

# Powering the AM335x/AM437x with TPS65218

This user guide is a reference for connectivity between the TPS65218 power management IC and the AM335x or AM437x processor. For detailed information about the TPS65218, AM335x, or AM437x see their respective data sheets.

## Contents

1	TPS65218 Overview .....	1
2	Connection Diagram for TPS65218 and AM335x .....	2
3	Power Rails for TPS65218 and AM335x .....	3
4	Connection diagram for TPS65218 and AM437x.....	4
5	Power Rails Connections for TPS65218 and AM437x .....	5
6	Power-Up/Power-Down Sequence for TPS65218.....	6
7	Memory Voltage Selection.....	7
8	Using LPDDR2 Memory .....	8
9	Warm Reset .....	9
10	Pull-Up Resistors .....	9

## List of Figures

1	Connection Diagram for TPS65218 and AM335x .....	2
2	Connection Diagram for TPS65218 and AM437x .....	4
3	TPS65218 Sequence Timing Diagram.....	6
4	Connection Diagram for TPS65218 and DDR2 Memory .....	8
5	Warm Reset Functionality .....	9

## List of Tables

1	Power Rails for TPS65218 and AM335x .....	3
2	Power Rails for TPS65218 and AM437x .....	5
3	TPS65218 Power-Up Sequence.....	6
4	DCDC3 Voltage Selection .....	7

## 1 TPS65218 Overview

The TPS65218 is an optimized and highly integrated power management solution for the AM 335x and AM437x processor. Features of the TPS65218 include:

- Three DC/DC step-down converters
- One LDO
- Three load switches
- Two micro-power DC/DC step-down converters
- Power path management for battery backup of the processor RTC
- Integrated voltage supervisor

## 2 Connection Diagram for TPS65218 and AM335x

The block diagram shown in Figure 1 illustrates the connections between the TPS65218 and the AM335x. Power rails and digital and analog signals are shown. The power rails may be used to power additional parts of the system.

