ATMEL SAMA5D3 Power Solution Using the ACT88329 PMIC

Abstract

This application note shows Qorvo's ACT88329 integrated PMIC power solution for the Atmel SAMA5D3 processor. It also shows how to convert an existing ACT8865 based design to an ACT88329 based design.

Introduction

The ACT88329 PMIC is an integrated ActiveCiPS™ power management integrated circuit. It powers a wide range of processors, including solidstate disk drives, video processors, FPGA's, wearables, peripherals, and microcontrollers. It is highly flexible and can be reconfigured via I^{2}C for multiple applications without the need for PCB changes. The low external component count and high configurability significantly speeds time to market. The core of the device includes three DC/DC step down converters using integrated power FETs and two low-dropout regulators (LDOs). Buck1 and LDO1 can be configured as a load switch.

Qorvo has optimized the ACT88329VU108 to support the Atmel SAMA5D3 sequencing and voltage requirements. The ACT88329 solution provides a smaller, more optimized solution than Qorvo's existing ACT8865 Atmel power solution. The ACT88329 is designed in a newer, more advanced silicon process, and provides better performance in a smaller package than the ACT8865. The ACT88329 offers more configurability, higher output current, and new features such as the proprietary ACOT (asynchronous constant on-time) control architecture to optimize the load transient response with smaller output capacitors. The ACT88329 has a smaller output inductor, capacitor, and package, which provides for more compact designs.

Table 1. ACT88329 and ACT8865 Key Differences

	ACT88329	ACT8865
Input voltage range	Vin = 2.7V to 5.5V	Vin = 2.5V to 5.5V
Power rails	5 (3 Bucks + 2LDOs)	7 (3 Bucks + 4LDOs)
Buck1	4A	1.15A
Buck2	4A	1.15A
Buck3	2A	1.3A
LDO1	390mA	320mA
LDO2	390mA	320mA
LDO4/5(ACT8865)	-	320mA
Operating Temperature	-40 to 150°C	-40 to 125°C
Package	2.2×2.6mm WLCSP-30	4×4mm TQFN44-32

Replacing the ACT8865 with the ACT88329

Replacing the existing ACT8865 solution with the upgraded ACT88329 requires a few simple steps. The device packages and pinouts are quite different, so this change requires a new PCB layout; however, the outputs and features are similar. The user just needs to match the ACT88329 outputs to the SAMA5D3 power inputs per Figure 1.
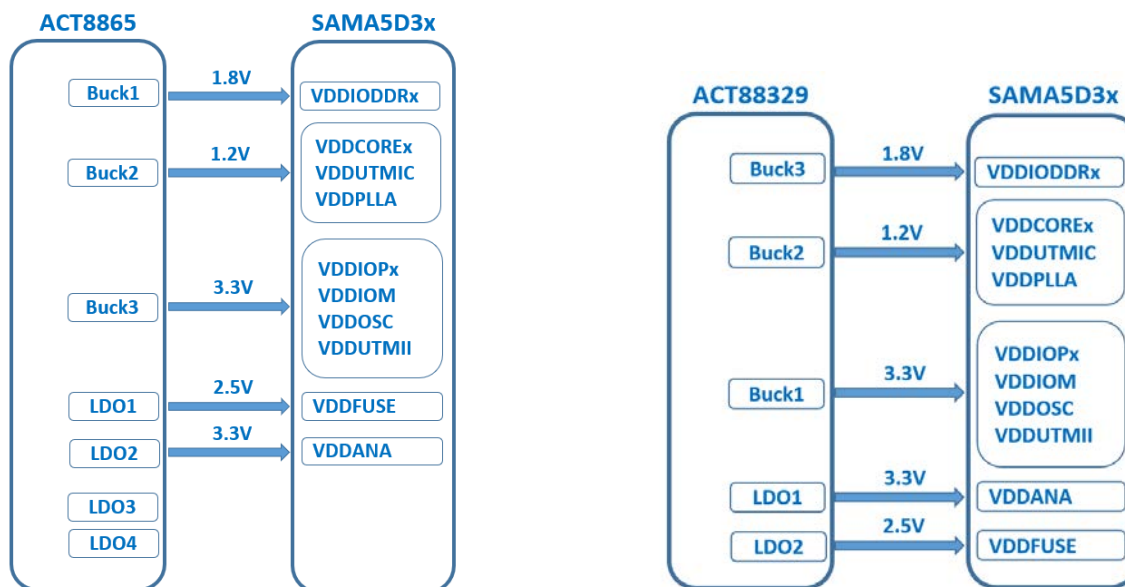

Figure 1. ACT8865 and ACT88329 Power Connections to the Atmel SAMA5D3

Output Voltages and Sequencing

ACT88329VU108 is specifically optimized to power the Atmel SAMA5D3. The output voltages and sequencing are directly compatible with the SAMA5D3 processor. The solution is configured for a 3.7V to 5V input voltage.

