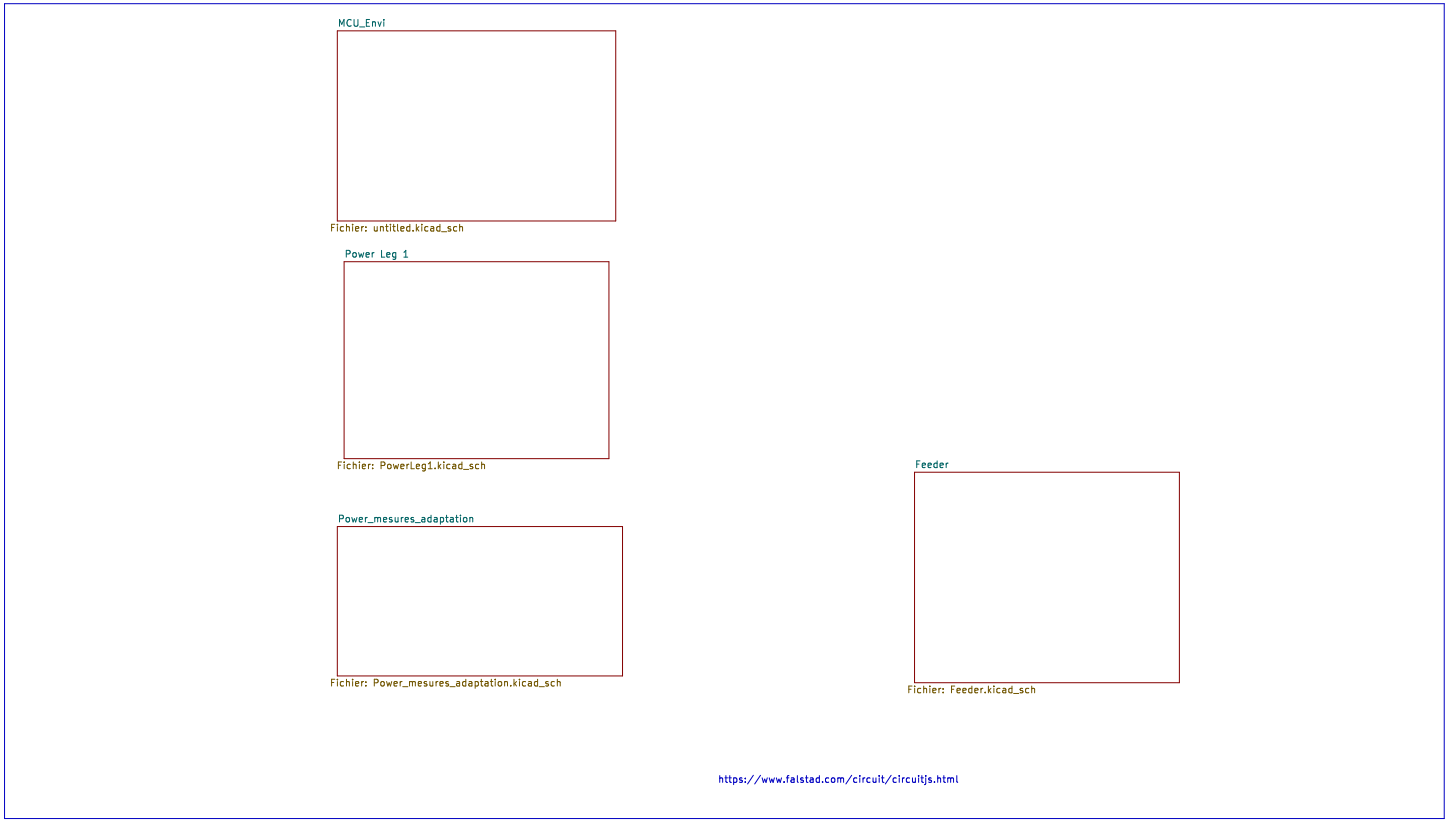
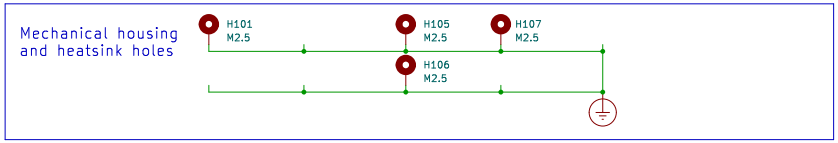
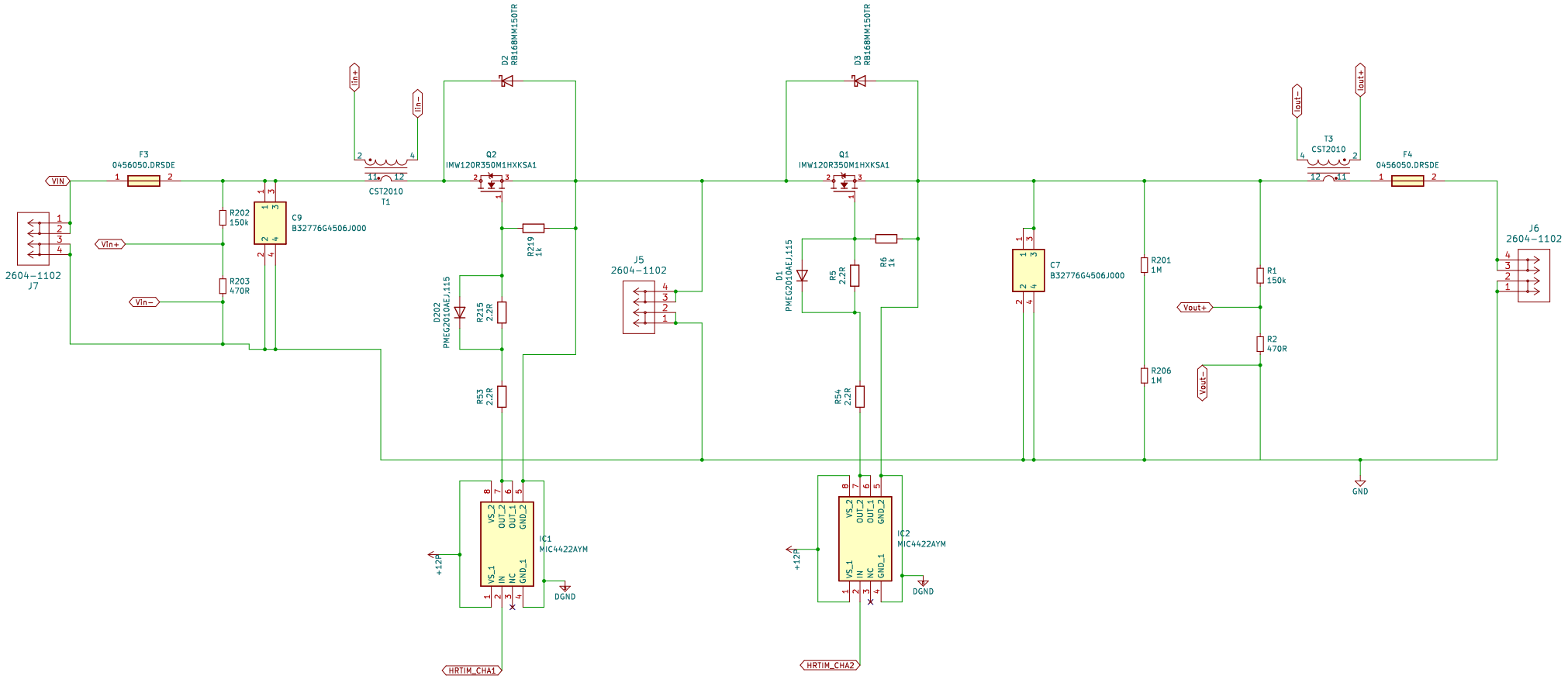
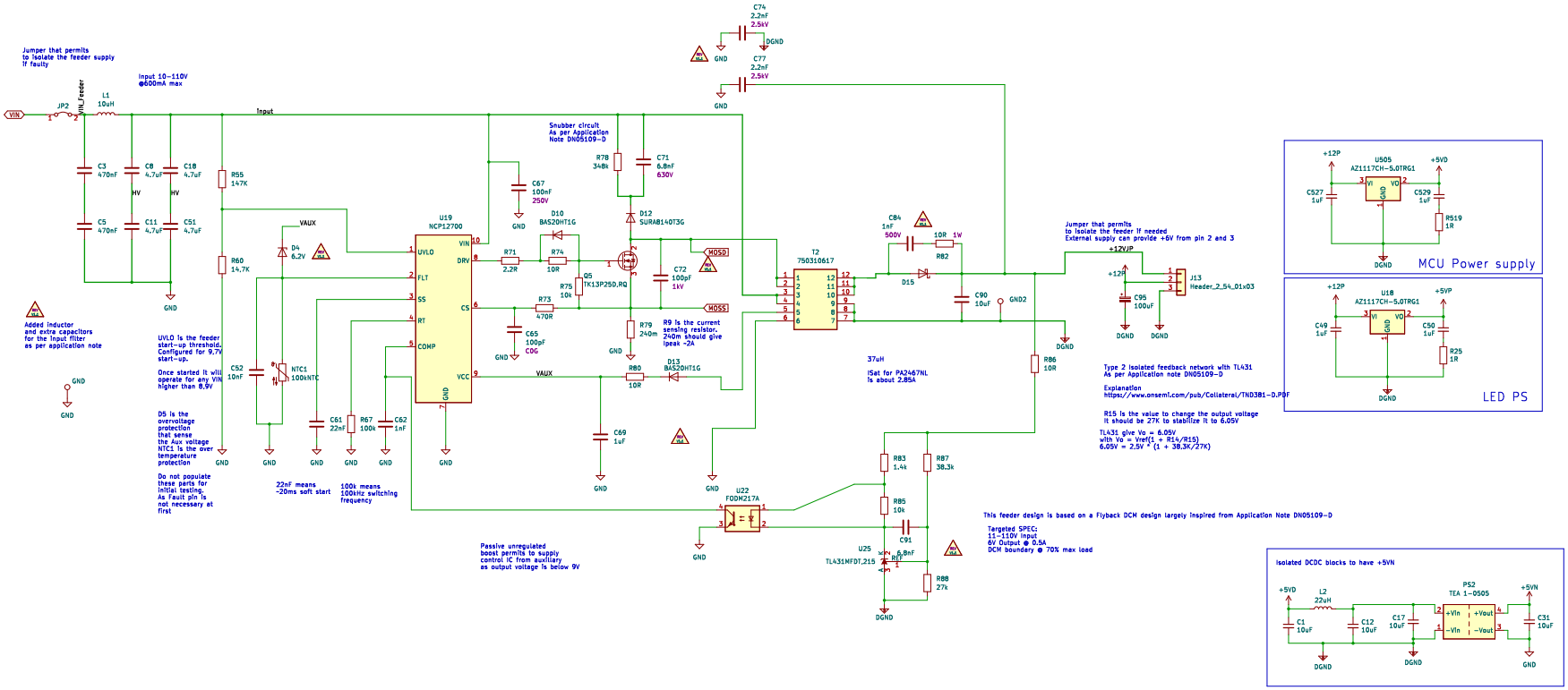
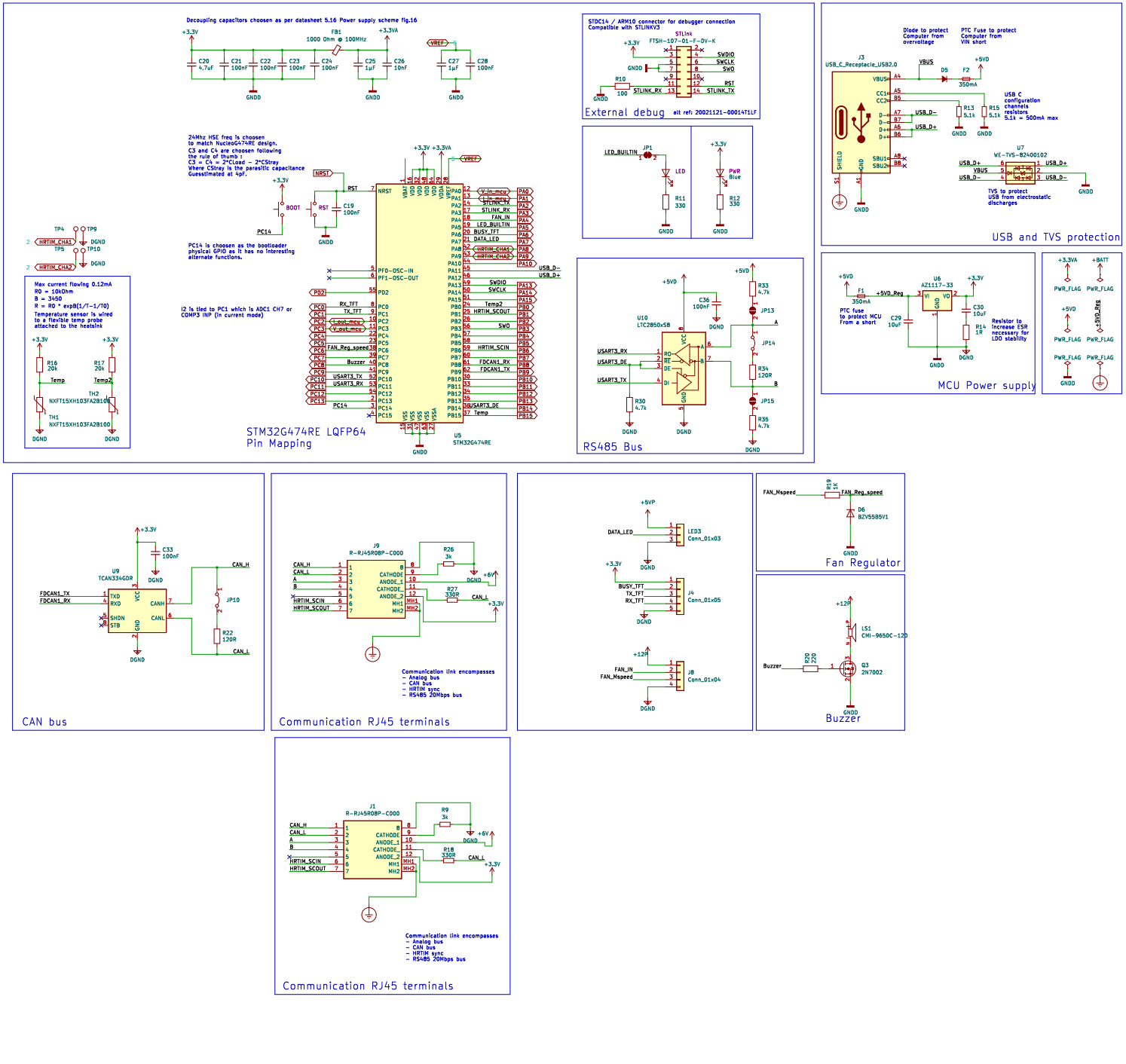


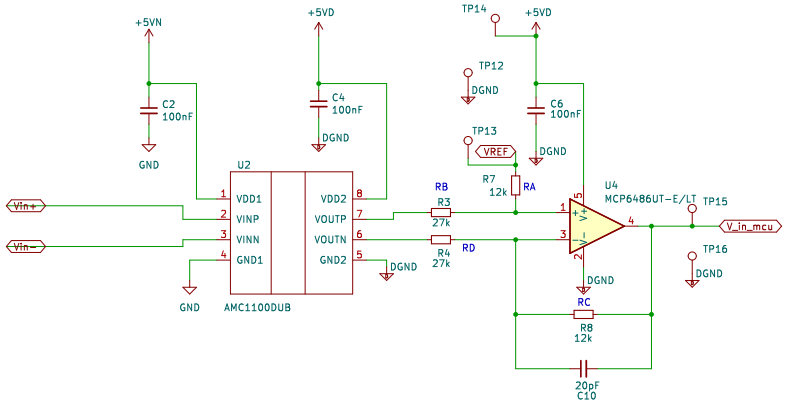
All ceramic capacitor X7R 50V unless specified
All resistor to be thin film 1/8Watt unless specified

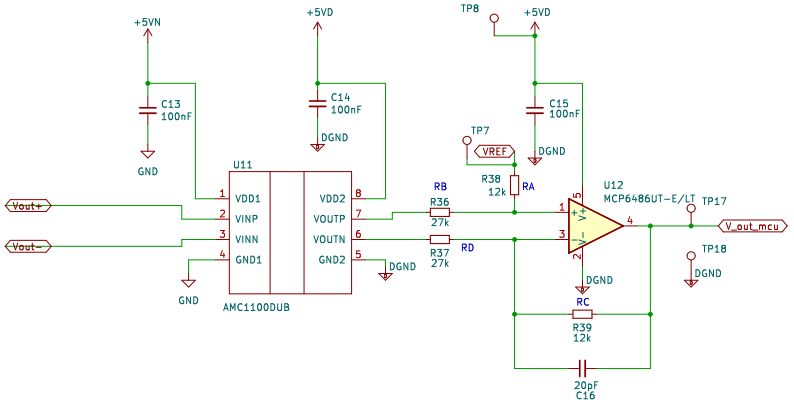


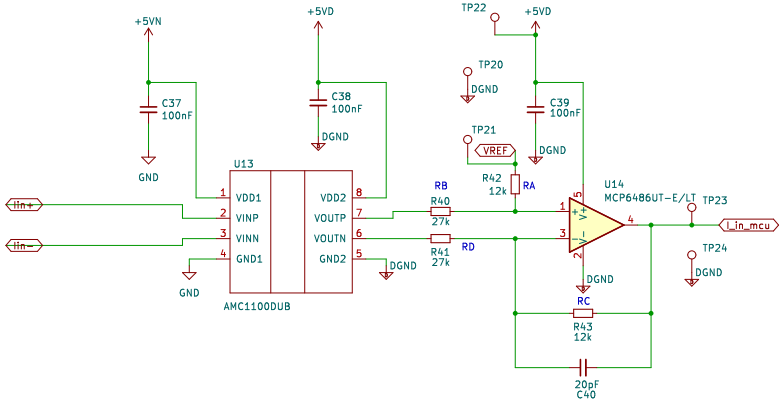

VIN
F3
0456050.DRSDE
J7
2604-1102
Vin+
Vin-
R202
150k
R203
470R
C9
B32776G4506J000
Vin+
Vin-
CST2010
T1
D2
RB168MM150TR
Q2
IMW120R350M1HXKSA1
R219
1k
D202
