CapDyn

Board configuration guide
Linear version

Introduction

This document will guide you in configuring CapDyn's board for your needs. The board provides the possibility to choose the number of stages that will be used to store energy gathered from the energy harvesting source: you can choose to use 3, 4, or 5 stages. After choosing the number of stages based on your needs, you have to go through the "configuration process" section in order to configure each section of the board properly. Furthermore, each section that composes the board can be tested individually.

Overview

The board is composed of 9 separate sections that you can see as black-box components in Fig.1

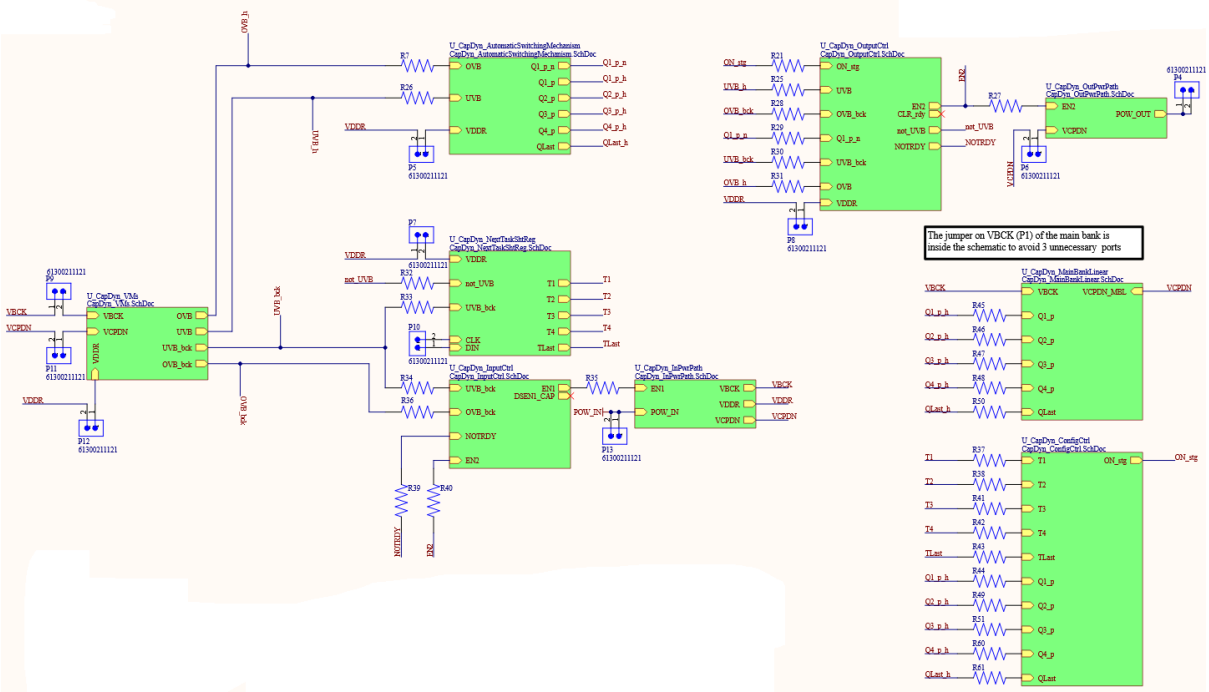

Fig. 1: Top level architecture

Each one needs to be properly configured in order to obtain the desired behaviour from CapDyn. For optimizing the number of components on the board, some ICs are shared across different sections of the board; these components have a dedicated power line to power them up when needed. The shared components are:

Shared component ID	Sections	Power jumper
U71	• Input Control • Next Task Shift Register	P16

U76	• Input Control • Next Task Shift Register • Voltage Monitor • Automatic Switching Mechanism	P14
U77	• Input Control • Automatic Switching Mechanism • Output Control	P15
U92	• Voltage Monitor • Automatic Switching Mechanism	P17

Table 1: Shared components

In the following sections we will describe the configuration process.
Some of the board's sections contain ICs that can be connected or omitted to change the board's configuration (0-OHM resistors, solder bridges) and others which can be connected in different ways according to the desired configuration (jumpers).
Note: all the resistors named in the following sections are intended to be 0-OHM resistors.

