Application Report
SLVAE15A–April 2020–Revised April 2020

Powering Processors and FPGAs With a Single Family of PMICs – TPS6521815, TPS6521825, and TPS65218D0

ABSTRACT

This application report shows how the TPS6521815 user-programmable power management IC (PMIC) gives design engineers the freedom to customize fully-integrated power solutions for any catalog processor or field-programmable gate array (FPGA). The TPS6521815 device is a multi-rail PMIC, providing users the ability to program non-volatile EEPROM memory to generate desired voltages, sequencing, and other special features to simplify design and reduce time-to-market. The same device can be programmed multiple times to power a wide variety of processors or FPGAs in different systems without PCB changes, therefore optimizing the number of components on the board.

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Trademarks

1 Introduction

Processors and field-programmable gate arrays (FPGAs) are the heart of any electronic system and they are the first component to be chosen in a design. What comes next is the decision on how to power these processors and FPGAs.

Designing the power architecture for different processors and FPGAs especially with a discrete architecture can lead to challenges like too many components in the bill of material, board space limitations, complex sequencing requirements, and more.

What if engineers had a user-programmable power management IC (PMIC) that could power a variety of processors or FPGAs for different platforms while at the same time simplify the design and take care of processor - PMIC handshake.

This document discusses the user-programmable PMIC, the TPS6521815 device, and how its pre-programmed variants – the TPS65218D0 and TPS6521825 devices are used to power specific processors.

2 TPS6521815 to Power a Variety of SoCs and FPGAs

The TPS6521815 device comes with a blank non-volatile EEPROM memory that can be programmed through the I2C interface to meet the power up default values; that is, output voltages, current, and sequencing requirement of any generic Arm® Cortex® processor or FPGA.

The TPS6521815 device consists of three adjustable step-down (buck) converters and the default output voltages for each converter can be adjusted through the I2C interface to power the processor core, MPU, and DDRx memory. The PMIC supports programmable power sequencing for all regulators, and an I2C interface for register reading and writing to the device.

The EEPROM of the device can be programmed up to 1000 times, which means you can re-use the same device and configure it multiple times to generate different power up values as long as the number of programming cycles does not exceed this amount.

Figure 1 shows an example of the TPS6521815 device powering the NXP i.MX 7Dual processor (the connection between the PMIC and processor). A complete reference design (hardware and software with documentation) is available to show that a TI user programmable PMIC can be configured to power a non-TI processor. Click on the TIDA-050034 (Integrated power supply reference design) to check out the full system-on-board (SOM) solution for NXP i.MX 7D and i.MX 7S systems.

