RF DIGITAL
CORPORATION

nRF24LE1
RF Module
RFD21731
RFD21732
RFD21734
RFD21736
ETSI • CE Compliant

RoHS

13715 Alton Pkwy • Irvine • CA • 92618
Tel: 949.610.0008 • Fax: 949.610.0009
www.rfdigital.com • sales@rfdigital.com

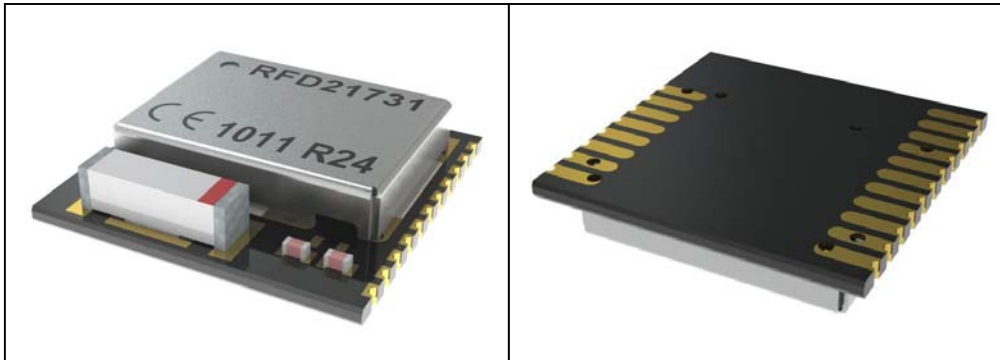# nRF24LE1 RF Modules
RFD21731 • RFD21732 • RFD21734 • RFD21736
(Also see FCC Approved part number: RFD21733)

RFD21731

15mm x 15mm • 0.600 inch x 0.600 inch

Complete ultra-low-power wireless system-in-module.
With built-in mixed signal flash microcontroller and advanced power management. NO RF Designing Required. NO parts required.

• w/ 32KHz Crystal
• Built-in Antenna

RFD21732

• w/ 32KHz Crystal
• Req. Ext. Antenna

RFD21734

Modular ultra low power wireless
Ultra low power wireless system-on-chip solution
The RFD21731, RFD21732, RFD21734 modules are a unique solution offering a complete ultra low power (ULP) wireless system-in-module solution. It integrates the nRF24LE1 radio+controller which is based on the industry leading nRF24L01+ 2.4GHz transceiver core, an enhanced 8051 microcontroller, flash memory and a wide range of analog and digital peripherals. The 8-bit microcontroller is powerful enough to run both the RF protocol stack and the application layer, enabling a true single chip implementation of ULP wireless applications.

Optimized for ultra low power wireless
Advanced power management and on-chip peripherals
The RFD21731, RFD21732, RFD21734s internal nRF24LE1 chip is optimized to provide a single chip solution for ULP wireless applications. The combination of processing power, memory, low power oscillators, real-time counter, AES encryption accelerator, random generator, plus a range of power saving modes provides an ideal platform for implementation of RF Protocols. Benefits include tighter protocol timing, security, lower power consumption and improved co-existence performance. For the application layer the nRF24LE1 offers a rich set of peripherals including: SPI, 2-wire, UART, 6 to 12-bit ADC, PWM, and an ultra low power analog comparator for voltage level system wake-up.

If you do not want to do any development at all, then use RFD21733 (FCC Approved)/ RFD21735 which are READY-TO-USE with its built-in user application interface (RFDP8). Includes RFID, Unique Electronic Serial Number, Logic Switch Transmitter Receiver. Serial UART 9600-8N1 and many easy-to-use addressable network modes.

Development Tools

The RFD21731, RFD21732, RFD21734 requires the user to write their own code to run on the built-in internal enhanced 8051 controller which allows tremendous flexibility to the engineer to realize their exact requirements, which requires the purchase of Nordic's nRFgo Starter Kit development environment in addition to at least one (preferred 2) RFD21736 adaptor module boards for use with the nRFgo.

NO Dev-Tools Option: The READY-TO-USE RFD21733 / RFD21735 do not require any development tools.

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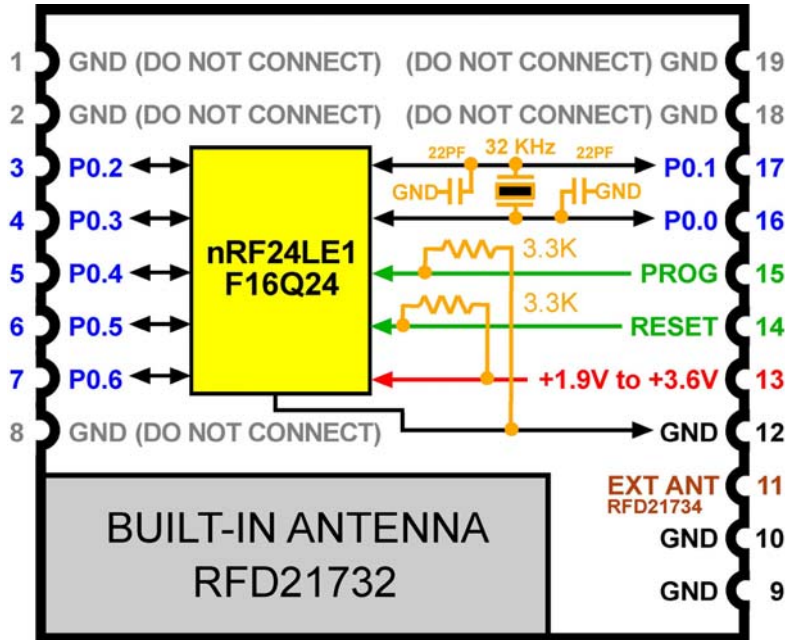
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RFD21732 / RFD21734 Pinout Chart (TOP VIEW)

1	GND (DO NOT CONNECT)	(DO NOT CONNECT) GND	19
2	GND (DO NOT CONNECT)	(DO NOT CONNECT) GND	18
3	P0.2	P0.1	17
4	P0.3	P0.0	16
5	P0.4	PROG	15
6	P0.5	RESET	14
7	P0.6	+1.9V to +3.6V	13
8	GND (DO NOT CONNECT)	GND	12
	BUILT-IN ANTENNA RFD21732	EXT ANT RFD21734	11
		GND	10
		GND	9

nRF24LE1 F16Q24 — 22PF, 32 KHz, 22PF, GND, 3.3K, 3.3K
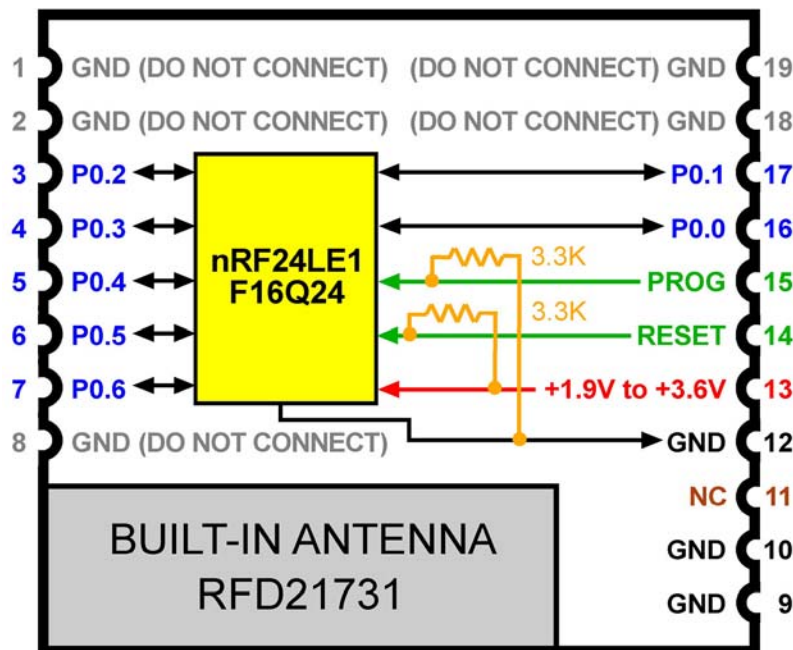
RFD21732 Signals

Built In Antenna
32 KHz Crystal

+1.9 to 3.6V
GND
P0.0 (RFD21732 32KHz)
P0.1 (RFD21732 32KHz)
P0.2
P0.3
P0.4
P0.5
P0.6
RESET
PROG

RFD21734 Signals

No Internal Antenna
32 KHz Crystal

+1.9 to 3.6V
GND
P0.0 (RFD21732 32KHz)
P0.1 (RFD21732 32KHz)
P0.2
P0.3
P0.4
P0.5
P0.6
RESET
PROG
External Antenna Pin

RFD21731 Pinout Chart (TOP VIEW)

1	GND (DO NOT CONNECT)	(DO NOT CONNECT) GND	19
2	GND (DO NOT CONNECT)	(DO NOT CONNECT) GND	18
3	P0.2	P0.1	17
4	P0.3	P0.0	16
5	P0.4	PROG	15
6	P0.5	RESET	14
7	P0.6	+1.9V to +3.6V	13
8	GND (DO NOT CONNECT)	GND	12
	BUILT-IN ANTENNA RFD21731	NC	11
		GND	10
		GND	9

nRF24LE1 F16Q24 — 3.3K, 3.3K

RFD21731 Signals

Built In Antenna
No 32 KHz Crystal

+1.9 to 3.6V
GND
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
RESET
PROG

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RFD21731, RFD21732, RFD21734 Features

- NO RF parts or layout required, fully contained, easy access to all digital lines.
- Typical outdoor range 300 feet (100 meters)
- 125 channels, 2400 to 2525 MHz.
- Current draw: 11.1 mA at 0 dBm Transmit, 13.3 mA at -94 dBm Receive.
- Fully featured ultra low power nRF24L01+ 2.4GHz transceiver core
- Worldwide 2.4GHz ISM band operation
- Enhanced ShockBurstTM hardware link layer
- 250 kbps, 1 Mbps and 2 Mbps on-air data rate options.
- Air compatible with nRF24L01, nRF24L01+, nRF24LU1 and nRF2401A
- Enhanced 8-bit 8051 compatible microcontroller
- 32-bit multiplication-division unit
- AES encryption/decryption accelerator
- 16 kbytes on-chip flash memory
- 1 kbyte on-chip data flash memory
- 512 bytes high-endurance data flash memory
- 1 kbyte on SRAM plus 256 bytes of IRAM
- Low power 16MHz crystal and RC oscillators
- Ultra low power 32kHz crystal and RC oscillators
- Flexible real-time counter and three 16-bit timers/counters
- Ultra low power analog comparator for system wake-up
- Rich set of digital interfaces including: SPI master/slave,
  2-wire master/slave, and UART
- 2-channel PWM
- Programmable resolution ADC: 6, 8, 10, or 12-bits
- Random Number Generator based on thermal noise
- 7 Programmable generic I/O pins

RFDP8 Option

RF Digital's RFDP8 high level application protocol firmware which runs on the nRF24LE1-F16Q24 is available pre-loaded on the RFD21733 / RFD21735, ideal for those who don't have time to write code.
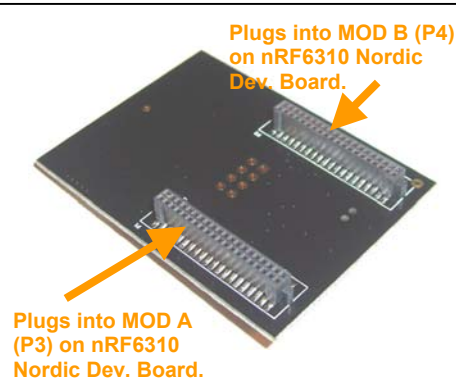
So if you don't want to do any development at all, then use RFD21733 / RFD21735 which are READY-TO-USE with its built-in user application interface (RFDP8). Includes RFID, Unique Electronic Serial Number, Logic Switch Transmitter / Receiver, Serial UART 9600-8N1 and many easy-to-use addressable network modes.

RFD21736 Eval adaptor board for nRFgo Starter Kit

The RFD21736 has a built-in RFD21731 and it plugs directly into Nordic's nRF6700 nRFgo Starter Kit board which is required to use the RFD21736. The RFD21736 has an on-board user switchable 32 KHz crystal, which allows evaluation of the RFD21732. (nRF6700 Required) You should ONLY use the RFD21736 and nRF6700 if you will be writing your own RF firmware, otherwise you should use the READY-TO-USE RFD21733, RFD21735, RFD21737.

RFD21736 Top View

Plugs into MOD B (P4) on nRF6310 Nordic Dev. Board.

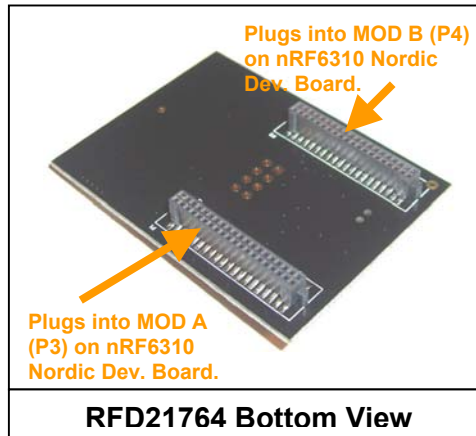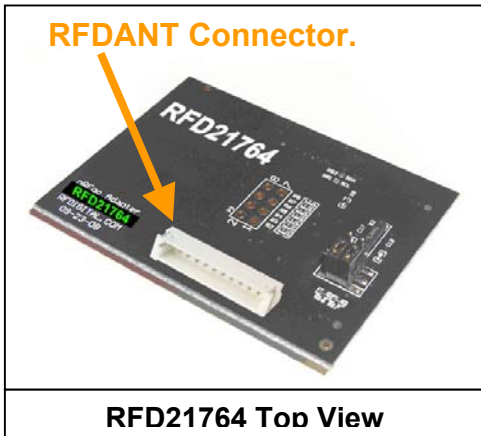Plugs into MOD A (P3) on nRF6310 Nordic Dev. Board.

RFD21736 Bottom View

Accessible Pins

+1.9 to 3.6V
GND
P0.0 Optional 32KHz
P0.1 Optional 32KHz
P0.2
P0.3
P0.4
P0.5
P0.6
RESET
PROG
With Switchable
32 KHz Crystal

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RFD21764 RFDANT Eval adaptor board for nRFgo Starter Kit

The RFD21764 includes an RFD21741 RFDANT which plugs into the RFD21764 board which plugs directly into Nordic's nRF6700 nRFgo Starter Kit board which is required to use the RFD21764. The 32 KHz crystal is populated on the RFD21764 but unused. **(nRF6700 Required)** You should **ONLY** use the RFD21764 and nRF6700 if you will be writing your own RF firmware, otherwise you should use the READY-TO-USE RFD21743 or RFD21742.

RFDANT Connector.

RFD21764 Top View

Plugs into MOD B (P4) on nRF6310 Nordic Dev. Board.

Plugs into MOD A (P3) on nRF6310 Nordic Dev. Board.

RFD21764 Bottom View

Accessible Pins

+1.9 to 3.6V
GND
P0.0 Optional 32KHz
P0.1 Optional 32KHz
P0.2
P0.3
P0.4
P0.5
P0.6
RESET
PROG

**RFD21764 with
RFD21741 RFDANT Plugged In**

RFDP8 Option

RF Digital's RFDP8 high level application protocol firmware which runs on the nRF24LE1-F16Q24 is available pre-loaded on the RFD21742 / RFD21743, ideal for those who don't have time to write code.

So if you don't want to do any development at all, then use RFD21743 / RFD21742 which are READY-TO-USE with its built-in user application interface (RFDP8). Includes RFID, Unique Electronic Serial Number, Logic Switch Transmitter / Receiver, Serial UART 9600-8N1 and many easy-to-use addressable network modes.

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RFDANT - RFD21741

The RFD21741 RFDANT is a full nRF24LE1 2.4 GHz radio transceiver, completely built into an antenna form factor allowing the entire radio transceiver to be outside your product, were only the power and signal cable will extend into your product enclosure to then be connected to your PCB with a simple 1.5mm SMT or THROUGH HOLE connector.

The RFD21741 RFDANT is currently available, as well as it's eval and programming board which is the RFD21764. The RFD21764 plugs into the Nordic nRFgo development board for programming and evaluation. The RFD21741 is functionally identical to the RFD21731 module and the RFD21764 works just like the RFD21736 eval board except it has an 11 pin 1.5mm connector on it so the RFDANT RFD21741 can plug into it for use with any other nRF24LE1 product running your own code.

The RFD21741 has been range tested at 2,000 feet which is 4x the range of the RFD21731 which is at 500 feet. No special PCB layout is needed for the RFD21741, simply just put a connector on your PCB and you are done . All this substantial range increase is achieved all without any increase in current or battery consumption.

The 2,000 foot range test was done using RF Digital's RFDP8 protocol running at 250 kbps and 0dbm power setting with the nRF24LE1.

The RFDANT is RF Digital's Worldwide Patent Pending Radio Inside Antenna product, which is a complete radio transceiver and antenna mounted inside of an antenna enclosure, suitable for mounting to virtually any type of end-product.

The entire radio transceiver is mounted inside the antenna enclosure, so there is no loss of RF power to the antenna from the module, and results in the most effective power transfer ratio possible, providing lowest power consumption possible to achieve a specific range.

The radio being inside of the antenna and outside the enclosure allows for more room inside the enclosure for the designers application electronics.

Minimal interference with the internal electronics of the enclosure results in better range and performance of the wireless system.

The actual effective antenna is pushed away from the enclosure, which reduces the effect of holding the enclosure, therefore improving the performance, range and predictability of the users wireless system.

Logic level signals are used through an unshielded cable (not coax) to the RFDANT, which can be run for long distances without any loss to the performance of the wireless transceiver.

By the antenna and module being fully outside allows for easy retrofit of nearly any product due to it not consuming any internal space inside the enclosure, drill a hole and screw it in, add a nut inside to secure it and wire the logic level signals to your electronics.

Mount on metal or plastic enclosures with no worry about ground effects.

Stable Antenna Pattern providing substantial, well-distributed, passive-gain for transmit and receive, results longer repeatable range from your wireless system.

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RFDANT - RFD21741 - ETSI • CE

U4
RFD21731 / RFD21732 / RFD21734 Module
RFDCHIP15MM
RF Digital
Top View

Pin	Label		Label	Pin	
1	GND		GND	19	
2	GND		GND	18	
3	P0.2		P0.1	17	P0.1
4	P0.3		P0.0	16	P0.0
5	P0.4		ICPROG	15	FACTORY_PROG
6	P0.5		RESET	14	RESET
7	P0.6		+V	13	+3.3V
8	GND		GND	12	
	ANTENNA		EXTANT	11	
			GND	10	
			GND	9	

J2
RFDANT 11 Pin Connector
RFDANT-SMT-11
455-1701-1

+3.3V — 1
— 2
RESET — 3
FACTORY_PROG — 4
P0.0 — 5
P0.1 — 6
P0.2 — 7
P0.3 — 8
P0.4 — 9
P0.5 — 10
P0.6 — 11
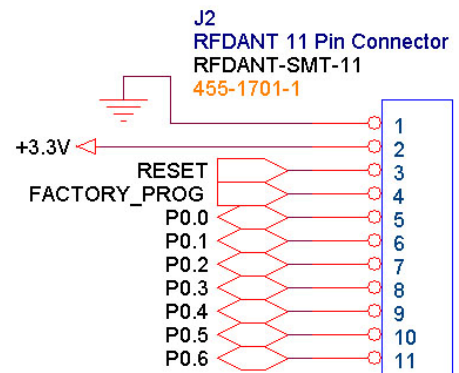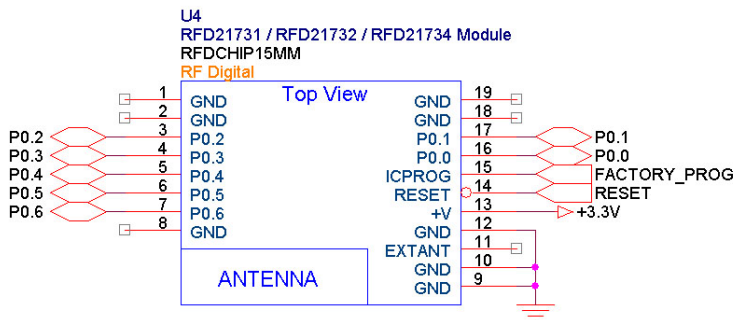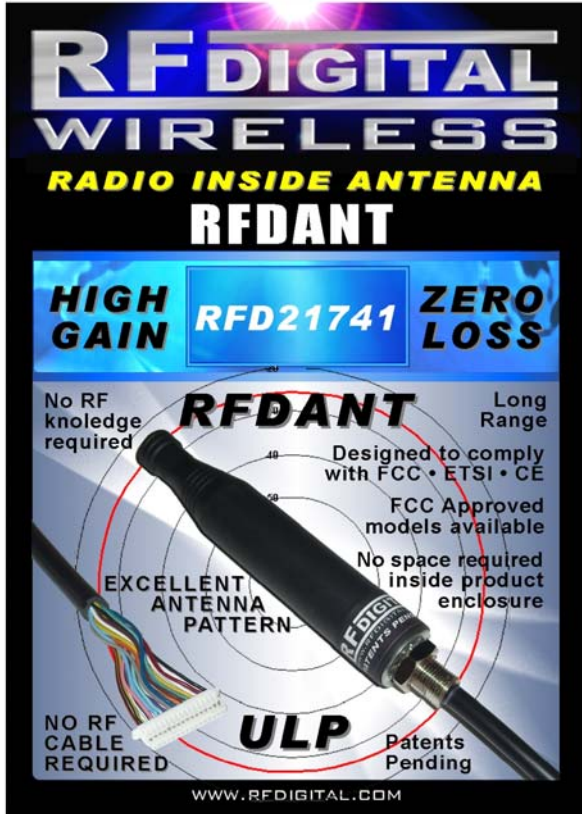
The pin out on the left is of the RFD21731 / RFD21732 / RFD21734 module which is referenced through out this document. To wire the RFDANT 11 pin connector, match up the pin labels shown in both drawings above. Treat the RFDANT RFD21741 as if it were an RFD21731 module and wire it the same way, except follow the pin outs shown above. The BLACK wire on the RFD21741 connector is pin 1.

