IEEE 802.3af DTE Power via MDI
System Considerations - System / PSE - PD issues

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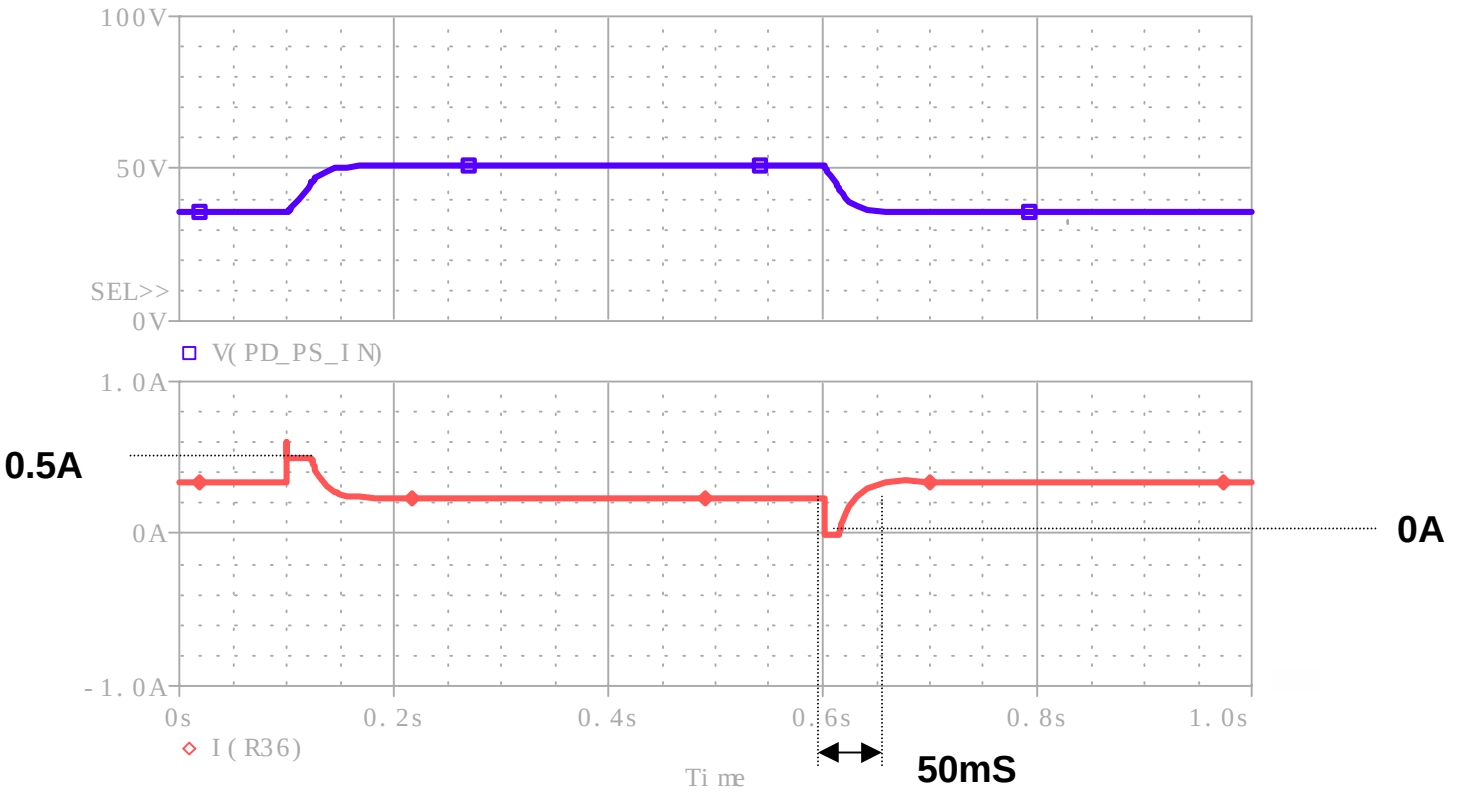
Topics for discussion / Analysis

