IEEE 802.3at
Voltage Limits

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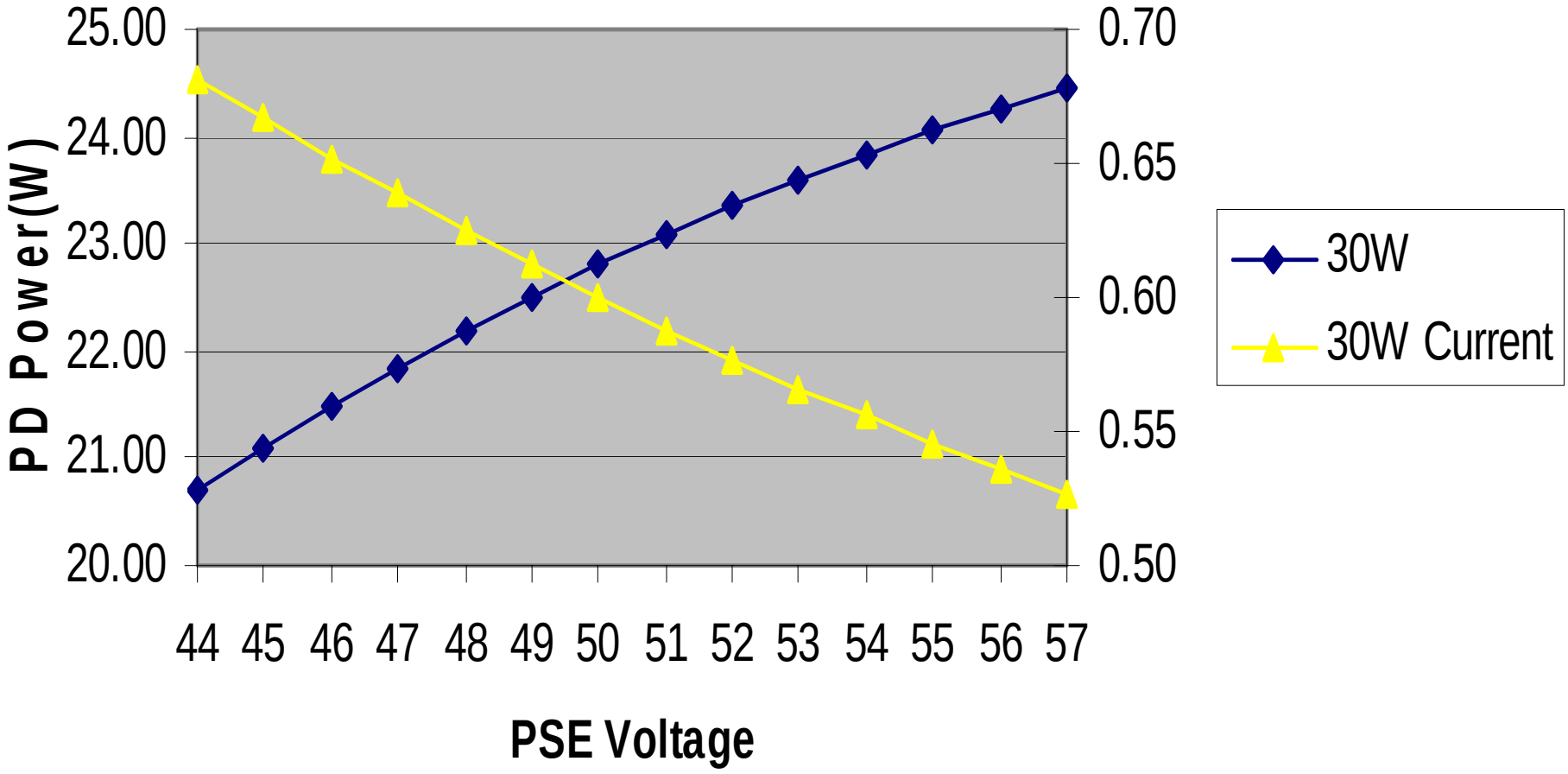
Jan 2006

Whats theoretical PD Power vs PSE Voltage due to drops in the cable?

