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IPS LED MONITOR

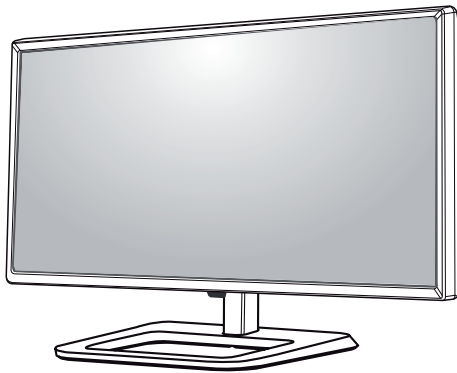
SERVICE MANUAL

CHASSIS : LM41C

MODEL : 31MU97 31MU97-BD

CAUTION

BEFORE SERVICING THE CHASSIS,
READ THE SAFETY PRECAUTIONS IN THIS MANUAL.



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SAFETY PRECAUTIONS

IMPORTANT SAFETY NOTICE

Many electrical and mechanical parts in this chassis have special safety-related characteristics. These parts are identified by \triangle in the Schematic Diagram and Exploded View.

It is essential that these special safety parts should be replaced with the same components as recommended in this manual to prevent Shock, Fire, or other Hazards.

Do not modify the original design without permission of manufacturer.

General Guidance

An **isolation Transformer should always be used** during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks.

It will also protect the receiver and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

If any fuse (or Fusible Resistor) in this TV receiver is blown, replace it with the specified.

When replacing a high wattage resistor (Oxide Metal Film Resistor, over 1 W), keep the resistor 10 mm away from PCB.

Keep wires away from high voltage or high temperature parts.

Before returning the receiver to the customer,

always perform an **AC leakage current check** on the exposed metallic parts of the cabinet, such as antennas, terminals, etc., to be sure the set is safe to operate without damage of electrical shock.

Leakage Current Cold Check(Antenna Cold Check)

With the instrument AC plug removed from AC source, connect an electrical jumper across the two AC plug prongs. Place the AC switch in the on position, connect one lead of ohm-meter to the AC plug prongs tied together and touch other ohm-meter lead in turn to each exposed metallic parts such as antenna terminals, phone jacks, etc.

If the exposed metallic part has a return path to the chassis, the measured resistance should be between 1 M Ω and 5.2 M Ω .

When the exposed metal has no return path to the chassis the reading must be infinite.

An other abnormality exists that must be corrected before the receiver is returned to the customer.

Leakage Current Hot Check (See below Figure)

Plug the AC cord directly into the AC outlet.

Do not use a line Isolation Transformer during this check.

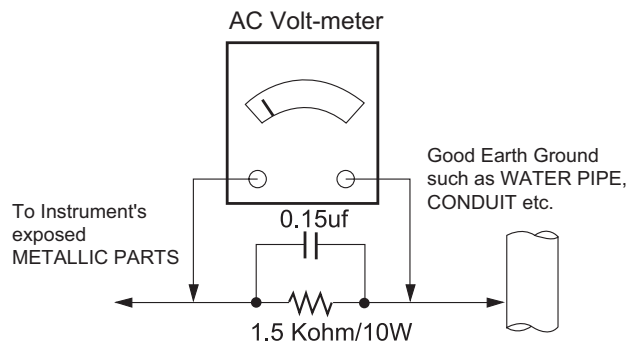
Connect 1.5 K / 10 watt resistor in parallel with a 0.15 uF capacitor between a known good earth ground (Water Pipe, Conduit, etc.) and the exposed metallic parts.

Measure the AC voltage across the resistor using AC voltmeter with 1000 ohms/volt or more sensitivity.

Reverse plug the AC cord into the AC outlet and repeat AC voltage measurements for each exposed metallic part. Any voltage measured must not exceed 0.75 volt RMS which corresponds to 0.5 mA.

In case any measurement is out of the limits specified, there is possibility of shock hazard and the set must be checked and repaired before it is returned to the customer.

Leakage Current Hot Check circuit




When 25A is impressed between Earth and 2nd Ground for 1 second, Resistance must be less than 0.1

*Base on Adjustment standard

SPECIFICATION

NOTE : Specifications and others are subject to change without notice for improvement.

1. Module General Specification

No	Item		Content	Remark
1	Customer		BRAND	
2	User Model Name		31MU97	
3	Sale region		Refer to Suffix standard	
4	Feature		31" LCD MONITOR(UHD)	
5	Chassis Name		LM41C	
6	General Scope	External SW &Adj.	 ◀, ▶, ▲, ▼, ⊙(push)	5-way joystick switch
		Function	PBP, Picture Mode Ratio, Gamma Calibration, ECO, Six Color, 5W speaker x 2, TCP, Screen split, USB hub(USB3.0 x 3)	
7	Power Code		Length : 1.55±0.05 M Shape : Wall-out Color : Black Weight : 0.16kg	Refer to Suffix standard and power cord table
8	Cable	USB	Length : 1.5m Shape : A-B Color : Black Pin Weight : 0.1kg	P/N : EAD61273120
		HDMI	Length : 1.8m Shape : Detachable Type Color : black Weight : 0.11kg	P/N : EAD00926103
		DP to Mini DP	Length : 1.8m Shape : Detachable Type Color : black Weight : 0.105kg	P/N : EAD63127601
9	Power		Input: AC100~240V 50~60Hz, 1.5A Max Output: DC 19V 6.2A 120W PSU Weight : 0.365kg	EAY63288601
10	Mechanical (ass'y)	Stand body	1kg	AAN750088
		Stand base	0.9kg	AAN750089
		Cable holder	0.008kg	AGF775993
		Screw	0.004kg (1ass'y : screw 2ea)	AGF767026
11	Manual ass'y		0.086kg	Refer to BOM
12	Handling guide		0.006kg	Refer to BOM
13	Factory calibration report		0.006kg	Refer to BOM
14	Applying module list		P/No	Specification
			EAJ62968501	LM310UH1-SLA2

- EDID Ver. 1.3 FOR HDMI1/2 PBP Data (256 Bytes)

00	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
00	FF	FF	FF	FF	FF	FF	00	1E	6D	EA	76	01	01	01	01	01
10	00	18	01	03	80	46	25	78	EA	1D	F1	AE	4F	35	B3	25
20	0D	50	54	21	08	00	71	40	81	80	81	C0	A9	C0	D1	C0
30	01	01	01	01	01	01	FD	72	00	A0	80	70	3E	80	20	58
40	65	0C	B8	6F	21	00	00	1A	02	3A	80	18	71	38	2D	40
50	58	2C	45	00	B8	6F	21	00	00	1E	00	00	00	FD	00	38
60	3D	1E	87	1E	00	0A	20	20	20	20	20	20	20	00	00	FC
70	00	33	31	4D	55	39	37	0A	20	20	20	20	20	20	01	6C
80	02	03	27	71	45	10	04	03	01	00	00	00	00	00	00	00
90	23	09	07	07	83	01	00	00	65	03	DC	00	10	00	00	00
A0	00	00	00	00	00	00	00	02	3A	80	18	71	38	2D	40	58
B0	2C	45	00	B8	6F	21	00	00	1E	01	1D	00	72	51	D0	1E
C0	20	6E	28	55	00	B8	6F	21	00	00	1E	00	00	00	00	00
D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	6B

- EDID Ver. 1.4 FOR DP/MiniDP PBP Data (256 Bytes)

00	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
00	FF	FF	FF	FF	FF	FF	00	1E	6D	EB	76	01	01	01	01	01
10	00	18	01	04	A5	46	25	78	9E	1D	F1	AE	4F	35	B3	25
20	0D	50	54	21	08	00	71	40	81	80	81	C0	A9	C0	D1	C0
30	01	01	01	01	01	01	FD	72	00	A0	80	70	3E	80	20	58
40	65	0C	B8	6F	21	00	00	1A	02	3A	80	18	71	38	2D	40
50	58	2C	45	00	B8	6F	21	00	00	1E	00	00	00	FD	00	38
60	3D	1E	87	1E	00	0A	20	20	20	20	20	20	20	00	00	FC
70	00	33	31	4D	55	39	37	0A	20	20	20	20	20	20	01	91
80	02	03	12	71	23	09	07	07	83	01	00	00	00	00	00	00
90	00	00	02	3A	80	18	71	38	2D	40	58	2C	45	00	B8	6F
A0	21	00	00	1E	01	1D	00	72	51	D0	1E	20	6E	28	55	00
B0	B8	6F	21	00	00	1E	00	00	00	00	00	00	00	00	00	00
C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	61

3.3. Function Check

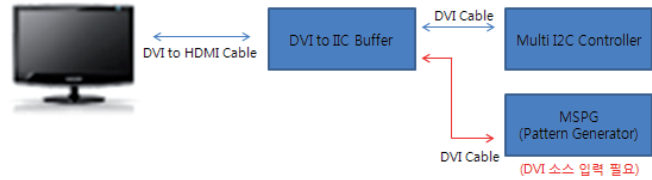
3.3.1. Check Screen

- Check input and signal items. (cf. work instructions)
- 1. HDMI1/2 (4096 x 2160 @24Hz)
- 2. DisplayPort1.2 (4096 x 2160 @60Hz) - using PC

4. Total Assembly line process

4.1. Write HDCP Key

- Write HDCP Key into EEPROM by using DDC2AB protocol & HDCP Adjustment Jig equipment.
- If error is occurred, try to write again.



4.2. White balance adjustment

- Adjust PRESET Warm(6500K) Color coordinates and Gamma calibration .
- Input Gamma calibration Pattern (R,G,B, Grey 20)
- Set as Warm(6500K) by commanding COLOR_MODE_CHANGE Command code.
- Gamma calibration and verify
Start - Read Elapsed time - Measure - Verify - Output Report - End
- Warm(6500K) Color adjustment.
Adjust to meet x/y color coordinate as below.

	2~4 min	4~8min	8~10min	10~25min	25~40min	40min~
x	0.318	0.318	0.317	0.316	0.314	0.313
y	0.339	0.338	0.337	0.334	0.332	0.329

* Save Warm(6500K) Color by commanding COLOR SAVE Command code.

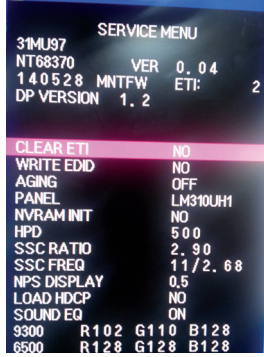
Insert HDMI Jack which is connected with PC for White Balance or equivalent device.

-> Total Assembly line should check whether the color coordinate(x,y) data refer to below table were meet or not.

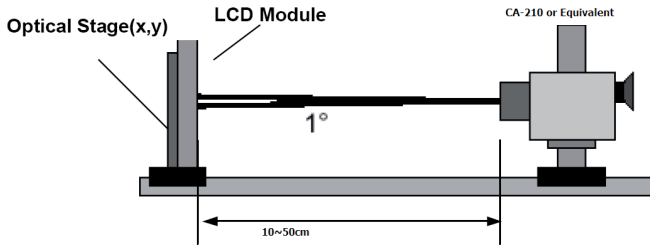
Color Temperature			Luminance(cd/m2)		
Cool	Medium	Warm	Cool	Medium	Warm
9,300k	8,000k	6,500k	Min : 170	Min : 200	Min : 260
°K	°K	°K			
X=0.283 (±0.03)	X=0.295 (±0.03)	X=0.313 (±0.03)			
Y=0.298 (±0.03)	Y=0.305 (±0.03)	Y=0.329 (±0.03)			
<Test Signal> Inner pattern (255gray,100IRE)			<Test Signal> Inner pattern (255gray,100IRE)		

*Note : x,y coordinates are drifted about 0.007 after 30 mins heat-run. So checking color coordinate within 5-min at total assembly line, consider x,y coordinates might be up to 0.007 than x,y target of each color temperature.

- * Note : Manual W/B process
- 1) Power off => Power on ('<' 3 times, '-' 1 time and push 'O')
 - 2) and push the "<" or "->".
 - 3) In Service Menu.



* When doing Adjustment, Please make circumstance as below.



4.3. DPM Operation check

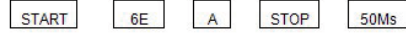
- Measurement Condition: 100 ~ 240 V @ 50/60Hz
- (1) Set Input to DVI-D, DisplayPort, HDMI1, HDMI2
- (2) Turn off the source device.
- (3) Check DPM operation refer to the below table.

Operating Condition	Sync (H/V) or Video	EUT (MSPG6100)	LED (SET)	Wattage (W)	
Sleep mode	Off/Off	Off	White blinking	1.2W	
Off mode	-	-	Off	0W	Mech. Switch off
			Off	0.5W	DC Switch Off

5. Signal composition for adjustment

5.1. I2C (100K BPS)

5.2. COMMUNICATION START



Until ACK BIT goes LOW, Repeat it.

5.3. Command form.

Command form use DDC2AB standard communication protocol.



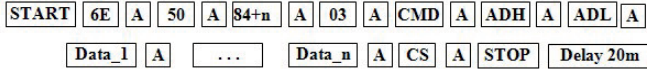
- LEN : DATA BYTE number to send.
- CMD : Command language that monitor executes.
- VAL : FOS DATA
- CS : Dada's CHECHSUM that transmit
- DELAY : 50MS
- A : Acknowledge

5.4. Screen adjust command (LENGTH = 84)

No.	Adjustment contents	CMD(hex)	ADR	VAL(hex)	Explanation
1	EEPROM ALL INITIAL	E4	00	00	adjustment Initialization
2	EEPROM READ	E7	Slave add		At EEPROM Read
3	EEPROM WRITE	E8	Slave add	Data	Write data at EEPROM
4	R GAIN	16	00	00-64	Tune Gain
5	G GAIN	18	00	00-64	
6	B GAIN	1A	00	00-64	
7	BRIGHT(Backlight)	10	00	00-64	
8	FACTORY RESET	F0	00	00	Tune Analog Bright Factory reset
9	AUTO_COLOR_ADJUST	F1	00	0	AUTO COLOR Tuning 0:Auto color
10	COLOR_MODE_CHANGE	F2	00	01	6500K
				02	9300K
11	Elapsed time Clear	E9	00	00	Aging off & Clear elapsed time
12	Aging On/Off	F3	00	FF/00	FF:ON / 00:OFF
13	Input Select	F4	00	0x00	1 DisplayPort
				0x90	2 HDMI1
				0x91	3 HDMI2
				0xD1	4 Thunderbolt
14	SYSTEM RESET	F5	00	00	Restart System
15	Select Language	68	00	0x00 ~ 0x0F	00 English
					01 German
					02 French
					03 Spanish
					04 Italian
					05 Swedish
					06 Finnish
					07 Portuguese
					08 Braz
					09 Polish
					0A Russian
0B Greek					
0C Ukrainian					
0D Chinese					
0E Japanese					
0F Korean					
	EDID SN UPDATE	0x77	0	0x01~0x02	0x01 : HDMI1 0x02 : HDMI2

5.5. EEPROM Data Write

5.5.1 Signal TABLE



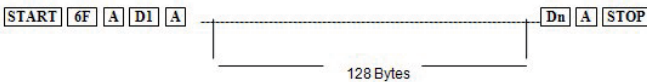
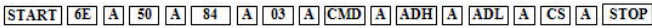
LEN : 84h+Bytes
 CMD : E8h
 ADH : E2PROM Slave Address(A0,A2,A4,A6,A8,AA,AC,AE),
 Not 00h(Reserved by Buffer To EEPROM)
 ADL : E2PROM Sub Address(00~FF)
 Data : Write data
 Delay : 20ms

5.5.2. Command Set

No.	Adjustment contents	CMD(hex)	LEN	Explanation
1	EEPROM WRITE	E8	94 (84+n)	16-Byte Write n-byte Write

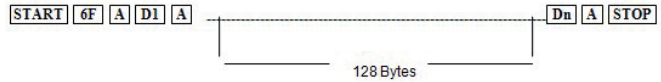
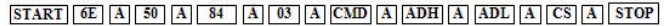
* Use

- FOS Default write :
 <14mode data> write
 SyncFlags,HPeriodH, HPeriodL, VtotalH,VtotalL,
 SrcHTotalH, SrcHTotalL
 SrcHStartH, SrcHStartL, SrcVStartH,SrcVStartL,
 HsyncPhase
- Temporary Data write: Write to particular address of EEPROM.



