

D52 ANT SoC Module Series



Module Hardware

- Integrated printed antenna
- On-board 32MHz and 32.768 kHz crystal clocks
- Supply Voltage range:
 - 1.7V to 3.6V (D52QD2M4IA)
 - 1.71V to 3.6V (D52QD2M4IA-A)
- Operating temperature: Industrial (-40°C to +85°C)
- Up to 30 GPIOs (D52QD2M4IA)
- Up to 24 GPIOs (D52QD2M4IA-A, D52MD2M8IA)
- Programmable output/channel from -20dBm to 4dBm
- Excellent receiver sensitivity
 - 93dBm (ANT mode)
 - 96dBm (BLE mode)
- 1dBm resolution RSSI
- Total 512kB flash, 64kB RAM
- SPI, I2C and UART interface
- ARM SWD interface
- Internal DC/DC converter supported
- 20 x 20mm module (D52QD2M4IA, D52QD2M4IA-A)
- 14 x 9.8 x 2.0mm module (D52MD2M8IA)
- Onboard 3-axis MEMS accelerometer (D52QD2M4IA-A)
 - LIS2DH by ST Microelectronics
 - 2 programmable interrupt pins
- Layout compatible options with N5150M4CD, N550M4CC, N548M4CB, ANTAP281M4IB, ANTC782M4IB (D52Q)¹
- Layout compatible options with N5150M8CD, N550M8CC, N548M8CB (D52M)¹
- Radio regulatory approval for major markets
- BLUETOOTH SIG qualification
- RoHS compliant

Series Members:

- D52QD2M4IA, D52QD2M4IA-A, D52QD2M6IA-A
- D52MD2M8IA (*coming soon*)

All preloaded with an ANT Network Processor application.

¹ In certain configurations; see section 2.2 - Pin-outs - for complete details

ANT® Operation (using the latest s212 or s332 SoftDevice)

- 79 selectable RF channels (2402 to 2480 MHz)
- Flexible network topologies: peer-to-peer, star, tree, high node count, mesh and more
- Broadcast, acknowledged, and burst data communication modes
- Built-in device search and pairing
- Built-in interference handling and radio coexistence management with application radio disable requests and application flash write/erase requests
- Enhanced ANT features:
 - Supports up to 15 logical channels each with configurable channel periods (5.2ms - 2s)
 - Advanced burst data transfer modes (up to 60kbps)
 - Optional channel encryption mode (aes-128)
 - Supports up to 8 public, private and/or managed networks
 - Advanced power management features to optimize application power consumption including Event Filtering and Selective Data Updates
 - Asynchronous transmit channel
 - Fast channel initiation

Bluetooth® low energy operation (when loaded with the latest S132 or S332 SoftDevice)

- Bluetooth 4.2 compliant low energy single-mode protocol stack suitable for Bluetooth low energy products
 - Concurrent Central, Observer, Peripheral, and Broadcaster roles with:
 - Multiple connections as a central
 - One connection as a peripheral
 - Observer
 - Broadcaster
 - Link layer
 - L2CAP, ATT, and SM protocols
 - GATT and GAP APIs
 - GATT Client and Server



Table of Contents

D52 ANT SoC Module Series	1
Table of Figures	4
List of Tables	4
Notices and Restricted use Information	5
One Year Limited Warranty	6
1 D52 ANT SoC Module Series Overview	7
1.1 Nomenclature.....	8
1.2 Production Tracking Code	8
1.3 Models	9
1.4 D52 ANT SoC Module Starter Kit and Components	10
2 Product Overview	11
2.1 Block Diagrams	11
2.2 Pin-outs	12
2.3 (Optional) Accelerometer Specification	14
2.4 Preloaded Software	14
2.5 D52 Module Programming.....	15
2.5.1 Programming via SWD interface.....	15
2.5.2 Initializing the SoftDevice	15
2.5.3 Configuring the dc/dc converter.....	15
2.6 Design considerations.....	15
2.6.1 M4 (D52Q) module mounting	16
2.6.2 M6 module mounting	17
2.7 Assembly Considerations.....	17
2.7.1 Moisture Control.....	17
2.7.2 Solder Stencil for M4 Module	17
2.7.3 Cleaning Process.....	17
3 Regulatory Approvals and Compliance	18
3.1 United States	18
3.2 Canada	18
3.3 European Economic Area	18
3.4 Australia and New Zealand.....	19
3.5 Japan.....	19
3.6 Korea.....	19
3.7 BLUETOOTH Qualification	19
4 Licensing & Conditions of Use	20
4.1 Conditions of Use	20



4.2	SoftDevice Licensing	20
5	Electrical Specifications	20
5.1	Recommended Operating Conditions	20
5.2	Absolute Maximum Ratings	20
5.3	Radio Operation Specifications and Antenna Characteristics.....	21
5.4	Electrical Specifications	22
6	Mechanical Drawings.....	23
7	Support	24
7.1	ANT Forum.....	24
7.2	Technical References	24
7.3	ANT Developer’s Zone	24
7.4	ANT and ANT+ Social Media	25
	Appendix A – Using the ANT Network Processor Configuration	26
	Pin Assignments in the ANT Network Processor Configuration	26
	Asynchronous Serial Mode.....	27
	Byte Synchronous Serial Mode.....	28
	DC/DC Configuration	29
	Appendix B – D52Q Module Pre-Loaded Software Versions	29



Table of Figures

Figure 1: D52 Module Series Nomenclature	8
Figure 2: Production Tracking Code	8
Figure 3: D52QD2M4IA-A (with accelerometer) Module Block Diagram	11
Figure 4: D52QD2M4IA Module Block Diagram	11
Figure 5: D52Q M4 Bottom View	12
Figure 6: D52Q M6 - Top View	12
Figure 7: D52Q M6 - Bottom View	13
Figure 8: Memory Map of the Preloaded Software	15
Figure 9: D52Q Module Mounting	16
Figure 10: D52Q signal pads, component outline and keepout areas	17
Figure 11: M4 Solder Stencil	17
Figure 12: D52Q M4 Module Typical Antenna Gain (dBi)	22
Figure 13: D52Q Mechanical Drawing	23
Figure 14: Using ANT Network Processor	26
Figure 15: D52Q M4 ANT NP Configuration Async Serial Connection	27
Figure 16: D52Q M4 ANT NP Configuration Byte Sync Connection	28

List of Tables

Table 1: D52 ANT SoC Module Series Models	9
Table 2: D52 ANT SoC Module Starter Kit	10
Table 3: D52 Module Series Pin-Out	14
Table 4: Accelerometer Pin Assignment	14
Table 5: SoftDevice Licensing and Downloads	20
Table 6: Absolute Maximum Ratings	20
Table 7: Recommended Operating Conditions	20
Table 8: D52 Module Antenna Gain	21
Table 9: Current Consumption of Radio Operation	21
Table 10: Pin Assignments in ANT Network Processor Configuration	26
Table 11: Asynchronous Serial Mode Baud Rate Select	27
Table 12: Byte-Sync Mode Speed Selection	28
Table 13: ANT DC/DC Configuration Command	29
Table 14: ANT DC/DC Configuration Response	29
Table 15: D52Q Preloaded Software Versions	29



Notices and Restricted use Information

Information contained in this document is provided only for your ("Customer" or "you") convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications.

Dynastream Innovations Inc. ("DYNASTREAM") makes no representations or warranties of any kind whether express or implied, written or oral, statutory or otherwise, related to the information, including but not limited to its condition, quality, performance, merchantability or fitness for purpose. DYNASTREAM disclaims all liability arising from this information and its use.

DYNASTREAM does not assume any responsibility for the use of the described ANT module ("the Module(s)"). DYNASTREAM makes no representation with respect to the adequacy of the module in low-power wireless data communications applications or systems. Any Products using the Module must be designed so that a loss of communications due to radio interference or otherwise will not endanger either people or property, and will not cause the loss of valuable data. DYNASTREAM assumes no liability for the performance of products which are designed or created using the Modules.

The Modules are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Module could create a situation where personal injury or death may occur. If you use the Modules for such unintended and unauthorized applications, you do so at your own risk and you shall indemnify and hold DYNASTREAM and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that DYNASTREAM was negligent regarding the design or manufacture of the Product.

The information disclosed herein is the exclusive property of DYNASTREAM, and is not to be reproduced and/or distributed without the written consent of DYNASTREAM. No part of this publication may be reproduced or transmitted in any form or by any means including electronic storage, reproduction, execution or transmission without the prior written consent of DYNASTREAM. The recipient of this document by its retention and use agrees to respect the security status of the information contained herein.

DYNASTREAM believes the information contained herein is correct and accurate at the time of its release. However, the information contained in this document is subject to change without notice and should not be construed as a commitment by DYNASTREAM unless such commitment is expressly given in a covering document.

