STM32G4 DPOW Discovery

MB1428

Table of contents

Sheet 1: Project overview (this page)

Sheet 2: MB1428_Top

Sheet 3: STM32 microcontroller I/Os

Sheet 4: STM32 microcontroller power

Sheet 5: USB PD & USB Type-C

Sheet 6: RGB LED Buck Converters

Sheet 7: Buck Boost Converter

Sheet 8: Extension connectors

Sheet 9: Power

Sheet 10: ST-Link/V3E

Sheet 11: Mechanical

Sheet 12: License agreement

Legend

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

Text to be added to silkscreen.

Warning text.

Notes to generate the board layout.

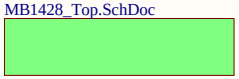
Open Platform License Agreement

The Open Platform License Agreement (“Agreement”) is a binding legal contract between you ("You") and STMicroelectronics International N.V. (“ST”), a company incorporated under the laws of the Netherlands acting for the purpose of this Agreement through its Swiss branch 39, Chemin du Champ des Filles, 1228 Plan-les-Ouates, Geneva, Switzerland.

By using the enclosed reference designs, schematics, PC board layouts, and documentation, in hardcopy or CAD tool file format (collectively, the “Reference Material”), You are agreeing to be bound by the terms and conditions of this Agreement. Do not use the Reference Material until You have read and agreed to this Agreement terms and conditions. The use of the Reference Material automatically implies the acceptance of the Agreement terms and conditions.

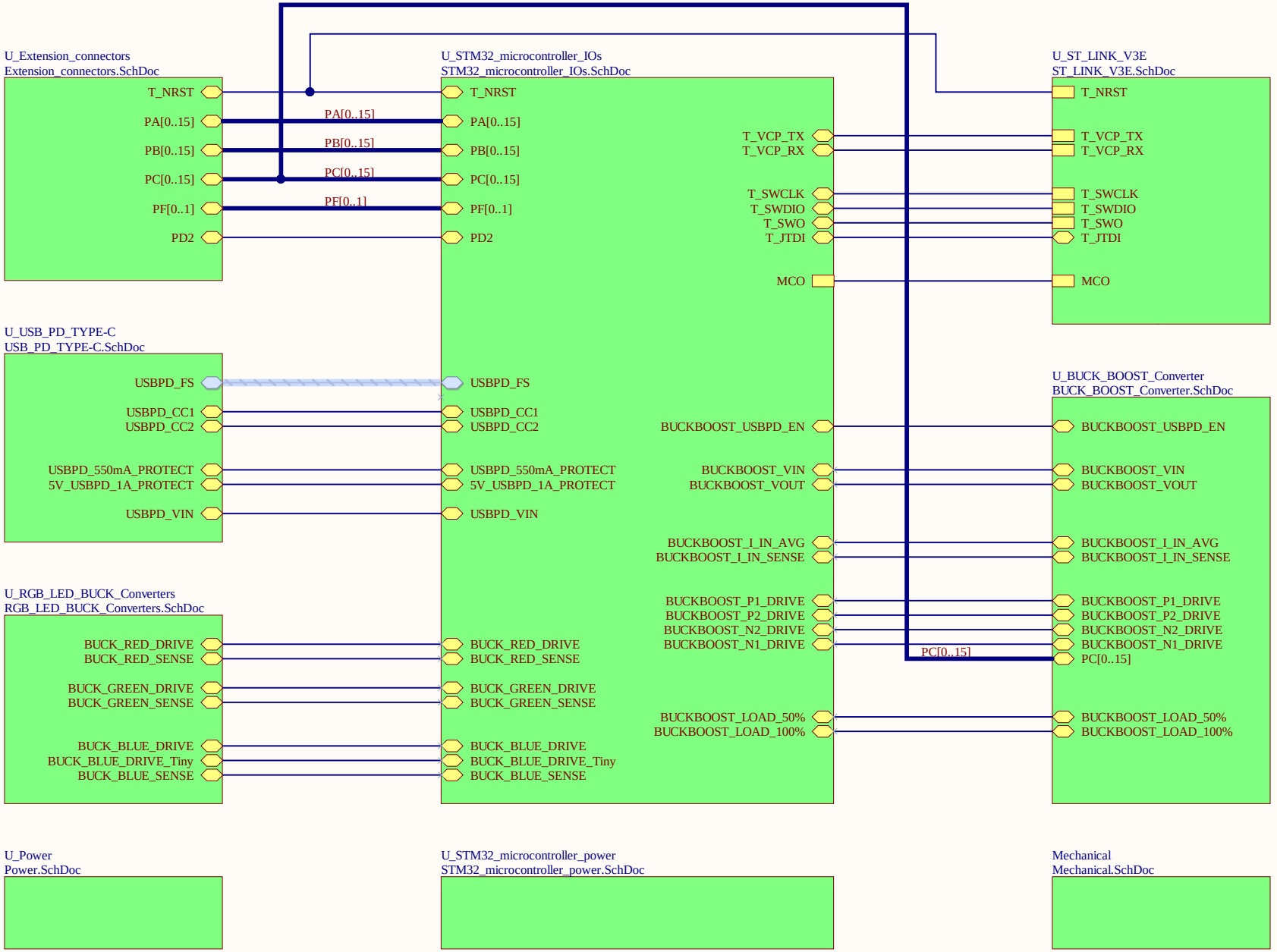
The complete Open Platform License Agreement can be found on www.st.com/opla.

U_MB1428_Top
MB1428_Top.SchDoc



Title: **Project overview**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A4	Date: 28-JUNE-19	Sheet: 1 of 12

life.augmented



Title: **MB1428_Top**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A4	Date: 28-JUNE-19	Sheet: 2 of 12

life.augmented

MICROCONTROLLER

T_SWDIO and T_SWCLK must be same length and shielded.

PA[0..15] PA[0..15]

PC[0..15] PC[0..15]

PF[0..1] PF[0..1]

Matched Net Lengths [Tolerance = 0.2mm]
Impedance Constraint [Min = 85.00 Max = 95.00]

USBPDFS
USBPD_FS_DM
USBPD_FS_DP
USBPD_FS

USBPD_FS_DM
USBPD_FS_DP
R96 0R
R95 0R
PA11
PA12
R91 DNF 0R
R90 DNF 0R

USBPD_FS_DM
USBPD_FS_DP

Resistors must be close to MCU with very short and symmetric topology : USB differential pair routed on Top and/or Bottom (with GND reference on L2 / L3). PA11 and PA12 with the 2 resistors with 55ohms single track constraints.

