

AN13898

OpenSDA on PN76 development boards

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Application note

Document information

Information	Content
Keywords	OpenSDA, PN76, development boards, SEGGER, debugging
Abstract	This document explains how to enable the OpenSDA interface for debugging on the PN76 development boards.



Revision history

Revision history

Rev	Date	Description
v.1.0	20230313	Initial version

1 Introduction

This document explains what OpenSDA is, what you can do with it and how to enable it on the PN76 family development boards. There are hardware changes involved and the OpenSDA microcontroller must be programmed.

- Due to the hardware changes, the JTAG/SWD connector "J17" is rendered useless. To use this connection again, you have to undo any changes.

The board used in this document is the PNEV7642A Rev.B without a preloaded K20.

Note: In future the K20 might come already preprogrammed with the OpenSDA application. This can be easily identified by plugging in a USB-C cable to J27 and check your device manager for an J-Link driver. If such devices appear, you do not have to undergo any programming steps to, and only need to prepare the hardware according to [Section 2](#).

1.1 OpenSDA

OpenSDA is an open-standard serial debug adapter offered by SEGGER [1]. It bridges serial and debug communications between a USB host and an embedded target processor. The hardware circuit is based on an NXP Kinetis K20 family microcontroller (MCU) with 128 kB of embedded flash and an integrated USB controller.

The host interface supports two application modes:

- **Mass storage device (MSD):** Allows easily programming the applications into the flash of the target processor by dragging the new binary onto the drive.
- **Debug Application:** Provides an interface to Integrated Development Environment (IDE) software, allowing the debug of an application directly from the OpenSDA interface.

Both application modes support the USB Communications Device Class (USB CDC Interface) that bridges serial communications between the USB host and a UART serial interface on the target processor.

In order to switch between these application modes, the OpenSDA interface processor must be started in bootloader mode and the corresponding OpenSDA application firmware has to be dragged and dropped into the drive.

2 Prepare hardware

Following hardware changes must be applied:

- Remove R70 and populate R69
 - This switches the SWD connection from the JTAG connector J17 to the OpenSDA block onboard.
- Populate R109 and R110
 - Connects the SWD from OpenSDA to the SWD connection of the board.
- Make sure that J31 and J32 are populated (default)

Following picture shows the location of the resistors which have to be resoldered:

