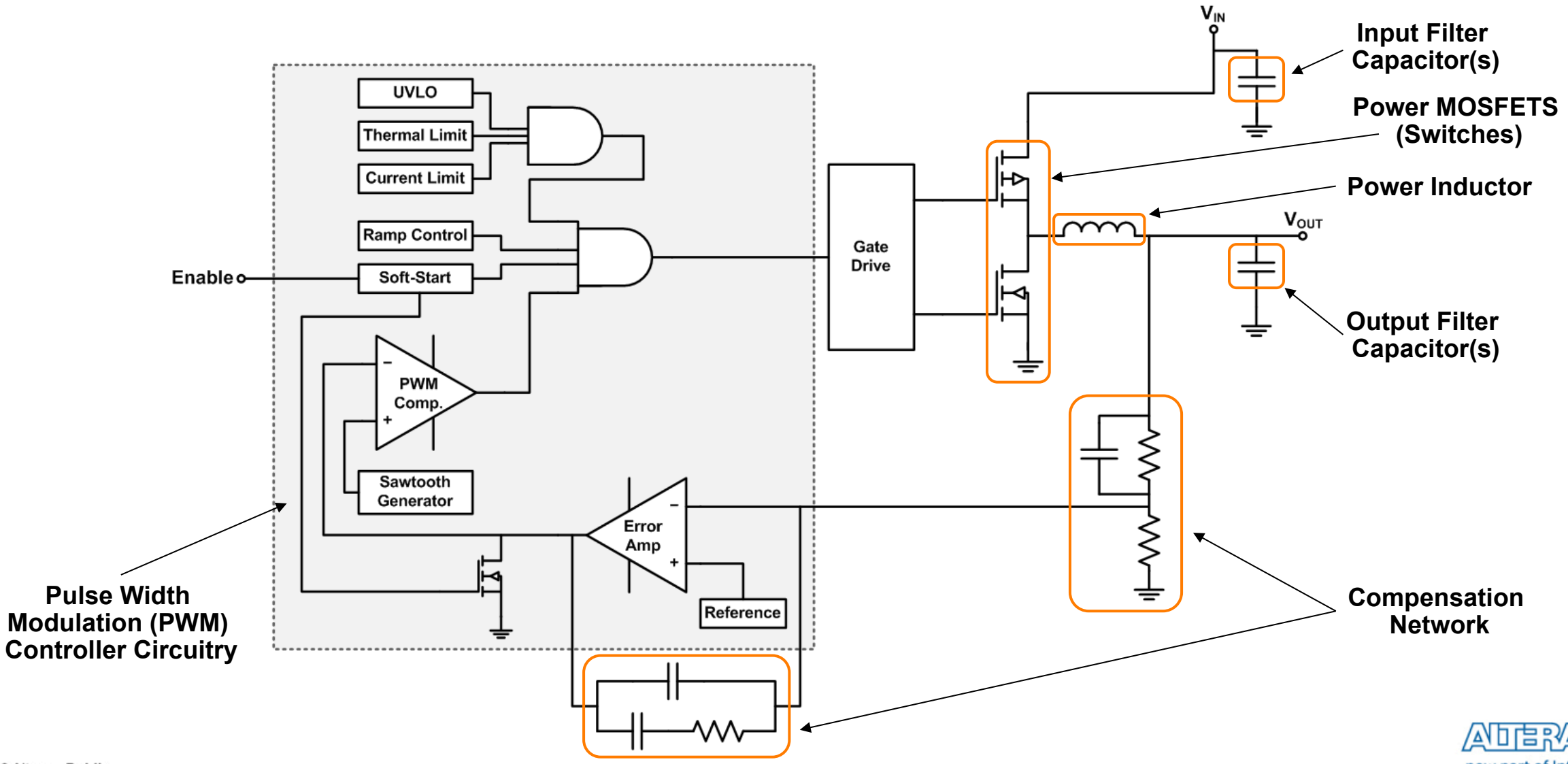
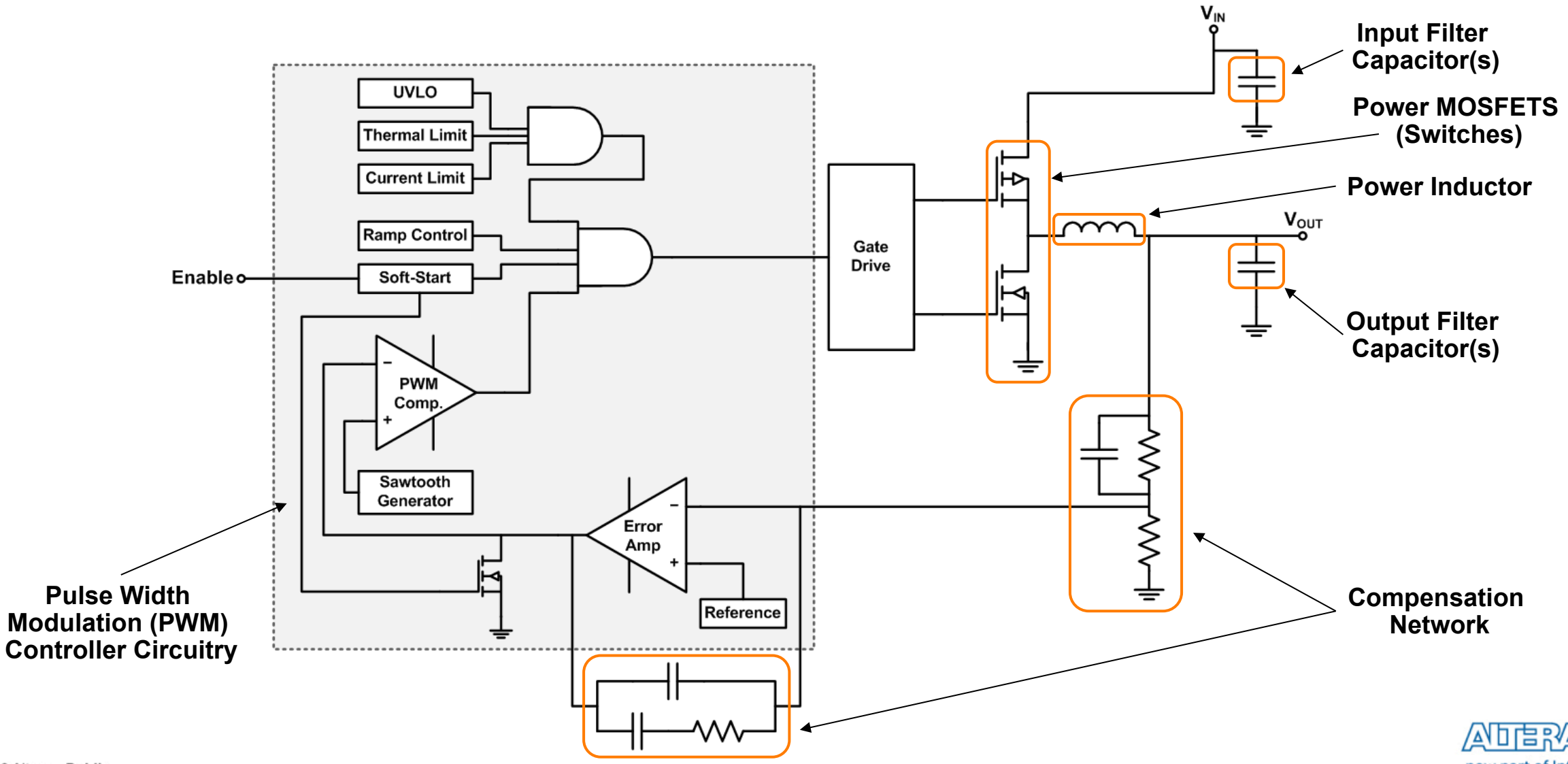
Tutorial:
The Benefits of Integrated PowerSoCs Versus Discrete Power Converters