PMEG2010AEJ,115
R215
2.2R
R53
2.2R
J5
2604-1102
D3
RB168MM150TR
Q1
IMW120R350M1HXKSA1
D1
PMEG2010AEJ,115
R5
2.2R
R6
1k
R54
2.2R
C7
B32776G4506J000
R201
1M
R206
1M
T3
CST2010
Vout+
Vout-
F4
0456050.DRSDE
R1
150k
R2
470R
Vout+
Vout-
J6
2604-1102
GND
IC1
MIC4422AYM
VS_2
OUT_2
OUT_1
GND_2
VS_1
IN
NC
GND_1
+12P
DGND
HRTIM_CHA1
IC2
MIC4422AYM
VS_2
OUT_2
OUT_1
GND_2
VS_1
IN
NC
GND_1
+12P
DGND
HRTIM_CHA2

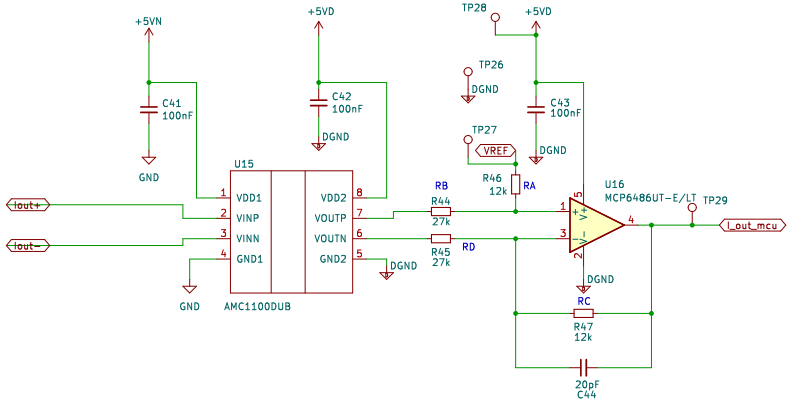

Jumper that permits to isolate the feeder supply if faulty
Input 10-110V @600mA max
VIN
JP2
VIN_Feeder
L1 10uH
Input
C3 470nF
C8 4.7uF
HV
C18 4.7uF
HV
