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



ON Semiconductor®

www.onsemi.com

EVAL BOARD USER'S MANUAL

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



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
Х	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 6.20f or later from https://www.segger.com/downloads/jlink (select J-Link software and documentation pack)
- 3. Download and "Install RSL10 Software Development Kit (SDK) Installer" from
 - http://www.onsemi.com/PowerSolutions/supportDoc.do?type=software&rpn=RSL10
 - a. Download the RSL10 SDK Getting Started Guide and RSL10 SDK Oxygen Eclipse CMSIS pack 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

Document Title 💌	Document ID/Size
RSL10 Bluetooth Mesh Getting Started Guide NEW	RSL10 Mesh Getting Started Guide (734kB)
RSL10 Bluetooth Mesh Package NEW	RSL10 Mesh Package (8386kB)
RSL10 Bluetooth Mesh Release Notes NEW	RSL10 Mesh Release Notes (7kB)
RSL10 SDK Getting Started Guide NEW	RSL10 SDK Getting Started Guide (1779kB)
RSL10 SDK LPDSP32 Package NEW	RSL10 LPDSP32 Package (9325kB)
RSL10 SDK Oxygen Eclipse CMSIS Pack NEW	ONSemiconductor.RSL10.2.1.10 (29697kB)
RSL10 SDK Release Notes NEW	RSL10 SDK Release Notes (22kB)
RSL10 Software Development Kit (SDK) Installer 2.1 🔒 🕬	RSL10 Development Tools (435874kB)
RSL10 Software Documentation Package NEW	RSL10 SDK Documentation Package (35959kB)
RSL10 Software Release Notes History NEW	RSL10 SDK Release Notes History (43kB)
RSL10 Software Signature Files NEW	RSL10 SDK Signature Files (1kB)
RSL10 Software Utility Apps NEW	RSL10 SDK Utility Apps (7649kB)

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)

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

Importing CMSIS Packages

5. Launch the RSL10 SDK

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

eclipse-workspace - I	clipse				
<u>File Edit N</u> avigate Se	arch Project Run Window Help				
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🕨 🗏 Bluetooth Developm RSL10			Components		
RSL10 Evaluation Bo RSL10		ONSemiconductor.RSL10	🔶 Up to date	ON Semiconductor RSL10 Device Family Pack	Examples
		 Generic 		Software Packs with generic content not specific to a devi	

Compiling and Flashing

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

eclipse-workspace - Eclipse			- Ö
<u>File Edit Navigate Search Project Run Window H</u> elp			
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type filter text	Search Example		type filter text
Board Summary	Example Action	Description	ONSemiconductor.BDK.0.4.1
All Boards 2 Boards	Battery Service Example (Bluetooth Devel 🔷 Copy	Example usage of BDK Battery Service Profile	Boards
Bluetooth Developm <u>RSL10</u>	BDK Push Button Example (Bluetooth Dev 🗢 Copy	Simple example on how to generate events when on-boa	A Components
RSL10 Evaluation 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 Scopy	Uses BNO055 located on MULTI-SENSE-GEVB to determin	 BDK Push Button Example (Bluetooth Development Kit)
	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
	NOA1305 Sensor Example (Bluetooth Dev 🕏 Copy	Measure Ambient Light levels by using NOA1305 sensor o	BNO055 Sensor Example (B Copy
	PIR Shield Example (Bluetooth Developm 🕏 Copy	Example that blinks on-board LED when motion is detect	 Custom Service Firmware (Bluetooth Development Kit)
	Software Timer Example (Bluetooth Deve 💠 Copy	Example showing Ticker, Timeout and Timer use cases of	 IDK Custom Service Example (Bluetooth Development Kit)
	Stepper Shield Example (Bluetooth Devel 🕸 Copy	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.