Switch Mode DC-DC Step Down Converter: Discrete versus PowerSoC Implementation



Switch Mode DC-DC Step Down Converter: Discrete Implementation



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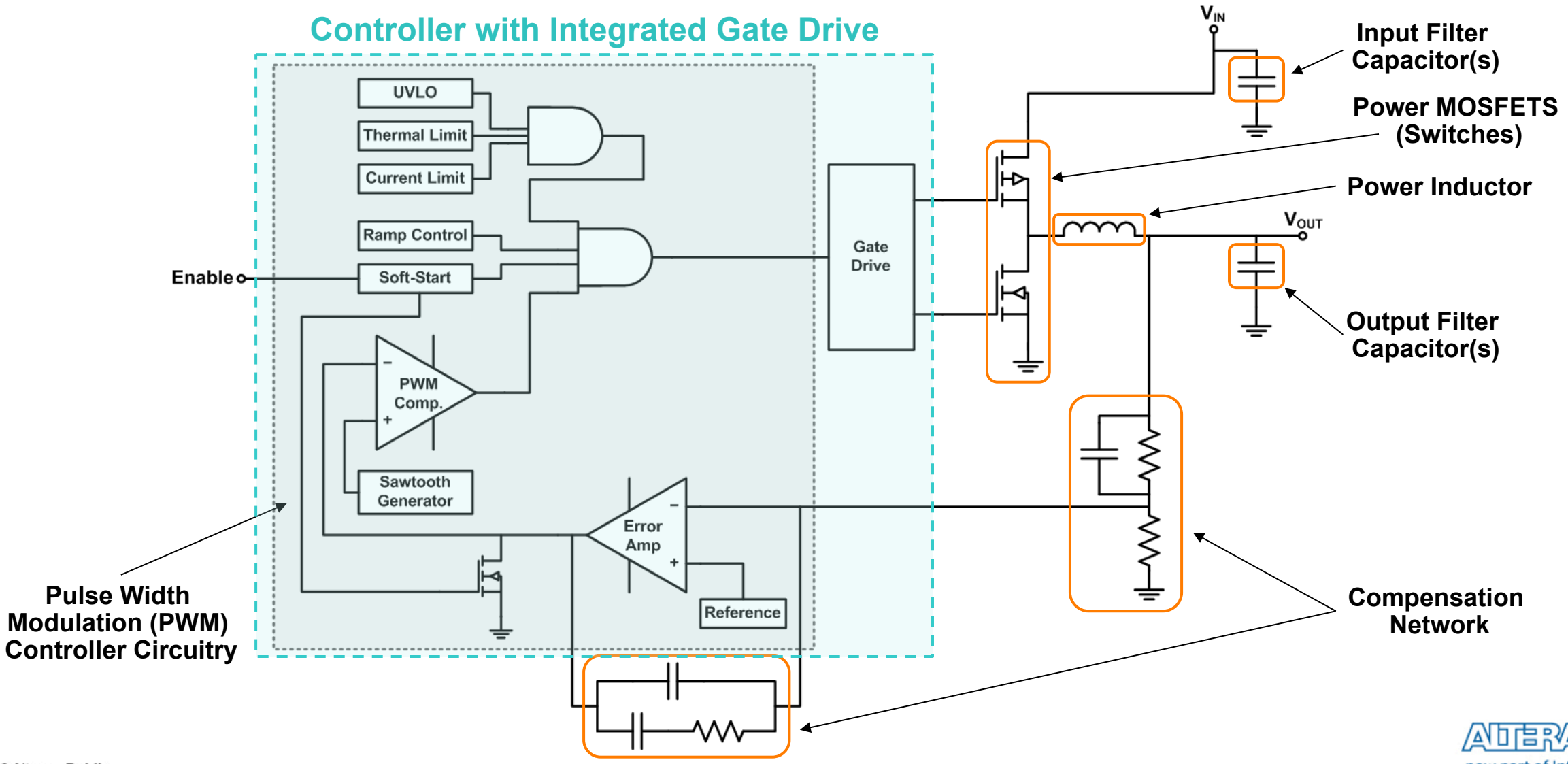