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RFDANT - RFD21741 Mating Connectors

Mating connectors for the 11 pin RFDANT connector, these part numbers can be found at Digikey in the USA http://www.digikey.com or at any other distributor. They are standard connectors and you may use other manufacturers as well.

1)   **Top Entry, Through Hole Type, 11 pos**
a.   Digikey P/N 455-1666-ND
b.   Manufacturer P/N: B11B--ZR

2)   **Side Entry, Through Hole Type, 11 pos**
a.   Digikey P/N 455-1678-ND
b.   Manufacturer P/N: S11B--ZR

3)   **Top Entry, SMT Type, 11 pos**
a.   Digikey P/N 455-1690-2-ND
b.   Manufacturer P/N: B11B—ZR-SM4-TF

4)   **Side Entry, SMT Type, 11 pos**
a.   Digikey P/N 455-1701-2-ND
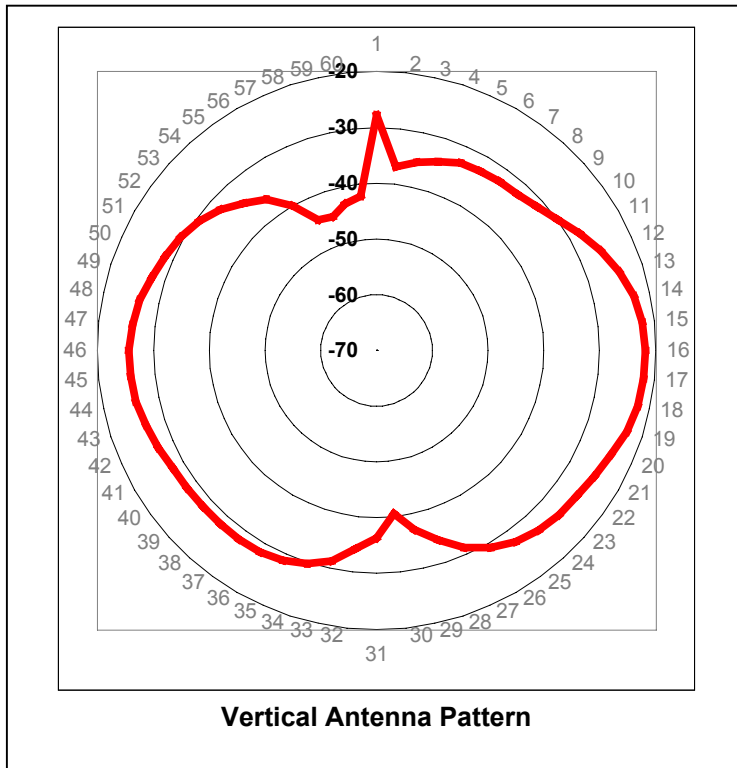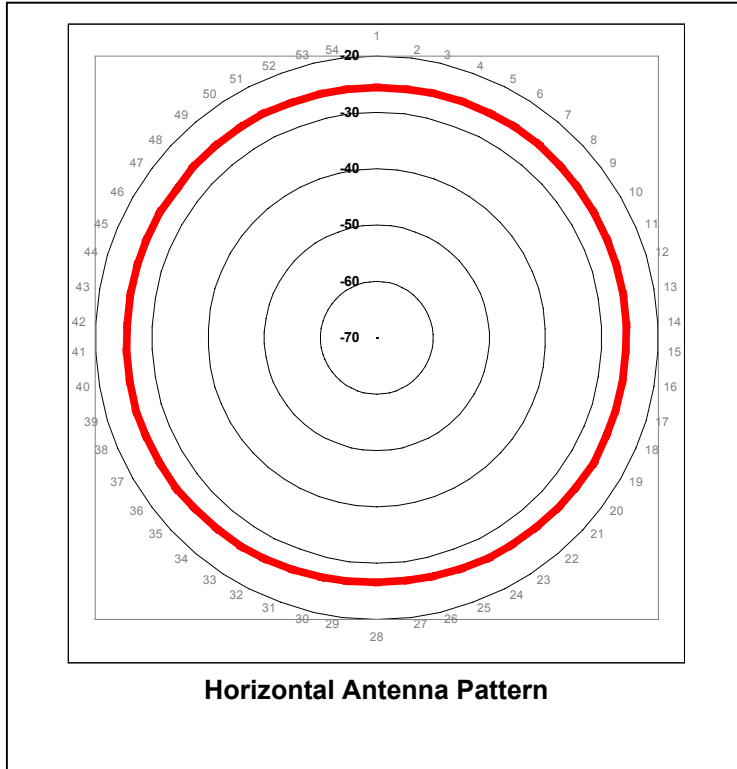b.   Manufacturer P/N: S11B—ZR-SM4-TF

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Horizontal Antenna Pattern

Vertical Antenna Pattern

RFDANT RFD21741 high performance antenna patterns are easily achieved without any RF considerations or knowledge because the 11 pin cable and connector only carries power and data signals so NO RF cable loss at all.

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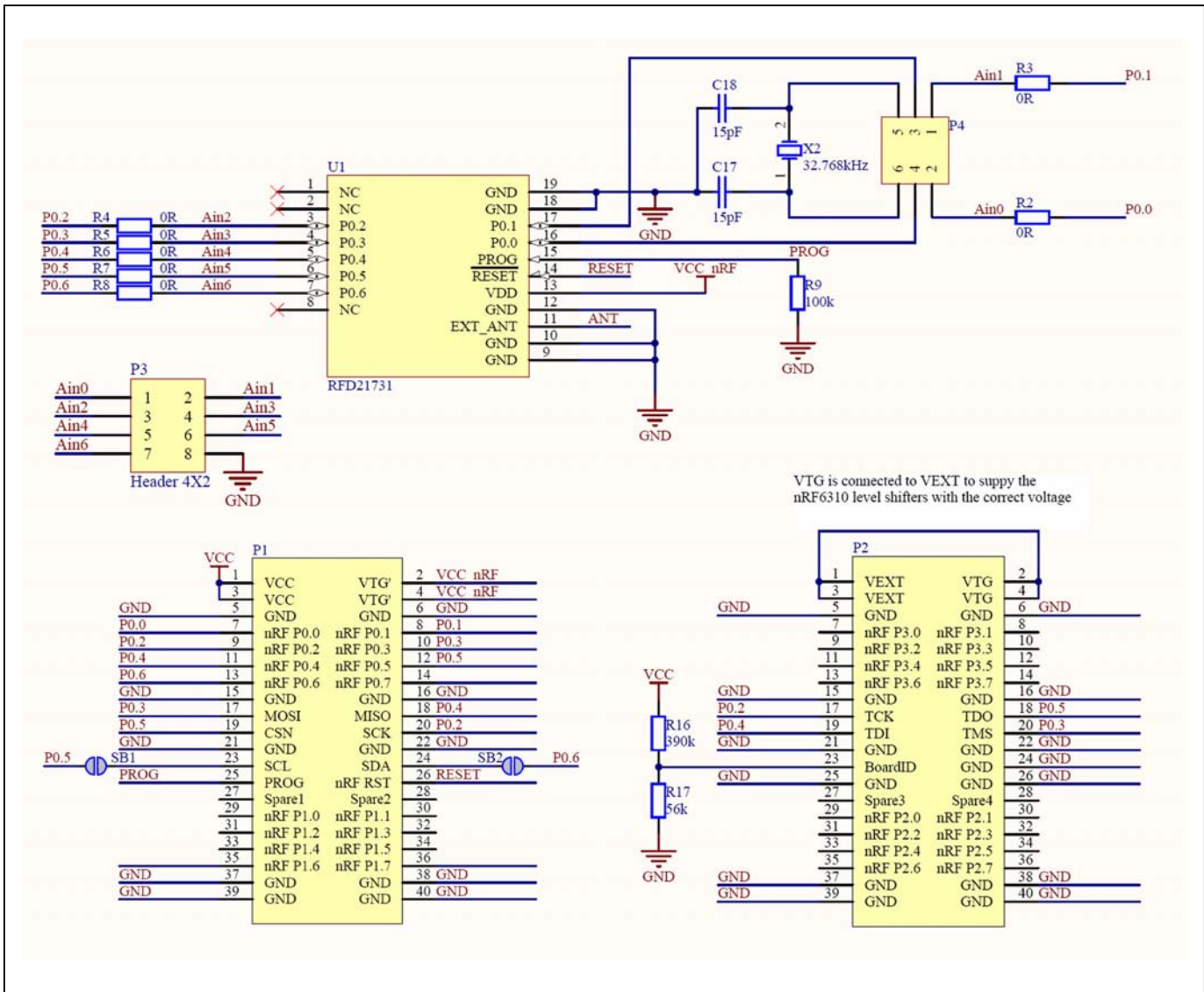
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RFD21736 Schematic (plugs onto the nRF6310 eval board)

The 390k and 56k voltage devider sets a specific voltage which will be read by the programming board that tells it which of the three possible options of nRF24LE1 ICs are plugged into the nRF6310 development (programming) board. The RFD21736 has an RFD21731 mounted on it, which uses the 24 pin 4x4mm nRF24LE1 from Nordic, the other 2 options which it does not use are the 5mm and 7mm options.

In the schematic above, P1 on the RFD21736 plugs into MOD A (P3) on the nRF6310 programming board.
In the schematic above, P2 on the RFD21736 plugs into MOD B (P4) on the nRF6310 programming board.

The Nordic nRF6310 development and programming board schematic is attached at the end of this document.

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RFD21736 Layout (plugs onto the nRF6310 eval board)

Top Layer Silk Screen
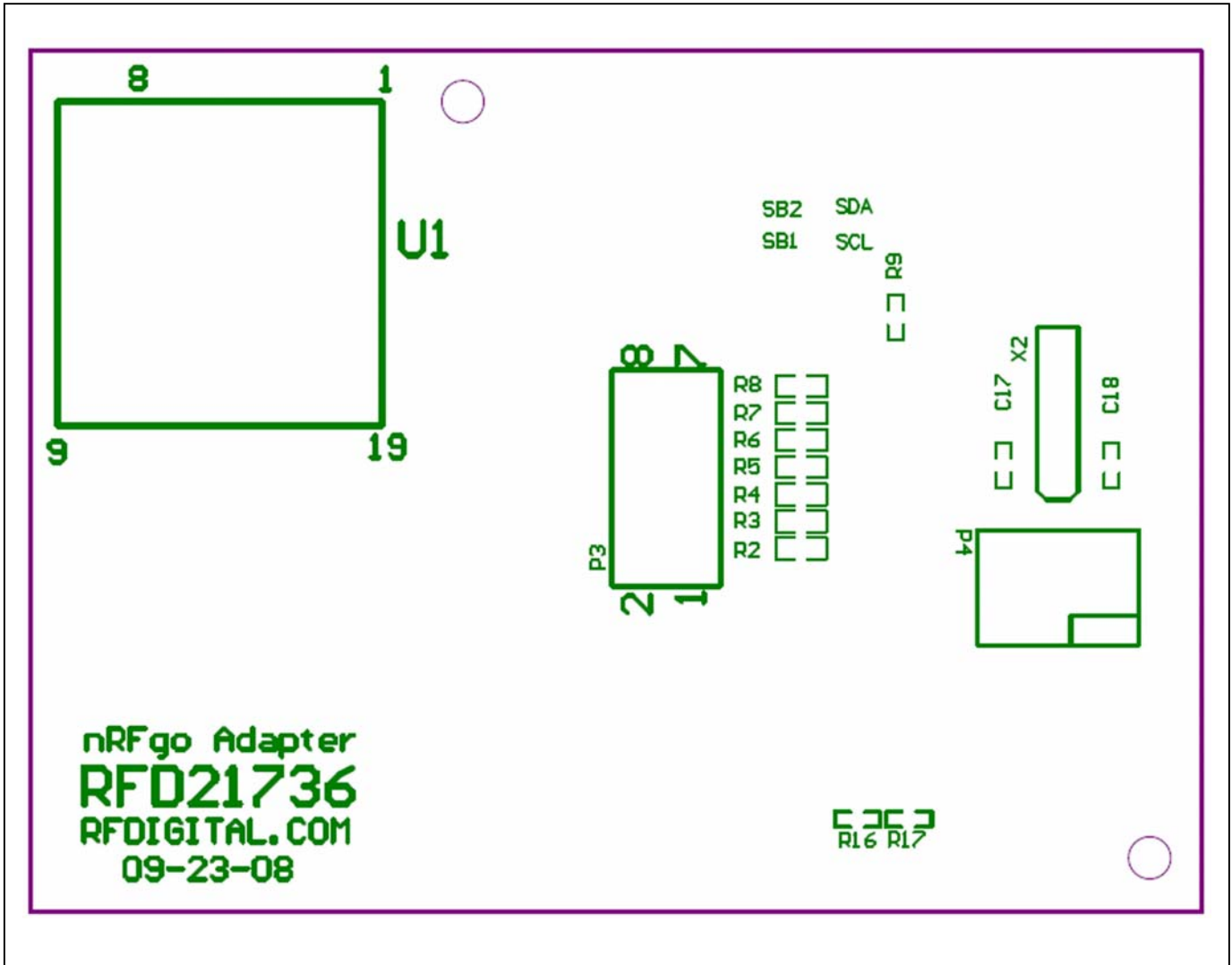
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RFD21736 Layout (plugs onto the nRF6310 eval board)

Top Layer Copper
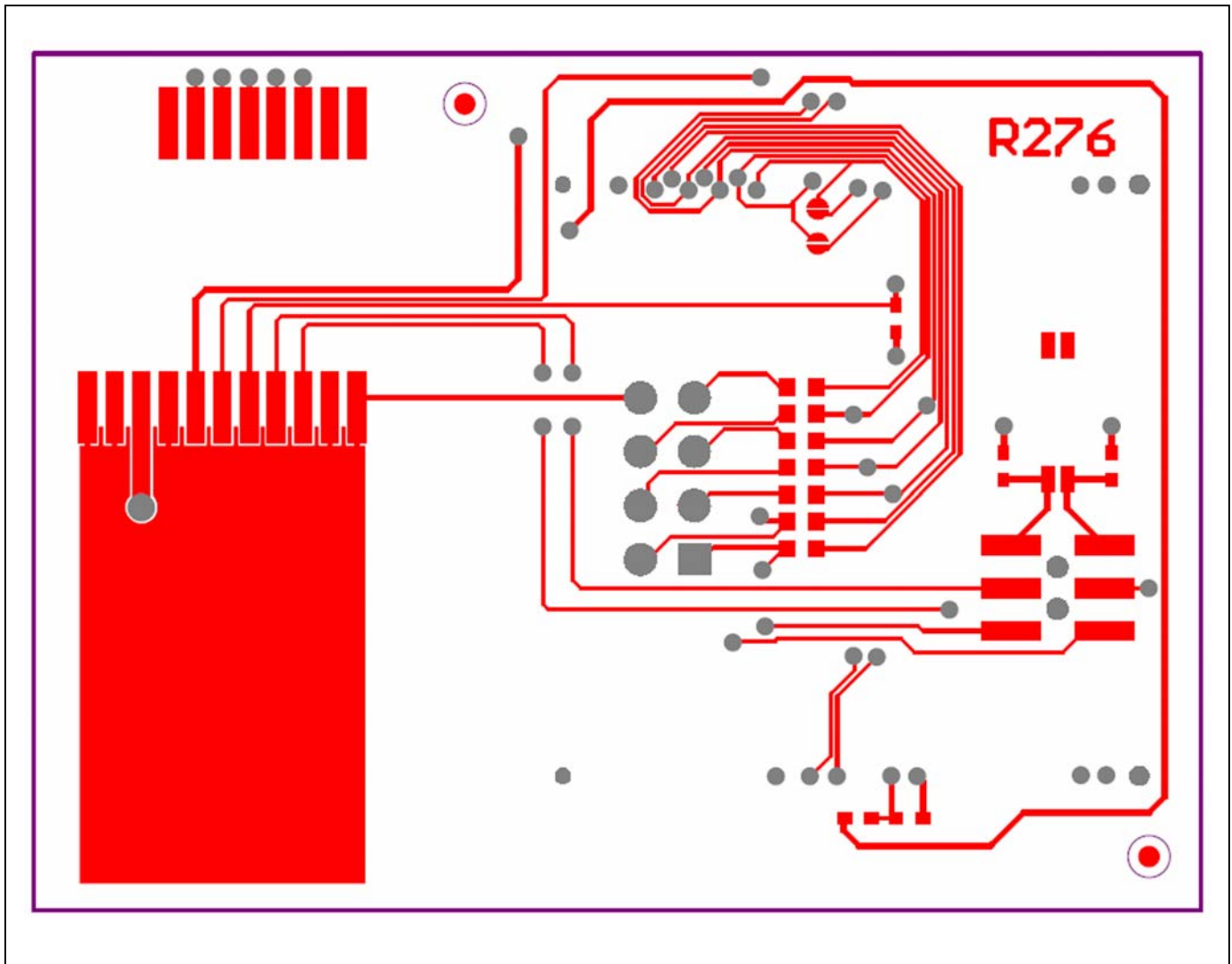
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RFD21736 Layout (plugs onto the nRF6310 eval board)

Bottom Layer Copper (reversed - viewed through the PCB)
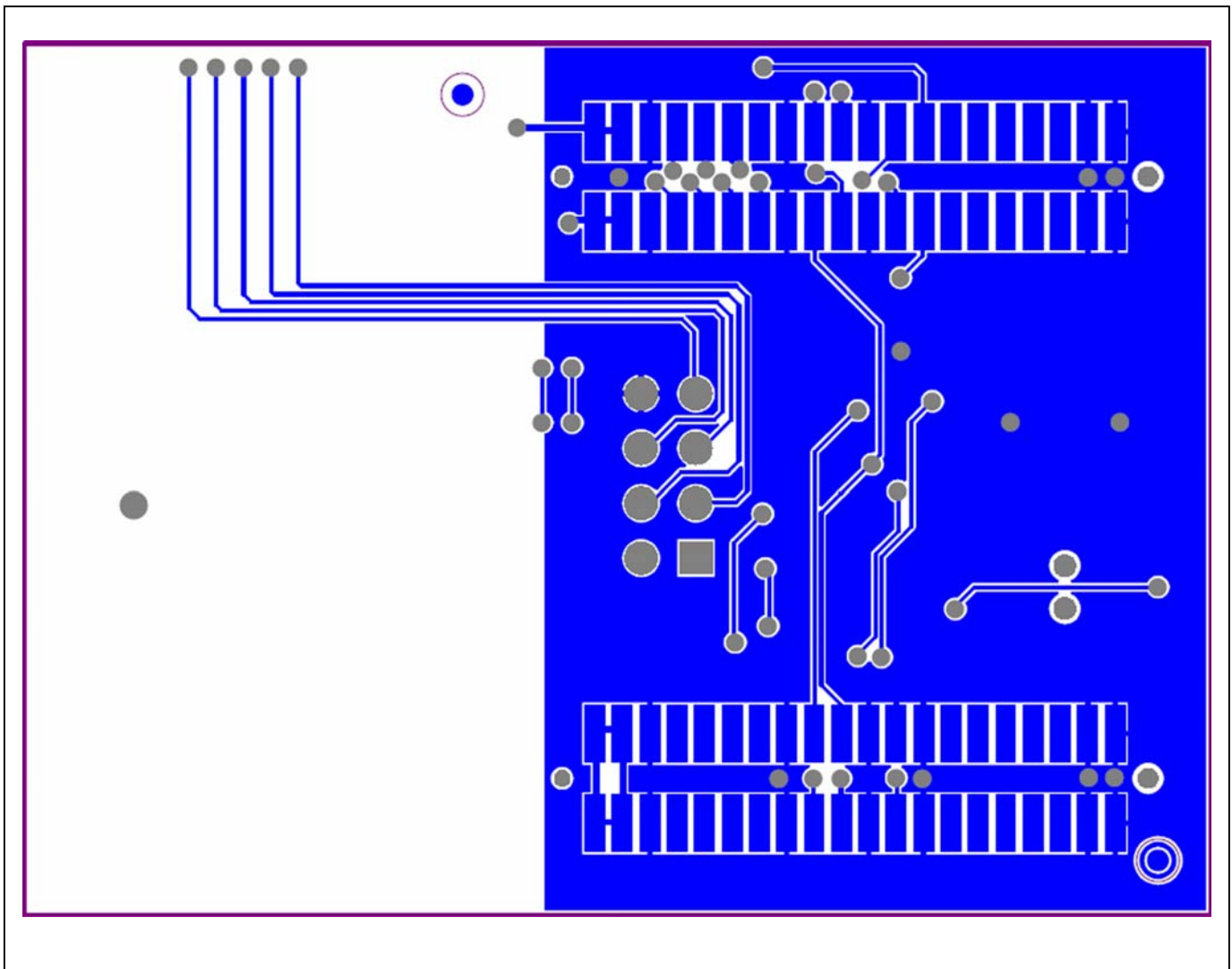
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RFD21736 Layout (plugs onto the nRF6310 eval board)

