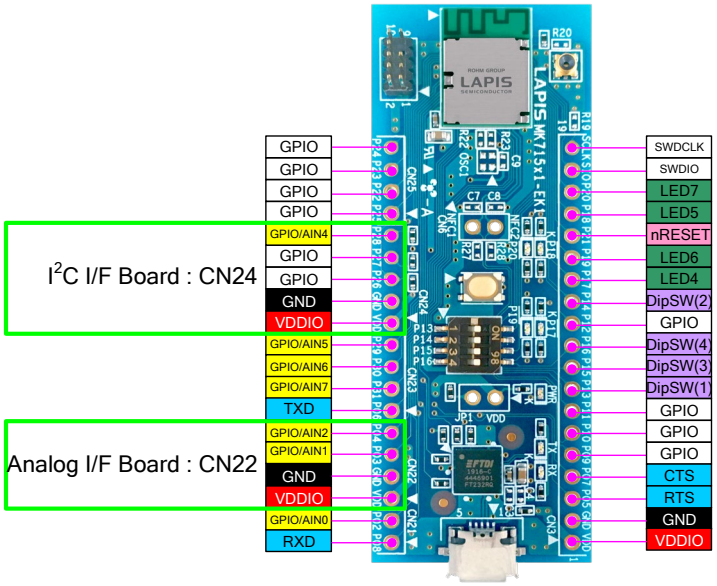
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2.4 Silkscreen Printing



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2.5 The pin assignment for External interface



CN25

Pin Name.	MK715x1EK1 Assignment	nRF52 Port	nRF52 Function
P24	GPIO	P0.24	GPIO
P23	GPIO	P0.23	GPIO
P22	GPIO	P0.22	GPIO
P25	GPIO	P0.25	GPIO

CN24 : Suitable for I2C I/F board connection

Pin Name.	MK715x1EK1 Assignment	nRF52 Port	nRF52 Function		I²C I/F board Pin Function
P28	GPIO/AIN4	P0.28	GPIO/AIN4		INT
P27	GPIO	P0.27	GPIO		SCL
P26	GPIO	P0.26	GPIO	Connection example	SDA
GND	GND	GND	Ground		GND
VDD	VDDIO	VDD	Power		VDD

【Supplement】
P26～P28 : 10kΩ pull-up

CN23

Pin Name.	MK715x1EK1 Assignment	nRF52 Port	nRF52 Function
P29	GPIO/AIN5	P0.29	GPIO/AIN5
P30	GPIO/AIN6	P0.30	GPIO/AIN6
P31	GPIO/AIN7	P0.31	GPIO/AIN7
P06	UART TXD	P0.06	GPIO

CN22 : Suitable for analog I/F board connection

Pin Name	MK715x1EK1 Assignment	nRF52 Port	nRF52 Function		Analog I/F board Pin Function
P04	GPIO/AIN2	P0.04	GPIO/AIN2		AOUT2
P03	GPIO/AIN1	P0.03	GPIO/AIN1	Connection example	AOUT1
GND	GND	GND	Ground		GND
VDD	VDDIO	VDD	Power		VDD

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CN21

Pin Name	MK715x1EK1 Assignment	nRF52 Port	nRF52 Function
P02	GPIO/AIN0	P0.02	GPIO/AIN0
P08	UART RXD	P0.08	GPIO

CN3

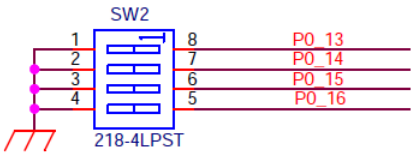
Pin Name	MK715x1EK1 Assignment	nRF52 Port	nRF52 Function
SCLK	SWDCLK	SWDCLK	SWDCLK
SIO	SWDIO	SWDIO	SWDIO
P20	LED7	P0.20	GPIO
P18	LED5	P0.18	GPIO
P21	nRESET	P0.21	GPIO/nRESET
P19	LED6	P0.19	GPIO
P17	LED4	P0.17	GPIO
P14	DIP SW (2)	P0.14	GPIO
P12	GPIO	P0.12	GPIO
P16	DIP SW (4)	P0.16	GPIO
P15	DIP SW (3)	P0.15	GPIO
P13	DIP SW (1)	P0.13	GPIO
P11	GPIO	P0.11	GPIO
P10	GPIO	P0.10	GPIO/NFC2
P09	GPIO	P0.09	GPIO/NFC1
P07	UART CTS	P0.07	GPIO
P05	UART RTS	P0.05	GPIO/AIN3
GND	GND	GND	Ground
VDD	VDDIO	VDD	Power

2.6 Switch

2.6.1 DIPSW-4

DIP SW is connected to four ports from P0.13 to P0.16
The port assignment and circuit configuration are shown below.

Symbol	Pin No.	GPIO	Initial setting
SW2	1	P0.13	On
	2	P0.14	Off
	3	P0.15	Off
	4	P0.16	Off



※DIP SW substitutes the four user buttons on the Nordic nRF52DK Board.

2.6.2 Reset Switch

Pushing the reset switch puts the MK715x1 into a reset state.



Reset Switch

State	Function
ON	P0.21/nRESET = Low (Reset state)
OFF	P0.21/nRESET = High (Reset releas state)

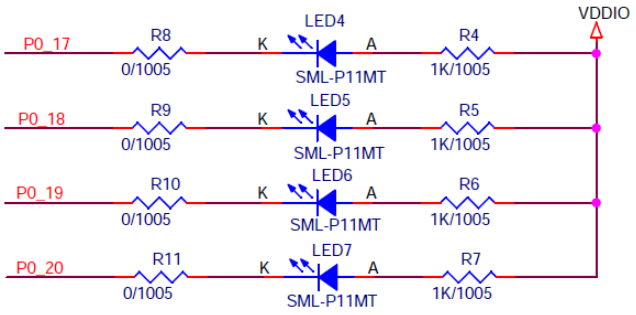
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2.7 LED

2.7.1 General-purpose LED

General-purpose LEDs (green) are connected to the ports from P0.17 to P0.20.
The port assignment and circuit configuration are shown below.

