MPS Digital Multiphase VR Introduce

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Outlines

- Basic terminologies
- Multiphase VR control methods
- Multiphase VR current balance
- MPS multiphase VR road map

Basic Terminologies

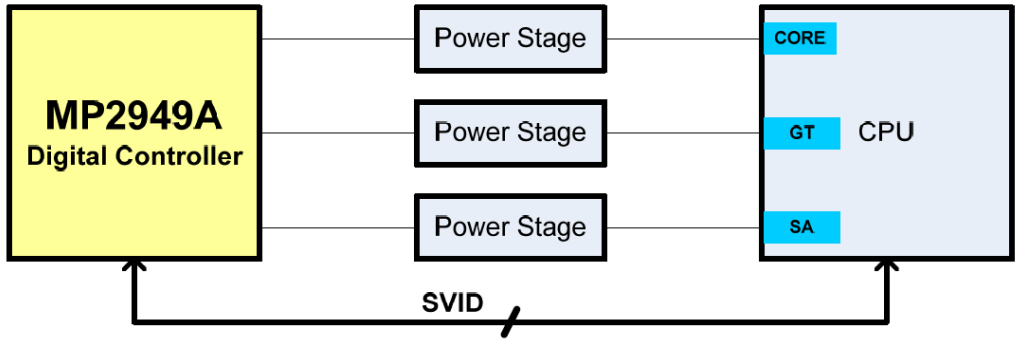
Phase and Rail

MP2949A

Tri-Loop Digital Multi-Phase Controller with PMBus Interface for IMVP8/9

FEATURES

- Up to 6-Phase Triple-Rail Digital PWM Controller
- Configurable Phase Number: 3+2+1, 4+1+1, 2+1+1, 1+1+1, etc.

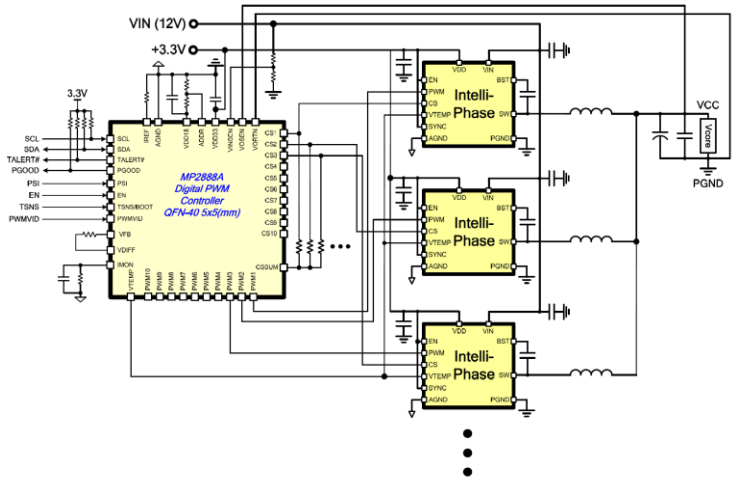


MP2888A

Digital, Multi-Phase PWM Controller with PMBus and PWM-VID

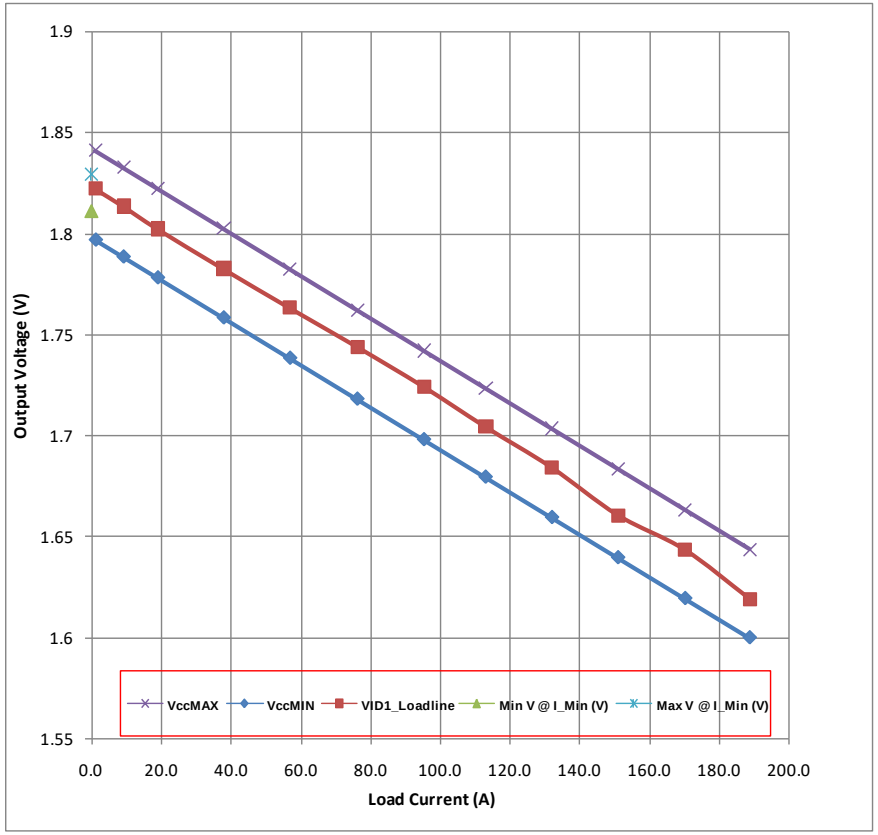
FEATURES

- Programmable Multi-Phase up to 10 Phases



VR/MTP/VID/DVID/CS/APS/Loadline(droop resistor)

