Schematic

DH electronics GmbH

Project:Avenger

PCB number: 588-100

Date: 14.12.2018 Created: MH

Notes:

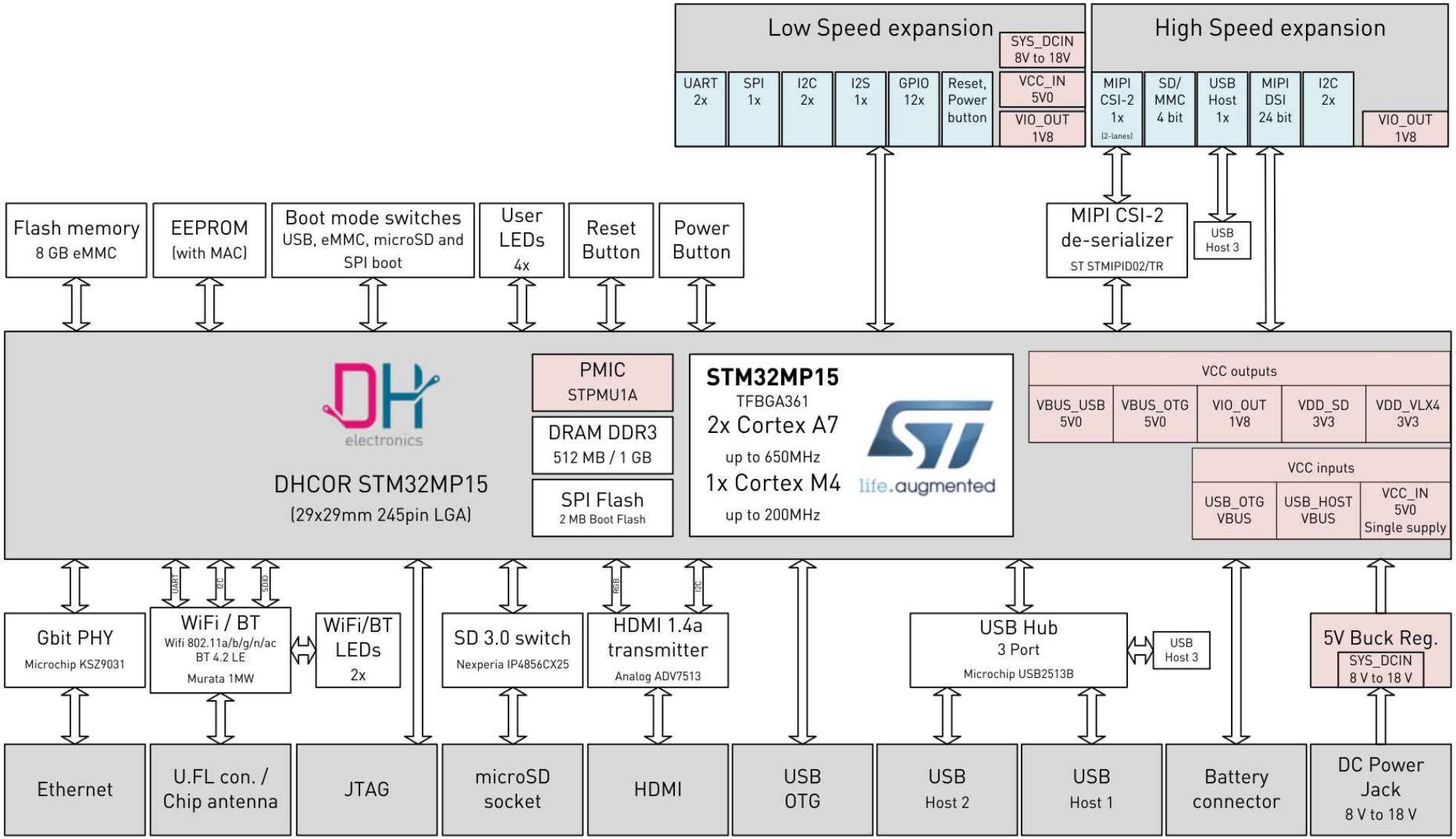
Content:

I2C4 Addresses:

PMIC STPMU1A:	0110011 = 0x34
MIPI CSI Bridge:	0010100 = 0x15
HDMI Transmitter:	1111010 = 0x7A
EEPROM (MAC Adress):	1010011 = 0x54

DH electronics

Project:	Avenger		
Description:	Cover sheet		
PCB number:	588-100	Revision:	R06
Variant:	HS00007	Page:	1 of 16



electronics

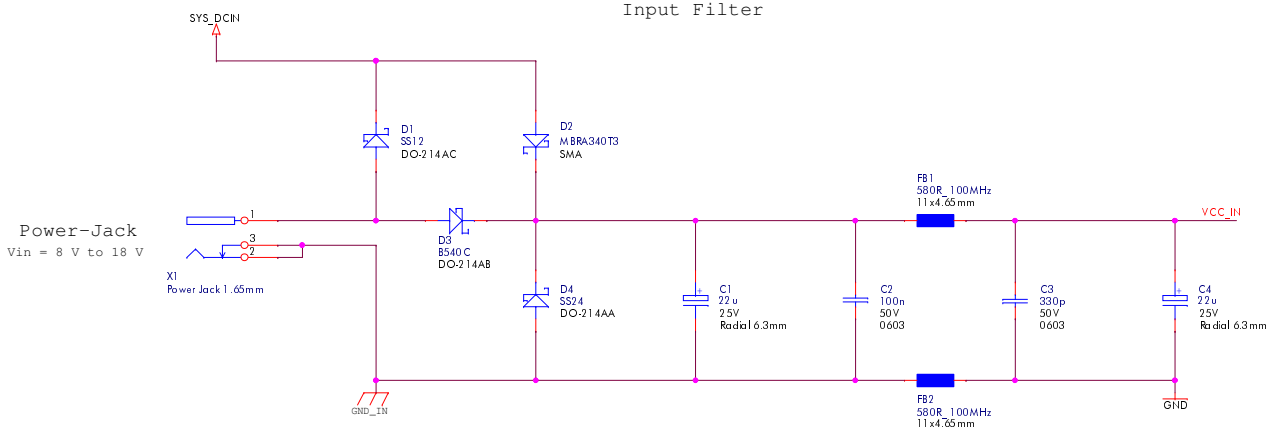
Project:	Avenger		
Description:	Block diagram		
PCB number:	588-100	Revision:	R06
Variant:	HS00007	Page:	2 of 16

