Type 0 Power Parameter Updates

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Channel V / I / P / R Assumptions

Desire for industrial compatible supply voltages

- Type 0 MPSE: 24V +/- 20% => 21.6V to 26.4V

Desire to align power consumption with ODVA

- PMPD_TYPE0 = 1.1W

Requirement to reach 50m with 16 nodes

- Assume 50m 20AWG cable @ 65C =~ 4Ω
- Assume 20cm node separation
- 16 Nodes at end of mixing segment

Requirement to stay above 16V at last MPD

The last degree of freedom in solving the system is the resistance through each node

Table 189–1—System power types

	30V Max MPSE (Type 0)	50V Max MPSE (Type 1)	Units
V_{MPSE} max	30	50	V
V_{MPSE} min	~~26~~ 21.6	45	V
V_{MPD} min	16	34	V
I_{MPSE} min	~~1000~~ 1100	1000	mA
P_{MPSE} min	~~26~~ 22.8	45	W
P_{MPD_1U} max	~~1~~ 1.1	2	W

Existing Presentations on Connector Resistance

Resistance through a node is made up of resistance due to connectors and resistance due to compensation

Connection resistance references:

https://ieee802.org/3/da/public/0724/Voss_01_da_2024_07_10.pdf

https://ieee802.org/3/da/public/0124/boyer_3da_RevB_01_24_24.pdf

Bob Voss's data suggests we need ~ 75mΩ allocated to connection resistance per node

- 15mΩ max resistance per connection (4 connections per node)
- Add ~20% for temperature

Currently the specification allocates 100mΩ to loop resistance between TC1 and TC2

- 75mΩ allocated to connectors
- 25mΩ left to allocate to 2 compensation elements (input / output elements)
- 25mΩ may be too low…

Compensation Elements

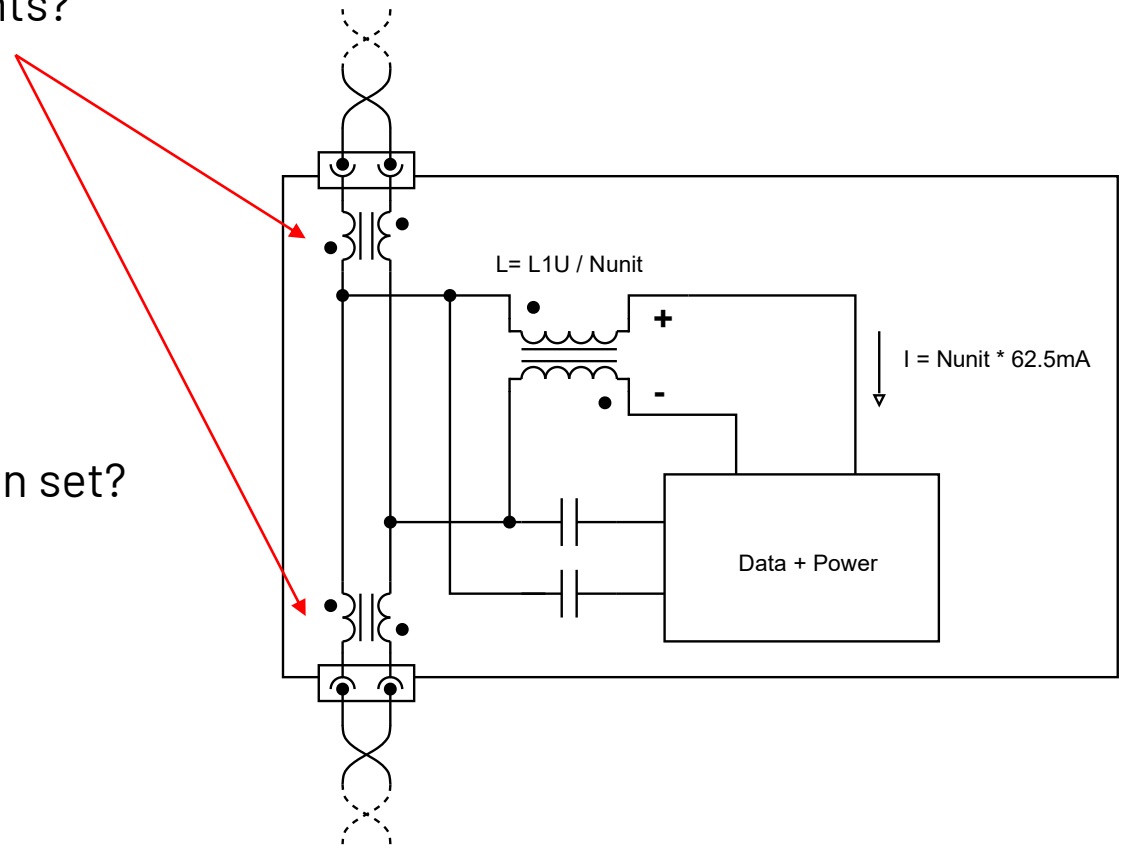
Low resistance / high current (>2A Isat) ~150nH coupled inductors are unique.

