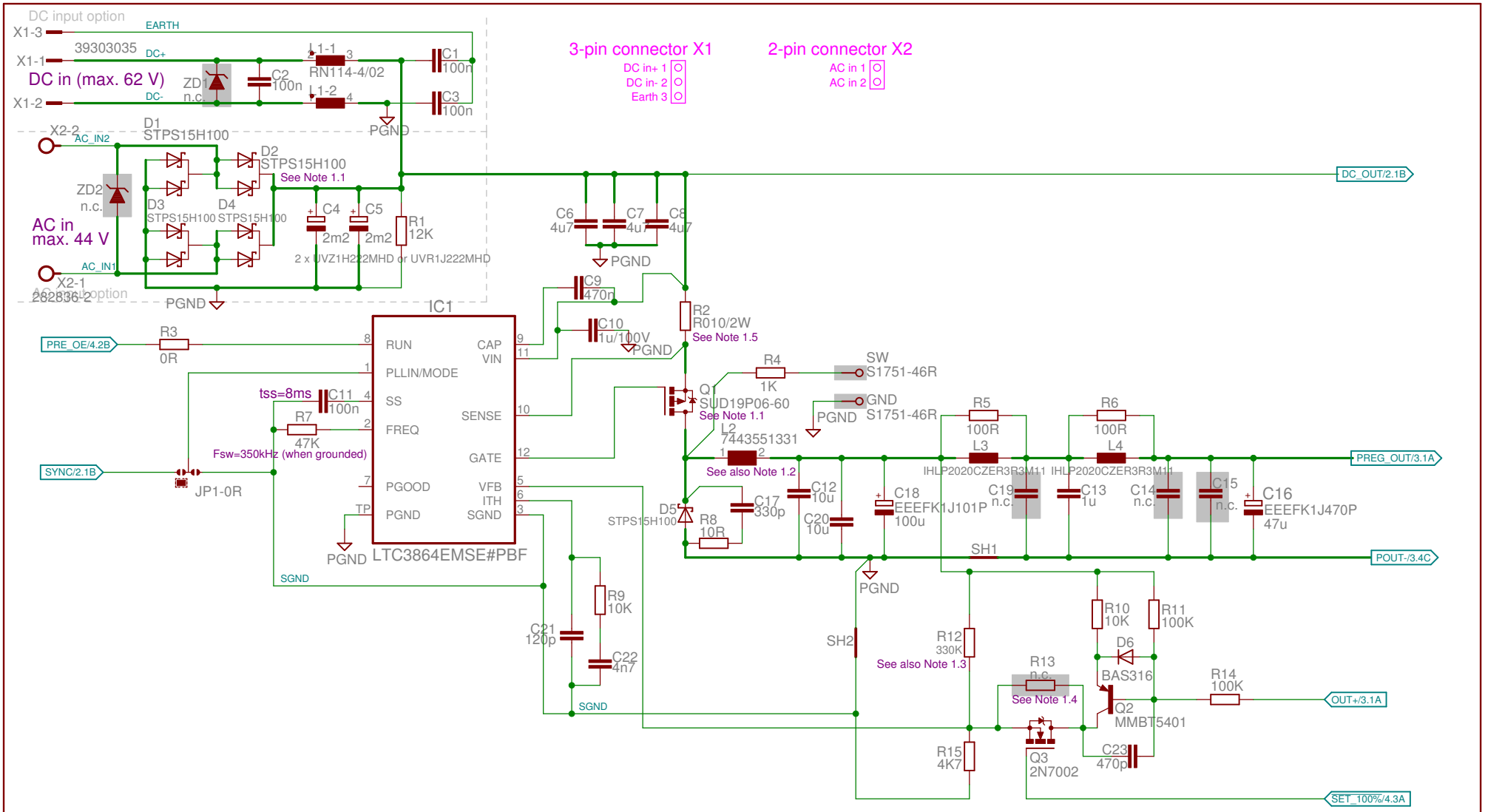

Note 1.1: D1-D5, L2 and Q1 requires thermal bridge to the external heatsink. See layer 114 on Board editor for an example.
Note 1.2: WE 7447709330, WE 7443551331, Coilcraft MSS1210-333, Coilcraft XAL1510-333, Vishay IHLP4040DZER470M11, etc.
Note 1.3: Use 240K for 30 VAC main transformer
Note 1.4: Install 0R only if 100% Duty cycle feature is not needed
Note 1.5: Use R020 for 0-3.12 A or R015 for 0-4.16 A range

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Repository: https://github.com/eez-open

SMPS power pre-regulator with 100% duty cycle

TITLE: EEZ PSU consolidated r5B9

Document Number:

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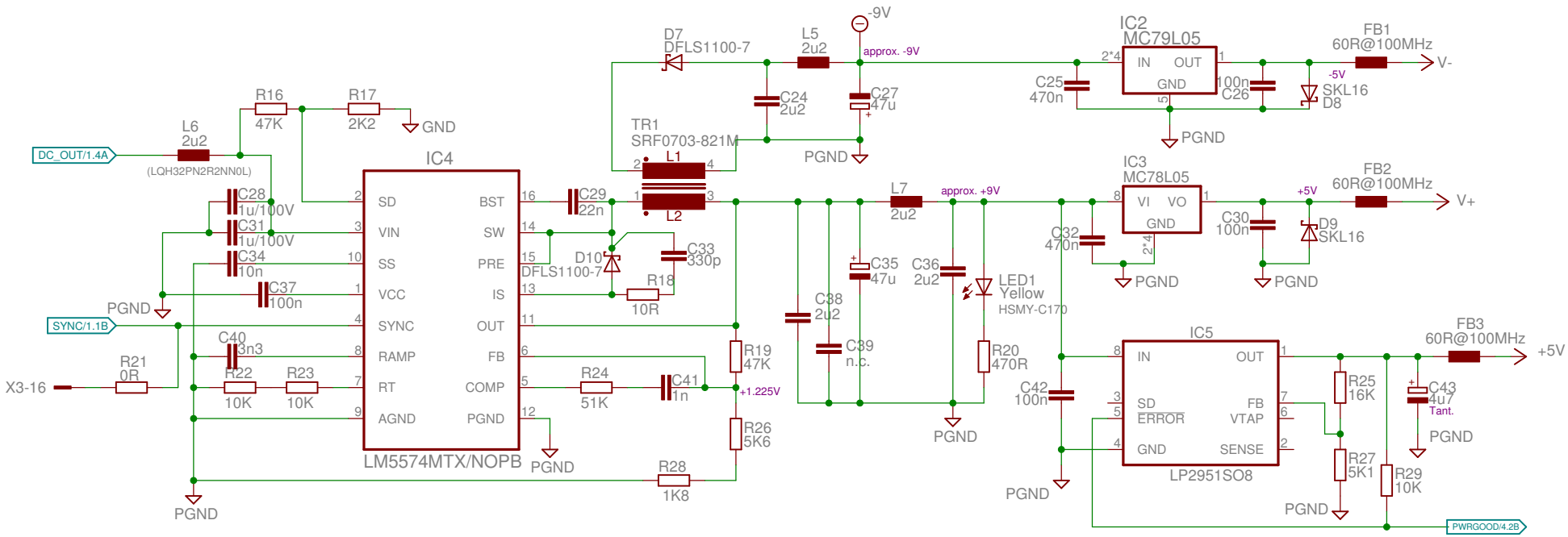
Sheet: 1/12



