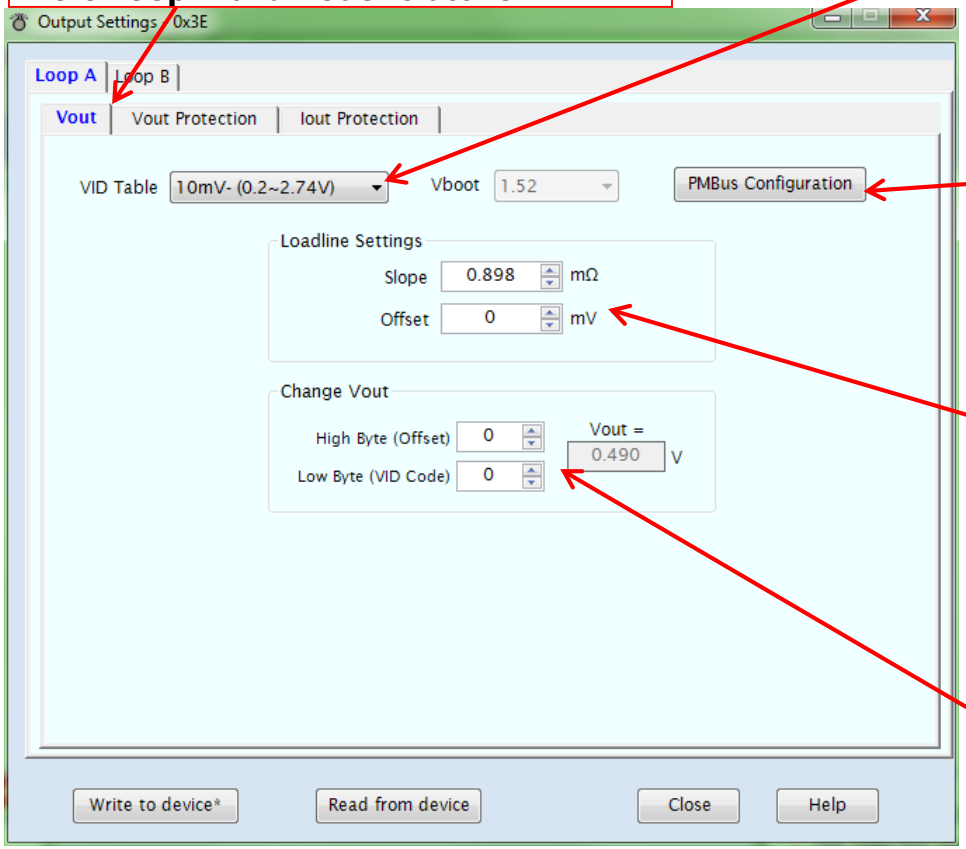
Output Settings... Loop A Vout

This window have 2 main tabs, one for each loop, and 3 sub tabs for each loop.

The active tab is highlighted in bold blue text

Here **Loop A** and **Vout** is active



VID table allow selection of VID voltage step. Here the part is in AMD mode and only one selection possible. Therefore it is grayed out and not changable

When In Intel mode 5 or 10mV table can be selected by going to the SVID window and change it there.

PMBus configuration:

Click this button to use PMBus commands to set Vout. It will open a PMBus window.

Loadline settings:

Loadline Slope: The wanted loadline can be entered or set using the small up/down arrows

Loadline offset: A drop down menu to select wanted offset

Change Vout: Manual control of Vout

HighByte (offset)

add an offset to existing voltage output

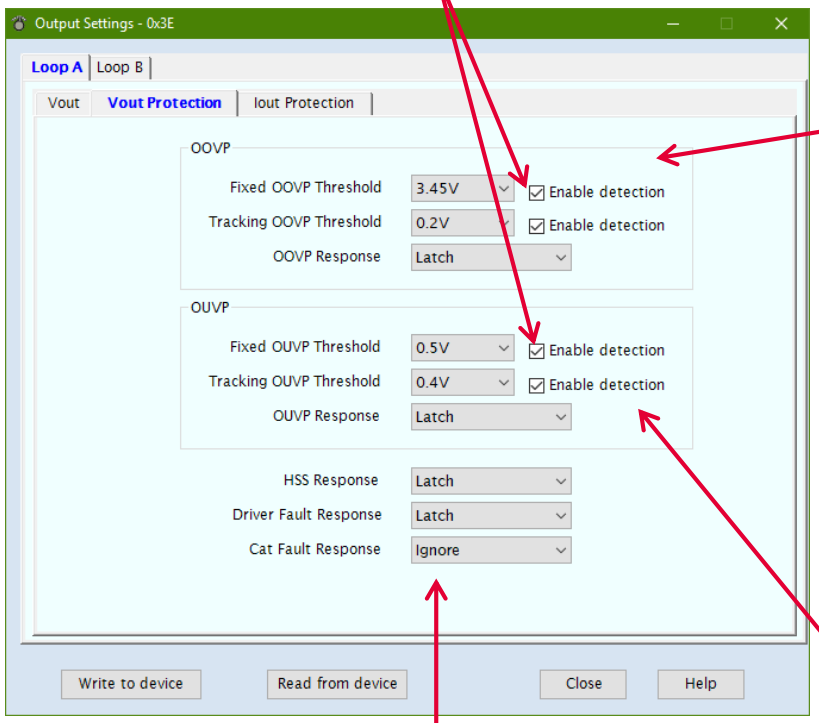
Low Byte (VID code)

Set a VID code for a specific Vout.

The Vout window helps telling what voltage the VID code will give.

Output Settings... Loop A Vout Protection

Check box to select if this setting should be active or not



OOVP: (Output Over Voltage protection)

Fixed OOVP Threshold: At what output voltage shall it be treated as Overvoltage. This is a fixed level

Recommended setting: <output cap rating and>Vout_max

Tracking OOVP Threshold: at what positive deviation from the wanted output voltage shall it treated as Overvoltage. Used when voltage ramps from one level to another.

Recommended setting: 400mV

Response: What to do if any of the limits above are exceeded and the check box is selected.

Response time:

It will be flagged if 4 consecutive samples at rate of 50Mhz are over the threshold

Note: Tracking OOVP won't turn on low side FET.