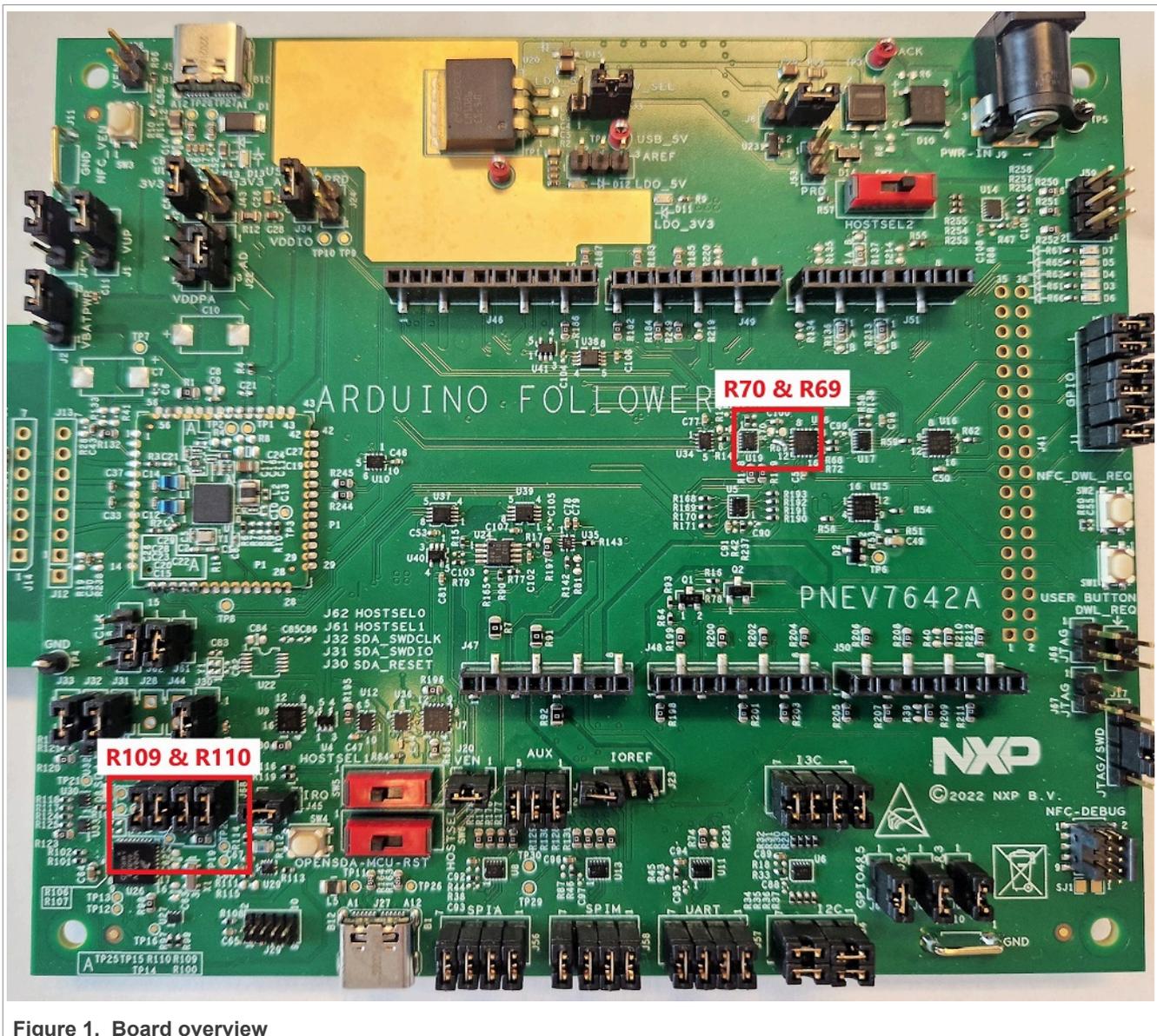


Figure 1. Board overview

2.1 R69 and R70

The resistor R70 must be removed and the resistor R69 must be populated with a 0 ohm resistor.

