On The PoC Inductor Selection

July 28, 2025

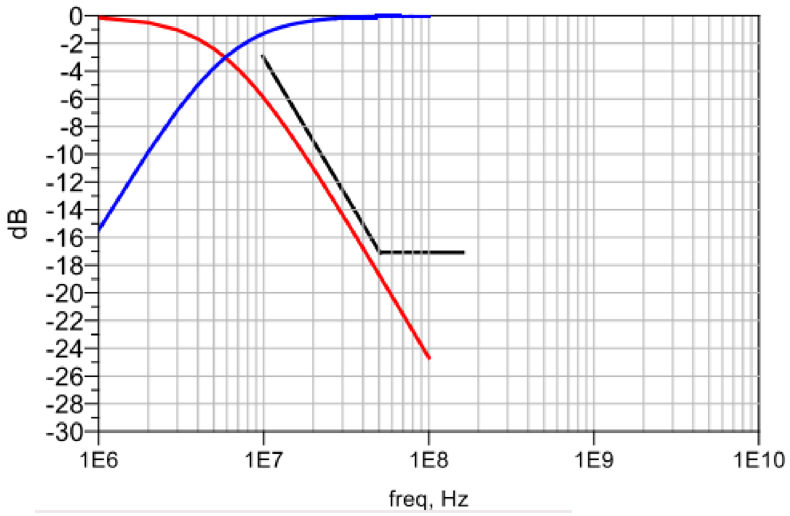
Ahmad Chini
Broadcom

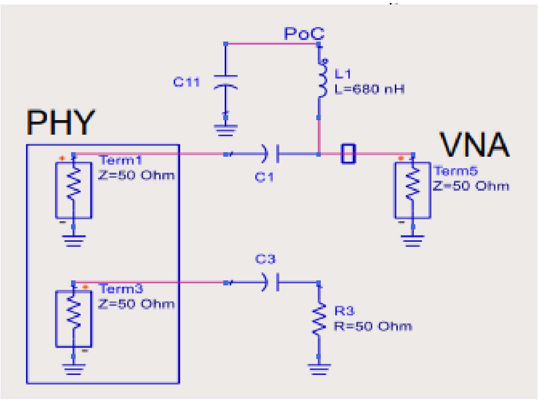
Foreword

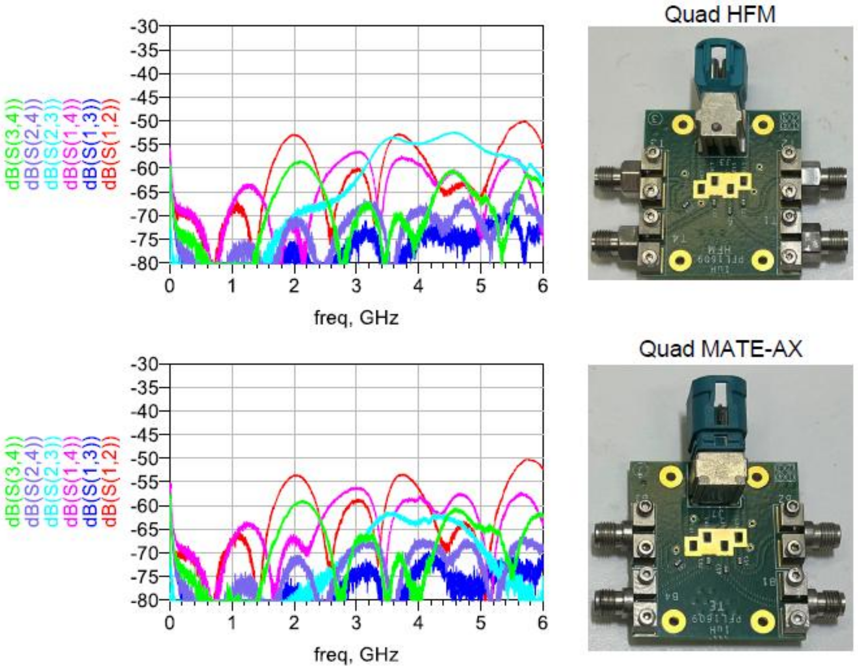
- PoC inductor choices and effect was discussed earlier[1] with the intention of reducing complexity and improve power efficiency.
- It was shown that with a proper MDI RL specification for 802.3dm, the inductor values down 1µH (typical) is allowed.
- The goal of PoC inductor optimization is not only to achieve a single inductor PoC solution, but also to optimize power loss, board area, relative cost, among others.
- This document shows the PoC inductors with smaller inductance provide favorite performance.