OUVP: (Output Under Voltage protection)

Fixed OUVP Threshold: At what output voltage shall it be treated as Undervoltage. This is a fixed level

Recommended setting: <system required min Vout and > fixed OUVP disable threshold

Tracking OUVP Threshold: at what negative deviation from the wanted output voltage shall it be treated as Undervoltage. Used when voltage ramps from one level to another.

Recommended setting: 300mV

Response: What to do if any of the limits above are exceeded and the check box is selected.

Response time:

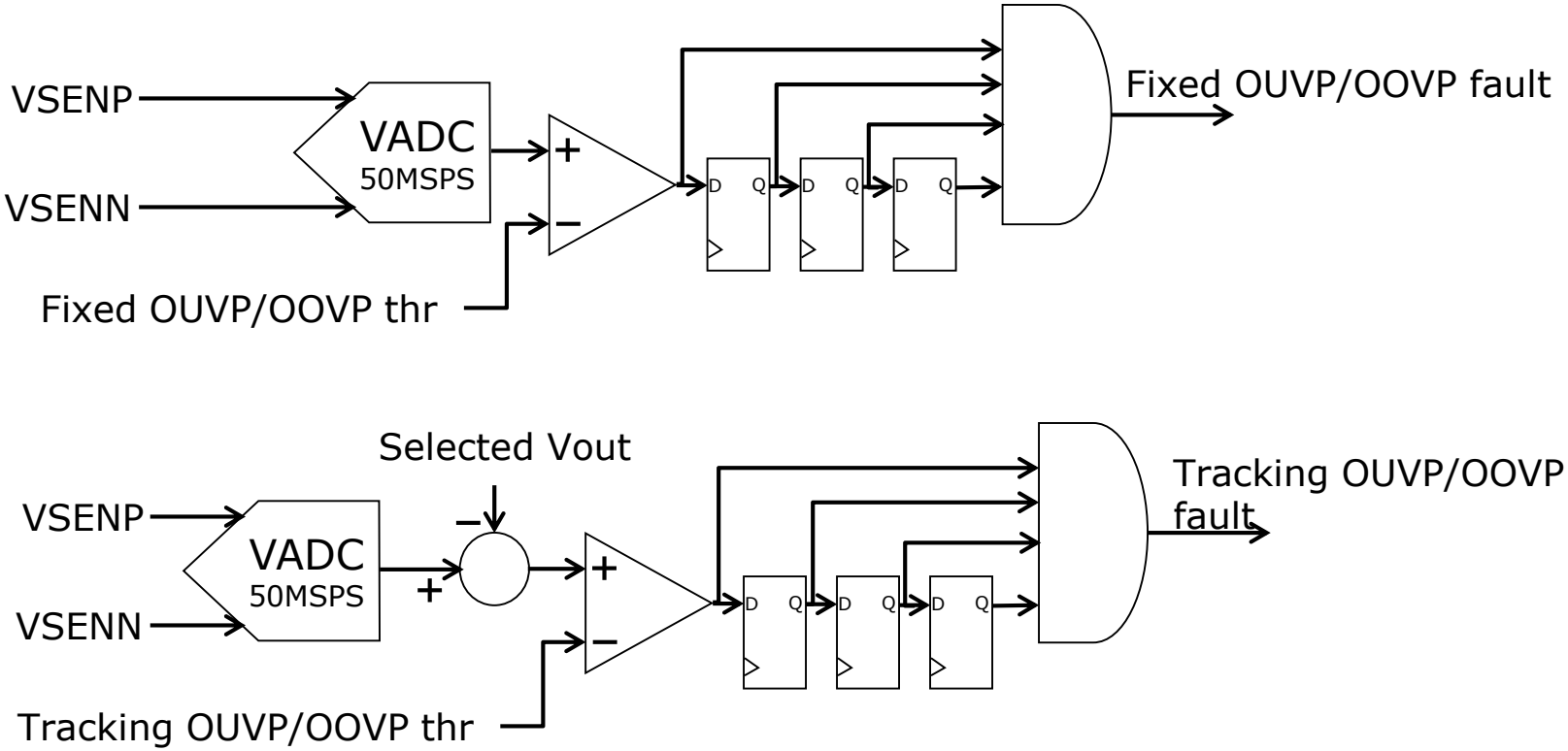
It will be flagged if 4 consecutive samples at rate of 50Mhz are over the threshold.

HSS Response: What to do if a High Side Short occurs

Driver Fault Response: What to do in the event of a Driver Fault signal is coming

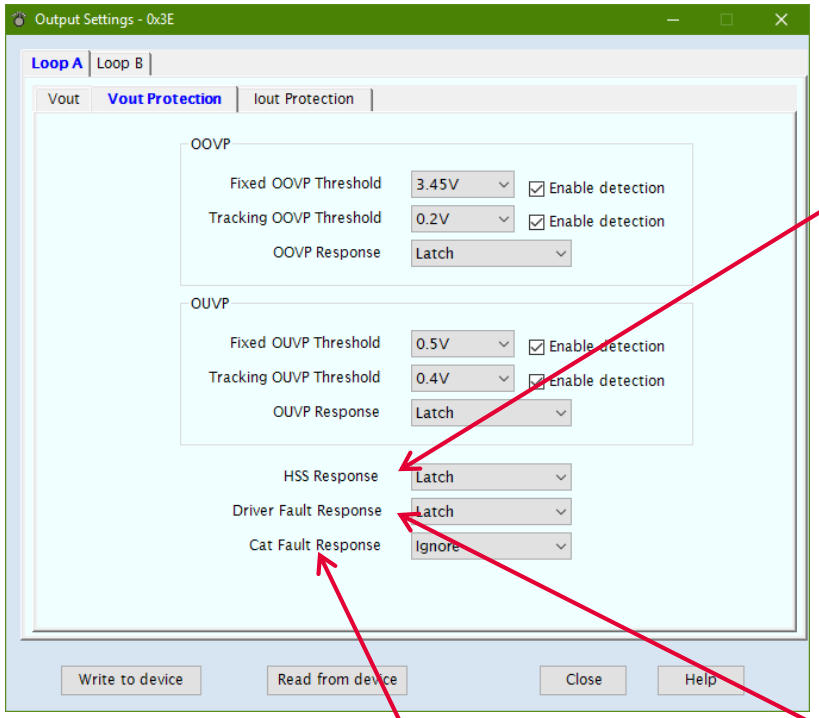
Cat Fault Response: What to do when a Catastrophic fault occurs

Output Settings...
Fixed/Tracking OOVP/OUVP fault



4 consecutive samples over/under the limit will trigger the fault.

