Power Coupling Inductance and Droop

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ANALOG DEVICES

AHEAD OF WHAT'S POSSIBLE™

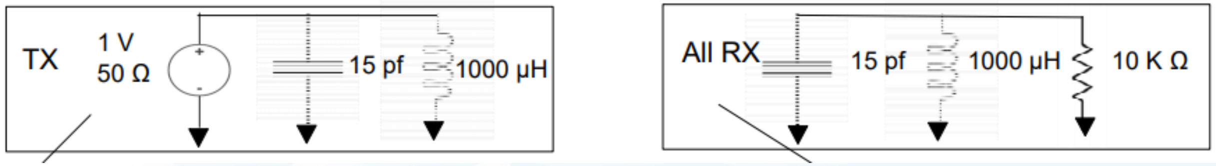
Critical Power Parameters

- Several critical system parameters should be resolved to move power specification forward
  - C_{PD} – Sets classification timing and inrush eg rise/fall times
  - R_{CABLE} – Determines P_{CABLE_max}, P_{PDs_max}
  - **L_{PD} – Affects economic feasibility and classification timing**
  - **N (num PDs) – Affects Inductor Size L_{PD}**
  - **Droop (V_{DROOP}, T_{DROOP})– Determines L_{PD}**
  - **Baud Rate - Determines L_{PD}**

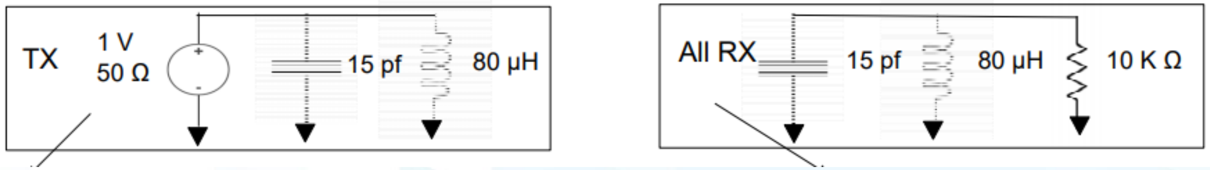
Modeling Hurdles

- We need real inductor models for the Mixing Segment Model
- Chris DiMinico's presentation on Nov 18, 2020 used 80uH and 1000uH ideal inductors
- 80uH * 16 taps is going to have much more droop than 1000uH * 16 taps
- 1000uH inductors have higher C-par than 80uH inductors of equal size (extracted from inductor SRF)

