

# ATMEL SAMA5D2 Power Solution Using the ACT88321 PMIC

## Abstract

This application note shows Qorvo's ACT88321 integrated PMIC power solution for the Atmel SAMA5D2 processor. It also shows how to convert an existing ACT8865 based design to an ACT88321 based design.

## Introduction

The ACT88321 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<sup>2</sup>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 ACT88321VU112 to support the Atmel SAMA5D2 sequencing and voltage requirements. The ACT88321 solution provides a smaller, more optimized solution than Qorvo's existing ACT8865 Atmel power solution. The ACT88321 is designed in a newer, more advanced silicon process, and provides better performance in a smaller package than the ACT8865. The ACT88321 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 ACT88321 has a smaller output inductor, capacitor, and package, which provides for more compact designs.

**Table 1. ACT88321 and ACT8865 Key Differences**

	ACT88321	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	2.2x2.6mm WLCSP-30	4x4mm TQFN44-32

## Replacing the ACT8865 with the ACT88321

Replacing the existing ACT8865 solution with the upgraded ACT88321 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 ACT88321 outputs to the SAMA5D2 power inputs per Figure 1.

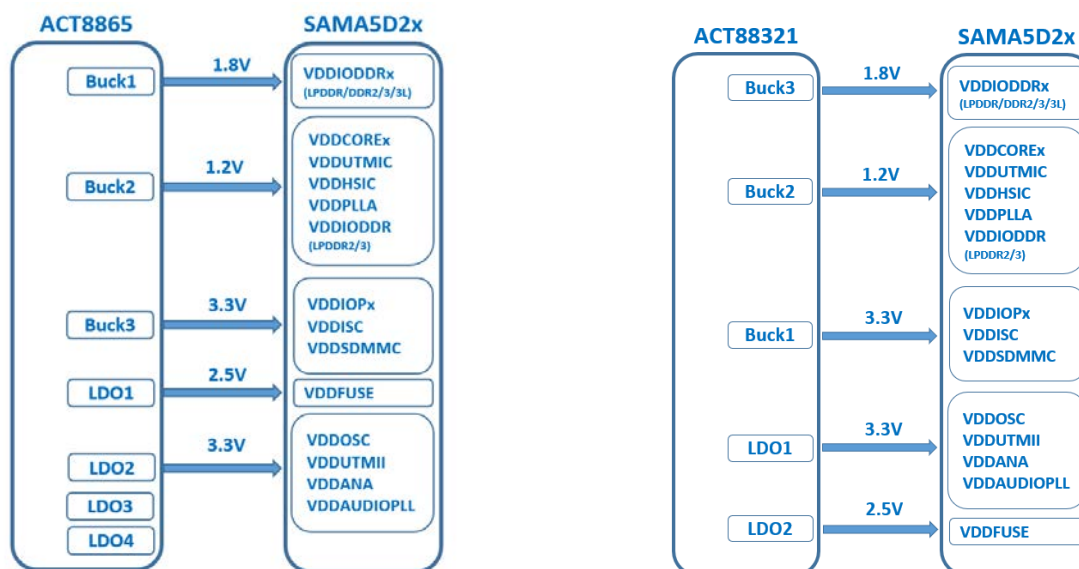


Figure 1. ACT8865 and ACT88321 Power Connections to the Atmel SAMA5D2

## Output Voltages and Sequencing

ACT88321VU112 is specifically optimized to power the Atmel SAMA5D2. The output voltages and sequencing are directly compatible with the SAMA5D2 processor. The solution is configured for a 5V input voltage.

The following table shows the ACT88321 output voltages, current limit, and switching frequencies. Note that there are two output voltage configurations. This allows the user to select a 1.8V or a 1.5V voltage for the SAMA5D2 VDDIODDR. The two different voltages are chosen with one of the ACT88321 GPIOs.

Table 2. ACT88321VU112 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	1.2	1.2	3.8	2000
Buck3	1.8	1.5	2.0	2000
LDO1	3.3	n/a	0.4	n/a
LDO2	2.5	n/a	0.4	n/a

Note that Qorvo also supports an Atmel SAMA5D3 solution with the ACT88329VU108. The ACT88329 solution supports a variable VDDCOREx voltage, while the ACT88321 solution supports a variable VDDIODDR voltage. Both solutions can support different voltage options for these or any other rails.

Figure 2 shows the startup and sequencing, which meets Atmel's SAMA5D2 sequencing requirements.

