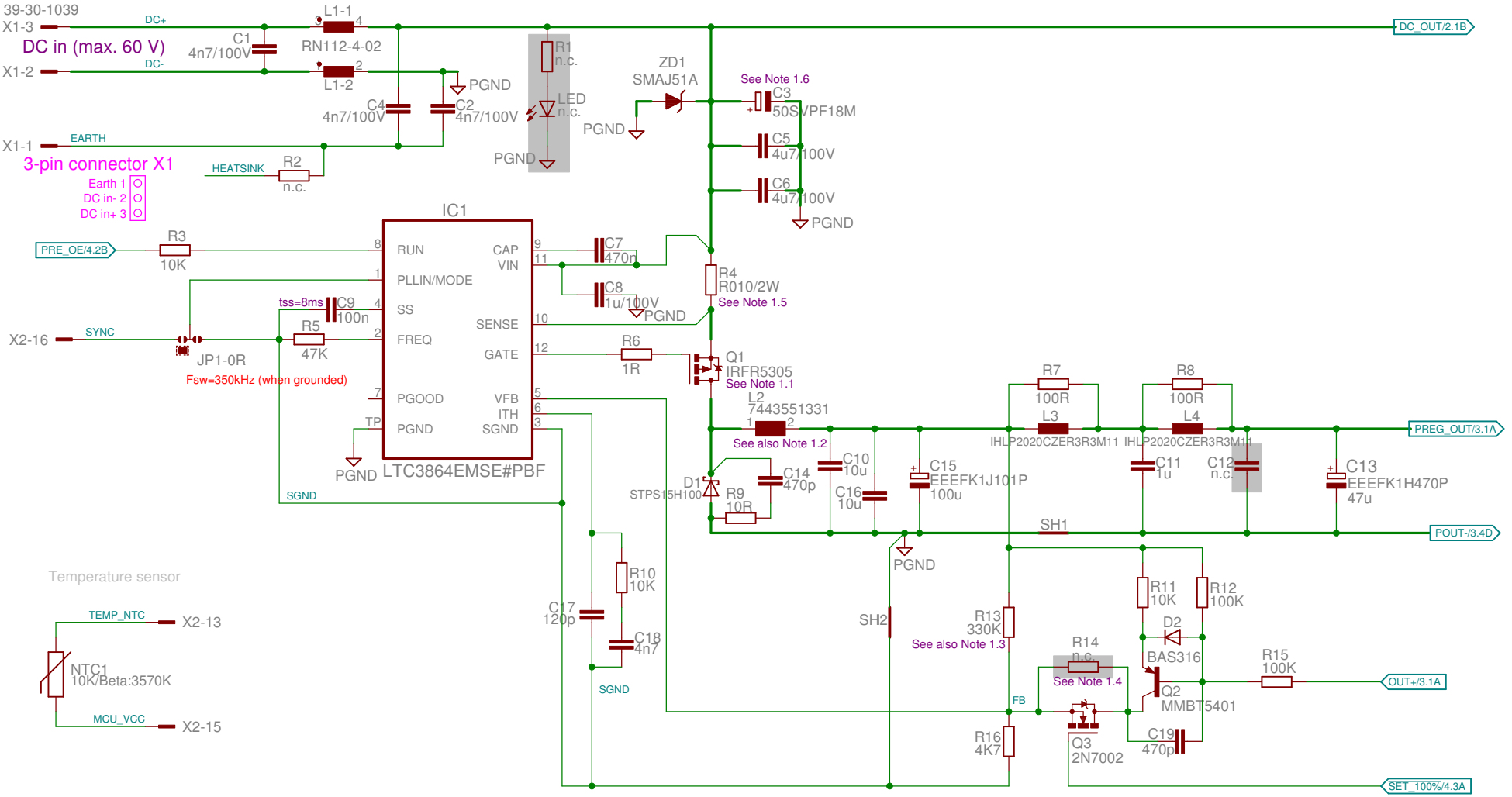


Note 1.1: Possible alternative AUIRFR5305, SUD19P06-60, SPD30P06P or other with similar or lower input capacitance
Note 1.2: WE 7447709330, WE 7443551331, Coilcraft MSS1210-333, Coilcraft XAL1510-333, Vishay IHLP4040DZER470M11, etc.
Note 1.3: Use 240K for 30 VAC main transformer
Note 1.4: Install 0R only if 100% Duty cycle feature for Low Ripple mode is not needed
Note 1.5: Use R020 for 0-3.12 A or R015 for 0-4.16 A range
Note 1.6: Replace ZD1 and C3, C5, C6 if Vin is above 50 V

Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open

SMPS power pre-regulator with 100% duty cycle

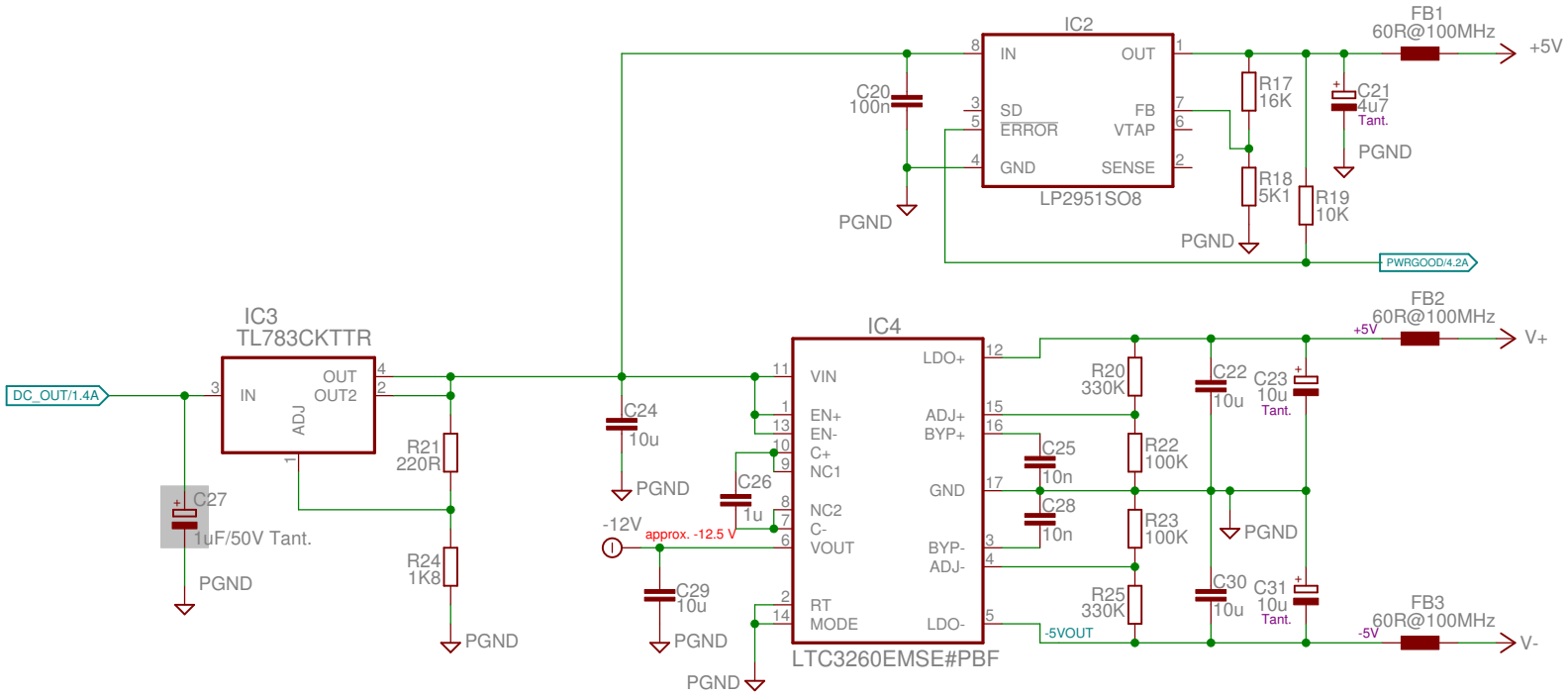
TITLE: EEZ PSU consolidated r5B12

Document Number:

REV:

Date: 05. 04. 2017. 09:47

Sheet: 1/12



Bias power supply (+/-5V, +5V, -12V)
Powergood signal

TITLE: EEZ PSU consolidated r5B12

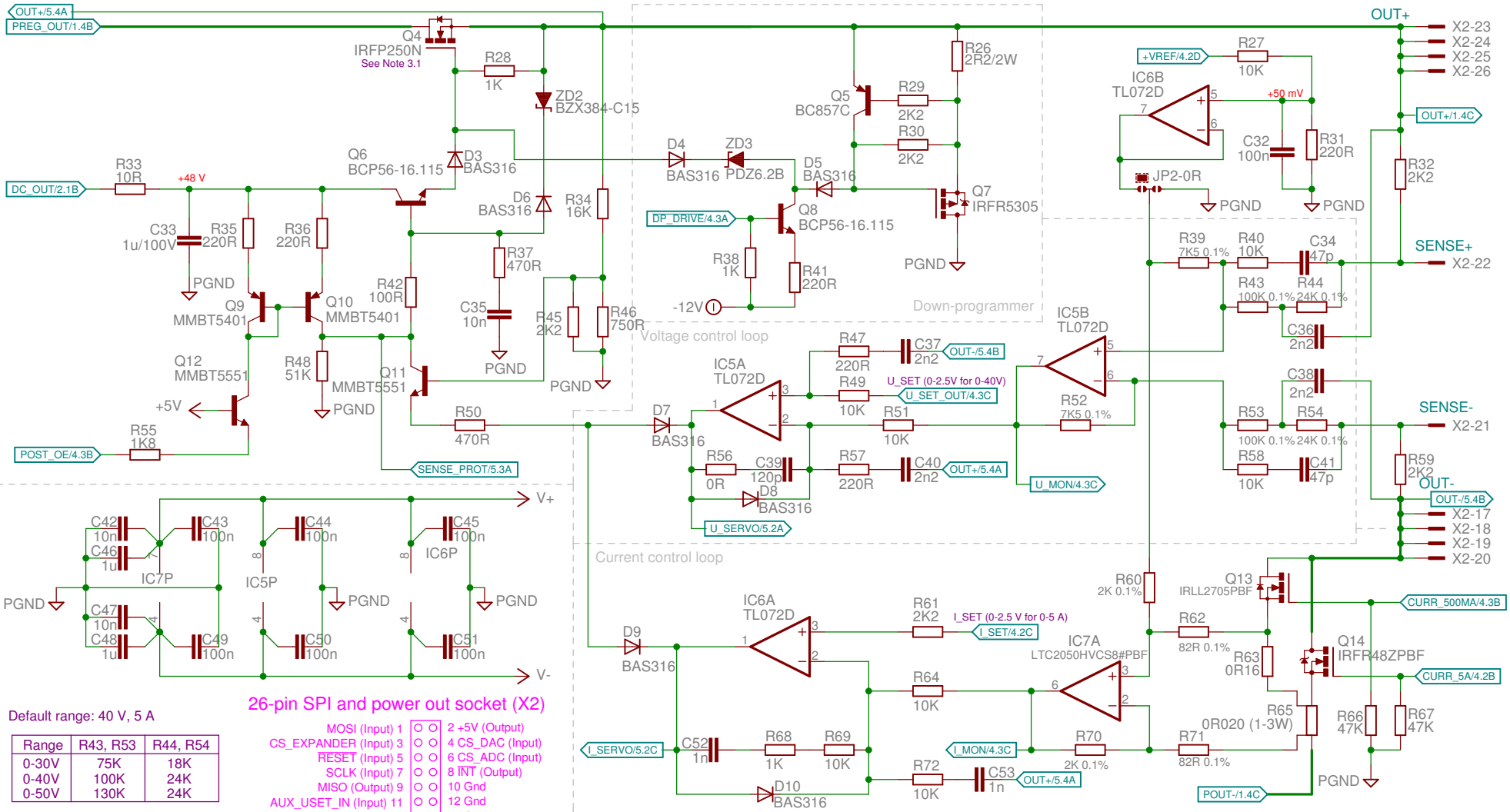
Document Number:

REV:

Date: 05. 04. 2017. 09:47

Sheet: 2/12

Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open



Default range: 40 V, 5 A

Range	R43, R53	R44, R54
0-30V	75K	18K
0-40V	100K	24K
0-50V	130K	24K

Range	R60, R70
0-3.12A	3K24
0-4.16A	2K74
0-5A	2K

26-pin SPI and power out socket (X2)

MOSI (Input) 1		2 +5V (Output)
CS_EXPANDER (Input) 3		4 CS_DAC (Input)
RESET (Input) 5		6 CS_ADC (Input)
SCLK (Input) 7		8 INT (Output)
MISO (Output) 9		10 Gnd
AUX_USET_IN (Input) 11		12 Gnd
TEMP_NTC (Output) 13		14 Gnd
MCU_VCC (Input) 15		16 Sync (Input)
-Vout 17		18 -Vout
-Vout 19		20 -Vout
Sense- (Input) 21		22 Sense+ (Input)
+Vout (Output) 23		24 +Vout (Output)
+Vout (Output) 25		26 +Vout (Output)

Note 3.1: Q4 is mounted on the external heatsink (e.g. RAD-A4463/120)

Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open

CV/CC linear post-regulator
Output enable and "down-programmer"

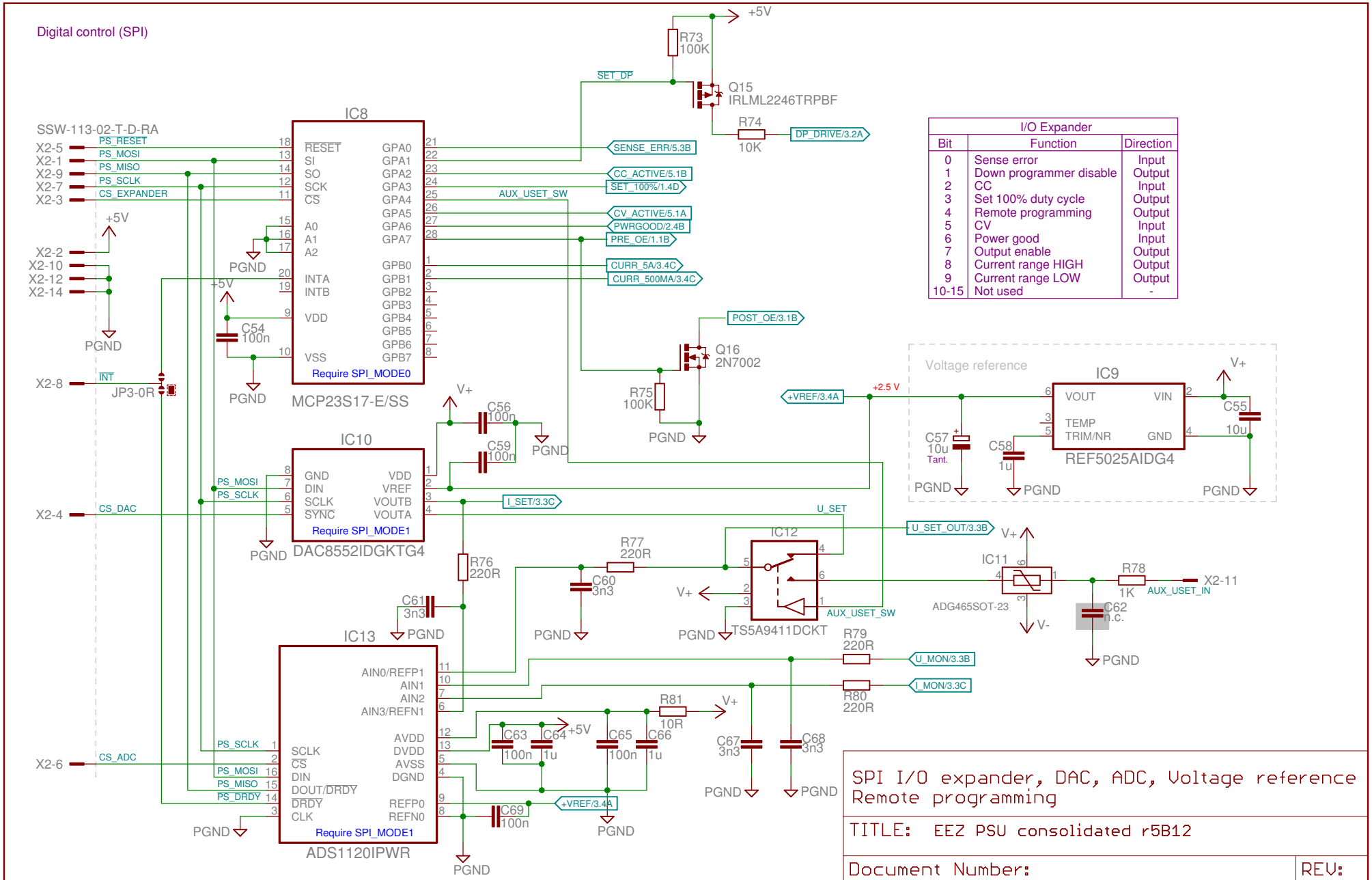
TITLE: EEZ PSU consolidated r5B12

Document Number:

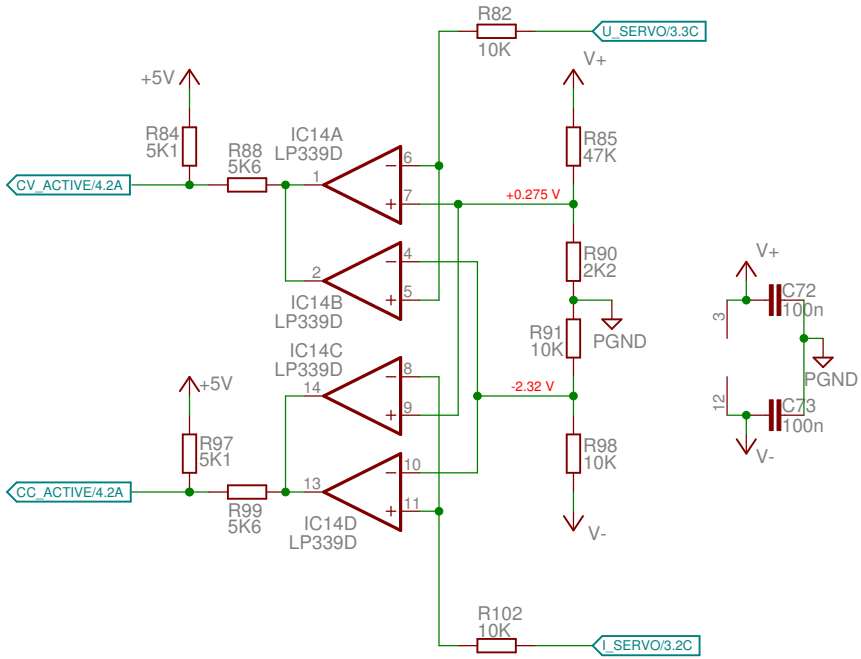
REV:

Date: 05. 04. 2017. 09:47

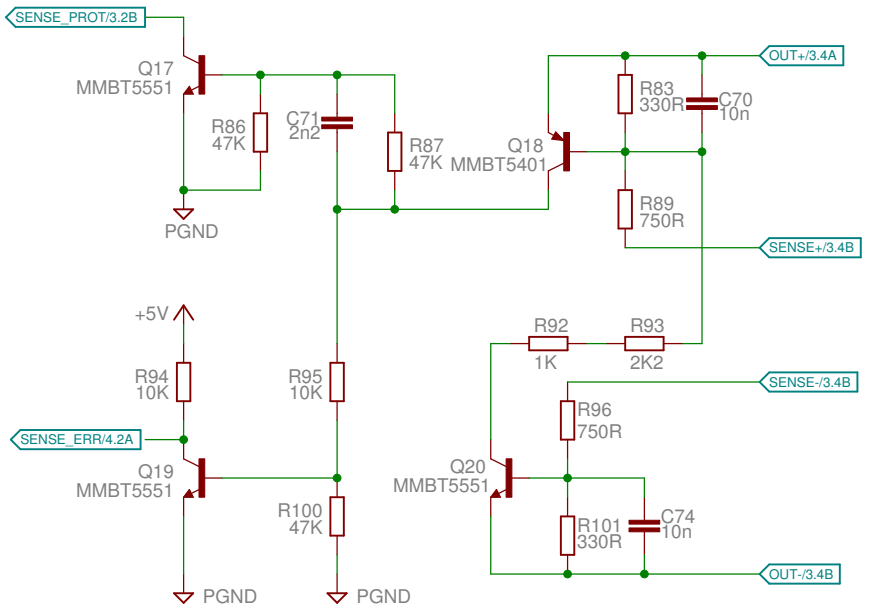
Sheet: 3/12


Digital control (SPI)
SSW-113-02-T-D-RA
X2-5
X2-1
X2-9
X2-7
X2-3
PS_RESET
PS_MOSI
PS_MISO
PS_SCLK
CS_EXPANDER
IC8
MCP23S17-E/SS
Require SPI_MODE0
RESET
SI
SO
SCK
CS
A0
A1
A2
INTA
INTB
VDD
VSS
GPA0
GPA1
GPA2
GPA3
GPA4
GPA5
GPA6
GPA7
GPB0
GPB1
GPB2
GPB3
GPB4
GPB5
GPB6
GPB7
SENSE_ERR/5.3B
CC_ACTIVE/5.1B
SET_100%/1.4D
CV_ACTIVE/5.1A
PWRGOOD/2.4B
PRE_OE/1.1B
CURR_5A/3.4C
CURR_500MA/3.4C
AUX_USET_SW
SET_DP
R73
100K
+5V
Q15
IRLML2246TRPBF
R74
10K
DP_DRIVE/3.2A
I/O Expander
Bit
Function
Direction
0
Sense error
Input
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
8
Current range HIGH
Output
9
Current range LOW
Output
10-15
Not used
-
X2-2
X2-10
X2-12
X2-14
PGND
C54
100n
X2-8
INT
JP3-0R
POST_OE/3.1B
Q16
2N7002
R75
100K
Voltage reference
IC9
REF5025AIDG4
VOUT
VIN
TEMP
TRIM/NR
GND
+VREF/3.4A
+2.5 V
V+
C55
10u
C57
10u
Tant.
C58
1u
IC10
DAC8552IDGKTG4
GND
DIN
SCLK
SYNC
VDD
VREF
VOUTB
VOUTA
C56
100n
C59
100n
I_SET/3.3C
X2-4
CS_DAC
U_SET
U_SET_OUT/3.3B
R76
220R
R77
220R
C60
3n3
C61
3n3
IC12
TS5A9411DCKT
AUX_USET_SW
IC11
ADG465SOT-23
V-
R78
1K
AUX_USET_IN
X2-11
C62
n.c.
R79
220R
R80
220R
U_MON/3.3B
I_MON/3.3C
IC13
ADS1120IPWR
Require SPI_MODE1
AIN0/REFP1
AIN1
AIN2
AIN3/REFN1
AVDD
DVDD
AVSS
DGND
REFP0
REFN0
SCLK
CS
DIN
DOUT/DRDY
DRDY
CLK
X2-6
CS_ADC
PS_DRDY
R81
10R
C63
100n
C64
1u
C65
100n
C66
1u
C67
3n3
C68
3n3
C69
100n
SPI I/O expander, DAC, ADC, Voltage reference
Remote programming
TITLE: EEZ PSU consolidated r5B12
Document Number:
REV:
Date: 05. 04. 2017. 09:47
Sheet: 4/12
Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open

