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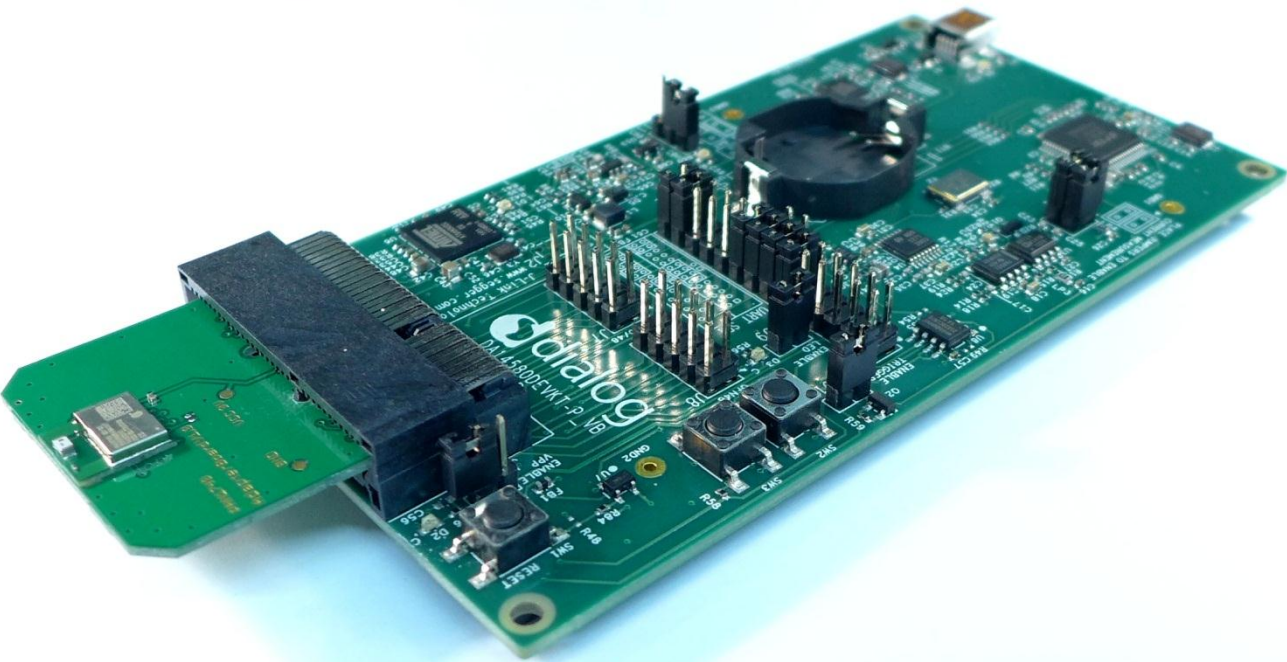
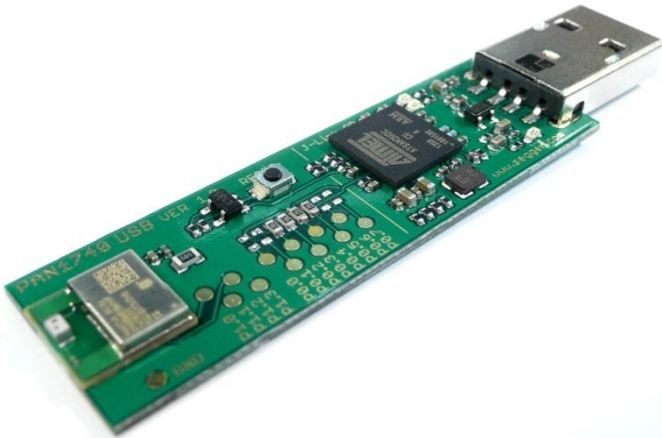
Email & Skype: info@chipsmall.com Web: www.chipsmall.com

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PAN1740 Design Guide



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1. SCOPE OF THIS DOCUMENT

This Design Guide applies to the Bluetooth development modules PAN1740 Experimenter Kit (PAN1740 EXP). The intention is to enable our customers to easily and quickly integrate Panasonic's PAN1740 module in their product.

This guide describes the Hardware and gives useful hints.

2. KEY BENEFITS WHEN USING PAN1740

- Single-mode Bluetooth Smart System-on-Chip
- ARM CORTEX M0 CPU
- Small 9.0 x 9.5 x 1.8 mm SMD package with antenna
- Includes 16 MHz and 32.768 kHz crystal
- Temperature Range from -40°C to +85°C
- Pre-programmed calibration data and BT-Address
- Peak Power consumption 4.9mA Rx and Tx
- Less than a few μ A in low power modes
- Link budget 93dBm (Rx Sensitivity -93, Tx 0 dBm)

3. BLUETOOTH LOW ENERGY

Bluetooth Low Energy (BLE), part of Bluetooth Ver. 4.0, specifies two types of implementation: Single mode and dual mode. Single mode chips implement the low energy specification and consume just a fraction of the power of classic Bluetooth, allowing the short-range wireless standard to extend to coin cell battery applications for the first time. Dual mode chips combine low energy with the power of classic Bluetooth and are likely to become a de facto feature in almost all new Bluetooth enabled cellular phones and computers.

Bluetooth marks

According to the new Bluetooth SIG marks "Bluetooth Smart" (single mode → mainly sensors) and "Bluetooth Smart Ready" (dual mode → gateway and hub devices) the PAN1740 fulfills criteria to label a product as a Bluetooth Smart device.



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4. DESCRIPTION PAN1740

PAN1740 is the next generation Bluetooth Low Energy Module from Panasonic with reduced form factor, significantly lower power consumption and embedded Software Stack. The Single mode Bluetooth Smart System-on-Chip module is optimized for low power, small size and low system cost products. It reduces external component count, development effort and time to market.

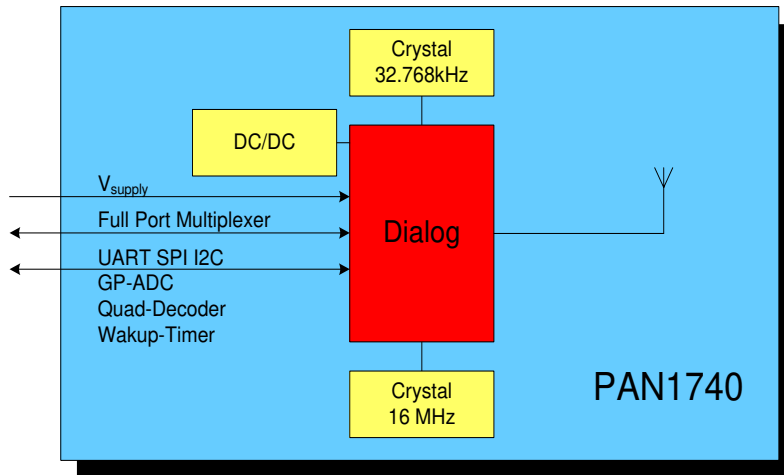
The Module is manufactured in a very small 9.0* 9.5* 1.8 mm SMD package with shielded case and chip antenna. The power consumption of only 4.9mA in Tx and Rx mode makes the use of coin cell batteries possible or reduces the needed battery capacity and cost of existing solution by at least 50%. It is qualified according to Bluetooth 4.0 standard. FCC, IC and CE approvals are under preparation.

The PAN1740 comes with a complete software development platform, which includes a qualified Bluetooth Smart single-mode stack that can be compiled with a number of available BLE profiles, custom application and programmed on the module. Multiple Bluetooth Smart profiles for consumer wellness, sport, fitness, security and proximity applications are supplied as standard, while additional customer profiles can be developed and added as needed.

Please contact your local sales office for further details on additional options and services, by visiting www.panasonic.com/rfmodules for U.S. and <http://industrial.panasonic.com/eu/> for Europe or write an e-mail to wireless@eu.panasonic.com

