MPD Cport MPSE Current Limit and dV/dt

Michael Paul

TBDs in Draft 1.3

Table 169–5—PSE output requirements

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

Table 169–8—MPD power supply limits

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	Input voltage	VPort_MPD	V	16	30	0	
				34	50	1	
2	Unit power	P_{MPD_1U}	W		1	0	1 unit load
					2	1	1 unit load
3	Unit loading	N_{unit}	-	1	16	ALL	Must be an integer
4	Input power	P_{MPD}	W	1	16	0	$N_{unit} * P_{MPD\_1U}$
				2	32	1	
5	Inrush current	I_{Inrush_MPD}	A	-	.01	ALL	
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	
8	Inrush backoff time	$T_{Inrush\_backoff}$	ms	10	20	ALL	
9	Inrush to operating state delay	T_{Delay}	ms	10	20	ALL	
10	MPD MPI capacitance during POWER_ON	C_{Port}	µF	-	TBD	ALL	
11	MPD current when connected to incompatible MPSE type	$I_{MPD\_Disabled}$	µA	-	500	ALL	

MPSE Current Limit and MPD Cport Requirements

MPSEs need to protect their power path during shorting events, while allowing some margin for over current events in a normally operating system.

For example:

- Addition of a node to an already operating system
- MPSE Supply Voltage Step
- Common mode voltage shift
- Etc..

MPSE Current limit must provide current to MPDs and extra charge to MPD bulk caps during a load step

MPDs need local bulk capacitance to provide a short loop path for local switching currents and filter load transients.

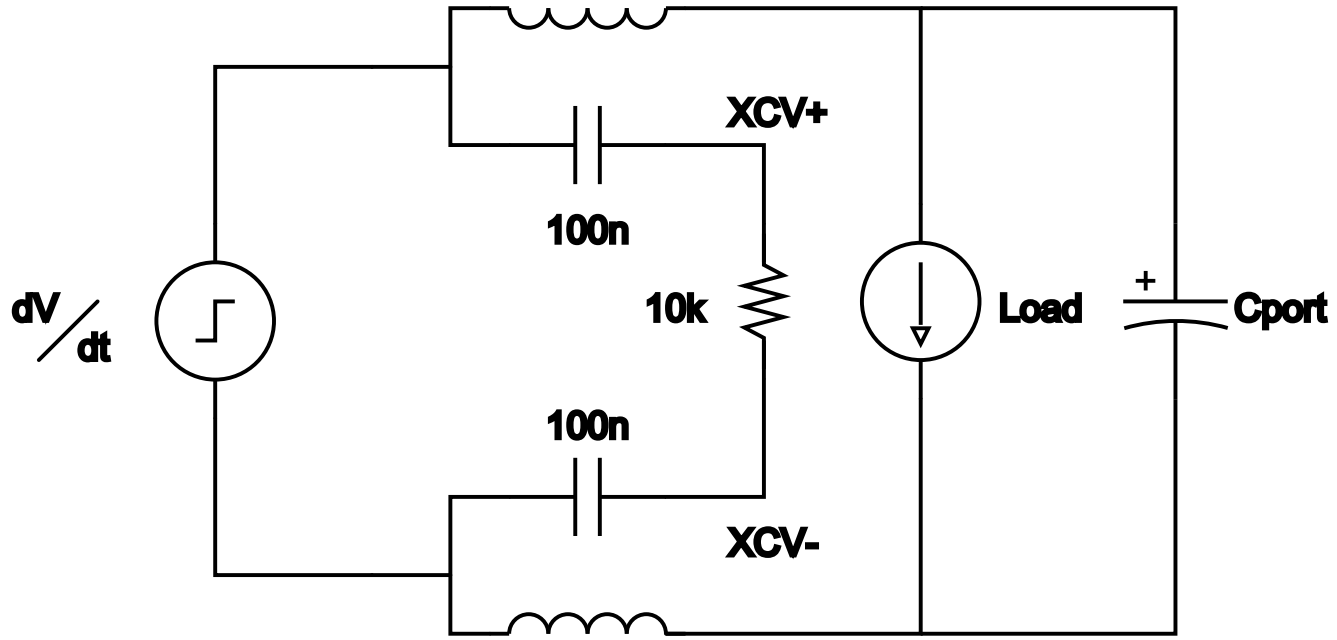
For example:

Prevent high frequency edges from conducting on the mixing segment

Charge reservoir to operate through common mode surge

Ilimit, Cport, and Mixing Segment dV/dt

- Simple phy input model has a wide bandwidth high pass filter
- Power system dV/dt is affected by Cport and Ilimit
  - Higher Cport leads to lower dV/dt
  - Lower current limit leads to lower dV/dt



Load Step Simulations

Method

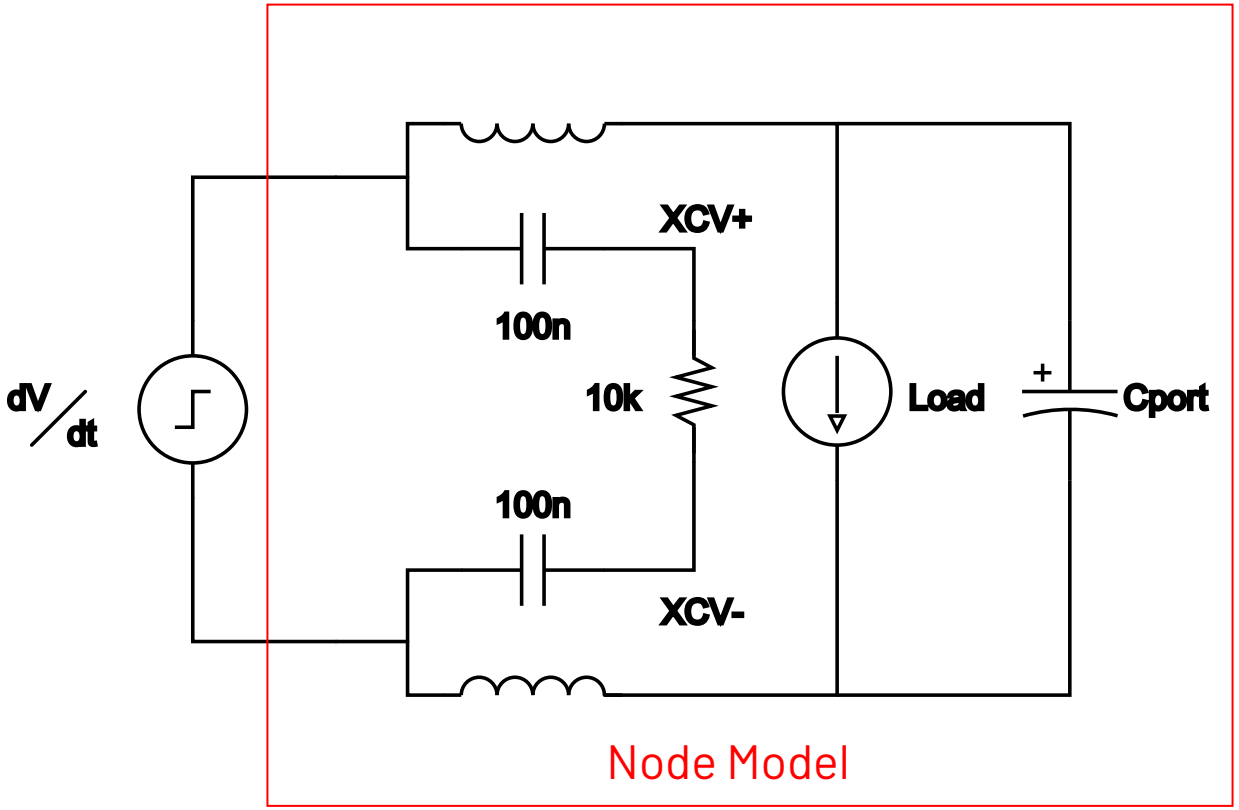
Variables:

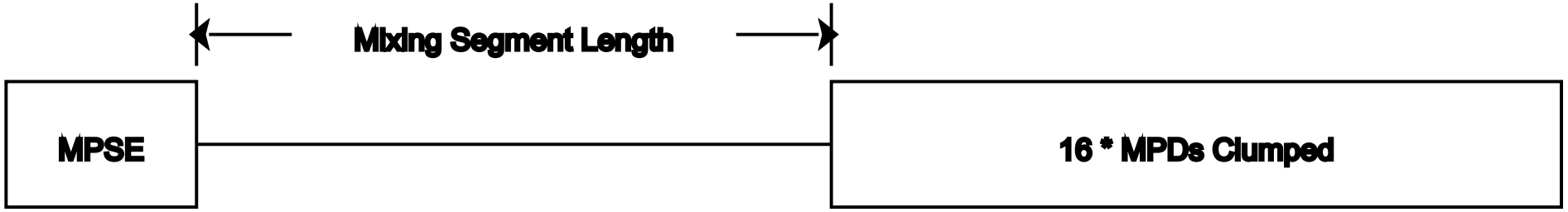
- Cport = 10uF, 180uF
- Mixing segment length = 1m, 50m

Step 16 MPD loads from 0W to 1W (16W total)

Look for effects on transceiver input voltage: "$V_{MPD16:PHY}$"

