TÉCNICO LISBOA

Lab 2

Power block verilog model

Systems On-Chip

Group nr.:	3
Student-ID-1: ist1112497	Kristian Guttormsen Gøystdal
Student-ID-2: ist1113000	Miki Tecle Hagos
Student-ID-3: ist1112548	Einar Bergslid

Electrical and Computer Engineering
IST-ALAMEDA

2024

1 Power block design

Based on the datasheet provided for the power block, we designed the power block like shown in Listing 1. The power block will provide these calculated values based on the different input configurations for the battery charger. The selection of current is made using the control signals, **cc**, **tc** and **cv**, that are set in the control unit.

```
1   // Calculate forced battery current
2   if (cc) begin
3     rl_iforcedbat = rl_C * (0.502 * icc[7] + 0.251 * icc[6] +
        0.1255 * icc[5] + 0.0627 * icc[4] + 0.0314 * icc[3] + 0.0157
        * icc[2] + 0.0078 * icc[1] + 0.0039 * icc[0]);
4   end else if (tc) begin
5     rl_iforcedbat = rl_C * (0.502 * itc[7] + 0.251 * itc[6] +
        0.1255 * itc[5] + 0.0627 * itc[4] + 0.0314 * itc[3] + 0.0157
        * itc[2] + 0.0078 * itc[1] + 0.0039 * itc[0]);
6   end else if (cv) begin
7     rl_iforcedbat = (rl_vcv - rl_vsensbat) / rl_Rch;
8   end else begin
9     rl_iforcedbat = 0;
10  end
```

Listing 1: `always` block that monitors charging state

2 Simulations

When simulating the new power charger block using the provided testbench we get the results shown in Listing 2. These values for the output current are close to the expected values for the given configurations for the battery and charger.

Listing 2: Console output from testbench of power block

```
cc=0, tc=0, cv=0, (cv_voltage=3,7V cc=0.2A tc=0,04A) output
   current is: 0.000000 A
cc=1, tc=0, cv=0, (cv_voltage=3,7V cc=0.2A tc=0,04A) output
   current is: 0.199200 A
cc=0, tc=1, cv=0, (cv_voltage=3,7V cc=0.2A tc=0,04A) output
   current is: 0.039200 A
```

```
cc=0, tc=0, cv=1, (cv_voltage=3,7V cc=0.2A tc=0,04A) output
   current is: 0.093250 A
Simulation complete via $finish(1) at time 400 NS + 0
```

In Figure 1, we can see the simulation of the charger using the old power block and how the values look for each charging mode.

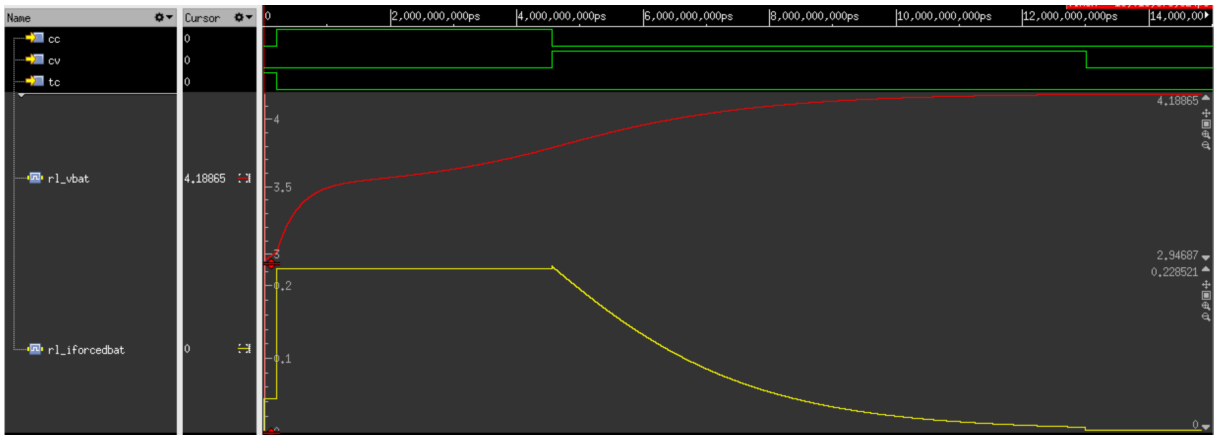

Figure 1: Current and voltage using old power block

This is how the charger with the new power block should look, with the correct current for each charging mode. If we compare Figure 1 to Figure 2, we can see that they share the same shape. The current value for the new power block is current reflected for each mode and the battery charges as expected.

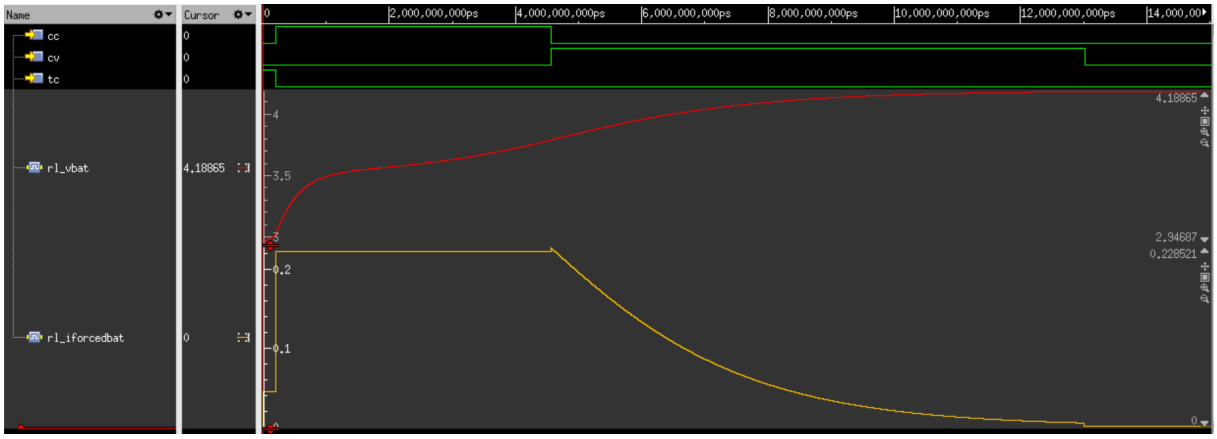

Figure 2: Current and voltage using new power block