Bluetooth[®] Low Energy IoT Development Kit (B-IDK) Getting Started Guide

INTRODUCTION

This document helps you get started with the Bluetooth Low Energy IoT Development Kit (B–IDK). The B–IDK is a comprehensive node–to–cloud and a modular IoT platform that allows development of various BLE based use cases. Along with the hardware and software, the B–IDK includes a mobile app to interact with sensors and actuators.

The B–IDK features RSL10, Industry's lowest power Bluetooth 5 SoC and comprises of a baseboard (BDK–GEVK) and several sensor and actuator daughter cards. For a complete listing of available daughter cards, please visit https://www.onsemi.com/B–IDK. The daughter cards connect to the baseboard, via the two PMOD connectors and/or the Arduino connector to enable various use cases.

Scope

This document covers the hardware setup, software architecture, B–IDK documentation and provides instructions on downloading firmware to the board. The details regarding the mobile app and cloud connectivity are not covered in this document.

HARDWARE

- BDK-GEVK B-IDK Baseboard
- Daughter Cards Optional
- BDK-DCDC-GEVB Power Shield For Use With Higher Power Daughter Cards Optional

Default Configuration

The BDK-GEVK is shipped with the following jumper configuration. As the board supports OBD, there is no need for an external debugger. In case an external debugger is used, connect it to SWD header, J6.

Powering the Board

Multiple options are available to power the BDK-GEVK.

- USB
- Coin Cell (CR2032)
- External AC/DC Adapter plus power shield (BDK–DCDC–GEVB)
- External Supply

When higher power daughter cards (listed below) are attached to the baseboard, external supply either using the power shield or direct is required.

Higher Power Daughter Cards

- D-LED-B-GEVK Dual LED Ballast
- D-STPR-GEVK Dual Stepper Motor Driver
- BLDC-GEVK BLDC Motor Driver



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EVAL BOARD USER'S MANUAL

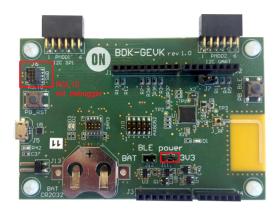


Figure 1. Board Photo

USB

The B–IDK can be powered via the USB port when the use case doesn't need any higher power daughter cards. An example configuration with the baseboard and a couple of sensor boards is shown below.



Coin Cell

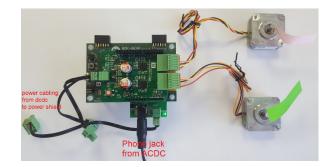
Once the firmware is flashed onto the baseboard, a coin cell (CR2032) may be used to power the system. Similar to USB based power supply, this method of powering is for use cases that don't utilize the higher power daughter cards. The jumper configuration must match the below table to allow for various power modes.

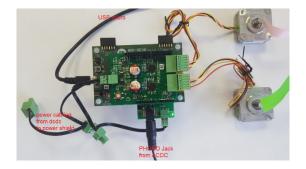
Table 1. JUMPERS

J11	J12	Usage
IN	Х	Programming and Power over USB
X	IN	After programming. Only RSL10 is powered.
IN	IN	After programming. Both RSL 10 and OBD Microcontroller are powered

External AC/DC Adapter Plus Power Shield (BDK-DCDC-GEVB)

For use cases that utilize higher power daughter cards, an external AC/DC power supply (Ex: SMI24–12–V–P6) plus the power shield (BDK–DCDC–GEVB) are needed to power the system. While the 3.3 V supply to the baseboard is provided by the power shield via the Arduino connector, power cables (Green connector) are required between BDK–DCDC–GEVB and the higher power daughter card. For firmware flashing and debugging, the USB cable may be plugged in simultaneously with this mode as shown below.





External Supply

The B–IDK can be powered by an external supply via J13. In this mode, the battery cannot be installed. Jumpers J11 and J12 must be installed.

SOFTWARE

The B-IDK software allows for rapid development of various use cases. This section details the prerequisites and detailed steps in downloading firmware onto the baseboard.

Prerequisites

- 1. Install 64-bit version of Java from https://www.java.com/en/download/
- 2. Install J-Link Version 6.32f or later from https://www.segger.com/downloads/jlink (select J-Link software and documentation pack)
- 3. Download and install"On Semiconductor IDE Installer" from
 - https://www.onsemi.com/PowerSolutions/product.do?id=RSL10
 - a. Download the RSL10 SDK Getting Started Guide and RSL10 CMSIS pack under "RSL10 Software Package" from the above site. All of these are highlighted in the picture below. Save the CMSIS pack in a folder, for example, C:\cmsis_packs



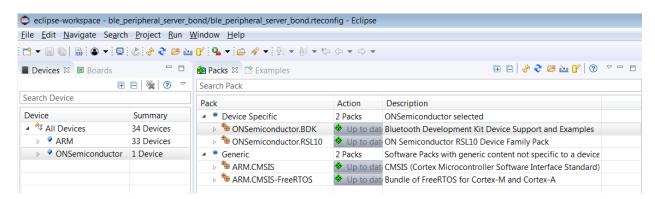
- 4. Download the B-IDK CMSIS pack from https://www.onsemi.com/B-IDK and save it in the same folder as the RSL10 CMSIS pack (see 3.a above)
- 5. CMSIS pack at item 4. is dependent on ARM CMSIS pack as well. Please install ARM CMSIS pack 5.5.1 or higher after download from: <u>https://github.com/ARM-software/CMSIS_5/releases</u>
- 6. CMSIS pack at item 4. is also dependent on ARM CMSIS FreeRTOS version 10.2.0 or higher for users exposed to design the code under FreeRTOS with RSL10: <u>https://github.com/ARM-software/CMSIS-FreeRTOS/releases</u>

The next section provides details on importing the downloaded CMSIS packs into the SDK.

Importing CMSIS Packages

1. Launch the RSL10 SDK ON Semiconductor IDE

- NOTE: Please import RSL10 CMSIS pack first as the B-IDK CMSIS pack (step 4 in the Prerequisites section) depends on the RSL10.
 - 2. Refer to Chapter 3 of RSL10 SDK Getting Started Guide (step 3.a) for step-by-step instructions on importing the CMSIS packs.
 - 3. Once all packs are successfully imported, they can be viewed in the CMSIS pack manager perspective as shown below.