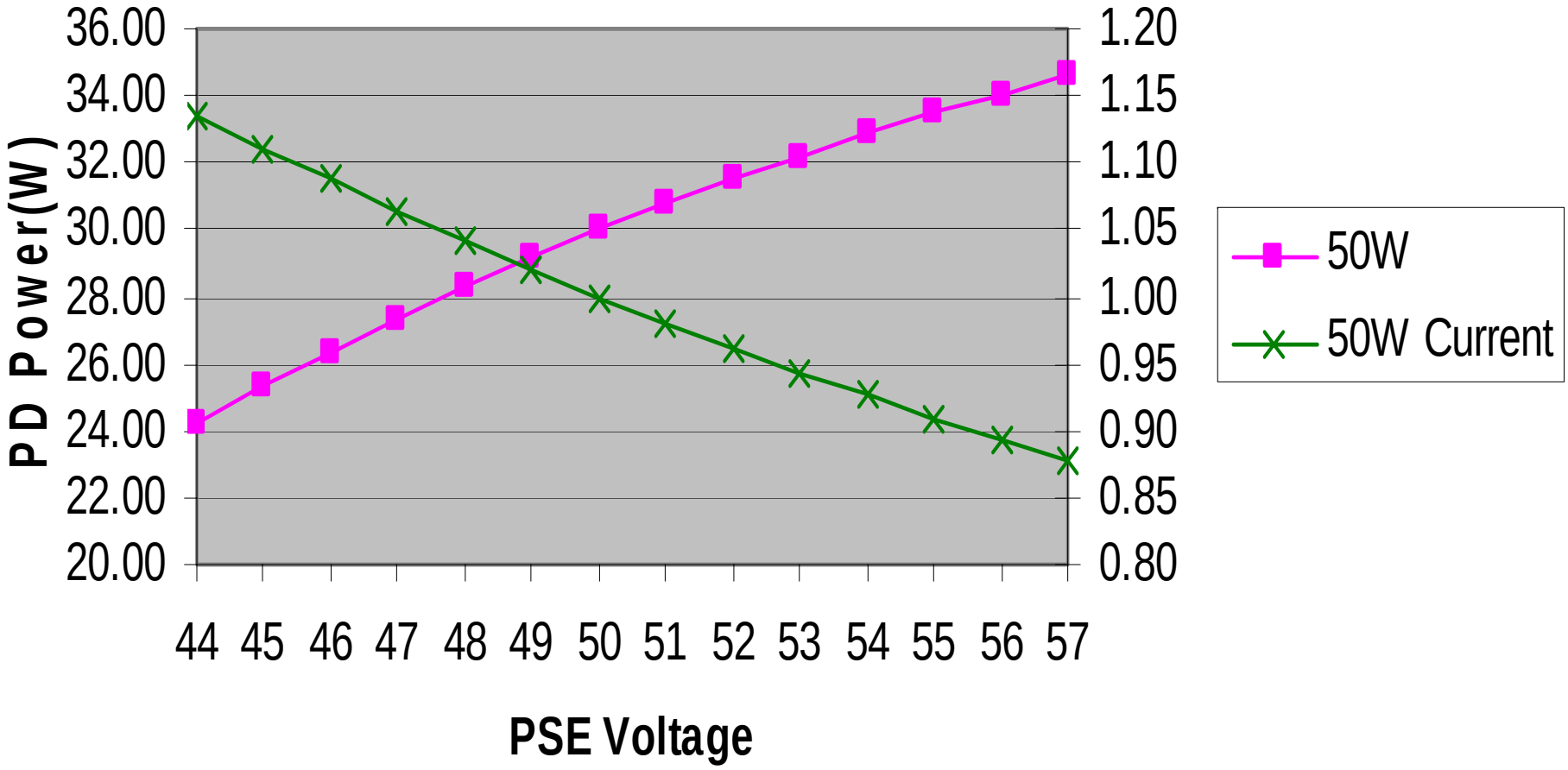
2 Pair Current vs Voltage

PSE Output(V)	Current @ **15.4W**	PD Pwr	Current @ **20W**	PD Pwr	Current @ **30W**	PD Pwr	Current @ **40W**	PD Pwr	Current @ **50W**	PD Pwr
57	**0.27**	13.94	**0.35**	17.54	0.53	24.46	0.70	30.15	0.88	34.61
56	**0.28**	13.89	0.36	17.45	0.54	24.26	0.71	29.80	0.89	34.06
55	**0.28**	13.83	0.36	17.36	0.55	24.05	0.73	29.42	0.91	33.47
54	**0.29**	13.77	0.37	17.26	0.56	23.83	0.74	29.03	0.93	32.85
53	**0.29**	13.71	0.38	17.15	0.57	23.59	0.75	28.61	0.94	32.20
52	**0.30**	13.65	0.38	17.04	0.58	23.34	0.77	28.17	0.96	31.51
51	**0.30**	13.58	0.39	16.92	0.59	23.08	0.78	27.70	0.98	30.78
50	**0.31**	13.50	0.40	16.80	0.60	22.80	0.80	27.20	**1.00**	30.00
48	**0.32**	13.34	0.42	16.53	0.63	22.19	0.83	26.11	**1.04**	28.30
47	**0.33**	13.25	0.43	16.38	0.64	21.85	0.85	25.51	**1.06**	27.37
46	**0.33**	13.16	0.43	16.22	0.65	21.49	0.87	24.88	**1.09**	26.37
45	**0.34**	13.06	0.44	16.05	0.67	21.11	0.89	24.20	**1.11**	25.31
44	**0.35**	12.95	0.45	15.87	0.68	20.70	0.91	23.47	**1.14**	24.17

