# TMS320DM644x Power Reference Design

This design is a modification of SLVR303 using the UCD9081 digitally programmable power supply sequencer.

## 1 Features

- Highly flexible sequencing design using the UCD9081, which is a digitally programmable 8-channel power supply sequencer
- Downloadable setup file for UCD9081 automatically configures sequencing requirements for the DM644x
- Design optimized for 5V input voltage

## 2 Introduction

This reference design is for the TMS320DM644x and accounts for voltage, current, and sequencing requirements. This design is a modification to SLVR303 reference design using the UCD9081 sequencer rather than discrete components for sequencing. The use of the UCD9081 adds significant flexibility to the design and can reduce overall system component count. The UCD9081 also adds monitoring functions for under-voltage and over-voltage as well as other monitoring features. The operating input voltage is 4.5V to 5.5V. This design is optimized for flexibility and low system cost.

## 3 Requirements

The TMS320DM644x requires three input rails, which are outlined in Table 1.

**Table 1. DM644x Power Requirements**

| POWER REQUIREMENTS FOR TMS320DM644x | | | | | | |
|---|---|---|---|---|---|---|
| | **Pin Name** | **Voltage (V)** | **Imax (mA)** | **Tolerance** | **Sequencing Order** | **Timing Delay** |
| Core | CVDD, VDDA1P1V, VDDA1P2LDO, CBVDDDSP | 1.2 | 1700 | ±5% | 1 | |
| I/O | DVDD33, USB_VDDA3P3 | 3.3 | 25 | ±4.5% | 2 | IO supplies must be powered up after core supplies have been powered up. |
| I/O | DVDD18, DVDDR2, DDR_VDDDLL, PLLVDD18, VDDA1P8V, USB_VDD1P8, MXVDD, M24VDD | 1.8 | 170 | ±5% | | IO supplies must be powered up within 100ms after core supply is stable. |

The rails must power-up and power-down in the proper order. On power-up, the 1.2V should come up first then 1.8V and 3.3V together or 1.8V then 3.3V.

# 4 Block Diagram

See the schematic for further detail.

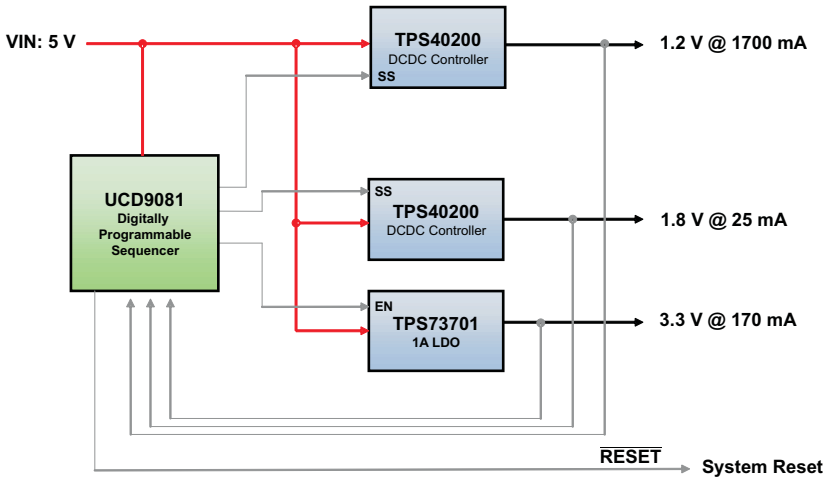


**Figure 1. Block Diagram of Power Design**

## *4.1 Power-Up Waveforms*

The figure below shows the power-up waveforms for the PMP4188 design.