Configuration process

Top-level schematic

To connect the board with the energy harvesting device you can use P13 for VDD and P2 for GND connections.

Each section that you can see in Fig. 1 has a dedicated power line and many 0-OHM resistors for input and output signals. For each section, you have to close the power jumper and to solder the adjacent 0-OHM resistors to connect each section's input to the rest of the circuit as described in Table 2.

Section	Power jumpers	0-OHM resistors on input signals
Voltage monitors	P9 - P11 - P12	-
Automatic switching mechanism	P5	R7 - R26
Output control	P8	R21 - R25 - R28 - R29 - R30 - R31
Output power path	P6	R27
Next task shift register	P7	R32 - R33

Main bank	P1 (see specific section for more details)	R45 - R46 - R47 - R48 - R50
Input control	-	R34 - R36 - R39 - R40
Input power path	-	R35
Configuration control	-	R37 - R38 - R41 - R42 - R43 - R44 - R49 - R51 - R60 - R61

Table 2: Top-level sections configuration

You also have to close the jumpers connected to the shared components if needed as described in Table 1.

Voltage monitors

See Table 2 for power jumpers and 0-OHM resistors on input signals.

This section contains shared components that need to be powered as described in table 1: U76 - U92.

No more configuration is needed.

Automatic switching mechanism

See Table 2 for power jumpers and 0-OHM resistors on input signals.

This section contains shared components that need to be powered as described in table 1: U76 - U77 - U92.

In this section, the components which can be used to choose the board's configuration are:
R3 - R4 - R5 - R6 - R58 - R59 - R94 - R95 - R96 - R98 - SBxx (solder bridges).
To configure this section for **3 stages:**

- Connect R3 - R98
- Close SB7 - SB9 - SB15 - SB20

To configure this section for **4 stages:**

- Connect R4 - R58 - R59 - R95 - R96
- Close SB8 - SB10 - SB12 - SB13 - SB15 - SB16 - SB18 - SB20

To configure this section for **5 stages:**

- Connect R5 - R6 - R58 - R59 - R94 - R95
- Close all the SBxx which are NOT connected to GND (SB8 - SB10 - SB11 - SB12 - SB13 - SB14 - SB17 - SB19)

Output control

See Table 2 for power jumpers and 0-OHM resistors on input signals.
This section contains shared components that need to be powered as described in table 1: U77.

No more configuration is needed.

Output power path

See Table 2 for power jumpers and 0-OHM resistors on input signals.

No more configuration is needed

Next task shift register

See Table 2 for power jumpers and 0-OHM resistors on input signals.

This section requires 2 external signals generated by the external MSP430FR5994 which have to be connected in the following way:

- Shift register data in: Connect to P10.1
- Shift register clock: Connect to P10.2

In this section, the components which can be used to choose the board's configuration are:
R55 - R1 - R2 - R8 - SBxx (solder bridges) - Jx (jumpers)
This section contains shared components that need to be powered as described in table 1: U76.
To configure this section for **3 stages:**

- Connect R1
- Connect pin 1 to pin 2 of J1 - J7 - J8 - J9 - J10
- Connect pin 2 to pin 3 of J2 - J3 - J4 - J5 - J6

To configure this section for **4 stages:**

- Connect R2 - R55
- Close SB1 - SB2 - SB4 - SB6
- Connect pin 1 to pin 2 of: J1 - J7 - J8 - J9 - J10
- Connect pin 2 to pin 3 of J2 - J3 - J4 - J5 - J6

To configure this section for **5 stages:**

- Connect R8 - R55
- Close SB1 - SB2 - SB3 - SB5
- Connect pin 1 to pin 2 of J1 - J7 - J8 - J9 - J10
- Connect pin 2 to pin 3 of J2 - J3 - J4 - J5 - J6

Additionally, this section allows you to freely insert a logical "one" inside the shift register at an position without relying on the action of the CLK line (**Note:** there must be exactly zero or one logical "one" inside the shift register for the board to work properly)
To set the **position 1** of the shift register:

- Connect pin 1 to pin 2 of J1 - J7 - J8 - J9 - J10
- Connect pin 2 to pin 3 of J2 - J3 - J4 - J5 - J6

To set the **position 2** of the shift register:

- Connect pin 1 to pin 2 of J2 - J6 - J8 - J9 - J10
- Connect pin 2 to pin 3 of J1 - J3 - J4 - J5 - J7