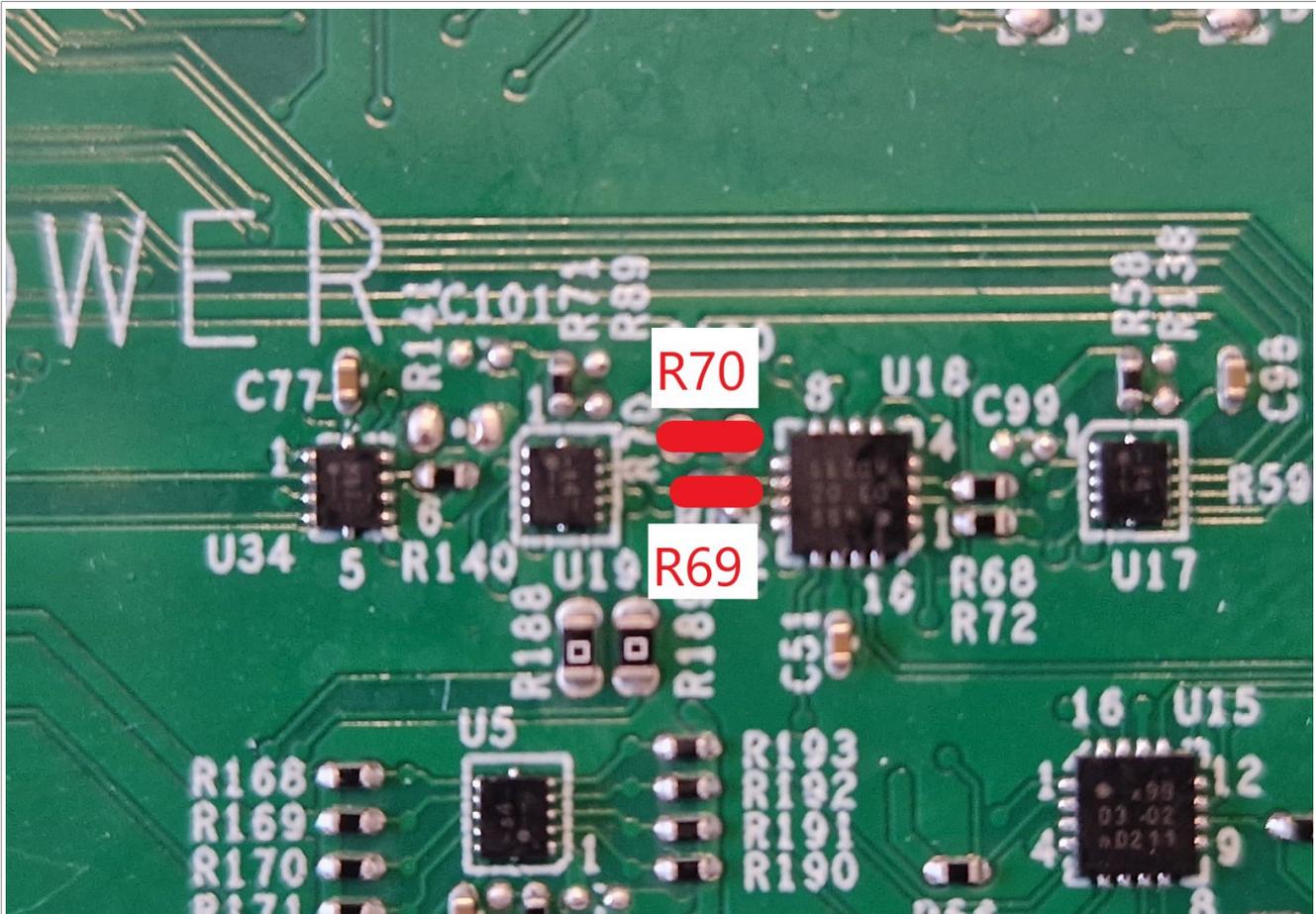


Figure 2. R69 and R70 location

2.2 R109 and R110

Both resistors are directly located below the jumper row and both are per default not populated. Solder a 0 ohm resistor to enable the SWD connection of the OpenSDA block.

