

## Comparing the Merits of Integrated Power Modules versus Discrete Regulators

— By Rich Rosen, Field Applications Engineer

### Introduction

Modern integration technologies have brought about improvements to the modular DC-DC voltage regulator. Time to market, cost, size constraints, reliability, and design capabilities are among the motivating factors in choosing modular power versus a traditional controller plus external components design. Each approach has its advantages and disadvantages. And often times, it is not possible to predict which choice will better satisfy the list of design criteria until the design process has been completed for each approach.

### What is a Modular Voltage Regulator?

The basic building blocks of a simple, non-isolated DC-DC switching voltage regulator can be seen in the schematics shown in **Figure 1**. PWM control, current switching, inductance, and capacitance for storing energy are all required. The modular regulator integrates the current switches and inductor while these are separate entities in a discrete design. Since the values of the energy-storing capacitors tend to be well over 1  $\mu\text{f}$ , they are integrated less often into a monolithic package.

### How to Choose between Discrete and Modular Power

Typically, the tradeoff is between cost of ownership, design effort, and performance.

The cost of ownership is the bill of materials (BOM) cost in addition to power designer labor fees plus test, potential redesign labor fees, and finally manufacturing/assembly costs. Other potential costs can include those associated with quality issues with an improperly designed supply.

Clearly, the design effort behind using a fully integrated power module is less than that of a discrete supply. But within the discrete regulator designs available, there exists a range of integration. For example, some regulators have built-in FET switches that remove the task of choosing the FETs and gate drive considerations. Controller ICs are the most flexible of choices but require a more expert level of design capability. Should one decide to tackle a non-modular approach, they should further investigate how “discretely” they wish to dive into the design. Fortunately, there are excellent tools available such as National Semiconductor’s WEBENCH® online design tool, that allow novice power supply designers to easily assemble discrete supply designs.

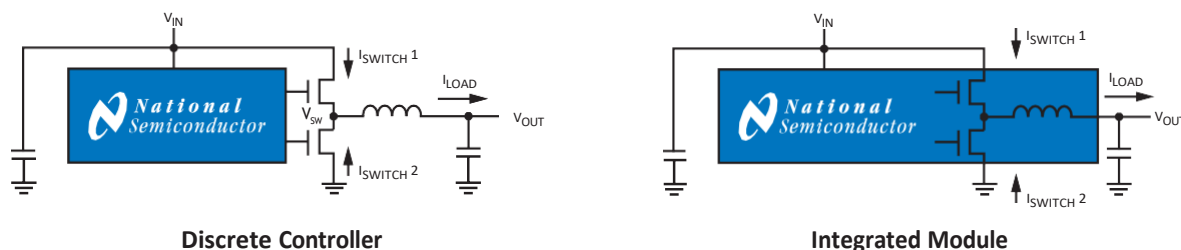


Figure 1. DC-DC Buck Regulator Integration Levels

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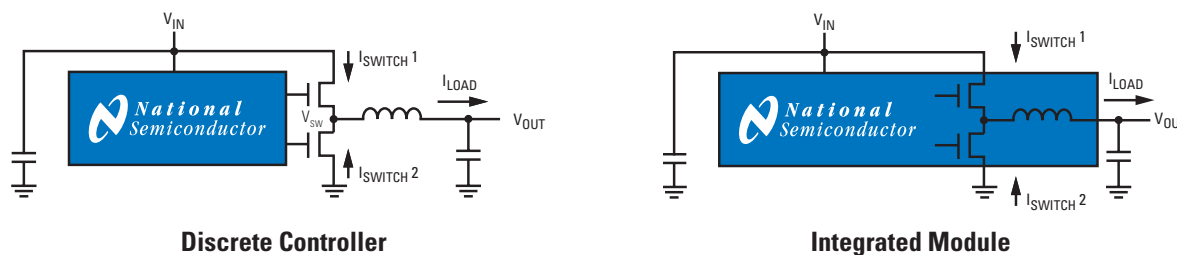


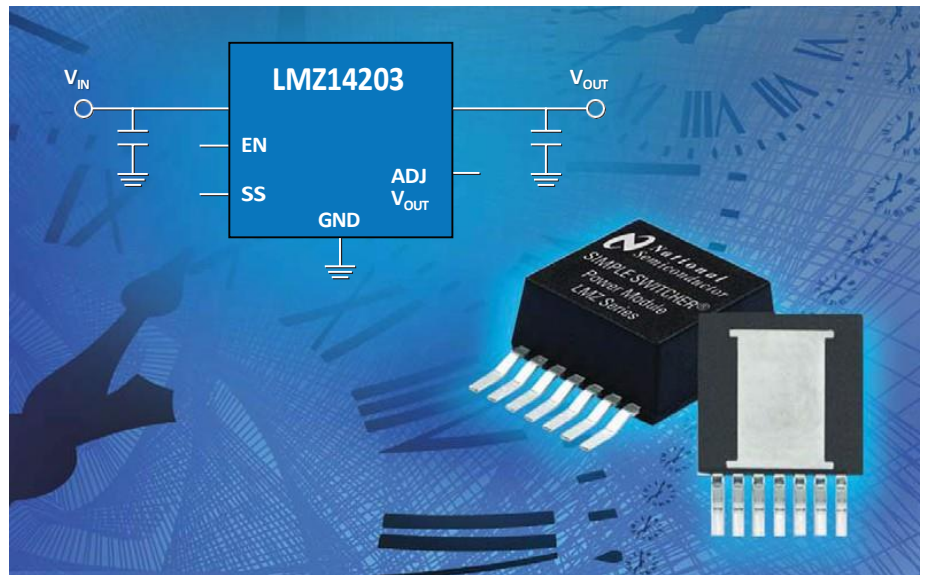
Figure 1. DC-DC Buck Regulator Integration Levels



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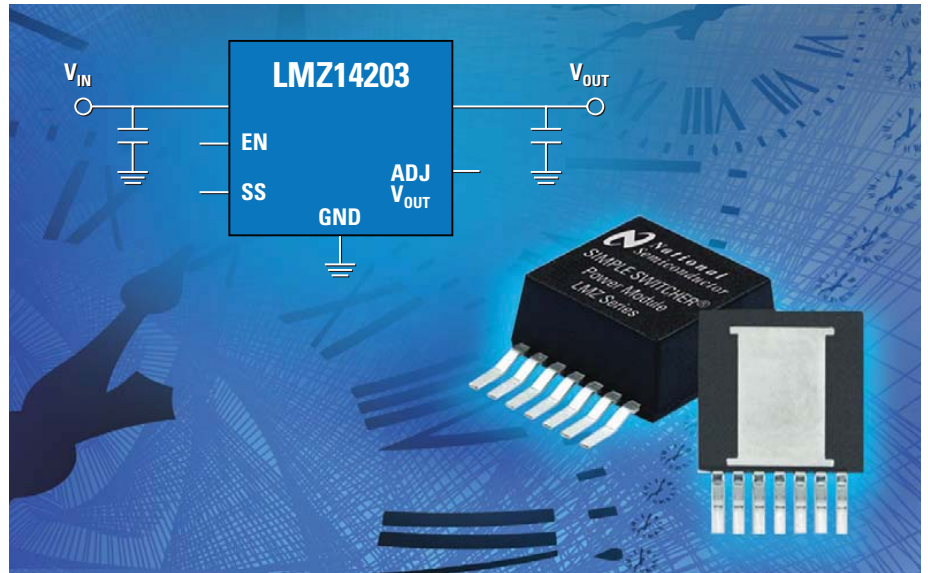


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