Preliminary Energy Balance

Supply with the DC-Jack Power Connector

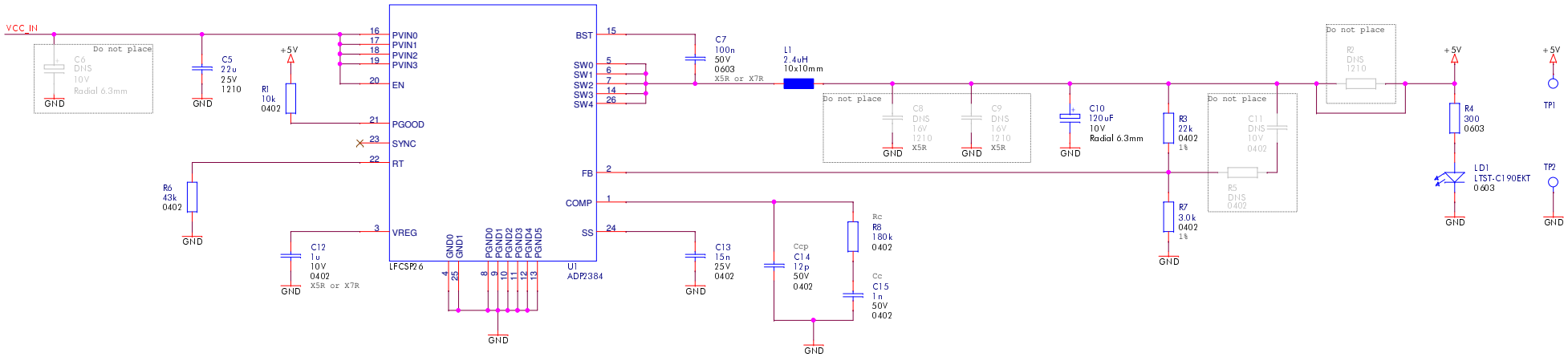
Power Source	Component	Voltage [V]	Max. Current [A]	Max. Power [W]	Function
External Power Supply	DC-Jack	8 to 18		26,3001	∑
DC-Jack	SYS_DCIN-line (Low Speed Connector)	8 to 18		7,0000	-
DC-Jack	Buck Regulator (ADP2384)	8 to 18		19,3001	∑
Buck Regulator (ADP2384)	+5V-line (Low Speed Connector)	5	1,0000	5,0000	-
Buck Regulator (ADP2384)	USB-Hub (2x USB Host)	5	1,0000	5,0000	-
Buck Regulator (ADP2384)	DHCOR STM32MP15 Power Supply Module	5	0,3000	1,5000	-
Buck Regulator (ADP2384)	HDMI Connector (+5V Pin)	5	0,1500	0,7500	-
Buck Regulator (ADP2384)	DHCOR STM32MP15 - PMIC 3,3V Rail	5		6,1901	∑
Buck Regulator (ADP2384)	DHCOR STM32MP15 - PMIC 1,8V Rail	5		0,8600	∑
DHCOR STM32MP15 - PMIC 3,3V Rail	DHCOR STM32MP15 LGA (VDDA)	2,9	0,3500	1,0150	-
DHCOR STM32MP15 - PMIC 3,3V Rail	DHCOR STM32MP15 LGA (VDDA_SD)	2,9	0,3500	1,0150	-
DHCOR STM32MP15 - PMIC 3,3V Rail	DHCOR STM32MP15 LGA (VDD_LDO2)	2,9	0,0000	0,0000	-
DHCOR STM32MP15 - PMIC 3,3V Rail	DHCOR STM32MP15 LGA (VDD_LDO6)	1,8	0,0000	0,0000	-
DHCOR STM32MP15 - PMIC 3,3V Rail	USB-Hub (USB2513B)	3,3	0,0700	0,2310	-
DHCOR STM32MP15 - PMIC 3,3V Rail	Ethernet Phy (KSZ9031)	3,3	0,3288	1,0850	-
DHCOR STM32MP15 - PMIC 3,3V Rail	HDMI transmitter (ADV7513, with LDO for 1.8V)	3,3	0,0788	0,2600	-
DHCOR STM32MP15 - PMIC 3,3V Rail	WiFi / BT (Murata 1MW)	3,3	0,4300	1,4190	-
DHCOR STM32MP15 - PMIC 3,3V Rail	SD 3.0 switch (IP4856CX25)	3,3	0,3030	1,0000	-
DHCOR STM32MP15 - PMIC 3,3V Rail	GoldCap for VBAT	3,3	0,0500	0,1650	-
DHCOR STM32MP15 - PMIC 1,8V Rail	DHCOR STM32MP15 LGA (VDD)	1,8	0,2778	0,5000	-
DHCOR STM32MP15 - PMIC 1,8V Rail	+1,8V-line (Low Speed Connector)	1,8	0,1000	0,1800	-
DHCOR STM32MP15 - PMIC 1,8V Rail	MIPI CSI-2 de-serializer (STMIPID02/TR)	1,8	0,1000	0,1800	-

Input Filter



Input Step-Down Converter

8 V to 18 V -> 5 V / 4 A



Design Guide:
Layout Recommendations available in the datasheet

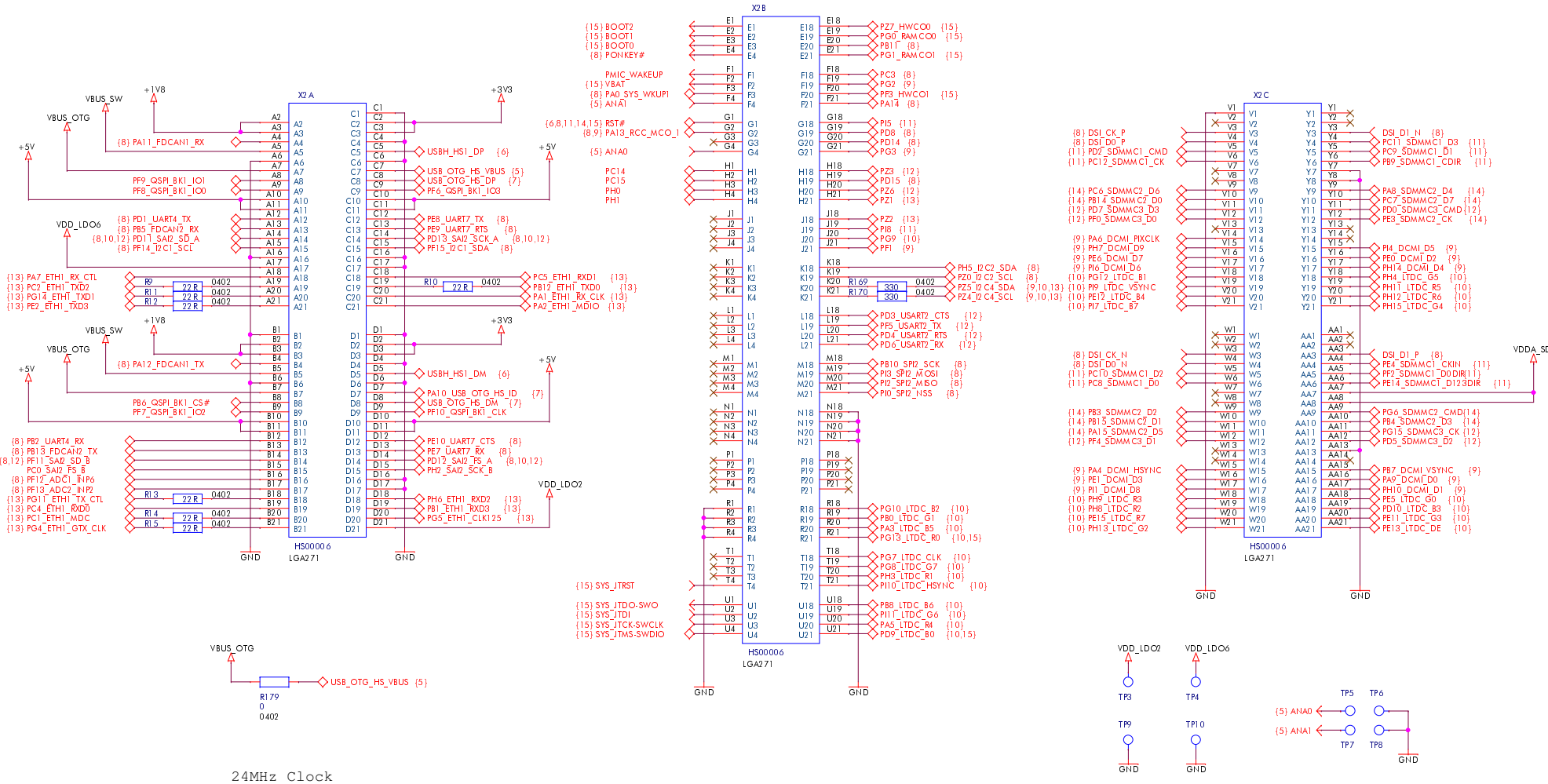
PIN RT:
43k Ohm at RT sets fsw to 1.192MHz

PIN SS:
Connect a capacitor from SS to GND to program the soft start time. If this pin is open, the regulator uses the internal soft start time.

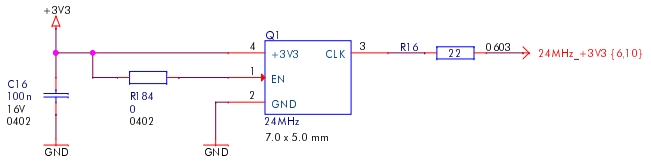
15nF ~ 3ms soft start time

DH electronics	Project: Avenger	
	Description: Power Supply	
	PCB number: 588-100	Revision: R06
	Variant: HS00007	Page: 4 of 16