- System dynamics effects on Imin/Imax requirements
- Where to locate inrush current limiter at PSE side or PD?
- PD input main requirements

System dynamics effects on Imin/Imax requirements



- Trace 1: PD input as a result of PSE output changes: 44V to 57V and from 57V back to 44V.
- Trace 2: PD Input current transients. Steady state within 50mSec. Current drops to zero!
- Similar behavior can be seen for load changes and during start-ups for specific parameters

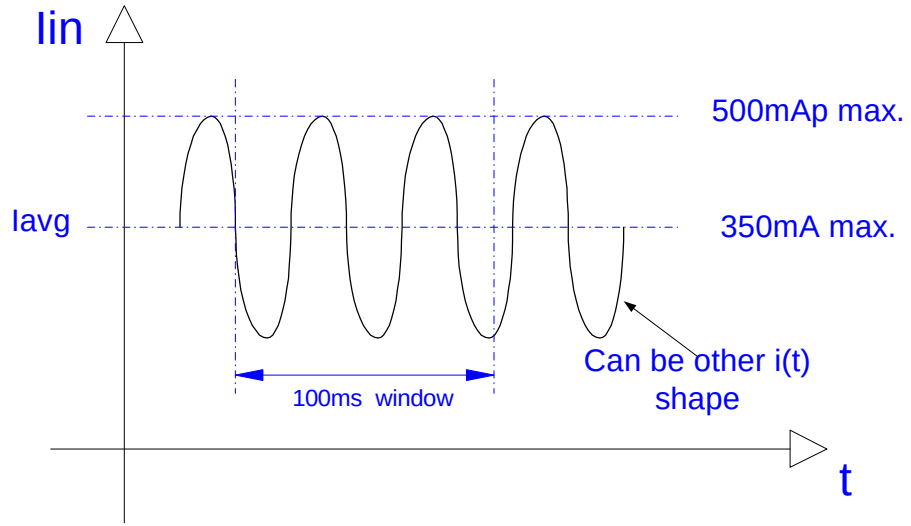
System dynamics effects on Imin requirements

- PSE will shut OFF if Iout<10mA
- During startup or rapid change at input voltage, or load changes, current may drop below 10mA.
- The above can be filtered by stating that PSE will shut off If Iout<10mA for T>100mSec.