5.6. E2PROM Data Read

5.6.1. Signal TABLE



5.6.2. COMMAND SET

No.	Adjustment contents	CMD (hex)	ADH (hex)	ADL (hex)	Explanation
1	EEPROM READ	E7	A0	0	0-Page 0~7F Read
2				80	0-Page 80~FF Read
3			A2	0	1-Page 0~7F Read
4				80	1-Page 80~FF Read
5			A4	0	2-Page 0~7F Read
6				80	2-Page 80~FF Read
7			A6	0	3-Page 0~7F Read
8				80	3-Page 80~FF Read
9			A8	0	4-Page 0~7F Read
10				80	4-Page 80~FF Read
11			AA	0	5-Page 0~7F Read
12				80	5-Page 80~FF Read
13			AC	0	6-Page 0~7F Read
14				80	6-Page 80~FF Read
15			AE	0	7-Page 0~7F Read
16				80	7-Page 80~FF Read

5.6.3. Use

Read E2PROM's specific area as unit of 128(80h)-byte. (84h)

5.6.4 EDID Write

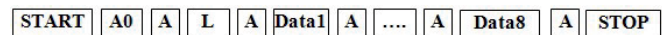
EEPROM access by using DDC2B protocol

- 1-Byte write



L : 0x00~0x7F
 D : data

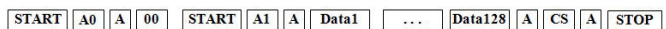
- 8-byte write



L : 0x00,0x10,....0x70

5.6.5. EDID Read

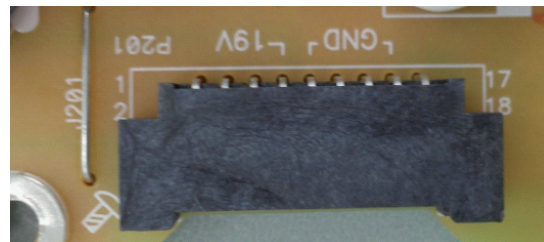
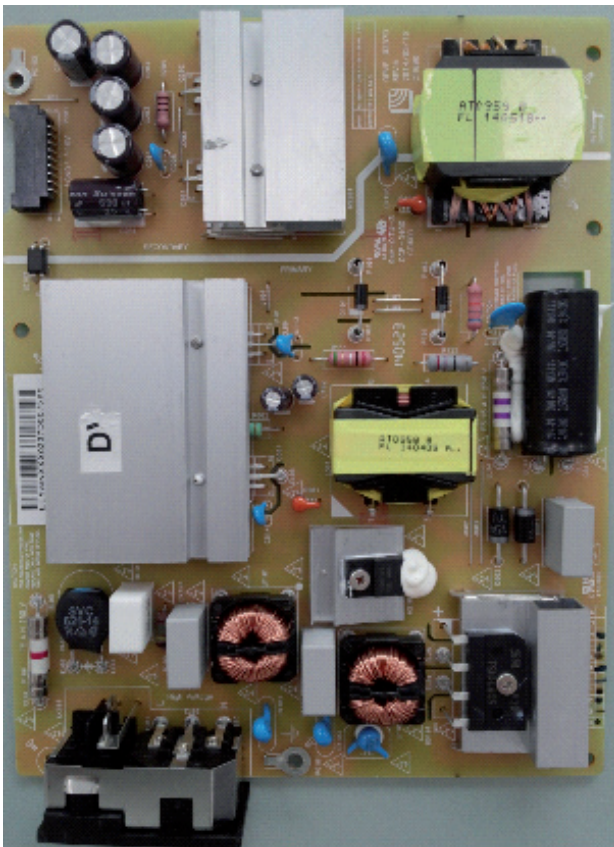
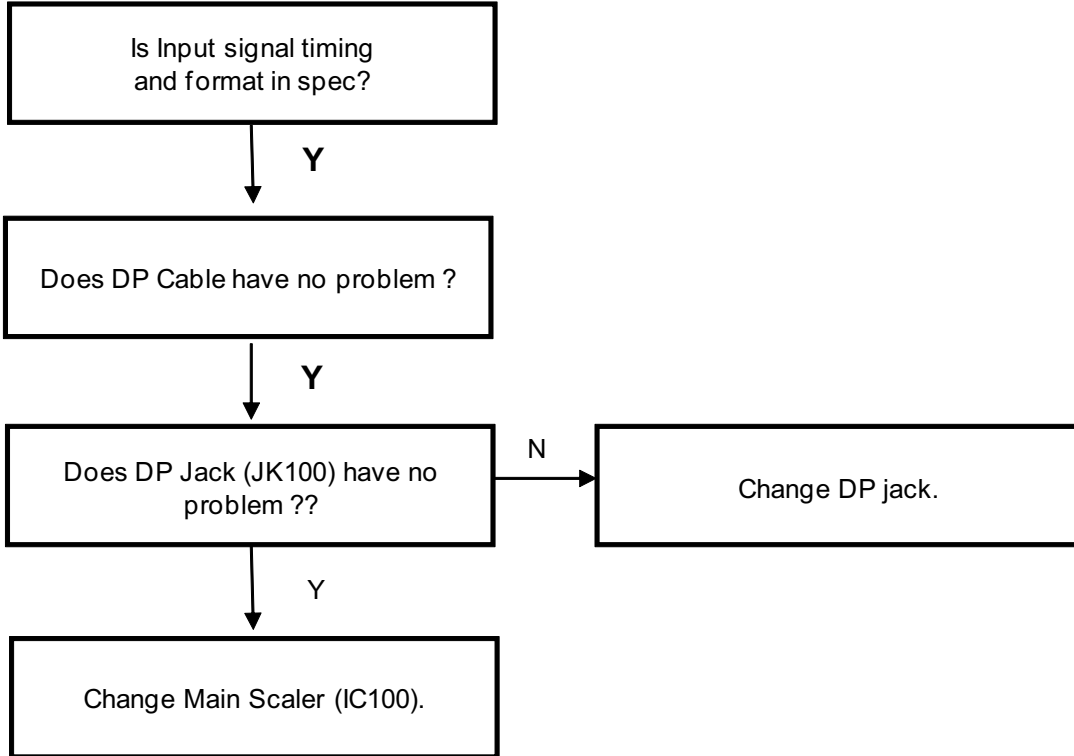
- DDC2B Command.(A0/A1)



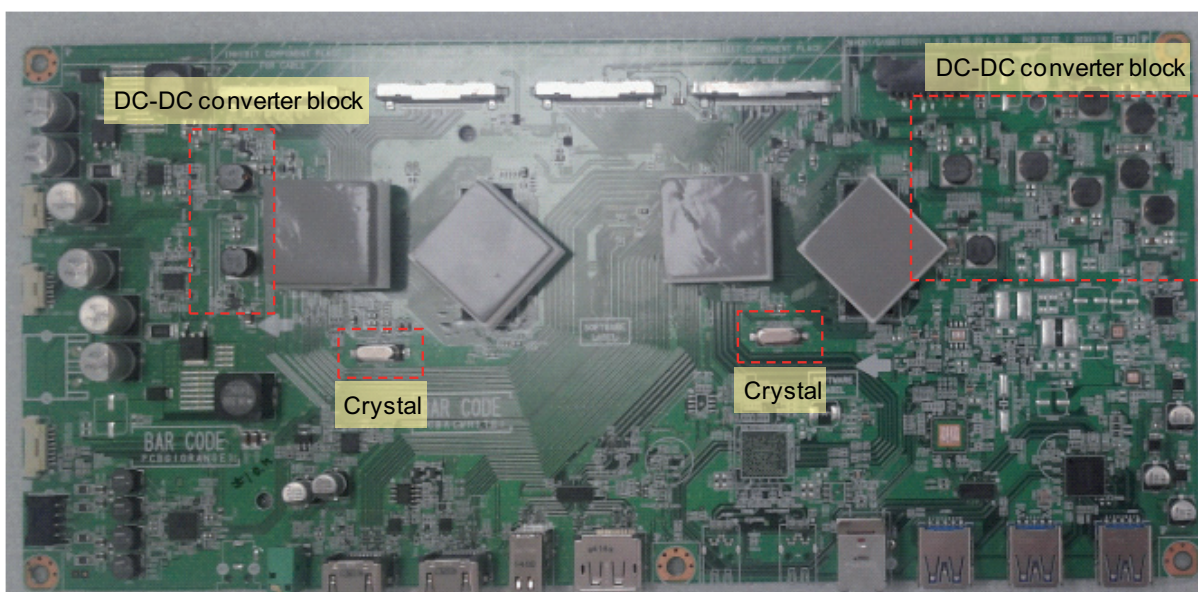
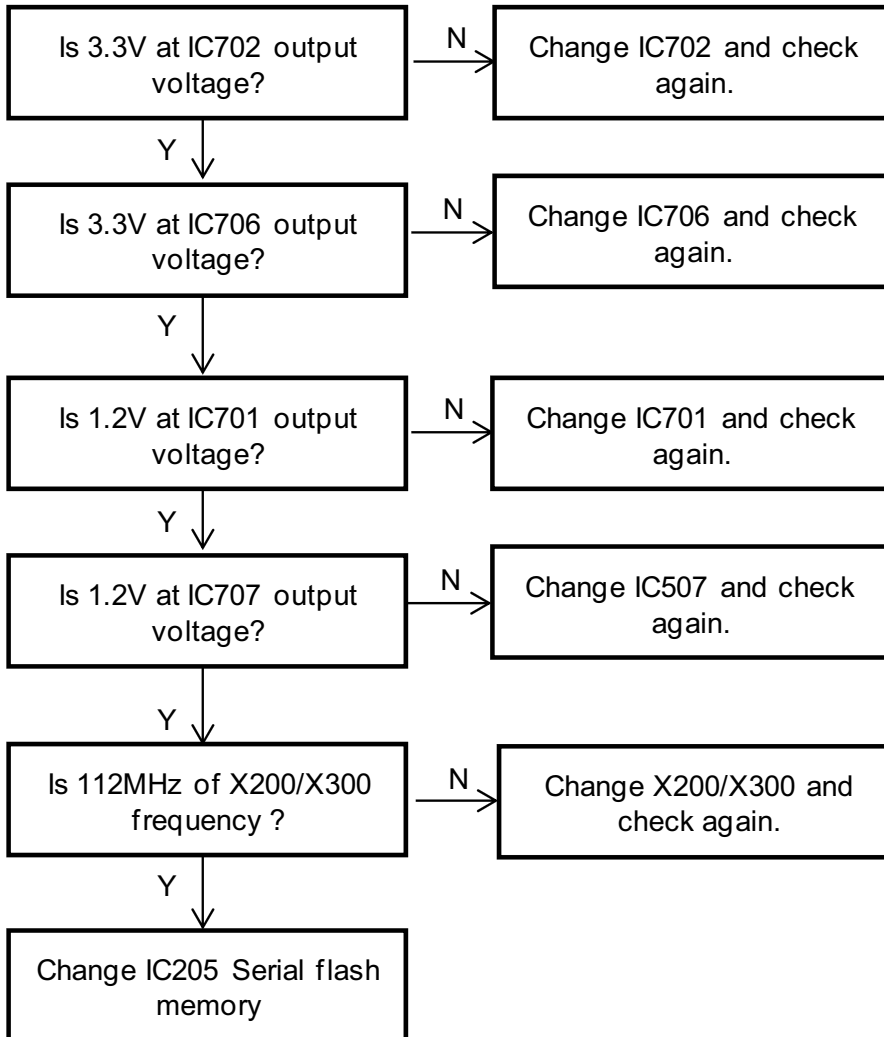
- 128 Byte transfer of EDID Buffer of MICOM

TROUBLE SHOOTING GUIDE

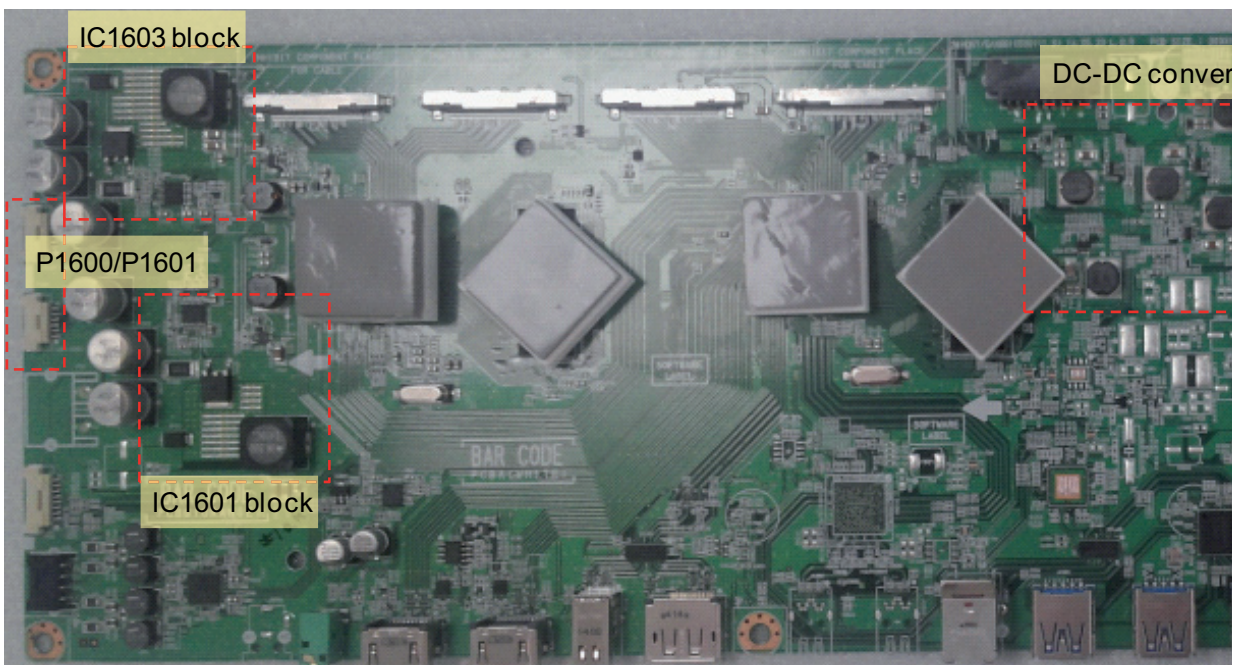
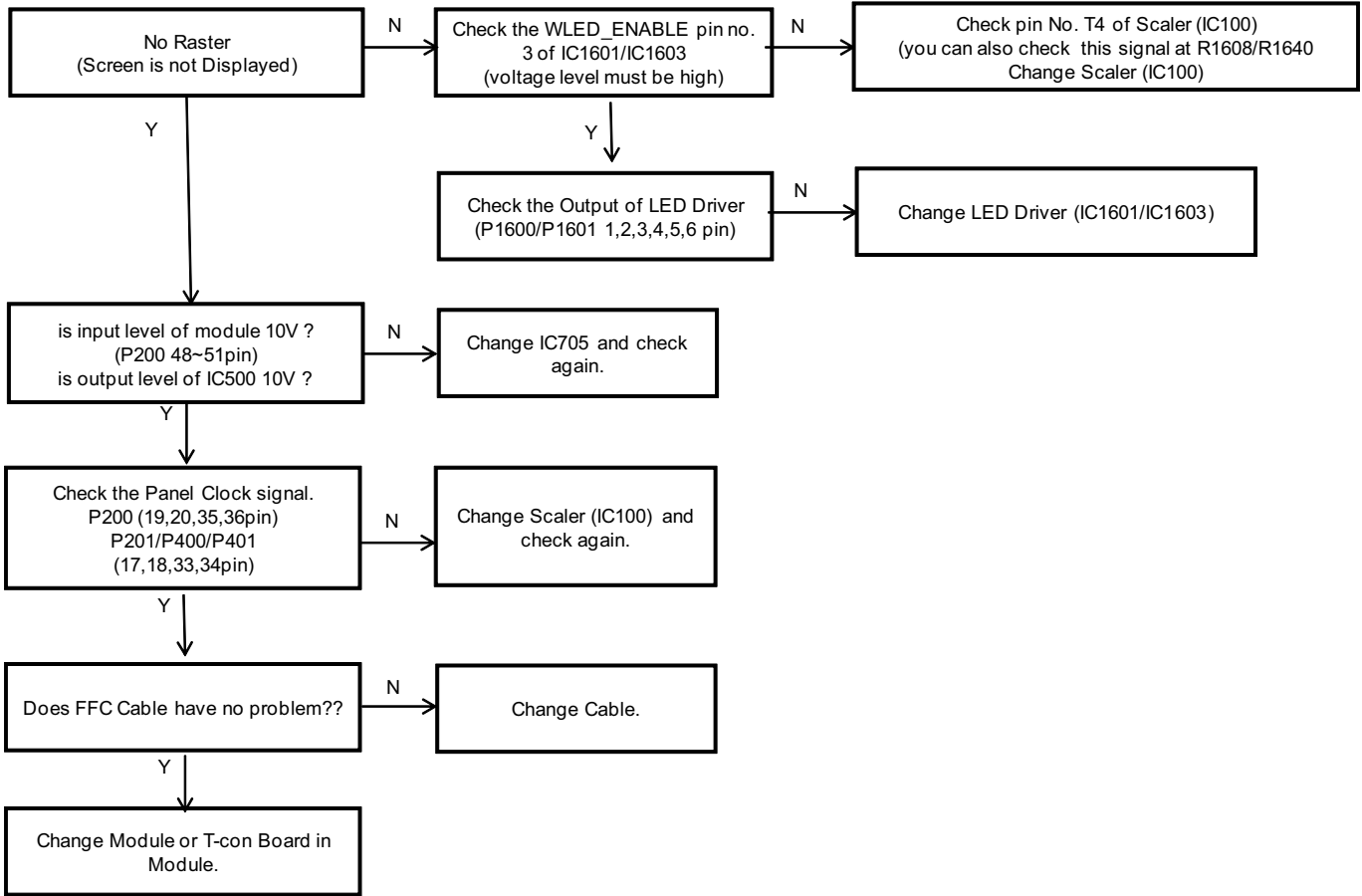
1. No Power (Power Board)



