IEEE802.3da standard review

A Leading Provider of Smart, Connected and Secure Embedded Control Solutions

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SMART | CONNECTED | SECURE

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Supporters

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Comments summary

Comment #	Figure/Table /Paragraph	Item #	Subject
1	Table 189-1	-	V_{MPSE_MAX}
2	Table 189-5	Item 11	ICUT
3	Table 189-5	Item 4	ILIM
4	Table 189-5	Item 5	TLIM
5	Paragraph 189.4.8	-	editorial
6	Table 189-5	Item 6	TINRUSH (editorial)
7	Table 189-4	Item 1	Ibad
8	Table 189-7	Item 4, 5, 10	Mark, discovery and Idle event current
9	Table 189-3	Item 7	Ishort
10	Paragraph 189.4.4.5	MPSE State diagram	state DISCOVERY_HIGH_MARK
11	Paragraph 189.4.4.5	MPSE State diagram	state DISCOVERY_LOW
12	Table 189-1	-	VMPD(min)
13	Figure 189-8	MPD state Diagram	Part C - PON_EVAL
14	Table 189-9	Item 11	MPD / MPSE TPS currents
15	Figure 189-8	MPD state Diagram	TPS current and MPD Disable current
16	Table 189-5	Item 6	MPSE Slew Rate
17	Figure 189-12	-	Grounded MPoE systems

Comment #1 : Table 189-1, V_{MPSE_MAX}

Table 189–1—System power types

	30 V Max MPSE (Type 0)	50 V Max MPSE (Type 1)	Units
V_{MPSE} max	30	~~50~~ **57**	V
V_{MPSE} min	21.6	45	V
V_{MPD} min	16	35.5	V
I_{MPSE} min	1100	1760	mA
P_{MPSE} min	23.76	79.2	W
P_{MPD_1U} max	1.1	4	W

Clause/Table	Issue	Suggested remedy	Notes
Table 189-1	Type 1 voltage range is too tight for regular commercial power supply	We propose to increase Type 1 voltage range up to 57V. Also **paragraph 189.6.3 Fault tolerance** require MPSE and MPD tolerate 60V. Therefore , why not to increase type 1 max voltage to 57 V as in POE?	

Comment #2 Table 189-5, I_{CUT}

Table 189–5—MPSE output requirements

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	DC output voltage during POWER_ON state	V_{MPSE}	V	21.6	30	0	
				45	50	1	
2	Continuous output capability in POWER_ON state	P_{MPSE}	W	23.76	—	0	See 189.4.7
				79.2	—	1	
3	Output slew rate dV/dt		V/ms	—	9.5	ALL	
4	Output current - at short circuit condition	I_{LIM}	A	1.2	2.3	ALL	See 189.4.9
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	$P_{MPSE}min/V_{MPSE}$	I_{LIM}	ALL	See 189.4.8
12	Overload time limit	T_{CUT}	ms	50	70	ALL	See 189.4.8

Clause/Table	Issue	Suggested remedy	Notes
Table 189-5	Item 11: 1. maximum ICUT is bounded by ILIM 2. Change paragraph 189.4.8	1. Add ILIM to ICUT max (similar to PoE standard) to item 11 2. See next page for update on paragraph 189.4.8	

Comment #3 Table 189-5, I_{LIM}

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	DC output voltage during POW-ER_ON state	V_{MPSE}	V	21.6	30	0	
				45	50	1	
2	Continuous output capability in POWER_ON state	P_{MPSE}	W	23.76	—	0	See 189.4.7
				79.2	—	1	
3	Output slew rate dV/dt		V/ms	—	9.5	ALL	
4	Output current - at short circuit condi-tion	I_{LIM}	A	1.2	2.3	ALL	See 189.4.9
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

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	DC output voltage during POW-ER_ON state	V_{MPSE}	V	21.6	30	0	
				45	50	1	
2	Continuous output capability in POWER_ON state	P_{MPSE}	W	23.76	-	0	See 189.4.7
				79.2	-	1	
3	Output slew rate dV/dt		V/ms	-	9.5	ALL	
4	Output current - at short circuit condi-tion	I_{LIM}	A	1.2	2.3	~~ALL~~ Type 0	See 189.4.9
				~~1.2~~ 1.94	2.3	~~ALL~~ Type 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

Clause/Table	Issue	Suggested remedy	Notes
Table 189-5	Item 4: ILIM min is too low for Type 1.	• Split the I_{LIM} value for Type 0 and Type 1. • Type 1 I_{LIM} must be always greater than the continuous current. • Suggested I_{LIM} value is 10% above I_{CUT}.	Calculations for **Type 1:** • **I_{CUT}** for max. continuous current = Pmpse(min) / Vmpse(min)= 79.2W / 45V = **1.76A** • **I_{CUT}** (max) < I_{LIM} • **I_{LIM}** = 1.10 x I_{CUT} • I_{LIM} = 1.76 A x 1.1 = 1.94A

Comment #4:Table 189-5, TLIM

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	DC output voltage during POW-ER_ON state	VMPSE	V	21.6	30	0	
				45	50	1	
2	Continuous output capability in POWER_ON state	PMPSE	W	23.76	100	0	See 189.4.7
				79.2	100	1	
3	Output slew rate dV/dt		V/ms	-	9.5	ALL	
4	Output current - at short circuit condi-tion	ILIM	A	1.2	2.3	ALL	See 189.4.9
5	Short-circuit time limit	TLIM	ms	~~50~~ 6	75	ALL	$V_{MPSE} \geq V_{MPSE(min)}$ See 189.4.9
6	Inrush time	TInrush	ms	10	20	ALL	See 189.4.9

Output voltage during transients- Should we add to the specs?

