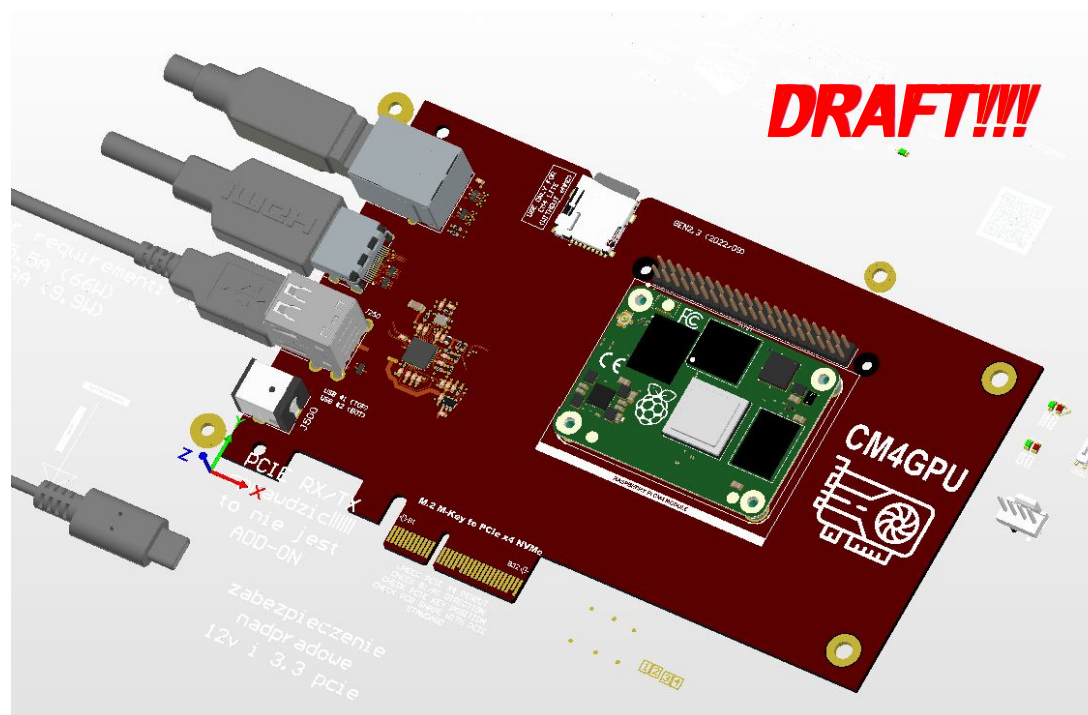


CM4 Module -> GPU card

PCB Project: CM4GPU
Version: V1
Revision: R1
Project State: DRAFT
Variant: [No Variations]
Print date: 10.11.2022

Page	Index
---	-----
01	Cover page
02	Block diagram
03	Top schematic
04	CM4 module - part #1
05	CM4 module - part #2
06	USB C interface
07	USB Hub
08	PCIe x4 slot
09	HDMI
10	100/1000M Ethernet
11	MicroSD card
12	MISC
13	Power supply
14	PCB marking and mechnics
15	Hardware changelog

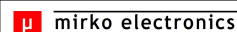
TOP VIEW



[02]Block_diagram.SchDoc

[03]Top.SchDoc

PCB
PCB BARE BOARD

		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A3
Title CM4GPU		Project CM4 Module -> GPU card	Version V1
Variant [No Variations]		RefDes: -	Revision R1
Designer M. Folejewski		Sheet 1 / 15	
File Name [01] Cover_page.SchDoc		Printed 10.11.2022	

Memory / Storage

MicroSD slot

Only for
CM4 Lite

J600

3V3_SD

U601
Power switch
1A limited

3V3

SD_PWR_ON

SDIO/eMMC

Video

HDMI #0 (Type A)

J400

5V_HDMI

HDMI

Networking

RJ45 (GbE)

J500

MDI

GbE

PCIe x4 Edge Connector

J???

PCIe (1-lane)

PCIe

MOD100
CM4 / CM4 Lite

Diagram requires update!

Power Supply (2-pin)

5V

3V3

1V8

5V

Q900/Q901
Power switch

OV/OC
Protection

5VIN

J900

5VDC ±5% @5A

USB-C

J200

5VDC ±5% @3A
Only USB 2.0 Data

USB #1/#2

J250

USB1
USB2

Connectivity

40-pin GPIO HAT

J100

GPIO
5V
3V3

5V Fan Socket

J800


5V

Diagram requires update!

U300
Buck converter
+3.3V/3A

3V3P

5V

 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title Block diagram			Version V1
Project: CM4 Module -> GPU card		RefDes: 1-99	Revision R1
Variant: [No Variations]		Sheet: 2 / 15	
Designer: M. Folejewski		Printed: 10.11.2022	
File Name: 1021Block_diagram.SchDoc			