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

ြဲ Project Explorer 🛛		日 😫 🍵 💈	□ □	xample.rteconfig 🔒 main.c 🛙
ics_example			19//	
 ✓ pir_shield_exam; ✓ X Binaries ✓ Includes ✓ Debug ✓ include ✓ RTE ✓ SrC ✓ abstract.html ♦ pir_shield_exa 📄 sections.ld 		<u>N</u> ew Go <u>I</u> nto	•	right (c) 2018 Semiconductor Components Industries LLC /a "ON Semiconductor"). All rights reserved. software and/or documentation is licensed by ON Semiconductor under ted terms and conditions. The terms and conditions pertaining to the ware and/or documentation are available at
		Open in <u>N</u> ew Window Show in Local Terminal	,	
		Copy Paste Delete Remove from Context	Ctrl+C Ctrl+V Delete Ctrl+Alt+Shift+Down	s and Conditions of Sale, Section 8 Software and/or documentation ware license agreement. Do not use this software and/or documentation ss you have carefully read and you agree to the limited terms and itions. By using this software and/or documentation, you agree to the ted terms and conditions.
	220	Nove Rename	F2	<pre>e <sbk.h> e <sbk.h> e <sbk.h></sbk.h></sbk.h></sbk.h></pre>
	4	Export CMSIS C/C++ Project		e "main.h"
		Build Project		n(void)
	\$	Clean Project Re <u>f</u> resh Clo <u>s</u> e Project Close <u>U</u> nrelated Projects	F5	32_t retval = 0; Initialize BDK library, set system clock to 8MHz. */ Initialize();
		Build Targets Index Build Configurations	k k	Initialize LED */ LLED_Init();
		Show in Remote Systems view		<pre>ntf("\r\n\nBDK - PIR Motion Detection Example.\r\n\n");</pre>

- NOTE: If the binaries are not seen, press F5 (refresh)
- 10. 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.



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

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Debug Configurations				
Create, manage, and run configurations				
□ ■ ¥ ■ ≯ ▼	Name: pir_shield_example Debug			
type filter text	🖹 Main 🛛 🏇 Debugger 🕨 Startup 🦫 Source 🔲 Common			
 C/C++ Application C/C++ Attach to Application 	Project:			
C/C++ Postmortem Debugger	pir_shield_example Browse			
C/C++ Remote Application	C/C++ Application:			
GDB Hardware Debugging GDB OpenOCD Debugging	Debug\pir_shield_example.elf			
GDB SEGGER J-Link Debugging	Variables Search Project Browse			
c pir_shield_example Debug	Build (if required) before launching			
 Launch Group Launch Group (Deprecated) 	Build Configuration: Select Automatically			
	© Enable auto build © Disable auto build			
	Use workspace settings <u>Configure Workspace Settings</u>			

- 12. The debug configuration for the selected example is automatically saved and there's no need to re-create it
- 13. On the Debugger tab, set RSL10 as the device name. Click Debug to launch the code.

Debug Configurations	
Create, manage, and run configurations	- The second sec
Create, manage, and functioning databas fype filter text C/C++ Application C/C++ Application C/C++ Postmortem Debugger C/C++ Remote Application CDB Hardware Debugging CDB Hardware Debugging CDB SeGER J-Link Debugging CDB SeGER J-Link Debugging Cip shield_example Debug Claunch Group Launch Launch	Name: pir_shield_example Debug Main 梦 Debugger ▶ Startup ₺ Source □ Common J-Link GDB Server Setup Start the J-Link GDB Server locally Connect to running target Executable: Silink_path/Silink_gdbserver/ Browse. Variables. Actual executable: C/Program Files (x86)/SEGGER/JLink_V634c//JLinkGDBServerCLexe (to change it use the global or workspace preferences pages or the project properties page) Device name: RSL10 Supported device names Endianness: Uittle © Big Connection: USB © IP (USB serial or IP name/address) Interface: © SWD © TAG
Filter matched 10 of 10 items	Initial speed: Auto Adaptiv © Fixed 1000 kHz GDB port: 2331 SWO port: 2332 Werify downloads I Initialize registers on start Regert Apply
0	Close

