TPS75005 Quick-Start Guide with C2000™ Controllers

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1 OVERVIEW

The TPS75005 is a complete power management solution for C2000 controllers from Texas Instruments. This document illustrates how to attach the TPS75005 to a C2000 controller.

2 PREPARATION

You can obtain the TPS75005EVM-023 from www.ti.com or through your local TI representative. It is assumed that you already have a C2000 controller evaluation kit or your own application circuit design that has a C2000 controller on it.

To evaluate the TPS75005 with your C2000 board, you must disconnect the existing (old) power solution from the C2000. Prepare the schematic of your C2000 board and locate these three electric nodes:

1. A logic signal connected to the $\overline{XRS}$ terminal of the C2000 controller.
2. A 1.8-V or 1.9-V power rail connected to the V_{DD} terminals of the C2000 controller.
3. A 3.3-V power rail connected to the V_{DDIO} terminals of the C2000 controller.

Figure 1 illustrates the removal of the existing C2000 power solution.

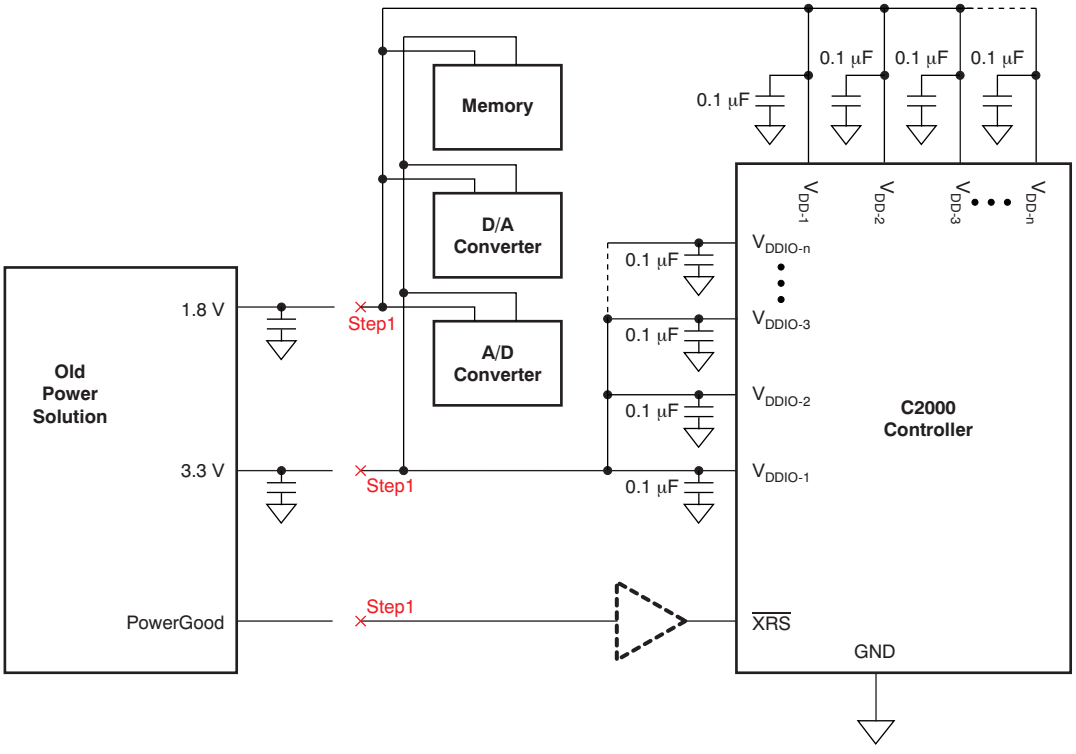

Figure 1. Removing the Old C2000 Power Solution

After finding the node in list item 1, disconnect it. In some cases, the $\overline{XRS}$ pin is driven by preceding logic buffers (such as the dashed-line buffer in Figure 1) and you may disconnect the old power solution at the input of such buffers.

