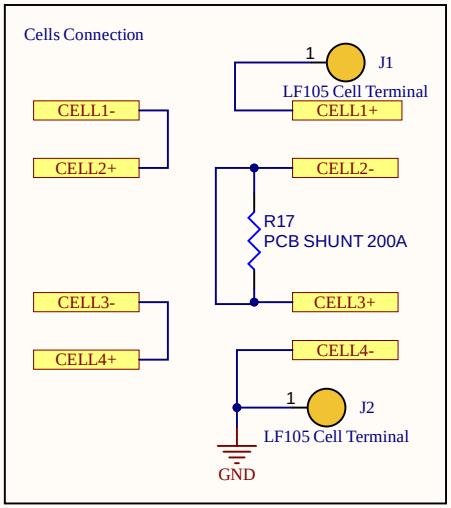

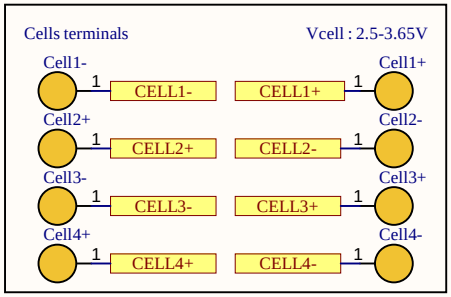

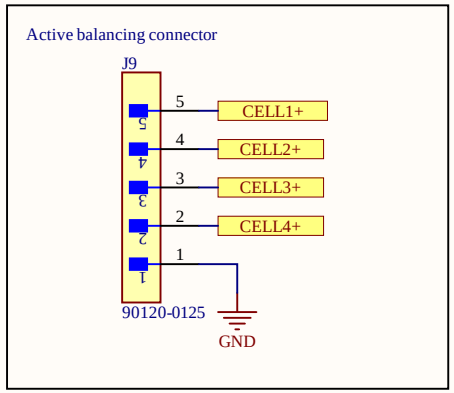

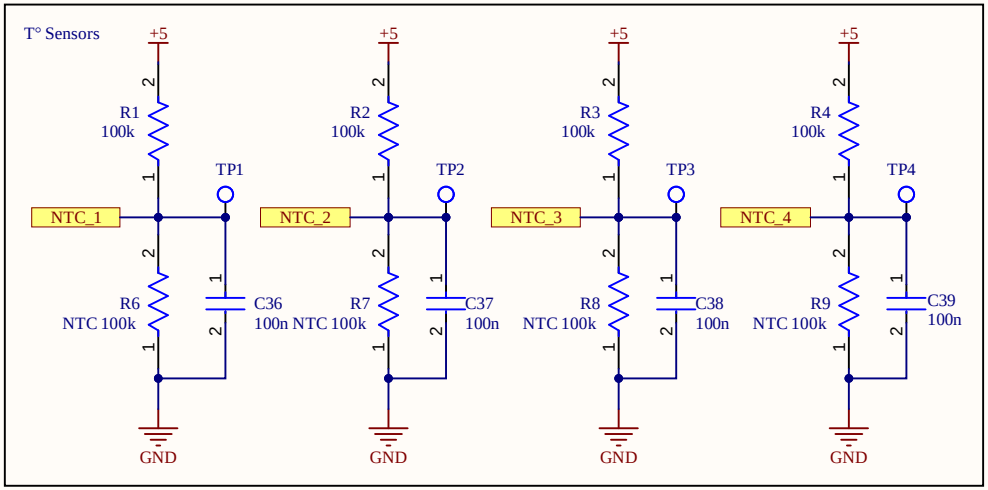

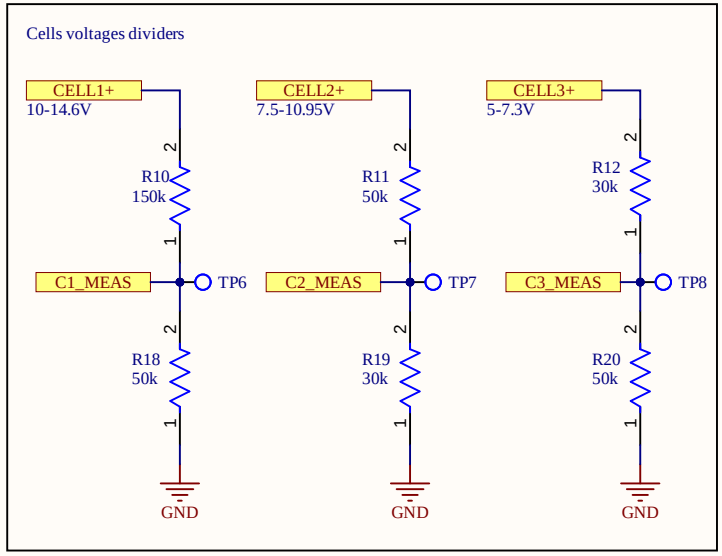