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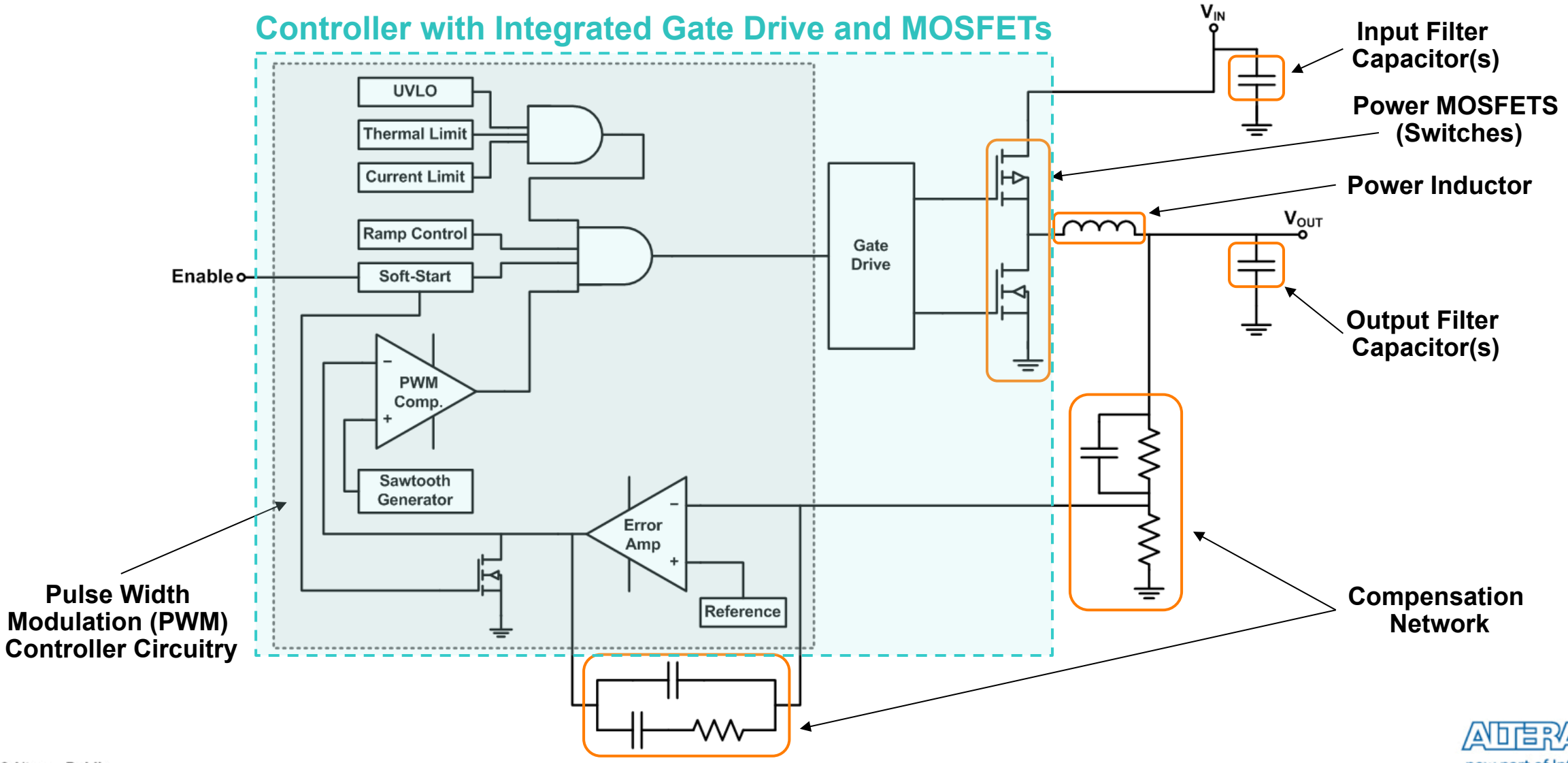