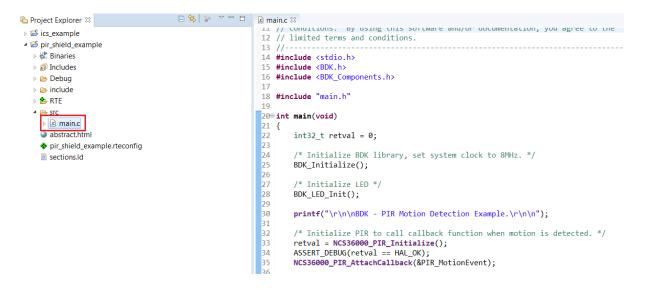


Compiling and Flashing

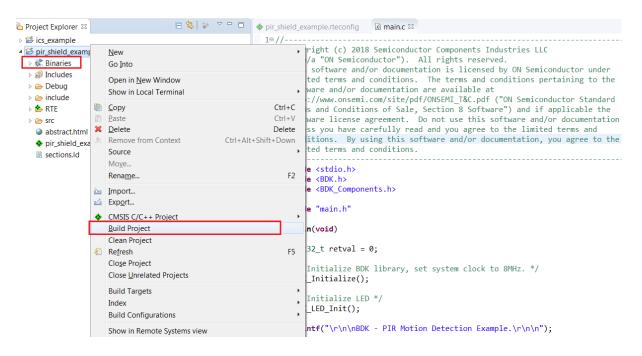
1. Choose an example (for example, pr_shield_example) to flash by copying it to the workspace.

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		BN0055 Sensor Example (Bluetooth Deve 💠 Cor	Uses BNO055 located on MULTI-SENSE-GEVB to determin	 BDK Push Button Example (Bluetooth Development Kit)
		Custom Service Firmware (Bluetooth Deve 💠 Co	exposes sensor data over Cusrom Service BLE Profile.	 Bdk_blinky (Bluetooth Development Kit)
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		Software Timer Example (Bluetooth Deve 💠 Cop	Example showing Ticker, Timeout and Timer use cases of	 IDK Custom Service Example (Bluetooth Development Kit)
		Stepper Shield Example (Bluetooth Devel 💠 Co	control two stepper motors via D-STPR-GEVB	 LED Ballast Shield Example (Bluetooth Development Kit)
				 NOA1305 Sensor Example (Bluetooth Development Kit)
				 PIR Shield Example (Bluetooth Development Kit)
				 Software Timer Example (Bluetooth Development Kit)
				 Stepper Shield Example (Bluetooth Development Kit)

NOTE: Once the example is copied, it can be viewed under Project Explorer. All source files including main are located in the src folder.

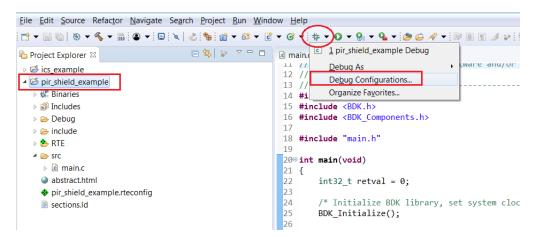


2. Right click and build the project. This creates binaries to be flashed to BDK-GEVK.



NOTE: If the binaries are not seen, press F5 (refresh).

3. Once the build is done, the code is ready to be flashed to the BDK–GEVK. Select the project (pir_shield_example), and go to the debug configurations as shown below.



4. Double click **GDB Segger J–Link Debugging** to create the debug configuration for the selected example.

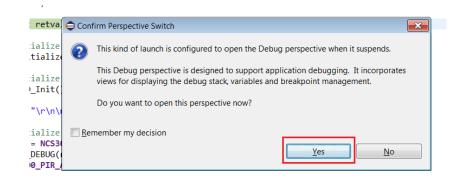
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NOTE: The debug configuration for the selected example is automatically saved and there's no need to re-create it.

5. On the **Debugger** tab, set RSL10 as the device name. Click **Debug** to launch the code.

Debug Configurations	
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Filter matched 10 of 10 items	Re <u>v</u> ert Apply
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6. For application debugging, confirm perspective switch by clicking Yes.



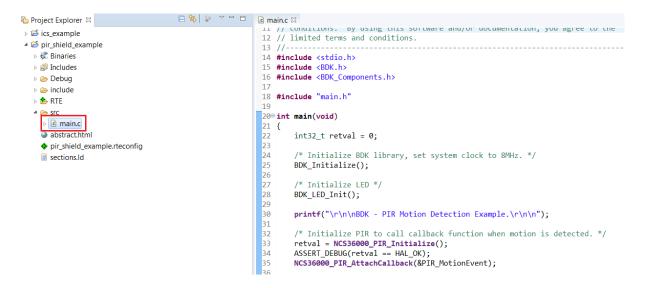
7. The debug session is now launched. Click Resume (F8) to start the target CPU.

Compiling and Flashing

1. Choose an example (for example, pr_shield_example) to flash by copying it to the workspace.

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Bluetooth Develop	orr RSL10	BDK Push Button Example (Bluetooth Dev 🔶 Copy	Simple example on how to generate events when on-boa	A Components
RSL10 Evaluation E	Bo RSL10	bdk_blinky (Bluetooth Development Kit) 💠 Copy	Example that blinks the on-board LED	Examples
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		Custom Service Firmware (Bluetooth Deve 🔶 Copy	Exposes sensor data over Cusrom Service BLE Profile.	 Bdk_blinky (Bluetooth Development Kit)
		IDK Custom Service Example (Bluetooth E 💠 Copy	Example usage of IDK Custom Service Profile	BME680 Sensor Example (B Collapse Selected
		LED Ballast Shield Example (Bluetooth De 🔶 Copy	Control two LEDs connected to D-LED-B-GEVK	ONSemiconductor::Bluet
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		PIR Shield Example (Bluetooth Developm 🔶 Copy	Example that blinks on-board LED when motion is detect	 Custom Service Firmware (Bluetooth Development Kit)
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				NOA1305 Sensor Example (Bluetooth Development Kit)
				 PIR Shield Example (Bluetooth Development Kit)
				 Software Timer Example (Bluetooth Development Kit)
				 Stepper Shield Example (Bluetooth Development Kit)

NOTE: Once the example is copied, it can be viewed under Project Explorer. All source files including main are located in the src folder.