After locating the nodes in list items 2 and 3, disconnect them as well. Usually, it is a good idea to locate the output capacitors for the 1.8-V and 3.3-V rails, then cut the PCB traces at the footprints of these output capacitors. As described in Figure 1, peripheral components that share the same power with V_{DD} and V_{DDIO} can be left as is. ***However, note that the total consumption current should not exceed 500 mA for both the V_{DD} and V_{DDIO} rails.*** (500 mA is the TPS75005 maximum-rated output current for both LDO1 and LDO2.)

Now the TPS75005 is ready to be plugged into the C2000 board.

3 PLUGGING IN THE TPS75005 TO THE C2000 BOARD (OUT1, OUT2, and PG)

Plug in the TPS75005 at the same location where the old power solution was removed, as described in the *Preparation* section.

Figure 2 shows where the TPS75005 is plugged in. Two 10-µF ceramic capacitors at OUT1 (for V_{DD}) and OUT2 (for V_{DDIO}) are needed. However, when using the TPS75005EVM-023, these capacitors are already in place on the EVM. Next, connect the voltage sensing terminals (OUT1_S to OUT1 and OUT2_S to OUT2) as close as possible to the output capacitors.

Then, connect the PG terminal to $\overline{XRS}$. Note that a 100-kΩ resistor is needed between OUT2 and PG so that there is a proper logic level to $\overline{XRS}$.

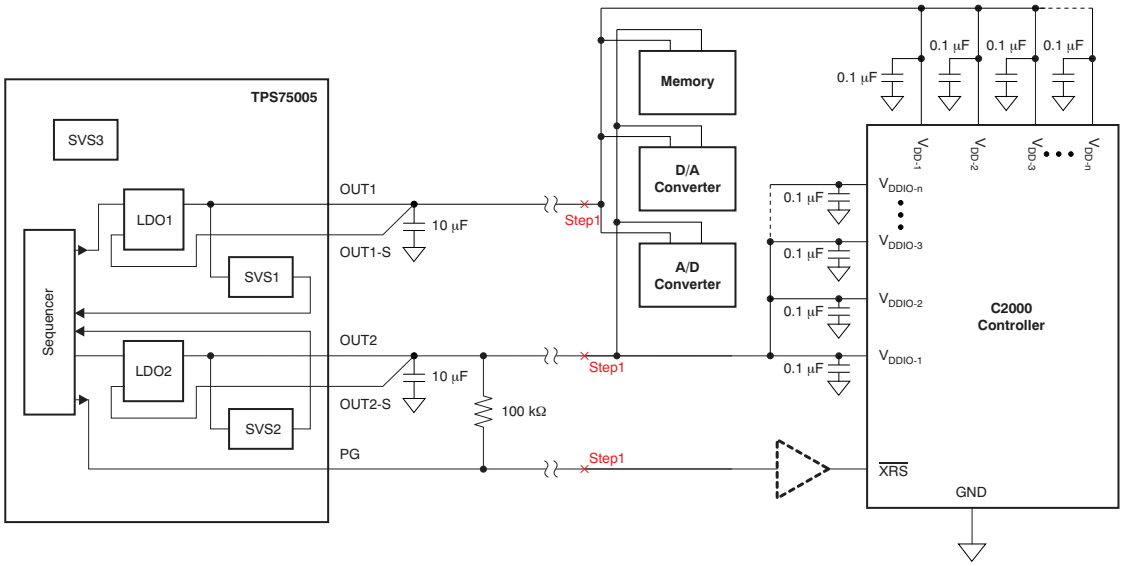

Figure 2. Plugging In the TPS75005 to the C2000 Controller

4 POWER PINS (VIN and GND)

This step is an easy step. Connect a 5-V power source to the VIN and GND pins of the TPS75005. Figure 3 illustrates this step.