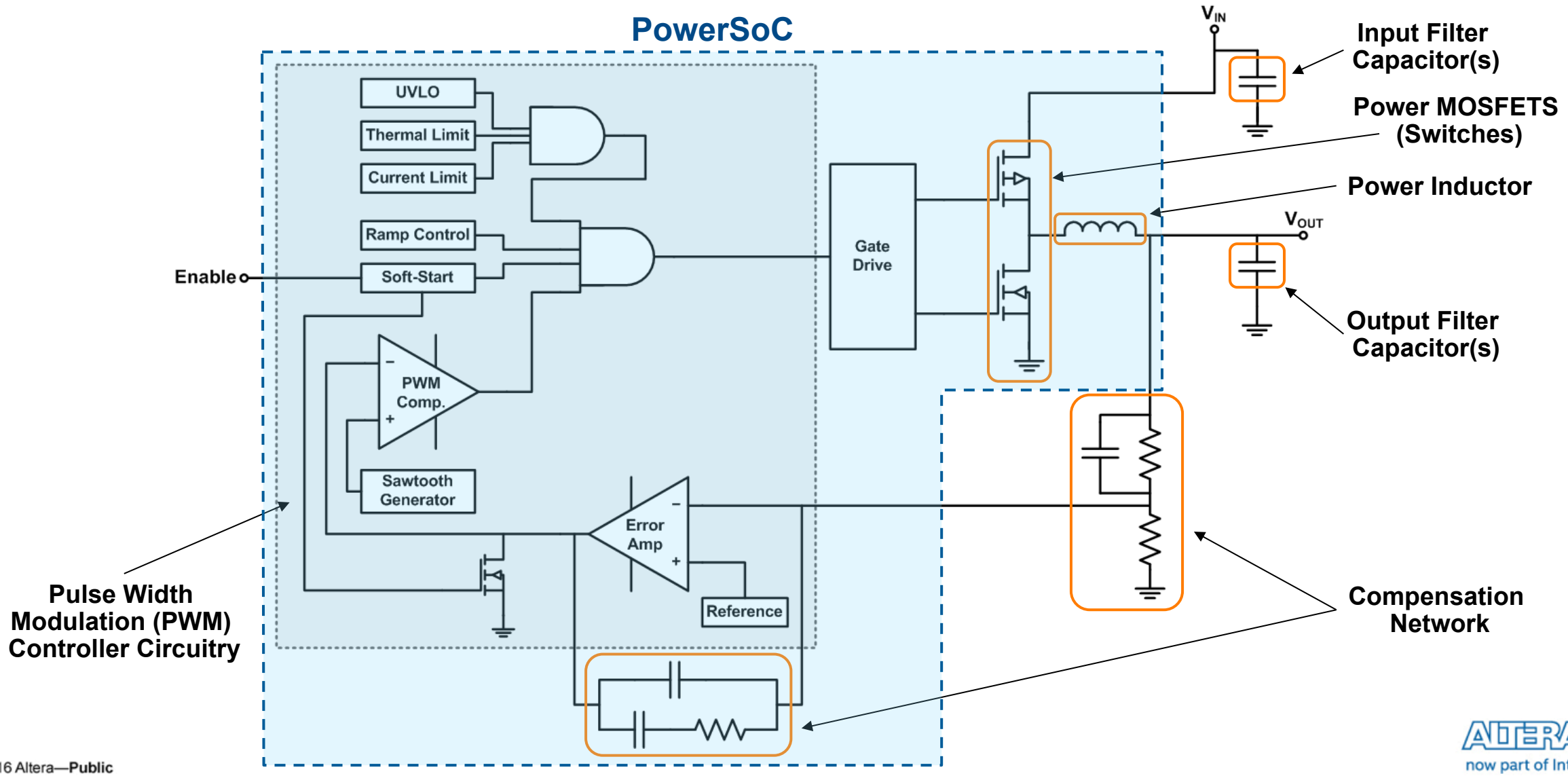
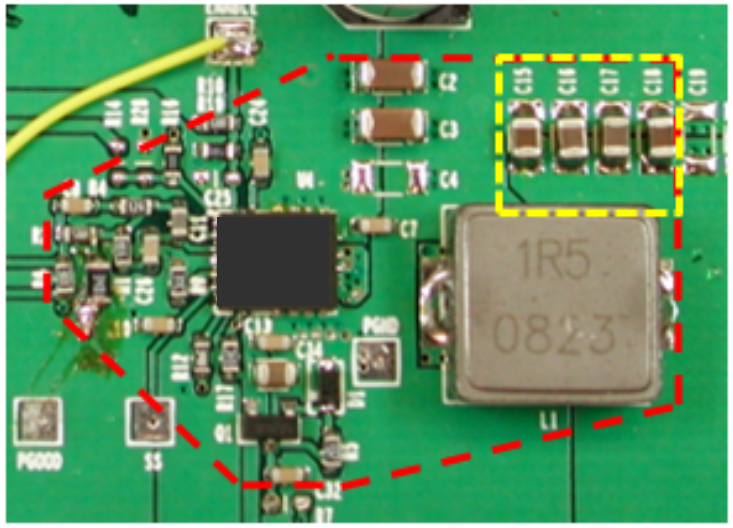