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

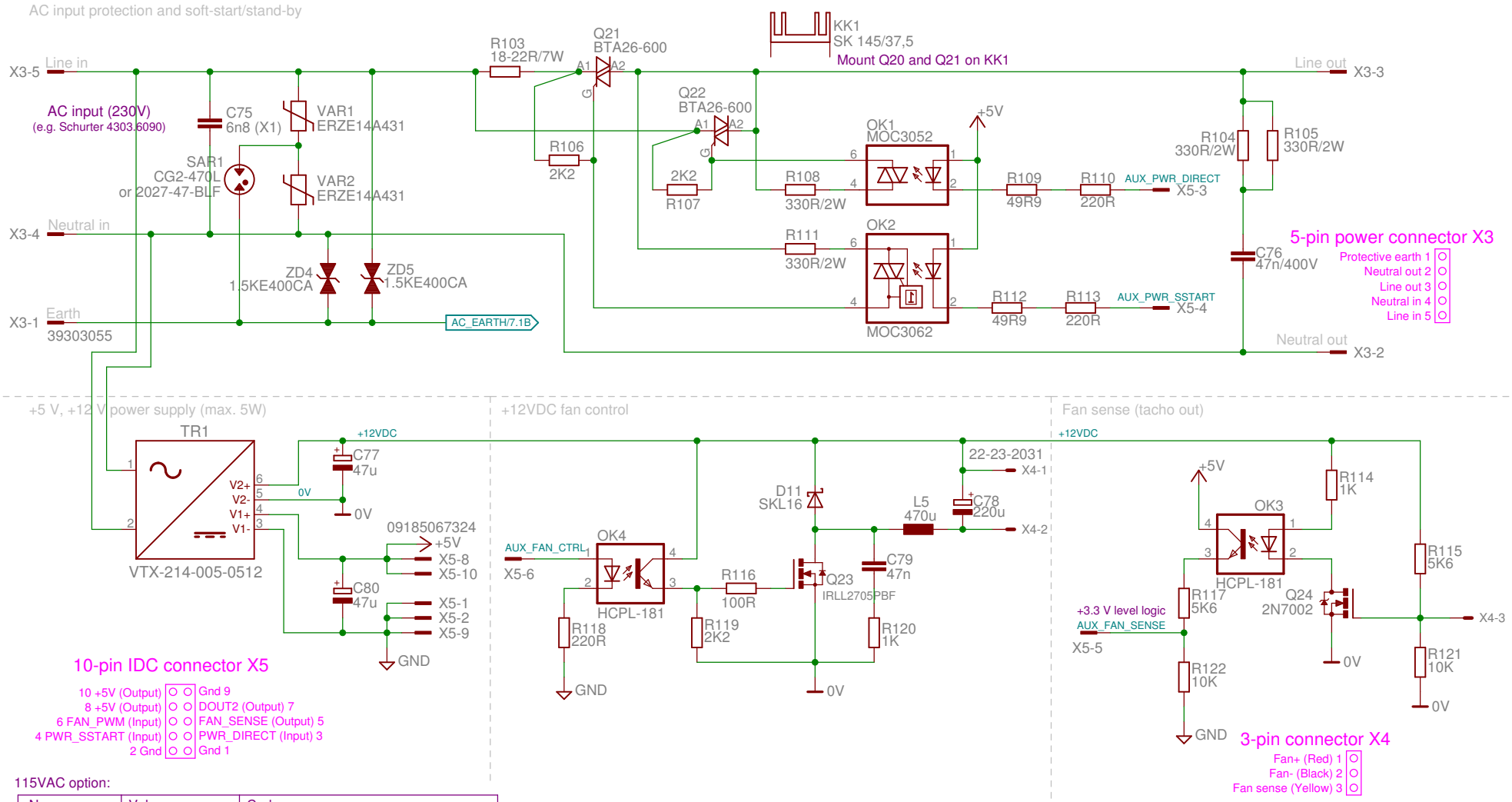


Remote sense reverse polarity detection



Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open

CC/CV indicators, Sense error detection	
TITLE: EEZ PSU consolidated r5B12	
Document Number:	REV:
Date: 05. 04. 2017. 09:47	Sheet: 5/12



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

Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open

AC input protection, in-rush current limiter
+5V/+12V 5W power supply, fan control

TITLE: EEZ PSU consolidated r5B12

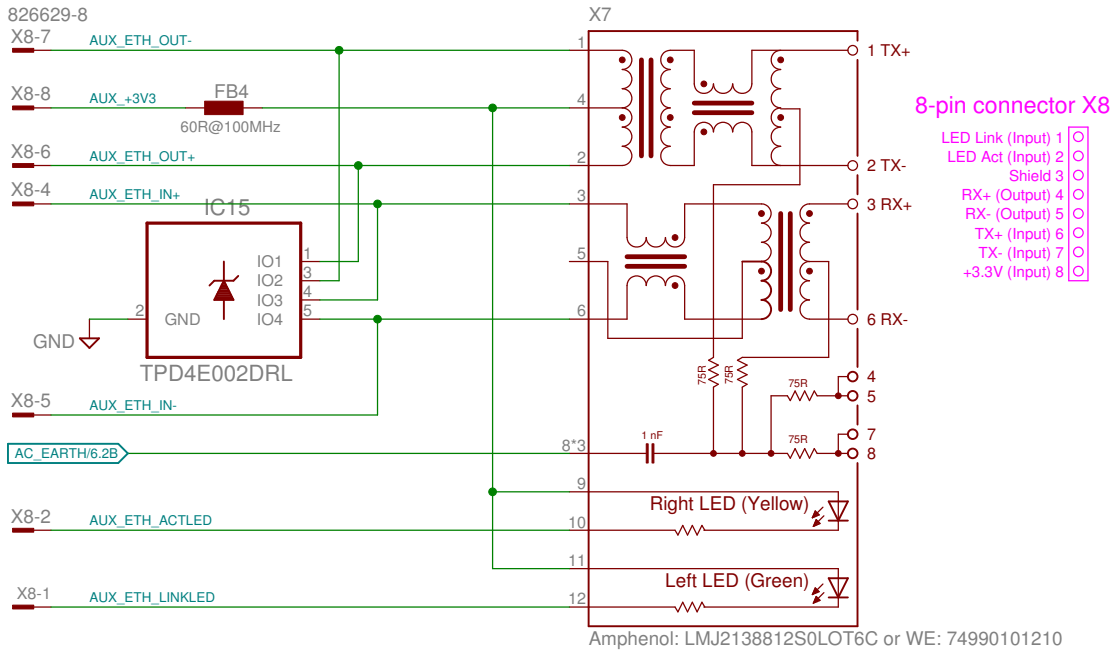
Document Number:

REV:

Date: 05. 04. 2017. 09:47

Sheet: 6/12

Ethernet connector with optional surge protection

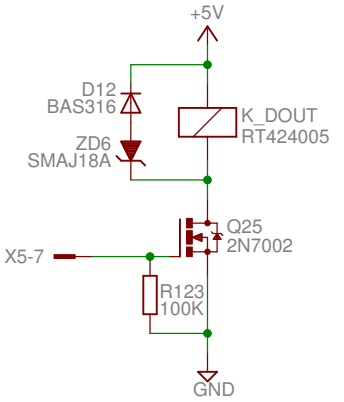


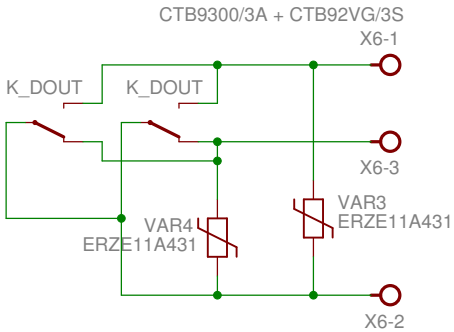
8-pin connector X8

- 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

Amphenol: LMJ2138812S0LOT6C or WE: 74990101210

Digital OUT2 relay





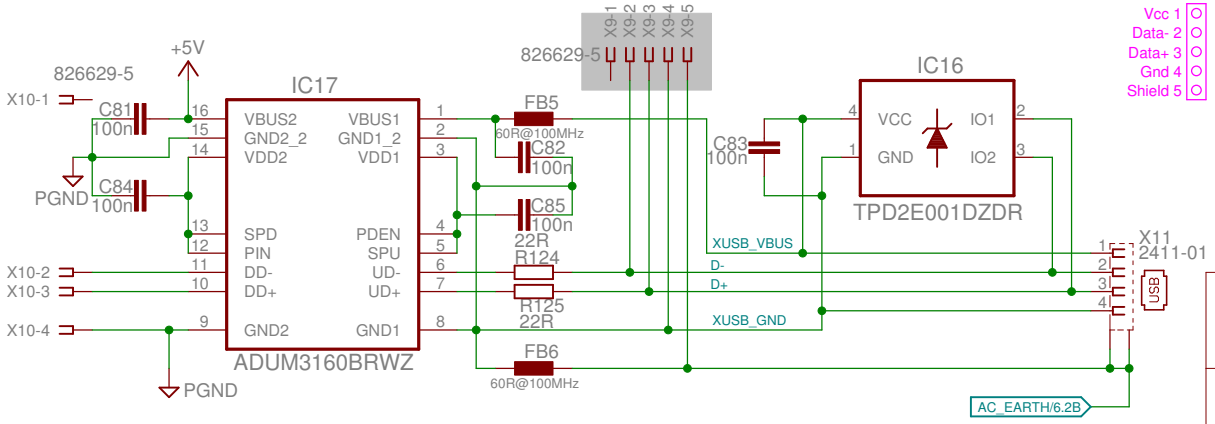
3-pin connector X6

- NO contact 1
- Common 2
- NC contact 3

