

TODO:

- Hall sensors (2 V diode for the supply + 2 × MOS level shifter)
- Tray full sensor
- Pinch sensor
- Dome LED

TODO later:

- Bluetooth (MDBT40?)

L. Sartory

Sheet: /
File: LitterRobot.sch

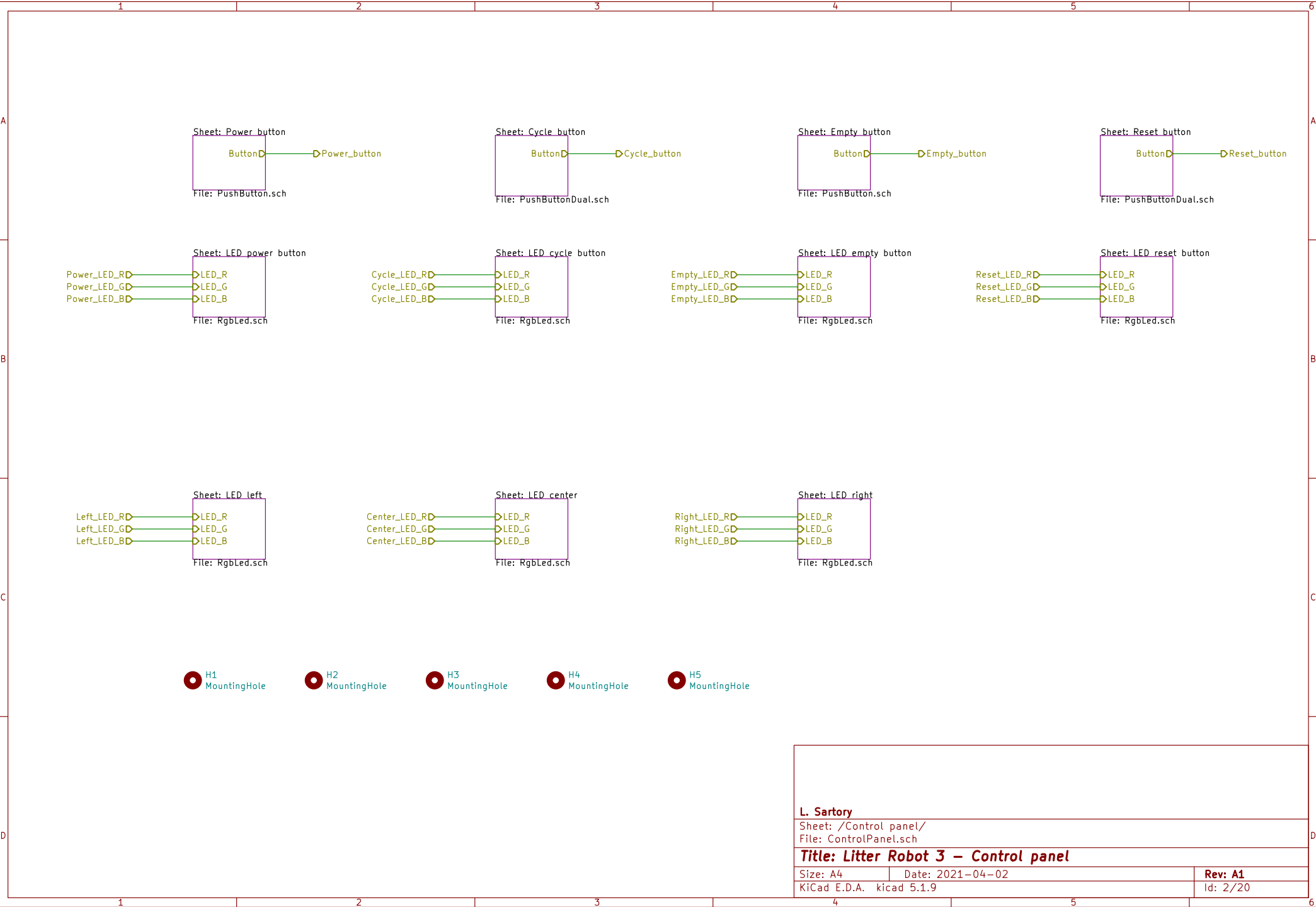
Title: Litter Robot 3 – Main board

Size: A4 Date: 2021-04-02

KiCad E.D.A. kicad 5.1.9

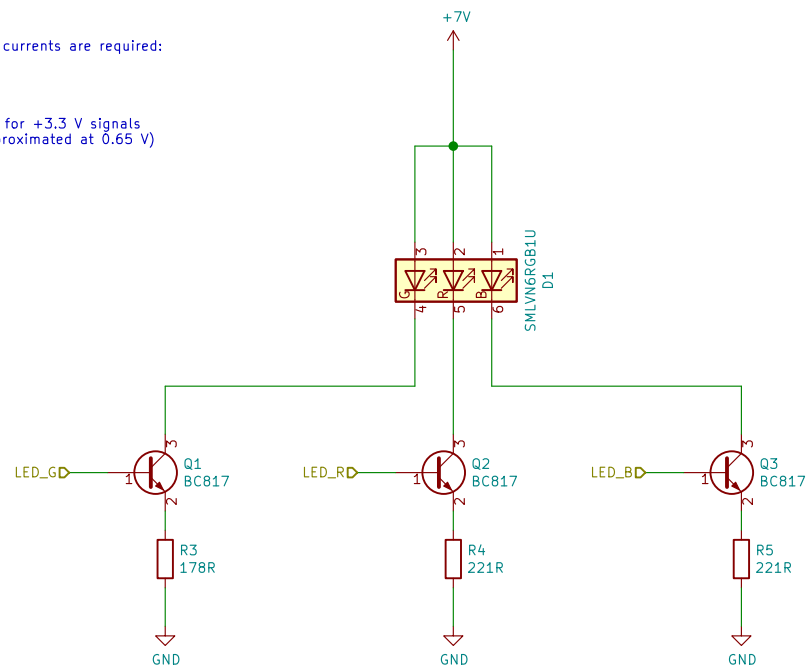
Rev: A1

Id: 1/20



For white light, the following currents are required:
 $I_{red} = 12 \text{ mA}$
 $I_{green} = 15 \text{ mA}$
 $I_{blue} = 12 \text{ mA}$

The resistors were calculated for +3.3 V signals
 (V_{be} of the transistors is approximated at 0.65 V)



L. Sartory

Sheet: /Control panel/LED left/
 File: RgbLed.sch

Title: Litter Robot 3 – RGB LED

Size: A4 Date: 2021-04-02