$V_{MPD16:PHY}$ = V(XCV+,XCV-) on node 16





Load Step 1

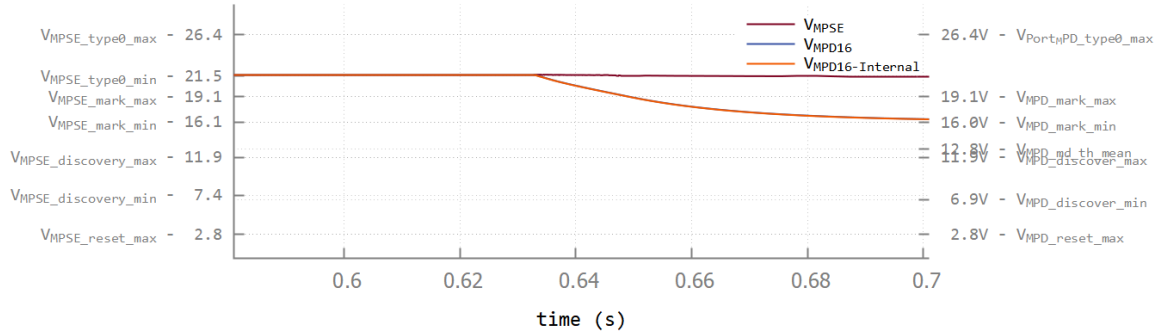
Nodes = 16

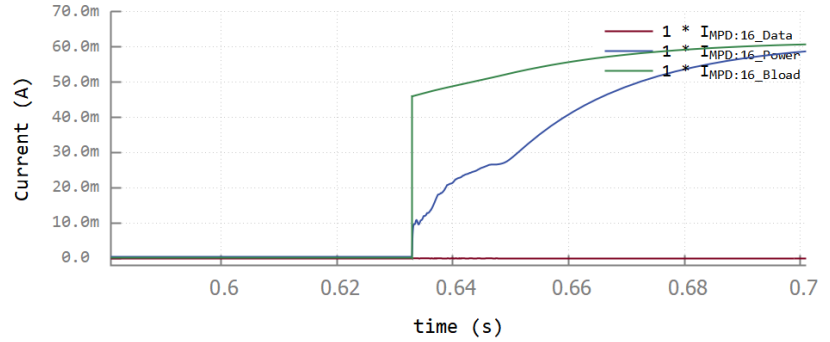
Step loads from 0 -> 1W simultaneously

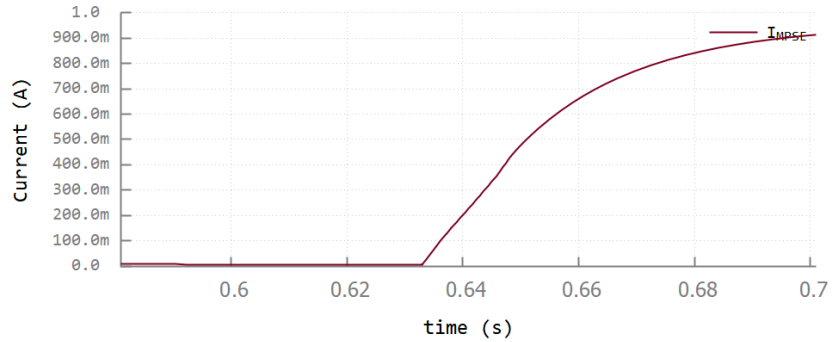
50 meter mixing segment

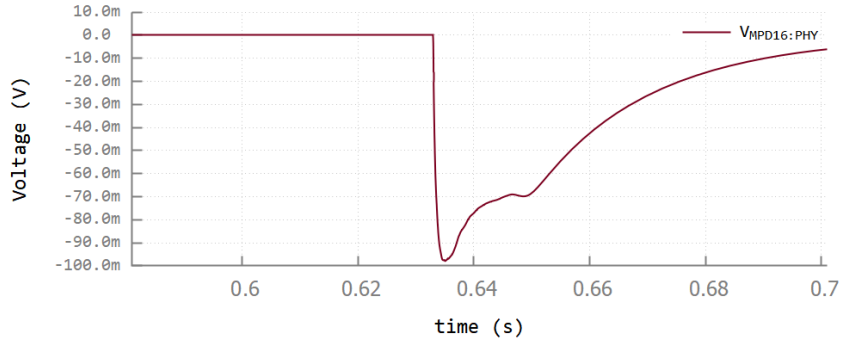
Cport = 180uF

~100mV glitch on transceiver input









Load Step 2

Nodes = 16

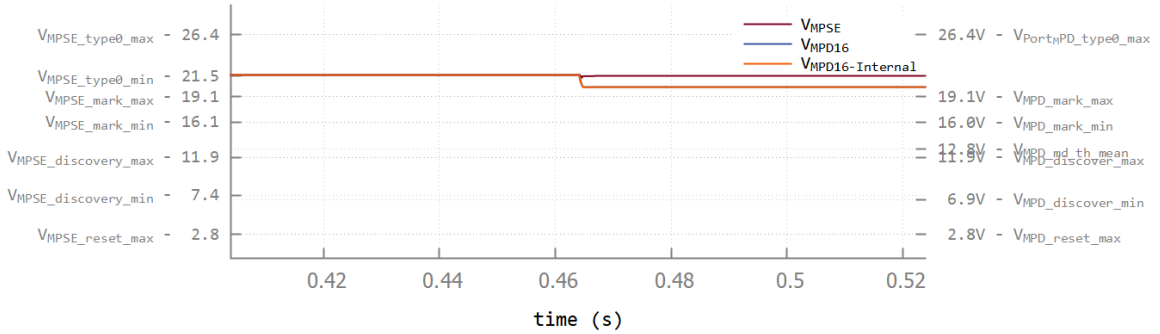
Step loads from 0 -> 1W simultaneously

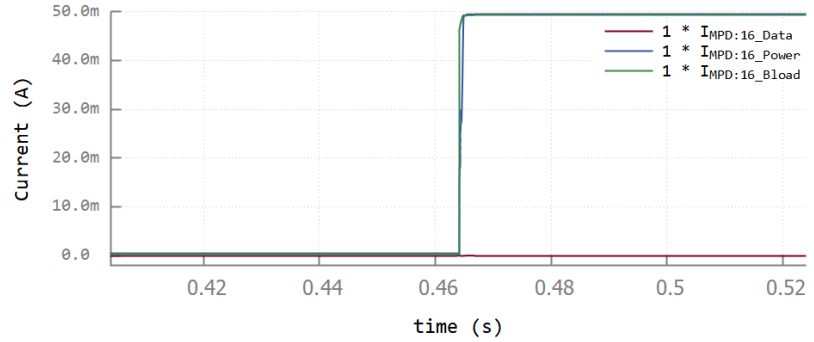
50 meter mixing segment

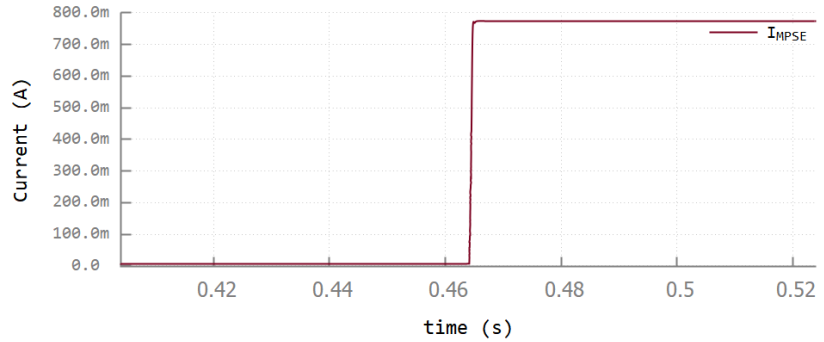
Cport = 10uF

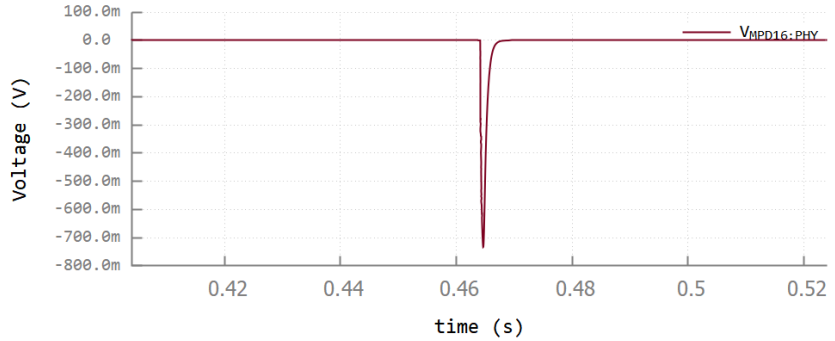
~800mV glitch on transceiver input