USB connector with optional isolator and surge protection

5-pin connector X9, X10

- Vcc 1
- Data- 2
- Data+ 3
- Gnd 4
- Shield 5



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

Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open

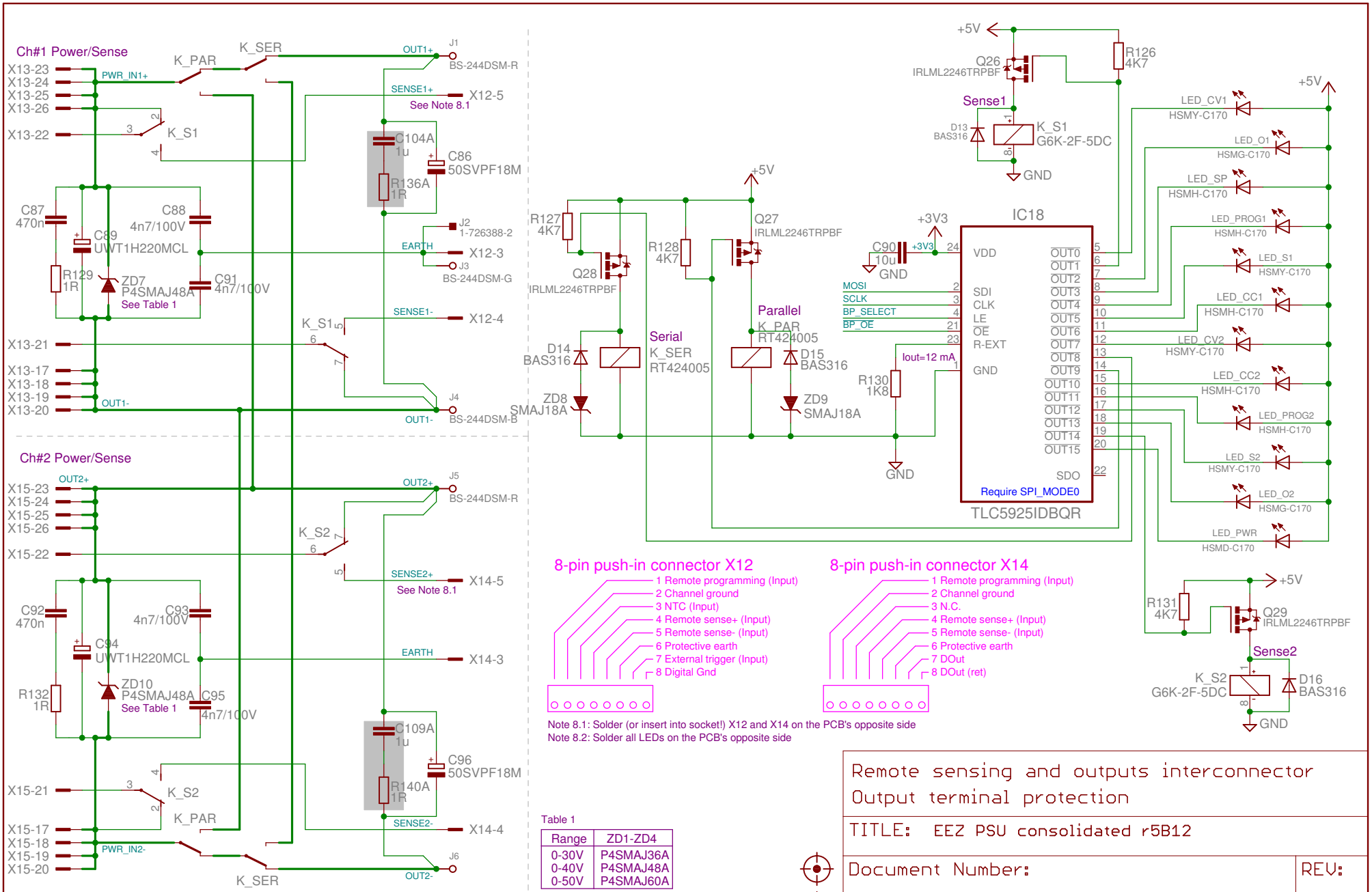
Ethernet and USB PCB connectors

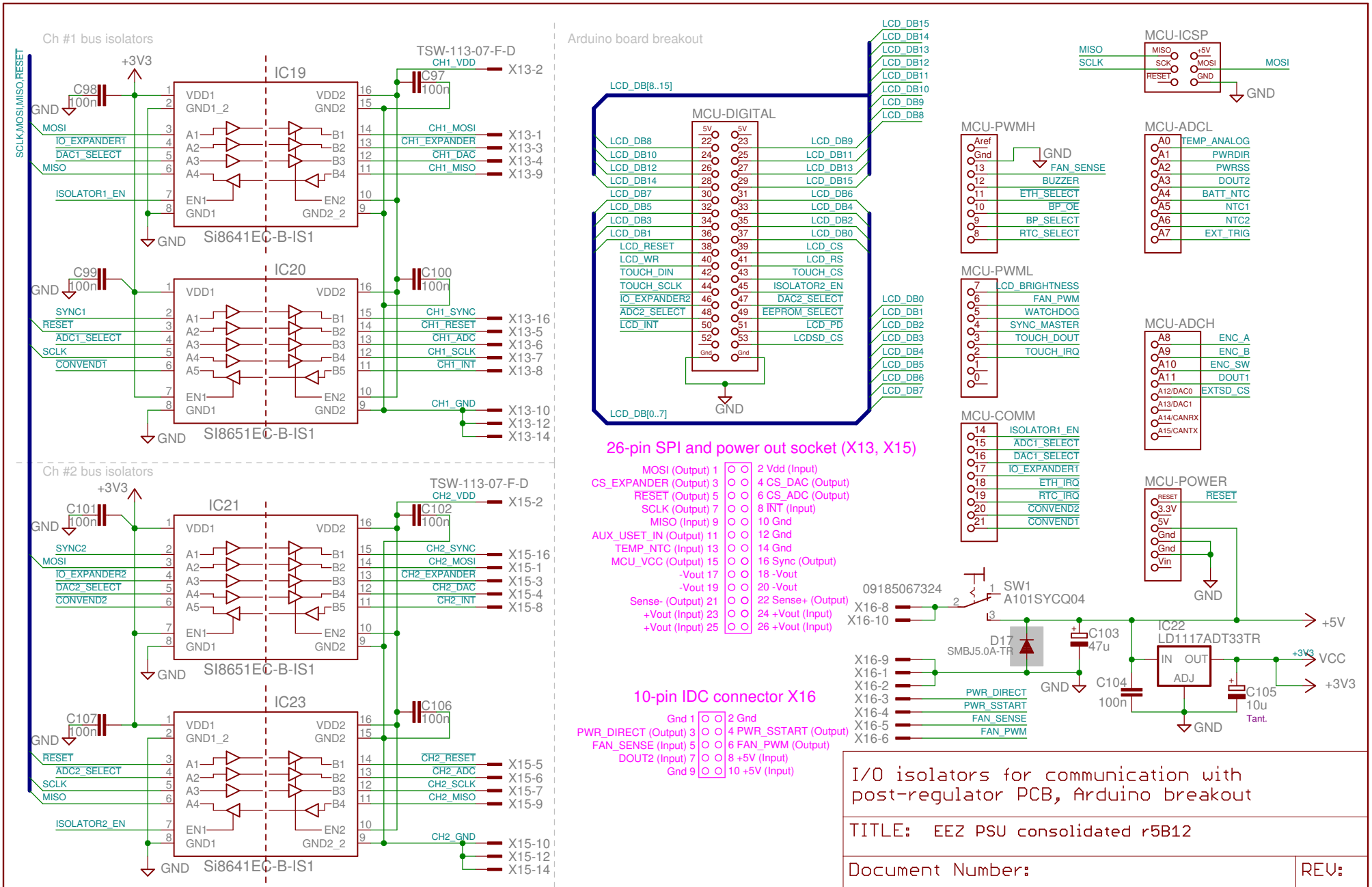
TITLE: EEZ PSU consolidated r5B12

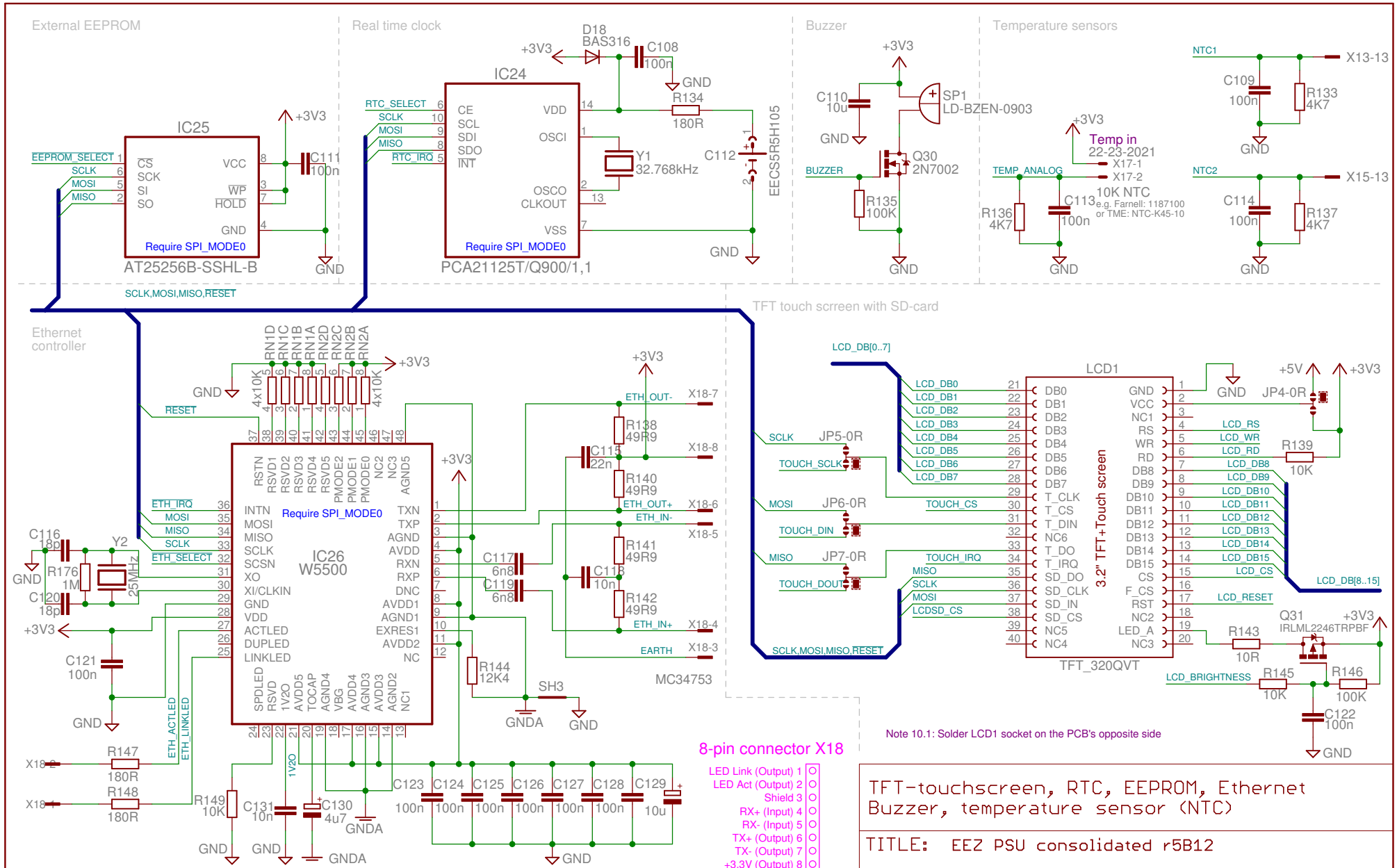
Document Number:

REV:

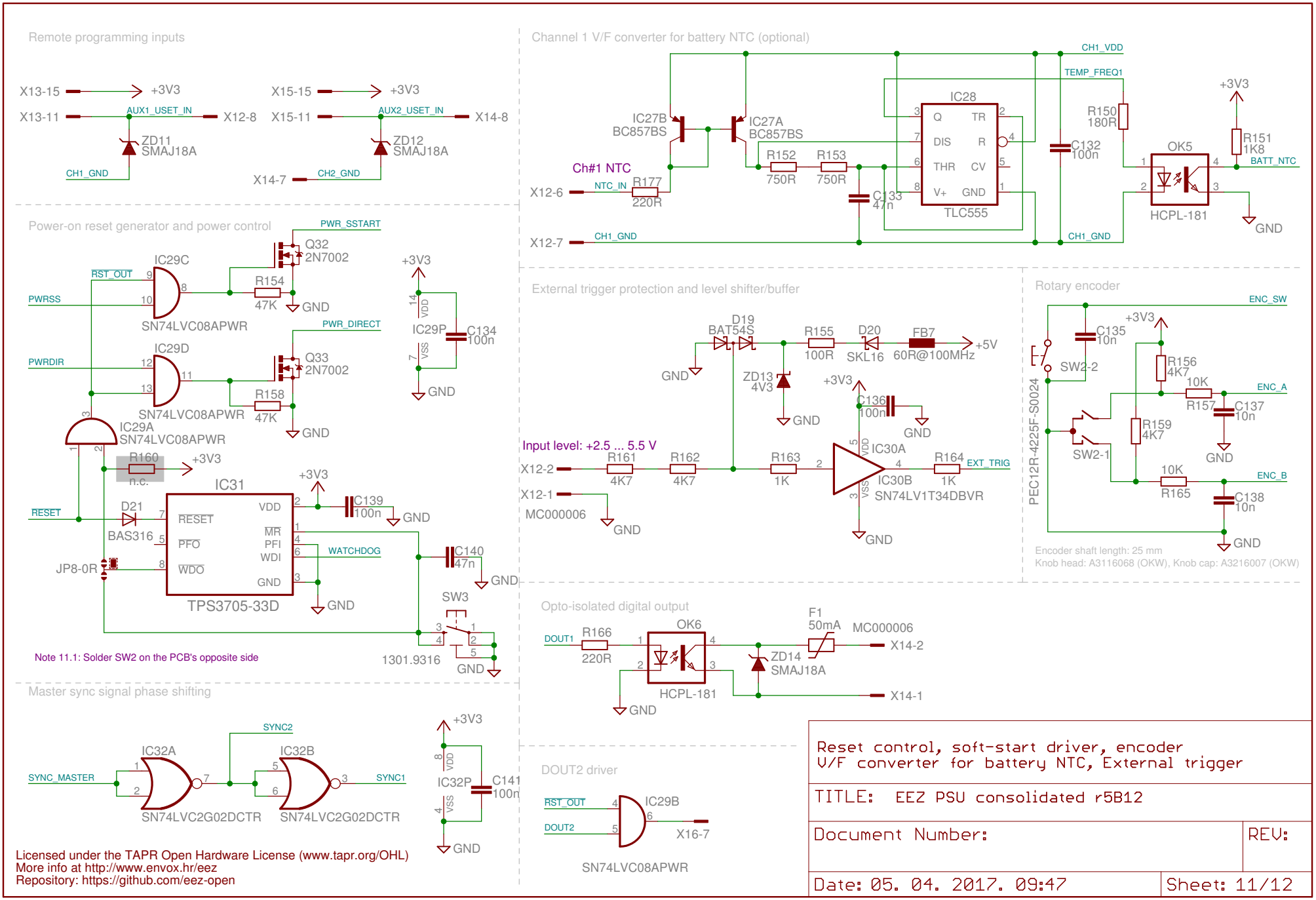
Date: 05. 04. 2017. 09:47


Ch#1 Power/Sense
X13-23
X13-24
X13-25
X13-26
X13-22
X13-21
X13-17
X13-18
X13-19
X13-20
PWR_IN1+
OUT1-
K_PAR
K_SER
K_S1
OUT1+
SENSE1+
See Note 8.1
SENSE1-
EARTH
C87 470n
C88 4n7/100V
C89 UWT1H220MCL
C91 4n7/100V
R129 1R
ZD7 P4SMAJ48A
See Table 1
C104A 1u
R136A 1R
C86 50SVPF18M
J1 BS-244DSM-R
J2 1-726388-2
J3 BS-244DSM-G
J4 BS-244DSM-B
X12-5
X12-3
X12-4
Ch#2 Power/Sense
X15-23
X15-24
X15-25
X15-26
X15-22
X15-21
X15-17
X15-18
X15-19
X15-20
PWR_IN2-
OUT2+
OUT2-
K_S2
SENSE2+
SENSE2-
EARTH
C92 470n
C93 4n7/100V
C94 UWT1H220MCL
C95 4n7/100V
R132 1R
ZD10 P4SMAJ48A
See Table 1
C109A 1u
R140A 1R
C96 50SVPF18M
J5 BS-244DSM-R
J6 BS-244DSM-B
X14-5
X14-3
X14-4
+5V
Q26 IRLML2246TRPBF
R126 4K7
Sense1
D13 BAS316
K_S1 G6K-2F-5DC
GND
R127 4K7
Q28 IRLML2246TRPBF
R128 4K7
Q27 IRLML2246TRPBF
Serial
K_SER RT424005
Parallel
K_PAR RT424005
D14 BAS316
D15 BAS316
ZD8 SMAJ18A
ZD9 SMAJ18A
+3V3
C90 10u
IC18
VDD
SDI
CLK
LE
OE
R-EXT
GND
SDO
MOSI
SCLK
BP_SELECT
BP_OE
Iout=12 mA
R130 1K8
Require SPI_MODE0
TLC5925IDBQR
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
R131 4K7
Q29 IRLML2246TRPBF
Sense2
K_S2 G6K-2F-5DC
D16 BAS316
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
8-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
7 DOut
8 DOut (ret)
Note 8.1: Solder (or insert into socket!) X12 and X14 on the PCB's opposite side
Note 8.2: Solder all LEDs on the PCB's opposite side
Table 1
Range | ZD1-ZD4
0-30V | P4SMAJ36A
0-40V | P4SMAJ48A
0-50V | P4SMAJ60A
Remote sensing and outputs interconnector
Output terminal protection
TITLE: EEZ PSU consolidated r5B12
Document Number:
REV:
Date: 05. 04. 2017. 09:47
Sheet: 8/12
Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)

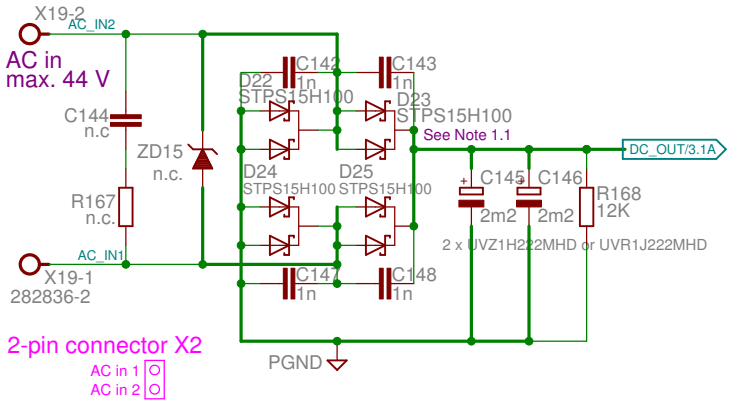

Ch #1 bus isolators
SCLK,MOSI,MISO,RESET
+3V3
C98
100n
GND
IC19
VDD1
GND1_2
VDD2
GND2
A1
A2
A3
A4
B1
B2
B3
B4
EN1
GND1
EN2
GND2_2
Si8641EC-B-IS1
MOSI
IO_EXPANDER1
DAC1_SELECT
MISO
ISOLATOR1_EN
TSW-113-07-F-D
CH1_VDD
X13-2
C97
100n
CH1_MOSI
CH1_EXPANDER
CH1_DAC
CH1_MISO
X13-1
X13-3
X13-4
X13-9
C99
100n
IC20
VDD1
VDD2
A5
B5
SYNC1
RESET
ADC1_SELECT
SCLK
CONVEND1
C100
100n
CH1_SYNC
CH1_RESET
CH1_ADC
CH1_SCLK
CH1_INT
CH1_GND
X13-16
X13-5
X13-6
X13-7
X13-8
X13-10
X13-12
X13-14
Ch #2 bus isolators
+3V3
C101
100n
IC21
SYNC2
MOSI
IO_EXPANDER2
DAC2_SELECT
CONVEND2
TSW-113-07-F-D
CH2_VDD
X15-2
C102
100n
CH2_SYNC
CH2_MOSI
CH2_EXPANDER
CH2_DAC
CH2_INT
X15-16
X15-1
X15-3
X15-4
X15-8
C107
100n
IC23
RESET
ADC2_SELECT
SCLK
MISO
ISOLATOR2_EN
C106
100n
CH2_RESET
CH2_ADC
CH2_SCLK
CH2_MISO
CH2_GND
X15-5
X15-6
X15-7
X15-9
X15-10
X15-12
X15-14
Arduino board breakout
LCD_DB[8..15]
MCU-DIGITAL
LCD_DB[0..7]
LCD_DB15
LCD_DB14
LCD_DB13
LCD_DB12
LCD_DB11
LCD_DB10
LCD_DB9
LCD_DB8
LCD_DB0
LCD_DB1
LCD_DB2
LCD_DB3
LCD_DB4
LCD_DB5
LCD_DB6
LCD_DB7
LCD_RESET
LCD_WR
TOUCH_DIN
TOUCH_SCLK
IO_EXPANDER2
ADC2_SELECT
LCD_INT
LCD_CS
LCD_RS
TOUCH_CS
ISOLATOR2_EN
DAC2_SELECT
EEPROM_SELECT
LCD_PD
LCDSD_CS
MCU-ICSP
MISO
SCLK
MOSI
RESET
+5V
GND
MCU-PWMH
Aref
Gnd
FAN_SENSE
BUZZER
ETH_SELECT
BP_OE
BP_SELECT
RTC_SELECT
MCU-ADCL
A0
A1
A2
A3
A4
A5
A6
A7
TEMP_ANALOG
PWRDIR
PWRSS
DOUT2
BATT_NTC
NTC1
NTC2
EXT_TRIG
MCU-PWML
LCD_BRIGHTNESS
FAN_PWM
WATCHDOG
SYNC_MASTER
TOUCH_DOUT
TOUCH_IRQ
MCU-ADCH
A8
A9
A10
A11
A12/DAC0
A13/DAC1
A14/CANRX
A15/CANTX
ENC_A
ENC_B
ENC_SW
DOUT1
EXTSD_CS
MCU-COMM
ISOLATOR1_EN
ADC1_SELECT
DAC1_SELECT
IO_EXPANDER1
ETH_IRQ
RTC_IRQ
CONVEND2
CONVEND1
MCU-POWER
RESET
3.3V
5V
Gnd
Vin
26-pin SPI and power out socket (X13, X15)
MOSI (Output) 1
2 Vdd (Input)
CS_EXPANDER (Output) 3
4 CS_DAC (Output)
RESET (Output) 5
6 CS_ADC (Output)
SCLK (Output) 7
8 INT (Input)
MISO (Input) 9
10 Gnd
AUX_USET_IN (Output) 11
12 Gnd
TEMP_NTC (Input) 13
14 Gnd
MCU_VCC (Output) 15
16 Sync (Output)
-Vout 17
18 -Vout
-Vout 19
20 -Vout
Sense- (Output) 21
22 Sense+ (Output)
+Vout (Input) 23
24 +Vout (Input)
+Vout (Input) 25
26 +Vout (Input)
10-pin IDC connector X16
Gnd 1
2 Gnd
PWR_DIRECT (Output) 3
4 PWR_SSTART (Output)
FAN_SENSE (Input) 5
6 FAN_PWM (Output)
DOUT2 (Input) 7
8 +5V (Input)
Gnd 9
10 +5V (Input)
09185067324
X16-8
X16-10
SW1
A101SYCQ04
D17
SMBJ5.0A-TR
C103
47u
IC22
LD1117ADT33TR
IN
OUT
ADJ
C104
100n
C105
10u
Tant.
VCC
+3V3
X16-9
X16-1
X16-2
X16-3
X16-4
X16-5
X16-6
PWR_DIRECT
PWR_SSTART
FAN_SENSE
FAN_PWM
Note 9.1: Solder SW1 on the PCB's opposite side
I/O isolators for communication with post-regulator PCB, Arduino breakout
TITLE: EEZ PSU consolidated r5B12
Document Number:
REV:
Date: 05. 04. 2017. 09:47
Sheet: 9/12
Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)