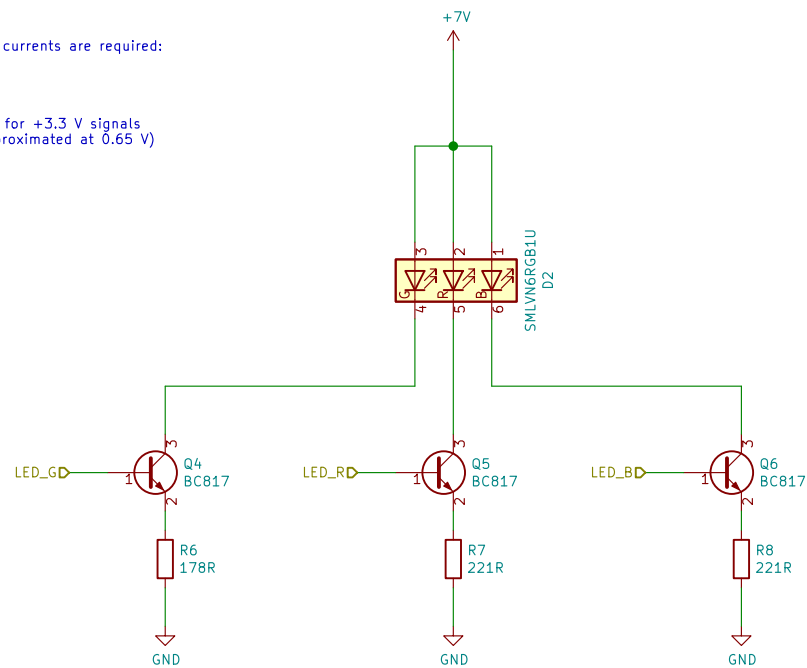
KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 3/20

For white light, the following currents are required:
I_{red} = 12 mA
I_{green} = 15 mA
I_{blue} = 12 mA

The resistors were calculated for +3.3 V signals
(V_{be} of the transistors is approximated at 0.65 V)



L. Sartory

Sheet: /Control panel/LED right/
File: RgbLed.sch

Title: Litter Robot 3 – RGB LED

Size: A4 Date: 2021-04-02

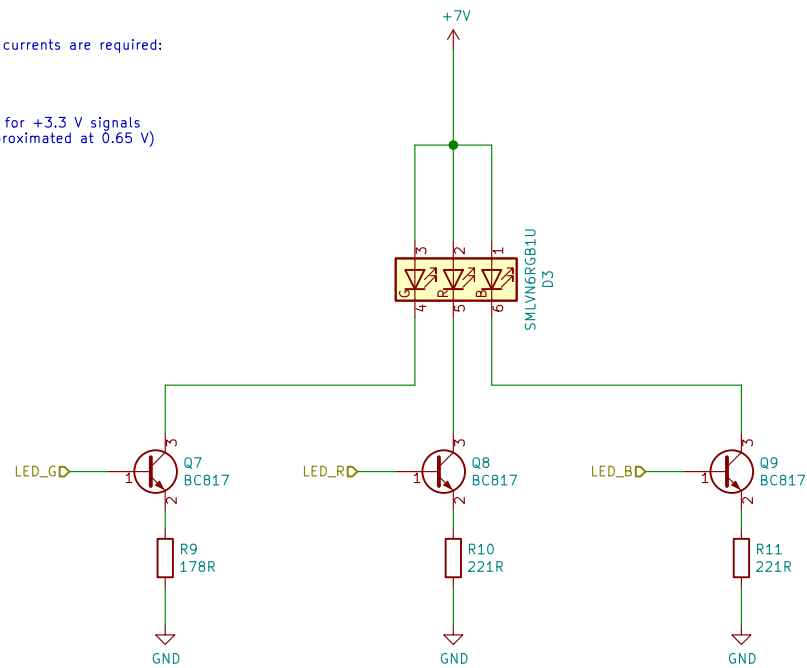
KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 4/20

For white light, the following currents are required:
I_{red} = 12 mA
I_{green} = 15 mA
I_{blue} = 12 mA

The resistors were calculated for +3.3 V signals
(V_{be} of the transistors is approximated at 0.65 V)