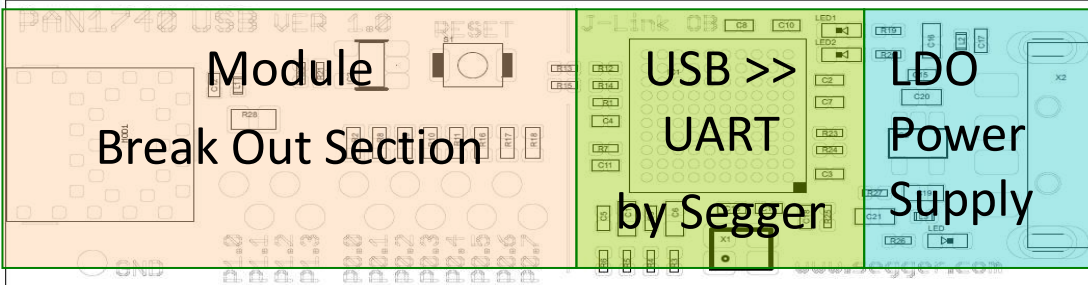
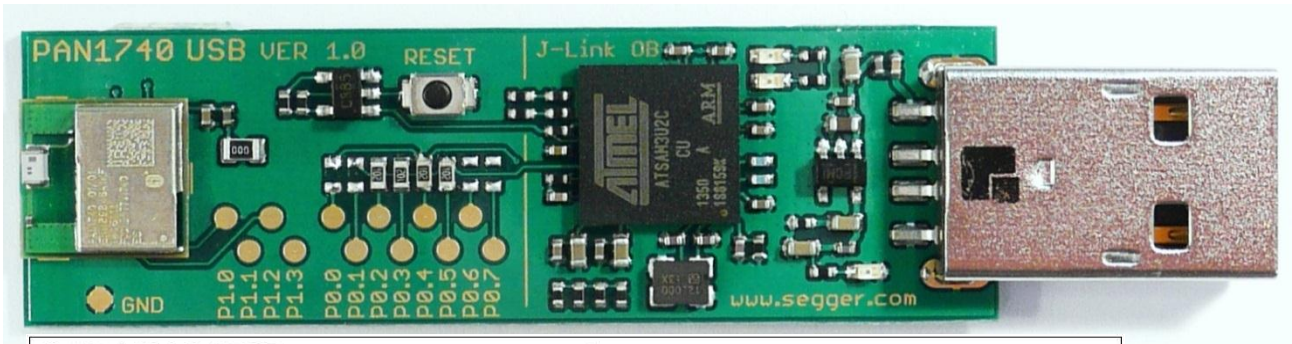
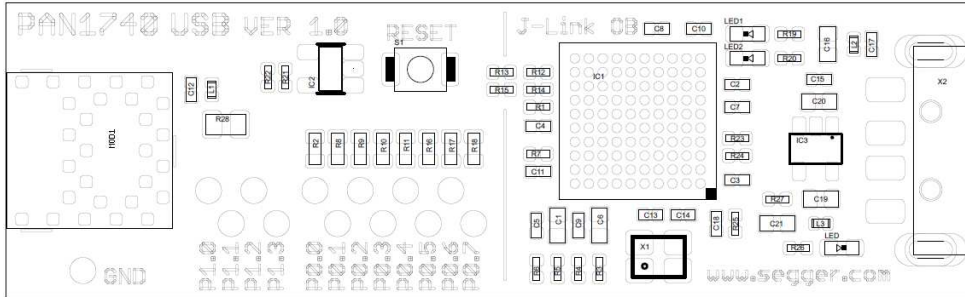
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5. BLOCK DIAGRAM PAN1740 MODULE



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6. PAN1740 USB-DONGLE



6.1. Functionality

Atmel μ C includes Segger USB-to-UART programmer (serial number on the backside)

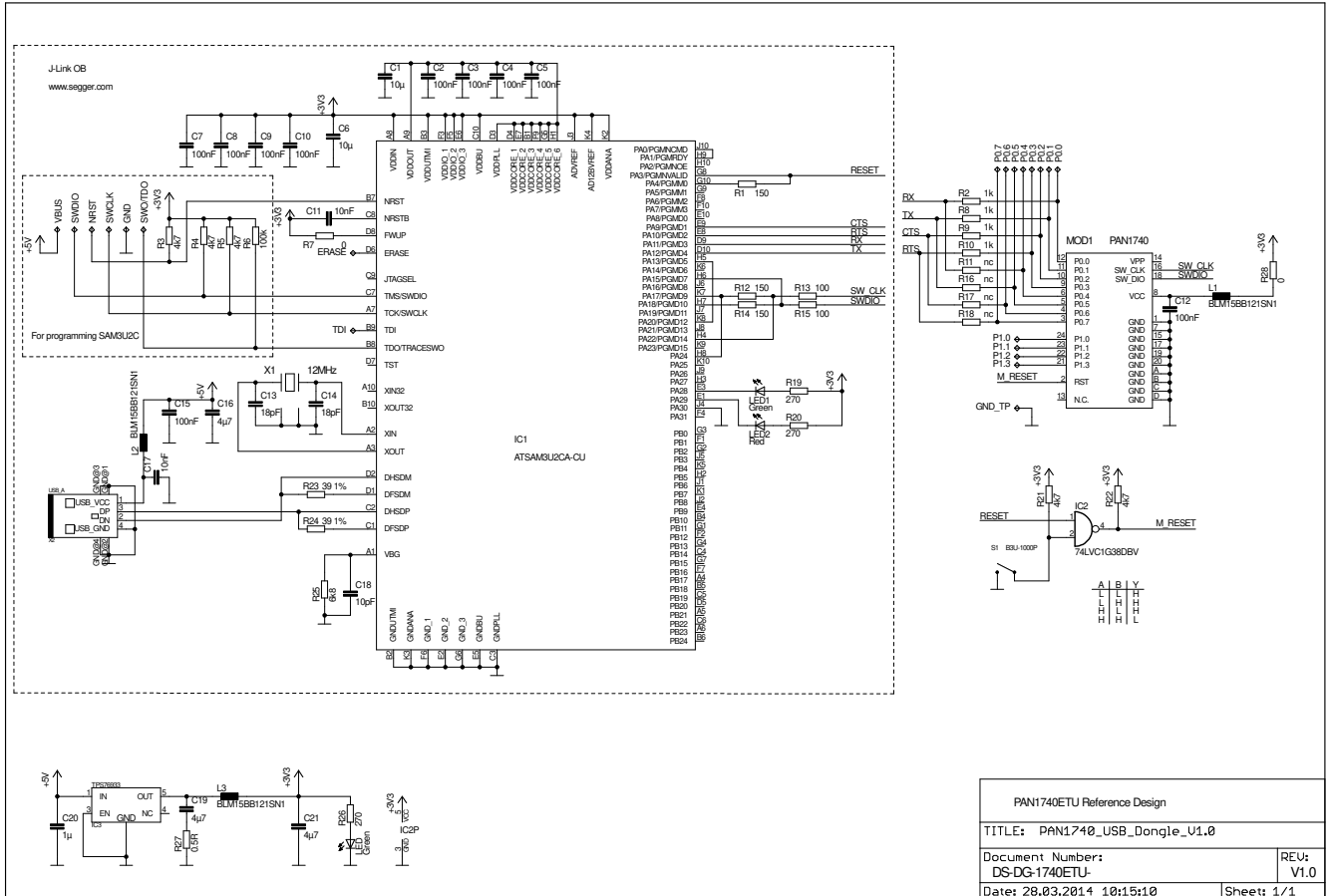
OTP cannot be damaged - Failsafe development

Runs with Dialog's Keil compiler projects

Runs with "Connection Manager"

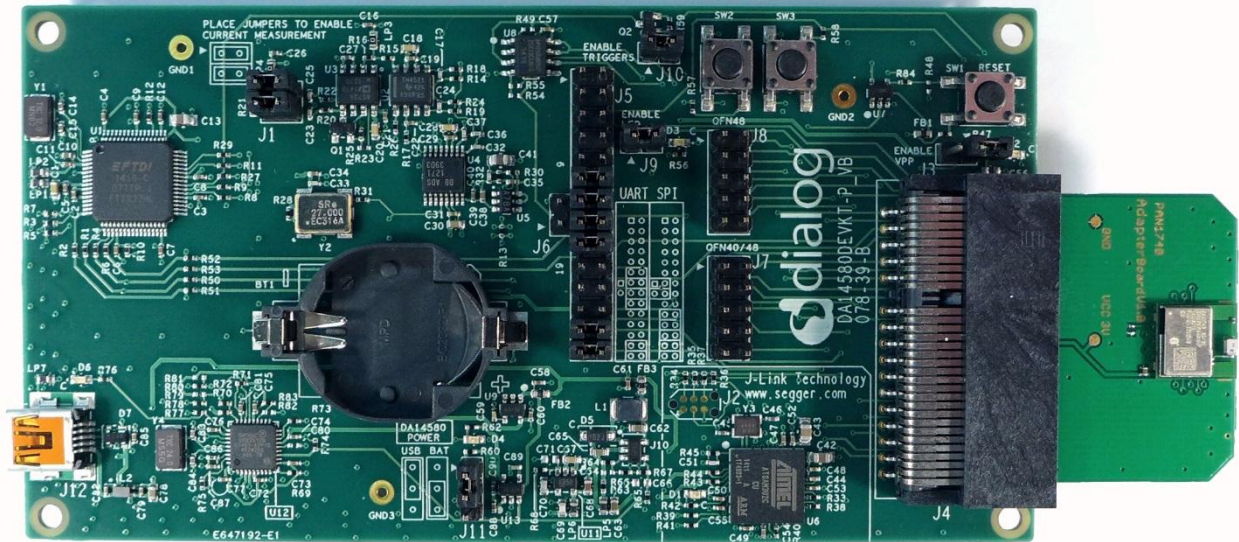
Can be used for SW development "on the fly"