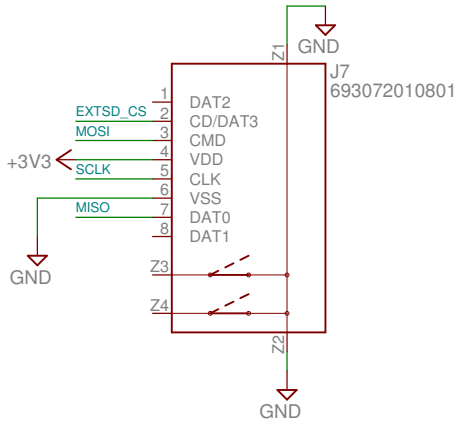
Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open


Remote programming inputs
X13-15
+3V3
X13-11
AUX1_USET_IN
X12-8
ZD11
SMAJ18A
CH1_GND
X15-15
+3V3
X15-11
AUX2_USET_IN
X14-8
ZD12
SMAJ18A
X14-7
CH2_GND
Channel 1 V/F converter for battery NTC (optional)
CH1_VDD
TEMP_FREQ1
IC28
IC27B
BC857BS
IC27A
BC857BS
Ch#1 NTC
X12-6
NTC_IN
R177
220R
R152
750R
R153
750R
C133
47n
TLC555
C132
100n
R150
180R
OK5
HCPL-181
+3V3
R151
1K8
BATT_NTC
GND
X12-7
CH1_GND
CH1_GND
Power-on reset generator and power control
PWR_SSTART
Q32
2N7002
IC29C
RST_OUT
PWRSS
SN74LVC08APWR
R154
47K
GND
PWR_DIRECT
IC29D
PWRDIR
SN74LVC08APWR
Q33
2N7002
R158
47K
GND
IC29A
SN74LVC08APWR
+3V3
IC29P
C134
100n
GND
R160
n.c.
+3V3
IC31
RESET
D21
BAS316
JP8-0R
VDD
RESET
MR
PFI
WDI
PFO
WDO
GND
TPS3705-33D
+3V3
C139
100n
GND
WATCHDOG
C140
47n
GND
SW3
1301.9316
GND
Note 11.1: Solder SW2 on the PCB's opposite side
External trigger protection and level shifter/buffer
D19
BAT54S
R155
100R
D20
SKL16
FB7
60R@100MHz
+5V
GND
ZD13
4V3
GND
+3V3
C136
100n
GND
Input level: +2.5 ... 5.5 V
X12-2
R161
4K7
R162
4K7
R163
1K
IC30A
IC30B
SN74LV1T34DBVR
R164
1K
EXT_TRIG
X12-1
MC000006
GND
GND
Rotary encoder
ENC_SW
+3V3
C135
10n
SW2-2
R156
4K7
10K
R157
C137
10n
ENC_A
PEC12R-4225F-S0024
R159
4K7
SW2-1
GND
10K
R165
ENC_B
C138
10n
GND
Encoder shaft length: 25 mm
Knob head: A3116068 (OKW), Knob cap: A3216007 (OKW)
Opto-isolated digital output
DOUT1
R166
220R
OK6
HCPL-181
GND
F1
50mA
MC000006
X14-2
ZD14
SMAJ18A
X14-1
Master sync signal phase shifting
SYNC2
IC32A
IC32B
SYNC_MASTER
SN74LVC2G02DCTR
SN74LVC2G02DCTR
SYNC1
+3V3
IC32P
C141
100n
GND
DOUT2 driver
RST_OUT
DOUT2
IC29B
X16-7
SN74LVC08APWR
Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open
Reset control, soft-start driver, encoder
V/F converter for battery NTC, External trigger
TITLE: EEZ PSU consolidated r5B12
Document Number:
REV:
Date: 05. 04. 2017. 09:47
Sheet: 11/12

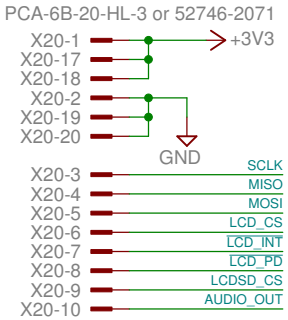
AC input option



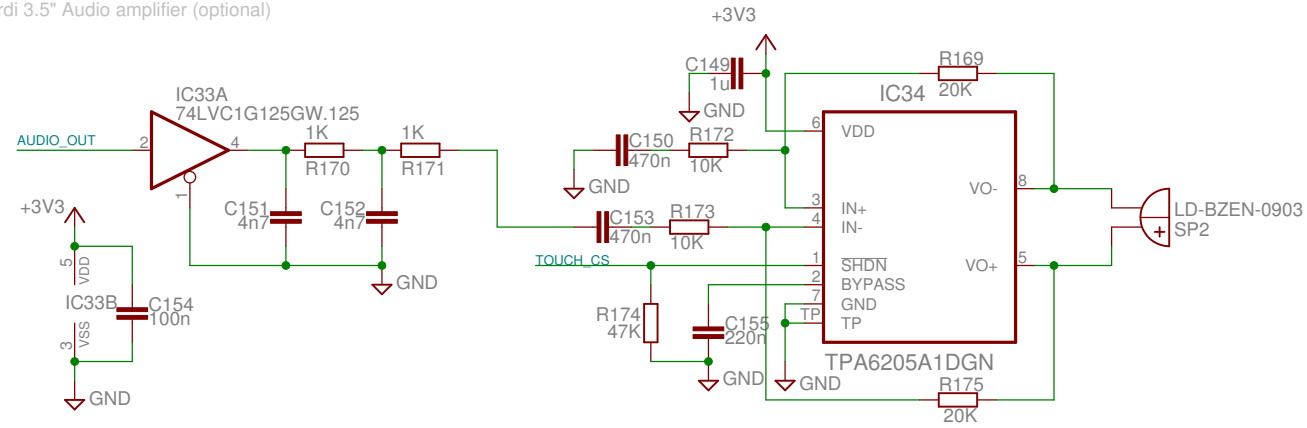
Micro SD card (optional)



Riverdi 3.5" LCD (optional)



Riverdi 3.5" Audio amplifier (optional)



Optional sections: AC input, 20-pin 3.5" TFT display
Audio amplifier for 3.5" TFT display, Micro SD card

TITLE: EEZ PSU consolidated r5B12

Document Number:

REV:

Date: 05. 04. 2017. 09:47

Sheet: 12/12

Licensed under the TAPR Open Hardware License (www.tapr.org/OHL)
More info at http://www.envox.hr/eez
Repository: https://github.com/eez-open