Clause/Table	Issue	Suggested remedy	Notes
Table 189-5	Item 5. 1. Short-circuit time limit of 50ms is too long for short-circuit condition. 2. Change paragraph 189.4.9. (see next slide)	1. Proposing to change Tlim_min to 6ms if voltage does not drop below Vpmse_min This is similar to IEEE802.3BT PoE standard for the same current 2. See next slide	

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Discuss: Paragraph 189.4.9

189.4.9 Short circuit current

During operation in the INRUSH and POWER_ON states, the MPSE shall limit the current to I_{LIM} for a duration of up to T_{LIM} in order to account for MPSE dV/dt transients at the MPI as defined in Table 189–5. If I_{MPSE} exceeds I_{LIM} min during the POWER_ON state, the MPSE output voltage may drop below V_{MPSE} min.

Suggested Remedy:

189.4.9 Short circuit current

During operation in ~~the INRUSH and~~ POWER_ON states, the MPSE shall limit the current to ILIM for a duration of ~~up to~~ TLIM in order to account for MPSE dV/dt transients at the MPI as defined in Table 189–5. If I_{MPSE} exceeds I_{LIM} min during the POWER_ON state, the MPSE output voltage may drop below V_{MPSE} min.
An MPSE in a power on state may remove power without regard to TLIM when the voltage no longer meets the V_{MPSE}(min) specification for a continuous period up to 250µs.
If a short-circuit condition occurs during INRUSH state, MPSE may remove power regardless of T_{INRUSH}.

This is added to prevent the MPSE from having to provide power during short-circuit condition, where up to 100W may be developing over the MPSE.

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Comment #5: Paragraph 189.4.8

189.4.8 Overload current

If the current exceeds ICUT for longer than TCUT, the MPSE may remove power. The cumulative duration of TCUT is measured using a sliding window of 1 second width. The minimum value of ICUT is PMPSE min/VMPSE to ensure that the PSE delivers the guaranteed power regardless of VMPSE. ICUT is required to scale with VMPSE if the MPSE cannot support a minimum of 1 A at any VMPSE. There is no maximum ICUT as the minimum ILIM bounds the maximum ICUT.

Suggested Remedy:

189.4.8 Overload current

If the current exceeds ICUT for longer than TCUT, the MPSE may remove power. The cumulative duration of TCUT is measured using a sliding window of 1 second width. The minimum value of ICUT is PMPSE min/VMPSE to ensure that the PSE delivers the guaranteed power regardless of VMPSE. ICUT is required to scale with VMPSE if the MPSE cannot support a minimum of 1 A at any VMPSE. ~~*There is no maximum ICUT as*~~ ILIM bounds the maximum ICUT.

Comment #6, Table 189-5, T_{INRUSH}

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	DC output voltage during POW-ER_ON state	VMPSE	V	21.6	30	0	
				45	50	1	
2	Continuous output capability in POWER_ON state	PMPSE	W	23.76	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 condi- tion	ILIM	A	1.2	2.3	ALL	See 189.4.9
5	Short-circuit time limit	TLIM	ms	50	75	ALL	See 189.4.9
6	Inrush time	TInrush	ms	10	20	ALL	**See 189.4.TBD**
7	MPD maintain power signature dropout time limit	TTPSDO	ms	320	400	ALL	See 189.4.10.1
8	PD TPS time for validity	TTPS	ms	6	-	ALL	See 189.4.10.1

Clause/Table	Issue	Suggested remedy	Notes
Table 189-5	**Item 6:** It specifies inrush time but if no inrush current specified it is not clear what is a purpose of inrush time?	Add explanation of inrush time, for example: "Time required by MPSE to set up and stabilize output parameters after discovery phase".	

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Comment #7, Table 189-4, I_{bad}

Table 189–4—Discovery rejection criteria

Item	Parameter	Symbol	Min	Max	Units
1	Reject discovery - short circuit	I_{bad}	~~30~~ 51	-	mA
2	Reject discovery - open circuit	I_{open}	-	75	µA

Clause/Table	Issue	Suggested remedy	Notes
Table 189-4	Reject Discovery - short circuit Ibad is lower than maximum allowed discovery current of MPDs. Ibad = 30mA, but 2mA x 16 = 32mA	Increase MPSE reject discovery short-circuit current above 16xImpd_discover(max) , for example, 51mA as in POE standard	

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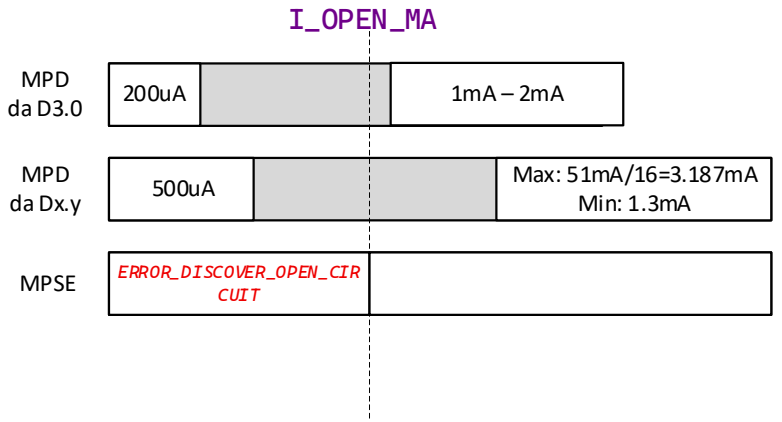
Comment #8, Table 189-7

Item	Parameter	Symbol	Min	Max	Units
1	Mark event voltage	VMPD_mark	16	19.1	V
2	Mark discovery threshold	VDiscovery_th	11.9	16	V
3	Discovery event voltage	VMPD_discover	6.9	11.9	V
4	Mark event current	IMPD_mark	0.1	~~0.2~~ **0.5**	mA
5	Discovery event current	IMPD_discover	~~1~~ **1.3**	~~2~~ **3.187**	mA
6	Discovery reset threshold	VReset_th	2.8	6.9	V
10	IDLE and OFFLINE event current	IMPD_idle	-	~~0.2~~ **0.5**	mA