Bottom Layer Silk Screen (reversed - viewed through the PCB)
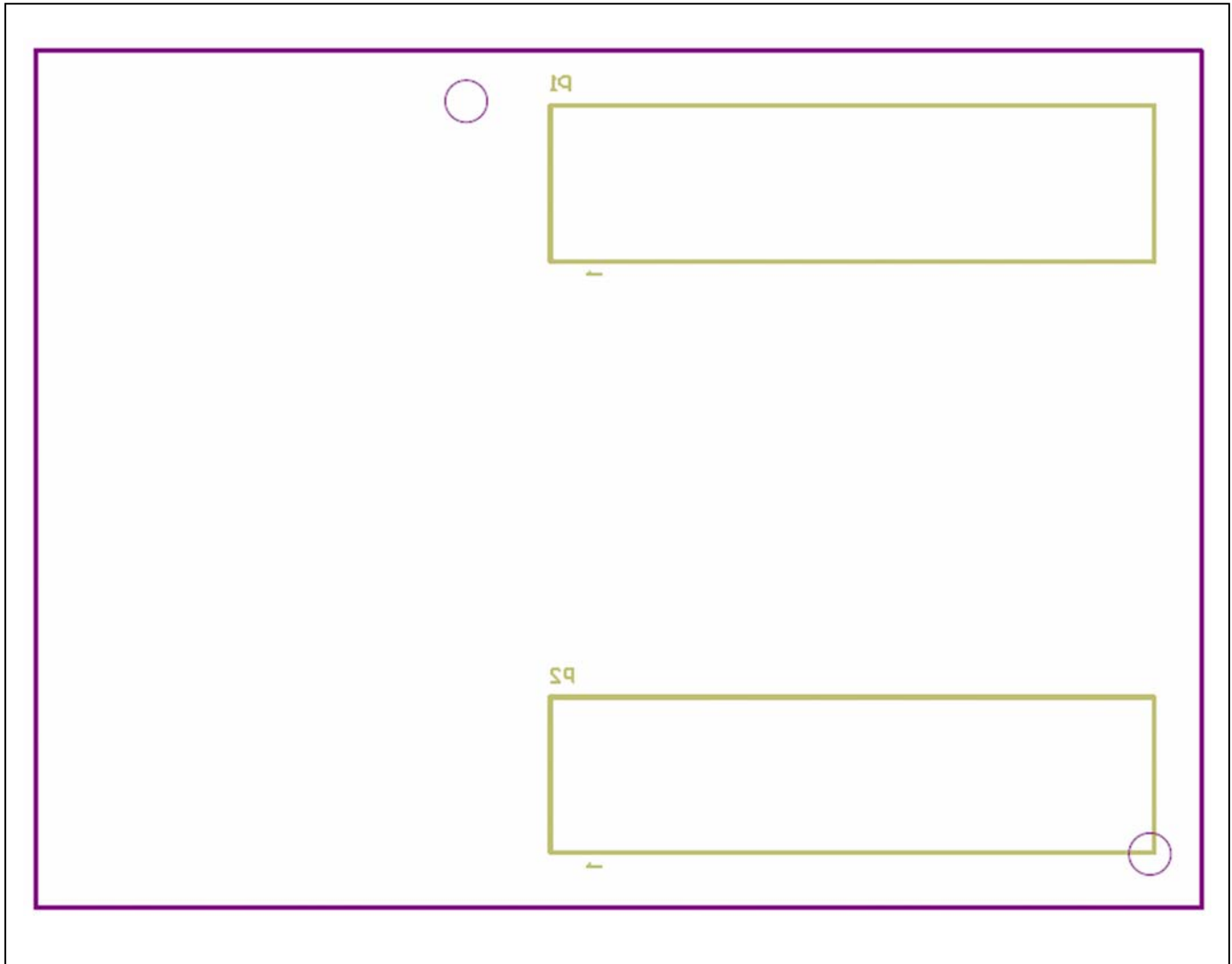
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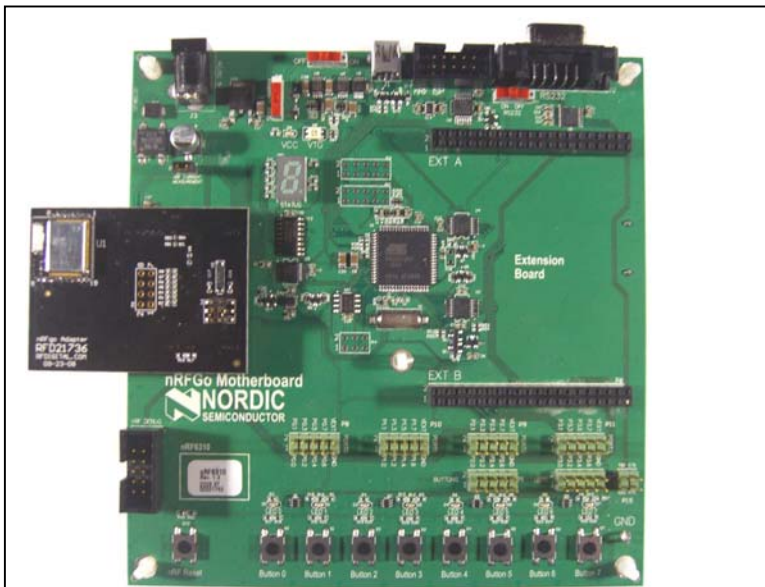# Nordic's nRF6700 nRFgo Starter Kit (Required)

Nordic nRFgo Board nRF6700

The nRF6700 nRFgo Starter Kit from Nordic comes with 2 nRF6700 development boards so you can have a complete communication system between at least 2 points.

The nRF6700 nRFgo Starter Kit is not complete. It requires one of three nRF24LE1 Development Kits from Nordic, which are radio boards that actually contain the nRF24LE1 IC. The difference between the three kits are which of the 3 flavors of IC are mounted on the boards in the kit. The IC that is inside RF Digital's module is the nRF24LE1-F16Q24. The Nordic radio board kit part number which represents the RF Digital module is the nRF24LE1-F16Q24-DK. Nordic's nRF24LE1-F16Q24-DK includes 3 radio boards, enough for a complete system.

RF Digital's RFD21736 radio board is sold individually, so you would need 2 pieces.

Nordic nRFgo Starter Kit Shown with RF Digital's RFD21736 module radio board plugged onto it.

Option 1:
Nordic's nRF6700
Nordic's nRF24LE1-F16Q24-DK

Option 2:
Nordic's nRF6700
RF Digital's RFD21736 (2 pieces)

Option 3:
Nordic's nRF6700
Nordic's nRF24LE1-F16Q24-DK
RF Digital's RFD21736 (1 piece)

Option 4:
Don't do any development at all, and just buy the READY-TO-USE, RFD21733, RFD21735, RFD21737, line of modules and eval boards which includes RF Digital's RFDP8 application protocol, that provides built-in functions for LOGIC SWITCH INPUTS / OUTPUTS, Serial UART at 9600-8N1 RFID, Unique Electronic Serial Number, PAIRING, and NETWORKING which allows you to be up and running in minutes!

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In System Programming (ISP) using the nRFgo

The RFD21731, RFD21732, RFD21734 all have the nRF24LE1 radio IC inside with a built-in 8051 controller. To program (load your own code) into the nRF24LE1 you the nRF6310 development board along with the nRFgo Studio software which is included in the nRF6700 nRFgo Starter Kit pictured above. The nRF6310 does not have an nRF24LE1 on it anywhere, you have two options with how to connect an nRF24LE1 to the nRF6310 development board. One option is that you can plug a Nordic development kit module (nRF24LE1-F16Q24-DK or RFD21736) into P3 and P4 on the nRF6310 development board. The second option is that you can use the ISP (In System Programming) connector (P16) located on the nRF6310. You must not use both, just use one or the other. In this section we will only be speaking about using the ISP only to program an RFD21731, RFD21732 or RFD21734 located on your own PCB using a cable from the nRF6310 development board P16 ISP port.

Location and pinout of P16 ISP Programming Connector.

P16 - PINOUT - TOP VIEW

Pin 1 of P16
ISP Programming Connector
on nRF6310 (nRFgo).
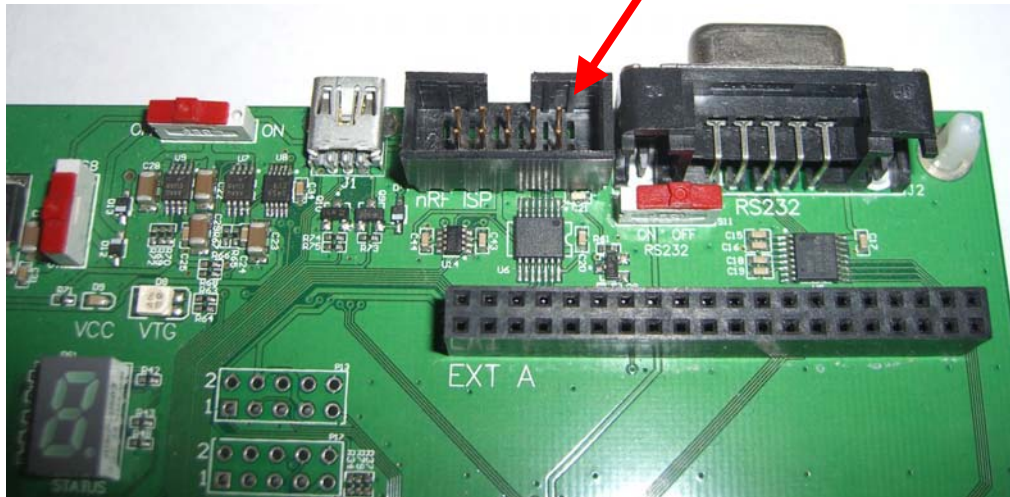
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Schematic - P16 section from nRF6310 development board
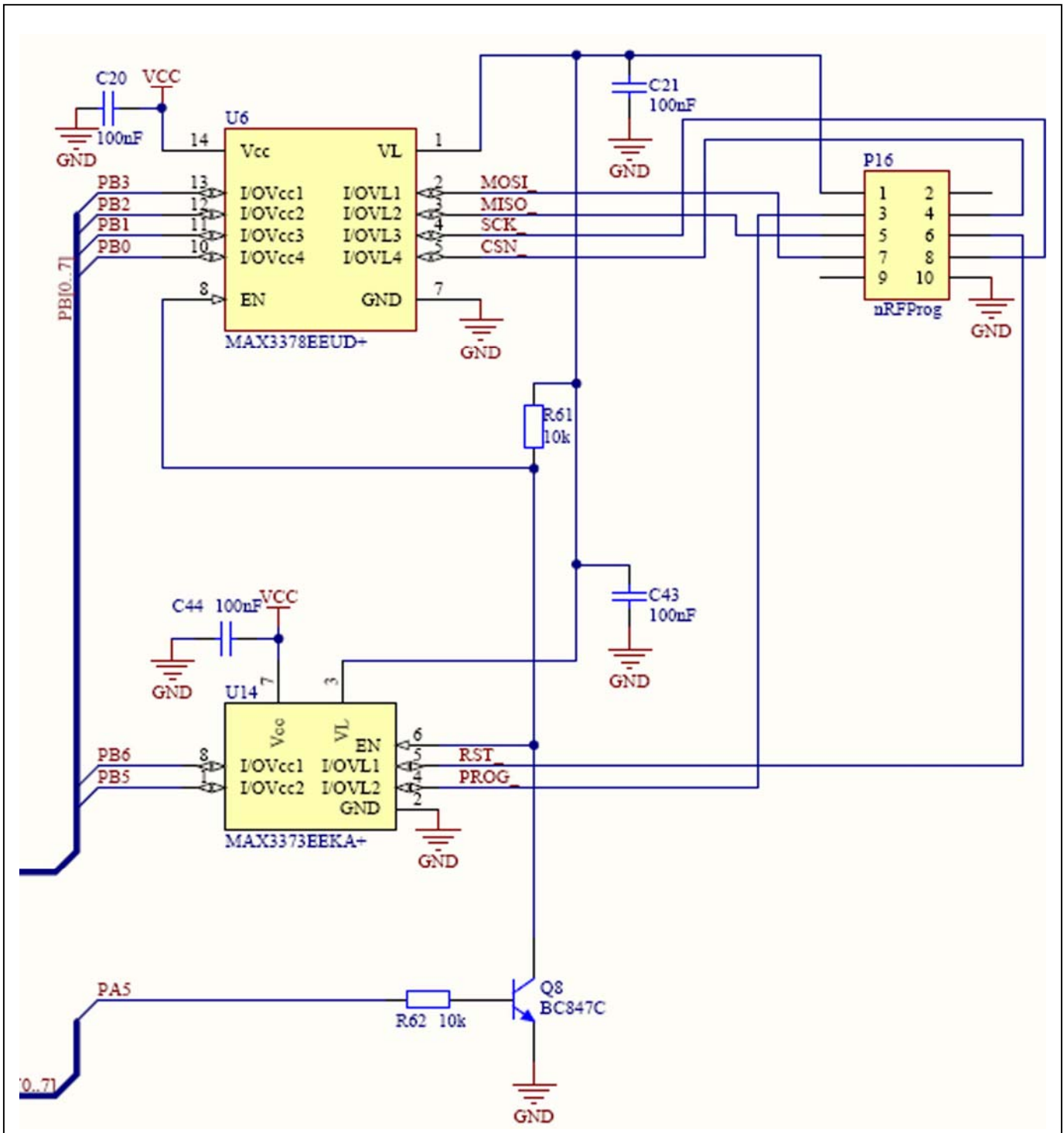
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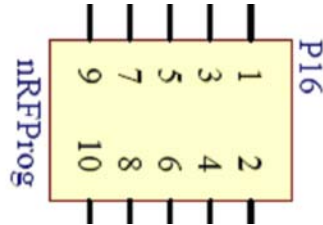RFD21731
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nRF24LE1-Q24 Pin Assignments

Blow is a copy from the Nordic nRF24LE1 data sheet version 1.4. Please refer to the Nordic data sheet for full details. This is only provided as a quick reference and not the information you should use for development.

Pin	Default connections		Dynamically enabled connections						
	Inputs[a]	Outputs[a]	XOSC32K	SPI Master	Slave/Flash SPI	HW Debug	2-Wire	PWM	ADC/COMP
			priority 1	priority 2	priority 3	priority 4	priority 5	priority 6	priority 7
P0.6	p0Di.6 UART/ RXD	p0Do.6				OCITO out	W2SDA inout	PWM1 out	AIN6 ana
P0.5	p0Di.5	p0Do.5 UART/ TXD			SCSN in / FCSN[b] in	OCITDO out	W2SCL inout		AIN5 ana
P0.4	p0Di.4 T0	p0Do.4		MMISO in	SMISO out / FMISO[a] out	OCITDI in			AIN4 ana
P0.3	p0Di.3	p0Do.3		MMOSI out	SMOSI in / FMOSI[a] in	OCITMS in		PWM0 out	AIN3 ana
P0.2	p0Di.2 GPINT1	p0Do.2		MSCK out	SSCK in / FSCK[a] in	OCITCK in			AIN2 ana
P0.1	p0Di.1	p0Do.1	CLKLF[c]						AIN1 ana
P0.0	p0Di.0 GPINT0	p0Do.0	CLKLF[d] ana						AIN0 ana

Conflict exists, use priorities to determine IO allocation

Conflict may exist depending on device configuration. In the case of a conflict, use priorities to determine IO allocation

nRF24LE1-Q24 to nRFgo P16 MISO MOSI Interface Explanation

Nordics nRFgo programming board uses an on-board AT90USB1287/16AU microcontroller to program the nRF24LE1-Q24 through a master-slave SPI communication using the MISO and MOSI lines on the AT90USB1287/16AU and the nRF24LE1-Q24. There are a set of pins required to perform the programming function and those pins are (in addition to power and ground): RST, PROG, SCN, SCK, MISO, MOSI. The RST, PROG, SCN and SCK signals are obvious they are outputs from the nRFgo programmer and inputs on the end of the nRF24LE1 module. However there are some easy mistakes that can be made with MISO and MOSI, so this is to explain detail about these two signals.

The nRF24LE1-Q24 Pin Assignments image (above) shows P0.2, P0.3, P0.4, P0.5 which are SCK, MOSIM MISO, CSN respectfully.

When the PROG pin is set to HIGH, those signals are called FSCN, FMISO, FMOSI, FSCK. They all have an "F" in front of them to indicate FLASH mode, which is only true when PROG line is high and SPI FLASH mode is entered.

This means that on the nRF24LE1-Q24 FMISO which is P0.4 is an OUTPUT and FMOSI which is P0.3 is an INPUT.

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The AT90USB1287/16AU schematic for PB [0..7] shown below, PB2 on the AT90USB1287/16AU is an MOSI signal Master Out, so it is an output since this chip is the master. The PB2 output signal goes into the left side of U6, into pin 12 and out pin 3 and then connects to pin 5 on P16, which then connects to P0.3 FMOSI on the nRF24LE1 which is pin 4 on the RFD21731,2,4 and pin 8 on the RFD21741.

The AT90USB1287/16AU schematic for PB [0..7] shown below, PB3 on the AT90USB1287/16AU is an MISO signal Master In, so it is an input since this chip is the master. The PB3 input signal goes into the left side of U6, into pin 13 and out pin 2 and then connects to pin 7 on P16, which then connects to P0.4 FMISO on the nRF24LE1 which is pin 5 on the RFD21731,2,4 and pin 9 on the RFD21741.

The AT90USB1287/16AU is the master and the nRF24LE1 is the slave.

AT90USB1287/16AU

U6 and P16

IGNORE THESE TWO MOSI AND MISO SIGNAL LABELS

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P16 programming connector wiring to external RF Module

The Nordic nRFgo board does not supply power to P16. You must supply your own power to pin 13 of module AND pin 1 of P16 on the nRF6310 board, because pin 1 of P16 sets the logic level voltage of P16, it must be the same voltage as the module supply. 1.9V minimum to 3.6V maximum, typically 3.0 or 3.3V.

nRF6310 - P16 nRFgo				RFD21731 RFD21732 RFD21734	RFD21741 RFDANT
VL	Pin 1	+V	+V	Pin 13	Pin 2
NC	Pin 2				
PROG	Pin 3	PROG	PROG	Pin 15	Pin 4
CSN	Pin 4	P0.5	FCSN	Pin 6	Pin 10
MOSI	Pin 5	P0.3	FMOSI	Pin 4	Pin 8
RST	Pin 6	RST	RST	Pin 14	Pin 3
MISO	Pin 7	P0.4	FMISO	Pin 5	Pin 9
SCK	Pin 8	P0.2	FSCK	Pin 3	Pin 7
NC	Pin 9				
GND	Pin 10	GND	GND	Pin 12	Pin 1

Ground
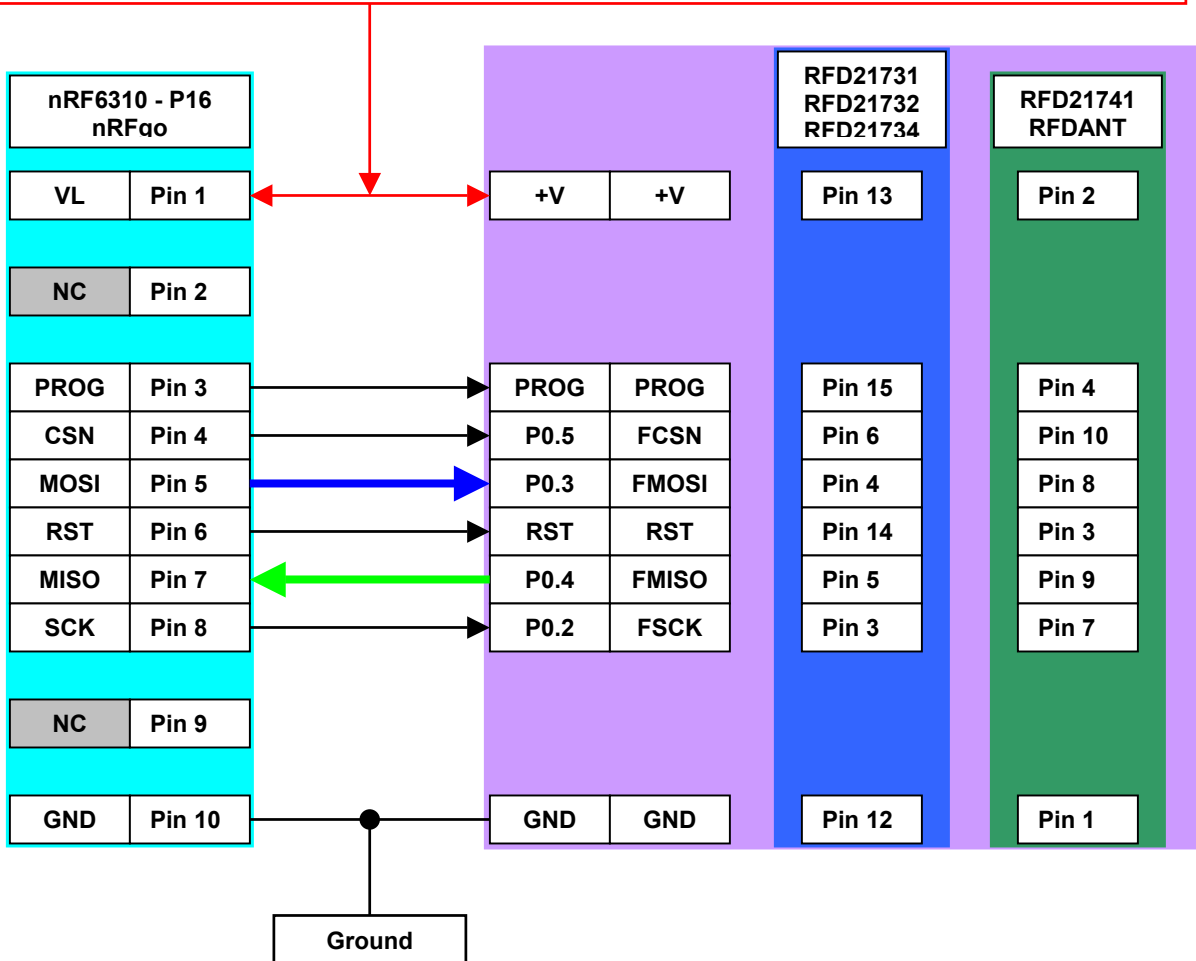
IMPORTANT

Pins 3, 4, 5 and 6 of the RFD21731, RFD21732, RFD21734 are used by the ISP for high speed communication when loading code (programming) the nRF24LE1. The MAX3373 and MAX3378 level shifter ICs used in the development to talk to these four lines must not be loaded too much, as if they are it will prevent programming of the nRF24LE1 inside of the module. So we have found that the minimum allowable value is a maximum resistive load to sink or source on any of the four pins is 47K ohms. 100K or larger is better. If you are programming module with pins 3, 4, 5 or 6 of the module not being tied to any point in your circuit other then to the P16 programming connector, then no need to worry about the loading. However if you are doing true in system programming where you are also using the four pins, then you must design your circuit in a way that when programming your circuit connections to any of those four pins do not cause any loader lower then 47k, as that will distort the high speed programming signals and prevent programming. If you encounter any programming problems using ISP, then look at all 6 programming signals and verify they look clean and do not have overshoot, ringing, distortion and have proper logic levels.