Switch Mode DC-DC Step Down Converter: PowerSoC Implementation



PowerSoC Products Offer a Much Smaller Total Solution Size Versus Discrete Solutions

4 A PowerSoC

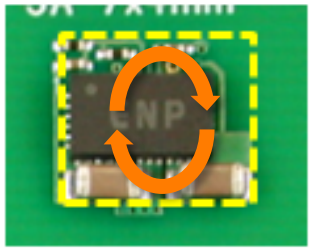


4 A Discrete Solution

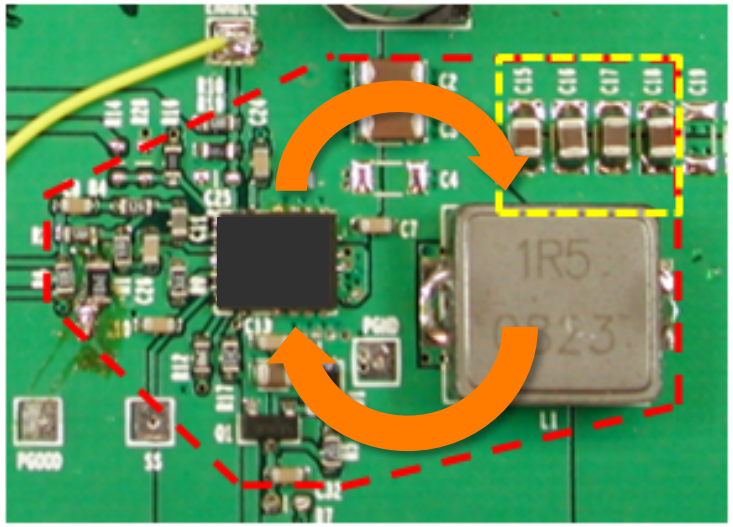
- The discrete solution takes up 7X more PCB area than the PowerSoC
- The PCB area savings that the PowerSoC provides can be used to:
  - Reduce the size of the PCB and save cost
  - Add additional features or components to the end product that otherwise would not be possible