14. For application debugging, confirm perspective switch by clicking Yes.

,

: retva	Confirm Perspective Switch
ialize	This kind of launch is configured to open the Debug perspective when it suspends.
ialize	This Debug perspective is designed to support application debugging. It incorporates views for displaying the debug stack, variables and breakpoint management.
"\r\n\I	Do you want to open this perspective now?
ialize = NCS30 DEBUG(1 0_PIR_0	<u>Remember my decision</u> <u>Yes</u>

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

eclipse-workspace - pir_shield_example/src/main.c - Eclipse				
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Image: Second		Name	Type	Value
# 2 pir_shield_example.elf		00- retval	int32_t	-536813312
🔺 🧬 Thread #1 57005 (Suspended : Breakpoint)				
main() at main.c:22 0x10025a				
JLinkGDBServerCLexe				
arm-none-eabi-gdb				
Semihosting and SWV				
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🖻 main.c 🛱 🖸 0x0				🗄 Outline 🖾 📃 🖣 🕷 🕷
11 // conditions. By using this solutione and/or documentation, you agree to the			*	stdio.h
12 // Timited terms and conditions.				BDK.h
14 #include <stdio.h></stdio.h>				BDK_Components.h
15 #include <bdk.h></bdk.h>				main.h
16 #include <bdk_components.h></bdk_components.h>				 main(void) : int
1/ 19 #include "main h"				 PIR_MotionEvent(void) : void
19				
200 int main(void)				
21 {				
<pre>>22 int32_t retval = 0;</pre>				
23 24 /* Initialize RDK library set system clock to 8MHz */				
25 BDK Initialize();				
26				
			F	1
🖵 Console 🛿 🖉 Tasks 🔝 Problems 🕡 Executables 🍠 Terminal 📓 Debugger Console 🔋 Memory				= × 🔆 2, 🖬 🖉 🖃
pir_shield_example Debug [GDB SEGGER J-Link Debugging] JLinkGDBServerCL.exe				
Read 2 bytes @ address 0x001029B8 (Data = 0x4D3C)				
Read 4 bytes @ address 0x00102AAL (Data = 0x001053D4) Read 2 bytes @ address 0x00103DAA (Data = 0x001053D4)				
Read 4 bytes @ address 0x0010290A (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

For logging/debugging the downloaded Firmware, either Eclipse or J-Link RTT may be used. This section provides instructions for both.

Using Eclipse

16. Click the Open a Terminal Icon



17. Enter the values shown below and launch the session. The incoming events are printed on the terminal window.

Caunch Terminal	
Choose terminal: Settings	Telnet Terminal
Hosts:	▼ ×
Host:	localhost
Port:	19021 -
Timeout (sec):	5
End of Line:	CR+NUL -
Encoding: Defa	ult (ISO-8859-1) 🔹
?	OK Cancel

🖨 eclipse-workspace - Source not found Eclipse	
File Edit Navigate Search Project Run Window Help	
🎋 Debug 🛛 🍇 🍺 🔻 🗖	(x)= Varial
ic pir_shield_example Debug [GDB SEGGER J-Link Debugging]	Name
▲ 2 pir_shield_example.elf	
Phread #1 57005 (Running : User Request)	
JLinkGDBServerCLexe	
E Sentitiosting and SWY	4
i main.c € 0xdeadbeee 🛙	
Break at address "0xdeadbeee" with no debug information available, or outside of program code.	
View Disassembly	
Configure when this editor is shown Preferences	
🖻 Console 🧟 Tasks 🦹 Problems 📀 Executables 🦻 Terminal 🕴 🗟 Debugger Console	
□ Telnet localhost (8/27/18 8:50 AM) 🛛	
SEGGER J-Link V6.34c - Real time terminal output	
J-LINK UB-SAMUSUIZE VS COMPILED JUL 12 2018 12:17:50 VS.0, SN=483035034 Process: JlinkGDRServer(L.exe	
PIR: Motion detected at 368662 ms.	
PIR: No motion at 370868 ms.	
PIR: Motion detected at 518577 ms.	
PIR. NO NOLIDI de J20/05 NS.	