Bold Lines highlight parameter change from last slide









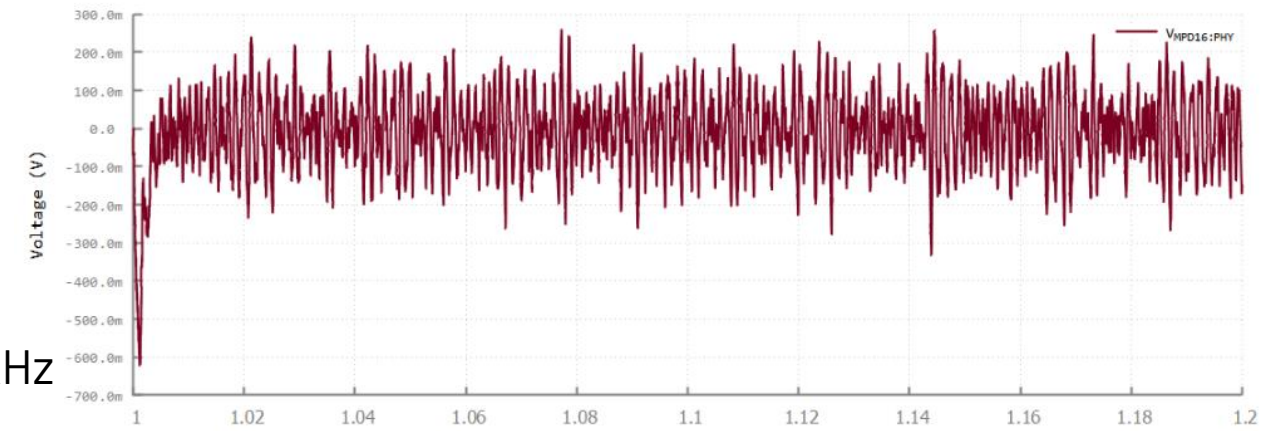
Variable Loading

16 MPDs changing between 0W -> 1W -> 0W at different times

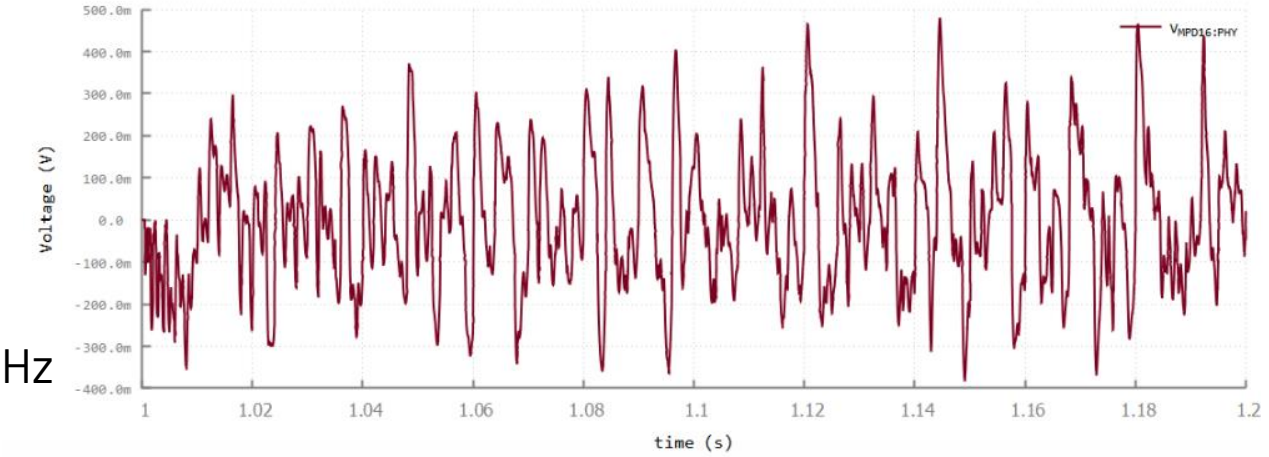
Each MPD has 10uF Cport

Expect baseline noise at transceiver input

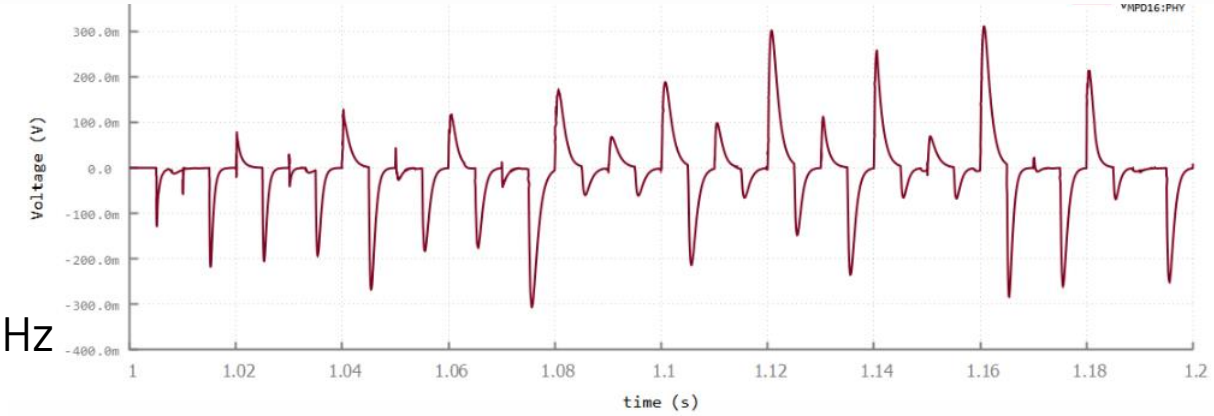
50kHz



5kHz



500Hz



Supply Step Simulations

Method

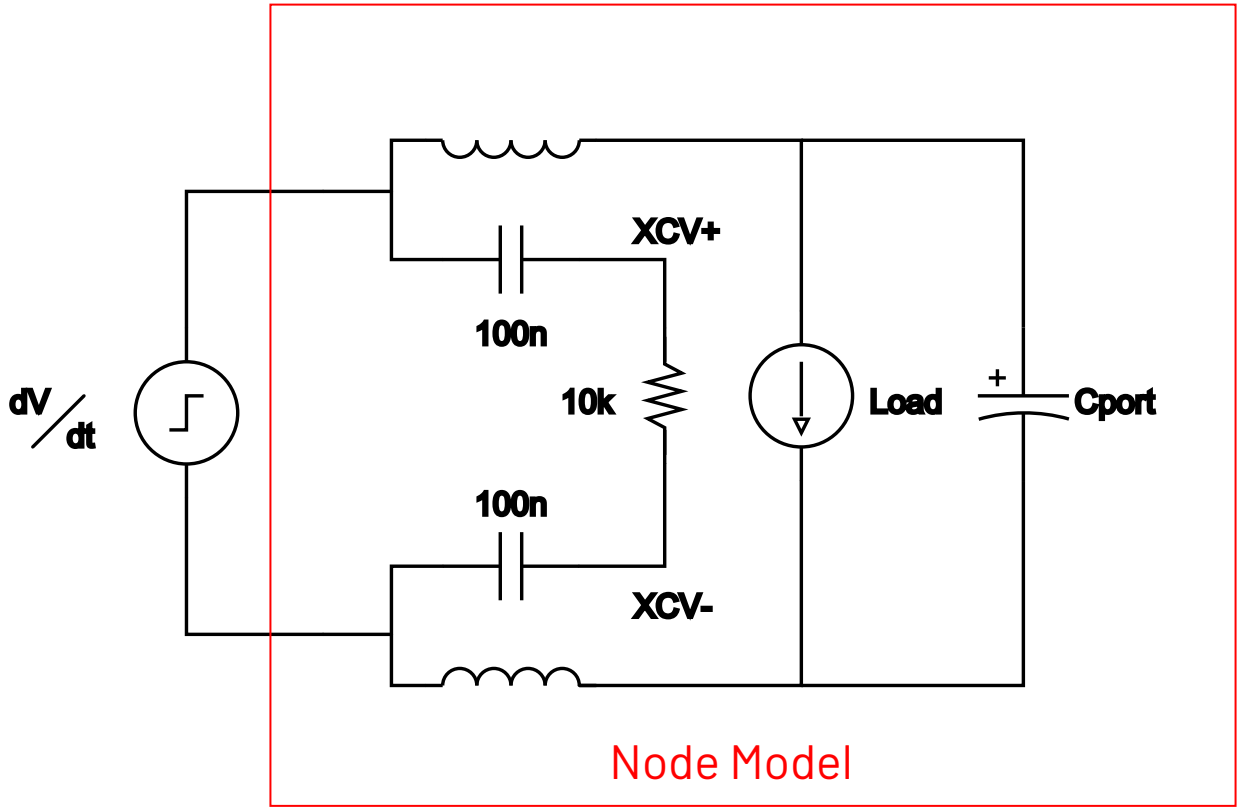
Variables:

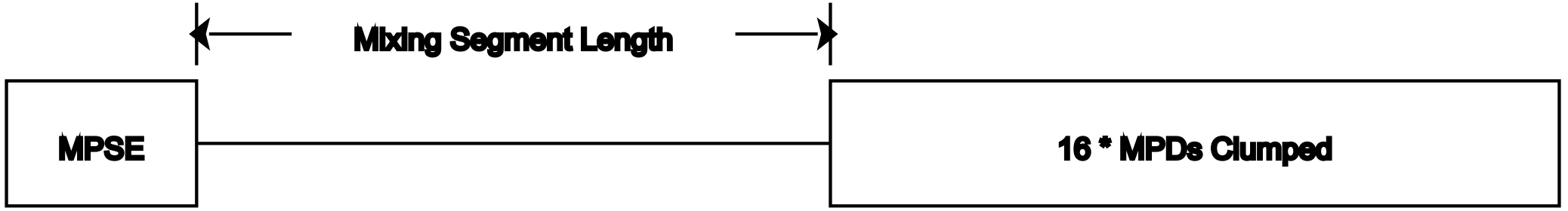
- Ilim = 1.1A, 3.8A
- Cport = 10uF, 180uF
- Mixing segment length = 1m, 50m

Step MPSE supply from 21.5V to 26.4V

Look for effects on transceiver input voltage: "$V_{MPD16:PHY}$"