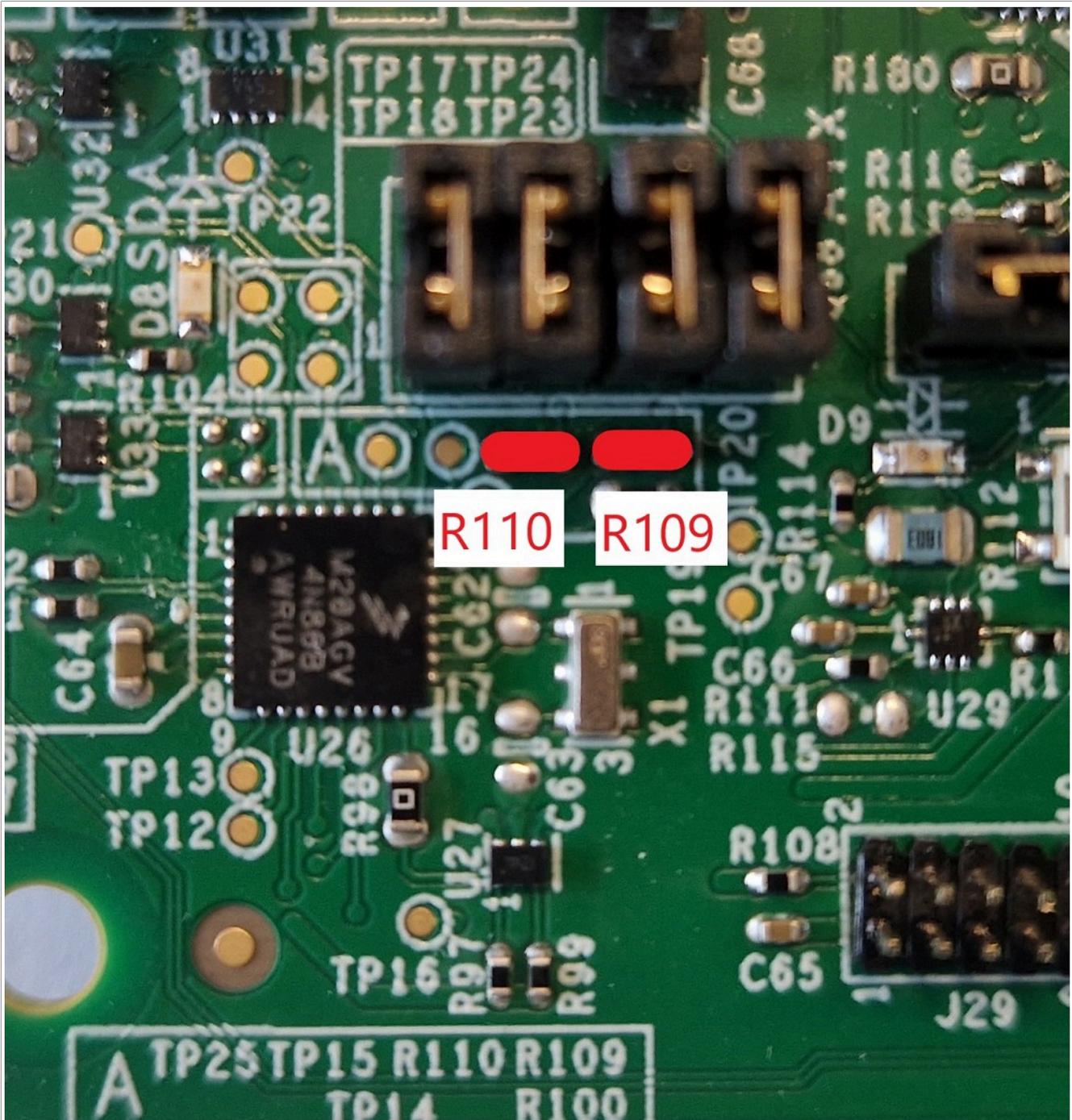


Figure 3. R109 and R110 location

3 Program OpenSDA bootloader

The onboard K20 is empty and the OpenSDA bootloader must be programmed from the user. This chapter explains how to program the bootloader and further on load the OpenSDA application on it.

For this document, a SEGGER J-Link and the tools coming with the J-Link SDK are used. Potentially any programmer which can program a Kinetis K20 can be used, but this is not explained within this document.

Prerequisites:

- Programmer capable to program Kinetis K20 (in this document used: SEGGER J-Link)
 - Connected to J29 (located in the OpenSDA section of the board)
- USB-C cable
 - Connected to J27 (located in the OpenSDA section of the board)
- K20 bootloader
 - Downloadable at the PN76 software section
- OpenSDA bootloader application (OpenSDA V2.1 bootloader)
 - Directly from SEGGER [\[1\]](#)

3.1 Program K20 bootloader

Connect the Programmer and USB-C cable to the PNEV7642A development board.



Figure 4. OpenSDA programming connection

Using J-Flash Lite to program the "K20_Backup_Bootloader.bin" to the K20:

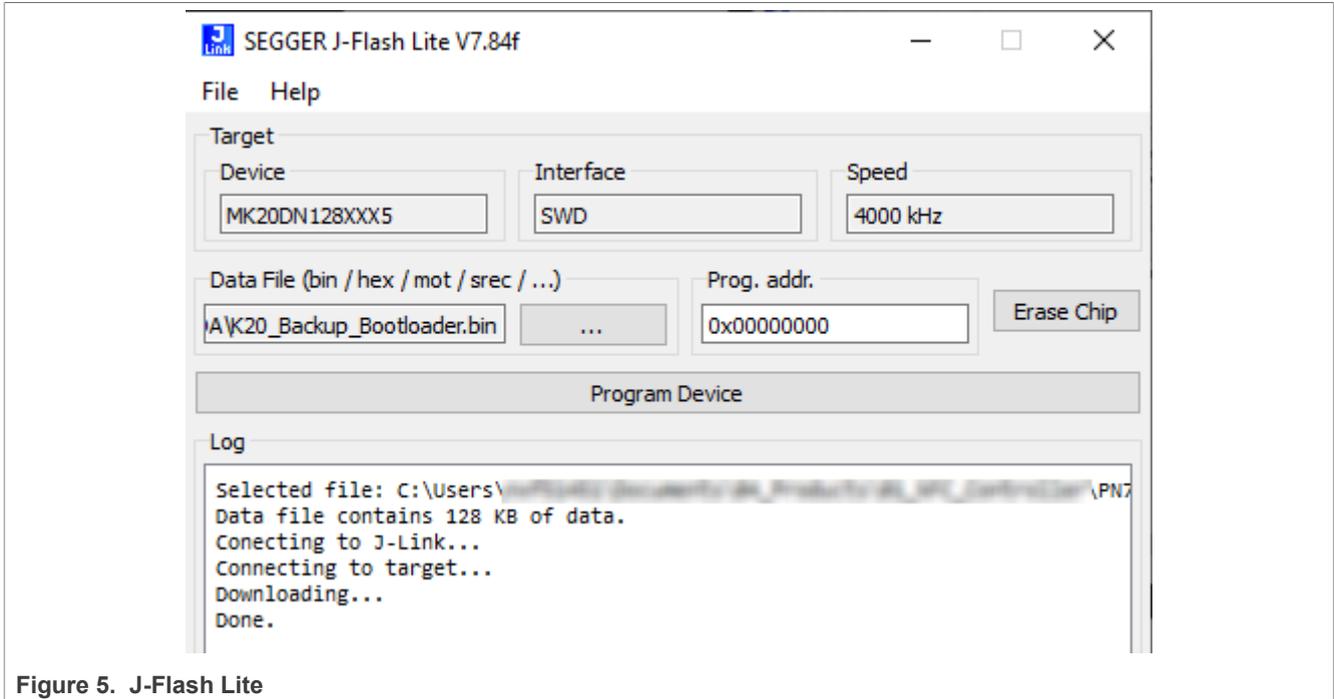


Figure 5. J-Flash Lite

After the download is successful, the programmer can be unplugged.