- VR means voltage regulator
- MTP means multiple-time programmer
- VID is same as Vref of DCDC converter
- DVID means dynamic VID
- CS means current sense
- APS means auto phase shedding
- Loadline(droop resistor) shows as picture



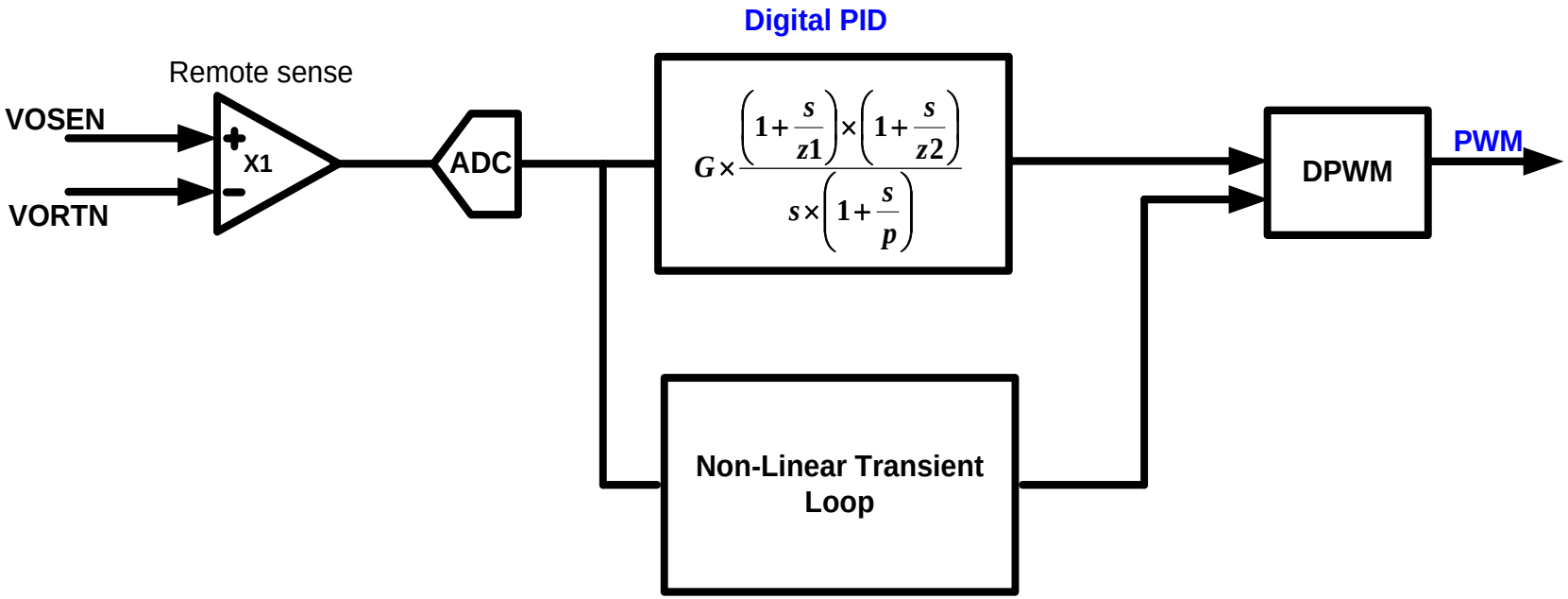
Protocols: SVID/SVI2/3/OVR/PVID/AVS/PMBUS

- SVID→ Intel
- SVI2/3→ AMD
- OVR→ NVidia
- PVID→ early Intel/POL
- AVS→ Arm-base IC
- PMBUS→ MPS and so on