USBPDFS_D_N
USBPDFS_D_P
R94 0R
R93 0R

BUCKBOOST_I_IN_SENSE SB13
BUCK_GREEN_SENSE
BUCKBOOST_VIN
BUCKBOOST_I_IN_AVG
BUCKBOOST_VOUT
SB14 I_IN_AVG
BUCKBOOST_VIN
BUCKBOOST_I_IN_AVG
BUCKBOOST_VOUT

BUCK_RED_SENSE
BUCK_BLUE_DRIVE
USBPD_CC1
USBPD_CC2

T_SWDIO SB29 T_SWDIO
T_SWCLK SB27 T_SWCLK
T_JTDI SB28 PA15 LED_DOWN_BLUE R88 47R

USBPD_VIN SB33
BUCKBOOST_USBPD_EN SB12
JOY_LEFT
JOY_DOWN
BUCK_RED_DRIVE
RC SINUS
BUCK_GREEN_DRIVE
BUCK_BLUE_DRIVE_Tiny
T_VCP_TX SB24 USART3_TX
T_VCP_RX SB23 USART3_RX
5V_USBPD_1A_PROTECT SB20
JOY_SELECT

BUCKBOOST_LOAD_50%
BUCKBOOST_LOAD_100%

U3A
MCU_IOs

PA0	12	BUCK_GREEN_SENSE				
PA1	13	BUCKBOOST_VIN				
PA2	14	BUCKBOOST_I_IN_AVG				
PA3	17	BUCKBOOST_VOUT				
PA4	18					
PA5	19					
PA6	20					
PA7	21	BUCK_RED_SENSE				
PA8	42	BUCK_BLUE_DRIVE				
PA9	43	USBPD_CC1				
PA10	44	USBPD_CC2				
PA11	45	USBPDFS_D_N				
PA12	46	USBPDFS_D_P				
PA13	49	T_SWDIO				
PA14	50	T_SWCLK				
PA15	51	T_JTDI				
PC0	8					
PC1	9					
PC2	10	USBPD_VIN				
PC3	11	BUCKBOOST_USBPD_EN				
PC4	22	JOY_LEFT				
PC5	23	JOY_DOWN				
PC6	38	BUCK_RED_DRIVE				
PC7	39	RC SINUS				
PC8	40	BUCK_GREEN_DRIVE				
PC9	41	BUCK_BLUE_DRIVE_Tiny				
PC10	52	T_VCP_TX				
PC11	53	T_VCP_RX				
PC12	54	5V_USBPD_1A_PROTECT				
PC13	2	JOY_SELECT				
PC14 - OSC32_IN	3	BUCKBOOST_LOAD_50%				
PC15 - OSC32_OUT	4	BUCKBOOST_LOAD_100%				
PF0 - OSC_IN	5	OSC_IN				
PF1 - OSC_OUT	6	OSC_OUT				
PB0	24	PB0	BUCK_BLUE_SENSE	BUCK_BLUE_SENSE	BUCK_BLUE_SENSE	
PB1	25	PB1	LED_LEFT_ORANGE			
PB2	26	PB2	JOY_DOWN			
PB3	56	PB3	T_SWO	T_SWO	T_SWO	
PB4	57		USBPD_CC2	USBPD_CC2	USBPD_CC2	
PB5	58	PB5	LED_UP_RED			
PB6	59		USBPD_CC1	USBPD_CC1	USBPD_CC1	
PB7	60	PB7	LED_RIGHT_GREEN			
PB9	62	PB9				
PB10	30	PB10	JOY_UP	SB26		
PB11	33	PB11	I_IN_SENSE	BUCKBOOST_I_IN_SENSE	BUCKBOOST_I_IN_SENSE	
PB12	34	PB12	BUCKBOOST_P1_DRIVE	BUCKBOOST_P1_DRIVE	BUCKBOOST_P1_DRIVE	
PB13	35	PB13	BUCKBOOST_N1_DRIVE	BUCKBOOST_N1_DRIVE	BUCKBOOST_N1_DRIVE	
PB14	36	PB14	BUCKBOOST_N2_DRIVE	BUCKBOOST_N2_DRIVE	BUCKBOOST_N2_DRIVE	
PB15	37	PB15	BUCKBOOST_P2_DRIVE	BUCKBOOST_P2_DRIVE	BUCKBOOST_P2_DRIVE	
PD2	55	PD2	550mA_PROTECT	SB19	USBPD_550mA_PROTECT	USBPD_550mA_PROTECT

R84 DNF 0R
R85 DNF 0R
R86 0R
R85 0R
SB16

PB4
PB6
T_SWO
USBPD_CC2
USBPD_CC1

PB[0..15] PB[0..15]

PD2

MCU CLK & RST

PB8-BOOT0 61 PB8 BOOT0 R83 DNF 10K

PG10-NRST 7 T_NRST

STM32G474RET6U

NOTE : BOOT0 is configured as PB8 by default thanks to nSWBOOT0 option bit re-programmed at 0

EXTERNAL HSE CLK

NX2016SA 24MHz
X2
C93 DNF 6.8pF
C92 DNF 6.8pF
GND GND

SB35 SB34 SB36
PF1 SB11
PF0 SB10
MCO

MCO

Parts must be close to MCU. Place on bottom side.

Parts above must be close to MCU, placed on bottom side

JOYSTICK FUNCTION

PC13 SB5 JOYSTICK_SELECT
PC4 SB2 JOYSTICK_LEFT
PC5 SB6 JOYSTICK_DOWN
PB2 SB3 JOYSTICK_RIGHT
PB10 SB4 JOYSTICK_UP

R70 100R
C12 100nF
C11 100nF
C10 100nF
C13 100nF
C15 100nF

U1
I/O1 I/O5
GND I/O4
I/O2 I/O3
ESDA6V1-5SC6

B2
COMMON
CENTER
LEFT
DOWN
RIGHT
UP
MT MT
MT-008A
JOYSTICK

HW20
JOYSTICK BLUE HAT

RC Sinus FUNCTION

PC7 R97 15K DNF TP4 TP RC Sinus
C41 10nF

RESET FUNCTION

T_NRST
R67 100R
C16 100nF
U2 ESDALC6V1-1U2
RESET
B1 SWITCH
HW21 BLACK HAT

USER LED FUNCTION

NOTE : During MCU Reset, PA15 will drive the LED_DOWN_BLUE at low luminance (thanks to PA15 nternal Pull-up present during T_NRST is low)