Clause/Table	Issue	Suggested remedy	Notes
Table 189-7	• **Items 4, 10:** Too tight current range of 0.1mA - 0.2mA over all MPD operating conditions for practical implementation • **Item 5**: Too tight current range of 1-2 mA over all MPD operating conditions for practical implementation.	• Proposing to change range to 1.3-3.187mA • Proposing to changel Impd_mark(max) to 0.5mA. Impd_idle(max) = 0.5mA	For Ibad(min) = 51mA: Impd_discover(max) = 51mA / 16units = **3.187mA.** Impd_discover(min) = 1.3mA to get reasonable gap from max value, and from Impd_mark(max)

Comment #9, Table 189-3

Table 189–3—MPSE discovery parameters

Item	Parameter	Symbol	Min	Max	Units
1	Discovery high mark voltage	V_{Mark}	16.1	19.1	V
2	Discovery low voltage	$V_{Discovery}$	7.4	11.9	V
3	Discovery current limit	$I_{Discovery\_LIM}$	50	100	mA
4	Discovery high event time	$T_{Discovery\_high}$	7	44	ms
5	Discovery low event time	$T_{Discovery\_low}$	20	44	ms
6	Discovery backoff time	$T_{Discovery\_Backoff}$	150	—	ms
7	Mark short circuit threshold	I_{Mark_short}	~~3~~ **8**	~~4~~ **12**	mA
8	Mark measurement delay	$T_{Mark\_measure}$	5	—	ms
9	Discovery measure-ment delay	$T_{Discover\_measure}$	6.5	—	ms
10	Discovery reset	V_{MPSE_reset}	0	2.8	V

Clause/Table	Issue	Suggested remedy	Notes
Table 189-3	Item 7, Mark Short circuit threshold spec Min as 3mA. But according to Table 189-7 item 4, Max mark event current is 0.2mA and for 16 MPDs, PSE will see 16x0.2mA=3.2mA current which is larger than sspecified PSE Mark short ccircuit current of 3mA	Change Mark short circuit Min current to Impd_mark(max) x 16. For Impd_mark(max) = 0.5mA (see comment #10): Min value 8mA. Max current to 12mA (Min + 4mA).	

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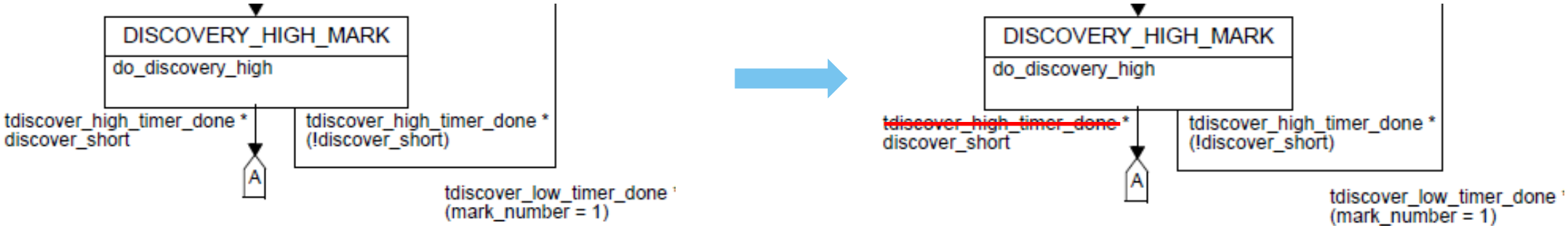
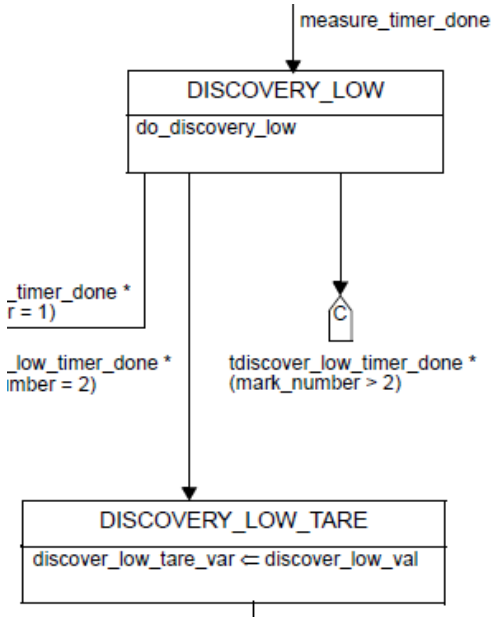
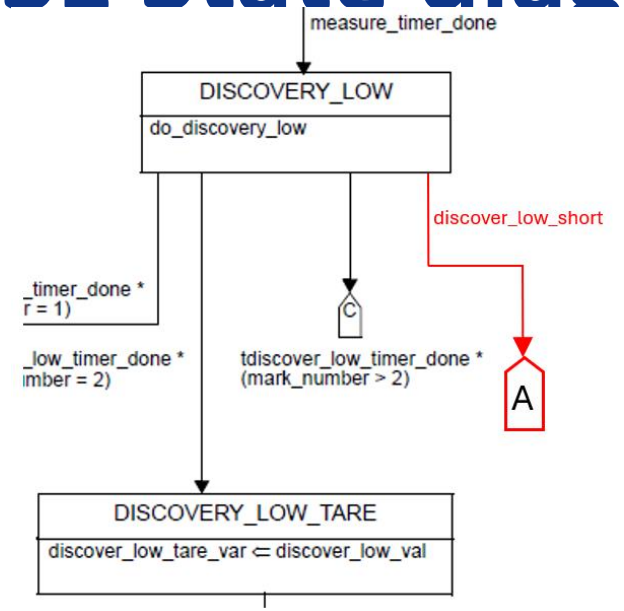
Comment #10, 189.4.4.5 MPSE State diagram