The D52 Series of modules have been designed to support the ANT and/or *Bluetooth*[®] low energy Protocols and are certified for use in many geographic regions around the globe. However, a product incorporating the D52 series module may carry the certification IDs of the module only if it complies with the restrictions and terms, including use of Dynastream-approved software, provided in the conditions of use available at:

www.dynastream.com/components/d52/conditions-of-use



One Year Limited Warranty

This D52 Module is warranted to be free from defects in materials or workmanship for 1 year from the date of purchase by the end customer. Within this period, Dynastream will, at its sole option, replace any D52 Modules that fail in normal use. Replaced D52 Modules have a 1 year warranty. Dynastream retains the exclusive right to replace (with a new or newly-overhauled replacement product) the D52 Module or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE THE SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY. Such replacement will be made at no charge to LICENSEE, provided LICENSEE shall be responsible for any transportation cost. This warranty does not apply to: (i) cosmetic damage, such as scratches, nicks and dents; (ii) damage caused by accident, abuse, misuse, water, flood, fire, or other acts of nature or external causes; (iii) damage caused by service performed by anyone who is not an authorized service provider of Dynastream; or (iv) damage to a D52 Module that has been modified or altered without the written permission of Dynastream. In addition, Dynastream reserves the right to refuse warranty claims against D52 Modules used in contravention of the laws of any country.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS, IMPLIED, OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE.

IN NO EVENT SHALL DYNASTREAM BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT.

To obtain warranty service, LICENSEE shall contact Dynastream for shipping instructions and obtain a return material authorization (RMA) tracking number. LICENSEE shall securely pack the D52 Modules and enclose a copy of the original sales receipt, which is required as the proof of purchase for a warranty claim, and write the tracking number clearly on the outside of the package. LICENSEE agrees to send the D52 Modules, freight charges prepaid, to the Dynastream address provided in the Module Distribution Agreement (see www.dynastream.com/components/d52/conditions-of-use).

©2016 Dynastream Innovations Inc. All Rights Reserved.



1 D52 ANT SoC Module Series Overview

Dynastream Innovations offers the [D52 series of ANT SoC Modules](#), based on Nordic Semiconductor's nRF52832 SoC supporting ANT, *Bluetooth*[®] low energy and extended features such as NFC. This expands Dynastream's portfolio of multi-protocol ultra-low power wireless modules, popularized with the [N5 series of modules](#). Features of the D52 series include:

- Nordic Semiconductor's nRF52832 chip with 64kB RAM, 512kB Flash and a 32-bit ARM Cortex M4F CPU
- Concurrent ANT and Bluetooth low energy protocol operation using supported SoftDevices (pre-compiled protocol stack solutions for the nRF52 SoCs):
 - S212 – ANT only SoftDevice from Dynastream Innovations
 - S332 – concurrent ANT and Bluetooth low energy SoftDevice from Dynastream Innovations
 - S132 – Bluetooth low energy only SoftDevice from Nordic Semiconductor
- Certification of compliance with regulation standards in major markets including North America, Europe, Australia / New Zealand, Japan and Korea²
- Qualification by the Bluetooth SIG
- Onboard 32MHz and 32.768kHz crystal clocks
- Preloaded ANT Network Processor Application, which uses the S212 SoftDevice (scalable ANT protocol stack with 15 channel support). The application provides a standard ANT serial interface front-end that can be connected to an external application controller.
- Easy reprogramming via the onboard SWD interface pins using off-the-shelf ARM programming tools
- D52Q models support drop-in compatibility with Dynastream ANTC782M4IB, ANTAP281M4IB, N5150M4CD, N550M4CC and N548M4CB modules (in certain configurations)³
- D52M models support drop-in compatibility with Dynastream N5150M8CD, N550M8CC, N548M8CB modules (in certain configurations)⁴
- The D52 ANT SoC module family include the following models:

Part no.	Description
D52QD2M4IA	20x20mm module with up to 30GPIOs and 8 analog inputs
D52QD2M4IA-A	20x20mm module with up to 24GPIOs and 5 analog inputs; onboard 3-axis MEMS accelerometer
D52MD2M8IA	14.0x9.8x2.0mm module with up to 24GPIOs and 8 analog inputs (<i>sampling soon</i>)
D52QD2M6IA-A	D52QD2M4IA-A mounted on a carrier board for starter kit and development use

The [D52 series development kit](#) (D52DK1) contains everything necessary to evaluate and begin development with D52 series modules, with support for the Nordic nRF5 SDK.

² Please see section 3 of this data sheet for details about leveraging D52 certification.

³ Layouts are compatible with D52Q when using the reset pin only; the nRF52832 supports separate reset and SWDIO lines rather than the single shared line from previous Nordic SoCs. See section 2.2 for more information.

⁴ Layouts are compatible with D52M when using the SWDIO pin only; the nRF52832 supports separate reset and SWDIO lines rather than the single shared line from previous Nordic SoCs. More information will be available as D52M models near launch.



1.1 Nomenclature

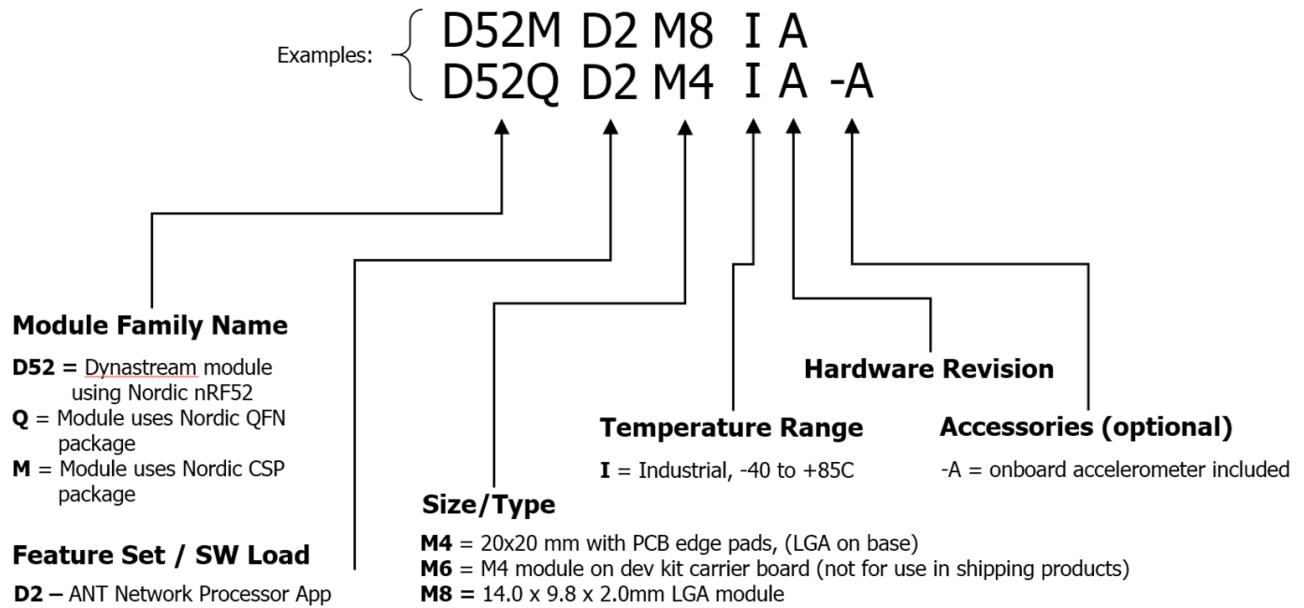


Figure 1: D52 Module Series Nomenclature

1.2 Production Tracking Code

For technical support and customer service purposes, a production code of three characters of the format “YWR” is laser marked on the RF shield as illustrated below. In the code, YW (“6K” in Figure 2, below) denotes production date code and R (“2” in Figure 2, below) denotes module version.



Figure 2: Production Tracking Code

Please refer to Appendix B – D52Q Module Pre-Loaded Software Versions for differences and important notes of each version.



1.3 Models

This section details some basic information about models in the D52 ANT SoC Module Series.




Module	Part No.	Description	Ordering/Package Information	Part Status*
	D52QD2M4IA	20x20mm module with up to 30GPIOs and 8 analog inputs	<ul style="list-style-type: none"> D52QD2M4IA-TRAY: 20pc in 4x5 tray D52QD2M4IA-REEL: 800pc on 13" tape and reel 	Active
	D52QD2M4IA-A	20x20mm module with up to 24GPIOs and 5 analog inputs; onboard 3-axis MEMS accelerometer	<ul style="list-style-type: none"> D52QD2M4IA-A-TRAY: 20pc in 4x5 tray D52QD2M4IA-A-REEL: 800pc on 13" tape and reel 	Active
(coming soon)	D52MD2M8IA	14.0x9.8x2.0mm module with up to 24GPIOs and 8 analog inputs (<i>sampling soon</i>)	<ul style="list-style-type: none"> D52MD2M8IA-TRAY: 40pc in 8x5 tray D52MD2M8IA-REEL: 1500pc on 13" tape and reel 	Preview
	D52D2M6IA-A	D52QD2MrIA-A mounted on a carrier board for starter kit and development use	<ul style="list-style-type: none"> D52QD2M6IA-A-TRAY: 10 pc on 150x165mm tray 	Active

Table 1: D52 ANT SoC Module Series Models

* PREVIEW - Device, tool, or software has been announced but is not in production. Samples may or may not be available;
ACTIVE: Device, tool, or software recommended for new designs.