PB7 R81 330R LED_RIGHT_GREEN
PA15 R89 470R LED_DOWN_BLUE
PB5 R82 1K LED_UP_RED
PB1 R80 1K LED_LEFT_ORANGE

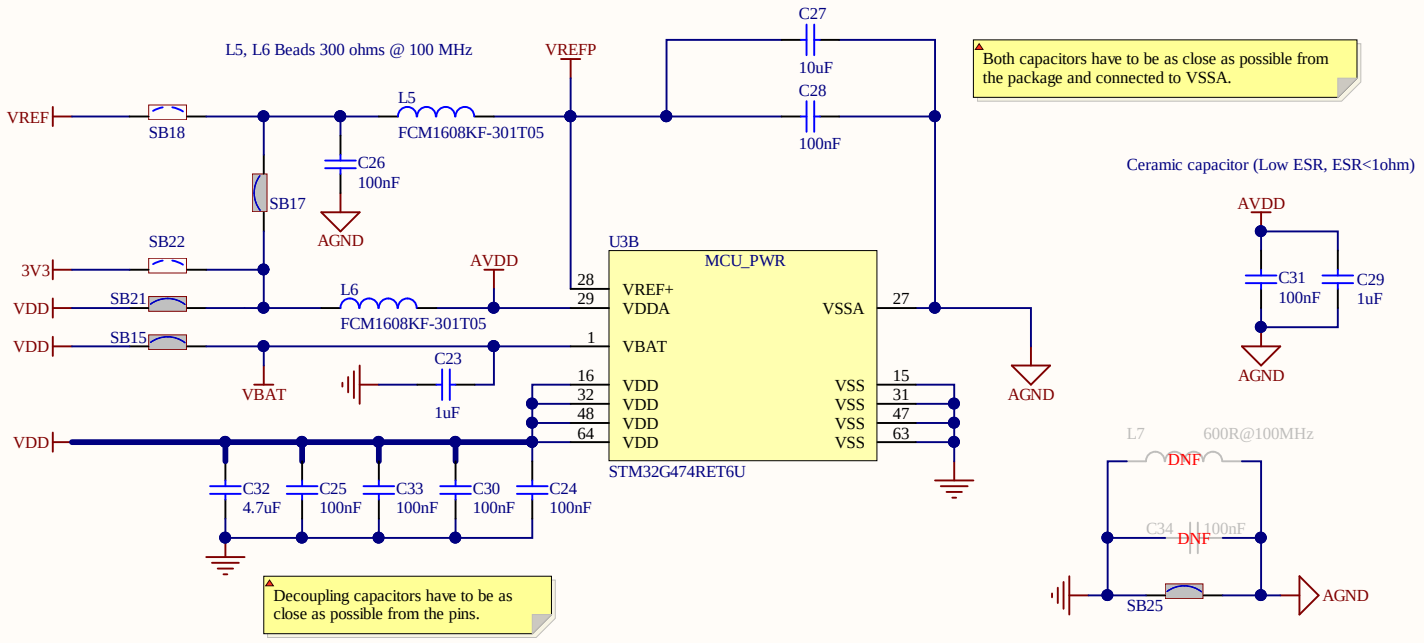
LD5 RED
LD3 ORANGE
LD4 GREEN
LD2 BLUE

R89 resistor to be placed very close to R88 of PA15

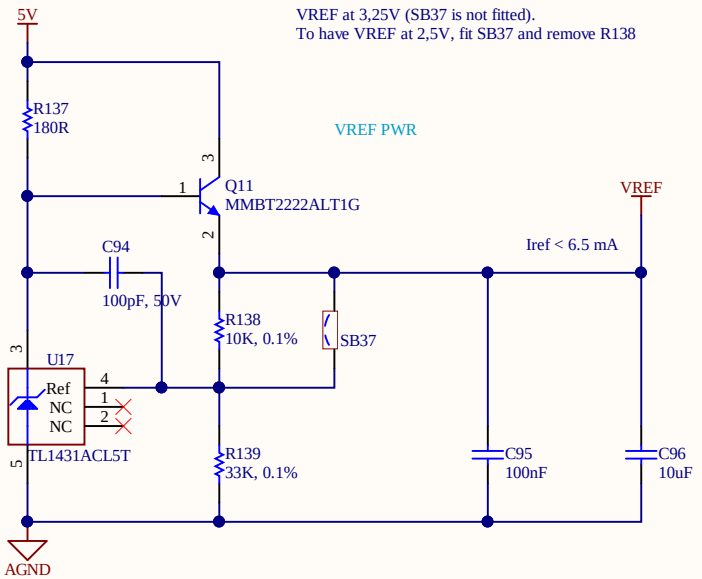
Title: STM32_microcontroller_IOs			
Project: STM32G4 DPOW Discovery			
Variant: G474RE			
Revision: B-01		Reference: MB1428	
Size: A3	Date: 28-JUNE-19	Sheet: 3 of 12	

life.augmented

MCU Power



VREF PWR



Title: **STM32_microcontroller_power**			
Project: **STM32G4 DPOW Discovery**			
Variant: G474RE			
Revision: B-01		Reference: MB1428	
Size: A4	Date: 28-JUNE-19	Sheet: 4 of 12	

life.augmented

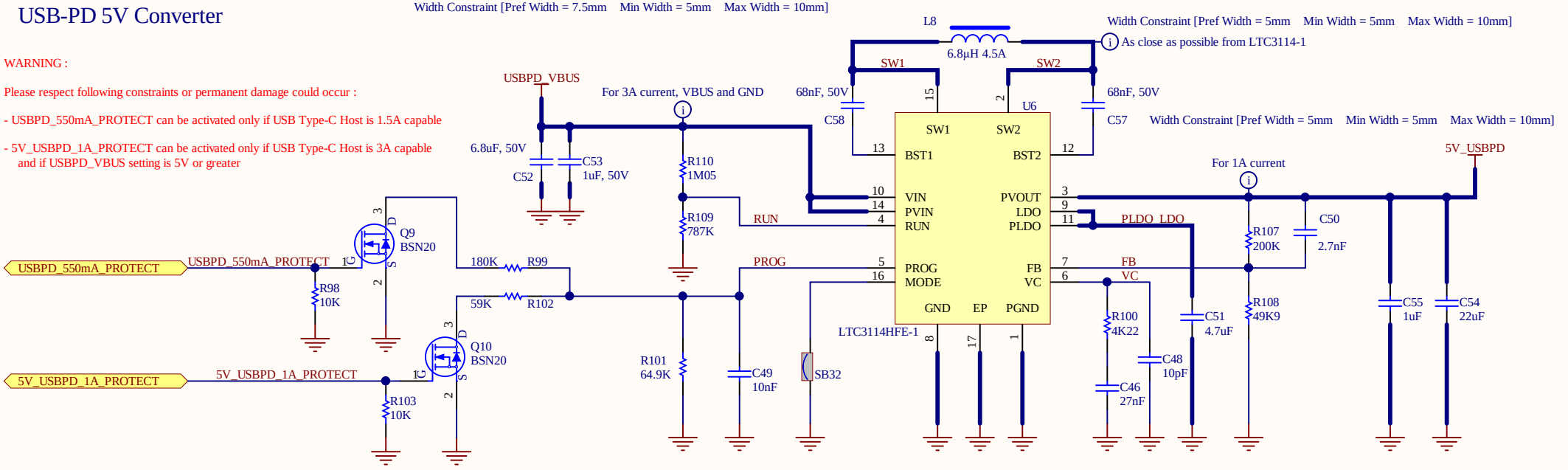
USB-PD 5V Converter

Width Constraint [Pref Width = 7.5mm Min Width = 5mm Max Width = 10mm]