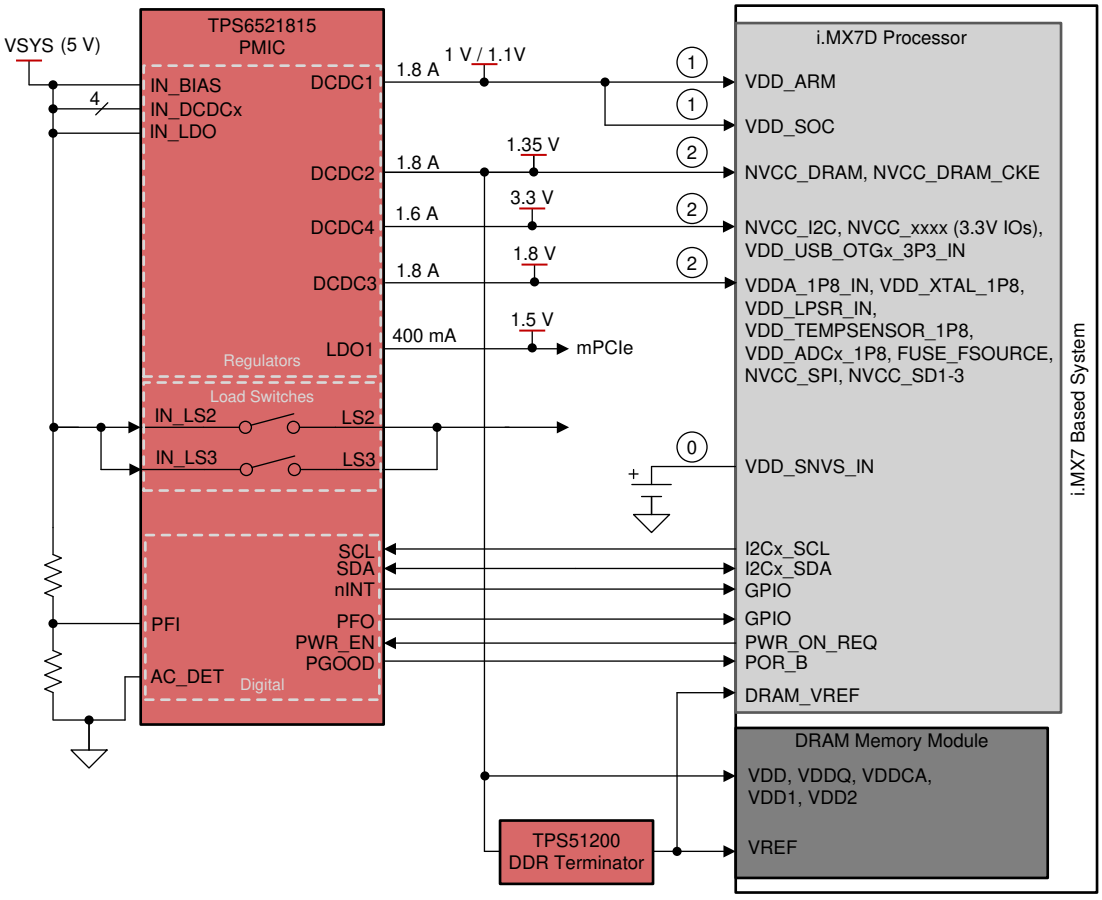

Figure 1. TPS6521815 Power Solution Block Diagram for i.MX7D Processor

3 TPS65218D0 to Power TI's AM335x and AM43xx Processors

The default EEPROM settings of the TPS65218D0 device are configured to meet the power-up requirements of TI's AM335x and AM43xx processors. In other words, output voltages and sequencing order are determined by an EEPROM-backed register map, which are pre-programmed or factory programmed to meet the power-up sequencing requirements of TI's AM335x and AM43xx processors.

Figure 2 shows the connections between the TPS65218D0 and the AM335x, AM43xx. Power rails and digital and analog signals are shown. The power rails may be used to power additional parts of the system.

Of all the AM335x and AM43xx PMIC options, the TPS65218D0 device supports the lowest power consumption mode for AM335x processors, making it the most power-efficient and suitable for both portable (Li-Ion battery) and non-portable (5-V adapter) applications.

The TPS65218D0 PMIC is an excellent solution for industrial applications using AM335x or AM43xx processors. This device provides five buck converters, one LDO, three load switches, and a buck-boost converter. There are advantages and unique characteristics of the PMIC, including the buck-boost converter, battery back-up property, tampering protection, voltage supervision, and more.