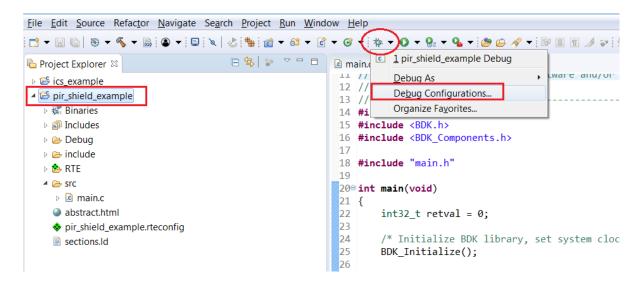


2. Right click and build the project. This creates binaries to be flashed to BDK-GEVK.

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NOTE: If the binaries are not seen, press F5 (refresh).

3. Once the build is done, the code is ready to be flashed to the BDK-GEVK. Select the project (pir_shield_example), and go to debug configurations as shown below.



4. Double click GDB Segger J–Link Debugging to create the debug configuration for the selected example.

Debug Configurations	
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NOTE: The debug configuration for the selected example is automatically saved and there's no need to re-create it.

5. On the Debugger tab, set RSL10 as the device name. Click Debug to launch the code.

Cebug Configurations	
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Create, manage, and run configurations	Name: pir_shield_example Debug Main * Debugger > Startup > Source Common J-Link GDB Server Setup Start the J-Link GDB Server locally Connect to running target Executable: Siglink_gdbserver} Actual executable: (to change it use the global or workspace preferences pages or the global or workspace preferences pages or the global device names Enclanness: Little Big Connection: Connection: USB Initial speed: Auto Adaptiv Fixed SWO port: 2332 Verify downloads Initialize registers on start
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6. For application debugging, confirm perspective switch by clicking Yes.

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7. The debug session is now launched. Click Resume (F8) to start the target CPU.

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200 int main(void)				
21 {				
<pre> 22 int32_t retval = 0; </pre>				
23 24 /* Initialize BDK library, set system clock to 8MHz. */				
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Read 4 bytes @ address 0x00102AB2 (Data = 0x00042000)				
Read 2 bytes @ address 0x001029BC (Data = 0x4295)				
Read 2 bytes @ address 0x001029BE (Data = 0x4A3D)				
Read 4 bytes @ address 0x00102AB6 (Data = 0x53D02000)				
Read 2 bytes @ address 0x001029C0 (Data = 0xD908)				

Logging/Debugging

The following options are available to log/debug the downloaded firmware:

- Eclipse RTT Console
- J-Link RTT
- AX8052F100 UART-SPI bridge

This section provides instructions for each of the above options.

Using Eclipse Console

1. Click the Open a Terminal Icon

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☆ Debug 🛛 Open a Terminal (Ctrl+A	lt+Shift+T)
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2. Enter the values shown below and launch the session. The incoming events are printed on the terminal window.

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J-Link OB-SAM3U128 V3 compiled Jul 12 2018 12:17:50 V3.0, SN=48303 Process: JLinkGDBServerCL.exe	0634
PIR: Motion detected at 368662 ms.	
PIR: No motion at 370868 ms.	
PIR: Motion detected at 518577 ms.	
PIR: No motion at 520783 ms.	

PIR: No motion at 520783 ms. PIR: Motion detected at 521608 ms. PIR: No motion at 523814 ms.

Using Eclipse Serial Console via UART-SPI Bridge.

When you do not want to use the Segger RTT viewer as serial console, the BDK–GEVK board is equipped with UART–SPI uC AX8052F100 flashed with special firmware, taking care of the entire serial communication with values returned on Terminal.

3. Click on the example's rteconfig file and choose under *Device/BDK/Output redirection*, SPI Bridge AXEM. Save, compile and flash the whole project.

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4. When the project runs, Click the **Open a Terminal** Icon.

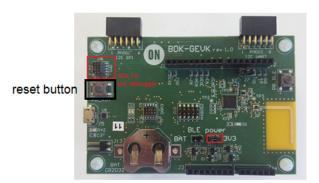
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* Debug Ø Open a Terminal (Ctrl+Alt+Shift+T)				
Image: Second				
4 🕃 pir_shield_example.elf				
Thread #1 57005 (Running : User Request)				
JLinkGDBServerCL.exe				
📕 arm-none-eabi-gdb				
Semihosting and SWV	۰			

5. Enter the appropriate COM port as shown below, and launch the session. The incoming events are entered on the terminal window.

¢	Launch Terr	ninal 🗖 🗖 💌
	Choose term	inal: Serial Terminal 🔹
	Settings	
	Serial port:	_
	Baud rate:	115200 ▼
	Data size:	8 🗸
	Parity:	None
	Stop bits:	1
	Encoding:	Default (ISO-8859-1) 🔹
	?	OK Cancel

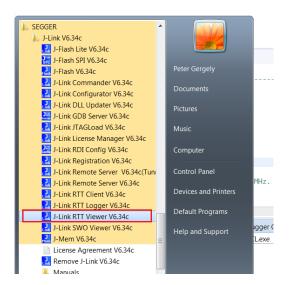
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File Edit Navigate Search Project Run Window Help		
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[c] pir_shield_example Debug [GDB SEGGER J-Link Debugging] [c] pir_shield_example.eff [v] Thread = 157005 (Running : User Request) JinkGDBServer(Lexe		Name
📕 arm-none-eabi-gdb		
Semihosting and SWV		
le main.c		
Break at address "0xdeadbeee" with no debug information available, or outside of program code.		
View Disassembly		
view bisossenibly		
Configure when this editor is shown Preferences		
🗳 Console 🧟 Tasks 🔝 Problems 📀 Executables 🖉 Terminal 🕸 🚱 Debugger Console		
E Telnet localhost (8/27/18 8:50 AM)		
SEGGER J-Link V6.34c - Real time terminal output		
J-Link OB-SAM3U128 V3 compiled Jul 12 2018 12:17:50 V3.0, SN=483035634		
Process: JLinkGDBServerCL.exe PIR: Motion detected at 368662 ms.		
PIR: No motion at 370868 ms.		
PIR: Motion detected at 518577 ms.		
PIR: No motion at 520783 ms.		
PIR: Motion detected at 521608 ms.		
PIR: No motion at 523814 ms.		