1

2

3

4

A

A

B

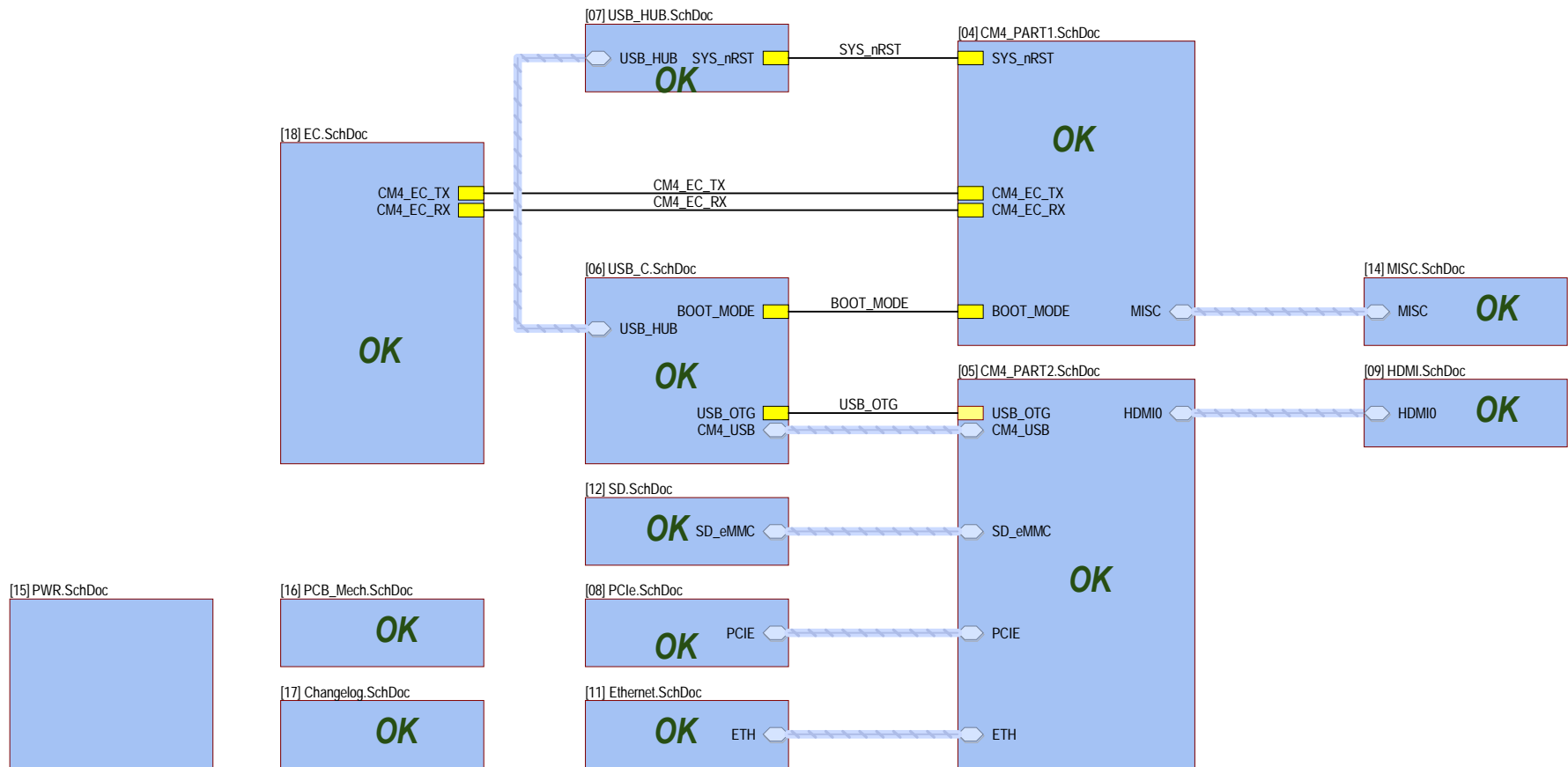
B


C

C

D

D



 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland		Size A4
Title Top schematic				Version V1
Project: CM4 Module -> GPU card				Revision R1
Variant: [No Variations]		RefDes: 1-99		
Designer: M. Folejewski		Sheet: 3 / 15		
File Name: [03] TOP.SchDoc		Printed: 10.11.2022		

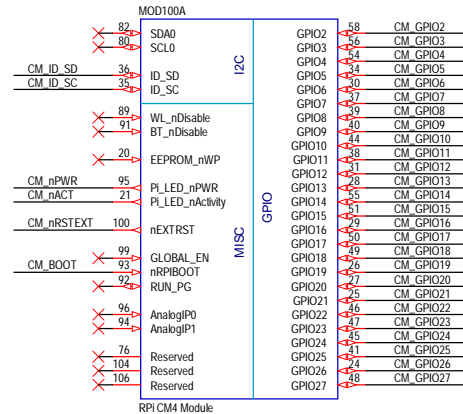
1

2

3

4

CM4 MODULE (PART #1)



SCH:

I2C0 Interface: SCL0 pin (GPIO45) and SDA0 pin (GPIO44) typically are used for Camera and Displays and have internal 1.8k pull up to CM4_3.3V. ID Interface (ID_SD/ID_SC): CM4 datasheet does not mention about pull-up resistors on ID_SD and ID_SC pins.

I2C1 (GPIO2/GPIO3) have 1.8k pull-up resistors added on CM 4 module.

SCH:

I2C (ID_SD/ID_SC): This I2C bus is normally used for identifying HATs (HAT ID EEPROM) and controlling CSIO and DSIO devices. At boot time this I2C interface will be interrogated to look for an EEPROM that identifies the attached board and allows automatic setup of the GPIOs (and optionally, Linux drivers).

DO NOT USE these pins for anything other than attaching an I2C ID EEPROM. Leave unconnected if ID EEPROM not required.

SCH:

I2C0 (SDA0/SCL0): This internal I2C bus is normally allocated to the CS1 and DS1 as these devices are controlled by the firmware.

SCH:

nRPIBOOT: A low on this pin force booting from an RPI server. If not used leave floating. Internally pulled via 10K to +3.3V.

SCH:

EEPROM_nWP pin: Leaving floating NB internally pulled up to CM4_3.3V via 100k (VIL < 0.8V) but can be grounded to prevent writing to the on board EEPROM which stores the bootcode.

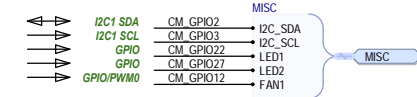
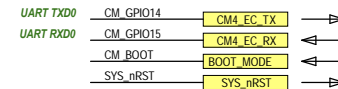
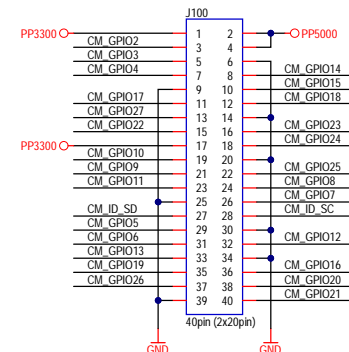
SCH:

1.8V and 3.3V Outputs +/-2.5%. Power Output max 300mA per pin for a total of 600mA. This will be powered down during power off or GLOBAL_EN being set low.

SCH:

GLOBAL_EN: Drive low to power off CM4. Internally pulled up with a 100k to +5V.