The following table shows the ACT88329 output voltages, current limit, and switching frequencies. Note that there are two output volage configurations. This allows the user to select a 1.35V or a 1.2V voltage for the SAMA5D3 VDDCOREx. The two different voltages are chosen with one of the ACT88329 GPIOs.

Table 2. ACT88329VU108 Voltage and Currents

Rail	Output Voltage Configuration 1 (V)	Output Voltage Configuration 2 (V)	Current Limit (A)	Fsw (kHz)
Buck1	3.3	3.3	3.8	2250
Buck2	1.35	1.2	3.8	2000
Buck3	1.8	1.8	2.0	2000
LDO1	3.3	n/a	0.4	n/a
LDO2	2.5	n/a	0.4	n/a

Figure 2 shows the startup and sequencing, which is meets Atmel's SAMA5D3 sequencing requirements.
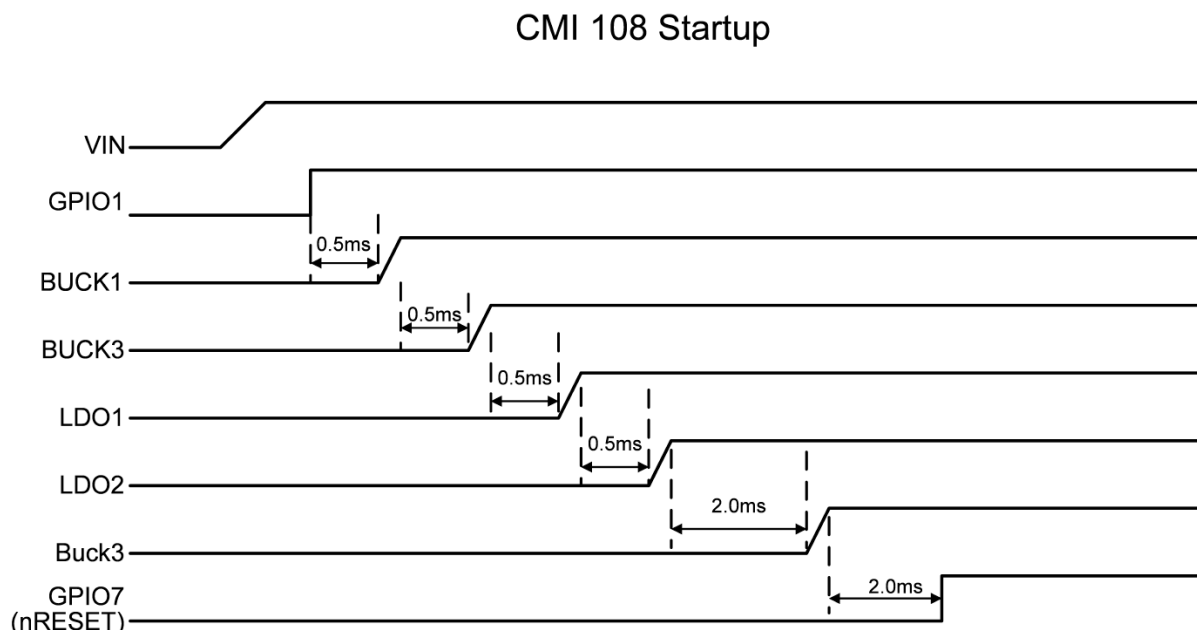

Figure 2. ACT88329VU108 Startup

GPIO Functionality

The ACT88329 contains 7 GPIOs. These can each be programmed to several different functions. Refer to the ACT88329 datasheet for more details about the available functionality. The ACT88329VU108 GPIOs, which are designed to support the ATMEL SAMA5D3 support the following functions.

GPIO1 (pin E2) – EXT_PG.

GPIO1 is configured as an EXT_PG input. When GPIO1 goes high, Buck1 turns on with a 500us delay, then all other outputs turn on with programmed sequencing. When GPIO1 goes low, the outputs turn off with their programmed 0ms delay times.

GPIO2 (pin D2) – Buck2 DVS

GPIO2 is configured as an input to select the Buck2 output voltage. When GPIO2 is H, VSET0 sets Buck2 to 1.35V. When GPIO2 is L, VSET1 sets Buck2 to 1.2V. This GPIO can be changed on the fly. Note that after startup, the user can manually program the Buck2 output voltage to change between two other different volage levels.

GPIO3 (pin C2) – nIRQ

GPIO3 is a standard open drain nIRQ signal.

GPIO4 (pin C5) – PWREN

GPIO4 is configured as the PWREN input. This GPIO is not typically needed with SAMA5D3 applications. If not used, tie high. The first time GPIO4 is pulled high it enables the IC to enter DPSLP mode. After this, when GPIO4 is pulled low, the IC enters DPSLP mode. When GPIO4 is pulled H again, the IC goes back to Active Mode.

GPIO5 (pin D3) – not used

GPIO5 is not used. It is configured as an open drain output and is high impedance. Leave floating or tie to ground.

