Proposal for Startup and Port Line/Load/Cross regulation/Transient Parameters

For IEEE 802.3af Standard Power over MDI

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General

The attached document includes the data and steps used to derive the Startup mode parameters and PSE output transient parameters covering the following modes:

1. Port to Port cross regulation
2. PSE output port load regulation
3. PSE output port line regulation including systems with Battery backup.

Equations and detailed discussion describe in “Port to Port Cross Regulation” Document.

In the following paragraphs, few changes have been made according to updates received at July, 11,2001 meeting.

Suggested spec is marked with yellow.

Input numbers

The input numbers used for deriving the startup parameters are:

1. Cpd=180Uf as the boundary number in which the PSE or the PD is responsible to limit the inrush current.
2. Cpdmax=570uF

The input numbers used for deriving the Line regulation specifications are:

1. Cpd=180Uf as the boundary number in which the PSE or the PD is responsible to limit the inrush current.
2. Cpdmax=570uF
3. Voltage can change from 57V to 44V or from 44V to 57V at a short time (~1msec)
4. Min load is 10mA

Calculation Procedure for Startup parameters

Tc=Cpd*Vp/Ip.
Vpmax=57V
Ipmin=0.4A , Ipmax=0.45
Cpd=180uF (PD input capacitor located after the isolating switch)
Tc=180uF57/0.4A=25.6ms ➔ 50mSec.

Suggested spec - PSE

- At startup mode, the PSE will limit its output current for Ip=0.4Amin-0.45A max for min 50msec max. TBDmsec. (70ms is suggested)

Suggested spec - PD

- For Cpd<180uF, PD can consume from PSE up to 0.4Ap limited by the PSE, for 50ms max.
- For Cpd>180uF, PD will limit its inrush current to be < 0.4A

Calculation Procedure for load/line/cross regulation parameters

PSE dv/dt limitations

Assuming the load connected in parallel to Cpd is a resistor and not constant power load:

The 180uF borderline used to derive the above the above spec is used here as well.
The reason for it is that for large PD input cap such as 570uF, the time duration required
To the 10mA load to discharge this capacitor can be as high as 600ms and we wish to limit this time to 400ms max.

dt=C*dv/di= 180uf*13V/0.01A=234ms
Imin=C*dv/dt
Imin=570u*13V/234ms = 31.66ma, The load current required to limit zero time current to be the same number as received for Cpd=180uF

Simulation results that support the above equations:
Exp-1:
570uF, dv=2v, 10mA load, Tc=115ms ➔ 200ms
Exp-2:
570uF, dv=13v, 10mA load, Tc=642ms ➔ 300ms, 30mA
Exp-3:
180uF, dv=13v, 10mA load, Tc=223ms => 300ms

Above 180uF, the min current should be calculated according to (570-180)/22mA = 17.7uF/1mA

18uF/1mA ➔ 56uA/uF. Example: the min current required for Cpd=470uF is
Imin=470uFx56uA/uF=26.32mA

Suggested spec – PSE

Negative Transient
For Cpd<180uF, Imin=10mA at the PD.
For Cpd>180uF, Imin=56uA/uF at the PD.
Td=300ms min; 400ms max.
Dv allowed to be 13V max.

- The PSE will remove the power for the port if the current is below 10mA for a time duration greater than 300ms and less than 400ms.

Positive Transient
Simulation Results
Exp-1:
570uf, dv=13v, 350mA load, 55ms. Actually above 180uF in the PD, the PD is responsible to limit the current and under this conditions Td is much less than 50ms hence no problem.
DV/DT =13V/5ms. Actually higher dv/dt can be used since the inrush current limit in the PSE or in the PD are limiting the peak current.

- The PSE will not remove the power from the port if the peak current is up to 0.4A to 0.45A for less than 50ms.

Suggested spec – PD

- Imin in the PD will be calculated according to the following rule: 56uA/uF.
  Example: the min current required for Cpd=470uF is Imin=470uFx56uA/uF=26.32mA