40-PIN GPIO HEADER



components - display 4 parameters: val/tol/pwr rating/package
 power rail nets - use Google convention (e.g. PP3300)

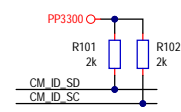
Used GPIOs:

- GPIO2 - I2C1 SDA
- GPIO3 - I2C1 SCL
- GPIO14 - UART TX (EC)
- GPIO15 - UART RX (EC)
- GPIO22 - GPIO (USER LED1 Green)
- GPIO27 - GPIO (USER LED2 Red)

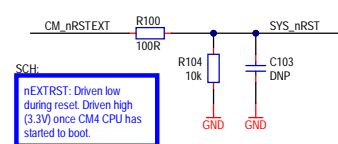
Raspberry Pi Pinout

3v3 Power	1	2	5v Power
GPIO 2 (I2C1 SDA)	3	4	5v Power
GPIO 3 (I2C1 SCL)	5	6	Ground
GPIO 4 (GPCLK0)	7	8	GPIO 14 (UART TX)
Ground	9	10	GPIO 15 (UART RX)
GPIO 17	11	12	GPIO 18 (PCM CLK)
GPIO 27	13	14	Ground
GPIO 22	15	16	GPIO 23
3v3 Power	17	18	GPIO 24
GPIO 10 (SPI0 MOSI)	19	20	Ground
GPIO 9 (SPI0 MISO)	21	22	GPIO 25
GPIO 11 (SPI0 SCLK)	23	24	GPIO 8 (SPI0 CE0)
Ground	25	26	GPIO 7 (SPI0 CE1)
GPIO 0 (EEPROM SDA)	27	28	GPIO 1 (EEPROM SCL)
GPIO 5	29	30	Ground
GPIO 6	31	32	GPIO 12 (PWM0)
GPIO 13 (PWM1)	33	34	Ground
GPIO 19 (PCM FS)	35	36	GPIO 16
GPIO 26	37	38	GPIO 20 (PCM DIN)
Ground	39	40	GPIO 21 (PCM DOUT)

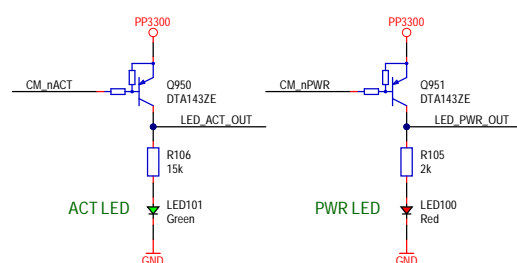
ID I2C



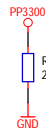
GLOBAL RESET



SYS LEDs



3V3 LOAD

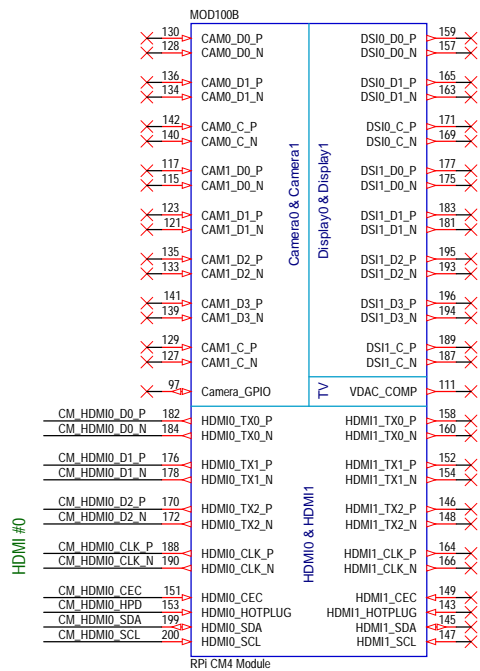


SCH:

Extra load on the 3V3 power rail to fix the HDMI issue with 5V LED.

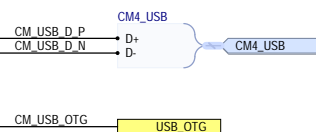
mirko electronics	Mirko Electronics Smoła Wawelskiego 1 30-535 Kraków, Poland	Size A3
Title Compute Module 4 (Part #1)	Version V1	Revision R1
Project: CM4 Module -> GPU card	RefDes: 100-199	
Variant: [No Variations]	Sheet: 4 / 15	
Designer: M. Folejewski	Printed: 10.11.2022	
File Name: 1041CM4_PART1.SchDoc		

CM4 MODULE (PART #2)



SCH:

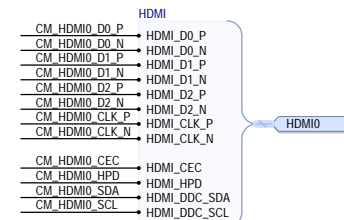
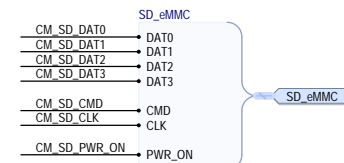
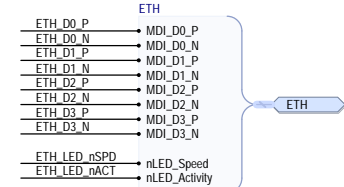
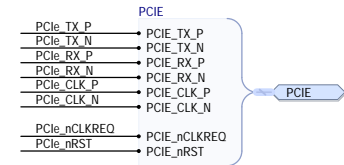
USB_OTG_ID: Input (3.3V signal) USB OTG Pin. Internal pulled up. The USB_OTG pin is used to select between USB host and device that is typically wired to the ID pin of a Micro usb connector. To use this functionality it must be enabled in the OS that is used. If using either as a fixed slave or fixed master, please tie the USB OTGID pin to ground.



MEZZANINE CONNECTORS

J103
CONNECTOR
Mezzanine, 100pin, 3.0mm

J104
CONNECTOR
Mezzanine, 100pin, 3.0mm



LAYOUT:

Route MIPI signals as matched length 100 Ohm differential pairs, each signal within a pair should ideally be matched to better than 0.15mm.

Route USB signals as matched length 90 Ohm differential pairs. The P N signals should ideally be matched to 0.15mm.

Route HDMI signals as matched length 100 Ohm differential pairs, each signal within a pair should ideally be matched to better than 0.15mm. Pairs don't typically need any extra matching as they only have to be matched to 25mm.

LAYOUT:

Route Ethernet signals as matched length 100 Ohm differential pairs with suitable clearances. Length matching between pairs should be better than 50mm, so in the typical case no length matching is required. However the signals within a pair need to be length matched, ideally to better than 0.15mm.

Route PCIe signals as matched length 90 Ohm differential pairs with suitable clearances. There is no need to match the lengths between pairs, only the signals within a pair need to be length matched ideally to better than 0.1mm.