1.4 D52 ANT SoC Module Starter Kit and Components

The D52 starter kit (D52DK1) contains all the hardware necessary to get developing with ANT, and the downloadable ANT SoC Module Starter Kit User Manual has full details on using the kit with reference examples and the nRF5 SDK from Nordic Semiconductor. The kit contents are described in Table 2, below:



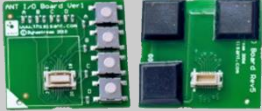



D52 Starter Kit		Part No: D52DK1	
Part No.	Description	Quantity	Picture
D52QD2M6IA-A	M4 module on carrier board with 20-pin Molex connector, NFC connections available, SWD programming header, additional through-hole connections for I/O pins	2	
ANTBAT2	Battery board with a Molex socket, a reset button and a five-position dip switch	2	
ANTIO1	I/O board with a Molex connector, a Molex socket, 4 LEDs and 4 buttons	2	
ANTUIF1	USB interface board with a Molex socket	1	
ANTUSB-m	ANT USB dongle	1	
	Segger J-Link Lite Programmer	1	

Table 2: D52 ANT SoC Module Starter Kit



2 Product Overview

2.1 Block Diagrams

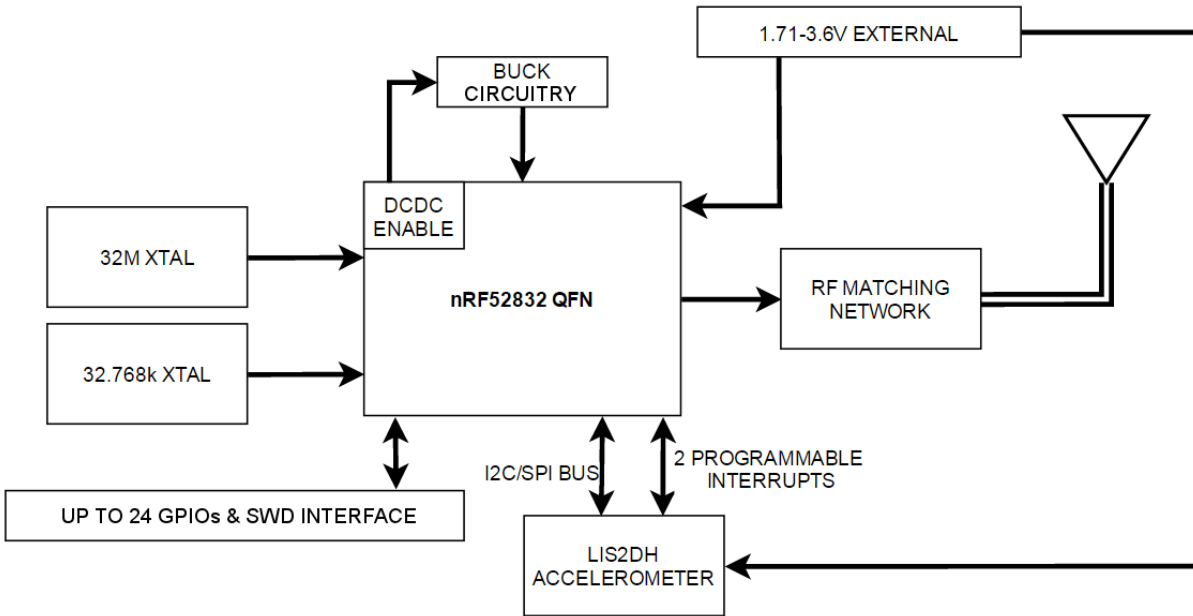


Figure 3: D52QD2M4IA-A (with accelerometer) Module Block Diagram

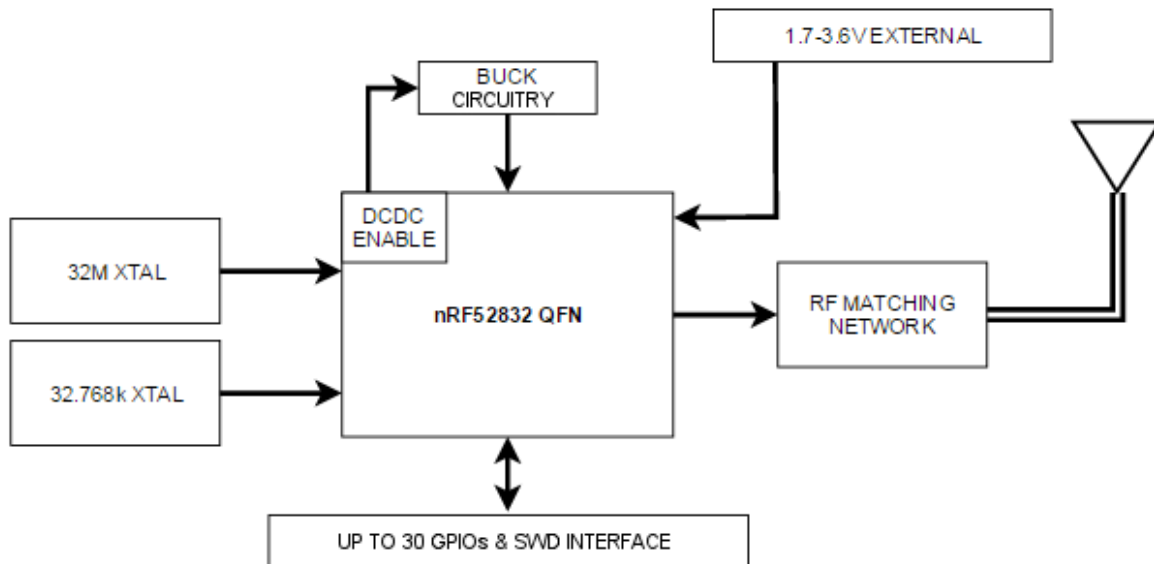


Figure 4: D52QD2M4IA Module Block Diagram



2.2 Pin-outs

A note on backwards drop-in compatibility: the D52Q modules support drop-in compatibility with ANTAP281M4IB, ANTC782M4IB, N5150M4CD, N550M4CC and N548M4CB modules from Dynastream Innovations under certain configurations. For drop-in compatibility, existing designs must use only the reset capability of the reset/SWDIO pin on previous modules. See pin H202, below. In addition to this, there must be nothing on existing designs that would contact the LGA pads in the middle of the D52Q modules.

A note on the preloaded Network Processor application: Please refer to Appendix A – Using the ANT Network Processor Configuration for ANT Serial Line specification.