Output settings…
Driver fault / HSS Response



HSS Response: What to do if a High Side Short is detected. i.e. High side MOSFET is shorted and Vout is raising by itself.

Input: phase current sampled at 50Mhz rate
Default threshold: 1.6 x P2CL
Response time:
80ns; 4 consecutive samples at 50Mhz rate greater than threshold

Cat Fault Response: What to do if a Catastrophic fault is detected.

Driver Fault Response: What action to do if a Driver Fault signal from Powerstages is detected

Input: Tmon Voltage signal

Detection is enabled all the time

If Tmon voltage is higher than 2 Volt Dr_fault (Driver Fault) will be reported

Response time:

- Tmon have to be high for minimum 200ns before fault is flagged
- Shutdown response at 60ns after fault is flagged

Shutdown response: Shutdown/Ignore/Hiccup

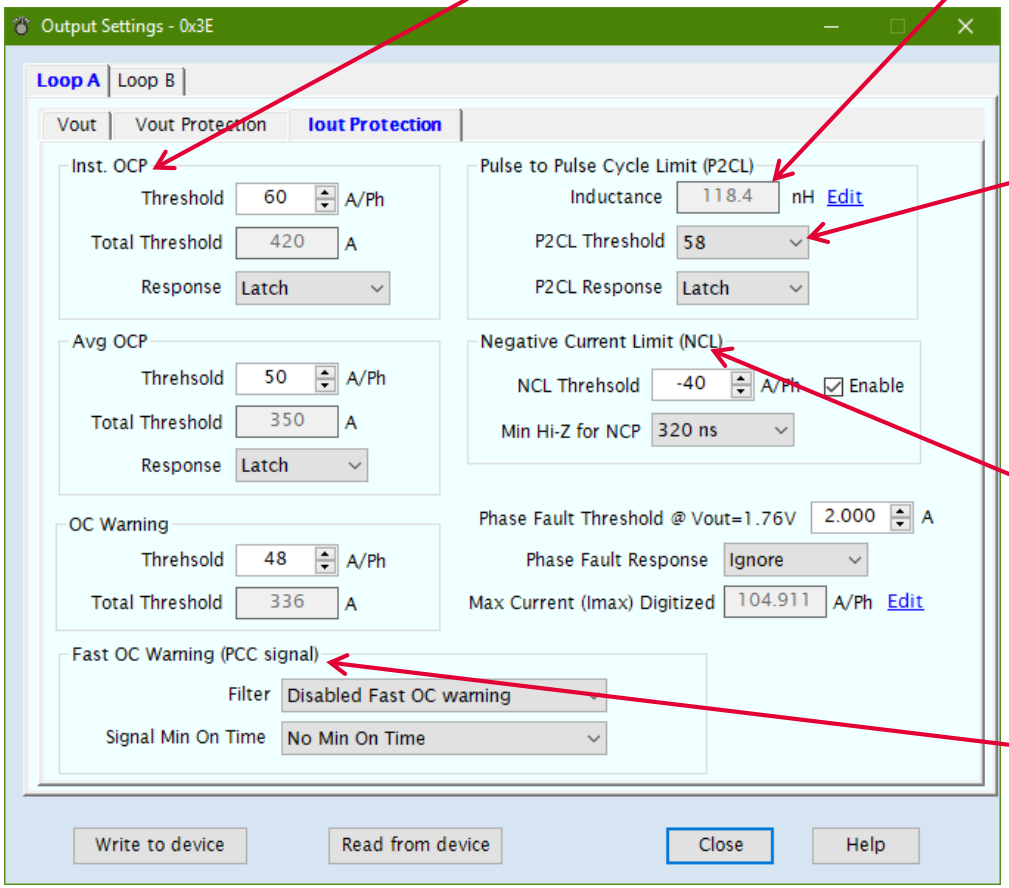
Output Settings... Loop A Iout Protection

Instant OCP (OverCurrent Protection) This looks at the instant peak current in each phase

In AMD mode if above this level for more than 10us then take action determined by the Response selected.

In Intel mode there is a 5 switching cycles delay before any action is taken.

See next page for block diagram of function



Inductance. Displayed as info as the value is important for the calculations for the P2CL function. If a change is needed click on the blue Edit link that will open another window where Inductance value can be edited.

Pulse to Pulse Cycle limit (P2CL).

A pulldown menu with phase current in Ampere. Designed to prevent output inductor saturation by monitoring peak inductor current per phase and limit PWM pulse width cycle by cycle. Recommended value is Isat @ 125 degC in inductor datasheet minus 1 or 2 A.

If current exceed this limit for 255 consecutive switchpulses a response will occur according to the setting of P2CL Response

