OverView

COMPANY:		
TITLE:	2017_01_15_release_v2	
DRAWN: >Eddy Zhang	CHECKED:	APPROVED:
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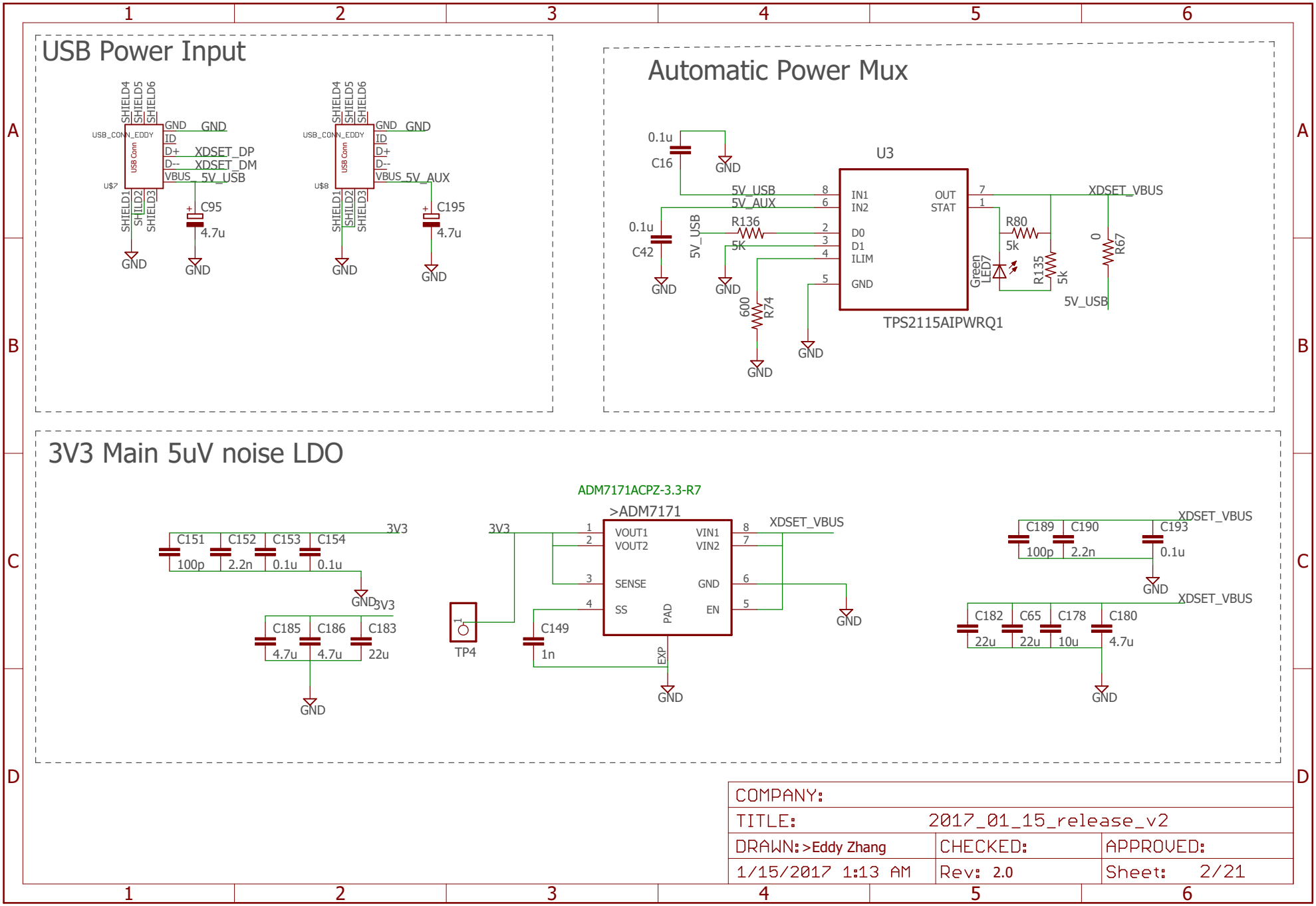
USB Power Input
USB_CONN_EDDY
SHIELD4
SHIELD5
SHIELD6
SHIELD1
SHIELD2
SHIELD3
GND
ID
D+
D--
VBUS
XDSET_DP
XDSET_DM
5V_USB
5V_AUX
C95
C195
4.7u
U$7
U$8
Automatic Power Mux
U3
TPS2115AIPWRQ1
IN1
IN2
OUT
STAT
D0
D1
ILIM
C16
C42
0.1u
R136
5k
R74
600
R80
R135
R67
0
Green
LED7
XDSET_VBUS
3V3 Main 5uV noise LDO
ADM7171ACPZ-3.3-R7
>ADM7171
VOUT1
VOUT2
VIN1
VIN2
SENSE
SS
PAD
EXP
EN
C149
1n
TP4
C151
C152
C153
C154
100p
2.2n
C185
C186
C183
4.7u
22u
C189
C190
C193
C182
C65
C178
C180
10u
COMPANY:
TITLE: 2017_01_15_release_v2
DRAWN:>Eddy Zhang
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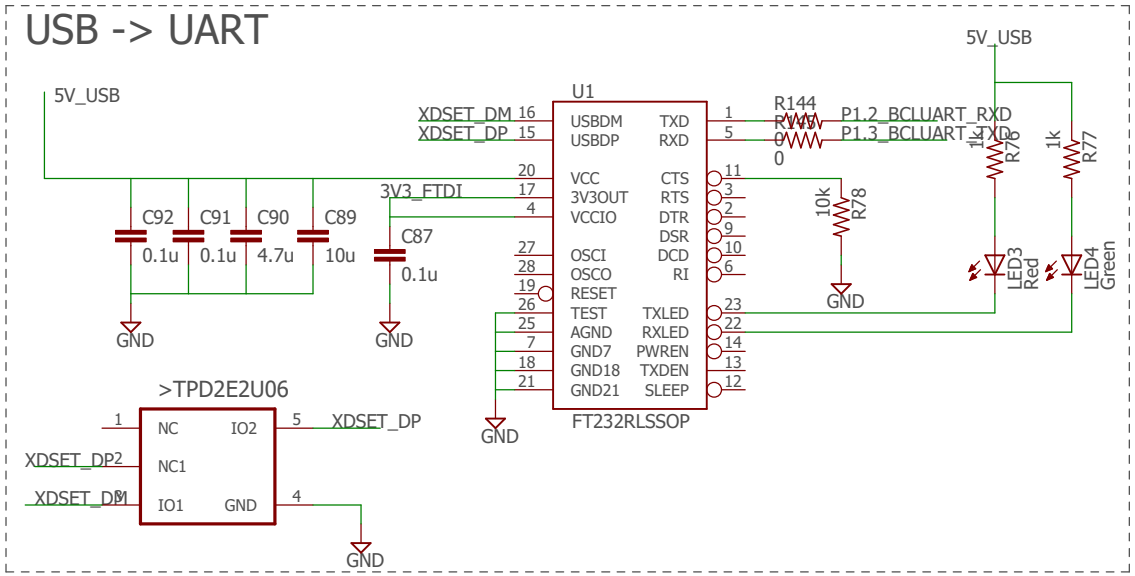
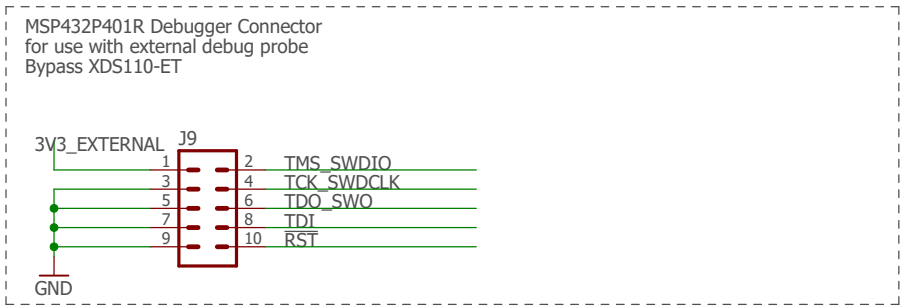
USB programming





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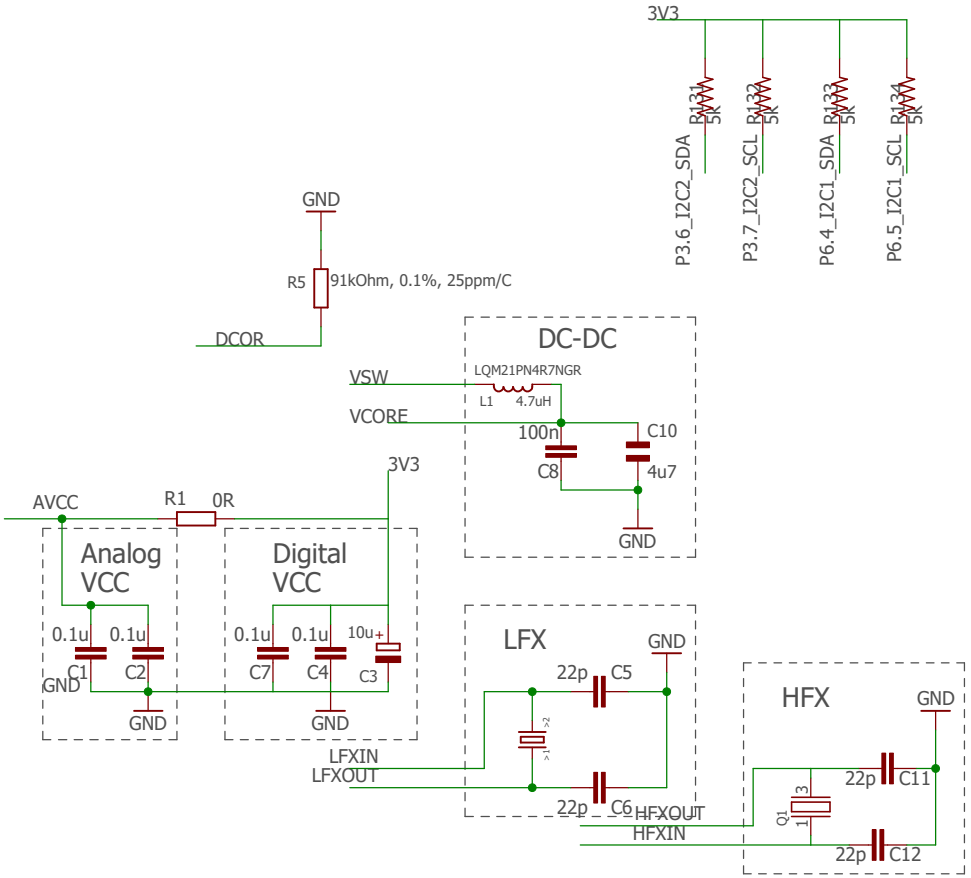
MCU:
MSP432P401R