LGA connector



24MHz Clock

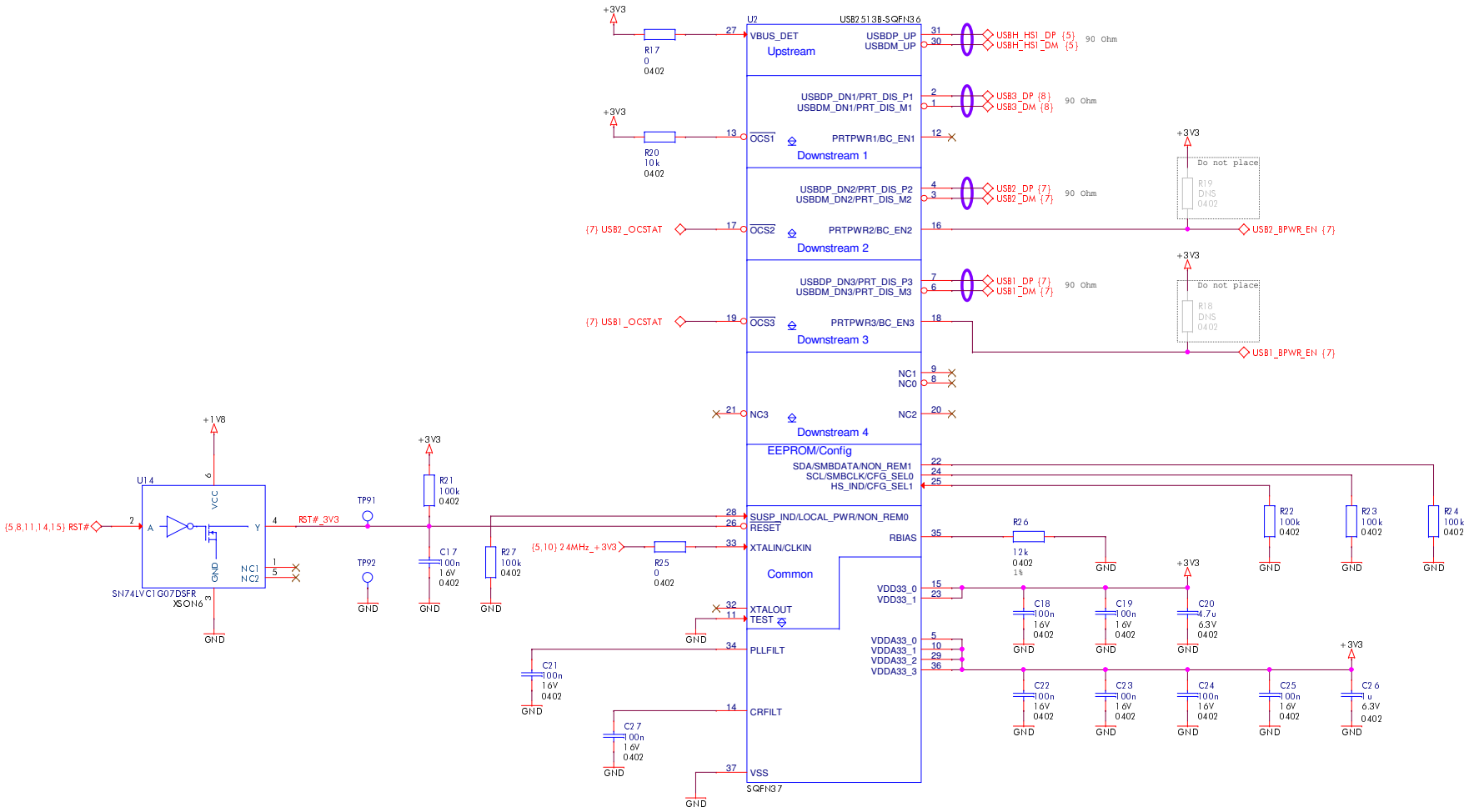


Design Guide Ethernet TX lanes
Place 22 Ohm Resistors close to the DHCOR Module

Clocksignals
The net "24MHz" operates at a voltage of 3.3 V while "PA13_RCC_MCO_1" runs at 1.8 V

DH electronics	Project: Avenger	
	Description: DHCOR STM32MP15 LGA	
	PCB number: 588-100	Revision: R06
	Variant: HS00007	Page: 5 of 16

USB Hub



Downstream 1
This port is connected to the Expansion Connector with its own +5V supply

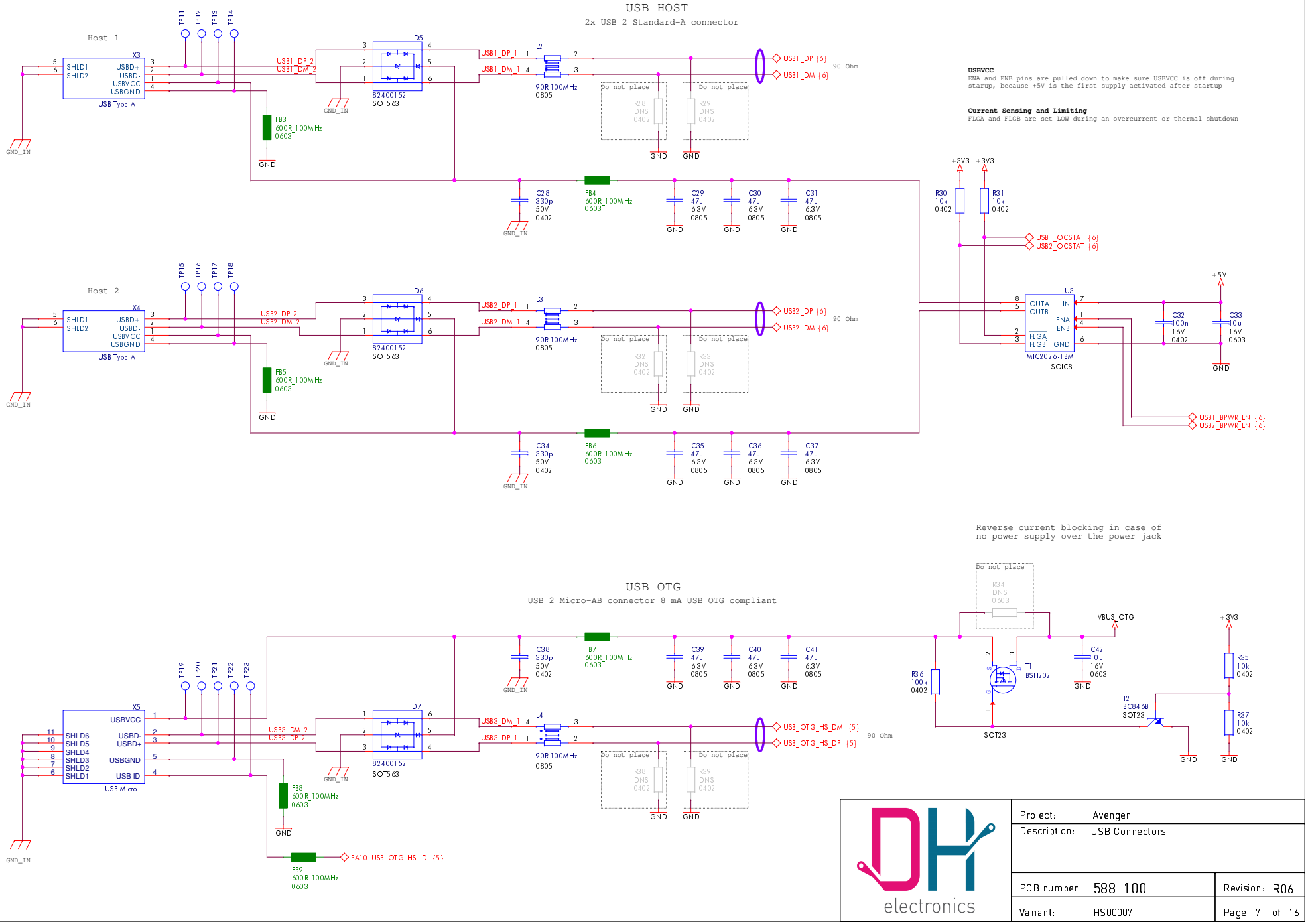
VBUS_DET:
For self-powered applications with a permanently attached host, this pin must be connected to a dedicated host control output, or connected to the 3.3 V domain that powers the host (typically VDD33).