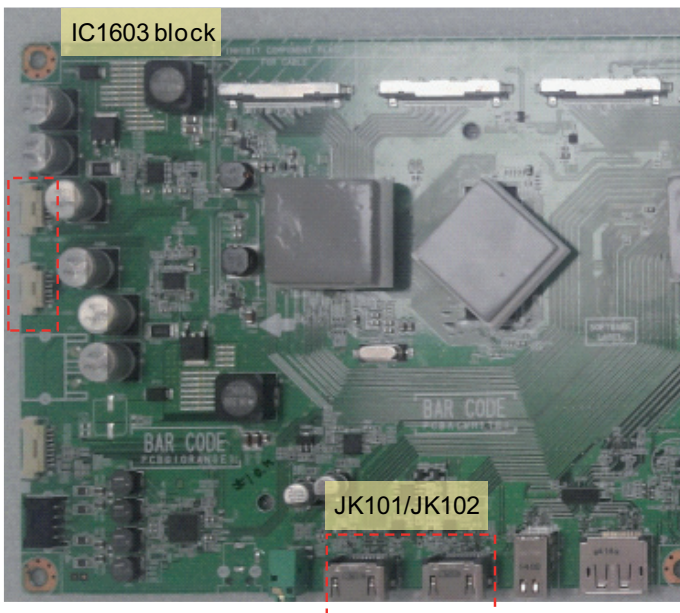
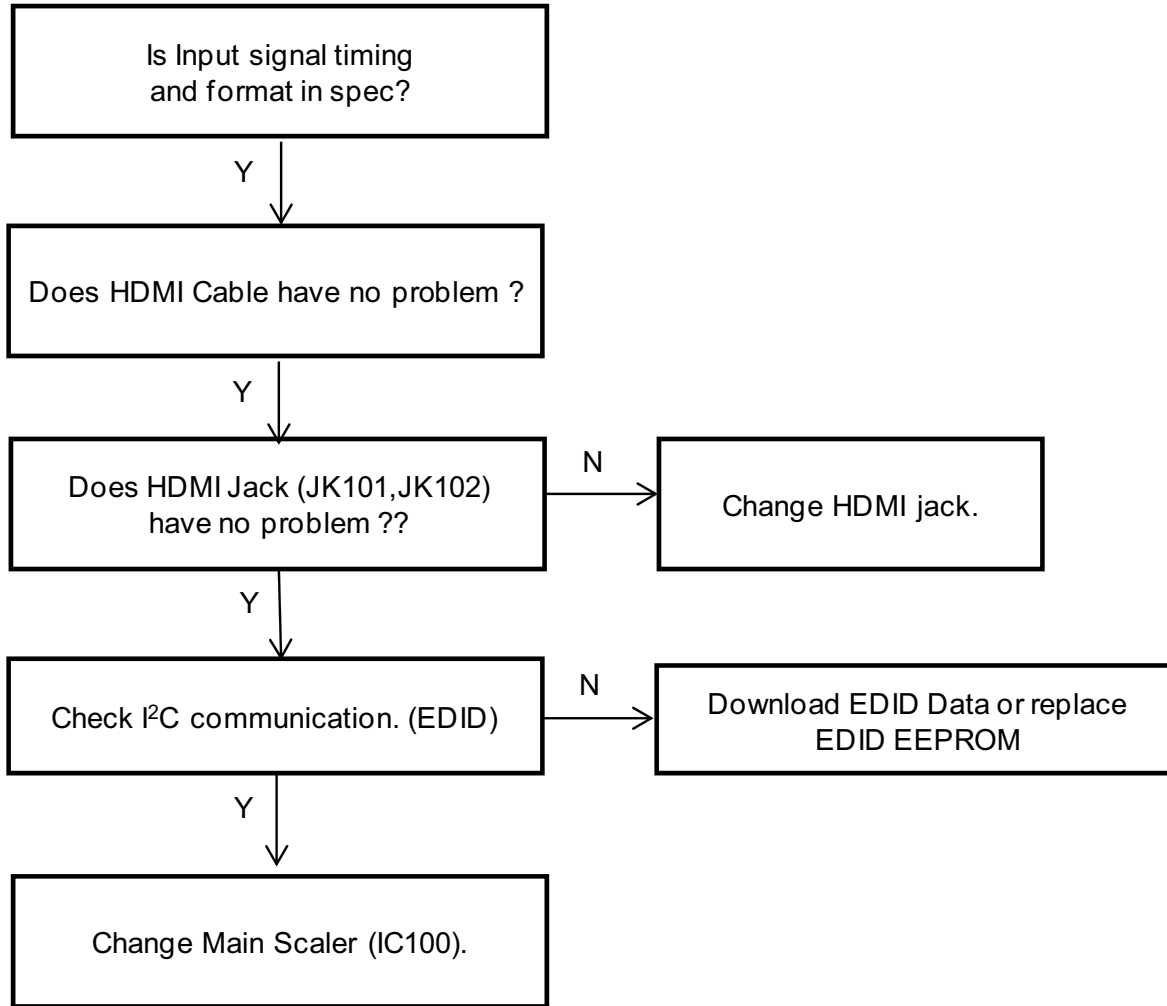
2. No Power (Main Board)



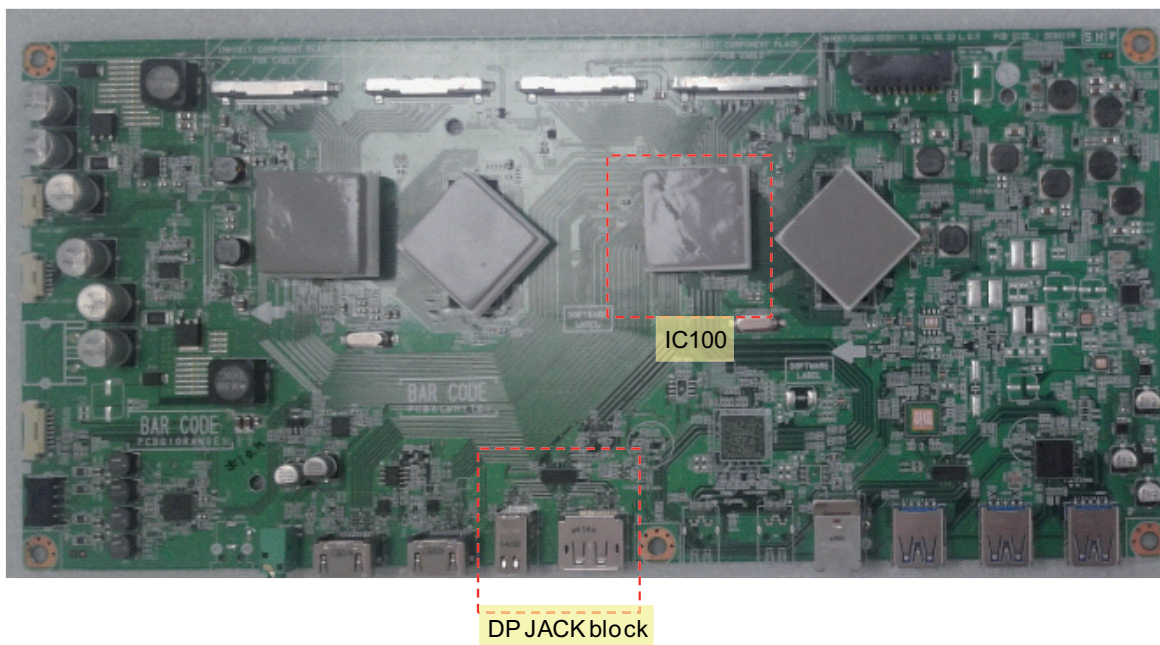
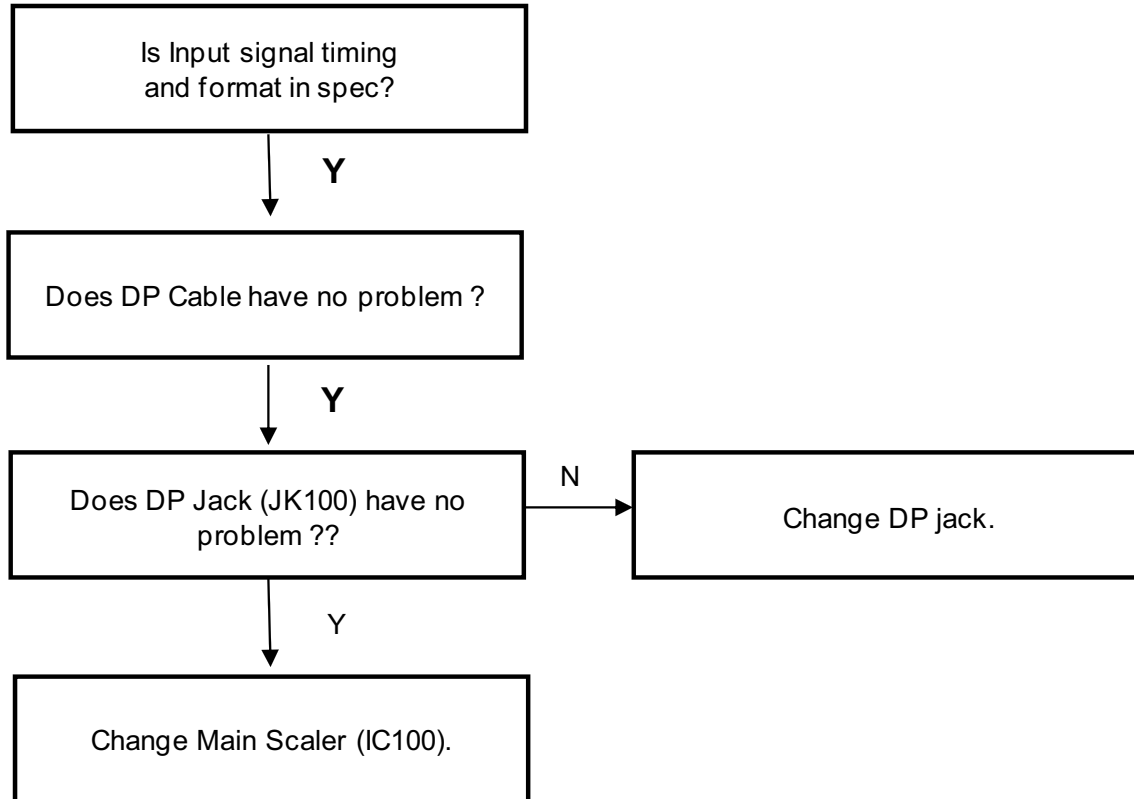
3. No raster