LAYOUT:

Impedance matching:
90 Ohm -> PCIe, USB
100 Ohm -> HDMI, Ethernet, MIPI (CSI, DSI)

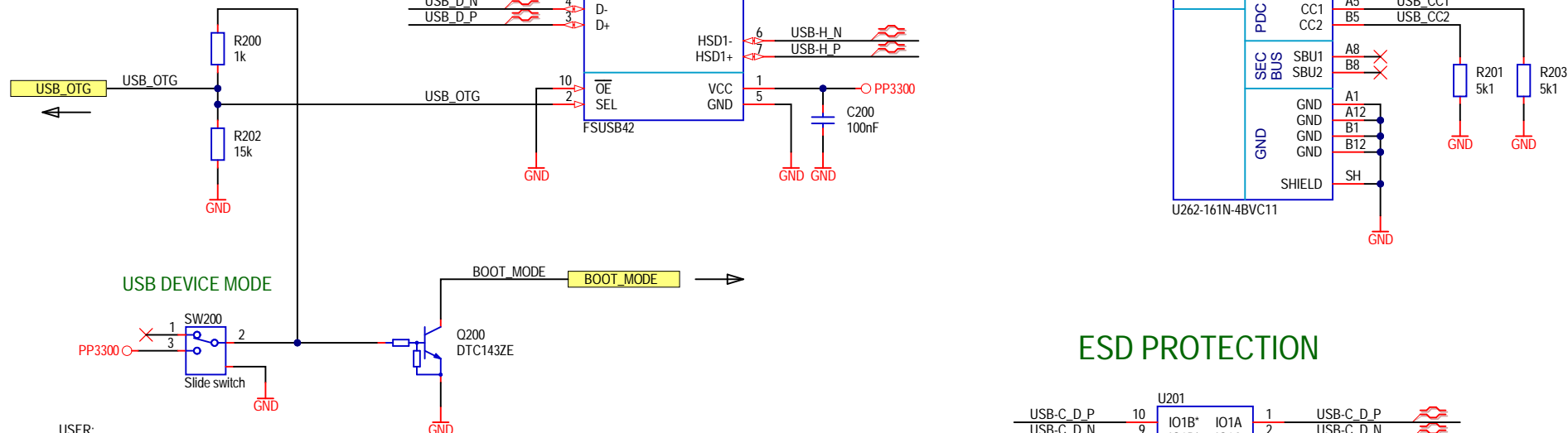
	Mirko Electronics Smoka Wawelskiego 1 30-535 Krakow, Poland		Size B
	Title Compute Module 4 (Part #2)		Version V1
	Project: CM4 Module -> GPU card	RefDes: 100-199	Revision R1
	Variant: [No Variations]	Sheet: 5 / 15	
	Designer: M. Folejewski	File Name: [05] CM4 PART2.SchDoc	Printed: 10.11.2022

USER:

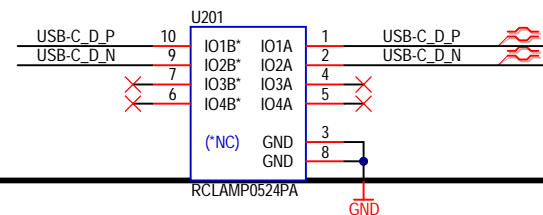
USB_OTG line: if USB-C cable is connected and SW200 jumper has shorted 2-3 pins then the CM4 becomes a USB Device.

USB SWITCH

USB TYPE C

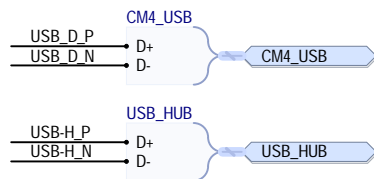


ESD PROTECTION



TESTPOINTS (DEBUG)

USB_OTG	TP200
BOOT_MODE	TP201
USB_CC1	TP203
USB_CC2	TP204
PP5000_USBC	TP205



BOM:

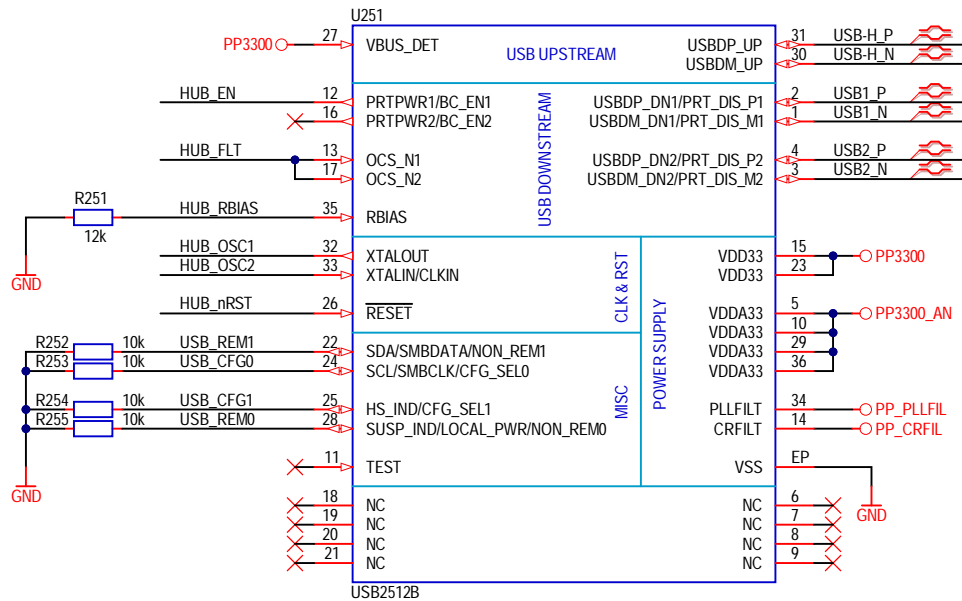
USB 3.1 Type C:
Use XKB Connectivity, MPN = U262-161N-4BVC11.
Description: vertical connector, 16 pins, USB 2.0 only, SMD version.