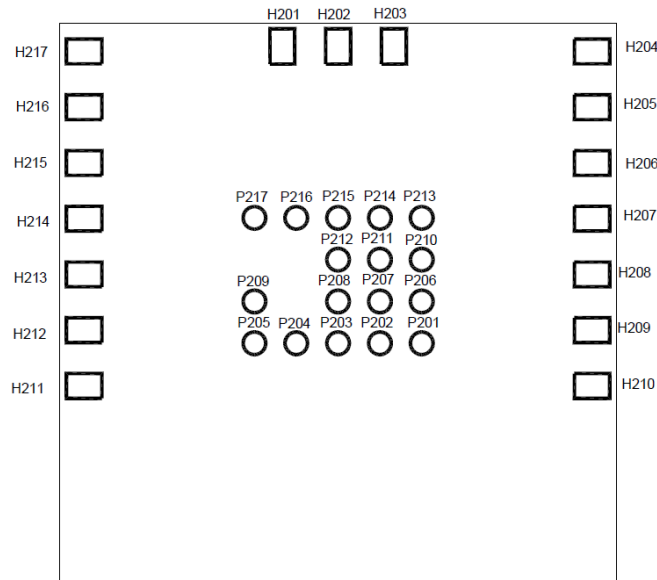


Figure 5: D52Q M4 Bottom View

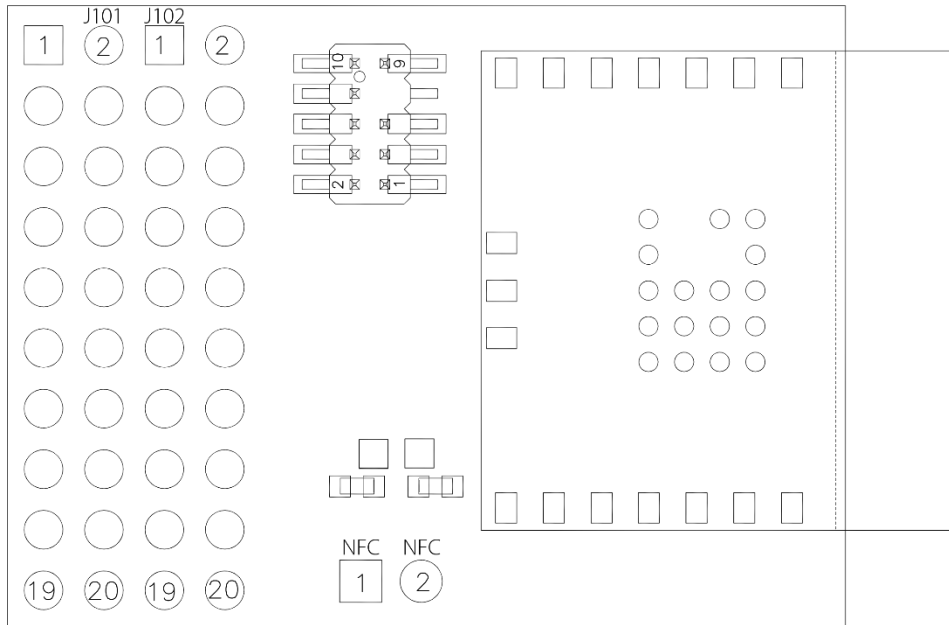


Figure 6: D52Q M6 - Top View



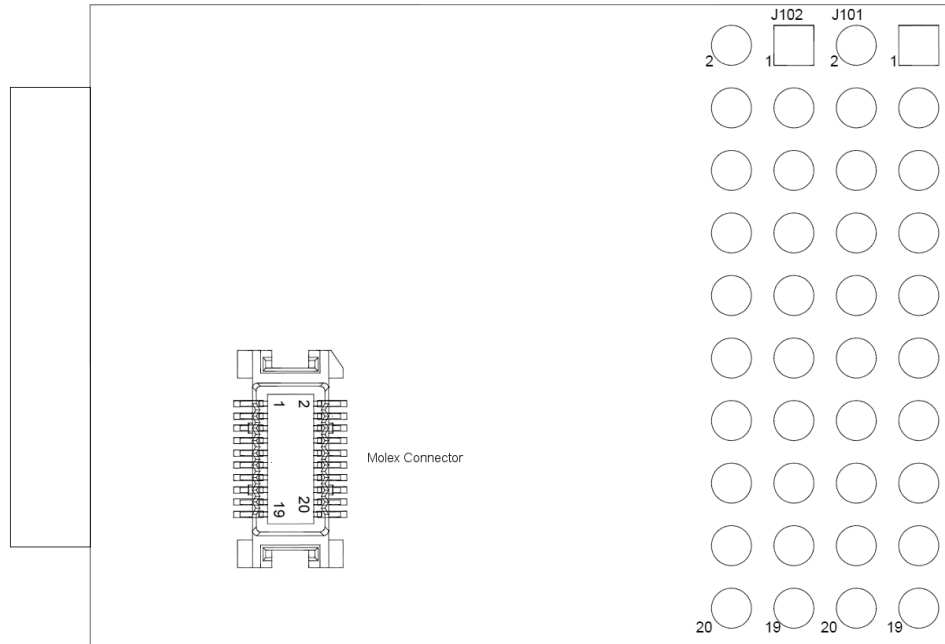


Figure 7: D52Q M6 - Bottom View

D52Q M4 Pin	D52Q M6		LIS2DH Pin (D52Q D2M4IA-A Only)	nRF52832 Pin Name	Description
	Molex Connector	Dev Board Pin			
H201	16	J102.19		SWDIO	Serial Wire Debug I/O for debug and programming
H202	10	J101.06		P021/RESET	General Purpose I/O / System Reset pin
H203	1	J101.01		VCC	Power Supply Pin
H204	19	J101.02, J101.08, J102.20		VSS	Ground
H205	6	J101.07		SWDCLK	Serial Wire Debug clock input for debug and programming
H206	17	J101.09		P006	General Purpose I/O
H207	15	J101.10		P007	General Purpose I/O
H208	-	J102.01		P002/AIN0	General Purpose I/O / Analog SAADC/COMP/LPCOMP input
H209	11	J101.17		P008	General Purpose I/O
H210	7	J101.19		P011	General Purpose I/O
H211	4	J101.04, J101.15		P017	General Purpose I/O
H212	3	J101.03, J101.11		P016	General Purpose I/O
H213	5	J101.18		P015	General Purpose I/O
H214	9	J101.20		P014	General Purpose I/O
H215	-	J102.17		P013	General Purpose I/O
H216	8	J102.15		P031/AIN7	General Purpose I/O / Analog SAADC/COMP/LPCOMP input
H217	2	J101.05		P012	General Purpose I/O
P201	-	NFC.2		NFC2/P010	NFC antenna connection / General Purpose I/O
P202	14	J102.04		P019	General Purpose I/O
P203	13	J102.06		P020	General Purpose I/O
P204	18	J102.08		P022	General Purpose I/O
P205	20	J102.10		P023	General Purpose I/O



D52Q M4 Pin	D52Q M6		LIS2DH Pin (D52Q D2M4IA-A Only)	nRF52832 Pin Name	Description
	Molex Connector	Dev Board Pin			
P206	-	NFC.1		NFC1/P009	NFC antenna connection / General Purpose I/O
P207	-	J102.07		P005/AIN3	General Purpose I/O / Analog SAADC/COMP/LPCOMP input
P208	-	J102.02		P018	General Purpose I/O
P209	12	J102.12		P024	General Purpose I/O
P210	-	J102.05		P004/AIN2	General Purpose I/O / Analog SAADC/COMP/LPCOMP input
P211	-	J102.03		P003/AIN1	General Purpose I/O / Analog SAADC/COMP/LPCOMP input
P212	-	J102.16	INT2	P026	General Purpose I/O
P213	-	J102.11	SDA/SDI/SDO	P029/AIN5	General Purpose I/O / Analog SAADC/COMP/LPCOMP input
P214	-	J102.13	SCL/SPC	P030/AIN6	General Purpose I/O / Analog SAADC/COMP/LPCOMP input
P215	-	J102.09	SDO/SA0	P028/AIN4	General Purpose I/O / Analog SAADC/COMP/LPCOMP input
P216	-	J102.18	CS	P027	General Purpose I/O
P217	-	J102.14	INT1	P025	General Purpose I/O

Table 3: D52 Module Series Pin-Out

2.3 (Optional) Accelerometer Specification

The D52Q module series supports an accelerometer accessory on the D52QD2M4IA-A. The accelerometer is the LIS2DH by STMicroelectronics. To make use of the accelerometer, the following pins are consumed:

D52QD2M4IA-A Pin	nRF52832 Pin	LIS2DH Pin
P212	P026	INT2
P213	P029/AIN5	SDA/SDI/SDO
P214	P030/AIN6	SCL/SPC
P215	P028/AIN4	SDO/SA0
P216	P027	CS
P217	P025	INT1

Table 4: Accelerometer Pin Assignment

SPI or I2C can be used to communicate with the accelerometer. To use I2C, pull-up resistors will need to be added to the appropriate pads.

For more information about D52Q pin assignments, refer to **Table 3: D52 Module Series Pin-Out**.

For more information about this component including data sheet and errata, please refer to the STMicroelectronics website:

- http://www.st.com/web/en/catalog/sense_power/FM89/SC444/PF252928.

2.4 Preloaded Software

The D52Q module is preloaded with the S212 ANT SoftDevice and the ANT Network Processor (NP) application as illustrated below. Depending on the module revision, the preloaded code may vary. Please refer to Appendix B – D52Q Module Pre-Loaded Software Versions for further details. Licensing terms for the preloaded software are described in the Module Distribution Agreement, which is referenced in section 4 – Licensing & Conditions of Use.

- **S212 SoftDevice** – Refer to the S212 nRF52832 SoftDevice Specification.
- **ANT Network Processor Application** – Refer to Appendix A – Using the ANT Network Processor Configuration



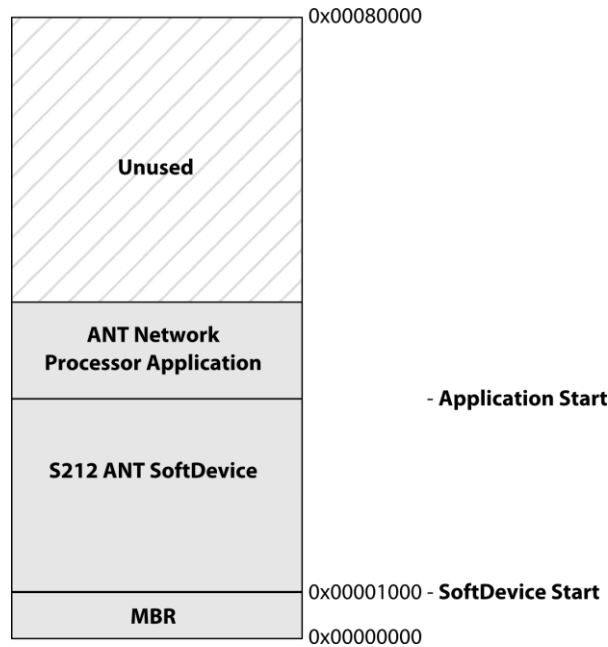


Figure 8: Memory Map of the Preloaded Software

2.5 D52 Module Programming

The D52 ANT SoC module series supports programming by standard Serial Wire Debug (SWD) interface. The two software components (the SoftDevice and the application code) must be version compatible to operate properly. To ensure proper operation after reprogramming, it is recommended that the module undergoes a full erasure (e.g. using the erase-all option in nrfjprog.exe/nRFgo Studio) and all desired software components be explicitly programmed onto the module.

2.5.1 Programming via SWD interface

The D52 ANT SoC Module series supports the Serial Wire Debug (SWD) interface, SWDCLK and SWDIO (refer to Table 3: D52 Module Series Pin-Out). Programming and debugging of the module only require commonly available tools, such as the Keil software development environment and the Segger J-Link programmer.

Please refer to "ANT SoC Module Starter Kit User Manual" from Dynastream Innovations for reference software setup and use with ANT using the Keil software and a J-Link programmer.

2.5.2 Initializing the SoftDevice

D52Q modules come with a 20ppm onboard 32 kHz crystal. When initializing the SoftDevice, it is important to set the crystal accuracy to be 20ppm. This clock source is selected when enabling the SoftDevice via the `sd_softdevice_enable` command.

2.5.3 Configuring the dc/dc converter

D52 series modules can make use of the DC/DC Converter on nRF52832 chips. This can improve power consumption under certain conditions.

2.6 Design considerations

RF performance is always affected by the environment. Good design makes a product less susceptible to adverse conditions. The recommendations in this section are guidelines only; you should thoroughly test your products in the intended use case environments and make necessary modifications and trade-offs.

For assistance in design, a STEP model package and Altium library are available from Dynastream Innovations.



