

# STM32L562E-DK

MB1373

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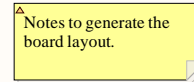
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## Legend

General comment such as function title, configuration, ...

Text to be added to silkscreen.

Warning text.



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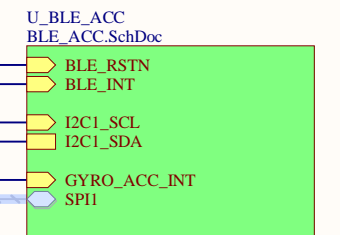
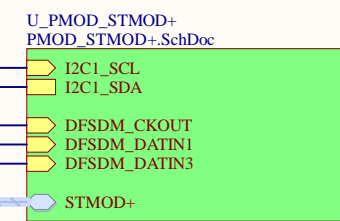
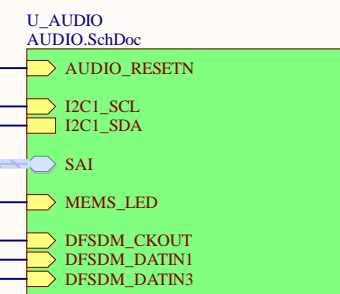
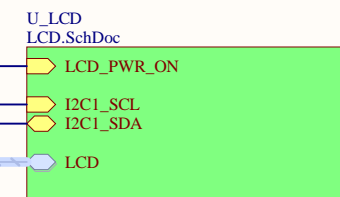
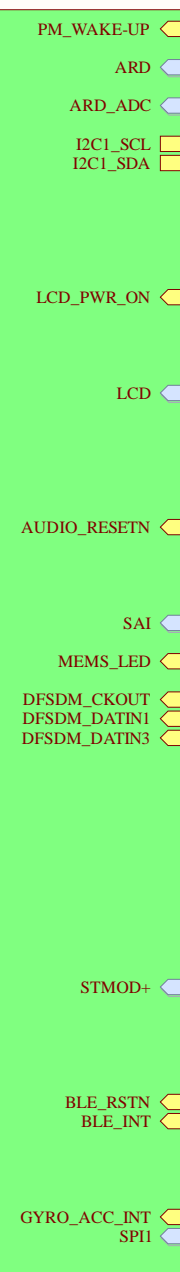
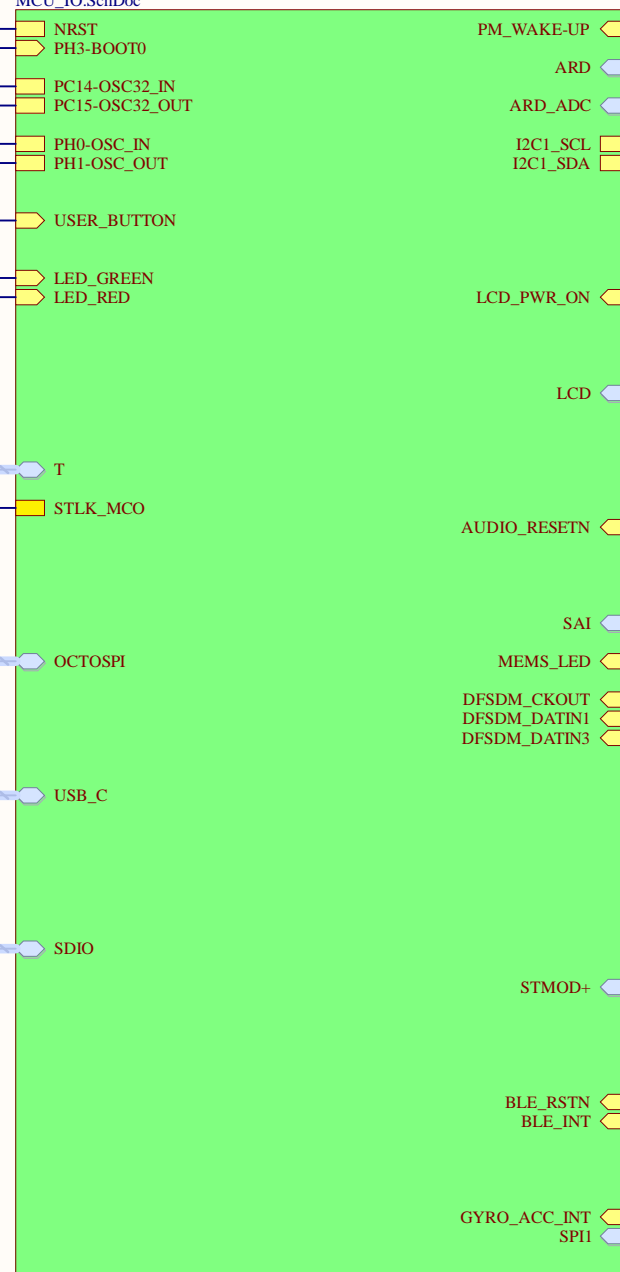
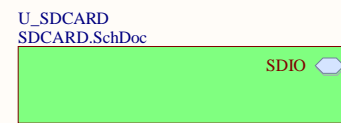
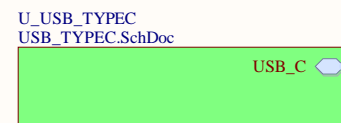
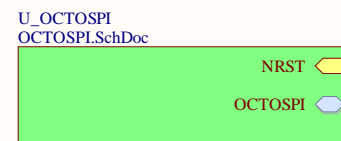
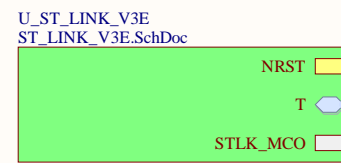
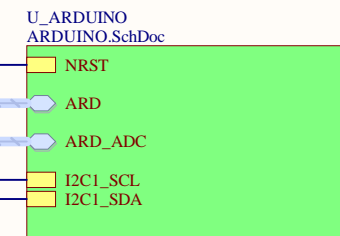
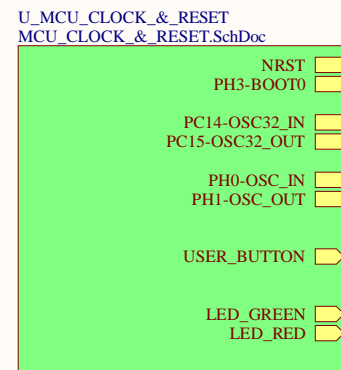
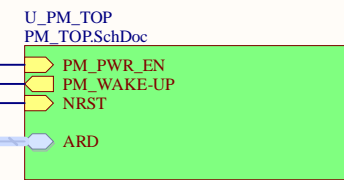
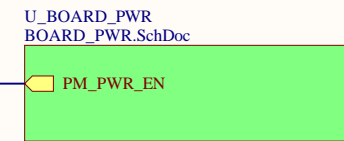
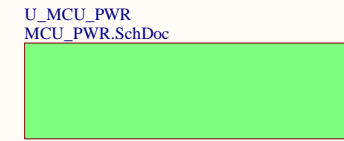
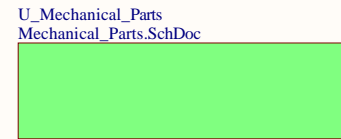
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U\_Top  
Top.SchDoc

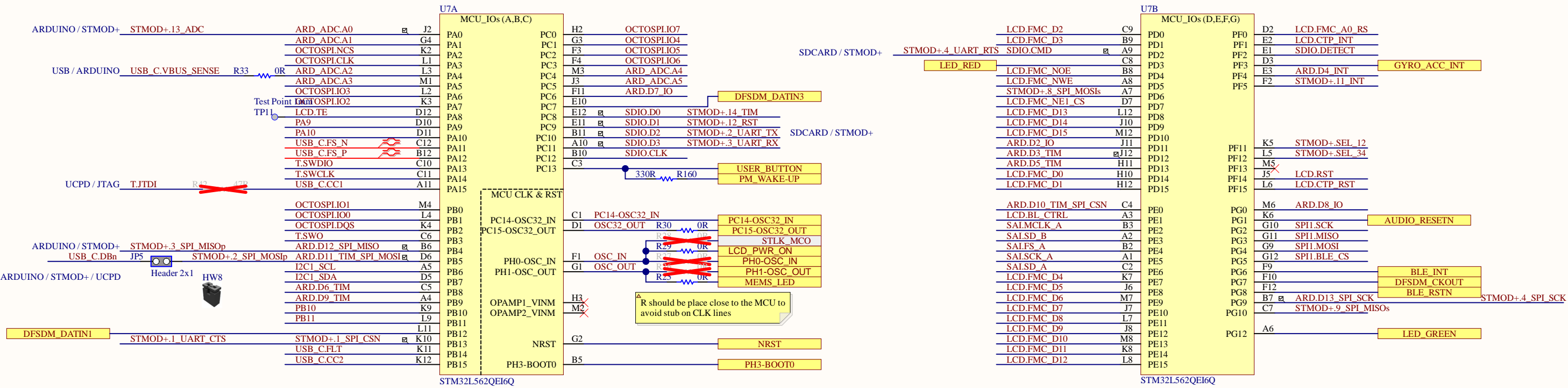


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Project: <b>STM32L562E-DK</b>	
Variant: <b>L562QEQ</b>	
Revision: <b>C-02</b>	Reference: <b>MB1373</b>
Size: <b>A4</b>	Date: <b>31/05/2023</b>
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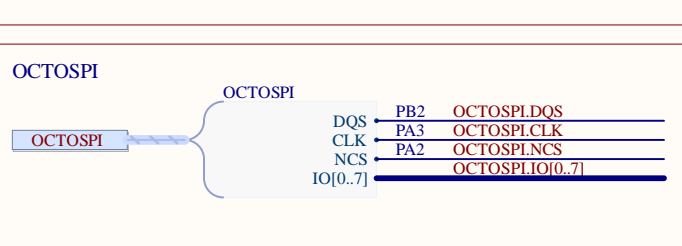
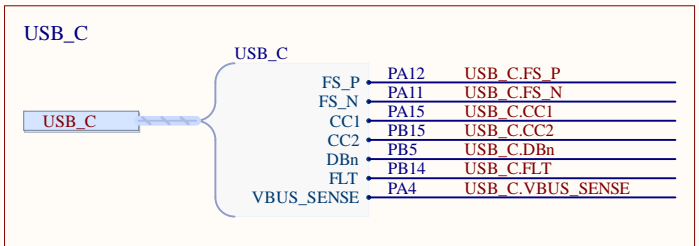
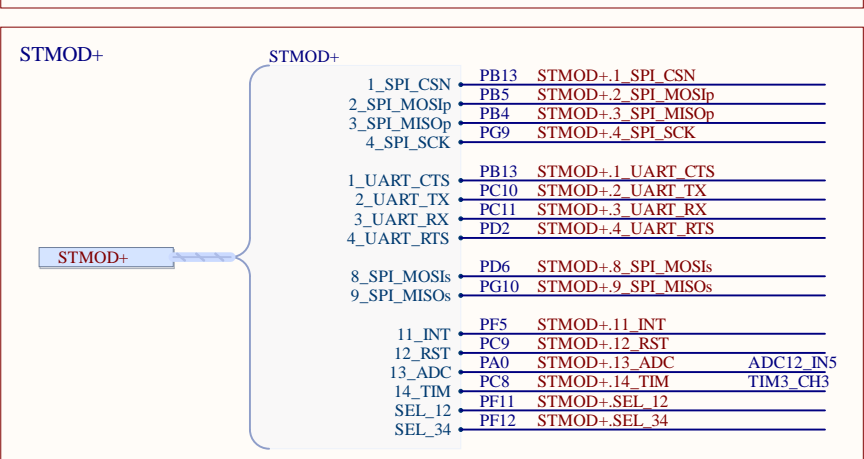
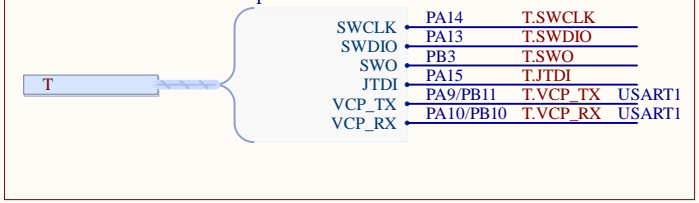
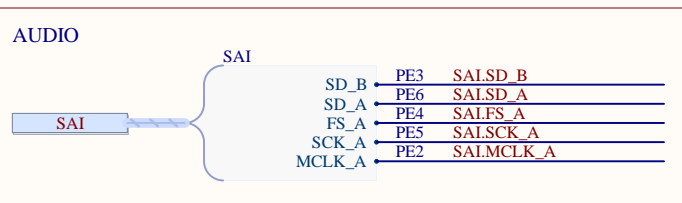
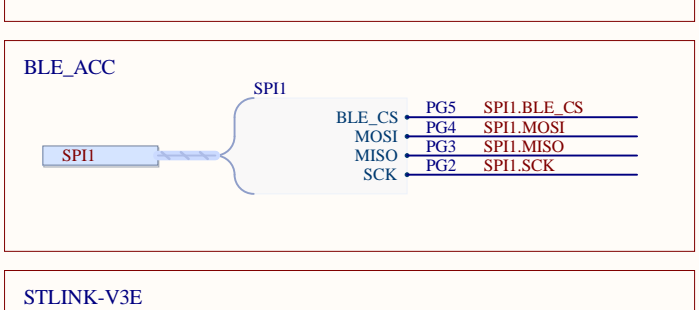
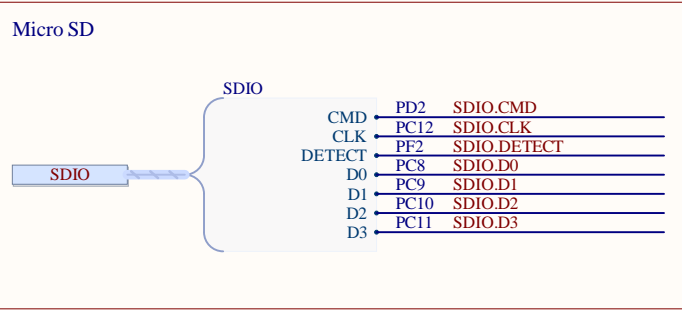
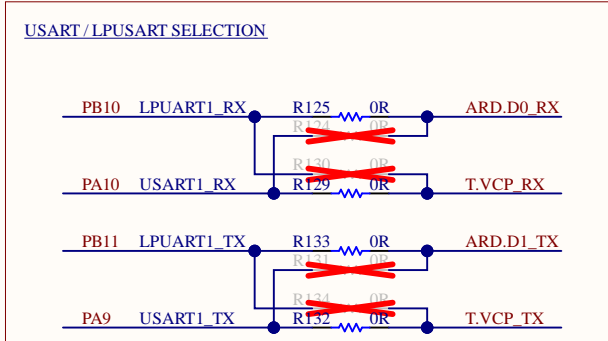
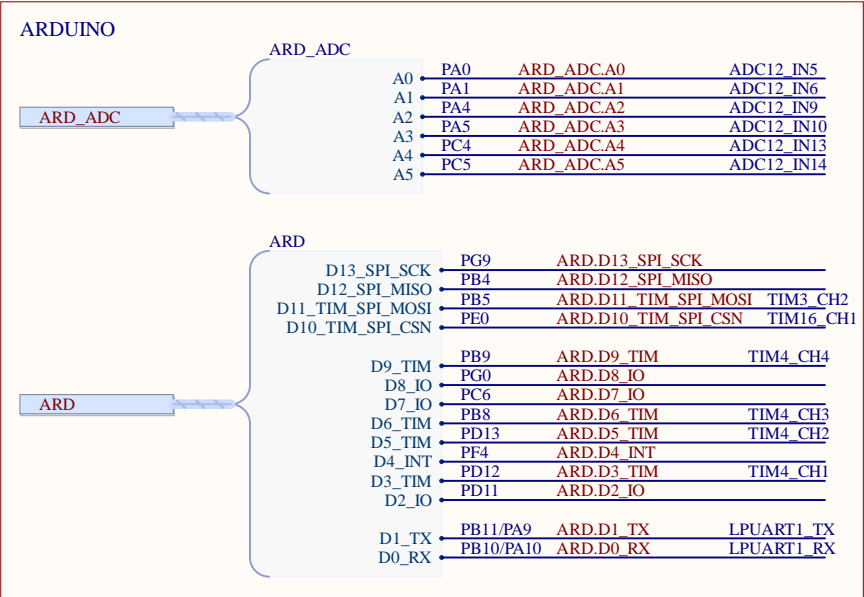
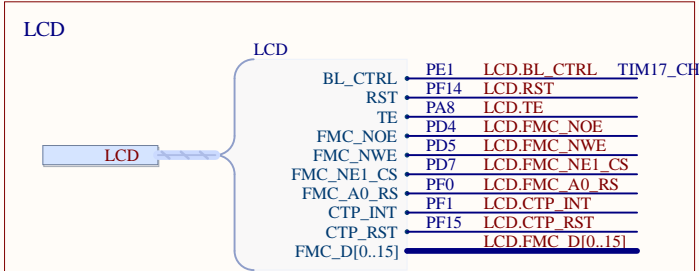
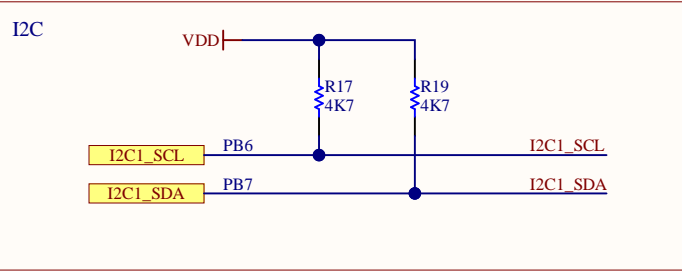