Bias power supply with SMPS pre-regulator

TITLE: EEZ PSU consolidated r5B9

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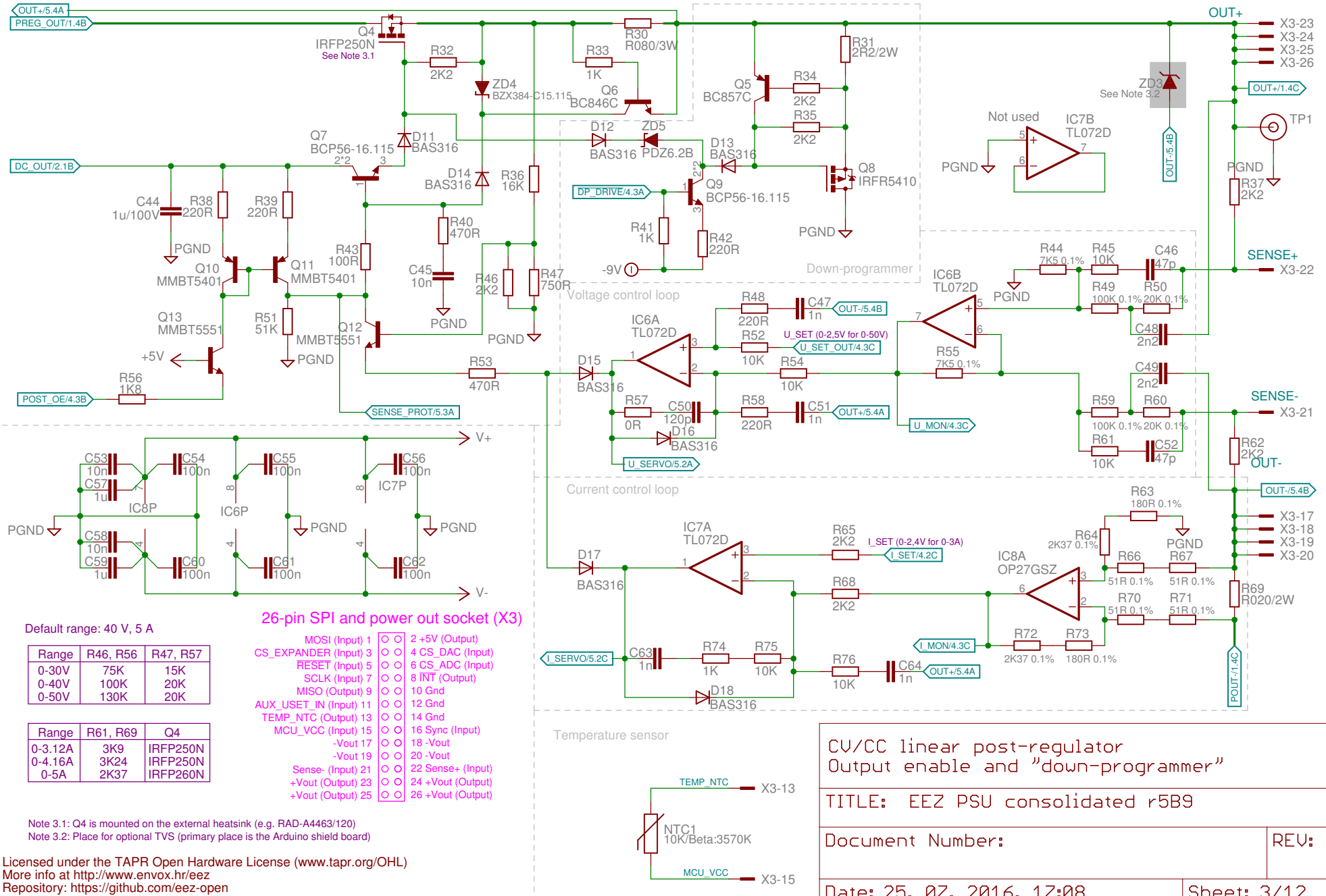
OUT+/5.4A
PREG_OUT/1.4B
Q4
IRFP250N
See Note 3.1
R32
2K2
ZD4
BZX384-C15.115
R33
1K
Q6
BC846C
R30
R080/3W
R31
2R2/2W
Q5
BC857C
R34
2K2
R35
2K2
OUT+
X3-23
X3-24
X3-25
X3-26
ZD3
See Note 3.2
OUT+/1.4C
TP1
Not used
IC7B
TL072D
PGND
OUT-/5.4B
R37
2K2
SENSE+
X3-22
DC_OUT/2.1B
Q7
BCP56-16.115
D11
BAS316
D12
BAS316
ZD5
PDZ6.2B
D13
BAS316
Q8
IRFR5410
DP_DRIVE/4.3A
Q9
BCP56-16.115
R41
1K
R42
220R
-9V
Down-programmer
C44
1u/100V
R38
220R
R39
220R
D14
BAS316
R36
16K
R40
470R
C45
10n
R43
100R
R46
2K2
R47
750R
Q10
MMBT5401
Q11
MMBT5401
Q13
MMBT5551
Q12
MMBT5551
R51
51K
+5V
R56
1K8
POST_OE/4.3B
SENSE_PROT/5.3A
R53
470R
Voltage control loop
IC6A
TL072D
R48
220R
C47
1n
OUT-/5.4B
R52
10K
U_SET (0-2,5V for 0-50V)
U_SET_OUT/4.3C
R54
10K
D15
BAS316
R57
0R
C50
120p
D16
BAS316
R58
220R
C51
1n
OUT+/5.4A
U_SERVO/5.2A
IC6B
TL072D
R44
7K5 0.1%
R45
10K
C46
47p
R49
100K 0.1%
R50
20K 0.1%
C48
2n2
R55
7K5 0.1%
U_MON/4.3C
C49
2n2
R59
100K 0.1%
R60
20K 0.1%
R61
10K
C52
47p
SENSE-
X3-21
R62
2K2
OUT-
OUT-/5.4B
X3-17
X3-18
X3-19
X3-20
R69
R020/2W
POUT-/1.4C
C53
10n
C57
1u
C54
100n
IC8P
C55
100n
IC6P
C56
100n
IC7P
V+
V-
PGND
C58
10n
C59
1u
C60
100n
C61
100n
C62
100n
Current control loop
IC7A
TL072D
D17
BAS316
R65
2K2