CFG_SEL:
CFG_SEL0[0] = 0 and CFG_SEL1[1] = 0 defines default configuration:
-Strap options enabled
-Self-powered operation enabled
-Individual power switchting
-Individual over-current sensing

NON_REM:
NON_REM0[0] = 0 and NON_REM1[1] = 0 indicates all ports as removable

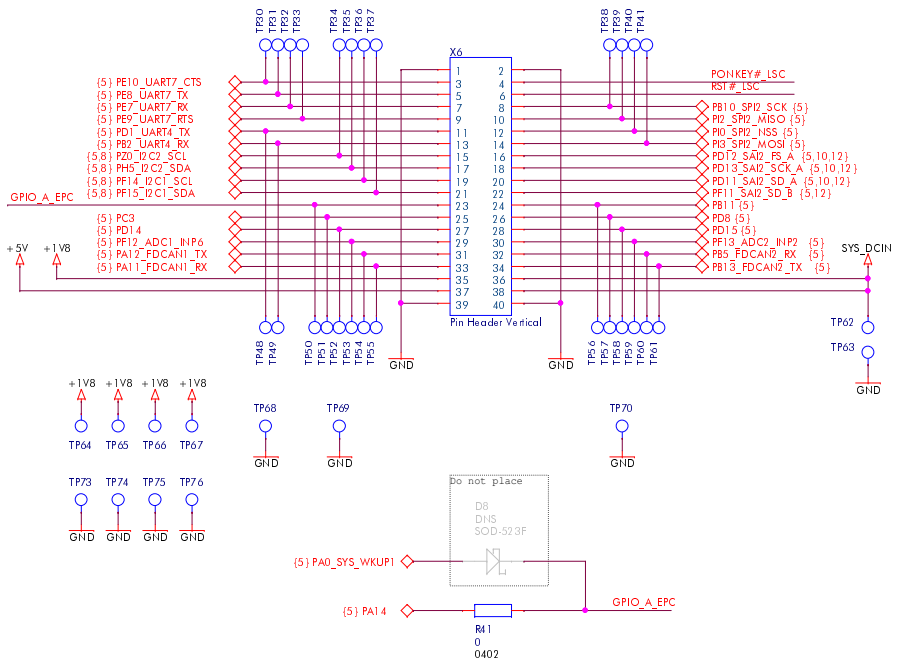
DH electronics

Project:	Avenger		
Description:	USB Hub		
PCB number:	588-100	Revision:	R06
Variant:	HS00007	Page:	6 of 16

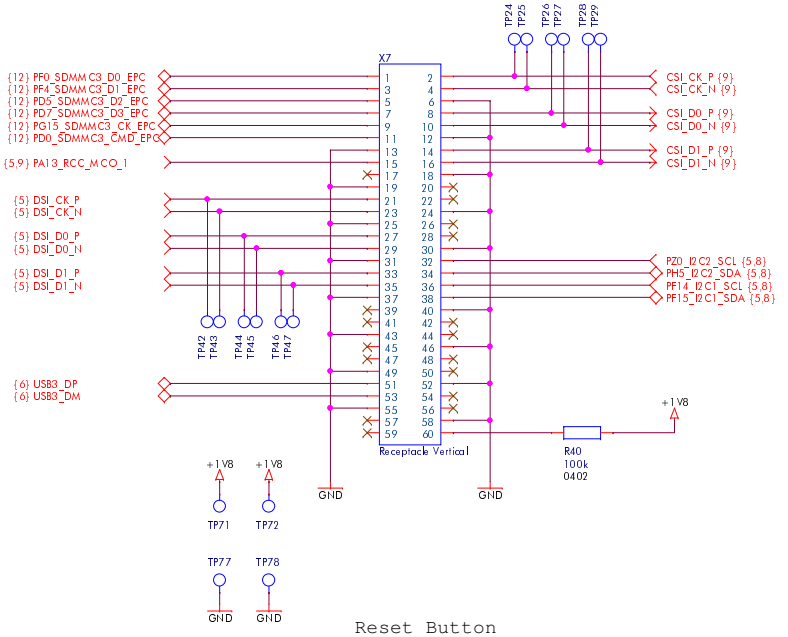


Project:	Avenger		
Description:	USB Connectors		
PCB number:	588-100	Revision:	R06
Variant:	HS00007	Page:	7 of 16

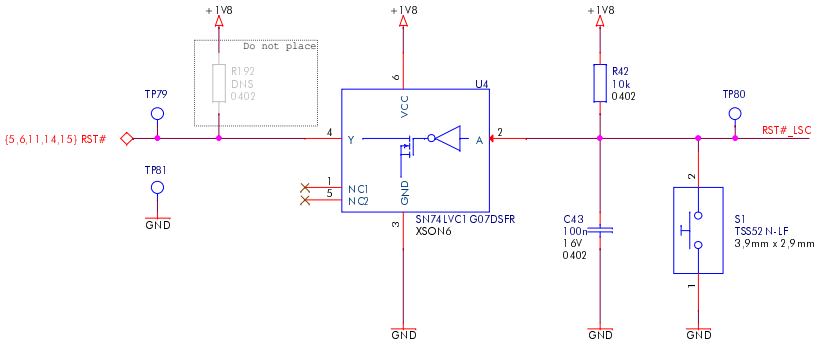
Low Speed Expansion Connector



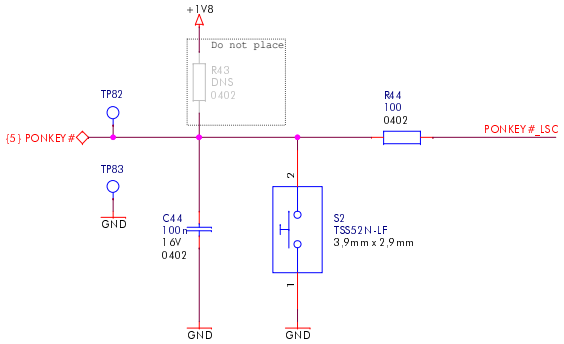
High Speed Expansion Connector



Reset Button



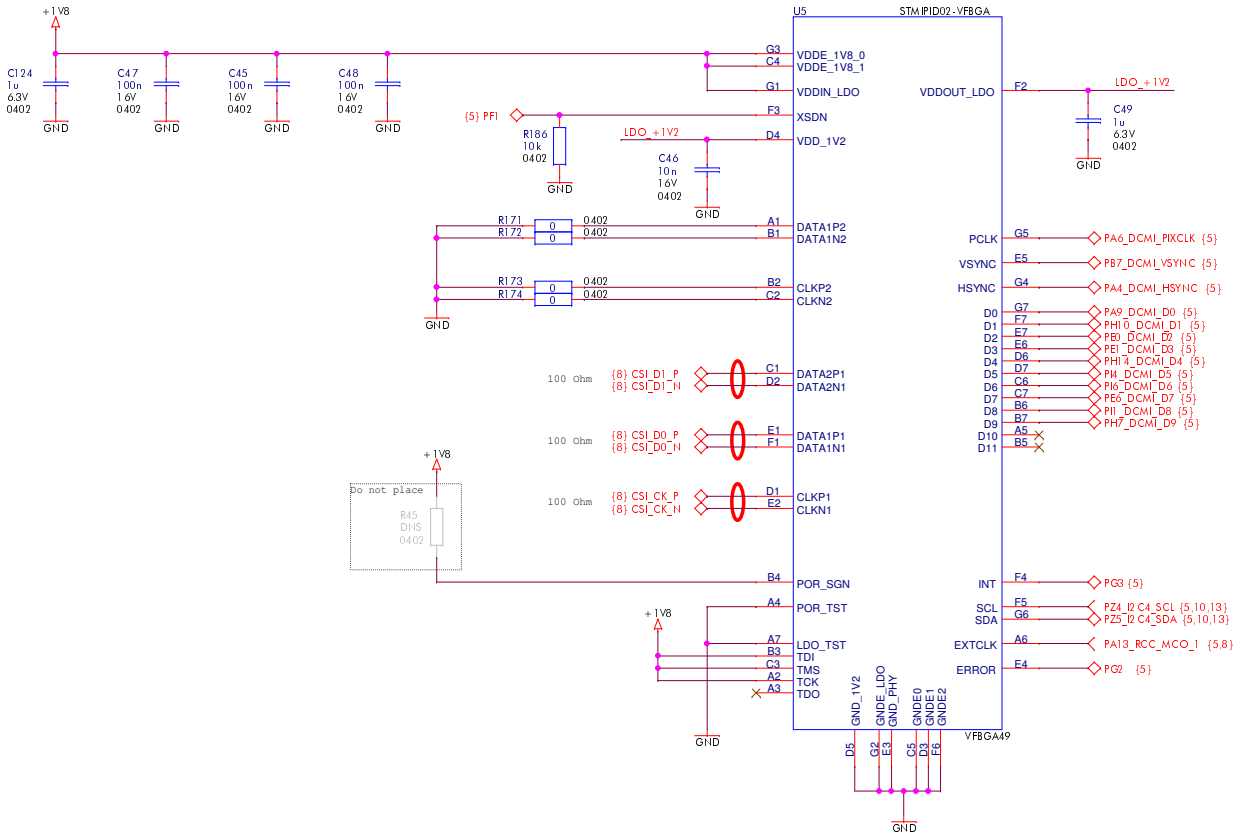
Power Button



PONKEY:
Resistor to Low-Speed Connector avoids an short circuit in case someone ties PONKEY#_LSC of the Low Speed Expansion Connector to VDD while pushing the power button

DH electronics	Project:	Avenger	
	Description:	Expansion Connectors	
	PCB number:	588-100	Revision: R06
	Variant:	HS00007	Page: 8 of 16

MIPI CSI Bridge



Design Guide:
The CSI-2 Clock lanes must be in the middle of the 2 data lanes

Design Guide:
The high speed signal pairs (CLKP1, CLKN1), (DATA1P1, DATA1N1) and (DATA2P1, DATA2N1) should be routed as balanced transmission lines with a characteristic differential impedance (Zodiff) of 100Ohm and matched in length.