I2C address:  
 AUDIO CODEC: CS42L51: Read 0x95 / Write 0x94 (AD0=0)  
 LCD-TOUCH-PANEL: Read 0xXX / Write 0xXX  
 GYRO-ACC: LSM6DSL: Read 0xD5 / Write 0xD4

**IT TABLE**

INT1 - PF1 - LCD-TOUCH-PANEL
INT2 - PF2 - SDCARD-DETECT
INT3 - PF3 - GYRO-ACCELEROMETER
INT4 - PF4 - ARDUINO
INT5 - PF5 - PMOD/STMOD+
INT11 - PD11 - Power Measurement / ARD.D2_IO
INT12 - PD12 - Power Measurement / ARD.D3_TIM
INT13 - PC13 - USER_BUTTON or ENERGY METER WAKE-UP



**LIMITATIONS : IO SHARED / EXCLUSIF**

Please refer to the User Manual for more detail

PA4 EXCLUSIF BETWEEN ARDUINO and UCPD  
 PA0 EXCLUSIF BETWEEN ARDUINO and STMOD+  
 PA15 EXCLUSIF BETWEEN UCPD and JTAG  
 PB5 SHARED BETWEEN ARDUINO and STMOD+ and EXCLUSIF WITH UCPD

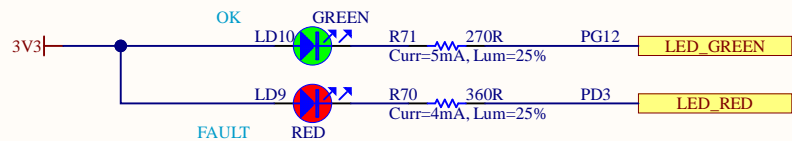
PC8 EXCLUSIF BETWEEN SDCARD and STMOD+  
 PC9 EXCLUSIF BETWEEN SDCARD and STMOD+  
 PC10 EXCLUSIF BETWEEN SDCARD and STMOD+  
 PC11 EXCLUSIF BETWEEN SDCARD and STMOD+  
 PD2 EXCLUSIF BETWEEN SDCARD and STMOD+

I2C1 (PB6/PB7) SHARED BETWEEN :  
 CTP, AUDIO CODEC, GYRO, ARDUINO, STMOD+

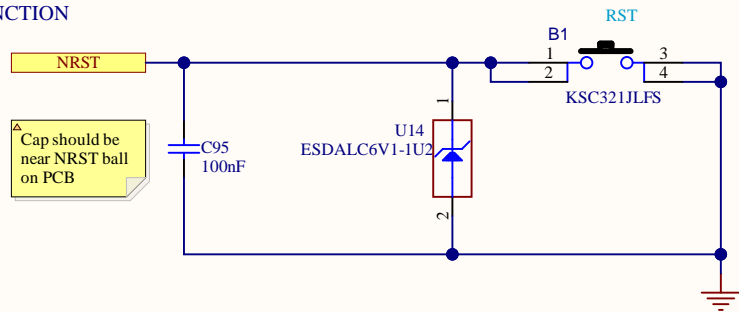
DFSDM (PB12, PG7, PC7) SHARED BETWEEN  
 ON BOARD MEMS, EXT-MEMS-MODULE, STMOD+

SPI3 (PB4, PB5, PG9) SHARED BETWEEN :  
 ARDUINO AND STMOD+

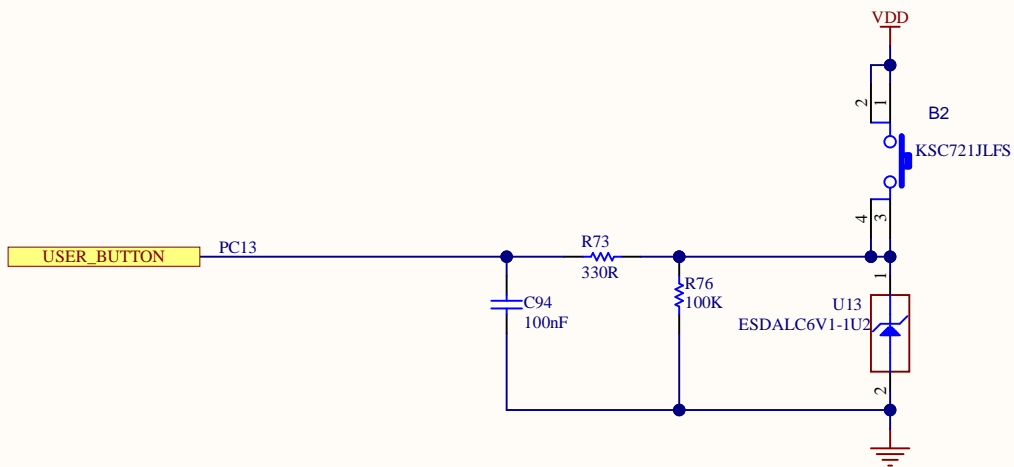
### USER LEDs



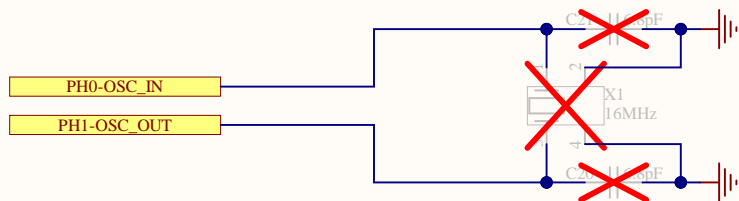
### RESET FUNCTION



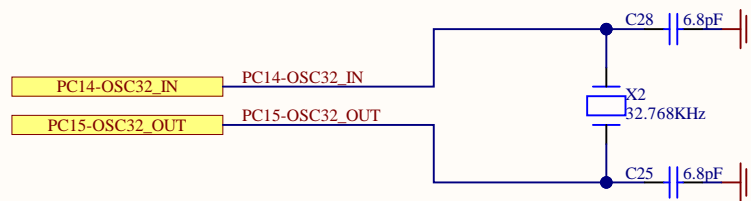
### USER BUTTON



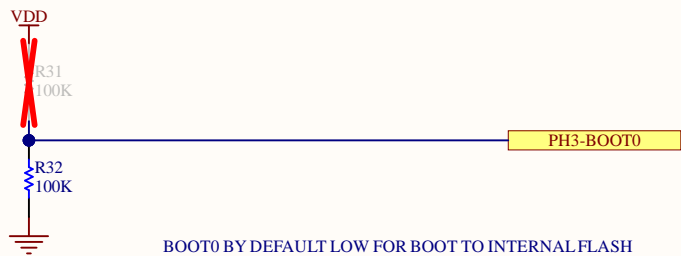
### EXTERNAL HSE CLK



### EXTERNAL LSE CLK



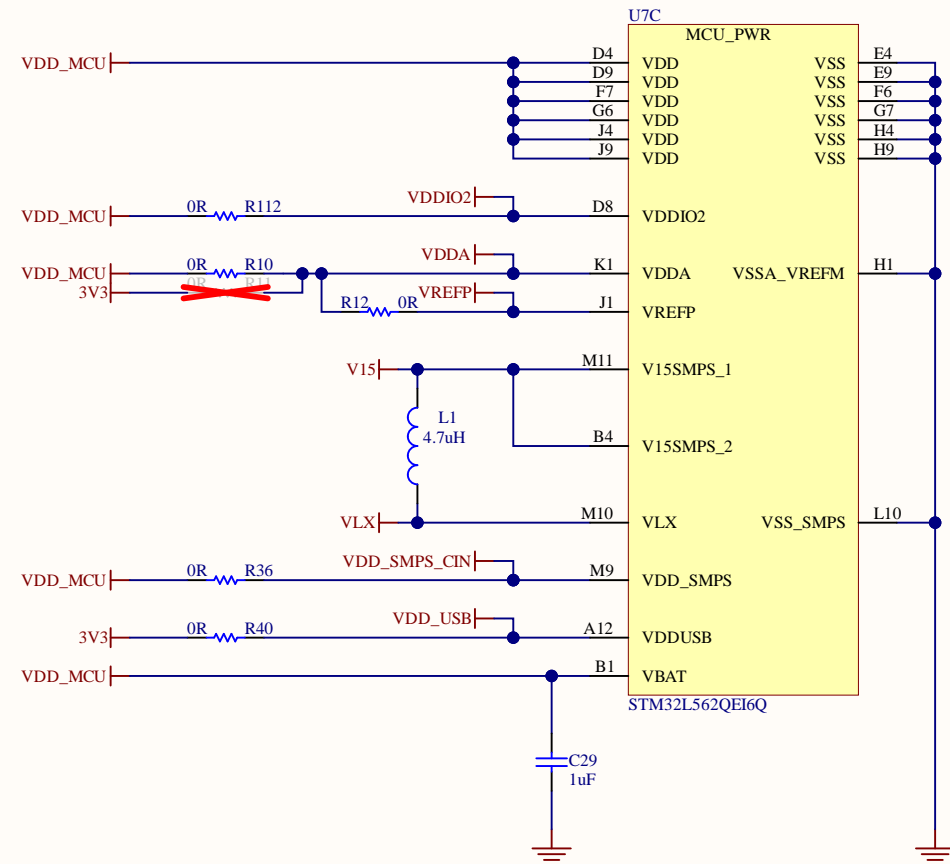
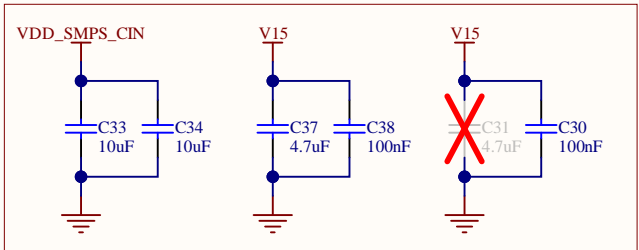
### PH3\_BOOT0



# STM32L5xx MCU PWR

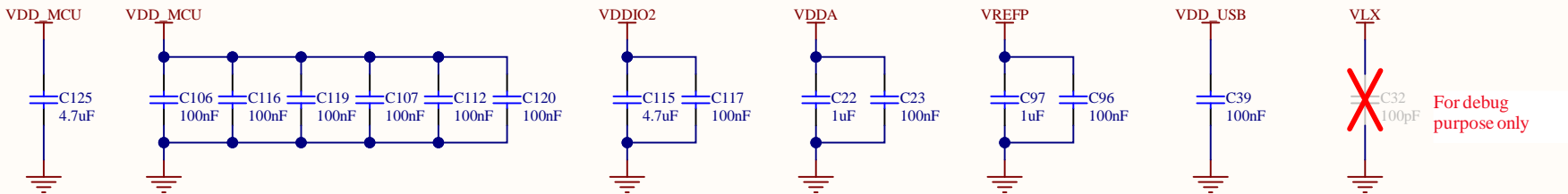
- Operating range:  $1V71 < VDD < 3V6$
- Operating range:  $1V08 < VDDIO2 < 3V6$  (only for IO G[15:2])
- Operating range:  $1V55 < VBAT < 3V6$
- Operating range:  $1V62 < VDDA < 3V6$
- Operating range:  $1V62 < VREF < 3V6$  (depend of VDDA)
- Operating range:  $3V0 < VDDUSB < 3V6$
- Operating range:  $1V71 < VDD\_SMPS < 3V6$

<sup>A</sup> "CIN" and "V15" capacitors should be as closed as possible to the MCU associated pad. V15 4.7µF should be place near Lxx. Or 1 couple of capacitors per pad (4.7µF / 100nF)



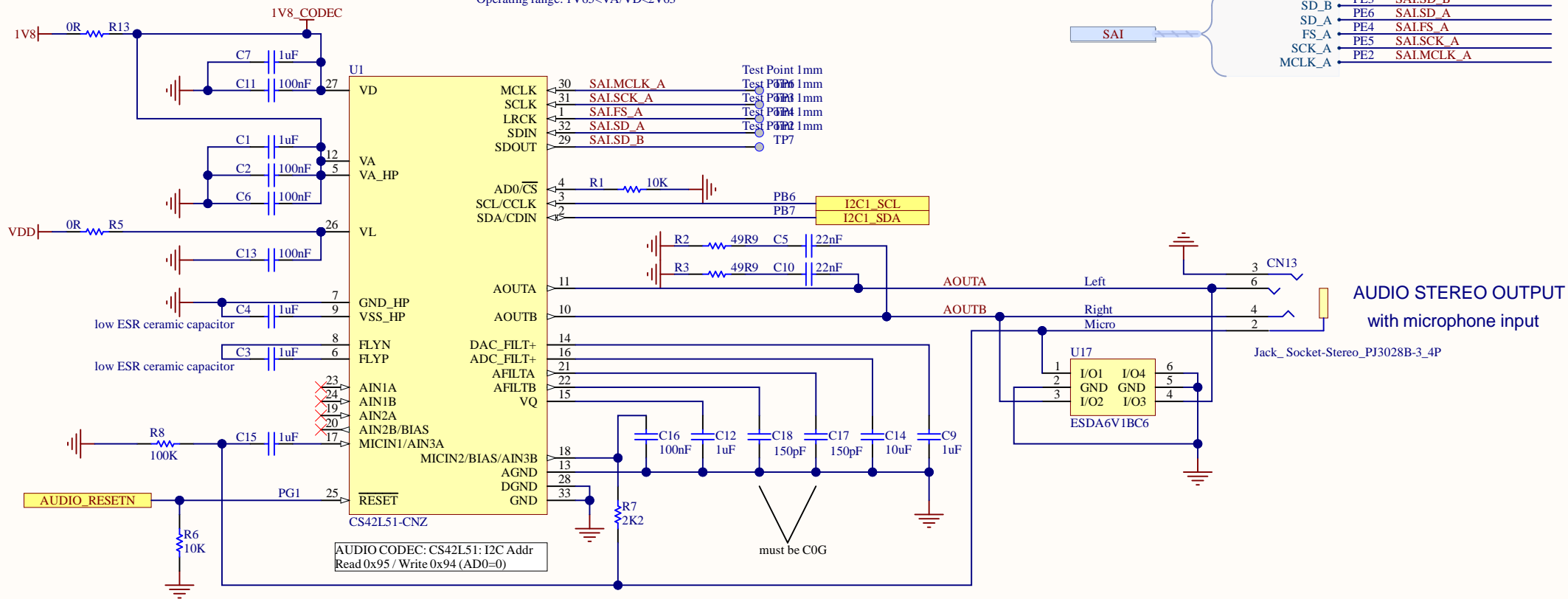
## MCU DECAPS

Ceramic capacitor (Low ESR, ESR<1ohm)



# AUDIO CODEC

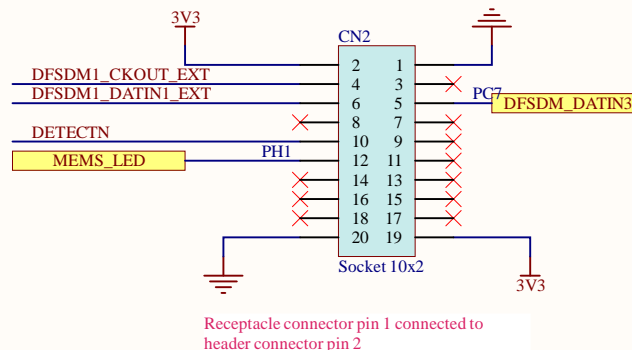
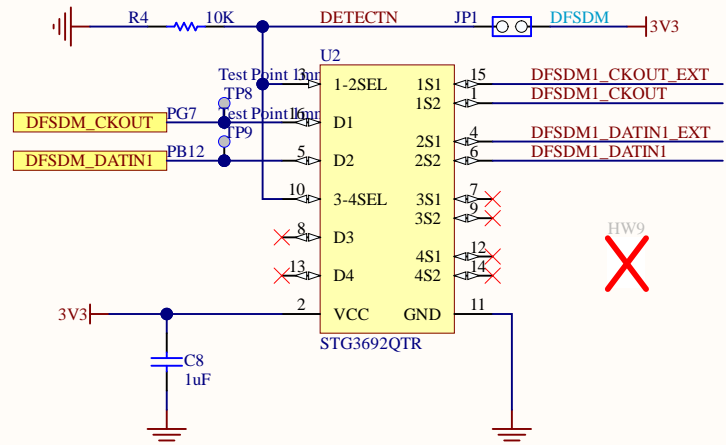
Operating range:  $1V65 < VL < 3V47$   
 Operating range:  $1V65 < VA / VD < 2V63$