System dynamics effects on Imax requirements

- PSE will shut OFF if Iout_avg > 350mA

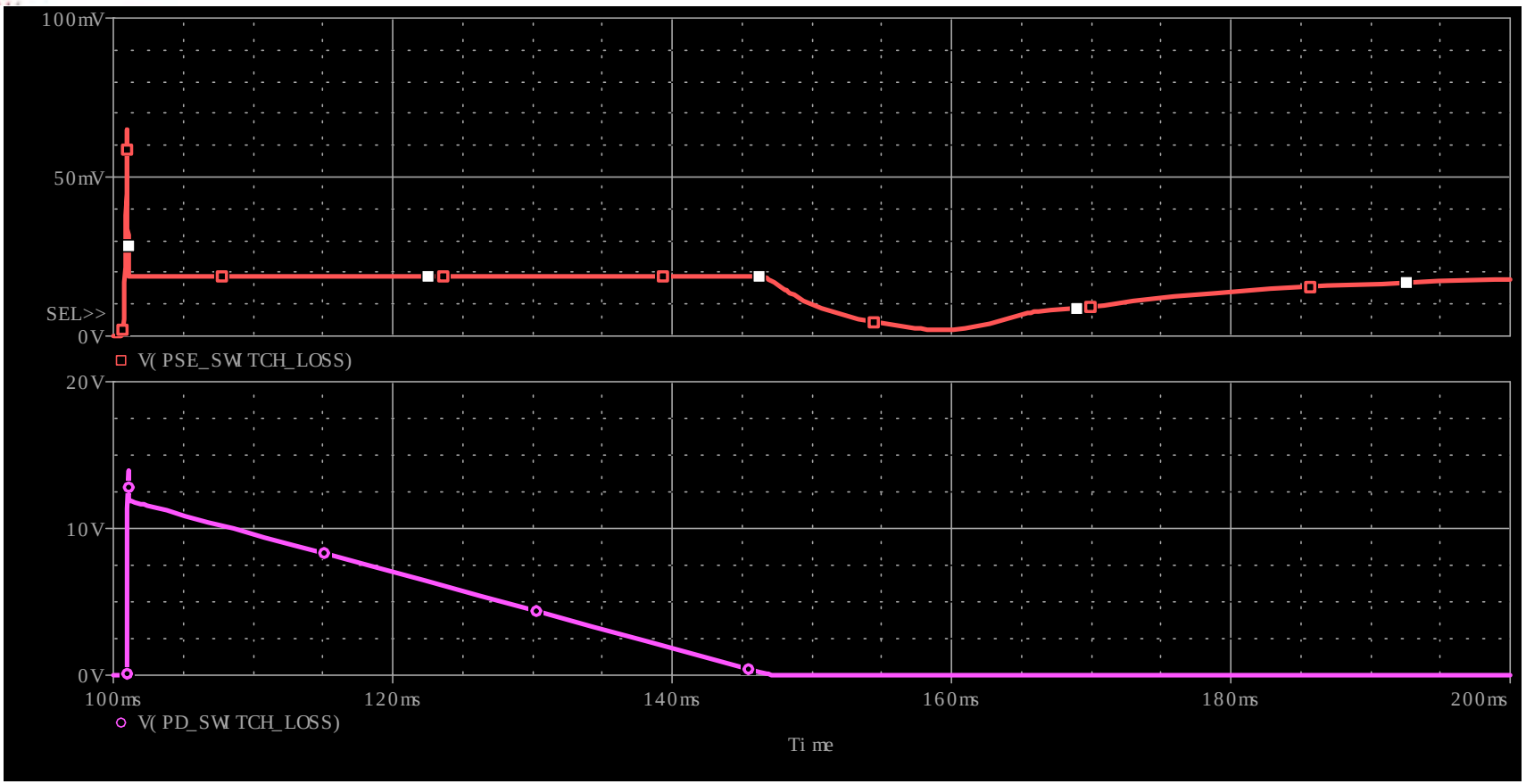
- During rapid change at input voltage, or load variations, current can be between 350mA to 500mA for T<100mS. Average current will be 350mA max for a time window of 100mSec at any time.



Where to locate inrush current limiter?

- Locating at PD - Pro's
  - By setting: PD current limit < PSE current limit
    - Optimizing Switch size to PD power and input cap requirements
    - Allow using Small package Switch in PSE
    - PSE switch may be integrated in PSE port chip ? (Chip vendors?)
    - May reduce overall system cost ? (PD designers?)

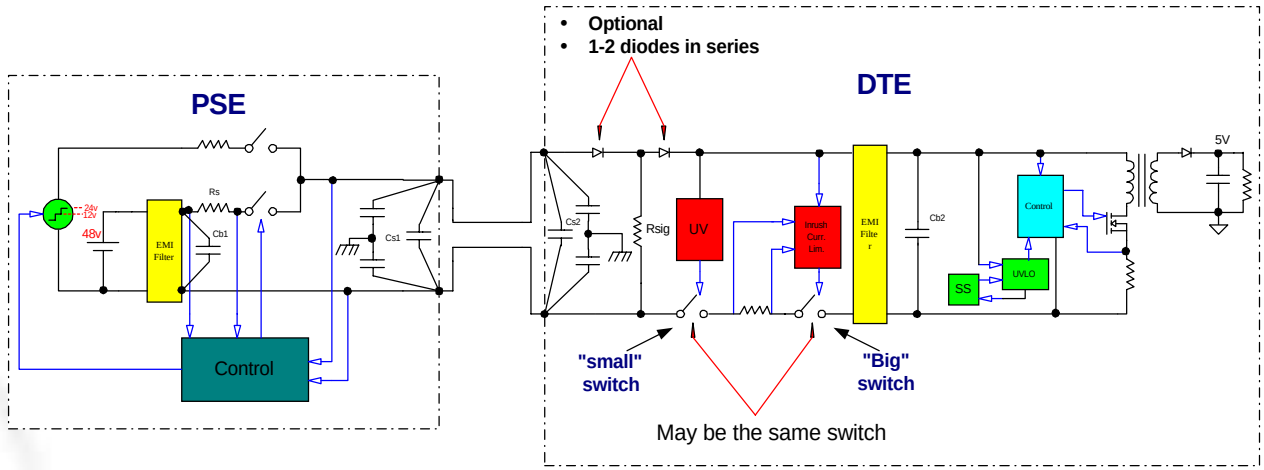
PD inrush current limit < PSE inrush current limit