2.6.1 M4 (D52Q) module mounting

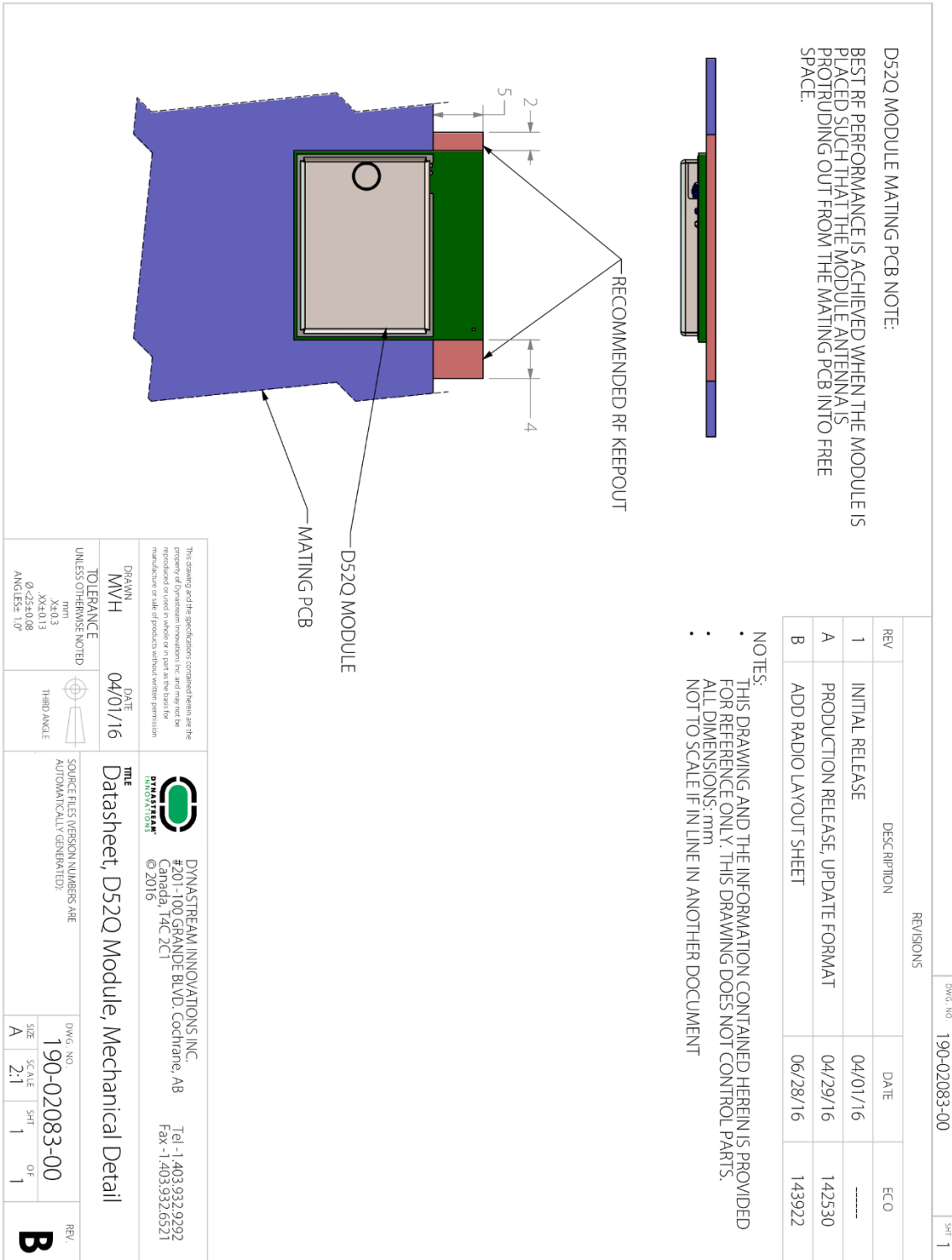


Figure 9: D52Q Module Mounting



Figure 10, below, shows D52Q signal pads and component outline in red, along with keepout areas in pink. There should not be any exposed copper or routing in the keepout areas. Please reference the D52Q Altium Footprint for more accurate keepout dimensions and positioning.

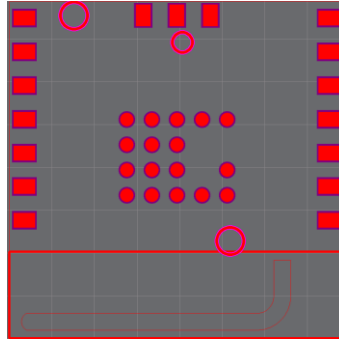


Figure 10: D52Q signal pads, component outline and keepout areas

2.6.2 M6 module mounting

The mating socket is Molex 52991-0208.

2.7 Assembly Considerations

2.7.1 Moisture Control

D52Q modules are rated at different levels per SKU:

- The D52QD2M4IA-A (module with accelerometer) is rated at level 3 (MSL3) as defined by IPC/JEDEC J-STD-020.
- The D52QD2M4IA is rated at level 2 (MSL2) as defined by IPC/JEDEC J-STD-20.

To ensure good solderability of the PCB pads, it is highly recommended to always have the modules intended for reflow well sealed when in storage.

2.7.2 Solder Stencil for M4 Module

The following reference example is used to create the D52QD2M6IA-A development modules:

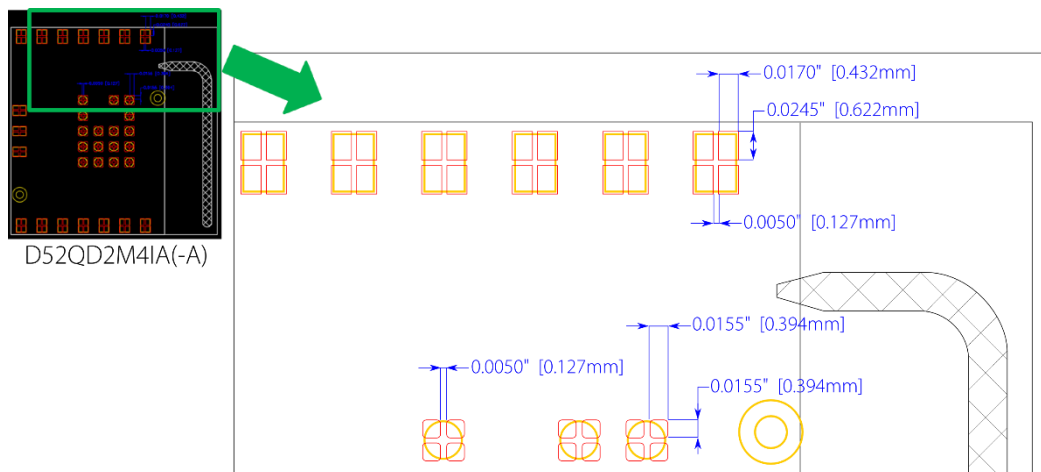


Figure 11: M4 Solder Stencil

2.7.3 Cleaning Process

The module is made using no-clean solder paste. No-clean process is recommended.



3 Regulatory Approvals and Compliance

The D52Q ANT SoC modules, when loaded with an ANT and/or BLUETOOTH low energy stack, have received regulatory approvals in the United States (FCC) and Canada (IC), and have been verified to conform to the appropriate regulations in Europe, Australia and New Zealand, Japan and South Korea. The modules have been qualified by BLUETOOTH SIG. Such approvals and qualification allow the user to place the module inside a finished product and, in most cases, not require regulatory testing for an intentional radiator, provided no changes or modifications are made to the module circuitry. This does not preclude the possibility that some other form of authorization or testing may be required for the finished product.

Changes or modifications could void the user's authority to operate the equipment. The end user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.

3.1 United States

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

A host product manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host product was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without containing a certified transmitter module, then a module is added, the host manufacturer is responsible for ensuring that the host continues to be compliant with the Part 15 subpart B unintentional radiator requirements after the module is installed and operational. Because this may depend on the details of how the module is integrated within the host, the module grantee (the party responsible for the module grant) shall provide guidance to the host manufacturer for ensuring compliance with the Part 15 Subpart B requirements.

This module is limited to OEM installation ONLY. The OEM Integrator is responsible for ensuring that the end-user has no manual instructions to remove or install the module. Changes or modifications not expressly approved by Dynastream could void the user's authority to operate the equipment.

If (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: 06R3067" or "Contains FCC ID: 06R3067" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.

3.2 Canada

This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

3.3 European Economic Area

The D52Q Modules are declared to be in conformance with the essential requirements and other relevant provisions of Directive 1999/5/EC, as a low-powered unlicensed transmitter:

IEC 60950-1:2005(2 nd Edition) + Am1:2009 + AM 2:2013	Information technology equipment. Safety. General requirements
EN 60950-1: 2006 /A11:2009 /A1:2010 /A12:2011 /A2:2013	



EN 300 328 V1.9.1:2015	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
EN 300 440-2 v1.4.1:2010	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range
EN 301 489-1 v1.9.2/-3 v1.6.1:2013 /-17 v2.2.1:2012	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD); Part 17: Specific conditions for Broadband Data Transmissions

3.4 Australia and New Zealand

The D52Q ANT SoC modules have been tested and found to comply with:



ACMA Radiocommunications (Short Range Devices) Standards 2014; 2400 and 5700 MHz bands only EN 60950-1: (2nd Edition) Information technology equipment. Safety. General requirements
AS/NZS CISPR 22:2009 Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement AS/NZS 4268:2012 – Radio equipment and systems – Short Range Devices – Limits and methods of measurement
EN 301 489-1/-3/-17 Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements ; Part 3: Specific conditions for Short-Range Devices (SRD); Part 17: Specific conditions for Broadband Data Transmission systems
EN 300 440 Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range EN 300 328 Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems

The ACMA supplier code number is N20233

3.5 Japan

The D52Q models have been granted type certificate (mark number R201-160147). Standard applied: 2.4GHz band wide-band low-power data communication system (item 19 of Article 2 paragraph 1).