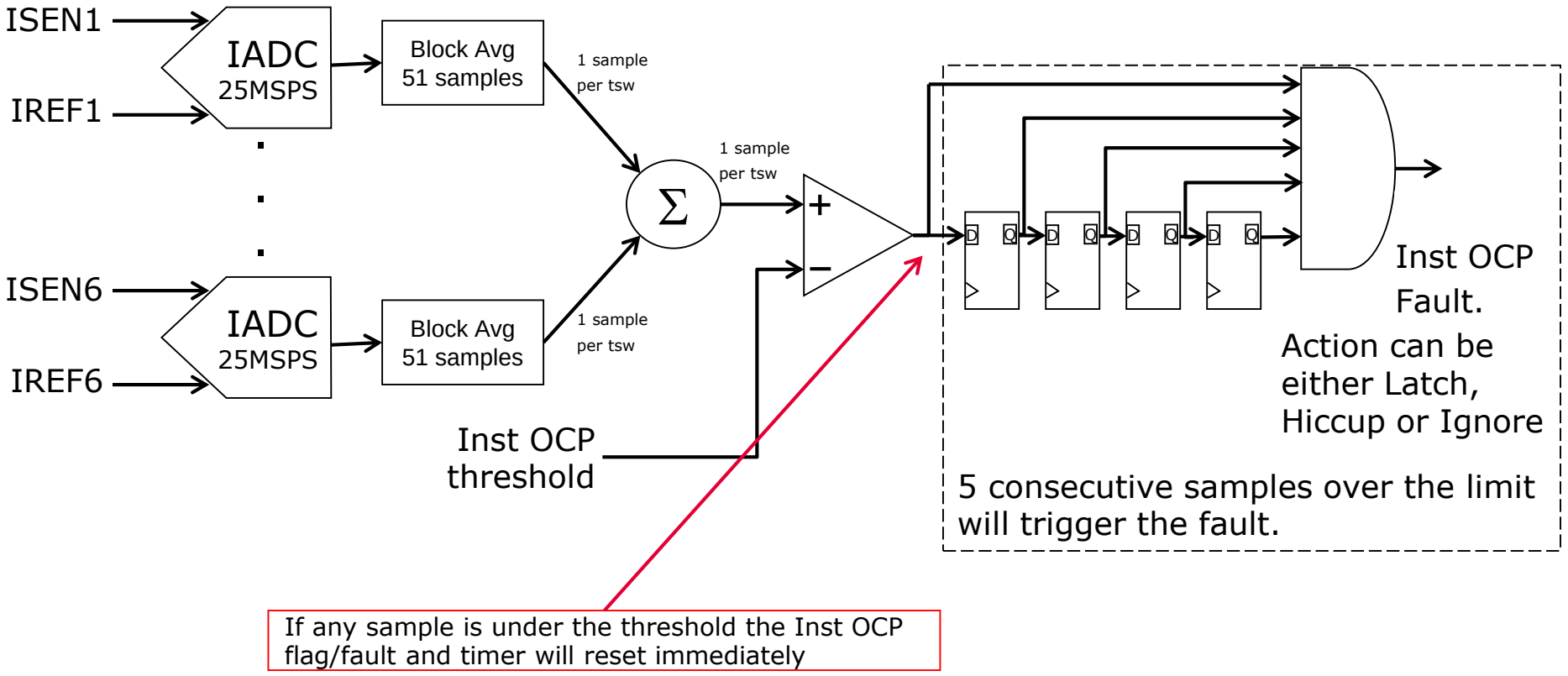
Negative Current Limit (NCL)

If the current in one phase goes too much negative its PWM output will go to High Impedance (Hi-Z) for a specified minimum time. This function can be enabled by marking the box next to Enable.
See explanation on following pages for function

Fast OC warning. Also called PCC in AMD applications. A fast selectable filtered OverCurrent warning signal. Filter can be selected for how long average time. The output can be selected for how long it will stay on after detection. It will reset itself after selected time if no more OC detected.

Output settings…
Inst OCP behavior

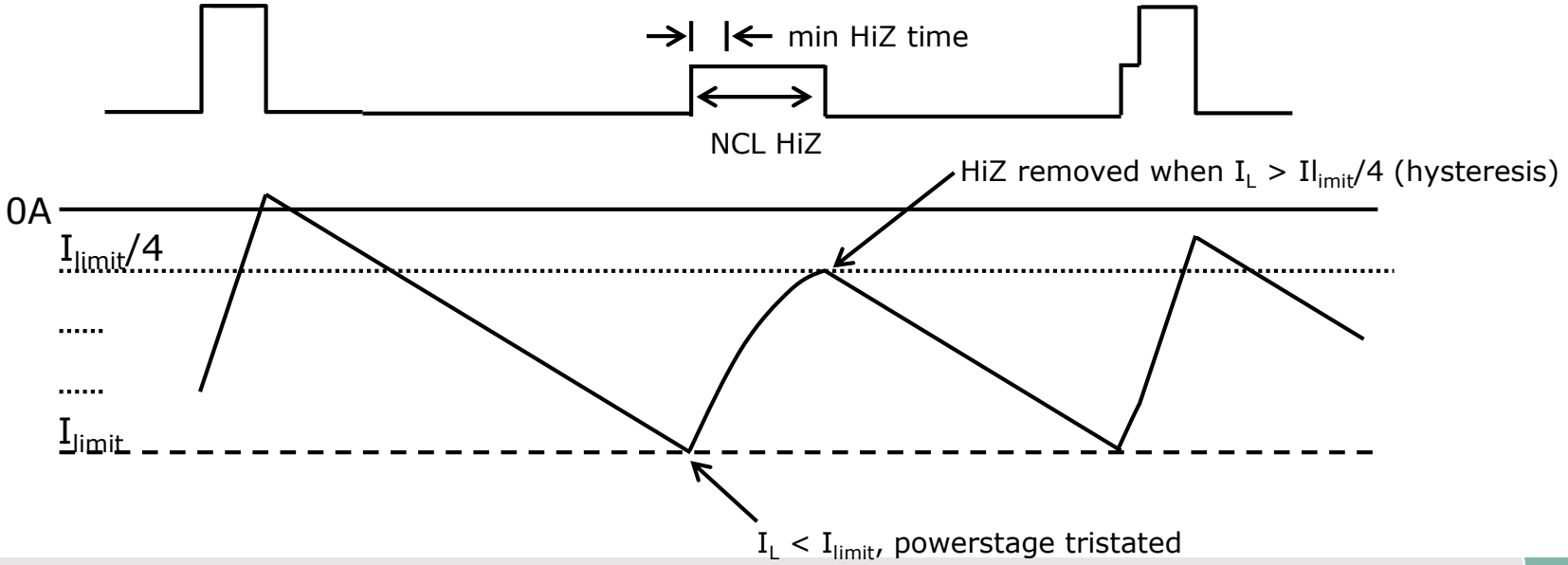
Notice that the current measured is the inductor current and not the direct load current. Inductor current rises slower than the load current and will add a delay that depends on variables like Inductance, Input voltage, output voltage and more.