1- https://www.ieee802.org/3/dm/public/0924/Chini_Tazebay_3dm_01a_0924.pdf

1uH PoC inductor Example[1]





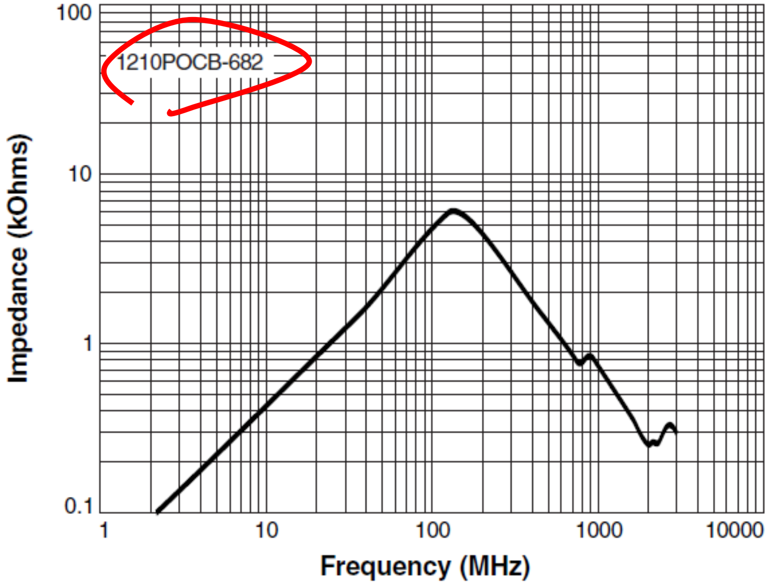


PFL1609 has a physical size of 1.6mm by 0.9mm

- It was shown earlier[1] that a PoC inductor of 1µH, e.g. PFL1609 may be used to meet MDI RL and with a good XTALK performance in a quad implementation and with a small board size

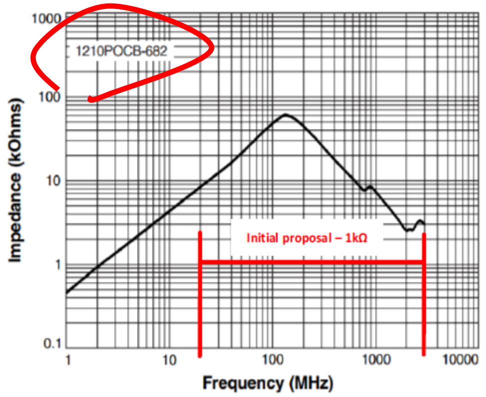
1- https://www.ieee802.org/3/dm/public/0924/Chini_Tazebay_3dm_01a_0924.pdf

New 6.8uH PoC Inductor!

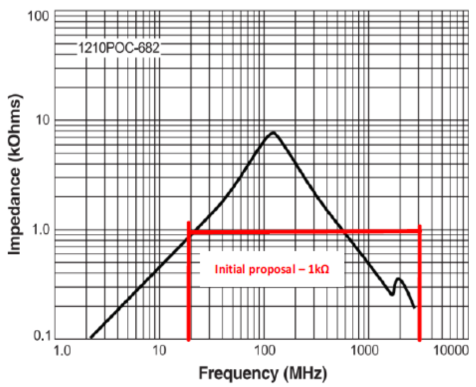


- Older PoC inductors have issues meeting the broadband noise rejection required for 802.3dm
- New PoC inductors are able cover broadband noise rejection required with broadband impedance response

New PoC Inductor



Old PoC Inductor



Referenced: https://www.coilcraft.com/getmedia/9804936a-6bb5-49a8-bcd2-09eba1192490/1210pocb.pdf
Referenced: https://www.coilcraft.com/getmedia/5e8de018-68c5-4442-84ce-d5212c44660c/1210poc.pdf