L. Sartory

Sheet: /Control panel/LED center/
File: RgbLed.sch

Title: Litter Robot 3 – RGB LED

Size: A4 Date: 2021-04-02

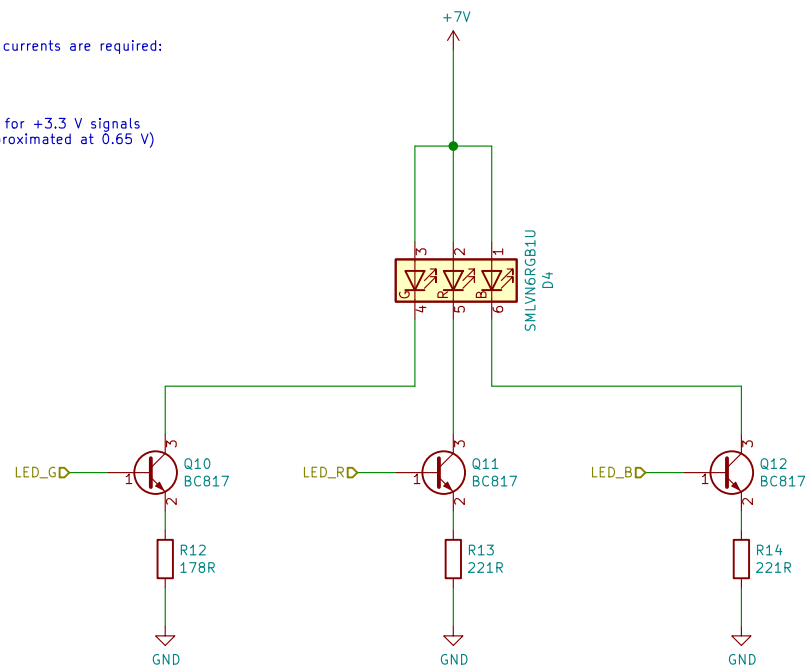
KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 5/20

For white light, the following currents are required:
I_{red} = 12 mA
I_{green} = 15 mA
I_{blue} = 12 mA

The resistors were calculated for +3.3 V signals
(V_{be} of the transistors is approximated at 0.65 V)



L. Sartory

Sheet: /Control panel/LED cycle button/
File: RgbLed.sch

Title: Litter Robot 3 – RGB LED

Size: A4 Date: 2021-04-02

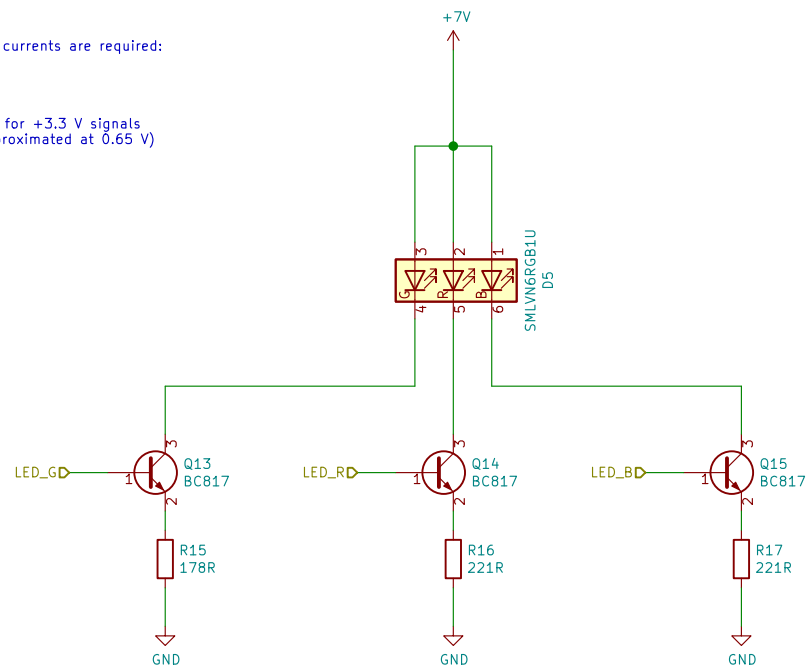
KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 6/20

For white light, the following currents are required:
I_{red} = 12 mA
I_{green} = 15 mA
I_{blue} = 12 mA

The resistors were calculated for +3.3 V signals
(V_{be} of the transistors is approximated at 0.65 V)



