The Benefits of FlexPower PMIC Devices

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TEXAS INSTRUMENTS

Introduction

As advanced driver assistance system (ADAS) applications are increasing in capabilities every year, the demand for system adaptability is greatly increasing. Front camera, radar, and domain controller applications within ADAS require high performance power solutions to enable driver assist capability. In order to enable these dynamic features, application processors are used to control and monitor these systems. Next generation processors require designers to select optimized PMICs to meet the power requirements of the processor and sequencing. Often times, processor power requirements change throughout the design cycle. TI's portfolio of FlexPower PMIC solutions provides an adaptable solution with multiphase technology. Multiphase PMICs allow power designers to easily adapt to changing power and sequencing needs by providing pin-for-pin multiphase configuration options and I2C programmability, providing ultimate power flexibility and scalability.

What is FlexPower?

FlexPower PMICs are flexible because of their ability to combine buck converter outputs and scalable because multiple FlexPower PMICs can be used to increase power rail coverage. Each multi-phase FlexPower PMIC contains a pre-configured phase configuration with varying number of output rails to correspond with given voltage and current specifications. The phases of the LP8756x-Q1 can be combined to generate five different output combinations as shown in Figure 1.

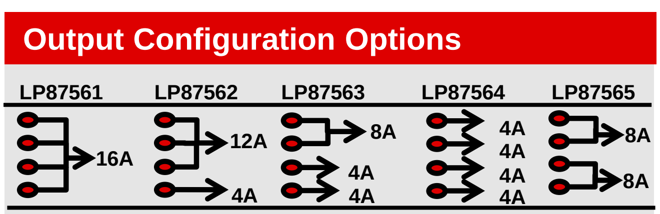

Figure 1. Output Configuration Options

With the I2C configurable versions of the FlexPower devices, output settings can be configured at start-up via I2C. These devices, such as the LP873x-Q1 and LP8756x-Q1 families, are programed with output rails initially disabled and are software configurable through I2C interface. As a result, customers can select a phase configuration that best matches customer requirements, then program the output voltages, current limits, and power-up and power-down sequence via I2C communication at the device power using a local MCU. In addition to the I2C configurable option, TI has released versions that are pre-programmed to power application-specific processors, such as, but not limited to, Jacinto™ 6 processors and AWR radar devices. In scenarios where custom application-specific settings need to be programmed into one-time programmable (OTP) default memory, contact your TI representative for more information on this programmability option. Due to the fact that FlexPower PMICs are smaller (2–4 rail) PMICs, they can be interfaced and combined with other FlexPower PMICs to expand the power rail count to the user's needed specifications, creating a distributed power solution. By being low rail count PMICs, FlexPower PMICs easily provide optimized solutions due to having no un-utilized regulators.

Multiphase and Distributed Power Advantages

Due to the multi-phase capability of the DC/DC regulators and the smaller rail count of each device, FlexPower PMICs enable designers to adapt to their changing requirements by combining or separating various FlexPower PMICs depending on the application requirements. This reduces the potential of having un-utilized regulators, ensuring a cost-optimized solution, no matter what the power requirements are. Multiple FlexPower PMICs can be combined to meet the exact needs of a SoC power requirement, without the need for the user to implement an external sequencer or external fault monitor.

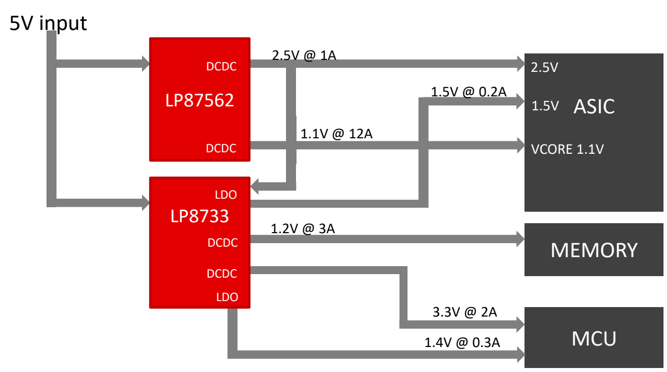

Figure 2. Distributed Power Example

By providing a distributed power solution, FlexPower PMICs help distribute thermals on the board. Traditional PMICs are highly integrated and, therefore, dissipate the heat of six or more regulators in the same package. In this case, the concentrated thermal dissipation may conflict with neighboring components, potentially hindering the overall system performance or capability. FlexPower PMICs resolve this issue by being a scalable multi-chip solution consisting of low-rail count ICs, which better distributes the thermal dissipation across the board as shown in Figure 2. Moreover, the smaller footprint of each individual flexpower PMIC enables more layout flexibility, allowing designers to collocate the PMIC next to the point of load.