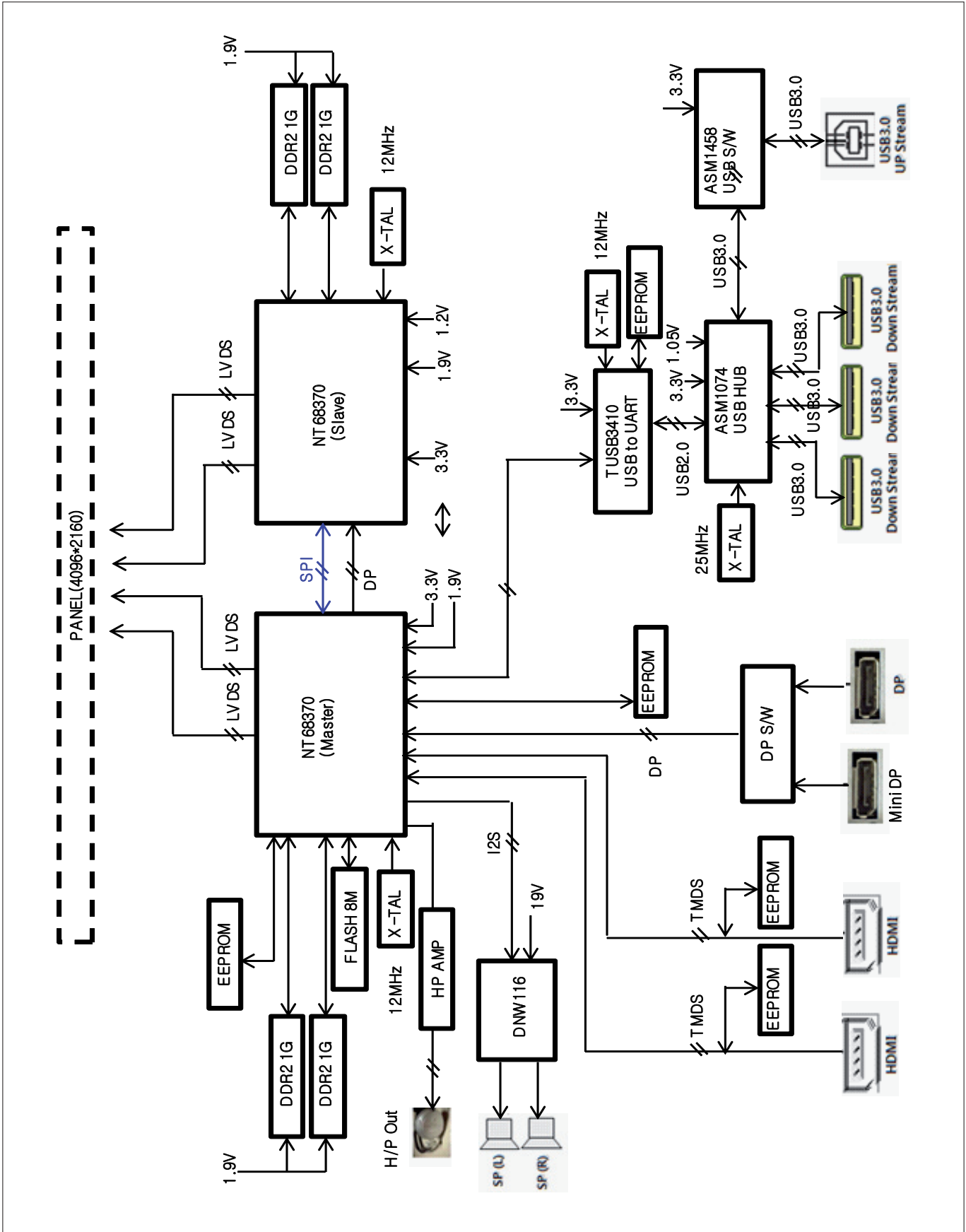
4. No Video – HDMI



5. No Video – DP



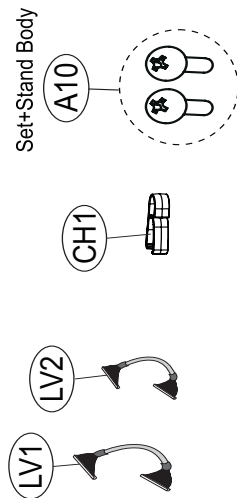
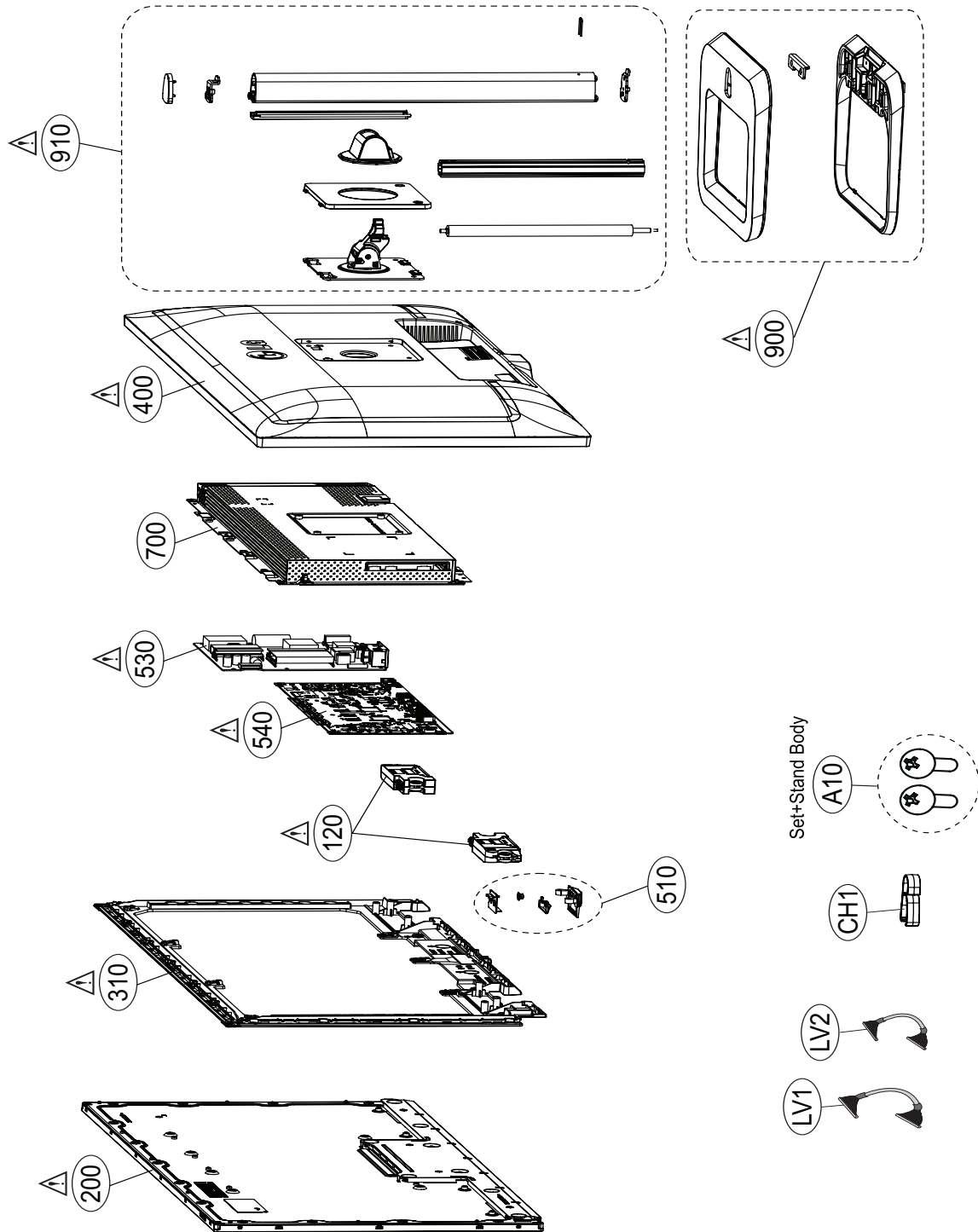
BLOCK DIAGRAM

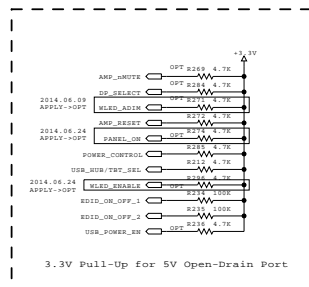


EXPLODED VIEW

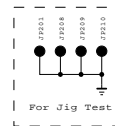
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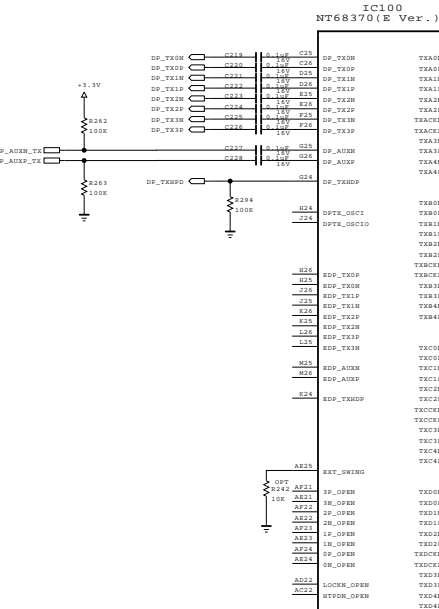
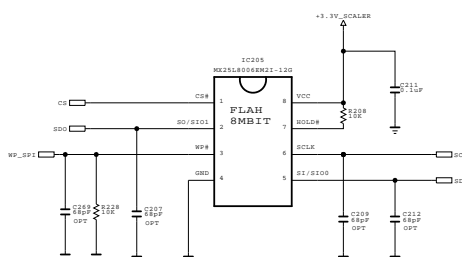




3.3V Pull-Up for 5V Open-Drain Port



For Jig Test

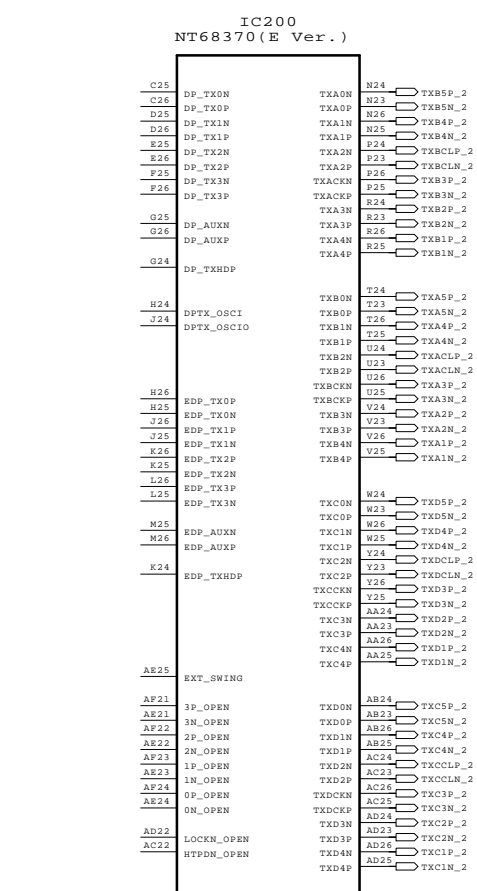
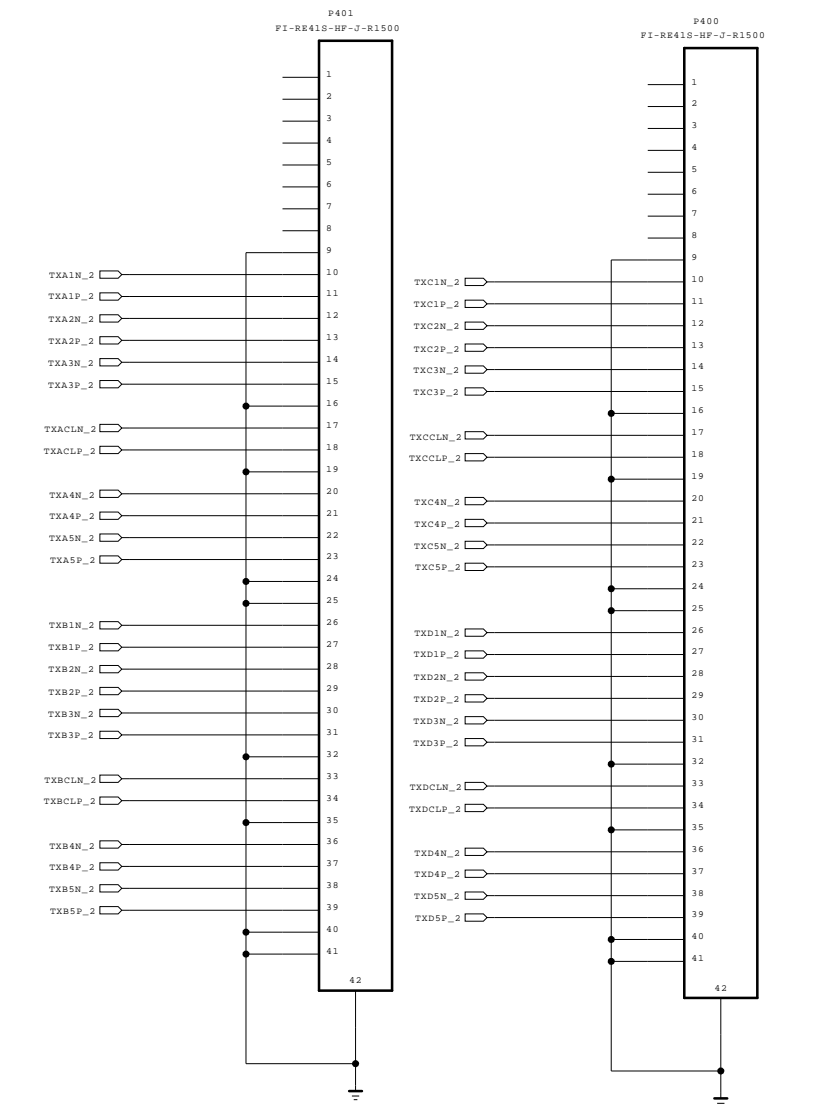
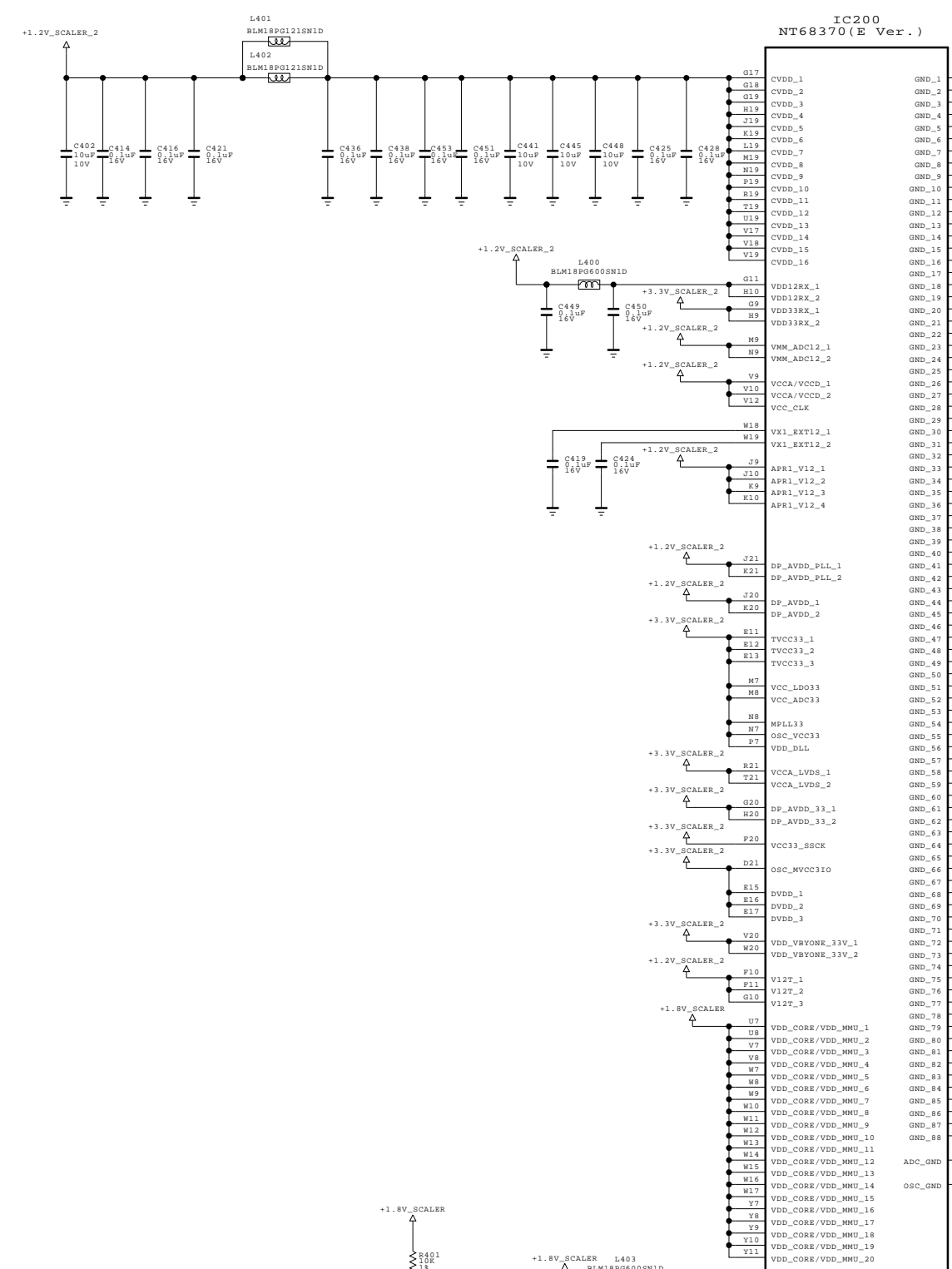
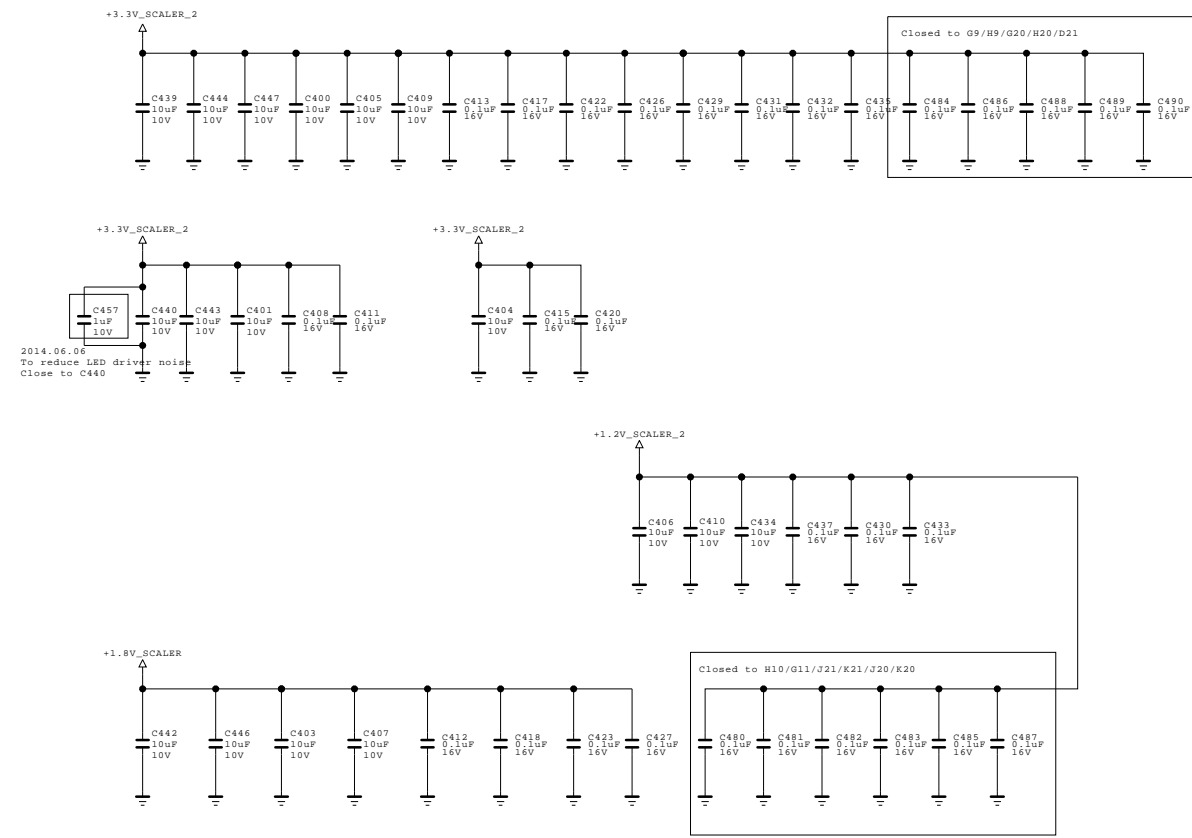


THE SYMBOL MARK OF THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION. FIRE AND ELECTRICAL SHOCK HAZARDS, WHEN SERVICING IF IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE SYMBOL MARK OF THE SCHEMATIC.

