

DESIGNING DIGITAL POWER SUPPLIES WITH A STATE MACHINE

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Digital power supplies enable many interesting functions. With a programmable regulation loop, a better loop behavior can be achieved for different operating conditions. Digital interfacing of the power supply with the complete system enables accurate monitoring of voltages and currents. Additionally, digital power supplies offer high flexibility. Different parameters can be modified fairly quickly. This simplifies the circuit design process and speeds up the development of system derivatives.

Still, many power supply experts have some resistance when it comes down to switching to digital. Power supply designers are typically not experienced software engineers. Usually a software engineer is added to the development team in a digital power supply project. Experience shows that the joint development of a power supply by a power supply expert and a software expert can yield to some complications.

The communication between the two can lead to misunderstandings and, as a result, project delays.

Graphical user interfaces (GUIs) are one solution for this dilemma. These simplify the programming of a digital power supply. Such GUIs are available from many different digital controller IC vendors. Usually they are designed in a way that a power supply expert can work with them intuitively. Figure 1 shows such a graphical user interface. Different aspects of the power supply can be selected with a mouse and different settings can be made in different functional diagrams on the screen.

Many different digital power supplies still have a significant disadvantage. The graphical user interface often generates a code, which is then compiled to run on the core of a microcontroller or on a DSP. The designer is fully responsible for the reliable function of the generated code. Errors may occur, which need to be found by test vectors as part of a qualification process. With every small modification in the graphical user interface, this qualification process needs to be repeated.

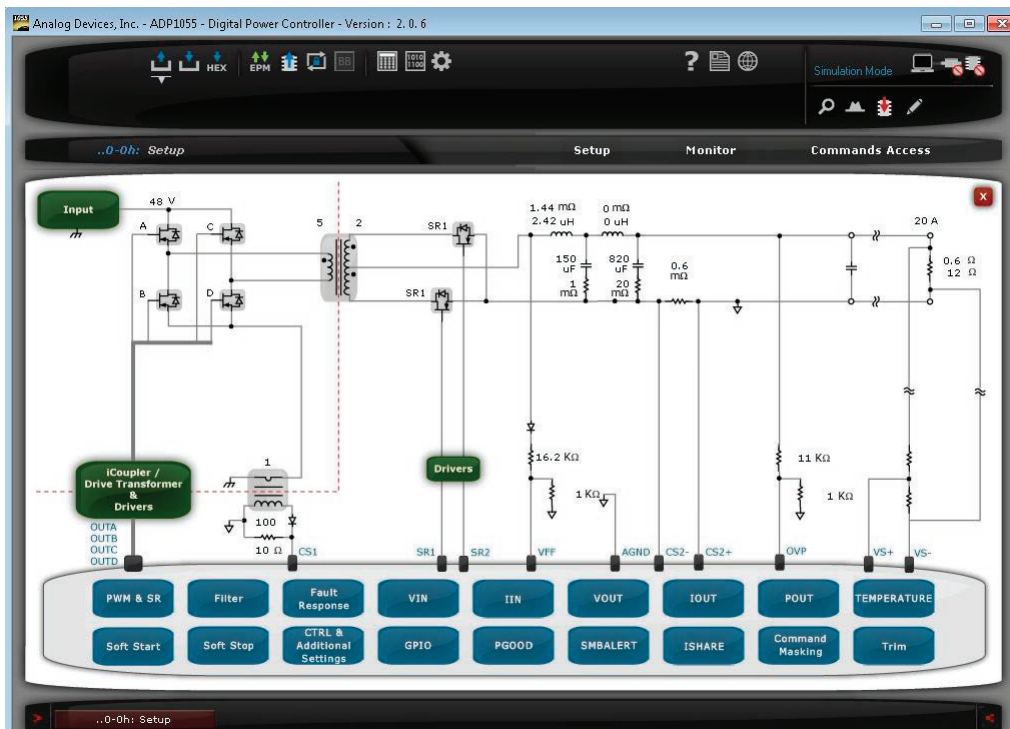


Figure 1. Graphical user interface of a digital power supply.

A much more convenient way is to select a digital power supply controller IC, which is based on a state machine. The ADP1055 from Analog Devices, for example, is such a device. Figure 2 shows the block diagram of the circuit. The digital logic acts just like a state machine. Changes in the behavior of the power supply can be set in the graphical user interface, as shown in Figure 1. These changes will not generate new code for a microcontroller; they will only set different states of registers in the state machine. Due to this process, the function of the digital power supply is still defined by the data sheet of the digital power supply controller IC and no software or code needs to be qualified.