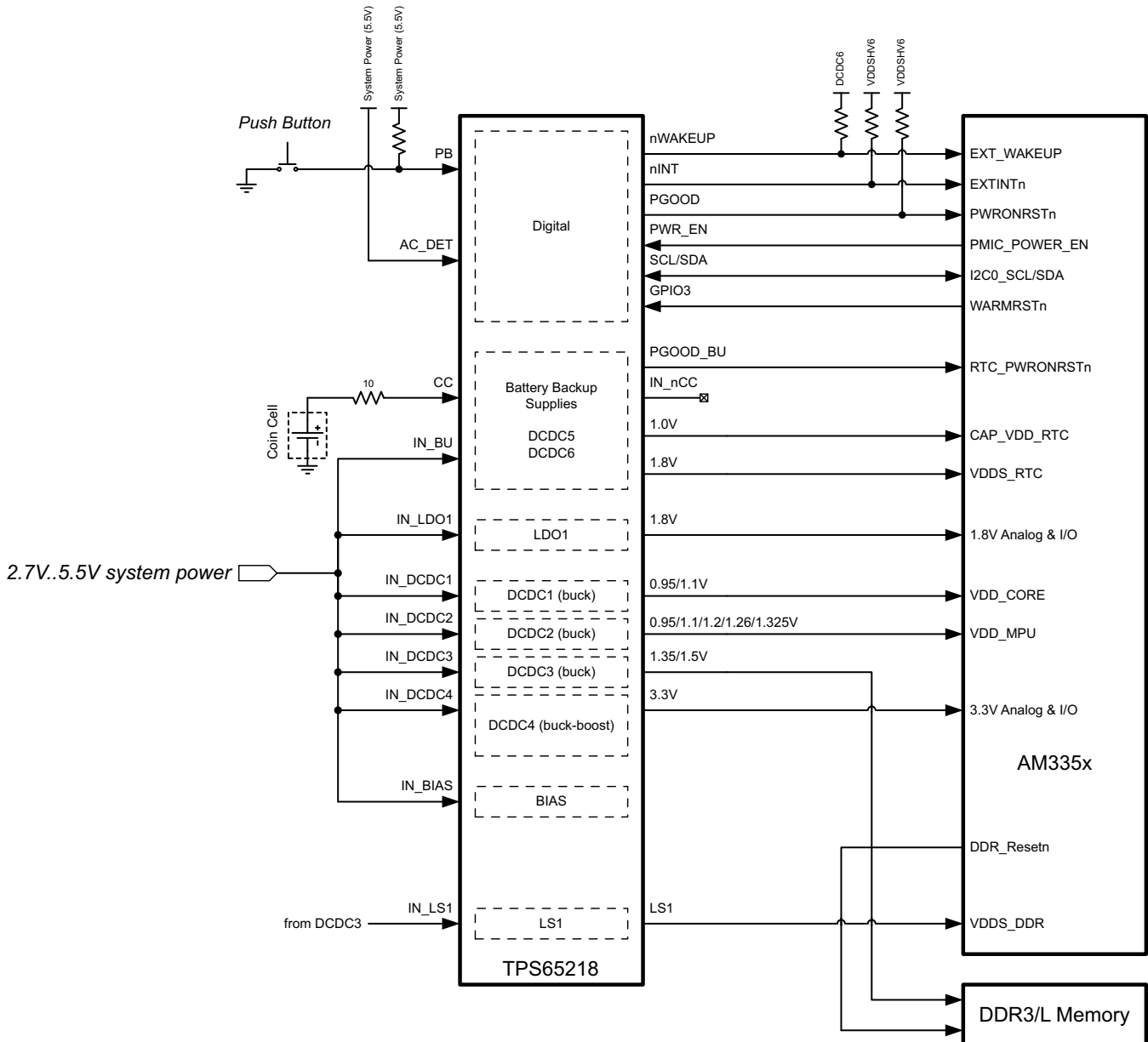


Figure 1. Connection Diagram for TPS65218 and AM335x

### 3 Power Rails for TPS65218 and AM335x

[Table 1](#) matches the AM335x power terminals with the appropriate power rail from the TPS65218.

**Table 1. Power Rails for TPS65218 and AM335x**

TPS65218	Voltage (V)	AM335x
DCDC1	0.95/1.1	VDD_CORE
DCDC2	0.95/1.1/1.2/1.26/1.325	VDD_MPU
DCDC3	1.35/1.5	DDR3L/DDR3 Memory VDDS_DDR
DCDC4	3.3	VDDSHVx (3.3 V)
		VDDA3P3V_USB0/1
DCDC5	1.0	CAP_VDD_RTC
DCDC6	1.8	VDDS_RTC
LDO1	1.8	VDDS
		VDDSHVx (1.8 V)
		VDDS_SRAM_CORE_BG
		VDDS_SRAM_MPU_BB
		VDDS_PLL_DDR
		VDDS_PLL_CORE_LCD
		VDDS_OSC
		VDDA1P8V_USB0/1
VDDA_ADC		

DCDC3 voltage is initially selected through the choice of resistor on the DC34\_SEL pin. Each output voltage can be changed dynamically while the TPS65218 is in active mode. This requires the use of I2C commands to the TPS65218.

#### 4 Connection diagram for TPS65218 and AM437x

The block diagram shown in Figure 2 illustrates the connections between the TPS65218 and AM437x. Power rails and digital and analog signals are shown. The power rails may be used to power additional parts of the system.