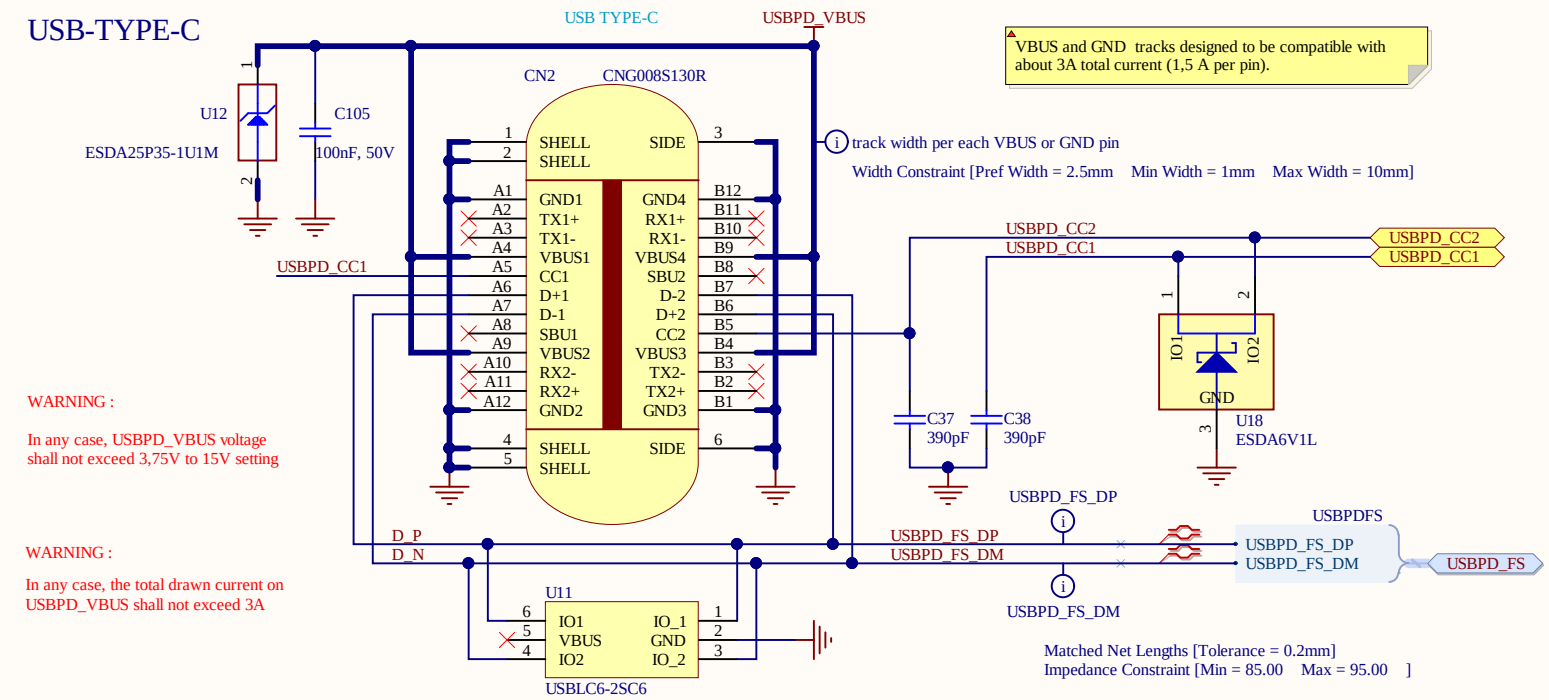
WARNING :

Please respect following constraints or permanent damage could occur :

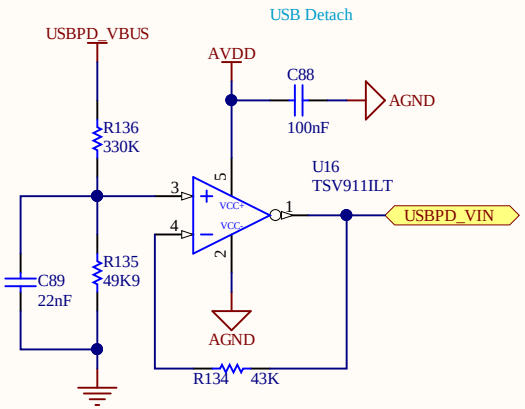
- USBPD_550mA_PROTECT can be activated only if USB Type-C Host is 1.5A capable
- 5V_USBPD_1A_PROTECT can be activated only if USB Type-C Host is 3A capable and if USBPD_VBUS setting is 5V or greater



