M28EVK Hardware Manual

Release 1

ARIES Embedded GmbH

August 30, 2016

CHAPTER

ONE

ABOUT THIS MANUAL

1.1 Imprint

Adress:

ARIES Embedded GmbH

Schöngeisinger Str. 84

D-82256 Fürstenfedbruck

Germany

Phone:

+49 (0) 8141/36 367-0

Fax:

+49 (0) 8141/36 367-67

1.2 Disclaimer

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1.3 Copyright

1.4 Registered Trademarks

1.5 Care and Maintenance

- Keep the device dry. Precipitation, humidity, and all types of liquids or moisture can contain minerals that will corrode electronic circuits. If your device does get wet, allow it to dry completely.
- Do not use or store the device in dusty, dirty areas. Its moving parts and electronic components can be damaged.
- Do not store the device in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the device in cold areas. When the device returns to its normal temperature, moisture can form inside the device and damage electronic circuit boards.
- Do not attempt to open the device.
- Do not drop, knock, or shake the device. Rough handling can break internal circuit boards and fine mechanics.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the device.
- Do not paint the device. Paint can clog the moving parts and prevent proper operation.
- Unauthorized modifications or attachments could damage the device and may violate regulations governing radio devices.

1.6 Change Log

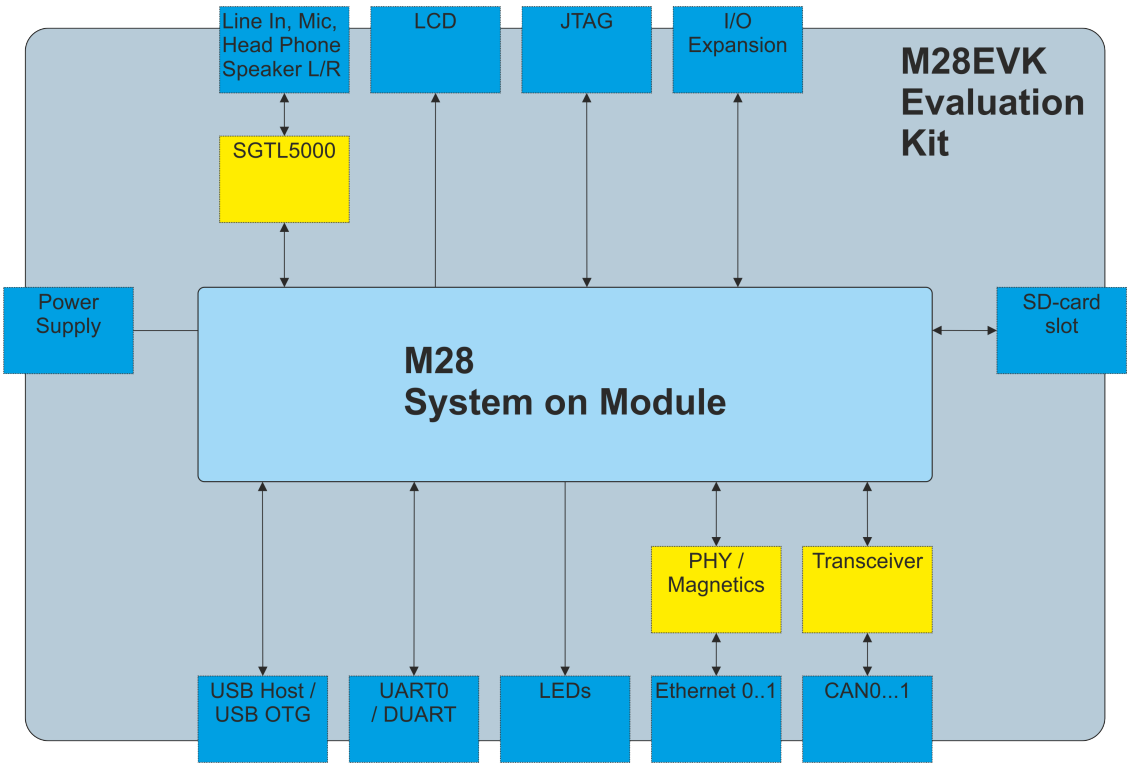
Revision	Date	Revised	Comment
1.0	08.02.2012	aw	Initial creation
1.1	20.08.2012	aw	Fixed connector assigment for DUART and UART0
1.2	07.11.2012	aw	Transition for web based documentation
1.3	07.11.2012	aw	QuickStart section added
1.4	30.06.2016	aw	Transition to pdf documentation

