Application Note

DA9061/2/3 Configuration of nSHUTDOWN / nRESETREQ and nOFF

AN-PM-063

Abstract

The nSHUTDOWN and nOFF inputs (DA9063 only) and nRESETREQ (DA9061/2 only) should be correctly configured to ensure the expected device operation is achieved through a VSYS brown-out. This is achieved by selection of appropriate external pull-up supplies.

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Contents

1 References

[1] DA9061, Datasheet, Dialog Semiconductor, 2015
[2] DA9062, Datasheet, Dialog Semiconductor, 2015
[3] DA9063, Datasheet, Dialog Semiconductor, 2015

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2 Introduction

The configuration of nSHUTDOWN and nOFF (DA9063 only) and nRESETREQ (DA9061/2 only) should be optimised to ensure correct power-up behaviour under all conditions. For these open-drain control signals it is important to choose appropriate pull-up supplies.

It should be considered that when the PMIC enters NO POWER Mode or RTC Mode, the PMIC supplies, including the 'always on' LDO1, will be turned off. This application note explains how the discharge of a pull-up rail can cause the nSHUTDOWN or nOFF inputs to be permanently-asserted, which then prevents the PMIC from leaving RESET Mode.

Note that the behaviour of the DA9063 nSHUTDOWN pin is the same as the DA9061/2 nRESETREQ pin. Please refer to the datasheets for explanations of the parameters discussed (VPOR, VDD_FAULT_LOWER and so on).

3 Explanation and Discussion

The PMIC may enter NO POWER Mode or RTC Mode as a result of a VDD_FAULT condition on VSYS. Examples of such fault conditions are a brown-out 'glitch' of the VSYS supply into the range VPOR < VSYS < VDD_FAULT_LOWER for >100 ms, or a brown-out to VSYS < VPOR of any duration. This causes an emergency shutdown of the supplies. If there is no backup battery (or it is insufficiently charged) then the VSYS fault results in the device entering NO POWER Mode. If the PMIC has RTC Mode enabled and the backup battery has sufficient charge, then the device instead enters RTC Mode.

A configuration to be avoided is illustrated in Figure 1 where nSHUTDOWN / nRESETREQ is pulled up to VLDO1. The device is shown to be stuck in RESET Mode at the right hand side of the plot. After a VSYS glitch, this same issue can be seen when the PMIC leaves either NO POWER Mode or RTC Mode. Note that the sensitivity of a particular system to the issue is dependent on the rate of rail discharge: (a) during the VSYS brown-out, and (b) after the brown-out where the PMIC regulator pull-downs are turned on. For example, Figure 1 illustrates how the discharge characteristic of VLDO3 is significantly different to VLDO1.

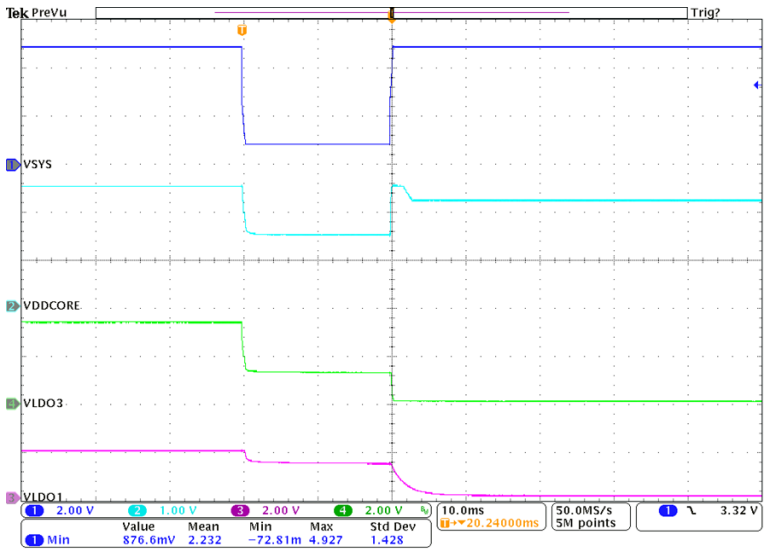

Figure 1: nSHUTDOWN Pull-Up to VLDO1 with a VSYS Glitch of 20 ms Down to ~0.9 V (which is below VPOR). When VSYS Recovers, the PMIC Attempts to Leave NO POWER Mode. VDDCORE Rises and, at this Instant, the Regulators are Discharged via the PMIC Internal Pull-Downs. The Decaying LDO1 Supply is Seen as a Logic Negative-Edge on nSHUTDOWN Which Causes the Device to Enter RESET Mode (indicated by a reduction of VDDCORE from 2.5 V to 2.2 V). Since nSHUTDOWN is Now Permanently Low, the PMIC Cannot Exit from this State

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A solution to the issue which is simple and effective is to drive the nSHUTDOWN / nRESETREQ pull-up with VDDCORE (Figure 2) or VSYS (Figure 3). Similar treatment of the DA9063 nOFF pull-up is also required.