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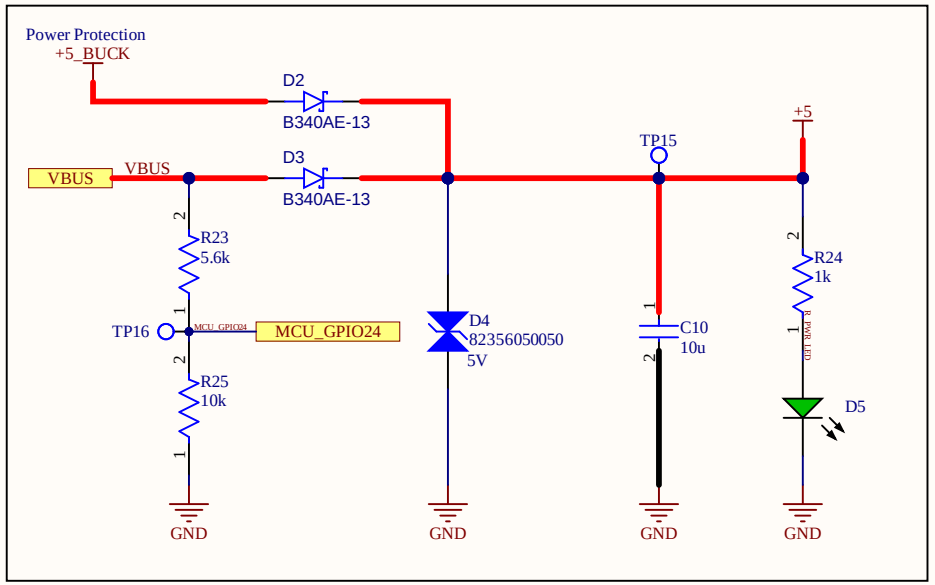
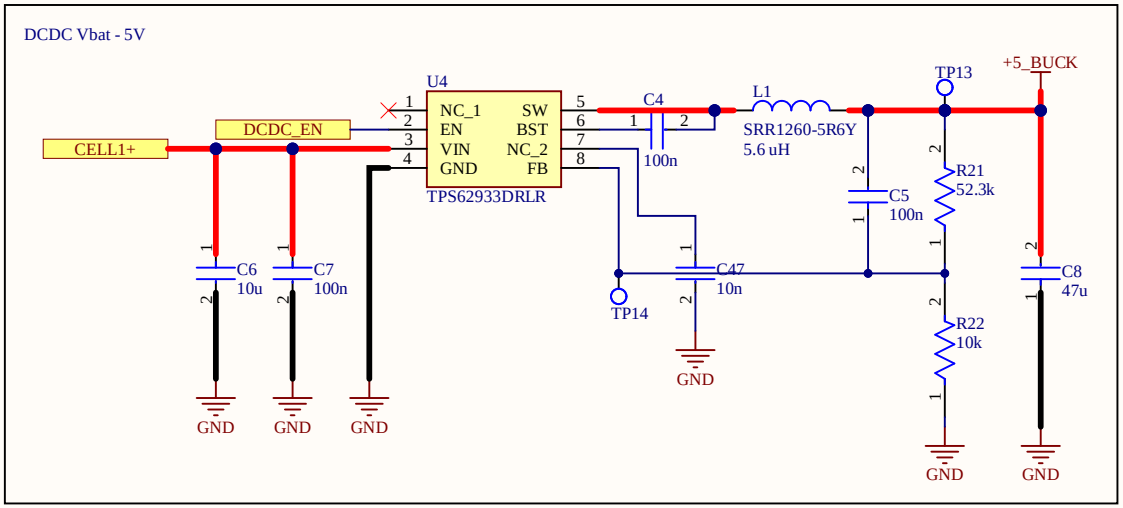
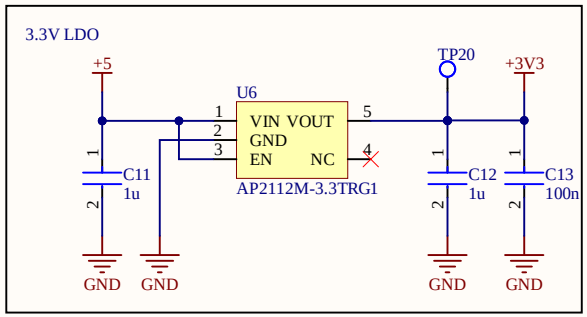




Design Notes :

3A capable
And much more...