Ch1 : 5V input voltage
Ch2 : 1.2V
Ch3 : 1.8V
Ch4 : 3.3V

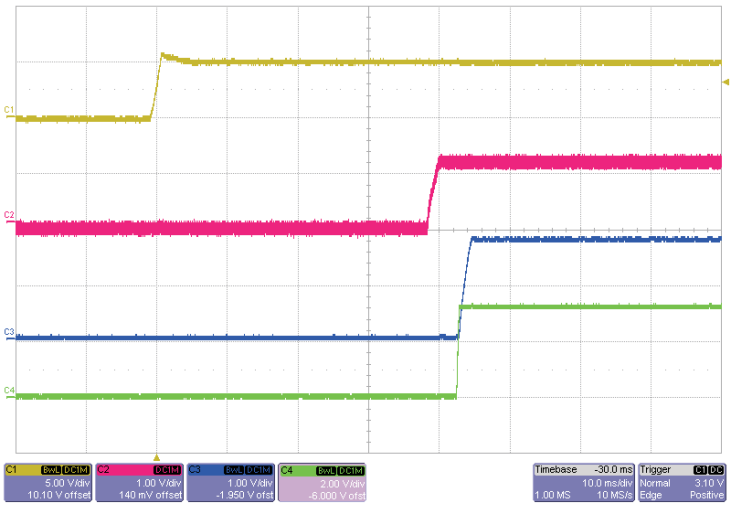

**Figure 2. Power-up Waveforms**

# 5 Schematics and Bill of Materials

## 5.1 Schematics

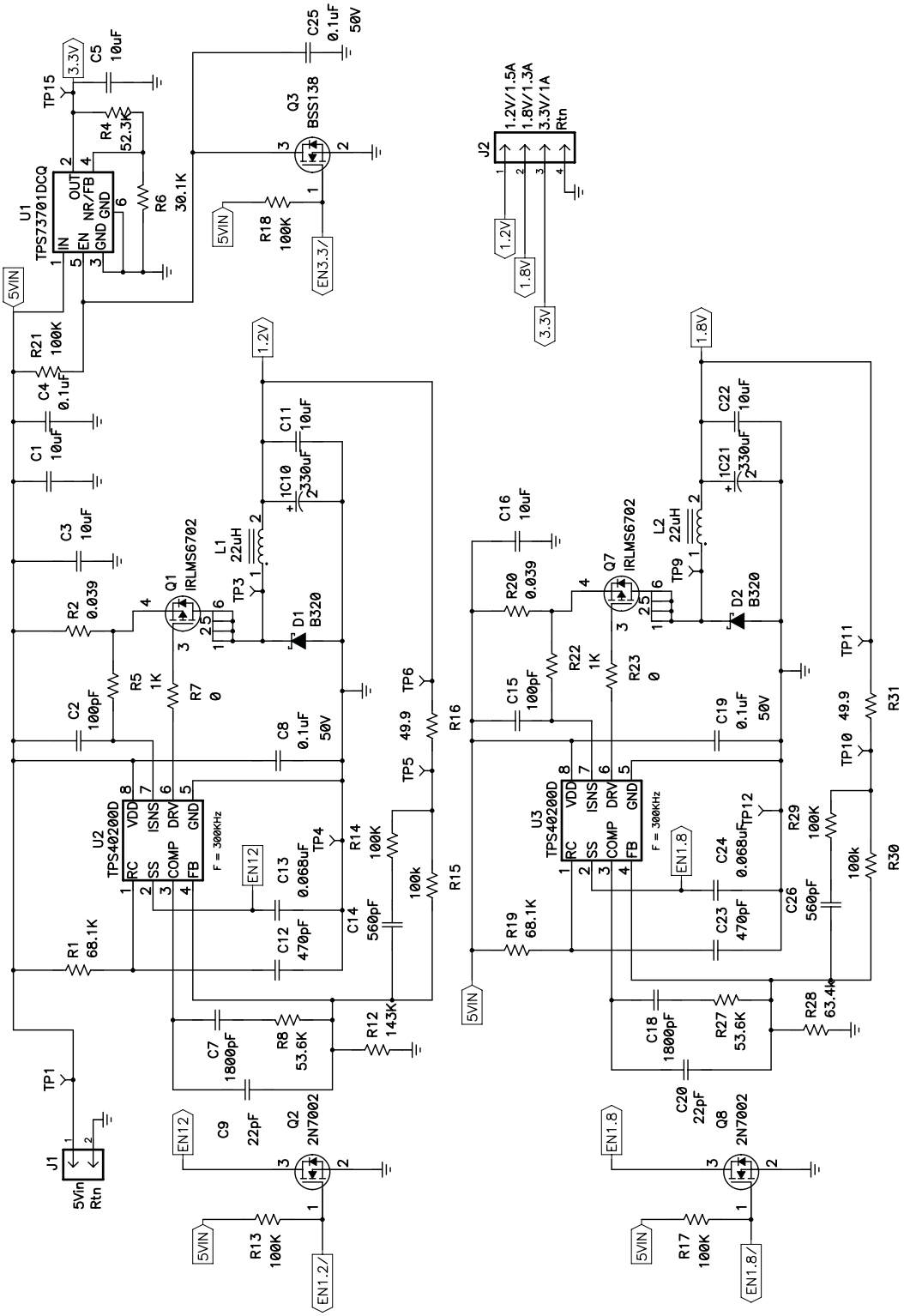


**Figure 3. Schematic**

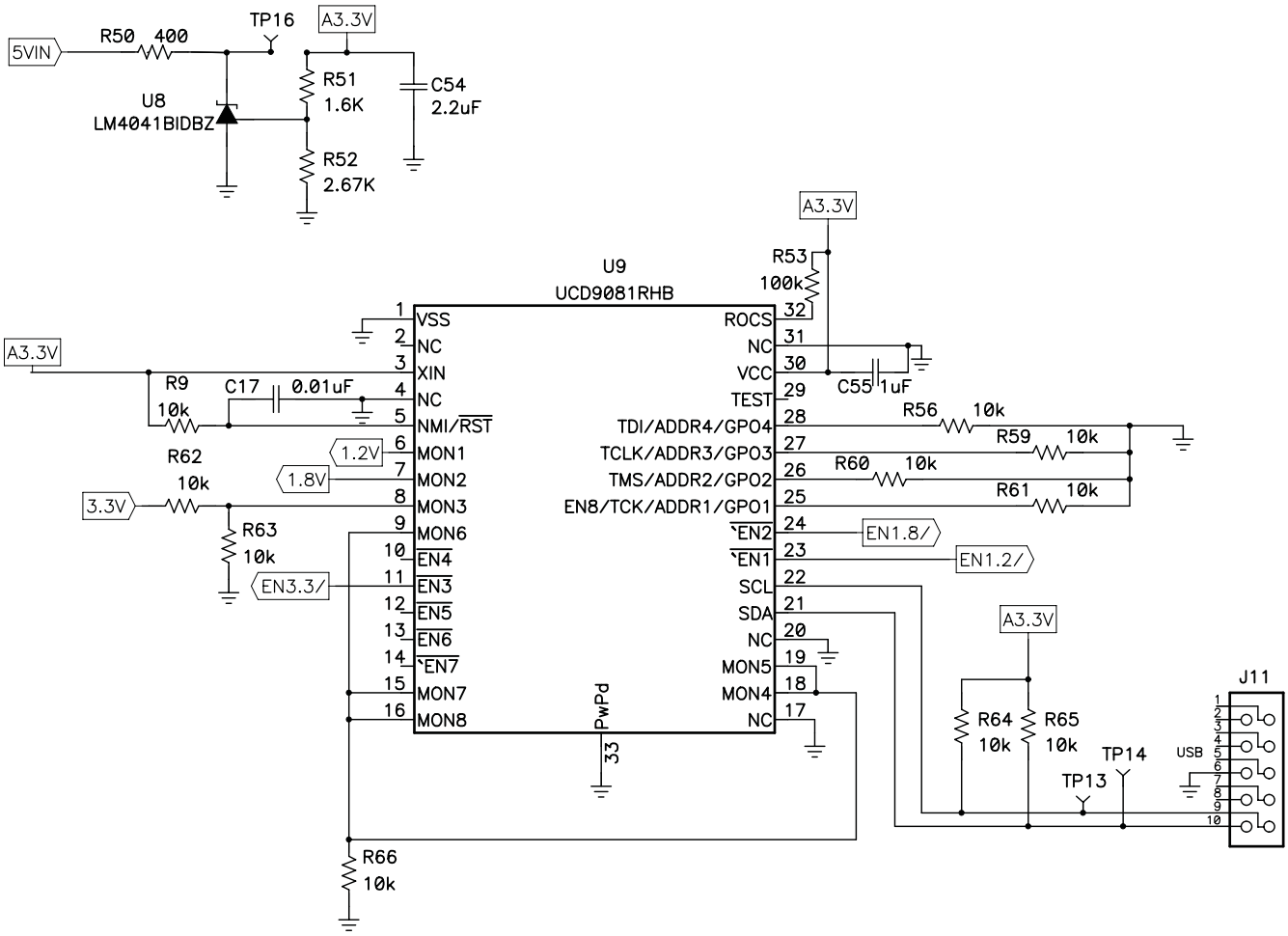


**Figure 4. Schematic**

## 5.2 Bill of Materials

**Table 2. PMP4118_REVB BOM**

| Count | RefDes | Value | Description | Size | Part Number | MFR |
|---|---|---|---|---|---|---|
| 3 | C1, C3, C16 | 10 µF | Capacitor, Ceramic, 10V, X7R, 20% | 0805 | Std | Std |
| 2 | C10, C21 | 330 µF | Capacitaor, Aluminum, 10V, 160 mΩ, ±20% | 0.328 × 0.390 inch | EEVFK1A331P | Panasonic |
| 2 | C11, C22 | 10 µF | Capacitor, Ceramic, 6.3V, X7R, 20% | 0805 | Std | Std |
| 1 | C12 | 470 pF | Capacitor, COG, 50V, 20% | 0603 | Std | Std |
| 2 | C13, C24 | 0.068 µF | Capacitor, Ceramic, 50V, COG, 20% | 0603 | Std | Std |
| 2 | C14, C26 | 560 pF | Capacitor, Ceramic, 50V, COG, 20% | 0603 | Std | Std |
| 1 | C17 | 0.01 µF | Capacitor, Ceramic, 10V, X7R, 20% | 0603 | Std | Murata |
| 2 | C2. C15 | 100 pF | Capacitor, Ceramic, 50V, COG, 20% | 0603 | Std | Std |
| 1 | C23 | 470 pF | Capacitor, Ceramic, 50V, COG, 20% | 0603 | Std | Std |
| 1 | C4 | 0.1 µF | Capacitor, Ceramic, 10V, X7R, 20% | 0603 | Std | Std |