PowerSoC Products Offer Better EMI Performance Versus Discrete Solutions

$$P_{RAD} = \eta \frac{\pi\left(\frac{2\pi r^2}{\lambda}\right)^4}{12}\left|I_0\right|^2$$



4 A PowerSoC



4 A Discrete Solution

- Radiated EMI comes from high di/dt currents flowing in loops
- Radiated power is proportional to the radius of the current loop and decreases by r^8
  - Since PowerSoC solutions have current loops with a much smaller radius (r) than discrete solutions, the radiated power is significantly lower

PowerSoC Products Offer Better System Reliability Versus Discrete Solutions

- The Failures in Time (FIT) rate of a power converter system is the sum of component FIT fates as follows:

$$FIT_{SYSTEM} = FIT_{CONTROLLER} + FIT_{MOSFETS} + FIT_{INDUCTOR} + FIT_{PASSIVES}$$

- Competing discrete solutions are not designed, tested, and qualified as a *complete* power converter system like PowerSoCs are

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4 A PowerSoC

Component	FIT Rate
PowerSoC	2.5
4 MLCC Passives	0.8 (4x0.2)
2 Resistors	0.2 (2x0.1)

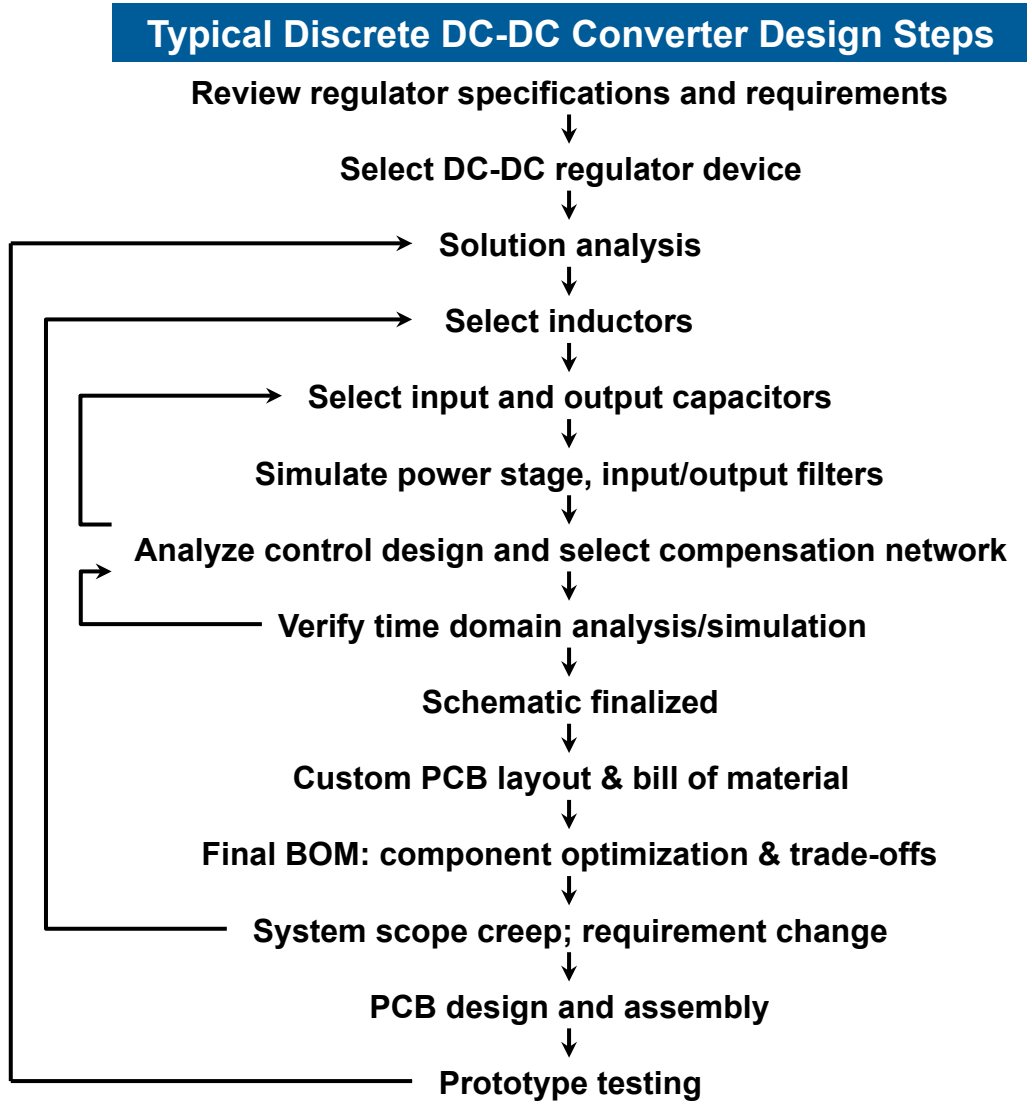
Total FITs: 3.5
Mean Time Between Failure (MTBF): 32,600 years