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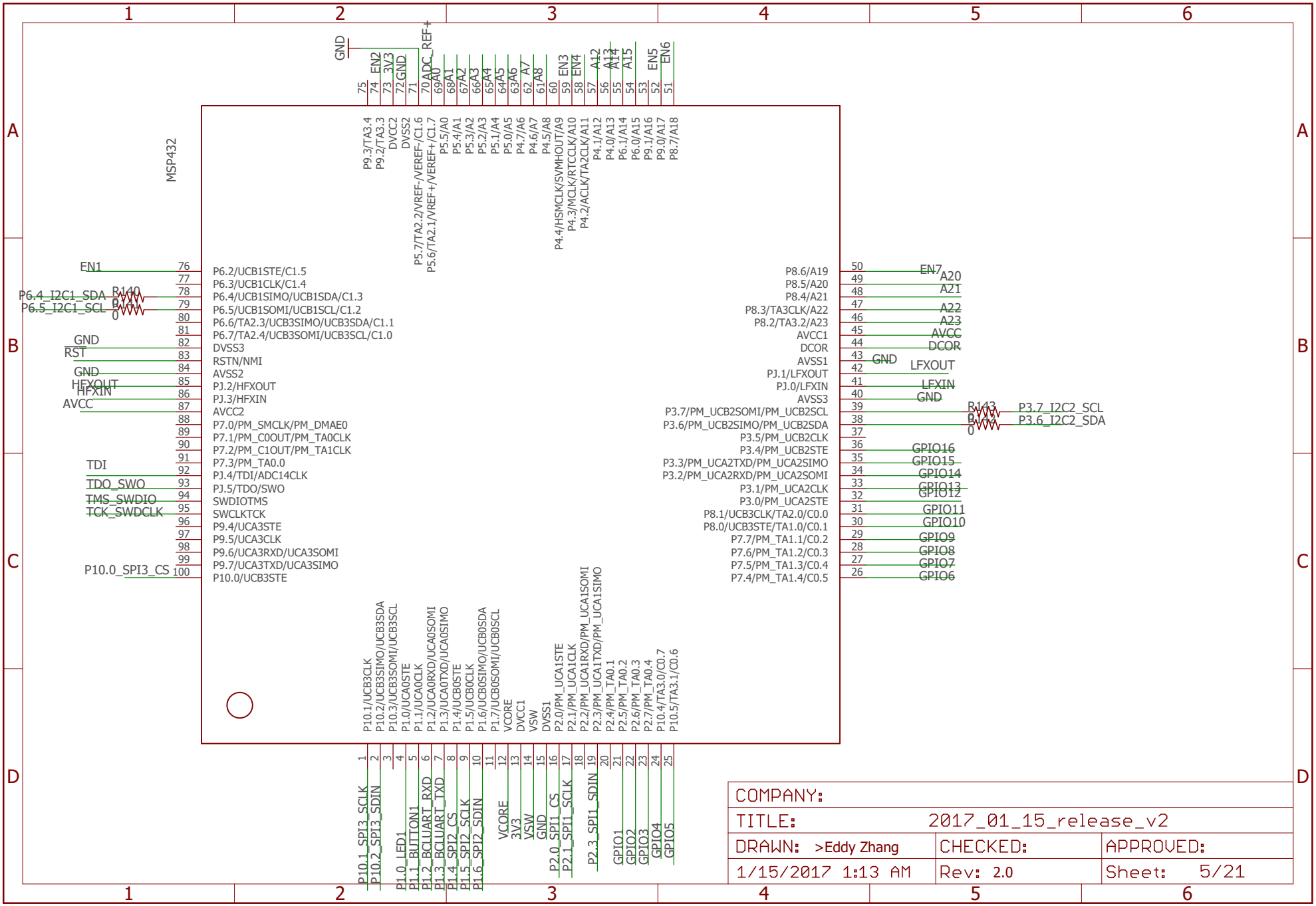
MSP432
P6.2/UCB1STE/C1.5
P6.3/UCB1CLK/C1.4
P6.4/UCB1SIMO/UCB1SDA/C1.3
P6.5/UCB1SOMI/UCB1SCL/C1.2
P6.6/TA2.3/UCB3SIMO/UCB3SDA/C1.1
P6.7/TA2.4/UCB3SOMI/UCB3SCL/C1.0
DVSS3
RSTN/NMI
AVSS2
PJ.2/HFXOUT
PJ.3/HFXIN
AVCC2
P7.0/PM_SMCLK/PM_DMAE0
P7.1/PM_C0OUT/PM_TA0CLK
P7.2/PM_C1OUT/PM_TA1CLK
P7.3/PM_TA0.0
PJ.4/TDI/ADC14CLK
PJ.5/TDO/SWO
SWDIOTMS
SWCLKTCK
P9.4/UCA3STE
P9.5/UCA3CLK
P9.6/UCA3RXD/UCA3SOMI
P9.7/UCA3TXD/UCA3SIMO
P10.0/UCB3STE
P8.6/A19
P8.5/A20
P8.4/A21
P8.3/TA3CLK/A22
P8.2/TA3.2/A23
AVCC1
DCOR
AVSS1
PJ.1/LFXOUT
PJ.0/LFXIN
AVSS3
P3.7/PM_UCB2SOMI/PM_UCB2SCL
P3.6/PM_UCB2SIMO/PM_UCB2SDA
P3.5/PM_UCB2CLK
P3.4/PM_UCB2STE
P3.3/PM_UCA2TXD/PM_UCA2SIMO
P3.2/PM_UCA2RXD/PM_UCA2SOMI
P3.1/PM_UCA2CLK
P3.0/PM_UCA2STE
P8.1/UCB3CLK/TA2.0/C0.0
P8.0/UCB3STE/TA1.0/C0.1
P7.7/PM_TA1.1/C0.2
P7.6/PM_TA1.2/C0.3
P7.5/PM_TA1.3/C0.4
P7.4/PM_TA1.4/C0.5
P9.3/TA3.4
P9.2/TA3.3
DVCC2
DVSS2
P5.7/TA2.2/VREF-/VEREF-/C1.6
P5.6/TA2.1/VREF+/VEREF+/C1.7
P5.5/A0
P5.4/A1
P5.3/A2
P5.2/A3
P5.1/A4
P5.0/A5
P4.7/A6
P4.6/A7
P4.5/A8
P4.4/HSMCLK/SVMHOUT/A9
P4.3/MCLK/RTCCLK/A10
P4.2/ACLK/TA2CLK/A11
P4.1/A12
P4.0/A13
P6.1/A14
P6.0/A15
P9.1/A16
P9.0/A17
P8.7/A18
P10.1/UCB3CLK
P10.2/UCB3SIMO/UCB3SDA
P10.3/UCB3SOMI/UCB3SCL
P1.0/UCA0STE
P1.1/UCA0CLK
P1.2/UCA0RXD/UCA0SOMI
P1.3/UCA0TXD/UCA0SIMO
P1.4/UCB0STE
P1.5/UCB0CLK
P1.6/UCB0SIMO/UCB0SDA
P1.7/UCB0SOMI/UCB0SCL
VCORE
DVCC1
VSW
DVSS1
P2.0/PM_UCA1STE
P2.1/PM_UCA1CLK
P2.2/PM_UCA1RXD/PM_UCA1SOMI
P2.3/PM_UCA1TXD/PM_UCA1SIMO
P2.4/PM_TA0.1
P2.5/PM_TA0.2
P2.6/PM_TA0.3
P2.7/PM_TA0.4
P10.4/TA3.0/C0.7
P10.5/TA3.1/C0.6
GND
EN2
3V3
GND
ADC_REF+
A0
A1
A2
A3
A4
A5
A6
A7
A8
EN3
EN4
A12
A13
A14
A15
EN5
EN6
EN1
P6.4_I2C1_SDA
P6.5_I2C1_SCL
R140
0
R141
0
GND
RST
GND
HFXOUT
HFXIN
AVCC
TDI
TDO_SWO
TMS_SWDIO
TCK_SWDCLK
P10.0_SPI3_CS
EN7
A20
A21
A22
A23
AVCC
DCOR
GND
LFXOUT
LFXIN
GND
R143
0
R142
0
P3.7_I2C2_SCL
P3.6_I2C2_SDA
GPIO16
GPIO15
GPIO14
GPIO13
GPIO12
GPIO11
GPIO10
GPIO9
GPIO8
GPIO7
GPIO6
P10.1_SPI3_SCLK
P10.2_SPI3_SDIN
P1.0_LED1
P1.1_BUTTON1
P1.2_BCLUART_RXD
P1.3_BCLUART_TXD
P1.4_SPI2_CS
P1.5_SPI2_SCLK
P1.6_SPI2_SDIN
VCORE
3V3
VSW
GND
P2.0_SPI1_CS
P2.1_SPI1_SCLK
P2.3_SPI1_SDIN
GPIO1
GPIO2
GPIO3
GPIO4
GPIO5
COMPANY:
TITLE: 2017_01_15_release_v2
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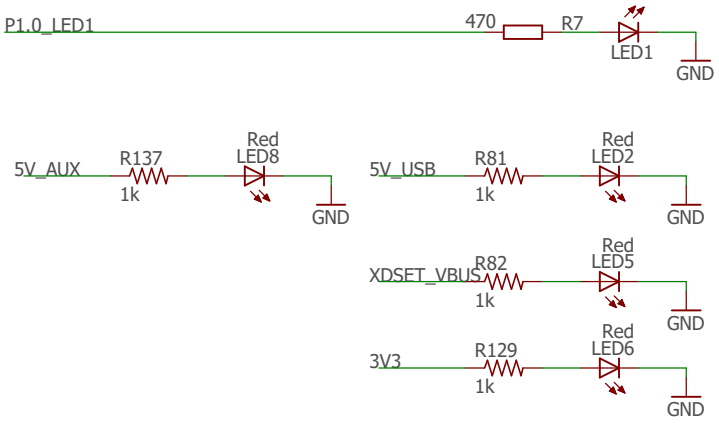
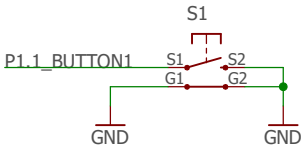
Buttons and LEDs