USB-TYPE-C

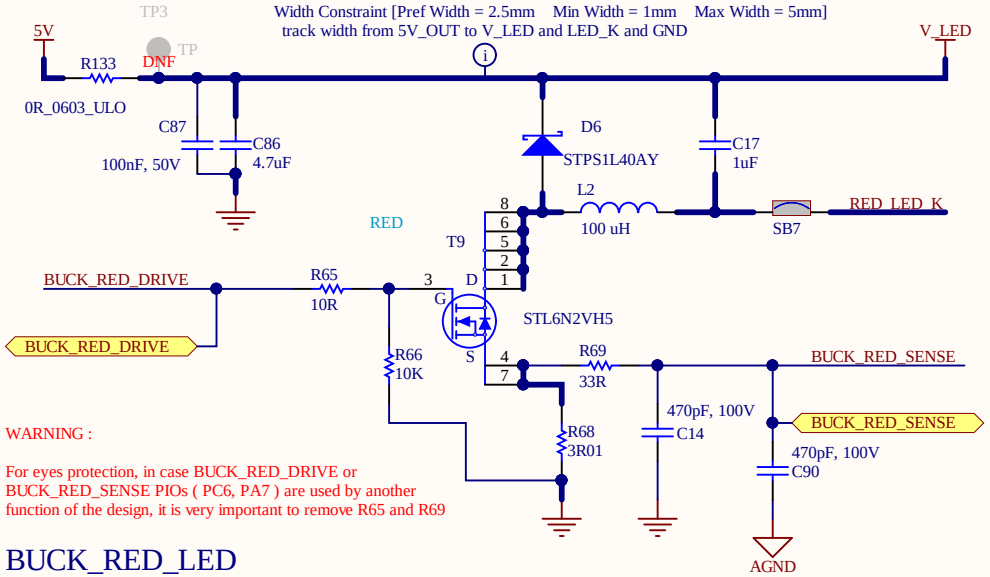


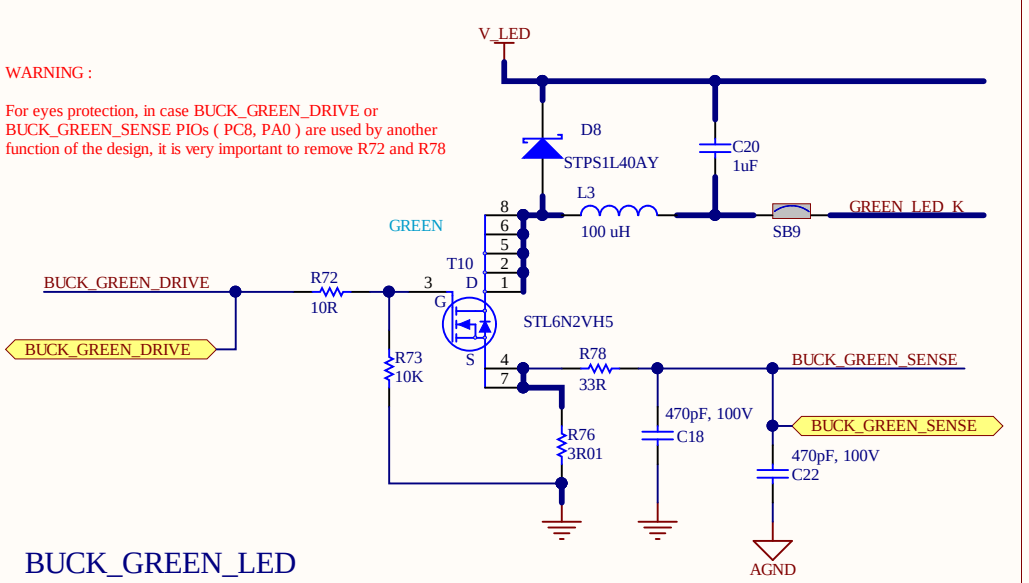
USB-PD Detach

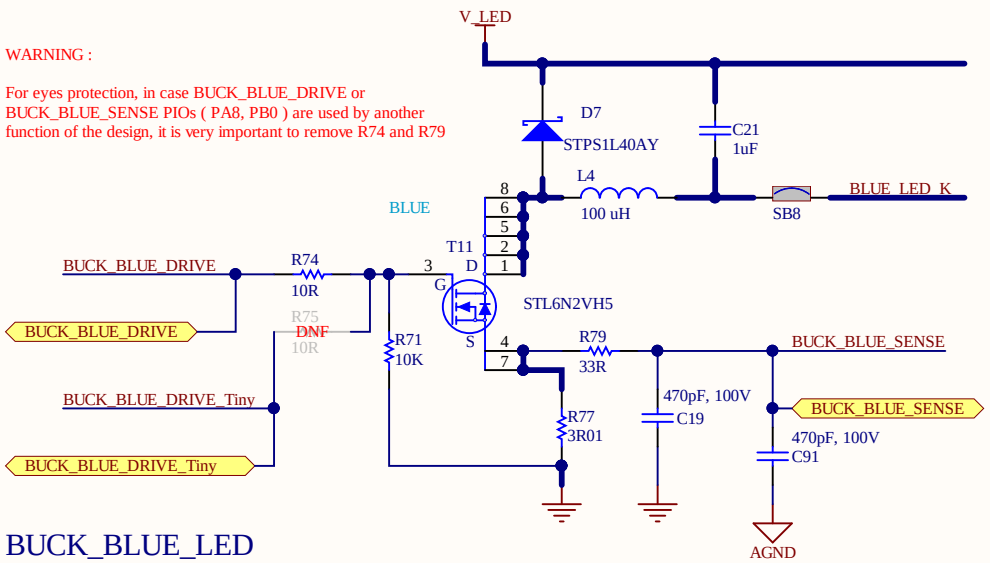


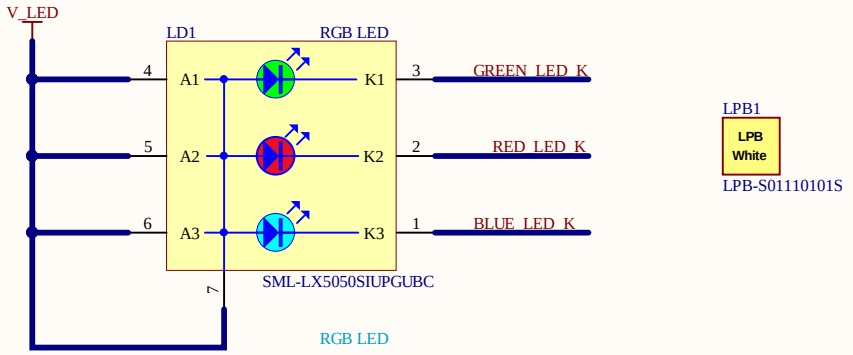
Title: **USB_PD_TYPE-C**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A4	Date: 28-JUNE-19	Sheet: 5 of 12

life.augmented





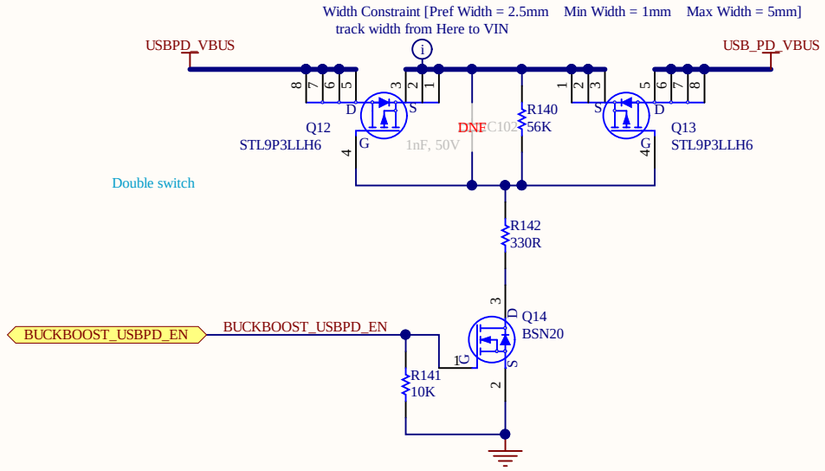




Title: **RGB_LED_BUCK_Converters**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A4	Date: 28-JUNE-19	Sheet: 6 of 12