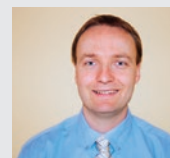
The combination of a graphical user interface and state machine simplifies the first steps in the domain of digital power supplies. This approach is especially attractive for organizations where there is no dedicated software engineer who can support the power management expert. Also, it is attractive in fields where qualification of software code poses a significant effort. An example of such a field is automotive.

Today there are many different power supply controllers that are based on a state machine. The ADP1055, which is shown in Figure 2, is intended for galvanically isolated power supplies for different topologies. However, it can also be used in point of load (POL) applications with interleaved technology.

For more information on any of the above mentioned products visit www.analog.com/DAC.

About the Author

Frederik Dostal studied microelectronics at the University of Erlangen, Germany. He began working in the power management business in 2001, and has been active in various applications positions, including four years in Phoenix, Arizona, working on switch mode power supplies. He joined Analog Devices in 2009 and works as a power management technical expert for Europe. He can be reached at frederik.dostal@analog.com.



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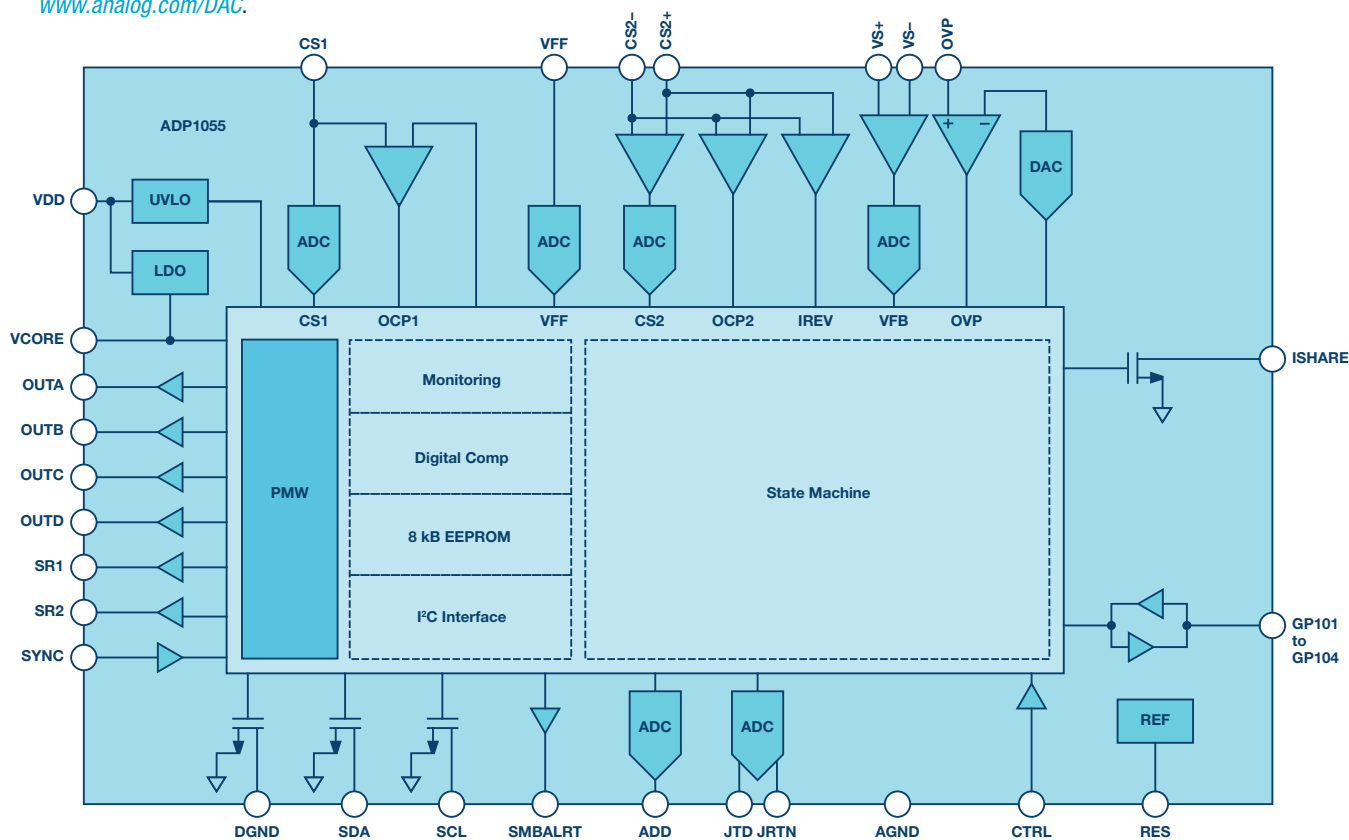


Figure 2. Block diagram of the ADP1055, which is based on a state machine.

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