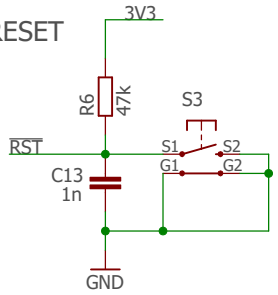
Board bring up
GPIO output



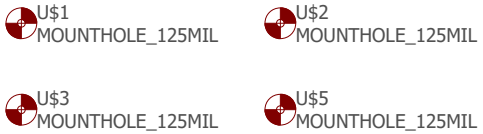
Board bring up
GPIO Input



RESET



Mounting Holes: 125 mil for 4-40/M2.5/M3 screws



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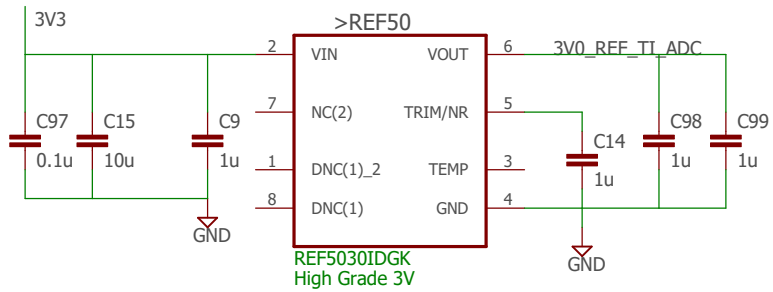
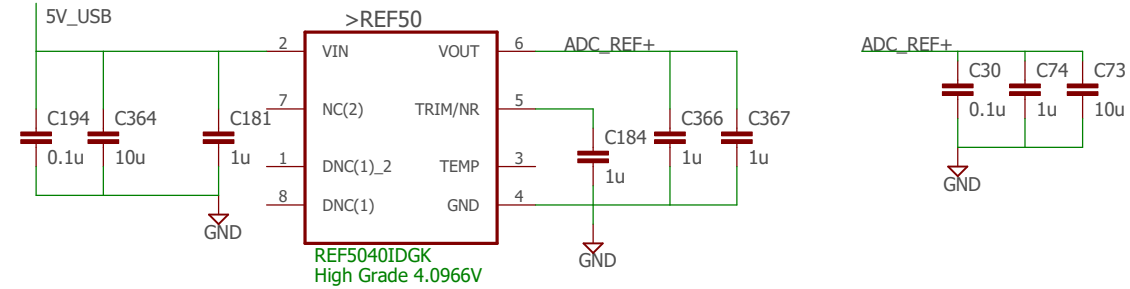
Reference_Voltage

3V0 REFERENCE FOR DAC



4V0 REFERENCE FOR ADC



V_sense_max = 0.2V * (1 + 95.3/4.99) = 4.0196V.
Therefore REF_ADC should be 4V

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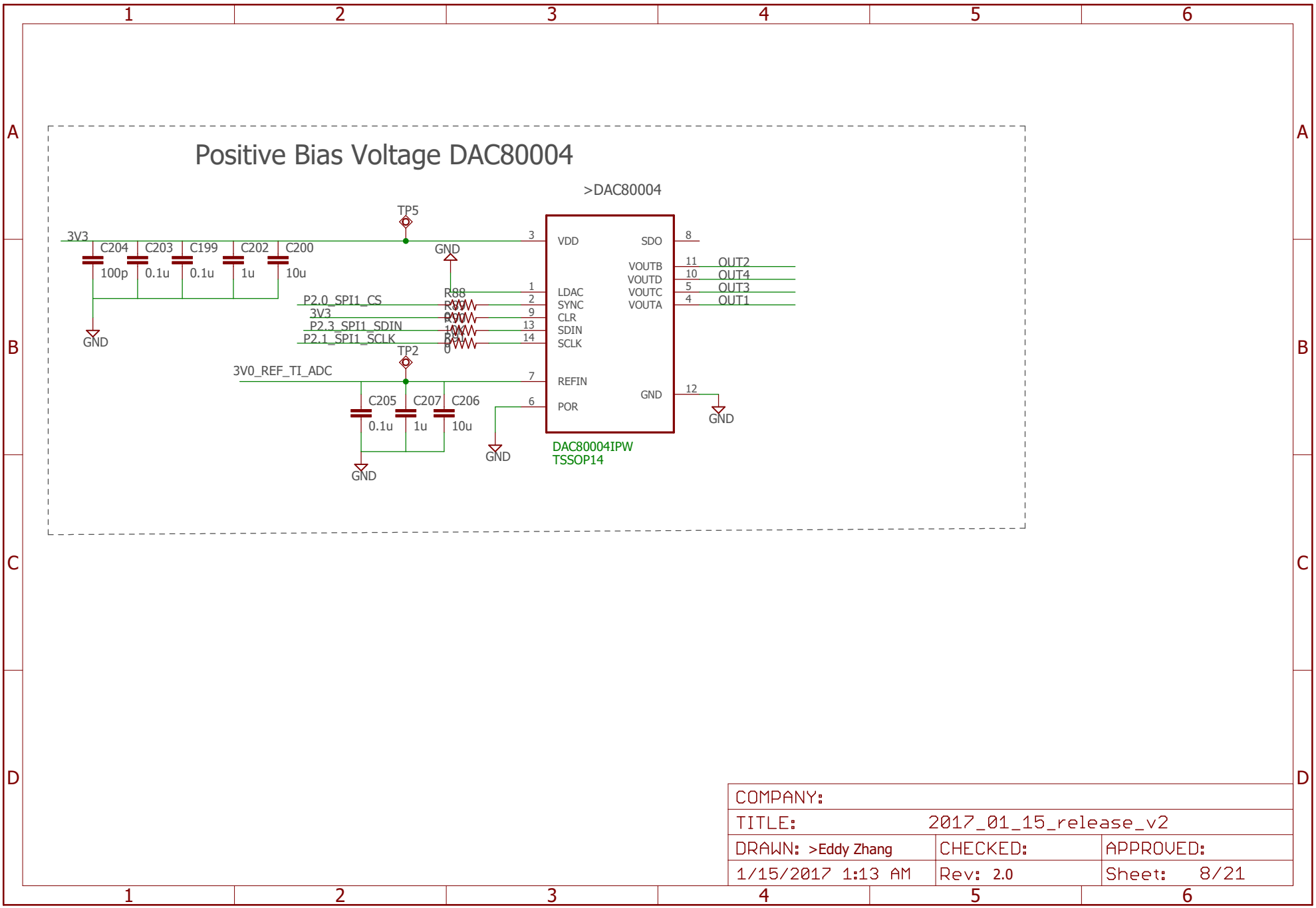