- Upper Trace PSE switch loss in mWatt (C.L set to 0.5A)
- Lower Trace: PD Switch loss in Watt (C.L set to 0.35A)

Where to locate inrush current limiter?

- Locating at PD - Con's
  - Can't utilize full 350mA with low cost implementation
    - Need to add sensing resistor with additional active switch (Mosfet,Bipolar and/or diode)
    - Not accurate, will force setting the threshold bellow 350mA



Where to locate inrush current limiter?

- Locating at PD - Con's
  - Can't suppress input current changes due to:
    - changing loads
    - Changing input voltage
  - Unless time depended circuits is added. Increase PD cost

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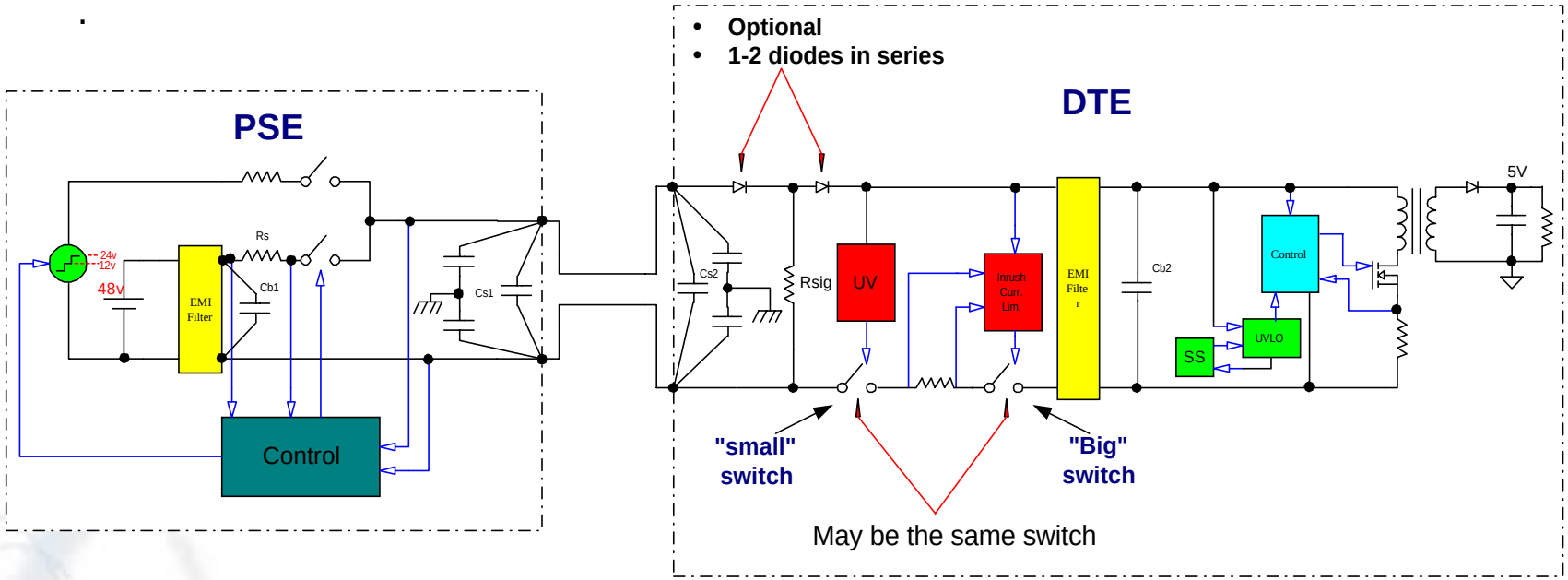
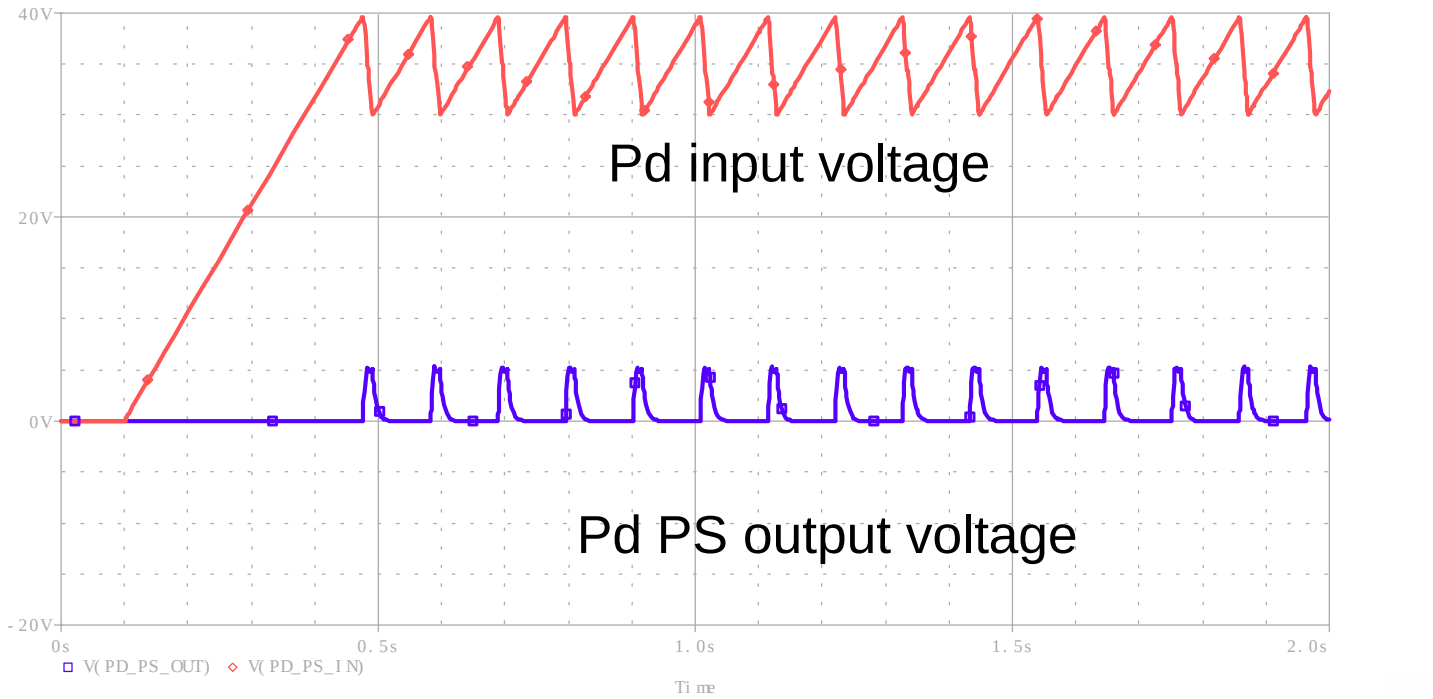