# Extension microphones module

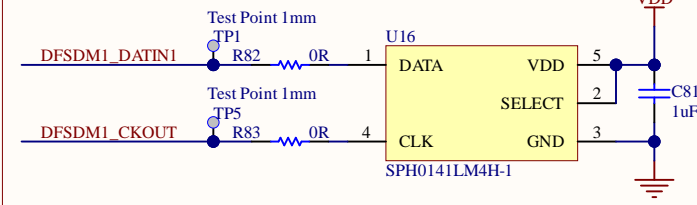
Operating range:  $1V65 < VDD < 3V6$

FIT JP1 TO CONNECT DFSDM TO STMOD+ AND DO NOT PLUG MODULE ON CN2



# MEMS

Operating range:  $1V62 < VDD < 3V6$

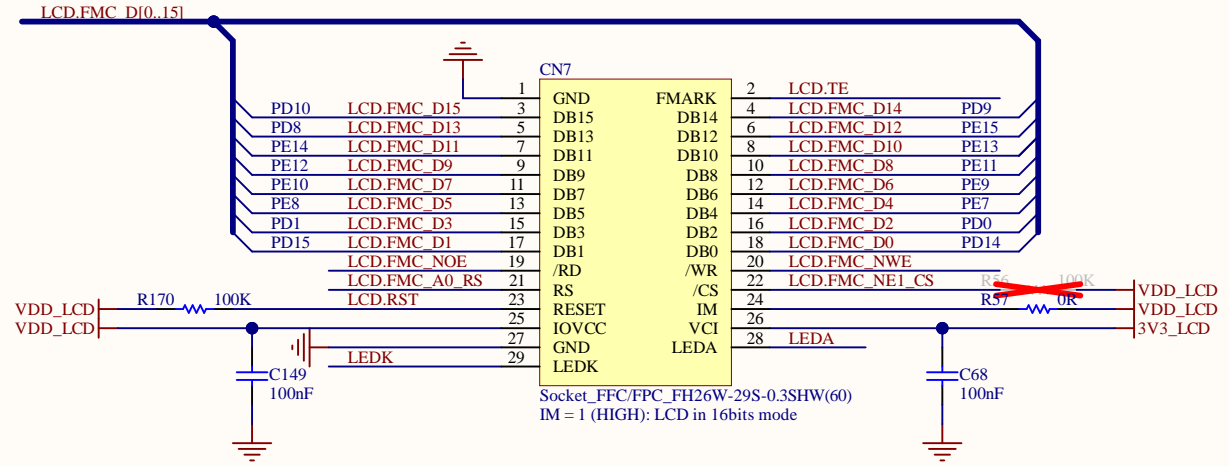
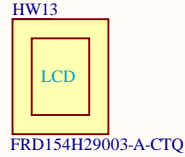
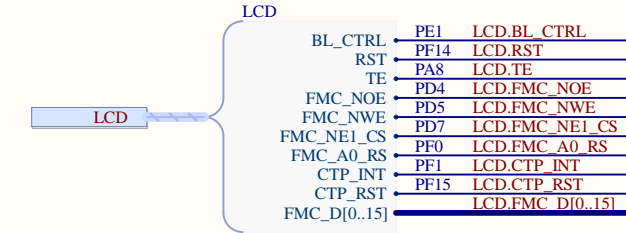


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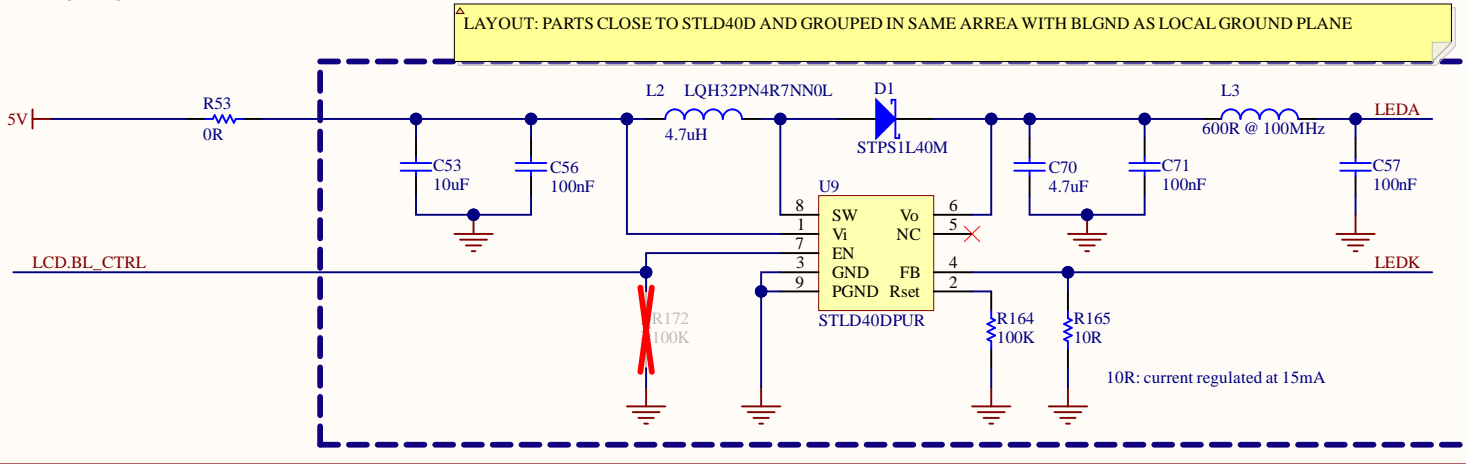
Some DFSDM signals are multiplexed with STMOD+, Ext-MEMS Module and on board Microphone.  
 In case STMOD+ SHIELD is plugged, Ext-MEMS Module should be disconnected, and Jumper JP1 should be set to connect DFSDM signals to STMOD+ module.



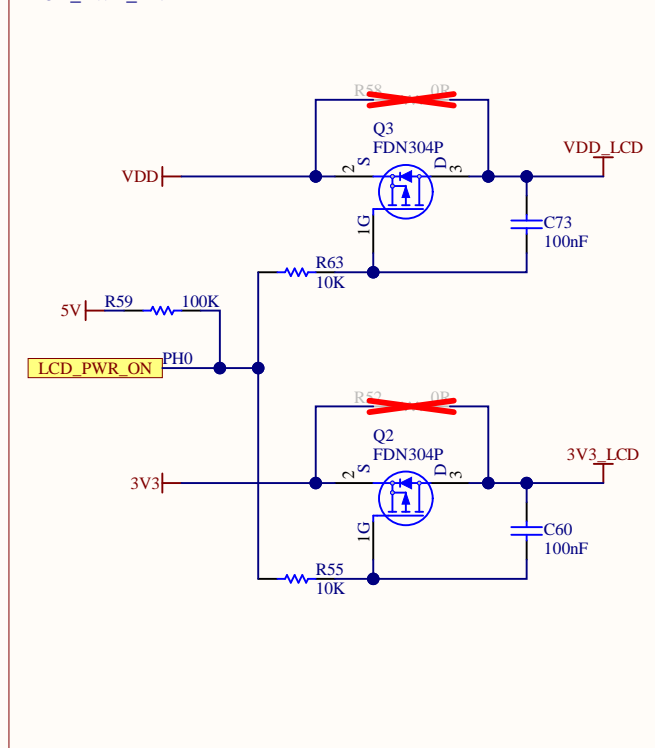
TFT LCD  
 Operating range: 1V65<IOVCC<3V3  
 Operating range: 2V4<VCI<3V3



### BACKLIGHT DRIVER

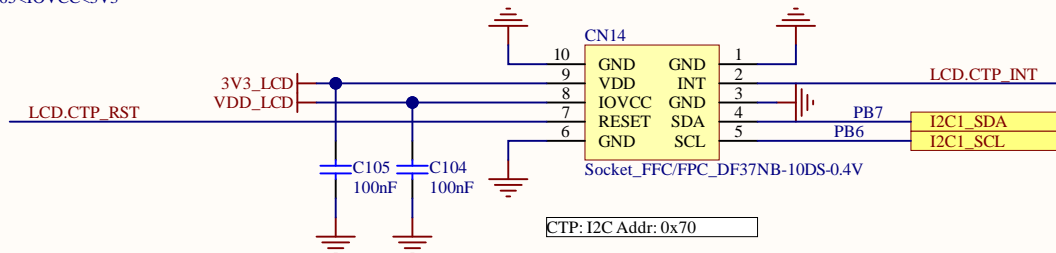


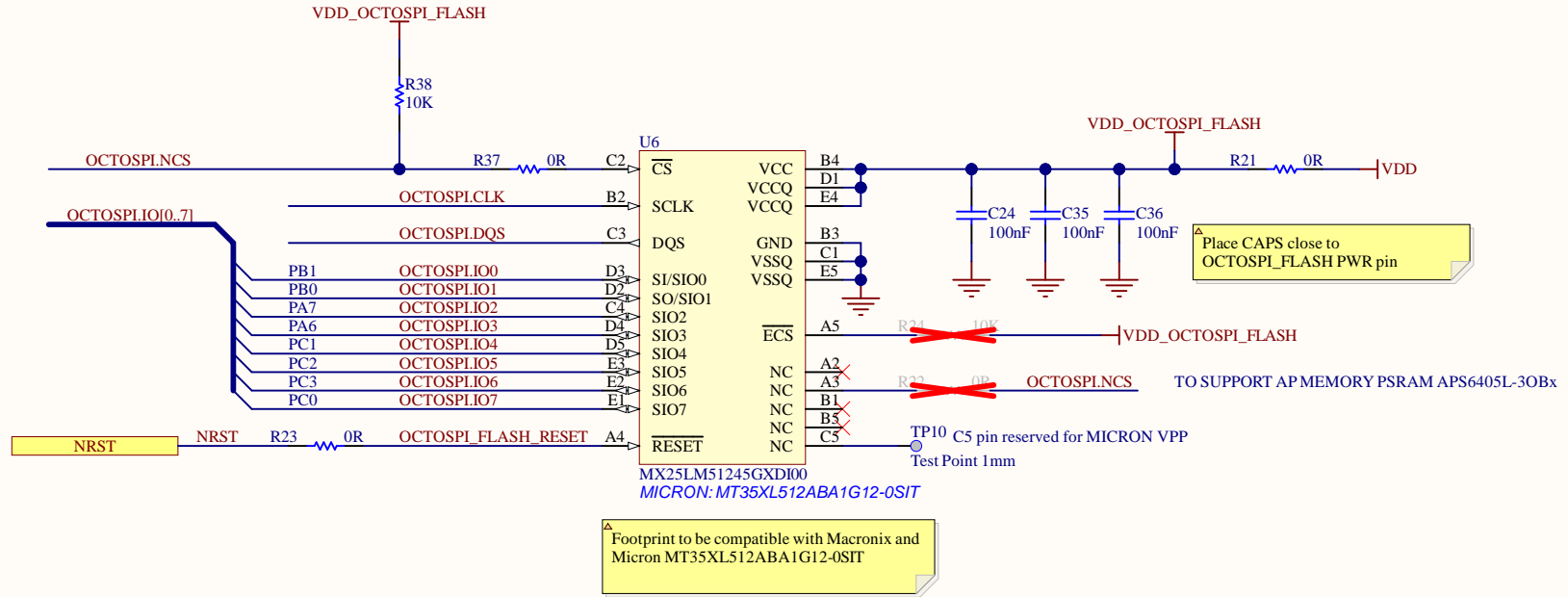
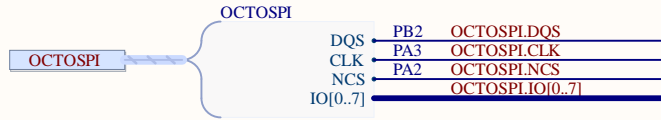
### LCD\_PWR\_ENABLE

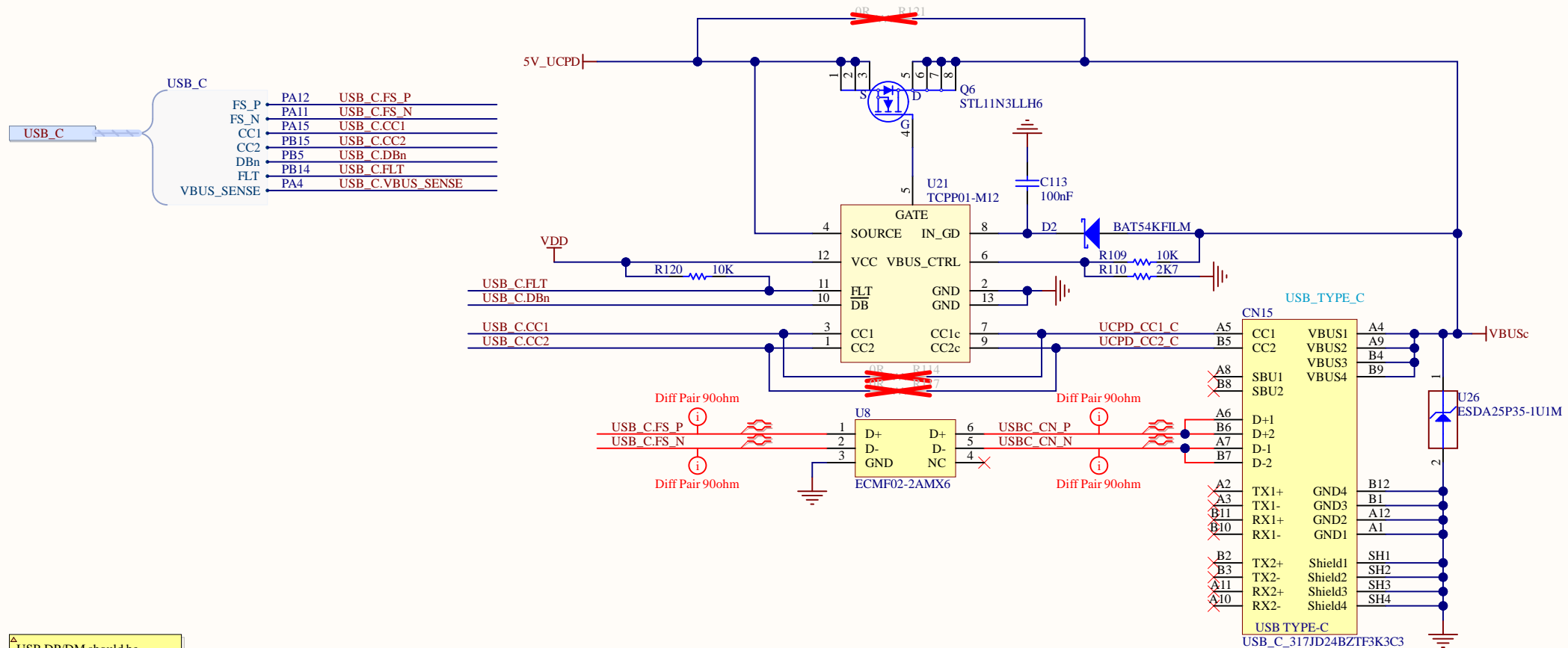


### TOUCH PANEL CONNECTOR

Operating range: 2V4<VDD<3V3  
 Operating range: 1V65<IOVCC<3V3

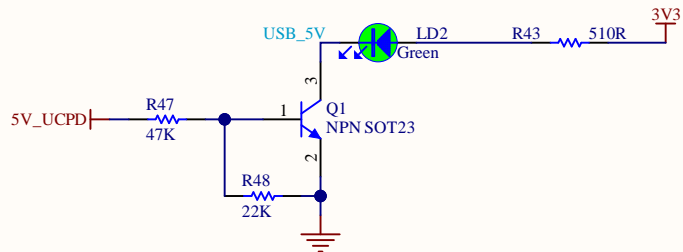




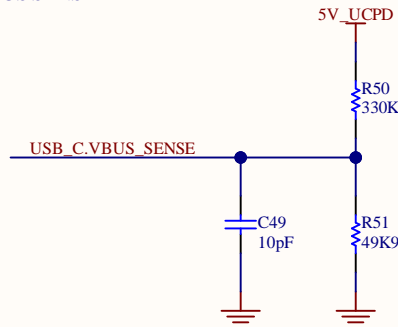


<sup>A</sup> USB DP/DM should be routed in 90 ohm diff +/- 10%

5V\_USB\_LED



VBUS SENSE



LIMITATION :

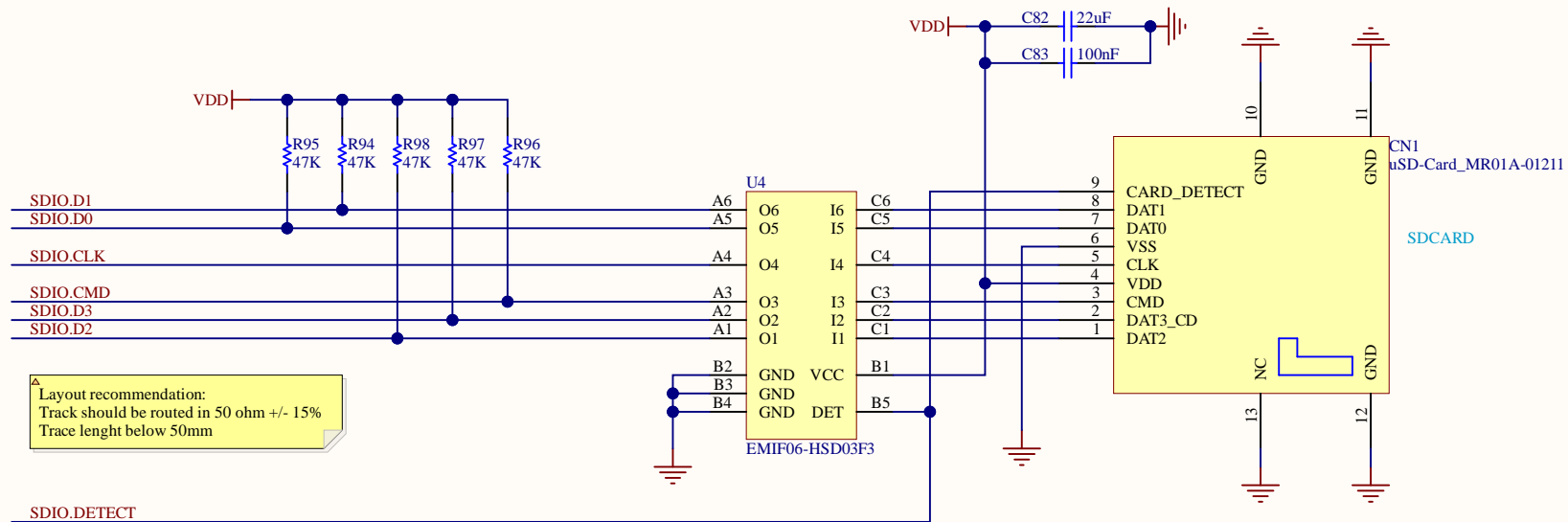
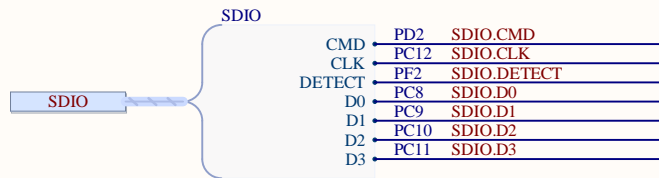
Some UCPD signals are multiplexed with ARDUINO: DBn / VBUS\_SENSE  
In case ARDUINO SHIELD is plugged, UCPD signals can be disconnected.  
User need to check that multiplexed signals are not used on both features simultaneously.