I_SET (0-2,4V for 0-3A)
I_SET/4.2C
R68
2K2
I_SERVO/5.2C
C63
1n
R74
1K
R75
10K
D18
BAS316
R76
10K
C64
1n
OUT+/5.4A
IC8A
OP27GSZ
R63
180R 0.1%
R64
2K37 0.1%
R66
51R 0.1%
R67
51R 0.1%
R70
51R 0.1%
R71
51R 0.1%
I_MON/4.3C
R72
2K37 0.1%
R73
180R 0.1%
Temperature sensor
TEMP_NTC
X3-13
NTC1
10K/Beta:3570K
MCU_VCC
X3-15
Default range: 40 V, 5 A
Range | R46, R56 | R47, R57
0-30V | 75K | 15K
0-40V | 100K | 20K
0-50V | 130K | 20K
Range | R61, R69 | Q4
0-3.12A | 3K9 | IRFP250N
0-4.16A | 3K24 | IRFP250N
0-5A | 2K37 | IRFP260N
26-pin SPI and power out socket (X3)
MOSI (Input) 1
CS_EXPANDER (Input) 3
RESET (Input) 5
SCLK (Input) 7
MISO (Output) 9
AUX_USET_IN (Input) 11
TEMP_NTC (Output) 13
MCU_VCC (Input) 15
-Vout 17
-Vout 19
Sense- (Input) 21
+Vout (Output) 23
+Vout (Output) 25
2 +5V (Output)
4 CS_DAC (Input)
6 CS_ADC (Input)
8 INT (Output)
10 Gnd
12 Gnd
14 Gnd
16 Sync (Input)
18 -Vout
20 -Vout
22 Sense+ (Input)
24 +Vout (Output)
26 +Vout (Output)
Note 3.1: Q4 is mounted on the external heatsink (e.g. RAD-A4463/120)
Note 3.2: Place for optional TVS (primary place is the Arduino shield board)
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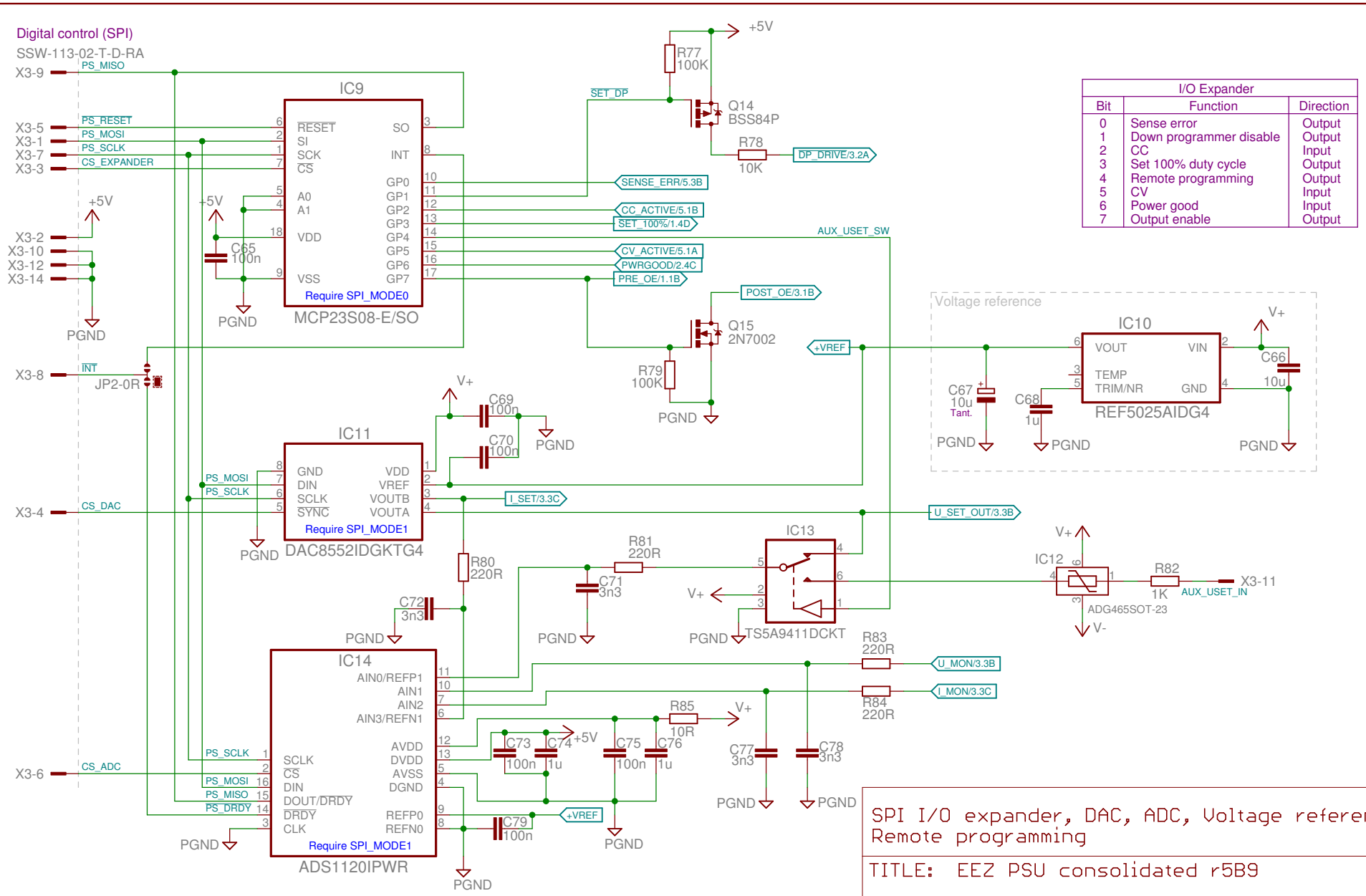
Repository: https://github.com/eez-open
CV/CC linear post-regulator
Output enable and "down-programmer"
TITLE: EEZ PSU consolidated r5B9
Document Number:
REV:
Date: 25. 07. 2016. 17:08
Sheet: 3/12



