Radio

nRF52 Global Tech Tour

Radio

- Highlights
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- Radio block diagram
- Specifications; nRF52 vs nRF51
- Encryption and packet assembly
- Hardware
  - External components
  - Simplified matching network

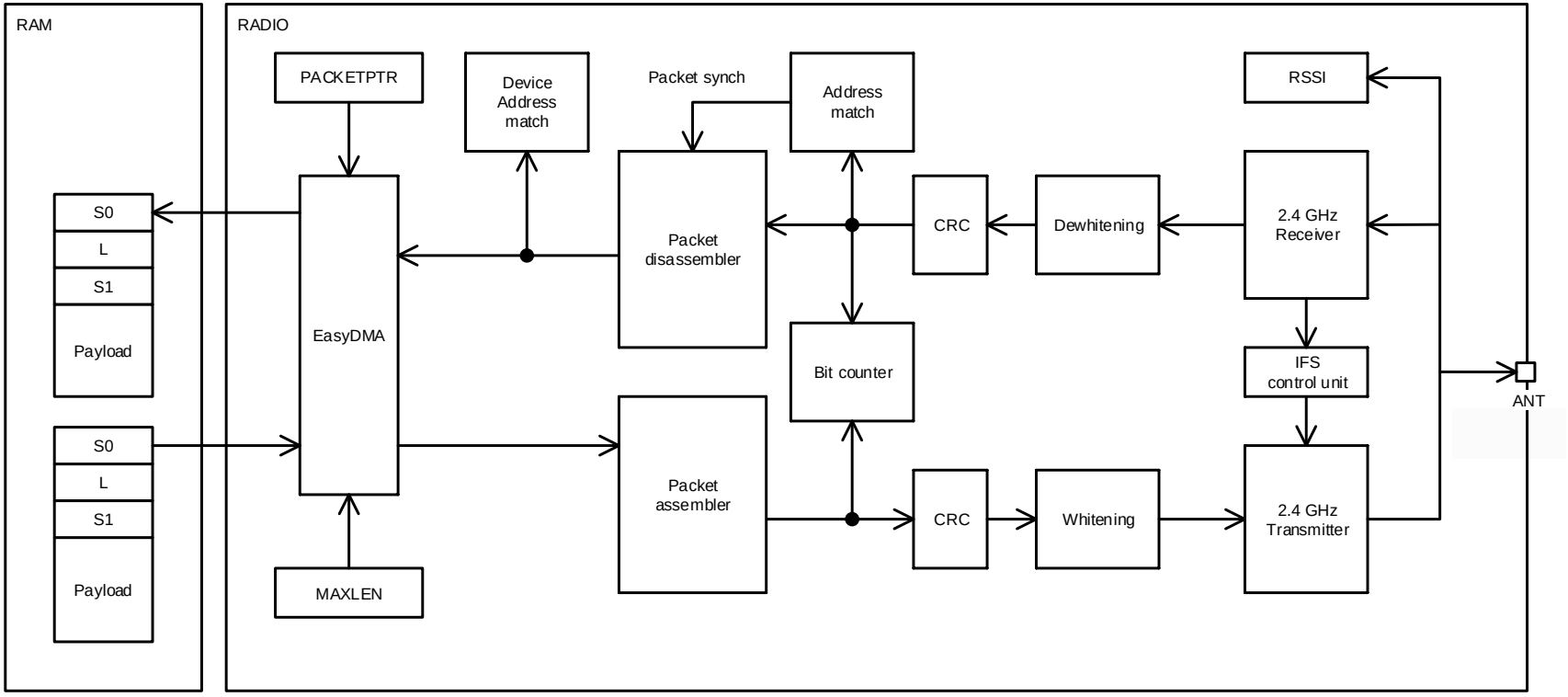
nRF52 radio highlights

- Multi-protocol 2.4GHz Transceiver
  - Bluetooth 4.2 compliant (LE only)
  - nRF24L series 1Mbps, 2Mbps compatible
  - ANT compatible (1Mbps)
- Baseband logic
  - “On the fly” packet assembly/dis-assembly, similar to Shockburst
  - Dynamic payload length – up to 256 bytes
  - Data whitening using 7-bit LFSR
  - PPI support for protocol hardware acceleration
- Processor interface
  - RAM mapped FIFOs, flexible size and placement
  - EasyDMA for payload data
  - SFR for configuration