LAYOUT:

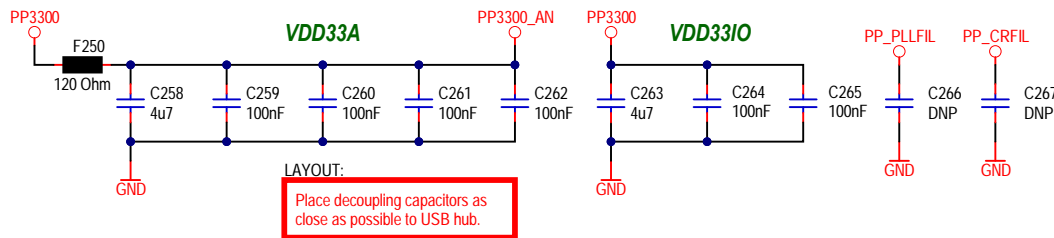
Route USB signals as matched length 90 Ohm differential pairs. The P N signals should ideally be matched to 0.15mm.

mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title USB-C interface and USB switch		Version V1	Revision R1
Project:	CM4 Module -> GPU card	RefDes:	200-249
Variant:	[No Variations]	Sheet:	6 / 15
Designer:	M. Folejewski	Printed:	10.11.2022
File Name:	[06] USB_C.SchDoc		

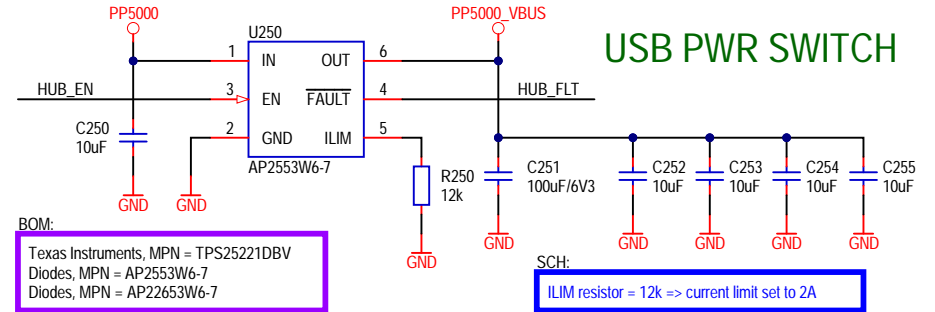
2-PORT USB HUB



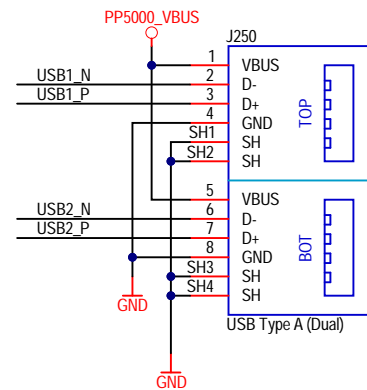
DECOUPLING CAPACITORS



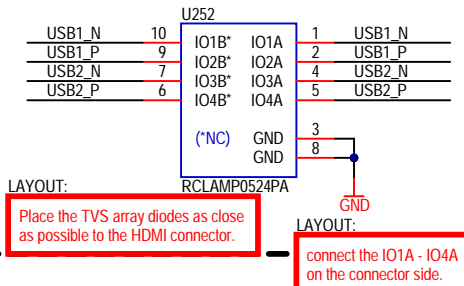
USB PWR SWITCH



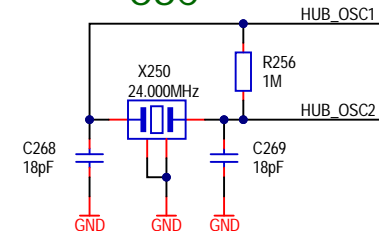
USB #1/#2



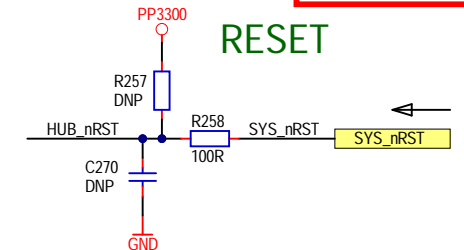
ESD PROTECTION



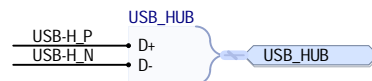
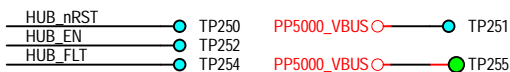
OSC



RESET

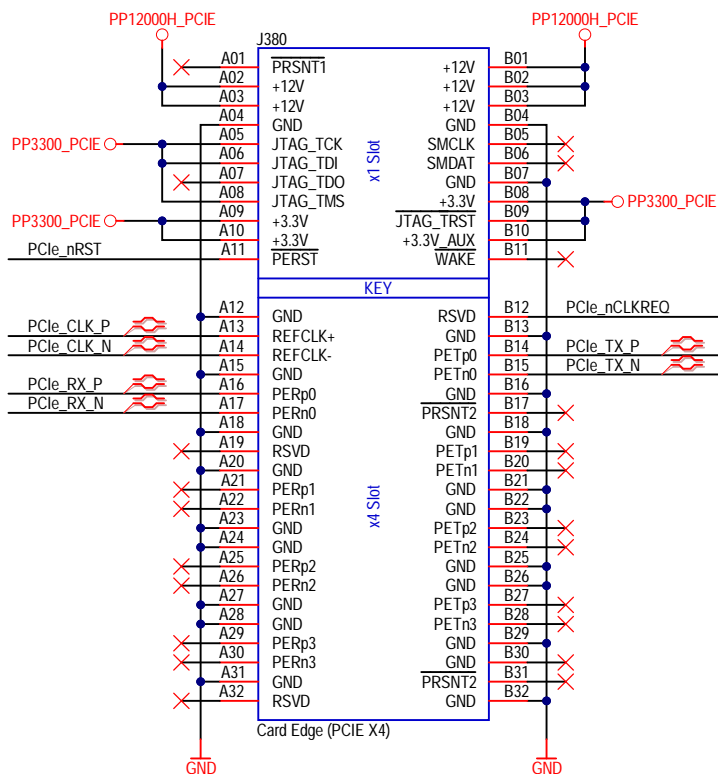


TESTPOINTS (DEBUG)



mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title 4-port USB 2.0 hub		RefDes: 250-299 Sheet: 7 / 15	Version V1
Project: CM4 Module -> GPU card Variant: [No Variations] Designer: M. Folejewski File Name: [07] USB_HUB.SchDoc		Printed: 10.11.2022	Revision R1

PCI Express x4 Edge Connector

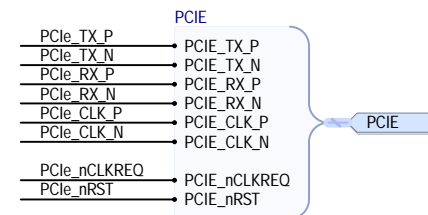
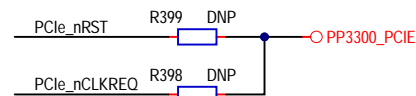


LAYOUT:

Route PCIe signals as matched length 90 Ohm differential pairs with suitable clearances. There is no need to match the lengths between pairs, only the signals within a pair need to be length matched ideally to better than 0.1mm.