Some ARDUINO signals are multiplexed with JTAG: CC1  
In case JTDI is used, USB TYPE C should be disconnected.  
User need to check that multiplexed signals are not used on both features



# SDCARD

Operating range: 2V7<VDD<3V6



Layout recommendation:  
Track should be routed in 50 ohm +/- 15%  
Trace length below 50mm

### LIMITATION :

Some SDCARD signals are multiplexed with PMOD / STMOD+  
In case SDCARD is plugged, PMOD / STMOD+ signals can be disconnected.  
Or user need to check that multiplexed signals are not used on both features simultaneously.

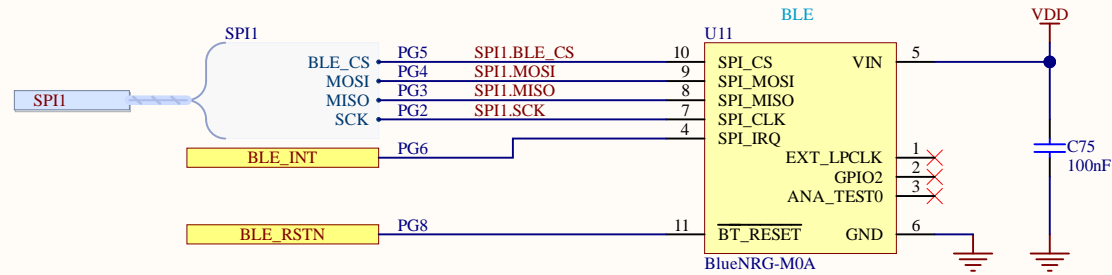
Title: SDCARD	
Project: STM32L562E-DK	
Variant: L562QEQ	
Revision: C-02	Reference: MB1373
Size: A4	Date: 31/05/2023
	Sheet: 10 of 21





## BLE

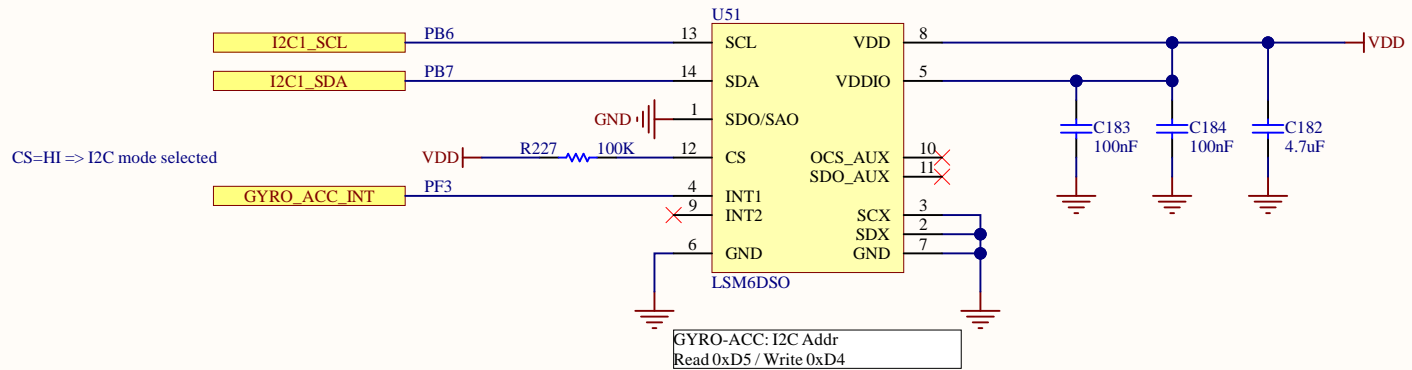
Operating range:  $1V7 < VDD < 3V6$

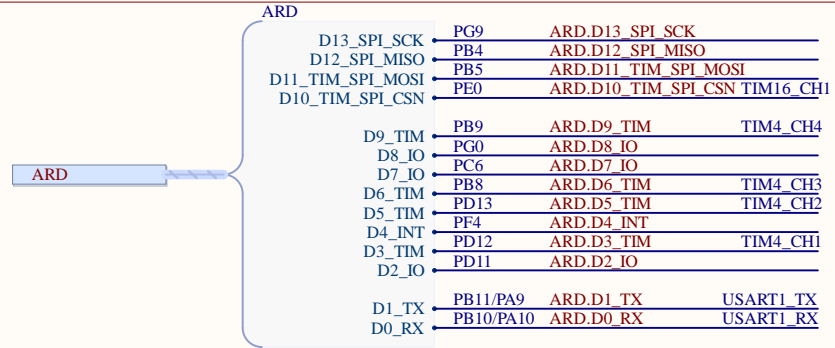
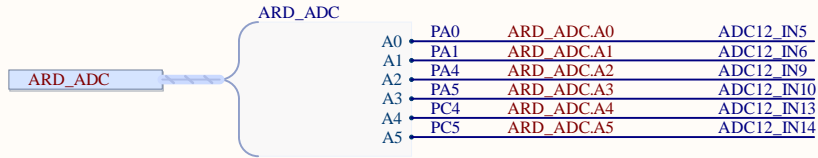


## 3D ACCELEROMETER & GYROSCOPE

Operating range:  $1V7 < VDD < 3V6$

Operating range:  $1V62 < VDDIO < 3V6$



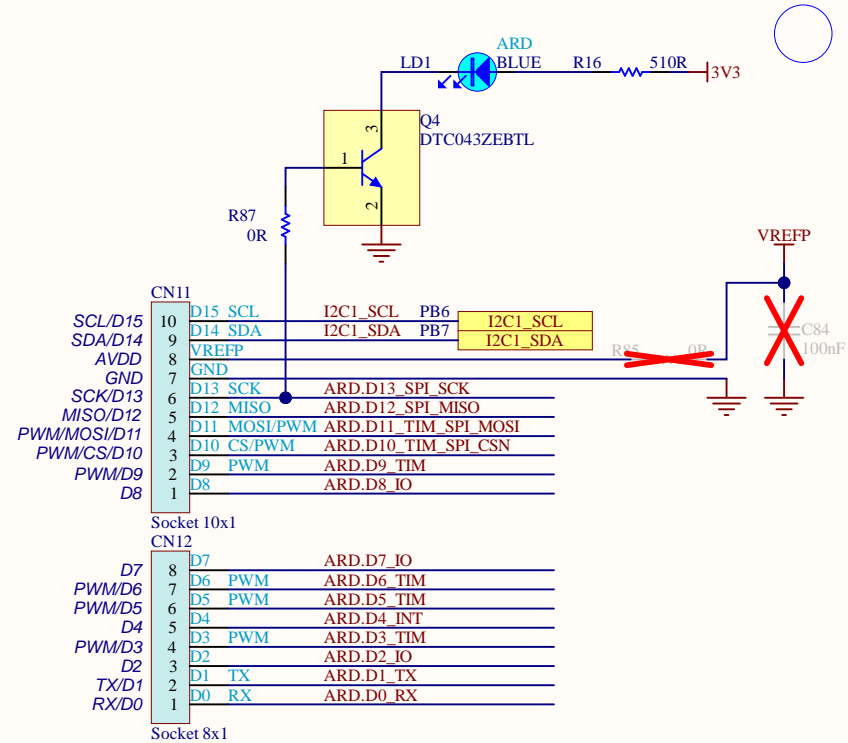
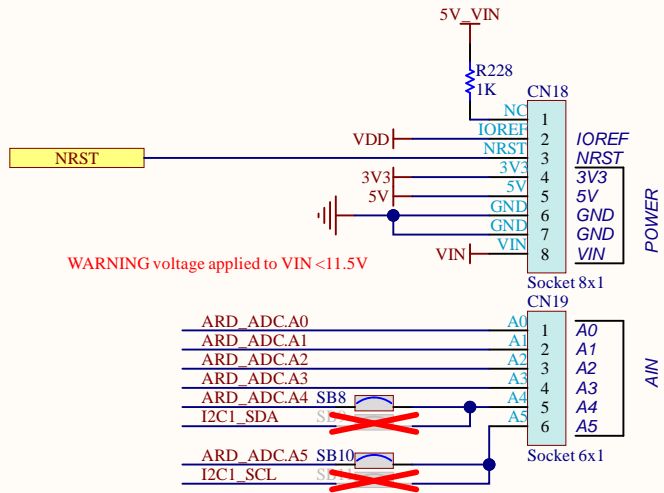


LIMITATION :

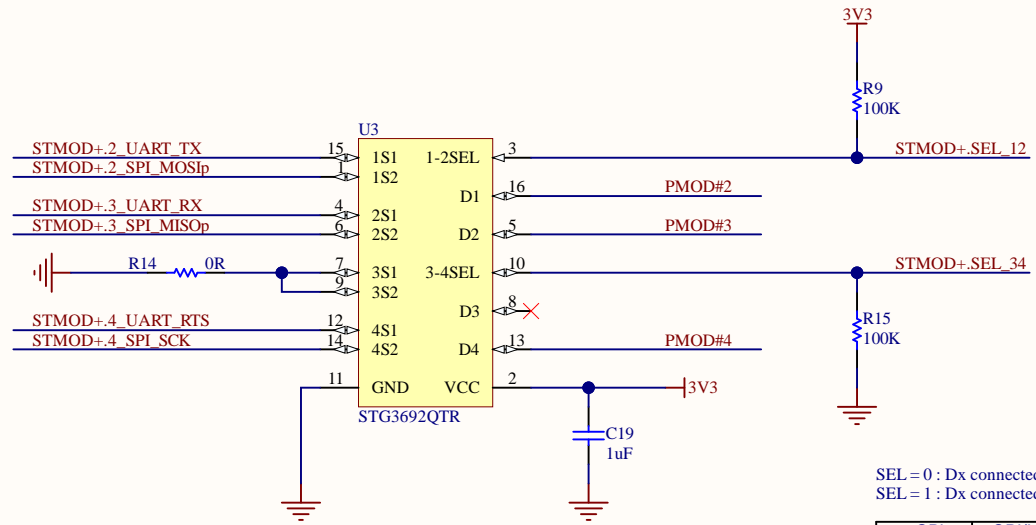
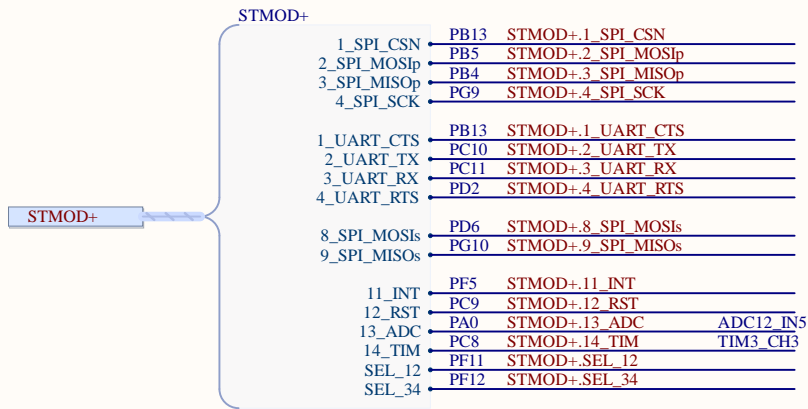
Some ARDUINO signals are multiplexed with UCPD: A2/D11  
 In case ARDUINO SHIELD is plugged, UCPD signals must be disconnected.  
 User need to check that multiplexed signals are not used on both features simultaneously.

Some ARDUINO signals are multiplexed with STMOD+ signals: A0  
 In case ARDUINO SHIELD is plugged, STMOD+ must be disconnected.  
 User need to check that multiplexed signals are not used on both features simultaneously.

SPI\_MISO, SPI\_MOSI and SPI\_SCLK can be used simultaneously.



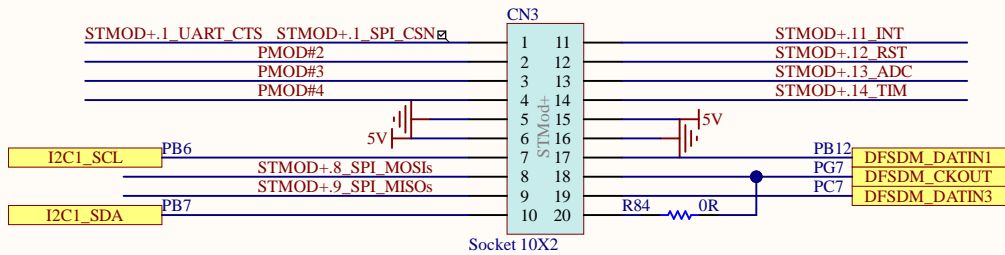
# PMOD / STMOD+ SWITCH



SEL = 0 : Dx connected to xS2  
SEL = 1 : Dx connected to xS1

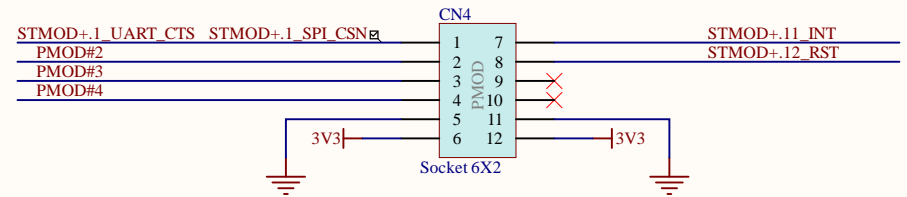
	SPI	SPI/UART (*)	UART
STMOD+ 1-2SEL	0	1 (*)	1
STMOD+ 3-4SEL	0	0 (*)	1
PMOD#1	NSS	NSS	CTS
PMOD#2	MOSIp	TX	TX
PMOD#3	MISOp	RX	RX
PMOD#4	SCK	SCK	RTS

## STMOD+



IF DFSMD IS USED ON STMOD+ MODULE  
FIT JP1 TO CONNECT DFSMD TO STMOD+  
AND DO NOT PLUG MODULE ON CN2

## PMOD



### LIMITATION :

Some SDCARD signals are multiplexed with PMOD / STMOD+  
In case SDCARD is plugged, PMOD / STMOD+ signals can be disconnected.  
Or user need to check that multiplexed signals are not used on both features simultaneously.

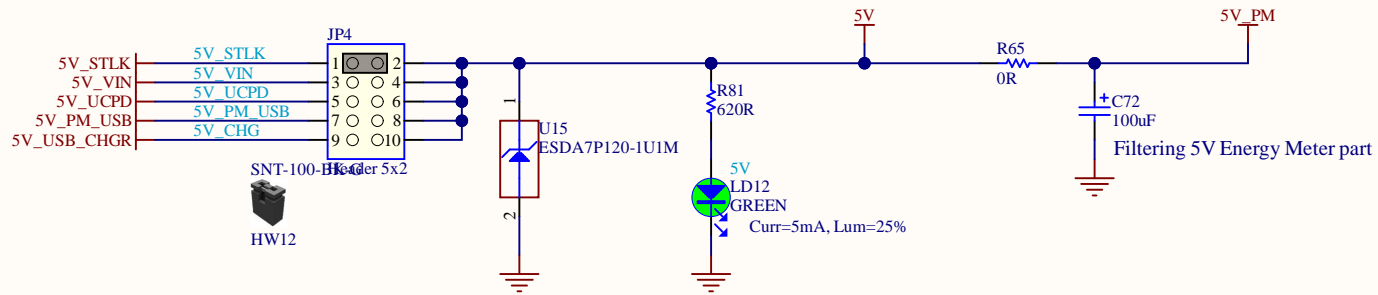
Some ARDUINO signals are multiplexed with PMOD / STMOD+ signals:  
In case ARDUINO SHIELD is plugged, STMOD+ must be disconnected.  
User need to check that multiplexed signals are not used on both features simultaneously.

SPI\_MISO, SPI\_MOSI and SPI\_SCLK can be used simultaneously.