PD Power Limit vs PSE Voltage
2pair @30W



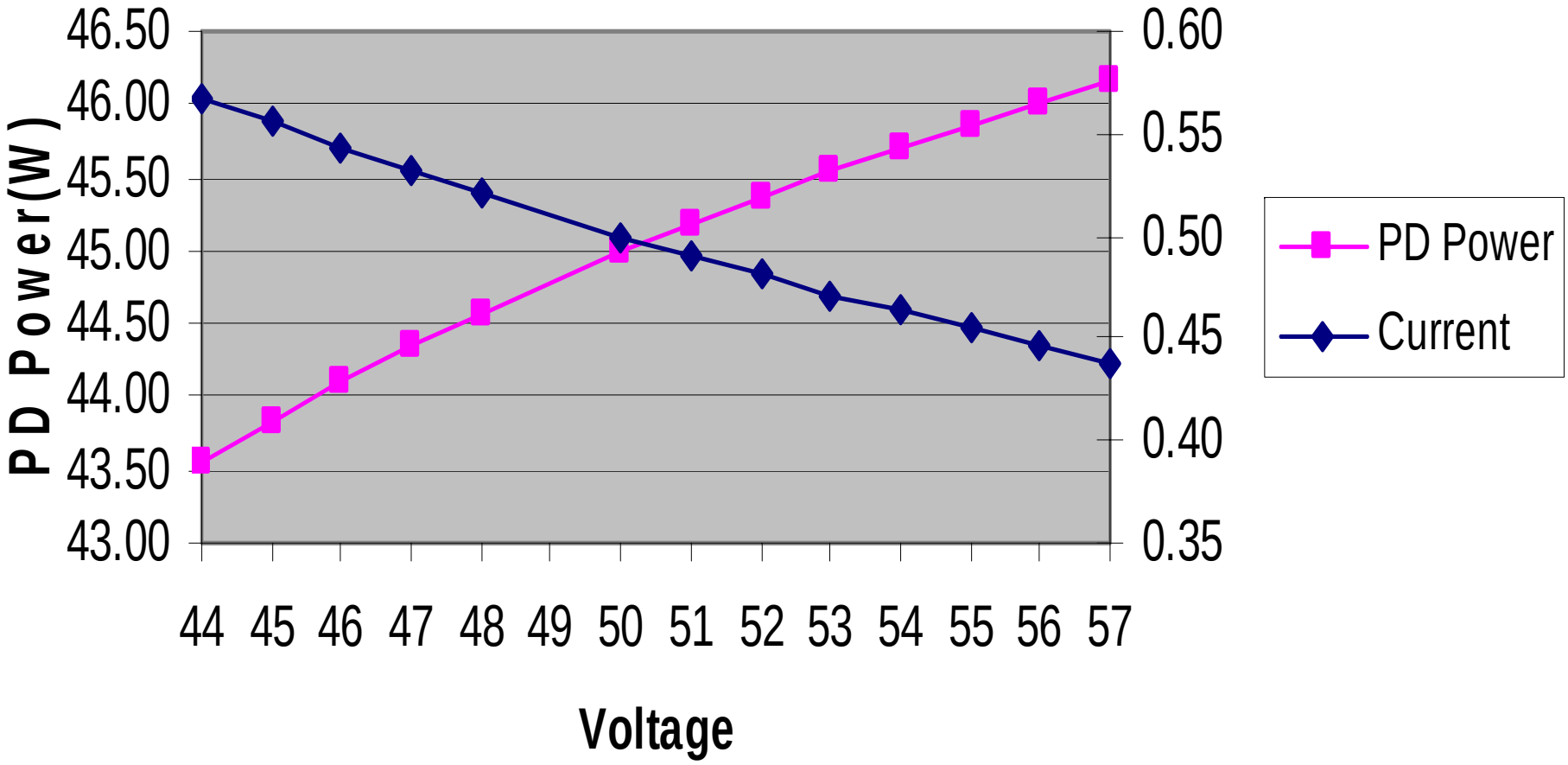
PD Power Limit vs PSE Voltage
2pair @50W