Design Notes :

Pd = (5-3.3)*0.2 = 0.34W
Tj = 0.34*98/0.5+45 = 111°C < 150°C OK
200mA Continious capable

Power equation

MCU + FLASH + 4*Balancing + CAN
100 + 25 + 4*5 + 50 = 195mA

Title		
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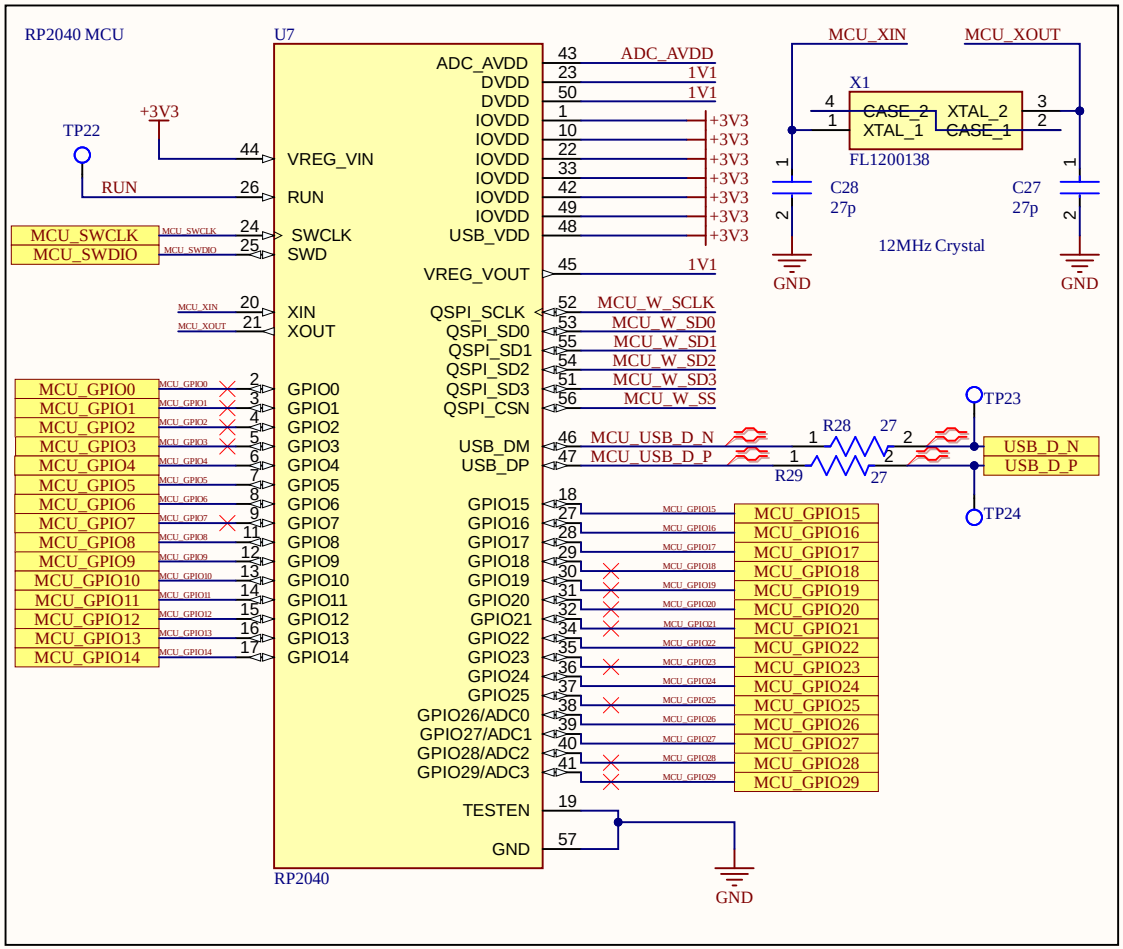
RP2040 MCU
U7
RP2040
TP22
+3V3
RUN
VREG_VIN
RUN
SWCLK
SWD
MCU_SWCLK
MCU_SWDIO
XIN
XOUT
MCU_XIN
MCU_XOUT
GPIO0
GPIO1
GPIO2
GPIO3
GPIO4
GPIO5
GPIO6
GPIO7
GPIO8
GPIO9
GPIO10
GPIO11
GPIO12
GPIO13
GPIO14
MCU_GPIO0
MCU_GPIO1
MCU_GPIO2
MCU_GPIO3
MCU_GPIO4
MCU_GPIO5
MCU_GPIO6
MCU_GPIO7
MCU_GPIO8
MCU_GPIO9
MCU_GPIO10
MCU_GPIO11
MCU_GPIO12
MCU_GPIO13
MCU_GPIO14
ADC_AVDD
DVDD
IOVDD
USB_VDD
VREG_VOUT
QSPI_SCLK
QSPI_SD0
QSPI_SD1
QSPI_SD2
QSPI_SD3
QSPI_CSN
USB_DM
USB_DP
GPIO15
GPIO16
GPIO17
GPIO18
GPIO19
GPIO20
GPIO21