4 A Discrete Solution

Component	FIT Rate
Controller	1.5
Inductor	5
10 MLCC Passives	2 (10x0.2)
1 Electrolytic Capacitor	5
9 Resistors	0.9 (9x0.1)

Total FITs: 14.4
Mean Time Between Failure (MTBF): 7,900 years

PowerSoC Devices Help Reduce Development Time and are Lower Risk Solutions than Discrete Solutions



A typical Discrete DC-DC converter design requires:

~464 people-hours

~19 steps with iterations

Source: Ease of Design Comparison, Darnell Group

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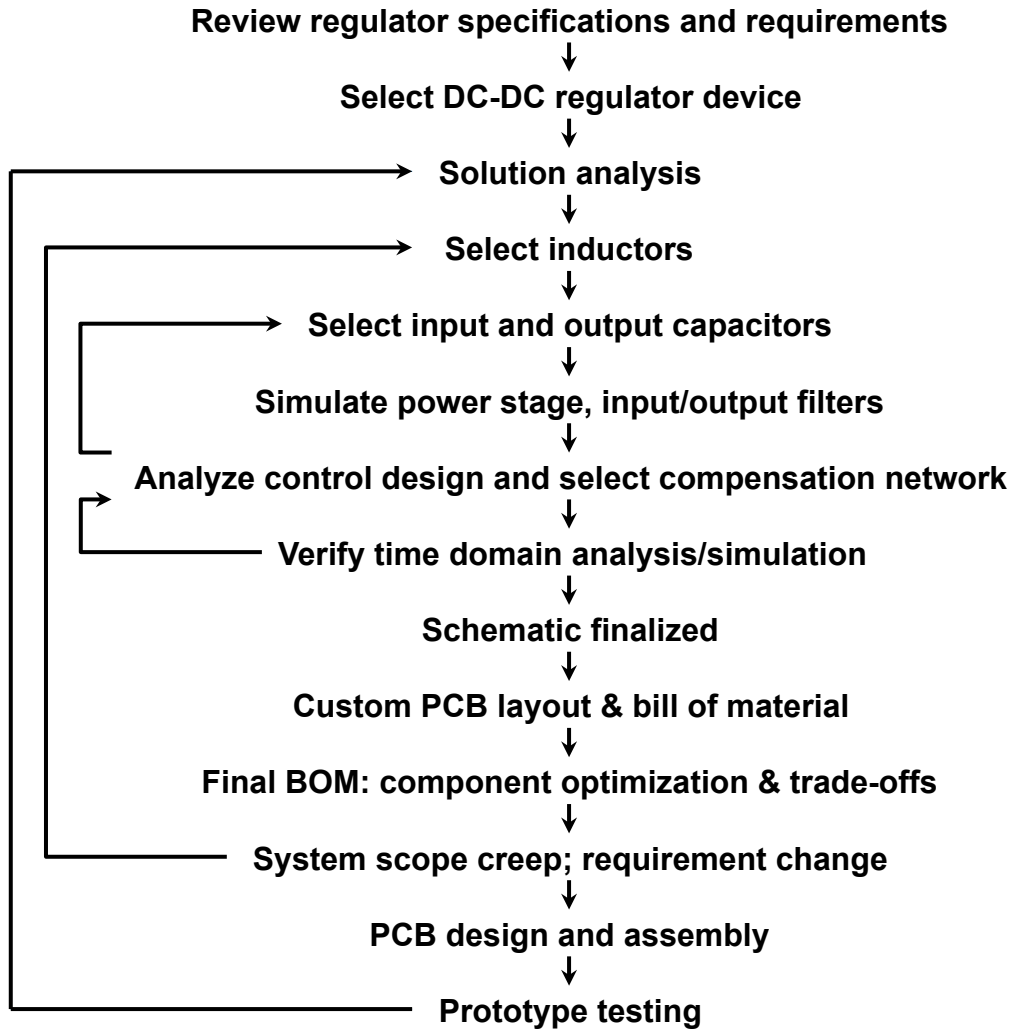
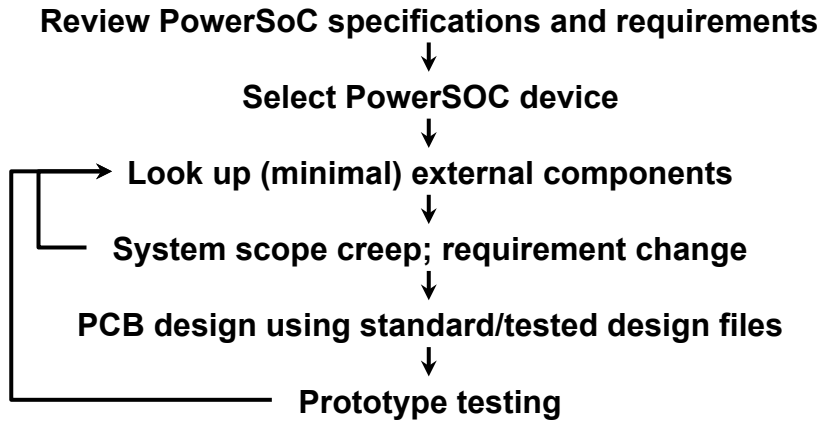
Typical Discrete DC-DC Converter Design Steps