Test Interface (ST internal use)
LDO_TST, TDI, TMS, TCK and TDO are Test interfaces for ST

INT:
This is a status showing reception of short packet in CSI stream which needs to be cleared by user.

ERROR:
This is an accumulated status of all Errors found in the chip. The individual status can be checked via I2C

Design Guide:
The PCLK, HSYNC, VSYNC must be routed in the middle of the output data bus for skew management reasons

I²C4 Address
Address: 0b0010100 = 0x14
Write: 0b00101000 = 0x28
Read: 0b00101001 = 0x29

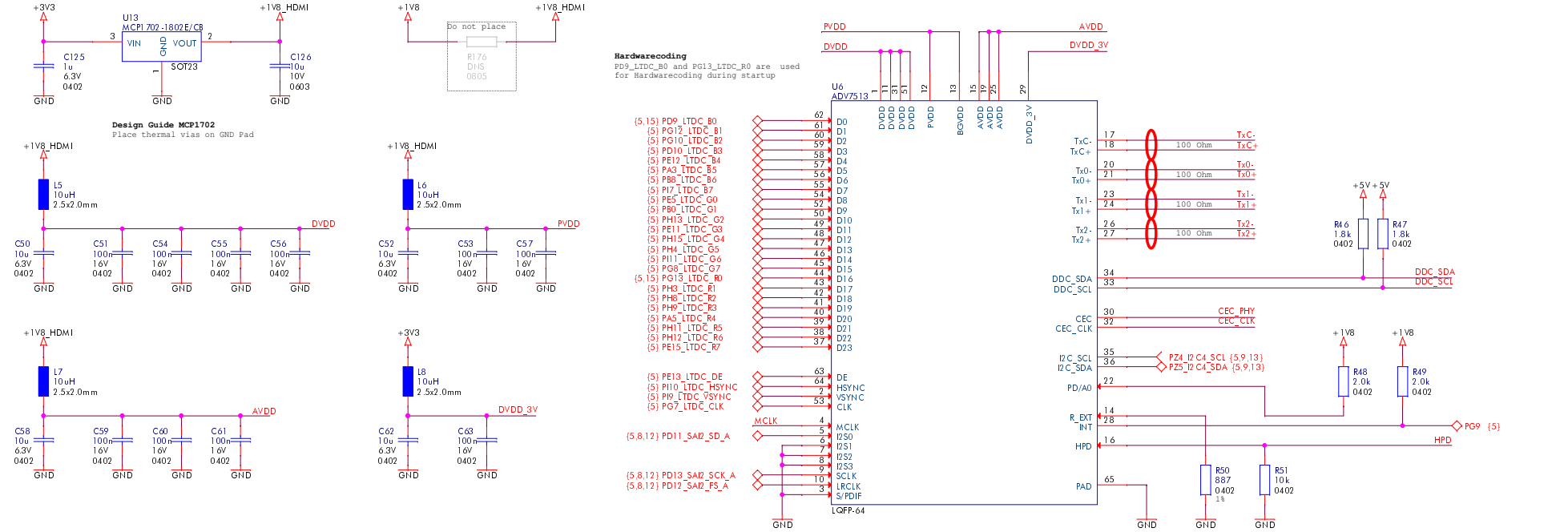
XSDN:
Chip Shutdown is connected GPIO to fit the power-up sequencing requirements

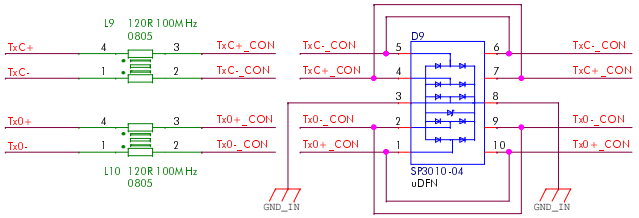
POR_SGN
Power On Reset

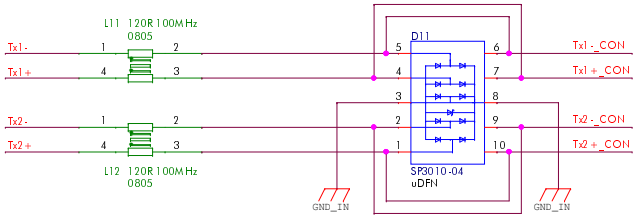
DH electronics

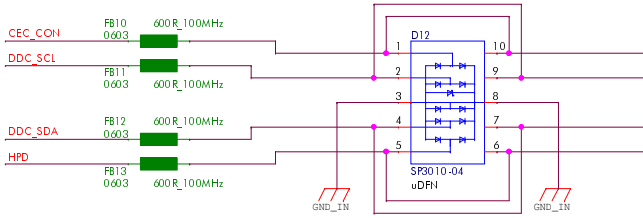
Project:	Avenger		
Description:	MIPI CSI Bridge		
PCB number:	588-100	Revision:	R06
Variant:	HS00007	Page:	9 of 16

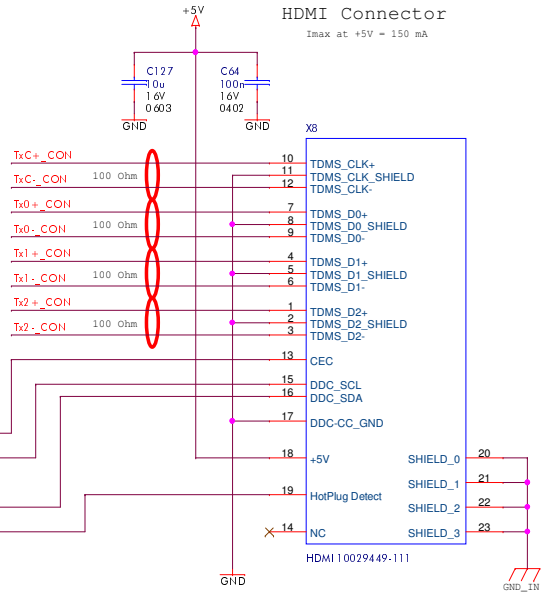
HDMI Transmitter

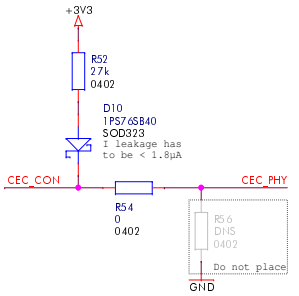


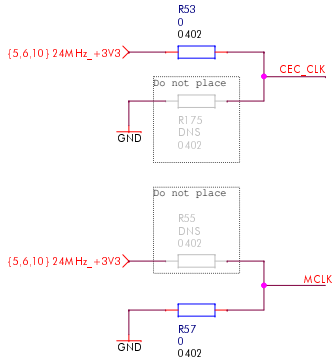












Design Guide R_EXT
Place as close as possible to the ADV7513
Avoid rooting near any switching signals, except for TMDS signals

RGB Interface
Set Input ID at adress 0x15 to 0b0000 for 24 bit RGB

Design Guide TMDS Outputs
The traces should also have a 50 Ohm transmission line impedance characteristic (100 Ohms differential). This is very important to avoid any reflections, thus outputting the best Eye Diagram. Also minimize the trace length as much as possible to minimize the resistance path. This is generally done by placing the ADV7513 close to the HDMI connector.