6.2. Schematic



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7. MOTHER BOARD



7.1. Functionality

The details of the mother board are described in the Dialog documentation

Can be used with PAN1740 Adapter Board

OTP can be programmed

Runs with Dialog's Keil compiler projects

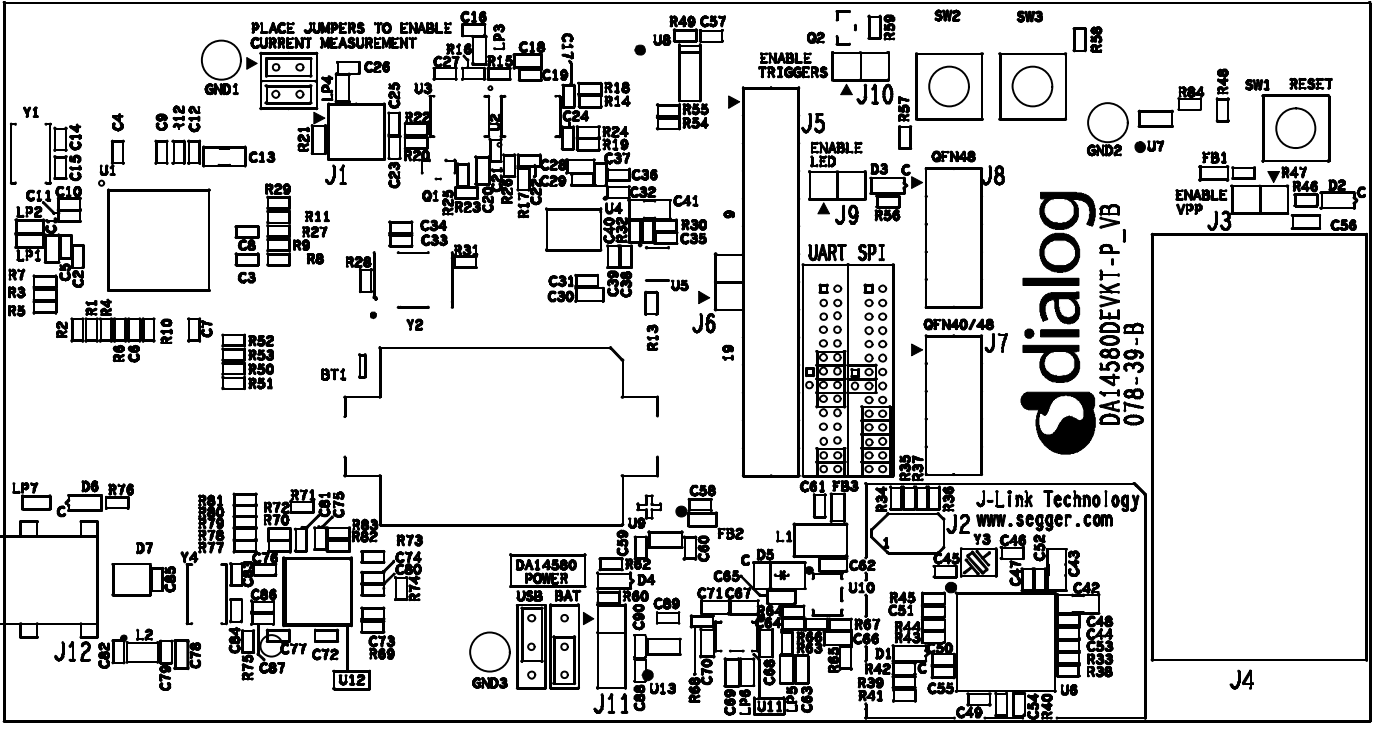
Runs with "Connection Manager"

Can be used for SW development "on the fly"

Runs with "Smart Snippets" including Power Profiler

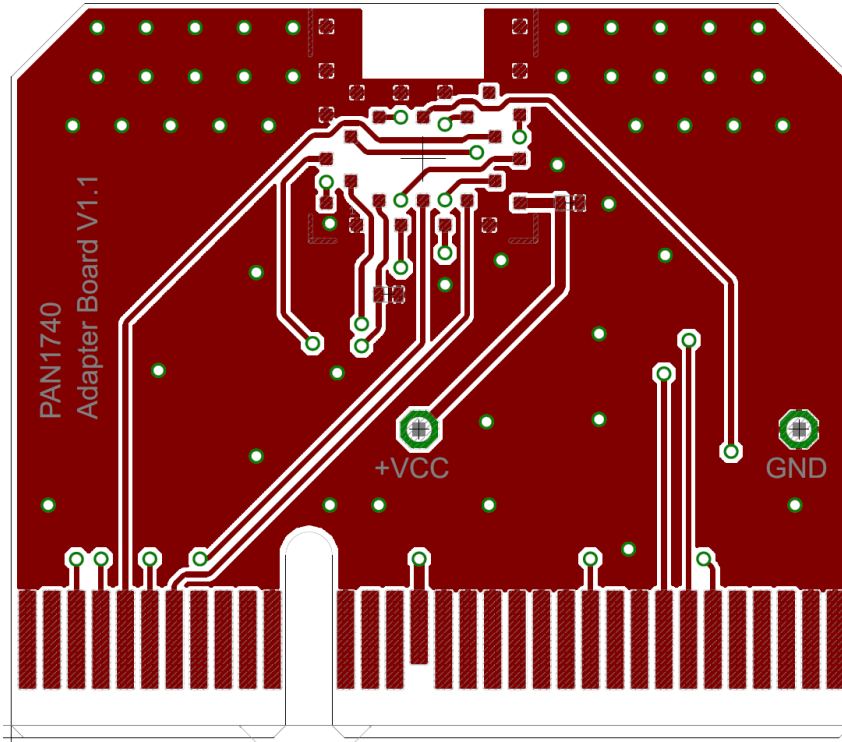
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7.2. Placement