Multiphase VR Control Methods

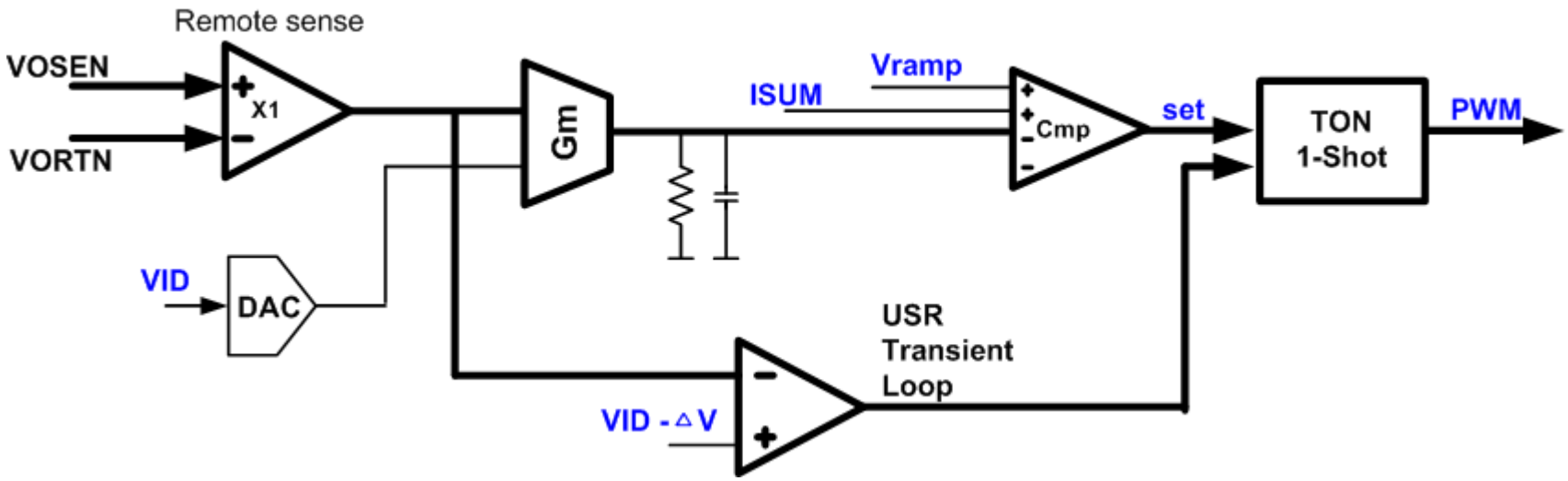
Typical Voltage Mode Digital Control

- Sophisticated pole and zero adjustment during operation
- Separated non-linear loop creates undershoot or ringback during tranisent
- Voltage mode control doesn’t guarantee cycle by cycle current sharing