L. Sartory

Sheet: /Control panel/LED reset button/
File: RgbLed.sch

Title: Litter Robot 3 – RGB LED

Size: A4 Date: 2021-04-02

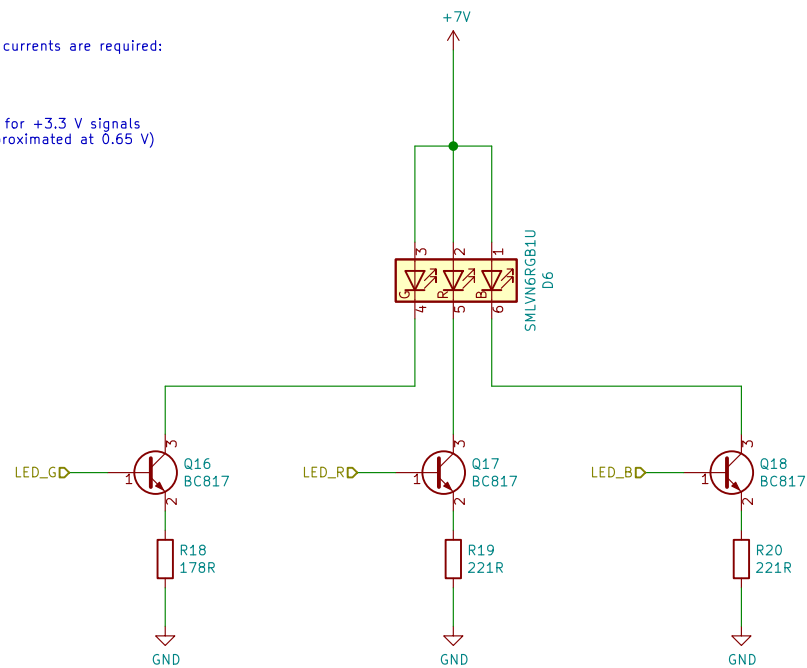
KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 7/20

For white light, the following currents are required:
I_{red} = 12 mA
I_{green} = 15 mA
I_{blue} = 12 mA

The resistors were calculated for +3.3 V signals
(V_{be} of the transistors is approximated at 0.65 V)