GPIO22
GPIO23
GPIO24
GPIO25
GPIO26/ADC0
GPIO27/ADC1
GPIO28/ADC2
GPIO29/ADC3
TESTEN
GND
MCU_W_SCLK
MCU_W_SD0
MCU_W_SD1
MCU_W_SD2
MCU_W_SD3
MCU_W_SS
MCU_USB_D_N
MCU_USB_D_P
ADC_AVDD
1V1
+3V3
X1
CASE_2
XTAL_2
XTAL_1
CASE_1
FL1200138
12MHz Crystal
C28
27p
C27
27p
R28
27
R29
27
TP23
TP24
USB_D_N
USB_D_P
Decoupling & ADC Vref
C19
2.2u
C20
100n
C21
100n
C22
100n
C23
100n
C24
100n
C25
100n
C26
100n
C16
2.2u
C17
100n
C18
100n
TP28
R32
200
R33
C29
2.2u
ADC_VREF
Bootloader SW
R30
1k
TP25
SW3
FSM4JSMATR
C42
100n
Reset SW
R31
10k
TP26
TP27
SW2
FSM4JSMATR
Q3
BSS138
C41
100n
SQPI Flash
U8
VCC
CLK
DI(IO0)
DO(IO1)
WP(IO2)
HOLD(IO3)
CS
EP
W25Q16JVUXIQ
C14
2.2u
C15
100n
Debug connector
J3
87224-3
UART Out
J8
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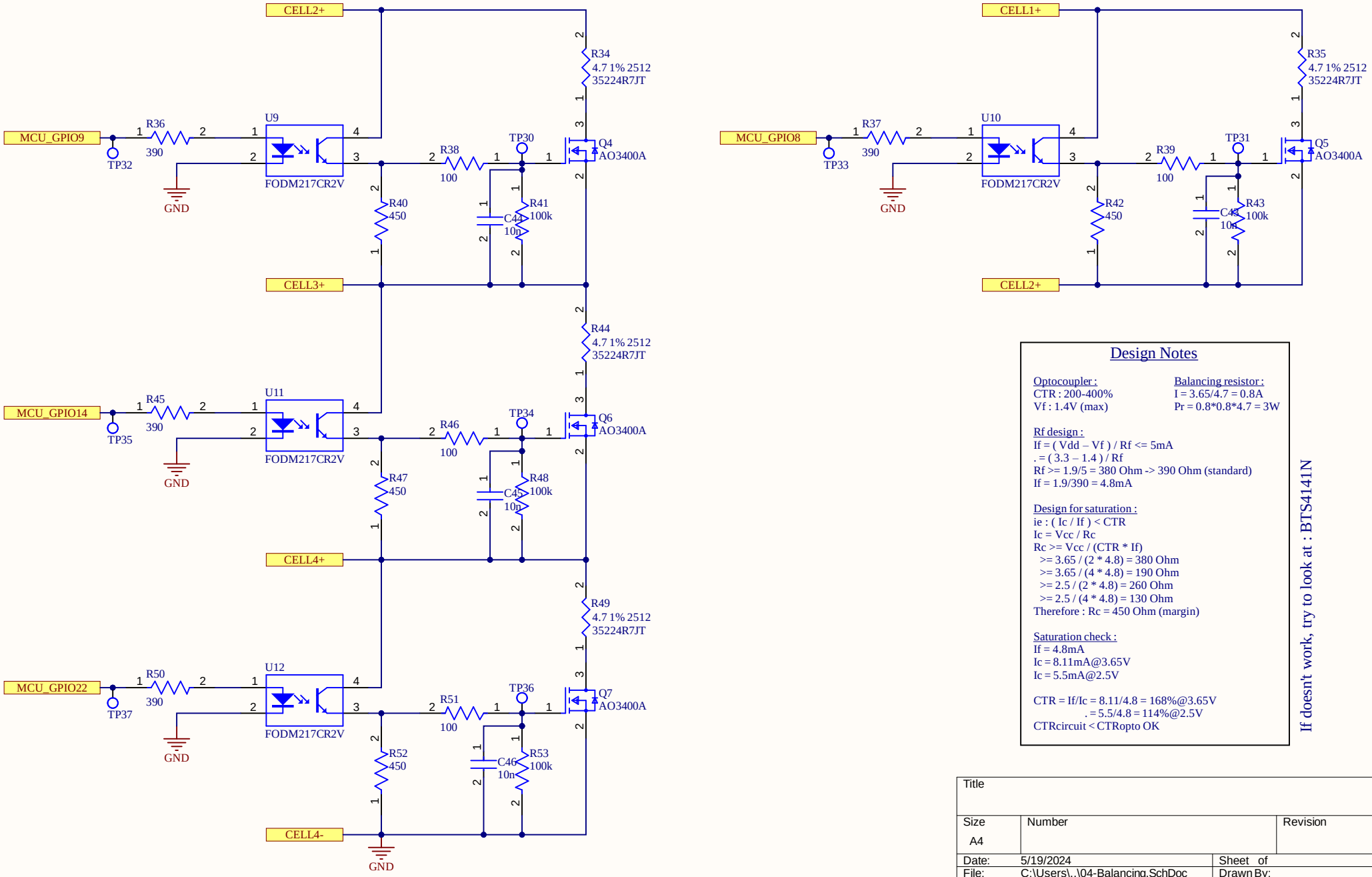