I/O Expander		
Bit	Function	Direction
0	Sense error	Output
1	Down programmer disable	Output
2	CC	Input
3	Set 100% duty cycle	Output
4	Remote programming	Output
5	CV	Input
6	Power good	Input
7	Output enable	Output

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SPI I/O expander, DAC, ADC, Voltage reference
Remote programming

TITLE: EEZ PSU consolidated r5B9

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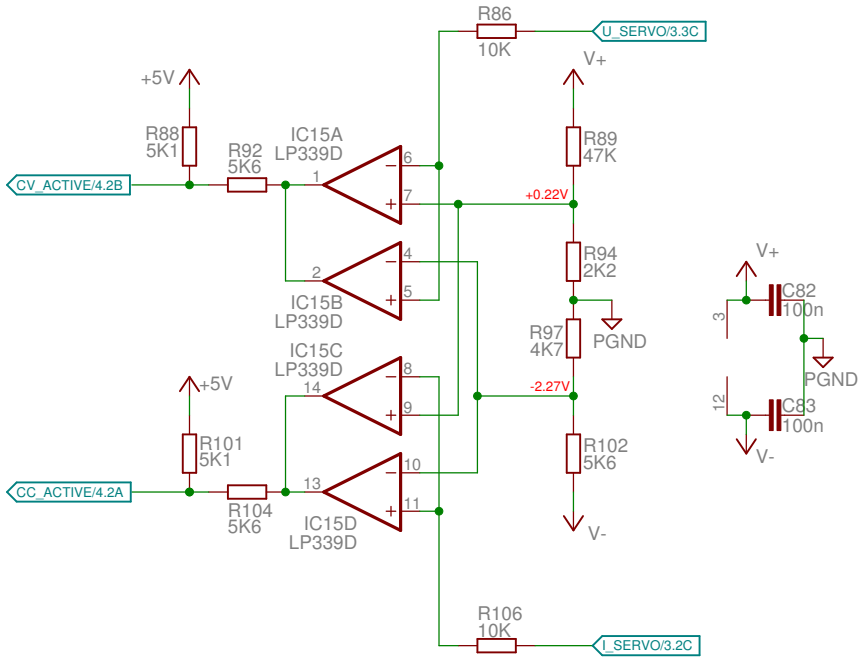
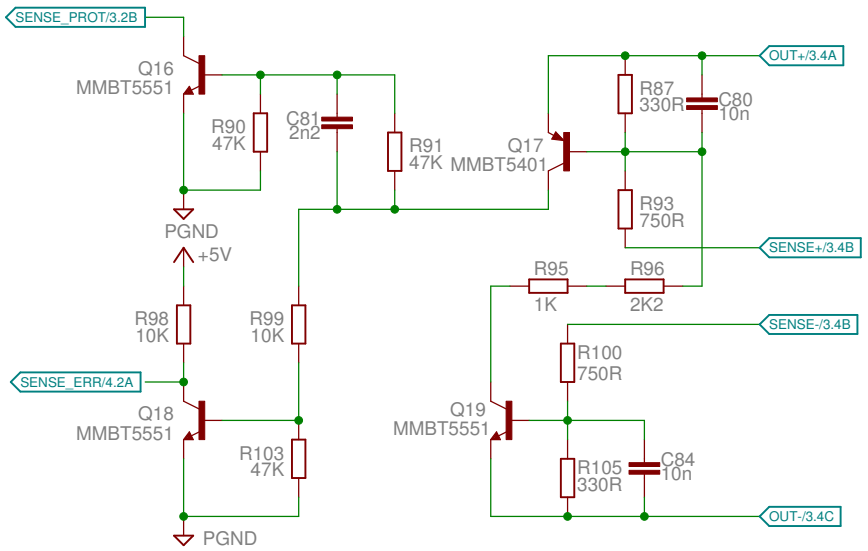
Constant Voltage (CV) and Constant Current (CC) mode indicator



Remote sense reverse polarity detection



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CC/CV indicators, Sense error detection	
TITLE: EEZ PSU consolidated r5B9	
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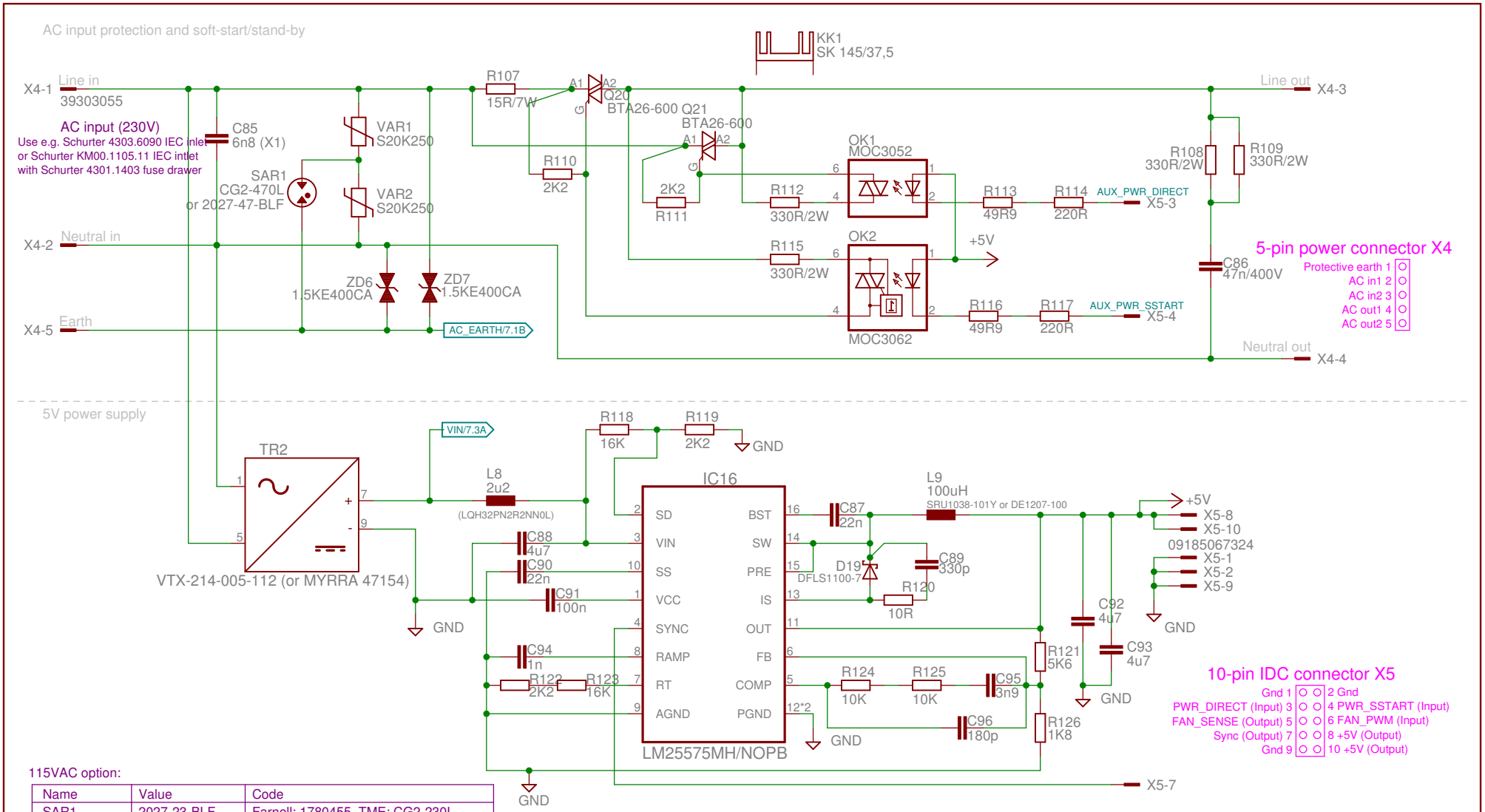

115VAC option:

Name	Value	Code
SAR1	2027-23-BLF	Farnell: 1780455, TME: CG2-230L
TR2	VPP24-210	Digikey: 237-1085-ND Mouser: 553-VPP24-210 Newark: 93F8764
	or AC/DC module Myrra 47202	Farnell: 2469211
VAR1, VAR2	S20K140	Farnell: 1004387, TME: SIOV-S20K140
ZD1, ZD2	1.5KE200CA	Farnell: 1837117, TME: 1.5KE200CA

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AC input protection, in-rush current limiter
+5V/1A power supply