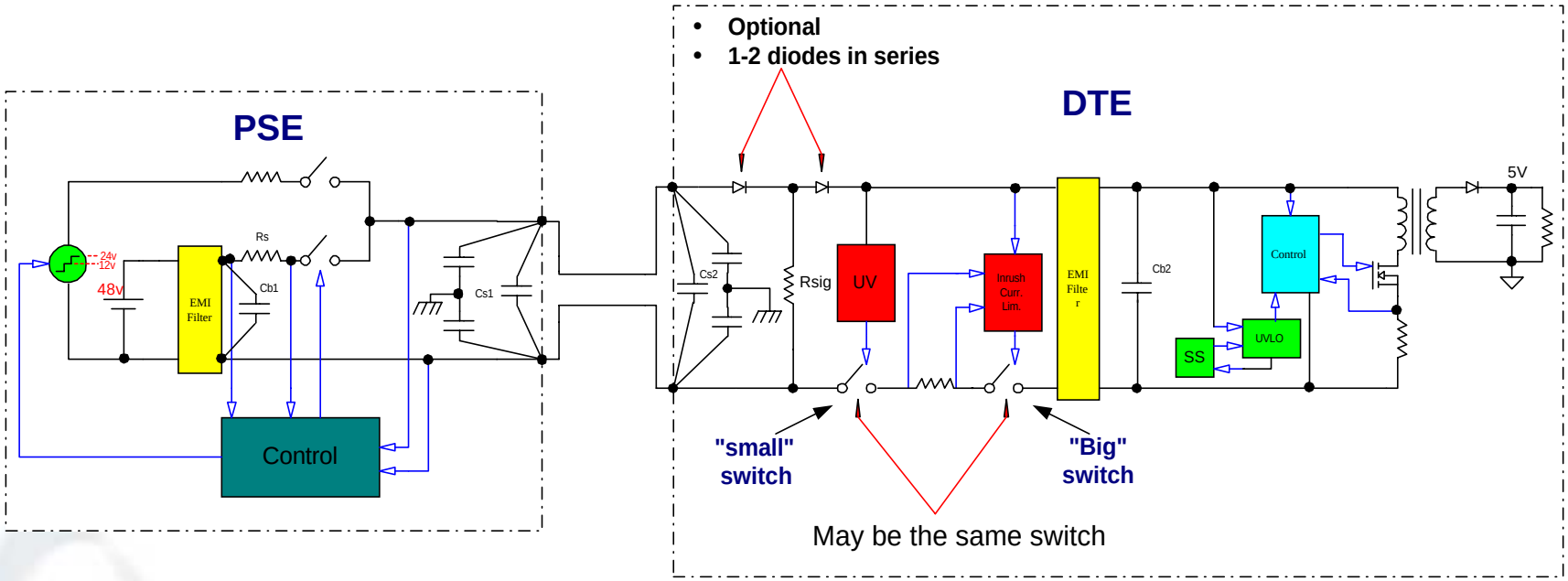
What happens if I_Limit < I_Operate



- Oscillations between PD power supply and inrush current limit circuit if I_Limit<I_Operate.
- Need more hardware to solve it.
- Two level limiter circuit.
- Increase cost.