$V_{MPD16:PHY}$ = V(XCV+,XCV-) on node 16





Type 0 Supply Step

Step MPSE Voltage from 21.5V to 26.4V

50 meter mixing segment

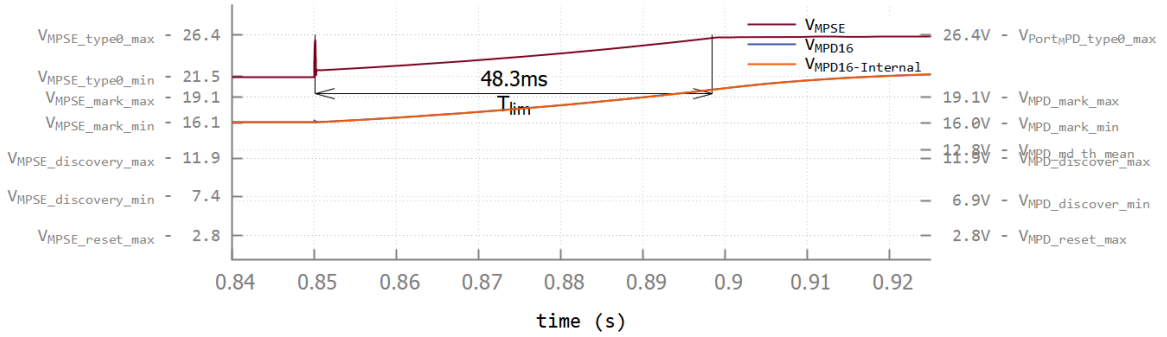
Ilim = 1.1A

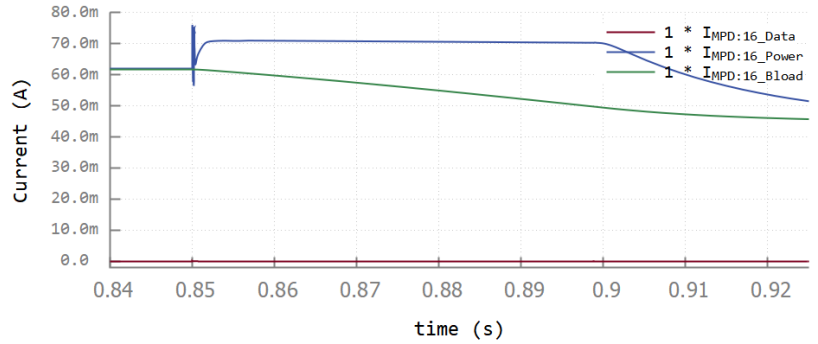
Nodes = 16

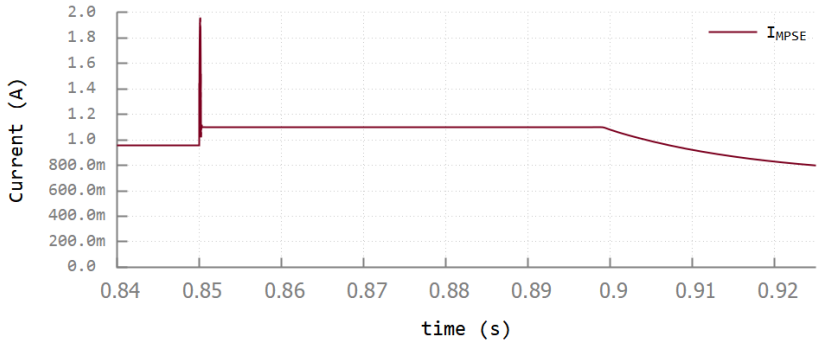
MPDs sinking 1W each

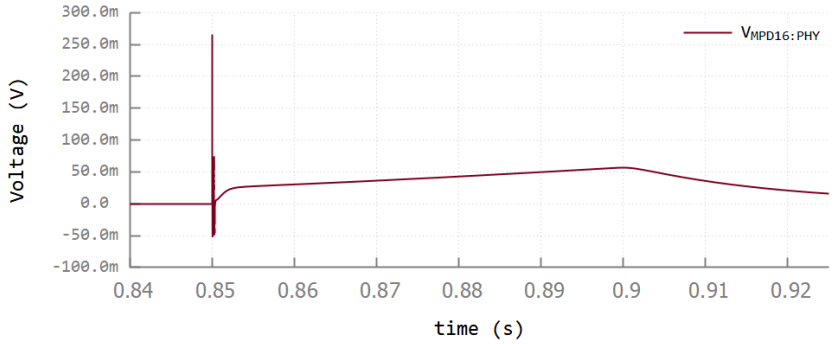
Cport = 180uF

Tlim < 50ms









Type 0 Supply Step

Step MPSE Voltage from 21.5V to 26.4V

50 meter mixing segment

Nodes = 16

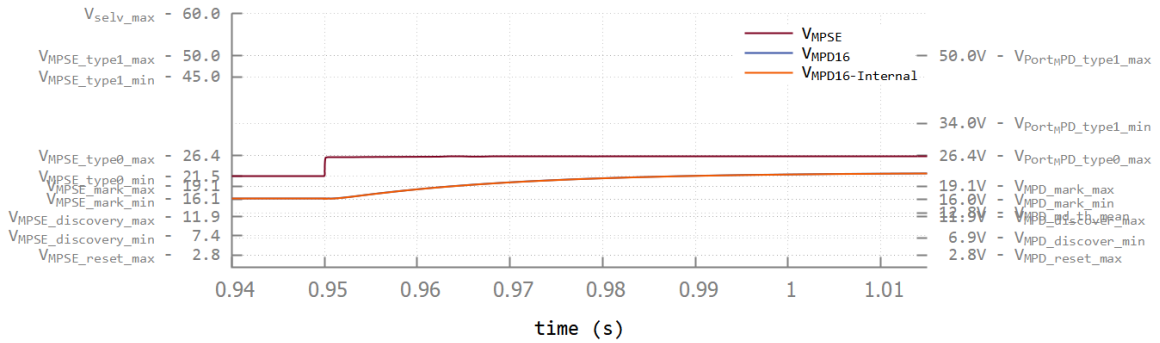
MPDs sinking 1W each

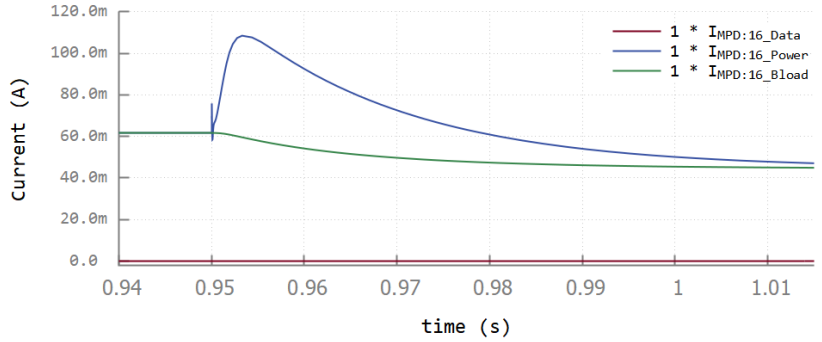
Ilim = 100W / 26.4V = 3.8A

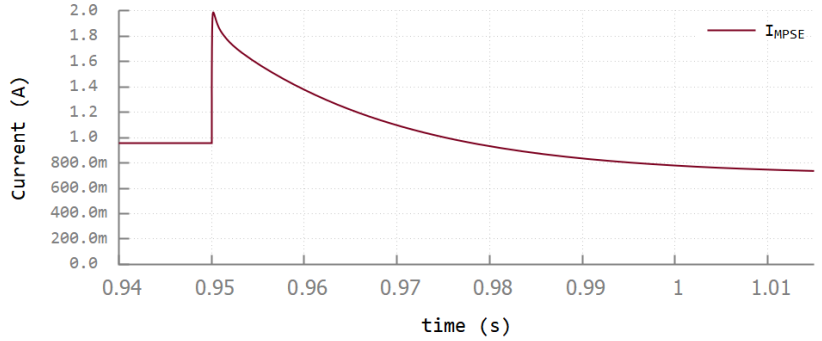
Cport = 180uF

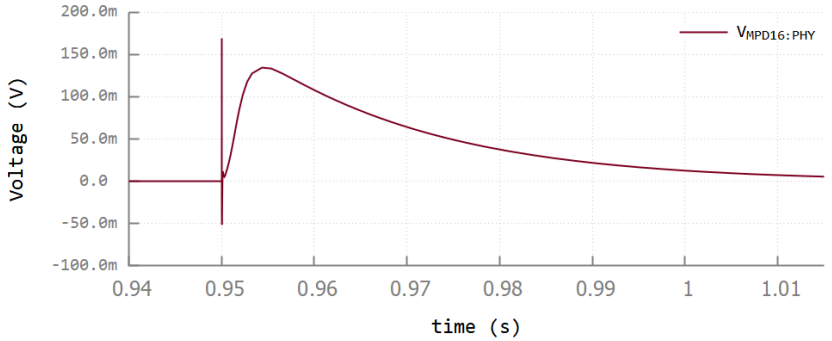
Tlim < 1ms

Bold Lines highlight parameter change from last slide









Type 0 Supply Step

Step MPSE Voltage from 21.5V to 26.4V

50 meter mixing segment

Nodes = 16

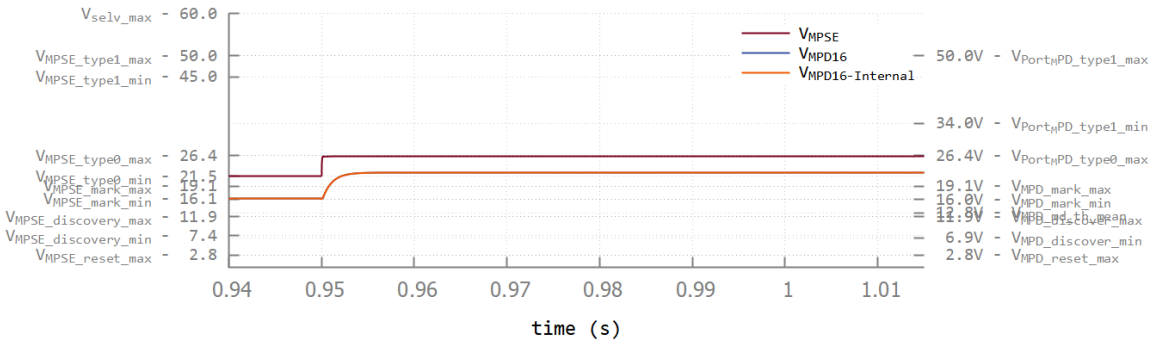
MPDs sinking 1W each

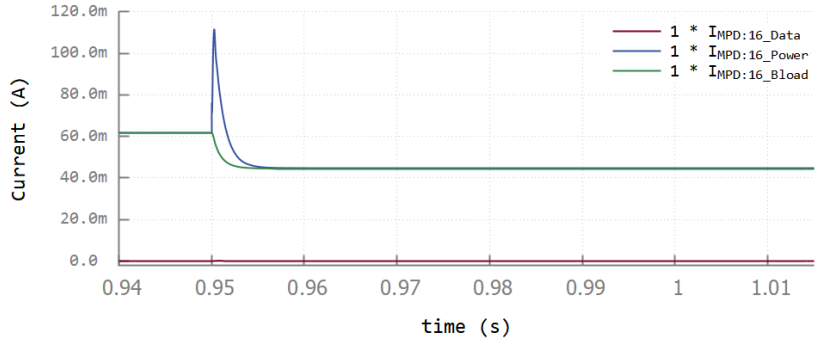
Ilim = 3.8A

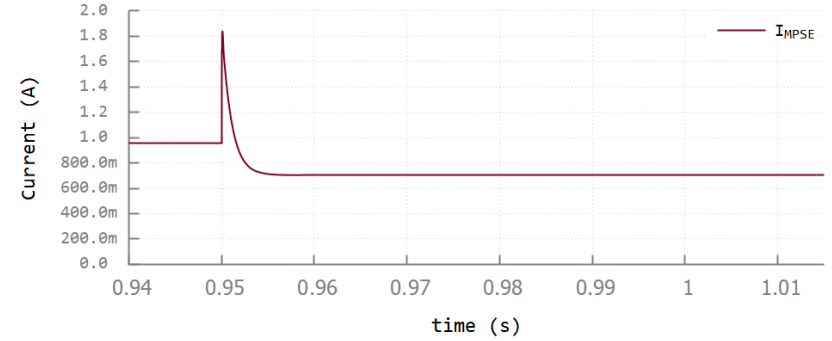
Cport = 10uF

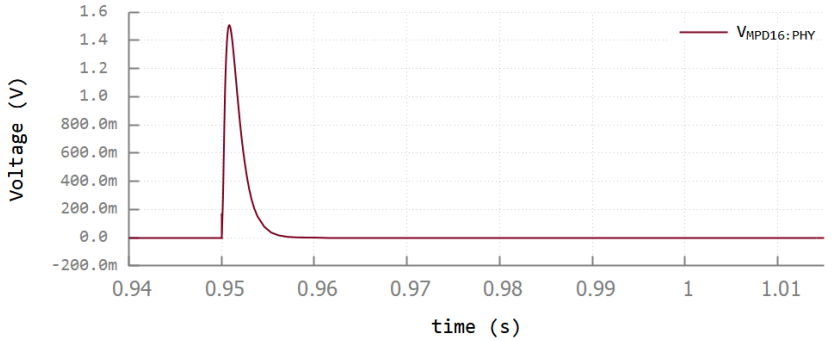
Tlim < 1ms