3.2 K20 bootloader

To bring the K20 into bootloader mode which populates a mass storage device on the host PC, follow these steps:

- Unplug the USB-C Cable on J27
- Press and hold SW4 (small white button located in the OpenSDA area)
- Plug in the USB-C cable on J27
- Release the reset button "SW4"

A mass storage device appears:

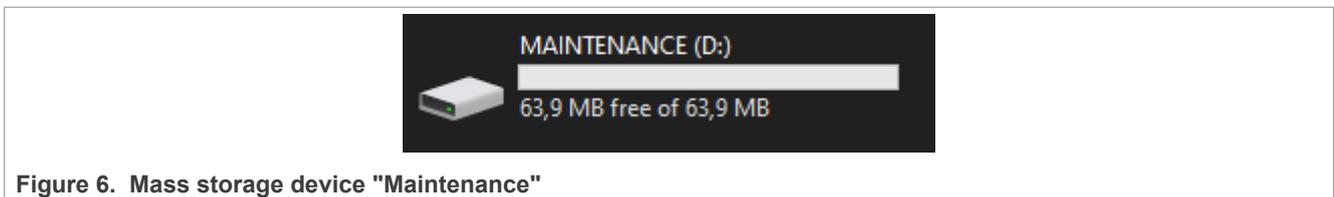


Figure 6. Mass storage device "Maintenance"

Onto this mass storage device, you can now load any OpenSDA application.

3.3 Load an OpenSDA application

After you have entered the bootloader mode, and a mass storage device appeared, you can load any OpenSDA application onto the K20. By simply drag&drop or copy&paste the application binary it is programmed.

We use the OpenSDA_V2.1.bin which we obtained previously from the SEGGER homepage.

After successful operation you see a J-Link device driver and COM Port in your device manager:

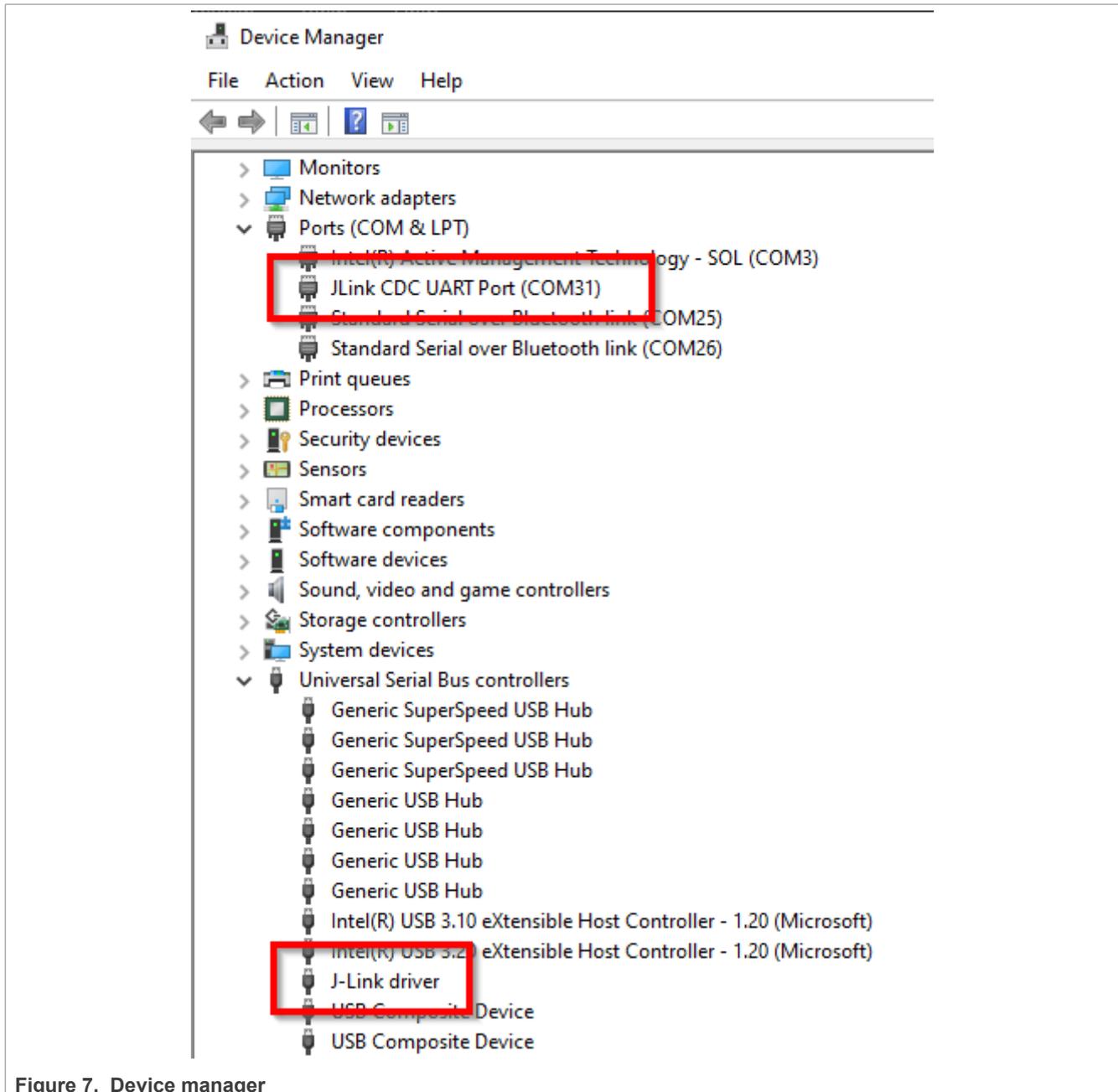
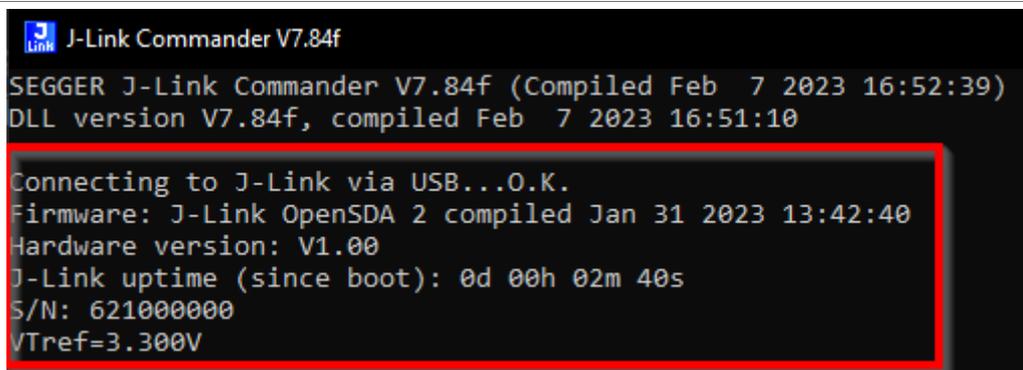


Figure 7. Device manager

To ensure the connection is working, you can open J-Link commander and see if it connects to J-Link OpenSDA.

A screenshot of the J-Link Commander V7.84f application window. The window title is "J-Link Commander V7.84f". The terminal output shows the following text: "SEGGER J-Link Commander V7.84f (Compiled Feb 7 2023 16:52:39)", "DLL version V7.84f, compiled Feb 7 2023 16:51:10", "Connecting to J-Link via USB...O.K.", "Firmware: J-Link OpenSDA 2 compiled Jan 31 2023 13:42:40", "Hardware version: V1.00", "J-Link uptime (since boot): 0d 00h 02m 40s", "S/N: 621000000", and "VTref=3.300V". A red rectangular box highlights the connection status and hardware information lines.

```
J-Link Commander V7.84f
SEGGER J-Link Commander V7.84f (Compiled Feb 7 2023 16:52:39)
DLL version V7.84f, compiled Feb 7 2023 16:51:10
Connecting to J-Link via USB...O.K.
Firmware: J-Link OpenSDA 2 compiled Jan 31 2023 13:42:40
Hardware version: V1.00
J-Link uptime (since boot): 0d 00h 02m 40s
S/N: 621000000
VTref=3.300V
```

Figure 8. J-Link commander OpenSDA connection

4 Use OpenSDA in MCUXpresso

The OpenSDA can be used as any other debugger within MCUXpresso [2].