C5 470nF
C11 4.7uF
C51 4.7uF
R55 147K
R60 14.7K
VAUX
D4 6.2V
Added inductor and extra capacitors for the input filter as per application note
GND
UVLO is the feeder start-up threshold. Configured for 9.7V start-up.
Once started it will operate for any VIN higher than 8.9V
D5 is the overvoltage protection that sense the Aux voltage NTC1 is the over temperature protection
Do not populate these parts for initial testing. As fault pin is not necessary at first
C52 10nF
NTC1 100kNTC
C61 22nF
R67 100k
C62 1nF
22nF means ~20ms soft start
100k means 100kHz switching frequency
U19 NCP12700
UVLO
FLT
SS
RT
COMP
VIN
DRV
CS
VCC
GND
Snubber circuit As per Application Note DN05109-D
C67 100nF 250V
D10 BAS20HT1G
R71 2.2R
R74 10R
R78 348k
C71 6.8nF 630V
D12 SURAB140T3G
Q5 TK13P25D,RQ
R75 10k
R73 470R
C65 100pF C0G
R79 240m
R9 is the current sensing resistor. 240m should give Ipeak ~2A
C72 100pF 1kV
MOSD
MOSS
R80 10R
D13 BAS20HT1G
VAUX
C69 1uF
Passive unregulated boost permits to supply control IC from auxiliary as output voltage is below 9V
C74 2.2nF 2.5kV
C77 2.2nF 2.5kV
T2 750310617
C84 1nF 500V
10R 1W
R82
D15
C90 10uF
GND2
37uH
ISat for PA2467NL is about 2.85A