No	Silkscreen Printing	port	LED active
LED4	P.17	P0.17	P0.17=Low
LED5	P.18	P0.18	P0.18=Low
LED6	P.19	P0.19	P0.19=Low
LED7	P.20	P0.20	P0.20=Low



2.7.2 Power LED

The Power LED (red) lights on when the power (VDDIO) to the MK715x1 is turned on.

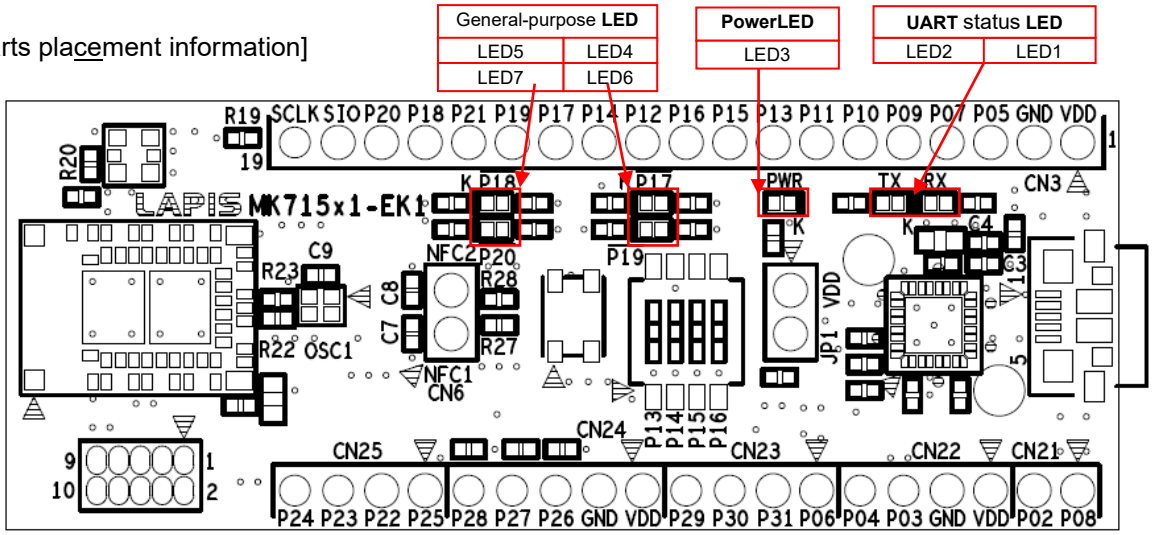
No	Silkscreen Printing
LED3	PWR

2.7.3 UART status LED

The UART status LED (green) flashes during UART transmission and reception.

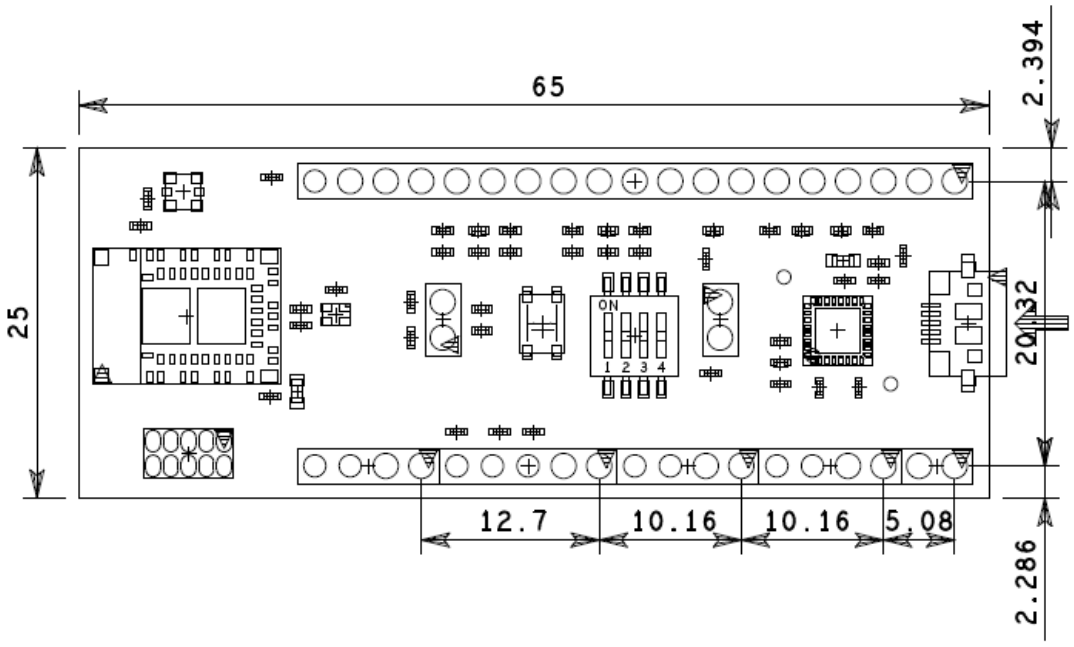
No	Silkscreen Printing
LED1	RX
LED2	TX

[Parts placement information]



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2.8 Outline



Unit [mm]

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3. How to use sample software

The AT command application software is installed in this kit. Please prepare MK715x1 evaluation kit and smartphone application "BLE Tool". This section briefly describes the operation of the AT command application, using the MK715x1 side as a peripheral device and connecting to a central device such as a smartphone as an example.

