

# Powering the Killer App

## An Overview of Power Options for the DaVinci Family

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**Texas Instruments**



# NOT COVERING THESE!



# POWERING THE KILLER APP

## Quick Intro to DCDC Products

### The Problems

- DaVinci Power Domains & Modes
- Sequencing Requirements

### Solutions

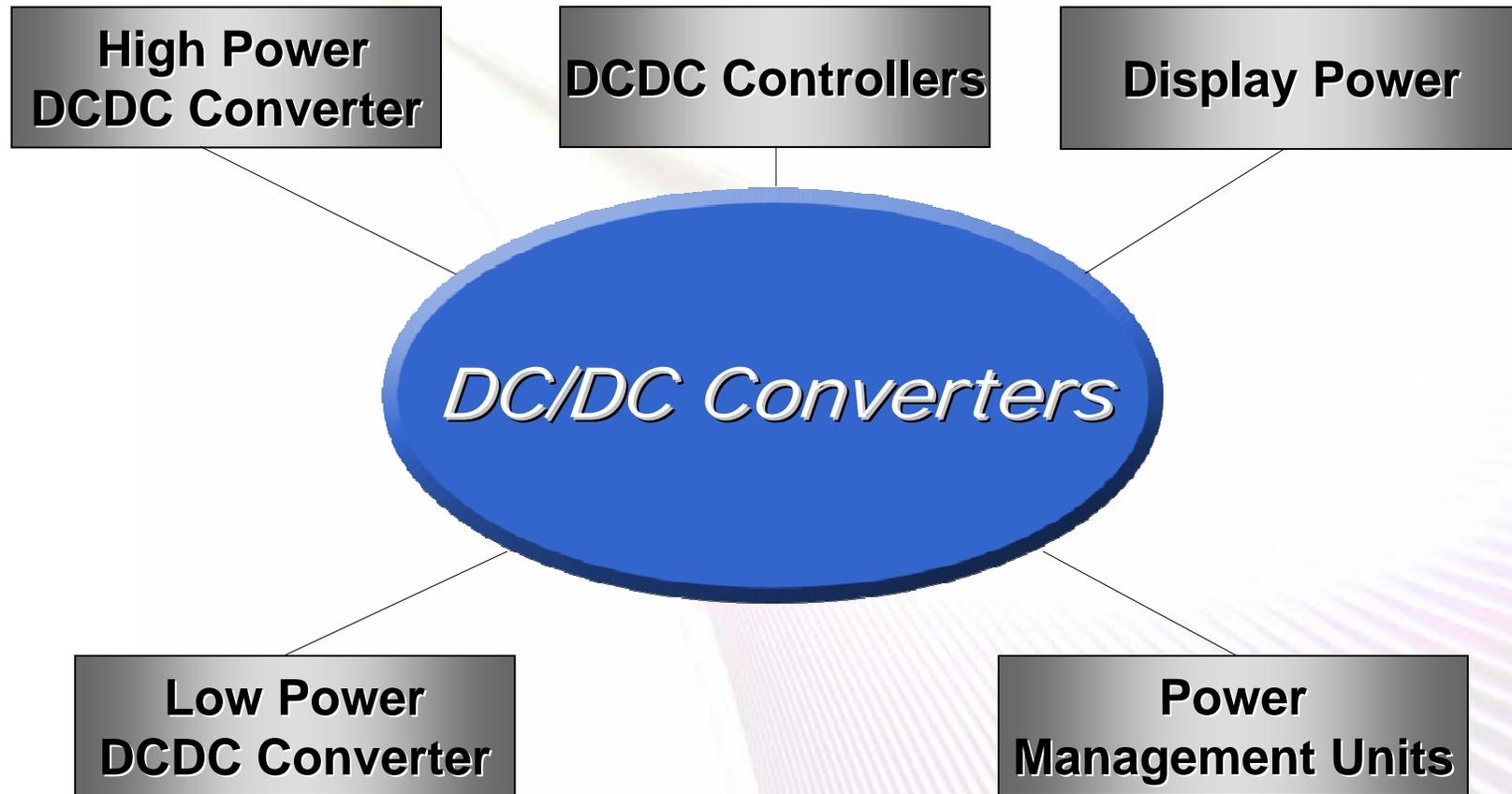
- A Discrete Power Supply Architecture
- An Integrated Power Supply Architecture