SECRET
LGElectronics

LG ELECTRONICS

MODEL	UHD MODEL	DATE	2014.2.14
BLOCK	GPIO/SCALER POWER/LVDS	SHEET	2 / 18

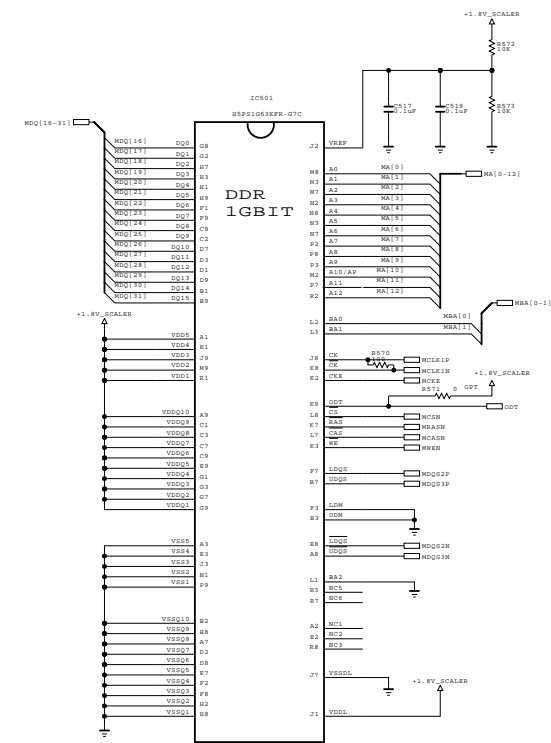
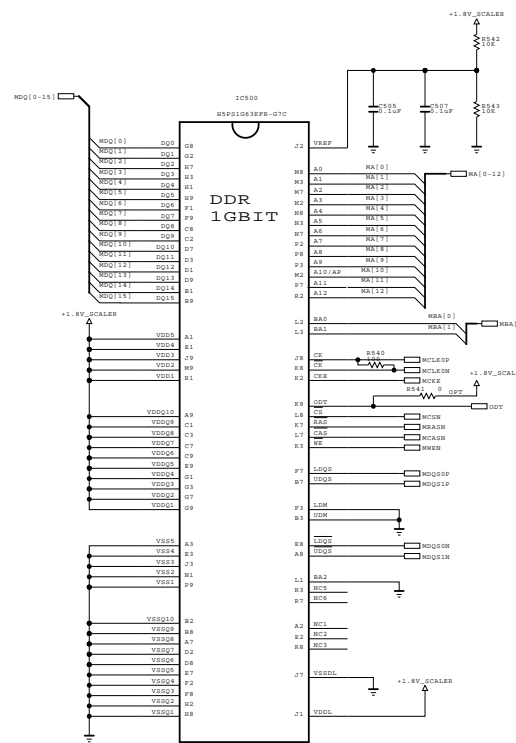
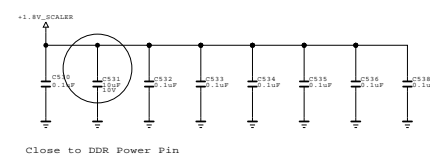
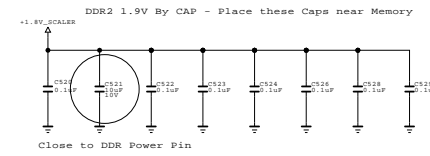
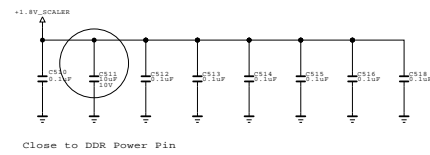
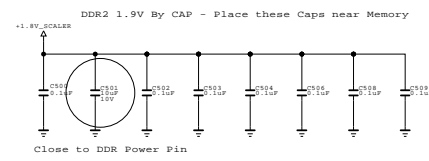


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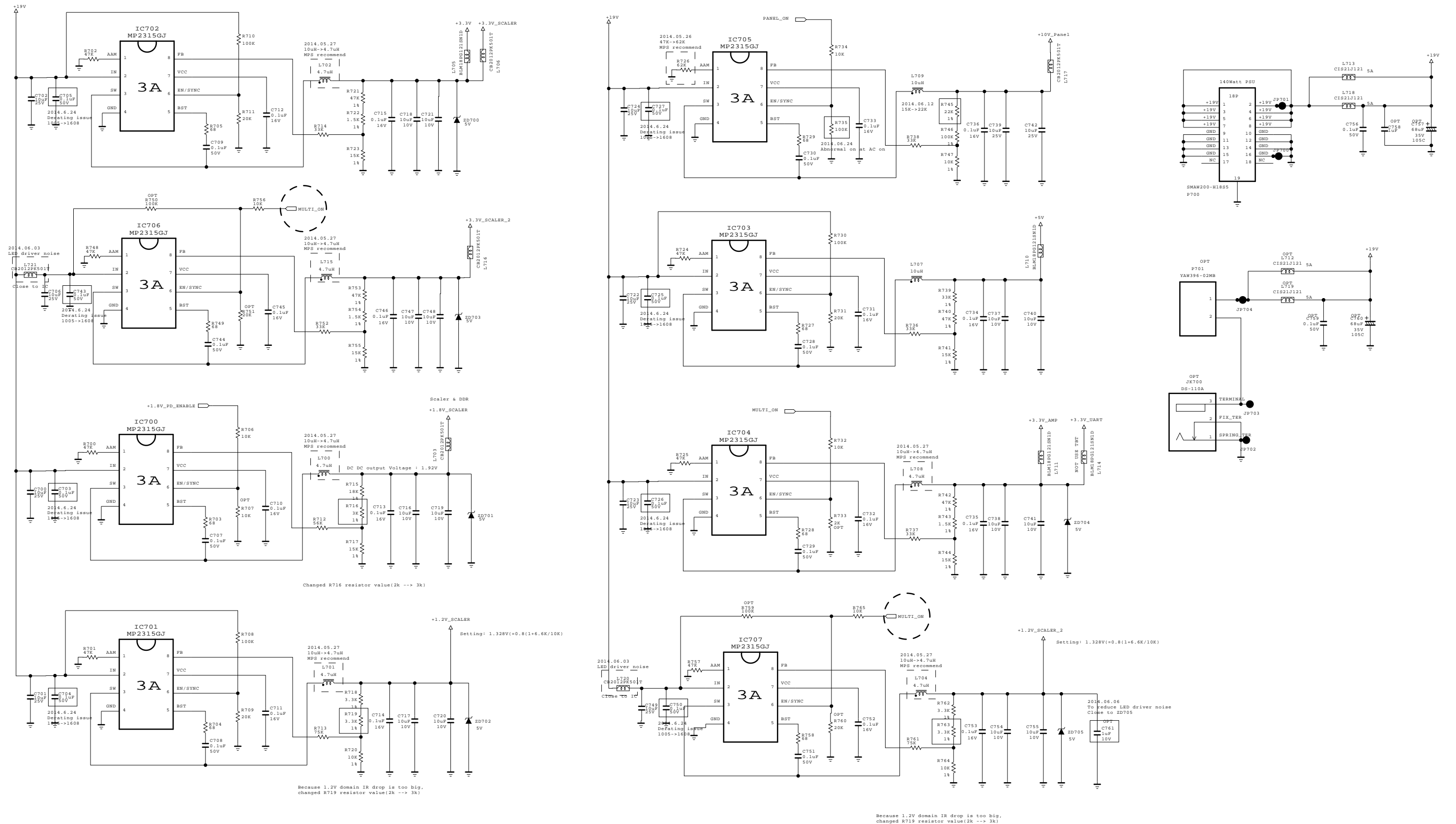
SECRET
LGElectronics



MODEL	UHD MODEL	DATE	2014.2.14
BLOCK	SLAVE SCALER POWER / LVDS	SHEET	4 / 18



MAIN SCALER POWER

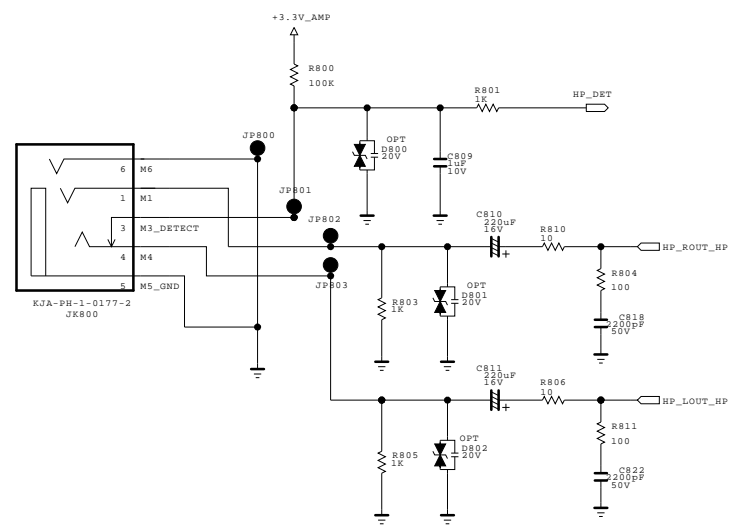
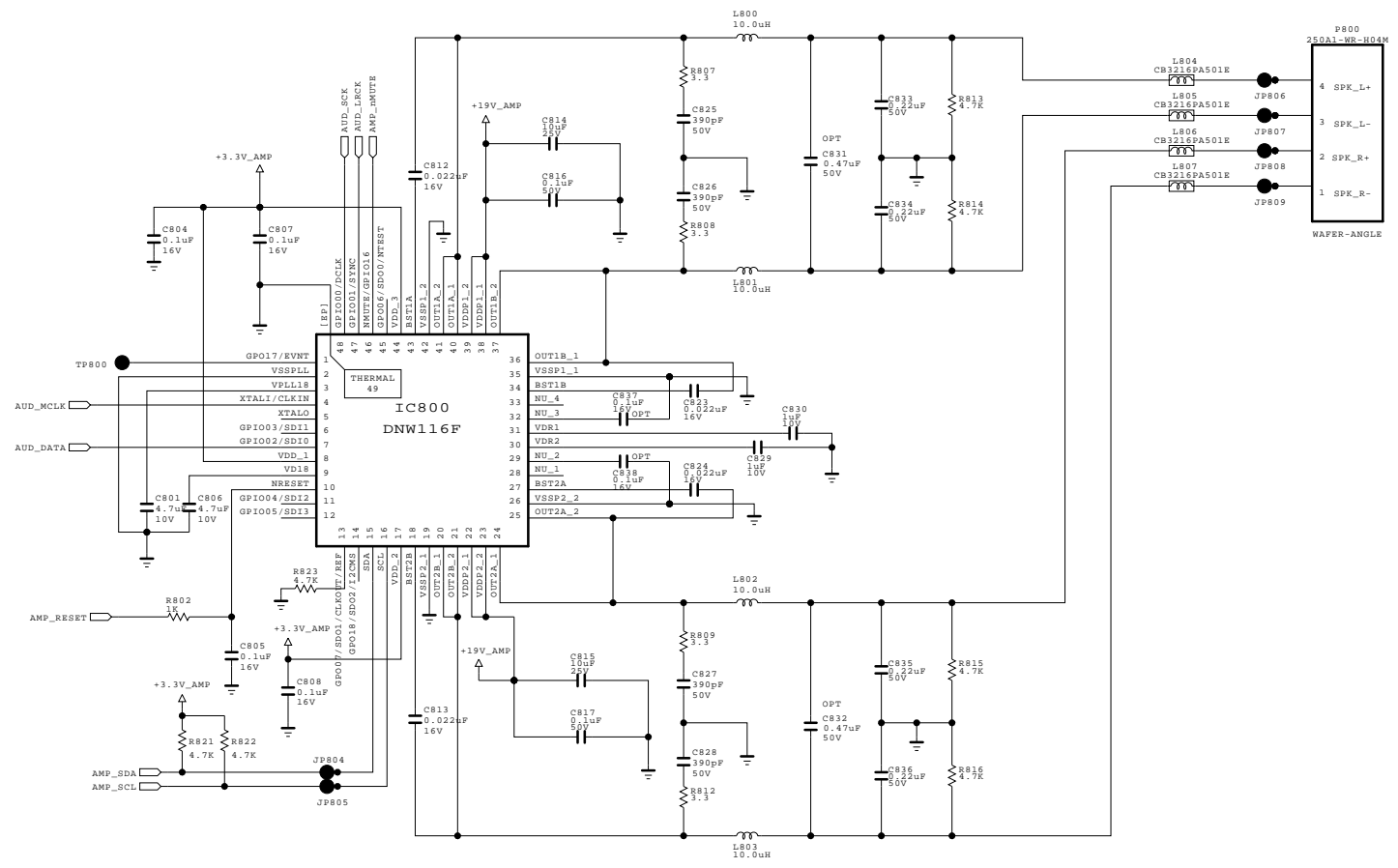
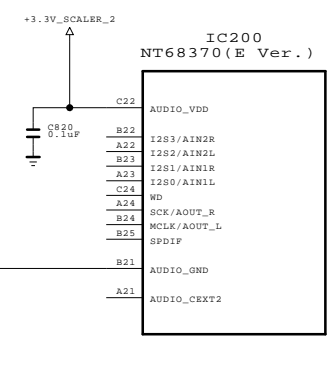
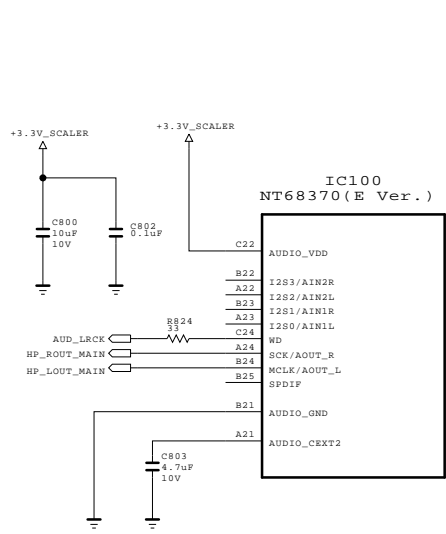


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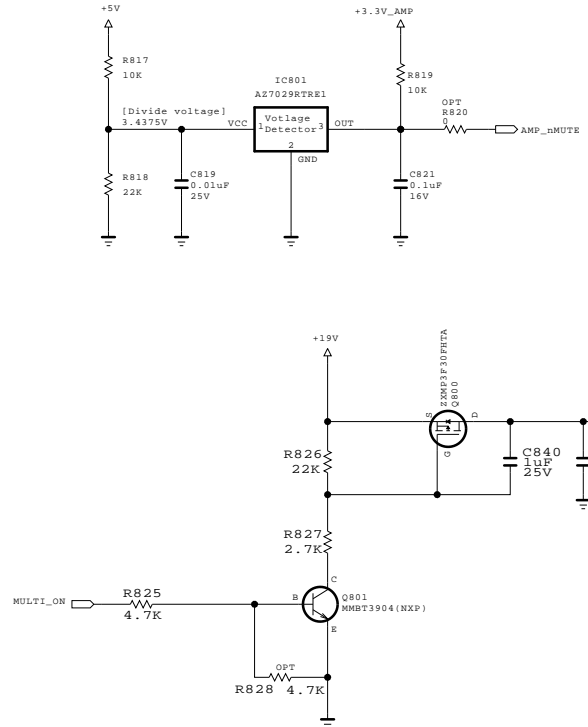
SECRET
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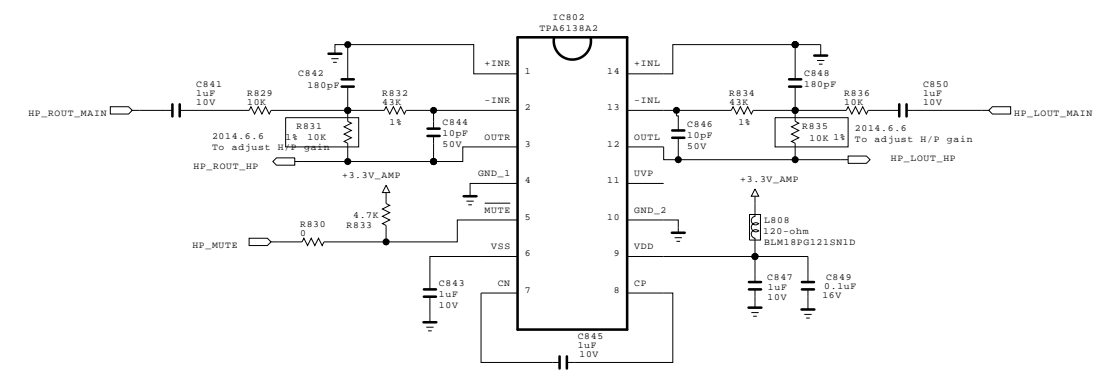
MODEL	UHD MODEL	DATE	2014.2.14
BLOCK	MAIN POWER	SHEET	7 / 18