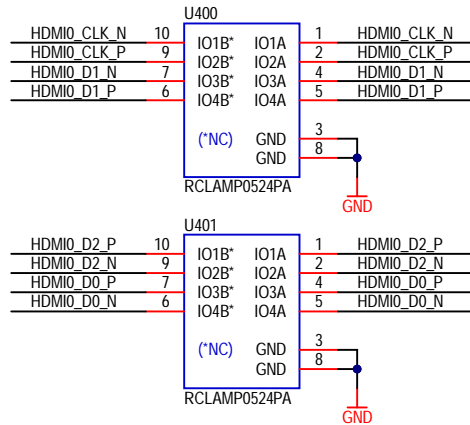
TESTPOINTS (DEBUG)

PCle_nCLKREQ TP300
PCle_nRST TP301



	Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland		Size A4
	Title M.2 PCIe x1 Socket		Version V1
Project: CM4 Module -> GPU card	Variant: [No Variations]	RefDes: 300-399	Revision R1
Designer: M. Folejewski	Sheet: 8 / 15	Printed: 10.11.2022	
File Name: [08] PCIe.SchDoc			

ESD PROTECTION



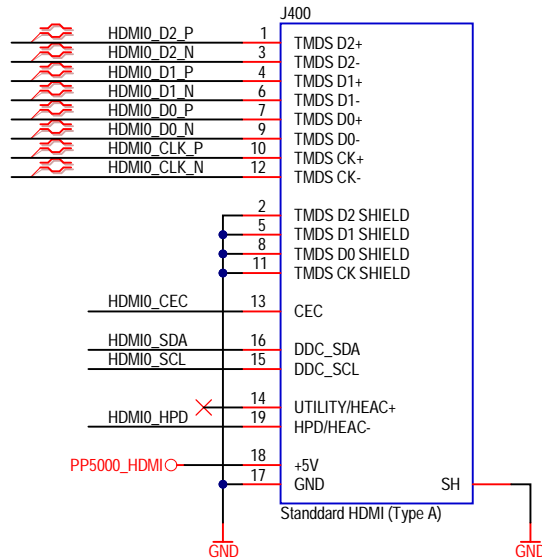
LAYOUT:

Place the TVS array diodes as close as possible to the HDMI connector.

LAYOUT:

connect the IO1A - IO4A on the connector side.

HDMI #0 (TYPE A)



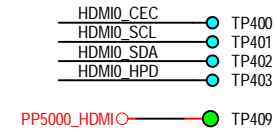
BOM:

HDMI #0 connector:
Wurth Elektronik, MPN = 685 119 134 923
BOOMELE, MPN = HDMI-001
Description: Type A (Standard), 19 pins, 0.50mm pitch, horizontal, SMD.

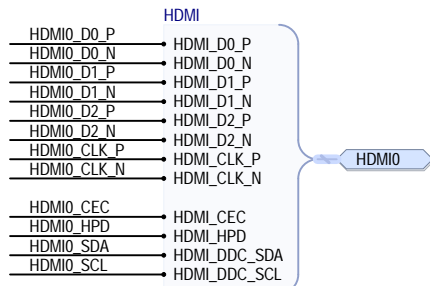
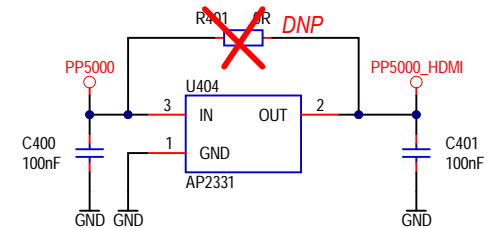
LAYOUT:

Route HDMI signals as matched length 100 Ohm differential pairs, each signal within a pair should ideally be matched to better than 0.15mm. Pairs don't typically need any extra matching as they only have to be matched to 25mm.

TESTPOINTS (DEBUG)

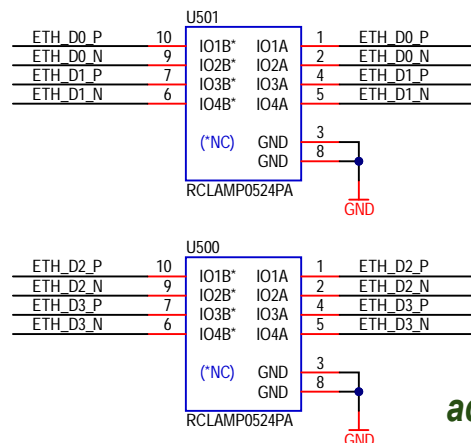


5V POWER SWITCH



	Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland		Size A4
	Title HDMI Interface		Version V1
Project: CM4 Module -> GPU card	RefDes: 400-449		Revision R1
Variant: [No Variations]	Sheet: 9 / 15		
Designer: M. Folejewski	Printed: 10.11.2022		
File Name: [09] HDMI.SchDoc			

ESD PROTECTION



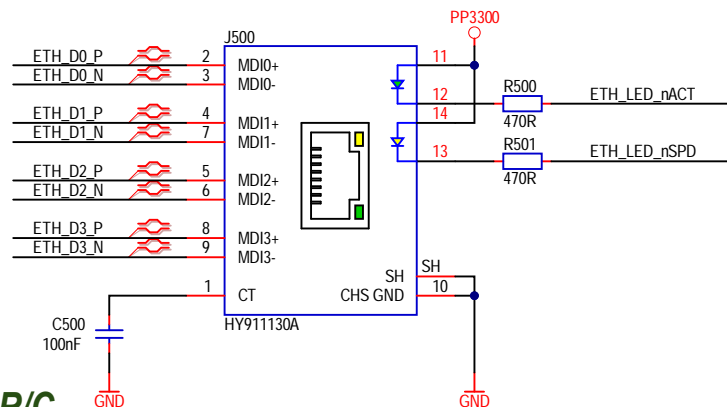
LAYOUT:

connect IO1A - IO4A on the connector side.

LAYOUT:

Place TVS array diodes as close as possible to RJ45 connector.

100/1000M ETHERNET



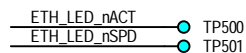
LAYOUT:

Route Ethernet signals as matched length 100 Ohm differential pairs with suitable clearances. Length matching between pairs should be better than 50mm, so in the typical case no length matching is required. However the signals within a pair need to be length matched, ideally to better than 0.15mm.

