

Integrated Passive Device for Nordic Semiconductor nRF5340-CLAA

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Abstract

This application note serves as a guide on the usage and performance of Johanson Technology's impedance-matched filter 2450FM05A0045001T, designed specifically for the Nordic Semiconductor chipset part number nRF5340-CLAA.

Introduction

Johanson Technology, Inc. (JTI) has created a miniature, impedance-matched filter that is designed to replace the original reference matching network for the Nordic Semiconductor nRF5340-CLAA chipset. This EIA 0202 (0.675mm x 0.53mm) component is designed to both simplify and condense the RF front-end space while providing the necessary filtering to meet certification standards. It is recommended for compact applications where PCB space is a priority in addition to consistency of RF performance over production.

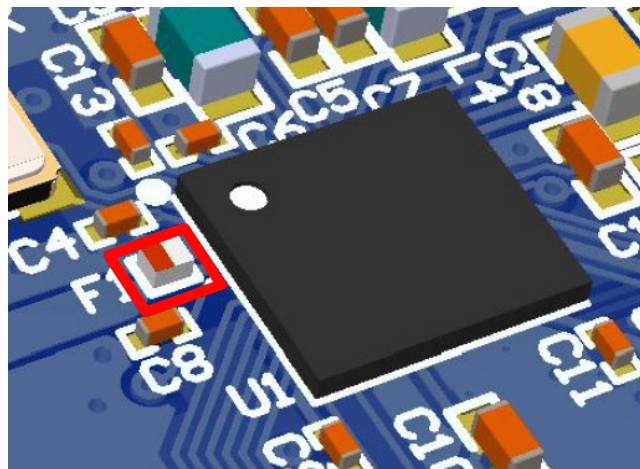


Figure 1. Johanson 2450FM05A0045001T shown in red area.

For more detailed information regarding this IPD, please see the [2450FM05A0045001T datasheet](#).

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Nordic Semiconductor nRF5340-CLAA Discrete Reference Design

The current L/C discrete reference design consists of 3 (4th NC) capacitors and inductors which make up the impedance matching and filtering portion of the RF front end.

Please note that this solution (similar to the original reference) does not include the tuning network for the antenna.

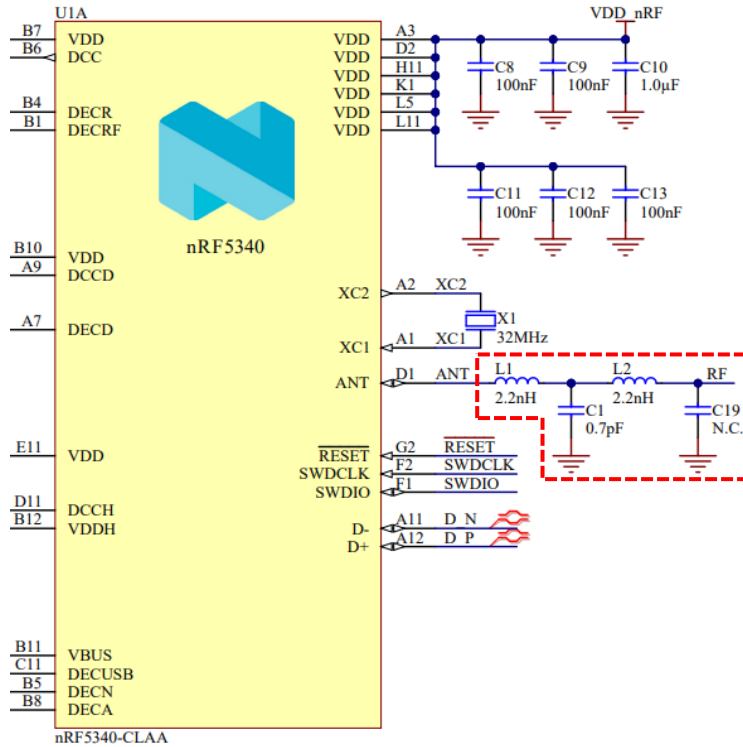


Figure 2. nRF5340-CLAA Reference Design Schematic with **Integrated Components in Red**

Nordic Semiconductor nRF5340-CLAA PCB Layout with Johanson 2450FM05A0045001T

The dimensions for this IPC are a 0.675mm x 0.53mm which is equivalent to an EIA 0202 package device. The exceptionally small size of this solution makes it ideal for compact designs.