CHAPTER

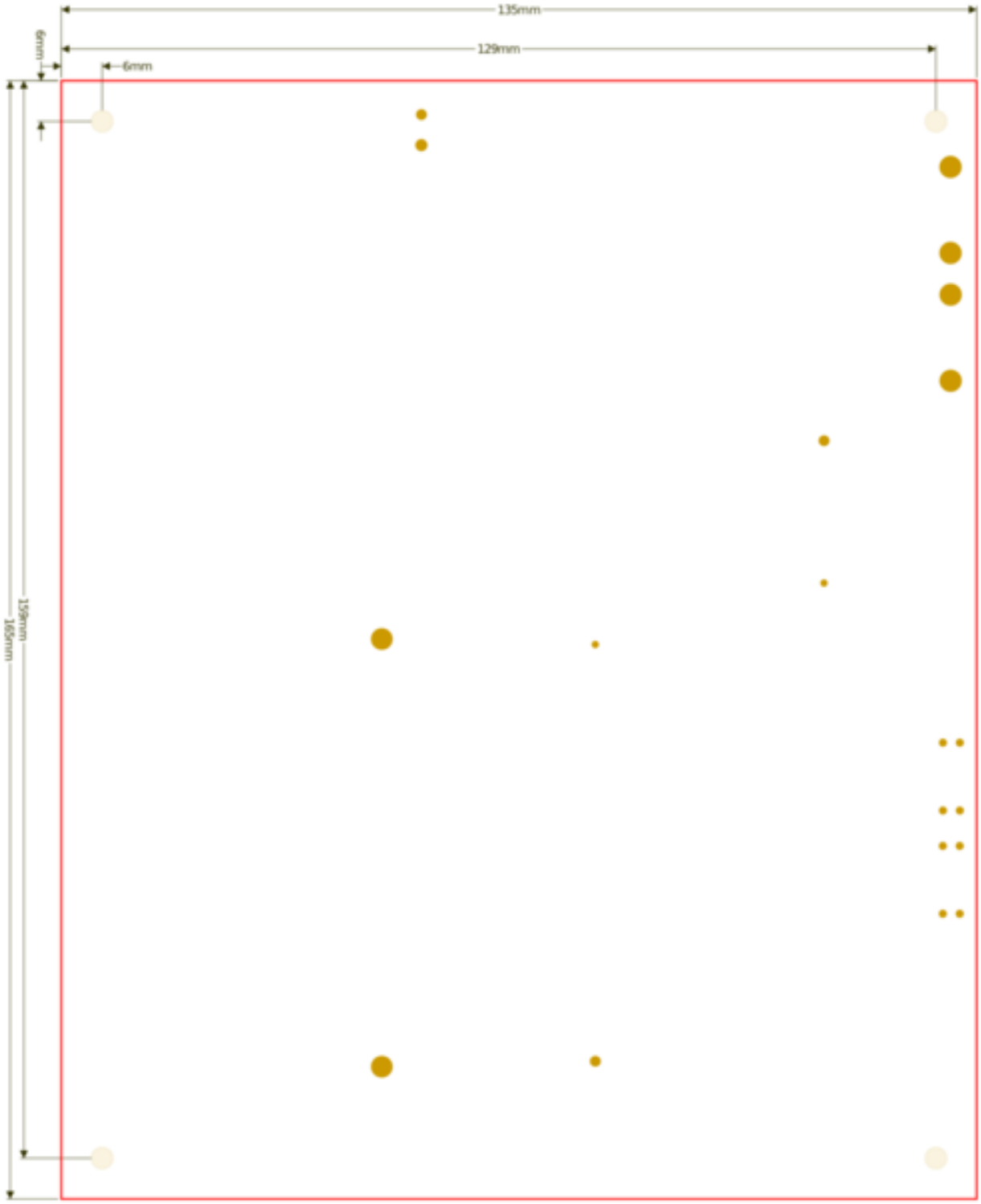
TWO

M28 EVALUATION KIT

2.1 Block Diagram



2.2 Dimensions

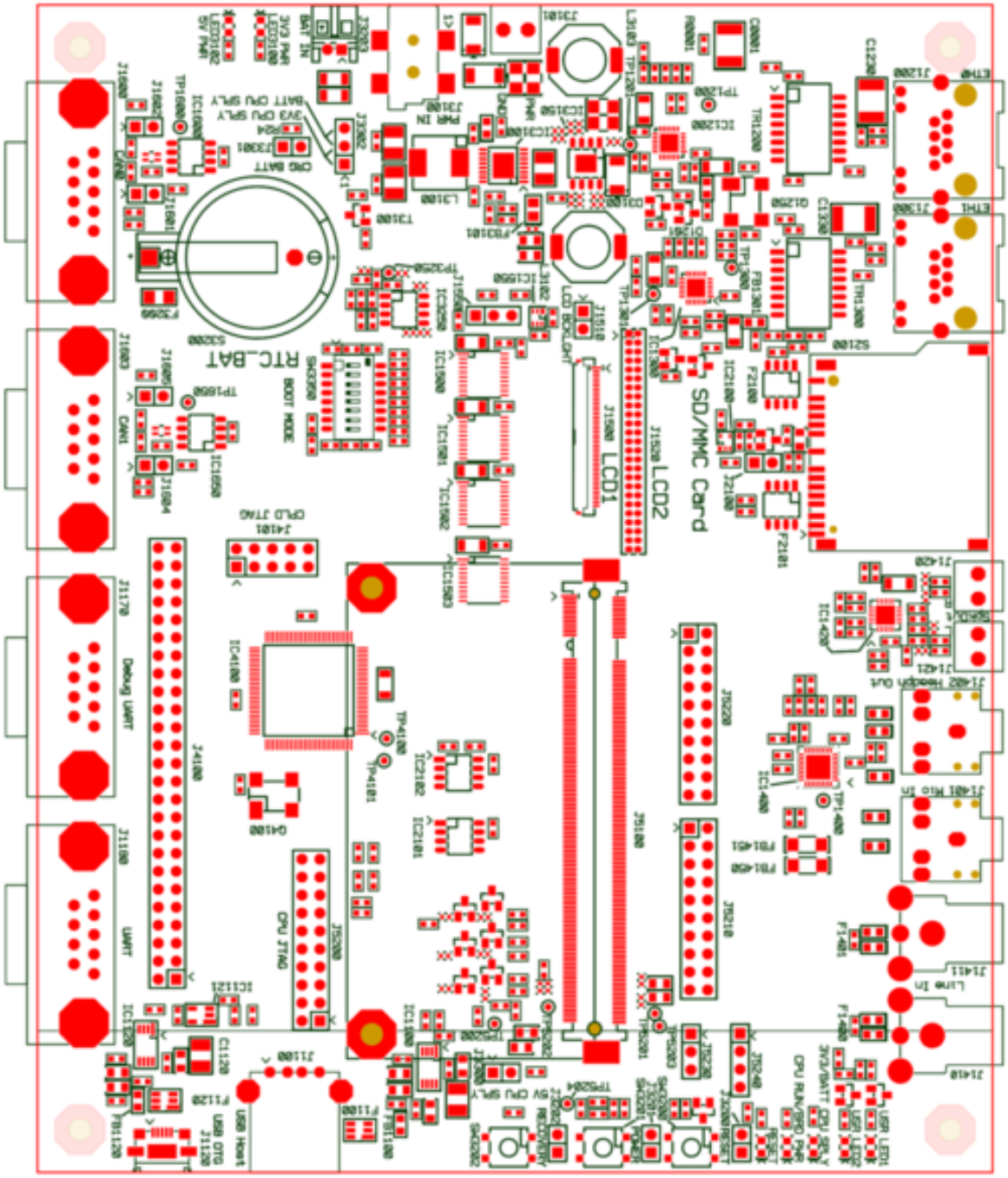


2.3 Feature Set

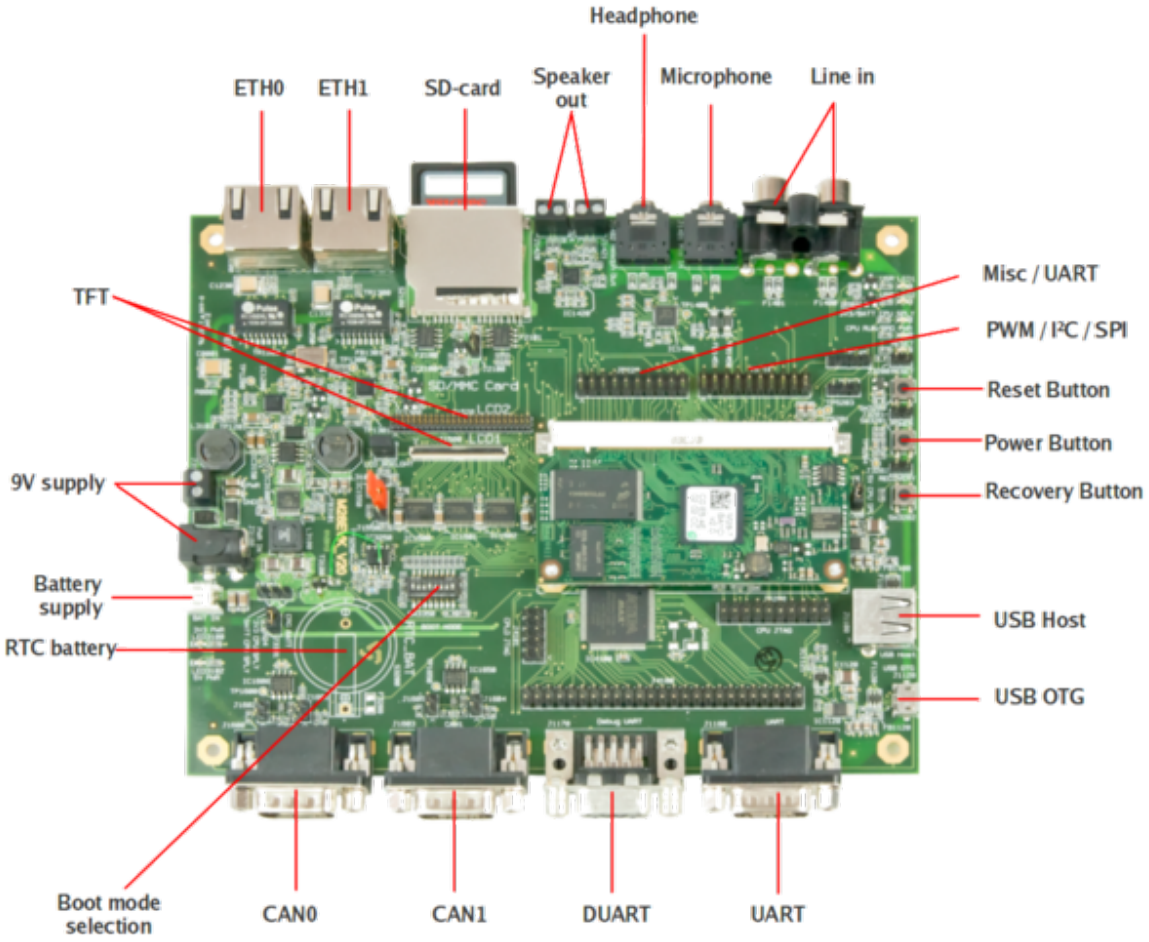
The M28 Evaluation Kit features

- MXM connector for M28 System On Module
- two Ethernet connectors RJ45 for 10/100MBit/s
- USB Host connector USB A, 4 pins
- USB device connector USB AB, 5 pins
- Debug UART on DSUB9 connector, RS232 interface
- UART0 on DSUB9 connector, RS232 interface
- CAN0 / CAN1 interfaces on DSUB9 connector each, optional termination
- Microphone In
- Headphone Out
- Line In
- Speaker Out
- SD card slot
- TFT display pin header / FFC
- Reset / Power / Recovery button
- JTAG
- Power supply 5V or battery

2.4 Parts Location



2.5 Parts Overview



CHAPTER

THREE

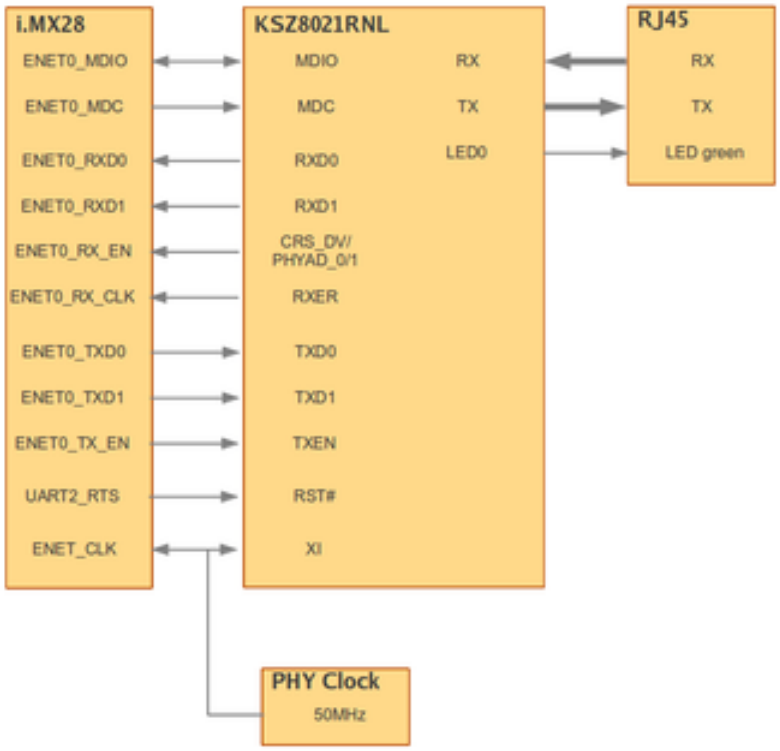
RESOURCES

3.1 Serial Interfaces

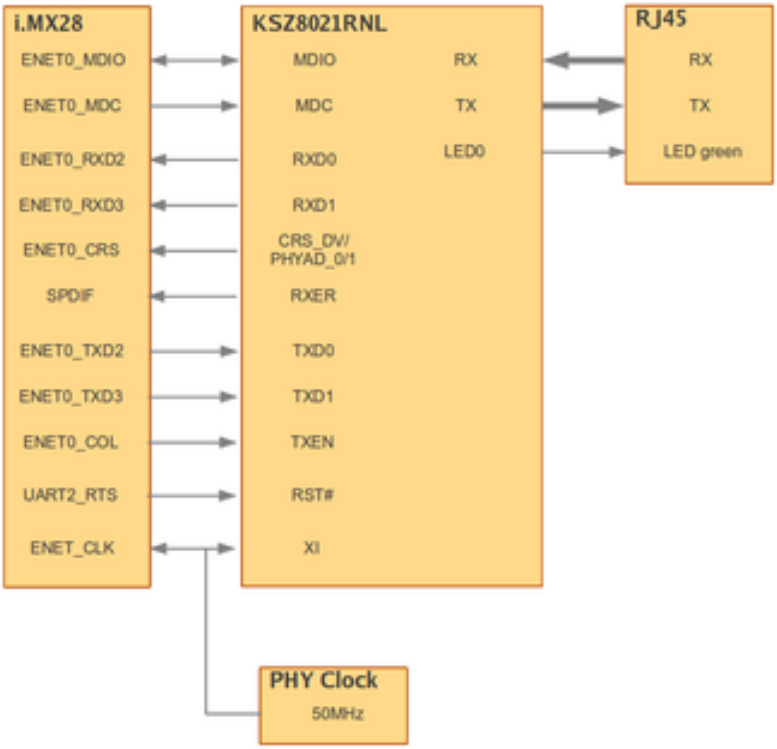
3.1.1 Ethernet

M28 supports two Ethernet interfaces ETH0 and ETH1 which are available on J1200 and J1300 RJ45 connectors.

The Ethernet0 PHY has MDIO adress 00000, the interface is implemented as follows:



The Ethernet1 PHY has MDIO adress 00011, the interface is implemented as follows:



3.1.2 UART

AUART0 is available as RS232 interface on the DSUB9 connector J1180 “UART”. The connector supplies the following pin out:

Pin	Signal
1	n.c.
2	RS2320_TX
3	RS2320_RX
4	n.c.
5	n.c.
6	n.c.
7	n.c.
8	n.c.
9	n.c.

The Debug UART DUART is available as RS232 interface on the DSUB9 connector J1170 “DUART”. The connector supplies the following pin out:

Pin	Signal
1	n.c.
2	RS2320_TX
3	RS2320_RX
4	n.c.
5	n.c.
6	n.c.
7	n.c.
8	n.c.
9	n.c.

The UART signals are available as TTL interface on connector J5220. Connector J5220 supplies the following pin out:

Pin	Signal
1	AUART0_CTS
2	SD_CARD_PWR_SW
3	AUART0_RTS
4	/SD_CARD_WP
5	AUART0_RX
6	AUART2_RX
7	AUART0_TX
8	AUART2_TX
9	AUART1_CTS
10	AUART3_CTS
11	AUART1_RTS
12	AUART3_RTS
13	AUART1_RX
14	/USBOTG_PWR_EN
15	AUART1_TX
16	/USB_HOST_PWR_EN
17	SPDIF
18	/ENET_RST
19	GND
20	GND

3.1.3 USB Host

Connector J1100 supplies a standard USB Host interface on a USB-A connector.

Pin	Signal
1	5V
1	USB1_DN
1	USB1_DP
1	GND

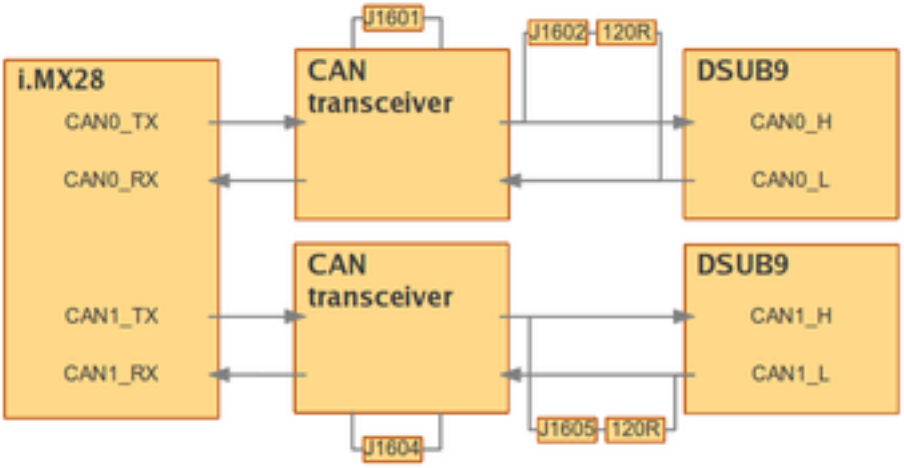
3.1.4 USB OTG

Connector J1120 supplies a standard USB device/OTG interface on a micro USB-AB connector:

Pin	Signal
1	5V
1	USB1_DM
1	USB1_DP
1	USB0_ID
1	GND

3.1.5 FlexCAN

On M28EVK the CAN interfaces are implemented as follows:



Connector J1600 supplies the interface CAN0:

Pin	Signal
1	n.c.
2	CAN0_RX
3	n.c.
4	n.c.
5	n.c.
6	CAN0_TX
7	n.c.
8	n.c.
9	n.c.

Closing Jumper J1602 causes the termination of interface CAN0 with 120Ω.

J1602	Termination
open	disabled
closed	CAN0_RX

Closing Jumper J1601 selects the operation mode for the transceiver of CAN0:

J1601	Mode
open	high speed
closed	standby

Connector J1603 supplies the interface CAN1:

Pin	Signal
1	n.c.
2	CAN0_RX
3	n.c.
4	n.c.
5	n.c.
6	CAN0_TX
7	n.c.
8	n.c.
9	n.c.

Closing Jumper J1605 causes the termination of interface CAN0 with 120Ω.

J1605	Termination
open	disabled
closed	CAN0_RX

Closing Jumper J1604 selects the operation mode for the transceiver of CAN0:

J1604	Mode
open	high speed
closed	standby

3.1.6 I2C

I²C signals are available on connector J5210.

Optionally a 128kBit I²C serial EEPROM can be mounted on the M28EVK (not populated in the default configuration). The intended part number is M24128-BRMN6 by STMicroelectronics, more information is available under http://www.st.com/internet/mcu/product/94348.jsp.

3.1.7 SSP/SPI

SSP signals are available on connector J5210.

Optionally an 8 Mbit SPI Flash can be mounted on the M28EVK (not populated in the default configuration). The intended part number is M25P80 by Numonyx, more information is available under http://www.micron.com/parts/nor-flash/serial-nor-flash/m25p80-vmc6g.