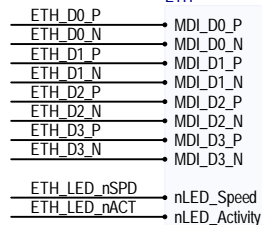
BOM:


RJ45 -> compatible connectors:
HanRun, MPN = HR911130A (HY911130A)
Link-PP, MPN = LPJG0806FBNL
Description: 100/1000M RJ45, Tab-down, G/Y LEDs

TESTPOINTS (DEBUG)



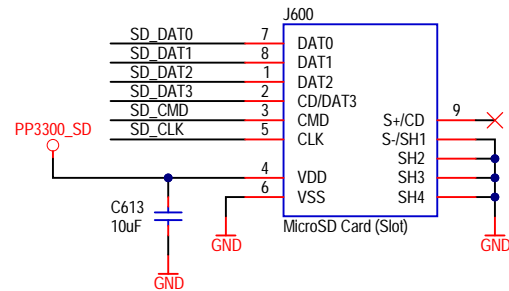
ETH



 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title 100/1000M Ethernet interface			Version V1
Project: CM4 Module -> GPU card			Revision R1
Variant: [No Variations]		RefDes: 500-599	
Designer: M. Folejewski		Sheet: 10 / 15	
File Name: [11] Ethernet.SchDoc		Printed: 10.11.2022	

add 4 parameters R/C

MICRO SD CARD



SCH:

Used MicroSD card slot: Hmax = 2.00 mm

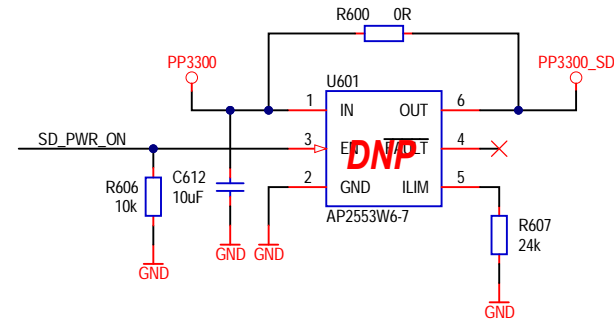
USER:

SD Card only for CM4 Lite module with no on-board Flash memory chip (eMMC).

BOM:

MicroSD slot -> compatible components:
GCT, MPN = MEM2055-00-190-01-A
SOFNG, MPN = TF-015
HOAUC, MPN = HYC77-TF09-200
XUNPU, MPN = TF-115

PWR SWITCH



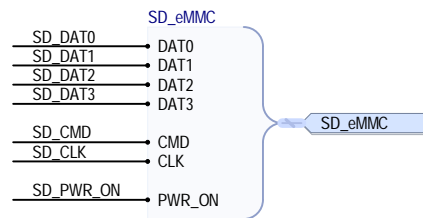
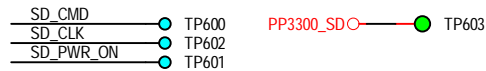
BOM:


Texas Instruments, MPN = TPS25221DBV
Diodes, MPN = AP2553W6-7
Diodes, MPN = AP22653W6-7

SCH:

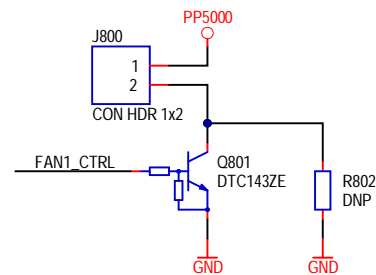
ILIM resistor = 24k => current limit set to 1.05A

TESTPOINTS (DEBUG)



 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title MicroSD slot			Version V1
Project: CM4 Module -> GPU card			Revision R1
Variant: [No Variations]		RefDes: 600-699	
Designer: M. Folejewski		Sheet: 11 / 15	
File Name: [12]SD.SchDoc		Printed: 10.11.2022	

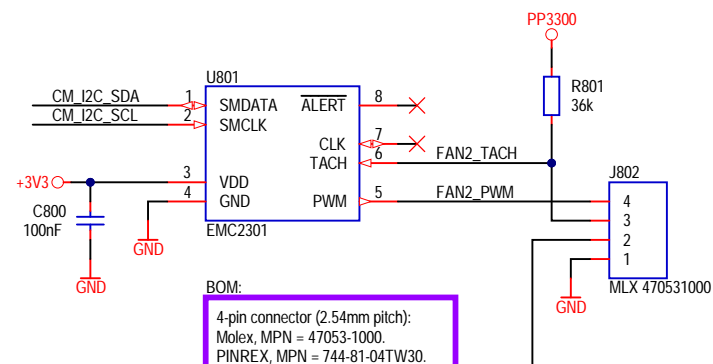
FAN1 (5V, ON/OFF)



USER:

FAN1 can be controlled by FAN1_CTRL line (by static GPIO level or by using PWM mode).
FAN1 control can be disabled (always on) by assembly R802 jumper.

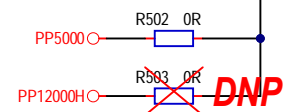
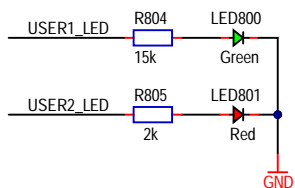
FAN2 (5V/12V PWM CTRL IC)



BOM:

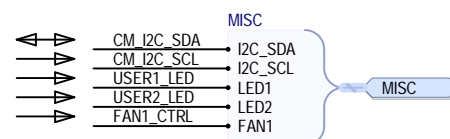
4-pin connector (2.54mm pitch):
Molex, MPN = 47053-1000.
PINREX, MPN = 744-81-04TW30.


USER LEDs



VOLTAGE RATING CONFIG

USE AS ASSEMBLY VARIANT MARKER ALSO




 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title MISC			Version V1
Project: CM4 Module -> GPU card			Revision R1
Variant: [No Variations]		RefDes: 800-899	
Designer: M. Folejewski		Sheet: 12 / 15	
File Name: [14] MISC.SchDoc		Printed: 10.11.2022	