Typical PowerSoC Design Steps



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The PowerSoC Advantage

A typical PowerSoC design requires:

~254 people-hours (45% less)

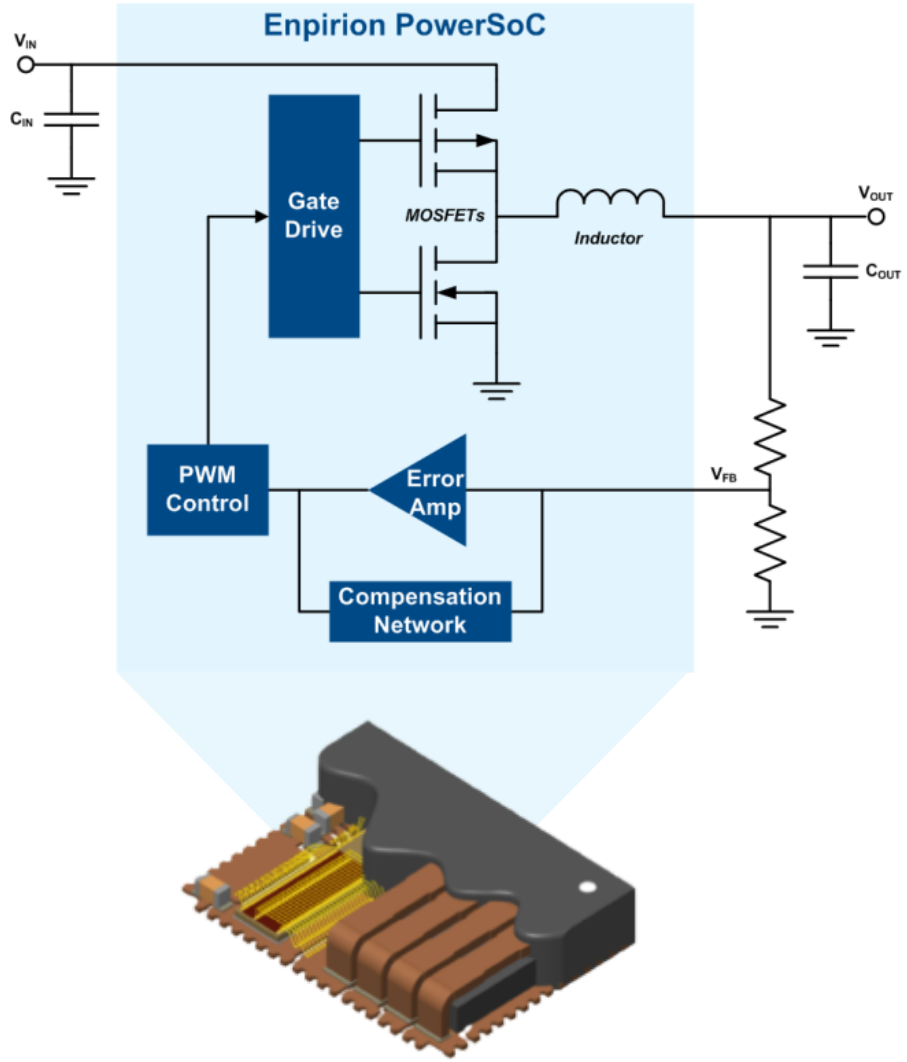
~6.7 steps with iterations

Source: Ease of Design Comparison, Darnell Group

Summary

PowerSoC solutions offer many benefits over discrete power solutions such as:

- Reduced PCB cost due to smaller size
- Better EMI performance because of their compact nature
- Improved system level reliability
- Faster, easier, lower cost, and lower risk development that improves time to market



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