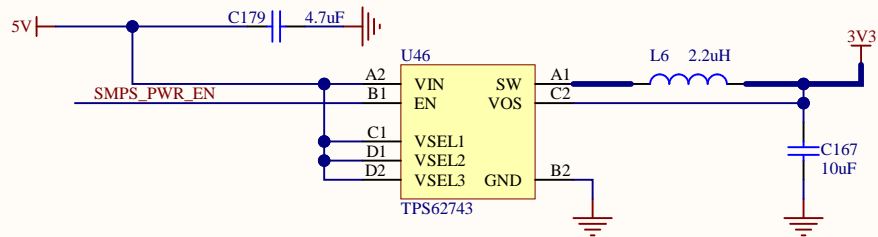
Title: <b>PMOD_STMOD+</b>	
Project: <b>STM32L562E-DK</b>	
Variant: <b>L562EQE</b>	
Revision: <b>C-02</b>	Reference: <b>MB1373</b>
Size: <b>A4</b>	Date: <b>31/05/2023</b>
Sheet: <b>13 of 21</b>	



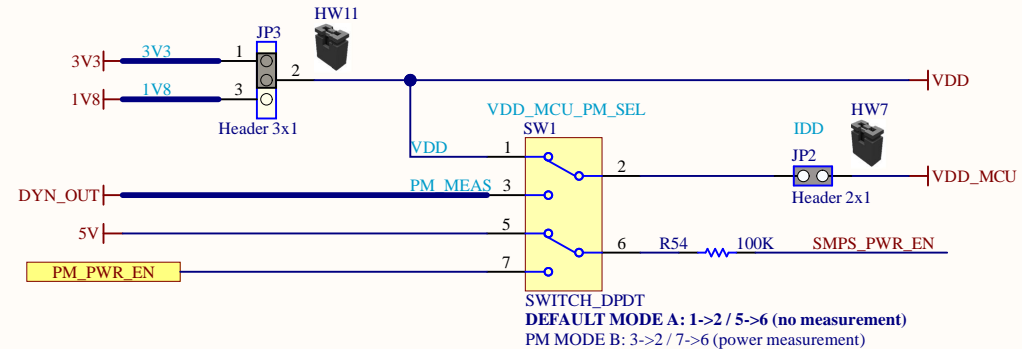
## 5V PWR SOURCE SELECTION



## 3V3 PWR SOURCE: 3V3 / 300mA



## VDD PWR SOURCE SELECTION: 1V8 / 3V3 / DYN\_OUT

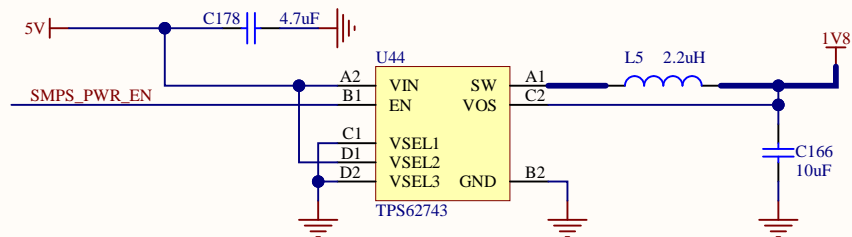


DYN\_OUT is the supply used for current measurement

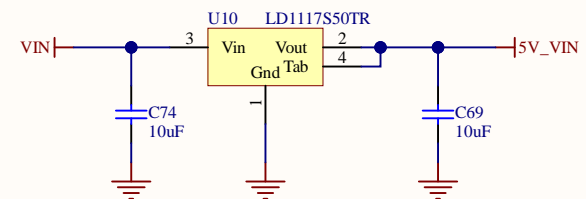
When DYN\_OUT is used, VDD should be align for IO compatibility 1V8 / 3V3

When DYN\_OUT is used on CN20 (external power measurement) SW1 should be set in mode A

## 1V8 PWR SOURCE: 1V8 / 300mA



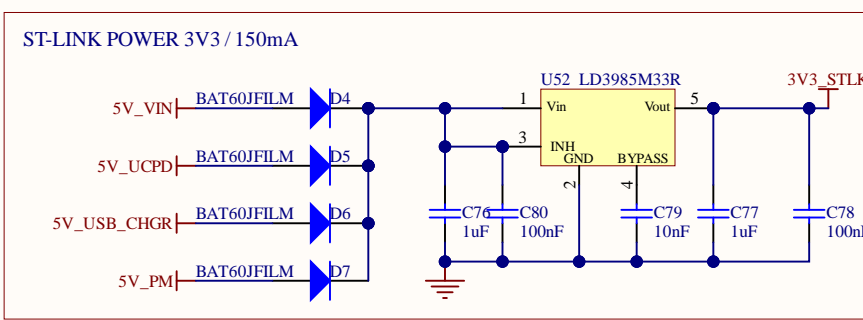
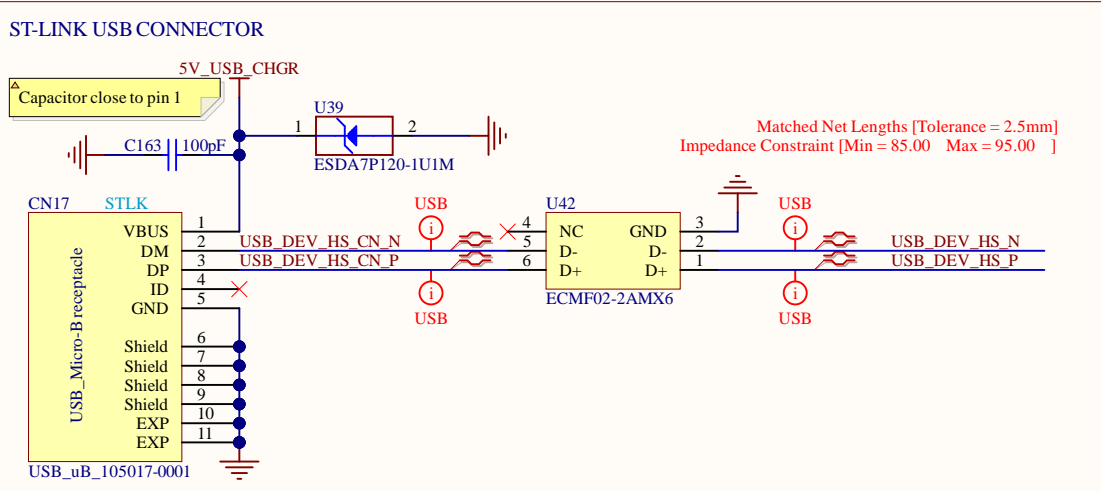
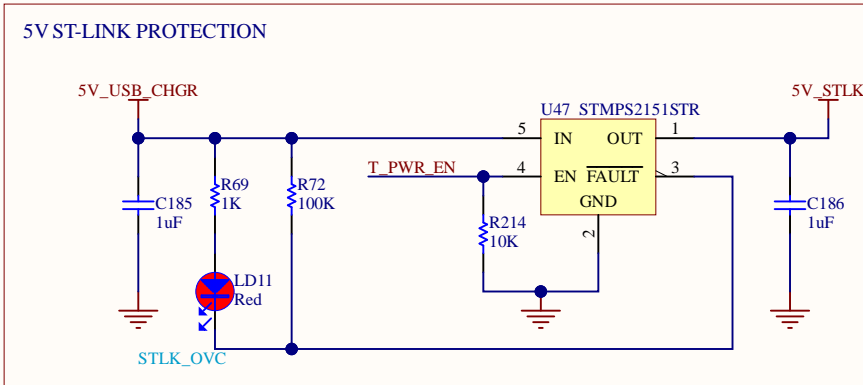
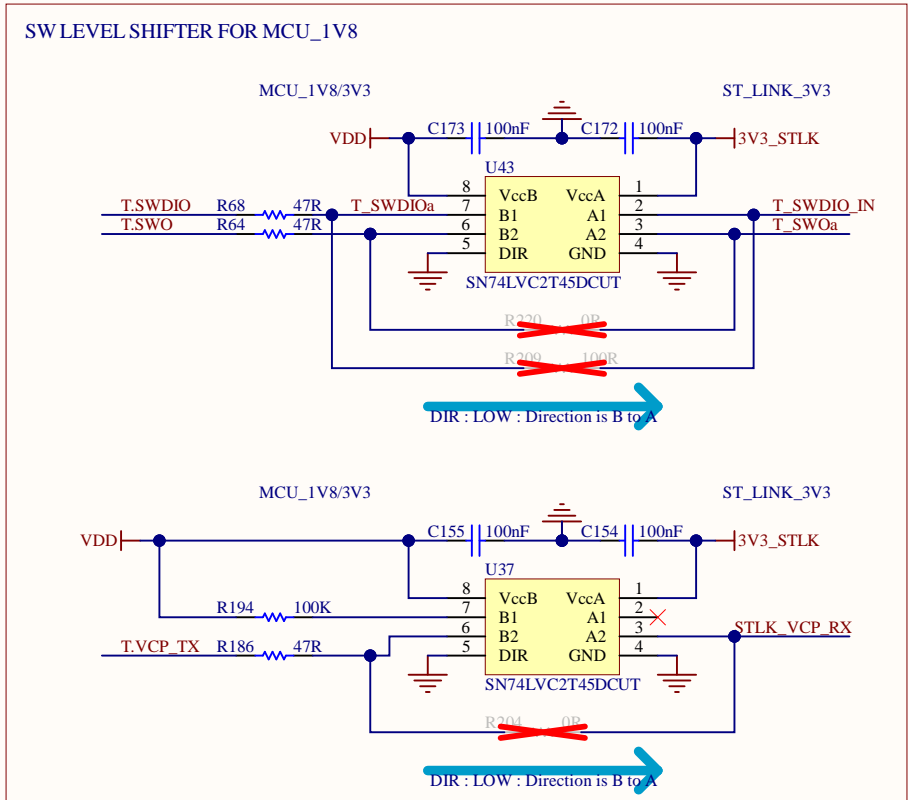
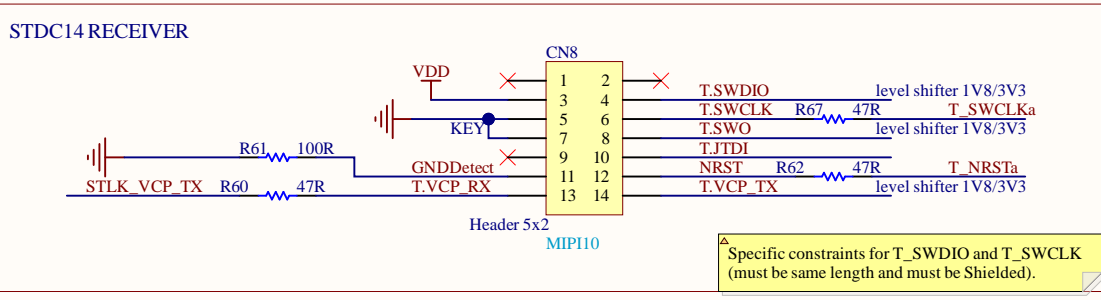
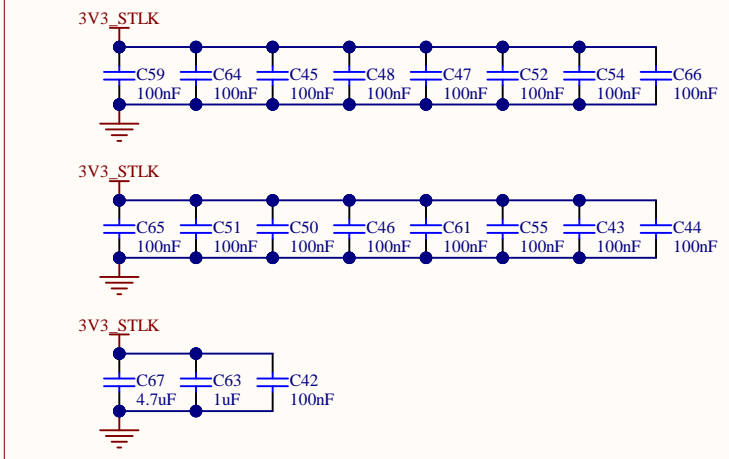
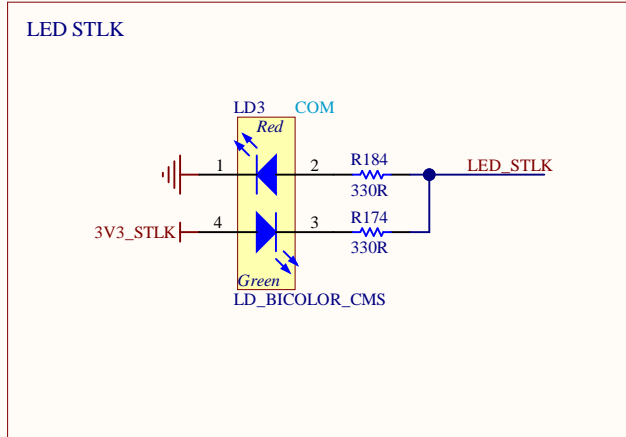
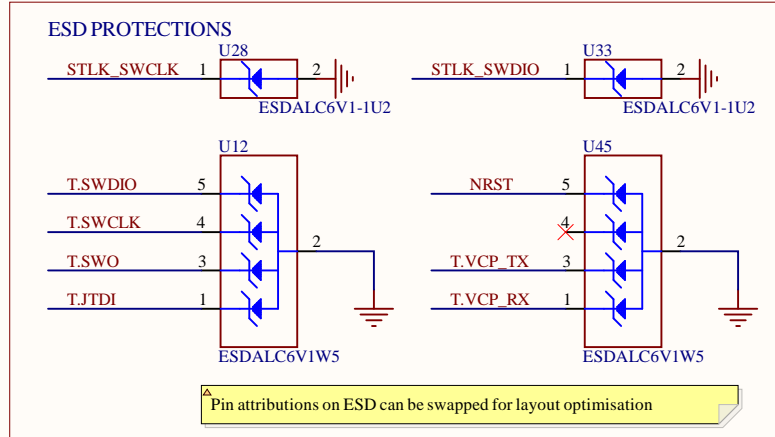
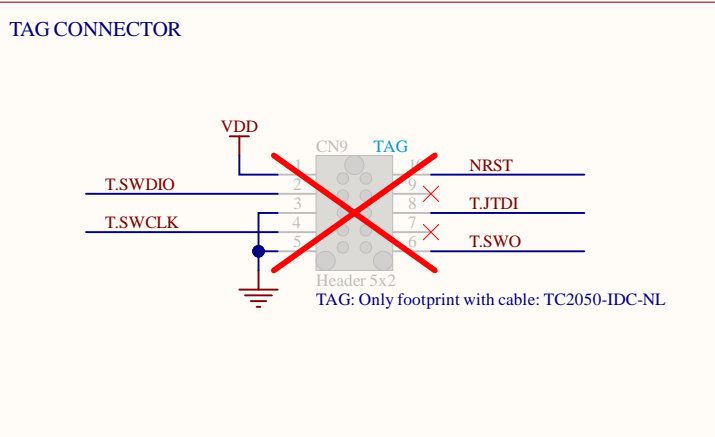
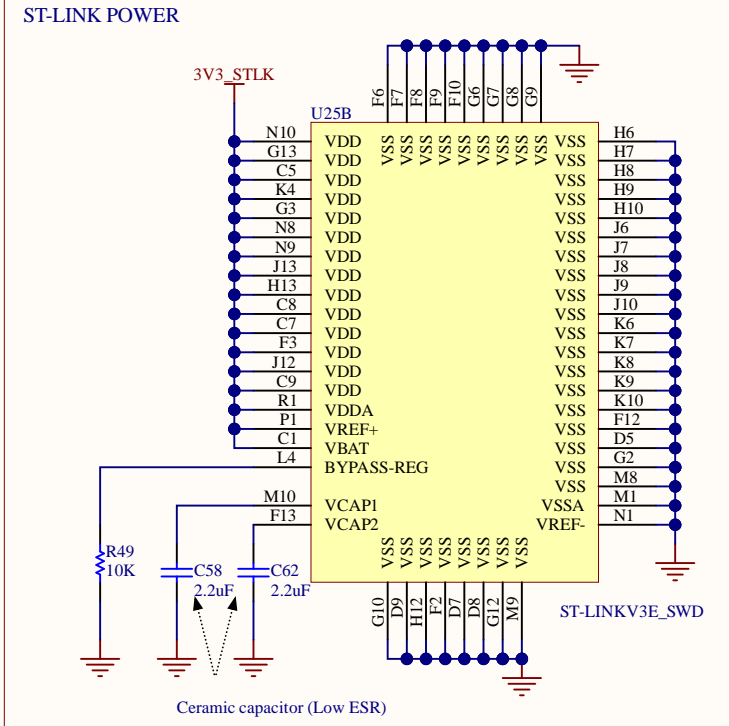
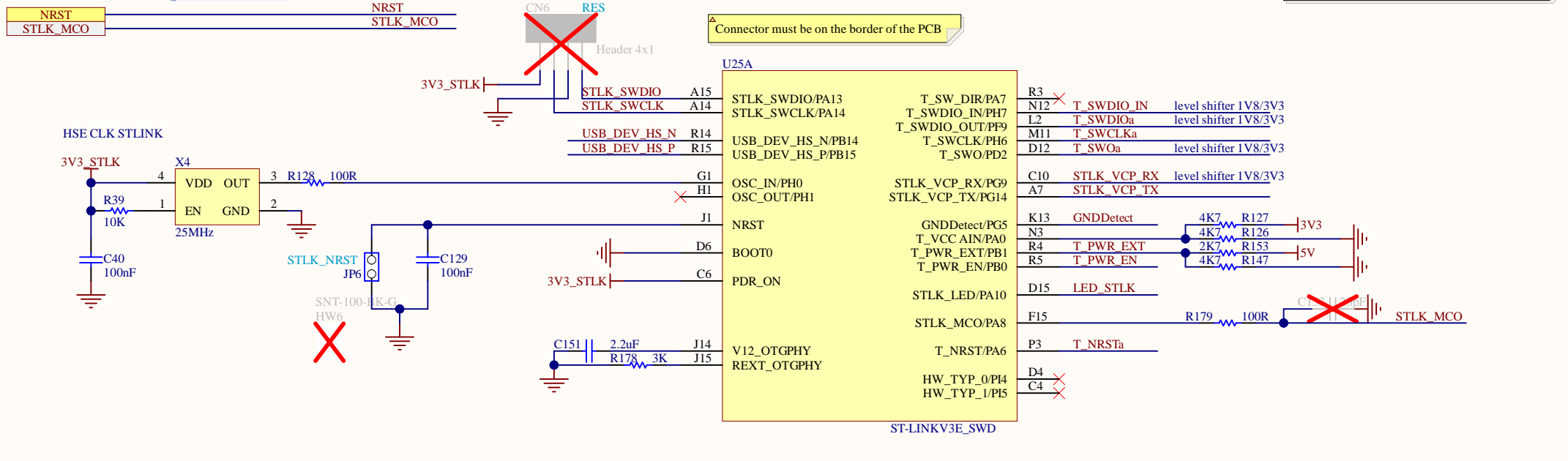
## VIN FROM ARDUINO up to 12V: OUTPUT 5V / Up to 800mA (depend of VIN)