3.2 CPU JTAG

M28 supports a JTAG interface for use of a standard JTAG tool on connector J5200. Connector J5200 provides the following pinout:

Signal 3V3	Pin 1	Pin 2	Signal 3V3
JTAG_TRST	3	4	GND
JTAG_TDI	5	6	GND
JTAG_TMS	7	8	GND
JTAG_TCK	9	10	GND
JTAG_RTCK	11	12	GND
JTAG_TDO	13	14	GND
•	15	16	GND
•	17	18	GND
•	19	20	GND

3.3 LCD and Touchscreen

3.3.1 LCD

On M28EVK all LCD signals are buffered by 74LVTH244MTC line driver and routed to connectors J1500 and J1520. By default connector J1500 aka LCD1 is populated and can be used with the default TFT display. Connector J1500 supplies the following pinout:

Pin	Signal
1	n.c.
2	n.c.
3	n.c.
4	LCD_BACKLIGHT
5	LCD_BACKLIGHT
6	LCD_BACKLIGHT
7	3V3
8	n.c.
9	LCD_ENABLE
10	LRADC4
11	LRADC3
12	PWM_3
13	LCD_D5
14	LCD_D4
15	LCD_D3
16	GND
17	LCD_D2
18	LCD_D1
19	LCD_D0
20	GND
21	LCD_D11
22	LCD_D10
23	LCD_D09
25	LCD_D8
26	LCD_D7
27	LCD_D6

Continued on next page

Table 3.1 – continued from previous page

Pin	Signal
28	GND
29	LCD_D17
30	LCD_D16
31	LCD_D15
32	GND
33	LCD_D14
34	LCD_D13
35	LCD_D12
36	GND
37	LRADC2
38	LRADC5
39	LCD_DOTCLK
40	n.c.
M1	GND
M2	GND

Connector J1520 provides the following pinout:

Signal	Pin	Pin	Signal
LCD_ENABLE	1	2	LRADC4
GND	3	4	LRADC3
LCD_D5	5	6	LCD_BACKLIGHT
LCD_D4	7	8	LCD_BACKLIGHT
LCD_D3	9	10	LCD_BACKLIGHT
GND	11	12	3V3
LCD_D2	13	14	LCD_D18
LCD_D1	15	16	GND
LCD_D0	17	18	LCD_D19
GND	19	20	LCD_D20
LCD_D11	21	22	LCD_D21
LCD_D10	23	24	LCD_D22
LCD_D09	25	26	GND
GND	27	28	LCD_D23
LCD_D8	29	30	LCD_WR_RWN
LCD_D7	31	32	LCD_CS
LCD_D6	33	34	LCD_HSYNC
GND	35	36	GND
LCD_D17	37	38	LCD_RD_E
LCD_D16	39	40	LCD_RESET
LCD_D15	41	42	LCD_VSYNC
LCD_D14	43	44	PWM_3
LCD_D13	45	46	GND
LCD_D12	47	48	LRADC2
LCD_DOTCLK	49	50	LRADC5

3.3.2 LCD-Backlight

Switching the backlight on/off

Connector J1510 provides a 2 pin header for connecting 5V to the backlight signals of connector J1500 and J1520.

J1510	LCD_BACKLIGHT
Open	Disabled
Closed	Enabled, backlightsignals of J1500 and J1520 are connected to 5V

Dimming the backlight:

J1550	LCD_BACKLIGHT
Close pins 1-2	Connect PWM4 of the I.MX28 CPU to voltage level translator MAX3371 to LCD backlight. Control LCD backlight by PWM signal.
Close pins 2-3	Connect LCD backlight to voltage divider R1552 – R1553.

!R1552/R1553 are not populated by default!

3.3.3 Touchscreen

The touchscreen controller is implemented by using the LRADC signals LRADC2, LRADC3, LRADC4 and LRADC5 on connectors J1500 and J1520.

3.4 I/O Expansion

For further implementations of GPIOs the CPLD Altera EPM3064ATI100-10N (http://www.altera.com/cgi-bin/devsearch.pl?pn=0&q=EPM3064ATI100-10N+++++++++&site=www) is connected to both SPI and I²C. For loading the CPLD a dedicated JTAG connector can be used:

Pin	Signal
1	TCK
2	GND
3	TDO
4	3V3
5	TMS
6	NC
7	NC
8	NC
9	TDI
10	GND

In total 50 GPIOs can be implemented via the CPLD:

Pin	CPLD Signal	Pin	CPLD Signal
1	A9	2	D14
3	A10	4	D13
5	A11	6	D12
7	A12	8	D11
9	A13	10	D10
11	A14	12	D9
13	A15	14	D8
15	B14	16	D7
17	B13	18	B12
19	D5	20	D6
21	D4	22	D3
23	D1	24	D2
25	C13	26	C15
27	C12	28	C14
29	C11	30	B11
31	C10	32	B10
33	C9	34	B9
35	C8	36	B8
37	C7	38	B1
39	C6	40	B2
41	C5	42	B3
43	C4	44	B4
45	C3	46	B5
47	C2	48	B6
49	C1	50	B7

3.5 Misc Signals

Pin	Signal
1	PWM0
2	SSP2_MISO
3	PWM1
4	SSP2_MOSI
5	PWM3
6	SSP2_SCK
7	PWM4
8	SSP2_SS
9	SSP1_CMD
10	SSP3_MISO
11	SSP1_DATA0
12	SSP3_MOSI
13	SSP1_DATA3
14	SSP3_SCK
15	SSP1_SCK
16	SSP3_SS
17	I2C_SDA
18	I2C_SCL
19	GND
20	GND

3.6 Audio

3.6.1 Headphone

Connector J1402 provides a standard Headphone Out interface for Audio applications and is connected to the SGTL5000 Audio Codec:

Pin	Signal
1	HP_VGND
2	HP_L
3	HP_R
4	n.c.
5	n.c.

3.6.2 Line In

Connectors J1410 and J1411 provide a standard Line In interface for Audio applications. They are connected to the SGTL5000 Audio Codec:

Connector J1410:

Pin	Signal
1	GND
2	LINEIN_R
3	GND
4	GND

Connector J1411:

Pin	Signal
1	GND
2	LINEIN_L
3	GND
4	GND

3.6.3 Microphone In

Connector J1401 provides a standard Microphone In interface for Audio applications and is connected to the SGTL5000 Audio Codec :

Pin	Signal
1	GND
2	MIC
3	n.c.
4	AGND
5	n.c.

3.6.4 Speaker

Connectors J1420 and J1421 provide a standard Speaker Out interface for Audio applications and are connected to the SGTL5000 Audio Codec whose output is gained by a TP2012D2 Audio Amplifier:

Connector J1420: Spk Out R

Pin	Signal
1	OUTR+
2	OUTR-

Connector J1421: Spk Out L

Pin	Signal
1	OUTL+
2	OUTL-

3.7 Boot-Mode Switch

Switch SW3350 enables the user to select different boot- and functional modes for the M28 System on Module:

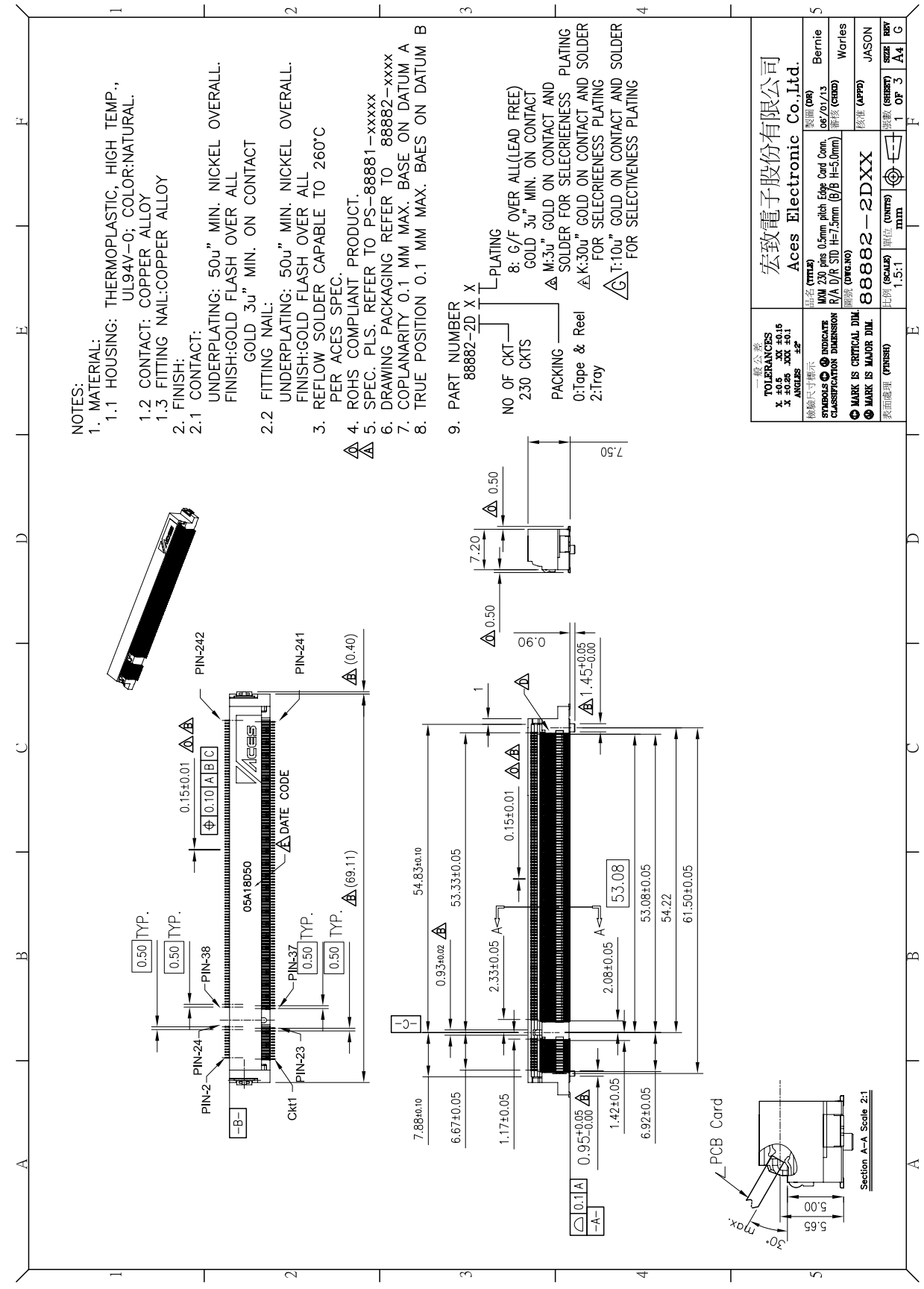
LCD_D[5]	LCD_D[4]	LCD_D[3]	LCD_D[2]	LCD_D[1]	LCD_D[0]	Port	Boot mode
X	X	0	0	0	0	USB0	USB (unencrypted vs. encrypted under OTP control)
X	0	0	0	0	1	I2C0	I2C0 master, 3.3 V
X	1	0	0	0	1	I2C0	I2C0 master, 1.8 V
X	0	0	0	1	0	SPI2	SPI master SSP2 boot from flash, 3.3 V
X	1	0	0	1	0	SPI2	SPI master SSP2 boot from flash, 1.8 V
X	0	0	0	1	1	SPI3	SPI master SSP3 boot from flash, 3.3 V
X	1	0	0	1	1	SPI3	SPI master SSP3 boot from flash, 1.8 V
X	0	0	1	0	0	GPMI	NAND, 3.3 V
X	1	0	1	0	0	GPMI	NAND, 1.8 V
X	0	0	1	0	1		Reserved
X	0	0	1	1	0	JTAG	Wait JTAG connection mode
X	0	0	1	1	1		Reserved
X	0	1	0	0	0	SPI3	SPI master SSP3 boot from EEPROM, 3.3 V
X	1	1	0	0	0	SPI3	SPI master SSP3 boot from EEPROM, 1.8 V
X	0	1	0	0	1	SSP0	SD/MMC master on SSP0, 3.3 V
X	1	1	0	0	1	SSP0	SD/MMC master on SSP0 1.8 V
X	0	1	0	1	0	SSP1	SD/MMC master on SSP1, 3.3 V
X	1	1	0	1	0	SSP1	SD/MMC master on SSP1 1.8 V
X	0	1	0	1	1		Reserved
X	0	1	1	0	0		Reserved
X	0	1	1	0	1		Reserved
X	0	1	1	1	0		Reserved
X	0	1	1	1	1		Reserved