Clause/Table	Issue	Suggested remedy	Notes
189.4.4.5, state DISCOVERY_HIGH_MARK	short circuit can be detected as soon as 5ms. however, based on state diagram, it is required to wait $t_{discovery\_high\_time}$ (min) 7ms before proceeding to BACKOFF state.	update the short condition in “DISCOVERY_HIGH_MARK” state from “tdiscover_high_timer_done * discover_short“ to “discover_short”	

Comment #11 189.4.4.5 MPSE State diagram





Clause/Table	Issue	Suggested remedy	Notes
189.4.4.5, state DISCOVERY_LOW	No testing for short-circuit condition. If a short occurs during the DICSOVERY_LOW state, or if the result is a non-valid value, no definition on how to proceed.	• Add new return variable (e.g. “discover_low_short”) to the function do_discovery_low, in similar to the function “do_discovery_high”. The new variable value is TRUE if the measured $I_{Discovery}$ is greater than I_{BAD} , otherwise the value is FALSE. • Modify state diagram as shown above.	

Comment #12, Table 189-1 (D3.0)

Table 189–1—System power types

	30 V Max MPSE (Type 0)	50 V Max MPSE (Type 1)	Units
V_{MPSE} max	30	50	V
V_{MPSE} min	21.6	45	V
V_{MPD} min	16	35.5	V
I_{MPSE} min	1100	1760	mA
P_{MPSE} min	23.76	79.2	W
P_{MPD_1U} max	1.1	4	W

See calculation of Michael Paul calculation

Clause/Table	Issue	Suggested remedy	Notes
Table 189-1 **Related also to:** **Table 189-5 (Items 1 and 2)** **Table 189-9** **(Items 1 and 4)**	MPSE minimum guaranteed current is lower than MPD max allowed current. MPSE minimum guaranteed current: 79.2W/45V = 1.76A MPD maximum allowed current: (16 x 4W)/35.5V = 1.803A	• For example, increase MPD minimum voltage to 36.4V Type 1: 64W/36.4V = 1.758A < Impse(min)	

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Comment #13, Figure 189–8—Top level MPD state diagram continued, part c

- If a Type0 MPD is connected to the bus, but the MPSE is Type 1, the MPD state-machine will loop infinitely between PON_EVAL state and PON_NO_POWER state.
- This is because preset_mismatch_indication is true, and also $V_{MPD} > V_{type0\_th}$ is true.
- This is also true for type 1 MPD and Type 0 MPSE.

What is the purpose of this loop?

See next slide with our proposal.