| 1 | C5 | 10 µF | Capacitor, Ceramic, 6.3V, X7R, 20% | 0805 | Std | Std |
| 1 | C54 | 2.2 µF | Capacitor, Ceramic, 6.3V, X7R, 20% | 0805 | Std | Std |
| 1 | C55 | 1 µF | Capacitor, Ceramic, 6.3V, X5R | 0603 | Std | Std |
| 2 | C7, C18 | 1800 pF | Capacitor, Ceramic, 50V, COG, 20% | 0603 | Std | Std |
| 3 | C8, C19, C25 | 0.1 µF | Capacitor, Ceramic, 50V, X7R, 15% | 0603 | Std | Std |
| 2 | C9, C20 | 22 pF | Capacitor, Ceramic, 50V, COG, 20% | 0603 | Std | Std |
| 2 | D1, D2 | B320 | Diode, Schottky, 3A, 30V | SMC | B330 | Diodes Inc. |
| 1 | J1 | PTC36SAAN | Header, Male 2-pin, 100mil spacing, (36-pin strip) | 0.100 inch x 2 | PTC36SAAN | Sullins |
| 1 | J11 | 2510-6002UB | Connector, Male Straight 2x10 pin, 100mil spacing, 4 Wall | 0.338 x 0.788 inch | 2510-6002UB | 3M |
| 1 | J2 | PTC36SAAN | Header, Male 4-pin, 100mil spacing, (36-pin strip) | 0.100 inch x 4 | PTC36SAAN | Sullins |
| 2 | L1, L2 | 22 µH | Inductor, SMT, 3.7A, 40mΩ | 0.492 sq" | DR125-220 | Coiltronics |
| 2 | Q1, Q7 | IRLMS6702 | MOSFET, P-ch, –2.3A, 200mΩ | Micro6 | IRLMS6702 | IR |
| 2 | Q2, Q8 | 2N7002 | MOSFET, N-ch, 60-V, 115-mA, 1.2 Ω | SOT23 | 2N7002DICT | Vishay-Liteon |
| 1 | Q3 | BSS138 | MOSFET, N-ch, 50-V, 200-mA, 3.5 Ω | SOT23 | BSS138 | Diodes, Inc. |