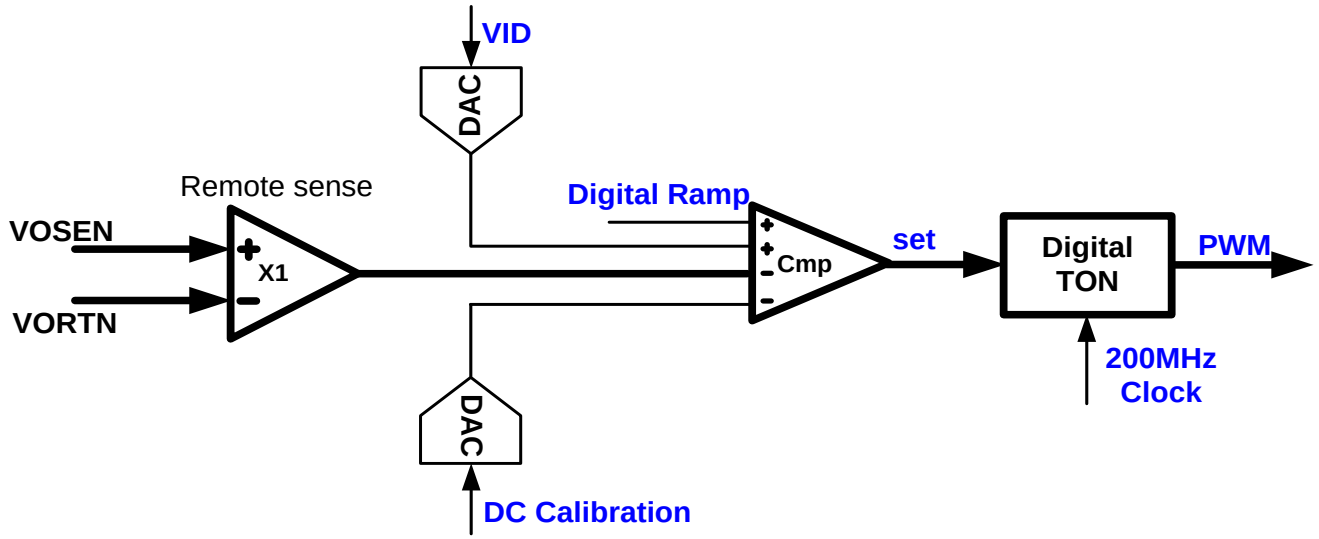
Dual Loop COT Control

- Separated non-linear loop creates undershoot or ringback during tranisent

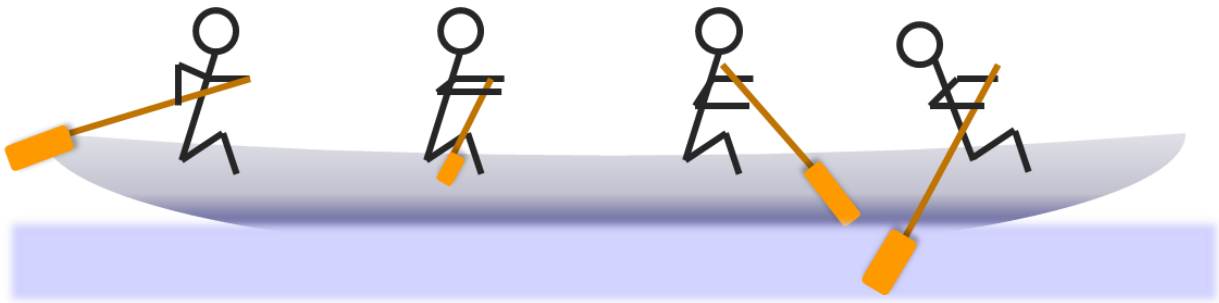


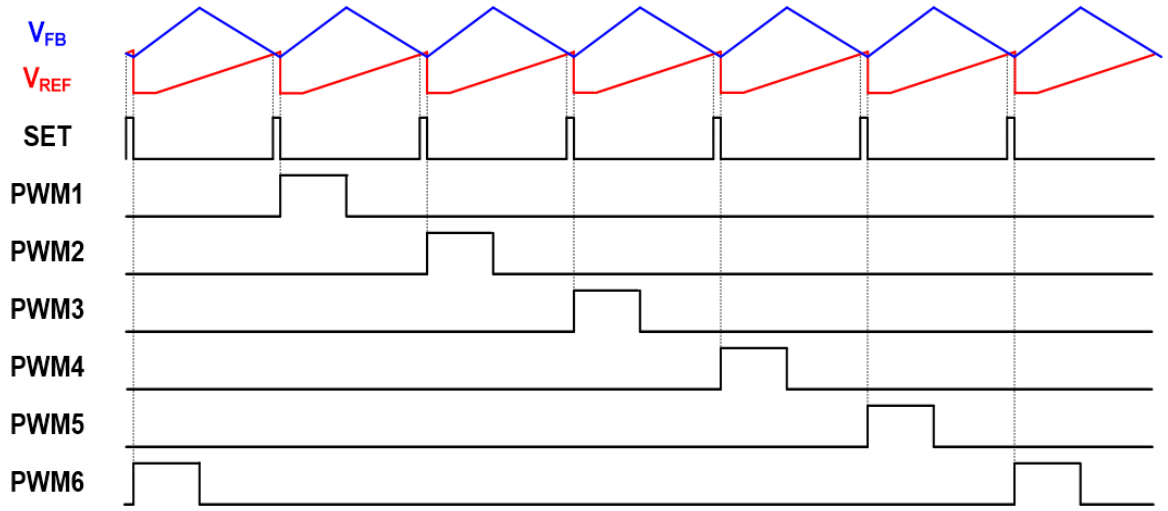
MPS Digital COT Control

- One fast loop takes care of both steady state and load transient
- MPS patented Technology-Simple, Fast and Fully Digital.