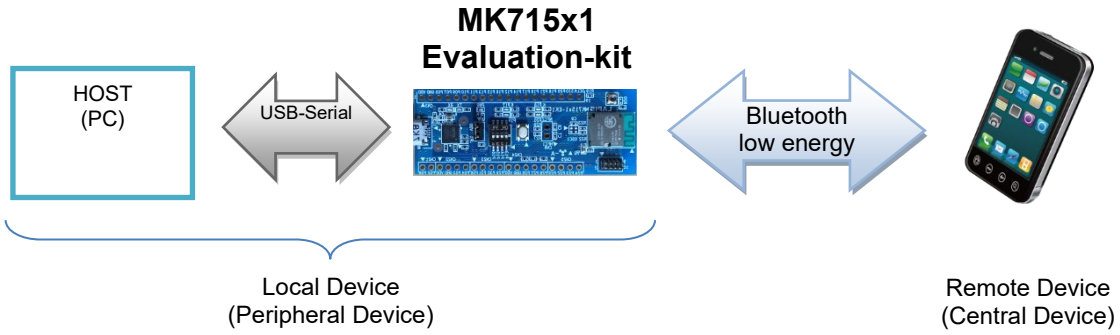


Fig. 3-1 : System configuration (when connecting to a smartphone, etc.)

Refer to "MK715x1 AT Command Application User's Manual" for detailed specifications of AT command application for MK715x1.

3.1 PC set up

1) Connect MK715x1EK1 and the USB port of your PC with USB cable(A-microB type).
When using it for the first time, USB serial conversion IC driver should be installed.
Download driver software from the following site, if necessary.
https://www.ftdichip.com/Drivers/VCP.htm

2) Start up terminal software such as Tera Term, and set the serial port as follows:

Port:	COM port number used
Baud Rate:	57,600 bps
Data:	8 bit
Parity:	None
Stop:	1 bit
Flow Control:	Hardware

3.2 Smartphone Set up

The application on the smartphone uses BLE Tool. Please download and install from the following.

Google Play : https://play.google.com/store/apps/details?id=com.lapis_semi.bleapp
App Store : https://itunes.apple.com/jp/app/ble-tool/id915714158?mt=8&ign-mpt=uo%3D4

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3.3 Terminal Software Operation

With the Dip Switch on the MK715x1 evaluation kit as the initial setting, pushing the reset button executes the AT command application. If you input "at<CR>" which is AT command for command acceptance confirmation from the terminal and then the result code string is output as shown below, UART communication between the PC and MK715x1 evaluation kit is normal. Input of "at" command is not output because echo back from MK715x1 is disabled.



Fig. 3-2 : Result code string output screen for command reception confirmation

Then, when you start the peripheral operation, type "atd <CR>" and the MK715x1 Evaluation Kit will start the advertisement transmission. Alternatively, to initiate a central operation, type "ata <CR>" and the MK715x1 Evaluation Kit will initiate a scan and search for peripheral devices. The preparation for the MK715x1 side is now complete.

3.4 BLE Tool operation

3.4.1 Application start

Tap the "BLE Tool" icon to start the application. (Fig. 3-3)



Fig. 3-3: BLE Tool

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3.4.2 Data communication

Bluetooth® Low Energy communication can be performed by the following steps.
For details on how to use "BLE Tool", refer to the related document "BLE Tool User's Manual".

A) When "BLE Tool" is started, the screen in Fig. 3-4 (A) is displayed. In this screen, the central side scans and displays Bluetooth® low energy devices from the detected advertisement packets. The AT command application for MK715x1 is displayed with the device name "LapisDev" by default, so tap this.

B) The Bluetooth® Low Energy connection procedure is executed, and the service search screen shown in Fig. 3-4 (B) is displayed. At this time, "CONNECT" is output to the terminal screen on the peripheral side. In the screen in Fig. 3-4 (B), the central side executes the service search and displays the detected services. In case of AT command application for MK715x1, two services of "Device Information" and "LAPIS Serial Port Profile" are displayed. The latter is the service used for data communication in AT command applications. Tap the "LAPIS Serial Port Profile" icon.

C) The screen shown in Fig. 3-4 (C) is displayed. You can send and receive data on this screen. When you tap the text box displayed at the bottom of the screen, the soft keyboard is displayed, so if you input a character string from the soft keyboard and tap the "Send" button, the character string you input to the peripheral will be sent. Similarly, if you enter characters from the terminal screen on the peripheral side, it will be sent to the central side.

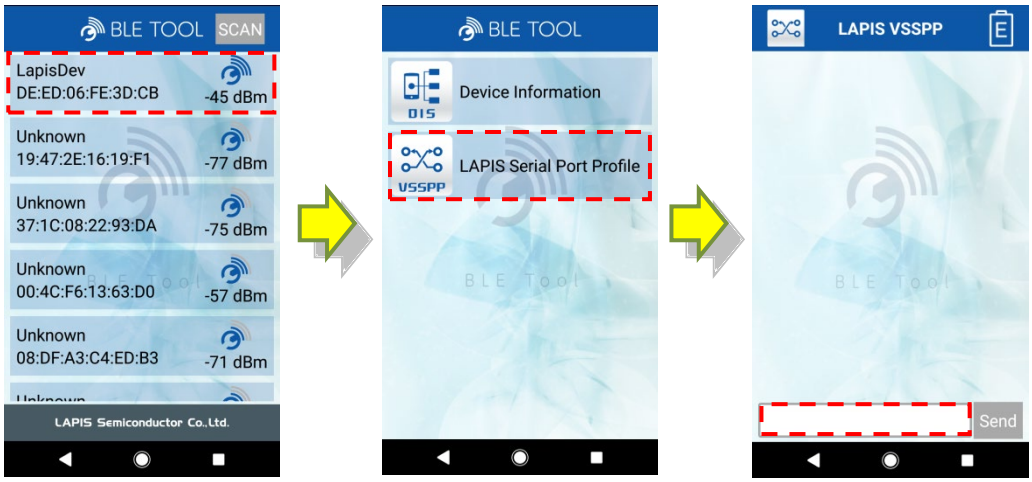


Fig. 3-4 : BLE Tool operation screen example

The figure below shows an example of performing data communication using the above procedure. The character string input from “BLE Tool” is output in black characters as shown in Fig. 3-5 (a), and the same character string is also output to the terminal on the peripheral side (Fig. 3-5 (b)). The character string input from the terminal on the peripheral side as shown in Fig. 3-5 (c) is output in red on the “BLE Tool” screen (Fig. 3-5 (d)).