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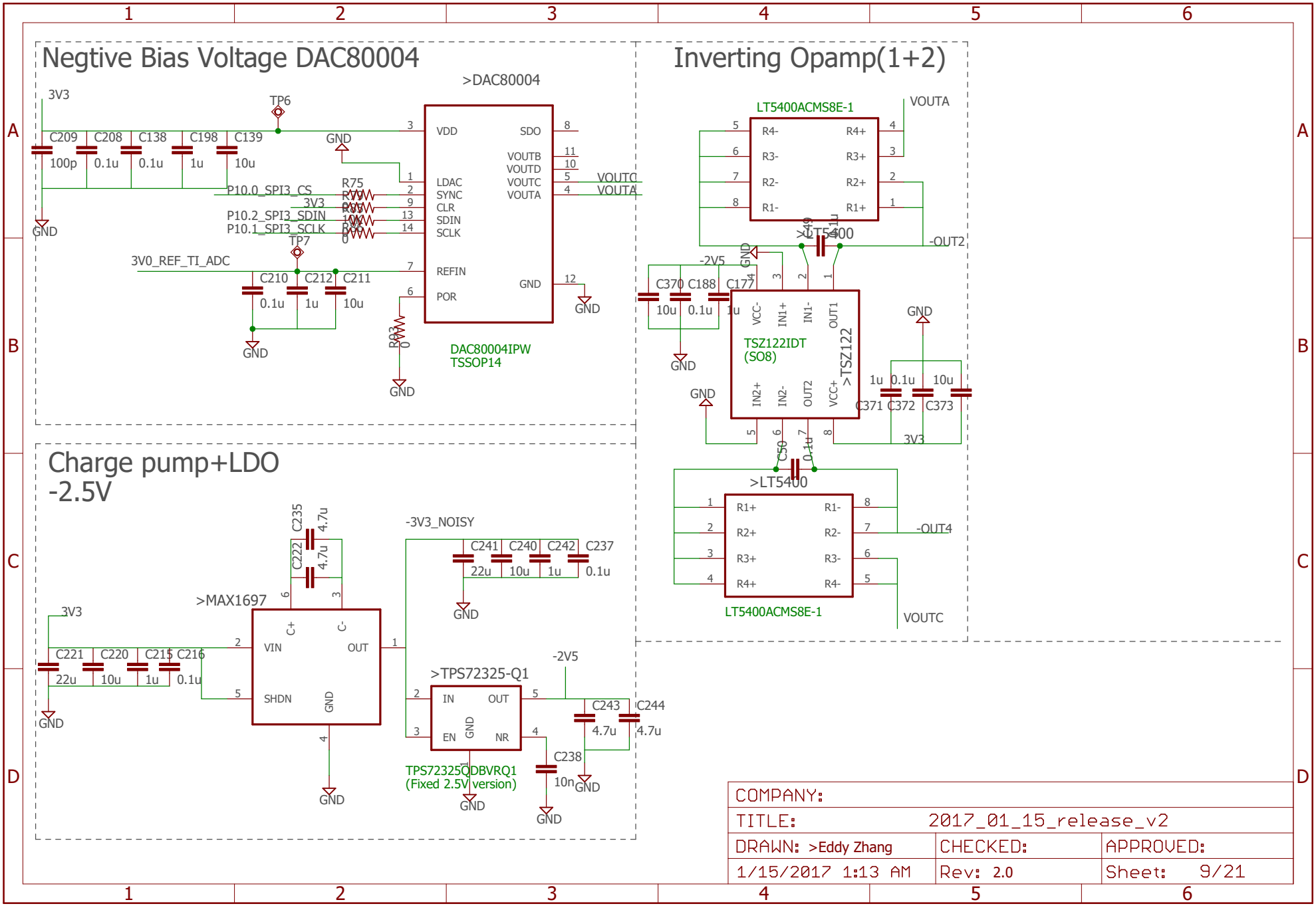
Negtive Bias Voltage DAC80004
>DAC80004
3V3
TP6
GND
C209 C208 C138 C198 C139
100p 0.1u 0.1u 1u 10u
P10.0_SPI3_CS
P10.2_SPI3_SDIN
P10.1_SPI3_SCLK
R75
R77
R78
R79
0
3V3
TP7
3V0_REF_TI_ADC
C210 C212 C211
0.1u 1u 10u
R83
0
VDD
SDO
VOUTB
VOUTD
VOUTC
VOUTA
LDAC
SYNC
CLR
SDIN
SCLK
REFIN
POR
DAC80004IPW
TSSOP14
Inverting Opamp(1+2)
LT5400ACMS8E-1
VOUTA
R4- R4+
R3- R3+
R2- R2+
R1- R1+
>LT5400
-OUT2
-2V5
C370 C188 C177
10u 0.1u 1u
VCC- IN1+ IN1- OUT1
TSZ122IDT
(SO8)
>TSZ122
IN2+ IN2- OUT2 VCC+
1u 0.1u 10u
C371 C372 C373
3V3
C50 0.1u
>LT5400
R1+ R1- -OUT4
R2+ R2-
R3+ R3-
R4+ R4-
LT5400ACMS8E-1
VOUTC
Charge pump+LDO
-2.5V
C235 4.7u
C222 4.7u
>MAX1697
3V3
C221 C220 C215 C216
22u 10u 1u 0.1u
C+ C-
VIN OUT
SHDN GND
-3V3_NOISY
C241 C240 C242 C237
22u 10u 1u 0.1u
>TPS72325-Q1
-2V5
IN OUT
EN GND NR
C243 C244
4.7u 4.7u
C238
10n
TPS72325QDBVRQ1
(Fixed 2.5V version)
COMPANY:
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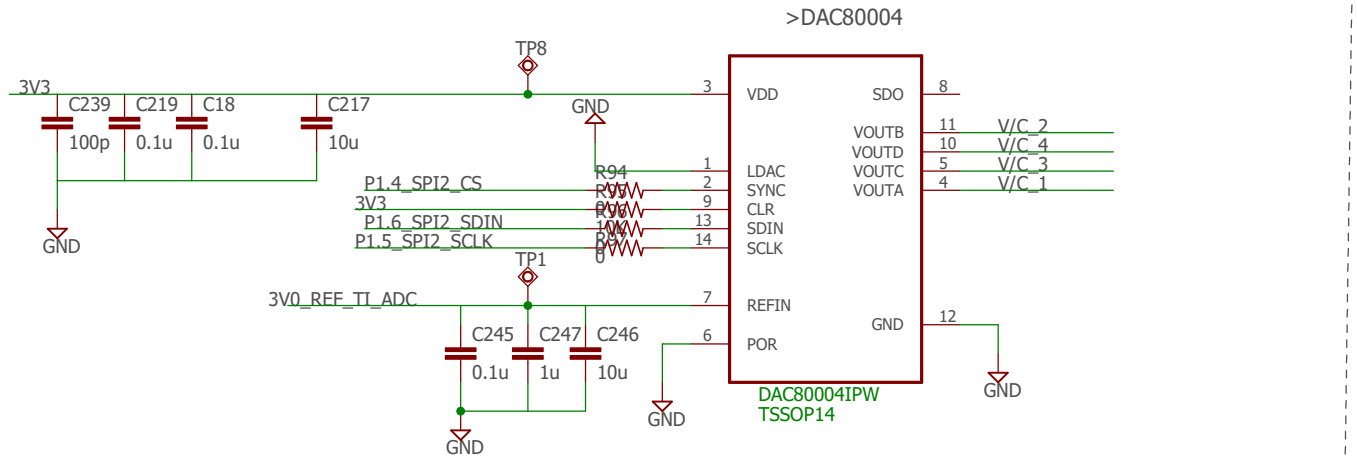
Bias Current (1/3)
DAC