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

Using J–Link RTT

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



19. Select USB and click OK

J-Link RTT Viewer V6.34c		
<u>File</u> <u>Terminals</u> Input Lo	🔜 J-Link RTT Viewer V6.34c Configuration 🛛 💦 🗪	
Log All Terminals Terr LOG: J-Link RTT Vi LOG: Terminal 0 add	Connection to J-Link USB Serial No Existing Session Specify Target Device Seriat file (actions)	
		4
	Target Interface & Speed	
	SWD 4000 kHz	
	RTT Control Block Auto Detection	
	OK Cancel	Enter
Ready.		0.00 MB

20. 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.





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



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				Board support package for BDK-GEVK evalution board
		Libraries			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]	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]	Protocol implementation and sytem node used by other sensor / actuator nodes.
			PIR Node		Exposes motion data provided by NCS36000 from PIR-GEVB
			ALS Node		Exposes ambient light levels measured by NOA1305 from ALS-GEVB
			ENV Node		Exposes environmental data measured by BME680 from MULTI-SENSE-GEVB
			AO Node		Exposes absolute orientation measured by BNO055 from MULTI-SENSE-GEVB
			STPR Node		Allows remote control of two stepper motors connected to D-STPR-GEVB.
			LEDB Node		Allows remote control of two power LEDs connected to D-LED-B-GEVK
			BLDC Node		Allows to remote control BLDC motor connected to BLDC-GEVB.
	Components				Platform independent software drivers for controlling of various external IC.
		LED Driver			
			NCV78763	J	Dual LED Driver and Power Ballast, for Automotive Front Lighting, 1.6 A, 2nd Generation
		Ambient Light Sensor			
			NOA1305	J	Ambient Light Sensor with I2C Interface and DarkCurrent Compensation
		Motor Driver		1	
			AMIS-3054	-	Micro-stepping stepper motor driver with SPI interface for bipolar stepper motors
		F 1 (10	LV8907.0W	J	Sensor-less Three-phaseBrushless DC MotorController, with GateDrivers, for Automotive
		Environmental Sensor	h	1	l
			DM6680]	Low power gas, pressure, temperature & numidity sensor
		motion sensor	h = -055	1	Intelligent O guing along https://www.intelligence.com
		Tauch Sansar	ccuona	1	intelligent 9-axis absolute orientation sensor
		rouch Sensor	LC717A00AD	1	Conseitance Digital Converter for Electrostatic Conseitive Teuch Sensors
	Davica		LUTTAUUAR		Capacitance-Digital-Converter for Electrostatic Capacitive Fouch Sensors
	Device	BDK	1		
		bbn	HAI	1	RSI 10 Perinheral abstraction layers for BDK applications
			Scheduling	1	Event Kernel wrapper for BDK applications
			Software Timer	1	Allows to create multiple timer events while using only single hardware timer
			Event Callback	1	Library for executing multiple event handlers when an event occurs
			Output Redirection	1	Redirects standard library output calls (printf,) to specified channel
				SEGGER RTT	Output is transmitted using UART peripheral
				UART	Output is transmitted over SWD using the on-board or external J-LINK deug probe
			AES		
BDK	BLE			-	
		Peripheral Server			
			Battery Service	1	Exposes current battery level to connected client and application.
			ICS Service		IDK Custom Service used to transmit sensor data using ICS Protocol library.
			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



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.