50 m –16 tap – 1000 µH PoDL



50 m –16 tap – PoDL

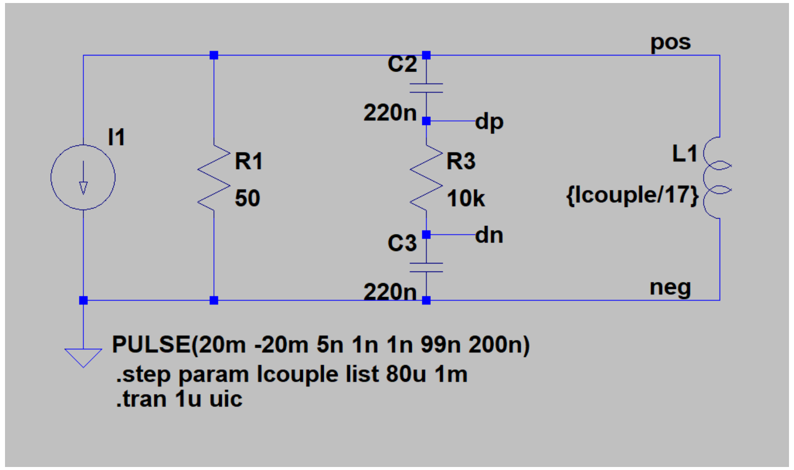


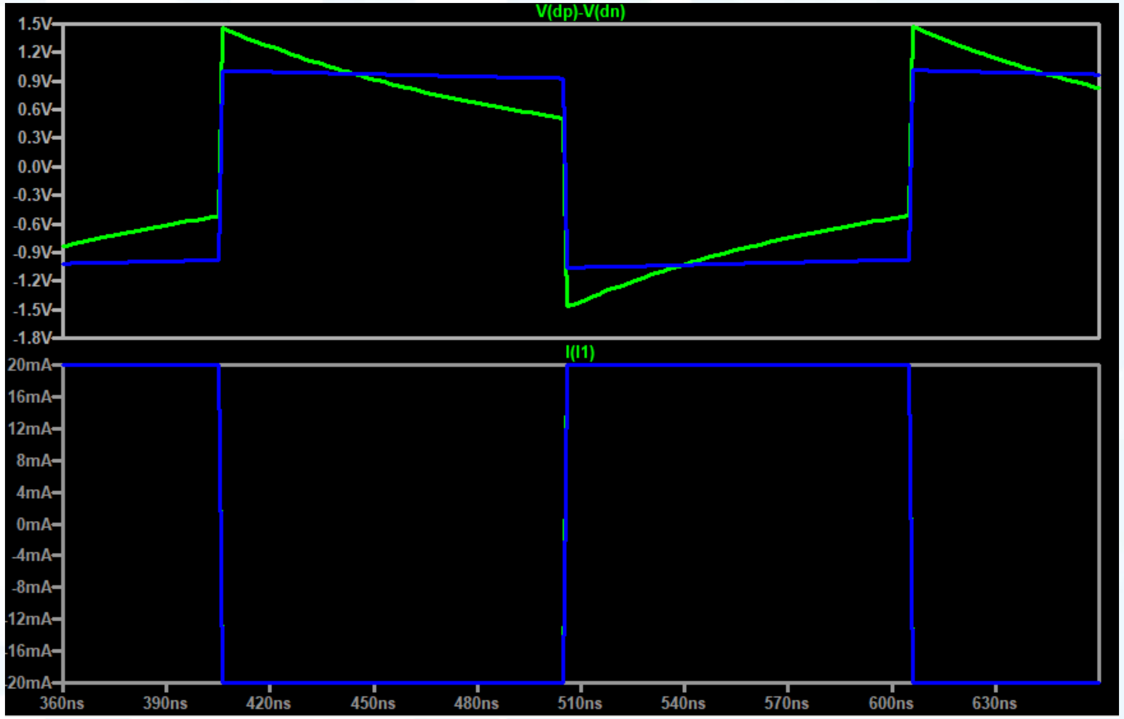
SPE Multidrop Enhancements Mixing Segment Considerations Update

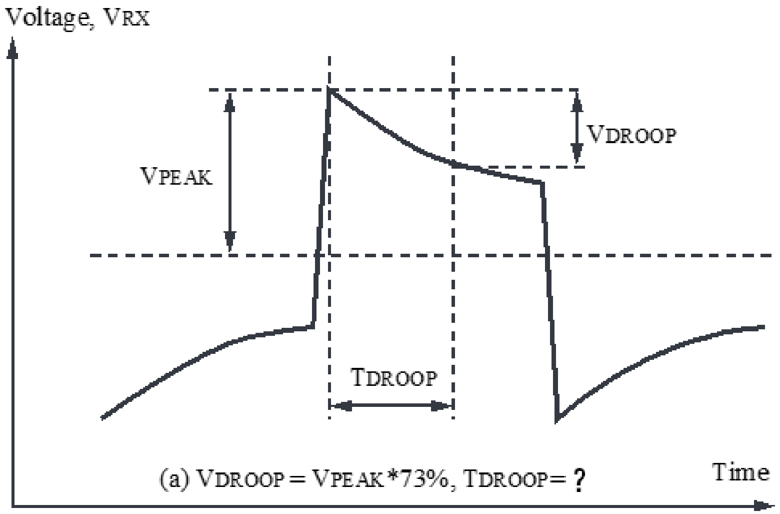
November 2020

Chris DiMinico/MC Communications/PHY-SI LLC/SenTekse/Panduit

Simple Model For Droop w/ 16 PDs + 1 PSE (80uH/node and 1000uH/node)