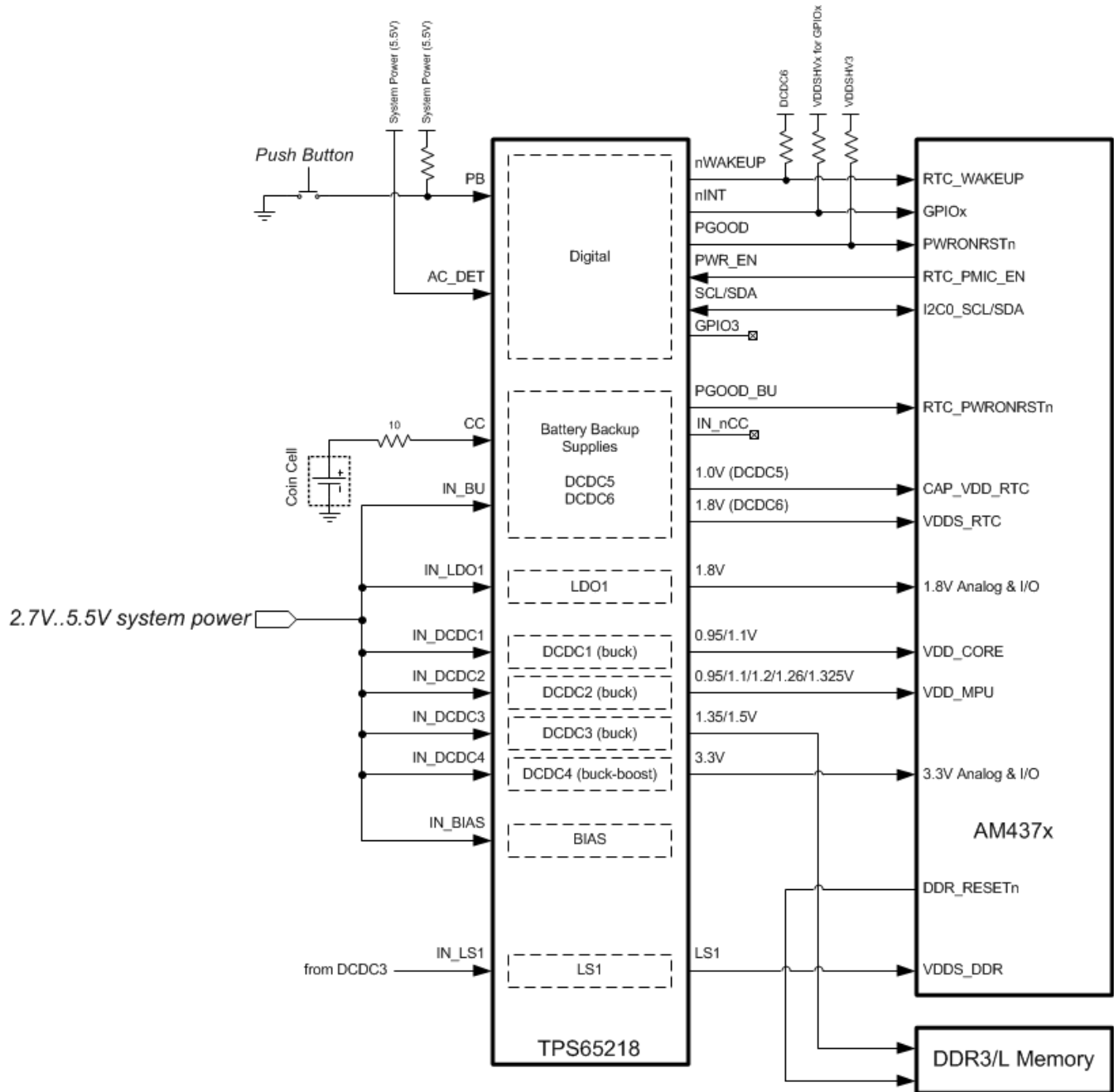


Figure 2. Connection Diagram for TPS65218 and AM437x

## 5 Power Rails Connections for TPS65218 and AM437x

[Table 2](#) matches the AM437x power terminals with the appropriate power rail from the TPS65218.

**Table 2. Power Rails for TPS65218 and AM437x**

TPS65218	Voltage (V)	AM437x
DCDC1	0.95/1.1	VDD_CORE
DCDC2	0.95/1.1/1.2/1.26/1.325	VDD_MPU
DCDC3	1.2/1.35/1.5	LPDDR2/DDR3L/DDR3 Memory
DCDC4	3.3	VDDSHVx(3.3 V)
		VDDA3P3V_USB0/1
		VDDS3P3V_IOLDO
DCDC5	1.0	CAP_VDD_RTC
DCDC6	1.8	VDDS_RTC
LDO1	1.8	VDDS
		VDDSHVx(1.8 V)
		VDDS_SRAM_CORE_BG
		VDDS_SRAM_MPU_BB
		VDDS_PLL_DDR
		VDDS_PLL_CORE_LCD
		VDDS_OSC
		VDDA1P8V_USB0/1
		VDDA_ADC0/1
		VDDS_PLL_MPU
		VDDS_CLKOUT
LS1	1.2/1.35/1.5 (Tied to DCDC3)	VDDS_DDR

DCDC3 voltage is initially selected through the choice of resistor on the DC34\_SEL pin. Each output voltage can be changed dynamically while the TPS65218 is in active mode. This requires use of I2C commands to the TPS65218.