L. Sartory

Sheet: /Control panel/LED empty button/
File: RgbLed.sch

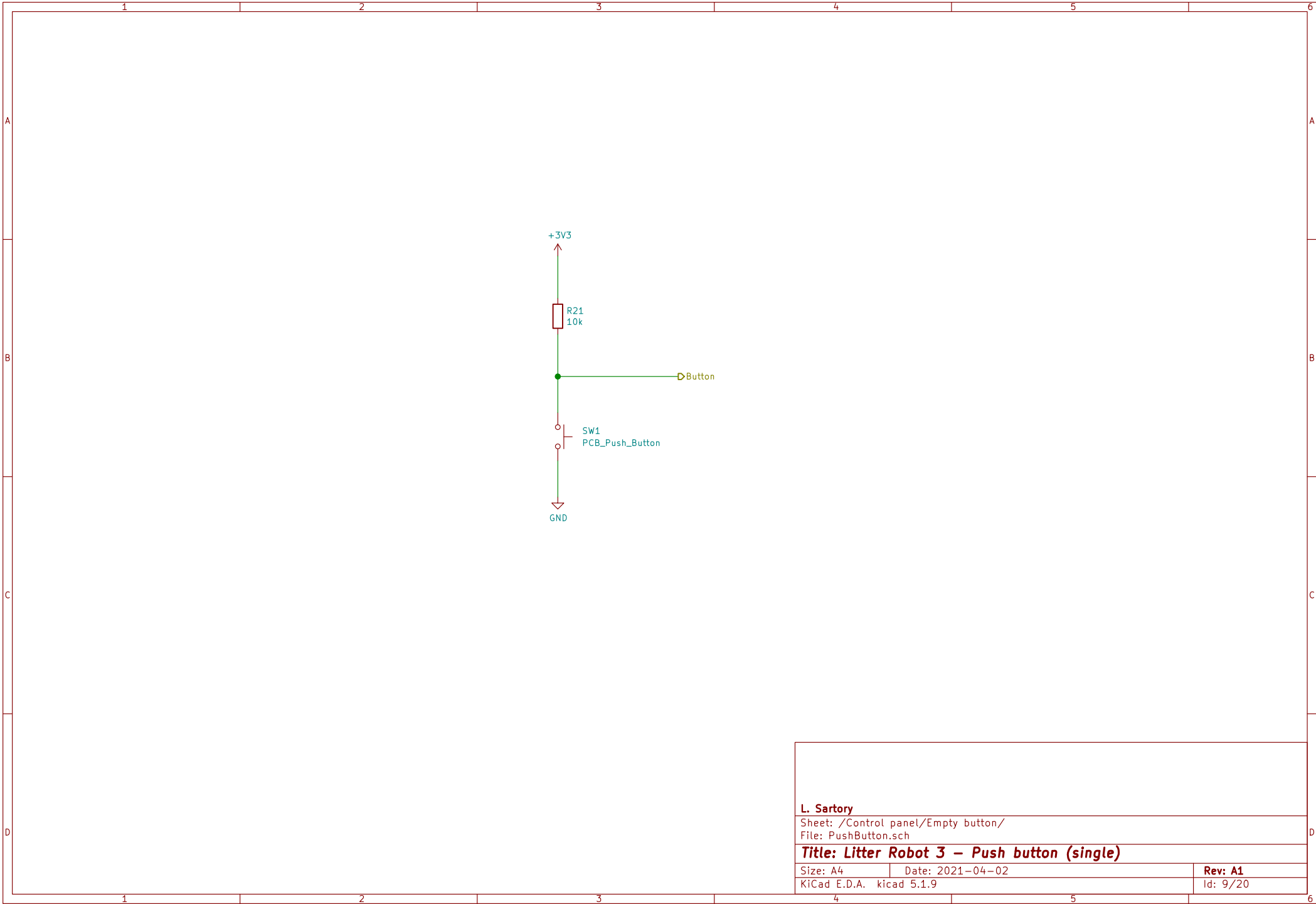
Title: Litter Robot 3 – RGB LED

Size: A4 Date: 2021-04-02

KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 8/20



L. Sartory

Sheet: /Control panel/Empty button/
File: PushButton.sch

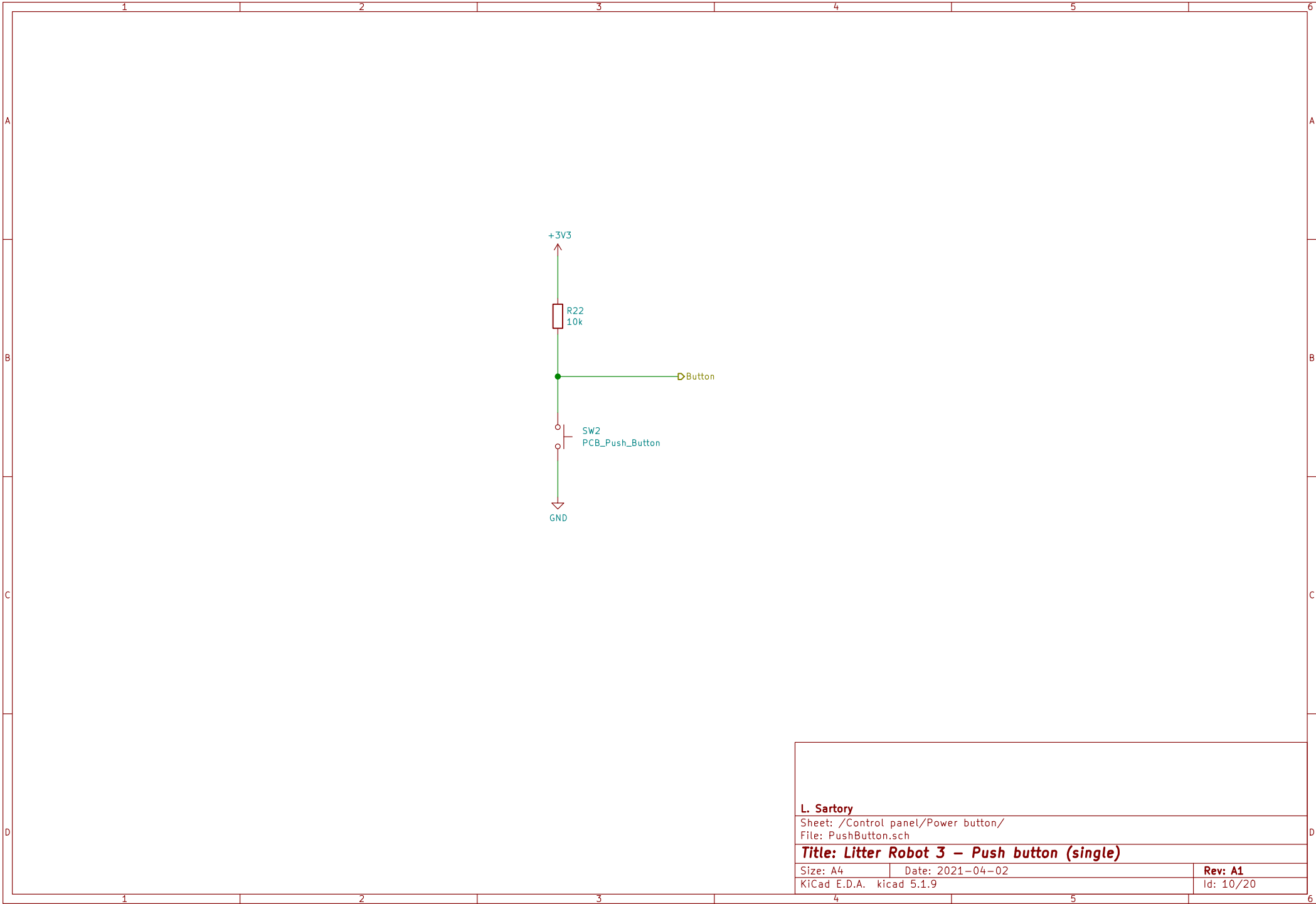
Title: Litter Robot 3 – Push button (single)

Size: A4 Date: 2021-04-02

KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 9/20



L. Sartory

Sheet: /Control panel/Power button/
File: PushButton.sch

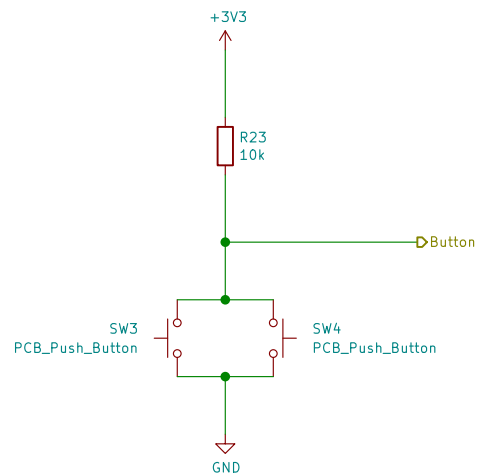
Title: Litter Robot 3 – Push button (single)

Size: A4 Date: 2021-04-02

Rev: A1

KiCad E.D.A. kicad 5.1.9

Id: 10/20



L. Sartory

Sheet: /Control panel/Cycle button/
File: PushButtonDual.sch

Title: Litter Robot 3 – Push button (dual)