Pop Noise Killer



EARPHONE AMP

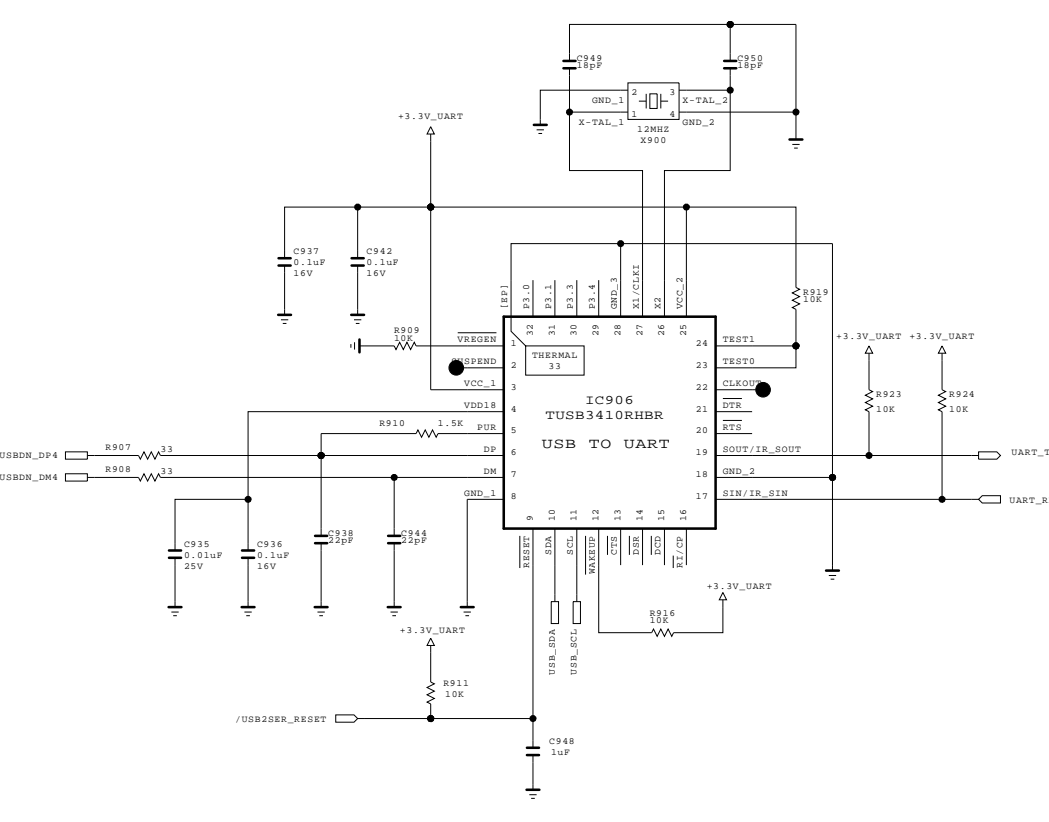
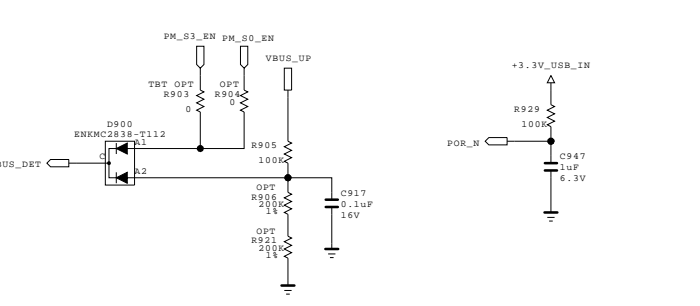
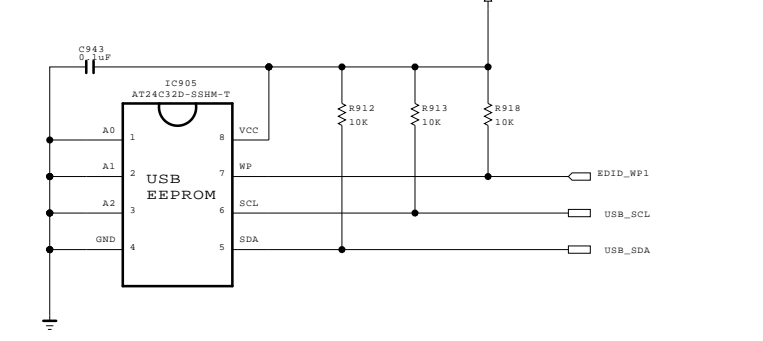
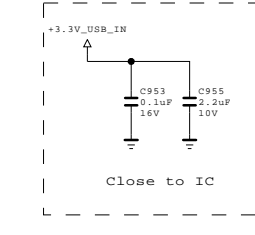
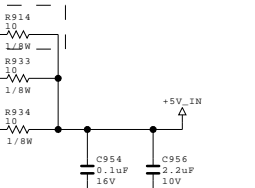
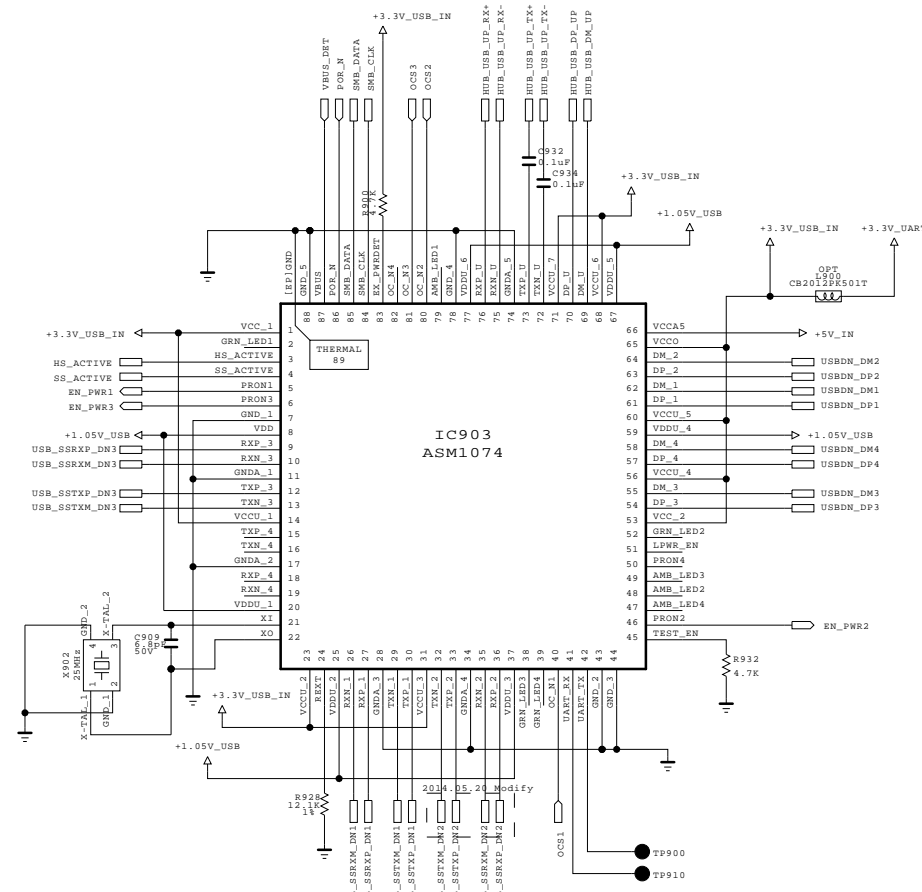
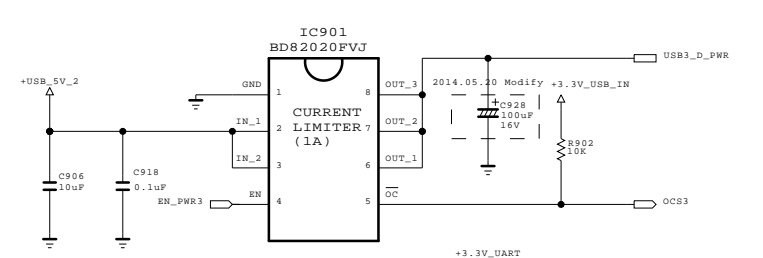
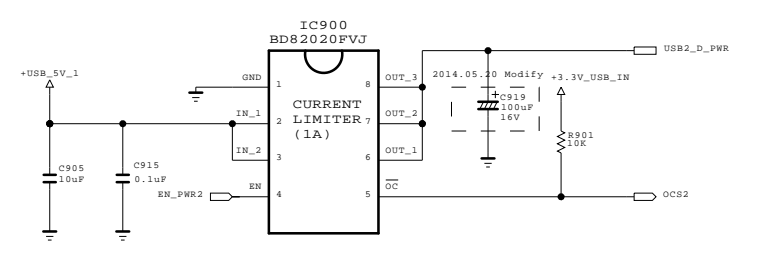
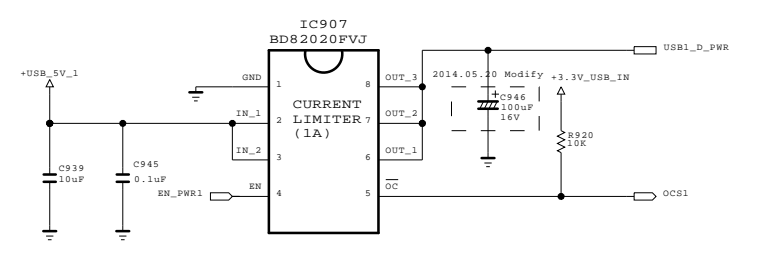
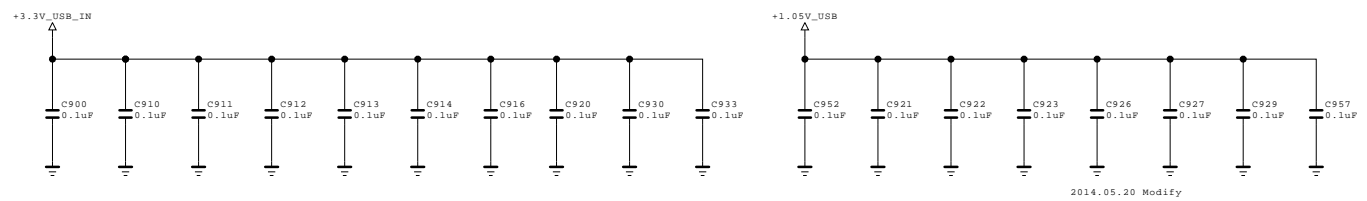
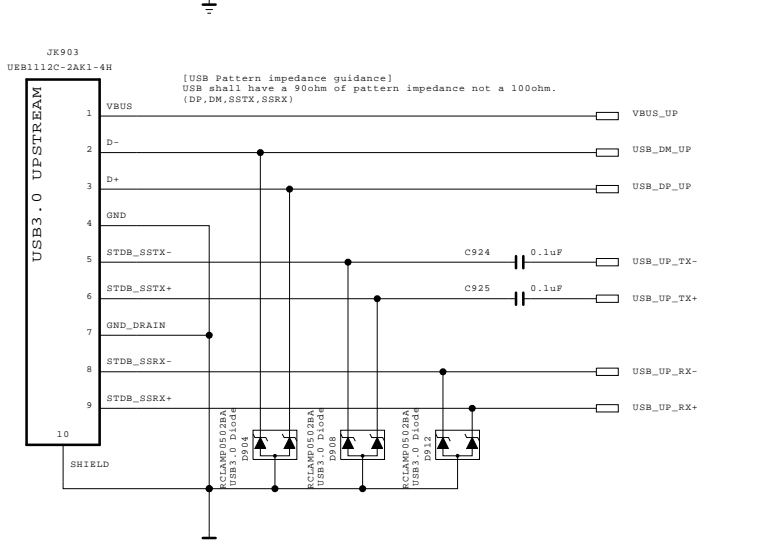
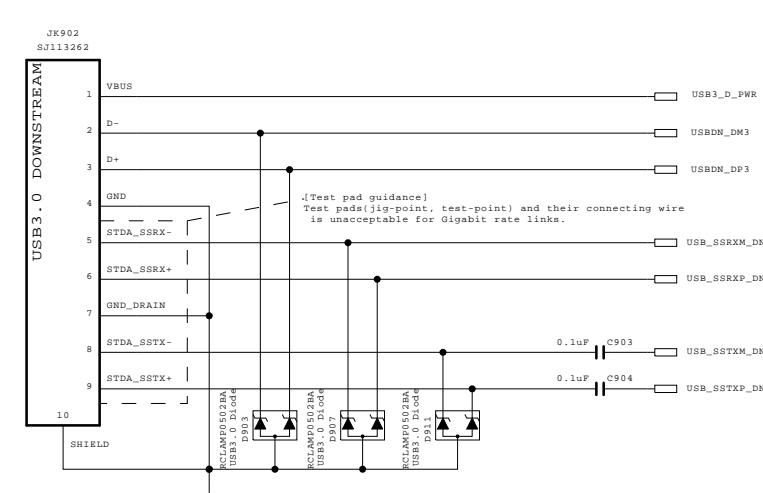
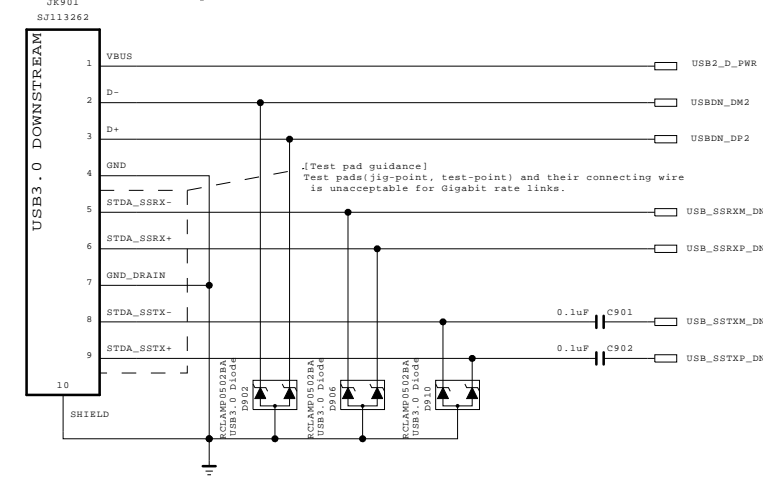
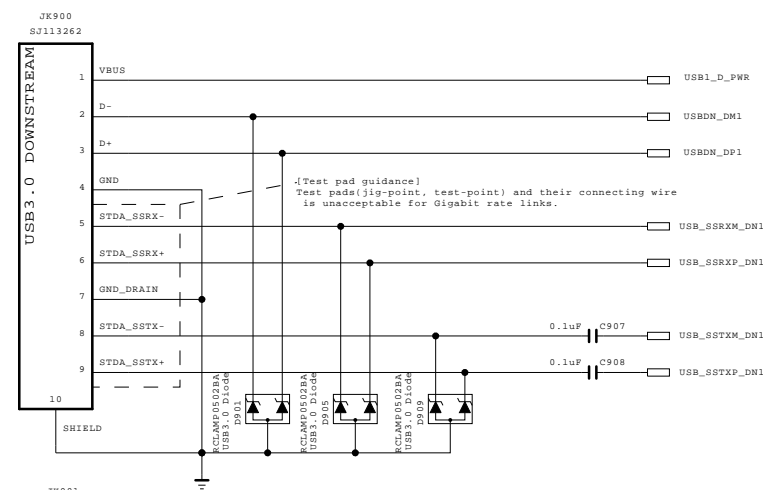


THE SYMBOL MARK OF THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION. FIRE AND ELECTRICAL SHOCK HAZARDS, WHEN SERVICING IF IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE SYMBOL MARK OF THE SCHEMATIC.