New features and improvements

- Digital RX IF filters
  - Better performance and selectivity
- Unlimited transmit time
- Fast RX and TX startup: 40 us.
- Increased frequency range
  - 2360 MHz to 2500 MHz
- Wide range RSSI: -90 dBm to -20 dBm
  - Always on, no current penalty
- 1.3 V radio operation -> more efficient use of the DCDC converter.
- On-chip balun: simpler layout and less RF components

Radio block diagram



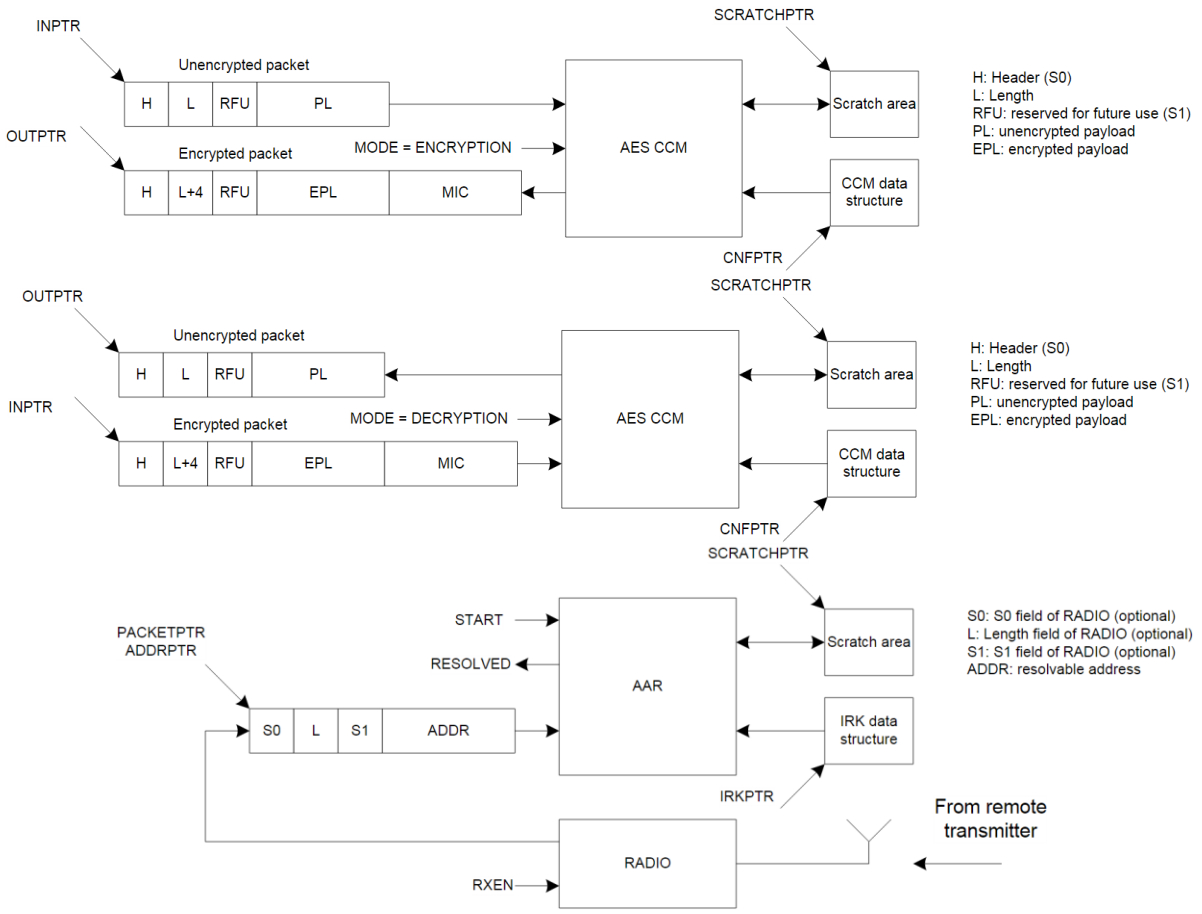
Identical to the nRF51

Specifications; nRF52 vs nRF51

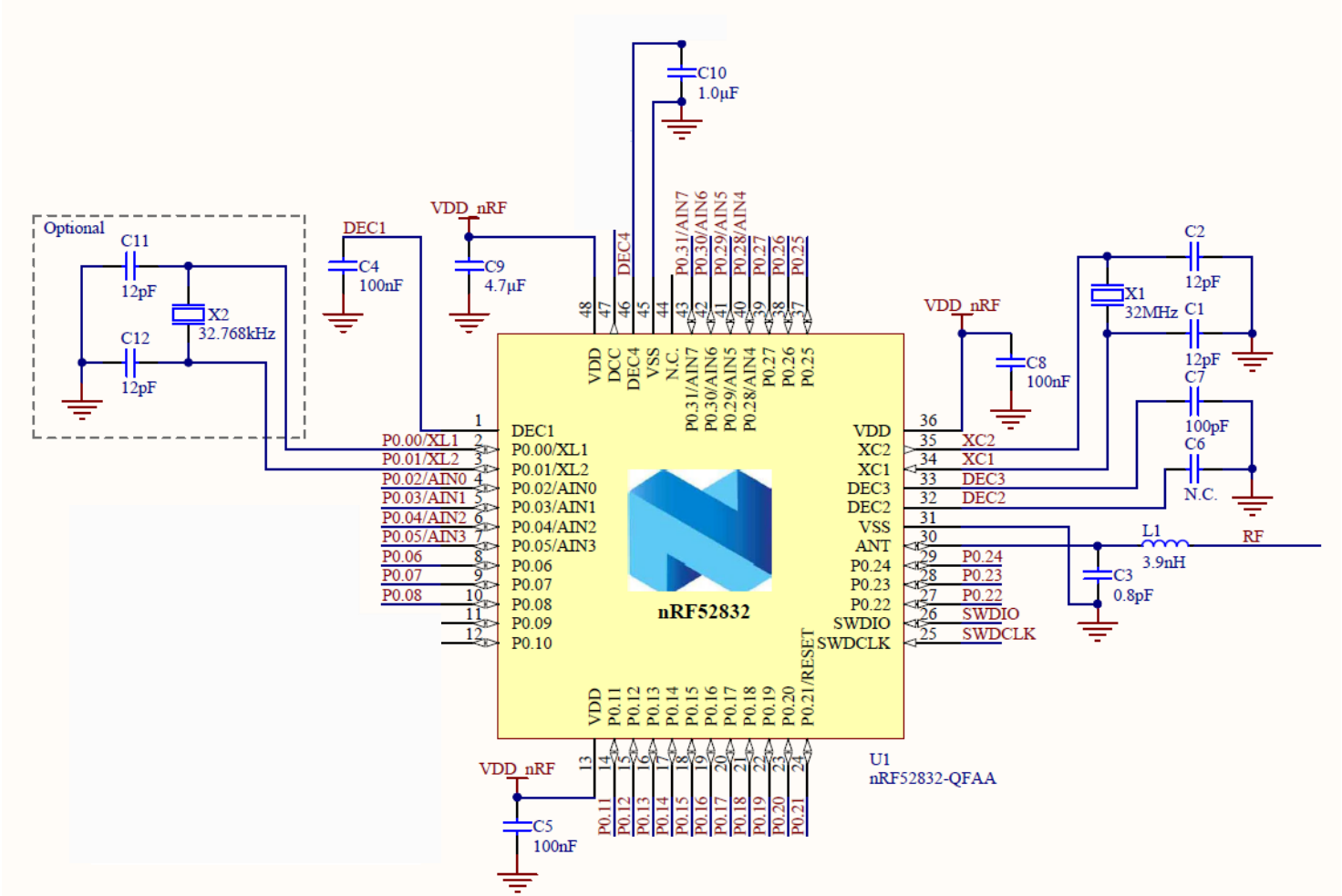
	nRF52832	nRF51	Δ
Protocol support	Bluetooth Smart, ANT, 2.4GHz RF	Bluetooth Smart, ANT, 2.4GHz RF	
RF interface	Single-ended, on-chip balun	Differential, off-chip balun	eBOM, PCB size
RX Sensitivity (1 Mbps BLE) TX Output power	-96 dBm Up to +4 dBm	-93 dBm Up to +4 (3) dBm	+ 4 dB link budget
RX Current	5.4 mA at 3 V with DC/DC 11.7 mA at 1.7 V with LDO	9.9 mA at 3 V with DC/DC 13 mA at 1.8 V with LDO	× ½ RX Current
TX Current (at 0dBm)	5.3 mA at 3 V with DC/DC 11.6 mA at 1.7 V with LDO	8 mA at 3 V with DC/DC 10.5 mA at 1.8 V with LDO	× 0.7 TX Power
Start-up (RX and TX) Switching (RX and TX)	40 µs 20 µs	130 µs 130 µs	> 3x faster
On-the-air data rate	1 and 2 Mbps	1 and 2 Mbps, 250 kbps	- 250 kbps
Total time in TX mode	Unlimited	4 or 16 ms (crystal dependent)	
Crystal frequency	32 MHz	16/32 MHz	