life.augmented

Double Switch

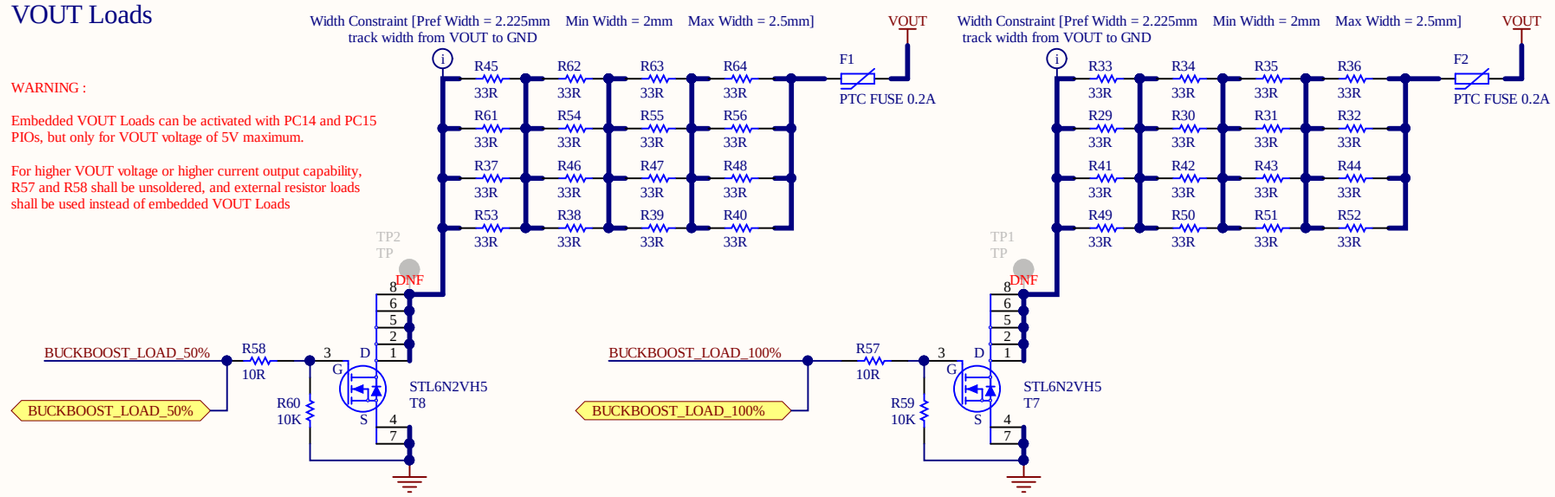


VOUT Loads

WARNING :

Embedded VOUT Loads can be activated with PC14 and PC15 PIOs, but only for VOUT voltage of 5V maximum.

For higher VOUT voltage or higher current output capability, R57 and R58 shall be unsoldered, and external resistor loads shall be used instead of embedded VOUT Loads



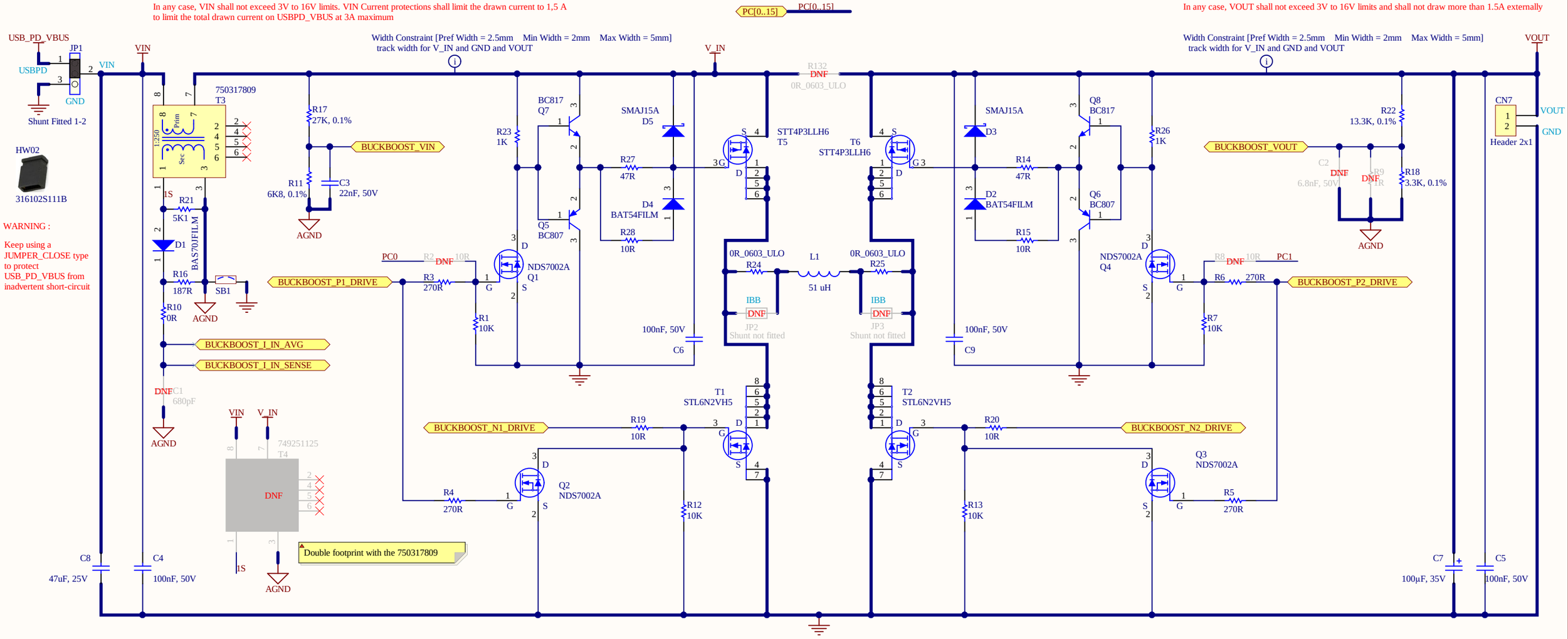
BUCKBOOST

WARNING :

In any case, VIN shall not exceed 3V to 16V limits. VIN Current protections shall limit the drawn current to 1,5 A to limit the total drawn current on USBPD_VBUS at 3A maximum

WARNING :