I²C4 Address
Address: 0b1111010 = 0x7A
Write: 0b11110100 = 0xF4
Read: 0b11110101 = 0xF5

Project:	Avenger		
Description:	HDMI		
PCB number:	588-100	Revision:	R06
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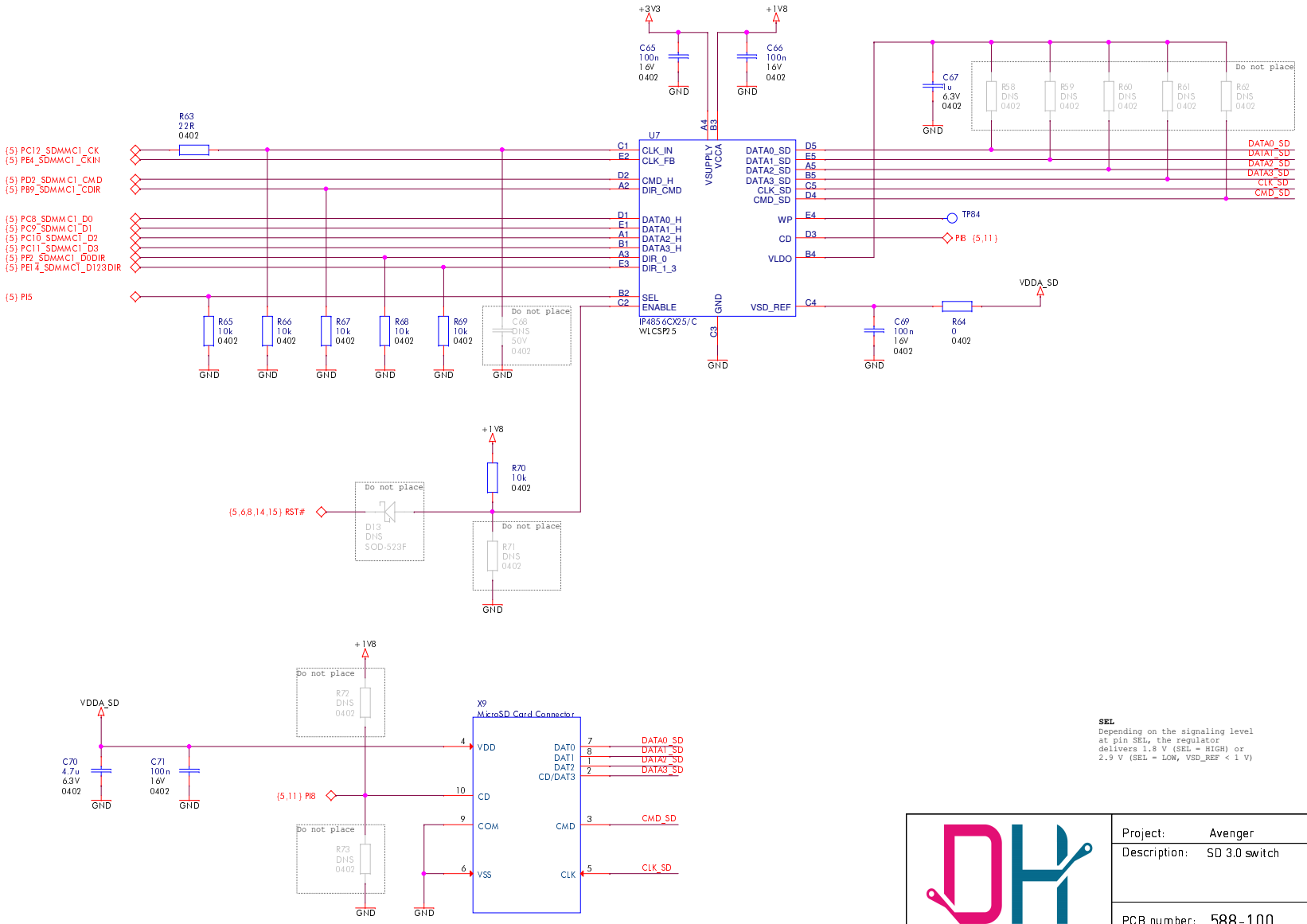
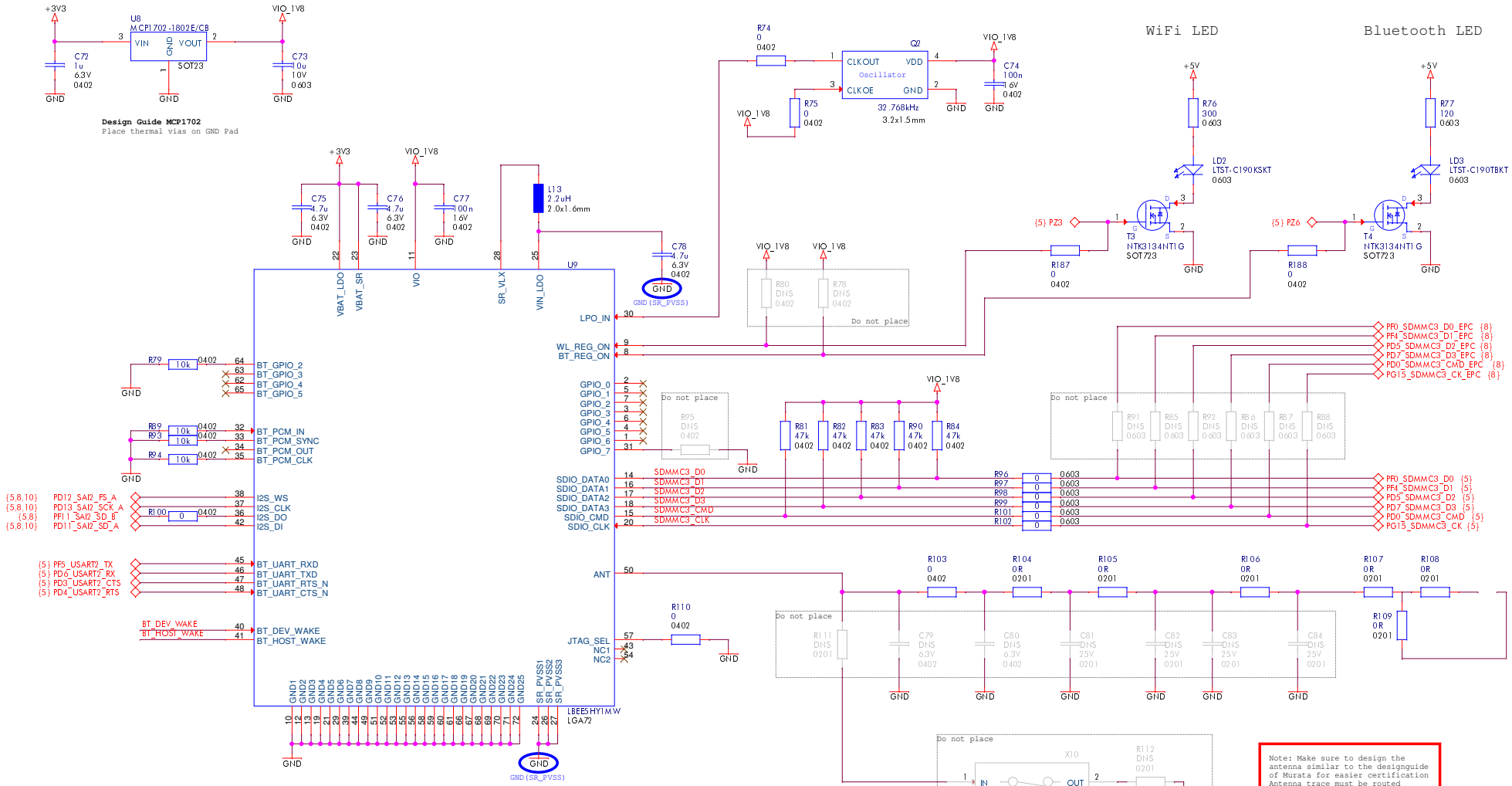
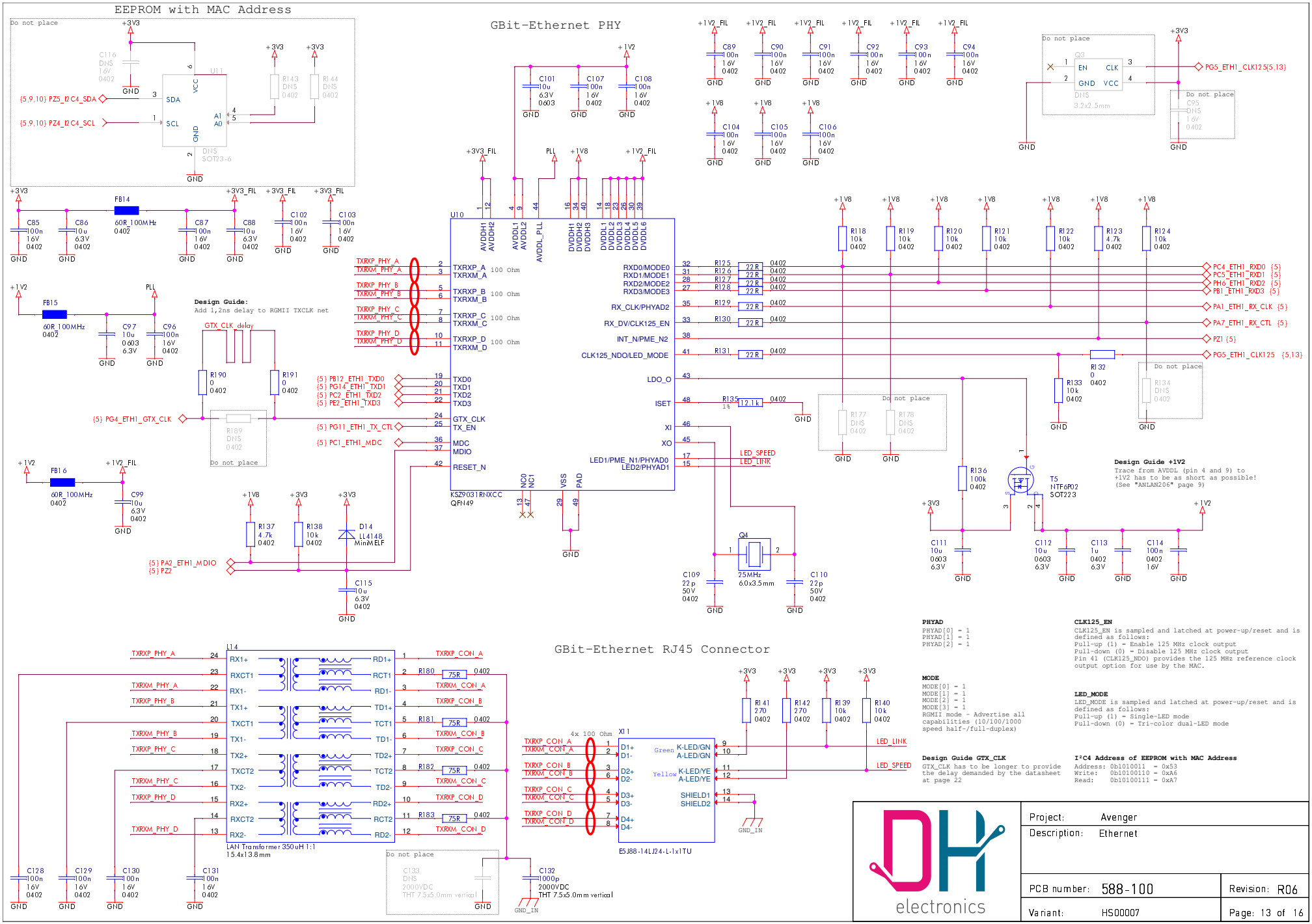