NOTE: You may reset (PB_RST) the BDK-GEVK (shown below) to launch the RTT terminal without needing to launch Eclipse.



Using J–Link RTT

6. After step 14 is done, open J-Link RTT viewer (should be installed when J-Link software package was installed per Step 2).



7. Select USB and click OK.

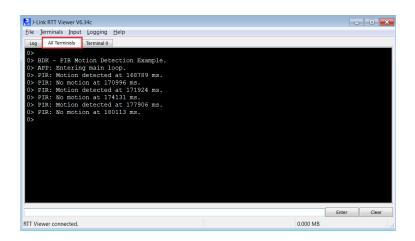
J-Link RTT Viewer V6.34c		
<u>File Terminals Input Loc</u>	🔜 J-Link RTT Viewer V6.34c Configuration 🛛 💦 💌]
Log All Terminals Terr LOG: J-Link RTT Vie LOG: Terminal 0 add	Connection to J-Link USB Serial No LCP/IP Existing Session Specify Target Device Script file (optional)	
	Target Interface & Speed	
	SWD 4000 kHz	
	RTT Control Block Auto Detection <u>A</u> ddress <u>Search Range</u>	
	OK Cancel	Enter Clear
Ready.		0.00 MB

8. RTT prompts you to select the appropriate microcontroller. Select RSL10 and click OK. The serial terminal is ready to use and the events from RSL10 can be observed by clicking the All Terminals Window.

🔜 J-Link RTT Vie	wer V6.34c	X
<u>File</u> <u>Terminals</u>	Input Logging Help	
Log All Termi	inals Terminal 0	
	: RTT Viewer V6.34c: Logging started. al 0 added.	
🛃 J-L	ink V6.34c Device Selection	23
•	The selected device "UNSPECIFIED" is unknown to this version of the J-Link software. Please make sure that at least the core J-Link shall connect to, is selected. Proper device selection is required to use the J-Link internal flash loaders for flash download or unlimited flash breakpoints. For some devices which require a special handling, selection of the correct device is in <u>UNE</u>	iportant.
	E	inter Clear
Ready.	Establishing J-Link connection 0.00 MB	

▼ Device RSL10	Core *	-		endian •
Device	Core	NumCo	Flash size	RAM size
RSL10	Cortex-M3 r2p1	1	390 KB	24 KB
d,modification of flash mem	iory during a debug sessio			ell <u>C</u> ancel
	FSL10 Device RSL10 ror J-Link. the is not required for most d d.modification of flash merei	IRSL10 Core Core RSL10 Cortex-M3 r2p1 Cortex-M3 r2p1 or J-Link. re is not required for most devices, but allows more aff	FRSL10 For a constraint of the set	

🔜 J-Link RTT Viewer V6.34c	- • •
Eile Terminals Input Logging Help	
Log All Terminals Terminal 0	
LOG: SWD speed too high. Reduced from 2667 kHz to 1800 kHz LOG: Scanning AP map to find all available APs LOG: AP[0]: Stopped AP scan as end of AP map has been reac LOG: AP[0]: AHB-AP (IDR: 0x24770011) LOG: Terating through AP map to find AHB-AP to use LOG: AP[0]: Core found LOG: AP[0]: AHB-AP ROM base: 0xE00FF000 LOG: CPUID register: 0x412FC231. Implementer code: 0x41 (A LOG: FPUnit: 2 code (BP) slots and 0 literal slots LOG: CoreSight components: LOG: CoreSight components:	ched
LOG: ROMTb1[0][0]: E000E000, CID: B105E00D, PID: 000BB000 LOG: ROMTb1[0][1]: E0001000, CID: B105E00D, PID: 003BB002 LOG: ROMTb1[0][2]: E0002000, CID: B105E00D, PID: 002BB003 LOG: RTT Viewer connected.	DWT FPB Enter Clear
RTT Viewer connected.	0.000 MB



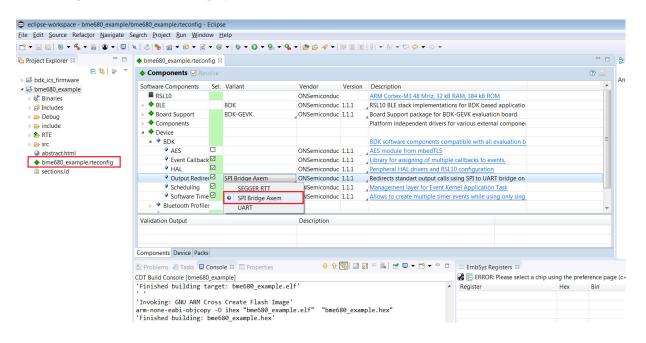
NOTE: You may reset (PB_RST) the BDK-GEVK (shown below) to launch RTT terminal without needing to launch Eclipse.



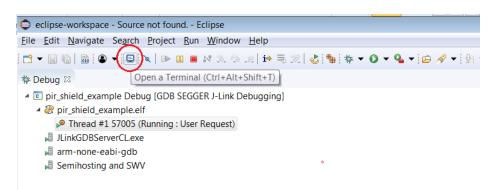
Using Eclipse Serial Console via UART-SPI Bridge

The BDK–GEVK board is equipped with UART–SPI microcontroller AX8052F100 flashed with special firmware, to enable serial communication with values returned to Terminal.

9. Click on example's rteconfig file and choose "SPI Bridge AXEM" under *Device/BDK/Output redirection*. Save, compile and flash the whole project.



10. When the project runs, Click the Open a Terminal Icon.

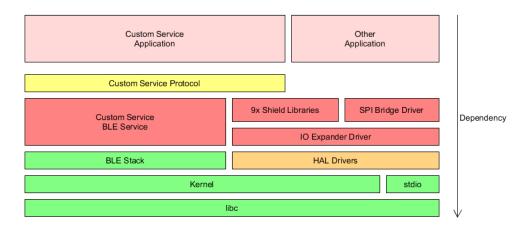


11. Enter the appropriate COM port as shown below and launch the session. The incoming events are printed on the terminal window.

