

# nVidia PWM...

These are the settings for the PWM VID mode. More details are on the following slides

The screenshot shows the 'nVidia PWM - 0x7C' configuration window. The window contains several settings and buttons. Red arrows point from text boxes to specific controls:

- Mark box to enable the PWM VID function:** Points to the 'Enable PWM-VID Function' checkbox.
- Select if Vboot should use the selected value to the right in this window or look at PWM signal to determining the output voltage:** Points to the 'Vboot Selection' dropdown menu.
- Select if direct digital PWM signal or use analog input from filtered PWM:** Points to the 'PWM VID Control Type' dropdown menu.
- Output voltage when PWM is 100%:** Points to the 'Vout (duty Cycle = 100%)' value field.
- Output voltage when PWM is 0%:** Points to the 'Vout (duty Cycle = 0%)' value field.

The window also displays the following settings:

- Dynamic Voltage Control: Disabled
- Vboot Selection: Vboot
- PWM VID Control Type: Digital
- VID Table: 6.25mV
- Vout (duty Cycle = 100%): 1.55000 V
- Vout (duty Cycle = 0%): 0.60000 V
- Loop A Vboot: 0.831 V
- Loop B Vboot: 0.819 V

Buttons at the bottom: Write, Close, Refresh.

# nVidia PWM... VID Overview

A pulse width modulated I/O that controls the Voltage Regulator VID set point (output voltage) by modulating the duty cycle of the signal sent

- PWM VID functionality applies to Loop 0 only
- An optional method of control is to digitize an analog voltage (VAUX) and generate an output voltage proportional to this input.

PWM VID implementation allows for

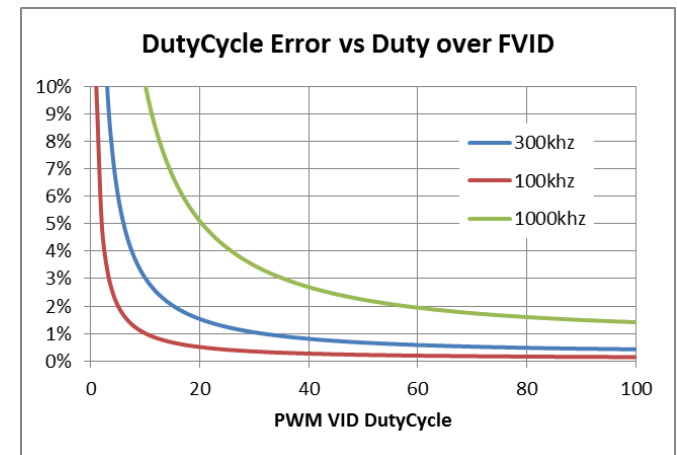
- Wider range of VID set points using a single I/O pin
- VID target change can be communicated in a single cycle
- PSI entry/exit is instantly communicated

# nVidia PWM... Analog Solution Notes

- › Vaux shares the same pin as btsen
  - consequently, the analog solution is suitable for single loop applications.
  - if a 2<sup>nd</sup> loop is needed, the digital solution is recommended.
  - Otherwise, the 2<sup>nd</sup> loop will not have independent temperature sense.

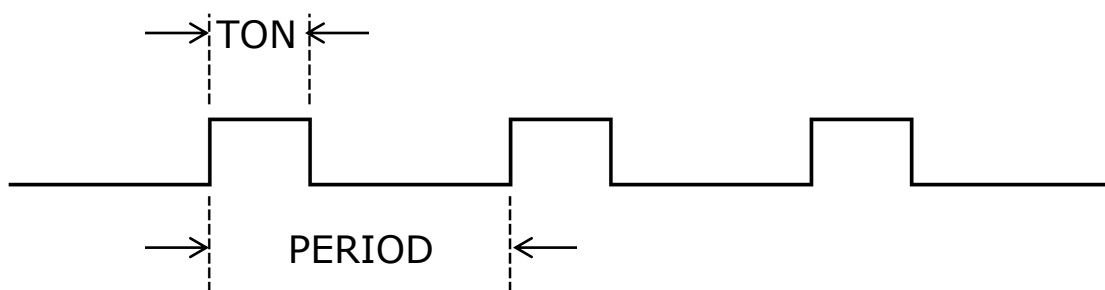
# nVidia PWM... Digital Solution

- › Page 0x70 dedicated for Digital PWM VID communication
- › Digital NVPWM connect directly to the SVD pin
- › Signal digitized by 100MHz clock (10ns resolution)
  - Typical FVID 300kHz
  - Usable FVID range 100kHz  $\leftrightarrow$  1MHz
- › Digital offset can be added via I2C



# nVidia PWM... Digital PWMVID Measurement

- › The dutycycle is calculated as the quotient of the ON time of the NVPWM over the PERIOD of the signal.
  - ON time is measured from the rising edge to the falling edge of the NVPWM
  - PERIOD is measured from a rising edge to the next rising edge



- › The calculation is updated on every rising edge of NVPWM
- › A continuous moving average of 4 dutycycles calculations is used to set the target voltage

# nVidia PWM... Digital Solution Equations

- ›  $\text{Duty} = \text{Ton} / \text{Period}$
- ›  $\text{Vout} = \text{vout\_vid\_vmin} + \text{duty} \cdot \text{pwm\_vid\_slope}$ 
  - $\text{pwm\_vid\_slope} = (\text{Vmax} - \text{Vmin}) / (5\text{mV})$  per 100% duty cycle change

# nVidia PWM... Slewrates

- › Analog solution
  - the slewrate of an instantaneous change in dutycycle will be filtered by the cap and associated resistor network dictating how fast the output can slew
- › Digital solution
  - the slewrate can be set in the Output Settings window. The fast slew rate setting is used.