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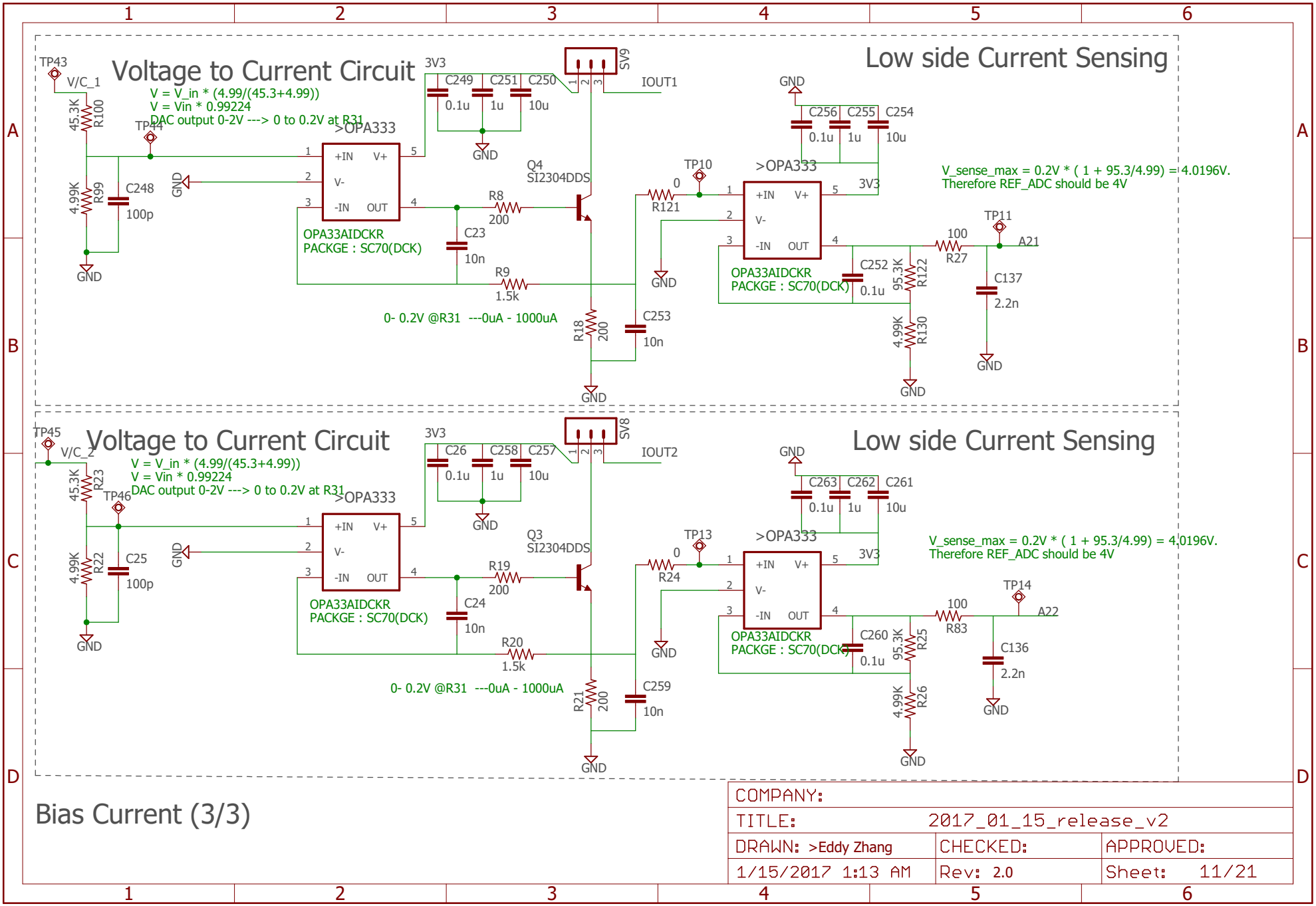
Voltage to Current Circuit
V = V_in * (4.99/(45.3+4.99))
V = Vin * 0.99224
DAC output 0-2V ---> 0 to 0.2V at R31
>OPA333
OPA33AIDCKR
PACKGE : SC70(DCK)
0- 0.2V @R31 ---0uA - 1000uA
Low side Current Sensing
V_sense_max = 0.2V * (1 + 95.3/4.99) = 4.0196V.
Therefore REF_ADC should be 4V
Voltage to Current Circuit
V = V_in * (4.99/(45.3+4.99))
V = Vin * 0.99224
DAC output 0-2V ---> 0 to 0.2V at R31
>OPA333
OPA33AIDCKR
PACKGE : SC70(DCK)
0- 0.2V @R31 ---0uA - 1000uA
Low side Current Sensing
V_sense_max = 0.2V * (1 + 95.3/4.99) = 4.0196V.
Therefore REF_ADC should be 4V
Bias Current (3/3)
COMPANY:
TITLE: 2017_01_15_release_v2
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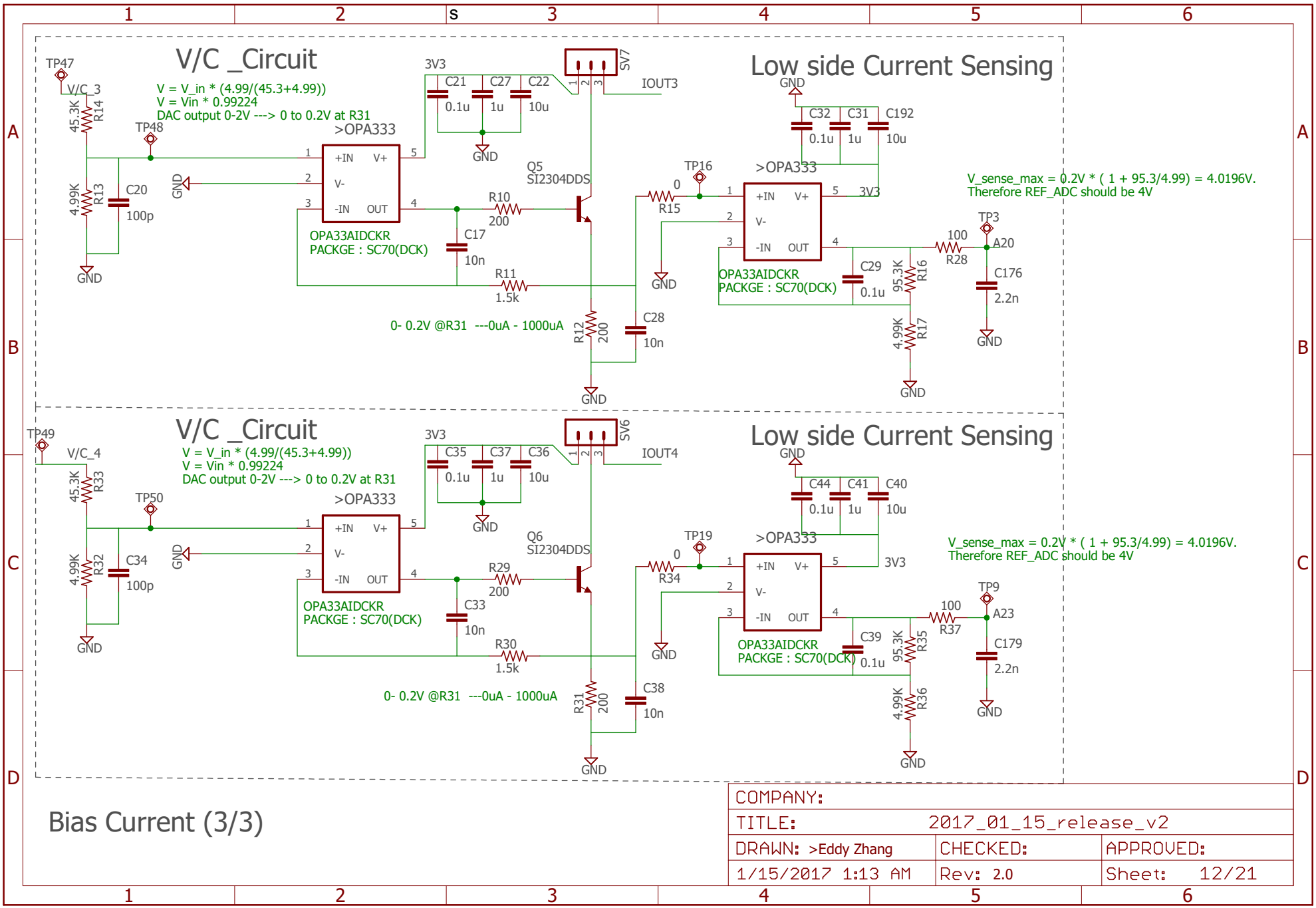
V/C _Circuit
Low side Current Sensing
V = V_in * (4.99/(45.3+4.99))
V = Vin * 0.99224
DAC output 0-2V ---> 0 to 0.2V at R31
>OPA333
OPA33AIDCKR
PACKGE : SC70(DCK)
Q5
SI2304DDS
0- 0.2V @R31 ---0uA - 1000uA
V_sense_max = 0.2V * (1 + 95.3/4.99) = 4.0196V.
Therefore REF_ADC should be 4V
V/C _Circuit
Low side Current Sensing
V = V_in * (4.99/(45.3+4.99))
V = Vin * 0.99224
DAC output 0-2V ---> 0 to 0.2V at R31
>OPA333
OPA33AIDCKR
PACKGE : SC70(DCK)
Q6
SI2304DDS
0- 0.2V @R31 ---0uA - 1000uA
V_sense_max = 0.2V * (1 + 95.3/4.99) = 4.0196V.
Therefore REF_ADC should be 4V
Bias Current (3/3)
COMPANY:
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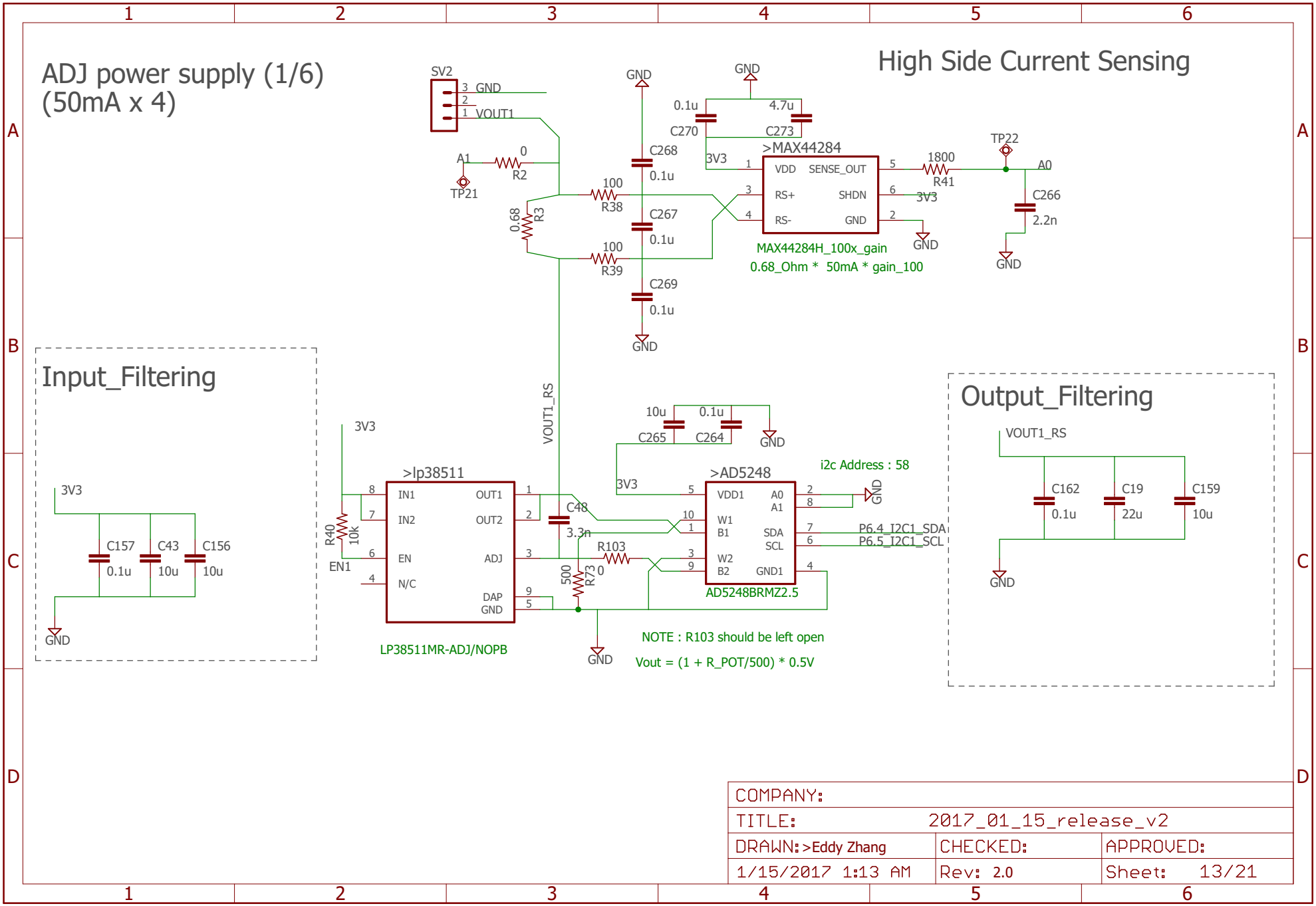
ADJ power supply (1/6)
(50mA x 4)
High Side Current Sensing
SV2
GND
VOUT1
A1
TP21
0
R2
100
R38
0.68
R3