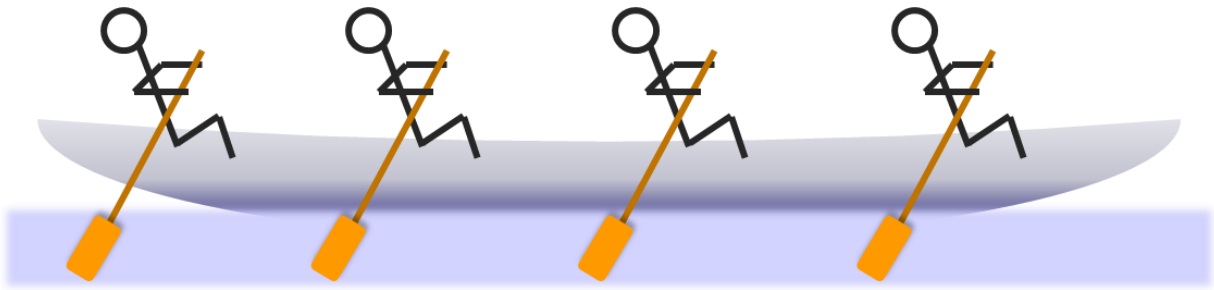


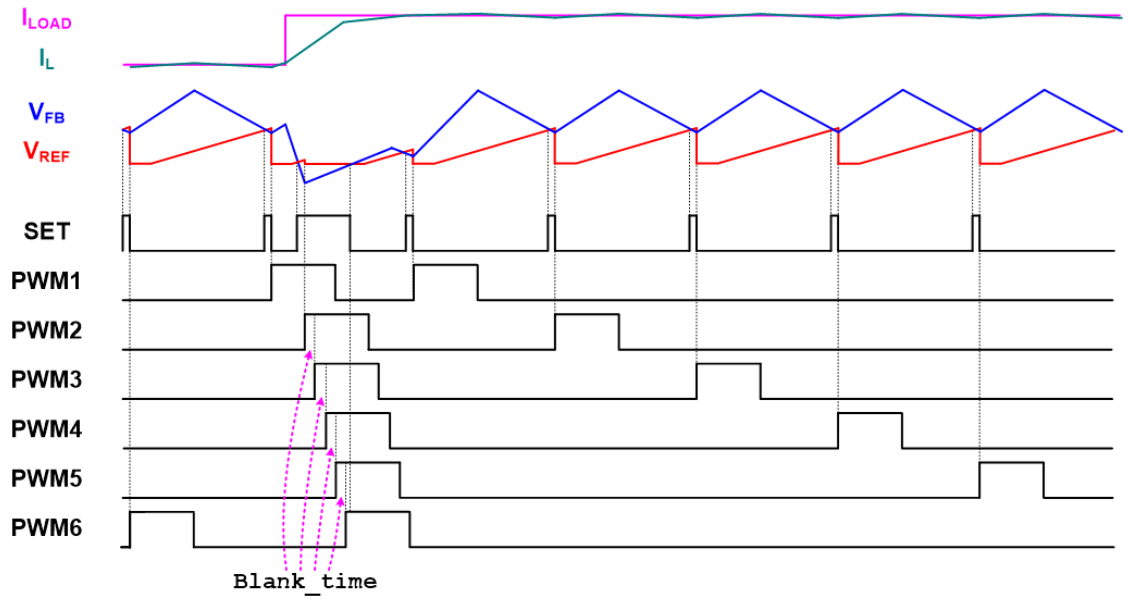
Digital COT Control – Steady State



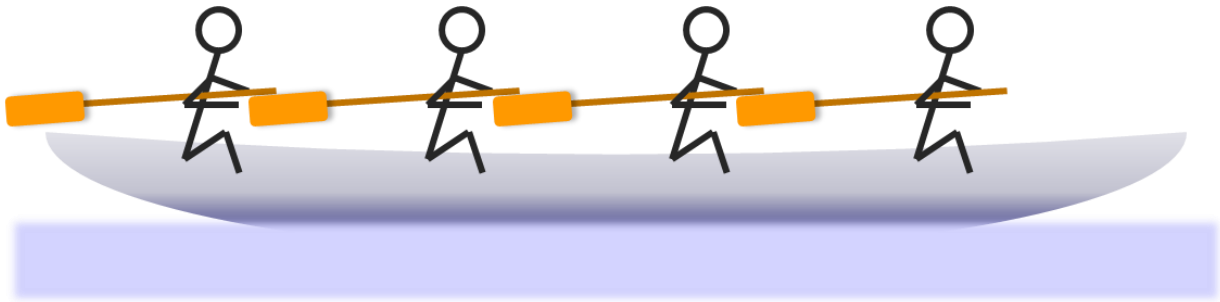


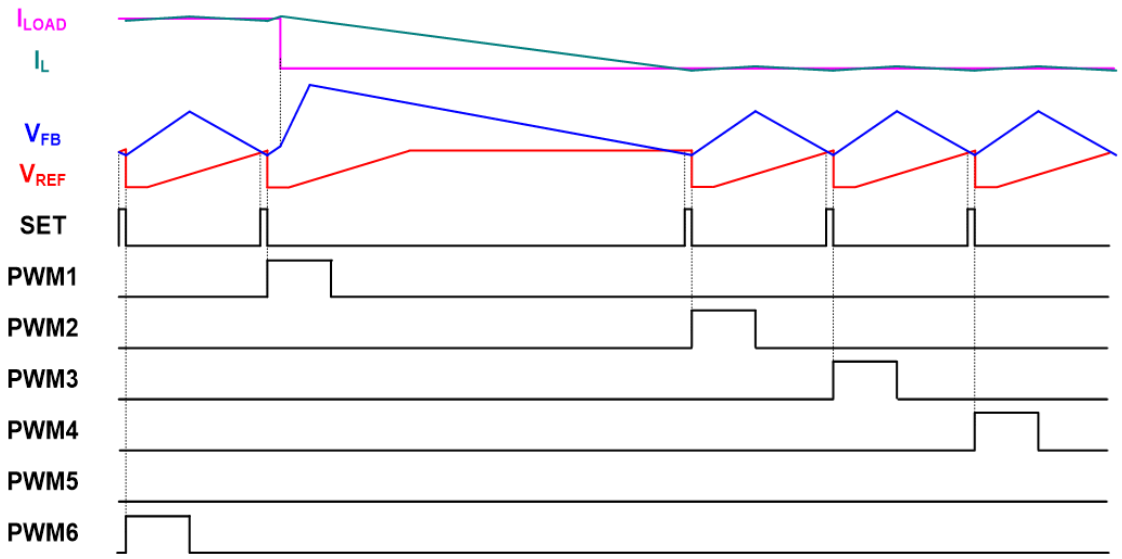
Digital COT Control – Load Step Up





Digital COT Control – Load Step Down

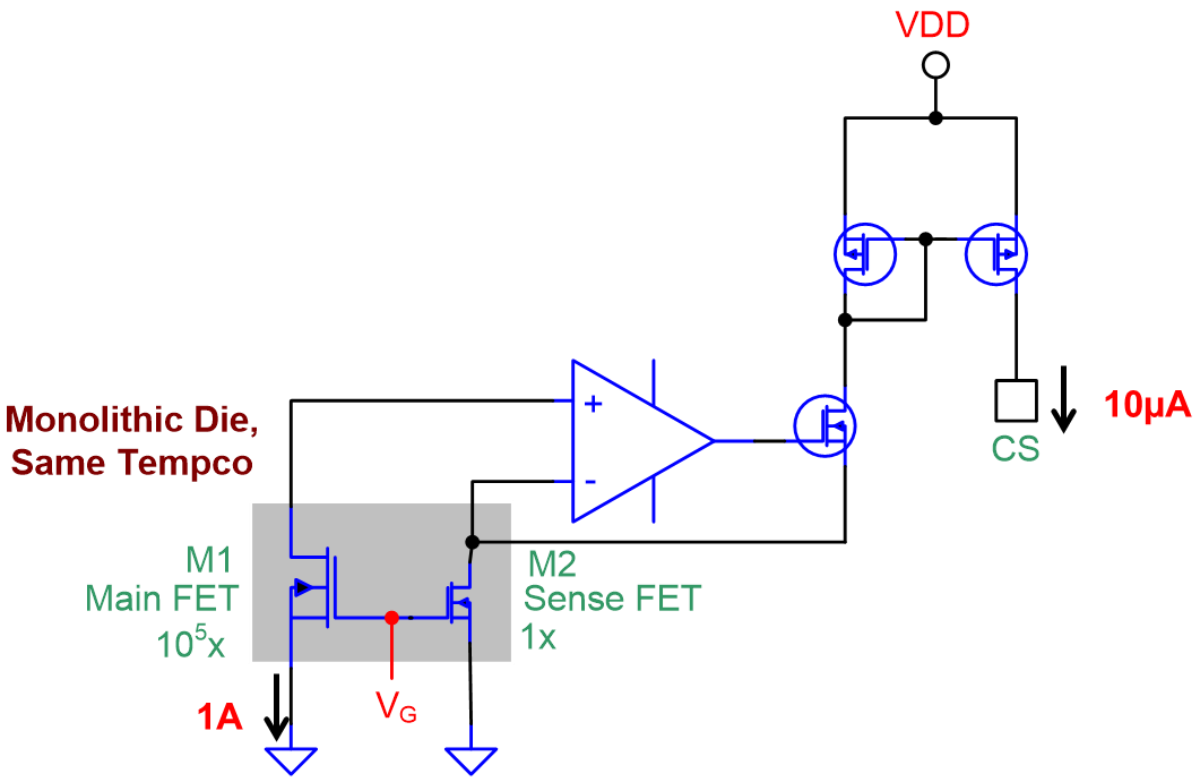


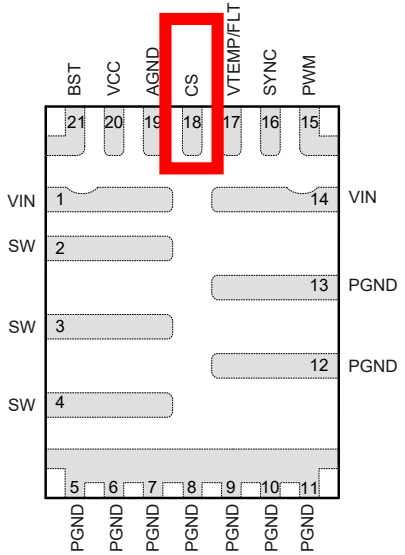


Multiphase VR Current Balance

Intelli-Phase Current Sense Principle

- Zero tempco due to monolithic die current sensing





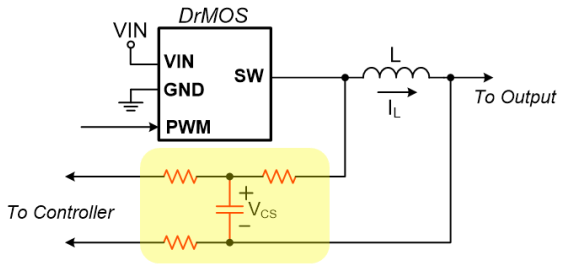
On-Die Current Sense Advantages

- CS outputs current proportional to inductor current. (10µA/A)
- Tracks cycle by cycle.
- Independent of the Temperature, Rdson, Inductor DC resistance, Duty-cycle and Frequency variations.

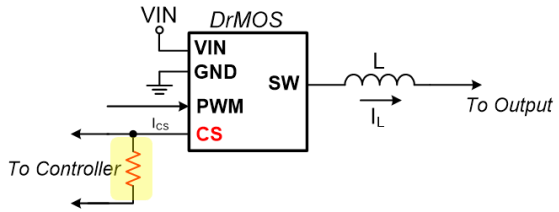
CS output matches inductor current very well during transient