## 6 Power-Up/Power-Down Sequence for TPS65218

Figure 3 describes the power-up and power-down sequence of the TPS65218. This sequence is specifically optimized for the AM437x and AM335x processor.

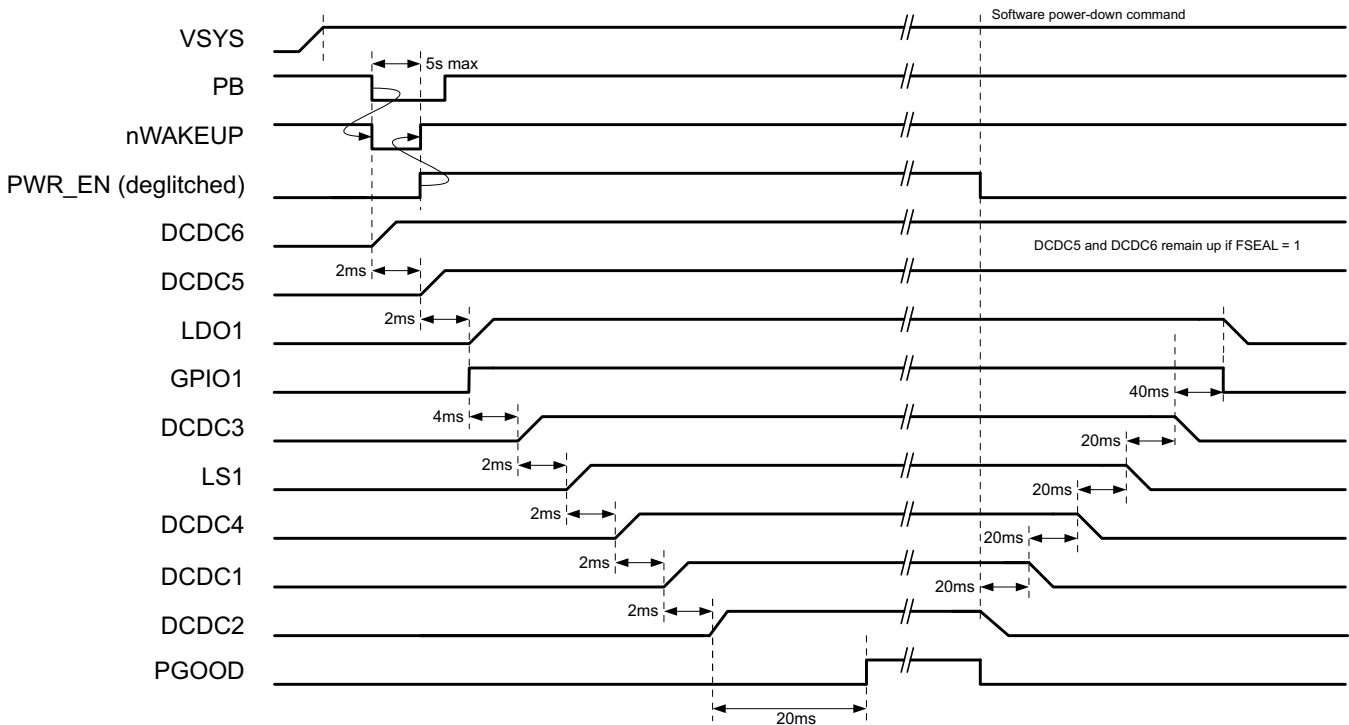


Figure 3. TPS65218 Sequence Timing Diagram

The power-up sequence is defined by a series of ten strobes and nine delay times. Each output rail is assigned to a strobe to determine the order in which the rails are enabled. The delay time in-between strobes is 2 ms by default. Table 3 lists the default strobe assignments for TPS65218.