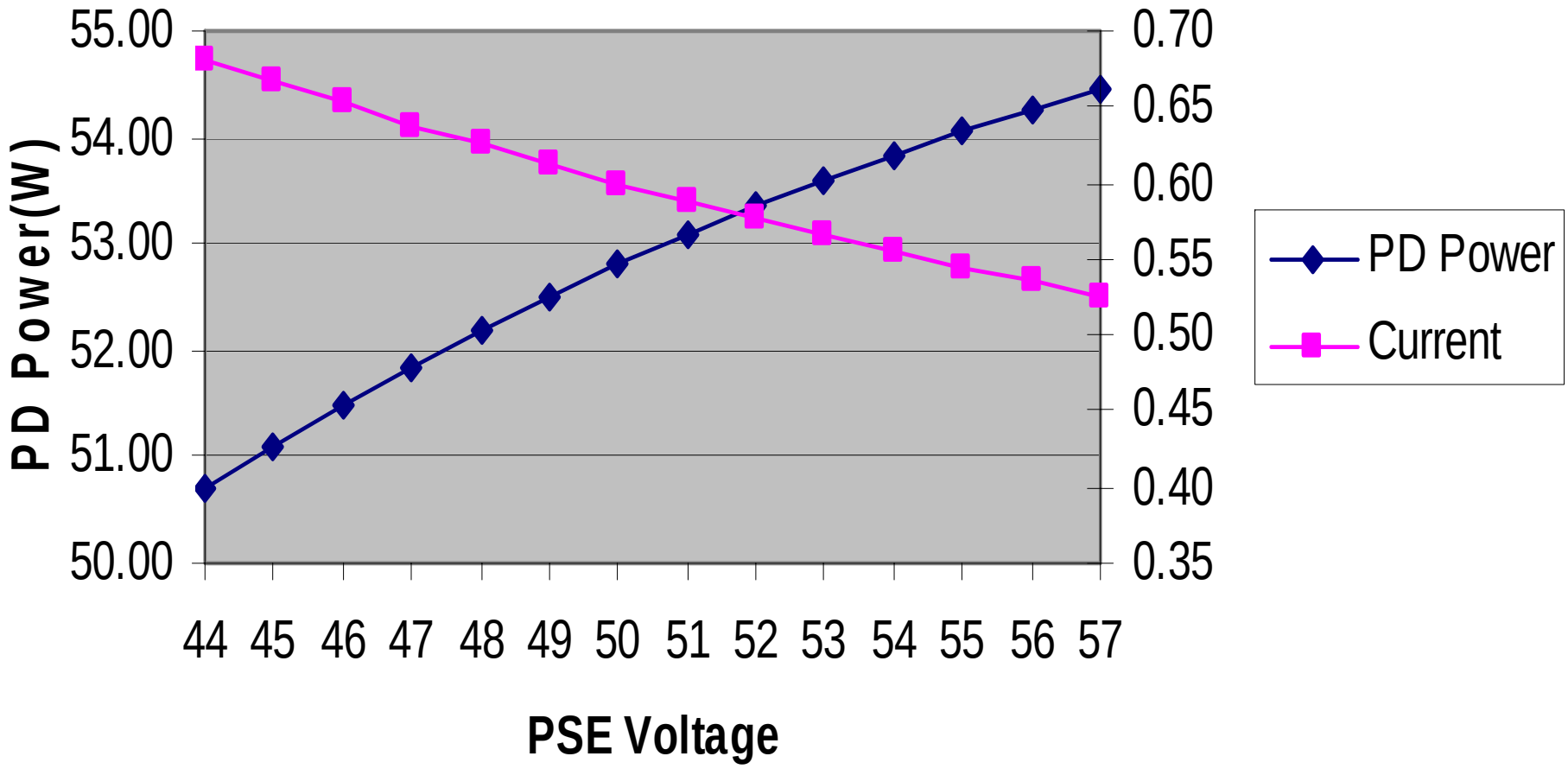
4Pair Current vs Voltage

PSE Output	Current @ **30W**	PD Pwr	Current @ **40W**	PD Pwr	Current @ **50W**	PD Pwr	Current @ **60W**	PD Pwr	Current @ **70W**	PD Pwr
57	0.26	28.61	0.35	37.54	0.44	46.15	0.53	54.46	0.61	62.46
56	0.27	28.57	0.36	37.45	0.45	46.01	0.54	54.26	0.63	62.19
55	0.27	28.51	0.36	37.36	0.45	45.87	0.55	54.05	0.64	61.90
54	0.28	28.46	0.37	37.26	0.46	45.71	0.56	53.83	0.65	61.60
53	0.28	28.40	0.38	37.15	0.47	45.55	0.57	53.59	0.66	61.28
52	0.29	28.34	0.38	37.04	0.48	45.38	0.58	53.34	0.67	60.94
51	0.29	28.27	0.39	36.92	0.49	45.19	0.59	53.08	0.69	60.58
50	0.30	28.20	0.40	36.80	0.50	45.00	0.60	52.80	0.70	60.20
48	0.31	28.05	0.42	36.53	0.52	44.57	0.63	52.19	0.73	59.37
47	0.32	27.96	0.43	36.38	0.53	44.34	0.64	51.85	0.74	58.91
46	0.33	27.87	0.43	36.22	0.54	44.09	0.65	51.49	0.76	58.42
45	0.33	27.78	0.44	36.05	0.56	43.83	0.67	51.11	0.78	57.90
44	0.34	27.68	0.45	35.87	0.57	43.54	0.68	50.70	0.80	57.35