Not impossible to make, but not common yet

We need to set a target for vendors that pushes the limits, but does not push cost too hard

What is a good target resistance for these unique elements?

What is left in the budget after other parameter have been set?



Power Budgeting for Type 0

Setting other desirable parameters:

Table 189–1—System power types

	30V Max MPSE (Type 0)	50V Max MPSE (Type 1)	Units
V_{MPSE} max	30	50	V
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I_{MPSE} min	~~1000~~ 1100	1000	mA
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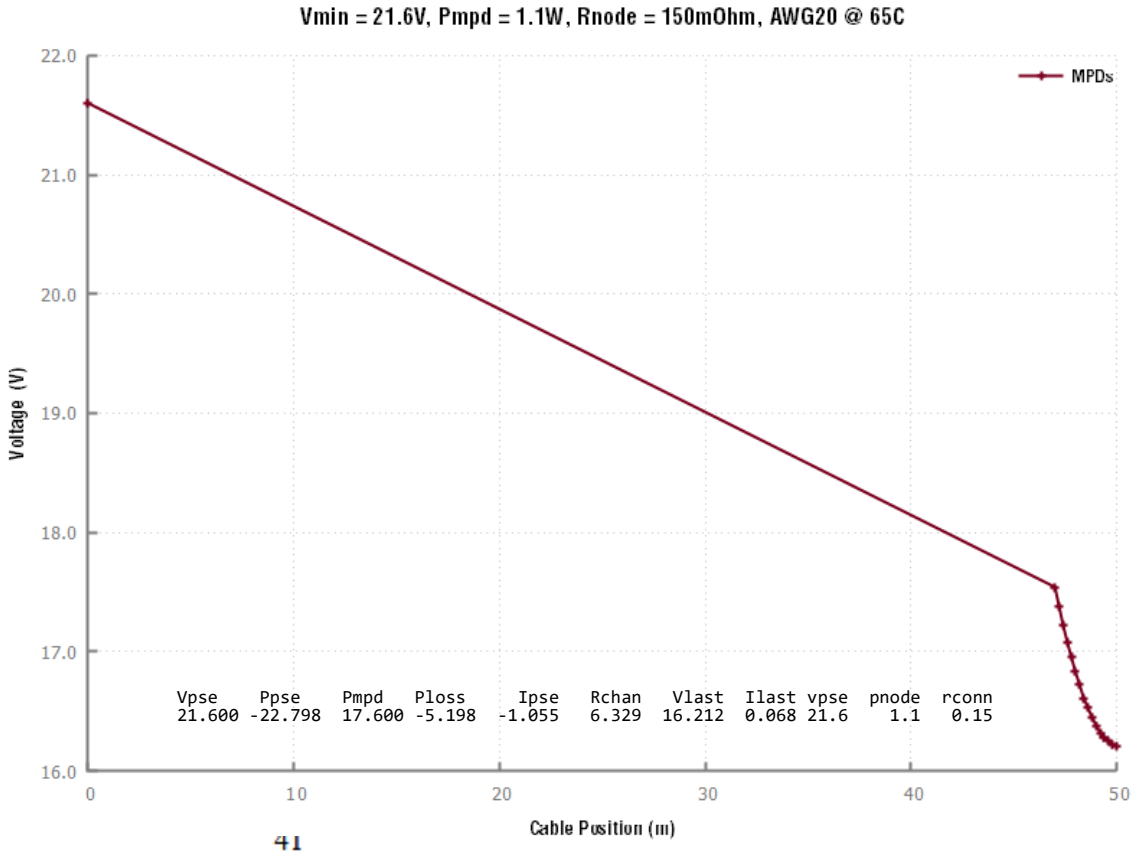