On-Die Current Sense Advantages

DCR Sensing



MPS Accu-Sense

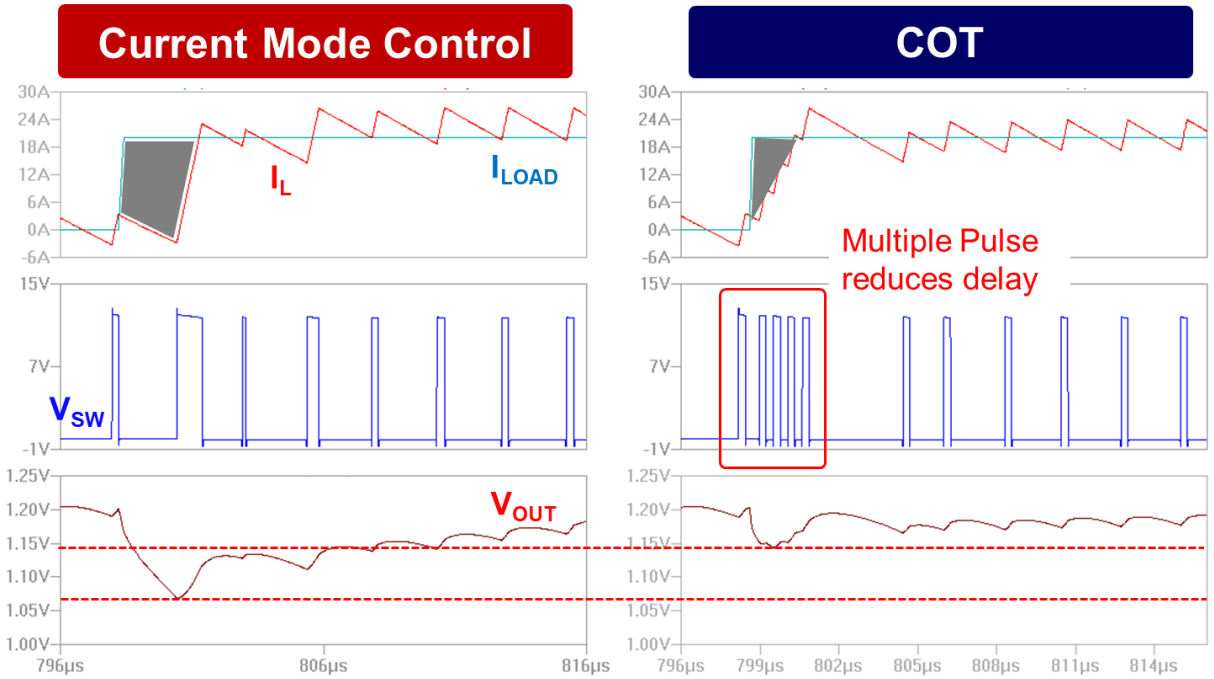


- Need 21 Components (Rx15 + Cx5 + NTC)
- 6%-8% DCR sensing error (at 25C)
- Noisy
- Hard to tune

- Only need 5 Resistors
- 3% current sensing error over temp.
- Clean signal
- Very easy to use

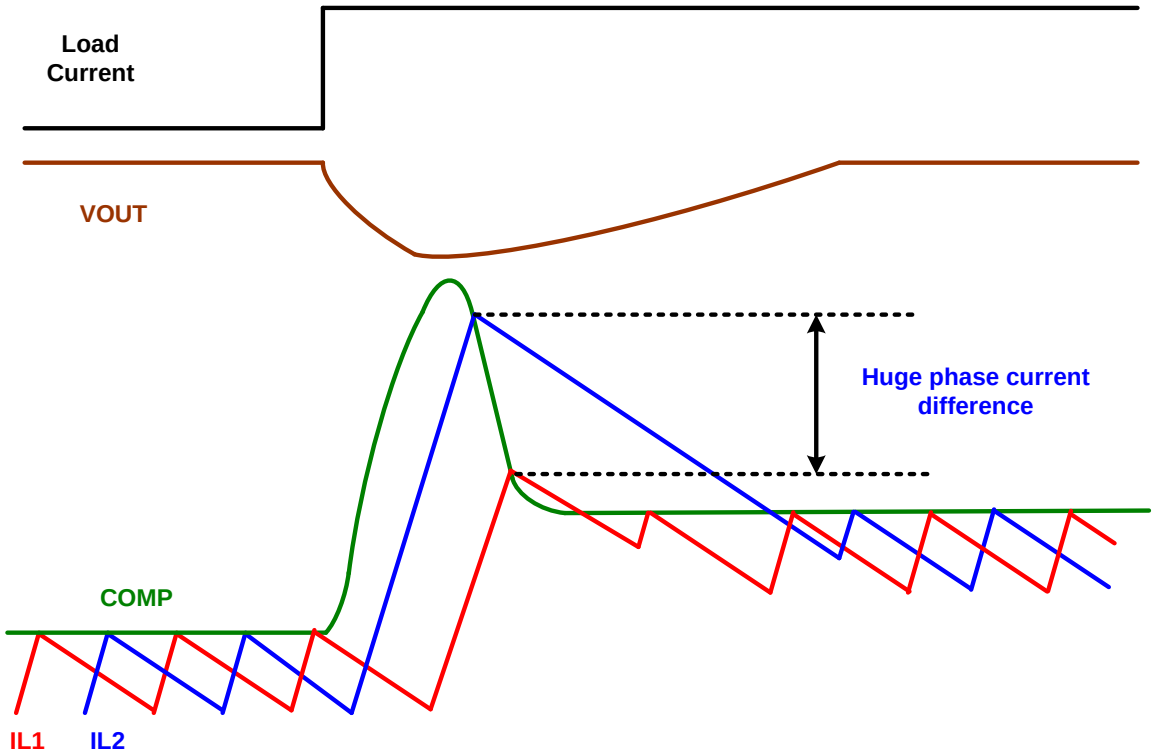
Saves Component Count & Cost!