Central
（Smartphone screen）

Peripheral
（MK715x1 Terminal software screen）

Fig. 3-5 : Example of data communication screen

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3.4.3 Read device information

The AT command application for MK715x1 also provides Bluetooth SIG standard device information service (DIS). As shown in Fig. 3-6, tap the “DIS” icon on the service search screen to read the device information of the peripheral. Fig. 3-6 shows the default settings for the AT command application for MK715x1. It is necessary to change the device information according to the customer system used. For correction of device information, refer to "MK715x1 AT Command Application User's Manual".

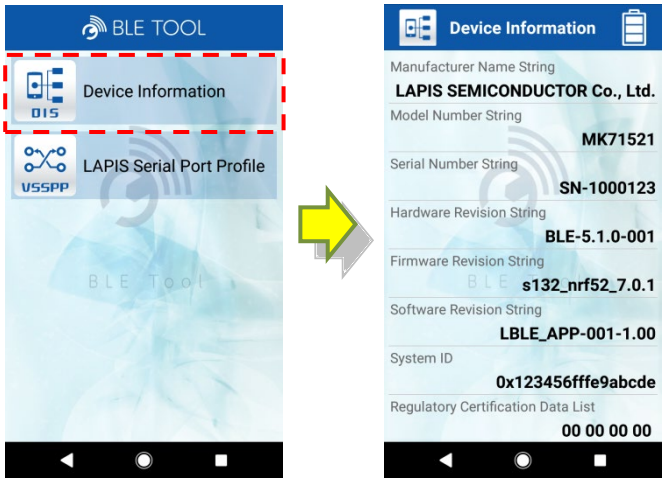


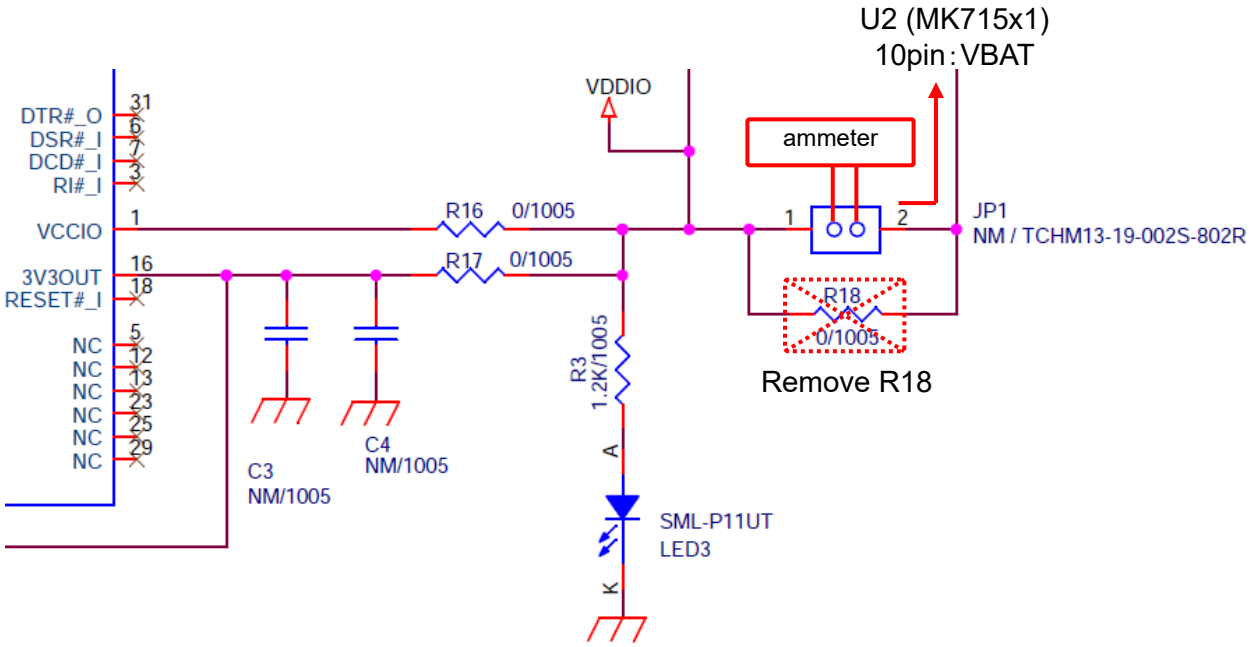
Fig. 3-6 : Device information screen example

This concludes the brief explanation of how to use the AT command application for the MK715x1. For other AT command operations, refer to "3. AT Command" in "AT Command Application for MK715x1 Quick Reference Guide".