During the design process, the user has to initially select a device that meets specific power requirements of the processor of the system or FPGA; however, those power requirements may change multiple times before the design is finalized. For example, assume the user's preliminary power estimate is to have four rails with the following specifications: 1.1 V/3 A, 3.3 V/2 A, 1.8 V/300 mA, and 3.3 V/250 mA. After testing and realizing that these rails are insufficient to power the required processor, the user realizes the needed changes to the four rails are: **1.1 V**/3 A, 3.3 V/**1 A**, **1.7 V/200 mA**, and 3.3 V/**250 mA**. These changes can easily be made with a simple change in the MCU code to output these required power rails as shown in Figure 3.

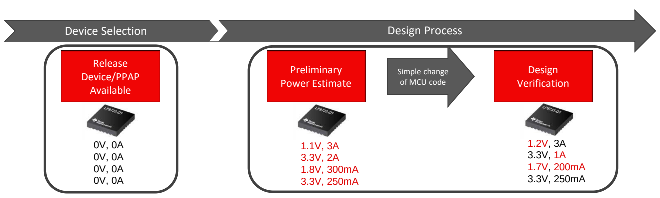

Figure 3. I2C Configuration Design Process

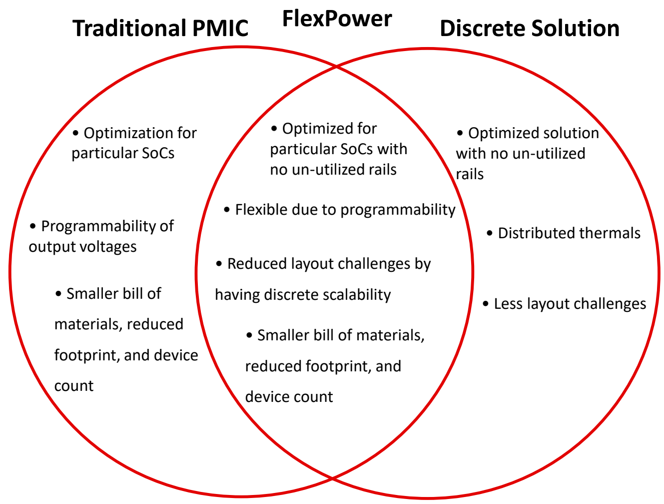

Figure 4. Summary of FlexPower Benefits

By providing the scalability of discrete components, and sequencing and monitoring features of a traditional PMIC, FlexPower solutions provide the best of both architectures as shown in Figure 4. Additionally, with software-configurable options, FlexPower PMICs allow reduced design cycle time and easy customization of the PMIC, ensuring that the PMIC is optimized for the specific power needs of the project.

Table 1. Device Recommendations

Device	V_{in} Range	Number of Power Rails	Max Current Per Channel	V_{out} Range	Features	Package
LP8732x-Q1	2.8 V–5.5 V	2 DC/DC Multiphase Buck Regulators, 2 LDOs	2 A	0.7 V–3.36 V (Buck) 0.8 V–3.3V (LDO)	PGOOD, I^2C	5x5-mm QFN
LP8733x-Q1	2.8 V–5.5 V	2 DC/DC Multiphase Buck Regulators, 2 LDOs	3 A	0.7 V–3.36 V (Buck) 0.8 V–3.3 V (LDO)	PGOOD, I^2C	5x5-mm QFN
LP8752x-Q1	2.8 V–5.5 V	4 DC/DC Multiphase Buck Regulators	4 A, 10 A total	0.6 V–3.36 V (Buck)	PGOOD, I^2C	4x4.5-mm QFN, HotRod
LP8756x-Q1	2.8 V–5.5 V	4 DC/DC Multiphase Buck Regulators	4 A, 16 A total	0.6 V–3.36 V (Buck)	PGOOD, I^2C	4x4.5-mm QFN, HotRod
LP875701-Q1	2.8 V–5.5 V	1 4-phase Buck Regulator	10 A	1.0 V (Buck)	PGOOD, I^2C, Improved DC and AC accuracy	4x4.5-mm QFN, HotRod
LP8770x-Q1	2.8 V–5.5 V	2 DC/DC Multiphase Buck Regulators, 1 5V Boost Regulator	3.5 A	0.7 V–3.36 V (Buck)	PGOOD, I^2C, Independent V_{ref}, Watchdog, and External voltage monitoring	5x5-mm QFN