Size: A4 Date: 2021-04-02

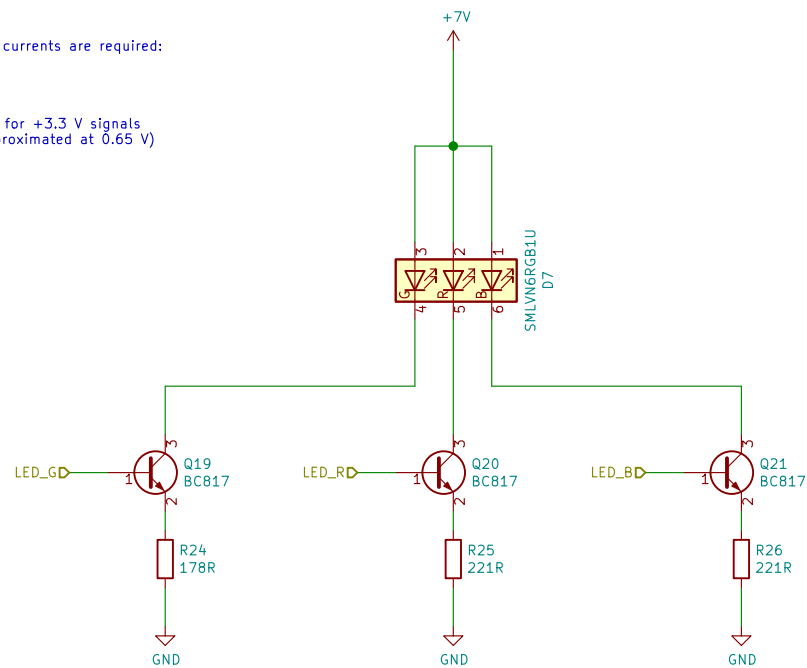
KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 11/20

For white light, the following currents are required:
I_{red} = 12 mA
I_{green} = 15 mA
I_{blue} = 12 mA

The resistors were calculated for +3.3 V signals
(V_{be} of the transistors is approximated at 0.65 V)



L. Sartory

Sheet: /Control panel/LED power button/
File: RgbLed.sch

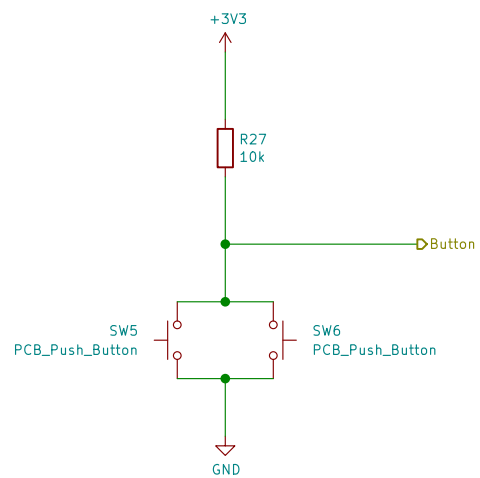
Title: Litter Robot 3 – RGB LED

Size: A4 Date: 2021-04-02

KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 12/20



L. Sartory

Sheet: /Control panel/Reset button/
File: PushButtonDual.sch

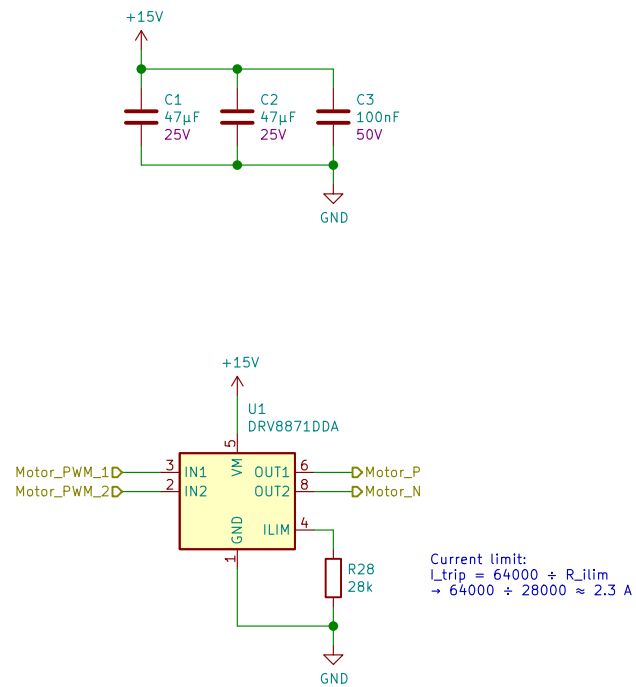
Title: Litter Robot 3 – Push button (dual)