TITLE: EEZ PSU consolidated r5B9

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Date: 25. 07. 2016. 17:08

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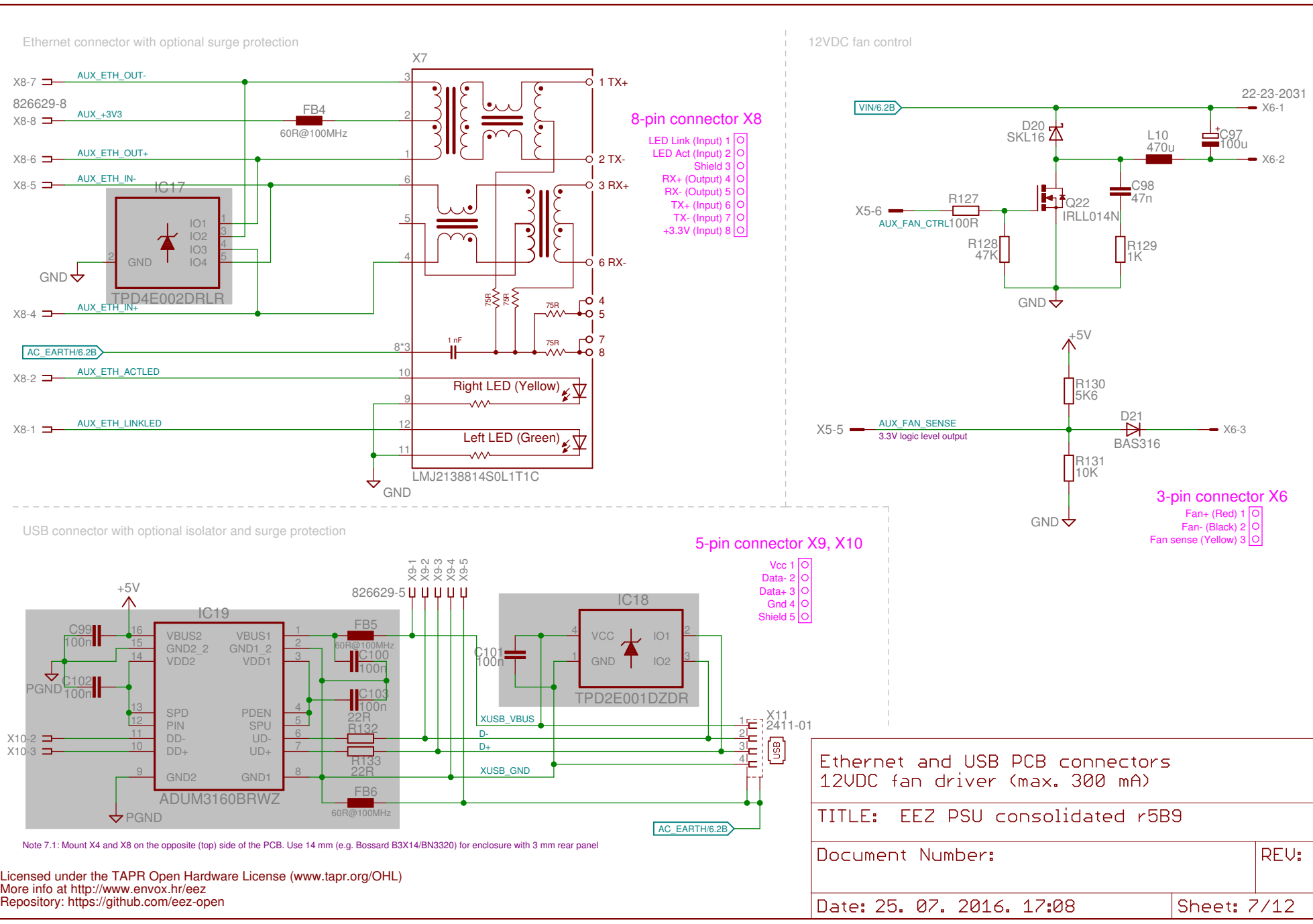
Ethernet connector with optional surge protection
X7
X8-7
AUX_ETH_OUT-
826629-8
X8-8
AUX_+3V3
FB4
60R@100MHz
X8-6
AUX_ETH_OUT+
X8-5
AUX_ETH_IN-
IC17
IO1
IO2
IO3
IO4
GND
TPD4E002DRLR
X8-4
AUX_ETH_IN+
AC_EARTH/6.2B
X8-2
AUX_ETH_ACTLED
X8-1
AUX_ETH_LINKLED
1 TX+
2 TX-
3 RX+
6 RX-
75R
1 nF
8*3
Right LED (Yellow)
Left LED (Green)
LMJ2138814S0L1T1C
GND
8-pin connector X8
LED Link (Input) 1
LED Act (Input) 2
Shield 3
RX+ (Output) 4
RX- (Output) 5
TX+ (Input) 6
TX- (Input) 7
+3.3V (Input) 8
12VDC fan control
VIN/6.2B
22-23-2031
X6-1
X6-2
D20
SKL16
L10
470u
C97
100u
C98
47n
Q22
IRLL014N
X5-6
AUX_FAN_CTRL
R127
100R
R128
47K
R129
1K
GND
+5V
R130
5K6
X5-5
AUX_FAN_SENSE
3.3V logic level output
D21
BAS316
X6-3
R131
10K
3-pin connector X6
Fan+ (Red) 1
Fan- (Black) 2
Fan sense (Yellow) 3
USB connector with optional isolator and surge protection
5-pin connector X9, X10
Vcc 1
Data- 2
Data+ 3
Gnd 4
Shield 5
826629-5
X9-1
X9-2
X9-3
X9-4
X9-5
+5V
IC19
C99
100n
C102
100n
PGND
VBUS2
GND2_2
VDD2
VBUS1
GND1_2
VDD1
SPD
PIN
DD-
DD+
PDEN
SPU
UD-
UD+
GND2
GND1
ADUM3160BRWZ
FB5
60R@100MHz
C100
100n
C103
100n
22R
R132
R133
22R
FB6
60R@100MHz
X10-2
X10-3
IC18
C101
100n
VCC
GND
IO1
IO2
TPD2E001DZDR
XUSB_VBUS
D-
D+
XUSB_GND
X11
2411-01
USB
AC_EARTH/6.2B
Note 7.1: Mount X4 and X8 on the opposite (top) side of the PCB. Use 14 mm (e.g. Bossard B3X14/BN3320) for enclosure with 3 mm rear panel
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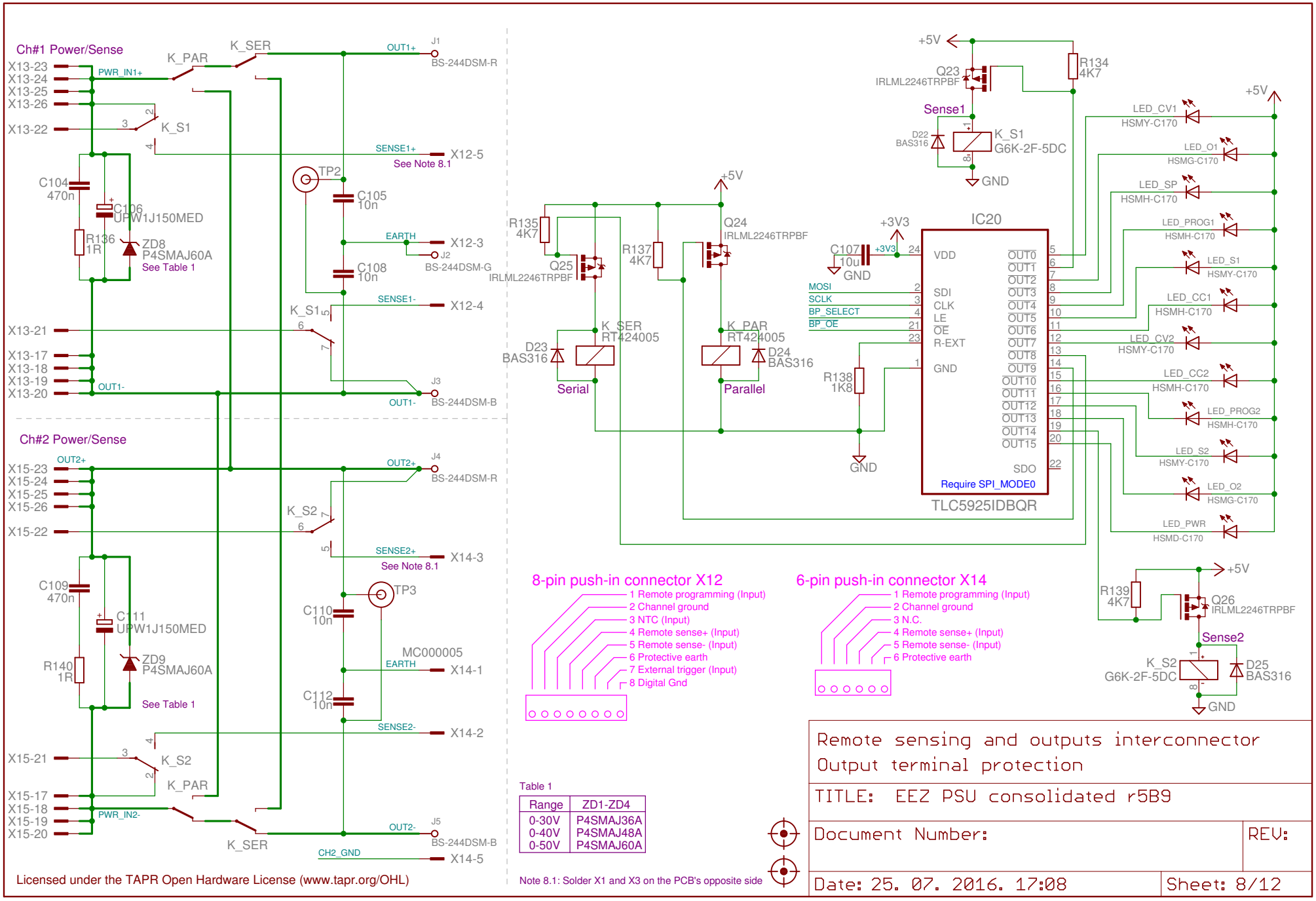
Repository: https://github.com/eez-open
Ethernet and USB PCB connectors
12VDC fan driver (max. 300 mA)
TITLE: EEZ PSU consolidated r5B9
Document Number:
REV:
Date: 25. 07. 2016. 17:08
Sheet: 7/12