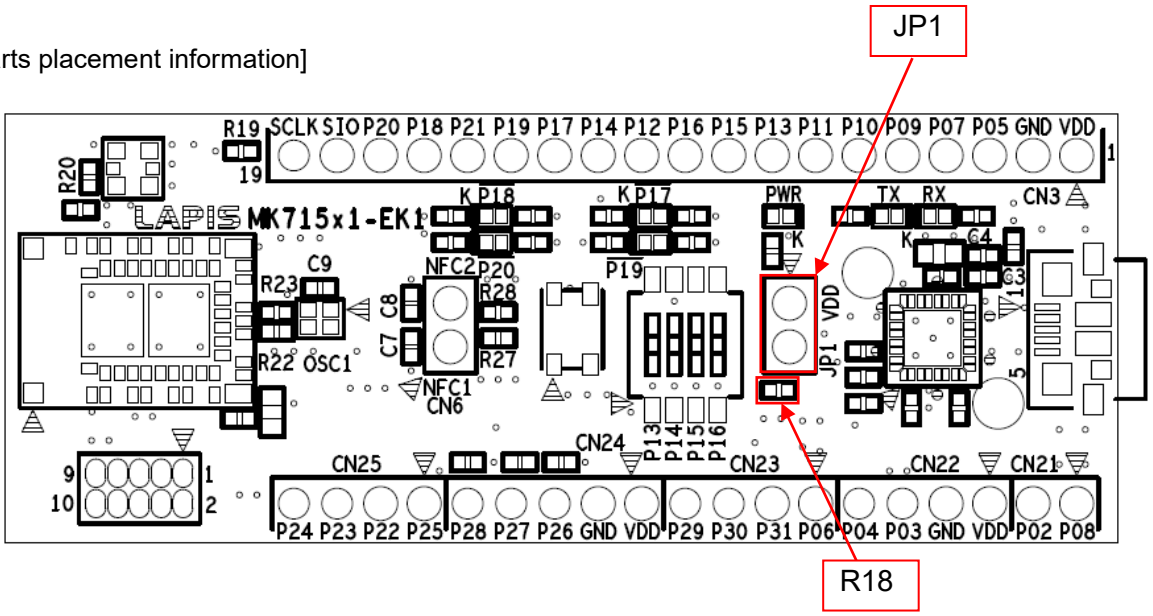
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4. Current measurement method

To measure the current of MK715x1, remove the R18 and insert an ammeter between pin1 and pin2 of JP1.



[Parts placement information]



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A. Appendix

A.1 Correspondence between each evaluation kit and Nordic SDK Example Project

If you use the Nordic SDK v16.0.0 Example Project, follow the table below.

Eval. Kit Name	Applicable Nordic DK Board Type	Preferable Nordic SoftDevice	Note
MK71511EK1	PCA10056e	S112	Some modifications are required (See A.2)
MK71521EK1	PCA10040	S132	

Table. A-1 : Correspondence between each evaluation kit and Nordic SDK Example Project

A.2 Example Project modification steps required for MK71511EK1

MK71511EK1's GPIO interface assignment is subjected to Nordic's PCA10040 board, so when using the Nordic SDK's Example Project with MK71511EK1, it is necessary to change the assignment of reset buttons and LEDs. The procedure is described below using the Example Project for the SEGGER Embedded Studio IDE of Blood Pressure Service of nRF SDK v16.0.0 as an example.

1) Open the following project file with SEGGER Embedded Studio IDE.
<unzipped location>¥nRF5_SDK_16.0.0_98a08e2¥examples¥
ble_peripheral¥ble_app_bps¥pca10056e¥s112¥ses¥ble_app_bps_pca10056e_s112.emProject

2) Select Project>Options from the Menu Bar.