If any sample is under the threshold the Inst OCP flag/fault and timer will reset immediately

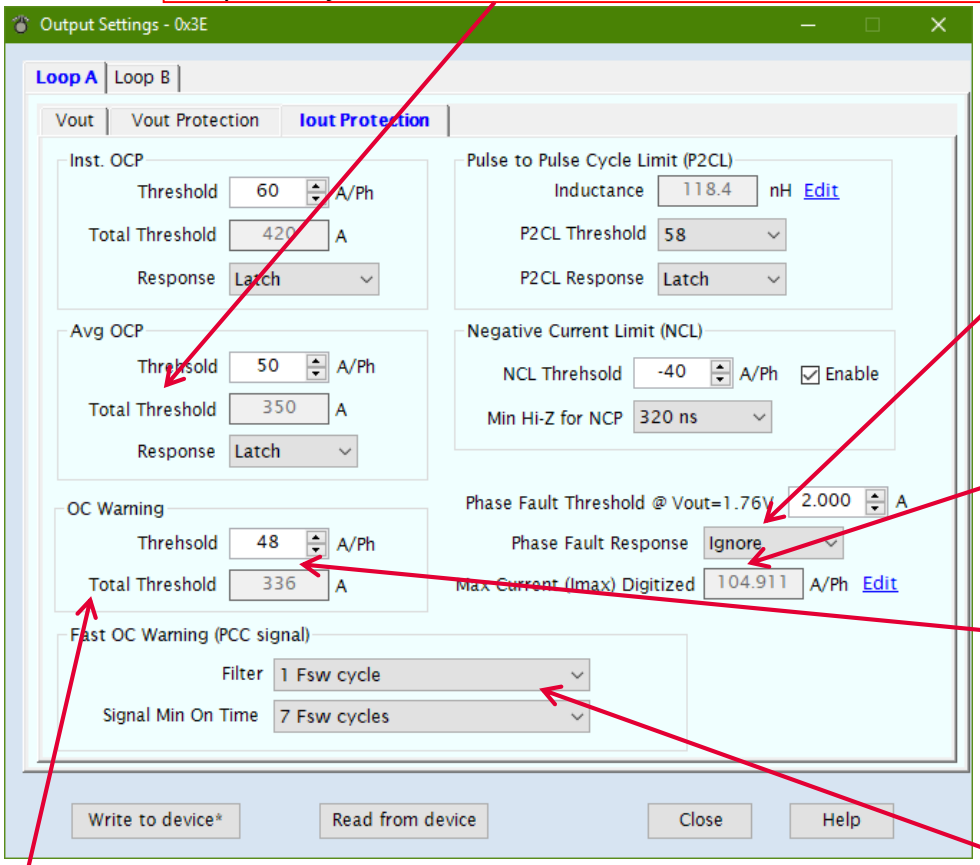
Output Settings...
NCL function explanation

- Input: Iout
- Response time: 5ns; No shutdown response available
- Recommended settings: amplitude should be greater than the negative current induced by Cdv/dt during DVID down.
- Shutdown response: Not available
- If inductor current is too negative, highside FET may fail during the dead time between lowside off and highside on due to too much current going into the highside body diode.
- NCL will set lowside to off once the inductor current reaches the negative current limit
- To avoid chatting, the hysteresis level is set to release the HiZ only when the inductor reaches ¼ of the negative current limit and a minimum HiZ on time is satisfied.



Output Settings... Loop A Iout Protection

Average OCP (OverCurrent Protection) This looks at the average current in each phase and if above this level then take action determined by the Response selected. Recommended settings: Maximum expected loadcurrent*1.15/Nph_max per phase Example in a 6phase system with Max 260A Threshold=260*1.15/6 = 50A



Phase Fault Response: What to do when a PhaseFault Signal comes from powerstages.

Max Current (Imax) Digitized: for information To change click the blue Edit text that open a new window

OC Warning (OverCurrent) This looks at the average current in each phase and if above this level then the corresponding warning flag in fault register is activated.

Fast OC warning (PCC). A fast lightly filtered OverCurrent warning signal. Filter can be selected for how long time Overcurrent have to be before activate output. The output can be selected for how long it will stay on after detection. It will reset itself after selected time if no more OC detected. It uses the same threshold current as set in OC warning.

Total threshold is calculated from the Threshold entered and the GUI knows number of phases to present the total output current where the warning trigger.

Output Settings...
Avg OCP or Avg OC Warning behavior

Filter

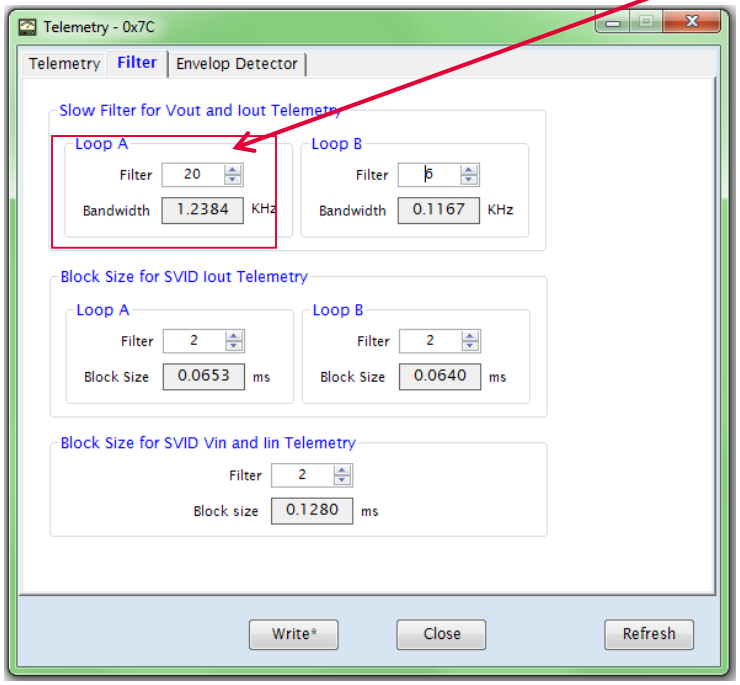
Filter frequency can be selected.