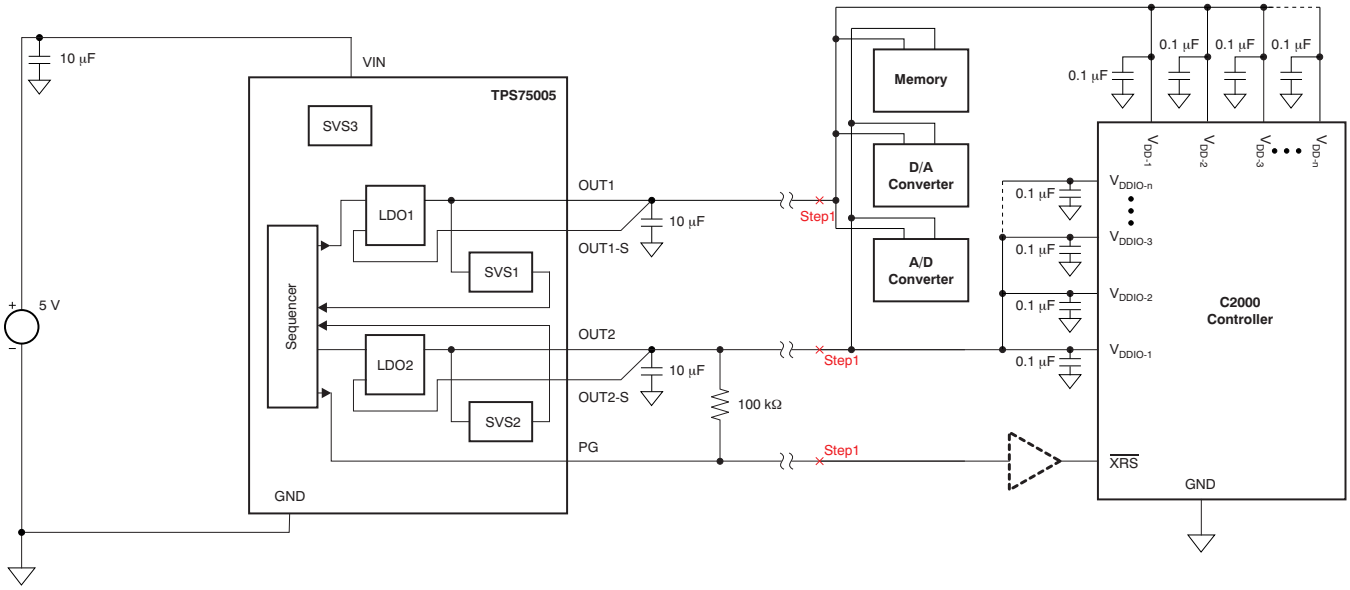

Figure 3. Connecting Power to the TPS75005

5 SETTING THE REMAINING PINS

In these steps, all of the remaining TPS75005 pins are properly connected.

5.1 Enable Pin (EN)

EN is the only input pin that should be actively controlled. Make a choice from the following scenarios:

1. Another microcontroller drives the TPS75005 EN terminal.
2. There is no control logic block that can drive EN.
3. There is no control logic block that can drive EN, but the system must be initiated at a certain VIN voltage.

In the first scenario, connect the EN terminal to the other microcontroller.

When choosing between scenarios 2 or 3 (and if there is no specific concern) it is recommended to choose scenario 3.

In scenario 2, connect the EN terminal to VIN. See the *Not Using the Third Voltage Monitor* section for more details.

In scenario 3, connect the EN terminal to the TPS75005 voltage monitor output, VDET. See the *Using the Third Voltage Monitor* section for more details.

Note that the rest of this quick-start guide assumes scenario 3 is chosen.

5.2 Not Using the Third Voltage Monitor (VMON and VDET)

If the TPS75005 third voltage monitor block (SVS3) is not needed, then VMON is connected to VIN and VDET is left floating. Connect VMON and VDET as shown in Figure 4.

Note that Figure 4 also shows how to configure EN for scenario 2, as described in the *Enable EN* section.