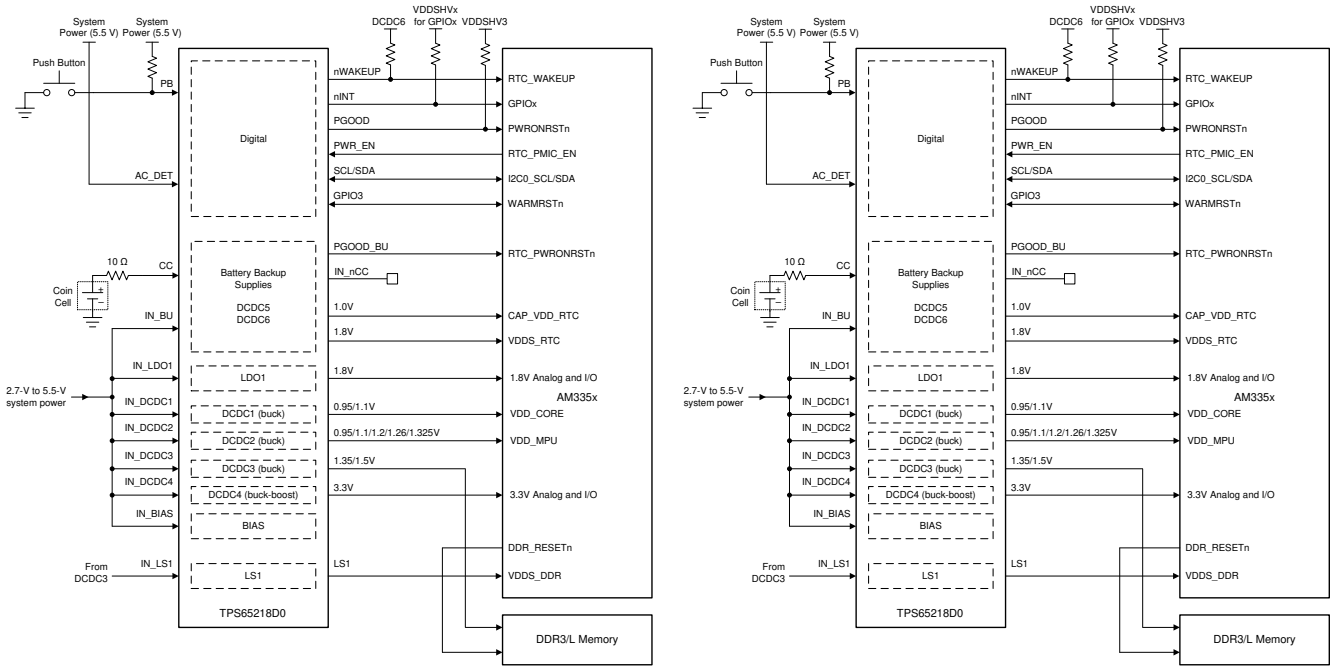

Figure 2. Connection Diagram for TPS65218D0 and AM335x, AM43xx Processors

4 TPS6521825 and LP873347 to Power NXP i.MX 8M Mini and Nano Processor

The TPS6521825 device is the same device as the TPS65218D0 device except that the TPS6521825 output voltages and sequencing order are pre-programmed to work with the LP873347 PMIC to power the i.MX 8M Mini and Nano processor.

The internal EEPROM of the TPS6521825 is pre-programmed with automatic sequencing for the NXP i.MX 8M Mini and Nano processor. The TPS6521825 device also consists of three adjustable step-down (buck) converters, one buck-boost converter, one adjustable LDO and three load switches with two selectable current limits.

The PMIC supports undervoltage lockout (UVLO), overtemperature warning and shutdown, separate power-good output, programmable power sequencing for all regulators, and an I2C interface for register reading and writing to the device.

Figure 3 shows the TPS6521825 PMIC in conjunction with the LP873347 PMIC powering the NXP i.MX8M mini processor.

TI integrated power supply reference design for the NXP i.MX 8M Mini processor, TIDA-050038, shows that PMICs – specifically the TPS6521825 and LP873347 devices- can power the NXP i.MX 8M Mini dual-core applications processor, MIMX8MM6DVTLZAA.