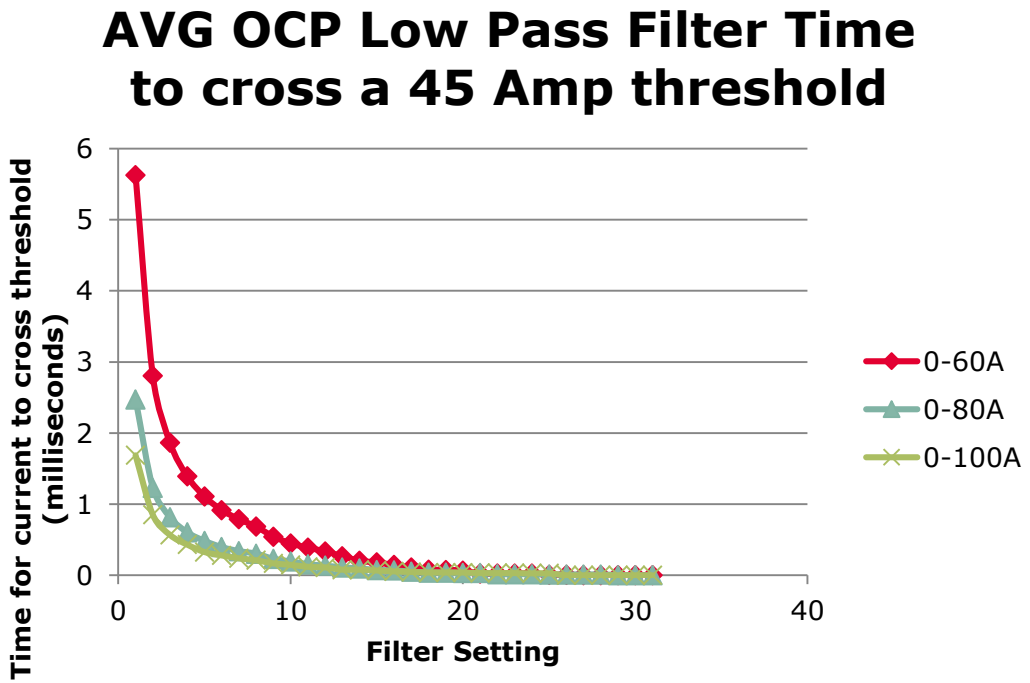
Time for a overcurrent signal to pass through the filter will depend on how much overcurrent.

Like for any low pass filter a small current step take longer time to get to the threshold than a large overcurrent. See graph for example where limit is selected to 45A and different current steps

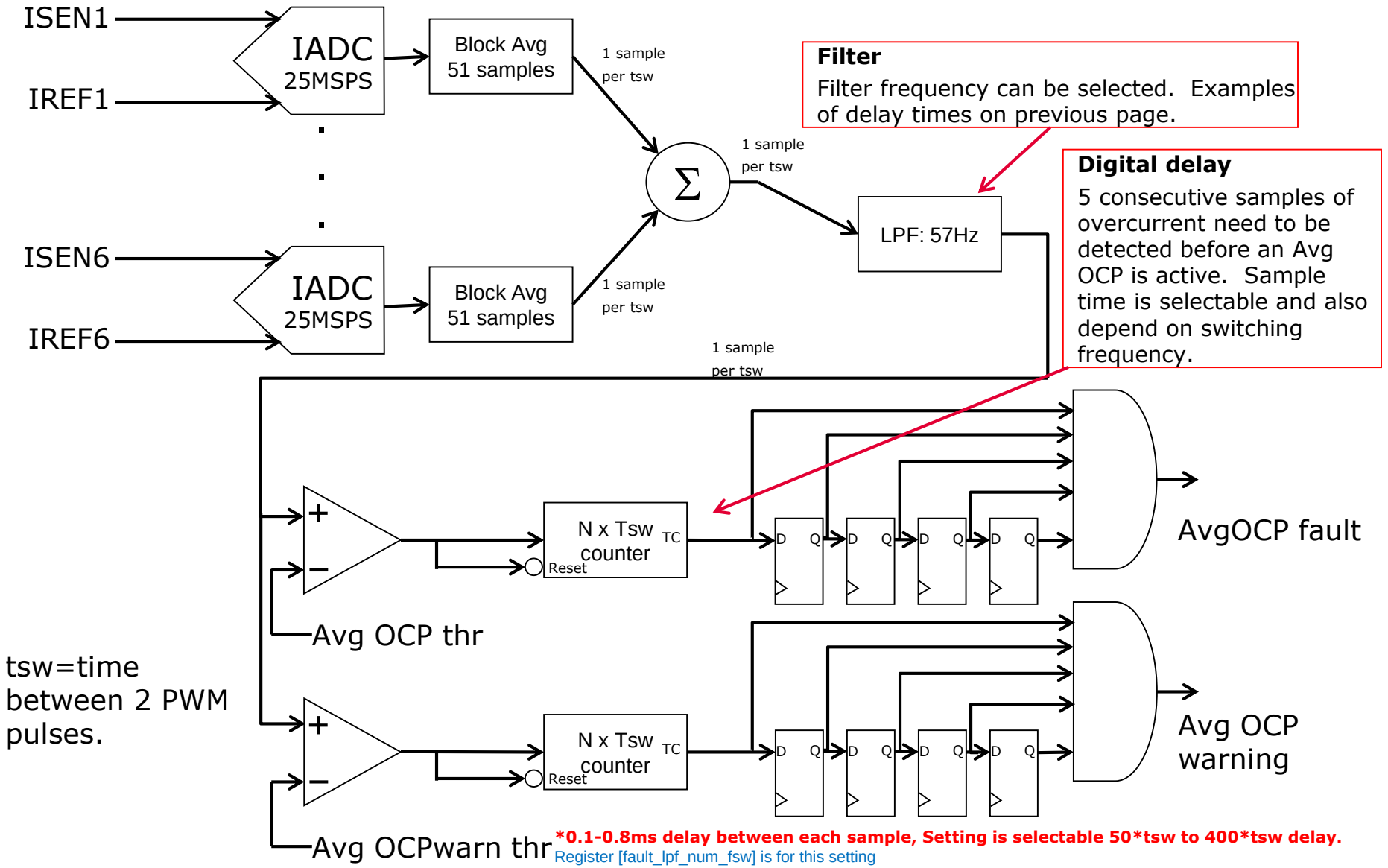
Total delay times from an Overcurrent to fault response is the sum of Filter frequency selected and the corresponding delay time and also depend on switching frequency as there is an 5 consecutive sample digital delay after the filter. This digital delay makes higher filter frequencies insignificant to total time delay.

See block diagram on next page for more details.