3.6 Korea

The D52Q modules have been certificated under the Clause 2, Article 58-2 of Radio Wave Act by Ministry of Science, ICT and future Planning, Republic of Korea. The certification No. is MSIP-CRM-D23-D52Q.

3.7 BLUETOOTH Qualification

The D52Q modules are listed as Bluetooth components (tested) on the Bluetooth SIG Qualified Design List [Qualified Design ID 83227; Declaration ID is D030904]. Further use of this design to create subsequent BLUETOOTH implementations can be achieved without further qualification provided that the resulting implementation has no negative material impact on the BLUETOOTH performance or functionality of the design.



4 Licensing & Conditions of Use

Products incorporating D52 series modules wishing to make use of the certifications outlined in section 3 must guarantee that they are using an approved ANT and or Bluetooth low energy SoftDevice and have entered into a D52 Series Module Distribution Agreement with Dynastream Innovations. Section 4.1 outlines the conditions of use for D52 modules (which includes the D52 Series Module Distribution Agreement), and Section 4.2 outlines where to obtain licenses for the approved SoftDevices.

4.1 Conditions of Use

The D52 Series of modules have been designed to support the ANT and/or Bluetooth low energy Protocols and are certified for use in many geographic regions around the globe. However, a product incorporating the D52 series module may carry the certification IDs of the module only if it complies with the restrictions and terms, including use of Dynastream-approved software, provided in the conditions of use available at:

www.dynastream.com/components/d52/conditions-of-use

4.2 SoftDevice Licensing

ANT and Bluetooth low energy SoftDevices approved for use on the D52 Module series as referenced in section 4.1 – Conditions of Use – are licensed separately from Dynastream Innovations and Nordic Semiconductor:

SoftDevice	Protocol(s)	Licenser	Link
S212	ANT	Dynastream Innovations	Dynastream SoftDevices
S332	ANT and Bluetooth low energy	Dynastream Innovations	Dynastream SoftDevices
S132	Bluetooth low energy	Nordic Semiconductor	Nordic Downloads

Table 5: SoftDevice Licensing and Downloads

5 Electrical Specifications

5.1 Recommended Operating Conditions

Parameter	Min	Max	Unit
Operating ambient temperature range, T _A	-40	+85	°C
Operating supply voltage	1.71 with accelerometer; 1.7 without	3.6	V

Table 6: Recommended Operating Conditions

5.2 Absolute Maximum Ratings

Parameter	Test Conditions	Min	Max	Unit
Supply Voltage (VCC)		-0.3	3.9	V
V _{I/O} , VCC ≤ 3.6V		-0.3	VCC+0.3	V
V _{I/O} , VCC > 3.6V		-0.3	3.9	V
Storage temperature range		-40	85	°C
ESD	All pads, according to human-body model, JEDEC STD 22, method A114		4	kV
	According to charged-device model, JEDEC STD 22, method C101		500	V

Table 7: Absolute Maximum Ratings



Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions are not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

5.3 Radio Operation Specifications and Antenna Characteristics

nRF52832 Output Setting (dBm)	Peak Antenna Gain (dBi)	EIRP (dBm)
0	0.5	0.5
+4	0.5	4.5

Table 8: D52 Module Antenna Gain

nRF52832 Output Setting (dBm)	Typical Peak Radio Current (mA)*
0 (DCDC, 3V)	5.3
0 (LDO, 3V)	11.6
+4 (DCDC, 3V)	7.5
+4 (LDO, 3V)	16.6

Table 9: Current Consumption of Radio Operation

* For additional information regarding radio current please refer to the nRF52832 product specification from Nordic Semiconductor



The following typical radiation pattern was recorded in an anechoic chamber at 2440MHz and 0dBm output following the recommended mounting guide.

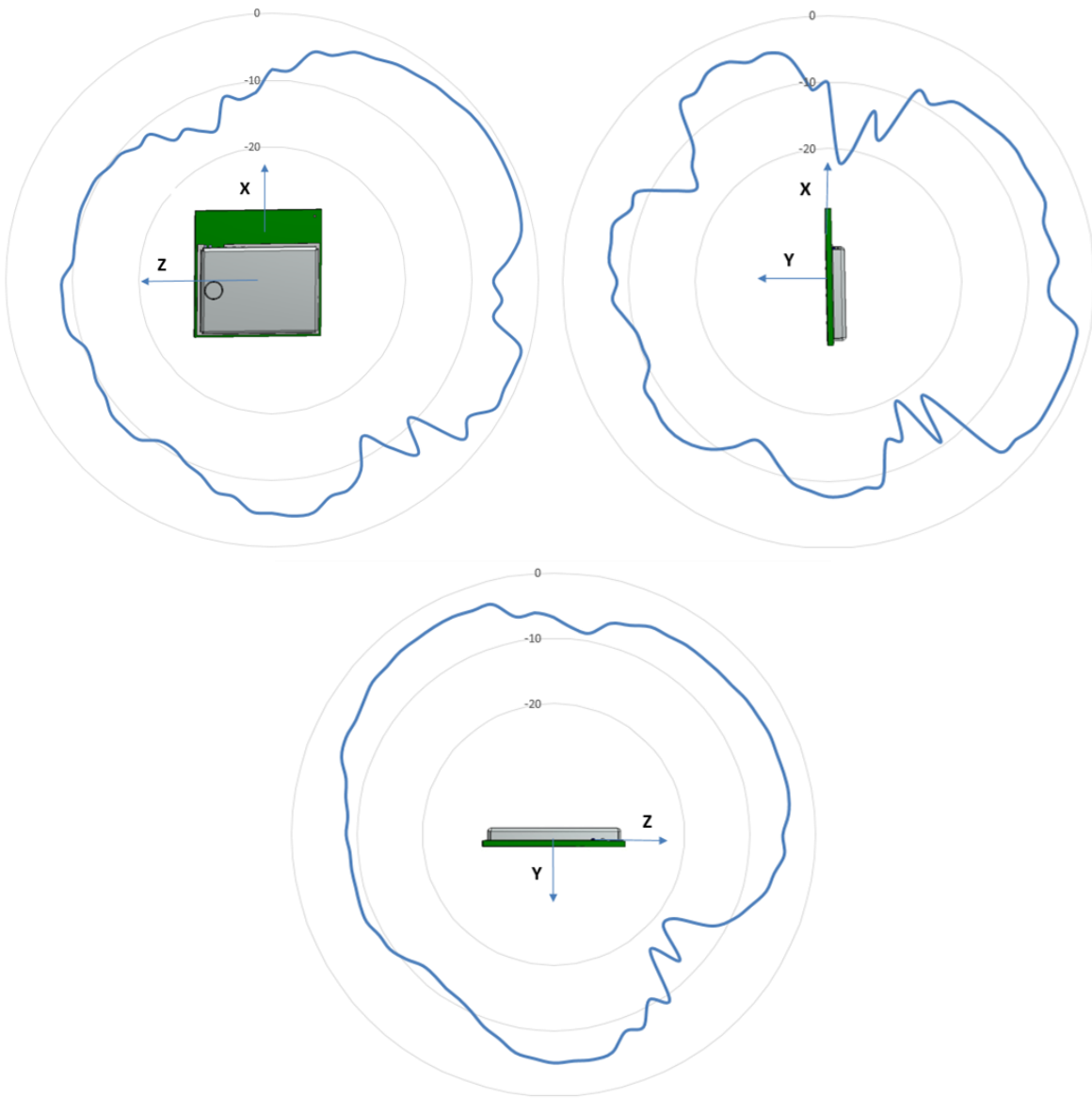


Figure 12: D52Q M4 Module Typical Antenna Gain (dBi)

To understand and properly use the radiation pattern for your design, please refer to the application note: Interpreting RF Radiation Patterns.

5.4 Electrical Specifications

Please refer to the nRF52832 Product Specification by Nordic Semiconductor.