Power Architectures for High Voltage Apps

Summary & Wrap-up

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# DCDC PRODUCTS



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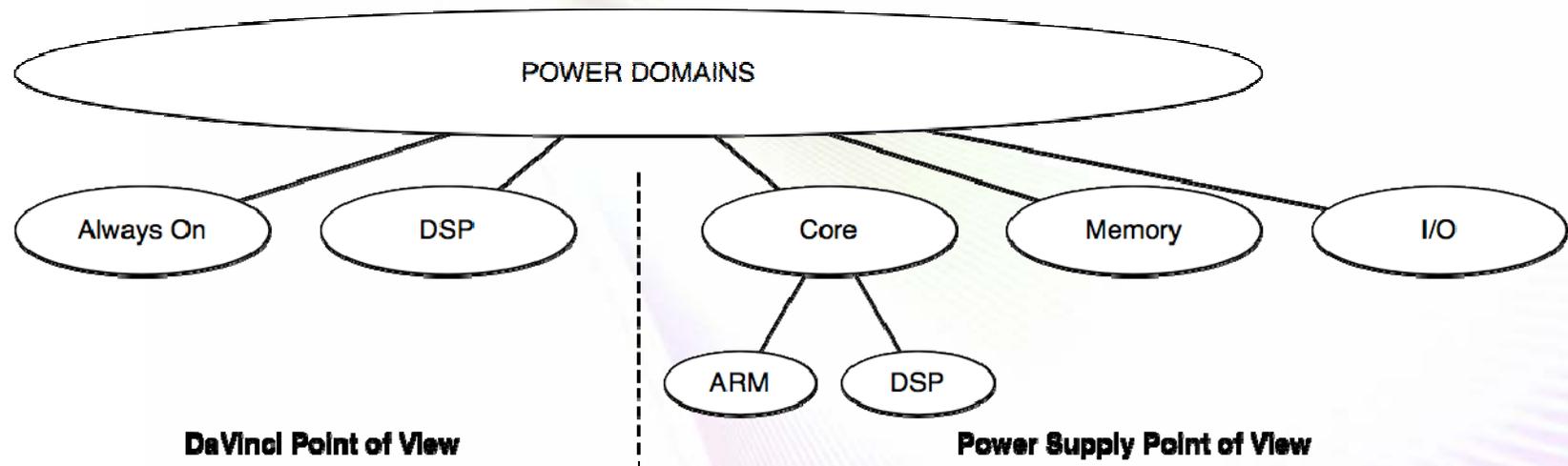
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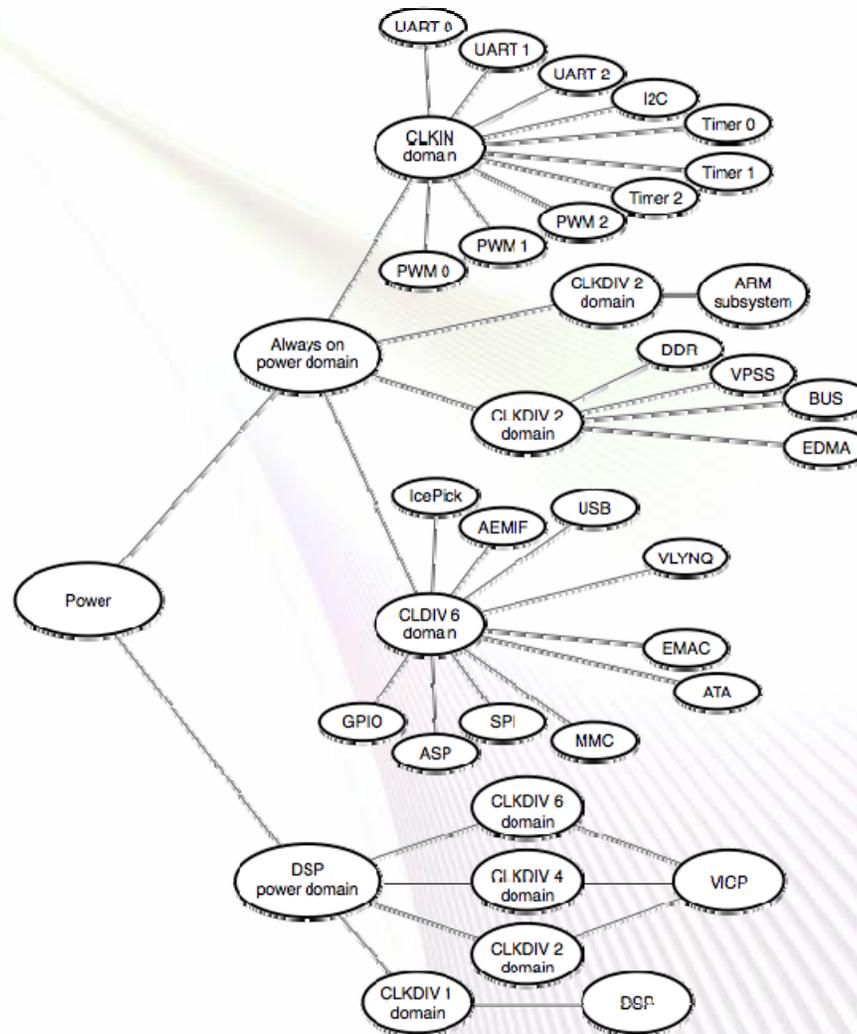
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# DaVinci POWER REVIEW



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# DOMAINS & CLOCKING



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# POWER RELATIONSHIPS

$$P_{\text{Total}} = P_{\text{Active}} + P_{\text{Leakage}}$$

- **Active, or Switching, Power**

- Square of Voltage
- Frequency

$$P_{\text{Active}} \propto V^2 f$$

- **Leakage Power**

- Voltage

$$P_{\text{Leakage}} \propto V$$

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# COMMON POWER STATES

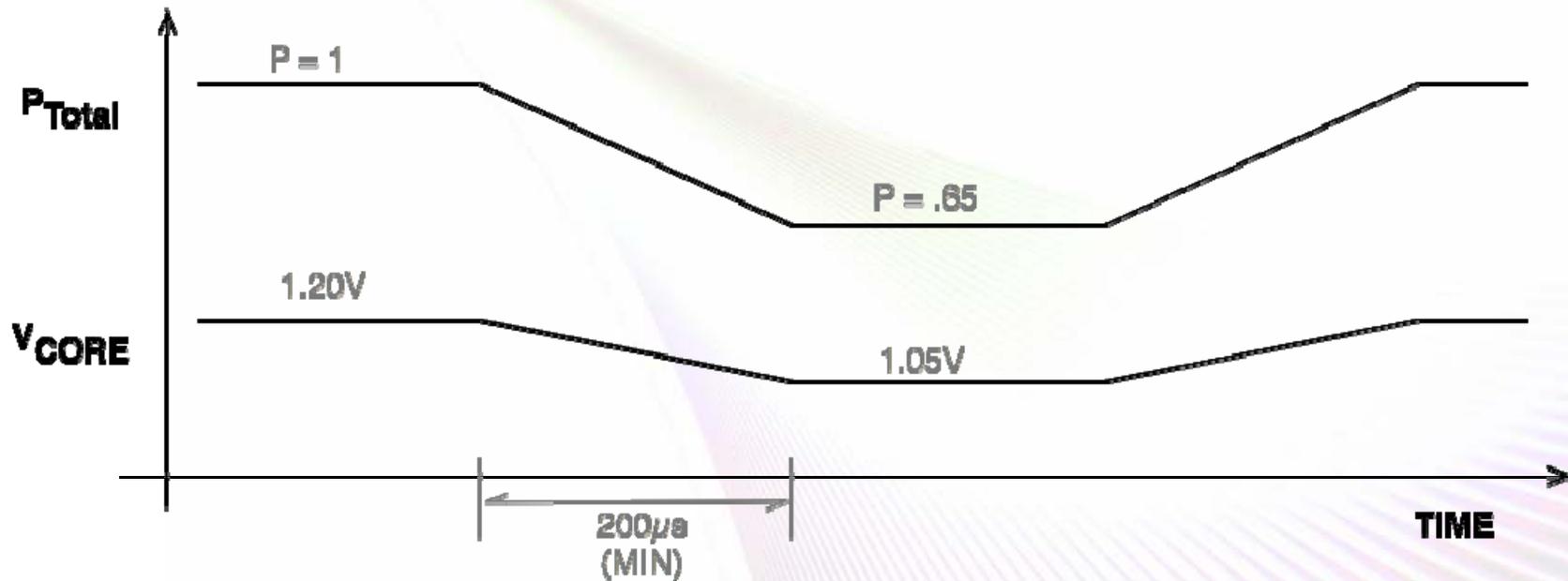
- Always On Domain*
- On
  - Clock Manipulation
    - Clock Gating
    - PLL Bypass
  - ARM Wait-For-Interrupt
    - Voltage still present
  - Off