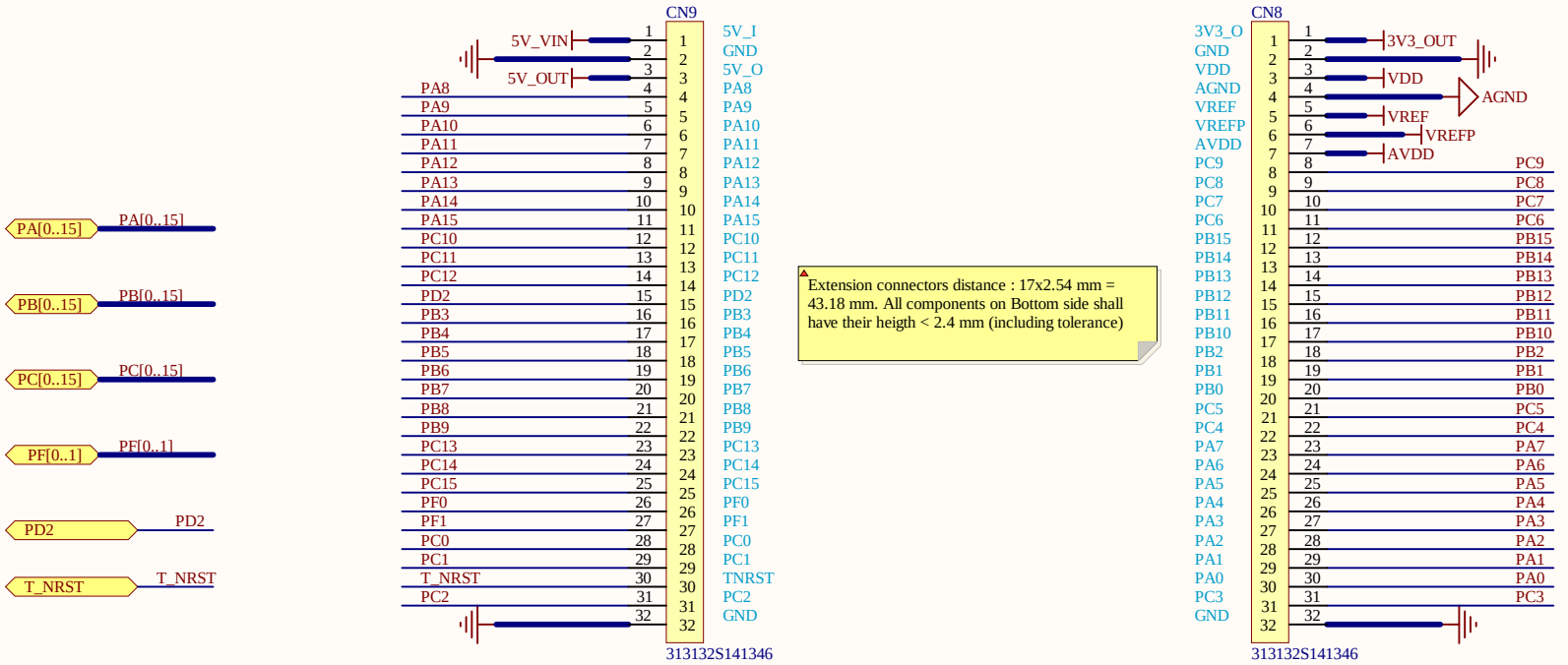
In any case, VOUT shall not exceed 3V to 16V limits and shall not draw more than 1.5A externally



Title: **BUCK_BOOST_Converter**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A3	Date: 28-JUNE-19	Sheet: 7 of 12

EXTENSION CONNECTORS

32 pin Extension Connectors



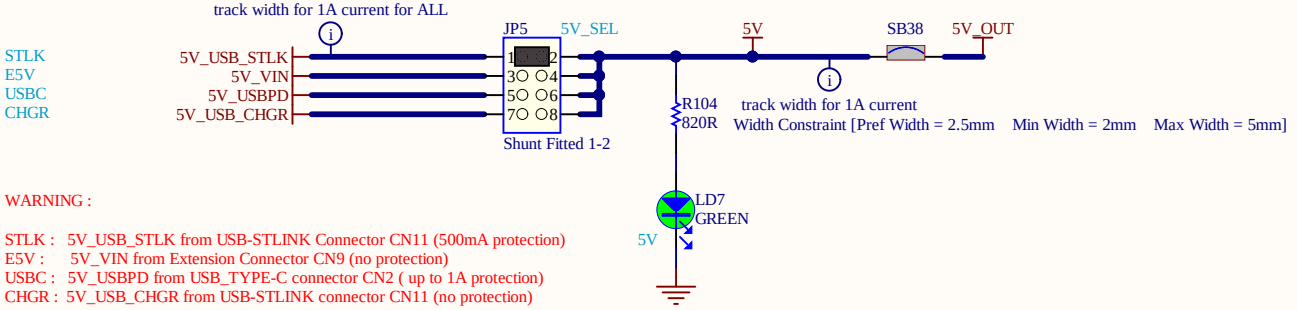
GND spacers

Title: **Extension_connectors**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A4	Date: 28-JUNE-19	Sheet: 8 of 12

5V PWR SELECTION

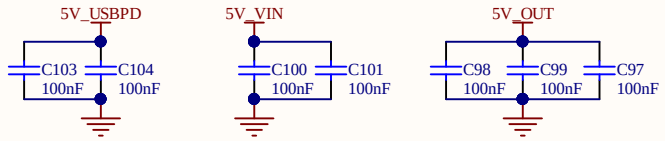
HW13
Cannot
open
file
316102S111A

Width Constraint [Pref Width = 2.5mm Min Width = 2mm Max Width = 5mm]
track width for 1A current for ALL



WARNING :

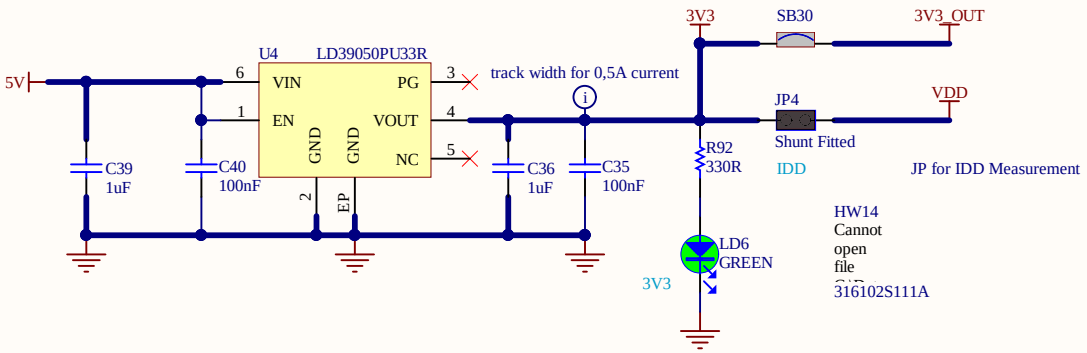
STLK : 5V_USB_STLK from USB-STLINK Connector CN11 (500mA protection)
E5V : 5V_VIN from Extension Connector CN9 (no protection)
USBC : 5V_USBPD from USB_TYPE-C connector CN2 (up to 1A protection)
CHGR : 5V_USB_CHGR from USB-STLINK connector CN11 (no protection)



to place on bottom for return current path between Power plans and GND

VDD PWR

Width Constraint [Pref Width = 1.5mm Min Width = 1mm Max Width = 3mm]