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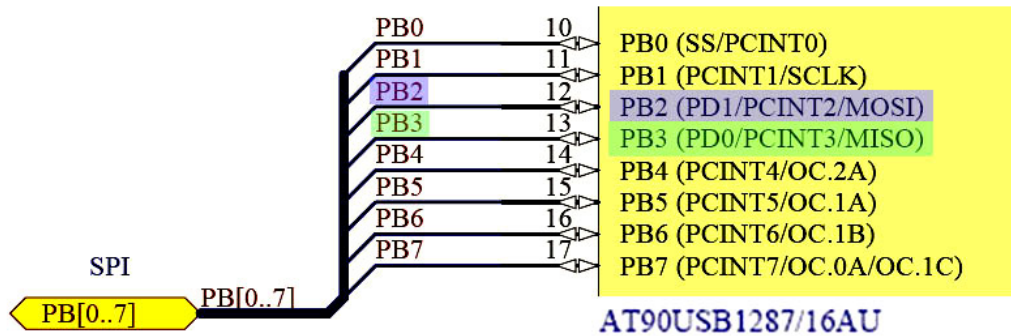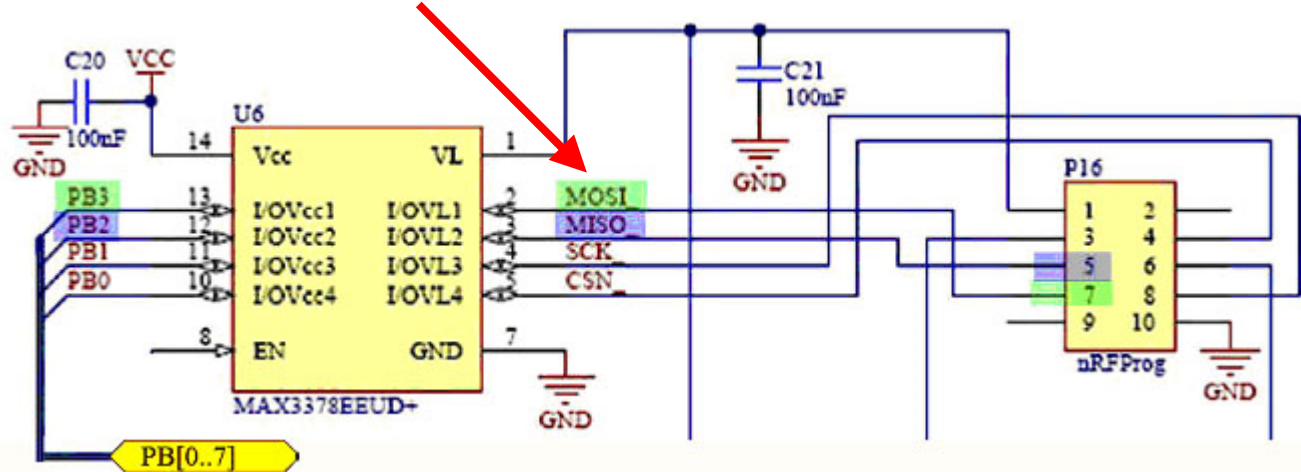www.rfdigital.com • sales@rfdigital.com

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Overall Dimensions • Top View
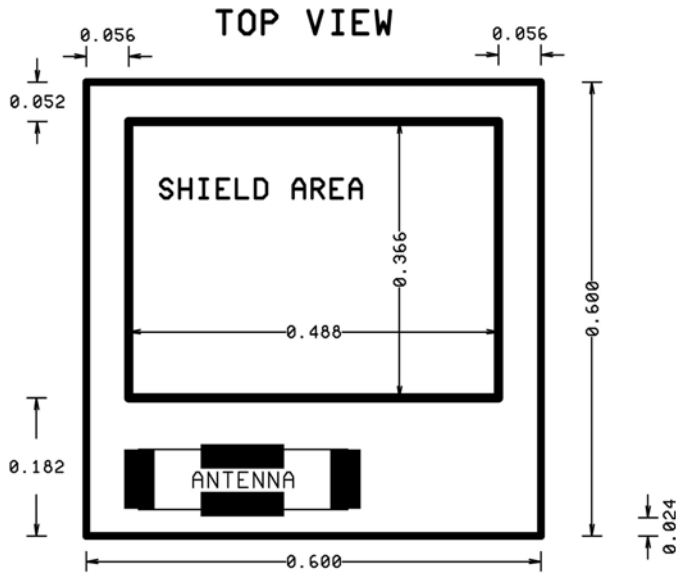
Overall Dimensions • Side View
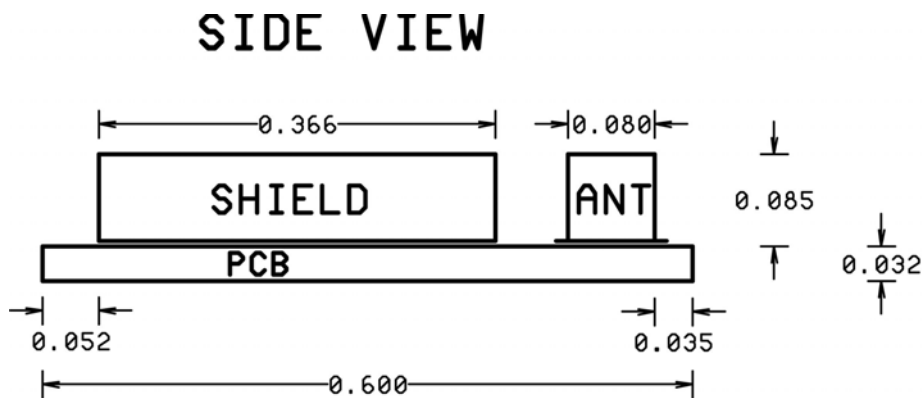
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PCB Layout

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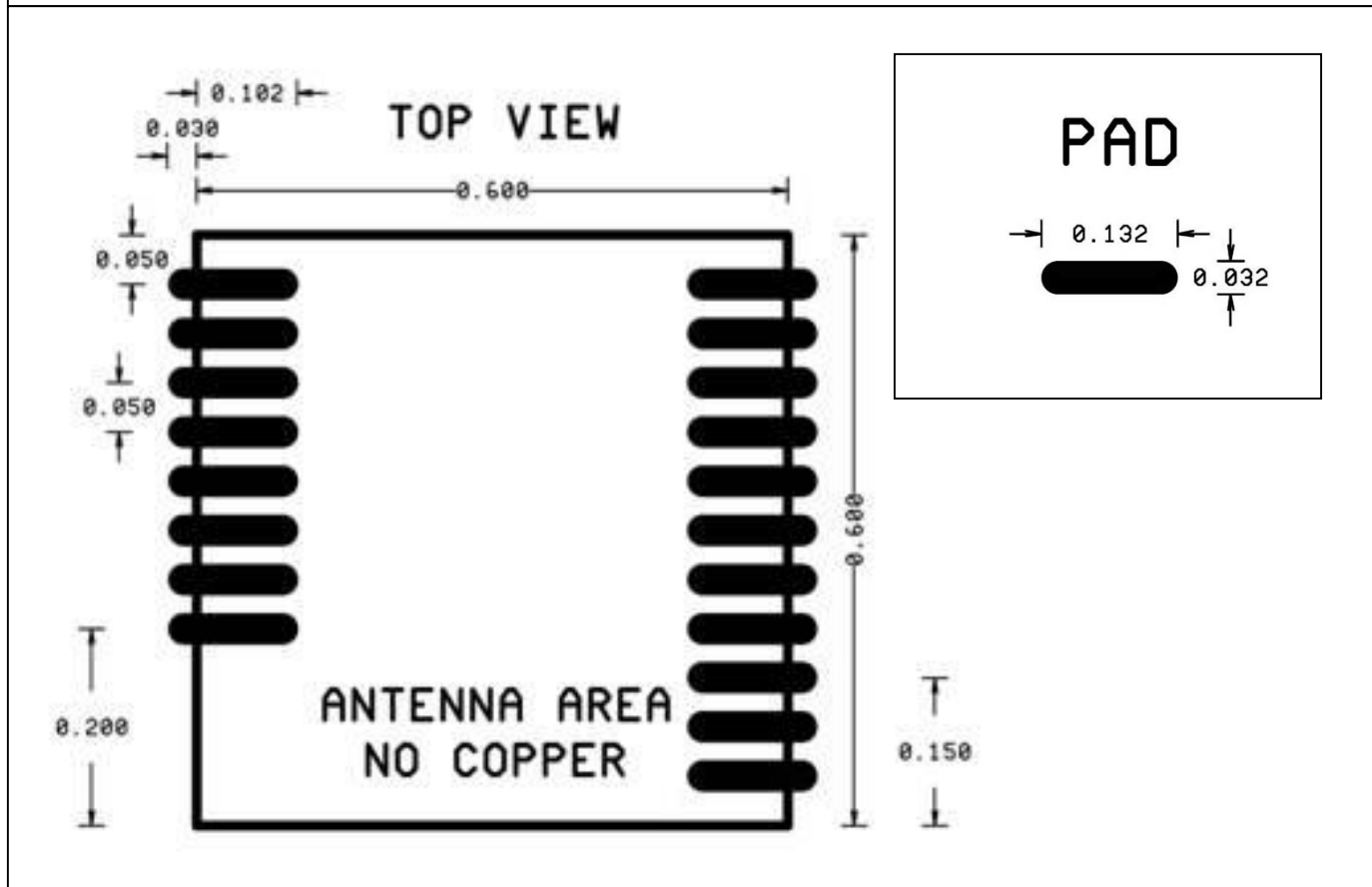
RoHS
Declaration Of Conformity
July 26, 2009

RF Digital declares that part numbers

- **RFD21731**
- **RFD21732**
- **RFD21733**
- **RFD21734**
- **RFD21735**
- **RFD21736**
- **RFD21737**
- **RFD21738**
- **RFD21739**
- **RFD21740**
- **RFD21741**
- **RFD21742**
- **RFD21743**
- **RFD21764**

are manufactured with RoHS materials.

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DECLARATION OF CONFORMITY

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- **RFD21741**
- **RFD21742**
- **RFD21743**

comply with ETSI EN 300 440-2 power requirements

as called out in the R&TTE V1.2.1 Directive

Technical documents for the above mentioned part numbers are held at
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Washing

The RFD21731, RFD21732 and RFD21734 are NOT washable.

Use no-clean flux, leaded or lead-free. If you attempt to wash the modules, water will enter beneath (inside) the RF shield and get trapped, which may cause device failure or damage once powered on. There is no way to make sure all water has been removed before powering the module so do NOT wash the modules.

Potting, Encapsulation and Conformal Coating

Do NOT pot or conformal coat the RFD21731, RFD21732 and RFD21734.

If you plan on encapsulating the RFD21731, RFD21732 or RFD21734 in a potting compound or conformal coating, you must assure that the compound in liquid or solid form does not enter under the shield where there are sensitive RF components. Some of the capacitive values are as low as half a picofarad and sensitive to contacting materials such as potting compounds. There are potting compounds and conformal coatings which have very good dielectric constants and are suitable for 2.4 GHz potting applications, however, when you apply any of these, they were accounted for in the circuit design and might reduce performance of the device or all together cause it not to function.

Applying any compound, conformal coating or potting directly to the module voids any and all warranty and support service.

If your application requires 100% sealing of the module, there is a way to do this very successfully without impacting the module performance. Simply place the module on your PCB. Place a plastic cover over the module (like a hat), make the cover large enough to cover the whole module. Apply glue around the bottom perimeter of the cover where it sits on the PCB. This allows the module to function in free airspace while there is a complete seal around it. This information is only for reference and you should do your own testing with your application to find the best suitable fit for your own design.

Reflow Profile

Use standard lead-free or leaded reflow profile for the RFD21731, RFD21732 and RFD21734. Your CM (Contract Manufacturer) should profile this module along with your PCB and all other parts on it through their reflow oven to properly set a profile suitable for all the parts on the board combined.

If you are building a double sided placement board, place this device last so it will not be attempted to be reflowed upside-down.

As with building any RF devices, you should always build a small quantity through your production process, test and verify, then increase your quantities to make sure the process is not harmful to the performance of your RF system. This is true with any RF system, including use of these modules.

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RFD21731 / RFD21732 / RFD21734 Tray Packaging

Tray Module Array: 6 x 15 = 90

Chamfer Indicates
Package PIN#1
Orientation

DETAIL A
SCALE 2 : 1

Module PIN#1
Orientation

DETAIL B
SCALE 1 : 1

BG1717 1.5

Top Tray
used for
cover only
with NO
Modules.

[1.8]
45.7 REF
7 Tray Stack Height

[5.35]
135.9 REF

[12.7]
322.6 REF

90 modules per tray x 6-stack = 540 modules

nRF24LE1
RF Module
RFD21731
RFD21732
RFD21734
RFD21736
ETSI • CE Compliant

RFD21731 / RFD21732 / RFD21734 Tray Packaging

322.6 REF
315
8x No Holes(Vacuum Pickup Cell)
135.9
92.1
12.7
Chamfer Indicates Package PIN #1 Orientation
2.54
34.3
25.4
255.3
19.5
DETAIL A
SCALE 1 : 1
19.5

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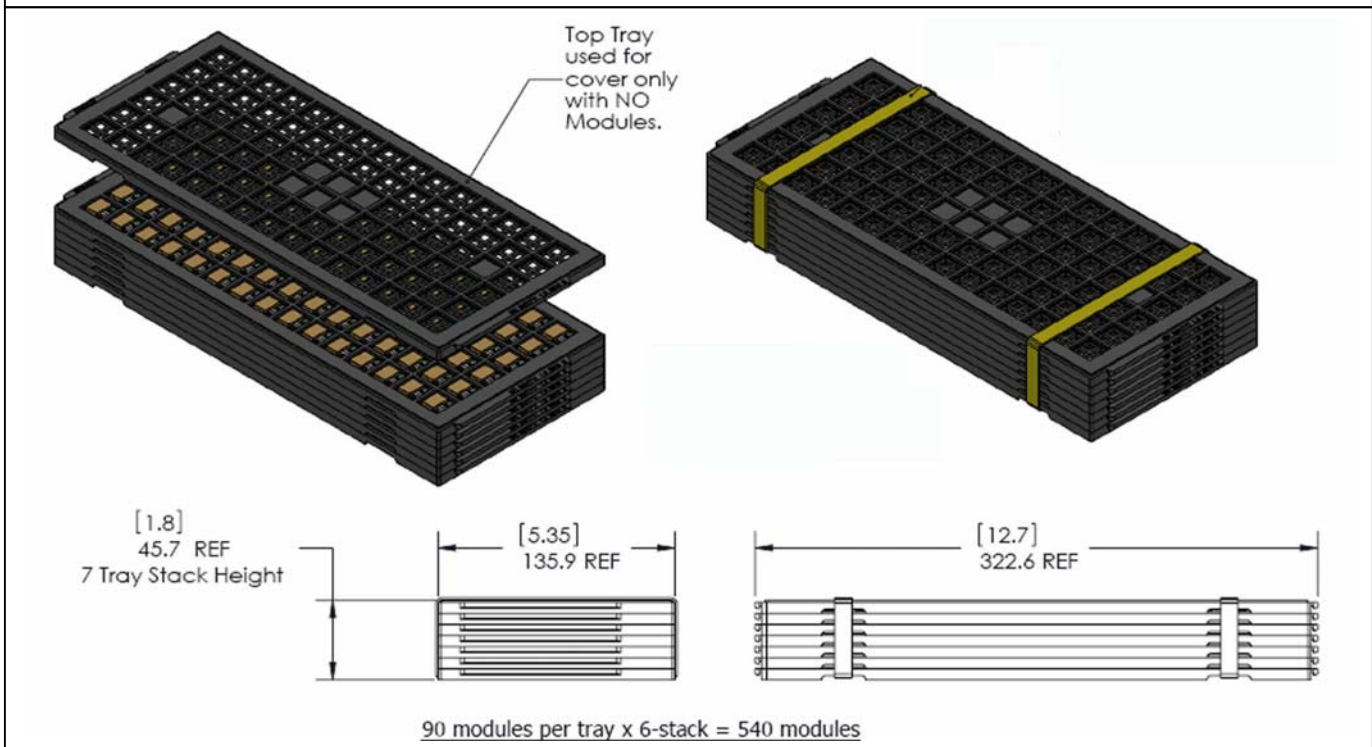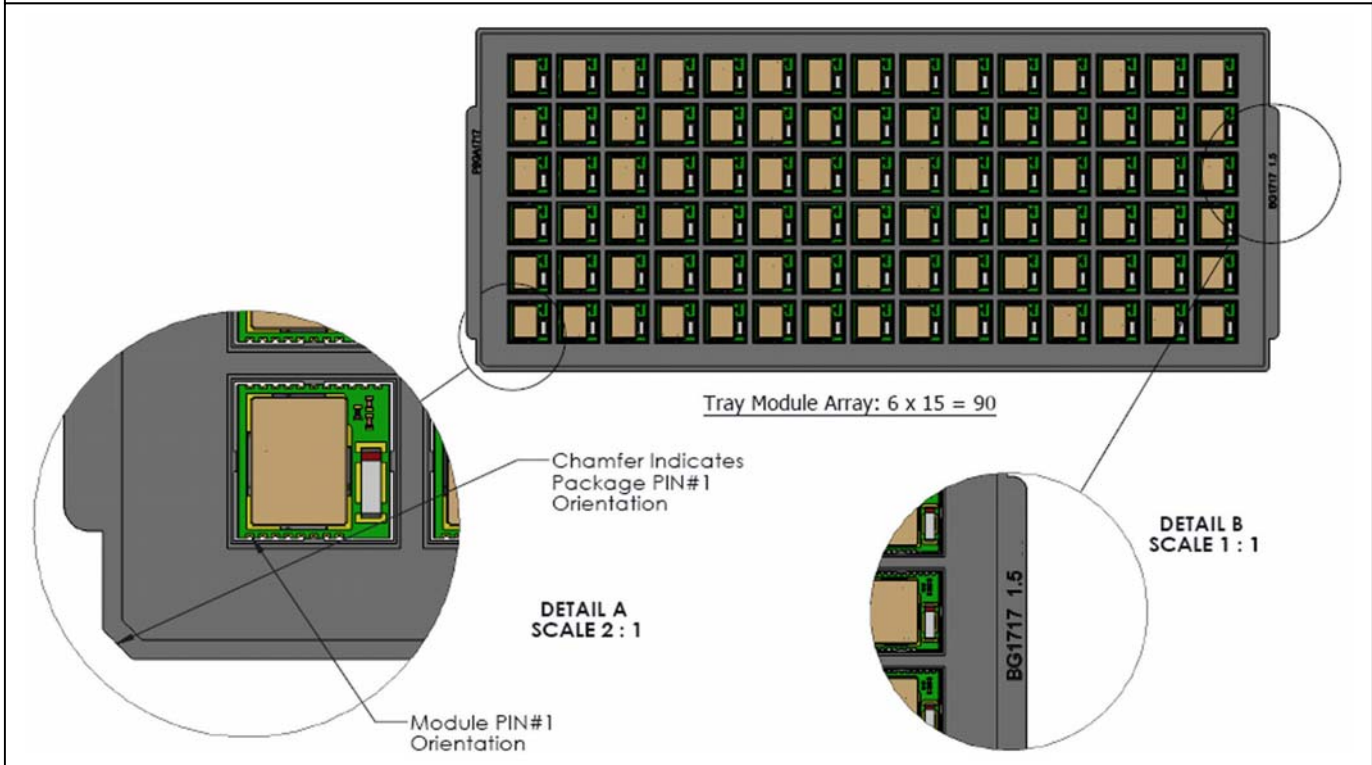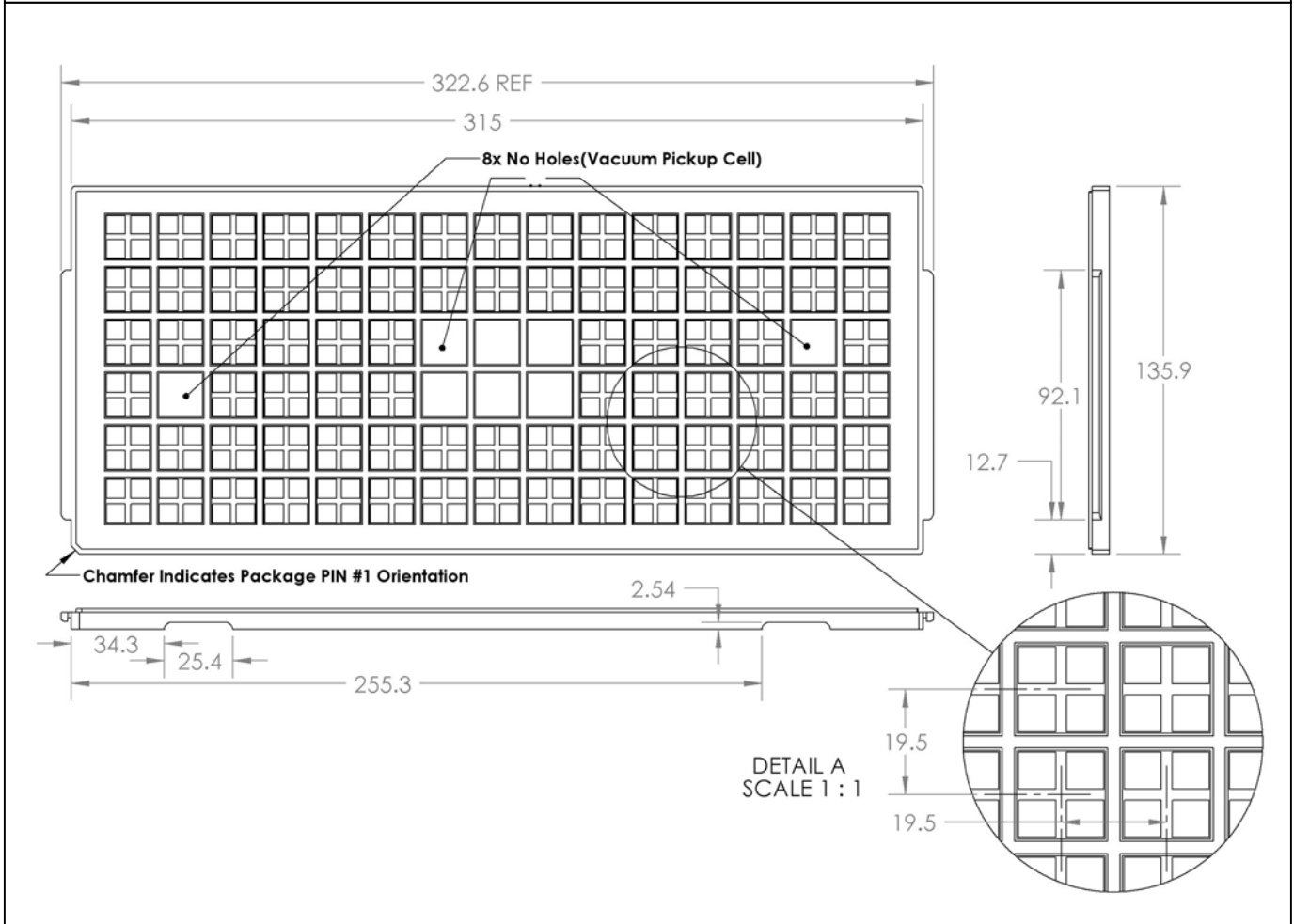
RFD21731 / RFD21732 / RFD21734 Tray Packaging