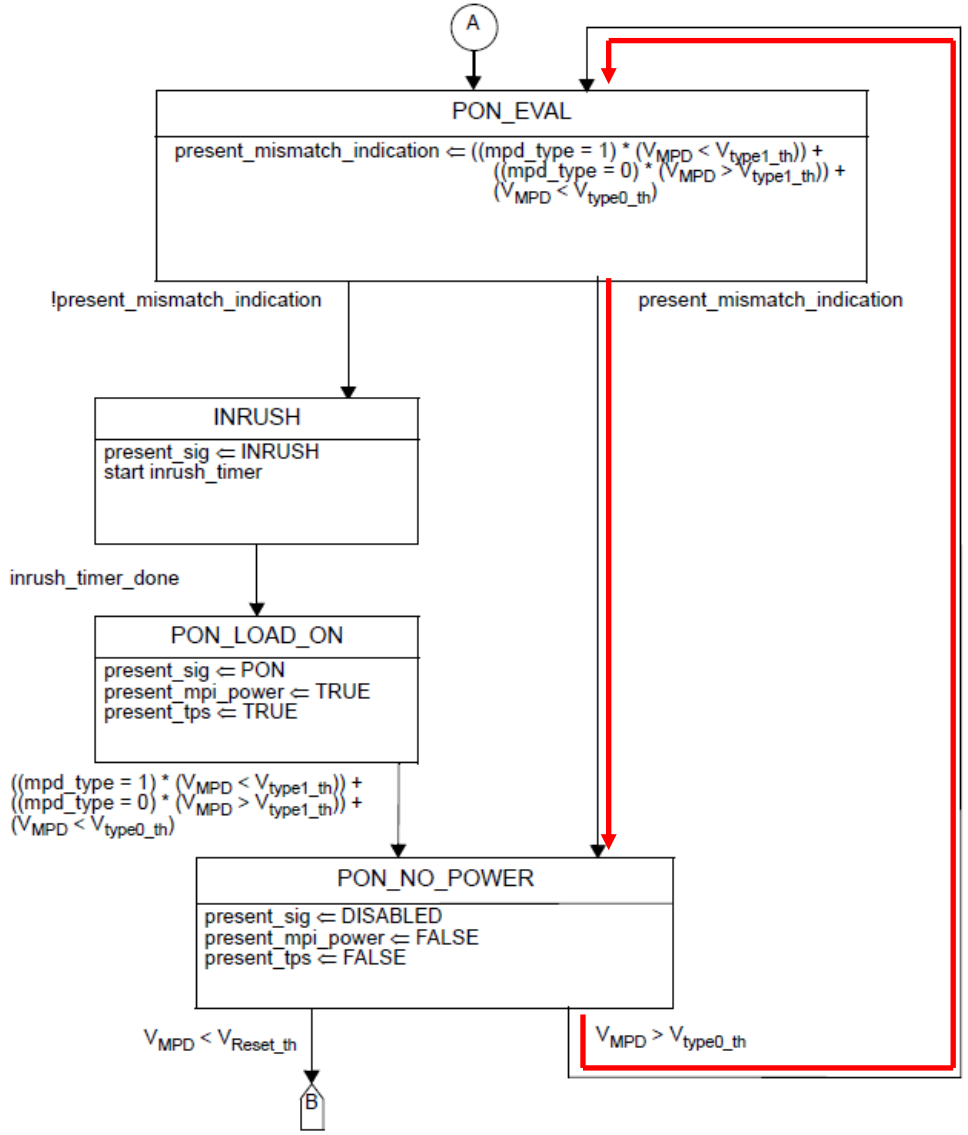


Figure 189–8—Top level MPD state diagram continued, part c

Comment #13, Figure 189–8—Top level MPD state diagram continued, part c

Current solution

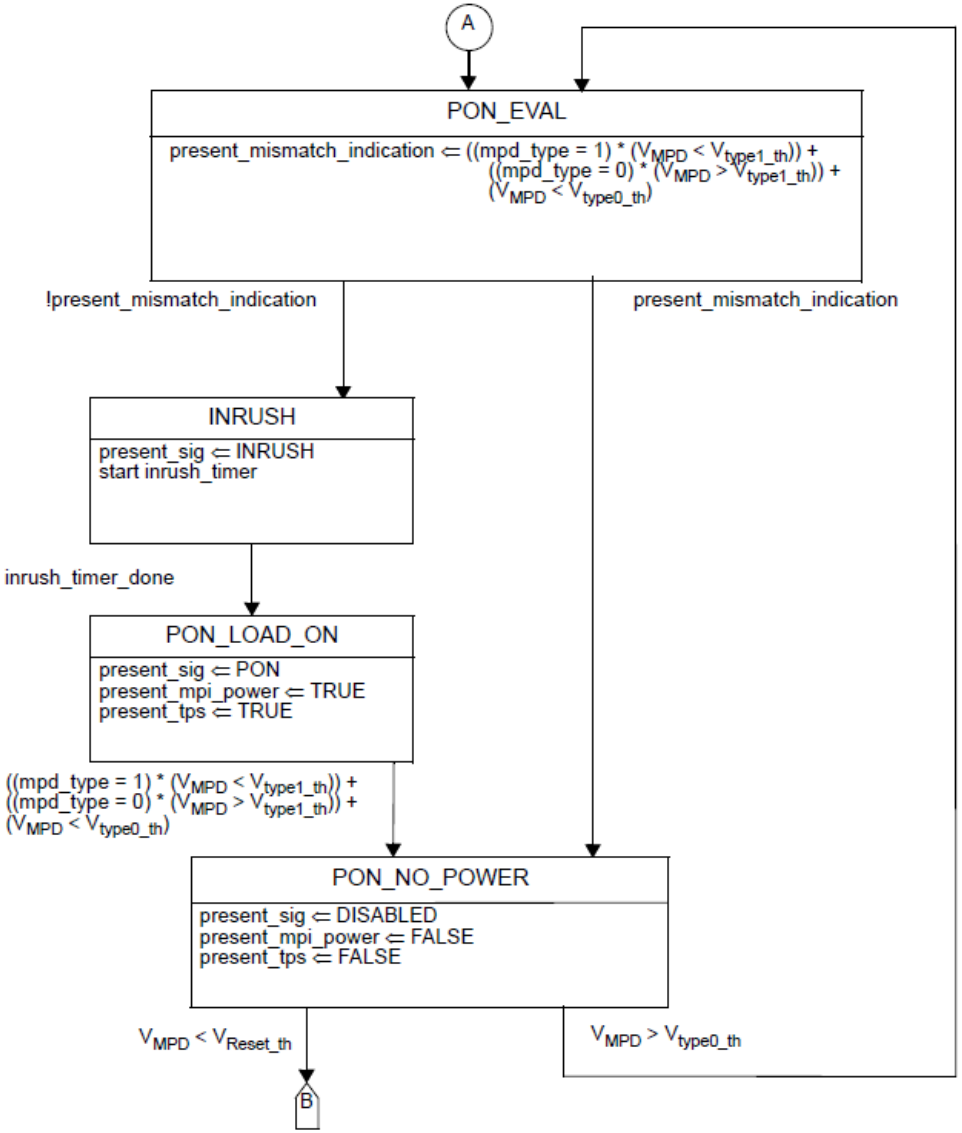
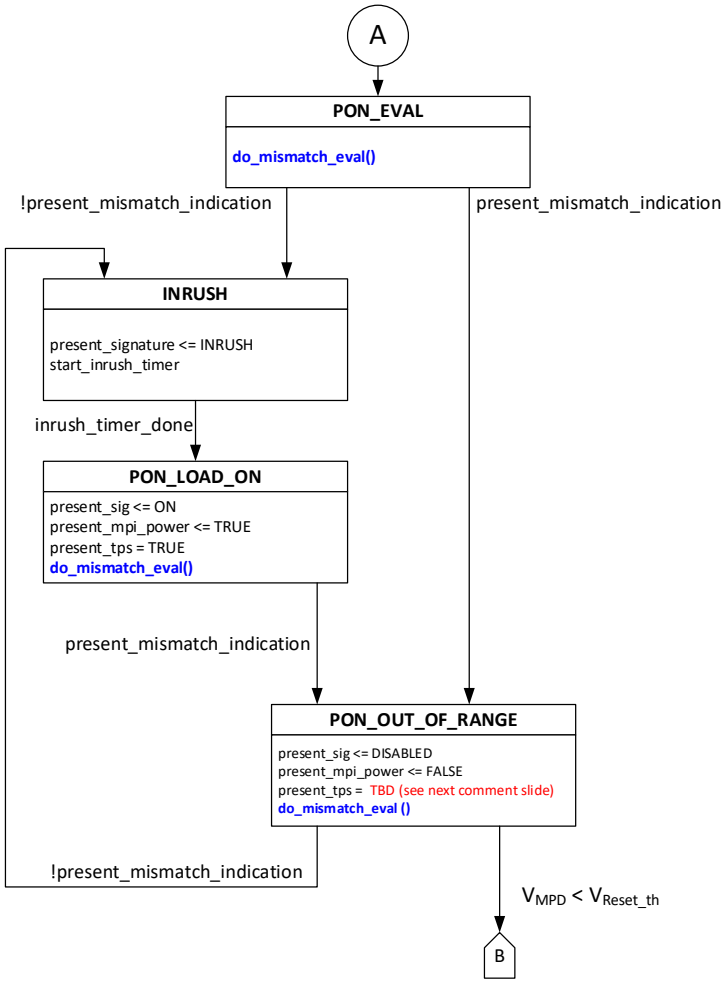