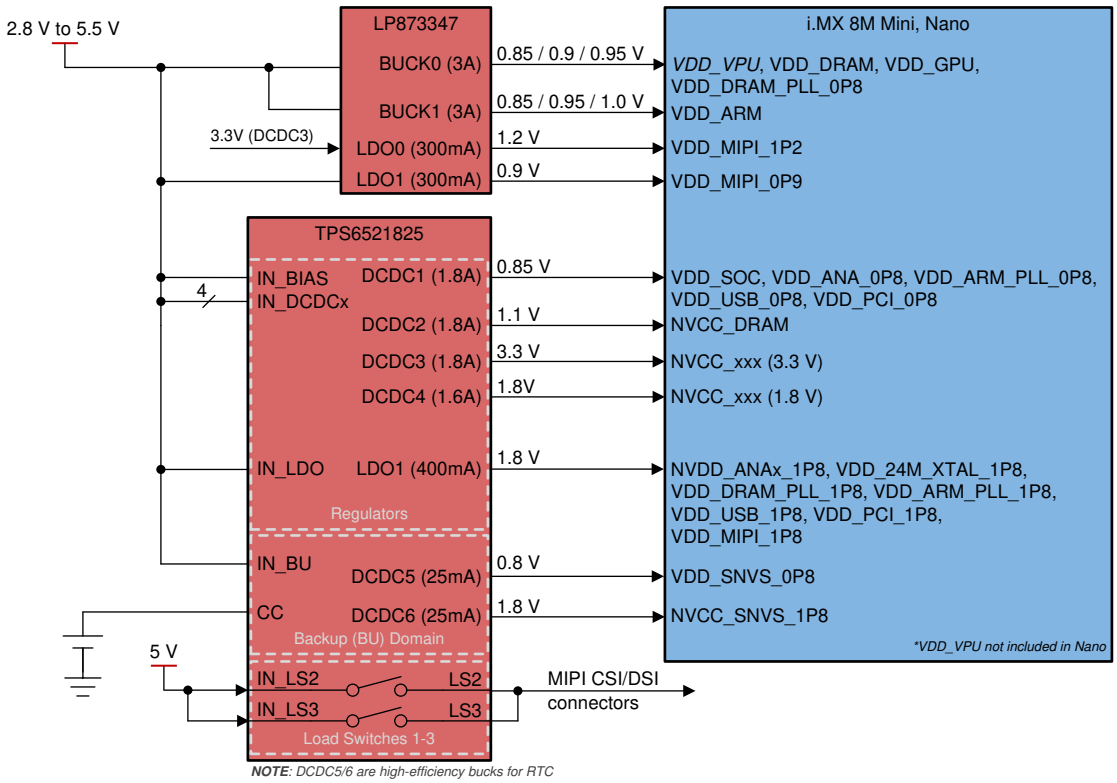

Figure 3. TPS6521825 Power Solution Block Diagram for i.MX 8M Mini-Processor

5 Summary

Although the TPS6521815, TPS65218D0, and TPS6521825 devices have the same pinout and share the same set of features, the TPS6521815 is a true user-programmable PMIC that gives you an option to program the internal non-volatile memory and make changes to output voltages, sequencing, voltage monitoring thresholds, GPIO control and more. The TPS6521815 device can be used to power a variety of SoCs and FPGAs whereas the TPS65218D0 and TPS6521825 devices are already pre-programmed to power a specific processor.

6 References

Processor	Title
i.MX 6ULL and 6UltraLite	*Powering the NXP i.MX 6ULL, 6UltraLite with the TPS6521815 PMIC Tech Note*
i.MX 7 Solo and Dual	*Powering the NXP i.MX 7 processor with the TPS6521815 PMIC Tech Note*
i.MX 8M Mini and Nano	*Powering the NXP i.MX 8M Mini and Nano with the TPS6521825 and LP873347 PMICs Tech Note*

- Texas Instruments, *TPS6521815 User-Programmable Power Management IC (PMIC) With 6 DC/DC Converters, 1 LDO, and 3 Load Switches Data Sheet*

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (April 2020) to A Revision	Page
• Added link to *TIDA-050034* on ti.com	2
• Added link to *TIDA-050038* on ti.com	4

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