Current Balance Introduce



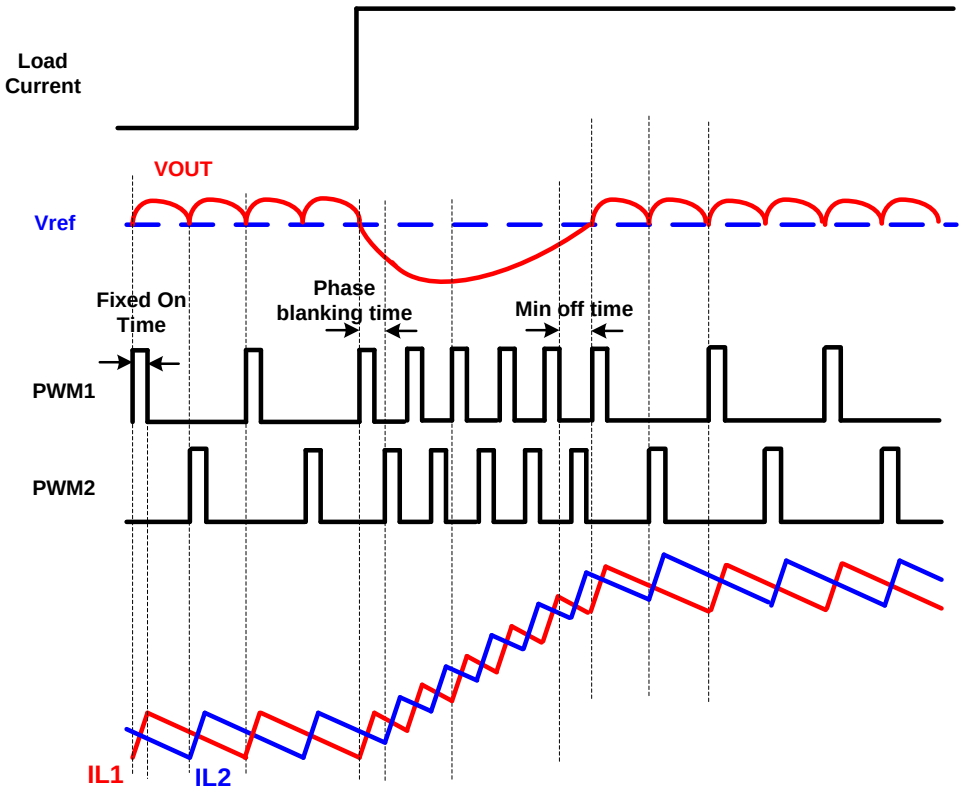
Current Balance Introduce

- Why dynamic current sharing for multiphase is difficult for voltage and current control
- In load step up mode, the leading phase would increase PWM on time dramatically, but due to PWM switching cycle delay, the lagging phase supports less current
- Huge current stress on one phase during fast load step up



Current Balance Introduce

- Reducing PWM off time to support load step up, while PWM on time keeps constant
- PWMs are evenly distributed to each phase , so each phase carries the average current even transient
- Inherently much better dynamic current sharing than voltage and current control



MPS Multiphase VR Road Map

Multiphase VR Road Map

	2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Intel Xeon Processor	**MP2955A** 7-ph/ 2-rail VR13	**MP2965** 7-ph/ 2-rail VR13.HC			**MP2975** 8-ph/ 2-rail VR13.HC	**MP2972** 12-ph/ 2-rail VR13.HC			**MP2971** 8-ph/ 2-rail VR14		**MP2973** 12-ph/ 2-rail VR14	
Intel IMVP	**MP2949A** 6-ph/ 3-rail IMVP8					**MP2979A** 6-ph/ 3-rail IMVP8	**MP2940A** 3-ph/ 1-rail IMVP9		**MP2950A** 6-ph/ 1-rail IMVP9			
AMD Gaming SoC	**MP2853** 5-ph/ 2-rail SVI2	**MP2945** 5-ph/ 2-rail SVI2							**MP2852** 13-ph/ 2-rail SVI2		**MP2855** 9-ph/ 2-rail SVI2	
AMD Server Processor	**MP2853** 5-ph/ 2-rail SVI2								**MP2852** 13-ph/ 2-rail SVI2		**MP2855** 9-ph/ 2-rail SVI2	
Nvidia GPU	**MP2888A** 10-ph/ 1-rail OVR4+	**MP2886A** 6-ph/ 1-rail OVR4+	**MP2884A** 4-ph/ 1-rail OVR4+		**MP2988** 3-ph/ 1-rail OVR3i							
AI Processor	**MP2965** 7-ph/ 2-rail AVS				**MP2975** 8-ph/ 2-rail AVS	**MP2978** 5-ph/ 2-rail AVS	**MP2972** 12-ph/ 2-rail AVS		**MP2852** 13-ph/ 2-rail AVS		**MP2926** 6-ph/ 3-rail AVS	**MP2882** 16-ph/ 2-rail AVS

Released

Sampling

Thank you