Design Notes

Optocoupler :
CTR : 200-400%
Vf : 1.4V (max)

Balancing resistor :
I = 3.65/4.7 = 0.8A
Pr = 0.8*0.8*4.7 = 3W

Rf design :
If = (Vdd – Vf) / Rf <= 5mA
. = (3.3 – 1.4) / Rf
Rf >= 1.9/5 = 380 Ohm -> 390 Ohm (standard)
If = 1.9/390 = 4.8mA

Design for saturation :
ie : (Ic / If) < CTR
Ic = Vcc / Rc
Rc >= Vcc / (CTR * If)
>= 3.65 / (2 * 4.8) = 380 Ohm
>= 3.65 / (4 * 4.8) = 190 Ohm
>= 2.5 / (2 * 4.8) = 260 Ohm
>= 2.5 / (4 * 4.8) = 130 Ohm
Therefore : Rc = 450 Ohm (margin)

Saturation check :
If = 4.8mA
Ic = 8.11mA@3.65V
Ic = 5.5mA@2.5V

CTR = If/Ic = 8.11/4.8 = 168%@3.65V
. = 5.5/4.8 = 114%@2.5V
CTRcircuit < CTRopto OK

If doesn't work, try to look at : BTS4141N

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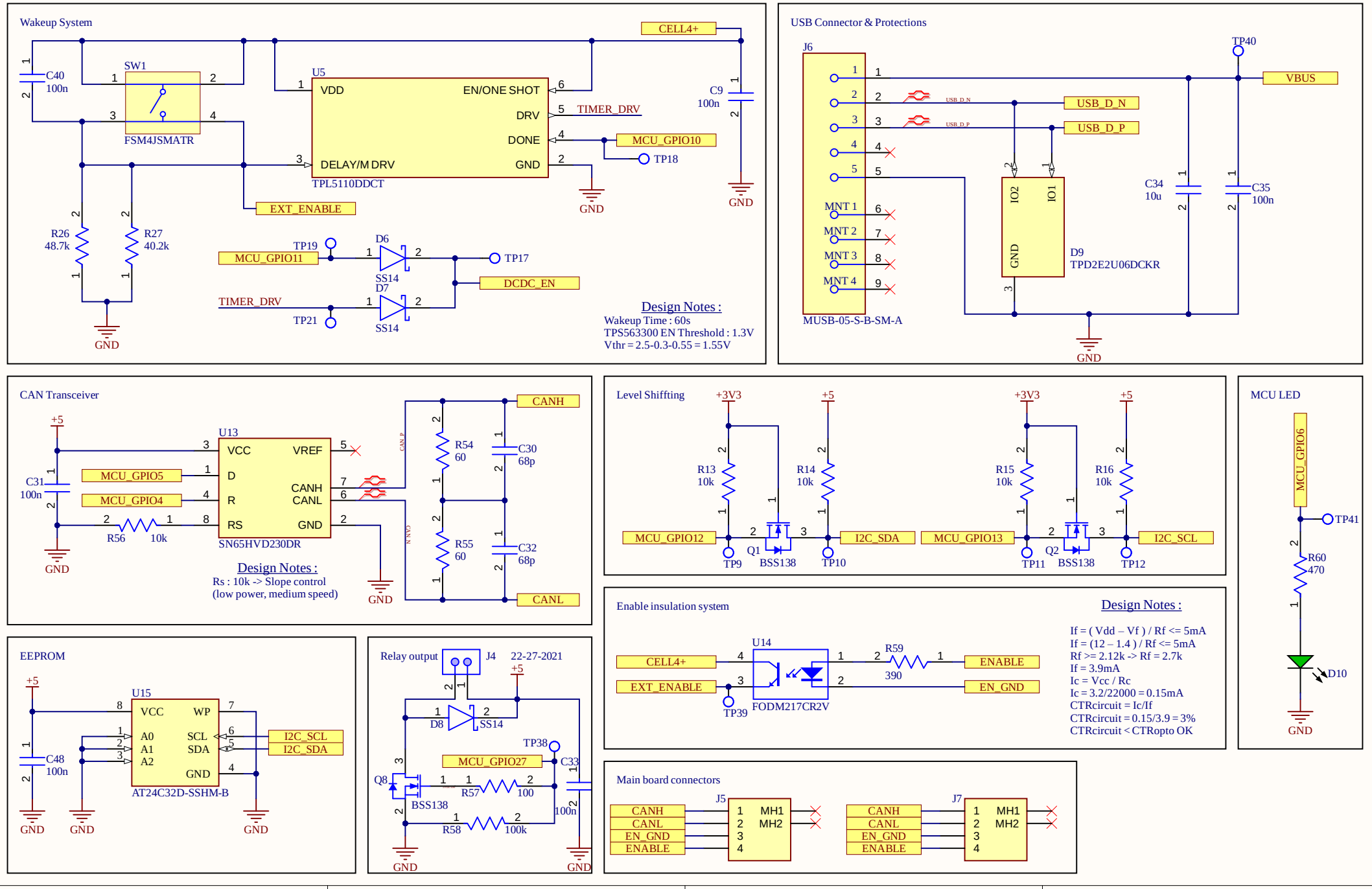
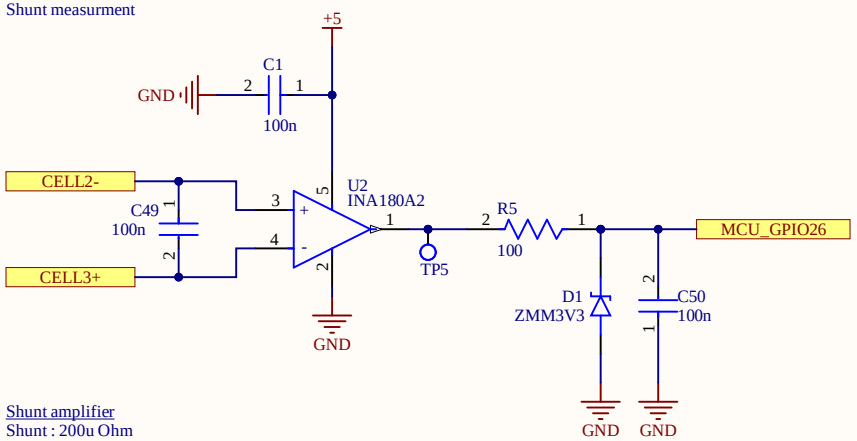