6 Mechanical Drawings

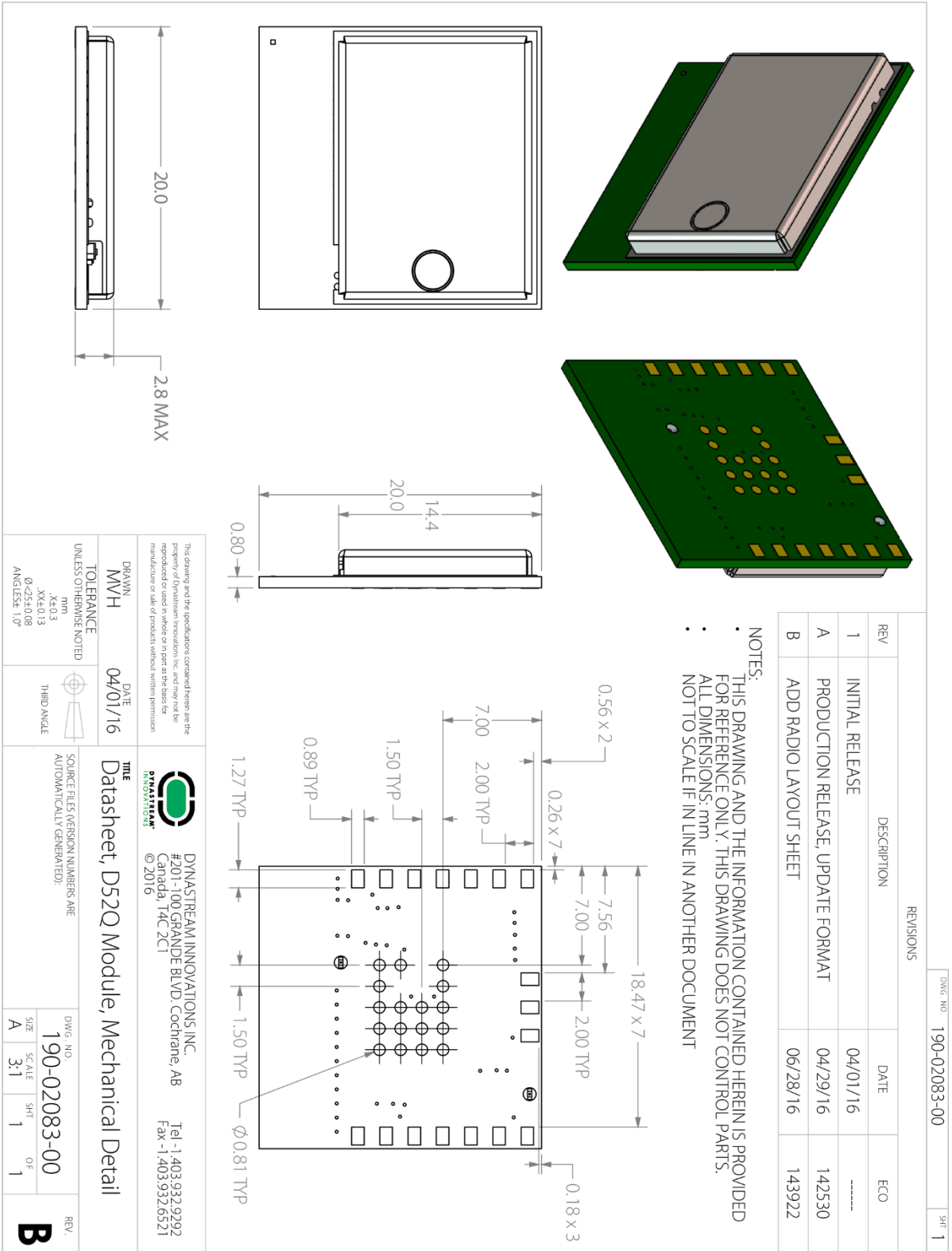


Figure 13: D52Q Mechanical Drawing



7 Support

The D52 ANT SoC module series uses nRF52832 from Nordic Semiconductor. You can seek technical support from Nordic Semiconductor, www.nordicsemi.com. Application support can be sought from Dynastream Innovations, via www.thisisant.com.

7.1 ANT Forum

Customers are encouraged to participate in the ANT forum moderated by the application engineering team of Dynastream Innovations for any engineering discussions. Joining the ANT forum is free and open at <http://www.thisisant.com/forum>.

7.2 Technical References

Documents

1. nRF52832 Product Specification, Nordic Semiconductor
2. nRF52 Series Compatibility Matrix, Nordic Semiconductor Infocenter
3. nRF52832 Objective Product Specification, Nordic Semiconductor
4. nRF52832 S212 SoftDevice Specification, Dynastream Innovations
5. nRF52832 S332 SoftDevice Specification, Dynastream Innovations
6. nRF52832 S132 SoftDevice Specification, Nordic Semiconductor
7. nRF52 Development Kit Documentation, Nordic Semiconductor Infocenter
8. ANT SoC Module Starter Kit User Manual, Dynastream Innovations
9. ANT Message Protocol and Usage, Dynastream Innovations
10. Interfacing with ANT General Purpose Chipsets and Modules, Dynastream Innovations
11. ANT Technical Note – Migrating an ANT nRF51 Project to nRF52
12. Application Note: Interpreting RF Radiation Patterns, Dynastream Innovations

Software

1. S212 nRF52832 SoftDevice, Dynastream Innovations
2. S332 nRF52832 SoftDevice, Dynastream Innovations
3. S132 nRF52832 SoftDevice, Nordic Semiconductor
4. nRF5 SDK, Nordic Semiconductor
5. ANT Network Processor Application Code
6. ANTwareII – a system testing and debugging tool, Dynastream Innovations
7. ObservANT – an ANT debugging tool, Dynastream Innovations

Design models

1. D52Q Altium library, Dynastream Innovations
2. D52Q module STEP model, Dynastream Innovations

The above documents and software are available at www.dynastream.com, www.thisisant.com and/or www.nordicsemi.com/infocenter.nordicsemi.com. User registration may be required.

7.3 ANT Developer's Zone

ANT development software tools, application notes, reference designs and other public resources are found in the ANT Developer's Zone at <http://www.thisisant.com/developer>.

To begin development with the ANT+ interoperability, please become an ANT+ Adopter or ANT+ Alliance member to obtain the access to the ANT+ Adopter Zone. ANT+ documents and design tools contained in the ANT+ Adopter zone include the ANT+ Device Profiles, ANT-FS specification, ANT software (PC/Mac) libraries with source code, simulator tools (SimulANT+), ObservANT, embedded reference designs with source code, and more.



7.4 ANT and ANT+ Social Media

Further information, resources and news about ANT can be found in social media:

- YouTube: <http://www.youtube.com/user/ANTAlliance>
- Twitter: <http://twitter.com/ANTPlus>
- Facebook: <https://www.facebook.com/thisisant>
- LinkedIn: <http://www.linkedin.com/groups?gid=1379137>



Appendix A – Using the ANT Network Processor Configuration

D52 modules are preloaded with a default ANT network processor reference code image in the application code space of the nRF52832. Using this configuration is similar to ANT legacy ICs or modules, as illustrated in the diagram below. This reference code is available upon request.

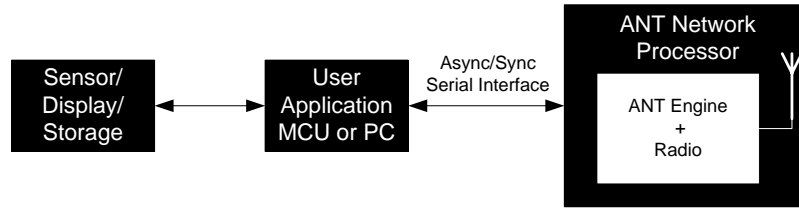


Figure 14: Using ANT Network Processor

With this configuration, the D52Q M4 model is basically drop-in compatible with ANT11TS33M4/5IB, ANTAP281M4/5IB, ANTC782M4/5IB modules, N5150M4CD, N550M4CC and N548M4CB modules (see 2.2: Pin-outs for complete details). Please note that C7 and AP2 modules supported bit synchronous, while the D52 Module Series do not. Byte synchronous and asynchronous are supported by the D52 Module Series network processor application.

For information regarding ANT network processor serial interfaces, please refer to document “Interfacing with ANT General Purpose Chipsets and Modules”.

Pin Assignments in the ANT Network Processor Configuration

In the pre-loaded ANT network processor configuration, specific functions are assigned to the module pins. The details are summarized below:

Note: For the Network Processor configuration, pins P201 – P217 are not used (no connection).

D52Q M4 Pin	D52Q M6 Molex Connector	nRF52832 Pin Name	ANT Network Processor Pin Assignments			
			Pin Name	Async Mode	Sync Mode	Function
H202	10	P021/nRESET	nRST	nRST	nRST	Reset the device
H203	1	VCC	VCC	VCC	VCC	Power supply source
H204	19	VSS	GND	GND	GND	Power supply ground
H206	17	P006	nSUSPEND / nSRDY	nSUSPEND	nSRDY	Async → Suspend control Sync → Serial port ready
H207	15	P007	SLEEP / nMRDY	SLEEP	nMRDY	Async → Sleep mode enable Sync → Message ready indication
H209	11	P008	PORTSEL	Tie to GND	Tie to VCC	Asynchronous or synchronous port select
H210	7	P011	BR2/SCLK	BR2	SCLK	Async → Baud rate selection Sync → Clock output signal
H211	4	P017	TXD0 / SOUT	TXD0	SOUT	Async → Transmit data signal Sync → Data output
H212	3	P016	RXD0 / SIN	RXD0	SIN	Async → Receive data signal Sync → Data input
H213	5	P015	BR1	BR1	Unused	Async → Baud rate selection Sync → Not used
H214	9	P014	BR3/SPD_SEL	BR3	SPD_SEL	Async → Baud rate selection Sync → Clock speed Selection
H217	2	P012	RTS/SEN	RTS	SEN	Async → Request to send Sync → Serial enable signal

Table 10: Pin Assignments in ANT Network Processor Configuration



Asynchronous Serial Mode

The baud rate of the asynchronous communication is controlled by the speed select signals BR1, BR2 and BR3. Please refer to the table below.