<u>File Edit Source Refactor Navigate Search Project Ru</u>	ın <u>W</u> indow <u>H</u> elp
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မြဲ Project Explorer 🛛 📄 🖘 🗢 🗖	i main.c ∞
Project Explorer 33 Project Explorer 34	<pre>@ mainc 23 1e //</pre>
Kiner.c [ONSemiconductor::BDK.Librari Kiner.c [ONSemiconductor::BDK.Libraries.S]	<pre>30 31 status = NOA1305_ALS_StartContinuous(APP_ALS_PERIODIC_INTERVAL_MS,</pre>
kg syscalls_segger_rtt.c [ONSemiconductor::BD]	32 &ALS_ReadCallback);
 RTE BDK BDK,PushButton.c [ONSemiconductor: BDK_Task.c [ONSemiconductor::BDK.librar BDK.c [ONSemiconductor::BDK.librar EventCallbackc [ONSemiconductor::BDK.librar HAL_clockc [ONSemiconductor::BDK.librar HAL_clockc [ONSemiconductor::BDK.librar HAL_Clock [ONSemiconductor::BDK.librar HAL_SPLc [ONSemiconductor::BDK.librar HAL_SPLc [ONSemiconductor::BDK.librar HAL_LOART.c [ONSemiconductor::BDK.librar HAL_CLOSEmiconductor::BDK.librar HAL_CLONSemiconductor::BDK.librar NA 	<pre>4 // IIIIS SOTUMATE and/or uccumentation is litensed by ON 3 5 // limited terms and conditions. The terms and conditior 6 // software and/or documentation are available at 7 // http://www.onsemi.com/site/pdf/ONSEMI_T&C.pdf ("ON Sem 8 // Terms and Conditions of Sale, Section 8 Software") and 9 // software license agreement. Do not use this software 10 // unless you have carefully read and you agree to the li 11 // conditions. By using this software and/or documentati 12 // limited terms and conditions. 13 // 14 #include <stdio.h> 15 #include <bdk.h> 16 #include "BDK_Components.h" 17 </bdk.h></stdio.h></pre>
R noal Open With	d)
Repear With Show in Local Terminal	► CMSIS Configuration Wizard
A RTE A RE A RE A SEG A S	Ctrl+C Ctrl+V Delete Ctrl+Alt+Shift+Down F2 Ctrl+Alt+Shift+Down F2 Ctrl+Alt+Shift+Down F2 Ctrl+Alt+Shift+Down F2 Ctrl+C C
▷ Le sysca in Import	<pre>VOA1305_ALS_startContinuous(APP_ALS_PERIODI(</pre>
🛛 🗟 USAI 🖾 Exp <u>o</u> rt	<pre>EBUG(status == 0);</pre>

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.

tion	Valu	le
SYSCLK Frequency	8 MI	Hz
APP Task Event Kernel message handler cour	1	48 MHz
HAL Pinmap Configuration		24 MHz
Board selection		16 MHz
Custom Pinmap		8 MHz
USART0_TX Pin	Z	02
USARTO_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	No p	bull
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.

otion	Value
Software Timer Configuration	
Timer resolution [us]	100
Hardware Timer Select	TIMER1
	TIMER0
	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.

≔ RTE_PCA9655E.h 🛛		
CMSIS Configuration Wizard		
Option	Value	
Enable PCA9655E shared interrupts		
Interrupt signal DIO Pad	13	
DIO Interrupt Source	0	
EventCallback event ID	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.

CMSIS Configuration Wizard				
Option	Val	Je		
Stepper Shield Left Channel				
Step Mode	1/4	Micro - Step		
Coil Peak Current	245	mA		
Direction Of Rotation	CW	motion		
NXT Edge Trigger	Risi	ng 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	1	
Direction Of Rotation		1 / 128 Micro - Step	l	
NXT Edge Trigger		1 / 64 Micro - Step	l	
Turn On / Off Slopes of Motor Driver		Compensated Full Step, 2 phase on	l	
Speed Load Angle Transparency Bit		Compensated Full Step, 1 phase on	l	
Speed Load Angle Gain		1 / 16 Micro - Step	l	
Enables doubling of the PWM frequency		1 / 8 Micro - Step	I	
Enables jittery PWM		1 / 4 Micro - Step	I	
Steps Per Revolution		Compensated Half Step	1	
٠		Uncompensated Half Step	l	
Sten Mode		Uncompensated Full Step	f	