Bold Lines highlight parameter change from last slide









Type 0 Supply Step

Step MPSE Voltage from 21.5V to 26.4V

50 meter mixing segment

Nodes = 16

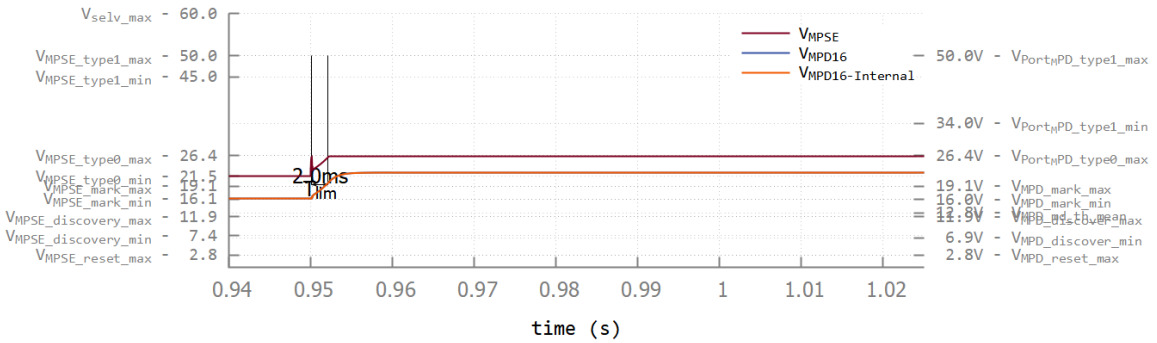
MPDs sinking 1W each

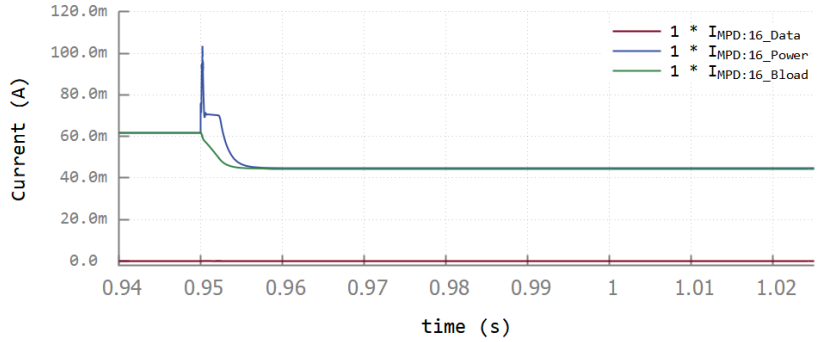
Ilim = 1.1A

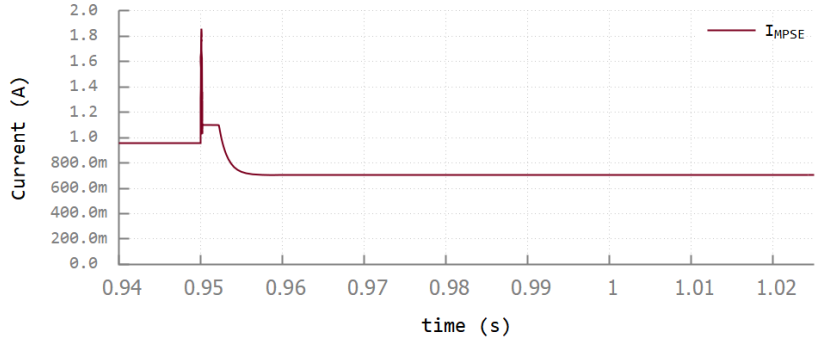
Cport = 10uF

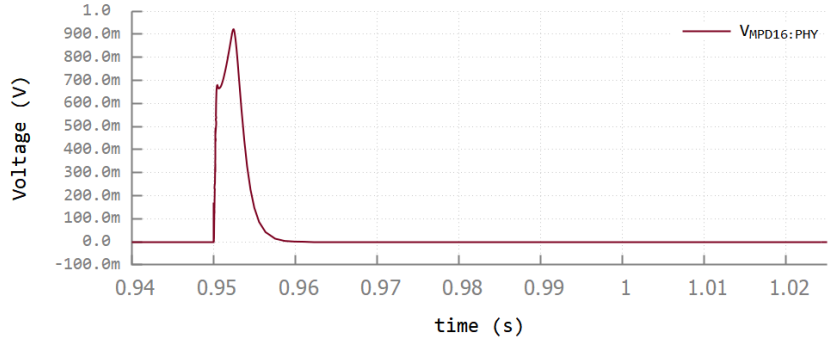
Tlim < 1ms

Bold Lines highlight parameter change from last slide









Type 0 Supply Step

Step MPSE Voltage from 21.5V to 26.4V

1 meter mixing segment

Nodes = 16

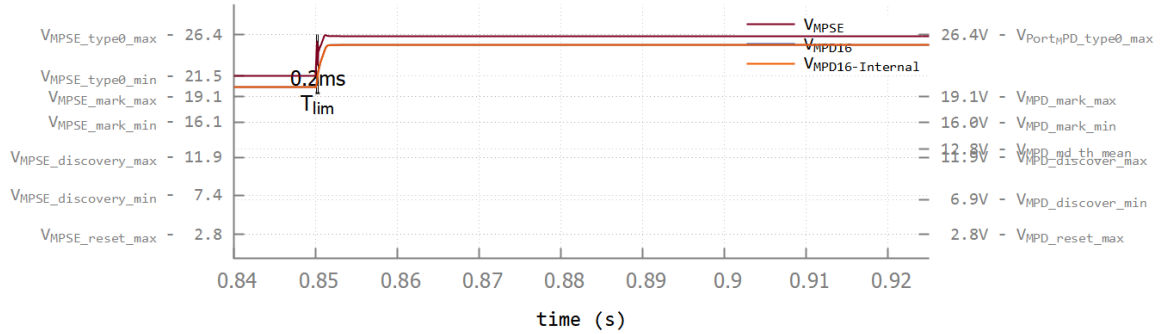
MPDs sinking 1W each

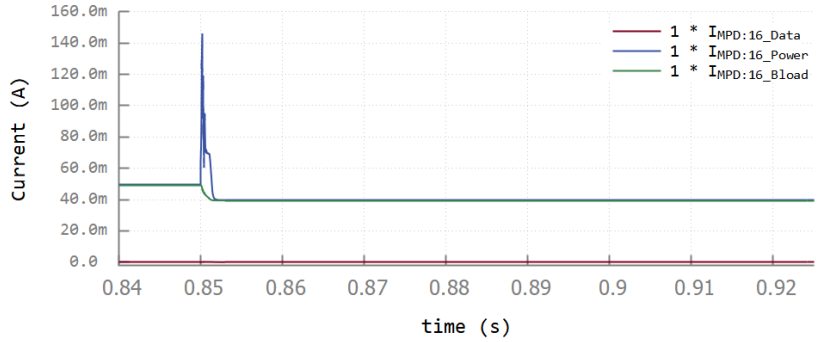
Ilim = 1.1A

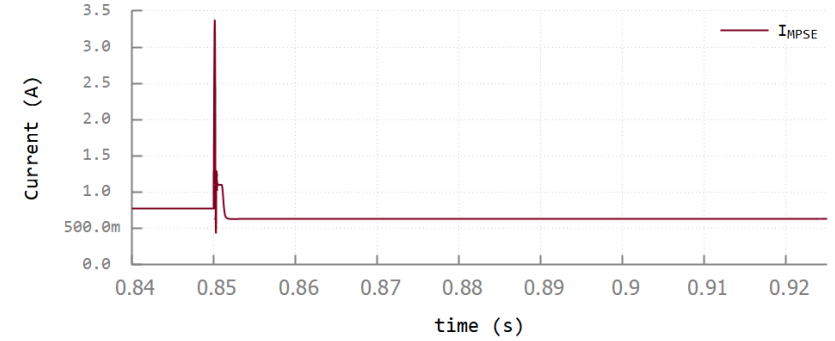
Cport = 10uF

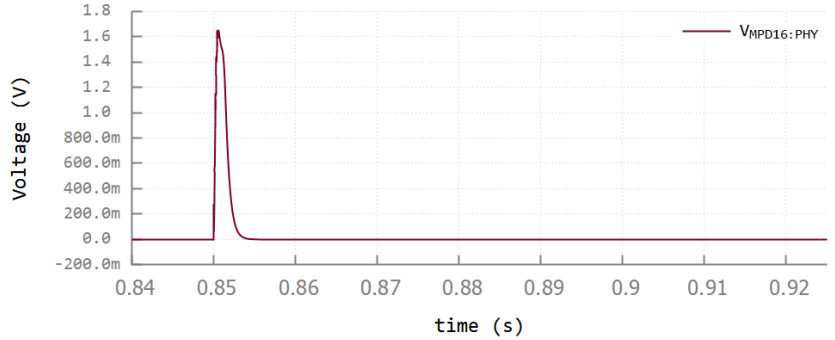
Tlim < 1ms

Bold Lines highlight parameter change from last slide









Type 0 Supply Step

Step MPSE Voltage from 21.5V to 26.4V

1 meter mixing segment

Nodes = 16

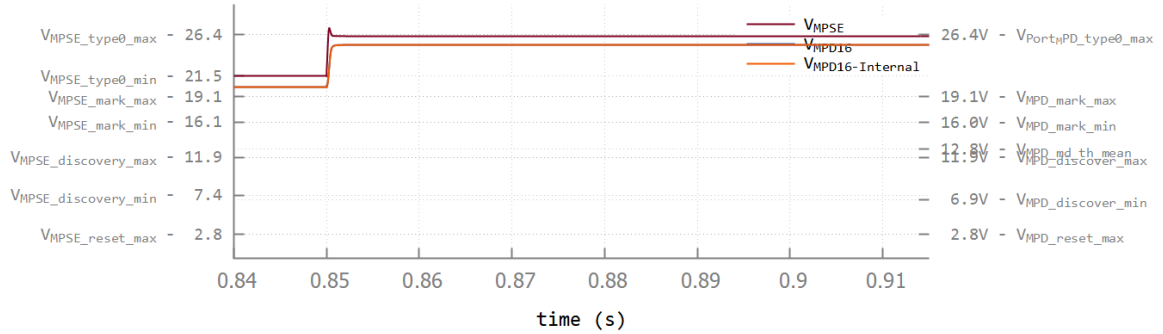
MPDs sinking 1W each

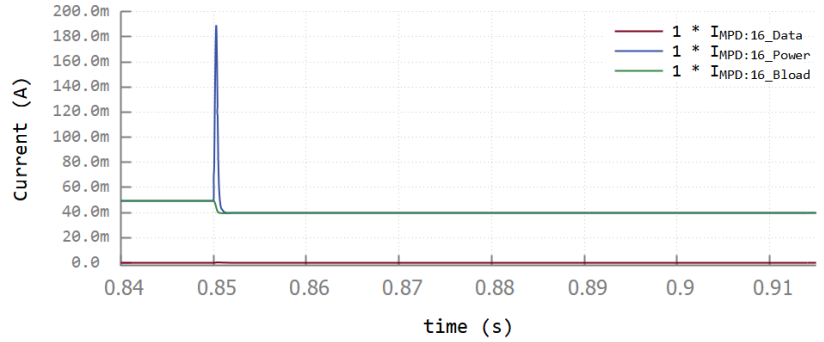
Ilim = 3.8A

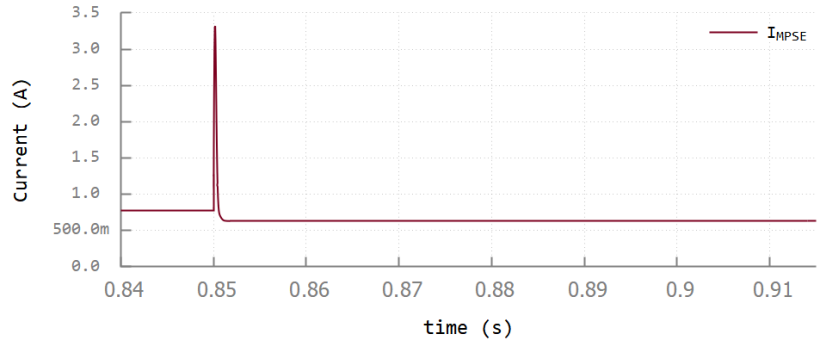
Cport = 10uF

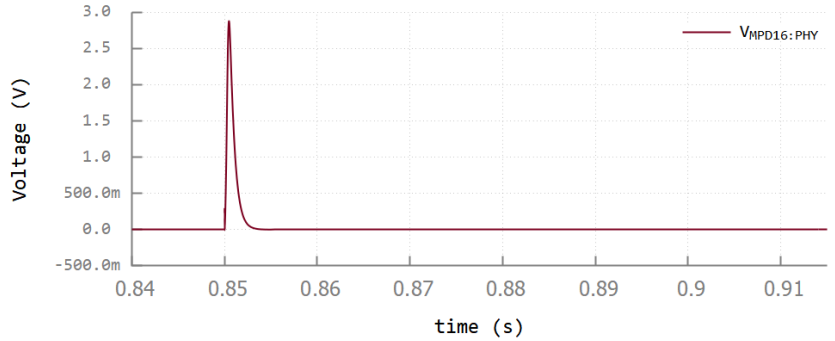
Tlim < N/A