7 Trays total, including 1 blank top tray

90 modules per tray x 6-stack = 540 modules

Top Tray used for cover only with NO Modules.
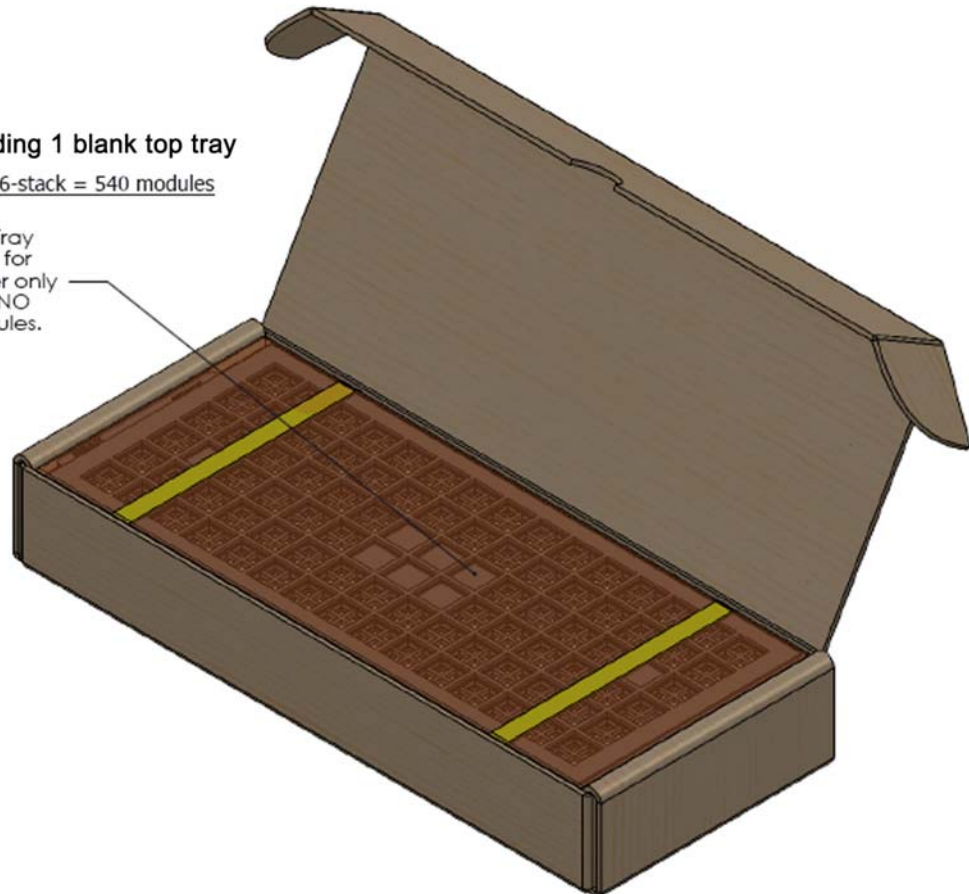
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Nordic nRF6310 Development / Programming Board Schematic
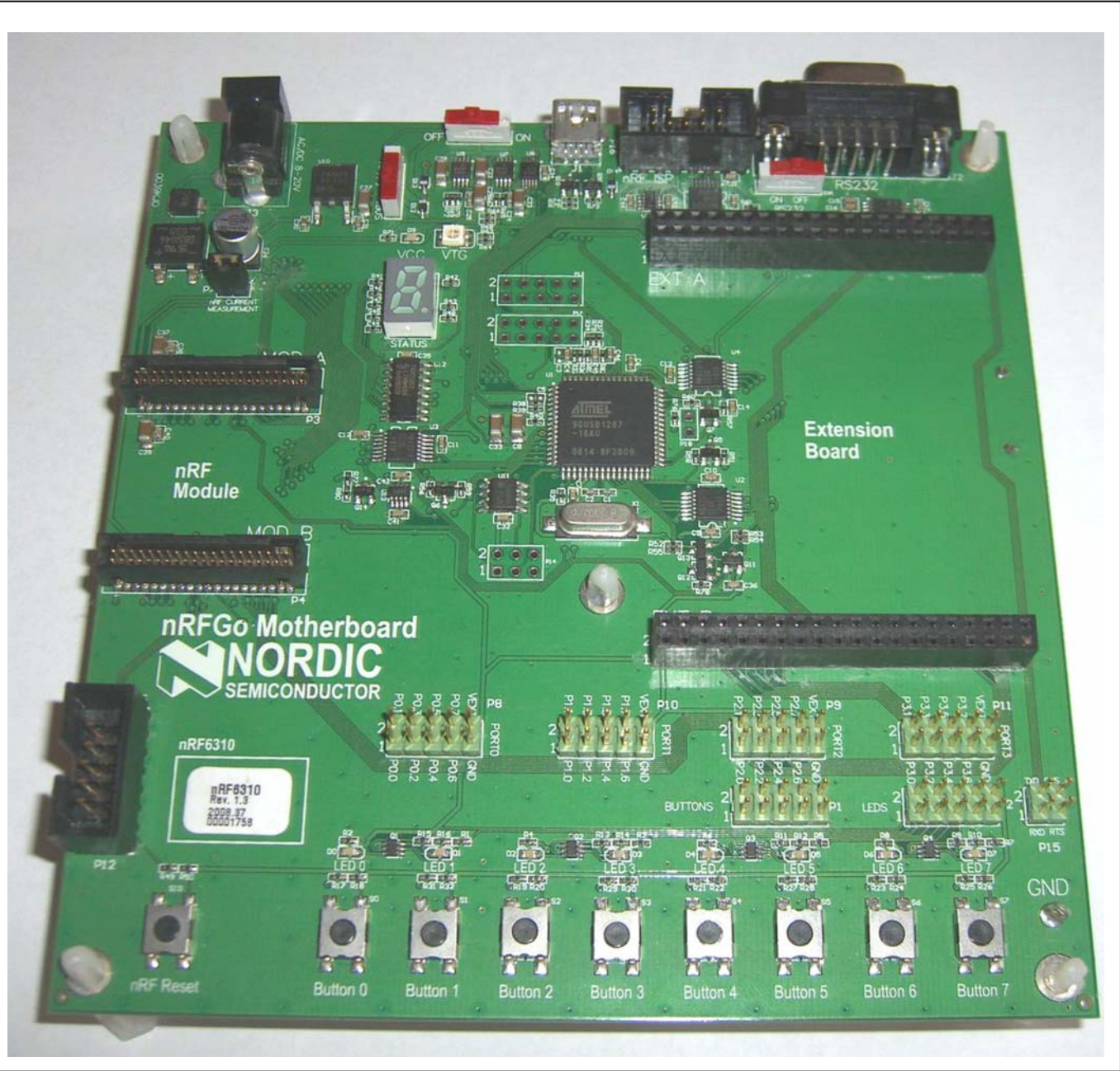
The following 5 pages of schematics are for the nRF6310 board above. Two of these boards are included with the Nordic nRF6700 kit. The nRF6700 kit is also referred to as the "nRFgo" kit. References made to the nRFgo board are referring to the nRF6310 board pictured above with it's schematic below.

Schematic sheet — partial text extraction:

Crystal / oscillator
- C1 33pF
- C2 33pF
- X1 8MHz
- GND

J1 Mini USB ABF
- 1 VBUS
- 2 D-
- 3 D+
- 5 GND
- 4 PE3 ID
- Shield
- VBUS
- R38 22R
- R39 22R
- R40 0R
- C33 10uF
- C8 10uF
- GND

U1 AT90USB1287/16AU

Pin	Signal
24	XTAL1
23	XTAL2
3	UVcc
4	D-
5	D+
6	UGND
7	UCap
8	Vbus
51	PA0 (AD0)
50	PA1 (AD1)
49	PA2 (AD2)
48	PA3 (AD3)
47	PA4 (AD4)
46	PA5 (AD5)
45	PA6 (AD6)
44	PA7 (AD7)
10	PB0 (SS/PCINT0)
11	PB1 (PCINT1/SCLK)
12	PB2 (PD1/PCINT2/MOSI)
13	PB3 (PD0/PCINT3/MISO)
14	PB4 (PCINT4/OC.2A)
15	PB5 (PCINT5/OC.1A)
16	PB6 (PCINT6/OC.1B)
17	PB7 (PCINT7/OC.0A/OC.1C)
35	PC0 (A8)
36	PC1 (A9)
37	PC2 (A10)
38	PC3 (A11/T.3)
39	PC4 (A12/OC.3C)
40	PC5 (A13/OC.3B)
41	PC6 (A14/OC.3A)
42	PC7 (A15/IC.3/CLK0)
20	/RESET
62	AREF
64	AVCC
21	VCC
52	VCC
22	GND
53	GND
63	GND
25	PD0 (OC0B/SCL/INT0)
26	PD1 (OC2B/SDA/INT1)
27	PD2 (RXD1/INT2)
28	PD3 (TXD1/INT3)
29	PD4 (ICP1)
30	PD5 (XCK1)
31	PD6 (T1)
32	PD7 (T0)
33	PE0 (/WR)
34	PE1 (/RD)
43	PE2 (ALE/HWB)
9	PE3 (IUID)
18	PE4 (INT4/TOSC1)
19	PE5 (INT5/TOSC2)
1	PE6 (INT6/AIN.0)
2	PE7 (AIN.1/UVcon)
61	PF0 (ADC0)
60	PF1 (ADC1)
59	PF2 (ADC2)
58	PF3 (ADC3)
57	PF4 (ADC4/TCK)
56	PF5 (ADC5/TMS)
55	PF6 (ADC6/TDO)
54	PF7 (ADC7/TDI)

Labels: DEBUG PA[0..7], SPI PB[0..7], 7-segment PC[0..7], PB[0..7], PD[0..7] 2-wire + spare 1-4, PE[0..7] Power supply UVcon, PF[0..7] JTAG

VCC decoupling
- R35 10k
- C3 NA, C4 100nF
- C5 NA, C6 100nF, C7 100nF
- GND
- RESET

HW ID
- VCC
- R33 390k
- R36 12k
- PF0
- GND

VTG measure
- VTG
- R79 10k, R34 10k
- R37 10k
- PF1
- GND

P18 USB Reset
- PE2
- 1
- 2
- GND

P17 Debug

PC3	1	2	PC4
PC5	3	4	PC6
PC7	5	6	PD2
PD3	7	8	PD4
VCC	9	10	

GND

BoardID PF2
- C45 100nF
- R81 470k
- GND GND

ExtID PF3
- C46 100nF
- R82 470k
- GND GND

U11 M95256-WMN6
- PA6 — 1 CS
- 3 WP
- VCC — 7 HOLD
- PB2 — 5 D
- PB1 — 6 SCL
- 8 VCC
- 2 Q PB3
- 4 GND
- C32 100nF
- VCC
- GND
- PB[0..7]

Title: **nRF6310**
Size: | Project Number: | Revision: 1.3
Date: 22.05.2008
File: Control MCU_Rev1_3.SchDoc
Sheet 1 of 5
Drawn By: KJO

NORDIC SEMICONDUCTOR

Device ports

Expansion ports

P3 MOD A
VCC / VTG'
GND / GND
nRF P0.0 / nRF P0.1
nRF P0.2 / nRF P0.3
nRF P0.4 / nRF P0.5
nRF P0.6 / nRF P0.7
GND / GND
MOSI / MISO
CSN / SCK
GND / SDA
SCL / nRF RST
PROG / Spare2
Spare1 / nRF P1.1
nRF P1.0 / nRF P1.3
nRF P1.2 / nRF P1.5
nRF P1.4 / nRF P1.7
nRF P1.6

P4 MOD B
VEXT / VTG
GND / GND
nRF P3.0 / nRF P3.1
nRF P3.2 / nRF P3.3
nRF P3.4 / nRF P3.5
nRF P3.6 / nRF P3.7
GND / GND
TCK / TDO
TDI / TMS
GND / GND
BoardID / GND
GND / GND
Spare3 / Spare4
nRF P2.0 / nRF P2.1
nRF P2.2 / nRF P2.3
nRF P2.4 / nRF P2.5
nRF P2.6 / nRF P2.7

P5 EXT A
VCC / VTG'
GND / GND
nRF P0.0 / nRF P0.1
nRF P0.2 / nRF P0.3
nRF P0.4 / nRF P0.5
nRF P0.6 / nRF P0.7
GND / GND
MOSI / MISO
CSN / SCK
GND / SDA
SCL / nRF RST
PROG / Spare2
Spare1 / nRF P1.1
nRF P1.0 / nRF P1.3
nRF P1.2 / nRF P1.5
nRF P1.4 / nRF P1.7
nRF P1.6

P6 EXT B
VEXT / VTG
GND / GND
nRF P3.0 / nRF P3.1
nRF P3.2 / nRF P3.3
nRF P3.4 / nRF P3.5
nRF P3.6 / nRF P3.7
GND / GND
TCK / TDO
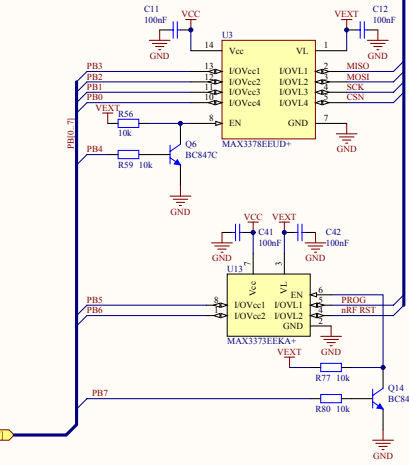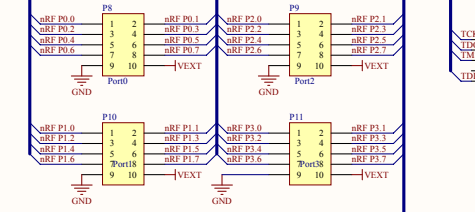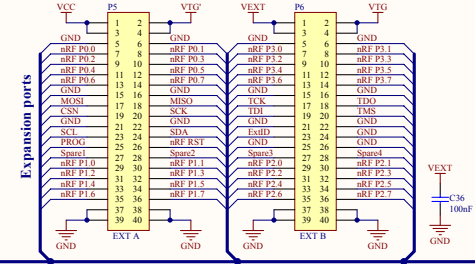TDI / TMS
GND / GND
ExtID / GND
GND / GND
Spare3 / Spare4
nRF P2.0 / nRF P2.1
nRF P2.2 / nRF P2.3
nRF P2.4 / nRF P2.5
nRF P2.6 / nRF P2.7

P8 Port0
nRF P0.0 / nRF P0.1
nRF P0.2 / nRF P0.3
nRF P0.4 / nRF P0.5
nRF P0.6 / nRF P0.7
VEXT

P9 Port2
nRF P2.0 / nRF P2.1
nRF P2.2 / nRF P2.3
nRF P2.4 / nRF P2.5
nRF P2.6 / nRF P2.7
VEXT

P10 Port1
nRF P1.0 / nRF P1.1
nRF P1.2 / nRF P1.3
nRF P1.4 / nRF P1.5
nRF P1.6 / nRF P1.7
VEXT

P11 Port3
nRF P3.0 / nRF P3.1
nRF P3.2 / nRF P3.3
nRF P3.4 / nRF P3.5
nRF P3.6 / nRF P3.7
VEXT

P7 Jumper
VTG' / VTG

P12 nRF Debug/JTAG
TCK
TDO
TMS
TDI
VEXT
nRF RST

R49 150R
R50 10k
S10
Module Reset

Closed for normal operation
Open for current measurements

VEXT will be connected to
VTG or VCC on the plug-in
module

U3 MAX3378EEUD+
C11 100nF VCC
C12 100nF VEXT
Vcc / VL
I/OVcc1 / I/OVL1
I/OVcc2 / I/OVL2
I/OVcc3 / I/OVL3
I/OVcc4 / I/OVL4
EN / GND
PB3 / MISO
PB2 / MOSI
PB1 / SCK
PB0 / CSN
R56 10k VEXT
Q6 BC847C
R59 10k
PB4
PB[0..7]

U4 MAX3378EEUD+
C13 100nF VCC
C14 100nF VEXT
Vcc / VL
I/OVcc1 / I/OVL1
I/OVcc2 / I/OVL2
I/OVcc3 / I/OVL3
I/OVcc4 / I/OVL4
EN / GND
PA0 / TCK
PA1 / TDO
PA2 / TDI
PA3 / TMS
VEXT
R57 10k
Q7 BC847C
PA7
R60 10k
PA[0..7]

U2 MAX3378EEUD+
C9 100nF VCC
C10 100nF VEXT
Vcc / VL
I/OVcc1 / I/OVL1
I/OVcc2 / I/OVL2
I/OVcc3 / I/OVL3
I/OVcc4 / I/OVL4
EN / GND
PD2 / Spare1
PD3 / Spare2
PD4 / Spare3
PD5 / Spare4
VEXT
R51 10k
Q5 BC847C
PD7
R58 10k
PD[0..7]

U13 MAX3373EEKA+
C41 100nF VCC
C42 100nF VEXT
Vcc / VL
I/OVcc1 / I/OVL1
I/OVcc2 / I/OVL2
GND / EN
PB5 / PROG
PB6 / nRF RST
VEXT
R77 10k
Q14 BC847C
R80 10k
PB7

Q11 FDV304P
R78 10k
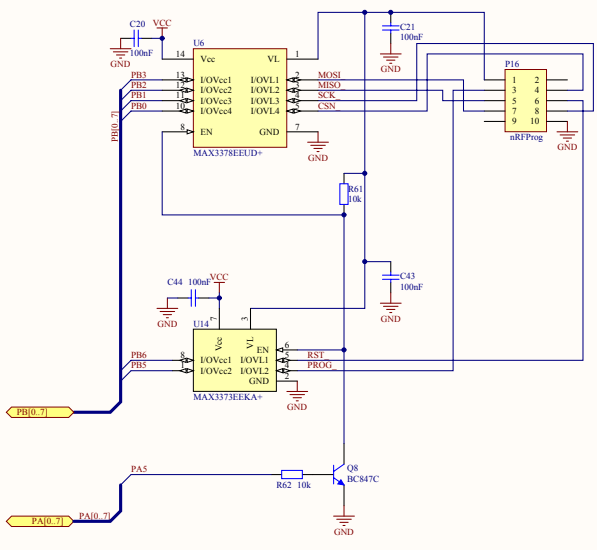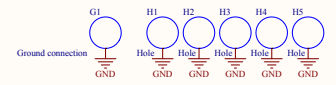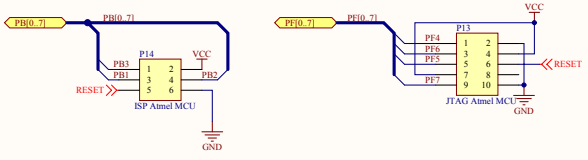PD6
VCC VCC
R52 10k
R55 10k
R53 10k
R54 10k
Q12 FDV301N
PD1
SDA
Q13 FDV301N
PD0
SCL
VEXT