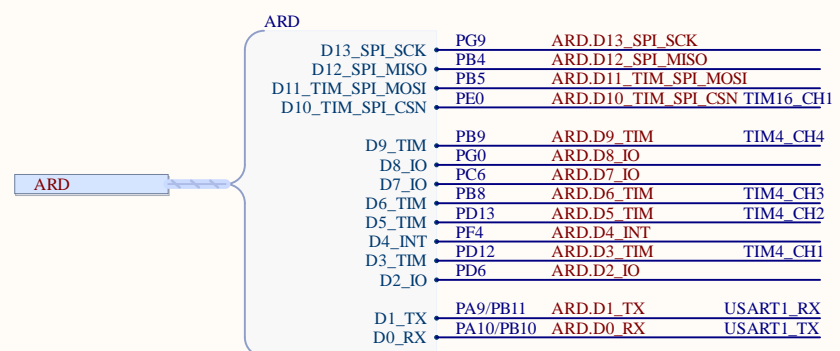
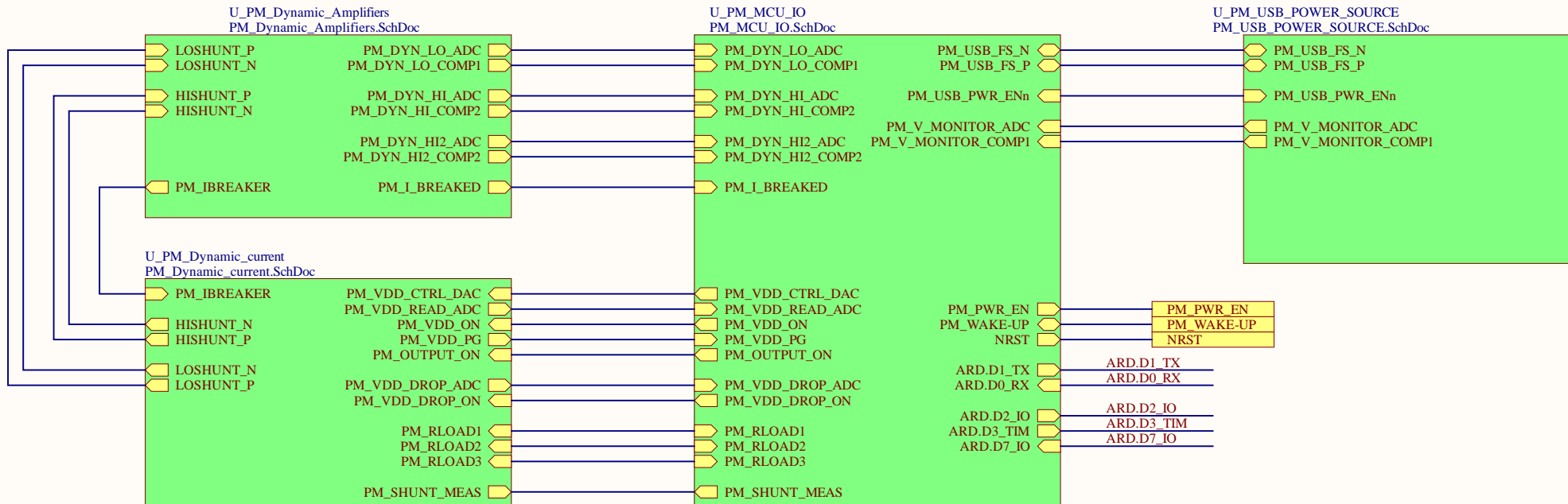




**LIMITATION :**  
Some JTAG signals are multiplexed with UCPD: T\_JTDI  
In case JTDI is plugged, USB TYPE C connector should be disconnected.  
User need to check that multiplexed signals are not used on both features simultaneously.

The routing of the tracks must be done on continuity from ST-LINK to 22ohm resistors and from resistors to Target MCU to avoid stub noises and EMC approach. (22ohm resistors must be very close to STDC14)





**PATENT PENDING**

Title: <b>PM_TOP</b>	
Project: <b>STM32L562E-DK</b>	
Variant: <b>L562QEQ</b>	
Revision: <b>C-02</b>	Reference: <b>MBI373</b>
Size: <b>A4</b>	Date: <b>31/05/2023</b>
Sheet: <b>16 of 21</b>	



EM\_MCU\_IO

Energy Meterring design identification  
Energy Mettering Range Detection

High state enables the VDD regulator  
Reads Power Good of VDD regulator  
High state disables HI current voltage loop  
DAC1 output controls output voltage VDD  
Do not connect here: DAC2 Output, see note\*  
ADC1,2\_IN11 measures VDD  
Low state enables the Dynamic Output

PM\_USB\_FS\_DIFF\_PAIR

COMP1\_OUT is DYN\_LO\_OVRCR  
ADC1,2\_IN16 reads VDD-DROP\_DAC  
COMP1\_INP monitors output supply voltage

COMP2\_INP detects overcurrent on HI2 (DYN)  
PB5= COMP2\_OUT to target MCU: HI or HI2 overcurrent (DYN)  
COMP2\_INP detects overcurrent on HI (DYN)

I2C bus to TEMP sensors  
Temperature alert from temperature sensors

3 TP For Debug Purpose

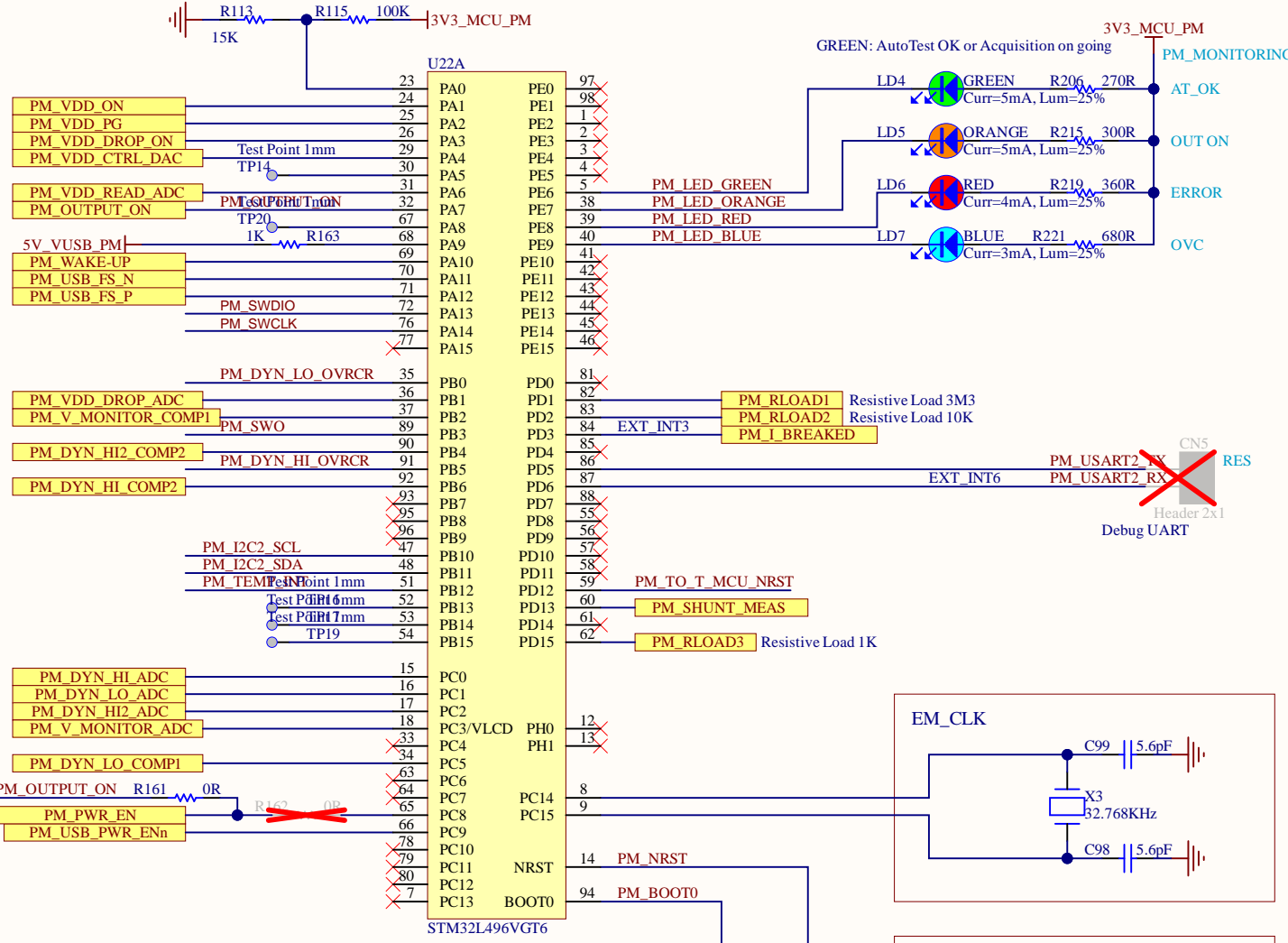
Dynamic current HI: ADC1,2,3\_IN1  
Dynamic current LO: ADC1,2,3\_IN2  
Dynamic current HI2: ADC1,2,3\_IN3  
Vmonitor: ADC1,2,3\_IN4

COMP1\_INP: threshold on DYN\_LO

ENABLE DK SMPS for POWER SEQUENCING  
Power switch to supply board from USB

Note \* regarding PA5:  
- In DYN mode: PA5 is the DAC2 output used as reference INM of COMP1 for overcurrent on DYN\_HI and DYN\_HI2  
- In STAT mode: PA5 = DAC2 is connected internally to INP of COMP1 to monitor V\_MONITOR

GPIOs interrupt vectors:  
EXTI0  
EXTI1  
EXTI2  
EXTI3: PD3\_I\_BROKEN  
EXTI4  
EXTI6 : PD6 interrupt input from Arduino connector pin D1  
EXTI12 : PB12 interrupt input for Temperature sensor

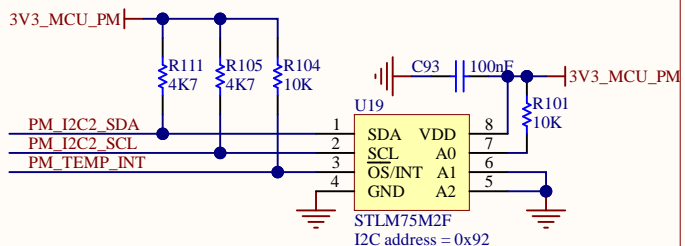


SPDT slider in position B:  
BOOT0 High AND nBOOT1 High = boot from System Flash Memory  
BOOT0 High AND nBOOT1 Low = boot from RAM

SPDT slider in position A:  
BOOT0 Low = boot from Flash memory

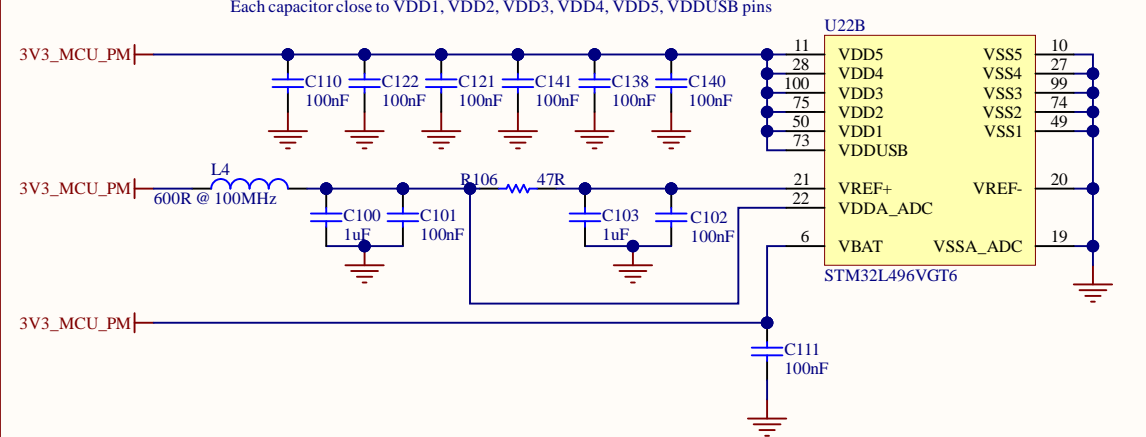
Cap should be near NRST ball on PCB

TEMPERATURE SENSOR

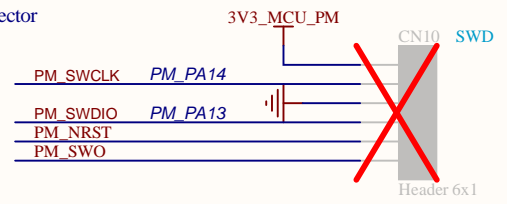


TEMP sensor should be place closed to the TARGET MCU

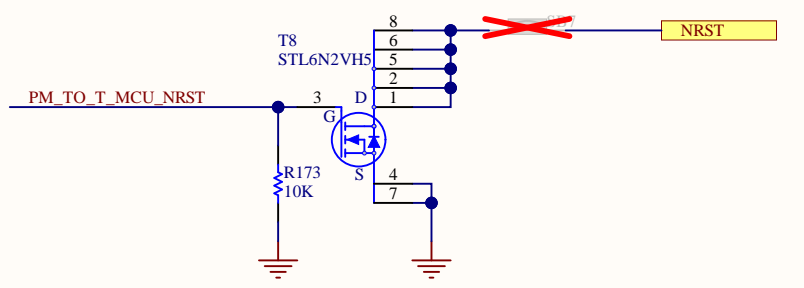
PM\_MCU\_DECAPS



Programming and debug connector

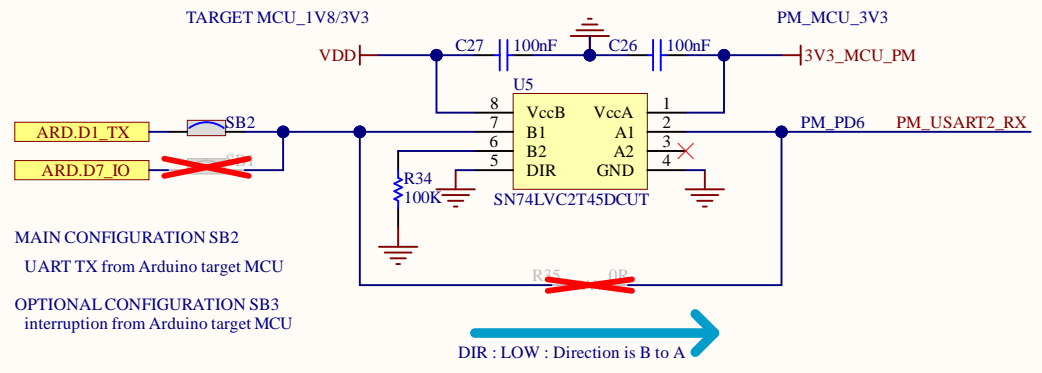


TARGET MCU RESET

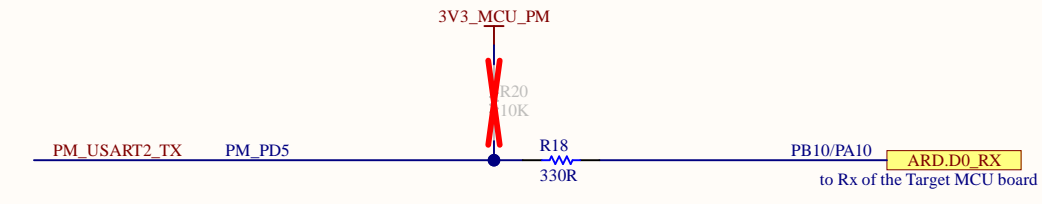


UART LINK BETWEEN PM AND TARGET MCU

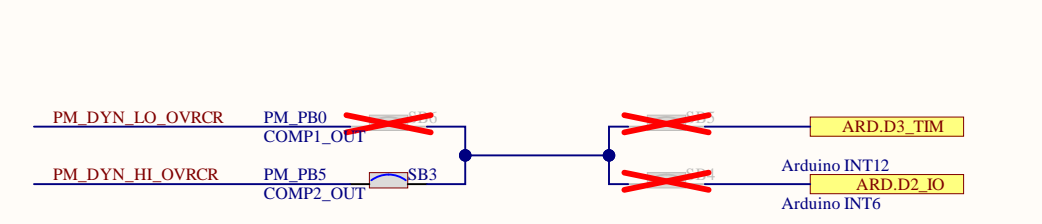
TARGET TX to PM RX: need LS for 1V8 mode