GPIO6 (pin D4) – Buck3 Voltage Select

GPIO6 is programmed as the voltage select input for Buck3. This GPIO is not typically needed with SAMA5D3 applications. Note that GPIO6 cannot be changed while the outputs are enabled. Note that both VSET0 and VSET1 are programmed to 1.8V. In order for GPIO6 to be ablet to change the Buck3 output voltage, either VSET0 or VSET1 must be reprogrammed after power is applied to the IC and while Buck3 is disabled.

When GPIO6 = H, Buck3 is set to its VSET0 voltage, 1.8V.

When GPIO6 = L, Buck3 is set to its VSET1 voltage, 1.8V.

GPIO7 (pin D1) – RESET

GPIO7 is configured as an open drain, digital output. nRESET gated by the logical AND of all voltage rails with a 2.5ms delay.

I2C Address

The CMI 108 7-bit I2C address is 0x25h. This results in 0x4Ah for a write address and 0x4Bh for a read address.

ACT88329VU108 Reference Schematic

The following schematic shows the general ACT88329 schematic. Note that all functions are integrated, and that the user only needs to add the power supply's external capacitors and inductors.
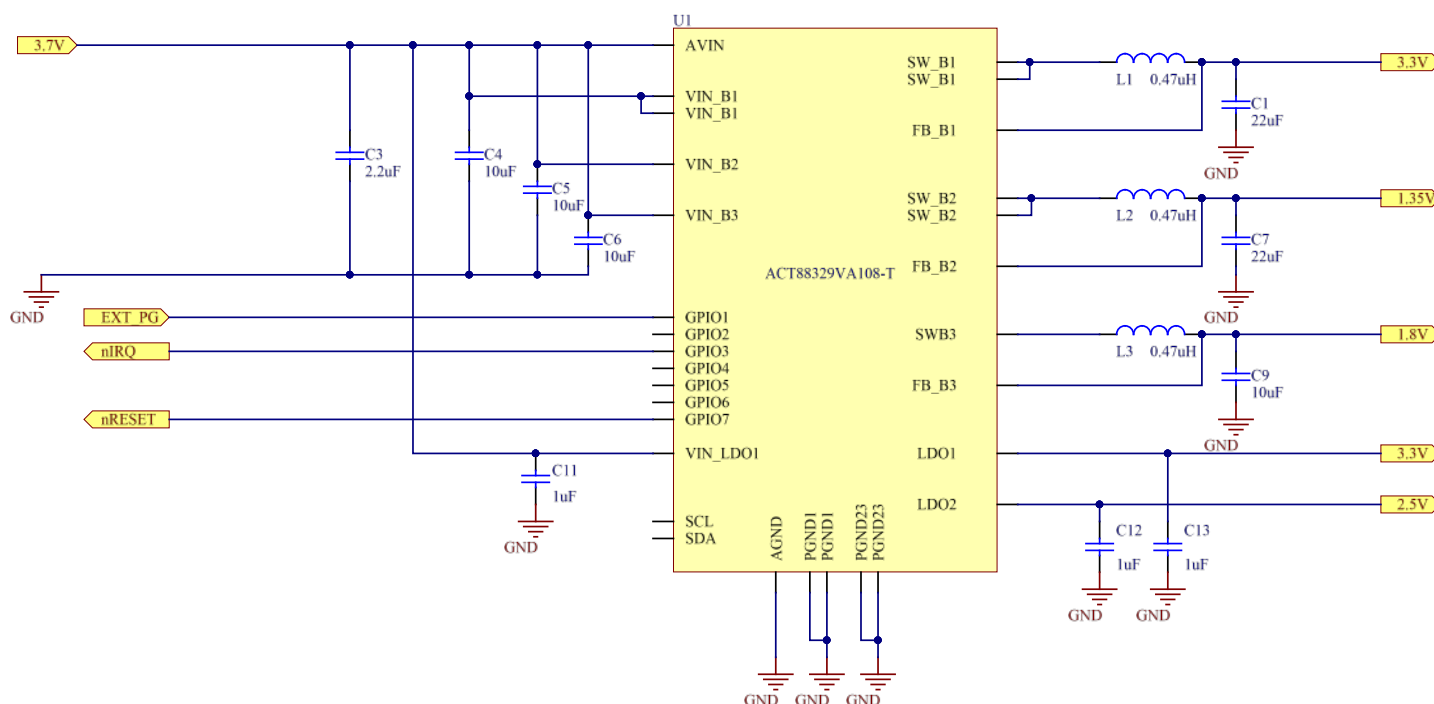

Figure 2. ACT88329 Reference Schematic

Referenced Documents

The reference documents below take precedence over the contents of this application note and should always be consulted for the latest information.

ACT88329 Data Sheet

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

   Web: www.qorvo.com

   Tel: 1-844-890-8163

   Email: customer.support@qorvo.com

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