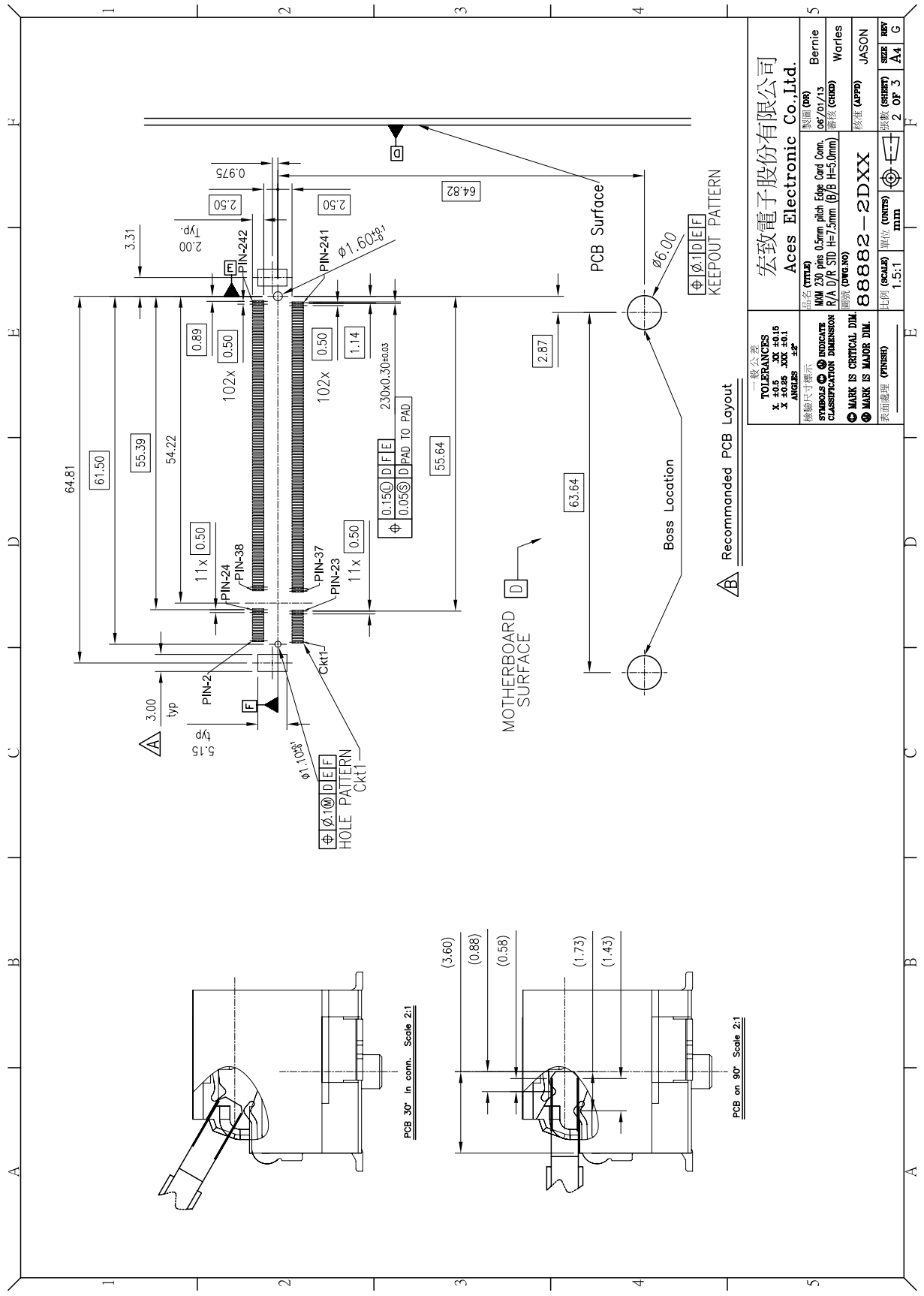
3.8 Accessories

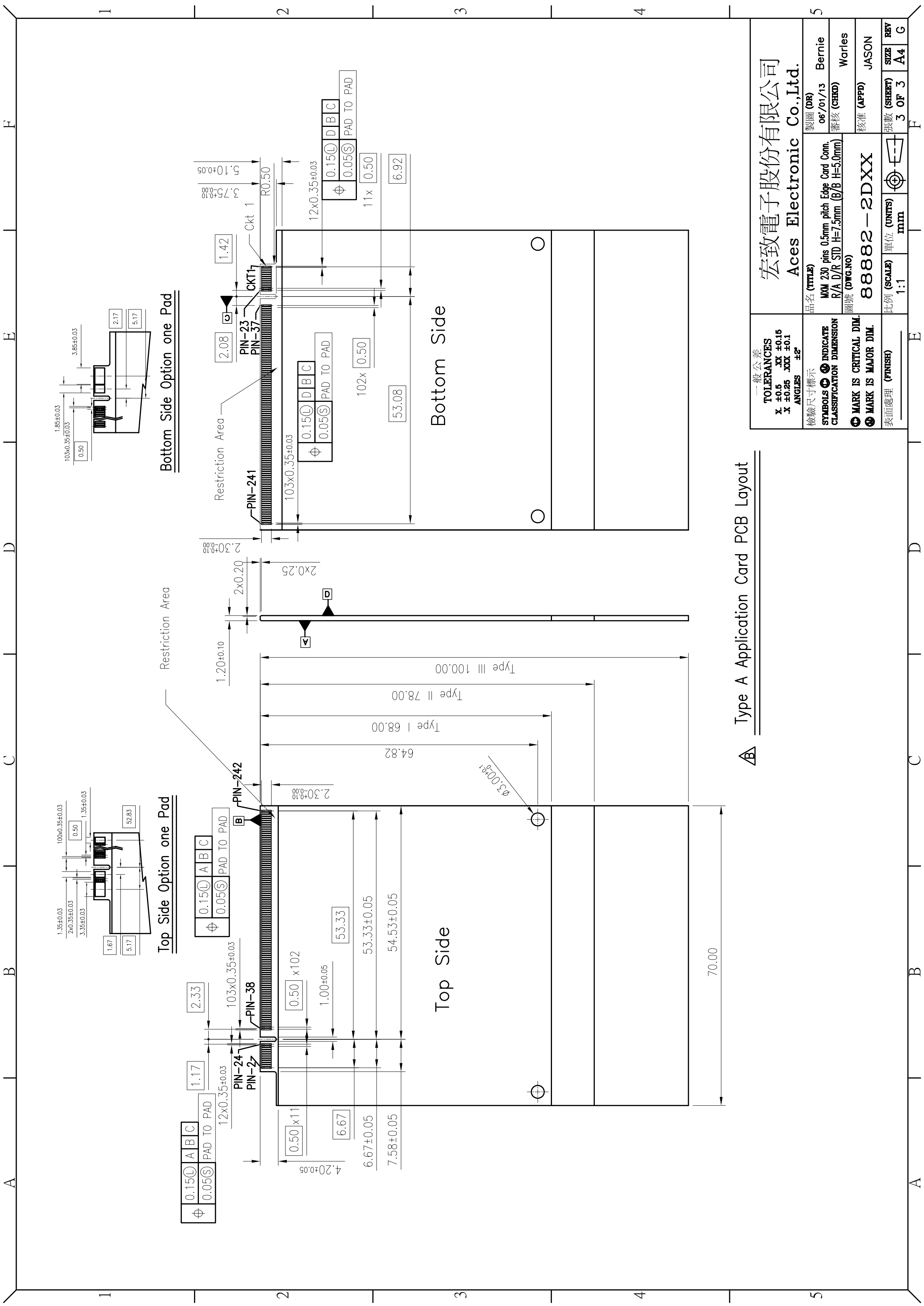
3.8.1 MXM2 Connector

The following parts are recommended for use with M28:

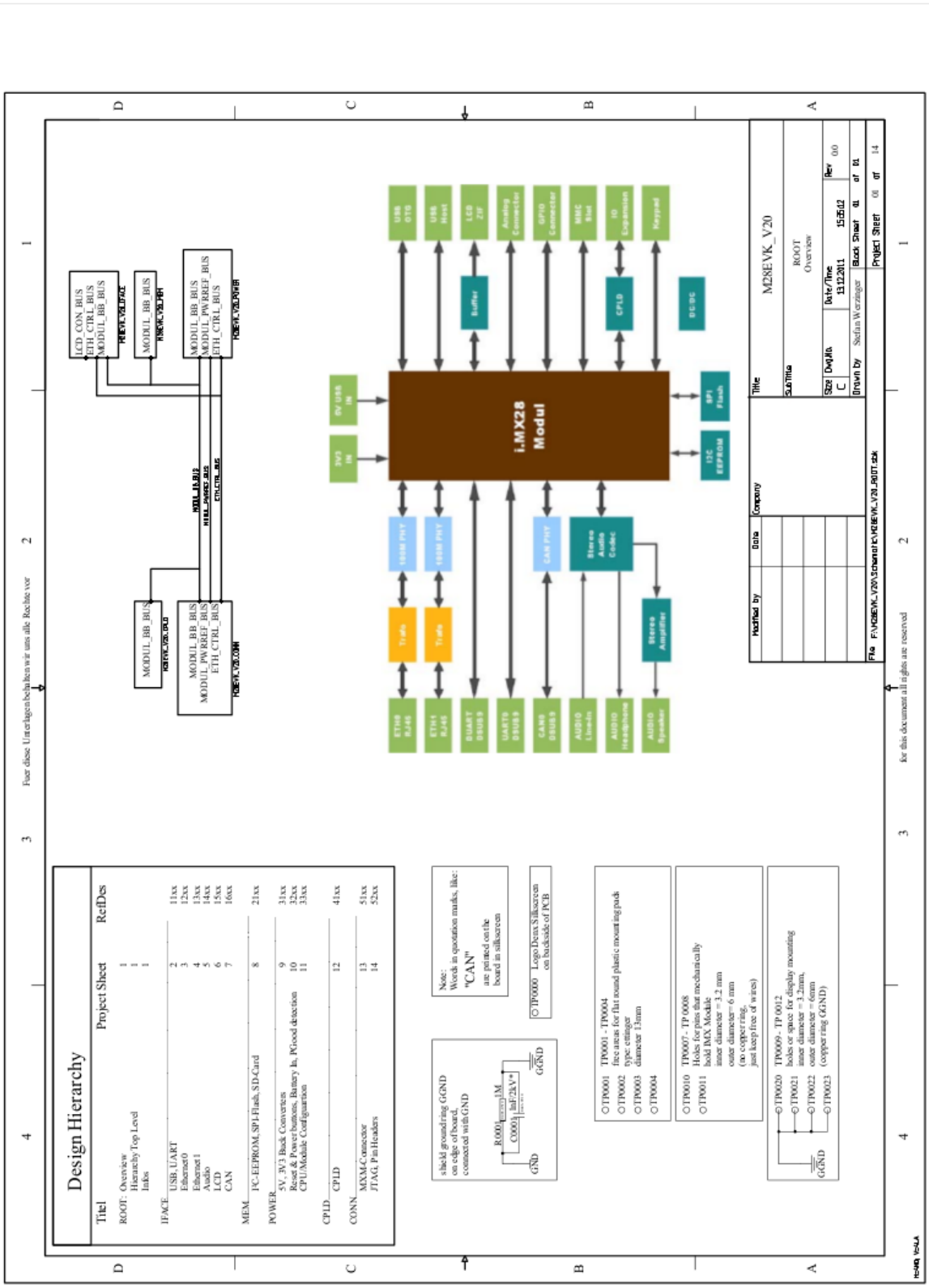
Part Number	Board to Board Height	Overall Height	Contact Area
88882-2D08	5,0	7,5	Gold Flash Over All
88882-2D0T	5,0	7,5	10u” Gold on Contact