To set the **position 3** of the shift register:

- Connect pin 1 to pin 2 of J3 - J6 - J7 - J9 - J10
- Connect pin 2 to pin 3 of J1 - J2 - J4 - J5 - J8

To set the **position 4** of the shift register:

- Connect pin 1 to pin 2 of J4 - J6 - J7 - J8 - J10
- Connect pin 2 to pin 3 of J1 - J2 - J3 - J5 - J9

To set the **position 5** of the shift register:

- Connect pin 1 to pin 2 of J5 - J6 - J7 - J8 - J9
- Connect pin 2 to pin 3 of J1 - J2 - J3 - J4 - J10

Main bank (linear)

See Table 2 for 0-OHM resistors on input signals.

In this section, the components which can be used to choose the board's configuration are:
R9 - R20 - R100 - R101 - R102 - R103 - P1 (jumper) - C3 - C4 - C18 - C19 - C20 - C21 - C22 - C23 - C24 - C25 - C26 - C27 - C28 - C40 - C49 - C50 - C51 - C52 - C53 - C54 - C55 - C56 - C57 - C58 - C59 - C60 - C61 - C62 - C63 - C64 - C65 - C66 - C67 - C68 - C69 - C70 - C71 - C72 - C73 - C74 - C75 - C76 - C77 - C78 - C79 - C80 - C81 - C82.

You can choose between 3 different types of capacitors to solder on the board to build the stages:

- **Supercap** (SCMR14D47PRBB0)
- **Ceramic** (GRM31CR60J227ME11L)
- **Tantalum** (TR3W157M020C0200)

In Table 3 you can read the capacitors you'll have to solder based on the required number of stages and the capacitor's type.

# of stages \ capacitors type	Supercap	Ceramic	Tantalum
3 stages	C3 - C19 - C22 - C23	C4 - C20 - C24 - C25	C18 - C21 - C26 - C27
4 stages	C3 - C19 - C22 - C23 - C28 - C40 - C49 - C50	C4 - C20 - C24 - C25 - C51 - C52 - C53 - C54	C18 - C21 - C26 - C27 - C55 - C56 - C57 - C58
5 stages	C3 - C19 - C22 - C23 - C28 - C40 - C49 - C50 - C59 - C60 - C61 - C62 - C63 - C64 - C65 - C66	C4 - C20 - C24 - C25 - C51 - C52 - C53 - C54 - C67 - C68 - C69 - C70 - C71 - C72 - C73 - C74	C18 - C21 - C26 - C27 - C55 - C56 - C57 - C58 - C75 - C76 - C77 - C78 - C79 - C80 - C81 - C82

Table 3: Capacitors configuration

To configure this section for **3 stages:**

- Connect R9 - R45 - R46
- Connect pin 1 to pin 2 of P1
- Read table 3 for capacitors configuration

To configure this section for **4 stages:**

- Connect R9 - R20 - R45 - R46 - R47 - R100 - R101
- Connect pins 1, 2, and 3 of P1
- Read table 3 for capacitors configuration

To configure this section for **5 stages:**

- Connect R9 - R45 - R46 - R47 - R48 - R100 - R101 - R102 - R103
- Connect pins 1, 2, 3 and 4 of P1
- Read table 3 for capacitors configuration

Input control

See Table 2 for power jumpers and 0-OHM resistors on input signals.

This section contains shared components that need to be powered as described in table 1: U76 - U77.

No more configuration is needed.

Input power path

See Table 2 for power jumpers and 0-OHM resistors on input signals.

No configuration is needed

Configuration control

See Table 2 for power jumpers and 0-OHM resistors on input signals.

In this section, the components which can be used to choose the board's configuration are:
R52 - R53 - R54 - R56 - R57
This section contains shared components that need to be powered as described in table 1: U76.
To configure this section for **3 stages:**

- Connect R54 - R56 - R57

To configure this section for **4 stages:**

- R53 - R54 - R56 - R57

To configure this section for **5 stages:**

- R52 - R53 - R54 - R56 - R57

Note: while R52 and R53 are used for choosing the number of stages, R54 - R56 and R57 can be removed to prevent a task at, respectively, TLast, T2 and T1 to be executed.