Wakeup System
C40
100n
SW1
FSM4JSMATR
U5
VDD
EN/ONE SHOT
DRV
DONE
DELAY/M DRV
GND
TPL5110DDCT
CELL4+
C9
100n
TIMER_DRV
MCU_GPIO10
TP18
GND
EXT_ENABLE
R26
48.7k
R27
40.2k
TP19
MCU_GPIO11
D6
SS14
TP17
DCDC_EN
TIMER_DRV
TP21
D7
SS14
Design Notes :
Wakeup Time : 60s
TPS563300 EN Threshold : 1.3V
Vthr = 2.5-0.3-0.55 = 1.55V
USB Connector & Protections
J6
MNT 1
MNT 2
MNT 3
MNT 4
MUSB-05-S-B-SM-A
TP40
VBUS
USB_D_N
USB_D_P
IO2
IO1
GND
D9
TPD2E2U06DCKR
C34
10u
C35
100n
CAN Transceiver
+5
C31
100n
U13
VCC
VREF
D
R
RS
GND
CANH
CANL
SN65HVD230DR
MCU_GPIO5
MCU_GPIO4
R56
10k
R54
60
R55
60
C30
68p
C32
68p
CANH
CANL
Design Notes :
Rs : 10k -> Slope control
(low power, medium speed)
Level Shiffting
+3V3
+5
R13
10k
R14
10k
R15
10k
R16
10k
MCU_GPIO12
MCU_GPIO13
Q1
Q2
BSS138
I2C_SDA
I2C_SCL
TP9
TP10
TP11
TP12
MCU LED
MCU_GPIO6
TP41
R60
470
D10
GND
Enable insulation system
U14
CELL4+
EXT_ENABLE
TP39
FODM217CR2V
R59
390
ENABLE
EN_GND
Design Notes :
If = (Vdd – Vf) / Rf <= 5mA
If = (12 – 1.4) / Rf <= 5mA
Rf >= 2.12k -> Rf = 2.7k
If = 3.9mA
Ic = Vcc / Rc
Ic = 3.2/22000 = 0.15mA
CTRcircuit = Ic/If
CTRcircuit = 0.15/3.9 = 3%
CTRcircuit < CTRopto OK
EEPROM
U15
VCC
WP
A0
A1
A2
SCL
SDA
GND
AT24C32D-SSHM-B
C48
100n
I2C_SCL
I2C_SDA
Relay output
J4
22-27-2021
D8
SS14
TP38
MCU_GPIO27
Q8
BSS138
R57
100
R58
100k
C33
100n
Main board connectors
J5
J7
CANH
CANL
EN_GND
ENABLE
MH1
MH2

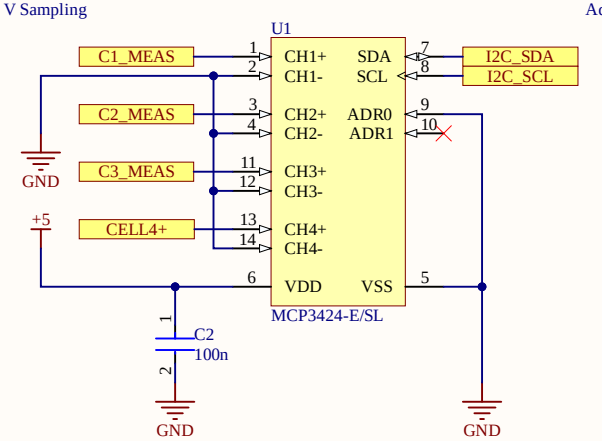
Shunt measurment



Shunt amplifier
Shunt : 200u Ohm
Current range : 0 - 250A
Vdrop : 50mV
Vout : 0-3.3V
Gain : 66 -> 50
Adjusted current range : 330A