SEL
Depending on the signaling level at pin SEL, the regulator delivers 1.8 V (SEL = HIGH) or 2.9 V (SEL = LOW, VSD_REF < 1 V)

DH electronics	Project:	Avenger	
	Description:	SD 3.0 switch	
	PCB number:	588-100	Revision: R06
	Variant:	HS00007	Page: 11 of 16



Project:	Avenger		
Description:	WiFi and Bluetooth		
PCB number:	588-100	Revision:	R06
Variant:	HS00007	Page:	12 of 16


EEPROM with MAC Address
GBit-Ethernet PHY
GBit-Ethernet RJ45 Connector
Design Guide:
Add 1,2ns delay to RGMII TXCLK net
Design Guide +1V2
Trace from AVDDL (pin 4 and 9) to +1V2 has to be as short as possible! (See "ANLAN206" page 9)
PHYAD
PHYAD[0] = 1
PHYAD[1] = 1
PHYAD[2] = 1
MODE
MODE[0] = 1
MODE[1] = 1
MODE[2] = 1
MODE[3] = 1
RGMII mode - Advertise all capabilities (10/100/1000 speed half-/full-duplex)
Design Guide GTX_CLK
GTX_CLK has to be longer to provide the delay demanded by the datasheet at page 22
CLK125_EN
CLK125_EN is sampled and latched at power-up/reset and is defined as follows:
Pull-up (1) = Enable 125 MHz clock output
Pull-down (0) = Disable 125 MHz clock output
Pin 41 (CLK125_NDO) provides the 125 MHz reference clock output option for use by the MAC.
LED_MODE
LED_MODE is sampled and latched at power-up/reset and is defined as follows:
Pull-up (1) = Single-LED mode
Pull-down (0) = Tri-color dual-LED mode
I²C4 Address of EEPROM with MAC Address
Address: 0b1010011 = 0x53
Write: 0b10100110 = 0xA6
Read: 0b10100111 = 0xA7
Project: Avenger
Description: Ethernet
PCB number: 588-100
Revision: R06
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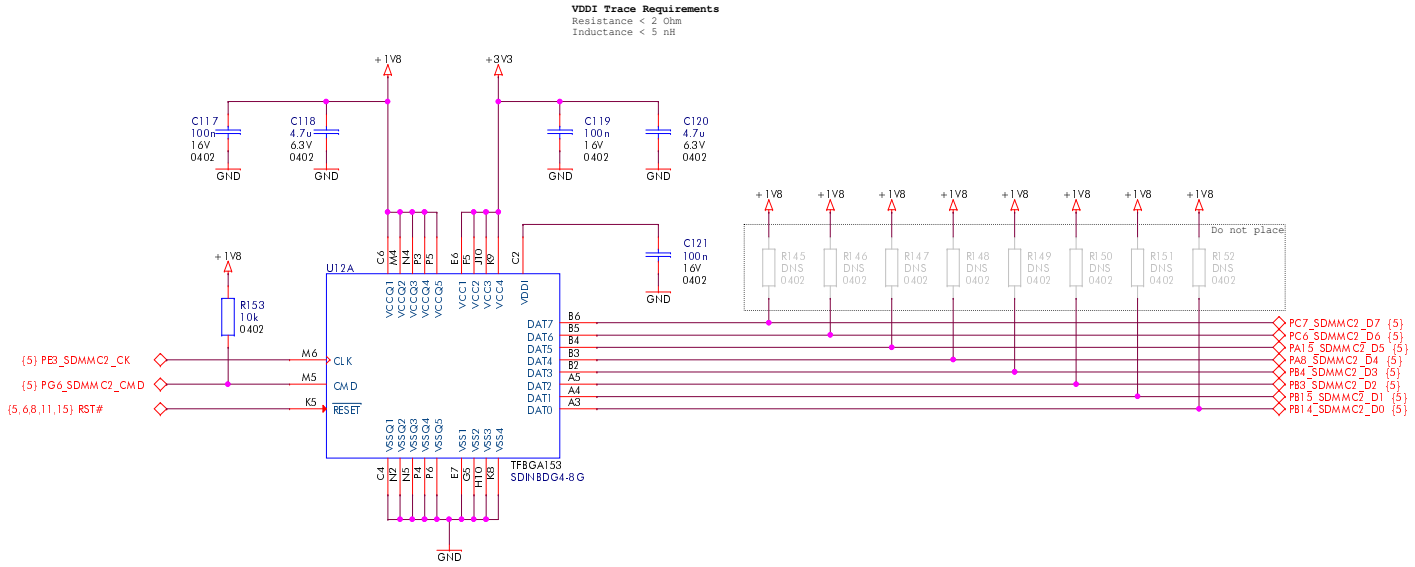
electronics

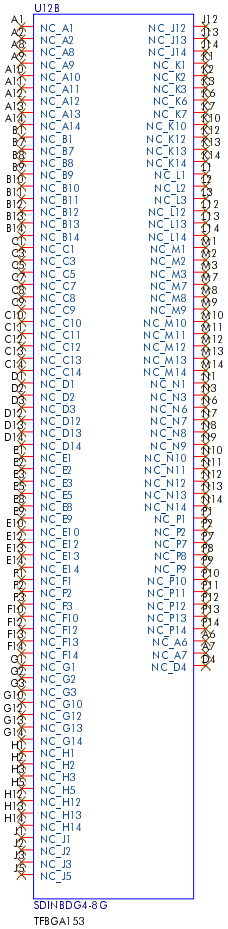
8GB eMMC Flash Drive



VCC
Core voltage 2.7 - 3.6 V

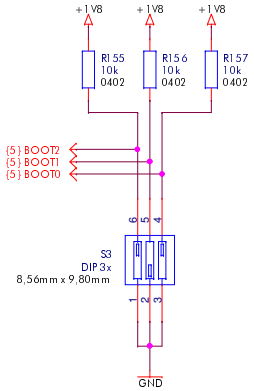
VCCQ
I/O (VCCQ) voltage, either 1.7 - 1.95 V or 2.7 - 3.6 V