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MODEL	UHD MODEL	DATE	2014.2.14
BLOCK	AUDIO	SHEET	8 / 18



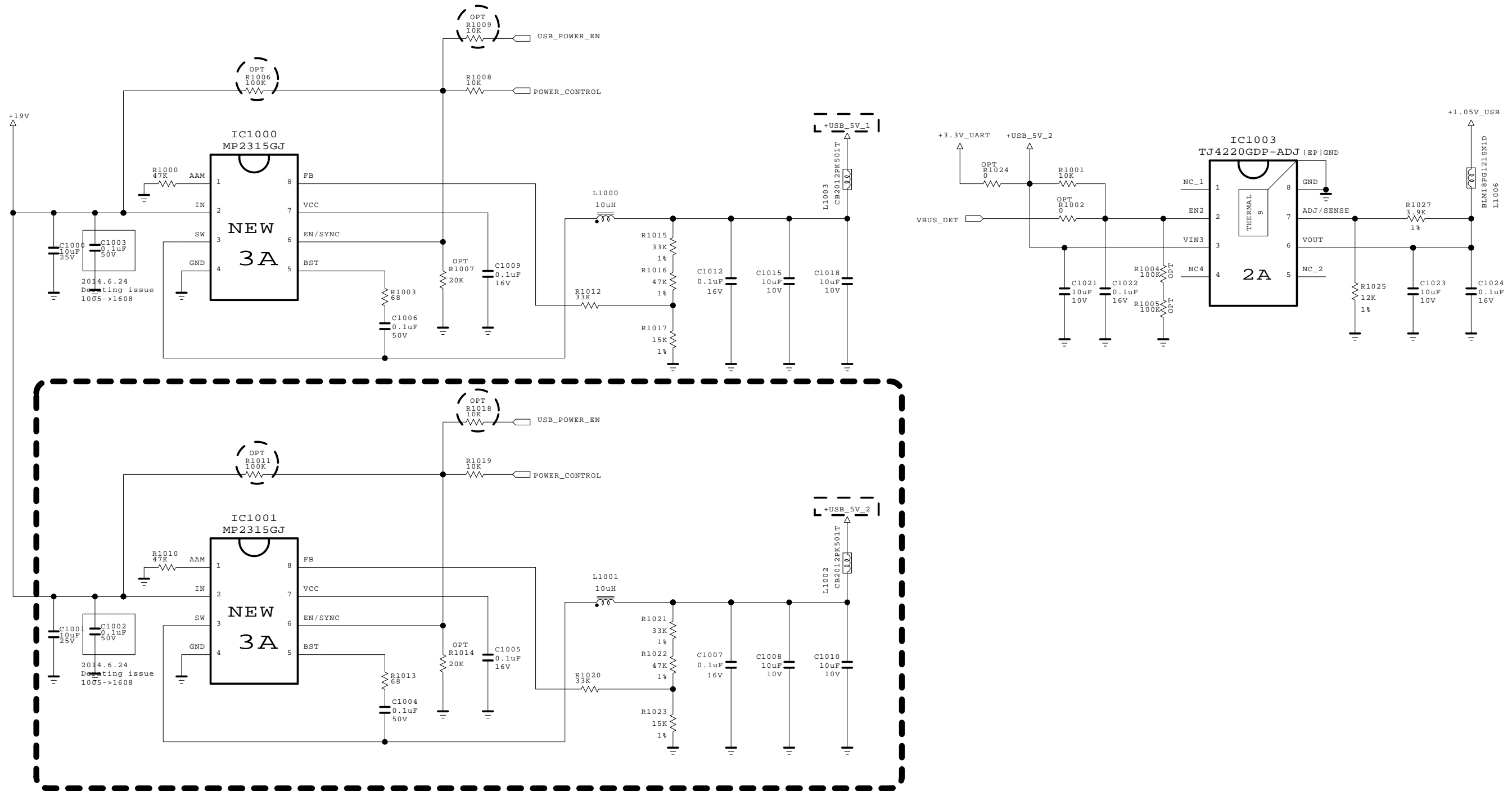
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MODEL	UHD MODEL	DATE	2014.2.14
BLOCK	USB UART	SHEET	9 / 18



USB3.0 POWER



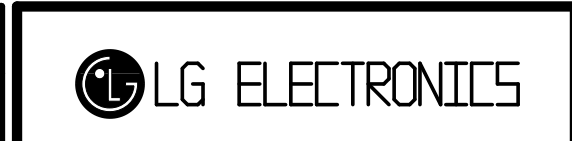
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SECRET	LG ELECTRONICS
LGElectronics	

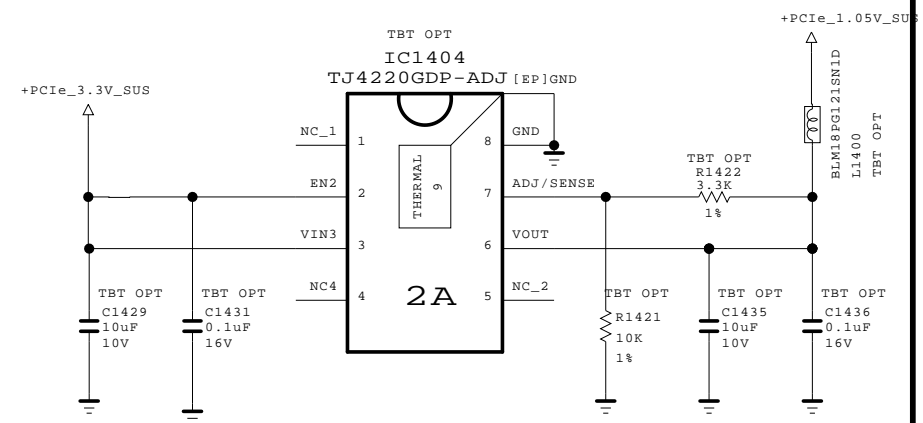
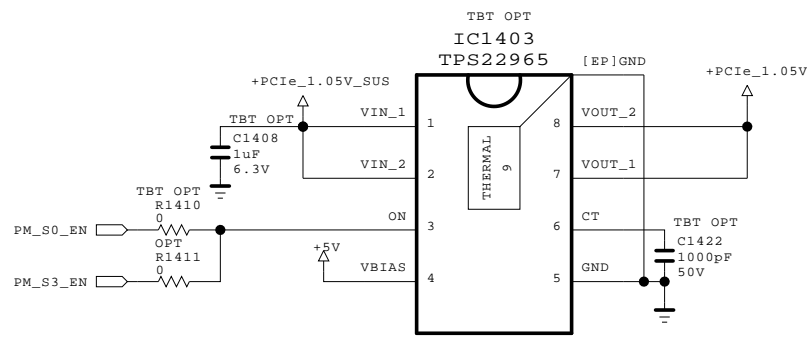
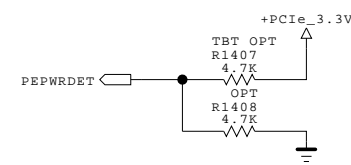
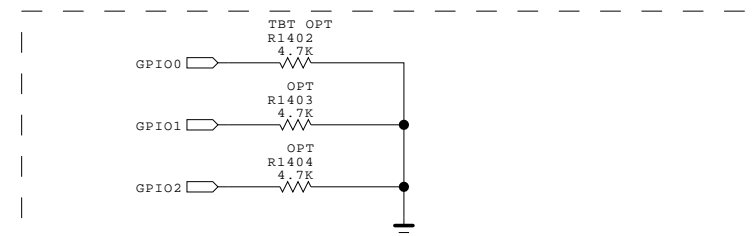
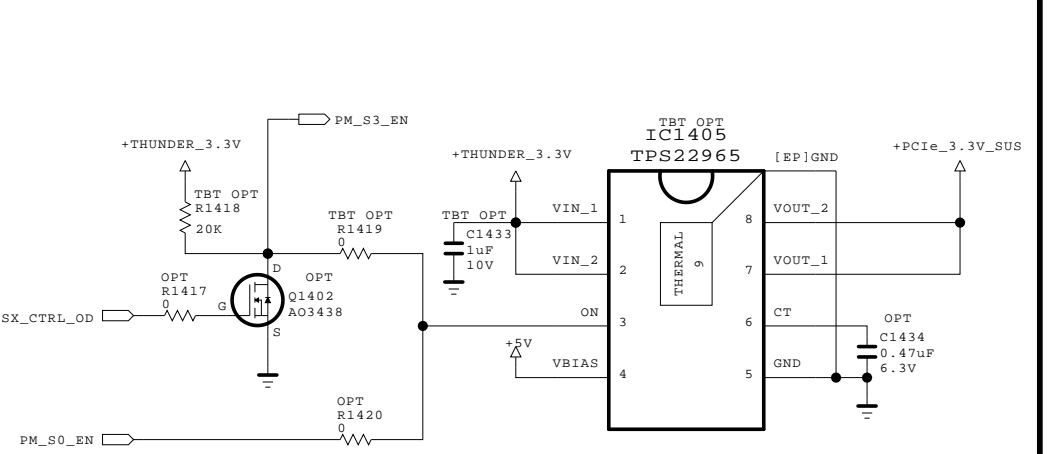
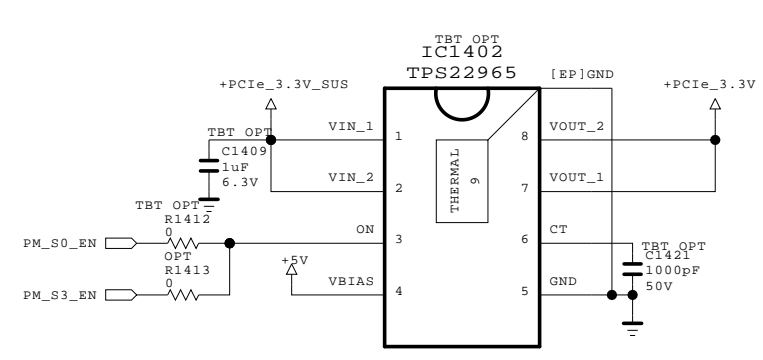
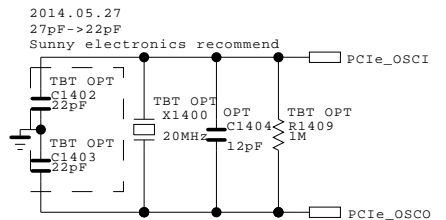
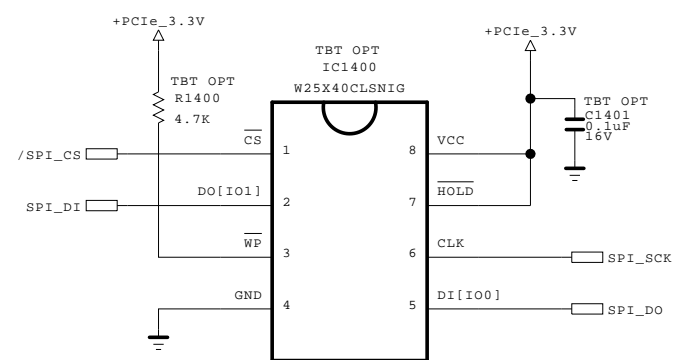
MODEL	UHD MODEL	DATE	2014.2.14
BLOCK	USB3.0 POWER	SHEET	10 / 18

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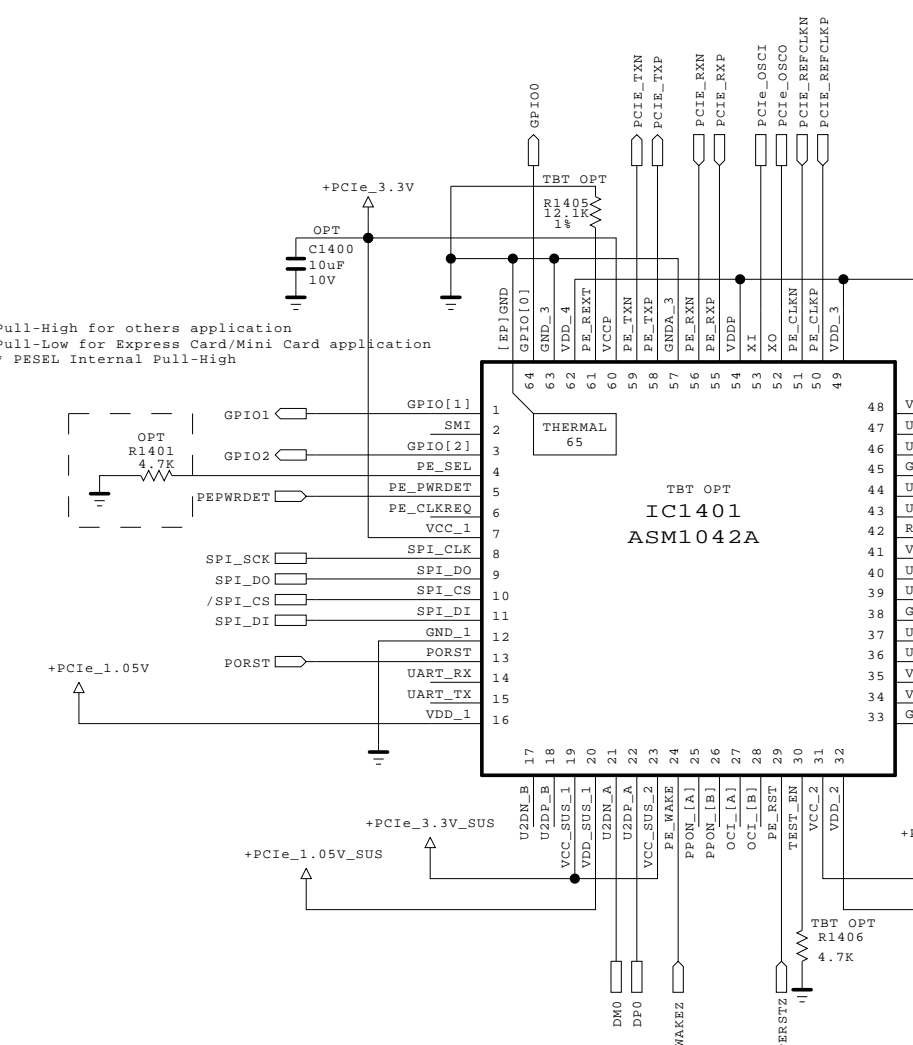


MODEL		DATE	
BLOCK		SHEET	/

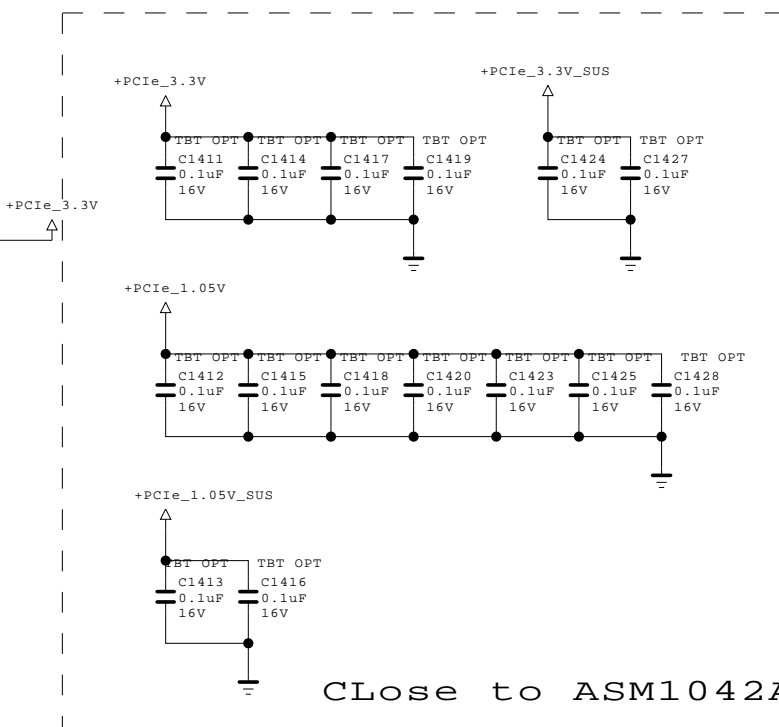
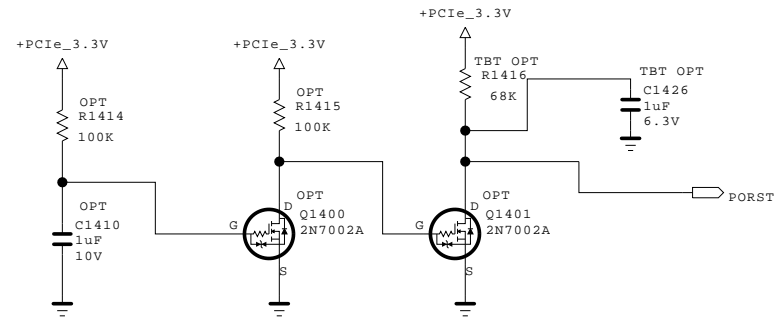