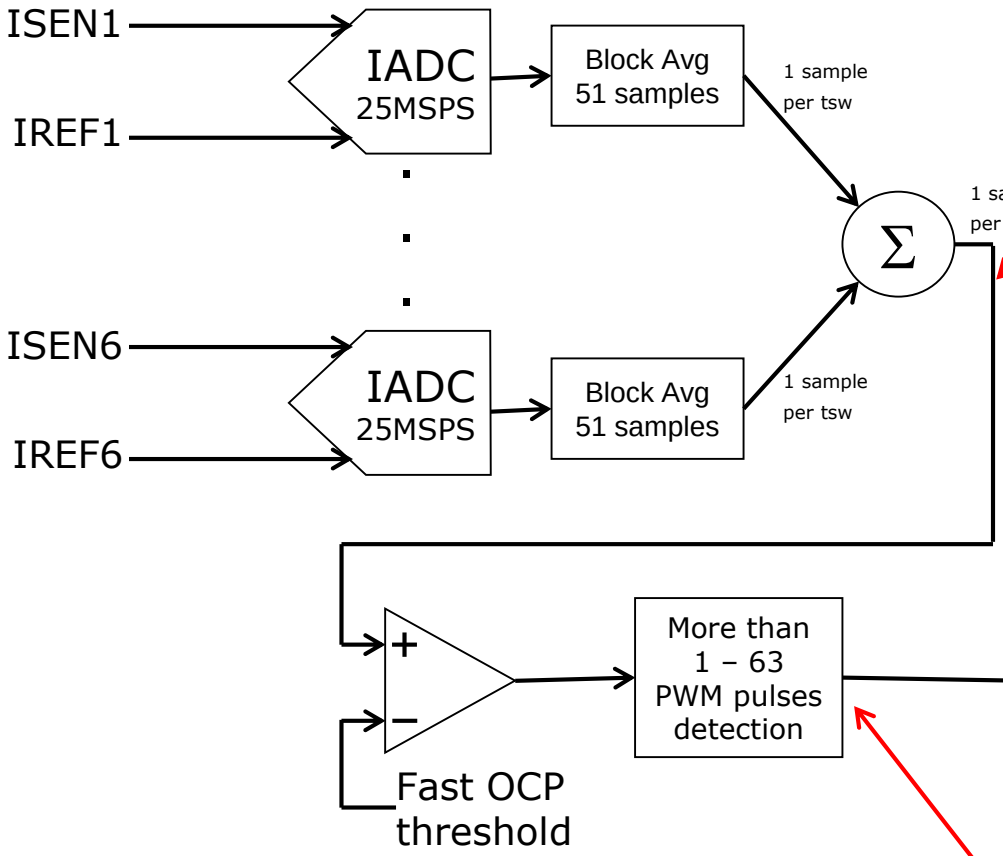




Output Settings...
Avg OCP and Avg OCP warning



Fast OC warning
AMD PCC peak current control



Delay time
1-2 full PWM cycles
Notice the sampling need at least one full PWM cycle to pass through the Block average filter and depending on how fast load current rises and when in time it happens it may need one more sample to reach the threshold level.

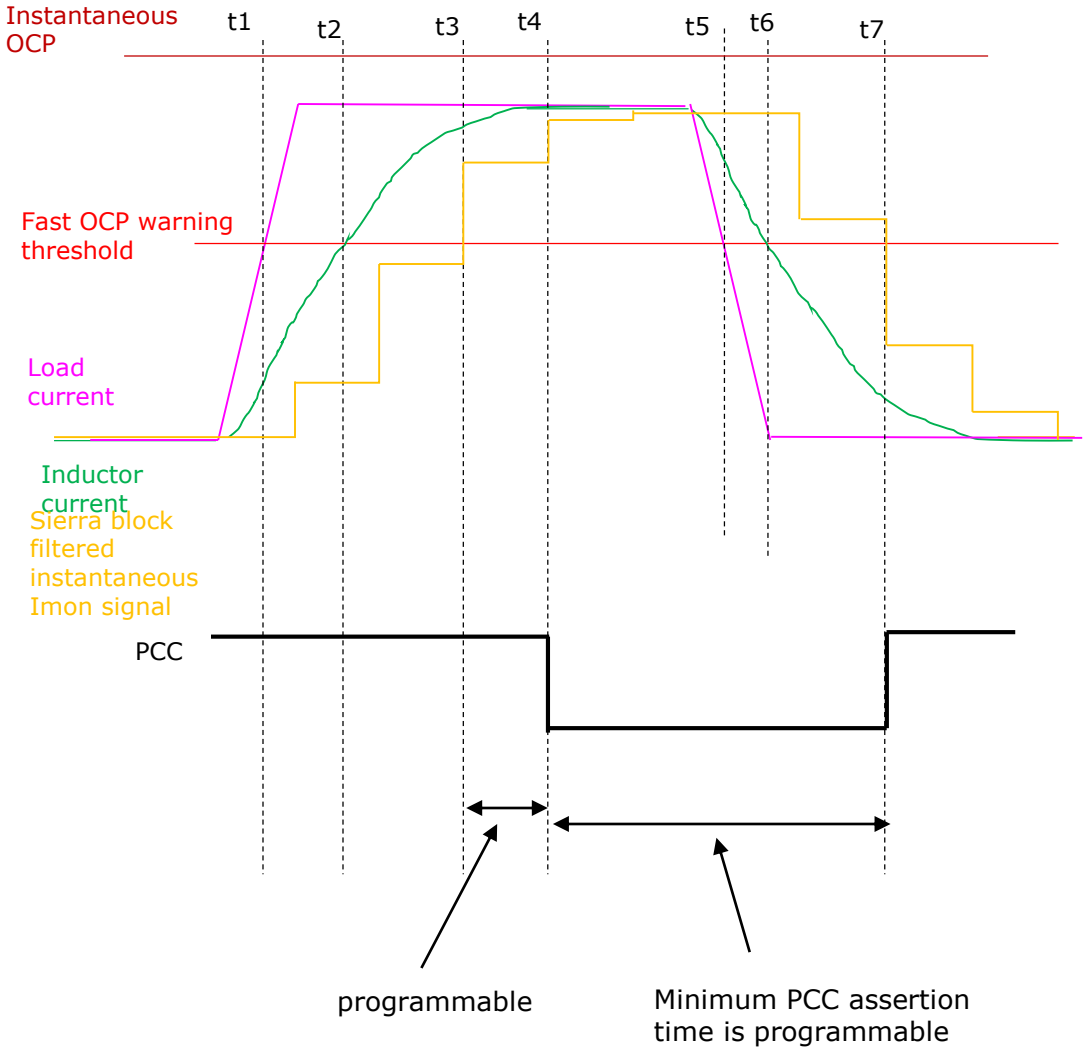
Notice that the current measured is the inductor current and not the direct load current. Inductor current rises slower than the load current and will add a delay that depends on variables like Inductance, Input voltage, output voltage and more.

tsw=time between 2 PWM pulses.