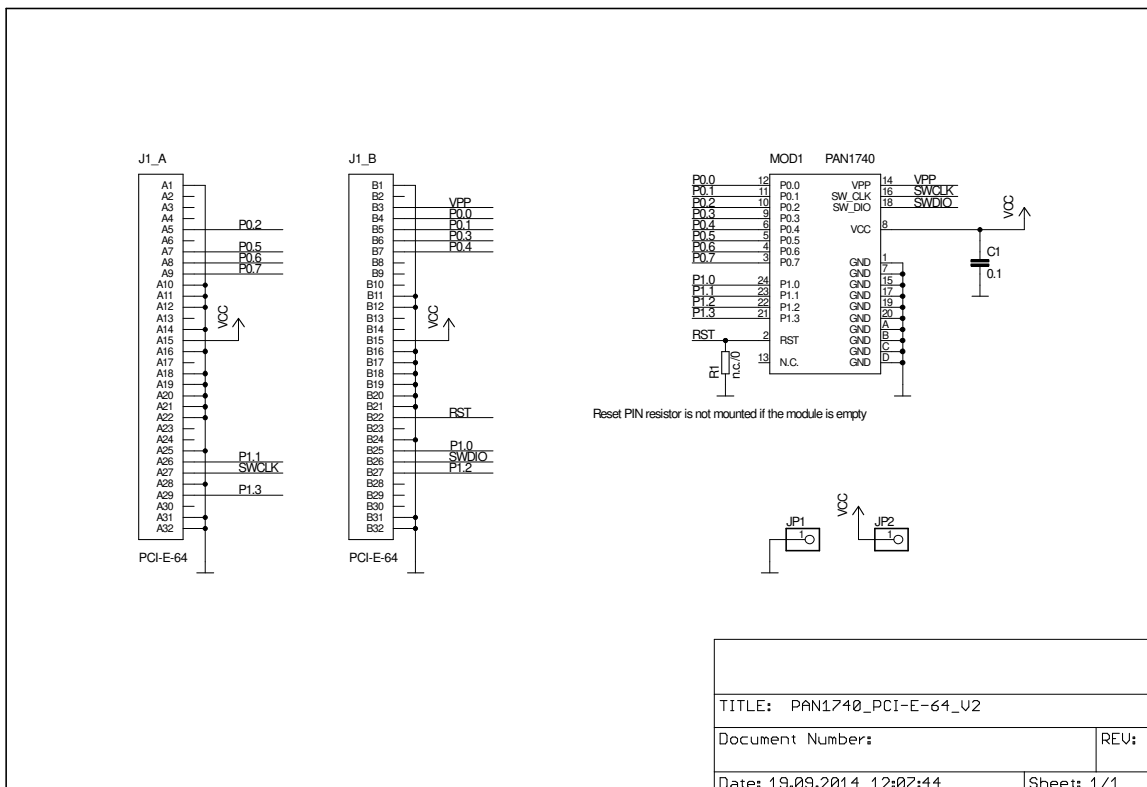


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8. PAN1740 ADAPTER BOARD

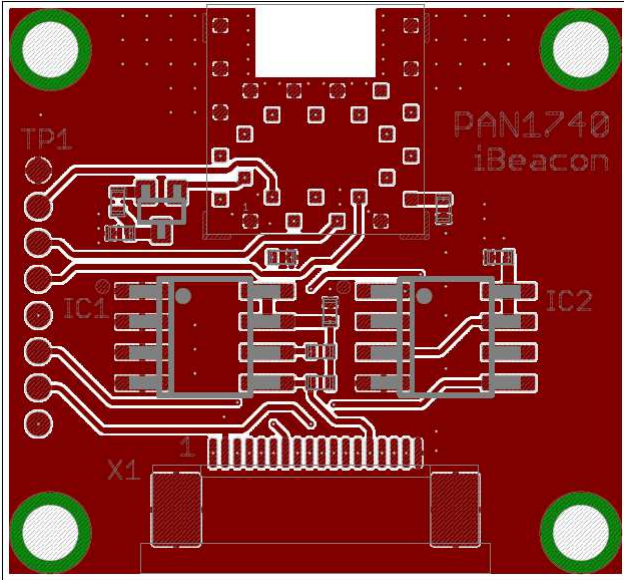


8.1. Schematic

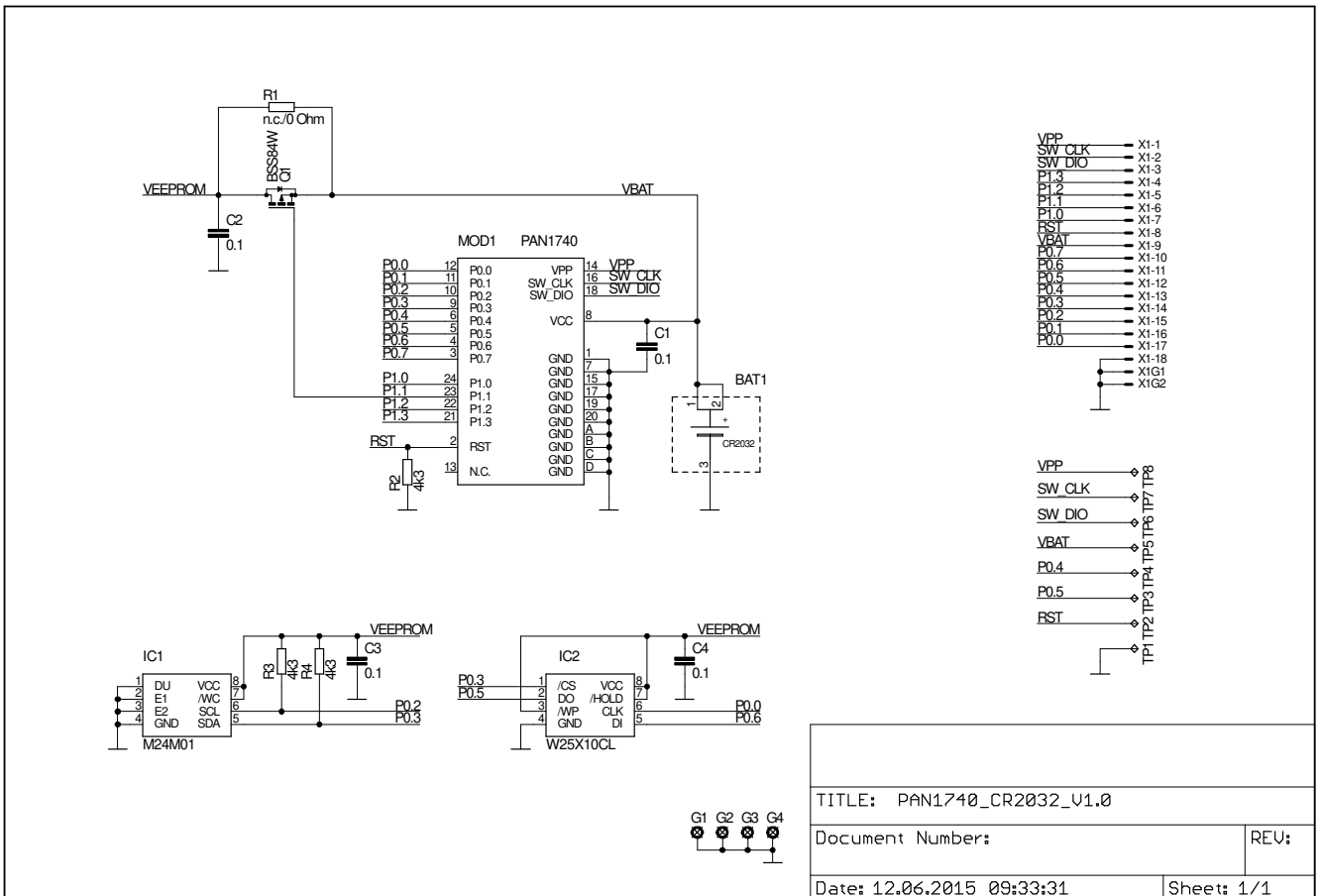


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9. BEACON



9.1. Schematic



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10. BEACON KIT

The Beacon-Kit consists of:

- 1 pc. Dialog Motherboard
- 1 pc. Flexible Flat Cable – 0.50 mm pitch – 18 conductors – 50 mm length – Type 2
- 1 pc. Beacon Adapter Board
- 5 pcs. Beacon

The Beacons come along pre-configured with Dialog's Beacon Software which makes it easy to start evaluating. Simply power them up by plugging a CR2032 battery and watch out for them using the *Locate Beacon App* which can be downloaded in the Google Play Store. This scenario is depicted below.



The Beacon software is stored in the SPI Flash (IC2) on the PCB and can be changed by establishing a connection between Dialog's Motherboard and a Beacon via the Beacon Adapter Board and the FFC as shown below.

Note: An FFC longer than 5cm can cause transmission errors when using JTAG. Hence, longer cables should use the UART interface to download software to the Beacon.



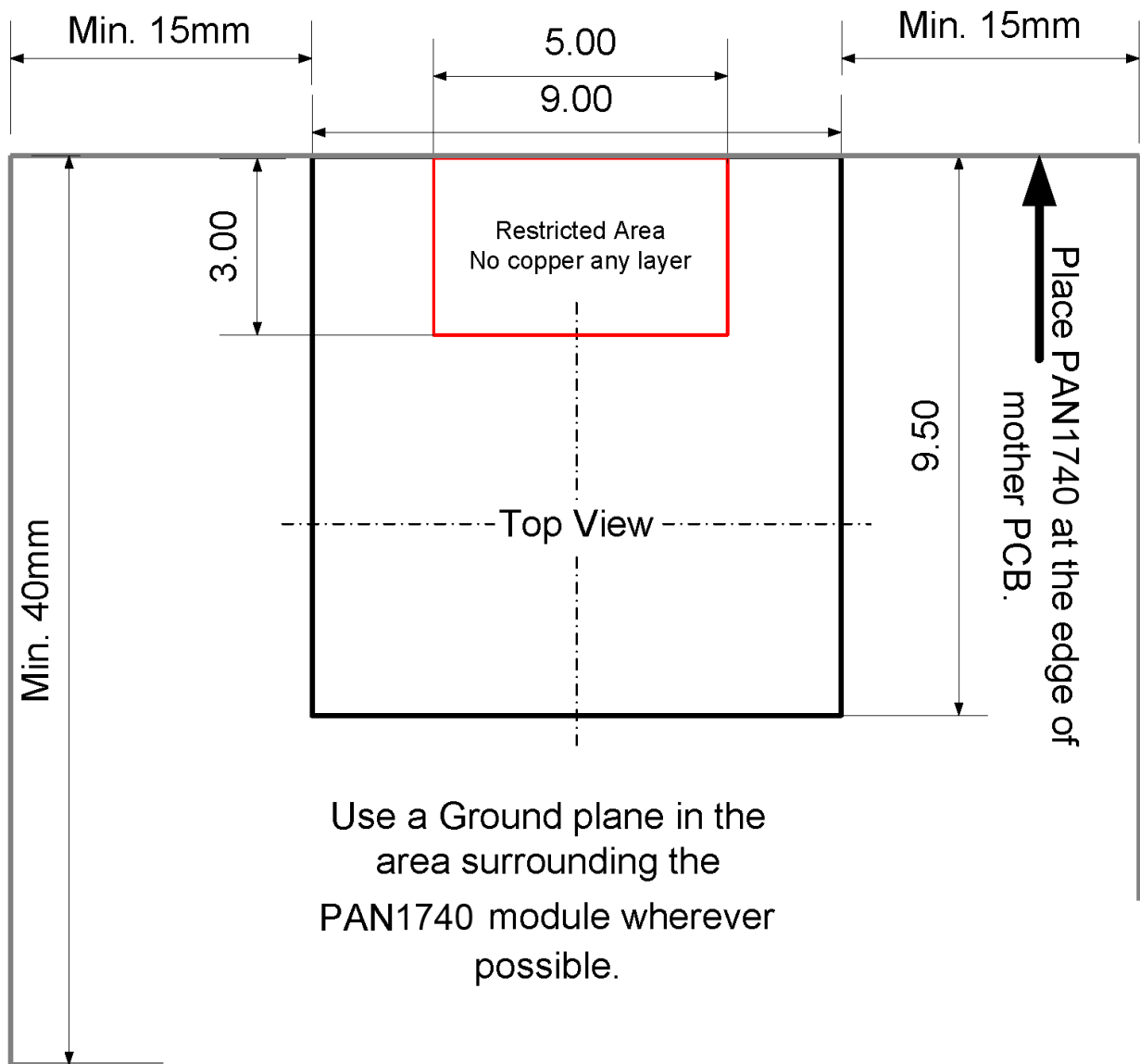
Simply change Dialog's Beacon code available on their website to your needs with Keil uVision, compile it and download it to the device using Smart Snippets for instance. Please read the following chapters and Dialog's Documentation to be able to download your code into the Beacon.