Table 3. TPS65218 Power-Up Sequence

Strobe 1	DCDC6
Strobe 2	DCDC5
Strobe 3	LDO1
	GPIO1
Strobe 4	
Strobe 5	DCDC3
Strobe 6	
Strobe 7	DCDC4
Strobe 8	DCDC1
Strobe 9	DCDC2
Strobe 10	

## 7 Memory Voltage Selection

DCDC3 can be configured to support a variety of DDR memory voltages. The desired voltage can be selected by placing a 1% resistor to ground on the DC34\_SEL pin. [Table 4](#) lists the available memory voltages and the needed resistor for each.

**Table 4. DCDC3 Voltage Selection**

Memory	DCDC3 Voltage (V)	Resistor (k $\Omega$ )
LPDDR2	1.2	0 (tie to ground)
DDR3L	1.35	12.1
DDR3	1.5	20
DDR2	1.8	31.6

## 8 Using LPDDR2 Memory

If LPDDR2 memory is used, an additional 1.8 V LDO is required. GPIO1 is programmed to properly sequence the additional LDO and should be tied to the LDO enable pin as seen in Figure 4.

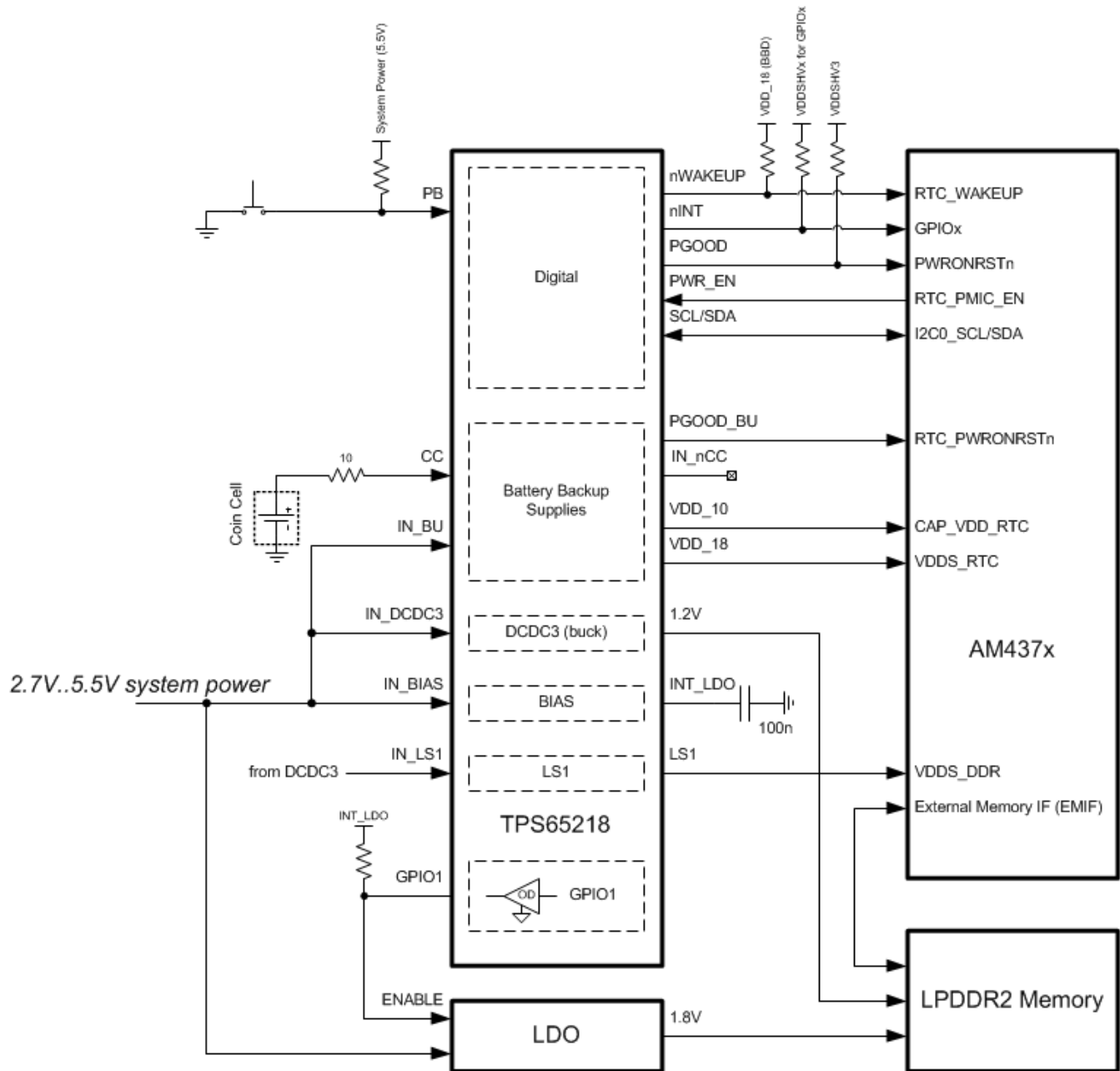


Figure 4. Connection Diagram for TPS65218 and DDR2 Memory