Design Guide
Designguide available at datasheet chapter 6



DH electronics	Project: Avenger		
	Description: eMMC		
	PCB number: 588-100		Revision: R06
	Variant: HS00007		Page: 14 of 16

Boot Selection

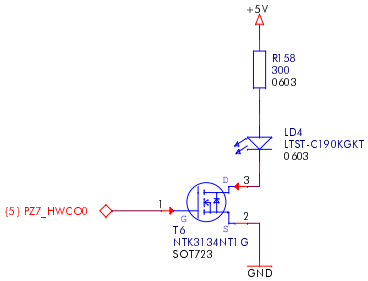


BOOT2 SW3	BOOT1 SW2	BOOT0 SW1 (Number at DIP switch)
0	0	0 = UART and USB
0	0	1 = NOR-Flash
0	1	0 = eMMC
0	1	1 = NAND-Flash
1	0	0 = Reserved
1	0	1 = SD-Card
1	1	0 = UART and USB
1	1	1 = SD-Card

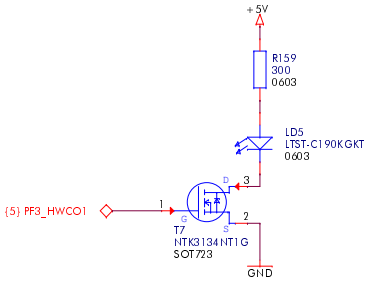
Switch "ON" means "0"

User LEDs

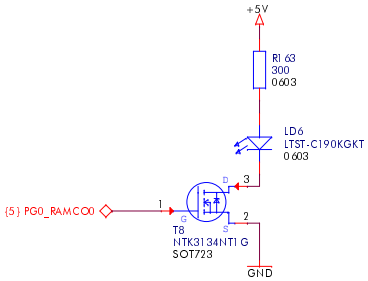
LED 0



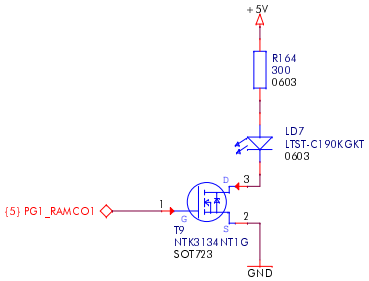
LED 1



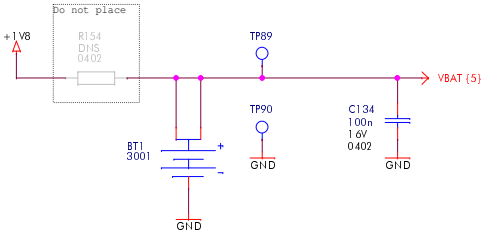
LED 2



LED 3

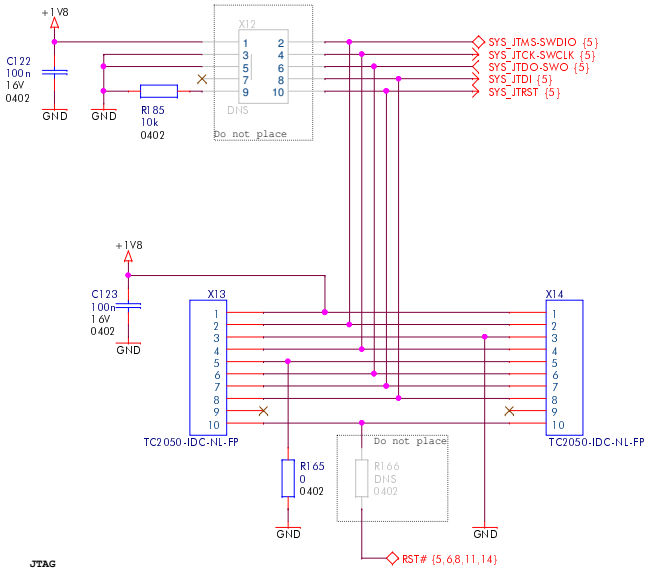


Connector for CR1220 Battery



JTAG

10-Pin connector (Top) and two Tag-Connect connectors on top and bottom of PCB (Bottom)



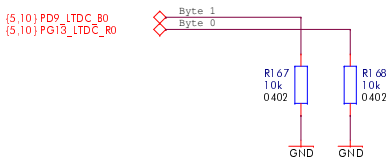
JTAG

To avoid any uncontrolled I/O levels, the STM32MP15 Series embeds internal pull-up and pull-down resistors on JTAG pins

- NJTRST: Internal pull-up
- JTDI: Internal pull-up
- JTDO-TRACESWO: Internal pull-up
- JTMS-SWDIO: Internal pull-up
- JTCK-SWCLK: Internal pull-down

Hardwarecoding

PD9_LTDC_B0 and PG13_LTDC_R0 are used as Hardwarecoding during startup



Hardwarecoding		
	PD9_LTDC_B0	PG13_LTDC_R0
Hardware version	Byte 1	Byte 0
HW100	0	0
HW200	0	1
HW300	1	0
HW400	1	1

electronics

Project:	Avenger	
Description:	Miscellaneous	
PCB number:	588-100	Revision: R06
Variant:	HS00007	Page: 15 of 16

Changelog:

588-100 R01 -> R02

MH/09-08-2018: Included footprint for the DHCOR Module and updated the pin assignment with the current versoin of the DHCOR Module
MH/21-08-2018: Replaced Goldcap with a CR1220 battery connector
MH/22-08-2018: Added Testpads for needle adapter and added new capacitor of the ADP2384
MH/27-08-2018: Connected PA0_SYS_WKUP1 to Expansion Connector
MH/03-09-2018: Added the changes recommended by the review
MH/04-09-2018: Added parts to the correct variant in the part manager

588-100 R02 -> R03

MH/07-09-2018: Changed pinning of HDMI connector in order to achive a smoother layout.
MH/10-09-2018: Added net-names and indicators for the differential pairs at USB, Changed diode D8 to DNP
MH/12-09-2018: Added 0-Ohm resistor at Q1 Pin 1
MH/13-09-2018: Added a 10k-Ohm resistor at JTAG Pin 9 to GND. Switched the regular GPIOs on the Low Speed Expansion Connector with the GPIOs which are capable of CAN an ADC to have more functions available to the user. Corrected Project name to "STM32MP15 96Boards"
SH/17-09-2018: Added R186, R187, R188. Set R78 and R80 on "Do not place"
SH/19-09-2018: Added C134, R189, R190, R191, R192, U14, TP91, TP92
MH/24-09-2018: Switched the Port 1 with Port 3 of the USB-Hub to avoid the crossing between them on the layout and inverted some pinnings on the diodes and inductors at the USB connectors.
MH/25-09-2018: Connected the mechanical pins of the HDMI-connector to GND_IN and corrected the description of the DIP-Switch (Switch "ON" means "0") and updated symbol of the LAN-Transformer

588-100 R03 -> R04

MH/01-10-2018: Corrected wrong connection of HDMI-connector and set the battery connector to be placed in the variant HS00007

588-100 R04 -> R05

MH/15-10-2018: Updated DH-part LD0037 to LD0037-R01 which is the same LED with some additional alternative LEDs reccomended by BMK. In the schematic these LEDs are LD4, LD5, LD6 and LD7. Updated ordering information of U10.
Changed C132 and C133 to new type due to PCN of the part used before.

588-100 R05 -> R06

MH/14-12-2018: R06 is the updated version for the first order (about 200pcs) for the embedded World. Set U11 and its peripherals to DNP because of the wrong connection to 3,3V instead of 1,8V. Changed manufacturer of C1 and C4 to Vishay.
Set C6 to DNP and placed C5 instead. Additional C5 has changed to 22uF. Changed Q1 to (DH part nuber) Y-0060. Changed eMMC to commercial type. Updated Q4 from the DH part number Y-0015-R01 to Y-0015-R02.
Changed R40 to 100k and set it to be placed as a standard. Set X12 to do not place (Double-checked with linaro, this connector doesn't need to be placed in the series product). Changed Project name.

588-100 R06 -> R07

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