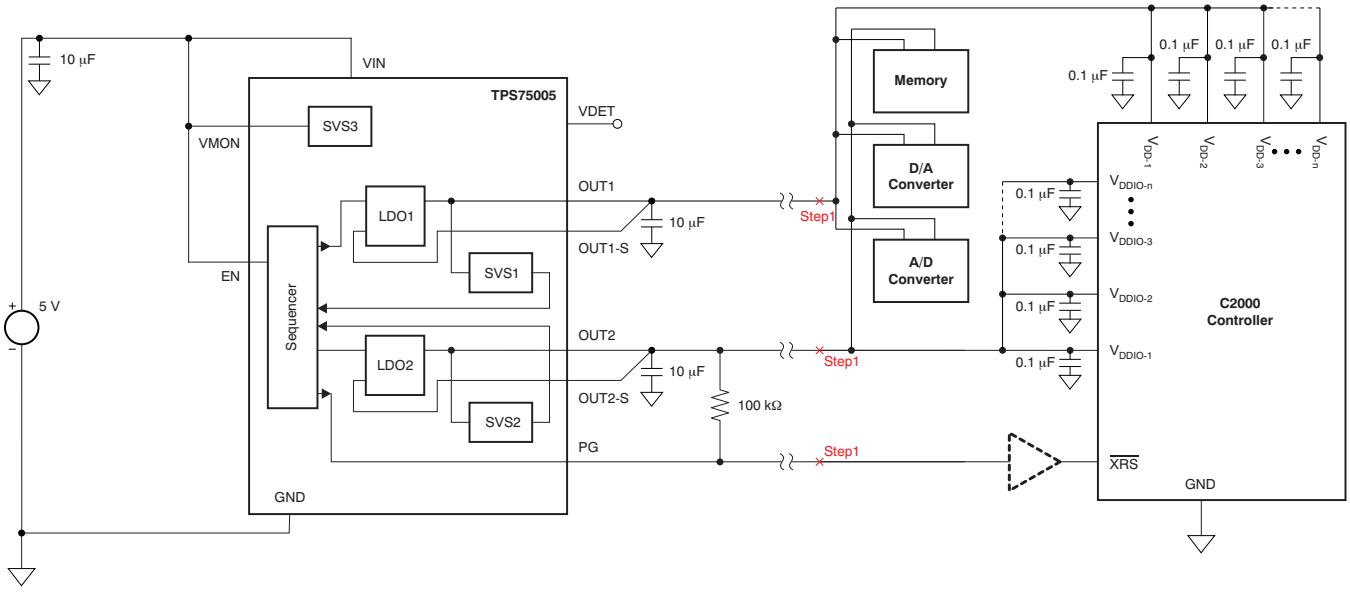

Figure 4. SVS3 Not Used

5.3 Using the Third Voltage Monitor (VMON and VDET)

The most popular use for the TPS75005 third voltage monitor block (SVS3) is to monitor the VIN voltage, as shown in Figure 5.

In this case, connect VMON to the voltage dividers (R1 and R2), and connect a 100-kΩ resistor between VIN and VDET. Then, connect the VDET node to the EN node so that the result of the VIN monitoring is used as an enable signal to the TPS75005 device.

The R1 and R2 values are calculated by Equation 1; the values used in Figure 5 monitor VIN at approximately 4.5 V.

$$\text{(SVS3 Detection Voltage Target)} = 1.206\ \text{(V)} \times \frac{R_1 + R_2}{R_2} \quad (1)$$