Ch#1 Power/Sense
X13-23
X13-24
X13-25
X13-26
X13-22
PWR_IN1+
K_PAR
K_SER
OUT1+
J1
BS-244DSM-R
K_S1
SENSE1+
See Note 8.1
X12-5
TP2
C104
470n
C106
UPW1J150MED
R136
1R
ZD8
P4SMAJ60A
See Table 1
C105
10n
EARTH
X12-3
J2
BS-244DSM-G
C108
10n
SENSE1-
X12-4
K_S1
X13-21
X13-17
X13-18
X13-19
X13-20
OUT1-
J3
OUT1-
BS-244DSM-B
Ch#2 Power/Sense
OUT2+
X15-23
X15-24
X15-25
X15-26
X15-22
J4
OUT2+
BS-244DSM-R
K_S2
SENSE2+
See Note 8.1
X14-3
C109
470n
C111
UPW1J150MED
R140
1R
ZD9
P4SMAJ60A
See Table 1
TP3
C110
10n
MC000005
EARTH
X14-1
C112
10n
SENSE2-
X14-2
X15-21
K_S2
K_PAR
X15-17
X15-18
X15-19
X15-20
PWR_IN2-
K_SER
OUT2-
J5
BS-244DSM-B
CH2_GND
X14-5
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+5V
R135
4K7
Q25
IRLML2246TRPBF
R137
4K7
Q24
IRLML2246TRPBF
K_SER
RT424005
D23
BAS316
Serial
K_PAR
RT424005
D24
BAS316
Parallel
GND
+5V
Q23
IRLML2246TRPBF
R134
4K7
Sense1
D22
BAS316
K_S1
G6K-2F-5DC
GND
+3V3
C107
10u
GND
IC20
MOSI
SCLK
BP_SELECT
BP_OE
SDI
CLK
LE
OE
R-EXT
GND
VDD
SDO
OUT0
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
OUT8
OUT9
OUT10
OUT11
OUT12
OUT13
OUT14
OUT15
Require SPI_MODE0
TLC5925IDBQR
R138
1K8
GND
LED_CV1
HSMY-C170
LED_O1
HSMG-C170
LED_SP
HSMH-C170
LED_PROG1
HSMH-C170
LED_S1
HSMY-C170
LED_CC1
HSMH-C170
LED_CV2
HSMY-C170
LED_CC2
HSMH-C170
LED_PROG2
HSMH-C170
LED_S2
HSMY-C170
LED_O2
HSMG-C170
LED_PWR
HSMD-C170
8-pin push-in connector X12
1 Remote programming (Input)
2 Channel ground
3 NTC (Input)
4 Remote sense+ (Input)
5 Remote sense- (Input)
6 Protective earth
7 External trigger (Input)
8 Digital Gnd
6-pin push-in connector X14
1 Remote programming (Input)
2 Channel ground
3 N.C.
4 Remote sense+ (Input)
5 Remote sense- (Input)
6 Protective earth
+5V
R139
4K7
Q26
IRLML2246TRPBF
Sense2
K_S2
G6K-2F-5DC
D25
BAS316
GND
Table 1
Range
ZD1-ZD4
0-30V
P4SMAJ36A
0-40V
P4SMAJ48A
0-50V
P4SMAJ60A
Note 8.1: Solder X1 and X3 on the PCB's opposite side
Remote sensing and outputs interconnector
Output terminal protection
TITLE: EEZ PSU consolidated r5B9
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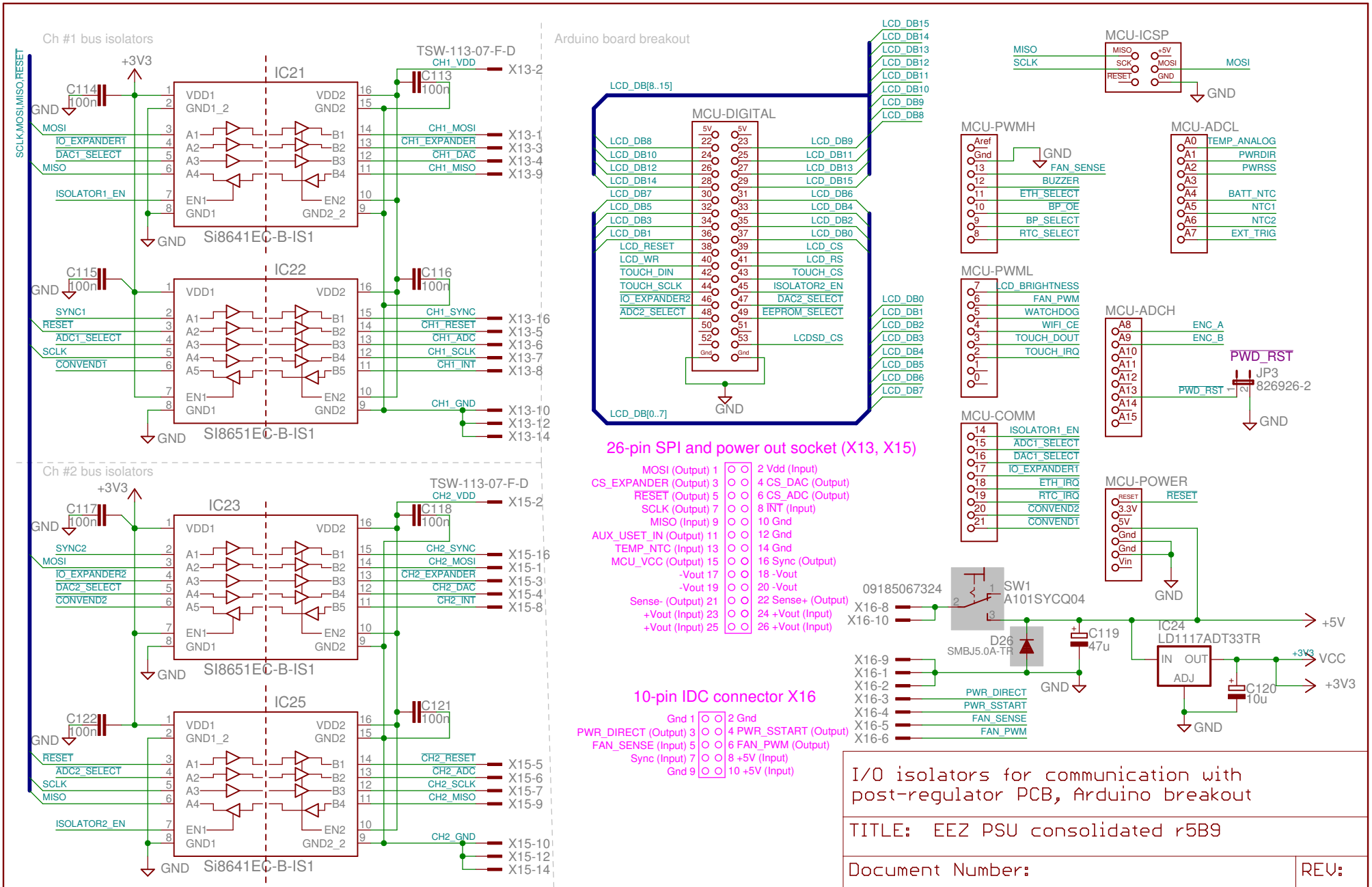