- DSP Domain*
- On
  - Clock Manipulation
    - Clock Gating
  - Static Power Down (IDLE)
    - Voltage still present
  - Off

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# DM6441 VOLTAGE SCALING

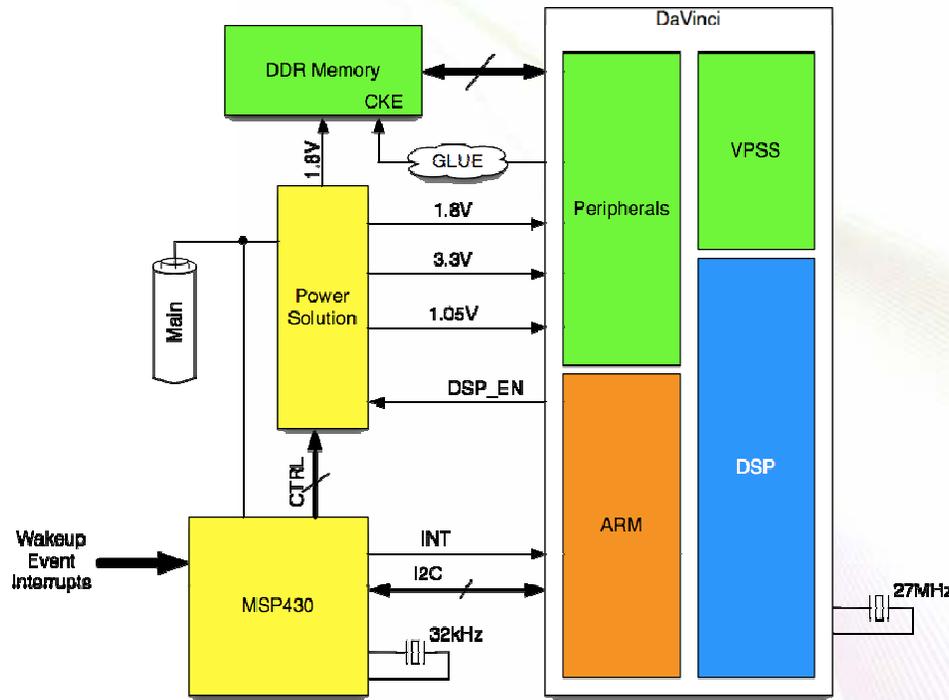


Requires interaction between  
DaVinci & the power solution

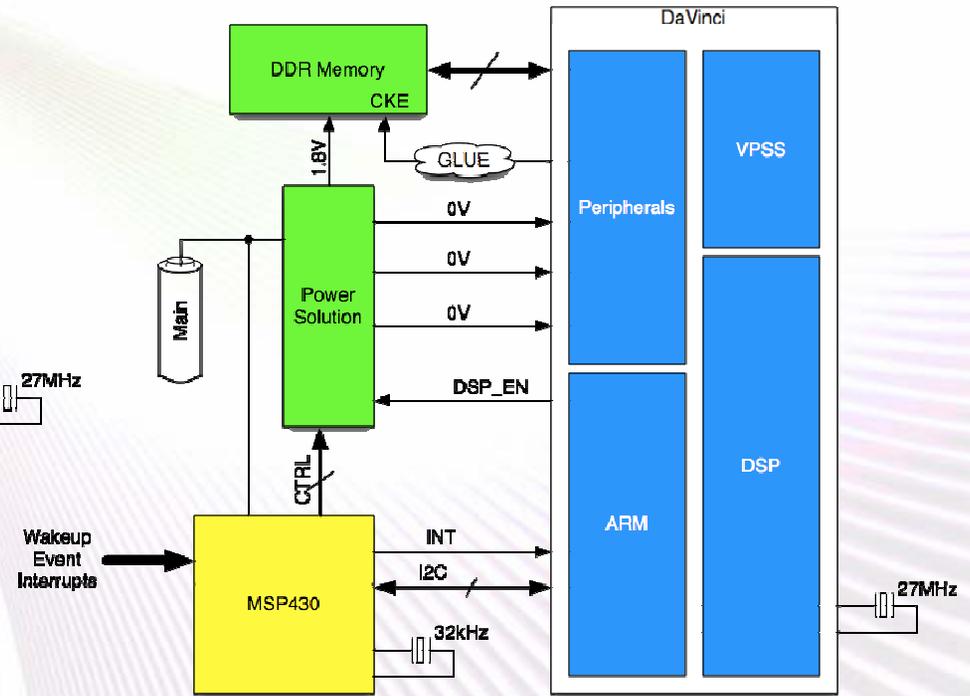
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# DM6441 DYNAMIC POWER DOWN

## Suspend to Memory



Requires interaction between DaVinci,  $\mu$ C & the power supply



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# WHAT DO THE POWER MODES MEAN?

| <i>Power Mode</i>                           | <i>DM6441 Total Power Consumption (approx)</i> |
|---|--|
| Video<br>(HD Video (720p) with 1.2V core)   | 800mW  |
| Video<br>(VGA Video with 1.05V core)        | 500mW  |
| MP3 Audio<br>(DSP:OFF)                      | 250mW  |
| SLEEP<br>(ARM:Wait For Interrupt & DSP:OFF) | 80mW   |
| OFF<br>(ARM:OFF & DSP:OFF)                  | 0mW  |

Measurements were taken with nominal silicon at room temperature.