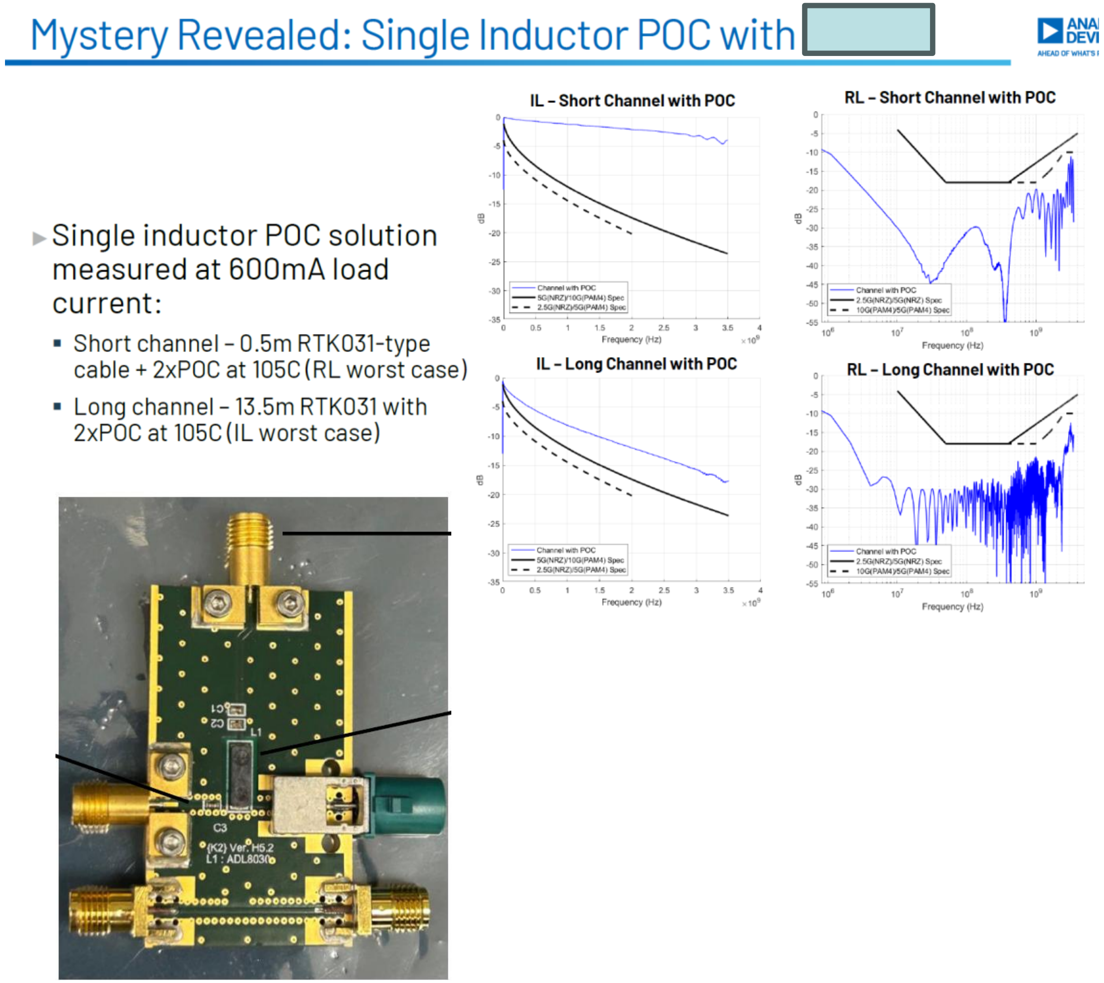
IEEE 802.3dm Task Force

- The so called "New PoC inductor" plot[1] is easily calculated from low frequency impedance to be 68.2μH and **not** 6.8μH! (**a typo?)**
- The referenced link shows the plot for 1210POCB-682 which is a 6.82μH and not as shown in the presentation[2]. With that, the stated proposal of staying above 1kOhm over whole bandwidth is not achieved.

2- https://www.ieee802.org/3/dm/public/0125/Houck_3dm_02_0121_5.pdf

Mystery PoC Inductor for FDD[3]

- The Return Loss plots for FDD[3], clearly show the proposed PoC inductor has inductance of grater than 10µH.
- The part number was not disclosed!
- The self resonance frequency of the inductor when installed on the board is seen to be about 30MHz.
- DCR of the inductor and power rating is not disclosed.
- The size of the inductor is not provided but judging by the connector size on the board, It should be about 8mm by 2mm.