Size: A4 Date: 2021-04-02

KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 13/20



L. Sartory

Sheet: /Motor driver/
 File: MotorDriver.sch

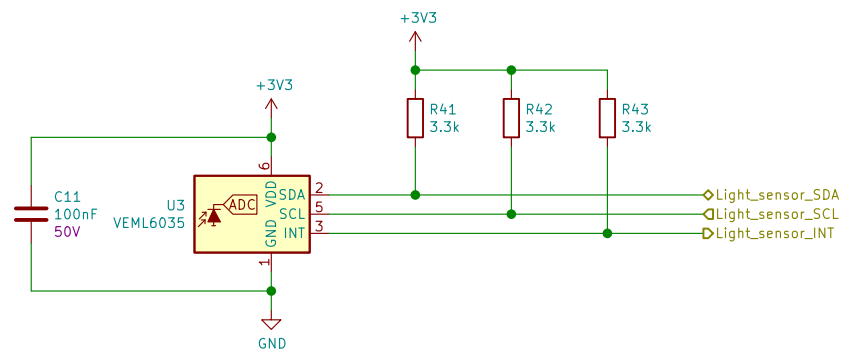
Title: Litter Robot 3 – Motor driver

Size: A4 Date: 2021-04-02

KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 14/20



L. Sartory

Sheet: /Light sensor/
File: LightSensor.sch

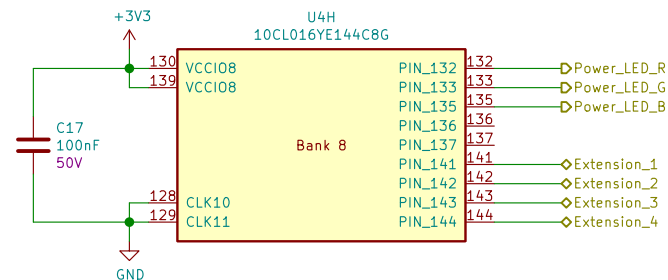
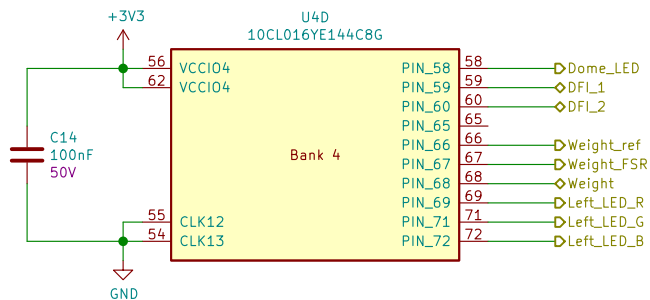
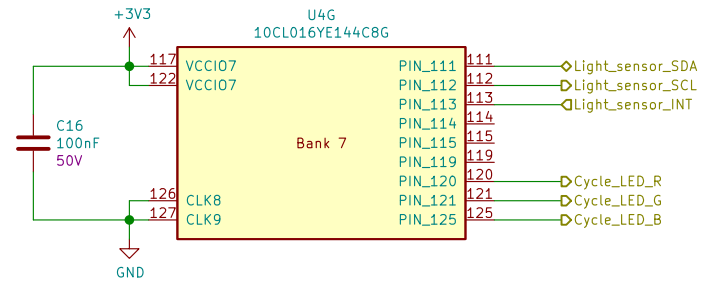
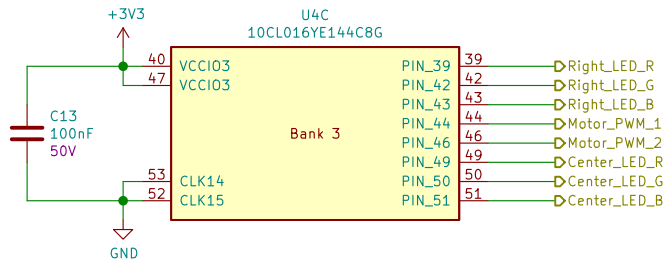
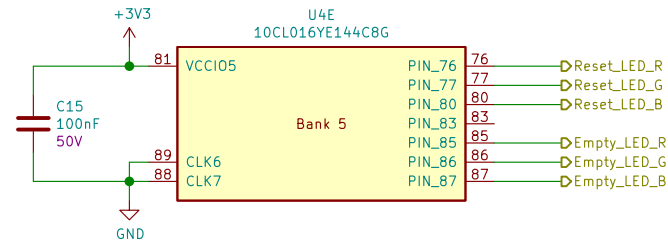
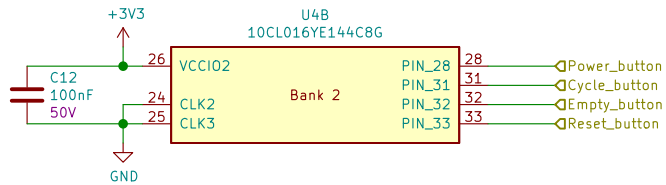
Title: Litter Robot 3 – Ambient light sensor

Size: A4 Date: 2021-04-02

KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 16/20



Sheet: FPGA config
Power_good

File: FpgaConfig.sch

Sheet: FPGA power

File: FpgaPower.sch

L. Sartory

Sheet: /FPGA/
File: Fpga.sch

Title: Litter Robot 3 – FPGA

Size: A4 Date: 2021-04-02
KiCad E.D.A. kicad 5.1.9

Rev: A1
Id: 17/20

Intel® Cyclone® 10 LP Device Family Pin Connection Guidelines:
<https://www.intel.com/content/dam/www/programmable/us/en/pdfs/literature/dp/cyclone-10/pcg-01021.pdf>

For other configuration device options:
<https://www.intel.com/content/www/us/en/programmable/support/support-resources/support-centers/configuration-support.html#intel-config-devices>