	🖨 Launch Terminal		
	Choose terminal: Serial Ter Settings Serial port Baud rate: 115200 Data size: 8 Parity: None Stop bits: 1 Encoding: Default (ISO-84	• • • • 859-1) •	
 eclipse-workspace - Source not found. File Edit Navigate Search Project Ri Image: Image: Image:	un Window Help ■ 해 & 아내 바 등 있니 같 한 GGER J-Link Debugging]	Cancel 1 * • • • • • • • • : ⊕ • • • : ⊕ : • • •	¥ i i v □ □ 00• Varia Name
main.c COxdeadbeee 33 Break at address "Oxdeadbeee" with no de View Disassembly Configure when this editor is shown Pref	ferences		4
□ Console ② Tasks № Problems ○ Exe □ Tenet localhost (8/27/18 8:50 AM) ☆ SEGGER J-Link V6.34c - Real time J-link 06-SAM3U128 V3 compiled : Process: JLinkGD8ServerCL.exe V1R: Motion detected at 368662 V1R: Motion detected at 518577 r V1R: Nontion at 520783 ms.	e terminal output Jul 12 2018 12:17:50 V3.0, ms.	ger Console	

SOFTWARE ORGANIZATION

For users modifying the example code and building new projects, the following sections detail the B-IDK software organization. The stack overview is shown below.



B-IDK CMSIS Software Organization

CMSIS pack and the associated software components handle multiple evaluation boards as different bundles of the standardized Board Support Cclass.

- This bundle shows only components supported by ON Semiconductor for a given board
- No confusing component variants

Common libraries and HAL are in a separate group within the Device class

Cbundle	Cclass	Cgroup	Csub	Cvariant	Description
BDK-GEVK					Board support package for BDK-GEVK evalution board
		Libraries	1		Board specific libraries
			LED	1	On-board LED support
			Button		On-board push button support
			PCA9655E		16-bit I2C IO Expander library
		IDK Shields			Support for Arduino / PMOD extension boards
			PIR-GEVB	1	PIR Motion detection using NCS36000
			ALS-GEVB	1	Measure Ambient light levels using NOA1305 ambient light sensor
			MULTI-SENSE-GEVB	rev2.1	Combines 3 sensors: BME680, BNO055, NOA1305
			BLDC-GEVK		
			D-LED-B-GEVK	1	
			D-STPR-GEVK	1	
		ICS Protocol			Libraries that allow connected BLE devices to take control over sensors / actuators using ICS Service.
			System Node	1	Protocol implementation and sytem node used by other sensor / actuator nodes.
			PIR Node	1	Exposes motion data provided by NCS36000 from PIR-GEVB
			ALS Node	1	Exposes ambient light levels measured by NOA1305 from ALS-GEVB
			ENV Node	1	Exposes environmental data measured by BME680 from MULTI-SENSE-GEVB
			AO Node	1	Exposes absolute orientation measured by BNO055 from MULTI-SENSE-GEVB
			STPR Node	1	Allows remote control of two stepper motors connected to D-STPR-GEVB.
			LEDB Node	1	Allows remote control of two power LEDs connected to D-LED-B-GEVK
			BLDC Node	1	Allows to remote control BLDC motor connected to BLDC-GEVB.
	Components				Platform independent software drivers for controlling of various external IC.
		LED Driver		_	
			NCV78763]	Dual LED Driver and Power Ballast, for Automotive Front Lighting, 1.6 A, 2nd Generation
		Ambient Light Sensor			
			NOA1305]	Ambient Light Sensor with I2C Interface and DarkCurrent Compensation
		Motor Driver			
			AMIS-3054		Micro-stepping stepper motor driver with SPI interface for bipolar stepper motors
			LV8907UW	J	Sensor-less Three-phaseBrushless DC MotorController, with GateDrivers, for Automotive
		Environmental Sensor			
			bme680	J	Low power gas, pressure, temperature & humidity sensor
		Motion sensor			
			bno055		Intelligent 9-axis absolute orientation sensor
		Touch Sensor			
			LC717A00AR		Capacitance-Digital-Converter for Electrostatic Capacitive Touch Sensors
	Device		•		
		BDK		•	
			HAL	-	RSL10 Peripheral abstraction layers for BDK applications.
			Scheduling	-	Event Kernel wrapper for BDK applications.
			Software Timer	-	Allows to create multiple timer events while using only single hardware timer.
			Event Callback	-	Library for executing multiple event handlers when an event occurs.
			Output Redirection		Redirects standard library output calls (printf,) to specified channel
				SEGGER RTT	Output is transmitted using UART peripheral
			450	UARI	Output is transmitted over SWD using the on-board or external J-LINK deug probe
BDI/	BLE		AES	J	
<u>BDK</u>	BLE	Design and Comme	1		
		Peripheral Server	Pattery Carries	1	Eveness surrent bettery level to connected elient and configuration
			Battery Service ICS Service	-	Exposes current battery level to connected client and application. IDK Custom Service used to transmit sensor data using ICS Protocol library.
			Peripheral Server		
			Peripheral Server		BLE Peripheral Server implementation for BDK applications.

Board Support

- Libraries to support BDK-GEVK, GPIO Expander, Various daughter cards and custom protocol (required for the mobile app)

Components

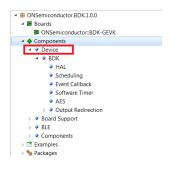
- Libraries attached to board support
- ◆ B ONSemiconductor.BDK.1.0.0

 ▲ Boards
 ■ Components
 ▶ Onsemiconductor.BDK-GEVK

 ◆ Components
 ▶ Board Support
 ▶ Motor Driver
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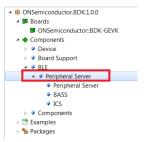
Device

• Abstraction layers for interfaces, timers, AES, serial re-direction, etc.



BLE

• Peripheral Server Support



CONFIGURATION SETUP

System settings can be configured directly from within the CMSIS pack. Each example is equipped with basic system configuration that covers three main categories. These are accessible in the RTE/BDK folder within the project. Each system configuration starts with "RTE_". As shown below, opening the RTE_... header files using the CMSIS configuration wizard (right click on the header file), displays the configuration table. Various application specific parameters can be set. This allows pre-configuration of RSL10 without the need for explicit programming.