Figure 189–8—Top level MPD state diagram continued, part c

Our Proposal

do_mismatch_eval():
calculates the following and returns "present_mismatch_indication":
present_mismatch_indication = ((mpd_type = 1) * ($V_{MPD} < V_{type1\_th}$)) + ((mpd_type = 0) * ($V_{MPD} > V_{type1\_th}$)) + ($V_{MPD} < V_{type0\_th}$)



Comment #14, TPS current and MPD Disable current issue

- A MPD may reach disabled mode if it has a mismatch between its type and the MPSE type.
- When an MPD is in DISABLED mode, its current can reach 5mA (Table 189-9), whereas the minimum IHOLD current of the MPSE is only 4mA.
- This may cause a DISABLED MPD to keep the MPSE powered as the disabled current is larger than the IHOLD current, even when all other MPDs have been disconnected – as the mismatch MPD will draw “disabled” current.
- **Concept of TPS does not work for multidrop…????**

Suggested Remedy:???

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	21.6	30	0	
				45	50	1	
2	Continuous output capability in POWER_ON state	P_{MPSE}	W	23.76	—	0	See 189.4.7
				79.2	—	1	
3	Output slew rate dV/dt		V/ms	—	9.5	ALL	
4	Output current - at short circuit condition	I_{LIM}	A	1.2	2.3	ALL	See 189.4.9
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	$P_{MPSEmin}/V_{MPSE}$	—	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
8	Mark Timer duration	T_{Mark}	ms	50	75	ALL	See 189.5.5.2
9	Inrush to operating state delay	T_{Inrush}	ms	50	75	ALL	
10	MPD MPI capacitance during POWER_ON	C_{Port}	µF	-	180	ALL	
11	MPD current when connected to incompatible MPSE type	$I_{MPD\_Disabled}$	mA	-	5	ALL	
12	MPD current slew rate dI/dt		mA/ms	-	100	ALL	