I/O isolators for communication with post-regulator PCB, Arduino breakout

TITLE: EEZ PSU consolidated r5B9

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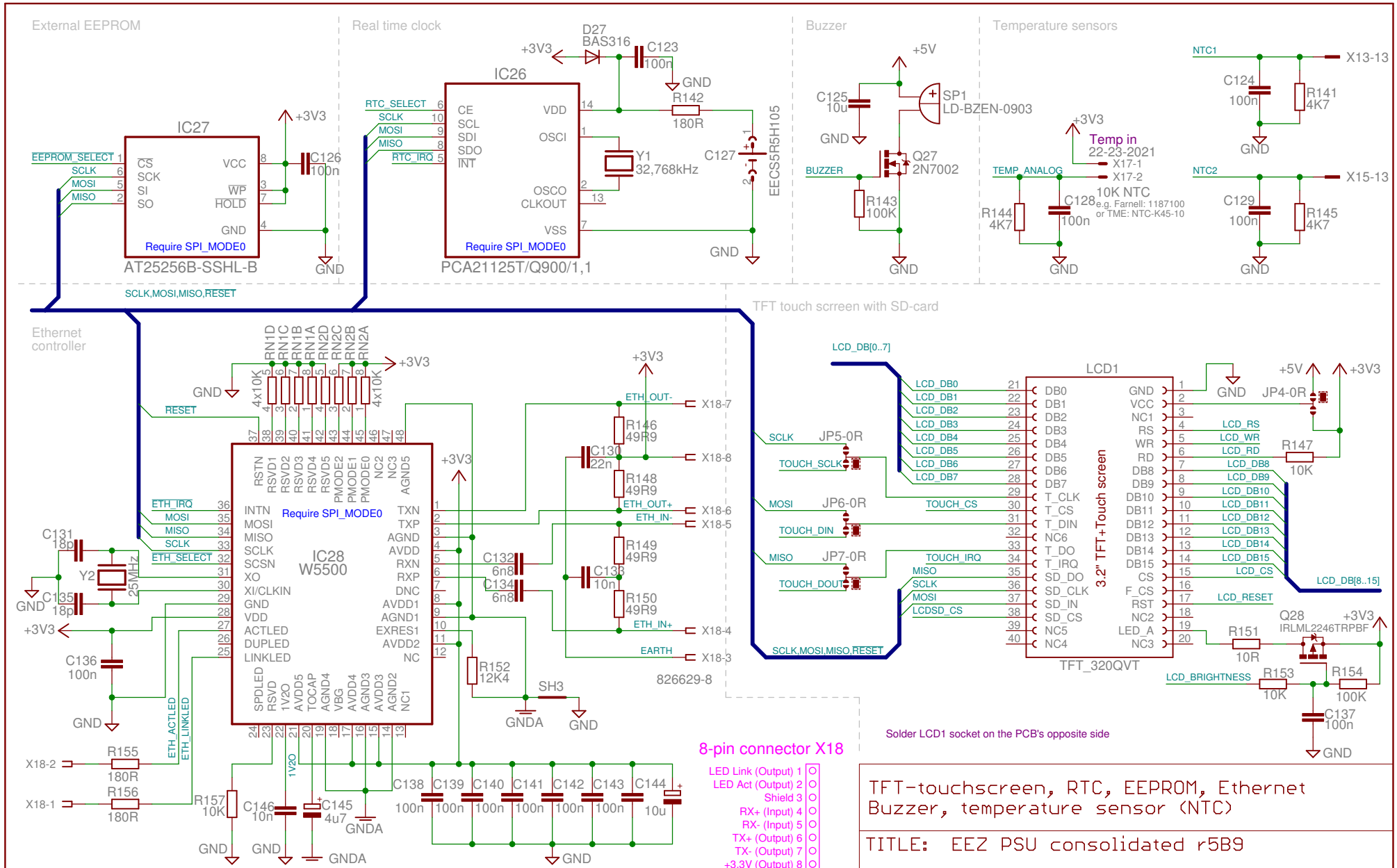