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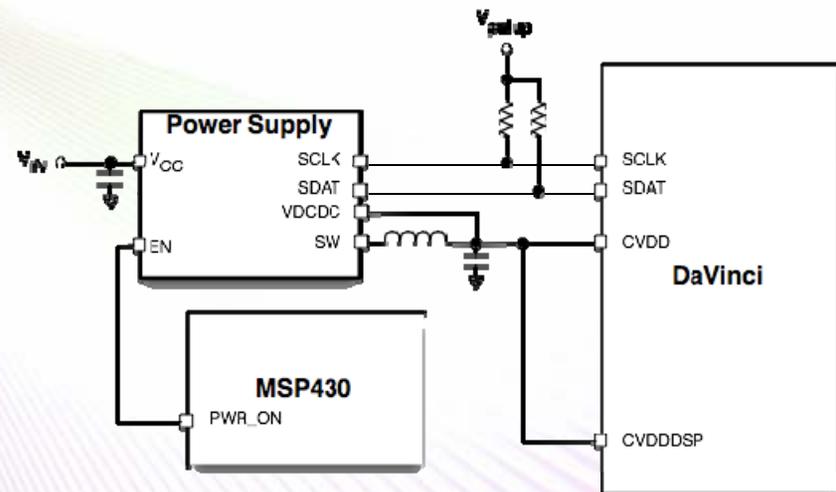
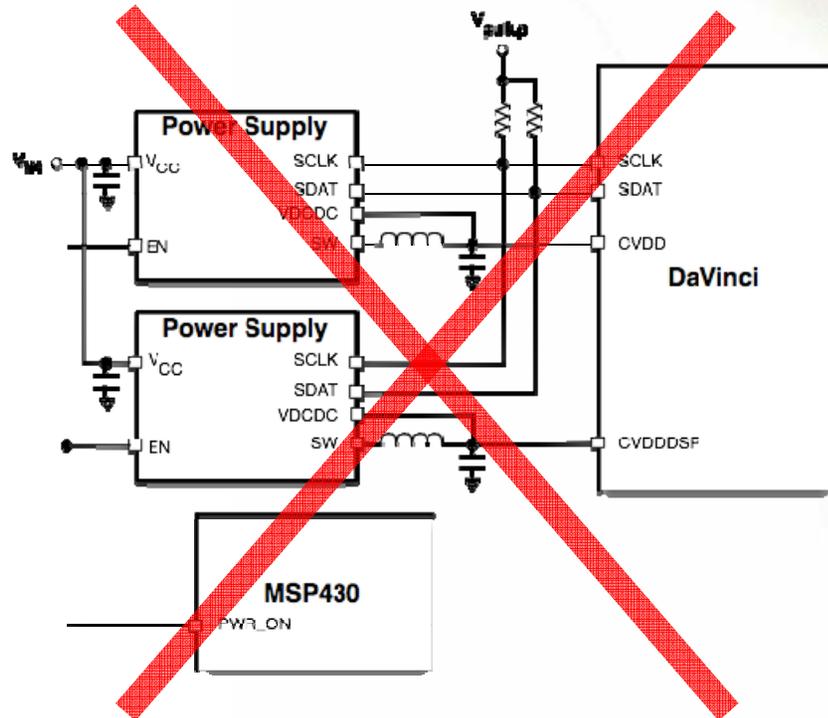
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# SELF-BOOT SEQUENCING

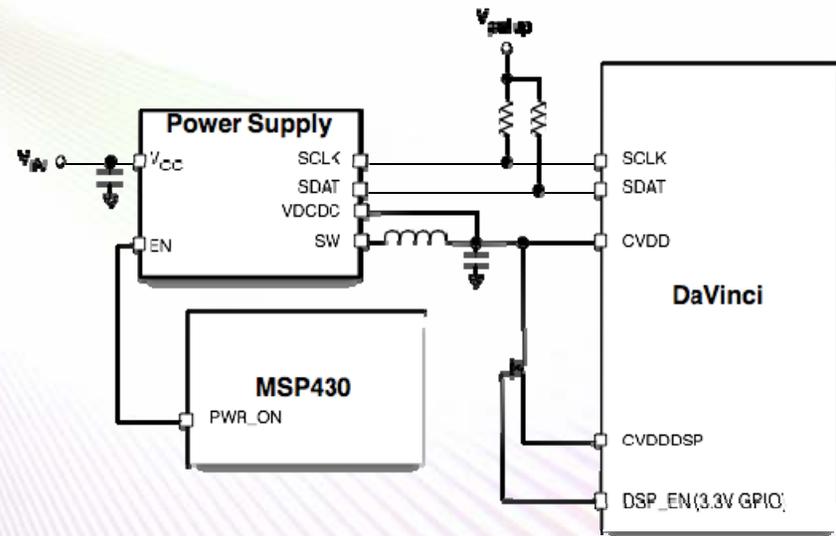
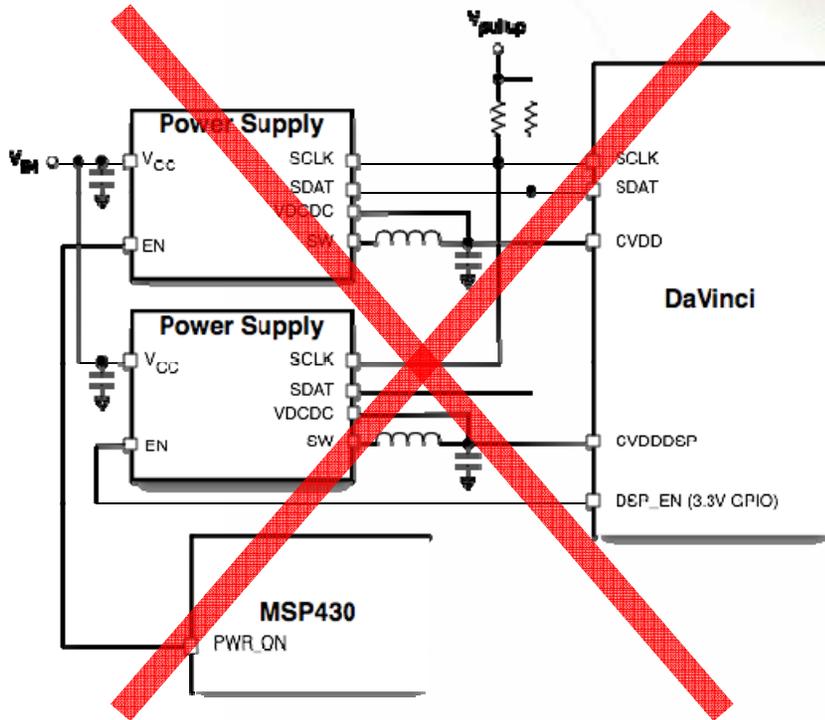
“If DSP Self-Boot mode is active,  $CV_{DD}$  and  $CV_{DDDSP}$  **must** be powered up at the same time.”