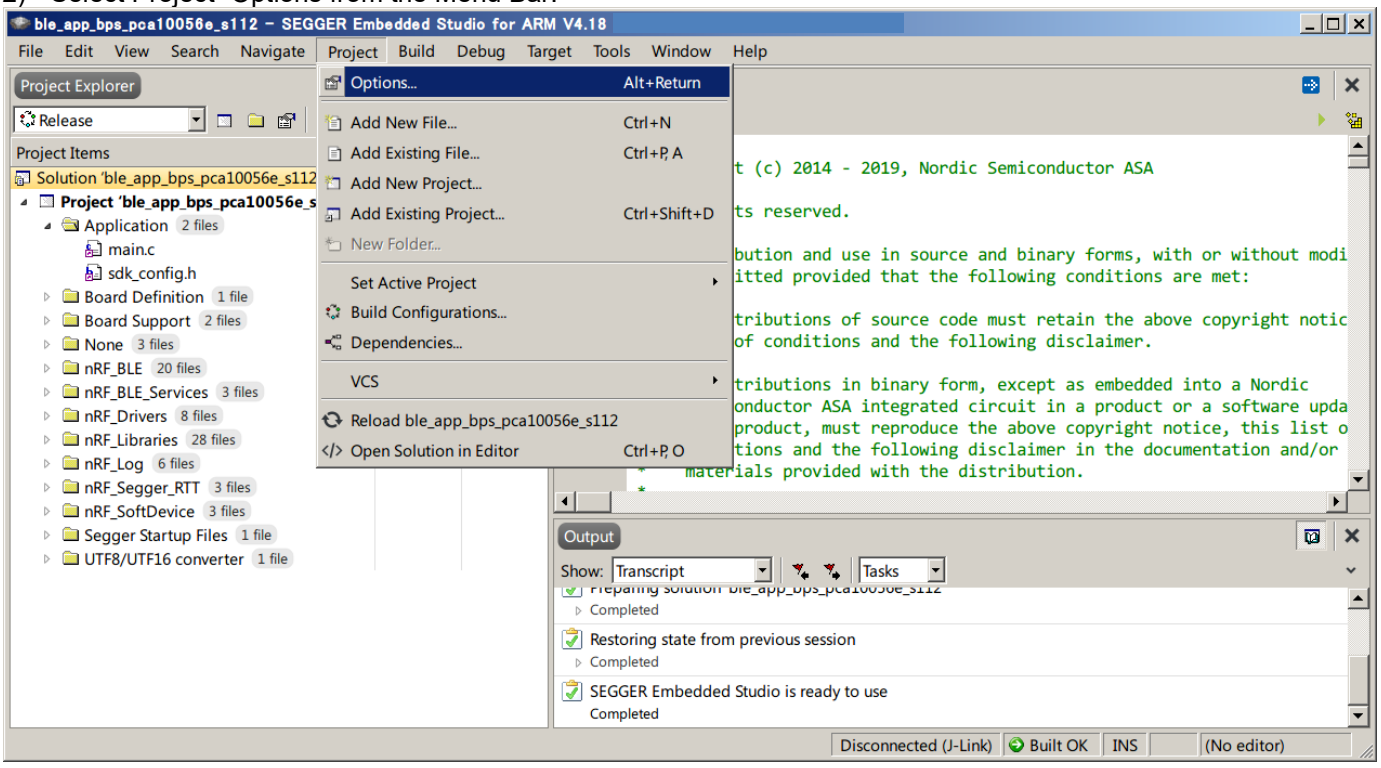


Fig. A-1 : Project "Option" settings

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3) Select "Common" setting.

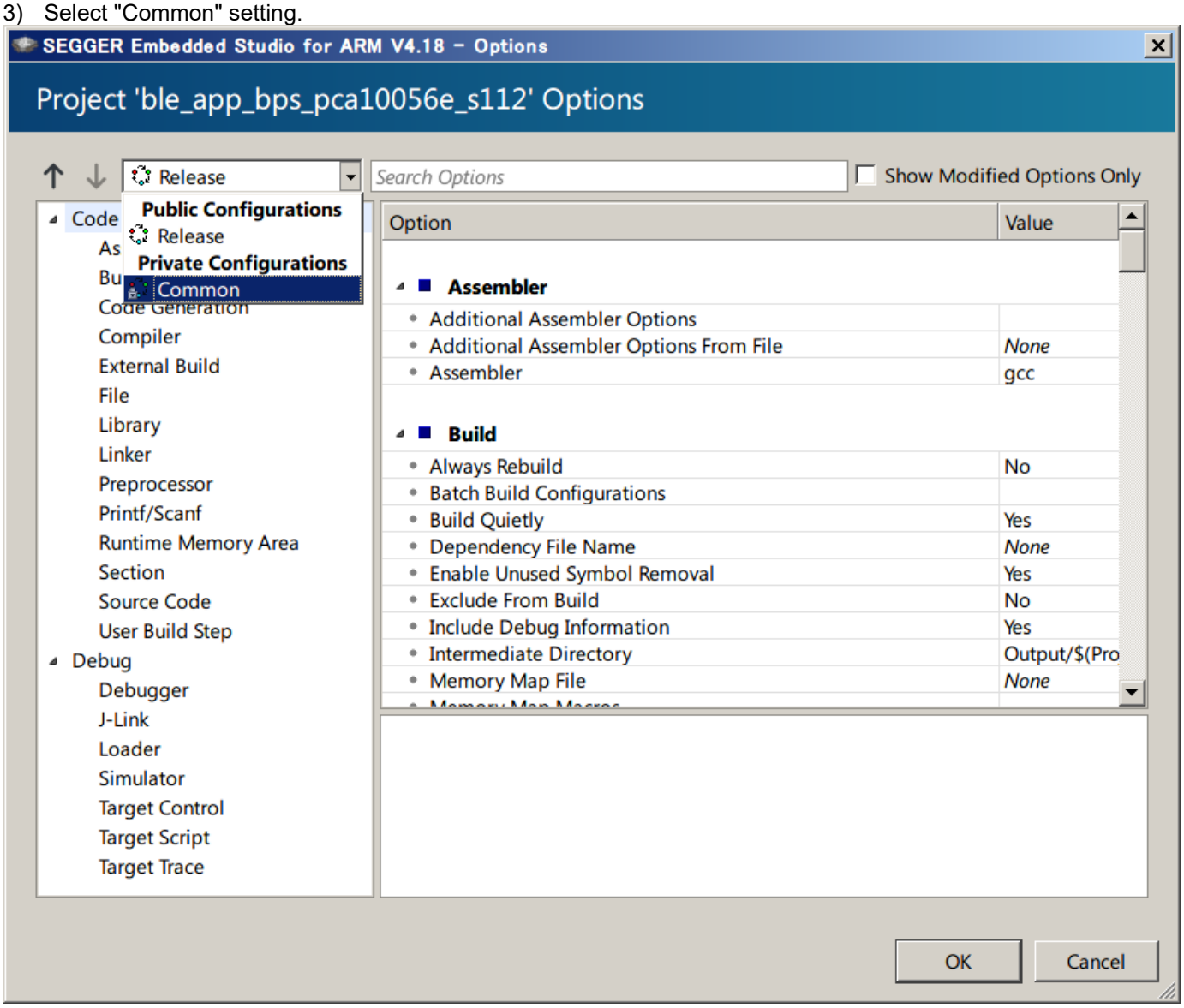


Fig. A-2 : "Common" setting

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4) Select "Preprocessor" in "Code list"