| 2 | R1, R19 | 68.1K | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 1 | R12 | 143K | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 6 | R13, R14, R17, R18, R21, R29 | 100K | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 2 | R15, R30 | 100K | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 2 | R16, R31 | 49.9 | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 2 | R2, R20 | 0.039 | Resistor, Chip, 1/3W, 5% | 1210 | ERJ-L14K39MU | Panasonic |
| 1 | R28 | 6.4k | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 1 | R4 | 52.3K | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 2 | R5, R22 | 1K | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 1 | R50 | 400 | Resistor, Chip, 1/10W, 1% | 0805 | Std | Std |
| 1 | R51 | 1.6K | Resistor, Chip, 1/16W, 0.1% | 0603 | Std | Std |
| 1 | R52 | 2.67K | Resistor, Chip, 1/16W, 0.1% | 0603 | Std | Std |
| 1 | R53 | 100k | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 1 | R6 | 30.1K | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 2 | R7, R23 | 0 | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 2 | R8, R27 | 53.6K | Resistor, Chip, 1/16W, 1% | 0603 | Std | Std |
| 10 | R9, R56, R59–R66 | 10k | Resistor, Chip, 1/16W, 5% | 0603 | Std | Std |
| 9 | TP1, TP3, RP6, TP9, TP11, TP13–TP16 | 5000 | Test point, Red, thru Hole Color Keyed | 0.100 x 0.100 inch | 5000 | Keystone |
| 2 | TP4, TP12 | 5011 | Test Point, Black, Thru hole | 0.125 x 0.125 inch | 5011 | Keystone |
| 2 | TP5, RP10 | 5013 | Test Point, Orange, Thru hole | 0.125 x 0.125 inch | 5013 | Keystone |
| 1 | U1 | TPS73701DCQ | IC, Cap-free NMOS, 400mA LDO Regulator with Reverse current protection | SOT223-6 | TPS73701DCQ | TI |

**Table 2. PMP4118_REVB BOM (continued)**

| Count | RefDes | Value | Description | Size | Part Number | MFR |
|---|---|---|---|---|---|---|
| 2 | U2, U3 | TPS402000D | IC, Low cost sync buck controller | SO-8 | TPS40200D | TI |
| 1 | U8 | LM4041BIDBZ | IC, Micropower shunt voltage reference 100 ppm/°C, 45µA–12mA, Adjustable | SOT23 | LM4041BIDB | TI |
| 1 | U9 | UCD9081RHB | IC, Power supply sequencer and monitor | QFN-32 | UCD9081RHB | TI |

Notes: 1. These assemblies are ESD sensitive, ESD precautions shall be observed.
2. These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
3. These assemblies must comply with workmanship standards IPC-A-610 Class 2.
4. Ref designators marked with an asterisk ('**') cannot be substituted. All other components can be substituted with equivalent MFG's components.

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