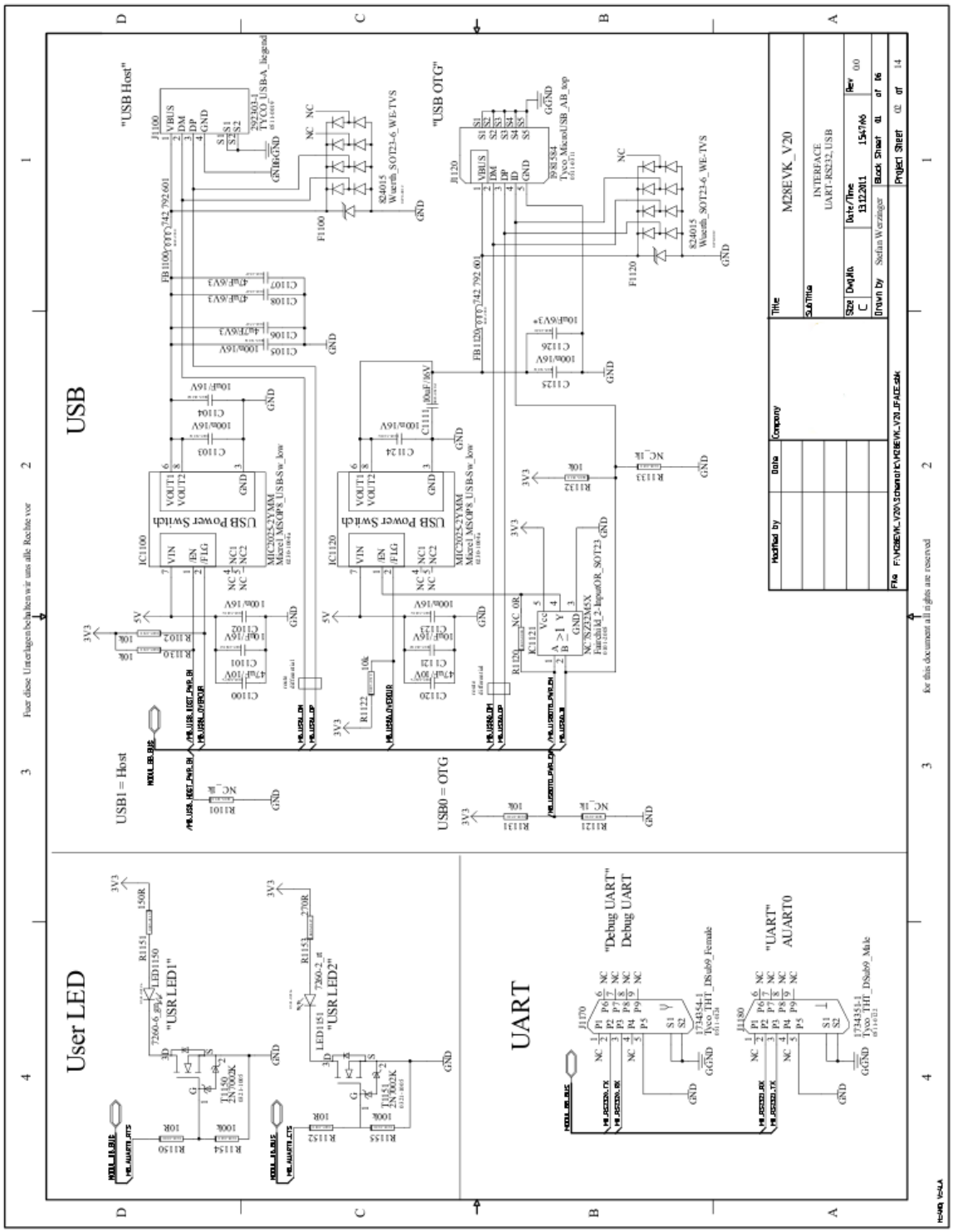

NOTES:
1. MATERIAL:
1.1 HOUSING: THERMOPLASTIC, HIGH TEMP., UL94V-0; COLOR:NATURAL.
1.2 CONTACT: COPPER ALLOY
1.3 FITTING NAIL:COPPER ALLOY
2. FINISH:
2.1 CONTACT:
UNDERPLATING: 50u" MIN. NICKEL OVERALL.
FINISH:GOLD FLASH OVER ALL
GOLD 3u" MIN. ON CONTACT
2.2 FITTING NAIL:
UNDERPLATING: 50u" MIN. NICKEL OVERALL.
FINISH:GOLD FLASH OVER ALL
3. REFLOW SOLDER CAPABLE TO 260°C PER ACES SPEC.
4. ROHS COMPLIANT PRODUCT.
5. SPEC. PLS. REFER TO PS-88881-xxxxx
6. DRAWING PACKAGING REFER TO 88882-xxxx
7. COPLANARITY 0.1 MM MAX. BASE ON DATUM A
8. TRUE POSITION 0.1 MM MAX. BAES ON DATUM B
9. PART NUMBER
88882-2D X X
PLATING
8: G/F OVER ALL(LEAD FREE)
GOLD 3u" MIN. ON CONTACT
M:3u" GOLD ON CONTACT AND SOLDER FOR SELECRIEENESS PLATING
K:30u" GOLD ON CONTACT AND SOLDER FOR SELECRIEENESS PLATING
T:10u" GOLD ON CONTACT AND SOLDER FOR SELECTIVENESS PLATING
NO OF CKT
230 CKTS
PACKING
0:Tape & Reel
2:Tray
一般公差
TOLERANCES
X ±0.5 XX ±0.15
X ±0.25 XXX ±0.1
ANGLES ±2°
檢驗尺寸標示
SYMBOLS INDICATE CLASSIFICATION DIMENSION
MARK IS CRITICAL DIM.
MARK IS MAJOR DIM.
表面處理 (FINISH)
宏致電子股份有限公司
Aces Electronic Co.,Ltd.
品名 (TITLE)
MM 230 pins 0.5mm pitch Edge Card Conn. R/A D/R STD H=7.5mm (B/B H=5.0mm)
圖號 (DWG.NO)
88882-2DXX
製圖 (DSE) Bernie 06/01/13
審核 (CHKD) Worles
核准 (APPD) JASON
比例 (SCALE) 1.5:1
單位 (UNITS) mm
張數 (SHEET) 1 OF 3
SIZE A4
REV G
PIN-2
PIN-24
PIN-38
PIN-37
PIN-23
PIN-242
PIN-241
Ckt1
-B-
-A-
-C-
05A18D50
DATE CODE
0.50 TYP.
0.15±0.01
0.10 A B C
(0.40)
(69.11)
54.83±0.10
53.33±0.05
0.93±0.02
2.33±0.05
2.08±0.05
53.08
53.08±0.05
54.22
61.50±0.05
7.88±0.10
6.67±0.05
1.17±0.05
1.42±0.05
6.92±0.05
0.95+0.05 -0.00
1.45+0.05 -0.00
0.90
7.20
7.50
0.1 A
PCB Card
5.65
5.00
Max.
Section A-A Scale 2:1

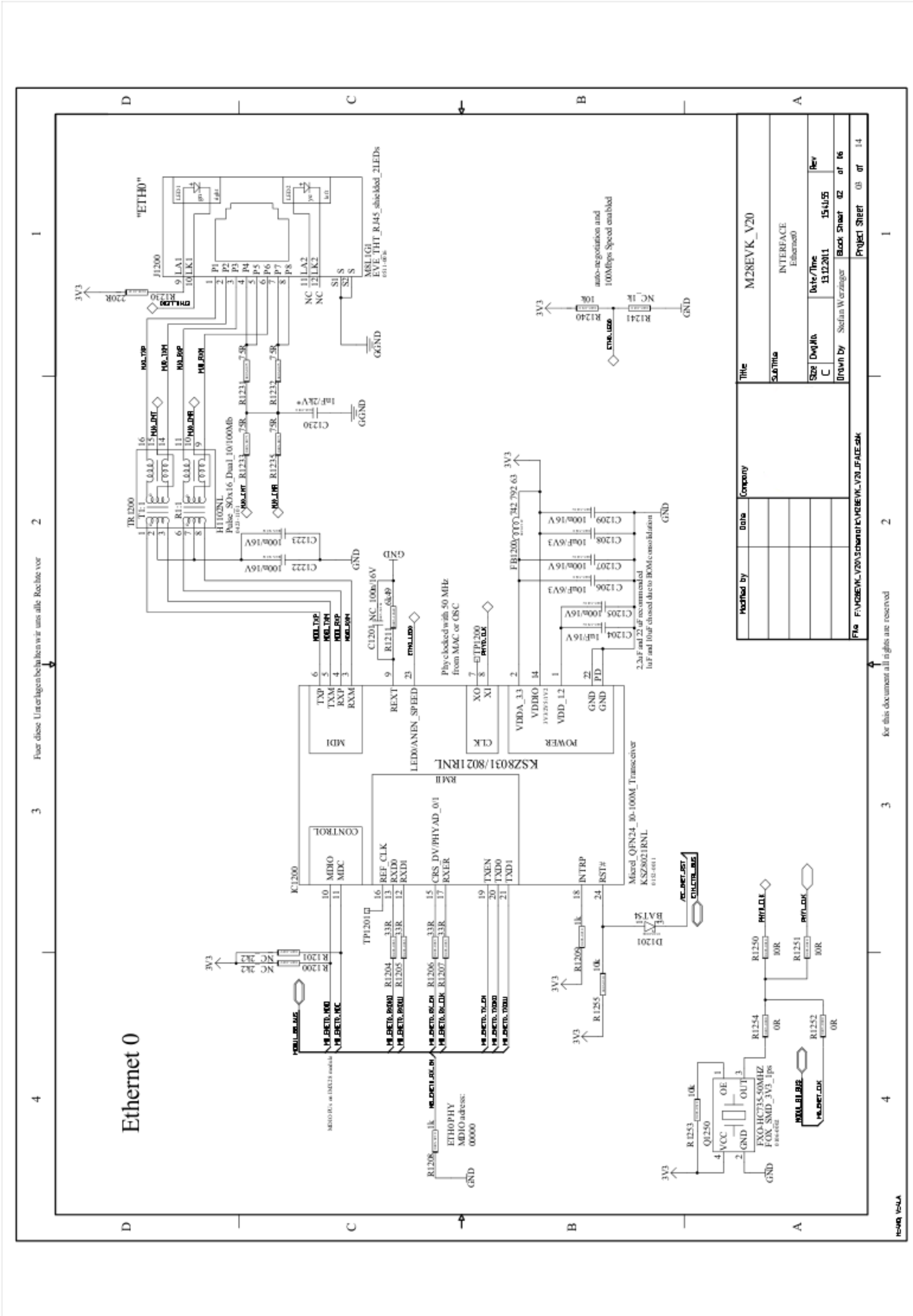

宏致電子股份有限公司
Aces Electronic Co.,Ltd.
88882-2DXX
MXM 230 pins 0.5mm pitch Edge Card Conn. R/A D/R STD H=7.5mm (B/B H=5.0mm)
Bernie
Warles
JASON
PCB Surface
KEEPOUT PATTERN
Recommanded PCB Layout
Boss Location
MOTHERBOARD SURFACE
HOLE PATTERN
PIN-1
PIN-2
PIN-23
PIN-24
PIN-37
PIN-38
PIN-241
PIN-242
Ckt1
64.82
63.64
61.50
55.64
55.39
54.22
64.81
2.87
PCB 30° In conn. Scale 2:1
PCB on 90° Scale 2:1


Type A Application Card PCB Layout
Top Side
Bottom Side
Top Side Option one Pad
Bottom Side Option one Pad
Restriction Area
Type III 100.00
Type II 78.00
Type I 68.00
宏致電子股份有限公司
Aces Electronic Co.,Ltd.
MXM 230 pins 0.5mm pitch Edge Card Conn.
R/A D/R STD H=7.5mm (B/B H=5.0mm)
88882-2DXX
TOLERANCES
mm
1:1
3 OF 3
A4
G

3.9 Schematics




USB
"USB Host"
"USB OTG"
USB1 = Host
USB0 = OTG
USB Power Switch
User LED
"USR LED1"
"USR LED2"
UART
"Debug UART"
Debug UART
"UART"
AUART0
M28EVK_V20
INTERFACE
UART-RS232_USB