## 9 Warm Reset

The TPS65218 supports warm reset functionality with the AM335x processor. This functionality is enabled on the TPS65218 by default, and can be disabled through I2C. When enabled, GPIO3 acts as the warm reset input to the PMIC. Asserting GPIO3 low causes DCDC1 and DCDC2 to slew back to their default value of 1.1 V.

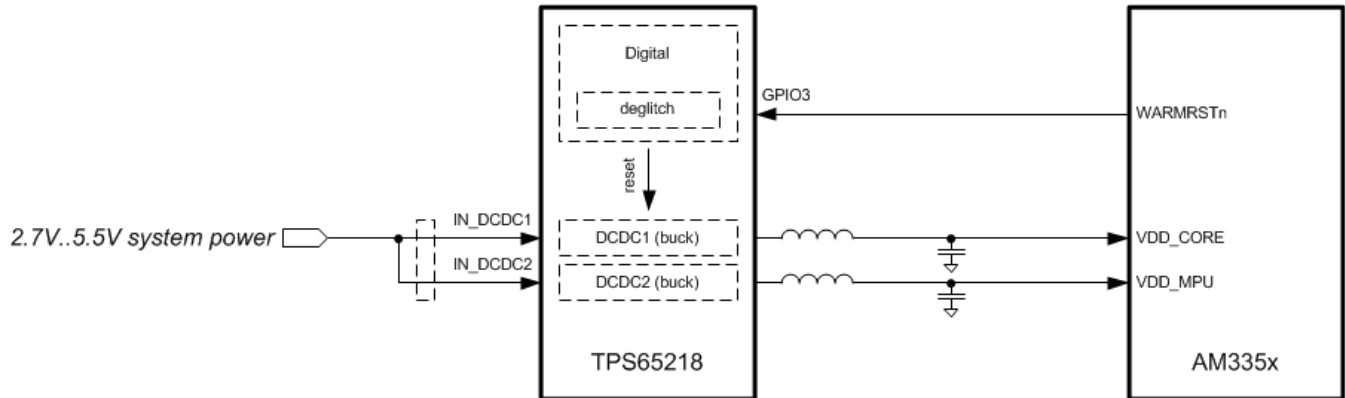


Figure 5. Warm Reset Functionality

## 10 Pull-Up Resistors

There are several pull-up resistors needed for operating the TPS65218 with the AM335x or AM437x processor. PB should be pulled up to VSYS. nWakeup should be pulled to DCDC6 so that the pull-up source is present even during SUSPEND and OFF mode. A 100-kΩ pull-up resistor should be used for nWakeup to minimize the current load on DCDC6. nINT, PGOOD, SCL, and SDA should be pulled up to the same supply that powers VDDSHVx for each signal. SCL and SDA use lower value pull-ups resistors in order to decrease rise time of these nodes during I2C communication.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)