# 802.3da Power Classes

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AHEAD OF WHAT'S POSSIBLE™

# Critical Power Parameters

- Coupling Inductance ($L_{PD}$) needs to be resolved to move power specification forward
  - **$L_{PD}$ – Affects economic feasibility and classification timing**
  - **N (num PDs) – Affects Inductor Size $L_{PD}$**
  - **Droop ($V_{DROOP}$, $T_{DROOP}$)– Determines $L_{PD}$**
  - **Bit Rate - Determines $L_{PD}$**
- Optimize $L_{PD}$ to minimize cost and size
- Make $L_{PD}$ inversely proportional to PD current
  - Allow high-power PDs to use lower $L_{PD}$ since fewer high-power devices can be connected

# Keep total inductance > 40uH

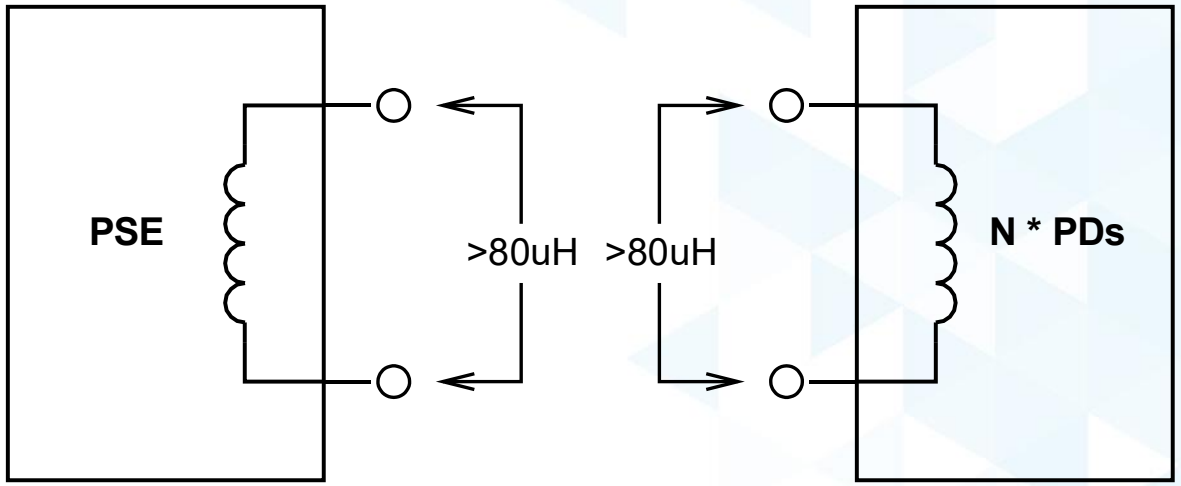



**Table 147–4—MDI impedance limit parameters**

| Parameter name | Unit of measure | Minimum value | Maximum value |
|---|---|---|---|
| $R$ | kW | 10 | — |
| $L$ | µH | 80 | — |
| $C_{tot}$ | pF | — | 180 |
| $C_{node}$ | pF | — | 15 |