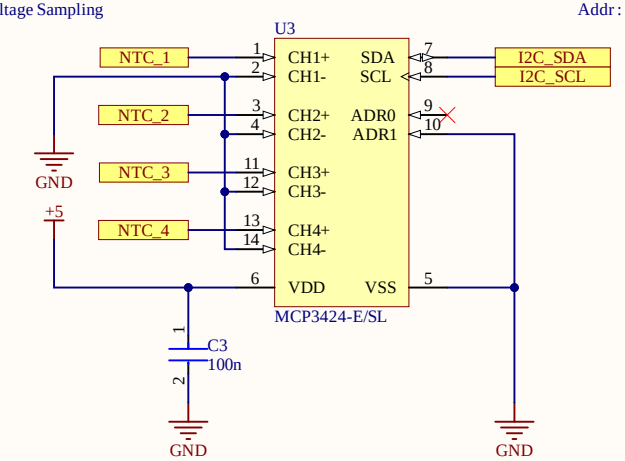
Cells V Sampling

Addr : 1101001
0x69



T° Voltage Sampling

Addr : 1101011
0x6B



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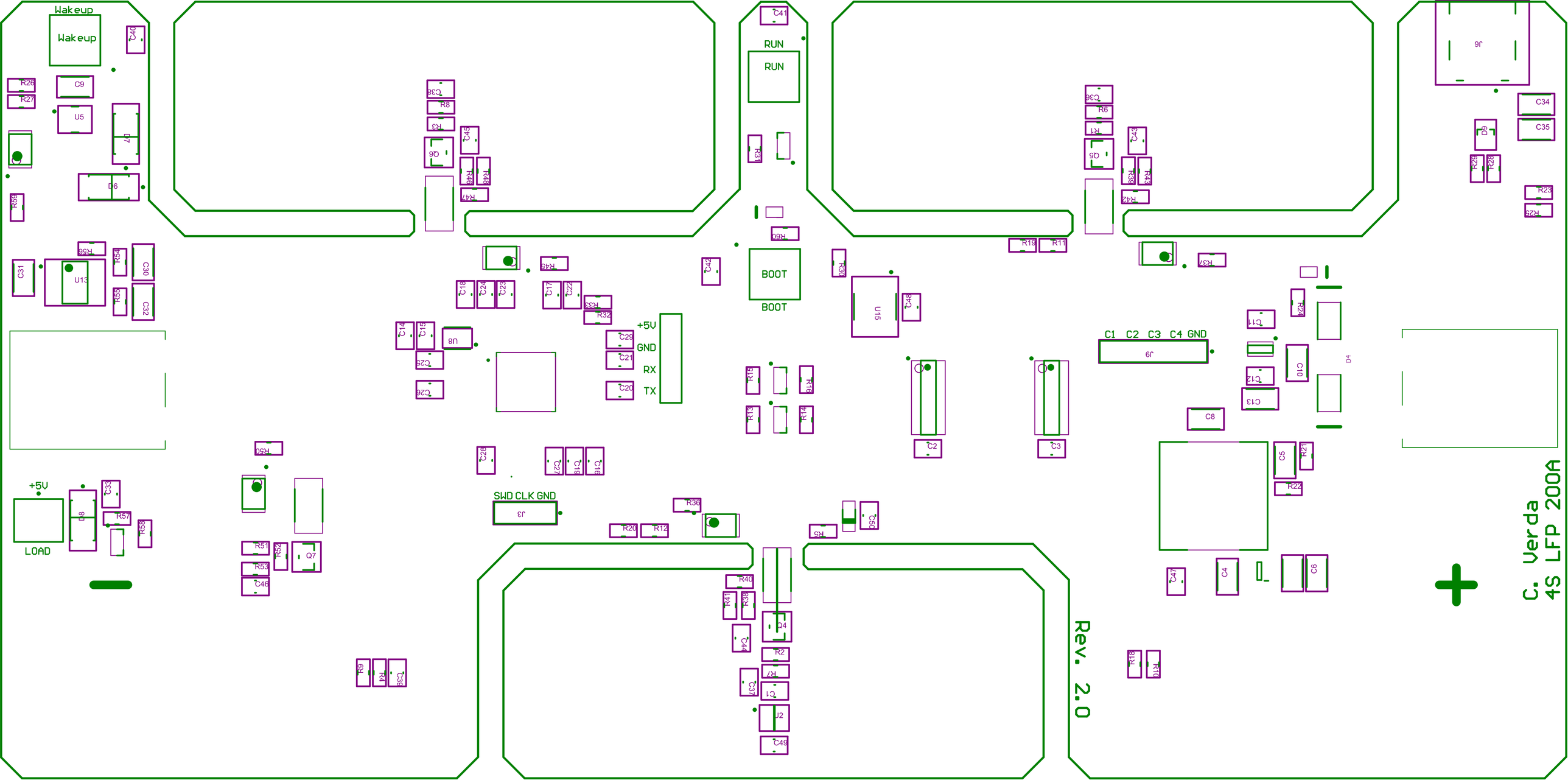
Wakeup
Wakeup
RUN
RUN
BOOT
BOOT
+5V
GND
RX
TX
SWD CLK GND
C1 C2 C3 C4 GND
LOAD
C. Verda
4S LFP 200A
Rev. 2.0