MT25QL128ABA8ESF-0SIT / MT25QL128ABA8ESF-0AAT
 MX25L12833FMI-10G
 S25FL128SAGMFI000

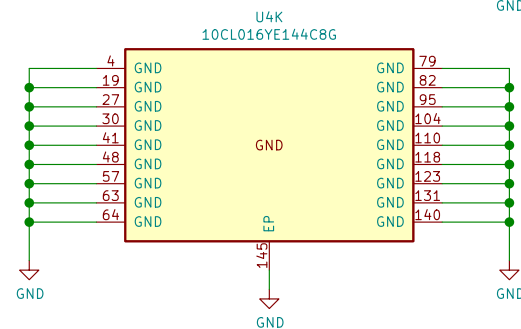
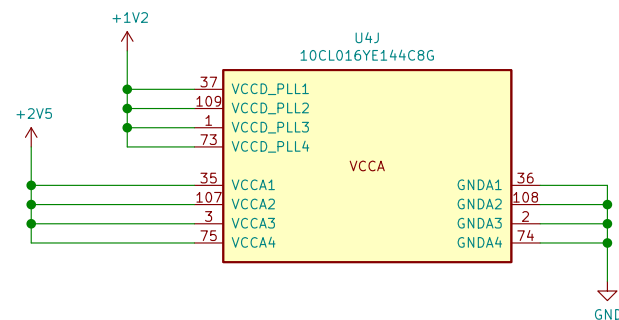
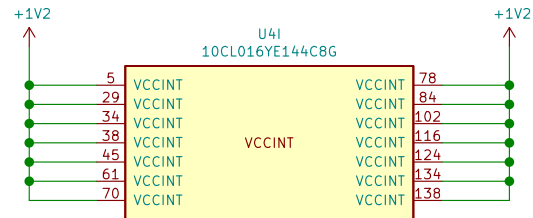
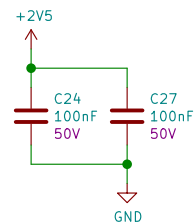
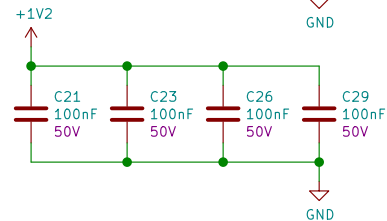
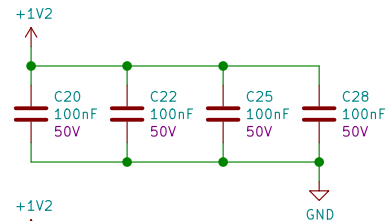
L. Sartory
 Sheet: /FPGA/FPGA config/
 File: FpgaConfig.sch
Title: Litter Robot 3 - FPGA configuration
 Size: A4 Date: 2021-04-02 Rev: A1
 KiCad E.D.A. kicad 5.1.9 Id: 18/20

MT25QL128ABA8ESF-0SIT / MT25QL128ABA8ESF-0AAT
MX25L12833FMI-10G
S25FL128SAGMFI000

Sheet: /FPGA/FPGA config/
File: FpgaConfig.sch

Size: A4	Date: 2021-04-02
KiCad E.D.A. kicad 5.1.9	

Rev: A1
Id: 18/20



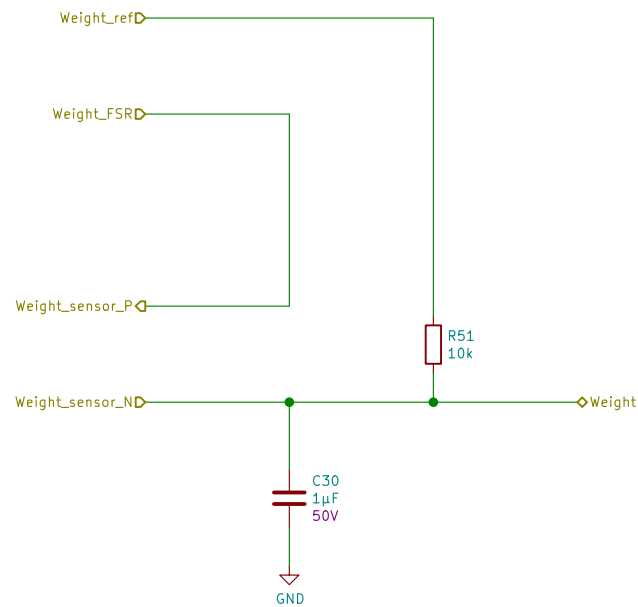
L. Sartory

Sheet: /FPGA/FPGA power/
File: FpgaPower.sch

Title: Litter Robot 3 – FPGA power supply

Size: A4 Date: 2021-04-02
KiCad E.D.A. kicad 5.1.9

Rev: A1
Id: 19/20



To measure the resistance of the force sensing resistor:

1. Set "Weight_ref" and "Weight_FSR" to high impedance
2. Set "Weight" to output low and ensure that the capacitor is completely discharged (i.e. wait long enough)
3. Set "Weight" to high impedance and set "Weight_FSR" to output high
4. Measure the time it takes until "Weight" is high
5. Repeat

Note: the reference resistor can be used instead of the FSR to periodically calibrate the measurement, since the value of the capacitor is not very accurate.

For reference:

$$\tau = R \times C = 10E3 \times 1E-6 = 10 \text{ ms} \rightarrow \sim 63.2 \% \text{ of } V_{\text{high}}$$

See https://makeabilitylab.github.io/physcomp/assets/datasheets/ForceSensitiveResistor_Interlink_IntegrationGuide.pdf (page 20)

L. Sartory

Sheet: /Weigh sensor/

File: WeightSensor.sch

Title: Litter Robot 3 – Weight sensor

Size: A4 Date: 2021-04-02

KiCad E.D.A. kicad 5.1.9

Rev: A1

Id: 20/20