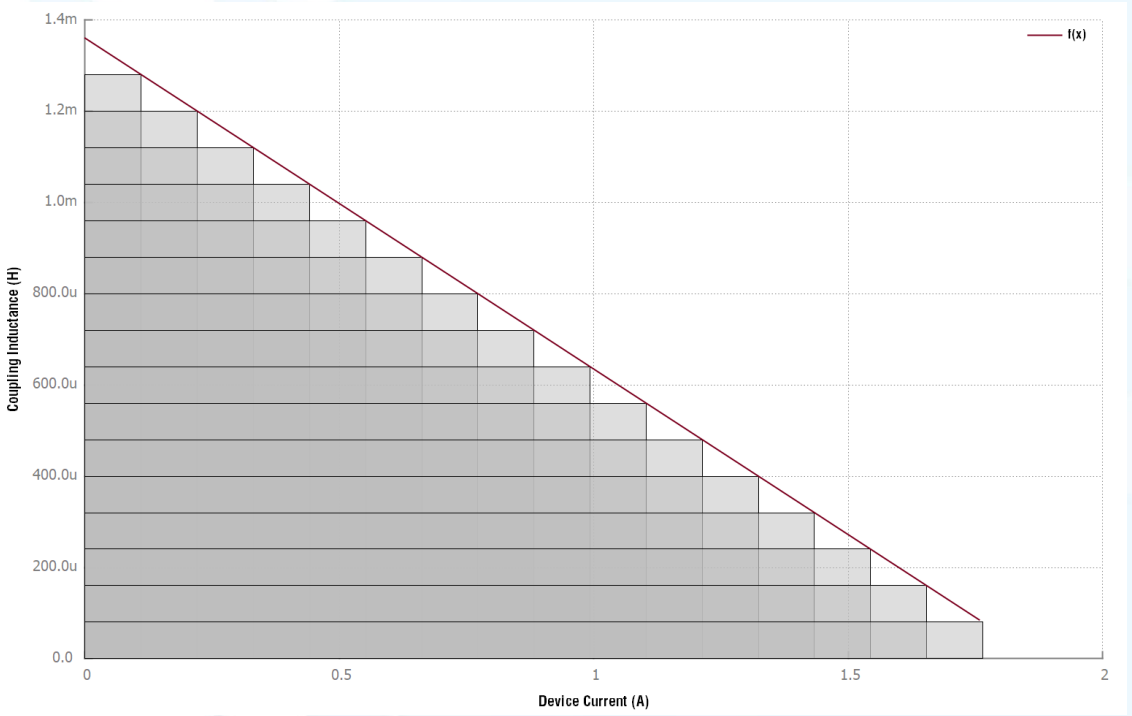
# Choosing Power Classes

- Set 90W maximum guaranteed PSE output
- Assume each mixing segment can support maximum of 16 PDs
- Divide 90W into 16 Classes
- Classes are linearly distributed
  - 90W / 16 Classes = 5.625W / Class
- Classes are ‘Tokens’
  - Each mixing segment has 16 tokens
    - Tokens use power budget
      - 1 x Class 16 (90W)
      - 1 x Class 15, 1 x Class 1 (84.375W + 5.625W = 90W)
      - 16 x Class 1 (16 x 5.625W = 90W)
      - 8 x Class 2 (8 x 11.25W = 90W)
      - 4 x Class 4 (4 x 22.5W = 90W)
      - 1 x Class 8, 1 x Class 4, 1 x Class 3, 1 x Class 1 (90W)
      - Etc…
- Sum of PD classes on a mixing segment <=16
  - Customer can sum the classes of attached devices to determine if another device can be added to a mixing segment

| Class | PSE Power | PSE Power |
|---|---|---|
| 1 | 1 x 5.625W | 5.625W |
| 2 | 2 x 5.625W | 11.25W |
| … | … | … |
| 15 | 15 x 5.625W | 84.375 |
| 16 | 16 x 5.625W | 90W |

# Choose Coupling Inductance By Class

- Set 80uH as minimum lumped inductance for all PDs
- 80uH x 16 Classes = 1280uH
  - Class 1 coupling inductance = 1280uH
  - Class 16 coupling inductance = 80uH
- Classes are ‘Tokens’
  - Each mixing segment has 16 tokens
    - Tokens use inductance budget
      - 1 x Class 16 (80 uH)
      - 16 x Class 1 (1280uH / 16 = 80uH)
      - 1 x Class 15, 1 x Class 1 (85.3uH || 1280uH = 80uH)
      - 8 x Class 2  (640uH / 8 = 80uH)
      - 4 x Class 4  (320 / 4 = 80uH)
      - 1 x Class 8, 1 x Class 4, 1 x Class 3, 1 x Class 1 (80uH)
      - Etc…
  - Sum of PD classes on a mixing segment <=16



# Continuing work

- Agree on minimum total inductance for the system (40uH?)
  - Trade off inductor size/cost with PHY complexity
    - Work on SCCP Timing
- Calculate delivered power
  - Cable thickness
  - Cable length
  - Device Separation
  - Connector Resistance
- Determine SCCP (detection) timing
- Verify $C_{NODE}$ Estimation
- Update Models