100
R39
C268
0.1u
C267
0.1u
C269
0.1u
0.1u
C270
4.7u
C273
3V3
>MAX44284
VDD
SENSE_OUT
RS+
SHDN
RS-
GND
1800
R41
3V3
TP22
A0
C266
2.2n
MAX44284H_100x_gain
0.68_Ohm * 50mA * gain_100
VOUT1_RS
Input_Filtering
3V3
C157
0.1u
C43
10u
C156
10u
GND
10u
C265
0.1u
C264
>lp38511
IN1
IN2
EN
N/C
OUT1
OUT2
ADJ
DAP
GND
R40
10k
EN1
C48
3.3n
R103
500
R73
0
LP38511MR-ADJ/NOPB
>AD5248
VDD1
W1
B1
W2
B2
A0
A1
SDA
SCL
GND1
i2c Address : 58
P6.4_I2C1_SDA
P6.5_I2C1_SCL
AD5248BRMZ2.5
NOTE : R103 should be left open
Vout = (1 + R_POT/500) * 0.5V
Output_Filtering
VOUT1_RS
C162
0.1u
C19
22u
C159
10u
COMPANY:
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DRAWN:>Eddy Zhang
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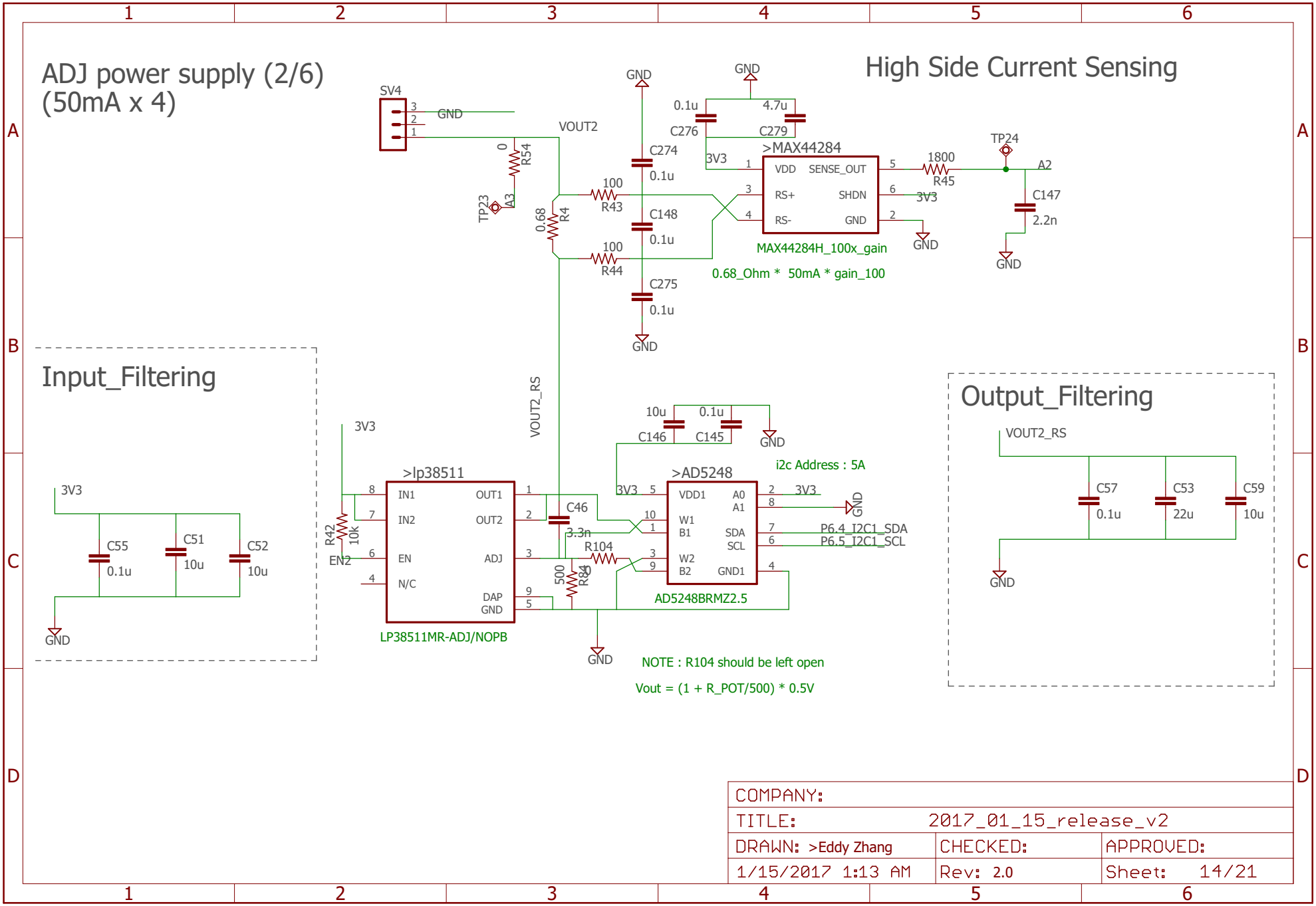
ADJ power supply (2/6)
(50mA x 4)
High Side Current Sensing
SV4
GND
VOUT2
0
R54
TP23
A3
0.68
R4
100
R43
100
R44
C274
0.1u
C148
0.1u
C275
0.1u
C276
0.1u
C279
4.7u
>MAX44284
VDD
SENSE_OUT
RS+
SHDN
RS-
GND
3V3
1800
R45
TP24
A2
C147
2.2n
MAX44284H_100x_gain
0.68_Ohm * 50mA * gain_100
Input_Filtering
C55
0.1u
C51
10u
C52
10u
VOUT2_RS
>lp38511
IN1
IN2
EN
N/C
OUT1
OUT2
ADJ
DAP
GND
R42
10k
EN2
C46
3.3n
R104
500
R84
LP38511MR-ADJ/NOPB
C146
10u
C145
0.1u
>AD5248
VDD1
W1
B1
W2
B2
A0
A1
SDA
SCL
GND1
i2c Address : 5A
P6.4_I2C1_SDA
P6.5_I2C1_SCL
AD5248BRMZ2.5
NOTE : R104 should be left open
Vout = (1 + R_POT/500) * 0.5V
Output_Filtering
C57
0.1u
C53
22u
C59
10u
COMPANY:
TITLE: 2017_01_15_release_v2
DRAWN: >Eddy Zhang
CHECKED:
APPROVED:
1/15/2017 1:13 AM
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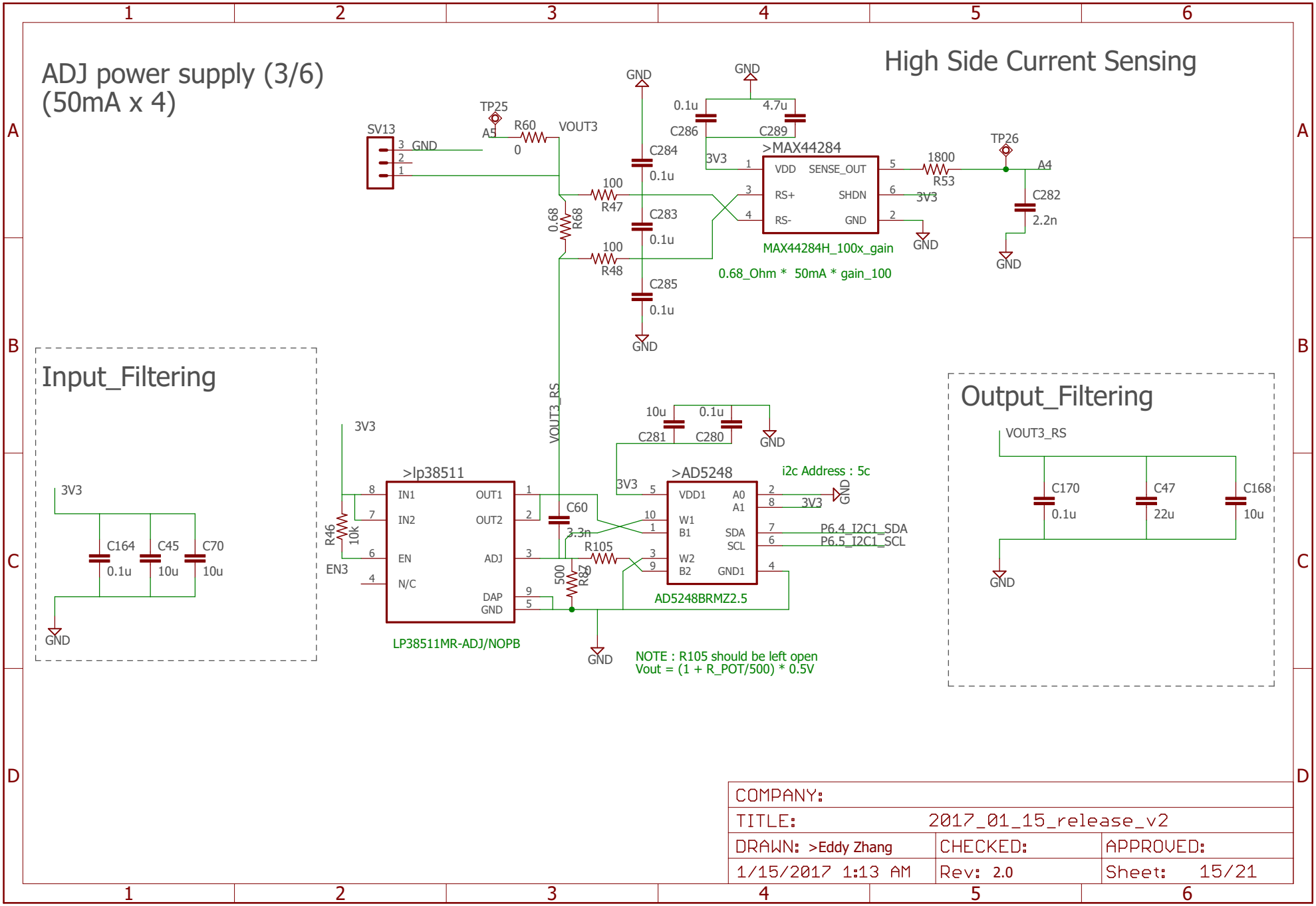
Sheet: 14/21