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# HOST-BOOT SEQUENCING

"...CV<sub>DD</sub> and CV<sub>DDDSP</sub> **may** be powered up at the same time, but CV<sub>DDDSP</sub> **may not** be powered up before CV<sub>DD</sub>. Prior to powering up the CV<sub>DDDSP</sub> supply, it should be left floating and not driven to ground."



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# BRING UP THE I/O & MEMORY

The Memory and I/O domains can be brought up.

| NO. |  | -594 |     | UNIT |
|-----|--|------|-----|------|
|     |  | MIN  | MAX |      |
| 1   | $t_{d(CVDD-DVDD)}$ Delay time, CVDD supply ready to DVDDXX supply ramp start | 0    | 100 | ms   |



Note A: DVDDXX denotes all I/C supplies.

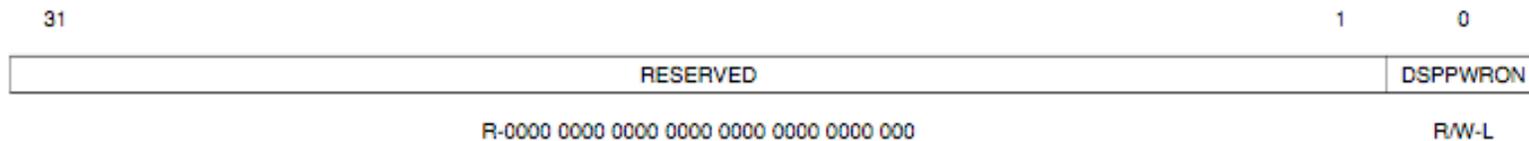
Figure 5-5. I/O Supply Timings

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# AND FINALLY...

In either boot sequence, there is an internal short that must be initiated once voltage is applied to the DSP power pins.

Figure 3-1. CHP\_SHRTSW Register



LEGEND: R = Read, W = Write, n = value at reset, L = pin state latched at reset rising

Table 3-2. CHP\_SHRTSW Register Description

| NAME     | DESCRIPTION   |
|----------|---|
| DSPPWRON | DSP power domain enable.<br>0 = DSP power domain off<br>1 = DSP power domain on |

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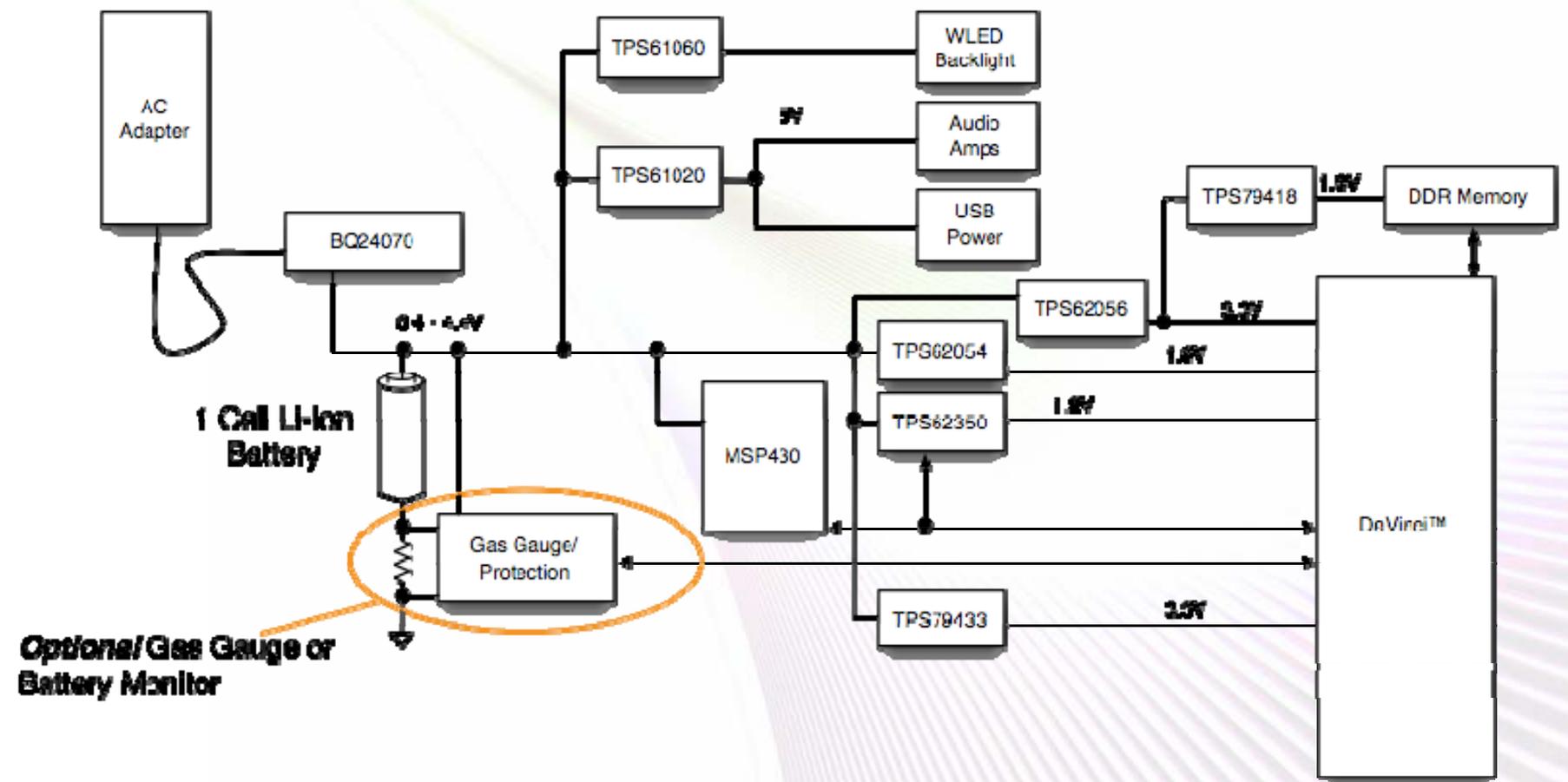
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# POWER CARE ABOUTS