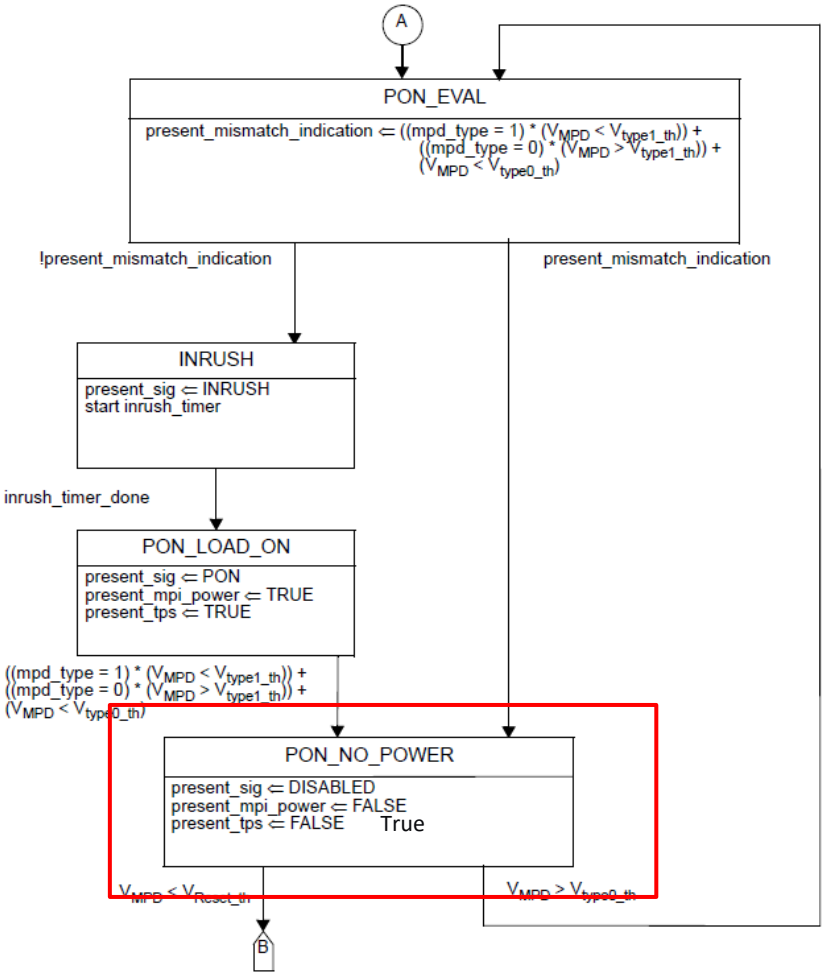


Figure 189–8—Top level MPD state diagram continued, part c

Comment #15, TPS current and MPD Disable current issue

Current solution

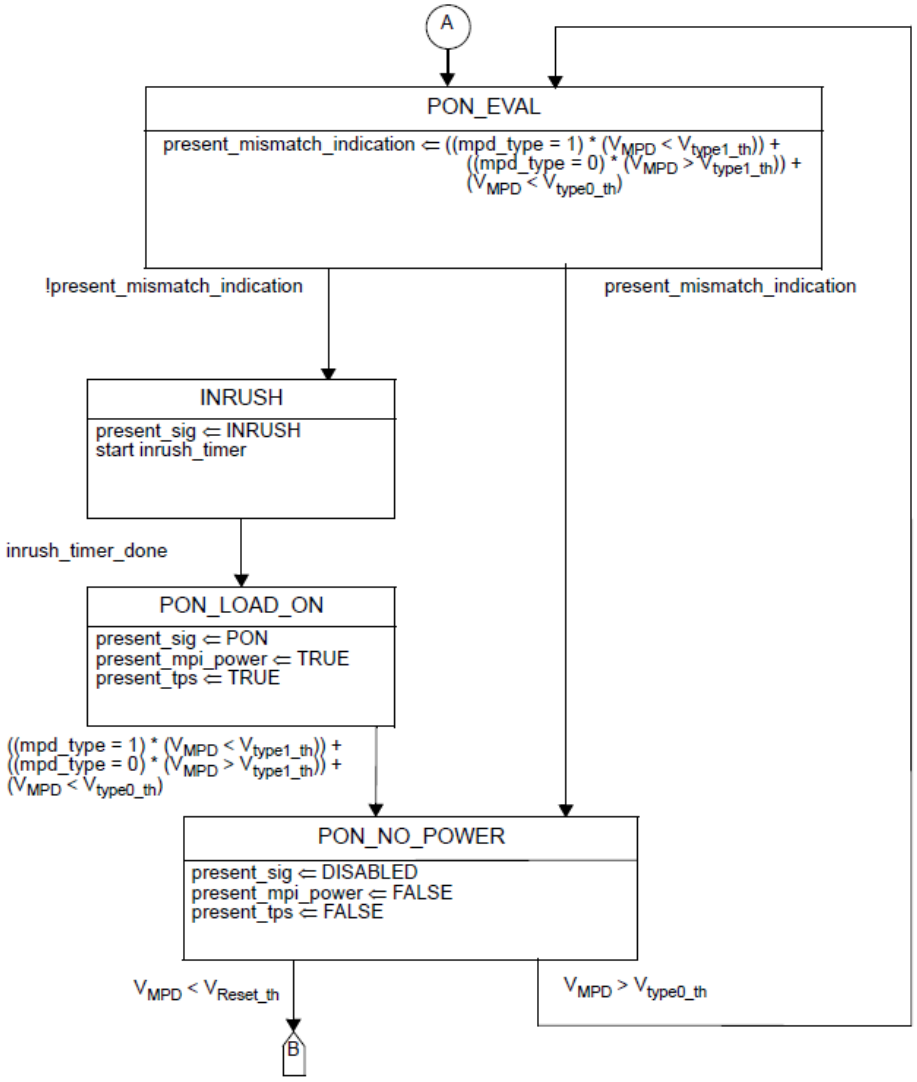
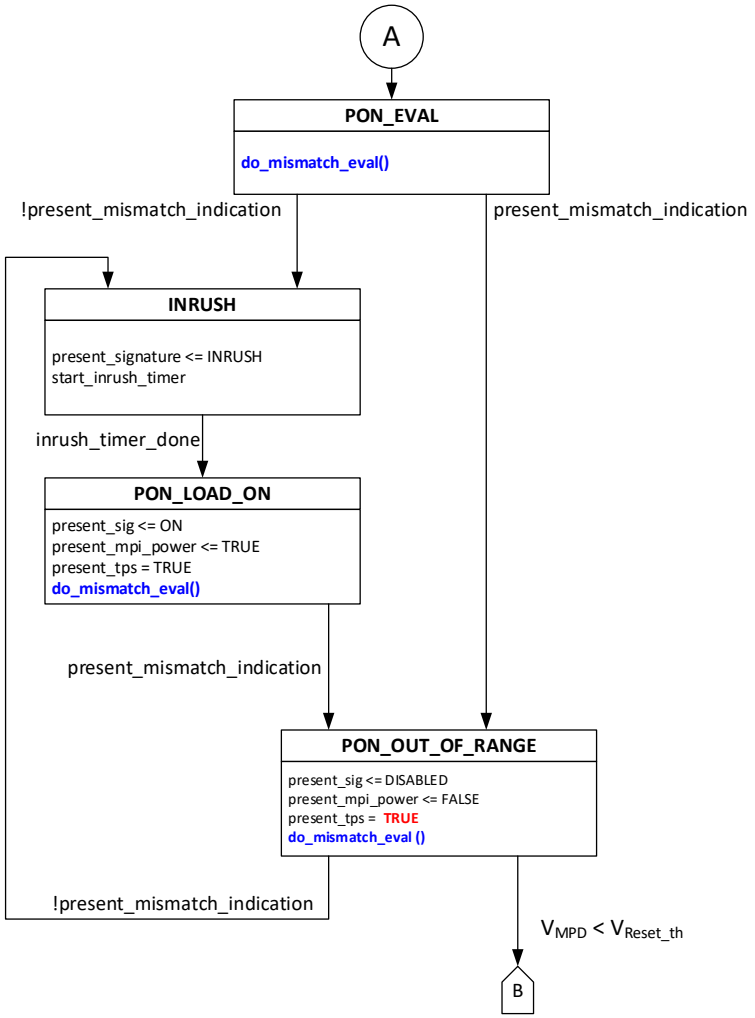


Figure 189–8—Top level MPD state diagram continued, part c

Our Proposal

do_mismatch_eval():
calculates the following and returns "present_mismatch_indication":
present_mismatch_indication = ((mpd_type = 1) * ($V_{MPD} < V_{type1\_th}$)) + ((mpd_type = 0) * ($V_{MPD} > V_{type1\_th}$)) + ($V_{MPD} < V_{type0\_th}$)



Comment #16, MPSE Slew Rate

- Table 189-5 Item 3 specifies Maximum MPSE Slew-rate of 9.5V/ms.
- This figure is much slower than the value received during MPSE inrush with a single MPD:
- C_{MPD} (min) = 5nF
- IMPS (min) = 1.1A

$$\frac{dV}{dt} = \frac{I}{C} > \frac{1A}{5n} = 200000\frac{V}{ms}$$

Suggested Remedy:

Add additional explanation about the conditions used to calculate this 9.5V/ms, or what purpose it serves . Indicate that it does not related to inrush.