Make sure that it is plugged in. To work on the PNEV7642A development board, you need at least the OpenSDA connected to J27 and a powered PNEV7642 board (by either USB "J5" or external power jack).

In MCUXpresso, before downloading or debugging code, it searches for attached probes. A window pops up with all discovered probes. Here you can use the J-Link OpenSDA same as any other debugger with the full capability of debugging, programming, and erasing the PN7642.

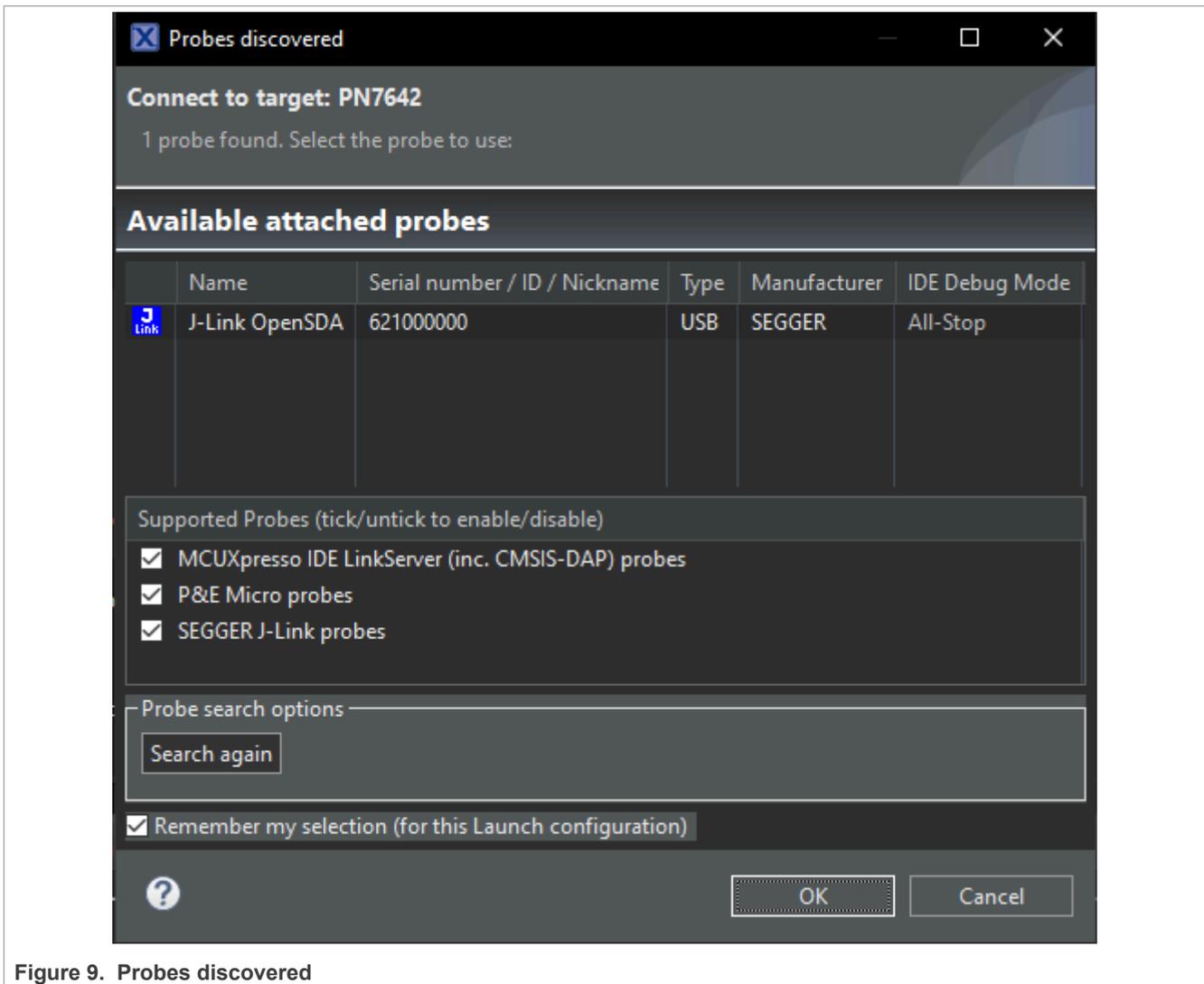


Figure 9. Probes discovered

After having chosen the J-Link OpenSDA, it downloads the chosen example to the PN7642 and start debugging.