- **Performance**
  - Low load efficiency
  - High current capability
  - Low standby current
- **Implementation ease**
  - Maximize available processor power savings
  - Minimize software development for power
  - Easy EMI filtering
- **Cost**

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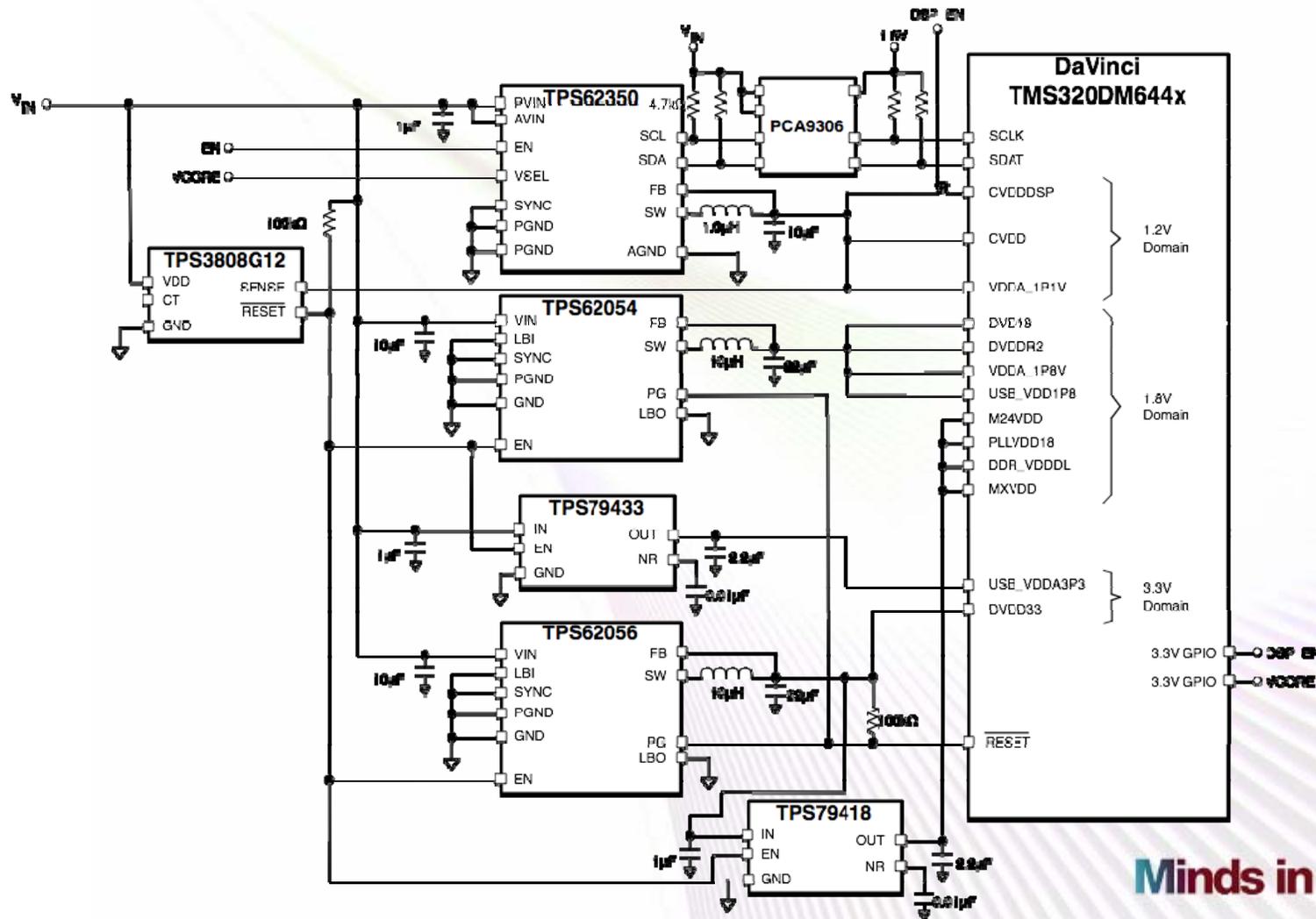
# A DISCRETE POWER SOLUTION



Optional Gas Gauge or Battery Monitor

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# FOCUS: DISCRETE DaVinci POWER



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# DISCRETE ADVANTAGES

- **Flexibility**
  - **Optimal part for each section**
  - **Placement**
  - **Vendor**

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# DISCRETE DISADVANTAGES

- **Space or Cost tradeoffs**
- **Difficult to take advantage of all possible power saving options**
- **Sequencing**
- **EMI**
  - **At a minimum, the clocks of discretets are not synchronized unless driven externally.**
  - **Picking the optimal part may mean picking parts that run at different clock frequencies. Each would have to be considered for EMI filtering.**