C36 100nF VEXT

BoardID → BoardID
ExtID → ExtID

PB[0..7]

PB[0..7]

PB3
PB1

P14
VCC
1 2 PB2
3 4
5 6

RESET

ISP Atmel MCU

GND

PF[0..7]
PF[0..7]

VCC

PF4
PF6
PF5
PF7

P13
1 2
3 4
5 6
7 8
9 10

RESET

JTAG Atmel MCU

GND

G1
Ground connection
GND

H1 Hole
GND

H2 Hole
GND

H3 Hole
GND

H4 Hole
GND

H5 Hole
GND

VCC
C35
100nF
GND

U12
16 VCC
RCLK
SRCLR
SRCLK
SER
GND
8

QA
QB
QC
QD
QE
QF
QG
QH
QH'

OE

VCC

74HC595D

GND

13 OE
12
10 PC2 Load
11 PC1 Clock
14 PC0 Data

GND

DS1
K
a
b
c
d
e
f
g
DP DP
HDSP-U503
GND

R41 150R
R42 150R
R43 150R
R44 150R
R45 150R
R46 150R
R47 150R
R48 150R

9
GND
1

7

PC[0..7]
PC[0..7]

C20 VCC
100nF
GND

U6
14 Vcc VL 1
13 I/OVcc1 I/OVL1 2
12 I/OVcc2 I/OVL2
11 I/OVcc3 I/OVL3
10 I/OVcc4 I/OVL4
8 EN GND 7

PB3
PB2
PB1
PB0

MAX3378EEUD+

PB[0..7]

C21
100nF
GND

MOSI
MISO
SCK
CSN

P16
1 2
3 4
5 6
7 8
9 10
nRFProg

GND

The device to be programmed
will supply U5 and U14 with
the correct voltage for logic
level shifting.
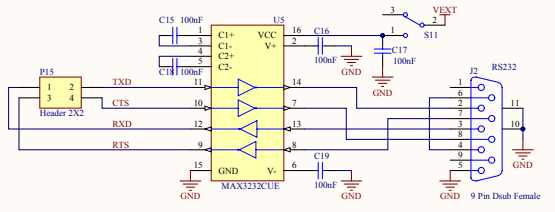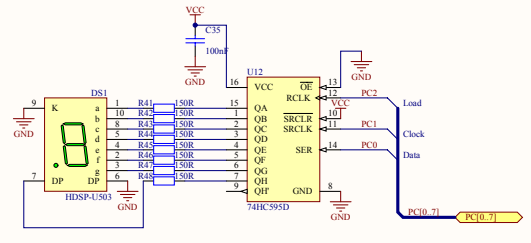
R61
10k

C43
100nF
GND

C44 100nF VCC
GND

U14
7 Vcc VL 3
8 I/OVcc1 I/OVL1 6
9 I/OVcc2 I/OVL2
EN 5
RST
PROG

PB6
PB5

MAX3373EEKA+

GND

PB[0..7]

PA5

R62 10k

Q8
BC847C

PA[0..7]
PA[0..7]

GND

C15 100nF
1 C1+
3 C1-
4 C2+
5 C2-

C18 100nF

U5
VCC 16 C16
V+ 2

C17
100nF

VEXT
3
2 1
S11

C2+
C2-

P15
1 2
3 4
Header 2X2

TXD 11
CTS 10
RXD 12
RTS 9

14
7
13
8

GND 15 GND V- 6 C19
100nF
GND

MAX3232CUE

GND

J2 RS232
1
6
2
7
3
8
4
9
5

11
10

GND

9 Pin Dsub Female

GND

Title
nRF6310

Size   Project Number
        ProjectNumber

Revision
1.3

Date: 22.05.2008
File: Interfaces_Rev1_3.SchDoc

Sheet 3 of 5
Drawn By: KJO

NORDIC
SEMICONDUCTOR

PE[0..7]

PE4   PE2   Up/Down
PE5   PE1   Increase

R63   R64
150R   150R

Vtarget Status

D8
HSMF-A203

R   G

VCC

R66
10k

PE0   Power OK
PE6   VTG Enable

R68
10k

GND

C22
10uF

GND

U7   Vtarget 0.9-3.6v

In   Out
In   Out
POK
Set
/SHDN   GND

MAX1806EUA33+

R65
470k

R67
15k

GND

C23   C24
10uF   100nF

GND   GND

VTG

VCC

R76
10k

GND

VCC

C34
100nF

GND

U8

/CS1   VDD   /CS2
U/D
/INC
W1   W2
L1   L2

MAX5454EUB+

GND

SM6T27CA

J3

PWR 2.1mm

D10   D11

GND

DBS104G

C26   C30
100uF 100nF

GND   GND

78M05   U10   VDD5V

IN   OUT
GND

GND

C31   C27
100nF 10uF

GND   GND

VBUS

S8

D12
BAT165

S9

ON/OFF

C28
10uF

GND

U9   Vfixed 3.8v

In   Out
In   Out
POK
Set
/SHDN   GND

MAX1806EUA33+

R69
470k

R72
22k

GND

R70   C29   C25
100k   10uF   100nF

GND   GND

VCC

R71
150R

D9

Green

GND

VTG'

C37   C38
10uF   100nF

GND   GND

VCC

C39   C40
10uF   100nF

GND   GND

BT1

3xAAA

GND

D13
BAT165

VDD5V   D14   VBUS

BAT165 R73   Q9
        10k   FDV304P

UVcon   R74 100k   Q10
                     BC847C

R75
10k

GND   GND

Note:
The board must supply 5V to VBUS
when U1 is in USB host mode (USB
OTG).

An External power supply must be used
in this case.

Title
nRF6310

Size   Project Number   Revision
                                      1.3
Date: 22.05.2008   Sheet 4 of 5
File: Power supply_Rev1_3.SchDoc   Drawn By: KJO

NORDIC
SEMICONDUCTOR

P1
1 2
3 4
5 6
7 8
9 10
Buttons
GND

P2
1 2
3 4
5 6
7 8
9 10
LEDs
GND

VEXT
R17 150R R18 10k S0 GND
VEXT
R19 150R R20 10k S2 GND
VEXT
R21 150R R22 10k S4 GND
VEXT
R23 150R R24 10k S6 GND

VEXT
R25 150R R26 10k S7 GND
VEXT
R27 150R R28 10k S5 GND
VEXT
R29 150R R30 10k S3 GND
VEXT
R31 150R R32 10k S1 GND

VCC R1 4.7k R2 150R D0 Q1A BC847BS GND
VCC R3 4.7k R4 150R D2 Q2A BC847BS GND
VCC R5 4.7k R6 150R D4 Q3A BC847BS GND
VCC R7 4.7k R8 150R D6 Q4A BC847BS GND

VCC R9 4.7k R10 150R D7 Q4B BC847BS GND
VCC R11 4.7k R12 150R D5 Q3B BC847BS GND
VCC R13 4.7k R14 150R D3 Q2B BC847BS GND
VCC R15 4.7k R16 150R D1 Q1B BC847BS GND

Title
nRF6310

Size Project Number Revision 1.3

Date: 22.05.2008
File: Buttons LEDs_Rev1_3.SchDoc
Sheet 5 of 5
Drawn By: KJO

NORDIC
SEMICONDUCTOR

RoHS
RFD21733
FCC APPROVED

RF DIGITAL
C O R P O R A T I O N

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Layout Examples

RFDANT	RF Module
RFD21743	RFD21731
RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

ETSI • CE Compliant

Surface Mounted RF Module Layout Examples
For Part Numbers RFD21731, RFD21732, RFD21733, RFD21734, RFD21735

Go to http://www.rfdigital.com for complete data sheet.

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21733 FCC Approved - Built-In Antenna

RFD21731 / RFD21732 / RFD21733

21731 / 21732 / 21733 / 21734 / 21735

For use with External Antenna
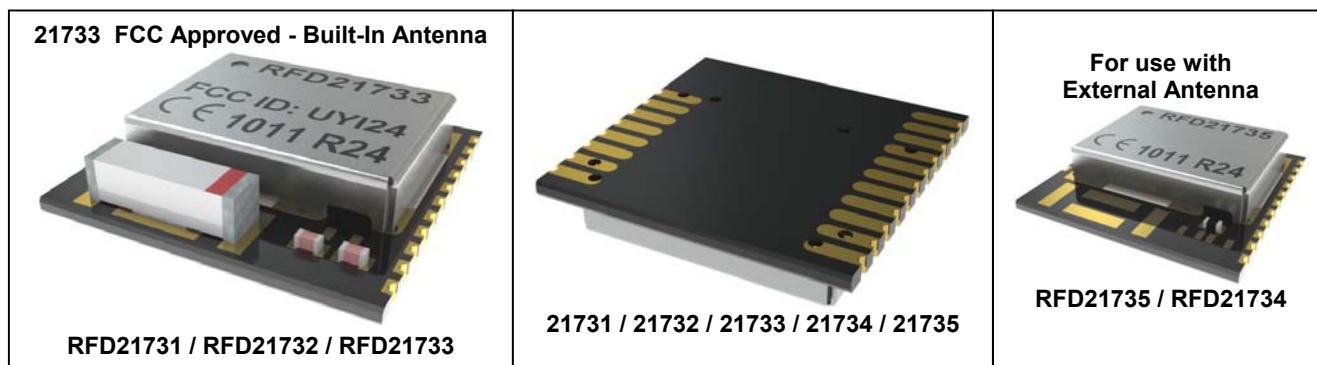
RFD21735 / RFD21734

Legend

Please use the legend below to identify the colors, objects and their meanings in this document.

- 0.031 to 0.062 PCB
- TOP COPPER
- BOTTOM COPPER
- NO COPPER or COMPONENTS
- VIA BETWEEN TOP AND BOTTOM

1

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Layout Examples

RFDANT	RF Module
RFD21743	RFD21731
RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

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RFD21731, RFD21732, RFD21733 Layout Example Pinout

This Layout Examples document only references pins that are common to all RFD21731,2,3,4,5 modules and matter to the layout, which are ground and external antenna connections where applicable. To keep the file size of this document small, some of the larger images are outputted in lower resolutions, for full details on pinouts refer to the data sheet for the appropriate part number, which can all be found at http://www.rfdigital.com.

Pins labels 3,4,5,6,7,14,15,16,17 change based on which part number module is being used, however that does not matter for this document, because the same layout rules apply to the RFD21731, RFD21732, RFD21733, RFD21734 and RFD21735 modules. Majority of this document addresses the RFD21731, RFD21732, RFD21733 and the end of this document addresses the RFD21734 and RFD21735.

If you have any questions, feel free to contact RF Digital Support anytime, we're always here to help you!

1 GND	GND 19
2 GND	GND 18
3 -	- 17
4 -	- 16
5 -	- 15
6 -	- 14
7 -	+V 13
8 GND	GND 12
	EXTA 11
	GND 10
	GND 9

RFD21733 / 21732 / 21731
ANTENNA AREA
NO COPPER ON ANY
LAYER IN THIS AREA

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RFD21731, RFD21732, RFD21733 Layout Examples

The following layout examples are for the RFD21731, RFD21732 and RFD21733 module which all have a built-in chip antenna. Later in this document there are examples for the RFD21734 and RFD21735 modules, which are for use with external antennas.

RFD21731, RFD21732, RFD21733 Antenna Pattern

This is a typical antenna pattern, however does vary based on many factors including surrounding components and ground planes. It is only provided as a reference. The one inch copper plane shown helps maintain the balanced antenna pattern and when possible should be used, if not possible, its not required.
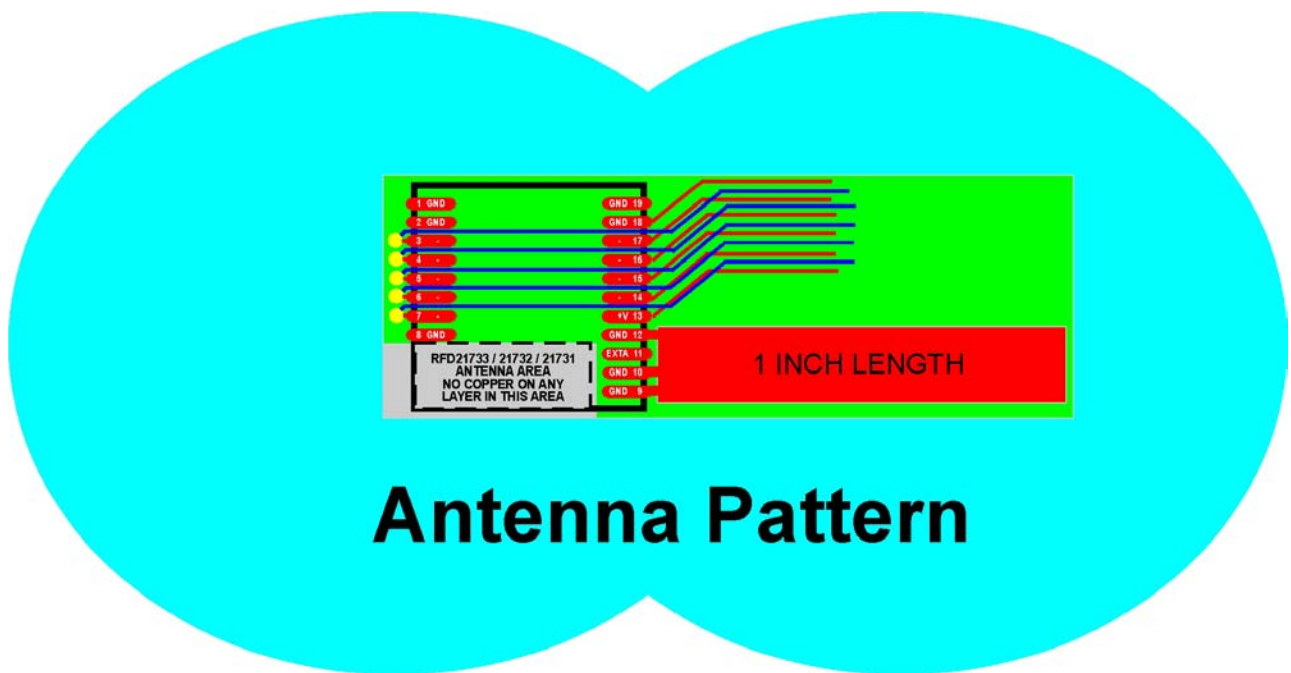
Antenna Pattern

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Layout Examples

RFDANT	RF Module
RFD21743	RFD21731
RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

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RFD21731, RFD21732, RFD21733 Keep Out Area - Example 1

When placing the module info a plastic enclosure, it is highly recommended that you locate the module in the corner of the enclosure / PCB so it will be as far away from your other components on the PCB and as close to free airspace as possible. In addition, you want to locate the module in a position in your product where it will have as much free airspace as possible near the antenna when in use. For example if it will be placed against a wall, it is preferred to locate the module so it will be in a location in your product where it will be on the side of the product where it will be further away from the wall, rather then directly next to it, so the RF signal can have as much free airspace to give you the best range performance possible. (Note: If you plan on using a metal enclosure, you can not locate the module inside of the enclosure or it will have very limited range, for metal enclosures we recommend the RFD21743 which is specifically suited for that.) The electrical ground connection to the module is to be made with a thin trace so the one inch ground plane off to the side can be effective.

Plastic Enclosure

1 INCH LENGTH

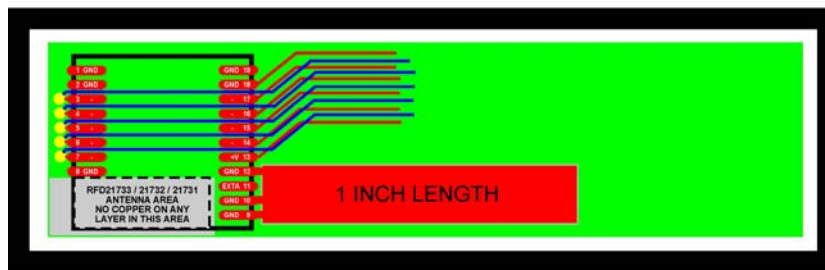KEEP AWAY FROM
ALL METAL OBJECTS

RF Signals in this area.
If you place anything such as components, wires, metal parts of any type in this area, it will block the RF signals and drastically limit your range. Leave this area open.
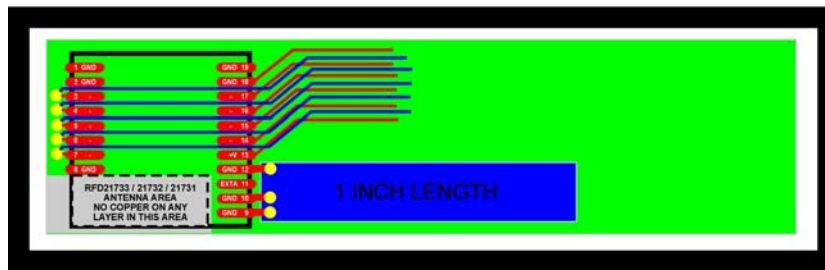
4

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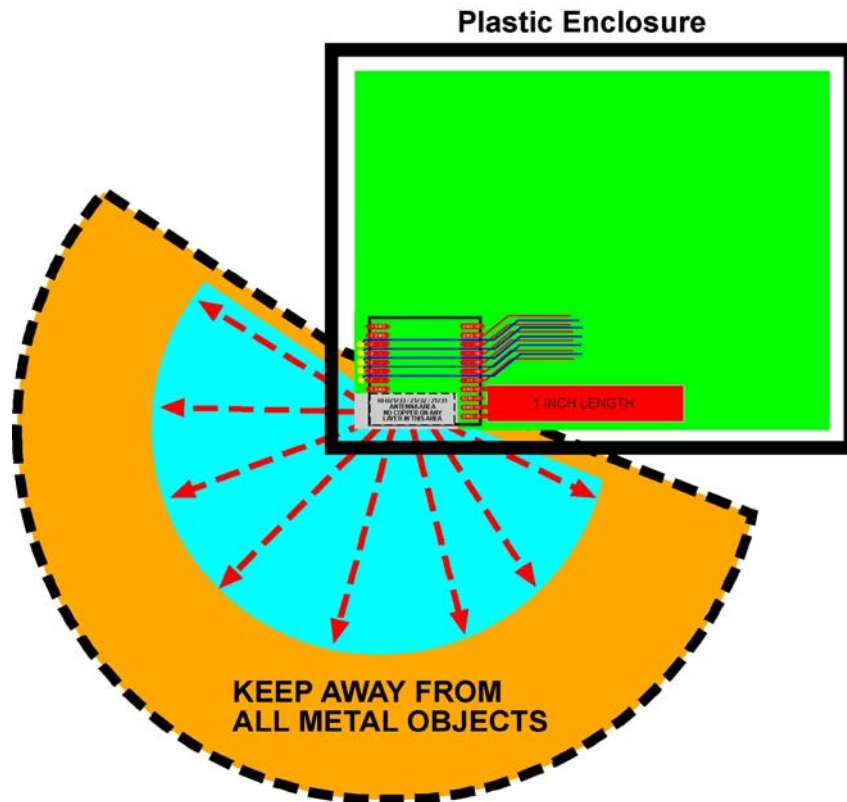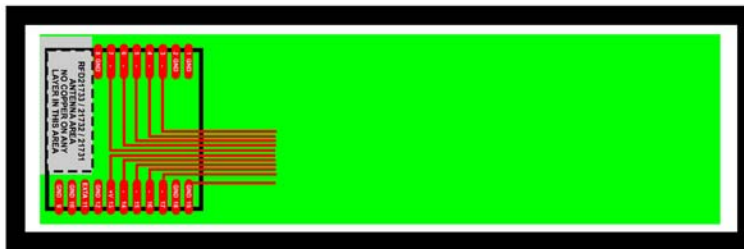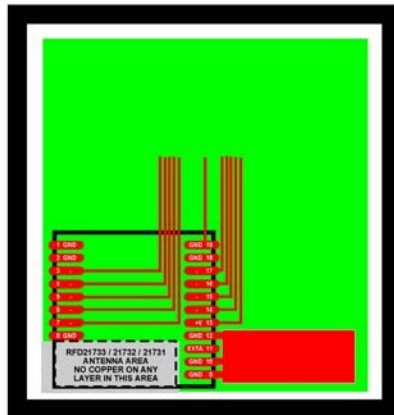
RFD21731, RFD21732, RFD21733 - Layout Examples 2

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground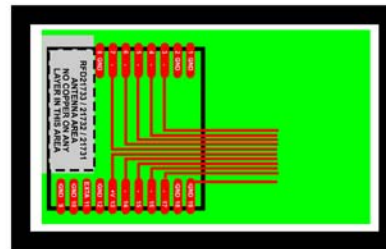 ar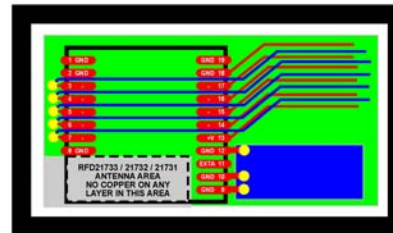ea to t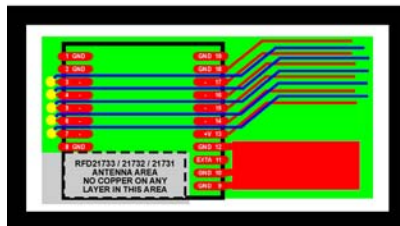he right of the module, again, only if possible. Also the signal connections to the module can be made on either layer. The electrical ground connection to the module is to be made with a thin trace so the one inch ground plane off to the side can be effective.