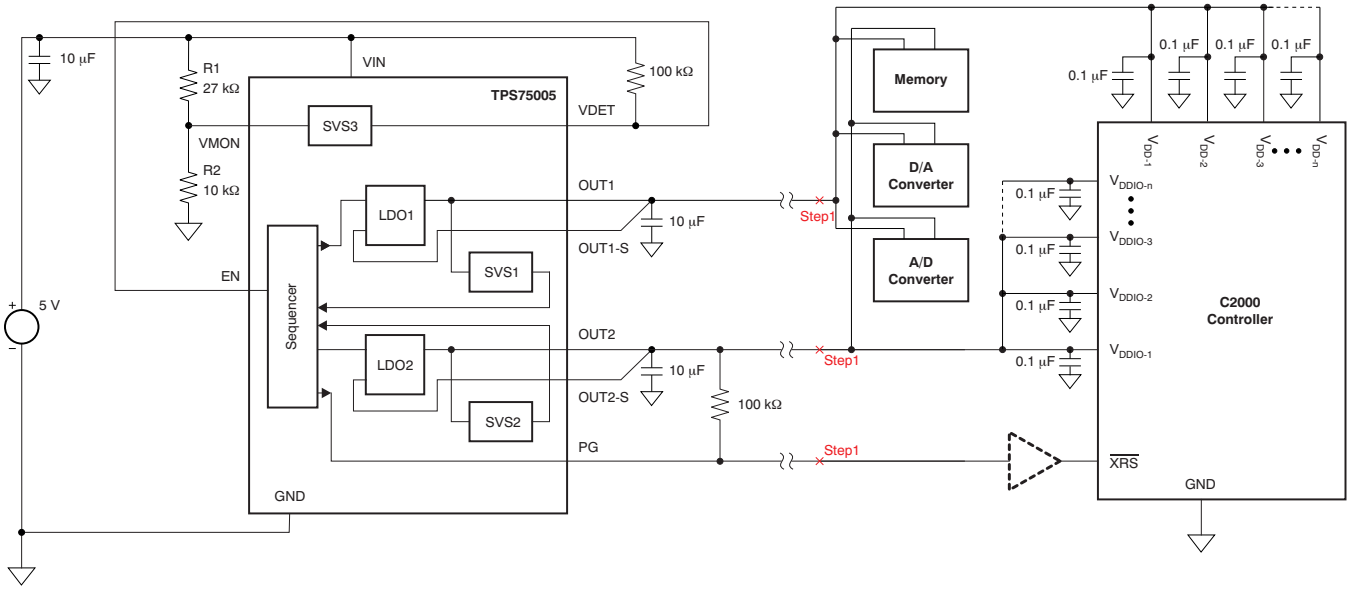

Figure 5. SVS3 Used to Monitor VIN

5.4 Selecting the Power Sequence (SEQ)

Now the proper power-up and power-down sequence must be set up, depending on the C2000 controller used. Refer to Table 1 and determine whether SEQ = L or SEQ = H is required.

Note that the rest of this quick-start guide assumes SEQ = L.

Table 1. SEQ Selection by C2000 Controllers

C2000 CONTROLLER	TPS75005 SEQ SETTING
F280x/F2801x	Logic low
F281x	Logic high
F2823x	Logic low
F2833X	Logic low

The result of this step is shown in Figure 6.