TARGET RX from PM TX: No need LS for 1V8 mode



IT to target MCU for Overconsumption Detection

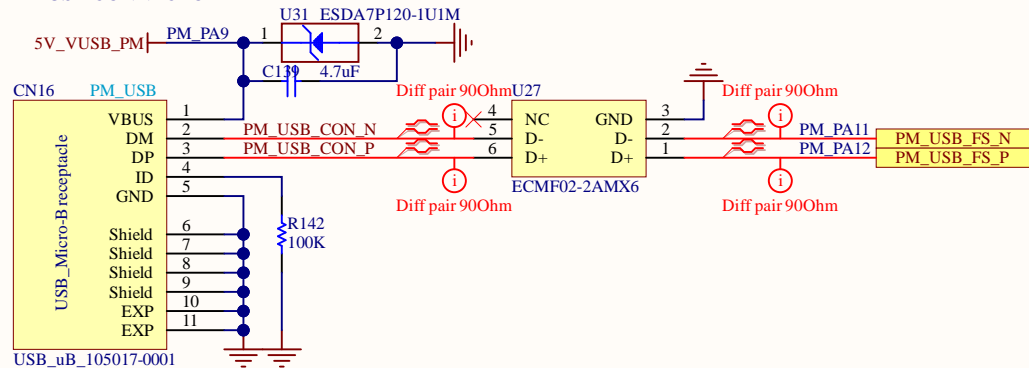


DYN\_HI and DYN\_HI2 overcurrent  
COMP2\_OUT is DYN\_HI\_OVRCR  
OR  
from analog watchdog from ADCs of HI\_ADC and LO\_ADC

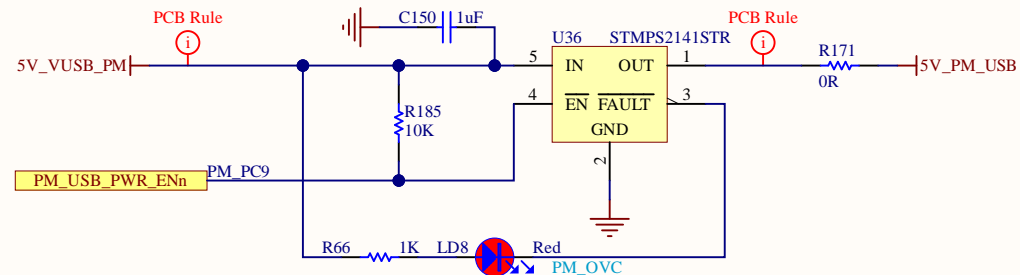
PATENT PENDING



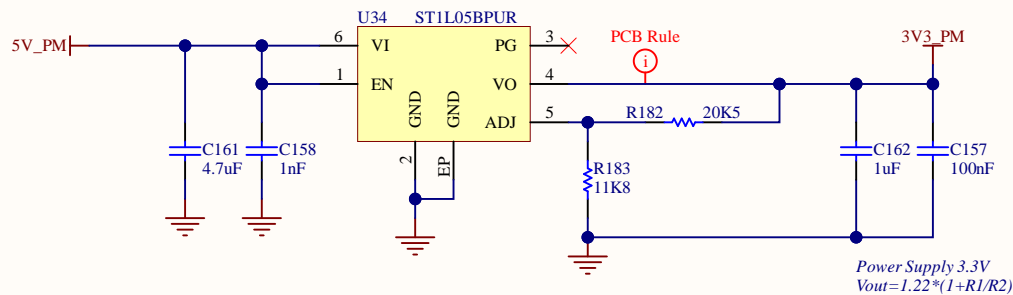
### PM USB CONNECTOR



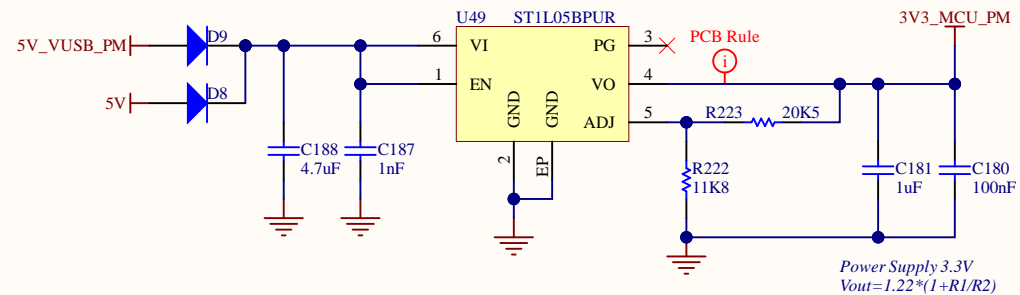
### PM USB 5V POWER SWITCH: 5V / 500mA



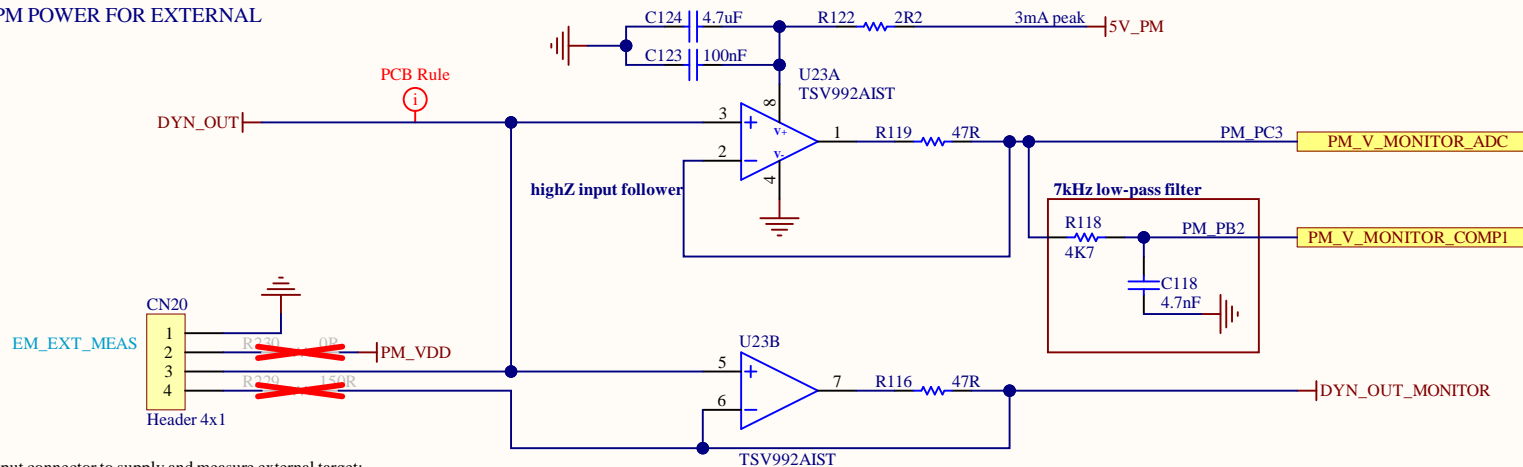
### PM POWER: 3V3 / 1A3



### PM POWER: 3V3 / 1A3



### PM POWER FOR EXTERNAL



Power supply details:

5V\_VUSB\_PM: 5V directly from PM USB connector,

5V\_PM: 5V supply from USB power switch output

3V3\_MCU\_PM: supplies the PM MCU STM32L4 only, independently of the other parts of the board.

This is available as soon as one of the 5V source is present. It is supposed to drain less than 100mA on VUSB.

3V3\_PM: 3V3 for the other part of PM part excepting the STM32L4

PM\_VDD: output of the programmable regulator for Power Measurement.

PM\_VDD give DYN\_OUT to supplies the target MCU and make current measurement

Output connector to supply and measure external target:

PIN 1: GND

PIN 2: Voltage source, current is not measured, it is not a copy of ourput voltage

PIN 3: Output with current measurement

PIN 4: Output voltage copy with 150R protection serial resistor, current is not measured

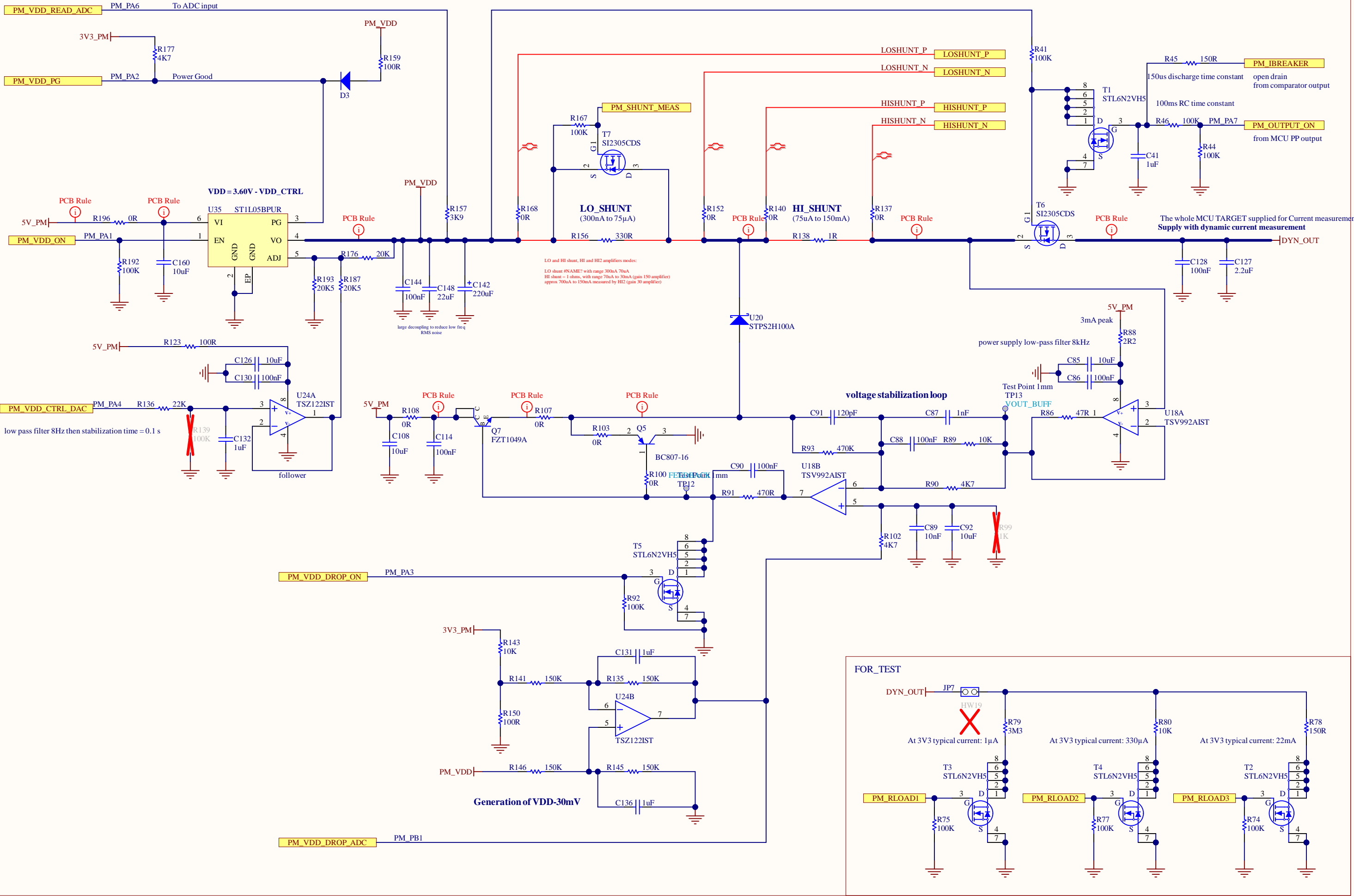
**PATENT PENDING**

Title: <b>PM_USB_POWER_SOURCE</b>	
Project: <b>STM32L562E-DK</b>	
Variant: <b>L562QEQ</b>	
Revision: <b>C-02</b>	Reference: <b>MB1373</b>
Size: <b>A4</b>	Date: <b>31/05/2023</b>
	Sheet: <b>18 of 21</b>





PM DYNAMIC CURRENT MEASUREMENT



LO and HI shunt, HI and HI2 amplifiers modes:  
 LO shunt #NAME? with range 300nA to 70uA  
 HI shunt = 1 ohms, with range 70uA to 30mA (gain 150 amplifier)  
 approx 700uA to 150mA measured by HI2 (gain 30 amplifier)

large decoupling to reduce low freq RMS noise

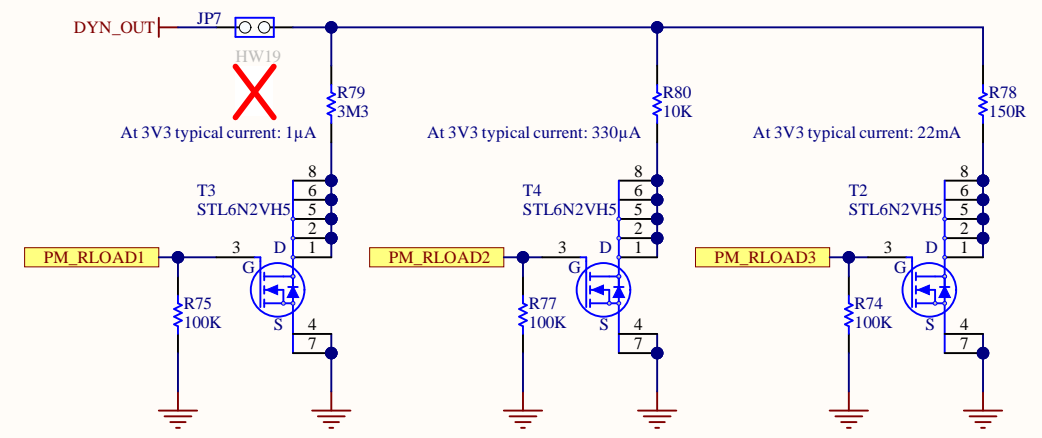
power supply low-pass filter 8kHz

voltage stabilization loop

low pass filter 8Hz then stabilization time = 0.1 s

The whole MCU TARGET supplied for Current measurement  
 Supply with dynamic current measurement