PD Power Limit vs PSE Voltage
4 Pair@50W PSE o/p



PD Power Limit vs PSE Voltage
4 Pair @60W PSE o/p

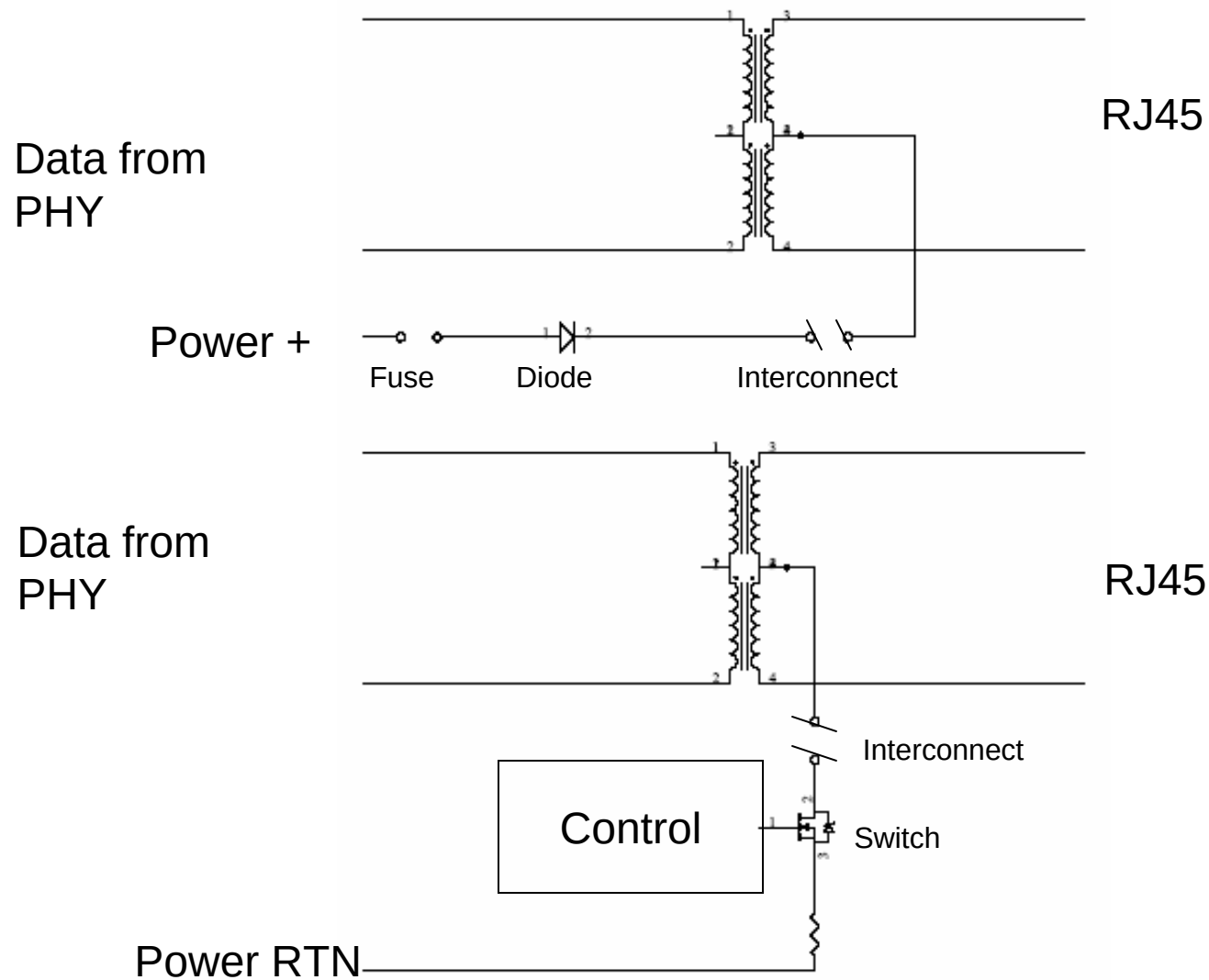


Conclusion

- Not much Power Increase per Volt above 51V
  - @ 0.5A less than 1W gained at PD per Volt
- PD Power above 51V @ 0.5A
  - 45W 4 Pair
  - 22.5W 2 Par