Ethernet 0
M28EVK_V20
INTERFACE
Ethernet0
KSZ8031/8021RNL
"ETH0"
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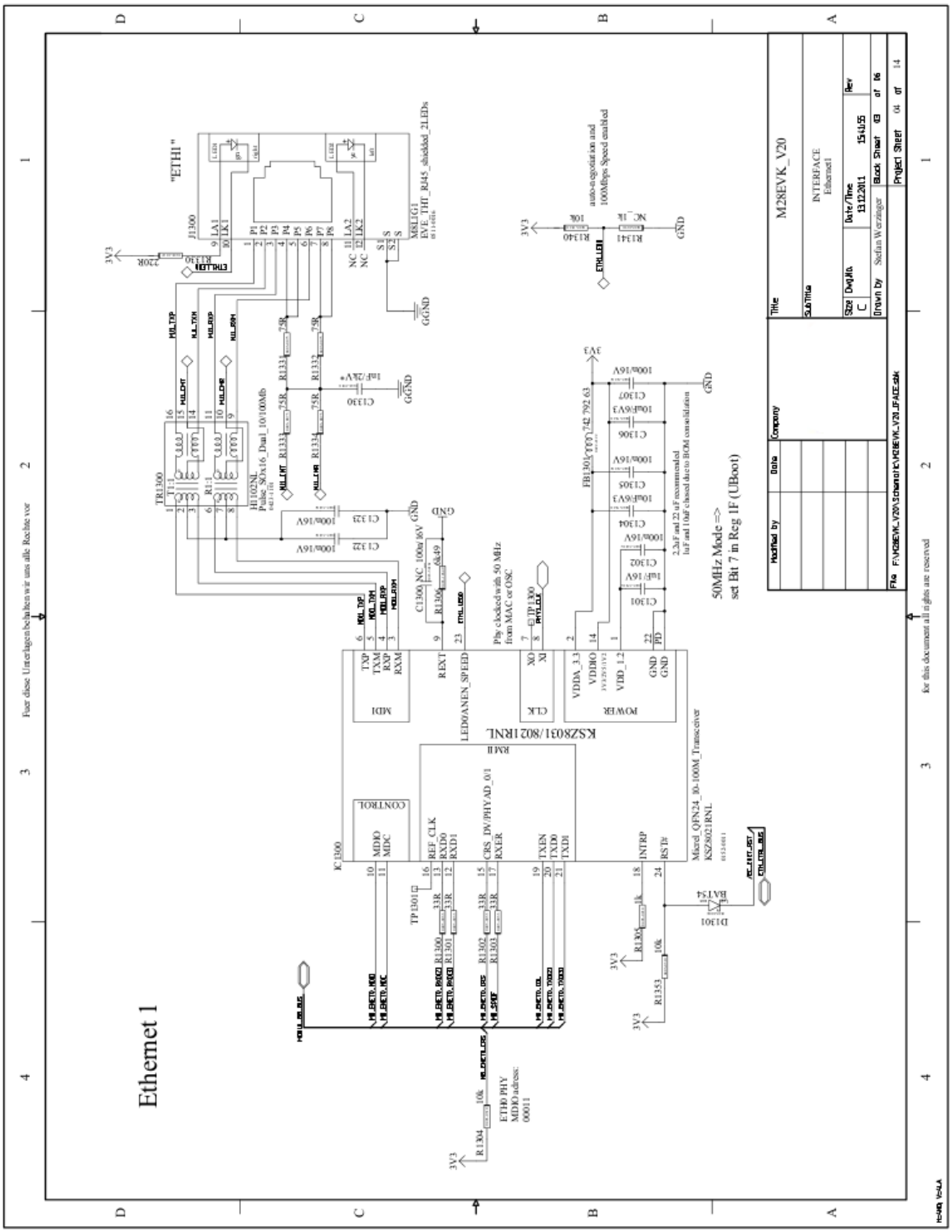
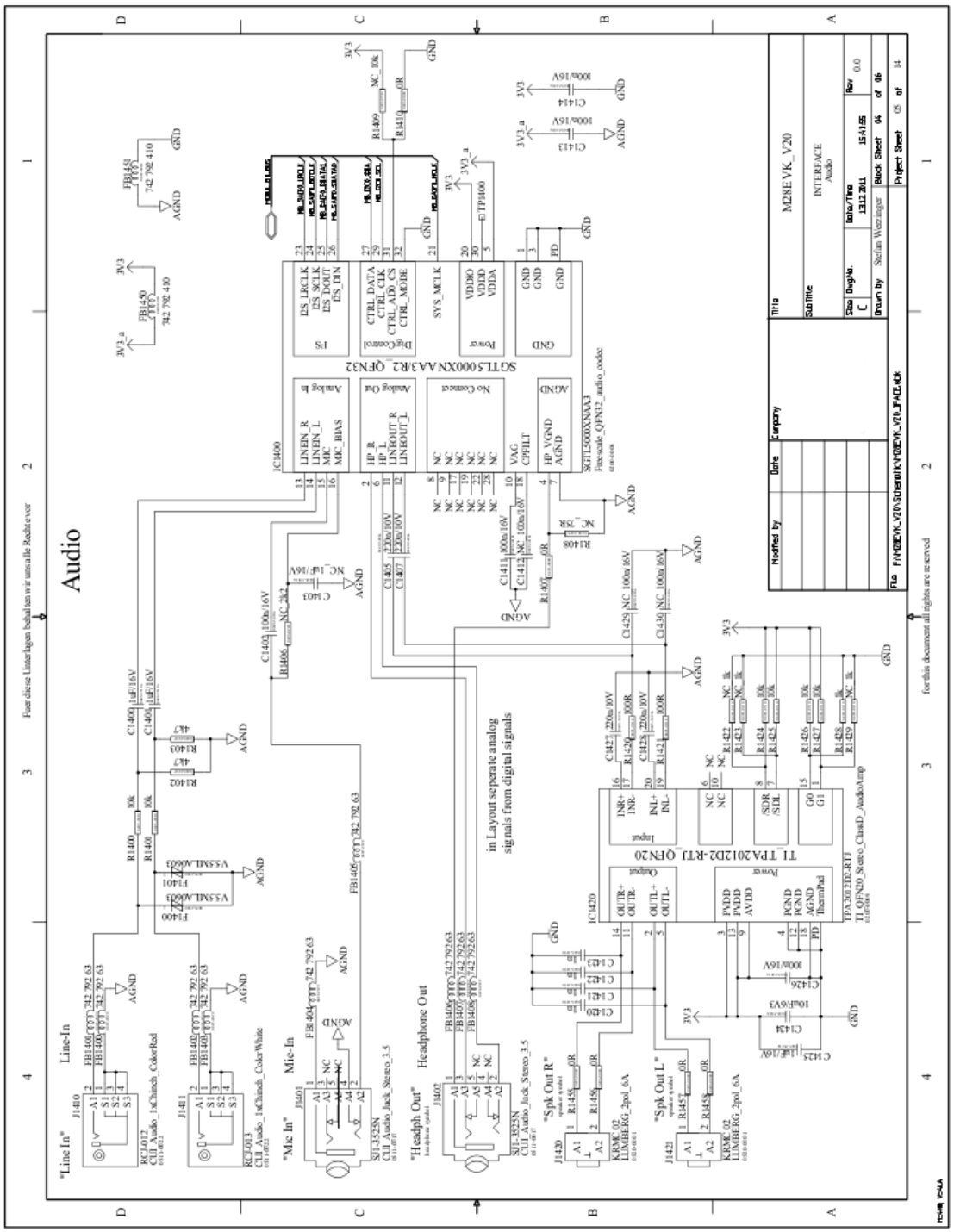
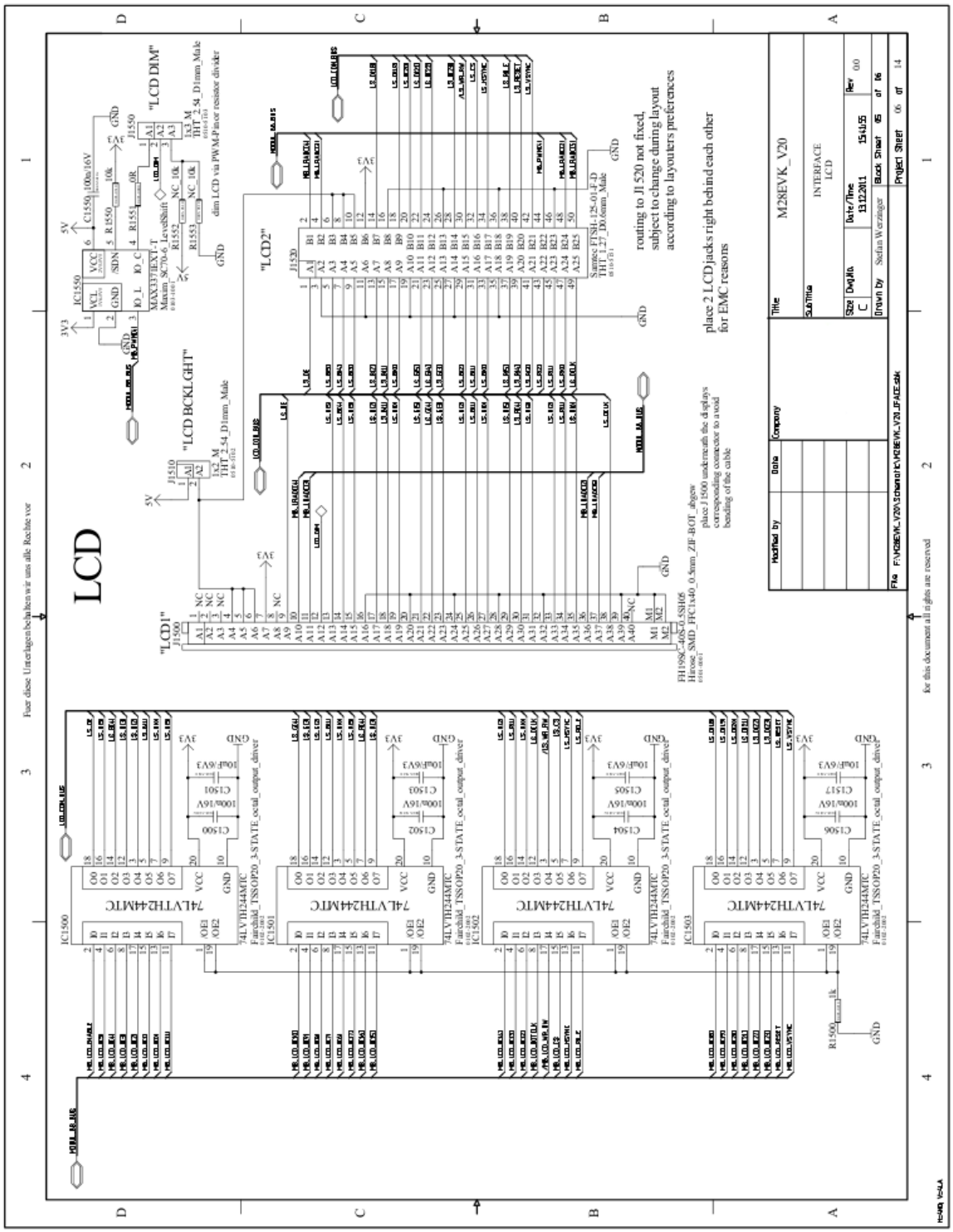
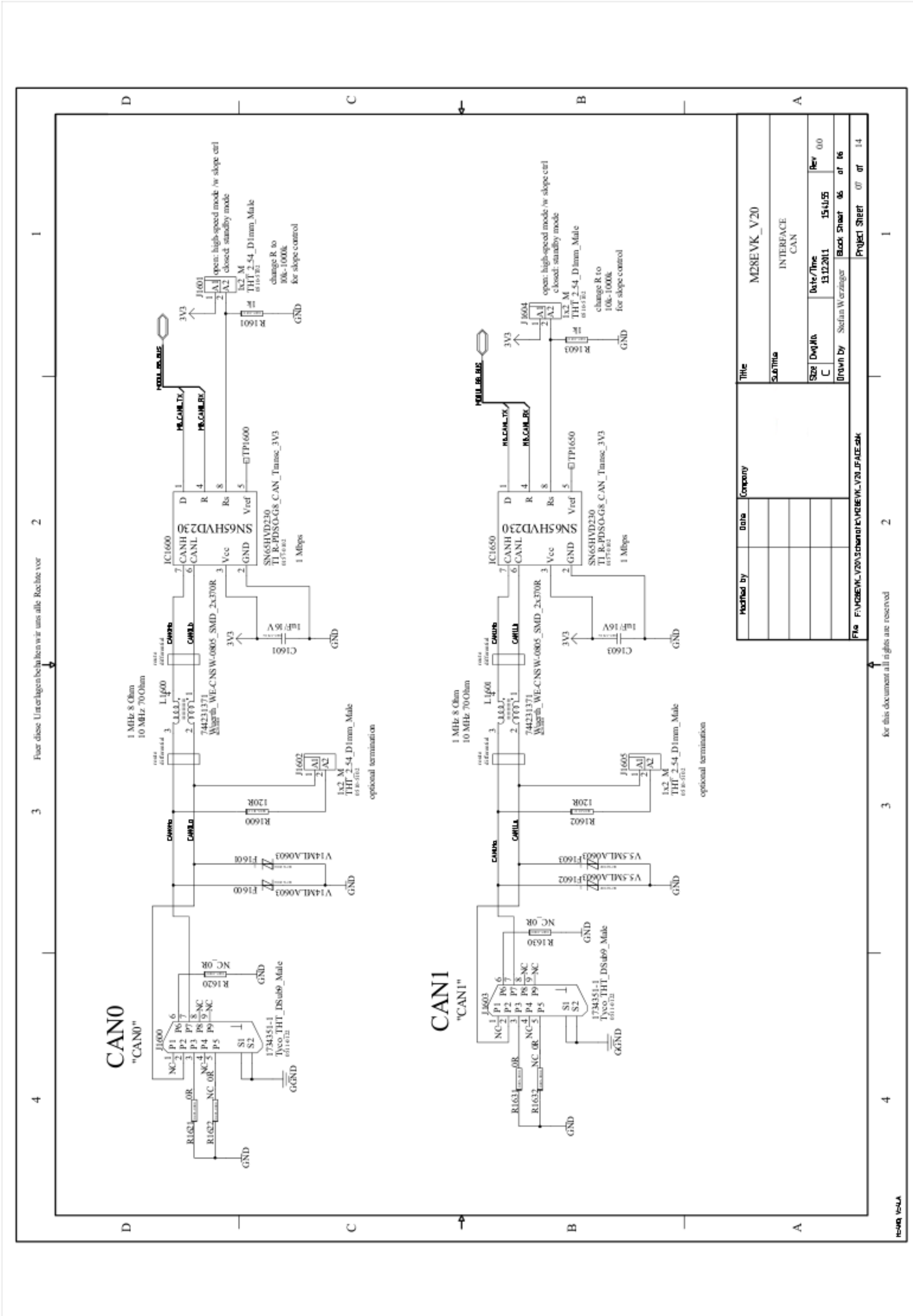

Ethernet 1
"ETH1"
KSZ8031/8021RNL
50MHz Mode =>
set Bit 7 in Reg 1F (UBoot1)
M28EVK_V20
INTERFACE
Ethernet1


Audio
Line-In
Mic-In
Headphone Out
in Layout seperate analog signals from digital signals
M28EVK_V20
INTERFACE
Audio


LCD
"LCD1"
"LCD2"
"LCD BCKLGHT"
"LCD DIM"
routing to J1 520 not fixed,
subject to change during layout
according to layouters preferences
place 2 LCD jacks right behind each other
for EMC reasons
M28EVK_V20
INTERFACE
LCD