Plastic Enclosure

1 INCH LENGTH

RFD21733 / 21732 / 21731
ANTENNA AREA
NO COPPER ON ANY
LAYER IN THIS AREA

RF Signals in this area.
If you place anything such as components, wires, metal parts of any type in this area, it will block the RF signals and drastically limit your range. Leave this area open.

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Layout Examples

RFDANT	RF Module
RFD21743	RFD21731
RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

ETSI • CE Compliant
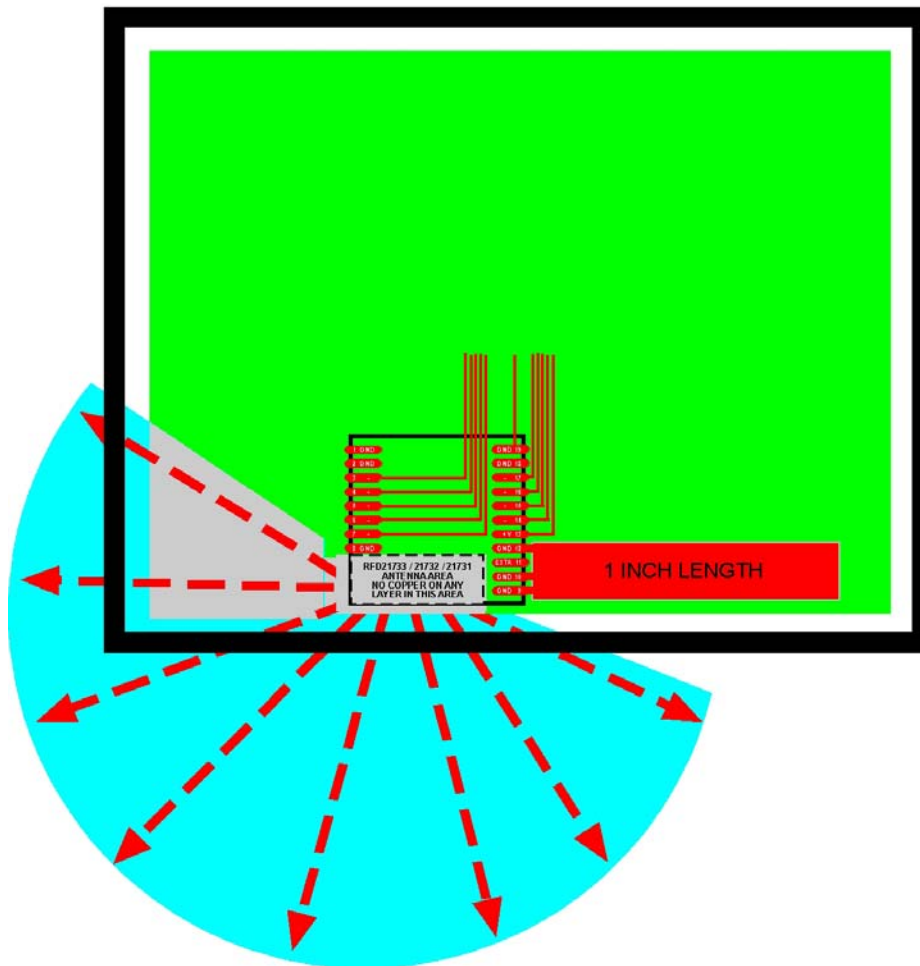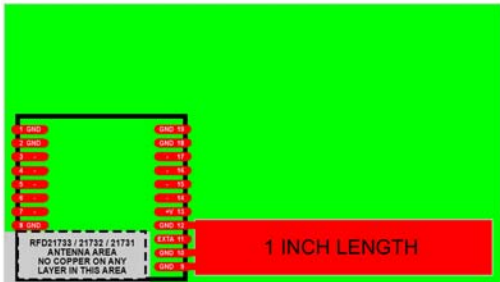
RFD21731, RFD21732, RFD21733 - Layout Examples 3

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground area to the right of the module, again, only if possible.

Plastic Enclosure

RF Signals in this area.
If you place anything such as components, wires, metal parts of any type in this area, it will block the RF signals and drastically limit your range. Leave this area open.

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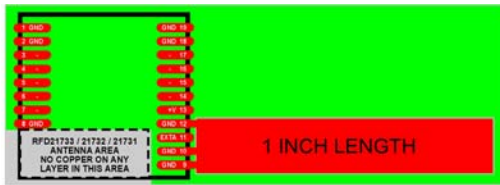Tel: 949.610.0008 • Fax: 949.610.0009
www.rfdigital.com • sales@rfdigital.com
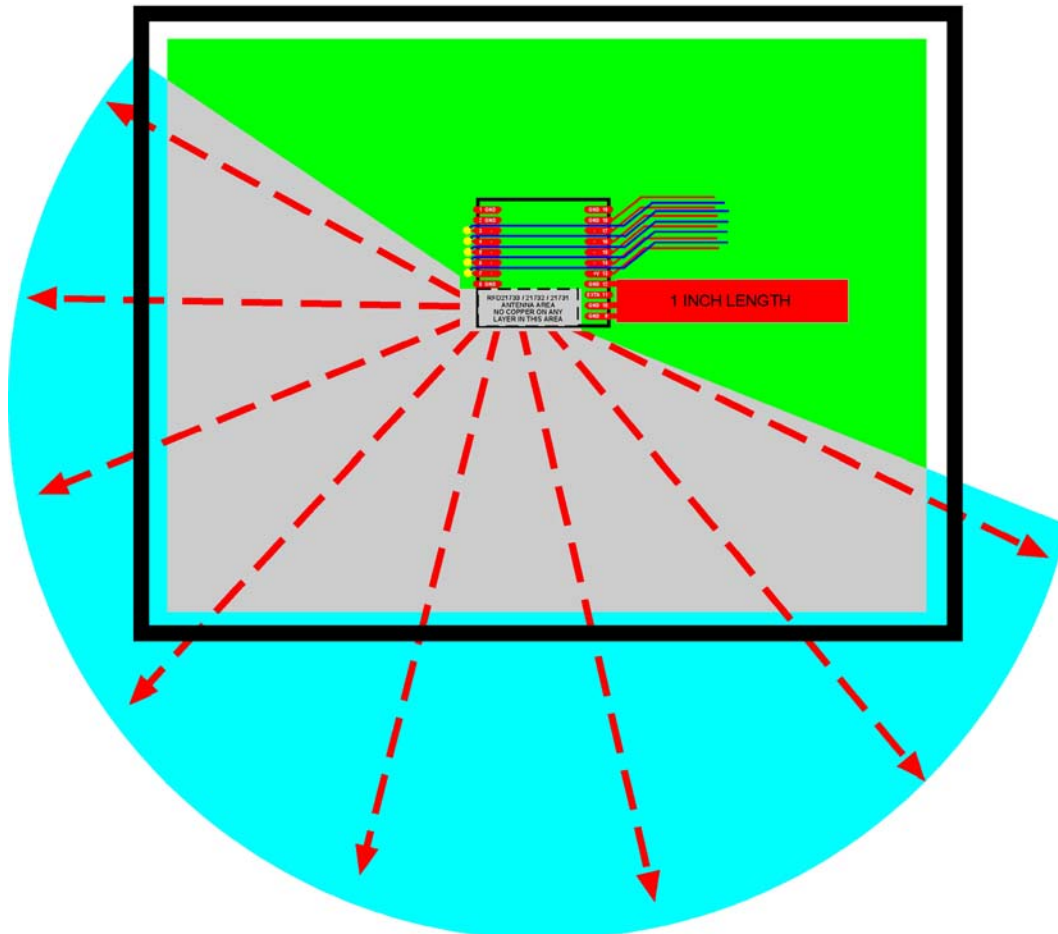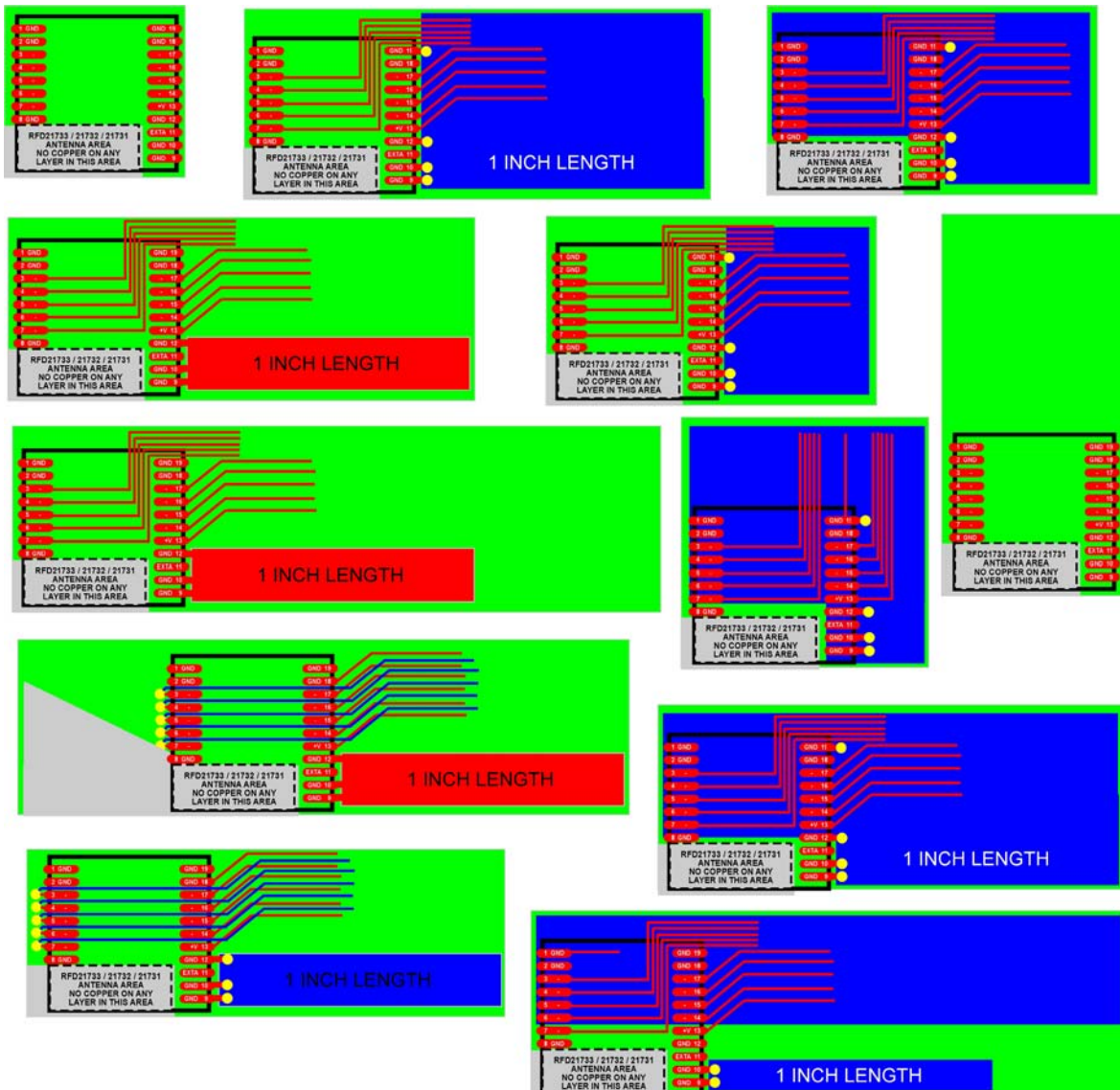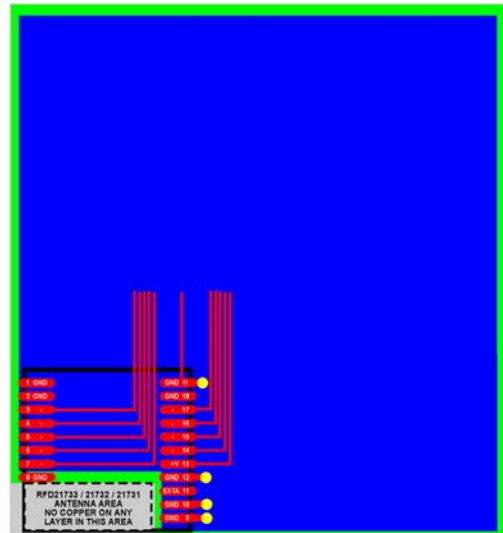
RFD21731, RFD21732, RFD21733 - Layout Examples 4

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground area to the right of the module, again, only if possible.

Plastic Enclosure

Plastic Enclosure

Plastic Enclosure

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Layout Examples

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RFD21743	RFD21731
RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

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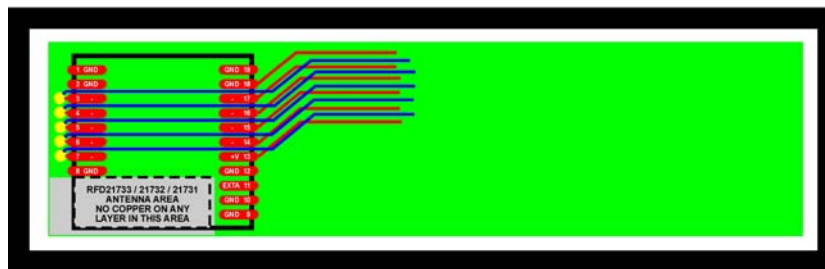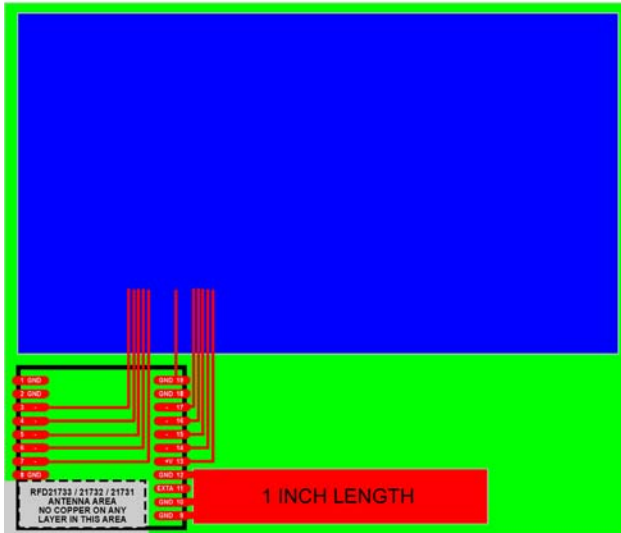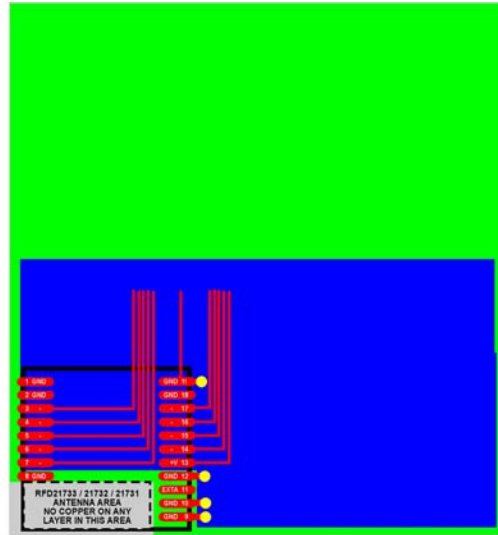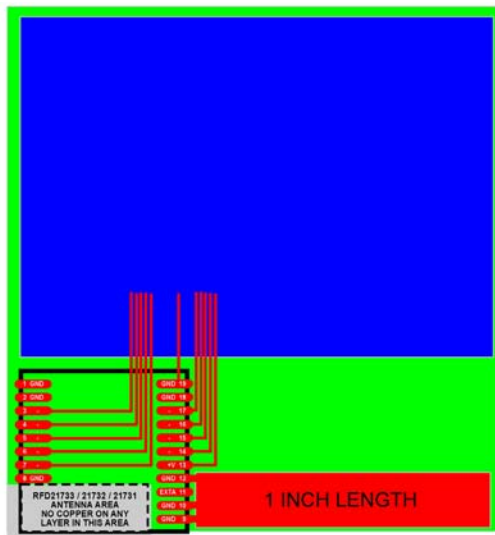
RFD21731, RFD21732, RFD21733 - Layout Examples 5

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground area to the right of the module, again, only if possible.

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Layout Examples
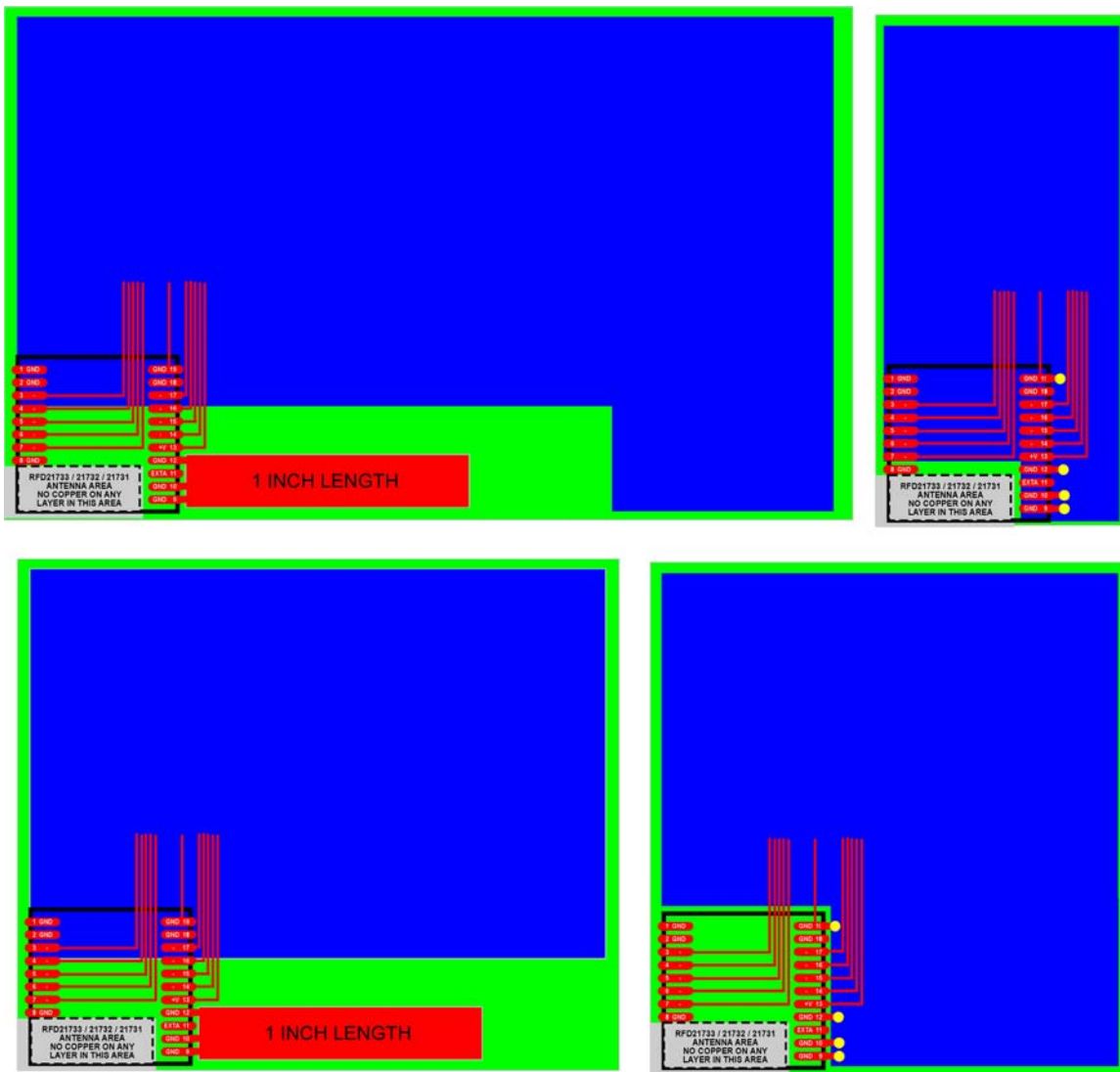| RFDANT	RF Module
RFD21743	RFD21731
RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

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RFD21731, RFD21732, RFD21733 - Layout Examples 6

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground area to the right of the module, again, only if possible.