Jumper that permits to isolate the feeder if needed External supply can provide +6V from pin 2 and 3
+12VP
C95 100uF
J13 Header_2_54_01x03
R86 10R
Type 2 isolated feedback network with TL431 As per Application note DN05109-D
Explanation https://www.onsemi.com/pub/Collateral/TND301-D.PDF
R15 is the value to change the output voltage it should be 27K to stabilize it to 6.05V
TL431 give Vo = 6.05V with Vo = Vref(1 + R14/R15) 6.05V = 2.5V * (1 + 38.3K/27K)
U22 FODM217A
R83 1.44
R87 38.3k
R85 10k
C91 6.8nF
U25 TL431MFDT,215
R88 27k
This feeder design is based on a Flyback DCM design largely inspired from Application Note DN05109-D
Targeted SPEC: 11-110V Input 6V Output @ 0.5A DCM boundary @ 70% max load
+12P
U505 AZ1117CH-5.0TRG1
+5VD
C527 1uF
C529 1uF
R519 1R
MCU Power supply
U18 AZ1117CH-5.0TRG1
+5VP
C49 1uF
C50 1uF
R25 1R
LED PS
Isolated DCDC blocks to have +5VN
+5VD
L2 22uH
C1 10uF
C12 10uF
C17 10uF
PS2 TEA 1-0505
+Vin
-Vin
+Vout
-Vout
+5VN
C31 10uF


Decoupling capacitors choosen as per datasheet 5.16 Power supply scheme fig.16
FB1
1000 Ohm @ 100MHz
C20 4.7uF
C21 100nF
C22 100nF
C23 100nF
C24 100nF
C25 1uF
C26 10nF
C27 1uF
C28 100nF
GNDD
24Mhz HSE freq is choosen to match NucleoG474RE design.