CAN0
"CAN0"
CAN1
"CAN1"
IC1600
IC1650
SN65HVD230
TI_R-PDSO-G8_CAN_Transc_3V3
1 Mbps
open: high-speed mode /w slope ctrl
closed: standby mode
change R to
10k-1000k
for slope control
1x2_M
THT_2.54_D1mm_Male
optional termination
1 MHz 8 Ohm
10 MHz 70 Ohm
744231371
Würth_WE-CNSW-0805_SMD_2x370R
1734351-1
Tyco_THT_DSub9_Male
V14MLA0603
V5.5MLA0603
1uF/16V
120R
NC_0R
3V3
GND
GGND
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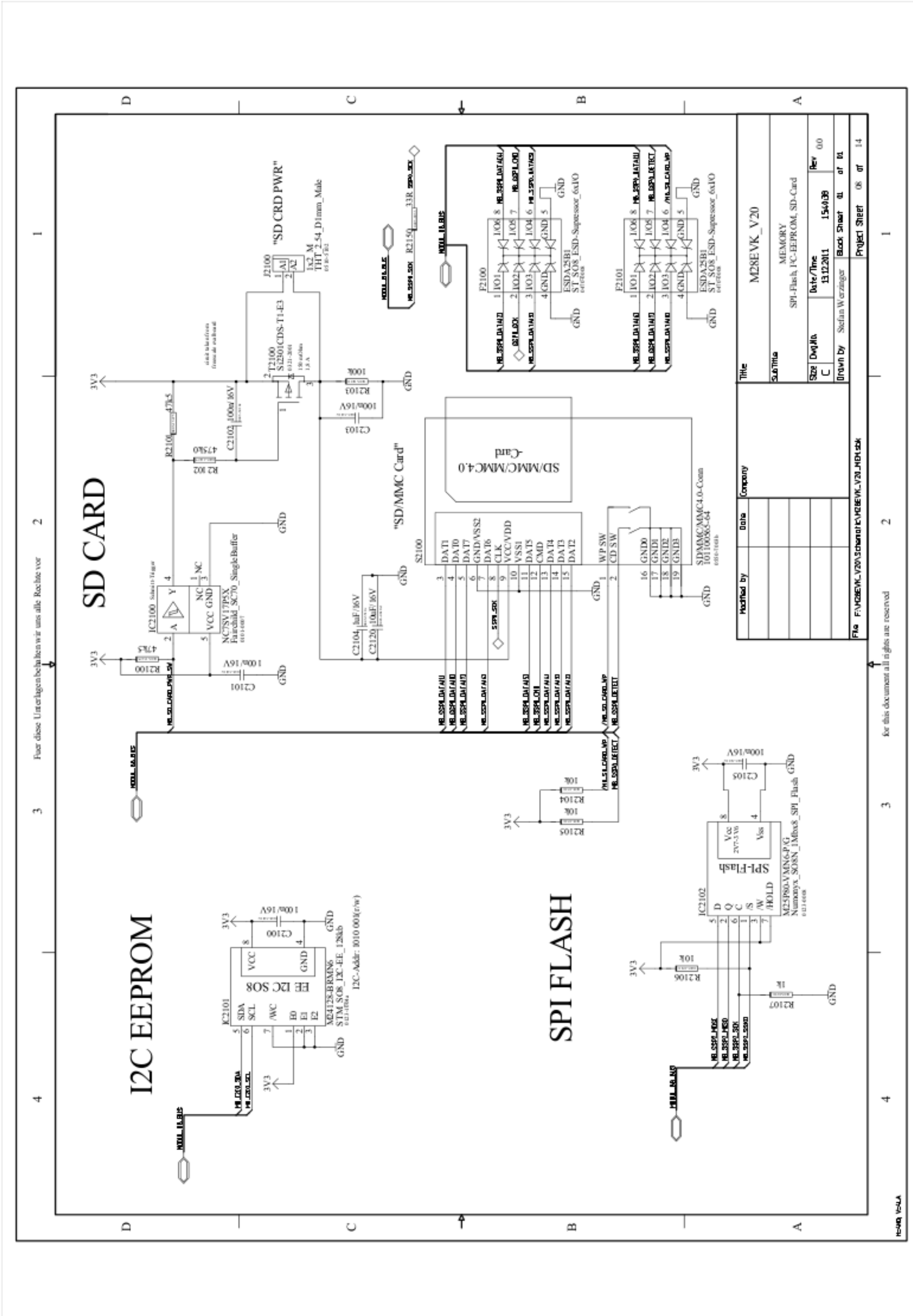
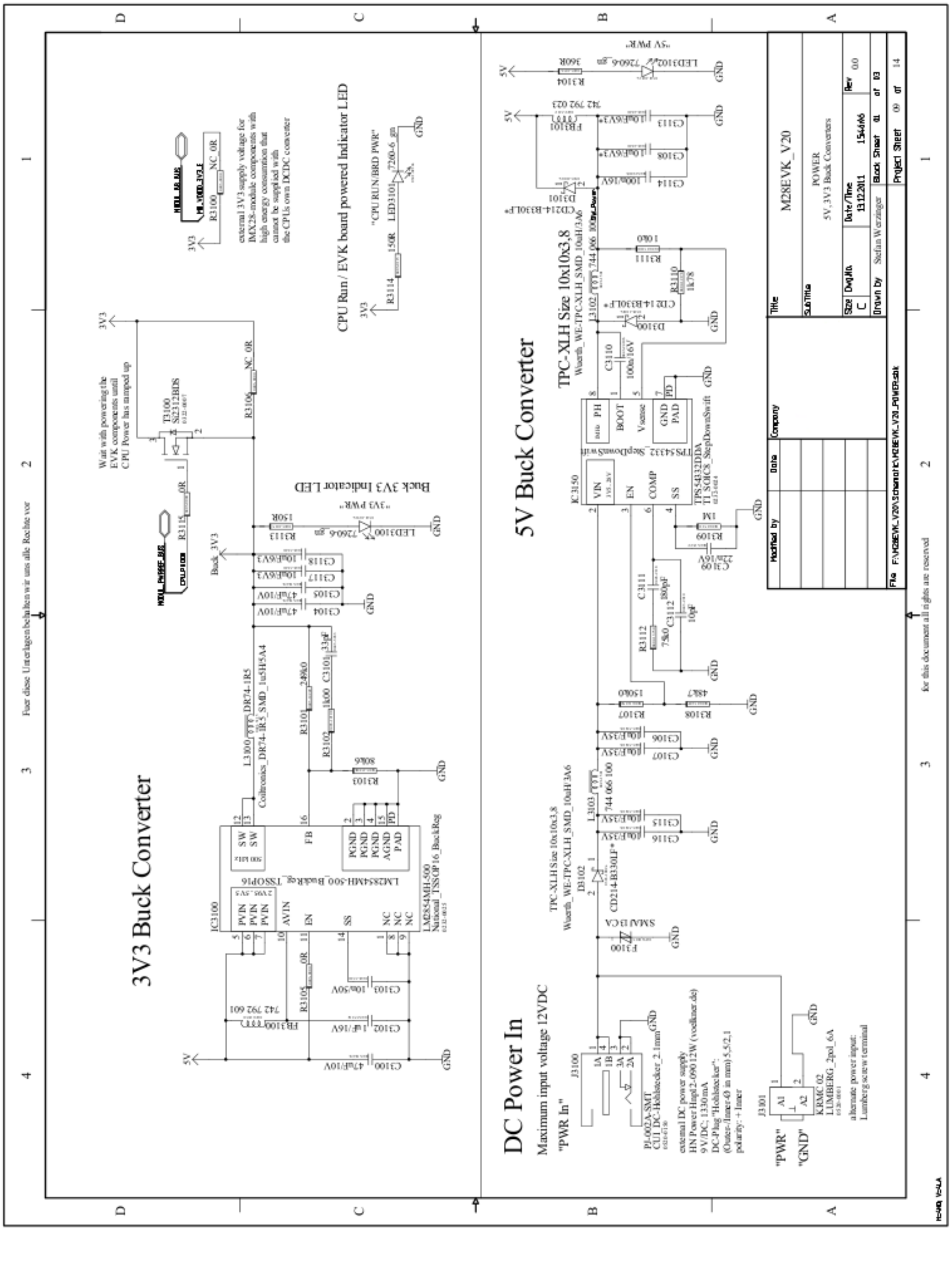
M28EVK_V20
INTERFACE
CAN
Stefan Werzinger
13.12.2011
15:41:55
Title
SubTitle
Size
C
Modified by
Date
Company
Drawn by
Date/Time
Block Sheet 06 of 06
Project Sheet 07 of 14
Rev
0.0


SD CARD
I2C EEPROM
SPI FLASH
"SD CRD PWR"
"SD/MMC Card"
SD/MMC/MMC4.0-Card
EE I2C SO8
SPI-Flash
M28EVK_V20
MEMORY
SPI-Flash, I²C-EEPROM, SD-Card
Stefan Werzinger
13.12.2011


3V3 Buck Converter
5V Buck Converter
DC Power In
Maximum input voltage 12VDC
CPU Run / EVK board powered Indicator LED
Buck 3V3 Indicator LED
TPC-XLH Size 10x10x3,8
M28EVK_V20
POWER
5V_3V3 Buck Converters
Stefan Werzinger
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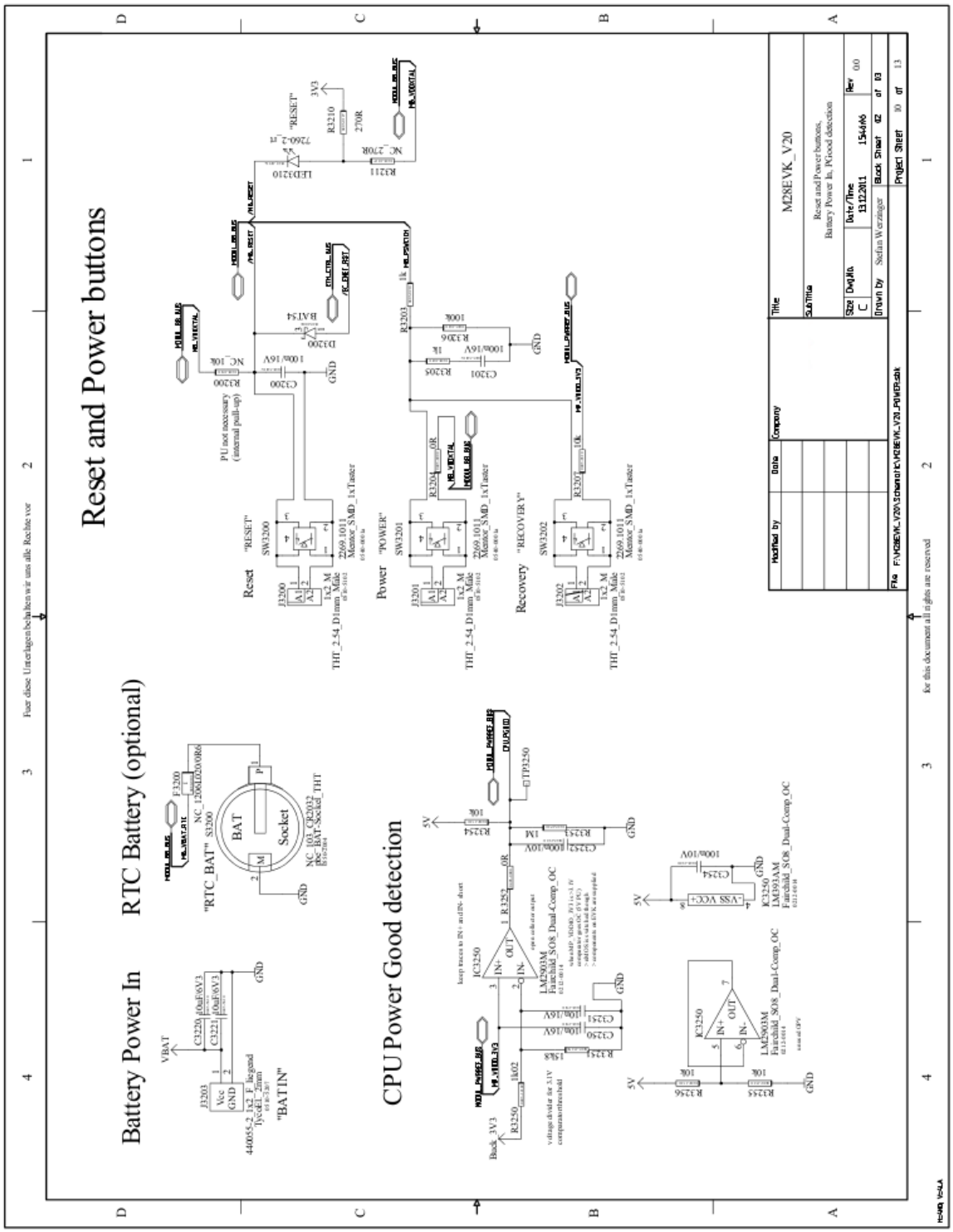
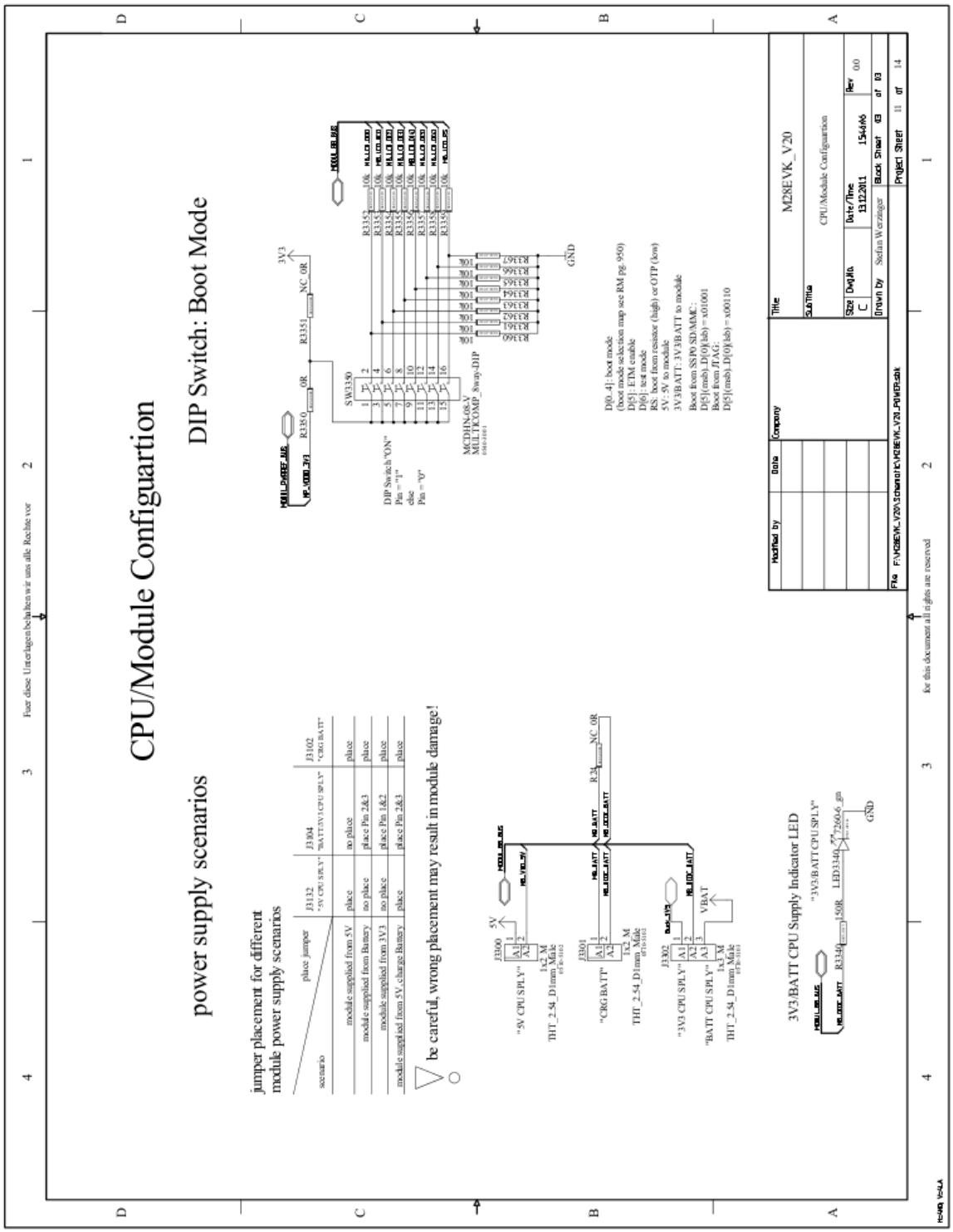
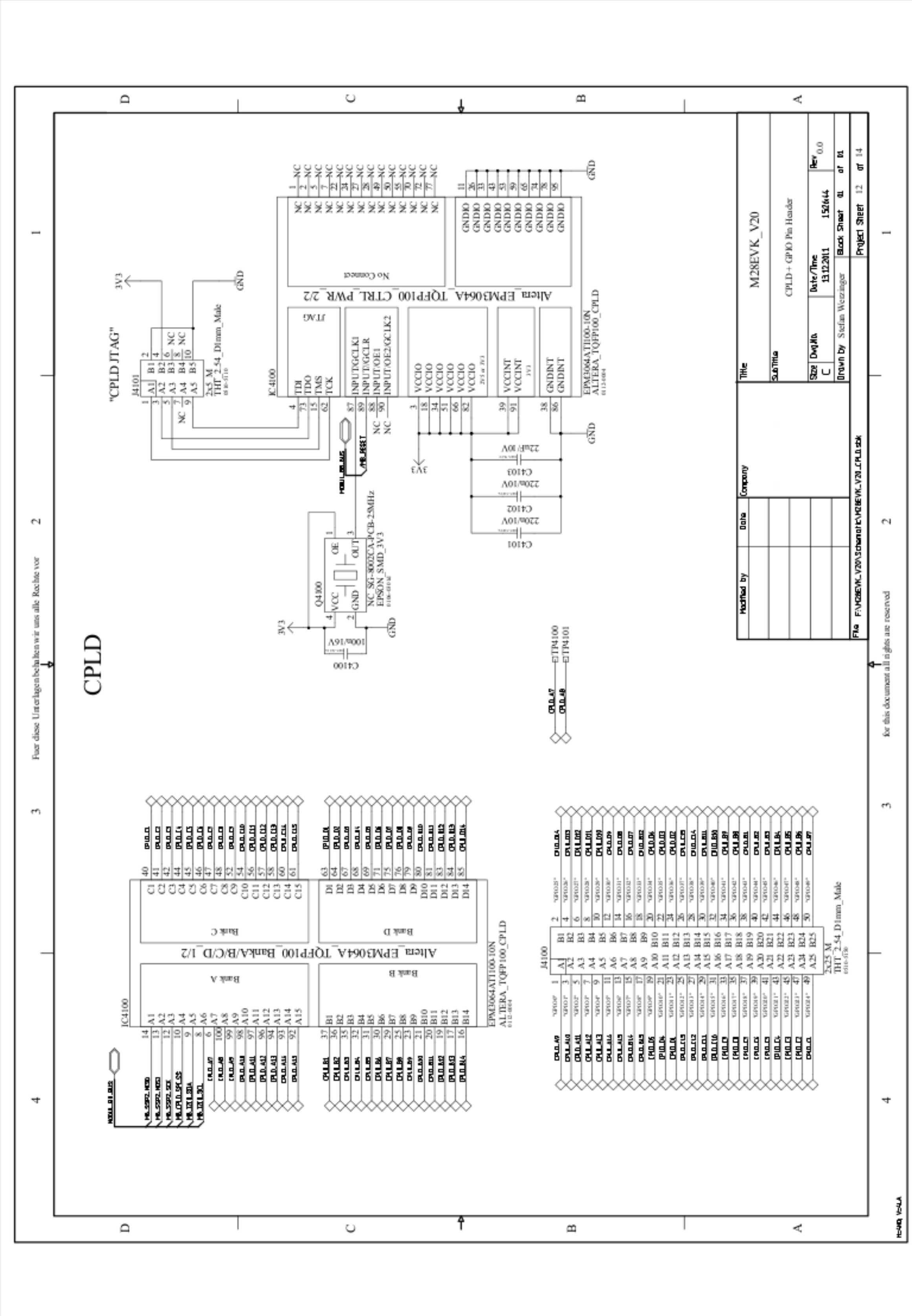