On the fly encryption and packet assembly

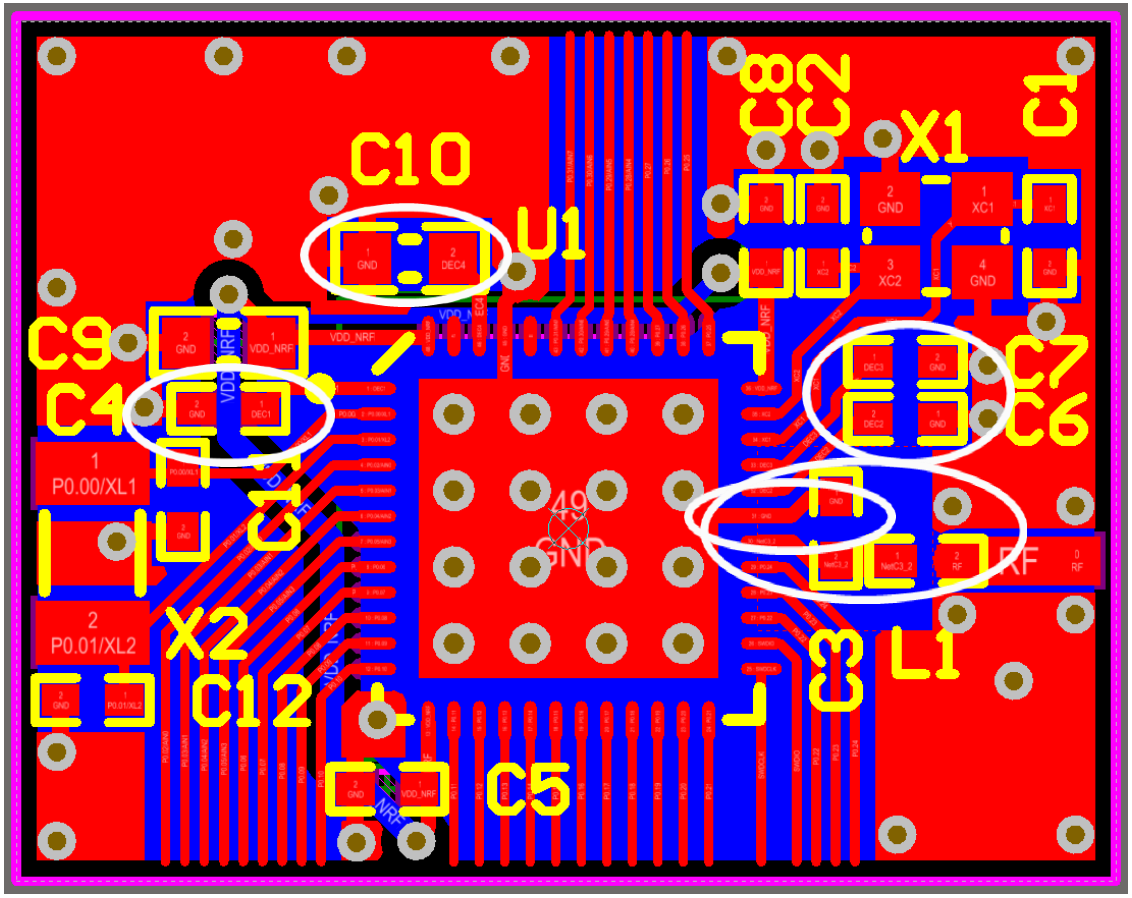
- Encrypt
- Decrypt
- Automatic address resolution



Schematic



Layout

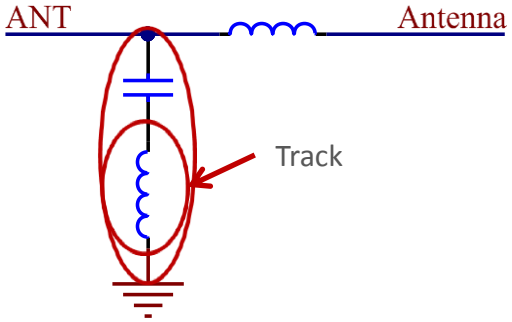


- Decoupling capacitors
- Matching network
- Track

Matching network

- On-chip balun
- Impedance transformation
- Harmonic filterering
- No need for a 3rd party filter balun!

Equivalent circuit



- Resonant frequency between 2nd and 3rd harmonic

$$f = \frac{1}{2\pi\sqrt{LC}} \approx 6\,\text{GHz}$$

$$C = 0.8\,\text{pF}$$

$$L = 0.9\,\text{nH} \approx 0.9\,\text{mm length}$$