C3 and C4 are choosen following the rule of thumb :
C3 = C4 = 2*CLoad - 2*CStray
Where CStray is the parasitic capacitance
Guesstimated at 4pF.
PC14 is choosen as the bootloader physical GPIO as it has no interesting alternate functions.
I2 is tied to PC1 which is ADC1 CH7 or COMP3 INP (in current mode)
STM32G474RE LQFP64
Pin Mapping
U5
STM32G474RE
STDC14 / ARM10 connector for debugger connection
Compatible with STLINKV3
STLink
FTSH-107-01-F-DV-K
External debug
alt ref: 20021121-00014ILF
LED_BUILTIN
LED
PWR Blue
R11 330
R12 330
Max current flowing 0.12mA
RO = 10kOhm
B = 3450
R = RO * expB(1/T-1/T0)
Temperature sensor is wired to a flexible temp probe attached to the heatsink
R16 20k
R17 20k
Temp
Temp2
NXFT15XH103FA2B100
RS485 Bus
U10
LTC2850xSB
R33 4.7k
R34 120R
R35 4.7k
R30 4.7k
JP13
JP14
JP15
USB and TVS protection
Diode to protect Computer from overvoltage
PTC Fuse to protect Computer from VIN short
J3
USB_C_Receptacle_USB2.0
D5
F2
350mA
USB C configuration channels resistors 5.1k = 500mA max
R13 5.1k
R15 5.1k
U7
WE-TVS-82400102
TVS to protect USB from electrostatic discharges
MCU Power supply
PTC fuse to protect MCU From a short
U6
AZ1117-33
C29 10uF
C30 10uF
R14 1R
Resistor to increase ESR necessary for LDO stability
PWR_FLAG
CAN bus
U9
TCAN334GDR
C33 100nF
JP10
R22 120R
Communication RJ45 terminals
J9
R-RJ45ROBP-C000
R26 3k
R27 330R
Communication link encompasses
- Analog bus
- CAN bus
- HRTIM sync
- RS485 20Mbps bus
Fan Regulator
FAN_Mspeed
R19 1K
FAN_Reg_speed
D6
BZV55B5V1
DATA_LED
LED3
Conn_01x03
BUSY_TFT
TX_TFT
RX_TFT
J4
Conn_01x05
FAN_IN
FAN_Mspeed
J8
Conn_01x04
Buzzer
LS1
CMI-9650C-120
Q3
2N7002
R20 220
J1
R9 3k
R18 330R









Low Side Voltage Measurement

Simulation available
https://tinyurl.com/2enzfg8c

Circuit can be seen as non inverting opamp
with gain : G = 1+(RC/RD) and a potential on non-inverting
input equal to Millman's theorem of :
V+ =((VOUTP-VOUTN)/RB)+(Vref/RA)/((1/RB)+(1/RA))

Measurements are thought for STM32G474RE
with either internal reference set to 2.048V (from VREFBUF register) or equivalent external voltage reference.