Title: **Power**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A4	Date: 28-JUNE-19	Sheet: 9 of 12

life.augmented

STLINK_MCU

DFU CONNECTOR

CN4

Header 4x1

DNF

SWD

3V3_STLK

HSE CLK STLINK

X1

NZ2520SH 25MHz

R116 10K

R117 100R

C59 100nF

C56 100nF

JP6 Shunt not fitted

STLK

NRST

R120 10K

R123 10K

C82 2.2uF

R131 3K

STLK_SWDIO A15

STLK_SWCLK A14

USB_DEV_HS_N R14

USB_DEV_HS_P R15

OSC_IN_STLK G1

H1

NRST J1

D6

C6

J14

J15

STLK_SWDIO/PA13

STLK_SWCLK/PA14

USB_DEV_HS_N/PB14

USB_DEV_HS_P/PB15

OSC_IN/PH0

OSC_OUT/PH1

NRST

BOOT0

PDR_ON

V12_OTGPHY

REXT_OTGPHY

T_SW_DIR/PA7

T_SWDIO_IN/PH7

T_SWDIO_OUT/PF9

T_SWCLK/PH6

T_SWO/PD2

STLK_VCP_RX/PG9

STLK_VCP_TX/PG14

GNDDetect/PG5

T_VCC AIN/PA0

T_PWR_EXT/PB1

T_PWR_EN/PB0

STLK_LED/PA10

STLK_MCO/PA8

T_NRST/PA6

HW_TYP_0/PI4

HW_TYP_1/PI5

R3

N12

L2 T_SWDIOa

M11 T_SWCLKa

D12 T_SWOa

C10 STLK_VCP_RX

A7 STLK_VCP_TX

K13 GNDDet

N3 T_VCC_AIN

R4 T_PWR_EXT

R5 T_PWR_EN

D15 LED_STLK

F15 STLK_MCO

P3 T_NRSTa

D4

C4

U9A

ST-LINKV3E_SWD

OFF HIGH

ON LOW

SW1 switches shall be ALL ON by default
(Low physical position)

TDP08H1SBD1_Symbol_180

SW1

R111 47R T_SWDIO

R112 47R T_SWCLK

R113 47R T_SWO

R114 47R T_VCP_TX

R105 47R T_VCP_RX

T_SWDIO

T_SWCLK

T_SWO

T_VCP_TX

T_VCP_RX

GNDDetect

R127 4K7

R126 4K7

R125 2K7

R124 4K7

3V3

5V

R130 100R

MCO

DNF C84 20pF

TNRST

JP7 Shunt Fitted

R115 47R

T_NRST

HW17
Cannot open file
316102S111A

ST-LINK POWER

3V3_STLK

U9B

ST-LINKV3E_SWD

R118 10K

C74 2.2uF

C78 2.2uF

Ceramic capacitor (Low ESR)

C80 100nF

C79 100nF

C63 100nF

C70 100nF

C81 100nF

C75 100nF

C72 100nF

C77 100nF

C83 100nF

C67 100nF

C76 100nF

C73 100nF

C71 100nF

C64 100nF

C65 100nF

C66 100nF

C60 4.7uF

C61 1uF

C62 100nF

STDC14 Receiver

DEBUG

CN1

STDC14

KEY

R106 100R

GNDDetect

T_VCP_RX

T_SWDIO

T_SWCLK

T_SWO

T_JTDI

T_NRST

T_VCP_TX

Specific constraints for T_SWDIO and T_SWCLK
(must be same length).

NOTE :
JTAG 4 wire Debug cannot be used in default configuration,
Please use SWD debug instead

ESD PROTECTIONS

U8

ESDALC6V1W5

U13

ESDALC6V1W5

U7

ESDALC6V1-1U2

ST-LINK USB CONNECTOR

5V_USB_CHGR

C85 100pF

U14

ESDA7P60-1U1M

Capacitor close to pin 1

Matched Net Lengths [Tolerance = 0.2mm]
Impedance Constraint [Min = 85.00 Max = 95.00]

CN3 USB STLK

USB_Micro-B receptacle

VBUS

DM

DP

ID

GND

Shield

EXP

USB_DEV_HS_CN_N

USB_DEV_HS_CN_P

USB

U15

ECMF02-2AMX6

NC

D-

D+

GND

USB_DEV_HS_N

USB_DEV_HS_P

USB_uB_105017-0001

ST-LINK POWER 3V3 / 150mA

5V_VIN

5V_USBPD

5V_USB_CHGR

BAT60JFILM D9

BAT60JFILM D10

BAT60JFILM D11

SB31

U5 LD3985M33R

Vin

Vout

INH

GND

BYPASS

3V3_STLK

C42 1uF

C43 100nF

C44 10nF

C45 100nF

C47 1uF

5V ST-LINK PROTECTION

5V_USB_CHGR

U10

STMPS2151STR

IN

OUT

EN

FAULT

GND

5V_USB_STLK

T_PWR_EN

C68 1uF

R121 1K

DNF R119 100K

R122 10K

LD8 RED

OC

C69 1uF

GND

CN12

Header 2x1

GND

GND

HW18
Cannot open file
316102S111A

CN11

Header 2x1

HW19
Cannot open file
316102S111A

Placed in same alignement than Extension Connectors at a distance multiple of 2.54 mm

TAG

TAG

CN10

DNF

TC2050-IDC-NL

T_SWDIO

T_SWCLK

T_NRST

T_SWO

LD9

Red

Green

R129 330R

R128 330R

LED_STLK

3V3_STLK

COM

LD_BICOLOR_CMS

Title: **ST_LINK_V3E**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A3	Date: 28-JUNE-19	Sheet: 10 of 12

life.augmented

HW8

BOARD REF

MB1428B-01 syywwxxxxx

HW9

DNF

B-G474E-DPOW1

HW6

ES

ES

HW7

PCB

MB1428B

HW22

BOARD CPN

B-G474E-DPOW1

HW23

BOARD QR CODE

QR code

Title: **Mechanical**		
Project: **STM32G4 DPOW Discovery**		
Variant: G474RE		
Revision: B-01		Reference: MB1428
Size: A4	Date: 28-JUNE-19	Sheet: 11 of 12

life.augmented