Current have to be above the limit for a selected number of switching pulses before output goes high. This to act as a filter for short overcurrents

Signal Min OnTime:
An overcurrent event may be to short for the external circuit. This allow any OverCurrent pulse to be stretched to be longer for easier detection

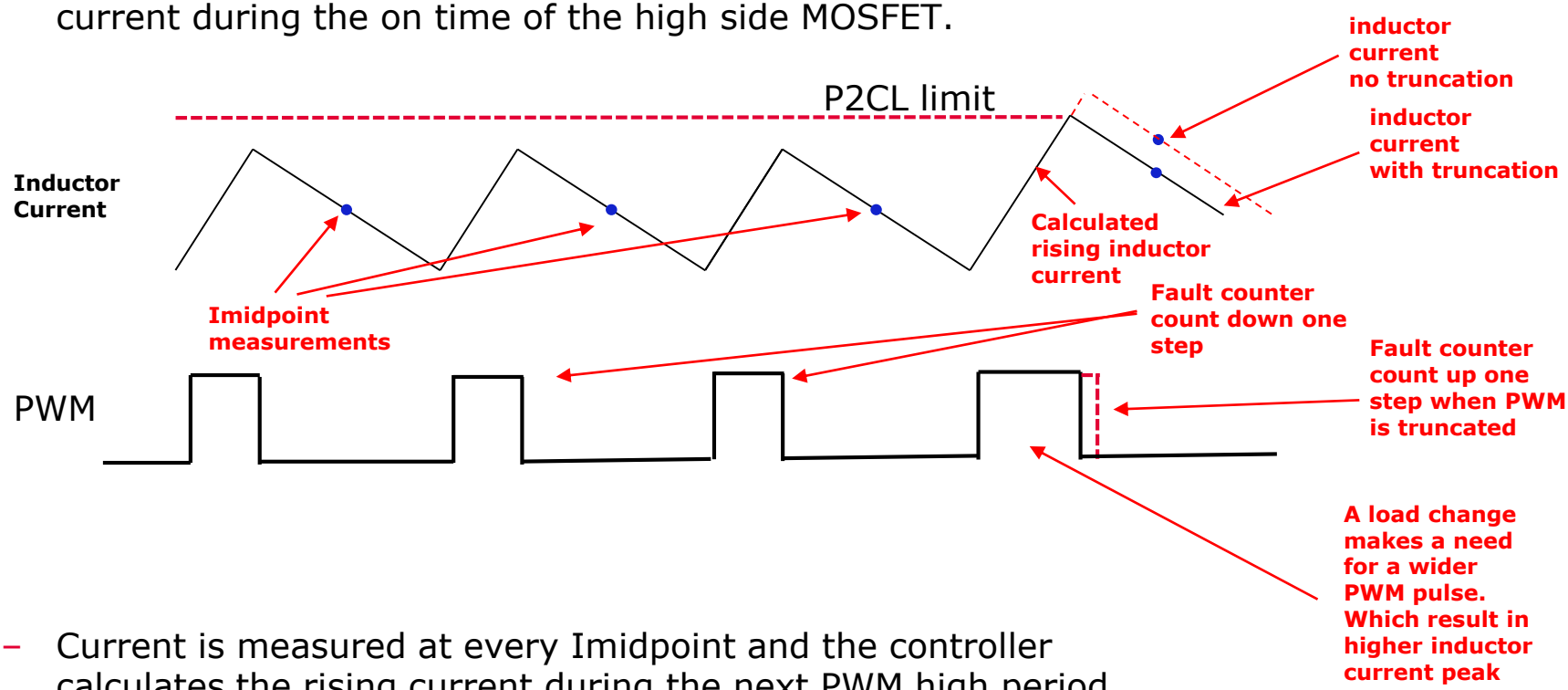
Fast OC warning
AMD PCC peak current control



- t1: load current reaches OCP warning threshold Some of the current comes from the output capacitors while inductor current takes time to increase
- t2: Inductor current reaches OCP warning threshold. Contribution to the delay between t2 and t1:
  - Output inductance (Higher=slower)
  - Input voltage (higher=faster)
  - Loop bandwidth (higher=faster)
- t3: Instantaneous Imon (switching cycle block averaged inductor current) reaches OCP warning threshold. Delay between t3 and t2 is <=two switching cycles
- t4: PCC is asserted. Delay between t4 to t3 is programmable in range of 1~63 switching cycles
- t5:load current decreases and reaches OCP warning threshold
- t6: Inductor current decreases and reaches OCP warning threshold
- t7:Instantaneous Imon follows inductor current and goes below OCP warning threshold which de-assert PCC signal. Note: the assertion time should be >minimum assertion time which is programmable in range from 0~63 switching cycles

P2CL Pulse to pulse cycle limit

- Internal Calculation of phase current
  - Inductor value , Measured Vin, Vout and Imidpoint are used to calculate the inductor current during the on time of the high side MOSFET.



  - Current is measured at every Imidpoint and the controller calculates the rising current during the next PWM high period.
  - When the calculated current reaches the P2CL limit the PWM will be truncated

P2CL Pulse to pulse cycle limit

Response :

- Each PWM pulse will immediately be truncated when the phase current exceed the P2CL limit
- Fault flagged after 255 switching cycles above limit.
  It uses an up/down counter.
  It will count down for all pulses that are below threshold and up again if new pulses exceed threshold.
  When number of accumulated above threshold pulses reaches 255 a fault signal is generated.
- A single pulse under threshold will not reset counter to 0 like the other current limit functions
- Counter do not go below 0

› Recommended settings: Inductor saturation current or 1-2A below saturation current

› Shutdown response: Shutdown/Ignore/Hiccup