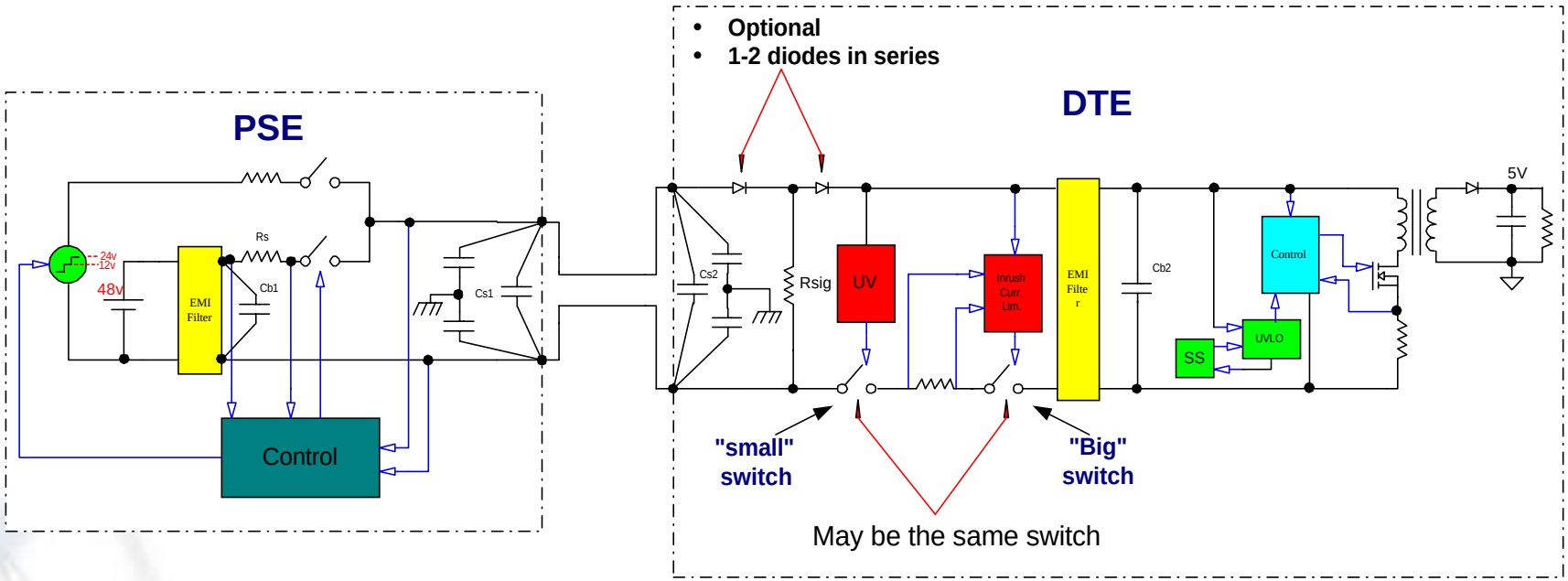
Where to locate inrush current limiter?

- Locating at PD - Con's
  - Using Inrush current limiter as the over-current protection of the PD, is not efficient solution (dissipates power) compared to the Inherent free of charge, efficient, pulse by pulse current limit implemented in the power supply commercial controller.



Where to locate inrush current limiter?

- PSE already contains some intelligence.
- Spreading it between PSE and PD will increase overhead costs.
- At max. allowed power, Problem is Moved from PSE to PD



Where to locate inrush current limiter?

- Summary
- PSE already contains the functions required for inrush current limiting.
- PSE should be design to support wide application range
- Inrush current-limit function cost > difference in PSE switch package size-cost
- PD is more sensitive to cost than PSE
- Integrating Mosfet in silicon chip involves HV technology. Increase cost (Chip vendors?)
- Bottom line
  - System cost will increase by adding inrush current limiter to PD
  - PD additional costs > PSE switch cost reduction

Where to locate inrush current limiter?

- Suggestion to optimum System cost/Performance ratio
- Normal Powering Mode
  - Max. average current……..350mA
  - Current peaks between 350mA-500mA are acceptable as long as the average over 100mSec time window at any time will be 350mA max.
  - Exceeding the above limits will turn of the port with in 100mSec.
  - Recovery from Overload condition…….5Sec max.
- Startup Mode
  - Current ……..500mA max. for 100mSec max.
  - Time window can be reduced to:
  - 55mSec, if PD input cap = 470uF
  - 42mSec, if PD turn on will occur at 40V-44V:

PD input main requirements.

- Detection Mode
  - Input cap……0.1uF max.
  - Input Resistance……25K? ±TBD% @ (2.8V<Vin<10V)?
  - No requirements @ 10V<Vin<30V
- Startup Mode
  - Power supply Turn On voltage……40V - 44V
  - Turn Off voltage …… 30V-34V
  - Input current…….. ……500mA, 100mSec.
- Normal Powering Mode
  - Power supply operating range…… 34V to 57V
  - Input current …… 10mA min. to 350mA max. averaged over 100mSec.
  - Input current peaks max. ……500mAp,350mA max. average/100mSec
- Off Mode
  - Input Voltage……Vin<(30V to 34V)
  - Input current ……Iin<10mA for t>100mSec
- EMI ……CLASS-B conduction/radiation.
- Other standards……..IEC950, 802.3