ADJ power supply (3/6)
(50mA x 4)
High Side Current Sensing
Input_Filtering
Output_Filtering
SV13
TP25
TP26
R60
0
VOUT3
GND
C284
0.1u
C283
0.1u
C285
0.1u
C286
0.1u
C289
4.7u
>MAX44284
VDD
SENSE_OUT
RS+
SHDN
RS-
GND
3V3
1800
R53
C282
2.2n
A4
100
R47
100
R48
0.68
R68
MAX44284H_100x_gain
0.68_Ohm * 50mA * gain_100
VOUT3_RS
3V3
C164
0.1u
C45
10u
C70
10u
>lp38511
IN1
IN2
EN
N/C
OUT1
OUT2
ADJ
DAP
GND
LP38511MR-ADJ/NOPB
R46
10k
EN3
C60
3.3n
R105
500
R87
C281
10u
C280
0.1u
>AD5248
VDD1
W1
B1
W2
B2
A0
A1
SDA
SCL
GND1
AD5248BRMZ2.5
i2c Address : 5c
P6.4_I2C1_SDA
P6.5_I2C1_SCL
NOTE : R105 should be left open
Vout = (1 + R_POT/500) * 0.5V
C170
0.1u
C47
22u
C168
10u
COMPANY:
TITLE: 2017_01_15_release_v2
DRAWN: >Eddy Zhang
CHECKED:
APPROVED:
1/15/2017 1:13 AM
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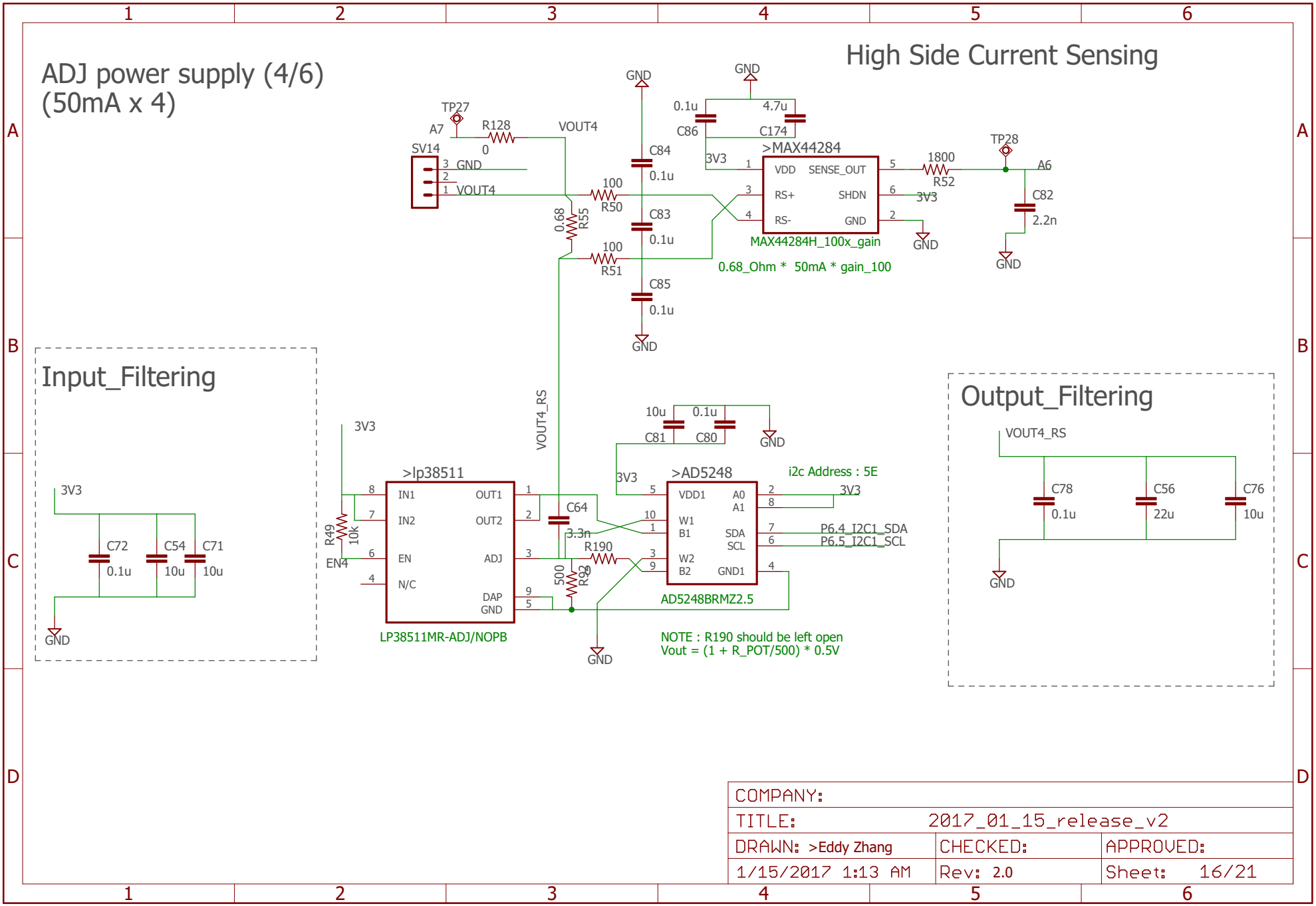
ADJ power supply (4/6)
(50mA x 4)
High Side Current Sensing
TP27
A7
R128
0
VOUT4
SV14
3 GND
2
1 VOUT4
GND
0.1u
C86
4.7u
C174
3V3
>MAX44284
VDD
SENSE_OUT
RS+
SHDN
RS-
GND
MAX44284H_100x_gain
0.68_Ohm * 50mA * gain_100
1800
R52
3V3
TP28
A6
C82
2.2n
C84
0.1u
C83
0.1u
C85
0.1u
100
R50
100
R51
0.68
R55
Input_Filtering
3V3
C72
0.1u
C54
10u
C71
10u
GND
VOUT4_RS
>lp38511
IN1
IN2
EN
N/C
OUT1
OUT2
ADJ
DAP
GND
LP38511MR-ADJ/NOPB
R49
10k
EN4
C64
3.3n
R190
500
R92
10u
C81
0.1u
C80
>AD5248
VDD1
W1
B1
W2
B2
A0
A1
SDA
SCL
GND1
i2c Address : 5E
P6.4_I2C1_SDA
P6.5_I2C1_SCL
AD5248BRMZ2.5
NOTE : R190 should be left open
Vout = (1 + R_POT/500) * 0.5V
Output_Filtering
C78
0.1u
C56
22u
C76
10u
COMPANY:
TITLE: 2017_01_15_release_v2
DRAWN: >Eddy Zhang
CHECKED:
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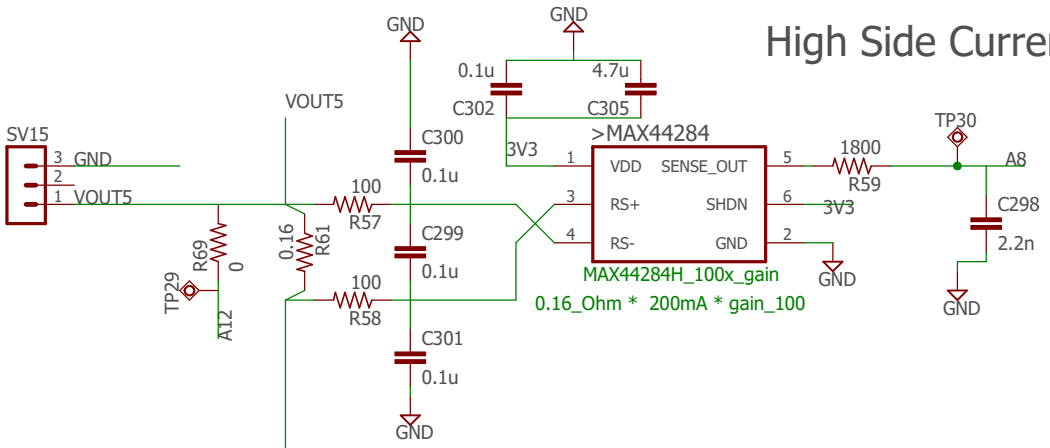
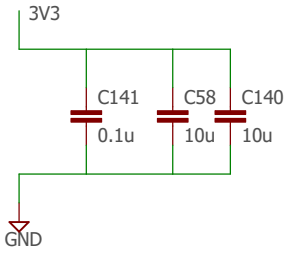
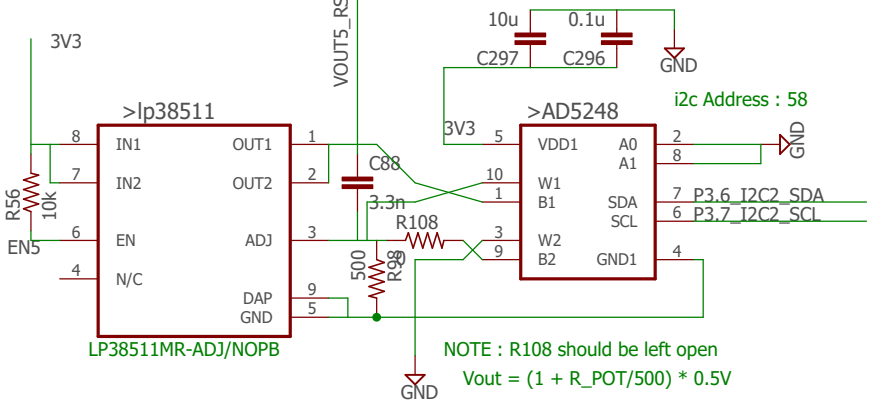
ADJ power supply (5/6)
(200mA x 2)