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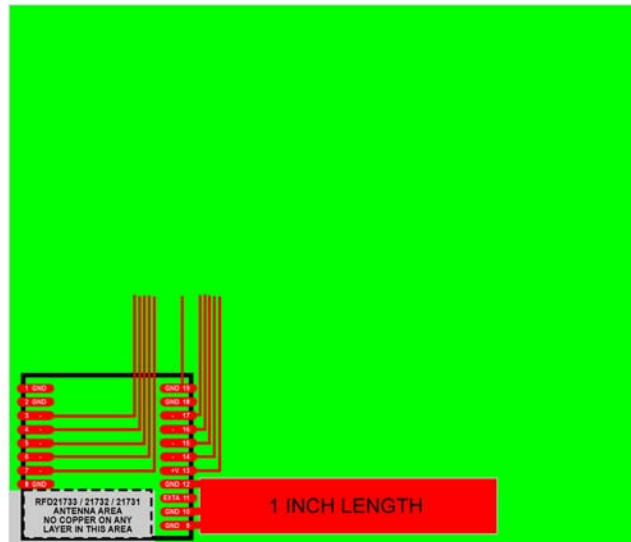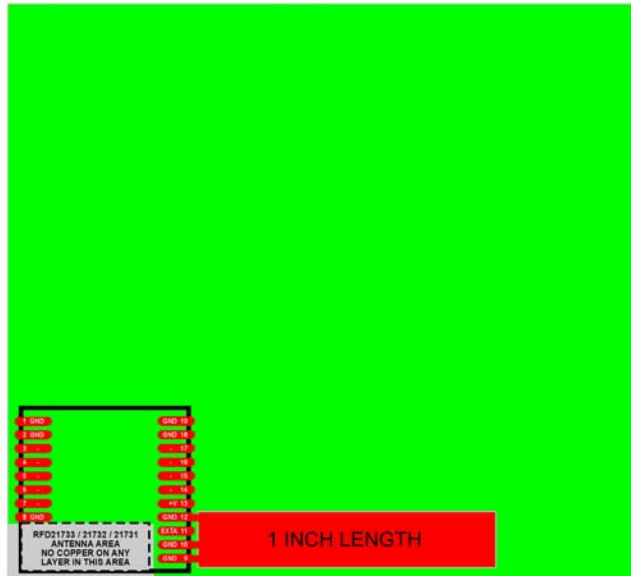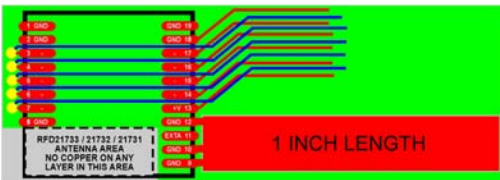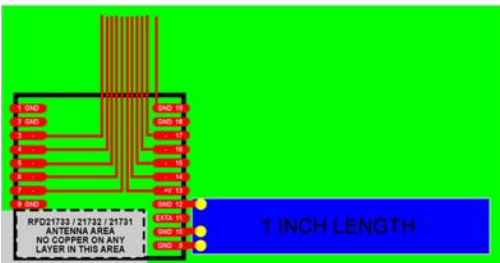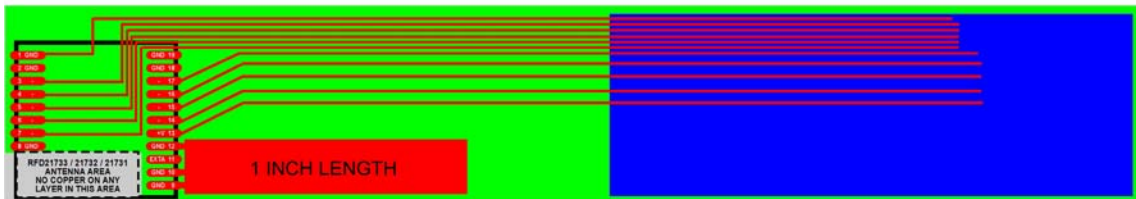
RFD21731, RFD21732, RFD21733 - Layout Examples 7

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground area to the right of the module, again, only if possible. Solid blue areas are solder side ground plane which can be used for user electronics as well as the module. These are all optional configurations and only for reference.

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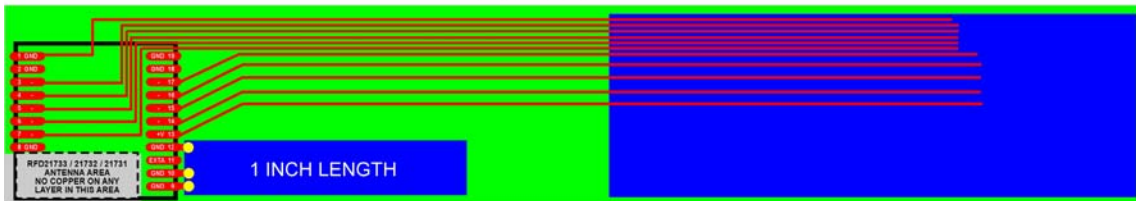## RFD21731, RFD21732, RFD21733 - Layout Examples 8

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground area to the right of the module, again, only if possible. Solid blue areas are solder side ground plane which can be used for user electronics as well as the module. These are all optional configurations and only for reference. The two left examples are preferred, but the two right ones will work as well, but will not have as good of an antenna pattern.
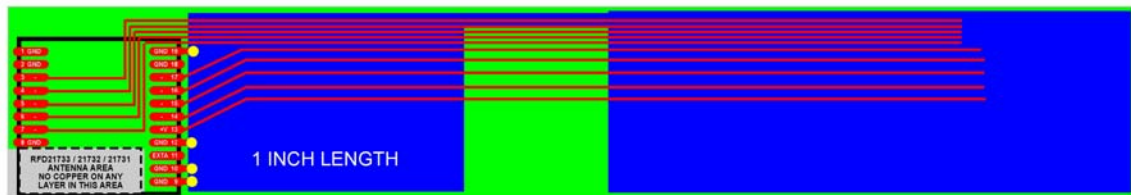

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Layout Examples

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RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

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RFD21731, RFD21732, RFD21733 - Layout Examples 9

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground area to the right of the module, again, only if possible. Solid blue areas are solder side ground plane which can be used for user electronics as well as the module. These are all optional configurations and only for reference. The two left examples are preferred, but the two right ones will work as well, but will not have as good of an antenna pattern.

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Layout Examples
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RFD21741   RFD21732
           RFD21733
           RFD21734
           RFD21735
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RFD21731, RFD21732, RFD21733 - Layout Examples 10

The gray area shows where to keep free from copper and components. The one-inch length copper area is optional, however does improve the range if you can add it. Parts can be placed all over the rest of the board, however if possible keep about a half-inch distance from the one inch length ground area to the right of the module, again, only if possible. Solid blue areas are solder side ground plane which can be used for user electronics as well as the module. These are all optional configurations and only for reference. The space in the ground plane helps provide some RF discontinuity for the module to have he best antenna pattern possible in this configuration, the optimal space to have is greater then 1.2 inches, but some space is better then no space.

13

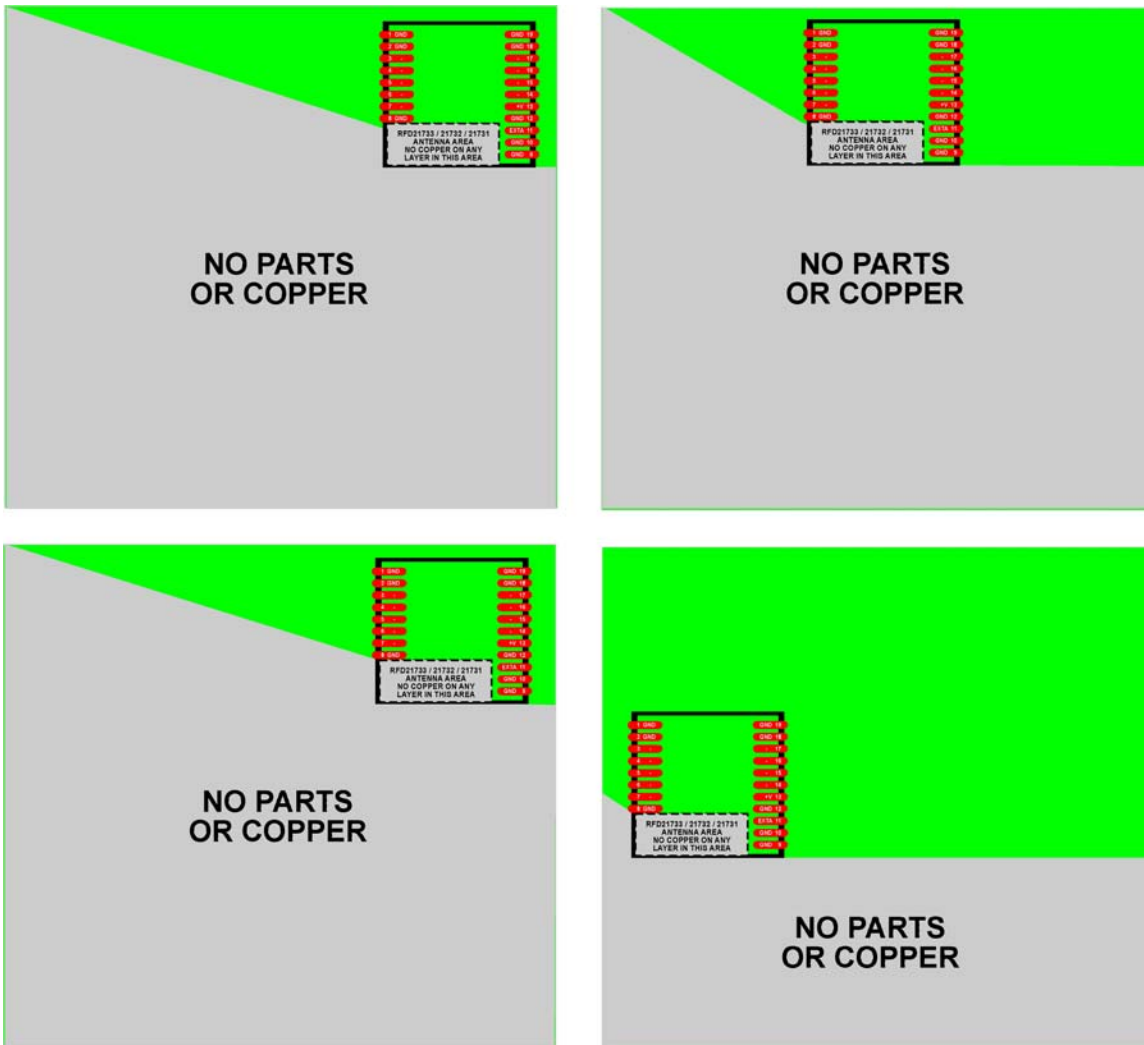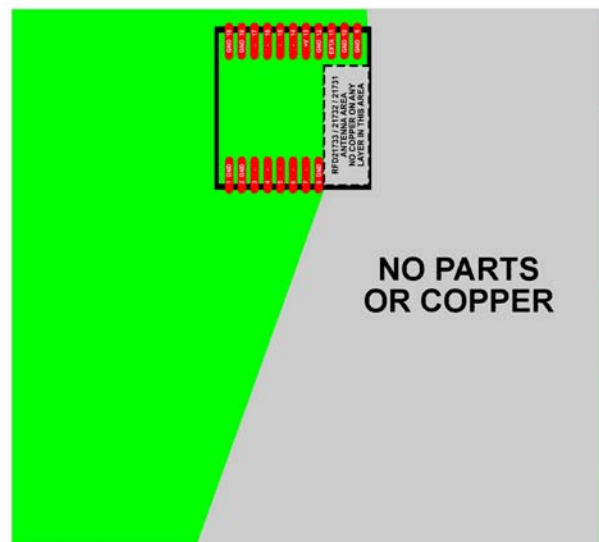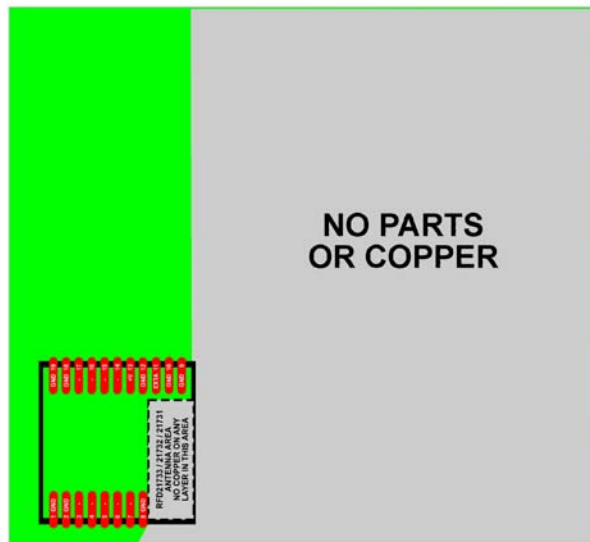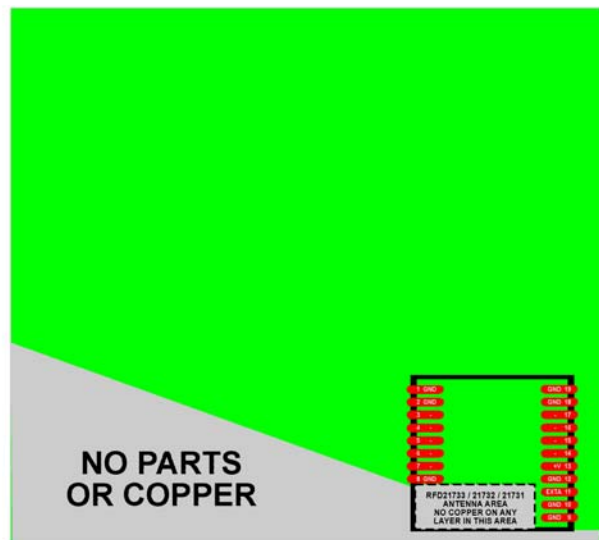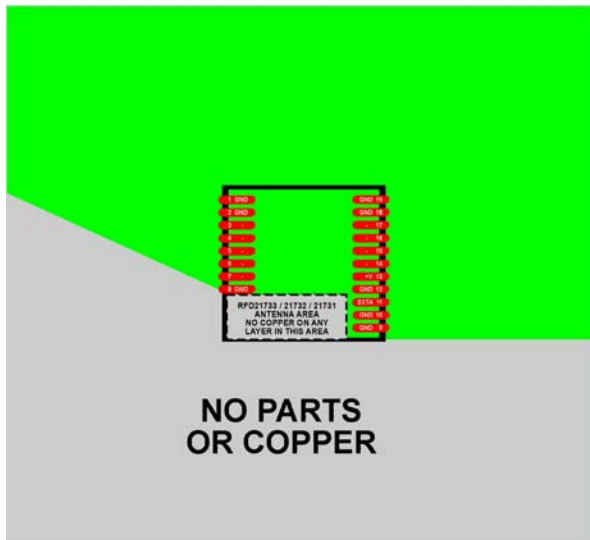For free RF layout design reviews, send color screen captures of your layout to support@rfdigital.com, you will save time and money before you fabricate your boards.
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RFD21741   RFD21732
           RFD21733
           RFD21734
           RFD21735
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RFD21731, RFD21732, RFD21733 - Layout Examples 11

The gray area shows where to keep free from copper and components. These shown are not good layout locations for the module since they take up most of your board area, it is best to locate the module similar to the examples shown in other areas of this document where you have more board space for your parts. These examples are shown as what NOT to do. If you place parts in the gray area, it will result in very bad range performance.

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Layout Examples

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RFD21731, RFD21732, RFD21733 - Layout Examples 12

The gray area shows where to keep free from copper and components. These shown are not good layout locations for the module since they take up most of your board area, it is best to locate the module similar to the examples shown in other areas of this document where you have more board space for your parts. These examples are shown as what NOT to do. If you place parts in the gray area, it will result in very bad range performance.

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	RFD21733
	RFD21734
	RFD21735

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RFD21731, RFD21732, RFD21733 - Layout Examples 13

The gray area shows where to keep free from copper and components. These are multi-module configurations. Typical layouts for diversity applications where you will use multiple receivers, transmitters or transceivers all on the same board to limit multipath impacts and increase effective communication range or provide a very solid coverage area with limited dead-zones. The distances shown are not optimal, however just provided as reference.
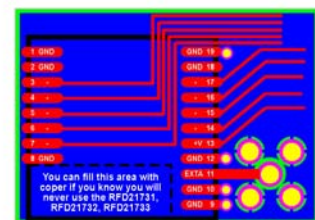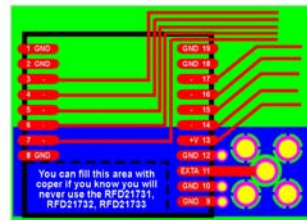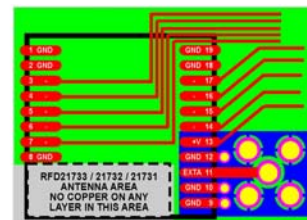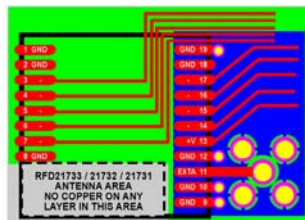
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Layout Examples

RFDANT	RF Module
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RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

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RFD21731, RFD21732, RFD21733 - Layout Examples 14

The gray area shows where to keep free from copper and components. These are multi-module configurations. Typical layouts for diversity applications where you will use multiple receivers, transmitters or transceivers all on the same board to limit multipath impacts and increase effective communication range or provide a very solid coverage area with limited dead-zones. The distances shown are not optimal, however just provided as reference.

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Layout Examples

RFDANT	RF Module
RFD21743	RFD21731
RFD21741	RFD21732
	RFD21733
	RFD21734
	RFD21735

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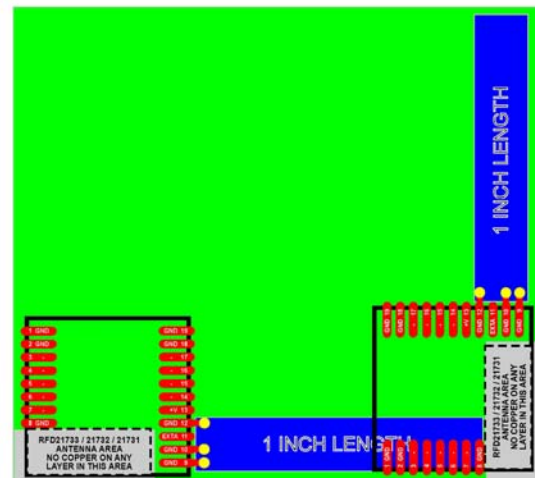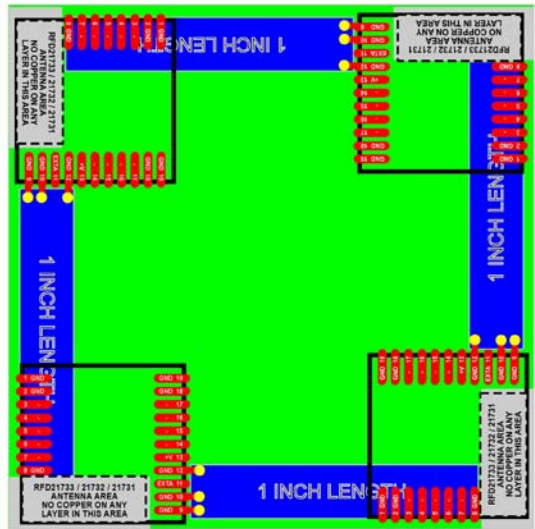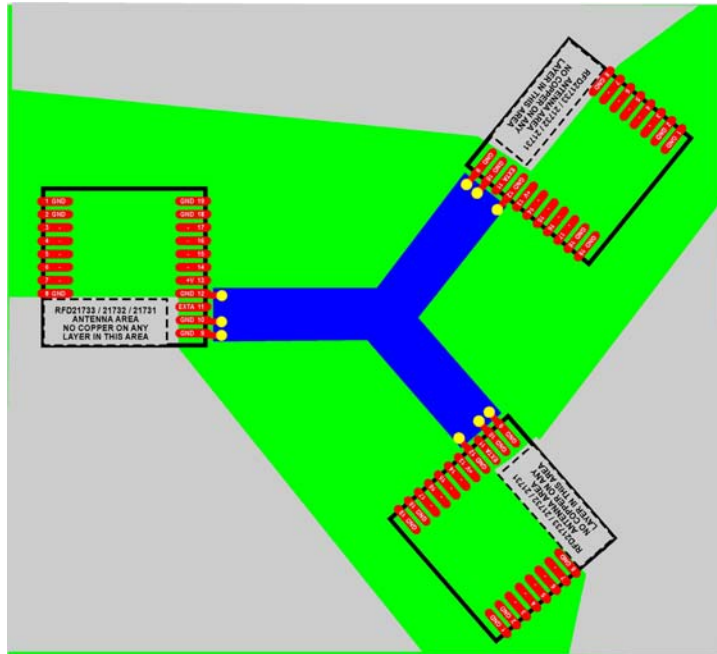
RFD21734 and RFD21735 - Layout Examples 15

The gray area shows where to keep free from copper and components. The RFD21734 and RFD21735 require the use of an external antenna and therefore the most common connector used for this is an SMA and the examples below show a typical SMA connector footprint interface.

PCB thickness is 0.031 inch to 0.062 inch, double sided. The blue color shows ground plane under the module on the solder side of the board.

If you place ground plane or any traces under the greay area marked no-copper, then you will not have the option to use the RFD21731 / RFD21732 / RFD21733 which are the on-board chip antenna versions of the RFD21734 / RFD21735. So it is your choice if you choose to flood copper under that area or not. There is no benefit to flood copper in that area. If you choose to make a dual-mode layout to handle both module options, with chip antenna or without (which is what we recommend), then also advise with the layout configurations above for proper application.

We highly recommend that you look at the RFD21743 before starting a design with the RFD21734 or RFD21735. The RFD21743 is the RF Digital Worldwide Patent Pending RFDANT which is a full RF Module in an antenna form factor (FCC approval pending) allowing you to simply plug it into any product and not needing to do any RF layouts or deal with connectors or cables, in addition to having exceptional range. Save time, money and no need for additional compliance approvals.

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Layout Examples

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	RFD21733
	RFD21734
	RFD21735

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