3- https://www.ieee802.org/3/dm/public/0325/[redacted]FDD_PHY_Simulation_Results_and_PHY_Complexity_rev1p0.pdf

Important Parameters for PoC Inductor Selection

- The MDI RL previously adopted for 802.3dm, allows inductors with typical values down to **1µH** to be used.
- 802.3dm contributions on FDD[1] and ACT have suggested larger inductor values and sizes.
- While single inductor solution has been a goal for all the proposed signaling approaches, there are other Important parameters for optimizing the PoC inductors.
    - **SRF:** Typically, PoC Inductors with higher SRF show better high frequency performance.
    - **DCR:** Lower DCR means lower power loss and less heat dissipation.
    - **Rated Current:** The working current with no significant self heat and saturation.
    - **Relative cost:** Ability to operate over a smaller inductor is beneficial for cost optimization as well.
    - **Width** (pad size): Smaller pad size on the board is preferred to reduce parasitic capacitance.
    - **Load variation noise**: Lower the inductance, lower is the transient noises generated by variation in the load (L.di/dt)

1- https://www.ieee802.org/3/dm/public/0325/[illegible]FDD_PHY_Simulation_Results_and_PHY_Complexity_rev1p0.pdf

Example Component Size, Various Inductances

Part number[1]	Inductance[2] ±20% (µH)	DCR (mOhms)[3] typ	DCR (mOhms)[3] max	SRF typ[4] (MHz)	Isat (mA)[5] 10% drop	Isat (mA)[5] 20% drop	Isat (mA)[5] 30% drop	Irms (mA)[6] 20°C rise	Irms (mA)[6] 40°C rise
PFL3215-681ME_	0.68	28	33	450	2100	2500	2700	1500	2100
PFL3215-102ME_	1.0	30	38	375	1800	2100	2300	1400	1900
PFL3215-222ME_	2.2	114	130	250	950	1200	1400	1100	1400
PFL3215-332ME_	3.3	175	195	190	730	920	1100	820	1100
PFL3215-472ME_	4.7	332	372	170	640	810	900	520	720
PFL3215-682ME_	6.8	640	720	155	600	700	750	370	500
PFL3215-103ME_	10	1290	1340	125	500	550	600	300	390
PFL3215-153ME_	15	1800	2100	105	350	420	440	240	320
PFL3215-333ME_	33	1700	1920	13.5	290	340	360	270	360

- The table above shows a range of power inductors with the same physical size of 3.2mm by 1.5mm
- Comparing DCR, SRF, and current level, it is seen that low inductance components have better DCR, SRF and current handling.

1µH versus 6.8µH PoC Inductor Examples

- **PFL2015-102 (a good choice for TDD)**
  - AEC-Q200, -40C to +125C
  - Size: 2.2 x **1.27** x 1.5
  - Inductance: 1µH
  - Max DCR (@25C): 130mΩ
  - SRF: 450MHz
  - Current (10% saturation and 20C rise): 900mA

- **1210POCB-682 (suggested for ACT[2])**
  - AEC-Q200, -40C to +125C
  - Size: 3.3 x **2.67** x 2.0
  - Inductance: 6.8µH
  - Max DCR (@25C): 210mΩ
  - SRF: 120MHz
  - Current (30% saturation and 15C rise at125C): 620mA

Current Level	**TDD PFL2510-102**	**ACT 1210POCB-682**
300mA	15mW	25mW
600mA	61mW	98mW

30% rise in DCR assumed with temperature

- The POC inductor suggested for ACT has
  - Larger pad size (2.67mm vs 1.27mm)
  - Lower current rating
  - ~66% Higher DCR (power loss)
  - ~40% Higher cost (https://www.coilcraft.com)

2- https://www.ieee802.org/3/dm/public/0125/Houck_3dm_02_0121_5.pdf

Summary and Conclusions

- The particular PoC inductors suggested for FDD[*] and ACT[**] have larger inductance than 1µH PoC inductor suggested for TDD.
- While single inductor PoC solution is mentioned for ACT, some other aspects of PoC inductor are not optimized.
- For a given physical size, 1µH inductor provides great advantages for DCR, SRF and current rating.
- There are many good choices available for 1µH PoC solution. An example PoC inductor is shown to have, lower size, higher current rating, lower power loss and lower cost when compared to 1210POCB-682 suggested for ACT.
- For TDD, there are many good 1µH inductors available that meet the MDI RL and provide more efficient solutions for PoC.

* https://www.ieee802.org/3/dm/public/0325[illegible]_FDD_PHY_Simulation_Results_and_PHY_Complexity_rev1p0.pdf

** https://www.ieee802.org/3/dm/public/0125/Houck_3dm_02_0121_5.pdf

Thank you

Questions?