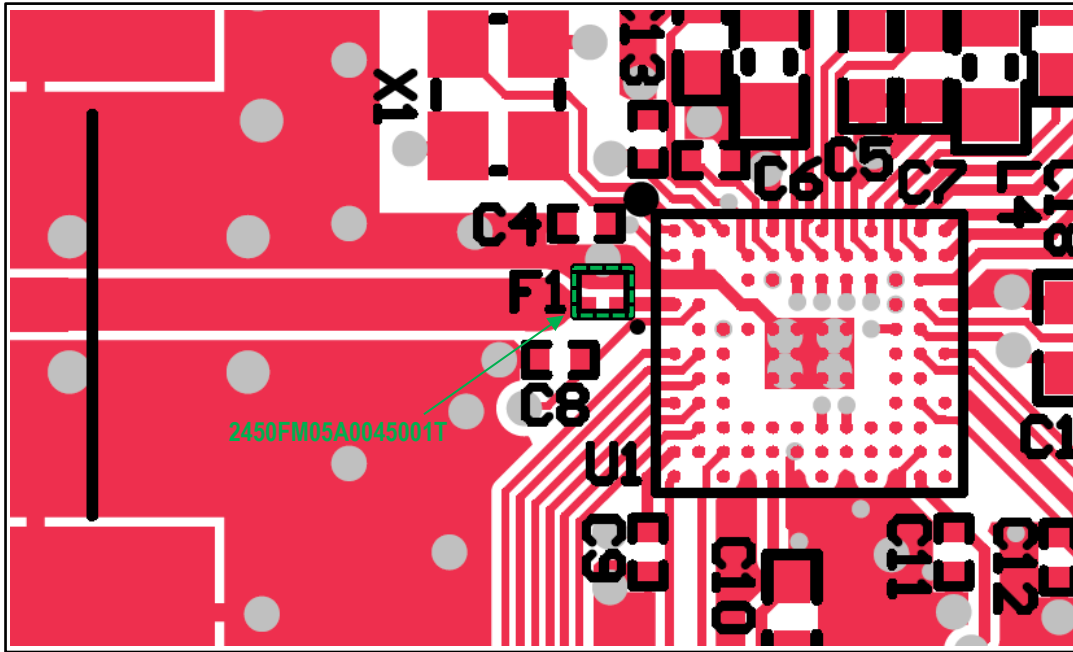


Figure 3. nRF5340-CLAA PCB Layout with Johanson 2450FM05A0045001T

If you would like to connect with a Johanson Technology RF engineer to go over the layout or suggest an antenna to go with your design, see our [Ask-a-question page](#).

Nordic Semiconductor nRF5340-CLAA Reference PCB Stack-up Information

Layer	Material	Thickness	Dielectric Material	Type	Gerber
 Top Overlay				Legend	GTO
 Top Solder	Surface Material	0.010mm	Solder Resist	Solder Mask	GTS
 Top Surface Finish	Nickel, Gold	0.004mm		Surface Finish	
 Top Layer	Copper	0.041mm		Signal	GTL
 Mid-Layer 1	Prepreg	0.073mm	FR-4 Low-CTEz, IPC-4101/128, Tg>150, Halogen-free, NanYa NPG-151	Dielectric	
 Mid-Layer 1	Copper	0.037mm		Signal	G1
 Layer 1	Core	1.224mm	FR-4 Low-CTEz, IPC-4101/128, Tg>150, Halogen-free, NanYa NPG-151	Dielectric	
 Layer 1	Copper	0.037mm		Signal	G2
 Bottom Layer	Prepreg	0.073mm	FR-4 Low-CTEz, IPC-4101/128, Tg>150, Halogen-free, NanYa NPG-151	Dielectric	
 Bottom Layer	Copper	0.041mm		Signal	GBL
 Bottom Surface Finish	Nickel, Gold	0.004mm		Surface Finish	
 Bottom Solder	Surface Material	0.010mm	Solder Resist	Solder Mask	GBS
 Bottom Overlay				Legend	GBO
Total thickness: 1.554mm					

Figure 4. nRF5340-CLAA Reference Design PCB Stack-up

Complete gerber files can be requested from us [directly](#).

Johanson 2450FM05A0045001T Reference PCB Layout

Figure 6 depicts some of the more important characteristics to follow to ensure optimal performance when implementing this IPD. Some key points are:

- Ensure that all RF transmission lines are designed to maintain 50Ω impedance.
- Distance between the IPD and transceiver RF pins is important for proper impedance matching.
- GND via placement plays a significant role in the harmonic filtering of this integrated device.

We recommend that designers download the below reference design layout package to find all the necessary information.

Full reference design layout package can be found [here](#).