Bold Lines highlight parameter change from last slide









Type 0 Supply Step

Step MPSE Voltage from 21.5V to 26.4V

1 meter mixing segment

Nodes = 16

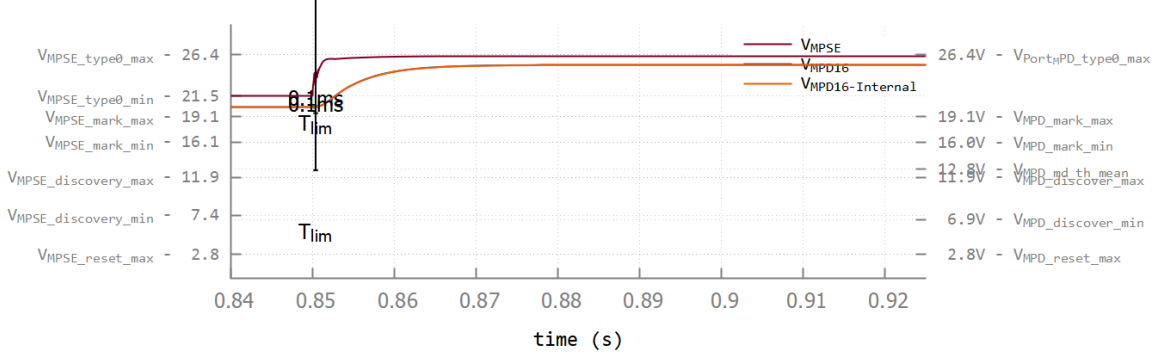
MPDs sinking 1W each

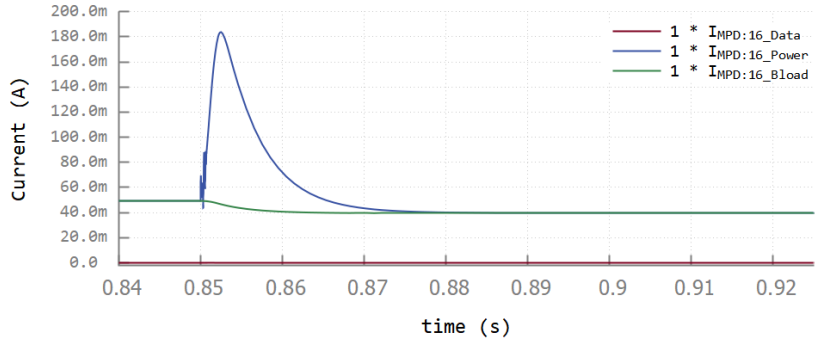
Ilim = 3.8A

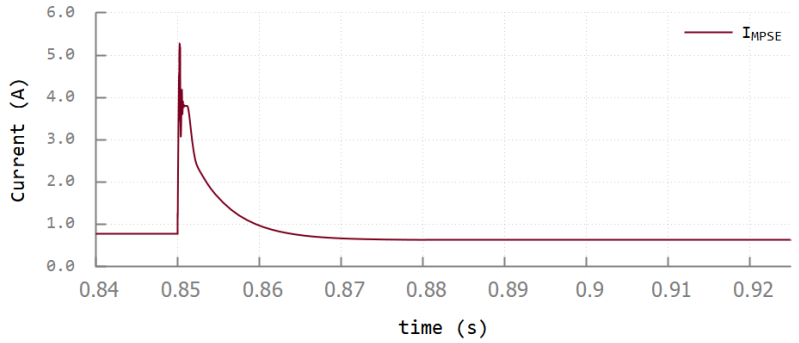
Cport = 180uF

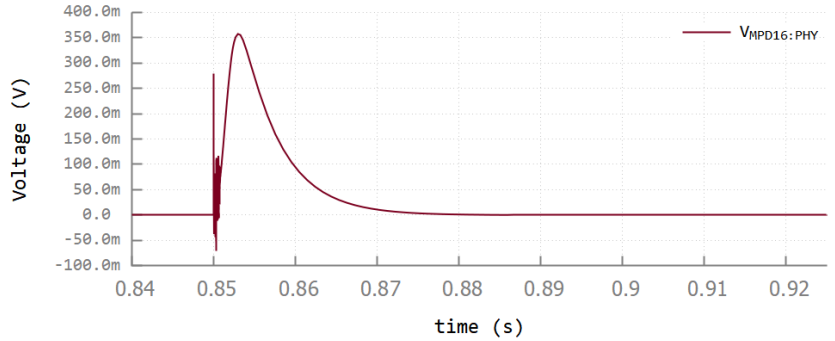
Tlim < 1ms

Bold Lines highlight parameter change from last slide









Type 0 Supply Step

Step MPSE Voltage from 21.5V to 26.4V

1 meter mixing segment

Nodes = 16

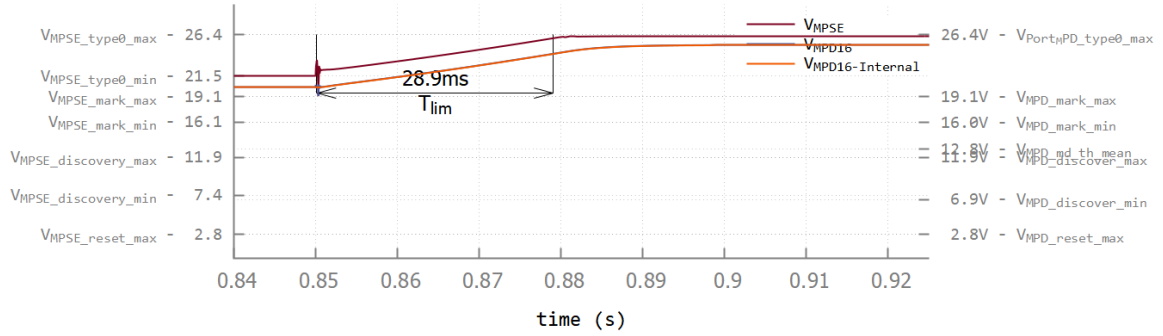
MPDs sinking 1W each

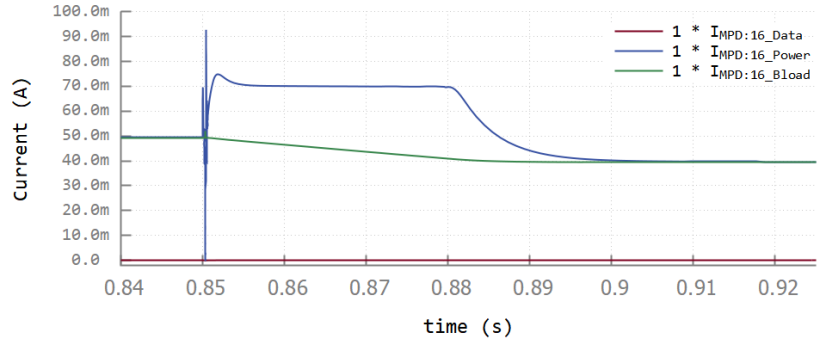
Ilim = 1.1A

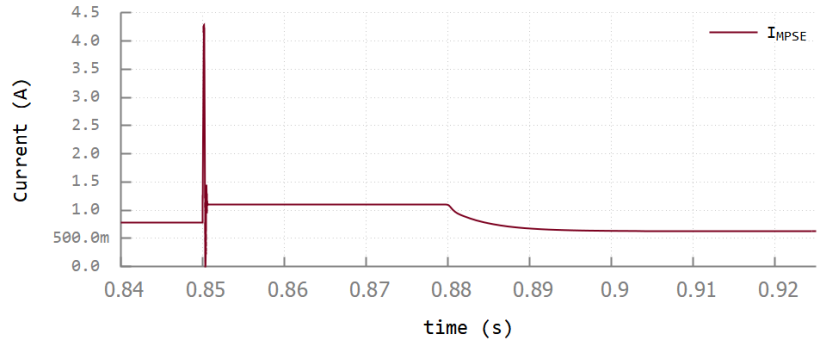
Cport = 180uF

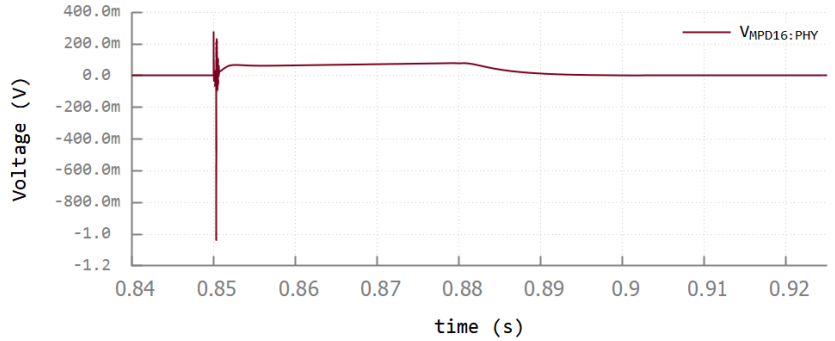
Tlim < 1ms

Bold Lines highlight parameter change from last slide









Summary

Length	Ilim	Cport	Vmax,phy
50	1.1	180	0.05
50	3.8	180	0.14
50	3.8	10	1.5
50	1.1	10	0.9
1	1.1	10	1.6
1	3.8	10	2.8
1	3.8	180	0.35
1	1.1	180	0.05

Smallest excursions are with:

- Large Cport
- Low Ilim

Suggested Current / Cport Limits

Current Limit

1.10A min

1.25A typ.

1.40A max