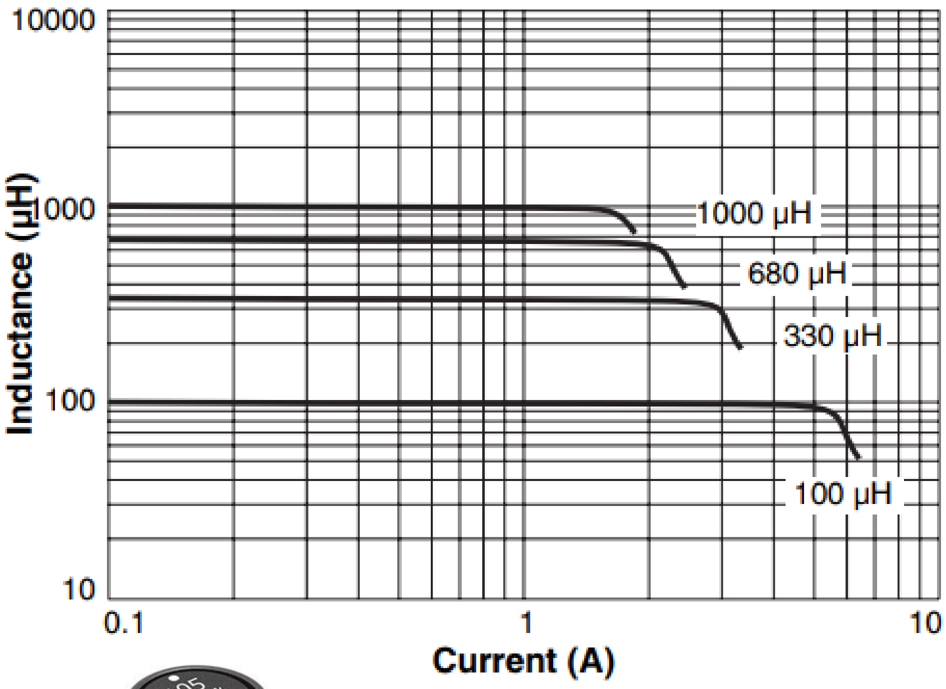
(a) VDROOP = VPEAK*73%, TDROOP= ?

- Can we specify a TDROOP and VDROOP?

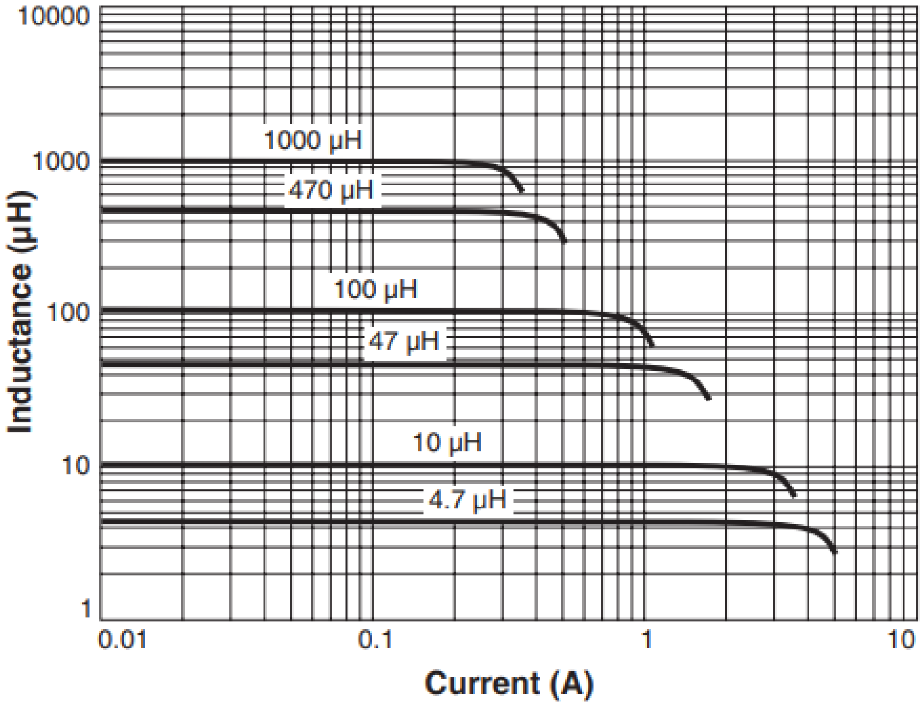
Example: Coilcraft MSS1812-T vs MSD7342

- Arbitrarily selected inductor vendor
- Size trades off with inductance and current carrying capability

Typical L vs Current



Typical L vs Current



Conclusions

- For power development to continue we need to settle on a number for minimum inductance (L_{PD}) per node
- The data path's tolerance to droop and the number of nodes in the system will be the determining factors
- Tolerating more droop will allow for smaller inductors – enables smaller solutions
- Can PDs that require more power use smaller coupling inductors?
  - Fewer high-power PDs can be powered per link segment
  - Coupling inductors could assigned per-class