Practical Voltage Range in PSE

PSE Model


Data from PHY
RJ45
Power +
Fuse
Diode
Interconnect
Data from PHY
RJ45
Interconnect
Control
Switch
Power RTN

Power Source Voltage Tolerance

- Initial Set-point 0.1% to 5%
- Load Regulation
- Line Regulation

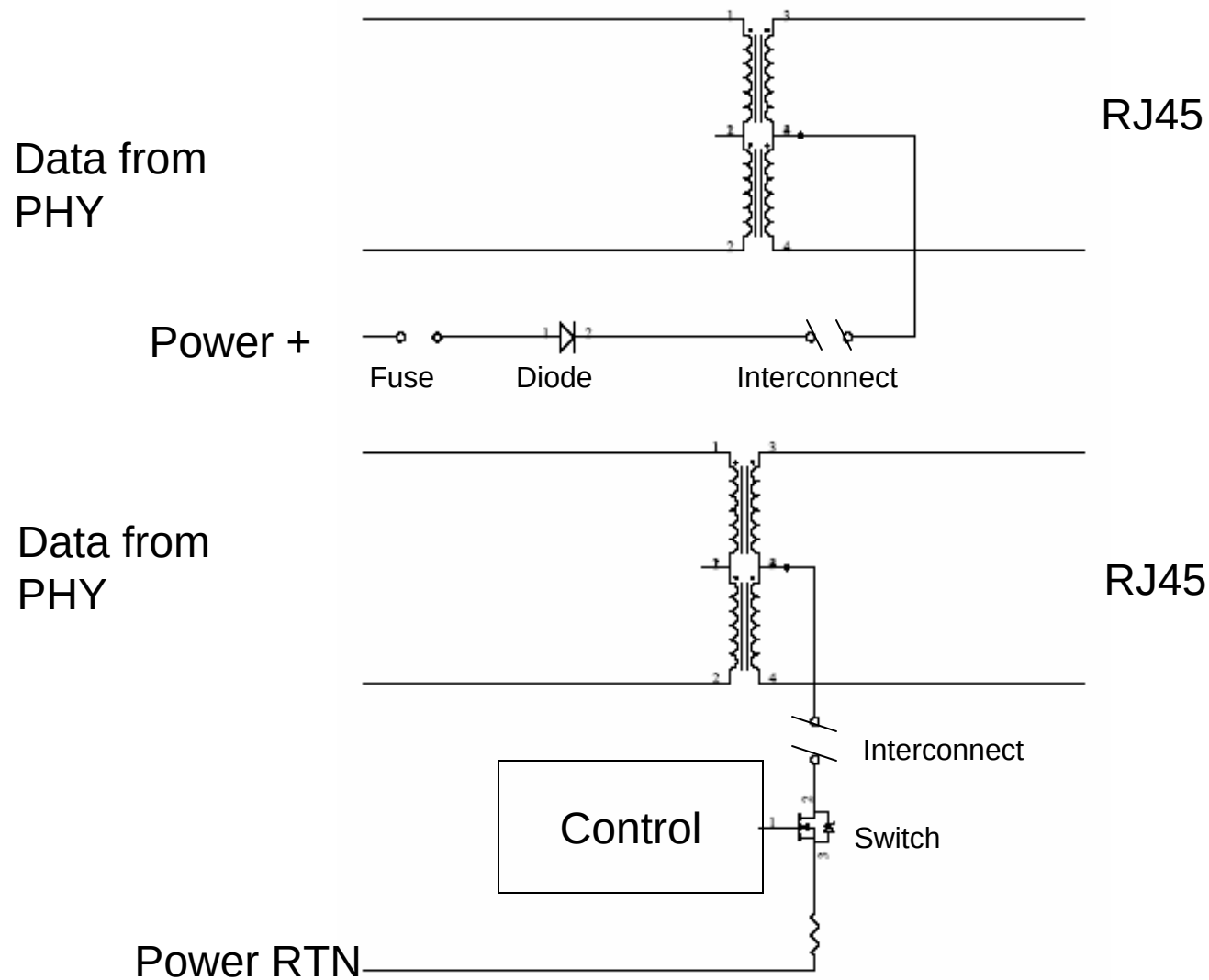
Typical +/-1 to 2%

- Temperature Drift 0.03%/deg C =~1%

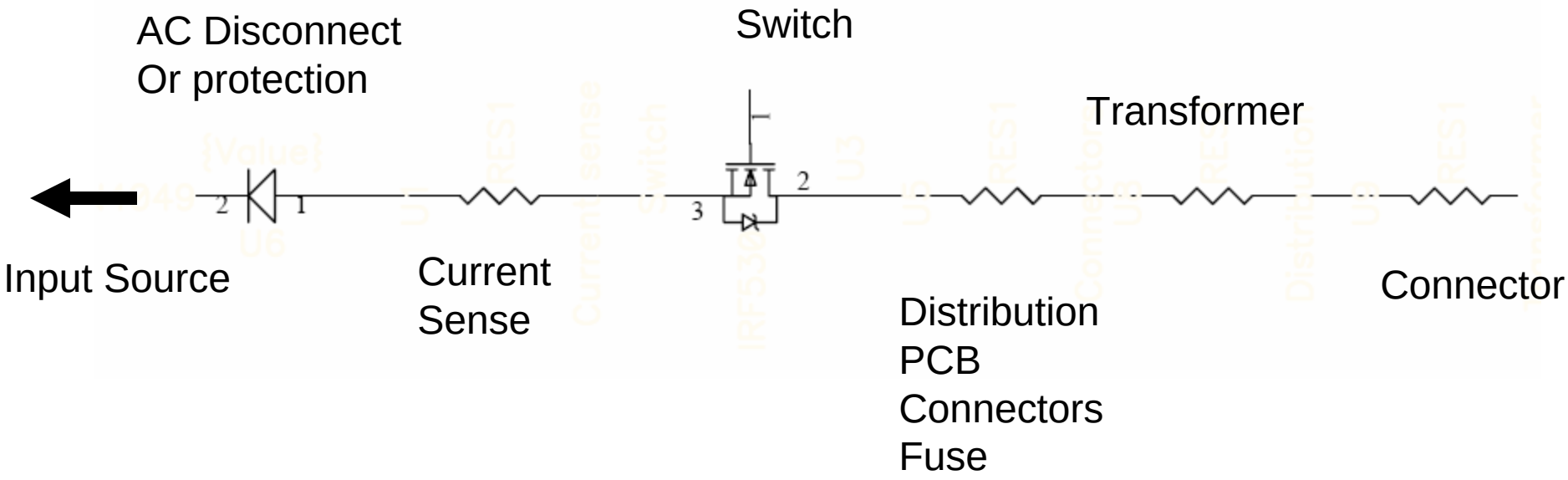
Total error range could +/-2% to 8%

@50V 2%=+/-1V 8%=+/-4V

PSE Model


Data from PHY
RJ45
Power +
Fuse
Diode
Interconnect
Data from PHY
RJ45
Interconnect
Control
Switch
Power RTN

PSE Loss Simple Model



PSE Losses

AC Disconnect or Redundant Diode	Current Sense	Switch	Distribution	Transformer	Connector
0.6V	.1 to 2 ohms	0.05 – 1 ohm	<0.5V	Measured 0.05-0.150V @350mA	0.3ohms
0.6V	@350mA 0.035 – 0.750V	0.017 - 0.35V	0.5V	0.05V	0.105V

PSE Loss @ 350mA

Realistic Design after the Power Supply.
All Regulation (Drops)

- Good Design 1.5V
- Poor DC Loss Design 3.5V

Pragmatic Solution