Reset and Power buttons
Battery Power In
RTC Battery (optional)
CPU Power Good detection
Reset
Power
Recovery
"RESET"
"POWER"
"RECOVERY"
"RTC_BAT"
"BAT IN"
M28EVK_V20
Reset and Power buttons,
Battery Power In, PGood detection


CPU/Module Configuartion
power supply scenarios
DIP Switch: Boot Mode
jumper placement for different
module power supply scenarios
be careful, wrong placement may result in module damage!
3V3/BATT CPU Supply Indicator LED
M28EVK_V20
CPU/Module Configuration


CPLD
"CPLD JTAG"
Altera_EPM3064A_TQFP100_CTRL_PWR_2/2
Altera_EPM3064A_TQFP100_BankA/B/C/D_1/2
M28EVK_V20
CPLD + GPIO Pin Header
Drawn by Stefan Wetzinger
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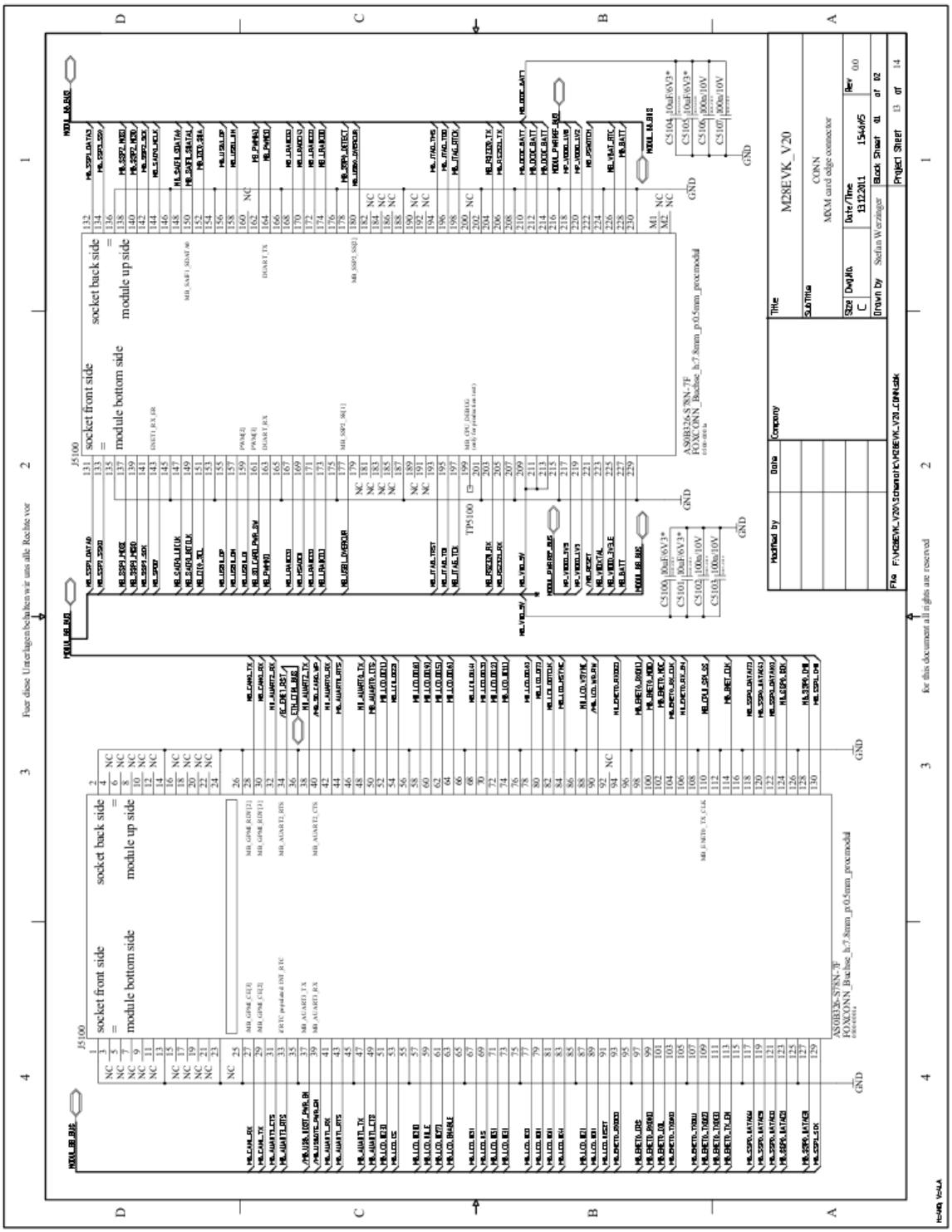

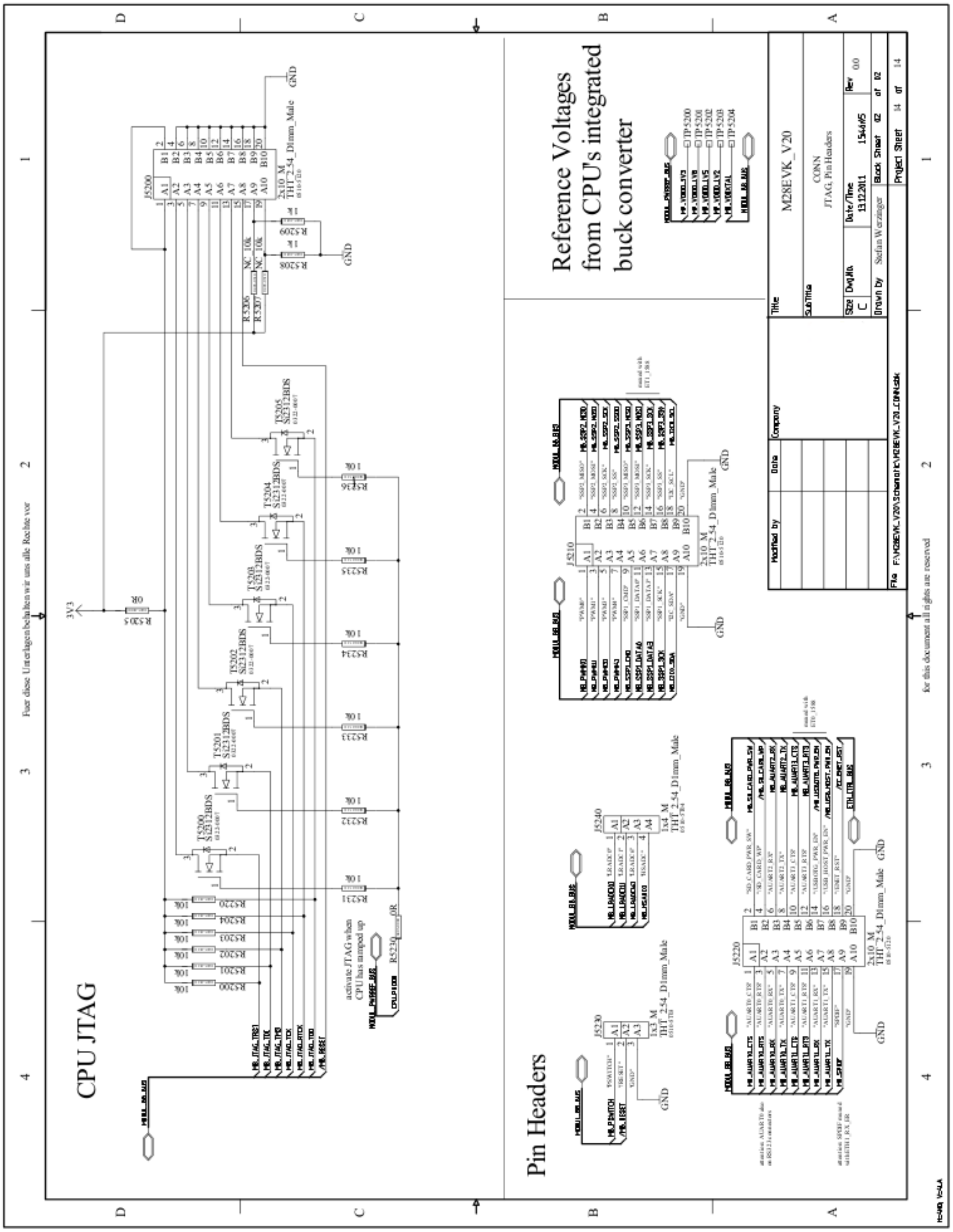
CPU JTAG
Pin Headers
Reference Voltages
from CPU's integrated
buck converter
M28EVK_V20
CONN
JTAG, Pin Headers
Stefan Werzinger
13.12.2011
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