Table 189–5—PSE output requirements

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	DC output voltage during POW-ER_ON state	V_{MPSE}	V	26	30	0	
				45	50	1	
2	Continuous output capability in POWER_ON state	P_{MPSE}	W	26	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 condi-tion	I_{LIM}	A	1.1	1.4	ALL	See 189.4.9
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

Comment #17, Grounded MPoE systems

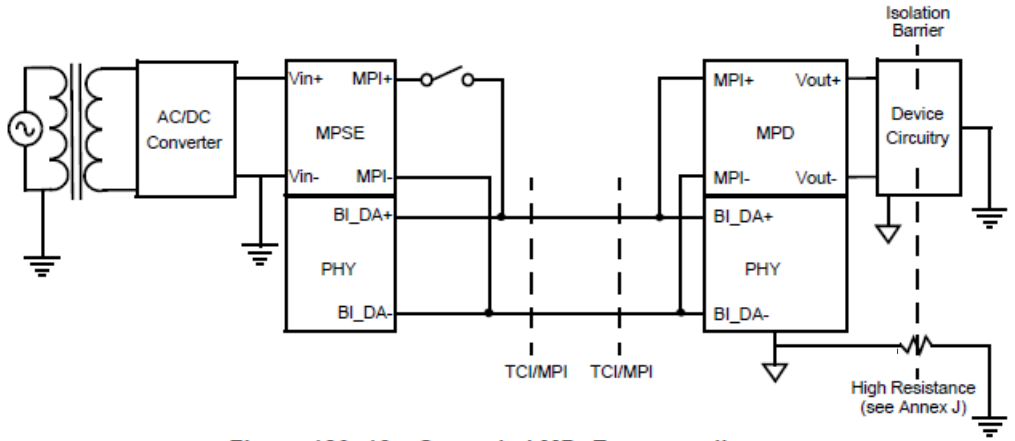
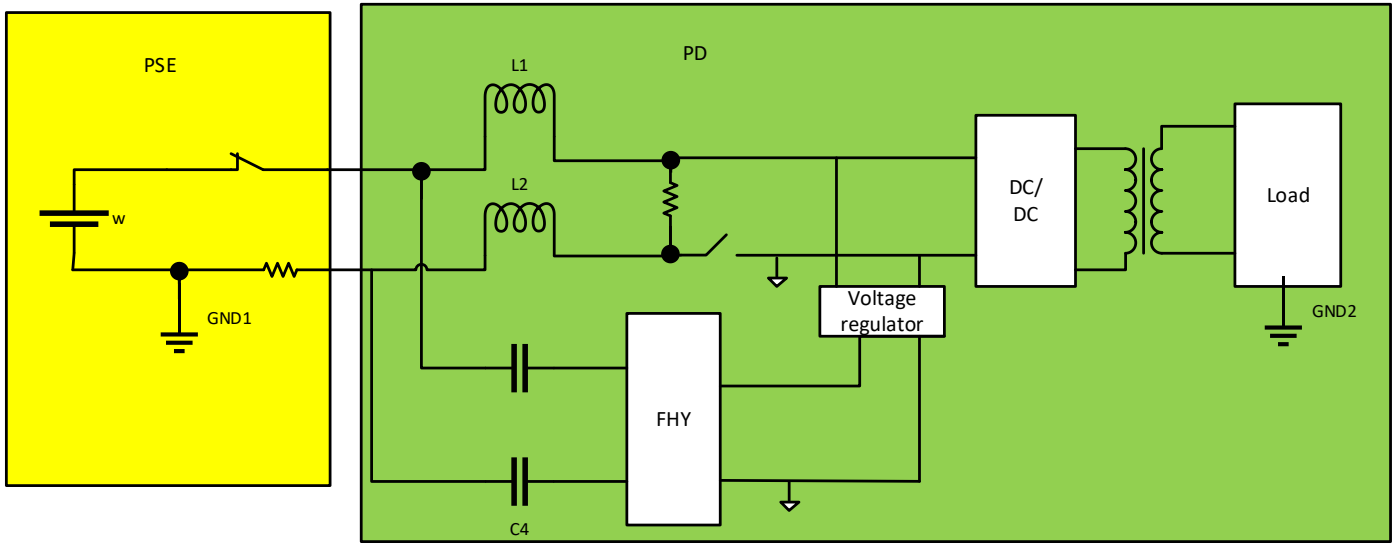


Figure 189–12—Grounded MPoE system diagram



189.6.2.2.1 MPoE requirements for grounded MPoE systems

A grounded MPSE does not require electrical power isolation between mixing segments, nor is electrical power isolation required between Clause 104 link segments and the MPoE mixing segments.

MPDs that are compatible with grounded MPSEs shall provide electrical power isolation between all accessible external conductors, including frame ground (if any), and all non-MPI conductors, including those not used by the MPD.

A device incorporating at least one MPD compatible with grounded MPSEs shall provide electrical power isolation between all MPIs on the device. Note this includes MPIs associated with either additional MPDs or any MPSE.

J.1 Electrical isolation

Electrical isolation is specified in numerous clauses of this standard to prevent propagation of faults across electrical interfaces. Clause 33 and Clause 145 Power over Ethernet (PoE) require isolation for all implementations of both PSEs and PDs and specify a slightly modified version of the electrical isolation test procedure. Clause 104 Power over Data Lines (PoDL) requires reduced isolation for PDs only and has no isolation requirements on PSEs.

Clause 189 MPoE differs in that it permits two system types with different MPI isolation requirements: Isolated MPoE and Grounded MPoE systems. This enables MPoE to adapt to common power distribution systems encountered in the environments where it is likely to be deployed.

J.1.3 Electrical isolation for partially isolated systems

Electrical isolation shall provide at least 1 MΩ DC isolation when measured using a 5 V ± 20% source voltage.

Need clarification: do we assume isolation switch is open and we measure Rds_off?