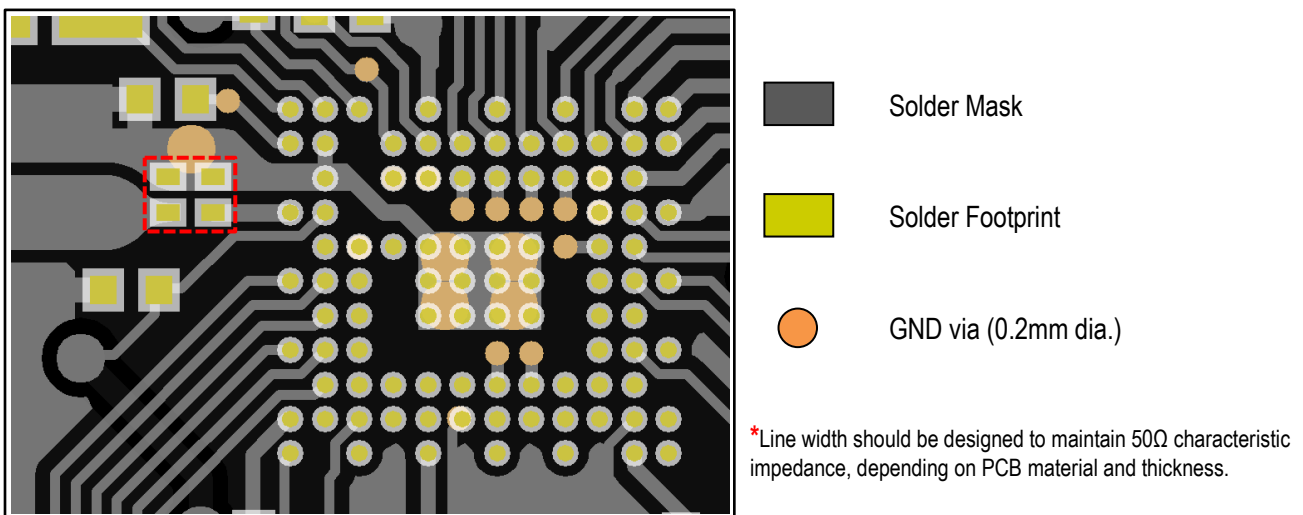


Figure 5. Johanson 2450FM05A0045001T Reference Layout

nRF5340-CLAA with 2450FM05A0045001T IPD Active Power Measurements (Conducted)

The following tables are active measured results of Johanson’s 2450FM05A0045001T IPD when paired with the Nordic Semiconductor nRF5340-CLAA chipset. These measurements are taken on Nordic Semiconductor’s nRF5340-CLAA development board.

2.4GHz, +0dBm Measurement (nRF5340-CLAA + 2450FM05A0045001T)

nRF5340 + 2450FM05A0045001T	Frequency	Measured Power (dBm)
Fundamental	2 400.00	0.76
2nd harmonic	4 800.00	-70.68
3rd harmonic	7 200.00	-72.58
4th harmonic	9 600.00	-45.63
5th harmonic	12 000.00	-70.56
Fundamental Mid	2 440.00	0.96
2nd harmonic	4 880.00	-73.93
3rd harmonic	7 320.00	-71.42
4th harmonic	9 760.00	-45.02
5th harmonic	12 200.00	-69.34
Fundamental Hi	2 480.00	0.88
2nd harmonic	4 960.00	-75.15
3rd harmonic	7 440.00	-70.26
4th harmonic	9 920.00	-43.41
5th harmonic	12 400.00	-67.94

Table 1. nRF5340-CLAA with Johanson 2450FM05A0045001T Measurement Summary 2.4GHz, +0dBm TX Power

2.4GHz, +3dBm Measurement (nRF5340-CLAA + 2450FM05A0045001T)

nRF5340 + 2450FM05A0045001T	Frequency	Measured Power (dBm)
Fundamental	2 400.00	3.18
2nd harmonic	4 800.00	-66.72
3rd harmonic	7 200.00	-61.83
4th harmonic	9 600.00	-40.52
5th harmonic	12 000.00	-57.23
Fundamental Mid	2 440.00	3.09
2nd harmonic	4 880.00	-67.13
3rd harmonic	7 320.00	-61.12
4th harmonic	9 760.00	-40.61
5th harmonic	12 200.00	-57.18
Fundamental Hi	2 480.00	3.00
2nd harmonic	4 960.00	-67.40
3rd harmonic	7 440.00	-59.42
4th harmonic	9 920.00	-40.28
5th harmonic	12 400.00	-57.39

Table 2. nRF5340-CLAA with Johanson 2450FM05A0045001T Measurement Summary 2.4GHz, +3dBm TX Power

Important Links

[*2450FM05A0045001T Datasheet*](#)

[*2450FM05A0045001T Reference Design Layout Package*](#)

[*Johanson Technology Ask-a-question*](#)

[*Nordic Semiconductor nRF5340 Transceivers*](#)

[*Nordic Semiconductor DevZone*](#)