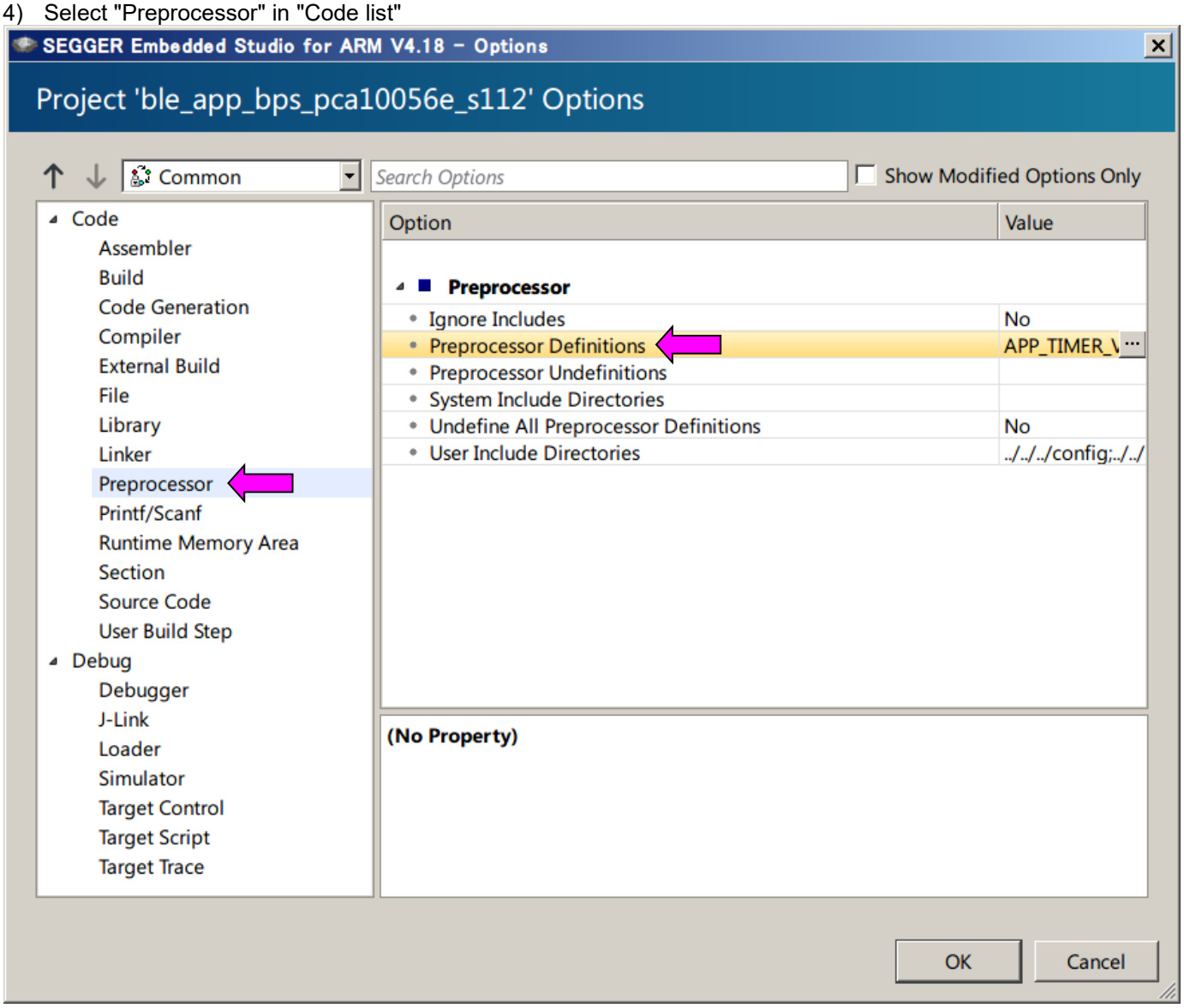


Fig. A-3: "Preprocessor" setting

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5) Double-click "Preprocessor Definitions" to display the setting screen.