High Side Current Sensing

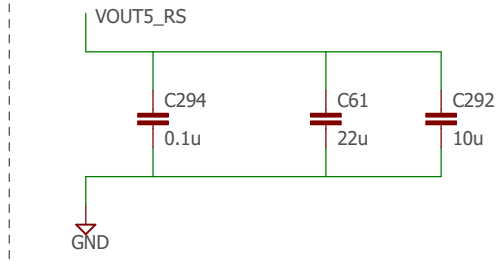


Input_Filtering





Output_Filtering



COMPANY: >Eddy Zhang		
TITLE: 2017_01_15_release_v2		
DRAWN: >Eddy Zhang	CHECKED:	APPROVED:
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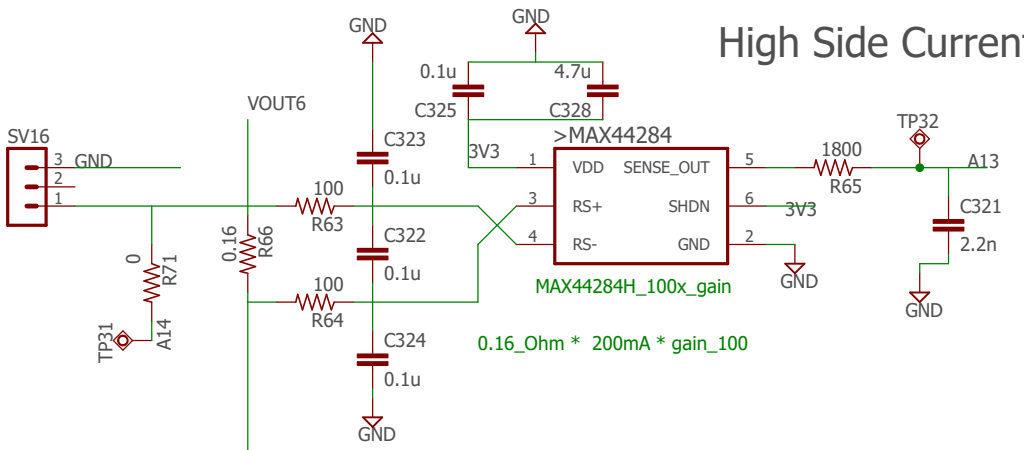
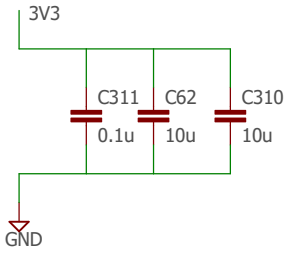
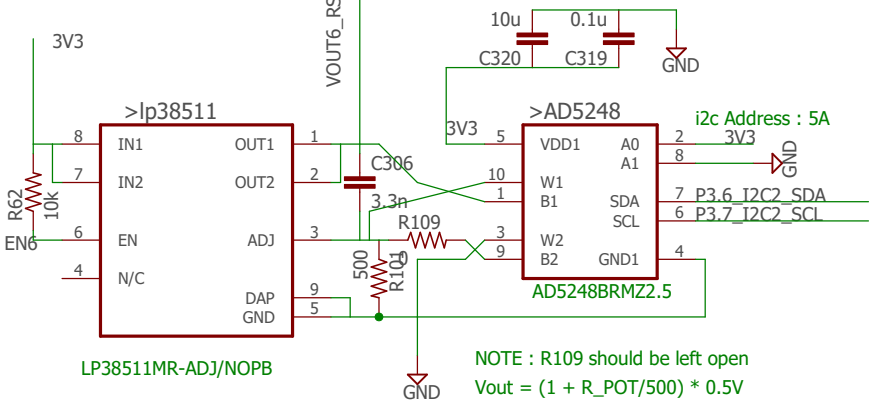
ADJ power supply (6/6)
(200mA x 2)

High Side Current Sensing

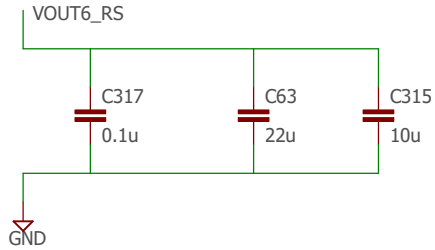


Input_Filtering





Output_Filtering



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TITLE:	2017_01_15_release_v2	
DRAWN: >Eddy Zhang	CHECKED:	APPROVED:
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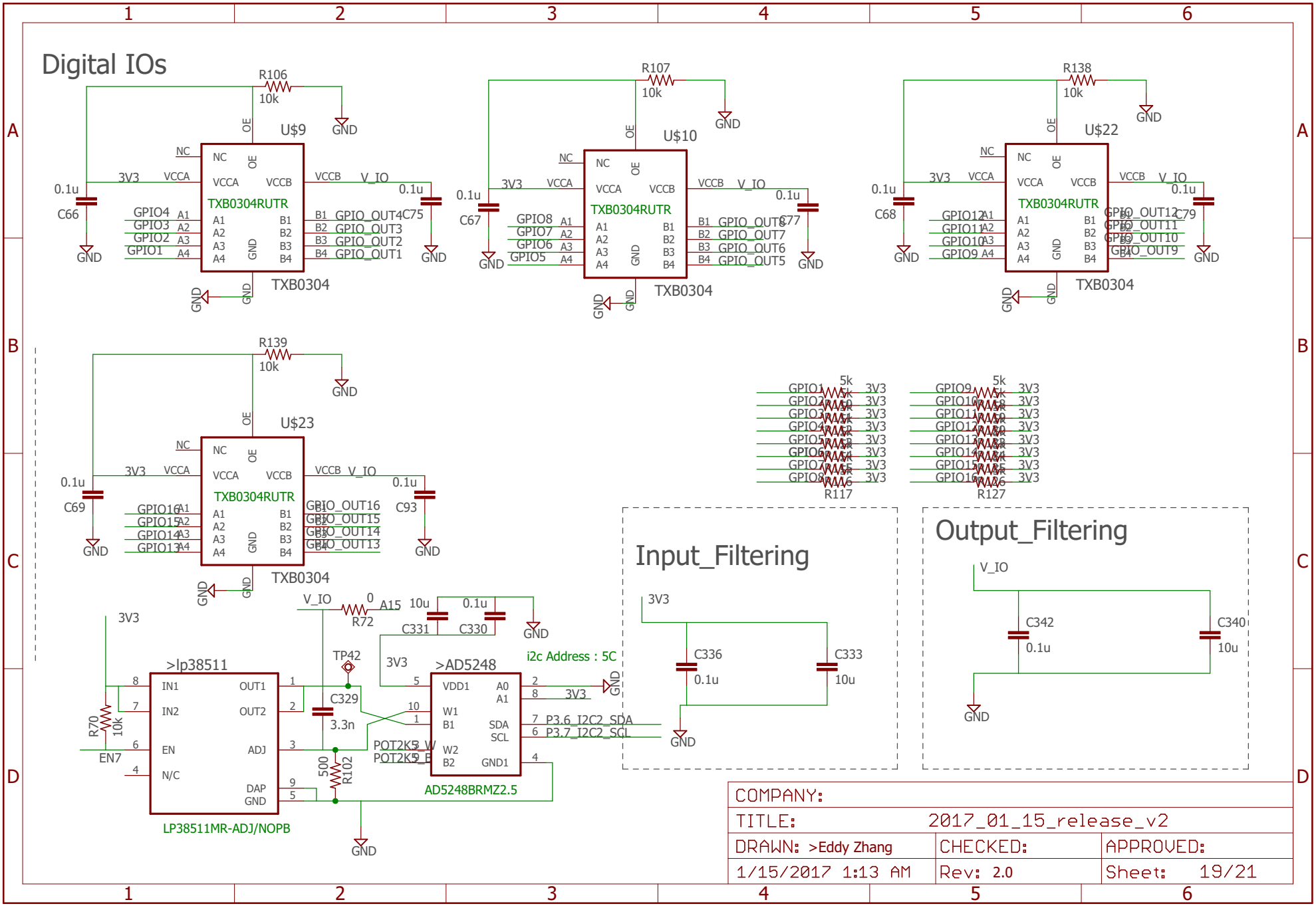
Digital IOs
U$9
U$10
U$22
U$23
TXB0304RUTR
TXB0304
R106
R107
R138
R139
10k
0.1u
C66
C67
C68
C69
C75
C77
C79
C93
3V3
V_IO
GND
GPIO1
GPIO2
GPIO3
GPIO4
GPIO5
GPIO6
GPIO7
GPIO8
GPIO9
GPIO10
GPIO11
GPIO12
GPIO13
GPIO14
GPIO15
GPIO16
R117
R127
5k
Input_Filtering
Output_Filtering
C336
C333
C342
C340
10u
>lp38511
LP38511MR-ADJ/NOPB
>AD5248
AD5248BRMZ2.5
i2c Address : 5C
R72
R70
R102
C329
3.3n
TP42
EN7
P3.6_I2C2_SDA
P3.7_I2C2_SCL
COMPANY:
TITLE: 2017_01_15_release_v2
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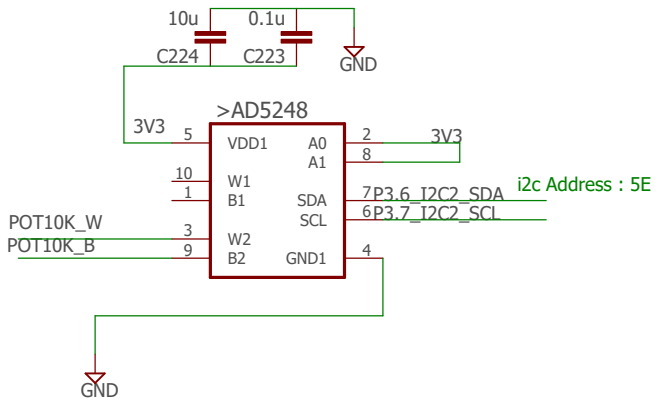
DIGITAL POT



COMPANY:		
TITLE:	2017_01_15_release_v2	
DRAWN: >Eddy Zhang	CHECKED:	APPROVED:
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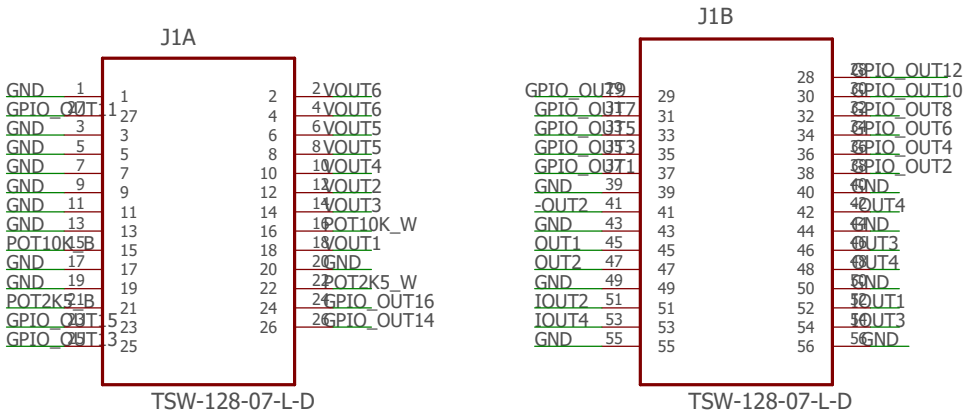
OUTPUT_HEADER



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TITLE:	2017_01_15_release_v2	
DRAWN: >Eddy Zhang	CHECKED:	APPROVED:
1/15/2017 1:13 AM	Rev: 2.0	Sheet: 21/21