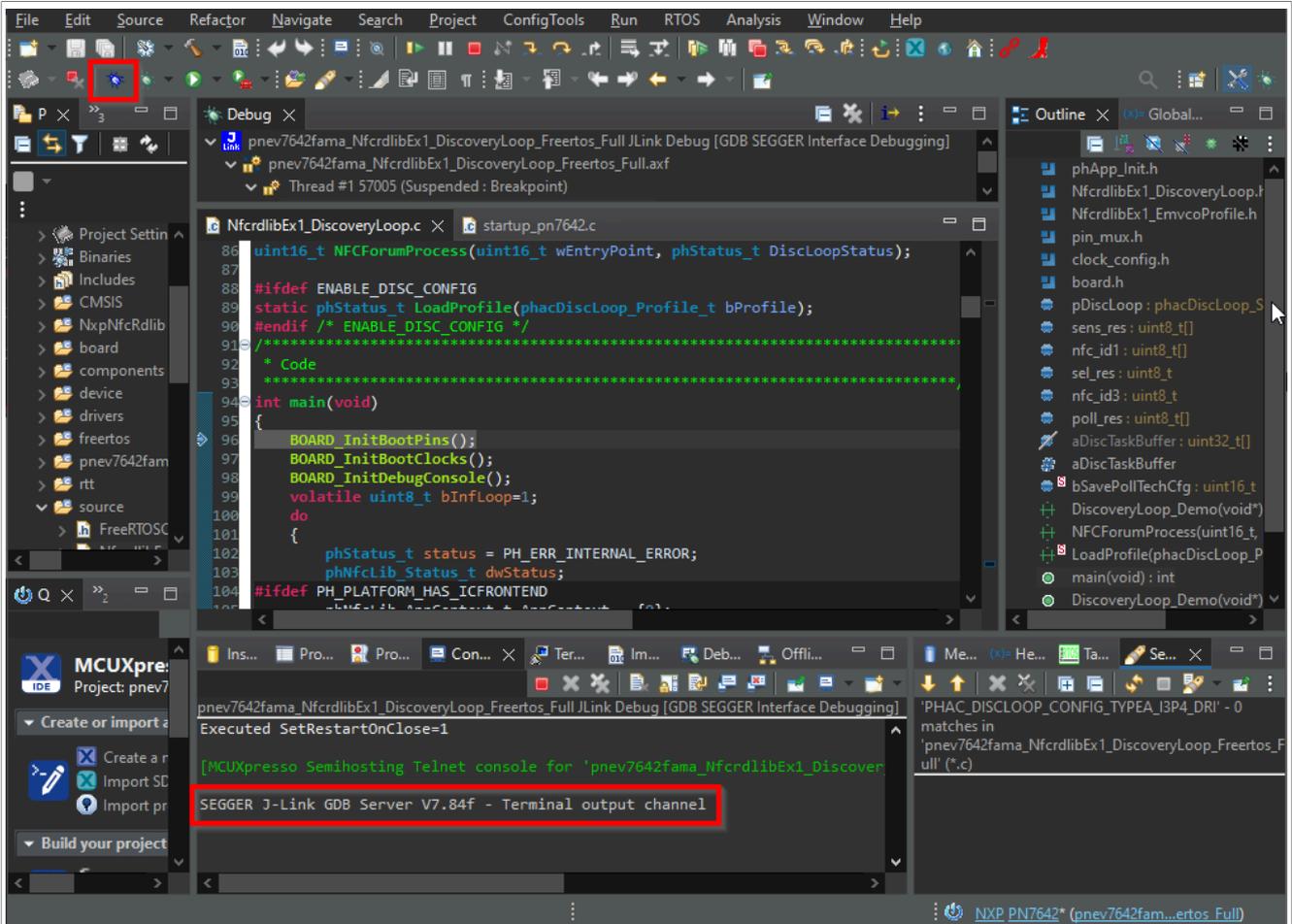


Figure 10. MCUXpresso debugging

5 References

- [1] SEGGER OpenSDA: <https://www.segger.com/products/debug-probes/j-link/models/other-j-links/opensda-sda-v2/>
- [2] MCUXpresso: <https://www.nxp.com/design:MCUXpresso-IDE>

6 Abbreviations

Table 1. Abbreviations

Acronym	Description
CDC	Communications Device Class
IDE	integrated development environment
JTAG	Joint Test Access Group
MCU	microcontroller
MSD	mass storage devic
OpenSDA	open-standard serial debug adapter
SDK	software development kit
SWD	serial wire debug
UART	universal asynchronous receiver transmitter

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