189.2 Mixing segment

The mixing segment consists of cable, nodes, and terminations (see Figure 189–1). 100 Ω terminations are connected at the ends of the mixing segment and must be AC coupled. The DC loop resistance of the cable (excluding connectors and attached DTEs) shall be less than or equal to 4 Ω.

This resistance budget is based on supporting up to 17 in-line nodes (1 MPSE and 16 MPDs). Each DTE, including mated connectors and compensation components, adds up to ~~100~~ mΩ to the loop resistance.

150

Each DTE adds 150mΩ

Set resistance through each node to 150mΩ

Allocates ~75mΩ to connectors

Allocates ~75mΩ to compensators

Achieves other power deliver goals (Vmpse_type0_min, Pmpd_type0, #Nodes, 50m Reach)

189.2 Mixing segment

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This resistance budget is based on supporting up to 17 in-line nodes (1 MPSE and 16 MPDs). Each DTE, including mated connectors and compensation components, adds up to ~~100~~ 150 mΩ to the loop resistance.

MPSE / MPD Table Changes

Table 189–5—PSE output requirements

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	DC output voltage during POWER_ON state	V_{MPSE}	V	~~26~~ 21.6	30	0	
				45	50	1	
2	Continuous output capability in POWER_ON state	P_{MPSE}	W	~~26~~ 22.8	100	0	See 189.4.7
				45	100	1	
3	Output slew rate dV/dt		V/ms	-	9.5	ALL	
4	Output current - at short circuit condition	I_{LIM}	A	1.1	~~1.4~~ 2.2	~~ALL~~ 0	See 189.4.9
				1.2	4.62	1	
5	Short-circuit time limit	T_{LIM}	ms	50	75	ALL	See 189.4.9
6	Inrush time	T_{Inrush}	ms	10	20	ALL	
7	MPD maintain power signature dropout time limit	T_{TPSDO}	ms	320	400	ALL	See 189.4.10.1
8	PD TPS time for validity	T_{TPS}	ms	6	-	ALL	See 189.4.10.1
9	DC TPS current	I_{HOLD}	mA	4	9	ALL	See 189.4.10.1
10	Error delay timing	T_{ED}	ms	750	-	ALL	
11	Overload current	I_{CUT}	A	P_{MPSE}/V_{MPSE}	-	ALL	See 189.4.8
12	Overload time limit	T_{CUT}	ms	50	70	ALL	See 189.4.8

Table 189–9—MPD power supply limits

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	Input voltage	V_{Port_MPD}	V	16	30	0	
				34	50	1	
2	Unit power	P_{MPD_1U}	W		~~1~~ 1.1	0 and 0/1	1 unit load
					2	1	1 unit load
3	Unit loading	N_{unit}	-	1	16	ALL	See 189.5.5.3
4	Input power	P_{MPD}	W	~~1~~ 1.1	~~16~~ 17.6	0 and 0/1	N_{unit} x P_{MPD_1U}
				2	32	1	
5	Inrush current	I_{Inrush_MPD}	mA	-	10	ALL	See 189.5.5.2
6	MPD Type 0 Voltage threshold	V_{type0_th}	V	11.9	16	ALL	
7	MPD Type 1 Voltage threshold	V_{type1_th}	V	30.1	34	ALL	