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TFT-touchscreen, RTC, EEPROM, Ethernet
Buzzer, temperature sensor (NTC)

TITLE: EEZ PSU consolidated r5B9

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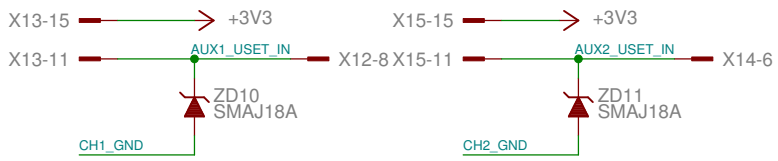
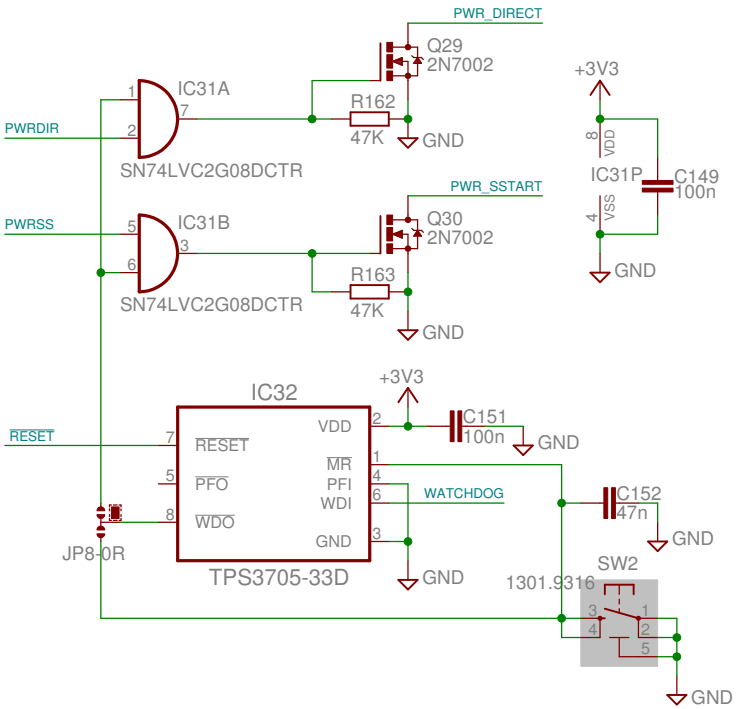
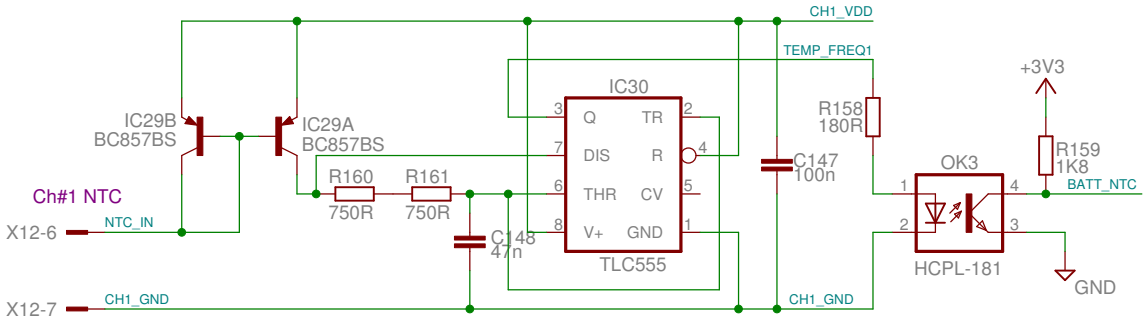
Remote programming inputs



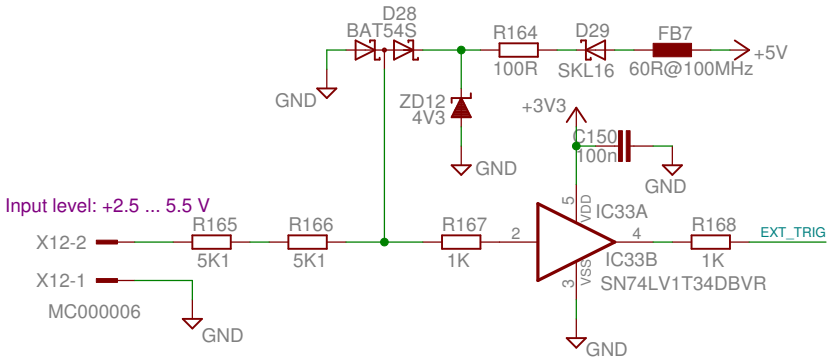
Power-on reset generator and power control



Channel 1 V/F converter for battery NTC (optional)



External trigger protection and level shifter/buffer



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Reset control, soft-start driver,
V/F converter for battery NTC, External trigger

TITLE: EEZ PSU consolidated r5B9

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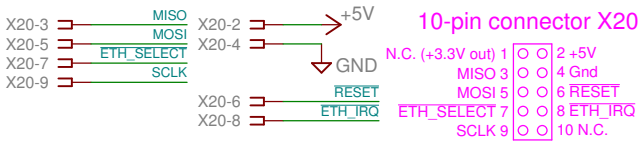
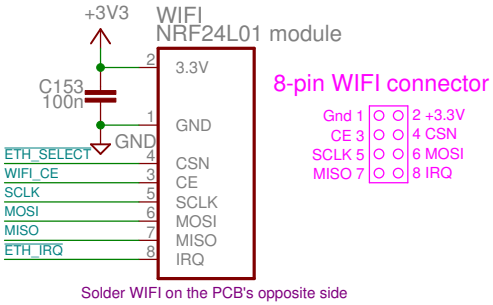
Optional Ethernet module connector

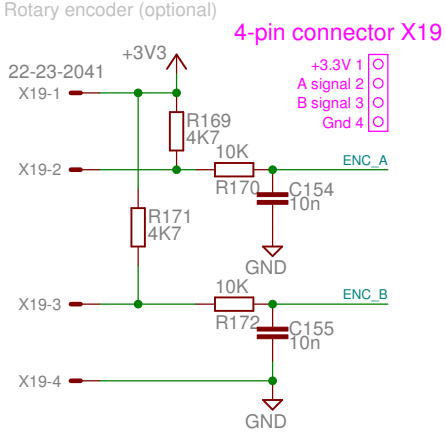


Optional Wifi module connector

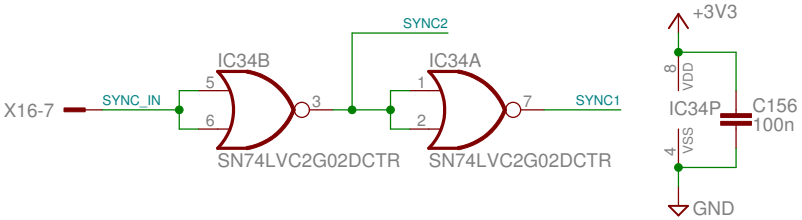


Solder WIFI on the PCB's opposite side

Rotary encoder (optional)



Master sync signal phase shifting



Optional ethernet, Wifi and encoder
Power boards SMPS sync

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