Attempt to provide at least 1.10A before current limit

Typical value of 1.25A +/- 12%

Cport max

Set to 180uF – Same as PoE

1.1A can inrush 16 nodes with 180uF Cport capacitance drawing full load (1W) each

Limit time is 48ms

Suggest we increase Tlim,min to 50ms

Maintain 75ms Tlim,max

Resolution to comments 102, 103 and 104

Table 169–5—PSE output requirements

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

Table 169–8—MPD power supply limits

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	Input voltage	VPort_MPD	V	16	30	0	
				34	50	1	
2	Unit power	P_{MPD_1U}	W		1	0	1 unit load
					2	1	1 unit load
3	Unit loading	N_{unit}	-	1	16	ALL	Must be an integer
4	Input power	P_{MPD}	W	1	16	0	N_{unit} * P_{MPD_1U}
				2	32	1	
5	Inrush current	I_{Inrush_MPD}	A	-	.01	ALL	
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	
8	Inrush backoff time	$T_{Inrush\_backoff}$	ms	10	20	ALL	
9	Inrush to operating state delay	T_{Delay}	ms	10	20	ALL	
10	MPD MPI capacitance during POWER_ON	C_{Port}	µF	-	~~TBD~~ 180	ALL	
11	MPD current when connected to incompatible MPSE type	$I_{MPD\_Disabled}$	µA	-	500	ALL	

Thank You