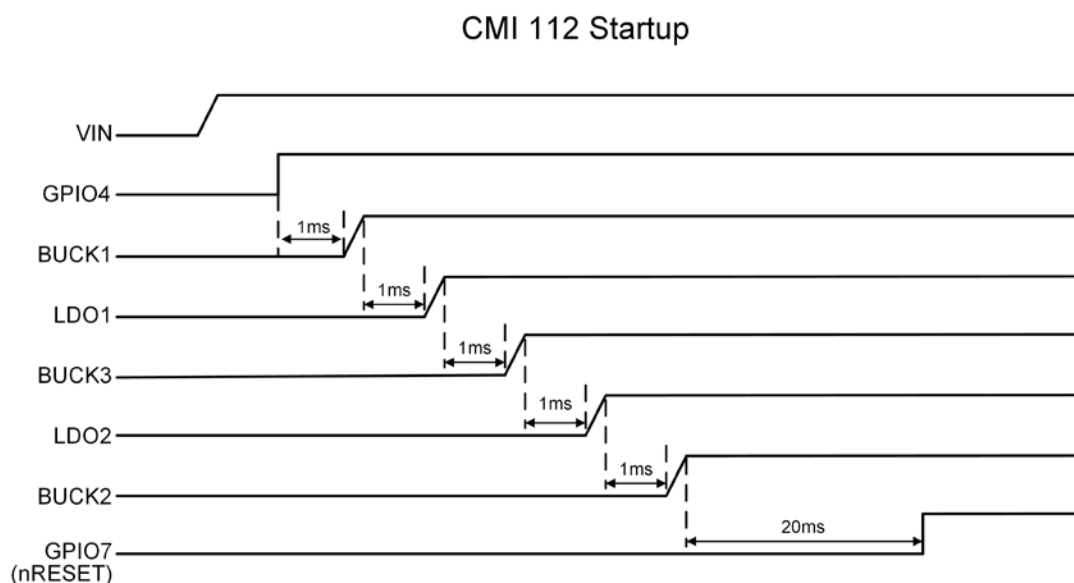


Figure 2. ACT88321VU112 Startup

## GPIO Functionality

The ACT88321 contains 4 GPIOs. These can each be programmed to several different functions. Refer to the ACT88321 datasheet for more details about the available functionality. The ACT88321VU112 GPIOs, which are designed to support the ATMEL SAMA5D2 support the following functions.

### GPIO2 (pin D2) – Buck3 Voltage Select

GPIO2 is configured as an input to select the Buck3 output voltage. When GPIO2 is H, VSET1 sets Buck3 to 1.5V. When GPIO2 is L, VSET0 sets Buck3 to 1.8V.

### GPIO4 (pin C5) – EXT\_PG

GPIO4 is configured as an EXT\_PG input. When GPIO4 goes high, Buck1 turns on with a 1ms delay, then all other outputs turn on with programmed sequencing. When GPIO4 goes low, the outputs turn off with their programmed 1ms delay times. LDO2 (VDDFUSE) has a 0ms turnoff delay.

### GPIO5 (pin D3) – nIRQ

GPIO5 is a standard open drain nIRQ signal.

### GPIO7 (pin D1) – RESET

GPIO7 is configured as an open drain, digital output. nRESET gated by Buck2 with a 20ms delay.

### I2C Address

The CMI 112 7-bit I2C address is 0x25h. This results in 0x4Ah for a write address and 0x4Bh for a read address.

## ACT88321VU112 Reference Schematic

The following schematic shows the general ACT88321 schematic. Note that all functions are integrated, and that the user only needs to add the power supply's external capacitors and inductors.

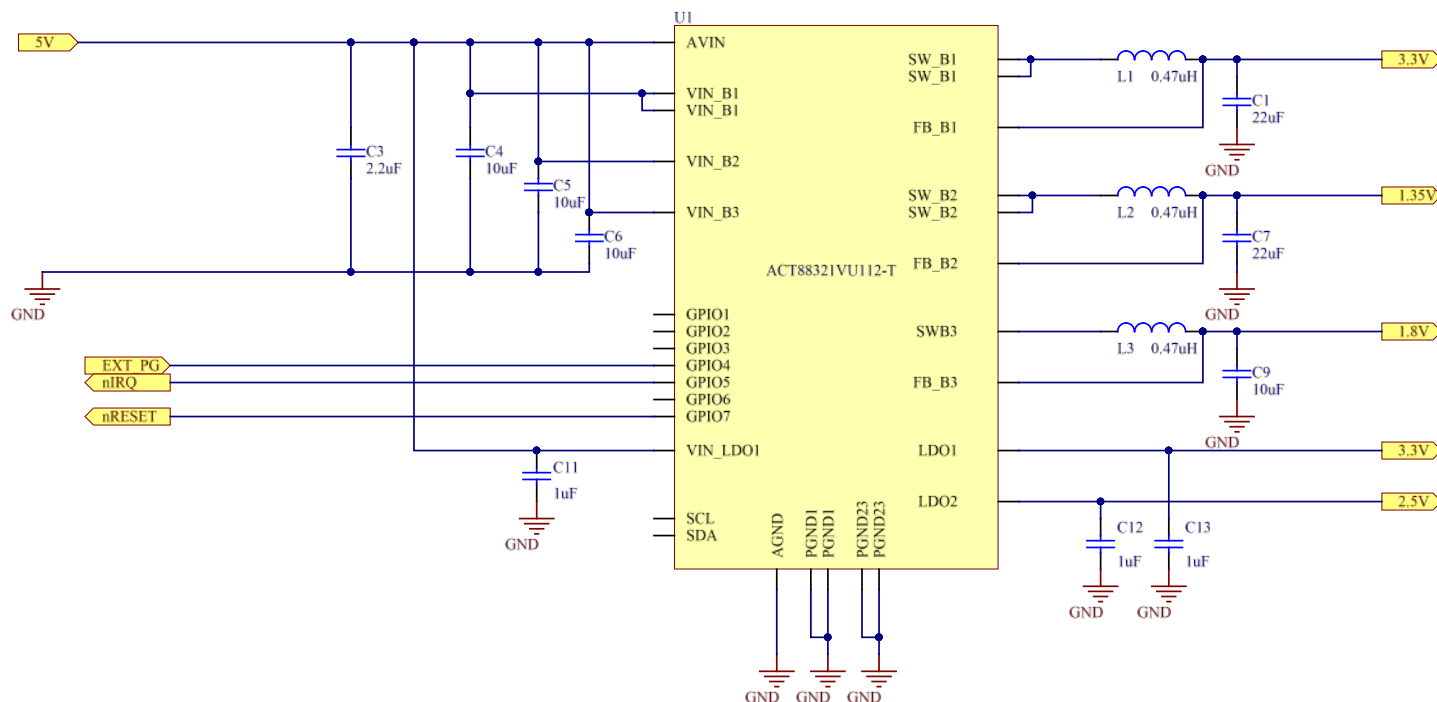


Figure 3. ACT88321 Reference Schematic

## Referenced Documents

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

ACT88321 Data Sheet

## Contact Information

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

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