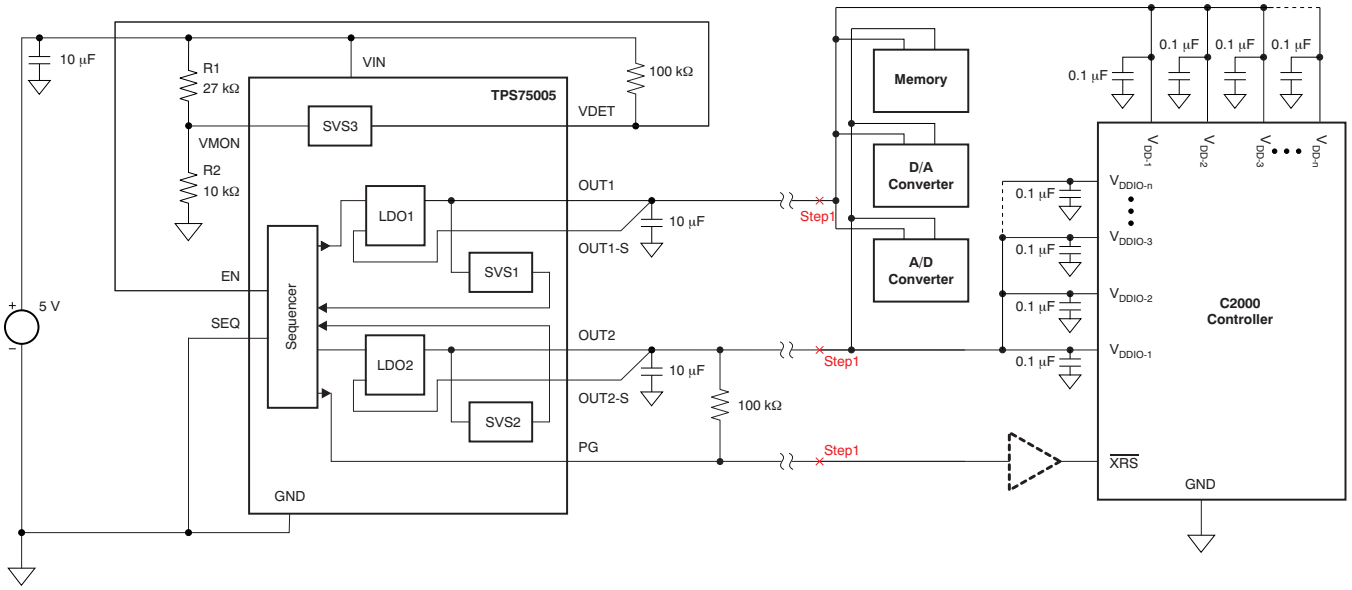

Figure 6. Setting SEQ

5.5 V_{DD} Voltage Setting

The V_{DD} voltage must be selected based on the required clock speed of the C2000 application. In most cases, select 1.8 V for V_{DD} with VSET = L.

Note that the rest of this quick-start guide assumes you selected VSET = L.

The result of this step is shown in Figure 7.

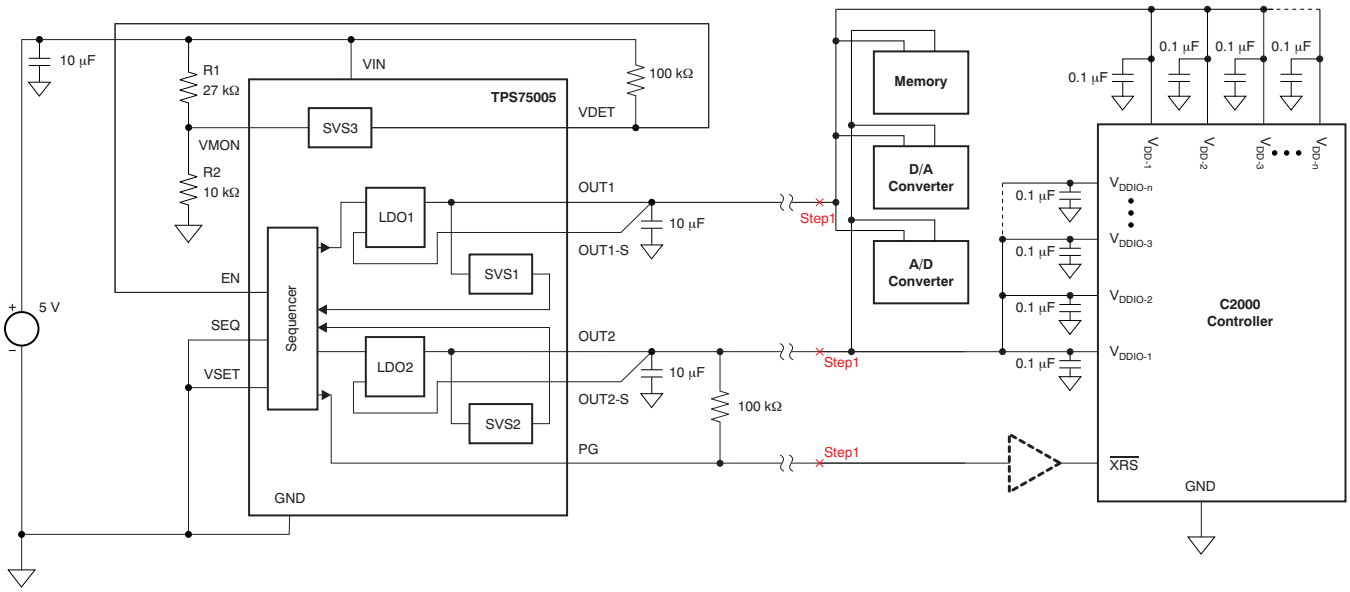

Figure 7. Setting VSET

5.6 Soft-Start, Delay-Setting, and Test Pins (SS1, SS2, CT1, CT2, and TEST)

This is the final step of the quick-start guide before powering up the system. Unless there are special requirements, keep the SS1, SS2, CT1, CT2, and TEST pins floating.