≔ RTE_NCV78763_LED.h 🛛	
CMSIS Configuration Wizard	
Option	Value
Enable Booster	
Booster PWM generation	Internal
Booster PWM Frequency	242 kHz
Booster Clock Inversion	
Booster Slope Compensation	10 mV / us
Booster Error Amplifier Gain [Siemens]	30 uS
Booster Overvoltage Shutdown	5.8 V
Booster Overvoltage Reactivation	-1 V
Booster Gate Voltage Threshold	0.4 V
Booster Minimum Off Time	115 ns
Booster Minimum On Time	150 ns
Booster Regulation Setpoint Voltage	45.0 V
Booster Current Limitation Peak Value	100 mV
Activate VBOOST_AUX_SUPPLY	
Booster Skip Clock Cycles	Disabled
Enable Buck Regulator Channel 1	
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
	•. •
Booster Overvoltage Reactivation Defines the hysteresis for the reactivation once t Default: -1 V for D-LED-B-GEVK	he overvoltage shutdown is triggered.
Source Editor CMSIS Configuration Wizard	

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 Serve	er				~
BASS					Exposes current battery level to connected client and application.
ICS					IDK Custom Service used to transmit sensor data using ICS Protocol library.
Peripheral Se	n 🗆				BLE Peripheral Server implementation for BDK applications.
Board Support		BDK-GEVK	ONSemiconduc	1.0.0	Board Support package for BDK-GEVK evaluation board.
ICS Protocol					A ··· · · -
IDK Shields					
AMIS30543_9	ST 🗆	D-STPR-GEVK			Control two stepper motors connected to D-STPR-GEVK using AMIS-30543 motor driver.
BME680_EN\		MULTI-SENSE-C			Measure temperature, humidity and atmospheric pressure using BME680 environmental ssensor
BNO055_ND		MULTI-SENSE-C			Determine absolute orientation of the board in space using BNO055 sensor
NCS36000_PI	R	PIR-GEVB			PIR motion detection using NCS36000 sensor
NCV78763_LI		D-LED-B-GEVK			Control two power LEDs connected to D-LED-B-GEVK using NCV78763 LED driver.
NOA1305_AL	s 🗆	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
Components					Platform independent drivers for various external components and IC.
Ambient Light S	e				
Environmental S	e				
LED Driver					
Motion Sensor					
Motor Driver					
🔺 📤 Dovico					

ON Semiconductor ⁴ ON BLococh LE Development Kit for RSL10	
BN0055 Absolute Orientation Sensor	
Absolute orientation sensor library (accelerometer, gyroscope, magnetometer). None	
Data Structures	
Neted NetWorks (NOV Collibration	
arrows uninate sectors. In dr	
Macros	
Refere BNOR55 (IDCF)/EDEXP_ADDRESS (2x43 >> 1) ICC address of IC extranter on Multisensor shield	
Retime BinOots_IBOOF_IDEXIP_PORT (1) ID expander port containing BNODS5 related signale.	
states BNOSS, NOOF_DOEZP, ST. PN (0) Do expande primeror test Mostors mutations	
Reading BN0055_NDOF_JOEXP_RST_PHI_MASK (1 << BN0055_NDOF_JOEXP_RST_PHI)	
Refine BNOKS_NOCF_IORE_INT_PN (1) I oregane ph number for BNOKS Interrupt signal.	
Reafine BN0055_NDOF_JOEXP_INT_RN_MASK (1~< BN0055_NDOF_JOEXP_INT_RN)	
Enumerations	
etum BN0655, NDOF_POWER(MODE_SUBOF_POWER_MODE_NORMAL = 0, BN0655, INDOF_POWER_MODE_LOW_POWER = 1, BN0655, INDOF_POWER_MODE_SUBPEND = 2) Analizate power modes of SN0055. More	
Functions	
HI21_E MOX055_MODF_IndEatra (void) MIDIATE ME AND CAR JUNCE / MOLETA (VOIDF) operation mode. More	
Int2_1 BNOSS_NDOF_549Powerhoos (erun BNOSS_NDOF_Powerhoos mose) Aloris to set chips power mode to reduce current consumption or disable sensors. More	
IN32_1_EN0055_IDD0F_GelCalibrationstatus (atout BN0055_IDD0F_Calibratus Vatuus) Results calibration status of BN0055 sensors. More	
In22_E IN0059_INCOF_ReadLinearAcond (RIVID/INS2 End L) (197) Read Lister The acceleration vector INS2 50 moleckies (No.e	
Int21_EINC055_INC07_HeadCortNut(statuct throB52_gravAt, Sed1_170) Reads Balled gravyAndroth Int55 Cont Roles. Mone.	
Int2_I IRU0555, IXO/F, Resided applicabilities (struct brockSp. garv., Sond., 1997) Read latels: a graduar station visitor in DS from device. International structures and the structure of the s	
Int21_EIN0565_IICO7_HeadsAnderMethoder (RtxLT stroS55_eMet_ford_) 797 Reads listed products deretation version to degees the nederation. Kone	
Run Time Environment Configuration	
These parameters are part of the RTE_BNOSS_NODF.h RTE configuration file and can be used to adjust library behavior. This file is copied into the Eclipse project when the BNOSS_NODF component is selected and can be edited by using the CLAS Configuration Wizerd editor.	
Pothe RTE_BNO055_NODF_EXT_CLK_SRC 1	
Detailed Description	
Detailed Description	
Assolute orientation sensor library (acobiscimeter, gyroscope, magnetioneser).	
ine bicuos ia a system in Haskage megrating a trastia accelerometer, a trastia gromagnetic sensor ano 32 di monocontoirer.	