FOR\_TEST

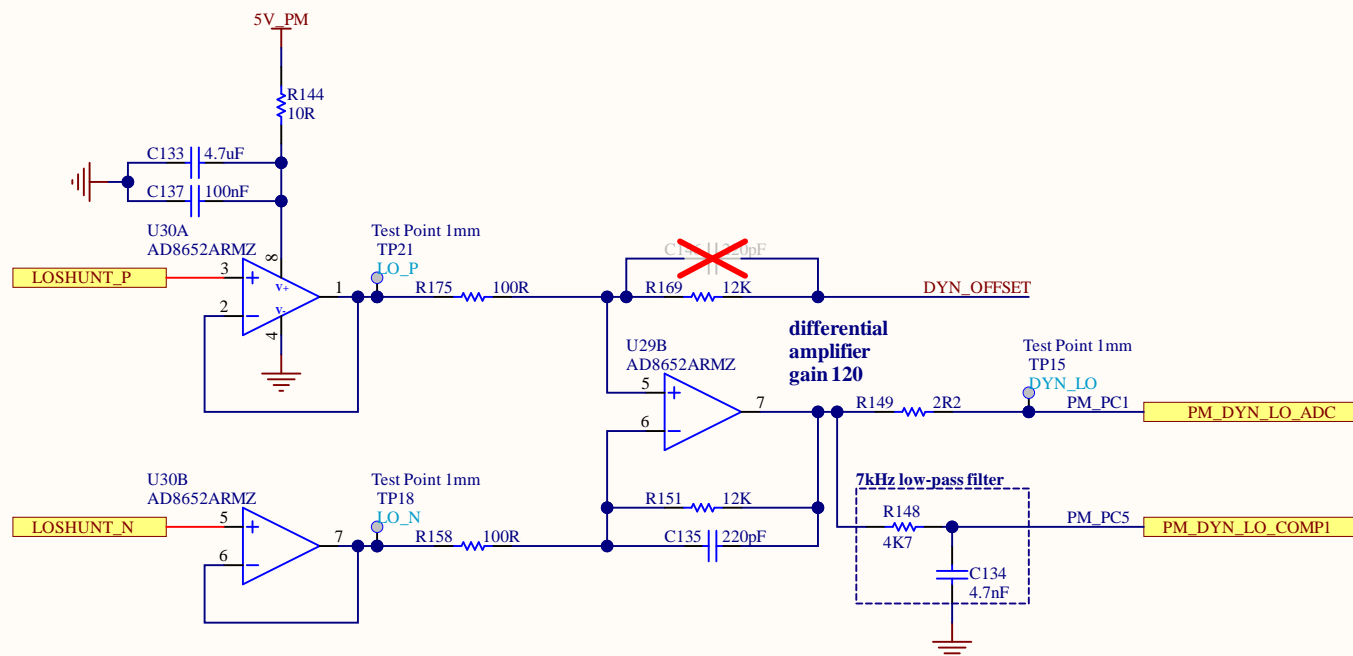


PATENT PENDING



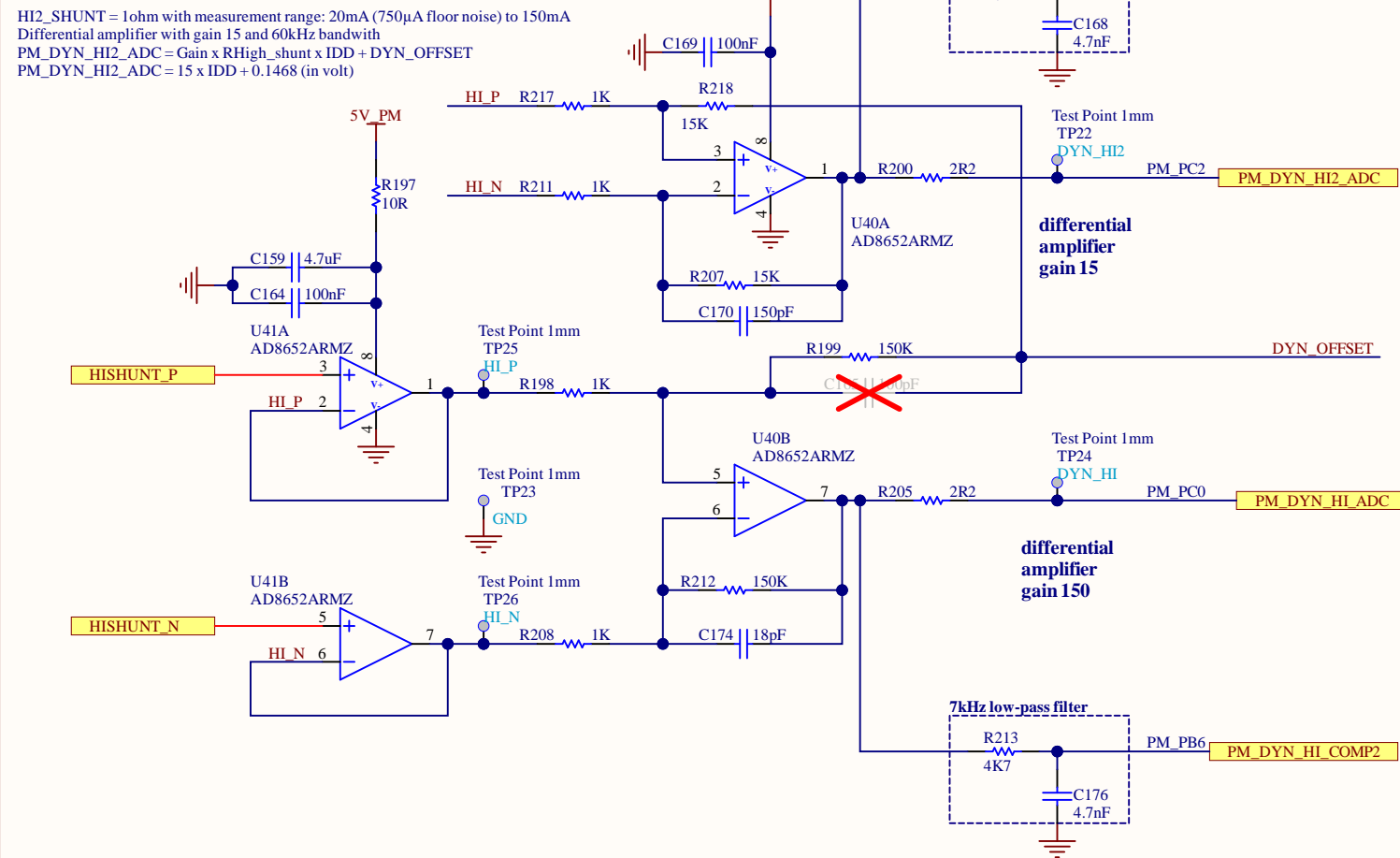
### LOW CURRENT RANGE MEASUREMENTS

LO\_SHUNT = 330ohm with measurement range: 300nA (300nA floor noise) to 75µA  
 Differential amplifier with gain 120 and 60kHz bandwidth  
 $PM\_DYN\_LO\_ADC = Gain \times R_{low\_shunt} \times I_{DD} + DYN\_OFFSET$   
 $PM\_DYN\_LO\_ADC = 39600 \times I_{DD} + 0.1468$  (in volt)



### HIGH CURRENT RANGE MEASUREMENTS

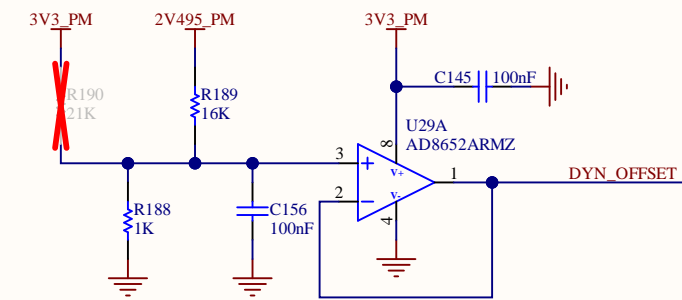
HI\_SHUNT = 1ohm with measurement range: 75µA (70µA floor noise) to 20mA  
 Differential amplifier with gain 15 and 60kHz bandwidth  
 $PM\_DYN\_HI\_ADC = Gain \times R_{high\_shunt} \times I_{DD} + DYN\_OFFSET$   
 $PM\_DYN\_HI\_ADC = 150 \times I_{DD} + 0.1468$  (in volt)



### DC OFFSET GENERATOR

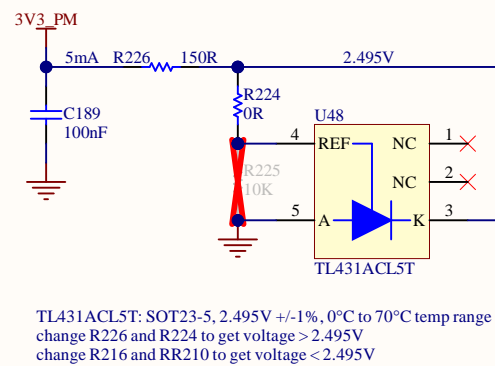
**DYN\_OFFSET = 146.8mV**

DYN\_OFFSET used to compensate input offset of DYN\_LO and DYN\_HI OpAmp  
 assumption: AD8652  $V_{io} = 0.3mV$  max;  $3 \times V_{io} \times gain = 3 \times 0.3 \times 150 = 135mV$  offset voltage min



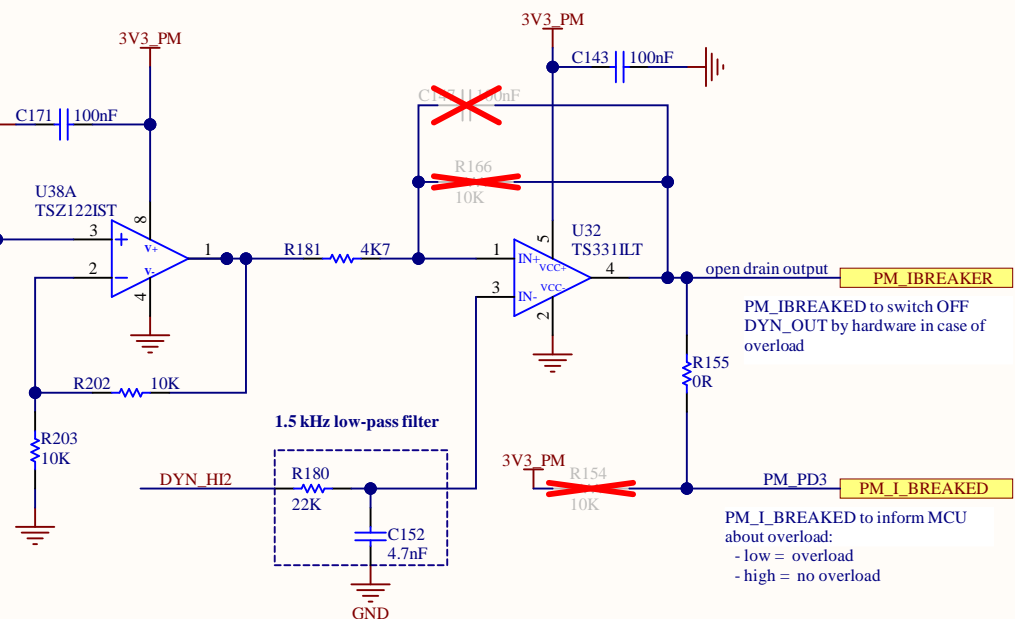
### CIRCUIT BREAKER

**166mA overload and short circuit protection**



**voltage summator**  
 2.495V + offset equiv to 166mA

**voltage comparator**  
 open drain output:  
 - low if  $I_{DD} \geq 166mA$   
 - HiZ if  $I_{DD} < 166mA$



**PATENT PENDING**



HW1

BOARD QR CODE

Sticker QR code

HW2

BOARD CPN

Board CPN

HW10

PCB

MBxxxxx

HW5

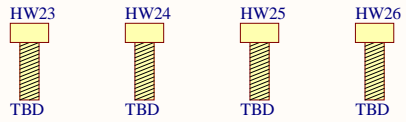
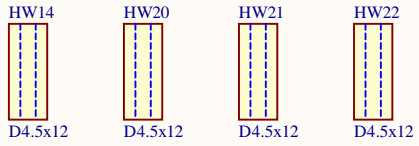
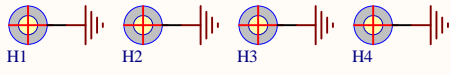
LOGO ST

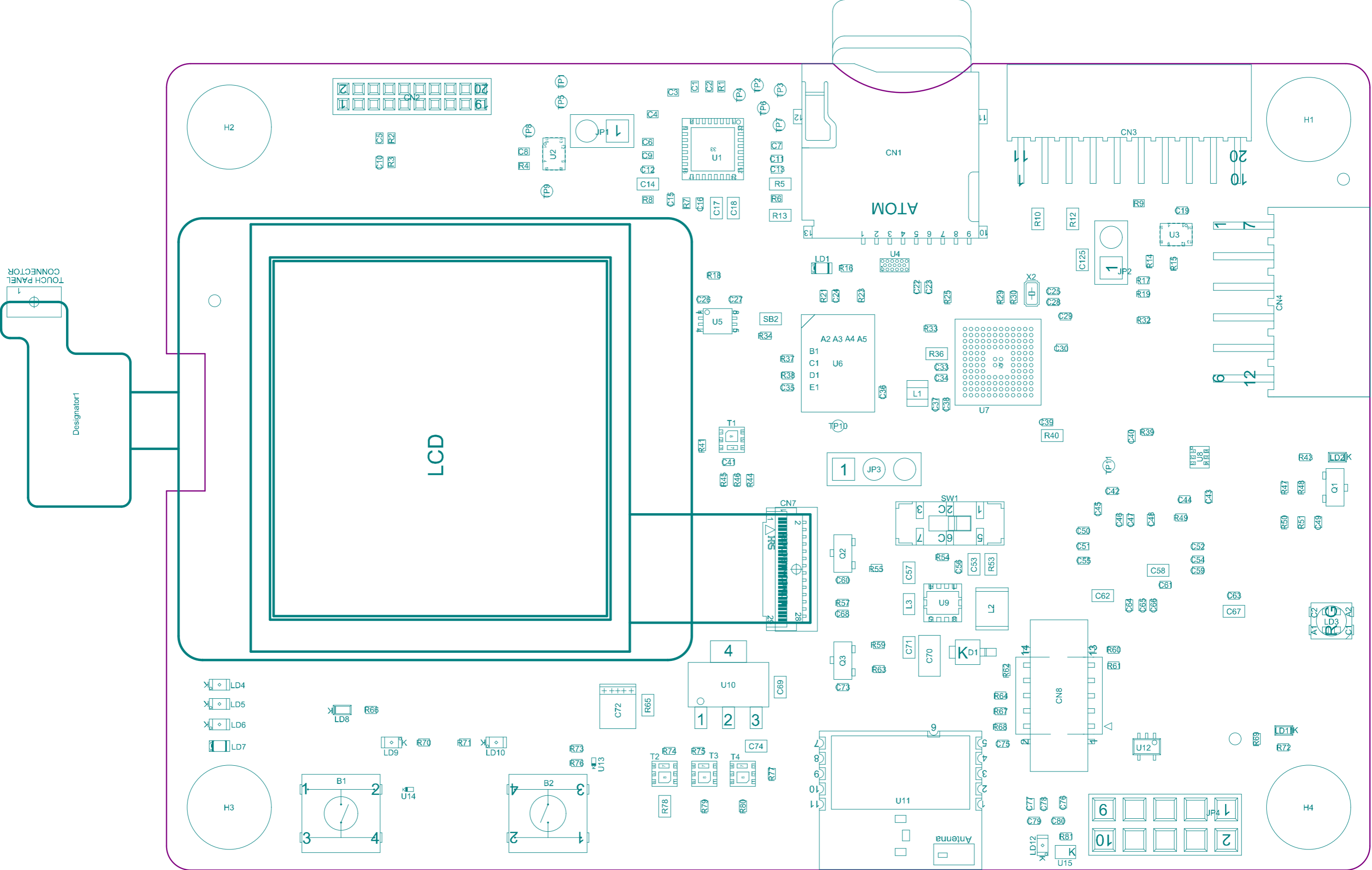
HW3


LOGO CE

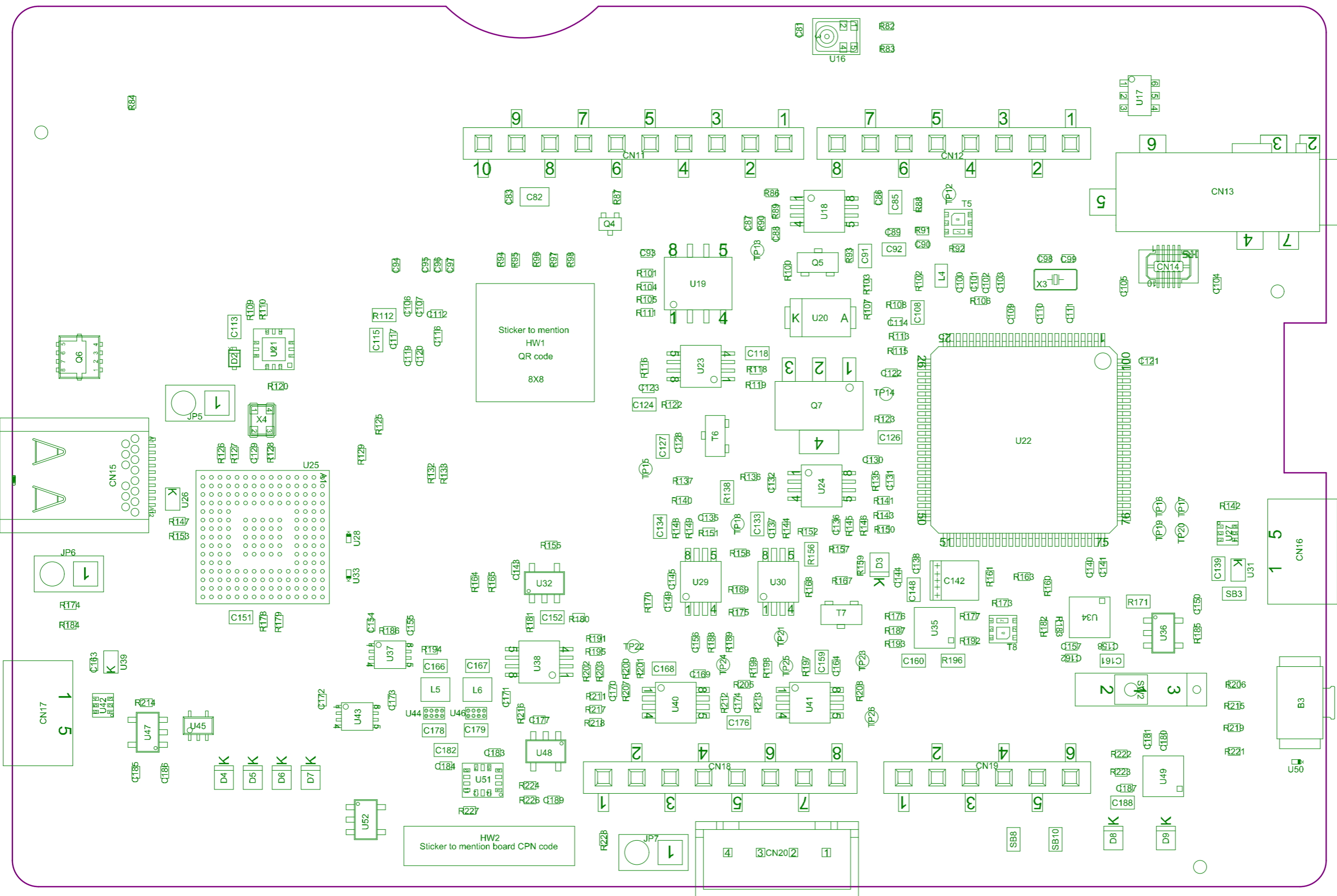
HW4

LOGO ROHS





Project: STM32L562E-DK		
Layer: M14-Top Assembly	Gerber: .GM14	
Variant: L562QEQ	Ref: MB1373	
Date: 19-JUN-14	Rev: C	



Project: STM32L562E-DK

Layer: M15-Bottom Assembly

Variant: L562QEQ

Date: 19-JUN-14

Gerber: .GM15

Ref: MB1373

Rev: C