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11. LAYOUT RECOMMENDATION

PAN1740 WITH ANTENNA PLACEMENT

← If possible place PAN1740 in the center of mother PCB. →



Dimensions are in mm.

Note: The above recommendation for the Ground plane is based on a double layer PCB. If additional ground planes are implemented in other layers and connected by sufficient vias the minimum xy dimensions can be reduced.

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12. DEVELOPMENT OF APPLICATIONS

In this and the following chapters, the basic tools and some examples are shown to get the USB-dongles running. All examples use Windows7 OS and iPhone 5G, but also higher versions should work.

Installing and running HW drivers on any system requires time and each step may require re-booting your system. Contact your system administrator if any system related problems appear during the installation phase. Install the drivers step-by-step in the below order and use the latest software releases.

There are two basic approaches for implementation:

1. Full embedded HCI with external host controller








If BLE functionality is being added to a running application -- E.g. for porting the setup GUI from your application into a smart phone -- developing a smart phone "App" and installing either a proprietary BLE profile on the host controller and or a BT-Sig certified profile should be considered. The BT-Developers portal provides guidance for this process -

<http://developer.bluetooth.org/>

2. Standalone sensor application


Applications requiring less than 32KB can reside and execute on the PAN1740 module. There are several examples in the Keil projects. The download link is in chapter 12.1. The profiles are located in the SDK folder (please use the latest release from Dialog website):

\\DA14580_SDK_3.0.4.0\dk_apps\src\ip\ble\hl\src\profiles

 include	21.03.2014 07:56	Dateiordner	
 misc	21.03.2014 07:56	Dateiordner	
 src	21.03.2014 07:56	Dateiordner	
 startup	21.03.2014 07:56	Dateiordner	
 580_peripheral_setup.uvproj	17.03.2014 14:14	µVision4 Project	23 KB
 DA14580_peripheral_setup.uvproj	17.03.2014 14:14	µVision4 Project	23 KB
 sysram.ini	12.02.2014 17:39	Konfigurationsein...	1 KB

Smart Snippets is needed to burn the application into the module. If you are working with the PAN1740ETU USB-Dongle applications can be developed and executed in RAM, but for security reasons it is not possible burn the OTP. Panasonic's Experimenters' kit is required to access OTP is accessible. Please contact your local sales distributor for support. The Experimenters' kit may be mandatory for production. For items beyond the scope of this design guide, refer to the Smart Snippets guide on the Dialog's support website. Following is a list of supported profiles.


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Software Features List (note 1)		DA14580-00	DA14580-01	
		2.0.4	3.0.2	3.0.4
"X" = Supported feature "NS" = Not Supported Feature		release date: 23/12/2014	release date: 28/03/2014	release date: 30/06/2014
1	Embedded Development Tools			
1.1	Keil project environment	X	X	X
1.2	JTAG debugger	X	X	X
1.3	GNU / GCC toolset	NS	NS	X
2	Stack			
2.1	Protocol features			
2.1.1	Bluetooth Smart 4.1 core stack	X	X	X
2.1.2	MTU size	23	23	23
2.1.3	Large packet support (L2CAP fragmentation)	NS	X	X
2.1.4	Master mode	X	X	X
2.1.5	Slave mode	X	X	X
2.1.6	Master and Slave sequentially	X	X	X
2.1.7	Multilink support (maximum links)	4	6	6
2.1.8	UUID 128bits	X	X	X
2.2	Low Energy features			
2.2.1	BLE timer wakeup	X	X	X
2.2.2	GPIO wakeup	X	X	X
2.2.3	Quadrature wakeup	X	X	X
2.2.4	Active mode	X	X	X
2.2.5	Extended Sleep Mode	X	X	X
2.2.6	Deep Sleep	X	X	X
3	Profiles			
3.1	Health Profile			
3.1.1	Blood Pressure Profile	X	X	X
3.1.2	Blood Pressure Service	X	X	X
3.1.3	Glucose Profile	X	X	X
3.1.4	Glucose Service	X	X	X
3.1.5	Health Thermometer Profile	X	X	X
3.1.6	Health Thermometer Service	X	X	X
3.2	Sports and Fitness Profile			
3.2.1	Cycling Power Profile	NS	NS	X
3.2.2	Cycling Power Service	NS	NS	X
3.2.3	Cycling Speed and Cadence Profile	X	X	X
3.2.4	Cycling Speed and Cadence Service	X	X	X
3.2.5	Location and Navigation Profile	NS	NS	X
3.2.6	Location and Navigation Service	NS	NS	X
3.2.7	Heart Rate Profile	X	X	X
3.2.8	Heart Rate Service	X	X	X
3.2.9	Running Speed and Cadence Profile	X	X	X
3.2.10	Running Speed and Cadence Service	X	X	X

..\DA14580_SDK_3.0.4.0\dk_apps\src\ip\ble\hl\src\profiles

(Please use the latest release from Dialog website)

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Software Features List (note 1)		DA14580-00	DA14580-01	
		2.0.4	3.0.2	3.0.4
"X" = Supported feature		release date:	release date:	release date:
"NS" = Not Supported Feature		23/12/2014	28/03/2014	30/06/2014
3.3	Proximity Profile			
3.3.1	Proximity Profile	X	X	X
3.3.2	Find Me Profile	X	X	X
3.4	Alerts and time Profile			
3.4.1	Time Profile	X	X	X
3.4.2	Current Time Service	X	X	X
3.4.3	Reference Time Update Service	X	X	X
3.4.4	Next DST Change Service	X	X	X
3.4.5	Phone Alert Status Profile	X	X	X
3.4.6	Phone Alert Status Service	X	X	X
3.4.7	Alert Notification Profile	X	X	X
3.4.8	Alert Notification Service	X	X	X
3.4.9	Immediate Alert Service	X	X	X
3.5	Peripherals Profile			
3.5.1	HID over GATT Profile	X	X	X
3.5.2	HID Service	X	X	X
3.6	Generic Profile			
3.6.1	Scan Parameters Profile	X	X	X
3.6.2	Scan Parameters Service	X	X	X
3.6.3	Battery Service	X	X	X
3.6.4	Device Information Service	X	X	X
3.6.5	Link Loss Service	X	X	X
3.6.6	Tx Power Service	X	X	X
3.6.7	Accelerometer	X	X	X
4	Peripheral Device Drivers/HAL			
4.1	UART driver	NS	X	X
4.2	GPIO driver	NS	X	X
4.3	SPI driver	NS	X	X
4.4	SPI Flash driver	NS	X	X
4.5	I2C EEPROM driver	NS	X	X
4.6	ADC driver	NS	X	X
4.7	Battery Level driver	NS	X	X
4.8	PWM driver	NS	X	X
4.9	Quadrature driver	NS	X	X
4.10	Wakeup timer driver	NS	X	X

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12.1. Basic Platform Tools

1. Windows 7 or higher - www.microsoft.com
2. Keil Compiler 32K free license – www.keil.com/arm/mdk.asp
3. Segger J-Link software - www.segger.com/jlink-software.html

Use the serial number from the bottom side of the USB-Dongle

4. Bluetooth 4.1 - www.bluetooth.org

12.2. Dialog Specific Tools

Download in the support forum <http://support.dialog-semiconductor.com> under the top menu bar "Software".

1. Connection Manager

Enables basic GATT connections between two BLE devices.

2. Dialogs Projects

Keil Projects with BLE Profiles and examples. These project files are used to implement the customers application. The BLE profiles are already implemented and you can setup the full feature set and I/O capability of the module.

3. Smart Snippets

Smart Snippets is the Tool for reading and writing the OTP. With this tool, the last step in the development chain can be performed by burning the OTP fuses. This tool does not work with the USB-Dongle for security reasons. The programming voltage of 6.8V needed to enable the programming is not supported.

12.3. Bluetooth Address and Crystal Trim Values

1. Main Frequency Calibration up to 1ppm @ 2.4GHz

Panasonic calibrates the 16 MHz crystal and writes this calibration data in the OTP header. This provides best performance and a stable frequency. Customers do not need to take care of this step in their production.

2. Pre-programmed Bluetooth/MAC Address

Each Bluetooth device must have a unique MAC address which is provided from the IEEE. Since this may lead to additional costs and registration effort for customers Panasonic burns a unique address into the OTP header from our database. Customers do not need to take care of this step in their production.

3. Precise High Performance Crystal Sleep clock

Since this is a low energy device and the key functionalities are the sleep functions with just a few μA current draw Panasonic has integrated a 32.768 kHz crystal clock into the PAN1740 module. Therefore no external components are needed and there are no hidden costs.