The reason the VSYS and VDDCORE supplies are unique in being unaffected by the issue, is that neither can undergo an on-to-off transition (creating falling edges on signals using them as a pull-up) when the system is powering-up or exiting RTC Mode.

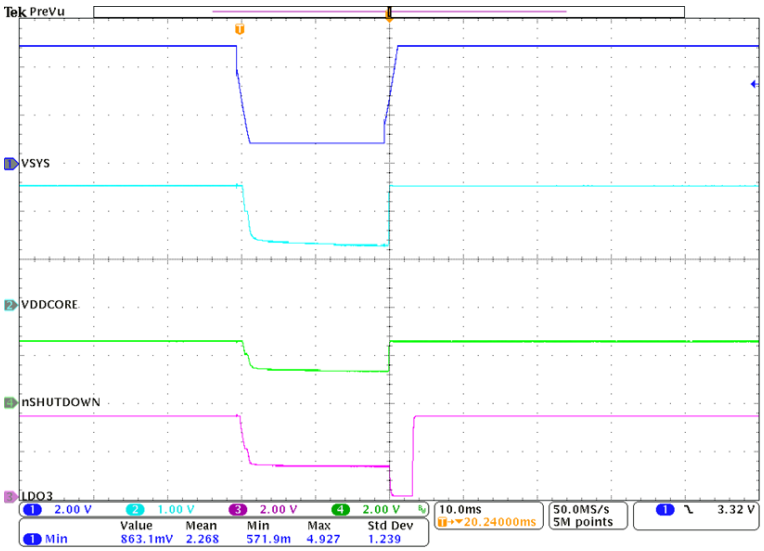

Figure 2: nSHUTDOWN Pull-Up to VDDCORE. The PMIC Correctly Returns to ACTIVE Mode After a 20 ms VSYS Glitch to <VPOR

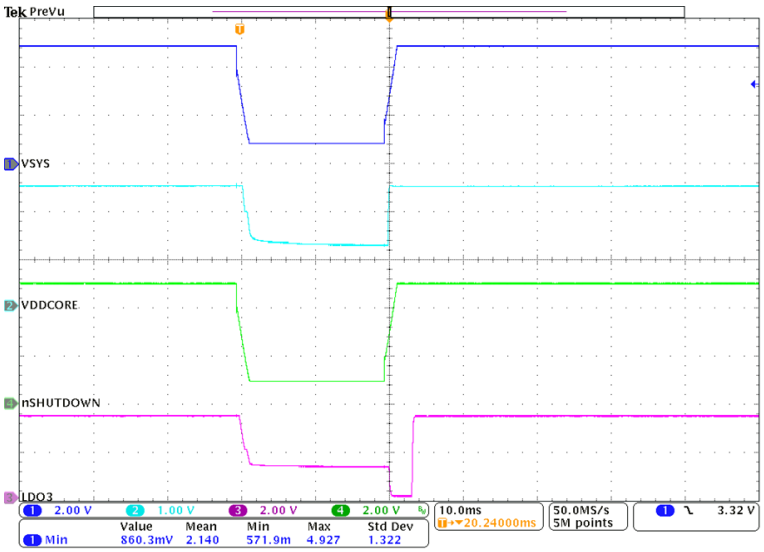

Figure 3: nSHUTDOWN Pull-Up to VSYS. The PMIC Correctly Returns to ACTIVE Mode After a 20 ms VSYS Glitch to <VPOR

4 Recommendations

For DA9063 designs with nOFF functionality:

1. The nOFF pull-up must be supplied from either VDDCORE (via 100 kΩ) or VSYS. Alternatively, some other truly ‘always-on’ external supply can be used.

For DA9061/2 and DA9063 applications:

2. nSHUTDOWN / nRESETREQ should be pulled up to either VDDCORE (via 100 kΩ) or VSYS. Alternatively, some other truly ‘always-on’ external supply can be used.
3. nSHUTDOWN / nRESETREQ should not be pulled up to a PMIC regulator output. This is because when the line is pulled low by a system signal the device enters RESET Mode. The device is then stuck in RESET Mode since the input’s pull-up rail has been turned off.
4. nSHUTDOWN / nRESETREQ should not be pulled up to the LDO1 ‘always on’ supply. This is because this rail is turned off as the PMIC passes through NO POWER Mode (as in the event of momentary VSYS power-loss).
5. nONKEY should be pulled up to VSYS. (A pull-up to VDDCORE would create a problem with waking-up from RTC Mode.)

Level shifters might be required where the nSHUTDOWN / nRESETREQ and nOFF signals are driven from low voltage domains. For a 1.8 V domain, this can sometimes be readily implemented by including a diode-drop in the pull-up path to VDDCORE.

Revision History

Revision	Date	Description
1.0	14-Aug-2015	Initial version.
2.0	17-Feb-2022	File was rebranded with new logo, copyright and disclaimer

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