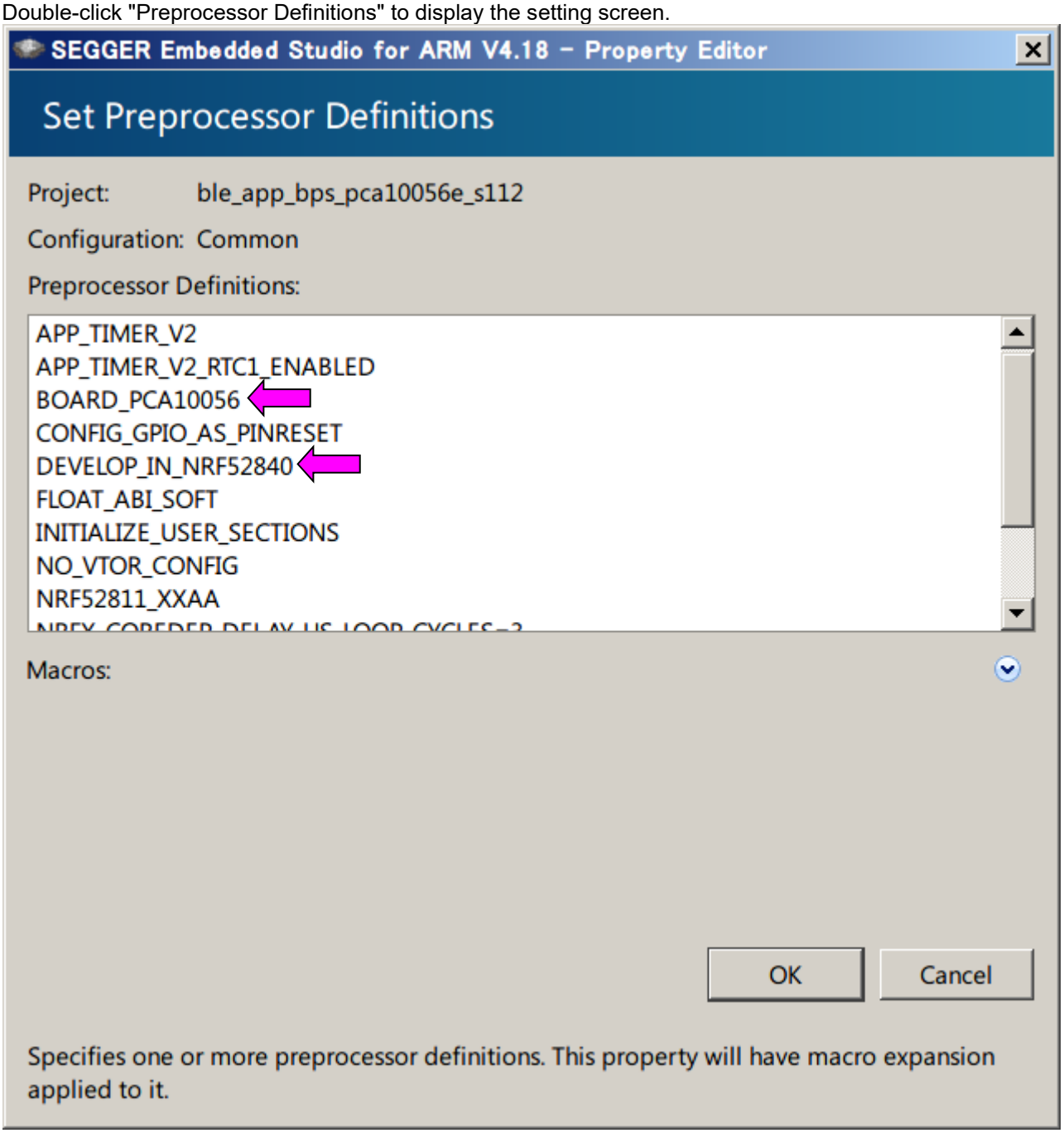


Fig. A-4: Changes to "Preprocessor Definitions"

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6) Change "BOARD_PCA10056" to "BOARD_PCA10040".
7) Delete "DEVELOP_IN_NRF52840".

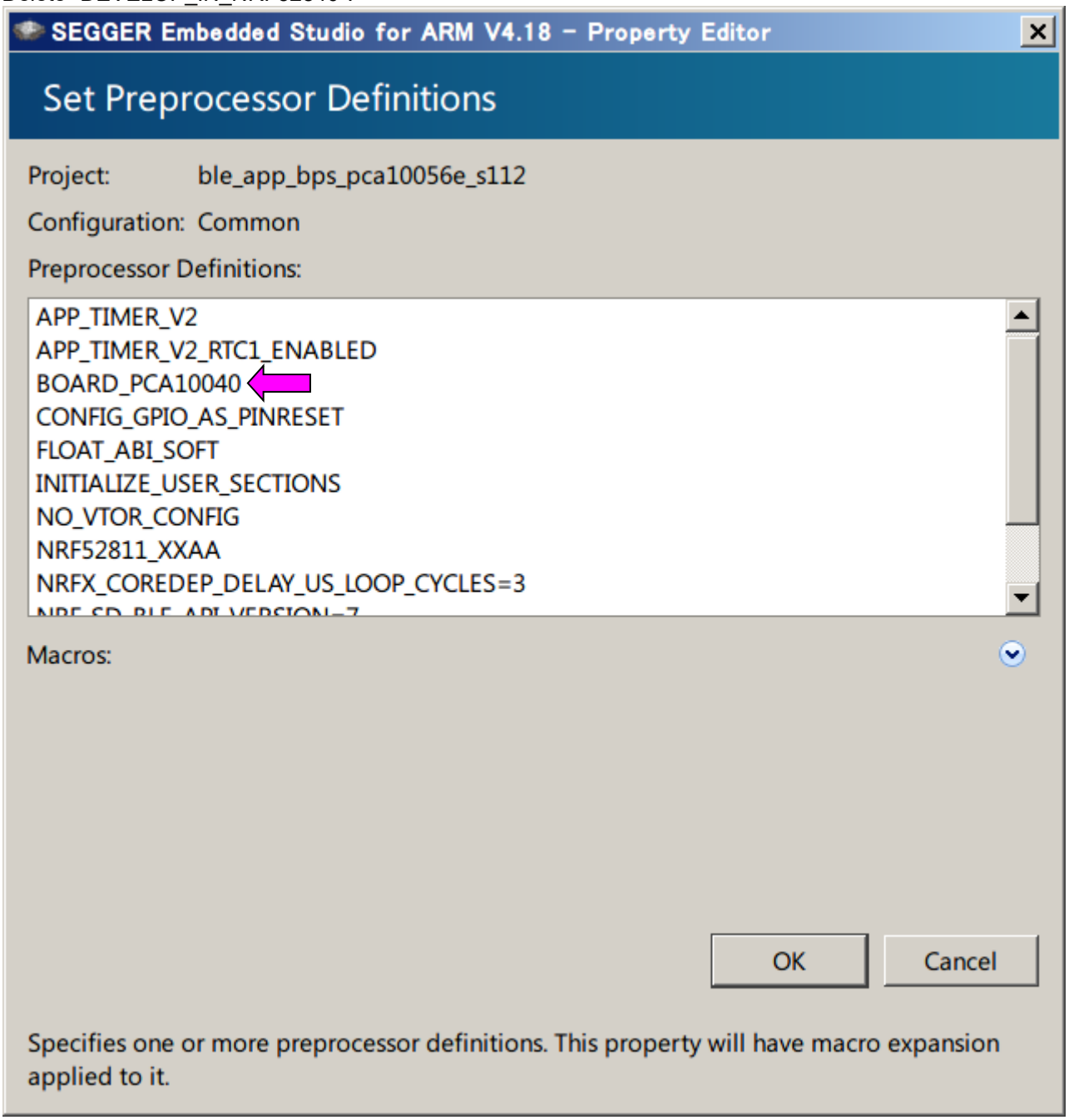


Fig. A-5: Modified "Preprocessor Definitions"

8) Click the "OK" button to close the screen.

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Revision History

Document No.	Issue date	Page		Revision description
		Before revision	After revision	
FEXK715x1EK1_ HardManual-01	Dec. 1, 2020	–	–	Final first edition

(Caution) This does not include typographical errors, changes in expressions, or corrections.

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