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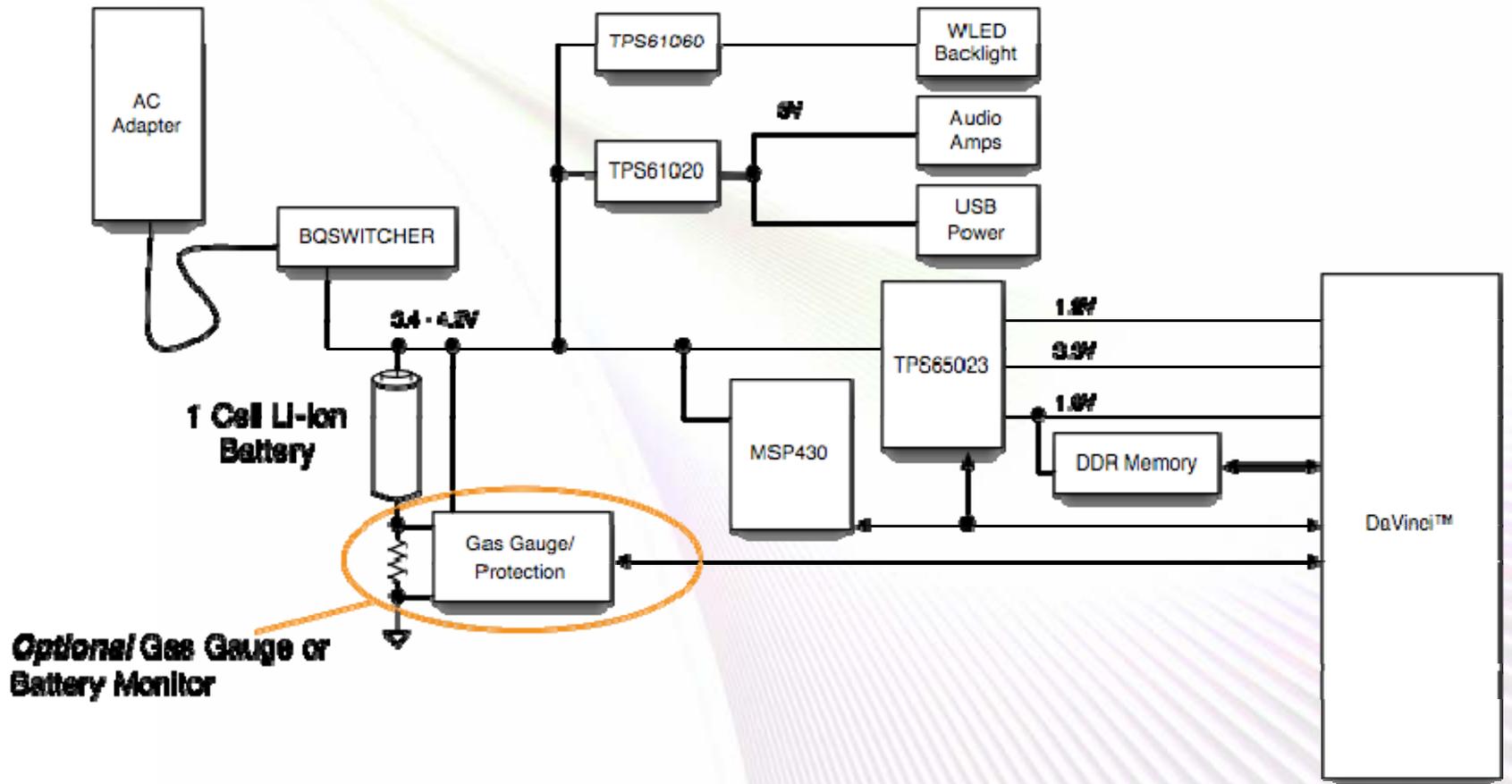
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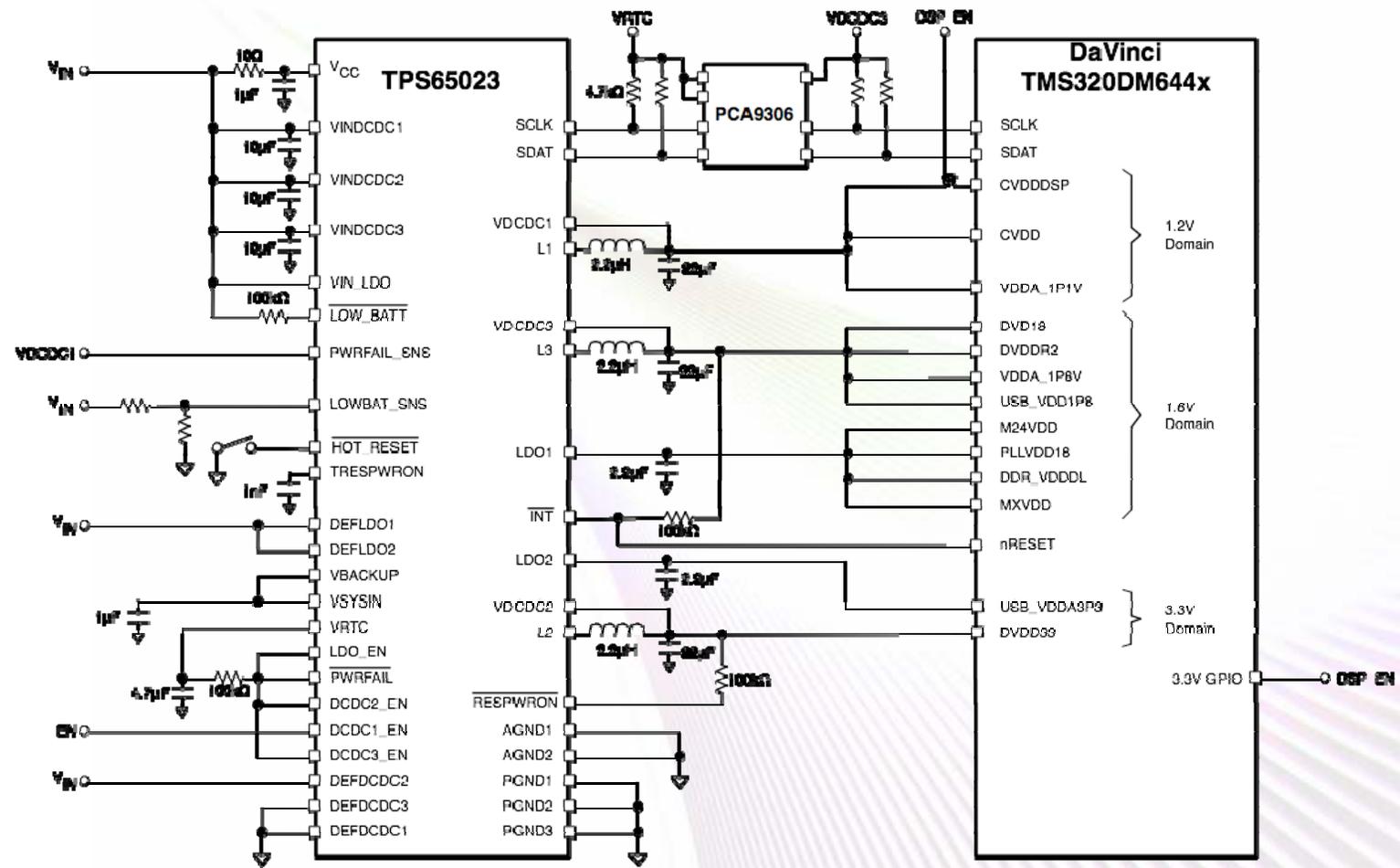
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# A SEMI-INTEGRATED SOLUTION