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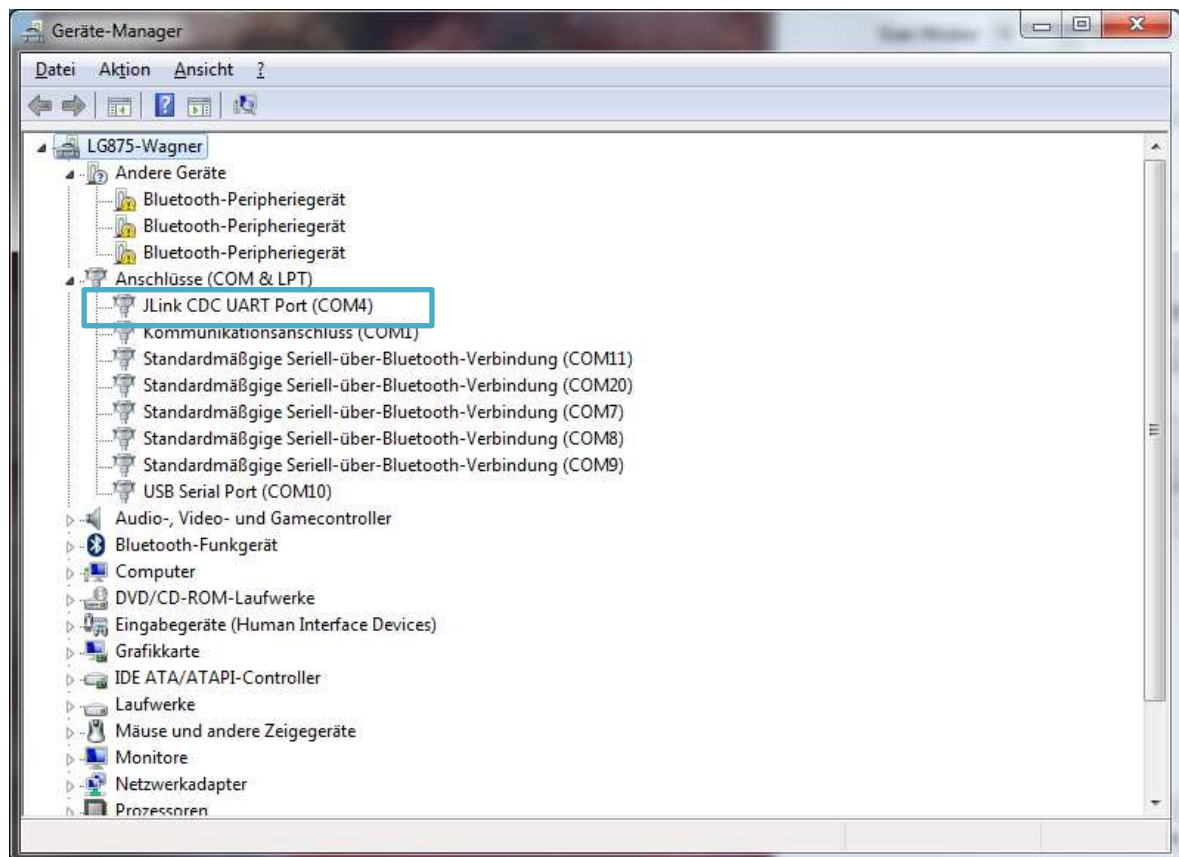
12.4. Example for Connection Manager

In the following example two USB-dongles are used. PAN1026-USB works as a peripheral and the PAN1740-USB as central device.

12.4.1. USB Driver

Download and install USB Drivers from Segger

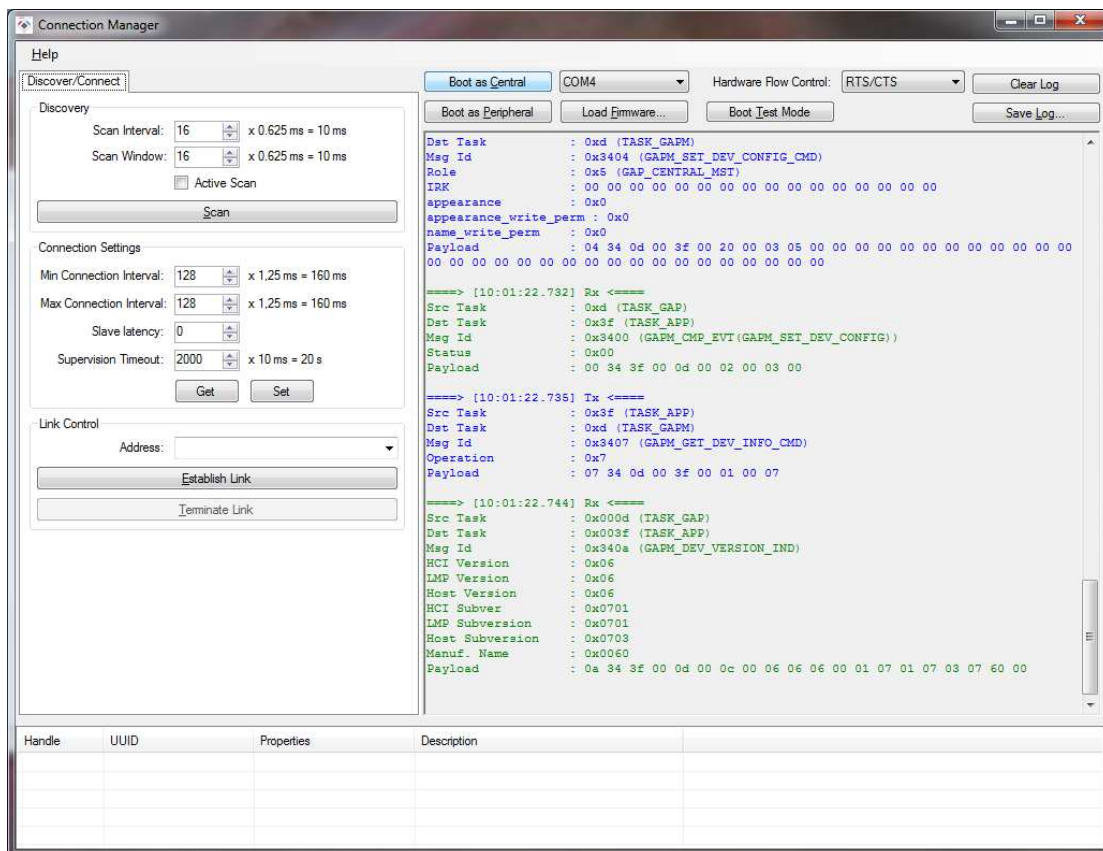
www.segger.com/jlink-software.html



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12.4.2. Start the Connection Manager

1. Make sure you have admin rights and access to the program folder
2. Wait until the init phase is finished
3. Press load Firmware and select "full_emb.hex"
4. Wait until the init phase is finished
5. Press either "Boot as Central" or "Boot as Peripheral" (Example shows Central)

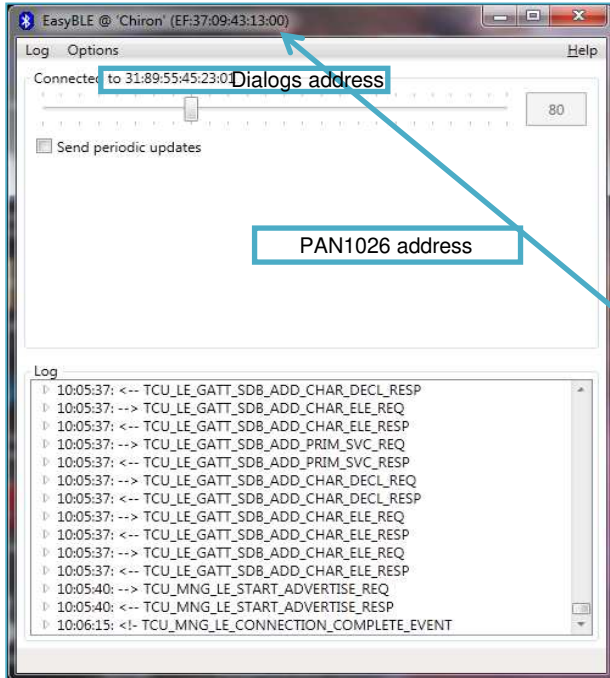


12.4.3. Make PAN1026 Peripheral visible

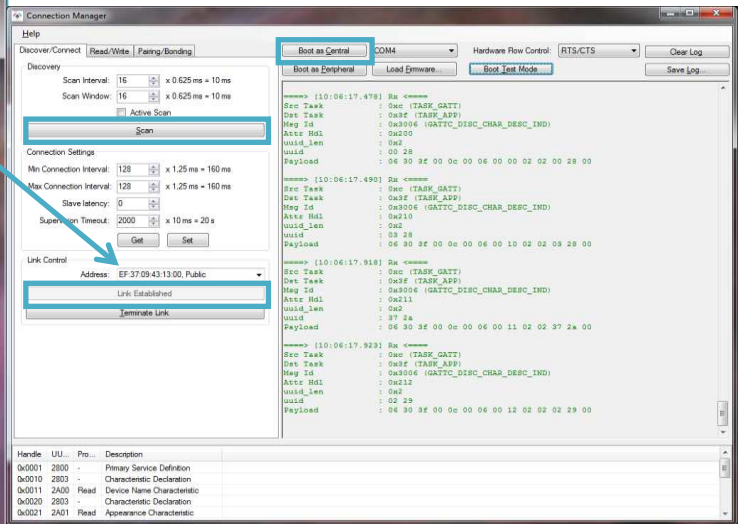
EasyBLE Tool and a PAN1026-USB dongle may be used to make a peripheral visible with the heart rate profile. Use this link to download EasyBLE:

<http://pideu.panasonic.de/files/Documents/WM%20Documents/PAN1026/EasyBLE.zip>

12.4.4. Open a Connection



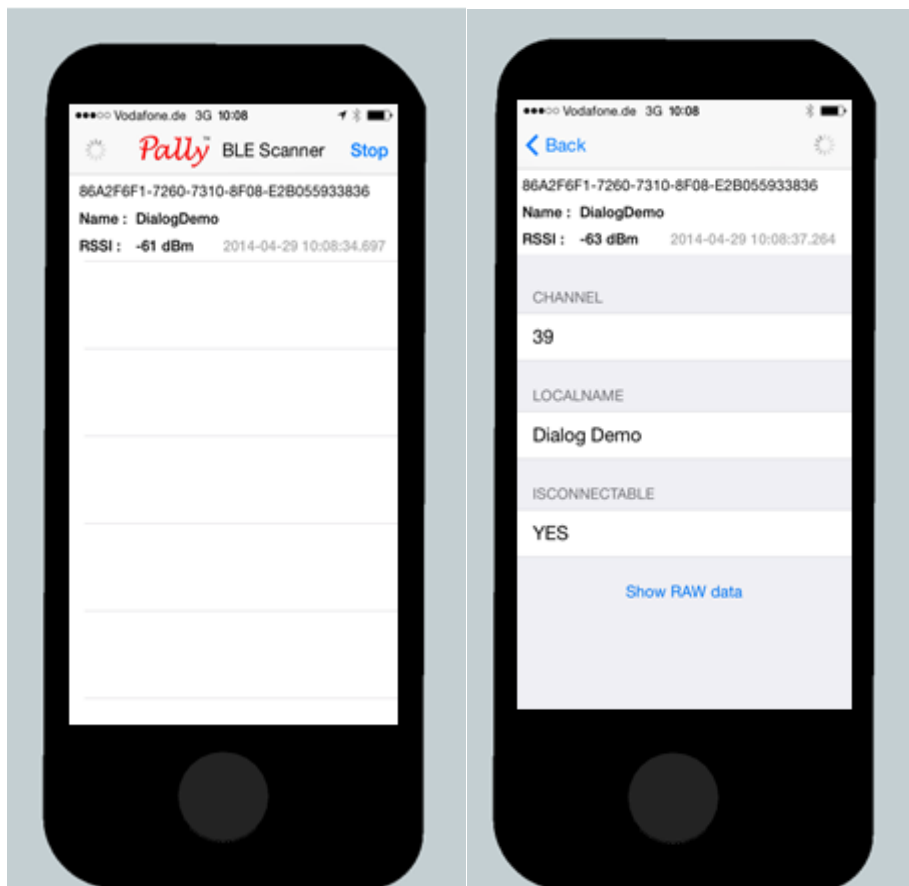
1. Press "Scan"
2. Select PAN1026 address and establish link



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12.4.5. iPhone Demo

The PAN1026 used in the example above may be substituted with an iPhone (model 4S and up) and e.g. "Bluetooth Smart Scanner" App.



"Bluetooth Smart Scanner" may be replaced by other BLE Apps for Android or Windows based smart phones. Depending on the application, a proprietary app may be written or existing certified BLE profile used.

12.4.6. Next Steps

The PAN1026 was chosen to demonstrate sending a heart rate payload data, as Connection Manager cannot send data, since it installs only the central or peripheral functionality on the PAN1740, but not the profile. Two PAN1740 USB dongles can be connected by setting one side to Central and the other to Peripheral. To send data you need to run the Keil project in debug mode together with a profile e.g. peripheral example, chapter 13 describes this process.

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13. RUN THE KEIL PROJECT EXAMPLE

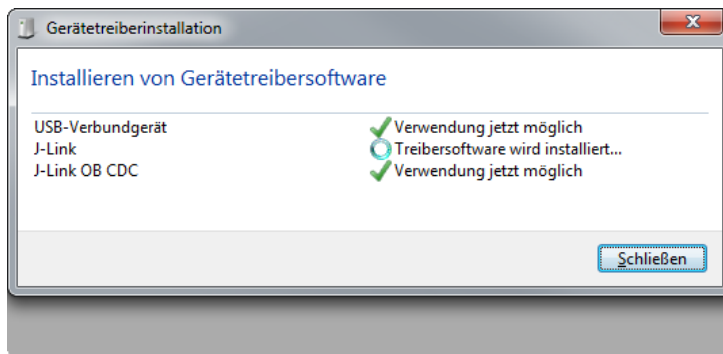
For more detailed information on project examples, refer to the Projects in Dialog's software download page. Recommended is the proximity example as this is the most common profile.

Download and install the SDK using the following URL:

<http://support.dialog-semiconductor.com/software-downloads/index>

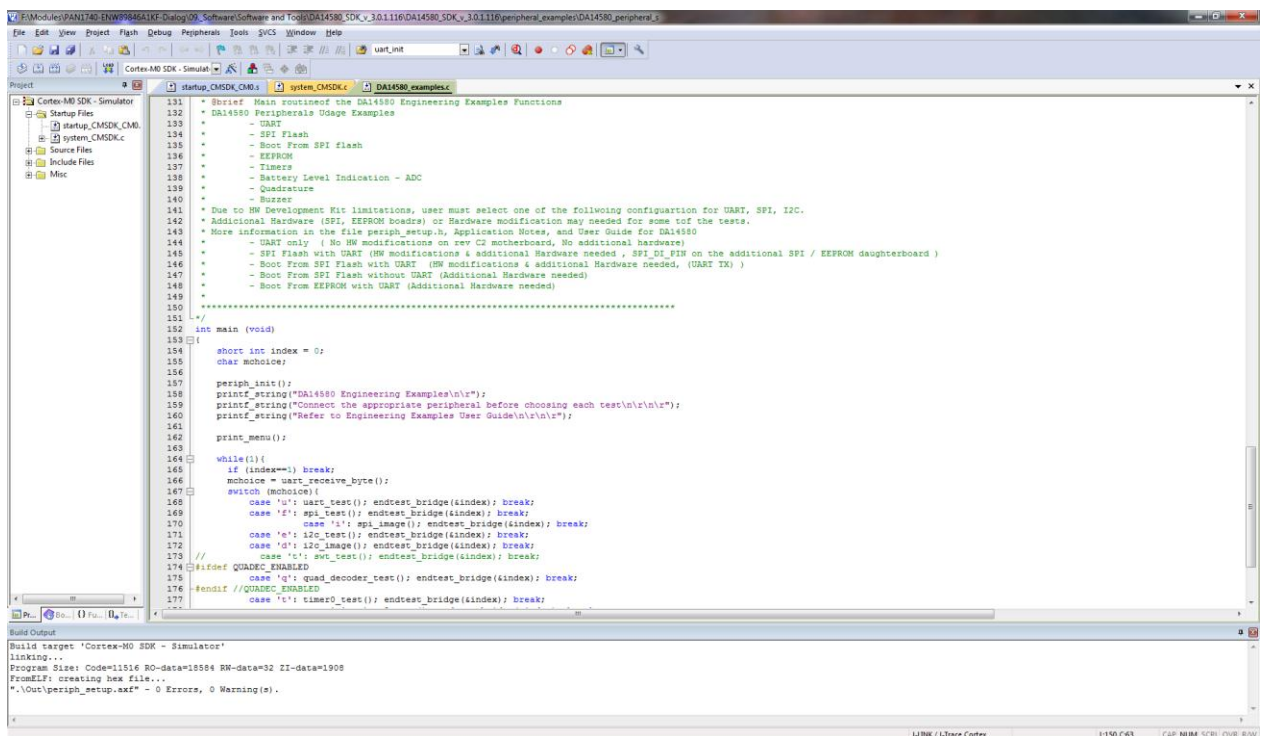
Install the dongle after the Segger J-Link software driver installation.

Refer to chapter 12.1 Basic Platform Tools to download them.