Project Explorer 😂		83 ▼ 8 ▼ 6 ▼ 1 巻 ▼ 0 ▼ 9; ▼ 4 ▼ 1 9 ⊕ <i>A</i> ▼ 1 8 ■ 1 2 2 2 2 1 4 7 0 0 ▼ 0 ▼ B mainc ⊠
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	ONSemiconductor::BDK.Librarie:	14 #include <stdio.h> 15 #include <bdk.h></bdk.h></stdio.h>
HAL_UART.	ONSemiconductor::BDK.Libra	16 #include "BDK_Components.h"
	emiconductor::BDK.Libraries.Co	17 18 #include "main.h "
	[ONSemiconductor::BDK.Librari	18 #include main.n
	ONSemiconductor::BDK.Compo	200 int main(void)
	[ONSemiconductor::BDK.Comp	21 { 22 int32_t status = 0;
RTE_BDK.h	ONSemiconductor::BDK.Librar	23
-	55E.h [ONSemiconductor::BDK.C =	24 BDK_Initialize(); 25
	reTimer.h [ONSemiconductor::B T_printf.c [ONSemiconductor::B[<pre>26 printf("\r\nAPP: NOA1305_ALS example.\r\n");</pre>
	T.c [ONSemiconductor::BDK.Libi	27
	ner.c [ONSemiconductor::BDK.Li	<pre>28 status = NOA1305_ALS_Initialize(); 29 ASSERT DEBUG(status == 0);</pre>
	[ONSemiconductor::BDK.Librari	30
	VSemiconductor::BDK.Libraries.S ger_rtt.c [ONSemiconductor::BD	<pre>31 status = NOA1305_ALS_StartContinuous(APP_ALS_PERIODIC_INTERVAL_MS, 32 &&ALS ReadCallback);</pre>
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A brief description on the header files is given below.

RTE_BDK.h

Parameters such as system clock frequency and the board that feature RSL10 (default set to BDK–GEVK), etc. can be set. Descriptions of each of these parameters are also provided.

ption	Valu	Je	
SYSCLK Frequency	8 M	Hz	
APP Task Event Kernel message handler cour		48 MHz	
HAL Pinmap Configuration		24 MHz	
Board selection		16 MHz	
Custom Pinmap	•	8 MHz	
USART0_TX Pin	Z		
USART0_RX Pin	4		
SPI0_MOSI Pin	7		
SPI0_MISO Pin	10		
SPI0_SSEL Pin	5		
SPI0_SCLK Pin	6		
I2C0_SCL Pin	1		
SPI1_SDA Pin	0		
I2C0 DIO Low Pass Filter	ENA	BLED	
I2C0 DIO Drive Strength	6X		
I2C0 DIO Pull Selection	Nop	pull	
LED Pin	14		
Button Pin	15		

RTE_Software_Timer.h

Various timers (4) supported by RSL10 can be configured by invoking the CMSIS configuration wizard on this header file. Timer 1 is used for B–IDK components.

ption	Value
Software Timer Configuration	
Timer resolution [us]	100
Hardware Timer Select	TIMER1
	TIMERO
	TIMER1
	TIMER2
	TIMER3

RTE_PCA9655.h

PCA9655 is the GPIO expander chip assembled on most daughter cards to expand interface functionality. Parameters related to this chip can be set here.

Value
13
0
1234

RTE_x.h

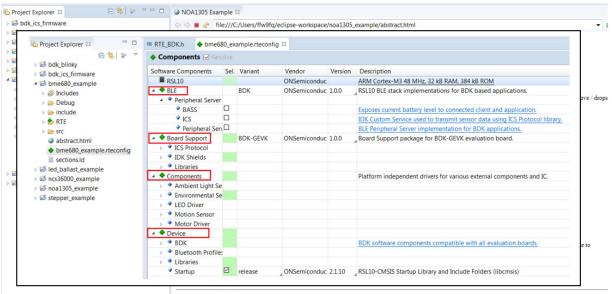
In addition to configuring system settings, all the supported daughter cards' parameters can be configured directly using the configuration wizard, without the need for programming. Once the parameters are changed per the application requirements, saving, rebuilding and flashing the project will let the new parameters take effect. Examples for the stepper and LED ballast daughter cards are shown below. Other daughter cards can be configured in a similar fashion.

-					
Option	Value				
Stepper Shield Left Channel					
Step Mode	1 / 4 Micro - Step				
Coil Peak Current	245 mA				
Direction Of Rotation	CW motion				
NXT Edge Trigger	Rising Edge				
Turn On / Off Slopes of Motor Driver	Very Fast				
Speed Load Angle Transparency Bit	SLA is not transparent				
Speed Load Angle Gain	0.5				
Enables doubling of the PWM frequency					
Enables jittery PWM					
Steps Per Revolution	200				
Stepper Shield Right Channel					
Step Mode	1 / 4 Micro - Step				
Coil Peak Current	1 / 32 Micro - Step				
Direction Of Rotation	1 / 128 Micro - Step				
NXT Edge Trigger	1 / 64 Micro - Step				
Turn On / Off Slopes of Motor Driver	Compensated Full Step, 2 phase on				
Speed Load Angle Transparency Bit	Compensated Full Step, 1 phase on				
Speed Load Angle Gain	1 / 16 Micro - Step				
Enables doubling of the PWM frequency	1 / 8 Micro - Step				
Enables jittery PWM	1 / 4 Micro - Step				
Steps Per Revolution	Compensated Half Step				
•	Uncompensated Half Step				
itep Mode	Uncompensated Full Step				

ption	Value
•	
	Internal
	242 kHz
,	
	10 mV / us
	30 uS
	5.8 V
	-1 V
-	0.4 V
-	115 ns
Booster Minimum On Time	150 ns
Booster Regulation Setpoint Voltage	45.0 V
	100 mV
Activate VBOOST AUX SUPPLY	
Booster Skip Clock Cycles	Disabled
D-LED-B-GEVK Channel 1 Peak current [m	252
D-LED-B-GEVK Channel 1 Average current	140
Enables the offset compensation for buck	
Comparator Threshold Voltage	0
Tunes the Toff x VLED value for channel 1	0
> Overcurrent Settings	
> Enable Buck Regulator Channel 2	
General Settings	
Thermal warning threshold	0
LED sampling duration selection	88
en en en en	• • •

DOCUMENTATION

Detailed documentation of all functions, code, APIs, HALs is part of the CMSIS package. Every use case (for a particular daughter card, service, etc.) copied into the workspace has its own manual with key description in the abstract.html page. URL Information and orderable part numbers are also provided as shown below.