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# FOCUS: INTEGRATED DaVinci POWER



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# INTEGRATED ADVANTAGES

- **Designed for specific purpose**
  - Takes advantage of the power saving possibilities
- **Ease in control**
  - Everything in one place
- **EMI**
  - Integrated solution runs with a single clock. EMI from all switching devices can be filtered with one solution.
- **Single device to order and place**

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# INTEGRATED DISADVANTAGES

- **Less Flexibility**
  - **Layout space must be made available**
  - **Vendor swapping not possible**
- **Not all blocks may be optimal for the each application**
  - **Current too high**
  - **Highest efficiency not targeted at apps primary current**

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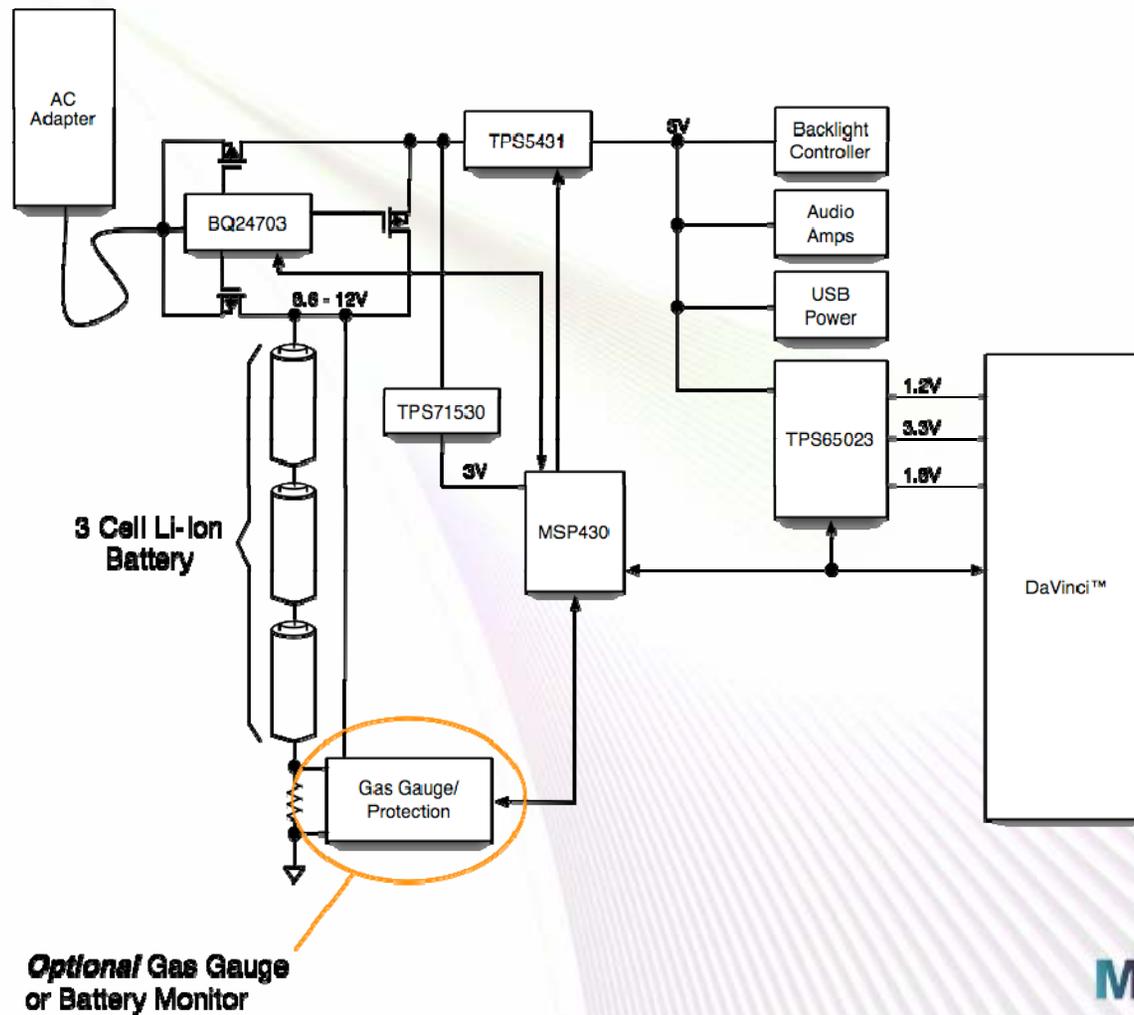
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# DEALING WITH HIGH VOLTAGE



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