The final schematic results are shown in Figure 7.

Remember the choices made for the EN, VMON, VDET, SEQ, and VSET pins. Depending on the choices, the results may differ slightly.

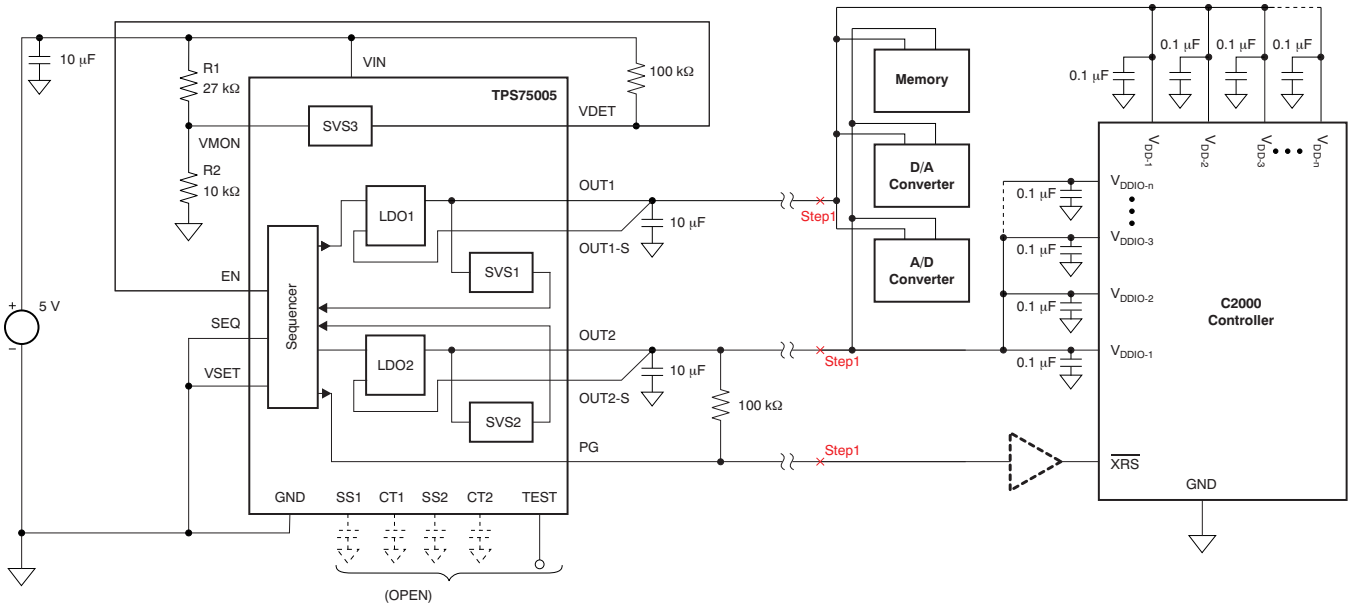

Figure 8. Final Schematic

6 POWER UP YOUR SYSTEM

Now the system is ready to be powered up.

If scenario 1 was selected in the *Enable Pin* section, then the 5-V power supply to the TPS75005 must be turned on first. Then the microcontroller sends the EN = H signal to the TPS75005. To stop the system, the microcontroller sends the EN = L signal to the TPS75005.

If scenarios 2 or 3 were selected in the *Enable Pin* section, then simply turn on the 5-V power supply to the TPS75005. As the 5-V power supply ramps up, the TPS75005 eventually starts working. To stop the system, turn off the 5-V power supply.

7 TROUBLESHOOTING

7.1 V_{DD} Shows 1.8 V But V_{DDIO} Stays at a Lower Voltage Than 3.3 V

Check that there is no diode connection from V_{DD} (anode) to V_{DDIO} (cathode) in the circuit block diagram of Figure 1. Use a multimeter in diode mode and verify that there is no diode.

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