GPIO0	GPIO1	GPIO2	FUNCTION
0	1	0	Asynchronous Mode(Default)
0	1	1	Debug / Test Mode
0	0	x	

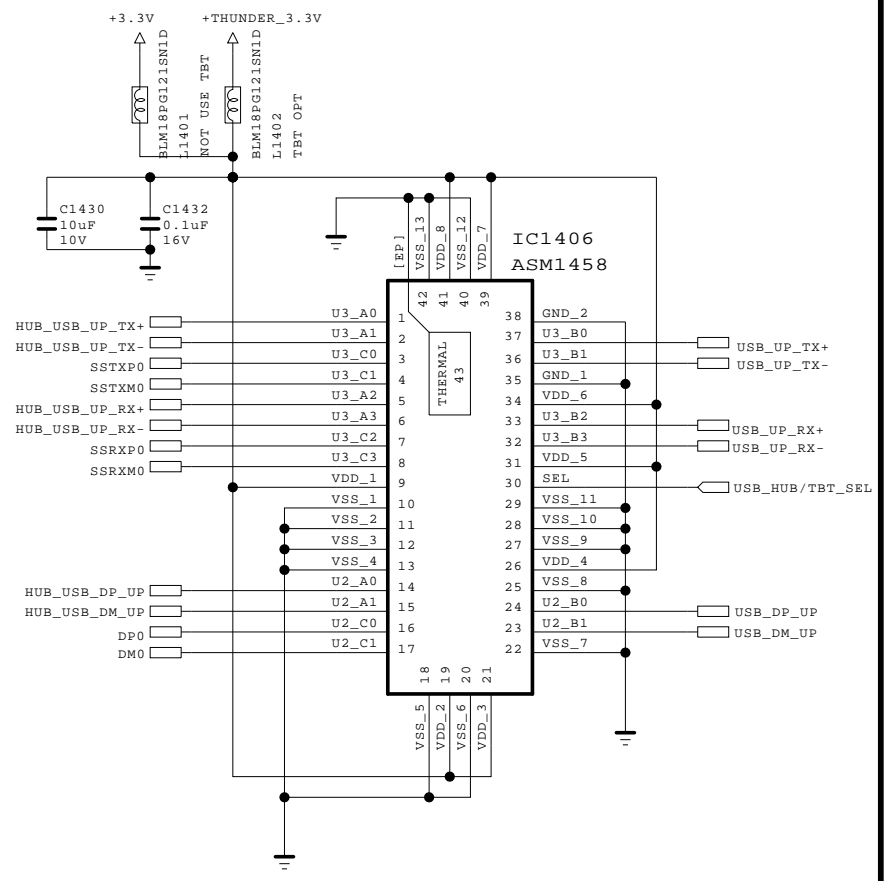
GPIO0, GPIO1, GPIO2 Internal Pull-High



Pull-High for others application
Pull-Low for Express Card/Mini Card application
* PESEL Internal Pull-High



Close to ASM1042A



THE ⚠ SYMBOL MARK OF THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION. FIRE AND ELECTRICAL SHOCK HAZARDS, WHEN SERVICING IF IS ESSENTIAL THAT ONLY MANUFACTURES SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE ⚠ SYMBOL MARK OF THE SCHEMATIC.

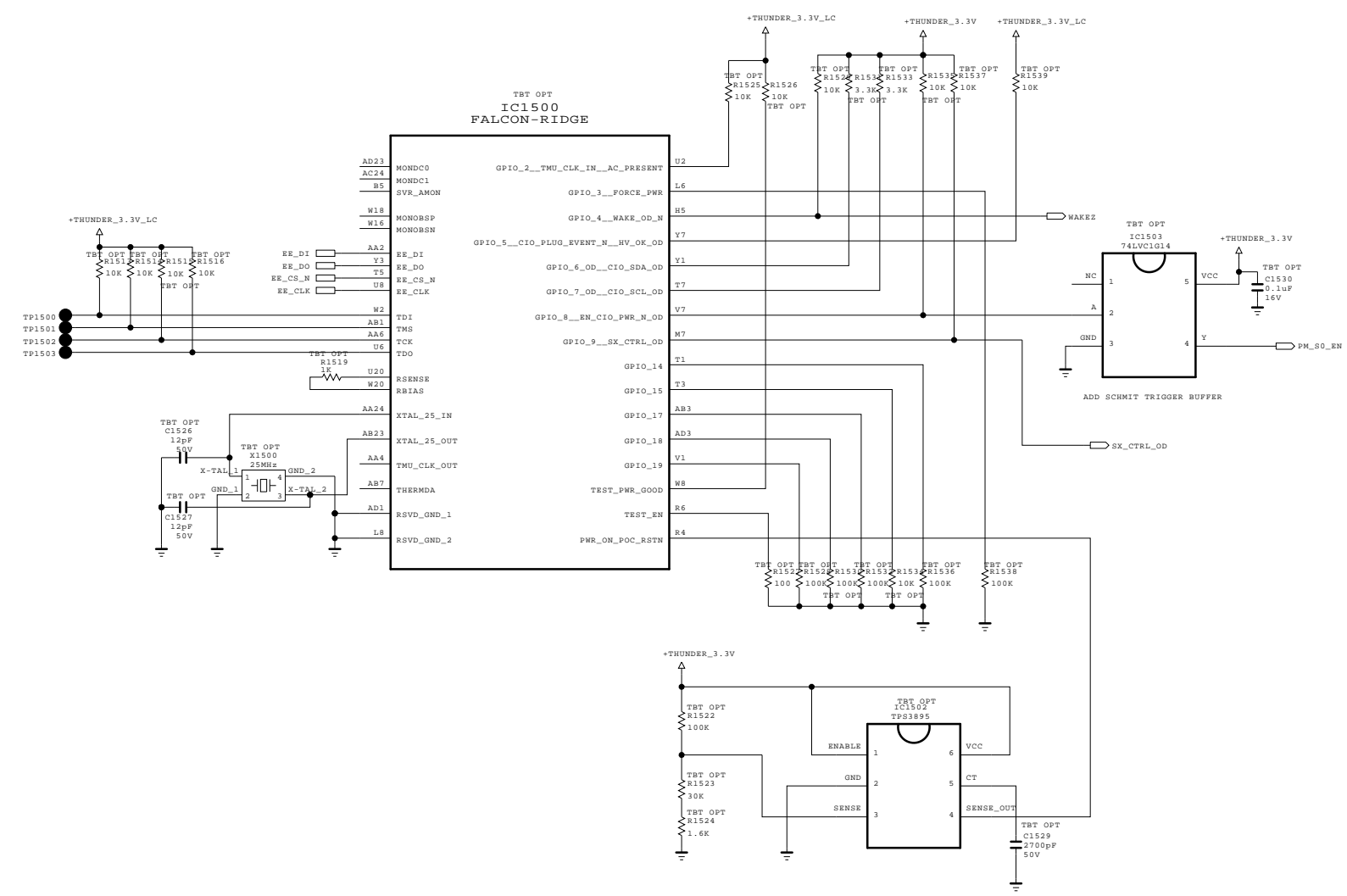
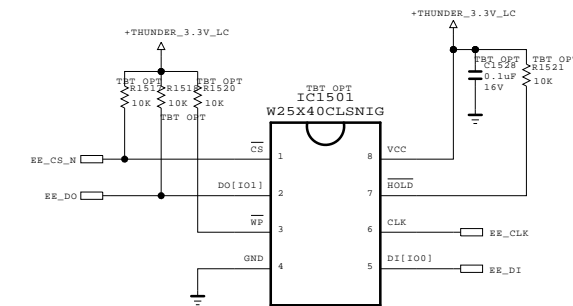
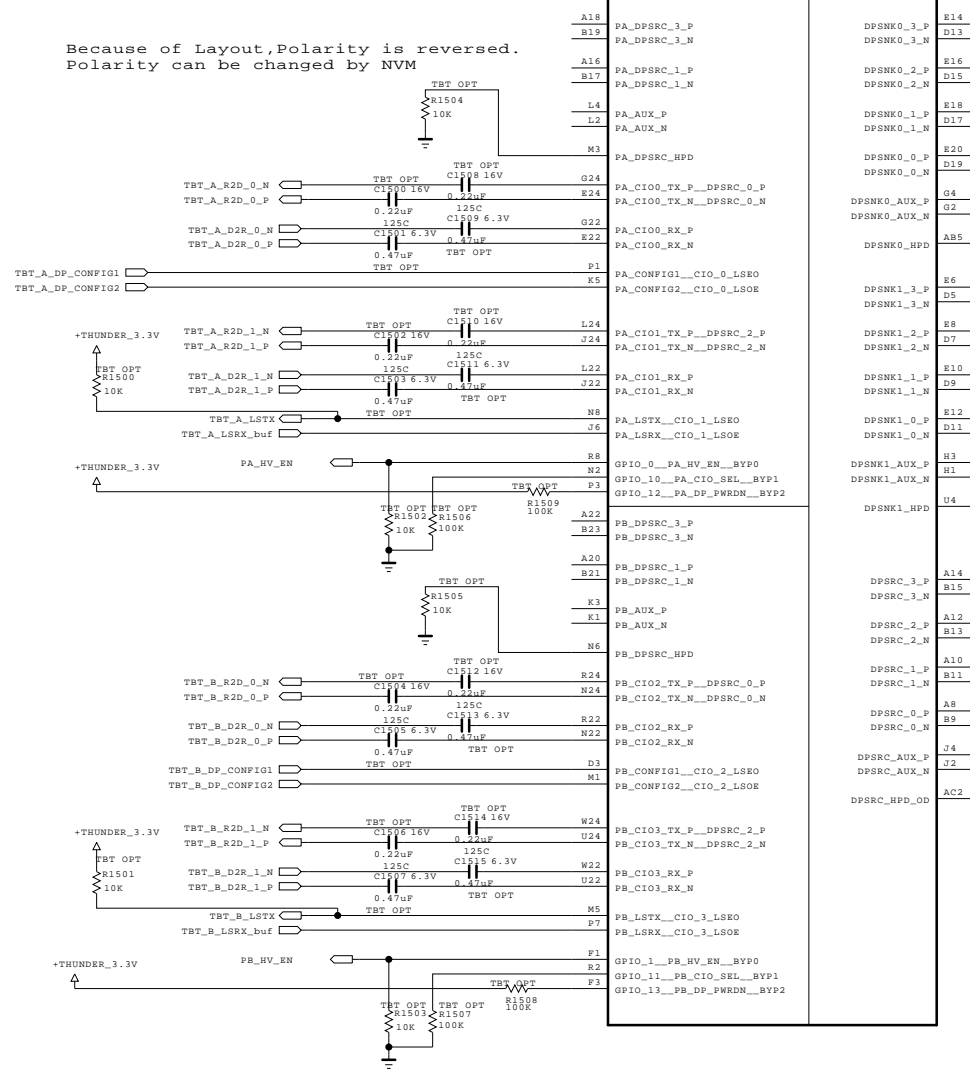
SECRET
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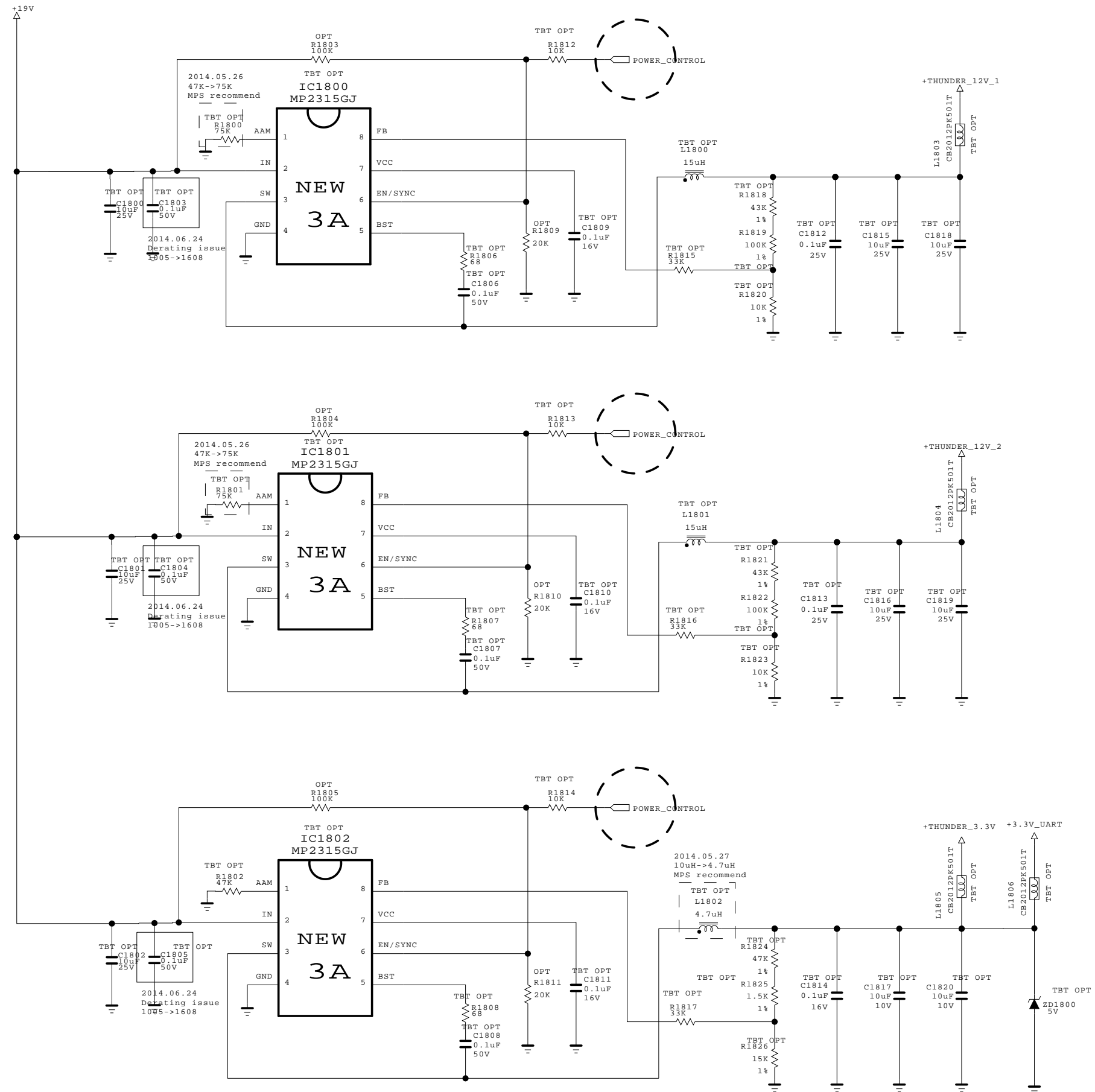
MODEL	UHD MODEL	DATE	2014.2.14
BLOCK	PCIE HOST CONTROLLER	SHEET	14 / 18



TBT OPT
IC1500
FALCON-RIDGE

Because of Layout, Polarity is reversed.
Polarity can be changed by NVM



THUNDER BOLT POWER



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MODEL	UHD MODEL	DATE	2014.2.14
BLOCK	THUNDER BOLT POWER	SHEET	18 / 18