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*.rteconfig

The *.rteconfig file lists the software components within the CMSIS pack as described in the B_IDK CMSIS Software Organization section. To access the components, double click *.rteconfig file. Extensive help is provided under the description tab.

Software Components	Sel.	Variant	Vendor	Version	Description	
RSL10			ONSemiconduc		ARM Cortex-M3 48 MHz, 32 kB RAM, 384 kB ROM	
🔺 💠 BLE		BDK	ONSemiconduc	1.0.0	RSL10 BLE stack implementations for BDK based applications.	
Peripheral Server						
BASS					Exposes current battery level to connected client and application.	
ICS					IDK Custom Service used to transmit sensor data using ICS Protocol library.	
Peripheral Sen C					BLE Peripheral Server implementation for BDK applications.	
A Soard Support		BDK-GEVK	ONSemiconduc	1.0.0	Board Support package for BDK-GEVK evaluation board.	
ICS Protocol						
IDK Shields						
AMIS30543_ST		D-STPR-GEVK			Control two stepper motors connected to D-STPR-GEVK using AMIS-30543 motor driver.	
BME680_ENV MULTI-SENSE-C				Measure temperature, humidity and atmospheric pressure using BME680 environmental ssensor.		
BNO055_NDO		MULTI-SENSE-C			Determine absolute orientation of the board in space using BNO055 sensor	
NCS36000_PIR		PIR-GEVB			PIR motion detection using NCS36000 sensor	
NCV78763_LEE		D-LED-B-GEVK			Control two power LEDs connected to D-LED-B-GEVK using NCV78763 LED driver.	
NOA1305_ALS		ALS-GEVB			Measure ambient light level using NOA1305 ambient light sensor	
Libraries						
Button					On-board Push Button support	
🖉 LED 🛛 🖸					On-board LED support	
PCA9655E					16-bit I2C IO Expander library	
A					Platform independent drivers for various external components and IC.	
👂 🕈 Ambient Light Se						
Environmental Se						
LED Driver						
Motion Sensor						
Motor Driver						

ON Sewiconductor ⁴ OI BLUE Development (If: for RSL10
BN0055 Absolute Orientation Sensor
Absolute orientation ennorr library (acceleronneter, gyroscope, magnetometer). More
Data Structures
Btvct BNOSS_NDOF_Calibatus
BVODSS satisfation status at socials. More etat. BNODS NOT Resources
Marros
maclubs setime BN0555,100F_0EVP_ADDRESS (0x45 + 1)
12C address of IO expander on Multisensor shield.
Refere NotoSS_UCOF_UCCEP_OTT (1) O equative Constanting SUCOST estude signal.
Redne BNOSS, NOOF JOER, RT PH (P) 10 opprehe minute for BNOSS service Service Service
Refere BN0055 NDOF_ICERP_RAT_PIN_MA3K (1~< BN0055_NDOF_ICERP_RAT_PIN)
Fastne BNOSS, JOOF, JOEP, JIT, FM (1) 10 oppunde minuter for BNOSS Interpt signal.
Retine BN0055 ND0F_IOEKP_INT_FNI_MASK (1 << BN0055_ND0F_IOEKP_INT_FNI)
Enumerations
erum BNOSS, NDOF, Powerlloos (BNOSS, NDOF, POWER, MODE, NORMAL = 0, BNOSS, NDOF, POWER, MODE, LOW POWER = 1, BNOSS, NDOF, POWER, MODE, INSPEND = 2) Available power modes of BNOSSS, More
Functions
nt21_1 (RU055_NDD7_Initiatizer (xod) Initiatize the XNOS5 and east in the Name Degrees of Presiden (NOS7) generation mode. None
Int2 1 BNORS NDOF Welf-Wentlook (num BNORS NDOF Powerload mode) Alows to scholps power mode to instale carried or sampling or disable series. Nore
In32_1 BNORF_GelCalibration Status (struct BNORS5_NDOF_Calibratus *status) Reads calibration status of BNOR55 emotion. More
Int21 E IND059, INDOF Read LinearAccole (Nucle Moste), Integrating and Linear Accole (Nucle Moste), Integrating and Accole (Nucle Moste), Integrat
In22_1 (INCOSE_INCOSE_INSCIENTING) (INCOMENDATION (INCOMENDATION) (INCOMENDATION (INCOMENDATION) (INCOMENDATIO
Int2_E IRX0555, INCOF_RestAngRedBallon (Retrot DroSS_prop_Datg_1*pt) Read- Utility Traigner futility reviser (Int PS from Service, More,
Int32 1 ENC055 NICOF_Readabordrentation (struct bnc055; euler_losa (1 par) Reads latest absolute orientation vector in degrees from device. More
Run Time Environment Configuration
These parameters are part of the RTE_BNOSS_NOOP.h RTE configuration file and can be used to adjust library behavior. This file is copied into the Exisps project when the BNOSS_NOOP component is seeded and can be edited by using the CARS Configuration Witard editor.
Redne RTE_BNO055_NDOF_EXT_CLK_SRC 1
Detailed Description
Absolute orientation sensor library (acotestrameter).
The BNOD55 is a System in Package Integrating a transit accelerometer, a transit accelerometer, a transit gyrotecope, a

Main Help Page

The main help page is accessible via Device/BDK, visible for all use cases in *.rteconfig file. It's further divided into various modules as shown below.

Software Components	Sel.	Variant	Vendor	Version	Description
RSL10			ONSemiconduc		ARM Cortex-M3 48 MHz, 32 kB RAM, 384 kB ROM
🖻 🚸 BLE		BDK	ONSemiconduc	1.0.0	RSL10 BLE stack implementations for BDK based applications.
Board Support		BDK-GEVK	ONSemiconduc	1.0.0	Board Support package for BDK-GEVK evaluation board.
Omponents					Platform independent drivers for various external components and IC.
🔺 💠 Device					
🔺 🕈 BDK					BDK software components compatible with all evaluation boards.
AES			ONSemiconduc	1.0.0	AES module from mbedTLS
Event Callback			ONSemiconduc	1.0.0	Library for assigning of multiple callbacks to events.
🕈 HAL			ONSemiconduc	1.0.0	Peripheral HAL drivers and RSL10 configuration
Output Redirection		SEGGER RTT	ONSemiconduc	1.0.0	Redirects standart output calls using SEGGER RTT
Scheduling			ONSemiconduc	1.0.0	Management layer for Event Kernel Application Task
Software Timer			ONSemiconduc	1.0.0	Allows to create multiple timer events while using only single hardware timer
Bluetooth Profiles					
Libraries					
Startup		release	ONSemiconduc	2.1.10	RSL10-CMSIS Startup Library and Include Folders (libcmsis)