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.
Components					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
Nodul	es
Cloc Defin	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 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 - id	cs_example/src/main.c - Eclipse			- 0
Eile Edit Source Refa	ctor <u>N</u> avigate Se <u>a</u> rch <u>P</u> roject <u>R</u> un <u>W</u>	indow Help		
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E 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	ONSemiconductor.BDK.0.4.1
🔺 🔧 All Boards	2 Boards	Battery Service Example (Bluetooth Devel 💠 Copy	Example usage of BDK Battery Service Profile	Boards
Bluetooth Developm RSL10		BDK Push Button Example (Bluetooth Dev Copy	Simple example on how to generate events when on-boa	Components
RSL10 Evaluation Bo RSL10		bdk_blinky (Bluetooth Development Kit) 💠 Copy	Example that blinks the on-board LED	4 📑 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 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 (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 Dev 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 💠 Copy	Example showing Ticker, Timeout and Timer use cases of	LED Ballast Shield Example Copy
		Stepper Shield Example (Bluetooth Devel 🗇 Copy	Control two stepper motors via D-STPR-GEVB	NOA1305 Sensor Example (
				PIR Shield Example (Bluetor
				Software Timer Example (BI W Run C/C++ Code Analysis
				Stepper Shield Example (Bli Source)

<u>File Edit Source Refactor Navigate Search Pr</u>	roject <u>R</u> un <u>W</u> indow <u>H</u> elp
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Project Explorer 🛛 🕞 😫 🔝 🗢 🗆 🗖	♦ bdk_ics_firmware.rteconfig 🛛 🖻 main.c 🛱
bdk_ics_firmware	58 BDK_Schedule();
Includes	59
D 🏷 RTE	60 /* Enter sleep mode until an interrupt occurs. */
🔺 🧁 SFC	61 SYS_WAIT_FOR_INTERRUPT;
⊳ 🖻 main.c	62 }
abstract.html	64 naturn 0:
bdk ics firmware rteconfig	65 }
sections Id	66
b 😤 bdk push button	67 /** Registers those sensor / actuator nodes whose components are enabled. */
b 😤 bme680 example	68 static void APP_AddCSNodes(void)
b theodo_example	69 {
bioo55_example	70 #ifdef RTE_BDK_ICS_NODE_ALS
Ics_example	71 if (CSN_ALS_CheckAvailability() == true)
	72 {
b 🗁 noa1305_example	<pre>/3 CS_RegisterNode(CSN_ALS_Create());</pre>
pir_shield_example	
Stepper_example	75 #endit /* RTE_BUK_ICS_NUDE_ALS */
	77 #ifdef RTE BDK TCS NODE PTR
	78 if (CSN PIR CheckAvailibility() == true)
	79 {
	<pre>80 CS_RegisterNode(CSN_PIR_Create());</pre>

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