4

EC_UART_TX → CM4_EC_RX

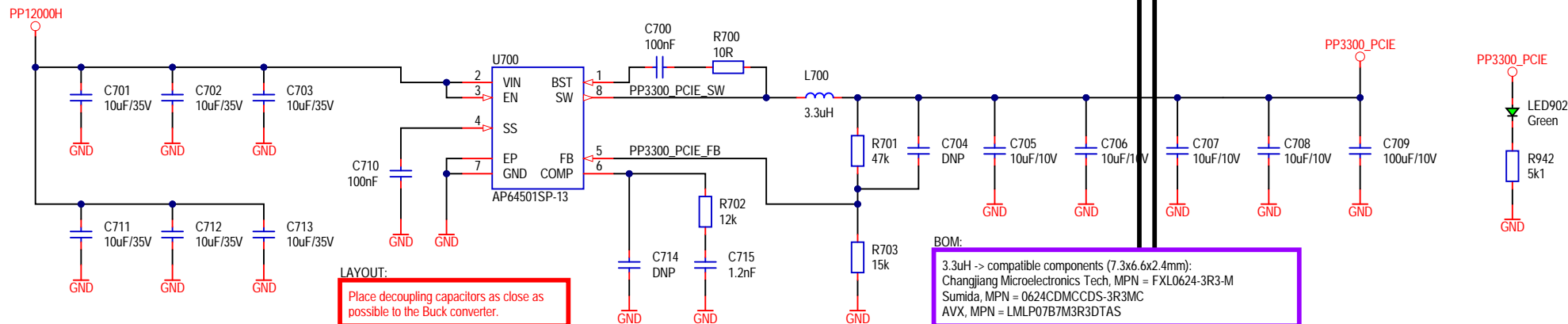
EC_UART_RX ← CM4_EC_TX

3.3V/300mA LDO

 mirkoelectronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland		Size A4
Title Embedded Controller (EC)				Version V1
Project: CM4 Module -> GPU card		RefDes: 900-949		Revision R1
Variant: [No Variations]		Sheet: 13 / 15		
Designer: M. Folejewski		Printed: 10.11.2022		
File Name: [18] EC_SchDoc				

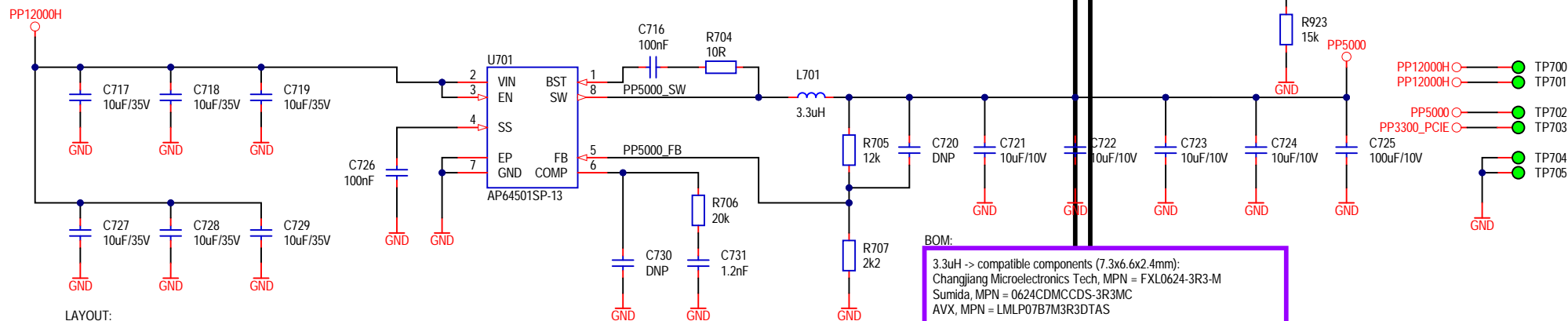
+3.3V @3A POWER SUPPLY (FOR PCIE ONLY)

7.5V - 28V INPUT



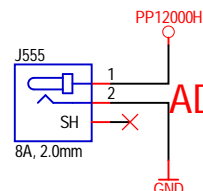
+5V @3A POWER SUPPLY

7.5V - 28V INPUT




+5V MAIN POWER SUPPLY

TESTPOINTS (DEBUG)
MCU ISP (UPDI) 3.3V/300mA LDO



ADD MOLEX CON

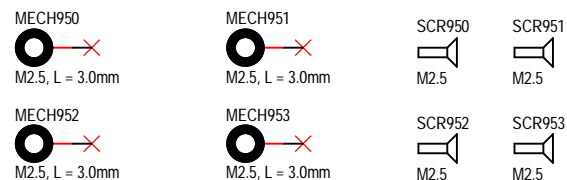
LED sygnalizacja 12V barrel + molex

 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title Power supply			Version V1
Project: CM4 Module -> GPU card			Revision R1
Variant: [No Variations]		RefDes: 900-949	
Designer: M. Folejewski		Sheet: 13 / 15	
File Name: [15] PWR.SchDoc		Printed: 10.11.2022	

PCB MOUNTING HOLES



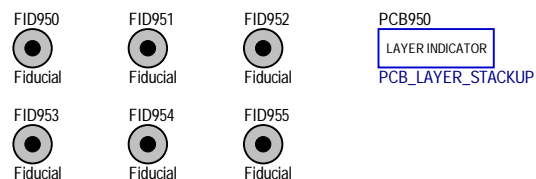
M2.5 STEEL SPACERS



BOM:


SMT Steel Spacer with internal Thread M2.5, L = 3.0mm:
Use Wurth Elektronik, MPN = 977 403 015 1.

PCB MARKING



ASSEMBLY VARIANT MARKER

dodac logo mirko + designed in poland jako komponenty!!!

 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title PCB marking & mechanical parts			Version V1
Project: CM4 Module -> GPU card		RefDes: 950-999 Sheet: 14 / 15	Revision R1
Variant: [No Variations]			
Designer: M. Folejewski			
File Name: [16] PCB_Mech.SchDoc		Printed: 10.11.2022	

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A

B

C

D

A

B

C

D

Hardware changelog

2022.10.27:
- project has started;
- imported schematics from existing designs;

2022.10.29:
- schematic update, minor changes;


2022.10.31:
- PCB shape according to PCIe standard;
- initial component placement of the front connectors;
- minor changes;

2022.11.02:
- added DC barrel jack;
- schematic: power supply update;

2022.11.03:
- component placement of the front connectors;
- microsd card: updated PCB edge;
- RefDes updated;

2022.11.09:
- power supply circuit created;
- added EC schematic page;
- minor changes;

2022.11.10:
- minor changes;
- RefDes updated;
- power supply circuit updated;

 mirko electronics		Mirko Electronics Smoka Wawelskiego 1 30-535 Kraków, Poland	Size A4
Title Hardware changelog			Version V1
Project: CM4 Module -> GPU card			Revision R1
Variant: [No Variations]		RefDes: -	
Designer: M. Folejewski		Sheet: 15 / 15	
File Name: [17] Changelog.SchDoc		Printed: 10.11.2022	

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