ON Semiconductor [®] BDK v1.0.0 Bluetooth LE Development Kit for RSL10
BDK
Abstraction layers for RSL10 Bluetooth Development Kit based applications. More
Modules
COMPONENTS
TASK_APP Management Application Task management & custom event scheduling.
Event Callback Library for attaching multiple callback functions (listeners) to single event source.
HAL Peripheral Hardware Abstraction Layer for RSL10.
Software Timer Allows creation of unlimited number of software timers with Ticker, Timeout and Timer functionality.
ANSI Terminal Color support Bring color to your terminal screen.
Target Evaluation board specific definitions.
API
Bluetooth Low Energy Library for handling of BLE functionality and libraries of supported BLE profiles.

Sub-sections may be expanded for further information (Ex: HAL interfaces shown below)

Periphera	al Hardware Abstraction Layer for RSL10. More
Vodul	es
	k Configurations tes possible clock configurations for proper operation of BDK.
12C 12C i	nterface for communication with connected shields.
SPI i	nterface for communication with connected shields.
UAR	T T interface for communication with connected shields.
Macro	s

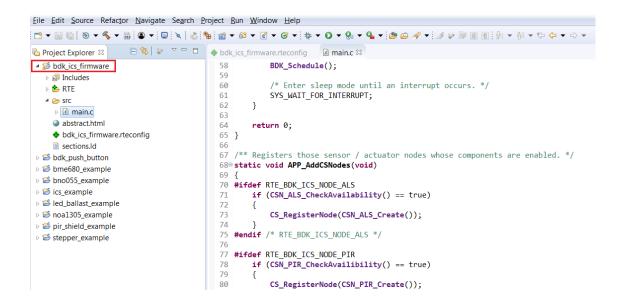
B-IDK also provides software timers and applications task manager abstraction layers to enable management of specific tasks and timing within the event kernel.

ON Semiconductor* ON BDK v1.0.0 Bluetooth LE Development Kit for RSL10
BDK
Abstraction layers for RSL10 Bluetooth Development Kit based applications. More
Modules
COMPONENTS
TASK_APP Management
Application Task management & custom event scheduling.
Event Callback Library for attaching multiple callback functions (listeners) to single event source.
HAL Peripheral Hardware Abstraction Layer for RSL10.
Software Timer Allows creation of unlimited number of software timers with Ticker, Timeout and Timer functionality.
ANSI Terminal Color support Bring color to your terminal screen.
Target Evaluation board specific definitions.
API
Bluetooth Low Energy Library for handling of BLE functionality and libraries of supported BLE profiles.

Custom Service Firmware

In order to read sensor data and control actuators connected to the BDK–GEVK from the RSL10 Sense and Control mobile app, the Custom Service Firmware must be downloaded onto the BDK–GEVK. This firmware can be found as Custom Service Firmware under examples in the CMSIS pack.

eclipse-workspace - ics_	example/src/main.c - Eclipse				- 0
Eile Edit Source Refacto	or <u>N</u> avigate Se <u>a</u> rch <u>P</u> roject <u>R</u> un <u>W</u>	indow Help			
📑 🕶 🔛 🚳 🐘 i 👁 🕶 i 🖻	0 8 🐐 8 8 8 🖬 9 🗸 🖉 🙆	≪▼[]J⊅[]] + 8] + 10 Φ + 0 +			Quick Access 🕴 😰 🗮 💽
Devices 🖪 Boards 😫	BE 🛛 🙀 🐃 🗆	📾 Packs 📑 Examples 😫		🗆 Only show examples from installed packs 🛛 🔊 🍣 😂 🧇 🔤 🤝 🖱	🗏 Pack Properties 🛛 🕀 🖂 🐨 😁
type filter text		Search Example			type filter text
Board	Summary	Example	Action	Description	A B ONSemiconductor.BDK.0.4.1
🔺 🍄 All Boards	2 Boards	Battery Service Example (Bluetooth Deve	Copy	Example usage of BDK Battery Service Profile	Boards
Bluetooth Develop	pm RSL10	BDK Push Button Example (Bluetooth Dev	Copy	Simple example on how to generate events when on-boa	A Components
RSL10 Evaluation I	Bo RSL10	bdk_blinky (Bluetooth Development Kit)	Copy	Example that blinks the on-board LED	 Examples
		BME680 Sensor Example (Bluetooth Deve	Copy	Uses BME680 located on MULTI-SENSE-GEVB to measure	 Battery Service Example (Bluetooth Development Kit)
		BNO055 Sensor Example (Bluetooth Deve	Copy	Uses BNO055 located on MULTI-SENSE-GEVB to determin	 BDK Push Button Example (Bluetooth Development Kit)
		Custom Service Firmware (Bluetooth Dev	Copy	Exposes sensor data over Cusrom Service BLE Profile.	 Bdk_blinky (Bluetooth Development Kit)
		IDK Custom Service Example (Bluetooth I	🕈 Сору	Example usage of IDK Custom Service Profile	 BME680 Sensor Example (Bluetooth Development Kit)
		LED Ballast Shield Example (Bluetooth De	Copy	Control two LEDs connected to D-LED-B-GEVK	 BNO055 Sensor Example (Bluetooth Development Kit)
		NOA1305 Sensor Example (Bluetooth De	Copy	Measure Ambient Light levels by using NOA1305 sensor o	 Custom Service Firmware (Bluetooth Development Kit)
		PIR Shield Example (Bluetooth Developm	Copy	Example that blinks on-board LED when motion is detect	IDK Custom Service Exampl Expand Selected
		Software Timer Example (Bluetooth Deve	🕈 Сору	Example showing Ticker, Timeout and Timer use cases of	LED Ballast Shield Example Copy
		Stepper Shield Example (Bluetooth Devel	🕈 Сору	Control two stepper motors via D-STPR-GEVB	NOA1305 Sensor Example (Build Configurations
					PIR Shield Example (Bluetor
					Software Timer Example (BI
					Stepper Shield Example (Bli Source)



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