BR3	BR2	BR1	Baud Rate
1	1	0	2400
0	0	0	4800
1	0	1	9600
0	1	0	19200
0	0	1	38400
0	1	1	57600
1	1	1	57600
1	0	0	115200

Table 11: Asynchronous Serial Mode Baud Rate Select

Asynchronous Serial Mode Connection Example

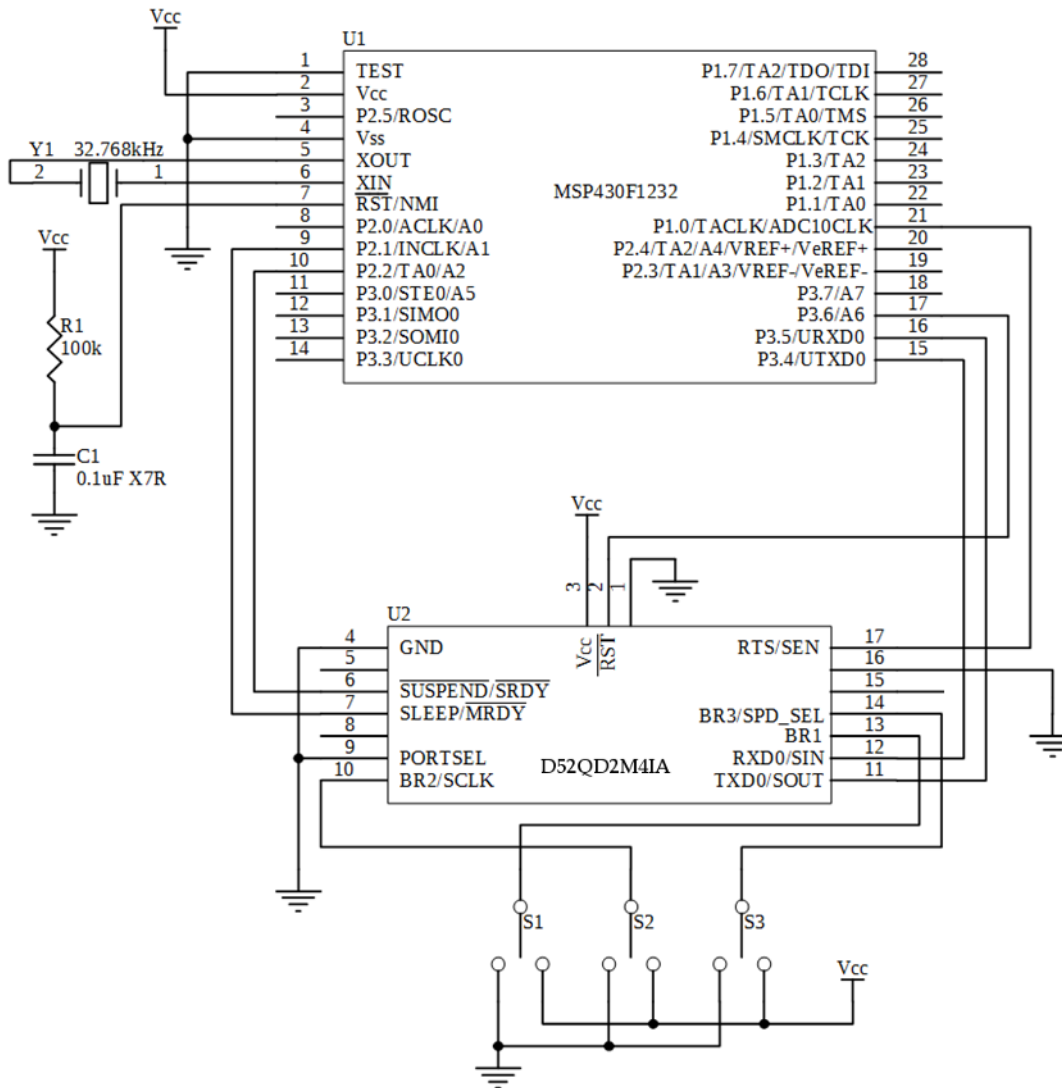


Figure 15: D52Q M4 ANT NP Configuration Async Serial Connection



Notes:

- Module RXD and TXD connected directly to hardware USART of microcontroller.
- Switches on baud rate selection pins (BR1, BR2 and BR3) are for ease of use only. They can be connected directly to the logic level of interest.
- RTS is hardware controlled on the D52 module and follows the RTS behaviour described in the nRF52 Series Reference Manual. In addition, RTS is toggled by the network processor application during message processing. If HW flow control is not available on MCU, the software implemented flow control must be able to manage serial communication flow control on a per byte level.

Byte Synchronous Serial Mode

The clock speed of the byte-Sync mode can be set to either 500KHz or 4MHz by setting BR3. Please refer to the table below.

SPD-SEL	Byte-Sync Speed
0	500KHz
1	4MHz

Table 12: Byte-Sync Mode Speed Selection

Byte Synchronous Mode Connection Example

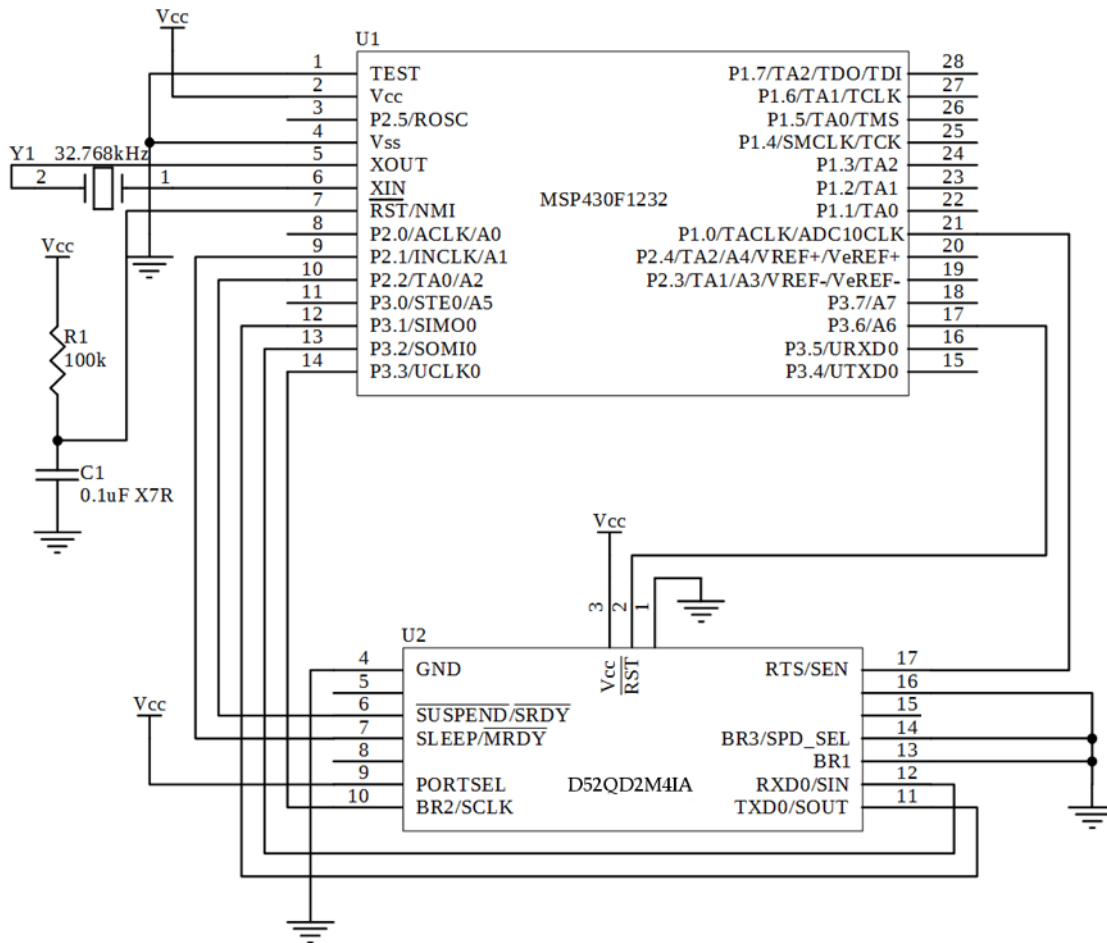


Figure 16: D52Q M4 ANT NP Configuration Byte Sync Connection



Notes:

- Module SOUT, SIN, and SCLK connected directly to hardware USART of microcontroller.
- SEN needs to be on an interrupt capable I/O pin on the microcontroller. (Interrupt pins located on Port 1&2 on the MSP430F1232)

DC/DC Configuration

The pre-programmed ANT Network Processor Application provides a method of configuring the DC/DC converter on the module via Serial Command. This allows modules featuring compatible ICs to use the DC/DC features of the nRF52832. Please refer to the nRF52832 Product Specification for details on the DC/DC. DC/DC should only be used on appropriate modules.

The following serial command message has been defined in the ANT network processor code. A host microcontroller can issue this command to the ANT network processor application to configure the DC/DC operation on the D52Q module.

Sync	Length	MsgID		Payload	Chksum
	0x02	0xE4	0x01	0x00 – DC/DC Disable 0x01 – DC/DC Enable	

Table 13: ANT DC/DC Configuration Command

After issuing the command, the following response is generated.

Sync	Length	MsgID				Response	Chksum
	0x04	0xE0	0x00	0xE4	0x01	0x00	

Table 14: ANT DC/DC Configuration Response

Note: Sync and Chksum values are defined in the document "Interfacing with ANT General Purpose Chipsets and Modules".

A response of 0x00 indicates successful configuration of the DC/DC.

Appendix B – D52Q Module Pre-Loaded Software Versions

Software Component	Version
S212 ANT SoftDevice built by and available from Dynastream	V 1.0.2
ANT Network Processor Application	V 1.0.0

Table 15: D52Q Preloaded Software Versions