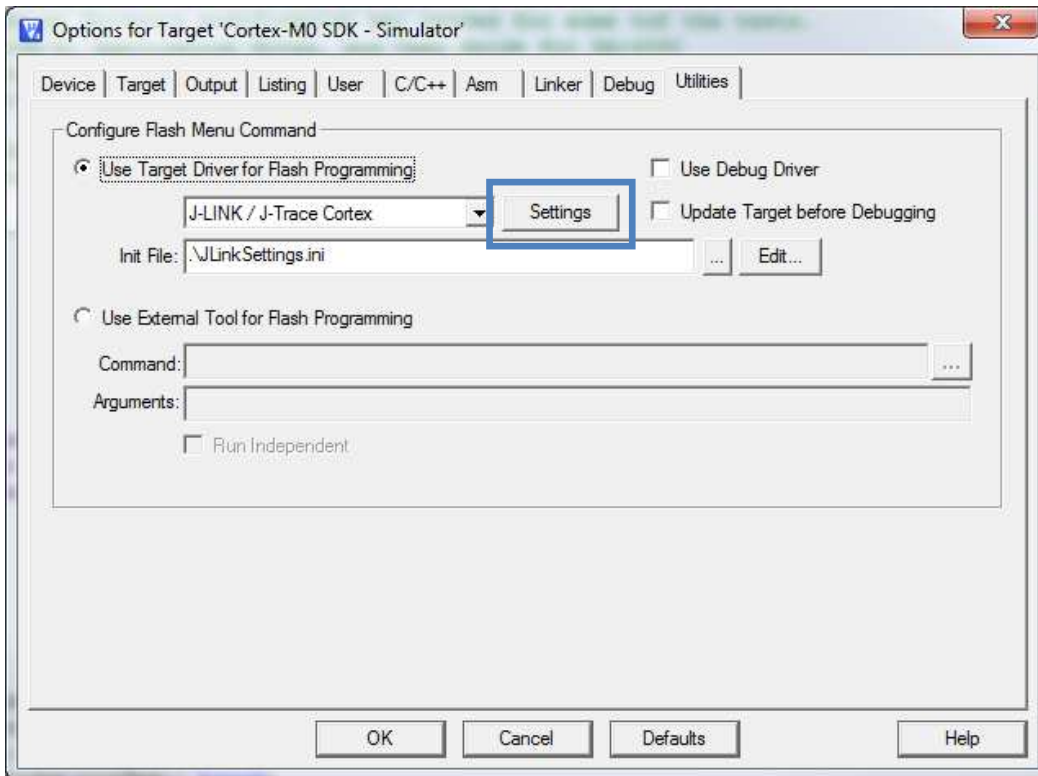
Open the proximity project example found in the Dialog SDK. The project is located in the following SDK folder (please use the latest release from Dialog website):

DA14580_SDK_3.0.2.1\dk_apps\keil_projects\proximity\monitor_fe_usb

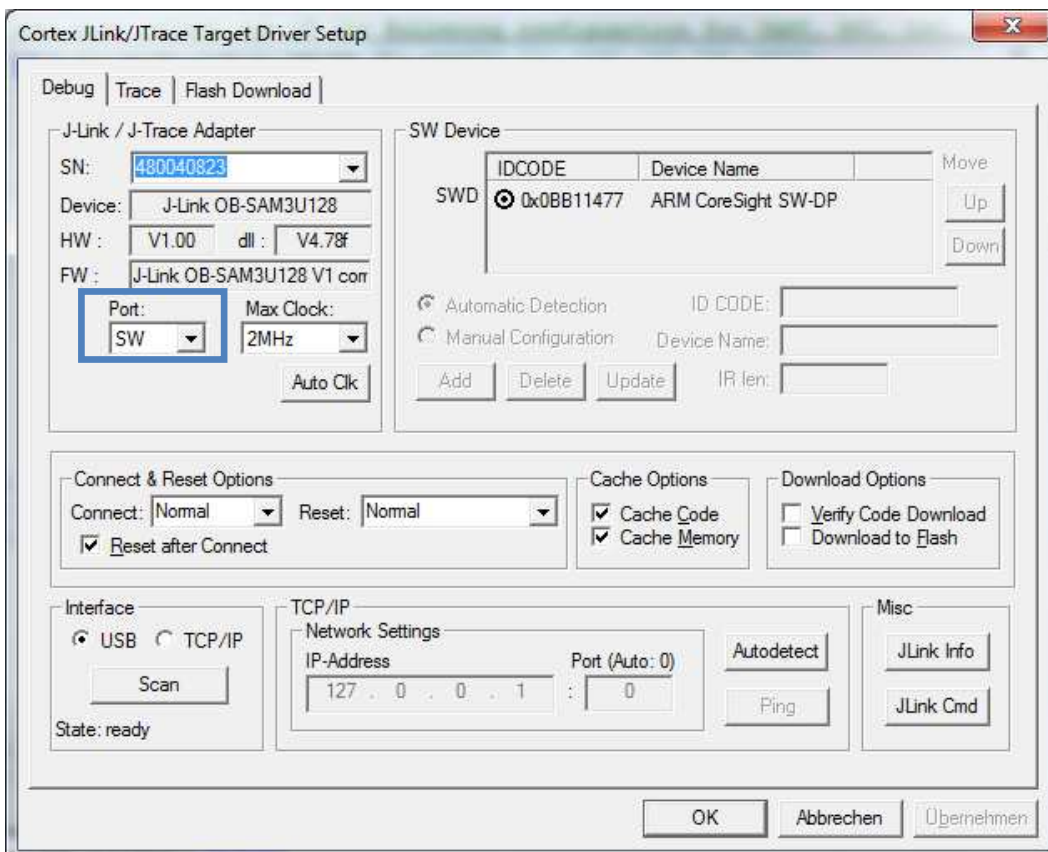


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In the Keil compiler Configure the Flash Target (Flash >> Configure Flash Tools). Choose "Settings".



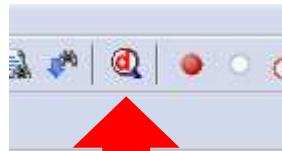
Click the Debug tab. Setup the Port in the J-Flash Settings to "SW". Press "OK".



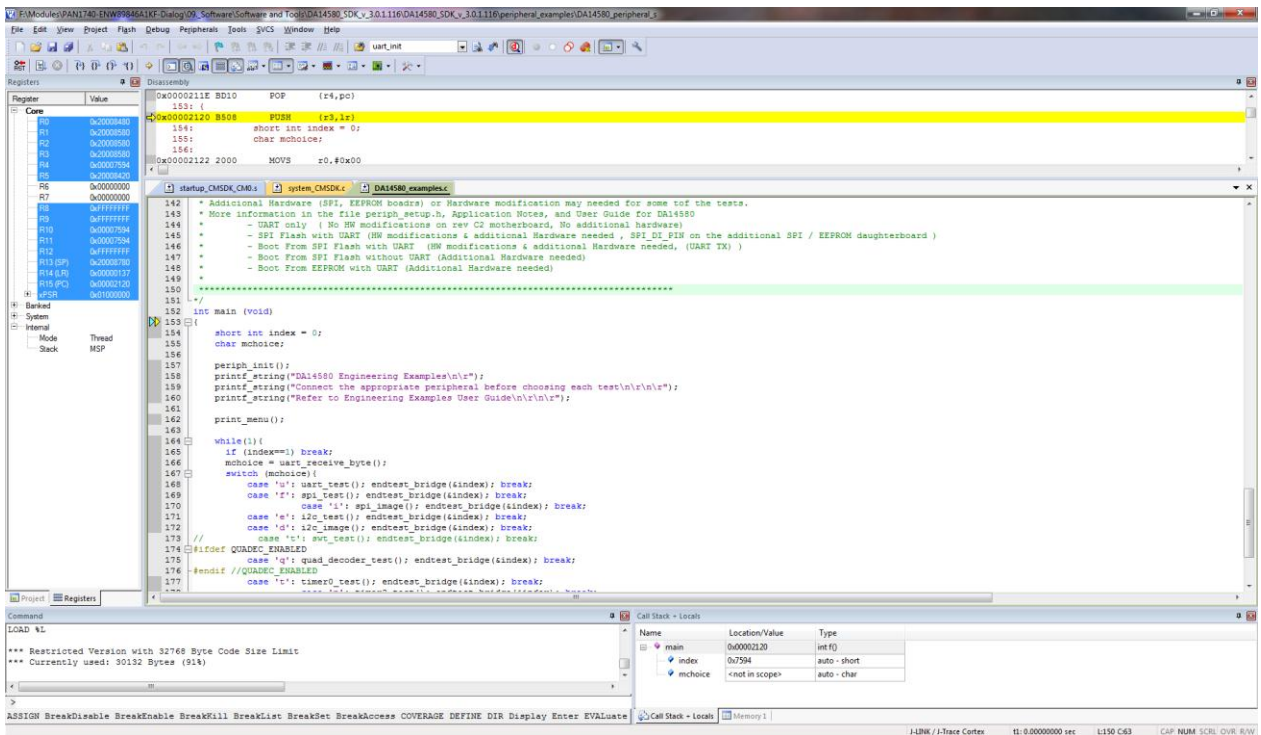
Build Target files (Press F7 or click on the build button) and run the debug session (Press "Ctrl"+F5 or click on the "Debug" button).



Build



Debug



The proximity project has now been compiled and downloaded into the RAM of the PAN1740ETU.